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NIST SP790, Volume 1

National Bureau of Standards Publications 1977–1987: Citations, Key Words, and Abstracts

Rebecca Pardee
Ernestine Gladden
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NATIONAL INSTITUTE OF STANDARDS &
TECHNOLOGY
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Gaithersburg, MD 20899

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August 1990



U.S. DEPARTMENT OF COMMERCE
Robert A. Mosbacher, Secretary

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CATALOG STRUCTURE AND USE

Volume 1 contains full bibliographic citations, key words, and abstracts for 15,746 National Bureau of Standards (NBS) (as of August 23, 1988 the National Institute of Standards and Technology (NIST)) papers published and entered into the National Technical Information Service (NTIS) collection between 1977 and 1987. Also included are several papers published prior to 1977 but not entered into the NTIS collection until 1977.

Entries are arranged by NTIS subject classifications which consist of 38 broad subject categories (see back cover) and over 350 subcategories. Within a subcategory, entries are listed alphanumerically by NTIS order number. The abstract numbers run consecutively from the first entry to the last.

Volume 2 contains four indexes to allow the user to identify papers by personal author, key words, title, and NTIS order/report number. Each entry contains the appropriate title, the NTIS order number, and the abstract number.

Papers may also be identified by searching the NTIS database either online via commercially available systems such as DIALOG, or in the issues of NTIS's *Government Reports Announcements and Index* and its *Government Reports Annual Index*.

AVAILABILITY AND ORDERING INFORMATION

The highest quality and least expensive copies of Government documents are available from the Superintendent of Documents, U.S. Government Printing Office (GPO), Washington, DC 20402. Publications cited with stock numbers (SN) should be ordered by these numbers. GPO will accept payment by check, money order, VISA, MasterCard, or deposit account. For availability and price, write to the GPO or telephone (202) 783-3238. Should a publication be out of print at the GPO, its continued availability is assured at NTIS which sells publications in microfiche or paper copy reproduced from microfiche.

If an entry has a price code, such as PC A04/MF A01, the publication may be ordered by NTIS order number from NTIS in paper copy (PC) or microfiche (MF) or both if both codes are given. Order from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. A copy of the latest price code schedule is available from NTIS. NTIS will accept payment by check, money order, VISA, American Express, MasterCard, or deposit account. NTIS is the sole source of Federal Information Processing Standards (FIPS), Interagency Reports (IRs), and Grant/Contract Reports (GCRs). For more information call (703) 487-4650. Place orders on (800) 336-4700.

Papers noted "Not Available NTIS" may be obtained directly from the author or from the external publisher cited. Such papers are not for sale by either the GPO or NTIS.

Two other sources for publications cited herein are depository libraries (libraries designated to receive Government publications) and Department of Commerce District Offices. Depository libraries are listed in Appendix A Volume 1. While not every Government publication is sent to all depository libraries, certain depositories designated as Regional Depositories receive and retain one copy of all Government publications made available. Contact the depository library in your area to obtain information on what is available and where.

Department of Commerce District Offices listed in Appendix B Volume 1 provide ready access at the local level to publications, statistical data and summaries, and surveys. Each District Office serves as an official sales agency of the Superintendent of Documents, U.S. Government Printing Office. A wide range of Government publications can be purchased from these offices. In addition, the reference library of each District Office contains review copies of many Government publications.

CITATIONS, KEY WORDS, AND ABSTRACTS

SAMPLE ENTRY

COMPUTERS, CONTROL & INFORMATION THEORY

NTIS Subject Category

Computer Software

NTIS Subcategory

707,250

Abstract Number

PB87-157228 PC **A05**/MF **A01**

NTIS order number Availability **Price Codes**

National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.

Corporate or performing organization

Programming Languages for Knowledge-Based Systems

Report Title

J. V. Cugini, Feb 87, 82p

Personal authors Report date Page count

NBS/SP-500/145

Report Number

Contract F-000000

Contract or grant number

Keywords: *Programming languages, *Symbolic programming, Procedure oriented languages, . . .

Keywords: * indicates keyword index entry

Knowledge-Based Systems (KBS) represent a new software methodology which can broaden the scope of computer applications. When developing such software . . .

Abstract

ADMINISTRATION & MANAGEMENT

Management Information Systems

700,001

FIPS PUB 107 PC **E14**

National Bureau of Standards, Gaithersburg, MD.

Local Area Networks: Baseband Carrier Sense Multiple Access with Collision Detection Access Method and Physical Layer Specifications and Link Layer Protocol. Category: Software and Hardware Standard. Subcategory: Computer Network Protocols.

Federal information processing standards (Final).

R. Rosenthal. c1984, 263p

Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: Computer systems hardware, Links, Standards, Specifications, *Computer networks, *Local area networks, *Federal information processing standards, Office automation, Access methods, Open system interconnections.

FIPS 107 is the first of a family of local area network standards that allow different manufacturer's equipment and devices to interconnect through networks. It specifies a network access technique used in office automation applications. The standard provides the mechanical, electrical, functional and procedural specifications and link protocol required to establish physical connections, to transmit bits and to send data link frames between nodes. (Copyright (c) 1984, The Institute of Electrical and Electronics Engineers, Inc.)

700,002

PB-265 694/0 PC **A05**/MF **A01**

National Bureau of Standards, Washington, D.C. System and Software Div.

CODASYL Data Base Approach: A COBOL Example of Design and Use of a Personnel File.

Final rept.,

E. H. Sibley. Feb 74, 84p NBSIR-74-500

Keywords: *Personnel management, *Information systems, *Computer programming, *Cobol, Data processing security, Medical records, Codasyl programming language, *Data base management systems, *Data base administrators, Management information systems.

This report introduces examples of the use of the proposed CODASYL Data Definition Language and Data Base Language extensions to COBOL. It does this by suggesting the needs and data base elements which can be expected for a set of simple personnel applications. The discussion of the data definitions centers around the decisions that the data administrator makes, and the tools that are provided for him. Then it discusses a few of the processes (programs) which are required by typical personnel departments, and shows their implementation (in outline) in three COBOL programs. The reader is expected to have some knowledge of the CODASYL specifications.

700,003

PB80-123359 Not available NTIS

National Bureau of Standards, Washington, DC.

New Issues Confronting the Information Systems Planner,

E. J. Istvan. Jun 79, 5p

Pub. in Infosystems 26, n6, p54, 58, 60, 62, 67, Jun 79.

Keywords: *Management information systems, Information systems, Technology assessment, Data processing security, Social effect, Reprints, Computer privacy.

Management Information Systems

Management information system planner faces a staggering array of new technological developments growing out of the computer and communications 'revolution.' Not only must he be concerned with cost effectiveness trade-offs or poorly understood competing technologies, but he also must be sensitive to society's favorable acceptance of or negative reaction to the widescale use of these technologies. His concerns must now encompass issues of freedom of information, privacy, property rights in information, protection of information, and the subtleties of differences between information pertaining to persons and that pertaining to corporate personalities. Some of the new technical possibilities, their potential social implications, and evolving trends in attempting to bring 'regularization' to this milieu is discussed.

700,004
PB85-182772 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rapid Prototyping of Information Management Systems.
Final rept.
B. I. Blum, and R. C. Houghton. 1982, 4p
Pub. in Sigsoft Software Eng. Not. 7, n5 p35-38 Dec 82.

Keywords: *Management information systems, *Production management, Prototypes, Systems engineering, Reprints, *Interactive systems, *Software tools, *Computer systems design, User needs.

Rapid prototyping is especially effective when implementing interactive information management systems. With the right tools, the development process for these systems involves the generation of successive prototypes where each successor is closer to the user requirement. The final prototype becomes either the production system or a production subsystem which is integrated into the total system. The tools used to generate successive prototypes are called application generators and program generators. There are several software engineering issues addressed by these tools.

700,005
PB86-128758 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Starting and Operating a Microcomputer Support Center.
A. T. Landberg, and S. Winkler. Oct 85, 41p NBS/SP-500/128
Also available from Supt. of Docs as SN003-003-02683-2. Library of Congress catalog card no. 85-600595.

Keywords: *Management information systems, *Microcomputers, Starting, Operations, Personnel, *Managers, Computing, End use, Support services.

The report identifies and discusses the management issues and resources needed to establish a microcomputer support center. For managers contemplating the establishment of such a center, the report provides information on requirements for staffing, space, equipment, software and operating policies. The information presented is derived from reviews and operational experiences of existing installations in the Federal Government and private sector.

700,006
PB86-137676
(Order as PB86-137627, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Metrics and Techniques to Measure Microcomputer Productivity.
W. M. Osborne, and L. Rosenthal. 9 Jul 85, 13p
Included in Jnl. of Research of the National Bureau of Standards, v90 n4 p305-317 Jul-Aug 85.

Keywords: *Office buildings, *Automatic control equipment, *Management information systems, Productivity, Performance evaluation, *Microcomputers, *Information processing.

While it is generally assumed that the use of microcomputers helps to improve productivity in an office environment, quantitative measures in this area are lacking. This paper addresses the measurement of the effect on productivity in an end user, office environment as a result of the introduction of micrcomputer-based technology. It is concerned with defining how productivity can be measured in such an environment and with current efforts to measure changes in productivity. It identifies and assesses the various techniques and measures used to describe the magnitude of productivity improvements that result from the use of microcomputers in the workplace, and makes recommendations for ways in which changes in productivity, may be measured.

700,007
PB86-138047 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Data Management and Programming Languages Div.
Dictionary Becomes a Tool for System Management.
Final rept.
D. W. Fife. 1984, 15p
Pub. in Advances in Data Base Management 2, p101-115 1984.

Keywords: *Information systems, *Management information systems, *Data processing, Dictionaries, Automation, Systems management, Organizations, Reprints, *Computer software, *Data base management, *Data flow analysis, *Tasks analysis, Technology innovation.

Information system managers have growing interest in an automated dictionary capability to catalog not only data, but also other resources, tasks, information flow, and their relationships within information processing systems. This chapter surveys the technical innovations of the needed software, called an Information Resource Dictionary System, and explains its typical application within an organization.

700,008
PB86-154820 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Guide on Selecting ADP (Automatic Data Processing) Backup Processing Alternatives.
Final rept.
I. E. Isaac. Nov 85, 43p NBS/SP-500/134
Also available from Supt. of Docs as SN003-003-02701-4. Library of Congress catalog card no. 85-600618.

Keywords: *Data processing, *Management information systems, *Backup systems, Contingency, Management, Strategy, Alternatives, Computer software.

The publication addresses the issue of selecting ADP backup processing support in advance of events that cause the loss of data processing capability. The document emphasizes the need for managers at all levels of the organization to support the planning, funding, and testing of an alternate processing strategy. It provides a general description of the alternatives, and recommends criteria for selecting the most suitable alternate processing method.

700,009
PB86-247624 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Personal Computer Networks.
Special pub. (Final).
J. Barkley. Jul 86, 62p NBS/SP-500/140
Also available from Supt. of Docs as SN003-003-02746-4. Library of Congress catalog card no. 86-600564.

Keywords: *Management information systems, Computer networks, Microcomputers, Surveys, Management, Administrative support, *Personal computers, *Office automation, End use.

The survey of personal computer network technology in today's office presents the point of view of the end user. It characterizes the capabilities of personal computer networks and the services which they provide the user in terms of generic features. As a result, technical management and end users will have an understanding of how personal computer networks can fit into an overall office automation strategy. The document does not discuss or evaluate alternatives for the sharing of data, such as, the manual exchange of floppy disks between personal computers.

700,010
PB88-139100 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Information Systems Engineering Div.
Information Resource Dictionary System.
Final rept.,
A. Goldfine. 1985, 9p
Pub. in Proceedings of the International Conference on Entity-Relationship Approach (4th), Chicago, IL., October 28-30, 1985, p114-122.

Keywords: Information systems, Organizations, Standards, Specifications, *Information management, *Data dictionaries, *Software tools.

Specifications for a standard Information Resource Dictionary System (IRDS) have been developed. The software tool documents, controls, protects, and facilitates the use of an organization's information resources. The system, which uses an entity-relationship-attribute model, includes the functions available in existing data dictionary systems. The paper introduces the organization and functions of the IRDS, and indicates some areas of current and future development.

Management Practice

700,011
PB-265 397/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Designing a Reliable Hierarchical Structure,
S. Goodman, and D. Shier. 1977, 13p
Pub. in SIAM J. Appl. Math., v32 n2 p418-430 Mar 77.

Keywords: *Organization theory, Structural design, Graph theory, Dynamic programming, Trees(Mathematics), Network analysis(Management), Reprints.

This paper considers the design and analysis of a class of managerial structures which are perhaps best illustrated by a spy network. The problem is formulated as a reliability problem on organizational trees, and two probabilistic performance measures are studied. With respect to either measure, it is possible to analyze the value of any given hierarchical structure. In addition, optimal organizational designs can be synthesized with respect to either criterion using for the one a dynamic programming approach and for the other a graph-theoretic solution method.

700,012
PB-268 162/5 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C. Experimental Technology Incentives Program.
Life Cycle Costing - Case Studies.
Final rept.
C. Hulick. 1 May 77, 112p NBS-GCR-ETIP-77-37
Prepared in cooperation with Federal Supply Service, Washington, D.C. and Logistics Management Inst., Washington, D.C.

Keywords: *Federal supply items, *Government procurement, *Cost engineering, Air conditioners, Refrigerators, Water heaters, Cost comparison, Bids, Competition, *Life cycle costing, Printer ribbons, Experimental Technology Incentives Program.

This report documents the use of life cycle cost procurements of window air conditioners, water heaters, refrigerator-freezers, and high-speed printer ribbons made by the Federal Supply Service (FSS), General Services Administration (GSA). These procurements were part of a program instituted by FSS to apply life cycle costing techniques to its procurement process. This program was instituted in conjunction with the Experimental Technology Incentives Program (ETIP) of the National Bureau of Standards. The material contained in this report explains how these products were selected for LCC, how the LCC criteria were developed, and what results were obtained. Details concerning the screening process used in selecting the products, the preparation of the invitation for bid document, the bids received and the evaluation, analysis and award process were covered in the reports.

700,013
PB-269 168/1 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Accounting Div.
Accounts Payable System, User's Guide.
May 77, 11p NBS/DF-77/006a
For system on magnetic tape see PB-269 167.

Keywords: *Accounts payable, *Computer programming, Programming manuals, Accounting, Ansi cobol, Univac 1108 computers, Accounts Payable System.

The Accounts Payable System consists of some 15 programs. Inputs are receiving reports and other documents evidencing receipt and acceptance of goods and services, and invoices. The system matches the

two and schedules matched invoices for payment. Outputs are: 1166 schedule, magnetic tape for Treasury, list of open accounts payable for general ledger reconciliation.

700,014
PB-269 942/9 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Systems and Software Div.
Computer Science and Technology: Features of Seven Audit Software Packages-Principles and Capabilities,
A. J. Neumann. Jul 77, 62p NBS-SP-500-13
Library of Congress catalog card no. 77-608147.

Keywords: *Auditing, *Computer applications, *Computer programming, Standards, Accounting, *Computer software.

The objectives of the auditing process are illustrated by a review of auditing standards for external and internal auditors. Some basic concepts of auditing are defined. Methods for computerized internal control are outlined. Characteristics and features for seven major commercially available audit software packages are described under common headings dealing with the computer environment, input file characteristics, history, availability and cost, and general system characteristics. Basic functions and specialized audit functions of software packages such as numerical and logical operations, stratification and aging, selection, and summarization are described for the various packages.

700,015
PB-270 889/9 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Accounting Div.
Internal Accounting Reports System, Documentation.
Mar 77, 22p NBS/DF-77/007a
For system on magnetic tape see PB-273 546.

Keywords: *Accounting, *Computer programming, Working capital, Fiscal policies, Financial management.

The Internal Accounting Reports System contains some 8 programs which supply data needed to prepare working capital fund fiscal reports, such as SF-133. The most important reports summarize accrued costs and unliquidated obligations by funding source and by object class, at the cost center level and above. Input data is supplied by the project reports system. (Portions of this document are not fully legible)

700,016
PB-270 902/0 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Accounting Div.
Project Reports System Documentation.
Aug 77, 49p NBS/DF-77/008a
For system on magnetic tape see PB-270 901.

Keywords: *Financial management, *Report generators, *Computer programming, Costs, Research projects, Univac 1108 computers, Cobol.

The Project Reports System consist of some 30 programs which produce about 20 reports of financial obligations at various levels of summarization. The reports are used by NBS managers to monitor spending on projects or programs for which they are responsible. (Portions of this document are not fully legible)

700,017
PB-272 188/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Role of Evaluation Systems in the Government Policy and Program Change: A Cybernetic Approach.
Final rept.,
V. Berlin, and R. Weiss. 1977, 6p
Pub. in Proceedings of Int. Conference on Cybernetics and Society, Washington, D.C., September 19-21, 1977, p17-22 1977.

Keywords: *Management engineering, *National government, *Government policies, *Cybernetics, Models, Feedback, Evaluation, Decision making, Project planning, Public administration, Revisions, Problem solving, Methodology, Social organization, Experimental design.

In a cybernetic model of the policy-making process, social program evaluation and administrative experimentation are feedback mechanisms. Such feedback is used to facilitate change in on-going government policies, programs, and processes. Problems associated with this methodology and an approach to the design of evaluation systems are described.

700,018
PB-281 915/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Efficient Equipment Maintenance: A Tool for Energy Conservation.
Final rept.,
J. Levy. 1978, 3p NBSIR-77-1210
Sponsored in part by Federal Energy Administration, Washington, D.C. Office of Energy Conservation and Environment.
Pub. in AACE Bulletin 20, n2 p49-51, Mar/Apr 78.

Keywords: *Equipment, *Maintenance, Mathematical models, Markov processes, Dynamic programming, Economic analysis, Optimization, Markov decision processes, Energy conservation, Reprints.

A general model of equipment performance as a function of maintenance is developed that permits quantification of the optimal level of maintenance in terms of performance attainment and relative factor costs. The model formulation is that of a finite state, finite action Markov decision process. The model will help persons responsible for making decisions concerning maintenance policies in selecting economically efficient levels of maintenance for elements of building service equipment.

700,019
PB-281 996/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Review of an Administrative Experiment in Organization Design: Some Lessons.
Final rept.,
S. D. Garrity. Oct 77, 3p
Pub. in Proceedings of Annual Conference of American Institute for Decision Sciences (9th), Chicago, Ill. 19-21 Oct 77 p398-400 Oct 77.

Keywords: *Organization theory, Program effectiveness, Design, Evaluation, Policies, Standardization.

An administrative experiment in organization design was conducted by the Experimental Technology Incentives Program with a regulatory commission and a standards development organization. The organization of the voluntary committees typically used to develop standards were restructured in a way that when hypothesized would accelerate the drafting of standards. While the results of the experimental changes are unclear at this time, the effort identified some major lessons for the conduct of administrative experiments. These include the necessity for specifying in advance the problem being addressed, the key stakeholders involved, and what the experiment can accomplish for these stakeholders. These issues are particularly important for experiments in which more than one organization is involved in the conduct of the experiment. In addition, the organizational structure used for conducting the experiment needs to be flexible enough to implement the change in design as well as evaluate the impacts.

700,020
PB-284 580/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Don't Define the Problem.
Final rept.,
I. M. Lloyd. Jun 78, 4p
Pub. in Public Admin. Rev., 4p May/June 78.

Keywords: *Management analysis, Problem solving.

The thesis is that management analysis of very complex problems may be facilitated if the effort to formulate a thoroughgoing definition of the problem is delayed or even omitted from the analysis. Attempts to define a very complex and dynamic problem may result in an oversimplified or erroneous definition which, in turn, leads to an irrelevant solution. The approach which this presentation examines is to experiment with tentative solutions and, by observing the results, arrive at an understanding of the problem.

700,021
PB-285 238/2 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C.
Guidelines for Specification and Procurement of Measurement Instrumentation,
J. King, H. S. Peiser, and R. C. Sangster. Jun 78, 28p NBSIR-78-891
Sponsored in part by Agency for International Development, Washington, D.C. Prepared in cooperation with Denver Research Inst., Colo.

Keywords: *Developing countries, *Measuring instruments, *Procurement, Guidelines, Specifications, Supply contracts, Bids, Purchasing, Technical assistance.

Guidelines are presented for specification and procurement of measurement instrumentation, for use by establishments in developing countries. They were developed in conjunction with a short course on this subject, presented in 1976 to a group of measurement experts from developing countries, by the Denver Research Institute of the University of Denver, Denver, Colorado, USA, under contract from the National Bureau of Standards, with funding from the Agency for International Development. Topics covered include trends in instrumentation, responsibilities of technical and purchasing staff members, motivation for purchase and specific purposes or goals, development of functional specifications, search for and evaluation of suppliers and candidate instruments, development of detailed specifications, identification of conditions of sale, issuance of requests for quotation and evaluation of bids, purchase order issuance and follow-up, formal acceptance of purchased equipment, and post-sale relations with seller.

700,022
PB-285 314/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cost/Productivity of Automatic/Conventional Typewriters.
Final rept.,
R. C. Oman. Jul 78, 5p
Pub. in Jnl. Syst. Management v29 n7 Issue n207 p10-14, Jul 78.

Keywords: *Office machines, *Cost analysis, Automatic typewriters, Productivity, Reprints.

One aspect of the trend to office automation is the increased use of automatic typewriters. An important consideration in the replacement of standard electric typewriters by automatic typewriters is the large difference in cost between the two machines. Automatic typewriters are often marketed on the basis that their increased cost in comparison to conventional typewriters is offset by dramatically increased typing productivity. This article compares the productivity of a sampling of automatic and conventional typewriters. The labor cost per page and the total cost per page (labor cost + equipment cost) are compared for this sample of automatic and conventional typewriters.

700,023
PB-285 315/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Implementing Change in Organizations, Based on Evaluative Research: A Bibliography.
Final rept.,
R. Oman. Aug 78, 25p
Pub. in Jnl. Admin. Series: Bibl. P-59 p1-24 (Vance Bibliographies, Monticello, Ill., Aug 78.)

Keywords: *Management analysis, *Bibliographies, Evaluation, Management planning, Program effectiveness, Organization theory, Reprints.

The purpose of this bibliography is to bring together sources that are relevant to the practitioner of evaluative research interested in the question of implementing organization change. Evaluative research includes any one of a number of functions, activities, and, in the Federal government, job series, which evaluate and propose changes to existing programs, organizations, and operations. These evaluative activities usually combine the role of change agent with that of an evaluator who judges an on-going situation against some standard, guideline, or principle and proposes change (or works toward change) in the desired direction. A commonly thought of form of evaluative research implies the application of scientific principles to improve the efficiency or effectiveness of an organization. Some examples of fields that apply scientific principles to organization problems are management science, industrial engineering, and operations research. For the purposes of this bibliography, however, the author has included fields which do not necessarily have a scien-

tific base (in the sense of logical positivist science), but which bring a perspective to bear on a particular situation with the hope of impacting decision makers and moving the organization in the desired direction. The perspective is legitimized by expertise in areas such as management, organization theory, organization development or other social and behavioral fields which are arts as well as sciences.

700,024
PB-292 850-SET PC **E08**
SRI International, Menlo Park, CA.
Management of Federal R and D for Commercialization.
1978, 337p-in 3v
Set includes PB-292 851 thru PB-292 853.

No abstract available.

700,025
PB-300 552/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Administrative Experimentation: A Methodology for More Rigorous 'Muddling Through'.
Final rept.
V. N. Berlin. Apr 78, 11p
Pub. in Management Science 24, n8, p789-799, Apr 78.

Keywords: *Decision making, *Management methods, Feedback, Consultants, Executive ability, Organization theory, Management planning.

Administrative experimentation is described as a more rigorous approach to the 'muddling through' style of managerial decision making. It includes a class of heuristics for obtaining feedback on management decisions in what amounts to a continuous trial and error process. A manager on his own, a manager consultant team, or a manager-researcher team can implement these heuristics in a variety of settings to serve a variety of purposes. A case study describing one application of this approach is presented.

700,026
PB80-128788 PC **A03**/MF **A01**
K G Associates, Dallas, TX.
Life Cycle Cost Workbook.
Final rept.,
J. W. Griffith. Nov 79, 32p NBS-GCR-79-186
Prepared in cooperation with Department of Health, Education, and Welfare, Washington, DC. Sponsored by the HEW/NBS Life/Fire Safety Program.

Keywords: *Cost comparisons, *Fire safety, Systems, Fire protection, Capitalized costs, Inflation(Economics), Income taxes, Financial management, Amortization, Depreciation, Accounting, Present worth, Cost analysis, Service life, *Life cycle costs.

The workbook presents a methodology to compare total or relative (Life Cycle) cost of the alternative plans. It is designed to be useable by any person who has access to the necessary financial data and rudimentary understanding of normal business financing and cost. The approach used is based on the completion of simple work sheets. All of the definitions and reference tables needed to execute the work sheets are included in the workbook. By use of this approach the health care provider, or other person responsible for making preliminary decisions among widely varying alternatives, can extend his information base beyond the traditional approach of first cost figures to consider the actual life cycle price.

700,027
PB80-146996 PC **A03**/MF **A01**
Temple, Barker and Sloane, Inc., Lexington, MA.
Regulatory Lag: Administrative Causes and Solutions.
Final rept.
Nov 79, 33p NBS-GCR-ETIP-79-72
Contract NOAA-5-35894

Keywords: *Reaction time, *Regulations, Rates(Costs), Electric utilities, Decision making, State government, Scheduling.

The report contains findings on methods for reducing the administrative causes of regulatory lag, that is the reduction of the time between the filing of an electric utility rate request and the final disposition of that request. The findings resulted from research and experiments performed for the Experimental Technology Incentives Program (ETIP) in several states during which an independent investigator analyzed all activities and information flows of several state utility commissions. Chief among the identified solutions to lag are caseload management, case scheduling, common data formatting, and delegated hearing procedures. The other tools, described in published reports, deal with performance evaluation, productivity, automatic and discretionary adjustment, rate structure, future test year, and long range planning.

700,028
PB80-162134 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Office of International Relations.
Consultation Visit to the Honduras Department of Engineering and Standardization.
Final rept.,
H. S. Peiser. Feb 80, 55p NBSIR-80-1969
Grant PASA-TA(CE)-7-71

Keywords: *Metric system, *Standardization, *Honduras, Developing countries, National government, Quality control, Industries, Consultants, Metrication.

The Government of Honduras, with support from the Agency for International Development, asked the National Bureau of Standards to provide consultation on an increased concern with standardization and measurement services. In this report, the author describes his brief visit to Tegucigalpa and his constructive discussions with governmental, industrial, and university authorities. Honduras has very considerable unexploited natural resources and a developing industrial manufacturing base in need of standardization, especially for quality control, to enter world markets. Honduras needs a new Weights and Measures Law and metrology and test laboratories, as well as some assistance for training technicians. Closer cooperation with regional standardization organizations is advocated. Domestically, measurement control in retail markets needs to be developed. Although officially Honduras is metric, the change to metric units has not been widely accepted by the public.

700,029
PB80-170202 Not available NTIS
National Bureau of Standards, Washington, DC.
Another Inventor's View on Innovation.
Final rept.,
J. Rabinow. Mar 80, 5p
Pub. in CHEMTECH 10, n3 p144-148 Mar 80.

Keywords: *Technology innovation, *Industries, Corporations, Productivity, Businesses, Inventions, Executives.

Innovation in the United States is suffering because our corporations are getting too large so that it is difficult for top management to be expert in all phases of the industry in which it is engaged. In the case of the conglomerates, the problems are even worse. Most of the great innovations have been made outside of large organizations and the writer is pessimistic because he believes that it is not likely that the trend to larger and larger sizes can be reversed.

700,030
PB80-204654 PC **A25**/MF **A01**
National Bureau of Standards, Washington, DC. Experimental Technology Incentives Program.
Procurement of Evaluation Systems: A Case Study of the Parametric Factor Evaluation Approach to Source Selection.
Final rept.,
A. S. Libman. Jul 80, 592p NBSIR-80-2092

Keywords: *Contract administration, *Government procurement, *Evaluation, Assessment, National government, Systems analysis, Selection, Contracted services, Consulting services, Recommendations, Theses.

The document is a case study of the use of a system contractor source selection process by a federal program. Its primary research value is as a bench mark for future case studies on source selection techniques in general and for future research on the specific source selection process reported on here. Its primary administrative value is to those responsible for procuring systems (and other complex and uncertain products, e.g., large evaluations) as an evaluation of the outcome of the use of the specific technique in terms of the issues critical to effective source selection. The specific problem for which the technique was used was the selection of two contractors to develop an ongoing capability to evaluate the results (agency and commercial impacts) of experimental modifications in procurement procedures by selected federal, state, and local government agencies. These evaluation systems were to be implemented by organizations outside of the developing organization.

700,031
PB81-108870 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Resource Requirements and Allocations in IRS' Audit Division: A Systems Analysis.
Final rept.
K. L. Hoffman, L. S. Joel, and M. H. Pearl. Feb 79, 81p NBSIR-79-1711
Sponsored in part by the Internal Revenue Service, Washington, DC.

Keywords: *Resource allocation, *Auditing, Taxes, National government, Income taxes, Game theory, Management planning, Law enforcement, *Internal Revenue Service, Income tax returns.

The report assesses the validity and effectiveness of the IRS Audit Division's Long Range Plan's strategies and approaches to resource requirements and allocations. The report (1) summarizes the examination and evaluation by NBS of IRS's current audit practices and plans for the future, and (2) presents our major conclusions and recommendations.

700,032
PB81-118523 Not available NTIS
National Bureau of Standards, Washington, DC.
Determining Cost Effectiveness of Automatic Typewriters.
Final rept.
R. Savitsky. Feb 80, 4p
Pub. in Jnl. Syst. Manage. 31, n2 p28-31 Feb 80.

Keywords: *Automatic typewriters, *Typewriters, Cost effectiveness, Productivity, Office management, Utilization, Office machines, Office typewriters, Manpower utilization, Labor estimates, Office equipment, Procurement, Word processing.

In order to justify the acquisition and continuing usage of automatic typewriters, definable criteria for determining their cost effectiveness can be developed and applied in an office. The criteria are based upon the relative costs and productivity of equipment to determine a breakeven level of utilization. The assumed benefit of automatic word processing equipment is in saved staff hours in the preparation of text. If the labor saved compensates for increased equipment costs, the automatic typewriter would be considered as cost effective. The analysis can be simplified by constructing graphs showing how intensively office equipment should be used so as to reach cost effectiveness.

700,033
PB81-140238 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Organization Culture on Managers,
L. A. Salomone. 1980, 13p
Pub. in Proceedings of the ASCE Convention and Exposition, Hollywood, FL., October 27-31, 1980, p1-13 1980.

Keywords: *Organization theory, Management analysis, Executives, Behaviors, Project management, Attitudes, Models.

Systematic examination of management, with few exceptions, is the product of the present century and especially of the past several decades, although most students of management would agree that problems of management have existed since the dawn of organized life. Changes in the size, diversity and complexity of projects have reemphasized the need for developing better and more effective techniques in projects management. In addition, the unsettled economic environment has reduced the number of new projects, and as a result, has increased the competition in private industry for those projects which are funded. Likewise, in government, similar pressure have been created because of efforts to decrease or hold down government spending. The management theory which is assisting the National Engineering Laboratory of the National Bureau of Standards in Washington, DC. and its managers in their search for excellence is presented, and the effect of organization culture on managers is discussed. Using the Managerial Grid developed by Robert R. Blake and Jane S. Mouton, the perceptions

of some government employees and corporate managers regarding the soundest organization culture are investigated. Also, results of an experiment in which government employees were asked to rank the alternatives to questions, designed to evaluate organization culture, based on how their organization actually operates are presented.

700,034

PB81-152100 PC **A07**/MF **A01**
Booz-Allen and Hamilton, Inc., Bethesda, MD.
Computer Science and Technology: Guidance on Requirements Analysis for Office Automation Systems.
Final rept.
S. Watkins. Dec 80, 128p NBS/SP-500-72
Contract NB80-SBCA-0351
Library of Congress catalog card no. 80-600179.

Keywords: *Office equipment, *Automation, Data processing equipment, Office management, Systems engineering, Requirements, National government, Telecommunication, Productivity, Auditing, *Data processing systems.

This guideline presents a methodology for determining the feasibility and practicality of introducing (or expanding) office automation systems within the Federal Government. It is applicable to all office automation technologies such as word processors, dictation equipment, and telecommunications and is designed for use by agency officials and other employees who have the responsibility for productivity improvement, procedural analysis data processing, or office systems.

700,035

PB81-199648 Not available NTIS
National Bureau of Standards, Washington, DC.
Priority Setting in Standardization Activities.
Final rept.
M. A. Breitenberg. Feb 81, 11p
Pub. in Standard Engineering 33, n1 p6-16 Feb 81.

Keywords: *Project planning, *Management methods, Ranking, Resources, Allocations, Standardization.

Setting workload priorities should be an important management function in any organization. This article discusses the need for a more formalized procedure for setting priorities and describes techniques a standards writing committee can use to select among possible standards activities.

700,036

PB81-204356 PC **A03**/MF **A01**
Research Triangle Inst., Research Triangle Park, NC.
Agency Impact Analysis: Life Cycle Costing in the Public Building Service.
Final rept.
J. E. S. Lawrence, and S. D. Garrity. May 79, 28p
NBS-GCR-ETIP-79-68
Contract NBS-6-35756

Keywords: *Public buildings, *Cost analysis, Construction costs, Office buildings, Government procurement, Operating costs, Technology innovation, *Life cycle costs, Energy use.

The project consisted of the design and implementation of a computer-based life cycle costing model for the long term economic-analysis of space acquisition options. This report reviews the project and discusses the lessons learned and whether further work on the project is justified. The authors find that the model has been most useful in improving the quality of life cycle costing analysis, especially by increasing flexibility with assumptions and providing more capability to examine sensitivity aspects. The model has further potential for assessing costs across and within space alternatives and in evaluating the actual costs of a specific acquisition. These analysis processes will require continual updates and improvements in the data used by the model in order to keep estimates current. Interest in the model continues widely in both the public and private sectors, particularly for the estimation of energy utilization costs.

700,037

PB81-216673 Not available NTIS
National Bureau of Standards, Washington, DC.
Design and Implementation of an Office Application Using Existing High Level Tools.
Final rept.
A. Mink, J. Knoerdel, and J. Brooks. 28 May 81, 13p
Pub. in Proceedings of the Trends and Applications 1981: Advances in Software Technology held at Gaithersburg, MD., p150-162, 28 May 81.

Keywords: *Office management, Systems engineering, Computer programming, Accounting, *Computer applications.

An experiment was conceived to provide insight into the problems of implementing computer based office application (CBOA) services using existing high level computer based office systems (CBOS) tools. The first step was to select a routine office application that was currently being performed in our environment, and an existing hight level CBOS tool on which to build support for this application. Once the application and tool were selected, the office workers affected by this CBOA were encouraged to participate in the design and implementation process to gain the maximum feedback. The goals were to accomplish this implementation by using existing CBOS tools, doing no programming, and to have the users understand the implementation as well as the designers.

700,038

PB81-225054 PC **A03**/MF **A01**
Florida State Dept. of Environmental Regulation, Tallahassee.
Analysis of the Procurement Policies of: Dade County, The City of Miami, The Dade County School System, Miami Dade Community College.
Final rept.
Jun 81, 33p NBS-GCR-81-309-SUPPL
Contract NB80-NAAE-4667
See also PB81-205445.

Keywords: *Procurement, *Government procurement, Florida, Government policies, Purchasing, Materials recovery, Public law, Natural resources, Conservation, *Dade County(Florida), Energy policy, Environmental protection.

The study examines the procurement policies of Dade County, City of Miami, Dade County School System, and the Miami Dade Community College on the procurement of products containing recycled materials. The study was to identify rules, regulations, policies, and barriers that affect such procurements. This report supplements the main study dealing with procurement policies at the state level.

700,039

PB81-238065 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Standards Committee Activities of the National Bureau of Standards: 1980 Highlights.
Final rept.
J. R. Debelius. May 81, 109p NBS-SP-605
Supersedes PB80-177447.

Keywords: *Participative management, *Personnel management, Professional personnel, Group dynamics, Standards, National government, Performance standards, *National Bureau of Standards, *Committees.

NBS uses a decentralized system for managing the participation of NBS representatives in outside standards committee activities. This type of management is governed by NBS policy; coordinated through standards offices in each NBS Major Operational Unit; and monitored and supported by the Office of Standards Information, Analysis, and Development (OSIAD). This report summarizes NBS standards committee activities during calendar year 1980. It contains highlights of significant technical and individual contributions made by NBS staff, a description of NBS Standards management and information activities, and a directory of standards committees on which NBS staff serve.

700,040

PB81-245060 Not available NTIS
National Bureau of Standards, Washington, DC.
Risk Assessment and Managerial Analysis.
Final rept.
Z. G. Ruthberg. 1980, 13p
Pub. in Electronic Data Processing Auditor, p31-42 1980.

Keywords: *Risk, *Management analysis, Computers, Security, Assessments, *Risk analysis.

Risk assessment (or analysis) is part of a growth set of concepts in the computer security and audit of computer security fields that are contributing to computer-based Generally Accepted Information Principles, Audit Practices, and Audit Standards for the information systems of the computer era. The National Bureau of Standards, the U.S. General Accounting Office, the American Institute of Certified Public Accountants, the Institute of Internal Auditors, and the Electronic Data Processing Auditors Association are contributing to these principles, practices, and standards. From a comprehensive management view, risk assessment is part of a larger activity which can be called a risk management program. Fifteen logical tasks properly belong to such a program. Risk analysis includes the first nine of these. The NBS method for risk analysis (a quantitative type) contains more tasks than the one defined here, but fewer than a risk management program. Although no risk assessment method in use today accomplishes all of its tasks well, many perform some in ways that are worth considering in future improved risk analyses. Since a quantitative risk analysis arrives at a conclusion with large uncertainties, qualitative methods are being used by some. SECURATE is such a method. More work needs to be done with both quantitative and qualitative methods before preferring one type over the other. The National Bureau of Standards has a current effort to produce a risk management standard that will specify a necessary minimum set of logical tasks.

700,041

PB81-247058
(Order as PB81-247017, PC **A04**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Player Aggregation in Noncooperative Games, II.
A. J. Goldman. 1 Apr 81, 9p
Prepared in cooperation with Johns Hopkins Univ., Baltimore, MD.
Included in Jnl. of Research of the National Bureau of Standards, v86 n4 p383-391, Jul-Aug 81.

Keywords: *Game theory, *Management games, Gaming models, Operations research, Mathematical models, Economic analysis, Agglomeration.

Conditions are given under which subsets of the players of a noncooperative game can be combined into aggregate players without changing the set of equilibrium-point solutions of the game. These conditions are shown to be the weakest possible ones with a certain specified kind of gnerality. Approximate versions of the results are also formulated and proven.

700,042

PB82-104308 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Experimental Technology Incentives Program.
Manual for Designing and Implementing a Process to Monitor Complex System Developments.
Final rept.
S. D. Garrity. Sep 81, 66p NBSIR-81-2328

Keywords: *Systems engineering, *Project management, *Technology innovation, *Manuals, User needs, Systems analysis, Management analysis, Research management, Incentives.

Projects aimed at developing new systems where there are substantial uncertainties as to system requirements, development processes, and ultimate ownership can present project managers with a range of complex, unstructured problems. A process to help identify and solve these problems in a timely, controlled manner is of central importance to the successful conduct of a development with these circumstances. The document presents a manual for designing and implementing a process to monitor key areas of a complex system development. The manual is derived from an internal study of system developments in the Experimental Technology Incentives Program (ETIP) of the National Bureau of Standards. The proposed monitoring process consists of a framework of thirty factors and a set of five functions which monitoring can serve.

700,043

PB82-115817 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC. Experimental Technology Incentives Program.
Monitoring System Development: A Framework and Application.
Final rept.
S. D. Garrity. Sep 81, 608p NBSIR-81-2327
See also report dated Sep 81, PB82-104308.

Keywords: *Systems engineering, *Project management, *Technology innovation, Problem solving, Systems management, Management analysis, Research management, Experimental Technology Incentives program.

The document describes a research project devoted to the examination of problems in complex system developments and to the development of a process managers can use to deal with them. Conducted within the Experimental Technology Incentives Program (ETIP), the research includes analysis of several ETIP projects, a review of the systems literature, presentation of a monitoring framework to help manage complex developments, and a brief application of the framework to one ETIP project.

700,044
PB82-120510 PC **A03**/MF **A01**
K G Associates, Dallas, TX.
Life Cycle Cost Workbook.
Final rept.
J. W. Griffith. Sep 81, 34p NBS-GCR-79-186-1
See also PB80-128788, NBS-GCR-79-186. Sponsored in part by Department of Health and Human Services, Washington, DC.

Keywords: *Cost comparison, *Fire safety, Fire protection, Income taxes, Service life, Cash flow, Cost analysis, Financial management, *Life cycle costs, Health care facilities.

The workbook presents a methodology to compare total or relative (Life Cycle) cost of the alternative plans. It is designed to be useable by any person who has access to the necessary financial data and a rudimentary understanding of normal business financing and cost. The approach used is based on the completion of simple work sheets. All of the definitions and reference tables needed to execute the work sheets are included in the workbook. By use of this approach the health care provider, or other person responsible for making preliminary decisions among widely varying alternatives, can extend his information base beyond the traditional approach of first cost figures to consider the actual life cycle price.

700,045
PB82-135856 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Rationale Statements for Voluntary Standards - Issues, Techniques, and Consequences.
Final rept.
D. A. Swankin. Nov 81, 92p NBS-GCR-81-347

Keywords: *Engineering standards, *Product development, Reasoning, Technical writing, Legislation.

The report provides an overview of the needs, practices and consequences of providing rationale statements for voluntary standards. The research consisted of a literature review, a review of relevant court cases, the collection and assessment of examples of rationale statements, and discussions with those involved in standards writing. Six examples of rationale are analyzed and a discussion of the most controversial issues associated with rationale statements follows. The report also contains a listing of product liability cases in which the issue of standards was raised and analyzes the legal consequences that rationale statements are likely to have on such cases.

700,046
PB82-165226 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Computer Science and Technology: Executive Guide to ADP Contingency Planning.
J. K. Shaw, and S. W. Katzke. Jan 82, 19p NBS-SP-500-85
Library of Congress catalog card no. 81-600182.

Keywords: *Management planning, Recovery, Downtime, *Data processing systems, *Emergency planning, Risk analysis, Emergency preparedness.

This publication has been prepared for executives and managers who depend on ADP resources and services to accomplish the organizational objectives for which they are responsible. The goal is to help in understanding the need for Automatic Data Processing (ADP) contingency planning, to specify management's scope of involvement, to indicate in summary form the contents of ADP contingency plans and how one proceeds in developing such plans.

700,047
PB82-168857 PC **A11**/MF **A01**
Florida Univ., Gainesville.
DMS Cost/Benefit Decision Model: Analysis, Comparison, and Selection of DBMS's.
S. Y. Su, D. S. Batory, S. B. Navathe, A. Olagunju, and J. Parkes. Jul 81, 226p NBS-GCR-82-375
Contract NB80-SBCA-0449

Keywords: *Benefit cost analysis, *Mathematical models, *Decision making, Decision theory, Cost analysis, Systems analysis, *Data management systems, *Data base management systems.

This report uses a hypothetical DMS decision problem to present the procedure of analysis, comparison, and selection of a data management system and to demonstrate the practical application of the decision model presented in our earlier reports. The analysis, comparison and selection of DMS's is carried out in the following steps: (1) select cost and preference (or performance) parameters; (2) formulate elementary criteria; (3) aggregate preferences; (4) issue RFP to vendors to get the official proposals containing all required data specifying the costs and capabilities of alternative systems; (5) compute the global preference of each competitive system and perform sensitivity analysis; (6) compute the global costs of competitive systems; and (7) perform cost-preference analysis to rank the systems. Examples are given to illustrate the procedures and techniques which can be used in each step to systematically evaluate the alternative systems. Some 120 elementary criteria and a criterion aggregation structure designed for DBMS analysis, comparison, and selection are provided in this report. They can be used as a guide to the users of the DMS cost/benefit decision model to formulate criteria and aggregation structures for their own decision situations.

700,048
PB82-170150 PC **A08**/MF **A01**
Florida Univ., Gainesville.
DMS Cost/Benefit Decision Model: Mathematical Models for Data Management System Evaluation, Comparison and Selection.
J. J. Dujmovic, and R. Elnicki. Jul 81, 168p NBS-GCR-82-374
Contract NB80-SBCA-0449

Keywords: *Benefit cost analysis, *Mathematical models, *Decision making, Decision theory, Cost analysis, Systems analysis, *Data management systems.

A detailed description of the LSP method is presented in this report. The main topics include: (1) development of system requirement tree; (2) detailed classification and description of elementary criteria; (3) logic aggregation of preference; (4) the analysis of elementary and compound preference aggregation functions; (5) cost analysis models for data management systems; and (6) a detailed presentation of the cost-preference analysis for system comparison and selection.

700,049
PB82-195025 PC **A05**/MF **A01**
Young (Arthur) and Co., Washington, DC.
Approach to ADP User Service Reporting,
J. M. Mohr, C. B. Wilson, and P. M. C. Chan. Mar 82, 97p NBS/GCR-82-382
Contract NB80-SBCA-0501

Keywords: *User needs, *Data processing, Management analysis, Reporting, Benefit cost analysis, *Computer performance evaluation.

An approach to ADP user service reporting is presented which uses the maximization of Net Benefit to the Organization (NBO) as the basic criterion for determining the needed level of ADP service. The goal of the User Service Reporting System (USRS) is to provide each of the groups within the management hierarchy with timely feedback on how well the ADP installation is supporting the needs of the organization. The report discusses the calculation of costs and benefits as well as factors affecting their optimization. The report identifies work units and service measures which are appropriate for a USRS. The usefulness and measurability of the proposed work units and service measures are discussed. A significant bibliography is included in this report.

700,050
PB82-234451 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Computer Science and Technology: Guide to Contracting for Software Conversion Services.
Final rept.
M. W. Skall. May 82, 71p NBS-SP-500-90
Library of Congress catalog card no. 82-600531.

Keywords: *Contracted services, Contract administration, Computer programming, Conversion, National government, *Computer program transferability, *Software conversion, Software engineering, Federal agencies.

The purpose of this guide is to educate the Federal manager in the benefits which can be gained by contracting for conversion services as well as to specify all the actions the agency must take to ensure a successful conversion contract. The guide concludes that a smooth conversion can be accomplished by thoroughly planning the contractor's activities and effectively communicating these plans to the contractor.

700,051
PB83-101816 PC **A04**/MF **A01**
Colorado Dept. of Administration, Denver. Div. of Purchasing.
Bid-Modifier as an Aid to Recycling.
Final rept.
20 Jan 82, 52p NBS-GCR-82-400
Contract NB81-NAAH-7437

Keywords: *Procurement, *Bids, Disposal, Costs, Purchasing, Recovery.

This study was designed to examine the possibility of using a bid-modifier to represent disposal costs, so that the purchase of recycled/recyclable materials might be encouraged. This study addressed a scheme designed to adjust bids received for a commodity. A factor called the Purchasing Adjustment for Recycling (PAR) was developed based on the examination of the following factors: (1) the two most common disposal systems (landfilling, and incineration), (2) the data from a literary search, (3) a simulation of the bid/award process using prior purchasing records, and (4) discussions with purchasing personnel about the problems and attitudes that could effect the use of a PAR factor in bid evaluation. The findings and recommendations provided in this study are expected to be of value to both public and private sectors of the nation.

700,052
PB83-177642 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Toward an Improved FIPS (Federal Information Processing Standards) Cost-Benefit Methodology, Phase 1: Descriptive Models - Data Processing Operations.
Final rept.
M. Fiorello, P. L. Eirich, and P. Kay. Jan 83, 72p NBS-SP-500-100
Library of Congress catalog card no. 82-600657. Prepared in cooperation with Fiorello, Shaw and Associates, McLean, VA.

Keywords: *Benefit cost analysis, *Cost benefit analysis, *Federal information processing standards, Data processing systems, Computer security.

This report presents a set of functional-flow descriptive models that can be used to categorize the operational activities of Federal data processing users. Data processing applications may be conceptually represented in descriptive model form by combining one or more of the basic models. The comprehensive framework for data processing operations provided by these descriptive models can be used in the identification of impacts from standards and guidelines and in the preparation of cost-benefit impact assessments. The framework provides both macro and micro levels of detail in order to link the descriptive models to additional data processing issues, such as computer security issues.

700,053
PB83-207209 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Standards Committee Activities of the National Bureau of Standards - 1982 Highlights.
Final rept.
K. G. Newell. Mar 83, 56p NBS-SP-650
See also PB81-238065.

Keywords: *Management analysis, *Participative management, *Standards, Professional personnel, Group dynamics, National government, *National Bureau of Standards, *Committees.

This report summarizes NBS standards committee activities and accomplishments during calendar year 1982. It describes the management of standards ac-

tivities at NBS, profiles NBS staff participation on outside standards committees, and highlights significant technical and individual contributions made by NBS staff. In 1982, 457 staff members (or 29% of NBS' professional, scientific, and technical staff) participated in 1,046 outside standards committees of 97 national and international standards organizations.

700,054
PB83-236646 Not available NTIS
National Bureau of Standards, Washington, DC.
Mathematical Modelling in the Context of Problem Solving.
Final rept.
R. D. Noble. 1982, 5p
Pub. in Math. Model 3, n3 p215-219 1982.

Keywords: *Problem solving, *Mathematical models, *Creativity, Thinking, Heuristic methods.

The process of mathematical modelling is shown to fit within the general context of problem solving. A problem solving process is described and detailed with examples from mathematical modeling. Creativity is discussed with descriptions of elements which are conducive to creativity, and also blocks to creativity are outlined. Heuristics or general guides to aid in solving problems are shown. This then gives one a general approach to mathematical modelling.

700,055
PB84-217058 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Washington, DC.
Recommended Practice for Measuring Simple and Discounted Payback for Investments in Buildings and Building Systems.
Final rept.
H. E. Marshall. Mar 84, 66p NBSIR-84-2850

Keywords: *Benefit cost analysis, *Buildings, Return on investment, Economic analysis, Cost effectiveness, Life cycle costs.

This report describes how to calculate simple and discounted payback measures of economic performance of buildings and building systems. Formulas for calculating payback, applications for evaluating and selecting projects, and limitations in the use of payback analysis are discussed. The simple payback method measures the time between the date of initial project investment and the date when cumulative future earnings or savings on that investment, net of cumulative future costs, just pay off the investment. The discounted payback method measures the time between the date of initial project investment and the date when the present value of future earnings or savings, net of the present value of future costs, just equals the initial investment. This recommended practice will assist the private and public building communities in making cost-effective decisions in the design, operation, maintenance, and retrofit of buildings.

700,056
PB84-221894 Not available NTIS
National Bureau of Standards, Washington, DC.
Using Standards to Select Equipment.
Final rept.
L. K. Eliason. Apr 84, 4p
Sponsored in part by National Inst. of Justice, Washington, DC.
Pub. in Police Chief LI, n4 p36-39 Apr 84.

Keywords: *Equipment specifications, *Police, Law enforcement, Standards, Consumers, Technology assessment, Procurement, Cost effectiveness, Reprints.

One of the goals of the Technology Assessment Program of the National Institute of Justice (NIJ) is to assist the law enforcement community by developing a listing of police equipment that has been tested in accordance with NIJ performance standards and passed the tests. To achieve this goal, the standard must be developed, independent testing laboratories must be accredited and the tests conducted. In this article, the author gives the necessary NIJ background material, details each step in the development of a typical performance standard, discusses the conception and growth of the Technology Assessment Program and describes how the products of the program can best be utilized by the client, in this case, the police community.

700,057
PB84-239755 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Office of Product Standards Policy.
Standards Committee Activities of the National Bureau of Standards - 1983 Highlights.
Special pub.
K. G. Newell. Apr 84, 57p NBS/SP-675
Also available from Supt. of Docs as SN003-003-02572-1. Library of Congress catalog card no. 84-601028. See also PB83-207209.

Keywords: *Management analysis, *Participative management, *Standards, Professional personnel, Group dynamics, National government, *National Bureau of Standards, *Committees.

This report summarizes NBS standards committee activities and accomplishments during calendar year 1983. It profiles NBS staff participation on outside standards committees and highlights significant technical and individual contributions made by NBS staff.

700,058
PB85-100410 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Building Equipment Div.
Interim Design Guidelines for Automated Offices.
A. I. Rubin. Aug 84, 117p NBSIR-84/2908
Sponsored in part by Public Buildings Service, Washington, DC.

Keywords: *Office management, *Automation, Design criteria, Organization theory, Office equipment, Environmental engineering.

This report presents interim guidelines for the design of offices using automated technologies. The introduction of automated systems into offices has changed the office setting as a place to work. Architects and other design professionals have responded to this technology by formulating a variety of design strategies. This report identifies design issues which merit consideration in automated offices, tentative criteria for environments and systems based on an overview of all resources used to develop this document, and typical approaches used accomplish design goals. Technological, ergonomic and organizational factors are considered from the standpoint of design implications.

700,059
PB85-106151 PC **A24**/MF **A01**
Toth (R.B.) Associates, McLean, VA.
Standards Activities of Organizations in the United States.
Final rept.
R. B. Toth. Aug 84, 575p NBS/SP-681
Supersedes PB-249 542. Also available from Supt. of Docs. as SN003-02602-6. Library of Congress catalog card no. 84-601084.

Keywords: *Directories, *Organizations, *Management engineering, *Standardization, Standards, State government, National government, Technology, Social welfare, Criteria, United States, Private associations, Federal agencies.

This directory is a guide to mandatory and voluntary standards activities in the United States at Federal and state levels and by nongovernment (trade associations, technical and other professional societies). It excludes proprietary (company standards) and local levels of government (i.e., county and municipal). It supersedes the 1975 edition (NBS SP 417), 'Directory of United States Standardization Activities' and, for the first time, includes standards distributors, libraries, and information centers, and union lists of standards repositories by regional areas. It also lists organizations that no longer develop standards or have become defunct since the previous directory was issued. Over 750 current descriptive commentaries are formatted, with subject headings to facilitate access to specific information. The main sections cover nongovernment; Federal Government; state procurement offices; sources of standards documents and information; a subject index and related listings covering acronyms and initials, defunct bodies, and those organizations with name changes. Organizations have been included if they develop standards or contribute to the standardization process, whether voluntary or mandatory, or are sources of standards documents or information. An introductory section provides general information on Federal (including military) standards activities, a list of 20 major nongovernment standards developers, some historical notes, and an overview of U.S. (national) standardization activities.

700,060
PB85-143295 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Innovation in Residential Construction.
Final rept.
F. T. Ventre. 1979, 10p
Sponsored by Massachusetts Inst. of Tech., Cambridge.
Pub. in Technology Review 82, n2 p50-59 1979.

Keywords: *Buildings, *Construction industry, Management, Strategy, Regulations, Analyzing, Policies, Government policies, Reprints, *Technology innovation.

Conventional indirect measures of technological change in industry are shown to mislead analysts of the building industry. The result is a continuing popular and academic misreading of the industry. The diffusion of 14 innovations in the industry are measured empirically rather than inferentially and differences in diffusion rates are related to the industry's 'management' of those innovations. A joint public-private strategy for managing future innovations is suggested. A more detailed, technical version of this paper will appear in Volume 10 of Policy Sciences. The current version is intended for policy makers in industry and government.

700,061
PB86-102217 PC **A04**/MF **A01**
Maryland Univ., College Park. Dept. of Textiles and Consumer Economics.
Implementation of OMB (Office of Management and Budget) Circular A-119: An Independent Appraisal of Federal Participation in the Development and Use of Voluntary Standards.
Final rept.
S. M. Spivak. May 85, 74p NBS//GCR-85/495

Keywords: *Government policies, *Standards, Government procurement, Evaluation, *Voluntary standards, *Product standards, *Federal agencies, *Regulatory agencies, *OMB Circular A-119, Private organizations.

This study was commissioned by the Office of Product Standards Policy, National Bureau of Standards, as an independent appraisal of the implementation of OMB Circular A-119 (hereinafter referred to as 'A-119' or the 'Circular'). A-119 establishes Federal standards policy for agency participation in the development and use of voluntary standards. This current report is a compendium of numerous interviews and discussions with standards practitioners from both the public and private sectors. It is their collected expertise regarding implementation of A-119 which form the bases for many of the opinions and conclusions summarized herein.

700,062
PB86-122827 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Operations Research Div.
Benefit-Cost Analysis, Life-Cycle Costing and Value Engineering.
Final rept.
H. E. Marshall. 1984, 9p
Pub. in Proceedings of International Symposium on Building Economics (3rd), Ottawa, Canada, July 18-20, 1984, p15-23.

Keywords: *Benefit cost analysis, Cost analysis, Value engineering, Evaluation, Buildings, Economic analysis.

The common theme that ties together benefit-cost (BC), life-cycle (LCC), and value engineering (VE) analyses is that each is concerned with improving the allocation of resources. This overview of Session A defines some of the common types of economic analysis approaches used in building evaluations, discusses both how they are alike and different, identifies problem areas, and describes current research to overcome those problems. The overview is intended to provide some perspective of how the different types of analyses are related. Papers in Session A are cited to illustrate the points made in the overview.

700,063
PB86-136629 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Executive Guide to Software Maintenance.
W. M. Osborne. 1985, 35p NBS/SP-500/130
Paper copy available from Supt. of Docs. SN003-003-02685-9.

Management Practice

Keywords: *Management, *Management information systems, Maintenance, Costs, Executives, Guidelines, *Computer software, Software quality control, Computer program reliability, Software configuration management, Software tools, User needs.

The Guide provides answers to sixty-four key questions about software maintenance. It is designed for Federal executives and managers who have a responsibility for the planning and management of software projects. It is also intended for Federal staff members affected by, or involved in, making software changes and who need to be aware of steps that can reduce both the difficulty and cost of software maintenance.

700,064
PB86-187705 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Operations Research Div.
Advantages of the Adjusted Internal Rate of Return.
Final rept.
H. E. Marshall. Feb 86, 6p
Pub. in Jnl. of the American Association of Cost Engineers 28, n2 p32-37 Feb 86.

Keywords: *Budgeting, Economic analysis, Buildings, Project management, Reprints, Economic impact, *Adjusted internal rate of return, *Internal rate of return.

The internal rate of return is used frequently in evaluating the economic impacts of construction and other capital budgeting projects. Two versions of the internal rate of return are used. The first is the unadjusted internal rate of return (IRR), which has been most commonly used. It measures over the life of the project the return solely on the original investment, implying the same return on reinvestments of project cash flows as that earned on the original investment. The second less commonly used version, is the adjusted internal rate of return (AIRR). It measures over the life of the project the combined return on the original investment and on the reinvested earnings, allowing for the reinvestment rate(s) to differ from the rate earned on the original investment. The article defines IRR and AIRR; describes the controversy over which measure is better; compares methods for computing them; discusses assumptions implicit and explicit in their calculation; and describes the advantages of using AIRR instead of IRR. Appropriate applications of the AIRR and its limitations are also discussed.

700,065
PB86-231305 PC **A04**/MF **A01**
Michigan Univ., Ann Arbor. Graduate School of Business Administration.
Due-Date Based Scheduling in a Flexible Manufacturing System (The ATS).
R. V. Rachamadugu, N. Raman, and F. B. Talbot.
Mar 86, 73p NBS/GCR-86/514
See also PB86-232402. Sponsored by National Bureau of Standards, Gaithersburg, MD.

Keywords: *Scheduling, Production planning, Automation, Optimization, *Flexible manufacturing systems, Computer aided manufacturing.

The paper is part of an ongoing project to develop a real-time scheduling system for the Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards in Gaithersburg, Maryland. It investigates the dynamic scheduling of the Automatic Turning Station (ATS) at the AMRF. The manufacturing characteristics of the ATS include processing of jobs in batches, and changeover times between jobs of different part types. The performance of the ATS is measured by mean flow time, mean tardiness, proportion of tardy jobs and standard deviation of tardiness.

700,066
PB87-105276 PC **A09**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Revised Interim Design Guidelines for Automated Offices.
A. I. Rubin. Aug 86, 179p NBSIR-86/3430
See also PB85-100410. Sponsored by General Services Administration, Washington, DC.

Keywords: *Office management, *Automation, Ergonomics, Design criteria, Organization theory, Office equipment, Environmental engineering, Workstations, Communication systems.

The report is an update of an earlier design guideline (NBSIR 84-2908). It is based upon an additional literature search and interviews. The information should still be considered tentative, since they are still based on judgement and practice, not formal studies. The introduction of automation into offices has changed the office as a workplace. Architects and other design professionals have responded to this technology by employing a number of design strategies. This report identifies design issues which merit consideration by the designer and suggests criteria and approaches that might be used in automated office design. Technological, ergonomic and organizational factors are all considered from the standpoint of their design implications. The present document is a major revision of the earlier study, including more than twice the number of reference documents than its predecessor.

700,067
PB87-179719 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Guidance on Requirements Analysis for Office Automation Systems.
Special pub.,
L. S. Rosenthal, E. G. Parker, T. Landberg, and S. W. Watkins. Mar 87, 106p NBS/SP-500/147
See also PB81-152100. Also available from Supt. of Docs as SN003-003-02791-0. Library of Congress catalog card no. 87-619807.

Keywords: *Office management, *Office equipment, Planning, Benefit cost analysis, Automation, Requirements, Guidelines, Data processing, *Office automation, *Managers, Word processing, Computer applications, Analysis.

The report is designed to help managers maximize the benefits to be achieved through the application of office automation technologies. It presents a systematic planning method which will guide the manager to technology solutions which can improve the quality, efficiency, or effectiveness of an organization's products or services. Planning for office automation is accomplished through a requirements analysis study. The study can be initiated in response to installing office automation systems in a non-automated office or acquiring additional systems for an existing automated environment. The report provides guidance in the overall process of determining requirements for office automation systems.

Personnel Management, Labor Relations & Manpower Studies

700,068
AD-P002 923/1 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Vigilance Performance of Security Force Personnel.
A. Ramey-Smith, and S. T. Margulis. 1 Jun 81, 9p
Pub. in Proceedings of the Symposium on the Role of Behavioral Science in Physical Security (5th Annual) Held at Gaithersburg, MD., June 11-12, 1980, AD-A138 882, p91-99.

Keywords: *Security personnel, *Performance(Human), *Behavioral science, Training, Vigilance, Management planning and control, Perception(Psychology), Response. Component Reports, Physical security.

The research being performed by the National Bureau of Standards (NBS) for the Defense Nuclear Agency (DNA) involves two tasks. Overall, its goal is to assess those factors that influence the individual state of vigilance in an effort to identify methods to improve this aspect of guard force performance on a daily and long term basis. The first task in achieving this goal is an investigation of the influences of the work environment on performance. That is, an evaluation will be performed of the factors related to the physical characteristics of the task that affect human behavior. This will involve a human engineering study of the vigilance task of security force personnel. The second task of this project is to study the influences of the social environment on a guard force performance. This aspect of the project will involve a social psychological and environmental study of the vigilance task. These two aspects of vigilance performance, that is, human engineering and social/environmental, are related. Both interact todefine the ultimate effectiveness of the guard's performance in a watchkeeping task. However, each is very broad in nature.

700,069
PB-280 301/3 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Projecting the Age Distribution of Full-Time Permanent Professional Staff at the National Bureau of Standards.
Final rept.,
L. S. Joel. Mar 78, 71p NBSIR-78-1458

Keywords: *Professional personnel, Forecasting, Mathematical models, Data analysis, Personnel management, Markov processes, Manpower utilization, Government agencies, National government, *National Bureau of Standards.

This report presents a simple mathematical model to project the age distribution of the full-time permanent professional (FTPP) staff of the National Bureau of Standards. The report includes a brief description of types of models currently in use for manpower analyses, discussion of the probable data requirements for reliable models, some staff profile information which supplements material in recent administrative reports, and the description of our model. The principal projection is that under status quo assumptions, (FTPP staff size, age distribution of hires, and the separation rates from age cohorts remain constant) the FTPP staff will in about 25 years reach a steady-state age distribution with average age about 1/2 year higher than its current level (just over 42 years). Comparison of this distribution with the present one shows moderate increases in the fractions of staff in ages 21-30 and 51-60, a fractional rise in turnover, and a general decrease in the groups 31-50 years old. A near term effect is the intensified loss of senior scientists.

700,070
PB-284 591/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Research in the Federal Government.
Final rept.
J. R. Rosenblatt. Aug 78, 2p
Pub. in Newslett. Caucus Women Stat., v8 n3 p9-10 Aug 78.

Keywords: *Females, *Research projects, Statistical analysis, Professional personnel, Project management, Reprints.

Scientific research in a non-academic environment is described from the perspective of a mathematical statistician working as collaborator with physical scientists.

700,071
PB80-119100 Not available NTIS
National Bureau of Standards, Washington, DC.
Women and Minorities in the Computer Professions.
Final rept.,
H. M. Wood. Jun 79, 5p
Pub. in Proceedings of the National Computer Conference (1979) Held at New York, NY. on June 6, 1979, p419-424, Jun 79.

Keywords: *Females, *Minority groups, *Computer personnel, Employment, National government, Statistical analysis, Specialized training, Labor force.

The paper examines statistics concerning the status of women and minorities in computer-related professions, both in the private work force and in the Federal Government. U.S. and Federal scientific labor force statistics are presented in order to establish a framework for assessing the relative status of computer-related fields. The focus of this report is on labor market experience (e.g., employment and unemployment rates, relative salaries). Studies addressing discrimination, societal, cultural and other employment and utilization-related factors are referenced.

700,072
PB80-177447 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
NBS Staff Participation in Outside Standards Activities, 1979 Highlights.
Final rept.,
J. R. Debelius. Mar 80, 68p NBS-SP-573

Keywords: *Professional personnel, *Performance, National government, Participative management, Standards, National Bureau of Standards.

NBS uses a decentralized system for managing the participation of NBS representatives in outside standards committees activities. This type of management is governed by NBS policy; coordinated through standards offices in each NBS Major Organizational Unit; and monitored and supported by the Office of Standards Information, Analysis and Development (OSIAD). The report summarizes NBS' standards activities during calendar year 1979. It contains information on NBS staff participation on standards committees, highlights of significant technical and individual contributions made by NBS staff, a description of NBS standards management activities, and a directory of staff participating on committees.

700,073
PB81-220006 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Visual Acuity Testing of Radiographic Inspectors in Nondestructive Inspection.
Final rept.
G. T. Yonemura. Jun 81, 32p NBS-TN-1143

Keywords: *Visual acuity, *Nondestructive tests, Radiography, Professional personnel, Inspection, Standards.

Visual acuity tests for radiographic inspectors should be correlated with the type of tasks encountered in real world radiography. The testing procedures should be capable of assessing differences in day to day performance of a given inspector as well as the performance of one inspector relative to other inspectors. Single line targets with specific parametric values for contrast, width, and blur are recommended to provide a means for testing a radiographic inspector for visual acuity. These targets may be used for periodic tests by the employing organization or for more frequent self testing by the inspector. Statistics from the National Health Survey, procedures recommended by the NAS-NRC Committee on Vision and real world radiographs have been utilized in arriving at recommended test configurations.

700,074
PB83-193102 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Profiles of Computer Programmers in the Executive Branch of the Federal Government.
Final rept.
P. B. Powell. Mar 83, 83p NBSIR-82-2565

Keywords: *Computer personnel, *National government, Programmers, District of Columbia, Characteristics, Recruiting, Interviews, Information systems, Maryland, Virginia.

The report is a detailed programmer survey compiled from interviews with eight selected organizations and an OPM data base. The survey includes staffing, hardware, programming activities and languages, contract support, programmer recruiting, quality control, personnel profile, and programmer activities. The OPM data base is summarized by age, grade and education for Computer Specialists in the Washington Metropolitan Area.

700,075
PB86-196383 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Operations Research Div.
Implementation Plan - Internal Revenue Service Strategic Intiatives ERR-9 and ERR-11.
Rept. for Aug-Dec 85.
R. E. Schofer. Mar 86, 47p NBSIR-86/3336
Sponsored by Internal Revenue Service, Washington, DC.

Keywords: Implementation, Interviews, Recruiting, *Internal Revenue Service, Data collection, *Human resources, *Strategic planning.

The Internal Revenue Service (IRS) Strategic Plan is comprised of 55 Strategic Initiatives selected to prepare the Service for effective and efficient operation in the 1990's. Strategic Initiative ERR-9 addresses the development and use of a trend-analysis monitoring system for human resources planning; ERR-11 utilizes these data in development of recruitment plans for the Internal Revenue Service. The Phase-I Report presents the results of a review of human-resources planning requirements and a review of current research and development projects which impact human resources planning in the Internal Revenue Service. A ten-step plan for building and implementing a trend monitoring system for human resources planning is presented. The system also can be used to analyze operational issues which frequently must be addressed by the Personnel Division of IRS. The only recommendation for field collection of data pertains to a sample of exit interviews of departing employees and some interviews of first-line supervisors to measure attitudes. A bibliography is presented in the Appendix of the Report.

Productivity

700,076
PB80-147333 PC **A09**/MF **A01**
Wilson (J.W.) and Associates, Inc., Washington, DC.
Measurement of Electric Utility Productivity. Volume I and Usage and Evaluation.
Final rept.,
L. A. Merewitz, and R. E. Miller. Jan 80, 190p NBS-GCR-ETIP-79-81
Contract NSB-5-35894

Keywords: *Electric utilities, *Productivity, *Rates(Costs), *Work measurement, Performance evaluation, Econometrics, Technology innovation, Incentives, Regulations, Government policies, Data processing, Bibliographies, Cost analysis, Expenses, Economic analysis, Management methods.

The report is one of series in an Experimental Technology Incentives Program (ETIP) project that developed analytic and management tools designed to accelerate or to otherwise improve electric utility rate case decisions in state regulatory commissions. The objective was to provide incentives for technological innovation. The report describes the performance evaluation work performed in actual rate case settings where the methods were tested and modified in experimental approaches. The work focuses on factor productivity methods which combine rate analysis and econometic approaches, Volume I is an analytical report and Volume II is a user's guide to the computer software developed in the experiments. Usage of the work is described and evaluated as part of Volume I.

700,077
PB80-151202 PC **A11**/MF **A01**
Wilson (J.W.) and Associates, Inc., Washington, DC.
Measurement of Electric Utility Productivity. Volume II.
Final rept.,
R. A. Shepherd, and R. E. Miller. Jan 80, 248p NBS-GCR-ETIP-79-82
Contract NBS-5-35894
See also PB80-147333.

Keywords: *Electric utilities, *Productivity, *Rates(Costs), *Work measurement, Performance evaluation, Econometrics, Technology innovation, Incentives, Regulations, Government policies, Decision making, Computer programs, Documentation, Systems analysis, Cost analysis, Expenses, Economic analysis, Management methods.

The report is one of a series in an Experimental Technology Incentives Program (ETIP) project that developed analytic and management tools designed to accelerate or to otherwise improve electric utility rate case decisions in state regulatory commissions. The objective was to provide incentives for technological innovation. The report describes the performance evaluation work in actual rate case settings where the methods were tested and modified in experimental approaches. The work focuses on factor productivity methods which combine rate analysis and econometric approaches. Volume I is an analytical report and Volume II is a user's guide to the computer software developed in the experiments.

700,078
PB81-246803 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Research for Building Construction Productivity: Report on the June 2, 1981 Conference.
L. E. Alfeld. Aug 81, 27p NBS-GCR-81-331
Prepared in cooperation with Decision Dynamics, Inc., Reston, VA. Sponsored in part by Chamber of Commerce of the United States, Washington, DC.

Keywords: *Productivity, *Construction industry, Meetings, Requirements, Research projects, Risk, Cost analysis, Quality assurance.

The conference was held to identify major research needs to improve commercial construction productivity. Productivity measures the relative values of the product of construction, the building, and the time, labor and capital used to produce, operate and maintain it. Therefore, both cost reduction and quality improvement are important in improvement of productivity. Twenty-six participants, from all sectors of the construction industry, met as a roundtable group. Five prepared papers served to stimulate wide-ranging discussion.

700,079
PB83-125757 PC **A18**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Improving Organizational Productivity.
Final rept.
C. B. Wilson. Oct 82, 420p NBS-SP-500-95
Proceedings of the Computer Performance Evaluation Users Group (CPEUG) Meeting (18th) held October 25-28, 1982 at Washington, D.C. See also report dated Oct 80, PB81-106486. Library of Congress catalog card no. 82-600622.

Keywords: *Productivity, *Meetings, Information systems, Computer systems hardware, Personnel management, Management analysis, Resource allocation, Organization theory, *Computer performance evaluation, Computer software, Benchmarking.

These Proceedings record the papers that were presented at the Eighteenth Meeting of the Computer Performance Evaluation Users Group (CPEUG 82) held October 25-28, 1982, in Washington, DC. With the theme, Improving Organizational Productivity, CPEUG 82 reflects the critical role of information services in the productivity and survival of today's organization. To meet this challenge, the scope of CPE must be expanded to address performance issues in all aspects of information systems (hardware, software, facilities, communications, personnel, policies, and procedures) throughout the system life cycle. The program was divided into three parallel sessions and included technical papers on previously unpublished works, case studies, tutorials, and panels. Technical papers are presented in the Proceedings in their entirety.

700,080
PB83-192625 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Productivity Measurement for the Construction Industry.
Final rept.
S. F. Weber, and B. C. Lippiatt. Feb 83, 42p NBS-TN-1172

Keywords: *Productivity, *Construction industry, Input, Output, Economic analysis, Production rate, Performance, Work measurement.

The fundamental concept underlying all productivity measures is a comparison of the output of a production process, an enterprise, an industry, or an economy with the corresponding factors of production (inputs) required to generate that output. Productivity measures are formulated as a ratio of output to one or more of the inputs. This report evaluates alternative productivity measures and concludes that the comprehensive Total Factor Productivity (TFP) method is preferred to the Single Factor Productivity method. To combine the multiple components in the denominator of a TFP index, a weighting system based on relative factor cost shares is recommended. A measurable index of the instantaneous rate of change in TFP between two time periods is derived from a general production function. The report also investigates the specific data requirements for implementing this TFP measure in the construction industry. An annotated bibliography is included.

700,081
PB84-113984 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Measurement and Analysis of Productivity Growth: A Synthesis of Thought.
Final planning rept. no. 17.
A. N. Link. Sep 83, 40p NBS-SP-660
Prepared in cooperation with North Carolina Univ. at Greensboro. Library of Congress catalog card no. 83-600556.

Productivity

Keywords: *Productivity, *Personnel development, Quality of life, Employment, Technology, Research, Economic conditions.

Productivity is one of the most important factors influencing our economic wellbeing. Productivity growth is essential to a higher standard of living and is vital to a sound economic and political environment. However, there has been a slowdown in the growth of productivity in the United States since the mid-1960s. This slowdown has caused concern among policy makers and researchers. Accordingly, several questions persist both in policy and academic circles. Why has productivity been slowing; and What can be done to reverse this trend. The purpose of this report is to address broadly the first of these two questions by surveying and synthesizing the vast literature on the measurement and determinants of productivity. This review is intended to be a source document for those interested in the measurement and analysis of productivity growth.

700,082
PB85-111821 Not available NTIS
National Bureau of Standards, Washington, DC.
Concepts of Model Confidence.
Final rept.
S. I. Gass, and L. S. Joel. 1981, 6p
See also PB81-158164.
Pub. in Computers and Operations Research 8, n4 p341-346 1981.

Keywords: *Confidence limits, *Decision making, *Models, Validating, Criteria, Mathematical models, Meeting, Verifying.

This report discusses the concept of confidence in results obtained from decision-aiding models. Model confidence is viewed not as an attribute of a model, but of the model user. We argue that confidence in a model is a result of the accumulation of information, the sum total of which leads to a judgmental statement by the decision-maker. We offer an approach to the analysis of such information by defining seven criteria against which the information can be interpreted. For each criterion, a minimal level of 'information satisfaction' is assumed that represents the decision-maker's threshold value. The meeting of all the criteria values informs the decision-maker that the model results can be used with an acceptable level of confidence.

700,083
PB88-110770 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Defining 'Productivity'.
Final rept.,
S. F. Weber. 1984, 1p
Pub. in Batiment International: Building Research and Practice, p201 Jul/Aug 84.

Keywords: *Productivity, *Construction industry, Input, Output, Economic analysis, Performance, Production rate, Work measurement.

The article summarizes research on alternative productivity measures for the construction industry. The shortcomings of the most widely used approach, the single factor productivity index, are discussed. The more comprehensive approach, called total factor productivity, is described. The specific recommendation is to use a total factor productivity index with relative input cost shares applied as weights to combine the input quantities.

Public Administration & Government

700,084
FIPS PUB 95 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Codes for the Identification of Federal and Federally-Assisted Organizations. Federal General Data Standard Representations and Codes.
Federal information processing standards (Final).
R. G. Saltman. 23 Dec 82, 80p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Coding, *Organizations, National government, Standards, *Federal agencies, *Federal information processing standards.

This Standard provides a four-character identifier for each organization listed. The two leftmost characters form a component data element, called the Treasury Agency Symbol (TAS), which is identical to the two-digit numerical code used in the budgetary process to identify major Federal agencies. Organizations that are related by a common budgetary appropriation usually have the same TAS code. Organizations identified in this Standard include legislative, judicial, and executive branch agencies, as well as those Federal-State, interstate, and international organizations that receive budgetary support. Government-sponsored enterprises and certain Federally-aided organizations are included also. Provision is made for the inclusion of additional categories or organizations.

700,085
PB-277 539/3 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
Decision Model for U.S. Computer Export Administration, A Preliminary Investigation.
Final rept.,
P. L. Eagan. Feb 78, 23p NBSIR-78-1435

Keywords: *Exports, *Computers, *Management, *Mathematical models, Design, National security, Economic factors, Government policies, United States government, USSR, Decision making, Strategic intelligence, Statistical decision theory, International trade, Control, Decision models.

This is a preliminary report on the feasibility of designing a statistical decision model of U.S. computer export administration. The study is based upon interviews with U.S. government officials involved in export administration and with academic analysts of U.S. and Soviet decision-making. Published materials related to East-West trade in high technology were also consulted. The report addresses three general questions: (1) Is a statistical decision model of U.S. computer export administration feasible; (2) What method(s) will be required in developing a model; (3) How can the model assist those responsible for U.S. computer export administration. Interviews and research materials indicate that a decision model of U.S. computer export is feasible. The major difficulty in designing such a model arises from the lack of commensurable indicators of the national security. Political and economic priorities are at stake in computer export administration. Without comparable measures of these priorities, operational utility statements for a decision model must be derived from estimates and informed value judgments of persons having substantive expertise in the strategic, political, and economic ramifications of U.S. high technology exports.

700,086
PB-280 421/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Experimental Incentives for National Procurement Policies.
Final rept.,
J. G. Berke. Oct 76, 5p
Sponsored in part by American Society for Testing and Materials, Philadelphia, Pa.
Pub. in Standards News, v4 n10 p13-17 Oct 76.

Keywords: *Product development, *Technology innovation, *Government procurement, Policies, Incentives, Local government, State government, National government, Purchasing, Life cycle costs, Federal agencies.

An overview of the Experimental Technology Incentives Program (ETIP) at NBS is presented. More specific description of the procurement policy area, the objectives and philosophy of operation is given. Details about specific product and systems experiment with major Federal, state and local procurement agencies such as Federal Supply Service of GSA, Veterans Administration, National Institute of Governmental Purchasing, National Association of State Purchasing Officials are described. Examples are given of purchases of applicances using LCC and on product suggestions supplied under Value Incentive clauses in procurement documents.

700,087
PB-295 838/7 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Office of International Relations.
Report to AID on an NBS/AID Course on Weights and Measures Services.
Final rept.
H. S. Peiser, C. C. Raley, and A. D. Tholen. Apr 79, 63p NBSIR-79-1721
Grant PASA-TA(CE)-6-71

Keywords: *Education, *Weight measurement, *Measurement, Weight(Mass), Metric system, Foreign countries, International relations, Liquefied petroleum gases, Meteorology, Industries, Personnel development, Evaluation.

The object of the course was to give weights and measures officials of industrializing nations insight into the weights and measures systems of the United States and the role of the National Bureau of Standards, so that these officials might consider what parts of the U.S. system might usefully be adapted to conditions in their home countries. An exchange of experience in each of the participant's countries was presented by delivered papers which are reproduced here. Countries represented included Argentina, Ecuador, Indonesia, Jamaica, Jordan, Kenya, Korea, Morocco, Panama, Philippines, and Sudan.

700,088
PB-298 446/6 PC **A06**/MF **A01**
Urban Inst., Washington, DC.
Regulatory Administrative Experiment Manual.
Interim rept.
J. N. Nay, and J. Waller. Jun 79, 118p NBS-GCR-ETIP-79-64
Contract NBS-7-35822

Keywords: *Public administration, *Regulations, Government policies, Technology innovation, Incentives, Evaluation, Experimental design, Reporting, Organization theory, Information needs, Agencies.

The document is an interim repository of material related to methods and processes for carrying out regulatory administrative experiments. It is one product of the Regulatory Processes and Effects (RPE) Project of the Experimental Technology Incentives Program (ETIP). The first two chapters provide an introduction to ETIP, the specific program involved, and the RPE project. Chapter III describes Evaluability Assessment, one of the methods used in this work. Chapter IV outlines the general approach to carrying out the work. The last chapter is an outline for reporting on interim progress of experimental situations. Two appendices are included.

700,089
PB-298 631/3 PC **A09**/MF **A01**
Urban Inst., Washington, DC.
Regulatory Processes and Effects Project.
Final rept.
J. N. Nay, and W. Frederick. Jun 79, 183p NBS-GCR-ETIP-79-65
Contract NBS-7-35822

Keywords: *Regulations, *Technology innovation, *Industries, Government policies, Impact, Incentives, Decision making, National government, Environments, Health, Utilities, Commerce, Nuclear energy, Research, Industrial technology, Agencies, Research and development.

The document is a summary of progress on the Center for Field Method's (ETIP) Regulatory Processes and Effects Project (RPE). The RPE project is working to analyze the effects of changes in regulatory processes on industrial innovation. Chapter I provides an overview of the project. Chapter II contains brief descriptions of each of ten regulatory situations included in the first year's work. The regulatory contexts and experimental changes are described together with a report on progress, implications of the work to date, and a listing of possible next steps. The final chapter describes implications for the future RPE project work. A number of detailed reports on specific regulatory situations are referenced in Chapter II.

700,090
PB-299 006/7 PC **A06**/MF **A01**
Public Interest Economics Center, Washington, DC.

Exploration of Regulatory Incentives for Innovation: Six Case Studies.
Final rept.
J. Booth, and Z. Cook. Aug 79, 110p NBS-GCR-ETIP-79-66

Keywords: *National government, *Regulations, *Incentives, *Technology innovation, Industries, Taxes, Environmental impacts, Legislation, Government policies, Standards, Economic impact, Social effect, Research, Commerce, *Industrial technology, Antitrust laws, Research development.

The document is an overview and synthesis of six feasibility explorations of changes in Federal regulation which might stimulate industrial innovation. Each case looks at a specific regulatory situation to identify a change which could be experimentally implemented in the present system to gage actual impacts on industrial innovation. These changes include compliance delays, effluent taxes and anti-trust exemptions. Because the underlying regulations have changed in some cases since the studies were completed, epilogues update the current regulatory situation.

700,091
PB-300 491/8 PC **A06**/MF **A01**
Assessment Group, Santa Monica, CA.
International Activities: The Fiscal Year 1978 Survey of International Programs at NEL.
S. Kramer, and M. Olmert. Aug 79, 122p NBSIR-79-1792

Keywords: *Laboratories, *National government, International relations, Exchanging, Technology innovation, Scientists, Engineering, Technology transfer, Cooperation, Directories.

The report presents a survey of a major phase of the international activities of the National Engineering Laboratoty (NEL), NBS, for the Fiscal Year 1978. There are a number of media through which international activities are conducted. The first of these is the formal visit by one or more NEL staffers to a foreign research organization or conference. The second category covers visits by foreign government scientists and research insjtitutions to the NBS facilities. Other media include exchange visits and the hosting of overseas guest workers at NBS. Although this report covers only the first category, some significant and gratifying contributions to international technical progress are detailed here. The report is organized by countries, international organizations and conferences. NEL professional staff involved in these activities are readily identified. The report is intended to serve as a directory and reference document for all those who seek information on the international activities of the National Engineering Laboratory, NBS.

700,092
PB-300 666/5 PC **A08**/MF **A01**
Department of Commerce, Washington, DC. Office of Product Standards.
Experience with the Department of Commerce Voluntary Consumer Product Information Labeling Program.
Final rept.
Aug 79, 154p
Prepared in cooperation with National Bureau of Standards, Washington, DC.

Keywords: *Consumers, *Information systems, Project planning, Policies, Standards, Marking, Testing, National government, Government agencies, Department of Commerce.

This comprehensive report describes the origin of the Voluntary Consumer Product Information Labeling Program (CPILP), the problems it encountered, and the reasons why it was suspended before sufficient evidence had been gained so as to adequately evaluate the program on its merits.

700,093
PB80-119803 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
National Bureau of Standards: A National Resource for Science and Technology, Fiscal Year 1978.
Final rept.,
M. Heyman. Jul 79, 89p NBS/SP-538

Keywords: *National government, *Laboratories, Standards, Computers, Environments, Productivity, Measurement, Medical equipment, Safety, Public health, Technology transfer, Quality, National Bureau of Standards.

The report highlights key accomplishments of the National Bureau of Standards during fiscal year 1978. NBS is the Nation's central reference laboratory for measurements in the physical sciences and engineering. The Bureau is a source of reference materials, data, standards, and technical guidelines needed to improve measurement techniques; it is also an independent government source for objective and technical research. This year's report includes summaries of NBS research on basic measurement improvement, electromagnetic interference, medical aids, consumer product safety, fire, building technology, nuclear safeguards, and energy. It details work on corrosion and other materials research, semiconductor technology, automation and computers, and environmental research. Also listed are the services and special programs which NBS offers, a review of NBS funds and facilities, and a summary of important legislation affecting NBS.

700,094
PB80-177967 Not available NTIS
National Bureau of Standards, Washington, DC.
National Bureau of Standards and the Individual Inventer.
Final rept.,
J. Rabinow. 13 Aug 79, 5p
Pub. in Proceedings of the Conference on Innovation, Entrepreneurship and the University, University of California, Santa Cruz, California, November 8-10, 1978, CIED Publ. p83-87, 13 Aug 79.

Keywords: *Inventions, *Technology assessment, Evaluation, Government policies, Technology innovation, Standards, Assessments, Energy, Meetings, Entrepreneurship.

The talk outlines the program of evaluating inventions submitted to the National Bureau of Standard's Office of Energy-Related Inventions. A brief history of the now defunct National Inventors Council is included.

700,095
PB80-199441 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Office of International Relations.
NBS/AID/PCSIR (Pakistan Council of Scientific and Industrial Research) Survey on Standardization and Measurement Services in Pakistan.
Final rept.,
H. S. Peiser, T. M. Manakas, and P. M. Odar. Jun 80, 116p NBSIR-80-2051
Grant PASA-TA(CE)-5-71

Keywords: *Standardization, *Measurement, *Pakistan, Standards, Temperature, Surveys, Meteorology, Units of measurement, Corporations, Technological intelligence, Weights and measures.

Following similar projects conducted by the National Bureau of Standards in other countries, the Ministry of Science and Technology of Pakistan and under it the Pakistan Council of Scientific and Industrial Research invited NBS to organize a six-man international team of experts in selected topics of metrology to advise on the adequacy and needs for standards and measurement services and to comment upon the plan to establish a new laboratory in Islamabad which would be the primary national standards body under the title of National Physical and Standards Laboratory. The team strongly endorsed the NPSL plan, having found every indication that a national focal point for good measurements appeared as a critical need for Pakistan's development. A summarizing letter of conclusions and recommendations is reproduced with other recommendations and relative remarks by visiting team members (Section III). For readers not familiar with Pakistan, Sections V and VI give some background on science and technology in Pakistan.

700,096
PB80-202575 PC **A08**/MF **A01**
Performance Development Inst., Washington, DC.
Interim Report on Potential ICC/ETIP (Interstate Commerce Commission/Experimental Technology Incentives Program) Administrative Experiments,
M. Mulkey, W. Frederick, and D. Fulmer. Mar 80, 170p NBS-GCR-ETIP-80-85
Contract NBS-7-35822

Keywords: *Rail transportation, *Cargo transportation, *Fruits, *Vegetables, *Regulations, Government policies, National government, Technology innovation, Commerce, Economic impacts, Interstate Commerce Commission.

The document describes work performed toward evaluating the commercial effects and implications for innovation of the recent decision of the Interstate Commerce Commission (ICC) to exempt railroad transportation of fresh fruits and vegetables from regulation. The first chapter provides an introduction and summary. Chapter II describes the historical background of ETIP's work in the area of regulation and freight transportation innovation, and the genesis of ICC's regulatory exemption for rail transportation of fresh produce. Chapter III discusses expectations, concerns and issues related to this exemption, and the environment for change in fresh produce rail transportation operations. Chapter IV addresses possible effects of the exemption on the ICC and in the commercial sector. Chapter V discusses other areas of transportation regulatory change which may be appropriate for study by ETIP.

700,097
PB80-226327 PC **A08**/MF **A01**
Charles River Associates, Inc., Boston, MA.
Innovation, Competition, and Government Policy: A Framework for Analysis.
Final rept.
Sep 80, 168p CRA-430, NBS-GCR-ETIP-80-92
Contract NBS-78-3600

Keywords: *Competition, *Technology innovation, *Government policies, Public administration, Incentives, Planning, Objectives, Organization theory, Resource allocations, Performance evaluation, Capital, Research and development, Antitrust laws.

The study has the following objectives: (1) to develop a methodology that policy makers can use to gain an increased understanding of the relationships between federal policies and the behavior and performance of firms in technology-based industries; (2) to test and refine this methodology; (3) to identify important policy problems; and (4) to design policy experiments.

700,098
PB81-120362 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Performance vs. Design Standards.
Final rept.
D. Hemenway. Oct 80, 44p NBS-GCR-80-287

Keywords: *Performance standards, *Design standards, *Government policies, National government, Design criteria, Specifications, Safety, Regulations, Economic analysis, Automobiles, Technology innovation, Competition, National Bureau of Standards, Health care.

The report compares and contrasts performance and design standards from an economic perspective. The research consisted of a careful examination of the literature and interviews with interested NBS personnel. The paper describes the characteristics of performance standards, explains why they are not used more often, and discusses particular areas where they may be appropriate. The report examines the design versus performance issue in automobile regulation and health care. There are suggestions for further NBS action to promote performance standards, and a listing of areas for further research. Nine brief cases at the end of the paper illustrate points made in the main text.

700,099
PB81-138661 Not available NTIS
National Bureau of Standards, Washington, DC.
Developing Recommendations to Improve Quality Assurance for Federal Monitoring Programs.
J. D. Buffington, and W. H. Kirchhoff. 1979, 6p
Pub. in Proceedings of the National Conference on Quality Assurance of Environmental Measurements Held at Denver, CO. on Nov 27-29, 1978, p1-6 1979.

Keywords: *Quality assurance, Environmental surveys, Coordination, Quality control, National government, *Environmental monitoring, *Data management, Agencies, Interagency coordination.

Responding to a Presidential directive, the council on Environmental quality (CEQ) is heading an Interagency Task Force to review Federal programs for environmental data and management and to recommend paths of action that can be taken to improve the effectiveness and efficiency of such programs. The Task Force has been at work for nearly a year and has involved nearly 200 people from more than 20 agencies. Reports and recommendations are not complete, but several common elements appear in the first draft re-

ports: (1) Agencies generally need to have control of their own programs, including the elements of data management and quality assurance; (2) There is need for oversight to make sure there is adequate coordination among agency programs and adequate quality assurance; (3) Agencies are reluctant to accept oversight placed in another agency.

700,100
PB81-175986 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
National Bureau of Standards 1980.
G. Porter. Jan 81, 45p NBS/SP-600

Keywords: *Laboratories, *National government, Standardization, Research, Construction, Calibrating, Computers, Energy, Environments, Fire safety, Productivity, Materials, Technology transfer.

National Bureau of Standards 1980 explains the Bureau's role as the central U.S. reference laboratory for the physical and engineering sciences. It also discusses briefly Bureau plans for its programs in electronics, automation, chemical processing, and materials research. Included in the report are highlights of recent accomplishments within the Bureau's National Measurement Laboratory, National Engineering Laboratory, and Institute for Computer Sciences and Technology. It describes more than 40 different projects in such areas as basic measurements and standards, energy research, environmental measurements, materials properties, industrial productivity, fire safety, building technology, calibration methods, and computer standards and guidelines. Also featured are summaries of NBS services to industry, other government agencies, and the public, as well as information on cooperative research programs and a directory of the names, titles, and phone numbers of NBS research managers.

700,101
PB82-135880 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Consumer Representation in Standards Development: Literature Review and Issue Identification.
Final rept.
M. A. Breitenberg, and R. G. Atkins. Sep 81, 79p NBSIR-81-2336
Sponsored in part by Food and Drug Administration, Silver Spring, MD. Bureau of Medical Devices.

Keywords: *Citizen participation, *Standardization, Product development, Decision making, National government, Medical equipment, Bibliographies, Literature surveys, Food and Drug Administration.

The report identifies for possible future study the major issues associated with the topic of consumer representation in the development of voluntary standards. The key terms (consumer and consumer representative) used in the report are defined, and background information on the Food and Drug Administration's medical device standards program is given. The report discusses important recent developments in consumer involvement in government and standards organization decisionmaking, and contains a review of Federal public participation programs. The literature on consumer representation is reviewed from the perspective of standards-developing groups and consumer organizations and the most salient documents are annotated. Based upon the available literature, supplemented by information obtained from personal contacts with affected parties, the major outstanding issues are summarized.

700,102
PB82-241365 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Science and Technology: The Challenges of the Future.
D. R. Johnson. May 82, 88p NBS-SP-627
Library of Congress catalog card no. 82-600544. Proceedings of the NBS 80th Anniversary Colloquium Series. February-March 1981.

Keywords: *Research management, *National government, Industries, Computers, Technology, Cooperation, Foreign countries, Productivity, Forecasting.

Challenges to science and technology in the 1980s are discussed in a series of six lectures by distinguished speakers. In the first lecture, Dr. Lewis Branscomb, Vice President and Chief Scientist of IBM, discusses the roles of the Department of Commerce and the National Science Foundation in the future. Mr. William Carey, Executive Officer, AAAS, follows with his views on the interrelationships between Government, science and the society in the 80s. Dr. Arthur Bueche, Senior Vice President, General Electric Company, focuses specifically on Government-industry relationships in the 1980s. In the next lecture, Dr. Arno Penzias of Bell Laboratories shares his thoughts and ideas about managing research in a changing environment. Mr. William Miller, President and Chief Executive Officer of SRI International, then discusses the national technological edge that the United States possesses in computer software. In the last lecture, Professor Richard Nelson of Yale University relates technological advantages to productivity and growth from an economical point of view.

700,103
PB83-134486 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. Experimental Technology Incentives Program.
Government and Innovation: Experimenting with Change (The Final Report of the Experimental Technology Incentives Program).
R. Hebert, and R. Hoar. Dec 82, 157p NBS-GCR-ETIP-82-100

Keywords: *National government, *Government policies, *Technology innovation, Research projects, Project management, Regulations, Procurement, Federal assistance programs, Industries, Businesses, Research and development.

This final report of the Experimental Technology Incentives Program (ETIP) contains a brief history of the program, a description of the major projects and accomplishments, a listing of lessons learned and a sampling of outside views and opinions of the program's strengths and weaknesses. An appendix contains a list of all projects (numbered sequentially) and published reports. The appendix also describes the process by which greater project detail and data can be obtained.

700,104
PB83-134494 PC **A16**/MF **A01**
National Bureau of Standards, Washington, DC. Experimental Technology Incentives Program.
Innovation in State Public Utility Commissions: An Exploratory Study of Techniques in Energy Regulation.
Final rept.
K. R. Flaherty. Jun 80, 372p NBSIR-80-2046

Keywords: *Technology innovation, *National government, Electric utilities, Regulations, Control, Systems analysis, Productivity, Computer programming, State government.

The research described in this study explores the implementation issue of four techniques in electric utility rate regulation by state public utility commissions. The techniques, considered innovations not previously used by a given state public utility commission, were advanced by the Experimental Technology Incentives Program in a project which explored regulatory lag and other hypotheses about the effect of regulatory improvements on technology.

700,105
PB83-231597 PC **A03**/MF **A01**
National Research Council, Washington, DC. Assembly of Mathematical and Physical Sciences.
Evaluative Report on the Institute for Applied Technology, National Bureau of Standards - Fiscal Year 1976.
Annual rept.
1977, 43p
Contract NBS-3-35701
See also PB83-231605.

Keywords: *Performance evaluation, *Technology innovation, Construction, Fire safety, *Federal agencies, *Institute for Applied Technology, Research and development, Consumer protection.

The Institute for Applied Technology (IAT), one of the major organizational units of the National Bureau of Standards, is concerned with developing technology and applying it to such areas as building research, fire research and safety, consumer product safety and performance, and electronic technology. Although much of its work is in support of other federal agencies, the Institute also provides technical assistance to state and local governments and to national and international standards-writing organizations in the development of standards. This report covers activities of the Institute during the 12 months preceding the Panel meeting on May 4-5, 1976.

700,106
PB83-231605 PC **A04**/MF **A01**
National Research Council, Washington, DC. Assembly of Mathematical and Physical Sciences.
Evaluative Report on the Institute for Applied Technology, National Bureau of Standards - Fiscal Year 1977.
Annual rept.
1978, 58p
Sponsored in part by National Bureau of Standards, Washington, DC.

Keywords: *Technology, Standards, Electronics, Buildings, Fires, *National Bureau of Standards, *Institute for Applied Technology, Energy conservation, Consumer products.

Contents: General Information; Reports of the Evaluation Panels--Institute for Applied Technology (400.00), Energy Conservation Programs, Standards Application and Analysis Division (401.00), Electronic Technology Division (425.00), Center for Consumer Product Technology (440.00), Center for Building Technology (460.00), Center for Fire Research (490.00).

700,107
PB86-111903 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
Public Sector-Private Sector Standards Interface in the U.S.
Final rept.
D. R. Mackay. 1982, 5p
Sponsored by Standards Engineering Society, Inc., Minneapolis, MN.
Pub. in Proceedings of Annual Conference of the Standards Engineering Society (31st), Ottawa, Ontario (Canada) on September 20-22, 1982, p56-60.

Keywords: *Standards, Policies, *Federal government, Trade Agreements Act.

The paper describes the early history of the involvement of Federal agencies in voluntary standards activities and the recent developments which have modified the respective roles of private sector organizations and public sector agencies. The impacts of the National Policy in Standards, OMB Circular A-119, the U.S. Trade Agreements Act on the private sector-public sector standards interface are discussed.

700,108
PB86-119195 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Operations Research Div.
Budget Estimates for Replacement of Plant and Facility Equipment at the National Bureau of Standards.
Final rept.
P. T. Chen, and R. E. Chapman. 1981, 17p
Pub. in ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Transactions 87, n1 p1243-1259 1981.

Keywords: *Budget estimates, *Maintenance, *Equipment replacement, Buildings, Cost analysis, Obsolete equipment, Renovating, Reprints, *National Bureau of Standards.

The study develops a framework, based on service life distributions fitted to data from a published survey, for dealing with the 'replacement problem.' Service life distributions are used to develop replacement schedules for approximately 50 major plant and facility equipment items at the National Bureau of Standards (NBS). The costs associated with these replacement schedules are estimated on an annual basis over a ten-year planning horizon using a probabilistic cost model. Estimates from this model are intended for use in budgeting for replacements over the planning horizon. The results of this study indicate that approximately $11 million (all estimates are in first quarter 1980 dollars) will be needed to meet expected replacements during fiscal years 1982 through 1991 at the NBS Gaithersburg site.

700,109
PB87-114641 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Physical Measurement Services.

National Bureau of Standards (NBS) Policy on the Use of Its Name in Advertising.
Final rept.
L. J. Kieffer. 1982, 2p
Pub. in NCSL Newsletter 22, n1 p12-13 Mar 82.

Keywords: *Advertising, Policies, Reprints, *National Bureau of Standards.

The information contained in NBS Letter Circular 1128, 'NBS Policy on Use of Its Name in Advertising,' is quoted. Additional information and discussion are presented to help explain and clarify the policy.

700,110

PB87-151973 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Program Office.
Infratechnologies and the Role of Government.
Final rept.,
G. Tassey. 1982, 18p
Pub. in Technological Forecasting and Social Change 21, p163-180 1982.

Keywords: *National government, *Industries, *Technology innovation, Policies, Infratechnologies, Commodities.

Government support of technological change is a complex issue because barriers resulting in underinvestment exist to some degree in most industries, so difficult allocation decisions for limited government resources are necessary. The structure and timing of government support is further complicated because in any one technological area, the nature and severity of underinvestment phenomena vary during the evolution or life cycles of the relevant industries. The paper focuses on the methods and rationale for government support of two elements in industrial technology, generic technology, from which specific products and processes (i.e., innovations) are derived, and 'infratechnologies', which are necessary for the evolution of the generic technology and its applications. Particular emphasis is given to infratechnologies because they are largely supplied by sources outside the industry and have consequently been largely overlooked in previous discussions of industrial policy. A case study of one major source of infratechnology, including quantitative estimates of industry impacts, is presented.

700,111

PB87-165163 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Internal Revenue Service Post-of-Duty Location Modeling System - Programmer's Manual for Pascal Solver,
P. D. Domich, R. H. F. Jackson, and M. A. McClain.
Feb 87, 62p NBSIR-86/3472
Sponsored by Internal Revenue Service, Washington, DC.

Keywords: *Site surveys, *Facilities management, *Programming manuals, *Regional planning, *Fixed costs, *Mathematical models, Lagrangian functions, Microcomputers, Data displays, Computer graphics, Optimization, Travel, Cost engineering, *Site selection, *Internal Revenue Service, *Government agencies, *PASCAL subroutine, *Fortran subroutine.

The report is a programmer's manual for a microcomputer system designed at the National Bureau of Standards for selecting optimal locations of IRS Posts-of-Duty. The mathematical model is the uncapacitated, fixed charge, facility location model which minimizes travel and facility costs. The package consists of two sections of code, one in FORTRAN and the other in PASCAL. The FORTRAN driver handles graphics displays and controls input and output for the solution procedure. The report discusses the mathematical techniques used to solve the mathematical model developed and includes a Greedy procedure, an Interchange procedure, and a Lagrangian approach to the related linear program. A description of these PASCAL routines and definitions of key data structures and variables are provided.

700,112

PB87-165171 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Internal Revenue Service Post-of-Duty Location Modeling System - Programmer's Manual for Fortran Driver,
P. D. Domich, R. H. F. Jackson, and M. A. McClain.
Feb 87, 55p NBSIR-86/3473
Sponsored by Internal Revenue Service, Washington, DC.

Keywords: *Site surveys, *Facilities management, *Regional planning, Programming manuals, Data displays, Microcomputers, Computer graphics, Cost engineering, *Site selection, *Government agencies, *Internal Revenue Service, Personal computers, PASCAL subroutines, Fortran subroutines, Costs.

The report is a programmer's manual for a microcomputer package which was designed by the National Bureau of Standards to assist the Internal Revenue Service in choosing locations for its posts-of-duty which will minimize costs to the IRS and to the taxpayer. The package was written in two sections of code, one in FORTRAN and the other in PASCAL. The manual describes the FORTRAN driver which handles graphics displays and controls input and output for the solution procedures.

Research Program Administration & Technology Transfer

700,113

PB-262 123/3 PC **A99**/MF **A01**
RAND Corp., Santa Monica, CA.
Analysis of Federally Funded Demonstration Projects. Volume 3: Supporting Case Studies.
Final rept.,
W. Baer, C. J. Conover, C. Cook, P. Fleischauer, and B. Goeller. Apr 76, 798p NBS-GCR-ETIP-76-07
Contract NBS-4-35959
See also Volume 2, PB-253 918.

Keywords: *Project planning, *Technology innovation, *Guidelines, *Federal assistance programs, Benefit cost analysis, Experimental design, Methodology, Criteria, Management, Monitoring, Evaluation, Time, Systems analysis, Grants, Nuclear powered ships, Solid waste disposal, Housing planning, Prosthetic devices, Medical services, Fish protein concentrates, Desalting, Passenger transportation, Materials recovery, Fuels, Case studies, Demonstration projects.

As a part of its program with respect to the funding of civilian research and development by the Federal Government, the Experimental Technology Incentives Program of the National Bureau of Standards awarded a contract to RAND, Santa Monica, CA, to conduct a study aimed 'To develop cost benefit and market/industrial/institutional criteria and guidelines for the use of Federally procured demonstration projects as catalysts for technological change.' This volume provides details of individual supporting case studies.

700,114

PB-267 037/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
When Science and Technology Stumble, Everyone Suffers,
R. M. Davis. 1976, 17p
Pub. in Proceedings Rockefeller University Anniversary Symposium (75th), New York, N.Y., March 8, 1976. Paper in Beyond Tomorrow. Trends and Prospects in Medical Science, Session III, p87-103 1976.

Keywords: *Technology, *Public relations, *Management planning, Social change, Surveys, Constraints, Development.

This paper looks at the decline of science and technology today and briefly traces some historical developments which have impacted on science and technology. Rapid communications and the application of technology have been effective in speeding up the rate of change in society. As a result, institutional barriers to thwart technological change and protect special interests have developed. Restoring public confidence in science and technology so as to bring about a better society will require changes in the interactions of government, science, technology, special-interest institutions and the individual. The issue of public control over the pace and direction of science must be settled, and attention must be paid to the need for scientific safeguards and preventive technology.

700,115

PB-268 491/8 PC **A08**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Science and Technology in America. An Assessment.
Final rept.,
E. Teller, N. Ramsey, W. O. Baker, H. Eyring, R. M. Thomson, G. Birkhoff, A. Perlis, R. C. Seamans, and S. Ramo. Jun 77, 165p NBS-SP-465
Library of Congress Catalog Card no. 76-600073.

Keywords: *Research, *Technology, *Organizations, Projects, Evaluation, Predictions, Materials, Chemistry, Applications of mathematics, Computers, Energy, Engineering, Quantum theory, Utilization, United States, Technology assessment, National Bureau of Standards, Science and technology, Anniversaries.

On the occasion of its 75th anniversary, the National Bureau of Standards presented a series of eight lectures by distinguished scientists and engineers assessing the current state and future prospects of broad physical sciences and technologies which underlie the mission of NBS and which also relate to many other technological issues of national concern.

700,116

PB-272 191/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Coping with Future Technology.
Final rept.
H. E. Sorrows. 1977, 2p
Pub. in Commerce Am. II, n20 p4-5, 26 Sep 77.

Keywords: *Technology, *Economic development, Trends, Requirements, Constraints, Recommendations, Technology innovation, United States, Econometrics, Free enterprise, Reprints.

Technology has been a primary determinant of U.S. economic growth and is essential to the continued health and vigor of the U.S. free enterprise system. Adverse technology based trends are now stifling further U.S. technological growth and threaten our economic vitality. An aggressive collaboration between industry, government and academia is called for to attack developing problems. This partnership should identify and foster critically needed technology whose development is inhibited by lack of skills or by lack of necessary private sector incentives.

700,117

PB-280 594/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Automatic Typewriter Studies.
Final rept.,
R. C. Oman. Apr 78, 6p
Pub. in Jnl. of System Management 29, n4 p18-23, Apr 78.

Keywords: *Research management, *Office machines, Automatic typewriters, Cost effectiveness, Surveys, Procurement, Decision making, Methodology, Reprints, Workload.

This report discusses four alternative methods for gathering information about typing workload when considering the replacement of conventional typewriters with automated typing equipment. Some of the advantages and disadvantages of the four methods are presented. The cost of conducting one such study is compared to automated equipment cost.

700,118

PB-285 481/8 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C.
NBS Special Foreign Currency Program in Yugoslavia 1973-1978,
D. M. Bluebond, R. S. Marvin, and H. S. Peiser. Sep 78, 86p NBS-TN-986
See also report for 1971-1972, COM-73-50183.

Keywords: *Yugoslavia, *Grants, National government, Research programs, Foreign countries, *National Bureau of Standards, *Special Foreign Currency Program, Federal agencies, Public Law 480.

An overview is given of grants awarded by the National Bureau of Standards under the Special Foreign Currency Program (SFCP) or by the U.S.-Yugoslav Joint Board. Each grant is identified by title, principal investigator, institution in Yugoslavia, NBS monitor, and the Monitor's organizational unit within NBS. The work is then described briefly under the three headings 'Sum-

mary Description of Project Goals,' 'Results and Implications to Date,' and 'List of Publications that Resulted from the Project.' To demonstrate the relevance of such grants to the programs of NBS, the grant descriptions are ordered by NBS institutes and divisions. The significance and purpose of the NBS/SFCP grant programs are discussed in the Foreword and the Introduction. The NBS monitors and the program manager judge this grant program to have had a high benefit to cost ratio from the viewpoint of NBS.

700,119
PB-287 335/4 PC **A04**/MF **A01**
Research Corp., New York.
Stimulating Invention Disclosures by Faculty Researchers. A Guide for the University Invention Administrator.
Oct 78, 64p
Grant NSF-RMI74-19416
Sponsored in part by National Bureau of Standards, Washington, DC. Experimental Technology Incentives program.

Keywords: *Universities, *Inventions, Professional personnel, Creativity, Technology transfer, Publishing, Patents, Research management, Policies.

This manual is intended as a guide for university administrators who wish to set up in-house programs to help faculty members in the recognition of inventions and to increase the flow of their disclosure. Aimed at both senior administrators and those personnel who are charged with the actual implementation of such programs, the manual presupposes little or no prior experience with the handling of invention disclosures at academic institutions.

700,120
PB-290 164/3 PC **A04**/MF **A01**
Massachusetts Inst. of Tech., Cambridge. Center for Policy Alternatives.
Influence of Defense Procurement and Sponsorship of Research and Development on the Development of the Civilian Electronics Industry.
Final rept.
J. M. Utterback, and A. E. Murray. 30 Jun 77, 62p
NBS-GCR-ETIP-78-49
Grant NBS-T-61329-1

Keywords: *Research management, *Procurement, *Electronics industry, National government, Research, Product development, Purchasing, Technology innovation, Economic impact, Manpower, Financing, Economic factors, Patents, *Department of Defense, Financial support, Industrial development, Research and development.

The goals of the study were to identify the means through which government purchasing and R and D sponsorship may have affected the industry and to discuss the implications for procurement policy experimentation by the Program. Available literature was reviewed and interviews were conducted with industry and government executives. Results have been divided into impacts on technology, which appear to be mostly indirect, and impacts on economics and manpower which are more direct. Characteristics of the industry that may have conditioned the effect of the government actions are also discussed.

700,121
PB-292 851/3 PC **A02**/MF **A01**
SRI International, Menlo Park, CA.
Management of Federal R and D for Commercialization. Executive Summary.
N. B. McEachron, H. S. Javitz, D. S. Green, J. D. Logsdon, and E. Milbergs. Sep 78, 19p NBS-GCR-ETIP-78-57
Contract NBS-5-35889
See also Final Report, PB-292 852.
Also available in set of 3 reports PC E08, PB-292 850-SET.

Keywords: *Research management, *Technology transfer, *Commerce, National government, Government policies, Technology innovation, Marketing, Market research, Coordination, Cooperation, Public relations, Contract administration, Resource allocation, Evaluation, Guidelines, *Research and development, *Federal programs, Private agencies, Experimental Technology Incentives Program.

The management of federal R&D intended for commercialization must consider issues of commercial acceptability as well as technical success. It is with these management issues that this report is concerned. Specifically, the purposes of the study was to: (1) Describe current policies and practices of federal agencies regarding the management of federally funded R&D intended for nonfederal application; and (2) Develop a set of empirically grounded recommendations for policies and practices that would improve the commercialization of federally funded R&D results.

700,122
PB-292 852/1 PC **A07**/MF **A01**
SRI International, Menlo Park, CA.
Management of Federal R and D for Commercialization. Final Report.
N. B. McEachron, H. S. Javitz, D. S. Green, J. D. Logsdon, and E. Milbergs. Sep 78, 143p NBS-GCR-ETIP-78-58
Contract NBS-5-35889
See also Executive Summary, PB-292 851, and Appendices, PB-292 853.
Also available in set of 3 reports PC E08, PB-292 850-SET.

Keywords: *Research management, *Technology transfer, *Commerce, National government, Government policies, Technology innovation, Marketing, Market research, Coordination, Cooperation, Public relations, Contract administration, Resource allocation, Evaluation, Project planning, Classifications, Surveys, Methodology, Regression analysis, Guidelines, *Research and development, *Federal programs, Private agencies, Experimental Technology Incentives Program.

The management of federal R&D intended for commercialization must consider issues of commercial acceptability as well as technical success. It is with these management issues that this report is concerned. Specifically, the purposes of the study was to: (1) Describe current policies and practices of federal agencies regarding the management of federally funded R&D intended for nonfederal application; and (2) Develop a set of empirically grounded recommendations for policies and practices that would improve the commercialization of federally funded R&D results.

700,123
PB-292 853/9 PC **A08**/MF **A01**
SRI International, Menlo Park, CA.
Management of Federal R and D for Commercialization. Appendices: Supporting Documentation.
N. B. McEachron, H. S. Javitz, D. S. Green, J. D. Logsdon, and E. Milbergs. Dec 78, 175p NBS-GCR-ETIP-78-58A
Contract NBS-5-35889
See also Final Report, PB-292 852.
Also available in set of 3 reports PC E08, PB-292 850-SET.

Keywords: *Research management, *Technology transfer, *Commerce, National government, Government policies, Technology innovation, Marketing, Market research, Surveys, Methodology, Project planning, Regression analysis, Interviews, Questionnaires, Classifications, Tables(Data), Guidelines, *Research and development, *Federal programs, Private agencies, Experimental Technology Incentives Program.

The document is the supporting documentation of an empirical investigation of federal civilian R&D management practices, conducted for the Experimental Technology Incentives Program (ETIP), National Bureau of Standards. The report is addressed to federal civilian policymakers and R&D managers responsible for planning, developing, and implementing R&D programs whose results are intended for eventual commercialization by the nonfederal private sector.

700,124
PB79-600054 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Managing Research.
D. T. Goodman. 1979, 2p
Pub. in Phys. Today Letter to the Editor 32, n1 p94-95 1979.

Keywords: *Management, Research.

No abstract available.

700,125
PB80-114150 Not available NTIS
National Bureau of Standards, Washington, DC.
Generic Approaches to Product Improvement Research.
Final rept.,
J. V. Fechter. Oct 78, 9p
Pub. in CP News 4, n1, p12-20, Oct 78.

Keywords: *Product development, *Research management, *Product safety, Performance, Design criteria, Consumer affairs, Human factors engineering, Methodology, Information services, Functional analysis, Consumer protection.

The report examines the generic approaches to product improvement research used by the Human Factors Section of the National Bureau of Standards. Specific studies are discussed where generic, rather than specific, information was sought for improving product performance and safety.

700,126
PB80-160716 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Economics of the Product Certification Industry: Some Research Needs.
Final rept.,
C. C. Rawie. Mar 80, 75p NBSIR-80-2001

Keywords: *Product inspection, *Quality assurance, *Research, Performance standards, Manufacturers, Product development, Government policies, Reliability, Quality control, Product liability, Product safety, Commercialization.

A number of private organizations certify products for safety and other qualities. With the increase in safety regulation, product liability suits, and interest in encouraging the use of new technologies through certification, certification is likely to become more and more important as a way to show conformance with voluntary or regulatory standards. There have been a number of Federal and State government activities related to product certification. However, the potential impact of past and proposed government actions is not clear. One reason may be that there has been insufficient study of the economics of the product certification industry. The paper asserts that such study is needed as a basis for setting government policy and raises issues that should be addressed concerning structure and performance of the product certification industry.

700,127
PB80-167398 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Efficient Allocation of Research Funds: Economic Evaluation Methods with Case Studies in Building Technology.
Final rept.,
H. E. Marshall, and R. T. Ruegg. Dec 79, 59p NBS-SP-558
Library of Congress catalog card no. 79-600210.

Keywords: *Allocations, *Research projects, *Construction, *Technology innovation, Research management, Budgeting, Benefit cost analysis, Return on investment, Payout time, Investments, Savings, Labor estimates, Materials estimates, Roofing, Shingles, Asphalts, Venting, Vents, Plumbing.

Public and private administrators of research programs are concerned with maximizing the payoffs from their research investments; that is, with allocating their limited budgets most efficiently. Benefit-cost, rate-of-return, payback, and other evaluation methodologies are examined for their usefulness in helping administrators to decide whether to accept or reject research projects leading directly to applications; to plan the scale of these research projects; and to identify priorities among alternative research investments, all of which may be profitable. Data needs for applying these evaluation methodologies are outlined. The net-benefits and rate-of-return methodologies are applied to two case studies involving research in the Center for Building Technology (CBT) of the National Bureau of Standards. The first deals with a heavier asphalt shingle for roofing, and the second deals with reduced-size venting in plumbing. The case studies show high payoffs in these two areas of research, both for society as a whole and for CBT's contribution in undertaking the research. Recommendations from the study are that research funds be allocated on the basis of anticipated payoffs determined through these evaluation tech-

niques, and that benefit and cost data for evaluating new technologies be collected.

700,128
PB80-179260 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Prospects for an OSHA/ETIP Project to Facilitate Technological Innovation.
Interim rept.,
M. A. Mulkey, and R. G. Weiss. May 80, 52p NBS-TN-1114
Sponsored in part by Urban Inst., Washington, DC.

Keywords: *Technology innovation, Utilization, Technology transfer, Government policies, Evaluation, Assessments, National government, Regulations, Technological intelligence, Standards, Experimentation, Productivity, *Occupational Safety and Health Administration.

This document describes the results of research performed to identify and screen candidate interventions for administrative experimentation with the Occupational Safety and Health Administration (OSHA) of the Department of Labor. The broader project, described elsewhere, is analyzing the effects of changes in regulatory processes on industrial innovation. The report presents preliminary conclusions regarding the appropriateness of experimental variances as a possible means of facilitating the introduction of new technology by industry. The first two chapters provide an introduction and a brief history of ETIP/OSHA work. Chapter III describes: the basic logic of expanding the use of OSHA's experimental variance authority to facilitate innovation; types of variances; the variance application and review processes; and limitations on the use of experimental variances to facilitate innovation. Chapter IV describes alternative OSHA policy change processes. The fifth chapter discusses OSHA's role in the equipment market, and Chapter VI describes possible future work.

700,129
PB80-199086 PC **E03**/MF **A01**
Department of Commerce, Washington, DC. Office of Product Standards.
Principal Aspects of U.S. Laboratory Accreditation Systems.
Jul 80, 161p
Supersedes PB-293 463.

Keywords: *Laboratories, *Research management, Project management, National government, State government, Local government, Trade associations, Research projects, Criteria, Standards, *Accreditation, Agencies.

The report presents two-page summaries of laboratory accreditation systems in three areas: Federal government, state and local government, and professional and trade associations. A total of 70 systems are included in the summaries. Information covered includes date established, type and scope of the systems, authority for the systems, funding and fees, fields of testing, standards and accreditation criteria employed, frequency and extent of laboratory assessment, appeal procedures, extent of proficiency testing required, the number of laboratories in the system, and the extent of international recognition. For each system a person has been identified who can process an application or is in other ways knowledgeable about the nature and content of the system.

700,130
PB81-236507 Not available NTIS
National Bureau of Standards, Washington, DC.
Meeting State and Local Government Needs by Transfer of Federal Laboratory Technology.
Final rept.
J. M. Wyckoff. 1981, 21p
Pub. in Jnl. of Technology Transfer 5, n2 p1-21 1981.

Keywords: *Technology transfer, *Local government, Laboratories, State government, Organizations, Trends, Requirements.

The need of State and local governments to deal with an increasing range of technological problems has led to the development of relatively new ways to call on Federal laboratories. This paper discusses the structure of these mechanisms for technology transfer, organizations involved in the systems that have developed, trends that affect these organizations and current problem areas.

700,131
PB82-102146 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
International Activities: The Fiscal Year 1979 Survey of International Activities at NEL.
S. Kramer, and M. Olmert. Sep 80, 128p NBSIR 80-2113
See also report for 1978, PB-300 491.

Keywords: *Laboratories, *Research management, *Technology transfer, *Engineering, Foreign countries, International relations, Technology innovation, Scientists, Engineers, Cooperation, Exchanging.

The report presents a survey of a major phase of the international activities of the National Engineering Laboratory (NEL), NBS, for the Fiscal Year 1979. The report is organized by countries, international organizations and conferences. NEL professional staff involved in these activities are readily identified. Guest workers are listed with their research interests. The report is intended to serve as a directory and reference document for all those who seek information on the international activities of the National Engineering Laboratory, NBS.

700,132
PB82-106006 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS, Volume 65, Number 4, May/June 1981.
Monthly rept.
Jun 81, 33p NBS/DIM-65/4
See also Volume 65, Number 3, PB81-235053.

Keywords: *Periodicals, *Technology innovation, Research projects, Automation, Failure, Aluminum, Data converters, Gas industry, Radiation, Comparators, Radiocarbon dating, National Bureau of Standards.

The monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Automation Research at NBS; Reducing the Risks of Failure; A New Twist on Dating; Results of Soft Aluminum Study Announced; Industry Gas Suppliers to Produce CRM's; New Standard Radiation Source Possible; New Mass Comparator is Quicker, Costs Less; and Data Converter Calibration Service Announced.

700,133
PB82-138819 PC **A07**/MF **A01**
Performance Development Inst., Washington, DC.
Toward Competitive Provision of Public Record Message Services.
Interim rept.
M. A. Mulkey, and K. P. Timpane. Oct 81, 149p NBS-GCR-ETIP-81-97
Contracts NBS-7-35822, NBS-78-3603

Keywords: *Telecommunications, *Competition, Marketing, Incentives, Services, National government, Government policies, Availability.

This report describes the current status of a cooperative project involving the Experimental Technology Incentives Program (ETIP) of the National Bureau of Standards and the Federal Communications Commission. The partnership was initiated in 1977 as one of several similar ETIP efforts to develop knowledge useful to policymakers on the interaction between regulation and private sector innovation. This volume reports on market trends evolving in the wake of the FCC opening up public message communication services to competition. The report concludes that while a few firms have entered the market to offer the public record message telecommunications services on a nonsubscription basis, these services are oriented toward use by businesses, not the individual, occasional user. While development in public message services has been slow, the area of business-oriented subscription record and data telecommunications and teleprocessing services has been very active. The report calls out regulatory issues worth resolving in order to ensure public availability and affordability of new services.

700,134
PB82-195173 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation Framework for Federal Technology Transfer Initiatives.
Final rept.
T. C. O'Brien, and L. M. Franks. 1981, 14p
Pub. in Jnl. of Technol. Transfer 6, n1 p73-86 1981.

Keywords: *Technology transfer, Evaluation, National government, Industries, Technology innovation, State government, Local government, Research projects.

Improved efforts to transfer the results of Federally-sponsored R&D to industry are cited as an approach to help reverse declines in the productivity and technological competitiveness of U.S. industry. As taxpayers and policymakers intensify their demands for accountability of public expenditures, technology transfer advocates must develop and apply analytic approaches which will measure the significant short and long-range impacts of Federally-sponsored programs, even though these impacts are especially difficult to measure directly. This paper suggests a framework for evaluating Federal technology transfer in terms of short, intermediate, and long range goals/outputs. It outlines critical determinants of program success and suggests performance indicators through which results could be measured.

700,135
PB82-216565 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
Laboratory Accreditation: Future Directions in the United States.
Final rept.
J. W. Locke. Mar 82, 176p NBS-SP-632
Proceedings of the NBS Workshop on Laboratory Accreditation Held at the National Bureau of Sandards, Gaithersburg, Maryland on November 16-17, 1981. Library Congress catalog card no. 82-600525

Keywords: *Laboratories, *Research management, Licenses, Meetings, Public opinion, Standardization, Accreditation.

The purpose of the Workshop sponsored by the National Bureau of Standards was to provide a public forum for the expression of views upon which recommendations could be developed to bring about a desirable and effective distribution of responsibilities between government and private sectors in the area of laboratory accreditation. The Workshop was initiated in response to two related requests to change the Department of Commerce's (DoC) National Voluntary Laboratory Accreditation Program (NVLAP) in order that NVLAP's laboratory accreditation activities would be transferred to the private sector and DoC's role would be limited to that of an accreditor of accreditation systems. As a basis for initiating public comment, 20 invited participants presented papers in five sessions: (1) background of U.S. laboratory accreditation; (2) international trade implications of laboratory accreditation; (3) need for laboratory accreditation; (4) criteria for recognizing laboratory accreditation systems; and; (5) a mechanism to accredit organizations which accredit testing laboratories. Approximately 200 people attended the Workshop and the written and oral reviews of all who participated are summarized in these Proceedings. Also included are written comments (letters) which were sent in by participants and other interested persons after the Workshop was concluded.

700,136
PB82-237694 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Bibliography on Laboratory Accreditation.
J. O. Bryson, D. Thomas, L. Drake, and W. Hall. Jun 82, 108p NBSIR-82-2523
Sponsored in part by International Lab. Accreditation Conference.

Keywords: *Laboratories, *Licenses, *Bibliographies, Acceptability, Tests, United States, Foreign countries, Communicating, Standards, *Accreditation.

This bibliography was prepared by staff members of the U.S. National Bureau of Standards at the request of and in cooperation with the International Laboratory Accreditation Conference (ILAC). The purpose of this work is to promote and accommodate the exchange of world wide information concerning laboratory accreditation and related subjects.

700,137
PB83-130278 PC **A06**/MF **A01**
National Research Council, Washington, DC.

Evaluative Report on the National Engineering Laboratory, National Bureau of Standards, Fiscal Year 1982.
Final rept.
Oct 82, 102p
Contract NB82-SBCA-1505

Keywords: *Laboratories, *National government, Evaluation, Project management, Financing, Personnel.

This report presents an evaluation of the technical functions and programs of the National Engineering Laboratory (NEL), one of the major organizational units of the National Bureau of Standards. It represents the work of eight Panels. One of the Panels is for the NEL as a whole and performs an overview function for the National Research Council. The other seven Panels review specific activities within NEL. This volume contains the full text of the reports of all eight Panels.

700,138
PB83-132803 PC **A07**/MF **A01**
National Research Council, Washington, DC.
Evaluative Report on the National Measurement Laboratory, National Bureau of Standards, Fiscal Year 1982.
Final rept.
Oct 82, 140p
Contract NB82-SBCA-1505

Keywords: *Laboratories, *Measurements, National government, Evaluation, Research projects, Project management, Personnel, Financing.

This report presents an evaluation of the technical functions and programs of the National Measurement Laboratory (NML), one of the major organizational units of the National Bureau of Standards. It represents the work of eleven Panels. One of the Panels is for the NML as a whole and performs an overview function for the National Research Council. The other ten Panels review specific activities within NML. This volume contains the full text of the reports of all eleven Panels. These reports deal with only a part of the total NBS effort.

700,139
PB83-164541 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 87, Number 5, September-October 1982.
Bi-monthly rept.
1982, 110p
See also Volume 87, Number 3, PB83-121582. Library of Congress catalog card no. 63-37059.

Keywords: *Research projects, Analysis of variance, Experimental design, Temperature, Meetings, Buildings, Construction materials, Nondestructive tests, Quality assurance.

Contents: Consensus values and weighting factors; Report on the Sixth International Symposium on Temperature; Nondestructive evaluation methods for quality acceptance of installed building materials.

700,140
PB83-192260 PC **E06**/MF **A01**
National Bureau of Standards, Washington, DC.
Federal Laboratory Directory 1982.
Final rept.
J. M. Wyckoff. Feb 83, 267p NBS-SP-646
Library of Congress catalog card no. 82-600663. Prepared in cooperation with Federal Laboratory Consortium for Technology Transfer.

Keywords: *Laboratories, *National government, *Directories, Technology transfer, Resources, Industries, Productivity, Information systems, Problem solving, Professional personnel, Research and development.

The Directory provides limited information about some 388 Federal laboratories with ten or more full-time professionals engaged in research and development. Summary data arranged by Federal agency and by State provide a broad overview of the Federal laboratory system. Laboratory lists by staff size, by State and by agency provide a cross reference. For each laboratory, a contact for obtaining technical information is given by name, address, and phone number. Major mission and major scientific or testing equipment is listed for each laboratory.

700,141
PB83-207837 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
National Bureau of Standards (Annual Report for Fiscal Years 1981 and 1982).
S. Shaffer. Feb 83, 29p NBS-SP-643

Keywords: *Research management, *National government, Primary standards, Calibrating, Measurement, Electronics, Automation, Fire safety, Computers, National Bureau of Standards.

The report explains the Bureau's role as the central U.S. reference laboratory for the physical and engineering sciences. Advances in materials science, semiconductor electronics, manufacturing automation, and dozens of other areas of NBS research are highlighted. Covering the Bureau's science and engineering measurement work during fiscal years 1981 and 1982, the report provides a broad view of some of the major projects that are underway or recently completed at NBS. Also featured are summaries of NBS services to industry, other government agencies, and the public, as well as information on cooperative research programs and a directory of the names, titles, and phone numbers of NBS research managers.

700,142
PB83-231308 PC **A02**/MF **A01**
National Research Council, Washington, DC. Assembly of Mathematical and Physical Sciences.
Evaluative Report on the Institute for Computer Sciences and Technology, National Bureau of Standards - Fiscal Year 1976.
Annual rept.
1978, 14p
Contract NBS-3-35701

Keywords: *Research management, *Computers, *Data processing, Standards, Technology innovation, Computer programming.

The Institute for Computer Sciences and Technology (ICST), one of the major organizational units of the National Bureau of Standards, is responsible, within the overall NBS mission, for strengthening and advancing computer and automation science and technology and fostering their application for public benefit. This report covers the activities of the Institute for Computer Sciences and Technology during the 12 months prior to the Panel meeting on March 18-19, 1976.

700,143
PB83-231316 PC **A02**/MF **A01**
National Research Council, Washington, DC. Assembly of Mathematical and Physical Sciences.
Evaluative Report on the Experimental Technology Incentives Program, National Bureau of Standards - Fiscal Year 1977.
Annual rept.
1978, 17p
Contract NBS-T-35702

Keywords: *Technology innovation, *Incentives, National government, Standards, Performance evaluation, Government policies, *Program evaluation.

The Experimental Technology Incentives Program (ETIP) is an experimental program charged with developing potential policies for the federal government that will help to increase innovative civilian technology. In cooperation with other federal agencies and with private-sector organizations, ETIP staff explores ways in which changes in the policies and procedures of the federal government can stimulate the development and use of technology for the nation's welfare. This report covers the activities of the Office of Experimental Technology Incentives Program during the 16 months preceding the Panel meeting on May 4, 1977.

700,144
PB83-231365 PC **A03**/MF **A01**
National Research Council, Washington, DC. Assembly of Mathematical and Physical Sciences.
Evaluative Report on the Institute for Materials Research, National Bureau of Standards - Fiscal Year 1976.
Annual rept.
1977, 43p
Contract NBS-3-35701
See also PB83-231373.

Keywords: *Research management, *Materials, Physical chemistry, Technology innovation, Chemical analysis, Polymers, Metallurgy, Performance evaluation, Inorganic compounds, Nuclear reactors, Radiation, Standards.

The Institute for Materials Research (IMR), one of the major organizational units of the National Bureau of Standards, conducts research to provide a better understanding of the basic properties of materials and develops methodology and standards for measuring their properties to help ensure effective utilization of technologically important materials by the nation's scientific, commercial, and industrial communities. This report covers activities of the Institute during the 12 months preceding the Panel meeting on January 26-27, 1976.

700,145
PB83-231373 PC **A03**/MF **A01**
National Research Council, Washington, DC. Assembly of Mathematical and Physical Sciences.
Evaluative Report on the Institute for Materials Research, National Bureau of Standards - Fiscal Year 1977.
Annual rept.
1978, 40p
See also PB83-231365. Sponsored in part by National Bureau of Standards, Washington, DC.

Keywords: *Research management, *Materials, Physical chemistry, Technology innovation, Chemical analysis, Polymers, Metallurgy, Performance evaluation, Inorganic compounds, Nuclear reactors, Radiation, Standards.

The Institute for Materials Research (IMR), one of the major organizational units of the National Bureau of Standards, conducts research to provide a better understanding of the basic properties of materials and develops methodology and standards for measuring their properties to help ensure effective utilization of technologically important materials by the nation's scientific, commercial, and industrial communities. This report covers activities of the Institute during the 12 months preceding the Panel meeting on January 25-26, 1977.

700,146
PB83-231399 PC **A02**/MF **A01**
National Research Council, Washington, DC. Assembly of Mathematical and Physical Sciences.
Evaluative Report on the Office of Standard Reference Data, National Bureau of Standards - Fiscal Year 1977.
Annual rept.
1977, 12p
Contract NBS-T-35702

Keywords: *Research management, *Standards, *Information centers, Performance evaluation, Data sources.

The Office of Standard Reference Data (OSRD) administers the National Standard Reference Data System, which provides critically evaluated data in the physical sciences on a national Basis. This includes arrangement for the continuing systematic review of the world literature in the physical sciences, the evaluation of the physical property data it contains, and the dissemination of these evaluated data in forms suitable for various user groups. The program also attempts to identify gaps where new measurements are required and to improve the quality standards in measuring and reporting physical and chemical data. This report covers activities of the Office of Standard Reference Data during the 12 months preceding the Panel meeting on March 28-29, 1977.

700,147
PB83-231639 PC **A05**/MF **A01**
National Research Council, Washington, DC. Assembly of Mathematical and Physical Sciences.
Evaluative Report on the Institute for Basic Standards, National Bureau of Standards - Fiscal Year 1976.
Annual rept.
1977, 88p
Contract NBS-3-35701
See also PB83-231647.

Keywords: *Standards, *Research management, Performance evaluation, Acoustics, Electromagnetic properties, Rodiation, Time, Noise, Mechanics, Astrophysics, Crogenics.

The Institute for Basic Standards (IBS), one of the major organizational units of the National Bureau of Standards, provides the central basis within the United States of a complete and consistent system of physical measurement; coordinates that system with the measurement systems of other nations; and furnishes essential services leading to accurate and uniform

physical measurements throughout the nation's scientific community, industry and commerce. This report covers activities of the Institute during the 12 months preceding the Panel meeting on December 11-12, 1975.

700,148
PB83-231647 PC **A04**/MF **A01**
National Research Council, Washington, DC. Assembly of Mathematical and Physical Sciences.
Evaluative Report on the Institute for Basic Standards, National Bureau of Standards - Fiscal Year 1977.
Annual rept.
1978, 74p
Contract NBS-T-35702
See also PB83-231639.

Keywords: *Standards, *Research management, Performance evaluation, Acoustics, Electromagnetic properties, Rodiation, Time, Noise, Mechanics, Astrophysics, Crogenics.

The Institute for Basic Standards (IBS), one of the major organizational units of the National Bureau of Standards, provides the primary standards within the United States for a complete and consistent system of physical measurement; coordinates that system with the measurement systems of other nations; and furnishes essential services leading to accurate and uniform physical measurements throughout the nation's scientific community, industry, and commerce. This report covers activities of the Institute during the 12 months preceding the Panel meeting on December 9-10, 1976.

700,149
PB83-235655 PC **A04**/MF **A01**
Charles River Associates, Inc., Boston, MA.
Analysis of the Role of the National Bureau of Standards in Supporting Industrial Innovation and Growth: Summary Report.
Planning rept. no. 16.
Apr 83, 55p NBS-GCR-83-426

Keywords: *Technology innovation, *Government policies, *Economic development, Legislation, Barriers, *National Bureau of Standards, Research and development.

The purpose of the study is to describe in economic and policy terms the philosophial and legislative missions of NBS that relate to industrial innovation and growth. A general conceptual framework is developed which identifies market failures or barriers to private innovation that are expected to be alleviated or removed most readily through the performance of research and development (R&D) or other technical activities by a government laboratory. The framework is applied to eight case studies of NBS research projects to assess their appropriateness from an economic perspective.

700,150
PB83-259572 PC **A05**/MF **A01**
King (Margery Hughes), Gaithersburg, MD.
Industrial Access to NBS (National Bureau of Standards) Technology.
Final rept. Sep 82-Apr 83.
M. H. King. 15 Apr 83, 78p NBS-GCR-83-430

Keywords: *Technology transfer, *National government, *Industries, Attitude surveys, Policies, Sources.

In September 1982, the Office of Research and Technology Applications (ORTA) at the National Bureau of Standards (NBS) initiated a study to determine ways and means to improve industrial access to research and development being done by NBS. A survey directed towards industry was developed. The survey was sponsored by and distributed to, approximately 275 member companies of the Industrial Research Institute and 610 members of the Commercial Development Association in January 1983. The 350 industrial respondents (39.5% response rate) showed a high level of interest in the R&D activities of the Federal labs and a willingness to share information in order to improve the technology transfer process from public to private sectors.

700,151
PB84-119478 PC **A05**/MF **A01**
National Research Council, Washington, DC.
Evaluative Report on the National Measurement Laboratory, National Bureau of Standards, Fiscal Year 1983.
Oct 83, 99p
Contract NB82-SBCA-1505
See also PB83-156513.

Keywords: *National government, *Research projects, Project management, Evaluation.

This report presents an evaluation of the technical functions and programs of the National Measurement Laboratory (NML), one of the major organizational units of the National Bureau of Standards. It represents the work of eight panels. One of the panels is for the NML as a whole and performs an overview function for the National Research Council. The other seven panels an office of non-destructive evaluation, office of standard reference data, center for absolute physical quantities, center for radiation research, center for chemical physics, center for analytical chemistry, and center for materials science within NML. This volume contains the full text of the reports of all eight panels. Readers should keep in mind that these reports deal with only a part of the total NBS efforts.

700,152
PB84-129873 PC **A05**/MF **A01**
National Research Council, Washington, DC.
Evaluative Report on the National Engineering Laboratory, National Bureau of Standards, Fiscal Year 1983.
Dec 83, 97p
Contract NB82-SBCA-1505
See also PB83-207837.

Keywords: *Research management, *National government, Standards, Electronics, Electrical engineering, Manufacturing, Buildings, Fire safety, Chemical engineering, National Bureau of Standards.

This report presents an evaluation of the technical functions and programs of the National Engineering Laboratory (NEL), one of the major organizational units of the National Bureau of Standards. It represents the work of eight panels. One of the panels is for the NEL as a whole and performs an overview function for the National Research Council. The other seven panels review specific activities within NEL. This volume contains the full text of the reports of all eight panels. Readers should keep in mind that these reports deal with only a part of the total NBS effort.

700,153
PB84-218031 PC **A20**/MF **A01**
National Bureau of Standards, Washington, DC. Information Resources and Services Div.
Publications of the National Bureau of Standards, 1983 Catalog.
Rept. for Jan-Dec 83.
R. J. Morehouse. May 84, 457p NBS/SP-305-SUPPL-15
See also PB82-242462. Also available from Supt. of Docs as SN003-003-02585-2. Library of Congress catalog card no. 48-47112.

Keywords: *Standards, *Bibliographies, *Catalogs(Publications), Abstracts, Indexes(Documentation), Authors, *Standard reference materials.

The 15th Supplement to Special Publication 305 lists the 1983 papers which reflect the results of National Bureau of Standards programs. Also included are those NBS papers published prior to 1983 but not reported in previous supplements of SP305. In addition to bibliographic data, key words, and abstracts for each publication and/or paper, the catalog provides an author and key word index. Errata pages for SP305, Supplement 14 (secs. 7, 8.1, and 8.2) follow Appendix B.

700,154
PB85-121390 PC **A11**/MF **A01**
Marley Organization, Inc., Ridgefield, CT.
Principal Aspects of U.S. Laboratory Accreditation Systems - Revised 1984.
Final rept.
C. W. Hyer. Oct 84, 247p NBS/GCR-84/472
Contract NB82-NAAM-7728
See also PB80-199086.

Keywords: *Laboratories, *Research management, Project management, National government, State government, Local government, Trade associations, Research projects, Criteria, Standards, *Accreditation.

The purpose of this report is to identify United States laboratory accreditation systems and to summarize the principal aspects of these systems. Previous reports were published in 1979 and 1980 under the same title. The latest adds forty-one systems not previously reported and contains 109 systems. The most significant addition to the report over and above previous editions is the information on 'Fields of Testing' and 'Products Covered' for each system. The report places the systems in four separate categories: (1) Federal Government Systems; (2) State Government Systems; (3) Local Government Systems; (4) Professional/Trade Organization Systems.

700,155
PB85-127421 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Public Information Div.
NBS (National Bureau of Standards) Research Reports.
Special pub.
Oct 84, 32p NBS/SP-680/1
Library of Congress catalog card no. 84-601124.

Keywords: *Research projects, Communications, Automation, Computers, Industries, Mapping, *National Bureau of Standards.

Contents:
- Focus on cooperation and communication; an introduction;
- Research updata;
- Standard interfaces key to factory automation;
- Standard data formats: transferring part designs betweem systems;
- How to secure your computer systems;
- Cold circuits next step in electronics revolution;
- New particles for measuring pigments, flour, blood cells;
- Measurement methods for a new industry: industrial radiation;
- Compositional mapping: NBS researchers take a glimpse into the atomic world;
- Tools of the NBS compositional mapping program;
- New publications;
- Conference calendar.

700,156
PB85-129591 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 89, Number 4, July-August 1984.
Aug 84, 46p
See also PB85-129609 through PB85-129625 and PB85-115426. Library of Congress catalog card no. 63-37059.

Keywords: *Research, Thermal expansion, Resistance thermometers, Radiotherapy, Hydrogen, Liquid helium, Iodine 125.

Contents:
- Exposure Standardization of Iodine-125 Seeds Used for Brachytherapy;
- Stability of Small Industrial Platinum Resistance Thermometers;
- Thermal Expansion of Liquid Normal Hydrogen Between 18.8 and 22.2 K.

700,157
PB85-153443 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Research Priorities for Improving the Effectiveness of Active Solar Hot Water and Space Conditioning Systems.
Final rept.
R. D. Dikkers, W. J. Kennish, C. B. Winn, and W. Huston. Dec 84, 76p NBSIR-84/2980
Contract DE-AI01-76PR06010
Prepared in cooperation with TPI, Inc., Beltsville, MD. and Solar Environmental Engineering Co., Inc., Fort Collins, CO.

Keywords: *Solar heating, *Solar water heating, *Research management, Maintenance, Research projects, Project planning, Performance evaluation, Reliability, Tests, Control equipment.

As part of the FY 1983 Department of Energy Systems Effectiveness Research Program, the National Bureau of Standards (NBS) was assigned responsibility for de-

veloping research priorities for improving the effectiveness (i.e., thermal performance, cost, reliability and maintainability) of active solar hot water and space conditioning systems. To carry out this task, NBS, in cooperation with various industry representatives, organized and conducted two meetings in August 1983. The first meeting covered all major aspects of active solar hot water and space conditioning systems. The second meeting dealt only with solar control subsystems. Based on information obtained from these meetings, recommended research priorities for improving the effectiveness of active solar energy systems are presented.

700,158
PB85-179042 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Materials Science.
Journal of Research of the National Bureau of Standards, Volume 89, Number 6, November-December 1984.
1984, 104p
See also PB85-179059 through PB85-179075 and PB85-161271. Also available from Supt. of Docs as SN703-027-00001-6. Library of Congress catalog card no. 63-37059.

Keywords: *Research projects, Brittleness, Fractography, Ceramics, Nondestructive tests, Toughness, Diffusion, Fatigue(Materials), Crystals, Stress analysis, Thermodynamics, Phase transformation.

Contents:
Indentation fractography:
A measure of brittleness;
Controlled indentation flaws for the construction of toughness and fatigue master maps;
The interactions of composition and stress in crystalline solids.

700,159
PB85-179083 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 90, Number 1, January-February 1985.
Feb 85, 92p
See also PB85-179091 through PB85-179117 and PB85-161271. Also available from Supt. of Docs as SN703-027-00002-4. Library of Congress catalog card no. 63-37059.

Keywords: *Research projects, Particle size, Density(Mass/volume), Solubility, Fiber optics, Laboratory equipment, Coupled column liquid chromatography, Standard reference materials.

Contents:
Development of a one-micrometer-diameter particle size standard reference material;
Stable law densities and linear relaxation phenomena;
An automated coupled-column liquid chromatography system for measuring aqueous solubilities of hydrophobic solutes;
Fiber optics emphasis on single mode.

700,160
PB85-183382 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
Standards Committee Activities of the National Bureau of Standards - 1984 Highlights.
Final rept.
K. G. Newell. Mar 85, 53p NBSIR-85/3129
See also PB84-239755.

Keywords: *Standards, Research management, National Bureau of Standards.

This report summarizes NBS standards committee activities and accomplishments during calendar year 1984. It profiles NBS staff participation on outside standards committees and highlights significant technical and individual contributions made by NBS staff. In 1984, 444 staff members (or 28% of NBS' professional, scientific, and technical staff) participated in 1,138 committees of 89 national and international standards organizations.

700,161
PB85-230704 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of the Associate Director for Programs, Budget and Finance.
Infra-technology Support for Indian Industry.
Final rept.
P. L. M. Heydemann. Jun 85, 1p
Pub. in Indo-American Business Times, Special Issue, p1 Jun 85.

Keywords: *India, *Industries, *Technology transfer, National government.

The author reviews the role of infratechnology services in the drive of the Indian government for industrial expansion and international competitiveness. Industry and agriculture in the U.S. have benefitted greatly from infratechnology support provided by the Federal government. A case is made for setting up similar support organizations in India to facilitate the establishment of new entrepreneurial companies. Such support is particularly necessary for manufacturers of sophisticated, technical products.

700,162
PB85-236354 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Public Information Div.
NBS (National Bureau of Standards) Research Reports, July 1985.
Special pub.
Jul 85, 38p NBS/SP-680/3
See also PB85-127421. Library of Congress catalog card no. 85-600549.

Keywords: *Research projects, Industries, Composite materials, Fire tests, Buildings, Heat pumps, Ozone, Electric current, Standards, Ultraviolet radiation, Calibrating, Astronomical telescopes, Quality assurance, Clinical chemistry, *National Bureau of Standards.

Contents:
NBS research on polymer composites: laying the scientific foundation for industrial advance;
Searching for the more vital volt, the apter ampere;
Evaluating volts, jolts, and lightning bolts: all in a day's work at NBS;
NBS fire research is framework for safer buildings;
The making of the advanced heat pump: research to influence the marketplace;
Measuring the two 'personalities' of ozone;
New ultraviolet wavelength standards will aid astronomy;
Calibrations for the space telescope;
NBS program boosts quality of clinical measurements.

700,163
PB86-154077 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
Self-Evaluative Laboratory Quality System.
C. J. Kelly, K. D. Bruley, D. H. Craig, D. J. Pangonis, and J. W. Locke. Nov 85, 64p NBSIR-85/3278
Prepared in cooperation with Ford Motor Co., Dearborn, MI.

Keywords: *Laboratories, *Quality assurance, Quality control, Measurement, Systems analysis.

The report describes the evaluation of Measurement Assurance Experiments (MAEs) for determining the quality of within-laboratory test data. A general self-evaluative quality system is outlined and objective measures of data quality, precision and/or accuracy are presented for four fully described MAEs. Measurement Assurance Programs (MAPs), laboratory accreditation, and internal quality audits are also discussed.

700,164
PB86-195211 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of the Director.
Technology Policy Experiment as a Policy Research Tool.
Final rept.
G. Tassey. 1985, 14p
Pub. in Research Policy 14, n1 p39-52 1985.

Keywords: *Research projects, *Policies, *Technology, Regulations, Reprints, Industrial development.

The roles of the policy experiment are described and characterized as an important step in the industrial policy research process. The elements of the policy experiment are identified and the steps described by which an experiment is conducted and the results integrated into the overall policy research process. The importance of experimentation is emphasized for the effective development, implementation, and evaluation of industrial growth policies for technology-based industries. A case study of a policy experiment with new analytical and institutional procedures for monitoring the impacts of venture capital market regulations is used to show how the policy experiment can provide the necessary iterative and low-risk, low-cost approach to policy change. Equally important, institutionalization of the procedures for monitoring existing policies and the provision of decision-relevant information are shown to be important benefits from policy experimentation in the context of the overall policy change process.

700,165
PB87-104741 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Public Information Div.
NBS (National Bureau of Standards) Research Reports, July 1986.
Jul 86, 37p NBS/SP-719
See also PB83-132704. Library of Congress catalog card no. 86-600556.

Keywords: *Research projects, National Bureau of Standards.

Contents: Research update; Spirit of cooperation alive and well at National Bureau of Standards; Taking the earth's measure at a unique institution; Gravity, when you get right down to it; The light fantastic; Safer, quicker ways to prepare samples for chemical analysis; Researchers study the process to improve measurement accuracy; Expanded version of IGES standard available; NBS studying new techniques to identify irradiated foods; NBS research in biotechnology: Providing the scientific fundamentals; New publications; Conference calendar.

700,166
PB87-157236 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Cooperative Research Opportunities at NBS (National Bureau of Standards).
Special pub.,
Dec 86, 57p NBS/SP-723
Also available from Supt. of Docs as SN003-003-02788-0. Library of Congress catalog card no. 86-600570.

Keywords: *Research projects, Chemical analysis, Ceramics, Chemical engineering, Polymers, Metallurgy, Nondestructive tests, *US NBS.

Contents: Cooperative research at NBS; Research opportunities; Analytical chemistry; Applied mathematics; Basic standards; Building technology; Ceramics; Chemical engineering; Chemical physics; Computer sciences and technology; Electronics and electrical engineering; Fire research; Fracture and deformation; Manufacturing engineering; Metallurgy; Neutron scattering and diffraction; Nondestructive evaluation; Polymers; Product standards; Radiation research; Standards reference data.

700,167
PB88-137062 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of the Director.
Engineering Property Data--A National Priority.
Final rept.,
E. Ambler. 1985, 5p
Pub. in ASTM (American Society for Testing and Materials) Standardization News, p46-50 Aug 85.

Keywords: *Engineering data, *Information systems, Access, Quality, Standardization, Leadership, Technical societies, Engineering societies, Materials, Reprints, *Technology transfer, Computer aided design, Computer aided manufacturing, Information dissemination, Personal computers, Government agencies, Metal properties council, National Bureau of Standards, User needs, Industry.

As American industry rises to meet new challenges, engineers are becoming aware of the need to improve the quality and accessibility of data needed for technical decisions. One major reason is the widespread computerization of industry. Computer-aided design and manufacturing (CAD/CAM) is a reality; now computers are being asked to provide better access to technical data. The paper describes the progress that the National Bureau of Standards, the Metal Properties

Council, and other groups have made towards meeting these needs. The key elements have been: better understanding of the role of large on-line systems and the use of personal computers, greater emphasis on the evaluation of data, and recognition of the importance of standards. Current ideas are discussed, and the need for leadership by existing technical societies and government agencies is highlighted.

700,168
PB88-147186 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Office of Energy-Related Inventions.
Energy Related Inventions Program.
Final rept.,
T. A. Coultas. 1985, 3p
See also DE87002295. Sponsored by American Solar Energy Society, Boulder, CO.
Pub. in Proceedings of the National Passive Solar Conference (10th), Raleigh, NC., October 15-20, 1985, p410-412.

Keywords: *Inventions, Evaluation, *Solar products, *Energy saving products.

One part of the United States Federal Nonnuclear Energy Research and Development Act of 1974 directs the National Bureau of Standards (NBS) to evaluate all promising nonnuclear energy-related inventions for the purpose of obtaining direct grants for their development from the Department of Energy (DOE). The purpose of the program is to provide an opportunity for independent inventors and small businesses to obtain Federal assistance in developing and commercializing their inventions. NBS evaluates the inventions and recommends those considered sufficiently promising to DOE for support. The operation of the program and several case histories will be discussed. Inventions such as one that produces fuel gas from wood, flat plate solar collectors, solar residential heating systems, energy from wind, and some novel solar energy conversion devices will be described. The path of these entrepreneurs through evaluation, grant, demonstration and market will be followed. Both the usual and some unusual pitfalls will be illustrated.

700,169
PB88-155775 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Status of Emerging Technologies: An Economic/ Technological Assessment to the Year 2000.
Final rept.,
E. Ambler. Jun 87, 33p NBSIR-87/3671

Keywords: *International trade, *Barriers, Computer science, Electronics, Materials, Medicine, Automation, Thin films, Exports, United States, Assessment, *Technology utilization, *Economic development, *Innovations, *Businesses, *Commercialization, *Trade barriers, Biotechnology, Office automation.

The Department of Commerce has concluded, in a review of emerging technologies and their future impacts on the economy, that American businesses lag behind many of their foreign competitors especially the Japanese, in exploiting technological breakthroughs. The review was ordered by Deputy Secretary Clarence J. Brown in April 1986 to identify the new technologies that will lead to new products or processes, analyze their commercialization, and recommend means of reducing the barriers. It is based on an assessment by technical experts and agency heads within the Department. They studied scientific and industrial plans and the commercialization process here and abroad. Remarks by Deputy Secretary Brown in releasing the report are included.

General

700,170
PB-259 998/3 PC **A03**/MF **A01**
Kempter-Rossman International, Washington, D.C.
Value Incentive Program Energy Conservation Compressors for Computer Room Air Conditioning Systems.
Final rept.
Oct 76, 39p NBS-GCR-ETIP-76-26

Keywords: *Incentive contracts, *Value engineering, *Government procurement, Cost analysis, Cost engineering, Air conditioning equipment, Compressors, Specifications, Computers, Life cycle costs, Experimental Technology Incentive Program, Value Management Program, Value Incentive Program.

The case study covers the use of the Value Incentive Clause by a GSA/FSS contractor to make product improvement suggestions on Energy Conservation Compressors for Computer Room Air Conditioning Systems. The use of this clause allows for contractors who hold FSS contracts to make suggestions to reduce the overall cost of procurement to the government and to share in the savings resulting from their suggestion. Copies of the GSA order, and the clause itself are included in addition to the specific changes proposed for the energy conservation compressors for computer room air conditioning systems.

700,171
PB-260 523/6 PC **A03**/MF **A01**
Kempter-Rossman International, Washington, D.C.
Value Incentive Program. Reduce Welding/Brazing on Wardrobe Hinge.
Final rept.
Oct 76, 40p NBS-GCR-ETIP-76-27
Prepared in cooperation with National Bureau of Standards, Washington, D.C. Experimental Technology Incentives Program.

Keywords: *Incentive contracts, *Cost engineering, Government procurement, Value engineering, Incentives, Specifications, Hinges, Life cycle costs, Experimental technology incentives program, Value incentive program.

The case study covers the use of the Value Incentive Clause by a GSA/FSS contractor to make product improvement suggestions to Reduce Welding/Brazing on Wardrobe Hinge. The use of this clause allows for contractors who hold FSS contracts to make suggestions to reduce the overall cost of procurement to the government and to share in the savings resulting from their suggestion. Copies of the GSA order, and the clause itself are included in addition to the specific changes proposed to reduce welding/brazing on wardrobe hinge.

700,172
PB-264 336/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Alternative Models of the Decision-Making Process and Their Implications for Information Packaging.
Final rept.,
J. C. Tucker. 1976, 10p
Pub. in Proceedings of Annual Meeting of the American Society for Information Science on Information-Politics (39th), San Francisco, Calif., October 4-9, 1976, 13, 10p, 1976.

Keywords: *Decision making, *Information systems, *Meetings, Organizing, Systems management, Classifications, Cybernetics, Models, Adaptive systems, Methodology, Cognition, Recommendations.

The organization of data into information for decision-making depends not only on the problem addressed, but also on the decision maker's thought processes. Three types of decision makers are described: the satisfier or cybernetic decision maker, the rational decision maker, and the adaptivizer. The rational decision maker is the classic type, described in economic and management literature. The cybernetic model of the decision maker is based on studies in cognitive psychology. The concept of the adaptive decision maker is relatively new, growing out of the present environment of uncertainty, rapid change, and interdependence, which requires flexibility. After examining the information processing characteristics of each of these types, the paper suggests some ways in which the information specialist might organize information to be presented to each type of decision maker to have maximum effect on the decision process.

700,173
PB-274 327/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparing the Benefits and the Costs of Electric Typewriters and Word Processors.
Final rept.,
R. C. Oman. 1977, 3p
Pub. in the Office 85, n6 p77-79 Jun 77.

Keywords: *Automatic typewriters, *Benefit cost analysis, Office management, Office typewriters, Productivity, Reprints.

There is a very large differential between the cost of conventional electric and automatic typewriters. The ratio of the costs is usually on the order of 1 to 20 or 30 depending on the particular models involved. Despite the difference in cost, automatic typewriters as they are used in many office situations seldom substantially increase productivity and sometimes decrease it. Unless automatic typewriters are used for rather special typing jobs, costs normally outweigh benefits. The article itemizes the benefits and costs of automatic typewriters and discusses the kind of typing situation where such typewriters can be beneficial. In addition, for those variables that can be easily quantified, a simple benefit/cost model using break-even analysis is presented. This model can be used as a guide to decision makers in determining whether the additional dollar investment in automatic typewriters can be economically justified through increased productivity.

700,174
PB-280 388/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Using Procurement Incentives for Technological Innovation.
Final rept.,
C. Hulick, and J. G. Berke. Jan 77, 3p
Pub. in Proceedings of 1977 Annual Reliability and Maintainability Symposium, Philadelphia, Pa., Jan 18-20, 1977, p78-80.

Keywords: *Product development, *Government procurement, *Technology innovation, Incentives, Industries, Local government, State government, National government, Purchasing, Life cycle costs, Government agencies.

The Experimental Technology Incentives Program is engaged in conducting procurement experiments with participating agencies to test the hypothesis that government procurement can through the use of procurement incentives induce private sector technological innovation. Experiments are currently underway at the Federal, State and local levels with participating agencies. The result of the ETIP work will be a summation showing which combination of individual agency characteristics and procurement incentives are most effective in bringing forth technological innovation.

700,175
PB-280 429/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Expanded Areas of Contracting: A Case Study on the Use of Performance Incentives to Achieve Technological Innovation.
Final rept.,
C. Hulick. Jun 77, 5p
Pub. in Proceedings of Annual Dept. of Defense Procurement Research Symposium (6th), U.S. Military Academy, West Point, N.Y. 22-24 Jun 77 p273-277 Jun 77.

Keywords: *Product development, *Government procurement, *Technology innovation, Incentives, Performance standards, Project management, Contracts, Government policies, Evaluation.

The purpose of this paper is to document a procurement experiment jointly sponsored by the Experimental Technology Incentives Program and the Federal Supply Service, wherein performance incentives were employed in an attempt to achieve technological innovation. The paper will first briefly describe the Experimental Technology Incentives Program, in particular the procurement portion, and then document the experiment design and implementation phases. Finally, issues to be resolved in the evaluation phase will be highlighted.

700,176
PB-296 912/9 PC **A09**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Office of Engineering Standards.
Standards Systems in Canada, the U.K., West Germany, and Denmark: An Overview.
Final rept.
D. Hemenway. Apr 79, 196p NBS/GCR-79/172

Keywords: *Standards, *Systems, *Canada, *United Kingdom, *West Germany, *Denmark, Standardization, Government policies, History, Organization theory, Finance, Acceptability, Consumers, Economic impact, Metric systems, Product development, Engineering standards, Certification, Labor force participation.

General

The report provides an overview of the voluntary standards systems of Canada, the UK, West Germany, and Denmark. The immediate purpose is to identify areas where further research might be useful. Ultimately, the aim is to gain a better understanding of national standards systems in other highly industrialized countries. Based on interviews and other research, the author discusses these aspects of the four standards systems: (1) history; (2) organization and finances; (3) standards development; (4) certification and accreditation; (5) international standards work; (6) consumer and labor participation; (7) metric conversion; (8) antitrust aspects; (9) research into economic impacts; (10) the government's use of standards and its role in standards work; and (11) other activities. The author concludes that further research is needed into standards systems of these and additional countries -- for example, Australia, Japan, and Sweden.

700,177
PB80-162126 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Standardization in France.
Final rept.,
I. M. Martinez. Mar 80, 66p NBSIR-79-1959

Keywords: *Standardization, *France, Specifications, Standards, Organization theory, Geography, Government policies, Political systems, Economic factors, Regulations, Engineering standards, Building codes, Design standards.

The report provides an overview of the voluntary standards system in France. It examines the following aspects of the French standard system: (1) Organization, (2) French Standards, (3) Standards Development, (4) Certification, (5) Government Use of Standards, (6) The Role of Consumers and Labor in Standardization, and (7) France's Participation in International Standards Activities.

700,178
PB80-216872 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
Testing Laboratory Performance: Evaluation and Accreditation.
Final rept.,
G. A. Berman. Aug 80, 182p NBS/SP-591
Library of Congress catalog card no. 80-600110.

Keywords: *Laboratories, *Tests, *Acceptability, *Meetings, Quality control, Quality assurance, Performance evaluation, Professional personnel, Acceptable quality level, *Accreditation.

The report contains proceedings of a Natinal Conference on Testing Laboratory Performance: Evaluation and Accreditation held at the National Bureau of Standards on September 25-26, 1979. Twenty-nine papers address various techniques for evaluating the performance of testing laboratories, quality control aspects of the testing function, existing and proposed accreditation programs and systems, and international coordination.

700,179
PB81-149460 Not available NTIS
National Bureau of Standards, Washington, DC.
Standards and Guidelines for Data.
P. W. Berger, and J. C. Tucker. 1980, 21p
Pub. in Chapter 8 in Data Handling for Science and Technology, an Overview and Sourcebook, p93-113 1980.

Keywords: *Data, *Standards, *Guidelines, Design standards, Engineering standards, Measurement, Data processing.

Measurements are made to establish hypotheses, control industrial processes, aid health care, and set standards. These measurements must be precise and must also be compatibie. Standard reference data systems provide critically evaluated numerical values of physical and chemical properties. Standard reference materials with accurately assessed properties provide means for comparison of instruments and methods. Engineering and product standards are written by national and international organizations to assure quality and compatibility of industrial output. Finally, major international attention has been focused on standardization of information processing. In addition to describing these levels of standardization, the chapter describes some of the standards organizations in various countries and gives an extensive bibliography.

700,180
PB81-151425 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Office of International Relations.
Standardization and Measurement Services in the Sudan.
Final rept. ·
H. S. Peiser, B. M. Gutterman, G. L. Louis, J. M. Pring, J. K. Taylor, A. D. Tholen, and C. S. Smith.
Aug 80, 90p NBSIR-80-2020
Grant PASA-TA(CE)-5-71

Keywords: *Sudan, *Standardization, *Measurement, Services, Units of measurement, Standards, Drug industry, Food industry, Cotton fabrics, Textile industry, Corporations, Government, Metrology.

A ten-member international team advisory to the Government of the Sudan's Ministry for Industry on Sudanese standardization and measurement services was organized by the U.S. National Bureau of Standards. The team split up into smaller specialist groups to survey the application of standardization and measurement technology to the following sectors: food industries, weights and measures (in retail markets), chemical industries standards and quality control, and textile (cotton). Detailed notes on the visit to 48 Sudanese organizations in industry and Government are reported.

700,181
PB81-152860 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Needs and Opportunities in Metrology of the Instituto de Pesquisas Tecnologicas for Effective Support of Brazilian Industry.
Final rept.
R. D. Huntoon. Feb 80, 37p NBSIR-80-1972
Sponsored in part by Instituto de Pesquisas Tecnologicas, Sao Paulo (Brazil), and Agency for International Development, Washington, DC.

Keywords: *Brazil, *Measurement, *Metrology, Standards, Technical assistance, Quality assurance, Standardization, Technology transfer, Industrial development.

A four-week joint study of measurement services of IPT served as a basis for examining the dislocations in the Sao Paulo measurement infrastructure. By comparing the activities in IPT, with its extensive knowledge of Brazilian technologies, was able to identify dislocations peculiar to Brazil and plan for itself appropriate corrective actions. The nature of the comparison and the corrective actions planned are presented in the report.

700,182
PB81-158164 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Concepts of Model Confidence.
S. I. Gass, and L. S. Joel. Jun 80, 42p NBSIR-80-2053
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Confidence limits, *Decision making, *Models, Validating, Criteria, Mathematical models, Verifying, Meeting.

The report discusses the concept of confidence in results obtained from large-scale modeling systems. It includes discussions of: our efforts to define model confidence; the workshop held for this purpose; a preliminary methodology to measure confidence; and, the survey conducted to obtain opinions on significant related issues.

700,183
PB81-184335 PC **A05**/MF **A01**
New Jersey Dept. of the Treasury, Trenton.
Procurement of Products Containing Recycled Materials in the State of New Jersey.
Final rept.
E. Josephson, T. Bush, G. Mazzone, G. McElroy, and T. Galbraith. Mar 81, 81p NBS-GCR-81-312
Contract NB80-NAAE-5229

Keywords: *Government procurement, *New Jersey, Materials recovery, Procurement, Purchasing, State government, Government policies, Commodities, Environmental impacts, Expenses, Regulations, *Recycled materials, Recycling, Energy consumption.

The report examines the current State activities, regulations, statutes, and policies, as well as technical institutional and economic barriers relating to the public procurement of products containing recovered or recycled materials. The report also lists the top ten commodities procured by the State in dollars plus a listing of products that, in the opinion of the State, have a high potential for the use of recycled or recovered material. The report includes a list of recommendations or suggested actions that could be taken to potentially improve the manufacture, distribution, and procurement of products containing recovered or recycled materials.

AERONAUTICS & AERODYNAMICS

Aerodynamics

700,184
PB-299 815/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Flutter of a Plate-Like Member in Horizontal Fluctuating Flow.
Final rept.,
E. Simiu, and R. H. Scanlan. Jul 79, 4p
Pub. in Eng. Struct. 1, n4, p207-210, Jul 79.

Keywords: *Structural members, *Aerodynamic stability, Flutter, Aeroelasticity, Suspension bridges, Aerodynamic loads, Dynamic response, Reprints.

A procedure is presented for determining the mean flutter velocity of a symmetrical plate with a vertical and a torsional degree of freedom in a flow with periodic horizontal fluctuations. Expressions of the self-excited forces based on a generalized Theodorsen - type model are used. The resulting flutter motion is described by a system of generalized Mathieu-Hill equations to which the stability criteria of the theory of dynamic systems with periodic coefficients are applied. A numerical example is given for a plate with mechanical characteristics comparable to those of a suspension bridge in a flow with fluctuations comparable to those occurring in natural winds. It is found that the effect of such fluctuations upon the value of the mean fluttrer velocity is negligible. This suggests that in investigating the aerodynamic stability of a suspension bridge with characteristics similar to those dealt with in the paper, it is permissible to neglect the effect of the horizontal fluctuations of the flow. Recently obtained experimental results are quoted which tend to confirm this result.

700,185
PB81-172116 Not available NTIS
National Bureau of Standards, Washington, DC.
Experimental Investigation of Drag on a Compliant Surface.
Final rept.
J. M. McMichael, P. S. Klebanoff, and N. E. Mease. 1980, 29p
Contract NASA-L-86654A
Pub. in Chapter in Viscous Flow Drag Reduction. Progress in Astronautics and Aeronautics 72, p410-438 1980.

Keywords: Turbulent boundary layer, Flat plate models, Feasibility, Reprints, *Drag reduction, Compliant surfaces.

The feasibility of reducing turbulent skin-friction drag by means of surface compliance was studied experimentally in a fully developed, flat-plate turbulent boundary-layer in air, using a membranous surface backed by a thin cavity containing a layer of polyurethane foam. Surface motion characteristics, boundary-layer structure, and overall drag were measured over a range of free-stream speeds from 7 to 30 meters per second and a range of membrane tensions from 44 to 350 Newtons per meters. Low amplitude, long wavelength motions predominate, and no significant change from the rigid surface skin friction coefficients was observed.

700,186
PB84-221068 Not available NTIS
National Bureau of Standards, Washington, DC.
Wind Loading and Strength of Cladding Glass.
Final rept.
D. A. Reed, and E. Simiu. Apr 84, 15p
See also PB83-214189.
Pub. in Jnl. of Struct. Eng. 110, n4 p715-729 Apr 84.

Keywords: *Glass, *Loads(Forces), *Aerodynamics, *Wind pressure, *Cladding, Buildings, Probability theory, Windows, Failure, Reprints.

A procedure for investigating glass cladding behavior under arbitrary loads, including fluctuating wind loads, was presented. The procedure accounts for the fact that internal stresses are nonlinear functions of the external loads, that initial glass strengths are random functions of position and direction, and that the glass strength undergoes degradation under the action of external loads in accordance with basic fracture mechanics laws that reflect subcritical crack growth. Numerical examples were presented and corresponding probability distribution curves were calculated, indicating the probability of failure of a specified panel subjected to fluctuating wind loads and to 1-minute constant loads. These curves were used to illustrate a methodology for assessing current glass cladding design procedures. For the case considered in the paper it was found that procedures based on the transformation of the peak wind load averaged over 1-2 seconds into an equivalent 1-minute load appear to result in overly optimistic assessments of the probability of failure of glass cladding under wind loads. The work reported in the paper is part of an ongoing window cladding research program being conducted at the National Bureau of Standards.

700,187
PB84-221712 Not available NTIS
National Bureau of Standards, Washington, DC.
Probabilistic Design of Cladding Glass Subjected to Wind Loads.
Final rept.
E. Simiu, and D. A. Reed. 1983, 22p
Pub. in Proceedings of International Conference on Application Statistics Probability Soil and Structural Engineering (4th), Florence, Italy, June 13-17, 1983, p1339-1360.

Keywords: *Glass, *Loads(Forces), *Aerodynamics, *Wind pressure, *Cladding, Buildings, Probability theory, Windows, Failure, Design criteria.

In the past decade significant advances have been made in the application of fracture mechanics concepts to the analysis of the strength of glass. To date, these advances have not been synthesized with current knowledge in the areas of extreme wind climatology and building aerodynamics. The objective of this paper is to describe a methodology based on such a synthesis that allows the development of risk-consistent design criteria for cladding glass applicable to buildings with known orientation for which the aerodynamic information is obtained in the wind tunnel. The paper is divided into four parts. The first part consists of introductory and background material, including definitions of basic terms and a brief description of the constituent elements of any procedure for the design of cladding glass. The second part presents a critique of current glass cladding design practice in the United States. The third and fourth parts describe, respectively, the proposed methodology and its fracture mechanics component.

700,188
PB87-122347 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Effect of Shear Layer Instabilities and Acoustic Modes on Vortex Formation in a Coflowing Jet.
Final rept.
J. M. McMichael, L. P. Purtell, R. W. Davis, and E. F. Moore. 1984, 7p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Proceedings of American Institute of Aeronautics and Astronautics Aerospace Sciences Meeting (2nd), Reno, NV., January 9-12, 1984, 7p.

Keywords: *Vortices, *Jets, Acoustics, Shear layers, Instability.

The early development of a circular jet issuing into a coflowing stream has been examined by hot-wire measurements and smoke-wire visualization. Linear stability theory has been found adequately to predict the response of the early shear layer to upstream disturbances. Knowing the exact nature of these disturbances (acoustic modes in the present case) is of utmost importance in understanding the character of oscillations in the shear layer and their subsequent evolution into vortical motions. It has been found that the coflowing stream has little influence on the stability characteristics of the early shear layer. On the other hand, the 'inner' shear layer (the remains of the inner boundary layer) strongly influences the stability characteristics. The response of the vortex development to controlled excitation has been found to be quite similar to that of the plane mixing layer provided that acoustic effects are taken into account.

Aeronautics

700,189
AD-A041 098/5 PC **A16**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Visual Range: Concepts, Instrumental Determination, and Aviation Applications.
Final rept.
C. A. Douglas, and R. L. Booker. Feb 77, 359p NBS-MONO-159, FAA/RD-77-8
Contract DOT-FA72WAI-267

Keywords: *Visual perception, *Range(Distance), *Optical instruments, Avionics, Visibility, Error analysis, Cloud height indicators, Transmissometers, Radiation attenuation, Visible spectra, Atmospheric scattering, Threshold effects, Backscattering, Runway visual range, Atmospheric attenuation, *Landing lights, Luminous intensity, Airports, Weather, Transportation safety, Measurement.

This document is a review of the principles, procedures, and instruments used in the measurement of visual range. The fundamental concepts of the visual range of objects and lights are discussed. The principles of operation of the several classes of atmospheric attenuation meters are reviewed and representative instruments are described. The course of development of the NBS transmissometer, its validation and application to aviation operations is reported. An error analysis is made of the effects of instrument errors and of differences in observer thresholds on visibility measurements. A chronological review of the development and application of the runway visual range concept is included together with a discussion of cloud height measurements.

700,190
PB81-143547 Not available NTIS
National Bureau of Standards, Washington, DC.
Survey Report--Altimeter Setting Indicators.
S. D. Wood, and C. R. Tilford. May 80, 17p
Pub. in Proceedings of the Air Data Systems Conference (1980) Held at the U.S. Air Force Academy, Colorado Springs, CO. on May 5-8, 1980, SRDS Tech. Letter Report No. RD-80-6-LR, 217p, 8 May 80.

Keywords: *Aircraft landings, *Altimeters, Calibration, Atmospheric pressure, Setting(Adjusting), Accuracy, Altimeter setting indicators.

The accurate altimetry required for landing approaches and terrain avoidance necessitates that reliable altimeter settings be available to compensate for changes in the local barometric pressure. The procedures and equipment used to provide altimeter settings and maintain their accuracy vary widely. In order to determine the accuracy actually found in the field a limited survey of altimeter setting indicators and some associated equipment was conducted at several locations. The results of that survey are presented.

700,191
PB84-244649 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Analyses of the FAA (Federal Aviation Administration) Post Crash Aircraft Fire Scenario.
Final rept.
J. G. Quintiere, and T. Tanaka. May 83, 13p
Sponsored in part by Federal Aviation Administration Technical Center, Atlantic City, NJ.
Pub. in Fire Technologies 19, n2 p77-89 May 83.

Keywords: *Aircraft fires, Aviation accidents, Aviation safety, Crash landing, Mathematical models, Reprints.

An attempt is made to develop mathematical predictions for various aspects of the dynamics of post crash aircraft fires. The basis of the analysis is the experimental simulation scenario under study by the FAA. The effects of wind are considered as well as the effect of interior and exterior fires. Suggestions are presented for estimating cabin door flow rates from measured temperatures.

700,192
PB85-145647 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Thermal Response of Aircraft Cabin Ceiling Materials during a Post-Crash, External Fuel-Spill, Fire Scenario.
L. Y. Cooper. Oct 84, 53p NBSIR-84/2912
Sponsored by Federal Aviation Administration, Washington, DC.

Keywords: *Aircraft fires, Fire tests, Aviation accidents, Aviation safety, Aviation fuels, Algorithms, Ceilings(Architecture), Materials, Fire safety, Fire resistant materials, Aircraft seats, *Aircraft crash fires, Exit, Emergency escape, Fire spread, Thermal response, Fuel spillage.

An algorithm is developed to predict the thermal response of aircraft ceiling materials during a post-crash fire scenario. The scenario involves an aircraft's emergency exit doorway which opens directly onto the flames of an external, fuel-spill fire which engulf a large portion of the fuselage. Data of near-ceiling temperatures acquired during a series of eight, full-scale, wide-body aircraft cabin, post-crash test simulations provide indirect validation of the algorithm. These tests involved cabins outfitted with single, mockup seats. Two other full-scale cabin tests involving fire spread through twenty-one seat arrays with different types of seat construction provide the input data required to exercise the algorithm in evaluations of fully outfitted cabins.

700,193
PB85-178333 PC **A04**/MF **A01**
Notre Dame Univ., IN. Dept. of Aerospace and Mechanical Engineering.
Numerical Simulations of the Effect of Floor and Ceiling Venting on Fire and Smoke Spread in Aircraft Cabins.
B. P. De Souza, K. T. Yang, and J. R. Lloyd. Feb 85, 72p NBS/GCR-84/479
Grant NB81-NADA-2000

Keywords: *Aircraft cabins, *Aircraft fires, Computerized simulation, Flow measurement, Mathematical models, Smoke, Vents, Ceilings(Architecture), Floors, Fire safety, UNDSAFE II computer code.

Several projects have studied the effects of fires on the interior environment of an aircraft. Fires both internal and external to the aircraft were considered. The thrust of the work was to obtain the interior flow field. The flow was calculated using two- and three-dimensional field models with experimental verification in a wind tunnel.

Aircraft

700,194
AD-A033 740/2 PC **A09**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Development of a Proposed Flammability Standard for Commercial Transport Flight Attendant Uniforms.
Final rept. Sep 74-Sep 76.
E. Braun, V. B. Cobble, J. F. Krasny, and R. Peacock. Aug 76, 191p FAA-RD-75-176
Contract DOT-FA75WAI-502

Keywords: *Uniforms, *Flight crews, *Commercial aircraft, *Fire safety, Flammability, Standards, Proposals, Transport aircraft, Test methods, Extinguishing, Heat flux, Fire resistant materials, Test equipment, Burning rate, Prototypes, Fabrics, Mannequin.

The objective of this work was to develop information to support a proposed flammability standard for flight attendant uniforms. Currently used uniforms were found to burn to varying degrees when exposed to a temporary small ignition source. The feasibility of de-

signing uniforms with improved fire safety is demonstrated. Trade-offs in terms of cost, appearance, serviceability, and comfort are discussed. A proposed flammability standard for flight attendant uniforms is included. It describes the tests and qualifying criteria needed to add self-extinguishing characteristics and heat flux resistance to various types of F/A uniform items.

700,195
AD-A050 923/2 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Time-Dependent Fire Behavior of Aircraft Cabin Materials.
Final rept. Mar 76-Jun 77.
C. Huggett. Dec 77, 43p FAA-RD-77-99
Contract DOT-FA76WAI-610

Keywords: *Aircraft cabins, *Aircraft fires, *Fire safety, Fire resistant materials, Fuel consumption, Exponential functions, Reaction time, Temperature, Smoke, Growth(General), Combustion stability, Laboratory tests, Tolerances(Physiology), Mathematical prediction.

In an aircraft cabin or other inhabited compartment, the early stages of fire growth are critical to life safety. During this period the rate of fire growth, as measured by the mass fuel consumption rate m, can be represented approximately as a simple exponential function of time. The rates of development of hazard from temperature rise and smoke and gas accumulation can be related to m. The growth constant k can be related to a small number of system parameters and fuel combustion properties. These properties are identified and laboratory methods for their measurement are suggested. In a fire situation, the critical hazard (temperature, smoke or gas) can be considered to be the one which first reaches a limiting human tolerance level. This mode can be identified and the effects of changes in design and materials on the rate of critical hazard development can be estimated. The simple exponential growth model may provide a means of predicting relative hazard with reasonable accuracy.

700,196
N81-74903/8 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
Materials for Cryogenic Wind Tunnel Testing.
R. L. Tobler. May 80, 136p NBSIR-79-1624, NASA-CR-165716
Contract NASA-L-59674A

Keywords: Materials, Cryogenics, Instruments, *Airplane models, *Wind tunnel tests.

A study was conducted to guide the evaluation and selection of materials and techniques to be used in construction of model aircraft for cryogenic wind tunnel testing. In this report, the mechanical, thermal, and electrical property behavior of materials at temperatures as low as 77 K is briefly reviewed. Metals, structural alloys, non-metals, composites, joining methods, coatings, sealants, adhesives, contact agents, lubricants, transducers, and instrumentation for cryogenic applications are discussed. Acceptable structural materials, conductors, and insulators are discussed for service at temperatures in the range 367 to 77 K. Numerous references to handbooks and other cryogenic data sources are cited as a guide to additional information.

700,197
PB78-600062 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Emergency Locator Transmitters--Effective Radiated Power Levels and Techniques of Determining Effective Radiated Power.
H. E. Taggart, J. L. Workman, and R. E. Nelson. 1971, 53p
Pub. in Report of the National Bureau of Standards Studies Emergency Locator Transmitters Effective Radiated Power Levels and Techniques of Determining Effective Radiated Power, Report No. FS-130-4, p1-53 1971.

Keywords: *Emergency transmitters, Measurement procedures, Radiated power.

This report is concerned with the specifications and methods of evaluating Emergency Locator Transmitters (ELT's) for lost aircraft. Heretofore, there were no uniform methods of evaluating the effectiveness of the various types of ELT's, and the minimum amount of power required for these devices to operate satisfactorily has been a point of much discussion. The purpose of this report is to clarify some of these areas by: (1) Establishing the minimum effective radiated power from an ELT required to generate a reliable field strength for a search aircraft located 25 nautical miles from the ELT at an altitude of 3500 feet above the ELT; (2) Developing an accurate measurement technique for evaluating an ELT; (3) Developing a measurement technique for testing ELT's on a production line basis. The results contained in this report are supported by both theoretical data and independently obtained measured data. The agreement between the two are used to establish limits of error for the ELT evaluation techniques.

700,198
PB81-600051 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
System for Inflating an Air Launched Balloon.
C. F. Sindt. 1979, 11p
Pub. in Proceedings 10th Air Force Geophysics Lab. Scientific Balloon Symp., Portsmouth, NH, Aug. 21-23, 1978, Report No. AFGL-TR-79-0053, p149-159 1979.

Keywords: *Balloon inflation, Cryogenic helium balloon inflation, Heat transfer, Liquid helium, Packed bed heat exchanger,

The paper describes a technique for inflating a balloon with helium as the balloon, its payload and the inflation system descend on a parachute. The helium used for inflation is stored in the liquid state and subsequently converted to gas using a hot bed heat exchanger. Two systems using this technique were tested. The first used a commercial liquid helium dewar and a heavy heat exchanger which was designed to prove the concept and not intended for flight. The second system which was to be taken to the launch altitude by a carrier balloon, provided 48.5 kg of helium gas at an average temperature of 248 deg. K in five minutes. The system which weighed 363 kg, incuding helium, was self contained and required a single electrical signal for activation.

700,199
PB83-119891 PC **A04**/MF **A01**
Factory Mutual Research Corp., Norwood, MA.
Computer Modeling of Aircraft Cabin Fire Phenomena.
M. A. Delichatsios, R. L. Alpert, L. Orloff, and M. K. Mathews. Oct 82, 65p NBS-GCR-82-404
Contract NB81-NADA-2007

Keywords: *Aircraft cabins, *Aircraft fires, Flame propagation, Heat flux, Computer programs, Mathematical models, Heat transfer.

A two-layer integral model is presented for the calculation of turbulent wall flows on a vertical wall including a burning wall. The turbulent flow is divided into inner and outer turbulent regimes. These regimes are matched on a dividing streamline after appropriate wall laws for the turbulent flow have been developed. Wall laws, which depend on the specific boundary conditions, are proposed for an adiabatic wall plume, with addition of an inert material at the wall and a burning wall. The present methodology could be used also to develop wall flow laws for a constant temperature or constant heat flux wall and the overfire region above a burning wall. Numerical results are presented for an adiabatic wall flow with constant buoyancy flux and a burning wall without appreciable radiation.

700,200
PB83-600039 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Airspeed Display Scale with Integral Trend Indication.
O. B. Laug, C. C. Gordon, and R. O. Stone. Filed 11 Jun 81, patented 15 Nov 83, 7p PAT-APPL-6-272 624, PATENT-4 415 974

Keywords: *Aircraft, Airspeed, Digital-electronic circuitry, Display scale.

A digitally activated display scale in association with digital-electronic circuitry, displays both the airspeed and airspeed trend of a landing aircraft. The digital/electronic circuitry process an analog voltage corresponding to an airspeed range of 80 to 179 knots to produce a digital number representative of the airspeed of the landing aircraft. The digital number is used to produce a continuous display of the airspeed and to indicate the trend of the airspeed as either increasing or decreasing.

Avionics

700,201
PB-277 982/5 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Applied Mathematics Div.
Problems in World-Wide Standardization of the Units of Altitude Measurement.
Technical rept.,
J. F. Gilsinn. Feb 78, 25p NBSIR-77-1386
Sponsored in part by Federal Aviation Administration, Washington, D.C.

Keywords: *Aircraft, *Altimeters, *Metric system, Standardization, Directional measurement, Air traffic control, Units of measurement, *Metrication.

The U.S. commitment to a voluntary conversion to metric units raises changeover problems in the fields of air traffic control and airspace management. This report begins by discussing current practice in altitude measurement and the rules for height maintenance now in effect worldwide. Four desirable features are given for an altitude measurement system, encompassing both the units of height measurement and the designation of cruising levels. Three alternative bases for the design of such a system are discussed and related to the desirable characteristics. Problems associated with each of the approaches are discussed and the many factors to be considered and the many interrelationships involved are examined.

Test Facilities & Equipment

700,202
PB-294 501/2 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Fluid Engineering Div.
Low-Velocity Airflow Calibration and Research Facility.
Technical note (Final).
L. P. Purtell, and P. S. Klebanoff. Mar 79, 26p NBS-TN-989
Contract H0133024

Keywords: *Subsonic wind tunnels, *Meteorological instruments, *Calibration, *Wind velocity, Air flow, Optical measuring instruments, Lasers, Laboratories, Mine ventilation.

In recent years concern for environmental quality, and occupational safety and health have generated a need for air flow measurements in lower velocity ranges than previously dealt with. There has been generated the need for more accurate measurements of airflow in a range of velocities which hitherto has not received much attention, i.e., below 152.4 meters (500 feet) per minute with particular emphasis on velocities less than 30.5 meters per minute. A low velocity airflow facility suitable for the calibration of wind speed measuring instruments and research in aerodynamics is described. The flow facility is of the open-return type with a test section 20 feet long, and nominally 3 x 3 feet in cross section. Special attention was given to obtaining an air stream with a high degree of spatial uniformity and low turbulence with excellent speed control over the range from 10 to 3300 feet per minute. Laser-optical methods with appropriate signal processing electronics are employed to establish a primary standard for the measurement of very low velocities. A crossed-beam dual-scattering laser-optical system is used that can operate with either forward or backscattering, and in a frequency shifted Bragg cell mode, or in a non-frequency shifted optical beam-splitter block mode. Detailed performance characteristics of the flow facility and the laser velocity standard are presented.

700,203
PB79-600068 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Wind Interaction of Neighboring Tall Buildings.
T. A. Reinhold. 1979, 4p
Pub. in Proceedings ASCE Third Engineering Mechanics Division Specialty Conf., Sept. 17-19, 1979, Austin, TX, p179-182 1979.

Keywords: *Aerodynamics, Boundary layers, Dynamic response, Interference effects, Tall buildings, Wind loads, Wind tunnels.

A wind-tunnel investigation into the influence of an upstream structure on the dynamic wind loads acting on a square-section tall building is described. The test configurations studied and the types of data obtained are presented. Rresults are discussed and some important observations are summarized. The paper contains a listing of reports which contain more detailed information concerning the tests and results.

700,204
PB85-136810 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Wind Tunnels Applied to Wind Engineering in Japan.
Final rept.
R. D. Marshall. Jun 84, 19p
Pub. in Jnl. of Structural Engineers 110, n6 p1203-1221 Jun 84.

Keywords: *Wind tunnels, Aerodynamics, Boundary layer, Research management, Test facilities, Engineering, Dimensions, Performance evaluation, Reprints.

Many large boundary layer wind tunnels have been commissioned in Japan over the past 10 years, giving Japan a commanding lead in this area of technology. Some reasons for this extensive building program include the recent concentration of government research institutes at Tsukuba, the increased emphasis on structural and bridge engineering by the heavy industry companies, and the emphasis placed on research by Japanese construction corporations. In general, Japanese universities have not been able to keep pace with the government and private sectors in providing their engineering laboratories with modern and expensive research facilities. Nevertheless, much of the new and exciting work in wind engineering is being done by the universities. The very substantial investment made in boundary layer wind tunnels over the past two years suggests that Japanese heavy industries and construction corporations see a bright future for wind engineering. It is concluded that a significant penetration of the U.S. market for specialized engineering services is likely to occur within the next few years. The paper presents basic dimensions and performance characteristics for several wind tunnels and four new boundary layer wind tunnels are described in detail.

700,205
PB85-140812 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Harmonic Optimization of a Periodic Flow Wind Tunnel.
Final rept.
J. P. Retelle, J. M. McMichael, and D. A. Kennedy. 1981, 6p
Sponsored by Air Force Academy, CO., and Colorado Univ. at Boulder.
Pub. in Jnl. of Aircraft 18, n8 p618-623 1981.

Keywords: *Wind tunnels, Unsteady flow, Revisions, Velocity, Harmonics, Performance, Vanes, Optimization, Design, Reprints.

This work describes a wind tunnel modification designed to superpose on the mean velocity sinusoidal longitudinal velocity fluctuations with minimal harmonic content. The technique is presented in light of a theoretical analysis of the low-frequency performance illustrating how harmonic suppression can be achieved with this particular design. Velocity fluctuations are produced by a system of primary rotating vanes and a bypass containing a secondary set of rotating vanes. Experimental data on tunnel performance are also presented.

700,206
PB85-224418 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Performance Requirements and Preliminary Design of a Boundary Layer Wind Tunnel Facility.
Final rept.
R. D. Marshall. May 85, 68p NBSIR-85/3168

Keywords: *Wind tunnels, *Boundary layer, Test facilities, Design, Performance, Contraction, Diffusers, Aerodynamics, Buildings, Structures, *Wind engineering.

This report describes performance characteristics and design details of a boundary layer wind tunnel for supporting research activities within the Center for Building Technology. Two preliminary designs, the first consisting of a conventional closed-circuit scheme in an over/under configuration and the second consisting of an open-circuit scheme with a 'pusher' or 'blow-down' configuration, are addressed.

700,207
PB86-123031 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.
Evaluation of Methods for Characterizing Surface Topography of Models for High Reynolds Number Wind-Tunnels.
Final rept.
E. C. Teague, T. V. Vorburger, F. E. Scire, S. W. Jensen, S. M. Baker, C. Trahan, and B. B. Gloss. 1982, 6p
Pub. in American Institute of Aeronautics and Astronautics Aerodynamic Testing Conference (12th), Williamsburg, VA., March 22-24, 1982, p246-251.

Keywords: *Wind tunnels, Evaluation, Wind tunnel models, Reynolds number, Boundary layer flow.

Because of the high Reynolds number of the National Transonic Facility, (NTF), and the attendant thin boundary layers, NASA is reexamining aerodynamic effects related to model surface topography definition. There are no data which demonstrate that the stylus profilometers used by model fabrication shops accurately determine the surface topography of surfaces typical of NBS models. The paper describes current work at the National Bureau of Standards, sponsored by NASA, to evaluate the performance of stylus profilometers for this application and to develop a light scattering instrument which will yield accurate characterizations of the surface microtopography and overcome the problems associated with stylus profilometry.

700,208
PB87-127932 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Surface Roughness Studies for Wind Tunnel Models Used in High Reynolds Number Testing.
Final rept.
T. V. Vorburger, M. J. McLay, F. E. Scire, D. E. Gilsinn, C. H. W. Giauque, and E. C. Teague. 1986, 6p
Sponsored by National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Pub. in Jnl. of Aircraft 23, n1 p56-61 Jan 86.

Keywords: *Wind tunnel models, *Surface roughness, Optical measurement, Reynolds number, Reprints, National Transonic Facility.

The paper focuses on stylus and optical techniques for the measurement of surface roughness in wind tunnel models. The stylus instruments provide detailed information, such as surface profiles and area maps, that may then be used either to calculate statistical properties (i.e., the rms surface roughness) or to study individual surface peaks or other features. By contrast, certain optical techniques yield area-averaged statistical properties of the surface roughness directly. Two instruments that use the technique of optical angular scattering are compared. One is a research instrument that has been developed to study the basic scattering phenomena by testing the optical theories and surface models used in inverse calculations of statistical roughness parameters. The second instrument is more compact and is under development as a hand held, on-line device to be used during manufacture of wind tunnel models for the National Transonic Facility at NASA Langley Research Center. The scattering geometries for the two instruments are compared and results from these instruments and the stylus technique are shown for roughness specimens that are typical of the surface finish of wind tunnel models.

700,209
PB88-109921 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Wind Tunnel Model Surface Gauge for Measuring Roughness.
Final rept.,
T. V. Vorburger, D. E. Gilsinn, E. C. Teague, C. H. W. Giauque, and F. E. Scire. Jun 87, 57p NBSIR-87/3586
Sponsored by National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.

Keywords: *Surface roughness, *Optical measuring instruments, Wind tunnel models.

The report covers research performed in the optical inspection of surface roughness by members of the Center for Manufacturing Engineering under contracts L-4718B and L-20078B with the NASA Langley Research Center. The project has proceeded along two lines: first research into a quantitative understanding of light scattering from metal surfaces and into the appropriate models to describe the surfaces themselves, and second, the development of a practical instrument for the measurement of rms roughness of high performance wind tunnel models with smooth finishes. The research has been discussed in previous articles and is only summarized here. The report is concerned primarily with the latter subject.

AGRICULTURE & FOOD

Agricultural Chemistry

700,210
PB87-197794 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Mass Basis Karl Fischer Titration Equation for Moisture Determination.
Final rept.,
F. E. Jones. 1985, 1p
Pub. in Jnl. of the Association of Official Analytical Chemists 62, n11 p1605 1985.

Keywords: *Grain, Moisture, Titration equation, Water content, Reprints, Karl Fischer titration, *Mass basis.

An equation is presented for calculation of moisture content of grain from measurements, on a mass basis, of various quantities in Karl Fischer titration procedures. This equation complements a similar equation in which the quantities are expressed on a volume basis.

Food Technology

700,211
PATENT-4 009 704 Not available NTIS
Department of Commerce, Washington, DC.
Cool-Touch Cooking Surfaces.
Patent.
L. A. Marzetta. Filed 17 Aug 76, patented 1 Mar 77, 4p PB-271 818/7, PAT-APPL-715 026
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, D.C. 20231 $0.50.

Keywords: *Patents, *Cooking devices, *Electric appliances, *Safety devices, Safe handling, Protection, Asbestos, Ceramics, PAT-CL-126-221.

The patent concerns a cool-touch safety covering for the cooking surfaces of warming trays, hot plates and other cooking appliances. The covering is fibrous, springy or otherwise compressible under the weight of a pan or other cooking utensil and its contents. In the uncompressed state, the covering stores relatively little heat per unit volume and transfers the heat relatively poorly, so that it will not burn a finger or other body surface briefly contacting it, even though the covering is heated to 200-300C or higher. In the compressed state, the covering transfers heat relatively well, thereby permitting an ample flow of heat to the utensil and its food or other contents. The covering may include one or more of the following: a matted felt of asbestos, ceramic or other thermally stable fibers; a wool-like layer of ceramic, metal or other fibers; a rippled sheet of thermally stable plastic or metal; a sandwich of springs or rings between sheets of plastic or metal; or spaced-apart metal or plastic screens.

700,212
PB-284 492/6 PC **A04**/MF **A01**

National Measurement Lab. (NBS), Washington, D.C. Polymer Science and Standards Div.
Evaluation of Existing Models Describing the Migration of Additives in Polymers.
Semi-annual rept. (Final), 1 Sep 77-30 Mar 78,
I. C. Sanchez, S. S. Chang, F. L. McCrackin, and L. E. Smith. Jul 78, 71p NBSIR-78-1499
Prepared for Food and Drug Administration, Washington, D.C. Bureau of Foods.

Keywords: *Mathematical models, *Plastics, *Food additives, *Packaging materials, Transport properties, Thermodynamics, Diffusion, Polymers, Additives.

The objective of this work is the development of mathematical models that describe the migration of a variety of small molecules in polymers that have applications in food contact uses. In the most general cases, these models will be able to predict the amount of additive migration given any particular time and temperature history. These models can serve as the technical basis for more efficient regulatory methods under existing frameworks or in the design and implementation of new indirect additive regulations or policy. The first steps in the development and assessment of such models are given in this report. The first section presents a preliminary survey of migration data applicable to food contact situations that are available in the current literature. The second section surveys available models describing migration and evaluates their present and potential utility. (Portions of this document are not fully legible)

700,213
PB-284 704/4 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
Evaluation of a Test Method for Measuring Microwave Oven Cooking Efficiency,
O. B. Laug. Sep 77, 36p NBSIR-77-1387
Sponsored in part by Federal Energy Administration, Washington, D.C.

Keywords: *Ovens, *Cooking devices, Microwave equipment, Efficiency, Tests, Evaluation, Thermal efficiency, *Microwave ovens.

A standard test procedure for measuring the energy efficiency of microwave ovens has been developed and tested on current representative products. The test method is based on the International Electrical Commission (IEC-SC-59H) procedure for measuring performance of microwave cooking appliances. The results of laboratory tests show that the method is repeatable, easy to perform, and requires a minimum of special techniques or apparatus. A technique was developed to measure the efficiency of cooking various foods in the ovens. The efficiencies determined by the standard test method are shown to be realistic and correlate well with the efficiencies determined by cooking a variety of foods.

700,214
PB-289 088/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of Trace Elements in New Food Grain SRM's Using Neutron Activation Analysis.
Final rept.,
T. E. Gills, M. Gallorini, and H. L. Rook. 1978, 5p
Pub. in Jnl. of Radioanalytical Chemistry, v46 p21-25 1978.

Keywords: *Grains(Foods), *Metals, *Neutron activation analysis, Trace elements, Public health, Monitoring, Chemical analysis, Standard reference materials, *Toxic substances, Reprints.

Potentially toxic metals in the food chain that can lead to deleterious effects on human health have been well documented. Because of the toxicity of some metals, levels of 1 ppm or less must be routinely monitored in foods to ensure human safety. To ensure the accuracy of measurement, NBS in a cooperative interagency agreement with the Food and Drug Administration is involved in developing and certifying selected elements in food grain as a part of the Standard Reference Material program. Both instrumental and radiochemical neutron activation analysis were used to analyze two food grain standard reference materials (Rice and Wheat Flours) for trace element certification.

700,215
PB-289 091/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Standard Reference Materials 1567, Wheat Flour, and 1958, Rice Flour, Certified for Concentrations of Selected Trace Element Nutrients and Environmentally Important Constituents.
Final rept.
R. Alvarez, and H. L. Rook. Aug 78, 7p
Pub. in Proceedings of National Conference on Wheat Utilization Research (10th), Tucson, AZ 16-18 Nov 77 p156-162 1978) (U.S. Dept. of Agriculture, Berkeley, CA.)

Keywords: *Flours(Food), *Nutrients, *Chemical analysis, Trace elements, Calibrating, Standards, Laboratory equipment, Concentration(Composition), *Standard reference materials, *Wheat flour, *Rice flour.

The National Bureau of Standards has issued two unfortified flour Standard Reference Materials--a bleached wheat flour and a rice flour. The Certificates of Analysis for SRM 1567, Wheat Flour, and SRM 1568, Rice Flour list concentration valuses for selected trace element nutrients, environmentally important elements, and other trace elements of undefined function. These SRM's were developed because of the importance of trace elements, which are present in foods at or below the parts-per-million level and because of the difficulty of determining them reliably. The certified reference materials are intended primarily for evaluating the accuracy of these elemental determinations in flours and other cereal foods. They will be useful for developing reliable trace element methods, for calibrating the instrumentation used in these analyses, and for providing certified values to which experimental data acquired at different times by the same or different laboratories can be compared.

700,216
PB-289 812/0 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Fields Div.
Electrical Characteristics of Corn, Wheat, and Soya in the 1-200 MHz Range.
R. N. Jones, H. E. Bussey, W. E. Little, and R. F. Metzker. Oct 78, 70p NBSIR-78-897

Keywords: *Corn, *Wheat, *Soybeans, *Moisture content, Dielectric properties, Microwaves, Power loss, Measurement, Loss tangent.

A set of coaxial sample holders together with a measurement and data reduction technique has been developed and applied to the study of the dielectric properties (epsilon* = epsilon'-j(epsilon double prime)) of wheat, corn, and soya over the 1 to 200 MHz range. Particular attention was given to the behavior of the dielectric properties as a function of percent moisture content, frequency, and packing density. Data were also taken to evaluate the dependence of dielectric properties on temperature and sample holder configuration. Some study was also devoted to the correlation between dielectric constant (epsilon'), loss factor (epsilon double prime), loss tangent (epsilon double prime/epsilon'), and percent moisture content. Particular emphasis was devoted to a study of high moisture corn (up to 40%).

700,217
PB80-211923 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS (National Bureau of Standards) Standard Reference Materials for Quality Control of Nutrient Element Determinations in Foods.
R. Alvarez, and T. C. Rains. 1980, 8p
Pub. in Nutrient Analysis Symp. Annual Meeting (93rd), Washington, DC., October 15-18, 1979, p86-93 1980.

Keywords: *Food, *Nutrients, *Chemical analysis, Quality control, Concentration(Composition), Samples, Standards, Reprints, Standard reference materials.

Accurate data on the chemical composition of foods are needed to determine the effects of changes in crop culture, animal feeds, and food processing on the nutrient content. In these studies, the data may be acquired over a long-term period by a single investigator or by a number of investigators in different laboratories using various methods and types of instruments. Unless each laboratory uses acceptable quality control procedures, faulty values leading to erroneous conclusions will result. Acceptable procedures require the use of reliable methods and food reference materials with certified concentration values for the nutrients of interest. Standard Reference Materials (SRM's) of food are issued by NBS as part of its SRM program. Examples of these SRM's are: Oyster Tissue (SRM 1566), Wheat Flour (SRM 1567), Rice Flour (SRM 1568), Brewer's Yeast (SRM 1569), Spinach (SRM 1570), and Bovine Liver (SRM 1577). SRM's are used to develop reliable methods and to ensure satisfactory quality control of the data provided by the methods by analyzing the SRM's together with the unknown samples. Agreement of the concentrations obtained for the SRM's with the certified values indicates satisfactory quality control.

700,218
PB80-211931 Not available NTIS
National Bureau of Standards, Washington, DC.
Biological Standard Reference Materials Certified for Chromium Content,
R. Alvarez, W. Wolf, and W. Mertz. 1979, 9p
Pub. in Proceedings of the Symposium on Chromium in Nutrition and Metabolism, Sherbrooke, Canada, July 13-15, 1979, Paper in Chromium in Nutrition and Metabolism, p85-93 1979.

Keywords: *Chromium, *Meetings, *Food, Cattle, Liver, National government, Yeast, *Standard reference materials, National Bureau of Standards.

A biological Standard Reference Material, SRM 1569 Brewers Yeast, has been certified for chromium content at 2.12 + or - 0.05 micrograms/g by the National Bureau of Standards. Fourteen laboratories participated in an interlaboratory comparison of analytical results on samples of SRM 1569 using a variety of methods. This study led to several conclusions. In general, the analytical results were either close to the certified value or too low with atomic absorption results showing more variation than those by activation analysis. The main analytical problem appeared to be either losses, or incomplete recovery during sample preparation. During certification of this material, a significant fraction of the 51Cr content of irradiated samples was volatilized and trapped during a digestion procedure. A second collaborative study with a different sample of brewers yeast, using various SRM's as a comparator was conducted. The results of this study show much better interlaboratory agreement. The level of chromium in SRM 1569 is somewhat higher than that found in most foods. The recent certification of chromium level of 0.088 + or - 0.012 micrograms/g for the previously issued Bovine Liver (SRM 1577) gives a reference material with lower content. The use of these two materials in reporting of analytical data for chromium in biological materials will allow valid comparisons of data between laboratories.

700,219
PB80-211956 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS (National Bureau of Standards) Plant Tissue Standard Reference Materials,
R. Alvarez. Jul 80, 3p
Pub. in Proceedings of the Symposium on Standardizing Methods for Soil Testing and Plant Analysis, Annual Meeting of the AOAC (92nd), Washington, DC., October 16-19, 1978, Jnl. of the Association of Official Analytical Chemists 63, n4 p806-808 Jul 80.

Keywords: *Plant tissues, *Food, *Nutrients, *Contaminants, *Meetings, Nutrition, Analyzing, Plants(Botany), *Standard reference materials, National Bureau of Standards.

NBS issues six Standard Reference Materials that are useful for the determination of nutrient and contaminant elements in plant tissues and agricultural food products. They are: SRM 1571 Orchard Leaves, SRM 1573 Tomato Leaves, SRM 1575 Pine Needles, SRM 1570 Spinach, SRM 1567 Wheat Flour, and SRM 1568 Rice Flour. These SRM's are used to calibrate instrumentation, to determine the accuracy of existing analytical methods, and to develop more accurate methods. The Certificate of Analysis for each SRM contains such informatin as the homogeneity of the powdered material, the minimum sample size to be used, the certified values for the elements with their uncertainties, and the noncertified values. A certified value is based either on concordant results by independent analytical methods or on results by a definite method i.e. an accurate method having identified, systematic errors. These certified values can serve as common reference points for comparison of data acquired over a long period by various investigators using a variety of methods.

700,220
PB80-220288 PC **A07**/MF **A01**

National Bureau of Standards, Washington, DC. National Measurement Lab.
Models for the Migration of Additives in Polyolefins.
Annual rept. 1 Oct 78-30 Sep 79,
L. E. Smith, S. S. Chang, F. L. McCrackin, I. C. Sanchez, and G. A. Senich. Aug 80, 134p NBSIR-80-1999
Sponsored in part by Food and Drug Administration, Washington, DC. Bureau of Foods.

Keywords: *Olefin resins, *Diffusion, *Food additives, *Packaging materials, Food packaging, Mathematical models, Decanes, Polyolefins.

The program has focused initially on the class of polymers best described as polyolefins. These polymers represent the majority of plastics used in packaging applications and the authors feel that models of migration developed for the principal members of the class will be applicable to most members with only minor modifications. The technical requirement that the polymers be equilibrium fluids rather than glasses can be established by a glass transition temperature well below the use temperature or by evidence of some crystallinity at use temperatures. Using these criteria, a preliminary classification of polymers based on chemical structure has been developed. The authors have found a formal decision tree to be a useful device to focus attention on the specific technical decisions involved in making regulatory judgments on indirect additive questions. A simple example of such a decision tree is given. The general form of this tree is, of course, independent of the polymer-migrant system involved but the functional forms used in the calculations of partition coefficients and diffusion constants are specific for the class of polymer involved. The determination of the appropriate functions for decisions is a principal objective of our work along with an assessment of the experimental data and methods needed as inputs.

700,221
PB81-118564 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS Standard Reference Materials 1567, Wheat Flour, and 1568, Rice Flour, Certified for Concentrations of Selected Trace Element Nutrients and Environmentally Important Constituents.
Final rept.
R. Alvarez, and H. L. Rook. Aug 78, 7p
Pub. in Proc. National Conf. on Wheat Utilization Research (10th), held at Tucson, AZ, Nov 16-18, 1977 p156-162 (Office of the Regional Administrator for Federal Research (Western Region), Science and Education Administration, U.S. Dept. of Agriculture, Berkeley, CA 94705, Aug 78.

Keywords: *Flours(Food), *Food analysis, *Trace elements, Chemical analysis, Nutrients, Concentration(Composition), Laboratory equipment, Calibrating, *Standard reference materials.

The National Bureau of Standards has issued two unfortified flour Standard Reference Materials--a bleached wheat flour and a rice flour. The Certificates of Analysis for SRM 1567, Wheat Flour, and SRM 1568, Rice Flour list concentration values for selected trace element nutrients, environmentally important elements, and other trace elements of undefined function. These SRM's were developed because of the importance of trace elements, which are present in foods at or below the parts-per-million level and because of the difficulty of determining them reliably. The certified reference materials are intended primarily for evaluating the accuracy of these elemental determinations in flours and other cereal foods. They will be useful for developing reliable trace element methods, for calibrating the instrumentation used in these analyses, and for providing certified values to which experimental data acquired at different times by the same or different laboratories can be compared.

700,222
PB81-126146 Not available NTIS
National Bureau of Standards, Washington, DC.
Migration Models for Polymer Additives.
I. C. Sanchez, S. S. Chang, and L. E. Smith. 1980, 8p
Pub. in Polym. News 6, p249-256 1980.

Keywords: *Polymers, *Food packaging, *Mathematical models, *Additives, Absorption, Reprints.

An important problem in food packaging is the absorption into food of chemicals present in the packaging material. For the past two years, the Polymer Science and Standards Division of the National Bureau of Standards has been studing the migration of additives from polymeric packaging materials to food simulating solvents. This study has been carried out under an interagency agreement with the Bureau of Foods of the U.S. Food & Drug Administration. Our primary goal in this research program has been to develop a migration model which can be used as a guide for the food packaging industry and serve as a sound scientific basis for FDA regulatory decisions. What follows is a brief progress report of our study.

700,223
PB82-196403 PC **A12**/MF **A01**
National Bureau of Standards, Washington, DC.
Migration of Low Molecular Weight Additives in Poloyefins and Copolymers.
Final rept.
S. S. Chang, G. A. Senich, and L. E. Smith. Mar 82, 259p NBSIR-82-2472
Sponsored in part by Food and Drug Administration, Washington, DC. Bureau of Foods. Portions of this document are not fully legible.

Keywords: *Food packaging, *Food additives, Copolymers, Diffusion, Concentration(Composition), Polyethylene, Olefin resins, Extraction, Storage, Gas chromatography, Isotopic labeling, Ethylene copolymers, Vinyl acetate copolymers, Tracer techniques, Numerical solution.

Food packaging is an inseparable part of modern life. Any substance that migrates from the packaging material into foods is viewed as indirect food additives. In connection with toxicological knowledge, it is important to know the amount of such indirect food additives expected to be present in the food during storage and processing. This program, sponsored by the Bureau of Foods of the Food and Drug Administration is to provide theoretical models, reliable data base, methodology to study the migration phenomena and to provide reasonable worst-case estimates for the concentrations of the indirect additives in food. In this final report, the authors present the results of approximately 250 completed migration experiments based on radiotracer techniques on the migration of low molecular weight hydrocarbons and antioxidants from polyethylene, polypropylene and ethylene-vinyl acetate copolymers. Results of a study for the determination of relative diffusion coefficients of several probe molecules in the polyethylene melt by inverse gas chromatography are also presented. Based on these studies, ethanol appears to be a far more reasonable food-oil stimulating solvent than n-heptane. Other pure or mixed triglycerides may also be considered as food-oil simulating solvents, however they may pose the same analytical difficulties as that of the food oil itself.

700,224
PB84-177823 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Role of Color in Lighting for Meat and Poultry Inspection.
B. L. Collins, and J. A. Worthey. Mar 84, 89p NBSIR-84-2829
Sponsored in part by Department of Agriculture, Washington, DC.

Keywords: *Food inspection, *Food analysis, *Meat, *Poultry, *Colors(Materials), *Chromaticity, Illuminescence, Inspection, Spectroradiometers, Reflectance, Light(Visible radiation), Luminous intensity.

The role of color in lighting for meat and poultry inspection is discussed. A review of literature relevant to the problem of quality of illumination is presented, along with literature specific to agricultural and veterinary problems. A psychophysical study of the accuracy of detecting and identifying selected defects in meat and poultry was conducted under five light sources: incandescent, cool white fluorescent, cool white deluxe, high pressure sodium (HPS), and low pressure sodium (LPS). The results indicated that more errors were made under the latter two sources, and that the inspection task was rated as more difficult under these sources. In addition, spectroradiometric measurements were made of defective and adjacent 'normal' tissue to document the kinds of spectral reflectance that exist in four species: chicken, cattle, turkey, and swine. These measurements indicated that differences in spectral reflectance characterized much of the tissue studied. Based on these data, recommendations are made to avoid the use of light sources with poor color rendering qualities in the inspection task.

700,225
PB85-145282 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radiation Chemistry of Water-Soluble Food Components.
Final rept.
M. G. Simic. 1983, 73p
Pub. in Chapter 9, Preservation of Food by Ionizing Radiations, p1-73 1983.

Keywords: *Food analysis, *Radiation chemistry, *Solubility, Reaction kinetics, Proteins, Amino acids, Carbohydrates, Vitamins, Proteins, Peptides, Preservation, Reprints, State of the art, Chemical reaction mechanisms, Free radicals.

Radiation chemistry of water-soluble food components has been reviewed and deals with state of art in radiation preservation of food. It covers kinetics and mechanisms of water free radical (e(-1)(sub aq), OH, H) reactions with (a) amino acids, peptides, proteins, (b) acids, esters and lipids, (c) carbohydrates, (d) vitamins.

700,226
PB85-202604 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radiation Dosimetry in Food Irradiation Technology.
Final rept.
W. L. McLaughlin, R. M. Uribe, and A. Miller. 1982, 3p
Pub. in Trans. American Nuclear Society 41, p23-25 1982.

Keywords: *Food irradiation, *Dosimetry, Quality assurance, Quality control, Gamma rays, Bremsstrahlung, Electron beams, Reprints, Food preservation.

Routine dosimetry is a valuable means of quality control in the preservation of food by ionizing radiation. The radiations include mainly gamma-ray photons (e.g. (60) Co and (137) Cs gamma rays), bremsstrahlung, and electron beams up to 10 MeV. The dose ranges are about 1 kilorad to several megarad. Because of this relatively wide dose range in food processing and the fairly high dose rates and possible extremes of environmental conditions in a process irradiator, dosimetry can require traceability to standards, i.e. by accurate calibration. Suitable care is also required in the selection of the proper dosimetry system for the purpose at hand. The aim of the present summary is to suggest appropriate methods of dosimetry and routine measurement procedures for achieving quality assurance in radiation processing.

700,227
PB85-229854 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Standardization of High-Dose-Measurement of Electron and Gamma Ray Absorbed Doses and Dose Rates.
Final rept.
W. L. McLaughlin. 1985, 15p
Pub. in Proceedings of the International Symposium on High-Dose Dosimetry, Vienna, Austria, October 8-12, 1984, p357-371 1985.

Keywords: *Dosimetry, *Heat measurement, Electron beams, Food irradiation, Gamma radiation, Standards.

Intense electron beams and gamma radiation fields are used for sterilizing medical devices, treating municipal wastes, processing industrial goods, controlling parasites and pathogens, and extending the shelf-life of foods. Quality control of such radiation processes depends largely on maintaining measurement quality assurance through sound dosimetry procedures in the research leading to each process, in the commissioning of that process, and in the routine dose monitoring practices. This affords documentation as to whether satisfactory dose uniformity is maintained throughout the product and throughout the process. Therefore, dosimetry at high doses and dose rates must in many radiation processes be standardized carefully, so that 'dosimetry release' of a product is verified. The standardization is initiated through preliminary dosimetry intercomparison studies such as those sponsored recently by the IAEA. This is followed by establishing periodic exercises in traceability to national or international standards of absorbed dose and dose rate.

700,228
PB86-202827 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Radiation Chemistry - Extravaganza or an Integral Component of Radiation Processing of Food.
Final rept.
M. G. Simic, M. Dizdaroglu, and E. DeGraff. 1983, 7p
Pub. in Proceedings of the International Meeting on Radiation Processing (4th), Dubrovnik, Yugoslavia, October 4-8, 1982, Radiation Physics and Chemistry 22, n1-2 p233-239 1983.

Keywords: *Food irradiation, Food processing, Radiochemistry, Radiation dose.

The role of radiation chemistry in irradiation processing of foods is discussed in detail. A few examples demonstrating the relevance of radiation chemistry of model systems to the Food Irradiation Technology are given. The importance of irradiation parameters such as dose, dose rate, temperature, atmosphere, physical state and additives in achieving acceptable and high quality of irradiated foods are emphasized. A few examples of radiation-induced free radical reactions in model compounds relevant to foods are also discussed.

700,229
PB87-149464 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Free Radical Chemistry of Natural Products.
Final rept.,
P. Neta, and M. G. Simic. 1985, 10p
Pub. in Chem. Changes Food Process., p63-72 1985.

Keywords: *Free radicals, *Food chemistry, Food processing, Chemical radicals, Reprints, *Chemical reaction kinetics, Peroxyl radicals, Alkoxyl radicals, Hydroperoxyl radicals, Superoxide radicals, Hydroxyl radicals.

Free radicals are continuously generated in natural products by various processes involving atmospheric oxygen, enzymes, light induced sensitization, heating, etc. They are unequivocally formed by ionizing radiation in the radiation processing of food. In the presence of oxygen most free radicals react with it to give corresponding peroxy radicals and/or superoxide radicals. The former process is more prevalent in hydrophobic media while the latter occurs frequently in aqueous media. Many of the naturally occurring free radicals can also be generated by radiation. Using pulse radiolysis in conjunction with product characterization, complete physico-chemical description of these radicals can be obtained and the kinetic and mechanistic aspects of their chemistry derived. Kinetic and mechanistic aspects of free radicals commonly found or expected to be present in natural products will be reviewed and the predictability of their reactions discussed.

700,230
PB87-162186 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Antioxidants.
Final rept.,
M. G. Simic, and E. P. L. Hunter. 1985, 13p
Pub. in Chem. Changes Food Process., p107-119 1985.

Keywords: *Food chemistry, *Antioxidants, Chemical reactivity, Chemical radicals, Chemical reactions, Reprints, Peroxy radicals, Phenoxy radicals.

The methods and techniques used in the measurements of the reactivities of antioxidant with free radicals in general are reviewed. Special attention is paid to the characterization of the antioxidant intermediates, e.g. to phenoxy radicals for phenolic antioxidants, and their reactivities with each other, other free radicals and food components. A distinction is made between the chemistry of the manmade antioxidants and the complex processes associated with the natural antioxidants.

700,231
PB88-117627 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Stabilization of Ascorbic Acid and Its Measurement by Liquid Chromatography in Nonfat Dry Milk.
Final rept.,
S. Margolis, and I. Black. 1987, 4p
Pub. in Jnl. of the Association of Official Analytical Chemists 70, n5 p806-809 1987.

Keywords: *Ascorbic acid, *Milk, *Dried foods, Vitamins, Reprints, *Nonfat dry milk, Liquid column chromatography.

The determination of ascorbic acid by liquid chromatography (LC) was improved by performing the analysis in the presence of solvents that had been purged with argon to reduce the concentration of oxygen. This methodological modification eliminated the oxidation of ascorbic acid during the chromatographic procedure and reduced the minimum detection level to 1 microgram. Solutions of ascorbic acid have been successfully stabilized for 67 days by addition of dithiothreitol to a deaerated solution of water-acetonitrile (25 + 75 v/v), sealed under argon in amber vials and stored at -20 degrees C.

General

700,232
PB77-600057 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Carbonated Soft Drink Bottles.
C. W. Devereux. 1977, 11p NBS-PS-73/77

Keywords: Glass, *Returnable and nonreturnable bottles, *Glass, Soda-lime-silica, *Manufacturing requirements.

This Voluntary Product Standard covers conventional returnable and nonreturnaable glass bottles manufactured from soda-lime-silica glass with nominal capacity of up to and including 36 fluid ounces, intended for use in the packaging of soft drinks carbonated to a maximum of five volumes. This standard also covers conventional returnable and nonreturnable glass bottles manufactured from soda-lime-silica glass and nominal capacity in excess of 36 fluid ounces, but not in excess of 68 fluid ounces, intended for use in packaging soft drinks carbonated to a maximum of four volumes. The standard provides manufacturing requirements for temper number, thermal shock resistance , internal pressure strength, simulated impact resistance, abrasion resistance, detection of visual defects, wall thickness, dimensional tolerances for height and major body diameter, tolerances for capacity and weight, perpendicularity, bottom characteristics, and bottle identification. A statement to be used on manufacturing orders and invoices specifying the maximum carbonation volumes intended for use with the bottles is included. These requirements apply only to glass containers currently being used and described as conventional containers; they do not apply to bottles which are plastic clad or encapsulated chemically tempered, or the results of other novel or innovative engineering or design developments. Definitions of the trade terms used and methods for identifying products which conform to this standard are included. Included in an appendix is information showing the relation of apparent to real temper number.

ASTRONOMY & ASTROPHYSICS

Astrogeology

700,233
PB-296 923/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dielectric Measurements of Lunar Soil.
Final rept.
H. E. Bussey. 1979, 3p
Pub. in Proceedings Lunar and Planetary Science Conf. (10th), Held at National Aeronautics and Space Administration, Houston, TX. Lyndon B. Johnson Space Center on Mar 19-23, 1979. Abstract in Lunar and Planetary Science, pt1 p140-142, 1979 (Lunar and Planetary Inst., Houston, TX.)

Keywords: Lunar dust, Dielectric properties, Frequencies, Temperature, Losses, *Lunar soil, Permittivity, Temperature dependence, Frequency dependence.

The dielectric constant and loss of lunar soil is given at +100 deg C, and -100 deg C, and over the frequency range 0.2 to 18 GHz. The soil had been exposed to air of 40 to 0 relative humidity. Therefore the loss was not typical of lunar conditions. A tentative conclusion is that a nonlinear packing density of the soil sample, 17 cm long in a coaxial line sample holder, resulted in artificial periodic variations of the apparent permittivity and loss. The permittivity was approximately 3.9 + or - 0.1 at 0.2 GHz and 3.7 + or - 0.1 at 18 GHz, at 25 deg C and a packing density of 1.85 g/cc. The average derivative of permittivity with respect to temperature was 0.014% per degree celsius. The derivative of the loss tangent was approximately 0.000025 per degree.

700,234
PB-296 944/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Open Circuited Coaxial Resonator for High Sensitivity Dielectric Measurements, Application to Lunar Soil 70051-20.
Final rept.
H. E. Bussey. 1979, 3p
Pub. in Proceedings Lunar and Planetary Science Conf. (10th), Held at National Aeronautics and Space Administration, Houston, TX. Lyndon B. Johnson Space Center on Mar 19-23, 1979. Abstract in Lunar and Planetary Science, pt1 p169-171, 1979.

Keywords: *Electric measuring instruments, Dielectric properties, Cavity resonators, Coaxial cables, Lunar rock.

This three page paper summarizes a sensitive (1 g sample) coaxial line cavity resonator method under vacuum conditions and plus or minus 100C which was developed for measurements of dielectric constant and loss of powders, liquids, and solid coaxial samples. The intended frequency range was 550 MHz fundamental, plus harmonics to 2750 MHz. The frequencies and Q's of the successive resonances were obtained by measuring the reflection coefficient versus stepped frequency of the 1-port cavity using an Automatic Network Analyzer programmed to skip from one resonance to the next. Results of the first three harmonics were reliable, giving permittivity = 2.15p with a density p of 1.6 g/ml and a loss tangent = p x 0.0038 both at 23C. The sample was dried by heating in vacuum. The change with temperature from 173 to 373 K was obtained. Results at higher harmonics were erroneous, apparently due to a coaxial bead type of resonance near 5 GHz.

700,235
PB80-178858 Not available NTIS
National Bureau of Standards, Washington, DC.
Microwave Dielectric Measurements of Lunar Soil with a Coaxial Line Resonator Method.
Final rept.,
H. E. Bussey. 1979, 8p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Lunar and Planetary Science Conference (10th), Houston, TX, March 19-23, 1979, p2175-2182 Dec 79.

Keywords: Lunar dust, Dielectric properties, Electrical measurement, Microwave frequencies, *Lunar soil, Temperature dependence.

A method is given for sensitive dielectric measurements at a series of microwave frequencies using a section of coaxial line. The line is used as a 1-port cavity resonator; it resonates when the electrical length of the center conductor (which is open circuited at each end) equals 1, 2..., N half-wavelengths. The dielectric properties of an Apollo 17 dried soil sample were measured in vacuum over a temperature range of 173 to 373 K.

700,236
PB85-145183 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Io: Energy Constraints and Plume Volcanism.
Final rept.
R. T. Reynolds, S. J. Peale, and P. Cassen. 1980, 6p
Pub. in Icarus 44, n2 p234-239 1980.

Keywords: *Volcanism, Jupiter(Planet), Sulfur dioxide, Reprints, *Io.

Observational and theoretical considerations support a model of Io which features a surface layer of sulfur overlying an active silicate crust. Such a model would imply frequent contact between silicate magma intru-

sions and the sulfur layer. This contact would produce volcanic plumes driven by high temperature sulfur vapor. The model meets observational constraints for a wide range of possible conditions in contrast to the special conditions required for plume generation by SO2. Characteristics of the two models are compared, and it is suggested that high spatial resolution infrared radiometry could identify the driving volatile.

Astronomy & Celestial Mechanics

700,237
PB-265 788/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mode Interaction in U TrA,
D. J. Faulkner. Oct 76, 10p
Pub. in Proceedings of Solar and Stellar Pulsation Conference, Los Alamos, N. Mex. 3-5 Aug 76 p66-75 Oct 76.

Keywords: *Variable stars, Pulse modulation, Stellar luminosity, Fourier analysis, Photoelectric emissions, *Cepheid variable stars.

Photoelectric observations of the double-mode Cepheid U TrA previously reported by Oosterhoff (1957a) and Jansen (1962) have been reanalyzed using Fourier techniques. The two reported periods have been confirmed and it has been shown that no further statistically significant periodicity is present. The two observed modes are subject to a strong mode interaction, but it is not yet clear whether this will have any implications for the pulsational masses derived for double-mode Cepheids.

700,238
PB-265 790/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Influence of Magnetic Fields on Nonradial Stellar Oscillations,
P. Smeyers. Oct 76, 10p
Pub. in Proceedings of Solar and Stellar Pulsation Conference, Los Alamos, N. Mex. 3-5 Aug 76, p140-149 Oct 76.

Keywords: *Stellar magnetic fields, Stars, Perturbation theory, Mathematical models, Oscillations, *Stellar oscillations.

A perturbation method is presented which allows us to determine the effect of a weak magnetic field on the linear and adiabatic nonradial oscillations of a star. The method has been applied to a model with uniform density pervaded by a magnetic field with both a poloidal and a toroidal component, and to a polytropic model with a magnetic field which is purely toroidal and has only a phi-component.

700,239
PB-281 964/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Ranging to the Moon: Eight Years of Scientific Progress.
Final rept.,
J. E. Faller. Apr 78, 11p
Pub. in Proceedings of Laser '77 Opto-Electronics Conference, Munich, Germany, 20-24 Jun 77 p1-11 Apr 78. (IPC Science and Technology Press, Ltd., Surrey, Eng.)

Keywords: *Moon, *Range finding, Laser beams, Reviews, *Laser range finding, Apollo.

This paper is based on the highlights address given by Dr. Faller at LASER 77 in Munich. It describes what is involved in lunar laser ranging, discusses some of the experiments and scientific accomplishments during the past eight years, and gives some history of the experiment.

700,240
PB80-227671 Not available NTIS
National Bureau of Standards, Washington, DC.
HEAO 1 Observations of Active Coronae in Main-Sequence and Subgiant Stars.
Final rept.,
F. M. Walter, J. L. Linsky, S. Bowyer, and G. Garmire. 1980, 5p
Contract NAS8-33084
Pub. in Astrophysical Jnl. 236, pL137-L141, 15 Mar 80.

Keywords: *Stars, Coronas, X rays, Reprints.

The authors have searched the HEAO1 data for evidence of X-ray emission from 105 bright late-type stars of luminosity class IV and V, selected on the basis of indirect optical evidence of the presence of a hot corona. Six of the target stars, were detected at the 3 sigma level and 15 were coincident with 2 sigma X-ray sources. On a statistical basis no more than 5 of these 21 sources are spurious. The authors conclude that they are observing the most active coronae of late-type stars which are not members of close binary systems. The RS CVn systems discovered to date seem to form a distinct class of coronal X-ray sources, but the lowest X-ray luminosity members of the group, of which Capella may be the prototype, appear to overlap the domain of these single stars with active coronae. The data do not fit the coronal model of Gorenstein and Tucker (1976), but they are consistent with the coronal loop of Rosner et al. as extended by Walter et al.

700,241
PB82-199332 Not available NTIS
National Bureau of Standards, Washington, DC.
Celestial Mechanics: Never Say No to a Computer.
Final rept.
A. Deprit. Dec 81, 5p
Pub. in Jnl. Guidance Control v4 n6 p577-581 Nov-Dec 81.

Keywords: *Celestial mechanics, *Orbits, Applications of mathematics, Reviews, Reprints.

The author presents an autobiographical review of orbital calculations 1950-1981, emphasizing the refinements which have evolved from a combination of analysis and automated algorithms.

700,242
PB83-236281 Not available NTIS
National Bureau of Standards, Washington, DC.
Reduction to the Rotation for Planar Perturbed Keplerian Systems.
Final rept.
A. Deprit. 1983, 19p
Pub. in Celestial Mechanics 29, p229-247 1983.

Keywords: *Celestial mechanics, Morse theory, Perturbation, Average, Hamiltonian functions, Lie algebras, Reprints.

After the mean anomaly has been removed from the perturbations, the reduced Hamiltonian becomes a function over the Lie algebra determined by the infinitesimal generators associated with the dynamical symmetries of an unperturbed Keplerian system. The phase space being now the group SO(3), average motions consist of rotations, and the normalized Hamiltonian serves as a Morse function whose critical points determine the intrinsic topology of the perturbed system.

700,243
PB84-223379 Not available NTIS
National Bureau of Standards, Washington, DC.
Secular Accelerations in Gylden's Problem.
Final rept.
A. Deprit. 1983, 22p
Pub. in Celestial Mechanics 31, p1-22 1983.

Keywords: *Celestial mechanics, *Two body problem, *Acceleration(Physics), Moon, Orbits, Hamiltonian functions, Reprints, Gravitational constant.

In a two body problem, any variation in time of the Keplerian parameter mu (product of the constant of gravitation G by the reduced mass m) causes a mean secular acceleration in the mean anomaly, but leaves the mean argument of perigee stationary. All asymptotic estimates for mean marginal rates of variation in the osculating elements, that Vinti established in the case when G is inversely proportional to the time, are now extended to the most general type of Glyden systems, and made into exact relations. The role of a Gylden system in explaining the marginal acceleration in the moon's mean motion is clarified. Separable Gylden systems are classified from a physical standpoint by the integrals that they admit.

700,244
PB84-225200 Not available NTIS
National Bureau of Standards, Washington, DC.
Elimination of the Nodes in Problems of N Bodies.
Final rept.
A. Deprit. 1983, 15p
Pub. in Celestial Mechanics 30, p181-195 1983.

Keywords: *Many body problem, Reprints, Reduction theorems, Quanternions, Transformations(Mathematics), Nodes.

In application of the Reduction Theorem to the general problem on n(>3) bodies, a Mathieu canonical transformation is proposed whereby the new variables separate naturally into (1) a coordinate system on any reduced manifold of constant angular momentum, and (2) a quadruple made of a pair of ignorable longitudes together with their conjugate momenta. The reduction is built from a binary tree of kinetic frames. Explicit transformation formulas are obtained by induction from the top of the tree down to its root at the invariable frame; they are based on the unit quaternions which represent the finite rotations mapping one vector base onto another in the chain of kinetic frames. The development scheme lends itself to automatic processing by computer in a functional language.

700,245
PB85-189413 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Dynamics of Orbiting Dust under Radiation Pressure.
Final rept.
A. Deprit. 1984, 30p
Pub. in The Big Bang and Georges Lemaitre, p151-180 1984.

Keywords: *Dust, *Orbits, Radiation pressure, Hamiltonian functions, Dynamics, Initial value problems, Three dimensional.

For a three-dimensional Keplerian system in the presence of a homogeneous field possibly in uniform rotation, action and angle variables are introduced by canonical transformation in the averaged Hamiltonian truncated at the first order. After substitution, the first order averaged system proves to be integrable. More precisely, it is shown how the orbit space decomposes into a pair of spheres in a three-dimensional space, on which the representative curves are the small circles induced by a finite rotation about a fixed axis. From this intuitive geometric picture follow simple formulas for solving the initial value problem.

700,246
PB86-130085 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Two Periods of TT Arietis.
Final rept.
J. R. Thorstensen, J. Smak, and F. V. Hessman. 1985, 9p
Grants NSF-AST81-08691, NSF-AST83-16496
Sponsored by National Science Foundation, Washington, DC.
Pub. in Publications of the Astronomical Society of the Pacific 97, p437-445 May 85.

Keywords: *Binary stars, *Variable stars, Spectroscopy, Photometry, Reprints, *TT Arietis Star.

The authors obtained velocities of the cataclysmic variable TT Ari in its high and intermediate photometric states, with the aim of clarifying the spectroscopic period and demonstrating that the spectroscopic and photometric periods are indeed distinct. It was found that no single period fits all the available data well; however, the original Cowley et al. period fits all the high-state data quite well. The authors conclude that the velocities change phase between the high and the intermediate states.

700,247
PB86-130143 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Structure Parameters of Galactic Globular Clusters.
Final rept.
R. F. Webbink. 1985, 37p
Grants NSF-AST83-17916, NSF-AST80-18859
Sponsored by National Science Foundation, Washington, DC.
Pub. in Dynamics of Star Clusters, IAU Symposium No. 113, Princeton, NJ., May 1984, p541-577 1985.

Keywords: Galaxies, *Globular clusters.

Observed and derived structure parameters are tabulated for 154 galactic globular clusters, 7 dwarf sphe-

roidal satellites of the Galaxy, and 6 globular clusters in the Fornax dwarf spheroidal. Observational parameters listed include equatorial coordinates, apparent level of the horizontal branch, reddening, subgiant branch color at the horizontal branch level, limiting and core angular radii, integrated magnitudes, and central surface brightnesses. Derived parameters include galactic coordinates, heliocentric and galactocentric distance, metallicity, limiting and core radii, central relaxation time scale, central mass density, central velocity dispersion, and central escape velocity.

700,248

PB86-132685 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Cepheid Distances from Blue Main-Sequence Companions.
Final rept.
E. Bohm-Vitense. 1985, 6p
Grant NSG-5398
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 296, p169-174, 1 Sep 85.

Keywords: Distance, Reprints, *Cepheid variables.

The absolute visual magnitudes of main-sequence Cepheid companions was determined from their effective temperatures. These are obtained by comparing the measured relative energy distributions with model atmosphere energy distributions. Assuming an average Galactic extinction law, it was found that the distance moduli for the Cepheids should be smaller by delta(m(v) - M(v)) = -0.5 as compared to the Sandage-Tammann relation.

700,249

PB88-117387 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Numerical Models of Star Formation in X-ray Cluster Cooling Flows.
Final rept.,
R. E. White, and C. L. Sarazin. 1987, 16p
Contract NAGW-764, Grant NSF-AST81-20260
See also PB88-117395. Sponsored by National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 318, p629-644, 15 Jul 87.

Keywords: Models, Reprints, *Galaxy clusters, *Cooling flows, Star formation, X ray sources, *Numerical models.

At the center of each observed X-ray cluster cooling flow is a central dominant galaxy accreting up to several hundred solar masses per year from the flow. To assess whether these galaxies are currently being formed by their associated cooling flows, the authors calculate theoretical models of such flows, including the effects of ongoing star formation. The authors relate the local star formation rate in these models to either the local cooling rate of the gas or the local growth rate of thermal instabilities. The authors show how the structure of cooling flows is affected by variations in the star formation rate, as well as by variations in intracluster temperature, overall accretion rate, elemental abundances, and the form of the gravitational potential. The authors calculate the X-ray emission from these models and show that the spatial variation of the hard/soft X-ray ratio is a clean diagnostic for ongoing star formation in X-ray cluster cooling flows. Finally, the authors calculate the spatial distribution of newly formed stars in each of the authors models and compare it to that of the accreting galaxy. The authors find that star formation in a cooling flow can produce stellar density profiles similar to those observed in galaxies. The authors also find that the shallowest density profile is still steeper than that of an isothermal. They thus conclude that accretion populations are more likely to contribute to the luminous parts of accreting galaxies unless the density profile of a dark component can be steeper than the canonical isothermal.

700,250

PB88-117395 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Determining Star Formation Rates in X-ray Cluster Cooling Flows.
Final rept.,
R. E. White, and C. L. Sarazin. 1987, 8p
Contract NAGW-764, Grant NSF-AST81-20260
See also PB88-117387. Sponsored by National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 318, p621-628, 15 Jul 87.

Keywords: Reprints, *Cooling flows, *Galaxy clusters, Intergalactic medium, Hydrodynamics, Interstellar matter, Stars, X rays.

Many X-ray clusters of galaxies are observed to have cooling flows at their centers. Each of these cooling flows is depositing mass onto a central dominant galaxy at a rate of approx 10-400 M per yr. With such large accretion rates it seems possible that these accreting galaxies are still being formed through ongoing star formation in their associated cooling flows. In the paper, the authors develop techniques to determine directly the distributions of local star formation rate, mass, gas density, temperature, and velocity from cooling flow X-ray surface brightness data. These techniques take account of the potentially important X-ray emission from starforming cooling condensations dropping out of the background flow. The authors consider separately surface brightness data with either good or poor energy resolution.

700,251

PB88-117411 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Determination of the Masses of the Magellanic Cloud Planetary Nebulae Using (O II) Doublet Ratio Electron Densities.
Final rept.,
M. J. Barlow. 1987, 23p
Pub. in Monthly Notices of the Royal Astronomical Society 227, p161-183 1987.

Keywords: Reprints, *Distance scales, *Electron densities, *Forbidden lines, *Magellanic clouds, Nebular masses, Planetary nebulae, Recombination radiation.

Spectrophotometric data, including (O II) 3726, 3729 A doublet ratios, are presented for 32 planetary nebulae (PN) in the Magellanic Clouds. It is argued that the electron densities derived from these ratios provide a much better diagnostic for the determination of nebular masses than previously assumed. The 32 PN are classified as either Type I or else as optically thick or optically thin in the hydrogen Lyman continuum. The optically thick PN are found to all have electron densities greater than 6000 per cm cube, while the optically thin PN all have electron densities below 500 per cm cube. The optically thin PN show a range of only a factor of 2.0 in their derived masses, and have a mean ionized mass of 0.27 plus or minus.0.06M. The absolute H Beta fluxes of the optically thick nebulae show a range of only a factor of 1.8. The application of these results to Galactic PN would yield distances which are generally larger than those previosly estimated. A method of distance determination is proposed for optically thin PN that uses integrated nebular (O II) electron densities rather than angular diameters.

Astrophysics

700,252

AD-A073 306/3 PC **A02**/MF **A01**
Colorado Univ. at Boulder.
Chromospheric Emission Lines in the Red Spectrum of AD Leonis. II. Physical Conditions in Flares.
T. J. Schneeberger, S. P. Worden, J. L. Linsky, and W. McClintock. 15 Dec 78, 5p AFGL-TR-79-0174
Contract NAS5-23274, Grant NGL-06-003-057
Pub. in Astrophysical Jnl., v231 n1 p148-151, 1 Jul 79. See also report dated 24 Apr 78, AD-A063 889. Sponsored in part by Contract NSF-AST-74-04129.

Keywords: Stellar atmospheres, Photometry, Chromosphere, Emission spectra, Reprints, *Stellar flares, AD Leonis star, Stellar spectra.

No abstract available.

700,253

AD-A111 867/8 PC **A02**/MF **A01**
Colorado Univ. at Boulder. Dept. of Astro-Geophysics.
Steady Flows in the Solar Transition Region Observed with SMM.
K. B. Gebbie, F. Hill, J. Toomre, L. J. November, and G. W. Simon. 28 May 81, 8p AFGL-TR-82-0071
Contracts F19628-77-C-0104, NASA-NSG-5318
Pub. in The Astrophysical Jnl. v251 pL115-L118, 15 Dec 81.

Keywords: *Solar atmosphere, *Atmospheric motion, Chromosphere, Experimental data, Reprints, SMM(Solar Maximum Mission).

No abstract available.

700,254

AD-A119 293/9 PC **A02**/MF **A01**
Air Force Geophysics Lab., Hanscom AFB, MA.
Vertical Flows of Supergranular and Mesogranular Scale Observed on the Sun with OSO 8.
Technical rept.
L. J. November, J. Toomre, K. B. Gebbie, and G. W. Simon. 11 Jan 82, 16p Rept no. AFGL-TR-82-0247
Pub. in the Astrophysical Jnl., v258 p846-859, 15 Jul 82.

Keywords: *Solar atmosphere, Atmospheric motion, Solar satellites, Granules, Solar spectrum, Reprints, OSO-8 satellite.

No abstract available.

700,255

N86-32377/1 PC **A03**/MF **A01**
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Definition and Empirical Structure of the Range of Stellar Chromospheres-Coronae Across the H-R Diagram: Cool Stars.
J. L. Linsky. 23 Sep 86, 34p NAS 1.26:176863, NASA-CR-176863
Contracts NGL-06-003-057, NAG5-82

Keywords: *Cool stars, *Giant stars, Magnetic flux, *Stellar atmospheres, *Stellar coronas, Stellar magnetic fields, Stellar radiation, A stars, Dwarf stars, Microwaves, Plasmas (Physics), Stellar rotation, Stellar temperature, Supergiant stars, Stellar chromospheres.

Major advances in our understanding of non-radiative heating and other activity in stars cooler than T sub eff = 10,000K has occured in the last few years. This observational evidence is reviewed and the trends that are now becoming apparent are discussed. The evidence for non-radiatively heated outer atmospheric layers (chromospheres, transition regions, and coronae) in dwarf stars cooler than spectral type A7, in F and G giants, pre-main sequence stars, and close binary systems is unambiguous, as is the evidence for chromospheres in the K and M giants and supergiants. The existence of non-radiative heating in the outer layers of the A stars remains undetermined despite repeated searches at all wavelengths. Two important trends in the data are the decrease in plasma emission measure with age on the main sequence and decreasing rotational velocity. Variability and atmospheric inhomogeneity are commonly seen, and there is considerable evidence that magnetic fields define the geometry and control the energy balance in the outer atmospheric layers. In addition, the microwave observations imply that non-thermal electrons are confined in coronal magnetic flux tubes in at least the cool dwarfs and RS CVn systems. The chromospheres in the K and M giants and supergiants are geometrically extended, as are the coronae in the RS CVn systems and probably also in other stars.

700,256

PB-262 607/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Millimeter Emission Lines in Orion A.
Final rept.,
F. J. Lovas, D. R. Johnson, D. Buhl, and L. E. Snyder. 1 Nov 76, 8p
Pub. in Astrophysics Jnl., v209 n3 p770-777, 1 Nov 76.

Keywords: *Interstellar matter, *Extraterrestrial radio waves, Millimeter waves, Emission spectra, Methanol, Acetonitrile, Acetaldehyde, Silicon monoxide, Hydrogen, Ethylene oxide, Reprints, Cyclopropenones, Orion A region.

During the course of a search of Orion A for signals from three large organic molecules, several millimeter wave lines from known interstellar molecules were ob-

served. Results of observations on methanol (CH3OH), methyl cyanide (CH3CN), methyl acetylene (CH3CCH), acetaldehyde (CH3CHO) and 29SiO are reported here. Emission signals from two hydrogen recombination lines (H41 alpha and H42 alpha) detected from the H II region of Orion A are also reported. Negative results were obtained for several millimeter wave transitions of ethylene oxide (CH2OCH2), acetone ((CH3)2CO), and cyclopropenone (HCCOCH).

700,257
PB-263 146/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Asymmetric HCN Line Profiles From the Orion Nebula.
Final rept.,
F. O. Clark. 1 Sep 75, 3p
Pub. in Astrophys. J. 200, pL115-L117 1 Sep 75.

Keywords: *Hydrogen cyanide, Hyperfine structure, Atomic spectra, Interstellar matter, Nebulae, Reprints, *Orion nebula, NGC 1976 nebula.

The hyperfine components of the HCN J = 1-0 transition in Orion are observed to be asymmetric. This asymmetry apparently indicates some inhomogeneity of the molecular cloud and is interpreted as due to radial motions in the source. The magnitude of these implied motions is discussed and the sense examined. Alternate interpretations are also discussed.

700,258
PB-264 337/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High-Resolution Stellar Vidicon Spectrophotometry. I. Variable Mass Loss from Arcturus and the Hypothesis of Giant Convective Elements.
Final rept.,
H. Y. Chiu, P. J. Adams, J. L. Linsky, G. S. Basri, S. P. Maran, and R. W. Hobbs. 1977, 10p
Contract NAS5-23274, Grant NGR-06-003-057
Pub. in Astrophys. J., v211 n2 p453-462, 15 Jan 77.

Keywords: *Stars, Spectrophotometry, Spectrum analysis, Gaint stars, Chromosphere, Photosphere, Vidicons, Reprints, *Arcturus Star, *Mass loss.

High-resolution spectrophotometry of the variable Ca II K-line in the K2 IIIp star alpha Boo was performed on five occasions over the period 1974 April-1976 February with the McMath Solar Telescope at Kitt Peak National Observatory and an experimental SEC vidicon camera. The results are compared with Copernicus observations of the Mg II h and k lines (1973 May 19; 1974 May 20) and with earlier Ca II data of Griffin, and it is found that either of two states may typically occur in the Arcturus chromosphere. From comparison with the results of model calculations for expanding chromospheres, it is concluded that these correspond respectively to a 'normal' state in which the mass loss dM/dt < 10 to the 9th power solar mass/yr and an 'abnormal' state in which dM/dt is approximately equal to 8 x 10 to the -9th power solar mass/yr. In the latter case, the expansion velocity is approximately 13 km/s at optical depth unity in the K-line, which exceeds the local sound speed. It is suggested that the abnormal state represents the rise to the photosphere of a very large convective element (d approximately r*) as hypothesized for red giants by Schwarzschild.

700,259
PB-264 433/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Line Formation in Expanding Atmospheres.
Final rept.,
D. G. Hummer. 1976, 32p
Grant NSF-MPS72-05026-A02
Pub. in Proceedings of IAU Symposium n70 on Be and Shell Stars, Bass River, Mass., Sep 75. Paper in Be and Shell Stars p281-312 1976.

Keywords: *Stellar spectra, *Stellar atmospheres, Line spectra, Reviews.

The current state of understanding of line formation processes in expanding atmospheres is reviewed, and the successes and limitations of current computational techniques are summarized. Some results for differential rotation are also given, although very little work has been done in this area. Special attention is given to the severe difficulties that are encountered in inferring the structure of rapidly expanding or rotating atmospheres from observed line profiles because of the failure under these conditions of the Eddington-Barbier relation in integrated light; the value in this respect of continuum and interferometric observations is emphasized.

700,260
PB-265 057/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Copernicus Observations of Nova Cygni 1975.
Final rept.,
E. B. Jenkins, T. P. Snow, W. L. Upson, S. G. Starrfield, J. S. Gallagher, M. Fiedjung, J. L. Linsky, R. Anderson, R. C. Henry, and H. W. Moos. 15 Feb 77, 5p
Contract NGR-06-003-057
Pub. in Jnl. Astrophysics, v212 n1 p198-202, 15 Feb 77.

Keywords: *Novae, Near ultraviolet radiation, Ultraviolet spectra, Gas ionization, Emission spectrum, Stellar spectra, Magnesium, OAO-3 satellite, Reprints.

Near ultraviolet radiation from Nova Cygni 1975 was detected by the Copernicus satellite on five occasions from September 1, 1975 to September 9, 1975. The nova was not seen in the UV after this date. The principal result was the observation of a broad emission feature from the MgII doublet at 2800A. The absence of strong UV radiation at shorter wavelengths suggests that these lines are produced by collisional excitation in the outer layers of an expanding shell with Te approximately 4000K. The continuum flux in the near UV decreased as the nova evolved, showing that the total luminosity decreased as the nova faded in the visible.

700,261
PB-265 870/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stellar Model Chromospheres. V. Alpha centauri A (G2 V) and alpha centauri B (K1 V),
T. R. Ayres, J. L. Linsky, A. W. Rodgers, and R. L. Kurucz. 1976, 12p
Contract NAS5-23274, Grant NGR-06-003-057
See also PB-247 029.
Pub. in Astrophys. J., v210 n1 pt1 p199-210, 15 Nov 76.

Keywords: *Stellar atmospheres, *Stellar spectra, *Chromosphere, *Photosphere, Calcium, Mathematical models, Gas ionization, Spectral lines, Emission spectra, Stars, Temperature, Profiles, Reprints, Photoionization, *Centauri A star, *Alpha Centauri star.

Models are proposed for the upper photospheres and lower chromospheres of alpha Cen A and B based on a partial redistribution (PRD) analysis of the Ca II K line cores and damping wings. Coude spectrograms of the Ca II regions in these stars obtained with the Mount Stromlo 74 inch (1.9 m) telescope are calibrated by fitting the far wing profiles of K with synthetic fluxes based on radiative equilibrium (RE) models. The RE calibrations are verified by comparison with independent calibrations using Willstrop's absolute photometry and narrow band fluxes obtained at Mount Stromlo.

700,262
PB-266 863/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Embedded Feature Model for the Interpretation of Chromospheric Contrast Profiles,
R. Steinitz, K. B. Gebbie, and V. Bar. 1977, 9p
Sponsored in part by NASA Scientific and Technical Information Facility, Baltimore, Md.
Pub. in Astrophys J., v213 p269-277, 1 Apr 77.

Keywords: *Chromosphere, Profiles, Mathematical models, Revisions, Comparison, Solar atmosphere, Spectrum analysis, Reprints, Becker model.

Contrast profiles obtained from chromospheric filtergrams and spectra of bright and dark mottles have to date been interpreted almost exclusively in terms of Becker's cloud model. Here the authors demonstrate the failure of this model to account in a physically consistent way for the observed contrasts. As an alternative, they introduce an embedded-feature model, restricting the discussion in this paper to stationary features. The model is then characterized by three independent parameters; the density of absorbing atoms, the geometrical depth, and the profile of the absorption coefficient. An analytic approximation to the contrast resulting from such a model reproduces well the observed behavior of all types of contrast profiles.

700,263
PB-268 949/5 Not available NTIS
National Bureau of Standards, Washington, D.C.
Extreme-Ultraviolet Observations of a Flare on Proxima Centauri and Implications Concerning Flare-Star Scaling Theory,
B. M. Haisch, J. L. Linsky, M. Lampton, F. Paresce, B. Margon, and R. Stern. 1 May 77, 5p
Contract NAS5-23274, Grant NGR-06-003-057
Astrophys. Jnl. v213 pL119-L123, 1 May 77.

Keywords: *Flare stars, *Far ultraviolet radiation, X rays, Mathematical models, *Proxima Centauri star, Reprints.

The authors report the first detection of extreme-ultraviolet radiation from the flare star Proxima Centauri.

700,264
PB-270 121/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Relation Between the Dynamics and the Flattening of Elliptical Galaxies.
Final rept.,
C. Hunter. Apr 77, 12p
Pub. in Astron. Jnl., v82 n4 p271-282 Apr 77.

Keywords: *Galaxies, Eccentricity, Distribution functions, Dynamics, Elliptical galaxies, Configurations.

The interrelations between the eccentricity of equidensity surfaces, the anisotropy of mean square velocities, and the mass distribution function f (assumed to be a function only of energy E and angular momentum J about the axis of symmetry) are studied. Distribution functions that are sepearable in E and J, such as are often assumed, give rise to eccentricity profiles in which the eccentricity declines substantially in the central regions. Conversely, if the eccentricity is to remain relatively uniform in the central regions, then the dependence of f on J must grow in relative significance at high energies. Properties of finite truncated isothermal spheres are also investigated. When their distribution functions are truncated smoothly in phase space, their radii, in particular, are shown to be curiously sensitive to the central potential, and able to vary by more than factor of 10.

700,265
PB-270 130/8 Not available NTIS
Maryland Univ., College Park.
Observation of the 6(sub 16) - 5(sub 15) Transition of Acetaldehyde in Sgr B2.
Final rept.,
W. Gilmore, M. Morris, D. R. Johnson, F. J. Lovas, B. Zuckerman, B. E. Turner, and P. Palmer. 15 Feb 76, 4p
Grant NSF-GP-26218
Prepared by National Bureau of Standards, Washington, D.C. Prepared in cooperation with Chicago Univ., Ill. Grant NSF-MPS73-05282.
Pub. in Astrophysical Jnl., v204 p43-46, 15 Feb 76.

Keywords: *Acetaldehyde, Intersteller matter, Line spectrum, Radio astronomy, Astronomical spectroscopy, Millimeter waves, Reprints, Sqr B2 radio source.

The 6(16) - 5(15) transition of acetaldehyde has been observed in the Sgr B2 molecular cloud. The broad line suggests that both the A and E symmetry states are present in essentially equal intensity. This is the first observation of acetaldehyde at mm wavelengths and the intensity indicates that many other mm wavelines should be detectable.

700,266
PB-270 308/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Collinear Configurations of Galaxies Can Be Stable.
Final rept.,
C. Hunter, and S. Tremaine. 1977, 9p
Grants NSF-MCS75-06177, NSF-AST76-80801
Sponsored in part by National Research Council of Canada, Ottawa (Ontario).
Pub. in Astron. J., v82 n4 p262-270 Apr 77.

Keywords: *Galactic structure, Stability, Many body problem, Reprints, Three body problem.

Collinear configurations of point masses have long been known as possible, though unstable, solutions of the three-body problem. But collinear configurations consisting of a massive and extensive central primary with two satellites may be stable. One possible stabilizing mechanism is the tide induced in the primary by the satellites. Another is reduction in the ratio of the primary's gravitational mass (as felt by the satellites) to

its inertial mass. This effect arises if the primary extends beyond the orbits of the satellites. Both stabilizing mechanisms may be relevant to the dynamics of barred galaxies, configurations of external galaxies and their satellites, and to the Large Magellanic Cloud-Galaxy Draco system.

700,267
PB-270 651/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Avoided Crossing of Modes of Non-Radial Stellar Oscillations.
Final rept.,
M. Aizenman, P. Smeyers, and A. Weigert. 1977, 6p
Grant NSF-AST76-01586
Pub. in Astron. Astrophys., v58 p41-46 1977.

Keywords: *Oscillators, *Stars, Main sequence stars, Frequency shift, Reprints.

The phenomenon of the interaction of two distinct types of oscillators is shown to occur in stars evolving away from the main sequence. This manifests itself in the occurrence of rapid shifts of frequency (bumping, avoided crossings) of the linear, adiabatic non-radial modes of oscillation of the star. The physical origin of this behavior is discussed. The behavior of the f-mode near l=1 is shown to exhibit a sequence of such avoided crossings.

700,268
PB-271 189/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis of the Chromospheric Spectrum of O I in Arcturus.
Final rept.,
B. M. Haisch, J. L. Linsky, A. Weinstein, and R. A. Shine. 1977, 13p
Contract NAS5-23274, Grant NGR-06-003-057
Pub. in Astrophys. J., v214 n3 p785-797, 15 Jun 77.

Keywords: *Stellar spectra, *Oxygen, Chromosphere, Chemical analysis, Ultraviolet spectra, Stellar atmosphere, Line spectra, Reprints, *Arcturus star.

The ultraviolet and near infrared spectra of O I in Arcturus are analyzed by a 15 level, 14 transition model for O I and the Ayres-Linsky model chromosphere. The authors found that the anomalously bright O I lambda1302, 1305, 1306 resonance lines can be readily explained by a L(beta)-pumped fluorescence mechanism as originally proposed by Bowen. Observed equivalent widths of the near infrared triplet and singlet lines are also consistent with the model predictions, but the lambda1355, 1359 intercombination lines and near infrared quintet lines may pose a problem.

700,269
PB-271 935/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stability Properties of Some Stellar Models in the Beta Cephei Regions.
Final rept.,
M. Aizenman, and A. Weigert. 1977, 3p
Grant NSF-AST76-01586
Pub. in Astronomy and Astrophysics, v56 p457-459 Apr 77.

Keywords: *Variable stars, Stellar spectra, Reprints, *Beta Cephei stars.

The nonradial quasiadiabatic stability of very different types of stellar models lying in the region of the observed Beta Cephei stars has been calculated. The models are found to be stable. The accuracy and validity of the usual treatment of vibrational stability for these stars is discussed.

700,270
PB-272 186/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cepheid Studies. I. Mode Interaction in the Beat Cepheid U Trianguli Australis.
Final rept.,
D. J. Faulkner. 1977, 8p
Pub. in Astrophysical Jnl., v216 p49-56, 15 Aug 77.

Keywords: *Variable stars, *Stellar spectra, Fourier analysis, Spectrum analysis, Cepheid stars, *Triangulum Australum Constellation.

Photoelectric observations of the beat Cepheid U TrA previously reported by Oosterhoff (1957a) and Jansen (1962) have been reanalyzed using Fourier techniques. The two reported periods have been confirmed and it has been shown that no further statistically significant periodicity is present. The two observed modes are subject to a strong mode interaction, but it is not yet clear whether this will have any implications for the pulsational masses derived for beat Cepheids. If U TrA is currently 'mode switching' the change in relative mode amplitudes since these observations were made should be readily detectable.

700,271
PB-273 088/5 Not available NTIS
National Bureau of Standards, Boulder, CO.
He I lambda 4471 Profiles in B Stars: Calculations with an Improved Line-Broadening Theory.
Final rept.,
D. Mihalas, A. J. Barnard, J. Cooper, and E. W. Smith. 1974, 4p
Pub. in Astrophys. Jnl. 190, p315-318, 1 Jun 74.

Keywords: *Stars, *Stellar spectra, *Helium, Line spectra, Stark effect, Excitation, Molecular energy levels, Bandwidth, Line width, Reprints, *B type stars.

Theoretical profiles for the He I lambda 4471 line in B-star spectra have been computed using an improved broadening theory (Barnard, Cooper and Smith 1973) and level populations determined by a self-consistent solution of the coupled transfer and statistical-equilibrium equations (Auer and Mihalas 1973). The broadening theory has been constructed to provide a more accurate description of the intensity and width of the forbidden 2 triplet p p(o)-4 triplet f F transition as measured in laboratory experiments. The results presented in this paper show that this revision of the broadening theory leads to computed stellar profiles which are in much better agreement with observed profiles than any previously obtained.

700,272
PB-273 089/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
He I lambda 4922 Profiles in B Stars: Calculations with an Improved Line-Broadening Theory.
Final rept.,
D. Mihalas, A. J. Barnard, J. Cooper, and E. W. Smith. 1975, 4p
Pub. in Astrophysical Jnl. 197, p139-142, 1 Apr 75.

Keywords: *Stars, *Stellar spectra, *Helium, Line spectra, Stark effect, Band width, Line width, Excitation, Molecular energy levels, Reprints, *B type stars.

Theoretical profiles for the He I lambda 4922 line in B-star spectra have been computed using the improved broadening theory of Barnard, Cooper, and Smith, and the level populations calculated by Auer and Mihalas from a simultaneous self-consistent solution of the coupled transfer and statistical equilibrium equations. The revised broadening theory yields excellent agreement with experimental measurements of the width and intensity of the forbidden 2 singlet p P(o)-4 singlet f F(o) transition. The results of this paper show that stellar profiles computed with the new theory are in excellent agreement with observed profiles, and the discrepancies between observation and theory that existed previously have now been removed.

700,273
PB-273 956/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
(30)SiO in the Interstellar Medium.
Final rept.,
F. O. Clark, and F. J. Lovas. 1 Oct 77, 2p
Pub. in Astrophysical Jnl., v217 pL47-L47-L48, 1 Oct 77.

Keywords: *Silicon monoxide, *Interstellar matter, Stellar atmospheres, Isotopes, Nebulae, Reprints, Orion Nebula, Sagettarius B2 radio source, Silicon 30.

The (39)Si isotopic form of SiO has been detected in Orion, Sagittarius B2, and possibly the envelope around an evolved star. The Orion isotopic abundances are decidedly terrestrial, while the Sagittarius B2 and the evolved star abundances do not appear to be.

700,274
PB-274 366/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Supernova Remnants.
Final rept.,
F. D. Kahn. 1975, 28p
Pub. in Proceedings 14th Int. Cosmic Ray Conference, v11 p3566-3593 1975.

Keywords: *Supernovae, *Energy dissipation, Interstellar matter, Pressure, Magnetic fields, Stars.

A supernova explosion probably begins with the sudden release of energy (about 10 to the 52nd power erg) in the dense neutron core of an extended star. The matter expelled from the core sweeps out through the envelope, heats the gas there and gives it a high outward velocity (about 10 to the 9th power cm/s). The expanding envelope radiates in the visible, reaching maximum brightness after some three weeks. It then dims over a period of months, and is kept hot during this time by a central source of energy. The radiative losses have little dynamical effect at this stage. Later the supernova ejecta interact with the surrounding interstellar matter. In Phase I of the interaction the majority of the mass in the remnant comes from the star; in Phase II the majority is interstellar gas. The latter phase ends when radiative losses from the remnant become dynamically important.

700,275
PB-275 022/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Detection of Interstellar Ethyl Cyanide.
Final rept.,
D. R. Johnson, F. J. Lovas, C. A. Gottlieb, E. W. Gottlieb, M. M. Litvak, M. Guelin, and P. Thaddeus. 1 Dec 77, 7p
Pub. in Astrophysics Jnl., v218 p370-376, 1 Dec 77.

Keywords: *Interstellar matter, *Astronomical spectroscopy, Cyanides, Nitrogen organic compounds, Nebulae, Emission spectra, Reprints, *Ethyl cyanide, Orion Nebula, SGr B2 radio source.

Interstellar ethyl cyanide (CH3CH2CN) has been detected in emission from the direction of the Orion Nebula and also from SGr B2. Ethyl cyanide is the third nine-atom molecule to be detected in the interstellar medium, and it is the most complex nitrogen containing compound found thus far. The Orion signals, characterized by an LSR velocity of +4.5 plus or minus 1 km/sec and a half width of 12.5 plus or minus 1 km/sec, imply that the new molecule is contained in a region that is dynamically different from the well established Orion molecular cloud.

700,276
PB-275 121/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Solar Output and Variability Viewed in the Broader Context of Stellar Activity.
Final rept.,
J. L. Linsky. Oct 77, 39p
Pub. as Chapter in The Solar Output and Its Variation, p477-515 Oct 77.

Keywords: *Stellar spectra, *Solar activity, Stars, Solar corona, Solar flares, Reprints.

A critical review is presented of stellar analogues of solar phenomena and structures including chromospheres, Transition regions, coronae, flares, cycles, and nonradiative heating of the outer layers of stars. The relevant diagnostics presently used or of potential use for deriving physical properties in various layers are discussed in detail. An extensive bibliography is included.

700,277
PB-275 144/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tidal Friction in Close Binary Stars.
Final rept.,
J. P. Zahn. 1977, 12p
Pub. in Astronomy and Astrophysics, v57 p383-394 1977.

Keywords: *Binary stars, Stellar structure, Tides, Reprints, *X ray stars.

The author examines various physical mechanisms which may produce tidal friction in close binary stars. They found that the most efficient in stars with convective envelopes is turbulent viscosity retarding the equilibrium tide, and in stars with radiative envelopes the action of radiative damping on the dynamical tide. Theoretical predictions based on these dissipative processes are in good agreement with the rotational velocities and orbital eccentricities observed in close binaries. The results are applied to the X-ray binaries Her X-1 and Cen X-3.

700,278
PB-275 145/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Sensitive Observation of the Far Ultraviolet (1160-1700 A) Spectrum of Arcturus and Implications for Its Outer Atmosphere.
Final rept.,
A. Weinstein, H. W. Moos, and J. L. Linsky. 15 Nov 77, 10p
Grant NGL-06-003-057
Pub. in Astrophysics Jnl., v218 p195-204, 15 Nov 77.

Keywords: *Stars, *Stellar atmospheres, Chromosphere, Far ultraviolet radiation, *Arcturus star.

A low resolution far ultraviolet (1160-1700 A) spectrum of Arcturus (alpha Boo, K2 IIIp) has been obtained using a new very sensitive rocket-borne spectrograph with a multi-element micro-channel plate detector. H I lambda 1216, O I lambda 1304, 0 I lambda 1356, and a broad unresolved emission near 1510 were detected. The ratio of 0 I lambda 1304 to 0 I lambda 1356 is similar to the solar ratio. This spectrum is very different from that of the Sun, with few emission features. The absence of certain emission lines in the spectrum of Arcturus implies either coronal temperatures outside the 20,000 to 350,000 K range (except for possibly 180,000 K plus or minus 20,000) or a lower coronal base pressure than previously assumed. A model of the chromosphere-corona transition region predicts fluxes too low to be presently detected. Theoretical predictions and considerations underlying coronal temperature estimates are discussed for Arcturus. The observation was coordinated with a simultaneous determination of the Arcturus L alpha flux by the U2 detector on the Princeton Experimental Package aboard OAO-Copernicus. The two measurements agree within 10% of each other.

700,279
PB-275 146/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis of the Linear, Adiabatic Oscillations of a Star in Terms of Potential Fields.
Final rept.,
M. L. Aizenman, and P. Smeyers. 1977, 14p
Grant NSF-AST76-01586
Pub. in Astrophysics and Space Science, v48 p123-136 1977.

Keywords: *Stars, Stellar structure, Pulsation, Reprints.

The linear adiabatic oscillations of a spherically symmetric star are analyzed in terms of potential fields. It is found that all displacement fields (rho)(xi) can be described as either spheroidal or toroidal fields.

700,280
PB-275 152/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cepheid Studies. II. A Third Period in the Beat Cepheid TU Cassiopeiae.
Final rept.,
D. J. Faulkner. 15 Nov 77, 11p
Pub. in Astrophysical Jnl., v218 p209-219, 15 Nov 77.

Keywords: *Variable stars, Pulsation, Reprints, *Cepheid stars.

Two hundred and ninety photoelectric observations of the beat Cepheid TU Cas made by several investigators prior to 1960 have been reanalyzed using Fourier techniques. The two previously reported periods 2(d).13931 and 1(d).51833 have been confirmed, and a small amplitude tertiary pulsation has been discovered at 1(d).25246. The amplitude gradation and period ratios of the pulsations suggest identification with the fundamental and first and second overtone radial modes. There is a strong mode interaction between the fundamental and first overtone.

700,281
PB-276 226/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Collapse of Unstable Isothermal Spheres.
Final rept.,
C. Hunter. 15 Dec 77, 12p
Pub. in Astrophysical Jnl., v218 p834-845, 15 Dec 77.

Keywords: *Stellar evolution, Hydrodynamics, Stellar rotation, Similarity theory, Reprints.

Similarity solutions provide simple analytical descriptions of modes of collapse of gravitationally unstable isothermal spheres, both before and after a collapsed core has formed. A new class of similarity solutions has been found, to add to the solutions obtained earlier by Larson, Penston and Shu. Numerical integrations of collapses were performed to study their resemblances to the similarity solutions. None of the collapses studied showed any strong tendency to a similarity solutions. Computed behaviors were generally intermediate between those described by similarity solutions, with the Larson-Penston solution giving the best description of the flow in the immediate neighborhood of the point of core formation. It was also found that perturbed gravitationally unstable spheres do not necessarily collapse; they may instead perform periodic oscillations of large amplitude.

700,282
PB-278 400/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Generalization of the Sobolev Method for Flows with Nonlocal Radiative Coupling.
Final rept.,
G. B. Rybicki, and D. G. Hummer. 1978, 22p
Grant NSF-AST76-22032
Pub. in Astrophysical Jnl. 219, n2 p654-675, 15 Jan 78.

Keywords: *Stellar atmospheres, Three dimensional flow, Thermal radiation, Atmospheric motion, *Radiative transfer, Sobolev approximation, Reprints.

The Sobolev, or escape-probability, method for solving radiative transfer problems in moving atmospheres is generalized to treat flows in which the line-of-sight component of the flow velocity is not monotonic; for these cases the purely local nature of the approximation is lost, and radiative coupling between distant parts of the atmosphere must be taken into account. The method is formulated for a general three-dimensional flow. For spherically symmetric cases in which the relative projected flow velocity on a line of sight goes through zero 2,3,...,N times, an integral equation for the source function is obtained. In the simplest nontrivial case when $N = 2$, it is shown that the normalization of the kernel is such that an iterative solution of the integral equation always converges rapidly. For spherically symmetric flows with $N = 2$, the kernel of the integral equation is expressed in closed form. Extensive numerical results for inverse power-law velocity fields are presented to illustrate the magnitude of the coupling between different parts of the atmosphere. Errors in the magnitude of the flux peak of 50% or larger are readily made if this coupling is neglected.

700,283
PB-280 816/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stellar Model Chromospheres. VI. Empirical Estimates of the Chromospheric Radiative Losses of Late-Type Stars.
Final rept.,
J. L. Linsky, and T. R. Ayres. 1 Mar 78, 10p
Grants NGL-06-003-057, NAS5-23274
Pub. in Astrophysical Jnl. 220, n2 p619-628, 1 Mar 78.

Keywords: *Chromosphere, *Stellar atmospheres, Solar spectrum, Stars, Sun, Magnesium, Reprints.

A method is developed for estimating the nonradiative heating of stellar chromospheres by measuring the net radiative losses in strong Fraunhofer line cores. This method is then applied to observations of the Mg II resonance lines in a sample of 32 stars including the Sun.

700,284
PB-280 823/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Accurate Spectroradiometry of Solar Simulators in the UV-B Spectral Region.
Final rept.,
R. D. Saunders, and H. J. Kostowski. 1977, 1p
Pub. in Proceedings of Electro-Optics/Laser 77 Conf. and Exposition, Anaheim, Calif., Oct 25-27, 1977, p458.

Keywords: *Solar simulators, *Ultraviolet spectroscopy, Solar ultraviolet radiation.

Methodology and equipment needed to make accurate solar measurements are discussed.

700,285
PB-281 054/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Collaboration with Henry Norris Russell Over the Years.
Final rept.,
C. Moore-Sitterly. 1977, 16p
Pub. in IAU Symposium No. 80, The HR Diagram: 100th Anniversary of Henry Norris Russell, Washington, D.C., Nov 2-5, 1977, p27-42 1977.

Keywords: *Astrophysics, Stellar evolution, Scientists, Solar physics, Stellar physics, *Russell Henry Norris, Hertzprung-Russell diagram.

The brilliant achievements of Henry Norris Russell have left a lasting imprint on science in many fields, but to this audience his contributions to astrophysics appear to be the most significant. The author's collaboration with him started in 1920. The assignments given to the author without warning ranged from the first-the laborious photographic determination of the moon's position, to the unraveling of the intricacies of complex atomic spectra, such as those of the alkaline earths, Ti I, Fe I, etc. Interspersed with these was the fascinating work on identifying, as to chemical origin, lines in solar and sun-spot spectra. His keen conception of calibrating the Rowland Intensity Scale by a detailed study of solar multiplets led, in turn, to his classical paper on 'The Composition of the Sun.' This pioneer work in solar physics laid a solid foundation for our present interpretation of XUV solar spectra and for abundance determinations in stellar spectra of many types. He instituted a comprehensive study of the motions of some 2500 double stars which provided not only dynamical parallaxes; but, also, a critical insight into the properties of these stars as described in the treatise on 'The Masses of the Stars' (1940).

700,286
PB-281 338/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Detection of Interstellar Vibrationally Excited Cyanoacetylene.
Final rept.,
F. O. Clark, R. D. Brown, P. D. Godfrey, J. W. V. Storey, and D. R. Johnson. 15 Dec 76, 2p
Pub. in Astrophysical Jnl., v210 n3 pL139-L140, 15 Dec 76.

Keywords: *Interstellar matter, Molecular energy levels, Molecular vibrations, *Acetylene/cyano, *Orion nebula, Extraterrestrial radio waves, Reprints.

Two transitions of the nu 7 vibrationally excited state of cyanoacetylene have been detected in the Orion molecular cloud. They are observed with LSR velocities of approximately 4 and 6 km/s. An unidentified line at 92.353 GHz was also observed.

700,287
PB-281 624/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Large Multi-Lensed Telescope: A Receiver for Point Sources in the Sky.
Final rept.,
J. E. Faller. 1978, 11p
Sponsored in part by National Aeronautics and Space Administration, Washington, D.C., Wesleyan Univ., Middletown, Conn. and Alfred P. Sloan Foundation, New York.
Pub. in Proceedings of Conference on Optical Telescopes of the Future, Geneva, Switzerland Dec 77 p301-311 1978.

Keywords: *Telescopes, Astronomical cameras, Performance evaluation, Design criteria, Optical measuring instruments.

A large 80 inch (2-meter) multi-lensed, computer-controlled and encoder-pointed telescope is described. It is being used as the receiver in the new high--performance lunar laser ranging station on Mt. Haleakala on the island of Maui, Hawaii; however it could also be used for other astronomical applications when the moon is not up. This telescope, which was designed for applications requiring aperture but not field, could impact the design of future very large astronomical instruments intended mainly for point-source spectroscopy and similar applications. The telescope and its performance to date are discussed.

700,288
PB-281 960/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rotation and Velocity Structure in the Core of the Optical Condensation B213 NW and Its Relation to the Parent Gas.
Final rept.,
F. O. Clark, and D. R. Johnson. 1 Mar 78, 10p
Pub. in Astrophysical Jnl., v220 n2 p500-509, 1 Mar 78.

Keywords: *Formaldehyde, *Interstellar matter, *Spectrochemical analysis, Rotation, Condensation, Optical properties, Reprints.

A small region around the high-density core of the optical condensation referred to as B213 NW has been studied in some detail. The 2 cm formaldehyde spectral line was used as a probe for the study. The gas in this region is observed to consist of several fragments, the most massive of which appears to be rotating. The other fragment observed with the 2 cm line appears to be unbound and will escape from B213 NW. The relationship between the gas in this dense core and the parent cloud is discussed. A new method of determining distance to dense gas clouds which exhibit rotation is outlined.

700,289
PB-282 001/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radio Detection of Interstellar DCO(+).
Final rept.,
J. M. Hollis, L. E. Snyder, F. J. Lovas, and D. Buhl.
15 Oct 76, 3p
Pub. in Astrophysical Jnl., v209 pL83-L85, 15 Oct 76.

Keywords: *Interstellar matter, *Deuterium compounds, *Formaldehyde, Emission spectra, Ions, Atomic energy levels, *Dust clouds, Reprints.

The J=1-0 transition of the deuterated formyl ion, DCO(+), has been detected in emission from NGC 2264 and Dr 21(OH) and from the cool dust cloud L134. Estimates for the column density ratios of H13CO(+) to DCO(+) are given for NGC 2264 and DR 21(OH); lower limits for the ratios are given for five other clouds. The DCO(+) detection in L134 provides unique observational evidence in support of chemical fractionation. The L134 results also suggest that the dust clouds may act as repositories for primordial deuterium.

700,290
PB-282 002/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radio Search for Interstellar CO(+), HCN(+), HNC(+), and CN(+) Ions.
Final rept.,
J. M. Hollis, B. L. Ulich, L. E. Snyder, D. Buhl, and F. J. Lovas. 1 Jan 78, 3p
Pub. in Astrophysical Jnl., v219 n1 p74-76, 1 Jan 78.

Keywords: *Interstellar matter, *Emission spectra, Molecular rotation, Carbon monoxide, Cyanides, Atomic energy levels, Ions, Extraterrestrial radio waves, Reprints.

The N = 1 - 0 transition of CO(+), with components J = 1/2 - 1/2 at 117.692 GHz and J = 3/2 - 1/2 at 118.102 GHz, has been searched for but not found in molecular clouds showing strong emission from the J = 1 - 0 transition of carbon monoxide. Rotational transition rest frequency calculations were made for HCN(+), HNC(+), and CN(+); subsequent interstellar searches were conducted for these ions but none was detected.

700,291
PB-282 120/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stellar Model Chromospheres. VII. Capella (G5 III+), Pollux (K0 III), and Aldebaran (K5 III).
Final rept.,
W. L. Kelch, J. L. Linsky, G. S. Basri, H. Y . Chiu, S. H. Chang, S. P. Maran, and I. Furenlid. 15 Mar 78, 18p
Contract NAS-52-32-74, Grant NGR-06-003-057
Pub. in Astrophys. Jnl., v220 n3 p962-979, 15 Mar 78.

Keywords: *Giant stars, *Stellar atmospheres, Stellar spectra, Photosphere, Binary stars, Capella star, Pollux star, Aldebaran star, Reprints.

Data from high-resolution SEC vidicon spectroscopy with a ground-based telescope (for the Ca II K line) and from spectral scans made with the BUSS ultraviolet balloon spectrograph (for the Mg II h and k lines) are used to derive models of the chromospheres and upper photospheres of these G-K giants. The models are based on partial redistribution analyses of the Ca II line wings and cores on the fluxes in the Mg II lines. The photospheres thus computed are hotter than predicted by radiative equilibrium models. T(min)/T(eff) is found to decrease with decreasing T(eff), while m0 (the mass column density at the top of the chromosphere) increases with decreasing stellar surface gravity. The computed pressure at the chromosphere top in the primary member of the Capella spectroscopic binary system is 400 times smaller than the transition region pressure derived by Haisch and Linsky (1976), which suggests that additional terms must be included in the transition region energy equations for giant stars. Estimates of the Ca II and hydrogen column densities are made for the circumstellar envelope of Aldebaran.

700,292
PB-282 146/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mass Loss from P Cygni: The Evidence of the Balmer Lines.
Final rept.,
D. Van Blerkom. 1 Apr 78, 7p
Sponsored in part by National Science Foundation, Washington, D.C.
Pub. in Astrophysical Jnl., v221 n1 p186-192, 1 Apr 78.

Keywords: *Stellar atmospheres, *Mass transfer, Stellar spectra, Spectral lines, P Cygni star, Balmer lines, Radiative transfer, Reprints.

Envelopes of stars which are losing mass are divided into two groups according to their velocity distribution. 'Rapid accelerators' are driven to nearly thermal velocity near the photosphere and then coast outward at nearly constant speed. 'Gradual accelerators' experience a steady increase in velocity over a sizeable fraction of the envelope. The Balmer line profiles from P Cygni are shown to be consistent with the latter class of envelope model. Very good agreement theory and observation is shown by a model with v(r) (alpha) r throughout and (M dot) = 0.00003 solar masses/year. A model in which the envelope decelerates is not required to account for the Balmer spectrum. This brings into accord the various indicators of envelope velocity: the line width - excitation energy correlation, the Balmer progression, and the free-free continuum.

700,293
PB-282 920/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Atmospheres of Central Stars.
Final rept.,
D. G. Hummer. Apr 78, 13p
Grant NSF-AST76-22032
Pub. in Proceedings of Planetary Nebulae, Observations and Theory, Cornell Univ., N.Y. 13-15 Jun 77. IAU Symp., n76 p171-183 Apr 78.

Keywords: *Stars, *Stellar atmospheres, *Planetary nebulae, Mathematical models, Visible spectrum, Helium.

This review begins with a brief summary of atmospheric models that are of possible relevance to the central stars of planetary nebulae, and then discusses the extent to which these models accord with the observations of both nebulae and central stars. Particular attention is given to the significance of the very high Zanstra temperature implied by the nebular He II lambda 4686 A line, and to the discrepancy between the Zanstra He II temperature and the considerably lower temperatures suggested by the appearance of the visual stellar spectrum for some of these objects.

700,294
PB-284 726/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Solar XUV He I and He II Emission Lines. II. Intensity Ratios and Distribution Functions.
Final rept.,
D. L. Glackin, J. L. Linsky, S. A. Mango, and J. D. Bohlin. 1 Jun 78, 9p
Grant NGR-06-003-057
Pub. in Astrophysical Jnl. 222, n2 p707-715, 1 Jun 78.

Keywords: *Sun, *Solar spectrum, *Chromosphere, Helium, Ultraviolet spectroscopy, Intensity, Distribution functions, Reprints.

From high resolution solar images the authors showed that the He II lambda 256 line intensity is uncorrelated with He II lambda 304 and that the lambda 256 line is formed by the photo-ionization-recombination process. Two also derive center-to-limb variations of He II lambda 304 and lambda 256 and He I lambda 584 and lambda 537 for network and cell regions separately and find that (1) in both network and cells lambda 304 and lambda 584 each limb brighten in the quiet Sun and limb darken in coronal holes, and (2) for both lambda 304 and lambda 584 network and cell regions are each brighter in the quiet Sun than in coronal holes. They concluded that the appearance of dark coronal holes in the helium lines is not a geometrical effect involving the chromospheric network, but is rather an intrinsic property of the atmospheric in both network and cell regions. They suggested that the network and cells can be heated as isolated atmospheres when solving the transfer equation in the helium lines.

700,295
PB-284 727/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photospheric Models of Solar Active Regions and the Network Based on the Mg II h and k Line Wings.
Final rept.,
N. D. Morrison, and J. L. Linsky. 1 Jun 78, 2p
Grant NGL-06-003-057
Pub. in Astrophysical Jnl. 222, n2 p723-724, 1 Jun 78.

Keywords: *Sun, *Solar spectrum, *Mathematical models, *Photosphere, Profiles, Temperature, Magnesium, Chromosphere, Reprints.

From a comparison between observed and computed wings of the Mg II resonance lines, the authors derived temperature versus mass column density for solar photospheric layers in plages and in the chromospheric network. The observed profiles were recorded on film by the Naval Research Laboratory's spectrograph on Skylab, with spectral resolution 0.12 A and spatial resolution 2 x 60 arcsec. They computed the theoretical profiles assuming partial coherent scattering. In the active regions, temperatures exceed those in the quiet Sun by up to 200 K near the temperature minimum and up to 400 K in deeper layers. In the observed network structure, the temperature is enhanced by 200 K at the temperature minimum but is the same as that in the quiet Sun at greater depths. The difference in the slope of the temperature distribution between the network and plages is real, but may refer only to long elements of the networks (cell boundaries), rather than to the brightest portions (vertices). Adjacent to the network is a region in which the temperatures are similar to those in the quiet Sun, except immediately below the temperature minimum, where the temperatures are depressed by 150 K. Since the observed temperature differences may arise in structures too small for the Skylab instrument to resolve, all differences quoted are lower limits.

700,296
PB-285 050/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Study of Mass Loss from the Mid-Ultraviolet Spectrum of alpha Cygni (A2 Ia), beta Orionis (B8 Ia), and eta Leonis (A0 Ib).
Final rept.,
H. J. G. L. M. Lamers, R. Stalio, and Y. Kondo. 1 Jul 78, 14p
Pub. in Astrophys. Jnl. v223 n1 p207-220 1 Jul 78.

Keywords: *Giant stars, *Ultraviolet spectra, Mass, Losses, Reprints.

The first results on mass loss from high resolution mid-ultraviolet spectra of alpha Cyg (A2 Ia), beta Ori (B8 Ia) and eta Leo (A0 Ib) are given. The spectrum of alpha Lyr (A0 V) is also included in this study as a comparison spectrum to distinguish photospheric lines from envelope lines. All spectra have been obtained with the echelle spectrograph of the new BUSS instrument. The resonance lines of Mg II and Fe II in alpha Cyg and beta Ori show violet shifted components. The presence of shells and the variation of resonance line profiles indicate that mass loss in high luminosity stars is not a stationary phenomenon. The mass loss rate of alpha Cyg derived from the Fe II resonance lines, assuming a blanketed LTE model atmosphere with a cool envelope is two orders of magnitude smaller than the value derived from the infrared excess. Several possible explanations for this discrepancy are discussed. Either the photospheric Lyman continuum is much brighter than predicted for LTE models, or the temperature in the envelope is higher than the effective temperature.

700,297
PB-285 214/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultraviolet Observations of Cool Stars. VI. L alpha and Mg II Emission Line Profiles (and a Search for Flux Variability) in Arcturus.
Final rept.,
W. McClintock, H. W. Moos, R. C. Henry, J. L. Linsky, and E. Barker. Jun 78, 11p
Grants NGR-06-003-057, NAS5-23274
See also PB-252 805.

Pub. in Jnl. Astrophys. J. Suppl. Series, v37 n2 p223-233, Jun 78.

Keywords: *Stellar spectra, *Ultraviolet spectra, Chromosphere, Line spectra, Calcium, Flux(Rate), Emission spectra, Copernicus satellite, Arcturus star, Reprints.

High-precision high-resolution profiles of the L alpha and Mg II k chromospheric emission lines from alpha Boo obtained with the Princeton Experimental Package aboard the Copernicus satellite are presented. Asymmetries seen in the profiles of these lines are probably intrinsic to the star, rather than the result of interstellar absorption. In contrast to previous observations of the Ca II K emission line, the authors found no evidence during a three-year period for variability in the profiles or in the total fluxes from these lines on time scales ranging from hours to months. A flux profile is presented of the O I lambda 1302 line and flux upper limits for L alpha, O VI lambda 1032, Si III lambda 1206, O V lambda 1218.

700,298
PB-285 221/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Plage Models.
Final rept.,
J. L. Linsky. 1977, 25p
Prepared in cooperation with National Aeronautics and Space Administration, Washington, D.C.
Pub. in Proceedings Orbiting Solar Observatory Workshop, Boulder, Colo., Nov 7-10, 1977. Paper in Orbiting Solar Observatory, v8 p139-163, 1977.

Keywords: *Solar activity, Photosphere, Chromosphere, Solar magnetic fields, *Solar plages.

This paper reviews some of the outstanding physical problems of solar active regions (plages) and discusses models which have been constructed for plages, including models for the upper photosphere, temperature minimum, and chromosphere regions. There is also a preliminary discussion of a new grid of plage models being constructed by Kelch, Morrison, and Linsky. These plage models, as well as models for the network and flares, are compared with average quiet Sun models to assess the relative degrees of temperature enhancement and excess radiative loss. In particular, the author discusses the question of whether 'chromospheric activity' can be most easily accounted for by means of enhanced temperature gradients at the base of the chromosphere or increased mass column densities at the top of the chromosphere. Some insight into this question can be gained by comparing models of the active chromosphere stars epsilon Eri and 70 Oph A to a model for the similar but quiet chromosphere star alpha Cen B.

700,299
PB-287 970/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mass Loss from P Cygni. II. An Equivalent Two-Level-Atom Approach.
Final rept.,
P. Kunasz, and D. Van Blerkom. 15 Aug 78, 5p
Pub. in Jnl. Astrophys., v224 n1 p193-197, 15 Aug 78.

Keywords: *Stars, *Spectral lines, Atoms, Infrared spectroscopy, Stellar spectra, *P Cygni stars, *Mass loss, Reprints.

The formation of the Balmer line spectrum of P Cygni is investigated using an equivalent two-level-atom formalism. This approach eliminates the artificial distinction between a continuum emitting core and line emitting envelope, and also does not employ a supersonic approximation in the line transfer problem. The results support the conclusion that a velocity distribution of the form V(r) alpha r exists in the envelope, and can account for the observed Balmer lines. A more complicated velocity law derived from infrared continuum measurements does not give a good representation of the Balmer lines.

700,300
PB-288 302/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Coordinated X-Ray, Optical, and Microwave Study of the Flare Star Proxima Centauri.
Final rept.
B. M. Haisch, J. L. Linsky, O. B. Slee, D. R. Hearn, A. R. Walker, A. E. Rydgren, and G. D. Nicolson. 1 Oct 78, 3p
Grants NGR-06-003-057, NsG-5211
Pub. in Astrophysical Jnl. 225, n1 pL35-L37, 1 Oct 78.

Keywords: *Flare stars, Visible spectrum, X rays, Microwaves, *Proxima Centauri star, Extraterrestrial radio emission.

Results are reported of a coordinated observing program to monitor the flare star Proxima Centauri for a period of three days in the X-ray, optical, and radio spectrum. During this interval 30 optical flares and 12 possible radio bursts were observed. No X-ray detections were made with the SAS-3 X-ray satellite. An upper limit of L(x)/L(opt) <0.08 for the brightest optical flare is derived. The most sensitive of the radio telescopes failed to detect 6-cm emissions during one major and three minor optical flares, and on this basis the authors derive an upper limit on the flare radio emission, L(R)/R (opt) $<$ 0.00002.

700,301
PB-289 007/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dwarf in Wolf-Rayet Clothing: HD 45166.
Final rept.,
D. Van Blerkom. 1 Oct 78, 6p
Pub. in Astrophys. Jnl. v225 n1 p175-180, 1 Oct 78.

Keywords: *Dwarf stars, Spectral lines, Hydrogen, Helium, Stellar atmospheres, Stellar spectra, Mass flow, Gas flow, Binary stars, *HD 45166 star, B stars, Wolf-Rayet stars, Reprints.

A coarse analysis of the hydrogen and helium lines of HD 45166 is performed, which supports the interpretation that the object is a binary composed of a late B star and a star of approximately one solar radius with a continuous energy distribution very much like that of Zeta Pup. It is surrounded by an envelope expanding at 150 km/s, formed by mass ejection at a rate of only 5 times 10 to the minus 8th power solar masses/yr. The small size and low ejection velocity give densities of He II in the envelope of about 10 to the 11th power/cc. The envelope environment is thus much like that of a normal Wolf-Rayet star, which it mimics with remarkable consistency.

700,302
PB-289 015/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Physical Properties of Solar Chromospheric Plages. III. Models Based on Ca II and Mg II Observations.
Final rept.,
W. L. Kelch, and J. L. Linsky. 1978, 9p
Grants NGL-06-003-057, NAS5-23274
See also COM-75-50209.
Pub. in Sol. Phys., v58 n1 p37-45, 1978.

Keywords: *Chromosphere, Solar atmosphere, Solar activity, Line spectra, Temperature, Density(Mass/volume), Mathematical models, *Faculae, Reprints.

A new grid of plage models is computed to determine the difference in temperature versus mass column density structure T(m) between plage regions and quiet solar chromosphere, and to test whether the solar chromosphere is geometrically thinner in plages.

700,303
PB-289 017/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultraviolet Observations of Cool Stars. VII. Local Interstellar Hydrogen and Deuterium Lyman Alpha.
Final rept.,
W. McClintock, R. C. Henry, J. L. Linsky, and H. W. Moos. 15 Oct 78, 17p
Grants NGR-006-003-057, NAS5-23274
Pub. in Astrophys. Jnl., v225 n2 p465-481, 15 Oct 78.

Keywords: Hydrogen, Deuterium, Lyman alpha radiation, Ultraviolet spectra, Interstellar matter, Stars, *Interstellar gas, Reprints.

High-resolution copernicus observations of the interstellar hydrogen and deuterium L alpha lines toward Epsilon Eridani and Epsilon Indi are presented and analyzed. Previous observations toward Alpha Centauri A and Alpha Aurigae are also reanalyzed. It is concluded that all the stellar and solar system data are consistent with a homogeneous region within 3.5 pc of the Sun in which n sub H is approximately equal to 0.10/cc to 0.15/cc and in which the flow velocity is 22 km/s from the direction alpha = 252 degrees, delta = -15 degrees. Beyond 3.5 pc the density probably decreases, but the flow vector is unchanged. There is no conclusive evidence that the deuterium-to-hydrogen ratio toward the four stars is significantly different from the value 0.000018 + or - 0.000004 derived by York and Rogerson toward OB stars. It is also concluded that the existence of a nearby interstellar cloud, which Vidal-Madjar et al. have proposed as approaching the solar system from 0.03 pc, is not supported by the data.

700,304
PB-289 020/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of an Expanding Dust Cloud on Radial Velocity Measurements.
Final rept.,
J. Van Blerkom, and D. Van Blerkom. 15 Oct 78, 6p
Pub. in Astrophys. Jnl., v225 n2 p482-487, 15 Oct 78.

Keywords: *Radio sources(Astronomy), Spherical shells, Dust, Scattering, Red shift, Masers, Radial flow, Monte Carlo method, *Cosmic dust, *Celestial masers, Alpha Herculis star, VY CMa radio source, Reprints.

Radial velocities of 'supergiant' maser sources, such as VY CMa, do not always agree with what would be expected if the maser emission originates in an expanding spherical shell. It has been proposed that the photospheric absorption lines are shifted to the red by scattering off dust grains in the shell. A Monte Carlo computation of this process is performed here. The results strongly support the scattering hypothesis, although the question of how the redshift can disappear in only a few years is bothersome. In particular, it is shown that if the spectrum of Alpha Her is passed through an expanding dust shell, the emergent spectrum is remarkably close to that of VY CMa.

700,305
PB-290 003/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Upper Limits on Extreme Ultraviolet Radiation from Nearby Main Sequence and Subgiant Stars.
Final rept.,
T. R. Ayres, J. L. Linsky, B. Margon, and S. Bowyer. Nov 78, 4p
Grant NAS5-23274, Grant NGL-06-003-057
Pub. in Astron. Astrophys., v70 n3 p431-434 Nov 78.

Keywords: Far ultraviolet radiation, Main sequence stars, Stellar atmospheres, Coronas, X rays, X ray sources(Astronomy), *Cosmic x-ray sources, Alpha Centauri A star, Stellar radiation, X ray astronomy, Subgiant stars, Reprints.

Flux upper limits for 44-800 A radiation were measured in a sample of five nearby main sequence stars and one subgiant star using the Apollo-Soyuz grazing incidence telescope. Comparisons of emission measure upper limits with the predictions of three different methods for estimating coronal properties cannot yet determine which, if any, are valid. Our data do rule out alpha Centauri A and B having active coronae with emission measures comparable to those of solar plages.

700,306
PB-290 004/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Expanding Envelopes of Early Type Stars: Current Status.
Final rept.,
J. P. Cassinelli, J. I. Castor, and H. J. Lamers. Oct 78, 10p
Pub. in Publ. Astron. Soc. Pac., v90 n537 p496-505 Oct 78.

Keywords: Stellar evolution, Gas ionization, Ultraviolet radiation, Theories, *Early stars, *Stellar winds, Star models, Reprints.

There are currently four theoretical models that have been developed to explain the winds or the origin of the anomalous ionization in the winds of early type stars. This paper reports the results of a workshop on stellar winds that held at JILA in Boulder, Colorado from 3 to 6 October 1977. Subsequent work that answered some of the questions raised at the meeting is also presented. The conferees concluded that the winds are probably due to radiation pressure in ultraviolet resonance lines, but that the anomalously high degree of ionization in the winds requires the input of nonthermal energy. Several as yet unexplained observations are mentioned, and areas for future studies are outlined.

700,307
PB-290 005/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Model Infrared Spectra for Accreting Stars.
Final rept.,
P. J. Bedijn, H. J. Habing, and T. de Jong. 1978, 12p
Pub. in Astron. Astrophys., v69 n1 p73-84, 1978.

Keywords: Stellar evolution, Infrared spectra, Stellar spectra, Theories, *Star accretion, Stellar envelopes, Early stars, Silicates, Star models, Reprints.

Infrared spectra were calculated for dusty circumstellar shells that accrete onto stars in free fall. The dust consists of silicate and graphite particles. The equation of radiative transfer and the two equations of thermal equilibrium are solved simultaneously one for each of the dust species. In four cases (BN object; OMC 2/IRS 3; RCW 57/IRS 1; Mon R2/IRS 2) model spectra are compared with spectra of observed infrared point sources. In each case good agreement between observation and prediction is obtained for a wide range of models.

700,308
PB-290 006/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Densities in Stellar Atmospheres Determined from IUE Spectra.
Final rept.,
G. A. Doschek, U. Feldman, J. T. Mariksa, and J. L. Linsky. 15 Nov 78, 4p
Pub. in Astrophys. Jnl. Lett., v226 n1 pL35-L38, 15 Nov 78.

Keywords: *Stellar atmospheres, *Electron density(Concentration), Far ultraviolet radiation, Ultraviolet spectra, Stellar spectra, Alpha Aurigae star, HR 1099 star, Lambda Andromedae star, Capella star, Reprints.

An EUV spectroscopic method is described for determining the electron density in solar and stellar plasmas for densities less than 10 to the 11th power /cc and for temperatures near 50,000K. The method is applied to IUE spectra of alpha, HR 1099, and lambda And. Preliminary results give densities of 10 to the 11th power / cc for Aur and lambda and times 10 to the 9th power / cc for HR 1099.

700,309
PB-290 029/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Chromospheric Emission Lines in the Red Spectrum of AD Leonis. I. The Nonflare Spectrum.
Final rept.,
M. S. Giampapa, J. L. Linsky, T. J. Schneeberger, and S. P. Worden. 15 Nov 78, 7p
Grants NGL-06-003-057, NAS5-27274
Pub. in Astrophysical Jnl. 226, n1 p144-150, 15 Nov 78.

Keywords: *Stellar spectra, *Flare stars, Stellar atmospheres, Hydrogen, Helium, Sodium, Visible spectrum, AD Leonis star, Reprints.

High resolution red (5300-7300 A) spectra of the flare star AD Leonis were obtained with the Kitt peak 4m echelle spectrograph system at a spectral resolution of 0.22 A at H alpha. A series of time-trailed plates with 5 hours integration were averaged together to obtain a very deeply exposed representation of the star's nonflaring spectrum.

700,310
PB-290 031/4 Not available NTIS
National Bureau of Standards, Washington, DC.
IUE Observations of Cool Stars: alpha Aurigae, HR 1099, lambda Andromedae, and epsilon Eridani.
Final rept.,
J. L. Linsky. 5 Oct 78, 6p
Grant NGR-06-003-057
Pub. in Nature 275, p389-394, 5 Oct 78.

Keywords: *Stellar atmospheres, *Ultraviolet spectra, Stellar spectra, Main sequence stars, Flare stars, Epsilon Eridani star, Lambda Andromedae star, Capella star, HR 1099 star, Reprints.

Initial IUE observations of four cool stars are reported. Observed fluxes and surface fluxes are given for several UV emission lines in the spectral range 1,175-2,000 A, obtained at low and high dispersion with the short-wavelength spectrograph and camera. These lines are formed in the outer atmospheres of these stars, in regions presumably analogous to the solar chromosphere and transition region. The surface fluxes in the lines increase along the sequence: quiet Sun, epsilon Eri, lambda And, alpha Aur, and HR1099. The 2.8-d RS CVn-type binary HR1099, observed on 1 March 1978 near the end of a major flaring episode, has line surface fluxes of the order of 100 times that of the quiet Sun, similar to those seen in solar flares. Line profiles and flux ratios in multiplets for Capella are presented, and comments given on the opacity of the lines and on a tendency of line width to increase with temperature of formation.

700,311
PB-292 577/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Simple Estimate of the Effect of a Thick Circumstellar Dust Shell on Photospheric Line Profiles.
Final rept.,
D. Van Blerkom, and J. I. Castor. 15 Jan 79, 5p
Grant NSF-AST76-22600
Pub. in Astrophys. Jnl., v227 n2 p543-547, 15 Jan 79.

Keywords: *Stellar spectra, Absorption spectra, Spectral lines, Stellar atmospheres, Photosphere, Dust, *Stellar envelopes, Radiative transfer, Alpha Herculis star, VY Canis Majoris star, Ras Algethi star, Reprints.

A star embedded in an optically thick dust shell may have a line spectrum that closely resembles the spectrum of some unobscurred star; e.g. VY CMa (shrouded) and alpha Her (unshrouded). This implies that the surface temperatures of the two stars are nearly equal, but since one is subject to a backwarming effect, the distribution of temperatures with depth in the respective atmospheres are dissimilar. It was found that effective temperatures and absorption line strengths are reduced in shrouded stars below the values that obtain in their unshrouded counterparts. For models of VY CMa that yield grain temperatures at the inner boundary of the dust shell consistent with observation, the reduction in strength of a visible line is small ($<$ or approximately $=$ 15%). Thus, the spectral distribution of alpha Her may be used as an approximation to that of VY CMa before it is scattered by the dust, without the necessity of first correcting for backwarming.

700,312
PB-294 163/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Height Variation of Supergranular Velocity Fields Determined from Simultaneous OSO 8 Satellite and Ground-Based Observations.
Final rept.,
L. J. November, J. Toomre, K. B. Gebbie, and G. W. Simon. 15 Jan 79, 14p
Grant NGL-06-003-057, Contract F19628 77-C-0104
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Journal 227, n2, p600-613, 15 Jan 79.

Keywords: *Solar atmosphere, *Flow distribution, Velocity, Solar structure, Chromosphere, Photosphere, Doppler effect, Ultraviolet spectroscopy, *Vertical distribution, OSO-8 satellite, Reprints.

Simultaneous satellite and ground-based observations of supergranular velocities in the Sun were made using the University of Colorado UV Spectrometer on OSO 8 and the Sacramento Peak Observatory diode array instrument. We compare our observations of the steady Doppler velocities seen toward the limb in the middle chromosphere and the photosphere: the observed Si II lambda 1817 and Fe I lambda 5576 spectral lines differ in height of formation by about 1400 km. The striking results of these observations are that supergranular motions are able to penetrate at least II density scale heights and that, in doing so, the motion increases from about 800 m/s in the photosphere to at least 3000 m/s in the middle chromosphere. Further, a distinct change appears to occur in the flow structure: whereas the horizontal component of the velocity predominates in the low photosphere, suggesting strong braking of vertical momentum, the motions higher in the atmosphere are more isotropic. These observations imply that supergranular velocities should be evident in the transition region. The strong horizontal shear layers in supergranulation must produce turbulence and internal gravity waves. These smaller scale motions have bearing on chromospheric heating and non-thermal line broadening.

700,313
PB-295 134/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Stellar Hydrodynamics of Thin Disk Galaxies.
Final rept.,
C. Hunter. 1 Jan 79, 20p
Pub. in Astrophysical Jnl. 227, p73-92, 1 Jan 79.

Keywords: *Galaxies, *Stellar motion, Galactic structure, Hydrodynamics, Perturbation, Oscillations, Galactic rotation, Spiral galaxies, Reprints.

A closed system of six stellar hydrodynamic equations is derived for describing the dynamics of perturbed motions of thin disk galaxies in which the motion is primarily circular. These hydrodynamic equations can be solved exactly in the special case of the uniformly rotating Maclaurin disk This solution is consistent with Kalnajs's exact solution of the collisionless Boltzmann equation for this disk, and describes the important barlike modes exactly. More generally, the stellar hydrodynamic equations provide a feasible method for calculating large-scale modes of oscillation of disk galaxies, and help elucidate the differences between stellar and gaseous disks.

700,314
PB-296 277/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Outer Atmospheres of Cool Stars. I. The Sharp Division into Solar-Type and Non-Solar-Type Stars.
Final rept.,
J. L. Linsky, and B. M. Haisch. 1 Apr 79, 6p
Contract NAS5-23274
Pub. in Astrophysical Jnl. 229, n1, pL27-L32, 1 Apr 79.

Keywords: *Stellar atmospheres, Stellar spectra, Ultraviolet spectra, Far ultraviolet radiation, Chromosphere, Coronas, Stellar structure, *Late stars, Stellar temperature, Stellar winds, Reprints.

IUE short-wavelength (1175-2000 A) spectra of late-type stars clearly indicate two separate and distinct groups of stars. The solar-type group shows spectral lines formed at temperatures of 5000 to 200,000 K, indicative of chromospheres, transition regions, and by implication, unseen coronae at hotter temperatures. The non-solar-type group shows lines formed at temperatures no hotter than 10,000-20,000K, indicative of chromospheres only. The authors interpret this acute change in character of the outer atmospheres of stars on either side of the sharp dividing line between the two groups as due either to the absence of hot material resulting from the rapid onset of large stellar winds, a hypothesis recently suggested on theoretical grounds by Mullan, or to very low transition-region densities, as suggested by a model stellar wind corona that the authors have calculated for Arcturus.

700,315
PB-296 282/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Atlas of Theoretical P Cygni Profiles.
Final rept.,
J. I. Castor, and H. J. Lamers. Apr 79, 31p
Grant NSF-AST77-23183
Pub. in Astrophysical Jnl. Supplement Series 39, n4, p481-511, Apr 79.

Keywords: *Stellar spectra, Line spectra, Ultraviolet spectra, Resonance scattering, Stellar atmospheres, Photosphere, P Cygni stars, Stellar winds, Reprints.

An atlas of theoretical P Cygni-type line profiles is presented. The profiles are calculated assuming resonance scattering and using the Sobolev approximation. The expanding envelope is characterized by two functions; the optical depth tau(v) and the velocity law v(r). The velocity law, the process of line formation, and the accuracy of the theoretical line profiles are discussed. The effect of collisional excitation is discussed and is found not to be important in most UV resonance lines, except in a star with a very high rate of mass loss and a small wind velocity.

700,316
PB-296 940/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Separate Spectra of the Visual Components of MWC 349.
Final rept.,
E. W. Brugel, and G. Wallerstein. 1 Apr 79, 3p
Pub. in Jnl. Astrophys., v229 n1 pL23-L25, 1 Apr 79.

Keywords: *Stellar spectra, *Binary stars, Emission spectra, Continuous spectra, Line spectra, Hydrogen, MWC 349 star system, Reprints.

Observations of MWC 349 show that the two components of this visual binary have grossly different spectra. The brighter star shows numerous permitted and forbidden emission lines, reminiscent of eta Car and LkH alpha 101, superimposed on a weak continuum. The fainter star shows emission only at H , which is much weaker than H alpha emission in the bright component, and a continuum that is stronger than that of the primary at lambda 7000. It is probably an early-type emission line star. The strong continuum of the secondary and the plethora of weak emission lines in the primary account for part of the anomalously high continuum relative to the hydrogen emission lines, that has previously been ascribed to a preplanetary disc. In light of these facts the general nature of the system is discussed.

700,317
PB-297 906/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Resolution Spectrograph for the Space Telescope.
Final rept.,
J. L. Linsky. 1979, 10p
Pub. in Proceedings of Society of Photo-Optical Instrumentation Engineers, Tucson, AR., Jan 29-Feb 1, 1979, SPIE 172 Instrumentation in Astronomy III, p254-263 1979.

Keywords: *Spectrographs, *Ultraviolet spectroscopy, Resolution, Ultraviolet radiation, Photocathodes, Spaceborne detectors, Astronomical spectroscopy, Spaceborne astronomy, Spaceborne telescopes.

A High Resolution Spectrograph (HRS) is being developed for ultraviolet astronomy with the Space Telescope. The instrument will provide a spectral resolution of about 1.2 x 120,000 over a nominal wavelength range of 110 - 320 nm, together with a spatial resolution of about 0.25 arc seconds. The two detectors will consist of 512-element Digicons with cesium telluride and cesium iodide photocathodes, respectively. Photoelectrons in transit between the photocathodes and the diodes within the Digicons can be deflected in two axes with 12-bit resolution. This feature facilitates a design that emphasizes reliability since (once a hermetic seal is opened in orbit), only two moving parts, a grating carrousel and a shutter, are required for regular operation of the HRS. The instrument will be controlled by a computer in the spacecraft. The scientific objectives of the HRS investigation relate to interstellar matter in our own and nearby galaxies, physical processes of stellar mass loss and mass transfer, chemical abundances, bright quasars and Seyfert galaxy nuclei, and solar system phenomena.

700,318
PB-297 909/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Apsidal Motion and Evolution of Cataclysmic Variables.
Final rept.,
B. Warner. 1978, 24p
Pub. in Acta Astronomica, Polska Akademia Nauk 28, n3 p303-326 1978.

Keywords: *Binary stars, *Mass transfer, Stellar motions, Angular momentum, Orbits, Stellar evolution, *White dwarf stars, Star accretion, Apsides, UX Ursa Majoris star, RW Trianguli star, Reprints.

Interpreted as apsidal motion, the cyclical orbital period changes of UX UMa and RW Tri indicate highly centrally condensed structures for the secondaries of these systems, suggesting that they are in Case B mass transfer. The consequences are explored of loss of angular momentum (via the accretion disc) from cataclysmic variables, both with and without mass loss from the white dwarfs. Illustrations are given of the resulting mass-radius relationship for the secondaries, and of the change in orbital period during evolution. The observed absence of high-luminosity secondaries (which occur in conservative evolution) is thereby explained.

700,319
PB-297 913/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
IUE and the Search for a Lukewarm Corona.
Final rept.,
J. M. Pasachoff, J. L. Linsky, B. M. Haisch, and A. Boggess. 1979, 6p
Pub. in Sky and Telescope 57, n5 p438-443 May 79.

Keywords: *Ultraviolet spectroscopy, Ultraviolet spectra, Stellar spectra, Nebulae, Planets, Spaceborne detectors, Astronomical spectroscopy, *IUE, Spaceborne astronomy, Spaceborne telescopes, Reprints.

Since January 1978, a new telescope in orbit has allowed the world's astronomers to take giant steps toward understanding stars, planets, nebulae, quasars, and other objects by studying their ultraviolet spectra. The International Ultraviolet Explorer (IUE) has coupled significant advances in the instrumentation aloft with interactive capabilities in the control room below in order to allow astronomers to guide and update their projects while the observations are being made. The capabilities of this system are described in detail.

700,320
PB-300 558/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Dimethyl Ether in Orion.
Final rept.,
F. O. Clark, F. J. Lovas, and D. R. Johnson. 15 Apr 79, 7p
Pub. in Astrophysical Jnl. 229, p553-559, 15 Apr 79.

Keywords: *Methyl ether, Interstellar matter, Rotational spectra, Nebulae, Reprints, *Orion Nebula, Cosmic gases.

Seven new dimethyl ether transitions have been observed in emission from the direction of the Orion Nebula. Dimethyl ether has also been detected in Sgr B2 in weak emission from two rotational transitions. The observed high-resolution spectra from several of the Orion transitions exhibit well-resoled splittings due to internal motions in the molecule. All of the Orion signals are quite narrow (average delta V approximately 2.3 km s) and centered near <average V sub (LSR)> equals 6.6 km s. Laboratory measurements of the rest frequencies of these same transitions are presented, along with the calculated relative intensities of the internal rotor split components.

700,321
PB78-600012 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Spectra of Molecules of Astrophysical Interest. XII. Hydroxyl Radical.
R. A. Beaudet, and R. L. Poynter. c1978, 52p
Included in Jnl. of Physical and Chemical Reference Data, v7 n1 p311-362 1978.

Keywords: *Hydroxyl radical, Interstellar molecules, Line strengths, Microwave spectra, Molecular properties, Radio astronomy.

The available data on the microwave spectrum of the hydroxyl radical are critically reviewed for information applicable to radio astronomy. Molecular properties such as the rotational constants, spin-orbit, spin-spin and hyperfine coupling constants and centrifugal distortion parameters employed in or derived from the analysis are tablulated. All the observed and predicted transitions of 16OH, 16OD, and 18OH below 300 GHz and lower state energy levels less than 4000 cm to the minus first power are presented for the ground vibrational state. The laboratory data on 17OH is included, but no predicted transitions are presented due to the limited data available. In addition to the transition frequencies the table contains the calculated line strengths and energies of the levels involved in the transition. An extensive bibliography of laboratory and astronomical studies of the hydroxyl radical is presented as an aid to workers in both fields.

700,322
PB78-600017 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Spectra of Molecules of Astrophysical Interest, XIII. Cyanoacetylene.
W. J. Lafferty, and F. J. Lovas. c1978, 53p
Included in Jnl. of Physical and Chemical Reference Data, v7 n2 p441-494 1978.

Keywords: *Cyanoacetylene, Interstellar molecules, Line strengths, Microwave spectra, Molecular constants, Radio astronomy, Rotational transitions.

The microwave spectrum of cyanoacetylene is critically reviewed for information applicable to radio astronomy. Molecular data such as the derived rotational constants, centrifugal distortion parameters, hyperfine coupling constants, electric dipole moment and molecular structure are tabulated. The observed rotational transitions are presented for the astronomically interesting isotopic forms and low-lying vibrational states of cyanoacetylene. Calculated rotational transitions up to 300 GHz are presented for the ground vibrational states of several isotopes.

700,323
PB79-600010 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Spectra of Molecules of Astrophysical Interest XIV. Vinyl Cyanide (Acrylonitrile).
M. C. L. Gerry, K. Yamada, and G. Winnewisser. c1979, 18p
Included in Jnl. of Physical and Chemical Reference Data, v8 n1 p107-124 1979.

Keywords: *Interstellar molecules, Microwave spectra, Molecular parameters, Radio astronomy, Rotational transitions, Vinyl cyanide.

The available data of the microwave spectrum of vinyl cyanide are critically reviewed and tabulated. Molecular data such as rotational constants, centrifugal distortion constants, hyper-fine coupling constants, dipole moments, and structural parameters are tabulated. Rotational transitions from 400 MHz to 200 GHz, which are likely to be ofinterest to radio astronomy, are calculated and tabulated along with their estimated 95% confidence limits.

700,324
PB79-600020 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Spectra of Molecules of Astrophysical Interest. XV. Propyne.
A. Bauer, D. Boucher, J. Burie, J. Demaison, and A. Dubrulle. c1979, 22p
Included in Jnl. of Physical and Chemical Reference Data, v8 n2 p537-558 1979.

Keywords: *Interstellar molecules, Line strengths, Microwave spectra, Molecular constants, Propyne, Radio astronomy, Rotational transitions.

The microwave spectrum of propyne is critically reviewed for information applicable to radio-astronomy. Molecular data such as the derived rotational constants, centrifugal distortion parameters, hyperfine coupling constants, electric dipole moment, and molecular structure are tabulated. The observed rotational transitions are presented for the astronomically interesting isotopic forms and the lowest lying vibrational state of propyne. Calculated rotational transitions are presented for the ground vibrational states.

700,325
PB79-600023 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Spectra of Molecules of Astrophysical Interest. XVI. Methyl Formate.
A. Bauder. c1979, 36p
Included in Jnl. of Physical and Chemical Reference Data, v8 n3 p583-618 1979.

Keywords: *Internal rotation, Interstellar molecules, Line strengths, Methyl formate, Microwave spectrum, Radio astronomy, Rotational transitions.

The microwave spectrum of methyl formate is critically reviewed for information appplicable to radio astronomy. The review is based on new laboratory measurements in the frequency range from 8 GHz to 58 GHz. Molecular data such as the derived rotational constants, centrifugal distortion parameters, internal rotation parameters, electric dipole moment and molecular structure are tabulated. Since the primary objective is to provide microwave spectral transitions applicale to radio astronomy observations, the review encompasses only the ground state rotational spectrum of the most abundant isotopic form of methyl formate, H12C16O212CH3. While all measured transitions are included, the predicted transitions were limited to J equal to or less than 12 in the range of 900 MHz to 250 GHz.

700,326
PB79-600033 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Spectra of Molecules of Astrophysical Interest. XVII. Dimethyl Ether.
F. J. Lovas, H. Lutz, and H. Dreizler. c1979, 58p
Included in Jnl. of Physical and Chemical Reference Data, v8 n4, p1051-1107 1979.

Keywords: *Dimethyl ether, Internal rotation, Interstellar molecules, Microwave spectrum, Radio astronomy, Rotational transitions.

The microwave spectrum of dimethyl ether (methoxymethane) is critically reviewed and supplemented through calculations which include the contributions of interrotation and centrifugal distortion in the molecular Hamiltonian. The primary objective of this review is to provide microwave spectral transitions applicable to molecular radio astronomy for the ground vibrational state rotational spectrum of the most abundant isotopic form of dimethyl ether, 12CH3, 16O 12CH3. While all measured rotational transitions are included the predicted transition frequencies were limited to J equal to or less than 5 in the range 1 GHz to 300 GHz. In order to provide a complete summary of the laboratory studies on dimethyl ether, the rotational constants of the less abundant isotopic species and excited torsional states are also tabulated and all reported rotational studies are referenced.

700,327
PB80-100779 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultraviolet Observations of Cool Stars. VIII. Interstellar Matter Toward Procyon.
Final rept.,
R. C. Anderson, R. C. Henry, H. W. Moos, and J. L. Linsky. 15 Dec 78, 5p
Pub. in Astrophysical Jnl. 226, n3, p883-887, 15 Dec 78.

Keywords: *Interstellar matter, *Hydrogen isotopes, Deuterium, Density(Number/volume), *Ultraviolet spectra, Absorption spectra Reprints, Isotope ratio.

The profile of the chromospheric L alpha emission line of the F5 IV-V star Procyon (alpha Canis Minoris, d = 3.5 pc) has been measured using the high-resolution Princeton spectrometer aboard NASA's Copernicus satellite. L alpha absorption lines of interstellar deuterium and hydrogen are distinctly present. The average number density of interstellar hydrogen along the line of sight is found to be 0.11 + or - 0.02 cu cm, similar to the densities that have been found in the directions of the stars epsilon Eridani, epsilon Indi, and alpha Centauri A. These stars are all within 3.5 pc of the Earth. The ratio of deuterium to hydrogen in the direction of Procyon is found to be 1.3 (+1.2, -0.5) x times 0.00001.

700,328
PB80-107345 Not available NTIS
National Bureau of Standards, Washington, DC.
Search for Coronal Soft X-ray Emission from Cool Stars with HEAO 1.
Final rept.,
T. R. Ayres, J. L. Linsky, G. Garmire, and F. Cordova. 1 Sep 79, 4p
Contract NAS8-33084
Pub. in Astrophysics Jnl. 232, n2, pL117-L120, 1 Sep 79.

Keywords: *Stellar atmospheres, Dwarf stars, Giant stars, Flare stars, X rays, Reprints, *X ray sources, Stellar coronas, G stars, BY Draconis star, AD Leonis star, X ray astronomy, K stars, M stars, Soft x radiation, Supergiant stars.

A search of the HEAO 1 A-2 experiment all-sky survey for coronal soft X-ray emission from a sample of active chromosphere G-M stars including six dwarfs, eight giants, four supergiants, and 10 dMe flare stars is summarized. Point sources were detected near the positions of several of the stars on the list. However, of these, only the flare stars BY Draconis (dM0e) and AD Leonis (dM3.5e) appear to be likely candidates for the detected X-rays.

700,329
PB80-108558 Not available NTIS
National Bureau of Standards, Washington, DC.
Stellar Model Chromospheres. X. High-Resolution, Absolute Flux Profiles of the Ca II H and K Lines in Stars of Spectral Types FO-M2.
Final rept.,
J. L. Linsky, S. P. Worden, W. McClintock, and R. M. Robertson. Sep 79, 28p
Contract NAS-52-32-74, Grant NGL-06-003-057
See also report dated 15 Mar 78, PB-282 120.
Pub. in Astrophys. J. Suppl. Ser. 41, n1, p47-74, Sep 78.

Keywords: *Stellar atmospheres, Stellar spectra, Chromosphere, Giant stars, Dwarf stars, Calcium, Ions, Line spectra, Reprints, Supergiant stars, F stars, G stars, K stars, M stars.

120 mA resolution spectra of the cores and wings of the Ca II H and K lines in 43 stars covering a wide range of spectral type and luminosity class are presented. Chromospheric radiative loss rates in the H and K lines are derived, and trends in these loss rates with effective temperature for dwarfs, giants, and supergiants are discussed. These loss rates are compared to similar rates for the Mg II h and k lines, and the doublet line ratios for H and K are discussed. The monochromatic surface fluxes for different features in the H and K lines are presented, and the radiation temperature is derived. Finally, data on emission lines in the wings of H and K are presented, and chromospheric radiative loss rates in the H epsilon line are compared with loss rates in the H and K lines.

700,330
PB80-115611 Not available NTIS
National Bureau of Standards, Washington, DC.
Binary Cepheid AU Peg.
Final rept.,
H. Harris, E. W. Olszewski, and G. Wallerstein. Oct 79, 5p
Pub. in Astronomical Jnl. 84, n10 p1598-1602 Oct 79.

Keywords: *Binary stars, Reprints, *AU Pegasi star, Cepheids.

A photometric and spectroscopic study of the Type II cepheid AU Pegasi indicates it is a member of a binary with a period < about 50 days. Constraints on the orbit indicate the companion is likely to be more massive than AU Peg and may be A compact object. The light curve, pulsation-velocity curve, and spectrum of AU Peg are consistent with its cepheid nature. However, the colors are peculiar and the large period changes remain to be explained.

700,331
PB80-117286 Not available NTIS
National Bureau of Standards, Washington, DC.
Lyman-alpha Rocket Spectra and Models of the Quiet and Active Solar Chromosphere Based on Partial Redistribution Diagnostics.
Final rept.,
G. S. Basri, J. L. Linsky, J.-D. F. Bartoe, G. Brueckner, and M. E. Van Hoosier. 15 Jun 79, 26p
Pub. Astrophysical Jnl. 230, n3, p924-949, 15 Jun 79.

Keywords: *Chromosphere, *Lyman alpha radiation, Solar spectrum, Ultraviolet spectra, Sunspots, Solar prominences, Reprints, Faculae, Solar granulation.

Lyman alpha line profiles obtained with 0.8 seconds of arc spatial resolution and 50 mA spectral resolution during the first rocket flight of the NRL High Resolution Telescope and Spectrograph instrument are presented. Absolute intensity L alpha profiles were obtained for network and cell regions in the quiet sun, umbral and penumbral regions of a sunspot, two plages, and a quiescent prominence off the limb. A new quiet sun chromosphere model is proposed; this model is consistent with the observed L alpha integrated intensity, the Lyman continuum slope, and the millimeter continuum.

700,332
PB80-118086 Not available NTIS
National Bureau of Standards, Washington, DC.
Stellar Model Chromospheres. IX. Chromospheric Activity in Dwarf Stars.
Final rept.,
W. L. Kelch, J. L. Linsky, and S. P. Worden. 15 Apr 79, 13p
Grants NGL-06-003-057, NAS5-23274
Pub. in Astrophys. J. 229, n2 p700-712, 15 Apr 79.

Keywords: *Stellar atmospheres, *Dwarf stars, Chromosphere, Calcium, Stellar spectra, Stellar structure, Reprints, *Star models, F stars, G stars, K stars, M stars, Calcium ions.

High-resolution Ca II K line profiles are used to derive photospheric and lower chromospheric models of eight main-sequence stars of spectral types F0 through M0. These stars exhibit different degrees of chromospheric activity as indicated by their chromospheric radiative losses. Plane-parallel homogeneous models are computed on the basis of partial redistribution diagnostics.

700,333
PB80-118110 Not available NTIS
National Bureau of Standards, Washington, DC.
Solar XUV He I and He II Emission Lines. I. Intensities and Gross Center-to-Limb Behavior.
Final rept.,
S. A. Mango, J. D. Bohlin, D. L. Glackin, and J. L. Linsky. 1 Mar 78, 9p
Grant NGR-06-003-057
Pub. in Astrophys. J. 220, n2 p683-691, 1 Mar 78.

Keywords: *Solar ultraviolet radiation, *Solar spectrum, Ultraviolet spectra, Far ultraviolet radiation, Chromosphere, Solar corona, Solar magnetic fields, Solar activity, Helium, Reprints, Coronal holes, Helium ions.

The authors derive the center-to-limb variation of the He II lambda 304 and lambda 256 lines and He I lambda 584 and lambda 537 lines for different solar features, but averaged over the chromospheric supergranulation structure. The general trend is for limb brightening in quiet-Sun regions, limb neutrality in unipolar magnetic regions (UMR), and limb darkening in polar coronal holes. The center-to-limb behavior in these optically thick emission lines indicates collisional excitation and decreasing transition-region temperature gradients with respect to optical depth in the sequence quiet Sun to UMR to coronal hole.

700,334
PB80-141658 Not available NTIS
National Bureau of Standards, Washington, DC.
Lyman Alpha Initiated Winds in Late-Type Stars.
Final rept.,
B. M. Haisch, J. L. Linsky, and K. A . van der Hucht. 1979, 11p
Grant NAS5-23274
Pub. in Proceedings of Symposium on The First Year of IUE, Held at London, England on Apr 4-6, 1979, p383-393, 1979.

Keywords: *Stellar atmospheres, Stellar spectra, Ultraviolet spectra, Lyman alpha radiation, Giant stars, Magnetohydrodynamic waves, *Stellar winds, *Late stars, Star models, M stars, K stars, Arcturus star, Alpha Bootis star, Alfven waves.

One of the first major results of the IUE survey of late-type stars was the discovery of a sharp division in the HR diagram between stars with solar type spectra (chromosphere and transition region lines) and those with non-solar type spectra (only chromosphere lines). This result is especially interesting in view of observational evidence for mass loss from G and K giants and supergiants discussed recently by both Reimers and Stencel. The authors have calculated models of both hot coronae and cool wind flows using stellar model chromospheres as starting points for stellar wind calculations in order to investigate the possibility of having a 'supersonic transition locus' in the HR diagram dividing hot coronae from cool winds. The authors conclude from these models that the L flux may play an important role in determining the location of a stellar wind critical point. The authors investigate in detail the interaction of L radiation pressure with Alfven waves in producing strong, low temperature stellar winds in the star Arcturus.

700,335
PB80-144215 Not available NTIS
National Bureau of Standards, Washington, DC.
Stellar Model Chromospheres. XI. A Survey of Ca II lambda 8542 Line Profiles in Late-Type Stars of Differing Chromospheric Activity.
Final rept.,
J. L. Linsky, D. M. Hunten, R. Sowell, D. L. Glackin, and W. L. Kelch. Nov 79, 20p
Grant NGL-06-003-057, Contract NAS5-23274
See also PB80-108558.
Pub. in Astrophysical Journal, Supplement Series 41, n3, p481-500, Nov. 79.

Keywords: *Stellar atmospheres, Stellar spectra, Calcium, Ions, Chromosphere, Line spectra, Infrared spectra, Giant stars, Binary stars, Reprints, F stars, G stars, K stars, Alpha Aurigae star, Capella star, Calcium ions, Supergiant stars.

Profiles of the Ca II infrared triplet line lambda 8542 in 49 stars of spectral type F9-K3 have been obtained. These data were obtained with a silicon diode vidicon detector system on the KPNO McMath telescope and have a spectral resolution of 0.14 A.

700,336
PB80-150469 Not available NTIS
National Bureau of Standards, Washington, DC.

Blue Stragglers as Long-Lived Stars.
Final rept.,
J. C. Wheeler. 1 Dec 79, 10p
Pub. in Astrophysics Journal 234, n2, p569-578, 1 Dec 79.

Keywords: *Stellar evolution, Star clusters, Main sequence stars, Statistical analysis, Reprints.

With the assumption that blue stragglers in open clusters evolve as standard main-sequence stars, the mass function and other statistical properties are derived. The mass function is very similar to the present mass function of field stars and is roughly consistent with hypotheses of ongoing star formation, stellar coalescence, and perhaps extended main-sequence lifetimes to explain the nature of blue stragglers. The steep mass function argues against the hypothesis of binary mass transfer. Other features of blue stragglers are inconsistent with noncoeval star formation and stellar coalescence. The notion that some stars undergo a longer-lived quasihomogeneous evolution is considered and shown to be consistent with many properties of blue stragglers.

700,337
PB80-150493 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Magnitude of the Field Population II. Cepheid XX Virginis.
Final rept.,
G. Wallerstein, and E. W. Brugel. Dec 79, 6p
Pub. in Astronomical Journal 84, n12, p1840-1845, Dec 79.

Keywords: *Stellar luminosity, Variable stars, Stellar magnitudes, Stellar motions, Star clusters, Reprints, *Cepheids, XX Virginis star, RR Lyrae star, Radial velocity, Population 2 stars, Globular clusters.

A radial velocity curve from 38 A/mm Palomar plates of XX Vir is presented. The velocity data are combined with UBV colors to derive the radius and M(v). The same method is also used to derive M(v) for RR Lyrae. The results are M(v) (RR Lyrae) = +0.6 and M(v). (XX Vir) = -0.7. The luminosity for XX Vir places it among the cepheids of similar periods in globular clusters.

700,338
PB80-159114 Not available NTIS
National Bureau of Standards, Washington, DC.
Outer Atmospheres of Cool Stars. II. MgII Flux Profiles and Chromospheric Radiative Loss Rates.
Final rept.,
G. S. Basri, and J. L. Linsky. 1979, 14p
Grants NAS5-23274, NGL-06-003-057
See also PB-296 277.
Pub. in Astrophys. Jnl. 234, n3 p1023-1034, 15 Dec 79.

Keywords: *Stellar atmospheres, Stellar spectra, Chromosphere, Reprints, G stars, K stars, M stars, Magnesium ions.

International Ultraviolet Explorer high-resolution spectra of the Mg II lambda lambda 2796, 2803 lines in 15 stars of spectral type G2-M2 including a wide range of luminosities are presented. These spectra are calibrated in absolute flux units at Earth and at the stellar surface, and the chromospheric radiative loss rates in the Mg II lines are compared with corresponding rates in the Ca II H, K, and lambda 8542 lines.

700,339
PB80-165574 Not available NTIS
National Bureau of Standards, Washington, DC.
Discovery of X-Rays from the 40 Eridani System.
Final rept.,
W. Cash, P. Charles, S. Bowyer, F. Walter, T. R. Ayres, and J. L. Linsky. 1 Aug 79, 4p
Contract NAS8-33084
Pub. in Journal of Astrophysics 231, n3, pL137-L140, 1 Aug 79.

Keywords: X rays, Stellar luminosity, Reprints, *Cosmic x-ray sources, 40 Eridani star, Stellar radiation, H0405-08 x ray source.

The detection of a new point source of soft X-rays (H0405-08) consistent with the position of the nearby triple star system 40 Eridani is reported. The authors discuss whether the likely source of the bulk of the X-rays is the K1 dwarf, the DA white dwarf, the dwarf M4 flare star, or accretion onto the white dwarf.

700,340
PB80-177983 Not available NTIS
National Bureau of Standards, Washington, DC.
Behavior of H alpha in Delta Cephei.
Final rept.,
G. Wallerstein. Dec 79, 3p
Pub. in Journal of Publ. Astron. Soc. Pacific 91 p772-724 Dec 79.

Keywords: *Stellar spectra, *Stellar atmospheres, Hydrogen, Spectral lines, Doppler effect, Silicon, Ions, Metals, Reprints, *H alpha line, Delta Cephei star, Silicon ions.

A new radial velocity curve for Delta Cephei is presented based on 10 A/mm red spectrograms. The curves for neutral metallic lines, low excitation ions, and high excitation Si II lines follow the curve of Shane (1958) within observational uncertainties. For H alpha the curve shows an amplitude 15 km/s larger than for the metallic lines. Arguments are presented to show that the H alpha absorption is formed high in the atmosphere of Delta Cephei.

700,341
PB80-178387 Not available NTIS
National Bureau of Standards, Washington, DC.
Outer Atmospheres of Cool Stars. IV. A Discussion of Cool Stellar Wind Models.
Final rept.,
B. M. Haisch, J. L. Linsky, and G. S. Basri. 1980, 15p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC. See also PB80-159114.
Pub. in Astrophys. Jnl. 235, p519-533, 15 Jan 80.

Keywords: Stellar atmospheres, Magnetohydrodynamic waves, Radiation pressure, Lyman alpha radiation, Reprints, *Stellar winds, *Late stars, Arcturus star, Alpha Bootis star, Alfven waves.

Possible wind models for late-type stars which appear not to have hot coronae and transition regions are investigated. Taking Arcturus as the prototypical star, wind models with $T < 20{,}000$ K are considered and for solutions with mass loss rates of the order of one billionth of a solar mass per year are sought.

700,342
PB80-178395 Not available NTIS
National Bureau of Standards, Washington, DC.
Observations of the Quiescent Corona, Transition Region, and Chromosphere in the dMe Flare Star Proxima Centauri.
Final rept.,
B. M. Haisch, and J. L. Linsky. 1980, 5p
Contracts NAS5-23274, NAS8-33333
Pub. in Astrophys. Jnl. 236, pL33-L37, 15 Feb 80.

Keywords: Stellar spectra, Stellar atmospheres, Ultraviolet spectra, X rays, Emission spectra, Chromosphere, Dwarf stars, Reprints, *Proxima Centauri star, Alpha Centauri star, Flare stars, Carbon ions, Nitrogen ions, Silicon ions, Stellar coronas, Red dwarf stars.

X-ray fluxes and ultraviolet spectra (1175-3200 A) of the dM5e flare star Proxima obtained with the imaging proportional counter on HEAO 2 and the ultraviolet spectrographs on IUE are presented. These observations are the first concrete evidence for a quiescent corona in an M dwarf outside of flares.

700,343
PB80-182272 Not available NTIS
National Bureau of Standards, Washington, DC.
Nucleosynthetic Yields and the History of the Stellar Birthrate.
Final rept.,
J. C. Wheeler, G. E. Miller, and J. M. Scalo. 1980, 5p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. Astron. Astrophys., v82 p152-156, 1980.

Keywords: *Stellar evolution, Supernovae, Iron, Carbon, Birth and death processes, Reprints, *Nucleosynthesis, Star models.

The rate of production of metals is recomputed using the constant mass stellar models of Arnett (1978) and the stellar birthrate of Miller and Scalo (1979), which has a higher birthrate for massive stars. Massive stars produce an appropriate amount of metals if the stars lose negligible mass and if the birthrate is constant. With constant mass evolution and a higher past birthrate, metals would be over-produced. Chiosi (1979) has shown that mass loss decreases the yield of massive stars. In this case massive stars can account for the observed metal abundances only if the birthrate were significantly higher in the past in contradiction to independent evidence that it is nearly constant.

700,344
PB80-195852 Not available NTIS
National Bureau of Standards, Washington, DC.
Energy Loss by Resonance Line Photons in an Absorbing Medium.
Final rept.,
D. G. Hummer, and P. B. Kunasz. 1 Mar 80, 10p
Contract NAS5-22833
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 236, n2 p609-618, 1 Mar 80.

Keywords: Quasars, Reprints, *Radiative transfer.

The mean path length of photons undergoing repeated scatterings in media of large optical thickness is calculated from accurate numerical solutions of the transfer equation including the effect of frequency redistribution characteristic of combined Doppler and natural broadening. Energy loss by continuous absorption process, such as ionization or dust absorption, is discussed, and asymptotic scaling laws for the energy loss, the mean path length, and the mean number of scatterings are inferred from the numerical data.

700,345
PB80-195860 Not available NTIS
National Bureau of Standards, Washington, DC.
Outer Atmospheres of Cool Stars. III. IUE Spectra and Transition Region Models for Alpha Centauri A and B.
Final rept.,
T. R. Ayres, and J. L. Linsky. 1 Jan 80, 9p
Contracts NAS5-23274, NGL-06-003-057
Pub. in Astrophysical Jnl. 235, n1 p76-84, 1 Jan 80.

Keywords: *Dwarf stars, *Stellar spectra, Stellar atmospheres, Ultraviolet spectra, Reprints, *Alpha Centauri Star.

The authors describe IUE ultraviolet spectra of two nearby dwarf stars, alpha Centauri A (G2 V) and B (K1 V). These data include high-resolution profiles of the Mg II h and k features and lower-resolution integrated fluxes of lines from the following species: H I, C I-IV, N v, O I, Al II, Si II-IV, and Fe II. It was found that surface fluxes in chromospheric and transition-region lines of alpha Cen A and B are nearly identical to those of the quiet Sun.

700,346
PB80-201270 Not available NTIS
National Bureau of Standards, Washington, DC.
Outer Atmospheres of Cool Stars. VI. Models for Epsilon Eridani Based on IUE Spectra of C II, Mg II, Si II, and Si III.
Final rept.,
T. Simon, W. L. Kelch, and J. L. Linsky. 1 Apr 80, 10p
Contract NAS5-23274, Grant NGL-06-003-057
See also PB80-178387.
Pub. in the Astrophysical Jnl. 273, n1 p72-81, 1 Apr 80.

Keywords: *Stellar atmospheres, Stellar spectra, Ultraviolet spectra, Reprints, *Epsilon Eridani Star, *Late stars.

Observations of the ultraviolet line spectrum of the active chromosphere star, epsilon Eridani, obtained with the IUE satellite have been analyzed. The authors have solved the coupled statistical equilibrium and radiative transfer equations for the prominent transitions of C II, Mg II, Si II, and Si III. A satisfactory fit to all of the line strengths can be achieved with a model similar to that recently proposed to explain bright points on the quiet Sun.

700,347
PB80-203052 Not available NTIS
National Bureau of Standards, Washington, DC.
Recommended Rest Frequencies for Observed Interstellar Molecular Transitions.
Final rept.,
F. J. Lovas, L. E. Snyder, and D. R. Johnson. Nov 79, 30p
Pub. in The Astrophysical Jnl., Supplement Series 41, p451-480 Nov 79.

Keywords: *Extraterrestrial radio waves, *Microwave spectra, *Interstellar matter, Reprints.

Astrophysics

The most accurate values presently available for the rest frequencies of all known interstellar molecular transitions are presented and recommended for reference in future astronomical observations in the radio and microwave regions. The recommended values have been carefully selected after critical evaluation of the spectroscopic literature. Probable error limits along with the proper molecular and quantum mechanical labels are presented for each observed transition. Representative line antenna temperatures are also presented for a typical source as a convenience to users. References are cited to both the astronomical and the laboratory literature.

700,348
PB80-208242 Not available NTIS
National Bureau of Standards, Washington, DC.
Supernovae in Molecular Clouds.
Final rept.,
J. C. Wheeler, T. J. Mazurek, and A. Sivaramakrishnan. 1 May 80, 12p
Pub. in Astrophysical Jnl, n3 pt1 p781-792, 1 May 80.

Keywords: *Supernoval, Interstellar matter, Stellar evolution, X rays, Reprints.

The evolution of a supernova buried in a molecular cloud is studied analytically and compared with preliminary numerical dynamical results.

700,349
PB80-212327 Not available NTIS
National Bureau of Standards, Washington, DC.
Dimethyl Ether in Orion,
F. O. Clark, F. J. Lovas, and D. R. Johnson. 15 Apr 79, 7p
Pub. in Astrophysical Jnl. 229, p553-559, 15 Apr 79.

Keywords: *Interstellar matter, *Microwave spectra, Nebulae, Reprints, *Ether/dimethyl, *Orion nebula.

Seven new dimethyl ether transitions have been observed in emission from the direction of the Orion Nebula. Dimethyl ether has also been detected in Sgr B2 in weak emission from two rotational transitions. The observed high-resolution spectra from several of the Orion transitions exhibit well-resolved splittings due to internal motions in the molecule. All of the Orion signals are quite narrow ((delta V) approximately equal to 2.3 km/s) and centered near (V(LSR)) = 6.6 km/s. Laboratory measurements of the rest frequencies of these same transitions are presented, along with the calculated relative intensities of the internal rotor split components.

700,350
PB80-212350 Not available NTIS
National Bureau of Standards, Washington, DC.
OH Pumping by IR Line Overlap. Application to Circumstellar Masers,
V. Bujarrabal, J. Guibert, N.-Q. Rieu, and A. Omont. 1980, 6p
Pub. in Astronomy and Astrophysics 84, p311-316 1980.

Keywords: Variable stars, Reprints, *Hydroxyl masers, Mira variables.

The authors analyze the pumping of 18 cm OH masers by the overlap of far infrared lines in an expanding or collapsing medium with a particular reference to circumstellar envelopes. The IR intensity absorbed in one far IR line is strongly perturbed by Doppler shifted absorption or emission of another IR line at other points in the envelope. Strong 18 cm inversions can result. The authors present a detailed model taking into account the great number of relevant overlaps. Main line intensities of circumstellar masers are easily accounted for, and the emission of the 1612 MHz line is also enhanced by the overlap effects. The pumping by far IR line overlap due to a large scale velocity field is probably more effective by an order of magnitude than all the other pumping mechanisms so far suggested for circumstellar main line masers.

700,351
PB80-215882 Not available NTIS
National Bureau of Standards, Washington, DC.
Additional Radial Velocities of Maser Stars and Related M Supergiants.
Final rept.,
G. Wallerstein, and W. M. Fawley. Apr 80, 5p
Pub. in Publications of the Astronomical Society of the Pacific 92, n546 p183-187 Apr 80.

Keywords: *Giant stars, Masers, Microwaves, Reprints, *Supergiant stars, Radial velocity.

New radial-velocity data for late supergiants with maser emission, long-period variable maser stars, and similar non-maser stars are presented. For VY CMa, the authors make use of 20 years of data to show that a correlation exists between the measured radial velocity and the spectral resolution. The correlation may be explained by reflection of starlight from moving dust in agreement with the line-profile calculations of van Blerkom and van Blerkom (1978). For the long-period variables, radial velocities of the K1 reasonance lines on 4 A/mm spectrograms strengthen the correlation between the circumstellar absorption lines and the violet edge of the thermal microwave emission.

700,352
PB80-216435 Not available NTIS
National Bureau of Standards, Washington, DC.
Direct Measurement of Solar Luminosity Variation.
Final rept.,
R. C. Willson, C. H. Duncan, and J. Geist. 1980, 3p
Pub. in Science 207, p177-179, 11 Jan 80.

Keywords: *Solar constant, Luminosity, Climatology, Reprints.

Two rocket flights of an absolute pyrheliometer, separated by 30 months, indicate an increase in solar luminosity (solar constant) of 0.4 percent. The significance of this result is considered in light of the instrument performance during the rocket flights and of pre- and postflight intercomparisons with independently maintained pyrheliometers. There is a high probability that the measured difference is real. Additional observations are required to determine whether the difference results from random fluctuations in solar luminosity, a nonrandom change of short duration, or a sustained change that has climatological significance.

700,353
PB80-216997 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultraviolet Spectroscopy of the Outer Layers of Stars.
Final rept.,
T. P. Snow, and J. L. Linsky. 1980, 23p
Grants NGR-06-003-057, NAS5-23274
Pub. in Astrophysics and Space Science 67, n2 p285-307 1980.

Keywords: *Ultraviolet spectroscopy, *Stellar atmospheres, Solar corona, Stellar structure, Mass, Reprints.

This chapter summarizes the authors present understanding of the outer layers of stars, specifically addressing questions of the physical structures, models, winds, mass loss, chromospheres, and coronae. For both hot and cool stars, ground-based visual spectroscopic measurements and ultraviolet spectroscopy from space experiments are reviewed and compared with theory. With this background, they propose new spectroscopic measurements in the ultraviolet for the space shuttle era, which will address and perhaps resolve important questions concerning the outer layers of stars.

700,354
PB80-217011 Not available NTIS
National Bureau of Standards, Washington, DC.
Stars with Anomalous Mass: Is There Funny Business on the Main Sequence.
Final rept.,
J. C. Wheeler. 1979, 16p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Comments on Astrophysics 8, n5 p133-148 1979.

Keywords: *Stellar evolution, Supernovae, Mass, Abnormalities, Reprints.

Throughout the subject of stellar astronomy there are examples of stars whose masses are anomalously high and hence their implied main-sequence lifetimes anomalously short compared to other measures of lifetime. The other factors determining times scales are varied; cluster turnoffs, extragalactic stellar populations, galactic kinematics and metal abundance. Several explanations are frequently proposed to account for these anomalies: delayed star formation, binary mass transfer and post-main-sequence evolutionary contortions. The purpose of this Comment is to review the examples of anomalous-mass stars (AMS) in order to remind the reader that they are a ubiquitous phenomenon. In addition, the possible explanations of the various classes of anomalous stars will be explored to see if a common phenomenon might be at work.

700,355
PB80-221559 Not available NTIS
National Bureau of Standards, Washington, DC.
HEAO 1 Observations of X-Ray Emission from Flares on dMe Stars.
Final rept.,
S. M. Kahn, J. L. Linsky, K. O. Mason, B. M. Haisch, C. S. Bowyer, N. E. White, and S. H. Pravdo. 1 Dec 79, 5p
Contract NAS8-33084
Pub. in Astrophysical Jnl. 234, n2 pL107-L111, 1 Dec 79.

Keywords: *Stars, Flares, X rays, X ray spectra, Reprints.

The authors report the detection of two X-ray flares from each of the nearby dMe stars, AT Mic and AD Leo, with the A-2 experiment on board HEAO 1. A spectrum obtained during the brighter AT Mic flare, the first X-ray spectrum of a stellar flare, is well matched by a thermal model. The estimated L(x)/L(opt) ratios exceed unity and are inconsistent with Mullan's flare model. The authors propose several scenarios to explain this discrepancy.

700,356
PB80-227689 Not available NTIS
National Bureau of Standards, Washington, DC.
Intercombination Line Oscillator Strengths for the MgI Isoelectronic Sequence.
Final rept.,
C. Laughlin, and G. A. Victor. 1979, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Astrophysical Jnl. 234, p407-409, 15 Nov 79.

Keywords: *Magnesium, Atomic spectra, Transition probabilities, Atoms, Reprints, Oscillator strengths.

Accurate calculations of the intercombination line oscillator strengths for the MgI isoelectronic sequence, through AR VIII, have been carried out using a semiempirical model potential method. The results differ significantly from some earlier semiempirical estimates but are in good agreement with some recent relativistic calculations.

700,357
PB80-228968 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectrum of the Nebulosity Around the Symbiotic Long-Period Variable, R Aquar II.
Final rept.,
G. Wallerstein, and J. L. Greenstein. Jun 80, 8p
Pub. in Publications of the Astronomical Society of the Pacific 92, p275-283 Jun 80.

Keywords: *Stars, Reprints.

Multichannel spectrophotometric and SIT spectrograph data are reported for R Aqr during its deep minimum of September 1977. Line identifications and fluxes are presented. The emission lines are analyzed to yield the following parameters. The reddening, which must be circumstellar at b = -70 deg, is 0.67 in (B-V). From the ratio of Balmer continuum emission to H Beta an electron temperature near 11,000 K is derived, with observational uncertainties that allow values from 9000 K to 16,000 K. A model of R Aqr with a white dwarf or O subdwarf accreting material that is lost by the long-period variable is discussed but to date there is no direct evidence that two separate stars are present. The evidence that the maxima were suppressed when the hot source was bright is used to question the binary hypothesis and to suggest that R Aqr may be a single star with a magnetically active region.

700,358
PB81-103962 Not available NTIS
National Bureau of Standards, Washington, DC.
Stellar Chromospheres.
Final rept.
J. L. Linsky. 1980, 49p
Contract NAS5-23274, Grant NGL-06-003-057
Pub. in Ann. Rev. Astron. Astrophys. 18, p439-488 1980.

Keywords: *Chromosphere, *Stars, Stellar structure, Ultraviolet spectroscopy, Mathematical models, Reprints.

This is a comprehensive review of recent observational and theoretical studies of stellar chromospheres. Specific topics covered include the definition of a stellar chromosphere, the regions of the H-R diagram in which chromospheres occur, semiempirical models of chromospheres in single stars, theoretical models, the Wilson-Bappu relation, systematic flow patterns, how chromospheres in close binary systems differ from chromospheres in single stars, and future prospects for research.

700,359

PB81-110686 Not available NTIS
National Bureau of Standards, Washington, DC.
Polarization Properties of the 86.2 GHz(nu) = 1, J = 2 (arrow) 1 SiO Maser.
Final rept.
T. Troland, C. Heiles, D. Johnson, and F. Clark. 15 Aug 79, 15p
Pub. in Jnl. Astrophysics 232, p143-157, 15 Aug 79.

Keywords: *Variable stars, *Interstellar matter, *Silicon monoxide, *Masers, *Polarization(Waves), Plane polarization, Nebulae, Reprints, Stokes parameters, Orion Nebula.

Complete Stokes parameters have been measured for a small sample of SiO masers associated with variable stars. These sources were found to be typically 15-30% linearly polarized and to exhibit no circular polarization above limits of as low as a few percent. The Orion Molecular Cloud source exhibited no linear or circular polarization greater than 3% during the present observing period. The Stokes parameters for R Cas, not necessarily including the total intensity, were found to vary over short periods. Comparison of the new profiles for regular variable stars with those obtained several optical periods earlier reveals substantial changes. No apparent correlation exists between these changes and the optical variations of the stars.

700,360

PB81-115503 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Sunspot Cycle Simulation Using a Narrowband Gaussian Process.
J. A. Barnes, H. H. Sargent, and P. V. Tryon. Sep 80, 25p NBS-TN-1022

Keywords: *Sunspots, Computerized simulation, Computer programs, BASIC programming language, Periodic variations, Mathematical prediction, Sunspot cycle, ARMS models, Gaussian processes.

The square of a narrowband Gaussian process is used to simulate sunspot cycles at computer speeds. The method is appealing because: (1) the model is extremely simple yet its physical basis, a simple resonance, is a widely occurring natural phenomenon, and (2) the model recreates practically all of the features of the observed sunspot record. In particular, secular cycles and recurring extensive minima are characteristic of narrowband Gaussian processes. Additionally, the model lends itself to limited prediction of sunspot cycles.

700,361

PB81-133431 Not available NTIS
National Bureau of Standards, Washington, DC.
Stellar Chromospheres.
J. L. Linsky. 1980, 4p
Contract NAS5-23274, Grant NGL-06-003-057
Pub. in Proceedings of Stellar Turbulence, IAU Colloques 51, University of Western Ontario, London, Canada, Aug 27-30, 1979, p248-277 1980.

Keywords: *Stellar atmospheres, Ultraviolet spectra, *Stellar chromospheres.

This is an in-depth review of the rapidly emerging field of chromospheres in cool stars. Specific topics covered include trends emerging from semiempirical models of single stars, theoretical models, the Wilson-Bappu relation and systematic flow patterns in stellar chromospheres. The review contains extensive references.

700,362

PB81-133506 Not available NTIS
National Bureau of Standards, Washington, DC.
IUE Spectra of a Flare in the RS Canum Venaticorum-Type System UX Arietis.
T. Simon, J. L. Linsky, and F. H. Schiffer. 1 Aug 80, 8p
Contract NAS5-23274, Grant NGL-06-003-057
Pub. in Astrophysical Jnl. 239, n3 p911-918, 1 Aug 80.

Keywords: *Binary stars, Stellar spectra, Stellar luminosity, Ultraviolet spectra, Reprints, *Stellar flares, Stellar coronas.

IUE spectra of UX Air, obtained during the large flare of 1979 January 1, exhibited chromospheric and transition region emission line fluxes about 2.5 and 5.5 time brighter than quiescent fluxes, respectively and up to 1400 times brighter than the quiet Sun. A high dispersion spectrum of the 2000-3000 A region exhibits enhanced Fe II emission, which is probably associated mainly with the KO IV star, and enhanced Mg II emission with asymmetric wings extending to +475 km/s. The authors interpret these line wings as evidence for mass flow from the KO IV star to the G4 V star.

700,363

PB81-134595 Not available NTIS
National Bureau of Standards, Washington, DC.
Stellar Chromospheres and Coronae.
J. L. Linsky. 1979, 7p
Pub. in Trans. IAU (Report of Commission 36 on Theory of Stellar Atmospheres), XVIIA, Pt. 2, p197-203 1979.

Keywords: *Stellar atmospheres, Stellar spectra, Reprints, *Stellar chromospheres, *Stellar coronas.

Important advances have been made recently in this field due to the development of spectroscopic diagnostics and the growth of ultraviolet and X-ray data from space. These data lead to estimates of physical properties in chromospheres and coronae of individual stars, and to a first generation of models. In some cases crude estimates of radiative losses have been made; these pose tests of theoretical estimates of nonradiative heating rates.

700,364

PB81-136855 Not available NTIS
National Bureau of Standards, Washington, DC.
Optical Observations of the Ultrahigh-Excitation Wolf-Rayet Star Sanduleak 3.
M. J. Barlow, J. C. Blades, and D. G. Hummer. Oct 80, 5p
Grant NSF-PHY76-04761
Pub. in Astrophysical Jnl. 241, pL27-L31, 1 Oct 80.

Keywords: *Stellar spectra, Reprints, *Wolf-Rayet stars, *Oxygen ions, Sanduleak 3 star.

Recombination lines of O VIII, O VIII in the optical spectrum of an O VI Wolf-Rayet star were identified, representing the first non X-ray detection of these ions in astronomical spectra and implying excitation energies in excess of 800 eV. Rapid variations on a timescale of tens of seconds have been observed in the profile of one of the O VII lines.

700,365

PB81-137184 Not available NTIS
National Bureau of Standards, Washington, DC.
Tidal Dissipation, Orbital Evolution and the Nature of Saturn's Inner Satellites.
S. J. Peale, P. Cassen, and R. T. Reynolds. 1980, 8p
Sponsored in part by National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.
Pub. in ICARUS 43, p65-72 1980.

Keywords: *Saturn(Planet), *Natural satellites, Reprints, Mimas, Dione, Tethys, Enceladus, Rhea.

Estimates of tidal damping times of the orbital eccentricities of Saturn's inner satellites place constraints on some satellite rigidities and dissipation functions Q. These constraints favor rock-like rather than ice-like properties for Mimas and probably Dione. Photometric and other observational data are consistent with relatively higher densities for these two satellites, but require lower densities for Tethys, Enceladus and Rhea. This leads to a nonmonotonic density distribution for Saturn's inner satellites, apparently determined by different mass fractions of rocky materials. In spite of the consequences of tidal dissipation for the orbital decay and implications for satellite compositions, tidal heating is not an important contributor to the thermal history of any Saturnian satellite.

700,366

PB81-138588 Not available NTIS
National Bureau of Standards, Washington, DC.
Additional Upper Limits on a Lyman-Alpha Halo Around PHL 957.
K. Davidson. Dec 79, 7p
Pub. in Astronom. Soc. Pac. 91, n544 p817-823 Dec 79.

Keywords: *Quasars, Reprints.

The Kitt Peak video camera and 2.1-m telescope have been used to look for a possible L(alpha) halo around the quasar PHL 957, especially within the annular region r approximately between 2 and 10 arc sec. No. halo was detected; this has implications regarding some of the absorption-line systems.

700,367

PB81-138646 Not available NTIS
National Bureau of Standards, Washington, DC.
Time Dependent, Optically Thick Accretion into a Black Hole.
D. L. Gilden, and J. C. Wheeler. Jul 80, 7p
Pub. in Astrophysical Jnl. 239, p705-711, 15 Jul 80.

Keywords: General relativity, Hydrodynamics, Reprints, *Black holes, Accretion.

A fully relativistic hydrodynamics code was used, which incorporates diffusive radiation transport, to study time-dependent, spherically symmetric, optically thick accretion into a black hole. It was found that matter free-falls into the hole regardless of whether the diffusion timescale is longer or shorter than the dynamical time. Nonadiabatic heating, due to magnetic field reconnection, was used. The internal energy thus generated affects the flow in a purely relativistic way, again ensuring free-fall collapse of the inflowing matter. Any matter enveloping a black hole will thus be swallowed on a dynamical timescale with relatively small net release of energy. The inclusion of angular momentum will not necessarily affect this conclusion.

700,368

PB81-138711 Not available NTIS
National Bureau of Standards, Washington, DC.
Pulsation of High Luminosity Helium Stars.
D. S. King, J. C. Wheeler, J. P. Cox, A. N. Cox, and S. W. Hodsen. 1980, 8p
Pub. in Proceedings for the Nonradial and Nonlinear Stellar Pulsation Workshop Held at the University of Arizona, Tuscon on Dec 12-16, 1979, p161-168 1980.

Keywords: Stellar evolution, Helium, Pulsation, *Stellar pulsations, *B stars.

For linear and nonlinear pulsations, calculations have been carried out for high luminosity helium rich stars. These stars have Y = 0.9 and X(12) = 0.1. A variety of masses have been investigated. This should place the models in the region of the H-R diagram occupied by the R CrB stars. Attempts are made to place limiting values on the stellar parameters L, (T sub e), and mass. One of the results of this calculation is to show that the blue edge of the pulsational instability strip for helium stars depends on the importance of radiation pressure. The dynamic behavior of these stars is discussed along with their possible evolutionary state.

700,369

PB81-140220 Not available NTIS
National Bureau of Standards, Washington, DC.
Relationship between the Envelope Composition of a 6 Solar Masses Red-Giant Model and Its Future Evolution,
D. Prialnik, and G. Shaviv. 1980, 8p
Pub. in Astronomy and Astrophysics 88, p127-134 1980.

Keywords: *Giant stars, *Stellar evolution, Instellar matter, Helium 3, Reprints.

The questions regarding the maximum mass of a main-sequence star that becomes a white-dwarf; the mass of single white dwafs; the enhanced abundance ratios of N/O and He/H in planetary nebulae, and the He3 abundance in planetaries and in the interstellar medium are shown to be interrelated. It is found that a model star of 6 solar masses in the main sequence develops prior to the double-shell source phase a C-O core of 0.82 solar masses, an enrichment of 27% in the He/H ratio, and a N/O ratio 5.5 times higher than the solar value. These results indicate that a 6 solar

masses star is a plausible planetary-nebulae progenitor. It is shown that intermediate mass stars, ejecting most of their mass during the red-giant stage, are important contributors of C and O isotopes and of He3 to the interstellar medium.

700,370
PB81-140345 Not available NTIS
National Bureau of Standards, Washington, DC.
Kelvin-Helmholtz Instability in Clusters of Galaxies.
M. Livio, O. Regev, and G. Shaviv. Sep 80, 4p
Sponsored in part by Tel-Aviv Univ. (Israel), and Israel American Bi-National Foundation, Ramat Aviv (Israel).
Pub. in Astrophysics Jnl. Letter 240, n2 pL83-L86, 1 Sep 80.

Keywords: *Intergalactic medium, Galaxies, Stability, Reprints, *Galactic clusters.

The motion of galaxies through the hot intracluster gas is examined. It is found that a Kelvin-Helmholtz instability develops at the interface between the moving galaxy and the gas. Its effect is gas stripping from the moving galaxy; the rate of stripping is estimated. The role of viscosity in this process is discussed.

700,371
PB81-144735 Not available NTIS
National Bureau of Standards, Washington, DC.
Microstructural Study of the Tishomingo Meteorite,
L. K. Ives, M. B. Kasen, R. E. Schramm, A. W. Ruff, and R. P. Reed. 1978, 16p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Geochim. Cosmochim. Acta 42, p1051-1066 1978.

Keywords: *Meteorites, Microstructure, Electron microscopy, X-ray analysis, X-ray diffraction, Metallography, Reprints, Tishomingo meteorite.

Metallography, electron microscopy and X-ray diffraction techniques were employed to study a fragment of the Tishomingo iron meteorite.

700,372
PB81-149288 Not available NTIS
National Bureau of Standards, Washington, DC.
Differences at Chromospheric Levels between RS CVn-type Binaries, Active and Quiet Chromosphere Single Stars, and Active and Quiet Regions in the Sun,
J. L. Linsky. 1980, 2p
Pub. in Proceedings of Joint Meeting of Close Binaries and Stellar Activity, Montreal, Canada, August 18, 1979, Paper in Highlights of Astronomy, p861-862 1980.

Keywords: *Binary stars, *Chromosphere, Ultraviolet spectra, Stellar spectra, *Stellar chromospheres.

This paper summarizes the differences in the properties of active chromospheres compared with quiet chromospheres by comparing active and quiet regions on the Sun, active and quiet chromosphere stars, and the very active chromospheres seen in close binary systems with chromospheres of single stars. In particular, the chromospheres of the RS CVn-type binary systems UX Arietis and HR 1099 and the chromosphere of UX Arietis during a flare are modeled.

700,373
PB81-157976 Not available NTIS
National Bureau of Standards, Washington, DC.
Radio Search for Interstellar Phosphorus Compounds.
Final rept.
J. M. Hollis, L. E. Snyder, F. J. Lovas, and B. L. Ulich. 1980, 3p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 241, p158-160, 1 Oct 80.

Keywords: *Nebulae, *Interstellar matter, *Phosphorus inorganic compounds, Phosphine, Nitrogen oxide(NO), Sulfur dioxide, Radio astronomy, Reprints, Orion Nebula, Phosphorus nitrides.

The J = 1-0 and 3-2 transitions of phosphorus nitride, PN, with resolvable hyperfine components at 46.99 GHz and blended components at 140.97 GHz, and transitions of phosphine, PH3, at 47.39 and 46.94 GHz, arising from a small induced dipole moment, have been searched for but not found in interstellar molecular clouds. The J = 3/2-1/2, F = 3/2-3/2 transition of nitric oxide, NO, and the J(K-K+) = 16(4,12)-15(5,11) transition of sulfur dioxide, SO2, have been detected in Orion and Sagittarius B2. An unidentified emission line, U140921.8 MHz, has been observed in IRC + 10216.

700,374
PB81-160921 Not available NTIS
National Bureau of Standards, Washington, DC.
Outer Atmospheres of Cool Stars. V. IUE Observations of Capella: The Rotation-Activity Connection.
Final rept.
T. R. Ayres, and J. L. Linsky. 1 Oct 80, 21p
Contract NAS5-23274, Grant NGL-06-003-057
See also PB80-178387.
Pub. in Astrophysical Jnl. 241, n1 p279-299, 1 Oct 80.

Keywords: *Stellar atmospheres, *Binary stars, Stellar spectra, Ultraviolet spectra, Reprints, Stellar chromospheres, Late stars, Capella star, Stellar winds.

Ultraviolet spectra of Capella (G6 III plus F9 III), obtained with the International Ultraviolet Explorer, is presented and analyzed. High-dispersion spectra in the 1150-2000 A region taken at orbital velocity crossing show no evidence for the increasing blueshifts with increasing temperature of formation previously inferred from Copernicus observations. We conclude that there is no discernible stellar wind from either component of the system.

700,375
PB81-163032 Not availaable NTIS
National Bureau of Standards, Washington, DC.
IUE Ultraviolet Spectra and Chromospheric Models of HR 1099 and UX Arietis.
Final rept.
T. Simon, and J. L. Linsky. 1980, 15p
Contract NAS5-23274, Grant NGL-06-003-057
Pub. in Astrophysical Jnl. 241, n2 p759-773, 15 Oct 80.

Keywords: *Binary stars, Stellar spectra, Ultraviolet spectra, Reprints, *Stellar chromospheres, Stellar coronas, Late stars.

IUE spectra (1150-3200 A) of the RS CVn-type systems HR 1099 and UX Ari, obtained at three quiescent phases each, is presented and analyzed.

700,376
PB81-169930 Not available NTIS
National Bureau of Standards, Washington, DC.
Search for the Lowest-Energy Conformer of Interstellar Glycine.
Final rept.
J. M. Hollis, L. E. Snyder, R. D. Suenram, and F. J. Lovas. 1 Nov 80, 6p
Pub. in Astrophysical Jnl. 241, p1001-1006, 1 Nov 80.

Keywords: *Interstellar matter, *Glycine, Radio astronomy, Amino acids, Ethylene oxide, Reprints.

The first search was made for the lowest-energy conformation of interstellar glycine. An emission line in Sgr B2 was detected which is coincident in frequency with the J(k-k+) = 14(1,14)-13(1,13) transition of conformer I glycine, but other transitions have not yet been found. Several previously unidentified interstellar lines were identified, such as methyl formate. The evidence for the existence of the elusive interstellar ethylene oxide--the only reported interstellar ring-structured molecule is discussed. Five unidentified interstellar lines were found.

700,377
PB81-171449 Not available NTIS
National Bureau of Standards, Washington, DC.
Outer Atmospheres of Cool Stars. VII. High Resolution, Absolute Flux Profiles of the Mg II h and k Lines in Stars of Spectral Types F8 to M5.
Final rept.
R. E. Stencel, D. J. Mullan, J. L. Linsky, G. S. Basri, and S. P. Worden. Nov 80, 20p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC. See also Part 6, PB80-201270.
Pub. in Astrophysical Jnl., Supplement Series 44, p383-402 Nov 80.

Keywords: *Stellar atmospheres, *Stellar spectra, Ultraviolet spectra, Giant stars, Magnesium, Reprints, *Late stars.

The authors present high-resolution IUE spectra of the emission cores of the Mg II resonance doublet at 280 nm in a selection of 54 stars, covering a range of spectral type from F8 to M5 and of luminosity class from supergiant (Ia) to subgiant (IV). These spectra were obtained with the LWR echelle system onboard the IUE satellite, and have been calibrated in absolute flux units using OAO 2 photometry of Eta UMa as a standard, plus the Barnes and Evans relations for stellar angular diameters.

700,378
PB81-182784 Not available NTIS
National Bureau of Standards, Washington, DC.
Gas in Globular Clusters. I. Time-Independent Flow Models.
Final rept.
D. J. Faulkner, and K. C. Freeman. 1 Jan 77, 14p
Pub. in Astrophysical Jnl. 211, n1 p77-90, 1 Jan 77.

Keywords: Stellar evolution, Interstellar matter, Hydrodynamics, Radio astronomy, Hydrogen, Reprints, *Globular clusters, Mass loss.

A search for H(alpha) emission in five globular clusters has yielded upper-limit ionized hydrogen masses within the core radii of M(H+)< 0.1-0.7 solar masses. This augments the findings of previous searches for ionized hydrogen (both radio and optical) that clusters are gas deficient with respect to the mass loss predictions of evolutionary theory, if the gas remains in the cluster. Time-independent gas flow models have been constructed for globular clusters of 100,000 solar masses and 1,000,000 solar masses, with physical assumptions chosen to maximize the predicted gas content. Integrated surface brightness and flux values for the flow models showed no clear conflict with the presently observed upper limits for the 21 cm line, the radio free-free, and H(alpha).

700,379
PB81-182818 Not available NTIS
National Bureau of Standards, Washington, DC.
Cyclotron Absorption in Accreting Magnetic White Dwarfs.
Final rept.
G. Chanmugam. 1 Nov 80, 9p
Pub. in Astrophysical Jnl. 241, n3 p1122-1130, 1 Nov 80.

Keywords: Dwarf stars, Binary stars, Ultraviolet radiation, Reprints, *White dwarf stars, *Magnetic stars.

The cyclotron absorption coefficient is calculated using a three-dimensional Maxwellian distribution for the electrons for a wide range of temperatures and frequencies. Numerical fits are presented and compared with previous results, whose range of validity is clarified. The results are applied to a plasma slab which is perpendicular to the magnetic field, and it is shown that there are deviations from the Rayleigh-Jeans spectrum predicted in earlier works. Comparison with observations for AM Herculis suggests that its magnetic field is about 5 x 10 to the 7th power gauss (or less).

700,380
PB81-182883 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Stellar Coronae: An Interpretation of X-Ray Emission from Non-Degenerate Stellar Sources.
Final rept.
J. L. Linsky. 1980, 19p
Contract NAS5-23274, Grant NGL-06-003-057
Pub. in Proceedings of HEAD/AAS Held at Cambridge, MA., on Jan 28-30, 1980, Paper in Cool Stars, Stellar Systems, and the Sun, p217-235 1980.

Keywords: Stars, Stellar magnetic fields, X rays, *Stellar coronas, Stellar rotation.

Arguments are presented to demonstrate that the acoustic wave heating theory of stellar coronae is inadequate to explain Einstein observations of stellar coronae as well as previous ultraviolet and x-ray observations of the Sun and other stars. Various lines of evidence are outlined that imply that magnetic fields, stellar rotation rates, and to some extent convection zone parameters are the important quantities in determining coronal heating and thus x-ray emission. These general results and the recent Einstein Observatory stellar observations suggest a speculative scenario of stellar coronae which is described in detail.

700,381
PB81-187858 Not available NTIS

National Bureau of Standards, Washington, DC.
Einstein X-ray Observations of Proxima Centauri and the Surrounding Region.
Final rept.
B. M. Haisch, J. L. Linsky, F. R. Harnden, R. Rosner, F. D. Seward, and G. S. Vaiana. 1 Dec 80, 5p
Sponsored in part by National Aeronautics and Space Administration, Arlington, VA.
Pub. in Astrophys. Jnl. 242, n2 pL99-L103, 1 Dec 80.

Keywords: *Flare stars, X rays, Reprints, *Proxima Centauri Star, Stellar coronas.

The first detection of both quiescent and flaring soft X-ray emission from a dMe flare star, Proxima Centauri (dM5e) is reported. The data are analyzed for temporal variability and spectral characteristics. Implications of these data for models of the quiescent and flare coronae of dMe stars are discussed.

700,382
PB81-207300 Not available NTIS
National Bureau of Standards, Washington, DC.
IUE Detection of Bursts of H Ly Alpha Emission from Saturn.
Final rept.
J. T. Clarke, H. W. Moos, S. K. Atreya, and A. L. Lane. 19 Mar 81, 2p
Pub. in Nature 290, n5803 p226-227, 19 Mar 81.

Keywords: Reprints, *Saturn atmosphere, Ultraviolet astronomy, IUE, NTISCOMNBS.

Potential sources of Ly alpha emission have been investigated in a series of observations of the Saturnian system carried out between January and July 1980 using the short wavelength spectrograph of the IUE observatory. North-south maps of the Ly alpha emission across the planet disk have shown pronounced spacial asymmetries in emission brightness. These asymmetries have been seen to vary markedly on a time scale of days and are interpreted as bursts of Ly alpha emission of a much as 1 kR brightness averaged over a 6 x 10 arc sec area, above a constant planetary emission level of 700-800 R.

700,383
PB81-227670 Not available NTIS
National Bureau of Standards, Washington, DC.
What Determines the Speed Class of Novae.
Final rept.
M. M. Shara, D. Prialnik, and G. Shaviv. 15 Jul 80, 6p
Pub. in Astrophysical Jnl. 239, p586-591, 15 Jul 80.

Keywords: *Novae, Carbon, Nitrogen, Oxygen, Reprints.

Recent theoretical hydrodynamic models show that novae of different speed classes can be obtained by varying the CNO enrichment and envelope mass. Recent observations seem to indicate that various degrees of CNO enrichment are found in the ejected shells of slow novae. The authors propose a unified picture for novae of different speed classes as a combination of CNO enrichment and envelope mass. Several consequences of the scheme are discussed. The observational and theoretical results are explained in the context of the unified picture.

700,384
PB81-233744 Not available NTIS
National Bureau of Standards, Washington, DC.
Vibrationally Excited Silicon Monoxide Masers.
Final rept.
D. Buhl, F. O. Clark, G. Chin, D. Glenar, T. Kostiuk, M. J. Mumma, and F. J. Lovas. 1980, 2p
Pub. in Proceedings of Symposium International Astronomical Union (87th), Mont Tremblant, Quebec, Canada, August 6-10, 1979, Paper in Interstellar Molecules, p537-538 1980.

Keywords: *Interstellar matter, *Silicon monoxide, *Masers, Microwave spectra.

Published data on a select group of SiO maser sources has been analyzed for velocity variations as a function of phase. No apparent correlation was found to a level of about 2 km/s. This places constraints on the location of the maser molecules. Such a correlation should be present at some level. The implications for future high resolution infrared measurements are discussed.

700,385
PB81-236242 Not available NTIS
National Bureau of Standards, Washington, DC.
Ratio of Mixing Length to Scale Height in Red Dwarfs.
Final rept.
A. N. Cox, G. Shaviv, and S. W. Hodson. Apr 81, 4p
Pub. in Astrophysical Jnl. 245, pL37-L40 Apr 81.

Keywords: *Dwarf stars, Mass, Luminosity, Helium 3, Reprints.

Previous completely convective theoretical models of low-mass stars, M approximately equal to, or less than 0.3 solar masses, predict a luminosity-mass relation which is below the observed one. The authors explain this disagreement by using the latest molecular opacities and by the consequent need to assume an l/(H sub p) ratio at T < 9000 K in the range 0.07-0.17, rather than the more conventional values of 1.0-2.0. When such a low surface layer l/(H sub p) ratio is assumed, we find significantly higher central temperatures (and hence luminosities) and quite large radiative cores, regardless of the deeper l/(H sub p) value and equation-of-state uncertainties. The low l/(H sub p) ratio is explained by the interaction of a magnetic field with convection. Several consequences of this result, including the interstellar abundance of 3He(+), are discussed.

700,386
PB81-236309 Not available NTIS
National Bureau of Standards, Washington, DC.
Results from an Extensive Einstein Stellar Survey.
Final rept.
G. S. Vaiana, J. P. Cassinelli, G. Fabbiano, R. Giacconi, L. Colub, P. Gorenstein, B. M. Haisch, F. R. Harnden, H. M. Johnson, J. L. Linsky, C. W. Maxson, R. Mewe, R. Rosner, F. Seward, K. Topka, and C. Zwaan. 1 Apr 81, 20p
Contracts NAS5-23274, NAS8-33333
Pub. in Astrophysical Jnl. 244, p163-181, 1 Apr 81.

Keywords: Reprints, *X-ray astronomy, Stellar coronas, X-ray sources(Astronomy).

The authors report the preliminary results of the Einstein Observatory stellar X-ray survey. To date, 143 soft X-ray sources have been identified with stellar counterparts, leaving no doubt that stars in general constitute a pervasive class of low-luminosity galactic X-ray sources. Stars have been detected along the entire main sequence, of all luminosity classes, pre-main sequence stars as well as very evolved stars.

700,387
PB81-236333 Not available NTIS
National Bureau of Standards, Washington, DC.
Evidence for Chromospheres and Coronae in Stars: Recent Observations, Some Unanswered Theoretical Questions, and a Speculative Scenario.
Final rept.
J. L. Linsky. 1981, 24p
Contracts NGL-06-003-057, NAS5-23274
Pub. in Proceedings of the NATO Advanced Study Institute held at Bonas, France on 25 August-September, 1980, Paper in Solar Phenomena in Stars and Stellar Systems, p99-122 1981.

Keywords: Stellar atmospheres, Stellar spectra, Ultraviolet spectra, X rays, *Stellar coronas, *Stellar chromospheres, *Ultraviolet astronomy, *X ray astronomy.

Recent ultraviolet spectra and X-ray flux measurements by the International Ultraviolet Explorer (IUE) and Einstein X-ray Observatory have had a major impact on our knowledge of which regions of the HR diagram definitely contain stars with chromospheres and coronae, and of the properties of these outer atmosphere layers. These observations are pointing to similarities and differences of these outer atmosphere layers compared with the solar atmosphere and the important roles played by magnetic fields. These data are also reorienting out thinking about physical processes occurring in the outer atmospheres of stars.

700,388
PB81-236564 Not available NTIS
National Bureau of Standards, Washington, DC.
Calculation of the Optical Spectra of the Cygnus Loop.
Final rept.
M. Contini, B. Z. Kozlovsky, and G. Shaviv. 1980, 8p
Pub. in Astronomy and Astrophysics 92, n3 p273-280 1980.

Keywords: Optical spectra, Reprints, *Supernova remnants, *Cygnus loop, Crab Nebula.

The optical spectra of the Cygnus Loop supernova remnant were calculated using a shock wave propagation model. The purpose was to fit the observed line ratios of the single filaments of the Cygnus Loop, and to investigate their structure. The best fitting parameters were obtained, and are discussed.

700,389
PB81-241150 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Solar X-ray Emission Line Profiles.
Final rept.
A. J. Burek, D. M. Barrus, R. L. Blake, and E. E. Fenimore. Jan 81, 17p
Pub. in Astrophysical Jnl., 243, n3 p660-676, 15 Jan 81.

Keywords: *Solar x rays, Neon, Emission spectra, Line spectra, Reprints.

Results are reported from the analysis of the X-ray emission line profiles for the Ne x L alpha and Fe xvii 4d singlet lines produced in an active region that was undergoing a radio and X-ray gradual rise and fall in intensity.

700,390
PB81-247371 Not available NTIS
National Bureau of Standards, Washington, DC.
High Resolution Absolute Flux Profiles of the Mg II h and k Lines in Evolved F8 to M5 Stars.
Final rept.
R. E. Stencel, D. J. Mullan, G. S. Basri, and J. L. Linsky. 1981, 8p
Pub. in Proceedings of the Year of IUE: The Universe in Ultraviolet Wavelengths (2nd) held at Greenbelt, MD., on May 7-9, 1980, p317-324 1981.

Keywords: Stellar spectra, Ultraviolet spectra, Magnesium, *Late stars, Stellar chromospheres.

Central results are given of a survey of the Mg II resonance line emission in a sample of over 50 evolved late-type stars, including spectral luminosity types F8 - M5 and Ia - IV. Observed and surface fluxes have been derived and correlations noted. The major findings include: (a) Mg II k emission core asymmetry transition near K1 III, analogous to that known for Ca II K; (b) a small gravity and temperature dependence of the Mg II chromospheric radiative loss rate.

700,391
PB81-247769 Not available NTIS
National Bureau of Standards, Washington, DC.
Detection of Mesogranulation on the Sun.
Final rept.
L. J. November, J. Toomre, K. B. Gebbie, and G. W. Simon. 1 May 81, 4p
Contract F9628-77-G-0104, Grant NsG-7511
Pub. in Astrophysical Jnl. 245, pL123-L126, 1 May 81.

Keywords: Velocity, Convection, Reprints, *Solar granulation.

Time averages of velocity measurements at disk center on the quiet Sun reveal the presence of a fairly stationary pattern of cellular flow with a spatial scale of 5 to 10 Mm. Such mesogranulation has an rms vertical velocity amplitude of about 60/ms superposed on the larger scale supergranular flows. The lifetimes of mesogranules appear to be at least two hours.

700,392
PB81-247819 Not available NTIS
National Bureau of Standards, Washington, DC.
Polarized Radiation from Hot Plasmas and Applications to AM Herculis Binaries.
Final rept.
G. Chanmugam, and G. A. Dulk. 1 Mar 81, 9p
Sponsored in part by National Science Foundation, Washington, DC., and National Aeronautics and Space Administration, Arlington, VA.
Pub. in Astrophysical Jnl. 244, n2 p569-578, 1 Mar 81.

Keywords: Plasma radiation, Reprints, *Stellar mass accretion, *Cyclotron radiation, Polarized light, White dwarf stars.

Absorption coefficients for the ordinary and extraordinary modes are calculated for cyclotron radiation from hot plasmas with temperatures between 0.2 and 20 keV. The results are applied to the accretion columns of the AM Herculis binaries. The linear and circular polarization properties of the observed polarized light can be understood if the emission is at approximately the

fifth harmonic of the cyclotron frequency. The magnetic fields in these systems are deduced to be roughly 4 x 10 to the 7th power gauss.

700,393
PB81-247827 Not available NTIS
National Bureau of Standards, Washington, DC.
IUE Spectra of a Flare in HR 5110: A Flaring RS CVn or ALGOL System.
Final rept.
T. Simon, J. L. Linsky, and F. H. Schiffer. 1981, 7p
Contract NAS5-23274, Grant NGL-06-003-057
Pub. in Proceedings of the Year of IUE (2nd): The Universe in Ultraviolet Wavelenghts held at Greenbelt, MD., on May 7-9, 1980, p435-441 1981.

Keywords: *Binary stars, Stellar spectra, Ultraviolet spectra, Stellar chromospheres, Radio bursts, IUE.

Ultraviolet spectra of the RS CVn-type binary system HR 5110 have been obtained with IUE on 1979 May 31 during a period of intense radio flaring of this star. High temperature transition region lines are present, but are not enhanced above observed quiescent strengths. The similarities of HR 5110 to the Algol system, AS Er, suggest that the 1979 May-June flare may involve mass exchange rather than annihilation of coronal magnetic fields.

700,394
PB81-248916 Not available NTIS
National Bureau of Standards, Washington, DC.
Mg II h and k Lines in a Sample of dMe and dM Stars.
Final rept.
M. S. Giampapa, P. L. Bornmann, T. R. Ayres, J. L. Linsky, and S. P. Worden. 1981, 8p
Contract NAS5-23274
Pub. in Proceedings of Second Year of IUE; The Universe in Ultraviolet Wavelengths, Greenbelt, MD., May 7-9, 1980, p279-286 1981.

Keywords: *Flare stars, Ultraviolet spectra, Stellar chromospheres, Late stars, IUE.

The authors present observed Mg II h and k line fluxes for a sample of 4 dMe and 3dM stars obtained with the IUE satellite in the long wavelength, low dispersion mode. The observed fluxes are converted to stellar surface flux units and the importance of chromospheric non-radiative heating in this sample of m dwarf stars in intercompared. In addition, they compare the net chromospheric radiative losses due to the Ca II H and K lines in those stars in the sample for which calibrated Ca II H and K line data exists.

700,395
PB81-248957 Not available NTIS
National Bureau of Standards, Washington, DC.
Simultaneous X-ray, Ultraviolet, Optical, and Radio Observations of the Flare Star Proxima Centauri.
Final rept.
B. Haisch, J. L. Linsky, O. B. Slee, B. C. Siegman, I. Nikoloff, M. Candy, D. Harwood, A. Verveer, P. J. Quinn, I. Wilson, A. A. Page, P. Higson, and F. D. Deward. 1981, 9p
Contracts NAS5-23274, NAS8-33333
Pub. in Astrophysical Jnl. 245, p1009-1017, 1 May 81.

Keywords: *Flare stars, Extraterrestrial radio waves, Ultraviolet spectra, X rays, Reprints, *Proxima Centauri Star, Stellar chromospheres, Stellar coronas.

The authors conclude that they have observed an X-ray flare more like a typical moderate to strong solar flare than heretofore seen on a flare star.

700,396
PB81-248973 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Instability in Accretion Flows onto Degenerate Stars.
Final rept.
S. H. Langer, G. Chanmugam, and G. Shaviv. 1 Apr 81, 4p
Grant NSF-AST78-06714
Pub. in Astrophysical Jnl. 245, pL23-L25, 1 Apr 81.

Keywords: Thermal stability, Reprints, *Stellar mass accretion, Instability, White dwarf stars.

The authors report the discovery of a new kind of thermal instability in accretion flows onto stellar atmospheres. The instability results in periodic variations in the height of the standoff shock which forms above the stellar surface. The hard X-ray temperature and luminosity vary with this period, as does any other radiation produced in the hot gas between the shock and the surface. Conditions for the appearance of this instability are most favorable in accreting white dwarf stars, such as cataclysmic variables and AM Her stars.

700,397
PB81-248981 Not available NTIS
National Bureau of Standards, Washington, DC.
Stability of Accretion Disks to Short Wavelength Perturbations.
Final rept.
M. Livio, and G. Shaviv. 1981, 9p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 244, p290-298, 15 Feb 1981.

Keywords: Reprints, *Stellar mass accretion, Instability.

The stability of accretion disks against short wavelength perturbations is analyzed. The disk is shown to be unstable to slow thermal perturbations propagating in the z-direction, for sufficiently high values of the stress parameter alpha and sufficiently low values of the ratio of gas to total pressure. The acoustic flux from the 'middle region' of the disk is estimated and discussed.

700,398
PB81-249021 Not available NTIS
National Bureau of Standards, Washington, DC.
Outer Atmospheres of Late-type Stars.
Final rept.
J. L. Linsky. 1981, 15p
Contract NAS5-23274, Grant NGL-06-003-057
Pub. in Proceedings of Workshop for Physical Processes in Red Giants (2nd), Sicily, Italy, September 3-13, 1980, Paper in Physical Processes in Red Giants, p247-261 1981.

Keywords: Giant stars, Stellar spectra, Ultraviolet spectra, X rays, *Stellar chromospheres, *Stellar coronas, *Late stars.

The author attempts to summarize the limited understanding of the outer atmospheres of red giants, by describing recent important observational results concerning chromospheres and coronae in late-type stars and how red giants fit into the emerging picture. In particular, the author points out where in the cool half of the HR diagram chromospheres, transition regions, coronae, and large mass loss occur, and suggests what the important parameters determining the energy balance of these layers might be.

700,399
PB81-249039 Not available NTIS
National Bureau of Standards, Washington, DC.
IUE Spectra of F and Late A Stars.
J. L. Linsky, and N. C. Marstad. 1981, 9p
Contract NAS5-23274, Grant NGL-06-003-057
Pub. in Proceedings of Second Year of IUE: The Universe in Ultraviolet Wavelengths, Greenbelt, MD, May 7-9 1980, p287-295 1981.

Keywords: Stellar evolution, Stellar spectra, Ultraviolet spectra, *Stellar chromospheres, Late stars, IUE.

The authors report on IUE spectra of alpha CMi (F5 IV-V), beta Cas (F2 IV), alpha Car (F0 Ib) , and gamma Boo (A7 III) in the context of the question as to whether chromospheres disappear in the early F-late A portions of the HR diagram.

700,400
PB81-600025 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Spectra of Molecules of Astrophysical Interest. XX. Methane.
I. Ozier, M. C. L. Gerry, and A. G. Robiette. c1981, 11p
Included in Jnl. of Physical and Chemical Reference Data, v10 n4 p1085-1095 1981.

Keywords: *Distortion dipole transitions, Interstellar molecules, Methane, Microwave spectra, Molecular parameters, Radio astronomy, Rotational transitions.

The available data on methane are critically reviewed for information applicable to radio astronomy. Molecular data such as rotational constants, centrifugal distortion constants, and the distortion electric dipole moment are presented for 12CH4 and 13CH4. Observed microwave, infrared-microwave double resonance, and molecular beam measurements of (Delta J = 0) frequencies are tabulated along with experimental uncertainties which represent estimated 95% confidence limits. For 12CH4, these data have been analyzed to predict all Q-branch rotational transitions for J less than 20; the predictions are presented with 95 percent confidence limits which have been calculated from the analysis.

700,401
PB81-600057 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cyclotron Emission from AM Herculis.
G. Chanmugam. 1981, 5p
Pub in. Proceedings Second Year of IUE: The Universe in Ultraviolet Wavelengths, Greenbelt, MD, May 7-9, 1980, p515-519 1981.

Keywords: *Binary stars, Cyclotron emission, Magnetic, Ultraviolet sources, White dwarfs.

The cyclotron absorption coefficients, in the ordinary and extraordinary modes, are calculated for the shock heated region of AM Her. The equations of radiative transfer are solved and the intensity of the emitted UV radiation determined as a function of angle. The average spectrum is shown to have deviations from the previously predicted Rayleigh-Jeans spectrum and the magnetic field of AM her is deduced to be roughly 5x10 to the 7th power gauss.

700,402
PB82-100272 Not available NTIS
National Bureau of Standards, Washington, DC.
Polarized Emission in the Broad SiO Feature from R Leo.
Final rept.
F. O. Clark, D. R. Johnson, T. H. Troland, and C. E. Heiles. 1980, 2p
Pub. in Proceedings of International Stronomical Union Symposium 87, Mont. Trenblant, Quebec, Canada, August 6-10, 1979, Paper in Interstellar Molecules, p543-544 1980.

Keywords: *Silicon monoxide, *Polarized electromagnetic radiation, Masers, Emission spectra, *R Leo Star, Radiative transfer.

Linearly polarized SiO emission spread over 12 km/s has been detected from the star R Leo. The position angle of polarized emission varies systematically with respect to the spectral line center. Interpreted in terms of radiative transfer theory, this change in position angle may be due to magnetorotation, which allows the determination of the magnetic field and the SiO systemic velocity.

700,403
PB82-112509 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Spectrum of SiO Near 1240cm-1 and Its Relation to the Circumstellar SiO Maser.
Final rept.
F. J. Lovas, A. G. Maki, and W. B. Olson. 1981, 9p
Pub. in Jnl. of Mol. Spectrosc. 87, p449-458 1981.

Keywords: *Silicon monoxide, *Infrared spectra, Interstellar matter, Masers, Reprints, High temperature.

The infrared absorption spectrum of the SiO molecule has been measured at temperatures between 1150 and 1350C with a tunable diode laser. Transitions ranging from J double prime=0 to J double prime=60 and v double prime=0 and v double prime=4 have been measured. These measurements have been combined with microwave measurements made by other workers to yield a consistent set of Dunham rovibrational constants. The relation of the infrared absorption spectrum to inversion mechanisms for the circumstellar SiO maser is discussed.

700,404
PB82-112640 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultraviolet Observations of the Io Torus from the IUE Observatory.
Final rept.
H. W. Moos, and J. T. Clarke. 1 Jul 81, 8p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 247, p354-361, 1 Jul 81.

Keywords: Ultraviolet spectra, Reprints, *Io, Oxygen ions, Sulphur ions, IUE.

The short wavelength spectrograph on the International Ultraviolet Explorer (IUE) has been used to obtain 11 A resolution spectra of the Io torus from 1175-1950 A. The four spectra, obtained in the springs of 1979 and 1980, show emissions (the difference of 40R) of S II lambda 1256 and S III lambda 1199. An unidentified feature is also present at 1729 A; a tentative identification as an intercombination line of S III is proposed.

700,405
PB82-112657 Not available NTIS
National Bureau of Standards, Washington, DC.
Winds in Late-Type Stars: Mechanisms of Mass Outflow.
Final rept.
J. L. Linsky. 1981, 26p
Contract NAG5-82, Grant NGL-06-003-057
Pub. in Proceedings of Effects of Mass Loss on Stellar Evolution Colloquium No. 59 held at Trieste, Italy on September 15-19, 1980, Paper in Effects of Mass Loss on Stellar Evolution, p187-212 1981.

Keywords: *Stellar winds, Late stars.

Four basic mechanisms have been proposed to explain the acceleration of winds in late-type stars -- thermal pressure gradients, radiation pressure on circumstellar dust grains, momentum addition by Alfven wave, and momentum addition by periodic shock waves. In this review, the author describes recent work in applying these mechanisms to stars, and considers whether these mechanisms can work even in principle and whether they are consistent with recent ultraviolet and X-ray data from the IUE and Einstein spacecraft.

700,406
PB82-117995 Not available NTIS
National Bureau of Standards, Washington, DC.
L134-L183-L1778 System of Interstellar Clouds.
Final rept.
F. O. Clark, and D. R. Johnson. 1 Jul 81, 8p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 247, p104-111, 1 Jul 81.

Keywords: *Interstellar matter, *Nebulae, Radio astronomy, Reprints.

Microwave spectral lines of several different molecules have been used as probes of a group of interstellar clouds which are located some 36 degrees above the galactic plane. These data suggest that the group of clouds may represent fragments of an original larger cloud. At three identifiable scale sizes, the observed gas appears to have progressively less rotation than expected from simple conservation of angular momentum, implying the existence of a redistributing mechanism at an early epoch. Radial velocities for the inner 4' of L134 and L183 are interpreted as retrograde rotation of the core region in each object. Recent magnetic braking calculations are employed to explain the observed effects.

700,407
PB82-119785 Not available NTIS
National Bureau of Standards, Washington, DC.
Outer Atmospheres of Cool Stars. IX. A Survey of Ultraviolet Emission from F-K Dwarfs and Giants with IUE.
Final rept.
T. R. Ayres, N. C. Marstad, and J. L. Linsky. 15 Jul 81, 15p
Contract NAS5-23274, Grant NGL-06-003-057
Pub. in Astrophysical Jnl. 247, p545-559, 15 Jul 81.

Keywords: *Dwarf stars, *Giant stars, Stellar atmosphere, Stellar spectra, Ultraviolet spectra, Reprints, *Stellar chromospheres, *Stellar coronas, Late stars, IUE.

Preliminary results are reported of an ultraviolet survey of cool-star emission properties with IUE. The authors present 1150-2000 A spectra of representative F-K dwarfs and giants and construct correlation diagrams that compare chromospheric and transition-region emission line strengths, and broad-band coronal soft-X-ray fluxes.

700,408
PB82-129974 Not available NTIS
National Bureau of Standards, Washington, DC.
Far-Ultraviolet Fluorescence of Carbon Monoxide in the Red Giant Arcturus.
Final rept.
T. R. Ayres, H. W. Moos, and J. L. Linsky. 1981, 4p
Grant NGL-06-003-057
Pub. in Astrophys. Jnl. 248, pL137-L140, 15 Sep 81.

Keywords: *Giant stars, *Carbon monoxide, Far ultraviolet radiation, Ultraviolet spectra, Stellar spectra, Reprints, *Arcturus star, Late stars, IUE.

Evidence is given that many of the weak features observed with the International Ultraviolet Explorer (IUE) in the far-ultraviolet (1150-2000 A) spectrum of the archetype red giant Arcturus (K2 III) are A-X fourth positive bands of carbon monoxide excited by chromospheric emissions of O I, C I, and H I. The appearance of fluorescent CO bands near the wavelengths of commonly used indicators of high-temperature plasma introduces a serious ambiguity in diagnosing the presence of hot material in the outer atmospheres of the cool giants by means of low-dispersion IUE spectra.

700,409
PB82-133869 Not available NTIS
National Bureau of Standards, Washington, DC.
Relations among Stellar X-ray Emission Observed from Einstein, Stellar Rotation and Bolometric Luminosity.
Final rept.
R. Pallavicini, L. Golub, R. Rosner, G. S. Vaiana, T. Ayres, and J. L. Linsky. 1981, 12p
Grant NGL-06-003-057
Pub. in Astrophysical Jnl. 248, p279-290, 15 Aug 81.

Keywords: *Stars, Reprints, *X ray astronomy, Early stars, Late stars, Stellar coronas, Stellar rotation.

The authors have determined the correlation between observed stellar X-ray luminosities, bolometric luminosities, and projected rotational velocities v sin i for stars of various spectral types and luminosity classes observed by the Einstein Observatory. Results are discussed.

700,410
PB82-133885 Not available NTIS
National Bureau of Standards, Washington, DC.
Density Sensitive C II Lines in Cool Stars of Low Gravity.
Final rept.
R. E. Stencel, J. L. Linsky, A. Brown, C. Jordan, K. G. Carpenter, R. F. Wing, and S. Czyzak. 1981, 7p
Contract NAS5-23274
Pub. in Monthly Notices of the Royal Astronomical Society Short Commun. 196, p47-53 1981.

Keywords: Ultraviolet spectra, Stellar spectra, Reprints, *Supergiant stars, *Late stars, Stellar chromospheres.

It is shown that the relative intensities of emission lines within the multiplet uv 0.01 of C II, around 2325 A, are sensitive to electron density in the range 10 to the 9th power $>$ N(e) $>$ 10 to the 7th power/cc. The lines therefore offer a valuable method for measuring N(e) in the chromospheres of late-type giants and supergiants. Calculated line ratios are compared with those observed in a range of objects.

700,411
PB82-133927 Not available NTIS
National Bureau of Standards, Washington, DC.
Tides of Io.
Final rept.
C. F. Yoder, and S. J. Peale. 1981, 35p
Pub. in Icarus 47, p1-35 1981.

Keywords: Jupiter(Planet), Tides, Resonance, Reprints, *Io.

The Galilean satellites Io, Europa and Ganymede interact through several stable orbital resonances. A theory of origin and subsequent evolution of these resonances outlined earlier (Yoder, 1979) is described in detail.

700,412
PB82-144163 Not available NTIS
National Bureau of Standards, Washington, DC.
Cool Half of the H-R Diagram in Soft X-rays.
Final rept.
T. R. Ayres, J. L. Linsky, G. S. Vaiana, L. Golub, and R. Rosner. 1 Nov 81, 7p
Contract NGJ-06-003-057
Pub. in Astrophysical Jnl. 250, p293-299, 1 Nov 81.

Keywords: X rays, Reprints, *Stellar coronas, Stellar rotation, Stellar winds, Late stars, Hertzsprung-Russell diagram.

Results are reported of an Einstein Guest Observing program to map the occurrence of soft X-ray emission, which is a signature of hot stellar coronae (T$>$ 1,000,000 K), in the cool half of the Hertzsprung Russell (H-R) diagram.

700,413
PB82-149089 Not available NTIS
National Bureau of Standards, Washington, DC.
First Detection of Nonflare Microwave Emission from the Coronae of Single Late-Type Dwarf Stars.
Final rept.
D. E. Gary, and J. L. Linsky. Nov 81, 9p
Grant NGL-06-003-057
Pub. in Astrophysical Jnl. 250, p284-292, 1 Nov 81.

Keywords: *Radio sources(Astronomy), *Dwarf stars, Reprints, Stellar coronas, Late stars.

An observing program is reported with the VLA in its C configuration to detect microwave radiation from the coronae of nearby late-type dwarf stars which are not members of close binary systems and do not have large winds. Six stars, chosen on the basis of strong apparent X-ray flux, were observed during a 24 hour period, and two stars were detected.

700,414
PB82-152091 Not available NTIS
National Bureau of Standards, Washington, DC.
Formation of Protostars in Collapsing, Rotating, Turbulent Clouds.
O. Regev, and G. Shaviv. May 81, 16p
Pub. in Astrophysical Jnl. 245, n3 p934-959, 1 May 81.

Keywords: Stellar evolution, Nebulae, Hydrodynamics, Reprints, *Protostars.

Collapse and star formation processes in rotating turbulent interstellar gas clouds have been studied. For this purpose, numerical collapse calculations have been performed for a number of representative cases. These calculations have been carried out by a two-dimensional hydrodynamical computer code, which solves the equations of hydrodynamics explicitly, coupled to the Poisson equation. The importance of this work lies in the fact that a new theoretical model is proposed, in which a central protostar forms as a result of the collapse of a protostellar rotating cloud.

700,415
PB82-152109 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Diffusion on Asymptotic Branching Evolution,
D. Prialnik, G. Shaviv, and A. Kovetz. Jul 81, 11p
Pub. in Astrophysical Jnl. 247, p225-235, 1 Jul 81.

Keywords: *Stellar evolution, Planetary nebulae, Diffusion, Reprints, White dwarf stars.

Evolution along the asymptotic branch leads to a configuration characterized by two burning shells that are close to each other and very thin. Under these circumstances, which involve steep composition gradients, encounters between charged particles of the stellar plasma lead to diffusion. The authors have studied the effect of diffusion on the asymptotic branch evolution of a 6 solar mass star mode. The most important conclusions are given.

700,416
PB82-199357 Not available NTIS
National Bureau of Standards, Washington, DC.
HM Sagittae: Symbiotic Cousin of the RS CVn Stars.
Final rept.
W. P. Blair, R. E. Stencel, G. Shaviv, and W. A. Feibelman. 1981, 7p
Pub. in Astronomy and Astrophysics 99, p73-79 1981.

Keywords: *Nebulae, *Variable stars, Spectrophotometry, Reprints.

Spectrophotometry of the symbiotic-like object HM Sagittae is presented and compared with earlier observations. The observations are examined in the context of the interacting single star wind model of planetary nebulae formation of Kwok and Purton (1979) and similarities and problems pointed out. The implication is that the object may not be a protoplanetary nebulae, but a symbiotic epilog to an aged RS CVn interacting binary.

700,417
PB82-211129 Not available NTIS
National Bureau of Standards, Washington, DC.

Astrophysics

Detection of the Torsionally Excited State of Methanol in Orion A.
Final rept.
F. J. Lovas, R. D. Suenram, L. E. Snyder, J. M. Hollis, and R. M. Lees. 2 Jan 82, 5p
Prepared in cooperation with Illinois Univ. at Urbana-Champaign., and New Brunswick Univ., Fredericton.
Pub. in Astrophysical Jnl. 253, p149-153, 1 Feb 82.

Keywords: *Methyl alcohol, *Molecular energy levels, Radio astronomy, Excitation, Reprints, *Orion A, Orion Constellation.

The authors report the detection of torsionally excited methanol (CH3OH, v(n) = 1) in Orion A. Several other weak features not attributable to methanol were also observed, and possible identifications are reported.

700,418
PB82-212143 Not available NTIS
National Bureau of Standards, Washington, DC.
Outer Atmospheres of Cool Stars. X. HR 1099 at Quadrature.
Final rept.
T. R. Ayres, and J. L. Linsky. Mar 82, 7p
Grant NGL-06-003-057
See also PB82-119785.
Pub. in Astrophysical Jnl. 254, n1 p168-174, 1 Mar 82.

Keywords: *Binary stars, Stellar spectra, Ultraviolet spectra, Reprints, *Stellar chromospheres, Late stars, Stellar coronas, Ultraviolet astronomy, IUE.

High dispersion, far-ultraviolet (1150-2000 A) spectra is reported of the active chromosphere, RSCVn binary HR 1099=V711 Tauri (K0 IV + G5 V), obtained with the International Ultraviolet Explorer.

700,419
PB82-212150 Not available NTIS
National Bureau of Standards, Washington, DC.
Unified Treatment of Escape Probabilities in Static and Moving Media. I. Plane Geometry.
Final rept.
D. G. Hummer, and G. B. Rybicki. Mar 82, 12p
Grant NSF-AST80-19874
Pub. in Astrophysical Jnl. 254, n2 p767-779, 15 Mar 82.

Keywords: *Stellar atmosphere, Stellar spectra, Photons, Reprints, *Radiative transfer, Escape.

An expression giving the escape probability for photons in a spectral line formed in a planar atmosphere with an arbitrary monotonic velocity law is derived and evaluated. For a small velocity gradient, the usual static result is recovered; for large velocity gradients the Sobolev result is obtained, but only at optical depths sufficiently large that the 'static' part of the escape probability is negligible. Extensive numerical results for the escape-probability function for a constant velocity gradient are given for Doppler, Voigt (a = 0.001, 0.01) and Lorentz profiles. The use of these results for flows with non-constant gradients is discussed.

700,420
PB82-226341
(Order as PB82-226333, PC **A09**/MF **A01**)
Massachusetts Inst. of Tech., Cambridge.
Turbulence, Plasma Containment, and Galaxies.
C. C. Lin. 5 Aug 81, 7p
Included in Jnl. of Research of the National Bureau of Standards, v86 n6 p557-563 Nov-Dec 81.

These three exciting areas of research, apparently disjointed in content, have similar basic mechanisms in common which can be described by the same mathematical principles, concepts, and methods. Scientific problems will be discussed in all three areas. Emphasis willbe placed on galaxies, where observational data are plentiful for checking the theory. A unified mathematical approach applicable to all three areas will then be decribed.

700,421
PB82-234683 Not available NTIS
National Bureau of Standards, Washington, DC.
Search for Apsidal Motion in 4U0115+63
R. L. Kelley, S. Rappaport, M. J. Brodheim, L. Cominsky, and R. Stothers. 15 Dec 81, 9p
Pub. in Astrophysical Jnl. 251, n2 p630-638, 15 Dec 81.

Keywords: Reprints, *Pulsars, X ray astronomy, Uhuru satellite.

A pulse arrival-time analysis of the archival Uhuru data was performed, from the 1971 transient outburst of the binary X-ray pulsar 4U0115+63. The 3.6 s X-ray pulsations are clearly present in the data, and the average fractional rate of change in pulse period over the 7 year interval 1971-1978 is given. This spin-up rate is consistent with an average source luminosity about 20 times less than that observed during its flare state.

700,422
PB82-234691 Not available NTIS
National Bureau of Standards, Washington, DC.
Evolution of Highly Compact Binary Stellar Systems.
Final rept.
S. Rappaport, P. C. Joss, and R. F. Webbink. 15 Mar 82, 25p
Pub. in Astrophysical Jnl. 254, n2, p616-640, 15 Mar 82.

Keywords: *Binary stars, *Stellar evolution, Computation, Reprints, Neutron stars, X ray astronomy.

The authors have calculated the evolution of close binary stellar systems composed of a collapsed star and a low-mass companion in an orbit with a period of about 3 hours or less at the onset of mass transfer. The low-mass (secondary) star is assumed to transfer mass onto the collapsed (primary) star due to the decay of the orbit resulting from gravitational radiation. Under these circumstances, the secondary is well represented by an n=3/2 polytrope. By using this approximation, we are able to explore the effects of varying a number of physical parameters, including the stellar masses, the composition of the secondary, and mass and angular momentum losses from the system. Moreover, we are able to follow the evolution until the secondary has been almost completely consumed.

700,423
PB82-235029 Not available NTIS
National Bureau of Standards, Washington, DC.
Far Ultraviolet Spectra and Geometric Albedos of Jupiter and Saturn.
Final rept.
J. T. Clarke, H. W. Moos, and P. D. Feldman. Apr 82, 13p
Grants Nsg-5255, NsG-5393
Pub. in Astrophysical Jnl. 255, n1 p806-818 Apr 82.

Keywords: *Planetary atmospheres, *Albedo, Ultraviolet spectra, Reprints, *Jupiter atmosphere, *Saturn atmosphere.

Photometrically calibrated spectra (1200-1940 A) of Jupiter and of Saturn, compiled from IUE observations over the period 1978 December through 1980 July, are presented along with the resulting wavelength variation of the geometric albedos of these planets.

700,424
PB82-236134 Not available NTIS
National Bureau of Standards, Washington, DC.
MV Lyrae: Spectrophotometric Properties of Minimum Light, or on MV Lyrae Off.
Final rept.
E. L. Robinson, E. S. Barker, A. L. Cochran, W. D. Cochran, and R. E. Nather. 15 Dec 81, 9p
Pub. in Astrophysical Jnl. v251 n2 p611-619, 15 Dec 81.

Keywords: *Variable stars, Spectrophotometry, Mass transfer, Reprints, Lyrae Constellation, White dwarf stars.

The nova-like variable MV Lyr is normally at maximum light near B about 12.5 but it occasionally fades to minimum light near B about 17.3. The authors have obtained photometric and spectrophotometric observations of MV Lyr at maximum light in 1969, and at minimum light in 1980. It is shown that minimum light is caused by a total cessation of mass transfer from the late-type star to the white dwarf in the system. The distribution of orbital periods of the cataclysmic variables has a gap at orbital periods between 2 hr and 3 hr, and MV Lyr is at the long-period edge of the gap. The authors argue that the cataclysmic variables do evolve through the gap but that they cease mass transfer while in the gap, becoming very difficult to detect. MV Lyr is an example of cataclysmic variable about to enter the gap.

700,425
PB82-236233 Not available NTIS
National Bureau of Standards, Washington, DC.
Multiaperture Photometry of Isolated Galaxies.
Final rept.
N. Brosch, and G. Shaviv. 15 Feb 82, 13p
Pub. in Astrophys. Jnl. n2 p526-538, 15 Feb 82.

Keywords: *Galaxies, Photometry, Reprints.

Multiaperture U, B, V photometry of isolated galaxies by Huchra and Thuan shows a behavior different from normal field galaxies, in that the inner regions of the isolated galaxies appear to have excess blueness similar to N-type galaxies. The implication of this finding is that gas, which does not excape from isolated galaxies, sinks into the nucleus and gives rise to nonthermal radiation.

700,426
PB82-236746 Not available NTIS
National Bureau of Standards, Washington, DC.
Detection of the 3.5 mm J=2-1, v=2 Transition of Circumstellar SiO.
Final rept.
F. O. Clark, T. H. Troland, F. J. Lovas, and P. R. Schwartz. Mar 81, 4p
Grant NSF-AST76-80200
Pub. in Astrophysical Jnl. 244, n2 pL99-L102, 1 Mar 81.

Keywords: *Silicon monoxide, *Radio astronomy, Variable stars, Masers, Reprints, Stellar envelopes, Mira star.

The 3.5 mm J=2-1, v=2 transition of circumstellar SiO has been detected for the first time. This transition, from the Mira variable star R Cas, was about 50 times weaker than the corresponding v=1 transition, both observed just prior to visual maximum. Three other SiO transitions from this star were also observed nearly simultaneously, these are the 3.5 mm J=2-1, v=1 line and the 7 mm J=1-0, v=1 and v=2 lines. Six more SiO maser stars showed no evidence of 3.5 mm v=2 emission during this observing period.

700,427
PB82-254384 Not available NTIS
National Bureau of Standards, Washington, DC.
Outer Atmospheres of Cool Stars. XI. High-Dispersion IUE Spectra of Five Late-Type Dwarfs and Giants.
Final rept.
T. R. Ayres, J. L. Linsky, G. S. Basri, W. Landsman, R. C. Henry, H. W. Moos, and R. E. Stencel. 15 May 82, 9p
Grant NGL-06-003-057
See also PB82-212143.
Pub. in Astrophysical Jnl. 256, n2 p550-558, 15 May 82.

Keywords: *Giant stars, *Dwarf stars, Stellar spectra, Ultraviolet spectra, Reprints, *Stellar chromospheres, Late stars, Ultraviolet astronomy, IUE.

High-dispersion, far-ultraviolet (1150-2000 A) spectra are presented for five late-type dwards and giants obtained with the International Ultraviolet Explorer.

700,428
PB82-261504 Not available NTIS
National Bureau of Standards, Washington, DC.
Far Infrared Spectra of H2 and Mixtures of H2-CH4 and H2-He.
Final rept.
G. Birnbaum. 1980, 3p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of NASA Workshop on Vibrational-Rotational Spectroscopy for Planetary Atmospheres, Annapolis, MD, March 17-19, 1980, 23p.

Keywords: *Infrared spectra, Planetary atmospheres, Thermal radiation, Far infrared radiation, Hydrogen, Helium, Methane, Mixtures, *Planetary radiation.

This report presents some recent laboratory measurements of the far infrared absorption of H2 and mixtures of H2 with CH4 and He and the fitting of the pure H2 spectra with a semi-empirical line shape. Such results are needed in analyzing the thermal emission from the atmospheres of the outer planets. The spectra discussed here, which are forbidden in the isolated molecule, are due to dipoles induced in colliding molecules by their electric fields.

700,429
PB82-261553 Not available NTIS

National Bureau of Standards, Washington, DC.
Low-Luminosity Accretion onto Magnetized Neutron Stars.
Final rept.
S. H . Langer, and S. Rappaport. Jun 82, 19p
Grants NSF-AST78-06714, NSF-AST80-19960
Pub. in Astrophysical Jnl. 257, n2 p733-751, 15 Jun 82.

Keywords: X rays, Gamma rays, Magnetic fields, Reprints, *Neutron stars, *Stellar mass accretion.

The behavior of matter accreting at low rates onto the polar caps of a highly magnetized neutron star was studied. Flow solutions were found for the case in which the matter undergoes a stationary collisionless shock. The electron and ion fluids are treated separately, and the ion temperature is found to be much higher than the electron temperature throughout the flow. The self-consistency of the assumptions and the results are discussed in detail.

700,430
PB82-264086 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Reflected and External Radiation on Stellar Flux Distributions.
Final rept.
D. G. Hummer. 15 Jun 82, 9p
Grant NSF-AST80-19874
Pub. in Astrophysical Jnl. 257, n2 p724-732, 15 Jun 82.

Keywords: *Stellar atmospheres, Reprints, Stellar winds, Stellar radiation.

The effect of radiation emitted or scattered by circumstellar material, such as a stellar wind, and falling on the stellar photosphere is investigated on the basis of a gray model atmosphere generalized to include the effects of an external radiation field and a surface boundary condition describing the reflection of a specified fraction, depending on the frequency, of the outgoing radiation. Substantial modifications both to the temperature and flux distributions are found.

700,431
PB82-264094 Not available NTIS
National Bureau of Standards, Washington, DC.
High Order Asymptotic Expansions of the Four Kernel Functions for Line Formation with the Voigt Profiles.
Final rept.
D. G. Hummer. 1982, 5p
Grant NSF-AST80-19874
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 27, n6 p569-573 1982.

Keywords: *Line spectra, Asymptotic series, Stellar atmospheres, Reprints, Kernal functions, Radiative transfer.

Analytical expressions are given for the coefficients, as a function of the Voigt parameter a, in the asymptotic expansions of the kernel functions K1(tau), K2(tau), M1(tau), and M2(tau) that describe the transfer of radiation scattered with complete redistribution over a Voigt profile.

700,432
PB82-264227 Not available NTIS
National Bureau of Standards, Washington, DC.
Reality of a Boundary in the H-R Diagram between Late-Type Stars With and Without High Temperature Outer Atmospheres.
Final rept.
T. Simon, J. L. Linsky, and R. E. Stencel. 1 Jun 82, 24p
Grants NAS5-82, NGL-06-003-057
Pub. in Astrophysical Jnl. 257, n1 p225-246, 1 Jun 82.

Keywords: *Giant stars, Stellar atmospheres, Ultraviolet spectra, Reprints, Late stars, Stellar chromospheres, Stellar coronas, IUE.

The authors tested the hypothesis originally proposed by Linsky and Haisch that a boundary exists in the H-R diagram separating yellow giants (V - R approximately equal or < 0.80), which typically show evidence of 100,000 K plasma in their outer atmospheres, from red giants and supergiants (V - R > 0.80), which typically show little or no evidence of any plasma hotter than 10,000 K. They present and discuss IUE 1150-2000 A low-resolution spectra of 39 late-type stars of luminosity classes I-IV.

700,433
PB82-600052 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Outer Atmospheres of Cool Stars. VIII. IUE Observations and Chromospheric Models for the Supergiant Stars Beta Draconis, Epsilon Geminorum, and Alpha Orionis.
G. S. Basri, J. L. Linsky, and K. Eriksson. 1981, 19p
Pub. in Astrophys. J. 251, n1 p162-180 Dec 1981.

Keywords: *Late-type stars, Stars, Individual, Stellar atmospheres, Stellar chromospheres, Ultraviolet spectrum.

The authors extend their program of semiempirical modeling of stellar chromospheres to a previously unstudied portion of the H-R diagram--the late-type supergiants. These models were computed to match high-resolution absolute flux profiles of the Ca II K and Mg II h and k lines. In our IUE ultraviolet spectra of epsilon Gem and alpha Ori the authors find no evidence for emission lines formed at temperatures hotter than approximately 10 to the 4th power K, and on this basis the authors compute chromospheric models which extend to m=10 to the minus 6th power g cm(-2) at temperatures rising to 6500 K and 7000 K, respectively. Upper limits on the surface flux of the C IV lambda 1549 emission feature in epsilon Gem are 0.1 that of the quiet Sun, and in alpha Ori the upper limits are 0.002 that of the quiet Sun, providing upper limits on the amount of 10 to the 5th power K plasma in these stars. By contrast, beta Dra shows strong emission lines of C II-IV, Si IV, He II, and N V. The authors tentatively extend the beta Dra chromospheric model up to 16,000 K at P(o)=2n ekT=0.012 dynes cm(-2). However, density-sensitive line ratios suggest P(o)=0.3 dynes cm(-2) at 60,000 K, and the authors discuss possible explanations for the discrepancy.

700,434
PB82-600060 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultraviolet and X-Ray Detection of the 56 Pegasi System (K0 IIp+WD): Evidence for Accretion of a Cool Stellar Wind onto a White Dwarf.
M. Schindler, R. E. Stencel, J. L. Linsky, G. S. Basri, and D. J. Helfand. 1982, 8p
Pub. in Astrophys. J. 263, p269-276 Dec 1982.

Keywords: *Stars, Ba II, Stars, Individual, Stars, Late-type, Stars, White dwarfs, Stars, Winds, Ultraviolet, Spectra.

IUE spectra of the slowly rotating mild barium star 56 Peg (HD 218356; K0 IIp) show excess continuum emission from 1300 to 2000 Alpha, a broad Lya absorption feature, and emission lines usually associated with a 10 to the 4th power-(2x10 to the the 5th power) K plasma. The best fit blackbody curve to the dereddened continuum gives a temperature of 32,000 + or - 4000 K and a radius for the object of (2.7 + or - 1.0) x 10 to the 9th power cm, consistent with that of a white dwarf. Einstein IPC observations of this sytem yield L sub x approximately equals 3 x 10 to the 31st power ergs s to the -1st power, which is as bright as the RS CVn binary systems. The X-rays can be fitted to a bremsstrahlung spectrum with kT=0.45 + or - 0.3 keV, or a blackbody spectrum with kT approximately equals 0.2 keV. Since bright X-ray and high temperature emission lines are unusual for single stars in this region of the H-R diagram, we do not believe that the 56 Peg primary has a hot corona and transition region. Instead, we propose that the observed X-ray luminosity is due to accretion onto the white dwarf of approximately 0.1% of the wind from the primary, which we assume has a reasonable mass loss rate of 2 x 10 to the minus 7th power to 4 x 10 to the minus 9th power M.yr(-1). The ultraviolet emission lines likely result from reprocessed X-radiation absorbed by the wind. The Mg II K line exhibits a time-varying emission core, that may be explained by ionization of Mg+ in the wind by X-rays from the white dwarf.

700,435
PB83-106203 Not available NTIS
National Bureau of Standards, Washington, DC.
Observatory Reports: The National Bureau of Standards.
Interim rept. 1977-Sep 81.
J. L. Tech, F. J. Lovas, and J. R. Fuhr. 1982, 5p
Pub. in Bull. Am. Astron. Soc. 14, n1 p365-369 1982.

Keywords: *Astronomical spectroscopy, Atomic spectra, Molecular spectra, Radio astronomy, Interstellar matter, Reprints.

Spectroscopic research done at NBS of astronomical interest is described.

700,436
PB83-142851 Not available NTIS
National Bureau of Standards, Washington, DC.
High Dispersion Far Ultraviolet Spectra of Cool Stars.
Final rept.
R. E. Stencel, J. L. Linsky, T. R. Ayres, C. Jordan, A. Brown, and O. Engvold. 1982, 4p
Grant NGL-06-003-057
Pub. in Proceedings of Advances in Ultraviolet Spectroscopy: Four Years of IUE Research, Greenbelt, MD., March 20-April 1, 1982, NASA Conference Publication 2238, p259-262 1982.

Keywords: *Giant stars, Stellar spectra, Ultraviolet spectra, Far ultraviolet radiation, Stellar chromospheres, Stellar coronas.

The authors present recent far UV high dispersion spectra of a pair of cool supergiant stars, Beta Dra (G2 Ib) and Alpha Ori (M2 Iab), which are examined in the context of current questions regarding stellar chromospheres, coronae and mass loss. These data argue for a discontinuous change in atmospheric properties between coronal and noncoronal type stars, and suggest a key role is played by the topology and stability of magnetic flux loops.

700,437
PB83-142869 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultraviolet Observations of Yellow Giant Stars.
Final rept.
T. Simon, and J. L. Linsky. 1982, 4p
Grant NAG5-82
Pub. in Proceedings of Advances in Ultraviolet Spectroscopy: Four Years of IUE Research, Greenbelt, MD., March 20-April 1, 1982, NASA Conference Publication 2238, p273-276 1982.

Keywords: *Giant stars, Ultraviolet spectra, Stellar chromospheres, Late stars, IUE.

Low-dispersion spectra of 18 yellow giant stars of spectral types G4-KO were obtained with the short wavelength camera of IUE. Using the emission strength of the C IV 1550 multiplet as a measure of high temperature 100,000 K plasma, we find that the normalized C IV flux, F(C) IV/I(bol), where I(bol) is the apparent stellar bolometric flux, is typically 10 to the -7th power or smaller, indicating very feeble stellar transition regions. By combining these results with earlier data from IUE, we show that there is nearly a two orders of magnitude spread in f(C IV)/I(bol) among the yellow giants. Several likely reasons for the observed range in high-temperature emission line strengths are discussed; the more likely appears to be that the majority of the yellow giant stars observed are slow rotators evolving across the Hertzsprung Gap for the second time along a blue loop.

700,438
PB83-142877 Not available NTIS
National Bureau of Standards, Washington, DC.
High Dispersion IUE Spectra of Active Chromosphere G and K Dwarfs.
T. R. Ayres, J. L. Linsky, A. Brown, C. Jordan, and T. Simon. 1982, 4p
Grants NAG5-82, NGL-06-003-057
Sponsored in part by Grant NAG5-199.
Pub. in Proceedings of Advances in Ultraviolet Spectroscopy: Four Years of IUE Research, Greenbelt, MD., March 20-April 1, 1982, NASA Conference Publication 2238, p281-284 1982.

Keywords: *Dwarf stars, Stellar spectra, Far ultraviolet radiation, Ultraviolet spectra, Stellar chromospheres, Late stars, Stellar coronas, IUE.

The authors analyze IUE far ultraviolet echelle spectra of three active chromosphere dwarf stars.

700,439
PB83-142885 Not available NTIS
National Bureau of Standards, Washington, DC.

Results of an IUE Program of Monitoring the Ultraviolet Emission Line Fluxes of Four Binary Systems: HR 1099, II Peg, AR Lac, and BY Dra.
Final rept.
N. Marstad, J. L. Linsky, T. Simon, M. Rodono, C. Blanco, S. Catalano, E. Marilli, A. D. Andrews, C. J. Butler, and P. B. Byrne. 1982, 4p
Grant NAG5-82
Pub. in Proceedings of Advances in Ultraviolet Spectroscopy: Four Years of IUE Research, Greenbelt, MD., March 20-April 1, 1982, NASA Conference Publication 2238, p554-557 1982.

Keywords: *Binary stars, Ultraviolet spectra, Stellar chromospheres, IUE.

The authors present a preliminary report on a collaborative program to obtain IUE spectra and optical photometry and spectra of three RS CVn-type binaries (HR 1099, II Peg, and AR Lac) and the prototype BY Dra system. The authors monitored these systems for at least one orbital phase, and detected periodic variations in emission line flux from II Peg and HR 1099, indicative of rotational modulation of an active region on the stars. For II Peg the active region is in phase with photometric minimum as expected, but for HR 1099 ultraviolet emission maximum occurs at the time of photometric maximum.

700,440
PB83-142893 Not available NTIS
National Bureau of Standards, Washington, DC.
Correlation between Chromospheric and Coronal Emission.
Final rept.
R. Hammer, J. L. Linsky, and F. Endler. 1982, 5p
Pub. in Proceedings of Advances in Ultraviolet Spectroscopy: Four Years of IUE Research, Greenbelt, MD., March 20-April 1, 1982, NASA Conference Publication 2238, p268-272 1982.

Keywords: *Stellar atmospheres, *Stellar chromospheres, *Stellar coronas.

According to empirical chromospheric models, the mechanical (magnetic and nonmagnetic) energy flux F(M) decreases over large parts of the solar chromosphere less rapidly than the pressure p (d log F(M)/d log p < 1). The total energy loss F(Loss) of the transition region and corona, on the other hand, increases faster than the pressure, P(TR), of the transition region (d log F(Loss)/ d log P(TR)> 1), as is indicated by theoretical models of coronal loops and open coronal regions as well as by semiempirical studies. Therefore, the relation d log F(M)/d log p < d log F(Loss)/d log P(TR) appears to be generally valid. In the present study the authors discuss the implications of this relation.

700,441
PB83-142901 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure and Energy Balance of Cool Star Atmospheres,
J. L. Linsky. 1982, 16p
Grants NAG5-82, NGL-06-003-057
Pub. in Proceedings of Advances in Ultraviolet Spectroscopy: Four Years of IUE Research, Greenbelt, MD., March 20-April 1, 1982, NASA Conference Publication 2238, p17-32 1982.

Keywords: *Stellar atmospheres, Ultraviolet spectra, Stellar magnetic fields, Stellar chromospheres, Stellar coronas, Late stars, IUE.

A broad theme emerging from IUE observations of cool stars is that magnetic fields control the structure and energy balance of the outer atmospheres of these stars. For this review the author summarizes the phenomena associated with magnetic fields in the Sun, and shows that similar phenomena occur in cool stars.

700,442
PB83-142919 Not available NTIS
National Bureau of Standards, Washington, DC.
Stellar Model Chromospheres. XIII. M Dwarf Stars.
Final rept.
M. S. Giampapa, S. P. Worden, and J. L. Linsky. 15 Jul 82, 21p
Grants NGL-06-003-057, NAG5-82
See also PB-282 120.
Pub. in Astrophysical Jnl. 258, n2 p740-760, 15 Jul 82.

Keywords: *Stellar atmospheres, *Dwarf stars, Stellar spectra, Ultraviolet spectra, Photosphere, Reprints, *Stellar chromospheres, Late stars.

The authors construct single-component, homogeneous model chromospheres that are consistent with high-resolution profiles of the Ca II K line calibrated in surface flux units for three dMe and 2 dM stars observed at quiescent times.

700,443
PB83-142950 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Recombination-Line Spectra of Wolf-Rayet Stars.
Final rept.
D. G. Hummer, M. J. Barlow, and P. J. Storey. 1982, 5p
Grant NSF-AST80-19874
Pub. in Proceedings of IAU Symposium Wolf-Rayet Stars, Cancun, Mexico, Sept. 1981, Paper in Wolf-Rayet Stars: Observations, Physics, Evolution, p79-83 1982.

Keywords: Stellar atmospheres, Stellar spectra, Infrared spectra, Carbon, Helium, *Wolf-Rayet stars.

Effective recombination coefficients have recently been calculated for recombination lines of He I, He II and C IV (among other ions with up to three electrons) for densities and temperatures appropriate for Wolf-Rayet atmospheres. These have been applied to recently obtained infrared spectra of gamma Vel in order to derive the He(+)/He(+2) and C(+4)/He(+) + He(+2) ratios.

700,444
PB83-143032 Not available NTIS
National Bureau of Standards, Washington, DC.
Outer Atmospheres of Cool Stars. XII. A Survey of IUE Ultraviolet Emission Line Spectra of Cool Dwarf Stars.
Final rept.
J. L. Linsky, P. L. Bornmann, K. G. Carpenter, R. F. Wing, M. S. Giampapa, S. P. Worden, and E. K. Hege. 15 Sep 82, 25p
Grants NAG5-82, NGL-05-003-057
Pub. in Astrophysical Jnl. 260, p670-694, 15 Sep 82.

Keywords: *Dwarf stars, Stellar spectra, Flare stars, Ultraviolet spectra, Reprints, Stellar chromospheres, Stellar coronas, Late stars, IUE.

The authors present and discuss IUE low dispersion spectra (1150-3200A) of four dM and six dMe stars, together with spectra of the first 10 Balmer lines and the Ca II H and K lines. From these calibrated spectra, the authors extract absolute line fluxes and surface fluxes for emission lines formed in the chromospheres (T<20,000 K) and transition regions (T=20,000-200,000 K) of these stars. These data, together with data for four G-M dwarfs previously observed by IUE and the quiet Sun and solar plage regions, are intercompared to search for systematic trends.

700,445
PB83-143305 Not available NTIS
National Bureau of Standards, Washington, DC.
Heating Mechanism for the Chromospheres of M Dwarf Stars.
Final rept.
M. S. Giampapa, L. Golub, R. Rosner, G. S. Vaiana, J. L. Linsky, and S. P. Worden. 1982, 7p
Pub. in Proceedings of the Cambridge Workshop on Cool Stars, Stellar Systems and the Sun (2nd), Cambridge, MA., October 21-23, 1982, Special Report Number 392, p73-79 1982.

Keywords: *Dwarf stars, X rays, Heating, *Stellar chromospheres, Late stars, Flare stars, Stellar coronas.

The authors' preliminary investigation corroborates the suggestion by Cram (1981) that X-ray heating by an overlying corona is the dominant heating mechanism in dMe stellar chromospheres. The authors speculate that for earlier stellar types, characterized by higher turbulent velocities, direct heating of the stellar chromosphere by magneto-acoustic mechanisms becomes relatively more important than external heating by coronal X-rays.

700,446
PB83-143628 Not available NTIS
National Bureau of Standards, Washington, DC.
Pulsation Periods of the Pulsating White Dwarf G117-B15A.
Final rept.
S. O. Kepler, E. L. Robinson, R. E. Nather, and J. T. McGraw. 15 Mar 82, 7p
Grant NSF-AST79-06340
Pub. in Astrophysical Jnl. 254, n2 p676-682, 15 Mar 82.

Keywords: *Dwarf stars, Periodic variations, Reprints, *White dwarf stars, *Stellar pulsations.

G117-B15A is a pulsating DA white dwarf, or ZZ Ceti type star. Using high-speed photometry accumulated over the 5 yr interval from 1975 to 1980, the authors have disentangled the unusually complex variations of its light curve.

700,447
PB83-143636 Not available NTIS
National Bureau of Standards, Washington, DC.
Multicolor Variations of the ZZ Ceti Stars.
Final rept.
E. L. Robinson, S. O. Kepler, and R. E. Nather. 1 Aug 82, 13p
Grant NSF-AST79-06340
Pub. in Astrophysical Jnl. 259, n1 p219-231, 1 Aug 82.

Keywords: *Dwarf stars, Periodic variations, Reprints, *White dwarf stars, *Stellar pulsations.

Although the ZZ Ceti stars, or pulsating white dwarfs, are usually thought to be pulsating in the non-radial g-modes, this conclusion is based entirely on the observed periods of the pulsations. Very little attention, either theoretical or observational, has been given to the spectral and multicolor variations of the ZZ Ceti stars. Therefore, in the first part of this paper, the authors calculate the theoretical color, radial velocity, and line profile variations of a white dwarf undergoing g-mode pulsations. In the second part of this paper, they report the results of their multicolor photometry of the ZZ Ceti star R548.

700,448
PB83-143651 Not available NTIS
National Bureau of Standards, Washington, DC.
BT Monocerotis: A New and Unusual Eclipsing Nova.
Final rept.
E. L. Robinson, R. E. Nather, and S. O. Kepler. 15 Mar 82, 7p
Grant NSF-AST79-06340
Pub. in Astrophysical Jnl. 254, n2 p646-652, 15 Mar 82.

Keywords: *Binary stars, *Novae, Reprints, *Eclipsing binary stars.

Photometric observations of BT Mon (=Nova Mon 1939) have shown that it is an eclipsing binary system with an orbital period of 0.3338141 day. The authors show that the accretion disk in BT Mon is exceptionally large and luminous. Its radius is within 75% of the radius of its Roche lobe, and is at least three times larger than the radius of a zero-viscosity disk; and its absolute visual magnitude is 4.0 + or - 1.0. The late-type star in BT Mon cannot simultaneously fit a main sequence mass-radius relation and a main sequence mass-luminosity relation, in the sense that it is underluminous for a normal main sequence star.

700,449
PB83-146449 Not available NTIS
National Bureau of Standards, Washington, DC.
Current NASA Studies for a Far-Ultraviolet Spectrographic Explorer (FUSE).
Final rept.
J. Linsky, A. Boggess, S. Bowyer, J. Caldwell, W. Cash, J. Cohen, A. Dupree, R. Green, E. Jenkins, M. Jura, D. Leckrone, H. W. Moos, B. Savage, M. Shull, T. Snow, J. G. Timothy, E. Weiler, and D. York. Jun 82, 13p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in European IUE Conference (3rd), Madrid, Spain, May 10-13, 1982, p473-485 Jun 82.

Keywords: *Scientific satellites, Far ultraviolet radiation, Ultraviolet spectra, *Far ultraviolet spectrographic explorer, *Mission planning.

This report summarizes the current status of planning by a NASA science working group for the proposed Far-Ultraviolet Spectrographic Explorer (FUSE). These plans are still far from complete and may be modified greatly before a final report is completed, but they envision a satellite to obtain spectra with resolutions (lambda/delta lambda) between 100,000 longer than 1216 A and 100-912 A. This report summarizes the important new scientific problems that can be studied by FUSE, but cannot be addressed by IUE or ST.

700,450
PB83-146480 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure, Energy Balance, and Winds of Cool Stars.
Final rept.
J. L. Linsky. 1982, 11p
Pub. in Proceedings of European IUE Conference (3rd), Madrid, Spain, May 10-13, 1982, p3-13 1982.

Keywords: Binary stars, Dwarf stars, Ultraviolet spectra, X rays, Barium, *X ray sources, Stellar coronas, Late stars, IUE, White dwarf stars.

IUE spectra of the slowly rotating mild barium star 56 Peg (HD 218356; KO IIp) show excess continuum emission from 1300 to 2000 A. The best fit to a Planck blackbody curve gives a temperature of 35,000 K and a radius for the object of 1.4 x 10 to the 9th power cm, consistent with that of a white dwarf. The X-rays can be fit to a bremsstrahlung spectrum. Since X-rays and high temperature emission lines are unusual for single stars in this region of the HR diagram, we do not believe that the 56 Peg primary has a hot corona and transition region. Instead, we suggest the observed X-ray luminosity is due to accretion onto the white dwarf of the wind from the primary. The ultraviolet emission lines likely result from reprocessed X radiation absorbed by the wind.

700,451
PB83-157057 Not available NTIS
National Bureau of Standards, Washington, DC.
Gas Dynamics of Flow Past Galaxies.
Final rept.
G. Shaviv, and E. E. Salpeter. 1982, 15p
Pub. in Astronomy and Astrophysics 110, p300-315 1982.

Keywords: Gas dynamics, Reprints, *Galactic evolution, Galactic clusters, *Intergalactic media.

Gas dynamic calculations are carried out numerically for a (spherical) galaxy with gas emission moving through intergalactic gas, separately for nonviscous flow and for overestimated transport coefficients. We find: (a) For nonviscous cases the rampressure stripping is never complete and Bremsstrahlung cooling induces an instability on a relatively short timescale. (b) Viscous dissipation and heat conduction by the plasma can prevent the instability and give rise to a steady state in which all the mass produced inside the galaxy is stripped away, irrespective of the flow conditions. (c) Mass loss occurs mostly via the tail. The temperature in the tail is lower than the temperature of the cluster gas. Bow stock is negligible. The rate of stripping depends on momentum flow. (d) The form and viscous drag coefficients are of the order of 0.1 and hence cannot be neglected in cluster evolution. The gravitational drag is however very small.

700,452
PB83-162180 Not available NTIS
National Bureau of Standards, Washington, DC.
Carbon Depletion in Turbulent Molecular Cloud Cores.
Final rept.
W. Boland, and T. deJong. Oct 82, 15p
Pub. in Astrophysical Jnl. 261, n1 p110-114, 1 Oct 82.

Keywords: *Carbon, *Interstellar matter, Turbulence, Reprints, *Molecular clouds, Interstellar chemistry.

Observations of dense molecular cloud cores indicate that about 10 percent of the carbon is still in the gas phase (depletion factor about 0.1) in spite of the fact that the depletion time, the time needed for heavy elements to freeze out on dust grains, is several orders of magnitude smaller than the cloud lifetime. To resolve this problem we suggest that the material in molecular cloud cores is circulated by turbulence and that every time a parcel of gas and dust reaches the outer layers of the core, dust mantles that have formed by accretion in the center are evaporated and/or photodesorbed.

700,453
PB83-177055 Not available NTIS
National Bureau of Standards, Washington, DC.
Velocity Gradient of B361.
Final rept.
F. O. Clark, and D. R. Johnson. Dec 82, 19p
Grant NSF-AST76-80200
Pub. in Astrophysical Jnl. 263, p160-165, 1 Dec 82.

Keywords: *Interstellar matter, Galaxies, Radio astronomy, Velocity, Reprints.

Observations of a well ordered velocity gradient which decreases with decreasing cloud radii are reported in the galactic gas cloud, B361. The source also exhibits systematic changes in spectral linewidth. The current observations confirm the suggestion of rotation in this source reported earlier. The marked decrease in rotation at smaller radii implies the presence of an effective mechanism for redistributing angular momentum. Magnetic braking is invoked to explain the observed effects.

700,454
PB83-177089 Not available NTIS
National Bureau of Standards, Washington, DC.
Polarization Properties of the 86 GHz SiO Maser Emission from R Cassiopeia.
Final rept.
F. O. Clark, T. H. Troland, and D. R. Johnson. Oct 82, 7p
Pub. in Astrophysical Jnl. 261, p569-575, 15 Oct 82.

Keywords: *Radio astronomy, Polarized electromagnetic radiation, Silicon monoxide, Stellar atmospheres, Masers, Variable stars, Reprints.

The authors have measured the polarization properties of the J = 2(arrow)1, v = 1 SiO circumstellar maser emission from R Cas over a period of nearly two years. They report the detection of a superbroad spectral feature of width about 18 km/s.

700,455
PB83-179564 Not available NTIS
National Bureau of Standards, Washington, DC.
Unusual Microwave Flare with 56 Second Oscillations on the M Dwarf L726-8 A.
Final rept.
D. E. Gary, J. L. Linsky, and G. A. Dulk. 15 Dec 82, 5p
Sponsored in part by National Aeronautics and Space Administration, Arlington, VA.
Pub. in Astrophysical Jnl. 263, n2 pL79-L83 15 Dec 82.

Keywords: Dwarf stars, Radio astronomy, Masers, Reprints, *Flare stars, Late stars.

Using the VLA, the authors have observed an unusual flare event on L726-8 A (dM5.5e), the primary star in the M dwarf system containing the prototype flare star UV Cet. The authors propose that the observed radiation was due to maser action, probably an electron-cyclotron maser, and that the energy release mechanism was modulated.

700,456
PB83-182584 Not available NTIS
National Bureau of Standards, Washington, DC.
Evolution of Chromospheres and Coronae in Solar Mass Stars: A Far Ultraviolet and Soft X-Ray Comparison of Arcturus (K2 III) and Alpha Centauri A (G2 V).
Final rept.
T. R. Ayres, T. Simon, and J. L. Linsky. 15 Dec 82, 12p
Grants NAG4-82, NGL-06-003-057
Pub. in Astrophysical Jnl. 263, n2 p791-802, 15 Dec 82.

Keywords: *Stellar evolution, Far ultraviolet radiation, X rays, Giant stars, Dwarf stars, Reprints, Stellar chromospheres, Stellar coronal, Late stars, Arcturus star, Alpha Centauri star.

The authors compare IUE far-ultraviolet and Einstein soft X-ray observations of the red giant Arcturus (alpha Bootis, K2 III) and the nearby yellow dwarf alpha Centauri A (G2 V), which are archetypes of solar mass stars in very different stages of evolution.

700,457
PB83-233874 Not available NTIS
National Bureau of Standards, Washington, DC.
Cool Luminous Stars.
Final rept.
J. L. Linsky. 1983, 12p
Sponsored in part by National Aeonautics and Space Administration, Washington, DC. and Colorado Univ. at Boulder.
Pub. in Advances in Space Research 2, n9 p249-260 1983.

Keywords: *Stars, Solar magnetic fields, Ultraviolet spectra, Binary stars, Stellar magnetic fields, Stellar chromospheres, Stellar coronas, Stellar winds.

A broad theme emerging from IUE and Einstein observations of cool stars is that magnetic fields control the structure and energy balance of the outer atmospheres of these stars. The author summarizes the phenomena associated with magnetic fields in the Sun, and shows that similar phenomena occur in cool luminous stars.

700,458
PB83-235200 Not available NTIS
National Bureau of Standards, Washington, DC.
Methanol in Orion A: Simultaneous Observations of Corresponding Rotational Transitions in the Ground and Torsionally Excited States.
Final rept.
J. M. Hollis, F. J. Lovas, R. D. Suenram, P. R. Jewell, and L. E. Snyder. 15 Jan 83, 3p
Pub. in Astrophysical Jnl. 264, n2 p543-545, 15 Jan 83.

Keywords: *Methyl alcohol, *Molecular rotation, Molecular energy levels, Excitation, Interstellar matter, Reprints, *Orion A region.

The authors have detected the 2(sub-1)(-1)(sub-1)E and 2(sub 0)-1(sub 0)A(+1) and partially resolved the 2(sub1)-1(sub 1)E and 2(sub 0) -1(sub 0)E transitions of torsionally excited methanol in Orion A while simultaneously observing the same transitions in the ground state. These well-calibrated observations allow us to conduct an analysis of radiative transfer and molecular excitation from which they conclude that the ground state transitions come from a region in which the molecular rotational temperature is 89+n-15 K and the torsionally excited transitions come from a region characterized by a rotational temperature of 213 + or - 60K. The implications of these results are discussed.

700,459
PB84-103563 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiative Transfer Problems in Planetary Nebulae.
Final rept.
D. G. Hummer. 1983, 8p
Grant NSF-AST80-19874
Pub. in Proceedings of the IAN Symposium n103, Planetary Nebulae, London, England, Aug 82, p211-218 1983.

Keywords: *Planetary nebulae, Ultraviolet radiation, *Radiative transfer.

In view of the enormous importance of the UV observations of planetary nebulae made possible by the IUE, this review will concentrate primarily on the formation of resonance lines in nebulae; an important special case is that of He II Ly(alpha) and its role in the Bowen mechanism.

700,460
PB84-105725 Not available NTIS
National Bureau of Standards, Washington, DC.
Quiescent Chromospheres and Transition Regions of Active Dwarf Stars: What Are We Learning from Recent Observations and Models.
Final rept.
J. L. Linsky. 1983, 22p
Grant NGL-06-003-057
Pub. in Proceedings of IAU Colloq. No. 71, Activity in Red Dwarf Stars, Catania, Sicily, August 10-13, 1982, p39-60 1983.

Keywords: *Dwarf stars, Reviews, *Stellar chromospheres, Late stars, Stellar magnetic fields.

The author reviews the rapid progress in our understanding of active dwarf stars, which has been stimulated by recent IUE, Einstein, and ground-based observations, by asking a series of questions. The most fundamental question is the extent to which magnetic fields control nonflare phenomena in these stars. There are a number of aspects to this questions. Recent observations are permitting us to begin to answer these questions.

700,461
PB84-105972 Not available NTIS
National Bureau of Standards, Washington, DC.
VLA (Very Large Array) Positions of OH/IR Stars.
Final rept.
P. F. Bowers, and T. deJong. May 83, 3p
Pub. in Astronomical Jnl. 88, n5 p655-657 May 83.

Keywords: *Radio sources(Astronomy), *Position(Location), Stars, Reprints, *Hydroxyl radicals, *Maser outputs.

Absolute positions of the 1612-MHz OH maser emission from 26 Type II OH/IR stars have been determined with the Very Large Array to an estimated positional accuracy of plus or minus 4 arcsec. Combined with earlier work, our results provide radio positions with errors <15 arsec for all known OH/IR stars between galactice longitudes of 10 degrees and 27.5 degrees with flux densities larger than 1.7 Jy.

700,462
PB84-106160 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Magnetic Fields in Stellar Chromospheres and Transition Regions.
Final rept.
J. L. Linsky. 1983, 6p
Grant NGL-06-003-057
Pub. in Proceedings of IAU Symposium No. 102, Solar and Stellar Magnetic Fields: Origins and Coronal Effects, August 2-6, 1982, p313-318 1983.

Keywords: Reviews, *Stellar chromospheres, *Stellar magnetic fields, Stellar conronas, Late stars.

In this review based largely on observations with the IUE and Einstein satellites, the author will summarize the different roles that magnetic fields play in controlling the structure and energy balance in the chromospheres and transition regions of late-type stars.

700,463
PB84-136043 Not available NTIS
National Bureau of Standards, Washington, DC.
Nature of Dwarf Novae.
Final rept.
J. Smak. 1 Sep 83, 4p
Pub. in Astrophysical Jnl. 272, n1 p234-237, 1 Sep 83.

Keywords: *Novae, Dwarf stars, Mass transfer, Reprints, *Stellar mass accretion, Accretion.

Observational data on mass-transfer rates and radii of disks indicate that the outer parts of disks in novae and nova-like binaries are sufficiently hot for stationary accretion; those in dwarf novae are too cool to avoid an accretion instability, while these in Z Cam systems are the borderline cases. The mass ratios of novae and nova-like binaries with main-sequence secondaries appear -- at a given orbital period -- to be systematically larger than those of dwarf novae, implying that higher mass ratios are responsible for higher mass-transfer rates.

700,464
PB84-136068 Not available NTIS
National Bureau of Standards, Washington, DC.
Outer Atmospheres of Cool Stars. XIII. Capella at Critical Phases.
Final rept.
T. R. Ayres, F. H. Schiffer, and J. L. Linsky. Sep 83, 11p
Contract NAG5-82, Grant NGL-06-003-057
See also PB82-254384.
Pub. in Astrophysical Jnl. 272, n1 p223-233 Sep 83.

Keywords: *Binary stars, *Giant stars, *Stellar atmospheres, Stellar spectra, Ultraviolet spectra, Emission spectra, Reprints, Capella stars, *Stellar chromospheres, Late stars, Ultraviolet astronomy, IUE.

The authors present a high-dispersion ultraviolet study of the late-type spectroscopic binary Capella covering critical phases-three quadratures and one conjunction--in the orbit, as observed with the International Ultraviolet Explorer. Their work supports the conclusion previously reached by Ayres and Linsky, based on an early IUE study of Capella with limited phase coverage, that the rapidly rotating F9 III secondary star in the system is considerably brighter than the more slowly rotating G6 III primary in ultraviolet emission lines characteristic of the chromospheric (T about 6000 K) and higher temperature plasmas.

700,465
PB84-136381 Not available NTIS
National Bureau of Standards, Washington, DC.
VLA Observations of Quiescent and Flare Microwave Emission from Late-Type Stars: A Unique Probe of Coronal Magnetic Fields.
Final rept.
D. E. Gary, J. L. Linsky, and G. A. Dulk. Aug 83, 4p
Grant NGL-06-003-057
Pub. in Proceedings of IAU Symposium (102) on Solar Stellar Magnetic Fields Held at Zurich (Switzerland) on August 2-6, 1982, p387-390 Aug 83.

Keywords: *Stellar magnetic fields, Extraterrestrial radio waves, *Stellar coronas, Stellar radiation, Late stars, Microwave emission, Stellar flares.

The authors report the measurement of steady microwave emission from a number of late-type stars, and discuss implications concerning coronal structure and magnetic field strength.

700,466
PB84-136407 Not available NTIS
National Bureau of Standards, Washington, DC.
WO Wolf-Rayet Stars.
Final rept.
M. J. Barlow, and D. G. Hummer. 1982, 7p
Grant NSF-AST80-19874
Pub. in Proceedings of IAU Symposium 99 on Wolf-Rayet Stars: Observations, Physics, Evolution, Held at Cancun (Mexico) on September 1981, p389-393 1982.

Keywords: *Stellar evolution, Chemical composition, Spectrophotometry, Surface temperature, *Wolf-Rayet stars, IUE.

The five stars listed by Sanduleak (1971) as having very strong O VI 3811, 34A emission are discussed on the basis of absolute visual spectrophotometry (3100-7400A), augmented by IUE observations for the first three of the list. Evidence is produced that four of these objects describe an evolutionary sequence that is an extention of the WC sequence. We have introduced the designation WO for these stars. Sand 3 is shown to have a true surface temperature not less than 200,000K, and is thought to be the remnant central star of a planetary nebula. The surface chemical composition is discussed.

700,467
PB84-136415 Not available NTIS
National Bureau of Standards, Washington, DC.
Coronae of Nondegenerate Single and Binary Stars: A Survey of Our Present Understanding and Problems Ripe for Solution.
Final rept.
J. L. Linsky. 1982, 26p
Grant NGL-06-003-057
Pub. in Proceedings of Symposium on X-ray Astronomy in the 1980s Held at Greenbelt, MD. on October 1981, p13-36 1982.

Keywords: Binary stars, Stars, X ray spectra, Reviews, *Stellar coronas, X ray astronomy.

Einstein has discovered X-ray emission from stars located in nearly every portion of the HR diagram, and, as a consequence, has completely changed our understanding of stellar coronae. Despite this great accomplishment or perhaps because of it, we now recognize that there are many important unanswered questions that require the capabilities of the next generation of X-ray instrumentation. In this survey, the author reviews what Einstein has told us about the coronae of stars in different portions of the HR diagram, and how the characteristics of such coronae compare with what we now know about the solar corona. For each type of star, the author then lists some important unanswered questions and the generic type of X-ray instrument required to answer these questions.

700,468
PB84-138338 Not available NTIS
National Bureau of Standards, Washington, DC.
Outer Atmospheres of Cool Stars. 14. A Model for the Chromosphere and Transition Region of Beta Ceti (G9.5 III).
Final rept.
K. Eriksson, J. L. Linsky, and T. Simon. 15 Sep 83, 13p
Grant NGL-05-003-057
See also PB82-254384.
Pub. in Astrophysical Jnl. 272, n2 p665-677, 15 Sep 83.

Keywords: *Stellar atmospheres, Stars, Ultraviolet spectra, Reprints, *Beta Ceti star, *Stellar chromospheres, Stellar coronas, Late stars.

The authors compute a model for the chromosphere and transition region of Beta Ceti (G9.5 III) consistent with IUE spectra of the resonance lines of Mg II, C II, and C IV. They treat the Mg II h and k lines in partial redistribution and the C II and C IV lines in complete redistribution. Quite good match to the observed line profiles is achieved for a hydrostatic equilibrium model with temperature plateaus at 5,500 K and 22,500 K. Ceti is important because it lies immediately to the left of the boundary in the H-R diagram generally separating stars with and without high temperature plasmas. This star is a very luminous X-ray emitter for its spectral type, which can be explained either by a corona containing mainly high pressure loops or a high pressure homogeneous corona overlying an inhomogeneous transition region.

700,469
PB84-138346 Not available NTIS
National Bureau of Standards, Washington, DC.
Formation of Emission Lines in the Expanding Chromospheres of Luminous Cool Stars. 1. The Importance of Atmospheric Extension and Partial Redistribution Effects.
Final rept.
S. A. Drake, and J. L. Linsky. 1 Oct 83, 9p
Grant NGL-06-003-057
Pub. in Astrophysical Jnl. 273, n1 p299-308, 1 Oct 83.

Keywords: *Stellar atmospheres, Ultraviolet spectra, Reprints, *Stellar chromospheres, Stellar winds, Late stars, Radiative transfer.

Most late type luminous stars are losing mass in cool stellar winds, although the mass loss rates and mechanisms of these outflows remain uncertain. In many red giants the only evidence for mass loss is the presence of a characteristic asymmetry in the strongest ultraviolet resonance lines, such as the Mg II k line. In this paper, we discuss the available methods for treating radiative transfer in such chromospheric lines in an expanding, extended medium and select the comoving frame method (including partial redistribution) as the most suitable. We briefly outline this technique in the context of a two level atom.

700,470
PB84-151570 Not available NTIS
National Bureau of Standards, Washington, DC.
Specific Luminosity of a Three-Dimensional Medium in Terms of the Escape Probability.
Final rept.
G. B. Rybicki, and D. G. Hummer. 1 Nov 83, 9p
Grant NSF-AST82-18375
Pub. in Astrophysical Jnl. 274, n1 p380-398, 1 Nov 83.

Keywords: *Stellar atmospheres, *Luminosity, Reprints, Accretion disks, Radiative transfer, Escape probability.

Radiation emitted by a three-dimensional medium and received by a distant observer is expressed in terms of the specific luminosity, which can be evaluated in terms of escape probability functions for the medium. This approach is simpler in many cases than an integration over the plane of the sky, because it allows any symmetries of the problem to be more fully exploited. Integral theorems are derived involving averaged escape probabilities that generalize a theorem of Irons (1978). Analogous results are presented for a three-dimensional line-emitting region in the Sobolev (or large velocity gradient) limit. To illustrate the theory, results for expanding spherical media and differentially rotating thin disks are discussed. Computationally useful results for several related escape probability functions are given.

700,471
PB84-154657 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Observations of OH/IR Stars.
Final rept.
F. Willems, and T. de Jong. Nov 82, 3p
Pub. in Astronomy and Astrophysics 115, n1 p213-215 Nov 82.

Keywords: Intermediate infrared radiation, Photometry, Reprints, *Infrared stars, *Hydroxyl radicals.

As part of a program to study in the infrared all presently known type II OH sources in a 140 square degrees area of sky along the galactic equator between longitudes 10 degrees and 27.5 degrees, the authors have identified several OH sources with previously unknown infrared counterparts. These identifications could only be made because accurate radio positions were available, partly determined by the authors using the Westerbork Radio Synthesis Telescope as a two-element interferometer at 18 cm. In this letter they present 1-20 micrometer observations obtained with the ESO 1 m telescope of the three brightest sources in the sample so far. All three sources show 10 micrometer silicate absorption.

700,472

PB84-221308 Not available NTIS
National Bureau of Standards, Washington, DC.
Sigma Geminorum (K1 III +): Variability of the Ultraviolet Emission Lines Near Conjuction.
Final rept.
T. R. Ayres, T. Simon, and J. L. Linsky. Apr 84, 5p
Grant NGL-06-003-057
Pub. in Astrophysics 279, n3 p197-201 Apr 84.

Keywords: *Stars, Emission spectra, Ultraviolet spectra, Stellar spectra, Far ultraviolet radiation, Oxygen, Magnesium, Silicon, Carbon, Line spectra, Reprints, *Stellar chromospheres, Late stars, IUE.

The authors report far-ultraviolet IUE echelle spectra of the moderate-period RS CVn system sigma Geminorum (K1 III + unknown). Despite the location of the red giant primary of sigma Gem in a portion of the H-R diagram where cool stellar winds are common, the authors find no evidence for circumstellar absorption features or blueward asymmetries in the chromospheric O I (or Mg I and Mg II) emission cores. However, observations on two consecutive days indicate significant changes in the profiles of high-excitation species, such as Si IV and C IV, which likely were produced by the rotation off of the visible hemisphere of the primary of a large-scale magnetic active region identified in a previous photometric study.

700,473

PB84-238419 Not available NTIS
National Bureau of Standards, Washington, DC.
Redshifts of High-Temperature Emission Lines in the Far-Ultraviolet Spectra of Late-Type Stars.
Final rept.
T. R. Ayres, R. E. Stencel, J. L. Linsky, T. Simon, C. Jordan, A. Brown, and O. Engvold. 15 Nov 83, 14p
Grant NGL-06-003-057
Pub. in Astrophysical Jnl. 274, n3 p801-814, 15 Nov 83.

Keywords: *Stellar spectra, *Red shift, Ultraviolet spectra, Far ultraviolet radiation, Stellar atmospheres, Reprints, Stellar chromospheres, Late stars, Stellar winds, Stellar coronas, IUE.

High-dispersion IUE spectra of six late-type stars exhibit small but statistically significant differential redshifts of high-temperature emission lines, like Si IV and C IV, with respect to low-temperature lines like S I and O I. The authors discuss several possible explanations for the stellar redshifts, including a warm wind (100,000 K) in which apparent redshifts are produced in optically thick lines by an accelerating outflow, and the downflowing component of a vertical circulation system for which the up-leg portion of the flow is too cool, too hot, or too tenuous to be visible in Si IV and C IV.

700,474

PB84-239292 Not available NTIS
National Bureau of Standards, Washington, DC.
Stellar Chromospheres and Coronae in the Ursa Major Cluster Stars.
Final rept.
F. M. Walter, J. L. Linsky, T. Simon, L. Golub, and G. S. Vaiana. Jun 84, 11p
Grant NGL-06-003-057
Pub. in Astrophysical Jnl. 281, p815-825 Jun 84.

Keywords: Stellar atmospheres, Ultraviolet spectra, X rays, Stellar spectra, Dwarf stars, Reprints, *Stellar chromospheres, *Stellar coronas, Ultraviolet astronomy, Late stars, IUE.

The authors discuss IUE spectra of 16 proposed members of the Ursa Major Cluster and Einstein X-ray images of nine of these stars and one additional star. It is found that 12 of these stars (six in the Nucleus and six in the Stream) exhibit bright ultraviolet and/or X-ray emission indicating that they are bona fide members of the young Ursa Major Cluster, whereas four stars (one in the Nucleus and three in the Stream) exhibit weak emission and are probably old field stars that have space velocities similar to the Cluster.

700,475

PB84-239946 Not available NTIS
National Bureau of Standards, Washington, DC.
Outer Atmospheres of Cool Stars. XV. High Dispersion Ultraviolet Studies of Active Chromospheres G-K Dwarfs with IUE.
Final rept.
T. R. Ayres, J. L. Linsky, T. Simon, C. Jordan, and A. Brown. 15 Nov 83, 10p
Grant NGL-06-003-057
See also PB84-138338.
Pub. in Astrophysical Jnl. 274, n3 p784-793, 15 Nov 83.

Keywords: *Stellar atmospheres, Ultraviolet spectra, Stars, Reprints, Stellar chromospheres, Stellar coronas, Late stars.

The authors have obtained IUE ultraviolet echelle spectra of three late-type active-chromosphere dwarf stars--chi Orionis (G0 V), xi Bootis A (G8 V) and epsilon Eridani (K2 V)--which they compare with previously published observations of the quiet chromosphere dwarfs alpha Centauri A (G2 V) and alpha Centauri B (K1 V).

700,476

PB84-239961 Not available NTIS
National Bureau of Standards, Washington, DC.
First Detection of Winds in Red Giants by Microwave Continuum Techniques.
Final rept.
S. A. Drake, and J. L. Linsky. 15 Nov 83, 5p
Grant NGL-06-003-057
Pub. in Astrophysical Jnl. Letters 274, n3 pL77-L81, 15 Nov 83.

Keywords: Extraterrestrial radio waves, Reprints, *Red giant stars, *Stellar winds, Stellar chromospheres, Late stars, Mass loss, Microwave emission.

The authors have observed six nearby red giants at 4885 MHz (6 cm) with the Very Large Array in an attempt to detect continuum emission. Results are discussed.

700,477

PB84-242072 Not available NTIS
National Bureau of Standards, Washington, DC.
Microwave Emission from the Coronae of Late-Type Dwarf Stars.
Final rept.
J. L. Linsky, and D. E. Gary. 15 Nov 83, 8p
Grant NGL-06-003-057
Pub. in Astrophysical Jnl. 274, n3 p776-783, 15 Nov 83.

Keywords: *Dwarf stars, Stellar magnetic fields, Extraterrestrial radio waves, Flare stars, Reprints, *Stellar coronas, *Microwave emission, Late stars.

The authors present VLA microwave observations of 14 late-type dwarf and subgiant stars and binary systems. This may provide the first direct evidence that the emission process is magnetic in character on dMe stars.

700,478

PB84-243849 Not available NTIS
National Bureau of Standards, Washington, DC.
X-ray Sources in Molecular Clouds.
Final rept.
S. Lepp, and R. McCray. 15 Jun 83, 8p
Pub. in Astrophysical Jnl. 269, p560-567, 15 Jun 83.

Keywords: *Interstellar matter, Infrared spectra, Emission spectra, Models, Reprints, *Molecular clouds, *X ray sources, Infrared astronomy.

Models are calculated for the structure and infrared line emission from a dense interstellar gas cloud containing a compact X-ray source. For constant gas pressure models, the resulting structure consists of nested spherical shells containing, respectively, coronal gas at $T > 1{,}000{,}000$ K, an H II region with T about 10,000 K, an H I region with T about 8000 K, and finally an H(2) region with $T < 5000$ K. Scaling laws are given for the locations of the transitions. Approximately 10% of the X-ray luminosity absorbed in the H(2) region is converted into infrared emission lines that may be observable. Line ratios are predicted.

700,479

PB85-100261 Not available NTIS
National Bureau of Standards, Washington, DC.
Outbursts of Dwarf Novae.
Final rept.
J. Smak. 1984, 14p
Pub. in Publications of the Astronomical Society of the Pacific 96, n575 p5-18 1984.

Keywords: *Novae, *Dwarf stars, Reprints, Star accretion, Instability.

A review is given of the observational facts related to the outbursts of dwarf novae and of the relevant aspects of the theory of accretion disks. It now appears possible to explain the outbursts of dwarf novae in terms of a nonstationary accretion behavior.

700,480

PB85-100287 Not available NTIS
National Bureau of Standards, Washington, DC.
Variability of Cool Stars at Optical and Ultraviolet Wavelengths.
Final rept.
J. L. Linsky, P. L. Bornmann, M. Rodono, V. Pazzani, A. D. Andrews, C. J. Butler, and P. B. Byrne. 1982, 3p
Pub. in Proceedings of Third European IUE Conference, Madrid, Spain, May 10-13, 1982, p165-167.

Keywords: *Stars, Light(Visible radiation), Ultraviolet radiation, Variability, *Flare stars, Stellar chromospheres, IUE.

Preliminary results of a collaborative observation program, involving ESS, NASA and SERC guest investigators with the International Ultraviolet Explorer, are presented. During thirteen eight-hour shifts, the flare star AU Mic was observed simultaneously with ground-based optical observations. In addition to one definite flaring event, remarkable changes of the BY Dra-type optical light curve and evidence of slow variability in the chromospheric and transition region (TR) line fluxes -- probably due to the rotational modulation of photospheric starspots and plages, respectively -- were found.

700,481

PB85-100303 Not available NTIS
National Bureau of Standards, Washington, DC.
Second-Order Escape Probability Approximations in Radiative Transfer.
Final rept.
D. G. Hummer, and R. B. Rybicki. 15 Dec 82, 10p
Grant NSF-AST80-19874
Pub. in Astrophysical Jnl. 263, n2 p925-934, 15 Dec 82.

Keywords: Stellar spectra, Approximation, Photons, Reprints, *Radiative transfer, Escape probability.

Second-order escape-probability approximations make some allowances for the transfer of radiation between the point where a photon is created and that where it escapes or is absorbed. An approximation of this kind has recently been formulated by Peutter et al. for planar atmospheres of finite thickness, in the form of a first-order differential equation relating the integrated mean intensity to the source function. The authors give two alternative normalizations to the one proposed by these authors; the first of these enforces global conservation of photons in each transition, and the second gives reasonably accurate results for much less computational effort than the first.

700,482

PB85-100311 Not available NTIS
National Bureau of Standards, Washington, DC.
Coordinated Einstein and IUE Observations of a 'Disparitions Brusques' Type Flare Event and Quiescent Emission from Proxima Centauri.
Final rept.
B. M. Haisch, J. L. Linsky, P. L. Bornmann, R. E. Stencel, S. K. Antiochos, L. Golub, and G. S. Vaiana. Apr 83, 11p
Contract NAG5-82, Grant NGL-06-003-057
Pub. in Astrophysics Jnl. 267, n1 p280-290 Apr 83.

Keywords: *Stars, Ultraviolet spectra, X rays, Reprints, *Flare stars, *Proxima Centauri star, Stellar chromospheres, Stellar coronas, IUE, HEAO 2.

The authors report on simultaneous Einstein and IUE observations of the dM5e flare star Proxima Centauri during a five hour period in August 1980.

700,483

PB85-100329 Not available NTIS
National Bureau of Standards, Washington, DC.

Astrophysics

OH/IR Stars: Late Stages of Evolution of Intermediate-Mass Stars.
Final rept.
T. de Jong. Nov 83, 9p
Pub. in Astrophysical Jnl. 274, p252-260 Nov 83.

Keywords: *Stellar evolution, *Radio astronomy, *Masers, Reprints, *Infrared stars, Hydroxyl radicals, Mass loss.

In this paper the author attempts to interpret a large body of radio and infrared data of OH/IR stars in terms of our present understanding of stellar evolution.

700,484
PB85-104669 Not available NTIS
National Bureau of Standards, Washington, DC.
HEAO-1 Observations of X-ray Emission from Flares on DME Stars.
Final rept.
S. M. Kahn, J. L. Linsky, K. O. Mason, B. M. Haisch, C. S. Bowyer, N. E. White, and S. H. Pravdo. 1979, 1p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 234, n2 p107 1979.

Keywords: *X ray spectra, Stars, Reprints, *Stellar flares, X ray sources.

The authors report the detection of 2 X-ray flares from each of the nearby dMe stars, AT Mic and AD Leo, with the A2 experiment on board HEAO-1.

700,485
PB85-108603 Not available NTIS
National Bureau of Standards, Washington, DC.
Extensive Galactic Search for Conformer II Glycine.
Final rept.
L. E. Snyder, J. M. Hollis, R. D. Suenram, F. J. Lovas, L. W. Brown, and D. Buhl. 1 May 83, 6p
Pub. in Astrophysical Jnl. 268, p123-128, 1 May 83.

Keywords: *Interstellar matter, *Glycine, Reprints.

The authors have conducted the most extensive galactic search reported to date for conformer II glycine, a higher energy form of the simplest amino acid. The search utilized four glycine transitions at centimeter wavelengths and 21 at millimeter wavelengths to observe 18 galactic molecular sources and one comet. No conformer II glycine lines were detected and measurements of representative sources were used to compute upper limits on total column densities. Several unidentified lines were detected and are reported here with some suggested possible identifications.

700,486
PB85-111805 Not available NTIS
National Bureau of Standards, Washington, DC.
New Interstellar Molecular Transitions in the 2-MM Range.
Final rept.
J. M. Hollis, L. E. Snyder, D. H. Blake, F. J. Lovas, R. D. Suenram, and B. L. Ulich. 1981, 30p
Pub. in Astrophysical Jnl. 251, n2 p541-548 1981.

Keywords: *Interstellar matter, *Molecular energy levels, *Molecular rotation, *Rotational spectra, Methyl alcohol, Sulfur dioxide, Reprints, *Acetylene/methyl, Acetylene/cyano.

The authors derive a Sgr B2 kinetic temperature of about 47 K based on previously unreported observations of K-components of the 9K-8K transition of CH3CCH. They searched for but did not detect the 14 sub (14,0)-13 sub (13,0), 14 sub (14,1)-13 sub (13,1), 15 sub (15,0)-14 sub (14,0) and 15 sub (15,1)-14 sub (14,1) transitions of H2SO4, the 25 sub (0,25)-24 sub (0,24) and 25 sub (1,25)-24 sub (1,24) transitions of HCOOCHO, the 4-3 transition of HCP, the 7-6 transition of OC(18 sup O), and the 2 sub (12)-1 sub (11) and 2 sub (02)-1 sub (01) transitions of HNO in several galactic molecular sources. They discuss the present evidence for the existence of interstellar HNO.

700,487
PB85-124360 Not available NTIS
National Bureau of Standards, Washington, DC.
Accretion in Cataclysmic Binaries. 3. Helium Binaries.
Final rept.
J. Smak. 1983, 5p
Pub. in Acta Astronomica 33, n3-4 p333-337 1983.

Keywords: Helium, Reprints, *Accretion disks, White dwarf stars.

Models of the vertical structure of helium accretion disks show thermal instability in the temperature range corresponding to the helium ionization. The critical effective temperatures, log (T sub e) = 4.1 and 3.95, are higher than in the case of hydrogen-rich disks. Of the two known helium cataclysmic binaries, AM CVn avoids the instability due to a high accretion rate, while GP Com - most likely - due to a very low accretion rate. Evidence is also presented to suggest that in GP Com the accretion pattern is modified by the magnetic field of the white dwarf.

700,488
PB85-129211 Not available NTIS
National Bureau of Standards, Washington, DC.
Ratio of Mixing Length to Scale Height in Red Dwarfs.
Final rept.
A. N. Cox, G. Shaviv, and S. W. Hodson. 1981, 1p
Pub. in Astrophysical Jnl. 245, n1 p37 1981.

Keywords: *Dwarf stars, Helium 3, Mass, Luminosity, Reprints.

Previous completely convective theoretical models of low-mass stars, M approx = or < 0.3 M0, predict a luminosity-mass relation which is below the observed one. The authors explain this disagreement by using the latest molecular opacities and by the consequent need to assume an l/H(p) ratio at T < 9000 K in the range 0.07-0.17, rather than the more conventional values of 1.0-2.0. When such a low surface layer l/H(p) ratio is assumed, we find significantly higher central temperatures (and hence luminosities) and quite large radiative cores, regardless of the deeper l/H(p) value and equation-of-state uncertainties. The low l/H(p) ratio is explained by the interaction of a magnetic field with convection. Several consequences of this result, including the interstellar abundance of 3He(+), are discussed.

700,489
PB85-141885 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Origin of Low-Velocity Absorption Components in the Magnesium II Resonance Lines of Hybrid-Chromosphere Stars.
Final rept.
S. A. Drake, A. Brown, and J. L. Linsky. 15 Sep 84, 10p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 284, n2 p774-783, 15 Sep 84.

Keywords: *Interstellar matter, Ultraviolet spectra, Reprints, *Stellar chromospheres, *Stellar envelopes, Stellar winds, Late stars, IUE.

The authors argue that the low velocity absorption features seen in the Mg II resonance lines of seven confirmed and three probable hybrid-chromosphere stars are interstellar rather than circumstellar in origin. From a comparison of radial velocities based on all available spectra in the IUE archives with estimates of the interstellar velocity along each line of sight, the authors found a good correlation between the observed position of the low velocity component and the predicted interstellar feature. They also show that previous arguments in favor of the circumstellar origin of the low velocity absorption features are either incorrect or implausible. Their conclusion may modify previously proposed models of hybrid star winds which have assumed a priori that both Mg II absorption components are circumstellar.

700,490
PB85-142289 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Indications of Circumstellar Ring Systems from SiO and H2O Maser Lines.
Final rept.
D. Van Blerkom. 1978, 5p
Grant NSF-AST76-22032
Pub. in Astrophysical Jnl. 223, n3 p835-839, 1 Aug 78.

Keywords: *Masers, Water vapor, Silicon oxides, Emission spectra, Line spectra, Reprints, *Stellar envelopes, Radiative transfer.

Several sources of maser line emission show a distinctive line profile; symmetrically displaced satellite components which flank a central feature. VY CMa, in particular, exhibits this type of profile in both SiO and H2O maser lines. It is argued that a rotating disk, viewed nearly edge-on, is a likely source of these lines. In order to account for changes in the SiO profiles in the space of two years, it is found that the disk must be broken into concentric rings. The sizes and rotational speeds of the rings imply a stellar mass of no greater than 4 M(0), and thus suggest that VY CMa is not a highly evolved star, but one that is just emerging from a cocoon of gas and dust. The model proposed has a ring system about the star and a more distant expanding region which is the remnant of the cocoon blown out by radiation pressure: SiO and H2O emission originates in the rings, while OH derives from the expanding gas. Although this is an attractive picture in many ways, there are a number of problems associated with it.

700,491
PB85-142578 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Models for the Active and Quiescent Regions on the RS CVn-Type System 2 Pegasi (HD 224085).
Final rept.
J. L. Linsky, A. Brown, N. C. Marstad, M. Rodono, A. D. Andrews, C. J. Butler, and P. B. Byrne. Jul 84, 4p
Grant NAG5-82
Pub. in Proceedings of European IUE Conference (4th), Rome, Italy, May 15-18, 1984, ESA SP-218, p351-354 Jul 84.

Keywords: *Binary stars, Stellar atmospheres, Ultraviolet spectra, Emission spectra, Faculae, IUE.

IUE observations of the RS CVn binary system II Pegasi obtained during the period 1981 October 1-7 have been used by Marstad to deduce the presence of a compact bright active region covering less than 10% of the primary's visible hemisphere. These same observations have not been used to derive the emission measure distributions and to calculate transition region models of the quiescent and plage (active) regions of II Peg. Active region models have been calculated assuming area coverages of 10, 6, 3 and 1% of the visible hemisphere. These models are used to provide lower limits to the electron pressure in the quiescent and plage regions, which are compared with the available density diagnostics. The amount of mechanical energy deposition required to account for the observed radiative losses is very large.

700,492
PB85-142586 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High-Resolution, Far-Ultraviolet Study of Beta Draconis (G2 Ib-II): Transition Region Structure and Energy Balance.
Final rept.
A. Brown, C. Jordan, R. E. Stencel, J. L. Linsky, and T. R. Ayres. 15 Aug 84, 14p
Grants NAG5-82, NGL-06-003-057
Sponsored in part by Grants NAG5-199 and NAS5-26409.
Pub. in Astrophysical Jnl. 283, p731-744, 15 Aug 84.

Keywords: *Stars, Giant stars, Ultraviolet spectra, Far ultraviolet radiation, Emission spectra, Resolution, Reprints, *Beta Draconis star, Stellar chromospheres, Stellar coronas, Late stars, Supergiant stars, IUE.

High resolution far-ultraviolet spectra of the star beta Draconis have been obtained with the International Ultraviolet Explorer satellite. The observed emission-line fluxes have been used to derive the mean emission measure distribution, which is used to construct models of the density and temperature variation with height as a function of the transition region pressure. The range of appropriate pressures is investigated from density-sensitive line ratios and through arguments concerning line opacities.

700,493
PB85-143345 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Coordinated IUE and Ground-Based Observations of Active Stars: Flare Events on YZ CMI, V 1005 Ori, and Leo and AR Lac.
Final rept.
M. Rodono, G. Cutispoto, S. Catalano, J. L. Linsky, D. M. Gibson, A. Brown, B. M. Haisch, C. J. Butler, P. B. Byrne, A. D. Andrews, J. G. Doyle, D. E. Gary, G. W. Henry, G. Russo, A. Vittone, and E. Scaltriti B. Foing. 1984, 6p
Pub. in Proceedings of European IUE Conference (4th), Rome, Italy, May 15-18, 1984, p247-252.

Keywords: Binary stars, Variable stars, *Stellar flares, IUE.

The authors present a preliminary report on coordinated observations of stellar flare obtained with IUE and several ground-based facilities, as part of collaborative campaigns carried out in February 1983, October 1983 and March 1984. One of the principal aims of these observations was that of observing stellar flare simultaneously over a wide range of wavelengths in order to study the effect of the flare radiation at different atmospheric levels. The authors' observations include time-resolved IUE and optical spectroscopy, narrow and wide-band optical photometry, IR photometry, and microwave observations. Among the major results are the first detection of IR flux decrease, or negative flare, in coincidence with flux increase at all of the other wavelengths.

700,494
PB85-143352 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Coronal Models Tested with IUE and Einstein Observations.
Final rept.
R. Hammer, and J. L. Linsky. 1984, 8p
Grants NGL-06-003-057, NAG5-82
Pub. in Proceedings of European IUE Conference (4th), Rome, Italy, May 15-18, 1984, p25-32.

Keywords: *Stellar atmospheres, *Stellar coronas, Stellar chromospheres, HEAO 2, IUE.

The authors review recent compilations of IUE and Einstein observations which show that the emissions from the various outer layers of cool stars are nonlinearly correlated. This result can be used to test theoretical corona models as well as hypotheses on the mechanism that determines the location of the transition region. In stars in which most of the X-ray emission originates in small coronal loops, it may be necessary that part of the emitting plasma is hotter than 20 million K or, alternatively, that the transition region is not only heated by thermal conduction, but also by downflows. The authors discuss observational evidence for both these effects. Finally, they consider methods for analyzing the geometrical structure of outer stellar atmospheres.

700,495
PB85-143360 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rotational Modulation of Spots and Plages on RS CVn Stars.
Final rept.
P. B. Byrne, J. G. Doyle, A. D. Andrews, C. J. Butler, N. Marstad, J. L. Linsky, T. Simon, M. Rodono, S Catalano, C. Blanco, E. Marilli, and V. Pazzani. 1984, 7p
Pub. in Proceedings of European IUE Conference (4th), Rome, Italy, May 15-18, 1984, p343-349.

Keywords: *Binary stars, *Variable stars, Emission spectra, Rotation, Modulation, *Faculae, IUE.

Observations of three RS CVn stars made with the IUE satellite are presented. Emission line fluxes are found to vary in anti-phase with the stars' optical variations. The authors interpret these correlations in terms of large-scale spots in the stellar photospheres with overlying magnetic loops, giving rise to nonthermal heating of the layers above the spots. Evidence of nonthermal gas motions is also presented which appear to be associated with the most active regions of the stars.

700,496
PB85-143378 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
IUE Observations of BY Draconis.
Final rept.
C. J. Butler, J. G. Doyle, A. D. Andrews, P. B. Byrne, and J. L. Linsky. 1984, 4p
Pub. in Proceedings of European IUE Conference (4th), Rome, Italy, May 15-18, 1984, p243-246.

Keywords: Emission spectra, Magnesium, *BY Draconis star, Stellar flares, Faculae, IUE.

Phased IUE observations of BY Draconis show no significant modulation of the prominent SWP emission lines over one rotation period. However, a marginally significant anticorrelation of the Mg II flux, and the flux in the LWR 'continuum' with the V light curve is observed, and is interpreted as due to 'plage' type areas over the photospheric spots. Two SWP spectra show sporadic enhancements of the emission lines as has been seen in other IUE spectra of flares.

700,497
PB85-144434 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hydrogen Dimer Structures in the Far-Infrared Spectra of Jupiter and Saturn.
Final rept.
L. Frommhold, and G. Birnbaum. 15 Aug 84, 4p
Pub. in Astrophysical Jnl. 283, pL79-L82, 15 Aug 84.

Keywords: Far infrared radiation, Infrared spectra, Absorption spectra, Hydrogen, Helium, Ratios, Reprints, *Jupiter atmosphere, *Saturn atmosphere, *Dimers, Voyager project.

On the basis of a spectral line shape computation, the authors show that small structures recently discovered in the Voyager spectra near the hydrogen S(sub 0)(0) and S(sub 0)(1) lines are due to bound-free transitions involving hydrogen dimers. This identification may stimulate laboratory observation, unavailable at this time, of a feature that may prove to be useful for a new helium/hydrogen ratio determination.

700,498
PB85-147320 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Eruptive Binaries, 11. Disk-Radius Variations in U Gem.
Final rept.
J. Smak. 1984, 4p
Pub. in Acta Astronomica, n1 p93-96 1984.

Keywords: *Novae, Reprints, *Accretion disks, *Dwarf novae.

New set of geometrical elements is determined from an improved analysis of eclipses of the hot spot. The radius of the disk, which expands during an outburst, shrinks exponentially from about (r sub d) = 0.39 immediately after outburst to about (r sub d) = 0.29 just before the next outburst. The expansion of the disk begins at the very onset of an outburst.

700,499
PB85-147338 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Accretion in Cataclysmic Binaries. 4. Accretion Disks in Dwarf Novae.
Final rept.
J. Smak. 1984, 29p
See also PB85-124360.
Pub. in Acta Astronomica 34, n2 p161-189 1984.

Keywords: *Novae, Reprints, *Accretion disks, *Dwarf novae.

Time-dependent disk models are constructed, including the effects of thermal instability due to the ionization of hydrogen. The results are very sensitive to the assumptions concerning the viscosity. It is argued that by comparing models based on different viscosity prescriptions with the observational data for dwarf novae it should be possible to get an insight into the nature of viscosity. In the first approximation it is found that models based essentially on the alpha-disk approach with alpha approximately = 0.2, but with lower viscosity at low temperatures, reproduce reasonably well the dwarf novae behavior.

700,500
PB85-147965 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Better Determinations of Mass Loss Rates for Red Giants and Supergiants.
Final rept.
S. A. Drake, and J. L. Linsky. 1984, 3p
Pub. in Proceedings of the Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun (3rd), Cambridge, MA., October 1983, p350-352, 1984.

Keywords: *Giant stars, Radio astronomy, *Mass loss, *Red giant stars, *Supergiant stars, Late stars, Stellar chromospheres, Stellar winds, Stellar radiation.

Mass loss in the form of stellar winds is of great relevance to the study of stellar atmospheres, stellar structure and evolution, and the interstellar medium, and progress in these areas would greatly benefit from reliable estimates of mass loss rates (M dot) for many stars. Deutsch (1956) first showed that significant mass loss does occur for cool, luminous stars, but order of magnitude or more disagreements in the value of (M dot) between different studies of the same star are fairly typical. Goldberg (1979) and Zuckerman (1980) have reviewed the optical and infrared techniques by which the vast majority of (M dot) estimates have been obtained. In this paper, the authors discuss the 'new' methods which have become available in the last decade or so using other wavelength regions. The authors limit this study to giants and super-giants of spectral type G to mid M, and thus do not mention (M dot) measurements in late M stars using molecular emission lines such as CO(J=2-1). They also exclude techniques that are only appropriate for binary systems of known orbital parameters.

700,501
PB85-147981 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Radio Observations of Active Stars: Direct Evidence for Polarity Reversals.
Final rept.
D. M. Gibson. 1984, 5p
Pub. in Proceedings of the Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun (3rd), Cambridge, MA., October 1983, p197-201, 1984.

Keywords: Radio astronomy, *Stellar coronas, *Polarity reversal, Stellar radiation.

Radio astronomical measurements of source spectra and polarization can provide significant insight into the physical conditions in the emitting regions. Such observations of active stars can be particularly useful because they provide information on coronal conditions which is different from, but complementary to, that obtained by X-ray observations. Observations at other bands (UV, optical, IR) allow us to 'connect' the corona to the stellar surface and, in effect, provide additional boundary conditions for our interpretations. The author evaluated the homogeneous gyrosynchrotron model for stellar radio emission proposed by Owen et al. (1976) and found it difficult to reconcile with models for the coherent radio emission from the same stars. The author found the statistics of stellar radio polarization to be inconsistent with this model as well. Finally, the author suggests that a phenomenological model based on the 'leading-following spot' geometry seen in active regions on the Sun serves to explain most of the peculiarities observed in radio star spectra and polarizations and, in fact, provides an explanation for similar peculiarities seen in the rapidly varying coherent emission.

700,502
PB85-148138 Not available NTIS
National Bureau of Standards, Boulder, CO.
RS CVn Binary Systems.
Final rept.
J. L. Linsky. 1984, 15p
Grant NGL-06-003-057
Pub. in Proceedings of Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun (3rd), Cambridge, MA., October 1983, p244-258 1984.

Keywords: *Binary stars, Ultraviolet spectra, Stellar magnetic fields, Reviews, Stellar chromospheres, Stellar coronas, X ray sources.

The author attempts to place in context the vast amount of data obtained in the last few years as a result of X-ray, ultraviolet, optical, and microwave observations of RS CVn and similar spectroscopic binary systems. As this topic is now very broad, the author concentrates on the RS CVn systems and their long-period analogs, and restricts the scope by attempting to answer on the basis of the recent data and theory the following questions: (1) Are the original defining characteristics still valid and still adequate. (2) What is the evidence for discrete active regions. (3) Have we derived any meaningful physical properties telling us about magnetic fields in RS CVn systems. (5) Is there evidence for systematic trends in RS CVn systems with spectral type.

700,503
PB85-202927 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Progress Report on the Analysis of Long Exposure SWP High Resolution Spectra of Cool Stars.
Final rept.
J. L. Linsky, T. R. Ayres, A. Brown, K. Carpenter, C. Jordan, P. Judge, B. Gustafsson, K. Eriksson, M. Saxner, O. Engvold, E. Jensen, O. K. Moe, and T. Simon. 1984, 5p
Grant NGL-06-003-057
Pub. in Proceedings of Future of Ultraviolet Astronomy Based on Six Years of IUE Research, Greenbelt, MD.,

April 3-5, 1984, NASA Conference Publication 2349, p445-449 1984.

Keywords: Ultraviolet spectra, Dwarf stars, Giant stars, *Stellar chromospheres, Barium stars, Supergiant stars, IUE.

During the last few years the authors have obtained very long exposure, high-dispersion SWP spectra of many stars located throughout the cool half of the HR diagram. These 12-21 hour exposures were obtained by combining NASA and Vilspa shifts so as to obtain the longest possible exposures at times of low background. Included are dwarf stars of spectral type GO V-M2 V, G9.5 III-M5 II giants, G2 Ib-M2 Iab supergiants, a number of RS CVn-type systems, and Barium stars. Given the importance of this data set and the many questions that it can answer with appropriate data reduction and extensive modeling efforts the authors summarize briefly what has and is being done with these data.

700,504
PB85-203586 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Atmospheric Properties of RU Lupi Derived from High- and Low-Resolution IUE Spectra.
A. Brown, M. V. Penston, R. Johnstone, C. Jordan, N. P. M. Kuin, M. T. V. T. Lago, B. Gross, and J. L. Linsky. 1984, 4p
Pub. in Proceedings of the Future of Ultraviolet Astronomy Based on Six Years of IUE Research, Goddard Space Flight Center, April 3-5, 1984, NASA Conf. Publ. 2349, p338-341.

Keywords: *Stellar atmospheres, Ultraviolet spectra, Line width, *RU Lupi Star, Stellar winds, IUE.

High- and low-dispersion spectra of the pre-main sequence star, RU Lupi, have been obtained using both the SWP and LWR cameras. Strong p Cygni line profiles are seen in Mg II and Fe II emission lines, indicating that the lines are formed in the stellar wind of RU Lupi. An increase in transition region line widths is seen with increasing temperature, which cannot be due solely to opacity broadening, thus indicating that kinematic broadening mechanisms (e.g. flows and turbulence) are dominant. The transition region density is about 3 x 10 to the 10th power/cc derived from the Si III lambda 1892/C III lambda 1909 line ratio. The status of the authors atmospheric modeling of RU Lupi is discussed.

700,505
PB85-207140 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Ultraviolet, Radio and X-ray Observations of Hybrid Stars.
Final rept.
S. A. Drake, A. Brown, and J. L. Linsky. 1984, 4p
Pub. in Proceedings of Future of Ultraviolet Astronomy Based on Six Years of IUE Research, Goddard Space Flight Center, April 3-5, 1984, NASA (National Aeronautics and Space Administration) Conf. Publ. 2349, p472-475.

Keywords: *Stars, Extraterrestrial radio waves, Ultraviolet spectra, X rays, Stellar winds, IUE.

In order to understand the nature of the circumsteller regions in the so-called hybrid (-chromosphere) stars, the authors have analyzed existing long wavelength IUE data of these stars, obtained new 6 cm radio observations with the VLA, and compiled all available X-ray observations. The authors conclude that the low-velocity absorption components seen in the Mg II h and k lines of hybrids are almost certainly interstellar and that only the high-velocity components are indicative of the stellar wind speeds.

700,506
PB85-208098 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Monsignor Georges Lemaitre.
Final rept.
A. Deprit. 1984, 30p
Pub. in The Big Bang and Georges Lemaitre, p363-392 1984.

Keywords: *Cosmology, *Biographies, Cosmic rays, General relativity, Universe, *Lemaitre Georges, Big bang cosmology.

Biography of the Belgian scientist, author of the Theory of the Expanding Universe and of the Big Bang Theory in Astronomy.

700,507
PB85-225712 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Predicted Long-Slit, High-Resolution Emission-Line Profiles from Interstellar Bow Shocks.
Final rept.
A. C. Raga, and K. H. Bohm. Jun 85, 24p
Grant NSF-AST83-14551
Pub. in Astrophysical Jnl., Supplement Series 58, p201-224 Jun 85.

Keywords: *Spectral lines, *Emission spectra, Interstellar matter, Shock waves, Stars, Reprints, Bow waves.

The authors have computed the position-dependent emission-line profiles (called 'position-velocity diagrams' by Choe, Bohm, and Solf) for the lines H(beta), (N II) lambda 6583, (S II) lambda 6731, (O I) lambda 6300, and (O III) lambda 5007 which are formed in a (somewhat simplified) model of a radiating interstellar bow shock of high Mach number. Such models have been suggested as an explanation of the emission-line spectra of Herbig-Haro objects in connection with the 'interstellar bullet model.' Some of the restrictive assumptions used in related earlier work have been eliminated. By comparing the authors results to the recent high-resolution long-slit coude spectra of Herbig-Haro objects (obtained by Bohm and Solf), important similarities are found.

700,508
PB85-226058 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Sobolev Approximation for Line Formation with Continuous Opacity.
Final rept.
D. G. Hummer, and G. B. Rybicki. 1 Jun 85, 10p
Grant NSF-AST82-18375
Pub. in Astrophysical Jnl. 293, p258-267, 1 Jun 85.

Keywords: *Spectral lines, Reprints, Radiative transfer, Sobolev approximation.

The Sobolev approximation for line-formation problems in atmospheres with high-speed flows is generalized to include the effects of continuum absorption and emission in the region of the line. The result is very simple, being expressed entirely in terms of known functions with the exception of one quantity of order unity, which is tabulated. Comparison with accurate numerical solutions for simple problems in plane-parallel geometry shows the approximation to be quite accurate in those regions of the atmosphere where the conditions for the validity of the approximation are satisfied. A three-dimensional version of the theory is given that applies to general geometries.

700,509
PB85-229920 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Observations of the SiC2 Radical Toward IRC+10216 at 1.27 Centimeters.
Final rept.
L. E. Snyder, C. Henkel, J. M. Hollis, and F. J. Lovas. 1985, 5p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 290, pL29-L33, 1 Mar 85.

Keywords: Molecular spectroscopy, Silicon carbides, Centimeter waves, Free radicals, Radio astronomy, Reprints, *Silicon dicarbide, *Carbon stars.

The first centimeter-wave transition of the recently identified SiC2 radical has been observed in the envelope of the evolved carbon star IRC +10216. The excellent agreement between their measured astronomical rest frequency and the predicted frequency, and their measured line intensity support the SiC2 identification. The high-resolution line profile and mapping data are used to estimate the size of the IRC +10216 SiC2 envelope and the abundance of SiC2 relative to H2.

700,510
PB85-230720 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Optical and Radio Study of the Taurus Molecular Cloud Toward HD 29647.
Final rept.
R. M. Crutcher. Jan 85, 14p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 288, p604-617, 15 Jan 85.

Keywords: *Interstellar matter, Radio astronomy, Reprints, *Molecular clouds, Taurus Constellation.

The advantages of combined optical and radio wavelength observations are discussed, and the first such comprehensive study of a dark molecular cloud is described. The line of sight to HD 29647, an eighth magnitude B6-7 IV Ng-Mn star which is behind the outer envelope of Taurus Molecular Cloud 1, has been studied.

700,511
PB86-101938 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Unexpected Ultraviolet Variability of Herbig-Haro Object 1.
Final rept.
E. W. Brugel, K. H. Bohm, J. M. Shull, and E. Bohm-Vitense. 1985, 4p
Grant NAG5-193
Pub. in Astrophysical Jnl. 292, pL75-L78, 15 May 85.

Keywords: *Interstellar matter, *Nebulae, Ultraviolet spectra, Variability, Reprints, IUE.

Between 1979 and 1983 the line fluxes of the C IV 1550 and C III 1909 emission lines in HH 1 have decreased monotonically by factors of at least 4-6, while no indications of drastic changes in the optical range (and specifically in the (O III)5007 line) have been found. Our result is based on four IUE spectra obtained by three different groups of observers. These relatively rapid changes can be used to estimate the thickness of the shocked layers and preshock density (eta sub 0). These results suggest a clumpy medium, with (eta sub 0) approx. = 1000/cc, leading to 'truncated' shock waves whose column densities are insufficient to develop complete recombination zones.

700,512
PB86-102464 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Photospheres of Hot Stars. 1. Wind Blanketed Model Atmospheres.
Final rept.
D. C. Abbott, and D. G. Hummer. Jul 85, 17p
Grant NSF-AST82-18375
Pub. in Astrophysical Jnl. 294, p286-302, 1 Jul 85.

Keywords: *Stellar atmospheres, Photosphere, Reprints, Stellar winds.

Preliminary to an extensive and detailed comparison of improved non-LTE photospheric models with observations of hot stars made with high photometric accuracy, the authors construct non-LTE stellar atmospheres which account for the radiation reflected back onto the photosphere by line and electron scattering from the wind. The effects of this 'wind blanketing' on the spectrum and internal structure of the atmosphere are given for an example with Teff=42,000 K, and a wide range of wind density, gravity, and model assumptions. Particular attention is given to the problem of determining Teff.

700,513
PB86-112133 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Combined Effect of Potential and Nonpotential Magnetic Fields on Equilibrium in Stellar Atmospheres.
Final rept.
E. B. Gliner. 1 Aug 84, 10p
Pub. in Astrophysical Jnl. 283, n1 p363-372, 1 Aug 84.

Keywords: *Stellar atmospheres, Stellar magnetic fields, Solar corona, Reprints.

An equilibrium in a plasma atmosphere around a gravitating body is considered with regard to both a magnetic field of electrical currents in the atmosphere and a magnetic field originating inside the star. The relation between the combined non-force-free magnetic field and the thermodynamic parameters of atmospheric

plasma is treated analytically on the basis of an approach which is discussed in detail. Though restricted by the axisymmetrical situation, the approach allows for multipole structure of a stellar magnetic field and arbitrary radial variation of a toroidal atmospheric magnetic field. Among phenomena caused by the combined magnetic field are inverted altitude run of density in the atmosphere, depletions and excesses in plasma density, 'north-south' atmospheric asymmetry, and inhomogeneous temperature distribution. Subsequent applications are discussed, in particular for the explanation of solar corona asymmetry.

700,514
PB86-128188 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Frequent Ultraviolet Brightenings Observed in a Solar Active Region with Solar Maximum Mission.
Final rept.
J. G. Porter, J. Toomre, and K. B. Gebbie. 1984, 8p
Grant NsG-5318
Sponsored by Air Force Geophysics Lab., Hanscom AFB, MA., and National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 283, n2 pt1 p879-886, 15 Aug 84.

Keywords: *Solar activity, Solar ultraviolet radiation, Ultraviolet spectra, Solar spectrum, Reprints.

Observations in the ultraviolet of sites of enhanced intensity within an active region on the Sun reveal frequent and rapid brightenings in Si IV and O IV line emission. These transition region lines were observed with 0.08 s sampling in time using the Ultraviolet Spectrometer and Polarimeter (UVSP) instrument on the Solar Maximum Mission (SMM) satellite. The observations suggest that intermittent heating events of modest amplitude are occurring at many sites within an active region. By selecting the brightest site at any given time within an active region and then sampling its behavior in detail within a 120 s interval, the authors found that about two-thirds of the samples showed variations of the Si IV line intensity. The brightenings typically lasted about 40 s to 60 s, though some were as brief as 20 s. Intensity increases of about 20% to 100% were commonly observed.

700,515
PB86-128865 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Microwave and Far-Infrared Spectra of the SiH Radical.
Final rept.
J. M. Brown, R. F. Curl, and K. M. Evenson. 1985, 4p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 292, p188-191, 1 May 1985.

Keywords: *Chemical analysis, *Microwave spectroscopy, *Silanes, Far infrared radiation, Reprints, *Laser spectroscopy.

The frequencies, wavelengths, and line strengths for transitions in the SiH molecule at microwave and farinfrared wavelengths have been calculated from an analysis of its laser magnetic resonance spectrum.

700,516
PB86-128873 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Observations of Interstellar Hydrogen and Deuterium Toward Alpha Centauri A.
Final rept.
W. B. Landsman, R. C. Henry, H. W. Moos, and J. L. Linsky. 1984, 7p
Grant NSG-5393
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 285, n2 p801-807, 15 Oct 84.

Keywords: *Interstellar matter, Ultraviolet spectra, Reprints, IUE.

The authors present a composite profile of the Ly(alpha) emission line of alpha Cen A, obtained from 10 individual spectra with the high-resolution spectrograph aboard the International Ultraviolet Explorer (IUE) satellite. There is excellent overall agreement with two previous Copernicus observations. Interstellar deuterium is detected, and a lower limit is set on the deuterium to hydrogen ratio. In addition, the deuterium bulk velocity appears blueshifted by 8 + or - 2km/s with respect to interstellar hydrogen, suggesting a nonuniform medium along the line of sight.

700,517
PB86-132677 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Blue Companions of Cepheids.
Final rept.
E. Bohm-Vitense, and C. Proffitt. 1985, 10p
Grant NSG-5398
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 296, p175-184, 1 Sep 85.

Keywords: Binary stars, Ultraviolet spectra, Reprints, *Cepheid variables, IUE.

Twenty-one Cepheids, known or suspected to have blue companions, were studied with the International Ultraviolet Explorer satellite. For 13 of them, companions were indeed seen, though they were generally fainteer in the UV than expected. For four Population I Cepheids, the suspected companions were not seen. For none of the Population II Cepheids could a compainion be detected. The authors discuss the effective temperatures and luminosities of the companions which could be observed and compare the positions of Cepheids and companions in the T(eff) luminosity diagrams with positions expected from stellar evolution calculations.

700,518
PB86-133550 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Polarization Properties and Time Variations of the SiO Maser Emission of R Leo.
Final rept.
F. O. Clark, T. H. Troland, G. H. Pepper, and D. R. Johnson. 1984, 11p
Pub. in Astrophysical Jnl. 276, n2 pt 1 p572-582, 15 Jan 84.

Keywords: *Masers, Variable stars, Reprints, *R Leo Star, *Silicon oxide masers, Stellar envelopes, Polarization.

The authors have measured the polarization properties of the v=l, J=2-l SiO circumstellar maser emission from R Leo over a period of three and one half years. As in previous reports, they present data concerning Stokes parameter I, and linear polarization.

700,519
PB86-133584 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
SiO Flux Measurements of Variable Stars.
Final rept.
F. O. Clark, T. H. Troland, G. H. Pepper, and D. R. Johnson. 1984, 5p
Pub. in Astrophysical Jnl. 283, n1 pt 1 p174-178, 1 Aug 84.

Keywords: *Variable stars, *Masers, Reprints, *Silicon oxide masers, Infrared astronomy, Stellar envelopes.

The authors report measurements of total flux for six circumstellar SiO maser sources. Both polarizations were measured simultaneously for these highly polarized sources. They compare SiO flux curves with infrared minima and maxima. The SiO flux correlates with the infrared flux, although a characteristic phase lag is present. The comparisons of SiO and infrared flux at light minimum are the most straightforward. Interpreted in terms of observed physical motions associated with these stars, the SiO-infrared phase lag of 63 to 129 days can be used to infer a scale size on the order of 10-13 cm. T he corresponding light travel time is of the order of 10-17 cm, which is well outside of the SiO line formation region. The observed phase lag is interpreted as strong evidence against direct stellar infrared radiation as an exciting mechanism for the majority of the SiO flux.

700,520
PB86-136827 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
VLA Observations of A and B Stars with Kilogauss Magnetic Fields.
Final rept.
S. A. Drake, D. C. Abbott, J. H. Bieging, E. Churchwell, and J. L. Linsky. 1985, 6p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Radio Stars Workshop, Boulder, CO., June 1984, p247-252 1985.

Keywords: *Radio sources(Astronomy), Stellar coronas, Stellar magnetic fields, Early stars.

The serendipitous discovery that the star sigma Ori E (B2 Vp (He Strong)) is a 3.5 mJy radio continuum source at 6 cm has stimulated a radio survey of other early-type stars with strong magnetic fields. No Ap stars have been detected of 8 observed, with typical 3 sigma upper limits of 0.5 mJy at 2 cm. Of 6 Bp stars examined, only HR 1890, also a helium-strong star, was detected. The authors discuss possible emission mechanisms for the observed radio emission, and conclude that nonthermal emission seems the most plausible, on the basis of the present data.

700,521
PB86-136835 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
VLA Radio Continuum Survey of Active Late-Type Giants in Binary Systems: Preliminary Results.
Final rept.
S. A. Drake, T. Simon, and J. L. Linsky. 1985, 6p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Radio Stars Workshop, Boulder, CO., June 1984, p253-258 1985.

Keywords: *Radio sources(Astronomy), *Binary stars, Giant stars, Stellar chromospheres, Late stars, Mass loss.

The authors have made sensitive survey at 6 cm of active G and K giants in binary systems, including the so-called Long-Period RS CVn stars. The systems observed have orbital periods in the range of about 10 to more than 100 days, and are judged to be active on the basis of their pronounced chromospheric and transition region emission lines and (where available) strong X-ray emission compared to single giants of similar spectral type. Results to date show that strong radio continuum emission at centimeter wavelengths is a common but not universal property of this class of stars. The authors discuss possible correlations between radio luminosity and other properties, such as X-ray luminosity, rotational period, and type of companion.

700,522
PB86-139870 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Mass Loss from Red Giants: Results from Ultraviolet Spectroscopy.
Final rept.
J. L. Linsky. 1985, 24p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Mass Loss from Red Giants, Los Angeles, California, June 1984, p31-54 1985.

Keywords: *Giant stars, Ultraviolet spectra, *Red giant stars, *Mass loss, Late stars, Stellar winds, X ray sources, Radiative transfer.

New instrumentation in space, primarily the IUE spacecraft, has enabled the application of ultraviolet spectroscopic techniques to the determination of physical properties and reliable mass loss rates for red giant winds. One important result is the determination of where in the H-R diagram are found stars with hot outer atmospheres and with cool winds. So far it appears that single cool stars, except perhaps for the so-called hybrid stars, have either hot outer atmospheres or cool winds but not both.

700,523
PB86-139888 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Astrophysics

Beyond Lyman Alpha: The New Frontier in Ultraviolet Spectroscopy.
Final rept.
J. L. Linsky. 1985, 9p
Pub. in Comments on Astrophysics 10, n6 p247-255 1985

Keywords: *Ultraviolet spectroscopy, Far ultraviolet radiation, Interstellar matter, Galaxies, Reprints, Stellar chromospheres, Stellar winds.

Major advances in our understanding of planets, stars, the interstellar medium, and galaxies will come from spectroscopy in the ultraviolet at wavelengths below 1200 A. While existing spacecraft like IUE and Space Telescope, now under construction, are sensitive only at longer wavelengths, the proposed FUSE/Columbus mission will obtain high resolution spectra in the below 1200 A region even of faint sources. This comment summarizes the scientific program of such a mission.

700,524
PB86-142379 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
North American Workshop on Cataclysmic Variables and Related Systems (8th).
R. F. Webbink. 1985, 10p
Pub. in Comments Astrophys. 10, n5 p189-198 1985.

Keywords: *Binary stars, Reprints, *Cataclysmic variables, White dwarf stars, X ray sources.

When the term 'cataclysmic variable' (CV) was coined by R. P. Kraft, he applied it strictly to eruptive variable stars -- the class included supernova, novae, and dwarf novae. From the beginning, it was clear that supernova were fundamentally different phenomena from novae and dwarf novae. The latter two types of objects had been found to have the same underlying physical nature: a low-mass dwarf star, fillings its Roche lobe, and transferring matter through an accretion disk onto a white dwarf star. Supernovae were quickly dropped as members of this class, but in the years since the term cataclysmic variable has been broadened to include other types of objects which, while they may not display well-developed eruptions, and may not all contain accretion disks, nevertheless share the same interacting red dwarf - white dwarf nature.

700,525
PB86-142668 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
AY Ceti: A Flaring, Spotted Star with a Hot Companion.
Final rept.
T. Simon, F. C. Fekel, and D. M. Gibson. 1985, 9p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 295, p153-161, 1 Aug 85.

Keywords: *Binary stars, Radio sources(Astronomy), Ultraviolet spectra, Reprints, *AY Ceti stars, Late stars, X ray sources, White dwarf stars, IUE.

AY Ceti is a late-type single-line spectroscopic binary, a bright X ray source, and a spotted star, as evidenced by its prominent photometric wave. In this paper, the authors report on observations made with the IUE satellite and the VLA radio interferometer. They conclude that the bright lines and soft X ray emission of AY Cet arise from the cool primary star, rather than from mass transfer and accretion onto the secondary as has recently been proposed for the similar system 56 Peg.

700,526
PB86-160116 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
HR Diagram for Normal Radio Stars.
Final rept.
D. M. Gibson. 1985, 6p
Pub. in Proceedings of the Radio Stars Workshop, Boulder, CO., June 1984, p213-218 1985.

Keywords: *Radio sources(Astronomy), Binary stars, *Radio stars, Hertzsprung-Russel diagram, Early stars, Late stars, Flare stars, Supergiant stars.

It is found that nonthermal radio emission is associated with stars in very specific locations on the HR diagram. The four classes of objects are typified by early-type mass-loss stars (05/WR), late-type giants and supergiants (M2II), subgiant K-stars (KO IV-III), and flare stars (dMe). The members of each class exhibit about the same maximum radio luminosities, log (L(R)/L(bol)), and flaring timescales, spectra, and polarizations. Membership in a binary system is not found to be a necessary condition for detectable nonthermal emission.

700,527
PB86-161056 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Nonthermal Radio Emission and the HR Diagram.
Final rept.
D. M. Gibson. 1985, 5p
Pub. in Proceedings of the NASA (National Aeronautics and Space Administration) Conference on the Origin of Non-Radiative Heating/Momentum in Hot Stars, Greenbelt, MD., June 5-7, 1984, p70-74 1985.

Keywords: *Radio sources(Astronomy), Binary stars, *Radio stars, Hertzsprung-Russel diagram, Early stars, Late stars, Flare stars.

To date, 77 normal stellar objects have been detected and identified as nonthermal radio sources. They are found in four locations on the HR diagram: the 05/WR region, the M2 II region, the KO IV region, and the dM region.

700,528
PB86-162062 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Evidence for Non-Radiative Activity in Stars with T(sub eff) < 10,000K.
Final rept.
J. L. Linsky. 1985, 23p
Contract NAG5-82
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of the NASA (National Aeronautics and Space Administration) Conference on the Origin of Nonradiative Heating/Momentum in Hot Stars, Goddard Space Flight Center, Greenbelt, MD., June 5-7, 1984, p24-46 1985.

Keywords: *Stars, Ultraviolet spectra, Radio astronomy, Reviews, Stellar chromospheres, Stellar coronas, Cosmic x-ray sources.

Major advances in the acquisition of evidence for and the understanding of nonradiative heating and other activity in stars cooler than T(sub eff) = 10,000 K has occurred in the last few years, primarily as a result of the IUE and Einstein spacecraft and the VLA microwave facility. In the paper the author critically reviews the evidence, and comments on the trends that are now becoming apparent.

700,529
PB86-162096 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Observations of Interstellar C2 toward Three Heavily Reddened Stars.
Final rept.
B. L. Lutz, and R. M. Crutcher. 1983, 45p
Grants NSF-AST81-14887, NSF-AST78-20131
Sponsored by National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 271, pL101-L105, 15 Aug 83.

Keywords: *Interstellar matter, *Carbon, Molecules, Abundance, Reprints.

Observations have been made of the 2-0 band of the Phillips system of interstellar C2 toward the heavily obscured early-type stars VI Cygni No. 12, HD 29647, and BD +66 deg 1675. The first direct proof that the rotational excitation temperatures of interstellar C2 are nonthermal was obtained. Toward VI Cygni No. 12, the rotational distribution cannot be characterized by a single, unique excitation temperature; the distribution is consistent with radiative pumping models. A very strong linear correlation was found between N(C2) and E(B-V), which suggests that the relative abundance of C2 is insensitive to a wide variation in physical conditions.

700,530
PB86-163573 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Radiation Driven Stellar Wind Model Atmosphere for the Wolf-Rayet Binary V 444 Cygni.
Final rept.
A. Pauldrach, J. Puls, D. G. Hummer, and R. P. Kudritzki. 1985, 4p
Pub. in Astronomy and Astrophysics 148, pL1-L4 1985.

Keywords: *Stellar atmospheres, Binary stars, Reprints, *Wolf-Rayet stars, Stellar winds.

Using the stellar parameters of the WN5 component of the eclipsing binary V 444 Cygni determined by Cherepashchuk et al. (1984) from multi-color light curves, and employing an improved theory of radiatively-driven stellar winds, the authors have calculated models which yield an extended, supersonically expanding photosphere, with values close to those observed for the photospheric radius, the mass-loss rate and the terminal velocity. The radial distributions of velocity and density are also in close agreement with those obtained by Cherepashchuk et al.

700,531
PB86-189172 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Nonradiative Activity across the H-R Diagram: Which Types of Stars Are Solar-Like.
Final rept.
J. L. Linsky. 1985, 30p
Grants NAGS-82, NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Solar Physics 100, p333-362 1985.

Keywords: *Stars, Ultraviolet spectra, X ray spectra, Identifying, Sun, Reprints, Stellar chromospheres, Stellar coronas, Hertzsprung-Russell diagram.

The author concludes that dwarf stars of spectral type G-M and rapidly rotating subgiants and giants of spectral type F-K in spectroscopic binary systems are definitely solar-like. Dwarf stars of spectral type A7-F7 are almost certainly solar-like, and T Tauri and other pre-Main-Sequence stars are probably solar-like. Slowly rotating single giants of spectral type F to early K are also probably solar-like, and the helium-strong hottest Bp stars are interesting candidates for being solar-like. The O and B stars exhibit some aspects of activity but probably have weak fields and are not solar-like. Finally, the A dwarfs and the cool giants and supergiants show no evidence of being solar-like.

700,532
PB86-193174 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Ion-Molecule Reaction Probabilities Near 10 K.
Final rept.
J. A. Luine, and G. H. Dunn. 1985, 4p
Contract NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 299, pL67-L70, 1 Dec 85.

Keywords: *Interstellar matter, Chemical reactions, Molecules, Ions, Nitrogen, Hydrogen, Ammonia, Cryogenics, Reprints, Ion traps.

Reaction probabilities have been measured near 11 K using an ion trap technique for some processes important for molecule formation in interstellar clouds. Probabilities were determined at 11 K = or < T = or < 20 K for the abstraction processes N(1+) + H2 -> NH(1+) + H and NH3(1+) + H2 -> NH4(1+) + H. New experimental upper limits were determined at 11 K for the radiative association reactions C(1+) + H2 -> CH2(1+) + h(nu) and HCO(1+) + H2 -> H3CO(1+) + h(nu). Reaction rate coefficients were deduced from the probabilities.

700,533
PB86-193216 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Photospheric Magnetic Field of the dM3.5e Flare Star AD Leonis.
Final rept.
S. H. Saar, and J. L. Linsky. 1985, 4p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 299, n1 pL47-L50, 1 Dec 85.

Keywords: Infrared spectra, Reprints, *Flare stars, *Stellar magnetic fields, AD Leo star.

A high-resolution infrared spectrum of the dM3.5e flare star AD Leo, obtained with the Kitt Peak 4 m Fourier Transform Spectrometer, clearly shows the presence of strong magnetic fields. This is the first detection of photospheric fields on a dMe star.

700,534
PB86-200995 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Optical Region Elemental Abundance Analyses of B and A Stars 4. Re-Evaluation with New Critically Compiled Fe II Oscillator Strengths and Improved Estimates of the Damping Constants.
Final rept.
S. J. Adelman, and J. R. Fuhr. 1985, 5p
Pub. in Astronomy and Astrophysics 152, p434-438 1985.

Keywords: *Stars, Abundance, Damping, Iron, Reprints, Oscillator strengths.

A new critical compilation of Fen f-values has recently been completed by Martin et al. To see how these values affect the derived stellar abundances both directly in changing the values of log Fe/H for individual lines and through the determination of the microturbulent velocities, the data for eleven (six normal and 5 slightly peculiar) sharp-lined B and A stars have been reanalyzed. At the same time, the choice of line damping constants has been investigated, especially for Fe I and Fe II lines.

700,535
PB86-204583 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Recommended Rest Frequencies for Observed Interstellar Molecular Microwave Transitions - 1985 Revision.
F. J. Lovas. c1986, 51p
Included in Jnl. of Physical and Chemical Reference Data, v15 n1 p251-303 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Microwave spectra, Radio astronomy, Hyperfine structure, *Interstellar gas, *Molecular clouds.

Accurate transition frequencies for the transitions of the molecular species detected in interstellar clouds are presented. These are recommended for reference in future astronomical observations in the radio and microwave regions. The transition frequencies have been selected through critical examination and analysis of the spectroscopic data in the literature. The species identity, quantum number labels, and probable error limits (2 o sigma) are presented for each transition. Representative line antenna temperatures are also given for a typical source as a convenience to users. References are cited to both the astronomical and laboratory literature.

700,536
PB86-212800 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Radio Continuum Emission from Winds, Chromospheres and Coronae of Cool Giants and Supergiants.
Final rept.
S. A. Drake, and J. L. Linsky. Mar 86, 19p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astronomical Jnl. 91, n3 p602-620 Mar 86.

Keywords: *Giant stars, *Radio sources(Astronomy), Reprints, *Supergiant stars, Stellar chromospheres, Stellar coronas, Stellar winds, Late stars.

In the paper the authors present the results of a sensitive VLA radio continuum survey at 6 cm of 39 of the nearest, single cool giants and supergiants with spectral types in the range G0-M5. The findings are discussed in the context of the various mechanisms that might be producing radio emission in these cool stars.

700,537
PB86-212826 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Simple Explanation for the Linsky-Haisch Boundary Line for Transition Layers.
Final rept.
E. Bohm-Vitense. 1986, 5p
Pub. in Astrophysical Jnl. 301, p297-301, 1 Feb 86.

Keywords: Reprints, *Stellar chromospheres, *Stellar coronas, Transition layers.

It was found that for stars with low gravitational acceleration, transition layers between chromosphere and corona cannot form, because the chromospheres are so extended that the mechanical energy flux decreases faster than the square of the electron density. There is not enough flux left to lead to a steep temperature increase in the transition layer and corona. If the dissipation length lambda for the mechanical energy flux is the same for all stars, the boundary line for transition layers would be expected to coincide with a line of g=const in the H-R diagram. The numerical value for the g depends on the dissipation length. A comparison with the observed boundary line shows that the dissipation length is not the same for all stars but increases roughly as to (Teff/G)to the 0.93 power.

700,538
PB86-212883 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
6 Centimeter Radio Survey of Short-Period Active Binary Stars.
Final rept.
S. A. Drake, T. Simon, and J. L. Linsky. May 86, 4p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astronomical Jnl. 91, n5 p1229-1232 May 86.

Keywords: *Binary stars, Radio sources(Astronomy), Reprints, Stellar coronas.

The authors have observed 13 binaries with periods in the range of 0.2 -2.0 days at 6 cm wavelength with the VLA. Eight out of these 13 systems were detected, of which seven are RS Canum Venaticorum systems and one is an Algol system, with observed fluxes in the range of 0.3-5.0 mJy. They briefly discuss the individual characteristics of the detected sources. As a group, relative to active binaries of longer orbital periods, the short-period active binaries have a slightly lower mean radio luminosity. There is also a clear correlation of high radio luminosity with high x-ray luminosity evident in these short-period systems, although the authors cannot determine a functional dependence from noncontemporary data.

700,539
PB86-228640 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Cepheid Mass Problem and Cepheid Binaries.
Final rept.
E. Bohm-Vitense. Apr 86, 11p
Grant NSG-5398
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 303, p262-272, 1 Apr 86.

Keywords: Stellar evolution, Binary stars, Mass, Reprints, *Cepheid variable stars.

Existing mass determinations for Cepheids with different periods are examined. Wesselink masses are independent of the adopted distance scale. For short periods (<6 days) they follow the sequence of evolutionary masses. For periods longer than 10 days they are lower by up to a factor of 2. The lower mass branch joins up with the bump masses. The new pulsational masses agree with the Wesselink masses for periods longer than 6 days. Cepheid masses determined by means of their giant companions also agree with the Wesselink masses and the new pulsational masses. While the error bars are large, the derived dynamical masses determined for S Mus and V636 Sco also agree with the low Wesselink and giant companion masses.

700,540
PB86-228665 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
SN 1985f: Death of a Wolf-Rayet Star.
Final rept.
M. C. Begelman, and C. L. Sarazin. Mar 86, 4p
Grant NSF-AST83-51997
Sponsored by National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 302, n2 pL59-L62, 15 Mar 86.

Keywords: *Supernoval, Reprints, *Wolf-Rayet stars, Supernova remnants, Cobalt 56, Nucleosynthesis.

From an analysis of the optical spectrum of SN 1985f, the authors show that the supernova ejecta contain about or > 5 solar masses of oxygen and very little hydrogen. They suggest that the explosion resulted from the pair instability supernova of a about 50 solar masses WO Wolf-Rayet star. The optical luminosity of the supernova is powered by the radioactive decay of (56)Co synthesized in the explosion. From the rate of decay of the optical emission, the authors estimate that the explosion occurred about 350 days before it was discovered in 1985 February.

700,541
PB86-229275 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
IUE Observations of Interstellar Hydrogen and Deuterium toward Alpha Centauri B.
Final rept.
W. B. Landsman, J. Murthy, R. C. Henry, H. W. Moos, J. L. Linsky, and J. L. Russel. 1986, 6p
Grants NAG5-82, NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 303, p791-796, 15 Apr 86.

Keywords: *Interstellar matter, Hydrogen, Deuterium, Ultraviolet spectra, Reprints, Alpha Centauri B star, IUE.

A profile is presented of the Ly alpha emission line of alpha Cen B (K1V,d=1.3 pc), obtained by addition of two IUE small-aperture, high-dispersion images.

700,542
PB86-229283 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Outer Atmosphere of Procyon (alpha CMi F5IV-V): Evidence of Supergranulation or Active Regions.
Final rept.
C. Jordan, A. Brown, F. M. Walter, and J. L. Linsky. 1986, 12p
Grant NAG8-477
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Monthly Notices of the Royal Astronomical Society 218, p465-476 1986.

Keywords: Ultraviolet spectra, X rays, Granulation, Reprints, *Procyon star, Stellar chromospheres, Stellar coronas, X ray astronomy, Stellar activity.

Observations made with the Einstein X-ray observatory and EXOSAT have shown Procyon(alpha CMi) to have a measurable X-ray flux. The flux observed is similar to the upper limits previously reported. The authors discuss the interpretation of the X-ray data in the context of models made previously by Brown & Jordan based on spectra obtained with the IUE satellite.

700,543
PB86-229291 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Ultraviolet, Optical, Infrared, and Microwave Observations of HR 5110.
Final rept.
I. R. Little-Marenin, T. Simon, T. R. Ayres, N. L. Cohen, P. A. Feldman, J. L. Linsky, S. J. Little, and R. Lyons. 1986, 11p
Grant NAG5-82
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 303, n2 p780-790, 15 Apr 86.

Keywords: *Binary stars, Ultraviolet spectra, Reprints, Late stars, Algol system, IUE.

HR 5110 is a close binary system which is viewed nearly pole-on (i=13 deg). A comparison of the characteristics of Algol and RS CVn systems to those of HR 5110 shows that HR 5110 can also be considered an Algol system. Because the primary star is relatively cool (F21V) and there is no apparent emission from an accretion disk, the authors are able to detect in IUE spectra the emission of an active chromosphere and transition region of the cooler (K0 IV) secondary. HR 5110 is important because it is the only known Algol

system for which the properties of the secondary star can be studied in detail.

700,544
PB86-230786 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Magnetic Field of the BY Draconis Flare Star EQ Virginis.
Final rept.
S. H. Saar, J. L. Linsky, and J. M. Beckers. Mar 86, 8p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 302, n2 p777-784, 15 Mar 86.

Keywords: Reprints, *Flare stars, *Stellar magnetic fields, Late stars, EQ Virginis star.

A new Zeeman analysis procedure, which includes radiative transfer effects and compensation for blends, was applied to high-resolution, high-signal-to-noise line profiles of the BY Draconis-type flare star EQ Vir obtained with the Multiple Mirror Telescope. Using a number of lines with effective Lande g factors ranging from 0.5 to 2.5, and two different analysis methods, the authors found a mean field of 2500 + or - 300 G covering 80% + or - 15% of EQ Vir.

700,545
PB86-230794 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Unraveling the Oldest and Faintest Recovered Nova: CK Vulpeculae (1670).
Final rept.
M. M. Shara, A. F. Moffat, and R. F. Webbink. 1985, 15p
Grants NSF-AST79-21073, NSF-AST80-18859
Sponsored by National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 294, n1 p271-285 1985.

Keywords: *Binary stars, *Novae, Variable stars, Nebulae, Reprints, CK vulpeculae star.

A narrow-band H(alpha) + (N II) CCD image of the field of Nova CK Vul (1670) shows nebulosity with a morphology (suggestive of equatorial ejection) with several bright subcondensations, and a central star. The net H(alpha) image also reveals a faint jet leading to an H(alpha)-bright knot, suggestive of polar ejection.

700,546
PB87-109716 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Molecular Thermal Emission and Its Relationship to Circumstellar Absorption, Stellar Absorption, and Stellar Emission in Red Variables.
Final rept.
G. Wallerstein. 1979, 13p
Pub. in Changing Trends in Variable Star Research IUE Colloq. 46, p177-189 1979.

Keywords: Absorption, Stars, Carbon monoxide, Shock waves, Silicon oxides, *Thermal emission, Long period variables, Chi Cygni star, T cepheid star, Mass loss, Stellar mass ejection.

Radial velocity data obtained from thermal SiO and CO as well as various optical features such as photospheric absorption lines, circumstellar features, and shock excited emission lines are assembled. Three types of stars: long period variables, supergiant M stars and semi-regular stars of late spectral type are included. The data are discussed to establish the motion of each layer with respect to the center of the star. For two stars, Chi Cygni and T Cepheid the data are discussed in considerable detail on the basis of spectrograms of very high depression.

700,547
PB87-109724 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Bright Pre-Main Sequence Variable HR 5999.
Final rept.
P. S. The, H. R. E. Tjin A Djie, A. Brown, C. Catala, V. Doazan, F. L. Linsky, R. Mewe, F. Praderie, A. Talavera, and C. Zwaan. 1985, 19p
Pub. in Irish Astronomical Jnl. 17, n2 p79-97 1985.

Keywords: *Variable stars, Reprints, *HR 5999 star, Stellar winds, Stellar chromospheres.

The bright and variable Herbig A7e star HR 5999 (V = 6.8 - 8.0) provides an excellent opportunity to make a detailed study of the properties and behavior of a massive (Approx. 3 M sub o) solar masses star in the quasi-hydrostatic equilibrium phase of its contraction towards the main sequence. Because of the irregular variability of the star, it is necessary to make coordinated (if possible simultaneous) observations in a wide range of wavelengths in order to delineate the relationship between the various observable quantities of its atmosphere (coulors, emission-line fluxes, wind velocities, etc.) before a dynamical model of the extended atmosphere can be developed. Recently a group of observers joined efforts to make coordinated EXOSAT, IUE and ground-based observations of HR 5999. The observations took place around 11 September 1983. After the observations were reduced, this group met on 7 May 1984 in Amsterdam to discuss these and previous observations. A summary of that meeting is presented.

700,548
PB87-111084 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Stellar Chromospheres, Coronae, and Winds: Present Status and Implications for Solar Astrophysics.
Final rept.
J. L. Linsky. 1981, 11p
Contract NAG5-82, Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Workshop on Precision Doppler Velocity Measurements in Astronomy Solar Instrumentation--What's Next, Sunspot, New Mexico, October 14-17, 1980, p180-190 1981.

Keywords: Chromosphere, Solar corona, Solar wind, *Stellar chromospheres, *Stellar coronas, *Stellar winds, Early stars, Late stars, IUE, HEAO 2.

Some of the important new results that are rapidly emerging from studies with the IUE and Einstein Observatories concerning the existence and properties of stellar chromospheres, coronae, and winds are reviewed, briefly. These results are radically altering our understanding of the outer atmospheres of late-type and early-type stars. They are also raising fundamental questions that can only be answered by new high resolution studies of the Sun. In a sense our vigorous pursuit of the solar stellar connection is about to complete a full circle in which studies of solar phenomena in stars have led to the posing of fundamental questions in astrophysics that require renewed studies of the Sun, but from a stellar perspective. In the paper the author lists a number of these fundamental questions for which well conceived Solar Optical Telescope (SOT) and ground-based observing programs can begin to provide answers.

700,549
PB87-128211 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Observations of Interstellar HI toward Nearby Late-Type Stars.
Final rept.
W. B. Landsman, R. C. Henry, H. W. Moos, and J. L. Linsky. 1984, 4p
Pub. in National Aeronautics and Space Administration Conference Publication, v2345 p60-63 1984.

Keywords: *Interstellar matter, Ultraviolet spectra, OAO 3, IUE.

High-dispersion Copernicus and IUE observations of chromospheric Ly alpha emission are used to study the distribution of HI in the local interstellar medium. Interstellar parameters are derived toward 3 stars within 5 pc of the sun, and upper limits are given for the Ly alpha flux from 9 other stars within 10 pc.

700,550
PB87-128237 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
IUE (International Ultraviolet Explorer) High-Dispersion Cool-Star Atlas.
Final rept.
T. R. Ayres, E. W. Brugel, J. L. Linsky, A. Brown, and K. G. Carpenter. 1986, 3p
Pub. in Proceedings of Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun (4th), Sante Fe, NM., October 16-18, 1985, p106-108 1986.

Keywords: Ultraviolet spectra, Atlases, *Cool stars, Late stars, Stellar chromospheres, IUE.

The authors are planning to compile a spectral atlas based on high-dispersion images of representative late-type stars recorded by the International Ultraviolet Explorer. They solicit advice from the ultraviolet community concerning how best to present the spectral material.

700,551
PB87-128245 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Precise Measurements of Radial Velocities of Far-Ultraviolet Emission Lines in Stars of Late Spectral Type.
Progress rept.
T. Ayres, O. Engvold, E. Jensen, and J. L. Linsky. 1986, 3p
Pub. in Proceedings of Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun (4th), Santa Fe, NM., October 16-18, 1985, p94-96 1986.

Keywords: Ultraviolet spectra, Far ultraviolet radiation, Emission spectra, *Beta draconis star, *Supergiant stars, Late stars, Stellar chromospheres, Radial velocity, IUE.

Recent high-dispersion, far-ultraviolet IUE spectra of the G-type supergiant beta Draconis contain evidence for organized, persistent downflows of gas, apparently confined to a high-density component of the stellar transition zone.

700,552
PB87-128252 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
What Stellar or Solar Radio Observations Teach Us about the Sun or Stars.
Final rept.
D. M. Gibson. 1986, 15p
Pub. in Proceedings of INDO/US Workshop on Solar Terrestrial Physics (2nd), New Delhi (India), January 30-February 3, 1984, p43-57 1986.

Keywords: *Solar radio emission, *Solar flares, Solar corona, Extraterrestrial radio waves, *Stellar flares, Stellar coronae, Stellar radiation.

Stellar analogs of solar microwave emissions are but one aspect of the solar stellar connection (SSC). In the paper, the author summarizes these observations, and shows how application of the SSC allows us to obtain fundamental insights into two important aspects of solar and stellar activity-flares and activity cycles.

700,553
PB87-128260 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Advanced X-ray Astronomical Facility (AXAF): A Powerful New Tool for Probing Stellar Coronae.
Final rept.
J. L. Linsky, and M. C. Weisskopf. 1986, 3p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun (4th), Sante Fe, NM., October 16-18, 1985, p250-252 1986.

Keywords: X ray spectra, *X ray astronomical facility, *X ray astronomy, *Stellar coronae.

AXAF, the next major step in NASA's program for X-ray astronomy, is presently in its Phase B definition and design phase and could be launched as early as 1993. The AXAF will be a long duration (> 15 years) national observatory with a majority of the observing time set aside for guest investigators. AXAF will have a grazing incidence telescope consisting of six nested Wolter type I paraboloid-hyperboloid mirror pairs ranging in diameter from 0.6 to 1.2 m, and a complement of powerful imaging and spectroscopic instruments. The telescope will have an angular resolution of 0.5 arcsecond, collecting area of 1700 sq cm, and significant energy response up to 10 keV. These characteristics and the modern instruments result in AXAF being a far more powerful observatory than HEAO-2 (Einstein) for probing stellar coronae.

700,554
PB87-128740 Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Transition Regions of Warm Stars.
Final rept.
F. M. Walter, and J. L. Linsky. 1986, 3p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun (4th), Santa Fe, NM., October 16-18, 1985, p50-52 1986.

Keywords: *Stars, Stellar chromospheres, Stellar coronae, Stellar magnetic fields.

There is a fundamental difference between the hot and cool stars. The former have convective envelopes, which manifest themselves in solar-like, magnetically driven activity, whereas the latter winds have radiatively-driven winds and exhibit different kinds of nonthermal activity. The transition occurs in the late-A or early F dwarfs. Theoretical considerations imply that the convective zone becomes thin in the early F dwarfs, and should effectively disappear by B-V = 0.30. Observations of stellar activity near this color should permit verification of the disappearance of the convective zone, as the convectively driven stellar activity might be expected to disappear as well. Furthermore, measurements of parameters for this activity may yield greater understanding of the convective zone and stellar dynamos.

700,555
PB87-128757 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Time Variability of Magnetic Fields on Epsilon Eridani.
Final rept.
S. H. Saar, J. L. Linsky, and D. K. Duncan. 1986, 3p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun (4th), Santa Fe, NM., October 16-18, 1985, p275-277 1986.

Keywords: *Stars, *Stellar magnetic fields, Epsilon Eridani star, Time dependence.

Since the first detections of magnatic fields on late-type dwarfs, the derived magnetic parameters have almost entirely been 'snapshots' of a given star's magnetic activity. Little is known about the distribution of fields with phase or their time evolution on any star other than the Sun. The authors have begun a synoptic program of stellar magnetic field measurements using the NSO McMath echelle/Reticon system to search for both rotational modulation of active regions and the growth and decay of magnetic areas with time. Both the area filling factor of active regions and the mean magnetic field in these regions are measured. The authors present some initial results from the program.

700,556
PB87-128765 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Further Observations of Magnetic Fields on Active Dwarf Stars.
Final rept.
S. H. Saar, and J. L. Linsky. 1986, 3p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun (4th), Santa Fe, NM., October 16-18, 1985, p278-280 1986.

Keywords: *Dwarf stars, *Stellar magnetic fields.

In previous studies, about 20 detections of field strengths (B) and surface area coverages (f) on some 35 stars have been made, using techniques pioneered by Robinson and Marcy. Surface averaged fields for the active G and K stars are typically about 700 G. Recent discoveries of fields on very chromospherically active flare and BY Draconis stars, however, reveal that these stars generate substantially more magnetic flux (<B>approx=2-3000 G). Extending this work, the authors present here photospheric magnetic field measurements for five more very active dwarfs.

700,557
PB87-128773 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
HR 5110: An Algol System with RS CVn Characteristics.
Final rept.
I. R. Little-Marenin, J. L. Linsky, and T. Simon. 1986, 3p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun (4th), Santa Fe, NM., October 16-18, 1985, p247-249 1986.

Keywords: *Binary stars, Ultraviolet spectra, IUE.

HR 5110 (HD 118216=BH CVn) is a close binary system which is viewed nearly pole-on (i=13 degrees). A comparison of the characteristics of Algol and RS CVn systems to those of HR 5110 shows that HR 5110 can also be considered an Algol system. Because the primary star is relatively cool (F2 IV) and there is no apparent emission from an accretion disk, the authors are able to detect in IUE spectra the emission of an active chromosphere and transition region of the cooler secondary. HR 5110 is the only known Algol system for which the properties of the secondary star can be studied in detail.

700,558
PB87-134185 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Intrinsic Parameters of Hot Blue Stars.
Final rept.
R. P. Kudritzki, and D. G. Hummer. 1986, 16p
Pub. in Luminous Stars and Associations in Galaxies, p3-18 1986.

Keywords: Stellar atmospheres, Galaxies, Reprints, *Hot stars, *Blue stars.

Advances in both theoretical understanding and observational capabilities in the past few years have made possible the determination of the effective temperature, surface gravity, and chemical abundance of massive stars with unprecedented accuracy. These data are in turn important for the study of galaxies, as stars are important sources of information concerning the evolutionary state, past and present chemical composition, and distance of the parent galaxy. In addition to this diagnostic role, stars are crucial as sources of light, matter, and metals in the galaxy. Thus an improved understanding of massive stars makes possible a better determination of the physical conditions in a galaxy as well as a deeper understanding of how it functions.

700,559
PB87-153680 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Photospheres of Hot Stars. 2. An Analysis of Zeta Puppis.
Final rept.,
B. Bohannan, D. C. Abbott, S. A. Voels, and D. G. Hummer. 1986, 8p
Grant NSF-AST85-05919
See also Part 1, PB86-102464. Sponsored by National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 308, n2 p728-735, 15 Sep 86.

Keywords: *Stellar atmospheres, Stellar evolution, Photosphere, Reprints, *Zeta Puppis star, Hot stars, Stellar winds.

High signal-to-noise ratio line profiles of zeta Puppis (O4f) obtained with a CCD camera are compared with theoretical model atmospheres that include radiation scattered back from the stellar wind onto the photosphere, an effect referred to as wind blanketing. Comparison with tracks of stellar evolution with mass loss suggests that zeta Puppis was initially a 70-90 solar mass star.

700,560
PB87-153730 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Observed and Computed Stellar Line Profiles: The Roles Played by Partial Redistribution, Geometrical Extent and Expansion.
Final rept.,
J. L. Linsky. 1985, 26p
Grant NGL-06-003-057, Contract NAG5-82
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in NATO Advanced Study Institutes Series C, Prog. Stellar Spectral Line Form 152, p1-26 1985.

Keywords: Ultraviolet spectra, Reprints, *Stellar radiation, *Stellar chromospheres, Stellar winds, Late stars.

Partial redistribution (PRD) radiative transfer is reviewed, with emphasis on the complex interaction of observations and theoretical predictions of spectral line shapes. Work is summarized that has led to 'realistic' plane parallel static chromospheric models for the Sun and other late-type stars, with emphasis on the determination of the temperature minimum at the base of the chromosphere and the physical basis for resonance line limb darkening, the brightness of the line wings, and the width of the emission features. The various roles played by atmospheric extension and expansion (winds) in determining resonance line profile shapes are discussed and the existing PRD calculations for late-type stars are summarized.

700,561
PB87-163671 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
VLA Radio-Continuum Survey of a Sample of Confirmed and Marginal Barium Stars.
Final rept.,
S. A. Drake, T. Simon, and J. L. Linsky. Jan 87, 5p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astronomical Jnl. 91, n1 p163-167 Jan 87.

Keywords: *Stars, *Radio sources(Astronomy), Radio astronomy, Identifying, Reprints, *Barium stars, Mass loss.

The authors describe a 6 cm VLA survey of five confirmed Ba II stars and eight mild Ba II stars.

700,562
PB87-163796 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Ultraviolet and Optical Variability of RY Tauri.
Final rept.,
A. Brown, J. L. Linsky, S. A. Drake, and W. Herbst. 1986, 3p
Contract NAG5-82
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Conference on New Insights in Astrophysics, London, England, July 14-16, 1986, p177-179.

Keywords: *Stars, Emission spectra, Ultraviolet spectra, Variability, Magnesium, *RY Tau star, *T Tauri stars, Stellar chromospheres, Stellar winds, IUE.

Ultraviolet and optical observations of the T Tauri star RY Tau show evidence for strong variability over the past two years. High dispersion IUE observations of the Mg II emission line profiles show significant changes in the wind of RY Tau, with the wind absorption almost disappearing on 1986 March 20. The behavior of the emission line flux variability when compared to the optical light curve shows evidence for both changes in circumstellar extinction and changes in starspot/plage distribution on the visible hemisphere of the star.

700,563
PB87-163804 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
High Dispersion IUE Observations of Hybrid-Chromosphere Stars.
Final rept.,
A. Brown, D. Reimers, and J. L. Linsky. 1986, 4p
Contract NAG5-82
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Conference on New Insights In Astrophysics, London, England, July 14-16, 1986, p169-172.

Keywords: *Stars, Emission spectra, Magnesium, *Stellar winds, Stellar chromospheres, IUE.

High dispersion, wavelength calibrated IUE spectra of the hybrid-chromosphere stars alpha TrA (K2 IIb-IIa) and gamma Ag1 (K3 II) are presented. These observa-

tions allow accurate measurement of the wind terminal velocities as seen in the Mg II emission line profiles.

700,564
PB87-163838 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Microwave Continuum Measurements and Estimates of Mass Loss Rates for Cool Giants and Supergiants.
Final rept.,
S. A. Drake, and J. L. Linsky. 1986, 7p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Irish Astronomical Jnl. 17, n3 p288-294 1986.

Keywords: *Giant stars, Radio sources(Astronomy), Radio astronomy, Microwaves, Reprints, *Supergiant stars, *Mass loss, Stellar chromospheres, Late stars.

The authors briefly summarize the results of a sensitive 6 cm radio continuum survey made with the NRAO Very Large Array of 39 of the nearest, single cool giants and supergiants with spectral types GO-M5. A detailed description of this survey will appear in a forthcoming paper (Drake and Linsky 1986). Our goal was to obtain accurate measurements of the mass loss rates of ionized gas for a representative sample of such stars to provide constraints upon and a better understanding of the total mass loss rates. These data should also be valuable in determining the mass loss mechanism for such stars.

700,565
PB87-163846 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Modelling Extended Chromospheres.
Final rept.,
J. L. Linsky. 1986, 9p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in the Irish Astronomical Jnl. 17, n3 p343-351 1986.

Keywords: *Stars, Ultraviolet spectra, Reprints, *Stellar chromospheres, Mass loss, Radiative transfer.

The author discusses calculations by Drake and by Drake and Linsky for the Mg II k line of Arcturus (alpha Boo, K2 III), assuming a spherically-symmetric chromosphere, two level mg(H+) ion, and angle-averaged R(II-A) (x',x) redistribution functions. These calculations were based on an original program by Paul Kunasz and modified to include partial redistribution of this particular type.

700,566
PB87-163853 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Where Do Flares Occur in RS CVn Systems - Analysis of the October 3, 1981 Flare on V711 Tau = HR 1099 Observed by IUE.
Final rept.,
J. L. Linsky, J. E. Neff, B. D. Gross, T. Simon, A. D. Andrews, and M. Rodono. 1986, 4p
Contract NAG5-82
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Conference on New Insights in Astrophysics, London, England, July 14-16, 1986, p161-164.

Keywords: *Binary stars, *Stellar flares, Stellar chromospheres, IUE.

The authors report on a unique set of observations of V711 Tau = HR 1099 (K1 IV and G2 V) in which high-resolution spectra with both the SWP and LWR cameras were obtained during the luminous flare of October 3, 1981. Multi-gaussian fits to the Mg II k and C IV 1548 A lines are consistent with the flare radial velocity being identical to that of the K star. Thus, the flare probably occurred on the K star. No evidence was found for flows as were previously seen during a flare on UX Ari.

700,567
PB87-165668 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Review of the Ultraviolet Studies of Galactic Novae.
Final rept.,
S. Starrfield. 1986, 7p
Pub. in Proceedings of Conference on New Insights in Astrophysics, London, England, July 14-16, 1986, p239-245.

Keywords: *Novae, Ultraviolet spectra, White dwarf stars, Ultraviolet astronomy, IUE.

The ultraviolet studies of galactic novae both in outburst and also in quiescence have provided new and fundamental data on these exploding stars. As a direct result of the IUE spectral studies, the authors have identified a new class of novae in which the outburst occurs on an ONeMg white dwarf. The authors have also been able to determine ejected masses, elemental abundances, and ultraviolet light curves for a wide variety of nova outbursts.

700,568
PB87-165700 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Proposed LYMAN Far Ultraviolet Spectroscopic Explorer.
Final rept.,
J. L. Linsky. 1986, 13p
Pub. in Proceedings of Conference of New Insights in Astrophysics, London, England, July 14-16, 1986, p537-549.

Keywords: Ultraviolet spectroscopy, Far ultraviolet radiation, *Ultraviolet astronomy.

Summarized here are the scientific and technical ideas presented in the proposal for the LYMAN Far Ultraviolet Spectroscopic Explorer in response to NASA's Dear Colleague Letter for Explorer Concepts. LYMAN is designed to answer a broad range of exciting questions in astrophysics that require high resolution, high sensitivity spectroscopy in the 912-1200 A band and in the EUV, which cannot be answered by other means.

700,569
PB87-165718 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
HRS GTO Program to Study the Neutral Hydrogen Column Density and D/H Ratio in the Local Interstellar Medium.
Final rept.,
J. L. Linsky, W. B. Landsman, B. D. Savage, S. R. Heap, A. M. Smith, and J. C. Brandt. 1986, 4p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Advances of Space Research 6, n2 p91-94 1986.

Keywords: *Interstellar matter, Ultraviolet spectra, Deuterium, Hydrogen, Reprints.

Early in the HST mission the HRS Team will observe the Lyman alpha line at 100,000 spectral resolution toward 7 late-type local stars. The purpose is to derive the hydrogen and deuterium column densities and D/H ratios along lines of sight toward nearby stars. Here they present theoretical line profiles that demonstrate why 100,000 spectral resolution and high signal-to-noise are needed to derive accurate column densities from spectral lines that lie close to the flat part of the curve of growth and may contain multiple velocity components. The aim of the HRS program is to obtain column densities in the hydrogen and deuterium Lyman alpha lines along a variety of lines of sight within and extending beyond the local cloudlet in which the Sun is located near an edge.

700,570
PB87-173688 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
High-Dispersion Observations of Alpha Bootis (K1 III) with the International Ultraviolet Explorer.
Final rept.,
T. R. Ayres, P. Judge, C. Jordan, A. Brown, and J. L. Linsky. 15 Dec 86, 13p
Grants NAG5-82, NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 311, n2 p947-959, 15 Dec 86.

Keywords: *Stars, Ultraviolet spectra, Reprints, *Arcturus star, *Alpha Bootis star, Stellar chromospheres, Late stars, IUE.

The authors have taken very deeply exposed echelle spectrograms of the bright red giant Arcturus (K1 III) using the International Ultraviolet Explorer. They have combined their new observations with existing material from the Archives of the IUE to construct high-quality tracings of important regions of the vacuum ultraviolet spectrum of the archetype early-K giant.

700,571
PB87-173704 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Rotational Modulation and Flares on RS CVn and BY Dra-Type Stars I. Photometry and Spot Models for BY Dra, AU Mic, AR Lac, II Peg and V711 Tau (=HR 1099).
Final rept.,
M. Rodono, G. Cutispoto, V. Pazzani, S. Catalano, P. B. Byrne, J. G. Doyle, C. J. Butler, A. D. Andrews, C. Blanco, E. Marilli, J. L. Linsky, F. Scaltriti, and M. Busso. 1986, 22p
Pub. in Astronomy and Astrophysics 165, p135-156 1986.

Keywords: *Stellar atmospheres, Variable stars, Binary stars, Photometry, Reprints, *Starspots, Late stars, Stellar flares.

The authors present multi-color wide-band photometry of five active stars obtained as part of a coordinated radio, optical and IUE program aimed at studying spatial and temporal correlations among activity phenomena at various atmospheric levels. The observations were carried out at several places before, during and after the period of IUE observations (3-8 August 1980 and 1-7 October 1981) for the purpose of determining the location, sizes and evolution of photospheric spots at the time when chromospheric, transition region and coronal activity data were obtained from UV and radio observations.

700,572
PB87-179446 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Torsionally Excited Methanol in Hot Molecular Cloud Cores.
Final rept.,
K. M. Menten, C. M. Walmsley, C. Henkel, T. L. Wilson, L. E. Snyder, J. M. Hollis, and F. J. Lovas. 1986, 10p
Grant NATO-731
Sponsored by North Atlantic Treaty Organization, Brussels (Belgium).
Pub. in Astronomy and Astrophysics 169, p271-280 1986.

Keywords: *Methyl alcohol, *Interstellar matter, Reprints, *Molecular clouds, *Methanols.

The authors report the detection of centimeter lines of torsionally excited methanol (CH3OH) towards four galactic molecular cloud sources using the Effelsberg 100-m telescope. It is shown that for the sources observed, radiative and collisional excitation are both capable of populating the torsionally excited levels.

700,573
PB87-180923 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Formation of a Solar Coronal Transient with Forerunner.
Final rept.,
E. B. Gliner, and V. A. Osherovich. 1987, 11p
Pub. in Astrophysical Jnl. 312, n1 p412-422, 1 Jan 87.

Keywords: *Solar corona, Magnetohydrodynamics, Solar magnetic fields, Transients, Reprints.

A model of a solar coronal transient in the course of its formation is constructed. The main idea is that the formation of a coronal transient occurs at a quasi-stationary state of the solar atmosphere as a result of the interaction of weak coronal currents with a slowly growing magnetic field originating below the future transient area. The explanation of forerunner formation which takes place much before the appearance of the transient itself is one of the verification of the model. The application of the model to the transient event of 1974 January 10 demonstrates the reasona-

ble values of model parameters for reproducing the observed columnar density distribution. An analytical technique, based on using exact analytical solution of the plasma equilibrium equation, is explained in detail.

700,574
PB87-201729 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Three Remarkable 6-cm Flares on YZ Canis Minoris.
Final Rept.,
D. M. Gibson. 1984, 7p
Pub. in Proceedings of Southwest Regional Conference for Astronomy and Astrophysics, Fort Davis, TX., May 14, 1983, v9 p35-41 1984.

Keywords: Radio astronomy, Circular polarization, *YZ Canis Minoris star, *Flare stars.

The dM3.5e flare star, YZ CMi, was observed at 6, 20, and 21-cm on 1982 October 26 as part of a continuing effort to monitor flare stars for both quiescent and flaring emission. The six-hour observing run was notable for three flares which occurred at 6-cm. No comparable activity was seen at the longer wavelengths.

700,575
PB87-219044 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Non-LTE Analysis of Massive Stars in the Magellanic Clouds.
Final rept.,
T. Gehren, D. Husfeld, R. P. Kudritzki, P. S. Conti, and D. G. Hummer. 1986, 2p
Pub. in Luminous Stars and Associations in Galaxies, p413-414 1986.

Keywords: Helium, Abundance, Reprints, *Magellanic Clouds, Early stars, Hot stars, Stellar temperature.

The effective temperatures, surface gravities, and helium abundances of six main-sequence O-type stars, obtained by fitting non-LTE model atmospheres to high quality spectra are presented. These are the first results from a long-term program to determine accurately the parameters and chemical abundances of massive stars in the Magellanic Clouds.

700,576
PB87-219077 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Acceleration of Charged Particles at Relativistic Shock Fronts.
Final rept.,
J. G. Kirk, and P. Schneider. 1987, 9p
Grant NSG-7128
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 315, n2 p425-433, 15 Apr 87.

Keywords: *Cosmic rays, Reprints, *Particle acceleration, Relativistic range, Cosmic radio sources, Galactic nuclei.

The diffusive acceleration of highly relativistic particles at a shock is reconsidered. Using the same physical assumptions as Blandford and Ostriker, but dropping the restriction to nonrelativistic shock velocities, we find approximate solutions of the particle kinetic equation by generalizing the diffusion approximation to higher order terms in the anisotropy of the particle distribution. The general solution of the transport equation on either side of the shock is constructed, which involves the solution of an eigenvalue problem. By matching the two solutions at the shock, the spectral index of the resulting power law is found by taking into account a sufficiently large number of eigenfunctions. Low-order truncation corresponds to the standard diffusion approximation and to a somewhat more general method described by Peacock. In addition to the energy spectrum, our method yields the angular distribution of the particles and its spatial dependence.

700,577
PB87-219085 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Non-Adiabatic Analysis of Low-Frequency Oscillations of Uniformly Rotating Stars.
Final rept.,
U. Lee, and H. Saio. 1987, 9p
Pub. in Monthly Notices of the Royal Astronomical Society 225, p643-651 1987.

Keywords: *Variable stars, Reprints, *Stellar oscillations.

Solving linear differential equations of fully non-adiabatic non-radial oscillations, the authors examined the stability of low-frequency oscillations of uniformly rotating massive main-sequence stars. They found that the dynamically overstable convective modes coupled with higher order g modes in the envelope remain overstable in the full non-adiabatic analysis. The amplitude of such mixed-mode oscillations is large both in the core and in the envelope. This result supports the suggestion based on an adiabatic analysis that such mixed-mode oscillations are responsible for the oscillations in the variable B stars.

700,578
PB87-220513 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Chromospheres and Coronae of Five G-K Main-Sequence Stars.
Final rept.,
C. Jordan, T. R. Ayres, A. Brown, J. L. Linsky, and T. Simon. 1987, 35p
Contract NAG5-82
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Monthly Notices of the Royal Astronomical Society 225, p903-937 1987.

Keywords: Ultraviolet spectra, Reprints, *Stellar chromospheres, *Stellar coronae, Cosmic x-ray sources, Late stars, IUE.

Five main-sequence stars (chi sup 1) Ori (GOV), alpha Cen A (G2V), xiBooA (G8V), alpha Cen B (KOV) and epsilon Eri (K2V) have been observed at low and high dispersion with the International Ultraviolet Explorer (IUE) satellite. The data obtained and X-ray observations reported in the literature are used here to make models of the structure of the atmospheres of these stars, from the high chromosphere to the corona. The electron pressures and coronal temperatures in these stars range from being similar to those in the quiet solar atmosphere (alpha Cen A) to the higher values found more typically in solar active regions (e.g., (chi sup 1)Ori, xi Boo A).

700,579
PB87-220554 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
New Measurements of Photospheric Magnetic Fields in Late-Type Stars and Emerging Trends.
Final rept.,
S. H. Saar, and J. L. Linsky. 1986, 4p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Adv. Space Res. 6, n8 p235-238 1986.

Keywords: *Stellar atmospheres, Measurement, Reprints, *Stellar magnetic fields, Late stars.

The authors report on recent results of their program to measure photospheric magnetic field strengths and filling factors from the analysis of unpolarized high spectral resolution and S/N line profiles. They have analyzed spectra obtained with the KPNO 4-m FTS, the MMT, and the McMath Reticon Spectrograph. With the latter instrument they now have an extensive data set through their synoptic and survey observing programs. Photospheric magnetic field parameters are obtained by comparison of observed and theoretical line profiles using a LTE code that includes line saturation and the full Zeeman pattern.

700,580
PB87-220562 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Linear Thermal Stability Analysis for the Vertical Structure of Alpha Model Accretion Disks.
Final rept.,
H. Saio, J. K. Cannizzo, and J. C. Wheeler. 15 May 87, 5p
Pub. in Astrophysical Jnl. 316, n2 p716-720, 15 May 87.

Keywords: Thermal stability, Reprints, *Accretion disks, *Star accretion, *Dwarf novae.

Linear equations are derived that describe the thermal stability of the convective and radiative vertical structure of an alpha model accretion disk. For a specific model chosen to be representative of a dwarf nova disk the authors find that the eigenfunction for the temperature, T, shows large excursions in the zone of partial ionization, but that the eigenfunctions for the unstable fundamental mode perturbations of the vertical distance, z, and flux, F(z), are nearly constant over the vertical extent of the disk. The growth of any instability is thus nearly homologous and the stability criteria derived for vertically averaged structures represent an adequate approximation.

700,581
PB87-222956 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Narrow-Angle Tail Radio Sources and the Distribution of Galaxy Orbits in Abell Clusters.
Final rept.,
C. P. O'Dea, C. L. Sarazin, and F. N. Owen. 1987, 14p
Pub. in Astrophysical Jnl. 316, p113-126, 1 May 87.

Keywords: *Radio sources(Astronomy), *Galaxies, Clustering, Cosmology, Reprints.

The distribution of the orientation of the tails of narrow-angle tail (NAT) radio sources can be used to constrain the distribution of galaxy orbits in clusters. In the paper, the authors present data on the orientations of the tails with respect to the cluster centers of a sample of 70 NATs in Abell clusters. They consider the whole sample as well as subsamples of sources based on projected distance from the cluster center and on cluster morphology.

700,582
PB87-223707 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
High Magnetic Reynolds Number Dynamo.
Final rept.,
F. W. Perkins, and E. G. Zweibel. Apr 87, 6p
Contract NASW-91
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Physics of Fluids 30, n4 p1079-1084 Apr 87.

Keywords: *Solar magnetic fields, Magnetohydrodynamics, Reprints.

A boundary-layer solution to a high magnetic Reynolds number R periodic dynamo model shows that: (1) flux expulsion forces the magnetic field into flux sheets; (2) the principal contribution to the alpha effect arises from regions of flow stagnation along a flux sheet; and (3) the alpha effect scales as 1/the square root of R. Arguments for these effects persisting in turbulent dynamos are given.

700,583
PB87-223715 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Off-Center Ignition of Nuclear Burning in Merging White Dwarfs.
Final rept.,
Y. Kawai, H. Saio, and K. Nomoto. 1987, 5p
Contract DE-AC02-76CH00016
Sponsored by Department of Energy, Washington, DC.
Pub. in Astrophysical Jnl. 315, p229-233, 1 Apr 87.

Keywords: *Binary stars, Nuclear fusion, Ignition, Reprints, *White dwarf stars.

The ignition of nuclear burning in merging white dwarfs is investigated for various combinations of component stars composed of He, C+O, and O+Ne+Mg. The authors assume that a rapidly accreting white dwarf mimics the massive component of a merging double white dwarf binary system. By computing steady models the authors obtain the location of nuclear ignition as a function of the accretion rate and the mass of accreting stars.

700,584
PB87-223780 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Search For Technetium (Tc II) in Barium Stars.
Final rept.,
I. R. Little-Marenin, and S. J. Little. Jun 87, 3p
Pub. in Astronomical Jnl. 93, n6 p1539-1541 Jun 87.

Keywords: *Technetium, Ultraviolet spectra, Line spectra, Reprints, *Barium stars, IUE, Ultraviolet astronomy.

The authors searched without success for the lines of Tc II at 2647.02, 2610.00 and 2543.24 A in IUE spectra of the barium stars HR 5058, omicron Vir, and zeta Cap. The lack of Te II implies that the observed s-process enhancements were produced more than half a million years ago and supports the suggestion that the spectral peculiarities of barium stars are probably related to the binary nature of the stars.

700,585
PB87-223798 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Investigation of Stellar Coronae with AXAF.
Final rept.,
J. L. Linsky. 1987, 14p
Contract NASA-H-80531B
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astro. Letters and Communications 26, p21-34 1987.

Keywords: X ray spectra, Reprints, *Stellar coronae, Flare stars, Late stars, Cosmic x-ray sources.

While the Einstein and EXOSAT satellites were able to discover many late-type stars as coronal X-ray sources and to study their statistical properties, they were unable to measure the coronal plasma physical parameters for most of these stars. The AXAF spectroscopic instruments will add enormously to the authors understanding of stellar coronal physics as high throughput, angular resolution, and spectral resolution are needed to measure the emission measure-temperature distribution, electron density, emitting volume, and flow velocities. These parameters are essential to model stellar coronae and to understand their energy balance. The author lists some of the fundamental questions of stellar coronal physics and indicate to what extent the different instruments on AXAF will be able to answer these questions.

700,586
PB87-224044 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Hydrodynamic Studies of Oxygen, Neon, and Magnesium Novae.
Final rept.,
S. Starrfield, W. M. Sparks, and J. W. Truran. Jun 87, 5p
Grant NSF-AST83-14788, Contract NASA-NAG5-481
Sponsored by National Science Foundation, Washington, DC., National Aeronautics and Space Administration, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Stellar Pulsations p401-405 Jun 87.

Keywords: *Novae, Oxygen, Neon, Magnesium, Reprints, *White dwarf stars.

In the paper the authors present the results of recent theoretical studies that have examined the properties of nova outbursts on O-Ne-Mg white dwarfs. These outbursts are much more violent and occur much more frequently then outbursts on CO white dwarfs. Hydrodynamic simulations of both kinds of outbursts are in excellent agreement with the observations.

700,587
PB87-224051 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Pulsational Analyses of Post Planetary Nebula Central Stars and Degenerate Dwarfs.
Final rept.,
S. Starrfield. Jun 87, 10p
Grant NSF-AST83-14788, Contract NASA-NAG5-481
Sponsored by National Science Foundation, Washington, DC., National Aeronautics and Space Administration, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Stellar Pulsations p332-341 Jun 87.

Keywords: *Planetary nebulae, *Variable stars, *Dwarf stars, Reprints, Stellar oscillations, Stellar pulsations.

Recent observational and theoretical studies of the ZZ Ceti variables (DA degenerate dwarfs), the DBV variables (DB degenerate dwarfs), and the GW Vir variables (DO degenerate dwarfs) have shown them to be pulsating in nonradial g-modes. The pulsation mechanism has been identified for each class of variable star. For the ZZ Ceti and DBV variables it is both the kappa and gamma effects in the partial ionization regions of either hydrogen or helium and also a recently identified pulsation driving mechanism called 'convection blocking.' For the GW Vir variables, it is the kappa and gamma effects in the partial ionization region of carbon and oxygen.

700,588
PB87-224077 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Low Frequency Oscillations of Uniformly Rotating Stars and a Possible Excitation Mechanism for Variable B Stars.
Final rept.,
U. Lee, and H. Saio. Jun 87, 4p
Pub. in Stellar Pulsation p102-105 Jun 87.

Keywords: *Variable stars, Reprints, *Stellar oscillations, *B stars.

In order to search for the excitation mechanism of variable B star pulsations, the authors have conducted a study of low frequency nonradial oscillations in a uniformly rotating massive main sequence star with a convective core. The first intention of their study was to examine Osaki's mechanism, which was originally proposed for the excitation mechanism of beta Cephei pulsations. Subsequently, they have tried to make clear the general nature of low frequency oscillations of rotating stars. In the paper, they summarize their present theoretical understanding of the properties of low frequency oscillations of rotating stars.

700,589
PB87-233904 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Rotational Modulation and Flares on RS CVn and BY Dra Stars. 6. Physical Parameters of the Chromospheres/Transition Regions of V 711 Tau(HR 1009), II Peg and AR Lac during October 1981.
Final rept.,
P. B. Byrne, J. G. Doyle, A. Brown, J. L. Linsky, and M. Rodono. 1987, 11p
Contract NASA-NAGS-82
See also PB87-173704. Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astronomy and Astrophysics 180, p172-182 1987.

Keywords: *Stellar atmospheres, Variable stars, Binary stars, Photometry, Reprints, *Starspots, Late stars, Stellar flares.

Ground-based optical and IUE satellite-ultraviolet observations of three RS CVn stars are combined with density sensitive line ratios and differential emission measure curves to describe the physical conditions in their outer atmospheres. Solar-like densities are found to be representative of average conditions on two of the stars, V 711 Tau and AR Lac. The authors estimate the total radiative losses from these two stars and find these to be larger than the Sun by at least two orders of magnitude. Consideration of the volume emitting in two of the principal transition region lines suggest a possible relation between the disk 'filling factor' for these two lines and the dynamo-related Rossby number. Only one hemisphere of the star II Peg, the one showing least evidence of starspots, is similar. On the opposite hemisphere the presence of a discrete emitting region is deduced which is almost coincident in phase with the passage of the dominant optical spot group across the visible disk. The dimensions of the region and an illustative interpretation in terms of a large emitting magnetic loop are discussed. The authors compare it to large active region loops on the Sun.

700,590
PB87-233979 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Theory of Transition-Layer Emission Measures and Coronae.
Final rept.,
E. Bohm-Vitense. 15 Jun 87, 10p
Grant NSG-5398
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 317, p750-759, 15 Jun 87.

Keywords: Temperature gradients, Stratification, Reprints, *Stellar coronas, Transition layers.

The authors study the temperature stratification and the emission measures for transition layers and coronae. The transition layers consist of two parts for which the energy balance is quite different. In the upper part of the transition layers, the temperature stratification is governed by heat conduction. In the lower part of the transition layers the temperature stratification is determined by an equilibrium between mechanical flux input and radiative energy losses. The coronal temperatures increase with increasing mechanical flux and damping length in the upper transition zone. For strong stellar winds, here is a noticeable reduction of the coronal temperature due to the wind.

700,591
PB88-111133 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Of Galactic Novae.
Final rept.,
S. Starrfield, and M. A. J. Snijders. 1987, 17p
Contract NAG5-481, Grant NSF-AST83-14788
Sponsored in part by Grant NSF-AST85-16173. Sponsored by Department of Energy, Washington, DC., National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Exploring the Universe with the IUE (International Ultraviolet Explorer) Satellite, p377-393 1987.

Keywords: *Novae, Reviews, White dwarf stars, Ultraviolet astronomy, IUE.

For the past 8 years novae have been studied by the International Ultraviolet Explorer Satellite and it is the purpose of the review to outline the advances made in the understanding of the nova outburst as a result of the ultraviolet observations. There have been more than 10 novae that were studied while in outburst and at least 10 more novae have been studied after they had returned to minimum. The authors have been able to determine elemental abundances, total mass ejected, and ejection speeds as a result of the IUE observations. They have also been able to determine rates of mass ejection by winds and mass accretion through the accretion disk. As a direct result of both ultraviolet and infrared studies, they have recently identified a new class of novae which are ejecting material rich in oxygen, neon, magnesium, and silicon. At the present time there are two bright novae being studied with the IUE satellite.

700,592
PB88-111141 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Chromospheres and Transition Regions.
Final rept.,
C. Jordan, and J. L. Linsky. 1987, 35p
Contract NAG5-82
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Exploring the Universe with the IUE (International Ultraviolet Explorer) Satellite, p259-293 1987.

Keywords: Ultraviolet spectra, *Stellar chromospheres, Cool stars, Late stars, IUE.

The chapter reviews studies on the chromospheres and transition regions of cool stars using the International Ultraviolet Explorer during the years 1978-1986. A bibliography of more than 150 entries is included.

700,593
PB88-120993 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Accurate Determination of the Fine-Structure Intervals in the triplet P Ground States of (13)C and (12)C by Far-Infrared Laser Magnetic Resonance.
Final rept.,
A. L. Cooksy, R. J. Saykally, J. M. Brown, and K. M. Evenson. 1986, 5p
Pub. in Astrophysical Jnl. 309, p828-832, 15 Oct 86.

Keywords: *Carbon 12, *Interstellar matter, Far infrared radiation, Ground state, Abundance, Reprints, *Carbon atoms, *Carbon 13, Fine structure, Laser magnetic resonance.

Accurate values are given for the fine-structure intervals in the triplet P ground state of neutral atomic carbon-12 and carbon-13 as obtained from laser magnetic resonance spectroscopy. The rigorous analysis of (13)C hyperfine structure, the measurement of reso-

nant fields for (13)C transitions at several additional far-infrared laser frequencies, and the increased precision of the (12)C measurements permit significant improvement in the evaluation of these energies relative to earlier work. The results will expedite the direct and precise measurement of these transitions in interstellar sources and should assist in the determination of the interstellar (12)C/(13)C abundance ratio.

700,594
PB88-121157 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
X-ray Sources in Regions of Star Formation. 2. The Pre-Main Sequence G Star HDE 283572.
Final rept.,
F. M. Walter, A. Brown, J. L. Linsky, A. E. Rydgren, F. Vbra, M. Roth, L. Carrasso, P. F. Chugainov, N. I. Shakovskaya, and C. L. Imhoff. 1987, 11p
Contract NAG5-82
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 314, p297-307, 1 Mar 87.

Keywords: Reprints, *X ray stars, T Tauri stars, Stellar chromospheres, Pre-main sequence stars, HDE 283572 star.

The authors have detected HDE 283572, a ninth-magnitude G star 8' south of RY Tau, as a bright X-ray source, and subsequent observations have revealed it to be one of the brightest late-type pre-main-sequence stars. It has a rotation period of 1.5(d) and strong chromospheric and coronal emission yet no evidence for an IR excess or a strong stellar wind. H(alpha) is in absorption. The Li abundance is cosmic. They conclude that HDE 283572 is a 2 solar masses naked T Tauri star. They have calculated simple models of the outer atmospheric structure of HDE 283572 based on the observed ultraviolet and X-ray emission measures.

700,595
PB88-129689 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Star Formation in X-ray Cluster Cooling Flows.
Final rept.,
R. E. White, and C. L. Sarazin. 1987, 9p
Contract NAGW-764, Grant NSF-AST81-20260
Sponsored by National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 318, p612-620, 15 Jul 87.

Keywords: Reprints, *Star formation, X ray sources, Galactic clusters.

At the center of each observed X-ray cluster, cooling flow is a central dominant galaxy accreting up to several hundred solar masses per year from the flow. With such accretion rates, the mass accumulated in a Hubble time by a central galaxy would be comparable to that of the galaxy itself. The authors therefore consider whether these accreting galaxies are formed, substantially or in part, by ongoing star formation in their associated cooling flows. In the paper, the first of a series, the authors derive the basic equations relevant to cooling flows, including the effects of star formation. They developed a local approximation for the star formation rate, based on a detailed thermal instability analysis which shows that the fastest-growing linear flow perturbations are radial, isobaric, and comoving. The prescription for the star formation rate allows analytic solutions to be found for both isobaric and gravity-dominated cooling flows.

700,596
PB88-134580 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
What Is the Essential Physics of Mass Loss from Late-Type Stars.
Final rept.,
J. L. Linsky. 1987, 17p
Grant NGL-06-003-057, Contract NASA-NAG5-82
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Circumstellar Matter, Proceedings of IAU Symposium 122, Heidelberg, Germany, June 23-27, 1986, p271-287 1987.

Keywords: Solar atmosphere, Reviews, Reprints, *Late stars, *Stellar mass, Mass loss, Mira variables, Supergiant stars.

In the review the author considers what clues the data are providing them concerning the mass loss from late-type stars. The author considers in turn, the major classes of mass-loss mechanisms (thermally-driven winds, radiatively-driven winds, and wave-driven winds), and considers whether the empirical mass loss rates and other data are consistent with any of these mechanisms acting alone. It is likely that several mechanisms act together to produce the large mass loss rates in the Mira and non-pulsating M supergiants. Studies of the solar atmosphere suggest that thermal bifurcation driven by molecular condensation instabilities may play a critical role in cooling the atmospheres of luminous cool stars and forming silicate dust. It is possible that several metastable modes of atmospheric structure may exist for a given set of stellar parameters.

700,597
PB88-140165 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
IUE Spectra of Flares on AU Mic.
Final rept.,
C. J. Butler, M. Rodono, and J. L. Linsky. 1986, 4p
See also N87-19203.
Pub. in New Insights in Astrophysics--8 Years of UV Astronomy with IUE, p229-232 1986.

Keywords: *Dwarf stars, Ultraviolet spectra, Reprints, *Au Mic star, *Stellar flares, Stellar activity, Ultraviolet astronomy, IUE.

IUE spectra were obtained in August 1980 through a substantial part of the optical cycle of the BY Draconis-type, spotted M dwarf star, AU Mic. No modulation of the ultraviolet emission line fluxes in antiphase with the optical curve was detected. Simultaneous optical photometry of AU Mic, when available, shows remarkably poor correlation of optical flare strength and ultraviolet emission-line enhancements. In general, the 'flares' detected on AU Mic, show considerable variety in the degree of enhancement in the various emission lines and optical continuum.

700,598
PB88-140173 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Correcting Observed Stellar Lyman Alpha Profiles for the Effects of Interstellar Absorption and Geocoronal Emission.
Final rept.,
J. E. Neff, J. L. Linsky, W. B. Landsman, and K. G. Carpenter. 1986, 4p
Contract NAG5-82
See also N87-19296. Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in New Insights in Astrophysics--8 Years of UV Astronomy with IUE, p669-672 1986.

Keywords: *Dwarf stars, Ultraviolet spectra, Stellar spectra, Absorption, Correction, Reprints, Late stars, Cool stars, Lyman lines, Geocoronal emissions, Ultraviolet astronomy, IUE.

The hydrogen Lyman alpha emission line is one of the most important cooling channels for the outer atmospheres of late-type stars. In cool dwarfs, its flux exceeds the sum of all the other transition region lines combined. Yet, despite its importance, most programs using the International Ultraviolet Explorer (IUE) to study late-type stars have neglected this important diagnostic, due to two observational complications -- geocoronal emission and interstellar absorption. The authors have developed techniques that allow them to compensate for both of these difficulties, and are applying these techniques to a large number of low-resolution IUE spectra of nearby late-type dwarfs.

700,599
PB88-140181 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
IUE Study of the Very Local Interstellar Medium.
Final rept.,
R. C. Henry, J. Murthy, H. W. Moos, W. B. Landsman, J. L. Linsky, A. Vidal-Madjar, and C. Gry. 1986, 4p
See also N87-19271.
Pub. in New Insights in Astrophysics--8 Years of UV Astronomy with IUE, p555-558 1986.

Keywords: *Interstellar matter, Far ultraviolet radiation, Deuterium, Hydrogen, Comparison, Reprints, Late stars, Capella star, Procyon star, Ultraviolet astronomy, OAO 3, IUE.

IUE and Copernicus results are compared, for studies of the very local interstellar medium. Despite its lower resolution, IUE produces results of comparable quality, giving important confirmation of Copernicus results on the density, temperature, turbulence, and deuterium-to-hydrogen ratio in the region within about 10 pc of the sun. The stars observed are in a very low-density quarter of the galaxy: multi-component structure seen in other directions may not be present in the direction of most of the authors observed stars. The exceedingly low densities observed in certain directions encourages the idea that EUV (wavelength <912 A) studies of certain normal stars may be possible.

700,600
PB88-140199 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Activity in Warm Stars: IUE Observations of Early F Dwarfs.
Final rept.,
F. M. Walter, and J. L. Linsky. 1986, 4p
Contract NAG5-429
See also N87-19172. Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in New Insights in Astrophysics--8 Years of UV Astronomy with IUE, p103-106 1986.

Keywords: *Dwarf stars, Emission spectra, Ultraviolet spectra, Reprints, *Stellar activity, Ultraviolet astronomy, IUE.

The authors discuss deep low dispersion, short wavelength IUE observations of 69 F dwarfs ($0.31 = \text{or} < B\text{-}V = \text{or} < 0.52$). They overexposed the long wavelength end of the SWP camera by up to 100 times in order to bring up the weak chromospheric and transition region (TR) emission lines. All but one of the stars observed show evidence for stellar activity, as defined by the presence of large C II and C IV surface fluxes, with fluxes in excess of 100,000 ergs/cm squared/sec. Unlike the situation in stars with $B\text{-}V > 0.45$, they observed no correlation between surface flux and the stellar rotation rate in the early F dwarfs.

700,601
PB88-140207 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
TZ Fornacis--An Eclipsing Capella-Like System Observed with the IUE.
Final rept.,
K. Eriksson, M. Saxner, B. Gustafsson, A. Ayres, J. L. Linsky, and J. Andersen. 1986, 3p
See also N87-19202.
Pub. in New Insights in Astrophysics--8 Years of UV Astronomy with IUE, p225-227 1986.

Keywords: *Binary stars, *Giant stars, Ultraviolet spectra, Emission spectra, Magnesium, Reprints, *Eclipsing binary stars, *TZ Fornacis stars, Late stars, Capella star, Stellar chromospheres, Ultraviolet astronomy, IUE.

Binary systems consisting of two late-type giants are rare, and TZ Fornacis is the only well-studied eclipsing binary with two late-type giants. This allows for accurate determination of e.g. the masses of the components and their evolutionary status. The authors have observed TZ For with the IUE in 1984-86, at orbital phases 0.0, 0.25 and 0.79. Most of the exposures were LWP-HI or SWP-LO. Conclusions are discussed.

700,602
PB88-140868 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Steady State Cooling Flow Models for Normal Elliptical Galaxies.
Final rept.,
C. L. Sarazin, and R. E. White. 1987, 17p
Contract NAGW-764, Grant NSF-AST81-20260
Sponsored by National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Astrophysical Jnl. 320, p32-48, 1 Sep 87.

Keywords: *Galaxies, Interstellar matter, Steady state, Cooling, X rays, X ray spectra, Reprints, *Elliptical galaxies, Flow models, Mass loss.

Recent X-ray observations show that normal elliptical galaxies contain large quantities of hot gas. They present spherically symmetric, steady state inflow models for this gas, which is assumed to be from stel-

Astrophysics

lar mass loss within the galaxy. Particular attention is paid to the boundary conditions on the flow. They calculate the X-ray luminosities, spectra, and surface brightness profiles of a grid of cooling flow models for galaxies spanning a range of optical luminosities. To constrain the amount of dark matter and the rates of energy and mass input in ellipticals, they consider galaxy models with and without dark halos and with various supernova and stellar mass-loss rates. They also consider the effects on the models of outer pressure variations and the inflow of external gas.

700,603
PB88-140876 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Simple Cooling Flow Model for X-ray Coronae Around Elliptical Galaxies.
Final rept.,
C. L. Sarazin. 1986, 6p
Grant NSF-AST81-20260, Contract NAGW-764
Sponsored by National Science Foundation, Washington, DC., and National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Gaseous Halos of Galaxies Workshop, Green Bank, WV., May 30-June 1, 1985, p223-228 1986.

Keywords: *Galaxies, Coronas, X rays, Cooling, *Elliptical galaxies, Flow models.

As a simple model for the x-ray coronae observed around normal elliptical galaxies, the author proposes that the hot gas forms a steady-state cooling flow, in which the gas is heated by ejection from stars and infall and not primarily by supernovae. This model requires that elliptical galaxies have heavy haloes, and that the rate of supernova heating be somewhat smaller than is usually thought. This model naturally reproduces the temperature, x-ray luminosity, and the density distribution of the hot gas.

700,604
PB88-140892 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Particle Acceleration at Shocks: A Monte Carlo Method.
Final rept.,
J. Kirk, and P. Schneider. 1987, 10p
Pub. in Astrophysical Jnl. 322, p256-265, 1 Nov 87.

Keywords: *Cosmic rays, Monte Carlo method, Synchrotron radiation, Shock waves, Reprints, *Particle acceleration, Relativistic range.

A Monte Carlo method is presented for the problem of the acceleration of test particles at relativistic shocks. The particles are assumed to diffuse in pitch angle as a result of scattering off magnetic irregularities frozen into the fluid. Our method involves techniques designed to handle this kind of diffusion efficiently. Several tests are performed using the analytic results available for both relativistic and nonrelativistic shock speeds. They then investigate the acceleration at relativistic shocks under the influence of radiation losses, and include the effects of a momentum dependence in the diffusion coefficient.

700,605
PB88-140918 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron Injection by Relativistic Protons in Active Galactic Nuclei.
Final rept.,
M. Sikora, J. G. Kirk, M. C. Begelman, and P. Schneider. 1987, 5p
Grant NSF-AST83-51997, Contract NAGW-766
Sponsored by National Science Foundation, Washington, DC., and National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 320, pL81-L85, 15 Sep 87.

Keywords: *Galactic cosmic rays, *Cosmic rays, Pair production, Quasars, X rays, Gamma rays, Protons, Electrons, Reprints, *Galactic nuclei, Photon-proton interactions, Cosmic x-ray sources, Particle acceleration.

It is shown that protons with Lorentz factors larger than about one million are cooled very rapidly by collisions with soft photons in the environment of an active galactic nucleus (AGN). Proton-photon collisions result in the production of ultrarelativistic e(+)e(-) pairs and mesons. The latter are predominantly neutral pions, which decay into gamma rays. Such gamma rays interact with soft photons, providing an additional source of ultrarelativistic pairs. As a result of p-gamma interactions, protons cannot be accelerated by the first-order Fermi process (e.g., in strong shocks) beyond some maximum Lorentz factor, which we estimate. If the energy distribution of accelerated protons is sufficiently flat, then most of the energy contained in relativistic protons will be transformed to pairs, and then to radiation. Under these conditions, proton cooling due to p-gamma interactions is much more important than energy losses due to inelastic proton-proton collisions. Pairs produced as a consequence of p-gamma interactions have much higher energies than those attainable through shock acceleration of electrons. These energies are large enough to initiate and sustain the pair cascade process, not only by Compton upscattering of ambient radiation, but also by synchrotron production of gamma rays and direct pair production by electron-photon interactions.

700,606
PB88-151980 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
IUE Observations of Hydrogen and Deuterium in the Local Interstellar Medium.
Final rept.,
J. Murthy, R. C. Henry, H. W. Moos, W. B. Landsman, J. L. Linsky, A. Vidal-Madjar, and C. Gry. 1987, 12p
Pub. in Astrophysical Jnl. 315, p675-686, 15 Apr 87.

Keywords: *Interstellar matter, *Hydrogen, *Deuterium, Ultraviolet spectra, Abundance, Reprints, Late stars, IUE, Procyon star, Altair star, Capella star.

The authors present and analyze high-dispersion IUE observations of the interstellar hydrogen and deuterium Ly(alpha) absorption profiles toward the late-type stars epsilon Eri (3.3 pc), Procyon (3.5 pc), Altair (5.1 pc), Capella (13.2 pc), and HR 1099 (33 pc).

700,607
PB88-152012 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Rotational Modulation and Flares on RS CVn and BY Dra Systems. 2. IUE Observations of BY Draconis and AU Microscopii.
C. J. Butler, J. G. Doyle, A. D. Andrews, P. B. Byrne, J. L. Linsky, P. L. Bornmann, M. Rodono, V. Pazzani, and T. Simon. 1987, 19p
Contract NAG5-82
See also PB87-173704, and PB88-152020. Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astron. Astrophys. 174, p139-157 1987.

Keywords: *Stellar atmospheres, Dwarf stars, Ultraviolet spectra, Variable stars, Reprints, *Starspots, *Stellar flares, Flare stars, Stellar activity, IUE.

IUE spectra were obtained in 1980 August and 1981 October through a substantial part of the optical cycle of two examples of the class of BY Draconis-type, spotted M-dwarf stars, AU Mic and BY Dra. For BY Dra itself, a small rotational modulation of the strong UV emission lines has probably been detected. This may be interpreted as evidence for 'plage-type' regions in the stellar chromosphere which overlie the photospheric spots. For AU Mic no such modulation is evident in the authors data.

700,608
PB88-152020 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Rotational Modulation and Flares on RS CVn and BY Dra Stars. 3. IUE Observations of V711 Tau (=HR1099), II Peg, and AR Lac.
Final rept.,
M. Rodono, P. B. Byrne, J. E. Neff, J. L. Linsky, T. Simon, C. J. Butler, S. Catalano, G. Cutispoto, J. G. Doyle, A. D. Andrews, and D. M. Gibson. 1987, 18p
Contract NAG5-82
See also PB88-152012. Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astron. Astrophys. 176, p267-284 1987.

Keywords: *Stellar atmospheres, Ultraviolet spectra, Variable stars, Reprints, *Stellar flares, *Starspots, Late stars, IUE.

The authors present observations of three RS CVn stars, which were obtained over the stellar rotation cycles with the IUE satellite. Emission lines from high-temperature transition regions and chromospheres analogous to those observed in the solar spectrum were observed. However, the stellar line surface fluxes are hundreds of times the solar values. The only visible component of II Peg and both components of V7 11 Tau and AR Lac appear to be chromospherically active. For the latter systems, the Mg(11) line surface flux from the G-type star is higher than that from the K subgiant, which dominates the observed UV line flux. Moreover, evidence of long-term ultraviolet variability is presented for AR Lac.

700,609
PB88-152533 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Office of Nondestructive Evaluation.
Experimental and Theoretical Investigation of the Far-Infrared Spectrum of H2-He Mixtures.
Final rept.,
G. Birnbaum, G. Bachet, and L. Frommhold. 1987, 7p
Pub. in Physical Review A 36, n8 p3729-3735, 15 Oct 87.

Keywords: *Hydrogen, *Helium, *Planetary atmospheres, *Infrared spectra, Absorption spectra, Far infrared radiation, Mixtures, Reprints.

New measurements of the rototranslational collision-induced absorption spectra in the far-infrared (FIR) frequency region of gaseous mixtures of hydrogen (H2) and helium (He) are reported. The frequency range extends up to 1500/cm at the temperature of 195 K, and 1700/cm at 296 K. The uncertainties of the measurement are assessed. Comparison with previous measurements show substantial agreement at frequencies where the measurements overlap. For comparison with the measurement, spectra are computed from the fundamental theory using a state of the art ab initio dipole function and an isotropic potential surface as input. The observed agreement suggests that for important applications, such as the analysis of the FIR spectra of the outer planets, the spectra can be obtained reliably as a function of frequency and temperature from quantum calculations of the kind presented here.

Cosmic Ray Research

700,610
N76-28148/4 PC **A03**/MF **A01**
National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
Reanalysis of the APOLLO Cosmic gamma-Ray Spectrum in the 0.3 to 10 Mev Energy Region.
J. I. Trombka, C. S. Dyer, L. G. Evans, M. J. Bielefeld, and S. M. Seltzer. Jun 76, 36p NASA-TM-X-71150, X-682-76-128
Contract NAS7-100

Keywords: *Apollo 16 flight, *Apollo 17 flight, *Cosmic rays, *Gamma rays, Background radiation, Bremsstrahlung, Crystals, Diffuse radiation, Neutrons, Occultation, Radiation detectors, Spectrum analysis.

No abstract available.

700,611
PB87-115424 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Flux Limit of Cosmic-Ray Magnetic Monopoles from a Multiply Discriminating Superconducting Detector.
Final rept.
M. W. Cromar, A. F. Clark, and F. R. Fickett. 1986, 3p
Pub. in Physical Review Letters 56, n24 p2561-2563, 16 Jun 86.

Keywords: *Cosmic rays, Superconductors, Detectors, Reprints, *Magnetic monopoles.

A multiply discriminating, three-loop superconducting monopole detector was operated for 1 yr. During this period 8523 h of data were accumulated. The sensing area averaged over solid angle for trajectories passing through a loop was 178 sq cm. With inclusion of double-coincidence events from trajectories passing through the shield but not through a loop, the total

sensing area averaged over solid angle was 1195 sq cm. No candidate monopole events were observed; this leads to an upper limit on the flux of cosmic-ray magnetic monopoles of 5.0 x 10 to the -12th power/sq cm sr s with a 90% confidence level.

700,612
PB87-181699 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Detection of Cosmic-Background Neutrinos by Acoustic Phonon Scattering.
Final rept.,
G. Tupper, M. Danos, B. Muller, and J. Rafelski. Jan 87, 3p
Pub. in Physical Review D 35, n1 p394-396, 1 Jan 87.

Keywords: Neutrinos, Reprints, *Cosmic neutrinos, *Neutrino detection, Phonon scattering, Background radiation, Big bang cosmology.

The possible detection of cosmic-background neutrinos is examined, using coherent neutrino-phonon scattering. The conclusion is that, at least for simple detector schemes, the reaction rate is unobservably small.

ATMOSPHERIC SCIENCES

Aeronomy

700,613
PB80-121320 Not available NTIS
National Bureau of Standards, Washington, DC.
Double Photoionization and Doubly Charged Ions in the Thermosphere.
Final rept.,
G. A. Victor, and E. R. Constantinides. Jun 79, 4p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Geophys. Res. Lett 6, n6 p519-522, Jun 79.

Keywords: *Ionosphere, *Thermosphere, *Photoionization, Atmospheric composition, Concentration(Composition), Reprints, *Oxygen atoms, *Chemical reaction mechanisms, Atmospheric chemistry.

The authors show that a plausible cross section for double photoionization of atomic oxygen, (h(nu)(lambda $<$ 254 P)+0 yields O(+2) + 2e yields the dominant source mechanism for O(+2) in the thermosphere. With this large source, harmony is obtained between the measured O(+2) concentrations and the large (K is approximately equal to 10 to the -9 power cc/s measured sink (by charge exchange with molecular species) at altitudes above about 250 km.

700,614
PB82-600017 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluated Kinetic and Photochemical Data for Atmospheric Chemistry: Supplement I.
D. L. Baulch, R. A. Cox, P. J. Crutzen, R. F. Hampson, J. A. Kerr, J. Troe, and R. T. Watson. 1982, 170p
Included in Jnl. of Physical and Chemical Reference Data, v11 n2 p327-496 1982.

Keywords: *Air pollution, Atmospheric chemistry, Chemical kinetics, Data evaluation, Gas phase, Photoabsorption cross section, Photochemistry, Quantum yield, Rate coefficient.

This paper updates and extends a previous critical evaluation of the kinetics and photochemistry of gas phase chemical reactions of neutral species involved in middle atmosphere chemistry (10-55 km altitude) (J. Phys. Chem. Ref. Data 9, 295 (1980)). The work has been carried out by the authors under the auspices of the CODATA Task Group on Chemical Kinetics. Data sheets have been prepared for 228 thermal and photochemical reactions, containing summaries of the available experimental data with notes giving details of the experimental procedures. For each reaction a preferred value of the rate coefficient at 298 K is given together with a temperature dependence where possible. The selection of the preferred value is discussed, and estimates of the accuracies of the rate coefficients and temperature coefficients have been made for each reaction. The data sheets are intended to provide the basic physical chemical data needed as input for calculations which model atmospheric chemistry. A table summarizing the preferred rate data is provided, together with an appendix listing the available data on enthalpies of formation of the reactant and product species.

700,615
PB85-129310 Not available NTIS
National Bureau of Standards, Washington, DC.
Induced Electric Currents in the Alaska Oil Pipeline Measured by Gradient Fluxgate and Squid Magnetometers.
Final rept.
W. H. Campbell, and J. E. Zimmerman. 1980, 7p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Geoscience and Remote Sensing 18, n3 p244-250 Jul 80.

Keywords: *Geomagnetism, Pipelines, Electric currents, Measurement, Magnetometers, Magnetic disturbances, Magnetic measurement, Measuring instruments, Auroras, Reprints, SQUID devices.

Fluxgate magnetometers in a gradient alignment and a gradient cryogenic SQUID magnetometer were used to determine the current induced in the Alaska oil pipeline during a period of geomagnetic disturbance. The measurements compared favorable to each other and to the nearby current determinations using a shunt connected directly to the pipe.

700,616
PB85-202612 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Anomalous Atmospheric Spectral Features between 300 and 310 NM Interpreted in Light of New Ozone Absorption Coefficient Measurements.
Final rept.
R. D. McPeters, and A. M. Bass. 1982, 4p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Geophysical Research Letters 9, n3 p227-230 Mar 82.

Keywords: *Albedo, *Ozone, Near ultraviolet radiation, Stratosphere, Atmospheric radiation, Reprints, Absorption coefficients, Nimbus 7 satellite.

Continuous scan data from the solar backscattered ultraviolet instrument on Nimbus 7 reveals real structure in the atmospheric albedo between 300 and 310 nm, a region in which spectral anomalies have been reported in ground based observations. The authors find that these spectral anomalies are largely explained as structure at the one to five percent level in the ozone absorption coefficient as measured by Bass and Paur. Previous ozone absorption coefficient measurements were insufficiently accurate to resolve this structure.

700,617
PB86-185469 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Auroral Implications of Recent Measurements on O(1S) and O(1D) Formation in the Reaction of N(+) with O2.
Final rept.
A. O. Langford, V. M. Bierbaum, and S. R. Leone. 1985, 4p
Contract F49620-83-X-0013
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Planetary and Space Science 33, p1225-1228 1985.

Keywords: *Auroras, Emission spectra, Oxygen, Reprints, Ion-molecule collisions, Nitrogen ions.

Recent flowing afterglow measurements have shown that the reaction of N(1+) with O2 produces 70 + or - 30% of the oxygen atom product as O(singlet D) and $<$0.1% as O(singlet S). These results indicate that this reaction does not contribute to the auroral green line emission (5577 A), but can account for about 10% of the observed red line (6300 A) auroral emission.

Dynamic Meteorology

700,618
PB-265 778/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Small-Scale Turbulence Structure.
Interim rept.,
P. S. Klebanoff, and F. N. Frenkiel. 1976, 5p
Pub. in Proc. Bat-Sheva Int. Seminar, Ben-Furion Univ. of Negev, Beersheva, Israel, March 17-20, 1975, Paper in MHD-Flows and Turbulence, p147-151 1976.

Keywords: *Turbulence, Atmospheric motion, Statistical analysis, Atmospheric boundary layer.

The results of an experimental investigation into the nature of the small-scale turbulence structure involving the measurement of high-order moments of turbulent velocity gradients are described. Comparisons with atmospheric investigations and theory are given.

700,619
PB-291 720/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mean Wind Profiles and Changes of Terrain Roughness.
Final rept.,
J. Bietry, C. Sacre, and E. Simiu. Oct 78, 9p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. Struct. Div., Am. Soc. Civ. Eng., v104 ST10 p1585-1593 Oct 78, Proc. Paper 14099.

Keywords: *Wind(Meteorology), *Terrain, Wind velocity, Boundary layer flow, Buildings, Skyscrapers, Atmospheric boundary layer, Reprints.

Information is presented on the wind structure in established flow over terrains with various roughness characteristics (open water, open terrain, suburban terrain, towns, centers of large cities). Based on recent results of theoretical and experimental meteorological studies, a simple procedure is then proposed, enabling the designer to assess the effect upon the mean wind profile of a roughness change upwind of the structure under consideration. The procedure, which is approximate but adequate for structural engineering purposes, is then illustrated in a numerical example.

700,620
PB80-150535 Not available NTIS
National Bureau of Standards, Washington, DC.
Laboratory Simulation of Turbulent Wind Spectra.
Final rept.,
E. Simiu. Dec 79, 5p
Pub. in Journal of the Engineering Mechanics Division, Proceedings of the American Society of Civil Engineers 105, nEM6, p1050-1054, Dec 79.

Keywords: *Boundary layer flow, *Turbulent flow, Turbulence, Skyscrapers, Buildings, Wind tunnel models, Reprints, Atmospheric boundary layer, Tall buildings.

A discussion is presented of the implications of recent results of atmospheric boundary layer research for the wind tunnel simulation of the along-wind response of tall structures. It is shown, on the basis of similarity considerations and of recently developed models of the atmospheric flow structure, that the turbulent fluctuations which cause resonant amplification effects in tall buildings do not appear to be similar in long wind tunnels to the corresponding fluctuations in atmospheric flows. It is suggested that corrections to the laboratory along-wind measurements may be required in order to account for possible differences between turbulence spectra in the atmosphere and the measured turbulence spectra obtained in the wind tunnel.

700,621
PB81-113227 Not available NTIS
National Bureau of Standards, Washington, DC.
Sampling Errors in Estimation of Extreme Hurricane Winds.
Final rept.
M. E. Batts, M. R. Cordes, and E. Simiu. Oct 80, 7p
Sponsored in part by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Proceedings of the ASCE Engineering Mechanics Division Specialty Conference Held at Austin, Texas on September 17-19, 1979, Jnl. of the Structural Division 106, nST10 p2109-2115 Oct 80.

Dynamic Meteorology

Keywords: *Hurricanes, *Wind velocity, Monte Carlo method, Sampling, Errors, Estimates, Mathematical prediction.

An investigation is presented into the magnitude of sampling errors in the estimation of extreme winds by Monte Carlo methods. It is shown that the coefficient of variation of the sampling errors is of the order of 10 percent for wind speeds with mean recurrence intervals of the order of 50 years. Results of calculations are presented showing the influence upon the estimates of the number of climatological data and the number of simulated hurricanes.

700,622
PB81-164840 Not available NTIS
National Bureau of Standards, Washington, DC.
Weibull Distributions and Extreme Wind Speeds.
Final rept.
E. Simiu, and J. J. Filliben. 1980, 10p
Pub. in Jnl. of the Structural Division 106. No. ST 12, p2365-2374 Dec 80.

Keywords: *Wind(Meteorology), Mathematical models, Weibull density functions, Reprints.

An investigation is presented into the question as to whether or not it may be assumed that the extreme wind population at various stations in the U.S. is described by probabilistic models with shorter tails than the Type I distribution. Statistical evidence, based on the comparative analysis of extreme wind data and of data generated by Monte Carlo simulation, appears to support this assumption at a large number of stations in the United States.

700,623
PB82-154311 Not available NTIS
National Bureau of Standards, Washington, DC.
Wind Speed - Damage Correlation in Hurricane Frederic.
Final rept.
K. C. Mehta, J. E. Minor, R. D. Marshall, and T. A. Reinhold. 1981, 14p
Pub. in Proceedings of American Society of Civil Engineers Convention and Exposition, Held in St. Louis, MO. on October 26-30, 1981 14p Nov 81.

Keywords: *Hurricanes, *Damage assessment, Building, Structures, Structural design, Wind velocity, Correlation techniques, Hurricane Frederic.

Damage to buildings and other structures caused by Hurricane Frederic's winds is reviewed and classified by level of engineering design and by range of maximum wind speed. Observations concerning the performance of buildings and structures are grouped according to whether the buildings and structures are fully engineered, pre-engineered, marginally engineered, or non-engineered. A major emphasis is placed on estimating wind speeds, at sites of damage observations, from anemometer data. Wind speed data is converted to equivalent maximum fastest-mile wind speeds at elevations of 10 meters over open terrain. Performance observations are further correlated with fastest-mile wind speed ranges of 70-85 mph, 85-100 mph, and 100-110 mph. These observations indicate that significant damage did not occur until wind speeds reached or exceeded design values.

700,624
PB82-265711 Not available NTIS
National Bureau of Standards, Washington, DC.
Probabilistic Description of Hurricane Wind Speeds.
Final rept.
M. E. Batts. Jul 82, 7p
Pub. in Jnl. of the Structural Division, American Society of Civil Engineers 108, nST7 p1643-1647 Jul 82.

Keywords: *Wind velocity, *Hurricanes, Weibull density functions, Estimating, Reprints, *Extreme value density functions.

This note presents information on the parameters of the best fitting Weibull Distributions estimated for hurricane windspeeds simulated as described in a previous paper, and shows the effect of the incorrect assumption that an Extreme Type I distribution rather than a Weibull distribution, is the appropriate description of the extreme windspeeds.

700,625
PB83-179226 Not available NTIS
National Bureau of Standards, Washington, DC.
Short-Term Records and Extreme Wind Speeds.
Final rept.
E. Simiu, J. J. Filliben, and J. R. Shaver. Nov 82, 6p
Pub. in American Society of Civil Engineers Technical Notes 108, nST11 p2571-2576 Nov 82.

Keywords: *Wind velocity, Structural engineering, Mathematical prediction, Statistical analysis, Probability theory, Reprints.

An empirical study was conducted to determine whether design wind speeds can be estimated confidently from short records, i.e., records extending over periods of a few years. It was found that 50-year speeds can be estimated confidently from 3-year records of the largest monthly speeds.

700,626
PB86-129608 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Autoregressive Representation of Longitudinal, Lateral, and Vertical Turbulence Spectra.
Final rept.
D. A. Reed, and R. H. Scanlan. 1984, 16p
Pub. in Jnl. of Wind Engineering and Industrial Aerodynamics 17, n2 p199-214 1984.

Keywords: *Wind velocity, Turbulence, Simulation, Spectra, Statistical analysis, Reprints.

A new method for simulation of fluctuating wind velocity time histories based on a combination of time series models and existing expressions for longitudinal, lateral, and vertical turbulence spectra is outlined. Related expressions for calculating the integral scale of turbulence, (x)Lu, are presented. Calculated values of (x)Lu using the new method are close to those obtained for various field data.

700,627
PB86-169026 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Directional Hurricane Wind Speeds.
Final rept.
E. M. Hendrickson, and E. Simiu. Feb 86, 34p
NBSIR-86/3317
See also PB81-143224. Sponsored by Nuclear Regulatory Commission, Washington, DC.

Keywords: *Wind velocity, *Hurricanes, *Coasts, Estimating, Wind direction, Statistical analysis, Sites, Nuclear power plants, Wind pressure, Magnetic tapes, Climate.

The report presents a simple procedure for estimating coastline hurricane wind speeds corresponding to any specified set of wind directions and to any specified mean recurrence interval. The procedure uses simulated directional hurricane wind speed data as described in the report Hurrican Wind Speeds in the United States (NBS BSS 124). These data are encoded on magnetic tape for 56 mileposts located along the U.S. Gulf and Atlantic coasts.

700,628
PB86-199932 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Wind Speed Estimation Errors in Hurricane Alicia.
Final rept.
R. D. Marshall. 1985, 11p
Pub. in Proceedings of Hurricane Alicia: One Year Later, Galveston, TX., August 16-17, 1984, p70-80 1985.

Keywords: *Wind velocity, *Hurricanes, Boundary layer, Errors, Weather observation, Mathematical models, Tropical cyclones, Structural engineering, Atmospheric boundary layer, *Hurricane Alicia.

The transformation of surface wind speeds observed in Hurricane Alicia to fastest-mile speeds corresponding to standard conditions makes use of representations of the atmospheric boundary layer that are based upon mean wind speeds averaged over a period of approximately 1 hour. Errors involved with estimating fastest-mile wind speeds include observation errors, site characterization errors, and modeling errors. When combined with modeling errors, estimates of fastest-mile speeds can be expected to have a range of error of about + or - 12 percent when derived from strip-chart records, and about + or - 16 percent when derived from hourly observations.

Meteorological Data Collection, Analysis, & Weather Forecasting

700,629
PB-273 949/8 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Thermal Engineering Section.
Estimating the Energy Conservation Potential of Ventilation Control through Weather Data Analysis.
Final rept.,
T. Kusuda, and J. W. Bean. Aug 77, 52p NBSIR-76-1088
Sponsored in part by Federal Energy Administration, Washington, D.C.

Keywords: *Energy conservation, *Ventilation, Buildings, Damper valves, Air circulation, Air conditioning, Meteorological data, Temperature measurement, Florida, District of Columbia, New Hampshire, Arizona, Nebraska, New Jersey, Tables(Data), Statistical data, Graphs(Charts), Orlando(Florida), Concord(New Hampshire), Phoenix(Arizona), Omaha(Nebraska), Newark(New Jersey).

Hourly weather data for six selected cities in the United States covering eleven consecutive years were analyzed to aid in estimating the possible energy saving that could be achieved by closing the outdoor dampers during unoccupied hours. Hourly temperature and enthalpy values are presented in histogram form for occupied and unoccupied periods (office use), with the suggestion that similar data processing be carried out for other cities as well.

700,630
PB80-181126 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Hurricane Wind Speeds in the United States.
Building science series (Final),
M. E. Batts, M. R. Cordes, L. R. Russell, J. R. Shaver, and E. Simiu. May 80, 54p NBS-BSS-124
Grant NSF-ENV77-16113
Sponsored in part by Department of Energy, Assistant Secretary for Conservation and Solar Applications. Prepared in cooperation with Russell (Larry) and Associates, Inc., Houston, TX. Library of Congress catalog card no. 80-600039.

Keywords: *Wind velocity, *Hurricanes, Building codes, Climatology, Statistical analysis, Tropical cyclones, Wind(Velocity), Monte Carlo method.

A Monte Carlo simulation technique is used to obtain estimates of hurricane wind speeds in the Gulf and East Coasts of the United States. The paper describes the sources of data, the probabilistic models for the climatological characteristics of hurricanes, and the physical models for the hurricane wind speed field used in the estimations.

700,631
PB81-143224 Not available NTIS
National Bureau of Standards, Washington, DC.
Hurricane Wind Speeds in the United States.
M. E. Batts, L. R. Russell, and E. Simiu. Oct 80, 16p
Grant NSF-ENV77-16113
Sponsored in part by Department of Energy, Washington, DC. Office of Conservation and Solar Applications.
Pub. in ASCE Jnl. Structural Div. 106, nST10, p2001-2016 Oct 80.

Keywords: *Building codes, *Hurricanes, *Coasts, Wind velocity, Tropical cyclones, Mathematical models, Monte Carlo method, Models, Atlantic Coast(United States).

A Monte Carlo simulation technique is used to obtain estimates of hurricane wind speeds in the Gulf and East Coasts of the United States. The paper describes the sources of data, the probabilistic models for the climatological characteristics of hurricanes, and the physical models for the hurricane wind speed field used in the estimations. Estimated values of fastest-mile hurricane wind speeds at 10 m above ground in open terrain at the coastline and at 200 km inland are given for various mean recurrence intervals.

700,632
PB82-118399 Not available NTIS
National Bureau of Standards, Washington, DC.

Wind Speed Averaging-Time Relationship: Experimental Data.
Final rept.
M. E. Batts, and M. J. Changery. 1980, 10p
Pub. in Proceedings of ASCE Annual Fall Convention, Hollywood, Florida, October 27-31, 1980, 10p.

Keywords: *Climatology, *Wind velocity, Measurement, Statistical analysis, Wind pressure, Periodic variations.

In the United States, the most common maximum windspeed measurements, for use in engineering calculations, are in units of fastest miles. Other measurements consist of averaged windspeed over longer intervals. Due to the way current code procedures to determine dynamic wind loads involve mean wind speeds, some conversion relation is necessary in order to compare these velocities. This paper deals with the problems associated with experimentally measuring the parameters of a conversion relation between windspeeds averaged over various time intervals.

700,633
PB84-220771 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
Fastest-Mile Wind Speeds in Hurricane Alicia.
Final rept.
R. D. Marshall. Jun 84, 71p NBS/TN-1197
Also available from Supt. of Docs as SN003-003-02592-5.

Keywords: *Hurricanes, *Wind velocity, Velocity measurement, Boundary layer, Building codes, Structural engineering, Mexico Gulf, Texas Gulf Coast(United States), Hurricane Alicia, Galveston(Texas), Houston(Texas).

Surface wind speeds recorded during the passage of Hurricane Alicia through the Galveston-Houston area on August 18, 1983, are used to estimate the fastest-mile wind speeds at 10 m above ground in open terrain. The paper describes the relationships between wind speeds for various averaging times and the boundary-layer representations used in the transformation to fastest-mile speeds. These speeds are compared with wind speeds recommended for the design of buildings and other permanent structures. Errors inherent in the original wind speed records and in the transformations are estimated.

700,634
PB84-245745 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
NBS (National Bureau of Standards) Daylight Availability Database.
S. Treado, G. Gillette, W. Remmert, and J. Bean. Jul 84, 55p NBSIR-84/2859
Sponsored in part by Naval Civil Engineering Lab., Port Hueneme, CA., National Fenestration Council, Topeka, KS., Naval Facilities Engineering Command, Alexandria, VA., Directorate of Civil Engineering (Air Force), Washington, DC., and Office of Chief of Engineers (Army), Washington, DC.

Keywords: *Daylight, *Irradiance, *Luminance, *Sky brightness, *Atmospheric temperature, *Buildings, Histograms, Availability, *Energy requirements.

This report presents an annual database containing hourly measurements of solar radiation, illumination, sky luminance, and ambient air temperature. The measurements were made at the National Bureau of Standards, Gaithersburg, Maryland. Both instantaneous hourly and integrated average hourly measurements are included, as are daily, monthly and annual average and totals. For each measured quantity, a histogram of the distribution of the data is presented for the year. The data measurement, collection, and analysis system is described. This type of information is useful for determining energy requirements of buildings.

700,635
PB86-137916 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Probability-Models for Annual Extreme Water-Equivalent Ground Snow.
Final rept.
B. Ellingwood, and R. K. Redfield. 1984, 7p
Pub. in Monthly Weather Review 112, n6 p1153-1159 1984.

Keywords: *Snowmelt, Probability theory, Statistical analysis, Loads(Forces), Roofs, Reprints, *Water equivalent, Northeast Region(United States).

A statistical analysis of annual extreme water-equivalents of ground snow (reported as inches of water) measured at 76 weather stations in the northeast quadrant of the United States through the winter of 1979-1980 is presented. The analysis suggests that probability distributions with longer upper tails than the Type I distribution of extreme values are preferable for describing the annual extremes at a majority of sites. Sampling errors and the selection of water-equivalents for planning and design purposes also are described.

700,636
PB87-140422 PC **A13**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Handbook for the Quality Assurance of Meteorological Measurements.
Final rept.
J. K. Taylor, and H. V. Oppermann. Nov 86, 290p
NBS/HB-145
Library of Congress catalog card no. 86-600583. Also available from Supt. of Docs. as SN003-003-02774-0.

Keywords: *Meteorological data, *Metrology, Quality assurance, Handbooks, Calibrating, Standards, Precision, Accuracy.

The general concept of quality assurance for metrological measurements is discussed. A number of Good Laboratory Practices (GLPs) and Good Measurement Practices (GMPs) related to metrology are compiled. Twenty recommended Standard Operations Procedures (SOPs) for high-accuracy mass, length, and volumetric calibrations made most frequently by State weights and measures laboratories are included. The statistical techniques useful for evaluating measurement quality are reviewed. Control charts most useful for metrological measurements are discussed.

700,637
PB87-219036 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Selection of Soil Thermal Properties for Mesoscale Numerical Models.
Final rept.,
L. A. Salomone. 1983, 4p
Pub. in Proceedings of the Conference on Severe Local Storms (13th), Tulsa, OK., October 17-20, 1983, p320-323 1983.

Keywords: *Weather forecasting, Mathematical models, Soil tests, Heat transfer, Soil water, Thermal conductivity, Surface waters, Vegetation, Connection, Boundary layer, *Severe storms.

Mesoscale numerical models developed for severe weather forecasting can be improved by incorporating smaller-scale features into model at the surface. Here, changes in soil thermal and moisture properties, elevation, surface vegetation and albedo are encountered. Therefore, each of these surface characteristics should be included in the model through the surface energy balance from which the surface temperature and humidity are computed. The paper discusses the factors that affect soil thermal resistivity and the equipment and approach that can be used for establishing representative values of thermal resistivity for mesoscale numerical models.

700,638
PB87-234100 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Heterodyne Measurements of Hot Bands and Isotopic Transitions of N2O near 7.8 Micrometers.
Final rept.,
A. Hinz, J. S. Wells, and A. G. Maki. 1987, 8p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Z. Phys. D - Atoms, Molecules and Clusters 5, p351-358 1987.

Keywords: *Nitrogen oxide, Nitrous oxide, Wavelengths, Reprints, *Calibration frequencies, *Heterodyne frequencies, Hot bands, Molecular constants.

Heterodyne frequency measurements are reported for absorption transitions of N2O in the frequency range from 1257 to 1335 cm(-1). The measurements use a CO laser as a transfer oscillator whose frequency is measured directly against combinations of frequencies of two stabilized CO2 lasers whose frequencies are well known. A tunable diode laser is locked to the N2O absorption feature and the frequency difference is measured between the diode laser and the CO lasr. The v3 fundamental bands of the 15N14N16O and 14N15N16O isotopes are reported. Measurements are also given for the 00(sup 002-001(sub 0) and 2(sup 0)1-02(sup 0)0, and 02(sup 2)1-02(sup 2)0 vibrational transitions of N2O. A table of frequencies is given for the 00(sup 0)2-00(sup 0)0 band near 2560 cm(-1) based on these and earlier measurements.

Meteorological Instruments & Instrument Platforms

700,639
PB-266 130/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nonlinear Pressure Terms and Alongwind Response,
R. Vaicaitis, and E. Simiu. Apr 77, 4p
Pub. in Jnl. of the Structural Div., Proceedings of the American Society of Civil Engineers, Technical Notes 103 ST4 p903-906 Apr 77.

Keywords: *Buildings, *Wind pressure, Structural design, Building codes, Velocity measurement, Numerical analysis, Error analysis, Wind velocity, Power spectra, Wind shear, Reprints, Procedures, *Tall buildings.

Current procedures for estimating alongwind response are based upon the assumption that the fluctuations about the mean of the wind pressures are proportional to the fluctuations about the mean of the wind speeds. Preliminary time-domain calculations have been reported in the literature which suggest that the errors inherent in this assumption may in certain cases be significant. The extent to which this is the case is investigated herein for building heights and terrain roughness conditions covering the range of interest in structural design.

700,640
PB-269 337/2 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Heat Div.
Fabrication of the Barium Fluoride Film Humidity Sensor by Industrial Firms.
Final rept.,
F. E. Jones. Aug 76, 74p NBSIR-76-1108
Sponsored in part by Air Force Geophysics Lab., Hanscom AFB, Mass.

Keywords: *Hygrometers, Fabrication, Barium halides, Thin films, Calibrating, Humidity, Detectors, Radiosondes, Manufacturing, Barium fluorides.

The barium fluoride film electric hygrometer element, which was conceived and developed at the National Bureau of Standards as a fast responding humidity sensor and which has been used in a variety of research applications, has been successfully fabricated by several commercial firms. This successful transfer of technology from the Federal Government to the private sector should assure the availability of the element for general use, including missile climatology and routing radiosonde use. Calibration equations have been developed and the analysis of calibration data has provided insight into the physical processes involved in the functioning of the element. It has been shown that the conductance (p/(p sub s)) isotherm (in itself a Type II isotherm in the Brunauer designation of physical adsorption isotherms) is a composite of a Type I and two Type III isotherms. The two Type III isotherm isotherm equations are of the form of the Freundlich isotherm equation. These results represent the solution of a long-standing problem in adsorption and have general application to other adsorption systems in addition to the water vapor-barium fluoride film system.

700,641
PB-284 864/6 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Fluid Engineering Div.

Meteorological Instruments & Instrument Platforms

Low Velocity Performance of a Ball Bearing Vane Anemometer.
Task rept. 1 Feb 77-31 Mar 77,
L. P. Purtell. Jun 78, 21p NBSIR-78-1485
Contract H0166198

Keywords: *Anemometers, *Calibration, Wind tunnel tests, Wind velocity, Ball bearings, Performance, Speed indicators, Laser velocimeters.

Performance of a ball bearing vane anemometer is evaluated over the speed range of 23 to 724 feet per minute including starting speed and stopping speed. The tests were performed in the NBS Low Velocity Airflow Facility which provides a uniform flow of low turbulence and utilizes a laser velocimeter as the velocity standard.

700,642
PB-291 987/6 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Fluid Engineering Div.
Characteristics of Helicoid Anemometers.
Final rept.
J. M. McMichael, and W. G. Cleveland. Aug 78, 17p NBSIR-78-1505
See also report dated Nov 75, PB-246 861. Sponsored in part by Federal Highway Administration, Washington, DC. Structures and Applied Mechanics Div.

Keywords: *Anemometers, Errors, Air flow, Reaction time, Wind velocity, Power spectra, Dynamic response, Unsteady flow, Mathematical models, *Helicoid anemometers.

An experimental study of the overspeeding error for helicoid anemometers in periodic air flows is described. The ranges of amplitude and frequency for which a simple nonlinear model for the dynamic response of such instruments remains valid are presented. It is shown that the model is valid for typical atmospheric applications of such instruments. A simple method is presented whereby the effects of inertial lag and nonlinearity may be taken into account in obtaining measurements of alongwind power spectra in the atmosphere.

700,643
PB81-138364
(Order as PB81-138356, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Simple Gravimetric Method to Determine Barometer Corrections,
R. M. Schoonover. 23 Apr 80, 5p
Included in Jnl. of Research of the National Bureau of Standards, v85 n5 p341-346, Sep-Oct 80.

Keywords: *Barometers, *Calibrating, Atmospheric density, Atmospheric pressure, Measurement, Correction.

Presented here is a gravimetric method to calibrate barometers. The difference in forces exerted on the pan of a balance is observed for two well characterized artifacts of nearly equal masses but different volumes. During the weighing, air temperature and relative humidity are measured; the ambient pressure is then calculated from an air density equation. A barometer correction is derived and then compared to an independent value based on a standard barometer. The data indicate that pressure can be calculated with an uncertainty (1 S.D.) of not more than 400 ppm at one atmosphere.

700,644
PB81-171464 Not available NTIS
National Bureau of Standards, Washington, DC.
Development of a Peak Gust Anemometer.
Final rept.
G. R. Walker, and R. D. Marshall. Oct 80, 4p
Pub. in Proceedings of the Australasian Hydraulics and Fluid Mechanics Conference (7th), Brisbane, Queensland, Australia, August 18-22, 1980, p151-154 Oct 80.

Keywords: *Meteorology instruments, *Anemometers, Wind velocity, Velocity measurement, Calibration, Field tests.

The development and field testing of a simple drag sphere device for recording peak wind gusts are described. Also presented are the performance criteria and rationale for selecting these criteria for tropical storm applications. Based on static and dynamic calibrations as well as limited field experience, recommendations are offered for improvements in future models of the peak gust anemometer.

700,645
PB86-245735 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Final Evaluation of a Color Calibrator for a Radar Remote Weather Display System.
L. G. Porter. Jul 86, 86p NBSIR-86/3403
Sponsored by Federal Aviation Administration, Washington, DC.

Keywords: *Meteorological radar, *Remote sensing, *Color codes, Display systems, Cathode ray tubes, Standardization, Calibration.

The report deals with the development and field testing of an inexpensive color calibrator for the standardization of the Weather Intensity Level (WIL) colors used in the FAA's Radar Remote Weather Display System or RRWDS. The report covers the field validation of the color calibrator and, as an end product, the construction of a tentative look-up table that identifies whether the six WIL colors are within acceptable limits. In addition, the report includes a general review of significant literature on color-coding, since RRWDS color codes weather information. The report presents first-of-its-kind objective data on the effects of ambient room lighting on colors used in a self-luminous display.

Physical Meteorology

700,646
PB-265 551/2 PC **A18**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Hourly Solar Radiation Data for Vertical and Horizontal Surfaces on Average Days in the United States and Canada.
Final building science series rept.,
T. Kusuda, and K. Ishii. Apr 77, 416p NBS-BSS-96
Library of Congress Catalog Card no. 77-608023.

Keywords: *Solar radiation, United States, Canada, Variations, Variability, Walls, Roofs, Tables(Data), Computer programs.

This report outlines the technique that was used to compute and tabulate the monthly average incident radiation on an hourly basis during the day for each month of the year, and each of eight different vertical orientations. The data was tabulated for 80 different locations in the United States and Canada. An additional parameter called sol-air temperature for glass was also computed and tabulated for each of the locations.

700,647
PB-270 123/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reaction Rate Data for the Stratosphere. How Good Are They Now.
Final rept.,
D. Garvin, R. F. Hampson, and M. J. Kurylo. 1975, 7p
Sponsored in part by Department of Transportation, Washington, D.C. Office of the Secretary.
Pub. in Proceedings of Conference on Climatic Impact Assessment Program (4th), Cambridge, Mass. Feb 75 p391-397 1975.

Keywords: *Reaction kinetics, *Stratosphere, Photochemical reactions, Data analysis, Atmospheric chemistry, Climatic Impact Assessment Program.

The reaction rate and photochemical data currently available for use in modelling of stratospheric chemistry are reviewed. They are characterized in terms of their quality and applicability. Of 46 'important' chemical reactions, the data for 33 are adequate. For 82 'less important' reactions, the data are generally less reliable, but in many cases sufficient. A similar pattern exists for photochemical processes. The data are adequate for 8 of 16 'important' processes and are adequate for 5 of 16 'less important' processes. A list of reactions for which more measurements are needed is supplied.

700,648
PB-275 124/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mass Spectrometric Detection of Dioxirane, H2COO, and Its Decomposition Products, H2 and CO, from the Reaction of Ozone with Ethylene.
Final rept.,
R. I. Martinez, R. E. Huie, and J. T. Herron. 1 Nov 77, 3p
Pub. in Chemical Physics Letters, v51 n3 p457-459, 1 Nov 77.

Keywords: *Mass spectroscopy, *Decomposition reactions, Air pollution, Oxygen organic compounds, Hydrogen, Carbon monoxide, Atmospheric composition, Gas analyses, Chemical analyses, Reprints, *Dioxirane, Atmospheric chemistry, Air pollution detection.

Dioxirane has been detected in the gas phase, by means of photoionization mass spectrometry, as a product of the low temperature reaction of ozone with ethylene. Hydrogen and carbon monoxide are found to be products of the decomposition of dioxirane. The significance of these observations to atmospheric chemistry is discussed.

700,649
PB78-600004 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Air Density Equation and the Transfer of the Mass Unit.
F. E. Jones. 1978,9p
Included in Jnl. of Research of the National Bureau of Standards, v83 n5 p419-428 Sep-Oct 1978.

Keywords: *Air buoyancy, Air density, Mass unit transfer, Real gas equation.

A new formulation of the equation for calculation of air density has been developed. The Cohen and Taylor value of the gas constant, currently accepted values of the atomic weights, and recent determinations of abundances of the various constituents of air have been used. The abundance of carbon dioxide has been treated as a variable and a factor enabling convenient adjustment of the apparent molecular weight of air for deviation of carbon dioxide abundance from a background value has been derived. A new table of the compressibility factor for the range of pressure and temperature of interest in standards laboratories has been calculated using recently determined values of virial coefficients. The enhancement factor, which has usually been ignored, has been explicitly included. A simple equation for the calculation of enhancement factor has been fitted to values in the range of pressure and temperature of interest. A simple equation for the calculation of saturation water vapor pressure has been fitted. Uncertainties, random and systematic, in the parameters and in the measurement of environmental variables and consequent uncertainties in calculated air density have been estimated. Application of the equation to air buoyancy determination and the transfer of the mass unit at the various national standards laboratories has been made.

700,650
PB80-141641 Not available NTIS
National Bureau of Standards, Washington, DC.
Flash Photolysis Resonance Fluorescence Investigation of the Reaction OH + CH3CC13 yields H2O + CH2CC13.
Final rept.,
M. J. Kurylo, P. C. Anderson, and O. Klais. Oct 79, 3p
Prepared in cooperation with National Aeronautics and Space Administration, Washington, DC. Upper Atmospheric Research.
Pub. in Geophys. Res. Lett., v6 n10 p760-762 Oct 79.

Keywords: *Reaction kinetics, Fluorescence, Mass spectroscopy, Comparison, Troposphere, Chemical reactions, Reprints, *Chloroform/methyl, *Atmospheric chemistry, *Flash photolysis, *Hydroxyl radicals.

The absolute rate constant for the reaction OH + CH3CCl3 yields H2O + CH2CCl3 has been determined by the flash photolysis resonance fluorescence technique from 253 to 363K. The results are used to recommend an Arrhenius expression. Use of this equation with atmospheric observational data on methyl chloroform nearly doubles the predicted tropospheric OH reaction sink strength for the removal of important atmospheric gases whose lifetimes are controlled by OH. Comparison of the results reported here with previously reported literature values indicates a strong interference of olefinic impurities on the past investigations.

700,651
PB80-154966 Not available NTIS
National Bureau of Standards, Washington, DC.
Upper Limit for the Rate Constant of the Biomolecular Reaction CH3+O2 yields OH+H2CO at 368 K.
Final rept.,
O. Klais, P. C. Anderson, A. H. Laufer, and M. J. Kurylo. 15 Oct 79, 4p
Pub. in Chem. Phys. Lett. 66, n3 p598-601, 15 Oct 79.

Keywords: *Reaction kinetics, *Formaldehyde, Chemical reactions, Fluorescence, Photolysis, Air pollution, Mathematical models, Reprints, *Atmospheric chemistry, *Hydroxyl radicals.

An upper limit for the rate constant of the bimolecular atmospheric reaction CH3 + O2 yields OH + H2CO at 368 K has been measured by monitoring OH using the flash photolysis--resonance fluorescence technique. Careful modeling of the system in conjunction with statistical analysis indicates an upper limit of k < or = 3 x 10 to the 16th power cc/mole/s. The rate constant for the reaction of OH with azomethane has also been measured.

700,652
PB81-110694 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Dependent Absorption Cross Sections for Formaldehyde (CH2O): The Effect of Formaldehyde on Stratospheric Chlorine Chemistry.
Final rept.
A. M. Bass, L. C. Glasgow, C. Miller, J. P. Jesson, and D. L. Filkin. Feb 80, 5p
Pub. in Planet Space Sci. 28, p675-679 Feb 80.

Keywords: *Formaldehyde, *Absorption cross sections, Chlorine, Ozone, Stratosphere, *Atmosphere chemistry.

New measurements are reported of the absorption cross sections of formaldehyde at 296 K and 223 K. These measurements are significantly lower than those reported in the earlier literature at ca. 353 K. The implications of the lower absorption cross sections for stratospheric chlorine chemistry are considered using one dimensional atmospheric model. A slight modification to ClX partitioning is predicted for the new cross sections, with only a small effect on estimated chlorine-catalyzed ozone perturbations.

700,653
PB81-133290 Not available NTIS
National Bureau of Standards, Washington, DC.
Rate Constant Measurements for the Reaction Cl + CH2O - HCl + CHO: Implications Regarding the Removal of Stratospheric Chlorine.
P. C. Anderson, and M. J. Kurylo. Aug 79, 15p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC., and Manufacturing Chemists Association.
Pub. in Jnl. Phys. Chem. 83, n16 p2055-2057, 9 Aug 79.

Keywords: *Reaction kinetics, *Formaldehyde, Stratosphere, Fluorescence, Chlorine, Reprints, *Chlorine atoms.

The flash photolysis resonance fluorescence technique was employed to investigate the rate constant for the reaction Cl + CH2O yields HCl + CHO from 223-323K.

700,654
PB81-196214
(Order as PB81-196198, PC **A08**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Refractivity of Air,
F. E. Jones. 23 Jul 80, 6p
Included in Jnl. of Research of the National Bureau of Standards, v86 n1 p27-32 Jan-Feb 81.

Keywords: *Atmospheric refraction, Atmospheric density, Carbon dioxide, Refractivity, Air, NTISCOMNBS.

The air density equation of Jones, Edlen's dispersion formula for standard air, and Edlen's empirically-derived expressions for the effects of CO2 abundance and water vapor partial pressure on refractivity have been combined into a simplified equation for the refractivity of air, and estimates have been made of uncertainties in calculated refractivity. Under ambient conditions typical of metrology laboratories, the agreement between the simplified equation and Edlen's formulation is well within the uncertainty in each. The simplified equation is valid in the visible region.

700,655
PB83-134908 Not available NTIS
National Bureau of Standards, Washington, DC.
Simplified Equation for Calculating the Refractivity of Air.
Final rept.
F. E. Jones. 15 Dec 80, 1p
Pub. in Applied Optics 19, n24 p4129, 15 Dec 80.

Keywords: *Atmospheric refraction, Atmospheric density, Refractivity, Air, Reprints.

The simplified equation for the calculation of the refractivity of air derived by combining the air density equation of Jones, Edlen's dispersion formula for standard air, and Edlen's empirically-derived expressions for the effects of CO2 abundance and water vapor partial pressure, is presented. The agreement between the simplified equation and Edlen's formulation, under ambient conditions typical of metrology laboratories, is well within the uncertainty in each.

700,656
PB83-184382 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Self-Study Manual on Optical Radiation Measurements. Part III. Applications, Chapter 1. Measurement of Solar Terrestrial Spectral Irradiance in the Ozone Cut-Off Region.
Final rept.
H. J. Kostkowski, R. D. Saunders, J. F. Ward, C. H. Popenoe, and A. E. S. Green. Dec 82, 94p NBS-TN-910-5
See also PB-268 502.

Keywords: *Optical measurement, *Radiometry, *Atmospheric attenuation, *Ultraviolet radiation, Ozone, Solar ultraviolet radiation, Spectroradiometers, Manuals, Spectroradiometry, State of the art.

This is the first chapter in Part III (Applications) of this Manual. Material developed in earlier chapters is used to perform state-of-the-art measurements in Gainesville, Florida, of solar terrestrial spectral irradiance between 290 (nm) and 340 (nm). The measurement equation is used to design the experiment and to address the effects of polarization, non-linearity, spectral scattering, distortion, slit-scattering function, spectral irradiance calibration, and wavelength calibration. Estimates are made of the uncertainties associated with all these factors. The total uncertainty is estimated to be about 10 percent. An appendix includes details for computing the solar terrestrial spectral irradiance between 280 and 310 (nm). Suggestions are made for reducing the uncertainty by about one third and for further research in UV solar terrestrial measurements.

700,657
PB85-116218 Not available NTIS
California Univ., Riverside.
Evaluation of Kinetic and Mechanistic Data for Modeling of Photochemical Smog.
R. Atkinson, and A. C. Lloyd. c1984, 130p
Prepared in cooperation with Environmental Research and Technology, Inc., Newbury Park, CA.
Included in Jnl. of Physical and Chemical Reference Data, v13 n2 p315-444 1984.

Keywords: *Photochemistry, *Smog, *Mathematical models, *Air pollution, Nitrogen oxides, Sulfur dioxide, Butane, Toluene, Xylenes, Nitrogen dioxide, Nitric acid, *Atmospheric chemistry, *Chemical reaction mechanisms, Butane/dimethyl, Ethene, Propene, Butene, Peroxyacetyl nitrate.

This review is a critical evaluation of the rate constants, mechanisms, and products of selected atmospheric reactions of hydrocarbons, nitrogen oxides, and sulfur oxides in air. The evaluation considers eight hydrocarbons (n-butane, 2,3-dimethylbutane, ethene, propene, 1-butene, trans-2-butene, toluene, and m-xylene) for which smog chamber irradiations have been carried out under carefully controlled conditions and which have been the subject of computer modeling studies by more than one research group. The reactions involved are treated in the following categories: inorganic reactions in organic-NOx-air irradiations; organic reactions of the formaldehyde-NOx-air system; organic reactions of the acetaldehyde-NOx-air system; organic reactions of the alkene-NOx-air systems; organic reactions of the alkane-NOx-air systems; organic reactions of selected carbonyl-NOx-air systems; organic reactions of the aromatic-NOx-air systems; combination reactions of peroxy radicals, and homogeneous gas phase SO2 reactions. This report considers literature through early 1983.

700,658
PB85-129336 Not available NTIS
National Bureau of Standards, Washington, DC.
Comments on 'Natural Tritiated Moisture Levels in Air Vary with Atmospheric Pressure'.
Final rept.
W. B. Mann. 1984, 1p
Pub. in International Jnl. of Applied Radiation and Isotopes 35, n2 p144 1984.

Keywords: *Tritium, *Atmospheric composition, *Atmospheric pressure, Natural radioactivity, Experimental data, Measurement, Reprints.

Dr. B.M. Coursey has drawn my attention to the comments of H.G. Ostlund and A.S. Mason on the paper entitled 'Natural tritiated moisture levels in air vary with atmospheric pressure', by G.G.J. Boswell and M. Ghannadi-Marageh. Ostlund and Mason draw attention in particular to the unnaturally high levels of tritium and to possible underestimates of the experimental uncertainties. This latter point is supported by the large spread of results at two of the pressures, 1020 and 1022mbar, shown in Fig. 1 of Boswell and Ghannadi-Marageh's paper. To credit such spreads to delayed effects due to changes in atmospheric pressure could be more persuasive if the experimental data correlating the changes of activity concentration with lags in changes in atmospheric pressure over periods of about '1 to 2 days' were given for pressures of both 1020 and 1022mbar. If these large spreads are, however, due to random experimental uncertainties, the few outliers at 1030mbar, only three out of a total of 81 results, cannot be considered to be excessive.

700,659
PB85-145423 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurements of Sky Luminance, Sky Illuminance, and Horizontal Solar Radiation.
Final rept.
S. Treado, and G. Gillette. 1983, 6p
Pub. in Jnl. of the Illuminating Engineering Society 12, n3 p130-135 Apr 83.

Keywords: *Sky, *Luminance, *Illuminance, *Daylighting, District of Columbia, Solar radiation, Measurement, Reprints.

Initial findings are presented of a sky measurement program currently underway at the National Bureau of Standards. Correlations are discussed relating horizontal illuminance to horizontal solar radiation, and zenith luminance to solar altitude angles for a North American climate (Washington, D.C.). These are simplified empirical equations to a complex phenomenon, but should be acceptable for most practical daylighting applications where accuracy is needed only within + or - 15%. Measurements were made only in the Washington, D.C. area. Similar efforts need to be made for other North American localities to validate these relationships.

700,660
PB85-145563 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Precision Atmospheric Ozone Measurements Using Wavelengths between 290 and 305 nm.
Final rept.
H. J. Kostkowski, R. D. Saunders, A. E. S. Green, J. F. Ward, and C. H. Popenoe. 30 Jun 84, 12p
Pub. in Jnl. of Geophysical Research 89, nD4 p5215-5226, 30 Jun 84.

Keywords: *Atmospheric composition, *Ozone, Atmospheric attenuation, Atmospheric radiation, Ultraviolet radiation, Solar radiation, Measurement, Spectroradiometers, Radiometry, Reprints.

It is shown theoretically that many errors are significantly less when determining atmospheric ozone thicknesses from measurements of solar terrestrial spectral irradiance in the wavelength region between 290 and 305 nm as compared to the 305- to 340-nm region employed by the Dobson spectrophotometer. In order to test this conclusion experimentally, an elaborate set of state-of-the-art measurements have been made in the shorter wavelength region in Gainesville, Florida, between June 13 and June 18, 1980. Details

of these measurements, including an extensive error analysis, are presented and indicate that such short-wavelength measurements, particularly between 295 and 305 nm, can be used to detect long-term changes of atmospheric ozone with an uncertainty not exceeding 1%. Observing conditions restricted the Gainesville measurements to zenith angles of less than 35 degrees. Further investigations are required to determine the shortest wavelength that can be used at significantly greater zenith angles.

700,661

PB85-219913 Not available NTIS
CODATA Task Group on Gas Phase Chemical Kinetics.
Evaluated Kinetic and Photochemical Data for Atmospheric Chemistry: Supplement 2.
D. L. Baulch, R. A. Cox, R. F. Hampson, J. A. Kerr, and J. Troe. c1984, 120p
Included in Jnl. of Physical and Chemical Reference Data, v13 n4 p1259-1380 1984. Available from American Chemical Society, 1155 Sixteenth St., N.W., Washington, DC 20036.

Keywords: *Reaction kinetics, *Photochemical reactions, *Vapor phases, *Air pollution, Gases, Dissociation reactions, Temperature, Tables(Data), Halogen compounds, Enthalpy, Nitrogen inorganic compounds, Physical properties, Chemical properties, Pressure, Spectroscopic analysis, Oxygen inorganic compounds, Absorption cross sections, Index terms, *Atmospheric chemistry.

The paper updates and extends previous critical evaluations of the kinetics and photochemistry of gas phase chemical reactions of neutral species involved in atmosphere chemistry. The work has been carried out by the authors under the auspices of the CODATA Task Group on Gas Phase Chemical Kinetics. Data sheets have been prepared for 256 thermal and photochemical reactions, containing summaries of the available experimental data with notes giving details of the experimental procedures. For each reaction, a preferred value of the rate coefficient at 298 K is given together with a temperature dependence where possible. The selection of the preferred value is discussed; and estimates of the accuracies of the rate coefficients and temperature coefficients have been made for each reaction. The data sheets are intended to provide the basic physical chemical data needed as input for calculations which model atmospheric chemistry. A table summarizing the preferred rate data is provided, together with an appendix listing the available data on enthalpies of formation of the reactant and product species.

700,662

PB86-113982 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Solar Cycle Effect on Atmospheric Carbon Dioxide Levels.
Final rept.
B. L. Kirk, and B. W. Rust. 1983, 8p
Pub. in Weather Clim. Responses. Sol. Var., p129-136 1983.

Keywords: *Atmospheric composition, *Carbon dioxide, *Solar cycle, Solar activity, Sunspots, Ocean temperature, Reprints, Sea surface temperature.

The authors present a causal time-series model for the Mauna Loa atmospheric CO2 record which supersedes a mathematical model (Rust et al., 1978, 1979) consisting of four effects represented by exponential and sine functions. One effect is a 142-month oscillation which trails the sunspot numbers by exactly a quarter-cycle. This suggests that solar activity affects the rate of change in the atmospheric CO2 abundance. The new model replaces the mathematical functions with four measured time series representing proposed physical causes and reduces the number of adjustable parameters from 13 to 5 with no significant deterioration in the fit. The authors present evidence that solar activity affects the CO2 abundance through variations in ocean temperature or circulation.

700,663

PB86-136959 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Infrared Band Strengths for Methyl Chloride in the Regions of Atmospheric Interest.
Final rept.
J. W. Elkins, R. H. Kagann, and R. L. Sams. 1984, 11p
Pub. in Jnl. of Molecular Spectroscopy 105, n2 p480-490 1984.

Keywords: *Chloromethanes, *Infrared spectroscopy, *Molecular vibration, *Atmospheric chemistry, *Air pollution, Greenhouse effect, Band spectro, Reprints, *Methane/chloro, *Fourier transform spectroscopy.

The infrared band strengths of seven vibrational band systems of methyl chloride between 3 and 17 micrometers region were measured at 296 + - 1 K using a Fourier transform infrared spectrometer. These results were obtained at a maximum instrumental resolution of 0.06/cm. The authors measurements should be of interest to atmospheric scientists, since methyl chloride may contribute measurably to the global greenhouse effect of the atmosphere.

700,664

PB86-138120 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Application of Tunable Diode-Laser Absorption for Trace Stratospheric Measurements of HCL - Laboratory Results.
Final rept.
A. Fried, R. Sams, and W. W. Berg. 1984, 14p
Pub. in Applied Optics 23, n11 p1867-1880 1984.

Keywords: *Atmospheric chemistry, *Hydrogen chloride, *Trace elements, *Chemical analysis, Absorption, Stratosphere, Concentration(Composition), Experimental design, Reprints, *Laser spectroscopy, *Air pollution detection.

The authors report the results of a laboratory study for detecting the important atmospheric molecule, HCl, using a tunable diode laser coupled to a multipass White cell. In contrast to many such prototype studies, the calibration in this work was carried out near the concentration range of interest and verified using three independent techniques. Employing pathlengths of 40-m, they have demonstrated a detection sensitivity (S/N=1) in the 200-300 parts-per-trillion range at pressures around 9 torr.

700,665

PB86-200763 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Microwave Spectra of Atmospheric Species.
Final rept.
F. J. Lovas. 1985, 13p
Pub. in Proceedings of CMA/NBS Workshop on Atmospheric Spectra, Gaithersburg, MD., November 3-4, 1983, p111 A14-III A26 Jun 85.

Keywords: *Atmospheric composition, Microwave spectroscopy, Molecular structure, *Chlorine nitrate(ClNO3), *Chlorine oxides, *Hypochlorous acid.

The status of microwave spectroscopy as applied to the property of the earth's atmosphere is described. The pertinent microwave literature is reviewed for molecular species present in trace amounts in the atmosphere according to their relative importance. New work on chlorine nitrate, hypochorous acid and chlorine monoxide performed at NBS is presented.

700,666

PB86-200771 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Critically Evaluated Microwave Spectral Data.
Final rept.
F. J. Lovas. Jun 85, 8p
Pub. in Proceedings of CMA/NBS Workshop on Atmospheric Spectra, Gaithersburg, MD., November 3-4, 1983, pIV-21-IV-28 Jun 85.

Keywords: *Microwave spectra, *Atmospheric composition, Molecular spectra.

A discussion is presented on the critical evaluation and cataloging of microwave spectra with special attention being given to those molecular species that play a role in the chemistry of the upper atmosphere. Data to be compiled and evaluated are spectral observations, molecular constants, and the sources of the data according to experimental technique.

700,667

PB86-207172 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Review of the Quail Roost II Receptor Model Simulation Exercise.
Final rept.
R. W. Gerlach, L. A. Currie, and C. W. Lewis. 1982, 14p
Pub. in Proceedings of Specialty Conference on Receptor Models Applied to Contemporary Pollution Problems, Danvers, MA., October 17-20, 1982, SP48, p96-109.

Keywords: *Atmospheric composition, *Aerosols, *Mathematical models, *Atmospheric models, Computerized simulation, Atmospheric dispersion, Intercomparison.

As a principal component of the Quail Roost II Receptor Model Workshop (March 1982) three sets of ambient aerosol compositional data were generated by computer simulation and distributed to several participants as a preliminary exercise in receptor model intercomparison and validation. The specific objectives of the exercise were: (a) to judge the resolving power and accuracy of alternative source apportionment methods; (b) to judge the meaninfulness of predicted vs. actual uncertainties in source apportionment; and (c) to judge the adequacy of the preliminary synthetic data set as a standard test bed for defining the performance of candidate methods. Generation of the data sets was accomplished through the use of the RAM dispersion model with real meteorological data, reasonable chemical source profiles for up to 13 source types, and random profile and measurement errors for nineteen elements and one isotopic ratio ((14)C/(12). Geographic placement of the sources and emissions rates were adjusted to yield an interesting level of complexity at the (single) receptor site.

700,668

PB86-240090 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Ultraviolet Cross-Sections of Ozone. 1. The Measurements.
Final rept.
A. M. Bass, and R. J. Paur. 1985, 6p
See also PB86-240108.
Pub. in Proceedings of Quadrennial Ozone Symposium, Halkidiki, Greece, September 3-7, 1984, Atmospheric Ozone, p606-610 1985.

Keywords: *Ozone, Absorption cross sections, Ultraviolet absorbers, Atmospheric attenuation, Temperature dependence, Atmospheric transmissivity.

Absorption cross-sections of ozone have been measured over the range 230 nm to 350 nm, and for temperatures 200K to 300K, with improved photometric accuracy and spectral resolution. These measurements are referred to the cross-section at the 253.65 nm mercury line, 1147 x 10 to the -20th power sq cm, and show an internal consistency of + or -1%.

700,669

PB86-240108 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Ultraviolet Cross-Section of Ozone. 2. Results and Temperature Dependence.
Final rept.
R. J. Paur, and A. M. Bass. 1985, 6p
See also PB86-240090.
Pub. in Proceedings of Quadrennial Ozone Symposium, Halkidiki, Greece, September 3-7, 1984, Atmospheric Ozone, p611-616 1985.

Keywords: *Ozone, Absorption cross sections, Ultraviolet absorbers, Atmospheric attenuation, Temperature dependence, Atmospheric transmissivity.

Tables of ozone absorption cross-section in the ultraviolet have been prepared for intervals of 0.05 nm over the range 245 to 340 nm. At each wavelength entry in the table a set of coefficients has been derived that permits the cross-section to be computed as a function of temperature, between 200K and 300K, with an accuracy of 1%.

General

700,670
PB81-178659 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectral Distribution of Solar Radiation.
Final rept.
A. T. Mecherikunnel, and J. C. Richmond. Sep 80, 86p
Sponsored in part by National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
Pub. in NASA Technical Memorandum No. 82021, p1-86 Sep 80.

Keywords: *Solar radiation, *Solar constant, *Irradiance, Atmospheric attenuation, Solar energy.

Available quantitative data on solar total and spectral irradiance is examined in the context of utilization of solar irradiance for terrestrial applications of solar energy. A brief review is given on the extraterrestrial solar total and spectral irradiances values. Computed values of solar spectral irradiance at ground level for different air mass values and various levels of atmospheric pollution or turbidity are also presented. Wavelengths are given for computation of solar absorptance, transmittance and reflectance by the 100-selected-ordinate method and by the 50-selected-ordinate method from air mass 1.5 and 2 solar spectral irradiance for the four degrees of atmospheric pollution.

700,671
PB84-245901 Not available NTIS
National Bureau of Standards, Washington, DC.
Data on Total and Spectral Solar Irradiance.
Final rept.
A. T. Mecherikunnel, J. A. Gatlin, and J. C. Richmond. 1 May 83, 6p
Pub. in Applied Optics 22, n9 p1354-1359, 1 May 83.

Keywords: *Solar constant, *Irradiance, *Solar radiation, Atmospheric attenuation, Solar energy, Reviews, Reprints, Atmospheric transmissivity.

This paper presents a brief survey of the data available on solar constant and extraterrestrial solar spectral irradiance. The spectral distribution of solar radiation at ground surface, computed from extraterrestrial solar spectral irradiance for several air mass values and for four levels of atmospheric pollution, is also presented. The total irradiance at ground level is obtained by integration of the area under the spectral irradiance curves. It is significant that, as air mass increases or as turbidity increases, the amount of energy in the infrared relative to the total increases, and that the energy in the UV and visible decreases.

BEHAVIOR & SOCIETY

Education, Law, & Humanities

700,672
PB-266 476/1 Not available NTIS
National Bureau of Standards, Gaithersburg. MD.
Patents - An Inventor's Viewpoint.
J. Rabinow. Feb 77, 18p
Pub. in Proceedings of Anniversary Meeting (50th) of the Patent and Trademark Institute of Canada, Held at Ottawa, Canada on September 15-17, 1976, Patent Trademark Inst. Can. Jnl. p 836-853 Feb 77.

Keywords: *Patents, *Regulations, Canada, Inventions, Creativity, *Patent laws, Reprints.

A committee of three Canadians has prepared a proposal for a new Patent Law for Canada and has published the Proposed Law and a Working Paper on it. A large section of the Working Paper is devoted to criticisms of patents in general. This talk was meant to refute these attacks. The main attacks involved calling patents monopolies, stating that authors and composers create new art but inventors do not, and that patents are simply means to reduce innovation and extort tributes from society by inventors who create nothing new but simply find that which is inherent in the nature of the world.

700,673
PB-297 642/1 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Law Enforcement Standards Lab.
Juror Response to Prerecorded Videotape Trials.
E. M. Robertson. Jun 79, 33p NBS-SP-480-30
Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, DC.

Keywords: *Attitude surveys, *Video tapes, *Litigation, *Private law, Ohio, Courts of law, Equity(Law), Substantive law, Awards, Tape recording, Torts, *Juries, *Civil proceedings, Trials, Trial procedures, Witnesses, Testimony.

The report is an analysis of the responses to an attitudinal questionnaire returned by 278 jurors who had participated in prerecorded videotaped (PRVTT) civil trials conducted in Ohio during 1975 and 1976. These trials differ from ordinary trials in two major respects: (1) The witnesses' testimony had been prerecorded for trial presentation and (2) the judge is not present during the videotape presentation. The responses indicated a generally favorable reaction to the use of PRVTT.

700,674
PB80-107444 Not available NTIS
National Bureau of Standards, Washington, DC.
Lead Isotopes in Some Japanese and Chinese Glasses.
Final rept.,
R. H. Brill, K. Yamasaki, I. L. Barnes, K. J. R. Rosman, and M. Diaz. 1979, 23p
Pub. in Ars Orientalis, v11 p87-109, 1979.

Keywords: *Lead glass, *Lead isotopes, China, Japan, History, Galena, Mineral deposits, Lead ore deposits, Archaeology, Reprints, Isotope ratio, Isotope applications.

Lead isotope ratios have been measured in a number of Japanese glasses or glass-like materials, in a few Chinese glasses and in galena ore samples from well defined areas in Japan. Measurable differences found in the ore samples indicate the possibility of identifying sources of lead in ancient glass, pottery, bronze, etc., and thus the possible site of manufacture. A particular set of 'Mara' glasses from the first half of the eighth century A.D. has been identified.

700,675
PB80-120579 PC **A13**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Regulatory Use of Standards: The Implications for Standards Writers.
Final rept.,
P. J. Harter. Nov 79, 286p NBS-GCR-79-171
Sponsored in part by Weil, Gotshal and Manges, Washington, DC.

Keywords: *Standards, *Regulations, Law(Jurisprudence), Safety, Writing, Organizations.

The purposes of this report are: (1) to help standards-writing organizations prepare standards that are acceptable to regulatory agencies for use in regulations or as an alternative to regulation; and (2) to suggest how regulatory agencies might improve their relationships with private sector standards organizations. The report describes how standards are used in regulatory programs and discusses the requirements imposed on agencies by administrative law. From this analysis, it is possible to make some general suggestions - for example: organizations writing standards for possible regulatory use should prepare an accompanying rationale and procedural history. The report summarizes complaints of standards organizations about regulatory agencies, and suggests how agencies might improve their relationships with standards organizations.

700,676
PB81-163107 Not available NTIS
National Bureau of Standards, Washington, DC.
Low Cost Approach to Modernize Undergraduate Electronic Laboratory Instruction.
Final rept.
D. J. Dumin. May 79, 3p
Pub. in Proceedings of Biennial University/Industry/Government Microelectronics Symposium (3rd), Lubbock, TX., May 21-23, 1979, p168-170.

Keywords: *Education, *Universities, Engineers, Electronics, Students, Cost control, Continuing education.

A program for development of a low cost approach for modernizing microelectronic undergraduate education is presented. The plan is based on the use of integrated circuit test wafers as the instructional tools to be used in the laboratory portion of microelectronic courses. The use of integrated devices and circuits at the wafer probe level would assist students in attaining a feel for the size and limitations of modern microelectronic devices and would act as a physical basis for electronics instruction. The approach attempts to minimize the total cost of this program at the university level and, thus, should help assure that this program is adopted by a large number of colleges and universities. This approach should also be attractive to small universities and minority universities where equipment budgets have been traditionally low. This approach should also find extensive use in continuing education of electrical engineers.

700,677
PB85-121465 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Data Requirements for the Seismic Review of LNG (Liquefied Natural Gas) Facilities.
W. D. Kovacs, E. V. Leyendecker, J. S. Leiss, and L. A. Lister. Jun 84, 52p NBSIR-84/2833
Sponsored in part by Federal Energy Regulatory Commission, Washington, DC.

Keywords: *Liquefied natural gas, *Facilities, *Earthquake resistant structures, Reviewing, Data, Site surveys, Information, Requirements, Safety, Standards, *Certification, Applicants, Federal energy regulatory commission.

This report describes data needed by the Federal Energy Regulatory Commission for the seismic review of Liquefied Natural Gas (LNG) facilities and is intended to expedite the certification process of the Federal Energy Regulatory Commission. It uses a format familiar to those industry representatives and their consultants who work on siting other safety-related structures. Available state and Federal regulations were reviewed for format and type of information required to develop a source document which can be used to establish a consistent format and content for applications in their submittal of the necessary geological-structural-seismic information required to analyze sites for LNG facilities. Design criteria and levels of safety to be used in analyzing sites were not considered.

700,678
PB85-145324 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Is Invention an Art. Since It is Fun, Should Inventors be Paid.
Final rept.
J. Rabinow. 1980, 4p
Pub. in Industrial Research/Development 22, n12 p88-91 1980.

Keywords: *Arts, Creativity, Inventions, Culture(Social sciences), Reprints.

Invention is an art form because it has the attributes of all arts: (1) It is the product of a person's mind. (2) It is the combination of prior knowledge, combined in new ways. (3) It requires a sophisticated audience well versed in the art to appreciate the product. (4) It produces an emotional reaction in the mind of a beholder so cultured. The talk relates anecdotes from my experiences and touches upon the fact that much of the present management of our technology does not appreciate the art.

700,679
PB85-172518 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Legal Metrology: How the National Bureau of Standards and ASTM Get Involved.
Final rept.
D. R. Mackay. Dec 84, 7p
Pub. in ASTM (American Society for Testing and Materials) Standardization News 12, n12 p28-30 Dec 84.

Keywords: *Metrology, Law(Jurisprudence), Reprints, *Legal metrology, *International Organization of Legal Metrology, American Society for Testing and Materials, National Bureau of Standards.

This paper describes the International Organization of Legal Metrology (OIML), its objectives and its procedures for the development of International Recommendations. The involvement of the United States in

this treaty organization is explained as is the development of U.S. positions on OIML documents. The interface between U.S. OIML activities and ASTM technical committee activities is described for medical instruments, pollution, temperature, and mechanical testing. The potential for future work is described for three areas. A summary of U.S. participation in OIML work is provided and aresponse is solicited from ASTM members who are interested in the work described.

700,680
PB85-187565 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Law Enforcement Standards Lab.
Guide to Computer-Aided Dispatch Systems.
Final rept.
D. J. Brenner, and M. A. Cadoff. Mar 85, 44p NBSIR-84/2991
Sponsored by National Inst. of Justice, Washington, DC.

Keywords: Command and control, Procurement, Decision making, Guidelines, Law enforcement, *Communications networks, *Dispatching, Computer system hardware, Computer software.

This guide provides current information on computer-aided dispatch (CAD) systems as they are used by law enforcement and other public safety agencies and is intended to serve as a procurement aid to those persons who are or will be involved with the planning and acquisition of a CAD system. Topics such as the improvements in operations that may result from installation of a CAD system, a description of the system components, various considerations that will require resolution when the decision is made to purchase a CAD system, and provision of sufficient background to enable a knowledgeable purchasing decision to be made are addressed. A general purchase implementation plan is included also.

700,681
PB85-202828 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Estimating the Effect of a Large Scale Pretest Posttest Social Program.
Final rept.
C. H. Spiegelman. 1979, 4p
Pub. in American Statistical Association 1979 Proceedings of the Social Statistics Section, p370-373 1979.

Keywords: *Educational sociology, Tools, Intelligence tests, Statistical analysis, Regression analysis, Errors, Reprints, *Education programs, *Program evaluation, Analysis, G.R.E. scores.

It is well known that nonrandomized education programs are difficult to evaluate (Campbell and Stanley (1968)). Some help in the evaluation may be obtained by using available instrumental variables, such as G.R.E. scores, or I.Q. tests. However, they should be used with great care as errors in these variables can mislead naively performed analysis. The work shown here gives a new procedure for evaluating pretest-posttest social programs. This paper summarizes the most important results and procedures found in Spiegelman (1976, 1977). Examples indicating how and when the new procedure may be useful are found at the end of this paper.

700,682
PB86-129715 PC **A03**/MF **A01**
Hilsenrath (Joseph), Silver Spring, MD.
National Academy of Sciences-National Research Council's Postdoctoral Research Associateship Program: An Account of Its Origin and Early History at the National Bureau of Standards.
J. Hilsenrath. Sep 85, 40p NBS/GCR-85/500
Sponsored by National Bureau of Standards, Gaithersburg, MD.

Keywords: History, Tables(Data), Education, Fellowships, *National Bureau of Standards, *Postdoctoral research, National Academy of Sciences.

The report reviews the origins and early history of the National Academy of Sciences-National Research Council's Postdoctoral Research Associateship Program at the National Bureau of Standards. It describes in detail the intra- and interagency discussions and negotiations that led to the program's creation. A number of tables are included with data on such parameters as the associates' disciplines and university affiliations, DOC-NBS awards associates have received, and those still at NBS.

700,683
PB87-201588 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Lead Isotope Studies of Some of the Finds from the Serce Liman Shipwreck.
Final rept.,
I. L. Barnes, R. H. Brill, E. C. Deal, and G. V. Piercy. 1986, 11p
Pub. in Proceedings of the Int. Archaeometry Symposium, Washington, DC, May 14-18, 1984, p1-11 1986.

Keywords: Glass, Ceramics, Mediterranean Sea, Turkey, *Shipwrecks, Tracer techniques, Lead isotopes, Sunken ships, Underwater archaeology.

The remains of a shipwreck at Serce Liman, along the southern coast of Turkey, were recently excavated by the Institute of Nautical Archaeology. The wreck was that of a merchant ship which went down in about A.D. 1025. A major part of the cargo consisted of more than half-a-million fragments of broken glass vessels and chunks of glass cullet. The excavators wish to learn whether the ship was Byzantine or Islamic, to trace the final route of the ship, to identify the nationality of her crew, and to learn where the glass was made. Identification of the proveniences of the cargo, the ship's fittings, and the personal belongings found on board could provide valuable evidence for answering these questions. Isotope determinations have been made for lead extracted from several lead-containing objects from the wreck. These include certain types of glasses, glazed ceramic wares, a bronze sword hilt, and a group of net sinkers. The study poses a severe test for the classification of objects and the determination of proveniences by lead isotope studies.

700,684
PB88-144142 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Preservation of the Declaration of Independence and the Constitution of the United States.
Final rept.
2 Jul 51, 21p NBS/CIRC-505
Also available from Supt. of Docs.

Keywords: Inert atmospheres, United States, *Historic preservation, *Declaration of Independence, *Constitution, *Preservation, Physical radiation effects.

At the request of the Librarian of Congress, an investigation was undertaken by the National Bureau of Standards to determine the best means of preserving the original copies of the Declaration of Independence and the Constitution of the United States. Consideration was given to three aspects of the problem. (1) Preservation of the documents in an inert atmosphere. (2) Filter to protect against harmful radiation. (3) Lighting conditions to improve viewing of the documents. The report summarizes the investigation on the first two subjects. The third subject will be discussed in a separate report.

International Relations

700,685
PB88-137120 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
National Bureau of Standards' International Relations.
Final rept.,
H. S. Peiser. 1980, 5p
Pub. in Proceedings of Commonwealth Regional Metrology Programme, Report on the First Review Meeting, Wellington, New Zealand, October 29-November 9, 1979, v2 p39-43 Apr 80.

Keywords: *International Relations, Meetings, International Cooperation, *National Bureau of Standards.

International relations are vital to the National Bureau of Standards. Our Director, Dr. Ernest Ambler, who would have wished, but was unable personally, to address you during this meeting, sends warm greetings, especially to PEL. He is himself very interested in the international and regional cooperative programmes of NBS. As his maturing years were spent within the Commonwealth, he would have appreciated participating in a meeting co-sponsored by the Commonwealth Science Council.

Job Training & Career Development

700,686
PB80-212277 Not available NTIS
National Bureau of Standards, Washington, DC.
Training in Legal Metrology,
H. F. Wollin. Mar 80, 3p
Pub. in Proceedings of the 1979 Annual Conference on Education and Training Workshop, Boulder, CO., October 15-17, 1979, NCSL Newsletter 20, n1 p23-25 Mar 80.

Keywords: *Specialized training, *Metrology, State government, Local government, Government employees, Education, Instructional materials.

NBS provides technical training to State and local regulatory officials and laboratory metrologists in the field of legal metrology. Such training is offered on a regular basis to develop and improve the professional skills of those who request the service. The training program is structured to be sensitive to the differing educational background of officials, their levels of experience and specialization of activities. Instruction is offered on the classroom, laboratory, and field and includes seminars for inspectors, metrologists, supervisors, and administrators.

700,687
PB82-212093 Not available NTIS
National Bureau of Standards, Washington, DC.
Contribution to Panel Discussion on Training Statisticians for Employment in Industry and Government.
Final rept.
C. Eisenhart. 1982, 25p
Pub. in Proceedings of Conference on Teaching of Statistics and Statistical Consulting, Ohio State University, p257-281 1982.

Keywords: *Specialized training, *Statistics, Government employees, Universities, United States, Australia, Curricula.

NBS and CSIRO programs in mathematics and statistics are compared and contrasted with respect to size, scope, operations, recruitment and in-service training. The report discusses inadequacy of mean square error, and some alternatives thereto, as characterizations of the accuracy of a measurement process, as background for procedure Hogben outlined for comparing the 'closeness' with which alternative statistical estimators determine the value of an unknown parameter. It reviews the experience and practices of the NBS Statistical Engineering Laboratory (now 'Division') with respect to recruitment and in-service training of statisticians and comments on the shortcomings of university training of statisticians in the U.S.A. for careers in the physical sciences, and mentions current developments in some biostatistics departments and state universities that show promise of overcoming these shortcomings.

700,688
PB88-138862 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Beginning at a Government Agency.
Final rept.,
J. S. Suehle. 1984, 1p
Pub. in Engineering Horizons, p52 1984.

Keywords: *Engineers, *Personnel development, Government, Laboratories, Reprints.

The author suggests that graduating engineers may want to consider beginning their professional careers in a government laboratory and outlines reasons why.

Psychology

700,689
PB-271 755/1 PC **A14**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.

Smoke as a Determinant of Human Behavior in Fire Situations (Project People).
Final rept.,
J. L. Bryan. 30 Jun 77, 304p NBS-GCR-77-94
Grant NBS-4-9027

Keywords: *Human behavior, *Fires, *Smoke, *Buildings, Data acquisition, Interviews, Questionnaires, Sites, Fire protection, Populations, Sequential analysis, Reaction time, Responses, Actions following perception, People project.

This study involved the interviewing of 584 occupants of buildings on fire by fire department officials at the scene of the fire incident. The analysis and study of the interview data involved the determination of the critical variables relative to the fire incident (e.g. area of fire origin), participant population parameters (e.g. location at time of awareness there was a fire) and the first, second and third actions of the participants after becoming aware of the fire incident. Statistical analyses were performed showing the relationship among the variables. Results were compared with those of a similar study conducted in England.

700,690

PB-271 980/5 PC **A09**/MF **A01**
California Univ., Berkeley. Architecture Life Safety Group.
Human Behavior in Institutional Fires and Its Design Implications.
Final rept.,
L. Lerup, D. Cronrath, and J. K. C. Liu. 28 Feb 77, 183p NBS-GCR-77-93
Grant NBS-6-9013
See also report dated Jul 76, PB-257 424.

Keywords: *Human behavior, *Fires, Sequential analysis, Decision making, Nurses, Nursing homes, Buildings, Emergency procedures, Mapping, Safety, Patients, Case studies, Building fires.

The objective of this project is to derive design implications from the in-depth analysis of behavior in institutional settings under fire. The context and data for this pursuit are drawn from ten case studies of significant nursing home fires which occurred in the United States between 1970 and 1974. The methodology used is based on a graphical (pictorial) and narrative mapping of fire and people behavior and it is an extension of the mapping system report in Report NBS-GCR 76-73 'Mapping of Recurrent Behavior Patterns in Institutional Building Under Fire: Ten Case Studies of Nursing Facilities.' (Portions of this document are not fully legible)

700,691

PB-275 540/3 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
Role of Behavioral Science in Physical Security,
J. J. Kramer. Feb 77, 122p NBS-SP-480-24
Proceedings of the Annual Symposium (First) Held at Defense Nuclear Agency, Washington, D.C. on April 29-30, 1976. Sponsored in part by Defense Nuclear Agency, Washington, D.C. Intelligence and Security Directorate. Includes report, Preliminary Observations of Complex Fence and Barrier Assaults--Phase II, p107-113. Library of Congress Catalog Card no. 77-600058.

Keywords: *Behavior, *Security, *Meetings, Reliability, Psychological effects, Terrorism, Infiltration(Personnel), Threat evaluation, Deterrence, Hijackings.

This document contains the proceedings of a 2-day Symposium/Workshop held in April 1976 on the application of behavioral science to the problems of physical security. The formal papers are divided into three topical sections: (1) Threat Analysis-Behavioral Factors and Consequences, (2) Human Reliability-Response Forces vs. Adversary, and (3) Methods of Measuring Behavioral Impact-Quantitative vs. Qualitative. Timely questions and challenges were explored in open discussion sessions following many of the presentations. The volume concludes with a brief summary of the panel-type workshop on the subject of threat analysis held on the second day.

700,692

PB-277 773/8 PC **A03**/MF **A01**
Loyola Univ. of Chicago, Ill. Fire and Human Behavior Research Center.
Model of Human Behavior in a Fire Emergency.
Final rept.,
L. Bickman, P. Edelman, and M. A. McDaniel. Dec 77, 33p NBS-GCR-78-120
Contract NBS-6-9015
Sponsored in part by Department of Health, Education and Welfare, Washington, D.C.

Keywords: *Human behavior, *Fires, *Emergency procedures, Fire fighting, Decision making, Safety, Attitudes, Fear, Mathematical models.

This paper describes a conceptual model which describes some of the significant factors thought to influence human behavior in a fire emergency. The model attempts to integrate previous research on fire and human behavior with relevant findings from the field of social psychology. The model involves three stages: (1) detection of cues; (2) definition of the situation; and (3) coping behavior. These stages describe the logical flow of behavior during a fire. Six categories of variables are presented which are hypothesized to affect behavior at each stage in the model: (1) physiological/physical; (2) intrapersonal; (3) education/preparation; (4) social; (5) fire characteristics; and (6) physical environment. The potential value of the model in explaining behavior in actual fires and in formulating future research is demonstrated with specific examples.

700,693

PB-283 927/2 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
Role of Behavioral Science in Physical Security,
J. J. Kramer. Jun 78, 97p NBS-SP-480-32
Proceedings of the Annual Symposium (2nd) Held at National Bureau of Standards, Washington, D.C. on March 23-24, 1977. Report on Law Enforcement Equipment Technology. Sponsored in part by Defense Nuclear Agency, Washington, D.C. Intelligence and Security Directorate. See also report dated Feb 77, PB-275 540.

Keywords: *Behavior, *Security, *Meetings, Reliability, Psychological effects, Clearances, Terrorism, Infiltration(Personnel), Threat evaluation, Deterrence.

Contents: The inadvertent adversary to nuclear security-ourselves (Don D. Darling); A behavioral analysis of the Adversary threat to the commercial nuclear industry-a conceptual framework for realistically assessing threats (Phillip A. Karber and R. W. Mengel); Behavior and misbehavior of terrorists: Some cross-national comparisons (D. Jane Pratt); Attributes of potential adversaries of U. S. nuclear programs (Allan M. Fine); Some ideas on structuring the problem of collusion (James NiCastro and Hugh Kendrick); Response force selection and training (Stephen L. Galloway); Uses of animal sensory systems and response capabilities in security systems (Robert E. Bailey and Marian Breland Bailey); Physiological correlates of information processing load-ongoing research and potential applications of physiological psychology (Thomas E. Bevan); Toward the collection of critically evaluated ergonomics data (Harold P. Van Cott and Joel J. Kramer).

700,694

PB-288 525/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Light and Vision.
Final rept.,
G. T. Yonemura. 1978, 21p
Pub. in Developments in Lighting - 1, J. A. Lynes, Ed., Ch2, 25-45 (Applied Science Publishers Ltd., Essex, England, 1978).

Keywords: *Illuminance, *Visual perception, *Illuminating, *Physiological psychology, Stimulus(Psychophysiology), Responses, Requirements, Information, Criteria, Reprints.

Three levels of visual information needs are defined. The psychophysical responses associated with these information requirements are identified and correlated with their stimulus counterparts. The criteria for recommending levels of illumination should be 'goodness of seeing' rather than 'just barely able to see'. Blur is introduced as a parameter that has been neglected in task description for lighting. The modulation transfer function is recommended as a technique that analytically describes the classical parameters associated with visual sensory performance as well as blur. The relative contributions from physiological and psychological variables in visual task performance studies are discussed.

700,695

PB-290 821/8 PC **A04**/MF **A01**
North Carolina Univ. at Chapel Hill. Dept. of Psychology.
Psychology of Firesetting: A Review and Appraisal.
Final rept.
R. G. Vreeland, and M. B. Waller. Dec 78, 58p NBS-GCR-79-157
Grant NBS-G7-9021

Keywords: *Fires, *Behavior disorders, Crimes, Motivation, Therapy, Children, Abnormal psychology, Treatment, *Arson, Pyromania, Behavior modification.

Despite a rather large and diverse literature on firesetting, relatively little is understood about its determinants. This situation exists partly because of the enormous difficulties in carrying out systematic, well-controlled research studies on firesetting. Legal difficulties in accessing samples of arsonists, the manner of legal disposition of arson cases, and the fact that relatively few arsonists are apprehended makes it likely that research samples will be narrow and biased; it is not surprising that conclusions have often been contradictory and comparisons between groups have been extremely difficult. A further problem is that previous attempts at classification of firesetters have usually been based arbitrarily upon one aspect of the act, such as the firesetting motive, while other, potentially more important, distinguishing features may have been overlooked. After reviewing previous attempts at classifying firesetters, the present study organizes current knowledge about characteristics of firesetters into four major categories: antecedent environmental conditions, organismic variables, actual firesetting behavior, and the consequences of firesetting. Understanding a firesetter's behavior requires an assessment of each of these categories, and types of firesetters may eventually be defined by clusters or patterns of characteristics rather than by a single, overriding feature. This approach is also useful in that it has theoretical implications as well as implications for prevention and treatment strategies.

700,696

PB-290 892/9 PC **A04**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Kensington Gardens Nursing Home on January 1, 1978.
Final rept.
J. L. Bryan, and P. J. DiNenno. 30 Jun 78, 66p NBS-GCR-79-159
Grant NBS-7-9014
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nursing homes.

The fire incident at the Kensington Gardens Nursing Home on January 1, 1978 was detected by the nursing staff at approximately 9:56 a.m., at which time the fire consisted of preflashover state in patient room 250. The fire apparently originated in an upholstered chair from discarded smoking materials or matches by the room's occupant. The fire department was notified at 9:59 a.m. by telephone. Housekeeping and nursing personnel assigned to the second floor, west wing, detected the fire in patient room 250 and immediately closed the door to this fire room. Other patient room doors in the fire zone were then closed, and three patients were evacuated from the fire zone before the corridor became untenable from smoke migration. The closing of the door to the fire involved room, and the closing of the patient room doors appeared to be critical adaptive actions in this fire incident.

700,697

PB-294 970/9 PC **A06**/MF **A01**
Wisconsin Univ.-Madison. Waisman Center on Mental Retardation and Human Development.

Behavioral and Physical Characteristics of Developmentally Disabled Individuals.
Final rept.
C. J. Overboe, and Y. Y. Wang. Oct 78, 109p NBS-GCR-79-167
Contract NBS-7-9019
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Handicapped persons, *Facilities, Quality of life, Safety, Fire protection, Characteristics, Mental disorders, Epilepsy, Residential buildings, *Group living.

The goal of the study is to provide a baseline of information to assist planners, consultants and decision-makers in determining realistic requirements for life safety in community-based group homes for the developmentally disabled. The paper is divided into three major sections. The first part provides an overview of the concept of developmental disabilities and discusses its prevalence. A section on the individual characteristics of mental retardation, cerebral palsy, epilepsy and autism is included. The second major part contains two sections. One describes the characteristics found in the current population of group home residents. The next section provides information on individuals presently residing in institutions for the mentally retarded and the developmentally disabled who may form part of the future population in community housing. The last major part provides a summary of descriptive data regarding severely retarded individuals.

700,698

PB-300 986/7 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Privacy as Information Management: A Social Psychological and Environmental Framework.
S. T. Margulis. Sep 79, 28p NBSIR-79-1793

Keywords: *Social psychology, Information, Management, Communication management, Secure communication, Organization theory, Availability, Social communication, *Privacy, *Information dissemination.

A social-psychological and environmental framework for a theory of privacy is summarized. The framework focuses on the management of information, the loss of which would or could have costly consequences for the target of the information. Key concepts, such as information, communication, personnal control, cost, and barrier, are defined and discussed. Particular emphasis is placed on influence of the objective physical environment on privacy.

700,699

PB80-103799 Not available NTIS
National Bureau of Standards, Washington, DC.
Human Behavioral Considerations in the Planning and Design of Passive Solar Systems for Commercial Facilities: An Exploratory Study of the Effects of Sun and Shade.
Final rept.,
F. I. Stahl, D. Conway, and M. R. Goglia. Oct 79, 4p
Pub. in Proceedings of the National Passive Solar Conference (4th) Held at Kansas City, MO. on October 3-5, 1979, p26-29, Oct 79.

Keywords: *Pedestrians, *Behavior, *Sunlight, Shops, Commercial buildings, Attitudes, Comfort, Environments, Decision making.

An exploratory study was conducted to determine whether alterations in sun and shade patterns (which may result from certain passive solar retrofit designs) influence window-shopping and other behaviors on retail streets. Pedestrians were observed at two urban locations. The hypothesis that in cool weather pedestrians prefer the sunny (rather than shady) side of retail streets was partially supported by the data. The hypothesis that durations of window-shopping and other relevant behaviors would be greater on the sunny side was not supported.

700,700

PB80-148596 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Georgian Towers on January 9, 1979.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 30 Apr 79, 45p NBS-GCR-79-187
Grant NBS-7-9014
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC. See also report dated 30 Jun 78, PB-290 892.

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Smoke, Attitudes, Apartment buildings, Specialized training, Cooperation.

The fire incident at the Georgian Towers Apartment Complex in Silver Spring, Maryland, on January 9,1979 was initially detected by the occupant of apartment 214 when he was awakened with his mattress on fire. The occupant attempted to remove the mattress from the apartment and, being unsuccessful, ran down four levels to the desk receptionist to call the fire department. The fire department received the alarm at 0246. The corridor door to the apartment of fire origin had been left open and, with the arrival of the Silver Spring Fire Department at 0248, flashover had occurred in the apartment, and smoke had completely saturated the second floor corridor of both the 'A' and 'B' wings. The fire was extinguished with two 2-inch hose lines, one from the corridor and one from the balcony. Smoke permeated most of the building, being especially heavy on the second, seventh, ninth and eleventh floors. A total fire department response of four alarms was required to assure the evacuation of over 250 occupants. Approximately 21 occupants required emergency medical treatment, 17 for smoke inhalation. The fire was confined to the apartment of origin and the immediately exposed second floor corridor area.

700,701

PB80-148661 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Law Enforcement Standards Lab.
Role of Behavioral Science in Physical Security.
J. J. Kramer. Dec 79, 115p NBS-SP-480-38
Proceedings of the Annual Symposium (3rd), Held at Arlington, VA on May 2-4, 1978. Prepared in cooperation with Defense Nuclear Agency, Washington, DC. Report on Law Enforcement Equipment Technology. See also report dated Jun 78, PB-283 927.

Keywords: *Behavior, *Security, *Meetings, Reliability, Psychological effects, Clearances, Terrorism, Infiltration(Personnel), Threat evaluation, Deterrence.

The document contains the proceedings of the third annual symposium on, 'The Role of Behavioral Science in Physical Security,' held in May 1978. The symposium provided a forum for the exchange of information between specialists in physical security and behavioral science through the presentation of eight papers and four structural workshops: Human Sensory Capabilities/Limitations; Human Engineering of the Workplace; Human Motivation, Attitudes, Error/Reliability; Personnel Selection, Placement, Training. The symposium concluded with a summary and synthesis of the results of the workshops and a panel discussion on new research thrusts.

700,702

PB80-158157 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the University Nursing Home on April 13, 1979.
Final rept.,
J. L. Bryan, and P. J. DiNenno. Jan 80, 39p NBS-GCR-80-191
Grant NBS-7-9014
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nursing homes.

At approximately 0833 hours on April 13, 1979, the smoke detector located on the ceiling of the lounge area at the south end of the corridor of the South Section of B wing on the second floor activated in the University Nursing Home, 901 Arcola Avenue, Silver Spring, Maryland. Approximately 21 patients were removed from rooms in the South Section by the fire department, 7 of these down ladders. An additional 26 patients were evacuated from the West Section of B wing. Seventeen patients were transported to hospitals for medical treatment with eight staff members. Two of these patients subsequently died. The total fire department response involved three alarms. The fire was extinguished within 5 minutes of the arrival of the first engine and within 9 minutes of smoke detector activation.

700,703

PB80-161599 PC **A04**/MF **A01**
North Carolina Univ. at Chapel Hill. Dept. of Psychology.
Personality Theory and Firesetting: An Elaboration of a Psychological Model.
Final rept.,
R. G. Vreeland, and M. B. Waller. Feb 80, 65p NBS-GCR-80-194
Grant NBS-7-9021

Keywords: *Fires, *Behavior disorders, Crimes, Motivation, Cognition, Children, Learning theory, Decision making, *Arson, Pyromania, Behavior modification.

The report attempts to develop a theoretical framework for understanding firesetting behavior in terms of social learning theory. Three major aspects of the interaction between a person's behavior and the social environment are considered. (1) At the behavioral level, the individual's behavior acts upon and is acted upon by the environment, and aspects of the rearing environment which may lead to firesetting are considered. (2) Vicarious processes determine how behavior is influenced by other sources of information, including modeling and instructional influences. (3) Cognitive processes determine how a person selects, encodes, and evaluates incoming information about the social environment, and how behavioral sequences are determined in light of the person's expectations and abilities. The implications of social learning theory for the treatment of firesetting in children and adults are discussed in detail. The present paper also provides a framework for future studies examining the social learning determinants of firesetting behavior.

700,704

PB80-163017 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at Thurston Hall on April 19, 1979.
Final rept.,
J. L. Bryan, J. A. Milke, and P. J. DiNenno. 31 Jul 79, 44p NBS-GCR-80-193
Grant NBS-7-9014
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Human behavior, *Fires, Fire fighting, Evacuating(Transporting), Students, Smoke, Attitudes, Buildings, Injuries, Specialized training, Cooperation, Universities, Dormitories.

The fire incident occurred on the fifth floor of Mabel Nelson Thurston Hall, George Washington University, 1900 F Street, N.W., Washington, D.C., on April 19, 1979. The fire incident was initially detected by a student who investigated an abnormal noise followed by smoke issuing from the corridor into the room 501, occupied by the student. Many students attempted to evacuate through the corridor, while others waited for rescue in their room. The District of Columbia Fire Department arrived after flashover had occurred in the corridor of the fifth floor. Eight hundred ninety-eight students and University staff residing in the building were evacuated.

700,705

PB80-177264 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the National Institutes of Health Clinical Center on April 21, 1979.
Final rept.,
J. L. Bryan, and P. J. DiNenno. Jan 80, 43p NBS-GCR-80-192
Contract NBS-7-9014
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, National government, National Institutes of Health.

This fire incident at the National Institutes of Health Clinical Center on April 21, 1979, was detected by a pharmacy technician on the ninth floor, west pediatrics nursing unit with the visual observation of smoke in the solarium lounge at approximately 1502. The technician immediately notified the charge nurse. The local alarm system was activated, which automatically transmitted an alarm to the National Institutes of Health Fire Department. Four ambulatory patients and two visitors were evacuated by the nursing staff and one ambulatory patient was evacuated by maintenance personnel. Bethesda Fire Department personnel rescued one infant. The Clinical Center was evacuated from the fourteenth through the third floors of approximately 184 patients and 50 visitors primarily by staff and NIH personnel in approximately 55 minutes. A total of seven persons was hospitalized for medical observation or treatment: four fire department personnel, one police officer, one visitor and one patient. The initial response by the National Institutes of Health Fire Department consisted of one engine and one ambulance with 5 personnel. The fire was extinguished by Bethesda Fire Department personnel with one 2 inch hose line from the standpipe system in stairway 7, in approximately 20 minutes. The fire damage in this 26 year old fire resistive building was limited to the solarium lounge and the corridor of the 9 west nursing unit.

700,706

PB80-179054 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Taylor House on April 11, 1979.
Final rept.,
J. L. Bryan, J. A. Milke, and P. J. DiNenno. Apr 80, 42p NBS-GCR-80-200
Grant NBS-7-9014
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Mental disorders, Death, Injuries, Halfway houses.

This fire incident originated on a sofa in the first floor lounge of the duplex unit at 1715 Lamont Street, N.W. Washington, D.C. on April 11, 1979. The duplex dwelling at 1715-17 Lamont Street, was known as the Taylor House and operated as a Community Residence Facility for fifty-one psychiatric residents on an out-patient status from St. Elizabeth's Hospital. At the time of the fire incident, there were a total of 26 residents in the 1717 duplex unit which received only light smoke damage. There were a total of 21 residents in the 1715 duplex unit, with two staff members at the time of the fire incident. The fire department personnel evacuated and rescued 7 residents from the building. There were a total of ten resident fatalities, and five residents suffered injuries requiring hospital treatment.

700,707

PB80-181654 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Harford Memorial Hospital on March 9, 1978,
J. L. Bryan, and P. J. DiNenno. 31 Jul 78, 47p NBS-GCR-80-209
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Cooperation, Nurses, Hospitals.

The fire incident at the Harford Memorial Hospital on March 9, 1978 was detected by the nursing staff in response to a patient's cries at approximately 0315 hours. The four nursing staff members upon entering patient room 373 observed the linen involved for an area of approximately 1.5 square feet and flames with a height of approximately 1 foot adjacent to the patient. The facility has a capacity of 289 patients and at the time of the fire incident 279 patients were registered. The building containing the patient areas is approximately eight years old and of fire resistive construction. Upon observing the fire, two of the nursing staff immediately removed the patient while the other two pulled the flaming linen on the floor and extinguished the fire with a 2-1/2 gallon labelled pressurized water extinguisher. The door to room 373 was closed; the hospital security notified; the patient placed in another room; and other patients reassured. The facility local alarm system was not activated; the facility emergency procedures were not initiated; and the fire department was not notified.

700,708

PB80-183205 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Patient Room Fire Incident at the Manor Care, Adelphi Nursing Home on March 1, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Jul 78, 41p NBS-GCR-80-208
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nurses, Nursing homes.

The fire incident in the patient room 229 at the Manor Care, Adelphi Nursing Home on March 1, 1978 was detected by the nursing staff at approximately 1230. The two story building of fire resistive construction was approximately ten years old. At the time of the fire incident, the facility, with a capacity of 210 patients, had a registered occupancy of 185 patients. The fire incident consisted of an electrical short circuit in a heating and air conditioning unit in the exterior wall of patient room 229. Eight patients in the fire zone were evacuated by the nursing staff to adjacent areas or the second floor. The facility local alarm system was actuated, the facility emergency procedures were initiated, and the fire department notified by telephone. The fire department responded and the evacuation of patients was completed upon their arrival. The electrical unit was disconnected.

700,709

PB80-183213 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Sacred Heart Home, March 19, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Jul 78, 43p NBS-GCR-80-205
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nurses, Nursing homes.

The fire incident at the Sacred Heart Home on March 19, 1978 was detected by the nursing staff at approximately 1330 hours. The nursing staff was investigating an odor of smoke on the third floor when the fire was detected in patient room 335, with flames issuing from a waste basket to a height of approximately eighteen inches. The facility has a capacity of 102 patients and at the time of the fire incident, had a registered capacity of 101 patients. The facility has the main building of protected noncombustible construction, is approximately forty-two years old and had the north wing of fire resistive construction added approximately 14 years ago. Upon detection of the fire, the nursing staff activated the local alarm system, which automatically transmits a signal to the fire department by a central station system arrangement, and also phoned the fire department. The nursing staff extinguished the waste container fire with water from the sink in room 335, evacuated the one ambulatory patient from room 335 and closed the patient room door. The fire emergency procedures of the facility were initiated by all the staff, the fire department responded and verified the extinguishment. There was reported to be no visible smoke accumulation in patient room 335 or the third floor corridor.

700,710

PB80-183221 PC **A04**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Manor Care, Hyattsville Nursing Home on January 10, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 30 Jun 78, 53p NBS-GCR-80-206
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Cooperation, Nurses, Nursing homes.

The fire incident at the Manor Care, Hyattsville Nursing Home on January 10, 1978 was detected by the nursing staff at approximately 2130 hours. The fire at detection involved multiple ignitions, some of which had self-extinguished. A preflashover fire was detected in the bathroom of the patient room of fire origin, room 65. The two-story building of fire resistive construction was approximately 12 years old. At the time of the fire incident the building had a registered occupancy of 126 patients. The fire was confined to the bathroom by staff action and extinguished by the operation of a single automatic sprinkler head. The facility alarm was activated and the fire department notified by telephone calls. The ten nursing staff on duty evacuated a total of ten patients from the fire zone on the terrace level and eight patients from the area above the fire zone in approximately 6.5 minutes, and was completed before the arrival of the fire department. The fire department confirmed extinguishment and performed overhaul and smoke removal operations.

700,711

PB80-185739 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Kitchen Fire Incident at the Manor Care, Adelphi (Maryland) Nursing Home on March 1, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Jul 78, 42p NBS-GCR-80-207
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Kitchens, Nursing homes.

The fire incident in the kitchen at the Manor Care, Adelphi Nursing Home on March 1, 1978 was detected by the cook at approximately 0615. The fire at the time of detection consisted of grease burning on the side of the stove with light smoke and flames approximately eighteen inches high. The two story building of fire resistive construction was approximately ten years old. At the time of the fire incident, the building, with a capacity for 210 patients, had a registered occupancy of 185 patients. The cook extinguished the fire with a ten pound all purpose listed dry chemical extinguisher. The local alarm system of the facility was not activated, the fire department was not notified, and since patients were not in the fire zone, no evacuation was initiated.

700,712

PB80-185770 PC **A02**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incidents at the University of Maryland Hospital on April 26 to May 8, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 30 Nov 78, 17p NBS-GCR-80-212
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Smoke, Attitudes, Buildings, Hospitals, Specialized training, Cooperation, Universities.

The eleven fire incidents at the University of Maryland Hospital from April 26 to May 8, 1978 involved incipient fires in trash containers in rest rooms and corridors. The fire incidents were all suspected to be of an intentional incendiary origin. The University of Maryland Hospital complex consists of four interconnected buildings of fire resistive construction varying in age from four to forty-five years of age. The hospital complex has a total patient capacity of 864 persons. These eleven fire incidents involved limited flame involve-

ment and smoke production. The Baltimore City Fire Department was notified and responded in five of the incidents. The remaining six fire incidents were extinguished by the University of Maryland Hospital staff or security personnel. Evacuation was not initiated in any of the fire incidents.

700,713
PB80-187578 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Magnolia Gardens Nursing Home on April 2, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Jul 78, 43p NBS-GCR-80-211
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nursing homes.

The fire incident at the Magnolia Gardens Nursing Home on April 2, 1978 was detected by the nursing staff at approximately 1510 hours. A member of the nursing staff noticed smoke issuing from a ceiling ventilation diffuser in the second floor lounge area. The facility has a capacity of 104 patients and 102 patients were registered at the time of the fire incident. The facility is a two story protected noncombustible construction fully sprinklered building. Upon the detection of the smoke in the second floor lounge area, the ten patients in the area were evacuated through smoke barrier doors to an adjacent area of the second floor. The patients involved were ambulatory or in wheelchairs. The nursing staff then notified the fire department by phone and activated the facility local alarm system. The facility emergency procedures were initiated, the fire department responded and determined the cause of smoke as an electrical motor failure. No smoke detectors or automatic sprinkler heads activated.

700,714
PB80-187859 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Anne Arundel General Hospital on May 1, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Oct 78, 27p NBS-GCR-80-213
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Patients, Attitudes, Hospitals, Buildings, Specialized training, Cooperation.

The fire incident at the Anne Arundel General Hospital on May 1, 1978 was detected by a Registered Nurse at approximately 0100 hours. The nurse was summoned to room 414 of A building by the patient's call button. The patient indicated his lighter had exploded injuring his hand. The eight story building of fire resistive construction was approximately nine years old. At the time of the fire incident the facility had a full patient capacity of 277 patients. No patients were evacuated. There was no visible fire or smoke observed by the staff, although an odor of lighter fluid was present and the patient suffered minor first degree burns to one hand. The fire involving the lighter appeared to have self extinguished. The facility fire emergency procedures were initiated, and the city of Annapolis Fire Department responded.

700,715
PB80-187909 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Manor Care, Largo Nursing Home on May 9, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 30 Sep 78, 32p NBS-GCR-80-215
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nursing homes.

The fire incident at the Manor Care, Largo Nursing Home on May 9, 1978 was detected by a staff member at approximately 0930 hours. The fire consisted of an odor of smoke, with some light visible smoke emitting from a washing machine in the laundry room on the first floor. The two-story building of fire resistive construction was approximately two years old. At the time of the fire incident the facility had a registered occupancy of 100 patients. The fire was confined to the washing machine by the staff action of disconnecting the electrical power to the machine. The facility local alarm system and public address system coded announcement were not activated. The fire department was notified and responded. Patients were not moved or evacuated, but retained in rooms with the doors closed.

700,716
PB80-187917 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Lorien Nursing Home on May 7, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Aug 78, 35p NBS-GCR-80-214
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nursing homes.

The report presents the analysis of the fire incident at approximately 1024 hours, Sunday, May 7, 1978 at the Lorien Nursing Home in Columbia, Howard County, Maryland. This fire incident involved an odor of smoke initially detected adjacent to a vacant patient room on the second floor of the three-story, fire resistive construction, fully sprinklered building. The facility fire reporting procedure was initiated; the fire department was notified and responded. Patients were retained in their rooms with the doors closed on the second floor, while approximately thirty patients were evacuated from the third floor by the four nursing staff members assigned to this area. The odor of smoke was determined to have been caused by the overheating of an automatic transfer switch in an enclosed metal panel box in the emergency generator room on the first (ground) floor of the building.

700,717
PB80-191000 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Avalon Manor Convalescent Center on June 16, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Oct 78, 36p NBS/GCR-80/220
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nurses.

The fire incident at the Avalon Manor Convalescent Center on June 16, 1978 was detected by the nursing staff at approximately 1215 hours. At detection, the fire involved an occupied upholstered chair in the second floor T.V. lounge. The two story building of fire resistive construction is approximately five years old. At the time of the fire incident, the facility had a full capacity of 115 patients. The facility emergency procedures were initiated and the volunteer fire department automatically notified with the activation of the local alarm system, through a remote station arrangement to their station response siren. The nursing staff initially evacuated eight patients from the area of origin, and a secondary evacuation of approximately thirty patients from the west wing, second floor to the east wing was accomplished. The fire and smoke were confined to the room of origin by the nursing staff closing of the patient room door and the construction. The fire was extinguished by the facility staff, prior to arrival of the fire department, with a 2-1/2 gallon pressurized water extinguisher and a five pound carbon dioxide extinguisher.

700,718
PB80-191018 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Sligo Gardens Nursing Home on June 10, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Aug 78, 41p
NBS/GCR-80-219
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nurses, Nursing homes.

The fire incident at the Sligo Gardens Nursing Home on June 10, 1978 was detected by the Second Floor, North Wing charge nurse at approximately 1330 hours. The fire at detection consisted of a flaming power cord to a television set in patient room 228. The two story building of fire resistive construction was approximately ten years old. At the time of the fire incident the building had a registered occupancy to the full capacity of 100 patients. One patient was evacuated by the nursing staff from the room of fire origin without injury. The fire and smoke propagation was limited to room 228 by the closing of the 3/4 hour fire resistive rated doors. The facility local alarm system was activated, the fire department notified and they responded. The fire has been extinguished prior to fire department arrival by nursing staff with a 5 pound all purpose dry chemical extinguisher.

700,719
PB80-192669 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Ann Arundel General Hospital on May 11, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 30 Nov 78, 31p
NBS/GCR-80-217
Contract NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Hospitals, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident at the Anne Arundel General Hospital on May 11, 1978 was detected by a Registered Nurse at approximately 0535 hours. The nurse was summoned to room 414 of A building by the patient's call button. The patient requested medication, and the nurse in moving the patient discoverd a charred area in the linen one inch in diameter warm to the touch. The eight story building of fire resistive construction was approximately nine years old. At the time of the fire incident the facility had a full patient capacity of 277 patients. Two patients were evacuated from room 414. There was no visible fire or smoke observed by the staff. The fire involving the charring of the bed linen appeared to have self extinguished. The facility fire emergency procedures were initiated, and the city of Annapolis Fire Department responded.

700,720
PB80-192677 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the American Nursing Home and Convalescent Center on May 11, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Aug 78, 45p
NBS/GCR-80/216
Contract NBS-7-9014

Keywords: *Human behavior, *Fires, Fire safety, Fire fighting, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nursing homes.

The fire incident at the American Nursing Home and Convalescent Center on May 11, 1978 was detected by the nursing staff at approximately 1540 hours. The fire at detection involved a polyurethane mattress on an unoccupied bed in patient room 308, the third floor west wing. The three-story and basement building of fire resistive construction was erected in 1973. At the time of the fire incident, the building had a registered occupancy of 265 patients. The fire was confined to the mattress of the bed in room 308 and essentially extinguished by nursing personnel with a 6 pound, 2A, 40BC rated extinguisher. The fire department was noti-

fied and responded, with their services being limited to salvage, overhaul and smoke removal. Nine nursing staff, including the Director of Nursing, evacuated the approximately twenty-five patients in the fire zone to other areas on the third floor in a two phase evacuation prior to fire department arrival. There were no patient or staff injuries in this fire incident, including the extinguishing operations.

700,721
PB80-194293 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Manor Care, Towson Nursing Home on October 18, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 22 Dec 78, 29p NBS-GCR-80-225
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire safety, Fire fighting, Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nursing homes.

The nursing staff at this nursing home facility were alerted to the occurrence of the fire incident at approximately 1957 hours on October 18, 1978 by an unusual popping noise and an odor of smoke. The odor was localized in the area of the second floor nurses station. The patients were immediately moved from the corridors into their rooms and all the patient room doors on the second floor were closed. Upon investigation the source of the smoke odor was identified as the electrical transformer box for the patient call system. The box was internally heated and warm to the touch. No smoke or flames were visible in the fire incident. Upon identification of the source of the smoke odor, the facility emergency procedures were initiated, the local alarm system was activated, and the fire department was notified. It responded and disconnected the power to the transformer and verified extinguishment. The two story fire resistive building was approximately two years old. The capacity of this nursing home was 115 patients, and the facility had a registered population of 109 patients at the time of the fire incident.

700,722
PB80-194863 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Allegany County Infirmary on May 16, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Aug 78, 47p NBS/GCR-80-218
Contract NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Hospitals, Buildings, Specialized training, Cooperation.

The fire incident at the Allegany County Infirmary on May 16, 1978, was detected by the nursing staff at approximately 0440, at which time the fire consisted of a sweater and robe, fabric materials on the floor of room 112B and fabric materials on a chair held by a patient at the corridor door to room 112B. The two story building of fire resistive construction was thirty years old. At the time of the fire incident, the facility had a registered occupancy of 71 patients. With the exception of minor burning on a chair held by a patient at the door to room 112B, the fire was confined within room 112B. The patient involved with moving the chair with the fire on it suffered first degree burns to one hand and both legs and feet. The fire department was notified automatically with the activation of the local fire alarm system within the facility at 0440 through an auxiliary system arrangement with the public fire alarm system. The four nursing staff in the facility evacuated the two non-mobile patients in their beds and extinguished the fire with a 2-1/2 gallon soda and acid extinguisher. The patients had been evacuated from the room of fire origin, other patient room doors closed and the fire extinguished upon arrival of the first due engine company. The fire department removed the smoke from the facility and performed salvage operations.

700,723
PB80-195605 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Manor Care, Largo Nursing Home on August 14, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 30 Sep 78, 36p NBS-GCR-80-223
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nurses, Nursing homes.

The fire incident at the Manor Care, Largo Nursing Home on August 14, 1978 was detected by the maintenance engineer at approximately 1100 hours. The fire at detection consisted of flaming in the flue of the incinerator with smoke propagation to the incinerator room and the first floor corridor of the east wing. The two story building of fire resistive construction was approximately two years old. At the time of the fire incident the building had a registered occupancy of approximately 100 patients. Forty patients were evacuated by the nursing staff from the second floor skilled care areas, above the area of fire origin, to the second floor solarium. The fire was contained within the incinerator and extinguished by the maintenance engineer with a 5 pound all purpose dry chemical extinguisher immediately prior to fire department arrival. The smoke spread was confined to the first floor east wing area by the smoke barrier doors, with smoke migration to the second floor east wing through minor openings between the first and second floor.

700,724
PB80-195704 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Maryland General Hospital on August 8, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 May 79, 28p NBS-GCR-80-222
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Patients, Hospitals, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident at the Maryland General Hospital on August 8, 1978 was detected by a nurses aide at approximately 0813 hours. The nurses aide detected an odor of smoke in the west corridor of the sixth floor central nursing unit. The nurses aide immediately reported the condition to the patient care coordinator who went to the corridor and observed a light haze of smoke at the ceiling. The patient care coordinator directed the nurses aide to report the fire incident to the facility telephone operator. The security director was also notified by phone and upon arrival activated the local alarm system. Activation of the local alarm system also automatically transmitted an alarm to the Baltimore City Fire Department through an auxiliary system arrangement. The smoke source was discovered to be a smoldering fire in an ash tray covered with a sheet. Upon staff removal of the sheet and adjacent fuel materials, the fire self-extinguished. The seven story central hospital building of fire resistive construction was approximately thirteen years old. At the time of the fire incident the sixth floor central nursing unit was at full capacity with thirty-eight patients. The Baltimore City Fire Department responded and verified extinguishment.

700,725
PB80-195811 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Anne Arundel General Hospital on November 14, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 22 Dec 78, 30p NBS-GCR-80-228
Contract NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Hospitals, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident at the Anne Arundel General Hospital on November 14, 1978 was detected by a nursing assistant at approximately 2015 hours. The nursing assistant entered room 412 of 'A' building to prepare the patient for sleeping. The nurses assistant in approaching the patient discovered a charred area completely through the linen one inch in diameter, and a scorched area on the mattress. The eight story building of fire resistive construction was approximately nine years old. At the time of the fire incident the facility had a full patient capacity of 277 patients. The 77 year old male patient was moved from the bed to a chair in room 412. There was no visible fire, smoke, or smoke odor observed by the staff. The fire involving the charring of the bed linen, and the scorching of the mattress appeared to have self extinguished. The facility fire emergency procedures were initiated, and the city of Annapolis Fire Department responded.

700,726
PB80-195944 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incidents at the Sheppard and Enoch Pratt Hospital on October 25 and 26, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Jan 79, 36p NBS-GCR-80-227
Contract NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Patients, Smoke, Hospitals, Attitudes, Buildings, Specialized training, Cooperation.

Two fire incidents occurred in this hospital facility on October 25 and 26, 1978. Both fires involved the suspected incendiary ignition of office papers and records on the desk top and the top of file cabinets in Room 327 of 'B' Building. Both fire incidents were detected by administrative staff personnel as an odor of smoke. The telephone operator of the facility was notified and the facility 'Fire Call' announcement was initiated over the public address system with the location of smoke odor. The facility fire brigade extinguished the fire on October 25 and the fire department was not notified. A safety officer extinguished the fire on October 26, and the fire department was notified at the request of the safety officer. It responded and verified extinguishment. Both fires were extinguished with six pound all purpose dry chemical extinguishers. Patient areas were not involved in either fire incident; no personnel were evacuated. The four-story fire resistive building was approximately 80 years old.

700,727
PB80-196025 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Washington Adventist Hospital on December 9, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Mar 79, 29p NBS-GCR-80-229
Contract NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Patients, Hospitals, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident at the Washington Adventist Hospital on December 9, 1978 was initially detected by a nurse's aide in nursing unit 3200 as an odor of smoke in the corridor near the elevator. The nurse's aide immediately activated the facility local alarm system at approximately 1047 hours. In accordance with the facility emergency procedures the hospital operator initiated the verbal 'Doctor Red' announcement on the public address system and notified the Department of Fire and Rescue Services Communication Center on the direct private phone line. The nursing staff in the facility placed patients in their rooms and closed the patient room doors. The hospital security staff and the Takoma Park Volunteer Fire Department responded to nursing unit 3200 which is located on the third floor of the 5-story and 2 basement fire resistive building. When the source of the smoke odor was not identified on the third floor, an investigative search of the lower floors was initiated. A light haze of smoke was detected outside the ladies locker room, room LL2 on the subbasement level, and a developing fire involving three lockers within the room. The fire department personnel immediately extinguished the fire with one 1-1/2 inch hose line supplied from the building wet standpipe system. Due to the fire resistive construction of the building, the location of the fire, and its immediate

suppression, the need for patient evacuation was precluded.

700,728

PB80-197254 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the North Arundel Hospital on September 4, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Oct 78, 29p NBS-GCR-80-224
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Hospitals.

The fire incident at the North Arundel Hospital on September 4, 1978 was detected by a nurse at approximately 1315 hours. The fire at detection consisted of a smoldering propagation with a char area approximately two inches in diameter on the bedspread and blankets covering a sleeping, sedated patient. The building in which the fire zone was located was of fire resistive construction, approximately four years old. At the time of the fire incident the building had a registered occupancy of approximately 285 patients. No patients were evacuated or moved in this fire incident. The bedding materials involved were removed from the bed and patient, carried to a utility room and extinguished by dousing with water in a sink. The staff and fire department were not notified, no visible smoke spread occurred, and there were no staff or patient injuries.

700,729

PB80-197262 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the St. Annes Infant Home on June 20, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 30 Sep 78, 26p NBS-GCR-80-221
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Patients, Children, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident at the St. Annes Infant Home on June 20, 1978, was detected by the administrator at approximately 2015 hours. The fire at detection involved the overheating of electrical switch gear, which produced a white-colored smoke, completely filling the boiler room in the basement. The four-story and basement building of fire resistive construction was erected approximately 15 years ago. At the time of the fire incident, the facility had an occupancy of 79 children and 15 mothers. The fire was confined to the overheated electrical switch gear, with no visible flames, and smoke limited to the boiler room, the area of fire origin. The fire department was notified and responded. No residents were moved within the facility or evacuated from the facility. The staff action of turning off the electrical power stopped the overheating, and of closing the boiler room door confined the smoke.

700,730

PB80-198195 Not available NTIS
National Bureau of Standards, Washington, DC.
Elementary Inequality.
Final rept.,
S. Haber. 1979, 5p
Pub. in International Jnl. Math. and Math. Sci. 2, n3 p531-535 1979.

Keywords: *Inequalities, Reprints.

A number of closely related inequalities are presented and proven. A typical related inequality is ((1+a) to the power b) = or > 1 + ab ((1+a(2) to the power (b-1)) for a, b = or > 0 - with the inequality reversed when 1 = or < 2.

700,731

PB80-199235 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Spring Grove Hospital Center on December 14, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Jan 79, 30p NBS-GCR-80-230
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Hospitals, Cooperation, Fire safety.

A secretary on Ward A of the White Building at the Spring Grove Hospital Center on December 14, 1978 at approximately 1205 hours detected an odor of smoke. The odor was localized in the corridor in the South West portion of the building. The secretary notified the telephone operator, who sent maintenance personnel to the building to locate the source of the smoke odor. Since smoke odor persisted the secretary called the safety officer. The safety officer immediately notified the telephone operator who initiated the facility emergency procedures and notified the fire department. The White Building was evacuated of approximately 120 patients and 12 nursing staff. The safety officer located the source of the smoke odor from a fluorescent light ballast in an office. The Baltimore County Fire Department arrived, verified extinguishment and removed residues of the smoke. The one-story, fire resistive building was approximately twenty years old. This is one building at this residential regional mental hospital center consisting of twenty-two buildings with a total capacity of 1,484 patients.

700,732

PB80-203672 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Maryland Masonic Home on June 21, 1979.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Aug 79, 31p NBS-GCR-80-243
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Elderly persons, Nursing homes.

This fire incident at the Maryland Masonic Home on June 21, 1979 was detected by a housekeeper upon entering resident room 116 at approximately 0910 hours and observing a light accumulation of smoke at the ceiling. The housekeeper turned on a window fan in the unoccupied room to remove the smoke, and left the room closing the door, to report the smoke. The housekeeper reported the smoke to the administrator who immediately ordered the fire department to be notified. The housekeeper and the administrator returned to room 116 to investigate the source of the smoke. Upon opening the closet doors, flames involving the contents evolved. The administrator ordered evacuation of the first floor and the assistant administrator extinguished the fire with the application of two, five pound, listed dry chemical extinguishers, rated 2A, 10BC. Three residents from the adjacent section A of the first floor were assisted in their evacuation by staff. Most of the residents of this facility were already outside the building due to a scheduled field trip, and approximately eight per cent of the residents are ambulatory. The fire and smoke effects of this fire incident were primarily limited to room 116 in this 100 bed facility of fire resistive construction, erected in 1934. The Baltimore County Fire Department responded and verified extinguishment with overhaul operations, and also conducted ventilation procedures.

700,733

PB80-204738 PC **A13**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Proceedings of International Seminar on Human Behavior in Fire Emergencies (2nd) Held on October 29-November 1, 1978.
Final rept.,
B. M. Levin, and R. L. Paulsen. Jun 80, 281p NBSIR-80-2070

Keywords: *Human behavior, *Fires, *Meetings, Fire safety, Evacuating(Transporting), Smoke, Buildings, Design, Communicating, Symbols.

The safety of building occupants in fire emergencies depends on both the fire protection features of the building and the actions of the occupants. Until recently fire protection experts have relied mainly on experience and intuition regarding the capabilities and actions of building occupants in the development of fire protection systems and training programs. Research projects underway can assist the fire protection experts by providing them with needed information to supplement their experience and intuition. This report contains summaries of some of the recent research in this field as reported at an international seminar on the subject. It also contains the invited papers presented at the seminar on the topic of panic.

700,734

PB80-204985 PC **A02**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Pikesville Nursing and Convalescent Center on February 8, 1979.
Final rept.,
J. L. Bryan, and J. A. Milke. 31 Aug 79, 20p NBS-GCR-80-236
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nursing homes.

The fire incident at the Pikesville Nursing and Convalescent Center on February 8, 1979 was initially detected by a laundress entering the laundry room. The laundress turned off the washing machine and also manually tripped the circuit breaker immediately after detection, which resulted in the extinguishment of the fire. The laundress then called the desk receptionist to initiate the facility emergency procedures and to notify the Baltimore County Fire Department. Patient room doors were closed by staff personnel and no patients were evacuated during this fire incident. Damage was limited to clothing inside the washing machine located in the basement of this two-story, 8 year old facility of protected non-combustible construction. The Baltimore County Fire Department responded and verified extinguishment.

700,735

PB80-204993 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the University of Maryland Hospital on February 6, 1979.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Mar 79, 29p NBS-GCR-80-234
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Hospitals, Specialized training, Cooperation.

The fire incident at the University of Maryland Hospital on February 6, 1979 was detected by a nurse at approximately 0840 hours. The nurse was alerted to the observation of flames in a microwave oven in the emergency room doctor's lounge, room G-1142, by a loud unusual noise. The nurse immediately reported the fire at the emergency room treatment area nurses station. The hospital emergency procedures were initiated with a phone call to the University Communication Center and activation of the building local alarm system. The fire in the microwave oven was extinguished by the nurse using a 10 pound, listed carbon dioxide extinguisher, rated 5 B,C. Following extinguishment a light haze of smoke was confined to the doctor's lounge. One patient in an adjacent emergency room treatment area was evacuated as a precautionary action. The fifteen story North Hospital Building of fire resistive construction was approximately five years old. At the time of the fire incident the twenty-five patient emergency room treatment area had ten patients. The Baltimore City Fire Department responded and verified extinguishment.

700,736

PB80-205651 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.

Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the University of Maryland Hospital on April 4, 1979.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 May 79, 29p NBS-GCR-80-240
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Hospitals, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident at the University of Maryland Hospital on April 4, 1979 was detected by two nurses at approximately 2130 hours. The nurses observed light white smoke being discharged from a heating and air conditioning unit with electrical arcing in room 4-207. The two patients in the room were evacuated and the facility emergency procedures were initiated with the phone call to the University Communication Center and the activation of the building local alarm system. The fire was attacked by a nursing staff member with a listed 3A, 30BC rated, all purpose dry chemical extinguisher. All ten patients on wing 4B were evacuated, eight patients in their beds, and two of these patients required portable oxygen. The initial arriving fire department personnel from the Baltimore City Fire Department assisted in the evacuation of the last three patients. Fire department personnel extinguished the fire by disconnecting the electrical power supply to the unit and the fire then self-extinguished. The fire department removed glass from two openable windows in room 4-207 and 4-209 to achieve ventilation in this twelve story main hospital building of fire resistive construction.

700,737
PB80-206204 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Sheppard and Enoch Pratt Hospital on June 24, 1979.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Aug 79, 26p NBS-GCR-80-244
Contract NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Hospitals, Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire was detected by a security officer during a normal routine patrol at approximately 2016 hours. The security officer observed smoke issuing into the corridor from room 48A, a laundry room, with a closed door. The security officer immediately activated an alarm box on the local alarm system, phoned the facility operator, and then radioed the security office. The fire incident occurred on the ground floor of the 'B' building erected approximately 80 years ago of fire resistive construction. The security officer obtained a five pound dry chemical listed extinguisher, rated 2A, 10BC, entered the laundry room, crawled to a trash can which contained the fire and discharged the extinguisher which effectively extinguished the flames. The fire was extinguished prior to the arrival of the facility fire brigade and the Baltimore County Fire Department. The Fire Department verified extinguishment, overhaul, and ventilation of the laundry room area. No patients were in the fire area, and no patients were evacuated.

700,738
PB80-207228 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Kensington Gardens Nursing Home on April 14, 1979.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 30 Jun 79, 26p NBS-GCR-80-242
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Patients, Smoke, Attitudes, Buildings, Evacuating(Transporting), Specialized training, Cooperation, Nursing homes.

The fire incident at the Kensington Gardens Nursing Home on April 14, 1979 was initially detected by a nurse on the first floor, central wing as an odor of smoke in the corridor adjacent to room 123, at approximately 0115 hours. The nurse detected smoke in room 123 and observed smoke issuing from an electrical unit heater in the room. The nurse immediately disconnected the electrical power cord to the heater from the wall socket and evacuated the single female patient in her bed from the room, along the corridor beyond the smoke barrier doors to the new section. During the evacuation of the patient other nursing staff were alerted, the local alarm system activated, the facility emergency procedures initiated and the Montgomery County Emergency Operations Center notified. The Kensington and Silver Spring Volunteer Fire Departments responded, verified extinguishment and conducted ventilation operations. The patient and one nursing staff member were transported by ambulance to the hospital for medical observation and examination as a precautionary measure.

700,739
PB80-207236 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Sheppard and Enoch Pratt Hospital on April 5, 1979.
Final rept.,
J. L. Bryan, J. A. Milke, and P. J. DiNenno. 31 Jul 79, 32p NBS-GCR-80-241
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Hospitals, Cooperation.

The fire incident at the Sheppard and Enoch Pratt Hospital on April 5, 1979 was detected by a patient at approximately 1721 hours. The fire at detection consisted of the blankets, linen and top surface over three-fourths of the area of a single bed in room 110 of wing 1-E of the Chapman Building. The fire was reported by phone to the facility operator who initiated the 'fire call' announcement on the public address system and notified the Baltimore County Fire Department. The approximately twenty ambulatory patients on the wing at the time of the fire were evacuated initially through the smoke barrier door to the stairway and eventually to the second floor of the building. The fire was extinguished by staff and the facility fire brigade, expending fifteen 5 pound dry chemical listed extinguishers with a 5A, 10BC rating. The fire department responded, verified extinguishment and performed salvage and overhaul operations.

700,740
PB80-207335 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Montgomery General Hospital on March 28, 1979.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 May 79, 28p NBS-GCR-80-239
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Hospitals, Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident at the Montgomery General Hospital on March 28, 1979 was initially detected by a nurses aide on the fifth floor, west wing as an odor of smoke while she was in room 517 at approximately 0100. The nurses aide immediately notified the charge nurse. Both nursing personnel then investigated to determine the source of the smoke odor. A light haze of smoke was observed at the ceiling of room 516, and a smoldering fire approximately four to five inches in diameter, on the cotton bed spread of an occupied patient bed. The nursing staff removed the bed spread and top sheet to a bathroom across the corridor and extinguished the fire in a sink. One staff member remained with the patient, and following extinguishment, the nursing shift coordinator and the fire department was notified. The Sandy Spring Volunteer Fire Department responded and verified extinguishment. The facility local alarm system and verbal fire announcement were not initiated and no evacuation was conducted in this 7 story fire resistive building constructed in 1971.

700,741
PB80-207343 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.

Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Southern Maryland Hospital Center on January 2, 1979.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 28 Feb 79, 33p NBS-GCR-80-232
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire safety, Fire fighting, Hospitals, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident at the Southern Maryland Hospital Center on January 2, 1979 was detected by a patient at approximately 0001 hours. The male patient in the psychiatric care unit on the fourth floor, west wing, reported to a nurse at the nurses station that there was an odor of smoke in the south corridor outside the closed door of vacant patient room 414. The nurse immediately initiated the facility fire emergency procedures with a phone call to the facility telephone operator. The telephone operator alerted the facility with a verbal 'Code Red' announcement over the public address system and phoned the Prince George's County Fire Communications Center on the '911' emergency number. The fire in a fiber glass waste container was extinguished by a male psychiatric patient using a 10 pound, listed all purpose dry chemical extinguisher, rated 5A, 60B, C. The smoke propagation was heavy in room 414, and moderate in the south corridor of the fourth floor, west wing. The smoke was confined to the west wing area by the smoke barrier doors. The smoke detector system in the psychiatric care unit, including room 414, activated immediately following extinguishment. The seventeen patients in the psychiatric care unit were all ambulatory and were evacuated to the fourth floor, east wing, following extinguishment for the duration of the night. The five and two story building of fire resistive construction was approximately thirteen months old. At the time of the fire incident, there were 17 patients in the 25 bed capacity psychiatric unit.

700,742
PB80-207889 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Ellicott City Middle School on February 14, 1979.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Mar 79, 28p NBS-GCR-80-237
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Schools, Students, Smoke, Attitudes, Buildings, Specialized training, Evacuating(Transporting), Cooperation.

The fire incident at the Ellicott City Middle School was detected at approximately 1030 hours on February 14, 1979. The fire was apparently detected in the two story ordinary construction building, approximately forty years old, by two teachers simultaneously. The detection involved an observation of a light haze of smoke in the second floor learning center with an odor of smoke. An odor of smoke was also detected in the first floor corridor near the cafeteria. Investigation of the source of the first floor odor resulted in the observation of a smoke accumulation in the locked and unoccupied band room. Approximately 4 teachers and 120 students, the classes from the first floor cafeteria and the second floor learning center, initiated their evacuation prior to the activation of the local alarm system. The remaining 27 teachers and 400 students evacuated the building in approximately 1-1/2 minutes. With the activation of the local alarm system, the school secretary notified the Howard County Fire and Rescue Emergency Communication Center by phone and the Ellicott City Volunteer Fire Company was dispatched. Due to the extreme cold weather, about 20F, the principal allowed the students and teachers to reenter the building to the gymnasium on the first floor after five minutes. The fire department command officer upon arrival requested the total evacuation of the building again. The fire department completed extinguishment of the fully developed post flashover fire in the first floor band room with 1-1/2 inch hose lines in approximately twenty minutes.

700,743
PB80-207897 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.

Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Sheppard and Enoch Pratt Hospital, February 7, 1979.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Mar 79, 27p NBS-GCR-80-235
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Hospitals, Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident occurred at approximately 0832 hours on February 7, 1979 in the main kitchen on the first floor of the Central Building. The fire was immediately detected by two of the kitchen staff since it was initiated with the explosive rupture of an aerosol can of grill cleaner. The can became a projectile and upset two 1-1/4 gallons cans of cooking grease which upon contacting heated areas of the gas fired stove and grill, immediately ignited. The resulting flames involved an area on the grill surface of approximately six square feet, with eight inch high flames. The smoke produced was immediately exhausted through the kitchen grill hood and duct system. The fire was extinguished by kitchen staff personnel using a 10 pound, listed carbon dioxide, rated 5 B, C extinguisher. The facility emergency procedures were initiated by the staff and both the hospital fire brigade and the Baltimore County Fire Department responded. The fire had been extinguished by the kitchen staff before the arrival of the fire brigade or the fire department. The dry chemical stove and duct extinguishing system were not activated in this fire incident. The fire had no effect on any areas beyond the kitchen in this three story and basement fire resistive building, which is approximately 80 years old. None of the patients in this 301 bed capacity psychiatric care institute were involved or threatened by this isolated and controlled fire incident and no patients were evacuated.

700,744

PB80-207905 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Washington Adventist Hospital on December 22, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 31 Jan 79, 31p NBS-GCR-80-231
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire safety, Fire fighting, Hospitals, Patients, Smoke, Attitudes, Buildings, Specialized training, Evacuating(Transporting), Cooperation.

The fire incident at the Washington Adventist Hospital on December 22, 1978 was detected by a staff employee at approximately 1028 hours. The fire at detection consisted of a plastic food tray, with plastic containers and paper combustibles on an energized hot plate in the clean utility room of nursing unit 2200 on the second floor. At detection, flames had achieved a height of approximately 24 inches and a dense black layer of smoke had accumulated 18 inches in depth at the ceiling of the room of origin. The six story building of fire resistive construction was approximately twenty-eight years old. At the time of the fire incident this hospital had a registered occupancy of 360 patients. Two patients were evacuated from the corridor adjacent to the room of origin, and one patient from a room across the corridor by the nursing staff. The fire and smoke propagation was limited to the clean utility room by the closing of the 20 minute fire resistive rated door. The hospital local alarm system was activated, the hospital fire brigade and the fire department was notified. The fire was extinguished by a physician and nursing staff personnel with a pitcher of ice water and a 2 1/2 gallon pressurized water extinguisher prior to fire department arrival. The fire department verified extinguishment and conducted overhaul and ventilation operations.

700,745

PB80-208986 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Crownsville Hospital Center on January 26, 1979.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 30 Jun 79, 28p NBS-GCR-80-233
Contract NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Hospitals, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident at the Crownsville Hospital Center on January 26, 1979 was detected by a patient at approximately 0420. The fire at detection consisted of a flaming linen bag in the linen room of ward 91 in the Medical-Surgical Building with flames to a reported height of four to five feet. The fire was reported by phone to the facility operator, and the local alarm system was activated, and the fire department notified. Approximately twenty-five patients were on ward 91 at the time of the fire incident. Fifteen patients were evacuated to ward 93. Nine patients were moved in beds, five were ambulatory and walked, and one was carried. Smoke spread through ward 91 due to the linen room door being left open, and the open plan design of the ward. The one story, fire resistive medical-surgical building was approximately twenty-two years old. The Anne Arundel County Fire Department responded and verified the fire extinguishment by a staff member with a five pound dry chemical listed extinguisher with a 5A, 10BC rating. The wet pipe automatic sprinkler system also activated from a single ordinary rated head. The fire department also performed salvage and overhaul operations.

700,746

PB80-209059 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Hidden Brook Treatment Center on February 15, 1979.
Final rept.,
J. L. Bryan, and J. A. Milke. 31 Aug 79, 32p NBS-GCR-80-238
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nurses.

The fire incident was detected at approximately 2330 by the activation of a smoke detector in the first floor corridor and the concurrent activation of the local alarm system. The nursing staff of three persons and one visitor directed and assisted the thirty-five ambulatory patients from the building in approximately seven minutes. The fire was initiated in the first floor lounge of the four story protected ordinary constructed building. The spread of fire within the lounge was initiated by fire retardant treated wall paneling. The vertical spread of flames and heat up th west stairway was limited by the one hour fire resistant rated door at the first floor. The spread of smoke was limited to a light accumulation in the patient occupied areas, even though dense smoke was observed in the first floor lounge, due to the effective operation of the corridor smoke barrier doors. The Harford County Communications Center was immediately notified by the staff. The Bel Air Volunteer Fire Department responded and extinguished the fire with one 1-1/2 inch hose line within 15 minutes of the activation of the detector, confining the fire to the area of origin, the first floor lounge. The fire department also performed ventilation, overhaul and salvage operations.

700,747

PB80-218076 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Franklin Square Hospital, June 13, 1979.
Final rept.,
J. L. Bryan, and J. A. Milke. Aug 80, 29p NBS-GCR-80-260
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Patients, Hospitals, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident at the Franklin Square Hospital on June 13, 1979 was initially detected at approximately 1026 by a nurses aide who observed smoke issuing from under the door of the vacant patient room 13. The nurses aide immediately activated the local alarm system, and the hospital operator initiated the verbal announcement on the public address system to activate the hospital emergency procedures. The operator also immediately notified the Baltimore County Fire Department via the direct private phone. Patient room doors were closed by the nursing staff throughout the three - central fire zone. Two members of the hospital fire brigade entered the room of fire origin, room 3113, and extinguished the fire in a cotton, boric acid treated mattress. The fire brigade members then removed the mattress through the window of room 3113. Damage was limited to the mattress, with smoke spread from room 3113 in both corridors of the three-central area. No patients were evacuated and there was no fire damage beyond the room of origin to this three story, fire resistive building constructed in 1977. The Baltimore County Fire Department responded, verified extinguishment of the mattress, and assisted the staff in ventilation of the third floor of the facility.

700,748

PB80-218084 PC **A02**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Union Hospital of Cecil County on July 29, 1979.
Final rept.,
J. L. Bryan, and J. A. Milke. Aug 80, 25p NBS-GCR-80-261
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Patients, Hospitals, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident at the Union Hospital of Cecil County on July 29, 1979 was initially detected by a pharmacy technician who perceived a smoke odor in the pharmacy on the first floor at approximately 1212 hours. The pharmacy technician immediately phoned the facility operator who initiated the facility fire emergency procedures with the public address system announcement and notified the fire department. The pharmacy technician and the laundry supervisor located the source of the smoke emitting from an exhaust duct in the linen finishing room on the first floor. Damage was limited to the duct in the finishing room and light smoke damage first floor area in the six story, fire-resistive, nine year old building. Patients were protected in their rooms behind closed doors. The fire self extinguished following the smoke detector activation of dampers in the duct. Ventilation of the first floor area with fans and overhaul procedures was performed by the Elkton and North East, Maryland Fire Departments with the Christinia and Newark, Delaware Volunteer Fire Departments.

700,749

PB80-218092 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Mt. Wilson Center on June 10, 1979.
Final rept.,
J. L. Bryan, and J. A. Milke. Aug 80, 32p NBS-GCR-80-262
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Hospitals, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident at the Mount Wilson Hospital Center on June 10, 1979 was initially detected by a Health Assistant who perceived smoke odor on the second floor of the Richie Building at approximately 1937 hours. The Health Assistant immediately directed the residents to evacuate and called to other staff for assistance. The arriving staff observed the smoke conditions in the corridors and activated the local alarm system and phoned the first floor staff to initiate the Hospital fire emergency procedures which include notification of the Baltimore County Fire Department. The Hospital Center security staff respond to the area of fire origin, room 205 and security guard suppressed the mattress flames with a five pound dry chemical extinguisher, rated 2A, 10BC. Damage was limited to the room of origin with smoke limited to two of the four smoke zones on the second floor of the protected ordi-

nary construction building erected approximately fifty years ago. All-fifty one of the residents of the Richie Building were evacuated without staff assistance and without injury. The Baltimore County Fire Department responded and completely ventilated the second floor fire zone with fans placed in open windows.

700,750
PB80-218100 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Reeder's Memorial Nursing Home, July 29, 1979.
Final rept.,
J. L. Bryan, and J. A. Milke. Aug 80, 29p NBS-GCR-80-264
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nursing homes.

The fire incident at the Reeder's Memorial Nursing Home on July 29, 1979 was initially detected by the nursing supervisor who perceived a smoke odor in the area adjacent to the dining area on the second floor at approximately 2206. The supervisor investigated and observed smoke in the dining room, which appeared to be centered in the nourishment center. The supervisor immediately closed the smoke barrier doors to isolate the smoke in the dining room area with another staff member. The Supervisor then phoned other staff personnel and the Boonsboro Volunteer Fire Department. The staff responded to the fire area and evacuated nine patients, from rooms 112, 115, and 117 adjacent to the dining room and nourishment center. The fire department arrived and determined the source of the smoke to be from an overheated electrical cord to an ice machine. Fire department personnel de-energized the ice machine and ventilated the nourishment center with portable fans. There were no injuries in this fire incident and no damage to the two story, three year old fire resistive building.

700,751
PB80-218118 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Crownsville Hospital Center on August 19, 1979.
Final rept.,
J. L. Bryan, and J. A. Milke. Aug 80, 32p NBS-GCR-80-265
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Hospitals, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident at the Crownsville Hospital Center on August 19, 1979 was initially detected by two patients in ward 02, adjacent to room 8D at approximately 1530. The patients observed smoke issuing from around the closed door to room 8D. The patients immediately phoned the staff at the nurses station on adjacent ward 01, and then evacuated the ward 02 area without assistance. The heavy black smoke was removed from this 25 year old, partially sprinklered, fire resistive construction building with fans through both doors and windows.

700,752
PB80-218357 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Mt. Wilson Center on September 4, 1979.
Final rept.,
J. L. Bryan, and J. A. Milke. Aug 80, 30p NBS-GCR-80-266
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Hospitals, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident at the Mount Wilson Hospital Center on September 4, 1979 was initially detected by a Health Assistant who observed smoke issuing from room 512 east wing of the main hospital building at approximately 0925 hours. The health assistant immediately called to other staff for assistance. The arriving staff observed the smoke flaming mattress in room 512, with smoke in the corridors and activated the local alarm system which initiated the hospital fore emergency procedures which include notification of the Baltimore County Fire Department. Additional hospital staff responded to the area of fire origin, room 512, and suppressed the mattress flames with two five pound dry chemical extinguishers, rated 2A, 10BC, following the initial suppression action of water from a trash can. Damage was limited to one of the five smoke zones on the fifth floor, east wing of the fire resistive construction building erected approximately twenty-seven years ago. All thirty-two of the patients of the fifth floor, east wing of the main hospital building were evacuated with staff assistance and without injury. The Baltimore County Fire Department responded and verified extinguishment of the mattress fire, and ventilated the fifth floor fire zone with fans placed in the opened windows.

700,753
PB80-218365 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident in the Diagnostic Center of the Patuxent Institute on March 5, 1980.
Final rept.,
J. L. Bryan, and J. A. Milke. Aug 80, 40p NBS-GCR-80-276
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Correctional institutions, Smokes, Personnel, Attitudes, Buildings, Specialized training, Cooperation.

This fire incident in the Diagnostic Center Building at the Patuxent Institute on March 5, 1980 was initially detected by a correctional officer in the guard station of the visitor's room in the basement at approximately 1020. The officer directed a visitor to leave and notify the building control center. Three correctional officers responded with two converted pressurized water 2&1/2 gallon extinguishers. The extinguishers were not able to produce an effective stream of water. The control center was notified to initiate the facility emergency procedures and three additional correctional officers responded with two dry chemical 2A, 10BC extinguishers and one 15 pound CO_2 extinguisher. These extinguishers were discharged on the flames with marginal effects. The correctional captain notified the control center to phone the Howard County Fire Department. The correctional officers evacuated from the visitors room and initiated the evacuation of approximately fifty staff personnel from the first floor. These personnel were moved through smoke during the evacuation. The fire department extinguished the fire in the basement visitors room with 1 and 1/2 inch hose line and one 2 inch hose line after a delayed interior attack due to the building security features. A second alarm response was initiated as a precautionary measure.

700,754
PB80-218373 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at Chesapeake Hall on February 3, 1980.
Final rept.,
J. L. Bryan, and J. A. Milke. Aug 80, 43p NBS-GCR-80-275
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Students, Universities, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident occurred on the second floor, north wing of Cheaspeake Hall, University of Maryland at Baltimore County in Catonsville, Maryland. The fire incident was simultaneously detected by the resident assistant on the second floor by smoke in her room, the activation of a smoke detector in resident room, 257, and activation of a trouble alarm in the resident director's apartment on the first floor at approximately 0359. The resident assistant opened her room door and observed heavy smoke and flames in the corridor on the north wing adjacent to room door 257. She returned to her room, 266 and dialed the public safety dispatcher on 3133 to have him notify the Baltimore County Fire Department in accordance with the facility emergency procedures. The resident director on the first floor, investigating the trouble alarm, heard screams from the second floor and investigated and upon seeing smoke, activated the local alarm system at the station on the first floor. The Baltimore County Fire Department received the alarm at 0403 and upon arrival the building had been evacuated by the approximately 200 residents. The fire was exinguished by the fire department personnel. It was confined to an area of approximately 80 square feet in the corridor with the smoke propagation confined to the second floor, north wing resident assistant was treated at the scene for smoke inhalation suffered in alerting the residents and female resident was treated at St. Agnes Hospital for injuries received from jumping from the second floor.

700,755
PB80-218381 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Peninsula General Hospital September 22, 1979.
Final rept.,
J. L. Bryan, and J. A. Milke. Aug 80, 38p NBS-GCR-80-270
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Hospitals, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident was apparently initiated with the ignition of the robe and bed clothes of a male patient in the bathroom of room 2102, on the second floor, East wing in the Cardiac Care Unit. The fire was detected by the observation of smoke emitting from under the bathroom door by three visitors in room 2102 at approximately 1650 on September 22, 1979. The visitors opened the door to the bathroom and observed the patient standing with the bathrobe in flames. Two of the visitors ran into the corridor calling 'Fire', while the third visitor attempted to smother the flames with a blanket. Staff personnel responded to the calls of 'Fire', and initiated the facility emergency procedures by dialing '11' on the facility phone. The facility operator initiated the verbal public address system announcement of 'Condition One', and notified the City of Salisbury Fire Department. The Facility Fire Brigade personnel responded with the 'Fire Cart'. Staff personnel in the area removed the patient from room 2102 by carrying and dragging while six patients in room 2102, 2103, and 2104 were evacuated in wheel chairs. The fire involving the patient and his clothing in the bathroom was extinguished with a listed 4A, 60 BC, rated dry chemical extinguisher, and by smothering with bed linens. The patient was taken to the emergency room for medical treatment. The fire damage was confined to the clothing of the male cardiac patient who died on September 24, 1979.

700,756
PB80-218399 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Fallston General Hospital January 27, 1980.
Final rept.,
J. L. Bryan, and J. A. Milke. Aug 80, 40p NBS-GCR-80-273
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Evacuating(Transporting), Patients, Hospitals, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident in the Fallston General Hospital on January 27, 1980 was detected by several patients who observed smoke emitting from under the door of patient room 2036, at approximately 1979. The patients in the psychiatric care ward in the south section, second floor of the service building alerted the staff by their verbal cries. A nursing assistant immediately responded, to room 2036, and upon observing the smoke and feeling heat through the closed room door, he immediately returned to the office and phoned the facility operator. The operator initiated the facility emergency procedures and notified the Hartford County Emergency Operations Center. The ten patients in the psychiatric care ward were evacuated into the adjacent north section geriatric ward on the second floor to the dining and day room. A mainte-

nance man and orderly attached the fire involving two mattresses on beds in room 2036 with two 2-1/2 gallon pressurized water extinguishers. Unsuccessful, they closed the door to the room and left. The maintenance man immediately returned and attempted to extend the 1 and 1/2 inch standpipe hose, but was forced to leave due to the smoke. The twenty-two geriatric patients were moved to the dining and day room on the geriatric ward. Upon the arrival of the fire department, all thiry-two of the patients were evacuated from the second floor to the first floor cafeteria. The fire department personnel extinguished the fire in patient room 2036 with the 1 and 1/2 inch standpipe hose and ventilated the psychiatric care ward.

700,757
PB80-218407 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Gunston School on November 30, 1979.
Final rept.,
J. L. Bryan, and J. A. Milke. Aug 80, 35p NBS-GCR-80-271
Grant NBS-7-9014

Keywords: *Human behavior, *Fire, Fire fighting, Fire safety, Evacuation(Transporting), Students, Schools, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident at the Gunston School on November 30, 1979 was initially detected by a student in room 35 at approximately 2250. The student observed flames emanating from an electric blanket on the floor in the South West Corner of the room. The student left the room crossed the corridor, and notified the student hall monitor. The student hall moniter returned to the room and verified the fire incident. The student resident of room 35 awakened her roommate. Prior to evacuation, the roommate attempted to smother the flames with bedding and being unsuccessful, she also suffered 3rd degree burns on both hands. The student hall moniter notified other students on her way to the second floor to notify the on-duty faculty member. She decided to activate the local alarm system from the manual activation station on the third floor at the North East Stairway. The faculty member returned with the student hall moniter to room 35 and upon observing the flames, she immediately ordered the complete evacuation of the building. She returned to her second apartment and phoned the Queen Annes County Fire Board. The 30 students evacuated the building in accordance with the pre-practiced evacuation routes. The Centerville Fire Department responded and extinguished the fire in room 35 with two 1 and 1/2 inch hose lines. The one student suffered minor burns to both hands. Damage was limited to room 35 and the third floor corridor of this 7 year old fire resistive constructed building.

700,758
PB80-218415 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Crownsville Hospital Center on October 5 and 12, 1979.
Final rept.,
J. L. Bryan, and J. A. Milke. Aug 80, 41p NBS-GCR-80-268
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire safety, Fire fighting, Evacuating(Transporting), Patients, Smoke, Attitudes, Hospitals, Buildings, Specialized training, Cooperation.

Both of the fire incidents at the Crownsville Hospital Center on October 5 and 12, 1979 were initially detected by patients in ward 01. The fire incident was detected at approximately 1353, and the second fire incident was detected at approximately 1455. The patients observed smoke issuing from room 3 due to a matress fire. The patients immediately called to the staff at the nurses station on ward 01. The staff evacuated the ward 01 area without assistance, due to the mobile nature of the twenty-five patients. The nursing staff on ward 01 activated a manual station on the local alarm system, and also phoned the facility operator who initiated the facility fire emergency plan and phoned the Anne Arundel County Fire Communications Center in both fire incidents. Both of these mattress fires were extinguished by nursing staff with a 2-1/2 gallon, pressurized water, rated 2A, extinguisher. Staff personnel then removed the smoldering mattress to the exterior of the building. The Anne Arundel County Fire Department responded and personnel confirmed the extinguishment of the mattress. Fire department personnel performed overhaul, salvage and ventilation operations. The smoke was removed from this 25 year old, partially sprinklered, fire resistive construction building with fans through both doors and windows. There were no patient injuries in either or these fire incidents and the damage was limited to the mattress in both incidents.

700,759
PB80-218423 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Bethesda Health Center on June 12, 1979.
Final rept.,
J. L. Bryan, and J. A. Milke. Aug 80, 27p NBS-GCR-80-263
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire safety, Fire fighting, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

A fire incident at the Bethesda Health Center on June 12, 1979 was automatically detected with the activation of a sprinkler head on the wet pipe system. Water from the sprinkler head operated the water flow switch, thereby activating the local alarm system and extinguished the fire in the laundry cart. The nursing supervisor proceeded through the facility attempting to loate the source of the waterflow alarm. The water flow activation of the sprinkler system is not indicated on the annunciator panel and she continued to search and noted smoke and water in the vicinity of the first floor laundry room. She reported the occurrence of the fire incident by dialing the 911 emergency number of the Montgomery County Emergency Operations Center and then continued to monitor the status of all areas of facility. Two patients were evacuated from their room in an adjacent area to a neighboring room in wheelchairs for precautionary purpose because of a small amount of smoke and water in the vicinity of their room. The fire was limited to a laundry cart, and the smoke was limited to the proximity of the laundry storage room. The Bethesda Fire Department verified extinguishment, performed ventilation, salvage, overhaul operations, including resetting of the alarm and sprinkler system.

700,760
PB80-218845 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Thomas B. Finan Center on September 9, 1979.
Final rept.,
J. L. Bryan, and J. A. Milke. Aug 80, 35p NBS/GCR-80-267
Contract NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident at the Thomas B. Finan Center on September 9, 1979 was detected by two housekeepers and a direct care aide who were investigating the ambiguous perceptual cue of an abnormal odor. At approximately 1255 hours they observed the mattress, with the resident on the mattress flaming in the seclusion room of cottage 4. The direct care aide went to initiate the alarm and the facility fire emergency procedures. One housekeeper took a blanket, entered the seclusion room and smothered the flames on the mattress and the resident. The resident was the only person injured in this fire incident and the smoke damage, to the one year old, unprotected, noncombustible constructed fully sprinklered building was limited to the seclusion room in the cottage 4 area. There was not enough heat generated to activate the sprinkler head in the seclusion room.

700,761
PB80-219009 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Crownsville Hospital Center on October 12, 1979.
Final rept.,
J. L. Bryan, and J. A. Milke. Aug 80, 30p NBS-GCR-80-269
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Patients, Hospitals, Smoke, Attitudes, Buildings, Specialized training, Cooperation.

The fire incident in the Meyers Building at the Crownsville Center on October 12, 1979 was initially detected by a resident as an ambiguous abnormal odor. The incident was detected at approximately 1612. The resident perceived the odor in the corridor of the central area of the building, adjacent to the dining area. The resident reported the suspected smoke odor to the staff at the nurses ward on 04. There were no resident or staff injuries in this fire incident and the damage was limited to the top of the desk, with smoke damage confined to the dining area during the five minutes of this fire incident on October 12, 1979. This was the second fire incident in the Meyer's Building on this date with the first fire incident consisting of a mattress fire on ward 01 as previously reported.

700,762
PB80-220429 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Roosevelt Hotel on April 24, 1979,
J. L. Bryan, J. A. Milke, and P. J. DiNenno. 31 Oct 79, 36p NBS-GCR-80-253
Grant NBS-7-9014
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Smoke, Hotels, Attitudes, Buildings, Specialized training, Cooperation, Injuries.

This fire incident occurred on the eighth floor of the Roosevelt Hotel, 2101 Sixteenth Street, N.W., Washington, D.C. on April 24, 1979. The fire incident was initially detected by a resident on the eighth floor who detected an odor of smoke and phoned the Hotel receptionist. The Hotel receptionist phoned the building engineer in the basement and the fire department. The fire department received the notification of the fire from the receptionist at 0701 hours. The fire department evacuated the eighth floor with personnel providing assistance to some residents from their breathing apparatus. The fire damage was limited to the room of origin, and smoke propagation to the eighth floor, of the fire resistive constructed building. A total second alarm fire department response was required to assure the evacuation of the residents. One resident, the sole occupant of room 818 was fatally injured, and four other residents received medical treatment at hospitals. Two of the injured residents from the eighth floor were treated for smoke inhalation and two residents from other floors were treated for chest pains.

700,763
PB80-224090 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Sheppard and Enoch Pratt Hospital, December 10, 1979.
Final rept.,
J. L. Bryan, and J. A. Milke. Aug 80, 32p NBS-GCR-80-272
Contract NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Evacuating(Transporting), Patients, Smoke, Attitudes, Hospitals, Buildings, Specialized training, Cooperation.

The fire incident was detected simultaneously by staff personnel on the basement level and first floor of A-3 wing, the 'A' building, at approximately 2108 on the evening of December 10, 1979. The staff member in the basement detected a smoke odor, but also visibly observed light smoke in the corridor adjacent to room 123. One staff member immediately phoned the operator, while the other staff member activated the local alarm system. The twenty-two ambulatory patients in the A-3 wing were evacuated to the A-1 wing immedi-

ately, and the smoke was not a factor in inhibiting the evacuation. The Baltimore County Fire Department was notified by the auxiliary system arrangement and responded. The electrical power to the 'A' building was discontinued at approximately 2110, while staff and fire department personnel investigated to find the smoke source. The source of the smoke was located in an overheated fan coil unit located above the ceiling of the first floor corridor of A-3 wing, and above the ceiling of room 123. There was no appreciable damage and no injuries in this fire incident in the 80 year old fire resistive building.

700,764
PB80-224918 PC **A02**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Washington Adventist Hospital on March 5, 1980.
Final rept.,
J. L. Bryan, and J. A. Milke. Sep 80, 25p NBS-GCR-80-274
Contract NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Patients, Smoke, Attitudes, Buildings, Specialized training, Hospitals, Cooperation.

The fire incident at the Washington Adventist Hospital on March 5, 1980 was initially automatically detected by the activation of a 165 degree F. sprinkler head on the wet pipe sprinkler system at approximately 0933 hours, which activated the local alarm system. In accordance with the facility emergency procedures the hospital operator initiated the verbal 'Doctor Red' announcement on the public address system and notified the Montgomery County Emergency Operations Center on the direct private phone line. Due to the initiation of a disaster simulation exercise at 0930 hours, the local alarm system activation for the fire was perceived to be related to the exercise. However, the hospital security staff and the Takoma Park Volunteer Fire Department responded to the x-ray area. The x-ray area is located on the first basement floor of the four story and two basement fire resistive building which is approximately seven years old. The fire department was at the hospital due to the disaster simulation exercise, and upon verification of a sprinkler activation radioed for a complete alarm assignment. Staff personnel in the x-ray area detected the fire in the Records Storage Room closet by the water on the floor with the smoke in the area, and utilized one 4A, 10BC rated and listed dry chemical extinguisher. Due to the fire resistive construction of the building, the location of the room of the fire origin on the first basement level, and the automatic sprinkler system extinguishment, the need for patient evacuation was precluded.

700,765
PB80-224934 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Wilson Health Care Center on June 25, 1980.
Final rept.,
J. L. Bryan, and J. A. Milke. Sep 80, 50p NBS-GCR-80-277
Contract NBS-7-9014

Keywords: *Human behavior, *Fires, Fire safety, Fire fighting, Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nursing homes.

A series of three fires occurred in the Wilson Health Care Center, 301 Russell Avenue, Gaithersburg, Maryland, in the early morning hours of June 25, 1980. The fires were all of undetermined, suspicious origin and all occurred in patient room 239, located on the second floor of the southwest wing. The Wilson Health Care Center is a portion of the Asbury Methodist Home Complex. The building of fire resistive construction was initially constructed in 1973 and the southwest wing involved in these fire incidents was constructed in 1980. The southwest wing is protected with combination smoke detectors and door closers on the patient room doors, wet pipe sprinkler system, class III standpipe system, smoke barrier doors in the corridors, and extinguishers distributed according to standard practice. The initial fire incident was detected after the flames had self-extinguished in a metal waste container in room 239 at about 0015 hours. The second fire incident was detected at about 0118 hours by the operation of the combination smoke detector and door closer on the door to patient room 239. This fire involved the cotton mattress, bedding and the vinyl covering of the foot board of a patient bed. Extinguishment was begun by staff use of a dry chemical extinguisher, and completed by the fire department. A third incident was discovered at 0448 hours by a nursing assistant who noticed water flowing from under the door of room 239. The sprinkler system had operated, extinguishing the fire in a combustible wardrobe.

700,766
PB81-134603 Not available NTIS
National Bureau of Standards, Washington, DC.
Psychological Aspects of Firesetting.
R. G. Vreeland, and B. M. Levin. 1980, 16p
Pub. in Chapter 3 in Psychological Aspects of Firesetting, p31-46 1980.

Keywords: *Behavior disorders, *Fires, Motivation, Crimes, Treatment, *Arson.

The purpose of this chapter is to examine some of the psychological factors involved in firesetting and arson. Although arson is a major problem and has been an area of behavioral research for over a century, the authors still know very little about its etiology and even less about its treatment. This paper summarizes the research literature and discusses: (1) types and motives of firesetters, (2) intellectual and academic performance of firesetters; (3) psychopathology of firesetting; and (4) treatment.

700,767
PB81-172132 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of the 'Acoustic Menu' in Assessing Human Response to Audible (Corona) Noise from Electric Transmission Lines.
Final rept.
J. A. Molino, G. A. Zerdy, N. D. Lerner, and D. L. Harwood. Nov 79, 11p
Contract DOE-EA-77-A-01-6010-A017-EES
Pub. in Jnl. of the Acoustical Society of America 66, n5 p1435-1445 Nov 79.

Keywords: *Human behavior, *Noise(Sound), Power transmission lines, Responses, Ambient noise.

A behavioral preference procedure, the 'acoustic menu,' was used to assess human aversion to the sounds from two samples of transmission line audible noise and from samples of other environmental noises. The audible (corona) noise produced by extra-high voltage (EHV), overhead transmission lines was tape-recorded during moist weather. Reproduced samples of corona noise, other common environmental noises, and artificial reference stimuli were compared in two experiments. The two corona noise samples were found to be equally preferred to: (1) a 1000 Hz octave band of noise about 11 dB SPL higher than the corona noises and (2) a collection of other environmental noises about 8 dB SPL higher than the corona noises. The corona noise samples were more aversive than the ambient sounds (including rainfall) occurring near rural transmission lines and were roughly equivalent in aversiveness to the noise from a room air conditioner (indoor recording). Knowledge of the source of the corona noise (from photographs and a brief description) did not affect its aversiveness. Of the simple frequency-weighting scales, the A-weighted sound level reduced the difference between the two corona noise samples and the set of other environmental sounds from about 8 dB SPL to about 3 dB. The D-weighted sound level further reduced this discrepancy to about 2 dB. These results were obtained with only two samples of corona noise; other samples may give different results.

700,768
PB81-185126 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Criteria for Recommending Lighting Levels.
G. T. Yonemura. Mar 81, 57p NBSIR-81-2231
Sponsored in part by Department of Energy, Washington, DC. Office of Building and Community Systems.Color illustrations reproduced in black and white.

Keywords: *Illuminance, *Behavior, Productivity, Requirements, Visual perception, Contrast, Standards.

The effect of lighting on behavior ranges from allowing simple detection of objects to creating moods and impressions. Lighting standards and recommendations for general applications should be based on the visibility (seeing) requirements where differences between individuals are minimal. Furthermore, lighting criteria or standards must evaluate the seeing process under stimulus conditions approximating those encountered in the real space. It is recommended that conspicuity, defined as: how well the detail stands out from the background, or ease of seeing be the metric for visibility. Subjective visual response criteria cannot be universally applied where significant differences in interpretations and evaluations between individuals and/or groups of individuals occur. Instead they should be treated as design options to be applied when they are important aspects of the intended function of the space. In discussing the above issues, the paper identifies the major categories of variables included in the perception of the visual environment and organizes them logically with respect to their relationship in developing lighting criteria and standards. This analysis includes a breakdown of the visual processes into sensory and perceptual components.

700,769
PB81-224545 PC **A11**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Determination of Behavior Response Patterns in Fire Situations, Project People II. Incident Reports, August 1977 to June 1980.
Final rept.
J. L. Bryan, P. J. DiNenno, and J. A. Milke. Dec 80, 237p NBS/GCR-80/297
Grant NBS-7-9014
Sponsored in part by Department of Health and Human Services, Washington, DC.

Keywords: *Human behavior, *Fires, Fire alarm systems, Fire departments, Fire extinguishers, Hospitals, Smoke, Investigations, Nursing homes.

The report is a summary and initial analysis of the sixty-five fire incidents included in the study population of Project People II. The fire incidents have been analyzed to present in tabular form the descriptive characteristics of the facilities with the construction, interior finish, and fire zone features shown. Staff and fire department behavioral actions were summarized and are presented in another table, with the number of persons evacuated, the means of evacuation, the extinguishment behavior, the closing of doors and the ventilation of smoke through the facility windows. The fire protection features of the facilities are presented in a third table. The sixty-five fire incidents included in this summary occurred between August 10, 1977 and June 25, 1980. The facilities involved in the incidents have primarily been health care facilities in accordance with the objectives of the research study, with twenty-five nursing home or convalescent center and thirty-three hospital incidents. In addition, two schools, two high rise apartments, two university dormitories and one correctional institution fire incidents were included due to the extensive evacuation behavior. The abstract of each fire incident report is presented with the diagrams of the maximum fire and smoke development in the realms and the movements of personnel in the behavioral episodes. The individual fire incidents were studied with a survey of the facility and interviews with critical fire department, staff and patient personnel.

700,770
PB81-241267 Not available NTIS
National Bureau of Standards, Washington, DC.
Psychoacoustic Evaluation of the Audible Noise from EHV Power Lines.
Final rept.
J. A. Molino, G. A. Zerdy, N D. Lerner, and D. L. Harwood. 1979, 4p
Sponsored in part by Institute of Electrical and Electronics Engineers, Inc., New York.
Pub. in Proceedings of IEEE/PES Transmission and Distribution Conference (7th), Atlanta, GA., April 1-7, 1979, Paper 79CH1399-5-PWR, p95-98 1979.

Keywords: *Noise(Sound), *Acoustic measurement, *Power lines, *Psychological effects, Transmission lines, Auditory perception, Human factors engineering.

A series of the three psychoacoustic experiments was conducted with samples of audible (corona) noise tape recorded 15 m (50 ft) from extra-high-voltage transmission lines. Altogether 77 listeners responded to these and other sounds in a realistic listening room environment. The results showed that corona noise is more aversive than the ambient sounds (including rainfall) occurring near rural transmission lines and that knowledge of the source of the corona noise did not affect its aversiveness to the listeners. The results also

showed that common acoustic measurement scales tend to underestimate the aversiveness of corona noise and that the high-frequency components of corona noise contribute most toward the aversive reactions of listeners.

700,771
PB82-133513 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Effects of Time-Varying Noise on Annoyance: A Review.
S. L. Yaniv, J. W. Bauer, D. R. Flynn, and W. F. Danner. Oct 81, 64p NBSIR-81-2377
Sponsored in part by Federal Highway Administration, Washington, DC.

Keywords: *Noise(Sound), *Responses, Time, Loudness, Forecasting.

The report summarizes the literature dealing with the adverse response of people to time-varying noise, and identifies both the acoustical and non-acoustical factors that influence the relationship between time-varying noise and annoyance. An examination of the laboratory research concerned with the functional relationship between annoyance and the temporal and acoustic parameters of noise shows the tenuousness of such relationships. The adequacy of currently used and/or proposed rating procedures for predicting subjective response to time-varying noise is examined. Critical gaps in current knowledge are identified.

700,772
PB82-136771 PC **A14**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Determination of Behavior Response Patterns in Fire Situations, Project People II - Health Care.
Final rept.
J. L. Bryan, and J. A. Milke. 31 Aug 81, 304p NBS-GCR-81-343
Contract NB80-NADA-1067
See also report for Aug 77-Jun 80, PB81-224545.

Keywords: *Human behavior, *Fires, Fire alarm systems, Fire departments, Fire extinguishers, Hospitals, Smoke, Investigations, Nursing homes.

This study involved the detailed investigation of 59 fire incidents in Health Care Facilities located in the State of Maryland, with one facility in Philadelphia. A total of 150 staff participants, 9 patients and 53 fire department personnel were interviewed relative to the fire and smoke development during the fire incident, and the human behavior responses of the participants during the fire incident. The analysis and study of the fire incident and interview data enabled the examination of the parameters of the fire incident including: area of fire origin, ignition and fuel characteristics, and the fire protection design features of the building. The human behavior variables of the fire incidents relative to the means of becoming aware of the fire incident, and the first three actions of the participants were compared to the variables of the fire and smoke development, previous training and fire experience of the participants, and with their belief in the safety of the building. Statistical analyses were performed indicating the relationships among the variables. The evacuation behavior was studied with the sequences of the actions adopted by the personnel.

700,773
PB82-210899 Not available NTIS
National Bureau of Standards, Washington, DC.
BFIRES-II: A Behavior Based Computer Simulation of Emergency Egress during Fires.
Final rept.
F. I. Stahl. Feb 82, 17p
Pub. in Fire Technology 18, n1 p49-65 Feb 82.

Keywords: *Computerized simulation, *Fires, *Human behavior, Buildings, Fire safety, Reprints, BFIRES computer program, Pedestrian safety, Emergencies.

This paper acquaints the reader with BFIRES, a computer program designed to simulate the emergency egress behavior of building occupants during fires. Use of the program is illustrated, and findings concerning the simulation's validity are presented. The ability of BFIRES to differentiate between building configurations, classes of occupants, and fire ignition scenarios is discussed. The conformance of BFIRES-produced pedestrian movement behavior with findings reported by other investigators is also treated.

700,774
PB83-135210 Not available NTIS
National Bureau of Standards, Washington, DC.
Arsonists: Who and Why. The Minds and Motives of People Who Set Fires.
Final Rept.
B. Levin, and R. Vreeland. Aug 82, 2p
Pub. in Firehouse 4, n8 p16-51 Aug 78.

Keywords: *Crimes, *Fires, Behavior disorders, Motivation, Reprints, Arsonists.

Firesetters who set fires for other than profit tend to be generally ineffective individuals with low scholastic ability or achievement. They tend to come from broken or disrupted homes and to have lived under harsh or frustrating circumstances. There does not appear to be important differences between such firesetters and other criminals and many firesetters do commit other crimes.

700,775
PB83-146589 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement and Prediction of Annoyance Caused by Time-Varying Highway Noise.
Final rept.
S. L. Yaniv, W. F. Danner, and J. W. Bauer. Jul 82, 7p
Sponsored in part by Federal Highway Administration, Washington, DC.
Pub. in Jnl. of The Acoustical Society of America 72, n1 p200-207 1982.

Keywords: *Noise(Sound), *Responses, Acoustic measurement, Urban areas, Loudness, Comfort, Forecasting, Psychological effects, Reprints.

Twenty-eight audiologically normal adult subjects participated in a study designed to assess how well six noise-rating indices would predict the annoyance caused by 3-minute recorded samples of traffic noise obtained from both nominally constant-speed and stop-and-go traffic. The study was performed in a laboratory simulating a home environment. Annoyance judgments were obtained through the use of a magnitude estimation technique involving a 10-point scale. Subjects were also asked if they could accept each of the 24 traffic sounds if heard on a regular basis in their homes. Data obtained indicate that the simpler noise-rating indices, such as the average sound level and the level exceeded 10 percent of the time, predict annoyance as well as, if not better than, complicated schemes incorporating a measure of either variability of rate of change of levels with time. Thus, it appears that the measurement and computational burdens associated with these complicated schemes are unwarranted.

700,776
PB83-198507 PC **A10**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Implications for Codes and Behavior Models from the Analysis of Behavior Response Patterns in Fire Situations as Selected from the Project People and Project People II Study Programs.
J. L. Bryan. Mar 83, 218p NBS/GCR-83-425
Contract NB80-NADA-1067
Sponsored in part by Department of Health and Human Services, Washington, DC.

Keywords: *Behavior, *Fires, Fire departments, Personnel, Models, Fire alarm systems, Hospitals, Residential buildings, Smoke, Investigations, Surveys.

The study described in this report involved an analysis of the previous Project People and the Project People II studies in relation to the identification of behavior response patterns. These response patterns are compared to the established and previously formulated models of behavior, and the provisions of the regional building codes and the NFPA Life Safety Code. This study evaluates the premodal concepts of Archea and Withey in relation to the identified behavioral response patterns of the participants in both the Project People study involved primarily with residential occupancies, and the Project People II study involved primarily with health care occupancies. The 1981 edition of the Code for Safety to Life from Fire in Buildings and Structures of the National Fire Protection Association, often referred to as the Life Safety Code, is also compared to the identified behavioral response patterns from the participants in both the Project People and the Project People II studies. Conclusions are derived regarding code provisions for exit sign marking, illumination, alarm systems, and smoke barrier doors.

700,777
PB83-222695 PC **A03**/MF **A01**
North Carolina State Univ. at Raleigh. Dept. of Industrial Engineering.
Egress Behavior Response Times of Handicapped and Elderly Subjects to Simulated Residential Fire Situations.
R. G. Pearson, and M. G. Joost. May 83, 50p NBS-GCR-83-429
Contract NB79-NADA-0012
Sponsored in part by Department of Health and Human Services, Washington, DC.

Keywords: *Behavior, *Fires, Elderly persons, Handicapped persons, Time studies, Evacuating(Transportation), Residential buildings.

This study involved the measurement of the times required to perform actions that are typically performed in nighttime residential fire emergencies. These actions include: calling fire department, searching for young child (i.e. doll), and donning a robe. The participants in the study included typical college students, elderly persons (including some with arthritic problems), blind people and young adults who use wheelchairs.

700,778
PB83-227116 PC **A05**/MF **A01**
North Carolina State Univ. at Raleigh. Dept. of Psychology.
Detection Times to Fire-Related Stimuli by Sleeping Subjects.
Interim rept.
M. J. Kahn. Jun 83, 100p NBS-GCR-83-435
Grant NB79-NADA-0012
Sponsored in part by Department of Health and Human Services, Washington, DC.

Keywords: *Fire alarm systems, *Human behavior, Responses, Fire detection systems, Residential buildings, Odor detection, Auditory perception, Smoke.

A laboratory study was conducted to determine human waking and response times to fire-related stimuli. Twenty-four college-age male subjects were tested with each subject being run for one night. Twelve subjects were exposed to smoke alarm warning signals of three intensities while a second set of twelve subjects was exposed to a smoke odor, a heat presentation, and one smoke alarm warning signal.

700,779
PB84-153329 Not available NTIS
National Bureau of Standards, Washington, DC.
Physics of Basketball: An Introduction to Scientific Thinking.
Final rept.
J. E. Faller. 1983, 12p
Pub. in Proceedings of 1983 Int. School Symp. Precision Measurement Gravity Experiment, Taipei, Republic of China, Jan 24-Feb 2, 1983, p9-20.

Keywords: *Thinking, *Experimental design, Physics, *Basketball.

Basketball, and in particular the physics of basketball, is used as an introduction to scientific thinking. The how's and why's of basketball are discussed, and their counterparts in the scientific approach are noted.

700,780
PB84-244680 Not available NTIS
National Bureau of Standards, Washington, DC.
Human Behavior and Fires: An Introduction.
Final rept.
R. L. Paulson. May 84, 13p
Pub. in Fire Technology 20, n2 p15-27 May 84.

Keywords: *Human behavior, *Fires, Fire safety, Evacuating(Transporting), Smoke, Buildings, Design criteria, Warning systems, Decision making, Reprints.

From a selected list of references, the author traces the developments in the research into human behavior in fire situations. This paper includes research approaches, people and design as related to the evacuation process, panic, behavioral tendencies, and decision-making, citing references from the author's paper: Human Behavior and Fire Emergencies: An Annotated Bibliography, NBSIR 81-2438.

700,781
PB85-172526 Not available NTIS

National Bureau of Standards, Gaithersburg, MD.
Human Behavior in Fire: What We Know Now.
Final rept.
B. M. Levin. 1984, 10p
Pub. in SFPE (Society of Fire Protection Engineers) Technology Report 84-3, 10p 1984.

Keywords: *Human behavior, *Fires, Decision making, Education, Fire protection, Fire alarm systems, Fire safety, Evacuation egress.

While the decisions and actions of people in fire emergencies sometimes may be unpredictable or erratic, it is more common for their decisions and actions to follow consistant behavioral patterns. Fire safety can be upgrading if we design fire safety systems and training programs based on common behavioral patterns. Some common behavioral patterns in fire emergencies are: 1. people will evacuate through a familiar route rather than through the best route; 2. women will tend to warn and assist others while men are more likely to fight the fire; 3. panic is very rare but heroic and altruistic actions are common; 4. many severely disabled people can evacuate themselves in a timely fashion in many buildings if there are no unnecessary barriers; and 5. many people will not respond to mild ambiguous fire cues.

Social Concerns

700,782
PB-279 246/3 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
Directory of Law Enforcement and Criminal Justice Associations and Research Centers.
Mar 78, 55p NBS-SP-480-20
Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, D.C. Library of Congress Catalog Card no. 78-600018. See also report dated Jun 73, COM-73-50624.

Keywords: *Law enforcement, *Criminal justice, *Organizations, *Directories, Societies, Centers, Research, Indexes, Statistical data, Executives, Municipalities, Courts of law, Professional personnel, Rehabilitation.

The directory lists national, nonprofit professional and volunteer social action associations and research centers which are active in the fields of law enforcement and criminal justice. The international and foreign organizations which are listed either have a large number of American members, have a U.S. chapter, or are doing work which is applicable to the United States. The local organizations which are listed either cover several States or are of national interest. The organizations are listed alphabetically. The format of an entry is: title of organization; mailing address; officer; telephone number; year founded; number of members; number of staff; description of purpose and activities; affiliations; publications; meetings. A subject index is included.

700,783
PB-295 037/6 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Consumer Sciences Div.
Group Homes for the Developmentally Disabled: Case Histories of Demographics, Household Activities, and Room Use.
Final rept.
A. M. Ramey-Smith, and J. V. Fechter. Oct 78, 66p NBSIR-79-1727
Sponsored in part by Rehabilitation Services Administration, Washington, DC.

Keywords: *Residential buildings, *Fire safety, Facilities, Characteristics, Mental deficiencies, Fire protection, Utilization, *Group homes, Mentally handicapped persons.

The document is the final report to the National Bureau of Standards' Center for Fire Research as part of their support to the Developmental Disability Office of the U.S. Department of Health, Education and Welfare. The objective of the present study was to obtain case history information on a sample of group homes for the developmentally disabled. Survey techniques were used to compile summary data on residents' room use and activities, the group home facilities, and demographics of the supervisors and residents. Data are presented for room use and activities of developmentally disabled residents and these data are compared to results available for the normal population. Summary data describe characteristics of the group homes, supervisors, and residents. Recommendations are presented regarding fire safety for developmentally disabled residents of group homes.

700,784
PB80-144173 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire and Life Safety for the Handicapped.
Final rept.,
B. M. Levin. Feb 80, 155p NBSIR-80-1965
Reports on Conference on Fire Safety for the Handicapped, Held at Washington, DC on Nov 26-29, 1979 and Workshops on Life Safety for the Handicapped, Held at Washington, DC and Sacramento, CA August and September 1979. Prepared in cooperation with AIA Research Corp., Washington, DC and Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Handicapped persons, *Fire safety, Meetings, Safety, Building codes, Buildings, Openings, Escape(Abandonment), Warning systems, Fire departments.

On November 26-29, 1979, the National Bureau of Standards hosted a Conference on Fire Safety for the Handicapped where 80 experts discussed the problems of the handicapped in fire emergencies, safety procedures, and hardware that upgrades their safety. The major work of the Conference was conducted by seven panels that met in parallel: overview, alarm systems, refuge, egress, self-protection, management actions, and emergency service actions. Six workshops were held in preparation for the Conference during August and September 1979 in the area of life safety for the handicapped in emergencies. The workshops were: codes and standards, emergency preparedness planning, building design, education, consumer interests, and products. Each of the 13 panels and workshops prepared a report containing background information and the recommendations of the panels. This document contains the 13 reports, the speeches at plenary sessions and supplementary comments by some of the participants.

700,785
PB80-195621 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the Lafayette Square Nursing Center on October 24, 1978.
Final rept.,
J. L. Bryan, and P. J. DiNenno. 28 Feb 79, 30p NBS-GCR-80-226
Grant NBS-7-9014

Keywords: *Human behavior, *Fires, Fire fighting, Fire safety, Patients, Smoke, Attitudes, Buildings, Specialized training, Cooperation, Nursing homes.

A staff member observed smoke issuing from the vacant patient room 313 on wing C at approximately 1130 hours on October 24, 1978. The staff member immediately activated the local alarm system and notified the security staff by phone. The security staff initiated the facility fire emergency procedures with the verbal public address system announcement and notified the fire department. The twenty-two patients on wing C had been moved to allow insect extermination operations that morning so wing 3-C was vacant. None of the 262 patients in the facility were evacuated. The fire was of electrical origin and propagated to the interior void space in the partition wall between patient rooms 311 and 313. The fire was extinguished by staff personnel utilizing six 2 1/2 gallon soda and acid extinguishers and two 10 pound carbon dioxide extinguishers. The Baltimore City Fire Department arrived, verified extinguishment and checked for extension of the fire within the wall. The five-story protected ordinary construction and fire resistive construction building was seventy-five years old. The area of fire origin was in the protected ordinary construction section fully protected with automatic sprinklers. The 264 capacity facility had a registerd occupancy of 262 patients at the time of the fire incident.

700,786
PB81-180549 PC **A05**/MF **A01**
BDM Corp., McLean, VA.
Building Security Demonstration: A Survey of Break-ins in Two Public Housing Sites.
Final rept. 1978-79.
P. M. Ryan, and D. R. De Vos. Nov 80, 100p BDM/W-80-353-TR, NBS-GCR-80-291
Contract EO-A01-78-00-3530
Sponsored in part by Department of Housing and Urban Development, Washington, DC.

Keywords: *Housing studies, *Security, Crime prevention, Behavior, Characteristics, Standards, Fear, Doors, Windows, Burglary.

The report presents the findings of a baseline crime victimization survey conducted in two public housing sites. These findings are part of a test of the validity of security hardware standards developed by NBS. Included in this report is an explanation of the methodology used, demographic and behavior patterns, physical characteristics, and the crime victimization experienced at both sites. Conclusions include the observation that crime patterns indicate the usual complex variables at work and casual relationships are conjectured to be number and skill of criminals, access and exposure of entry portals, number of resident adults in the household, and quality of the building/site security system.

700,787
PB81-180960 PC **A03**/MF **A01**
North Carolina Univ. at Chapel Hill. Dept. of Psychology.
Report of a Conference on Fire Emergency Plans in Group Homes for the Developmentally Disabled.
Final rept.
M. B. Waller, and R. G. Vreeland. Mar 81, 32p NBS-GCR-81-315
Grant NB79-NADA-0020
Sponsored in part by Department of Health and Human Services, Washington, DC.

Keywords: *Handicapped persons, *Fire safety, Meetings, Mental deficiency, Houses, Insurance, Specialized training, Incentives.

The report is the product of a conference held on June 1, 2, and 3, 1980 in Chapel Hill, North Carolina. The participants in the conference were brought together to discuss guidelines for fire emergency plans in group homes for the developmentally disabled. Participants included a broad cross section of those concerned about fire safety in group homes for the developmentally disabled, including fire protection engineers, group home owners and operators, fire service personnel, as well as experts in training group home staff and in developmental disabilites, insurance, and behavior in fire. This report contains some of the substance of their discussions. The guidelines provided in this report include suggestions regarding training programs and facility fire emergency plans. A checklist for both local fire service personnel and group home staff is provided to assist these groups in developing adequate fire emergency plans. Recommendations are made in the areas of information availability, incentive systems, and evaluation procedures.

700,788
PB81-184954 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Buildings Accessibility for the Disabled: A Review of Research Needs.
S. C. Adler, and B. C. Pierman. Mar 81, 43p NBSIR-81-2245
Sponsored in part by Architectural and Transportation Barriers Compliance Board, Washington, DC.

Keywords: *Handicapped persons, *Buildings, *Availability, Fire safety, Architecture, Barriers, Legislation, Research projects, Requirements, Architectural barriers.

The report traces the evaluation of public policy on accessible environments; discusses the need for development of a research basis for the design of accessible buildings including accessibility standards for both new and existing buildings, summarizes the results and research recommendations of both the Conference on Fire Safety for the Handicapped held at NBS on November 26-29, 1979 and the joint ATBCB/NBS Conference on Accessibility Guidelines held in Bethesda, Maryland on October 31 - November 1, 1979, and presents an overview of current NBS accessibility research plans.

Social Concerns

700,789
PB81-238255 MF **A01**
National Bureau of Standards, Washington, DC.
Breath Alcohol Sampling Simulator (BASS) for Qualification Testing of Breath Alcohol Measurement Devices.
Special pub.
A. Flores, L. K. Eliason, and Y. C. Wu. Jul 81, 34p
NBS-SP-480-41
Sponsored in part by National Highway Traffic Safety Administration, Washington, DC. Prepared in cooperation with Transportation Systems Center, Cambridge, MA.

Keywords: *Alcoholism, *Motor vehicle operators, Measuring instruments, Respiration, Blood analysis, Simulators.

The blood alcohol content of an individual suspected of driving while intoxicated is often measured through the analysis of a breath sample using an evidential breath tester (EBT). Two factors determine the ability of an EBT to provide an accurate analysis of alcohol concentration: (a) the capability of obtaining an appropriate breath sample, and (b) the inherent accuracy of the analytical instrument. This report characterizes the relevant breath parameters and describes a breath alcohol sample simulator (BASS) that was developed as a means of reproducing accurate equivalents of human breath. The report discusses measurements made on human subjects to establish values for parameters the BASS must accommodate, and to demonstrate the validity of the BASS as a replacement for human drinking subjects with different levels of alcohol content and a range of physiological characteristics.

700,790
PB82-133539 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Results of Fingerprint Image Quality Experiments.
R. T. Moore. Jun 81, 50p NBSIR-81-2298
Sponsored in part by Federal Bureau of Investigation, Washington, DC.

Keywords: *Identification systems, *Crimes, Crime reduction, Problem solving, Images, *Fingerprints.

A series of experiments were conducted to determine the variation in the scores developed using a matching algorithm designated as the M-82 for mating fingerprints of different image quality that had been read by the Automatic Fingerprint Reader System (AFRS) of the FBI. The variations in image quality resulted from the use of a variety of card stocks and recording techniques to record the print of a single finger. For each image recording process, a sample of 56 finger-pairs were matched and mean single-finger score values were developed. These varied over a factor of more than 70 to one. The best scores were developed from images placed on very white, slick appearing, calendared card stock with the use of film strips that had been pre-inked and which could be separated to expose an ink film of predetermined thickness and uniformity. This combination had less resistance to smearing than fingerprints produced on the same stock from the use of a preinked porous pad. However, the latter still produced acceptably high scores.

700,791
PB82-144007 Not available NTIS
National Bureau of Standards, Washington, DC.
Laboratory Flammability Test for Institutional Mattresses.
Final rept.
V. Babrauskas. Nov 81, 6p
Pub. in Fire Jnl. 75, n6 p35-40 Nov 81.

Keywords: *Correctional institutions, *Bedding equipment, *Flammability testing, Fire tests, Fire resistant materials, Fire safety, Reprints.

Minimum mattress fire safety is provided by the mandatory Federal cigarette ignition standard FF 4-72. This is generally considered not to be sufficient for the jail or prison environment where flaming ignitions can well be expected and egress may be restricted. Until now additional safety could only be provided by either explicitiy banning certain materials or else requiring full-scale demonstration tests. The former discourages innovation while the latter is difficult to control and reproduce. To eliminate these difficulties, a set of bench-scale laboratory test procedures has been developed for testing mattresses and classifying their performance. A program of full-scale fire testing identified four distinct performance groups. The laboratory test procedures correctly classify the performance into the same groups as the full-scale fire tests. For general use in correctional facilities only mattresses conforming to the highest group requirements (Group A) are recommended. The same test procedure is also applicable to cell padding materials.

700,792
PB82-236191 Not available NTIS.
National Bureau of Standards, Washington, DC.
Current State of Regulations Providing Safety Considerations in Buildings Accessible to the Handicapped.
Final rept.
I. A. Benjamin. Mar 82, 5p
Sponsored in part by American Inst. of Architects.
Pub. in Proceedings Conference on Life Safety and the Handicapped (1980), Held at Howard University, Washington, DC., Oct 26-29, NBS-GCR82-383 p14-18.

Keywords: *Handicapped persons, *Safety, Buildings, Barriers, Fires, Regulations, Architectural barriers.

Federal, state and local regulations have been issued to make buildings increasingly accessible to the handicapped. It is now a major concern to make certain there is adequate provision in these same buildings for the life safety of the handicapped under fire conditions. After briefly reviewing the extent to which accessibility for the handicapped has been mandated by law, recent efforts to modify existing codes to address the life safety problems associated with accessibility will be discussed.

700,793
PB83-139345 PC **A06**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Matter of Time - A Comprehensive Guide to Fire Emergency Planning for Board and Care Homes.
Final rept.
N. E. Groner. Nov 82, 119p NBS-GCR-82-408
Contract NB81-NADA-2024
Sponsored in part by Department of Health and Human Services, Washington, DC.

Keywords: *Fire safety, *Houses, Elderly persons, Mental disorders, Handicapped persons, Planning, Fire protection, Escape systems.

This manual advises persons concerned about planning for fire emergencies in board and care homes. Because board and care homes encompass a wide variety of facilities, the manual does not suggest any single plan, but rather instructs operators how to tailor plans to the circumstances in particular board and care homes. The manual includes exercises designed to select the most appropriate combinations of escape and refuge strategies for particular facilities, and how to anticipate the assistance needs of residents in a fire emergency. Also included are nontechnical descriptions of fire protection techniques appropriate to board and care homes, specific suggestions for training staff and residents using three types of fire drills, and advice about how to motivate staff and residents and how staff and residents should react when a fire is suspected or discovered. Finally, appendices provide step-by-step guides for writing emergency procedures for individuals or groups of both residents and staff, as well as a list of resources where interested persons can seek further help.

700,794
PB84-165778 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Multi-Year Affirmative Action Program for Women and Minorities for Fiscal Years 1982 through 1986 Washington, DC. and Boulder, Colorado. Executive Summary.
Final rept.
L. K. Despeaux. Dec 83, 29p NBSIR-83-2798

Keywords: *National government, *Discrimination, *Females, Civil service, Government employees, Executives, Minority groups, Objectives, Civil rights, Equal opportunity.

The NBS multi-year affirmative action program has been designed to assist the Bureau in meeting the goal established by Congress in the Civil Service Reform Act of 1978--i.e., to provide... a federal workforce reflective of the nation's diversity. Women and minorities are underrepresented in scientific occupations at NBS. Although women and minorities are employed in most all administrative, technician, clerical, and blue collar occupations, they are generally underrepresented or absent from higher grades. The affirmative action program has been designed to improve or correct these problems by using three strategies.

700,795
PB85-124329 Not available NTIS
National Bureau of Standards, Washington, DC.
Comment on 'The Standardization of Time' by Zerubavel.
Final rept.
I. R. Bartky. May 84, 6p
Pub. in American Jnl. of Sociology 89, n6 p1420-1425 May 84.

Keywords: *Time, *Standardization, History, Reprints, Daylight saving time, Time zones, Standard time.

E. Zerubavel's recent article, 'The Standardization of Time: A Sociohistorical Perspective,' describes the establishment of American time zones and the use of time zones worldwide. Unfortunately a number of conclusions regarding these systems and their adoption processes are based upon technical misunderstandings and errors of fact. This comment on Zerubavel's article identifies some of the technical errors and shows consequentially why the conclusions are untenable.

BIOMEDICAL TECHNOLOGY & HUMAN FACTORS ENGINEERING

Biomedical Instrumentation & Bioengineering

700,796
PB-264 340/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Application of Pulse Compression Techniques to Medical Ultrasound.
Final rept.,
S. I. Parks, and M. Linzer. 1976, 5p
Pub. in Proceedings of the Society of Photo-Optical Instrumentation Engineers, Conf., Washington, D.C., September 16-19, 1976, Paper in Application of Optical Instrumentation in Medicine V, 96, p349-353 1976.

Keywords: *Diagnosis, *Ultrasonic frequencies, *Bioinstrumentation, *Ultrasonic tests, Health care technology, In vivo analysis, Humans, Heart, Pulse compression, Signal processing.

The application of pulse compression to medical ultrasound is discussed. This approach can decrease peak power and increase sensitivity in ultrasonic diagnosis. A prototype system with 8:1 compression ratio and 0.6 microsec resolution is described. Compressed echo waveforms were obtained from an aluminum bar and from a human heart in vivo.

700,797
PB-266 491/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Squid Instruments and Shielding for Low-Level Magnetic Measurements,
J. E. Zimmerman. Feb 77, 9p
Pub. in Jnl. Appl. Phys. v48 n2 p702-710 Feb 77.

Keywords: *Bioinstrumentation, *Measuring instruments, Magnetic measurement, Shielding, Enclosures, SQUID devices, Magnetoencephalography, Biomagnetism, Josephson effect, Reprints.

A thick-walled aluminum enclosure was used to provide low-frequency shielding for biomagnetic studies with SQUID magnetic gradiometers. The shield provides an attenuation proportional to frequency above 1/3 Hz. A 24-hole fractional-turn SQUID gradiometer has been used in the enclosure to carry out studies of magnetoencephalography on humans. An asymmetric

configuration for a second-derivative gradiometer has been developed which provides a significant increase in sensitivity and resolution over more conventional symmetric arrays.

700,798
PB-268 635/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pressure Transducer Evaluation,
P. S. Lederer. 1977, 9p
Pub. in Proceedings of Workshop on Biomedical Pressure Measurements, Case-Western Reserve University, Cleveland, Ohio, Dec. 4-5, 1975, p183-191 1977.

Keywords: *Pressure sensors, Measuring instruments, Performance evaluation, Tests, Bioinstrumentation, Calibrating.

In order to assure meaningful measurements with pressure transducers, their performance characteristics must be evaluated. Static and dynamic calibration techniques, as well as environmental and durability test procedures are discussed. Reference is made to on-going work at the National Bureau of Standards, as well as to the standardization activities of professional societies.

700,799
PB-270 126/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Metallic Surgical Implants: State-of-the-Art.
Final rept.,
A. C. Fraker, and A. W. Ruff. May 77, 13p
Pub. in Jnl. of Metals, v29 n5 p1-7 May 77.

Keywords: *Implantation, *Metals, Mechanical properties, Standards, Regulations, Requirements, Orthopedics, Reprints, *Biomaterials, Implant retrieval.

Metallic surgical implants in use today have been discussed in terms of their properties and the implant requirements (biocompatibility, mechanical properties and environmental stability) imposed on them. Research of numerous workers is included in the review which lists 73 references. Emphasis is placed on the use of metals for orthopedic purposes but other uses are discussed briefly. Implant retrieval studies, standards and regulation are discussed.

700,800
PB-271 177/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Model for the Interaural Time Differences in the Azimuthal Plane.
Final rept.,
G. F. Kuhn. 1977, 11p
Pub. in J. Acoust. Soc. Am., v62 n1 p157-167 Jul 77.

Keywords: *Auditory perception, Ear, Anatomical models, Models, Reprints, Interaural intensity differences, *Interaural time differences.

An objective study of the steady-state interaural time difference (ITD) was performed on a manikin comprised of a head and torso. Data were taken for both a bare and clothed torso. The measured ITD's correspond reasonably accurately at the low and the high frequencies to the computed theoretical values for a rigid sphere of an effective radius a. The theoretical ratio of the low-frequency (500 Hz) ITD to the high-frequency (2000 Hz) ITD is 3/2. The measured ITD is a minimum between 1.4 and 1.6 kHz for angles of incidence, theta(inc), of sound between 15 degrees and 60 degrees. At both the low and the high frequencies the data can be expressed by universal curves when the ITD is normalized by (a/c(0))sin theta(inc) where c(0) is the speed of sound in air and theta(inc) is the angle of incidence. Both the steady-state ITD and the interaural sound-pressure-level difference (iLD) show differences between measurements made with the bare torso and those with a clothed torso. These objective results support the subjective measurements of past experiments, which showed that in man there was no localization improvement below approximately 500 Hz, poor localization between 1000 and 2000 Hz, and a change in the localization cue around 1400 Hz from ITD to ILD.

700,801
PB-271 600/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Acoustic Pressure Field Alongside a Manikin's Head with a View Towards in situ Hearing-Aid Tests.
Final rept.,
G. F. Kuhn, and E. D. Burnett. 1977, 8p
Pub. in J. Acoust. Soc. Am., v62n2 p416-423 Aug 77.

Keywords: *Hearing aids, *Audiometry, Sound pressure, Head, Diffraction, Frequencies, Responses, Anatomical models, Tests, Measurement, Reprints.

The frequency responses of hearing aids measured in a free field differ from those measured on the head of a person or a manikin due to the scattering of the sound by the head and the torso. In order to compare and interpret the response of hearing aids located on the head at various frequencies it is necessary to know precisely the spatial pressure distribution. The amplitude and phase of the acoustic pressure were measured alongside a manikin's head in increments ranging from 2 to 5 mm with frontal sound incidence. The acoustic driver was located in front of the manikin at distances of 1.0 and 3.5 m from the ear-canal axis. The test frequencies were the octave band center frequencies from 0.5 to 4.0 kHz and the third-octave band center frequencies from 4.0 to 8.0 kHz. The sound pressure level varies smoothly, as a function of position, alongside the head for frequencies equal to or less than 2.0 kHz. At frequencies equal to or greater than 4.0 kHz the pressure level changes rapidly with position. Particularly severe pressure minima were found to exist around the pinna at 6.3 and 8.0 kHz.

700,802
PB-272 199/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of Physical and Mechanical Testing.
Final rept.,
G. Dickson. 1977, 22p
Pub. in Proceedings of Anniversary Progress in Dental Materials (100th) at Ann Arbor, Michigan on October 1, 1975, p29-50 1977.

Keywords: *Dental materials, Mechanical tests, Procedures, Physical tests, Mechanical properties, Physical properties, Specifications.

Instrumentation and experimental procedures used for determination of the physical and mechanical properties of dental materials have changed greatly in the past 100 years, but intelligent researchers 100 years ago were asking some of the same questions about the characteristics of their materials that are being asked today. Today there is a background of accumulated knowledge of dental materials and service conditions and a relationship with an extensive materials science that permit the questions to be asked more precisely. Technology is available for applying mechanical forces or other forms of excitation to materials in a more precise fashion, to measure the responses of the materials more accurately, and to analyze the data more rapidly and more completely than could the early researchers. Future developments in physical and mechanical testing for determination of basic properties and for evaluation of dental materials depend upon the advancement of this technology, but even more so upon the soundness of the physical principles and the attention to clinical revelance with which the technology is applied to dental problems.

700,803
PB-273 091/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nonmetallic Electrode System for Recording EEG and ECG in Electromagnetic Fields.
Final rept.,
W. F. Flanigan, R. R. Bowman, and W. R. Lowell. 1977, 3p
Prepared in cooperation with Naval Undersea Center, San Diego, Calif. Sponsored in part by Office of Naval Research, Arlington, Va.
Pub. in Physiol. Behavior Brief Commun. 18, p531-533 1977.

Keywords: *Electrodes, *Bioinstrumentation, Electrocardiography, Electroencephalography, Electrophysiologic recording, Turtles, Electromagnetic fields, Reprints, Nonmetallic electrodes.

The construction of a nonmetallic electrode/lead system for recording biopotentials in the presence of electromagnetic fields is described. The system is simple to prefabricate and about as versatile and easy to use as metallic electrodes and connecting wires. It has been used for acute and chronic EEG and ECG recordings from chelonians (turtles and tortoises) with consistently satisfactory results.

700,804
PB-275 122/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Investments for Chromium-Based Alloys.
Final rept.,
C. P. Mabie. 1977, 3p
Grant PHS-DE-04058
Pub. in Proceedings of Conference on Alternatives to Gold Alloys in Dentistry, National Institutes of Health, Bethesda, Md. 24-26 Jan 77 p186-201 1977.(DHEW/PUB/NIH-77/1227).

Keywords: *Chromium alloys, *Dental materials, Differential thermal analysis, Tests, Visual inspection, X ray analysis, Thermal analysis, Dimensional stability, Investment castings.

Optical microscopic, x-ray, differential thermal, and thermal dimensional change studies have been made on investments used for chromium-based alloys. These studies have revealed that reactions during burnout and casting bear critically upon investment performance. It has become apparent that there is a need to formulate investment systems which given better refractory performance during burnout and casting.

700,805
PB-276 536/0 PC **A09**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
Attack and Release Characteristics of Compression Hearing Aids.
Final rept.,
E. D. Burnett, and M. A. Bassin. Dec 76, 176p
NBSIR-76-1179
Sponsored in part by Veterans Administration, Washington, D.C. Dept. of Medicine and Surgery.

Keywords: *Hearing aids, *Medical equipment, Performance tests, Performance evaluation, Graphs(Charts), Reaction time, Manufacturers.

The attack and release time characteristics of 81 compression hearing aids are presented. The input signal used was that specified in the standard, ANSI S3.22.

700,806
PB-277 317/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Clinical Fixed Points - The Melting Point of Gallium.
Final rept.,
D. D. Thornton, and B. W. Mangum. 1976, 4p
Pub. in Proceedings Session Comite Consultatif de Thermometrie (11th), Comite Int. des Poids et Mesures, Sevres, France, June 15-16, 1976, Paper T 17 in Comite Consultatif de Thermometrie, pT157-T160 1976.

Keywords: *Gallium, *Melting points, *Temperature measuring instruments, Metals, Temperature, Medical laboratories, Thermistors, Calibrating.

There is a special need for a reliable, simple, and economical system of temperature reference points between 0C and 100C. This need arises from an increasingly wide usage of electronic thermometers, which use thermistor sensors. The complete temperature characteristics of thermistors and the possibility of calibration drift make it important to be able to quickly calibrate them at several points in the temperature range of interest. The need for high accuracy in temperature measurement is particularly acute in clinical laboratories where thermistors are used as temperature sensors in automated enzyme analyzers. The authors propose to document a set of liquid-solid phase transitions to be used as fixed points. In this paper the authors demonstrate that the melting point of 7 N's pure gallium, at 29.772C, is reproducible to a millikelvin and that small (20 grams) samples can be used to calibrate thermistors to this accuracy and any thermometer to an accuracy of 10 mK or better in a temperature controlled bath.

700,807
PB-278 403/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fracture Mechanics of Alumina in a Simulated Biological Environment.
Final rept.,
E. M. Rockar, and B. J. Pletka. 1978, 11p
Prepared in cooperation with Pennsylvania State Univ., University Park. Dept. of Materials Science.
Pub. in Proceedings Int. Symposium on Fracture Mechanics (2nd), State College, PA., July 26-29, 1977, Paper in Fracture Mechanics of Ceramics, n4 p725-735 1978.

Keywords: *Aluminum oxide, *Fracture properties, Ceramics, Chemical compounds, Inorganic compounds, Materials, Crack propagation, Effectiveness, *Environmental effects, *Biomaterials, Biological systems.

Dense, polycrystalline alumina, because of its high compressive strength and excellent biocompatibility, will soon be used in human prosthetic devices. However, the environmental effects of the biological system on the long term strength and wear of alumina have not been evaluated. As a preliminary investigation of this problem, crack propagation data on nine types of highly dense alumina were obtained in environments of distilled water, and Krebs-Ringer solution. The data were obtained primarily by strength measurements using a biaxial tension test. Variations in crack propagation data were observed among the different materials. The causes of these variations are discussed in terms of microstructure and environment.

700,808
PB-280 596/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Adsorption and Conformation of Plasma Proteins-Physical Approach.
Final rept.,
B. W. Morrissey. 10 Feb 77, 15p
Sponsored in part by National Heart, Lung, and Blood Inst., Bethesda, Md. Biomaterials Program.
Pub. in Annual of NY Academy of Science 283, p50-64, 10 Feb 77.

Keywords: *Proteins, *Adsorption, Blood plasma, Materials, Implantation, Cardiovascular system, Interfaces, Solids, Solutes, Surface properties, Stability, Biophysics, Reprints, *Biomaterials, *Blood compatible materials.

The adsorption of clotting factors and proteins on the surface of artificial materials placed in the cardiovascular system can modify both their biological activity and the subsequent interaction of formed cellular elements with the surface. The important concepts and techniques describing protein adsorption, protein desorption and exchange, and the conformation and conformational changes of adsorbed proteins at the solid/solution interface are reviewed. In particular, recent in situ ellipsometric, infrared bound fraction, and radiotracer rate studies carried out in the laboratories have shown that plasma proteins exhibit different conformational stabilities upon adsorption, and have different dependences upon such parameters as surface concentration, applied potential, surface free energy, pH, and ionic strength. Serum albumin and prothrombin change little in conformation upon adsorption with no effect of surface concentration, while the conformation of gamma-globulin is markedly dependent on surface concentration. All proteins studied show a dependence of the adsorbed conformation on surface free energy of the substrate, and on an impressed potential.

700,809
PB-281 355/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Method Evaluates Coupling Agents Bonding Polymer to Tooth Mineral.
Final rept.,
W. V. Loebenstein, and J. W. Kumpula. Oct 77, 8p
Pub. in Jnl. of Dental Research, v56 n10 p1219-1226 Oct 77.

Keywords: *Dental materials, *Binders(Materials), Adhesives, Methodology, Evaluation, Tests, Tensile strength, Reprints, GMA matrix.

Polymerized test specimens consist of a Bis-GMA matrix and a filler of synthetic hydroxyapatite previously coated with the coupling agent under investigation. As the concentration of filler increases for a given coupling agent, the specimen's tensile strength decreases. The more effective the coupling agent, the less pronounced is the decrease. Application of the method is proposed for classifying coupling agents as well as providing a means for assessing the weakening effects of environmental exposure.

700,810
PB-281 923/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Piezoelectric Effect in Bone (Abstract Only as C4.10).
Final rept.,
A. J. Bur. 1975, 1p
Pub. in Proceedings of Annual Conference on Engineering in Medicine and Biology (28th), New Orleans, La. Sept. 20-24, 1975, 17, 192, 1975.

Keywords: *Piezoelectricity, *Bones, Law frequencies, Biophysics, Electrical properties, Cattle, Temperature, Humidity, Compressing, Shear properties, Measurement.

The piezoelectric properties of bovine bone have been measured as a function of temperature, relative humidity, and frequency of applied stress. Measurements were made in compression and shear. The data show dispersion effects in shear which are sensitive to changes in relative humidity or water content of the sample. At low frequencies, less than 10 Hz, a large interfacial or Maxwell-Wagner polarization was observed.

700,811
PB-287 023/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Properties of Sealants Containing Bis-GMA and Various Diluents.
Final rept.,
G. M. Brauer. 1978, 11p
Grant PHS-DE-40015
Sponsored in part by National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. of Dental Research 57, n4 p597-607 Apr 78.

Keywords: *Dental materials, *Sealers, Procedures, Performance tests, Formulations, Evaluation, Protective coatings, Reprints.

Properties of commercial and a series of experimental pit and fissure sealants, based on Bis-GMA were determined using rapid test procedures. By proper selection of monomeric diluent and addition of a photocrosslinking agent, the characteristics of sealant formulations can be varied widely.

700,812
PB-287 024/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Adhesive Bonding of Various Materials to Hard Tooth Tissues. XIV. Enamel Mordant Selection Assisted by ESCA (XPS).
Final rept.,
R. L. Bowen. 1978, 6p
Grant PHS-DE-02494-10
Pub. in Jnl. of Dental Research 57, n4 p551-556 Apr 78.

Keywords: *Adhesive bonding, *Teeth, *Dental materials, Enamels, Surface properties, Tissues(Biology), Materials, Analyzing, Chemical analysis, Reprints, Electron spectroscopy, Photoelectron spectroscopy.

Surface analysis by XPS (X-ray photoelectron spectroscopy), also called ESCA (electron spectroscopy for chemical analysis), indicates that only certain cations are appreciably sorbed by enamel from an acid etching solution containing phosphoric acid and equimolar concentrations of candidate mordant salts.

700,813
PB-287 027/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Adhesive Bonding of Various Materials to Hard Tooth Tissues. X. Initial Rates of Adsorption of Nickel or Copper Ions on Hydroxyapatite Surface.
Final rept.,
D. N. Misra, and R. L. Bowen. 1978, 11p
Grant PHS-DE-02494-09
Pub. in Jnl. Biomedical Materials Research 12, p505-515 1978.

Keywords: *Adhesive bonding, *Teeth, *Dental materials, Adsorption, Nickel, Copper, Ions, Calcium, Ions, Ion exchanging, Resins, Polymers, Reprints, *Hydroxylapatite.

Initial rates of ion-exchange adsorption of nickelous or cupric ions with calcium ions on the surface of synthetic hydroxyapatite were studied in aqueous nitrate solutions. A kinetic interpretation has been proposed. The determination of the initial rates is important for a systematic investigation of adhesion of certain properly designed substances that may mediate a chemical bonding between dental resins and mordanted calcified tissues.

700,814
PB-289 886/4 PC **A05**/MF **A01**
SRI International, Menlo Park, CA.
Assessing the Results of the Portable Oxygen Generator Experiment.
Final rept.
N. B. McEachron, and E. G. Woodward. Oct 77, 84p
NBS-GCR-ETIP-78-50
Contract NBS-6-35757

Keywords: *Medical equipment, *Oxygen supply equipment, *Procurement, Experimental data, Evaluation, Recommendations, Objectives, Data collection, Tables(Data), Respiratory diseases, Patients, Specifications, Design, Portable equipment, National government, Assessments, Veterans Administration, National Bureau of Standards, Policy making, Chronic obstructive lung disease, Ambulatory health care, *Oxygen generators.

The report is the result of an exploratory evaluation of the portable oxygen generator (POG) procurement experiment conducted by the Veteran's Administration (VA) under the sponsorship of the Experimental Technology Incentives Program (ETIP) of the National Bureau of Standards. The report is intended for use by procurement policymakers within and outside the VA and ETIP who are concerned with improving procurement practices. The SRI overall assessment is that the VA attempted through this experiment to substantially improve the state of the art for supplying oxygen to chronic obstructive pulmonary disease patients, and that for the most part such an improvement did not occur. However, this attempt has provided useful lessons for the appropriate role of two-step prototype procurement (TSPP) and for the appropriate processes by which specifications should be developed.

700,815
PB-296 743/8 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC.
Facts About Hearing and Hearing Aids.
Consumer information series.
E. Corliss, and S. Halpin. 1978, 33p NBS/CIS-4
Supersedes COM-72-50055. Revision of report dated Nov 71. Sponsored in part by Food and Drug Administration, Washington, DC.

Keywords: *Deafness, *Auditory perception, Etiology, Hearing, Physiology, Ear(Anatomy), Therapy, Medical equipment, Costs, *Hearing aids.

The booklet will show how the ear functions, describe various types of impairment, explore the different kinds of hearing aids available, and offer practical suggestions for their selection, use, and maintenance. It also talks about the hearing aid regulation established by the Food and Drug Administration and what one should do to obtain quality hearing aid health care.

700,816
PB-298 757/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Durability of the Bond Between Bone and Various 2-Cyanoacrylates in an Aqueous Environment.
Final rept.,
G. M. Brauer, J. W. Kumpula, D. J. Termini, and K. M. Davidson. 1979, 14p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. Biomed. Material Research, v13 p593-606, 1979.

Keywords: *Bones, *Bonding, Durability, Water, Esters, Strength, *Acrylic acid/cyano, Reprints.

The durability of the bond strength developed between 2-cyanoacrylate esters and bone has been determined by aging specimens in water. One-day bond strength of the isobutyl and isomeric amyl 2-cyanoacrylates varied from 6.2 to 7.2 MPa. The strength of the bond decreased on storage or on thermocycling in water. Hydrolytic stability increased with increasing length of the alkyl ester group. After a six-month storage in water the various amyl 2-cyanoacrylates retained from 70% to 73% of their one-day bond strength. Pretreatment of the bone surface prior to application of the adhesive did not prove beneficial. The cured 2-cyanoacrylate can be removed from the substrate surface by appropriate solvents. Thus, it is not bonded covalently to bone. The bond strength, especially of the isobutyl and amyl 2-cyanoacrylates to bone in an aqueous environment, appears to be superior to other adhesives. Provided these monomers are biocompatible, they may be useful clinically where an intermediate-term adhesion is desired.

700,817
PB80-119191 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Microanalysis of Pathological Specimens in situ with a Laser-Raman Microprobe.
Final rept.,
J. L. Abraham, and E. S. Etz. 9 Nov 79, 3p
Pub. in Sci. 206, p716-718, 9 Nov 79.

Keywords: *Lasers, *Microanalysis, *Raman spectroscopy, Pathology, Histology, Tissues(Biology).

A laser-Raman microprobe has been used to identify microscopic inclusions of silicone polymer in standard paraffin sections of lymph node. This example of organic chemical microanalysis in situ in pathological tissue represents an extension of microanalytical capabilities from elemental analysis, performed with electron and ion microprobes, to compound specific molecular microanalysis.

700,818
PB80-120884 Not available NTIS
National Bureau of Standards, Washington, DC.
Raman Microprobe Study of Biological Mineralization in situ: Enamel of the Rat Incisor.
Final rept.,
F. S. Casciani, and E. S. Etz. 1979, 4p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD.
Pub. in Proceedings of Annual Microbeam Analysis Society/1979 Conference (14th), San Antonio, TX., August 13-17, 1979, p169-172 1979.

Keywords: *Microanalysis, *Raman spectroscopy, *Tissues(Biology), Teeth, Enamel, Dentin.

The NBS laser-Raman microprobe is used in a study of the mineralization process in enamel of the rat incisor. In microprobe measurements on thin (10 micro m thickness) sections of the mineralized biological tissue, vibrational Raman spectra are obtained from microscopic regions (6-20 micro m lateral resolution) which are characteristic of the major inorganic and organic components of the tissue. The interpretation of these spectra permits the identification of the mineral phases and any changes in both concentration and distribution of the mineral during the early stages of enamel development. The spectra of mineralizing enamel and mature enamel show the development of biological apatite (Ca10(PO4)6(OH)2) as reflected in the Raman scattering intensity changes for the strong approximately 960 micro m-1 phosphate Raman band. These changes in the apatite content of the tissue are followed over a later distance of 30 micro m from the ameloblast-enamel junction to the dentino-enamel junction. This type of information has heretofore not been available by any other probe technique and provides new insights into the process of biological mineralization.

700,819
PB80-120959 Not available NTIS
National Bureau of Standards, Washington, DC.
Raman Microprobe Studies of Two Mineralizing Tissues: Enamel of the Rat Incisor and the Embryonic Chick Tibia.
Final rept.,
F. S. Casciani, E. S. Etz, D. E. Newbury, and S. B. Doty. 1979, 9p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD.
Pub. in Scanning Electron Microsc. Pt. II, p383-391 1979.

Keywords: *Microanalysis, *Raman spectroscopy, *Tissues(Biology), Bones, Dentin, Enamel.

The laser-Raman microprobe developed at the National Bureau of Standards has been applied to the study of the mineralization process in rat incisor enamel and embryonic chick tibia. Cryostat sections were prepared from fresh frozen tissues and allowed to air dry. In these mineralizing tissues two forms of phosphorus compounds have been observed: (1) an inorganic phase identified as apatitic phosphate and (2) an organic phosphate. The distribution of these components from the mineralizing front to regions of higher mineralization has been determined with a spatial resolution of approximately 15 micro m. The studies suggest the existence of a carbonate, with a Raman band corresponding to that of the mineral huntite, Mg3Ca(CO3)4, and found in regions of low phosphate mineral content.

700,820
PB80-123177 Not available NTIS
National Bureau of Standards, Washington, DC.
X-Ray Source Characteristics and Detection Efficiencies of Prototype Lixiscopes.
Final rept.,
S. M. Seltzer. 1978, 4p
Pub. in NASA Conference Publication 2112, Preliminary Applications and Evaluation Results, p11-14 1978.

Keywords: *Meetings, *X rays, *Medical equipment, Characteristics, Detection, Efficiency, Radiography, *Lixiscopes.

Important components used in the prototype Lixiscope (low-intensity x-ray-imaging scope) are the radioactive x-ray source and the scintillator screen. Calculated data are given pertinent to the spectra and intensity of x-rays emitted by the commercially available 125I and 153 Gd finite, encapsulated sources used. Detection efficiencies for a rare-earth and a CsI scintillator screen are compared.

700,821
PB80-123185 Not available NTIS
National Bureau of Standards, Washington, DC.
Lixiscope: A Pocket-Size X-Ray Imaging System.
Final rept.,
L. I. Yin, and S. M. Seltzer. 1978, 5p
Pub. in Physics in Medicine and Biology 23, n5, p993-997 1978.

Keywords: *X rays, *Radiography, *Medical equipment, X rays, Dosage, Patients, *Lixiscopes.

This note describes a low-intensity X-ray imaging device with the acronym Lixiscope. This device was originally conceived for use in X-ray astronomy where single-photon visualisation is required; however, the extension of its capabilities to medical and dental radiography soon became evident. The high sensitivity and large gain of the Lixiscope make it possible to reduce the patient dose by approximately 10,000 in certain diagnostic procedures as compared to conventional practice. Such extensive dose reduction not only allows safe fluoroscopic examinations, but also enables the use of radioactive sources in lieu of X-ray machines. Furthermore, because the Lixiscope produces a visible-light output image, it can be easily recorded on fast instant-processing films or used in conjunction with any other image recording and processing devices. As will be shown, the small format of the Lixiscope in conjunction with a minute radio-active sources provides a truly portable, nearly pocket-size fluoroscopic system.

700,822
PB80-142979 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Residual Mercury Content on Creep in Dental Amalgams.
Final rept.,
N. W. Rupp, G. C. Paffenbarger, and P. R. Patel. Jan 80, 4p
Sponsored in part by American Dental Association, Chicago, IL.
Pub. in Journal of American Dental Association 100, p52-55, Jan 80.

Keywords: *Dental materials, *Mercury amalgams, Creep properties, Silver alloys, Tin alloys, Copper containing alloys, Particles, Reprints.

Creep or flow of dental amalgam has been associated by many clinical investigators with the marginal integrity of amalgam restoration. Therefore the effect of the residual mercury content on this important property, creep, was investigated. The residual mercury content of amalgam test specimens were varied by a delay in compaction after trituration of 1/2, 3 and 6 minutes as is done in clinical practice. Twelve commercial alloys were used in preparing the amalgam specimens.

700,823
PB80-145766 Not available NTIS
National Bureau of Standards, Washington, DC.
Information Storage Requirements in Radiology.
Final rept.,
J. W. Motz, and M. Danos. 1979, 4p
Pub. in Proceedings of the SPIE Conference on Recent and Future Developments in Medical Imaging II, San Diego, California, August 27-29, 1979, SPIE J. 206, p56-59 1979.

Keywords: *Information capacity, *Data storage, *Radiology, Images, Digital systems, Requirements, Image processing, X ray images.

The number of bits required for storing the information contained in an x-ray image depends primarily on the x-ray exposure at the image plane and on the desired spatial resolution. This dependence has been determined from calculations of the maximum attainable signal-to-noise ratios for exposures and resolutions respectively in the regions from 0.01 to 100 milliroentgens and 0.0001 to 1 sq cm. The results show that for the different image sizes and exposures used in diagnostic radiology, the number of bits required for the storage of these images extends from approximately 100,000 to 10 to the 8th power.

700,824
PB80-178064 Not available NTIS
National Bureau of Standards, Washington, DC.
Optimizing Creep and Corrosion Properties in a Dispersant Amalgam Using Manganese.
Final rept.,
R. M. Waterstrat. Oct 78, 3p
Grant PHS-DE-02455
Pub. in Jnl. Dent. Res., v57 n9-10 p873-875 Sep/Oct 78.

Keywords: *Dental materials, *Mercury amalgams, Creep properties, Corrosion resistance, Manganese containing alloys, Copper containing alloys, Silver alloys, Reprints.

It is shown that the creep behavior of a commercial dispersant-amalgam containing copper is improved by the addition of a manganese-containing alloy. This improvement is apparently obtained without any serious changes in corrosion resistance, provided that no more than 20% of the Mn alloy is added.

700,825
PB80-184708 Not available NTIS
National Bureau of Standards, Washington, DC.
Absorbed Dose Water Calorimeter.
Final rept.,
S. R. Domen. Apr 80, 3p
Sponsored in part by National Cancer Inst., Bethesda, MD.
Pub. in Medical Physics 7 n2 p157-159 Apr 80.

Keywords: *Calorimeters, Medical equipment, Measuring instruments, Thermal measuring instruments, Absorption, Dosage, Water, Reprints.

Advantage was taken of the low thermal diffusivity of water and the imperviousness of polyethylene film to water to construct a calorimeter for directly measuring absorbed dose in that medium. An ultrasmall bead thermistor was sandwiched between two thin films stretched on polystyrene rings and immersed in an unregulated water bath. Ten cobalt-60 irradiation runs were made with a precision of 0.5% mean error of the mean at a dose rate of 66 mGy/s. Further development is directed toward a standard instrument that can be used in a medical therapy beam.

700,826
PB80-197478 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
X-Cal - A Calibration System for Electrical Measurement Devices Used with Diagnostic X-Ray Units.
Final rept.,
R. H. McKnight, and R. E. Hebner. Jun 80, 78p
NBSIR-80-2072

Keywords: *Electric measuring instruments, *Calibrating, *Voltage dividers, X ray apparatus, Medical equipment, Diagnosis.

The X-CAL high-voltage-divider calibration system was designed to calibrate the direct and alternating voltage measurement capabilities of commercial high voltage dividers used to characterize diagnostic x-ray units. In addition, there is capability for determining the frequency response of these dividers and for the calibration of the filament current and anode current measurement features of specific commercially-available devices. The calibration system combines in a single unit a range of capabilities which allows calibration of a device under test to be accomplished with a minimum of set up time. This report gives a description of the motivation for, the operation of and the design details of the X-CAL system. It lists the specified accuracies and the ranges of applicable parameters of the various

subsystems, describes the five different calibrations which can be performed using the X-CAL system, discusses techniques used in the original calibration of the X-CAL system itself, and contains the basic circuit diagrams for the system.

700,827
PB80-199888 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Absorbed Dose and Dose Gradients.
Final rept.,
W. L. McLaughlin. 1980, 29p
Pub. in Proceedings of Seminar on Radiation Sterilization of Plastic Medical Devices, University of Lowell, MA, March 28-29, 1979, Radiat. Phys. Chem. 15, p9-38 1980.

Keywords: *Dosimetry, *Radiation dosage, *Sterilization, Medical equipment, Plastics, Electron beams, Gamma rays, Dyes.

The more reliable systems and procedures of dosimetry for radiation sterilization applications are described, along with sources of uncertainty and ways to achieve optimum accuracy and reproducibility. Dosimetry practice in production must be accompanied by correct methods of dosimeter calibration to achieve measurement assurance and quality control. For routine use and for determination of dose distributions, certain thin-film dosimeters satisfying cavity-theory requirements are most suitable.

700,828
PB81-126245 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Zinc in Dental Amalgams.
L. B. Johnson, and G. C. Paffenbarger. Aug 80, 8p
Pub. in Jnl. of Dental Research 59, n8 p1412-1419 Aug 80.

Keywords: *Dental materials, *Mercury amalgams, *Zinc, Silver containing alloys, Tin containing alloys, Zinc containing alloys, Reprints.

Over a century ago the role of zinc in dental amalgam was not well understood. A review of the literature show this situation holds today as manifested by the difference in findings and by the indicated need for further research. Some additional experimental evidence showed these results on amalgams made from a series of 25 alloys, based upon compositions near Ag3Sn, with zinc contents of 0, 1, 3, 5 and 7 atomic per cent: (1) The mercury-alloy ratios increased gradually with increasing zinc content. For the higher zinc contents (5 and 7 per cent) this ratio became quite critical. (2) The higher the zinc content in the alloy, the higher was the mercury content of the amalgam. This held true also with increase in the silver content of the alloys. (3) The close agreement between the measured and the calculated densities of the amalgams indicated low porosities, a very desirable property. (4) With increasing zinc content both the initial contraction and the overall dimensional change were much less and reproducibility was better. (5) The compressive strengths of the amalgams increased with increasing zinc content of the alloys. (6) The use of Mahler's 'slow compressive strength' test indicated that creep decreased with decreasing zinc content.

700,829
PB81-135600 Not available NTIS
National Bureau of Standards, Washington, DC.
Degradation Resistance of Some Candidate Composite Biomaterials.
G. B. McKenna, G. W. Bradley, H. K. Dunn, and W. O. Statton. 1979, 16p
Sponsored in part by National Science Foundation, Washington, DC. and Orthopedic Research and Education Foundation.
Pub. in Jnl. of Biomedical Materials Research 13, p783-798 1979.

Keywords: *Degradation, *Polyamide resins, *Fibers, Composites, Autoclaving, Environments, Stability, Reprints, Biomaterials.

The degradation resistance of matrix, fiber and composite systems which the authors have been studying as candidate orthopedic materials has been examined in two appropriate environments. Both resistance to steam sterilization in an autoclave environment and resistance to a simulated physiologic solution have been studied. In the autoclave study, samples were placed in a pressure cooker at 123C for differing amounts of time and tested for retention of mechanical properties. Results indicate that most of the materials tested could be autoclaved several times, as long as autoclave times did not exceed 1 hr. Longer autoclave times result in an accelerated degradation and loss of strength of all materials except the polypropylene. Polysulfone degrades after even the shortest autoclave duration. Resistance to the simulated physiologic environment was tested by measuring retention of mechanical properties after immersion times in pseudo-extracellular fluid (PECF) at 37C for as long as three years. None of the materials showed any significant changes in properties after immersion in the PECF.

700,830
PB81-163131 Not available NTIS
National Bureau of Standards, Washington, DC.
Microcalorimetry and Its Applications.
Final rept.
E. J. Prosen. 1980, 7p
Pub. in Proceedings of Symposium on Biological Effects, Imaging Techniques, and Dosimetry of Ionizing Radiations, Rockville, MD., June 6-8, 1979, Paper in HHS Publication (FDA)80-8126, Radiological Health, p147-153 1980.

Keywords: *Meetings, *Heat measurement, Clinical chemistry, Metabolism, Radiation, Blood serum, *Calorimetry, Cardiac pacemakers.

The technique of microcalorimetry is illustrated briefly by the use of the NBS microcalorimeter for clinical analysis of substrates and enzymes in human serum, the identification of bacteria, the determination of heats of metabolism of living sea urchin eggs, and the determination of self-discharge of cardiac pacemaker batteries. A description is given of a special microcalorimeter - respirometer apparatus for the determination of the heat of metabolism per mole of oxygen utilized by living animal or cultured cells and its use in the study of stresses (such as ionizing and non-ionizing radiation, chemicals or drugs, and other stresses) on such living cells. Such measurements give an overall indication of the 'health' or viability of such cell systems before and after the stress and perhaps will show recovery from stresses.

700,831
PB81-166928 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Evaluation of Methods of Characterizing the Porosity of Porous Polymeric Implant Materials: A Review of the Current Status of Porosity Measurements.
Annual rept. 22 May-30 Sep 80.
R. E. Dehl, W. H. Grant, and J. M. Cassel. Feb 81, 50p NBSIR-81-2212
Sponsored in part by Food and Drug Administration, Silver Spring, MD. Bureau of Medical Devices.

Keywords: *Porosity, *Polymers, Evaluation, Methodology, Characteristics, Measurements, Polyethylene, Medical equipment, Carbon, Composite materials, *Biomaterials, *Implants.

A search of the published literature pertaining to porous polymeric implant materials has been made. The two porous materials currently dominant in implant surgery, namely, porous high density polyethylene and a porous composite of polytetrafluoroethylene and carbon, have been reviewed with respect to the following criteria pertinent to their medical applications: (1) Information supplied by the manufacturers about their methods of characterizing the porosity of their materials, (2) recommendations of the ASTM for quantitative porosity characterization of these materials, and (3) clinical studies of the materials as replacement prostheses in middle ear surgery. A computer search for new quantitative methods of measuring more size revealed nothing appropriate to these materials. However, disputes in the current literature suggest that current protocols for porosity characterization are inadequate for proper interlaboratory comparison of experimental data.

700,832
PB81-187502 Not available NTIS
National Bureau of Standards, Washington, DC.
Time-Dependent Failure of a Polyolefin Rubber Candidate Material for Blood Pump Applications.
Final rept.
G. B. McKenna, and R. W. Penn. 1980, 15p
Sponsored in part by National Institutes of Health, Bethesda, MD.
Pub. in Jnl. of Biomedical Materials Research 14, p689-703 1980.

Keywords: *Butyl rubber, *Olefin resins, Failure, Mechanical hearts, Medical equipment, Reprints, Blood pumps, Cardiac assist devices, *Biomaterials.

Failure behavior of a polyolefin elastomer which is a candidate material for blood pump applications has been studied under uniaxial and equibiaxial test conditions. Both static and dynamic (fatigue) testing were performed to study four aspects of material failure behavior as suggested by a cumulative damage failure model. Results from testing a standard formulation butyl rubber are presented for comparison. Our results show that the uniaxial failure behavior under static loads for the butyl rubber is superior to that of the polyolefin rubber at high loads but that the polyolefin is superior at low loads. Under fatigue loading conditions, the failure times for both rubbers decrease with increasing test frequency. The observed frequency dependence lies between that predicted by the cumulative damage model and that predicted by a cycle dependent fatigue model. The distributon of failure times for the polyolefin rubber is broader than that for the butyl rubber. For both uniaxial and equibiaxial testing, the distribution of failure times changes in going from the static testing to dynamic testing. This is true for both rubbers.

700,833
PB81-197576 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Derivatized Silica-Sol Particles as Immunospecific Markers for High Resolution Electron Microscopy.
Final rept.
W. Haller. Feb 80, 7p
Pub. in Proceedings of the Conference on Chemistry of Solid/Liquid Interfaces Held at Dubrovnik, Yugoslavia on June 25-July 3, 1979, Paper in Croatica Chemica Acta 53, n2 p373-379 Feb 80.

Keywords: *Meetings, *Electron microscopy, *Silicon dioxide, Marking, Particles, Influenza virus, Antigens, NTISCOMNBS.

Colloidal silica spheres with 13-14 micrometer diameter were derivatized by first introducing aldehyde surface functionality followed by covalent attachment of immunoglobulins specific to influenza virus. Size distribution width in the particle suspension was narrowed by chromatography on controlled pore glass. Saturation labeling of virus surface antigens on infected human cells was carried out with suspensions having 10 to the 14th power spheres per cu cm. The visibility and the fine structure of the markers on cell surfaces are shown in transmission electromicroscopy with replicas and ultrathin sections.

700,834
PB81-227555 Not available NTIS
National Bureau of Standards, Washington, DC.
Consideration of Some Factors Influencing Compatibility of Dental Porcelains and Alloys Part II: Porcelain/Alloy Stress.
Final rept.
E. O. Widera, A. Holmes, and E. E. Parry. Apr 81, 9p
Sponsored in part by the National Inst. of Dental Research, Bethesda, MD. and the Naval Medical Research and Development Command, Bethesda, MD.
Pub. in Proceedings of International Precious Metals Conference (4th), Toronto, Ontario, Canada, June 4-6, 1980, p283-291 Apr 81.

Keywords: *Dental materials, Compatibility, Porcelain, Alloys, Stresses, Composite structures.

The change in gap of a procelain veneered split metal ring has been previously proposed as an indication of compatibility. Gap changes were measured for several combinations of opaque and body porcelain fired on a dental alloy ring. Finite element and theoretical calculations of the gap change, when compared with experimental observations, indicate stress relief in porcelain-metal composite systems at temperatures well below the glass transition temperature, T sub g. Extension of the bimaterial compatibility index to more complex (more than two layer) systems is shown to require further consideration. Stress analyses based on Timoshenko's equation for shape change of multimaterial thermostats leads to oversimplified states of stress and cannot yield the detailed information on shear and tensile stresses needed for viscous flow above T sub g and brittle fracture below T sub g.

700,835
PB81-227662 Not available NTIS
National Bureau of Standards, Washington, DC.
SEM Studies of Dental Casting Alloy Corrosion Behavior.
Final rept.
H. Weber, and A. C. Fraker. 1979, 2p
Pub. in Proceedings of Annual Electron Microscopy Society of America Meeting (37th), San Antonio, TX., August 1979, p280-281 1979.

Keywords: *Dental materials, *Corrosion, Castings, Scanning electron microscopy.

Scanning electron microscope (SEM) studies were used to correlate surface film formation and local corrosion attack with the metal microstructure. The metals investigated were dental casting alloys based on the Ni-Cr system. By the use of anodic polarization measurements combined with SEM studies, it was found that there are significant differences in the corrosion behavior of the three commercial Ni-Cr materials studies.

700,836
PB81-234718 Not available NTIS
National Bureau of Standards, Washington, DC.
National Bureau of Standards Hearing Aid Test Procedures.
Final rept.
E. D. Burnett. 1981, 168p
Sponsored in part by Veterans Administration, Washington, DC.
Pub. in Chapter III in Handbook of Hearing Aid Measurement 1981, p9-176.

Keywords: *Hearing aids, Auditory perception, Methodology, National government, Measurement, Medical equipment, National Bureau of Standards, *Veterans Administration.

The methods used by the National Bureau of Standards for testing hearing aids for the Veterans Administration. Emphasis is placed on the measurement of the insertion response. New in the discussion this year are the measurement of telephone coil sensitivity, random-noise transfer functions, the coherence function, and the input-output characteristics.

700,837
PB82-100231 Not available NTIS
National Bureau of Standards, Washington, DC.
Exposure Limits Imposed by Screen-Film Systems on the Transfer of Image Information.
Final rept.
J. W. Motz, C. E. Dick, and M. Danos. 1981, 5p
Pub. in Proceedings of Applications of Optical Instrumentation in Medicine IX, San Francisco, CA., March 22-24, 1981, SPIE 273, p52-56 1981.

Keywords: *X ray analysis, X ray fluorescence, Information, Efficiency, Photographic film, Medical equipment.

Information transfer in a screen-film system occurs over a limited region of x-ray exposures because of the non-linear response of film to light emitted from the x-ray fluorescent screen. Based on screen light emission and film response data, the information transfer efficiency of a typical screen-film system is determined as a function of x-ray exposure for different x-ray energies. The method of determining this transfer efficiency is described, and the x-ray exposure regions over which information tranfer can occur with this system is delineated for different x-ray energies.

700,838
PB82-143942 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Power Dual Six-Port Automatic Network Analyzer for Determining Biological Effects of RF and Microwave Radiation.
Final rept.
C. A. Hoer. 1981, 3p
Pub. in Proceedings of IEEE MTT-S International Microwave Symposium (1981), Los Angeles, California, June 15-19, 1981, Paper in IEEE MTT-S International Microwave Symposium Digest, IEEE Cat. No. 81CH1592-5, p157-159.

Keywords: *Network analyzers, *Bioinstrumentation, Radio waves, Microwaves, Reflection, Coefficients, Six-port.

The design, calibration and performance of a high-power (1 to 1000W) automatic network analyzer based on the six-port concept are described for the 10 to 100 MHz range.

700,839
PB82-195207 Not available NTIS
National Bureau of Standards, Washington, DC.
Metals in Solution in Mercury Expressed from Copper-Rich Dental Amalgams.
Final rept.
G. C. Paffenbarger, N. W. Rupp, and R. M. Waterstrat. Jan 82, 3p
Sponsored in part by American Dental Association, Chicago, IL.
Pub. in Jnl. of Dent. Res. 61, n1 p30-32 Jan 82.

Keywords: *Dental materials, *Mercury amalgams, Solubility, Copper containing alloys, Reprints.

Metals dissolved in excess mercury expressed from copper-rich amalgams ranged from 0.06 to 0.63 wt %. Such small percentages are not likely to affect pertinent properties. The solubility data may assist in explaining the kinetics of hardening of amalgams.

700,840
PB82-210154 Not available NTIS
National Bureau of Standards, Washington, DC.
Fundamental Aspects of the Corrosion of Metallic Implants.
Final rept.
J. Kruger. 1979, 21p
Pub. in ASTM Spec. Tech. Pub. 684, p107-127 1979.

Keywords: *Corrosion, Alloys, Passitivity, Reprints, *Biological implants.

The corrosion of metals in the aqueous environments of body fluids involves the setting up of electrochemical corrosion cells. The corrosion produced by these cells is controlled by thermodynamic and kinetic factors. The thermodynamic factors determines corrosion tendencies; the kinetic factors determines rate. Galvanic corrosion is mainly affected by thermodynamic factors and occurs when two metals with widely differing potentials are placed in contact with each other. Other forms of corrosion depend more directly on factors controlling the rate of corrosion. For most alloys used in implants the corrosion rate is mainly dependent on the protective properties of the thin passive films that exist on the surfaces of these alloys. The quality of protection afforded by passive films is related to their ability to resist chemical breakdown by damaging species and, once broken down, their ability to reform rapidly (repassivate). The interplay between breakdown and repassivation is important in determining susceptibility of metallic implants to pitting crevice corrosion, stress corrosion, corrosion fatigue, intergranular corrosion, and fretting corrosion.

700,841
PB82-211152 Not available NTIS
National Bureau of Standards, Washington, DC.
Apparatus for Measuring Wear of Dental Restorative Materials.
Final rept.
J. E. McKinney. 1982, 11p
Sponsored in part by National Institutes of Health, Bethesda, MD.
Pub. in Wear 76, p337-347 1982.

Keywords: *Measuring instruments, *Wear, *Dental materials, Mercury amalgams, Reprints.

A pin and disc wear apparatus developed for application to dental restorative materials is described. Fully automatic wear generation and data acquisition are conducted on three specimens simultaneously. At arbitrarily selected intervals during wear generation, a series of track depth measurements on the specimen discs are made around the wear track using linear variable differential transformers. A discussion of probable error sources and estimates of experimental uncertainties is included.

700,842
PB83-143784 Not available NTIS
National Bureau of Standards, Washington, DC.
Characterization of Porosity in PTFE-Carbon composite Implant Materials by Mercury Porosimetry.
Final rept.
R. E. Dehl. 1982, 5p
Sponsored in part by Food and Drug Administraton, Silver Spring, MD. Bureau of Medical Devices.
Pub. in Jnl. of Biomedical Materials Research 16, p715-719 1982.

Keywords: *Mercury, *Porosity, *Carbon, Composite materials, Fluorine organic compounds, Reprints, *Polyethylene/trifluoro.

Questions have been raised about the use of mercury intrusion porosimetry to measure interconnecting pore sizes and void volumes in relatively soft and flexible materials such as porous implant composites of PTFE and carbon fibers. The authors have studied the effect of precompression of one such commercial composite on the mercury intrusion curves which cover all pore diameters greater than about 16 micrometers, the range of interest for tissue ingrowth applications. Prior compression by a pressure 20% greater than that encountered by the material during a mercury intrusion experiment did not change the ensuing pore size distribution curve, as compared with a noncompressed sample. Deformation of the material at higher pressures sufficient to decrease the sample volume inelastically by 17,33, and 67% changed the shape of the mercury intrusion curves significantly, indicating that this technique can be used to detect prior deformation of an 'unknown' sample. In the undeformed material, less than 15% of the total void as measured by mercury porosimetry consists of interconnecting pores >100 micrometers in diameter and more than 50% of the void volume is composed of pores >40 micrometers in diameter.

700,843
PB83-172023 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Characterization of Porosity in Porous Polymeric Implant Materials.
Annual rept. for Oct 80-Sep 81.
R. E. Dehl, W. H. Grant, and J. M. Cassel. Feb 82, 61p NBSIR-81-2459
Sponsored in part by Food and Drug Administration, Washington, DC. Bureau of Medical Devices.

Keywords: *Porosity, *Polymers, Evaluation, Methodology, Characteristics, Measurements, Polyethylene, Medical equipment, Carbon, Composite materials, *Biomaterials, *Implants.

The report describes the application of several methods of porosity characterization to two commercial polymeric implant materials, a porous polyethylene and a composite of PTFE and carbon. In exploring the use of mercury porosimetry to determine interconnecting pore size distributions in the composite, we have found that, contrary to widespread belief, this rather soft and deformable material was not distorted by the mercury pressures required to measure its pore size distribution. The mercury intrusion technique indicated that the porous polyethylene has a narrower distribution of pore sizes than the composite.

700,844
PB83-179499 Not available NTIS
National Bureau of Standards, Washington, DC.
Research Problems in Coupler and In Situ Measurements on Hearing Aids.
Final rept.
E. D. Burnett, E. L. R. Corliss, and V. Nedzelnitsky. Dec 82, 7p
Pub. in The Vanderbilt Hearing-Aid Report, p67-73 1982.

Keywords: *Hearing aids, Measurement, Amplification, Loudness, Distortion, Signal to noise ratio, Reprints.

This paper discusses experimental developments, partially achieved, to make the objective measurements on hearing aids more closely resemble the conditions under which hearing aids are used.

700,845
PB83-183459 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Characterization of Porosity in Porous Polymeric Implant Materials.
Annual rept. Apr-Sep 82.
R. E. Dehl. Feb 83, 53p NBSIR-83-2645
Sponsored in part by Food and Drug Administration, Silver Spring, MD. Bureau of Medical Devices. See also PB83-172023.

Keywords: *Porosity, *Polymers, Evaluation, Methodology, Characteristics, Measurements, Polyethylene, Medical equipment, Carbon, Composite materials, *Biomaterials, *Implants.

In this report, the authors describe (1) the continued exploration of methods for characterizing the porosity of two commercial implant materials, a porous polyethylene and a composite of polytetrafluoroethylene and carbon, and (2) the compressive stress-strain behavior of these materials. A major emphasis was placed upon optical image analysis of porous polyethylene. The pore volume fraction obtained from analysis of 20 photomicrographs (0.47) agreed well with the fraction previously found by two other methods.

700,846
PB83-191114 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
NBS (National Bureau of Standards) and Industrial Biotechnology: Instrumentation and Associated Measurement Needs.
T. C. O'Brien. Mar 83, 63p NBSIR-83-2667

Keywords: *Instruments, Medical equipment, Trends, Research and development, Requirements, Measurement, Marketing, *Bioinstrumentation, *National Bureau of Standards.

This report describes some initial steps NBS could take to identify: industrial biotechnology's instrument needs and associated measurement-related problems, areas where there will likely be an industry underinvestment in resolving these needs/problems, and the appropriate research and service activities NBS could undertake in order to be responsive to some of this industry's infrastructure technology needs. The report accomplishes this by: (a) examining biotechnology instrumentation trends; (b) identifying specific instrumentation measurement-related R&D barriers and opportunities; and (c) providing examples of NBS scientific capabilities related to industrial biotechnology instrument needs and instrument development directions.

700,847
PB84-137884 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Porcelain/Alloy Interfacial Diffusion Zones on Thermo-Mechanical Strain.
Final rept.
J. A. Tesk, R. W. Hinman, G. E. O. Widera, A. D. Holmes, and J. M. Cassel. May 83, 5p
Pub. in Jnl. of Dental Research 62, n5 p585-589 May 83.

Keywords: *Dental materials, Chemical bonds, Diffusion, Alloys, Porcelain, Thermal expansion, Strains, Interfaces, Reprints.

Chemical bonding between dental porcelains and alloys results from interdiffusion of porcelain and metal ions. An interfacial diffusion zone is created which, most likely, has properties different from those of bulk materials. The changed interface might affect experimental measurements of thermo-mechanical strain. To determine the magnitude and conditions under which this would occur, the interface was modeled as the intermediate layer of a three-layered porcelain-veneered split-metal ring. Layer thicknesses and coefficients of thermal expansion were varied, and the effects on gap change after cooling through 500C were calculated. Results are presented in a series of 14 Figs., ten curves each, which depict not only interfacial effects, but are extended for use in interpretation of the effects of properties of opaques and glazes as well. Under most conditions, the interface will not affect experimental measurements; some special exceptions are noted.

700,848
PB85-111789 Not available NTIS
National Bureau of Standards, Washington, DC.
Monte Carlo Simulation of Sub-Micrometer Linewidth Measurements in the Scanning Electron Microscope.
Final rept.
G. G. Hembree, S. W. Jensen, and J. F. Marchiando. 1981, 4p
Pub. in Proceedings of Annual Conference Microbeam Analysis Society (16th), July 13-17, 1981, p123-126.

Keywords: *Electron microscopes, Simulation, *Backscattered electron images, *Linewidth measurements.

Monte Carlo calculations are made to simulate experimental SEM line scans across submicrometer structures. Calculations are performed for a specimen consisting of submicrometer metal lines on a silicon substrate. The response of a split annular PN junction diode backscatter electron detector is modeled by simulating the solid angle of collection as well as the linear energy response of the detector. The influence on the simulated backscattered electron signal due to parameters such as electron beam voltage, electron beam voltage, electron beam size, metal line composition, and metal line thickness is investigated. The significance of these parameters as they affect the accurate measurement of sub-micrometer linewidths is also considered.

700,849
PB85-119980 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Characterization of Porosity in Porous Polymer Implant Materials.
Annual rept. Apr-Sep 83.
R. E. Dehl. Sep 84, 32p NBSIR-84/2883
See also PB83-172023. Sponsored in part by National Center for Devices and Radiological Health, Rockville, MD.

Keywords: *Porosity, *Polymers, Evaluation, Methodology, Characteristics, Measurements, Polyethylene, Medical equipment, Carbon, Composite materials, *Biomaterials, *Implants.

The investigation of the methods of characterizing the porosity of two porous polymeric implant materials have been concluded with the work discussed in this report. The two materials, a porous polyethylene (PPE) and a porous composite of polytetrafluoroethylene and carbon (PTFE-C) have been further investigated by the method of quantitative microscopy. The mean pore volume fractions of 30 samples each of PPE and PTFE-C were found to be 0.48 and 0.69, respectively, and are in good agreement with other measurements of this quantity. The mean intercept length for PPE was found to be 76 micrometers, and for PTFE-C, 67 micrometers. Both values are somewhat larger than the average interconnecting pore 'diameters' as measured by mercury porosimetry. The reproducibility of mercury porosimetry data has been tested by examining 16 samples of PTFE-C in thin sheet form and 6 samples of laminated blocks. The mean and standard deviation of four parameters derived from the mercury intrusion curves were calculated. A high correlation was found between the specific pore volume and the position of the mercury intrusion curve along the pressure axis. A number of random errors pertaining to mercury porosimetry were discovered and are discussed in this report.

700,850
PB85-147924 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calibration of Flat 60-Hz Electric Field Probes.
Final rept.
M. Misakian. 1984, 4p
Sponsored by Department of Energy, Washington, DC.
Pub. in Bioelectromagnetics 5, n4 p447-450 1984.

Keywords: *Probes, Calibrating, Electric fields, Reprints.

The influence of nearby ground planes, perturbation of surface charge distributions, and fringing fields on the electric field between parallel plates are characterized to define a parallel plate system that can be used to calibrate flat 60-Hz electric field probes.

700,851
PB85-195931 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of the X-Ray Induced Light Photons Emitted from Radiographic CaWO4 Intensifying Screens.
Final rept.
H. Roehrig, B. Lum, S. Nudelman, M. P. Capp, and C. E. Dick. 1979, 8p
Sponsored by Society of Photo-Optical Instrumentation Engineers, Bellingham, WA.
Pub. in Application of Optical Instrumentation in Medicine (7th), Toronto, Canada, March 25-27, 1979, Proceedings of Society of Photo-Optical Instrumentation Engineering 173, p8-15.

Keywords: *Image intensifiers, *Radiology, *Calcium tungstates, *Luminous intensity, X rays.

For calcium tungstate intensifying screens employed in film-screen imaging systems, Coltman found that approximately 1000 light photons of average energy 2.7 eV were produced for each 50 keV x-ray absorbed. Of this number, he found that only about 55% are emitted from the output side of a 109 mg/sq cm screen. The authors have developed a method based on counting single photons to determine this number for various thickness of calcium tungstate screens. For calcium tungstate screens with thicknesses of 30, 50, 86, and 123 mg/sq cm, the average numbers of light photons emitted per absorbed x-ray are measured for 8 x-ray energies between 17- and 69-keV. The values for 50 keV are less than the values found by Coltman. Studies of the causes of this discrepancy are in progress.

700,852
PB85-207165 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Post-Curing of Dental Restorative Resin.
Final rept.
W. Wu, and B. M. Fanconi. 1983, 4p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Polymer Engineering and Science 23, n13 p704-707 1983.

Keywords: *Dental materials, Copolymers, Curing, Reprints, Propenoic acid/methyl-(methylethylidene)bis(phenyleneoxy(hydroxy-propanediyl))ester.

The post-curing of a BIS-GMA based copolymer system at 37C and 100% RH was monitored using Fourier Transform IR (FT-IR). The dependence of degree of post-curing on the monomer and initiator components was investigated. The further polymerization achieved by elevating the temperature was measured using differential scanning calorimetry (DSC).

700,853
PB85-207249 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Technique for Characterizing Casting Behavior of Dental Alloys.
Final rept.
R. W. Hinman, J. A. Tesk, R. P. Whitlock, E. E. Parry, and J. S. Durkowski. Feb 85, 5p
Sponsored by National Inst. of Dental Research, Bethesda, MD. and National Naval Dental Center, Bethesda, MD.
Pub. in Jnl. of Dental Research 64, n2 p134-138 Feb 85.

Keywords: *Dental materials, *Casting alloys, Behavior, Prosthetic devices, Nickel chromium alloys, Reprints.

A technique for characterizing casting behavior of dental alloys has been developed and tested. The method employs easily reproducible specimen patterns and uses equipment and procedures generally available in dental prosthetic laboratories. A castability value is arrived at by counting complete segments of a cast alloy grid.

700,854
PB85-229466 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Studies of Porous Metal Coated Surgical Implants.
A. C. Fraker, A. W. Ruff, A. C. Van Orden, H. Hahn, A. J. Bailey, and C. D. Olson. Jun 85, 57p NBSIR-85/3166
Contract FDA-224-79-5023
Prepared in cooperation with ARTECH Corp., Falls Church, VA.

Keywords: *Surgical implants, *Medical equipment, Metals, Biocompatibility, Corrosion, Fatigue, Coatings, *Biomaterials, Cobalt chromium molybdenum alloy, Metal porous coating, Titanium 6 aluminum 4 vanadium alloy.

The material in the report deals with the subject of metal porous coated surgical implants which are used primarily for orthopedic applications. The report is presented in three parts. The first part gives a brief history of the development of various types of metal porous coated implants and discusses the need for improved fixation of orthopedic devices which led to the investigation of porous coatings for bony ingrowth attachment. The second part of the report contains experimental data on the corrosion behavior of sintered spheres of Co-Cr-Mo and analysis of surface films after exposure to saline solution. The third part reports on a corrosion-fatigue study of arc plasma sprayed porous Ti and Ti-6A1-4V coatings. The porous coatings on the materials studied did not adversely affect

the corrosion or mechanical properties of the material. Changes in processing, contamination, etc. could have detrimental effects on the chemical and mechanical behavior of the materials.

700,855
PB86-102936 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Improving the Casting Accuracy of Fixed Partial Dentures.
Final rept.
R. W. Hinman, J. A. Tesk, E. E. Parry, and G. T. Eden. Apr 85, 6p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. of Prosthetic Dentistry 53, n4 p466-471 Apr 85.

Keywords: Casting, Alloys, Accuracy, Reprints, *Partial dentures, Denture bases, Prosthodontics.

Recent economic conditions have caused a steady increase in the use of base metal alloys for fixed partial dentures (FPD). Unfortunately, base metal alloys are not as readily soldered as gold-based alloys, which predicates a need for techniques to ensure the accuracy of one-piece multiunit castings of base metal alloys. An investigation of the variables that affect the accuracy of one-piece FPD castings was initiated.

700,856
PB86-124062 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mechanical Durability of Candidate Elastomers for Blood Pump Applications.
Final rept.
G. B. McKenna, and R. W. Penn. 1982, 6p
Pub. in Proceedings of World Biomaterials Congress (1st), Baden, Austria, April 12, 1980, Advances in Biomaterials 3, p629-634 1982.

Keywords: Fatigue, Cyclic loads, Failure, Durability, *Blood pumps, *Biomaterials, Circulatory assist devices.

The mechanical durability of an elastomer is a critical factor in its suitability for blood pump applications. In such applications an elastomeric bladder is expected to undergo cyclic stress or strain histories at a frequency of approximately 2 Hz for periods of several years. Test methodologies for characterizing the mechanical durability of such materials do not exist. Based on previous work using an additivity of (or cumulative) damage rule as a framework to describe time dependent failure of both glassy and semicrystalline polymers (1,2), the authors have developed a useful methodology for describing the mechanical durability of elastomers which are candidate materials for blood pump applications. Within this framework, the authors are in the process of characterizing the mechanical durability of a polyolefin rubber, a urethane-silicone copolymer elastomer and a segmented polyurethane elastomer all of which are candidate materials for blood pump applications. The authors have also prepared a standard butyl rubber in out laboratory for use as an interlaboratory control for comparisons with other labs testing the same materials.

700,857
PB86-133378 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.
NBS (National Bureau of Standards) Hearing Aid Test Procedures and Test Data.
Final rept.
E. D. Burnett, and M. Turica. 1982, 213p
Sponsored by Veterans Administration, Washington, DC.
Pub. in Handbook of Hearing Aid Measurement 1982, p8-221.

Keywords: *Medical equipment, Handbooks, Responses, Reprints, *Hearing aids, National Bureau of Standards, Veterans Administration.

The methods used by NBS for testing hearing aids for the Veterans Administration are described. Several possible methods of measuring the acoustic response of hearing aids are discussed, with emphasis on the measurement of the insertion response, which is the method used by NBS. The measurement method for determining the saturation sound pressure level, gain, harmonic distortion, equivalent input noise level, frequency response, telephone coil sensitivity, and directionality are discussed. Samples of the test results are included.

700,858
PB86-140027 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Mesh Monitor for Casting Characterization.
Final rept.
J. A. Tesk, O. Okuno, R. W. Penn, S. Hirano, and H. R. Kase. 1985, 11p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Noble Metals Fabrications and Technology Seminar, p35-45 1985.

Keywords: *Dental materials, *Casting, *Monitors, Alloys.

Numerous new dental casting alloys are appearing on the market. The response of each alloy to casting variables is often incompletely known. It is desirable to have some simple method to monitor and predict the response to changes in casting conditions. A polyester sieve mesh has been found to provide a pattern which serves as an effective monitor.

700,859
PB86-160561 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.
NBS (National Bureau of Standards) Hearing Aid Test Procedures and Test Data.
Final rept.
E. D. Burnett, M. T. Tarica, and P. A. Jurgens. 1983, 355p
Sponsored by Veterans Administration, Washington, DC.
Pub. in Veterans Administration Handbook of Hearing Aid Measurement, p7-361 1983.

Keywords: *Medical equipment, Responses, Tests, Procedures, Reprints, *Hearing aids, Veterans Administration, National Bureau of Standards.

The methods used by NBS for testing hearing aids for the Veterans Administration are described. Several possible methods of measuring the acoustic response of hearing aids are discussed, with emphasis on the measurement of the insertion response, which is the method used by NBS. The measurement method for determining the saturation sound pressure level, gain, harmonic distortion, equivalent input noise level, frequency response, telephone coil sensitivity, and characteristics of special-purpose hearing aids are discussed.

700,860
PB86-230513 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Chemically Modified Electrode Sensors.
Final rept.
R. A. Durst, and E. A. Blubaugh. Oct 85, 11p
Pub. in ACS Symposium Series No. 309, p245-255, 1 Oct 85.

Keywords: Chemical analysis, Electrodes, Fabrication, Bioinstrumentation, Reprints, *Chemically modified electrodes.

The review gives a brief summary of the types of chemically modified electrodes, their fabrication, and some examples of their uses. One especially promising area of application is that of selective chemical analysis. In general, the approach used is to attach to the electrode surface electrochemically reactive molecules which have electrocatalytic activity toward specific substrates or analytes. In addition, the incorporation of biochemical systems should greatly extend the usefulness of these devices for analytical purposes.

700,861
PB86-231586 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Dependence of Curing Time, Peak Temperature, and Mechanical Properties on the Composition of Bone Cement.
Final rept.
G. M. Brauer, D. R. Steinberger, and J. W. Stansbury. 1986, 14p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. of Biomedical Materials Research 20, p839-852 1986.

Keywords: *Bone cements, *Curing, *Composite materials, Temperature, Mechanical properties, Composition, Reprints.

Commercial bone cements usually contain hydroquinone as the polymerization inhibitor and N,N-dimethyl-p-toluidine as the accelerator in the benzoyl peroxide-initiated redox polymerization. The former compounds have certain shortcomings in their biocompatibility profile. Measurements of the setting times, polymerization exotherms, and postpolymerization strengths of the cured monomer-polymer compositions show that the hydroquinone can be replaced by food grade di-tert-butyl-p-cresol(BHT). The more reactive 4-N,N-(dimethylamino)phenethanol can replace 4-N,N-dimethyl-p-toluidine, yielding cements with shorter setting times and increased strengths. Excessive heat liberated on polymerization can be reduced by partial substitution of higher-molecular-weight methacrylates, e.g., dicyclopentenyloxyethyl methacrylate for methyl methacrylate, but there is a decrease in strength of the resulting polymer.

700,862
PB86-241882 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Dental Base-Metal Casting Alloys: Physical Metallurgy.
Final rept.
J. A. Tesk, and R. M. Waterstrat. 1986, 5p
Pub. in Encyclopedia of Materials Science and Engineering, v2 p1056-1060 1986.

Keywords: *Dental materials, Cobalt alloys, Nickel alloys, Stainless steels, Titanium alloys, Reprints, *Casting alloy.

Composition, properties and microstructure of nonprecious dental casting alloys are reviewed. Relevance to needs for clinical performance is discussed and clinical applications for each class of alloy is presented. Alloy systems include Cobalt-Chromium-Molybdenum, Nickel-Chromium, Ferritic and Austenitic Stainless Steels and Titanium Alloys.

700,863
PB87-218293 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Generation of Separate Density and Compressibility Images in Tissue.
Final rept.,
S. J. Norton. Jul 83, 13p
Pub. in Ultrasonic Imaging 5, n3 p240-252 Jul 83.

Keywords: *Compressibility, *Density, Imaging, Reprints, *Diffusion tomography, Image reconstruction, Ultrasonic tomography.

A method is suggested for reconstructing separate images of the variations in density and compressibility in the same tissue sample. The images can be obtained from near-scattering measurements using only two long, rectangular transducer elements. As in diffraction tomography, 180 degrees access around the region of interest is required. The approach differs from conventional diffraction tomography, however, in that no transducer arrays are required and broadband illumination is used. A flat transducer, assumed long relative to the extent of the object, is used as a source of broadband, plane-wave illumination, and as a receiver of the backscattered sound. A second transducer, oriented at a different angle with respect to the first, is used as a receiver only. The two transducers are rotated together 180 degrees around the object, and backscattering measurements are performed during the rotation. The arrangement can be shown to sample the plane-wave spectrum of the object directly, and provides sufficient information to reconstruct independent images of the variations in both the density and compressibility of the scattering medium. Image resolution is limited by the bandwidth of the illuminating sound.

700,864
PB88-110739 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Adsorption of PMDM, the Adduct of Pyromellitic Dianhydride with 2-hydroxyethyl Methacrylate, on Hydroxyapatite.
Final rept.,
D. N. Misra, and R. L. Bowen. 1987, 8p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Colloids and Surfaces 26, p101-108 1987.

Biomedical Instrumentation & Bioengineering

Keywords: *Dentin, *Dental materials, Calcium phosphates, Adsorption, Enamels, Bonding, Reprints, Apatites.

Adsorption of an isomeric mixture of the adduct of pyromellitic dianhydride with 2-hydroxy-ethyl methacrylate, PMDM, from ethanolic solutions onto synthetic hydroxyapatite was studied at 23 degrees C. This was done to determine if PMDM adsorbs on synthetic hydroxyapatite surfaces and to elucidate its role in a procedure for bonding composites with dentin and enamel.

700,865
PB88-122072 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Dental Adhesive Bonding.
Final rept.,
R. L. Bowen. 1987, 1p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Update, p8 Aug/Sep 87.

Keywords: *Dental materials, *Enamels, Bonding, Adhesion, Reprints.

After decades of research, a combined dentin and enamel bonding method developed at the Paffenbarger Research Center, National Bureau of Standards, is beginning to address and minimize problems associated with the adhesion of dental composites to tooth surfaces. At the conclusion of a five-year clinical trial, it is hoped that new products based on these new adhesive materials will be introduced into U.S. and international dental materials markets.

700,866
PB88-141106 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
High Resolution Radiography: Applications to Biomedical Imaging.
Final rept.,
R. C. Dobbyn, M. Kuriyama, S. Takagi, and L. C. Chow. 1987, 4p
Grants PHS-DE-05030, PHS-DE-06060-01
Sponsored by Public Health Service, Rockville, MD.
Pub. in Proceedings of the Southern Biomedical Engineering Conference (6th), Dallas, TX., October 23-24, 1987, p194-197.

Keywords: *Meetings, *Radiography, X rays, *Biomedical imaging, Microradiography.

The superior spatial resolution obtained with parallel-beam microradiography over conventional contact microradiography has allowed us to image microstructural features of dental hard tissue not previously reported. The efforts to extend these techniques to provide a real-time capability for viewing in situ demineralization and remineralization effects, at and below the 1 um level, have resulted in an instrument with several novel and unique features having direct application to biomedical imaging. Using a synchrotron radiation source of x-rays and diffraction image magnification, the authors are now able to eliminate undesired scattered radiation. In addition, the energy range over which the instrument operates allows one to change magnification at will (x-ray zoom lens) and gives considerable flexibility in optimizing image contrast.

700,867
PB88-141270 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Research Directions for Bioanalytical Sensors Development.
Final rept.,
R. A. Durst, A. L. Plant, L. L. Brown, R. M. Kannuck, and J. M. Bellama. 1986, 12p
Pub. in Bioelectroanalytical Symposium (1st), p3-14 1986.

Keywords: *Bioinstrumentation, Detectors, Reprints.

Bioanalytical sensors (biosensors) are a relatively new class of analytical devices which use biological components for the recognition of specific analytes and the measurement of the resulting amplified chemical perturbation. Both electrochemical (voltammetric) and optical (fluorescence) measurements will be used to quantify the extent of analyte-induced biochemical reaction. As envisioned in the research, the biosensors will consist of three components: biological receptors, liposomes (for marker encapsulation), and electrochemical and optical detectors. The sensitivity of electrochemical detection is improved by the modification of electrodes with ion-exchange polymers. The use of the electrode in conjunction with complement or surfactant lysis of marker-containing liposomes provides a novel approach to the development of an extremely sensitive bioanalytical sensor.

700,868
PB88-147558 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Laser Resonance Ionization Mass Spectrometry.
Final rept.,
J. D. Fassett, L. J. Moore, J. C. Travis, and J. R. DeVoe. 1985, 6p
Pub. in Science 230, n4723 p262-267 1985.

Keywords: *Lasers, Reprints, *Inorganic analysis, *Mass spectrometers, Resonant ionization, Ultratrace analysis.

The brief review describes the recent research in the coupling of lasers with mass spectrometers for investigating resonant ionization processes of inorganic species. The laser-mass spectrometer system promises to make significant improvements in ionization efficiency, to reduce isoboric interferences thereby simplifying chemical processing for isotope dilution mass spectrometry, and the measurement of abundance ratios.

Bionics & Artificial Intelligence

700,869
PB82-227547 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Overview of Expert Systems,
W. B. Gevarter. May 82, 74p NBSIR-82-2505
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.

Keywords: *Artificial intelligence, Computer programming, Heuristic methods, Systems engineering, *Expert systems, *Computer software.

This report provides an overview of Expert Systems - currently the hottest topic in the field of Artificial Intelligence. Topics covered include what it is, techniques used, existing systems, applications, who is doing it, who is funding it, the state-of-the-art, research requirements, and future trends and opportunities.

700,870
PB83-115642 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Overview of Computer Vision,
W. B. Gevarter. Sep 82, 170p NBSIR-82-2582
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.

Keywords: *Visual perception, *Artificial intelligence, Technology assessment, Images, Pattern recognition, Robots, *Computer vision, Scene analysis, Computer applications.

This report provides on overview of computer vision. The emphasis is on image understanding and scene analysis, though pertinent aspects of pattern recognition are treated. Image processing for sensor correction, rectification, image enhancement, etc., is not covered. This report reviews the basic approach to computer vision systems, the techniques utilized, applications, the current existing systems and state-of-the-art, issues and research requirements, who is doing it and who is funding it, and finally future trends and expectations. The intent is to provide an overall perspective of this vital field with its many participants, that will be useful to engineering and research managers, potential users and others who will be impacted by this field as it unfolds.

700,871
PB83-217547 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Overview of Artifcial Intelligence and Robotics. Volume 2. Robotics.
W. B. Gevarter. Mar 82, 103p NBSIR-82-2479
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.

Keywords: *Artificial intelligence, *Robots, Technology assessment, Financing, Japan, Manufacturing, Research and development.

This report provides an overview of the rapidly changing field of robotics. It is intended to be read by the technically oriented layman, such as engineering managers, government funding offices, and others who desire an overall perspective of the field but are unable to obtain it from the highly technical and unintegrated literature in the field, or from the more flamboyant but non-technical feature articles in the popular press. The report incorporates definitions of the various types of robots, a summary of the basic concepts utilized in each of the many technical areas, review of the state-of-the-art and statistics of robot manufacture and usage. Particular attention is paid to the status of robot development, the organizations involved, their activities, and their funding. A 5-10 year forecast of the emerging technology is also included. The majority of the material in this report is drawn from the activities in the U.S. and Japan, the principal players in the world of robotics.

700,872
PB83-217562 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Overview of Expert Systems.
W. B. Gevarter. May 82, 75p NBSIR 82-2505
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.

Keywords: *Artificial intelligence, Technology assessment, Systems engineering, Financing, *Expert systems, Research and development, Knowledge representation.

This report provides an overview of Expert Systems - currently the hottest topic in the field of Artificial Intelligence. Topics covered include what it is, techniques used, existing systems, applications, who is doing it, who is funding it, the state-of-the-art, research requirements, and future trends and opportunities.

700,873
PB84-178037 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Overview of Artificial Intelligence and Robotics. Volume 1. Artificial Intelligence. Part A - The Core Ingredients.
W. B. Gevarter. Feb 84, 75p NBSIR-83-2799
See also PB83-217547.

Keywords: *Artificial intelligence, *Robots, Heuristic methods, Cognition, Computers, Speech recognition, Speech, *Expert systems, Speech synthesis.

Artificial Intelligence (AI) is an emerging technology that has recently attracted considerable attention. Many applications are now under development. The goal of Artificial Intelligence is focused on developing computational approaches to intelligent behavior. This goal is so broad--covering virtually all aspects of human cognitive activity--that substantial confusion has arisen as to the actual nature of AI, its current status and its future capability. This volume, the first in a series of NBS/NASA reports on the subject, attempts to address these concerns. Thus, this report endeavors to clarify what AI is, the foundations on which it rests, the techniques utilized, applications, the participants and, finally, AI's state-of-the-art and future trends. It is anticipated that this report will prove useful to government and private engineering and research managers, potential users, and others who will be affected by this field as it unfolds.

700,874
PB86-238839 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Structure for Generation and Control of Intelligent Behavior.
Final rept.
J. S. Albus. 1983, 4p
Pub. in Proceedings of Institute of Electrical and Electronics Engineers International Conference on Computer Design: VLSI in Computers, Port Chester, NY., October 31-November 3, 1983, p25-28.

Keywords: *Planning, Intelligence, Behavior, Objectives, *Artificial intelligence, *learning machines, Goals, Computer architecture.

A hierarchical architecture which has the ability to generate and control intelligent behavior is presented. Three parallel cross-coupled hierarchies are proposed of (1) a task or goal decomposition hierarchy, (2) a sensory processing hierarchy, and (3) a world modeling hierarchy. The upper levels of these hierarchies have the ability to select goals, evaluate results, and generate plans. Intelligence is defined to be the set of computing mechanisms that enable an organism or a machine: (1) to select good goals, and (2) to act in a manner which tends to optimize the probability of success in achieving the selected goals.

700,875
PB87-129037 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Survey of Current Robot Metrology Methods.
Final rept.
K. Lau, and R. J. Hocken. 1984, 4p
Pub. in CIRP Annals 33, n2 p485-488 1984.

Keywords: *Robots, Metrology, Instruments, Reproducibility, Kinematics, Dynamics, Accuracy, Tests, Laboratories, Research projects.

In response to industrial needs, performance measures for robots are being developed in laboratories around the world. Although as yet no universally accepted tests for robots have been adopted, researchers have developed or are developing procedures in instrumentation for examining repeatability, kinematics, dynamics, and positioning accuracy of industrial robots.

Human Factors Engineering

700,876
AD-P002 927/2 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Washington, DC.
Ergonomic Data Base for Physical Security.
P. C. Goodman. 1 Jun 81, 8p
Pub. in Proceedings of the Symposium on the Role of Behavioral Science in Physical Security (5th Annual) Held at Gaithersburg, MD., June 11-12, 1980, AD-A138 882, p141-148.

Keywords: *Ergonomics, *Area security, *Data bases, Man machine systems, Human factors engineering, Warning systems, Intrusion detection, Behavioral science, Component Reports, Physical security.

The National Bureau of Standards has been exploring the possibility of developing an ergonomics data system since 1976. We summarize some of our preliminary findings and outline our future plans to extend this work to benefit the multidisciplinary field of physical security.

700,877
PB-269 531/0 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
Considerations in Establishing Performance Criteria for Structural Firefighters Helmets.
Final rept.,
N. J. Calvano. May 77, 111p NBSIR-77-1251

Keywords: *Helmets, *Fire fighting, Criteria, Impact tests, Penetration, Configuration, Human factors engineering, Thermal resistance, Flammability, Materials, Standards, Performance.

The report describes the development of performance criteria for firefighters' helmets. Biomedical and physiological considerations are discussed. Fire helmet construction and test methods for impact attenuation, penetration resistance, heat resistance and flammability are described. Results of tests on various types of fire helmets are presented. A proposed standard for fire helmets is included.

700,878
PB-272 862/4 PC **A10**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Thermal Analysis - Human Comfort - Indoor Environments: Proceedings of a Symposium Held at Gaithersburg, Maryland on February 11, 1977.
Final rept.,
B. W. Mangum, and J. E. Hill. Sep 77, 201p NBS-SP-491
Library of Congress catalog card no. 77-12602.

Keywords: *Thermal analysis, *Meetings, *Comfort, Human factors engineering, Environmental engineering, Environments, Heat stress, Buildings, Tables(Data), Productivity, Models, Responses, Monitors, Industrial atmospheres, Industrial hygiene, Energy conservation, *Indoor atmospheres, Occupational safety and health.

These are the proceedings of a symposium sponsored by NBS for the purpose of exploring new aspects of indoor thermal environments caused by the impact of energy conservation in new and existing buildings. Eleven formal papers were presented along with opening and closing remarks, as follows: Opening Remarks, J. Wright; Thermal Comfort in Indoor..., P. Fanger; The Use of Modeling Human Responses..., N. Azer and S. Hsu; Industrial Heat Stress Monitoring, F. Dukes-Dobos; Establishment of the Boundaries to Comfort..., R. Goldman; Heat Stress, Work Function..., A. Dasler; Effect of Energy Conservation Guidelines..., A. Gagge and R. Nevins; Radiation Measurement for Thermal Comfort..., L. Berglund; Experimental Analysis of Thermal Acceptability, R. Gonzalez; Rating of Environments for Human Thermal Comfort..., T. Benzinger; Aspects of Indoor Environments: Tolerable vs. Comfortable..., E. Buskirk; Assessing Productivity Decrements in Heat and Cold..., D. Wyon; Summary and Closing Remarks, P. McNall.

700,879
PB-279 923/7 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
Survey of Clothing Requirements for Uniformed Law Enforcement Officers.
Apr 78, 24p NBS-SP-480-29
Prepared in cooperation with Welson and Co., Inc., Hartford, Conn. Sponsored in part by Law Enforcement Assistance Administration, Washington, D.C.

Keywords: *Uniforms, *Police, Clothing, User needs, Identification, Protective clothing, Requirements, Surveys, Size determination, Durability.

Until recently, the police uniform has largely been considered or designed primarily for identification. There is, however, a growing realization in the law enforcement community that uniforms should also be designed and constructed to serve other requirements, namely: comfort durability, and weather and hazard protection. This document reports the results of a survey of user requirements from 307 police agencies and provides guidance to law enforcement officials in the design, construction and materials used in police uniforms.

700,880
PB-283 219/4 PC **A08**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C.
Standard Ergonomics Reference Data System: The Concept and Its Assessment.
Final rept.,
H. P. Van Cott, J. J. Kramer, V. J. Pezoldt, L. G. Porter, C. Fried, J. V. Fechter, J. J. Persensky, and W. H. Teichner. Jun 78, 166p NBSIR-77-1403

Keywords: *Human factors engineering, *Data, *Standards, Information systems, Planning, Authropometry, Physiology, Behavior, User needs, Industries, Technology, Consumer affairs, Product safety, SERDS(Standard Ergonomics Reference Data Systems), Standard ergonomics reference data systems, Data bases.

The report culminates a feasibility study effort aimed at assessing the needs of industry, government and the research community for standard ergonomics (human factors) data, proposing a system concept and preliminary plan for the development and operation of a standard ergonomics reference data system (SERDS) and assessing the scientific and technical challenges to be met in system implementation. The data base proposed would provide, for the first time, a single point of access to reliable, current anthropometric, behavioral and physiological data for application to technology design. Critically evaluated numeric data, standardization and the conduct of a National Ergonomics Survey are the major focal points of the system concept.

700,881
PB-289 006/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Toward the Collection of Critically Evaluated Ergonomics Data.
Final rept.
H. P. Van Cott, and J. J. Kramer. 1978, 3p
Pub. in Proc. Human Factors Society Annual Meeting (22nd), Held at Detroit, MI on Oct 16-19, 1978 p617-619 (Human Factors Society, Santa Monica, CA. 1978).

Keywords: *Human factors engineering, *Meetings, Planning, Data acquisition, Standards, Measurement, Criteria, User needs.

At the 1977 meeting of the HFS a concept was presented for a Standard Ergonomics Reference Data System. The system would have two goals (1) the critical evaluation and integration of data from the existing published ergonomics literature, and (2) the development and application of standard measurement methods to collect key ergonomics data representative of the U.S. population not found in the published literature in a reliable form. The presentation covers progress made in 1978 to assess user data needs and develop critical evaluation criteria, in light of significant overall program planning changes.

700,882
PB-295 088/9 PC **A03**/MF **A01**
New Mexico State Univ., Las Cruces. Dept. of Psychology.
Critical Evaluation of Data for a Standard Ergonomics Reference Data System (SERDS).
Final rept.
W. H. Teichner, and E. Williams. Jan 79, 37p NBS/GCR-79/169
See also report dated Jun 78, PB-283 219.

Keywords: *Human factors engineering, *Data, *Standards, Information systems, Planning, Anthropometry, User needs, Industries, Technology, Consumer affairs, Product safety, Data acquisition, Quality control, Research, Reliability, Validity, Sensitivity, SERDS(Standard Ergonomics Reference Data Systems), Standard ergonomics reference data systems, Data bases.

The report discusses quality control procedures appropriate for a Standard Ergonomics Reference Data System (SERDS). Suggested procedures include maintaining and utilizing existing centers of excellence in specific areas of ergonomics to perform the critical reviews of published research and also produce handbooks of suggested data collection methodologies. Methodology handbooks would serve not only to maintain quality control for data accepted into SERDS, but would also improve the quality of ergonomic research in general if the suggested methodologies became standard practice for researchers. Problems of data validity, reliability, and sensitivity are discussed. Without reaching any final conclusion because the system is not yet established, suggestions are made to include foreign language experts in evaluation center staffs; to use different quality control levels as a function of the type of ergonomic data being collected; to plan on reconsidering acceptable quality control levels as the amount and quality of data improves in a given area of ergonomics; and to include formal advisory boards to review SERDS operation and quality control procedures. Coding schemes for categorizing data and querying the system are also suggested.

700,883
PB-297 910/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Relation of Thermal Comfort to Learning and Performance: A State-of-the-Art Report.
Final rept.
P. E. McNall. 1979, 9p
Pub. in Proceedings of ASHRAE Semiannual Meeting on HVAC--Human Factors, Philadelphia, PA., Jan 28-Feb 2, 1979, Paper PH-79-9, n2 in ASHRAE Trans. 85, Pt I, p759-767 Jun 79.

Keywords: *Comfort, *Learning, Air conditioning, Human factors engineering, Motivation, Fatigue, Education, Environments.

The results of several research projects are summarized. These projects have attempted to relate thermal comfort, learning and productivity. They show indications of positive correlation (optimal comfort appears to result in maximum learning, etc.) but these are not well supported by commonly accepted experimental statistics. The problem seems to rest in quantifying highly variable individual human motivation as other

experimental conditions are varied. This seems particularly true in the usually employed experiments of a few hours' duration on many human subjects. On the other hand, investigating long-term effects of fatigue and motivation over many weeks is expensive and time-consuming, and control of the subjects when they are not under the experimental conditions has been minimal in studies of this type up to the present time.

700,884
PB80-130529 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
History of Walkway Slip-Resistance Research at the National Bureau of Standards.
Final rept.,
S. C. Adler, and B. C. Pierman. Dec 79, 40p NBS-SP-565
Library of Congress catalog card no. 79-600179.

Keywords: *Passageways, *Sidewalks, *Sliding friction, Human factors engineering, Friction, Traction, Research management, Test equipment, National government, National Bureau of Standards.

The report summarizes NBS research in the area of walkway and shoe slip-resistance measurement since 1924 and outlines current activities that will provide a technical basis for slip-resistance measurement. Current activities in data base development and identification of standard reference surfaces contribute to a rational basis for quantitative slip-resistance criteria for building codes and standards. Proposed future research thrusts include personal factors such as human biokinetic and perceptual variables, as well as environmental factors such as lighting in the built environment. The research will contribute to the development of new intervention strategies to reduce deaths and injuries due to slips and falls.

700,885
PB80-142961 Not available NTIS
National Bureau of Standards, Washington, DC.
Designing for an Acceptable Wind Environment.
Final rept.,
E. A. Arens. 1979, 19p
Pub. in Proceedings of the ASCE Convention and Exposition, Atlanta, GA, October 23-25, 1979, ASCE Preprint 3756, p1-19 1979.

Keywords: *Pedestrians, *Comfort, Environments, Design, Forecasting, Wind velocity, Predictions, Acceptability.

The comfort of pedestrians has been neglected by designers because first, there are few suitable outdoor comfort criteria, and second, it is difficult to predict the climatic characteristics around proposed buildings. The paper summarizes available information on comfort in cool and cold environments. The mechanical effects of wind on comfort are now better understood than the thermal effects of climate and provide a practical basis for assessing pedestrian comfort in outdoor spaces. The limits of acceptable windspeed become the criteria to determine whether a space is comfortable or uncomfortable at a given time. The report concludes with microclimatic-prediction techniques and procedures for determining the probability of a proposed pedestrian area being uncomfortable over time. Such a probability figure may indicate project acceptability, and suggest the level of mitigation measures worth taking.

700,886
PB80-164957 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Mathematical Model for Use in Evaluating and Developing Impact Test Methods for Protective Headgear,
R. E. Berger. Oct 79, 79p NBSIR-80-1987

Keywords: *Helmets, *Impact tests, Mathematical models, Evaluation, Protection, Injuries, Head(Anatomy), Criteria, Headgear, Test methods.

A lumped parameter mathematical model was developed to connect injury parameters in real life head impact environments to output parameters of test methods for evaluating protective headgear. Analytical/experimental schemes were developed for mathematically representing the parameters that characterize each of the three distinct elements of the model--the head or headform, the impact surface, the helmet. A comparison of the model output to experimental results showed a satisfactory agreement. The model was shown to be useful in determining test method pass/fail criteria which correspond to the threshold of injury in the real life situation.

700,887
PB80-187321 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Emergency Egress from Mobile Homes: Anthropometric and Ergonomic Considerations.
Final rept.,
V. J. Pezoldt. May 80, 47p NBSIR-80-2049
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research.

Keywords: *Fire safety, *Trailers, Anthropometry, Houses, Escape(Abandonment), Human factors engineering, Handicapped persons, Requirements, Standards, Mobile homes.

The report summarizes a two task effort which is part of the National Bureau of Standards evaluation of the Federal Mobile Home Construction and Safety Standard. The first task consists of a review of relevant anthropometric data from which egress requirements might be drawn. The second task is an empirical study of egress designed to generate data which can assist HUD in evaluating the existing size requirements for egress devices. The degree to which the requirements in the current standard for location and operating characteristics of egress device latches and other operating mechanisms are acceptable varies for different segments of the population at risk. The limited applicable anthropometric data suggests that the requirements are sufficient for the most part, for average, healthy, normally ambulatory adults. The minimum opening size requirements were also shown to be acceptable for average healthy adults under most conditions tested. However, devices which meet the maximum sill height allowed by the standard were shown to be extremely difficult to negotiate or unusable by a significant portion of the experimental test subjects. Implications of the present egress requirements for escape by handicapped or otherwise impaired individuals are discussed.

700,888
PB80-199292 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Equal Apparent Conspicuity Contours with Five-Bar Grating Stimuli.
Final rept.,
G. T. Yonemura, E. J. Rinalducci, R. L. Tibbott, and L. A. Fogelgren. May 80, 40p NBSIR-79-1925
Prepared in cooperation with Virginia Univ., Charlottesville. Dept. of Psychology. Sponsored in part by Department of Energy, Washington, DC. Div. of Building and Community Systems.

Keywords: *Visual perception, Tests, Visibility, Illuminance, Contrast, Perception, Laboratories.

The report discusses the results of laboratory studies on equal conspicuity (contrast) contours using as the test stimuli five-bar grating patterns, with the results of other experiments in this series conducted by NBS. Basic groundwork is provided for additional experiments and analysis which will form a practical basis for recommending energy-conserving design illumination levels that conform to real-world office activities.

700,889
PB81-144719 Not available NTIS
National Bureau of Standards, Washington, DC.
New Bioclimatic Chart for Passive Solar Design,
E. Arens, R. Gonzalez, L. Berglund, P. E. McNall, and L. Zeren. Oct 80, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the American Society of the International Solar Energy Society and National Passive Solar Conference Annual Tech. Conference Passive Systems Div. (5th), University of Massachusetts, Amherst, October 19-26, 1980, p1202-1206 Oct 80.

Keywords: *Human factors engineering, *Comfort, Environments, Bioclimatology, Clothing.

The paper presents a substantially revised version of the original bioclimatic chart developed by Olgyay and Yaglou in the 1950s, incorporating recent research results. A thermophysiological model developed at the J.B. Pierce Foundation Laboratory was used to simulate the thermal behavior and resulting comfort sensation of an individual at two clothing levels, and a rate of activity typical of office work, house work, or shopping. The criteria for the boundaries of the comfort zone are based on ASHRAE Standard 55-74, as currently being proposed for revision. Examples of the chart are presented, both in the original format and in the format of the psychrometric chart.

700,890
PB81-197022 PC **A12**/MF **A01**
Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
Network Models for Building Evacuation: A Prototype Primer.
R. L. Francis, and L. G. Chalmet. Mar 81, 254p NBS-GCR-81-316
Contract NB79-NAD-0021

Keywords: *Buildings, *Fires, *Personnel, *Evacuating(Transportation), Network flows, Models, Algorithms, Linear programming, Fire safety, Building fires, Building evacuation, NTISCOMNBS.

If you think of a building evacuation as involving the flow of people through well defined passageways, it is natural to consider the evacuation problem to be a network flow problem. You will discover, as compared to other approaches, that network approaches can be cheaper, more precise, can handle larger problems, and, because they can be used quickly and allow data to be changed easily, they greatly facilitate the comparison of many alternatives. A sequence of three successively more general and more detailed types of network models is presented, which are termed for convenience the Graphical Model, the Intermediate Model, and the Dynamic Model respectively. Since the Intermediate and Dynamic Models share a number of common network modeling features, prior to considering the Intermediate Model a chapter is devoted to basic network modeling ideas. The last two chapters contain a case study along with conclusions and a few words of warning.

700,891
PB81-215683 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of a Hand Probe for Use in a Product Safety Regulation.
Final rept.
J. J. Persensky, and J. L. Gagnon. 1980, 18p
Pub. in Proceedings of Human Factors and Industrial Design in Consumer Products Symposium, Medford, MA, May 28-30, 1980, p155-172.

Keywords: *Accident investigations, *Injuries, Safety, Models, Anthropometry, Tools, NTISCOMNBS.

An evaluation of a hand probe and test procedure was performed by the National Bureau of Standards (NBS) as part of a Consumer Product Safety Commission effort to establish a performance-based safety standard for power lawn mowers. The evaluation involved analysis of in-depth accident reports, review and analysis of existing anthropometric data, graphic modeling of the hazard intrusion envelope, critique of the test procedure and analysis of an effectiveness forecast. Analysis of mower-hand accident reports indicated that most mower accidents involved operators reaching into the discharge chute where the rotating blade was contacted. Data on hand position and orientation at the time of injury indicate a need for a test procedure which represents the dynamic nature of hand intrusion.

700,892
PB82-235052 Not available NTIS
National Bureau of Standards, Washington, DC.
New Bioclimatic Chart for Environmental Design.
Final rept.
E. Arens, L. Zeren, R. Gonzalez, L. Berglund, and P. E. McNall. 1981, 11p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of International Congress, Povoa de Varzim, Portugal, May 12-16, 1980, Paper in Building Energy Management, p645-655 1981.

Keywords: *Comfort, *Bioclimatology, Temperature, Humidity, Environments, Winter, Architecture, Design.

The bioclimatic chart developed in the 1950's by Olgyay is revised, using the latest available research on human response to the thermal environment. The chart shows the various combinations of air temperature, humidity, radiation (from the surroundings and the sun) and wind or air motion, which provide thermally acceptable conditions for average people, clothed for

the average indoor winter conditions and slightly active. The chart extends the usual indoor conditions to those outdoors, with much greater differences among the thermal properties, so that indoor and outdoor conditions can be reasonably controlled for comfort purposes through architectural design or with simple mechanical equipment.

700,893
PB83-201442 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Some Criteria for Colors and Signs in Workplaces.
Final rept. 1978-83.
R. A. Glass, G. L. Howett, K. Lister, and B. L. Collins. Apr 83, 99p NBSIR-83-2694
Sponsored in part by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Warning devices, Safety, Workplace layout, Human factors engineering, Color, Visual aids, Standards, Perception, Illuminating, *Work environment, Signs, Energy conservation.

The use of safety-related visual displays such as signs and colors in workplaces is discussed. The discussion includes a review of relevant national and international standards for safety colors and signs. It also includes a review of measures of spatial resolution in human vision, as well as of color sensitivity and color appearance. In addition, research on the effectiveness of safety signs, symbols, and colors is reviewed. Based on the initial literature review, the appearance of safety colors under energy efficient light sources was identified as an area for detailed research. As a result, a laboratory study was conducted in which the color appearance of 45 different color samples under five light sources including energy efficient ones was determined for seven subjects. The results indicated the existence of a set of colors which was more identifiable under all light sources than the current standard safety colors.

700,894
PB83-250589 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Size of Letters Required for Visibility as a Function of Viewing Distance and Observer Visual Acuity.
Technical note.
G. L. Howett. Jul 83, 75p NBS-TN-1180

Keywords: *Visual acuity, *Symbols, Legibility, Visibility, Contrast, Luminance.

A formula is derived giving the letter stroke-width needed for legibility of words on a sign at any given distance by an observer with any given visual acuity. The stroke width, in turn, determines the letter size, depending upon the characteristics of the type face used. The derivation is strictly mathematical and is based on the assumption that beyond a distance of a few meters, a person's visual acuity is specifiable by a fixed visual angle, independent of the distance. The information implicit in the formula is also presented graphically, in four plots that apply to four different combinations of length units for measuring stroke width and viewing distance. Also presented are formulas and graphs for correcting the critical stroke width for nonstandard contrast or background luminance. These correction formulas are based on a body of data on visual acuity as a function of contrast and background luminance, and a formula fitting the mid-ranges of the data.

700,895
PB84-244664 Not available NTIS
National Bureau of Standards, Washington, DC.
Human Awakening and Subsequent Identification of Fire Related Cues.
Final rept.
M. J. Kahn. Feb 84, 7p
Pub. in Fire Technology 20, n1 p20-26 Feb 84.

Keywords: *Warning systems, *Reaction time, *Arousal, Detection, Smoke, Tests, Sleep, Auditory perception, Fires, Heat, Fire safety, Human factors.

Twenty-four college-age male subjects, employed for one night each, were evaluated on their ability to awaken and then identify fire cues. Twelve subjects were exposed to smoke alarm warning signals of three intensities, while the second twelve subjects were exposed to a smoke odor, a heat presentation, and a single smoke alarm warning signal. Subjects were, in all cases, awakened by alarms that reached their ears at signal/noise ratios of 34 dB. They were considerably less likely to be awakened by heat, the smoke odor, and alarm sounds that reached their ears at signal/noise ratios of 10 dB or less. Upon awakening, subjects repeatedly failed to correctly label radiant heat presentations and smoke alarm warnings as fire cues.

700,896
PB85-142610 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crash Helmets.
Final rept.
N. J. Calvano. Jun 84, 9p
Sponsored by National Inst. of Justice, Washington, DC.
Pub. in National Inst. of Justice Standard-0105.01, 9p Jun 84.

Keywords: *Helmets, *Motor vehicles, *Standards, Requirements, Tests, Impact strength, Visibility, Penetration.

This standard establishes requirements and methods of test for helmets to be worn by drivers and passengers of surface vehicles. This standard is a revision of and supersedes NILECJ-STD-0105.00 dated June 1975. This revision of the standard changes the impact attenuation requirements, deletes the requirement for wet testing of helmets, modifies the requirement and test method for peripheral vision limits, and clarifies test methods and test equipment requirements.

Life Support Systems

700,897
PB87-140299 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Application of Smoke Detector Technology to Quantitative Respirator Fit Test Methodology.
Final rept.
G. W. Mulholland, R. Bukowski, B. Y. H. Liu, and V. Szymanski. Nov 86, 63p NBSIR-86/3481
Prepared in cooperation with Minnesota Univ., Minneapolis. Particle Technology Lab. Sponsored by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Respirators, Test methods, Measurement, Design, *Smoke detectors, Human factors engineering.

A quantitative respirator fit test apparatus was developed based on using a light-scattering type smoke detector for the sensing element and a clinical nebulizer for the aerosol source. The performance of three smoke detectors and nine clinical nebulizers considered for use in the final system are reported. Key design features of the apparatus include the generation of a corn oil aerosol concentration of 500 mg/m3 at a flow rate of 50 l/min and LED display for protection factors of 25, 50, 125, and 450. The total cost of the component parts for the apparatus is less than $300. The apparatus is designed to meet the need for a low cost, easy to use instrument for quantitatively monitoring a respirator's fit to a worker's face.

Prosthetics & Mechanical Organs

700,898
PB-259 199/8 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Polymers Div.
Interaction of Blood Proteins with Solid Surfaces.
Annual rept. 1 Nov 75-15 Aug 76.
L. E. Smith, R. E. Dehl, W. H. Grant, R. R. Stromberg, and B. W. Morrissey. 16 Aug 76, 42p NBSIR-76-1128
Contract PAS-HB-3-0014
See also report dated Mar 76, PB-251 917.(PC A03/MF A01)

Keywords: *Blood proteins, *Surface chemistry, Polarimetry, Materials, Surface properties, Adsorption, Polymers, Implantation, Mechanical hearts, Mechanical organs, *Blood compatible materials, *Biomaterials.

The investigation is designed to help characterize the surface properties of cardiovascular implant materials. Such properties largely determine the success or failure of implants and may therefore be used as the basis for in vitro test methods. The focus of this investigation has been on the measurement of protein adsorption on surfaces, emphasizing measurements of the conformational changes which occur upon adsorption. Several materials have been examined by ellipsometry and a number have been found suitable for further work. Conformational changes at very short adsorption times are of considerable importance and preliminary results indicate that the techniques are capable of measurements at times as short as two seconds. The use of light scattering to measure the conformation of protein adsorbed on small particles has been evaluated in a study of gamma-globulin adsorption on polystyrene. The results agree well with similar measurements made by ellipsometry.

700,899
PB-265 802/9 PC **A07**/MF **A01**
National Bureau of Standards, Washington, D.C. Metallurgy Div.
Retrieval and Analysis of Orthopaedic Implants.
Special pub.,
A. Weinstein, E. Horowitz, and A. W. Ruff. Apr 77, 134p NBS-SP-472
Sponsored in part by Food and Drug Administration, Washington, D.C., American Society for Testing and Materials, Philadelphia, Pa., and American Academy of Orthopaedic Surgeons, Chicago, Ill. Prepared in cooperation with Tulane Univ., New Orleans, La. Biomaterials Lab. Library of Congress catalog card no. 77-608031.

Keywords: *Meetings, *Implantation, *Orthopedic equipment, *Prosthetic devices, Degradation, Physical properties, Mechanical properties, Tissues(Biology), Compatibility, Metals, Models, Recommendations, Analyzing, Health care technology, Performance evaluation, Materials, Failure, Surgery, Orthopedics, Appendices, *Orthotics, Biomaterials, *Implant retrieval, Biomechanics.

Contents:
- Overview--performance feedback via device retrieval and analysis;
- A review of metallurgical failure modes in orthopedic implants;
- Models for systemic effects of metallic implants;
- Tissue reaction to biomaterials;
- Clinical biomechanics;
- Femoral stem performance;
- Orthopedic implant retrieval analysis;
- Legal aspects of device retrieval;
- Panel discussion, implant retrieval--problems and opportunities;
- Workshop, what is the national need.

700,900
PB-270 598/6 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Electronic Technology Div.
Semiconductor Measurement Technology: Reliability Technology for Cardiac Pacemakers II - A Workshop Report. Proceedings of a Workshop Held at the National Bureau of Standards, Gaithersburg, Maryland on July 19-20, 1976,
H. A. Schafft. Aug 77, 48p NBS-SP-400-42
Library of Congress Catalog Card No. 77-608149.

Keywords: *Meetings, *Mechanical organs, Procurement, Electric equipment, Heat measurement, Moisture, Electrical faults, Electric batteries, Reliability, Tests, Electric connectors, Performance, Bioengineering, Cardiac pacemakers, Cardiac assist devices, Hybrid microcircuits.

Contents: Process validation wafers for use in procuring reliable custom integrated circuit chips (M. G. Buehler); High reliability microcircuit procurement controls (W. J. Kitchen, Jr. and T. H. Brown); Mechanisms of dendritic growth (R. P. Frankenthal); Use of epoxies in hybrid microcircuits (R. F. Redemske); Microcalorimetric study of cardiac pacemakers and batteries (E. J. Prosen and J. C. Colbert); Statistical methods for estimating the longevity of pacemaker batteries (D. J. Gerrard); Applications and pitfalls of reliability prediction (J. H. Maness and S. Kus); A reliability comparison of semiconductor and microcircuit technologies (H. A. Lauffenburger); Moisture measurement, leak rate, and reliability (R. E. Sulouff); The fundamentals of leak testing for cardiac pacemakers (S. Ruthberg); Pacemaker leads - a physician's view (V. Parsonnet, M.D.);

The performance of implantable pacing leads - a status report (P. P. Tarjan).

700,901
PB-272 547/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Attack and Release Times of Automatic-Gain-Control Hearing Aids.
Final rept.,
E. D. Burnett, and H. C. Schweitzer. 1977, 3p
Sponsored in part by Veterans Administration, Washington, D.C. Dept. of Medicine and Surgery.
Pub. in Jnl. of the Acoustical Society of America 62, n3 p784-786 Sep 77.

Keywords: *Hearing aids, Performance evaluation, Automatic gain control, Reprints.

The attack and release times were measured on each of three samples of 27 different models of compression-type hearing aids using the test conditions specified in ANSI Standard S3-22 (1976). The results indicate that almost all of the hearing aids tested have attack times less than or equal to 10 ms. A little more than half of the hearing aids had release times of 50 ms or less. The range of the attack times varied from 1 to 23 ms and the release times from 5-600 ms.

700,902
PB-279 827/0 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Polymers Div.
Interaction of Blood Proteins with Solid Surfaces.
Annual rept. 16 Aug 76-30 Jul 77,
L. E. Smith, W. H. Grant, and R. E. Dehl. 31 Jul 77, 60p NBSIR-77-1392
See also report dated 16 Aug 76, PB-259 199.

Keywords: *Blood proteins, *Surface chemistry, Surface properties, Interactions, Materials, Adsorption, Polymers, Proteins, Implantation, Mechanical hearts, Mechanical organs, Autoradiography, Polarimetry, *Blood compatible materials, *Biomaterials.

The purpose of this investigation is to help develop methods for characterizing the surface properties of cardiovascular implant materials. It is expected that these properties, which are related to the success or failure of implants, will ultimately form the basis for in vitro testing of prospective implant materials. The investigation is focused upon three aspects of blood protein adsorption on surfaces, namely (1) the total amount of protein adsorbed, (2) the spatial distribution of adsorbed protein on the surface, and (3) the conformation of adsorbed protein molecules. A number of materials produced by contractors to the NHLBI Biomaterials Program have been examined by ellipsometry and by the adsorption of radiolabeled proteins. Autoradiography has been used to study the uniformity of protein adsorption on several surfaces. Evidence for the migration of proteins into biomaterials has been discovered. Adsorption studies of gamma-globulin on a specially prepared oxidized silicon surface have contributed to our basis understanding of the adsorption of blood proteins on surfaces.

700,903
PB-295 085/5 PC **A03**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Polymer Science and Standards Div.
Physical Testing of Polymers for Use in Circulatory Assist Devices.
Annual rept. no. 1, Oct 77-Aug 78.
R. W. Penn, and G. B. McKenna. Jul 78, 46p NBSIR-79-1741
Contract N01-HV-8-0003
See also report dated Jun 78, PB-286 129.

Keywords: *Elastomers, *Fatigue tests, Carbon black, Fillers, Physical properties, Mechanical properties, Thermal properties, Olefin resins, Polymers, Medical equipment, Mechanical hearts, *Biomaterials, *Blood compatible materials, Cardiac assist devices, Blood pumps.

The concept of linear additive damage has been used to relate sinusoidal fatigue data with creep failure time data on two polymers. Deviations of fatigue data from predictions made from creep failure time data were found to be in opposite directions for a glassy and a semicrystalline polymer. Further work will extend this study to elastomers and candidate biocompatible materials. Specimens of Avcothane 51, obtained from rejected intra-aortic balloons, reflection spectroscopy, as well as by optical microscopy. Significant differences were observed between the two surfaces of the intra-aortic balloon similar to those which had been previously reported. Optical microscopy has revealed circular features near the surface of the balloon wall which the authors are tempted to characterize as regions of segregated PDMS on a much grosser scale than has been previously reported. The authors have prepared carefully controlled samples of an NBS standard butyl rubber and distributed test specimens to other investigators involved in physical testing of polymers for use in circulatory assist devices. This material has mechanical properties similar to candidate biocompatible materials and may be useful as an interlaboratory standard and for test method development. Preliminary design and construction of a biaxial fatigue test cell has been completed. Fatigue experiments on butyl rubber using this device have indicated that only minor modifications will be necessary before initiation of fatigue testing on candidate biomaterials. A multiposition test station for these cells is being assembled.

700,904
PB-296 731/3 PC **A07**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Semiconductor Measurement Technology: Reliability Technology for Cardiac Pacemakers III - A Workshop Report.
Final rept.
H. A. Schafft. Jun 79, 137p NBS-SP-400/50
Workshop Proceedings Held at Gaithersburg, Maryland on October 19-20, 1977. Library of Congress catalog card no. 78-600158.

Keywords: *Meetings, *Reliability, *Technology, *Mechanical hearts, Measurement, Storage batteries, Performance evaluation, Procedures, Radiography, Semiconductors(Materials), Nondestructive tests, *Cardiac pacemakers, Cardiac assist devices.

The workshop, third in a series, served as a forum for pacemaker manufacturers and other interested parties to address technical questions relevant to the enhancement and assurance of cardiac pacemaker reliability. Extended summaries are provided of 27 talks and of eight sets of group encounter discussions on the following topic areas: microcalorimetric measurements to evaluate nondestructively batteries used in pacemakers; qualification procedures, end-of-life prediction, and neutron radiography interrogation of lithium-based batteries; measurement of moisture; moisture effects on the reliability of pacemakers and components; electrostatic-induced damage to semiconductor devices; procurement of high reliability semiconductor components; automated testing of pacemakers; actuarial analyses of lead and pacemaker failures; pacemaker case welding processes; surface contamination measurements; corrosion and accelerated tests for metallic materials; and conformal coatings for pacemaker applications.

700,905
PB-299 447/3 PC **A03**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Polymer Science and Standards Div.
Interaction of Blood Proteins with Solid Surfaces.
Annual rept. 1 Aug 77-30 Sep 78.
R. E. Dehl, and W. H. Grant. 30 Sep 79, 49p NBSIR-79-1784
See also report dated 31 Jul 77, PB-279 827. Sponsored in part by National Heart, Lung, and Blood Inst., Bethesda, MD. Devices and Technology Branch.

Keywords: *Blood proteins, *Surface chemistry, Surface properties, Interactions, Materials, Adsorption, Polymers, Proteins, Implantation, Mechanical hearts, Mechanical organs, Autoradiography, Polarimetry, *Blood compatible materials, *Biomaterials.

The purpose of this investigation is to help develop methods of characterizing the surface properties of implant materials for use in the cardiovascular system. These properties are related to the ultimate success or failure of an implant in vivo. The investigation during the current reporting period has been chiefly concerned with the amount of protein deposited on implant material surfaces. Ion exchange treatment of radiolabeled proteins has been found to lead to much greater accuracy and reliability of adsorption measurements. Results are reported for the quantitative adsorption of labeled proteins thus purified onto well characterized test surfaces, and onto the surfaces of materials supplied by contractors to the NHLBI Biomaterials Program. The effect of the label (125I vs. 14C) on adsorption of proteins was studied. Hydrophobic and hydrophilic oxidized silicon surfaces were used to demonstrate that the adsorption of gamma-globulin, measured by ellipsometry, and serum albumin, measured by radiolabeled protein, both are significantly affected by charge interactions between the surface and the protein.

700,906
PB77-600069 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS Results of Hearing Aid Performance Tests.
E. D. Burnett, and M. A. Bassin. 1977, 245p
Pub. in Handbook of Hearing Aid Measurement, p32-276 1977.

Keywords: *Hearing aids.

Data for hearing aid testing for the Veterans Administration for their use in Fiscal Year 1977 are presented. The methods used are those previously agreed upon with the Veterans Administration.

700,907
PB77-600070 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS Hearing Aid Test Procedures.
E. D. Burnett. 1977, 20p
Pub. in Handbook of Hearing Aid Measurement, p12-31 1977.

Keywords: Anthropometric manikin, Free-field measurements, *Hearing aid tests, Orthotelephonic response.

This report discusses the current test procedures used by NBS to evaluate the electroacoustic properties of hearing aids. It includes the technical and practical reasons for performing the various tests in the manner described and in certain cases presents ideas and preliminary test methods for the evaluation of special-purpose hearing aids. However, the specific details of the electronic equipment used to perform the tests are not described.

700,908
PB79-600057 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS Hearing Aid Test Procedures and Test Results of FY 78 Hearing Aids.
E. D. Burnett. 1979, 324p
Pub. in Handbook of Hearing Aid Measurement 1979.

Keywords: *Anthropometric manikin, Free-field measurements, Hearing aids, Hearing aid tests, Orthotelephonic response.

This report discusses the current test procedures used by NBS to evaluate the electro-acoustic properties of hearing aids. It includes the technical and practical reasons for performing the various tests in the manner described and in certain cases presents ideas and preliminary test methods for the evaluation of special-purpose hearing aids. However, the specific details of the electronic equipment used to perform the tests are not described.

700,909
PB83-126698 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Metallurgical Studies of Interface Bonding on Implant Alloys.
A. C. Fraker, A. W. Ruff, K. J. Bundy, S. A. DeMontigny, P. Sung, A. C. Van Orden, and K. M. Speck. Oct 82, 98p NBSIR-82-2563
Contract FDA-224-79-5023

Keywords: *Prosthetic devices, *Medical equipment, Stress analysis, Implantation, Dissimilar materials bonding, Titanium alloys, Corrosion resistance, Surface finishing, Literature surveys.

A literature review covering articles on stress analyses in total hip replacement prostheses and the metal/bone cement interface is presented. The literature indicated the need for a test which utilized loading in torsion, and such a test was developed and is described. The test can be used to determine the influence of various parameters, including surface roughness and passivation and sterilization treatment on the strength of the metal/bone cement bond. Some preliminary tests were conducted and results are given. Future work using the mechanical test developed is discussed. Additional studies were conducted on the surface preparation of titanium, and data are presented to show that changes in initial electrochemical behavior and varying degrees of surface roughness occur depending on

whether the metal receives a neutral, alkaline or acidic washing treatment.

700,910
PB85-197499 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fit of Multiple Unit Fixed Partial Denture Castings.
Final rept.
R. W. Hinman, J. A. Tesk, E. E. Parry, and G. T. Eden. 1981, 1p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. of Dental Research 60, 376p 1981.

Keywords: *Dental materials, Dental prostheses, Casting, Reprints, Prosthodontics.

There exists a general consensus within dentistry that the technique which produces the best fit of fixed partial dentures involves the casting of single units which are subsequently joined by soldering. Base metal alloys unfortunately do not, as a class, lend themselves to soldering as readily as do gold based alloys. The difficulties with soldering these alloys predicate the need for techniques which will maximize the accuracy of one piece multiunit castings. A hardened steel die system has been devised to approximate a maxillary three unit FPD. Pressure formed, annealed wax patterns of nearly invariant dimensions are produced and measured and subsequently compared to the resultant castings.

700,911
PB86-123072 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
SEM (Scanning Electron Microscopy) Studies of Co-Cr-Mo Surgical Implant Alloy Corrosion Behavior.
Final rept.
A. C. Van Orden, J. L. Chidester, A. C. Fraker, and P. Sung. 1982, 2p
Pub. in Proceedings of Annual Meeting Electron Microscopy Society of America (40th), Washington, DC., August 9-13, 1982, p520-521.

Keywords: *Surgical implants, Anodic polarization, Corrosion, Cobalt, Chromium, Molybdenum, *Scanning electron microscopy.

The influence of small variations in the composition of Co-Cr-Mo alloys was studied using SEM, energy dispersive x-ray analysis, and electrochemical measurements. SEM and EDX data were correlated with data from in vitro corrosion measurements involving anodic polarization and repassivation measurements. The effects of small variations in alloy composition are evident through SEM and EDX studies of the surface film. The alloy with the highest amount of Fe was shown to have the thickest film. The film was shown to be enriched in Fe, Mo and Si, and depleted in Co and Cr. It can be concluded from this study, that small variations in alloy composition affect the composition and stability of the passive film formed on the surface of the alloys.

700,912
PB86-201407 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Mechanical Properties and Structure of Ti-6A1-4V with Graded-Porosity Coatings Applied by Plasma Spraying for Use in Orthopedic Implants.
Final rept.
H. Hahn, P. J. Lare, R. H. Rowe, A. C. Fraker, and F. Ordway. 1985, 13p
Pub. in Proceedings of the Corrosion and Degradation of Implant Materials Symposium (2nd), Louisville, KY., May 9-10, 1983, ASTM (American Society for Testing and Materials) Spec. Tech. Pub. 859, p179-191 1985.

Keywords: Titanium alloys, Aluminum containing alloys, Vanadium containing alloys, Coatings, Mechanical properties, Corrosion fatigue, *Surgical implants, Titanium alloy 6 Al 4V.

The object of the work was to determine mechanical properties of implants with graded porous coatings without reference to the properties of the ingrown bone. Optimum strength of a bone/implant interface consisting of porous metal and ingrown bone requires a gradation from base metal to the original bone. The composite metal-bone interface can be obtained by applying a metal coating of graded porosity, varying from near zero at the substrate surface to more than 50% at the outermost layer on the original implant. Graded porous coatings of titanium or Ti-6Al-4V were obtained by plasma spraying of selected particle size fractions in three layers of successively decreasing density the top coat being made with 300 to 850 pm powder. Tensile and shear strengths of the coatings were determined by cementing coated samples face to face with an adhesive resin to simulate ingrown bone. Data from these tests are given. Shear strength values ranged from 5.6 to 9.9 MPa (815 to 1430 psi) and tensile strength values were 5.1 to 25. 5 MPa (745 to 3700 psi). Failure occurred within the porous coating and not at the interface between the substrate and the coating. Corrosion fatigue tests in Hanks' solution at 37 deg. C (98.6 deg. F) and a pH of 7.4, with a cyclic, fully reversed, peak torsional shear strain of plus or minus 0.01, gave lifetimes comparable to or better than those reported for mill-annealed Ti-6Al-4V, except for the samples that had been smtered.

Protective Equipment

700,913
PB80-600053 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Riot Helmets and face Shields.
N. J. Calvano, and R. Gorden. 1980, 18p
Pub. in NIJ-Std-0104.01 1980.

Keywords: *Face shield, Headgear, Helmet, Impact, Protective equipment, Riot helmet.

This standard establishes performance criteria and test methods for helmets and face shields intended for use by law enforcement officers. Helmet tests include requirements for impact attenuation, penetration resistance, and chin strap/retention system integrity. Face shield requirements include impact attenuation and optical properties.

Tissue Preservation & Storage

700,914
PB82-264185 Not available NTIS
National Bureau of Standards, Washington, DC.
National Environmental Specimen Bank Pilot Program.
Final rept.
S. A. Harrison, T. E. Gills, E. J. Maienthal, H. L. Rook, S. A. Wise, R. L. Zeisler, and G. M. Goldstein. 1980, 12p
Pub. in Proceedings of Symposium Trace Substances in Environmental Health XIV. 1980, Columbia, Missouri, June 10-12, 1980 p329-340 1980.

Keywords: Sampling, Homogenizing, Storage, Liver, Humans, *National Environmental Specimen Bank, Analytical methods, *Specimen handling.

In response to the increasing concern for the potential dangers to human health and the environment by the influx of man-made substances in our ecosystem, the U.S. EPA, in cooperation with the National Bureau of Standards (NBS), is currently studying the feasibility of establishing a National Environmental Specimen Bank. Recently, a five year pilot program was initiated at NBS to provide experience in all phases of specimen banking, i.e. collection, storage evaluation and analysis. These activities have been implemented for the first sample included in this pilot study: human liver samples. This paper will describe the sampling protocol, homogenization procedure, storage evaluation, and analytical techniques employed for these liver samples.

General

700,915
PB-292 284/7 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Product Safety Technology Div.
Methodology for Choosing Test Parameters to Evaluate Protective Headgear.
Interim rept.
R. E. Berger, and N. J. Calvano. Nov 78, 76p NBSIR-78-1547

Keywords: *Protectors, *Headgear, *Protective clothing, *Impact tests, Methodology, Tests, Helmets, Tolerances(Physiology), Materials, Sensitivity, Experimental data, *Head injuries.

The effects of changing test variables (headform, impact velocity, impact surface, impact site) on output parameters (peak acceleration, severity index) were studied. Twelve football helmets representing six different types of energy absorbing systems were used in the test. Results show good correlation between metal and humanoid headforms during top impacts but poor correlations when helmets were impacted on the back. Correlation between impact surfaces was high. Peak acceleration correlated well with severity index.

700,916
PB79-600051 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of Selected Toxic Elements in Biological Matrices Using Radiochemical Activation Analysis.
T. E. Gills, M. Gallorini, and R. P. Greenberg. 1979, 12p
Pub. in Proceedings 3rd Int. Conf. on Nuclear Methods in Environmental and Energy Research, Columbia, MO, Oct 10-13, 1977, p597-609 1978.

Keywords: *Radiochemical, Selectivity, Sensitivity, Toxic elements.

Neutron activation analysis, coupled to improved or modified radiochemical procedures, was used in the analysis of several selected toxic elements in biological matrices. These procedures proved effective in achieving maximum sensitivities and accuracies for the following elements; HG, Se, As, Sb and Cd. This paper describes the application of these radiochemical procedures and their use at the National bureau of Standards in the Standard Reference Material certification program.

700,917
PB80-151491 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Selected Test Variables on the Evaluation of Football Helmet Performance.
Final rept.,
N. J. Calvano, and R. E. Berger. 1979, 9p
Pub. in Med. Sci. Sports 11, n3 p293-301 1979.

Keywords: *Head(Anatomy), *Injuries, *Helmets, Tests, Impact tests, Performance evaluation, Reprints.

The most important variables in helmet test methods (headform, impact surface, velocity) were studied by systematically changing the test variables and measuring the effect of these changes on the output responses (peak acceleration and severity index) of helmeted headforms. The degree of correlation between variables was also measured. The metal headform yielded consistently higher results than the humanoid headform but the differences between the two were much greater during impacts at the back site. Also, correlation between humanoid and metal headforms was significantly higher for top impacts than for rear impacts. These discrepancies between top and rear impacts were attributed to difficulties in the neck mounting system with the humanoid headform which causes inordinate bending during impacts. The soft impact surface yielded lower responses than the hard surface for both headforms, correlations between soft and hard surfaces were high in all cases. A small change in impact velocity (4.5 to 5 m/sec) resulted in a substantially higher output response. Correlation between velocities were much lower for the back impact site than the top.

700,918
PB80-164247 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.

General

Diffusion Layers and Strength of Soldered Ti Joints Using Noble Galvanic Coatings (Diffuzionnye Sloi i Prochnost' Payanykh Soedinenii Titana S Primeneniem Gal'vanopokrytii Blagorodnykh Metallov),
V. V. Bondarev, and A. Y. Shinyaev. 1979, 9p
DMDC-20686, TT-79-58157
Trans. of Novye Issled Titan Splavov, Moscow, p309-311 1965. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Soldered joints, Titanium, Titanium alloys, Gold coatings, Silver coatings, Platinum coatings, Precious metal coatings, Palladium, Rhodium, Diffusion, Strength, Translations.

Galvanic coatings of Au, Pt, Pd, and Rh were applied to Ti and Ti alloys. The coated specimens were then either soft or hard soldered together. The soldered samples were then tested in tension till failure. Strength of the soldered joints was then correlated with previous heat treatments, microstructure and test variables.

700,919

PB85-207306 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Law Enforcement Standards Lab.
Ballistic Resistance of Police Body Armor.
Final rept.
Mar 85, 17p
Sponsored by National Inst. of Justice, Washington, DC.
Pub. in NIJ (National Inst. of Justice) Standard-0101.02, 17p Mar 85.

Keywords: *Protective clothing, *Armor, *Ballistic deformation, Penetration, Reprints, Kevlar.

The standard establishes minimum performance requirements and methods of test for the ballistic resistance of police body armor. This standard is a revision of NILECJ-STD-0101.01, dated December 1978. This revision adds performance requirements for level III-A, a requirement to test fabric armor for shots impacting the armor at an incident angle of 30 degrees, and a test method that simulates a multishot assault. In addition, the test round velocity for level IV armor has been changed from 838 plus or minus 15 m (2750 plus or minus 50 ft) per second to 868 plus or minus 15 m (2850 plus or minus 50 ft) per second and the allowable time to test the wet conditioned armor has been increased. The scope of the standard is limited to ballistic resistance only and does not address threats from knives or sharply pointed instruments, a different type of threat.

700,920

PB85-207314 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Law Enforcement Standards Lab.
Riot Helmets and Face Shields.
Final rept.
Oct 84, 21p
Sponsored by National Inst. of Justice, Washington, DC.
Pub. in NIJ (National Inst. of Justice) Standard-0104.02, 21p Oct 84.

Keywords: *Protective clothing, *Face shield, *Headgear, Helmet, Reprints.

The standard establishes requirements and methods of test for helmets and face shields to be worn by law enforcement officers during civil disturbances, riots, or other situations that pose a threat of injury from blows to the head. This standard is a revision of and supersedes NIJ Standard-0104.01 dated August 1980. This revision of the standard changes the impact attenuation requirement, deletes the requirement for wet testing of helmets, modifies the requirement and test method for peripheral vision limits, and clarifies test methods and test equipment requirements. The scope of the standard is limited to riot helmets and face shields. It should be noted that they are not designed to offer protection against gunfire.

BUILDING INDUSTRY TECHNOLOGY

Architectural Design & Environmental Engineering

700,921

AD-A154 174/7 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Airborne Sound Transmission Loss Characteristics of Wood-Frame Construction.
Forest Service general technical rept.
F. F. Rudder. Mar 85, 30p Rept no. FSGTR-FPL-43

Keywords: *Sound transmission, *Transmission loss, *Wood, Airborne, Buildings, Construction materials, Data bases, Doors, Laboratory procedures, Measurement, Methodology, Numerical methods and procedures, Predictions, Sound transmission, Transmission loss, Walls, Acoustic absorption, Acoustic materials, Frames, Theory, Acoustic properties, Floors, Ceiling, Wood frame construction.

This report summarizes the available data on the airborne sound transmission loss properties of wood-frame construction and evaluates the methods for predicting the airborne sound transmission loss. The first part of the report comprises a summary of sound transmission loss data for wood-frame interior walls and floor-ceiling construction. Data bases describing the sound transmission loss characteristics of other building components, such as windows and doors, are discussed. The second part of the report presents the prediction of the sound transmission loss of wood-frame construction. Appropriate calculation methods are described both for single-panel and for double-panel construction with sound absorption material in the cavity. With available methods, single-panel construction and double-panel construction with the panels connected by studs may be adequately characterized. Technical appendices are included that summarize laboratory measurements, compare measurement with theory, describe details of the prediction methods, and present sound transmission loss data for common building materials.

700,922

DE85001736 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Correlations of Solar Irradiance and Daylight Illuminance for Building Energy Analysis.
G. Gillette, and S. Treado. Oct 84, 35p ORNL/Sub-81-22201/2
Contract AC05-84OR21400

Keywords: *Daylighting, *Buildings, Cloud Cover, Diffuse Solar Radiation, Direct Solar Radiation, Energy Analysis, Insolation, Seasonal Variations, Standards, Turbidity, ERDA/320100.

The concept of luminous efficacy, the ratio of daylight illuminance to solar irradiance, is investigated for use in building energy analyses. Horizontal and vertical luminous efficacies are evaluated as functions of solar altitude, cloud condition, atmospheric extinction coefficient, turbidity, and season. Based on sky measurements made at the National Bureau of Standards, values of luminous efficacy for total, diffuse, and direct beam radiation are presented. (ERA citation 09:050006)

700,923

PB-263 262/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Representation and Use of Design Specifications.
Interim rept.,
S. J. Fenves, and R. N. Wright. 1975, 27p
Pub. in Proceedings of Symposium on Structural and Geotechnical Mechanics, Urbana, Illinois, October 2-3, 1975. Paper in Structural and Geotechnical Mechanics, p278-304 1977.

Keywords: *Design, *Specifications, Construction industry, Building codes, Computer programming, Graph theory, Performance standards, *Computer aided design, Decision tables.

Design specifications are presented as the primary communication and control tool for the design and construction industry. Requisite properties of completeness, uniqueness, and correctness are identified, and the role of performance and limit state concepts in specifying intent of the specifications are emphasized. Formal representational methods are presented at three levels: decision tables for specification provisions, an information network for related provisions, and argument trees for organizing and outlining. An idealized process for specification development is presented, and the use of the representational tools for checking specifications and providing strategies for textual expression is described and illustrated. Development of computer aids for specification processing in design and conformance checking is described.

700,924

PB-263 883/1 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C. Thermal Engineering Section.
Thermal Performance of a Two-Bedroom Mobile Home.
Final rept.,
G. J. Teitsma, and B. A. Peavy. Jan 77, 101p NBSIR-76-1182
Sponsored in part by Federal Energy Administration, Washington, D.C. Prepared in cooperation with Dow Chemical Co., Midland, Mich.

Keywords: *Mobile homes, *Thermal measurements, *Performance tests, Leakage, Energy, Efficiency, Thermal insulation, Walls, Heat loss, Convection, Seasonal variations, Gas furnaces, Fluid infiltration, Air flow, Two bedroom homes.

Tests were conducted on a mobile home located in an Environmental Climatic Laboratory for the purpose of evaluating its thermal performance. The heating demand greatly affected the part-load efficiency of a gas-fired, forced-air, sealed-combustion furnace system. The practice of installing oversized heating plants is criticized for seasonal operating efficiencies. Air leakage measurements were performed using a pressurization technique. Separate air infiltration tests using the SF6 tracer-gas technique showed how somewhat higher air infiltration rates were induced by operation of the mobile home heating plant. A thermographic survey of interior surfaces showed how the technique used to install the wall insulation may allow wrinkles formed in the surface of the insulation to form air paths running the height of the wall cavity. Convective air flow through these paths may create heat leaks on the building surface which can have an impact on the overall heat-loss rate. Separate tests were also conducted to identify places in the mobile home envelope having high condensation potential.

700,925

PB-266 332/6 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Building to Resist the Effect of Wind. Volume I. Overview.
Building science series (Final),
R. D. Marshall, N. J. Raufaste, and S. A. Kliment.
May 77, 38p NBS-BSS-100-1
Library of Congress catalog card no. 77-600013. Prepared in cooperation with Kliment (Stephen A.), New York.
Also available in set of 5 reports PC E08, PB-266 331-SET.

Keywords: *Residential buildings, *Wind pressure, Design criteria, Disasters, Construction materials, Construction management, Socioeconomic status, Technology transfer, Bangladesh, Philippines, Jamaica, Developing countries, Low rise buildings, Wind resistant structures.

This document presents the background, goals, procedures and results of a project to develop improved design criteria that would make low-rise buildings in developing countries better able to withstand the effects of extreme winds. The project stemmed from the belief that additional research on wind was needed to reduce loss of life and property, human suffering, disruption of productive capacity and costs of disaster relief. The 3 1/2 year project began in early 1973 and produced these results: the development of improved design criteria; a methodology for the estimation of extreme wind speeds; the development of wind tunnel

modeling techniques; a heightened awareness of the wind problem and the need to guard against it; the emergence of useful working relationships between NBS/AID and public and private decision makers in developing countries subject to extreme winds, especially the Philippines, Jamaica and Bangladesh; and the documentation of important information in the areas of wind design speeds and pressure coefficients, economic forecasting, socio-economic and architectural concerns, and construction detailing practices. Also during the project, a program began in the training of professionals and technicians in developing countries to carry out wind measurements and analyses. In addition, methods to ensure transfer of information to user groups were employed.

700,926

PB-266 333/4 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Building to Resist the Effect of Wind. Volume II. Estimation of Extreme Wind Speeds and Guide to the Determination of Wind Forces.
Final rept. 1975,
E. Simiu, and R. D. Marshall. Jul 75, 33p NBS-BSS-100-2
Grant PASA-TA(CE)-04-73
Prepared in cooperation with Kliment (Stephen A.), New York. Library of Congress catalog card no. 77-600013. See also Volume 1, PB-266 332.
Also available in set of 5 reports PC E08, PB-266 331-SET.

Keywords: *Residential buildings, *Wind pressure, Design criteria, Disasters, Construction materials, Construction management, Socioeconomic status, Technology transfer, Bangladesh, Philippines, Jamaica, Developing countries, Low rise buildings, Wind resistant structures.

This paper briefly describes some of the more common flow mechanisms which create wind pressures on low-rise buildings and the effects of building geometry on these pressures. It is assumed that the basic wind speeds are known and a procedure is outlined for calculating design wind speeds which incorporates the expected life of the structure, the mean recurrence interval, and the wind speed averaging time. Pressure coefficients are tabulated for various height-to-width ratios and roof slopes. The steps required to calculate pressures and total drag and uplift forces are summarized and an illustrative example is presented.

700,927

PB-266 334/2 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Building to Resist the Effect of Wind. Volume III. A Guide for Improved Masonry and Timber Connections in Buildings.
Building science series (Final) 1976,
S. G. Fattal, G. E. Sherwood, and T. L. Wilkinson. May 77, 60p NBS-BSS-100-3
Grant PASA-TA(CE)-04-73
Prepared in cooperation with Forest Products Lab., Madison, Wis. Library of Congress catalog card no. 77-600013. See also Volume 2, PB-266 333.
Also available in set of 5 reports PC E08, PB-266 331-SET.

Keywords: *Residential buildings, *Wind pressure, Design criteria, Disasters, Construction materials, Construction management, Socioeconomic status, Technology transfer, Bangladesh, Philippines, Jamaica, Developing countries, Low rise buildings, Wind resistant structures.

This report investigates the use of connectors for masonry and timber elements in low-rise buildings. Connector characteristics and construction details that improve a building's response to extreme wind effects are given primary emphasis. Recommendations include improvements through better utilization of connector technology showing good feasibility of introduction in developing countries. The building systems considered in this study fall within the low to moderate cost category.

700,928

PB-266 335/9 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Building to Resist the Effect of Wind. Volume IV. Forecasting the Economics of Housing Needs: A Methodological Guide.
Building science series (Final) 1976,
J. G. Kowalski. May 77, 40p NBS-BSS-100-4
Grant PASA-TA(CE)-04-73
Library of Congress catalog card no. 77-600013. See also Volume 3, PB-266 334.
Also available in set of 5 reports PC E08, PB-266 331-SET.

Keywords: *Residential buildings, *Wind pressure, Design criteria, Disasters, Construction materials, Construction management, Socioeconomic status, Technology transfer, Bangladesh, Philippines, Jamaica, Developing countries, Low rise buildings, Wind resistant structures.

The Agency for International Development sponsored with the NBS, a 3 1/2 year research project to develop improved design criteria for low-rise buildings to better resist the effects of extreme winds. Housing is probably the single most important consumer good in most economies. Measuring the size of a region's unmet housing need is a first step to planning and implementing improvements in housing conditions. This report analyzes the concept of housing needs in an economic framework. A methodology for estimating and projecting housing needs at the regional level is developed. The methodology attempts to make explicit the income redistribution intent which is the core meaning behind the concept of housing needs. Project results are presented in five volumes. Volume 1 gives an overview of the research activities, accomplishments, results and recommendations. Volume 2 presents a methodology to estimate design wind speeds and a guide to determine wind forces. Volume 3 discusses a guide for improved use of masonry fasteners and timber connectors. Volume 4 furnishes a methodology to estimate and forecast housing needs at a regional level. Socio-economic and architectural considerations of the Philippines, Jamaica and Bangladesh are presented in Volume 5.

700,929

PB-266 336/7 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Building to Resist the Effect of Wind. Volume V. Housing in Extreme Winds: Socio-economic and Architectural Considerations.
Building science series (Final) 1976,
S. A. Kliment. May 77, 41p NBS-BSS-100-5
Grant PASA-TA(CE)-04-73
Prepared by Kliment (Stephen A.), New York. Library of Congress catalog card no. 77-600013. See also Volume 4, PB-266 335.

Keywords: *Residential buildings, *Wind pressure, Design criteria, Disasters, Construction materials, Construction management, Socioeconomic status, Technology transfer, Bangladesh, Philippines, Jamaica, Developing countries, Low rise buildings, Wind resistant structures.

Typical socio-economic conditions in the Philippines, Jamaica, and Bangladesh are identified. These conditions include strong respect for traditional materials and methods of house construction, and suspicion of innovative forms and approaches; a rising proportion of urban poor who live in squatter settlements; and a rising ratio of inhabitants whose incomes are at a level where they cannot afford housing of any kind. The importance of land from a social standpoint is stressed. The report reviews the sites and services concept whereby low income persons are provided a site equipped with basic utilities but must erect and maintain a house upon it. Recommendations include: placement of buildings to exploit terrain; adherence to good practices in the configurations of the main elements of a house (these are shown by means of simple drawings); and use of cheap, strong and locally available materials.

700,930

PB-266 478/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Code Calibration of Extreme Wind Return Periods,
E. Simiu, and B. Ellingwood. Mar 77, 5p
Pub. in Jnl. Struct. Div. ASCE Tech. Notes 103 ST3 p725-729 Mar 77.

Keywords: *Buildings, *Wind pressure, *Building codes, Structural design, Gust loads, Probability, Statistical data, Reprints.

Design wind speeds upon which the Uniform Building Code provisions are based represent the highest fastest mile wind speeds observed in a 39-year period at the recording stations. This study shows that the most likely value of the largest of n maximum yearly wind speeds is nearly equal to the wind speed corresponding to an n-year mean recurrence interval. UBC provisions can thus be directly compared to probabilistic provisions which are based on the return period concept.

700,931

PB-267 167/5 CP **T06**
National Bureau of Standards, Washington, D.C. Building Environment Div.
NBSLD (National Bureau of Standards Load Determination), The Computer Program for Heating and Cooling Loads in Buildings. Release No. 1.
Software,
T. Kusuda, and J. P. Barnett. Apr 77, mag tape NBS-BSS-69-BCD, NBS/DF-77/003
Source tape is in EBCDIC character set. Tape(s) can be prepared in most standard 7 or 9 track recording modes for one-half inch tape. Identify recording mode desired by specifying character set, track, density, and parity. Call NTIS Computer Products if you have questions. Also available as 9-track ASCII.

Keywords: *Software, *Heating load, *Cooling load, *Computer programs, *Buildings, FORTRAN, Conduction, Heat transmission, Heat balance, Transfer functions, Time dependence, Design, Energy requirements, Magnetic tapes, NBSLD computer program, UNIVAC 1108 computers.

A comprehensive computer program called NBSLD, the National Bureau of Standards Load Determination program, has been developed at NBS to reflect the time change of the many building parameters which are pertinent to accurate estimation of energy usage for heating and cooling. Current status of heating and cooling load techniques is reviewed. Of general interest are unique features of NBSLD which are not available in existing computer programs. A summary of various subroutines of NBSLD is given along with the detailed procedures for them. These subroutines constitute the recommended subroutine algorithms of the ASHRAE Task Group on Energy Requirements. Complete Fortran listing of NBSLD and data preparation forms are given for those who wish to use the program. The NBSLD computation is on the basis of the detailed solution of simultaneous heat balance equations at all the interior surfaces of a room or space. Transient heat conduction through exterior walls and the interior structures is handled by using conduction transfer functions. The use of heat balance equations, although time consuming in calculation, can avoid the vagueness and uncertainties inherent in the more popularly used weighting factor approach. In addition, it is more accurate for a specific building design...Software Description: The program is written in the FORTRAN programming language for implementation on a UNIVAC 1108 computer using the UNIVAC 1100 Exec 8, version 33, operating system. 250K of core storage are required to operate the program.

700,932

PB-267 168/3 CP **T06**
National Bureau of Standards, Washington, D.C. Building Environment Div.
NBSLD (National Bureau of Standards Load Determination), The Computer Program for Heating and Cooling Loads in Buildings. Release No. 1.
Software,
T. Kusuda, and J. P. Barnett. Apr 77, mag tape NBS-BSS-69-ASCII, NBS/DF-77/004
Source tape is in ASCII character set. Character set restricts preparation to 9 track one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products, if you have questions. Price includes documentation, PB-267 169. Also available as 7-track BCD.

Keywords: *Software, *Heating load, *Cooling load, *Computer programs, *Buildings, FORTRAN, Conduction, Heat transmission, Heat balance, Transfer functions, Time dependence, Design, Energy requirements, Magnetic tapes, NBSLD computer program, UNIVAC 1108 computers.

A comprehensive computer program called NBSLD, the National Bureau of Standards Load Determination program, has been developed at NBS to reflect the time change of the many building parameters which are pertinent to accurate estimation of energy usage

for heating and cooling. Current status of heating and cooling load techniques is reviewed. Of general interest are unique features of NBSLD which are not available in existing computer programs. A summary of various subroutines of NBSLD is given along with the detailed procedures for them. These subroutines constitute the recommended subroutine algorithms of the ASHRAE Task Group on Energy Requirements. Complete Fortran listing of NBSLD and data preparation forms are given for those who wish to use the program. The NBSLD computation is on the basis of the detailed solution of simultaneous heat balance equations at all the interior surfaces of a room or space. Transient heat conduction through exterior walls and the interior structures is handled by using conduction transfer functions. The use of heat balance equations, although time consuming in calculation, can avoid the vagueness and uncertainties inherent in the more popularly used weighting factor approach. In addition, it is more accurate for a specific building design...Software Description: The program is written in the FORTRAN programming language for implementation on a UNIVAC 1108 computer using the UNIVAC 1100 Exec 8, version 33, operating system. 250K of core storage are required to operate this program.

700,933

PB-267 230/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Application of Thermography for Evaluating Effectiveness of Retrofit Measures,
R. A. Grot, D. T. Harrje, and L. C. Johnston. 1977, 15p
Sponsored in part by National Science Foundation, Washington, D.C. and Energy Research and Development Administration, Washington, D.C.
Pub. in Proceedings of Biennial Infrared Information Exchange (3rd), St. Louis, Mo. 24-26 Aug 76 p103-117 1977.

Keywords: *Residential buildings, *Heat loss, Temperature measuring instruments, Thermography, Effectiveness, Insulation, Infrared detection, *Energy conservation, *Retrofitting, Energy consumption, Reprints.

Retrofit measures in single family dwellings are considered an important part of the overall U.S. energy conservation program. Thermography was used to evaluate the effectiveness of a number of different retrofit measures normally available to the resident-owner. In this study, a group of townhouses was selected which, it was suspected, could benefit by commonly available retrofit measures. These houses were thermographically inspected before and after various retrofit measures were performed. Thermography was found to be an effective tool for evaluating these retrofit measures which decreased the energy consumption by about 25%.

700,934

PB-268 081/7 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C.
43 Rules: How Houses Can Better Resist High Wind,
S. Kliment, N. J. Raufaste, and R. D. Marshall. May 77, 14p NBSIR-77-1197
Grant PASA-TA(CE)-94-73

Keywords: *Residential buildings, *Wind(Meteorology), Design criteria, Construction materials, Construction joints, Fasteners, *Wind resistant structures.

This guide presents to designers, builders, government and private building authorities, and building owners and occupants a series of effective methods for improving the resistance of new and existing buildings against high winds. The methods described may be applied to improving the construction of new buildings as well as to increase the wind resistance of existing buildings. This material offers guidelines for selecting the location and orientation of buildings and the building shapes, for suggesting methods of construction, for recommended building details, and for local production of connectors and fasteners. It covers two common types of construction - masonry and timber - as well as selected details, based on local materials such as bamboo and adobe.

700,935

PB-268 202/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Design, Construction and Operation of a Scanning Radiometer for Measurement of Plane Radiant Temperature in Buildings.
Final rept. FY 1974,
T. H. Benzinger, B. W. Mangum, and J. E. Hill. 1976, 19p
Pub. in Proceedings ASHRAE Semi-Annual Meeting, Seattle, Washington, June 25-July 1, 1976, ASHRAE Trans. 82, p260-278 1976.

Keywords: *Radiometers, Scanning, Temperature measuring instruments, Buildings, Comfort, Human factors engineering.

In order to accurately determine the effect of low-temperature radiation on the thermal comfort of building occupants, a new scanning radiometer has been designed and constructed. The instrument has been constructed. The instrument has been constructed using commercially available semiconductor thermopiles which have been arranged in a chessboard fashion with alternate thermopiles being coated with either a highly absorptive or highly reflective surface. The instrument has been designed to measure the effective temperature in a hemisphere facing the sensor over the temperature range normally encountered in building occupied spaces. It can be used in a stationary position or to 'scan' an occupied space to determine the degree of asymmetry of the radiation.

700,936

PB-268 580/8 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Representation and Use of Design Specifications.
Final rept.,
S. J. Fenves, and R. N. Wright. Jun 77, 55p NBS-TN-940
Also pub. in Structural and Geotechnical Mechanics, 1977. See also Interim report dated 1975, PB-263 262.

Keywords: *Specifications, Construction industry, Building codes, Computer programming, Graph theory, Network flow, Performance standards, *Design specifications, *Computer aided design, Decision tables.

Design specifications are presented as the primary communication and control tool for the design and construction industry. Requisite properies of completeness, uniqueness and correctness are identified, and the role of performance and limit state concepts in specifying intent of the specifications are emphasized. Formal representation methods are presented at three levels: decision tables for specification provisions, an information network for related provisions, and argument trees for organizing and outlining. An idealized process for specification development is presented, and the use of the representational tools for checking specifications and providing strategies for textual expression is described and illustrated. Development of computer aids for specification processing in design and conformance checking is described.

700,937

PB-269 297/8 PC **A10**/MF **A01**
National Bureau of Standards, Washington, D.C. Architectural Research Section.
Window Design Strategies to Conserve Energy.
Final rept.,
S. R. Hastings, and R. W. Crenshaw. Jun 77, 207p NBS-BSS-104
Contract E(49-1)-3800
Sponsored in part by Department of Housing and Urban Development, Washington, D.C.

Keywords: *Buildings, *Windows, Solar heating, Reflective insulation, Ventilation, Design criteria, Window glass, Window glazing, *Daylighting, *Energy conservation.

A multitude of design strategies are available to achieve energy-efficient windows. Opportunities for improving window performance fall into six groups: site, exterior appendages, frame, glazing, interior accessories, and building interior. Design strategies within these groups can improve one or more of the six energy functions of windows: solar heating, daylighting, shading, insulation, air tightness, and ventilation. Included in this report are 33 strategies; an explanation of the physical phenomena responsible for each strategie's energy performance, summarized energy and non-energy advantages and disadvantages; aesthetic considerations; cost approximations; example installations, laboratory studies, or calculations by the authors; and references. Intended readers include professional designers, lessors and owners of commercial space, home buyers and owners, window component manufacturers, and researchers. The report's purpose is to draw attention to the wide range of options currently available to conserve energy with windows.

700,938

PB-272 511/7 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Design and Evaluation Criteria for Energy Conservation in New Buildings,
J. L. Heldenbrand. 26 Feb 76, 107p NBSIR-74-452
Revision of report dated 27 Feb 74. Sponsored in part by National Conference of States on Building Codes and Standards, Inc., McLean, Va.

Keywords: *Buildings, *Energy conservation, Energy management, Design criteria, Heating, Cooling, Ventilation, Dynamic structural analysis.

This document is a set of design and evaluation criteria for energy conservation in most types of new buildings. The National Conference of States on Building Codes and Standards (NCSBCS) requested that the National Bureau of Standards (NBS) develop such a document with the intent that it could serve as a basis for a national standard developed through the voluntary consensus process. The design and evaluation criteria focus on building subelements and service system arrangements. Special provisions offer added flexibility for both conventional and innovative designs. The technical portions of the document are organized into four complementary sections: requirements, criteria, evaluation and commentary. Existing standards and procedures promulgated by organizations such as the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), the American Society for Testing and Materials (ASTM) and the American National Standards Institute, Inc. (ANSI) are referenced whenever possible. The evaluation statements describe how to verify that candidate solutions meet the stipulated criteria. Finally, the commentary statements convey the intent of the criteria and, in a number of cases, explain how the criteria were selected.

700,939

PB-273 946/4 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Radiant Heating in Seamless Flooring - A Feasibility Study.
Final rept.,
P. G. Campbell, M. A. Post, M. Godette, and W. E. Roberts. Jul 77, 31p NBSIR-77-1263
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Assistant Secretary for Policy Development and Research.

Keywords: *Radiant heating, *Floors, *Residential buildings, Radiant heating panels, Electric heating, Feasibility, Performance tests, *Seamless flooring.

The purpose of this study was to determine the feasibility of using radiant heating in seamless flooring as a supplemental heating source in housing units. The resistance of twenty seamless flooring systems to abrasion, flow, impact, flame, stain, moisture and elevated temperature were evaluated using laboratory tests Power requirements and the magnitude and uniformity of surface temperatures of nine electrical heating elements, functioning as radiant heating panels, were experimentally determined and evaluated. The radiant heating panels were coated with selected seamless flooring systems and the performance characteristics of the radiant panel-seamless flooring system were evaluated. The report contains a summary of test results demonstrating the feasibility of the radiant panel-seamless flooring system and the identification of areas for future research.

700,940

PB-274 331/8 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C.
Simplified Procedure for Calculating the Direct Components of Contrast Rendition Factor and Equivalent Sphere Illumination,
J. B. Murdoch. Nov 77, 76p NBSIR-77-1303
Sponsored in part by Department of Energy, Washington, D.C. Div. of Buildings and Community Systems.

Keywords: *Interior lighting, *Commercial lighting, Contrast, Illuminance, Computation, Shadows, Contrast rendition factor, Equivalent sphere illumination.

A procedure is presented which enables the user to compute the direct components of contrast rendition factor (CRF) and equivalent sphere illumination (ESI) for an interior lighting design with the aid of a card-programmable hand calculator. The underlying theory and equations of CRF and ESI are discussed, including a consideration of body shadow, intensity distribution curve interpolations, bidirectional luminance factor approximating equations and Inverse Square approximations. The procedure is designed so that the user is a participant in the computations as they progress and thus is able to modify a lighting design in 'midstream' to improve CRF or ESI. A set of user instructions is included with the calculator programs.

700,941
PB-274 334/2 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C.
Three Proposed Typical House Designs for Energy Conservation Research,
S. R. Hastings. Oct 77, 39p NBSIR-77-1309
Sponsored in part by Energy Research and Development Administration, Washington, D.C., and Department of Housing and Urban Development, Washington, D.C.

Keywords: *Houses, *Energy conservation, Design, Construction materials, Thermal insulation, Heat transfer.

The report provides three house designs typifying the majority of new house construction in the U.S. Included are: scaled drawings detailing the construction of the houses, a breakdown of envelope components by surface area, a schedule of materials with supporting survey statistics from the National Association of Home Builders, a table of heat transfer properties of the specified materials, and recommendations for how these typical house designs can provide a basis for further work in the areas of fire research, durability, security, and environmental behavior in addition to energy conservation.

700,942
PB-274 970/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison of the Thermal Performance of Three Insulating Materials Commonly Used to Retrofit Exterior Frame Walls in Existing Residences.
Final rept.,
D. M. Burch, C. I. Siu, and F. J. Powell. 1976, 12p
Sponsored in part by Federal Energy Administration, Washington, D.C.
Pub. in Proceedings of Annual Meeting of Com. B1, IIF-IIR on Heat and Mass Transfer in Porous Structures, Washington, D.C. 14-16 Sep 76, Bulletin de l'Institut International du Froid (France), v2 p151-162 1976.

Keywords: *Thermal insulation, *Cellulosic resins, *Glass wool, *Urea formaldehyde resins, Synthetic fibers, Thermal conductivity, Residential buildings, Walls, Condensing, Performance, Retrofitting.

The paper describes experimental measurements conducted at the National Bureau of Standards to compare the thermal performance of three different insulating materials commonly used to retrofit the exterior frame walls of existing residential buildings. The insulation materials selected for study were cellulosic fiber, fibrous glass wool, and urea-formaldehyde foam. The thermal conductivities of the three materials were measured using the guarded-hot-plate apparatus according to Standard Method of Test ASTM C 177-71. Heat-transmission and moisture measurements were performed on a full-scale test wall that was exposed to simulated winter conditions in the laboratory. Similar measurements were also conducted on wall sections of a test house insulated with the various materials. Other performance properties such as shrinkage and settling are also reported.

700,943
PB-274 979/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Task Lighting--Another View.
Final rept.,
G. T. Yonemura. Nov 77, 4p
Pub. in Lighting Design Appl., p27-30 Nov 77.

Keywords: *Interior lighting, *Luminous intensity, Illuminating, Energy conservation, Level(Quantity), Human factors engineering, Recommendations, Reprints.

The current North American lighting level recommendations are based on data derived from experiments in which the observers were required to detect the presence of a luminous disc. Experiments were conducted at real world levels, that is, the targets are seen 100% of the time but with differing levels of goodness of seeing. Under these suprathreshold conditions the behavior of the eye is different from that obtained under threshold conditions. Experiments were conducted with gratings and alphabets as test objects. The threshold function is monotonic, that is, contrast required for detection decreases monotonically as luminance is increased, whereas the suprathreshold experiments result in a function with a minimum or optimum luminance level. The implementation of these findings as a reference base for recommending levels of illumination are discussed.

700,944
PB-275 126/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Vapor Condensation in Air-Pervious Insulation.
Final rept.,
T. Kusuda, and W. Ellis. 1976, 12p
Pub. in Proceedings of Annual Meeting of Com. B.1, IIF-IIR on Heat and Mass Transfer in Porous Structures, Washington, D.C. 14-16 Sep 76, Bulletin de l'Institut International du Froid, v2 p139, 150 1976.

Keywords: *Thermal insulation, Cold storage, Barrier coatings, Glass textiles, Water vapor, Condensation, Degradation.

Theoretical and experimental studies were conducted on moisture accumulation problems in air-pervious insulation subjected to a steep temperature gradient. The principal test wall studied was a wooden partition for a cold storage installation consisting of warm-side vapor barrier, six inches of fibrous glass insulation, and a one-inch fibrous-glass interior finish board. Experimental data indicated that moisture accumulation became serious only when the vapor barrier was punctured both at the top and bottom of the test wall, thus causing a convective air in-flow at the top and outflow at the bottom. The data further showed that with this type of leakage, most of the moisture accumulation occurred only at the top region of the wall. A small scale apparatus was used to test the moisture accumulation and drying-out performance of tube-type specimens that represent a portion of an insulated exterior wall subjected to simultaneous flow of air, moisture, and heat. These test results show that a slight air pressure differential across the insulation has much stronger influence on the vapor condensation problem than the much higher water vapor pressure differential.

700,945
PB-275 127/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
SATG: A Useful Concept for Window Heat Gain Analysis.
Final rept.,
T. Kusuda. 1977, 11p
Pub. in Proceedings of RILEM/ASTM/CIB Symposium on Evaluation of External Vertical Surfaces of Buildings, Helsinki, Finland 28 Aug-2 Sep 77 p157-167 1977.

Keywords: *Heat transfer, *Windows, Window glass, Solar heating, Gain, Thermal analysis, SATG concept.

In an effort to evaluate the combined effect of solar heat gain and conduction heat transfer window glass, a new concept called SATG is introduced. SATG is the sum of the outdoor temperature plus the solar heat gain divided by the overall heat transfer coefficient. It represents a maximum possible temperature that space behind the window can attain, had there been no heat loss. Hourly SATG values for the single- and double-glaze windows of various orientations were determined by using ten years weather record of Washington, D.C. and were represented in the form of a frequency histogram. Also developed from these data are hourly solar-air degree hours as an index to evaluate the net heat transfer through windows.

700,946
PB-275 147/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Infrared Technique for Measuring Heat Loss.
Final rept.,
D. M. Burch, and T. Kusuda. 1977, 11p
Pub. in RILEM/ASTM/CIB Symposium on Evaluation of Performance of External Vertical Surfaces of Buildings, Helsinki, Finland 28 Aug-2 Sep 77 p62-72 1977.

Keywords: *Heat loss, *Infrared thermal detectors, *Thermal measuring instruments, Television systems, Heat transmission, Heat measurement, Heat flux, Buildings, Walls.

The paper describes a newly developed technique for estimating heat-loss rate, using an infrared television system. A device called a heat-flow reference pad was developed that makes it possible to estimate quantitatively the heat-loss rate at the surface of a building without the need for a conventional heat-flow meter to be mounted on the surface. The infrared measurement technique predicted heat-loss rates in the laboratory and field within approximately 12%.

700,947
PB-275 410/9 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
National Cancer Institute's Emergency Virus Isolation Facility: A Case Study for Use in Developing a Methodology of Post-Occupancy Evaluation.
Final rept.,
G. E. Turner, J. Elder, and A. I. Rubin. Dec 77, 70p NBSIR-77-1402
Sponsored in part by National Institutes of Health, Bethesda, Md. Engineering Design Branch.

Keywords: *Viruses, *Biological laboratories, Hazardous materials, Safety, Methodology, Isolation, Malignant neoplasms, Architecture, Buildings, Design, Evaluation, Interviews, Models, Recommendation, Construction management, Environmental engineering, Medical research, *National Cancer Institute, Cancer.

The National Cancer Institute's Emergency Virus Isolation Facility is a laboratory building designed to provide an experimental research environment for all levels of hazardous work related to virus-cancer research. This report represents an attempt to develop a generalizable model for building evaluation through the analysis of the pre-design programming process and the post-construction operation management of the facility.

700,948
PB-276 394/4 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Noise Criteria for Buildings: A Critical Review.
Special pub.,
S. L. Yaniv, and D. R. Flynn. Jan 78, 86p NBS-SP-499
Sponsored in part by Environmental Protection Agency, Washington, D.C. Office of Noise Abatement and Control. Library of Congress catalog card no. 77-18709.

Keywords: *Buildings, *Noise pollution, Acoustic measurement, Psychological effects, Noise reduction, Building codes, Sound transmission, *Noise sources, *Environment pollution.

A review is given of existing criteria that could be applied to rating the noise environment in dwellings, to rating noise isolation between dwellings, and to rating noise isolation from outside to inside a dwelling. It is concluded that the central problem is to select appropriate criteria for rating the interior noise environment. Once this is done, criteria for noise isolation can be derived directly and these in turn can be used to derive performance requirements for building elements, such as partitions and exterior walls.

700,949
PB-278 601/0 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Thermal Performance of a Two-Bedroom Mobile Home.
Final rept.,
G. J. Tietsma, and B. A. Peavy. Feb 78, 63p NBS-BSS-102
Prepared in cooperation with Dow Chemical Co., Midland, Mich. Sponsored in part by Federal Energy Administration, Washington, D.C. Supersedes rept. no. NBSIR-76-1182, PB-263 883.

Keywords: *Mobile homes, *Thermal measurements, Performance tests, Thermal insulation, Energy conservation, Heat loss, Seasonal variations, Thermography, Air flow, Trailers, Houses, Thermal efficiency, Two bedroom homes, Tracer gases.

Tests were conducted on a mobile home located in an Environmental Climatical Laboratory for the purpose of evaluating its thermal performance. The heating demand greatly affected the part-load efficiency of a

gas-fired, forced-air, sealed-combustion furnace system. The practice of installing oversized heating plants was shown to result in low seasonal operating efficiencies. Air leakage measurements were performed using a pressurization technique to quantify the amount of air leakage through the various parts of the mobile home. Separate air infiltration tests using the SF6 tracer-gas technique showed that somewhat higher air infiltration rates were induced by operation of the mobile home heating plant. A thermographic survey of interior surfaces showed that the technique used to install the wall insulation may allow wrinkles formed in the surface of the insulation to form air paths running the height of the wall cavity. Convective air flow through these paths may create heat leaks on the building surface which can have an impact on the overall heat-loss rate. Separate tests were also conducted to identify places in the mobile home envelope having high condensation potential.

700,950
PB-278 619/2 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Simplified Analysis of Thermal and Lighting Characteristics of Windows: Two Case Studies.
Final rept.,
T. Kusuda, and B. L. Collins. Feb 78, 111p NBS-BSS-109
Sponsored in part by Energy Research and Development Administration, Washington, D.C. and Department of Housing and Urban Development, Washington, D.C. Library of Congress Catalog Card no. 77-600071.

Keywords: *Windows, *Architecture, Human factors engineering, Energy conservation, Heating load, Cooling load, Illuminating, Office buildings, Residential buildings, Structural analysis.

Results of a simplified analysis for annual heating, cooling, and lighting requirements associated with windows are presented. The analysis includes the effects of window size, heat transfer, solar shading, and compass orientation for typical commercial and residential modules located in a climate typical of Washington, D.C. Three different modes of operation with respect to heating and cooling requirements through windows were assessed: external loads only; external and internal; and external, internal, and daylight. In addition, the effects of selective fenestration heat-transfer management, such as planned employment of thermal shutters and shading devices, and off-hour temperature setback were considered. This analysis assumed that daylight could replace or supplement artificial light whenever it could supply a specified minimum level of illumination. The use of daylight was found to offer the greatest potential for reducing energy costs, particularly when combined with selective fenestration management.

700,951
PB-278 621-T PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Building Research Translation: French Acoustical Comfort Standards.
Final rept.,
S. G. Weber. Mar 78, 71p NBS-TN-710-8
Trans of Centre Scientifique et Technique du Batiment, Paris. Cahiers (France) n168, Apr 76 (Cahier 1373). Tr. by Information Simplified, Inc., Alexandria, Va. See also PB-280 055-T.

Keywords: *Residential buildings, *Noise reduction, Building codes, Acoustic insulation, Ceilings(Architecture), Sound transmission, Walls, Floors, Noise pollution, France, Translations.

This report offers methods of providing levels of residential acoustical comfort which meet French specifications contained in the French order of June 1969, and some methods which may facilitate meeting the more stringent requirements of the Acoustical Comfort Standard. Two levels of solutions are thus identified: first, those which meet the basic French building code regulations; and, second, those which can bring dwelling units up to the French Acoustical Comfort Standard. Recent advances in acoustical knowledge as applied to residential construction created a need for this revision to the earlier edition to provide new examples of solutions which meet building code requirements as well as solutions qualifying for the Acoustical Comfort Standard Label.

700,952
PB-280 055-T PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Building Research Translation--Discomfort Due to Wind Near Buildings: Aerodynamic Concepts.
Final rept.,
J. Gandemer. Mar 78, 51p NBS-TN-710-9
Trans. of Centre Scientifique et Technique du Batiment, Paris. Cahiers (France) n170, Jun 76 (Cahier 1384). Tr. by Information Simplified, Inc., Alexandria, Va. See also PB-278 621-T.

Keywords: *Buildings, *Wind(Meteorology), *Aerodynamic loads, Wind pressure, Fluid flow, Gust loads, Wind tunnel models, Flow visualization, France, Translations.

Flow patterns at ground level in groups of buildings result from the complex interaction between the wind (impact, average speed distribution with height, and turbulance) and the buildings themselves (shapes, sizes, arrangements, etc). The increase in the number of very tall structures and the more or less arbitrary, with respect to wind, placing of large structures have frequently demonstrated the lack of adaptation of the structural environment to wind phenomena. Manifestation at ground level, such as zones of high speeds or eddies, make the approach to buildings uncomfortable (sometimes even dangerous) for the pedestrian. Elimination of these problems requires better knowledge of air flows around structures and formulation of practical plans that the architect or city planner can use in designing larger structural units. This report summarizes work carried out at the CSTB institute in Nantes in 1973 and 1974 and gives the main results of the study A guide is included which furnishes simple rules or practical advice that can be used by architects and city planners.

700,953
PB-280 546/3 Not available NTIS
National Bureau of Standards, Washington, D.C.
Automated Air Infiltration Measurements and Implications for Energy Conservation.
Final rept.,
D. T. Harrje, and R. A. Grot. 1977, 8p
Sponsored in part by Department of Energy, Washington, D.C., and National Science Foundation, Washington, D.C. Applied Science Research Applications.
Pub. in Proceedings of International Conference on Energy Use Management, Tucson, Arizona, October 24-28, 1977, p457-464 1977.

Keywords: *Energy conservation, *Space heating, *Buildings, Sulfur hexafluoride, Gas chromatography, Laboratory equipment, Monitoring, *Tracer studies, *Air infiltration.

In the average home approximately one third of the energy for space heating is lost through air infiltration. The driving forces for air infiltration often become more severe in larger buildings. Correlation of air infiltration with parameters that are building-related (cracks, seals, porosity, etc.), occupant-related (door, vent, window openings, etc.) weather-related (wind direction, and intensity, outside temperature, etc.) and terrain-related (nearby structures, trees, fences, etc.) has required the development of specialized monitoring equipment. Using sulphur hexafluoride as a tracer gas, using automated procedures for seeding the gas into the building, and measuring the subsequent concentration decay, air infiltration has been measured for a wide range of cicumstances. The details of the instrumentation presented here include: injection procedures, sampling methods, detection of the appropriate gas chromatograph concentration peak, and recording the data on magnetic tape for easy retrieval for computer calculations. The data resulting from such air infiltration instrumentation uses are providing the basis for improved energy modeling in buildings, evaluation of energy conserving retrofits, new and old building inspection, and a better evaluation of other air infiltration measurement techniques.

700,954
PB-282 133/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sampling Errors in Estimation of Extreme Winds.
Final rept.,
E. Simiu, J. Bietry, and J. J. Filliben. Mar 78, 11p
Grant NSF-ENV77-16113
Pub. in Jnl. Struct. Div. Am. Soc. Civ. Eng. 104 nST3 p491-501 Mar 78.

Keywords: *Skyscrapers, *Wind pressure, Gust loads, Dynamic response, Building codes, *Tall buildings.

The closure to the paper 'Equivalent Static Wind Loads for Tall Building Design' published in April 1976 is presented following four discussions of the paper published in the February 1977, April 1977, June 1977, and October 1977 issues of the ASCE Journal of the Structural Division.

700,955
PB-282 866/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Human Response to Windows.
Final rept.,
B. L. Collins. 1977, 12p
Pub. in Proceedings of RILEM/ASTM/CIB Symposium Evaluation Performance External Vertical Surfaces of Buildings, Otaniemi, Espoo, Finland, 28 Aug-2 Sep 77, v1 p327-338 1977.

Keywords: *Windows, *Environmental engineering, *Comfort, Psychological effects, Illuminating, Esthetic properties, Ventilation, Daylighting, Energy conservation, Glare, Interior decorating, Temperature.

Research into human reaction to windows must consider several different types of response. Windows provide important psychological benefits. They afford a view out, with necessary and desired information about the external world. In addition, they provide dynamic change within a space through continuous variations in external lighting. In addition, one type is that of the physical impact of the window upon comfort, and the problems brought up by such areas as temperature, vision, and noise. Finally, it is important to consider the actual use of windows. The way in which people actually use windows and window accessories can be critical to the acceptable performance of glazed areas. Different experimental techniques for assessing these types of response are reviewed, along with pertinent results from different researchers.

700,956
PB-283 011/5 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Determination and Verification of Thermal Response Factors for Thermal Conduction Applications.
Final rept.,
B. A. Peavy. Apr 78, 34p NBSIR-77-1405

Keywords: *Heat transfer, *Thermal conductivity, *Buildings, Heat flux, Partial differential equations, Walls, Ceilings(Architecture), Floors, Computer programs, Fortran, Fortran 5 programming language, UNIVAC-1108 computers.

The program computes thermal response factors of multi-layer building constructions (one to seven layers) for thermal conduction applications. Provision is made for including or excluding surface film thermal resistances. Input includes time increment (1 hour, 1/2 hour, etc.), number of layers, thermal properties and descriptions of each layer. Output includes the thermal response factors, X, Y and Z. The main program is amendable to use as a subprogram in a larger program for use in thermal conduction applications.

700,957
PB-283 722/7 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Center for Building Technology.
Air Leakage Measurements in Three Apartment Houses in the Chicago Area,
C. M. Hunt, J. Porterfield, and P. Ondris. Jun 78, 28p NBSIR-78-1475

Keywords: *Apartment buildings, *Air circulation, *Leakage, Thermal measurements, Thermal insulaton, Air flow, Illinois, *Air infiltration, Chicago(Illinois).

Air infiltration measurements were made in three apartment houses in the Chicago area using SF6 as a tracer gas. Two were in tenement districts and one was suburban. Data were collected in selected apartments in each building, and these data were used to estimate the infiltration rate for the entire building. Whole building estimates of 0.94 and 1.2 air changes per hour were obtained under the conditions of tests in the tenement apartments, and 0.82 air changes per hour in the suburban apartment. Comparisons of the tightness of individual dwelling units by fan pressurization-depressurization techiques were also made. The

suburban apartment was found to be much tighter than the other two apartments. The difference was much greater than predicted by the tracer tests. An analysis of the ASHRAE Crack Method is also made. (Portions of this document are not fully legible)

700,958
PB-284 497/5 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Center for Building Technology.
Effects of Moisture in Built-Up Roofing--A State-of-the-Art Literature Survey.
Final rept.,
H. W. Busching, R. G. Mathey, W. J. Rossiter, and W. C. Cullen. Jul 78, 81p NBS/TN-965
Sponsored in part by Civil Engineering Lab. (Navy), Port Hueneme, Calif., and Department of the Air Force, Washington, D.C.

Keywords: *Buildings, *Roofing, *Moisture, Roofs, Heat loss, Nondestructive tests, Radiation measuring instruments, Gravimetric analysis, Capacitive reactance, Thermography, Electrical resistance, Microwave equipment, Bibliographies, *Roofing materials.

A literature review of the effects of moisture on built-up roofing was made. Quantitative data were summarized for some properties of membrane roofing including: permeability, absorption, thermal expansion, thermal resistance, tensile strength, modulus, and fungus attack resistance. Example calculations of possible temperature and moisture gradients for two typical roof sections were presented. Nondestructive evaluative methods to locate moisture in roofing systems were summarized and include gravimetric, nuclear, capacitance, infrared imagery, electrical resistance, and microwave methods. A review of techniques to dissipate moisture in roofing is presented.

700,959
PB-284 988/3 PC **A06**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C.
Design Guide for Reducing Transportation Noise In and Around Buildings.
Final rept.,
D. S. Pallett, R. Wehrli, R. D. Kilmer, and T. L. Quindry. Apr 78, 109p NBS-BSS-84
Library of Congress Catalog Card no. 76-58340.

Keywords: *Buildings, *Noise reduction, *Design criteria, Noise pollution, Environmental protection, Environmental engineering, Site surveys, Aircraft noise, Acoustic measurement, Instructional materials, *Transportation noise, *Environmental noise, *Noise levels, *Instruction manuals.

This design guide presents a unified procedure for the selection of noise criteria in and around buildings, for the prediction of exterior and interior noise levels arising as a consequence of transportation systems operations, and for the evaluation of the adequacy of building designs with regard to environmental noise. Noise criteria levels are suggested in terms of equivalent sound levels (Leq). Simplified predictive methods enable the estimation of noise levels arising as a consequence of highway, railway, and aircraft operations. The sound isolation provided by the building shell is estimated by means of a new single-figure rating system. Finally, design manipulations which may make possible the improvement of the acoustic conditions in and around buildings are suggested.

700,960
PB-285 145/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Wind Direction on the Static and Dynamic Wind Loads on a Square Section Tall Building.
Final rept.,
T. A. Reinhold, P. R. Sparks, H. W. Tielman, and F. J. Maher. May 78, 17p
Grant NSF-ENG75-05327-A01
Pub. in Proceedings Collow. on Industrial Aerodynamics (3rd), Aachen, Germany on Jun 14-16, 1978. Paper in Building Aerodynamics, pt1 p263-279 (Fluid Mechanics Lab., Dept. of Aerodynamics, Fachhochschule-Aachen, Germany, May 1978)

Keywords: *Skyscrapers, *Wind pressure, Gust loads, Dynamic pressure, Dynamic response, Dynamic loads, Wind tunnel models, *Tall buildings.

This paper presents the results of a wind-tunnel investigation into the effect of wind direction on the wind loads on a square cross-section building model with sharp corners and an aspect ratio of 8.33 to 1. The studies were carried out in a flow which simulated the mean and turbulent properties expected for an urban boundary layer wind. The static and dynamic wind loads were determined at 6 levels throughout the height of the model. From these loads, local and overall force coefficients were determined for forces normal to the model's faces and for torques about the vertical axis through the geometrical center of the model cross-section. These coefficients are presented together with spectra for the modal forces and modal torques associated with the fundamental translational and modes of the corresponding full structure. Results indicate that the greatest mean forces do occur when the wind is normal to a building's face but that this is not the case for the mean torques. At certain wind directions mean forces are very sensitive to changes in direction. The dynamic loads suggest that the greatest translational response of the full-scale building would occur in the cross-wind direction with the wind blowing in a direction normal to a face. The greatest dynamic torsional response would also be associated with that direction.

700,961
PB-287 413/9 PC **A05**/MF **A01**
National Trust for Historic Preservation, Washington, DC.
Assessment of Current Building Regulatory Methods as Applied to the Needs of Historic Preservation Projects.
Final rept.
R. V. Keune, and P. Cooke. Oct 78, 90p NBS/SP-524
Contract NBS-6-13981

Keywords: *Architecture, *Buildings, Regulations, Safety, Objectives, Requirements, Criteria, Tests, Standards, Health, Building codes, Research, *Historic preservation.

To meet contemporary health and safety requirements as defined by the building regulatory system, conflicts frequently occur with the needs of historic building preservation projects. This project: (1) identified, evaluated and proposed historic preservation categorical definitions as applied to buildings; (2) developed performance objectives, requirements, criteria and tests for each definition category; and (3) identified and assessed those current methods most commonly used by regulatory jurisdictions to mitigate adverse impacts on building preservation projects.

700,962
PB-290 043/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Note on Response Factors and Conduction-Transfer Functions.
Final rept.
B. A. Peavy. 1978, 3p
Pub. in Proceedings Symposium American Society of Heating and Air-Conditioning Engineers Annual Meeting, Atlanta, GA., January 29-February 2, 1978, ASHRAE Trans. 84, Pt 1, p688-690 1978.

Keywords: *Buildings, *Heating load, *Cooling load, Transfer functions, Heat transfer, Dynamic response, Conduction, NBSLD computer program.

The thermal response factor technique for calculating dynamic heat conduction through walls, floors, and roofs is used in many computer programs for determining building heating and cooling loads. Considerable computation time and computer memory space are devoted to the use of this technique, and it is advantageous to reduce the time and space required. Reduction in computation time and computer memory space can be achieved by the use of the zeroth through fifth-order conduction-transfer functions. Computation time can be reduced by about one-half, and it is possible to reduce the memory space to one-fourth of that presently used in the computer program NBSLD.

700,963
PB-291 797/9 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Analysis of the Behavior of Stair Users.
J. A. Templer, G. M. Mullet, J. Archea, and S. T. Margulis. Nov 78, 74p NBSIR-78-1554
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD. Directorate for Engineering and Science. Prepared in cooperation with Georgia Inst. of Tech., Atlanta. Coll. of Architecture.

Keywords: *Stairways, *Product safety, Consumer affairs, Design, Safety, User needs, Hazards, Accident prevention, Video tapes, Safe landing, Recommendations, Standards, Human behavior.

The National Bureau of Standards has conducted research for the Consumer Product Safety Commission the objective of which is to recommend ways to reduce the frequency and severity of stair and landing accidents. One of the several approaches to identifying stair hazards is to videotape stair use in a variety of public settings. About 50 hours of videotape of stair use have been collected and it has been processed in various ways to provide information on typical human responses to stairs and landings. This report of an analysis of videotape of stair use focuses on the relationship between the occurrence of incidents, including falls, and the stair users' characteristics, user behavior, and environmental conditions. The analysis relies, in part, on a comparison of matched samples of incident and non-incident user groups. Based on the findings of the analysis, a literature review, and other research on stair use by the authors, 44 performance statements are proposed which, if applied to stair design, should substantially reduce the frequency and severity of stair accidents.

700,964
PB-292 202/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Exit Emergency: A Blueprint for Design Standards Research.
Interim rept. Apr-Jul 78.
F. I. Stahl. Feb 79, 13p
Pub. in Construction Specifier p65-77, Feb 79.

Keywords: *Buildings, *Architecture, *Landscaping, Barriers, Fire safety, Human factors engineering, Handicapped persons, Hazards, Design standards, Regulations, Research, Accessibility, Emergencies, Physically handicapped persons.

Needs for a more complete and effective technical basis for design standards impacting occupants' access to, movement within, and egress from buildings and building sites are discussed. It is suggested that a major cause of injury and death from fire, and of inconvenience and psychological stigmatization to physically handicapped persons, results (even in code-complying buildings and sites) from adherence to design regulations which are narrowly founded upon physical and engineering principles alone. This paper recommends that psychological aspects of dangerous and stressful situations guide the development of standards for emergency egress facility design, and that such therapeutic objectives as 'normalization' guide development of barrier-free design regulations. Finally, the paper outlines particular programmatic themes and research tasks, and discusses the role of the National Bureau of Standards in improving the technical basis for egress and accessibility design regulations.

700,965
PB-292 928/9 PC **A07**/MF **A01**
Buffalo Organization for Social and Technical Innovation, Inc., NY.
Home Safety Guidelines for Architects and Builders.
D. Alessi, and M. Brill. Dec 78, 126p NBS/GCR-78/156
Contract EO-AOI-78-00-3511

Keywords: *Residential buildings, *Accidents, Stairways, Windows, Baths, Doors, Accident prevention, *Home accidents.

This document has as its goal the analysis, organization and presentation of state-of-the-art information on home accidents and ways to reduce their frequency and/or severity. It is intended to be used in the design and rehabilitation of dwellings and its primary users are intended to be architects, followed by homebuilders, product designers and homeowners. The National Electronic Injury Surveillance System (NEISS) of the U.S. Consumer Product Safety Commission (CPSC), collects and organizes accident data according to product, frequency, severity of injury and on age and sex of accident victims. These data are statistically representative of accidents occurring nationwide, as are the injury costs associated with each accident type. Using this substantial and elegant data base, several sophisticated analyses of accidents involving the fixed architectural elements of homes, such as stairs, floors, bathtubs and showers, doors, and windows have recently been undertaken under the sponsorship of various government agencies. This series of analyses has resulted in a much clearer picture of how

accidents involving these housing elements occur and of their associated costs to the nation. This document brings together these research findings as a guide to design and construction.

700,966
PB-294 856/0 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Environmental Design Research Div.
Pedestrian Movement on Ramps - A Preliminary Investigation.
G. E. Turner, and B. L. Collins. Mar 79, 64p NBSIR-79-1729

Keywords: *Public buildings, *Ramps, *Pedestrians, Stairways, Passageways, Performance, *Pedestrian traffic flow.

The research investigates pedestrian movement characteristics on two specific building ramps. Variables of pedestrian movement such as speed, flow, and area were studied, as well as the relationships between these variables. In addition, the specific measurements of speed, flow and area were compared with similar measurements determined by other researchers not only for ramps, but also for stairs and level surfaces. Finally, suggestions were made for additional research into the characteristics of pedestrian movement on various elements of the building circulation system.

700,967
PB-294 993-T PC **A11**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Planning for Foot Traffic Flow in Buildings.
V. M. Predtechenskii, and A. I. Milinskii. c1978, 248p TT-75-52054
Trans. of mono. Proektirovanie Zhdanii s Uchetom Organizatsii Dvizheniya Lyudskikh Potokov, Moscow, 1969. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Public buildings, *Pedestrians, *Passageways, Architecture, Design, Coordination, Layout, Traffic, Translations, USSR, *Foreign technology, Traffic flow.

This book presents the methodology and results of experimental and theoretical study of the movement of people, the fundamentals of the theory and the calculation of the process, as well as practical recommendations for incorporating the findings in the planning and design of public buildings. The material is presented in such a way that it could serve simultaneously as a text for advanced engineering students and as a practical handbook to aid in the design of large public buildings and connecting passageways for large flows of foot traffic.

700,968
PB-295 338/8 PC **A06**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Economic Evaluation of Windows in Buildings: Methodology.
Building science series.
R. T. Ruegg, and R. E. Chapman. Apr 79, 116p NBS-BSS-119
Library of Congress catalog card no. 79-600042.

Keywords: *Buildings, *Windows, *Cost analysis, Residential buildings, Commercial buildings, Environmental engineering, Thermal efficiency, BASIC(Programming language), Computer programs, *Life cycle costs, *Energy conservation.

This study, which is one part of a National Bureau of Standards interdisciplinary project on windows, is aimed at improving the cost-effectiveness of window selection and use in buildings. It develops and illustrates a life-cycle costing evaluation model and computer program for assessing for alternative window systems the net dollar impact of acquisition, maintenance and repair, heating and cooling energy gains and losses, and artificial lighting and daylighting tradeoffs. The method is applicable to the evaluation of many different window sizes: designs, accessories, and uses, both for new and existing residential and commercial buildings. Two step-by-step examples of evaluating selected window alternatives in a residence and in an office building in Washington, DC. serve to illustrate the application of the method. A companion report, A Regional Economic Assessment of Selected Window Systems, presents the results of eight additional residential case studies and eight additional commercial case studies. While the emphasis of this report is on the method of evaluation, the companion report focuses on summarizing the results of a regional analysis in a form that will be convenient for use by building owners, operators, designers, financiers, and builders, those whose interest centers on the actual implementation of research results.

700,969
PB-295 444/4 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Thermal and Service Systems Div.
Low-Cost Method for Measuring Air Infiltration Rates in a Large Sample of Dwellings.
R. A. Grot. Apr 79, 14p NBSIR-79-1728
Sponsored in part by Community Services Administration, Washington, DC.

Keywords: *Residential buildings, *Air flow, *Flow measurement, Gas sampling, Environmental engineering, Leakage, Heat loss, Weatherproofing, Air infiltration, Tracer gases.

A method for collecting air infiltration data in a large sample of dwellings is presented. The method consists of a tracer gas dilution technique employing air sample bags which are analyzed in a central laboratory. The method will be applied to a Community Services Administration optimal weatherization demonstration in approximately 300 dwellings on 16 sites throughout the United States. The method will yield air exchange rates under typical heating season condition for each dwelling in the demonstrations. Preliminary data on air infiltration rates in low-income housing in Portland, Maine are presented.

700,970
PB-295 551/6 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Center for Building Technology: A Perspective - 1979.
M. Olmert. May 79, 33p NBS-SP-439-1
Library of Congress catalog card no. 79-600060. See also report dated Jan 76, PB-250 856.

Keywords: *Buildings, *Construction, *Laboratories, Safety, Construction materials, Environmental engineering, Research, Tests, National Bureau of Standards, Center for Building Technology, Federal agencies, *Energy conservation.

This report presents an overview of the National Bureau of Standards Center for Building Technology's research, its accomplishments, and ongoing projects. The mission of the Center for Building Technology is threefold: (1) to advance building technology by providing technical and scientific bases for criteria and standards that improve the usefulness, safety, and economy of buildings; (2) to provide technical assistance to all sectors of the buildings community; and (3) to develop improved techniques by which the end-users in buildings, communities and industrial processes can conserve energy.

700,971
PB-297 704/9 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Study of the Dynamic Flue-Gas Temperature and Off-Period Mass Flow Rate of a Residential Gas-Fired Furnace.
Final rept.
C. Park, W. J. Mulroy, and G. E. Kelly. Jul 79, 44p NBS-TN-999
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Gas furnaces, Flue gases, Temperature, Mass flow, Flow rate, Residential buildings, Efficiency, Fuel consumption, Damping.

The flue-gas temperature and mass flow rate through a gas-fired furnace were studied in the laboratory. Temperature profiles were measured under cycling conditions and compared with profiles predicted mathematically using data obtained while the furnace was cooling down from steady-state operation and warming up from equilibrium. The mass flow rates at various flue-gas temperatures were measured using both a vane anemometer and a tracer-gas technique, and these results are compared with the mass flow rate predicted by the theoretical equations. The effect on the off-period flow rate of automatic stack dampers having different sized damper openings was experimentally determined. Theoretical equations are presented for predicting the effectiveness of a stack damper as a function of the ratio of the area of the damper to the area of the stack and a system friction factor.

700,972
PB-298 784/0 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Use of Aerial Infrared Thermography to Compare the Thermal Resistances of Roofs.
Final rept.
D. M. Burch. Aug 79, 43p NBS-TN-1107
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Roofs, *Thermal resistance, Thermography, Infrared detection, Aerial surveys, Heat loss, Thermal radiation, Energy audits, Energy conservation.

The paper investigates whether a comparative roof survey using aerial infrared thermography can be used to rank the roofs of residential and commercial buildings according to their thermal resistance. Mathematical models are presented for predicting the apparent radiance temperatures of these roof systems. These models are used to investigate the differences in apparent radiance temperature between roofs having various thermal resistances. These predicted differences are then compared with predicted differences in apparent radiance temperature caused by typical variations in roof emittance, local outdoor temperature, and local wind speed throughout the macroclimate. The transmission characteristics of the atmosphere are reviewed, and the required dew-point spread for preventing dew or frost formation on a roof is examined.

700,973
PB-299 448/1 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Thermal and Service Systems Div.
Computer Analysis of Energy Requirements in Single-Family Residences: A Limited Case Study of the Effects of Envelope Design.
Final rept. Feb-Jun 75.
W. L. Carroll, and J. P. Barnett. Jul 79, 32p NBSIR-79-1732
Sponsored in part by Department of Housing and Urban Development, Washington, DC.

Keywords: *Residential buildings, *Houses, Heating load, Cooling load, Windows, Doors, Walls, Roofs, Thermal insulation, Thermal efficiency, Structural design, Variations, Computerized simulation, *Energy consumption, *Energy analysis, Energy requirements.

A number of design variations of a typical one-story single-family residence were analyzed to determine annual heating and cooling energy requirements. The National Bureau of Standards Load Determination computer program, NBSLD, was used to accomplish the analysis. Design details for each of the residence variations are described in detail. Annual heating and cooling energy requirement calculations are presented and discussed.

700,974
PB-300 706/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Instrumentation for Monitoring Energy Usage in Buildings at Twin Rivers.
Final rept.,
D. T. Harrje, and R. A. Grot. 1978, 7p
Sponsored in part by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Energy and Buildings, 1, p293-299 1977/78.

Keywords: *Energy, *Measuring instruments, Temperature measuring instruments, Consumption, Buildings, Monitoring, Monitors, Reprints, *Energy use, Twin Rivers Project.

The measurement systems used at Twin Rivers for determining energy usage are described. These include a weather station, three different systems for the measurement of temperatures and energy-related events in a house, automated devices to measure the air infiltration rate, and infrared thermography. Each of these systems playd a role in assessing the actual usage of energy in individual buildings, in identifying the factors that determine energy consumption, and in checking

the accuracy of theoretical models for predicting the energy performance of dwellings.

700,975
PB77-600018
(Order as PB276 556, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Fundamentals of Bulding Heat Transfer.
T. Kusuda. 1977, 10p
Included in Jnl. of Research of the National Bureau of Standards, v82 n2 97-106 1977.

Keywords: Air-leakage, *Heat transfer, Energy analysis, *Heat and cooling loads, Heat loss and Heat gain, Multiroom problems.

Basic problems and unique features of building heat transfer are described in relation to the heating and cooling load calculation, which is a starting point for building energy consumption analysis and equipment sizing. Detailed discussion is given of the relationship between heat loss (heat gain) and heating load (cooling load). Also outlined is a discussion of the multispace heat transfer problems in which the air and heat exchange equations among adjacent spaces in a building are solved simultaneously with the radiant heat exchange equations for the surfaces of each room.

700,976
PB80-101355 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Investigation of Air-Infiltration Characteristics and Mechanisms for a Townhouse.
Final rept.,
S. J. Treado, D. M. Burch, and C. M. Hunt. Aug 79, 38p NBS-TN-992
Sponsored in part by Naval Facilities Engineering Command, Washington, DC., Directorate of Civil Engineering, Washington, DC., and Office of Chief of Engineers, Washington, DC.Color illustrations reproduced in black and white.

Keywords: *Houses, *Air flow, Leakage, Permeability, Energy conservation, Measurement, Thermography, Construction materials, Townhouses, Infiltration, Tracer techniques.

Air infiltration measurements using a tracer-gas technique and the pressurization technique were performed on a three-bedroom townhouse having a gas-fired, forced-air furnace system, in order to quantify the amount of air infiltration due to various mechanisms. These mechanisms include combustion and draft-diverter air requirements, air leakage from supply-air ducts, and air leakage through the solid parts of the building envelope as well as air leakage through cracks around windows and doors. A thermographic survey was also performed in conjunction with pressurization of the structure, in an attempt to identify specific leaks. An apparatus for measuring the air permeability of building materials was used to analyze the significance of air permeation through solid building elements. Based on the findings of the study, general guidelines are presented for reducing air infiltration in residences.

700,977
PB80-103682 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Temperature Measurement on Operating Surface Mounted Lighting Fixtures,
P. M. Fulcomer. Sep 79, 24p NBSIR-79-1912
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Lighting equipment, *Safety engineering, Incandescent lamps, Fire hazards, Temperature measurement, Houses, Ceilings(Architecture), Thermal insulation, Overheating, Wiring, Electric wire.

Potentially hazardous temperatures may result from adding thermal insulation in the attic above surface mounted incandescent lighting fixtures and/or operating these fixtures with lamps of higher wattage than specified. This study was concerned with the range of temperatures generated (1) within the fixture, (2) within the electric junction box associated with the fixture and (3) on the adjoining ceiling and attic surfaces. Test results indicate that the addition of minimal insulation (equivalent to R11) over a surface mounted lighting fixture which contains two or more rated lamps, is likely to cause normal household branch circuit supply wiring associated with the fixture to operate above its specified 60C temperature rating. Overlamping (using lamps of higher wattage than specified for the fixture) and/or additional load current flowing through the branch circuit wire will cause even higher supply wire temperatures. With all three conditions present (i.e., insulation over the fixture, overlamping, and an additional 15 ampere load current flowing through the supply wire), the tests indicate that the temperature of associated branch circuit wiring will exceed 80C for a one lamp fixture and 100C for fixtures with two or more lamps.

700,978
PB80-104722 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Temperature Measurement on Operating Recessed Lighting Fixtures,
P. M. Fulcomer. Sep 79, 24p NBSIR-79-1913
Prepared in cooperation with Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Lighting equipment, *Safety engineering, Incandescent lamps, Fire hazards, Temperature measurement, Ceiling(Architecture), Thermal insulation, Barriers, Houses, Overheating, Wiring, Electric wire, Recessed lighting fixtures.

Potentially hazardous temperatures may result from adding thermal insulation in the attic above recessed incandescent lighting fixtures. The National Electric Code for 1978 specifies that '...thermal insulation shall not be installed within three inches of a recessed fixture enclosure, wiring compartment or ballast and shall not be so installed above the fixture as to entrap heat and prevent the free circulation of air...' The purpose of this investigation was to determine the effectiveness of various protective barriers in maintaining the requisite three-inch spacing and in preventing over-temperature conditions when loose-fill insulation is installed around recessed lighting fixtures. For the devices tested, the results indicate that properly installed open-top barriers are sufficient to allow the fixture and associated branch circuit wiring to operate within specified ratings. However, a barrier closed at the top by any method, can cause branch circuit wiring, the external surface of the barrier and/or parts of the fixture to operate at temperatures above those designated as 'safe'.

700,979
PB80-119712 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Post-Occupancy Evaluation: A Case Study of the Evaluation Process,
J. Elder, G. E. Turner, and A. I. Rubin. Jul 79, 68p NBSIR-79-1780
Sponsored in part by General Services Administration, Washington, DC.

Keywords: *Buildings, *User needs, Design, Evaluation, Information, Research, Questionnaires, Heating, Air conditioning, Architecture, Structural design, National Bureau of Standards, Human factors.

Within the past decade, growing numbers of architects, educators, building users and researchers have begun to question the state-of-the-art of building design. The most common complaint is that buildings do not adequately fulfill the needs of their users. This report addresses the problem by examining the need to identify, develop and apply user information as an integral part of the design process. The study reported here was conducted for GSA at the Richard H. Poff Courthouse and Federal Building in Roanoke, Virginia. The study examined (1) the design process, (2) the information available to those making design decisions, (3) how that information was used, and (4) the effects of selective design decisions. In addition, design problems of particular interest to GSA were considered from the viewpoint of several groups involved with the design and use of the building -- GSA, the architect, the building manager, the agencies and the employees.

700,980
PB80-123094 PC **A06**/MF **A01**
Integrated Systems, Inc., Brunswick, MD.
Smoke Movement Studies at the NIH Clinical Center.
Jun 78, 101p NBS/GCR-79/183
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Hospitals, *Fire tests, *Air circulation, *Smoke, Air flow, Stairways, Elevators(Lifts), Fire safety, National Institute of Health.

Air movement in the NIH Clinical Center was analyzed in order to evaluate possible smoke movement in the event of a real fire. The experimental techniques employed were pressure mapping and tracer gas tests. The tests were conducted under both summer and winter conditions which produce different air flow conditions. In addition, the location of the neutral planes in elevator shafts and stairwells changed significantly with the seasons.

700,981
PB80-141088 Not available NTIS
National Bureau of Standards, Washington, DC.
Life-Cycle Costing Translating Cost-Saving Potential into Real Dollars in the Area of Building Energy Management.
Final rept.,
R. T. Ruegg. Mar 79, 5p
Pub. in Building. Oper. Manage., v26 n3 p52-56, Mar 79.

Keywords: *Buildings, *Environmental engineering, *Cost analysis, Public buildings, Investments, Reprints, *Life cycle costs, *Energy management.

This article provides an overview of life-cycle costing as an aide to making energy conservation investment decisions in buildings. It reports briefly on the current status of the life-cycle costing approach in government and business as applied to energy conservation, reviews essential features of the method, and explains how it can be used to solve five common investment problems. It is aimed at operators, owners, and managers of commercial, industrial, institutional, and educational buildings.

700,982
PB80-150501 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of Low-Moisture-Permeability Insulation as an Exterior Retrofit System--a Condensation Study.
Final rept.,
D. M. Burch, A. G. Contreras, and S. J. Treado. 1979, 16p
Pub. in Proceedings of the ASHRAE Annual Symposium on Field Measurements on Effectiveness of Thermal Retrofitting of Structures. ASHRAE Annl. Mtg., Detroit, Michigan, June 25-27, 1979. ASHRAE Trans. 85, Part 2, p547-562 1979.

Keywords: *Walls, *Thermal insulation, Performance evaluation, Moisture content, Heat transmission, Permeability.

Laboratory and field studies were carried out to determine whether the use of low-moisture-permeability insulation as an exterior retrofit system increases winter moisture accumulation within the existing wood siding, sheathing, and cavity insulation. A full-scale insulated test wall was sandwiched between a hot and cold box apparatus in the laboratory. The exterior surface of one half of this test wall was fitted with a low-permeability insulation retrofit system. The exterior surface of the test wall was subsequently exposed to two consecutive steady-state winter conditions, while the interior surface was exposed to a typical indoor condition for a residence. The moisture accumulations within various components of the two halves of the test wall were compared. The moisture-transfer processes which occurred in the test wall were modeled with an ASHRAE diffusion model modified with a term to account for air leakage from the hot to the cold box. A limited field survey of several wall constructions was carried out to compare field observations of moisture conditions with laboratory results. In addition, the effect of accumulated moisture of wall heat transmission was examined.

700,983
PB80-185622 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Method of Testing, Rating and Estimating the Heating Seasonal Performance of Heat Pumps,
W. H. Parken, G. E. Kelly, and D. A. Didion. Apr 80, 66p NBSIR-80-2002
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Heat pumps, Performance tests, Ratings, Residential buildings, Seasonal variations, Operating costs, Computations.

Test and rating procedures are presented for electrically-driven residential air-to-air heat pumps operating

in the heating mode. The procedures are designed to include the effects of part-load (cyclic) operation, variations in outdoor temperature, and frost formation on the heating performance. Using the test procedure results, a calculation procedure is presented for estimating the heating seasonal performance (HSPF) and cost of operation of residential heat pump units.

700,984
PB80-194905 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Effect of Moisture on the Thermal Conductance of Roofing Systems.
Building Science Series (Final rept.),
L. I. Knab, D. R. Jenkins, and R. G. Mathey. Apr 80, 58p NBS-BSS-123
Library of Congress catalog card no. 80-600031. Sponsored in part by Department of Energy, Washington, DC. Architectural and Engineering Systems Branch.

Keywords: *Buildings, *Roofs, *Moisture content, *Thermal conductivity, Thermal resistance, Insulation, Roofing, Performance tests.

The results of laboratory tests are presented describing the effect of the moisture content on the thermal conductance of roofing systems containing insulation. Roofing systems, consisting of five types of rigid-board roof insulations with attached four-ply bituminous built-up membrane, were tested. Moisture was induced into the roofing system specimens by maintaining a constant water vapor pressure difference across them. Moisture gain in the insulation varied depending on the type and thickness of the insulation. A procedure was developed, using a heat-flow meter apparatus (ASTM C 518 type), to carry out thermal conductance tests on roofing specimens containing moisture. More than 200 tests were performed over a wide range of moisture contents. The approximate moisture distribution in the insulation was determined from core samples. Relationships between the thermal conductance and moisture content are presented. The relationships show that the presence of moisture in roofing systems can cause significant increases in the thermal conductance, depending on the type and thickness of the insulation.

700,985
PB80-200520 Not available NTIS
National Bureau of Standards, Washington, DC.
Hazards: High Winds.
Final rept.,
E. Simiu. 1980, 5p
Pub. in J. Architect, Educ. 33, n4 p23-27 1980.

Keywords: *Buildings, *Wind(Meteorology), Tornadoes, Hurricanes, Aerodynamic loads, Gust loads, Wind pressure, Hazards, Structural design, Reprints.

The paper provides information, believed to be useful to architectural students and faculty, on damage caused by windstorms, extreme wind climatology, wind effects on buildings, tornado effects on buildings, effects of winds on users of buildings and outdoor spaces, sources of data on wind effects, and possible research topics on architectural implications of windstorms.

700,986
PB80-207848 Not available NTIS
Microprocessor Applications and Building Control Systems to Achieve Energy Conservation.
Y. M. L. Chang, and J. Y. Shih. Jul 80, 47p NBSIR-80-2065

Keywords: *Building automation, Building controls, Building energy management systems, Chiller controls, Distributed control systems, *Energy conservation, Energy conservation devices, Microcomputers and minicomputers, Microprocessor applications, Programmable controllers.

The report investigates the capabilities of microprocessors in building control applications so that requirements to expedite these applications may be developed. Microprocessor applications in both conventional control systems and in local-loop energy conservation devices are examined. In addition, special applications of microprocessors in buildings are explored. The development of microprocessor technology is also discussed.

700,987
PB80-209885 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Economic Analysis of Improved Efficiency for Central Air Conditioners.
Final rept.,
S. R. Petersen, G. E. Kelly, and D. A. Didion. Jun 80, 56p NBSIR-80-1993
Sponsored in part by Department of Energy, Washington, DC. Office of Building and Community Systems.

Keywords: *Air conditioners, Economic analysis, Efficiency, Standards, Central air conditioners.

The development of minimum performance standards for central air is required by the National Energy Act of 1978 and is the responsibility of the Department of Energy (DOE). This report attempts to assist DOE in this endeavor by providing an analysis of the life-cycle savings and costs associated with improvements in the energy efficiency of central air conditioners. It develops a rational methodology that can be used in setting minimum standards which are economically and technically justified and makes recommendations which the authors feel meet these criteria for both split and package central air conditioners.

700,988
PB80-212335 Not available NTIS
National Bureau of Standards, Washington, DC.
Mathematical Model for Predicting Attic Ventilation Rates Required for Preventing Condensation on Roof Sheathing,
D. M. Burch, and D. E. Luna. 1980, 20p
Pub. in Proceedings of the ASHRAE Semiannual Meeting, Los Angeles, CA., February 1980, ASHARE 86, pt1 p201-220 1980.

Keywords: *Residential buildings, *Ventilation, Humidity control, Air circulation, Heat transfer, Roofs, Condensation, Mathematical models, Reprints, *Attic ventilation, Moisture control.

A mathematical model for predicting the heat transfer and moisture-transfer processes in residential attic spaces is presented. This model is utilized to predict attic ventilation rates required for preventing condensation or frost accumulation on the underside of roof sheathing. Attic ventilation charts are developed covering a wide range of outdoor temperatures, ceiling thermal resistances, and ceiling air penetration rates. The effectiveness of a ceiling vapor barrier is investigated. The effect of indoor humidification on the required attic ventilation rate is examined. Using measured data of Hinrichs, attic ventilation rates predicted by the mathematical model are converted into net free ventilation areas for soffit venting. These values are subsequently compared with the attic ventilation requirements of ASHRAE and the HUD Minimum Property Standards.

700,989
PB80-226707 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Air Leakage Measurements of an Unpartitioned Mobile Home.
Final rept.,
S. Silberstein. Aug 80, 28p NBSIR-80-2105
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Houses, *Trailers, *Air flow, Leak detectors, Air circulation, Sulfur hexafluoride, *Mobile homes, Tracer techniques, Tracer gases.

Air exchange rates, of an unpartitioned mobile home were measured at various indoor-outdoor temperature differences, using SF6 tracer in an environmental chamber, and found to be lower than for conventional buildings but similar to other mobile homes. There was little scatter from the regression equation I = 0.0182 + 0.0118 (delta T), with relative standard errors of the first and second coefficients of 62 and 2.5%, respectively.

700,990
PB81-104366 Not available NTIS
National Bureau of Standards, Washington, DC.
Dimensional Coordination in Building.
Final rept.
H. J. Milton. May 80, 18p
Pub. in AIA Metric Building and Construction Guide, ch6 p43-60 May 80.

Keywords: *Buildings, Structural design, Design, Construction, Coordination, Dimensions, Metric system, Modules, Construction materials, Reprints.

The chapter provides a general outline of the concepts of metric dimensional coordination in building, based on the international building module of 100 mm, and selected multimodules. The development of the idea of dimensional coordination in the U.S. is traced and contrasted with international developments. Definitions are provided of dimensional coordination and modular coordination. Major elements of a systematic approach to dimensional coordination are listed and include: modules and preferred dimensions; space reference systems, or grids; functional activity spaces; controlling dimensions for building design; coordinating dimensions for building products and assemblies; production (work) sizes, rules of fit, and joints; construction layout; and, drawing conventions, symbols and definitions. These elements are illustrated as needed. Detailed discussion deals with: modules and modular dimensions, including a rationale for their selection; reference grids; horizontal, vertical and intermediate controlling dimensions in building; and, preferred component and assembly sizes, and a matrix for their systematic selection. Suggestions for preferred dimensions and sizes are made for a number of building products, such as panels, masonry units, boards, sheet materials, tiles, partitions, doorsets, windows, skylights, and spacing of concealed members. Advantages of dimensional coordination, and pros and cons, have been summarized.

700,991
PB81-104390 Not available NTIS
National Bureau of Standards, Washington, DC.
SI Units in Architecture.
Final rept.
H. J. Milton, and R. T. Packard. May 80, 8p
Pub. in AIA Metric Building and Construction Guide, ch3 p13-20 May 80.

Keywords: *Metric system, *Construction, *Architecture, Dimensions, Structural design, Reprints.

The chapter provides advice on conversion approaches, preferred dimensions and values, and SI units for use in architecture and building. Specific discussions relate to SI units for length, area, volume and section modulus, mass, time, and temperature.

700,992
PB81-109191 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Field Investigation of the Performance of Residential Retrofit Insulation.
Final rept.
J. L. Weidt, R. J. Saxler, and W. J. Rossiter. Sep 80, 70p NBS-TN-1131
Sponsored in part by Department of Energy, Washington, DC. Office of Weatherization Assistance.

Keywords: *Residential buildings, *Thermal insulation, Moisture content, Glass fibers, Foam, Cellular materials, Urea formaldehyde resins.

A study was conducted to obtain information on the performance of in-service insulations of the type commonly used in the United States to retrofit sidewalls of housing: urea-formaldehyde based foam, loose-fill cellulose, and loose-fill mineral fiber. In the field phase of the study, observations were made on performance-related factors such as: the completeness of filling the cavity, the condition of the insulation and wall components, and evidence of moisture accumulation such as water stains on sheathing, studs and other wall components. Shrinkage was observed to have occurred for all urea-formaldehyde based foam specimens. Where measurable, it was found to be within a range of 4 to 9 percent. For the six test house containing loose-fill insulation which were opened at the top of the wall cavity, only one with cellulose contained a void of undetermined origin at the location. Insulation specimens removed from the walls were tested to determine their density, thermal resistivity and moisture content. The pH and moisture absorption of the urea-formaldehyde based form specimens were also determined. Results of the laboratory measurements are discussed and compared with data from other studies. Relationships between the moisture contents of the samples and their thermal resistivities were not found. Results indicated that the retrofitting of the inspected sidewalls was for the most part accomplished without adverse effect upon them.

700,993
PB81-147365 PC **A07**/MF **A01**

National Bureau of Standards, Washington, DC. National Engineering Lab.
User Acceptance of an Energy Efficient Office Building--A Study of the Norris Cotton Federal Office Building.
Building Science Series (Final).
J. Elder, and R. L. Tibbott. Jan 81, 130p NBS-BSS-130
Library of Congress catalog card no. 80-600188. Sponsored in part by Department of Energy, Washington, DC. Office of Building and Community Systems.

Keywords: *Office buildings, *Environments, Attitude surveys, User needs, Comfort, Illuminating, Ventilating, Windows, Temperature, Public opinion.

The General Services Administration built the Norris Cotton Federal Office Building in Manchester, New Hampshire and chose it as a demonstration project for studying the effectiveness of energy conservation techniques in the design and operation of a contemporary office building. User acceptance of both the innovative and conventional design features in the building was measured by administering a questionnaire to employees shortly after occupancy of the building and again eight months later.

700,994
PB81-152886 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Daylighting, Window Management Systems, and Lighting Controls.
Final rept.
S. Treado, and T. Kusuda. Dec 80, 80p NBSIR-80-2147
Sponsored in part by Naval Facilities Engineering Command, Washington, DC., Directorate of Civil Engineering (Air Force), Washington, DC., Office of Chief of Engineers (Army), Washington, DC., and Department of Energy, Washington, DC.

Keywords: *Daylighting, Buildings, Light control, Windows, Management, Architecture, Design, Illuminance, Energy conservation.

This report investigates major factors concerning windows in buildings and their effect on visual conditions, thermal conditions, and energy requirements. Empirically obtained data are presented for daylight illumination as a function of solar radiation, sky condition, window size and orientation, and interior reflectance. The thermal and visual effects of several window management strategies are examined along with an analysis of automatic lighting controls. Daylight utilization is seen to offer great potential for minimizing lighting load in perimeter building areas, and careful determination of lighting needs and window management strategies can provide additional benefit.

700,995
PB81-153652 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Laboratory Evaluation of Nondestructive Methods to Measure Moisture in Built-Up Roofing Systems.
Building science series (Final).
L. Knab, R. Mathey, and D. Jenkins. Jan 81, 176p NBS-BSS-131
Sponsored in part by Directorate of Engineering and Services (Air Force), Washington, DC. Library of Congress catalog card no. 80-600189.

Keywords: *Roofs, *Moisture content, *Nondestructive tests, Roofing, Thermography, Infrared equipment, Capacitance meters, Dielectric properties, Nuclear scattering, Backscattering.

This laboratory study investigated the reliability and accuracy of three types of nondestructive evaluation (NDE) methods to quantitatively determine the moisture content of the insulation in built-up roofing specimens. These methods were electrical capacitance, nuclear backscatter, and infrared thermography. Thirty-six roofing specimens, which consisted of five types of rigid-board roof insulations, with attached bituminous built-up membranes were tested over both concrete and steel decks. A wide range of moisture contents was induced into the specimens by maintaining a constant water vapor pressure difference across them. Two performance characteristics of the NDE methods were evaluated: (a) the minimum moisture content a method could detect, and (b) the relationship between NDE response and moisture content beyond the minimum detectable moisture content. The two performance characteristics were assessed through normalization parameters defined in terms of the NDE response and its scatter about a fitted curve. There were differences in the performance characteristics, the magnitude of which depended on the NDE method, the specimen composition, and the deck type used.

700,996
PB81-157505 PC **A14**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Building for People: Behavioral Research Approaches and Directions.
Final rept.
A. I. Rubin, and J. Elder. Jun 80, 317p NBS-SP-474
Library of Congress catalog card no. 80-600065.

Keywords: *Architecture, *User needs, *Human factors engineering, Design, Buildings, Environments, Anthropometry, Color, Sound waves, Perception, Comfort, Surveys.

The primary goal of this report is to acquaint the practicing architect and the architectural student with the potential contributions of the social sciences to the solution of building design problems. The report is divided into seven major parts, each part containing several chapters. Part I explores problems connected with today's buildings and advocates a design approach based on a team concept including architects, behavioral researchers, and engineers. Part II takes up the scientific approach to research, stressing the need for employing experimental controls and systematic procedures to collect objective data. Parts III, IV, and V describe methods employed by researchers to collect Man/Environment (M/E) data. The emphasis is on the need to develop systematic procedures to collect information, because only in this way can significant progress be made in developing a discipline of M/E studies. Part VI summarizes the major points and indicates approaches and directions for developing such a discipline. Part VII contains reference information to broaden the perspective of the reader with respect to M/E issues. The final part of the work contains a glossary, bibliographic information, and an index.

700,997
PB81-157893 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Functional Performance Requirements for the Environmental and Service Systems in Detached Housing, and Their Impact on Building Energy Use.
Final rept.
P. R. Achenbach. Jan 81, 171p NBS-GCR-80-280
Sponsored in part by Department of Energy, Washington, DC. See also report dated Oct 80, PB81-135642.

Keywords: *Residential buildings, *Environmental engineering, Heating, Air conditioning, Illuminating, Ventilation, Electric appliances, Standards, *Detached houses, *Energy consumption, *Single family houses.

The energy used for the environmental and service functions of space heating and cooling, domestic water heating, ventilation, lighting, and food and laundry services should all be taken into account in developing energy budgets for detached housing. The report states the functional performance requirements that should be met by these systems simultaneously with efficient energy utilization. It also identifies existing and proposed standards, guidelines, and criteria for the performance of these systems; shows how the performance criteria impact energy use; and summarizes the research needed to complete or produce consensus standards for the separate systems that can be introduced into energy performance standards for detached housing.

700,998
PB81-158610 PC **A16**/MF **A01**
Bolt Beranek and Newman, Inc., Cambridge, MA.
Impact Noise Testing and Rating / 1980.
Final rept.
T. J. Schultz. Jan 81, 363p NBS-GCR-80-249
Contract NB79-SBCA-0118
See also report dated Jan 74, COM-75-10133.

Keywords: *Buildings, *Noise pollution, *Acoustic measurement, Noise(Sound), Noise reduction, Structural analysis, Reviews, *Impact noise.

A state-of-the-art review of impact noise testing and rating is presented. A historical perspective of impact noise testing and rating covers the first efforts in the 1920's through the most recent research results. The current research is discussed, with the emphasis on the development of standardized test methods and impact noise rating methods. An outline for future research needs is presented in light of the current state-of-the-art. A bibliography containing over 200 references to impact noise testing and rating is included in the report.

700,999
PB81-159626 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Building Accessibility in Relation to Door Hardware, Door Users, and Door Use.
Final rept.
S. T. Margulis. Jan 81, 55p NBSIR-80-2174
Prepared in cooperation with Architectural and Transportation Barriers Compliance Board, Washington, DC.

Keywords: *Buildings, *Doors, *Human factors engineering, Handicapped persons, Performance evaluation, Fasteners, Latches, Locks(Fasteners), Standards.

This report reviews the technical literature related to doors as architectural barriers. It examines the concept of disability and the associated concepts of impairment and handicap. It is concluded that these terms lack consensus of meaning. The concept of functional capacity is recommended as an alternative because of the more direct linkage between capacity and performance. A review of the conceptual literature on functional capacity and its measurement leads to the conclusion that functional capacities relevant to building accessibility generally have been identified, but more precise specifications and improved ergonomic procedures for testing capacities of the disabled are required. Furthermore, a distinction is drawn between functional capacity and door use patterns. The latter refers to how capacities are applied during actual door use. Last, door systems are examined, particularly locking and latching mechanisms, door openers and door closers. The existing literature on these raises questions about the adequacy of current accessibility codes and standards with regard to these components. Based on unresolved problems and current needs, research addressing accessibility relevant objectives is recommended.

701,000
PB81-159709 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Computer Program for Analysis of Pressurized Stairwells and Pressurized Elevator Shafts.
Final rept.
J. H. Klote. Jan 81, 88p NBSIR-80-2157

Keywords: *Buildings, *Stairways, *Elevators(Lifts), *Fire safety, Pressurizing, Air flow, Pressure gradients, Computer programs.

Pressurized stairwells and pressurized elevators can be used as a means of providing a smoke free exit route during fire situations. This paper describes a computer program which analyzes systems intended to pressurize stairwells or elevator shafts. The basic assumptions and limitations of the program are also discussed. The appendices contain a program listing and examples.

701,001
PB81-165490 PC **A07**/MF **A01**
Pyros, Inc., Gaithersburg, MD.
Annotated Bibliography for Wood Combustion Activities in the Residential Sector.
Final rept.
D. M. Capozzi. Jan 81, 142p NBS-GCR-80-298
Contract NB80-NAAE-6619
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Residential buildings, *Fireplaces, *Wood products, *Bibliographies, Space heaters, Combustion, Fire safety, Stoves, Standards, Abstracts.

The U.S. Department of Energy, as part of its conservation mission, is dedicated to increasing the use of renewable energy resources as a replacement for fossil fuels, particularly oil and natural gas. The increased use of wood energy for the space heating of residential and commercial buildings provides an important opportunity to replace the use of fuel oil. This report cites over 500 recent publications within the United States and Canada related to wood combustion. A brief description of most articles is included.

Where known, the availability of the various citations is annotated.

701,002
PB81-187064 PC **A04**/MF **A01**
Bolt Beranek and Newman, Inc., Cambridge, MA.
Structureborne Sound in Buildings: Needed Practical Research in Light of the Current State of the Art.
Final rept.
E. Ungar. Jun 80, 57p BBN-4309, NBS-GCR-80-248
Contract NB79-SBCA-0118

Keywords: *Buildings, *Noise pollution, Noise reduction, Vibration, Sound transmission, Acoustic insulation, Technology assessment.

An overview of the current state-of-the-art of structureborne sound in buildings is presented. A general introduction to the field of structureborne sound is included with a discussion of important phenomena. Summaries of recent investigations described in the technical literature are discussed relevant to excitation and local response, propagation, radiation, and control of structureborne sound in buildings. Topics for future research in structureborne sound in buildings are presented based upon this review. An annotated bibliography of recent investigations is appended.

701,003
PB81-187072 PC **A07**/MF **A01**
Wyle Labs./Wyle Research, Arlington, VA.
Sound Transmission through Building Structures - Review and Recommendations for Research.
Final rept.
B. H. Sharp, P. K. Kasper, and M. L. Montroll. Jul 80, 146p WR-80-20, NBS-GCR-80-250
Contract NB79-SBCA-0144

Keywords: *Buildings, *Noise pollution, Noise reduction, Vibration, Sound transmission, Acoustic insulation, Acoustic measurement, Technology assessment.

This report presents a critical review of the status of technology in sound transmission through building structures, and identifies specific areas for further research. The approach taken in the review follows the steps involved in the design process, namely, prediction, measurement, and evaluation. Priorities for further research are based on the potential for achieving the following objectives: to develop new technology to reduce the cost of noise control in buildings; to increase confidence that designs will provide the required acoustical privacy; and to identify and apply sound isolation techniques that reduce energy consumption.

701,004
PB81-207193 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Absorber Geometry on Apparent Absorption Coefficients as Measured in a Reverberation Chamber.
Final rept.
T. W. Bartel. Apr 81, 10p
Pub. in Jnl. of Acoustical Society of America 69, n4 p1065-1074 Apr 81.

Keywords: *Acoustic insulation, *Acoustic absorption, Acoustic impedance, Absorptivity, Acoustic properties, Buildings, NTISCOMNBS.

Measurements were made in the NBS reverberation chamber to determine the apparent random incidence absorption coefficient as a function of the area, perimeter, and shape of the test specimens for three different materials arrayed as combinations of rectangular pieces. Measurements made with the specimen edges exposed and with the edges covered with reflecting material were compared. The experimental results were compared with a theoretical model using values of the acoustical admittance obtained from impedance tube measurements performed on the same materials. Both the experimental and theoretical results indicate that the random incidence absorption coefficient increases approximately linearly with E, the ratio of the perimeter to the area of the specimen for values of E ranging from 1.3 to 3.3 to the minus 1. The theoretical analysis indicates, however, that a linear extrapolation to the value E approximately equal to 0 is not necessarily valid. It was found that if specimen area and perimeter are kept constant, the values of the random incidence absorption coefficient decrease by a few percent as the specimen shape is changed to increase the number of vertices (inside plus outside right-angle corners) in the configuration.

701,005
PB81-229163 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Pedestrian Movement Characteristics on Building Ramps.
Final rept.
G. Turner, and B. Collins. Jun 81, 60p NBSIR-81-2310

Keywords: *Buildings, *Ramps, *Pedestrians, Stairways, Mobility, Statistical data.

Knowledge of design for effective pedestrian circulation is one of the main requirements in building planning. While an understanding of pedestrian movement characteristics on the various component parts that make up a building circulation system is the key to effective planning, one component type, the ramp, has rarely been the subject of building circulation research. The research described in the report is the result of an investigation of pedestrian movement characteristics on four specific building ramps during two different professional athletic contests. Variables of pedestrian movement such as speed, flow, and density were studied as well as the relationships between them. In addition, counts of pedestrians by sex were made. Results were compared for the specific ramps and with previously reported data obtained for ramps, stairs, and level surfaces.

701,006
PB81-236499 Not available NTIS
National Bureau of Standards, Washington, DC.
Wind Speed Distributions and Reliability Estimates.
Final rept.
E. Simiu, J. R. Shaver, and J. J. Filliben. May 81, 5p
Pub. in Jnl. of the Structural Division, Proceedings of the American Society of Civil Engineers Technical Notes 107, nST5 p1003-1007 May 81.

Keywords: *Structures, *Wind pressure, Wind velocity, Probability distribution functions, Estimates.

The purpose of this note is to present an investigation into the effect upon the estimation of safety levels for wind-sensitive structures of the model that describes the probabilistic behavior of the extreme wind speeds. Such an investigation is motivated by recent research results, according to which extreme wind speeds are in most cases best modeled by probability distributions with considerably shorter tails than the Type I Extreme Value distribution, in particular by the Rayleigh distribution. It is shown that safety levels estimated on the basis of the assumption that the Rayleigh distribution holds are significantly higher than those previously estimated in the literature.

701,007
PB81-238545 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Performance Evaluation of A Typical Energy Monitoring System for Steam Flow in Buildings.
D. W. Baker, J. Y. Kao, and D. A. Didion. Jul 81, 64p NBSIR-81-2313
Sponsored in part by Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Buildings, *Steam heating, *Steam flow, Flow measurement, Differential pressure, Pressure measurement, Probability theory, Errors, *Energy consumption.

Some important design features and measurement techniques are discussed for determining energy rates in building systems flowing steam. Emphasis is on use of differential pressure (delta P) type flowmeter systems where delta P pressure and temperature instrumentation only can receive direct calibration. The role of systematic and random type errors in measurement of building energy is discussed and an appropriate method is given for estimating the uncertainty in the energy consumed. An example calculation of uncertainty in accumulated energy used for a 1 year period is given from typical operating data for one of the NBS laboratory buildings. The uncertainty is estimated to be 3.2% for a two-meter (series) configuration and 4.3% for a single meter (high range meter) configuration.

701,008
PB81-243255 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Regional Economic Assessment of Selected Window Systems.
Final rept.
R. T. Ruegg, and R. E. Chapman. Jul 81, 127p NBSIR-81-2248
See also report dated Apr 79, PB-295 338.

Keywords: *Buildings, *Windows, *Cost analysis, Window glazing, Residential buildings, Commerical buildings, Environmental engineering, Thermal efficiency, *Life cycle costs, *Energy conservation.

This study, the fifth in a series of reports from the National Bureau of Standards interdisciplinary project on windows, provides guidance in selecting and using windows in buildings for greater cost effectiveness. It presents the life-cycle costs of selected window systems used in a room of a representative residence and in an office module of a representative commercial office building for nine cities in the United States representing five heating zones and four cooling zones. The cities covered are Miami, Florida; Atlanta, Georgia; Washington, DC; Portland, Maine; Indianapolis, Indiana; San Antonio, Texas; Los Angeles, California; Bismarck, North Dakota; and Seattle, Washington. The results of the regional analyses are summarized, and the implications of these results are considered, both for selecting windows in new buildings and for managing windows in existing buildings. The emphasis of this report is on conveying the research findings to builders, designers, and building owners and operators -- those involved immediately with the building process.

701,009
PB81-243487 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Moisture Detection in Roofing by Nondestructive Means--A State-of-the-Art Survey.
D. R. Jenkins, R. G. Mathey, and L. I. Knab. Jul 81, 86p NBS-TN-1146
Sponsored in part by Deputy Chief of Staff, Logistics and Engineering (Air Force), Washington, DC. Directorate of Engineering and Services.

Keywords: *Roofs, *Moisture content, *Nondestructive tests, Infrared scanners, Capacitance meters, Radiofrequency pulses, Microwave equipment, Nuclear radiation, Instrument characteristics, Nuclear instruments.

A literature survey is presented of nondestructive evaluation (NDE) methods for detection of moisture in roofing systems. The methods discussed include the use of capacitance-radio frequency instruments, capacitance-microwave instruments, nuclear meters, and thermal infrared scanners. For each method, the principles of operation are reviewed and the measured properties which are affected by moisture are identified. Factors other than moisture which may affect the response of the instruments are also described for each method. These factors produce responses which are similar to those due to moisture and include nonuniformities in the roofing system, roof construction details, and building equipment. The use of each NDE method in actual moisture surveys is reviewed. It is emphasized in the report that the validitity of roofing moisture surveys depends on both a knowledge of the factors noted above and a familiarity with roofing practice. Furthermore, cores of the roofing system at selected points are needed to confirm NDE observations. To define operating conditions for infrared scanners, calculated temperatures of roof surfaces over dry and over wet insulation are presented for representative night and day conditions.

701,010
PB81-245334 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Effects of Home Weatherization on Occupant Comfort: First Report of a Field Study.
R. E. Clark. Sep 81, 83p NBSIR-81-2335
Sponsored in part by Community Services Administration, Washington, DC.

Keywords: *Residential buildings, *Weatherproofing, Environmental engineering, Temperature measurement, Thermal insulation, Comfort, Surveys, Questionnaires, *Retrofitting.

This study reports preliminary examination of data testing the hypothesis that, when existing residences are treated with weatherization retrofitting measures intended primarily to save fuel, house occupants are likely to report improvement in wintertime comfort.

Data were obtained through questionnaire-guided interviews with individuals in 108 experimental houses and 37 control houses. These houses, at nine sites representing a range of U.S. climates, were part of a three-year National Weatherization Demonstration, sponsored by the Community Services Administration and planned and managed by researchers at the Center for Building Technology of the National Bureau of Standards. The experimental houses had been weatherized to determine how much their fuel usage could be reduced by cost-effective retrofitting. The control houses had not been weatherized in the demonstration. Interview topics included: thermostat setting patterns, impressions of comparative comfort, amounts of clothing worn, and specific comfort and temperature ratings for the house as a whole and for individual rooms in the house. Preliminary examination of the data has focussed on: (1) a composite 'comfort change' index, comprised of indicators derived from thermostat setting practices in unusually cold weather, impressions of change in comfort-related attributes of the indoor environment, amounts of clothing worn in winter, and comfort ratings, (2) the specific comfort ratings, and (3) the temperature ratings. The results presented offer strong indications of support for the hypothesis.

701,011
PB82-101247 Not available NTIS
National Bureau of Standards, Washington, DC.
Field Survey of the Performance Properties of Insulation Used to Retrofit Cavity Walls of Residences.
Final rept.
W. J. Rossiter, J. L. Weidt, and R. J. Saxler. 1981, 15p
Sponsored in part by Department of Energy, Washington, DC. Office of Weatherization Assistance.
Pub. in Proceedings of American Society of Heating, Refrigerating and Air-Conditioning Engineers/Department of Energy-Oak Ridge National Laboratory Conference on Thermal Performance of the Exterior Envelopes of Buildings, Kissimmee, FL., 3-5 December, 1989, ASHRAE SP28, p901-915 1981.

Keywords: *Thermal insulation, *Residential buildings, Walls, Performance, Surveys, Retrofitting.

A study was conducted to obtain information on the performance of retrofit insulations which had been installed in the sidewalls of existing residences. Most of the thirty-nine houses included in the study had wood-frame sidewall construction and were located in the mid-West, mid-Atlantic and Northeast. The insulations represented those commonly used in the United States to retrofit sidewalls of housing: urea-formaldehyde based foam, loose-fill cellulose, and loose-fill mineral fiber. With few exceptions, the insulations had been installed in the sidewalls at least 2 years prior to their examination and their ages ranged from about one and a half to ten years.

701,012
PB82-107350 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Determining Cost-Effective Insulation Levels for Masonry and Wood-Frame Walls in New Single-Family Housing.
Building science series (Final).
S. R. Petersen, K. A. Barnes, and B. A. Peavy. Aug 81, 129p NBS-BSS-134
Library of Congress catalog card no. 81-600083. Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Residential buildings, *Walls, *Thermal insulation, *Cost effectiveness, Structural design, Brick construction, Concrete blocks, Wooden structures, Thermal analysis, *Life cycle costs.

Economically optimal insulation methods and resistance levels for three different types of walls in a one-story, single-family residence are calculated for a wide range of geographic locations, energy prices, heating and cooling equipment efficiencies, and financial evaluation criteria. The three basic wall types examined are 8-in concrete block walls, brick and block walls, and wood-frame walls with lightweight siding. Changes in annual heating and cooling requirements for an 1176 square feet prototype house resulting from several different insulation resistances in each wall type are calculated using the NBS Load Determination program and Test Reference Year climate data for a number of geographic locations. Changes in heating requirements are correlated with heating degree days to provide estimates of energy savings in all geographic regions of the continental United States. Cooling requirements are not found to vary significantly with the thermal resistance of the walls under a typical operating profile except in the southwestern desert. An index number system is developed to quickly determine insulation levels based on the data generated in the report.

701,013
PB82-112624 Not available NTIS
National Bureau of Standards, Washington, DC.
Labor and Materials Costs of Weatherizing Low-Income Housing.
Final rept.
B. C. Lippiatt, and S. F. Weber. 1981, 11p
Sponsored in part by Community Services Administration, Washington, DC.
Pub. in Proceedings of the National Conference on Optimal Weatherization held at Washington, DC., on December 8-10, 1980, Paper in Optimal Weatherization, p103-113 1981.

Keywords: *Housing studies, *Weatherproofing, Labor estimates, Construction costs, Insulation, Heat loss, Cost analysis, *Weatherization, Energy conservation.

This paper presents the major results of a project involving the collection and analysis of field data from 12 U.S. cities on the costs of retrofitting low-income houses for energy conservation. The energy conservation techniques presented consist of a variety of architectural weatherization options designed to reduce heat losses due either to air infiltration or conduction. This project is part of the Community Services Administration Weatherization Demonstration Program being carried out with technical assistance from the National Bureau of Standards. The methods used to collect and synthesize the data on the major cost components of installing these architectural options are described. The results include the mean unit cost of installing each option by city, and the relative importance of labor and materials costs. The results suggest that if a primary national policy goal were to create jobs in weatherization, then the infiltration options should be emphasized since they are more labor-intensive than the conduction options.

701,014
PB82-112665 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Computer-Simulated Thermal Performance: The Norris Cotton Federal Office Building.
Final rept.
W. B. May, and L. G. Spielvogel. 1981, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the ASHRAE Semi-Annual Meeting held at Chicago, IL., on January 25-29, 1981, ASHRAE Jnl. 87, pt1 p43-50 1981.

Keywords: *Office buildings, *Environmental engineering, Computerized simulation, Temperature control, Air conditioning, Heating, Heat pumps, Fuel consumption, Norris Cotton Federal Office Building, Energy conservation.

Five computer-based simulations of the Norris Cotton Federal Office Building (NCFOB) in Manchester, New Hampshire, were performed using a state-of-the-art proprietary hour-by-hour building simulation program. Results of the simulations are compared with each other and with actual measured data at several levels of detail including total energy consumption, consumption by fuel type, and heating and cooling requirements. Good agreement between the simulation and actual data is demonstrated and consequences of design features are discussed.

701,015
PB82-118084 Not available NTIS
National Bureau of Standards, Washington, DC.
Modern Developments in Wind Engineering: Part 2.
Final rept.
E. Simiu. Oct 81, 7p
Pub. in Eng. Struct. 3, p242-248 Oct 81.

Keywords: *Buildings, *Wind pressure, Wind tunnel models, Aerodynamic forces, Turbulence, Building codes, Reprints.

This is the second paper in a series devoted to a review of the state of the art in wind engineering. The paper presents information on wind tunnel testing for both research and design purposes. Specific topics covered include: The influence of viscosity effects upon the reliabiliity of test results for bodies with curved shapes and with sharp edges; the extent to which atmospheric turbulence needs to be simulated in laboratory tests; the effect of turbulence scale and turbulence intensity upon aerodynamic forces; and difficulties encountered in the simulation of point and area loads.

701,016
PB82-118092 Not available NTIS
National Bureau of Standards, Washington, DC.
Modern Developments in Wind Engineering: Part 1.
Final rept.
E. Simiu. Oct 81, 9p
Pub. in Eng. Struct. 3, p233-2411981.

Keywords: *Buildings, *Structural design, *Wind pressure, Hurricanes, Tornadoes, Gust loads, Meteorological data, Reprints, Wind profiles.

The paper presents a state of the art review of material applicable to structural design, from the following areas: meteorology, micrometeorology (mean wind profiles and atmospheric turbulence characterization), and extreme wind climatology in well-behaved climates, hurricane-prone regions and tornado-prone regions.

701,017
PB82-132259 CP **T05**
National Bureau of Standards, Washington, DC.
Hurricane-Induced Wind Loads.
Software.
E. Simiu. 1981, mag tape NBS/DF-81/005
Source tape is in ASCII character set. Character set restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation, PB82-132267.

Keywords: *Software, *Building, *Wind pressure, Wind velocity, Aerodynamic characteristics, Panels, Gust loads, Computer programs, Fortran, Meteorological data, Hurricanes, Perkin-Elmer 7/32 computers, Atlantic Coast(United States), Gulf Coast(United States).

The purpose of the program is to estimate wind loads on cladding or structural members not susceptible to resonance or aeroelastic effects. The input to the program consists of the location of the structure along the Gulf or East Coast. The distance between the structure and the shoreline, and the pressure coefficients corresponding to winds from various compass directions referenced with respect to the mean hourly wind speed at the top of the structure. The output consists of the hurricane-induced wind loads corresponding to various mean recurrence intervals...Software Description: The program is written in the Fortran programming language for implementation on a Perkin-Elmer 7/32 computer using the Kennedy 9000 operating system. 64K bytes of core storage are required to operate the model.

701,018
PB82-132267 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Hurricane-Induced Wind Loads.
M. E. Batts, and E. Simiu. Aug 81, 23p NBS/DF-81/005A
Grant NSF-CEE80-25718
For system on magnetic tape, see PB82-132259.

Keywords: *Buildings, *Wind pressure, Wind velocity, Aerodynamic characteristics, Panels, Gust loads, Mathematical models, Computer programming, Meteorological data, Hurricanes, Atlantic Coast(United States), Gulf Coast(United States).

A computer program was developed that uses as input the aerodynamic coefficients corresponding to eight or sixteen compass directions and produces as output wind loads on cladding or structural members corresponding to various mean recurrence intervals.

701,019
PB82-133984 Not available NTIS
National Bureau of Standards, Washington, DC.
Air Exchange Measurements in a High-Rise Office Building.
Final rept.
C. M. Hunt, and S. J. Treado. 1981, 18p
Pub. in Proceedings of ASHRAE/DOE/ORNL Conference on Thermal Performance of Exterior Envelope of Buildings, Orlando, Florida, December 3-5, 1979, ASHRAE SP 28, p160-177 1981.

Keywords: *Office buildings, *Ventilation, *Air circulation, Seasonal variations, Pressure gradients, Wind(Meteorology), *High rise buildings, *Air exchange.

Air exchange rates were measured in the tower of an 11-story office building using SF6 as a tracer gas. Fall and winter air exchange rates, I (hr to the minus 1), measured with make-up and main exhaust pathways blocked, could be represented as a function of wind spread, W (mi/hr), by the equation I = 1.08 + 0.036W - 0.0005W squared, sigma = 0.15. Wind direction and temperature difference (stack effect) exerted little effect on air exchange rate. In this building, toilet exhausts and other weather-independent mechanisms were more important than natural infiltration in producing air exchange. Inside-outside pressure difference measurements were monitored as a function of temperature and wind speed. Also, a preliminary analysis of predicted air infiltration by the Shaw-Tamura model was undertaken. The results of this preliminary analysis were consistent with the observations that the stack effect was unimportant and that natural infiltration contributed only part of the total air exchange. However, the plot of calculated infiltration rate as a function of wind speed, using the Shaw-Tamura model, had a different form than the plot of measured data.

701,020
PB82-135609 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Single-Room Heat Balance for Building Heat Transfer.
B. A. Peavy. Nov 81, 21p NBSIR-81-2321
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Buildings, *Heat balance, Heat transfer, Heating load, Cooling load, Subroutines, ROOMZ computer program.

A single-room heat balance has been developed to provide a more precise computational tool. The primary purpose for this tool is to evaluate the effects of approximations presently used in computer programs on the determination for building heating and cooling loads. Specific algorithms to be incorporated in the room heat balance concern radiosity shape factors, temperature difference dependent convection heat transfer coefficients, simulated room mass, and an iterative methodology for solution of room temperatures.

701,021
PB82-135823 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Solar Radiation and Illumination.
Final rept.
S. Treado, and T. Kusuda. Nov 81, 35p NBS-TN-1148
Prepared in cooperation with Naval Facilities Engineering Command, Washington, DC; Department of the Air Force, Washington, DC; Department of the Army, Washington, DC and Department of Energy, Washington, DC. Office of Building and Community Systems.

Keywords: *Daylighting, Data, Solar radiation, Irradiance, Illuminance.

Experimental data were collected and analyzed under various cloud cover conditions to establish the relationship between solar irradiance and illuminance. Empirically derived equations are presented for estimating diffuse and total illuminance as a function of total and diffuse solar radiation.

701,022
PB82-136284 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Documentation of Program for Determination of Conduction Transfer Functions.
B. A. Peavy. Nov 81, 50p NBSIR-81-2353

Keywords: *Buildings, *Heat transfer, Conduction, Thermal radiation, Transfer functions, Time dependence, Heat flux, Mathematical models, Computer programs, PC computer program, ABC computer program, ROOTS computer program.

Conduction transfer functions are used to predict the time-dependent one-dimensional conduction heat transfer at surfaces of single- or multi-layer building constructions based on heat flux and temperature history at each surface. By the use of conduction transfer functions, heat transfer problems employing nonlinear boundary conditions such as thermal radiation and time-dependent changes in the surface film resistances can be solved. Because conduction transfer functions are analytically derived with an initial time condition of zero temperature potential throughout the solid materials, it becomes necessary to initialize the computation by including exposure to a number of outdoor weather cycles such that satisfactory initial conditions of temperature and heat flux exist at the inside and outside surfaces. The program is set up for the use of 1-, 2-, or 3-hour time intervals, depending on the thickness of the building construction. The program allows for the combination of two building constructions, e.g., the parallel heat flow paths found in woodframe walls.

701,023
PB82-138199 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Crowd Ingress to Places of Assembly: Summary and Proceedings of an Experts' Workshop.
F. T. Ventre, F. I. Stahl, and G. E. Turner. Sep 81, 148p NBSIR-81-2361

Keywords: *Meetings, *Facilities management, *Buildings, *Safety engineering, Recreational facilities, Architecture, Environmental engineering, Management methods, Accident prevention, *Crowd control.

The movement of large crowds into places of assembly has resulted in death and injury to facility patrons and staff. Facility designers and managers seeking guidance have found little relevant information in the technical literatures of architectural and crowd control. The Law Enforcement Assistance Administration and the National Bureau of Standards convened the most knowledgeable persons in North America in the topic of crowd ingress to places of assembly to: identify best current design practices; identify best current facilities management practices; and define research needed to support improved practices in design and management. The report documents the design and management practices suggested by the assembled experts, reports related activities of the International Association of Auditorium Managers and suggests a program of research leading to improved quantitative design and evaluation procedures for crowd ingress.

701,024
PB82-138744 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Analysis of Data from the Energy Monitoring and Control System at the Norris Cotton Federal Office Building.
W. B. May. Nov 81, 98p NBSIR-81-2358
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Buildings, Data processing, Data, Monitoring, Control equipment, Commercial buildings, *Energy conservation, Energy use.

The Norris Cotton Federal Office Building (NCFOB) in Manchester, New Hampshire, is a medium-size office building, occupied in September 1976, designed to serve as a demonstration and a feasibility test for energy-conserving building features. A building energy monitoring and control system was operated as a data acquisition system over a 13-month period ending in September 1980. Experience encountered during the checkout and operation of the system is discussed. Results from data reduction procedures used to calculate approximately 160 parameters describing the energy performance of the building are presented on a monthly basis. Hourly data are also presented for daily building operation profiles, building envelope performance, and performance of the mechanical systems.

701,025
PB82-140047 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Method for Assessing Costs of Noise Control Requirements in Multifamily Residential and Educational Buildings.
Final rept.
S. F. Weber, F. F. Rudder, and M. J. Boehm. Dec 81, 120p NBSIR-81-2366
Sponsored in part by Environmental Protection Agency, Washington, DC. Office of Noise Abatement and Control.

Keywords: *Buildings, *Noise reduction, *Construction costs, Construction materials, Walls, Doors, Windows, Floors, Ceiling(Architecture), Structural design, Acoustic insulation, Cost analysis, Design criteria.

This report presents a methodology developed to measure the cost impacts of acoustical performance requirements for new buildings. The methodology can be applied to a wide range of noise control requirements. The cost items addressed by this methodology are expected changes in construction costs, the cost of acoustical testing to certify levels of performance, code administration costs, and energy savings due to modifications of the building envelope. The building components considered, which are those most commonly affected by noise comtrol requirements, are doors, windows, interior walls, exterior walls, and floor/ceiling assemblies. The basic cost assessment method consists of linear cost estimation equations for most component designs commonly used in educational and multifamily residential buildings. Each equation relates the acoustical performance of the design to its construction cost so that construction costs associated with alternate levels of acoustical performance can be compared. The methodology also includes a cost minimization model useful for selecting the least-cost design for a particular level of acoustical performance.

701,026
PB82-142209 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Calculation of Inter-Room Air Movement for Multi-Room Building Energy Analysis.
G. N. Walton. Nov 81, 37p NBSIR-81-2404
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Residential buildings, *Air circulation, Air flow, Thermal conductivity, Convection, Transfer functions, Thermal radiation, Computer programming, MRLP computer program, Fortran 77 programming language, Air infiltration, Energy balance.

A model is presented for computing the infiltration and air flow between rooms of a multi-room building in terms of basic principles of fluid mechanics. This model has been incorporated into a comprehensive loads-predicting computer program. Air flows, room temperatures, and heating loads for a typical townhouse under different conditions of environment and with various construction features are computed. These calculations show the feasibility of detailed multi-room air movement analysis. They also indicate that when the inter-room openings of a low-rise structure are large compared to the envelope openings, the infiltration and total load can be accurately, and more quickly, computed by assuming no resistance to air flow between rooms. This property will also allow simplified calculations for high-rise buildings with many rooms. Methods are proposed for handling more complex air flow phenomena.

701,027
PB82-152521 Not available NTIS
National Bureau of Standards, Washington, DC.
Extreme Wind Speeds and Structural Failure Risks.
Final rept.
E. Simiu, J. R. Shaver, and J. J. Filliben. Nov 80, 15p
Pub. in Proceedings Conference Climate and Risk, Arlington, VA., May 27-29, 1980, Paper MTR-80W322-01, 1,p2-86--2-100 Nov 80.

Keywords: *Buildings, *Hurricanes, Wind velocity, Monte Carlo method, Probability distribution functions, Climatology, Gulf Coast(United States), East Coast(United States), Risk analysis.

A first objective of the paper is to describe recent NBS research results in the field of extreme wind climatology. These results include the finding that at most locations in the U.S. extreme wind speeds are described by probabilistic models with considerably shorter tails than the Extreme Value Type I distribution. Estimates of hurricane wind speeds along the Gulf and East coasts are presented, based on Monte Carlo simulation techniques used in conjunction with statistical data on the climatological characteristics of hurricanes. Also presented in the paper are estimates of member reliabilities that take into account the various uncertainties concerning the behavior of the member during its anticipated life. The dependence of such estimates upon the assumed probability distribution of the extreme wind speeds is discussed, and it is shown

that current reliability estimates based on an Extreme Value Type I model of the extreme wind speeds appear to be unduly pessimistic.

701,028
PB82-154279 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Calculated Hourly Cooling Load and Indoor Temperature with Measured Data for a High Mass Building Tested in an Environmental Chamber.
Final rept.
T. Kusuda, and J. W. Bean. 1981, 11p
Pub. in American Society of Heating, Refrigerating and Air-Conditioning Engineers Transactions 87, pt 1 p1232-1242 1981.

Keywords: *Residential buildings, *Desert tests, Environmental tests, Cooling load, Heating load, Diurnal variations, Temperature gradients, Reprints.

A one-room high mass test building designed for a hot and dry desert climate was tested in the NBS environmental chamber under simulated diurnal cycles representing typical summer sol-air temperature profiles. The measured nighttime cooling requirement as well as the daytime temperature drifts were compared against the calculated values obtained from the detailed hourly simulation computer program. The purpose of the tests was to prove the effectiveness of nighttime cooling when the cooling efficiency is high, and subsequent use of the stored coolness in the structure to eliminate daytime mechanical cooling when the cooling efficiency is low. Although the NBSLD calculated daytime temperature-rise profiles are very close to what was measured, the calculated cooling load profile differed from the measured data. The differences are, however, attributable to the large amount of latent cooling load resulting from the release of moisture from the structural concrete.

701,029
PB82-154287 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Calculated Hourly Cooling Load and Attic Temperature with Measured Data for a Houston Test House.
Final rept.
T. Kusuda, E. T. Pierce, and J. W. Bean. 1981, 15p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in American Society of Heating, Refrigerating and Air-Conditioning Engineers Transactions 87, pt 1 p1185-1199 1981.

Keywords: *Residential buildings, *Ventilation, Cooling load, Seasonal variations, Heat balance, Computerized simulation, Texas, Reprints, DOE-2 computer program, BLAST-2 computer program, Attics, Houston(Texas), Computer applications.

During the summer and autumn of 1977, NBS conducted attic ventilation experiments in three test houses in Houston, Texas. Hourly cooling loads were measured, together with indoor/outdoor climatic data, to allow precise comparison between the computer-simulated values with those measured values. In this paper, measured hourly cooling loads as well as attic temperature of one of the test houses were compared with those determined by the detailed heat balance simulation calculation used in NBSLD, the National Bureau of Standards heating/cooling load determination program. Measured cooling loads for a steady three-day period were also compared with those determined by two other public domain energy simulation programs, DOE-2 and BLAST-2.

701,030
PB82-154295 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of DOE-2-Generated Residential Design Energy Budgets with Those Calculated by the Degree-Day and Bin Methods.
Final rept.
T. Kusuda, I. Sud, and T. Alereza. 1981, 16p
Sponsored in part by Department of Energy, Washington, DC. Architectural and Engineering Branch.
Pub. in American Society of Heating, Refrigeration and Air-Conditioning Engineers Transactions 87, pt 1 p491-506 1981.

Keywords: *Residential buildings, Performance standards, Energy, *Residential design energy budgets, DOE-2 computer program, Computer applications.

Residential design energy budgets for the buildings energy performance standards were generated by the use of the DOE-2 computer program for four different types of structures in 10 different localities throughout the U.S. The DOE-2 calculations for these conditions were repeated by simplified procedures using the degree-day and bin methods. By modifying the basis for the degree-day data from 65F to building specific value, remarkably close agreements were obtained between the DOE-2 and the degree-day results. Also, good agreements were obtained between the DOE-2 results and the ASHRAE TC4.7 method.

701,031
PB82-154303 Not available NTIS
National Bureau of Standards, Washington, DC.
Standards Criteria for HVAC Systems and Equipment Performance Simulation Procedures.
Final rept.
T. Kusuda. Oct 81, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in American Society of Heating, Refrigeration and Air-Conditioning Engineers Jnl. 23, p25-28 Oct 81.

Keywords: *Performance standards, Buildings, Heating equipment, Air conditioning equipment, Ventilators, Energy, Computation, Reprints.

Systems simulations have been considered an essential part of the building energy calculations used for regulations such as the Building Energy Performance Standards. Regardless of whether or not the BEPS survive political changes with the current administration, these are still critical ingredients for HVAC equipment analysis and accurate energy calculations.

701,032
PB82-155177 Not available NTIS
National Bureau of Standards, Washington, DC.
Weatherization Retrofitting and Occupant Comfort.
Final rept.
R. E. Clark. 1981, 8p
Pub. in Proceeding of Natl. Conf. Optimal Weatherization, Held at Washington, DC on December 8-10, 1980, Paper in Optimal Weatherization, p60-67 1981.

Keywords: *Houses, Comfort, Human factors engineering, *Weatherization, Retrofitting, Energy conservation.

This report discusses preliminary findings of a field study of occupant comfort impressions in weatherized houses. The data covered: (1) thermostat setting practices; (2) comparative amounts of clothing worn; (3) direct report of comparative comfort, (4) comfort ratings (on a five-point scale) and temperature ratings (on the ASHRAE seven-point scale).

701,033
PB82-169145 PC **A06**/MF **A01**
Auburn Univ., AL. Dept. of Mechanical Engineering.
Investigation of Creosoting and Fireplace Inserts,
T. T. Maxwell, D. F. Dyer, G. Maples, and T. Burch.
Dec 81, 110p NBS/GCR-81/365
Contract NB80-NADA-1012
Sponsored in part by Department of Energy, Washington, DC., and Consumer Product Safety Commission, Washington, DC.

Keywords: *Residential buildings, *Fireplaces, Space heaters, Inserts, Structural design, Creosote, Fire tests, Fire safety, *Fireplace inserts.

The report describes the work carried out to determine the safety of fireplace inserts. Chapter 2 covers the review and classification of fireplace inserts. A description of the appliances used in the current study, both fireplaces and fireplace inserts, is included in Chapter 3. Chapter 4 discusses chimney creosoting. Several earlier studies are described for background information, and then the results of the present study are presented. Results of the thermal performance tests are presented in Chapter 5. Finally, conclusions and recommendations for future study are given in Chapter 6.

701,034
PB82-182379 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Seasonal Heat Loss Calculation for Slab-on-Grade Floors.
T. Kusuda, M. Mizuno, and J. W. Bean. Mar 82, 50p NBSIR-81-2420
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Floors, *Heat loss, Computation, Heat transfer, Buildings, Periodic variations, Data, Concrete slabs.

In order to facilitate an efficient slab-on-grade heat transfer calculation on a comprehensive energy analysis program such as DoE-2, BLAST and NBSLD, heat transfer calculations for slab-on-grade floors are reviewed. The computational procedure based on the Lachenbruch method is studied in depth to generate monthly average temperatures at a given depth below the floor slab. The data generated by the Lachenbruch method are then used to develop a simplified procedure for determining the monthly average earth temperatures below the floor slab. These monthly average temperature data can be used for the hourly response factor analysis of floor-slab heat transfer.

701,035
PB82-195215 Not available NTIS
National Bureau of Standards, Washington, DC.
Building Ventilation Measurements, Predictions, and Standards.
Final rept.
P. E. McNall. Jun 81, 15p
Pub. in Proceedings of Symposium on Indoor Air Pollution, Committee on Public Health, Held at New York Academy of Medicine, NY on May 28-29, 1981. Bull. New York Academy of Medicine 57, n10 p1027-1042 Dec 81.

Keywords: *Buildings, *Air pollution, Ventilation, Air circulation, Contaminants, Air pollution control, Quality of life, Engineering standards, *Air quality.

This paper discusses the energy importance of reduced ventilation. The new ASHRAE Standard 62-1981, Ventilation for Acceptable Indoor Air Quality, and extensive field measurements of ventilation are discussed. A predictive model for indoor air contaminant concentrations in residences and its verification are presented and the effects of several variables are discussed. Additional research on the indoor emanation rates of contaminants which are or may be health hazards would enable the prediction of indoor contaminant levels with various control options. Such predictions could be used to verify or refine indoor air quality standards.

701,036
PB82-203639 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Economics and Energy Conservation in the Design of New Single-Family Housing.
Final rept.
S. R. Petersen. Aug 81, 161p NBSIR-81-2380
Sponsored in part by Department of Energy, Washington, DC., and Department of Housing and Urban Development.

Keywords: *Residential buildings, *Environmental engineering, *Cost analysis, Space heating, Cooling systems, Insulation, Seasonal variations, Construction, Structural design, *Energy conservation, Life cycle costs.

This report investigates the extent to which certain energy conservatin modifications to the envelope design of a new, single-family house are economically justified for a wide range of climates and projected energy costs. The report provides background information on those factors that give rise to space heating and cooling loads in buildings and examines in greater detail than in previous reports the thermal interdependencies within and among envelope components that can greatly affect heating and cooling loads. Economic criteria for determining a minimum life-cycle cost building envelope design are formulated and a priority-ranking method is developed to assist in the calculation of these designs.

701,037
PB82-210949 Not available NTIS
National Bureau of Standards, Washington, DC.
Single Zone Computer Model for Residential Furnace Location Analysis.
Final rept.
C. Park. 1981, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of ASHRAE Annual Meeting (1981), Cincinnati, OH, 28 June-1 July 1981, ASHRAE Transactions 87, Pt. 2, p897-920 1981.

Keywords: *Residential buildings, *Environmental engineering, Furnaces, Fossil fuels, Fuel consumption, Cyclic loads, Temperature control, Thermostats, Computerized simulation, *Residential furnaces.

A computer model has been constructed to determine in situ performance of a fossil fuel-fired residential furnace. This single zone model deals with both the cases when the furnace is within the zone or outside of the zone. Based upon existing computer models such as NBSLD and DEPAF, a dynamic simulation model is developed to analyze the dynamic interaction of a heating unit, a thermostat, and a building envelope. Room air temperature is evaluated every minute while the excitation of outdoor air temperature is considered every 30 minutes. Thermal behavior of the furnace is evaluated every 5 seconds. Two kinds of thermal response factors of the structure incorporate with heat balance equations. Simulation results of indoor installation are compared with experimentally measured values. Good agreement is obtained. Energy consumptions for indoor and outdoor installations are compared. This computer model may serve as a vehicle for sensitivity analysis due to the furnace configuration, the thermostat settings, and the building structure changes.

701,038
PB82-234766 Not available NTIS
National Bureau of Standards, Washington, DC.
Research Support for Defense Construction: The National Bureau of Standards.
Final rept.
J. T. Ichter, J. D. Long, W. E. Reeve, and N. Raufaste. Jun 82, 3p
Pub. in Military Engineer 74, n480 p209-211 May-Jun 82

Keywords: *Buildings, *Structural design, Technical assistance, Construction materials, Environmental engineering, Wind pressure, Plumbing, Economic factors, Reprints.

The article reviews the National Bureau of Standards' Center for Building Technology (CBT) technical assistance provided to the Department of Defense's Tri-Services Committees. For over 40 years CBT has provided the Tri-Service Committees with a technical base to improve their building design and construction practices in a variety of areas: plumbing, structures, organic coatings, wind loads, environmental effects, energy conservation, and building economics. CBT findings have resulted in material and labor savings.

701,039
PB82-234790 Not available NTIS
National Bureau of Standards, Washington, DC.
Bridging the Gap between Component and Energy Performance Criteria.
Final rept.
J. L. Heldenbrand, D. K. Ross, R. G. Stein, and W. K. Y. Tao. Jan 82, 11p
Sponsored in part by Department of Energy, Washington, DC. Office of Building and Community Systems.
Pub. in Lighting Design and Application 12, n1 p41-51 Jan 82.

Keywords: *Office buildings, *Design criteria, Lighting equipment, Illuminating, Environmental engineering, Commercial lighting, Reprints, *Energy conservation, *Energy management.

In order that building designers and builders may analyze and compare the energy (as contrasted with power or peak demand) implications of their design decisions, a method for performing the analysis and target goals for the design energy consumption is needed. One approach to developing such a capability is to bridge the gap between component performance standards, such as ANSI/ASHRAE/IES 90 A, and design performance at the whole building level. A missing link is subsystem performance criteria. This paper provides background on the need for performance-based criteria for the energy subsystem in buildings, describes a framework for one such approach, and illustrates application to energy-conserving illumination subsystems for office buildings.

701,040
PB82-234808 Not available NTIS
National Bureau of Standards, Washington, DC.
Window Management: An Overview.
Final rept.
B. L. Collins. 1979, 8p
Pub. in ASHRAE Trans. 85, n2 p633-640 1979.

Keywords: *Buildings, *Windows, Ventilation, Illumination, Thermal conductivity, Window glass, Reprints, *Energy conservation, *Energy management.

Window management has been defined as the selective alteration of the window's thermal and light transmission properties. In this paper the use of window management to alter window properties is discussed in terms of the need for energy conservation in buildings. Initially, a brief review of the psychological reaction to windows is given. Then thermal calculation of the energy balance at the window is given in terms of the use of daylight and window management. Finally, several studies on actual window management practices are given. These include the use of natural ventilation, natural light, and venetian blinds. In conclusion, the need for further research into the factors that affect the use of window management is suggested, along with the urgent requirement to evaluate the window as a total system.

701,041
PB82-234840 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Room Models for Control Analysis.
Final rept.
B. A. Borresen. 1981, 11p
Sponsored in part by Department of Energy, Washington, DC. Office of Building and Community Systems, Norges Tekniske Hoegskole, Trondheim, and Civil Engineering Lab. (Navy), Port Hueneme, CA.
Pub. in Proceedings of ASHRAE 1981 Annual Meeting, Cincinnati, Ohio, June 28-July 1, 1981, ASHRAE Transactions 87, pt 2 p251-261 1981.

Keywords: *Mathematical models, *Buildings, Control, Air conditioning, Ventilation, Dynamic response.

The analysis of a dynamic control loop often requires the use of a room model. This paper discusses four simplified dynamic room models which in different ways takes into account the thermal interaction between room air and surrounding walls. The room air is assumed to be fully mixed. It is shown that the choice of simplification level employed depends on how closely the long time responses and stationary values are to fit the actual room response. For modeling short time dynamic responses, a simple time constant corresponding to the air change rate of the room is usually adequate and will lead to choosing control parameters which are conservative. An experimental procedure for achieving typical parameter values is discussed.

701,042
PB82-236217 Not available NTIS
National Bureau of Standards, Washington, DC.
Direct Digital Control of an Air Handler.
Final rept.
C. W. Hurley, W. May, G. E. Kelly, and B. Borresen. 1981, 19p
Sponsored in part by Department of Energy, Washington, DC., Naval Civil Engineering Lab., Fort Hueneme, CA., and Norewegian Inst. of Technology, Irondheim.
Pub. in Proceedings EMCS-Energy Management and Controls Society Conference (6th), Houston, TX., Nov 4-7 1981, pi1-18.

Keywords: *Controllers, *Ventilation, Temperature control, Digital systems, Algorithms, Buildings, Automatic control, Microprocessors.

A microprocessor-based direct digital controller employing a PI algorithm has been used to perform local loop control on a large air handling unit in an office-laboratory building at the National Bureau of Standards in Gaithersburg, Md. The controller has successfully held the supply air temperature from the air handling unit at desired setpoints over a period of several months. Two methods used for interfacing the digital controller to the existing pneumatic control system are described. Problems encountered with air leaks in the existing pneumatic control system and their effect on the control of the supply air temperature are discussed for each type of digital-to-pneumatic interface.

701,043
PB82-248113 Not available NTIS
National Bureau of Standards, Washington, DC.
Solar Energy System Performance Standards and Criteria - NBS Activities.
Progress rept.
R. D. Dikkers. Jul 79, 11p
Contract DOE-EA-77-A-01-6010
Sponsored in part by Department of Housing and Urban Development, Washington, DC.
Pub. in Proceedings of Solar Heating and Cooling Commercial Demonstration Program Contractors' Review (2nd), San Diego, CA, December 13-15, 1978, p13-23 Jul 79.

Keywords: *Buildings, *Solar energy, Performance standards, Solar heating, Cooling.

One of the important objectives of the National Program for Solar Heating and Cooling of Buildings is the development of 'solar energy system performance standards and criteria for the production and installation of solar energy systems, subsystems and components with appropriate provisions for consumer protection.' To assist the Department of Energy (DOE) and the Department of Housing and Urban Development (HUD) in accomplishing the above objective, the National Bureau of Standards (NBS) has been actively working with standards-writing organizations, industry, designers, consumers and other members of the building community for the past few years to help develop performance criteria and standards for solar heating and cooling applications. This overview paper describes the current status and highlights of NBS activities which are being carried out with financial support from DOE and HUD.

701,044
PB82-260811 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Nontechnical Summary of the Final Report 'Optimal Weatherization of Low-Income Housing in the United States: A Research Demonstration Project'.
Final rept. Sep 77-Sep 81.
S. T. Margulis, and R. E. Clark. Aug 82, 45p NBSIR-82-2539
Contract CSA-A8B-0018

Keywords: *Low income groups, *Housing studies, *Weatherproofing, Fuel consumption, Thermal insulation, Space heating, Bibliographies, Abstracts, *Energy conservation, *Energy consumption.

This report summarizes in nontechnical language the nature and results of the Community Service Administration's (CSA's) Optimal Weatherization Demonstration Research Project carried out by the National Bureau of Standards (NBS). This summary draws on the final report of the field evaluation of the Demonstration, an NBS publication entitled Optimal Weatherization of Low-Income Housing in the U.S.: A Research Demonstration Project (NBS BSS 144). Unless stated otherwise, this report references the final report. The CSA/NBS demonstration installed both architectural (Building shell) and mechanical systems weatherization options, and achieved, when both types of options were used, an average reduction in space heating fuel consumption of 41 percent, at an average weatherization cost of $1,862 per house.

701,045
PB82-263336 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Health and Safety Considerations for Passive Solar Heated and Cooled Buildings.
Final rept.
F. E. Metz, J. H. Pielert, P. W. Cooke, and D. Walton. Aug 82, 67p NBSIR-82-2554
Contract DE-AI01-76PR06010

Keywords: *Buildings, *Solar heating, *Radiant cooling, Building codes, Environmental engineering, Fire safety, Structural design, *Passive solar heating systems, *Passive solar cooling systems, *Air quality.

Passive solar buildings often introduce alternative construction techniques, and new materials and applications which presently have limited guidelines concerning safe application. This report discusses research conducted to pursue the nature of health and safety considerations in application of solar passive technology to buildings and how they would be affected by current building regulatory requirements. Health and safety considerations associated with solar passive systems are discussed including: indoor air quality; structural safety; fire safety; and environmental issues such as ventilation, illumination, temperature control, humidity and noise control. The report also identifies technical issues and research needs for addressing health and safety issues in passive solar technology.

701,046
PB82-264235 Not available NTIS

National Bureau of Standards, Washington, DC.
Air Flow and Multi-Room Thermal Analysis.
Final rept.
G. N. Walton. 1982, 11p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in American Society of Heating, Refrigerating and Air-Conditioning Engineers Transactions 88, Technical paper no. 2704, pt. 2, 11p 1982.

Keywords: *Buildings, *Rooms, *Air circulation, Heating load, Air flow, Ventilation, Environmental engineering, Computerized simulation, Reprints.

A model for computing the infiltration and air flow between rooms of a multi-room building is presented in terms of basic principles of fluid mechanics. This model has been incorporated into a comprehensive loads-predicting computer program. Air flows, room temperatures, and heating loads for a typical townhouse under different conditions of environment and with various construction features are computed. These calculations show the feasibility of detailed multi-room air movement analysis. They also indicate that when the inter-room openings of a low-rise structure are large compared to the envelope openings, the infiltration and total load can be accurately, and more quickly, computed by assuming no resistance to air flow between rooms. This property will also allow simplified calculations for high-rise buildings with many rooms. Methods are proposed for handling more complex air flow phenomena.

701,047
PB82-265380 PC **A04**/MF **A01**
TPI, Inc., Beltsville, MD.
National Bureau of Standards Passive Solar Test Building Handbook.
Final rept.
K. W. Lindler. Aug 82, 56p TPI/SR-82-05, NBS-GCR-82-398
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Test facilities, *Buildings, *Solar heating, Handbooks, Walls, Windows, Roofs, Floors, Heat measurement, *Passive solar heating systems, Floor plans.

The National Bureau of Standards Passive Solar Test Building was constructed for the class A Passive Solar Program of the U.S. Department of Energy. The Test Building is located in Gaithersburg, Maryland (39.0 deg n latitude, 77.3 deg W longitude) at an elevation of 417 ft. The handbook provides a complete physical description of the building including floor plans and dimensions, structure, wall cross-sections, and material properties. The location of various sensors installed in and around the building is also provided.

701,048
PB82-600057 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Lessons from an Energy-Efficient Test-Bed.
T. E. Richtmyer, W. B. May, C. M. Hunt, and J. E. Hill. 1980, 16p
Pub. in Build. Res. Pract., p344-359 Nov/Dec 1980.

Keywords: *Air-cooling, Air leakage, Energy, Heat-recovery, Insulation, Measurement, Office-building, Radiant, Solar, Space-heating.

The Norris Cotton office building in New Hampshire, USA, is a bold design experiment to achieve year-round comfort conditions with full energy-efficiency. This interim report by staff of the US National Bureau of Standards shows how the design goal has now been virtually achieved. But the building's deliberately complex HVAC system has created control problems, with under-performance of some sub-systems. Moreover, the benefits of sophisticated building details were at first nullified by inadvertent thermal bridges.

701,049
PB83-117317 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Optimal Weatherization of Low-Income Housing in the U.S.: A Research Demonstration Project.
Building science series (Final).
R. Crenshaw, and R. E. Clark. Sep 82, 172p NBS-BSS-144
Library of Congress catalog card no. 82-600576.
Sponsored in part by Community Service Administration, Washington, DC.

Keywords: *Residential buildings, *Low income groups, *Weatherproofing, Space heating, Fuel consumption, Thermal insulation, *Energy consumption.

This report describes and presents the results of the Community Service Administration's (CSA's) Optimal Weatherization Demonstration Research Project carried out by the National Bureau of Standards (NBS). The CSA/NBS demonstration installed both architectural (building shell) and mechanical systems building weatherization options, and achieved, when both types of options were used, an average reduction in space heating fuel consumption of 41 percent, at an average weatherization cost of $1,862 per house.

701,050
PB83-133595 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Thermal Comfort in Passive Solar Buildings - An Annotated Bibliography.
A. I. Rubin. Oct 82, 83p NBSIR-82-2585
Contract DE-AI01-76PRO6010

Keywords: *Buildings, *Solar heating, *Comfort, Environmental engineering, Human factors engineering, Temperature gradients, Temperature control, Bibliographies, *Passive solar heating systems, *Thermal comfort.

This study consists of a selective annotated bibliography of thermal comfort research organized around major subject areas, and recommendations for future research concerned with thermal comfort in passive solar buildings. No attempt has been made to provide a comprehensive treatment of this extensive area of investigation--as this would be beyond the scope of the project under which this work was performed. Instead, the intent has been to sample the range of experimental variables and research methods employed by thermal comfort researchers--and to indicate significant findings. The major goals for the present report are to describe the state-of-the-art of thermal comfort research and findings and to indicate the research needed to develop the information required by those responsible for specifying, designing and operating passive solar buildings.

701,051
PB83-134254 Not available NTIS
National Bureau of Standards, Washington, DC.
Stairwell Pressurization.
Final rept.
J. H. Klote. 1980, 19p
Pub. in ASHRAE Trans. 86, Pt. 1, p604-623 1980.

Keywords: *Stairways, *Fire safety, Design criteria, Pressurizing, Smoke, Field tests, Reprints.

Pressurized stairwells have been used increasingly in the past few years to provide smoke free escape routes. However, there are no accepted design procedures for these systems. The paper provides a discussion of several of the designs currently in use. In particular, single and multiple injection systems are discussed. A report is made on field tests on five pressurized stairwells. The testing is part of a continuous program to evaluate alternate systems, in an attempt to establish design recommendations for the future.

701,052
PB83-135111 Not available NTIS
National Bureau of Standards, Washington, DC.
Summary of the NBS-NCSBCS Joint Conference on Building Rehabilitation Research and Technology for the 1980's.
Final rept.
J. G. Gross. 1980, 7p
Pub. in Proceedings Building Rehabilitation Research and Technology for the 1980's, San Francisco, CA, December 12, 1979, p308-312 1980.

Keywords: *Buildings, *Building codes, Meetings, Renovating, Rebuilding, Economic analysis, Law(Jurisprudence), *Earthquake engineering, *Energy conservation.

This paper is the summary of a two-day technical conference, held on December 10-11, 1979, in San Francisco, California. It summarizes the twenty plus technical papers presented in four technical sessions, keynote address, and discussion of the HUD Rehabilitation Guidelines. The four technical sessions were building code development and enforcement; energy conservation; seismic considerations and solutions; and legal implications and economic approaches. The paper is to be published by the National Conference of States on Building Codes and Standards as part of the proceedings of this joint NBS-NCSBCS Conference.

701,053
PB83-137141 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Laboratory Tests of a Residential Unitary Water-Source Heat Pump.
W. J. Mulroy, and G. E. Kelly. Nov 82, 45p NBSIR-81-2287
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Residential buildings, *Heat pumps, Heating, Cooling, Heat exchangers, Air flow, Water flow, Flow rate, Performance evaluation, *Water source heat pumps.

The performance of a residential heat pump was measured in the laboratory over a broad range of source water temperatures (40F to 90F). Tests were performed in both heating and cooling operational modes and for both steady-state and cyclic operation. For both heating and cooling operations, the unit capacity and coefficient of performance were found to be linear functions of the average of the unit source and outlet water temperatures. In heating, the unit capacity, COP, and part load performance increased with increasing water temperature. In cooling, the unit capacity, COP, and part load performance decreased with increasing water temperature. The measured degradation coefficients ranged from 0.09 to 0.21 for heating and from 0.10 to 0.18 for cooling. An appendix is included in which the effect of the degradation coefficient and of supplemental resistance heat on the unit heating and cooling seasonal performance factors is calculated.

701,054
PB83-137166 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Test Method and Calculation Procedure for Determining Annual Efficiency for Vented Household Heaters and Furnaces Equipped with Modulating-Type Thermostat Controls,
E. Kweller, and R. L. Palla. May 82, 67p NBSIR-82-2497
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Residential buildings, *Heating equipment, *Thermal efficiency, Furnaces, Temperature control, Thermostats, Venting, Periodic variations, Computer programs, FBVH computer program.

As annual operating efficiency of vented heating equipment is affected by burner fuel and combustion air modulation, it is important to differentiate between the various types of controls in determining annual energy requirements. Test procedures for evaluating annual efficiency have already been developed and implemented by the Department of Energy (DoE) for furnaces with single-stage thermostat control. A modified test procedure is necessary to account for operation with fuel modulation. A revised procedure which accommodates two types of fuel modulating controls has recently been developed. Tests are conducted at reduced and maximum firing rates, and along with typical derived values from a bin analysis of weather data. The fraction of the total hours for each operating mode is obtained to calculate a weighted annual efficiency. These test methods and calculation procedures are based on and are an extension to the current DoE test procedures for the single-stage type of thermostat control of central warm air furnaces.

701,055
PB83-139253 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Moisture on the Thermal Conductance of Roofing Systems.
Final rept.
L. I. Knab, D. R. Jenkins, and R. G. Mathey. 1981, 20p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of ASHRAE/DoE Conference on Thermal Performance of the Exterior Envelope of Buildings, Kissimmee, FL, December 3-5, 1979, p816-835.

Keywords: *Roofs, *Moisture content, *Thermal conductivity, Insulation, Thermal resistance, Thermal measurements.

The results of laboratory tests are presented describing the effect of the moisture content on the thermal conductance of roofing systems containing insulation. Roofing systems, consisting of five types of rigid-board roof insulations with attached four-ply bituminous built-up membrane, were tested. Moisture was induced into the roofing system specimens by maintaining a constant water vapor pressure difference across them. Moisture gain in the insulation varied depending on the type and thickness of the insulation. A procedure was developed, using a heat-flow meter apparatus (ASTM C518 type), to carry out thermal conductance tests on roofing specimens containing moisture. More than 150 tests were performed over a wide range of moisture contents. The approximate moisture distribution in the insulation was determined from core samples.

701,056

PB83-146936 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Quality of Inspections Utilizing Infrared Technology on Weatherization Retrofit Installations.
Y. M. L. Chang, and R. A. Grot. Nov 82, 111p NBSIR-82-2510
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Residential buildings, *Heat loss, Infrared radiation, Temperature measuring instruments, Thermal insulation, Defects.

A comparative evaluation of various portable infrared sensing systems used for detecting heat loss anomalies within building envelopes was performed. This is the second of a two-stage applied research program sponsored by the Department of Energy to assess the application and reliability of using infrared technology. Twelve single-family residences in three cities from the Weatherization Program of the Community Services Administration were employed as field samples. The results of infrared surveys carried out by thermographic surveying firms and those by the National Bureau of Standards were analyzed and compared in the categories of: completeness of scanning, identification of defects, weather condition of inspection, and method of equipment operation. The thermograms of uninsulated areas, sketches of observed thermal deficiencies, and total areas of defects for each dwelling are presented.

701,057

PB83-151308 PC **A05**/MF **A01**
Mueller Associates, Inc., Baltimore, MD.
Statistical Analysis of Thermal Performance Predictions of Passive Solar Heated Residences.
P. A. Sabatiuk. Jan 82, 90p NBS-GCR-81-341
Contract NBS-78-3534
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research.

Keywords: *Residential buildings, *Solar heating, Heat storage, Heat loss, Heating load, Cooling load, Guidelines, *Passive solar heating systems, *Passive solar cooling systems, Data bases.

In support of the development of thermal performance criteria for residential passive solar buildings, a statistical and graphical analysis of design, climatic, and predicted performance data was performed for houses in the HUD Passive Residential Design Competition and the HUD Cycle 5 Residential Solar Demonstration Program. These passive residences are located in all regions of the United States requiring space heating, and they represent a variety of passive solar systems types including direct gain, indirect gain, and solarium (isolated gain) type systems. The results of these analyses are being used to develop proposed minimum acceptable levels of thermal performance for the residential passive performance criteria. A large data base was compiled for the houses in these two HUD cycles, including parameters such as solar aperture area, January net solar contribution, and auxiliary energy use.

701,058

PB83-158543 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Amendments to ATC (Applied Technology Council) 3-06 Tentative Provisions for the Development of Seismic Regulations for Buildings for Use in Trial Designs.
E. V. Leyendecker. Dec 82, 88p NBSIR-82-2626
Sponsored in part by Federal Emergency Management Agency, Washington, DC. Also pub. as Building Seismic Safety Council, Washington, DC. rept. no. BSSC-82-2.

Keywords: *Buildings, *Earthquake resistant structures, *Design standards, Construction materials, Structural design, Building codes, Guidelines, *Seismic design, Earthquake engineering.

This report presents amendments to the seismic design recommendations contained in the report 'Tentative Provisions for the Development of Seismic Regulations for Buildings' developed by the Applied Technology Council. These amendments were prepared in a review project conducted by the Building Seismic Safety Council and the National Bureau of Standards. The amendments plus the Tentative Provisions will be used in a trial design program to provide information for estimating the impact of adopting the recommendations.

701,059

PB83-179291 Not available NTIS
National Bureau of Standards, Washington, DC.
Probability Based Load Criteria: Load Factors and Load Combinations.
Final rept.
B. Ellingwood, J. G. MacGregor, T. V. Galambos, and C. A. Cornell. May 82, 20p
Pub. in Jnl. of The Structural Division, American Society of Civil Engineers Technical Notes 108, nST5 p978-997 May 82.

Keywords: *Buildings, Structural design, Loads(Forces), Probability theory, Building codes, Materials specifications, Reprints.

This paper is the second of two papers that describe a study conducted to develop a probability-based load criterion, including load factors and load combinations, suitable for use with the loads specified in American National Standard A58, Building Code Requirements for Minimum Design Loads in Buildings and Other Structures. The general approach taken in this study was (1) estimate the levels of reliability implied by the use of various current design standards and specifications for common design situations in which performance generally is felt to be satisfactory; (2) select a format for the proposed criterion that balances theoretical consistency and appeal with ease of use in practice; (3) select a set of load factors and load combinations that make it possible for material specification writers to prescribe resistance criteria that would result, on the average, with designs similar to those currently obtained; (4) provide calculation aids for determining resistance factors to enable a specification writing group to develop resistance factors corresponding to desired reliabilities without further computer operations.

701,060

PB83-179309 Not available NTIS
National Bureau of Standards, Washington, DC.
Reliability of Wood Structural Elements.
Final rept.
B. R. Ellingwood. Jan 81, 15p
Pub. in Jnl. of The Structural Division, American Society of Civil Engineers Technical Notes 107, nST1 p73-87 Jan 81.

Keywords: *Buildings, *Wooden structures, Timber construction, Design criteria, Probability theory, Design standards, Reprints.

Recent trends in development of standards for design have been toward the use of probabilistic limit states concepts. The development of such criteria requires that a large amount of data be examined by the appropriate standards writing organizations. This paper describes basic statistical information that currently is available for developing probability based limit states design criteria for timber structures. A number of problem areas are discussed where additional study appears necessary or desirable prior to implementing such criteria practice.

701,061

PB83-179317 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Reliability for Masonry Structures.
Final rept.
B. R. Ellingwood. May 81, 17p
Pub. in Jnl. of the Structural Division, American Society of Civil Engineers Technical Notes 107, nST5 p757-773 May 81.

Keywords: *Buildings, *Masonry, Design criteria, Loads(Forces), Safety, Mechanical properties, Reprints.

Strength design and the use of loading criteria based on probabilistic limit states design principles are relatively new concepts in the masonry area. However, these procedures afford a number of advantages for design. Implementation of these concepts requires an assessment of statistical data on masonry strength, the establishment of appropriate measures of reliability for design, and the development of safety factors to be applied to material and load variables. Available strength data on brick and concrete masonry construction are summarized and a few reliability calculations are made to show how masonry compares with other engineered construction materials.

701,062

PB83-179325 Not available NTIS
National Bureau of Standards, Washington, DC.
Wind and Snow Load Statistics for Probabilistic Design.
Final rept.
B. Ellingwood. Jul 81, 6p
Pub. in Jnl. of the Structural Division, American Society of Civil Engineers Technical Notes 107, nST7 p1345-1350 Jul 81.

Keywords: *Buildings, Loads(Forces), Wind pressure, Snow, Building codes, Probability distribution functions, Dynamic response, Reprints.

Structural reliability analyses and probability-based limit states design require statistical descriptions of structural load and load effect variables. Probability distributions for wind and snow loads on structures are derived using recent statistical data and an approximate numerical technique for convolving the probability distributions of the basic variables.

701,063

PB83-179358 Not available NTIS
National Bureau of Standards, Washington, DC.
Safety Checking Formats for Limit States Design.
Final rept.
B. R. Ellingwood. Jul 82, 13p
Pub. in Jnl. of The Structural Division, American Society of Civil Engineers Technical Notes 108, nST7 p1481-1493 Jul 82.

Keywords: *Buildings, *Structural design, Construction materials, Design criteria, Probability theory, Structural engineering, Guidelines, Design standards, Reprints.

The growing need for a unified approach to structural design for different construction materials and technologies is met by the limit states design approach. Several standards-writing committees currently are considering how best to implement practical limit states design criteria. This paper examines the relative advantages of several approaches proposed for this purpose, with regard to their ability to provide desired uniform levels of reliability for all probable design situations. The choice of an appropriate approach is found to depend on fundamental characteristics of structural behavior, and thus might not be the same for different construction materials.

701,064

PB83-180174 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Measurement Methods for Diagnostic Procedures in Evaluation of Thermal Integrity of Building Envelopes.
R. A. Grot, D. M. Burch, and S. Silberstein. Nov 82, 142p NBSIR-82-2605
Sponsored in part by General Services Administration, Washington, DC.

Keywords: *Buildings, *Thermal measurements, Infrared detection, Air circulation, Radiometers, Calorimeters, Heat flow meters, Measuring instruments, Diagnosis, Guidelines, *Federal buildings.

This report presents reviews of various measurement and inspection techniques appropriate for the develop-

ment of detailed diagnostic procedure for assessing the thermal performance of the exterior envelopes of federal buildings. The inspection techniques include the use of ground-based infrared thermographic surveys, aerial infrared surveys, tracer gas air infiltration measurement, pressurization tests for measuring the tightness of the building envelope, and spot radiometer surveys for detecting gross defects. Heat flow meters, a portable calorimeter, and a microprocessor-driven envelope testing unit are also considered.

701,065
PB83-181628 Not available NTIS
National Bureau of Standards, Washington, DC.
Probability-Based Load Criteria I - Assessment of Current Design Practice.
Final rept.
T. V. Galambos, B. Ellingwood, J. G. MacGregor, and C. A. Cornell. May 82, 18p
Pub. in Jnl. of the Structural Division, American Society of Civil Engineers Technical Notes 108, nST5, p959-976 May 82.

Keywords: *Buildings, Structural design, Loads(Forces), Design standards, Probability theory, Reprints.

This is the first of two papers that describe a study conducted to develop probability-based load factors and load combinations suitable for use with the loads specified in American National Standard A58 on design loads and with all common construction materials and technologies. The first part of the study involved the selection of a probabilistic methodology for performing the necessary reliability analyses and the collection and examination of statistical data on structural resistance and loads. Levels of reliability implied by the use of current design standards and specifications for common design situations in which performance generally is felt to be satisfactory, then were estimated.

701,066
PB83-181644 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Thermal Soil Properties for Energy Transfer Modeling of Buildings.
Final rept.
L. A. Salomone, and W. D. Kovacs. Sep 82, 25p
Pub. in Proceedings of Energy Conservation in Building Design, Construction and Management Conference, Minneapolis, MN., September 15-16, 1982, p137-161 1982.

Keywords: *Buildings, *Soil properties, Thermal resistivity, Heat loss, Soil water, Thermodynamic properties, Field tests.

The paper presents the factors that affect the thermal conductivity of soils that surround buildings and demonstrates the importance of predicting in-situ soil thermal properties. The state-of-the-art field and laboratory procedures used to evaluate the thermal conductivity of fine-grained soils are presented. Results demonstrate the need for incorporating changes in thermal resistivity caused by changes in soil moisture in computer models of the thermal performance of buildings.

701,067
PB83-182295 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
SOLCOM: A Computer Program to Integrate Solar and Conservation Economics for New Commercial Buildings.
Final rept.
S. R. Petersen. Jan 83, 137p NBSIR-83-2658
Sponsored in part by Department of Energy, Washington, DC. Office of Solar Heat Technologies.

Keywords: *Commercial buildings, *Solar heating, Cost analysis, Cooling, Algorithms, Optimization, Computer programs, *Energy conservation, *SOLCOM computer program, Life cycle costs, BASIC(Programming language).

This report provides a methodology, algorithms and a computer program for determining the least life-cycle cost combination of three interdependent conservation strategies in new commercial buildings. These three strategies include (1) envelope modifications to reduce seasonal and peak load heating and cooling requirements, (2) heating and cooling plant modifications to increase their seasonal efficiency, and (3) the use of an active solar space and water heating system. The resulting computer program, called SOLCOM, can be run on a microcomputer in three stages.

701,068
PB83-182576 Not available NTIS
National Bureau of Standards, Washington, DC.
Curvature of Sound Decays in Partially Reverberant Rooms.
Final rept.
T. W. Bartel, and S. L. Yaniv. Dec 82, 7p
Pub. in Jnl. of the Acoustical Society of America 72, n6 p1838-1844 Dec 82.

Keywords: *Rooms, *Acoustic measurement, Reverberation, Acoustic absorption, Sound transmission, Acoustic fields, Reprints.

Measurements were conducted to investigate the departure from linearity of sound decays in partially reverberant rooms--that is, rooms, such as are found in office buildings and residences, that are less reverberant than laboratory reverberation chambers. The extent to which the nonlinearities in the decay curves could be reduced by means of an ensemble-averaging procedure was determined.

701,069
PB83-194225 PC **A13**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Thermal Analysis Research Program Reference Manual.
G. N. Walton. Feb 83, 290p NBSIR-83-2655
Sponsored in part by Department of Energy.

Keywords: *Residential buildings, *Heating load, *Cooling load, Thermal analysis, Heat transfer, Heat balance, Temperature control, Computer programs, Fortran, *Energy conservation, TARP computer program, Fortran 77 programming language.

The Thermal Analysis Research Program (TARP) has been developed as a research tool for the thermal analysis of buildings. It especially aims to study the interactions of many complex heat transfer phenomena. TARP uses the detailed heat balance method for the simultaneous calculation of the energy requirements of multiple rooms. Interroom conductive and convective processes are simulated in detail. This program reference manual describes the algorithms, input, output, and program structure of TARP. The program is written to be portable and modifiable. It is written in FORTRAN 77 and has run on CDC and UNIVAC computers. Future expansions of the program are anticipated, particularly for the simultaneous simulation of equipment performance and building thermal response.

701,070
PB83-198556 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Method for Assessing Benefits of Airborne Noise Isolation Requirements in Residential and Educational Buildings.
Final rept.
F. F. Rudder. Apr 83, 67p NBSIR-83-2680
Sponsored in part by Environmental Protection Agency, Washington, DC. Office of Noise Abatement and Control.

Keywords: *Buildings, *Noise reduction, Acoustic measurement, Environmental impacts, Noise pollution, Building codes, *Noise levels.

This report presents a method for estimating benefits accruing from implementing acoustical performance requirements for new buildings. The method can be applied to a wide range of environmental noise conditions and noise isolation requirements for building envelopes. Benefits are estimated based upon the distribution of population with outdoor noise level and the noise isolation provided by the building envelope. A method is described for estimating noise isolation performance of existing construction based upon local conditions.

701,071
PB83-203026 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Technique for Tracking the Effect of Weatherization Retrofits on Low-Income Housing.
Y. M. Chang, and R. A. Grot. Apr 83, 50p NBSIR-83-2676
Sponsored in part by Community Services Administration, Washington, DC.

Keywords: *Residential buildings, *Weatherproofing, Housing studies, Low income groups, Fuel consumption, Data acquisition, *Energy conservation.

This report presents a technique for analyzing the effect of energy saving retrofits installed in low-income housing under a nationwide weatherization demonstration program. A tracking technique, based on the calculated balance-point temperature of each home prior to the weatherization, was developed to estimate the would-be fuel consumption over a period of time if the house had not been weatherized. The savings in fuel consumption for a home can be determined from the difference between the actual usage after retrofit and the calculated usage if it were not retrofitted. Besides the overall reduction, the saving in energy usage during different time periods while the house is being weatherized can be visualized from the graphical representation of the tracking technique.

701,072
PB83-207167 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Evaluation of Construction Loads in Multistory Concrete Buildings.
Building science series (Final).
S. G. Fattal. Feb 83, 144p NBS-BSS-146
Sponsored in part by Occupational Safety and Health Administration, Washington, DC. Library of Congress catalog card no. 82-600579.

Keywords: *Buildings, *Concrete construction, Concrete slabs, Reinforced concrete, Shoring, Static loads, Dynamic loads, Construction management, Data acquisition.

Construction loads in a multistory flat plate concrete building were measured using strain-gaged metal shores and an analog recorder. The instrumented shores were placed within an interior bay of the third story under the formwork for the fourth story floor slab, and loads on the shores were measured continuously over a 24-hour period during the casting and partial curing cycle of that slab. The loads on some of these shores, when subsequently used as reshores in the same bay, were measured during an 8-hour period which included the casting of the fifth story floor slab. A time-lapse camera, operating synchronously with the load data acquisition system, gathered simultaneous photographic evidence of the construction activities during load monitoring periods. This report presents a complete documentation of the field data in compact form for subsequent use in related studies. The load data is interpreted and compared with construction load and design provisions of current standards.

701,073
PB83-207829 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Low-Voltage Room Thermostat Performance.
Final rept.
J. Y. Kao, G. Sushinsky, D. A. Didion, E. J. Mastascusa, and J. Chi. Apr 83, 49p NBS-BSS-150
Sponsored in part by Department of Energy, Washington, DC. and Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Buildings, *Temperature control, *Thermostats, Low voltage, Computerized simulation, Computer programs, Performance evaluation.

To predict performance of low voltage electric thermostats in a dynamic building system, a computer model representing two types of thermal feedback was developed. Unlike the information obtained from existing test standards, this model allows thermostat performance to be determined under any load conditions. As input to the model, the basic parameters of thermostat performance were first identified and then determined experimentally in a controlled laboratory facility. The experimental results from the tests were used as input parameters for the simulation model. Based upon the results from the simulation model and test results on four commercially-available thermostats, a switch-feedback model computer simulation is recommended for studying low-voltage room thermostat performance.

701,074
PB83-214593 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.

Daylighting Model for Building Energy Simulation.
Final rept.
G. Gillette. Mar 83, 139p NBS-BSS-152
Library of Congress catalog card no. 83-600513. Sponsored in part by National Fenestration Council, Topeka, KS., and Department of Energy, Washington, DC.

Keywords: *Buildings, *Illumination, *Sunlight, Daylight, Luminance, Computerized simulation, Computer programs, Fortran, DAlite computer program, Fortran 77 programming language.

A computer model is outlined for estimating the annual energy performance of a daylighted building. The daylighting model is a system of FORTRAN subroutines designed for inclusion into larger building energy simulation programs such as DOE-2, BLAST, and NBSLD. Once incorporated into the main energy program, these subroutines will allow the existing program to account for the energy tradeoffs associated with natural illumination. The daylighting model, DALITE, comprises three separate routines to do three separate functions. The first routine generates hourly sky luminances and sky illuminances as well as direct sun illuminance, taking solar radiation and sun position data as input. The second predicts interior daylight illumination at various points within a room due to any number of windows, skylights or clerestories. The last routine adjusts the electric lighting load (via photoelectric controls) in response to the available daylight.

701,075

PB83-214692 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Energy and Cost Evaluation of Solar Window Film Use in an Office Building.
Technical note (Final).
S. Treado, J. Barnett, and T. Kusuda. Mar 83, 130p NBS-TN-1174

Keywords: *Office buildings, *Windows, Cooling load, Heating load, Guidelines, Cost effectiveness, Temperature gradients, *Solar films, *Energy conservation, *Passive solar cooling systems, Computer applications, DOE-2 computer program, Life cycle costs.

The impact of solar window film utilization on building HVAC system loads, energy consumption and costs, is examined for a typical office building. The evaluation includes characterization and measurement of important film properties, performance of single-glazing window systems with and without film, simulation of annual building energy performance using the DOE-2 computer program, and a life-cycle cost analysis. Six window film options are compared to clear glass performance for seven climatic regions throughout the United States.

701,076

PB83-216341 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Selected Measured Data from Residential Housing for Use in Testing and Verification of Building Energy Analysis Programs.
J. P. Barnett. Jan 82, 65p NBSIR-81-2456
Sponsored in part by Department of Energy, Washington, DC. Architectural and Engineering Systems Branch.

Keywords: *Residential buildings, Heating, Cooling, Data acquisition, *Energy consumption, Computer applications.

A set of measured residential data has been culled from three larger data sets for use in the testing and verification of building energy analysis programs. The data consist of hourly values for heating/cooling system performance and weather conditions that are sufficient in detail, it is believed, for all existent computer programs. These dates have been encoded onto a magnetic tape. In addition, general information has been collected on the houses, occupants/occupant use, and heating/cooling systems.

701,077

PB83-226639 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Computer Modeling of the Vapor Compression Cycle with Constant Flow Area Expansion Device.
Final rept.
P. Domanski, and D. Didion. May 83, 163p NBS-BSS-155
See also PB83-226647. Sponsored in part by Department of Energy, Washington, DC. Errata sheet inserted.

Keywords: *Buildings, *Air conditioning equipment, *Heat pumps, Refrigerant compressors, Capillary tubes, Heat transfer coefficient, Mass transfer, Mathematical models, Computerized simulation, User needs, Fortran, HPSIM computer program, Fortran 4 programming language.

An analysis of the vapor compression cycle and the main components of an air source heat pump during steady-state operation has been performed with emphasis on fundamental phenomena taking place between key locations in the refrigerant system. The basis of the general heat pump model formulation is the logic which links the analytical models of heat pump components together in a format requiring an iterative solution of refrigerant pressure, enthalpy and mass balances. The modeling effort emphasis was on the local thermodynamic phenomena which were described by fundamental heat transfer equations and equation of state relationships among material properties.

701,078

PB83-226647 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Computer Modeling of the Vapor Compression Cycle with Constant Flow Area Expansion Device: Appendix J.
Final rept.
P. Domanski, and D. Didion. May 83, 103p NBS-BSS-155-APP-J
See also PB83-226639. Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Buildings, *Air conditioning equipment, *Heat pumps, Refrigerant compressors, Capillary tubes, Heat transfer coefficient, Mass transfer, Computer programs, Fortran, HPSIM computer program, Fortran 4 programming language.

The modeling effort emphasis was on the local thermodynamic phenomena which were described by fundamental heat transfer equations and equation of state relationships among material properties. In the compressor model several refrigerant locations were identified and the processes taking place between these locations accounted for all significant heat and pressure losses. Evaporator and condenser models were developed on a tube-by-tube basis where performance of each coil tube is computed separately by considering the cross-flow heat transfer with the external air stream and the appropriate heat and mass transfer relationships. A capillary tube model was formulated with the aid of Fanno flow theory.

701,079

PB83-234328 Not available NTIS
National Bureau of Standards, Washington, DC.
Fire Testing of Roof-Mounted Solar Collectors by ASTM E 108.
Final rept.
D. Waksman, and W. D. Walton. May 82, 13p
Sponsored in part by Department of Energy, Washington, DC. See also PB82-117698.
Pub. in Fire Technology 18, n2 p174-186 May 82.

Keywords: *Roofs, *Solar energy concentrators, *Fire tests, Fire resistance, Building codes, Reprints, *Solar collectors.

A study was undertaken to investigate the use of ASTM E 108 (NFPA 256, UL 790), Fire Tests of Roof Coverings, for testing roof-mounted solar energy collectors. The ASTM E 108 test method is commonly referenced in building codes as the procedure for determining the fire resistance classification of roof coverings. To date, no data have been available regarding the influence of solar collectors on the fire characteristics of roof coverings or on collectors used as roof coverings. This study focuses primarily on class C intermittent flame, spread of flame, burning brand tests, although several class A and B burning brand tests were conducted.

701,080

PB83-234419 Not available NTIS
National Bureau of Standards, Washington, DC.
Aerodynamic Coefficients and Risk-Consistent Design.
Final rept.
E. Simiu. May 83, 12p
Pub. in Jnl. Struct. Eng., Am. Soc. Civ. Eng. 109, n5 p1278-1289 May 83.

Keywords: *Buildings, *Wind pressure, Gust loads, Aerodynamic characteristics, Structural design, Climatology, Reprints.

A simple procedure is presented for estimating the reliability of wind-sensitive structures whose orientation is not specified. The procedure is based on a second moment reliability approach and makes use of (1) aerodynamic coefficients obtained experimentally as functions of wind direction, and (2) climatological data consisting of sets of largest annual speeds associated with winds blowing from each of the eight (or sixteen) compass directions. An illustration of the procedure, based on sets of actual data, is presented.

701,081

PB83-234633 Not available NTIS
National Bureau of Standards, Washington, DC.
Assessment of Significant Acoustical Parameters for Rating Sound Insulation of Party Walls.
Final rept.
J. P. Vian, W. F. Danner, and J. W. Bauer. Apr 83, 8p
Prepared in cooperation with Centre Scientifique et Technique du Batiment, Grenoble (France).
Pub. in Jnl. of the Acoustical Society of America 73, n4 p1236-1243 Apr 83.

Keywords: *Buildings, *Acoustic insulation, Noise reduction, Noise pollution, Sound transmission, Reprints, *Foreign technology, *Noise levels.

To test the adequacy of French regulations for sound isolation in buildings, subjects were asked to rate their annoyance with samples of music filtered by electronic insulation curves representing different party walls. The different insulation curves provided an A-weighted level reduction of 51 dB with a pink noise source, which is the required level difference for party walls specified by French regulations. However, the different insulation curves did not provide the same degree of sound isolation with various music samples due to source spectral differences. The annoyance results were not predicted by the French.

701,082

PB83-235390 Not available NTIS
National Bureau of Standards, Washington, DC.
Study of Sensor Errors on Building Energy Consumption.
Final rept.
J. Y. Kao, and E. T. Pierce. 1982, 9p
Sponsored in part by Civil Engineering Lab. (Navy), Port Hueneme, CA.
Pub. in Proceedings of Energy Management and Controls Society Conference (7th) Salt Lake City, UT. p9 Nov 14-17 1982.

Keywords: *Buildings, *Temperature control, *Automatic control, Heating, Ventilation, Air conditioning, Detectors, Error analysis, Computerized simulation, *Energy consumption, *Energy conservation, Computer applications.

A computer simulation was used to examine the effects of errors in the sensors of automatic controls for HVAC systems. The simulation examined two types of sensors, dry bulb temperature and dewpoint temperature, used in air handling systems. Four sensor functions were studied: outside air and return dry-bulb temperature sensor, outside air and return dewpoint sensor, mixed air temperature sensor, and cooling coil discharge air sensor. Errors in these sensors may result from inferior quality, improper calibration, or drift.

701,083

PB83-235978 Not available NTIS
National Bureau of Standards, Washington, DC.
Building in Eclipse, Architecture in Secession.
Final rept.
F. T. Ventre. Dec 82, 4p
Pub. in Progressive Architecture 63, n12 p58-61 Dec 82.

Keywords: *Buildings, *Structural design, Construction industry, Market surveys, Investments.

The report documents gradual shifts in the Nation's investment mix and more abrupt changes in market share among the professions providing design and consulting services to the building industry. The article suggests reasons for these shifts and identified possible responses by the design and consulting professions and, particularly, by the growing community of building researchers.

701,084
PB83-236182 PC **A03**/MF **A01**
American Inst. of Architects Foundation, Washington, DC.
Status Report of Escape and Rescue Model.
D. M. Alvord. Jun 83, 40p NBS-GCR-83-432
Grant NBS-DA2037
Sponsored in part by Department of Health and Human Services, Washington, DC.

Keywords: *Buildings, *Escape systems, Fire safety, Escape and rescue, Elderly persons, Handicapped persons, Mathematical models, Computerized simulation, Human factors engineering, Board and care homes, *Emergency preparedness, Simscript 11-5 computer language.

This report focuses on the Escape and Rescue Model, a deterministic discrete-event simulation model for the emergency evacuation of board and care homes. Part A is an overview of the model, describing its capabilities, input requirements, basic framework, and permissible resident types, as well as some future directions the model may take. Part B contains a brief description of a recent survey of board and care homes in which many fire drills were performed, followed by a somewhat more detailed discussion of the utilization of the survey data to calibrate and validate the simulation model. Finally, two example simulation runs appear in order to illustrate the aforementioned validation as well as to provide representative simulation output.

701,085
PB83-236315 Not available NTIS
National Bureau of Standards, Washington, DC.
Air Infiltration and Building Tightness Measurements in Passive Solar Residences.
Final rept.
A. K. Persily, and R. A. Grot. 1983, 6p
Contract DE-AI101-76PR06010
Pub. in Proceedings of Annual Conference ASME Solar Energy Division (5th), Orlando, Florida, April 18-21, 1983, p116-121.

Keywords: *Residential buildings, *Solar heating, Air flow, Pressurization, Flow measurement, Leak detectors, Passive solar heating.

The airtightness of about fifty passive solar homes located throughout the United States was studied using low cost measurement techniques. These homes are part of the Solar Energy Research Institute Class B program to evaluate the thermal performance of passive solar residential buildings. As part of this evaluation, the homes were subjected to pressurization tests to measure airtightness and tracer gas measurements to determine air infiltration rates. In pressurization testing, a fan induces a large inside-outside pressure difference and one measures the flow required to sustain this pressure difference. To measure the air infiltration rate, one releases a quantity of tracer gas concentration over time. The tracer gas measurements used air bags to collect the interior air samples, and these bags were shipped to the National Bureau of Standards for analysis. Each home was subjected to one pressurization test and/or a small number (1 or 2) of tracer gas tests.

701,086
PB83-236638 Not available NTIS
National Bureau of Standards, Washington, DC.
Laboratory Studies of Infrared Thermography in Roofing Moisture Detection.
Final rept.
D. R. Jenkins, L. I. Knab, and R. G. Mathey. 1982, 14p
Sponsored in part by Deputy Chief of Staff, Logistics and Engineering (Air Force), Washington, DC. Directorate of Engineering and Services.
Pub. in American Society for Testing and Materials Special Technical Publication 779, p207-220 1982.

Keywords: *Roofs, *Moisture content, *Temperature measuring instruments, Infrared detection, Heat flow, Heat transmission, Reprints, *Infrared thermography.

A laboratory evaluation of infrared thermography for detecting moisture in roofing specimens is presented. This study was based on laboratory controlled specimen preparation and testing conditions. For steady-state heat flow, and in a few cases, transient heat flow, the effects of moisture on the surface temperature of the roofing specimens were determined by thermocouples and thermography. Surface temperatures determined by infrared thermography were shown to correlate well with the thermocouple temperatures. Two system performance parameters were assessed: threshold moisture content, and the slope of the instrument response-versus-moisture content curve.

701,087
PB83-240481 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Evaluation of the Daylight and Energy Performance of Windows, Skylights, and Clerestories.
S. Treado, G. Gillette, and T. Kusuda. Jun 83, 27p NBSIR-83-2726
Sponsored in part by National Fenestration Council, Topeka, KS., Naval Facilities Engineering Command, Washington, DC.,Directorate of Civil Engineering (Air Force), Washington, DC. and Office of the Chief of Engineers (Army), Washington, DC.

Keywords: *Commercial buildings, *Daylighting, Architecture, Windows, Skylights, Heating, Cooling, *Energy conservation, Computer applications, NBSLD-2 computer program, Clerestories.

This paper examines the impact of several fenestration options on building space heating, cooling, and lighting loads. The use of skylights, windows, and clerestories is evaluated for a single floor commercial building, using the NBSLD-2 building energy analysis computer program, which possesses a fully integrated daylight model (DALITE). The evaluation focuses on the impact of daylighting on heating and cooling energy and equipment sizing, the potential reduction in electric lighting energy requirements through daylight utilization, the relative daylighting/thermal performance of skylights, clerestories, and windows, and the effect of building orientation on fenestration optimization and selection.

701,088
PB83-241034 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Swiss Research in Building Heating Conservation.
S. R. Hastings, and R. C. Ruggli. Jun 83, 148p NBSIR-83-2724
Contract DE-AI101-76PRO6010
Sponsored in part by Swiss National Energy Research Fund, Basel. Prepared in cooperation with Eidgenoessische Materialpruefungs- und Versuchsanstalt, Duebendorf (Switzerland).

Keywords: *Buildings, *Heating, Solar radiation, Residential buildings, Office buildings, Apartment buildings, Greenhouses, Research projects, *Foreign technology, *Energy conservation, *Passive solar heating systems, *Active solar heating systems, Computer applications, Trombe walls.

Swiss research on heating energy conservation in buildings is presented to encourage communication among researchers. A background on Switzerland's climate, geography, construction industry, and energy situation is included to provide a context for the subsequent review of a sample of research projects. Each project is described with a statement of research objectives, technical approach taken, project status, brief findings, future work planned or recommended, and resulting publications. The sample of projects is taken from the subjects of community scale solar concepts, mathematical simulation, instrumented test cabins, instrumented buildings, and design tools and data bases.

701,089
PB83-241919 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Time of Day Control and Duty Cycling Algorithms for Building Management and Control Systems.
W. B. May. Jun 83, 62p NBSIR-83-2713
Sponsored in part by Department of Energy, Washington, DC., and Naval Civil Engineering Lab., Fort Hueneme, CA.

Keywords: *Buildings, *Environmental engineering, Heating, Ventilation, Air conditioning, Scheduling, *Energy management, *Building management.

Software is an important component of building management and control systems (BMCS). Although much software is available in proprietary or system dependent form, public domain control software and algorithms are rare. This report describes concepts, algorithms, and software used in BMCS components developed in the NBS building systems and controls laboratory. The concepts and basic algorithms for time of day (scheduled start/stop) control and duty cycling of electrical equipment in building heating, ventilating, and air conditioning systems are presented.

701,090
PB83-242222 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Optimum Start/Stop Control Algorithm for Heating and Cooling Systems in Buildings.
C. Park. Jun 83, 71p NBSIR-83-2720
Sponsored in part by Department of Energy, Washington, DC., and Naval Civil Engineering Lab., Fort Hueneme, CA.

Keywords: *Buildings, *Heating, *Cooling, Optimization, Algorithms, Control theory, Computer programs.

When a building structure is occupied intermittently, energy savings can be realized from the optimal start-up and shut-down of the heating or cooling system. This strategy, known as optimum start/stop control, reduces energy consumption by delaying the start-up of the space conditioning system until the last moment and then initiating shut-down as early as possible, while maintaining a present level of comfort during the period of building occupancy. Based on the bang-bang control theory, a simple optimum start/stop control algorithm is developed for computerized control systems in buildings. The optimum start time is obtained by finding the intersection of cool-down and heat-up curves that are approximated by exponential fitting of the previous and current day's data.

701,091
PB83-249722 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Strategies for Energy Conservation for a Large Office Building.
J. Y. Kao. Jul 83, 71p NBSIR-83-2746
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Office buildings, *Heating, *Ventilation, *Air conditioning, Louisiana, Wisconsin, Tennessee, California, Washington(State), District of Columbia, *Energy conservation, *Energy consumption, BLAST-2 computer program, Computer applications.

A comparative analysis is made of the thermal performance of selected HVAC systems and control strategies commonly employed in large office buildings. The comparisons are made for six geographical locations representing wide climatic variations within the continental United States.

701,092
PB83-250423 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Automated Control of Lighting and Fenestration.
S. J. Treado. Jul 83, 20p NBSIR-83-2728
Sponsored in part by Naval Facilities Engineering Command, Washington, DC., Directorate of Civil Engineering (Air Force), Washington, DC. and Office of the Chief of Engineers (Army), Washington, DC.

Keywords: *Commercial buildings, *Lighting equipment, *Windows, Automatic control, Cooling load, Heating load, Solar radiation, *Computer applications.

This paper describes an automatic system for controlling the lighting and window shading in a commercial building. The system utilizes a microcomputer to monitor solar radiation and illumination levels and interior and exterior air temperatures, processing the input parameters to determine the optimum lighting level, window area, and solar film position to minimize building heating and cooling loads due to windows and lighting. The control methodology and logical flow are presented, along with a sample control program written in FORTRAN. The response of the system to various combinations of weather conditions is examined.

701,093
PB83-250563 PC **A05**/MF **A01**
State Univ. of New York at Buffalo.
Office Structures and Enclosures: Directions in Innovative Technology.
G. R. Schmitz, and T. D. Csizmadia. Jul 83, 80p NBS-GCR-83-434
Sponsored in part by Public Building Services, Washington, DC.

Keywords: *Office buildings, *Structural design, Structural members, Technology assessment, Dynamic response, Architecture, *Energy conservation.

Selected issues and innovative technological responses related to structures and enclosures of office buildings are presented. Innovations are based on a better use or improvement of existing technology, or a transfer of superior technology. Structural support system innovations are often concerned with economy, flexibility of use and human safety and comfort in highrise and long-span structures. Wind and seismic forces constitute major problems which can be solved through innovative structural systems and/or their new combinations, through mass reduction, structural damping devices, aerodynamic shapes, choice of materials and methods. Structural innovations are further related to specific elements such as roofs, floors, bearing walls, columns, bracings, and foundations. Enclosure system issues are concerned with the design, construction, maintenance and operation of the roof, the exterior wall and their components.

701,094
PB83-261495 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Annual Variation of Temperature Field and Heat Transfer Under Heated Ground Surfaces (Slab-on-Grade Floor Heat Loss Calculation).
Building science series.
T. Kusuda, O. Piet, and J. W. Bean. Jun 83, 70p NBS-BSS-156
Library of congress catalog card no. 83-600539.

Keywords: *Floors, *Heat loss, *Slab on ground construction, Heat transfer, Soil properties, Temperature, Buildings, Fourier transformation, Steady state, Thermal cycling tests, Delsante method, Numerical solution.

Seasonal sub-surface ground temperature profiles and surface heat transfer were determined for the condition whereby one and more than one region of the earth's surface temperature were disturbed. The analysis was conducted by numerical integration using a closed form solution based on the Green's function. Monthly profiles of earth temperature isotherms under a house of 20' x 20' (6.1m x 6.1m) floor area and under a ground of six houses near a wooded area are presented. The heat losses calculated from this approach for square slabs of various sizes were compared with those derived from the recent analytical solution of Delsante et al. resulting in good agreement.

701,095
PB83-262873 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Laboratory Investigation of Refrigerant Migration in a Split Unit Air Conditioner.
W. J. Mulroy, and D. A. Didion. Aug 83, 50p NBSIR-83-2756
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Air conditioners, *Refrigerants, Heat pumps, Pneumatic valves, Regression analysis, Evaporators, Heat transfer, Losses.

The relationship between cyclic refrigerant migration and cyclic loss for a residential, split-system air conditioner has been investigated. The cyclic refrigerant migration was measured at different points in the operating cycle by simultaneously shutting five pneumatic valves which isolated the refrigerant in the major system components. The refrigerant was then removed, weighed, and returned to the system. The unit tested was found to have a high initial capacity as migrated refrigerant was removed from the evaporator and then a low, slowly increasing capacity as trapped refrigerant was returned to the system from the accumulator. The unit performance was also compared to single and double time constant regressive approximations and to the time constant calculated from the evaporator mass and heat transfer coefficient. Although relationships between migrated refrigerant and cyclic capacity were observed, no practical refrigerant migration test method that would be less burdensome than the cyclic tests of ASHRAE Std. 116 appears possible at this time.

701,096
PB84-102110 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Air Exchange Rate Measurements in the National Archives Building.
S. Silberstein, R. A. Grot, D. O. Pruitt, P. Engers, P. Lane, and S. E. Schweinfurth. Sep 83, 28p NBSIR-83-2770
Sponsored in part by General Services Administration, Washington, DC., and National Archives and Records Service, Washington, DC.

Keywords: *Buildings, *Air circulation, Heating, Air conditioners, Ventilation, Pressurization, *National Archives Building, *Federal buildings.

Air exchange measurements were carried out at the National Archives Building under various combinations of temperature and wind speed. The average air exchange rate under normal operation of the heating, ventilating, and air-conditioning system (HVAC) was 0.9 h to the minus 1 for an average temperature difference of 11.3C and an average wind speed of 2.7 m/s. This rate is approximately twice those for new General Services Administration (GSA) office buildings. No clear dependence of air exchange rate on temperature differences up to 17C or wind speeds up to 5 m/s was found.

701,097
PB84-104249 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
NBS Thermal Integrity Diagnostic Tests on Eight GSA Federal Office Buildings.
Interim rept.
R. A. Grot, Y. M . Chang, A. K. Persily, and J. B. Fang. Sep 83, 53p NBSIR-83-2768
Sponsored in part by Public Buildings Service, Washington, DC.

Keywords: *Buildings, *Thermal measurements, Pressurization, Leakage, Air circulation, Temperature measuring instruments, *Federal buildings.

This report summarizes preliminary results of diagnostic tests to evaluate the thermal integrity of eight Federal office buildings located throughout the country. The test results include tracer gas measurements of air infiltration rates, pressurization tests of the air tightness of the building shell, and inspections of the envelope employing infrared thermography. In addition, the thermal U-values of exterior walls were measured with both heat flow meters and a portable calorimeter box. The data collected on these buildings are still undergoing analysis and therefore are to be considered preliminary.

701,098
PB84-105683 Not available NTIS
National Bureau of Standards, Washington, DC.
Minimum Cost Design for Noise Insulation in Building Construction.
Final rept.
F. F. Rudder, and S. F. Weber. Jun 83, 18p
Sponsored in part by Environmental Protection Agency, Washington, DC. Office of Noise Abatement and Control.
Pub. in Noise Control Engineering Jnl. 20, n3 p104-121 May/Jun 83.

Keywords: *Buildings, *Acoustic insulation, Construction costs, Noise reduction, Structural design, Mathematical models, Reprints, Computer applications.

A method is described for estimating the construction cost of building components designed to achieve a specified level of noise insulation. The method also determines the noise insulation value of each component of a multi-component wall such that the wall achieves a design level of noise insulation at the minimum construction cost. Curves of minimum construction cost as a function of design noise insulation are easily generated using the method. All calculations can be performed using a pocket calculator. The adjustment of construction cost estimates to account for inflation and geographic variation is discussed. Detailed examples illustrate the application of the method to design problems.

701,099
PB84-106954 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of the Performance Concept to Rehabilitation - Field Application and Evaluation.
Final rept.
J. G. Gross. 1982, 14p
Pub. in Proceedings of ASTM/CIB/RILEM Symposium on Performance Concept in Building (3rd), Lisbon, Portugal, March 29-April 2, 1982, 2, Section III.2, p205-218 1982.

Keywords: *Buildings, *Renovating, Evaluation, Technology assessment.

This report presents the author's review of five papers presented to Section III, Application of the Performance Concept to Rehabilitation, Group III.2, Field Application and Evaluation, of the Third International Symposium on the Performance Concept in Buildings, sponsored by ASTM, CIB, and RILEM. Discussed is the need for and the importance of pre-rehabilitation evaluation for the success of any rehab project. Summarized is the need for evaluation research in the area of the physical sciences, engineering, economics, and user needs.

701,100
PB84-106962 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of the Performance Concept to Rehabilitation - Field Application and Evaluation, Final Report.
J. G. Gross. 1982, 5p
Pub. in Proceedings of ASTM/CIB/RILEM Symposium on Performance Concept in Building (3rd), Lisbon, Portugal, March 29-April 2, 1982, 2, Section III.2, p227-231 1982.

Keywords: *Buildings, *Renovating, Evaluation, Technology assessment.

This paper summarizes the Session III.2 Application of the Performance Concept to Rehabilitation, 'Field Application and Evaluation,' of the 3rd ASTM/CIB/RILEM Symposium on the Performance Concept in Building, held in Lisbon, Portugal, March 29, 30, 31, and April 1 and 2, 1982. Provided is a session summary with identified research and technical needs to facilitate the application of the performance concept to rehabilitation of existing buildings.

701,101
PB84-111491 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
General Guidelines for the On-Site Calibration of Humidity and Moisture Control Systems in Buildings.
R. W. Hyland, and C. W. Hurley. Sep 83, 59p NBS-BSS-157
Library of Congress catalog card no. 83-600574.

Keywords: *Buildings, *Humidity control, Moisture content, Hygrometers, Wet bulb temperature, Dew point, Psychrometric charts, Detectors, Calibration, Ideal gas law, *Energy management.

The control of the moisture content of the air in buildings directly affects the comfort of the building occupants and is one of the more important tasks of an energy management and control system (EMCS). This report was written for the purpose of assisting the managers and operators of EMCS in buildings in the understanding and use of various techniques for on-site measurement of the moisture content in the air. In addition, various methods of on-site calibration of typical types of moisture monitoring instruments are also discussed.

701,102
PB84-122530 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Automated Office - an Environment for Productive Work, or an Information Factory: A Report on the State-of-the-Art.
A. I. Rubin. Nov 83, 209p NBSIR-83-2784-1
Sponsored in part by Public Buildings Service, Washington, DC.

Keywords: *Office buildings, *Environments, Design, Human factors engineering, Acoustics, Illuminating, Comfort, Job analysis, Quality of life, Automation.

The study is a report of research findings and recommendations covering topic which influence automated office design. The subjects covered are: office design, office information systems, organizational factors, ergonomics, technology, and communications. Advances in technology, coupled with the explosive growth of office-based work have resulted in the automation of many offices. To date, technology has provided the major impetus for automation, with mixed results. Systems frequently do not meet the needs of the end-user because of the lack of appropriate planning. Design issues are particularly neglected during planning, resulting in problems with the visual, thermal, and acoustic environment in many offices. These effects are particularly detrimental since many office automation, management, and design experts agree that the quality of the environment is especially important in the electronic office - to offset the impersonality of many office tasks, and changes in work procedures resulting in limited social interaction with colleagues. These issues are discussed as they relate to the development of design guidelines and criteria for automated offices. The report contains an extensive bibliography, dealing with the topics cited above.

701,103
PB84-135607 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Air Quality Criteria for Storage of Paper-Based Archival Records.
R. G. Mathey, T. K. Faison, S. Silberstein, J. E. Woods, W. B. Johnson, W. Lull, C. Madson, A. Turk, K. Westlin, and P. Banks. Nov 83, 112p NBSIR-83-2795
Sponsored in part by General Services Administration, Washington, DC., and National Archives and Records Service, Washington, DC.

Keywords: *Archives, *Air pollution, *Papers, *Environmental engineering, Sulfur dioxide, Nitrogen oxides, Ozone, Temperature, Humidity, Storage, *Air quality, *Air pollution effects(Materials).

Criteria for temperature, relative humidity, and gaseous and particulate contaminant concentrations are proposed for spaces used for storage and preservation of paper-based archival records. The criteria are based on available information from the literature, and recommendations of the January 19-20, 1983, National Bureau of Standards Workshop on Environmental Conditions for Archival Storage. Methods are discussed for meeting these criteria. Air quality criteria are proposed for different categories for archival storage. Factors to consider in the design of archival storage facilities are addressed and recommendations made to aid in the design of environmental conditioning systems for these facilities. A review of literature describes the damage that may be caused by high temperature, high and low relative humidity, and air pollutants to paper-based records. Results of measurements of temperature, relative humidity, air exchange rate, and gaseous contaminant concentrations (sulfur dioxide, nitrogen oxides, and ozone) in the National Archives Building in Washington, D.C., are presented. These measurements are compared with those made in other buildings having controlled environments.

701,104
PB84-136373 Not available NTIS
National Bureau of Standards, Washington, DC.
Approximate Method for Determining Monthly Heat Loss from Earth-Contact Floors.
Final rept.
T. Kusuda. 1983, 9p
Pub. in Proceedings of International Symposium on Use of Computers in Environmental Engineering Related to Buildings (4th) Held at Tokyo (Japan) on March 30-April 2, 1983, p110-118 1983.

Keywords: *Buildings, *Slab on ground construction, *Heat loss, Periodic variations, Temperature gradients, Floors, *Foreign technology.

Based on extensive earth temperature calculations using a Green's function type solution of the heat conduction equation, a simplified procedure was developed to permit the evaluation of monthly heat loss from the slap-on-grade floor. The results obtained by the method developed herein was compared against those determined by Delsante's more rigorous and analytical formula.

701,105
PB84-141621 Not available NTIS
National Bureau of Standards, Washington, DC.
Housing Construction in Areas of Mine Subsidence.
Final rept.
F. Y. Yokel, L. A. Salomone, and R. E. Gray. Sep 82, 17p
Pub. in Am. Soc. Civ. Eng. J. Geotech. Eng. Div. 108, nGT9 p1133-1149 Sep 82.

Keywords: *Residential buildings, *Underground mining, *Subsidence, Settlement(Structural), Site surveys, Structural design, Foundations.

Many areas in the United States are underlain by abandoned mines and many more areas will be undermined in the future. As mine cavities collapse they cause settlement and ground distortions on the surface which may damage or destroy buildings and utilities. Many of these subsidence-prone areas are presently used or will be used in the future for residential housing development. Three problems associated with the development of mine subsidence areas are addressed: site exploration and evaluation; site development; and housing construction in mine subsidence areas.

701,106
PB84-142231 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
Comparative Analysis of Thermographic Inspections Performed on Retrofitted Homes.
Y. M. Chang, and R. A. Grot. May 83, 191p NBSIR-83-2701
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Residential buildings, *Thermal insulation, Heat loss, Temperature measuring instruments, Infrared equipment, Field tests, Performance evaluation, *Thermographic inspection.

An applied research program was sponsored by the Department of Energy to analyze and compare the results from inspections that utilized infrared sensing systems to identify thermal deficiencies in buildings. This research consisted of both the laboratory evaluation of the commonly used infrared sensing equipment for building inspections and the field evaluation of the accuracy and consistency of the results of thermographic surveys performed by various thermographic inspectors. The field evaluation of thermographic inspection performed by infrared contractors was undertaken using residences previously inspected by the National Bureau of Standards (NBS) as part of the Community Services Administration Weatherization Program. The results of the first phase was carried out in 1978-79 and published in a previous report. The present report contains the analysis and comparison of thermal anomalies detected by NBS and infrared contractors, during the second phase of this research program, on twenty single-family residences in five cities in 1980-81.

701,107
PB84-152479 Not available NTIS
National Bureau of Standards, Washington, DC.
Calorimetric Test Facility for Field Measuring Thermal Performance of Passive/Hybrid Solar Components.
Final rept.
M. E. McCabe, S. Robinson, and J. LeCourte. 1983, 14p
Contract DE-A1101-76PR06010
Pub. in Proceedings of Thermal Performance Exterior Envelopes of Building II, held at Las Vegas, NV. on December 6-9, 1982, p673-686 1983.

Keywords: *Test facilities, *Solar heating, *Thermal measurements, Passive systems, Buildings, Heat transfer, Heat storage.

Studies of thermal performance of passive solar building have indicated a need for precise field measurement of solar heat gain and thermal heat loss or gain for modular passive/hybrid solar components. A description of the conceptual design and the major assemblies and subsystems for a new calorimetric test facility is presented. The facility is designed for field testing of passive solar components at the National Bureau of Standards in Gaithersburg, MD. It is anticipated that the test facility will provide a substantial improvement in the field measuring techniques for passive and hybrid solar components over the test cells currently in use and thereby provide a firm technical basis from which laboratory test procedures can be evaluated.

701,108
PB84-152495 Not available NTIS
National Bureau of Standards, Washington, DC.
Repeatability and Accuracy of Pressurization Testing.
Final rept.
A. K. Persily. 1983, 11p
Contract DE-AC02-77CS20062
Prepared in cooperation with Princeton Univ., NJ.
Pub. in Proceedings of Thermal Performance Exterior Envelopes Buildings II, held at Las Vegas, NV. on December 6-9, 1982, p380-390 1983.

Keywords: *Buildings, *Pressurizing, Leakage flux, Seasonal variations, Moisture content, Error analysis, Standard deviation, *Airtightness.

Pressurization testing has been used worldwide to evaluate the airtightness of building envelopes and to aid in locating air leakage sites. While pressurization testing has the advantages of providing a quick and inexpensive measure of a home's tightness, questions exist concerning the short and long term reproducibility of the test results. In order to experimentally determine the repeatability of pressurization test results, a home was pressure tested about eighty times over one year. The effect of weather conditions during the test on the test results was studied, along with changes in the results over time.

701,109
PB84-154004 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Calibration of Temperature Measurement Systems Installed in Buildings.
Building science series (Final).
C. W. Hurley, and J. F. Schooley. Jan 84, 87p NBS-BSS-153
Also available from Supt. of Docs. as SN003-003-02546-1. Library of Congress catalog card no. 83-600622.

Keywords: *Calibrating, *Temperature measuring instruments, *Buildings, Thermometers, Resistance thermometers, Thermocouples, Thermistors, Pressure, Thermopiles, Integrated circuits, Temperature control, Accuracy, Standards.

Energy Management Control Systems (EMCS) cannot function properly or efficiently without accurate temperature measurements since temperature is one of the fundamental measurements of any EMCS. This report was written for the purpose of describing various methods of on-site calibration of temperature sensing devices used in EMCS and to review the characteristics of these devices that are directly related to calibration. The significance of recording the results of each calibration is emphasized and the possible effects of systematic errors in temperature monitoring systems is discussed.

701,110
PB84-157973 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Automated Office: An Environment for Productive Work, or an Information Factory: Executive Summary.
A. I. Rubin. Dec 83, 22p NBSIR-83-2784-2
Sponsored in part by General Services Administration, Washington, DC.

Keywords: *Office buildings, *Environments, Design, Human factors engineering, Acoustics, Illuminating, Comfort, Job analysis, Quality of life, Automation.

This study is a report of research findings and recommendations covering topics which influence automated office design. The subjects covered are: office design, office information systems, organizational factors, ergonomics, technology and communications. Advances in technology, coupled with the explosive growth of office-based work have resulted in the automation of many offices. To date, technology has provided the major impetus for automation, with mixed results. Systems frequently do not meet the need of the end-user because of the lack of appropriate planning. Design issues are particularly neglected during planning, resulting in problems with the visual, thermal, and acoustic environment in many offices.

701,111
PB84-160993 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.

On-Site Calibration of Flow Metering Systems Installed in Buildings.
Building science series.
D. W. Baker, and C. W. Hurley. Jan 84, 157p NBS-BSS-159
Also available from Supt. of Docs. as SN003-003-02551-8. Library of Congress catalog card no. 83-600626. Sponsored in part by Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Flowmeters, *Buildings, Flow rate, Calibrating, *Energy management systems, *Energy conservation.

This report summarizes the various types of flowmetering devices used in energy management and control systems (EMCS), various methods for their initial calibration and, when practical, techniques for maintaining their calibration while they are in service. Emphasis is placed on the use of transfer reference meter systems, where the working meter is calibrated on site by connecting it in series with a calibrated transfer meter of any variety. Other methods of calibration are also described. Reference tables and the necessary equations for flow calculations are presented throughout the text and in the appendicies. Illustrative examples are given in detail for the calculation of flow using each type of metering device described.

701,112
PB84-178284 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Economizer Algorithms for Energy Management and Control Systems.
C. Park, G. E. Kelly, and J. Y. Kao. Feb 84, 82p NBSIR-84-2832
Sponsored in part by Department of Energy, Washington, DC. Office of Building and Community Systems, and Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Buildings, *Environmental engineering, Heating, Cooling, Algorithms, Computer programs, Fortran. Dry bulb temperature, *Energy management, *Energy conservation, Fortran 77 programming.

Economizer cycles have been recognized as important energy conservation measures for building air handling systems and have been included in most Energy Management and Control Systems (EMCS). This report describes the psychrometric processes of the most commonly used economizer cycles and presents algorithms for implementing these cycles on a typical Energy Management and Control System.

701,113
PB84-216514 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Building Equipment Div.
Test Procedures for Rating Residential Heating and Cooling Absorption Equipment.
B. Weber, R. Radermacher, and D. Didion. Apr 84, 79p NBSIR-84-2867
Sponsored in part by Oak Ridge National Lab., TN.

Keywords: *Residential buildings, *Heating, *Cooling, Gas heating, Gas cooling, Air conditioning equipment, Heat pumps, Seasonal variations, Performance evaluation.

Test and rating procedures are presented for gas-fired absorption devices operating in either the heating or cooling modes. These procedures are designed to include the effects of part-load and cyclic operation, variations in outdoor temperature, and frost formation during the heating mode. Both air-source and ground water source absorption heat pumps are considered, as well as air cooled and ground water cooled air-conditioners and water chillers. A calculation procedure is presented for estimating the heating and cooling seasonal performance and cost of operation of residential water chillers, air-conditioners, and heat pump units.

701,114
PB84-217025 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
Air Flow Calibration of Building Pressurization Devices.
A. K. Persily. Apr 84, 31p NBSIR-84-2849

Keywords: *Buildings, *Air flow, Air circulation, Doors, Calibration, Pressurizing.

Whole building pressurization devices, or blower doors, have been used to quantify building air-tightness and to determine compliance with air tightness standards. Using pressurization testing in air-tightness standards requires knowledge of the accuracy of the air flow rate measurement techniques employed by blower doors. The quantitative accuracy of existing air flow calibrations are not known and have been questioned. The blower doors considered in this report employ calibration formula relating the air flow rate through the door to the fan speed and the pressure difference across the door. Such fan speed calibrations must be done accurately over a wide range of fan speed/pressure difference combinations and in a physical setting that closely approximates the manner in which the blower doors are used in the field.

701,115
PB84-217413 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Building Equipment Div.
Control Algorithms for Building Management and Control Systems -- Hot Deck/Cold Deck/Supply Air Reset, Day/Night Setback, Ventilation Purging, and Hot and Chilled Water Reset.
W. B. May. Mar 84, 75p NBSIR-84-2846
Sponsored in part by Department of Energy, Washington, DC. Office of Building and Community Systems, and Naval Civil Engineering Lab., Port Hueneme, CA.

Keywords: *Buildings, *Environmental engineering, Automatic control equipment, Air conditioning equipment, Ventilation, Heating equipment, Controller characteristics, Computer programs.

Software is an important component of building management and control systems (BMCS). This report describes concepts, algorithms, and software used in BMCS components developed in the NBS building systems and controls laboratory. The basic concepts, considerations and general algorithms for hot deck/cold deck supply air setpoint reset, day/night thermostat and ventilation setback, ventilation purging, and hot/chilled water supply setpoint reset are presented. Reset is the changing of a setpoint on a Heating, Ventilating and Air Conditioning (HVAC) system controlled by a feedback controller to match the system output to the system load. Setback is the changing of HVAC system operation to reduce energy use during unoccupied periods. Purging is the use of outdoor air during unoccupied periods to reduce mechanical conditioning requirements. Specific implementations of the algorithms in software on an actual BMCS are presented as examples.

701,116
PB84-217918 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
Effectiveness of Solar Shading for an Office Building.
Final rept.
S. Treado, J. Barnett, and W. Remmert. May 84, 115p NBS/BSS-161
Also available from Supt. of Docs as SN003-003-02584-4. Library of Congress catalog card no. 84-601038. Sponsored in part by General Services Administration, Washington, DC., Naval Facilities Engineering Command, Alexandria, VA., Directorate of Civil Engineering (Air Force), Washington, DC. and Office of the Chief of Engineers (Army), Washington, DC.

Keywords: *Shades, *Commercial buildings, *Cooling, Solar radiation, Windows, Cost effectiveness, Savings, Computerized simulation, Heating, Performance evaluation, Climate, United States, *Solar screens, *Energy consumption.

The impact of solar shading of windows on building energy consumption, energy costs and occupant comfort is examined for a typical office building. Measurements of the solar and thermal performance characteristics of three solar screens are reported. Using the DOE-2 computer program, annual building energy simulations were performed for seven climatic locations in the United States. Thirteen combinations of window thermal transmittance and shading coefficient are examined for each location. The analysis includes separate evaluations for buildings with all-year cooling and summer-only cooling. The results indicate that solar shading can reduce building energy consumption and improve comfort conditions in buildings with significant cooling loads. The optimum shading device characteristics vary with climatic location.

701,117
PB84-221621 Not available NTIS
National Bureau of Standards, Washington, DC.
Simplified Methods for Determining Seasonal Heat Loss from Uninsulated Slab-on-Grade Floors.
Final rept.
T. Kusuda, and J. W. Bean. 1984, 22p
Pub. in American Society of Heating, Refrigeration and Air-Conditioning Engineers Transactions 90, pt. 1 p611-632 1984.

Keywords: *Floors, *Slab on ground construction, *Heat loss, Green's function, Fourier transformation, Comparison, Finite element analysis.

Three different types of slab-on-grade heat loss calculation procedures are discussed and compared with each other. The procedures discussed are the Green's function type solution, Delsantes Fourier Transform type solution and the Mitalas procedure derived from the finite element analysis. Although the Green's function and Delsante type solutions agree very well with each other, the Mitalas solution showed a larger time lag effect resulting in lower winter heat loss and much higher summer floor heat loss than those determined by the other two methods.

701,118
PB84-221985 Not available NTIS
National Bureau of Standards, Washington, DC.
Effective Use of Daylighting.
Final rept.
S. J. Treado, and G. L. Gillette. Jun 83, 9p
Pub. in Proceedings of the Energy Technol. Conf. (10th), Washington, DC., 28 Feb-2 Mar 83, p647-655 Jun 83.

Keywords: *Daylighting, Buildings, Architecture, Windows, Cooling load, Heating load, Effectiveness, Energy analysis.

The type, size and configuration of fenestration apertures have a strong impact on building lighting, heating and cooling loads. Daylight utilization has been shown to have good potential for reducing lighting energy requirements; however, the effect of daylighting schemes on building space heating and cooling energy requirements must also be considered. Since the luminous efficacy of solar radiation is typically two or three times that of electric light sources, the substitution of the proper levels of daylight for electric lighting can reduce lighting and cooling loads substantially, while providing the additional psychological and aesthetic benefits traditionally associated with fenestration in buildings. This paper describes some of the results obtained from measurements and computer simulations regarding the optimum utilization of daylight in buildings. The findings are summarized in the form of design guidelines for effective fenestration utilization.

701,119
PB84-223262 Not available NTIS
National Bureau of Standards, Washington, DC.
Conduction Transfer Functions and the Heat Balance Method for Thermal Simulation of Multiroom Buildings.
Final rept.
T. Kusuda, and G. N. Walton. 1983, 178p
Pub. in Proceedings of Thermal Mass Effects Buildings, Oak Ridge National Laboratory, Knoxville, TN, June 2-3, 1982, COF-8206130, p99-176 1983.

Keywords: *Buildings, *Heat balance, Finite element analysis, Finite difference theory, Heat transfer, Air circulation, Time dependence.

Methods for modeling thermal mass are reviewed: finite difference and finite element techniques, recent developments in time domain and frequency domain conduction transfer functions, and a new analytic solution for three dimensional heat transfer in a slab-on-grade configuration. Convective and radiative processes which thermally connect the building masses with the room air and each other are briefly discussed. The equations for single and multiroom energy balances are described. These include new methods for interroom air movement. A set of sample calculations are presented to show the influence of various simulation methods, particularly as they relate to multiroom analysis, on comfort and energy use.

701,120
PB84-241421 PC **A09**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Applied Mathematics.

Economic Evaluation of Building Design, Construction, Operation and Maintenance. Seminar Workbook.
Technical note (Final).
R. T. Ruegg. Jun 84, 182p NBS/TN-1195
Sponsored in part by Public Buildings Service, Washington, DC. Also available from Supt. of Docs as SN003-003-02597-6.

Keywords: *Public buildings, *Economic analysis, *Cost effectiveness, Engineering costs, Operating costs.

This workbook has been prepared for participants in the seminar, 'Economic Evaluation of Building Design, Construction, Operation and Maintenance.' It has two main functions: (1) to provide basic resource materials, references, and introductions to methods employed in the seminar and (2) to provide instructional problems for solution by the participants. Specifically, it contains brief discussions of key elements in performing economic evaluations: discounting, escalation, establishing a study period, project selection techniques, and treatment of uncertainty; explanations of supporting analysis techniques: break-even analysis and replacement theory; and problems, worksheets, and solutions.

701,121
PB84-246032 Not available NTIS
National Bureau of Standards, Washington, DC.
Daylighting Computation Procedure for Use in DOE-2 and Other Dynamic Building Energy Analysis Programs.
Final rept.
G. Gillette, and T. Kusuda. Jan 83, 11p
Sponsored in part by National Fenestration Council, Topeka, KS.
Pub. in Jnl. of the Illuminating Engineering Society 12, n2 p78-85 Jan 83.

Keywords: *Daylighting, Computerized simulation, Buildings, Reprints, *Energy conservation, Energy analysis, Passive solar heating systems.

A computer model is discussed for estimating the annual energy performance of a daylighted building. The model is designed for inclusion into larger building energy simulation programs such as DOE-2, BLAST, and NBSLD, where it will provide means of evaluating the impact of daylighting as it relates to the total building's energy requirements. Algorithms have been developed for giving hourly sky conditions, hourly interior daylight, and hourly adjusted electric lighting load. Extensive comparisons with field measurements show a correlation in most cases of within 30% of real conditions.

701,122
PB85-100634 PC **A14**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Applied Mathematics.
Instructor's Manual: Economic Evaluation of Building Design, Construction, Operation and Maintenance.
Final rept.
R. T. Ruegg, and H. E. Marshall. Jun 84, 322p NBS/TN-1194
Also available from Supt. of Docs as SN003-003-02596-8. Sponsored in part by Public Buildings Service, Washington, DC.

Keywords: *Buildings, *Economic analysis, Construction costs, Cost effectiveness, Cost engineering, Benefit cost analysis, Return on investment, Manuals.

This instructor's manual describes each section of a three-day technical seminar on how to measure the economic impact of alternative designs, systems, and operation and maintenance strategies in Federal buildings. The manual was prepared to help instructors of the General Services Administration conduct technically sound and comprehensive seminars.

701,123
PB85-102739 Not available NTIS
National Bureau of Standards, Washington, DC.
Designing Effective Zoned Smoke Control Systems.
Final rept.
J. H. Klote. Nov 83, 3p
Pub. in Building Design and Construction 24, n11 p90-92 Nov 83.

Keywords: *Fire protection, *Smoke abatement, Ventilation, Exhaust systems, Air flow, Fumes, Reprints.

From its inception on the late 1960's, smoke control technology has advanced to the point where there are numerous buildings in the United States and Canada with systems to control smoke from building fires. This paper discusses the principles of smoke control and the concept of zoned smoke control systems. The advantage of having the smoke zone coincide with the heating, ventilating, and air-conditioning (HVAC) zones is discussed.

701,124
PB85-110427 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Building Equipment Div.
Test Methods for the Direct Measurement of Stack Energy Loss during the Off-Period of Space Heating Equipment.
E. Kweller, and R. A. Wise. Sep 84, 66p NBSIR-84/2869
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Space heating, Gas heating, Tests, Energy dissipation, Flues, Thermal measurements, Thermal efficiency, Heat loss, Simulation.

Evaluations have been made of a possible alternative to the tracer gas test method now being used to measure off-period energy loss of space heating equipment with vent dampers. This alternative method offers the potential of a direct measurement method without the need for expensive tracer gas type instrumentation. The method uses a controlled flow of gas to a small gas fueled burner to simulate normal flue or stack temperatures previously measured during a cool-down test. Energy metered through the gas burner during the simulation gives a direct measurement of the thermal energy losses out of the stack. Results in comparison with the tracer gas method of test were lower for off-period energy loss measurements. A trend to better agreement between the two methods was noticeable for test furnaces with greater fuel input rates. Further development testing and evaluation will be required before the simulation can be considered as an acceptable alternative test method.

701,125
PB85-119345 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Thermal Performance Testing of Passive Solar Components in the NBS (National Bureau of Standards) Calorimeter.
M. E. McCabe, C. E. Hancock, and M. Van Migom. Aug 84, 71p NBSIR-84/2920
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Calorimeters, *Thermal measurements, Tests, Components, Performance, Windows, Solar energy, Test facilities, Walls, Passive solar heating systems, Passive solar cooling systems, Solar collectors, Shutters.

Studies of the thermal performance of passive solar buildings have indicated a need for precise measurement of solar heat gain and thermal heat loss or gain for modular passive/hybrid solar components in the outdoor environment. A description of the design, calibration, and initial operational results for a new calorimetric test facility designed to perform these measurements is presented in this report. The test facility is located at the National Bureau of Standards in Gaithersburg, MD, and it is anticipated that it will provide a substantial improvement in the measuring techniques for passive and hybrid solar components over the field test cells currently in use. Thermal performance data were taken for four passive solar test articles during the winter of 1982-1983, including two windows and two collector storage walls. Test results are correlated as U-values and Shading Coefficients for the two windows.

701,126
PB85-120657 Not available NTIS
National Bureau of Standards, Washington, DC.
Experimental Evaluation of Engine-Driven Heat Pump Systems.
Final rept.
B. R. Maxwell, and D. A. Didion. 1978, 18p
Pub. in Proc. ASME Winter Annu. Meet., Energy Conservation in Building Heat and Air Conditioning Systems, San Francisco, California, December 10-15 1978, p59-76.

Keywords: *Heat pumps, *Engines, *Drives, Stirling cycle engines, Diesel engines, Experimental data, Performance, Capacity, Heating, Cooling, Compressors, Temperature, Reprints, Energy conservation, Coefficient of performance.

A laboratory investigation was conducted of an engine-driven air-to-air, variable speed, 3-ton Rankine heat pump. A water-cooled Stirling engine was used in one series of tests and a water-cooled Diesel engine of comparable size was used in another series. The steady-state part-load performance of both engine-driven systems was determined as a function of outdoor temperature and compressor speed. Engine coolant energy and recoverable exhaust energy were determined and included in the heating mode calculations. Heating and cooling capacities, system coefficients of performance, and seasonal performance factors were determined for both systems. Additional tests were concerned with defrost-mode energy requirements and the influence of coolant temperature on system performance.

701,127
PB85-123651 Not available NTIS
National Bureau of Standards, Washington, DC.
Reliability Based Criteria for Reinforced Concrete Design.
Final rept.
B. Ellingwood. 1979, 15p
Pub. in American Society of Civil Engineers Jnl. Struct. Div. 105, n4 p713-727, 4 Apr 79.

Keywords: *Reinforced concrete, *Buildings, *Design criteria, Reliability, Construction materials, Design standards, Resistance, Loads(Forces), Structural engineering, Probability theory, Reprints.

Probabilistic limit states design concepts have evolved over the past decade because of the potential that they afford for simplifying the design process and placing it on a consistent basis for various construction materials. Several different criteria formats have been proposed, which have the common feature that their various load and resistance factors have a reliability basis. Two such criteria for reinforced concrete design are examined in this paper. The development of practical reliability based design criteria is also illustrated. While these are consistent with appropriate measures of design uncertainty and reliability and have a well established rationale, they retain the simple characteristics of existing criteria with which designers in the US feel comfortable.

701,128
PB85-125817 Not available NTIS
National Bureau of Standards, Washington, DC.
Adaptive Controller for Heating and Cooling Systems: Modeling, Implementation and Testing.
Final rept.
C. Park, and A. J. David. 1982, 8p
Pub. in Proceedings of Winter Annual Meeting of the American Society of Mechanical Engineers (103rd), Phoenix, AZ, November 14-19, 1982, 8p.

Keywords: *Controllers, Adaptive systems, Automatic control, Algorithms, Space HVAC systems, Energy consumption, Microprocessors.

The use of adaptive control algorithms was studied for microprocessor driven direct digital control of elementary building heating and cooling subsystems. An algorithm was designed for digital regulation of a linear, time-invariant first-order system with a system dead time. A recursive least squares algorithm was used to estimate, on-line, the parameters of the system. The parameter estimates were then used to calculate the feedback gains of a Proportional plus Integral (PI) controller.

701,129
PB85-134054 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Universal Economic Optimization Paths for Solar Hot Water Systems in Commercial Buildings.
Final rept.
G. T. Sav. 1979, 13p
Pub. in Energy 4, n3 p415-427 Jun 79.

Keywords: *Size determination, Optimization, Climatology, Commercial buildings, Economic analysis, Incentives, Marketing, Solar energy, *Solar water heating, Solar collectors.

This paper presents a simplified methodology for determining the economically optimal size solar hot water system to install in a commercial building. The method-

ology can be used to develop universal economic optimization paths for relatively broad climatological areas. The optimization paths show the optimal collector area as a linear function of annual hot water load, for a given set of economic parameters. Moreover, the paths show that for any climatological area, the optimal fraction of load supplied by solar is independent of the level of hot water load. The optimization paths appear to be an extremely valuable tool for developing regional sizing guidance to the building community, for conducting sensitivity analyses, and for developing regionally efficient monetary incentives for increasing the market penetration of solar energy.

701,130
PB85-143311 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Criteria for Recommending Lighting Levels.
Final rept.
G. T. Yonemura. 1981, 17p
See also PB81-185126. Sponsored by Department of Energy, Washington, DC. Office of Building and Community Systems.
Pub. in Light Research and Technology 13, n3 p113-129 1981.

Keywords: *Illuminating, Luminous intensity, Human factors engineering, Visual perception, Visibility, Criteria, Reprints.

The role of lighting on behavior ranges from allowing simple detection of objects to creating moods and impressions. Lighting standards and recommendations for general applications should be based on the visibility (seeing) requirements where differences between individuals are minimal. The evaluative visual response where significant differences in interpretations and evaluations between individuals and/or groups of individuals do occur cannot be universally applied, but should be treated as design options to be applied when they are important aspects of the intended function of the space. But the lighting criteria or standard must evaluate the seeing process under stimulus conditions approximating those encountered in the real space. It is recommended that conspicuity, defined as: 'how well the detail stands out from the background', or ease of seeing be the metric for visibility.

701,131
PB85-145316 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Impact of a Retrofitted Heat Recovery Unit on an Existing Residential Heat Pump and Water Heater.
Final rept.
K. M. Tu, and S. Fischler. 1980, 25p
Sponsored by Oak Ridge National Lab., TN.
Pub. in Proceedings of Conference Waste Heat Recovery for Energy Conservation - Residential and Light Commercial Heat Pumps, Air Conditioning, and Refrigeration Systems, West Lafa yette, IN., September 15-17, 1980, p 55-79.

Keywords: *Heat pumps, *Heat recovery, *Hot water heating, Residential buildings, Performance tests, Temperature, Compressors, *Retrofitting, Energy conservation.

Two heat recovery units were retrofitted, one at a time, with one heat pump and one storage-type water heater to produce two integrated heat pump - heat recovery unit - water heater systems. Each system was operated with appropriate measuring devices to determine the effect(s) of using the 'retrofit' heat recovery unit on the performance of the heat pump and water heater. The system was operated with the outdoor unit of the heat pump in an environmental chamber with 'outdoor temperatures' of 75, 85, 95, and 20F. The indoor unit of the heat pump was in an environmental chamber whose 'indoor temperature' was set at 80F when the outdoor temperature was 75, 85, 95F, and 70F when the outdoor temperature was set at 20F. The indoor relative humidity was maintained at approximately 50%. The heat recovery unit and water heater were in an environmental chamber set at the 'basement temperature' of 65F with 50% relative humidity.

701,132
PB85-151561 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ventilation Concepts for Office Buildings.
Final rept.
P. E. McNall, and A. K. Persily. 1984, 10p
Sponsored by American Conference of Governmental Industrial Hygienists, Inc., Cincinnati, OH.
Pub. in Annual American Conference of Governmental Industrial Hygienists 10, p49-58 1984.

Keywords: *Office buildings, *Ventilation, Heating equipment, Air conditioning equipment, Reprints, Air quality.

This paper describes several heating, ventilating, and air-conditioning (HVAC) systems which are commonly used in new and existing office buildings. These systems are analyzed from the viewpoint of how well they provide ventilation to the interior spaces for air quality purposes. Several problems are identified, which need further research to ensure adequate ventilation for air quality.

701,133
PB85-159069 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Innovative Office Building Structures and Enclosures: A Survey of Experts.
G. Turner, S. T. Margulis, M. Brill, and C. Coburn.
Nov 84, 120p NBSIR-84/2950
Prepared in cooperation with Buffalo Organization for Social and Technical Innovation, Inc., NY., and State Univ. of New York at Buffalo. Sponsored by Public Buildings Service, Washington, DC.

Keywords: *Office buildings, Construction, Design, Surveys, Structural engineering, Enclosures, Construction materials.

This report presents the results of a study undertaken to identify probable trends affecting the form/design, materials and construction technologies of future office buildings. A literature review was conducted that addressed emerging technologies for structural systems and exterior enclosures of office buildings. Issues identified in the review were used to develop questionnaires for surveying expert opinions about technological innovations. Experts estimated the availability and importance of various structural and enclosure innovations, and provided their perceptions of the benefits and constraints of up to 10 innovations of their choosing.

701,134
PB85-163376 PC **A03**/MF **A01**
Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
Thickness Effect in Low-Density Insulation.
P. J. Burns. Aug 84, 48p NBSIR-84/2906
Sponsored by Department of Energy, Washington, DC.

Keywords: *Thermal insulation, Thickness, Glass fibers, Heat transfer.

A discussion is presented of theory of heat transfer in low-density, glass-fiber insulation via conduction, convection, and radiation. It is concluded that the primary modes of heat transfer in this material are air conduction and radiation. An analysis of NBS data of measured apparent thermal conductivity for different thicknesses results in a parameter estimate of the optical extinction coefficient. This parameter determines the amount of change in apparent thermal conductivity as a function of sample thickness. This phenomena is referred to as the 'thickness effect'.

701,135
PB85-163392 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Short Duration Winter-Time Performances of Different Passive Solar Systems.
B. M. Mahajan. Sep 84, 59p NBSIR-84/2930
Sponsored by Department of Energy, Washington, DC.

Keywords: Performance, Buildings, Data, *Passive solar heating systems, Trombe walls.

The report describes the test building, instrumentation, data acquisition system and procedures, and test conditions for the two performance monitoring experiments. The report contains representative data from the two performance monitoring experiments and results from a preliminary analysis of the data, and compares the performance of the three test cells. The data presented include: solar radiation; wind speed and air infiltration; ambient and room air temperatures; average, centroidal, maximum and minimum room air temperatures in the direct gain and Trombe wall cells; cell floor surface temperatures; and auxiliary energy supplied. The report also contains predicted values of the ratios of various irradiation quantities and the auxiliary energy required to maintain the cells at 20C, and compares the predicted values with the measured data.

701,136
PB85-165645 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Validation of Daylight Prediction with CEL-1.
S. Treado, C. Francisco, and D. Holland. Dec 84, 25p NBSIR-84/2937
Sponsored by Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Illuminance, *Interior lighting, *Daylighting, Tests, Predictions, Office buildings, Commercial lighting, Windows, Solar radiation, Weather, CEL-1 computer program, Computer aided design.

Calculations of interior illuminance levels using the CEL-1 computer program are compared to measurements, for a typical office space. The comparisons are made for a wide range of sky conditions, solar intensities and seasonal intervals using a north facing window. The statistical uncertainty associated with the interior daylight calculations is examined and the sources of the uncertainty are discussed.

701,137
PB85-167336 CP **T05**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
CEL-1: Conservation of Electric Lighting.
Software.
S. Treado. 1 Oct 84, mag tape NBS/DF-85/008
Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions.

Keywords: *Software, *Buildings, *Illuminating, Computerized simulation, Performance, Daylighting, FORTRAN, Windows, CEL 1 computer program, BLAST computer program, Energy analysis, Energy conservation, Computer aided design.

The CEL-1 (Conservation of Electric Lighting) computer program is a design and analysis tool for the design of building lighting systems. It is capable of detailed simulation of lighting system performance, including the effects of daylighting. The interaction between the lighting system and the building heating and cooling systems is accomplished through a custom interface with the BLAST (Building Loads Analysis and System Thermodynamics) building energy analysis program. This tape contains the CEL-1 program Fortran Source files, data files and procedure files, including all updates and changes through 10/1/84. A major addition is the BLAST/CEL-1 interface routine. Software description: The model is written in the FORTRAN programming language for implementation on a CDC 760 computer using the NOS 1.4 Version 528 operating system. Memory requirement is 128 K bytes.

701,138
PB85-177905 PC **A03**/MF **A01**
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
Mapping Principles for the Standards Interface for Computer Aided Design.
L. A. Lopez, and S. L. Elam. Feb 85, 40p NBSIR-85/3115

Keywords: *Building codes, *Design standards, Mapping, Construction, Data processing, *Computer aided design, Analysis, Data bases.

Integrated computed aided design has great potential for increasing the quality and efficiency of the design process. However, building designs are subject to requirements expressed in standards (including project-specific criteria, specified national standards and building codes). Standards must be incorporated correctly and efficiently in the computer aided design process in order that the process be correct and efficient. Standards must be programmed for data processing, checked for consistency with the project and legal requirements, and updated when these requirements are changed or updated. Programs for standards, applications programs for design, and project data bases should be distinct, but integrable, to permit each to be developed independently, but then to be widely applicable in association with other programs. Techniques developed for standards analysis, systhesis and expression (SASE) are extended to allow SASE representations of standards to serve as programs expressing the standards for use in computer aided design. Mapping principles are derived to define the data inter-

face requirements between SASE representations of standards and applications programs.

701,139
PB85-177939 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
HVACSIM(+) Building Systems and Equipment Simulation Program Reference Manual.
D. R. Clark. Jan 85, 111p NBSIR-84/2996
Sponsored by Department of Energy, Washington, DC. Office of Building and Community Systems, and Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: Equipment, Buildings, Control equipment, Air conditioning, Ventilation, Heating, Heating equipment, Computerized simulation, Mathematical models, *Building systems, *HVACSIM+ computer simulation package.

HVACSIM+ is a modular, non-proprietary computer simulation package developed at the National Bureau of Standards, designed to allow detailed simulation of entire building energy systems: the heating, ventilating, and air conditioning (HVAC) system, the equipment control system, the building shell, the physical plant, and the dynamic interactions among these subsystems. The HVACSIM+ package consists of a main simulation program, a library of sub-routines containing mathematical models of building energy system components, and two programs used in preparing a description of the system to be simulated. Models representing the components of a physical plant, such as boilers and chillers, and a model representing a multizone building, are under development and will be added to the HVACSIM+ package as they become available.

701,140
PB85-178325 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
CEL-1 User's Guide Update.
S. J. Treado, C. L. Francisco, and D. B. Holland. Nov 84, 74p NBSIR-84/2974
Sponsored by Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Lighting equipment, Illuminance, Irradiance, Daylighting, Systems engineering, CEL-1 computer program, Programming manuals, Energy conservation.

This is a guide to using the CEL-1.1 version of the CEL-1 Lighting Computer Program. CEL-1.1 has the capability of producing hour-by-hour lighting power multipliers for a one-year simulation period. This guide focuses on: (a) the new program routines (b) the interactive capabilities of CEL-1.1 (c) the routines for compiling different types of routines (d) computer terminology and accessing the necessary routines for running CEL-1.1 (e) updates and revisions to the existing CEL-1 manuals.

701,141
PB85-191963 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Field Performance of Three Residential Heat Pumps in the Cooling Mode.
W. H. Parken, D. A. Didion, P. H. Wojciechowski, and L. Chern. Mar 85, 82p NBSIR-85/3107

Keywords: *Heat pumps, Residential buildings, Thermostats, Cooling systems, Air conditioning, Field tests, Performance evaluation, Tests, Efficiency, Data acquisition, Energy conservation.

Field data was acquired for three residential heat pumps and the part load performance factor and seasonal cooling energy efficiency ratio were evaluated. Laboratory tests were conducted on a unit identical to one of the field-tested heat pumps and performance results compared. Thermostat data was also acquired and a semi-empirical model developed.

701,142
PB85-195956 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Design and Analysis of Passive Solar Heating Solutions for Neighborhood Commercial Strip Settings.
Final rept.
K. Ruberg. 1979, 5p
Pub. in Proceedings of the National Passive Solar Conference (4th), Kansas City, MO., October 3-5, 1979 p576-580.

Keywords: *Commercial buildings, Design, Thermal analysis, Performance, Urban areas, *Passive solar heating systems, Energy conservation, Energy consumption.

As part of an NBS study on urban solar applications, two passive solar heating methods and preliminary thermal performance data are described for a prototypical neighborhood commercial strip.

701,143
PB85-196582
(Order as PB85-196541, PC **A07**/MF **A01**)
Florida Univ., Gainesville.
Microcomputer Design Tool to Aid Construction Professionals to Comply with the Florida Model Energy Efficiency Code.
G. D. Cook. Apr 85, 26p
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology, and National Conference of States on Building Codes and Standards, Inc., Herndon, VA.
Included in Research and Innovation in the Building Regulatory Process: Proceedings of the NBS/NCSBCS Joint Conference (6th), Technical Seminar on Streamlined Administrative Procedures, Computers in Construction, and Fire Safety Technology held at Denver, Colorado on September 11, 1984, p45-70 Apr 85.

Keywords: Residential buildings, Computer programs, Florida, *Energy efficiency standards, Compliance, Computer aided design, Energy consumption.

This paper discusses the development and use of an Apple II+ compatible computer program that calculates the residential Energy Performance Index (EPI) under Section 9 of the Florida Model Energy Efficiency Code. The program was developed as a design tool for builders, engineers, architects, and others in the construction field desiring to achieve cost effective and superior residential energy performance under the code.

701,144
PB85-196608
(Order as PB85-196541, PC **A07**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Emerging Engineering Methods Applied to Regulatory Fire Safety Needs.
H. E. Nelson. Apr 85, 9p
Sponsored by National Conference of States on Building Codes and Standards, Inc., Herndon, VA.
Included in Research and Innovation in the Building Regulatory Process: Proceedings of the NBS/NCSBCS Joint Conference (6th), Technical Seminar on Streamlined Administrative Procedures, Computers in Construction, and Fire Safety Technology held at Denver, Colorado on September 11, 1984, p83-91 Apr 85.

Keywords: *Fire protection, *Building codes, Design, Buildings, Safety.

The development of fire science has progressed to a point where an analytical engineering methodology for fire protection design is emerging. This presentation outlines the elements of such a method and provides an example of one facet and a broad range of references for those interested in deeper examination.

701,145
PB85-198927 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Laboratory Tests of a Gas Fueled Modulating Type Hot Water Boiler.
E. R. Kweller. Apr 85, 59p NBSIR-85/3142
Sponsored by Department of Energy, Washington, DC.

Keywords: *Boilers, *Hot water heating, Space heaters, Simulation, Fuel consumption, Gas furnaces, Efficiency, Tests, Heat transfer, *Gas fired.

The objective of this study was to set up a modulating controlled hot water boiler in the laboratory and to simulate a variety of conditions that were cited by manufacturers of boilers as influencing and being distinct operating parameters for boilers. A further objective of these tests was to compare these responses of the fuel input rate with the mode of operation which was previously described for modulating controlled space heaters and furnaces. The variation of controlled fuel rate to the burner via the fuel modulating valve was measured under several controlled conditions. Effects of heating load, burner cycling rate and zone control, were investigated. The response of gas pressure modulation to the burner of a hot water boiler heating system was studied in several series of tests in the laboratory. A boiler load simulator was set up and used for these tests to control the heating load (heat transfer rate at the radiators) and to simulate a variety of operating conditions that would be expected to exist with a boiler installed in the home. The effects of heat transfer rate and boiler water operating temperature on the modulated gas pressure are presented as a series of data in charts showing controlled gas pressure versus time.

701,146
PB85-205250 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Sensor Errors.
Final rept.
J. Y. Kao. Jan 85, 5p
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Jnl. 27, n1 p100-104 Jan 85.

Keywords: *Sensors, *Air circulation, Errors, Automatic control equipment, Computerized simulation, Buildings, Reprints, *Energy consumption, Building systems.

The paper examines the energy effect of sensing errors of an air handling system. The energy waste caused by errors of various automatic control sensors in a variable air volume system are simulated with a computer program and the results are presented and discussed. Some sensing errors cause substantial energy waste. The paper also describes the causes of sensing errors frequently seen in an air handling system - from building design and installation to building operation. Recommendations for minimizing these errors are given.

701,147
PB85-205615 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sites and Services Projects in Seismic Regions.
Final rept.
E. Simiu. 1984, 6p
Pub. in Jnl. of Archit. Plan. Res. 1, n3 p175-180 1984.

Keywords: *Structural engineering, Earthquakes, Urban development, Wind pressure, Buildings, Developing countries, Reprints, *Earthquake engineering, Low cost housing.

It is shown in this note that incremental expansion schemes pose special and delicate structural design problems that arise from the evolutionary nature of the building process in sites and services projects. A first type of problems arises if an initial but incomplete shelter core is provided on the site. In that case efficient ways must be found to ensure the structural integrity of the initial construction. A second type of problem is due to the difficulty of tying successive incremental portions of the dwelling both to the initial construction and among themselves in such a manner as to create systems that are structurally sound at all times. Without due attention to such problems the resulting construction can be unnecessarily uneconomical as well as constituting a serious hazard to life and property in case of earthquake or tropical cyclone. The purpose of this note is to illustrate these two types of problems by using examples of shelter construction in actual sites and services projects.

701,148
PB85-208015 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Design as a Function of Responses to Fire Cues.
Final rept.
B. M. Levin. 1985, 6p
Pub. in Proceedings of Research and Design '85: Architectural Applications of Design and Technology Research, Los Angeles, CA., March 14-18, 1985, p289-294.

Keywords: *Buildings, *Design, *Fire safety, *Human behavior, Safety engineering, Architecture, Evacuation, Means of egress.

Studies of the actions of building occupants in fire emergencies show that people often do not initiate an evacuation immediately upon hearing an alarm or smelling smoke. Unless the size, location and danger of the fire is obvious, investigation is a likely action. In

addition, ignoring the first signs of a fire is not a rare event. Once an evacuation is initiated, people often attempt to leave by the most familiar rather than most direct route and they often do not or cannot see and follow exit signs. The paper provides current state of the art guidance on how people respond in fire emergencies and how the architect can modify total designs (including alarms, public address systems, location of and approaches to emergency exits, etc.) to take advantage of the anticipated response of the occupants in danger. The information will aid the architect in developing designs that increase the likelihood that building occupants will use the emergency evacuation system as the architect intended.

701,149
PB85-224459 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Laboratory Design and Test Procedures for Quantitative Evaluation of Infrared Sensors to Assess Thermal Anomalies.
Y. M. Chang, and R. A. Grot. Jun 85, 86p NBSIR-85/3131
Sponsored by Department of Energy, Washington, DC. Prepared in cooperation with DCS Corp., Alexandria, VA.

Keywords: *Infrared thermal detectors, Evaluation, Tests, Calibrating, Temperature, Buildings, Variability, Display devices, Infrared radiation, Heat loss, *Infrared thermography, Modulation transfer functions.

The report presents the description of the laboratory apparatus and preliminary results of the quantitative evaluation of three high-resolution and two low-resolution infrared imaging systems. These systems which are commonly used for building diagnostics are tested under various background temperatures (from -20C to 25C) for their minimum resolvable temperature differences (MRTD) at spatial frequencies from 0.03 to 0.25 cycles per milliradian. The calibration curves of absolute and differential temperature measurements are obtained for three systems. The signal transfer function and line spread function at ambient temperature of another three systems are also measured. Comparisons of the dependence of the MRTD on background temperatures from the measured data with the predicted values given in ASHRAE Standards 101-83 are also included. The dependence of background temperatures for absolute temperature measurements are presented, as well as comparison of measured data and data given by the manufacturer. Horizontal on-axis magnification factors of the geometric transfer function of two systems are also established to calibrate the horizontal axis for the measured line spread function to obtain the modulation transfer function. The variation of the uniformity for horizontal display of these two sensors are also observed. Included are detailed descriptions of laboratory design, equipment setup, and evaluation procedures of each test.

701,150
PB86-103462 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Ventilation Effectiveness in Mechanically Ventilated Office Buildings.
A. K. Persily. Aug 85, 40p NBSIR-85/3208
Sponsored by Department of Energy, Washington, DC. Office of Building and Community Systems.

Keywords: *Ventilation, *Office buildings, Efficiency, Effectiveness, Measurement, Measuring instruments, Air flow, *Air quality, Air infiltration.

The paper examines several definitions of ventilation effectiveness and associated tracer gas measurement techniques. Techniques for making ventilation effectiveness measurements in mechanically ventilated office buildings are discussed with reference to building and mechanical equipment design and tracer gas instrumentation. Specific strategies are proposed for measuring ventilation effectiveness on different scales ranging from individual rooms to whole buildings.

701,151
PB86-110103 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Humidity Sensors for HVAC (Heating, Ventilation and Air-Conditioning) Applications.
Final rept.
C. W. Hurley, and S. Hasegawa. May 85, 18p
Sponsored by Civil Engineering Lab. (Navy), Port Hueneme, CA.
Pub. in Proceedings of International Symposium on Recent Advances in Control and Operation of Building HVAC Systems, Trondheim, Norway, May 22-23, 1985, p173-190.

Keywords: *Moisture content, *Environmental engineering, *Psychrometers, *Dew point, *Buildings, Hygrometers, Heating equipment, Ventilation, Air conditioning, Cost analysis, Ideal gas law.

The monitoring and control of the moisture content of the air within a building is required to operate the heating, ventilation and air-conditioning (HVAC) equipment in the most efficient manner to meet the demands of the people and equipment working in the building. The ideal gas equation can be used for this purpose since only negligible errors will result. Seven types of relative humidity sensors are discussed. The basic principles of operation, cost ranges, expected accuracies, linearities, operating limits, etc. are given. A section is devoted to methods of avoiding the high limits of relative humidity sensors. Finally, a discussion of the principles of operation, cost, operating limits, etc. is presented on dew-point hygrometers and their applications in HVAC systems.

701,152
PB86-124864 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Field Evaluation of Aerial Infrared Surveys for Residential Applications.
Final rept.
S. J. Treado, and D. M. Burch. 1982, 7p
Pub. in Proceedings of the Society of Photo-Optical Instrumentation Engineers, Ottawa, Ontario, September 1-4, 1981, Paper in Thermal Infrared Sensing Applied to Energy Conservation in Building Envelopes (Thermosense IV) 313, p28-34 1982.

Keywords: *Residential buildings, Aerial surveys, Roofs, Thermal analysis, Remote sensing, *Infrared thermography, Energy conservation.

The effectiveness of aerial infrared thermography as an energy audit procedure for residences having pitched ventilated roofs is investigated. Three adjacent unoccupied houses were instrumented to provide ground-truth comparison data under various weather conditions. Factors affecting the accuracy of this technique are identified and analyzed, and guidelines are presented concerning the recommended use of aerial infrared thermography as a procedure for assessing the thermal performance of residences.

701,153
PB86-129772 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Validation Tests of the Thermal Analysis Research Program.
G. N. Walton, and K. Cavanaugh. Sep 85, 52p NBSIR-85/3211

Keywords: *Buildings, *Thermal analysis, Tests, Research projects, Computerized simulation, Energy analysis.

In the study analytical and empirical tests were performed using the Thermal Analysis Research Program (TARP). TARP was found to be very accurate relative to the analytical tests (calculations for simplified conditions) which covered steady and transient conduction, internal radiant interchange, latent loads, and clear sky solar gains. Six one-room buildings with different wall constructions provided data for the empirical tests.

701,154
PB86-130614 PC **A10**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
HVACSIM+ Building Systems and Equipment Simulation Program - Users Guide.
D. R. Clark, and W. B. May. Sep 85, 203p NBSIR-85/3243
See also PB85-177939. Sponsored by Department of Energy, Washington, DC. Office of Building and Community Systems, and Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Environmental engineering, *Computerized simulation, Buildings, *Building systems, *HVACSIM (+) computer program.

HVACSIM+ is a modular, non-proprietary computer simulation package developed at the National Bureau of Standards. The package consists of a general-purpose modular simulation program called MODSIM, a library of component models specific to building systems, and a simulation editor called HVACGEN. The latter is used to facilitate the creation and modification of simulation descriptions. HVACSIM+ is designed to allow detailed simulation of entire building systems or portions of such systems. This includes the heating, ventilating, and air conditioning (HVAC) system, the equipment control system, the conditioned zones within a building, the building shell, and the dynamic interactions among these subsystems. This document describes the procedures for installing HVACSIM+ on a particular computer, for setting up a simulation description using HVACGEN, and for running a simulation using MODSIM.

701,155
PB86-133493 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Role of Thermography in the Assessment of the Thermal Integrity of Federal Office Buildings.
Final rept.
Y. M. Chang, and R. A. Grot. 1984, 9p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) International Conference on Thermal Infrared Sensing for Diagnostics and Control (Thermosense 6), Oak Brook, IL., October 2-5, 1983, v446 p47-55 1984.

Keywords: *Office buildings, Ground based detectors, Thermal analysis, *Infrared thermography, Energy conservation, Federal buildings.

Results were presented from ground-based infrared thermographic studies performed by NBS on eight Federal Office Buildings. Infrared thermography was used to observe the thermal anomalies in those buildings, as part of a diagnostic program to evaluate the thermal integrity of building envelopes. Thermographic data were collected via complete exterior scannings and selected interior scannings at regions where thermal defects were identified or suspected during the outside inspections. Analysis from thermographic inspections with examples of defects found in some of these buildings are also included. The potential applications of the diagnostic procedures to both new and existing buildings are discussed.

701,156
PB86-135274 PC **A09**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Evaluation of the Thermal Integrity of the Building Envelopes of Eight Federal Office Buildings.
R. A. Grot, A. K. Persily, Y. M. Chang, J. B. Fang, and S. Weber. Sep 85, 199p NBSIR-85/3147
Sponsored by Public Buildings Service, Washington, DC. Office of Design and Construction.

Keywords: *Thermal insulation, *Office buildings, Thermal analysis, Measurement, Tests, Air infiltration, Thermography.

Diagnostic test methods were applied to eight federal office buildings in order to assess the applicability of these measurement methods for determining the thermal integrity of the building envelope. The eight federal office buildings were located in Anchorage, AK; Ann Arbor, MI; Columbia, SC; Fayetteville, AR; Huron, SD; Norfolk, VA; Pittsfield, MA and Springfield, MA.

701,157
PB86-137981 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Heat Loss Due to Thermal Bridges in Buildings.
Final rept.
J. B. Fang, R. A. Grot, K. W. Childs, and G. E. Courville. 1984, 9p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of the Society of Photo-Optical Instrumentation Engineers International Conference on Thermal Infrared Sensing for Diagnostics and Control (Thermosense 6), Oak Brook, IL., October 2-5, 1983, v446 p34-42 1984.

Keywords: *Heat loss, Office buildings, Heat transmission, *Heat flow, Infrared thermography.

Building envelopes often contain numerous highly conductive heat flow paths, called thermal bridges, which are major sources of heat loss and areas of deterioration of building materials due to moisture condensa-

tion. Some examples of thermal bridges occurring in office buildings are presented. Infrared thermography was used to identify the locations and magnitudes of thermally defective areas resulting from inadequate construction, design, or substandard workmanship in existing buildings.

701,158
PB86-138211 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Assessment of the Application of Thermography for the Quality Control of Weatherization Retrofits.
Final rept.
R. A. Grot. 1980, 16p
Sponsored by Department of Energy, Washington, DC. Pub. in Proceedings of National Conference on Thermal Infrared Sensing Technology for Energy Conservation Programs (2nd), Thermosense 2, Albuquerque, New Mexico, November 7-9, 1979, p193-208 1980.

Keywords: *Residential buildings, Thermal insulation, Quality control, *Weatherization.

Approximately 65 single-family low-income homes in eight cities (Portland, Maine; Minneapolis/St. Paul, Minnesota; Fargo, North Dakota; Tacoma, Washington; St. Louis, Missouri; Washington, D.C.; Atlanta, Georgia; and Charleston, South Carolina) were retrofitted using such weatherization techniques as caulking and weatherstripping, adding attic insulation, installing storm windows and doors, insulating basements and crawl spaces, and insulating exterior walls with either ureaformaldehyde (UF) foam or blown-in cellulosic insulation. Thermographic surveys of these dwellings were performed after the weatherization work was completed in order to assess the quality of workmanship and to determine the percentage of wall not insulated by the contractors, and other defects which still existed in the dwelling.

701,159
PB86-153848 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Opportunities for Full-Scale Testing of Residential Building Interactions in Environmental Chambers.
A. K. Persily. Dec 85, 21p NBSIR-85/3194
Sponsored by Department of Energy, Washington, DC. Architectural and Engineering Systems Branch.

Keywords: *Residential buildings, Test chambers, Testing, Performance evaluation, Energy conservation.

The report focuses on opportunities for full-scale testing of residential building interactions in environmental chambers, where one has control of weather conditions and occupant effects. Such research will increase our understanding of the physical nature of these interactions and their effects on energy use, comfort, cost, and other factors. In the report the authors review past and current research in the area of full-scale testing in environmental chambers and other related work. Based on the review, further research is proposed in several important areas of residential building performance.

701,160
PB86-163821 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Building Emulation Computer Program for Testing of Energy Management and Control System Algorithms.
W. B. May, and C. Park. Dec 85, 133p NBSIR-85/3291
Sponsored by Civil Engineering Lab. (Navy), Port Hueneme, CA., and Department of Energy, Washington, DC. Office of Building and Community Systems.

Keywords: *Buildings, *Computerized simulation, Computer programs, Heating, Ventilation, Air conditioning, Algorithms, Control equipment, *Energy management.

A building emulator can be used to test energy management and control systems (EMCS). The emulator uses a computer program to simulate the responses of a building including the equipment, building space, and building envelope to EMCS commands. Building model software for the emulator has been developed at the National Bureau of Standards (NBS) in an effort to assist the United States Naval Civil Engineering Laboratory (NCEL), which is developing a sophisticated building emulator. The concept of the building emulator and the building emulator computer program are described in this report. The program includes the weather, the air handling unit, the zone, and the comfort model. In addition, the energy compilation routine is also included. The models presented here are simplified models. With these abridged models, a single zone building with exterior walls and a single deck air handling unit are simulated. A complete FORTRAN source code of the building emulator computer program is appended.

701,161
PB86-165438 PC **A07**/MF **A01**
West Virginia Univ., Morgantown. Dept. of Civil Engineering.
Convective Heat Loss from Windows: A Review of the Literature.
D. D. Gray. Feb 86, 127p NBS/GCR-86/504
Contract DE-AC02-83CH10093
Prepared in cooperation with American Society for Engineering Education, Washington, DC. Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology, and Department of Energy, Washington, DC.

Keywords: *Windows, *Heat loss, Convection, Tests, U-values.

It is necessary to be able to calculate heat loss through fenestration systems such as windows, patio doors, and skylights, in order to size building equipment for peak loads and to estimate annual energy costs for buildings. One of the most important factors that influences thermal performance of windows is heat transfer by convection between the interior and exterior surfaces and their respective environments. In particular, a better understanding of wind and thermal induced convection heat transfer at the exterior surface is needed to resolve the present discrepancies in window thermal testing. The report presents the result of an extensive search of the English-language literature for publications relevant to the phenomena of convection from windows.

701,162
PB86-166600 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Estimating Interroom Contaminant Movements.
G. N. Walton. Nov 85, 26p NBSIR-85/3229
Sponsored by Department of Energy, Washington, DC. Office of Building and Community Systems.

Keywords: *Ventilation, *Air pollution, Contaminants, Energy, Air flow, Circulation, Models, *Indoor air pollution, Computer applications.

Development of infiltration and interroom airflow calculation methods, driven by a concern for indoor air quality have led to a computer simulation of interroom contaminant movement. The model, which assumes fully mixed room air, shows that open doorways provide rapid mixing between rooms in buildings using forced air heating. It also confirms that it is most energy efficient to remove the contaminant nearest its source. Detailed modeling of the variations in contaminant concentration within a room is not presently feasible. The concept of ventilation effectiveness should provide sufficient accuracy and reasonable computing speed to be added to some existing energy analysis programs. Current energy analysis programs with long timesteps tend to run into convergence problems when solving the system performance and interroom airflows simultaneously. Short timestep simulation may be required. The need for computer modeling is demonstrated by the subtle behavior of a very simple system which removes contaminants by forced ventilation.

701,163
PB86-166626 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Indoor Air Quality Modeling, Phase 1 Report. Framework for Development of General Models.
P. McNall, G. Walton, S. Silberstein, J. Axley, K. Ishiguro, R. Grot, and T. Kusuda. Oct 85, 65p NBSIR-85/3265
Sponsored by Environmental Monitoring Systems Lab., Research Triangle Park, NC.

Keywords: *Ventilation, *Air pollution, Models, Circulation, Development, Predictions, Formaldehyde, Radon, Nitrogen oxides, Smoke, Particulates, Carbon dioxide, Carbon monoxide, *Indoor air pollution.

The report presents a framework for the development of a model for predicting the indoor air pollutant concentrations in a variety of building types under practical conditions of weather, building occupancy, building construction and pollutant source strength. The general concepts needed for developing an indoor air quality model are treated. Examples of the current state of indoor air quality models are given. The pollutants discussed are formaldehyde, radon, nitrogen oxides, tobacco smoke, particulates, carbon dioxide, and carbon monoxide.

701,164
PB86-189891 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Building Energy Analysis with BLAST and CEL-1.
S. J. Treado, D. B. Holland, W. E. Remmert, and W. Pierpoint. Feb 86, 174p NBSIR-85/3256
Sponsored by Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Daylighting, Buildings, Illuminating, Solar radiation, Computer programs, *Energy analysis, Energy consumption.

The report describes the capabilities of the BLAST and CEL-1 computer programs and the procedures for using a hybrid version which incorporates both programs into a single design and analysis tool. Details on assembling the required information for development of the input files and the actual execution of the hybrid program are covered. The program allows detailed simulation of actual lighting systems using CEL-1 including daylighting effects while providing BLAST with lighting energy modifiers on an hourly basis. The procedure is demonstrated using a sample building.

701,165
PB86-189909 PC **A10**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
HVACSIM+ Building Systems and Equipment Simulation Program: Building Loads Calculation.
C. Park, D. R. Clark, and G. E. Kelly. Feb 86, 203p NBSIR-86/3331
See also PB86-130614. Sponsored by Department of Energy, Washington, DC. Office of Building and Community Systems, and Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Environmental engineering, *Buildings, Computerized simulation, Building systems, HVACSIM(+) computer program.

A non-proprietary building system simulation program called HVACSIM+, which stands for HVAC SIMulation PLUS other systems, has been developed at the National Bureau of Standards (NBS) in an effort to understand the dynamic interactions between a building shell, an HVAC system, and building controls. HVACSIM+ consists of a main simulation program, a library of HVAC system component models, a building shell model, and interactive front end input data generation programs. The report presents the overall architecture of the HVACSIM+ program, algorithms used in the main simulation program, a brief discussion of the numerical methods used in solving a system of non-linear simultaneous equations, integrating stiff ordinary differential equations and interpolating data and descriptions of the building shell and zone models.

701,166
PB86-196300 PC **A07**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Linear Opponent-Colors Model Optimized for Brightness Prediction.
Final rept.
G. L. Howett. Feb 86, 127p NBSIR-85/3202

Keywords: *Illuminating, *Brightness, Color, Mathematical models, Luminance, Color vision, Optimization.

Formal multivariate optimization techniques were applied in an attempt to determine how well a linear, opponent-colors model of color vision could account for specific brightness-matching data. The data fitted were from a single experiment by Sanders and Wyszecki that matched an adjustable white light in brightness to each of a set of lights of 96 different colors and constant luminance. A generalized, linear, opponent-colors model was formulated, which included the models of Guth (and co-workers), Ingling (and co-workers), and Thornton as special cases. The model contained 10 parameters, including nine determining

the spectral responses of the three opponent-level channels and one determining the rule for combining the outputs of the three channels to obtain an estimate of equivalent luminance (the luminance of an equally bright white light). Despite difficulties with the optimization procedure, a model was found that correlates better than 0.98 with the fitted data. The predictions of the model for various other color-vision functions were explored and compared with corresponding predictions of the Guth and Lodge model and the Thornton model.

701,167
PB86-196466 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Applications of Aerial Thermography for Residential Energy Analysis.
Final rept.
S. J. Treado, and D. M. Burch. 1983, 1p
Sponsored by Department of Energy, Washington, DC. Office of Building and Community Systems.
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Jnl. EN 25, n5 p52 1983.

Keywords: *Residential buildings, Aerial photography, Heat loss, Reprints, *Energy analysis, *Infrared thermography.

The effectiveness of aerial infrared thermography as a residential energy analysis procedure is investigated. Factors affecting the accuracy and utility of the technique are identified and analyzed, including the effects of location microclimate and different thermostat setpoints. Guidelines are presented concerning the recommended use of aerial thermography as a procedure for assessing the thermal performance of residences.

701,168
PB86-196755 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Sky Luminance and Direct Beam Illuminance.
S. J. Treado, W. E. Remmert, and J. W. Bean. Mar 86, 51p NBSIR-85/3251

Keywords: *Sky, *Luminance, *Daylighting, Irradiance, Illuminance, Measurement, Beams(Radiation).

Measurement of sky illuminance, sky luminance, direct beam illuminance and direct beam irradiance are analyzed and discussed. The database consisted of an annual set of integrated hourly measurements made at the National Bureau of Standards, Gaithersburg, Maryland. The relationship between diffuse sky illuminance and luminance of selected portions of the sky dome is examined. Measured sky luminances are compared to luminance calculated using equations for three standard sky types-clear, partly cloudy and overcast. The results indicate that the luminance distribution of actual skies varies considerably from the standard skies.

701,169
PB86-203593 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Low-Cost Measurement of the Air Leakage in Homes.
Final rept.
G. T. Linteris, and A. K. Persily. 1984, 2p
Sponsored by Department of Energy, Washington, DC. Office of Buildings Energy R and D.
Pub. in Proceedings of Summer Study in Energy Efficient Buildings, Santa Cruz, CA., August 22, 1982, p547-548 1984.

Keywords: *Residential buildings, Air, Leakage, Pressurizing, Tests, Measurement, *Air infiltration.

Simultaneous air infiltration measurements were performed in a group of fourteen nominally identical wood frame houses located in New Jersey, for three test periods. The results of the measurements indicate that there was more than a two to one variation in infiltration between the houses. The fourteen houses were pressure tested using the Blower Door apparatus, and these results are also presented. Comparisons are made between the two measurement techniques. Several state-of-the-art air infiltration predictive models are used to predict the air infiltration rates in the houses and these are compared with the measured infiltration rates.

701,170
PB86-210093 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Measurement-Based Calculation of Infiltration in Passive Solar Performance Evaluation.
Final rept.
B. Hamilton, B. Sachs, J. Duffy, and A. Persily. 1983, 6p
Sponsored by Department of Energy, Washington, DC. Pub. in Proceedings of National Passive Solar Conference (8th), Sante Fe, NM., September 7-9, 1983, Progress in Passive Solar Energy Systems, v8 p295-300.

Keywords: *Residential buildings, Fluid infiltration, *Solar energy.

Low-cost, measurement-based techniques for calculation of infiltration as a variable in passive solar performance evaluation are suggested as an improvement over the use of an assumed constant air-change rate. Results of infiltration measurements and calculations are reported for 70 passive solar homes. Comparisons are made between two infiltration estimation techniques for 41 of these monitored buildings.

701,171
PB86-229598 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Comparison of Measured and Predicted Sensible Heating and Cooling Loads for Six Test Buildings.
D. M. Burch, G. N. Walton, B. A. Licitra, and K. Cavanaugh. Jun 86, 29p NBSIR-86/3399
Sponsored by Electric Power Research Inst., Palo Alto, CA.

Keywords: *Heating loads, *Cooling loads, Residential buildings, Evaluation, Energy conservation.

Hourly sensible heating and cooling loads for six test buildings were predicted using two computer programs, called TARP and EMPS. The predicted loads were compared to corresponding measured loads for winter heating, spring heating, and summer cooling periods. Both computer programs predicted the general trends of the measured data.

701,172
PB87-106746 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Dynamic Models for HVAC System Components.
Final rept.
D. R. Clark, C. R. Hill, and C. W. Hurley. 1985, 10p
Sponsored by Department of Energy, Washington, DC. Office of Building and Community Systems, and Civil Engineering Lab. (Navy), Port Hueneme, CA.
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions 1B, p737-746 1985.

Keywords: Computerized simulation, Mathematical models, Heat exchangers, Ducts, Pipes(Tubes), Reprints, *Space HVAC systems.

A method for representing transport delays is presented, and dynamic models for a pipe or duct and for a hot water coil are derived. Briefer descriptions of models for several other components of an air handler are given. Comparisons between experimental data and simulation results are provided to support the validity of the models. Detailed simulations of a complete heating coil control loop serve as the basis for experimental verification of the component models and their interactions.

701,173
PB87-108098 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Thermal and Services Systems Div.
Assessment of Retrofitting Automatic Vent Dampers on Oil-Fired Residential Heating Systems in the New England Area.
Final rept.
L. Katzman, G. E. Kelly, and M. E. Kuklewicz. 1978, 7p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Conference on Documentation and Analysis of Improvements in Efficiency and Performance of HVAC Equipment and Systems, West Lafayette, IN., October 23-25, 1978, p180-186.

Keywords: *Residential buildings, *Heating, Vents, Boilers, Furnances, Fuels, Savings, *Draft control systems, New England.

A field study involving the installation of twenty-one automatic vent dampers on oil-fired, residential furnaces and boilers in the New England area is described. Good agreement is shown to exist between the measured percent fuel savings, obtained by comparing test periods before and after modification, and the percent fuel savings predicted using an NBS recommended procedure for determining the part load and seasonal efficiency of such equipment. The NBS procedure is then used to generalize the results to an average U.S. climate and a fixed heating system oversizing of 70 percent. Information is also presented on various problems encountered during the study with the installation of automatic vent dampers on oil-fired residential furnaces and boilers.

701,174
PB87-115440 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Solar Energy Absorption by Vertical Cylindrical-Tube Absorbers in Sunspace Enclosures.
Final rept.
M. E. McCabe, and M. van Migom. 1983, 8p
Sponsored by Department of Energy, Washington, DC. Passive and Hybrid Solar Energy Div.
Pub. in Proceedings on Winter Annual Meeting of the American Society of Mechanical Engineers, Boston, MA., November 13-18, 1983, 8p.

Keywords: *Solar heating, *Buildings, Enclosures, Energy absorption, *Passive solar heating systems, *Solar absorbers.

Solar energy absorption in a building sunspace having a south-facing glazing and a row of parallel, uniformly-spaced, vertical, cylindrical solar absorbers is considered. The opaque cylindrical absorbers might be a part of a passive solar heating system which contains features of both a direct-gain and a collector-storage wall system. Considerable control over the gain of direct solar energy and thermal energy storage within a building space can be achieved by varying the diameter and spacing of the cylindrical tubes. A two-dimensional model is formulated for a horizontal, planar enclosure in which the cylinderical absorber tube is subdivided uniformly into a number of surface elements and the glazing and sunspace surfaces are each represented as single surface elements. The results are presented as dimensionless ratios of absorbed-to-incident solar flux. Plots of the spatial distribution of absorbed solar flux are presented for hourly time increments for a winter day.

701,175
PB87-117974 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Probabilistic Models of Snow Loads on Structures.
Final rept.
B. Ellingwood, and M. O'Rourke. 1985, 9p
Pub. in Structural Safety 2, n4 p291-299 1985.

Keywords: *Buildings, *Loads(Forces), Climatology, Snow, Building codes, Design standards, Statistical analysis, Roofs, Probability distribution functions, Reprints.

Snow loads provide the governing load requirements for the structural design of roofs in many northern climates or mountainous regions. Current design practice in most countries is to calculate the roof snow load as the product of a ground load and a dimensionless ground-to-roof conversion factor. Both parameters are random variables, and appropriate fractiles of their distributions must be determined for use in design codes. Statistical data are presented on the ground snow obtained from analysis climatological data, and on ground-to-roof conversion factors measured by surveys of snow accumulation on roofs. These data are proving valuable in structural code development.

701,176
PB87-118071 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Part-Load Performance Characteristics of Residential Absorption Chillers and Heat Pumps.
Final rept.
D. A. Didion, and R. Radermacher. 1984, 6p
Sponsored by Department of Energy, Washington, DC., and Oak Ridge National Lab., TN.
Pub. in Int. Jnl. Refrig. 7, n6 p393-398 1984.

Keywords: *Heat pumps, *Air conditioners, Absorption, Degradation, Loads(Forces), Testing, Reprints.

A series of laboratory performance tests were conducted on an absorption cycle water chiller and heat pump. The part-load performance was compared to the full-load capacity and coefficient of performance. The causes of performance degradation with shorter operating times are speculated upon with partial substantiation resulting from tests on the chiller after it had been modified to prevent off cycle fluid migration.

701,177
PB87-120234 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Measurement and Quantification of Thermal Bridges in Four Office Buildings.
Final rept.
R. A. Grot, K. W. Childs, J. B. Fang, and G. E. Courville. 1985, 16p
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions 91, Pt 1B p558-573 1985.

Keywords: *Office buildings, *Heat loss, Heat transfer, Measurement, Conduction, Reprints, Energy conservation, Heat flow.

Thermal bridges are highly conductive heat flow paths within the building envelopes. The effects of thermal bridges on the overall heat loss through a building envelope are described. Thermally deficient areas caused by thermal bridges were found and their sizes ascertained in four office buildings by means of infrared thermography. Quantification of the heat loss caused by thermal bridging was achieved using field data obtained with heat flux transducers, along with a detailed analysis of the exterior thermographs and architectural drawings of the buildings involved. Field data were compared with the predictions obtained using a two-dimensional heat transfer model of the transient heat conduction within the exterior wall-floor system.

701,178
PB87-120242 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
In situ Measurement of the Thermal Resistance of Building Envelopes of Office Buildings.
Final rept.
J. B. Fang, and R. A. Grot. 1985, 15p
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions 91, Pt 1B p543-557 1985.

Keywords: *Office buildings, *Thermal resistance, Measurement, Heat loss, Reprints, Energy conversation.

The thermal resistances of various sections of building envelopes in seven office buildings have been determined using heat flow meters and a portable calorimeter during the winter heating season. These buildings are situated in various climatic zones of the United States. They have exterior masonry walls of different types of design and constructions. The effects of the length of measurement period, and the time lag between the air temperature difference across the envelope and the heat flow on the results of in-situ thermal resistance measurements are discussed. The thermal resistance values derived from data obtained with the calorimeter are generally lower than those by heat flow meters due to additional heat losses associated with the framing members. In general, the measurement accuracy can be improved through correction for time lag. Reliable thermal resistance data are obtainable if the duration of heat flow and air temperature measurements is at least 24 hours. These resistance values departed from the predicted values by an average of 14%, the worst case being 45%.

701,179
PB87-122461 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Window Glass Facades as Structural Systems: An Improved Reliability-Based Design Procedure.
Final rept.
E. Simiu, and A. Filotti. 1985, 10p
Pub. in Proceedings of the International Conference on Structural Safety and Reliability ICOSSAR '85 (4th), Kobe, Japan, May 27-29, 1985, 10p.

Keywords: *Window glass, Architecture, Buildings, *Wind loads.

The purpose of the paper is to present a risk-consistent procedure for the design of glass cladding facades subjected to wind loads. The procedure is applicable to buildings with specified orientation, and accounts in a probabilistically rigorous manner for the dependence upon wind direction of both the extreme wind speeds and the pressure coefficients. In addition, the procedure is consistent with the fact that both the wind loads acting on various panels and the load capacities of the panels may be mutually correlated. It is shown that, depending upon building orientation, the procedure presented here can lead to significant reductions in the cost of glass cladding facades while ensuring safety levels at least as high as those inherent in current practice.

701,180
PB87-128070 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Air Infiltration Site Measurement Techniques.
Final rept.
D. T. Harrje, R. A. Grot, and D. T. Grimsrud. 1982, 19p
Sponsored by Department of Energy, Washington, DC. Office of Buildings Energy R and D.
Pub. in Proceedings of the Air Infiltration Centre Conference on Building Design for Minimum Air Infiltration (2nd), Stockholm, Sweden, September 21-23, 1981, p115-133 1982.

Keywords: *Buildings, Measurement, Measuring instruments, *Air infiltration, *Tracer techniques, Computer applications.

A summary of the existing types of air infiltration measurement techniques and instrumentation using tracer gases is presented. Automated air infiltration instrumentation used by researchers in the United States, Canada, the United Kingdom, Denmark, Sweden, and Switzerland is described. The equipment can operate in the dilution (decay) mode, constant flow mode and the constant concentration mode. Most of these instruments are microcomputer or microprocessor based and capable of performing real time determination of the air infiltration rate in multizone buildings and monitor the state of additional parameters such as temperature, wind speed and energy consumption. Two simple techniques, the air bag or container method and the average infiltration monitor, developed by researchers in the United States are summarized.

701,181
PB87-134326 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Specifications for Thermal and Environmental Evaluations of Advanced-Technology Office Buildings.
A. K. Persily. Nov 86, 96p NBSIR-86/3462
Sponsored by Public Buildings Service, Washington, DC.

Keywords: *Office buildings, Evaluation, Specifications, *Energy management, *Environmental engineering, *Federal buildings, US GSA.

Specifications for conducting a thermal and environmental evaluation program for advanced technology office buildings are presented. The program is to be used by the General Services Administration (GSA) in designing and assessing the performance of these new federal office buildings. The document consists of three basic sections: (1) programing directives - a description of requirements regarding the diagnostic center and associated items, and quantitative architectural performance standards, to be used in the building design process; (2) construction specifications - detailed specifications regarding the procurement and installation of sensors and equipment for use in the evaluations, written in the Masterspec format developed by the Construction Specifications Institute; (3) work statements - detailed descriptions of each of the thermal and environmental evaluations for use in procuring the services of individuals or organizations to perform the tests. The three sections are intended for use by GSA in the design and procurement processes, and are therefore presented in formats appropriate to GSA's needs.

701,182
PB87-153821 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Ventilation Measurements in Large Office Building.
Final rept.,
A. K. Persily, and R. A. Grot. 1984, 1p
Sponsored by Public Buildings Service, Washington, DC., and Department of Energy, Washington, DC.
Pub. in ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Jnl. 26, n5 p55 1984.

Keywords: *Ventilation, Air infiltration, Reprints, *Office buildings, Tracer techniques, Federal buildings.

Ventilation rates were measured in nine office buildings using an automated tracer gas measurement system. The buildings range in size from a two-story federal building with a floor area of about 2,000 sq meter to a 26-story office building with a floor area of 64,000 sq meter. The ventilation rates were measured for about one hundred hours in each building over a range of weather conditions. The results are presented and examined for variation with time and weather. In most cases, the ventilation rate of a building is similar for hot and cold weather. In mild weather, outside air is used to cool the building and the ventilation rate increases. In the buildings where infiltration is a significant portion of the total ventilation rate, this total rate exhibits a dependence on weather conditions. The measured ventilation rates are discussed in relation to the outside air intake strategy in each building.

701,183
PB87-161899 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Pressurization Testing of Federal Buildings.
Final rept.,
A. K. Persily, and R. A. Grot. 1986, 17p
Sponsored by General Services Administration, Washington, DC.
Pub. in American Society for Testing and Materials Special Technical Publication 904, p184-200 1986.

Keywords: Pressurizing, Reprints, *Federal buildings, *Airtightness, Air infiltration.

Seven federal buildings ranging in size from 1900 to 48,000 sq. meter of floor area were pressure tested to determine the airtightness of the building envelopes. These tests are part of a larger project to evaluate the thermal integrity of the envelopes of federal buildings. The buildings were pressurized using the air-handling equipment in the buildings and a constant-injection, tracer gas technique to measure the airflow through the fans. In addition, selected windows in some of these buildings were pressure tested separately to determine the airtightness of individual components. The results of the whole building and component pressurization tests are presented and discussed. In addition, the component pressurization test results are used to estimate the contribution of the windows to the total building air leakage. The results of the building pressurization tests are compared empirically to measured infiltration rates on the same buildings. The large building infiltration model developed by Shaw and Tamura of the National Research Council of Canada is applied to the buildings to predict air infiltration rates induced by weather.

701,184
PB87-161907 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Measurements of Air Infiltration and Airtightness in Passive Solar Homes.
Final rept.,
A. K. Persily. 1986, 15p
Contract DE-AI01-76PR06010
Sponsored by Department of Energy, Washington, DC.
Pub. in American Society for Testing and Materials Special Technical Publication 904, p46-60 1986.

Keywords: *Houses, Reprints, *Airtightness, Passive solar heating systems, Passive solar cooling systems.

The airtightness of 82 passive solar homes located throughout the United States was studied using tracer gas measurements of air infiltration and pressurization testing. The air infiltration measurements employed the tracer gas decay technique in a low-cost mode employing air sample bags and off-site infiltration determination. The infiltration rates measured under natural conditions ranged from about 0.05 to almost 2 air changes per hour (ACH). The pressurization test results ranged from 1 to more than 30 ACH at 50 Pa, with

an average of about 10 ACH. By comparing the pressurization measurements on these homes to measurements on other homes, the passive solar homes were found to be in general no tighter than other U.S. homes. The air infiltration and pressurization measurements of the Class B homes were compared using existing infiltration models and other empirical relations.

701,185
PB87-173761 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Effect of Wall Mass on the Summer Space Cooling of Residences.
Final rept.,
D. M. Burch, S. A. Malcolm, and K. L. Davis. 1984, 1p
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Jnl. 26, n5 p39 1984.

Keywords: *Residential buildings, *Walls, *Cooling load, Reprints, Thermal mass, Energy conservation.

Six test buildings were extensively instrumented for measuring summer space cooling loads and indoor comfort. The test buildings were 20x20 ft (6.1x6.1m) one-room buildings and had the same floor plan and orientation. They were identical, except for the wall construction, which was as follows: insulated lightweight wood frame; uninsulated lightweight wood frame; uninsulated masonry with outside mass; uninsulated masonry; log; and insulated masonry with inside mass. The test buildings were exposed to summer climate at Gaithersburg, MD. Tests were carried out to investigate the effect of wall mass on the space cooling requirements when the test buildings were operated in the following fashions: fixed indoor thermostat setting of 65 degree F (18 degree C), fixed indoor thermostat setting of 76 degree F (24 degree C), and night ventilation cooling. The purpose of the test with a fixed indoor thermostat setting of 65 degree F (18 degree C) was to simulate building performance with a thermostat setting of 76 degree F (24 degree C) which would occur in hotter climates. The study conclusively demonstrates the existance of a thermal mass effect on daily cooling requirements, peak cooling load, and the cooling energy savings achieved by night ventilation for the six test buildings.

701,186
PB87-174306 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.
Field Performance of Three Residential Heat Pumps in the Heating Mode,
J. Y. Kao, W. J. Mulroy, and D. A. Didion. Feb 87, 80p NBSIR-87/3528
Sponsored by Department of Energy, Washington, DC.

Keywords: *Heat pumps, Residential buildings, Space heating, Defrosting, Field tests, Houses.

The report presents the results of a field performance study of three heat pumps operating in the heating mode. The objective of this study was to evaluate the thermal, energy, defrosting, cycling, and other related performance under in-situ conditions and to confirm the validity of Department of Energy (DoE) test procedures by comparing these field results with those obtained in the laboratories. The seasonal COPs without auxiliary heat were 1.83, 2.31, and 1.92. The seasonal COPs with auxiliary heat were 1.71, 1.95, and 1.60. General agreement was found in two houses for cycling rates and building load estimation. Defrost penalty was found to be light above 40 deg F. One house was analyzed for cyclic performances. The cyclic degradation factor (CD) was found to be worse than the optional factor (0.25) of the DoE procedure.

701,187
PB87-180253 PC **A11**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Applied Economics Group.
Comprehensive Guide for Least-Cost Energy Decisions,
R. T. Ruegg, and S. R. Petersen. Jan 87, 245p NBS/SP-709
Also available from Supt. of Docs as SN003-003-02790-1. Library of Congress catalog card no. 86-600605. Prepared in cooperation with Catholic Univ. of America, Washington, DC. Sponsored by Department of Energy, Washington, DC.

Keywords: *Energy conservation, *Cost analysis, Economic analysis, Federal buildings, Computer applications.

The purpose of the book is to assist builders, building designers, owners, and operators to find a balance between energy consumption and energy conservation which will result in more cost-effective buildings. It assists in four ways: by guiding the decision maker to ask the right economic questions; by showing how to evaluate the cost effectiveness of energy conservation and renewable energy investments; by providing two computational aids- worksheets and a computer program; and by supplying some of the data that are needed to make the evaluations.

701,188
PB87-184750 CP **D99**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
NBSLCC Program (for Microcomputers).
Software,
S. R. Petersen, and R. T. Ruegg. Apr 87, 1 diskette NBS/SW/DK-87/006
The software is contained on 5 1/4-inch diskette, double sided, double density compatible with the IBM PC XT AT microcomputer. Diskettes are in the ASCII format. Price includes documentation, PB87-180253. Contact NTIS Computer Products for prices.

Keywords: *Software, *Buildings, Cost engineering, Diskettes, *Energy conservation, Life-cycle cost, L=Basic, H=IBM PC; IBM PC/XT; IBM PC/AT.

The diskette provides the NBSLCC programs and related files referenced in NBS SP 709, Comprehensive Guide for Least-Cost Energy Decisions. The NBSLCC programs perform economic analysis of buildings, building systems and components, with special emphasis on energy conservation projects. Software Description: The software is written in Basic for implementation on IBM-PC/XT/AT machines using the MS-DOS operating system. A minimum of 128K bytes of core storage is required.

701,189
PB87-219135 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Procedure for Measuring the Dynamic Thermal Performance of Wall Specimens Using a Calibrated Hot Box.
Final rept.,
D. M. Burch, R. R. Zarr, T. K. Faison, B. A. Licitra, and C. E. Arnold. 1987, 13p
Sponsored by Department of Energy, Washington, DC.
Pub. in ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Transactions, v93 pt2 13p 1987.

Keywords: *Walls, *Composite materials, *Heat transfer, Measurement, Finite difference theory, Polystyrene, Thermal insulation, Reprints.

An experimental procedure is developed that permits a calibrated hot box to be used to measure the transient heat-transfer rate through a composite wall specimen. In this procedure, a composite wall specimen is installed between the metering and climatic chambers of a calibrated hot box (CHB), and a time-dependent outdoor climatic condition, such as a sol-air diurnal temperature cycle, is generated in the climatic chamber. The metering chamber is maintained at a typical indoor condition and is used as a calorimeter. The transient heat-transfer rate through the wall specimen at hourly time steps is determined from an energy balance of the metering chamber. In the energy balance, the time-dependent heat-transfer rate through the specimen support frame is predicted using a finite-difference model, and the energy-storage rate within the metering chamber is predicted using a semi-empirical model. A dynamic calibration test was conducted to investigate the accuracy of this procedure. A masonary wall, comprised of 4-in-thick (0.1 m) polystyrene insulation and 5.6-in-thick (0.14 m) solid concrete block and having known heat-transfer properties, was tested. Good agreement was observed between the measured-and-predicted-specimen heat-transfer rates, thereby supporting the validity of the energy balance under dynamic conditions.

701,190
PB88-122122 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Refrigerant Migration in a Split-Unit Air Conditioner.
Final rept.,
W. J. Mulroy, and D. A. Didion. 1985, 14p
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions 91, pt1A p193-206 1985.

Keywords: *Refrigerants, *Air conditioners, Measurement, Capacity, Performance evaluation, Cyclic loads, Tests, Standards, Mathematical models, Reprints.

The relationship between cyclic refrigerant migration and cyclic loss for a residential, split-system air conditioner has been investigated. The cyclic refrigerant migration was measured at different points in the operating cycle by simultaneously shutting five pneumatically operated valves that isolated the refrigerant in the major system components. The refrigerant was then removed, weighed, and returned to the system. The unit tested was found to have a high initial capacity as migrated refrigerant was removed from the evaporator and then a low, slowly increasing capacity as trapped refrigerant was returned to the system from the accumulator. The unit performance was also compared to single and double time constant regressive approximations and to the time constant calculated from the evaporator mass and heat transfer coefficient.

701,191
PB88-122130 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Testing and Rating Solar Domestic Hot Water Systems Using ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Standard 95-1981.
Final rept.,
A. H. Fanney, K. A. Reed, and J. E. Hill. 1983, 30p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Solar '83 International Solar Energy Symposium, Palma de Mallorca, Spain, October 2-6, 1983, p135-165.

Keywords: *Solar heating, *Hot water heating, Residential buildings, Tests, Standards, Performance evaluation, Solar collectors, Reprints.

ASHRAE has recently adopted ASHRAE Standard 95-1981, Methods of Testing to Determine the Thermal Performance of Solar Domestic Water-Heating Systems. The Standard requires the complete system, including auxiliary energy sources, to be assembled in the laboratory and subjected to a daily hot water load and irradiation profile until the daily system performance is repeatable. Data are then collected and analyzed to determine the fraction of the daily energy requirements met by solar energy. The system's solar collector array can be irradiated by a solar simulator or the net thermal energy delivered by an irradiated collector array may be provided by the use of a nonirradiated array in series with a conventional energy source.

701,192
PB88-122148 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Effect of Wall Mass on the Annual Space Heating and Cooling Loads of Residences.
Final rept.,
D. M. Burch, and B. A. Licitra. 1987, 8p
Pub. in Proceedings of International Congress of Building Energy Management (3rd), ICBEM '87, Lausanne, Switzerland, September 28-October 2, 1987, p248-255.

Keywords: *Walls, *Space heating, *Residential buildings, Insulation, Computer programming, Climate, Wood construction, Temperature, Reprints, TARP computer programming.

The space heating and cooling loads for a house containing partition walls and interior furnishings is simulated using a computer program called TARP. Separate computer runs are carried out for the following wall constructions: insulated wood frame: insulated masonry with mass on the exterior; and insulated masonry with insulations sandwiched between interior and exterior mass. The reductions in annual space heating and cooling loads achieved in the houses with masonry wall construction compared to identical houses with lightweight wood-frame wall construction are computed for five climates.

701,193
PB88-128640 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Fenestration Design for Building Atria,
S. J. Treado, D. B. Holland, J. W. Bean, and G. L. Gillette. Sep 87, 170p NBSIR-87/3594
Sponsored by Department of Energy, Washington, DC., and American Architectural Mfrs. Association, Des Plaines, IL.

Keywords: *Architecture, *Windows, *Buildings, *Atria, Computerized simulation, Design, Graphs(Charts), *Energy efficiency.

The influence of fenestration design on building energy performance is evaluated, based on measurements in four atrtium buildings and a series of detailed computer simulations using TARP and CEL-1. The impact of glazing area and solar-optical properties is examined for a linear and central atrium building for eight geographical locations. The usefulness of automatic solar shading and heat storage strategies is also investigated. Guidelines are presented for effective design of atrium fenestration.

701,194
PB88-128996 PC **A07**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Characterization of Microenvironments and the Degradation of Archival Records: A Research Program,
E. Passaglia. Oct 87, 129p NBSIR-87/3635

Keywords: *Archives, *Air pollution, *Papers, Environmental engineering, Sulfur dioxide, Nitrogen oxides, Ozone, Temperature, Humidity, Storage, *Air pollution effects(Materials), Microenvironments.

Air pollutants increase the rate of degradation of documents and records in archival storage. However, with the exception of books, most of these documents and records are not exposed to the ambient environment of the archive stacks. They are instead stored in containers of various kinds. The records therefore experience the microenvironment of the interior of the container, which may be more benign than the macroenvironment exterior to it. In the report, the environment inside a container, and any changes that can occur in it as the exterior environment changes, is modelled. On the basis of the modelling, and what is known about the effects of pollutants on the degradation of archival records, a research program designed to lead to an understanding of the maximum benefit that could be obtained with various containers is laid out. The design and materials of construction are specifically discussed.

701,195
PB88-129887 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Allocating Funds among Projects with Variable Designs and Sizes.
Final rept.,
R. T. Ruegg. 1987, 5p
Pub. in Heating/Piping/Air Conditioning 59, n9 p75-79 Sep 87.

Keywords: *Heating, *Energy conservation, *Air conditioning, Project planning, Economic analysis, Cost effectiveness, Return on investment, Allocations, Guidelines, Reprints, *Funds, Budgeting.

When funds are limited, upgrading the design or increasing the size of variable-design/size projects may mean choosing fewer total projects. The paper provides guidelines for designing, sizing, and selecting projects under alternative budgetary conditions in order to maximize the return on the total investment. It emphasizes and illustrates with examples, the importance of identifying the appropriate budgetary perspective.

701,196
PB88-141163 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Aerial Thermography and Spot Radiometer Applications for Detecting Thermal Anomalies of Office Buildings.
Final rept.,
Y. M. Chang, and L. S. Galowin. 1985, 12p
Sponsored by General Services Administration, Washington, DC.
Pub. in Thermal Infrared Sensing for Diagnostics and Control (Thermosense VII), v520 p178-189 1985.

Keywords: *Heat losses, *Infrared thermography, *Radiometers, Aerial monitoring, Roofs, Office buildings, Reprints.

Aerial thermography and spot radiometer techniques were used for the assessment of roofs and heat loss through building envelopes of office buildings. The inspections were part of the diagnostic programs developed by the National Bureau of Standards (NBS) for the General Services Administration (GSA) to evaluate the thermal integrity of new and existing office buildings. The infrared inspections by aerial thermography and spot radiometer measurements were performed by outside contractors; all other tests were performed by NBS. The paper presents the analysis and results reported by the contractors, and discusses the capabilities and limitations of equipment with recommendations for aerial thermography and spot radiometer inspections on office buildings.

701,197
PB88-152327 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Review of Tracer-Gas Techniques for Measuring Airflows in Buildings.
Final rept.,
P. L. Lagus, and A. K. Persily. 1985, 13p
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions 91, pt2B p1075-1087 1985.

Keywords: *Air infiltration, *Tracer techniques, Ventilation, Commercial buildings, Reprints.

The paper describes tracer gas measuring techniques that have been used to characterize ventilation and air infiltration in buildings, with an emphasis on recent developments and applications in large industrial and commercial structures. Fundamentals and applications are presented for both single and multiple tracer gas methods.

Building Equipment, Furnishings, & Maintenance

701,198
PB-263 882/3 PC **A17**/MF **A01**
IIT Research Inst., Chicago, IL. Engineering Mechanics Div.
Detector Sensitivity and Siting Requirements for Dwellings - Phase 2.
Final rept.,
S. W. Harpe, T. E. Waterman, and W. J. Christian. Feb 77, 379p IITRI-J6340, NBS-GCR-77-82
Contract NBS-4-36092
See also PB-247 483. Prepared in cooperation with Underwriters' Labs., Inc., Northbrook, Ill.

Keywords: *Fire detection systems, *Smoke, *Warning systems, Detectors, Sensitivity, Residential buildings, Performance evaluation, Field tests, Summer, Autumn, Windows, Classifications, Responses, *Smoke detectors, Two story homes.

The contract for a field investigation of the effectiveness of residential smoke detectors was extended to cover 36 additional tests investigating details not completely covered in the first report. The objective of the second phase of the program was to gather information on fires under summer/fall conditions without air conditioning and to expand available information on high volume, two story structures. The effects of open windows, new technical developments in photoelectric detector design, and the response of semiconductor type residential gas detectors and mechanically powered heat detectors were also included.

701,199
PB-266 484/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Field Investigation of Residential Smoke Detectors.
Final rept.,
R. W. Bukowski. May 77, 4p
Pub. in Southern Bldg. p28-31, Apr/May 77.

Keywords: *Residential buildings, *Detectors, *Smoke, Performance tests, Warning systems, Sensitivity, Safety, Position(Location), Escape(Abandonment), Time, Ionization, Photoelectric cells, *Smoke detectors, Escape time.

A test program was undertaken to investigate the operation of residential smoke detectors under actual field conditions. The main objectives were to determine: (1) minimum sensitivity, (2) best location, and (3) escape time provided by a group of typical detectors. Instrumentation was used to determine theoretical response times of an 'ideal' detector as a base line for evaluation of detector performance. The tests were conducted using smoldering or flaming ignition of sofas, chairs and mattresses in various rooms in two abandoned, single-family houses scheduled for demolition. Work was carried out during winter and summer seasons with central heating and cooling on and off.

701,200
PB-272 064/7 PC **A07**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Combustion of Mattresses Exposed to Flaming Ignition Sources. Part I. Full-Scale Tests and Hazard Analysis.
Final rept.,
V. Babrauskas. Sep 77, 147p NBSIR-77-1290
Sponsored in part by Department of Health, Education and Welfare, Washington, Veterans Administration, Washington, D.C., Department of Defense, Washington, D.C. and Consumer Product Safety Commission, Washington, D.C.

Keywords: *Bedding equipment, *Fire tests, Ignition, Flame propagation, Hazards, Hospitals, Data acquisition, Research, Flammability, Facilities, Mattresses, Prisons, Room fires, Health care institutions.

A test program was conducted to assess the hazards of institutional mattresses when subjected to a sustained flaming ignition source. This report gives results on full-scale room burns of ten different mattress types under several ventilation conditions. Tenability and rapid flame spread potential criteria were applied in a hazard assessment which showed a wide range of behavior among mattresses now being used in institutions. An extensive review of previous fire tests involving mattresses is included.

701,201
PB-272 882/2 PC **A09**
Factory Mutual Research Corp., Norwood, Mass.
Environments of Fire Detectors. Phase 1: Effect of Fire Size, Ceiling Height and Material. Volume 1. Measurements.
Technical rept.,
G. Heskestad, and M. A. Delichatsios. May 77, 186p FMRC-22427-Vol-1, RC76-T-37, NBS-GCR-77-86
Grant NBS-6-9001
Prepared in cooperation with Fire Detection Inst., Wilmington, Del.

Keywords: *Fire detection systems, *Fire tests, Ceilings(Architecture), Wood, Polyurethane resins, Cotton fabrics, Polyvinyl chloride, Fire safety, *Smoke detectors, *Fire detectors, *Room fires.

An experimental program has been initiated to map ceiling environments to which fire detectors are exposed for various combinations of room geometry, ceiling configuration, fire type, and detector spacing. This report covers Phase I of the program, which considered (1) flat, extensive ceiling areas, (2) a quiescent test space, (3) flaming and smoldering fires of wood, cotton, foamed polyurethane, and polyvinyl chloride, (4) ceiling heights of 8, 15 and 29 ft, and (5) instrument stations at 10, 20, and 40 ft from the geometric fire axis. Measured environmental parameters included temperature, velocity, and optical density. In addition, response times of a set of five fire detectors (heat detectors of fixed temperature, rate-of-rise, and rate anticipation types; one ionization smoke detector; and one photoelectric smoke detector of the reflection type) were recorded at each instrument station. A total of 49 fire tests were conducted. The reduced data are presented in two tables, one listing detector response times and the other listing the environmental data. Analysis of the data is presented in a second volume (Volume II) and includes determination of spacing requirements for fire detectors in flaming fires. (Portions of this document are not fully legible)

701,202
PB-272 883/0 PC **A07**/MF **A01**

Factory Mutual Research Corp., Norwood, MA.
Environments of Fire Detectors. Phase 1: Effect of Fire Size, Ceiling Height and Material. Volume 2. Analysis.
Technical rept.,
G. Heskestad, and M. A. Delichatsios. Jul 77, 131p
FMRC-22427-Vol-2, RC77-T-11, NBS-GCR-77-95
Grant NBS-6-9001
Prepared in cooperation with Fire Detection Inst., Wilmington, Del.

Keywords: *Fire detection systems, *Fire tests, Ceilings(Architecture), Wood, Polyurethane resins, Cotton fabrics, Polyvinyl chloride, Fire safety, *Smoke detectors, *Fire detectors, *Room fires.

This volume is an analysis of experimental data presented in Volume 1 on the ceiling environment and response to this environment by various types of fire detectors. Data and the analysis pertain to flat, extensive ceilings and quiescent surroundings. The results for smoldering fires are found to be of limited utility because of dominant influence of uncontrolled variables such as pre-existing temperature stratifications; however, an anomalous smoke pattern has been explained, which should aid future investigations. The results of environmental variables versus time for the unsteady, flaming fires are found to correlate very well in coordinates which intrinsically account for variations in fire-growth rate and ceiling height. Hence, ceiling temperatures and velocities can be predicted as function of time for any combination of fire-growth rate and ceiling height. Optical densities for a given combustible material are found to be in approximately constant ratio to the local temperature rise. In flaming fires smoke detectors are found to respond at approximately constant temperature rise of the fire gases; this temperature rise depends on the combustible material and mode of fire spread. The response of heat detectors is shown to be predictable theoretically from the temperature and velocity fields and key detector characteristics. The final section of the report deals with spacing requirements of fire detectors in flaming fires as influenced by ceiling height, fire-growth rate, and detector characteristics. The results are presented in graphical and tabular forms.

701,203
PB-273 943/1 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Preliminary Report on Evaluating Alternatives for Reducing Upholstered Furniture Fire Losses,
B. Buchbinder, S. G. Helzer, and F. L. Offensend.
Nov 77, 31p NBSIR-77-1381
Prepared in cooperation with SRI International, Menlo Park, Calif.

Keywords: *Furniture, *Upholstery, *Fires, Flames, Flame propagation, Probability distribution functions, Cost analysis, *Upholstered furniture, Product safety.

This paper presents preliminary results from a pilot project designed to test the utility of applying decision analysis to fire hazard problems. To test the methodology, an analysis is being performed to determine the effectiveness and economic consequences of alternative intervention strategies for reducing upholstered furniture fire losses in residences. A probabilistic model has been developed to assess quantitatively the expected fire losses under each alternative. This paper describes the analysis on one alternative: the proposed upholstered furniture standard currently under consideration by the Consumer Product Safety Commission. The loss model for this alternative is described in some detail. Preliminary results on costs, losses, and cost plus loss to society and the present value of these quantities are presented. A subsequent report will update this analysis with revised data, and present a comparison of the proposed standard with other alternative strategies.

701,204
PB-278 605/1 PC **A05**/MF **A01**
Maryland Univ., College Park. Coll. of Engineering.
Interaction of Fire and Sprinklers,
C. L. Beyler. Sep 77, 80p NBS/GCR-78-121
Grant NBS-6-9008
Sponsored in part by Department of Health, Education and Welfare, Washington, D.C. Report on HEW-NBS Fire/Life Safety Program.

Keywords: *Fire extinguishers, *Sprinkler systems, Drops(Liquids), Fire protection, Dispersing, Vaporizing.

Models of the actuation of sprinklers, drop dynamics in a nonfire situation, and drop dynamics in a fire situation are developed. Sensitivity analysis is performed with the models. The actuation model makes use of empirical curve fit relations for the temperature and velocity fields of the ceiling-jet. The relations are the result of curve fits to the exact solutions given by Alpert's model. The model also makes use of 'Plunge Test' data as developed by Heskestad and Smith. The model of nonfire drop dynamics developed is found to be unable to predict the distribution pattern from sprinklers. The model utilizes a single constant initial velocity for all drops. Results indicate that a distribution of initial velocities exists. The model of drop dynamics in a fire indicates that evaporation need not be considered when studying drop penetration through the fire plume. The fire plume is found to effect similarly all drops which exceed a critical diameter. Below the critical diameter the drop is carried away by the plume. The critical diameter is a function of the heat output.

701,205
PB-278 820/6 PC **A06**/MF **A01**
IIT Research Inst., Chicago, IL. Engineering Mechanics Div.
Modifications to the RFIRES Preflashover Room Fire Computer Model,
R. Pape, and T. Waterman. Mar 77, 104p NBS-GCR-77-113
Grant NBS-T-9022
Sponsored in part by Department of Health, Education, and Welfare, Washington, D.C.

Keywords: *Houses, *Furniture, *Fires, Combustion, Smoke, Flashover, Volatility, Computer programs, RFIRES computer program, *Room fires.

An analysis of the capability of RFIRES methodology was made using test data from the NBS 'Nike Fire Test Facility'. The analysis did show some limitation in predicting the exact occurrence of flashover. The RFIRES code has been modified to incorporate several modes for combustion of residual fuel and air in the upper spaces of the room, predicting smoke and toxic gas generation, and to simplify the temperature of lower room walls calculation.

701,206
PB-279 372/7 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Flammability Testing for Carpet.
Final rept.,
I. A. Benjamin, and S. Davis. Apr 78, 15p NBSIR-78-1436

Keywords: *Carpets, *Flammability, Fire tests, Flame propagation, Fire resistant textiles, Floor coverings, Fire spread.

As use of carpet has increased in recent years, more and more attention has been focused on different test methods for measuring its flammability. The carpet industry, as well as regulatory agencies have been working on test procedures which would provide consumer protection and not be overly burdensome. All carpet sold in this country must pass the 'pill test.' The pill test provides 'first-to-ignite' protection for carpet flooring systems located within rooms or undivided building spaces. Criteria have been proposed using the new Flooring Radiant Panel Test which provide equivalent safety to that level provided by the Life Safety Code. The Flooring Radiant Panel Test is both reproducible and related to 'real world' performance. This publication explains the features of this test.

701,207
PB-279 937/7 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Fire Alarm and Communication Systems,
R. W. Bukowski, R. L. P. Custer, and R. G. Bright.
Apr 78, 51p NBS-TN-964

Keywords: *Fire alarm systems, Fire detection systems, Buildings, Residential buildings, Control equipment, Telecommunication, Sprinkler systems, Multiplexing, High rise buildings, High rise apartment buildings, Flame detectors, Smoke detectors.

The operation and use of all current types of fire alarm and communication systems are discussed. This includes the differences between and operating features of local, auxiliary, remote station, proprietary, and central station systems, high-rise communication systems and residential fire detection devices. A discussion of commonly used fire detectors is given including operation, installation and application considerations. Indicating devices, sprinkler supervisory devices, maintenance, reliability and code/standard compliance are also covered.

701,208
PB-289 965/6 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Smoke Detector Design and Smoke Properties.
Final rept.
R. W. Bukowski, and G. W. Mulholland. Nov 78, 55p NBS-TN-973
Errata sheet inserted.

Keywords: *Smoke, *Detectors, Photometers, Particle size, Fire detection systems, Aerosol generators, Test equipment, *Smoke detectors, *Ionization detectors.

The importance of a reference photometer and reference ionization detector in improving the reliability of smoke detectors is discussed. Recent developments in smoke detector technology are highlighted and theoretical as well as practical experience in regard to detector performance is summarized. Comparison of the theoretically predicted response of smoke detectors as a function of particle size with measured values is given. A monodisperse aerosol generator, an electrical aerosol analyzer with a size sensitivity from 0.01 to 1 micrometer, and an optical particle counter are described. The size distribution, mass and number concentration, optical density, and coagulation frequency for smoke from burning heptane and smoldering cotton lamp wick are presented. It is shown that a Junge type size distribution provides a good fit to the measured size distribution for both fresh and aged smoke.

701,209
PB-290 951/3 PC **A09**/MF **A01**
Factory Mutual Research Corp., Norwood, MA.
Environments of Fire Detectors. Phase II: Effect of Ceiling Configuration. Volume I. Measurements.
Final rept.
G. Heskestad, and M. A. Delichatsios. Jun 78, 180p
FMRC-22584, NBS/GCR-78-128
Grant NBS-6-9001
Prepared in cooperation with Fire Detection Inst., Wilmington, DC. See also report dated May 77, PB-272 882.

Keywords: *Fire detection systems, *Fire tests, *Ceilings(Architecture), Performance evaluation, Measurement, Fire safety, Tables(Data), Fire detectors, Smoke detectors, Room fires.

This report describes Phase II of a sustained research program to map ceiling environments to which fire detectors are exposed. Phase I, reported previously, concerned flat, horizontal ceilings of large extent. Phase II extends ceiling measurements of temperature, velocity and optical density to six different beam configurations in extensive, horizontal ceilings. As in Phase I, the response times of variously located sets of fire detectors were measured (three types of heat detectors, an ionization detector and a photo-electric smoke detector). A total of 21 fire tests were conducted. The reduced data are presented in two tables, one listing detector response times and the other listing environmental data. Analysis of the data is presented in a second volume (Volume II).

701,210
PB-291 826/6 PC **A03**/MF **A01**
SRI International, Menlo Park, CA.
Assessing the Results of the LCC Water Heater Experiment. Volume I: Main Report.
Final rept.
N. B. McEachron, D. C. Hall, and L. F. Lewis. Sep 77, 50p NBS-GCR-ETIP-78-51
Contract NBS-6-35757
See also Volume 2, PB-291 827.

Keywords: *Water heaters, *Technology assessment, Cost analysis, Market surveys, Procurement, Federal supply items, Thermal efficiency, *Life cycle costs, *Energy conservation.

This report presents an exploratory evaluation of the commercial impact of experiments using a life cycle costing (LCC) strategy in the procurement of water heaters; the experiments were conducted by the Federal Supply Service (FSS) and the Experimental Technology Incentives Program (ETIP). The purpose of the evaluation was to answer three questions: what was industry's response to the procurement by FSS, in

terms of technological changes in water heaters supplied and subsequently commercialized; how appropriate have FSS methods been for measuring the value of these product changes to the government as user; and if the procurement strategy were altered in various ways, what would be the likely changes in these commercial impacts.

701,211
PB-291 827/4 PC **A07**/MF **A01**
SRI International, Menlo Park, CA.
Assessing the Results of the LCC Water Heater Experiment. Volume II: Appendices.
Final rept.
N. B. McEachron, D. C. Hall, and L. F. Lewis. Sep 77, 139p NBS-GCR-ETIP-78-52
Contract NBS-6-35757
See also Volume 1, PB-291 826. Portions of this document are not fully legible.

Keywords: *Water heaters, *Technology assessment, Cost analysis, Market surveys, Procurement, Federal supply items, Thermal efficiency, Questionnaires, *Life cycle costs, *Energy conservation.

This report presents an exploratory evaluation of the commercial impact of experiments using a life cycle costing (LCC) strategy in the procurement of water heaters; the experiments were conducted by the Federal Supply Service (FSS) and the Experimental Technology Incentives program (ETIP).

701,212
PB-292 052/8 PC **A05**/MF **A01**
Purdue Univ., Lafayette, IN.
Development of Performance Tests for Upholstered Furniture Frames. Description of Equipment. Part 2.
C. A. Eckelman. 2 Aug 78, 96p
Contract GS-00S-41025
See also PB-292 055. Sponsored in part by National Bureau of Standards, Washington, DC. Experimental Technology Incentives Program.

Keywords: *Furniture, *Upholstery, *Government procurement, Performance tests, Loads(Forces), Test equipment, Pneumatic equipment, Wood products, Frames, National government, General Services Administration.

The document describes in detail the equipment developed and used to test upholstered furniture frames. All facets of the pneumatic, mechanical and electrical systems developed are discussed. The tests are currently being used by GSA to buy certain styles of Performance Tested furniture for use by the Federal Government. The Test Method is a result of a joint GSA-Purdue University Project to establish performance tests which will enable the Government to purchase commercially-available furniture and eliminating the use of government-unique items.

701,213
PB-292 054/4 PC **A06**/MF **A01**
Purdue Univ., Lafayette, IN.
Performance Test Method for Upholstered Furniture Frames.
C. A. Eckelman. 2 Aug 78, 121p
See also PB-292 055. Sponsored in part by National Bureau of Standards, Washington, DC. Experimental Technology Incentives Program.

Keywords: *Furniture, *Upholstery, *Government procurement, National government, Performance tests, Test equipment, Wood products, Frames, Loads(Forces), General Services Administration.

The document lays the groundwork for GSA document: FEHS 78-125, The Performance Test Method for Upholstered Furniture. Included in the document are in-depth discussions on the scope, summary of method, definitions, test specimens, conditioning of wood specimens, common test equipment, a complete description of the nine tests, reporting information, parts list, document list, and addresses. This test method is a result of a joint GSA-Purdue University Project to establish performance tests which will enable the Government to purchase commercially-available furniture and eliminating the use of government-unique items.

701,214
PB-292 055/1 PC **A04**/MF **A01**
Purdue Univ., Lafayette, IN.
Performance Test Method for Upholstered Furniture with Revision No. 1.
C. A. Eckelman, and J. E. Winandy. 28 Sep 78, 55p FEHS-78/125
Contract GS-00S-41025
See also PB-292 052. Sponsored in part by National Bureau of Standards, Washington, DC. Experimental Technology Incentives Program.

Keywords: *Furniture, *Upholstery, *Government procurement, Performance tests, Loads(Forces), Wood products, Frames, National government, General Services Administration.

The document describes in detail what the GSA Upholstered Furniture Performance tests entail and exactly how to perform these tests. These tests are currently being used by GSA to buy certain styles of Performance Tested Furniture for use by the Federal Government. This Test Method is a result of a joint GSA-Purdue University Project to establish performance tests which will enable the Government to purchase commercially-available furniture and eliminating the use of government-unique items.

701,215
PB-293 263/0 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Law Enforcement Standards Lab.
Catalog of Security Equipment.
J. V. Fechter, and E. M. Robertson. Nov 78, 61p NBS-SP-480-35
Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, DC. Library of Congress catalog card no. 78-600140.

Keywords: *Buildings, *Security, *Catalogs(Publications), Electronic security, Warning systems, Locks(Fasteners), Protectors, Manufacturers, *Crime prevention, *Intrusion detection, *Intrusion detectors, *Burglary.

This catalog is concerned primarily with security equipment which can be used to prevent 'crimes of opportunity' against homes and businesses. The purpose of the catalog is to make readers aware of the available types of security equipment and to identify their manufacturers. Equipment is classified into four functional areas: physical security, access control, alarm systems, and business and industry equipment. Within each functional area, each item of equipment is identified and described in terms of its cost range, usual application, and manufacturers.

701,216
PB-295 357/8 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Product Safety Technology Div.
Possible Fire and Electric Shock Hazards from Hot Lamps in Miniature Christmas Tree Light Strings and Decorations.
P. M. Fulcomer. Mar 79, 36p NBSIR-79-1716
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Lighting equipment, *Hazards, Fire hazards, Electrical shock, Lamps, Decorating, Safety, Christmas tree lights.

Failure to replace burned out lamps in series-constructed miniature Christmas light strings, or replacement with lamps of incorrect voltage rating, can lead to very high power dissipation by some or all of the lamps in the series string. Hot spot surface temperatures as high as 470C were measured for lamps subjected to simulation of the above conditions. Additional testing showed that contact with surface temperatures above 390C can cause glowing ignition, within two minutes, of cellulose material (e.g., tissue paper, decorative cotton) often found in the vicinity of Christmas light strings, and can cause flaming ignition in some samples of absorbent, untreated cotton. Furthermore, the hot spot surface temperature of normally operating lamps (no excessive power dissipation) can, particularly if the filament is off center, be higher than the melting temperature of some commonly used plastic insulating materials such as polyethylene. Contact between a hot lamp and insulating material can thus cause a shock hazard due to exposure of current carrying parts. Light string design and performance requirements that would prevent these hazards are discussed in the report.

701,217
PB-295 431/1 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Thermal and Service Systems Div.
Preliminary Data on the Field Performance of Storage-Type Residential Water Heaters.
R. A. Grot, and L. S. Galowin. Apr 79, 28p NBSIR-78-1496

Keywords: *Residential buildings, *Water heaters, Hot water heating, Gas heaters, Electric heating, Performance, Statistical data.

The early results of a field experiment for determining the performance of gas and electric residential storage water heaters are presented. Energy requirements for hot water supply and hot water consumption and usage pattern data are presented and analyzed using statistical techniques in order to display average load curves and the variation about the average. It is shown that the daily energy usage of these water heaters is approximately a linear function of the energy content of the drawn daily water consumption. This fact allows a simple procedure to be used for evaluating the effects of retrofit actions on the performance of the water heater.

701,218
PB-296 279/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Review of Fire Incidents Related to Wood-Burning Appliances.
Final rept.
R. D. Peacock. 1979, 24p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Wood-Heating Seminar IV, Held at Portland, OR. on March 21-24, 1979, p43-66 1979.

Keywords: *Heating equipment, *Stoves, *Fire safety, *Accident investigations, Wood, Statistical data, Risk, Wood burning stoves, Fire investigations.

As a part of the Department of Energy program to advance the technology for the utilization of fuelwood as an alternate energy source for applications ranging from single-family dwellings to apartment complexes and small industries, a review is presented of fire incidents and fire deaths attributable to wood-burning appliances. Initiated to establish accident patterns and to determine the risks involved with the use of wood-burning equipment, the survey represents a compilation of approximately 11,800 fire incidents including injuries and deaths associated with solid fuel burning appliances.

701,219
PB-298 657/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Fire Alarm Communications.
Final rept.,
R. W. Bukowski, R. L. P. Custer, and R. G. Bright. 1979, 27p
Pub. in Handbook of Building Security Planning and Design, Chapter 19, p19-1-19-27 1979.

Keywords: *Fire alarm systems, *Telecommunication, Fire detection systems, Control equipment, Residential buildings, Multiplexing, Standards, Reprints.

The operation and use of all current types of fire alarm and communication systems is discussed. This includes the differences between and operating features of local, auxiliary, remote station, proprietary, and central station systems, high-rise communication systems and residential fire detection devices. A discussion of commonly used fire detectors is given including operation, installation and application considerations. Indicating devices, sprinkler supervisory devices, maintenance, reliability and code/standard compliance is also covered.

701,220
PB-300 318/3 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Full-Scale Burning Behavior of Upholstered Chairs.
V. Babrauskas. Aug 79, 92p NBS-TN-1103
Sponsored in part by Veterans Administration, Washington, DC., Department of Defense, Washington, DC., and Consumer Product Safety Commission, Washington, DC.

Keywords: *Chairs, *Upholstery, *Flammability, Fire tests, Furniture, Burning rate, Combustion products, Upholstered furniture.

A test program was conducted to determine the fire behavior of a variety of upholstered chairs subjected to a flaming ignition. Major variables were materials and construction of chairs, room ventilation, and type of ignition sources. A total of 16 types of traditional and modern design chairs were tested in a full-scale, otherwise unfurnished room. A folded up newspaper at the seat area was used as the standard ignition source. Room tenability criteria were based on smoke, concentrations of gaseous combustion products, and heat flux. One or more tenability criteria were exceeded for 14 chairs, in times ranging from 100 sec to 650 sec; two chairs burned without exceeding any of the tenability criteria. A review is included of previous upholstered furniture experiments using flaming ignition sources and of existing or proposed small-scale standard tests.

701,221
PB78-600008 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cost/Benefit Framework for Consumer Product Safety Standards.
C. O. Muehlhause. 1978,25p
Included in Jnl. of Research of the National Bureau of Standards, v83 n5 p459-483 Sep-Oct 1978.

Keywords: *Consumer, Cost-benefit, Fire hazard, Market, Regulation safety standards, Upholstered furniture.

The effect of a mandated consumer product safety standard on the net public benefit is expressed in terms of the difference between two well characterized market states (pre- and post-standard), each of which is assumed to be in static equilibrium. The analysis is facilitated by treating the post-standard state as one which can be 'derived' from the pre-standard state by (1) expanding the production cost and demand functions around their initial market values and (2) introducing modifications in the production cost function required for compliance with the standard. A gain in net benefit would imply that promulgation of the standard is favorable; however, a variety of uncertainties are encountered in estimating the incremental changes in production, demand, compliance, and regulatory costs. These are discussed, some of the simpler situations which may prevail are disclosed, and the sources of expertise required to effect the analysis are identified. The detailed portion of the analysis undertaken in this paper is one which attempts to derive a market factor such that when it is multiplied by the basic increment in manufacturing cost necessary to comply with the standard yields the loss in net benefit due to the market system. The results are then applied to a case involving the manufacturing and retailing of upholstered furniture, which industries may be subject to a certain fire prevention standard.

701,222
PB80-100001 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Investigation of the Effects of Heating and Air Conditioning on the Performance of Smoke Detectors in Mobile Homes.
Final rept.,
R. W. Bukowski. Oct 79, 182p NBSIR-79-1915
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Residential buildings, *Trailers, *Fire detection systems, Fire tests, Fire alarm systems, Installation, Walls, Fire safety, *Mobile homes, *Smoke detectors.

Since its original promulgation in June 1976, the U.S. Department of Housing and Urban Development's Federal Mobile Home Construction and Safety Standard has required the installation of at least one smoke detector to protect the mobile home occupants. The location of the smoke detector was based on earlier tests in a mobile home conducted by NBS in 1976. Because of the limited scope of the earlier NBS tests and subsequent improvements in the design of smoke detectors and the construction of mobile homes, a new series of tests was conducted to evaluate the influences of the operation of central forced-air heating and air conditioning systems on the performance of smoke detectors representative of those which are currently being installed. The tests were conducted with upholstered chairs in smoldering and flaming fire modes, representing key residential fire death scenarios. Tests were conducted in both summer and winter weather conditions. The effects of detector location (wall or ceiling and position within the bedroom corridor) and the effects of open and closed bedroom doors were also investigated. The report concludes that, for the scenarios examined, a properly functioning ionization or photoelectric smoke detector mounted near the ceiling on the inside or outside wall at the living room end of the corridor should provide an alarm in sufficient time for occupant escape.

701,223
PB80-178155 Not available NTIS
National Bureau of Standards, Washington, DC.
Testing Symbols for Fire Situations.
Final rept.,
B. C. Pierman, and N. D. Lerner. Mar 80, 2p
Pub. in Fire Command, v47 n3 p12-13 Mar 80.

Keywords: *Fire safety, *Symbols, Standardization, Visual perception, Tests, Buildings, Doors, Fire alarm systems, Fire fighting.

This article describes the testing and development of pictorial signs for fire situations. The use of symbols for visual communication and issues of standardization are discussed. The National Bureau of Standards has cooperated actively with the National Fire Protection Association in studying two sets of symbols, and the testing programs are described. One set of pictograms included fire safety symbols, for alerting building occupants to aspects of egress, fire alarm, fire fighting, and fire safety. The other set was fire fighting symbols, to aid fire fighters in locating and identifying equipment and utilities. Work on both symbol sets is directed toward eventual standardization by NFPA.

701,224
PB80-180938 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of the Flooring Radiant Panel Test as a Standard Test Method.
Final rept.,
C. H. Adams, and S. Davis. Mar 80, 58p NBSIR-79-1954
Sponsored in part by Society of the Plastics Industry, Inc., New York.

Keywords: *Floor coverings, *Flammability testing, Carpets, Fire safety, Flame propagation, Fire tests, Flux(Rate), Radiant panel tests.

This report deals with the standardization phase of the Flooring Radiant Panel Test. It describes work done to develop the test as a standard for measuring one of the major factors contributing to the potential fire hazard of floor covering systems used in corridors and exitways. The investigation involved major interlaboratory test programs and focused on: (1) establishing realistic test conditions; (2) defining and minimizing variability; (3) drafting a complete and concise test procedure; and (4) demonstrating the soundness of the method. Required flux profile instrumentation calibration procedures were developed and proven. 'Critical Radiant Flux' data obtained on representative floor covering systems showed the rank ordering of important products such as man-made and natural fiber carpets, vinyl asbestos tile, and hardwood flooring. Acceptable repeatabilities of about 20% (within-laboratory variability) and reproducibility of about 35% (between laboratory variability) were demonstrated in two major NBS/MMFPA/CRI interlaboratory carpet system test programs. Fourteen laboratories participated in these full factorial statistically designed experiments with each laboratory testing eighteen carpet materials.

701,225
PB80-194798 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Computerized Approach for Identifying Cost-Effective Fire Safety Retrofits in Health Care Facilities.
Final rept.,
R. E. Chapman, W. G. Hall, and P. T. Chen. Jan 80, 126p NBSIR-79-1929

Keywords: *Fire safety, *Safety engineering, *Cost effectiveness, Construction, Hospitals, Computer programs, Flow charts, Building codes, Structural engineering, Renovating, Prices, Cost analysis, Linear programming, *Health care facilities, *Retrofitting, Institutional facilities, Nursing homes.

The study focuses on how a computerized version of the Fire Safety Evaluation System developed by the Center for Fire Research at the National Bureau of Standards can be used to determine equivalence to the Life Safety Code in the least costly manner. This study presents a programmer-oriented discussion of the mathematical, economic and engineering considerations that went into the development of the linear programming algorithm for identifying cost-effective retrofits. Programmer-oriented topics treated in this report include: a discussion of user options; program documentation; format statements; flow charts; sample computer runs; and a complete listing of the computer program.

701,226
PB80-600050 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Metallic Window Foil for Intrusion Alarm Systems.
G. N. Stenbakken, and L. K. Eliason. 1980, 11p
Pub. in NIJ-Std-0319.00.

Keywords: *Alarm, Burglar alarm, Detector, Intrusion alarm, Standard, Test method, Window foil.

This standard establishes performance requirements and methods of test for window foil used in intrusion alarm systems as a sensor to detect the breakage of glass. The standard applies only to metallic foil for use on glazing materials consisting solely of glass.

701,227
PB80-600051 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Physical Security of Window Units.
J. S. Stroik, T. Reichard, D. Washington, and L. K. Eliason. 1980, 19p
Pub. in NIJ-Std-0316.00.

Keywords: *Burglary resistance, Frames, Hardware, Hinges, Locks, Performance standard, Test methods, Window, Window assemblies, Window components.

This document establishes performance requirements and methods of test for the resistance to forced entry of window units intended for use in residences and some small businesses. This standard addresses the capability of window units to frustrate the 'opportunity' crimes committed by unskilled and semi-skilled burglars. The skilled or rarely used methods of gaining entry through window units are not addressed. This standard is compatible with the NIJ standards for the physical security of single-swing entry doors and sliding glass door units.

701,228
PB81-145823 PC **E05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire Safety of Wood-Burning Appliances, Part 1: State of the Art Review and Fire Tests, Volume 1 and Volume 2.
Final rept.
R. D. Peacock, E. Ruiz, and R. Torres-Pereira. Nov 80, 80p NBSIR-80-2140
Sponsored in part by Department of Energy, Washington, DC. Part 1, Volume 2, is in microfiche form in the back of Part 1, Volume 1. It consists of 6 MF inserts 48X reduction.

Keywords: *Stoves, *Wood, *Fire safety, Fire tests, Chimneys, Flues, Heating equipment, Heat transfer, Wood burning stoves.

A series of 18 full-scale tests was conducted in an instrumented test room using five different wood-burning appliances. These tests were designed (1) to establish typical operating conditions including temperatures on the appliances, chimneys, and adjacent combustible surfaces; (2) to study the effects of a variety of combinations of appliance design, clearance to combustibles, and room construction on temperatures on adjacent combustible surfaces; and (3) to compare these measured values with theoretical predictions of wall surface temperature. Additional tests were conducted to compare a standardized fuel source with typical oak logs. A review of literature related to wood-heating safety included in this study revealed that current codes are based on data almost 40 years old. The results of these tests point out some areas where the codes should be modernized to accurately reflect the newer appliances and construction techniques.

701,229
PB81-159956 PC **A10**/MF **A01**

National Bureau of Standards, Washington, DC. National Engineering Lab.
Joint US-USSR Seminar on Mathematical Methods for Estimating the Fire Endurance of Structural Assemblies.
Final rept.
R. S. Levine. Dec 80, 213p NBSIR-80-2188

Keywords: *Structures, *Fire resistance, Steel structures, Wooden structures, Reinforced concrete, Fire tests, Mathematical models, Heat transfer, Stress analysis, *Foreign technology.

This is the first of a series of planned yearly joint seminars on specific applied fire safety research topics. The Soviet papers were translated into English by the Soviets, but editorial changes have been made by U.S. personnel who are expert in the particular subject. It is intended that the original authors' meanings have not been changed. In some cases, the U.S. presentations are not yet available as published papers, or were summaries of work that has already been published elsewhere. Hence, one of the U.S. presentations is in the form of slides and commentary. These presentations, in the form given, are intended to represent up-to-date U.S. technology.

701,230
PB81-161531 PC **A02**/MF **A01**
Auburn Univ., AL. Dept. of Mechanical Engineering.
Fire Safety of Wood-Burning Appliances. Part II: Fireplace Inserts, A Design Review.
T. T. Maxwell, G. Maples, D. F. Dyer, and T. Burch.
Nov 80, 21p NBS-GCR-80-292
Grant NB80-NADA-1012
See also Part 1, PB81-145823.

Keywords: *Fireplaces, *Wood, *Fire safety, Accessories, Inserts, Doors, Flues, Convectors, Fireplace inserts.

The objective of this review is to identify the generic types of fireplace inserts currently available. Three methods were used to gather information: (1) questionnaires were mailed out to manufacturers of wood-burning equipment; (2) a literature review was conducted; (3) data was collected firsthand at an industry trade show. The information obtained by these methods was sorted and reviewed. A precise definition of a fireplace insert was formulated in order to reduce the variety of units to be considered. The units which fit this definition were then categorized according to the following observable physical characteristics: (1) single-box or double-box construction, (2) glass doors or metal doors, (3) positive or non-positive flue connection, and (4) forced or natural convection.

701,231
PB81-164535 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of Guide Specifications for the 1980 Exterior Restoration of the White House.
P. G. Campbell, G. A. Sleater, and M. A. Post. Oct 80, 131p NBSIR-80-2122
Sponsored in part by National Park Service, Washington, DC.

Keywords: *Buildings, *Renovating, *Materials specifications, Protective coatings, Paints, Paint removers, Field tests, Artificial weathering tests, Guidelines, District of Columbia, *White House.

At the request of the National Park Service, a study was performed to develop guide specifications for use in the 1980 exterior restoration of the White House. The study included (1) an evaluation of historic practices and difficulties from painting of the White House, (2) an evaluation of technical literature on surface cleaning procedures and coating systems, (3) laboratory tests of selected coatings and field tests of selected surface cleaning procedures and coatings and (4) development of guide specifications. Four coating materials were selected for evaluation in laboratory and field tests and four surface cleaning methods were evaluated in a field test at the White House, of which one system was recommended for use in the 1980 restoration. This report presents the findings of the study and includes the proposed guide specifications.

701,232
PB81-166639 PC **A09**/MF **A01**
IIT Research Inst., Chicago, IL.
Development of a Fire in a Room from Ignition to Full Room Involvement--RFIRES.
Supplemental rept.
R. Pape, T. E. Waterman, and T. V. Eichler. Jan 81, 186p NBS-GCR-81-301
Grant NB79-SBCA-0068

Keywords: *Buildings, *Fires, *Computerized simulation, Furniture, Ignition, Flame propagation, Combustion, Computer programs, User needs, Burning rate, *Room fires, RFIRES computer program, Fortran 5 programming language, Fire models.

This report collects in a unified manner documentation pertaining to the computer code RFIRES. RFIRES is a computer model developed to predict the response of a room to the burning of items within it. The model considers a rectangular room with a single door or window opening to a large reservoir of clean air, up to 10 rectangular, box-shaped fuel items can be considered. The documentation includes flow charts, input and output instructions, code listing, summary of physical equations, results of comparisons to experimental fires, sensitivity analyses, and probabilistic descriptions of fuel item burning rates.

701,233
PB81-166647 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Single-Family Residential Fire and Live Loads Survey.
L. A. Issen. Dec 80, 180p NBSIR-80-2155
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Residential buildings, *Fires, Demographic surveys, Fire safety, Households, Dynamic loads, Construction materials, Furniture, Tables(Data), *Fire loads, *Mobile homes, *Room fires.

A fire and live load survey of 359 residences, consisting of 61 single family attached (SFA), 200 single family detached (SFD), and 98 mobile homes (MH), was made in the metropolitan Washington, DC., area using an inventory technique rather than actual weighing of the room contents. The survey was performed to gain information on live and fire loads which would be used to develop a realistic fire test exposure curve for single family homes (SFA, SFD, and MH), and to gain experience in household surveys that would be useful in a similar nationwide survey. The fire load is reported in terms of composition and of an equivalent 8000 Btu/lb fuel. The live loads and movable contents fire loads were similar for the three occupancies, but the room finish fire load was higher in mobile homes due to the more extensive use of plywood in the interior wall finish. The weighted mean (according to floor area) of the live load observed in the survey for each of the three classes of housing was approximately 10 lb/sq. ft. The corresponding weighted mean movable contents fire loads were approximately: SFA, 7 lb/sq. ft.; SFD, 7 lb/sq. ft.; MH, 6 lb/sq. ft. The total weighted mean fire loads (contents and finish) were approximately: SFA, 13 lb/sq. ft.; SFD, 13 lb/sq. ft.; MH, 18 lb/sq. ft. The nominal 0.95 fractile live and fire loads were also calculated.

701,234
PB81-170664 PC **A05**/MF **A01**
IIT Research Inst., Chicago, IL.
Preflashover Room Fire Model: Parametric Sensitivity Analysis and Development of a Submodel for Burning Furniture Items.
Final rept.
R. Pape. Jan 81, 76p NBS-GCR-81-300
Contract NB79-SBCA-0068

Keywords: *Buildings, *Fires, *Flame propagation, Mathematical models, Furniture, Flammability, Fire tests, *Room fires, RFIRES computer program, Fire models.

The focus of this project was to extend the Fire Modeling capabilities for furniture fires, both numerically and experimentally. Numerical work was based on the existing RFIRES computer code. A sensitivity analysis was performed for this program and a user manual compiled as part of this project. Two types of experiments were conducted -- fires with real furniture, and idealized simple geometry fires, intended to study flame spreas characteristics. Since the RFIRES code at present lacks a flame spread subroutine an extensive literature search was conducted to identify suitable flame spread models. Analysis of the available background here led to a formulation of the basic features required for a flame spread subroutine. Special emphasis was placed on the ability to treat non-standard plume configurations.

701,235
PB81-172355 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Estimating Safe Available Egress Time from Fires.
Final rept.
L. Y. Cooper. Feb 81, 72p NBSIR-80-2172
Sponsored in part by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Buildings, *Fires, Flame propagation, Fire detection, Reaction time, Mathematical models, Fire safety, *Room fires, *Exit time, Fire models.

A general technique for estimating the time available for safe egress from a fire is presented. By introducing a qualitative and quantitative model of hazard development, the details of the technique are formulated for the room of fire origin problem. The inputs to the model are the area and ceiling height of the room, data from free burn tests of characteristic fuel assemblies likely to be found therein, the anticipated model of fire detection, and a criterion for the onset of untenability. The output is an estimate of the length of time between detection of a fire and the onset of untenable conditions. Results of applying the estimation technique are presented and discussed.

701,236
PB81-181919 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Combustion of Mattresses Exposed to Flaming Ignition Sources. Part II. Bench-Scale Tests and Recommended Standard Test.
Final rept.
V. Babrauskas. Feb 81, 82p NBSIR-80-2186
See also Part 1, PB-272 064. Sponsored in part by Consumer Product Safety Commission, Washington, DC.

Keywords: *Bedding equipment, *Fire tests, Ignition, Hospitals, Hazards, Flammability, Correctional institutions, Health facilities, Mattresses, Prisons.

Ten mattress types were subjected to full-scale fire tests in the earlier part of this project. Burning behavior was determined and hazard was assessed by classifying into performance groups. In the present study bench-scale test procedures were examined for suitability for classifying mattress combustion behavior when exposed to flaming ignition sources. Several tests were examined, and a test protocol was developed based on two procedures -- measurement of rate of heat release and smoke production. These procedures enable the performance classification, as established by full-scale tests, to be reproduced by convenient laboratory tests. Details are given for conducting the required tests and illustrative performance of some two dozen samples is recorded.

701,237
PB81-182586 PC **E09**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Burning of Wood and Plastic Cribs in an Enclosure. Volumes 1 and 2.
Final rept.
J. G. Quintiere, and B. J. McCaffrey. Nov 80, 202p NBSIR-80-2054
Sponsored in part by Products Research Committee. Includes 10 sheets of 24X reduction Microfiche.(Volume 2 on Michrofiche).

Keywords: *Furniture, *Cellular plastics, *Fire tests, Flame propagation, Burning rate, Heat flux, Heat of combustion, Flammability testing, *Room fires, *Fire spread.

This study was designed to assess the fire hazard of a cellular plastic material which has comparable structural characteristics to wood. The study attempts to determine the relative fire risk of such materials in furniture. Rigid (high density) structural polyurethane foam and sugar pine were selected for fuels and burned in the form of cribs in a room. The crib loading and door width were parameters experimentally varied. Twenty-one room fire experiments and eight free burn experiments were conducted. Measurements of mass loss, temperature, heat flux, CO2 and

O2 concentration were recorded. These data were analyzed and empirical correlations were developed for air flow rate and upper gas temperature. A theoretical fire simulation model was developed and yielded results in fair to good agreement with the data. An extrapolation with the theoretical model was used to predict the critical (or minimum) fuel pyrolysis rate to cause flashover (as implied by 2 W/square centimeters of incident radiation to the room floor). This was done for various size rooms and door openings. It appears that to cause flashover, for a given room and door size, about twice as much wood must be involved in fire as the rigid polyurethane material.

701,238
PB81-186918 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Selected Methods for Condition Assessment of Structural, HVAC (Heating/Ventilating/Air Conditioning), Plumbing, and Electrical Systems in Existing Buildings.
Final rept.
F. H. Lerchen, J. H. Pielert, and T. K. Faison. Dec 80, 112p NBSIR-80-2171
Sponsored in part by Department of Housing and Urban Development, Washington, DC.

Keywords: *Buildings, *Renovating, Structural members, Heating equipment, Ventilation, Air conditioning equipment, Electric equipment, Plumbing, Evaluation, *Building rehabilitation, *Condition assessment.

This report was developed with the intent of assisting government officials, designers, builders, code officials, and others involved with making technical decisions relative to building rehabilitation to evaluate the condition of existing buildings. The report describes evaluation methods available specifically for use with the structural materials of concrete, steel, masonry, and wood, as well as, for use with the supportive systems of heating/ventilating/air conditioning, plumbing, and electrical. Both commonly used methods and other possible (but more technically complex) laboratory methods are described for the reader. Comparative tables are provided, where possible, to aid the reader in making a quick selection of the evaluation method most appropriate for the particular parameter to be tested. Considerably more information is included in the area of structural systems than in the rest of the report because of the fact that this report supplements a previous effort to develop a technical manual on structural strength for rehabilitation of existing buildings.

701,239
PB81-214025 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Will the Second Item Ignite.
V. Babrauskas. May 81, 34p NBSIR-81-2271

Keywords: *Furniture, *Burning rate, Flame propagation, Combustion, Fire tests, Thermal radiation, Heat flux, *Room fires, *Fire spread, NTISCOMNBS.

The burning of more than a single fuel item in a room fire has not been well characterized. The first step in describing multiple item burning is to determine if, in fact, it will occur. This question has been experimentally explored from two aspects. (1) The radiant heat fluxes from burning first-to-ignite objects have been measured, along with their mass loss rates. (2) The ignitability of exposed objects has been determined using a bench-scale uniform flux ignitability test. It is then suggested that whether the second item will ignite can best be determined analytically from considering these two sets of results.

701,240
PB81-229247 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Dependence of Model Waste Solid Transport Characteristics in Drainage Systems on Solid Geometry, Mass and Pipe System Parameters.
J. A. Swaffield. Jul 81, 45p NBSIR-81-2307
Sponsored in part by the Department of Housing and Urban Development, Washington, DC. Prepared in cooperation with Brunel Univ., Uxbridge (England).

Keywords: *Piping systems, *Drainage, *Transport properties, Buildings, Plumbing, Solid waste disposal, Flushing, Great Britain, Hospitals.

Test results are presented for the transport characteristics of an extensive range of geometrically similar model solids in a 100 mm diameter UPVC drain pipe. Model solids were based on commercially available sanitary towels (napkins) discharged into the pipe system via a series of U.K. standard watercloset (w.c.) types. Following a data fit analysis, relationships are presented linking solid transport characteristics to solid, pipe and w.c. parameters. These relationships, linked to observation of installed hospital drainage systems in the U.K., will allow laboratory test methods to be utilized in predicting the effect of design changes on system performance.

701,241
PB81-236515 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Annual Efficiency of Vented Heaters Equipped with Thermally Activated Vent Dampers.
Final rept.
E. R. Kweller, and W. F. Mullis. Jun 81, 16p
Pub. in Proceedings of the ASHRAE Semi-Annual Meeting Symposium on Efficiency of Combustion Systems held at Chicago, IL., on January 25-29, 1981, ASHRAE Transactions 87, pt1 p753-768 Jun 81.

Keywords: *Heating equipment, *Vents, *Thermal efficiency, Heat loss, Gas heaters, Space heaters, *Energy conservation, *Dampers.

It was determined which of the part-load losses can be adequately measured using the current DOE procedure, which part load losses cannot be measured using the DOE procedure, and seasonal efficiencies for three vented heaters using the current and a modified procedure. All stack losses associated with the calculation of part-load utilization efficiency were reviewed in the development of a test method for heaters equipped with the thermally-activated vent damper. Annual fuel utilization efficiency and associated energy savings were determined for two thermal vent dampers tested with three types of gas-fueled heaters which operate in either the cycling mode or in the modulating fuel input mode. Test results showed energy savings from 1 to 9 percent depending on the type of heater as well as the type of damper used.

701,242
PB82-107020 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Characterizing the Thermal Response of Fusible-Link Sprinklers.
Final rept.
D. D. Evans, and D. Madrzykowski. Aug 81, 41p NBSIR-81-2329

Keywords: *Fire detection systems, *Sprinkler systems, Gas flow, Dynamic response, Fire tests, *Thermal response.

Measurements of the thermal response of selected fusible-link sprinklers to sudden immersion into a hot gas flow are presented. Two methods of characterizing the response are detailed. One method explicitly accounts for phase change, the other does not. The methods are compared by using each to predict the response of a sprinkler to a selected mattress fire exposure.

701,243
PB82-132531 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
Tracing Lighting Design Decisions for New Open Office Space: A Pilot Study.
E. T. White. Jun 81, 198p NBS-GCR-81-333
Prepared in cooperation with Florida Agricultural and Mechanical Univ., Tallahassee.

Keywords: *Office buildings, *Lighting equipment, Design criteria, Decision making, Illumination, Models, Surveys.

The research activity consisted of an exploration of the design decision making process used by architects, engineers, and lighting designers for the illumination needs in open office situations. Approximately 30 firms with extensive lighting design experience comprised the sample of organizations who participated in the study. They ranged in size from large A/E and architectural companies to small lighting design and space planning offices. Personal interviews were conducted with the individual (or group) primarily responsible for making lighting design decisions. The object of the interview was to determine the criteria used (and their interrelationships) to make lighting decisions and to explore in detail how task lighting and ambient lighting requirements are established and put into practice to support necessary and desired activities. The data obtained during the interviews were used to formulate a lighting design process model, which explores the interactions among the many variables considered in lighting design. This design process model may be used as the first step in the formulation of a more generalized model which may be used for other design decisions -- e.g. acoustics, thermal environment, space requirements, etc.

701,244
PB82-135617 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of a Candidate Test Method for the Measurement of the Propensity of Cigarettes to Cause Smoldering Ignition of Upholstered Furniture and Mattresses.
Final rept.
J. F. Krasny, P. J. Allen, A. Maldonado, and N. Juarez. Oct 81, 44p NBSIR-81-2363

Keywords: *Furniture, *Flammability testing, Ignition, Smoking, Burning rate, Upholstery, Bedding equipment, *Cigarettes, *Smoldering.

A candidate test method for the measurement of the propensity of cigarettes to cause smoldering ignition of upholstered furniture and mattresses was developed. It consists of placing burning cigarettes on pieces of a standard, alpha cellulose, chromatographic paper and measuring the weight loss rate of the paper/cigarette system. The results were compared to the propensity of cigarettes to ignite upholstered furniture substrates. The agreement was satisfactory. Of the approximately 30 cigarette brands investigated, most had a similar propensity to ignite the upholstered furniture substrates, but a few ignited fewer substrates, and exhibited longer times to ignition on those which ignited. Many upholstered furniture substrates resisted ignition by any cigarette, while others were ignited even by those commercial cigarettes which ranked lowest in ignition propensity in these tests. However, a substantial number of upholstered furniture types did ignite with some cigarettes but not with others. Self-extinguishment time does not define the propensity of a cigarette to ignite upholstered furniture.

701,245
PB82-149196 Not available NTIS
National Bureau of Standards, Washington, DC.
Measuring Evacuation Difficulty in Board and Care Homes.
Final rept.
N. E. Groner, B. M. Levin, and H. E. Nelson. Sep 81, 8p
Pub. in Fire Jnl. 75, n5 p44-50, 109 Sep 81.

Keywords: *Buildings, *Fire safety, Fire protection, Building codes, Elderly persons, Handicapped persons, Evacuating(Transportation), Reprints, *Nursing homes, *Health care facilities.

The recent increase in multifatality fires in board and care homes can be attributed to the recent proliferation of these homes coupled with unavailability of an appropriate model code at the national level. Currently available model codes work poorly because they do not take into account the wide variations in the assistance needs of residents in an emergency evacuation and the availability of staff members to provide the needed assistance. The Center for Fire Research, National Bureau of Standards, has devised a fire safety evaluation system that bases the amount of fire protection features required in the building on a measure of the difficulty in evacuating the home. This measure, the Evacuation Difficulty Index, is computed from ratings of the residents on evacuation-relevant 'risk factors' and on the availability of staff members to assist residents. The article outlines the rationale and development of the Evacuation Difficulty Index.

701,246
PB82-149832 Not available NTIS
National Bureau of Standards, Washington, DC.
Fire Safety and Disabled Persons.
Final rept.
B. M. Levin, and H. E. Nelson. Sep 81, 6p
Pub. in Fire Jnl. 75, n5 p35-40 Sep 81.

Keywords: *Buildings, *Handicapped persons, *Fire safety, Fire protection, Fire alarm systems, Evacuating(Transportation), Elderly persons, Reprints, *Nursing homes, *Health care facilities.

The scope and nature of the problem of disabled persons in fire emergencies are discussed. Although specific solutions may need to be developed for particular disability types and occupancy settings, there are some principles which should be generally applied. These principles relate to general safety, methods of enabling disabled persons to meet their own safety needs, the role of others in providing assistance, and fire emergency planning. The options of evacuation or remaining in areas of safety are considered. An evacuation problem can result from the circumstance where a mobility impaired person has accessed upper floors of a building through use of an elevator, but cannot use this elevator for egress in a fire emergency. Efforts are underway to modify the Life Safety Code of the National Fire Protection Association to address this problem. Fire safety for disabled persons is discussed in the context of different occupancy types. There are currently no codes specifically established for one occupancy type, board and care homes. These homes may contain elderly, developmentally disabled, or emotionally impaired individuals. The National Bureau of Standards' effort to develop a fire safety evaluation system for this occupancy type is described.

701,247
PB82-198664 Not availble NTIS
National Bureau of Standards, Washington, DC.
Fast Repsonse Sprinklers in Patient Room Fires.
Final rept.
J. G. O'Neill. Nov 81, 21p
Pub. in Fire Technology 17, n4 p254-274 Nov 81.

Keywords: *Hospitals, *Fire protection, *Sprinkler systems, Fire tests, Fire safety, Bedding equipment, Smoke, Reaction time, Reprints, *Room fires, *Health facilities.

The Center for Fire Research conducted a series of tests which examined the use of automatic sprinklers in patient room fires. The full-scale fire tests were conducted in a patient room, corridor, lobby test arrangement. The results of tests, involving mattresses and bedding as the burning items, indicated that smoke obscuration was significantly lower in tests where simulated fast response sprinklers were used. In tests involving combustible clothing wardrobes however, the simulated fast response sprinklers did not improve overall performance compared to the results of tests with conventional fusible element sprinklers.

701,248
PB82-212887 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
Time-Based Capabilities of Occupants to Escape Fires in Public Buildings: A Review of Code Provisions and Technical Literature.
Final rept.
F. I. Stahl, J. J. Crosson, and S. T. Margulis. Apr 82, 167p NBSIR-82-2480
Sponsored in part by Federal Emergency Management Agency, Washington, DC.

Keywords: *Public buildings, *Fires, *Human behavior, Fire safety, Fire protection, Building codes, Human factors engineering, Evacuating(Transportation), *Emergency egress.

This document reviews available technical literature pertaining to exit facility design and emergency escape provisions of the National Fire Protection Association's Life Safety Code (1976 Edition) in order to determine the technical support for such provisions. The report focuses on the time-based capabilities of building occupants to effect rapid evacuations, in relation to evacuation time available during fires. A number of functional criteria are examined in relation to Code provisions influencing the design of means of egress and fire protection and protective signalling systems for places of assembly, residential occupancies, mercantile occupancies, and business occupancies. Provisions affecting fire exit drill and building management practices are also considered.

701,249
PB82-230269 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Elevators as a Means of Fire Escape.
J. H. Klote. May 82, 37p NBSIR-82-2507
Sponsored in part by Veterans Administration, Washington, DC.

Keywords: *Fires, *Elevators(Lifts), *Escape systems, Evacuating(Transportation), Handicapped persons, Field tests, Air flow, Pressurizing, *Building fires, Fire exits.

This paper is the initial report of an ongoing project at NBS to investigate the use of elevators as a means of fire escape for the handicapped. The use of stairwells for fire evacuation poses a problem for people who cannot use stairs because of physical disabilities. This paper discusses some of the major problems associated with the use of elevators as a means of fire exit and proposes a conceptual solution to those problems. A report is made on field tests of four buildings with elevator protection systems. These protection systems and their interactions with other systems are examined.

701,250
PB82-248121 Not available NTIS
National Bureau of Standards, Washington, DC.
Fire Tests and Hazard Analysis of Upholstered Chairs.
Final rept.
V. Babrauskas. Mar 80, 5p
Pub. in Fire Jnl. 74, n2 p35-39 Mar 80.

Keywords: *Chairs, *Upholstery, *Fire tests, Ignition, Combustion products, Smoke, Heat flux, Flammability testing, Fire safety, Reprints, *Room fires.

A test program was conducted to determine the fire behavior of a variety of upholstered chairs subjected to a flaming ignition. Major variables were materials and construction of chairs, room ventilation and type of ignition sources. A total of 16 types of traditional and modern design chairs were tested in a full-scale, otherwise unfurnished room. A folded up newspaper at the seat area was used as the standard ignition source. Room tenability criteria were based on smoke, concentrations of gaseous combustion products, and heat flux. One or more tenability criteria were exceeded for 14 chairs, in times ranging from 100 sec to 650 sec; two chairs burned without exceeding any of the tenability criteria.

701,251
PB82-248154 Not available NTIS
National Bureau of Standards, Washington, DC.
Estimating Room Flashover Potential.
Final rept.
V. Babrauskas. May 80, 11p
Pub. in Fire Technology 16, n2 p94-104 May 80.

Keywords: *Furniture, *Burning rate, *Fire tests, Flammability testing, Flame propagation, Fire hazards, Heat flux, Ventilation, Reprints, *Room fires, *Flashover.

Room flashover is the ultimate event in a fire signalling the untenability for the occupants. Despite this importance, hazard evaluations of furnishings and other common fuel loads have normally not been based on estimates of flashover potential. A simple combustion model is considered and available experimental data examined.

701,252
PB82-251125 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Full-Scale Study of the Effect of Pendent and Sidewall Location on the Activation Time of an Automatic Sprinkler.
W. D. Hayes, and R. H. Zile. Jul 82, 75p NBSIR-82-2521
Sponsored in part by Fire Administration, Washington, DC., and Department of Health and Human Services, Washington, DC.

Keywords: *Sprinkler systems, *Reaction time, Fire safety, Dynamic response, Ceilings, Walls, Installing, Test facilities, *Room fires.

A series of 17 full-scale tests was conducted to obtain measurements of the thermal response behavior of simulated and actual sprinklers positioned in the pendent and two separate sidewall locations. Exposure fires were simulated by a propane burner, and replicated the approximate temperature rises of several different burning furniture items typically found in residential and board-and-care type occupancies.

701,253
PB82-254814 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Computer Program for Analysis of Smoke Control Systems.
Final rept.
J. H. Klote. Jun 82, 68p NBSIR-82-2512, NBS/DF-82/003A
For system on magnetic tape, see PB82-254822.

Keywords: *Fires, *Air circulation, *Smoke, Elevators(Lifts), Stairways, Pressurizing, Fire safety, Air flow, Differential pressure, Fortran, *Building fires, *Smoke control, UNIVAC-1100/82 computers.

This paper describes a computer program developed to analyze systems intended to control smoke in building fires. These systems include pressurized stairwells, pressurized elevator shafts, zone smoke control systems, and pressurized corridors. This program calculates air flows and differential pressures throughout a building in which a smoke control system is operating. The basic assumptions and limitations of the program are also discussed. The appendices contain a program listing and examples.

701,254
PB83-100263 PC **A05**/MF **A01**
Maryland Univ., College Park.
Investigation of the Water Quality and Condition of Pipe in Existing Automatic Sprinkler Systems for the Analysis of Design Options with Residential Sprinkler Systems.
Final rept.
J. E. Alleman, J. A. Milke, and H. E. Hickey. Aug 82, 96p NBS-GCR-82-399
Contract NB80-NADA-1011

Keywords: *Residential buildings, *Sprinkler systems, *Water quality, Potable water, Pressure reduction, Contaminants, Corrosion environments, Water analysis, Water pollution, Fire protection, Piping systems.

The objectives of this study were (1) to investigate the potential effect of backflow of sprinkler water into potable water; and (2) to investigate the potential severity of the pressure reduction due to tuberculation in pipes in residential sprinkler systems.

701,255
PB83-192674 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
Fire Safety Evaluation System for Board and Care Homes.
Final rept.
H. E. Nelson, B. M. Levin, A. J. Shibe, N. E. Groner, R. L. Paulsen, D. M. Alvord, and S. D. Thorne. Mar 83, 196p NBSIR-83-2659
Sponsored in part by Department of Health and Human Services, Washington, DC.

Keywords: *Fire safety, *Residential buildings, *Elderly persons, Handicapped persons, Standards, Evacuating(Transportation), Apartments.

Board and Care Homes for residents with mental retardation, the infirmitities of age, or mental illness are a new type of occupancy, and model fire safety codes do not have requirements specifically for this type of occupancy. In support of efforts to write model codes for this type of occupancy, a Fire Safety Evaluation System has been developed. It can be used for determining if a home has fire safety equivalent to that obtained by meeting the requirements of a given code. The system was calibrated for use with a proposed chapter of the Life Safety Code.

701,256
PB83-197509 PC **A02**/MF **A01**
Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
Network Models of Building Evacuation: Development of Software System.
Final rept.
T. M. Kisko, and R. L. Francis. Dec 82, 15p NBS-GCR-82-417
Contract NB81-NADA-2057

Keywords: *Fire safety, *Buildings, *Evacuation(Transportation), Networks, Algorithms, Mathematical models, EVACNET computer program, Computer applications.

When the evacuation of a building involves the flow of people through well defined passageways, it is natural to consider the evacuation problem to be a network flow problem. EVACNET+ is a user friendly interactive computer program that accepts a user defined net-

work model of a building, converts that model to a time expanded dynamic 'transshipment' network, and solves the dynamic network using a capacitated minimum cost network flow algorithm. The solved dynamic network gives a time-dependent plan to evacuate the building in a minimum time, and identifies building evacuation bottlenecks.

701,257
PB83-201467 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Experimental and Analytical Investigation of a Residential Hot Water Boiler with Finned Copper Tube Heat Exchangers.
W. J. Mulroy, and C. Park. Apr 82, 66p NBSIR-83-2648
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Residential buildings, *Water heaters, Heat exchangers, Cooling fins, Boilers, Gas valves, Temperature measuring instruments, Operating costs, Computerized simulation.

In response to a request by a manufacturer of a nontypical boiler, the Department of Energy requested the National Bureau of Standards to perform laboratory measurements under controlled conditions of the effect on seasonal performance of several features (finned copper tube heat exchanger, water circulating pump delay, and gas valve modulation) of this boiler that might cause it to be unfairly treated by the existing test procedure. As a result of this study, recommended changes to the existing test procedure to allow rating tests with water circulating pump delay are presented. A recommended change to the assigned cyclic jacket loss factor and a simplified procedure for experimentally determining this factor are also presented. No change to the current test procedure treatment of gas valve modulation or flue gas mass flow as a function of temperature are recommended.

701,258
PB84-102615 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Civilian Residential Fire Fatality Rates: Six High-Rate States Versus Six Low-Rate States.
J. R. Hall, and S. G. Helzer. Aug 83, 37p NBSIR-83-2754
Sponsored in part by Federal Emergency Management Agency, Washington, DC.

Keywords: *Fires, *Residential buildings, *States(United States), *Mortality, Statistical data, Tables(Data), Accident causes.

The report presents results of an analysis of 1,600 fire fatalities occurring in six states with high fire-death rates and six states with low fire-death rates. Reasons for the differences in rates are explored, with special attention to victim age, sex, race, and condition at time of ignition. Fire cause patterns are touched on only lightly but are addressed more extensively in the companion piece to this report, 'Rural and Non-Rural Civilian Residential Fire Fatalities in Twelve States', NBSIR 82-2519.

701,259
PB84-217520 PC **A02**/MF **A01**
Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
Network Models of Building Evacuation: Development of Software System.
Final rept.
T. M. Kisko, and R. L. Francis. May 84, 25p NBS/GCR-84/457
Contract NB81-NADA-2057
See also PB83-197509.

Keywords: *Fire safety, *Buildings, *Evacuation(Transportation), Networks, Algorithms, Mathematical models, EVACNET computer program, Computer applications.

This report summarizes the efforts of the second year of a project to develop user friendly software for the network modeling of building evacuation. When the evacuation of a building involves the flow of people through well defined passageways, it is natural to consider the evacuation problem to be a network flow problem. EVACNET+ is a user friendly interactive computer program that accepts a user defined network model of a building, converts that model to a time expanded dynamic 'transhipment' network, and solves the dynamic network using a capacitated minimum cost network flow algorithm. The solved dynamic network gives a time-dependent plan to evacuate the building in a minimum time, and identified building evacuation bottlenecks.

701,260
PB84-221423 Not available NTIS
National Bureau of Standards, Washington, DC.
Calculating Sprinkler Actuation Time in Compartments.
Final rept.
D. D. Evans. Mar 84, 29p
Pub. in Proceedings of Symposium Computer Applications Fire Protection: Analysis, Modeling, Design held at Leesburg, Virginia on March 19-21, 1984, 29p.

Keywords: *Fire protection, *Sprinklers, Automatic control, Heat, Thermal measurement, Buildings, Fires.

A generalized method is presented for determining the response time for thermally actuated sprinklers installed near the ceiling of both large and small compartments. A substitute source for the actual fire is calculated to account for the effects of a warm gas layer in the upper portion of the enclosure on ceiling-layer flow temperatures. Illustrative examples are given for the change in response time for sprinklers. For comparative purposes sprinkler response is also calculated for the limiting case of an unconfined ceiling.

701,261
PB84-221431 Not available NTIS
National Bureau of Standards, Washington, DC.
Smoke Movement in Rooms of Fire Involvement and Adjacent Spaces.
Final rept.
L. Y. Cooper. 1984, 14p
See also PB83-250951. Sponsored in part by Department of Health and Human Services, Washington, DC. and Department of the Interior, Washington, DC.
Pub. in Fire Safety Jnl. 7, p33-46 1984.

Keywords: *Fires, *Buildings, *Periodicals, Combustion products, Fire detection, Hazards, Smoke, Growth, Mathematical models, Doors, Fire fighting, Fire safety, Reprints.

Key to the solution of fire safety design problems is the capability to predict the dynamics of enclosure fire environments. This paper presents a detailed qualitative description of the generic phenomena which occur during typical fire scenarios. The focus of attention is on the effects within building compartments of fire involvement, i.e., compartments made up of a single enclosed space or a space of two or more rooms interconnected by significant penetrations such as open doors or windows. Throughout the discussion reference is made to quantitative methods for predicting some of the most significant of these effects. Reference is also made to available mathematical/computer models which use these latter methods to quantitatively predict the overall fire environment. The basic topics that are covered are: fire growth in combustibles of fire origin; development of the fire plume and interaction of the plume with the ceiling surface.

701,262
PB84-221605 Not available NTIS
National Bureau of Standards, Washington, DC.
Rate of Heat Release: Implications for Engineering Decision.
Final rept.
C. Huggett. 1980, 13p
Pub. in Proceedings of Engineering Applications Fire Technology Workshop held at Gaithersburg, Maryland on April 16-18, 1980, p233-245 1980.

Keywords: *Fire safety, Mathematical models, Tests, Heat transfer, Research, Measurements, Ignition, Oxygen, Consumption, Heat release.

The purpose of this paper is to review the present status of rate of heat release measurements and to explore the potential applications of such measurements to the design of a more fire safe environment. The rate of heat release is an essential input to the solution of the central problem of fire research to predict the course of a fire given the pre-fire state of the system and a source of ignition. Modern rate of heat release measurements fall into two categories; laboratory methods designed to characterize a fire property of a material under carefully controlled conditions, and system tests designed to characterize the burning of large and complex systems and structures under conditions simulating a real fire. The oxygen consumption technique of rate of heat release measurement shows promise in both applications.

701,263
PB84-221696 Not available NTIS
National Bureau of Standards, Washington, DC.
Fire Test Methods: Classification and Application.
Final rept.
A. F. Robertson. 1983, 10p
Pub. in American Society for Testing and Materials 816, p3-12 1983.

Keywords: *Fire safety, *Fire tests, Model tests, Tables(Data).

It is shown that traditional fire test methods have in many cases represented physical models of real prototype fires. The results of applying them serve in a significant way to predict the behavior of a prototype system when exposed to fire. Consequently, the fire safety community has thought of fire tests as yielding information on the behavior of a fire system. Most of the new consumer protection fire tests adopted by the government may be considered as typical of the fire system type. Recently, there has been a trend toward introduction of a new series of tests that measure, often in technical terms, one or more specific fire properties. Many of these properties must usually be considered together to predict the behavior of a fire system. Thus, it becomes important for the user of the fire test to understand the nature of the test he plans to apply. It is unfortunate that explanatory material to assist the user in such understanding is usually not considered an integral part of the test method and is often omitted by those adopting the test for regulatory purposes. Action is proposed to correct such a defect. A table is provided to show the way in which the author has classified representative fire tests.

701,264
PB84-222074 Not available NTIS
National Bureau of Standards, Washington, DC.
Detector Response in Large Buildings.
Final rept.
I. A. Benjamin. 1980, 23p
Pub. in Proceedings of Engineering Applications Fire Technology Workshop, National Bureau of Standards, Gaithersburg, Maryland, April 16-18, 1980, 23p.

Keywords: *Detectors, Design, Maintenance, Buildings, Fire safety, *Smoke detection.

Presentation of some background on the operations of two types of detectors the thermal detector, usually a fixed temperature or rate of rise detector; and the aerosol detector, usually of either photoelectric or ion chamber design. Some discussion was given on the characteristics of the detectors and experience with them. Sets of design data have been presented and are available for the location of both types of detectors under flat and beamed typed of ceilings. The thermal detector data is based on the U.L. spacings, as a measure of the detector response. The design data for the aerosol detectors is based on a material response number and L value, characteristics length, both of which characteristics are not currently available but must be obtained from the manufacturer.

701,265
PB84-225671 Not available NTIS
National Bureau of Standards, Washington, DC.
Using the Harvard Fire Simulation.
Final rept.
J. A. Rockett, M. Morita, and T. Handa. 1983, 6p
Prepared in cooperation with Tokyo Univ. (Japan).
Pub. in Fire Science and Technology, v3 n1 p57-62 1983.

Keywords: *Fires, *Simulation, Vents, Walls, Algorithms, Combustion, Mathematical models, Reprints, Computer application.

Use of the Harvard Fire Simulation during the winter and spring of 1982 for the modeling of some Japanese fire situations is summarized for the Joint United States-Japan Natural Resources meeting. Enrichments to the 'official' level V version of the simulation are discussed. These include interlayer mixing in the vicinity of vents and its effect on the room heat balance, and the inclusion of a wall burning algorithm as an option of the simulation.

701,266
PB84-226471 Not available NTIS

National Bureau of Standards, Washington, DC.
Modeling of NBS (National Bureau of Standards) Mattress Tests with the Harvard Mark V Fire Simulation.
Final rept.
J. A. Rockett. 1982, 16p
See also PB82-176082.
Pub. in Fire and Materials 6, n2 p80-95 1982.

Keywords: *Bedding equipment, *Fires, *Simulation, Combustion, Burning time, Residential buildings, Smoke, Combustion products, Mathematical models, Gases, *Mattresses, Nursing homes, Harvard Mark 5 fire model.

NBS burned eleven mattresses made up with bedding in two different rooms, typical of a residential bedroom and a nursing home patient room, respectively. Seven of the mattresses flamed and burned vigorously, the other four were of a construction or so heavily flame inhibited that they only smoldered. The burning behavior of the seven that flamed was modeled with the Harvard Mark V fire simulation. The experimental burn behavior for tests conducted in one room was well reproduced using only total weight of combustible, surface area and heat of combustion. Smoke production values were found to have little effect on the predicted behavior except for the smoke production itself. Fires in a second room, whose ventilation was intentionally restricted by the configuration of the adjoining space, could not be as well reproduced by the present, single room fire model. During this study several changes were made to the simulation. The most significant change was the inclusion of mixing of the hot, exiting fire gases with the cold incoming air. As a part of this, the inter-layer radiation exchange was reformulated to include the effect of smoke contamination of the lower layer. The reformation of the radiation model had a marked effect on the predicted upper layer gas temperatures generally improving the quality of the simulation.

701,267
PB84-226877 Not available NTIS
National Bureau of Standards, Washington, DC.
Minutes of Ad Hoc Mathematical Fire Modeling Group Workshop on Modeling of Fire Suppression.
Final rept.
R. S. Levine. May 84, 17p
Pub. in Fire Technology 20, n2 p47-63 May 84.

Keywords: *Fire extinguishers, *Fire fighting, Fire extinguishing agents, Heat transfer, Methodology.

I conclude, tentatively, from the several research projects on extinguishment, that there are two important extinguishment mechanisms, and both of them can be incorporated into the models: (1) diluting the combustion air with vaporized extinguishing agent until the oxygen content of the lower layer is too small to sustain combustion; and (2) removing thermal energy from the pyrolyzing solid surface as by water droplets impacting on it. Method 1 requires enough extinguishing agent so that its heat of vaporization is of the order of the heat stored in the ceiling layer plus the thermal output of the fire. It is possible that the stirring caused by a sprinkler in a small room will rapidly carry vaporized extinguishing agent into the lower layer. Method 2 requires only a few percent of the amount of extinguishing agent in method 1, provided it can be efficiently delivered to the fuel surface.

701,268
PB84-244318 Not available NTIS
National Bureau of Standards, Washington, DC.
Human Behavior in the MGM Grand Hotel Fire.
Final rept.
J. L. Bryan. Mar 82, 10p
Pub. in Fire Jnl. 76, n2 p37-41, 44-48 Mar 82.

Keywords: *Fires, *Hotels, *Behavior, Questionnaires, Responses, Evacuation(Transportation), Surveys.

Immediately after the MGM Grand Hotel fire occurred in Las Vegas, Nevada, on the morning of November 21, 1980, the NFPA expressed interest in a systematic study of the responses of the hotel's guests during the fire. The four-page questionnaire consisted of 28 check-off, fill-in, and completion items. On the last page was a diagram of the Tower-floor arrangement of the hotel on which guests were asked to indicate their movements within the building and their egress route from the building. This questionnaire was developed from an interview questionnaire previously used and from the questionnaire used by the NFPA after the Beverly Hills Supper Club fire of 1977.

701,269
PB85-105518 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Safety Evaluation System for National Park Service Overnight Accommodations.
Final rept.
H. E. Nelson, A. J. Shibe, B. M. Levin, S. D. Thorne, and L. Y. Cooper. Sep 84, 100p NBSIR-84/2896
Sponsored in part by National Park Service, Washington, DC.

Keywords: *Fire safety, *National parks, *Hotels, Evaluation, Requirements, Smoke, Houses, Residential buildings.

A fire safety evaluation system for overnight accommodations has been developed and is ready for use in evaluating the fire safety of National Park Service residential accommodations. The system can be used to determine combinations of widely accepted fire safety equipment and building construction features that provide a level of safety equivalent to that required by the Life Safety Code of the National Fire Protection Association. An approach for controlling smoke from fires in atrium-like arrangements is also presented.

701,270
PB85-123404 Not available NTIS
National Bureau of Standards, Washington, DC.
Credible Engineering Methodologies (As a Solution to Bridging the Technology Gap).
Final rept.
H. E. Nelson. 1983, 46p
Pub. in Proceedings of Communications between Fire Research Community Owner-Operators of Buildings, Washington, DC, November 10, 1983, p51-96 1984.

Keywords: *Fire safety, *Fire protection, *Buildings, Methodology, Engineering, Mathematical models, Design, Hazards, Human factors.

There is a technical communications gap between the fire research community and the community of owner/operators of buildings seeking to understand and manage fire safety requirements. The emerging fire protection engineering technology is proposed as the best means of bridging this gap. The paper presents an example to demonstrate the present and potential capabilities of creditable fire protection engineering methods. An approach to addressing specific problems is also offered. The fire protection engineering method proposed involves the combination of emperical data; formulae; and mathematical models that trace the impact of fire induced stress, the response of the structure, the impact of fire safety design, and the actions of people in case of fire.

701,271
PB85-132918 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Benefit-Cost Model of Residential Fire Sprinkler Systems.
Final rept.
R. T. Ruegg, and S. K. Fuller. Nov 84, 153p NBS/TN-1203
Also available from Supt. of Docs as SN003-003-02622-1

Keywords: *Sprinkler systems, Houses, Residential buildings, Benefit cost analysis, Fire protection, Economic analysis, Risk, Fire safety, Decision making, Economic models, Breakeven point, Cost benefit analysis.

This paper develops and applies decision models for evaluating the economic efficiency of providing fire loss mitigation in houses through the use of a new technology: fast-response sprinkler systems. A model is developed for calculating present value net benefits as they would accrue to an owner-occupant or an owner of a rental house who installs a sprinkler system. Costs and benefits of owning a system are estimated for selected hypothetical cases pertaining to a new, single-family dwelling in the United States. The estimates are then used to illustrate the model. Minimum or maximum values that key decision variables must take in order for sprinkler systems to be cost effective in the selected applications are calculated through break-even analysis. Related models are developed for evaluating the economic merits of sprinkler systems from the standpoint of developers and local governments. Implications for the research and building communities are discussed.

701,272
PB85-135440 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Estimating Effectiveness of State-of-the-Art Detectors and Automatic Sprinklers on Life Safety in Residential Occupancies.
Final rept.
E. K. Budnick. Aug 84, 18p
See also PB84-153980.
Pub. in Fire Technology 20, n3 p5-22 Aug 84.

Keywords: *Fire detection systems, *Sprinkler systems, *Fire protection, Fire safety, Residential buildings, Fire losses, Evaluation, Effectiveness.

The report provides a qualitative assessment of the life safety impact of early warning fire detection and automatic sprinkler technology in residential occupancies. This assessment is based on the results of full-scale studies and statistics on residential fire fatalities from the NFIRS data base. Estimates of the impact of three alternatives, smoke detectors, standard automatic sprinklers, and residential sprinklers, are provided for major fire hazard scenarios in residential occupancies. The results of this study indicate that significant life safety benefits can be derived from broad application of detectors and sprinklers in all residential buildings.

701,273
PB85-137677 PC **A03**/MF **A01**
Dayton Univ., OH. Research Inst.
Furniture Fire Model.
M. A. Dietenberger. Nov 84, 49p NBS/GCR-84/480
Grant NB83-NADA-4056

Keywords: *Furniture, *Fires, Mathematical models, Flame propagation, Upholstery, Fabrics, Ignition, Burning rate, Buildings, Houses.

A sub-model describing upholstered furniture burning is being developed for installation within a general room fire model. Current computer room fire codes do not have algorithms for determining the burning rates of upholstered furniture. Since upholstered furniture items are a major factor in many room fires, a requirement for such a sub-model was seen. As a consequence, the University of Dayton Research Institute undertook to develop such an algorithm. This report represents the first year's efforts towards that objective.

701,274
PB85-148153 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermal Actuation of Extinguishing Systems.
Final rept.
D. D. Evans. 1984, 14p
See also PB84-177146.
Pub. in Combustion Science and Technology 40, p79-92 1984.

Keywords: *Fire extinguishers, Temperature, Plumes, Fire detection systems, Extinguishing, Fire protection, Actuation, Sprinkler systems, Responses, Reprints, Thermal actuation, Building systems.

A brief review of the Response Time Index (RTI) method of characterizing the thermal response of commercial sprinklers and heat detectors is presented. Measured ceiling layer flow temperature and velocity histories from a bedroom fire test are used to illustrate the use of RTI in calculating sprinkler operation times. In small enclosure fires, a quiescent warm gas layer confined by the room walls may accumulate below the ceiling before sprinkler operation. The effects of this warm gas layer on the fire plume and ceiling-jet flows are accounted for by substitution of an equivalent point source fire. Relationships are given for the location and strength of the substitute source relative to a point source representation of the actual fire. Encouraging agreement was found between measured ceiling-jet temperatures from steady fires in a laboratory scale cylindrical enclosure put into dimensionless form based on parameters of the substitute fire source, and existing empirical correlations from fire tests in large enclosures in which a quiescent warm upper gas layer does not accumulate.

701,275
PB85-179729 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Jefferson National Memorial Historical Site Analysis of Impact of Fire Safety Features.
H. E. Nelson. Mar 85, 41p NBSIR-84/2897
Sponsored by National Park Service, Washington, DC.

Keywords: *Fire safety, *Museums, Buildings, Evacuation(Transportation), Sprinkler systems, Jefferson National Memorial Historical Site, Smoke detectors.

An analysis is made of the rate of the potential intrusion of hazardous environments in a museum facility as compared to the capacity of the exit system to evacuate the occupants.

701,276
PB85-200103 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Buoyant Plume-Driven Adiabatic Ceiling Temperature Revisited.
L. Y. Cooper, and A. Woodhouse. Apr 85, 32p NBSIR-85/3134

Keywords: *Heat transfer, *Convection, *Fires, *Buildings, Coilings(Architecture), Plumes, Mathematical models, Walls, Adiabatic conditions, Temperature distribution, Research.

In previous works, the convective heat transfer from buoyant plume-driven ceiling jets to unconfined ceilings has been estimated using a formula for the temperature distribution below an adiabatic ceiling, Tad, obtained from experimental data. The present study re-evaluates this data, and develops an independent estimate for Tad. The analysis takes account of the effect of ceiling surface re-radiation, and use is made of the previously established similarity between plume/ceiling- and jet/wall-driven heat transfer phenomena. The latter similarity is the basis of a correlation of recently reported free jet-wall jet 'recovery temperature' data into a normalized Tad distribution. All of the analysis leads to new formulae for estimating the convective heat transfer to ceilings during enclosure fires.

701,277
PB85-207173 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermal Performance Comparisons for a Solar Hot Water System.
Final rept.
R. A. Fisher, and H. A. Fanney. 1983, 5p
Sponsored by Department of Energy, Washington, DC.
Pub. in ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Jnl. 25, n8 p27-31 1983.

Keywords: Hot water heating, Thermal efficiency, Performance, Reprints, *Solar water heaters.

The performance of two identical solar domestic hot water (SDHW) heaters subjected to various load profiles is compared. Three hourly load profiles having the same total daily load and two variations in total daily load are considered. Comparisons are made based on measured performance for two double-tank direct solar hot water systems located at the National Bureau of Standards Solar Test Facility. The experimental investigation reveals that load profiles have a small effect on the thermal performance of a typical SDHW system.

701,278
PB86-102225 PC **A04**/MF **A01**
Stanford Univ., CA. Dept. of Aeronautics and Astronautics.
Behavior of Furniture Frames during Fire.
Rept. for 1 Oct 83-30 Sep 84.
G. S. Springer. May 85, 58p NBS/GCR-85/494
Grant NB83-NADA-4019

Keywords: *Fires, *Furniture, Frames, Evaluation, Behavior, Tests, Wood products, Mathematical models, Mechanical properties, Strength, Fasteners, Failure, Temperature, Time measurement, Residential buildings, Construction materials, Fire tests, Computer applications.

The objective of the investigation is to evaluate the behavior of furniture frames during fire. Tests were performed measuring the strengths and deflections of wooden (southern pine) bends and joints exposed to elevated temperatures. The times to failure were also determined. A model was developed describing the strengths of wooden bends. Building on this model, a computer code was written which can be used to calculate the strengths of bends at room temperature. The code will serve as a basis for calculating the changes in strengths at elevated temperatures and for predicting the failure time.

701,279
PB86-105970 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD.
Application of Models to the Assessment of Fire Hazard from Consumer Products.
Final rept.
R. W. Bukowski. Aug 85, 32p NBSIR-85/3219
Sponsored by Consumer Product Safety Commission, Washington, DC.

Keywords: *Fire hazard, Mathematical models, Evaluation, Risk, Furniture, Bedding equipment, Toxicity, Combustion.

The differences among models of fire, fire hazard, and fire risk are described. The use of field, zone, and network models for fire hazard assessment is discussed. A number of available single and multiple compartment models are described. Key considerations with respect to the use of the current models by the Consumer Product Safety Commission for hazard assessment from upholstered furniture and mattress fires is presented. Modifications necessary to improve the capability of these models for hazard assessment are identified. Model validation, output presentation, and data sources are discussed. Recommendations on specific models for the sponsor to consider for further study and use are provided.

701,280
PB86-105996 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD.
Methods to Calculate the Response Time of Heat and Smoke Detectors Installed Below Large Unobstructed Ceilings.
D. D. Evans, and D. W. Stroup. Jul 85, 50p NBSIR-85/3167
Sponsored by Nuclear Regulatory Commission, Washington, DC.

Keywords: *Early warning systems, Safety devices, Computer programs, Heat measurement, Heat transmission, Detection, Reaction time, Feedback control, Fortran, *Smoke detectors.

Recently developed methods to calculate the time required for ceiling mounted heat and smoke detectors to respond to growing fires are reviewed. A computer program, that calculates activation times for both fixed temperatures and rate of rise heat detectors in response to fires that increase in heat release rate proportionally with the square of time from ignition, is given. This program produces equivalent results to the tables published in Appendix C, Guide for Automatic Fire Detector Spacing, (NFPA 72E, 1984). A separate method and corresponding program are provided to calculate response time for fires having arbitrary heat release rate histories. This method is based on quasi-steady ceiling layer gas flow assumptions. Assuming a constant proportionality between smoke and heat release from burning materials, a method is described to calculate smoke detector response time modeling the smoke detector as a low temperature heat detector in either of the two response time models.

701,281
PB86-166642 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Behavior of Upholstered Furniture.
Final rept.
V. Babrauskas, and J. Krasny. Nov 85, 106p NBS/MONO-173
Also available from Supt. of Docs as SN003-003-02710-3. Library of Congress catalog card no. 85-600620.

Keywords: *Furniture, *Upholstery, *Fire tests, *Flammability, Ignition, Smoke, Flame propagation, Heat flux.

A systematic review is made of engineering data on the major aspects of upholstered furniture flammability: cigarette ignition, small open flame ignition, radiant ignition, transition from smoldering to flaming, flame spread rates, and heat release and mass loss rates during fully-involved burning. Other areas discussed, but for which less data are available, include smoke production and radiant heat fluexes. Mattresses and transportation vehicle seating are included, along with upholstered chairs, loveseats, and sofas. Appropriate test methods most suitable for measuring each of these properties are discussed. Where available, relationships are presented which permit the quantitative prediction of full-scale furniture behavior from bench-scale tests. Where such relationships are not available, generalizations of qualitative results of empirical tests are given. Areas where substantive work is not available are outlined.

701,282
PB86-185311 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Need and Availability of Test Methods for Measuring the Smoke Leakage Characteristics of Door Assemblies.
Final rept.
L. Y. Cooper. 1986, 20p
See also PB84-216480. Sponsored by Department of Health and Human Services, Washington, DC., Bureau of Mines, Washington, DC., and National Park Service, Washington, DC.
Pub. in ASTM (American Society for Testing and Materials) Special Technical Publication 882, p310-329 1985.

Keywords: *Doors, *Smoke, *Leakage, Buildings, Reprints, Compartment fires.

The paper identifies and places into perspective relevant information that would assist in focusing future research and development on test methods to measure the smoke leakage characteristics of door assemblies. The concept of smoke compartmentation is introduced and developed. The importance of cross-door pressure differential in establishing the performance of door assemblies in fire-generated environments is discussed. Door assembly performance then is related to life safety, in general, and to the design of compartments of safe refuge, in particular. The entire discussion suggests a listing of required door assembly test methods and, finally, leads to a review of the availability and development status of existing and potential future test method candidates.

701,283
PB86-185675 PC **A05**/MF **A01**
Dayton Univ., OH. Research Inst.
Mathematical Modeling of Furniture Fires.
Interim rept.
M. A. Dietenberger. Feb 86, 83p NBS/GCR-86/506
Grant NB83NADA-4056
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Furniture, *Flammability, Burning rate, Flame propagation, Flammability testing, Fire damage, Mathematical models, Fire models.

The objective of the work was to develop a working computer model of a furniture fire which utilizes the bench scale measurements on furniture samples of burning rate history, flame spread rate, time to ignition, and the fraction of fuel converted to soot. The primary prediction of the model was to be the burning rate of a furniture fire as a function of time.

701,284
PB86-196326 PC **A08**/MF **A01**
Stanford Univ., CA. Dept. of Aeronautics and Astronautics.
Behavior of Furniture Frames during Fire. Final Report.
G. S. Springer. Apr 86, 162p NBS/GCR-86/512
Contract NB83-NAD-4019
See also PB86-102225. Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Furniture, *Fires, Frames, Fire studies.

The objective of the investigation was to evaluate the behavior of furniture frames during exposure to elevated temperatures such as may arise in fires. An analytic method was developed for calculating stresses and strains in wooden beams and bends at elevated temperatures. Models were established for calculating the degradation in strength of wood due to elevated temperature exposure and for predicting the times to failure of loaded wooden structures.

701,285
PB86-196409 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Initial Test Results and Test Plan for Differential Temperature Controllers Used in Solar Energy Systems.
Final rept.
J. Greenberg. Apr 86, 145p NBSIR-86/3346
Contract DE-AI01-76PR06010
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.

Keywords: *Temperature control, Control equipment, Cooling systems, Heating, Controllers, *Solar heating systems, *Solar cooling systems.

The initial test results and procedures used to conduct tests on differential temperature controllers used in solar energy systems are discussed. These tests were performed on generally non-adjustable, non-display units and include the following functional tests conducted at ambient conditions: delta T 'on' and 'off'; recirculating freeze protection with and without auxiliary sensor; controller response to sensor sensitivity; storage high temperature limit; and pump 'off' below 80 C. Controller sensitivity to line voltage variation tests were also conducted at ambient conditions and include: delta T 'on' and 'off' and recirculating freeze protection. The controller test fixture is also described along with the recommended use of decade resistance boxes to simulate thermistor inputs. An overall test plan is also included as an appendix to the report.

701,286
PB86-210721 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Evaluation of Furniture Fire Hazard Using a Hazard-Assessment Computer Model.
Final rept.
R. W. Bukowski. 1985, 8p
Pub. in Fire and Materials 9, n4 p159-166 1985.

Keywords: *Furniture, *Fire hazards, Fire resistant coatings, Upholstery, Residential buildings, Toxicity, Burning rate, Smoke, Reprints.

The Center for Fire Research Fire (Toxic) Hazard-Assessment computer model was used to evaluate the potential for hazard reduction by the modification of the combustion properties of upholstered furniture items in a residential occupancy. The potential benefits of these modifications are compared with the effects of variations in room size and construction to determine if they would be realized across a range of housing sizes and types. The results demonstrate the greatest benefit by the reduction of the mass loss (burning) rate of the item regardless of room size and even if the means used to reduce the burning rate results in an increase in smoke production and material toxicity.

701,287
PB87-101002 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Relative Propensity of Selected Commercial Cigarettes to Ignite Soft Furnishings Mockups.
J. F. Krasny, and R. G. Gann. Jun 86, 57p NBSIR-86/3421
Sponsored by Consumer Product Safety Commission, Washington, DC.

Keywords: *Furniture, *Fabrics, *Ignition, Upholstery, Tests, *Cigarettes.

The report covers the first project performed under the Cigarette Safety Act of 1984, the determination of whether and to what extent commercial cigarettes have differing propensities to ignite upholstered furniture substrates. For this purpose, a test was developed under which 12 types of commercial cigarettes were placed on 18 substrates varying in fabric, padding, and configuration. It was found that there are statistically significant differences in ignition propensity among the cigarettes on three substrates. No significant differences were found on the other 15 substrates. However, no one of the packings consistently showed low ignition propensity on all three substrates. The mass loss rate of both the cigarette and substrate during the tests was recorded and did not appear to be a reliable predictor of ignition propensity.

701,288
PB87-128138 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
New Approach to Fire Toxicity Data for Hazard Evaluation.
Final rept.
V. Babrauskas, B. C. Levin, and R. G. Gann. 1986, 6p
Pub. in American Society for Testing and Materials Standardization News 14, n9 p28-33 Sep 86.

Keywords: *Fires, *Toxicity, *Combustion products, Tests, Hazards, Models, Reprints, Cone calorimeters.

An N-gas model involving a reduced dependence on animal testing is proposed both for obtaining fire toxicity data for hazard modeling and for premarketing screening of commercial products and materials. Current toxicity measures rely almost exclusively on animal testing. The proposed new approach is based on obtaining the time-dependent generation rates of a limited number of important toxic species using a suitable combustion apparatus, such as the Cone Calorimeter. The new approach will not entirely eliminate the need for animal testing, since a check-test will still be necessary, but it promises to substantially reduce the need for animals.

701,289
PB87-128153 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Quarter-Scale Room Fire Tests of Interior Finishes.
Final rept.
B. T. Lee. 1985, 7p
Pub. in Fire and Materials 9, n4 p185-191 1985.

Keywords: *Finishes, *Fire hazards, *Buildings, Model tests, Flashover, Ignition, Reprints.

A technique for modeling fire buildup in rooms with combustible interior finish is discussed. Use of the technique resulted in good agreement between fires conducted in one-quarter scale model rooms with a doorway opening and those performed in full-scale rooms. The effects of burner location and heating rate on flashover in a well-insulated room were also studied to help select a suitable ignition source size and placement for testing of interior finish materials.

701,290
PB87-128161 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Standard Room Fire Test Development at the National Bureau of Standards.
Final rept.
B. T. Lee. 1985, 16p
Pub. in American Society for Testing and Materials Special Technical Publication 882, p29-44 1985.

Keywords: *Finishes, *Fire tests, *Buildings, Plywood, Polystyrene, Gypsum, Evaluation, Flashover, Thermal radiation, Calorific value, Heat of combustion, Reprints.

Research results with the proposed ASTM standard room fire test for interior finish materials are presented. The materials selected for the study were two untreated plywoods, a fire-retarded plywood, polystyrene, polyisocyanurate, and gypsum board. Three 900 s duration test scenarios were considered. The study demonstrated that all three scenarios could adequately differentiate material fire behavior, in terms of the maximum degree of fire buildup attained and the time to reach the maximum, for the materials selected. Thermal radiation incident on the floor and doorway air temperature were found to be the most consistent parameters for determining room fire buildup including room flashover. Surface flame spread and rate of heat release are presented for the room fires. Unit area rate of heat release from these fires were found to correlate marginally with calorimeter data for the same materials.

701,291
PB87-134292 PC **A08**/MF **A01**
Case Western Reserve Univ., Cleveland, OH. Dept. of Mechanical and Aerospace Engineering.
Discharge Distribution Performance for an Axisymmetric Model of a Fire Sprinkler Head.
B. Wendt, and J. M. Prahl. Oct 86, 170p NBS/GCR-86/517
Contract NB82-NADA-3038
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Fire safety, *Sprinklers, Droplets, Computer programs, Graphs(Charts), Performance, Models, Water sprays.

A nondimensional description of spray discharge distribution performance of fire sprinkler heads is developed. The description emphasizes the sprinkler's ability to evenly distribute the spray over the maximum possible floor area. Illustration of the description is provided by data obtained from an apparatus developed to study the axisymmetric jet impingement on a flat disk. The apparatus employs the disintegration of an axisymmetric film to produce the droplet spray. Sheet breakup radius varies as the inverse one third power of the Weber number based on jet diameter, in agreement with data obtained by Huang. Variable discharge distribution performance is achieved by controlled axial vibrations of the disk. Identical nondimensional distributions are obtained at a frequency ratio defined as the ratio of the driving frequency to the frequency of maximum growth of sinuous waves, as outlined by Squire. A spray modelling procedure is developed to give analytical discharge distributions. An investigation of the resulting patterns indicates a volume mean droplet diameter in agreement with a predicted value obtained from a correlation given by Dundas and Huang.

701,292
PB87-171492 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
STOVE: A Predictive Model for Heat Transfer from Solid-Fuel Appliances,
R. D. Peacock, and R. A. Dipert. Feb 87, 67p NBSIR-86/3300

Keywords: *Heating equipment, *Chimneys, *Fire safety, Walls, Heat transfer, Radiant heating, Fire tests, Models, Computer programs, *Wood burning appliances, STOVE computer program, Fortran 77 programming language.

A computer implementation of a model to predict temperatures on wall and wall protector surfaces exposed to the heating of an appliance such as a solid fuel heating appliance is described. A steady state heat transfer model with flexibility to describe a generalized method of protection for a combustible wall surface is presented along with a computer program implementing the model. Good agreement was found comparing the model predictions with data previously collected during full scale experiments conducted to evaluate the effectiveness of generic methods of wall protection in reducing temperatures on combustible wall surfaces. Extensive references of research related to solid fuel heating safety are included.

701,293
PB87-182002 PC **A05**/MF **A01**
Dayton Univ., OH. Research Inst.
Description and Results of Furniture Fire Modules Within FAST (HEMFAST (Heat and Mass Transport of Furniture Fire, Smoke and Toxic Gases)).
Interim technical rept. 1 Jun 85-1 Jun 86,
M. Dietenberger. Mar 87, 76p NBS/GCR-87/527
Grant NANB-D0557
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Fire tests, Furniture, Smoke, Computerized simulation, Fortran, HEMFAST computer program.

The Heat and Mass Transport of Furniture Fire, Smoke and Toxic Gases (HEMFAST) program simulated the furniture fire and the toxic gas growth in a room and its spread to the other rooms. This was achieved by incorporating an improved furniture fire model into the FAST model in current usage at NBS. The furniture fire model was designed to be self-controllable in simulating a fire source utilizing as inputs only the bench scale data of new scalable material burning rates, flame spreading, thermal ignition, and the flame properties of the following: soot volume fraction, CO2 and H2O mass fractions of fuel weight, and gas temperatures. Since the Hottels' zoning method was used in the thermal radiation model it was possible to consider surface emissivities less than unity on all surface elements, and to consider three isothermal gray gas volumes which are the high-temperature flaming plume, the sooty upper gas layer, and the lower gas layer at 50% relative humidity. Some salient features are noted in the simulation of a sample fire growth on a furniture mockup.

701,294
PB87-200390 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Performance of Instantaneous Gas-Fired Water Heaters,
J. E. Harris, and J. Greenberg. May 87, 60p NBSIR-87/3537
Sponsored by Department of Energy, Washington, DC. Building Equipment Div.

Keywords: *Water heaters, *Energy efficiency, Energy conservation, Performance tests, Gas appliances, Tankless water heaters.

Four different instantaneous, gas-fired water heaters were tested to develop a test method to determine recovery efficiency (Er) and energy factor (EF). All four of the water heaters were from foreign countries (West Germany, the United Kingdom, France and Japan). Various flow rates and water draws were used during the tests to determine their influence on the recovery efficiency and energy factor. In addition, the pilot light power consumption was measured to determine the effect of a variable pilot light power rate on the energy factor. The use of recovery efficiency as a performance index seems appropriate for these units, however, the use of energy factor as presently calculated, needs further study.

701,295
PB87-201786 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Ceiling Jet-Driven Wall Flows in Compartment Fires,
L. Y. Cooper. Apr 87, 27p NBSIR-87/3535

Keywords: *Buildings, *Fires, Air flow, Walls, Ceilings(Architecture), Penetration, Flow rate, Flame propagation, Heat transfer, Plumes.

Analytic estimates are developed for the early depth of penetration of and the lateral entrainment into negatively buoyant, ceiling jet-driven wall flows which are generic to compartment fire scenarios. When walls are not too far from the fire source, of the order of the fire-to-ceiling distance, it is found that the penetration of the downward flow near such walls is a large fraction of the fire-to-ceiling distance itself, and that this fraction is relatively independent of the details of fire size, spacings, etc. Also, net rate of entrainment into the wall flow as it is buoyed back upward to the ceiling elevation is found to be several times larger than the flow rate of the driving ceiling jet flow immediately upstream of ceiling jet - wall impingement.

701,296
PB87-201851 PC **A10**/MF **A01**
California Inst. of Tech., Pasadena. Guggenheim Jet Propulsion Center.
Entrainment, Chemistry, and Structure of Fire Plumes,
S. J. Toner, E. E. Zukoski, and T. Kubota. Apr 87, 223p NBS/GCR-87/528
Grant NANB-600638
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Fires, *Flames, *Buildings, Plumes, Carbon monoxide, Soot, Combustion products, Stoichiometry, Gas analysis, Mathematical models.

The paper examines the chemistry of a flame as it impinges on a hot vitiated atmosphere. Several of the products of combustion (CO, soot etc.) are measured as a function of flame impingement, length of the flame below the hot layer and size of the fire.

701,297
PB87-201869 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Cigarette Ignition of Soft Furnishings - A Literature Review with Commentary,
J. F. Krasny. Apr 87, 109p NBSIR-87/3509

Keywords: *Ignition, *Furniture, *Upholstery, Combustion, Flammability testing, Bedding equipment, *Cigarette smoking.

Literature pertinent to the ignition by smoldering cigarettes of upholstered furniture and mattresses (soft furnishings) was searched through early 1986. This included literature on the smoldering behavior of cigarettes in air and their behavior on a variety of substrates simulating soft furnishings. According to the reviewed literature, the smoldering behavior of cigarettes on substrates differs from that of cigarettes burning in air: on substrates, cigarette temperatures tend to be lower, and burning rates slower. These differences seem to be larger for substrates which ignite than for those which self-extinguish after the cigarette burns out. The characteristics of soft furnishings which insure resistance to cigarette ignition have been established, but those of cigarettes with low propensity to ignite furnishings have not.

701,298
PB87-233771 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Elevators as a Means of Fire Escape.
Final rept.,
J. H. Klote. 1983, 16p
See also PB82-230269.
Pub. in ASHRAE Transactions, v89 part IB p362-377 1983.

Keywords: *Fires, *Elevators(Lifts), *Escape systems, Evacuating(Transportation), Handicapped persons, Field tests, Air flow, Pressurizing, Reprints, *Building fires, Fire exits.

The paper is the initial report of an ongoing project to investigate the use of elevators as a means of fire escape for the handicapped. The use of stairwells for fire evacuation poses a problem for people who cannot use stairs because of physical disabilities. The paper discusses some of the major problems associated with the use of elevators as a means of fire exit and proposes a conceptual solution to those problems. A report is made on field tests of four buildings with elevator protection systems. These protection systems and their interactions with other systems are examined.

701,299
PB88-155825 PC **A05**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Development of Cost Effective Techniques for Alleviating Water Supply Deficiencies in a Residential Sprinkler System,
J. A. Milke, and J. L. Bryan. Nov 87, 76p NBS/GCR-87/533
Grant NANB-D0720
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research, and Fire Administration, Emmitsburg, MD.

Keywords: *Sprinkler systems, *Residential buildings, *Water supply, Houses.

Simple cost effective techniques for alleviating water supply deficiencies in a residential sprinkler system installed in a one- or two-family dwelling have been examined. The equipment associated with compensating for an inadequate municipal water supply using water storage tanks, booster pumps, and large diameter pipe have been investigated for efficiency and cost effectiveness. Hydraulically-designed, NFPA 13D, residential sprinkler systems in seven residences were used to carry out this research.

Building Standards & Codes

701,300
PB-268 131/0 PC **A06**/MF **A01**
Utah Univ., Salt Lake City. Div. of Community and Urban Development.
Self-Help Housing Construction: A Review.
Final rept.,
May 77, 123p NBS/GCR-77-88
Contract NBS-S-199178-71

Keywords: *Construction, *Houses, Regulations, Standards, Building codes, Federal assistance programs, Project management, Low income groups, Bibliographies, *Self help housing.

The NBS is pursuing new research into how best to construct buildings, including housing. This report discusses one type of housing construction -- self-help, wherein the proposed occupant and owner builds his own dwelling either on his own, or collaboratively with a group of prospective homeowners. The self-help idea can also be applied to remodeling, rehabilitation, dwelling additions, or just minor repairs and improvements, for which it is also referred to as do-it-yourself labor. The report describes self-help, suggests how self-help projects can be supported, explores the feasibility of using component systems in self-help projects, and provides references and bibliographic materials.

701,301
PB-272 209/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
How to Stop Worrying and Love Benefit/Cost Analysis.
Final rept.,
C. A. Chapman. 1977, 3p
Pub. in Std. Eng. 29, n3 p54-56 Jun 77.

Keywords: *Building codes, *Benefit cost analysis, Standards, Fire safety, Design standards, Cost effectiveness, Reprints.

Economic analysis is useful in justifying standards efforts, setting priorities for standards work, and making decisions about specific standards. In using economic analysis, some basic laws should be kept in mind: (1) There is no free lunch; (2) There's always something you forgot; and (3) Money is a common measure of (almost) everything. This paper shows how to apply these and some other concepts to standards related problems. It gives hypothetical examples concerning mobile home fire safety standards and effluent measurement methods, and real examples from work by economists in the NBS Center for Building Technology. The CBT projects involve energy conservation in buildings, reduced sized venting, and ground fault circuit interrupters.

701,302
PB-274 335/9 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C.
Preliminary Examination of Building Regulations Adopted by the States and Major Cities.
Draft rept.,
P. W. Cooke, and R. M. Eisenhard. Nov 77, 125p NBSIR-77-1390

Keywords: *Building codes, *Standards, *United States, Urban planning, Wiring, Plumbing, Fire safety, Elevators(Lifts), Boilers, Legislation.

Preliminary information describing regulatory codes and standards bearing on building construction and occupancy, which have been adopted by the various states and certain major cities in the U.S., are presented in a series of summary tables. The tables and accompanying notes provide information on salient elements of the enabling legislation, the type of codes and standards promulgated, and the respective agencies charged with the administration and enforcement of each regulatory program. Other features of the various regulatory programs (e.g., occupancy classifications covered, preemptive status of codes, etc.) are also enumerated. The regulatory programs and the respective code disciplines which are summarized include: building; mechanical; plumbing; electrical; fire and life safety; elevators; gas fittings; and boiler and pressure vessels.

701,303
PB-274 613/9 CP **T02**
National Bureau of Standards, Washington, D.C. Standards Application and Analysis Div.
References to U.S. Standards by Selected Building Codes, (EBCDIC Version).
Data file,
J. M. Hicks, and P. E. Majewski. 1976, mag tape NBS/DF-78/001
Source tape is in EBCDIC character set. Tape(s) can be prepared in most standard 7 or 9 track recording modes for one-half inch tape. Identify recording mode desired by specifying character set, track, density, and parity. Call NTIS Computer Products, if you have questions. Documentation available as PB-259 626.

Keywords: *Data file, *Building codes, *Standards, Magnetic tapes.

The file features titles and numerical designations of 1,800 standards, issued by 90 U.S. standards-writing organizations, that are referenced in 54 U.S. building codes. It contains 20,000 records of code references represented in interagency report NBSIR 76-1140 'Standards Referenced in Selected Building Codes'

(NTIS PB-259 626/UC) and its supplement. The standards are all those referenced in: (1) the four model building codes; the 1976 National Building Code developed by the American Insurance Association (AIA); the 1975 Basic Building Code developed by the Building Officials and Code Administrators International, Inc. (BOCA); the 1973 Uniform Building Code developed by the International Conference of Building Officials (ICBO); and the 1973 Standard Building Code developed by the Southern Building Code Congress International, Inc. (SBCC); (2) the 20 existing state codes; and (3) the codes of the 30 largest U.S. cities. In addition to titles and numbers of standards referenced in the codes, the file contains the following information: the date of the most recent version of the standard (based on information available at the time NBSIR 76-1140 was compiled) and the date of the standard as referenced in the code, the name of the organization which issued the standard, the code(s) referencing it, the date of the code, and the sections within the code where the standard is referenced. The file can assist the building community and various standards-writing groups in updating, utilizing and maintaining the standards referenced in building codes.

701,304
PB-274 614/7 CP **T02**
National Bureau of Standards, Washington, D.C. Standards Application and Analysis Div.
References to U.S. Standards by Selected Building Codes (UNIVAC FIELDATA).
Data file,
J. M. Hicks, and P. E. Majewski. 1976, mag tape
NBS/DF-78/002
Source tape is in FIELDATA character set. Character set restricts preparation to 7 track, one-half inch tape only. Identify recording mode by specifying density and parity only. Call NTIS Computer Products, if you have any questions. Documentation available as PB-259 626.

Keywords: *Data file, *Building codes, *Standards, Magnetic tapes.

The file features titles and numerical designations of 1,800 standards, issued by 90 U.S. standards-writing organizations, that are referenced in 54 U.S. building codes. It contains 20,000 records of code references represented in interagency report NBSIR 76-1140 'Standards Referenced in Selected Building Codes' (NTIS PB-259 626/UC) and its supplement. The standards are all those referenced in: (1) the four model building codes; the 1976 National Building Code developed by the American Insurance Association (AIA); the 1975 Basic Building Code developed by the Building Officials and Code Administrators International, Inc. (BOCA); the 1973 Uniform Building Code developed by the International Conference of Building Officials (ICBO); and the 1973 Standard Building Code developed by the Southern Building Code Congress International, Inc. (SBCC); (2) the 20 existing state codes; and (3) the codes of the 30 largest U.S. cities. In addition to titles and numbers of standards referenced in the codes, the file contains the following information: the date of the most recent version of the standard (based on information available at the time NBSIR 76-1140 was compiled) and the date of the standard as referenced in the code, the name of the organization which issued the standard, the code(s) referencing it, the date of the code, and the sections within the code where the standard is referenced. The file can assist the building community and various standards-writing groups in updating, utilizing and maintaining the standards referenced in building codes.

701,305
PB-274 972/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of the Frost Point of Air in Sealed Insulating Glass.
Final rept.,
F. J. Powell, and M. H. Hahn. 1976, 8p
Pub. in Proceedings of Annual Meeting of Com. B.1, IIF-IIR on Heat and Mass Transfer in Porous Structures, Washington, D.C. 14-16 Sep 76, Bulletin de l'Institut International du Froid (France), v2 p131-138 1976.

Keywords: *Thermal measurement, *Standards, Building codes, Window glass, Frost, Seals(Stoppers), Tests, Sealed insulating glass.

The background, objective and results of the Research Associate Program recently completed at the National Bureau of Standards (NBS) with the American Society for Testing and Materials (ASTM) is summarized. This program was concerned with the development of test methods and standards for use with factory-produced double-glazed insulating-glass window units. A permanently sealed air space between two or more panes of glass is desired to increase the resistance to the flow of heat through window glass and at the same time provide a unit that would not allow moisture condensation to form on the interior glass surfaces over the lifetime of the unit. In addition to interfering with vision, repeated moisture condensation in the form of liquid water or frost, with subsequent evaporation of the moisture, tends to leave a residue on these surfaces that are not accessible for cleaning. A new device for making non-destructive measurements (repeatable to within 0.5C (1F) of the dew/frost point of the air-space in these sealed units is described (U.S. Patent 3,896,658) and the ASTM Standards produced in conjunction with the program are described and referenced (ASTM designation E546-75, E576-76, E-6 P1, E-6 P2, and E-6 P3).

701,306
PB-276 926/3 PC **A09**/MF **A01**
Rensselaer Polytechnic Inst., Troy, N.Y. School of Architecture.
Toward a Performance Approach to Life Safety from Fire in Building Codes and Regulations.
Final rept.,
D. S. Haviland. Jan 78, 191p NBS-GCR-78-118
Sponsored in part by Public Health Service, Washington, D.C.

Keywords: *Buildings, *Building codes, *Fire safety, Structural design, Standards, Fire prevention, Fire protection.

Building codes in use throughout the U.S. contain mostly prescriptive provisions which specify how a proposed building must be designed and constructed. Prescriptive provisions tend to leave little latitude for the building's designer to exercise expert judgment or use modern materials and methods even though these might improve the finished building or reduce its cost. A solution to this dilemma is the use of performance provisions for building codes. Performance provisions state how the building is to function or operate to satisfy the needs of its occupants, and leaves much discretion to the building's designer as to how the specified performance is to be achieved. This report discusses the performance provisions which should be considered by building researchers, code authorities, and by those who enforce the Nation's building regulatory system.

701,307
PB-279 091/3 PC **A12**/MF **A01**
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
Detailed Application of a Technology for the Formulation and Expression of Standards Applied to the American National Standard Building Code Requirements for Minimum Design Loads in Buildings and Other Structures (ANSI A58.1-1972).
Civil engineering studies (Final),
L. K. Cunningham, J. W. Melin, and R. L. Tavis. Jan 78, 262p STRUCTURAL RESEARCH SER-446, UILU-ENG-78-2003, NBS/GCR-78/123
Contract NBS-6-13980

Keywords: *Building codes, *Design standards, *Technology assessment, Network analysis(Management), Decision theory, Dynamic loads, Specifications, *Information processing, *Information networks, *Design loads.

This investigation applies decision-table and information-network technology in the analysis of the American National Standard Building Code Requirements for Minimum Design Loads in Building and Other Structures (ANSI A58.1-1972). Part I summarizes the logic and technology available for decision-table and information-network analysis. It also sets down a rationale for the attempt to apply this logic at the requisite level of detail and develops the concepts, policies, and procedures that enable such application. Part II applies the available technology to the ANSI Standard, and in a detailed commentary on each decision table and on the information network, sets down the questions raised by the analysis of each. General questions about the ANSI Standard, classification of data, and potential application of these methods in the expression of standards follow. The analysis concludes by testing the validity of its proposition in the overall findings of the work.

701,308
PB-280 113/2 PC **A07**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Proceedings of the (8th) Annual Conference of the National Conference of States on Building Codes and Standards (NCSBCS).
Final rept.,
S. A. Berry. Jan 78, 147p NBSIR-77-1413
Held in Santa Fe, New Mexico on April 27-May 1, 1975.

Keywords: *Building codes, *Standards, *Meetings, Proceedings, Construction industry, Construction management, Reporting, *Mobile homes.

This document contains the edited proceedings of the 8th Annual Conference of the National Conference of States on Building Codes and Standards (NCSBCS), held in Santa Fe, New Mexico, April 27 - May 1, 1975. In addition, it includes listings of the State Delegates and Committee members for the 8th Annual Conference Year, and the Committee Reports, as finalized, submitted and approved by the State Delegates to NCSBCS, meeting in Annual Session.

701,309
PB-282 495/1 PC **A08**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C.
Investigation of Standards, Performance Characteristics and Evaluation Criteria for Thermoplastic Piping in Residential Plumbing Systems.
Building Science Series (Final),
R. S. Wyly, W. J. Parker, E. T. Pierce, D. E. Rorrer, J. R. Shaver, G. C. Sherlin, and M. Tryon. May 78, 153p NBS-BSS-111
Library of Congress Catalog Card no. 78-600037. Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Assistant Secretary for Policy Development and Research.

Keywords: *Plastic pipes, *Plumbing, Residential buildings, Performance evaluation, Thermoplastic resins, Polyvinyl chloride, ABS resins, Piping systems, Acoustic properties, Fire safety, Toxicity, Shock resistance, Dimensional stability, Utilization, Standards.

The application of the performance concept to the evaluation of piping systems of innovative materials is explored. User needs are considered and several material-related physical parameters are studied that might be used as measures of satisfaction of the user needs. Information was reviewed on usage, performance characteristics and standards for thermoplastic pipe and fittings, and special laboratory tests were made to study selected characteristics and test methods. A number of performance statements and evaluation methods are recommended or discussed that relate to characteristics associated with polyvinyl chloride (PVC), acrylonitrile-butadiene-styrene (ABS) and chlorinated polyvinyl chloride (CPVC). This approach was taken to illustrate the application of performance evaluation methodology to plumbing materials.

701,310
PB-284 685/5 PC **A10**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Building Economics and Regulatory Technology Div.
State Adopted Building Regulations for the Construction of Manufactured Buildings - An Analysis,
P. W. Cooke, and R. M. Eisenhard. Jul 78, 223p
NBSIR-78-1503

Keywords: *Buildings, *Modular structures, *Building codes, Construction, Standards, Prefabrication, State government, Statistical data, *Prefabricated buildings, *Industrialized housing.

This report summarizes the status and characteristics of State adopted building regulatory programs specific to the construction of manufactured buildings. Included are tabularized data and summary information relative to technical codes upon which regulations are based, extent to which established technical provisions contained in recognized national model codes have been amended by certain States, differences from a regulatory standpoint between each states treatment of manufactured building construction and conventional construction, occupancy classifications and type of compliance assurance activities covered by each states' program, and definitions for 'manufactured building' and related terms as defined in state regulations.

701,311

PB-284 819/0 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Building Economics and Regulatory Technology Div.
Standards Referenced in the National Building Code.
Final draft rept.,
J. M. Hicks. Jul 78, 39p NBSIR-78-1490
Supplement to Rept. no. NBSIR-76-1140, PB-259 626.

Keywords: *Building codes, *Standards, Construction materials, Structural design, Regulations, National government, Safety engineering.

This report is a supplement to NBSIR 76-1140, 'Standards Referenced in Selected Building Codes,' published by the U.S. Department of Commerce, National Bureau of Standards, and is intended to provide a base for assisting the building community in updating, utilizing and maintaining the standards referenced in the 1976 edition of the National Building Code promulgated by the American Insurance Association. In addition to identifying each standard referenced in the code, this publication lists the current date of the standard, its title, the date of the code and the locations within the code where the standard is referenced.

701,312

PB-287 405/5 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Center for Building Technology.
Economic Analysis of Building Code Impacts: A Suggested Approach.
Final rept.
J. S. McConnaughey. Oct 78, 68p NBSIR-78-1528

Keywords: *Building codes, *Economic impact, Construction costs, Benefit cost analysis, Standards, Electrical shock, Interrupters.

This report suggests an approach which can be used by building officials and legislative bodies faced with making building code decisions. A method to evaluate many of the potential benefit and cost impacts of specific building code provisions is developed. The report also defines and categorizes the economic impacts of building codes. While no approach to classifying building code impacts will be fully appropriate for all uses, the definitions and categories proposed may help to clarify or reconcile some of the differing opinions concerning the impact of building codes. Finally, the report illustrates the suggested approach by evaluating the 1975 National Electrical Code requirement for the use of Ground Fault Circuit Interrupters (GFCIs) in residences. Based on sensitivity analysis, estimates are made of how much it costs society in order to save one life through the GFCI code provision. This case study conclude that the estimated cost to save a life is nearly $4 million. A lower bound estimate of the cost to save a life is about $2.5 to $3.5 million.

701,313

PB-287 801/5 PC **A06**/MF **A01**
Massachusetts Inst. of Tech., Cambridge. Dept. of Architecture.
Investigation of Regulatory Barriers to the Re-Use of Existing Buildings.
N. J. Habraken, and A. M. Beha. Oct 78, 120p NBS/GCR-78/139
Grant NBS-G7-9018

Keywords: *Buildings, *Renovating, *Building codes, Construction, Management planning, Statistical data, Local government, Government policies.

This team investigation focuses on provisions of the regulatory systems which adversely impact re-use of existing buildings. The findings are separated into experientially based team analyses of regulatory systems and data gathered from several Massachusetts sources. A series of recommendations for resolution of specific code problems are made, and a research agenda is presented to identify areas for future study towards the resolution of code-rehab conflicts.

701,314

PB-288 762/8 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Plan for the Assessment and Implementation of Seismic Design Provisions for Buildings.
Final rept.
C. C. Culver, R. E. Chapman, P. W. Cooke, B. R. Ellingwood, S. G. Fattal, J. R. Harris, and E. V. Leyendecker. Oct 78, 31p NBSIR-78-1549
Grant NSF-ENV77-15084

Keywords: *Building codes, *Earthquake resistant structures, Structural design, Design criteria, Hazards, Decision making, Standards, *Earthquake engineering, *Seismic design, Seismic risk.

This plan deals with the assessment and implementation of tentative seismic design provisions developed by the Applied Technology Council as part of the Cooperative Federal Program in Building Practices for Disaster Mitigation of the National Science Foundation and the National Bureau of Standards. The plan was prepared based on comments received from a broad spectrum of representatives of the building community. The National Bureau of Standards invited participation from a broad spectrum of interests to help develop the plan. Trade associations, industry group, professional organizations, the model code organizations, standards organizations and Federal agencies were included; groups with national representation rather than regional or local interest were selected. The plan includes four phases (1) Review and Refine Tentative Provisions, (2) Trial Designs and Impact Assessment, (3) Consideration and Adoption of Provisions, and (4) Assistance to Facilitate Implementation. It can form the basis for the assessment and implementation of the tentative seismic design provisions. As the effort proceeds, it may be necessary to refine the plan. Additional details will need to be specified for the individual tasks. These will be influenced by the procedure adopted to carry out the activities.

701,315

PB-289 009/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Decision-Aiding Communications in the Regulatory Agency: The Partisan Uses of Technical Information.
Final rept.,
F. T. Ventre. 1977, 14p
Pub. in Ind. Forum v8 n1 p15-28 1977.

Keywords: *Building codes, *Regulations, Construction industry, Construction management, Decision making, Technology innovation, Reprints.

Based on a nationally representative survey of 1,200 municipal building departments, the report describes the partisan uses of information in a regulatory setting. Each of the agencies was facing a specific decision to alter its regulations to accommodate innovative building techniques. The agencies identified the various members of the building community--builders, designers, vendors, users, regulators--who came forward to initiate the change, to discuss its advantages or disadvantages, and then to assert a position either supporting or resisting the agency decision to modify the regulation. The local building industry, accused by many of being the greatest source of resistance to technical innovation, was found to be the strongest force for change, equalling and sometimes surpassing the positive influence of the model code groups.

701,316

PB-293 240/8 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Economics and Regulatory Technology Div.
Selected Papers Dealing with Regulatory Concerns of Building Rehabilitation.
Final rept.
P. W. Cooke. Feb 79, 98p NBS-SP-536
Library of Congress catalog card no. 79-600012.

Keywords: *Buildings, *Rehabilitation, *Building codes, Construction, Fire prevention, Design standards, Fire safety, Law enforcement, *Historic preservation.

This publication consists of a collection of six papers common to the subject of rehabilitation and preservation of existing buildings and how the present system of regulating construction for the public benefit presents various barriers that must be more fully understood in order that rational solutions can be developed and implemented. The papers have been reprinted from the Proceedings of previous national conferences dealing with building regulatory research held under the joint sponsorship of NBS and the National Conference of States on Building Codes and Standards. The titles of the papers are: 'Building Codes: Preservation and Rehabilitation' by Robert J. Kapsch, 'Information Structure of Building Codes and Standards for the Needs of Existing Buildings' by Baird Smith, 'Contractor Understanding Relative to Rehab Costs' by Richard S. Harrington, 'The Role of Fire Prevention and Control on Building Construction and Regulation' by William H. McLain, 'Rehabilitation as an Instrument in Meeting Housing Need: Can It Really Work.' by Jane Heron, and 'Building Codes and Historic Preservation in Savannah, Georgia' by Mires Rosenthal.

701,317

PB-295 434/5 PC **A14**/MF **A01**
National Engineering Lab. (NBS), Washington, DC.
Extreme Wind Speeds at 129 Stations in the Contiguous United States.
Building science series.
E. Simiu, M. J. Changery, and J. J. Filliben. Mar 79, 324p NBS-BSS-118
Grant NSF-ENV77-16113
Sponsored in part by Department of Energy, Washington, DC. Assistant Secretary for Conservation and Solar Applications. Library of Congress catalog card no. 79-600018. Prepared in cooperation with National Climatic Center, Asheville, NC.

Keywords: *Building codes, *Wind(Meteorology), Wind pressure, Velocity measurement, Probability distribution functions, Storms, Wind direction, Statistical data, Standard deviation.

The purpose of this report is to present information on recorded and predicted wind speeds at 129 airport stations in the contiguous United States at which reliable records are available over a number of consecutive years. This information is provided to serve as basic documentation from which appropriate decisions can be made on values of design wind speeds to be specified in building codes and standards or on specific projects. Included in the report are: recorded wind speeds and anemometer elevations; predicted wind speeds based on probability distributions of the largest values; estimates of the sampling errors inherent in the predicted wind speeds; a description of the statistical procedure used in the analysis of the data; and a discussion of the results of the analysis.

701,318

PB-295 708/2 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Economics and Regulatory Technology Div.
Impact of Building Regulations on Rehabilitation - Status and Technical Needs.
Technical note.
J. G. Gross, J. H. Pielert, and P. W. Cooke. May 79, 55p NBS-TN-998

Keywords: *Buildings, *Building codes, Renovating, Housing studies, Urban planning, Urban renewal, Economic impact, Regulations.

This report presents the results of a study of the impact of regulations on building rehabilitation and includes a discussion of the activities of the Building Rehabilitation Technology Program of the Center for Building Technology. Particular activities discussed relative to existing buildings include: (1) development of the technical bases for regulations and an improved regulatory process, (2) development of new technology and evaluation tools, and (3) development of responsive and cost-effective decision tools. A new code concept is outlined which could be a replacement for the '25-50 percent' rule presently in codes for new construction. This rule often controls the amount of work that may be required in the rehabilitation of existing buildings. The status of existing code documents for building rehabilitation is provided along with an overview of other publications which discuss the impact of building regulations on rehabilitation.

701,319

PB-300 329/0 PC **A10**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Proceedings of the National Conference on Regulatory Aspects of Building Rehabilitation.
Final rept.
S. A. Berry. Aug 79, 222p NBS-SP-549
Library of Congress catalog card no. 79-600095. Held at Washington, DC. on October 30, 1978.

Keywords: *Urban renewal, *Buildings, *Building codes, *Meetings, Construction management, Construction costs, Performance standards, Fire safety.

This document contains a total of 18 presented papers, all of which address the subjct of rehabilitation--currently a critical issue in the Nation's effort to revitalize its cities and house its citizens. Public sector, as well as private ector programs and experiences toward achieving this goal are covered in one general and three technical sessions.

701,320
PB78-600033 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
International Trends and Developments of Importance to the Metrication Plans of the U.S. Construction Community.
C. T. Mahaffey. 1978, 72p NBS-TN-976

Keywords: *International building performance standards, *Metrication, Internationally harmonized building regulations.

In 1974 the National Bureau of Standards' Center for Building Technology began an investigation of international developments in the construction field seeking to identify those of importance to U.S. metrication planning. This report identifies and describes a group of related developments selected on the basis of their importance and potential impact on the metric future of the U.S. construction community. The purpose of the report is not to discuss the merits of going metric, but rather to display the trends and developments in the metric building world that the U.S. is preparing to join. The report suggests that many nations, recognizing unique opportunities in a world that will soon have a common measurement system, have already begun to capitalize on the global adoption of SI--the International System of Units. The report describes the extensive efforts underway to reduce obstacles to trade caused by incompatible national regulations, standards, and certification to standards. It describes the trade implications of the Helsinki international agreements reached at the Helsinki meeting of the Conference on Security and Cooperation in Europe and being advanced in the proposed Standards Code developed by the negotiators involved in the General Agreement on Tariffs and Trade (GATT). It describes the changes in the marketplace for building components brought about by the worldwide adoption of the international standard dimensioning module of 100 mm. It describes the launching and the status of the United Nations project aimed at the international harmonization of national building regulations; the involvement and reorganization of the building standards activity of the International Organization for Standardization (ISO); the significance of the international evaluation mechanisms developed by the European Union of Agreement; and, the initiation of international performance standards developed through ISO Technical Committee 59--Building Construction. All of which should be of special interest to those concerned with the development of a remarkably similar program assigned to the National Institute of Building Sciences (NIBS). U.S. metric conversion plans could be designed to take advantage of the opportunities uniquely associated with an SI world or they could treat metrication simply as the adoption of a more modern U.S. measurement system. The report identifies this choice as a major metrication issue for the U.S. construction community. For this reason the report should be of interest to members of the American National Metric Council and of the U.S. Metric Board. The appendix to this report contains a brief description of 22 international organizations considered to be of future significance to the U.S. as it joins the SI metric building world.

701,321
PB80-119068 Not available NTIS
National Bureau of Standards, Washington, DC.
Cost-Effective Methods for Achieving Compliance to Firesafety Codes.
Final rept.,
R. E. Chapman. Sep 79, 10p
Pub. in Fire Jnl. 73, n5, p30-39, 123, Sep 79.

Keywords: *Fire safety, *Building codes, *Cost effectiveness, Economic analysis, Hospitals, Guidelines, Safety engineering, *Health care facilities, *Nursing homes, Least cost analysis.

The identification of cost-effective levels of fire safety in health care facilities is a major concern to hospital administrators, fire safety engineers and public policy makers. The prohibitive costs of strict compliance to the prescriptive provisions of the Life Safety Code in hospitals and nursing homes has led to the development of an equivalency methodology, the Fire Safety Evaluation System. The equivalency methodology provides a means for identifying how combinations of several widely accepted fire safety systems can be used to produce a level of safety equal to that of the prescriptive provisions of the Life Safety Code. Three topics are described briefly in this paper. They are: (1) the Fire Safety Evaluation System; (2) a computerized version of the Fire Safety Evaluation System which permits the least-cost means of achieving compliance to the Life Safety Code to be identified; and (3) an indication of the cost-saving potential of the Fire Safety Evaluation System based on a case study of a typical general hospital.

701,322
PB80-134901 Not available NTIS
National Bureau of Standards, Washington, DC.
Solving Problems in the Structural Design Field.
Final rept.,
J. G. Gross, J. C. Spence, and R. A. Crist. Jan 80, 5p
Pub. in Consulting Engineer, p86-90, Jan 80.

Keywords: *Buildings, *Structural design, *Design standards, Regulations, Problem solving, Technology assessment, Reprints.

This paper provides background information on the development and use by the United States building community of structural design standards. The use of such standards for regulatory purposes is discussed. Standard generation methods, with particular emphasis on the 'consensus process', are compared. Potential new structural design standards resulting from technical advancements and changing societal needs are identified. Federal Government, building community, legal and consumer interest concerns for changing developmental processes are reviewed. Five possible major changes in approach are foreseen.

701,323
PB80-153992 Not available NTIS
National Bureau of Standards, Washington, DC.
Technical Evaluation Needs for Building Rehabilitation.
Final rept.,
J. H. Pielert, and J. G. Gross. 1979, 7p
Pub. in Proceedings of Canadian Building Congress - Rehabilitation of Buildings (2nd), Toronto, Canada, Oct 15-17, 1979, p93-99 1979.

Keywords: *Buildings, *Renovating, Building codes, Guidelines, Construction management, Technology assessment, *Building rehabilitation, Building Rehabilitation Technology Program.

The paper reviews an aspect of the Building Rehabilitation Technology Program in the Center for Building Technology (CBT) of the National Bureau of Standards related to the development of performance evaluation methods needed to make rehabilitation decisions. CBT is developing manuals which will include state-of-the-art listings of technical data for building components and specific health safety and general welfare attributes; e.g., strength and stability, accident safety, health and sanitation, and energy conservation. These manuals will cover: (1) test methods for destructive and nondestructive evaluation of existing construction, (2) methods of analyses to predict the performance of existing construction, (3) field inspection and evaluation methodologies, (4) data on the performance of systems no longer used, and (5) data on rehabilitation experiences. The status of these various technical evaluation activities is discussed, and an overview is given of the other aspects of the CBT Building Rehabilitation Technology Program.

701,324
PB80-203581 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Modeling of Standards: Technical Aids for Their Formulation, Expression, and Use.
Final rept.,
R. N. Wright, S. J. Fenves, and J. R. Harris. Mar 80, 18p NBSIR-80-1979
Prepared in cooperation with Carnegie-Mellon Univ., Pittsburgh, PA.

Keywords: *Buildings, *Design standards, Network analysis(Management), Decision making, Systems analysis, Technical writing, Performance standards.

Standards are the primary communication and control mechanism used to describe building practices and products in communications between the various participants in the building process. Most prior research related to building standards has been concerned with understanding and improving the performance of building products. This work, in contrast, is concerned with improving the organization, expression and interpretation of the information contained in a standard. Techniques are described for objective and rigorous representation of the meaning of a standard. These allow it to be tested for aspects of clarity, completeness, consistency and correctness. Furthermore, the techniques allow alternative organizations and expressions to fit the needs of various users with assurance that meanings remain unchanged and that users will readily find and understand all provisions even in a new or unfamiliar standard.

701,325
PB80-207632 PC **A12**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Research and Innovation in the Building Regulatory Process: Proceedings of the NBS/NCSBCS Joint Conference (4th) Held at St. Louis, Missouri on September 11, 1979, in Conjunction with the Annual Meeting of the National Conference of States on Building Codes and Standards (NCSBCS), Inc. (12th).
Final rept.,
S. A. Berry. Jun 80, 270p NBS-SP-586
Sponsored in part by National Conference of States on Building Codes and Standards, Inc., McLean, VA. Library of Congress catalog card no. 80-600080. See also report dated Jun 77, PB-267 310.

Keywords: *Construction industry, *Buildings, *Building codes, *Meeting, Regulations, Law enforcement, Design criteria, Metric system, Environmental engineering, Insulation, Energy conservation.

The Proceedings of the 4th Annual NBS/NCSBCS Joint Conference on Research and Innovation in the Building Regulatory Process contain nineteen technical papers, the opening remarks and Keynote Address. The subject matter covered in these Proceedings includes: Issues in Building Code Enforcement; Legal, Political and Educational Aspects of Code Enforcement; Studies Dealing with Housing Codes; Energy Conservation and the Built Environment; Design Considerations and Their Impact on Code Enforcement; and, Innovative Regulatory Approaches for Metrication, Insulation Standards, and Climatic Conditions.

701,326
PB81-104382 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Metrication on Building Codes and Standards.
Final rept.
C. T. Mahaffey. May 80, 6p
Pub. in AIA Metric Building and Construction Guide, ch9 p85-90 May 80.

Keywords: *Building codes, *Metric system, Dimensions, Coordination, Reprints.

The chapter contains an analysis of major metric conversion issues relating to U.S. building standards and codes, with special emphasis on the need for proper planning and coordination. Among technical issues in the change, both the selection of correct SI units, and the consideration of dimensional coordination in the selection of new and preferred metric dimensions are stressed. International progress in standardization and in the harmonization of building regulations is addressed.

701,327
PB81-111742 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Review and Refinement of ATC 3-06 Tentative Seismic Provisions. Report of Technical Committee 9: Regulatory Use.
Final rept.
J. H. Pielert, and P. W. Cooke. Oct 80, 71p NBSIR-80-2111-9
Prepared in cooperation with Building Seismic Safety Council. Sponsored in part by Federal Emergency Management Agency, Washington, DC.

Keywords: *Buildings, *Earthquakes, *Building codes, Design criteria, Standards, Regulations, Meetings, Recommendations, *Seismic design, *Seismic risk, Earthquake engineering.

The Tentative Provisions for the Development of Seismic Regulations for Buildings were developed by the Applied Technology Council to present, in one comprehensive document, current state-of-knowledge pertaining to seismic engineering of buildings. The Tentative Provisions are in the process of being assessed by the building community. This report is one of a series of reports that documents the deliberations of a group of professionals jointly selected by the building Seismic Safety Council and the National Bureau of Standards and charged with reviewing the Tentative Provisions prior to the conduct of trial designs. The report contains the recommendations and records of the committee charged with review of the regulatory implementation and enforcement aspects of the provisions. The committee made two recommendations for revisions to the Tentative Provisions and five additional recommendations concerning subsequent activities, such as the conduct of trial designs. These recommendations were made to the parent group, the Joint Committee on Review and Refinement, and their action on these recommendations is documented in a companion report.

701,328
PB81-111759 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Review and Refinement of ATC 3-06 Tentative Seismic Provisions. Report of Technical Committee 2: Structural Design.
Final rept.
J. R. Harris. Oct 80, 92p NBSIR-80-2111-2
Prepared in cooperation with Building Seismic Safety Council. Sponsored in part by Federal Emergency Management Agency, Washington, DC.

Keywords: *Buildings, *Earthquakes, *Building codes, Design criteria, Standards, Regulations, Meetings, Recommendations, Structural design, *Seismic design, *Seismic risk, Earthquake engineering.

The Tentative Provisions for the Development of Seismic Regulations for Buildings were developed by the Applied Technology Council to present, in one comprehensive document, current state-of-knowledge pertaining to seismic engineering of buildings. The Tentative Provisions are in the process of being assessed by the building community. This report is one of a series of reports that documents the deliberations of a group of professionals jointly selected by the Building Seismic Safety Council and the National Bureau of Standards and charged with reviewing the Tentative Provisions prior to the conduct of trial designs. The report contains the recommendations and records of the committee charged with review of the general structural design and analysis provisions. The committee made 27 recommendations for revisions to the Tentative Provisions and five additional recommendations concerning subsequent activities, such as the conduct of trial designs. These recommendations were made to the parent group, the Joint Committee on Review and Refinement, and their action on these recommendations is documented in a companion report.

701,329
PB81-120842 PC **A14**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Comparison of Selected Codes and Standards Relating to Existing Residential Buildings.
Final rept.
P. W. Cooke. Jul 80, 311p NBSIR-80-2081

Keywords: *Residential buildings, *Building codes, Design standards, Ventilation, Plumbing, Illuminating, Fire safety, Structural parts, Noise reduction, Quality assurance.

The performance levels of older residential buildings generally do not comply with the standards for safety or function that are required of new buildings. This report presents a comparative analysis of the specific provisions contained in seven codified documents that have been promulgated to regulate the health and safety aspects of existing residential buildings. The study examines and presents information on the extent to which codes vary among each other in establishing minimum requirements for life, health and safety in existing dwellings, the differing approaches provided by traditional housing codes in contrast to more recently developed rehabilitation guideline documents regarding performance levels, and the degree to which each code meets its intended goals of providing and maintaining human shelter, protection, and privacy. The code provisions are compared and analyzed in sixteen major code areas (e.g., structural requirements, light and illumination, plumbing requirements, etc.). Various inconsistencies among code documents with respect to uniformity and irrational approaches in the historical development of code provisions are indicated.

701,330
PB81-128845 PC **A14**/MF **A01**
Montana State Univ., Bozeman. School of Architecture.
Literature Review: The Building Regulatory System in the United States.
Final rept.
E. S. Smyrl .Oct 80, 320p NBS-GCR-80-286
Contract NBS-6-14568

Keywords: *Buildings, *Building codes, *Bibliographies, Law(Jurisprudence), Regulations, Liabilities, Litigation.

This review, annotated bibliography and index covers literature and legal citations on the U.S. building regulatory system. The scope of the review generally includes the period from 1950 through 1978. The review is divided into two parts. The first part deals with court decisions and legal citations which serve to define code authority and establish the legal basis of building regulations in the United States. The second part deals with articles and other information on the development and philosphy of building codes, their economic impacts, regulatory obstacles, and the application of building codes to existing buildings and new technologies.

701,331
PB81-159600 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Modeling of Standards: Technical Aids for Their Formulation, Expression, and Use.
Final rept.
R. N. Wright, S. J. Fenves, and J. R. Harris. Dec 80, 17p NBSIR-80-1979-1
See also report dated March 1980, PB80-203581.

Keywords: *Buildings, *Design standards, Network analysis(Management), Decision making, Systems analysis, Technical writing, Performance standards.

Standards are the primary communication and control mechanism used to describe building practices and products in communications between the various participants in the building process. Most prior research related to building standards has been concerned with understanding and improving the performance of building products. This work, in contrast, is concerned with improving the organization, expression and interpretation of the information contained in a standard. Techniques are described for objective and rigorous representation of the meaning of a standard. These allow it to be tested for aspects of clarity, completeness, consistency and correctness. Furthermore, the techniques allow alternative organizations and expressions to fit the needs of various users with assurance that meanings remain unchanged and that users will readily find and understand all provisions even in a new or unfamiliar standard.

701,332
PB81-163081 Not available NTIS
National Bureau of Standards, Washington, DC.
New Tools for Standards Writers.
Final rept.
J. R. Harris, S. J. Fenves, and R. N. Wright. Jul 80, 7p
Pub. in American Society for Testing and Materials Standardization News 8, p10-16 Jul 80.

Keywords: *Construction industry, *Standards, Technical writers, Technical writing, Guidelines, Information systems, Reprints.

This paper describes rational methods intended to assist standards developers in the formulation and expression of standards. The methods of analysis provide objective measures of clarity, completeness and consistency in the organization and content of a standard. The methods provide both guides to the organization of the text of a standard and a formal representation that can assist standards writers in determining whether their intent is expressed correctly. For illustrative purposes, the paper draws upon a recent major application of the analysis to the 'Tentative Provisions for the Development of Seismic Regulations for Buildings.' The paper describes the experience gained through the interaction between the analysts and the team which developed the seismic provisions. These interactions suggest guidelines for the future role of analysts within standards writing groups.

701,333
PB81-163842 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Draft Seismic Standard for Federal Buildings.
J. R. Harris, and E. V. Leyendecker. Jan 81, 97p NBSIR-81-2195
Sponsored in part by Federal Emergency Management Agency, Washington, DC.

Keywords: *National government, *Buildings, *Earthquake resistant structures, Structural design, Design standards, Foundations, Dynamic structural analysis, Building codes, *Government buildings, *Seismic design, Earthquake engineering.

This standard has been prepared for uniform use by all Federal agencies as an adaptation of existing voluntary standards, model building codes, Federal regulations, and research reports. It is closely based on the seismic requirements of the Uniform Building Code (which, in turn, are based on the Recommended Lateral Force Requirements and Commentary published by the Structural Engineers Association of California). However, there are many instances of substantive differences from the UBC. Several important provisions, including the seismic zoning map, have been adapted from the Tentative Provisions for the Development of Seismic Regulations for Buildings developed by the Applied Technology Council. A number of provisions have been added to this standard that are based on the current practices and policies of various Federal agencies. Furthermore, this standard is organized considerably differently from the UBC and many provisions are phrased differently.

701,334
PB81-187551 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Review and Refinement of ATC 3-06 Tentative Seismic Provisions. Report of Technical Committee 1: Seismic Risk Maps.
Final rept.
B. R. Ellingwood. Oct 80, 31p NBSIR-80-2111-1
Sponsored in part by Federal Emergency Management Agency, Washington, DC. Prepared in cooperation with Building Seismic Safety Council. See also PB81-111759.

Keywords: *Buildings, *Earthquakes, *Building codes, Geological maps, Seismic surveys, Design criteria, Regulations, Meetings, Recommendations, *Seismic risk, Earthquake engineering, Seismicity index.

The Tentative Provisions for the Development of Seismic Regulations for Buildings were developed by the Applied Technology Council to present, in one comprehensive document, current state-of-knowledge pertaining to seismic engineering of buildings. The Tentative Provisions are in the process of being assessed by the building community. This report is one of a series of reports that documents the deliberations of a group of professionals jointly selected by the Building Seismic Safety Council and the National Bureau of Standards and charged with reviewing the Tentative Provisions prior to the conduct of trial designs. The report contains the recommendations and records of the committee charged with review of the seismic risk maps. The committee made 4 recommendations for revisions to the Tentative Provisions. These recommendations were made to the parent group, the Joint Committee on Review and Refinement, and their action on these recommendations is documented in a companion report.

701,335
PB81-187569 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.

Review and Refinement of ATC 3-06 Tentative Seismic Provisions. Report of Technical Committee 3: Foundations.
Final rept.
L. A. Salomone. Oct 80, 56p NBSIR-80-2111-3
Sponsored in part by Federal Emergency Management Agency, Washington, DC. Prepared in cooperation with Building Seismic Safety Council.

Keywords: *Buildings, *Earthquakes, *Building codes, Foundations, Footings, Design criteria, Standards, Regulations, Recommendations, Structural design, *Seismic design, *Seismic risks, Earthquake engineering, Soil structure interactions.

This report documents the activities of Technical Committee 3: Foundations. Other committee reports are similarly available. The task of Technical Committee 3 was to review and refine Chapter 6, Soil-Structure Interaction and Chapter 7, Foundation Design Requirements in the ATC report (NBS SP-510) entitled, 'Tentative Provisions for the Development of Seismic Regulations for Buildings.' Two meetings were held. The opening meeting of the group was on December 11, 1979, and the concluding meeting was on February 5, 1980. The minutes of these meetings and the findings/recommendations of Technical Committee 3 are presented in this report. These recommendations were made to the parent group, the Joint Committee on Review and Refinement, and their action on these recommendations is documented in a companion report.

701,336
PB81-187577 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Review and Refinement of ATC 3-06 Tentative Seismic Provisions. Report of Technical Committee 6: Steel.
Final rept.
H. S. Lew. Oct 80, 38p NBSIR-80-2111-6
Sponsored in part by Federal Emergency Management Agency, Washington, DC. Prepared in cooperation with Building Seismic Safety Council.

Keywords: *Buildings, *Earthquakes, *Building codes, Steel construction, Design criteria, Standards, Regulations, Meetings, Structural design, *Seismic design, *Seismic risk, Earthquake engineering.

The Tentative Provisions for the Development of Seismic Regulations for Buildings were developed by the Applied Technology Council to present, in one comprehensive document, current state-of-knowledge pertaining to seismic engineering of buildings. The Tentative Provisions are in the process of being assessed by the building community. This report is one of a series of reports that documents the deliberations of a group of professionals jointly selected by the Building Seismic Safety Council and the National Bureau of Standards and charged with reviewing the Tentative Provisions prior to the conduct of trial designs. The report contains the recommendations and records of the committee charged with review of the steel design provisions. The committee made 6 recommendations for revisions to the Tentative Provisions and three additional recommendations. These recommendations were made to the parent group, the Joint Committee on Review and Refinement, and their action on these recommendations is documented in a companion report.

701,337
PB81-187585 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Review and Refinement of ATC 3-06 Tentative Seismic Provisions. Report of Technical Committee 7: Wood.
Final rept.
C. W. C. Yancey. Oct 80, 42p NBSIR-80-2111-7
Sponsored in part by Federal Emergency Management Agency, Washington, DC. Prepared in cooperation with Building Seismic Safety Council.

Keywords: *Buildings, *Earthquakes, *Building codes, Design criteria, Standards, Regulations, Meetings, Wood products, Structural design, *Seismic design, *Seismic risk, Earthquake engineering.

The Tentative Provisions for the Development of Seismic Regulations for Buildings were developed by the Applied Technology Council to present, in one comprehensive document, current state-of-knowledge pertaining to seismic engineering of buildings. The Tentative Provisions are in the process of being assessed by the building community. This report is one of a series of reports that documents the deliberations of a group of professionals jointly selected by the Building Seismic Safety Council and the National Bureau of Standards and charged with reviewing the Tentative Provisions prior to the conduct of trial designs. The report contains the recommendations and records of the commitee charged with review of the provisions for the design and detailing of wood structures. The committee made 14 recommendations for revision to the Tentative Provisions. These recommendations were made to the parent group, the Joint Committee on Review and Refinement, and their action on these recommendations is documented in a companion report.

701,338
PB81-187593 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Review and Refinement of ATC 3-06 Tentative Seismic Provisions. Report of Technical Committee 8: Architectural, Mechanical and Electrical.
Final rept.
T. K. Faison. Oct 80, 44p NBSIR-80-2111-8
Sponsored in part by Federal Emergency Management Agency, Washington, DC. Prepared in cooperation with Building Seismic Safety Council.

Keywords: *Buildings, *Earthquakes, *Building codes, Design criteria, Elevators(Lifts), Standards, Regulations, Meetings, Recommendations, Structural design, *Seismic design, *Seismic risk, Earthquake engineering.

The Tentative Provisions for the Development of Seismic Regulations for Buildings were developed by the Applied Technology Council to present, in one comprehensive document, current state-of-knowledge pertaining to seismic engineering of buildings. The Tentative Provisions are in the process of being assessed by the building community. This report is one of a series of reports that document the deliberations of a group of professionals jointly selected by the Building Seismic Safety Council and the National Bureau of Standards and charged with reviewing the Tentative Provisions prior to the conduct of trial designs. The report contains recommendations and records of the committee charged with the review of the material related to architectural, mechanical and electrical provisions. The committee made seven general recommendations for revision and one recommendation for the addition of a new section on elevator design requirements. These recommendations by Committee 8 were made to the parent group, the Joint Committee on Review and Refinement, and their action on these recommendations is documented in a companion report.

701,339
PB81-217812 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Estimating Benefits and Costs of Building Regulations: A Step by Step Guide.
Final rept.
C. C. Rawie. Jun 81, 94p NBSIR-81-2223

Keywords: *Building codes, *Benefit cost analysis, Standards, Economic analysis, Fire safety, Construction, Accidents, Urban planning, Energy conservation, Sensitivity analysis, NTISCOMNBS.

This is a how-to guide intended to help building officials, elected officials, builders, architects, engineers, and others determine the benefits and costs of proposed building code changes. The guide describes seven steps in the benefit-cost analysis. They are: (1) define the problem, including selecting prototype buildings to analyze; (2) estimate impacts on building-related costs, including government costs; (3) estimate impacts on building safety and performance; (4) select a method of relating benefits and costs (the recommended measure is Net Monetary Benefits together with information on physical life safety impacts); (5) estimate aggregate impacts on the code jurisdiction as a whole; (6) perform a sensitivity analysis; and (7) write up the results, being careful to present information on non-monetary as well as monetary effects. Worksheets are provided to assist in the analysis.

701,340
PB81-247272 Not available NTIS
National Bureau of Standards, Washington, DC.
Logical Analysis of Tentative Seismic Provisions.
Final rept.
J. R. Harris, S. J. Fenves, and R. N. Wright. Aug 81, 13p
Pub. in Jnl. of the Structural Division, Proceedings of the American Society of Civil Engineers 107, nST8 p1629-1641 Aug 81.

Keywords: *Earthquakes, *Building codes, Standards, Earthquake resistant structures, Regulations, *Foreign technology, *Seismic design.

This paper describes a study of the format and expression of the Tentative Provisions for the Development of Seismic Regulations for Buildings developed by the Applied Technology Council. The methods of analysis employed provide objective measures of clarity, completeness, and consistency, and an alternative formal representation with which to examine the correctness of the provisions. The formal representation of the provisions and the findings of the analysis will assist those concerned with the future development of the provisions and their implementation within the various national standards and model codes.

701,341
PB81-248890 Not available NTIS
National Bureau of Standards, Washington, DC.
Information Flow in the Development of Earthquake Provisions for Building Codes.
Final rept.
J. R. Harris. 1978, 19p
Pub. in Proceedings of Conference V Communicating Earthquake Hazard Reduction Information, Denver, CO, May 22-24, 1978, p288-306 1978.

Keywords: *Building codes, *Earthquakes, Regulations, Construction industry, Decision making, Construction management, *Seismic risk.

This report describes how information flows through the building regulatory system and how this flow is being taken into account in the development of new building code provisions for earthquake hazards. Many sectors of the construction community play a role in the complex flow of information in and out of building codes, each with its own set of decision makers, but the local building official is the key figure. The history of earthquake provisions in building codes shows a slow evolution that is typical in the building regulatory system, partially because of the complex pattern of communication and decision making. New provisions have recently been developed for consideration by the regulatory community, but it will be several years before their path through various standards and model codes into legal building codes is complete.

701,342
PB81-600032 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Review and Refinement of ATC 3-06 Tentative Seismic Provisions. Report of Technical Committee 5: Masonry.
E. V. Leyendecker, and L. E. Cattaneo. 1980, 349p NBSIR-80-2115-S

Keywords: *Building, Building codes, Building design, Earthquakes, Engineering, Masonry, Standards, Structural engineering,

The Tentative Provisions for the Development of Seismic Regulations for Buildings were developed by the Applied Technology Council to present, in one comprehensive document, the current state of knowledge pertaining to seismic engineering of buildings. The Tentative Provisions are in the process of being assessed by the building community. The report is one of a series of reports that documents the deliberations of a group of professionals jointly selected by the Building Seismic Safety Council and the National Bureau of Standards and charged with reviewing the Tentative Provisions prior to the conduct of trial designs. The report contains the recommendations and records of the committee charged with review of the masonry design provisions. The committee made 109 ballot recommendations for revisions to the Tentative Provisions. These recommendations were made to the parent group, the Joint Comittee on Review and Refinement, and their action on these recommendations is documented in a companion report.

701,343
PB81-600033 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Review and Refinement of ATC 3-06 Tentative Seismic Provisions. Report of Joint Committee on Review and Refinement.
E. V. Leyendecker, and J. R. Harris. 1980, 334p
NBSIR-80-2111-11

Keywords: *Building, Building codes, Building design, Earthquakes, Engineering, Standards, Structural engineering,

The Tentative Provisions for the Development of Seismic Regulations for Buildings were developed by the Applied Technology Council to present, in one comprehensive document, current state-of-knowledge pertaining to seismic engineering of buildings. The Tentative Provisions are in the process of being assessed by the building community. The report is one of a series of reports that documents the deliberations of a group of professionals jointly selected by the Building Seismic Safety Council and the National Bureau of Standards and charged with reviewing the Tentative Provisions prior to the conduct of trial designs. The group is divided into nine technical committees, each of which focused on a particular portion of the Tentative Provisions. The nine committees proposed recommendations for change to the parent group, the Joint Committee, through a Coordinating Committee. The Coordinating Committee made some modifications to the technical committees' recommendations to ensure consistency among the recommendations. The report documents the actions of the Joint Committee on the 198 recommendations for change that were presented to it. The first part of the report is a summary of the results, and the appendices contain the full documentation for each recommended change. The actions of each of the nine technical committees is documented in a separate report.

701,344
PB82-117631 PC **A07**/MF **A01**
Rice Center, Houston, TX.
Review of Standards and Common Practices in Building Site Regulation Technical Issues and Research Needs.
Sep 81, 137p NBS-GCR-81-332
Contract NBS79-SBCA-0174

Keywords: *Buildings, *Construction, *Engineering standards, Building codes, Environmental engineering, Streets, Landscaping, Storm sewers, Waste water, Water supply, Land use zoning, Regulations.

Widely used design and service standards are identified for five elements of site development subject to government regulation: streets, sitework, drainage, waste water and water supply. Standards in use are found to vary widely from minimums to contradict one another. The report suggests that local custom rather than site engineering research forms the basis for development regulation. The report also found that: (1) some standards do not protect health and safety; (2) many regulations do not incorporate by reference relevant standards; and (3) not all referenced standards are technically current. The report lists areas of needed research and suggests methods for resolving conflicts among development standards.

701,345
PB82-120346 PC **A13**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Organization of Building Standards: Systematic Techniques for Scope and Arrangement.
Final rept.
J. R. Harris, and R. N. Wright. Sep 81, 282p NBS-BSS-136
Library of Congress catalog card no 81-600087.

Keywords: *Buildings, *Construction management, *Standards, Guidelines, Specifications, Building codes, Classifications, Computer programming, Decision making, OUTDEX computer program, Computer applications.

Standards should be organized so that they provide reliable and quick access to the provisions of the standard. Organization is considered to deal with both the scope and the arrangement of the provisions of a standard. It is found to have objective qualities that allow it to be treated formally. Necessary and desirable qualities for an organization are identified, verified, and adopted as objectives and guidelines. The basic element of the system for organizing standards is the classification of the provisions of a standard. A faceted structure, providing a clear division between those levels that are strictly logical and those that are not, is recommended for the classification system. A relevant basis is found for classifying requirements using an idealized model of the relation between syntax and semantics. Development of the classification constitutes a formal treatment of scope. The classification is easily transformed into an index. Development of an outline from the classifiers constitutes a formal treatment of the arrangement. Criteria for placement of provisions in outlines and for construction of outlines from the classification are proposed to promote the objectives of organization. A computer algorithm for interactive outline generation is developed and evaluated. Measures are defined for the comparison of alternate outlines for the same standard.

701,346
PB82-130915 PC **A12**/MF **A01**
National Bureau of Standards, Washington, DC.
Review and Refinement of ATC 3-06 Tentative Seismic Provisions. Report of Technical Committee 4: Concrete.
Final rept.
R. D. Marshall, and K. Woodward. Oct 80, 253p
NBSIR-80-2111-4
See also PB81-187569. Sponsored in part by Federal Emergency Management Agency, Washington, DC.

Keywords: *Buildings, *Earthquakes, *Reinforced concrete, *Building codes, Design criteria, Structural design, Standards, Regulations, Recommendations, Earthquake resistant structures, *Seismic design, *Seismic risk, Earthquake engineering, Soil structure interactions.

The tentative provisions for the development of seismic regulations for building were developed by the Applied Technology Council to present, in one comprehensive document, current state-of-knowledge pertaining to seismic engineering of buildings. The tentative provisions are in the process of being assessed by the building community. This report is one of a series of reports that documents the deliberations of a group of professionals jointly selected by the Building Seismic Safety Council and the National Bureau of Standards and charged with reviewing the tentative provisions prior to the conduct of trial designs. The report contains the recommendations and records of the committee charged with review of the reinforced concrete design provisions. The committee made 19 recommendations for revisions to the tentative provisions. These recommendations were made to the parent group, the Joint Committee on Review and Refinement, and their action on these recommendations is documented in a companion report.

701,347
PB82-139551 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Estimating Economic Impacts of Building Codes.
Final rept.
C. C. Rawie. Nov 81, 164p NBSIR-81-2402

Keywords: *Building codes, *Economic impact, Construction costs, Economic analysis, Benefit cost analysis, Safety, Regulations, Cost estimates, Sensitivity analysis.

This report describes a method for estimating the benefits and costs of proposed changes in building codes. A companion report by the author, Estimating Benefits and Costs of Building Regulations: A Step-by-Step Guide, published by the National Bureau of Standards as NBSIR 81-2223, provides a simplified description of the same basic method. This report shows the reader how to set up the problem, discount impacts to their present value, estimate code impacts on building costs, estimate effects on building safety, compute aggregate impacts, and conduct a sensitivity analysis. One chapter discusses the problem of assigning a dollar value to life safety. Worksheets and an extensive list of references, including sources of data on building costs and hazards, are included.

701,348
PB82-260993 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Analysis of Sections 4.2 through 4.14 of the GSA Proposed Uniform Federal Accessibility Standard,
G. Turner. Aug 82, 60p NBSIR-82-2567
Sponsored in part by General Services Administration, Washington, DC.

Keywords: *Buildings, *Handicapped persons, *Availability, Design criteria, Building codes, Standards, Performance evaluation, Accident prevention, Human factors engineering, *Federal standards, Computer applications.

Recently, the General Services Administration (GSA) developed a draft uniform accessibility standard (the focus of this report) intended to be promulgated in conjunction with the Department of Housing and Urban Development, the Department of Defense, and the United States Postal Service. Under contract to the General Services Administration, the National Bureau of Standards (NBS), Center for Building Technology assisted in the review of part 4, sections 4.2 through and including 4.14 of the draft standard in order to determine the extent to which previously identified problems of accessibility (NBS database) were addressed by the provisions of the standard. The analysis was carried out by reviewing and classifying the provisions of the draft standard; searching the NBS data base for information relevant to the classes of provisions in the draft standard; and comparing the provisions with the NBS database.

701,349
PB82-261587 Not available NTIS
National Bureau of Standards, Washington, DC.
International Performance-Based Standard Method of Developing National Product Specification Standards.
Final rept.
C. T. Mahaffey. 1980, 6p
Pub. in Proceedings of Int. Standardization--Testing, Certification and Related Matters, and Their Implication Under Trade Agreements Act of 1979, Washington, DC, October 15-16, 1980, p1-6.

Keywords: *Building codes, *Performance standards, Specifications, Tests, International trade, *National product standards.

This paper describes and proposes international consideration of a method that coordinates the international and national application of the ISO concept of 3 levels of standards. These 3 levels, intended to establish a technically-based hierarchy among standards, are defined by ISO as follows: Level 1--Fundamental standards--General principles and fundamental standards for buildings and civil engineering structures; Level 2--Wide Ranging Standards--Standards for groups of products concerning preferred dimensions, performance requirements, general test methods, etc.; and Level 3--Specific Standards--Descriptive standards for specific building products, materials or components concerning properties, test methods, etc. This proposed method pertains directly to the development and use of wide ranging ISO level 2 performance standards and related test methods--for products grouped according to their intended end-uses--in the subsequent development of national, level 3 specification standard, for each alternative nationally-manufactured product within such end-use groupings.

701,350
PB83-236356 Not available NTIS
National Bureau of Standards, Washington, DC.
Safety Research Programs Conducted at the Center for Building Technology.
Final rept.
N. J. Raufaste. May 83, 2p
Pub. in South. Build., p7-8, Apr/May 83.

Keywords: *Construction industry, *Buildings, *Safety, Building codes, Standards, Construction management, Reprints.

This paper reviews safety research at the Center for Building Technology, National Bureau of Standards. This research addresses safety during construction and in use and provides a sound technical basis for the codes and standards development process.

701,351
PB84-138478 Not available NTIS
National Bureau of Standards, Washington, DC.
Towards Unified Probability-Based Design.
Final rept.
B. Ellingwood. Apr 83, 10p
Pub. in Building Research and Practice 9, n2 p162-171 Apr 83.

Keywords: *Buildings, *Structural design, *Materials specifications, Construction materials, Reinforced concrete, Steel construction, Building codes, Probability theory, Research projects.

The specification of a common basis for structural design and a common set of load factors and load combinations would harmonize and simplify design, particularly in structures where more than one construction material is used. Recent advances in applying probabilistic methods to structural design now make this feasible and practical. This article reviews some of the recent developments in research and implementation of probability-based design emphasizing, in particular, contributions made by the continuing research programs in the Center for Building Technology on structural loads and reliability.

701,352
PB84-171610 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Status of Building Code Provisions for Solar Energy Systems.
Final rept.
D. R. Conover. Feb 84, 140p NBS-GCR-84-460
Sponsored in part by Department of Energy, Washington, DC. Prepared in cooperation with National Conference of States on Building Codes and Standards, Inc., Herndon, VA.

Keywords: *Building codes, *Solar energy, Solar heating, Residential buildings, Technology assessment, Guidelines, *Solar cooling.

The recent increase in the use of solar energy systems has concurrently brought about an increased concern for health and life safety issues in buildings using solar energy systems. Some of these concerns, such as electrical connections and plumbing system design, have been addressed for years in the building codes used throughout the United States. Others, such as separation of potable water and toxic heat transfer fluids, have not received as much attention (especially in residential construction) until the increased use of solar energy systems. Regardless, those responsible for ensuring the safety of the U.S. building stock have needed code provisions with which to address the safety aspects of solar energy systems. The purpose of this report is to outline the current status of technical criteria the code enforcement community utilizes in regulating solar energy systems design and installation in new and existing building construction.

701,353
PB84-221365 Not available NTIS
National Bureau of Standards, Washington, DC.
Probability-Based Loading Criteria for Codified Design.
Final rept.
B. Ellingwood. 1983, 12p
Pub. in Proceedings of Int. Conf. for Application Statistics Probabilities Soil Structural Engineering (4th) held at Florence, Italy on June 13-17, 1983, p237-248 1983.

Keywords: *Building codes, *Loads(Forces), Safety, Design standards, Design criteria, Regulations.

Traditional structural design criteria lack consistency in the levels of safety and serviceability they accord different structures. Considerable improvements have been obtained recently using the unifying concept of limit states design along with a probabilistic approach to treating uncertainties invariably found in engineering practice. The paper describes some of these recent developments, illustrating how reliability-related research can be transformed into safety and serviceability criteria in codes and other regulatory documents.

701,354
PB85-196558
(Order as PB85-196541, PC **A07**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Common Format for the Model Building Codes: An Application of Advanced Techniques for Standards Analysis, Synthesis and Expression.
F. I. Stahl. Apr 85, 24p
Sponsored by National Conference of States on Building Codes and Standards, Inc., Herndon, VA.
Included in Research and Innovation in the Building Regulatory Process: Proceedings of the NBS/NCSBCS Joint Conference (6th), Technical Seminar on Streamlined Administrative Procedures, Computers in Construction, and Fire Safety Technology held at Denver, Colorado on September 11, 1984, p3-28 Apr 85.

Keywords: *Building codes, *Standards, Classifications, Regulations, Variability, *Format, Data bases, Computer software.

Current research at the NBS Center for Building Technology (CBT) supports development of a common format for the model building codes. This study demonstrates an application of advanced techniques for standards analysis, synthesis and expression (SASE) to code format development. Specifically, the SASE techniques allow model code provisions to be stored in specialized databases, classified for easy access, and displayed in conjunction with any candidate code format. By 'mapping' the technical contents of existing model codes onto various candidate formats, each candidate may be evaluated as to the extent to which it adequately contains and provides access to code provisions. Moreover, the mapping technique permits analysts to determine whether or not the provisions of any individual code have been properly or logically classified. Results of CBT's research will facilitate the more rational development of a common format for model building codes.

701,355
PB85-196574
(Order as PB85-196541, PC **A07**/MF **A01**)
Texas Univ. at Austin.
Automation of the Building Code Compliance.
S. Jaeger, and L. Harelik. Apr 85, 8p
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology, and National Conference of States on Building Codes and Standards, Inc., Herndon, VA. Prepared in cooperation with Austin Building Inspection Dept., TX.
Included in Research and Innovation in the Building Regulatory Process: Proceedings of the NBS/NCSBCS Joint Conference (6th), Technical Seminar on Streamlined Administrative Procedures, Computers in Construction, and Fire Safety Technology held at Denver, Colorado on September 11, 1984, p37-44 Apr 85.

Keywords: *Building codes, Automation, Standards, *Compliance, Computer software.

This is a software development project using microcomputers to check a proposed building project's compliance with the building codes. Plan review and permit procedures in metropolitan building inspection departments are encumbered with a number of problems. Among these are the logistics of processing the increasingly complex construction projects and processing them in a reliable, replicable and consistent manner. This program provides the means toward those ends.

701,356
PB85-196590
(Order as PB85-196541, PC **A07**/MF **A01**)
Atkinson-Noland and Associates, Inc., Boulder, CO.
Automated Checking of Simply-Supported Prismatic Reinforced Concrete Beams for Compliance with Code Requirements.
J. L. Noland, and R. Bedell. Apr 85, 12p
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology, and National Conference of States on Building Codes and Standards, Inc., Herndon, VA.
Included in Research and Innovation in the Building Regulatory Process: Proceedings of the NBS/NCSBCS Joint Conference (6th), Technical Seminar on Streamlined Administrative Procedures, Computers in Construction, and Fire Safety Technology held at Denver, Colorado on September 11, 1984, p71-82 Apr 85.

Keywords: *Beams(Supports), *Reinforced concrete, *Building codes, Automation, Regulations, Design, *Compliance.

Building regulations in their various forms are an important part of the construction industry because they establish standards of quality which are intended to assure at least minimal levels of performance and safety. Automated constraint processing, i.e., checking the characteristics of a given design against the minimum characteristics required by regulation via computer, permits extensive and complex regulations to be more comprehensively and accurately utilized.

701,357
PB85-196624
(Order as PB85-196541, PC **A07**/MF **A01**)
Maryland Dept. of Economic and Community Development, Annapolis.
Second Look at Fire Protection Code Criteria.
D. Hammerman. Apr 85, 4p
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology, and National Conference of States on Building Codes and Standards, Inc., Herndon, VA.
Included in Research and Innovation in the Building Regulatory Process: Proceedings of the NBS/NCSBCS Joint Conference (6th), Technical Seminar on Streamlined Administrative Procedures, Computers in Construction, and Fire Safety Technology held at Denver, Colorado on September 11, 1984, p113-116 Apr 85.

Keywords: *Fire protection, *Building codes, Fire safety, Design, Buildings, Construction, Regulations.

Building codes and fire codes have placed a great deal of emphasis on fire safety design criteria. Fire safety criteria in the codes are the accumulation of provisions based upon the role of judgment and gathering of historical and scientific data. And this approach has not been without considerable gain in the prevention of fires and reduction in the loss of life in buildings. Recognizing the lack of sophisticated fire data of years ago, it is apparent that the entire subject of building construction classifications and building size limitations must be studied to produce more scientifically-based results.

701,358
PB85-227676 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Data-Base Requirements at the Engineering Stage.
Final rept.
R. N. Wright. 1985, 6p
Sponsored by National Research Council, Washington, DC. Advisory Board on the Built Environment.
Pub. in Proceedings of Workshop on Advanced Technology for Building Design and Engineering (ABBE), Woods Hole, MA., June 17-22, 1984, p43-48 1985.

Keywords: *Building codes, *Construction, Design standards, Workshops(Meetings), Engineering, Requirements, *Computer aided design.

Data on requirements and engineering standards for design are outlined for discussion and a Workshop conducted by National Research Council Advisory Board on the Built Environment.

701,359
PB86-111432 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD.
Removing Regulatory Constraints to Building Rehabilitation.
Final rept.
J. H. Pielert, and C. J. Dinezio. 1982, 11p
Sponsored by American Society for Testing and Materials, Philadelphia, PA.
Pub. in Performance Concept in Building: Advances in the Development of the Concept and Its Application in Rehabilitation, v1 p469-479.

Keywords: *Buildings, *Renovating, *Regulations, Building codes, Requirements, Massachusetts.

The paper reports on the formulation of a regulatory concept for the rehabilitation of existing buildings by the National Bureau of Standards in consultation with other representations of the U.S. building community and its implementation by the State of Massachusetts. The proposed regulatory concept discussed in this paper allows rehabilitation of existing buildings without necessarily meeting all new construction code requirements. Recognizing that their statewide building code was a constraint to rehabilitation, Massachusetts developed new code provisions for existing buildings based on this concept. The resulting Article 22 of the State Building Code utilizes a performance approach which allows compliance alternatives in lieu of strict compliance with the prescriptive provisions of the code for new construction. The impact of Article 22 is discussed along with a case study illustration.

701,360
PB86-139771 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Operations Research Div.
Cost Impact of the NEHRP (National Earthquake Hazards Reduction Program) Recommended Provisions on the Design and Construction of Buildings.
Final rept.
S. F. Weber. 1985, 19p
Sponsored by Federal Emergency Management Agency, Washington, DC.

Pub. in Societal Implications: Selected Readings, p1-1 - 1-19 1985.

Keywords: *Building codes, *Construction costs, *Cost analysis, Design standards, Regulations, Safety factor, Earthquake resistant structures, Reprints.

The paper provides some information on the approximate cost impacts resulting from implementation of the NEHRP (National Earthquake Hazards Reduction Program) Recommended Provisions (Building Seismic Safety Council 1984 a) and proposes research to obtain improved estimates of cost impacts. The information is derived from the 52 case studies of the Building Seismic Safety Council (BSSC) trial design program conducted in 1983-84 and based on an amended version of the Applied Technology Council's Tentative Provisions for the Development of Seismic Regulations for Buildings (ATC Tentative Provisions).

701,361
PB86-195583 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Expressing Standards for Computer-Aided Building Design.
Final rept.
F. I. Stahl, R. N. Wright, S. J. Fenves, and J. R. Harris. 1983, 6p
Pub. in Computer Aided Design 15, n6 p329-334 Nov 83.

Keywords: *Buildings, *Building codes, Design, Standards, Reprints, Computer-aided-design.

The article discusses a set of techniques for expressing and organizing the contents of building design standards, and suggests that application of these techniques, in conjunction with a restructuring of data flow strategies within computer-aided building design (CABD) software systems, are needed to reduce the effort and cost required to maintain CABD systems applicable and current. The article stresses application of these techniques to analyzing the clarity, consistency, and completeness of existing building design standards, and to developing new standards.

701,362
PB86-199924 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Probability-Based Load Criteria for Structural Design.
Final rept.
B. Ellingwood. 1985, 10p
Sponsored by American Society of Civil Engineers, New York.
Pub. in Proceedings of Concepts and Methods in Structural Safety Studies, Denver, CO., April 27-May 3, 1985, p120-129.

Keywords: *Building codes, *Structural design, Loads(Forces), Design standards, Structural engineering.

Load criteria for use in limit states design of structures are developed using probabilistic methods. Statistical data on load and strengths are integrated by the reliability analysis to yield criteria that are consistent with a prescribed measure of reliability. The load criteria, while having a conventional appearance, lead to more uniform reliability and performance than is possible with existing specifications. The load criteria have been included in American National Standard A58.1-1982, Minimum Design Loads for Buildings and Other Structures, and provide a focus for material specification writers as limit states design methods are developed for different construction materials.

701,363
PB86-199940 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Standards Interface for Computer-Aided Design: An Overview of Some Technical Problems Associated with Automated Design Checking.
Final rept.
F. I. Stahl. 1984, 8p
Pub. in Proceedings of Conference on Computing in Civil Engineering (3rd), San Diego, CA., April 2-6, 1984, p560-567.

Keywords: *Building codes, *Design standards, Structural design, Structural engineering, *Computer aided design.

Building quality can be improved and building costs reduced through more effective computer utilization in design and construction. To accomplish these objectives improved interfaces are needed between building project databases and computer-based procedures for analysis and design, and between computer-based engineering procedures and applicable design standards. The report examines the hypotheses that: (1) the ability to easily maintain design standards data is fundamental to CAD system effectiveness; (2) the configuration of presently available computer-aided structural design (CASD) system software inhibits efficient design standards data modification, requiring costly maintenance to avoid software obsolescence and limiting the overall usefulness of these systems; and (3) methods to enhance the efficiency of criterion checking and standards data maintenance are required to increase the utilization of CAD technology.

701,364
PB86-230968 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Regulatory Response to Technical Innovation in Residential Construction.
Final rept.
F. T. Ventre. 1984, 9p
Pub. in Proceedings of HUD/NIBS Conference on Next Generation of Housing Technology, Orlando, FL., April 26-27, 1982, p83-91 1984.

Keywords: *Residential buildings, *Construction, Regulations, Standards, Construction industry, Control, Regulations.

Describes varieties of regulation, their uses and abuses and their effects on the wider use of innovative technology in residential building construction. Offers frameworks for resolving regulatory questions and describes NBS contributions to regulatory reform.

701,365
PB87-105219 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Improving Building Regulations for Rehabilitation.
Final rept.
J. C. Gross. 1985, 14p
Pub. in Proceedings of ACI Symposium on Rehabilitation, Renovation and Preservation of Concrete and Masonry Structures, Quebec City (Canada), 20-25 September 1981, p121-134 1985.

Keywords: *Building codes, Renovating, Regulations, Reconditioning, Maintenance.

The purpose of the paper is to provide an overview of building regulations applied to rehabilitation. Discussed are (1) constraints due to regulation, (2) recent technical activity to improve rehabilitation regulation, and (3) needed research to permit more effective use of our existing building stock.

701,366
PB87-108627 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Overview of Building Regulations That Relate to Rehabilitation.
Final rept.
J. H. Pielert. 1982, 9p
Pub. in Evaluation, Maintenance, and Upgrading of Wood Structure, Chl.6 p39-47 1982.

Keywords: *Buildings, *Regulations, *Rehabilitation.

No abstract available.

701,367
PB87-180865 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Standards--Tools for Excellence.
Final rept.,
R. D. Dikkers. 1987, 2p
Sponsored by National Inst. of Corrections, Washington, DC.
Pub. in Corrections Today, v49 n2 p170-171 Apr 87.

Keywords: *Building codes, Electronic security, Window glazing, Reprints, *Correctional facilities, *Jails.

General information on the development and use of building standards, and the need for guidelines, test methods, and other standards to assist in the selection of building materials, components, and systems for use in correctional facilities (jails prisons, etc.) is presented. The plans for a NBS project to address the development of standards for correctional facility products and systems is also briefly described.

701,368
PB87-201844 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.
SASE - Standards Analysis, Synthesis and Expression Program: User Manual,
S. J. Fenves, M. T. Slava, and J. P. Barnett. Apr 87, 143p NBSIR-87/3514
Prepared in cooperation with Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.

Keywords: *Standards, *Building codes, *Structural engineering, Construction, Construction materials, SASE computer program, User manuals(Computer programs), Earthquake engineering.

The Standards Analysis, Synthesis and Expression (SASE) program is intended to assist organizations engaged in the formulation, promulgation and maintenance of standards. It is expected that the user of SASE is familiar with the tutorial material contained in the report Introduction to SASE: Standards, Analysis, Synthesis and Expression. The manual is intended to provide detailed user instructions and serve as the reference manual on the use of the SASE program.

701,369
PB87-209052 PC **A09**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Introduction to SASE: Standards Analysis, Synthesis, and Expression,
S. J. Fenves, R. N. Wright, F. I. Stahl, and K. A. Reed. May 87, 188p NBSIR-87/3513
See also PB87-201844. Prepared in cooperation with Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.

Keywords: *Standards, *Building codes, Building, Classification, Standardization, Methodology, *SASE system, Knowledge representation.

The Standards Analysis, Synthesis, and Expression (SASE) methodology provides an objective and rigorous representation of the meaning of a standard. It is intended to assist organizations engaged in the formulation, promulgation, and maintenance of standards. In this discussion, the term standard includes all types of normative documents used to define the required qualities of buildings, building products, materials, or building processes. The term includes legal building regulations, consensus standards such as those of the American National Standards Institute and of the International Organization for Standardization, and proprietary specifications. Standards from many technology areas should be equally amenable to the SASE methodology. However, the methodology and the information models on which it is based have been tested extensively only in areas of building technology.

701,370
PB88-147715 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Applying Expert Systems to Building Standards.
Final rept.,
K. A. Reed. 1987, 2p
Pub. in Building Design and Construction 28, n11 p72-73 Nov 87.

Keywords: *Building codes, *Expert systems, Standards, Integrated systems, Reprints.

Current activity in the Computer Integrated Construction Program relating to standards and expert systems is summarized.

Construction Management & Techniques

701,371
PB-265 803/7 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Applied Technology.

Recommended Practice for the Use of Metric (SI) Units in Building Design and Construction.
Interim rept.,
H. J. Milton. Apr 77, 51p NBS-TN-938

Keywords: *Construction industry, *Buildings, *Metric system, Design, Construction, Conversion, Units of measurement, Management planning, Construction management, *International system of units, *Metrication.

This Technical Note contains a comprehensive set of recommendations for the use of metric (SI) units in building design and construction. It includes descriptive material dealing with the structure of the International System of Units (SI); rules and recommendations for the presentation of SI units and symbols, and of numerical values associated with SI; a set of tables showing working units and typical applications for SI units in building design and construction; and a section dealing with special considerations in the selection and use of SI units in design and construction. Appendixes show conversion factors for the most common units; superseded metric units not recommended for use with SI; an SI units and relationships chart; and appropriate references. This document was prepared to provide the technical basis for an ASTM reference standard on recommended practice for the use of metric (SI) units in building design and construction.

701,372
PB-269 775/3 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Opening the Doors to Better Building, Choices for the Building Community.
Final rept.,
S. A. Kliment. Jul 77, 37p NBS-SP-476
Library of Congress catalog card no. 77-8362.

Keywords: *Construction industry, *Construction management, *Meetings, Technology innovation, Contractors, Building codes, Coordination, Management, Design standards, *Life cycle costing.

Several problem areas were identified in three workshops and one national symposium which was held to pinpoint choices open to the building community from improved building procurement practices. Some of the problem areas identified are: inconsistency in building codes and standards; inadequate bridges between design and construction; and the dissemination of post-construction information. Other problems which were addressed were: long-term economy; technical innovation; performance data; interdisciplinary training and education; and traditional attitudes in building practices.

701,373
PB-275 524/7 PC **A09**/MF **A01**
Ehrenkrantz (Ezra D.) and Associates, New York.
Beyond the Performance Concept.
Dec 77, 191p NBS/GCR-77/107
Contract NBS-35717

Keywords: *Houses, *Construction management, Construction industry, Technology assessment, Technology innovation, Design criteria, Standards, Identifying, Research needs.

This report of a brief study attempts to identify the knowledge-based problems of those responsible for building design, and to suggest areas in which the Institute for Applied Technology should focus its present and future efforts in order to improve building.

701,374
PB-277 670/6 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Reliability Basis of Load and Resistance Factors for Reinforced Concrete Design.
Final rept.,
B. Ellingwood. Feb 78, 102p NBS-BSS-110
Library of Congress Catalog Card no. 77-600072.

Keywords: *Buildings, *Reinforced concrete, *Design criteria, Building codes, Design standards, Loads(Forces), Probability theory, Statistical analysis.

Engineering decisions must be made in the presence of uncertainties which arise as a consequence of imperfect information and knowledge and inherent randomness in many design parameters. It is on account of these uncertainties and potential risks arising therefrom that safety margins provided by load and resistance factors are required in design. Reliability methods are employed in this study to facilitate the selection of criteria for reinforced concrete design. These methods, which are based on probability theory, provide a logical basis for determining the manner in which uncertainties in resistance and loads affect design safety and how their effects should be controlled in building standards. Following a comprehensive analysis of uncertainty measures, safety indices associated with existing reinforced concrete design are evaluated. Design criteria commensurate with levels of uncertainty and required reliability are then presented. Simplification of these leads to practical reliability based criteria which retain the relatively simple characteristics of existing criteria and yet have a well established and documented rationale.

701,375
PB-284 518/8 PC **A18**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Building Economics and Regulatory Technology Div.
Research and Innovation in the Building Regulatory Process.
Final rept.,
P. W. Cooke. Aug 78, 411p NBS-SP-518
Proceedings of the NBS/NCSBCS Joint Conference (2nd), Held at Bozeman, Montana on September 20, 1977, in Conjunction with the Annual Meeting of the National Conference of States on Building Codes and Standards, Inc. (NCSBCS) (10th). Prepared in cooperation with National Conference of States on Building Codes and Standards, Inc., McLean, VA.

Keywords: *Buildings, *Building codes, *Regulations, *Meetings, Energy conservation, Solar heating, Structural engineering, Design criteria, Fire safety, Noise reduction, Noise pollution, Management planning, Law(Jurisprudence), Design standards, Solar cooling.

The Second NBS/NCSBCS Joint Conference on Research and Innovation in the Building Regulatory Process was held in Bozeman, Montana on September 20, 1977. The proceedings contain the 25 papers presented at the eight technical sessions. The technical sessions addressed the following issues: Implementation of solar and energy conservation building standards; Issues in building regulation; Considerations in the development of energy conservation building standards; Developing new approaches for formulating building regulations; State experiences in the development of energy conservation building standards; The expanding role of the building official; Application and impact of building energy conservation standards; Administration of building regulations.

701,376
PB-285 534/4 PC **A09**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Metrication in Building Design, Production, and Construction--A Compendium of 10 Papers.
Final rept.,
H. J. Milton. Sep 78, 199p NBS-SP-530
Library of Congress Catalog Card no. 78-600086.

Keywords: *Construction industry, *Metric system, *Technology assessment, Standardization, Conversion, Management planning, Building codes, Learning transfer, *Metrication.

This publication is a compendium of ten papers prepared during 1977 by Hans J. Milton, Technical Consultant on metrication and dimensional coordination to the NBS Center for Building Technology. It may be used as an information and general reference document in the metric subject area. International experience has enabled the author to refer to precedent in other English-speaking countries which have preceded the United States in the change to metric (SI). The papers are directed at the disciplines of building design, production, and construction. However, they contain much information which could be adapted for use in other sectors of the economy. Some of the subject areas addressed are: management and economics of metrication; specific product metrication; public construction sector role in metrication; building standards and codes in metrication; graphic design in metrication; and, United States' opportunities in metrication. A subject index has been included for ready reference to specific metric topics.

701,377
PB-290 022/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Guidelines for Housing Construction in Mine Subsidence Areas.
Final rept.
F. Y. Yokel. 1978, 11p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Proceedings of the International Conference on Evaluation and Prediction of Subsidence Held at Pensacola Beach, FL. on January 1978, p129-139 1978.

Keywords: *Houses, *Construction, *Underground mining, *Subsidence, Foundations, Site surveys, Construction management.

Suggested guidelines for the construction of housing in mine subsidence areas are outlined and discussed. The guidelines deal with site evaluation, site development, and housing construction.

701,378
PB-295 142/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Our Metric Future. An Analysis of Metrication's Impact Upon Construction Specifications.
Final rept.
H. J. Milton. Feb 79, 12p
Pub. in Constr. Specifier 32, n2, p36-47, Feb 79.

Keywords: *Construction industry, *Specifications, *Metric system, Conversion, Impact, *Metrication.

The paper examines some of the background considerations in metrication for the construction community, highlights some of the changes that will need to be made, examines different approaches to conversion, and suggests adaptive strategies for the construction specifications sector during the transitional period.

701,379
PB-298 627/1 PC **A16**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Economics and Regulatory Technology Div.
Research and Innovation in the Building Regulatory Process.
Final rept.
P. W. Cooke. Jul 79, 361p NBS-SP-552
Sponsored in part by National Conference of States on Building Codes and Standards, Inc., McLean, VA. See also 2nd Annual Conference, dated Aug 78, PB-284 518. Library of Congress catalog card no. 79-600090. Proceedings of NBS/NCSBCS Joint Conference (3rd), Annapolis, MD., 12 Sep 78,

Keywords: *Buildings, *Building codes, *Regulations, *Meetings, Energy conservation, Solar heating, Structural engineering, Design criteria, Fire safety, Cost analysis, Law(Jurisprudence), Design standards, *Metrication, Computer applications.

The third NBS/NCSBCS Joint Conference on Research and Innovation in the Building Regulatory Process was held in Annapolis, Maryland on September 12, 1978. The proceedings of the Joint Conference include the opening remarks, the Keynote Address and the 24 papers presented at the technical sessions dealing with various aspects of building regulatory research and innovative administrative application of building codes and standards. The eight technical sessions were organized around the following themes: Regulatory Aspects of Fire Safety; Standards Development Activities and the Building Regulatory Process; Accommodating Provisions for the Elderly and Handicapped in Building Regulations; Implementation of Energy Conservation Building Regulations at the State Level; Application of Computers and Information Systems for Building Regulation and Construction; Energy Conservation, Solar Energy and the Built Environment; Issues Concerning the Intent, Formulation and Economic Impact of Regulations; and Metrication, Industrialized Buildings and Complex Structures. In addition, three other research papers covering Lighting, Tax Shelters, Resource Zoning, and Land Use Planning are also included.

701,380
PB80-167497 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Study of Work Practices Employed to Protect Workers in Trenches,
J. Hinze, and N. J. Carino. Mar 80, 125p NBSIR-80-1988
Sponsored in part by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Safety, *Regulations, Construction industry, Standards, Excavation, Shoring, Trenching, Surveys.

Results of a field study of trenching practices, safety related problems in trenching, and the effect of the Occupational Health and Safety Administration (OSHA) regulations for excavation, trenching and shoring are presented. The data were gathered from over 100 interviews with contractors and foremen in various regions of the country and from the answers to questionnaires sent by contractors' associations to their membership. The data indicate: (1) the technical aspects of trenching work, (2) the industry's opinion of the current OSHA regulations, and (3) factors affecting safety performance in trenching work.

701,381
PB81-163925 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Productivity in Residential Construction: An Annotated Bibliography.
Final rept.
B. E. Thompson, and R. E. Chapman. Feb 81, 60p NBSIR-80-2150

Keywords: *Residential buildings, *Construction, *Renovating, *Bibliographies, Construction costs, Economic analysis, Housing studies, Building codes, Productivity, Abstracts, *Building rehabilitation.

This report presents a state-of-the-art review of the technical literature related to one or more of the factors affecting productivity in residential construction. Particular emphasis is placed on identifying potential sources of variation between the level of productivity in new housing construction versus that in housing renovation. Although this report focuses on the residential sector, emphasis is also placed on topics such as contruction management and cost control which perhaps more appropriately apply to the non-residential sector. The references have been categorized so that articles dealing with specific productivity and construction topics can be easily identified. The categories emphasized in this report are: general productivity/productivity measurement; construction productivity; residential rehabilitation/renovation; construction/housing costs; construction cost estimation and control; economics of construction; and building codes and regulations.

701,382
PB82-121047 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Removing Regulatory Restraints to Building Rehabilitation: The Massachusetts Experience.
J. H. Pielert. Oct 81, 61p NBS-SP-623
Library of Congress catalog card no. 81-600141.Portions of this document are not fully legible.

Keywords: *Buildings, *Renovating, State government, Government policies, Regulations, Building codes, Massachusetts.

Throughout the United States, increasing concern is being expressed for the need to more fully utilize the existing building stock. The report documents a process that was initiated in late 1977 and continues to the present time in which particular regulatory problems impacting building rehabilitation were identified, a regulatory concept which responded to these problems was formulated, and the actual implementation of the new approach in the State of Massachusetts. Article 22 of the Massachusetts State Building Code is printed in the Appendix of the report and four case studies of actual buildings which were rehabilitated are included.

701,383
PB82-210329 Not available NTIS
National Bureau of Standards, Washington, DC.
Building-Related Research of the U.S. National Bureau of Standards.
Symposium paper.
R. N. Wright. Oct 81, 3p
Pub. in Proceedings of Latin American Symposium on Rational Organization of Building Applied to Low-Cost Housing, Sao Paulo, Brazil, p335-347 1981.

Keywords: *Buildings, *Research projects, Research management, Technology transfer, Construction management, Standards, *Fire research.

Building-related research and technology transfer activities at the U.S. National Bureau of Standards (NBS) are described to: assist Latin American housing and building organizations formulate building practices effective for their particular needs, provide access to potentially useful NBS research results, and identify opportunities for cooperative studies with NBS. The Performance Concept (which relates building practices explicitly to qualities required for usefulness, safety and economy) guides NBS building research. Fundamental research makes clearer and more explicit the causes and consequences of building performance qualities and provides the foundations for sustained, cumulative improvements in building practices. Practical measurement technology is developed to assist the building community in achieving intended performance qualities.

701,384
PB83-193094 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Standards Interface for Computer-Aided Design.
F. I. Stahl. Apr 83, 50p NBSIR-83-2671

Keywords: *Buildings, *Structural design, Construction management, Building codes, Design standards, Quality control, Cost engineering, *Computer aided design, ICES/STRUDL computer program, GENESYS computer program.

Building quality can be improved and building costs reduced through more effective computer utilization in design and construction. To accomplish these objectives improved interfaces are needed between building project databases and computer-based procedures for analysis and design, and between computer-based engineering procedures and applicable design standards. This latter task involves a set of problems termed the Standards Interface for Computer-Aided Design (SI/CAD). These problems comprise the focus of the current report. The SI/CAD is shown to be a critical determinant of computer-aided design (CAD) system effectiveness, particularly in the domain of structural engineering design. This report examines the hypotheses that: (1) the ability to easily maintain design standards data is fundamental to CAD system effectiveness; (2) the configuration of presently available computer-aided structural design (CASD) system software inhibits efficient design standards data modification, requiring costly maintenance to avoid software obsolescence and limiting the overall usefulness of these systems; and (3) methods to enhance the efficiency of criterion checking and standards data maintenance are required to increase the utilization of CAD technology.

701,385
PB84-221977 Not available NTIS
National Bureau of Standards, Washington, DC.
Deformation and Failure in Large-Scale Pullout Tests.
Final rept.
W. C. Stone, and N. J. Carino. Dec 83, 13p
Pub. in Jnl. of the American Concrete Institute 80, n6 p501-513 Nov-Dec 83.

Keywords: *Concretes, *Cracking(Fracturing), *Strain measurement, Failure, Crack propagation, Loads(Forces), Compressive strength, Reprints, *Pullout tests.

An experimental study was performed to gain an understanding of the failure mechanism of the pullout test. Two large-scale pullout inserts were fabricated and embedded in large concrete blocks. Micro-embedment strain gages were placed in the concrete to measure the internal strain distribution in critical regions. Insert disk displacements were also measured along the line of load application.

701,386
PB85-118388 Not available NTIS
National Bureau of Standards, Washington, DC.
Criteria for Assuring Safety during Erection of Concrete Shell Structures.
Final rept.
E. O. Pfrang, and H. S. Lew. 1980, 3p
Sponsored in part by Laboratorio Central de Estructuras y Materiales, Madrid (Spain).
Pub. in Bulletin of the International Association for Shell and Spatial Structures 21-3, n74 p5-8 1980.

Keywords: *Safety engineering, *Construction, Criteria, Shells(Structural forms), Hyperbolic parabolic shells, Personnel, Hoisting, Personnel development, Reinforced concrete, Reprints.

This paper summarizes criteria for assuring safety during construction of reinforced concrete hyperbolic shell structures. The criteria are based on the current U.S. regulations for concrete construction. The criteria highlight important provisions in regulations affecting the safety of workers. Special attention is given to those provisions covering construction loadings, construction sequences, hoisting systems and personnel safety training.

701,387
PB85-189322 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Integration of Construction in the Building Process.
Final rept.
R. N. Wright. 1984, 5p
Sponsored by Waterloo Univ. (Ontario).
Pub. in Proceedings of Int. Symposium on Organization and Management of Construction (4th), Waterloo, Ontario, Canada, July 22-26, 1984, CIB W-65 1984, 4, p1161-1165.

Keywords: *Construction, *Management, *Buildings, Information systems, Safety, Economics, Organizational structure.

Integration of construction into the whole building process will promote the usefulness, safety and economy of buildings. Advanced information technologies provide technical bases for accomplishing this integration. Participants are encouraged to work with the Working Commission on Organization and Management of Construction of the International Council for Building Research, Studies and Documentation to achieve this integration.

701,388
PB85-196566
(Order as PB85-196541, PC **A07**/MF **A01**)
Arkansas State Univ., State University.
Structural Safety Assessment during the Construction Phase.
T. J. Parsons. Apr 85, 7p
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology, and National Conference of States on Building Codes and Standards, Inc., Herndon, VA.
Included in Research and Innovation in the Building Regulatory Process: Proceedings of the NBS/NCSBCS Joint Conference (6th), Technical Seminar on Streamlined Administrative Procedures, Computers in Construction, and Fire Safety Technology held at Denver, Colorado on September 11, 1984, p29-35 Apr 85.

Keywords: *Safety, *Structures, *Construction, Loads(Forces), Reinforced concrete, Buildings, Shoring.

A technique is proposed which can be used with reasonable accuracy to determine the effects construction loads have on the structure capacity of a reinforced concrete building. The technique accounts for different types of slab construction, variations in concrete strength throughout the structure, and the nature of different shoring and reshoring systems. The technique uses the equivalent frame method to determine moments and shear forces produced in the structure by the imposed construction loads, and compares these resultants to the shear and moment capacity of the structure at various stages of construction.

701,389
PB85-201762 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Introductory Remarks at the Third International Symposium on Building Economics.
Final rept.
R. N. Wright. 1984, 2p
Pub. in Proceedings of Int. Symposium on Building Economics (3rd), CIB Working Commission W-55, Ottawa, Canada, July 18-20, 1984, p7-8.

Keywords: *Economics, *Buildings, Financial management, Construction management, Decision making, Research, Policies.

Building Economics provides information and techniques needed by policy makers affecting human welfare and the building community and by decision makers in the building process. Participants are encouraged to work with the Working Commission on Building Economics of the International Council for Building Research, Studies and Documentation to advance knowledge and practice in building economics.

701,390
PB86-110137 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Treatment of Accidental Loads and Progressive Failures in Design Standards.
Final rept.
B. Ellingwood. 1981, 17p
Pub. in Structural Safety and Reliability, p649-665 1981.

Keywords: *Structural design, Loads(Forces), Structural engineering, Building codes, *Structural failure, Structural reliability.

Accidental loads not presently considered in the design of most structures may have catastrophic consequences if they occur. If the structure is not properly designed and detailed, a local failure resulting from the accidental load may initiate a chain reaction of failures throughout a major portion of the structure. The development and implementation of design procedures to control the effects of accidental loads and progressive failures is discussed in the paper. The probability of the initiating event and the probability of a structural failure when the event occurs are both considered. Loading criteria are given for the loads that the damaged structure must carry in order to prevent a progressive failure from initiating from a zone of local damage.

701,391
PB87-164042 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
New Concepts for Construction Practice Standards for Excavations.
Final rept.,
F. Y. Yokel, R. M. Chung, and R. L. Stanevich. Apr 81, 6p
Pub. in Concrete Pipe News, p1-6 Apr 81.

Keywords: *Excavation, Soil classification, Construction industry, Standards, Reprints.

A previous NBS study concluded that it is in many instances not practical to require that an engineer design the shoring or determine the steepest allowable sideslope for shallow excavations (excavations less than 20 feet deep which cause most of the accidents in excavation cave-ins). Thus, it is necessary to have a standard or regulations which can be understood and implemented by supervisory personnel in the field. The important features of a Standard Practice are discussed.

701,392
PB88-129903 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Graphical Approach to Discounted Payback.
Final rept.,
H. E. Marshall. 1985, 16p
Pub. in Construction Management and Economics 3, p105-120 1985.

Keywords: *Construction costs, *Buildings, *Project management, Graphs(Charts), Discounting, Benefit cost analysis, Cost effectiveness, Reprints, *Payback, *Discounted payback, Economic indicators.

Construction planners and building owners use payback frequently as an index of economic performance. Discounted payback, which considers the time value of money in measuring the time to project payoff, is a more accurate index of project cost effectiveness than simple payback. But being more difficult to calculate, it is used less often than simple payback. The paper provides a unique set of graphs that helps decision makers find discounted payback quickly and easily without complex calculations. Appropriate applications of simple and discounted payback are described. Examples of economic efficiency losses from using payback instead of more appropriate evaluation measures and from using simple instead of discounted payback are presented.

Construction Materials, Components, & Equipment

701,393
PB-259 126/1 PC **A04**/MF **A01**
Factory Mutual Research Corp., Norwood, MA.
Scaling of Radiative Characteristics of Turbulent Diffusion Flames.
Technical rept.,
G. H. Markstein. Jun 76, 51p FMRC-22361-4, RC-B-66, NBS-GCR-76-80
Grant NFPCA-76006
Sponsored in part by National Science Foundation, Washington, D.C. Research Applied to National Needs.(PC A04/MF A01)

Keywords: *Fires, *Thermal radiation, *Energy transfer, *Diffusion flames, Gas dynamics, Fuels, Propane, Measurement, Radiometers, Flow rate, Mathematical analysis, Turbulent flow, Flame propagation, Fire research.

Despite its recognized important role in fire, radiative energy transfer is relatively less well understood than other aspects of fire spread. As yet, a quantitative determination of fire radiation from first principles is not possible, and alternative semi-empirical methods must be employed. The present study, as part of a continuing effort to provide quantitative formulations of fire radiation, deals with the particular case of scaling the radiative properties of turbulent gaseous-fuel diffusion flames with fuel flow rate. Although currently restricted to this type of flame, the success of the work suggests that the general principles developed here may be applied in future studies to other types of fires such as pool or wall fires.

701,394
PB-266 041/3 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Stone Preservatives: Methods of Laboratory Testing and Preliminary Performance Criteria.
Final rept.,
G. A. Sleater. May 77, 83p NBS-TN-941
Sponsored in part by National Park Service, Washington, D.C.

Keywords: *Construction materials, *Rocks, *Preservatives, Accelerated tests, Environmental tests, Weathering, Thermal properties, Chemical attack, Buildings, Performance evaluation, Ultraviolet radiation, Sulfuric acid, Corrosion tests, Sodium sulfates, Sodium chloride, Specifications, Criteria, Air pollution, Air pollution effects(Materials).

Although numerous materials have been proposed as preservatives for stone in historic buildings and monuments, their efficacy is difficult to establish. A laboratory research program of accelerated simulated stone decay was used to obtain data on stone preservatives and to suggest criteria for their selection. Over 50 materials usable as stone preservatives were tested. Tests to simulate stone decay were of two types: (1) Exposure to combined weathering factors using a special test chamber for accelerated decay (CAD), in which chemical attack, salt and water action, and thermal effects were simulated in one operation; (2) Exposure to single causes of stone decay using sulfurous acid fog, sodium chloride fog, water condensation/evaporation cycling, sodium sulfate penetration and crystallization, and ultraviolet radiation. Methods for measuring the effects of the exposures are given together with the test data; these have been used to set limits of acceptable performance in preliminary performance criteria for the selection of stone preservatives. The behavior of each stone preservative tested in meeting these criteria is given. No one stone preservative met all criteria.

701,395
PB-267 221/0 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Applied Technology.
Performance of Branch Circuit Electrical Terminations of Copper and Aluminum Non-Metallic Sheathed Cable.
Final rept.,
L. W. Masters, E. J. Clark, and E. J. Embree. Nov 76, 35p NBSIR-76-1184
Sponsored in part by Naval Facilities Engineering Command, Washington, D.C., Directorate of Civil Engineering (Air Force), Washington, D.C. and Office of the Chief of Engineers (Army), Washington, D.C.

Keywords: *Wiring, *Electric cables, Aluminum, Buildings, Copper, Performance, Military facilities, Electric outlets, Overheating.

A study was performed to provide the Tri-Services Committee on Building Materials with guidelines regarding the use of aluminum branch circuit wiring in military buildings. The first part of the study consisted of identifying military bases which contain buildings with aluminum wired branch circuits. Personnel at a number of the bases were contacted in order to estimate the extent of observed problems. Laboratory tests were performed on CO/ALR and non-CO/ALR duplex receptacles wired with both aluminum and copper non-metallic sheathed cable. Overheating of aluminum wired termination points was observed with some receptacles in a current cycling test using non-CO/ALR receptacles at screw torque levels of 0.023 and 0.069 kg-m (2 and 6 lb-in). Aluminum wired non-CO/ALR receptacles tested at 0.138 kg-m (12 lb-in) screw torque showed no signs of overheating and copper wired non-CO/ALR receptacles showed no signs of overheating regardless of screw torque. The report presents the findings of the study and includes guidelines regarding the use of aluminum branch circuit wiring in military buildings. (Color illustrations reproduced in black and white.)

701,396
PB-267 845/6 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Properties of 21 Year Old Coal-Tar Pitch Roofing Membranes: A Comparison with the NBS Preliminary Performance Criteria,
R. G. Mathey, and W. J. Rossiter. Jun 77, 27p NBSIR-77-1256

Keywords: *Roofs, *Construction materials, *Membranes, *Pitch(Material), Coal tar, Aging tests(Materials), Visual inspection, Buildings, *Roofing materials.

The properties of coal-tar pitch roof membranes approximately 21 years old were compared to the properties reported for such membranes in NBS Building Science Series 55, 'Preliminary Performance Criteria for Bituminous Membrane Roofing.' Samples of the old membranes were taken from eight buildings having roof areas that range from 0.5 to 1.5 million square feet (4.6 to 15 sq km). The buildings were located at three sites in or near the state of Kentucky. The roof membranes on these buildings had been subjected to different maintenance procedures. Laboratory tests conducted on 47 membrane samples included tensile strength, modulus of elongation and coefficient of expansion. The thermal shock factor was calculated for each sample. Laboratory observations were made of the membrane samples to determine between-ply bitumen thickness, weight per unit area, ply adhesion, pliability and condition of the membrane.

701,397
PB-268 112/0 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Computer Program for the Thermal Analysis of the Fire Endurance of Construction Walls.
Final rept.,
F. C. W. Fung. Jun 77, 63p NBSIR-77-1260

Keywords: *Buildings, *Walls, *Fire tests, Thermal analysis, Computer programs, Thermal conductivity, Heat transfer, Composite structures, FORTRAN, User needs, *Composite construction, *Fire endurance, UNIVAC 1108 computers.

A general one-dimensional transient heat and mass transfer numerical program has been developed for composite building constructions. Since typical building constructions consist of a series of composite layers and intermediate air layers transient heat transfer is modeled by conduction through solids and by radiation and convection through air spaces. In addition the program has built-in features for ease of application to building constructions where various combinations of solid-to-solid and solid-to-air interfaces are encountered. The complete Fortran language program as used on the NBS Univac 1108 computer is given. A discussion of the program and instruction for its use are facilitated by the aid of examples. Numerical solutions using the present program compare favorably with experimental data in standard fire endurance tests.

701,398
PB-271 097/8 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.

Evaluation of Fire Properties of Generic Gypsum Board Products.
Final rept.,
J. R. Lawson. Aug 77, 31p NBSIR-77-1265

Keywords: *Fire tests, *Wallboard, *Buildings, Gypsum, Walls, Ceilings(Architecture), Flame propagation, Ignition, Burning rate, Heat transfer, *Fire research, Fire spread, Gypsum board.

An evaluation of the fire properties of generic gypsum board products was made in order to obtain a better understanding of the material's reaction to a fire environment. These gypsum board products are typically used in wall and ceiling assemblies throughout the United States. Four small-scale fire test methods were used in the examination of the materials' fire properties. The tests conducted were for potential heat, ease of ignition by flame impingement, rate of heat release, and rate of flame spread. All of these properties are of major importance in the design of a building. Standard fire test methods were used for the development of data on rate of flame spread and potential heat characteristics. The ease of ignition and rate of heat release characteristics were determined by fire tests recently developed at the National Bureau of Standards.

701,399
PB-271 847/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Adobe Building Materials: Properties, Problems, and Preservation.
Final rept.,
J. R. Clifton. 1977, 4p
Pub. in Tech. Conservation, p30-34 Spring 77.

Keywords: *Construction materials, *Residential buildings, Soils, Bricks, Fabrication, Molding techniques, Sunlight, Research, Preserving, *Adobe brick, Reprints.

Earth, air, and water--three of the four elements of the ancient world--have been combined for several millennia to form a versatile building material. This product, sun-dried earth bricks, or adobe, was easy to make and use in pre-industrialized societies. No great technical skill or equipment was necessary. Fabrication required only mixing soil and water, shaping the mixture into forms, and exposing them to the atmosphere to set them. Once hardened, the bricks were ready to use. The National Bureau of Standards is studying the properties of adobe to determine what problems may be associated with it, and how best to preserve adobe in old buildings.

701,400
PB-274 982/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cost Savings from Reduced-Sized Venting.
Final rept.,
H. E. Marshall, R. T. Ruegg, and R. S. Wyly. 1977, 8p
Pub. in Plumbing Eng., pt1 v5 n4 p35-38 Jul/Aug 77, pt2 v5 n5 p45-46, 64 Sep/Oct 77.

Keywords: *Vents, *Plumbing, Cost engineering, Size determination, Building codes, Drains, Reprints.

Venting is required for all sanitary drain-waste-vent systems in buildings to maintain the traps of plumbing fixtures and thereby help prevent the entry of sewer gases into the building. Past research at NBS has shown that reduced-sized-venting (RSV), an innovative type of venting which utilizes dry vent pipes substantially smaller in size than those permitted by existing plumbing codes, meets the performance requirements imposed on conventional vent systems by the prescriptive requirements of codes for one and two-story houses. Builders, contractors, plumbers, and consumers of housing want to know the potential money savings from using RSV. Based on use of plastic pipe and depending on other assumptions made, estimates of potential savings per single-family household over the next 11 years are from $74 to $129, and for the nation as a whole, from $88 million to $244 million. Realization of these potential savings depends on how fast code authorities accept RSV in the plumbing codes and how fast builders and developers implement RSV technology once it is authorized in the codes.

701,401
PB-275 390/3 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Performance of a Water-Thinned Polyurethane Seamless Flooring System.
Final rept.,
M. Godette, and P. G. Campbell. Dec 77, 79p NBSIR-77-1399
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Energy, Building Technology, and Standards Div.

Keywords: *Polyurethane resins, *Floors, Experiments, Field tests, Water, Solvents, Performance evaluation, Comparison, Tests, Abrasion, Smoke, Wear resistance, Durability, Tensile strength, Elongation, Impact strength, Indentation, Dimensional stability, Flame spread.

This paper summarizes the work of a two-year project to evaluate the performance of a water-thinned polyurethane seamless flooring system. The goals of this project included: (1) To evaluate by laboratory tests and field demonstrations the performance and durability characteristics of a water-thinned polyurethane seamless flooring system; (2) To compare the performance of a water-thinned polyurethane system with solvent-thinned polyurethane systems and other conventional flooring materials; and (3) To recommend performance criteria for the selection of water-thinned polyurethane seamless flooring systems. The project was divided into two phases, laboratory evaluation and field demonstration. Data obtained from local maintenance engineers at the 20 demonstration sites confirmed laboratory findings that the system did not compare favorably with conventional flooring systems for use in high traffic areas.

701,402
PB-277 536/9 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C.
Fire Endurance Tests of Residential Walls Containing Branch Circuit Wiring. Preliminary Findings.
Final rept.,
L. A. Issen. Feb 78, 65p NBSIR-78-1415
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Assistant Secretary for Policy Development and Research.

Keywords: *Walls, *Fire resistance, Residential buildings, Electric wire, Wiring, Fire tests.

Two fire endurance tests were performed to study the effects of branch circuit electric wiring and wiring devices on the fire resistance of a gypsum board and wood stud one-hour fire-rated wall. The tests simulated potential fire spread between (a) horizontally adjacent occupancies and (b) vertically adjacent occupancies. Each test wall assembly included both nonmetallic sheathed cable (type NM) and armoured cable (type AC), with and without 3-1/2 inch thick glass fiber insulation. The tests were conducted with a slightly positive pressure in the furnace, to represent the overpressure generated in room fires. The tests showed that the presence and penetrations of electric branch circuit cables and wiring devices lowered the fire resistance of a one-hour rated gypsum board and wood-stud wall by 13 minutes when based on flame penetration of the unexposed surface wallboard and by 23 minutes when based on flame penetration at the wiring devices. The tests showed no significant difference in the performance of the different cable types.

701,403
PB-280 810/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Approach to the Development of Predictive Service Life Tests for Building Components and Materials.
Final rept.,
L. W. Masters. 1977, 13p
Pub. in Proceedings of RILEM/ASTM/CIB Symposium on Evaluation of the Performance of External Vertical Surfaces of Buildings, Otaniemi, Espoo, Finland 28 Aug-2 Sep 77, v2 p176-188 1977.

Keywords: *Buildings, *Construction materials, *Service life, Aging tests(Materials), Accelerated tests, Degradation, Life tests.

A systematic approach to the development of predictive service life tests and the improvement of existing service life tests for building components and materials is outlined. The approach consists of four parts: Problem Definition, Pre-Testing, Testing and Interpretation and Reporting of Data. It can be applied to all components and materials comprising a building system. For example, the approach can be applied at the component level to foundations, walls, floors and roofs. It can also be applied to materials comprising components, e.g. coatings, roofing, concrete, sealants, adhesives, metals, wood and others. Application of the approach to many components and materials is limited, at present, because of the lack of knowledge regarding exposure conditions and mechanisms of failure. Despite these limitations, however, the approach will help in (1) identifying the data needed to develop more definitive tests, (2) ensuring the best possible test is developed and (3) providing a uniform approach to service life prediction and the reporting of results.

701,404
PB-283 934/8 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Center for Building Technology.
Elastomeric Roofing: A Survey.
Technical note,
W. J. Rossiter, and R. G. Mathey. Jul 78, 58p NBS/TN-972
Sponsored in part by Naval Facilities Engineering Command, Alexandria, Va., Directorate of Engineering and Services (Air Force), Washington, D.C. and Office of the Chief of Engineers (Army), Washington, D.C.

Keywords: *Roofing, *Elastomers, Roofs, Construction materials, Membranes, Substrates, Weathering, Mechanical properties, Performance, Reviews, *Roofing materials, State of the art.

In recent years the use of elastomeric roofing systems in the United States has been increasing. A survey was conducted to ascertain the current state-of-the art of these roofing systems. The information obtained in the survey was gathered from a literature search complemented by the opinions of people knowledgeable in the field including researchers, contractors, manufacturers and users. A listing of the current elastomeric roofing materials was compiled, along with test methods for determining the properties of membranes fabricated with these materials. The principal materials, available in either liquid or sheet applied systems, included acrylic, butyl, chlorosulphonated polyethylene, EPDM (ethylene propylene diene terpolymer), neoprene, polyvinyl chloride (PVS) and vinyl, silicone and urethane. In addition to these materials some composite membranes were also available. Factors affecting the performance of the membranes were identified including durability, design of the roofing system, substrate condition at the time of application attachment of the membrane to the substrate and workmanship during application. The performance of elastomeric roofing was discussed based on its advantages, disadvantages and limitations. Guidelines to assist the user in the selection and use of elastomeric roofing were prepared for both new and remedial roofing applications. Criteria were not available to evaluate or predict the performance of elastomeric roofing. As a first step in the development of criteria, preliminary performance characteristics were suggested.

701,405
PB-284 485/0 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Center for Building Technology.
Performance Criteria and Plumbing System Design,
M. J. Orloski, and R. S. Wyly. Aug 78, 64p NBS-TN-966

Keywords: *Houses, *Plumbing, *Design criteria, Piping systems, Venting, Drainage, Hydraulic jump, Mathematical models, Water conservation.

An overview is presented indicating how the performance approach to plumbing system design can be used to extend traditional methods to innovative systems. Identification of the plumbing performance needed in a built system is used to classify current design criteria intended to furnish this level of performance. Some current design criteria may provide a higher level of performance than is actually needed by the user. In other cases, no standard test method, criterion, or evaluation technique exists. Putting existing knowledge into a performance format increases the utility of this knowledge and facilitates identification of needed research to fill the gaps. Some of the mathematical models now used for system design and pipe sizing in plumbing codes are reviewed in the context of performance-oriented research. The results of experimental work in plumbing systems with reduced-size vents (smaller than allowed by codes) are presented as an example of the use of the performance approach, and illustrate a case where performance criteria permit relaxing of vent design practice. Conceivably

the re-examination by plumbing designers of traditional design criteria against measured user needs could be beneficially extended to other areas of plumbing design such as water distribution, storm drainage, and plumbing fixtures. Beyond this, it has been recognized that uniform guidelines for evaluation of innovative systems, based on research findings, are essential for wide acceptance of performance methods, particularly by the regulatory community.

701,406
PB-284 517/0 PC **A04**/MF **A01**
California Univ., Berkeley. Fire Research Group.
Numerical Procedure for Calculating Temperature in Hollow Structures Exposed to Fire,
U. Wickstrom. Aug 77, 64p UCB-FRG-77-9, NBS-GCR-77-100
Grant NBS-G7-9006

Keywords: *Buildings, *Fires, *Ceilings(Architecture), *Heat transfer, Convection, Heat transmission, Finite element analysis, Finite difference theory, Fortran, Computer programming.

An approximate theory for two-dimensional heat transfer in hollow structural elements exposed to fire is described. Radiation as well as convection heat transfer are accounted for. The theory is coded in a set of Fortran subroutines that can easily be adapted to most programs for analysis of solid state conduction using finite element or finite difference approximations. For voids with piecewise straight boundaries and all angles between surfaces less than or equal to 180 degrees, a set of equations has been programmed to calculate view factors. In calculating convection heat exchange, it is assumed that the heat capacity of enclosed air is negligible, and that a uniform effective air temperature can be calculated as a function of surrounding surface temperature only. To illustrate the method, the finite element program FIRES-T is employed. Four hollow structures exposed to ASTM E-119 fire are analyzed. For two of the examples where experimental data are available excellent agreement between measured and calculated temperature is achieved.

701,407
PB-285 186/3 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Preliminary Study of the Fire Safety of Thermal Insulation for Use in Attics or Enclosed Spaces in Residential Housing.
Final rept.,
D. Gross. Jul 78, 48p NBSIR-78-1497

Keywords: *Residential buildings, *Thermal insulation, *Fire safety, Mineral wool, Cellulose, Glass fibers, Fire tests, Material specifications, *Attics.

An evaluation was made of the appropriateness of the flammability requirements in Federal specifications for loose-fill cellulosic and mineral fiber insulation and mineral fiber batts and blankets. This included an analysis of currently used standard test methods for measuring insulation flammability or combustibility and their principle limitations. To provide for more meaningful evaluations, a review was made of fire statistics and of likely fire occurrences, particularly for retrofit insulation in attic and enclosed spaces of residential buildings. A series of laboratory tests was conducted using an attic floor radiant panel test and a cigarette smoldering test to simulate flaming and smoldering exposures. Mockup tests on attic floor sections were conducted to validate the extent of flame spread on attic insulation and the initiation of smoldering ignition from covered recessed light fixtures. Based on these tests, changes were recommended to Federal Specifications HH-I-515C, HH-I-521E and HH-I-1030A.

701,408
PB-285 297/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
All's Well that Vents Well. Pre-Occupancy Performance of Field Units with Reduced Size Vents.
Final rept.,
M. J. Orloski. 1976, 10p
Pub. in Proc. Amer. Soc. Sanitary Engineering Annual Meeting, Philadelphia, Pa., Oct 24-27, 1976, p55-64 1976.

Keywords: *Residential buildings, *Plumbing, *Vents, Piping systems, Venting, Building codes, Design standards.

Reduced-size vents were installed in six one- and two-story houses at Andrews Air Force Base, Maryland. Tests were conducted before occupancy to evaluate the performance of the system, principally by measurements of trap-seal retention, under loads believed representative of service conditions. These field test results are a follow-on to those of the National Bureau of Standards laboratory work on reduced-size venting which were reported at the ASSE Convention in 1974. Both the laboratory and field test results show the viability of reduced-size venting. This is expected to contribute to the inclusion of reduced-size venting in plumbing codes.

701,409
PB-295 041/8 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Protecting Adobe Walls from Ground Water.
Final rept.
J. R. Clifton, and F. Davis. Mar 79, 29p NBSIR-79-1730
Sponsored in part by National Park Service, Washington, DC.

Keywords: *Walls, *Clays, *Fluid infiltration, Permeability, Ground water, Grout, Membranes, Drainage, *Adobe bricks.

Two methods for creating impervious membranes in existing adobe walls were investigated. They were the injection of chemical grouts and installation of a metallic membrane. Chemical grouting was unsuccessful because of the low permeability of the tested adobe materials. The metallic membrane did prevent the migration of moisture in the adobe underneath the membrane, weakening the adobe. Further, soluble salts migrated to the surface of the wet adobe. Alternative methods for protecting adobe structures from ground water and runoff water are discussed, including the installation of effective drainage systems and upgrading the foundations.

701,410
PB-297 843/5 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Mechanical Properties of Adobe.
J. R. Clifton, and F. L. Davis. May 79, 50p NBS/TN-996
Sponsored in part by National Park Service, Washington, DC.

Keywords: *Construction materials, *Structural clay products, Compressive strength, Flexural strength, Moisture content, Nondestructive tests, Mechanical properties, *Adobe bricks, Historical buildings.

Relationships between the compressive strength and creep, and the moisture contents of adobe were investigated. Moisture was found to have a deleterious effect on these mechanical properties of adobe, its severity increasing with increasingly higher relative humidities and higher moisture contents. It was concluded that rain and ground water would have a greater deleterious effect on the mechanical properties of adobe than high relative humidities. The physicochemical properties of adobe, mix proportions, drying conditions, and shrinkage of specimens were also found to influence the compressive strength of adobe. Procedures for preparing, curing and testing of adobe specimens are given. A nondestructive test method, based on measuring the penetration resistance of adobe, was found to give reliable predictions of the compressive strength and moisture content of adobe specimens.

701,411
PB77-600019
(Order as PB276 556, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Static Pressure Measurements of Enclosure Fires.
B. J. McCaffrey, and J. A. Rockett. 1977, 10p
Included in Jnl. of Research of the National Bureau of Standards, v82 n2 107-117 1977.

Keywords: Buoyancy pressure, *Enclosure fires, Entrainment, Fire induced flows, Models, Physical scale, Plumes.

Some enclosure-fire static pressure measurements are presented for both full and scale model rooms and are compared with the present hydraulics-orifice flow model for fire induced flows into and out of enclosures. Results indicate that the vertical pressure differential (enclosure to ambient) follows the expected hydrostatic distribution quite well and accurately reflects the doorway inflow and outflow gas velocities. Measurement of ceiling and floor differential pressure using different numbers of gas burners yields insight into gross plume entrainment and illustrates how the neutral plane and thermal discontinuity vary with upper gas temperature. Correlating upper gas temperature with fire size and enclosure height makes it possible to predict at what heat release rate a given enclosure might become fully involved, i.e., by using the temperature at which the thermal discontinuity approaches the floor. In terms of present fire plume modeling large entrainment coefficients (0.3-0.4) are required in order to reproduce the enclosure flows for both the small and large scale results. A noted deficiency in the plume model appears in the small scale results where the data suggest that the entrainment should exhibit a much stronger dependence on the fuel injection rate than that predicted by the theory.

701,412
PB77-600063 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Physical Security of Door Assemblies and Components.
J. S. Stroik. 1977, 33p
Pub. in NILECJ-STD-0306.00.

Keywords: *Burglary resistance, *Door assemblies, Door components, Doors, Frames, Hardware, Hinges, Locks, Security standards.

Security standards for doors have been developed at the National Bureau of Standards to evaluate burglar-resistance of door assemblies and components. Criteria were established by analysis of available data on burglary methods, by duplication of the attacks, and finally by measurement of the duplicated attacks applicable to the standards' scope. The scope includes development of standards designed to resist only burglary attacks defined as 'common' or 'opportunity' attacks on residences and small businesses. Four classes were established, from class I which includes attributes for the lowest level of resistance, up to class IV with attributes for the highest level of resistance. Requirements are specified as performance criteria with test methods described in detail. Two classification methods were established, one for door assemblies, the other for door assembly components. Included in an appendix is a description of the test equipment used at the National Bureau of Standards.

701,413
PB77-600072 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mechanically Actuated Switches for Burglar Alarm Systems.
G. Stenbakken, and M. Isler. 1977, 18p
Pub. in NILECJ-STD-0302.00.

Keywords: *Burglar alarm sensor, Burglar alarm system, *Door switch, Mechanically actuated switch, Alarm system, Mechanically actuated switch, Perimeter sensor, Switch.

This standard establishes performance criteria for mechanically-actuated electrical switches intended for use in protective intrusion alarm circuits to monitor the position of doors, windows, etc. These devices cause the initiation of an alarm signal to a police panel, central station, or local audible alarm device. Included are requirements and test methods for performance, electrical properties and materials. The performance characteristics addressed are those that affect the false alarm susceptibiiity of the device. This standard does not provide performance criteria for the ability of these devices to resist attempts to defeat them through physical or surreptitious attack.

701,414
PB80-101967 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Economic Analysis of Insulation in Selected Masonry and Wood-Frame Walls.
Final rept.,
S. R. Petersen. Sep 79, 138p NBSIR-79-1789
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of the Assistant Secretary for Policy Development and Research.

Keywords: *Residential buildings, *Walls, *Thermal insulation, *Cost benefit analysis, Masonry, Wood, Wallboard, Economic analysis, Insulation resistance, *Life

cycle costs, Computer aided analysis, Energy conservation.

This report provides a life-cycle cost-benefit analysis of several alternative methods for insulating 8inch(200 mm) concrete masonry walls in new single-family residences. In addition, a cost-benefit analysis for insulation in wood-frame walls is provided, consistent with the assumptions used in the masonry wall analysis. A dynamic load simulation model, NBSLD, was used to calculate the heating and cooling requirements for a 1176 square foot (110 square milimeters) house with different levels of thermal resistance for both wall types in eight geographic locations. These data are used to calculate the reduction in annual heating and cooling requirements due to several different types of insulation in the cores and furring spaces of the masonry wall and the cavities of the wood-frame wall. Economic analysis is applied to determine estimates of life-cycle savings from insulation for different locations and furnace types in order to determine the most cost-effective insulation level. In general it is found that the maximum economically justifiable level of insulation in the masonry wall is considerably lower than for the wood-frame wall because of the significantly higher cost of insulating masonry walls.

701,415
PB80-117211 Not available NTIS
National Bureau of Standards, Washington, DC.
Allulam Design Criteria for Temporary Structures.
Final rept.,
L. I. Knab, and R. C. Moody. Sep 78, 10p
Pub. in Jnl. of the Structural Division, Proceedings of the American Society of Civil Engineers 104, nST9, Proceedings Paper 14031, p1485-1494, Sep 78.

Keywords: *Buildings, *Bridges(Structures), *Construction materials, *Laminated wood, Gluing, Design criteria, Flexural strength, Stress analysis, *Temporary construction.

If temporary structures having lives of 2-5 years are designed using criteria for permanent structures with lives of 50-75 years, overly conservative designs can result. This paper presents a systematic, rational basis for developing criteria for glue laminated timber temporary bridges and buildings. Second moment reliability theory, which requires estimates of the mean and coefficient of variation of resistance and load, is used to compute measures of safety, called safety index values. These index values are computed for permanent and temporary structural elements. Allowable stresses for temporary structures are determined by choosing corresponding safety index values which will provide adequate safety relative to the safety of permanent structures, while reflecting the temporary nature of the structures. Examples of how allowable flexural stresses are developed for bridges and buildings are given.

701,416
PB80-117682 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Soil and Rock Anchors for Mobile Homes - A State-of-the-Art Report.
Building science series,
W. D. Kovacs, and F. Y. Yokel. Oct 79, 164p NBS-BSS-107
Prepared in cooperation with Purdue Univ., Lafayette, IN. Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of the Assistant Secretary for Policy Development and Research. Library of Congress catalog card no. 79-600143.

Keywords: *Residential buildings, *Trailers, *Anchors(Structures), Soil mechanics, Soil classification, Wind(Meteorology), Loads(Forces), Reviews, *Mobile homes, *Soil anchors, State of the art.

Available anchor hardware is surveyed and evaluated and pull-out capacity data are compared with hypotheses for predicting anchor pull-out capacity based on soil mechanics principles. The evidence suggests that our ability to predict anchor pull-out capacity by soil mechanics principles is inadequate, and that there is a need for the standardization of test procedures and soil classification and for further test data. Suggestions for future research are presented.

701,417
PB80-129265 MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire Research and Safety.
Final rept.,
M. A. Sherald. Nov 79, 732p NBS-SP-540
Proceedings of the Joint Panel Conference of the United States-Japan Cooperative Program in Natural Resources (3rd) Held at Gaithersburg, MD. on March 13-17, 1978.
Microfiche copies only.

Keywords: *Fire safety, *Meetings, Fire tests, Fire resistance, Flammability testing, Smokes, Fire alarm systems, Toxicity, Human behavior, *Building fires, *Smoke detectors, Fire research, Fire models.

The Third Joint Panel Meeting of the United States - Japan Panel on Natural Resources (UJNR), Fire Research and Safety consisted of in-depth technical sessions on detection and smoke properties, modeling of fire, and toxicity of fire gas. Progress reports briefly covered human behavior, building systems, and smoke control. This proceedings includes the technical papers presented at the meeting along with the ensuing discussion and the summary reports prepared by each session chairman.

701,418
PB80-138175 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Interlaboratory Evaluation of the Cyclone Settled Density Test for Cellulosic Loose Fill Insulation.
Final rept.,
J. R. Lawson. Dec 79, 21p NBSIR-79-1930
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD. Textile and Mechanical Engineering Group.

Keywords: *Thermal insulation, Cellulose, Materials tests, Density(Mass/volume), Evaluation, Tests.

The cyclone settled density test for cellulosic loose fill insulation was evaluated in an interlaboratory test program. Seven laboratories tested seven cellulosic loose fill insulations manufactured for the home insulation market. The participating laborattories were surveyed to evaluate the test apparatus and test methodology used at each location. The study indicated that there is reasonable assurance that test results on the same material obtained at one laboratory can be reproduced in one of the other laboratories.

701,419
PB80-202922 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Stone Consolidating Materials - A Status Report.
Final rept.,
J. R. Clifton. May 80, 57p NBS-TN-1118
Sponsored in part by National Park Service, Washington, DC.

Keywords: *Construction materials, *Rocks, *Consolidation, Preservatives, Durability, Deterioration, Silicates, Calcium hydroxides, Barium hydroxides, Silanes, Polymers, Acrylic resins, Acrylic copolymers, Vinyl resins, Epoxy resins, Strontium hydroxides.

Information on types of stone consolidating materials, their performances, and uses are critically reviewed. Processes responsible for the deterioration of stone and criteria for selecting stone consolidants are also reviewed. The main function of stone consolidants is to reestablish the cohesion between particles of deteriorated stone. In addition, a good consolidant should meet performance requirements concerning durability, depth of penetration, effect on stone porosity, effect on moisture transfer, compatibility with stone, and effect on appearance. Stone consolidants can be divided into four main groups, according to their chemistry. These groups are inorganic materials, alkoxysilanes, synthetic organic polymers, and waxes. Epoxies, acrylics, and alkoxysilanes are currently the most commonly used consolidating materials. Certain waxes have been found to have excellent consolidating abilities. Waxes, however, tend to soften and to accumulate grime and dust. Inorganic materials and some organic polymers have a tendency to form shallow, brittle layers near the surface of stone. These treated layers often separate from the untreated stone. Alkoxysilanes have excellent penetrabilities and are considered by some stone conservators as the most promising consolidating materials. However, a universal consolidant does not exist and many factors must be considered in selecting a consolidant for a specific stone structure.

701,420
PB80-214000 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Measurement of the Smoke Leakage of Door Assemblies during Standard Fire Exposures.
Final rept.,
L. Y. Cooper. Jun 80, 72p NBSIR-80-2004
Sponsored in part by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Buildings, *Fire tests, *Doors, *Smoke, Gas flow, Flow rate, Leakage, Fire safety, *Building fires, Smoke movement.

A basis for relating overall intrabuilding smoke migration dynamics to high temperature, door assembly smoke leakage measurements is formulated. The results of applying the tentative, high temperature, ISO test method DP 5925 Part 3, which was developed to measure smoke leakage of door assemblies during the course of a standard fire endurance test, are reported. A critical analysis reveals that the basic objective of the method is limited in its utility in the sense that fire scenarios in high-rise buildings may not be adequately simulated. Consistent with the above-mentioned experimental results, troublesome theoretical problems with the test method and its procedures are identified. These lead to a conclusion that the test method as written is generally unreliable. An alternate test concept which removes the above-mentioned DP 5925 Part 3 limitation and all of its problems is described and its development is advocated.

701,421
PB80-215320 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Approach to Improve Durability Tests for Building Materials and Components.
Final rept.,
G. Frohnsdorff, L. W. Masters, and J. W. Martin. Jul 80, 39p NBS-TN-1120

Keywords: *Buildings, *Construction materials, *Service life, Durability, Life tests, Accelerated tests, Construction industry.

Durability tests usually provide relative measures of the time building materials and components will perform their itended functions under the expected service conditions. This is not adequate to ensure the proper selection of new building materials and components because quantitative measures of long-term performance are needed. Although many tests have been developed to accelerate degradation processes of building materials, they are seldom fully adequate for reliably predicting long-term performance. In this paper, a recommended practice, ASTM E 632-78, which provides a framework for the development of improved durability tests, is outlined. The application of the recommended practice, which does not specify an analysis procedure, is illustrated by examples from the literature using both deterministic and probabilistic approaches. While probabilistic concepts have not been applied extensively to materials durability problems in the construction industry, these concepts offer new opportunities for obtaining improved quantitative predictions of the service life of building materials.

701,422
PB80-220437 PC **A03**/MF **A01**
Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
Investigation of Fire Impingement on a Horizontal Ceiling,
H. Z. You, and G. M. Faeth. Oct 79, 49p NBS-GCR-80-251
Grant NBS-7-9020

Keywords: *Buildings, *Ceilings(Architecture), *Fire tests, Heat flux, Heat transfer, Convection, Radiant heating, Fire safety, *Building fires.

This report covers the second year of a three-year study. The first year of the investigation was devoted to convective ceiling heat flux measurements. The present effort concentrated on radiative heat flux measurements and a portion of the flow structure measurements. A new experimental apparatus was constructed which allows the long term testing needed for structure measurements. This arrangement has a water-cooled ceiling, 1 m in diameter. The fire source is simulated by a 55 mm ID burner fueled with natural

gas operating at heat release rates up to 8.5 kW. Convective and radiative heat fluxes are measured with heat flux gages, mean gas temperatures were obtained with fine wire thermocouples, mean velocities and velocity fluctuations are measured with a laser Doppler anemometer, an impact probe is also used for mean velocities, and mean concentrations are measured by isokinetic gas sampling with gas chromatograph. Measurements completed to date include: flame shape, convective and radiative heat fluxes to the ceiling, radiative heat fluxes to the ambiance, mean temperatures, and mean velocities and velocity fluctuations in the plume portion of the flow.

701,423
PB80-224835 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire Performance of Loose Fill Cellulosic Insulation in Residential Occupancies - A Progress Report.
Interim rept.,
L. A. Issen. Aug 80, 53p NBSIR-80-2085
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Residential buildings, *Insulation, *Fire tests, Thermal insulation, Fire resistance, Fire safety.

The smoldering and flame spread properties of cellulosic loose fill insulation were examined as a function of retardant type, particle size, and concentration to provide a basis for the development of improved fire test methods. A series of laboratory insulations was prepared whose fire performance covered an extended range of critical radiant flux in the attic floor radiant panel test and weight loss in the cigarette smoldering test. These materials were evaluated in a recessed light fixture test in a simulated attic configuration.

701,424
PB80-600025 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Design for Better Window Performance.
S. R. Hastings, and P. Driscoll.1980,1p NBS-SP-575

Keywords: *Design elements, Energy performance of windows, Window attributes, Window design, Window design elements, Window performance.

The wall chart 'Design for Better Window Performance' describes window and other design elements and the impact of these design elements singly and in combination on window performance and building attributes. The design elements are grouped into four categories: Exterior-windbreaks, shades, coverings and sun orientation; Frame-insulating frame, opening type, weather strip and hardware; Glazing-multi-glazing, reflective glazing, plastic glazing and glass block; Interior-interior shading, interior coverings, integral lighting and interior mass. The impacts of these design elements are describes in a matrix form and address the following window and building attributes: Airtightness, Water tightness, Natural ventilation, Insulation, Solar admittance, Daylighting, Visual separation, Acoustical isolation, Safety, Access/Egress, Ease of operation, Forced entry resistance, and Durability/Maintenance. The chart is designed for ready reference during the design process.

701,425
PB80-600055 Not availabale NTIS
National Bureau of Standards, Gaithersburg, MD.
Physical Security of Sliding Glass Door Units.
T. W. Reichard, and L. K. Eliason. 1980, 14p
Pub. in NIJ-STD-0318.00.

Keywords: *Burglary resistance, Forced entry Patio door, erformance criteria, Performance standard, Sliding glass door, Test methods.

This document is a voluntary performance standard developed by the Law Enforcement Standards Laboratory. This standard establishes performance requirements and methods of test for the resistance to forced entry of sliding glass door units intended for use in residences. The capability of sliding glass door units to frustrate the 'opportunity' crimes committed by unskilled and semi-skilled burglars is addressed. The rarely used methods of gaining entry through sliding glass door units, and those used only by skilled burglars, are not addressed.

701,426
PB81-113847 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Modeling for Determination of Temperatures of Electrical Cables within Thermally Insulated Walls.
Interim rept.
D. D. Evans. Oct 80, 30p NBSIR-80-2129
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Electric wire, Wiring, Walls, Thermal insulation, Temperature, Resistance heating, Mathematical models.

Models have been developed to predict the temperature rise caused by resistive heating of a current-carrying electric cable within an insulated wall cavity, with emphasis on simplified models to minimize computation time. Predictions are compared to measurements performed on a AWG-12 2-G NM cable installed in a laboratory wall space mock-up. Results of the two-dimensional model are within 15 percent of the measured temperatures. The heat sink effect of the wood studs within the wall on the temperature rise of the section of cable passing through them is demonstrated both with experiment and calculation.

701,427
PB81-144404 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire Performance of Selected Residential Floor Constructions Under Room Burnout Conditions.
Interim rept.
J. B. Fang. Dec 80, 81p NBSIR-80-2134
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Residential buildings, *Floors, *Fire tests, Fire resistance, Joists, Construction materials, Fire resistant materials, *Room fires.

A series of seven large-scale room burnout fire tests was conducted with a set of selected residential floor-ceiling assemblies to provide data on the performance of the assemblies; these will be compared with the results in future tests on the same constructions in a fire endurance furnace. Four wood-frame and three light gage steel-frame, load-bearing assemblies, each measuring 3.7 x 3.7 m in size, were exposed from the underside to a fire environment produced from the burning of typical furniture and interior finish materials in a room. The fire resistance periods based on flame-through of floor assembly and structural failure of floor joists varied from 10 to 12 minutes for floors with unprotected wood joists and was 4 minutes or less for floors with unprotected steel joists. The addition of a 12.7 mm thick gypsum board ceiling as a protective layer increased the fire resistance time of the steel joisted floor assembly approximately 12 minutes.

701,428
PB81-145690 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Evaluation of Electrical Connections for Branch Circuit Wiring.
Building Science Series (Final).
W. J. Meese, and R. W. Beausoliel. Nov 80, 71p NBS-BSS-128
Library of Congress catalog card no. 80-600169.
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research, Washington, DC.

Keywords: *Electric connectors, *Wiring, *Safety, Performance tests, Performance evaluation, Residential buildings.

Performance criteria and test procedures are presented for the evaluation of electrical connections in branch circuit wiring. Investigations and research undertaken to determine needed characteristics of innovative electrical connections are summarized. Design and installation strategies to lessen the chances of electrical connection failures are discussed. Inherent weaknesses are described for design and installation methods of common types of branch circuit wiring connections or terminations, which appear to make them vulnerable to loosening and overheating. There are technology improvements which demonstrate that innovative electrical connections can be developed which may be less costly when installed, and have less chance of becoming hazardous, than common conventional connections.

701,429
PB81-145781 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Calculated Operating Temperatures of Thermally Insulated Electric Cables.
Final rept.
D. D. Evans. Jan 81, 41p NBS-TN-1133
Sponsored in part by Consumer Product Safety Commission, Washington, DC.

Keywords: *Fire safety, *Electric wire, Wiring, Thermal insulation, Electrical insulation, Temperature, Computation, Buildings.

Steady-state operating temperatures of current-carrying electric cables buried axially in cylinders of thermal insulation were calculated. Combinations of six types of nonmetallic electric cable, two thermal insulation materials, five thermal insulation thicknesses and a range of currents both greater and less than the typical rated service currents for the cables were studied. These calculations show that thermally insulated electric cables carrying the rated current may exceed the rated operating temperature limit for common cable jacket materials.

701,430
PB81-172512 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Electrical Aspects of the CSA/NBS Weatherization Study.
M. P. Vaishnav. Jan 81, 53p NBSIR-81-2203
Sponsored in part by Consumer Product Safety Commission, Washington, DC.

Keywords: *Wiring, *Houses, *Safety, Electric wire, Surveys, Thermal insulation, Hazards.

Results of a study to determine the present condition of the electrical wiring system in existing houses at ten sites across the country are presented in this report. The aim of the investigation was to develop information to assess the potential safety impact that the addition of thermal insulation to residential structures could have on their electrical systems. A previous study indicated the nature of some of the technical problems found in selected homes as identified by the residents and by inspectors having no formal training in electrical inspections. The present study is based on the evaluation of electrical problems in 157 houses by technically qualified persons.

701,431
PB81-175994 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Cooling of Bitumen During Construction of Built-Up Roofing Systems, A Mathematical Model.
Final rept.
W. J. Rossiter, R. G. Mathey, H. W. Busching, and W. C. Cullen. Mar 81, 79p NBS-TN-1135
Prepared in cooperation with Clemson Univ., SC. Dept. of Civil Engineering.

Keywords: *Roofing, *Bitumens, Mathematical models, Computer programs, Cooling, Heat transfer, Finite difference theory.

This report describes a mathematical model based on finite-difference equations for calculating transient heat flow to estimate the cooling time of hot roofing bitumen. Estimates of the time required for hot bitumen to cool from its application temperature to 300F (149C) were computed as a function of material and environmental factors including: quantity of applied bitumen, bitumen application or contact temperature, air temperature, wind speed, and thermal properties of the bitumen and of the roofing components. The model was used to predict cooling times expected for hot asphalt applied to typical substrates with thermal properties representative of those of polyurethane foam and glass fiber insulation boards, insulating concrete, plywood, concrete and steel decks, and roofing felt on decks or insulations. In addition, the model was used to predict cooling times for hot coal tar pitch applied to concrete and to felt adhered to glass fiber insulation.

701,432
PB81-179178 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.

Review of Measurements, Calculations and Specifications of Air Leakage Through Interior Door Assemblies,
D. Gross. Feb 81, 24p NBSIR-81-2214

Keywords: *Doors, *Fire safety, Air flow, Leakage, Fire doors, Buildings, Smoke, Measurement, Computation.

A review was made of measurements and calculations of air leakage through door assemblies in order to evaluate their effectiveness as barriers to smoke flow. It was noted that typical fire doors are not capable of meeting proposed limitations of air leakage at ambient temperatures and that significant air leakage may also occur through interior walls. It was concluded that first priority should be given to developing and validating a standardized test method for air leakage measurements.

701,433
PB81-179657 PC **A09**/MF **A01**
Portland Cement Association, Skokie, IL.
Simulation of Realistic Thermal Restraint During Fire Tests of Floor and Roof Assemblies.
Final rept.
T. D. Lin, and M. S. Abrams. Mar 81, 178p NBS-GCR-81-317
Grant NBS-4-9011

Keywords: *Floors, *Roofs, *Fire tests, Concrete slabs, Heat transmission, Stress analysis, Reinforced concrete, Thermal expansion, Temperature distribution, Computerized simulation, *Building fires, Computer aided analysis.

A five phase program was conducted to simulate and measure the thermal restraint of concrete floor and roof slabs during standard fire exposure tests. Phase I involved measuring temperature distributions, expansions and deflections of small size slabs. In Phases II and III, computer programs for heat flow calculations and stress analysis were developed. Six 14 x 18 ft floor slabs were tested for 4-hr. durations, during which expansions in both directions were controlled to follow computed time-expansion relationships. Differences were noted and are probably associated with creep strains not considered in the computer model. Four more large slabs were fire tested in Phases IV and V. Expansions and restraining forces were measured in tests with and without compressible pads. Reasonable agreement was obtained and it is therefore possible to use fixed frame furnaces to simulate realistic thermal restraints in fire tests of floor slabs. No spalling or structural damage was observed during any of the tests.

701,434
PB81-181851 PC **A04**/MF **A01**
California Inst. of Tech., Pasadena.
Entrainment in Fire Plumes.
E. E. Zukoski, T. Kubota, and B. Cetegen. Nov 80, 53p NBS-GCR-80-294
Grant NBS-G8-9014

Keywords: *Buildings, *Fires, *Flame propagation, Mass flow, Flow rate, Air entrainment, Diffusion flames, Plumes, Building fires.

A new technique for measurement of mass flow rates in buoyant fire plumes is described. The characteristics of 10 to 200 kw methane diffusion flames stabilized on porous-bed burners of 0.10 - 0.50m diameter are described. A transition in the dependence of flame height on heat input and burner size was observed when the flame height was about four times the burner diameter. The mass flow rates in the buoyant plumes produced by the fires were measured for a range of elevations starting just below the time-averaged top of the flame and extending to six times this flame height. The mass flow rates in this region of the plume were correlated by the use of a simple plume model. Atmospheric and forced disturbances in the air being entrained increased the entrainment rate of the plume.

701,435
PB81-196396 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Technical Support for the Consumer Product Safety Commission 1979 Interim Standards for Cellulose Insulation.
Final rept.
D. D. Evans, and S. Davis. Mar 81, 54p NBSIR-81-2213
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Residential buildings, *Thermal insulation, *Cellulose, *Fire tests, Flame propagation, Fire resistant materials, Flux(Rate), Heat flux, Fire safety, *Attic fires, *Flame spread, Smoldering tests, NTISCOMNBS, NTISCPSC.

The attic floor radiant panel test (AFRPT) and smoldering combustion test are two fire performance tests required by the Consumer Product Safety Commission (CPSC) as part of a mandatory standard for loose fill cellulosic home insulation. In providing technical support to CPSC, the sensitivity to variations in parameters of each test method were studied. Specimen density was found to have no effect on critical radiant flux values when measured with the AFRPT for two paper-based cellulosic insulations tested at densities below 48 kg/cubic meters. A low flux exposure profile, ranging from 0.04 to 0.35 W/square centimeters, was developed to extend the range of the AFRPT about the region of greatest interest. The critical radiant flux measured using the low flux profile was found to be sensitive to changes in preheat time from the prescribed two minute specimen preheat. Large-scale attic fire tests verified the predictive ability of AFRPT measurements. Results from the smoldering combustion test were shown to be sensitive to test room humidity conditions over the range of 39 to 84 percent RH.

701,436
PB81-197006 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Effects of Thermal Insulations on Electrical Connections and Outlet Boxes.
Final rept.
R. W. Beausoliel, J. R. Clifton, and W. J. Meese. Apr 81, 53p NBSIR-81-2220
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Thermal insulation, Residential buildings, Walls, Urea formaldehyde resins, Cellulose, Evaluation, Electric connectors, Electric outlets, Switchgear, Corrosion, Hazards, Wiring, Electric wire, Tests, Electrical shock, Safety, NTISCOMNBS, NTISDE.

When residential walls are retrofitted with foamed-in urea formaldehyde or blown-in cellulose thermal insulations, the insulation may enter electrical outlet and switch boxes. The effects of these thermal insulations on the durability of electrical components were studied. These studies were carried out at 44, 75, and 96 percent relative humidities with test periods between one and twelve months. Laboratory test methods were developed and tests performed to determine the electrical and corrosive effects of urea formaldehyde and cellulose thermal insulation contained in electrical outlet and switch boxes.

701,437
PB81-205288 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire Tests of Stairwell-Sprinkler Systems.
Final rept.
L. Y. Cooper, and J. G. O'Neill. Apr 81, 84p NBSIR-81-2202
Sponsored in part by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Buildings, *Stairways, *Fire tests, Sprinkler systems, Evaporative cooling, Spray nozzels, Flame propagation, Fire extinguishing agents, Fire safety, NTISCOMNOA, NTISHEWOSH.

The effect of water curtain or spray nozzel fire protection of an open stairwell was studied experimentally. The experimental setup includes a three story stairtower with a contiguous first story burn room. The instrumentation used to measure the flow phenomenology resulting from fire sizes up to 4MW/(13.6 million BTU/hr.) with and without sprinkler operation is described. A model of evaporation cooling of the hot fire gases as they pass up through the first to second floor stairwell-sprinkler system component is introduced. Based on this model the data are analyzed and correlated for the purpose of identifying both a cooling and a water usage efficiency for each of the system components that were tested. Application of these measured performance characteristics and their extension to stairwell-sprinkler components of different geometries and configurations are discussed.

701,438
PB81-215774 Not available NTIS
National Bureau of Standards, Washington, DC.
Approach to Modeling Wall Fire Spread in a Room.
Final rept.
J. G. Quintiere. 1981, 14p
Pub. in Fire Saf. J. 3, p201-214 1981.

Keywords: *Buildings, *Walls, *Fires, Flame propagation, Fire tests, Construction materials, Burning rate, *Fire spread, *Room fires, NTISCOMNBS.

An attempt is made to develop a framework for modeling wall fire spread in a room. The zone methodology for treating developing room fires is used, and its characteristic layer equations are discussed. A review was made of studies on the rate of burning and spread on vertical surfaces. Both of these phenomena are shown to depend on the incident radiative heat flux and the local oxygen concentration. Functional expressions are suggested, and a strategy is presented for incorporating these component analyses into a wall flame spread model. The goal of this model would be to assess the risk of rapid fire growth (flashover) relative to wall property data found through fundamental principles and through empirical fire test methods.

701,439
PB81-216988 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Survey of United States Research Projects Publications in the Field of Fire Safety of Buildings and Structures.
R. S. Levine. Jun 81, 45p NBSIR-81-2294

Keywords: *Fire safety, *Bibliographies, Flamrnability testing, Fire resistance, Flame propagation, Fire detection systems, Fire resistant coatings, Fire tests, Human behavior, *Building fires, *Fire spread, NTISCOMNBS.

This report is an annotated bibliography of some 166 U.S. papers on fire safety research, published 1978-1980. Prepared as part of a US-USSR agreement to cooperate in this field, it includes chapters on testing materials for flammability, smoke generation and toxicity, fire resistance of structures, compartment fire modeling, automatic detection and suppression, and human response in fires.

701,440
PB81-238487 PC **A03**/MF **A01**
SRI International, Menlo Park, CA.
Effect of Fire Retardants on the Heat-Release Rate of Building Materials.
Interim rept. 1 Oct 78-30 Jun 80.
S. B. Martin, and L. B. Inman. Jul 81, 40p NBS/GCR-81-329
Contract EO-A01-78-3559

Keywords: *Buildings, *Construction materials, *Flammability testing, Fire resistant materials, Cellulose, Thermal radiation, Heat measurement, Calorimeters, Fire tests.

A method was developed for making up thick cellulosic specimens with thermocouples implanted at various depths to determine the time dependent temperature profiles when exposed to external radiant fluxes. Specimens of alpha cellulose, both untreated and treated with 2 percent by weight of Na2B4O7, were exposed to an applied radiant flux of 3.7 W/square centimeters in the SRI heat release rate calorimeter in order to examine the effect of the fire retardants on the heat release rate. The results on a limited number of tests suggest that the char enhancement, produced by the presence of Na2B4O7, reduces the heat release rate mainly by the reduction of the caloric value of the volatile products rather than by the insulating effect of the increased char layer thickness.

701,441
PB81-238495 PC **A03**/MF **A01**
Underwriters' Labs., Inc., Northbrook, IL.
Measurement of Air Flow Around Doors Under Standardized Fire Test Conditions.
Report for Jun 78-Jan 79.
R. M. Berhinig. Jul 81, 43p NBS/GCR-81-330
Grant NBS-G8-9010

Keywords: *Fire doors, *Air flow, *Fire tests, Test equipment, Gas furnaces, Calibration, Flow measurement, Leakage.

Fire tests were conducted to obtain data for evaluating the reproducibility and accuracy of a test method being proposed by the International Standards Organization.

The proposed test method is intended to provide for measurement of the air flow through fire door assemblies during a standardized fire exposure test. The furnace used to conduct the fire tests was the vertical panel furnace of Underwriters Laboratories, Inc. The furnace is ordinarily used to conduct tests in accordance with ASTM E 152 (UL 10B), Fire Test of Door Assemblies. The fire door assembly tested consisted of a nominal 3 by 7 ft. flush-type, hollow metal door attached to a steel frame mounted in a brick masonry wall. During the tests, measurements were made of the air flow through the fire door assemblies, the deflection of the door assemblies and the temperature and pressure conditions within the furnace and test assemblies.

701,442
PB81-239634 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Precision Measurements on Fibrous Glass Insulation.
B. Branthover, R. Veale, and C. Siu. Nov 80, 37p
NBSIR-80-2091

Keywords: *Thermal insulation, Glass fibers, Dimensional measurement, Thickness, Thermal resistance, Standard reference materials.

This paper is concerned with the technique in measuring the thickness of low density fibrous glass materials. The new method of measurement described provides a higher degree of accuracy than previously accomplished. The new procedure determined a specific force to be used for measuring. Also, a stacking technique was carried out to see what effect placing a number of test samples on top of each other would be. The results of the entire testing will aid in the development of a standard reference material to be used for thermal resistance measurement systems.

701,443
PB81-240210 Not available NTIS
National Bureau of Standards, Washington, DC.
Selecting Optimal Product Sizes.
Final rept.
D. R. Shier. 1980, 13p
Pub. in Jnl. of Undergraduate Math. Appl. 1, n4 p19-31 1980.

Keywords: *Product development, *Size determination, *Construction materials, Standards, Optimization, Structural design, Construction industry.

The article describes a practical problem that arises when only some of the possible sizes for an industrial product are to be stocked, and demands for unstocked sizes are met by using a larger stocked size (subsequently cut to the smaller desired size). The study was undertaken as the result of suggestions of the possibility of simplifying and rationalizing the enormous array of standard sizes for products within the building industry. Mathematical models can be identified that capture certain essential features of this problem, and associated solution methods can be developed as well. However, such models are not equally desirable in terms of their range of applicability and computational feasibility. The pitfalls and potentials of two particular approaches to selecting optimal sizes are illustrated here.

701,444
PB82-107046 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Smoldering Combustion Hazards of Thermal Insulation Materials.
Interim rept. 1 Oct 79-30 Apr 81.
T. J. Ohlemiller. Aug 81, 69p NBSIR-81-2350
Sponsored in part by Oak Ridge National Lab., TN.
See also ORNL-SUB-7686-1.

Keywords: *Buildings, *Thermal insulation, *Combustion, Flammability testing, Fire hazards, Flame propagation.

The smoldering combustion hazards of cellulosic loose fill insulation materials fall into three categories: smolder initiation, smolder propagation and transition from smoldering into flaming. The previous findings on the initiation problem are summarized briefly. They serve as the basis for recommendations on an improved smolder ignition test method which is designed to give ignition temperatures comparable to those in practice. The proposed test method requires checking against full-scale mock-up results before it can be considered for implementation. Smolder propagation, driven by buoyant convection, through a thick (18 cm) layer of cellulosic insulation has been extensively examined. A heavy (25% add-on) loading of boric acid cuts the propagation rate in half (from approx. 0.3 to 0.15 cm/min) but does not come close to stopping this process. Analysis of experimental profiles for temperature, oxygen level and remaining organic fraction strongly indicate that the smolder wave is oxygen-supply controlled and that it involves both first and second stages of oxidative heat release from the insulation material. The balance of involvement of the two stages varies with depth in the layer. It appears that efforts to develop improved means of suppressing smolder propagation must be directed at the entire oxidation process. However, since boric acid is fairly effective at slowing the second stage of oxidation, most new efforts should be aimed at the first stage of oxidation (which also is responsible for smolder initiation).

701,445
PB82-112384 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Radon Transport Through and Exhalation from Building Materials: A Review and Assessment.
Interim rept.
R. Colle, R. J. Rubin, L. I. Knab, and J. M. R. Hutchinson. Sep 81, 107p NBS-TN-1139
Sponsored in part by Office of Radiation Programs, Washington, DC.

Keywords: *Buildings, *Construction materials, *Radon, *Transport properties, Gas sampling, Flux density, Fluid flow, Concrete, Permeability.

This report was prepared, at the request of the U.S. Environmental Protection Agency, for the purpose of reviewing, assessing, and summarizing what is currently known about radon transport through and exhalation from building materials. In four chapters, the report (1) considers the routes of entry of radon into buildings, describes the basic models for radon transport through building materials, critically reviews the small number of existing values for the necessary transport coefficients, and summarizes the solutions of both steady-state and time-dependent transport cases; (2) reviews and considers how the microstructural properties and internal characteristics of building materials may affect the transport and exhalation of radon; (3) considers the exhalation process from a more macroscopic, phenomenological viewpoint, and summarizes selected experimental data on radium concentrations in building materials, radon flux and exhalation from soils and building materials, and the effects of meteorological variables on radon exhalation; and (4) reviews and assesses various measurement methodologies that are used for laboratory and in situ studies of radon transport and exhalation. Needs for further research in each area are also recommended.

701,446
PB82-112475 Not available NTIS
National Bureau of Standards, Washington, DC.
Simplified Theory for Generalizing Results from a Radiant Panel Rate of Flame Spread Apparatus.
Final rept.
J. Quintiere. 1981, 9p
Pub. in Fire and Materials 5, n2 p52-60 1981.

Keywords: *Fire tests, *Walls, *Flame propagation, Radiant heating, Flux(Rate), Ignition temperature, Reprints, *Flame spread.

Experimental results on the rate of lateral flame spread and time for piloted ignition under an externally imposed radiant flux were analyzed with a simple theoretical model. The data were developed from a radiant panel apparatus that considers a wall mounted sample with a flux distribution (q(e)) of 5 W cm to the minus 2 at the ignited end to 0.2 W cm to the minus 2 at the other end.

701,447
PB82-117698 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Fire Testing of Roof-Mounted Solar Collectors by ASTM E 108.
W. D. Walton, and D. Waksman. Aug 81, 75p
NBSIR-81-2344
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Buildings, *Solar energy concentrators, *Roofs, *Fire tests, Building codes, Flammability testing, Flame propagation, Fire resistance.

A study was undertaken to investigate the use of ASTM E 108 (NFPA 256, UL 790), Fire Tests of Roof Coverings, for testing roof-mounted solar energy collectors. The ASTM E 108 test method is commonly referenced in building codes as the procedure for determining the fire characteristics of roof coverings. To date, no data have been available regarding the influence of solar collectors on the fire characteristics of roof coverings or on collectors used as roof coverings. This study focused primarily on class C intermittent flame, spread of flame, and burning brand tests, although several class A and B burning brand tests were conducted. The collectors studied were commercially available and constructed with a broad variety of glazing, casing, and insulation materials representative of those commonly in use. The collectors were tested on sloped, asphalt shingled roofs with three types of mountings: integrally as the roof, directly on the roof covering, and on standoffs above the roof covering. Data are presented showing the results of the testing conducted. An evaluation of the testing procedures as they apply to roof-mounted solar collectors is given.

701,448
PB82-127762 Not available NTIS
National Bureau of Standards, Washington, DC.
Smoke Filling in an Enclosure.
Final rept.
G. Mulholland, T. Handa, O. Sugawa, and H. Yamamoto. 1981, 13p
Pub. in Proceedings of Joint ASME/AIChE National Heat Transfer Conference (20th), Milwaukee, Wisconsin, August 2-5, 1981, Paper 81-HT-8, p1-13 1981.

Keywords: *Fire tests, *Smoke, Flame propagation, Diffusion flames, Heat loss, *Room fires, *Smoke movement, *Fire research.

The filling of an enclosure by smoke generated by a diffusion flame was studied by measuring the smoke extinction coefficient and temperature versus height during the filling process. An operational definition of the smoke front passage time is given and is shown to be useful in correlating experimental results. Semi-quantitative agreement is found between the Baines-Turner theory and experiments with propane and acetylene fuels with heat fluxes over the range 11 to 32 kW. Smoke leakage near the floor of the enclosure and flow down the cool walls result in more rapid smoke filling than is predicted. Also, the filling process was found to be about 50% faster when the burner was moved off center. A thin smoke layer was found to broaden as it moved down suggesting either an effective diffusion from the layer or an enhanced oscillatory motion of the layer as it moves down. The temperature and smoke concentration profiles were found to have different shapes in part as a result of a large heat loss affecting the temperature profile. Approximately 80% of the total heat generated by combustion was lost to the ceiling and walls. The long time smoke concentration profile was qualitatively different from the Baines-Turner result for the asymptotic profile. It was found that the conversion ratio of fuel to particulate is a non-linear function of fuel flow rate and that the shape of the curve is sigmoidal, which appears to be a common characteristic of sooting systems.

701,449
PB82-127788 Not available NTIS
National Bureau of Standards, Washington, DC.
Estimating Room Temperatures and the Likelihood of Flashover Using Fire Test Data Correlations.
Final rept.
B. J. McCaffrey, J. G. Quintiere, and M. F. Harkleroad. May 81, 22p
Pub. in Fire Technology 17, n2 p98-119 May 81.

Keywords: *Fire tests, Temperature, Ventilation, Flame propagation, *Room fires, *Flashover, Fire research.

A simple procedure is presented for estimating room temperature and the likelihood of the occurrence of flashover in an enclosure. Upper room gas temperature from many fire test data sources is correlated with fire size, door opening, geometry and thermal properties of the enclosure. A cross plot of the data is then made at a prescribed hazardous temperature level yielding the flashover criteria. The fire safety engineer can use these results for quantitiative estimations of the effects of building design and fire load, for example, on the tendency for flashover as defined by a temperature limit.

701,450
PB82-128331 Not available NTIS
National Bureau of Standards, Washington, DC.
Brief Status Report on NBS/CFR Sprinkler System Projects.
Final rept.
J. G. O'Neill. Jun 78, 12p
Pub. in Proceedings of Conference on Low Cost Residential Sprinkler System, Baltimore, Maryland, November 29-30, 1977, p1-12 Jun 78.

Keywords: *Fire detection systems, *Sprinkler systems, Stairways, Fire protection, Structural design, Carbon monoxide, *Health care facilities, Fire research.

NBS/CFR, Program for Fire Detection and Control Systems is presently engaged in two major sprinkler research projects. One is a study of automatic sprinklers in health care facilities and, the other is a study of sprinkler and spray methods for protection of open or partially open stairways. The purpose of the first project is to determine engineering design parameters for automatic sprinklers in health care facilities. The impact of sprinklers is being measured against overall fire control, lead times necessary for evacuation and tenability conditions necessary for patients who must remain. Preliminary results from seven tests including smoke obscuration and carbon monoxide levels after sprinkler operation are presented. The results indicate that the presence of a privacy curtain between the patient's bed and the sprinkler delayed fire extinguishment and, subsequently, carbon monoxide levels were significantly higher. The purpose of the second project is to develop alternative engineering design parameters for protection of open or partially open stairways by incorporating sprinkler or sprinkler-vent systems. A description of the test facility and an outline of the test plan are provided. Experimental work is scheduled to begin in early 1978.

701,451
PB82-130261 Not available NTIS
National Bureau of Standards, Washington, DC.
Experimental Study of Upper Hot Layer Stratification in Full-Scale Multiroom Fire Scenarios.
Final rept.
L. Y. Cooper, M. Harkleroad, J. Quintiere, and W. Rinkinen. 1981, 12p
Pub. in Proceedings of Joint ASME/AIChE National Heat Transfer Conference (20th), Milwaukee, Wisconsin, August 2-5, 1981, Paper 81-HT-9, p1-2 1981.

Keywords: *Buildings, *Fire tests, Smoke, Stratification, Propagation, *Room fires.

This paper describes an experimental study of the dynamics of smoke filling in realistic, full-scale, multiroom fire scenarios. The test space involved 2 to 3 rooms, connected by open doorways. During, the course of the study these were partitioned to yield four different configurations ranging in total plan area from 40.6 square meters to 89.6 square meters. One of the rooms was a burn room containing a methane burner which produced either a constant energy release rate of 25, 100, or 225 kW or a time-varying energy release rate which increased linearly with time from zero at ignition to 300 kW in 10 minutes. An artificial smoke source near the ceiling of the burn room provided a means for visualizing the descent of the hot layer and the dynamics of the smoke filling process in the various spaces. In addition to visual data, recorded on videotape, the development of the hot stratified layers in the various spaces was monitored by vertical arrays of thermocouples and photometers. A layer interface was identified from these data, and its position as a function of time was determined. An analysis and discussion of these results are presented.

701,452
PB82-130279 Not available NTIS
National Bureau of Standards, Washington, DC.
Heat Transfer from a Buoyant Plume to an Unconfined Ceiling.
Final rept.
L. Y. Cooper. 1981, 9p
Pub. in Proceedings of Joint ASME/AIChE National Heat Transfer Conference (20th), Milwaukee, Wisconsin, August 2-5, 1981, Paper 81-HT-7, p1-9 1981.

Keywords: *Ceilings(Architecture), *Fires, Heat transfer, Flame propagation, Plumes.

The heat transfer to confined ceilings during enclosure fires is related to the heat transfer to unconfined ceiling surfaces from buoyant plume driven ceiling jets. This paper briefly discusses this relationship, and then focuses attention on the unconfined ceiling problem. Previously published theoretical and experimental studies dealing with interactions of unheated free jets and solid surfaces as well as literature which focuses directly on fire plume - unconfined ceiling interactions are brought to bear on the problem. A critical review of all of this literature results in easily applicable formulae for estimating the heat transfer in question.

701,453
PB82-130428 PC **A06**/MF **A01**
Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
Investigation of Fire Impingement on a Horizontal Ceiling,
H. Z. You, and G. M. Faeth. Oct 78, 113p NBS/GCR-79-188
Grant NBS-7-9020
See also report for Oct 79, PB80-220437.

Keywords: *Buildings, *Ceilings(Architecture), *Fire tests, Heat flux, Heat transfer, Convection, Radiant heating, Fire safety, *Building fires, *Room fires.

This report discusses research completed under NBS Grant No. 7-9020, during the period September 1, 1977 to August 31, 1978. The investigation considers the processes which occur when a turbulent fire impinges upon a horizontal ceiling. Measurements were conducted to determine free flame heights, impinging flame lengths along the ceiling, ceiling heat fluxes and mean temperature distributions in the flow. Both unconfined and confined ceilings were considered. Theoretical analysis was completed in order to suggest simple methods for correlating the data. The fire source was simulated by burning wicks soaked with liquid fuel (methanol, ethanol, 1-propanol and n-pentane). The range of test variables involved ceiling diameters of 610-660 mm, ceiling heights of 58-940 mm, wick diameters of 10-107 mm and curtain wall heights (for confined ceilings) as large as the ceiling height.

701,454
PB82-131459 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Annual Conference on Fire Research (5th).
Final rept.
S. M. Cherry. Oct 81, 188p NBSIR-81-2382
See also report dated Dec 80, PB81-158305.

Keywords: *Fire safety, *Meetings, Fire hazards, Fire protection, Mathematical models, Aircraft fires, Flame propagation, Human behavior, Smoke, Combustion products, Toxicity, *Fire research, *Room fires, *Fire models.

This report contains extended abstracts of grants and contracts for fire research sponsored by the Center for Fire Research, National Bureau of Standards, as well as descriptions of the internal programs of the Center for Fire Research.

701,455
PB82-136466 PC **A04**/MF **A01**
California Inst. of Tech., Pasadena. Guggenheim Jet Propulsion Center.
Entrainment in the Near Field of a Fire Plume.
Final rept. 1 Jul 80-30 Jun 81.
E. E. Zukoski, T. Kubota, and B. Cetegen. Nov 81, 68p NBS-GCR-81-346
Grant NBS-G8-9014

Keywords: *Flames, *Entrainment, Flame propagation, Fire tests, Plumes, Mathematical models, Turbulence.

This report concerns entrainment measurements made in the near field of a fire plume. The flame geometry and entrainment rates of 10-80 kW methane diffusion flames stabilized on 0.1, 0.19 and 0.5 m. dia. porous bed burners are described. Flame heights based on high speed photographs are presented and correlations are developed for several characteristics of the flame geometry. The entrainment process in a fire plume was found to occur in three distinct modes: a laminar flame, in the zone close to the burner surface; a turbulent flame, at larger heights; and a turbulent plume, in the region above the visible flame. A simple model based on these three processes is proposed and compared with entrainment measurements.

701,456
PB82-139486 PC **A09**/MF **A01**
Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
Documentation for CFC V, the Fifth Harvard Computer Fire Code.
H. E. Mitler, and H. W. Emmons. Oct 81, 189p NBS-GCR-81-344
Grant NBS-G7-9011

Keywords: *Fires, *Computer programming, Mathematical models, Subroutines, Fortran, User needs, CFC V computer program, Fortran 4 programming language, Fire research.

This is a complete documentation of the fifth version of the Computer Fire Code (Mark 5). Mark 5 is of course a substantial improvement over Mark 4, which in turn had expanded and generalized Mark 3, etc. Although imposingly thick, this document has been written in a form which may be easily read, as each section begins with a brief outline of that section. The details are then given in the following paragraphs, for the interested reader. The Computer Fire Code permits the calculation of the evolution of a fire in an enclosure with a number of vents, and containing a number of objects (flammable or otherwise). The fire may be of several kinds, and the calculation will proceed for whatever time the user selects. Suggestions for the improvement of the program itself or of this document will be gratefully received. The tape containing the program itself is available at cost.

701,457
PB82-139999 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Furnace Pressure Probe Investigation.
J. S. Steel. Dec 81, 30p NBSIR-81-2415

Keywords: *Fire tests, *Furnaces, *Pressure sensors, Pressure measurement, Probes, Static pressure.

Several pressure probes of types used in fire endurance furnaces were tested at room temperature and compared in a furnace. It is suggested that total pressure be measured instead of static pressure and that the most accurate probe is a small flush hole in the specimen.

701,458
PB82-140252 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Field Measurement of Branch Circuit Wire Temperatures.
T. K. Faison. Oct 81, 45p NBSIR-81-2347
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Electric wire, *Wiring, *Residential buildings, Temperature measurement, Thermal insulation, Hazards.

The National Bureau of Standards (NBS), under the sponsorship of the U.S. Department of Energy (DOE), planned and conducted a program to monitor temperature excursions of residential branch circuit wiring under field conditions. This program was conducted to develop a field data base needed to determine the prevailing conditions in the field and to respond to various assertions that the encapsulation of branch circuit wiring within thermal insulation is a potential hazard. It has been demonstrated through previous laboratory investigations that buried wires, when operated continuously at rated ampacity, will exceed the thermal limit established by the National Electrical Code (NEC). Approximately 2,800 circuits in 667 residences were monitored through a volunteer program with the utilities. The results of the study show that slightly more than one-third of the circuits monitored operated at or above the thermal limit established by the NEC, 60C (140F). Thermal distributions are shown for variables such as: region, season, and age.

701,459
PB82-142076 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Reduced-Scale Modeling of Mobile Home Fires: A Progress Report.
Interim rept.
D. P. Klein. Dec 81, 66p NBSIR-81-2333
Sponsored in part by Department of Housing and Urban Development, Washington, DC.

Keywords: *Residential buildings, *Trailers, *Fire tests, Construction materials, Combustion, Flammabil-

ity, Fire safety, Models, *Mobile homes, *Flashover, Room fires.

A series of fire tests was conducted in the bedroom of a single-wide mobile home and in a quarter-scale model of that bedroom. The objectives of the tests were to evaluate the relationship between fire buildup in the reduced-scale and full-scale enclosures and to determine the feasibility of using a reduced-scale model test to assess the potential contribution of particular combinations of interior finish materials to fire growth in a mobile home. The model tests simulated the phenomena of fire growth and flashover; however, the time to flashover occurred later in the model than in the full-scale bedroom. Flashover was taken as the time at which the level of radiation at the center of the floor reached 2 W/square centimeter. Several modifications to the model were examined but none adequately corrected the time delay to flashover. However, by monitoring the upper air temperature in the model, the occurrence or nonoccurrence of flashover for corresponding full-scale tests could be reliably predicted. Therefore, the use of a quarter-scale model was judged to be feasible.

701,460
PB82-155151 Not available NTIS
National Bureau of Standards, Washington, DC.
Future of Fire Protection Engineering.
Final rept.
I. A. Benjamin. 1981, 7p
Prepared in cooperation with Illinois Inst. of Tech., Chicago. Dept. of Fire Protection and Safety Engineering.
Pub. in Proceedings of Ann. Fire Protection Seminar Held at Illinois Inst. of Tech., Chicago, Illinois on March 14, 1981, 7p 1981.

Keywords: *Fire protection, *History, Reviews, Building codes, Fire extinguishers, Sprinkler systems.

The report reviews the history and changes in fire protection engineering over the last 30 years and discusses areas where major changes will be occurring in the future in the profession.

701,461
PB82-155235 Not available NTIS
National Bureau of Standards, Washington, DC.
Model to Predict the Conditions in a Room Subject to Crib Fires.
Final rept.
J. Quintiere, K. Steckler, and B. McCaffrey. 1981, 12p
Pub. in Proceedings of Specialists Meeting Int. Combustion Inst. (1st), Held in Talence, France on July 20-24, 1981 12p 1981.

Keywords: *Buildings, *Fires, Burning rate, Flame propagation, Mass flow, Flow rate, Mathematical models, Reprints, *Room fires, Fire spread.

A model is formulated and executed to predict the burning conditions of a crib fire in a room. The results are compared to data for wood or plastic crib fires. Selected results are presented on rate of mass loss, temperatures, concentrations, and mass flow rates. Both transient and peak fire conditions are reported. The overall accuracy of the model can be assessed.

701,462
PB82-165838 PC **A05**/MF **A01**
Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
Investigation of Fire Impingement on a Horizonal Ceiling,
H. Z. You, and G. M. Faeth. Dec 81, 84p NBS/GCR-81/304
Grant NBS-7-9020

Keywords: *Ceilings(Architecture), *Fires, Flame propagation, Heat transfer, Turbulence, Heat flux, Mathematical models, Fire hazards, *Building fires, Fire models.

The structure and heat transfer properties of fires and fire plumes impinging on a horizontal ceiling were investigated. Profiles of mean velocity, temperature, composition and mixture fraction were measured. Turbulence quantities were also measured in the plume, including longitudinal fluctuations and Reynolds stress. Other measurements were as follows: convective and radiative heat fluxes to the ceiling, radiative heat flux to the surroundings, and flame shape. The measurements were compared with predictions of both differential and integral models. A k-e-g differential model was examined for the plume portion of the flow. This model was originally developed for forced combusting flows and while it includes buoyancy affects in the mean equations, the effect of buoyancy on turbulence quantities is ignored. The prediction of radiation was simplified, in order to avoid complications due to the presence of soot, by either neglecting radiative heat losses entirely or by assuming that a fixed fraction, 20%, of the energy released by combustion was lost due to radiation. Integral models were developed for both the plume and ceiling jet portions of the flow. Computational convenience was emphasized during the construction of these models; therefore, 'top-hat' profiles a flow entrainment expression, and a mixing-controlled combustion model are assumed.

701,463
PB82-183732 PC **A05**/MF **A01**
TRW, Inc., Redondo Beach, CA.
Towards Wind-Aided Flame Spread Along a Horizontal Charring Slab: The Steady-Flow Problem.
Final rept.
G. Carrier, F. Fendell, and S. Fink. Feb 82, 88p NBS/GCR-82-377
Contract NB80-NADA-1065

Keywords: *Buildings, *Ceilings, *Fire tests, Flame propagation, Heat transfer, Wind(Meteorology), Transport properties, Combustion, Charring, *Room fires.

The spread of fire across the ceiling of a large room (or long corridor) in a structure is modeled as wind-aided flame spread along a horizontal char-forming thick slab, in the presence of significant convective, diffusive, and radiative transport. The goal is to predict the rate of streamwise advance of the site on the solid-gas interface at which the pristine solid undergoes endothermic degradation to a combination of (1) a porous carbonaceous heat-retaining matrix, and (2) a mixture of (partially combustible) vapors that move through the matrix to the outer gas. This rate of advance of the thermal-degradation site is sought as a function of normally available data concerning the thermodynamic and physical properties of the solid and the thermodynamic and dynamic state of the hot vitiated bulk gas that flows over the slab. A nonlinear, unsteady, two-spatial-dimension treatment in the Shvab-Zeldovich approximation entails boundary-layer simplification in the manner of Prandtl convective-transport simplification in the manner of Oseen, and thin-flame simplification in the manner of Burke and Schumann. Whereas the formulation given here is general and is to be solved in subsequent work for a partially involved slab, the solution here is limited to the steady-state problem.

701,464
PB82-183914 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Plan for a Round Robin of Hot Boxes.
Final rept.
E. L. Bales. Feb 82, 40p NBSIR-81-2443
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Buildings, *Fire tests, Specifications, Thermal conductivity, Heat transfer, Walls, Ceilings(Architecture), *Calibrated hot boxes, *Hot boxes.

A plan for an interlaboratory round robin series of tests sponsored by the American Society for Testing and Materials (ASTM) using calibrated or guarded hot-box equipment is described. These testing methods are designed to measure the thermal conductance of full-scale building sections such as walls, roofs and floors. Results from about 25 hot boxes in the U.S. and Canada are expected to produce improved calibration techniques and repeatability and uncertainty information useful for improving ASTM specifications.

701,465
PB82-184045 PC **A05**/MF **A01**
Underwriters' Labs., Inc., Northbrook, IL.
Investigation of Fire Hazards of Fireplace Inserts in Factory-Built and Masonry Fireplaces.
W. R. Terpstra, M. L. Jorgenson, and L. J. Dosedlo. Jan 82, 83p NBS-GCR-82-368
Contract NB80-NADA-1016

Keywords: *Fireplaces, *Fire tests, Chimneys, Masonry, Inserts, Doors, Fire hazards, Heating equipment, Fireplace inserts.

This report describes an investigation of fireplace inserts installed in factory-built and masonry fireplaces for use as solid fuel burning, residential heaters. The objective of the program was to develop information on temperatures that occur in such fireplace/fireplace insert combinations, and at adjacent combustible materials during continuous firing of the fireplace/fireplace insert combination. Presently recommended practices for construction of fireplaces were reviewed, and several fireplace and insert combinations were fire tested. The program considered (1) material, construction and structural aspects, (2) securement and stability of the fireplace insert, (3) chimney connections, (4) temperature rise, and (5) leakage of combustion products.

701,466
PB82-185307 PC **E05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Analysis of Data from Room Fire Test of Parsons Tables and Comparison with Laboratory Test Methods for Flame Spread amd Smoke Generation, Volume I and Volume II.
Final rept.
D. D. Evans. Nov 81, 103p NBSIR-81-2400
Includes one sheet of 24X reduction microfiche.

Keywords: *Buildings, *Tables(Furniture), *Fire tests, Flame propagation, Furniture, Flammability testing, Smoke, Structural plastics, *Room fires, Computer applications.

Data from a series of 18 room fire tests in which a Parsons table was the only combustible item were analyzed. Selected data from the tests were compared to laboratory fire test data from the ASTM E162 surface flammability test, and a modified smoke density test. The flame spread index from the ASTM E162 test was not shown to be a dependable indicator of either the time for table fire involvement or room fire intensity. Results from the National Bureau of Standards smoke chamber using an MOD (mass optical density) method for data reduction were able to predict the smoke production rate and total smoke production from the table fires to within 34 percent and in several cases within 5 percent.

701,467
PB82-192451 Not available NTIS
National Bureau of Standards, Washington, DC.
Preliminary Evaluation of the Tensile and Elongation Properties of Single-Ply Sheet Roofing Membrane Materials.
Final rept.
R. G. Mathey, and W. J. Rossiter. Sep 81, 471p
Sponsored in part by National Research Council, Washington, DC. and National Research Council of Canada, Ottawa (Ontario).
Pub. in Proceedings of Int. Conf. (2nd) on the Durability of Building Materials and Components, Held at Gaithersburg, MD. on September 14-16, 1981, p442-451 1981.

Keywords: *Roofing, *Membranes, *Proceedings, Polymeric films, Elastomers, Bitumens, Thermal environments, Tension tests.

A summary is presented of the results of a preliminary evaluation of two performance properties, tensile strength, and ultimate elongation, of nineteen single-ply sheet roofing membrane materials. Also reported are the changes in mass and length of the membrane materials caused by exposure to heat. The nineteen materials represented the general categories of single-ply sheet membranes (elastomeric, plastomeric, and modified bitumens) and were typical of those used in the United States. Membrane materials included neoprene, ethylene propylene diene terpolymer, chlorosulphonated polyethylene, polyvinyl chloride, chlorinated polyethylene, and modified bitumens. The membrane materials were tested in tension before and after exposure to heat, and heat followed by ultraviolet radiation from a xenon arc. Control (unexposed) specimens were tested at 70 and 0 F and the exposed specimens were tested at 0 F. Three ASTM tensile test procedures were selected to determine the tensile and elongation properties of the membrane materials. All nineteen materials were tested according to a procedure for rubber. The plastics and modified bitumens were also tested according to procedures applicable to reinforced fabrics and bituminous roofing membranes, respectively.

701,468
PB82-192956 PC **A03**/MF **A01**

National Bureau of Standards, Washington, DC. National Engineering Lab.
Calculations of the Heat Release Rate by Oxygen Consumption for Various Applications.
W. J. Parker. Mar 82, 44p NBSIR-81-2427-1

Keywords: *Fire tests, *Calorimeters, Oxygen consumption, Air flow, *Room fires, Heat release rate.

The oxygen consumption technique is emerging as a powerful tool for determining the heat release rate in a number of diverse fire test applications, including room fire tests, fire endurance tests, the ASTM E 84 tunnel test, and various heat release rate calorimeters. Depending upon the constraints of the test, the accuracy required, the availability of instrumentation and computational facilities, and the willingness to put up with experimental inconveniences, a number of instrumentation options have been considered--each of which require different calculational procedures. The purpose of this report is to develop the equations in a general way and show how to adapt them to various applications such as: closed systems versus open systems; trapping carbon dioxide before it reaches the oxygen analyzer, measuring it, or assuming that it is equal to the reduction in oxygen concentration; ignoring carbon monoxide or measuring it; accounting for the density of the exhaust gases or assuming that it is the same as for air; using a high temperature oxygen cell which measures the oxygen concentration in the exhaust duct directly or a paramagnetic analyzer for which corrections must be made for water vapor trapping; taking into account or ignoring the ambient concentration of water vapor and carbon dioxide; and, improving the accuracy for open systems by monitoring the water vapor in the exhaust duct. The equations developed here should be useful to anyone setting up a new system and will provide a means of calculating the errors which might be expected when simplified procedures are used.

701,469

PB82-194515 PC **A06**/MF **A01**
AIA Research Corp., Washington, DC.
Proceedings of the Conference on Life Safety and the Handicapped (1980).
Final rept.
E. W. Kennett. Mar 82, 125p NBS-GCR-82-383
Contract NB80-NADA-1058
Held at Washington, DC. on October 26-29 1980. Sponsored in part by Veterans Administration, Washington, DC., Federal Emergency Management Agency, Washington, DC., and Department of Health and Human Services, Washington, DC., and Department of Labor, Washington, DC.

Keywords: *Buildings, *Disasters, *Handicapped persons, *Meetings, Building codes, Fire safety, Specialized training, Fire departments, Warning systems, *Emergency planning.

Our society has made a conscious decision to integrate the handicapped into the 'mainstream' of everyday life. Significant progress has been made toward making buildings accessible to the handicapped, but this very success brings a concomitant responsibility for dealing with the problem of protection and emergency exit. Simply stated, ingress implies egress. The 1980 Conference on Life Safety and the Handicapped was another step in an ongoing process of responsibly addressing this issue. The objectives were education, articulation, and formulation: education as to the overall existence of the issue, articulation of specific problems and needs, and formulation of a national agenda for how to address the issue. Toward the goal of formulating a National Agenda, a significant portion of the conference was devoted to a set of twelve workshops. Sixteen topic papers were presented during the conference. Seventeen consensus recommendations were produced in the final plenary session. The conference was produced by the National Task Force on Life Safety and the Handicapped and AIA Research Corporation; sponsored by the National Bureau of Standards; and funded by the Veterans Administration, the Federal Emergency Management Agency, the U.S. Department of Health and Human Services, and the U.S. Department of Labor.

701,470

PB82-195520 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Smoke Movement Through a Suspended Ceiling System.
Final rept.
J. H. Klote. Feb 82, 79p NBSIR-81-2444
Sponsored in part by Veterans Administration, Washington, DC. and Department of Health and Human Services, Washington, DC.

Keywords: *Hospitals, *Fires, *Smoking, Ceilings(Architecture), Fire tests, Ventilation, Health facilities, Smoke control.

A series of full-scale tests were conducted to evaluate smoke movement through a suspended ceiling and into an interstitial space of a hospital type facility. A test facility specifically constructed for this project is described. The test series consisted of one smoke candle test and 12 fire tests including both smoldering and flaming fires. Smoke movement through the suspended ceiling system was evaluated in terms of the total smoke movement through the test facility. The effects of ventilation and smoke exhaust on smoke concentration in the test facility were investigated.

701,471

PB82-196700 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Application of the Method of Characteristics to Predict Attenuation in Unsteady Partially-Filled Pipe Flow.
J. Swaffield. Mar 82, 90p NBSIR-82-2478
Contract HUD-H-48-78
Prepared in cooperation with Brunel Univ., Uxbridge (England). Dept. of Building Technology.

Keywords: *Buildings, *Water pipelines, *Drains, Pipe flow, Supercritical flow, Subcritical flow, Unsteady flow, Surges, Computer programs, Fortran, Solid waste disposal, *Foreign technology, TRANSCC computer program, Perkin Elmer 732 computers, Method of characteristics.

The mechanism of flow attenuation in partially filled unsteady pipe flow is presented and shown to have relevance to the design of gravity drainage systems. The equations defining unsteady flow in partially filled pipe are derived and shown to be capable of solution by means of the method of characteristics. This technique as a method of predicting flow depth, velocity and wave speed along a long drainage pipe at a range of pipe gradients, diameters, and roughness coefficients was tested by means of numerical examples for a series of simulations run on a digital computer. Additionally, limited experimental verification of the analysis technique is presented for the supercritical flow response to a short duraction inflow surge. Generally, the technique developed was found to be applicable to the design of drainage systems and further work is proposed to both extend the experimental verification and for the greater complexity of the multi-branched pipe system.

701,472

PB82-199324 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Committee E-5 in International Standardization of Fire Tests.
Final rept.
D. Gross. Dec 81, 4p
Pub. in American Society for Testing and Materials Standardization News 9, n12 p28-31, 41 Dec 81.

Keywords: *Fire tests, *Engineering standards, Planning, Policies, Materials tests, Laboratories, Technology transfer, Reprints.

ASTM committee E-5's role in international fire test standardization dates back to February 1967 when the United States became an official participating member of ISO Technical Committee 92 on Fire Tests. Over the past fifteen years, the world-wide growth of interest in international standardization has been paralleled by a similar growth of interest among U.S. materials producers, testing laboratories and regulatory officials. As the U.S. Technical Advisory Group (TAG) to ISO TC 92, subcommittee E 5.34 representing E-5, has played a key role in planning, policy and information transfer.

701,473

PB82-215088 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Evaluation of Wall Protection Systems for Wood Heating Appliances.
J. J. Loftus. May 82, 62p NBSIR-82-2506
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD., and Department of Energy, Washington, DC.

Keywords: *Wallboard, *Radiant heating, *Fire protection, Heating equipment, Stoves, Gypsum, Protection, Fire safety.

Measurements of the surface heating potential of unprotected and protected gypsum wallboard materials in close proximity to irradiating surfaces of home heating appliances have been made. A total of 4 unprotected walls and 19 protected interior wall surfaces were evaluated in tests where stove-to-wall clearances were varied from 7.5 to 90 cm (3 to 36 in) and stove surface temperatures were maintained at five different temperature levels ranging from 150-350C (300-660F).

701,474

PB82-225079 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire Endurance Tests of Selected Residential Floor Constructions.
J. B. Fang. May 82, 115p NBSIR-82-2488
Sponsored in part by Department of Housing and Urban Development, Washington, DC.

Keywords: *Residential buildings, *Floors, *Fire tests, Flammability testing, Fire resistance, Wooden structures, Steel construction, Heat flux, Burning rate.

A series of 10 load-bearing, wood- and steel-framed residential floors was evaluated for structural fire resistance in a fire endurance furnace. Nine wood-frame and one light gauge steel-frame, protected and unprotected floor/ceiling assemblies, each measuring 3.05 x 2.44 m in size, were exposed from the underside to either the newly developed high-intensity, short-duration fire exposure or the standard ASTM E 119 time-temperature curve. The fire endurance time based on the passage of flames to the unexposed face of the floor with unprotected wood joists varied from 6 to 9 minutes under the newly developed fire exposure and 16 to 18 minutes subject to the standard ASTM fire.

701,475

PB82-239062 Not available NTIS
National Bureau of Standards, Washington, DC.
Closed-Form Approximation for Post-Flashover Compartment Fire Temperatures.
Final rept.
V. Babrauskas. 1981, 11p
Pub. in Fire Safety Jnl. 4, p63-73 1981.

Keywords: *Fires, *Models, Temperature, Fire safety, Flashover, Reprints, *Compartment fires, *Fire models, *Fire endurance.

A method is developed, suitable for design purposes, which allows approximate post-flashover fire temperatures to be calculated without the use of computer codes. Thermoplastic pool fires, wood crib fires, and other fires of known fuel release rate are treatable. Results typically agree to within 3% of exact computer code solutions.

701,476

PB82-239120 Not available NTIS
National Bureau of Standards, Washington, DC.
Flame Lengths Under Ceilings.
Final rept.
V. Babrauskas. 1980, 8p
Pub. in Fire and Materials 4, n3 p119-126 1980.

Keywords: *Ceilings, *Fire tests, Flame propagation, Air entrainment, Fire hazards, Reprints, *Room fires.

The evaluation of hazards from developing room fires often requires a knowledge of flame lengths developed by burning objects. Procedures for estimating flame lengths have been available only for vertical plume fires, where there is no flame impingement on the room ceiling. Calculational procedures are here developed for approximate calculation of flame lengths when part of the flame flow is along the ceiling. Four common geometries are treated: unbounded ceiling, plume near corner, plume in corner, and one-directional corridor spread. Ceiling flame lengths are calculated by use of the assumption that the total air entrained up to the flame tip is the same for ceiling flow as for the free fire.

701,477
PB82-243155 Not available NTIS
National Bureau of Standards, Washington, DC.
Progress of Fire Safety Standards--Fire Standards Activities in ASTM.
Final rept.
D. Gross. 1981, 2p
Pub. in Fire and Materials 5, n4 p177-178 1981.

Keywords: *Buildings, *Fire tests, *Standards, Construction materials, Fire resistance, Flammability testing, Engineering societies, Reprints, *Room fires, American Society for Testing and Materials.

The American Society for Testing and Materials (ASTM) is the largest standards-writing organization in America, providing voluntary consensus standards for materials, products, systems and services. ASTM Committee E 5 on Fire Standards is a committee responsible for the development, revision and approval of fire standards used to assess the fire performance of materials, products, assemblies and systems.

701,478
PB82-245812 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Computer Fire Modeling for the Prediction of Flashover.
R. D. Peacock, and J. N. Breese. May 82, 91p NBSIR-82-2516
Sponsored in part by Department of Health and Human Services, Washington, DC.

Keywords: *Buildings, *Fires, Mathematical models, Computer programming, Ventilation, Aspect ratio, Flame propagation, Construction materials, Predictions, *Flashover, *Room fires, Computer applications.

The study presents an initial look at the potential for the use of fire growth models. A technique is presented, based upon numerous fire growth predictions, to estimate the minimum energy required to produce temperature levels capable of promoting flashover in a variety of room configurations. The parameters investigated included room size, room ventilation, ceiling height and room lining material. A comparison is presented of the predictions made with available full-scale fire test data and with other predictions. The technique, although needing refinement, shows promise to estimate flashover potential.

701,479
PB82-252339 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of an Ease of Ignition Test Using a Flame Exposure.
J. R. Lawson, and W. J. Parker. Jun 82, 67p NBSIR-82-2503
Sponsored in part by Naval Sea Systems Command, Washington, DC., and Gypsum Association, Evanston, IL.

Keywords: *Buildings, *Construction materials, *Fire tests, Ignition, Heat flux, Gas flow, Flow rate, Walls, Flame propagation, Burning rate, *Room fires.

A test for the ease of ignition of interior finish materials by flame exposure was developed. Two specimens, 140 mm (5.5 in) wide by 152 mm (6 in) high, face each other at a distance of 53 mm (2.1 in) apart. A methane diffusion flame passes between their surfaces and extends to about 152 mm (6 in) above them. The operator observes the specimen surface and records the time-to-flame attachment. A phototube, which views the exposure flame, shows a marked increase in output when the specimens start contributing fuel. The times-to-flame attachment were compared with the observed times of wall involvement in some full-scale tests. The ignition sensitivity is expressed by the time-to-flame attachment and by the time-to-fuel contribution. The times-to-flame attachment measured in the ignition apparatus generally ranked 22 materials with the observed times of wall involvement in full-scale tests. The results of this test may be useful as one factor in computer models of fire growth in enclosures.

701,480
PB82-257684 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Analysis of Smoldering Fires in Closed Compartments and Their Hazard Due to Carbon Monoxide,
J. G. Quintiere, M. Birky, F. MacDonald, and G. Smith. Jul 82, 50p NBSIR-82-2556

Keywords: *Buildings, *Fire hazards, *Carbon monoxide, Fire tests, Lethal dosage, Mathematical models, Risk, *Room fires, *Smoldering fires, Computer applications.

A review was made of smoldering fire experiments conducted in closed room and buildings. The results were summarized by tabulating maximum levels of CO, the time integral of CO concentration (dose), CO2, temperature rise and oxygen consumption. A hazard timebased on the attainment of a CO dose equal to 4.5% CO-minutes and the time for transition to flaming were also tabulated. The likelihood of reaching a critical during smoldering seems to be comparable to the likelihood of having transition to flaming occur. A theoretical model, requiring inputs of CO production rate and energy release rate, was executed and compared with available data. The theoretical results for CO concentration as a function of time were in good agreement with the experimental data. The model offers a means of extrapolating test data to compartments of various size in order to assess the general hazard of CO due to smoldering.

701,481
PB82-263369 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Evaluating Alternative Strategies for Reducing Residential Fire Loss: The Fire Loss Model.
Interim rept.
A. Gomberg, B. Buchbinder, and F. L. Offensend. Aug 82, 68p NBSIR-82-2551
Prepared in cooperation with SRI International, Menlo Park, CA.

Keywords: *Residential buildings, *Fire losses, *Fire detection systems, Fire protection, Fire alarm systems, Sprinkler systems, Decision theory, *Smoke detectors.

This report provides a preliminary documentation of a decision analysis framework for evaluating alternative residential fire loss reduction strategies. The framework, when it is completed, will provide a systematic means for assessing the costs and losses occurring under different intervention strategies. The current report focuses entirely on the problem of assessing fire losses, as this is where most of the uncertainty on system performance occurs. Subsequent reports will address the cost of the alternatives, after which the alternatives can be compared on a comprehensive cost/benefit basis.

701,482
PB82-264029 Not available NTIS
National Bureau of Standards, Washington, DC.
International Standardization of Fire Tests of Building Materials and Structures: A Progress Report.
Final rept.
D. Gross. Mar 79, 4p
Pub. in Fire Jnl. 73, n2 p79-82, 90 Mar 82.

Keywords: *Fire tests, *Engineering standards, Construction materials, Fire resistance, Standardization, Fire safety, Engineering societies, Reprints.

A brief history is provided of the formation and growth of ISO Technical Committee 92 on Fire Tests of Building Materials and Constructions. Present and future standards and Working Group activities are described. Comparisons are made between national, international and regional standardization activities dealing with fire tests.

701,483
PB82-264201 Not available NTIS
National Bureau of Standards, Washington, DC.
Measuring the Leakage of Door Assemblies during Standard Fire Exposures.
Final rept.
L. Y. Cooper. 1981, 12p
Pub. in Fire and Materials 5, n4 p163-174 1981.

Keywords: *Buildings, *Doors, *Smoke, Leakage, Fire tests, Engineering standards, Reprints, *High rise buildings, *Building fires.

A basis for relating overall intrabuilding smoke migration dynamics to high temperature, door assembly smoke leakage measurements is formulated. The results of applying the tentative, high temperature, International Organization for Standardization (ISO) test method DP 5925 Part 3, which was developed to measure smoke leakage of door assemblies during the course of a standard fire endurance test, are reported. A critical analysis reveals that the basic objective of the test method is limited in its utility in that fire scenarios in high-rise buildings may not be adequately simulated. Independent of this limitation the analysis then identifies certain theoretical problems with the test method and its procedures. These lead to a conclusion that the test method is not generally reliable. An alternate test concept which removes the above-mentioned limitation and all of its problems is described, and its development is advocated.

701,484
PB82-264433 Not available NTIS
National Bureau of Standards, Washington, DC.
In Case of Fire - Use the Stairwells, Elevators Aren't Safe.
Final rept.
W. Schmidt, and J. H. Klote. May 82, 5p
Sponsored in part by Veterans Administration, Washington, DC.
Pub. in Specifying Engineer 47, n5 p82-86 May 82.

Keywords: *Handicapped persons, *Fire safety, *Stairways, *Elevators(Lifts), Smoke, Pressurization, Air circulation, Fire protection, Reprints, *Building fires, *Fire exits.

This paper is the initial report of an ongoing project at NBS to investigate the use of elevators as a means of fire escape for the handicapped. The use of stairwells for fire evacuation poses a problem for people who cannot use stairs because of physical disabilities. This paper discusses some of the major problems associated with the use of elevators as a means of fire exit and proposes a conceptual solution to those problems. A report is made on field tests of four buildings with elevator protection systems. These protection systems and their interaction with other systems is examined.

701,485
PB82-600006
(Order as PB83-164541, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Nondestructive Evaluation Methods for Quality Acceptance of Installed Building Materials.
J. R. Clifton, and N. J. Carino. 1982, 32p
Included in Jnl. of Research of the National Bureau of Standards, v87 n5 p407-438 1982.

Keywords: *Building materials, Concrete, Evaluation, Inplace testing, Inspection, Nondestructive testing, Quality assurance.

A review of methods developed for the nondestructive evaluation (NDE) of building materials is presented. The generic features of NDE methods are discussed. This is followed by descriptions of specific methods. The principles underlying the operation of the methods are described, along with their typical applications, advantages, and limitations. A table is included summarizing the characteristics of various NDE methods.

701,486
PB82-600041 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fire Safety in Dwellings and Public Buildings.
F. B. Clarke, and M. M. Birky. 1981, 14p
Pub. in Bull. N.Y. Acad. Med. 57, n10 p1047-1060 Dec 1981.

Keywords: *Cigarettes, Codes, Escape, Fatalities, Fire, Flaming, Flashover, Nonresidential, Residential, Scenario, Smoldering.

Some of the principal factors in building fire safety are reviewed. The most important factors are: (1) Fatal fires occur almost exclusively in buildings, the great majority in residences; (2) The building serves to catch and hold combustion products, inhalation of which is the actual cause of death; (3) Most fatal building fires involve the burning of the contents, rather than the structure itself--these contents are increasingly of synthetic materials; (4) Improved technology is now available, both for making furnishings resistant to small ignition sources and for suppressing residential fires; (5) Smoke detectors are now widely used in homes, with some positive effect being observed in national fire experience; (6) Most code enforcement focuses on relatively large buildings (i.e., those other than one and two family homes), and the fire safety record of these

structures is comparatively good; (7) Seldom is as much attention paid to the fire properties of common building contents, and it is evolutionary changes in these, as well as unforseen characteristics of building occupants, which is a major challenge to building regulation; (8) New building designs and materials put great demands on the adaptability of code requirements, leading to increased demands for equivalency systems.

701,487
PB82-600051 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Roots and History of Committee E-5.
A. F. Robertson. 1981, 7p
Pub. in ASTM Stand. News 9, n12 p14-20 Dec 1981.

Keywords: *ASTM E-5, Fire tests, Histories, Test methods.

ASTM originally developed as an American Section of the International Association for Testing Materials in 1898. Committee P, on Fireproofing, was the predecessor of the present committee E-5 on Fire Test Methods. A brief narrative review is presented of the somewhat tedious development of fire test methods during the first fifty years of the committee's existence.

701,488
PB82-600053 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cooling Time of Hot Bitumen During Built-Up Roofing Construction.
W. J. Rossiter, R. G. Mathey, H. W. Busching, and W. C. Cullen. 1981, 9p
Pub. in Proceedings 2d Int. Symp. Roofs and Roofing, Brighton, England, Sept. 21-24, 1981, p489-497 1981.

Keywords: *Asphalt viscosity, Bitumen cooling time, Roofing bitumens.

The most widely accepted waterproofing system for low-sloped roofs in the United States is bituminous built-up roofing. In the construction of bituminous built-up roofing systems, hot bitumen is generally applied to roofing components such as deck, insulation, and felts in order to adhere them to each other and to form a waterproof membrane. Bitumens commonly used as waterproofing materials and adhesives in built-up membranes are asphalt and coal tar pitch.

701,489
PB83-101931 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Measurement of Material Flame Spread Properties.
J. G. Quintiere, M. Harkleroad, and D. Walton. Aug 82, 48p NBSIR-82-2557
Sponsored in part by Federal Aviation Administration Technical Center, Atlantic City, NJ.

Keywords: *Wood particle boards, *Fire tests, *Flame propagation, Douglas fir wood, Ignition, Flames, Heat flux, *Flame spread.

A concept was examined for measuring flame spread parameters suitable for predicting the performance of a material in fires. The study examines a radiant panel test apparatus used to measure downward and lateral flame spread, and ignition. An analysis of data from tests of Douglas fir particle board is presented. A procedure has been identified for measuring specific parameters useful in the general prediction of ignition and flame spread for complex materials.

701,490
PB83-107714 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Flow Induced by Fire in a Compartment.
K. D. Steckler, J. G. Quintiere, and W. J. Rinkinen. Sep 82, 104p NBSIR-82-2520

Keywords: *Fires, *Flame propagation, Air flow, Flow rate, Mass flow, Walls, Doors, Windows, Fire tests, *Room fires.

Fifty-five full-scale steady-state experiments were conducted to study the flow induced by a simulated pool fire in a compartment under conditions characteristic of the developing fire. The mass flow rate through the door or window opening and bounds on the fire plume entrainment rate are presented as a function of opening geometry, fire strength, and fire location.

701,491
PB83-118117 PC **A06**/MF **A01**
Construction Technology Labs., Skokie, IL.
Short-Term Creep of Concrete at Elevated Temperatures.
M. Gillen. Sep 82, 112p NBS-GCR-82-407
Grant NB80-NADA-1009

Keywords: *Concretes, *Fire tests, Creep tests, High temperature tests, Compressive strength, Moisture content, Concrete durability, Thermal stresses, Computer programs.

Two hundred thirty-one creep strain tests were conducted at temperatures from ambient to 1200F over periods from 6 to 24 hours on 2X4-in. cylindrical concrete specimens. In addition, forty-five compressive strength tests were conducted on heated concrete specimens. Test variables included load (0.30, 0.45, and 0.60 (f' sub c)), temperature (73 to 1200F), rate of heating (0 and 10F/min.), length of heating (6 and 24 hr), aggregate type (calcareous, siliceous, and lightweight), variation of compressive strength with temperature, and concrete relative humidity (0, 50, and 100% RH). A model of short-term creep of concrete at elevated temperatures as a function of significant test variables was developed.

701,492
PB83-119909 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
System for Fire Safety Evaluation for Multifamily Housing.
Interim rept.
H. E. Nelson, and A. J. Shibe. Sep 82, 161p NBSIR-82-2562
Sponsored in part by Department of Housing and Urban Development, Washington, DC.

Keywords: *Housing studies, *Fire safety, Evaluation, Fire protection, Fire hazards, Structural design, Risk, Design standards, Computer programs, *Multifamily residences, Delphi techniques, Risk analysis.

A qualitative evaluation system for grading multifamily housing in terms of fire safety has been developed and is ready for testing in Department of Housing and Urban Development field offices. The system is designed to be used to identify a variety of combinations of widely accepted fire safety equipment and building construction features that provide a level of safety equal or greater than that achieved by conformance to the explicit requirements of the HUD Minimum Property Standards. In this evaluation, equivalent safety performance is gauged in terms of overall level of safety provided rather than a component by component comparison.

701,493
PB83-155887 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Annual Conference on Fire Research (6th).
Final rept.
S. M. Cherry. Nov 82, 185p NBSIR-82-2612
See also PB81-110447.

Keywords: *Fire safety, *Meetings, Fire protection, Fire hazards, Flammability, Human behavior, Combustion, Flame propagation, Fire resistant textiles, Toxicity, Research projects, Fire spread.

This report contains extended abstracts of grants and contracts for fire research sponsored by the Center for Fire Research, National Bureau of Standards, as well as descriptions of the internal progams of the Center for Fire Research.

701,494
PB83-156984 Not available NTIS
National Bureau of Standards, Washington, DC.
Sprinklers Come Home at Last.
Final rept.
D. D. Evans. Oct 82, 3p
Pub. in Fire Service Today 49, n10 p14-16 Oct 82.

Keywords: *Residential buildings, *Sprinkler systems, *Fire tests, Fire extinguishers, Fire protection, Fire safety, Reprints, *Room fires.

Two full-scale room fire tests conducted to demonstrate the performance of a new low-cost residential sprinkler system are described. These tests were conducted in Springdale, Arkansas on August 1, 1981 as part of the Federal Emergency Management Agency Operation Dixieland program. The residential sprinkler system extinguished both living room and bedroom test fires confining damage to the immediate area around on newspaper filled plastic waste paper container used as the ignition source.

701,495
PB83-157024 Not available NTIS
National Bureau of Standards, Washington, DC.
Repeatability of Large-Scale Room Fire Tests.
Final rept.
J. B. Fang. Feb 81, 10p
Sponsored in part by Department Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.
Pub. in Fire Technology 17, n1 p5-16 Feb 1981.

Keywords: *Buildings, *Fire tests, Floors, Ceilings(Architecture), Fire resistance, Analysis of variance, Reprints, *Room fires.

Statistical analysis was performed on the experimental results of four full-scale room fire tests from a series of floor-ceiling assembly fire resistance tests conducted a basement recreation room.

701,496
PB83-159129 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Quarter-Scale Modeling of Room Fire Tests of Interior Finish.
B. T. Lee. Mar 82, 73p NBSIR-81-2453
Sponsored in part by Naval Sea Systems Command, Washington, DC.

Keywords: *Buildings, *Fire tests, Plywood, Glass fibers, Foam rubber, Air flow, Burning rate, Flame propagation, *Room fires.

A technique for modeling fire build-up in rooms with combustible interior finish was refined to achieve closer simulation of full-scale fire development. Fire experiments were performed in one-quarter scale model rooms and full-scale rooms having a doorway opening. The interior finish test materials were nitrile foam rubber, fibrous glass, and plywood; a gas burner was employed as the fire source in a rear corner of the room. It was necessary to lower the doorway in the model by as much as 14 percent to obtain flashover with the same equivalent heating rate that produced flashover in the full-scale test. At the same time, the width of the doorway in the model was increased appropriately to maintain the same volumetric air flow rate.

701,497
PB83-161497 PC **A03**/MF **A01**
Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
Home Fire Project: 1972-1982.
Final rept.
Nov 82, 50p NBS-GCR-82-416
Grant NBS-G-9011

Keywords: *Fires, *Research projects, Combustion, Fire damage, Fire hazards, Fire safety, Models, Bibliographies, Fire tests, *Building fires, *Room fires, *Fire research, *Fire spread.

This report is a review of the accomplishments of a joint fire research effort between Harvard University and Factory Mutual Research Corporation. The summary applies to a ten year period - 1972-1982. A catalogue of subjects is presented with a technical description of the work along with an annotated bibliography. The subjects include: spontaneous combustion, fire spread, vitiated combustion, radiation from flames, radiation scaling, vent flow, extinguishment, atmospheric modeling, pressure modeling, full-scale tests, and the computation of a fire.

701,498
PB83-162339 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Experimental Evaluation of Circulation Loop Drain and Vent Plumbing Modifications for Building Rehabilitation.
F. Winter, and L. Galowin. Dec 82, 96p NBSIR-82-2602

Keywords: *Buildings, *Renovating, *Plumbing, Piping systems, Vents, Exhaust pipes, Air flow, Performance evaluation.

Rehabilitation or modernization of existing buildings frequently imposes increased loads on the plumbing water supply and drainage system. The requirement for venting in U.S. practice is intended to prevent trap seal loss from exceeding values prescribed in model plumbing codes. The vent piping in older buildings may be marginal for retrofit under code requirements for new construction with the same or increased numbers of fixtures and devices installed into the plumbing system. An experimental laboratory investigation of a circulation loop modification to a drain-waste-vent (DWV) system was conducted to determine the change in performance. An experimental evaluation of the performance of the modified system and a conventional system were undertaken for a variety of simulated wastewater-loads with various plumbing fixtures and multi-story soil stack loads. The performance parameters considered were trap seal failures, backflow, and the siphonic action of the water closets. Also, the dynamic responses to pressure excursions and air flow rates in the branches were measured. Both systems were tested to the limiting condition for single-stack performance over a range of air flow rates into the soil and vent stack.

701,499

PB83-163386 PC **A06**/MF **A01**
California Univ., Berkeley. Dept. of Civil Engineering.
Intralaboratory Evaluation of a Room Fire Test Method.
Final rept. 1 Aug 80-31 Jul 81.
F. L. Fisher, and R. B. Williamson. Jan 83, 120p NBS-GCR-83-421
Contract NB80-NADA-1072

Keywords: *Walls, *Ceilings, *Fire tests, Plywood, Gypsum, Heat flux, Smoke, Carbon monoxide, Air flow, *Room fires.

A series of experiments were conducted with the proposed ASTM standard room fire test. The combinations included (1) gypsum board walls and ceiling, (2) gypsum board walls and plywood ceiling, (3) plywood walls and gypsum board ceiling, and (4) plywood walls and ceiling. The total rates of production of heat, smoke, and carbon monoxide and the rates of air inflow to the room and enthalpy flow into the exhaust dust were measured during these tests. The maximum temperatures averaged over the top of the room were 400C and 750C for combination (1) and (2) respectively. In spite of the high temperature and the extention of the flame beyond the doorway, the total heat release rate for combination (2) was only 840 kW, the heat flux on the floor was less than 20 kW/square meter which is the criterion for flashover, and the newspaper indicators did not ignite. The temperatures exceeded 750C and the fire had to be extinguished before the maximum was reached for the other combinations. Their total heat release rates reached 3.6 MW at the time of extinguishment and exceeded 1 MW at the time of flashover.

701,500

PB83-164368 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of Hazardous Conditions in Enclosures with Growing Fires.
Final rept.
L. Y. Cooper. Jan 83, 34p NBSIR-82-2622

Keywords: *Buildings, *Fires, Flame propagation, Combustion, Heat transfer, Fire hazards, Mathematical models, *Room fires, *Flame spread.

A mathematical model for simulating the environment in enclosures during the growth stage of hazardous fires was developed previously. To use the model one must specify the energy release rate of the fire, certain heat transfer parameters, the area and height of the enclosure and the elevation of the fire above the floor. Solution to the model's equations would yield the time-varying thickness, temperature, and product of combustion concentrations of an upper smoke layer which starts to drop from the enclosure ceiling at the time of ignition.

701,501

PB83-200113 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Analysis of Electrical Fire Investigations in Ten Cities.
Interim rept.
A. Gomberg, and J. R. Hall. Mar 83, 58p NBSIR-83-2677
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Residential buildings, *Fires, Electric devices, Fire safety, Circuit breakers, Electric fuzes, Electric wire, Wiring, Fire damage, *Electrical fires.

This interim report describes the progress and conclusions to date on an analysis of electrical fire cases by the Center for Fire Research, National Bureau of Standards for the Consumer Products Safety Commission. The report describes the 110 detailed electrical fire investigation reports from 10 participating cities, and discusses preliminary findings resulting from analysis of the computerized data from those reports. These preliminary findings are being used to guide a follow on effort, to be reported on at a later date, to obtain, encode and analyze additional data from the original 110 cases, in order to better define and describe the most significant failure modes of electrical components and the sequences of events which lead to electrical fire ignition.

701,502

PB83-208173 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Review of Compartment Fire Models.
W. W. Jones. Apr 83, 44p NBSIR-83-2684

Keywords: *Buildings, *Fires, Mathematical models, Heat loss, Heat flux, Thermal radiation, Convection, Plumes, Flame propagation, *Room fires, *Fire models.

The concept of zone modeling as it has been applied to fire problems is examined. The existing models which embody the zone concept are compared in order to ascertain the state-of-the-art in understanding of fire growth and fire spread processes. This review is intended to be a starting point for future modeling efforts and thus the discussion centers around the use of the various submodels.

701,503

PB83-208470 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Guidelines for Assessment and Abatement of Asbestos-Containing Materials in Buildings.
J. H. Pielert, and R. G. Mathey. May 83, 75p NBSIR-83-2688
Sponsored in part by General Services Administration, Washington, DC.

Keywords: *Buildings, *Construction materials, *Asbestos, Abatement, Flame resistant materials, Air pollution, Guidelines, Regulations.

This report presents guidelines for the assessment and abatement of asbestos-containing materials in buildings based on available information. Background information is given on the history and use of asbestos-containing products in buildings, and regulations pertaining to their use. Included are control measures for buildings containing asbestos materials, procedures for determining condition of the materials, and abatement techniques for containment and removal. A summary is presented of recent guide specifications and standards developed by industry, government agencies, and a standards organization which are related to asbestos-containing materials in existing buildings. These documents include guidance for the control, assessment, and abatement of such materials.

701,504

PB83-209320 PC **A05**/MF **A01**
Bush (Kenneth E.), Relay, MD.
Users Guide for the Application of Table 1 - Safety Parameter Values for the Fire Safety Evaluation System for National Park Service Facilities.
Final rept.
K. E. Bush, H. L. Bradley, and H. D. Hicks. May 83, 95p NBS-GCR-83-427
Contract NB82-NAAK-9114
Sponsored in part by National Park Service, Washington, DC.

Keywords: *Residential buildings, *Fire safety, Hotels, Motels, Construction, Guidelines, Fire protection, *Smoke detectors.

This guide is developed to provide definitions, explanations, and background information for the application of Table 1 - safety parameter values for both large overnight accommodations and dormitory facilities as defined in the accompanying worksheets and glossary. It also provides, through expanded text and illustrations, suggestions for the reasonable and intended uniform application of the evaluation system, and to clarify and describe terminology in fire safety parameters which may be unfamiliar to the user. The desired result of this guide is for the user to evaluate the parameters as described in the Fire Safety Evaluation System to existing park service accommodations.

701,505

PB83-214189 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Wind Loading and Strength of Cladding Glass.
Building science series (Final).
D. A. Reed, and E. Simiu. May 83, 52p NBS-BSS-154
Library of Congress catalog card no. 83-600515.

Keywords: *Buildings, *Window glass, *Wind pressure, Aerodynamic loads, Fractures(Materials), Stress analysis, Probability theory, Computer programs, *Glass cladding.

A procedure for investigating glass cladding behavior under arbitrary loads, including fluctuating wind loads, is presented. The procedure accounts for the fact that internal stresses are nonlinear functions of the external loads, that initial glass strengths are random functions of position and direction, and that glass strength undergoes degradation under the action of external loads in accordance with basic fracture mechanics laws. Numerical examples are presented, and corresponding probability distribution curves are calculated, indicating the probability of failure of a specified panel subjected to fluctuating wind loads and to 1-minute constant loads. These curves are used to illustrate a method for assessing current glass cladding design procedures.

701,506

PB83-233940 Not available NTIS
National Bureau of Standards, Washington, DC.
Upgrading Old Plumbing Vent Systems.
Final rept.
L. S. Galowin, and F. Winter. 1983, 14p
Pub. in Building Research and Practice 11, n1 p22-35 Jan/Feb 83.

Keywords: *Buildings, *Renovating, *Plumbing, Piping systems, Vents, Pipe flow, Air flow, Reprints.

Rehabilitation, modernization, or renovation of existing buildings, as a resource to be conserved or recycled and reused, frequently imposes increased loads on the plumbing water supply and drainage system. The requirement for venting in U.S. practice is intended to prevent trap seal loss from exceeding values prescribed in model plumbing codes. The vent piping in older buildings may be marginal for retrofit under current requirements with the same or increased numbers of fixtures and devices installed into the plumbing system. An experimental laboratory investigation of circulation loop modification to the drain-waste-vent (DWV) system to relieve the marginal performance of existing installations is reported.

701,507

PB83-234336 Not available NTIS
National Bureau of Standards, Washington, DC.
Convective Heat Transfer to Ceilings Above Enclosure Fires.
Final rept.
L. Y. Cooper. 1982, 7p
Pub. in Proceedings of International Symposium on Combustion (19th), Haifa, Israel, August 8-11, 1982, p933-939.

Keywords: *Buildings, *Ceilings(Architecture), Heat transfer, Fires, Convection, Fire tests, *Room fires.

Several theoretical and experimental results which are useful in estimating convective heat transfer from buoyant plumes to unconfined ceilings are to be found in the literature. While these results are applicable for estimating ceiling heat transfer in enclosure fires at early times, this is not generally the case once the inevitable layer of hot plume gases start to accumulate near the ceiling. In this paper a method for estimating ceiling heat transfer under the general conditions of

the latter scenario is outlined, and a partial verification of its validity is provided. The method requires results for unconfined ceiling heat transfer which are also summarized.

701,508
PB83-234344 Not available NTIS
National Bureau of Standards, Washington, DC.
Computation of Fire Induced Flow and Smoke Coagulation.
Final rept.
H. R. Baum, R. G. Rehm, and G. W. Mulholland. 1982, 11p
Pub. in Proceedings of International Symposium on Combustion (19th), Haifa, Israel, August 8-13, 1982, p921-931.

Keywords: *Buildings, *Fires, Smoke, Mathematical models, Finite difference theory, Fire tests, *Computer applications.

Mathematical models for the calculation of the dynamics of smoke and hot gases induced by enclosure fires are presented. The models predict the evolution of the size distribution of smoke aerosol under the influence of coagulation, as well as the large scale fluid motion and temperature fields. The calculations contain three main ingredients; a finite difference solution of a hydrodynamics problem, the computer evaluation of an exact solution to the aerosol coagulation equation, and a LaGrangian particle tracking scheme to imbed the coagulation dynamics in the hydrodynamics. The hydrodynamics model is a time dependent variable density, two dimensional, infinite Grashof number flow driven by a prescribed heat source.

701,509
PB83-234823 Not available NTIS
National Bureau of Standards, Washington, DC.
Mathematical Modelling of Time Dependent Wave Attenuation and Discrete Solid Body Transport in Gravity Driven Partially Filled Pipe Flows.
Final rept.
J. A. Swaffield, S. Bridge, and L. S. Galowin. 1982, 11p
Pub. in Proceedings of International Conference on Finite Elements in Water Resources (4th), Hannover, Germany, June 21-15, 1982, 11p.

Keywords: *Buildings, *Plumbing, Piping systems, Pipe flow, Drainage, Transport properties, Mathematical models, Method of characteristics.

The method of characteristics is applied to solve the unsteady partially filled pipe flow equations applying to the flow in building drainage systems. Wave attenuation, together with the propagation of steep fronted waves and the transport of discrete solids, is modelled and comparisons drawn with experimental investigations undertaken with representative pipe size and flow loading values.

701,510
PB83-235671 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Significance of a Wall Effect in Enclosures with Growing Fires.
L. Y. Cooper. Jun 83, 44p NBSIR-83-2730

Keywords: *Buildings, *Fires, *Flame propagation, Flames, Buoyancy, Convection, Radiant heating, Algorithms, Mathematical models, *Room fires, *Wall flow, Computer applications.

This paper studies the significance of a wall effect that has been observed during the growth stages of enclosure fire experiments. Relative to the two-layer phenomenon which tends to develop during such experiments, the effect has to do with the near-wall downward injection of hot upper layer gases into the relatively cool uncontaminated lower layer. It is conjectured that these observed wall flows are buoyancy driven, and that they develop because of the relatively cool temperature of the upper wall whose surfaces are in contact with the hot upper layer gases.

701,511
PB83-236067 Not available NTIS
National Bureau of Standards, Washington, DC.
Heat Transfer from a Buoyant Plume to an Unconfined Ceiling.
Final rept.
L. Y. Cooper. 1981, 9p
Pub. in Proceeding of Joint ASME/AIChE National Heat Transfer Conference held at Milwaukee, WI on August 2-5, 1981.

Keywords: *Ceilings(Architecture), *Fire tests, Heat transfer, Plumes, Fire safety.

The heat transfer to confined ceilings during enclosure fires is related to the heat transfer to unconfined ceiling surfaces from buoyant plume driven ceiling jets. This paper briefly discusses this relationship, and then focuses attention on the unconfined ceiling problem. Previously published theoretical and experimental studies dealing with interactions of unheated free jets and solid surfaces as well as literature which focuses directly on fire plume-unconfined ceiling interactions are brought to bear on the problem. A critical review of all of this literature results in easily applicable formulae for estimating the heat transfer in question.

701,512
PB83-236307 Not available NTIS
National Bureau of Standards, Washington, DC.
Fire Safety Equivalency System for Overnight Accomodations.
Final rept.
H. E. Nelson. 1982, 6p
Sponsored in part by National Park Service, Washington, DC.
Pub. in Trends 19, n2 p31-36 1982.

Keywords: *National parks, *Hotels, *Fire safety, Recreational facilities, Fire protection, Reprints.

A quantitative evaluation grading system for National Park Service Hotel and Dormitory Accommodations is in advanced stages of development. This article reports the status and presents the format of the evaluation procedure. The article is directed to persons responsible for NFP or similar types of facilities.

701,513
PB83-236323 Not available NTIS
National Bureau of Standards, Washington, DC.
Mathematical Model for Estimating Available Safe Egress Time in Fires.
Final rept.
L. Y. Cooper. Dec 82, 10p
Sponsored in part by Department of Labor, Washington, DC., Department of Health and Human Services, Washington, DC., Bureau of Mines, Washington, DC., and National Park Service, Washington, DC.
Pub. in Fire and Materials 6, n3-4 p135-144 Sep/Dec 82.

Keywords: *Buildings, *Fire safety, Fire hazards, Evacuating(Transportation), Mathematical models, Reprints, *Room fires, Computer applications.

A mathematical model for estimating the time available for safe egress from a fire is formulated. The model simulates the conditions which develop during the course of an enclosure fire. Since life safety considerations are primary, the simulation model which is adopted focuses attention only on phenomena which develop between the times of fire ignition and onset of hazardous conditions. This allows significant simplifications in modeling which may not be otherwise justified. Using computed variables of a simulated fire scenario of interest, times of fire detection and onset of hazard which are deduced from realistic detection and hazard criteria would be estimated. The Available Safe Egress Time (ASET) would be defined as the length of the time interval which separates these two events. Quantitative specifications for a variety of detection and hazard criteria are identified. Results of exercising the model are presented, and ASET estimates are obtained for a wide variety of realistic fire scenarios.

701,514
PB83-237495 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Simple Correlation for Predicting Temperature in a Room Fire.
J. G. Quintiere. Jun 83, 52p NBSIR-83-2712

Keywords: *Buildings, *Fire tests, Combustion, Specific heat, Mathematical models, *Room fires.

The use of a simple formula for predicting upper compartment gas temperature in a fire is demonstrated. The formula is given in terms of energy release rate, vent geometry, and compartment lining material properties. It treats discrete fires within the room. Several examples are considered to show the versatility of the formula and its general level of accuracy.

701,515
PB83-250951 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Smoke Movement in Rooms of Fire Involvement and Adjacent Spaces.
L. Y. Cooper. Jul 83, 40p NBSIR-83-2748

Keywords: *Buildings, *Fire safety, Smoke, Air flow, Flame propagation, Combustion products, *Room fires.

Key to the solution of fire safety design problems is the capability to predict the dynamics of enclosure fire environments. This paper presents a detailed qualitative description of the generic phenomena which occur during typical fire scenarios. The focus of attention is on the effects within building compartments of fire involvement, i.e., compartments made up of a single enclosed space or a space of two or more rooms interconnected by significant penetrations such as open doors or windows. Throughout the discussion reference is made to quantitative methods for predicting some of the most significant of these effects. Reference is also made to available mathematical/computer models which use these latter methods to quantitatively predict the overall fire environment.

701,516
PB83-253948 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Low-Sloped Roofing Research Plan.
Final rept.
W. C. Cullen, W. J. Rossiter, R. G. Mathey, and J. R. Clifton. Jul 83, 44p NBS-SP-659
Library of Congress catalog card no. 83-600551.

Keywords: *Buildings, *Roofing, Membranes, Thermal insulation, Maintenance, Design standards.

This report presents a long-range plan for roofing research. The plan was developed in response to a need for roofing research addressing major materials problems and changes in low-sloped roofing materials technology. The intent of the plan is to establish the technical basis for developing standards and minimum levels of performance to assist in the selection of cost-effective and durable roofing materials. Four major areas of needed research are identified: low-sloped roofing systems, roofing membranes including single-ply and built-up, thermal insulation for roofing systems, and condition assessment and repair of roofs. Within each research area, a goal is given as well as a number of objectives to achieve the goal. A recommended approach to accomplish each objective is also given.

701,517
PB83-256099 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Model of Multiroom Fire Spread.
Final rept.
T. Tanaka. Aug 83, 179p NBSIR-83-2718

Keywords: *Buildings, *Fires, Flame propagation, Heat transfer, Burning rate, Computer programming, *Room fires, *Fire spread, Computer applications.

Some refinements have been made on a multi-room fire spread model. The primary improvements are that a model on excess fuel burning in arbitrary room has been introduced, that a model for the prediction of gas concentrations has been added, that subroutine ABSORB, which was created by Modak, has been introduced to predict the upper layer emissivity, that a new fire plume model developed by McCaffrey has been included to remove the inaccuracy and inplausibility of a vertical point heat source plume model, and that the code has been revised so that it can deal with tall buildings with somewhat less computer memory size.

701,518
PB83-256511 PC **A05**/MF **A01**
Massachusetts Univ., Amherst.
Waking Effectiveness of Household Smoke and Fire Detection Devices.
Final rept.
E. H. Nober, H. Pierce, and A. Well. Jul 83, 94p
NBS-GRC-83-439
Grant NBS-DA0001

Keywords: *Houses, *Fire alarm systems, *Reaction time, Sound generators, Performance evaluation, Motor reactions, Field tests, Smoke detectors.

The present work consists of three experiments. Experiment A measured the frequency response and directionality of five typical home smoke alarms. In experiment B, normal-hearing young adults were subjected to alarm signals of 85, 70, and 55 dBA while asleep in their own bedrooms under both low and moderate background noise levels. In experiment C, subjects included families with and without children, varying types of housing, elderly, and developmentally disabled populations. Times required to awaken and evacuate all subjects in the household were measured. The report concludes that college-aged subjects can be awakened and alerted with alarm levels as low as 55 dBA (even with moderate background noise) and that evacuation times for families, geriatric and developmentally disabled populations seem to be in a range of one to two minutes.

701,519
PB83-261503 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Computer Analysis of a Pressurized Stairwell.
J. H. Klote, and X. Bodart. Aug 83, 37p NBSIR-83-2737
Prepared in cooperation with Centre Scientifique et Technique du Batiment, Station de Recherche, Champs Sur Marne, (France).

Keywords: *Buildings, *Stairways, *Fire tests, Pressurization, Air flow, Pressure gradients, Computerized simulation, Mathematical models, Computer applications, Building fires.

In recent years pressurized stairwells have been incorporated in buildings in an effort to provide smoke free exits during building fires. This paper compares the results of tests conducted in a pressurized stairwell at Champs Sur Marne, France, with computer analysis using a computer code developed at the National Bureau of Standards (NBS). A second paper is planned which will compare the NBS program with the Centre Scientifique et Technique du Batiment (CSTB) program for the same series of tests. Agreement between the NBS computer simulation and the test data was good for all tests analyzed. The appropriateness of using exclusively a flow exponent of 1/2 for smoke control design is reevaluated, and is found to have only a slight effect on the results of a computer simulation.

701,520
PB84-103258 Not available NTIS
National Bureau of Standards, Washington, DC.
Methodology for Developing Tests to Aid Service-Life Prediction of Single-Ply Roofing Membranes.
Final rept.
W. J. Rossiter, and R. G. Mathey. 1983, 8p
Pub. in Proceedings of NBS/NRCA Conference on Roofing Technology (7th), Gaithersburg, Maryland, April 14-15, 1983, p4-11.

Keywords: *Roofing, *Membranes, Performance standards, Service life, Construction materials, Durability.

The rapid growth in the use of single-ply roofing membranes has created a need for performance standards which include requirements and tests for evaluating their service life. A methodology is described for developing tests for aiding service-life prediction of single-ply membranes. The methodology is based on an ASTM practice for developing accelerated tests to aid in the prediction of the service life of building materials and components. The ASTM practice outlines a logical sequence of steps to be taken which are applicable to aid in predicting the service life of membrane materials. A summary of the ASTM practice is given and examples of the application of many of its steps to single-ply roofing systems are presented.

701,521
PB84-103530 Not available NTIS
National Bureau of Standards, Washington, DC.
Meaning of Durability and Durability Prediction.
Final rept.
G. Frohnsdorff, and L. W. Masters. 1980, 3p
Pub. in Proceedings of International Conference on Durability of Building Materials and Components (1st) Ottawa, Canada, Aug 21-23, 1978.

Keywords: *Buildings, *Construction materials, Durability, Service life, Predictions.

The concept of durability is not well-defined. The term durability is often used to imply the possession of qualities associated with long-life. In some standards for building components, it is nonquantitative and implies that design requirements are likely to be exceeded for the design service or some other specified period. An ASTM recommended practice, E632-78, for the prediction of service life is outlined. The application of the recommended practice to service life prediction is illustrated by an example from the literature and by an example from work being planned.

701,522
PB84-106616 Not available NTIS
National Bureau of Standards, Washington, DC.
Concept for Estimating Available Safe Egress Time in Fires.
Final rept.
L. Y. Cooper. 1983, 10p
Pub. in Fire Safety Jnl. 5, n2 p135-144 1983.

Keywords: *Fire safety, Fire detection, Hazards, Mathematical models, Reprints, *Room fires.

Available Safe Egress Time (ASET) in enclosure fires is defined as the time between fire detection and the onset of conditions which are hazardous to continued human occupancy. A general technique for estimating this time interval is introduced. A description of hazard development is presented. This description identifies the variables of fire growth which are significant to life safety. A conceptual engineering model which simulates these variables is formulated. Because of the primary focus on life safety, as compared with property protection or structural integrity per se, the suggested modeling includes significant simplifying assumptions which would not be otherwise justified. The concepts developed in this paper provide a rational basis for the use of a mathematical model and user oriented computer program, presented in other works, to actually carry out ASET calculations for compartments of fire origin.

701,523
PB84-114578 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Calculating Fire Plume Characteristics in a Two Layer Environment.
D. D. Evans. Sep 83, 49p NBSIR-83-2670

Keywords: *Fires, *Plumes, Flame propagation, Fire tests, Gas flow, Sprinkler systems, Fire safety, *Room fires.

Methods are developed to determine axial gas flow conditions within a weakly buoyant plume that passes from an ambient quiescent environment, in which the plume originates, to an upper layer at elevated temperatures. The methods are appropriate for inclusion in two layer analysis of enclosure fire. In particular, they are a first step in developing a prediction of actuation time for thermally activated automatic sprinklers exposed to an enclosure fire. Results obtained with various methods are compared with measurements in a 1.22 m diameter cylindrical enclosure.

701,524
PB84-118397 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Smoke Control for Elevators.
J. H. Klote. Jun 83, 62p NBSIR-83-2715
Sponsored in part by Veterans Administration, Washington, DC.

Keywords: *Fires, *Elevators(Lifts), *Handicapped persons, Stairways, Pressure, Buildings.

This paper is the second report of an ongoing project at the National Bureau of Standards (NBS) to investigate the use of smoke control in an attempt to allow the use of elevators as a means of fire escape for the handicapped. The use of stairwells for fire evacuation poses a problem for people who cannot use stairs because of physical disabilities. This paper discusses some of the major problems associated with the use of elevators as a means of fire exit and proposes a conceptual solution to those problems. A report is made on field tests of six buildings with elevator protection systems. A simple relationship is developed for the pressure differences across the elevator shaft and across the elevator lobby for one type of elevator pressurization system. Vertical pressure profiles of such systems are also discussed.

701,525
PB84-121581 PC **A05**/MF **A01**
Notre Dame Univ., IN. Dept. of Aerospace and Mechanical Engineering.
Scaling Correlations of Flashover Experiments.
Final rept.
A. M. Kanury. Oct 83, 81p NBS-GCR-83-448
Grant NB81-NADA-2021

Keywords: *Flame propagation, Heat flux, Thermal measurement, Smoke, Fire tests, Fire safety, *Room fires, Flashover.

The objective of research described here is to develop a correspondence between the measurements made on the fire growth process to flashover in compartments of different scales. Such a development is useful in predicting, from the necessarily limited existing experimental information, the conditions conducive to result in flashover and the time to flashover. Special consideration is given to the role of the room dimensions (absolute and relative), the lintel height, wall-linings, the character of the fire source, and others. Preliminary scaling rules are synthesized to relate the full-scale compartment fires with small scale test fires; these rules are then applied to certain full-and quarter-scale model test data of the Bureau of Standards focusing on the issue of flashover as influenced by lintel height, partially successful.

701,526
PB84-123165 PC **A05**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Calculations of Wall Fire Spread in an Enclosure.
K. D. Steckler. Nov 83, 76p NBSIR-83-2765
Sponsored in part by Armstrong World Industries, Lancaster, PA., and Department of Health and Human Services, Washington, DC.

Keywords: *Walls, *Flame propagation, Burning rate, Heat transfer, Energy dissipation, Mathematical models, *Room fires.

Mathematical models of fire growth in enclosures offer a potential for assessing the risk of materials with respect to a hazard such as flashover. The development of a model for fire spread over wall lining materials is presented. The work covers the development of a transient two-layer zone model, initially formulated for crib fires in a room, then adapted to simulate a spreading corner wall fire. The local wall flame spread rate and burning rate per unit are expressed in the model as functions of the external radiation incident upon the burning surface and the oxygen concentration in the adjacent gas layer (zone). Flame spread is limited to the horizontal direction. Results for a fictitious wall lining material are presented. Major elements of the results are shown to be in qualitative agreement with experience. Finally, areas for improvement and the direction of future efforts are noted.

701,527
PB84-124338 PC **A13**/MF **A01**
National Bureau of Standards, Washington, DC.
Design of Smoke Control Systems for Buildings.
J. H. Klote, and J. W. Fothergill. Jul 83, 287p NBS/HB-141
Sponsored in part by Veterans Administration, Washington, DC. and American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA. Prepared in cooperation with Integrated Systems, Brunswick, MD. Library of Congress catalog card no. 83-600558.

Keywords: *Buildings, *Fires, Air flow, Stairways, Pressurization, Fire safety, Fire tests, Computer programs, Smoke, *Smoke control, Computer aided design.

This book consolidates and systematically presents data and calculational procedures necessary to smoke control systems designers and discusses design criteria. The book was originally intended for use by mechanical engineers. However, it also may be useful to fire protection engineers and code officials. Included are discussions of the driving forces of smoke movement, the principles of smoke control, calculation of effective flow areas, concept of symmetry, and design parameters. A computer program for analysis of smoke control systems is presented. Concepts of stairwell pressurization and zoned smoke control are presented. Numerous hand calculated examples and computer calculated examples are included.

701,528
PB84-135953 Not available NTIS
National Bureau of Standards, Washington, DC.

Significance of a Wall Effect in Enclosures with Growing Fires.
Final rept.
L. Y. Cooper. 1983, 10p
Pub. in Proceedings of National Heat Transfer Conference (21st) Held at Seattle, WA. on July 24-28, 1983, p97-106 1983.

Keywords: *Walls, *Flame propagation, Combustion, Plumes, Smoke, Mathematical models, *Room fires.

This paper studies the significance of a wall effect that has been observed during the growth stage of enclosure fire experiments. Relative to the two-layer phenomenon which tends to develop during such experiments, the effect has to do with the near-wall downward injection of hot upper layer gases into the relatively cool uncontaminated lower layer. It is conjectured that these observed wall flows are buoyancy driven, and that they develop because of the relatively cool temperatures of the upper wall whose surfaces are in contact with the hot upper layer gases.

701,529
PB84-137801 Not available NTIS
National Bureau of Standards, Washington, DC.
Finite Difference Calculations of Buoyant Convection in an Enclosure. Part 1. The Basic Algorithm.
Final rept.
H. R. Baum, R. G. Rehm, P. D. Barnett, and D. M. Corley. Mar 83, 19p
Pub. in SIAM Jnl. of Sci. Stat. Comput. 4, n1 p117-135 Mar 83.

Keywords: *Walls, *Flame propagation, Convection, Buoyancy, Mathematical models, Finite difference theory, Reprints, *Room fires.

A novel mathematical model of buoyant convection in an enclosure, developed earlier, is solved by finite difference techniques in the two-dimensional case. This model has been developed as a principal analytical tool for the prediction of the movement of smoke and hot gases in fires. Effects of large density variations caused by substantial heating are retained while acoustic (high-frequency) waves, which are unimportant to buoyant convection, are analytically filtered out. No viscous or thermal conduction effects are included in the model. These two characteristics (filtering and no dissipative effects) distinguish the model from all others describing buoyant convection. The mathematical model consists of a mixed hyperbolic and elliptic set of non-linear partial differential equations: the problem is a mixed initial, boundary value one.

701,530
PB84-152529 Not available NTIS
National Bureau of Standards, Washington, DC.
Plume Flow in a Two-Layer Environment.
Final rept.
D. D. Evans. 1983, 11p
Pub. in Proceedings of National Heat Transfer Conference (21st), held at Seattle, WA. on July 24-28, 1983, p89-95.

Keywords: *Ceilings(Architecture), *Sprinkler systems, *Fire tests, Gas flow, Plumes, *Room fires.

Methods are developed to determine axial gas flow conditions within a weakly buoyant plume that passes from an ambient quiescent environment, in which the plume originates, to an upper layer at elevated temperature. The methods are appropriate for inclusion in two layer zonal models of enclosure fires. In particular, they provide a means of calculating starting conditions for the ceiling jet flow and actuation times for thermally sensitive automatic sprinkler heads located near the compartment ceiling. Calculated results are compared to measurements made in a 1.22 m diameter cylindrical enclosure.

701,531
PB84-155209 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Buoyant Source in the Lower of Two, Homogeneous, Stably Stratified Layers: A Problem of Fire in an Enclosure.
L. Y. Cooper. Dec 83, 27p NBSIR-83-2789

Keywords: *Fires, Plumes, Buoyancy, Flame propagation, Heat transfer, Smoke, Mathematical models, Fire tests, *Room fires.

A point source of buoyancy is located at a specified elevation within the lower of two homogeneous, stably stratified layers. A turbulent buoyant plume is formed above the source, and it impinges on the layers' interface. Depending on the strength of the source, its position below the interface and on the density difference of the two layers, it is conjectured that either a central portion of the impinging plume flow will penetrate and continue upward into the far field of the upper layer as a buoyant plume, the outer portion of the flow penetrating but then dropping down toward the interface because of negative relative buoyancy, or none of the impinging plume flow will penetrate the upper layer (in-depth) because of its being uniformly of negative relative buoyancy. Associated with these possible conditions will be an effective horizontal outflow of fluid at the interface. The paper derives and solves a set of model equations for these plume-interface interactions, and the results are applied to a generic heat transfer problem related to fires in enclosures.

701,532
PB84-159789 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Analysis of Electrical Fire Investigations in Ten Cities.
Final rept.
J. R. Hall, R. Bukowski, and A. Gomberg. Dec 83, 66p NBSIR-83-2803
See also PB83-200113. Sponsored in part by Consumer Product Safety Commission, Washington, DC.

Keywords: *Residential buildings, *Fires, Electric devices, Fire safety, Circuit breakers, Electric fuzes, Electric wire, Wiring, Fire damage, *Electrical fires.

This report describes the results of an analysis of electrical fire cases by the Center for Fire Research, National Bureau of Standards for the Consumer Product Safety Commission. The report describes the 105 detailed electrical fire investigation reports from 10 participating cities and discusses findings resulting from analysis of the data from those reports. These findings include the effects of tampering, alterations and other system problems, factors that may cause overcurrent devices to fail to operate, the role of extension cords misused as permanent extensions of building wiring, the problems of loose connections between receptacles and wiring, and other scenarios and sequences of events that lead to electrical fire ignition.

701,533
PB84-171172 PC **A22**/MF **A01**
California Inst. of Tech., Pasadena.
Natural Convection Flows and Associated Heat Transfer Processes in Room Fires.
Doctoral thesis.
W. S. Sargent. c1983, 524p NBS-GCR-83-447
Contract NB82-NADA-3033

Keywords: *Fires, *Heat transfer, Fire tests, Convection, Temperature gradients, Heat transfer coefficient, Plumes, Mathematical models, Theses, *Room fires.

This report presents the results of experimental investigations of natural convection flows and associated heat transfer processes produced by small fires in rooms with a single door or window opening. Calculation procedures have been developed to model the major aspects of these flows. Two distinct sets of experiments were undertaken. First, in a roughly 1/4 scale facility, a slightly dense solution of brine was allowed to flow into a tank of fresh water. The resulting density difference produced a flow which simulated a very small fire in a room with adiabatic walls. Second, in an approximately 1/2 scale test room, a nearly stoichiometric mixture of air and natural gas was burned at floor level to model moderate strength fires. In this later facility, we directly measured the heat conducted through the walls, in addition to determining the gas temperature and composition throughout the room.

701,534
PB84-203348 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
Evaluation of Thermal Energy Conservation Schemes for an Experimental Masonry Building.
Final rept.
P. S. Gujral, R. J. Clark, and D. M. Burch. Jul 82, 43p NBS/BSS-137
Library of Congress catalog card no. 81-600175. Prepared in cooperation with Skidmore, Owings and Merrill, Chicago, IL., and King Abdulaziz Univ., Jeddah (Saudi Arabia).Color illustrations reproduced in black and white.

Keywords: *Solar energy, *Cooling, *Heating, *Buildings, Space heating, Ventillation, Heat transfer, Masonry, *Energy conservation, *Passive solar heating, Space cooling.

A one-room masonry building with exterior polystyrene rigid board insulation was built within a large environmental chamber at the National Bureau of Standards. Various climatic conditions were simulated within the chamber, and the transient thermal response of the test building was monitored. Three schemes (night cooling using a ceiling-mounted valance cooling coil, natural ventilation night cooling, and passive solar heating) were investigated with regard to energy conservation. The test results indicated that these operating practices resulted in a considerable reduction in energy consumption for space heating and cooling. The measured performance of the test building compared favorably with the corresponding performance obtained with an analytic model.

701,535
PB84-216472 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Fire Research.
Buoyancy-Induced Wall Flow Due to Fire in a Room.
Final rept.
Y. Jaluria. May 84, 97p NBSIR-84-2841
Prepared in cooperation with Rutgers - The State Univ., New Brunswick, NJ.

Keywords: *Buildings, *Walls, *Fires, Boundary layer flow, Buoyancy, Flow rate, Plumes, Fire tests, *Room fires.

A study of buoyancy-driven flow generated adjacent to the vertical walls of a room due to fire in the room has been carried out. The boundary layer flow that arises over the vertical walls due to the resulting difference between the wall and gas temperatures was analyzed, employing the integral analysis method. The flow rate, momentum and convected energy in the downward flow that arises in the heated upper layer and those in the upward flow that is generated in the cooler lower layer were determined. The separation point and the region near it where the flow starts separating from the wall are studied. Though more detailed and more accurate computations are included, an approximate method for evaluating the wall effects for a two-layer model and for an experimental study is outlined.

701,536
PB84-216480 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Fire Research.
Need and Availability of Test Methods for Measuring the Smoke Leakage Characteristics of Door Assemblies.
L. Y. Cooper. May 84, 35p NBSIR-84-2876

Keywords: *Buildings, *Fires, *Smoke, Doors, Leakage, Fire tests, Pressure gradients, *Room fires.

This paper identifies and places into perspective relevant information that would assist in focusing future research and development on test methods to measure the smoke leakage characteristics of door assemblies. The concept of smoke compartmentation is introduced and developed. The importance of cross-door pressure differential in establishing the performance of door assemblies in fire generated environments is discussed. Door assembly performance is then related to life safety, in general, and to the design of compartments of safe refuge, in particular. All of the discussion suggests a listing of required door assembly test methods, and, finally, leads to a review of the availability and development status of existing and potential future test method candidates.

701,537
PB84-216548 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Fire Research.
Thermal Response of Unconfined Ceilings Above Growing Fires and the Importance of Convective Heat Transfer.
L. Y. Cooper. Apr 84, 37p NBSIR-84-2856

Keywords: *Buildings, *Ceilings(Architecture), *Fires, Flame propagation, Heat transfer, Thermal radiation, Plumes, Boundary value problems, *Room fires.

A procedure is developed to calculate the thermal response of unconfined ceilings above growing fires.

The procedure uses an algorithm for conduction into the ceiling material. It takes account of heat transfer due to radiation from the combustion zone to the ceiling surface, and due to reradiation from the ceiling to the floor and furnishings. Finally, the procedure uses a previously developed algorithm for convective heat transfer to the ceiling from the fire-plume-driven ceiling jet. The procedure is used to predict radial-dependent surface temperature histories of typical ceiling materials under a variety of different realistic levels of hazardous fire energy generation rates and combustion zone-ceiling separation distances. The results give an indication of the influence of convective heat transfer on peak ceiling thermal response, losses from fire plume gases, and radial variations and peak values of ceiling-to-floor irradiation during enclosure fires.

701,538
PB84-217041 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Fire Research.
Field Tests of the Smoke Control System at the Bay Pines VA (Veterans Administration) Hospital.
J. H. Klote. May 84, 51p NBSIR-84-2868
Sponsored in part by Veterans Administration, Washington, DC.

Keywords: *Hospitals, *Fire tests, *Smoke, Field tests, Pressurizing, Air circulation, Florida, *Smoke, *Health care facilities, Bay Pines hospital.

The Veterans Administration (VA) has sponsored a project at the Center for Fire Research of the National Bureau of Standards to study smoke control in VA hospitals and to develop new design approaches and methods of acceptance testing. This paper is the first report of this project, and it presents the results of a field test on the VA Bay Pines Hospital. In general the smoke control systems at this hospital performed well, however, there were some problems. These problems are discussed along with specific recommendations for their corrections and general recommendations to prevent similar problems in future hospitals. It was observed that the bidirectional double doors in the hospital acted in a manner similar to barometric dampers to limit pressure differences.

701,539
PB84-217066 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Fire Research.
Fire Research Publications, 1983.
N. H. Jason. Apr 84, 20p NBSIR-84-2871
See also PB83-238915.

Keywords: *Fires, Bibliographies, Meetings, Contracts, Grants, *Fire research.

Only publications prepared by members of the Center for Fire Research (CFR), by other National Bureau of Standards (NBS) personnel for CFR, or by external laboratories under contract or grant from the CFR are cited. For documents that are available for purchase from either the Government Printing Office (GPO) or the National Technical Information Service (NTIS), the specific order number has been included in the citation.

701,540
PB84-217496 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Fire Research.
Park Service Room Fire Test Simulations Using the Harvard Level 5.2 Computer Fire Model.
J. A. Rockett. Jun 84, 46p NBSIR-83-2805
Sponsored in part by Department of Health and Human Services, Washington, DC., and National Park Service, Washington, DC.

Keywords: *Furniture, *Fire tests, Ignition, Hotels, Calorimeters, Fuels, Heat transfer, Computerized simulation, Area, Mathematical models, *Rooms.

The Fire Center has conducted a series of full-scale tests of hotel-like rooms. The furnishings were a bed with headboard 'made up' with bedding, and a wooden sidetable. The ignition source was a wastebasket. The furniture was burned in the new NBS furniture calorimeter and in a 2.44 x 3.66 x 2.44 high room. As an adjunct to analysis of the test results, a series of simulations of the fire tests were run using the Harvard Fire Simulation. This report describes the simulations and their results. The principal finding of the simulations was that the room had little effect in augmenting the burning of this fuel package. The simulation result was partially due to the burn algorithm used and partially due to the relatively large fire area and short assumed flame radiation extinction length.

701,541
PB84-218064 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Office of Product Standards Policy.
National Voluntary Laboratory Accreditation Program Proficiency Testing for Thermal Insulation Materials Laboratory Accreditation Program Round 9 - August 1983.
Final rept.
J. Horlick. Jun 84, 21p NBSIR-84/2890

Keywords: *Buildings, *Fire tests, Laboratories, Flammability testing, Combustion, Insulation, Thermal conductivity, *Accreditation.

The National Voluntary Laboratory Accreditation Program (NVLAP) is a federal program which accredits testing laboratories satisfying published criteria. One Laboratory Accreditation Program (LAP) accredits laboratories for thermal insulation materials test methods. Participation in proficiency testing is required for certain test methods including: settled density, smoldering combustion, surface flammability, and thermal conductivity. Analyses and summaries of the test data returned by 30 laboratories for these methods for Insulation LAP Proficiency Testing Round 9 are reported. A description of NVLAP proficiency testing and how it fits into the laboratory evaluation process is given.

701,542
PB84-218387 Not available NTIS
National Bureau of Standards, Washington, DC.
Prediction of Corridor Smoke Filling by Zone Models.
Final rept.
W. W. Jones, and J. G. Quintiere. 1984, 15p
Pub. in Combustion Science and Technology, v35 n5-6 p239-253 1984.

Keywords: *Buildings, *Fire safety, Mathematical models, Smoke, Rooms, Gas flow, Graphs(Charts), Reprints, *Fire spreading, Compartments.

Several zone models which are being used to predict the growth and spread of fires in compartments have been examined. The authors have benchmarked these models against a set of experiments which were designed to isolate the phenomenon of smoke filling in a room adjacent to a fire source, and connected by a variable opening. Good agreement is achieved between multi-compartment models and experiment. As an adjunct, the authors have implemented correlation based on a simple theory which collapses all of the data into a single graph by using dimensionless groups. These groups then contain most of the significant variables important in describing the flow of a gas from one compartment to another.

701,543
PB84-218734 Not available NTIS
National Bureau of Standards, Washington, DC.
Aspects of Stochastic Modeling for Structural Fire Safety.
Final rept.
D. Gross. May 83, 12p
Pub. in Fire Technology, v19 n2 p103-114 May 83.

Keywords: *Buildings, *Fire safety, Mathematical models, Stochastic processes, Risk, Structures, Floors, Reprints.

A brief review is presented of methods for stochastic modeling of fires of sufficient severity to threaten the structural safety of buildings. Information is provided on the rate of fire occurrences according to the floor area at risk for the major occupancy types.

701,544
PB84-218965 Not available NTIS
National Bureau of Standards, Washington, DC.
Development of Hazardous Conditions in Enclosures with Growing Fires.
Final rept.
L. Y. Cooper. 1983, 19p
See also PB83-164368.
Pub. in Combustion Science and Technology 33, p279-297 1983.

Keywords: *Buildings, *Fires, Flame propagation, Combustion, Heat transfer, Fire hazards, Mathematical models, Reprints, *Room fires, *Flame spread.

A mathematical model for stimulating the environment in enclosures during the growth stage of hazardous fires was developed previously. To use the model one must specify the energy release rate of the fire, certain heat transfer parameters, the area and height of the enclosure and the elevation of the fire above the floor. Solution to the model's equations would yield the time-varying thickness, temperature, and product of combustion concentrations of an upper smoke layer which starts to drop from the enclosure ceiling at the time of ignition. In this paper the model equations are solved for the general class of fires whose energy release rate, Q, and product of combustion generation rates, C, are approximately proportional to t to the nth power (t is time and $n > 0$). For such fires, general results for the complete solution history of the enclosure environment are obtained and presented in the form of graphs, and, where possible, by closed form analytic expressions. Use of the results is illustrated in two example problems. The first of these involves a problem in smoldering combustion where, according to experimental data, the combustion zone can be simulated by an $n = 1$ fire. The second involves a prediction of the environment produced in an enclosure which contains an $n = 2$ fire, which simulates a specific, large-scale, flaming fire hazard.

701,545
PB84-221241 Not available NTIS
National Bureau of Standards, Washington, DC.
How Close Are We to Scientifically Based Fire Protection Engineering.
Final rept.
H. E. Nelson. 1984, 6p
Pub. in Proceedings of International Fire Protection Engineering Institute (4th) held at Brunnen, Switzerland on February 26-March 10, 1984, 6p 1984.

Keywords: *Fire protection, *Fire safety, Engineering, Mathematical models, Technology transfer, Reprints, *Foreign technology.

It is proposed that fire science advances of recent years are now reaching a state of knowledge that permits the emergence of a scientifically based fire protection engineering technology. It is proposed that a clear overview of an effective engineering approach is apparent and to at least an initial degree supported by engineering capabilities.

701,546
PB84-221274 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Conductivity of Concrete Mortar.
Final rept.
L. L. Sparks. 1983, 9p
Sponsored in part by Maritime Administration, Washington, DC.
Pub. in Proceedings of Thermal Conductivity 17, held at Gaithersburg, Maryland on June 15-18, 1983 p655-663 1983.

Keywords: *Thermal conductivity, *Concrete, Moisture content, Measurement, Low temperature tests, High temperature tests, Mortars(Material), Pressure, Temperature gradients, Reprints, *Guarded hot plate apparatus.

The thermal conductivity of a single concrete mortar specimen with varying moisture content is reported in the temperature range from 95 to 320K. The measurements were made in a guarded hot plate apparatus (ASTM C-177). Moisture migration caused by temperature gradients was minimized by studying the saturated specimen in the low-temperature region. Specimen moisture content and concomitant thermal conductivity were altered by imposing low-pressure, high temperature conditions on the specimen. The effect of changing the moisture content is discussed.

701,547
PB84-221969 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Analytical with Experimental Internal Strain Distribution for the Pullout Test.
Final rept.
W. C. Stone, and N. J. Carino. Feb 84, 10p
Pub. in Jnl. of the American Concrete Institute 81, n1 p3-12 Jan-Feb 84.

Keywords: *Concretes, *Strain measurement, *Cracking(Fracturing), Strength, Tests, Determination of stress, Reprints, Finite element analysis, *Pullout tests.

Axisymmetric, two-dimensional, linear-elastic finite element solutions for the internal strain distribution of

the pullout test were compared with experimental data from two large-scale pullout tests. Good agreement was found between experimental and analytical strains up to the load which caused first cracking in the laboratory specimens.

701,548
PB84-231067 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
Selection, Procurement, and Description of Salem Limestone Samples Used to Study the Effects of Acid Rain.
M. Ross, and L. Knab. Jul 84, 23p NBSIR-84/2905
Sponsored in part by National Park Service, Washington, DC. Prepared in cooperation with Geological Survey, Reston, VA.

Keywords: *Building stones, *Weathering, *Limestone, Exposure, Assessments, Geology, Marking, Surface finishing, Air pollution, *Acid rain, *Air pollution effects(Materials), *Salem limestone, Building materials.

This report describes the selection, procurement, and description of the Salem Limestone to be used in field exposure tests to assess the effects of acid rain on building stone. The rationale for choosing Salem Limestone is given and a brief geological description of the stone is provided. Preparation of the stone samples for field exposure, including cutting, surface finishing and labeling, is presented.

701,549
PB84-241728 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
Weatherization of Residences: Criteria for Retrofit Materials and Products.
Technical note.
W. J. Rossiter, and R. G. Mathey. Aug 84, 72p NBS/TN-1201
Sponsored in part by Department of Energy, Washington, DC. Also available from Supt. of Docs as SN003-003-02599-2.

Keywords: *Weatherproofing, *Houses, Materials, Thermal insulation, Storm windows, Doors, Weatherstripping, Thermostats, Fire safety, Energy conservation.

Criteria are given for retrofit materials and products included in the DoE Weatherization Assistance Program. These materials and products are thermal insulation, storm windows and doors, replacement windows and doors, caulks and sealants, weatherstripping, vapor retarders, clock thermostats, and replacement glazing. The criteria are based on a consideration of factors such as thermal performance, fire safety, durability, quality, conformance to building codes, use, and ease of installation. The retrofit materials and products are listed by generic type along with pertinent standards and specifications. Precautions to be followed during their insulation are also given for each of the items. Fire safety requirements for thermal insulations are recommended with regard to the use and locations where they are installed.

701,550
PB85-106391 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Ring-on-Ring Tests and Load Capacity of Cladding Glass.
Final rept.
E. Simiu, D. A. Reed, C. W. C. Yancey, J. W. Martin, and E. M. Hendrickson. Aug 84, 64p NBS/BSS-162
Grant NSF-CEE83-08329
Also available from Supt. of Docs as SN003-003-02605-1. Library of Congress catalog card no. 84-601098.

Keywords: *Sheet glass, Panels, Glass, Heat treated glass, Failure, Computer programs, Surface defects, Estimates, Test equipment, Probability theory, Tests, Buildings, Fracture strength, Loads(Forces).

Although ring-on-ring test results have been used in the past to obtain information on the strength of glass, no methodology has so far been developed in the literature explicitly relating such results to the load capacity of cladding glass. The main purpose of this report is to propose such a methodology. The proposed methodology makes use of recent advances in the modeling of the fracture mechanics behavior of glass and the calculation of stresses in plates exhibiting geometric nonlinearity. Evidence is presented which strongly suggests that the probability distribution of the load capacity of cladding glass panels whose failure is due to surface flaws can be estimated reliably on the basis of results of ring-on-ring tests used in conjunction with (a) numerical methods for the analysis of stresses in plates, and (b) information on the elastic and fracture mechanics behavior of glass currently available or that can be obtained routinely.

701,551
PB85-115558 Not available NTIS
National Bureau of Standards, Washington, DC.
Prediccion de la Resistencia del Concreto a Partir de su Madurez (Method for Prediction of Strength and Resistance of Concrete Based on the Maturity Concept).
Final rept.
H. S. Lew, and T. W. Reichard. 1980, 9p
Pub. in Rev. IMCYC 18, n113 p35-40, 43-46, 30 Sep 80.

Keywords: *Concretes, Predictions, Strength, Curing, Compressive strength, Cements, Temperature, Age, Regression analysis, Reprints.

Prediction of potential strength of concrete based on the maturity concept is presented. The maturity, which is expressed as the integral of the curing temperature with respect to time, is related to the compressive strength of standard cylinders cured at 35F, 55F, and 90F. The relationship between the compressive strength and maturity is obtained by regression analysis. Other published data are also used in the analysis of the relationship. It is shown that the function relating the compressive strength with the logarithm of maturity is nonlinear and that the relationship is dependent on type of cement, water/cement ratio, and brand of cement for a given type.

701,552
PB85-119337 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Influence of Vertical Compressive Stress on Shear Resistance of Concrete Block Masonry Walls.
K. Woodward, and F. Rankin. Oct 84, 62p NBSIR-84/2929

Keywords: *Concrete blocks, *Masonry, *Walls, Structural analysis, Mortars(Materials), Shear tests, Shear properties, Axial stress, Compressive properties, Loads(Forces), Displacement, Cracks, Cracking(Fracturing).

The results from tests on eight ungrouted and unreinforced concrete block masonry walls are presented. The emphasis of the research program is the influence of vertical in-plane compressive stress on the lateral in-plane load resistance of the walls. Each wall has nominal dimensions of 64 in. x 64 in. x 8 in. and is fabricated from similar materials by the same experienced mason. The masonry units are hollow concrete block having a nominal compressive strength of 1800 psi based on the gross area. The mortar was proportioned as a Type S. The walls are tested in the NBS Tri-directional Testing Facility using fixed ended boundary conditions at the top and bottom of the wall. Lateral in-plane displacements were applied at the top of the wall while maintaining a constant compressive axial load. The vertical compressive stress varies between 120 and 500 psi (based on net cross-sectional area) in the test program. The test results indicate that there is a linear relationship between increasing amounts of vertical compressive stress and the resulting increased in-plane maximum lateral load resistance.

701,553
PB85-128957 Not available NTIS
National Bureau of Standards, Washington, DC.
Review of Mathematical Modeling Applied to the Manufacture and Use of Portland Cements.
Final rept.
G. Frohnsdorff, and J. R. Clifton. 1980, 23p
Pub. in Proceedings of the Institute of Electrical and Electronics Engineers Cement Industry Technical Conference, Toronto, Canada, May 19, 1980, 23p.

Keywords: *Portland cements, Mathematical models, Manufacturing, Cement, Industries, Processing, Utilization, Performance, Clinker, Grinding mills, Kilns.

To optimize the manufacture and use of portland cements, whether in respect to cost, energy use, or product quality, the individual operations in the overall manufacturing processes and their interactions must be understood. If they are understood, the processes and their interactions should be describable in mathematical terms. Mathematical models of the chemical and mechanical processes in the manufacture and use of cement, and of the cement industry as a whole, are reviewed. On the basis of the information reviewed, it appears feasible to develop useful macromodels encompassing cement manufacture and use. Such mathematical models could provide important tools for assessing the use of energy and other resources in the cement and concrete industries, and stimulating the development of more refined and realistic models.

701,554
PB85-129401 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical Performance Model for Roofing Membranes.
Final rept.
J. M. Pommersheim, R. G. Mathey, and J. R. Clifton. Jun 83, 19p
Pub. in Jnl. Struct. Eng. 109, n6 p1431-1449 Jun 83.

Keywords: *Roofing, Membranes, Roofs, Bonding, Performance, Mathematical models, Failure, Stresses, Strains, Mechanical properties, Joining, Fabrics, Felts, Bituminous coatings, Reprints.

The mechanical performance of built-up roofing membranes, fully bonded to an underlying deck or substrate was modeled. Both linear and nonlinear stress-strain behaviors were considered in the model development. The model is compared to previously developed models. It was found that the equality of the complementary strain energy of the fabric or felt layer with the strain energy of the bonding adhesive or bitumen layer governs both the conditions under which membrane integrity is lost and the mode of failure. Failure can occur either by membrane splitting or adhesive disbonding. The testing criteria developed are applied to a sample case.

701,555
PB85-131878 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Field Hydraulic Performance of One- and Two-Story Residential Plumbing Systems with Reduced-Size Vents.
R. S. Wyly, and L. S. Galowin. Oct 84, 106p NBSIR-84/2860
Sponsored in part by Department of Defense, Washington, DC., and Department of Housing and Urban Development, Washington, DC.

Keywords: *Plumbing, Residential buildings, Vents, Performance.

The report describes hydraulic tests of drain-waste-vent systems with reduced-size vents installed in single-family housing units at Andrews Air Force Base, Camp Springs, Maryland. The vent systems of six field units were sized according to a procedure based on findings in prior laboratory investigations. The tests reported were conducted on three of the units before occupancy. Principal measurements made were trap-seal reduction and pneumatic pressure excursions in selected vents, using test procedures developed in the laboratory and adapted to field conditions. Results of the preoccupancy tests showed adequate performance with the reduced-size vents. A procedure for the design of reduced-size vent systems is presented that should be of interest to plumbing designers and groups engaged in updating plumbing codes.

701,556
PB85-156560 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Clearances and Methods of Protection for Wall and Ceiling Surfaces Exposed to Radiant Heating Appliances.
Final rept.
J. J. Loftus, and R. D. Peacock. Dec 84, 116p NBS/TN-1205
Sponsored by Consumer Product Safety Commisssion, Washington, DC., and Department of Energy, Washington, DC.

Keywords: *Barriers, *Thermal resistance, *Fire protection, *Clearances, Chimneys, Fire safety, Residential buildings, Tests, Walls, Ceilings(Architecture), Stoves, Radiant heating, Fire code.

The Center for Fire Research in the National Bureau of Standards has evaluated the fire hazard potential associated with the installation and use of solid fuel burning appliances (and chimney connectors) in residential housing. For this three-part study, mock-up and full scale room walls and ceilings were exposed to radiant energy from chimney connectors and an appliance operated under normal and overfire conditions at various distances or clearances from the room members. Peak surface temperature rise measurements were made on exposed and protected walls and ceilings and comparisons were made with surface temperature rise limitations established by building and fire codes.

701,557
PB85-158160 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Evaluation of Thimble-Chimney Connector (Wall Pass-Through) Systems for Solid Fuel Burning Appliances.
J. J. Loftus, and R. D. Peacock. Nov 84, 68p NBSIR-84/2969
Sponsored by Department of Energy, Washington, DC., and Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Connectors, *Chimneys, Fire safety, Performance evaluation, Residential buildings, Stoves, Walls, Thermal resistance, Radiant heating, Fire code.

This report is part of an ongoing project at the National Bureau of Standards (NBS) to evaluate the fire safety of solid fuel burning appliance installations in residential homes and buildings. Previous work included evaluations of different protection devices designed to shield room walls and ceilings from the effects of radiant energy from hot appliance and chimney connector pipe surfaces, the objective being to determine which systems would help maintain surface temperatures on combustibles within code recommended temperature levels. For this segment a total of 17 different thimble-chimney connector (wall pass-through) systems connected to chimney connector pipes from a stove were evaluated for their ability to provide thermal protection for combustibles (wood studs and headers, etc.) in room walls.

701,558
PB85-189256 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Upgrading Plumbing Vent Systems in Rehab Buildings.
Final rept.
L. S. Galowin, and F. Winter. Dec 84, 5p
Pub. in Heating/Piping/Air Conditioning 56, n12 p113-117 Dec 84.

Keywords: *Venting, *Buildings, *Plumbing, Circulation, Vents, Performance evaluation, Drains, Traps, Wastes, Reprints, *Retrofitting.

Rehabilitation, modernization, or renovation of existing buildings, as a resource to be conserved or recycled and reused, frequently imposes increased loads on the plumbing water supply and drainage system. An experimental laboratory investigation of 'circulation loop' modification to the drain-waste-vent (DWV) system to relieve the marginal performance of existing installations is reported. The experimental evaluations of the performance of the modified system and a conventional system were undertaken for a variety of wastewater load simulated conditions with various plumbing fixtures and multistory soil stack loads. The performance parameters considered were evaluation of trap seal failures and siphonic action of the water closets. Also, the dynamic responses to pressure excursions and air flow rate distributions in the branches were measured. Both systems were tested to the limiting condition for single-stack performance over a range of air flow variations into the soil and vent stack.

701,559
PB85-195311 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Urea-Formaldehyde Foam Insulations: A Review of Their Properties and Performance.
Technical note (Final).
W. J. Rossiter, and R. G. Mathey. Mar 85, 74p NBS/TN-1210
Sponsored by Department of Energy, Washington, DC. Also available from Supt. of Docs as SN003-003-02641-7.

Keywords: *Thermal insulation, *Urea formaldehyde resins, Performance, Buildings, Standards, Cellular plastics, Properties, Energy conservation, Retrofitting, Indoor air pollution.

This report presents a review of the properties and performance of urea-formaldehyde foams pertinent to their use as thermal insulation for buildings. The review is based primarily on existing published literature. The factors affecting the performance of these insulations are listed and discussed. Included among these factors are durability, effect on energy conservation, effect on other building materials, fungus resistance, shrinkage, and temperature and humidity effects on foam. A key issue involving the use of urea-formaldehyde foam insulation is its release of formaldehyde, other gases, and particulates into the air of residences. Information concerning the release of these agents is summarized.

701,560
PB85-202117 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Impact Testing of Concrete.
Final rept.
J. R. Clifton, and L. I. Knab. 1983, 8p
Sponsored by Defense Nuclear Agency, Washington, DC.
Pub. in Cement and Concrete Research 13, n4 p541-548 Jul 83.

Keywords: *Concretes, *Impact tests, Penetration, Projectiles, Impact strength, Latex, Compressive strength, Failure, Reinforced concrete, Steels, Reprints.

Three test methods were developed to determine the resistance of concrete subjected to low velocity single- and repeated impact to failure, and to higher velocity small projectiles. These performance tests were used to evaluate the effects of reinforcing concrete with one or more of the following reinforcement types: steel fibers, rebar or expanded metal. Concretes with and without latex were included.

701,561
PB85-203479 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis of Smoldering Fires in Closed Compartments and Their Hazard Due to Carbon Monoxide.
Final rept.
J. G. Quintiere, M. M. Birky, F. Macdonald, and G. Smith. 1982, 2p
See also PB82-257684.
Pub. in Fire and Materials 6, n3-4, p99-110 Sep-Dec 82.

Keywords: *Buildings, *Fire hazards, *Carbon monoxide, Fire tests, Lethal dosage, Mathematical models, Risk, Reprints, *Room fires, *Smoldering fires, Computer applications.

A review was made of smoldering fire experiments conducted in closed rooms and buildings. The results were summarized by tabulating maximum levels of CO, the time integral of CO concentration ('dose'), CO2, temperature rise and oxygen consumption. A hazard time based on the attainment of a CO dose equal to 4.5% CO-minutes and the time for transition to flaming were also tabulated. The chance of reaching a critical CO condition during smoldering seems to be comparable to the chance of having transition to flaming occur. A theoretical model, requiring inputs of CO production rate and energy release rate, was executed and compared with available data. The theoretical results for CO concentration as a function of time were in good agreement with the experimental data. The model offers a means of extrapolating test data to compartments of various size in order to assess the general hazard of CO due to smoldering.

701,562
PB85-224467 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Assessment of Needs for New Thermal Reference Materials.
B. Rennex. May 85, 92p NBSIR-85/3146
Sponsored by Department of Energy, Washington, DC.

Keywords: *Calibrating, *Thermal measuring instruments, *Thermal insulation, Construction materials, Thermal measurements, Heat transfer, Thermal conductivity, Thermal resistance, Temperature.

Thermal insulation specimens are required by users to calibrate their heat transfer apparatuses. This report assesses the need for additional calibration specimens to cover a wider range of test conditions and materials. It examines two major sources of measurement error related to the use of calibration specimens. The first is due to the lack of uniformity over a specimen area and the second is due to systematic apparatus errors which vary with the values of specimen mean temperature and thermal conductivity. Possible solutions to these problems are given, based on information obtained from users in universities, industry, and government laboratories. These include recommendations to provide calibration specimens over a wide range of values of specimen temperature and thermal conductivity.

701,563
PB85-243715 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Preliminary Recommendations for Maintenance of Factory Coated Metal Siding and Roofing.
M. C. McKnight, R. G. Mathey, and R. W. Drisko. Jun 85, 87p NBSIR-85/3193
Sponsored by Air Force Engineering and Services Center, Tyndall AFB, FL. Prepared in cooperation with Naval Civil Engineering Lab., Port Hueneme, CA.

Keywords: *Roofing, *Siding, *Maintenance, Coatings.

Recommendations and guidelines are presented for condition assessment and maintenance of the exterior surfaces of factory coated metal siding and roofing. The metal siding and roofing products commonly encountered on Air Force installations are addressed. The types of deterioration of metal buildings and appropriate methods of repair and maintenance procedures are related to the materials and construction practices used. The results of field observations of the condition of many types of coatings on metal siding and roofing in varying states of deterioration are reported. A quantitative condition assessment procedure was developed for exterior surfaces of metal buildings and consists of two parts. First, the condition of the siding and roofing of the building is evaluated using inspection forms, visual standards, and descriptions of levels of deterioration. In the second part, recommended maintenance procedures are determined using the evaluation data and analytical procedures which were developed. Visual standards and detailed coating failure descriptions were developed in order to identify and categorize the condition of the metal siding and roofing of buildings.

701,564
PB86-108180 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Assessment of the NBS (National Bureau of Standards) 1-Meter Guarded-Hot-Plate Limits.
Final rept.
B. G. Rennex. Aug 85, 98p NBSIR-85/3221
Contract DE-AI05-85OR21513
Sponsored by Department of Energy, Washington, DC. Office of Buildings Energy R and D.

Keywords: *Thermal insulation, Thermal resistance, Thermal conductivity, Performance evaluation, Calibrating, *Guarded hot plates, *Building materials.

Accurate measurement of the thermal resistance of insulation and building materials is a matter of national interest. A viable national calibration program must consist of accurate apparatuses, appropriate test methods, and calibration specimens available over the needed ranges of test and material parameters, such as temperature and apparent thermal conductivity. The apparatuses are operated according to the test methods to provide these calibration specimens. It is necessary to know the apparatus accuracy over the entirety of the operating ranges over which the calibration specimens are measured. The objective of this report is to evaluate the operating capability of the NBS 1-m Guarded-Hot-Plate apparatus according to three kinds of limiting factors. The first kind is the limits of temperature over which the various apparatus components can be used without suffering damage. The second kind is the limits of plate temperatures, specimen thickness, atmospheric pressure, and relative humidity that can be achieved with the existing control systems. The third kind is any limits on the values of apparent thermal conductivity, thermal resistance, or specimen thickness due to measurement error considerations.

701,565
PB86-112794 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Design of Round-Robin Tests Using Guarded/Calibrated Hot Boxes, Guarded Hot Plates, Heat Flow Meters.
Final rept.
F. J. Powell, and E. L. Bales. 1983, 17p
Sponsored by American Society for Testing and Materials, Philadelphia, PA., and Oak Ridge National Lab., TN.
Pub. in American Society for Testing and Materials Special Technical Publication 789, p248-264 1983.

Keywords: *Thermal insulation, *Thermal resistance, Heat flow meters, Tests, Calibrating, Reprints, Energy conservation.

The design and procedure of a round-robin sponsored by ASTM C-16 using guarded hot-boxes (ASTM C-236) and calibrated hot-boxes (ASTM C-draft in process) is described. A description of an International Standards(ISO) sponsored round-robin of tests using guarded hot-plate and heat flow meter apparatuses to measure the thermal resistance of thick thermal insulation materials is given. A brief summary of a three phase round-robin program sponsored by the ASTM C-16.30 Subcommittee on Thermal Measurements and the Mineral Insulation Manufacturers Association (MIMA) on several types of glass fiber insulation material is given.

701,566
PB86-114006 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Stone Consolidating Materials.
Final rept.
J. R. Clifton, and G. Frohnsdorff. 1982, 25p
See also PB80-202922.
Pub. in Conservation of Historic Stone Buildings and Monuments, p287-311 1982.

Keywords: *Consolidation, *Building stones, Performance evaluation, Service life, Construction materials, Field tests, Laboratory equipment, Reprints.

Mechanisms by which stone consolidants function are outlined. Evaluation of stone consolidants usually requires both laboratory and field tests to determine their initial and long-term performances. ASTM Standard E 632, Recommended Practice for Development of Accelerated Short-Term Tests for Prediction of the Service Life of Building Materials and Components, can be used to provide guidance on the test program. Materials which have been investigated as stone consolidants are reviewed. They fall into four main groups: inorganic materials, alkoxysilanes, synthetic organic polymers, and waxes. A universal stone consolidant does not exist, but epoxies, acrylics, and alkoxysilanes are the most commonly used consolidants.

701,567
PB86-130986 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Data Sources for Parameters Used in Predictive Modeling of Fire Growth and Smoke Spread.
D. Gross. Sep 85, 41p NBSIR-85/3223

Keywords: *Flame propagation, *Flammability testing, Fire point, Burning rate, Combustion products, Smoke, Thermophysical properties.

Sources of data needed for predictive modeling of fire growth by FAST and ASET, two computer codes developed at the Center for Fire Research, are identified for a few selected materials. Data includes thermophysical properties of compartment lining materials and burning rates and combustion product generation rates for typical combustible contents.

701,568
PB86-133592 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nondestructive Evaluation in Rehabilitation and Preservation of Concrete and Masonry Materials.
Final rept.
J. R. Clifton. 1985, 11p
Sponsored by Construction Engineering Research Lab. (Army), Champaign, IL.
Pub. in American Concrete Institute Special Publication 85-2, Rehabilitation, Renovation and Preservation of Concrete and Masonry Structures, p19-29 1985.

Keywords: *Concretes, *Masonry, *Assessments, Nondestructive tests, Reinforcing materials, Buildings, Renovating, Evaluation, Reprints, *Preservation.

The paper describes nondestructive evaluation (NDE) methods that can be used in assessing the condition of concrete and masonry materials and components in structures being rehabilitated or preserved. Metal reinforcement is also included. The appropriate use of NDE methods is discussed and a recommended approach to selecting NDE methods for specific sitquations is given.

701,569
PB86-137924 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Limit States Criteria for Masonry Construction.
Final rept.
B. Ellingwood, and A. Tallin. 1985, 15p
Pub. in Jnl. of Structural Engineering 111, n1 p108-122 Jan 85.

Keywords: *Masonry cements, Masonry, *Brick construction, Construction materials, Criteria, Tests, Reprints.

Specifications for masonry and other construction materials are expected to move gradually over the next several years toward the adoption of probability-based limit states criteria for design. The paper illustrates how such criteria might be developed for brick and concrete masonry construction using, as an example, masonry walls loaded in combinations of axial compression and our-of-plane flexure. The paper shows the type of data that are necessary and how that data can be manipulated within the probabilistic framework to develop probability-based resistance criteria.

701,570
PB86-138351 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Acceptance Testing of the NBS (National Bureau of Standards) Calibrated Hot Box.
Interim rept.
R. R. Jones. 1983, 16p
Sponsored by Department of Energy, Washington, DC. Assistant Secretary for Conservation and Renewable Energy. Prepared in cooperation with American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA.
Pub. in ASHRAE/DOE Conference - Thermal Performance of the Exterior Envelopes of Buildings 2, Las Vegas, NV., December 6-9, 1982, p687-702 1983.

Keywords: *Calibrating, Testing, Walls.

The paper describes the acceptance testing requirements for a new calibrated-hot-box facility at the National Bureau of Standards, designed to permit simultaneous measurement of heat, moisture, and air flow in wall constructions while subjected to dynamic ambient conditions. The performance requirements specified for the calibrated hot box wall tester and the performance tests required to be met before final acceptance are discussed. Precision and accuracy considerations are set forth. The paper also proposes potential avenues of research and the issues related to carrying out a comprehensive testing program for evaluation of the performance of wall sections.

701,571
PB86-140332 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD.
Economic Considerations in Insulating Masonry and Wood-Frame Walls of Single-Family Housing.
Final rept.
S. R. Petersen. 1979, 19p
Sponsored by American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc., Atlanta, GA., and Department of Energy, Washington, DC.
Pub. in Proceedings of the American Society of Heating, Refrigeration and Air-Conditioning Engineers/Department of Energy-Oak Ridge National Laboratory Conference on Thermal Performance of the Exterior Envelopes of Buildings, Kissimmee, Florida, December 3-5, 1979, p522-540 1981.

Keywords: *Residential buildings, *Economic analysis, Walls, Insulation, Masonry, Evaluation.

Maximum economic levels of insulation in masonry walls are expected to be lower than those for wood-frame walls in many parts of the United States for two distinct reasons: (1) insulation costs are significantly higher for masonry walls, and (2) energy savings are somewhat lower because of differences in the dynamic thermal performance of the two wall types. The report examines the impact ofboth of these factors in determining economically optimal insulation levels for several types of wall construction used in single-family housing, over a wide range of geographic locations.

701,572
PB86-141926 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Validation Tests of an Earth Contact Heat Transfer Algorithm.
G. N. Walton. Oct 85, 34p NBSIR-85/3201
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.

Keywords: *Buildings, Heat transfer, Algorithm, Experimentation, Tests.

Experimental tests and numerical calculations are performed to determine the suitability of including a simplified earth contact heat transfer algorithm in building energy analysis computer simulations. Reasonable agreement is shown between the finite difference test program and the simplified method. There is very good agreement between the floor surface temperature of the NBS Passive Solar Test Facility and the temperature predicted by the test program.

701,573
PB86-142403 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Criteria and Design Guidelines for Reduced-Size Vents for One and Two Story Housing Units.
Final rept.
R. Wyly, and L. S. Galowin. 1985, 26p
Sponsored by Department of Defense, Washington, DC., and Department of Housing and Urban Development, Washington, DC.
Pub. in ASPE Jnl. of Engineered Plumbing 1, n2 p97-122 Jul 85.

Keywords: *Residential buildings, *Plumbing, *Vents, Hydraulic test units, Measurement, Ventilation, Reprints.

The report describes hydraulic tests of drain-waste-vent systems with reduced-size vents installed in single-family housing units at Andrews Air Force Base, Camp Springs, Maryland. The vent systems of six field units were sized according to a procedure based on findings in prior laboratory investigations. The tests reported were conducted on three of the units before occupancy. Principal measurements made were trap-seal reduction and pneumatic pressure excursions in selected vents, using test procedures developed in the laboratory and adapted to field conditions. Results of the preoccupancy tests showed adequate performance with the reduced-size vents. A procedure for the design of reduced-size vent systems is presented that should be of interest to plumbing designers and groups engaged in updating plumbing codes.

701,574
PB86-153491 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
User's Guide for FAST.
W. D. Walton, S. R. Baer, and W. W. Jones. Dec 85, 36p NBSIR-85/3284

Keywords: *Fires, Computer programs, Smoke, *Compartment fires.

FAST is a multicompartment zone type computer model which predicts the smoke hazard development in each compartment based on a description of the compartments and the fire. A FORTRAN program has been written for the model. The user's guide provides a detailed description of the data input requirements and the output produced by version 17 of the program. Also included are sample program input and output.

701,575
PB86-153913 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

ASET-B: A Room Fire Program for Personal Computers.
W. D. Walton. Dec 85, 42p NBSIR-85/3144-1
Sponsored by National Park Service, Washington, DC., and Department of Health and Human Services, Washington, DC.

Keywords: *Fires, *Forecasting, Computer programs, Smoke, *Compartment fires, Fire studies.

ASET-B, a personal computer program for predicting the fire environment in a single room, is presented. ASET-B solves the same differential equations as the previously developed computer program, ASET (Available Safe Egress Time), using a simpler numerical technique. ASET-B requires as input the height and area of the room, the elevation of the fire above the floor, a heat loss factor, and a fire specified in terms of heat release rate. The program predicts the thickness and the temperature of the hot smoke layer as a function of time. ASET-B is written in BASIC and is not subject to copyright. This paper describes the program and its use. Included are a listing of the program, program variable name listing and a sample run. A discussion of user modifications also is given.

701,576
PB86-166998 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Roof Management Programs.
W. J. Rossiter, W. C. Cullen, and R. G. Mathey. Nov 85, 61p NBSIR-85/3239
Prepared in cooperation with Cullen (William C.) Associates, Potomac, MD. Sponsored by Postal Service, Washington, DC.

Keywords: *Roofs, *Construction management, Roofing, Design, Maintenance.

Roof management programs are used by private and public sector organizations in the United States to help assure that low-sloped roofing systems will perform as intended over their intended service lives. This report reviews those programs. Three general types of roof management programs are identified and discussed. The three types of roof management program currently conducted are: (1) total roof management which treats the design, construction, and maintenance of new and existing roofing; (2) new construction management dealing with design and installation; and (3) maintenance management which considers the maintenance and repair of existing roofs. Four elements are considered essential to an acceptable roof management program: (1) the roof system criterion; (2) quality assurance; (3) quality control; and (4) responsibility. In addition to the roof management programs that have been developed in the private and public sectors, several companies have organized to provide owners with total or partial roof management services.

701,577
PB86-192408 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Slide Rule Estimates of Fire Growth.
Final rept.
J. R. Lawson, and J. G. Quintiere. 1985, 26p
Sponsored by David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.
Pub. in Fire Technology 21, n4 p267-292 Nov 85.

Keywords: *Fires, *Flame propagation, Estimates, Smoke, Reprints, Fire models, Compartment fires.

A series of prediction methods has been assembled to provide an analytical basis for estimating fire growth in compartments. Solutions for each prediction method can be made using programmable scientific calculators. Prediction methods are presented for: fire size and growth rates, mass loss rates, radiant heat flux, flame height, radial flame impingement, heat flux to a ceiling, smoke filling of a room, carbon monoxide hazard with smoldering fires, temperature rise in a compartment, ventilation flow rate, flashover occurrence, corridor smoke transfer and filling, smoke concentration, visibility, flame spread rates, and fire burn time.

701,578
PB86-192499 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Finite-Element Analysis of Temperature-Induced Stresses in Single-Ply Roofing Membranes.
Final rept.
W. J. Rossiter, and M. E. Batts. 1985, 14p
Pub. in Durability of Building Materials 2, n3 p195-208 Jan 85.

Keywords: *Roofing, *Thermal stresses, Finite element analysis, Stress analysis, Reprints.

A linear finite-element method of analysis was used to calculate stresses induced in a single-ply roofing membrane by thermal gradients through the roof system. The roofing system in the analysis consisted of a totally adhered or loose-laid EPDM membrane, two layers of fibrous glass insulation board, and a metal deck.

701,579
PB86-196334 PC **A04**/MF **A01**
Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
Model for Vertical Wall Fire in a Stratified Atmosphere.
Annual rept. 15 Aug 84-14 Aug 85.
A. K. Kulkarni, and J. Hwang. Mar 86, 63p NBS/GCR-86/510
Contract NANB-4D0037
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Fires, Mathematical models, Laminar flow, Walls, Flammability testing, *Fire models, *Fire studies, Compartment fires.

A comprehensive mathematical model is presented for understanding the characteristics of a burning vertical wall immersed in a quiescent ambient atmosphere having a nonuniform vertical distribution of temperature and oxidizer mass fraction. Such a stratified atmosphere occurs, for example, in the interior of a room or aircraft cabin on fire. A set of partial differential equations and suitable boundary conditions describing a laminar flow of exothermically reacting species is solved using the Keller Box finite difference scheme. Results of burning rate and flow parameters (such as the maximum vertical velocity, flame position, etc.) are presented for many different cases of stratified atmosphere.

701,580
PB86-196573 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Assessment of Accuracy of In-situ Methods for Measuring Building Envelope Thermal Resistance.
J. B. Fang, R. A. Grot, and H. S. Park. Mar 86, 28p NBSIR-86/3328
Sponsored by Department of Energy, Washington, DC. Office of Buildings Energy R and D.

Keywords: *Thermal resistance, *Buildings, Insulation, Thermal insulation, Heat flux, Calorimeters, Thermal measurements, Field tests.

A series of field and laboratory tests were conducted to evaluate the accuracy of in-situ thermal resistance measurement techniques. The results of thermal performance evaluation of the exterior walls of six thermal mass test houses situated in Gaithersburg, Maryland are presented. The wall construction of these one-room houses includes insulated light-weight wood frame, uninsulated light-weight wood frame, insulated masonry with outside mass, uninsulated masonry, log, and insulated masonry with inside mass. In-situ measurements of heat transfer through building envelopes were made with heat flux transducers and portable calorimeters.

701,581
PB86-196631 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Effect of Age Upon Diffusion in Hydrated Alite Cement.
Final rept.
L. J. Parrott, R. G. Patel, D. C. Killoh, and H. Jennings. 1984, 5p
Pub. in Jnl. of the American Ceramic Society 67, n4 p233-237 1984.

Keywords: *Cements, Diffusion, Porosity, Microstructure, Calcium sillicates, Permeability, Reprints, *Alite.

The diffusion properties of hydrated alite cement have been compared with measurements of the degree of hydration and of pore structure for a range of ages. During hydration the large pores in the hydrated alite were progressively filled with a porous calcium silicate hydrate gel. At early stages of hydration the larger pores were directly interconnected and diffusion rates were consequently rapid. At later stages of hydration the hydrate shells around adjacent alite grains began to intergrow continuity of the larger pores is reduced. Diffusion rates then deminish rapidly with only small amounts of additional hydration. Quantitative microscopy, thermogravimetric analysis, calorimetry, quantitative X-ray diffraction and butane adsorption were used to study the microstructural development in the hydrating alite. Geometric and spacial characteristics of the pores in the hydrated alite were investigated by microscopic examination of resin replicas.

701,582
PB86-200367 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Prediction of Upholstered Chair Heat Release Rates from Bench-Scale Measurements.
Final rept.
V. Babrauskas, and J. F. Krasny. 1985, 17p
Pub. in Proceedings of Fire Safety: Science and Engineering, ASTM STP 882, p268-284 1985.

Keywords: *Chairs, *Flammability testing, *Fire safety, Fire tests, Seats, Upholstery, Furniture, Calorimeters, Fire studies.

In an earlier study a full-scale furniture calorimeter was used to determine the heat release rates for upholstered chairs containing various construction materials. Samples of these same material combinations have now been tested in a bench-scale apparatus, the cone calorimeter. A correlation was established between bench-scale and full-scale data. Thus, it appears that prediction of flashover potential of a single upholstered item may be possible by using bench-scale results.

701,583
PB86-201027 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Buoyant Plume-Driven Adiabatic Ceiling Temperature Revisited.
Final rept.
L. Y. Cooper, and A. Woodhouse. 1985, 6p
See also PB85-200103. Sponsored by American Society of Mechanical Engineers, New York.
Pub. in Proceedings of National Heat Transfer Conference, Heat Transfer in Fire and Combustion Systems, Denver, CO., August 4-7, 1985, p167-172.

Keywords: *Fires, Convection, Heat transfer, *Plume-driven ceiling jet, Compartment fires, Fire models, Fire studies.

In previous works, convective heat transfer from buoyant plume-driven ceiling jets to unconfined ceilings has been estimated using a formula for the temperature distribution below an adiabatic ceiling.

701,584
PB86-201795 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Service Life Prediction: The Barriers and Opportunities.
Final rept.
L. W. Masters. 1983, 11p
Sponsored by Conseil International du Batiment pour la Recherche l'Etude et la Documentation, Rotterdam (Netherlands).
Pub. in Proceedings of the Congress CIB 83 (Conseil International du Batiment pour la Recherche l'Etude et la Documentation) (9th), Stockholm, Sweden, August 15-19, 1983, p9-19.

Keywords: *Construction materials, Buildings, Degradation, Durability, Deterioration, Service life, Tests, *Foreign technology.

The need to advance the state of knowledge of service life prediction of building materials and, thereby, reduce a barrier to innovation and improved cost effectiveness has stimulated a number of internationally sponsored activities. The purpose of the paper is to identify some of the primary technical barriers and research opportunities that are presented to international groups working together to meet the need for improved service life predictions.

701,585
PB86-202488 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD.
Suggested Approaches for Revisions of Preliminary Performance Criteria for Tensile and Tensile Fatigue Strength Tests of Bituminous Membrane Roofing.
H. W. Busching, W. J. Rossiter, and R. G. Mathey. Apr 86, 65p NBSIR-86/3347
Prepared in cooperation with Clemson Univ., SC. Dept. of Civil Engineering. Sponsored by Du Pont de Nemours (E.I.) and Co., Old Hickory, TN. Textile Fibers Dept.

Keywords: *Roofing, *Bitumens, Tensile strength, Tensile properties, Evaluation.

Alternative approaches are reviewed for revision of the original NBS preliminary performance criteria for tensile strength and tensile fatigue strength of bituminous membrane roofing. Reviews of five approaches - elasticity theory, brittle fracture, viscoelasticity theory, strain energy and finite element techniques - were completed. Advantages and limitations of these approaches were identified and use of the strain energy approach for both tensile strength and tensile fatigue strength preliminary performance criteria was recommended.

701,586
PB86-203585 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Effect of Wall Mass and Insulation on Energy Consumption in Residential Buildings: An Experimental Study.
Final rept.
D. M. Burch. 1983, 11p
Sponsored by Conseil International du Batiment pour la Recherche l'Etude et la Documentation, Rotterdam (Netherlands).
Pub. in Proceedings of CIB Congress to Build and Take Care of What We have Built with Limited Resources (9th), Stockholm, Sweden, August 15-19, 1983, v3a, p245-255.

Keywords: *Residential buildings, Walls, Thermal insulation, *Energy consumption.

The paper investigates the effect of wall mass on the space heating and space cooling requirements of residential buildings. Six test buildings were extensively instrumented and subsequently exposed to outdoor climatic conditions near Washington, D.C. No reductions in space heating requirements attributed to wall mass were observed during the winter heating season when some space heating was provided each hour of the test. However, during the intermediate heating season and the summer cooling season, when the heating/cooling plant did not operate during a portion of the day, significant reductions in space heating/cooling requirements attributed to wall mass were observed.

701,587
PB86-203601 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
NBS (National Bureau of Standards) Line-Heat-Source Guarded Hot-Plate for Thick Materials.
Final rept.
F. J. Powell, and B. G. Rennex. 1983, 16p
Sponsored by American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA.
Pub. in Proceedings of ASHRAE/DOE Conference on Thermal Performance of the Exterior Envelopes of Buildings 2, Las Vegas, NV., December 6-9, 1982, p657-672 1983.

Keywords: *Thermal measuring instruments, *Thermal insulation, Thermal resistance, *Guarded hot plate.

The use of higher R-value and thicker thermal insulation materials required NBS to produce a new apparatus for absolute measurements of thick materials that can be used as transfer standards. These standards are used for calibration of guarded hot-plate (ASTM C-177) or heat flow meter (ASTM C-518) equipment in user laboratories across the country. The paper gives a technical description of the as-built apparatus including dimensions and a summary of the rational used for the selection of the apparatus materials, the control instrumentation and the data logging equipment.

701,588
PB86-203999 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Methodology for Assessing the Thermal Performance of Low-Sloped Roofing Systems.
S. J. Treado, W. J. Rossiter, and R. G. Mathey. May 86, 51p NBSIR-85/3264
Sponsored by Department of Energy, Washington, DC.

Keywords: *Roofs, *Thermal analysis, Heat transmission, Moisture, Thermal resistance, Thermal efficiency, Energy conservation.

A methodology was developed to estimate the thermal performance of existing low-sloped roof systems. The methodology was based on a review of available information and experience. Roof system thermal resistance is used as the thermal performance characterization parameter. The procedure for determining total roof thermal resistance is described, including measurement and calculation methods, and adjustments for moisture intrusion, insulation gaps and fasteners.

701,589
PB86-229515 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
NBS (National Bureau of Standards)/Harvard Mark VI Multi-Room Fire Simulation.
J. A. Rockett, and M. Morita. May 86, 30p NBSIR-85/3281

Keywords: *Fire tests, Fires, *Compartment fires, Fire models, Fire studies.

The NBS/Harvard Mark VI multi-room fire simulation program structure is discussed and compared with Harvard V. In addition to the current, operating version of Mark VI, a development version is being used to test enrichments which can be readily moved into the operational version as they mature.

701,590
PB86-245719 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Conference on Accreditation of Construction Materials Testing Laboratories, May 14-15, 1986. Executive Summary.
J. H. Pielert. Jun 86, 28p NBSIR-86/3397
Sponsored by American Society for Testing and Materials, Philadelphia, PA.

Keywords: *Construction materials, *Materials specifications, *Meetings, Materials tests, Standards.

The Conference was structured to consider: The status of existing laboratory evaluation and accreditation programs; current trends in the accreditation process; and the need for and nature of a coordinated accreditation system. Included the presentation of invited papers and four workshop sessions.

701,591
PB86-247889 PC **A03**/MF **A01**
Factory Mutual Research Corp., Norwood, MA.
Spray Cooling in Room Fires.
Technical rept.
H. Z. You, H. C. Kung, and Z. Han. Jul 86, 46p NBS/GCR-86/515
Contract NB83-NADA-4054
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Fire tests, Ceilings(Architecture), Sprinklers, Cooling, Spraying, *Compartment fires, Room fires, Fire studies.

A series of 25 fire tests were conducted to investigate cooling in room fires by sprinkler spray. The tests were conducted in a test room, which had an opening centered in one of the 3.66 m walls. The fire source was a spray fire with constant heptane flow rate, located opposite the room opening. In each test only one sprinkler was installed at the ceiling.

701,592
PB87-103321 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Modeling Window Optics for Building Energy Analysis.
G. N. Walton. Jul 86, 50p NBSIR-86/3426
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.

Keywords: *Windows, *Optical tests, Daylighting, Heating, Energy conservation, Energy efficiency.

The report discusses modeling the optics of windows for the purposes of simulating building energy requirements or daylighting availability. The theory for calculating the optical performance of conventional windows is reviewed. The simplifications that might commonly be made in creating computational models are analyzed.

701,593
PB87-104113 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Design of a Calibrated Hot-Box for Measuring the Heat, Air, and Moisture Transfer of Composite Building Walls.
Final rept.
P. R. Achenbach. 1981, 1p
Pub. in Proceedings of ASHRAE/DOE-ORNL Conference on Thermal Envelope of Buildings, Orlando, FL., December 3-5, 1979, p16 1981.

Keywords: *Buildings, Heat transfer, Walls, Thermal transfer.

A large calibrated hot-box is to be constructed at the National Bureau of Standards to support the development of standard procedures for measuring the heat, air and moisture transfer of room-size (3.0 by 4.5 m) exterior-wall specimens under a range of simulated climatic conditions. The apparatus will be used for research in both steady-state and dynamic thermal performance in support of standard test methods; for study of the processes of heat transfer, air leakage and moisture transfer in building walls as aids to the design and construction of buildings for energy conservation; and to provide traceability in measurement to NBS through calibration services, Standard Reference Materials or the National Voluntary Laboratory Accreditation Program.

701,594
PB87-106738 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Moisture and Roof Performance.
Final rept.
D. M. Burch, R. G. Mathey, and W. J. Rossiter. 1984, 3p
Pub. in ASTM (American Society for Testing and Materials) Standardization News 12, n11 p26-28 1984.

Keywords: *Roofs, *Moisture content, Roofing, Standards, Condensing, Reprints.

The article discusses moisture problems in ventilated attics of residential buildings and in low sloped roofing systems of industrial and commercial buildings. Existing standards relating to control of moisture are described. A synopsis of recent research on moisture problems in roofing systems is provided. The need for new standards is assessed.

701,595
PB87-122784 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
DATAPLOT as an Expert System for Interactive Data Analysis.
Final rept.
J. J. Filliben, and J. T. Fong. 1984, 19p
Pub. in Proceedings of 1984 ASME Pressure Vessels and Piping Conference and Exhibition, San Antonio, TX., June 17-21, 1984, v96 p37-55.

Keywords: *Computer graphics, Fortran, Microstructure, Quality control, Microcomputers, Construction materials, *Expert systems, *DATAPLOT system, Language programming, Interactive systems, High level languages, Data analysis, Case studies.

A brief description of DATAPLOT(TM), a Fortran-based interactive, high-level language for data analysis and graphics, is presented. Capabilities of the most recent version (83/6) of DATAPLOT are described and illustrated with two examples. The use of DATAPLOT as an 'expert' system for 'advanced' data analysis, as implemented in a new version (84/6), is introduced through a case study involving the analysis of some microstructural data for use in the quality control of a rear axle housing casting of nodular cast iron. A discussion of the significance of the enhanced version of DATAPLOT is included.

701,596
PB87-134839 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Window U-Values: Research Needs and Plans.
Final rept.
W. P. Goss, and M. E. McCabe. 1986, 7p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of ASHRAE/DOE/BTECC Conference on Thermal Performance of the Exterior Envelopes of Buildings III, Clearwater, FL., December 2-5, 1985, p716-722 1986.

Keywords: *Windows, Thermal conductance, Measurement, Thermal properties, Test methods, Transmittance, *U values.

Recently, there has been significant interest in developing a standard test procedure for determining the thermal transmittance (U-value) and thermal conductance (C-value) of window and window treatment products. Currently, several test methods are used to measure these quantities, and the proponents of these methods do not agree on a standard procedure for measurement. As a result, it is difficult to compare the U-values and overall thermal performance of different windows and window treatment products. The paper discusses the specific research needed to address the above problem, as well as a detailed two-phase program to perform that research.

701,597
PB87-138376 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Strain Energy of Bituminous Built-Up Membranes: An Alternative to the Tensile Strength Criterion.
W. J. Rossiter, and D. P. Bentz. Sep 86, 68p NBSIR-86-3418
Prepared in cooperation with Du Pont de Nemours (E.I.) and Co., Old Hickory, TN. Textile Fibers Dept.

Keywords: *Rooting, *Bitumens, *Tensile strength, Tension tests, Membranes, *Building materials.

The study was conducted to revise the performance criterion for tensile strength of bituminous built-up membranes. Bituminous membrane samples, fabricated from polyester fabric, polyester-glass composite fabric, and single plies of APP- and SBS-modified bitumen, were tested in tension to determine their load-elongation properties and to measure their strain energy. The results of the tensile tests of the new bituminous membranes indicated wide variability of load and elongation among the different types of materials.

701,598
PB87-150504 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Proposed Experimental Program for Large-Scale Braced-Frame Connections.
Final rept.,
J. L. Gross. 1986, 17p
Sponsored by American Inst. of Steel Construction, Chicago, IL.
Pub. in Proceedings of AISC National Engineering Conference: Solutions in Steel, Nashville, TN., June 12-14, 1986, p16-1--16-17.

Keywords: *Frames, *Joints(Junctions), *Buildings, Gusset plates, Loads(Forces), Structural design, Steel structures, *Braced frames.

Diagonal bracing systems are frequently employed in steel framed structures to provide stability and to resist both wind and seismic loads. It is common in such bracing systems to use gusset plates to attach the diagonal braces to the main framing members. Analytical studies have shown that the force distribution in a gusseted connection depends upon all of the structural components constituting the connection including the gusset plate, diagonal brace or braces, column, beam, and fasteners (bolts or welds). Research is currently in progress at the National Bureau of Standards (NBS) to determine experimentally the behavior of gusseted, connections. Three 3/4-scale braced frame subassemblages, each with a different connection detail will be tested. The objectives of the NBS experimental program on braced frame connections are presented. The selection of the subassemblage to be tested, based on prototype behavior, is described. And the details of the proposed test specimens and loading are given.

701,599
PB87-152310 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Influence of Mortar Bedding on Masonry Prism Behavior,
P. Gaynor, K. Woodward, and C. Scribner. Feb 87, 69p NBSIR-86/3467

Keywords: *Mortars(Materials), *Masonry, Concrete blocks, Compression tests, Ultimate strength, Prisms.

The results from compression tests of seventy ungrouted, hollow, concrete block masonry prisms are presented. The prisms are three-high, stack-bonded assemblages. The varied parameters in the investigation include block strength, mortar type, and mortar bedding type (area). The resulting data include the ultimate strength of the prisms and strains measured at various locations on each prism. Major observations of prism behavior are that mortar type has a neglible influence on prism behavior, block strength affects prism ultimate strength in proportion to its own ultimate strength variation, and mortar bedding type significantly affects ultimate strength, its variability, strain distributions, and mode of failure. It is recommended that faceshell bedded prisms not be used as quality control samples for masonry construction because of their disturbed strain fields and higher variability of test data.

701,600
PB87-153094 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Service Life Prediction from Accelerated Aging Test Results Using Reliability Theory and Life Testing Analysis.
Final rept.,
J. W. Martin. 1985, 21p
Pub. in Proceedings of NATO Advanced Research Workshop on Problems in Service Life Prediction of Building and Construction Materials, Paris, France, September 10-12, 1984, p191-211 1985.

Keywords: *Construction materials, *Accelerated tests, Service life, Cost analysis, Reliability, Risk, Life tests.

Accelerated aging test procedures used in high technology industries were applied to building products. The emphasis in these procedures is in the mathematical analysis of the life data. One of the more successful mathematical procedures is reliability theory and life testing analysis. In the paper, the basic format of this analysis procedure is outlined and several applications are presented in which these techniques were applied to predicting the service life of building materials and products. The results of these analyses are very promising and it is concluded that reliability theory and life testing analysis techniques should be readily adaptable for predicting the service lives of a wide range of building products and materials.

701,601
PB87-157145 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Glass Strength Degradation under Fluctuating Loads.
Final rept.,
D. A. Reed, and E. R. Fuller. Jul 85, 8p
Pub. in Jnl. of Structural Engineering III, n7 p1460-1467 Jul 85.

Keywords: *Glass, Buildings, Loads(Forces), Cladding, Aerodynamics, Deformation, Mechanics, Failure, Probability theory, Reprints, Wind loads.

An alternative approach for estimating the strength degradation, and ultimately, the failure of glass cladding subjected to fluctuating loadings is proposed. The procedure is formulated using fracture mechanics concepts employed previously by Evans and Fuller (1973). This approach is simple computationally and does not require time integration of fluctuating stress or pressure loading time histories.

701,602
PB87-180873 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Durability Performance Criteria for Building Materials.
Final rept.,
G. Frohnsdorff, and L. Masters. 1984, 10p
Pub. in Durability of Concrete Structures, p317-326 Apr 84.

Keywords: *Concrete structures, *Construction materials, Service life, Durability, Accelerated tests, Predictions, *Building materials.

Performance criteria for the durability of building materials are needed if innovation is not to be unnecessarily inhibited. The criteria must be relatable to the required service lives of the materials in given applications. The relationships will often have to be established by predicting the service life from a combination of expert knowledge and the results of properly structured short-term tests. In view of the importance of the predictions, it is essential that a standard methodology be established for making and reporting the predictions and for assessing their reliability. A methodology for developing tests for use in predicting service lives of building materials and components has been standardized by ASTM. It is ASTM E-632, Standard Practice for Developing Accelerated Tests to aid Prediction of the Service Life of Building Components and Materials. Whereas, in the past, predictions of service life have often been made by individual experts, computer-based expert systems could be used as a way of sharing expert knowledge in the future to make decisions of improved quality. It is conceivable that standard expert systems could be developed and maintained by standards committees.

701,603
PB87-214110 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Interim Procedure to Measure the Thermal Performance of Window Systems,
M. E. McCabe, and W. P. Goss. Jun 87, 124p NBSIR-87/3569
Sponsored by Bonneville Power Administration, Portland, OR.

Keywords: *Windows, *Heat transfer, Architecture, Skylights, Convection, Heat loss, Commercial buildings, Residential buildings, Window glass, Double glazing, U-values, Energy conservation.

The purpose of the report is to review the current sources of information on U-values and to describe the state of thermal test methods used for windows in order to provide the Bonneville Power Administration with some general guidelines in the application of thermal test data for use in the Model Conservation Standards (MCS) by the Northwest Power Planning Council. At present, considerable controversy exists in the window industry regarding the thermal testing of windows, therefore no consensus-based standards are available.

701,604
PB87-231007
(Order as PB87-230975, PC **A04**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD.
Finite Element Study of Transient Wave Propagation in Plates,
M. Sansalone, N. J. Carino, and N. N. Hsu. 25 Mar 87, 12p
Included in Jnl. of Research of the National Bureau of Standards, v92 n4 p267-278 Jul-Aug 87.

Keywords: *Wave propagation, *Concrete, *Failure, *Nondestructive tests, Impact, Stresses, Displacement, Plates(Structural members), Finite element analysis, Impact-echo method, Green's function.

Studies of transient wave propagation in plates were carried out to establish a basis for the impact-echo technique as a nondestructive test for flaw detection in concrete. The surface displacements caused by stress waves generated by point impact on a plate were calculated using both the Green's function solution and the finite method; displacement waveforms obtained by the two approaches showed good agreement. Displacement and stress fields in a plate were studied using finite element analysis. It was shown that transient point load applied normal to a stress-free boundary gives rise to P- and S-'wakes'-disturbances trailing the P- and S-waves. The displacement and stress fields in each wake resemble those in the preceding wave.

701,605
PB87-231015
(Order as PB87-230975, PC **A04**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD.
Finite Element Study of the Interaction of Transient Stress Waves with Planar Flaws,
M. Sansalone, N. J. Carino, and N. N. Hsu. 25 Mar 87, 12p
Included in Jnl. of Research of the National Bureau of Standards, v92 n4 p279-290 Jul-Aug 87.

Keywords: *Wave propagation, *Concrete, *Failure, Nondestructive tests, Impact, Displacement, Stresses, Plates(Structural members), Finite element analysis, Green's function, Impact-echo method.

The paper presents a finite element study of transient wave propagation in plates containing planar flaws. The effects on displacement waveforms caused by waves diffracted from the sharp edges of a flaw are determined. Displacement fields within a plate containing a flat-bottom hole show the interaction of transient stress waves with a planar flaw. Waveforms obtained from the finite element analysis were compared with experimentally obtained waveforms.

701,606
PB87-231718 CP **T05**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
FAST: A Model for the Transport of Fire, Smoke and Toxic Gases. Version 17.
Model-Simulation,
W. W. Jones. 1985, mag tape NBS/SW/MT-87/008
Supersedes PB85-150555.
Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation, PB85-109130, and PB86-153491.

Keywords: *Models-simulation, Computer programs, Smoke, *Compartment fires, *Toxic substances.

A numerical implementation of a zone model which will transport fire, smoke and toxic gases in a multi-compartment structure. The model includes the calculations necessary for a toxic hazard evaluation of materials...Software Description: The model is written in the FORTRAN programming language for implementation on a PERKIN-ELMER 3200 computer using the OS32/6.2 operating system. Memory requirement is 128 K bytes.

701,607
PB87-233540 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
RILEM: Reunion Internationale des Laboratoires d'Essais et de Recherches sur les Materiaux et les Constructions.
Final rept.,
J. R. Wright. 1983, 4p
Sponsored by American Concrete Inst., Detroit, MI.
Pub. in Concrete International, p47-50 May 83.

Keywords: *Construction materials, *Standards, *Meetings, Civil engineering, Reprints, *Foreign technology.

The paper is a review of the International Union of Testing and Research Laboratories for Materials and Structures (RILEM). The paper describes the formation and development of RILEM, its scope of work, current activities and possible future directions. The work of RILEM is to bring experts in the field of building materials, structural components, and civil engineering structures together in order to evaluate research results, evaluate testing methods, stimulate and promote research, and make the results of research accessible by publishing state-of-the-art reports, technical recommendations, and other technical documents. RILEM carries out its work through 38 technical committees, more than half of which have members from the United States. Some committees are cosponsored by other international organizations. Technical committees in turn sponsor technical symposia and seminars. In addition, they prepare technical recommendations which serve as the scientific or engineering basis for national and international standards. The paper presents the organizational structure of RILEM, a listing of current officers, a description of RILEM's long-range planning effort for the 1980's.

701,608
PB88-110820 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Properties of Weathered Uncoated and 'Restaurant'-Coated Bituminous Built-Up Roofing Membranes.
Final rept.,
R. G. Mathey, and W. J. Rossiter. 1983, 20p
See also AD-A130 563. Sponsored by Naval Civil Engineering Lab., Port Hueneme, CA., and Department of Energy, Oak Ridge, TN.
Pub. in Durability of Building Materials 2, p59-78 1983.

Keywords: *Roofs, Bitumens, Felts, Performance evaluation, Reprints, *Foreign technology.

A study to compare the performance properties of weathered built-up membranes which had and had not been subjected to an application of 'resaturant'-type coatings has been conducted. The membrane samples (asphaltic and coal-tar pitch) which were taken from roofs of buildings ranged in age from 14 to 26 years. Sections of these roofs had been treated with one of three proprietary 'resaturant' type coatings. The age of the coatings ranged from 12 to 29 months. The membrane samples removed from the roofs were visually examined in the laboratory to determine their general condition, the extent of adhesion between plies of felts, the number of plies, and the thicknesses of the interply bitumen.

701,609
PB88-134531 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Single-Ply Standards on the Way.
Final rept.,
W. J. Rossiter. 1983, 1p
Pub. in Roof Design 1, n4 p12 Dec 83.

Keywords: *Roofing, Standards, Elastomers, Bitumens, Reprints, Single ply roofing.

No abstract available.

701,610
PB88-147723 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Nondestructive Evaluation Methods for Assessing the Quality of Seams in Single-Ply Membranes.
Final rept.,
J. R. Clifton, J. L. Pizzutti Dos Santos, and W. J. Rossiter. 1985, 5p
Sponsored by Naval Civil Engineering Lab., Port Hueneme, CA.
Pub. in A Decade of Change and Future Trends in Roofing, Proceedings of the International Symposium on Roofing Technology (2nd), Gaithersburg, MD., September 18-20, 1985, p433-437.

Keywords: *Roofing, *Nondestructive tests, Ultrasonic tests, Infrared thermal detectors, Voids, Defects, Delaminating, Reprints.

The feasibility of using the ultrasonic pulse echo method and the infrared thermography method for detecting the presence of voids and delaminations in adhesive-bonded seams in single-ply membranes was investigated in laboratory and field exploratory studies. Preliminary results suggest that these methods could be used to locate voids and delaminations in seams.

701,611
PB88-152541 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
NVLAP (National Voluntary Laboratory Accreditation Program) and the Thermal Insulation Proficiency Testing Program.
Final rept.,
J. Horlick, and H. W. Berger. 1985, 20p
Pub. in Jnl. of Thermal Insulation 8, p278-297 Apr 85.

Keywords: *Laboratories, *Thermal insulation, Flammability, Combustion, Tables(Data), Reprints, NVLAP(National Voluntary Laboratory Accreditation Program), US NBS.

The paper describes the National Voluntary Laboratory Accreditation Program (NVLAP), administered by the National Bureau of Standards, and summarizes the proficiency testing program for the Thermal Insulation Materials Laboratory Accreditation Program (Insulation LAP). NVLAP and its procedures for assessing, evaluating, and accrediting laboratories are presented briefly. The scope of the Insulation LAP is described. The results of the proficiency testing program over a four year period of testing are given. Eight tables show the statistical results of data submitted by participating laboratories for thermal transmission properties, thermal conductance, surface flammability, settled density, critical radiant flux, and smoldering combustion.

701,612
PB88-153739 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.
Standards for Building Materials, Equipment and Systems Used in Detention and Correctional Facilities.
Final rept.,
R. D. Dikkers, and B. C. Reeder. Nov 87, 116p
NBSIR-87/3687
Sponsored by National Inst. of Corrections, Washington, DC.

Keywords: *Construction materials, *Prisons, Fire safety, Security, Standards, Jails.

Because of equipment and system performance problems which have occurred in jails and prisons, the National Institute of Corrections (NIC), U.S. Department of Justice, initiated a study at the Center for Building Technology, National Bureau of Standards (NBS) in September 1986. The general objective of the study is to develop guidelines, test methods and the technical bases for standards which would assist in the selection, application, and maintenance of building materials, equipment and systems for use in detention and correctional facilities.

701,613
PB88-155817 PC **A06**/MF **A01**
Portland Cement Association, Skokie, IL.
Flexural and Shear Behavior Reinforced Concrete Beams during Fire Tests.
Final rept.,
T. D. Lin, B. Ellingwood, and O. Piet. Nov 87, 104p
NBS/GCR-87/536
Grant NBS-G8-9027
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Reinforced concrete, *Beams(Supports), *Fire resistance, Flexural strength, Shear strength, Thermal analysis.

The results of fire resistance tests of six reinforced concrete beams exposed to the standard ASTM E119 test conditions and to a short duration high intensity fire are described and summarized. The measured temperatures, deflections, expansions and slopes together with the thermal and structural properties of concrete and steel were used to validate predictive thermal structural analysis computer programs.

Structural Analyses

701,614
NUREG/CR-4328 PC **A03**/MF **A01**
Brookhaven National Lab., Upton, NY.
Probability Based Load Combination Criteria for Design of Shear Wall Structures,
H. Hwang, K. Nakai, M. Reich, B. Ellingwood, and M. Shinozuka. Jan 86, 43p BNL-NUREG-51905
Contract DE-AC02-76CH00016
Errata sheet inserted. Prepared in cooperation with National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology, and Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics. Sponsored by Nuclear Regulatory Commission, Washington, DC. Office of Nuclear Regulatory Research, and Department of Energy, Washington, DC.

Keywords: *Earthquake resistant structures, *Reinforced concrete, Shear loads, Earthquakes, Design, Reliability, Nuclear power plants, *Shear walls.

The report describes the development of probability-based load combination criteria for the design of reinforced concrete shear wall structures subjected to dead load, live load and earthquake. The proposed design criteria are in the load and resistance factor

design (LRFD) format. The load and resistance factors are determined for flexure and shear limit states and target limit state probabilities. The flexure limit state is defined according to the ACI ultimate strength formula. The shear limit state is established from experimental results.

701,615
PB-263 527/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Live-Load Survey Results for Office Buildings.
Final rept.,
C. G. Culver. Dec 76, 16p
Pub. in Jnl. of the Structural Div., Proceedings of the American Society of Civil Engineers, v102 nST12 p2269-2284 Dec 76.

Keywords: *Office buildings, *Dynamic loads, Loads(Forces), Mathematical models, Office equipment, Design criteria, Reprints.

Live load data obtained from a survey of twenty-three office buildings located in various regions throughout the United States are presented. The buildings ranged in height from two stories to forty-nine stories. Data for government and private office buildings are included. Statistical summaries of the data are presented and the effects of various factors such as building height, building age, geographic location, room use and room size are discussed. A mathematical model expressing the relationship between the live load in offices and the significant factors affecting the load magnitude is also presented. The data presented may be used to evaluate current requirements for design loads for buildings and also for research studies of load effects in buildings.

701,616
PB-263 886/4 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Investigation of the Skyline Plaza Collapse in Fairfax County, Virginia.
Final rept. Jun 73,
E. V. Leyendecker, and S. G. Fattal. Feb 77, 95p NBS-BSS-94
Sponsored in part by Occupational Safety and Health Administration, Washington, D.C. Library of Congress catalog card no. 77-600002.

Keywords: *Apartment buildings, *Collapse, Concrete slabs, Structural analysis, Formwork(Construction), Shear properties, Columns(Supports), Virginia, Fairfax County(Virginia), Skyline Plaza, Progressive collapse.

The collapse of the Skyline Plaza apartment building A-4 has been studied by using information contained in case records of the Occupational Safety and Health Administration (OSHA), U.S. Department of Labor and obtained from on-site inspections by investigators from the National Bureau of Standards. Non-compliance with OSHA construction standards has been identified with regard to formwork, field-cured concrete specimens and crane installation. Specifically, the construction procedures did not comply with standards for the removal of supporting forms. It is concluded that premature removal of forms was a contributing factor to the collapse in building A-4. An analysis of the 23rd-floor slab indicates that its most likely mode of failure was in shear around one or more columns in section 3 of the floor slab. The strength of the 23rd-floor slab on the day of collapse has been estimated to be at a level that removal of shoring could have produced shear failure in the slab.

701,617
PB-265 103/2 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Earthquake Related Activities of the Center for Building Technology.
Status rept. to Dec 76,
C. G. Culver. Mar 77, 24p NBSIR-76-1193

Keywords: *Earthquake resistant structures, Design, Buildings, Structural engineering, Structural design, Disasters, Abatement, *Earthquake engineering, Disaster mitigation.

The report describes activities related to earthquake engineering being carried out by the Center for Building Technology as part of the Center's overall Disaster Mitigation Program. Laboratory and field research, post disaster investigations and efforts to develop comprehensive earthquake resistant design provisions are included. The professional disciplines within the Center and the laboratory facilities are discussed. Recent accomplishments and mechanisms employed for facilitating implementation of the Center's research results are also discussed.

701,618
PB-274 977/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Smoke Control by Systematic Pressurization.
Final rept.,
F. C. W. Fung. Nov 75, 9p
Pub. in Proceedings of CIB Symposium, Hertfordshire, England 4 Nov 75, Fire Research v11 n4 p261-269 Nov 76.

Keywords: *Fires, *Smoke abatement, Ventilation, Air circulation, Exhaust systems, *High rise buildings, *Smoke control, Seattle Federal Building, Chicago Federal Building, Reprints.

An experimental investigation of smoke control in high-rise buildings by the 'Systematic Pressurization' concept is presented here. This concept of smoke control involves the utilization of a modified building air-handling system. The building is generally divided vertically into several horizontal smoke control zones, each containing a predetermined number of floors. Upon smoke alarm the air-handling system is programmed to switch to smoke control mode by providing 100% exhaust to the smoke zone and 100% supply to the other zones. The idea is to simultaneously exhaust smoke from its zone of origin, and prevent smoke propagation to the other zones by pressurization. Examples of the zoned or systematic pressurization smoke control concept are the Seattle and Chicago Federal Buildings. An extensive series of experiments, using the sulfurhexafluoride smoke simulation system, were performed to evaluate these buildings. During the experiments, complete stairwell and elevator shaft pressure profiles under normal and smoke control operations were also obtained. The effectiveness of the smoke control system as implemented in these federal buildings is discussed in the light of normalized sulfurhexafluoride concentrations and the pressure profiles.

701,619
PB-274 988/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reliability of RC Beams Subjected to Fire.
Final rept.,
B. Ellingwood, and J. Shaver. May 77, 13p
Pub. in Jnl. of the Structural Division, Proceedings of the American Society of Civil Engineers, v103 ST5 p1047-1059 May 77.

Keywords: *Beams(Supports), *Reinforced concrete, *Fire resistance, Thermal stresses, Fire tests, Thermal degradation, Structural engineering, *Fire endurance, Reprints.

Methods for analytically predicting the behavior of reinforced concrete beams subjected to fire are presented. These incorporate the temperature-dependent strength degradation in the steel as well as thermal and creep strains. The parameters most important for predicting beam behavior are identified through a sensitivity study, and the application of reliability analysis in developing fire-resistant design procedures is discussed.

701,620
PB-274 989/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Statistical Analysis of RC Beam-Column Interaction.
Final rept.,
B. Ellingwood. Jul 77, 12p
Pub. in Jnl. of the Structural Division, Proceedings of the American Society of Civil Engineers, v103 ST7 p1377-1388 Jul 77.

Keywords: *Structural members, *Reinforced concrete, Beams(Supports), Columns(Supports), Loads(Forces), Bending, Probability, Statistical analysis, Reprints.

Analysis of uncertainties plays a central role in all reliability-based design procedures. Herein, the uncertainty in the resistance of reinforced concrete numbers subjected to combined bending and thrust is studied using Monte-Carlo techniques. The effects of load eccentricity, reinforcement ratio, and the contributions of individual uncertainties in the design parameters are examined. The results should aid in determining resistance factors for reinforced concrete design which are commensurate with the level of uncertainty using reliability-based concepts.

701,621
PB-274 990/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis of Live Loads in Office Buildings.
Final rept.,
B. Ellingwood, and C. Culver. Aug 77, 10p
Pub. in Jnl. of the Structural Division, Proceedings of the American Society of Civil Engineers, v103 ST8 p1551-1560 Aug 77.

Keywords: *Office buildings, *Dynamic loads, Design standards, Office equipment, Probability, Loads(Forces).

An analysis of live loads in offices is presented, which applies probabilistic live load models to the results of a recent survey of US office buildings conducted by the National Bureau of Standards. The results are compared to a study of live loads in offices in the United Kingdom and to the design loads currently specified by ANSI A58.1-1972. On the basis of this study, a new expression for computing allowable reductions in live loads at large loaded areas is proposed.

701,622
PB-275 621/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Estimation of Alongwind Building Response.
Final rept.,
E. Simiu, R. D. Marshall, and S. Haber. Jul 77, 14p
Pub. in Jnl. of the Structural Division, Proceedings of the American Society of Civil Engineers, v103 ST7 p1325-1338 Jul 77.

Keywords: *Buildings, *Wind pressure, Gust loads, Wind velocity, Dynamic response, Building codes, Reprints.

The differences between the dynamic alongwind response, the gust factors, and the total alongwind response obtained using various current procedures may in certain cases be as high as 200,100, and 60 percent, respectively. The purpose of this paper is to investigate the causes of such differences. To provide a framework for this investigation, the paper presents an overview of the questions involved in determining alongwind structural response, and a critical description of the basic features of procedures currently in use. A comparison is made between alongwind deflections of typical buildings selected as case studies, calculated by both new and traditional procedures, some of which are described in various building codes. The reasons for the differences between the respective results are pointed out. The procedures were evaluated on the basis of a recently developed method which uses a logarithmic variation of wind speed with height above ground, a height-dependent expression for the spectrum of the longitudinal wind speed fluctuations. The method also allows for realistic cross-correlations between pressures on the windward and leeward building faces.

701,623
PB-276 501/4 PC **A16**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Earthquake Resistant Masonry Construction: National Workshop.
Building science series (Final),
R. A. Crist, and L. E. Cattaneo. Sep 77, 374p NBS-BSS-106
Grant NSF-ENV75-20127
Proceedings of a National Workshop held at the National Bureau of Standards, Boulder, Colorado on September 13-16, 1976. Library of Congress Catalog Card no. 77-600053. See also PB-264 424.

Keywords: *Earthquake resistant structures, *Meetings, Masonry, Brick construction, Concrete construction, Building codes, Concrete blocks, Design criteria, Structural design, Mathematical models, *Masonry construction, *Seismic design, Seismic loads.

The National Workshop on Earthquake Resistant Masonry Construction provided an exchange of information between researchers and practicing engineers for the purpose of orienting pertinent research toward national needs concerning current problems related to design criteria. These proceedings contain the reports presented by researchers and by users of design criteria, as well as transcripts of the discussions which followed the individual presentations. In addition, the proceedings include recommendations which emanated from working sessions held by five working groups of

participants. Technical areas covered by the groups were (1) code requirements, (2) design criteria, (3) mathematical models, (4) test standardization and material properties, and (5) retrofit and repair. The recommendations were derived to identify research which would lead to improved output in each of the technical areas in order to benefit national needs.

701,624
PB-278 620/0 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Building Research Translation: The Behavior of Concrete Structures in Fire - A Method for Prediction by Caiculation.
Final rept.,
S. G. Weber. Mar 78, 85p NBS-TN-710-10

Keywords: *Buildings, *Concrete construction, *Fire resistance, Reinforced concrete, Temperature distribution, Thermal stresses, Modulus of elasticity, France, Building codes, *Fire codes.

This method provides a means for predicting, by calculation, the resistance to fire of a reinforced or prestressed concrete element of construction, in accordance with 1959 French directives. The method is useful in allowing builders to design structures which show the degree of fire resistance required by the various French construction regulations in force. According to those regulations, only a test furnishes legal proof of fire resistance. French researchers hope this first step will lead to the acceptance in France of fire resistance calculations as legal proof of satisfactory resistance. (Portions of this document are not fully legible)

701,625
PB-278 661/4 PC **A11**/MF **A01**
California Univ., Berkeley. Fire Research Group.
FIRES-RC II. A Computer Program for the Fire Response of Structures-Reinforced Concrete Frames (Revised Version),
R. H. Iding, B. Bresler, and Z. Nizamuddin. Jul 77, 249p UCB-FRG-77-8, NBS/GCR-78-115
Grants NBS-G7-9006, NSF-ERT70-01080-A05
See also report dated Jul 74, PB-235 954.

Keywords: *Concrete structures, *Reinforced concrete, *Fire resistance, Fire safety, Dynamic structural analysis, Thermal stresses, Thermal resistance, Finite element analysis, Fortran, Computer programs, FIRES-RC 2 computer program.

FIRES-RC II is a computer program used to evaluate the structural response of reinforced concrete frames in fire environments. The report describes the analytical and material behavior models upon which FIRES-RC II is based. The thermal response associated with fire environments used for the analysis of reinforced concrete frames in FIRES-RC II is predicted by a companion computer program, FIRES-T. A nonlinear, direct stiffness formulation coupled with time step integration is the analytical technique used in FIRES-RC II. Within a given time step, an iterative approach is used to find a deformed shape which results in equilibrium between internal stresses and external forces. The material behavior models for concrete and steel account for dimensional changes caused by temperature differentials, changes in mechanical properties of materials with changes in temperature, degradation of sections by cracking and/or crushing, and increased rates of shrinkage and creep with an increase in temperature. Nonlinear stress-strain laws, in which inelastic deformation associated with unloading is accounted for, are used in FIRES-RC II to model concrete and steel behavior. The report includes a user's manual for FIRES-RC II, a sample problem, and a listing of the program.

701,626
PB-280 397/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Model for Formulating Seismic Design Provisions.
Final rept.,
C. Culver. Jun 77, 10p
Pub. in Proceedings of CENTO Seminar on Recent Advances in Earthquake Hazard Minimization, Tehran, Iran, 14-16 Nov 76 p536-545 Jun 77.

Keywords: *Buildings, *Earthquake resistant structures, Earthquakes, Earth movements, Structural design, Building codes, *Earthquake engineering, *Seismic design, *Ground motion.

The paper describes a program currently underway in the United States to develop improved seismic design provisions for buildings. Organization of the activity, the form of the provisions and the technical areas included are discussed. Important aspects of the provisions dealing with: (1) design ground motion, (2) structural design, (3) architectural and mechanical-electrical design, and (4) existing buildings are summarized.

701,627
PB-281 464/8 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Literature Review of Fire and Live Load Surveys in Residences.
Final rept.,
L. A. Issen. May 78, 29p NBSIR-78-1440
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Assistant Secretary for Policy Development and Research.

Keywords: *Houses, *Fire safety, Structural engineering, Surveys, Structural design, Loads(Forces), Statistical data, Fire prevention, Residential buildings.

A search of the literature shows that most load surveys have been concerned with commercial and industrial occupancies and only a few have dealt with residences. Many surveys have been inadequately reported from a statistical viewpoint, and the data have been misapplied. A common error has been to assume that the largest observed load is the largest expected load. The statistics of extremes should be used to determine resonable design values. Methods for estimating the sampling size (for a prescribed accuracy) are given and illustrated with examples.

701,628
PB-285 139/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Test Methods for Windows and Walls - The Need for a Testing Program.
Final rept.,
H. R. Trechsel. 1977, 9p
Pub. in Proceedings RILEM/ASTM/CIB Symp. on Evaluation of Performance of External Vertical Surfaces of Buildings, Otaniemi, Espoo, Finland, Aug 28-Sept 2, 1977, v2 p374-382 1977.

Keywords: *Buildings, *Windows, *Walls, Design, Structural analysis, Dynamic tests, Reliability.

Despite an advanced state of the art in the design of building walls and windows, and despite the extensive testing on building envelope elements, some rather spectacular failures of such elements have occurred in recent years. The paper discusses several selected factors affecting the reliability of test results: number of specimens to be tested, process for selecting specimens and single performance characteristic tests. Based on these factors, it is proposed that testing be considered as an integral part of the design and build process. It is further suggested that the systems approach be used for developing a test program based on the various trade-offs between cost for the testing and the potential risk for failure.

701,629
PB-292 304/3 PC **A06**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Development of an Improved Compression Test Method for Wall Panels.
Building science series (Final).
C. W. C. Yancey, and L. E. Cattaneo. Feb 79, 112p NBS-BSS-95
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards. Library of Congress catalog card no. 78-600165.

Keywords: *Panels, *Compression tests, Walls, Loads(Forces), Tests, Computer programs, Wallboard, Sandwich panels, Plywood, Fiberboards, Fiberglass reinforced plastics, Sandwich laminates.

An experimental and analytical investigation of the primary factors involved in the testing of prototype wall panels under axial compression loading is reported. The objective of the investigation was to develop a method of testing wall specimens that incorporates the best features of ASTM Standard Method E 72 while at the same time incorporating improvements in the areas of deficiency in the Standard. Twenty-five laboratory tests were conducted on samples composed of five types of wall panel construction. The panels were tested to failure under either of two different eccentricities of load, while being supported with one of two types of idealized end conditions. Selected test results and detailed descriptions of the laboratory procedures used are presented. A computer-aided analytical study of the variables affecting the degree of uniformity of loading was conducted. Equations based on the analogy of beams supported on elastic foundations were used in the analysis. A study of the statistical parameters commonly used to interpret test results was conducted to establish useful guidelines for predicting structural performance on the basis of small sample test results. A compression test method applicable to traditional and innovative wall constructions is presented. The principal additions in the revised test method are as follows: (a) a provision for variable eccentricity, (b) a procedure for selecting a load distribution assembly which will be compatible with the test panel.

701,630
PB-292 362/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Approaches for Design Against Progressive Collapse.
Final rept.,
B. Ellingwood, and E. V. Leyendecker. Mar 78, 11p
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.
Pub. in Jnl. of the Structural Division, Proceedings of the American Society of Civil Engineers 104, nST3, Proc. Paper 13610 p413-423, Mar 78.

Keywords: *Buildings, *Design standards, Structural design, Design criteria, Loads(Forces), Hazards, Probability theory, *Progressive collapse, Reprints.

A progressive collapse is a chain reaction type of failure which follows damage to a relatively small portion of a structure. Progressive collapse constitutes an unacceptable hazard in many buildings, and thus procedures for its control should be incorporated in building standards. Design strategies for reducing the risk of initial failure and for controlling the amount of damage that occurs are presented and their relative advantages are discussed. Design criteria are given for the reduced loads to be carried by a damaged structure.

701,631
PB-294 757/0 CP **T05**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Buffeting of Tall Structures by Strong Winds, Windload Program.
Software.
E. Simiu, and D. W. Lozier. 1979, mag tape NBS/DF-79/001
Supersedes rept. no. NBS/DF-76/001, PB-247 929.
Source tape is in EBCDIC character set. Tapes can be prepared in most standard 7 or 9 track recording modes for one-half inch tape. Identify recording mode desired by specifying character set, track, density, and parity. Call NTIS Computer Products if you have questions. Also available as punched cards.

Keywords: *Software, *Buildings, *Wind pressure, Structural engineering, Mathematical models, Computer programming, Dynamic response, Gust loads, Fortran, Tall buildings, Univac 1108 computers.

A computer program is presented for the calculation of the along-wind response of tall buildings. The program represents an updated version of, and supersedes, a similar program developed by the authors in 1975. Program input includes building dimensions, natural frequencies, damping coefficients, modal shapes, and weight distribution, design wind speed, roughness of surrounding terrain, pressure coefficients on windward and leeward faces, and specific weight of air. The output consists of mean, rms, and peak deflections, and rms and peak accelerations...Software Description: The program is written in the Fortran X for implementation on a Univac 1108 computer using the EXEC 8 operating system. 36K bytes core storage are needed to operate the system.

701,632
PB-297 463/2 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. Center for Building Technology.
Measurement of Wind Loads on a Full-Scale Mobile Home.
Final rept.
R. D. Marshall. Sep 77, 133p NBSIR-77-1289
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy,

Building Technology and Standards. See also PB-273 190-T.

Keywords: *Trailers, *Houses, *Aerodynamic loads, Wind pressure, Structural design, Aerodynamic forces, Wind velocity, Building codes, *Mobile homes.

An experimental investigation of wind loads acting on a full-scale mobile home is reported. The objectives of the investigation were (1) the direct measurement of surface pressures and overall drag and lift forces, (2) the formulation of recommended loads for the design of mobile homes and their anchoring systems to resist forces due to wind and (3) the measurement of deflections and the identification of failure modes with application of simulated wind loads. Measurements were obtained for a variety of wind speeds and relative wind directions using a mobile home with nominal plan dimensions of 12 by 60 ft (3.7 by 18.3m). Wind speeds were measured at five levels ranging from 3 to 18m and the mean velocity profiles were found to be best described by a power law with exponent alpha = 0.18. Extreme negative pressure fluctuations were found to occur on the end walls and along the perimeter of the roof. The resonant component of response of the mobile home to drag and lift forces is negligible for basic wind speeds up to 90 mph (40 m/s) and the average maximum lift loads are not strongly influenced by the presence or absence of skirting. Recommended design loads are based on the average maximum event in a time interval of 1000 seconds and are tabulated for assumed basic wind speeds of 70 and 90 mph (31 and 40 m/s) and a moderately open wind exposure.

701,633

PB-298 559/6 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Fields Div.
Feasibility Study on the Use of a Microwave System for the Nondestructive Evaluation of Historic Adobe Structures.
D. R. Belsher. Jul 79, 33p NBSIR-79-1610
Contract NPS-PX-8109-9-0003

Keywords: *Brick structures, *Nondestructive tests, Electromagnetic testing, Microwaves, Continuous wave radar, Dielectric properties, Moisture, Feasibility, Measurement, Adobe bricks, Adobe soils.

A frequency-modulated continuous wave (FM-CW) radar system was used at Tumacacori National Monument to provide usable on site information and to evaluate its potential for nondestructively measuring certain parameters associated with the soundness of historic adobe walls. The parameters of interest considered were layer thickness, presence, position, and thickness of voids or other inhomogeneities, and moisture content and its distribution. The results were generally favorable. The results indicate that an FM-CW system can nondestructively provide a major portion of the information needed to evaluate the soundness of adobe structures at a relatively low cost and in less time than present techniques. With some further work the FM-CW system can be developed into a useful archeological exploration and evaluation tool that should operate in rock and soils other than adobe.

701,634

PB-298 901-T PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Fire Protection Design Standards for Buildings and Structures, Building Standards and Regulations SNiP II-A.5-70.
16 Sep 70, 36p NBS-GCR-79-176
Trans. of National Committee of the Council of Ministers USSR on Building Construction (GOSSTROY USSR), Building Standards and Regulations, Part II, Section A, Chapter 5, by Boris W. Kuvshinoff.

Keywords: *Buildings, *Fire safety, Fire protection, Standards, Building codes, Construction materials, Fire resistant materials, Design criteria, *Foreign technology.

SNiP Chapter II-A.5-70 'Fire Protection Standards for the Design of Buildings and Structures' has been developed by Central Scientific Research Institute for Industrial Buildings, Department of Industrial Building Design of Gosstroy USSR, Central Scientific Research Institute of Experimental Design of Residential Buildings, Department of Public Buildings, and All-Union Scientific Research Institute of Fire Protection, Ministry of the Interior, USSR. This Chapter supersedes SNiP II-A.5-62 'Fire Protection Requirements. Principles of Design'.

701,635

PB-299 904/3 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Fire Effects on Reinforced Concrete Members.
Final rept.
B. Ellingwood, and J. Shaver. Aug 79, 44p NBS/TN-985

Keywords: *Concrete structures, *Fire resistance, Concrete construction, Reinforced concrete, Fire tests, Thermal analysis, Dynamic structural analysis.

Fire ratings for structural assemblies in the U.S. are currently measured by endurance of or temperature rise in components subjected to a standard test. Analytical procedures show considerable promise for alleviating the extensive testing required, and for placing fire resistant structural design on a limit states basis. In this study, thermal and structural analyses for reinforced concrete members are validated using experimental data. Temperature distributions computed in reinforced concrete members for several realistic fire exposures are examined and compared to the distributions measured in a standard test. Parameter studies show the effect of typical variations in thermal diffusivity, emissivity and conductivity. Structural responses for the different fire exposures are also briefly compared.

701,636

PB80-129182 PC **E13**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Analysis of Tentative Seismic Design Provisions for Buildings.
Final rept.
J. R. Harris, S. J. Fenves, and R. N. Wright. Jul 79, 602p NBS-TN-1100
Grants NSF-AEN76-14698, NSF-AEN76-19033
Prepared in cooperation with Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.Includes 3 sheets of 48X reduction microfiche with each order.

Keywords: *Earthquakes, *Building codes, *Design standards, Earthquake resistant structures, Decision making, Dynamic structural analysis, Information systems, Network analysis(Management), *Seismic design, Earthquake engineering.

This report presents the results of a thorough study of the internal logic of the Tentative Provisions for the Development of Seismic Regulations for Buildings developed by the Applied Technology Council. The methods of analysis employed in the study provide objective measures of clarity, completeness, and consistency and an alternative form in which to examine the technical validity of the provisions. These methods include decision logic tables for examining individual provisions, information networks for representing the precedence among provisions, and classification of the provisions to study their scope and arrangement. A formal representation of the provisions is presented by the data items, decision tables, networks, and classification systems developed in the study. An index and several alternate arrangements of the provisions are also included. Opportunities for improvement of the tentative provisions are identified and discussed, and considerations for their future development and implementation within various national standards are highlighted.

701,637

PB80-144207 Not available NTIS
National Bureau of Standards, Washington, DC.
Revised Procedure for Estimating Along-Wind Response.
Final rept.,
E. Simiu. Jan 80, 10p
Pub. in Jnl. of Struct. Div. Am. Soc. Civ. Eng. 106, nST1 p1-10 Jan 80.

Keywords: *Buildings, *Wind pressure, Gust loads, Aerodynamic forces, Dynamic response, Turbulence, Building codes, Reprints.

A revised version is presented of a procedure for calculating along-wind response previously developed by the author. This version differs from the previous procedure in three respects. First, it incorporates recent improvements in the modeling of mean wind profiles and of the turbulence intensity. Second, it includes a correction in the Monte Carlo integration algorithm employed to obtain the rms values of the fluctuating response and thus results in more accurate values of the calculated along-wind response; and third, it is simpler to use. A numerical example is given illustrating the use of the procedure.

701,638

PB80-196512 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of a Probability Based Load Criterion for American National Standard A58, Building Code Requirements for Minimum Design Loads in Buildings and Other Structures.
Final rept.,
B. Ellingwood, T. V. Galambos, J. G. MacGregor, and C. A. Cornell. Jun 80, 232p NBS-SP-577
Prepared in cooperation with Washington Univ., St. Louis, MO. Dept. of Civil Engineering; Alberta Univ., Edmonton. Dept. of Civil Engineering; and Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

Keywords: *Building codes, *Aerodynamic loads, Probability density functions, Static loads, Dynamic loads, Design, Specifications, Construction materials, Computer programs, Fortran, UNIVAC-1108 computers.

Recommended load factors and load combinations are presented which are compatible with the loads recommended in the proposed 1980 version of American National Standard A58, Building Code Requirements for Minimum Design Loads in Buildings and Other Structures (ANSI A58.1-1980 D). The load effects considered are due to dead, occupancy live, snow, wind and earthquake loads. The load factors were developed using concepts of probabilistic limit states design which incorporate state-of-the-art load and resistance models and available statistical information. Reliabilities associated with representative structural members and elements designed according to current (1979) structural specifications were calculated for reinforced and prestressed concrete, structural steel, cold-formed steel, aluminum, masonry and glued-laminated timber construction. The report presents the rationale for selecting the criterion format and load factors and describes the methodology to be followed by material specification groups for determining resistance factors consistent with the implied level of reliability and the statistical data. The load factors are intended to apply to all types of structural materials used in building construction.

701,639

PB81-140063 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Thermal Resistance Measurements of a Built-Up Roof System.
Final rept.
S. J. Treado. Oct 80, 28p NBSIR-80-2100
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Buildings, *Roofs, *Thermal resistance, Heat transmission, Temperature measuring instruments, Infrared equipment, Roofing, *Built up roofs.

This report describes factors which affect the thermal performance of built-up roof systems, and a technique for making in-place measurements of thermal resistance. This measurement technique utilizes a combination of infrared thermographic imaging, surface heat-flow meters, and surface thermopiles. The thermal resistance of the roof system is computed based on temperature differences across the roof and the measured heat flow through the roof. A field test of the measurement procedure is detailed, along with an examination of the time period required to perform a roof thermal resistance measurement, as related to the thermal time lag for heat flow through the roof due to the effect of the thermal mass of the roof. Roof thermal resistance determinations performed according to this measurement procedure are found to be very accurate, if measurements are performed over a sufficient time interval, the minimum interval being dependent upon the thermal mass of the roof system.

701,640

PB81-145559 Not available NTIS
National Bureau of Standards, Washington, DC.

Influence of Wind Direction on the Response of a Square-Section Tall Building.
T. A. Reinhold, and P. R. Sparks. 1980, 14p
Grant NSF-ENV75-05327
Pub. in Proceedings of the International Conference on Wind Engineering (5th), Ft. Collins, CO., July 8-14, 1979, I, Sessions I-V, pVI-3-1 - VI-3-14 1980.

Keywords: *Buildings, *Aerodynamic loads, Wind pressure, Gust loads, Dynamic response, Wind tunnel models, *Tall buildings.

This paper describes a wind-tunnel study to determine the effect of wind-direction on the response of a square-section tall building with an 8.33 to 1 aspect ratio. Rigid models instrumented with pressure transducers were used to determine the mean force coefficients and the modal force coefficients for the fundamental translational and torsional modes of the building. Using these values and typical stiffness and damping values, the influence of wind-direction on the response of 500:1 prototype building were computed. The greatest responses were generally found to occur when the wind was blowing onto the face of the building and these responses are compared with values predicted by current design procedures.

701,641
PB81-174690 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Construction of Housing in Mine Subsidence Areas.
F. Y. Yokel, L. A. Salomone, and R. M. Chung. Jan 81, 55p NBSIR-81-2215
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Mines(Excavations), *Subsidence, *Houses, *Site surveys, Subsurface investigations, Foundations, Design criteria, Construction, Soil mechanics, Structural design, *Risk analysis.

Criteria for site exploration, risk assessment, site development and housing construction in actual and potential mine subsidence areas are recommended. Appendix A includes guidance for subsidence profile determination and a proposed mathematical model which may aid in predicting complex subsidence patterns. Appendix B includes a commentary and proposed equations and procedures for the design of rigid and flexible foundations.

701,642
PB81-180978 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
NBS Studies of Mobile Home Foundations.
F. Y. Yokel, R. M. Chung, and C. W. C. Yancey. Mar 81, 47p NBSIR-81-2238
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards, and Federal Insurance Administration, Washington, DC.

Keywords: *Trailers, *Houses, *Foundations, Anchors(Structures), Wind pressure, Floods, Loads(Forces), *Mobile homes.

Two papers are presented which discuss the results of tests on soil anchors used to secure mobile homes and of an analytical study of wind and flood loads on soil anchors.

701,643
PB81-182552 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Study of Reaction Forces on Mobile Home Foundations Caused by Wind and Flood Loads.
Building Science Series (Final).
F. Y. Yokel, C. W. C. Yancey, and C. L. Mullen. Mar 81, 84p NBS-BSS-132
Library of Congress catalog card no. 81-600025.
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Engineering, Building Technology and Standards, and Federal Insurance Administration, Washington, DC.

Keywords: *Residential buildings, *Trailers, *Foundations, Wind pressure, Floods, Loads(Forces), Supports, Standards, *Mobile homes, *Tiedowns.

Forces acting on the foundations of mobile homes subjected to wind and flood loads were calculated and are presented in a series of computer-generated charts. The loading conditions considered are the two levels of wind loads presently stipulated in the Federal Mobile Home Construction and Safety Standard, a hurricane windload recommended by the National Bureau of Standards (NBSIR 77-1289), buoyancy forces, and draft forces resulting from flood water flow. The calculated forces are compared with present anchoring requirements in ANSI Standard 119.3 (NFPA No. 501 A). It is concluded that diagonal ties are instrumental in resisting wind forces, and that vertical ties are more effective than diagonal ties in resisting flood forces.

701,644
PB81-234700 Not available NTIS
National Bureau of Standards, Washington, DC.
Wind Direction Effects on Cladding and Structural Loads.
Final rept.
E. Simiu, and J. J. Filliben. Jul 81, 6p
Sponsored in part by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Eng. Struct. 3, p181-186 Jul 81.

Keywords: *Buildings, *Cladding, *Aerodynamic loads, Aerodynamic forces, Gust loads, Dynamic response, Panels.

A simple procedure is proposed for estimating wind loads corresponding to various return periods, which takes into account directional information on both wind speeds and aerodynamic response. Examples of the application of the procedure are given, which show that (1) cladding loads calculated without taking directional information on extreme wind speeds into account may in certain cases be larger than the actual loads by a factor of two or more, and (2) it is not appropriate, in general, to account for wind direction effects by multiplying loads determined without regard for these effects by a reduction factor of 0.8, as has been suggested in the literature. In its present form, the procedure is applicable to cladding panels and members of relatively rigid structures in regions not subjected to hurricane winds.

701,645
PB82-117409 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Investigation of Construction Failure of Harbour Cay Condominium in Cocoa Beach, Florida.
H. S. Lew, N. J. Carino, S. G. Fattal, and M. E. Batts. Sep 81, 139p NBSIR-81-2374
Sponsored in part by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Residential buildings, *Collapse, *Accident investigations, Concrete construction, Shear properties, Shear tests, Concrete slabs, Failure, Florida, Harbour Cay Condominium, Cocoa Beach(Florida), *Progressive collapse.

The investigation of the collapse of a five-story reinforced concrete flat-plate structure under construction at Cocoa Beach, Florida is presented in this report. The investigation included onsite inspection, laboratory tests and analytical studies. Based on the results of this investigation, it is concluded that the most probable cause of the failure was insufficient punching shear capacity in the fifth-floor slab to resist the applied construction loads. Two factors contributed to the low punching shear capacity: one in the design and the other in the construction of the building. In the design, the omission of a check for punching shear resulted in a smaller slab thickness than needed to satisfy the Code requirements. In construction, the use of specified chairs having insufficient height to support the top reinforcing steel resulted in more than the cover specified in the structural drawings. Both factors contributed to reducing the effective depth of the slab such that it had insufficient strength to resist the construction loads. The analysis showed that shear stresses in the slab at many column locations on the fifth floor exceeded the nominal shear strength. Thus, punching shear failure at one of the columns precipitated a progressive failure of the slab throughout the entire fifth floor. Collapse of the fifth floor, in turn, caused the successive collapse of the lower floor slabs. The failure of the fifth floor slab most likely initiated at column G-2, an interior column which supported the last bay of freshly placed roof concrete prior to the collapse.

701,646
PB82-130436 PC **A09**/MF **A01**
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
National Office Live Loads Survey.
Final rept.
C. A. Cornell. Oct 76, 187p NBS/GCR-76-81
Contract NBS-4-35715

Keywords: *Office buildings, *Dynamic loads, Structural design, Office equipment, Furniture, Probability theory, Mathematical models, Surveys.

This report presents the final recommendations for a National Bureau of Standards program to survey, analyze, and model the gravity live loads in modern office buildings in the U.S. A basic premise is that a probabilistic model (or models) should be used as a basis for identifying the important parameters and thus for designing the experiment and for directing the analysis of the data. Chapter 2 discusses these models. They include not only basic models for describing and predicting (in probabilistic terms) sustained and peak loads (and structural load effects), but also simple models for guiding design standards and an explanatory (room) sector load model (ESLM) to be used to study loads and to reduce sampling effort. The other major chapters, Chapters 3 and 4, discuss the statistical aspects of the program: the survey design (by building, by room sector, and by bay) and the data reduction needed for the purposes of model parameter estimation, model checking, and possible model modification. The final chapters summarize (1) the conduct of the survey (including a pilot survey and two stages of a main survey), (2) the computer program requirements, (3) the analytical and numerical studies to be carried out once the data reduction is complete, and (4) a set of reports that might represent the final product of the survey.

701,647
PB82-151259 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Mechanical Performance of Built-Up Roofing Membranes.
Final rept.
J. M. Pommersheim, and R. G. Mathey. Dec 81, 63p NBS-TN-1152
Prepared in cooperation with Bucknell Univ., Lewisburg, PA.

Keywords: *Roofing, *Membranes, Roofs, Insulation, Asphalts, Bitumens, Tensile properties, Thermal shock, Joints(Junctions), Mathematical models.

For built-up roofing membranes with either linear or non-linear stress-strain behavior, fully bonded to an underlying deck or substrate which undergoes displacement, it is the equality of the complementary strain energy of the fabric or felt layer with the strain energy of the bonding adhesive or bitumen layer, which governs both the conditions under which membrane integrity is lost and the mode of failure by either membrane splitting or adhesive bonding. The testing criteria developed are applied to a sample case.

701,648
PB82-234097 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Load-Displacement Characteristics of Shallow Soil Anchors.
Final rept.
F. Y. Yokel, R. M. Chung, F. A. Rankin, and C. W. C. Yancey. May 82, 166p NBS-BSS-142
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Library of Congress catalog card no. 82-600509.

Keywords: *Houses, *Trailers, *Anchors(Structures), Cyclic loads, Foundations, Soil properties, Wind pressure, Water pressure, Uplift pressure, Field tests, *Mobile homes.

Tests on shallow soil anchors, commonly used by the mobile home industry, including 6-in single helix and 4-in double helix anchors as well as three types of swivel anchors, were conducted on three sites: a silty site, a sandy site, and a clay site. Test variables included direction of anchor installation; direction of loading; anchor depth; size of anchor plate; and cyclic load effects. The effect of these test variables on load-displacement characteristics, measured at the anchor head, is investigated.

701,649
PB82-242363 PC **A16**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Investigation of the Kansas City Hyatt Regency Walkways Collapse.
Building science series (Final).
R. D. Marshall, E. O. Pfrang, E. V. Leyendecker, K. A. Woodward, R. P. Reed, M. B. Kasen, and T. R. Shives. May 82, 366p NBS-BSS-143
Library of Congress catalog card no. 81-600538.

Keywords: *Hotels, *Passageways, *Collapse, Structural steels, Hangers, Rods, Failure, Box beams, Loads(Forces), Missouri, Hyatt Regency Hotel, Kansas City(Missouri).

An investigation into the collapse of two suspended walkways within the atrium area of the Hyatt Regency Hotel in Kansas City, Mo., is presented in this report. The investigation included on-site inspections, laboratory tests and analytical studies. Three suspended walkways spanned the atrium at the second, third, and fourth floor levels. The second floor walkway was suspended from the forth floor walkway which was directly above it. In turn, this fourth floor walkway was suspended from the atrium roof framing by a set of six hanger rods. The third floor walkway was offset from the other two and was independently suspended from the roof framing by another set of hanger rods. In the collapse, the second and fourth floor walkways fell to the atrium floor with the fourth floor walkway coming to rest on top of the lower walkway.

701,650
PB82-263955 Not available NTIS
National Bureau of Standards, Washington, DC.
Re-examination of the Relation between Splitting Tensile and Compressive Strength of Normal Weight Concrete.
Final rept.
N. J. Carino, and H. S. Lew. 1982, 6p
Pub. in ACI Jnl. of Technical Papers, Title No. 79-23, p214-219, May-Jun 82.

Keywords: *Buildings, *Concrete construction, Concretes, Tensile strength, Compressive strength, Loads(Forces), Building codes, Regression analysis, Reprints.

Based on statistical analyses of selected data, which included concretes with compressive strengths from 980 psi (6.9 MPa) to 5750 psi compressive strength function is not the most appropriate relation for selected data or data with a similar precision and the same range; rather, a simple power function is more applicable over a wide range of concrete strengths.

701,651
PB82-265703 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Convection and Design Wind Speeds.
Final rept.
E. Simiu. Jul 82, 7p
Pub. in Jnl. of the Structural Division, American Society of Civil Engineers 108, nST7 p1671-1675 Jul 82.

Keywords: *Wind velocity, *Structural engineering, Design, Heat transfer, Convection, Estimating, Reprints.

Estimates are presented of the extent to which the effect of thermal convection upon wind profiles is significant in structural engineering and extreme climatological calculations. The estimates are based upon Monin and Obukhov's theory and recent experimental results reported in the meteorological literature.

701,652
PB83-111385 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Investigation of Construction Failure of Harbour Cay Condominium in Cocoa Beach, Florida.
Final rept.
H. S. Lew, N. J. Carino, S. G. Fattal, and M. E. Batts. Aug 82, 140p NBS-BSS-145
Supersedes PB82-117409. Library of Congress catalog card no. 82-600566.

Keywords: *Residential buildings, *Collapse, *Accident investigations, Concrete construction, Shear properties, Shear stress, Concrete slabs, Structural design, Florida, *Progressive collapse, Cocoa Beach(Florida).

The investigation of the collapse of a five-story reinforced concrete flat-plate structure under construction at Cocoa Beach, Florida is presented in this report. The investigation included onsite inspection, laboratory tests and analytical studies. Based on the results of this investigation, it is concluded that the most probable cause of the failure was insufficient punching shear capacity in the fifth-floor slab to resist the applied construction loads.

701,653
PB83-145698 Not available NTIS
National Bureau of Standards, Washington, DC.
Collapse of the Kansas City Hyatt Regency Walkways.
Final rept.
E. O. Pfrang, and R. Marshall. Jul 82, 4p
Pub. in Civil Engineering 52, n7 p65-68 Jul 82.

Keywords: *Hotels, *Passageways, *Collapse, Box beams, Suspending(Hanging), Loads(Forces), Structural design, Missouri, Reprints, *Walkways, *Atriums, Kansas City(Missouri).

An investigation into the collapse of two suspended walkways within the atrium area of the Hyatt Regency Hotel in Kansas City, MO., is presented in this report. The investigation included on-site inspections, laboratory tests and analytical studies. Three suspended walkways spanned the atrium at the second, third, and fourth floor levels. The second floor walkway was suspended from the fourth floor walkway which was directly above it. In turn, this fourth floor walkway was suspended from the atrium roof framing by a set of six hanger rods. The third floor walkway was offset from the other two and was independently suspended from the roof framing by another set of hanger rods. In the collapse, the second and fourth floor walkways fell to the atrium floor with the fourth floor walkway coming to rest on top of the lower walkway.

701,654
PB83-154187 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Investigation of Floor Vibrations in the 'D' Wing of the Main Building of the Bureau of Engraving and Printing.
T. A. Reinhold, F. Y. Yokel, and F. F. Rudder. Dec 82, 40p NBSIR-82-2599
Sponsored in part by Bureau of Engraving and Printing, Washington, DC.

Keywords: *Machinery, *Foundations, *Vibration, Buildings, Floors, Reinforced concrete, Impact strength, Cyclic loads.

Floor vibrations induced in a Bureau of Engraving and Printing building by a recently-installed perforator were investigated by measuring relative acceleration amplitudes and phase relationships between a reference position and points on a grid laid out on the affected floor. From these measurements, it was possible to determine mode shapes, resonant frequencies and displacement amplitudes. On the basis of the displacement amplitudes, anticipated cyclic stresses in the structural system were estimated. The results of the measurements and analysis were compared with existing data on vibration-induced structural damage and fatigue strength of steel and reinforced concrete. Damping ratios were also determined in a separate test, in order to ascertain at later dates whether any structural deterioration is taking place.

701,655
PB83-172676 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Plan for a Trial Design Program to Assess Amended ATC 3-06 Tentative Provisions for the Development of Seismic Regulations for Buildings.
J. R. Harris, and E. V. Leyendecker. Nov 82, 30p NBSIR-82-2589
Also pub. as Building Seismic Safety Council, Washington, DC. rept. no. BSSC-82-1. Sponsored in part by Federal Emergency Management Agency, Washington, DC.

Keywords: *Earthquake resistant structures, *Buildings, *Structural design, Building codes, Dynamic loads, Guidelines, Management planning, Cost estimates, *Seismic design, Earthquake engineering.

This report presents a trial design program to establish the technical viability of the recommendations contained in the report 'The Tentative Provisions for the Development of Seismic Regulations for Buildings' developed by the Applied Technology Council and subsequently modified in a review project conducted by the Building Seismic Safety Council (BSSC) and the National Bureau of Standards. The trial design program is intended to provide information for estimating the impact of adopting the recommendations in the tentative provisions, evaluate the useability of the tentative provisions, establish the technical viability of the tentative provisions and obtain objective information for the future resolution of disputes concerning specific provisions.

701,656
PB83-176917 Not available NTIS
National Bureau of Standards, Washington, DC.
Probability Based Load Criterion for Structural Design.
Final rept.
B. Ellingwood, T. V. Galambos, J. G. MacGregor, and C. A. Cornell. Jul 81, 3p
Pub. in Civil Engineering, p74-76 Jul 81.

Keywords: *Structural design, *Building codes, *Probability theory, Loads(Forces), Buildings, Standards, Reprints, *Load criteria.

Recommended load factors and load combinations are presented which are compatible with the loads recommended in the proposed 1980 version of American National Standard A58, Building Code Requirements for Minimum Design Loads in Buildings and Other Structures (ANSI A 58.1-1980 D). The load effects considered are due to dead, occupancy live, snow, wind and earthquake loads. The load factors were developed using concepts of probabilistic limit states design which incorporates state-of-the-art load and resistance models and available statistical information. The load factors are intended to apply to all types of structural materials used in building construction.

701,657
PB83-177014 Not available NTIS
National Bureau of Standards, Washington, DC.
Probability-Based Criteria for Structural Design.
Final rept.
B. Ellingwood, and T. V. Galambos. 1982, 12p
Pub. in Struct. Safety 1, p15-26 1982.

Keywords: *Structural design, *Building codes, *Probability theory, Loads(Forces), Buildings, Standards, Reprints, *Load criteria.

Probability-based loading and resistance criteria are presented that are suitable for routine safety checking in design. The criteria are based on a comprehensive analysis of statistical data on structural loads and resistances and an examination of levels of reliability implied by the use of current design standards and specifications. The criteria are intended to be used in specifications that are oriented towards limit states design.

701,658
PB83-179366 Not available NTIS
National Bureau of Standards, Washington, DC.
Cause of the Condominium Collapse in Cocoa Beach, Florida.
Final rept.
H. S. Lew, N. J. Carino, and S. G. Fattal. Aug 82, 10p
Sponsored in part by Occupational Safety and Health Administration, Washington, DC.
Pub. in Concr. Int. 4, n8 p64-73 Aug 82.

Keywords: *Buildings, Collapse, Shear properties, Structural design, Building codes, Concrete construction, Florida, Reprints, Cocoa Beach(Florida), Condominiums, Punching shear.

This paper gives the results of an investigation, by a team from the National Bureau of Standards (NBS), into the collapse of a five-story flat plate condominium building in Cocoa Beach, Florida. The collapse occurred on March 27, 1981, while the casting of the roof was in progress; 11 workers were killed and 23 were injured. The NBS investigators conducted onsite inspections, made laboratory tests, and made analytical studies. It was concluded that the most probable cause of the collapse was inadequate punching shear capacity in the fifth-floor slab to resist the imposed construction loads. The punching shear capacity was inadequate due to the combined effects of two factors: one in the design the other in the construction of the building. The omission of punching shear and deflection analyses in the design resulted in a thinner slab than that required to satisfy applicable Code requirements.

Structural Analyses

701,659
PB83-234385 Not available NTIS
National Bureau of Standards, Washington, DC.
Probability of Structural Failure from Abnormal Load.
Final rept.
B. Ellingwood, E. V. Leyendecker, and J. T. P. Yao. Apr 83, 16p
Pub. in Jnl. of Struc. Eng., Am. Soc. Civ. Eng. 109, n4 p875-890 Apr 83.

Keywords: *Residential buildings, *Structural design, Loads(Forces), Building codes, Design standards, Probability theory, Reprints, *Progressive collapse.

Abnormal loads, which usually are not considered in structural design because of their low probability of occurrence, may initiate a catastrophic failure if they occur. A case study shows that the probability of structural failure due to a gas explosion in a residential compartment may exceed probabilities associated with unfavorable combinations of ordinary design loads. Therefore, specific provision in design standards to mitigate the effects of abnormal loads appear warranted.

701,660
PB83-235648 Not available NTIS
National Bureau of Standards, Washington, DC.
Wind-Induced Cladding Loads in Hurricane-Prone Regions.
Final rept.
E. Simiu, and M. E. Batts. Jan 83, 5p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. of the Structural Division, American Society of Civil Engineers Technical Notes 109, n1 p262-266 Jan 83.

Keywords: *Buildings, *Cladding, *Wind pressure, Hurricanes, Wind velocity, Panels, Reprints.

A brief review is presented of a procedure for estimating wind-induced pressures on cladding which is rigorous statistically and convenient for practical application. The procedure takes into account the dependence of the extreme wind speeds upon direction, but is not applicable to the estimation of cladding loads in hurricane-prone regions. An extension of that procedure for application to such regions is then presented. The theory that makes this extension possible is explained, and a computer program for calculating cladding pressures induced by hurricane winds is described.

701,661
PB83-236299 Not available NTIS
National Bureau of Standards, Washington, DC.
Ground Snow Loads for Structural Design.
Final rept.
B. Ellingwood, and R. Redfield. Apr 83, 15p
Pub. in Jnl. Struct. Eng., Am. Soc. Civ. Eng. 109, n4 p950-964 Apr 83.

Keywords: *Roofs, *Snow, Loads(Forces), Probability theory, Structural design, Reprints.

Snow loads for structural design are calculated as the product of the ground snow load and a snow load coefficient that transforms the ground load to a roof load. This article presents a statistical analysis of annual extreme water-equivalents (reported as inches of water) of ground snow measured at 76 weather stations in the northeast quadrant of the United States through the winter of 1979-1980.

701,662
PB83-239582 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Lateral-Torsional Response of Structures Subjected to Seismic Waves.
S. T. Wu, and E. V. Leyendecker. Jun 83, 32p
NBSIR-83-2727

Keywords: *Earthquake resistant structures, Structural design, Seismic waves, Rotation, Dynamic response, Eccentricity, *Seismic design, Earthquake engineering.

The behavior of coupled lateral-torsional systems subjected to seismic waves is investigated analytically. The report presents the numerical results of a parametric study for structures subjected to S-H waves. Case studies are provided to show the contribution of each of the selected parameters to the rotational response of the systems. These parameters are: geometric eccentricity, aspect-ratio of the foundation mat, damping ratio, and the ratio of the rotational to translational frequencies. Dynamic eccentricity is selected as an index to represent the level of the response. The sensativity due to the deviation of the input spectrum is investigated. Accidental eccentricities due to seismic waves are also evaluated. Design concerns are given on how the design eccentricity should be considered based on this study.

701,663
PB84-122092 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
Behavior of Concrete Block Masonry Walls Subjected to Repeated Cyclic Displacements.
K. Woodward, and F. Rankin. Oct 83, 180p NBSIR-83-2780
Sponsored in part by Bureau of Mines, Washington, DC.

Keywords: *Walls, *Concrete blocks, Cyclic loads, Cracks, Strain measurement, Fatigue limit, Strain rate.

An experimental investigation into the behavior of unreinforced, ungrouted concrete block masonry walls subjected to repeated in-plane cyclic displacements was undertaken. A total of 15 walls were tested of which 10 were 64 in. x 64 in. planar walls and 5 were 64 in. higher corner walls having equal leg lengths of 48 in. The primary parameter varied in the investigation was loading history. Monotonic tests at both slow and rapid strain rates were done. The cyclic tests included fully reversed displacement patterns and reversed displacement patterns superimposed on static displacement offsets. The cyclic tests included at least 100,000 repetitions. The test results indicated a pronounced effect of loading history on the wall performance, but only at load/displacements nearing the load capacity failure point.

701,664
PB84-136399 Not available NTIS
National Bureau of Standards, Washington, DC.
Review of the Skyline Plaza Collapse.
Final rept.
N. J. Carino, K. A. Woodward, E. V. Leyendecker, and S. G. Fattal. Jul 83, 8p
Pub. in Concr. Int. 5, n7 p35-42 Jul 83.

Keywords: *Apartment buildings, *Collapse, Concrete construction, Concrete slabs, Strength, shoring, Casualties, *Progressive collapse, Skyline Plaza apartments.

On March 2, 1973 portions of the Skyline Plaza apartment building collapsed during its construction. The collapse resulted in the death of 14 workers with 34 other workers injured. This article summarizes the results of the failure investigation carried out by the National Bureau of Standards (NBS) to determine the cause of the collapse. Based on structural analyses and estimates of concrete strength at the time of the failure, the NBS investigators concluded that the probable cause of the collapse was a punching shear failure of the 23rd-floor slab. The critical condition was attributed to premature removal of shoring below the 23rd-floor slab at the time the 24th floor was being placed, and the low maturity of that portion of the 23rd floor which was unshored.

701,665
PB84-217462 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
NBS (National Bureau of Standards) Tri-Directional Test Facility.
K. Woodward, and F. Rankin. May 84, 45p NBSIR-84-2879

Keywords: *Structural analysis, *Buildings, *Earthquake resistant structures, *Test facilities, Loads(Forces), Hydraulic servomechanisms, Actuators, Lateral pressure, Computer applications.

A general description of a unique structural testing apparatus is presented. The apparatus is called the NBS Tri-directional Test Facility (NBS/TTF). The NBS/TTF can subject large structural elements to a wide variety of three-dimensional loadings including both translations and rotations in three orthogonal directions. The facility is computer based with all aspects of data acquisition, reduction, and display coordinated and controlled by a minicomputer. The minicomputer also controls the loading of test specimens as directed by the operator. The loads are applied by a closed-loop hydraulic system having seven independently servo-controlled hydraulic actuators. Test specimens having dimensions as large as 3 m long by 3 m deep by 3.5 m high may be installed and tested in the facility. Lateral forces of up to + or - 900 kN may be imposed on the test specimen in combination with vertical forces of up to + or - 1800 kN.

701,666
PB84-218882 Not available NTIS
National Bureau of Standards, Washington, DC.
Structural Serviceability. Floor Vibrations.
Final rept.
B. Ellingwood, and A. Tallin. Feb 84, 1p
Pub. in Jnl. of Structural Engineering v110 n2 p401-418 Feb 84.

Keywords: *Floors, *Deflection, *Vibration, Dynamic response, Structural design, Motion, Stiffness, Mathematical models, Humans, Acceptability, Reprints.

Floor vibrations arising from normal human activity may affect the serviceability of modern building structures, which are becoming lighter and more flexible than before. Existing serviceability criteria for floors are reviewed in the light of research dealing with human perception of structural motion. The dynamic response of floors to realistic pedestrian movement excitation models is analyzed. Tentative serviceability criteria to minimize floor vibrations that are objectionable to building occupants are presented.

701,667
PB84-221456 Not available NTIS
National Bureau of Standards, Washington, DC.
Probability-Based Wind Load Description for Cladding and Structural Members Sensitive to Wind Direction Effects: A Survey of Recent Research.
Final rept.
E. Simiu. 1983, 8p
Pub. in Proceedings of International Conference on Application Statistics Probability Soil Structural Engineering held at Florence, Italy on June 13-17, 1983, p273-280.

Keywords: *Meetings, *Buildings, Loads(Forces), Design, Wind(Meteorology), Risk, Aerodynamics, Structural members, Probability, *Wind loads.

A review is presented of procedures for describing wind loads in both well-behaved and hurricane-prone regions. In addition, recent research is described pertaining to the risk-consistent design of wind-sensitive structures with both specified and unknown orientation.

701,668
PB85-120673 Not available NTIS
National Bureau of Standards, Washington, DC.
Influence of Wind Direction on the Response of a Square-Section Tall Building.
Final rept.
T. A. Reinhold, P. R. Sparks, H. W. Tielman, and F. J. Maher. 1980, 14p
Pub. in Proc. Int. Conf. Wind Eng. (5th), Colorado State University, Fort Collins, Colorado, July 8-14 1979, v2 p685-698 1980.

Keywords: *Buildings, *Wind direction, Superstructure, Wind pressure, Wind tunnels, Tests, Dynamic loads, Dynamic response, Dynamic structural analysis.

This paper presents the results of a wind-tunnel investigation into the effect of wind direction on the wind loads on a square cross-section building model with sharp corners and an aspect ratio of 8.33 to 1. The studies were carried out in a flow which simulated the mean and turbulent properties expected for an urban boundary layer wind. The static and dynamic wind loads were determined at 6 levels throughout the height of the model. From these loads, local and overall force coefficients were determined for forces normal to the model's faces and for torques about the vertical axis through the geometrical center of the model cross-section. These coefficients are presented together with spectra for the modal forces and modal torques associated with the fundamental translational and modes of the corresponding full structure.

701,669
PB85-136232 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Statistical Tests of Environmental Load Data.
Final rept.
B. Ellingwood. Jun 84, 5p
Pub. in Jnl. of Structural Engineers 110, n6 p1400-1404 Jun 84.

Keywords: *Structural design, *Climatology, Loads(Forces), Statistical tests, Snow, Wind pressure, Probability theory, Statistical analysis, Structural engineering, Reprints.

Basic climatological variables such as wind speed, ground snow and other environmental effects are needed to calculate structural design loads. The design loads are contingent on the selection of suitable probability distributions for these climatological variables. This note compares the probability plot correlation criteria as a tool for statistical analysis and testing of environmental data to other common methods as a tool for testing and analyzing environmental data.

701,670
PB85-137420 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Probability - Based Design for Engineered Masonry Construction.
Final rept.
B. Ellingwood, and A. Tallin. Jan 84, 4p
Pub. in Proceedings of American Society of Civil Engineers, Specialty Conference on Probability Mechanics and Structural Reliability, Berkeley, CA., January 11-13, 1984, p82-85.

Keywords: *Masonry, *Construction, Buildings, Design, Structural engineering, Specifications, Probability theory, Criteria, Limits, Reliability, Walls, Loads(Forces).

Specifications for masonry and other construction materials are expected to move gradually over the next several years toward the adoption of probability-based limit states design. This paper summarizes how such criteria might be developed for brick and concrete masonry construction using, as an example, walls loaded in combinations of axial compression and out-of-the-plane flexure.

701,671
PB85-140424 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
West Virginia Cooling Tower Collapse Caused by Premature Form Removal.
Final rept.
H. S. Lew. 1980, 6p
Sponsored by Occupational Safety and Health Administration, Washington, DC.
Pub. in Civil Engineering 50, n2 p62-67 Feb 80.

Keywords: *Cooling towers, *Collapse, Failure, Loads(Forces), Stresses, Formwork(Construction), Concrete construction, Concretes, Shells(Structural forms), Reprints.

The collapse of the natural-draft hyperbolic concrete cooling tower unit no. 2 at the Pleasants Power Station at Willow Island, West Virginia was investigated by the National Bureau of Standards. The investigation included onsite inspections, laboratory tests of construction assembly components and concrete specimens, and analytical studies. Based on the results of these field, laboratory and analytical investigations, it was concluded that the most probable cause of the collapse was due to the imposition of construction loads on the shell before the concrete of lift 28 had gained adequate strength to support these loads. The analysis of the shell indicated that the collapse initiated at the part of the shell in lift 28 where cathead no. 4 was located. It further showed that calculated stress resultants at several points in that part equaled or exceeded the strength of the shell in compression, bending and shear.

701,672
PB85-144939 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dynamic Response of Structural Systems Subjected to Horizontal Propagating Shear Waves.
Final rept.
S. T. Wu, and E. V. Leyendecker. Jul 84, 8p
Pub. in Proceedings of World Conference on Earthquake Engineering (8th), San Francisco, CA., July 21-28, 1984, p355-362.

Keywords: *Dynamic structural analysis, Secondary waves, Seismic waves, Dynamic response, Structures, Eccentricity, Analysis(Mathematics), Building codes, Earthquake resistant structures, *Earthquake engineering, Case studies.

This paper presents the numerical results of a parametric study for structures subjected to shear horizontal propagating waves. Dynamic behavior of coupled lateral-torsional systems subjected to seismic excitations is investigated analytically. Case studies are provided to show the contribution of each of the selected parameters to the rotational response of the system. Dynamic eccentricity is selected as an index to represent the level of the response. The dynamic characteristics of the systems and motions are also discussed based on this proposed approach.

701,673
PB85-144947 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Statistical Aspects of Wind and Snow Loading.
Final rept.
R. B. Corotis, and B. R. Ellingwood. Aug 84, 4p
Pub. in Proceedings of Engineering Mechanics Division Specialty Conference (5th), University of Wyoming, Laramie, WY., August 1-3, 1984, p1200-1203.

Keywords: *Structural engineering, *Snow, *Wind pressure, Loads(Forces), Statistical analysis, Structural design, Mathematical models, Building codes.

Economic loss due to natural hazards in the United States is well in excess of ten billion dollars a year. However, research into improved probabilistic modeling of these hazards, and structural advances to limit the loss, attract only relatively small support outside the earthquake engineering community. This paper discusses some particular probabilistic modeling aspects of two widespread hazards; wind and snow.

701,674
PB85-159960 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Implementation of Compressible Shoring Analysis for Multistory Concrete Construction.
J. L. Gross. Dec 84, 61p NBSIR-84/2964

Keywords: *Concrete construction, *Shoring, *Structural analysis, Buildings, Loads(Forces), Safety, Computerized simulation, Concrete structures.

The report presents an analytical procedure for determining the loads on the shoring system and supporting slabs in multistory cast-in-place concrete construction. The procedure assumes that the slabs are supported by evenly distributed compressible shores and reshores and employs the stiffness method of analysis to solve for the loads on the shoring system and slabs as construction advances. The number of shores and reshcres; shore, reshore and base support stiffnesses; casting rate; and concrete strength gaining characteristics are considered in the analysis. Details of the implementation of the shoring analysis in the form of a computer program are presented. The strategy for determining the next phase in the casting cycle is described and the details are given for formulating the stiffness equations and loads for each phase. Several example problems are presented to demonstrate the use of such a procedure in assisting to make critical decisions regarding planning of the casting schedule and determining when formwork can be safely removed.

701,675
PB85-187334 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Acoustoelastic Evaluation of Arbitrary Plane Residual Stress States in Nonhomogeneous, Anisotropic Plates.
R. B. King, and C. M. Fortunko. Nov 83, 3p
Pub. in Ultrasonics 21, n6 p256-258 Nov 83.

Keywords: *Residual stress, Theories, Normal stress, Velocity measurement, Nondestructive tests, Determination of stress, Evaluation, Homogenity, Secondary waves, Reprints, *Anisotropic plates, *Ultrasonic tests.

In this paper, it is shown that relative ultrasonic velocity measurements can be used to determine the difference of normal stress components in non-homogeneous, anisotropic plates containing arbitrary residual stress states. Previously the theory relating the velocity of Shear-waves to stress and material anisotropy was limited to the case where the principal directions of stress are parallel to the axes of material symmetry. In this paper, the authors remove this restriction by extending the theory. They also suggest possible experimental procedures for validating the new theory.

701,676
PB85-187417 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Modern Developments in Wind Engineering: Part 3.
Final rept.
E. Simiu. 1982, 9p
See also PB82-118084.
Pub. in Engineering Structures 4, n2 p66-74 1982.

Keywords: *Wind pressure, *Structural engineering, Stacks(Exhaust), Chimneys, Mathematical models, Dynamic response, Measurement, Aeroelasticity, Fluid flow, Vortices, Reprints.

The paper presents a review of fundamental research on the across-flow response of cylindrical structures immersed in a steaming fluid, and of practical procedures for the estimation of the across-wind response of vertical structures such as chimneys and stacks with circular cross-sections. The results obtained by using the procedures reviewed in the paper are compared with reported measurements of the response of a full-scale tapered chimney. This comparison shows that improvements are needed in the modeling of the across-wind response of chimneys and stacks.

701,677
PB85-196400 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Monitoring of Dynamic Response of Floor in 'D' Wing of the Main Building, Bureau of Engraving and Printing.
F. Y. Yokel, and P. W. Mayne. Mar 85, 15p NBSIR-85/3126
Sponsored by Bureau of Engraving and Printing, Washington, DC. Prepared in cooperation with Law Engineering Testing Co., McLean, VA.

Keywords: *Dynamic structural analysis, *Public buildings, Vibration, Floors, Structural engineering, Degradation.

In December 1981, the National Bureau of Standards investigated structural vibrations induced in the first floor of the 'D' wing of the main building of the Bureau of Engraving and Printing. In January 1985, additional measurements were performed to check whether there are any changes in the response characteristics of the floor systems which might indicate structural degradation. The results of these measurements are presented.

701,678
PB85-200087 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Influence of Block and Mortar Strength on Shear Resistance of Concrete Block Masonry Walls.
K. Woodward, and F. Rankin. Apr 85, 74p NBSIR-85/3143

Keywords: *Masonry, *Concrete blocks, *Walls, Failure, Tests, Mortars(Materials), Shear strength, Axial stress.

Data from seventeen masonry wall panel tests are presented. All of the walls are ungrouted, unreinforced, and constructed with hollow concrete block. The primary variables in the test series are block and mortar strength, but the applied vertical compressive stress and wall aspect ratio are also varied. The walls are built with either a 'high' strength block or a 'low' strength block having gross area unit strengths of approximately 1800 psi and 1300 psi, respectively. The mortar is either a Type S or Type N mortar and, for convenience, is identified as high and low strength mortar, respectively. Thirteen of the wall panels have nominal dimensions of 64 in. long x 64 in. high x 8 in. thick, but two of the walls are 96 in. long and the remaining two walls are 48 in. long. The applied net area vertical compressive stress is constant for a given test, but varies between 100 psi and 400 psi for tests in the series reported herein. The walls are tested in the NBS Tri-directional Test Facility using fixed-ended boundary conditions at the top and bottom of the walls. A vertical compressive stress is applied and maintained while in-plane lateral displacements are imposed at the top of the wall.

701,679
PB85-205649 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Modern Developments in Wind Engineering. Part 4.
Final rept.
E. Simiu. 1983, 9p
See also PB85-187417.
Pub. in Engineering Structures 5, n4 p273-281 Oct 83.

Keywords: *Structural engineering, *Wind pressure, Deflection, Buildings, Vibration, Torsion, Reprints.

This is the fourth in a series of review papers devoted to the state-of-the-art in wind engineering. Previous papers were published in the October 1981 and January 1982 issues of Engineering Structures. This paper presents a review of information on along-wind, across-wind, and torsional response of tall buildings, and on the mitigation of wind-induced vibrations through the use of tuned mass dampers.

701,680
PB85-205748 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of Internal Strain in Cast-Concrete Structures.
Final rept.
W. C. Stone. 1983, 9p
Pub. in Experimental Mechanics 23, n4 p361-369 Dec 83.

Keywords: *Concrete structures, *Strains, Castings, Finite element analysis, Reprints.

A practical method for experimentally measuring strain profiles inside cast-concrete structures is presented. The technique employs micro-embedment strain gages which are oriented along paths of interest inside the structural element prior to casting. Tests of numerous post-tensioned concrete box girder anchorage elements, and of large-scale pullout test specimens instrumented with micro embedment gages have shown good agreement between the measured strains and those predicted by means of detailed finite element analyses within the linear elastic region of the material.

701,681
PB86-122843 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures and Materials Div.
Predictive Service Life Testing of Structural and Building Components.
Final rept.
L. W. Masters. 1982, 11p
Pub. in Structural Use of Wood in Adverse Environments, p425-435 1982.

Keywords: *Structural analysis, *Service life, *Structural members, Forecasting, Depreciation, Aging tests(Materials), Buildings, Wooden structures, Evaluation, Reprints, Accelerated life tests.

The paper describes the methodology by which service life data can be obtained and the problems encountered in predicting service life from short-term(or predictive service life) tests. A systematic approach aimed at reducing the problems encountered in predictive testing is described. The approach provides guidelines for evaluating existing predictive service life tests and for developing new, more reliable tests as they are needed. Application of the systematic approach to many components is limited, at present, because of the lack of knowledge regarding exposure conditions and mechanisms of degradation. Despite these limitations, however, the approach is useful in (1) identifying the data needed to develop more definitive tests, (2) ensuring the best possible test is developed, and (3) providing a uniform approach to service life prediction and the reporting of the results.

701,682
PB86-124039 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Research in Earthquake Hazards Reduction at the National Bureau of Standards.
Final rept.
E. V. Leyendecker, J. R. Harris, R. N. Wright, and E. O. Pfrang. 1980, 6p
Pub. in Proceedings of World Conference on Earthquake Engineering (7th), Istanbul, Turkey, September 8-13, 1980, v9 p75-80.

Keywords: *Earthquake resistant structures, Seismic design, Building codes, Standards, *Earthquake engineering.

Current and planned Earthquake Hazard Reduction programs for Research and Standards Development at the National Bureau of Standards are being conducted in order to meet the responsibilities assigned to NBS under the President's National Earthquake Hazards Reduction Program. These responsibilities to: (1) provide technical support to the building community in the development of seismic design and construction provisions for building codes and national standards. (2) provide technical support to the Federal agencies in development of seismic design and construction provisions for Federal programs and (3) perform research on performance criteria and supporting measurement technology for earthquake resistant construction, are being carried out in cooperation with the Federal and private sectors.

701,683
PB86-125168 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Wind Loading and Reliability-Based Design.
Final rept.
E. Simiu, and J. R. Shaver. 1980, 12p
Pub. in Proceedings of International Conference on Wind Engineering (5th), Ft. Collins, CO., July 8-14, 1979, v2 p1281-1291 1980.

Keywords: *Structural design, Design, Wind pressure, Loads(Forces), *Wind engineering, Wind loads.

The implementation of second-moment formats for the design of wind-sensitive structures requires the clarification of a number of questions which are investigated in the paper. These include the dependence of reliability-based criteria upon type of extreme wind distribution; the influence upon such criteria of sampling and observation errors in the estimation of extreme winds, as well as of errors in the estimation of aerodynamic and structural parameters; the relation between safety indices and nominal probabilities of failure; the dependence of member safety upon wind climate; and the validity of linear approximations to the expression for the load factor.

701,684
PB86-136967 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Serviceability Limit States: Wind Induced Vibrations.
Final rept.
B. Ellingwood, and A. Tallin. 1984, 14p
Pub. in Jnl. of Structural Engineering 110, n10 p2424-2437 Oct 84.

Keywords: *Dynamic structural analysis, *Human factors engineering, Buildings, Design, Random vibration, Loads(Forces), Wind pressure, Stiffness, Reprints.

The article summarizes existing data regarding human tolerance of building motion and describes how a simple checking procedure for this serviceability limit state might be developed using random vibration theory to relate the fluctuating wind forces to structural response.

701,685
PB86-164506 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Interdependence between Dynamic Surge Motions of Platform and Tethers for a Deep Water TLP (Tension Leg Platform).
Final rept.
E. Simiu, and A. Carasso. 1985, 6p
Sponsored by Minerals Management Service, Reston, VA.
Pub. in Proceedings of International Conference on Behaviour of Offshore Structures (BOSS '85) (4th), Delft, The Netherlands, July 1-5, 1985, p557-562.

Keywords: *Offshore structures, Dynamic response, Dynamic structural analysis, *Tetherlines.

The tethers of tension leg platforms (TLPs) undergoing surge motions are subjected to inertia and hydrodynamic loads. The purpose of the paper is to present an investigation into the effects of the tether curvature caused by these loads. The investigation is conducted by solving the coupled equations of surge motion of the tethers and of the platform.

701,686
PB86-189065 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Dynamic Eccentricity of Structures Subjected to S-H Waves.
Final rept.
S. T. Wu, and E. V. Leyendecker. 1984, 10p
Pub. in Earthquake Engineering and Structural Dynamics 12, n5 p619-628 Sep/Oct 84.

Keywords: *Dynamic structural analysis, Structural analysis, Eccentricity, Seismic waves, Dynamic response, Reprints.

The paper presents the analytical result of a parametric study for a coupled lateral-torsional structural system subjected to seismic waves. Dynamic eccentricity is used as an index to represent the level of structural response. Case studies are provided to show the effects of a few parameters related to the characteristics of the structural systems. These parameters include the shape and size of the foundation mat. Accidental eccentricities due to seismic waves for the corresponding cases are also found and compared.

701,687
PB86-192200 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Wind-Induced Motion of Tall Buildings.
Final rept.
A. Tallin, and B. Ellingwood. 1985, 8p
Pub. in Engineering Structures 7, n4 p245-252 1985.

Keywords: *Buildings, Skyscrapers, Wind pressure, Loads(Forces), Vibration, Reprints.

Modern buildings that are designed so that their lateral drifts under statically applied wind loads are less than some fraction of building height may vibrate excessively during winds and cause building occupants alarm. Methods are presented for evaluating the vibration characteristics of buildings using random vibration theory to relate the fluctuating wind forces to structural response.

701,688
PB86-195013 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Analysis of Torsional Moments on Tall Buildings.
Final rept.
A. Tallin, and B. Ellingwood. 1985, 5p
Pub. in Jnl. of Wind Engineering and Aerodynamics 18, p191-195 1985.

Keywords: *Buildings, Skyscrapers, Torsional strength, Torque, Reprints, Wind tunnel tests.

Spectra of fluctuating wind forces on tall buildings can be determined experimentally from wind tunnel model tests either by measuring base torques using a force balance or by integrating the pressures measured on the sides of the model. The force balance technique is less costly, but may substantially overestimate the actual generalized forces. This study examines the relation between the spectra of base torques and generalized torques experienced by tall buildings.

701,689
PB86-195203 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Wind-Induced Lateral-Torsional Motion of Buildings.
Final rept.
A. Tallin, and B. Ellingwood. Oct 85, 16p
Pub. in Jnl. of Structural Engineering III, n10 p2197-2213 Oct 85.

Keywords: *Buildings, *Vibration, Motion, Wind pressure, Loads(Forces), Deflection, Stiffness, Reprints.

Fluctuating wind forces on tall buildings can cause excessive building motion which may be disturbing to the occupants. A method to assess motion sensitivity of square isolated buildings is developed using random vibration theory to relate dynamic along-wind, across-wind, and torsional forces to building accelerations. Wind tunnel test data are analyzed to determine the spectra of force components and correlations among components of force and mechanical coupling of components of motion introduced by eccentricities of the centers of mass and rigidity from the building centroid are examined. Comparisons are made with more

common building analyses, where the forces are assumed to be statistically uncorrelated and the components of motion are assumed to be uncoupled.

701,690
PB87-108635 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Wind Tunnel Simulation of Along-Wind Tall Building Response: Micrometeorological and Similarity Considerations.
Final rept.
E. Simiu. Jun 78, 1p
Pub. in Colloquium on Industrial Aerodynamics (3rd), Aachen, West Germany, June 18-20, 1978.

Keywords: *Buildings, *Wind pressure, *Towers, Dynamic structural analysis, Simulation, Comparison, *Wind effects, *Tall buildings, Wind tunnel tests, Atmospheric boundary layer.

A discussion is presented of the implications of recent results of atmospheric boundary layer research for the wind tunnel simulation of the along-wind response of tall structures. It is shown, on the basis of similarity considerations and of recently developed models of the atmospheric flow structure, that the turbulent fluctuations which cause resonant amplification effects in tall buildings are not similar in long wind tunnels to the corresponding fluctuations in atmospheric flows. The question is discussed of the corrections that should be applied to the along-wind response measurements obtained in the wind tunnel in order to account for differences between turbulence spectra in the atmosphere and in the laboratory.

701,691
PB87-150520 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Planning and Conduct of Full Scale Measurements of Wind Loads.
Final rept.,
R. D. Marshall. 1985, 12p
Pub. in Proceedings of India-U.S. Workshop on Wind Disaster Mitigation, Madras, India, December 17-20, 1985, p125-136.

Keywords: *Buildings, *Wind pressure, Instrumentation, Wind engineering.

The paper describes the types of measurements required for the study of wind effects on buildings and other structures in full scale. Also described are the types of instruments commonly used to obtain these measurements, their physical characteristics, and their limitations. The paper considers sources of measurement errors and describes certain hardware configurations and measurement techniques that have proved useful in conducting full-scale studies.

701,692
PB87-150546 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Recent Developments and Applications in Wind Engineering.
Final rept.,
E. Simiu. 1986, 18p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Proceedings of U.S. PRC Japan Trilateral Symposium Workshop on Engineering for Multiple Natural Hazards Mitigation, Beijing, China, January 7-12, 1985, pW-1-1--W-1-18 1986.

Keywords: *Building codes, Structural engineering, Aerodynamics, Aeroelasticity, Dynamic structural analysis, Wind engineering.

The paper presents a review of recent developments in wind engineering that have influenced or are expected to influence building code provisions and design practice in the United States. Developments are reviewed in the following areas: micrometeorology, extreme wind climatology, aerodynamics, structural dynamics, aero-elasticity, and structural reliability. Also presented in the paper is a review of applications of these developments to various practical design problems.

701,693
PB87-151304 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Recent Investigations into Wind Effects on Cladding Glass.
Final rept.,
E. Simiu, and E. M. Hendrickson. 1985, 8p
Grant NSF-CEE83-0829
Sponsored by National Science Foundation, Washington, DC.
Pub. in Proceedings of U.S. National Conference on Wind Engineering (5th), Lubbock, TX., November 6-8, 1985, p2A-17--2A-24.

Keywords: *Glass, *Buildings, *Wind loads.

The paper describes investigations conducted in four areas: estimating the 60-sec constant load equivalent, from the point of view of the panel behavior, to a wind load with any specified time history; estimating the 60-sec load capacity of a glass panel of any given size, given the probabilistic description of the basic strength properties of the glass; estimating the probabilistic description of the basic strength properties of glass from the analysis of results of tests conducted on small samples by the ring-on-ring test method; designing window glass facades on a risk-consistent basis to meet safety-related design criteria acceptable to the building official. Main results reported include the following: the two-parameter Weibull distribution, heretofore employed in the literature to describe the behavior of cladding glass, is an unacceptable model; the estimated 60-sec load capacity of glass panels depends significantly upon aspect ratio; and the reliability-based analysis and design of glass cladding can result in considerable cost reductions at equal safety levels or in considerably improved safety levels at equal costs.

701,694
PB87-151312 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Environmental Load Direction and Reliability Bounds.
Final rept.,
E. Simiu, S. D. Leigh, and W. A. Nolan. May 86, 5p
Sponsored by Minerals Management Service, Reston, VA.
Pub. in Jnl. of Structural Engineering 112, n5 p1199-1203 May 86.

Keywords: Multivariate analysis, Structural analysis, Reliability, Reprints, *Wind loads.

The probability of failure of a structure or member subjected to directional environmental loads depends upon the correlations between data characterizing the loads in any two directions. The purpose of this note is to investigate the extent to which the simplifying assumption that all these correlations are zero is acceptable in practical structural reliability. Numerical examples are presented from which it is concluded that in the case of wind loads, for both well-behaved and hurricane-prone climates, neglecting the effect of the correlations results in the overestimation of failure probabilities by a factor of about two or less.

701,695
PB87-151981 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Wind Engineering: A Review of Recent Work.
Final rept.,
E. Simiu. 1986, 10p
Pub. in Interdisciplinary Science Reviews 11, n1 p32-41 1986.

Keywords: Micrometeorology, Structural design, Dynamic structural analysis, Reliability, Reprints, *Wind engineering, Wind loads.

The review covers recent developments in wind engineering that have influenced or are expected to influence building code provisions and design practice. Developments are reviewed in the following areas: micrometeorology, extreme wind climatology, aerodynamics, structural dynamics, aeroelasticity, and structural reliability. Also presented in the paper is a review of applications of these developments to various practical design problems.

701,696
PB87-161063 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Dynamic Stability of Structures Subjected to Seismic Shear Waves.
Final rept.,
S. T. Wu, and C. G. Culver. 1984, 7p
Pub. in Proceedings of Annual Technical Session - Structural Stability Research Council: Stability under Seismic Loading, San Francisco, CA, April 10-11, 1984, p169-175.

Keywords: Dynamic response, Structural analysis, *Seismic design, *Earthquake engineering, Nonlinear analysis.

Dynamic stability of structures under periodic load has been investigated extensively. The results from those studies can be applied to problems related to stability of structures subjected to seismic waves without difficulty. However, the previous studies have presupposed that the lateral response is the primary response and the torsional response is the secondary one. In the paper, the lateral and torsional stability will be considered simultaneously by including the corresponding motions at the foundation level directly. The basic equation will thus be different from the ones in previous studies. Discussions on the types of the solutions implied in the governing equations are also given.

701,697
PB87-161089 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Limit State Probabilities for Wood Structural Members.
Final rept.,
E. M. Hendrickson, B. Ellingwood, and J. Murphy. Jan 87, 19p
Pub. in Jnl. of Structural Engineering 113, n1 p88-106 Jan 87.

Keywords: *Building codes, *Timber construction, Wooden structures, Design standards, Limit design method, Structural analysis, Reliability, Beams(Supports), Reprints.

Estimates of the limit state probability for wood members, where the limit state is failure by creep rupture, must be based on analyses that take into account the temporal characteristics of the applied loads. These estimates require: (1) construction of appropriate load process models; (2) a probabilistic description of wood member strength; and (3) a cumulative damage analysis. Reliability analyses of beams subjected to dead, snow, and live loads were performed to evaluate the effects of using different load duration models and different parameters in the snow and live load process models. It was found that the most important factor determining failure is the duration and magnitude of the extreme load pulses. The choice of load duration model, in contrast, was relatively unimportant. Reliabilities associated with existing design criteria were evaluated, and resistance factors for use in a proposed load and resistance factor design format were determined, using glulam beams in bending as an example.

701,698
PB87-161204 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Seismic Design Guidelines for Federal Buildings,
E. V. Leyendecker. Feb 87, 103p NBSIR-87/3524
Also pub. as Interagency Committee on Seismic Safety in Construction rept. no. ICSSC/RP-1. Prepared in cooperation with Interagency Committee on Seismic Safety in Construction. Sponsored by Federal Emergency Management Agency, Washington, DC.

Keywords: Buildings, Building codes, Standards, *Earthquake engineering, *Government buildings, *Seismic design, *Federal buildings, Guidelines.

The document has been prepared as a coordinated adaptation of existing voluntary standards, model building codes, Federal regulations, and research reports for use by Federal agencies. The technical content is similar to the seismic requirements of the 1985 Uniform Building Code (UBC). However, there are instances of substantive difference from the UBC. Several important provisions have been incorporated from other sources considered in the adaptation. For example, the seismic zone map is the one in current use in ANSI A58.1-1982 Minimum Design Loads for Buildings and Other Structures. A number of provisions have been added to these guidelines that are based on the current practices and policies of various Federal Agencies. Furthermore, in the spirit of improvement, the

document is organized considerably differently from the UBC and many provisions are phrased differently.

701,699
PB87-164059 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Analysis of Shoring Loads and Slab Capacity for Multistory Concrete Construction.
Final rept.,
J. L. Gross, and H. S. Lew. 1986, 22p
Sponsored by Occupational Safety and Health Administration, Washington, DC.
Pub. in Proceedings of International Conference on Forming Economical Concrete Buildings (2nd), Chicago, IL., November 28-30, 1984, p109-130 1986.

Keywords: *Concrete slabs, Loads(Forces), Buildings, Concrete construction, Formwork(Construction), Microcomputers, Computer applications.

The paper describes a microcomputer-based program which can be used to assist the contractor in evaluating the safety and economy of alternate construction schemes in cast-in-place multistory concrete building construction. The program, developed at the National Bureau of Standards, assumes that the slabs are supported by evenly distributed, compressible shores or reshores. Forces on the slabs are computed by assuming that superimposed construction loads are distributed to the shoring system and interconnected floors in proportion to their relative stiffnesses. The method takes into account both the stiffness of shores and reshores and any precompression in the reshores. Slab capacity is computed from a maturity-based model of concrete strength prediction. The computed slab loads are compared with the slab capacities to determine whether the load on any slab exceeds the capacity of that slab for any stage of construction. By varying the number of shored and reshored stories, the precompression of reshores, and rate of construction, the optimum casting schedule can be determined. Examples are given which illustrate how the program can be used to assist the contractor in determining a safe casting schedule and to guide the contractor in formwork removal.

701,700
PB87-164125 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Multivariate Distributions of Directional Wind Speeds.
Final rept.,
E. Simiu, E. M. Hendrickson, W. A. Nolan, I. Olkin, and C. H. Spiegelman. 1985, 5p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Structural Engineering-ASCE 111, n4 p939-943 1985.

Keywords: *Wind direction, Structural engineering, Multivariate analysis, Wind velocity, Reprints, *Wind loads.

An extended abstract is presented in which: Existing methods for taking wind directionality into account in structural engineering calculations are reviewed; A new such method is proposed; It is shown that published data issued by the National Oceanic and Atmospheric Administration are sufficient to characterize the directional extreme wind climate.

701,701
PB87-172706 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Building Structural Failures - Their Cause and Prevention.
Final rept.,
J. G. Gross. Oct 86, 13p
Pub. in Jnl. of Professional Issues in Engineering 112, n4 p236-248 Oct 86.

Keywords: *Buildings, Structural design, Failure, Building codes, Collapse, Foundations, Reprints.

Many recent collapses of U.S. buildings have occurred both during construction and following occupancy. Such failures have received professional and public attention due to the attendant major losses of life and property. Five recommendations resulting from the Engineering Foundation Conference, Building Structural Failures-Their Cause and Prevention, held in Santa Barbara, California, November 6-11, 1983 are highlighted. The recommendations address structural integrity, life safety assurance, peer review, definition and assignment of responsibility, and unified risk insurance. The nature and magnitude of the problem, the design process, the construction process, legal implications, and the regulatory process are covered.

701,702
PB87-187225 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
National Earthquake Engineering Experimental Facility Study. Phase One. Large Scale Testing Needs.
Final rept.,
C. F. Scribner, and C. G. Culver. Apr 87, 76p NBS/SP-729
Also available from Supt. of Docs as SN003-003-02795-2. Library of Congress catalog card no. 87-619811. Sponsored by Federal Emergency Management Agency, Washington, DC., and National Science Foundation, Washington, DC.

Keywords: *Test facilities, Planning, Structural engineering, Dynamic tests, Buildings, Industrial plants, *Earthquake engineering, High rise buildings, Low rise buildings, Seismic effects.

The report summarizes information obtained during the first year of a four-year feasibility study for a national earthquake engineering experimental facility. A five-year research program is presented for a national facility in which full-scale or large-scale structures or structural components would be subjected to static or dynamic lateral loads. The facility would have applicability to tests in the following areas: low-rise buildings, medium-rise buildings, high-rise buildings, industrial processing facilities, and power facilities. Representatives from a broad spectrum of professional, industrial, and trade organizations and Federal agencies participated in developing the research program. A comparison of existing testing facilities in the U.S. and other countries engaged in seismic testing and a discussion of international cooperation in large-scale testing are included.

701,703
PB87-199964 PC **A99**/MF **E04**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Wind and Seismic Effects: Proceedings of the Joint Panel Meeting of the U.S.-Japan Cooperative Program in Wind and Seismic Effects (17th), Held at Tsukuba, Japan on May 21-24, 1985.
N. J. Raufaste. May 86, 740p NBSIR-86/3364

Keywords: *Meetings, Soils, Pipelines, Buildings, Bridges, Tsunamis, *Wind loads, *Seismic effects, Storm surges, Earthquake engineering.

The publication, the proceedings of the Joint Meeting, includes the program, list of members, formal resolutions, and technical papers. Papers were presented under five themes: Wind engineering, earthquake engineering, storm surge and tsunamis, U.S.-Japan cooperative research program, and reports on the Nihonkai-Chubu earthquake and the Naganoken-Seibu earthquake. Subjects covered in the papers presented include: (1) characteristics of strong winds; (2) wind loads on structures and design criteria; (3) earthquake ground motions; (4) soil liquefaction studies and methods to improve liquefaction resistance; (5) seismic loads on structures and design criteria; (6) stress analyses of pipelines during earthquakes; (7) full-scale seismic experiments; (8) earthquake hazard reduction program; (9) use of the microcomputer for earthquake studies; (10) quantitative evaluation of damages caused by winds and earthquakes; and, (11) tsunami research projects.

701,704
PB87-199972 PC **A22**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Wind and Seismic Effects: Proceedings of the Joint Meeting of the U.S.-Japan Cooperative Program in Natural Resources Panel on Wind and Seismic Effects (18th), Held at Gaithersburg, Maryland on May 12-15, 1986.
Final rept.,
N. J. Raufaste. Apr 87, 515p NBSIR-87/3540

Keywords: *Meetings, Storms, Pipelines, Accelerometers, Bridges, Tsunamis, Soils, *Wind loads, *Earthquake engineering, Seismic effects, Storm surges.

Subjects covered in the papers presented include: (1) characteristics of stongwinds; (2) wind loads on structures and design criteria; (3) earthquake ground motions; (4) soil liquefaction studies and methods to improve liquefaction resistance; (5) seismic loads on structures and design criteria; (6) stress analyses of pipelines during earthquakes; (7) full-scale seismic experiments; (8) earthquake hazard reduction program; (9) use of the microcomputer for earthquake studies; (10) quantitative evaluation of damages caused by winds and earthquakes; and, (11) tsunami research projects.

701,705
PB87-210191 PC **A11**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Engineering Aspects of the September 19, 1985 Mexico Earthquake.
Final rept.,
W. C. Stone, F. Y. Yokel, M. Celebi, T. Hanks, and E. V. Leyendecker. May 87, 228p NBS/BSS-165
Also available from Supt. of Docs as SN003-003-02803-7. Library of Congress catalog card no. 87-619819. Prepared in cooperation with Geological Survey, Menlo Park, CA., and Geological Survey, Golden, CO.

Keywords: Earthquakes, Building codes, Foundations, Mexico, *Earthquake engineering, Seismic design, Ground motion, Mexico City(Mexico).

Following the September 19, 1985 Mexico earthquake, a team consisting of four engineers and one seismologist from the National Bureau of Standards (NBS) and the United States Geological Survey (USGS) was dispatched to Mexico City to provide technical advice to the US rescue effort and to assess structural damage. The report is primarily based on data gathered by the team, but it also contains a compilation of other available information. The report addresses the origin and characteristics of the observed ground motion, the ability of buildings designed in accordance with present and proposed seismic design provisions to resist this type of ground motion, and observed data on structural and foundation failures.

701,706
PB87-219028 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Construction Failures: Legal and Engineering Perspectives.
Final rept.,
H. S. Lew. 1983, 15p
Sponsored by American Bar Association, Chicago, IL., and American Society of Civil Engineers, New York.
Pub. in Construction Failures: Legal and Engineering Perspectives, 15p 1983.

Keywords: *Concrete construction, *Failure, Collapse, Errors, Design, Safety, Engineering drawings, Structural engineering, Reprints, Falsework.

Common causes of construction failures are examined with examples drawn from a number of recent catastrophic concrete construction failures. They are identified as those resulting from (1) errors in design of permanent structures, (2) errors in design of falsework, (3) lack of communication between designer and constructor, and (4) poor construction practices. In order to improve construction safety, it is recommended that the constructor develop a basic construction plan. The plan should include, but not be limited to, (1) design loads for construction, (2) design calculations for falsework, (3) criteria for falsework removal and imposition of construction loads, (4) establishment of bench marks for each stage of construction and (5) personnel training in construction operation.

701,707
PB88-129002 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Preliminary Performance Criteria for Stone Treatments for the United States Capitol,
J. R. Clifton. Oct 87, 42p NBSIR-87/3542

Keywords: *Renovating, Reconditioning, Limestone, Performance, Criteria, Treatment, Paints, Weathering, *United States Capitol.

The West Central Front of the United States Capitol is being restored, including cleaning and repainting the sandstone, and replacing badly deteriorated sandstone with Indiana limestone. Application of stone treatments was proposed as a way of extending the lives of the sandstone and paint. However, without

adequate selection criteria there was no certainty of effective performance by stone treatments. The purpose of the study was to develop performance criteria to assist in the selection of stone treatments. Based on an analysis of expected deterioration processes, it is concluded that deterioration of the sandstone was most likely associated with water penetration into the exposed outer surface. Therefore, if a treatment is to be used, it should protect the outer surface of the sandstone from rain penetration. In addition, the treatment should penetrate and consolidate any deteriorated stone. Also, treatment should not cause premature failure of the paint. Based on these requirements, four preliminary performance criteria were developed, but have not been verified by long-term studies. Of five stone treatments evaluated, one met the four criteria. It is recommended that treatment be used on areas of deteriorated sandstone needing consolidation and on stone in areas subjected to the most severe weathering locations.

701,708
PB88-130331 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Whittier Narrows Earthquake of October 1, 1987. A Reconnaissance Report,
H. S. Lew. Nov 87, 36p NBSIR-87/3667

Keywords: *Earthquakes, *Reporting, *Bridges(Structures), Buildings, Houses, Damage assessment, Photographs, *Seismic design, Earthquake engineering, Whittier(California).

Within hours following the Whittier Narrows earthquake of October 1, 1987, a structural engineer from the Center for Building Technology, National Bureau of Standards surveyed the damage to buildings and other structures. The area investigated covers Los Angeles and other communities including Whittier, Alhambra, and Pasadena. The report consists of photographs, all of which were taken by the NBS team. The photographs presented herein are intended to serve as (1) documentation of the damage resulting from the earthquake and (2) as a source document for further studies, research and recommendations.

701,709
PB88-147319 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Serviceability Limit States: Deflection.
Final rept.,
T. V. Galambos, and B. Ellingwood. 1986, 18p
See also PB85-196095.
Pub. in Jnl. of Structural Engineering 112, n1 p67-84 1986.

Keywords: *Reliability, *Deflection, Roofs, Floors, Wind loads, Snow, Frames, Reprints.

The paper examines the reliability of floor and roof deflections due to occupancy and snow loads, respectively, and of lateral frame deflections due to wind loads. These deflections are determined for unfactored code-specified loads, and they are not to exceed professionally established deflection limits. First-order, second-moment probabilistic theory is used in the analysis. Values of the reliability index are calculated for eight and one year reference periods. Recommendations are made with regard to load levels to be used in the serviceability analysis of deflection-sensitive and deflection-insensitive structures.

General

701,710
PB-264 335/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Status and Problems of Fire Detection for Life Safety in the United States.
Final rept.,
R. G. Bright. 1977, 12p
Pub. in Proceedings of Symposium National Academy of Sciences-National Research Council on Fire Detection for Life Safety, Washington, D.C., March 31-April 1, 1975. Paper in Fire Detection and Life Safety, p3-14 1977.

Keywords: *Fire detection systems, *Residential buildings, *Meetings, Smoke, Fire safety, Systems engineering, Technology, Detectors, Improvement, Comparison, Performance standards, Smoke detectors, Deficiencies, Advantages and disadvantages, Building fires.

About 12,000 persons lose their lives in fires each year in the U.S. Two-thirds of these persons die in home fires. If fire detectors for life safety are to be effective, their use in dwellings must be systematized. Any of the three conventional fire detector types, flame, heat, or smoke, can serve for life safety. Comparing advantages and disadvantages of each type of detector indicates smoke detectors should be the most effective of the three. There are, however, some technical and design deficiencies with smoke detectors which must be overcome if these devices are to realize their maximum potential as life saving devices.

701,711
PB-264 368/2 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Study of Fire Spread in Multi-Family Residences: The Causes - The Remedies.
Final rept.,
B. M. Vogel. Feb 77, 23p NBSIR-76-1194

Keywords: *Fires, *Residential buildings, Assignable causes, Research, Apartment buildings, Fire safety, Fire walls, Building codes, Metropolitan areas, District of Columbia, Recommendations, Revisions, Fire walls, Design standards, *Multifamily dwellings, *Fire spread, Remedies, Violations, Deficiencies, Faulty construction.

This report identifies the major elements contributing to the spread of fire in multi-family buildings, where the fire is beyond the area of origin. The data were collected from 84 separate fires involving low-rise (garden apartments) residential buildings in the Washington, D.C. metropolitan area. This report categorizes the contributing factors of the fire spread into construction deficiencies, design deficiencies, and possible code violations; and suggests the need for specific revisions to building codes.

701,712
PB-267 278/0 PC **A06**/MF **A01**
Notre Dame Univ., IN. Dept. of Aerospace and Mechanical Engineering.
UNDSAFE-I: A Computer Code for Buoyant Flow in an Enclosure.
Technical rept.,
K. T. Yang, and L. C. Chang. 1 Mar 77, 106p TR-79002-77-1, NBS-GCR-77-84

Keywords: *Fires, *Buildings, *Computer programs, *Fluid dynamics, Numerical analysis, Doors, Windows, Openings, Pressure distribution, Ceilings, Floors, Models, Fortran, UNDSAFE 1 computer program, Buoyant flow, Fire spread, *Corridor fires, Fire research.

This report describes a numerical computer code known as UNDSAFE-1 for predicting the flow, temperature and pressure fields in a simple two-dimensional rectangular enclosure due to a volumetric heat source. It accommodates either a doorway or a window, and a variety of conditions such as location, extent and strength of the heat source as well as various thermal boundary conditions along the ceiling and the floor of the enclosure. Physical effects taken into account in this code include strong buoyancy, compressibility, and turbulence. The code is fully documented and explained in this report in terms of input data and format as well as available output options. A complete numerical example is presented.

701,713
PB-267 310/1 PC **A22**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of Building Standards and Codes Services.
Research and Innovation in the Building Regulatory Process. Proceedings of the NBS/NCSBCS Joint Conference (1st) Held at Providence, Rhode Island on September 21-22, 1976, in Conjunction with the Annual Meeting of the National Conference of States on Building Codes and Standards (NCSBCS), Inc. (9th).
Special pub.,
P. W. Cooke. Jun 77, 504p NBS-SP-473
Prepared in cooperation with National Conference of States on Building Codes and Standards, Inc., Washington, D.C. Library of Congress catalog card no. 77-8273.

Keywords: *Building codes, *Buildings, *Regulations, *Meetings, Technology innovation, Research, Energy, Conservation, Management planning, Information systems, Economic factors, Metric system, Rehabilitation, Solar radiation, Energy conservation, Alternatives, Environmental issues.

The First NBS/NCSBCS Joint Conference on Research and Innovation in the Building Regulatory Process was held in Providence, Rhode Island on September 21-22, 1976. The proceedings of the Joint Conference include the opening remarks, the Keynote Address, the technical papers presented at each session, and a summary of a panel discussion on the future of building regulatory research. The subject matter covered in the papers includes: new alternatives in environmental research, energy conservation, solar energy, building innovations, information processing, metrication, and the preservation and rehabilitation of buildings, all associated with regulatory processes.

701,714
PB-267 316/8 PC **A99**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Wind and Seismic Effects - Proceedings of the Joint Panel Conference of the U.S.-Japan Cooperative Program in Natural Resources (8th) Held at National Bureau of Standards, Gaithersburg, Maryland on May 18-21, 1976.
Special rept.(Final),
H. S. Lew. May 77, 630p NBS-SP-477
Library of Congress Catalog Card no. 77-600015.

Keywords: *Bridges, *Buildings, *Earthquakes, *Wind pressure, *Meetings, Earth movements, Seismic waves, Typhoons, Tornadoes, Design criteria, Nuclear power plants.

The Eighth Joint Meeting of the U.S.-Japan Panel on Wind and Seismic Effects was held in Gaithersburg, Maryland on May 18-21, 1976. The proceedings of the Joint Meeting include the program, the formal resolutions, and the technical papers. The subject matter covered in the papers includes wind effects on structures and design criteria; extreme winds for structural design; earthquake ground motions and instrumentation; seismicity and earthquake risk; seismic effects on structures and design criteria; lessons learned from recent natural disasters; design of nuclear reactor facilities.

701,715
PB-267 869/6 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Terms and Definitions for Door and Window Security.
Final rept.,
J. S. Stroik. Feb 77, 21p NBS-SP-480-22
Prepared for Law Enforcement Assistance Administration, Washington, D.C.

Keywords: *Residential buildings, *Security, *Dictionaries, Terminology, Definitions, Doors, Windows, Glossaries.

This is a glossary of definitions for those terms most frequently encountered in the spoken and written vocabulary concerning door and window security. Compiled from dictionaries, glossaries, professional literature and technical publications, the definitions were either used as found or rewritten into simpler and more descriptive language. Terms and definitions for alarm systems are not included.

701,716
PB-268 132/8 PC **A04**/MF **A01**
McFarland (M. Carter), Falls Church, Va.
Government-Supported Residential Rehabilitation.
Final rept.,
M. C. McFarland. Jun 77, 60p NBS/GCR-77-87
Contract NBS-S-315688-73

Keywords: *Houses, *Rehabilitation, *Federal assistance programs, Urban renewal, Building codes, Law enforcement, Projects, Residential buildings, Renovating, Surveys, Resources, Economic development, Conservation, Standards, Dilapidated dwellings, Remodeling.

The NBS is developing new research to determine how best to remodel and rehabilitate existing buildings as a way of conserving the Nation's resources. As background information, this report discusses the

three major programs in residential rehabilitation which HUD has conducted in the past. The programs, whose needs, history, examples, and outcomes are discussed, are urban renewal rehabilitation, concentrated code enforcement, and project rehabilitation. The author was an economist at HUD when these programs were conceived and carried out, and was involved with them either directly or indirectly.

701,717
PB-268 389/4 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Evaluation of the Egress Provisions of the HUD Mobile Home Construction and Safety Standard.
Final rept. 30 Jul 76,
S. C. Adler. May 77, 78p NBSIR-77-1246
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Assistant Secretary for Policy Development and Research.

Keywords: *Houses, *Trailers, *Doors, *Windows, *Panels, Fire safety, Escape systems, Standards, Human factors engineering, *Mobile homes, *Emergency exits.

Evaluative tests were carried out to assess the adequacy and sufficiency of the HUD Mobile Home Construction and Safety Standards. Project activities included library research, laboratory testing and construction of a Mobile Home Emergency Egress Demonstration Unit. The study recommended: (1) establishment of performance goals to relate the desired objective (safe egress) to the specific requirements of the standard; (2) expansion of the scope of the requirements to assure that egress devices do not adversely affect the safety or security of the mobile home under normal living conditions; and (3) support of applied research to interrelate egress requirements, device characteristics, and human capabilities.

701,718
PB-269 780/3 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Building Technology Publications - 1976. Supplement 1,
J. R. Debelius. 1977, 81p NBS-SP-457-Suppl-1
Supplement to report dated Dec 76, PB-261 216.

Keywords: *Construction, *Technology, *Bibliographies, Documents, Abstracts, Subject index terms, Indexes(Documentation), Authors, Subject indexing, Information systems, Handbooks, Technical reports, Patents, Libraries, Buildings, Construction materials, *Building technology, Center for Building Technology.

The complete citations for publications of the NBS Center for Building Technology (CBT) are given for the period January-December 1976. This supplement to NBS Special Publication 457, 'Building Technology Publications 1965-1975,' includes the titles and abstracts for CBT papers published during 1976 in both NBS and non-NBS media; key-word and author indexes are also included, along with general information and the availability of CBT publications. Publications constitute the major end product of CBT programs and provide the primary means of communicating the results of NBS programs to its varied technical audiences, as well as to the general public.

701,719
PB-269 866/0 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Control of Smoke Movement in Buildings: A Review.
Final rept.,
I. A. Benjamin, F. Fung, and L. Roth. Apr 77, 44p NBSIR-77-1209
Paper was originally presented at the UJNR Conference (United States and Japan Panel on Natural Resources) in Tokyo, Japan (BRI) on October 21, 1976.

Keywords: *Fire fighting, *Smoke abatement, *Buildings, Flow, Technology, Models, Computer programming, Dynamics, Control, Reviews, Methodology, Simulation, *Building fires, *Smoke control.

A state-of-the-art review of efforts in smoke movement and smoke control is presented. Basic principles, experimental techniques and results, computer models, and smoke control methods which have been employed are presented. The paper covers all work in the area of smoke movement and smoke control but emphasizes the work of NBS.

701,720
PB-269 965/0 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Fire Research Publications, 1976.
Final rept.,
N. H. Jason. Jul 77, 15p NBSIR-77-1277
See also PB-257 837.

Keywords: *Fire safety, *Research projects, *Bibliographies, Technical reports, Meetings, Fire hazards, Flammability, Fire detection systems, *Fire research, Building fires.

The document is a supplement to the previous editions of Fire Research Publications which covered the years 1969-1972, 1973, 1974 and 1975. Only publications prepared by the members of the Center for Fire Research (CFR), by other National Bureau of Standards (NBS) personnel or external laboratories under contract or grant from the CFR are cited. Articles published in NBS house organs also are cited.

701,721
PB-270 343/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fire Death Scenarios and Fire Safety Planning.
Final rept.,
F. B. Clarke, and J. Ottoson. 1976, 5p
Pub. in Fire J., v70 n3 p117-118 May 76.

Keywords: *Fire losses, *Residential buildings, *Scenarios, Death, Damage, Injuries, Smoking, Ignition, Statistical distributions, Household fabrics, Fire safety, Planning, Causal analysis, Reprints.

The purpose of this paper is to introduce the fire loss scenario as a tool for planning. Scenarios are defined in terms of categories of fire loss (death, injury or property loss) and the circumstances (occupancy type, ignition source, etc.) which surround each incident. Fire statistics from four sources are combined to provide a quantitative ranking of the most important scenarios for fire deaths. Fourteen scenarios account for approximately 66 percent of U.S. fire deaths. The most important of these is the residential fire deaths caused by ignition of furnishings items by careless smoking. This scenario scene accounts for 27 percent of fire deaths. The implications of these findings for planning for safety programs are discussed.

701,722
PB-271 171/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Emergency Communications in High-Rise Buildings,
R. A. Glass, and A. I. Rubin. 1977, 9p
Pub. in Chapter 22 in Human Response to Tall Buildings, CDS/34, p293-301 1977.

Keywords: *Fire safety, *Telecommunication, Safety, Buildings, Disasters, Human factors engineering, Tall buildings, Emergency operations, High rise buildings, Reprints.

The safety of occupants of high rise buildings during fire emergencies is often determined by the adequacy of the communications available to them -- indicating how to respond. Visual signals (warning lights and directional signs) and auditory alarms and verbal messages are generally employed to serve this function. The actual signals now used in buildings have been developed over the years in a piecemeal fashion with minimal systematic research input. The adequacy of these signals have come into question in recent years, especially as a result of the potential for a major disaster associated with high-rise building fires. The paper traces the problems associated with communications systems presently in use from the standpoint of the occupant.

701,723
PB-271 187/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Insulation on the Surface Temperature of Roof Membranes.
Final rept.,
W. J. Rossiter, and R. G. Mathey. 1976, 5p
Pub. in Roofing/Siding/Insulation, p35-38, p136 Apr 76.

Keywords: *Roofs, *Thermal insulation, *Surface temperature, Radiant cooling, Solar heating, Solar radiation, Heat balance, Reprints.

The surface temperatures of black, gray and white roofs were calculated for various thicknesses of insulation located between the membrane and roof deck. The calculations were performed using a steady-state heat balance equation to illustrate the increase in roof surface temperatures due to solar radiation. The calculations indicate that the first increment (about 1 inch) of insulation causes a significant rise in the roof surface temperature due to solar radiation. Increasing the amount of insulation above this first increment to greater thicknesses does not appreciably increase the roof surface temperature.

701,724
PB-271 192/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Insulation on the Surface Temperature of Roof Membranes.
Final rept.,
W. J. Rossiter, and R. G. Mathey. 1976, 12p
Pub. in Roofing Spec., p28-39 May 76.

Keywords: *Roofs, *Thermal insulation, *Surface temperature, Radiant cooling, Solar heating, Solar radiation, Heat balance, Reprints.

The surface temperatures of black, gray and white roofs were calculated for various thicknesses of insulation located between the membrane and roof deck. The calculations were performed using a steady-state heat balance equation to illustrate the increase in roof surface temperatures due to solar radiation. The calculations indicate that the first increment (about 1 inch) of insulation causes a significant rise in the roof surface temperature due to solar radiation. Increasing the amount of insulation above this first increment to greater thicknesses does not appreciably increase the roof surface temperature.

701,725
PB-271 193/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Small-Scale Enclosure for Characterizing the Fire Buildup Potential of a Room.
Final rept.,
W. J. Parker, and B. T. Lee. 1974, 30p
Contract N00024-69-F-S177
Pub. in Proc. Meeting to Honor Clay Preston Butler on the Occasion of his 70th Birthday, Experimental Methods in Fire Research, Menlo Park, California, May 9-10, 1974, p43-72 1974.

Keywords: *Fires, *Enclosures, *Test facilities, Buildings, Model tests, Fire tests, Measurement, Flashover, Combustion, *Room fires, Fire spread.

A 0.76 by 0.76 m (30 by 30 inch) enclosure with a 0.61 m (24 inch) high ceiling was used to model some fires in a 3 x 3 x 2.4 m (10 x 10 x 8 ft) burnout room. Temperatures, oxygen concentrations, air velocity, and conductive and radiative heat fluxes were measured. The highest average air temperature in the upper part of the room was taken as a measure of the fire buildup potential of the room. Upper air temperatures attained in the model were similar in most cases to those in the full-scale compartment. From energy balance considerations this air temperature was related to the oxygen depletion in the room and was shown to correlate well with the oxygen content of the combustion gas and air exhausting from the model and full-scale room fires.

701,726
PB-272 053/0 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Design Methods for Reducing the Risk of Progressive Collapse in Buildings.
Final rept.,
E. V. Leyendecker, and B. R. Ellingwood. Apr 77, 75p NBS-BSS-98
Supersedes NBSIR 76-1106. Errata sheet inserted. Library of Congress catalog card no. 77-608039.

Keywords: *Buildings, *Collapse, *Risk, Building codes, Design criteria, Loads(Forces), Damage assessment, Structural design, *Progressive collapse, *Risk analysis, Abnormal loads.

A progressive collapse is described as a chain reaction of failures following damage to a relatively small portion of a structure. The damage which results characteristically is out of proportion to the damage which initiated the collapse. The basic concepts associated with progressive collapse are described and the background leading to the concepts is summarized. Possible causes of progressive collapse are discussed, with concentration on abnormal events which have a low

probability of occurrence but may have catastrophic consequences. A case study of the probability of structural failure as a consequence of one type of abnormal load (a gas explosion) shows that these probabilities exceed levels generally considered acceptable to engineers. Direct design strategies for reducing progressive collapse are described as (1) the Alternate Path Method and (2) the Specific Local Resistance Method. Equations for load combinations, including appropriate load factors, are presented for each design method. The advantages and disadvantages of each approach are described and it is concluded that the alternate path method affords the designer more flexibility. Although the design strategies are applicable to any type of structure at any time in its life cycle, this report provides detailed recommendations for completed buildings.

701,727
PB-272 069/6 PC **A06**/MF **A01**
California Inst. of Tech., Pasadena. Guggenheim Jet Propulsion Center.
Experimental Investigation of the Heat Transfer from a Buoyant Gas Plume to a Horizontal Ceiling - Part 1. Unobstructed Ceiling.
Quarterly progress rept. Mar-Jun 75,
C. C. Veldman, T. Kubota, and E. E. Zukoski. 1975, 117p NBS-GCR-77-97
Grant NBS-5-9004

Keywords: *Fires, *Plumes, *Heat transfer, *Buildings, Ceilings(Architecture), Model tests, Fire tests, Temperature measurement, Rates(Per time), Buoyancy, *Room fires.

This report presents an experimental investigation of the axisymmetric heat transfer from a small scale fire and resulting buoyant plume to a horizontal, unobstructed ceiling during the initial stages of development. A propane-air burner yielding a heat source strength between 1.0 kW and 1.6 kW was used to simulate the fire, and temperature measurements were carried out in the plume, ceiling jet, and on the ceiling. Heat transfer data were obtained by using the transient method and applying corrections for the radial conduction along the ceiling and losses through the insulation material. A comparison with data from experiments which involved larger heat sources indicates that the predicted scaling of temperatures and heat transfer rates for larger scale fires is adequate.

701,728
PB-272 189/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Full Scale Testing: Low Rise.
Final rept.,
R. D. Marshall. 1976, 4p
Pub. in Proceedings of Workshop on Wind Load Requirements for Buildings, Northwestern Univ., Evanston, Illinois, June 3-4, 1976, p159-162 1976.

Keywords: *Buildings, *Wind pressure, Residential buildings, Dynamic loads, Gust loads, Low rise buildings.

This paper gives a brief description of the work being done by the Center for Building Technology in the area of wind forces on single family dwellings and the ANSI 58 code.

701,729
PB-272 356/7 PC **A08**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Observations on the Behavior of Buildings in the Romania Earthquake of March 4, 1977.
Final rept.,
G. Fattal, E. Simiu, and C. Culver. Sep 77, 172p NBS-SP-490
Sponsored in part by Agency for International Development, Washington, D.C. Office of Foreign Disaster Assistance. Library of Congress catalog card no. 77-600035.

Keywords: *Buildings, *Earthquakes, *Damage assessment, Reinforced concrete, Precast concrete, Earthquake resistant structures, Building codes, Structural engineering, Rumania, *Earthquake engineering, *Seismic design.

Observations are presented of the damage to buildings resulting from the earthquake of March 4, 1977 in Romania. The report was prepared by engineers from the National Bureau of Standards who participated as members of the U.S. government team dispatched to Romania under the auspices of the Office of Foreign Disaster Assistance, Agency for International Development. A summary of the team's activities is included. Background data on the seismic history of Romania, the characteristics of the earthquake and descriptions of damage to specific buildings are also included. The types of building construction and the history of the development of seismic design requirements for buildings in Romania are discussed. Recommendations are presented for needed building research based on the observations.

701,730
PB-272 855/8 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Building Technology Project Summaries, 1976.
Special pub. (Final),
M. Olmert. Jul 77, 85p NBS-SP-446-1
See also report dated Apr 76, PB-255 877.

Keywords: *Construction industry, *Buildings, *Technology assessment, Construction management, Building codes, Research projects, Management planning, Construction materials, Structural analysis, Energy conservation.

Contents: Energy conservation; Energy conservation in communities; Solar energy; Economics; Thermal studies; Mechanical systems; Plumbing; Sensory environment; Materials; Structural; Disaster mitigation; Architectural research; Safety; Mobile homes; Codes and standards; Housing and building technology.

701,731
PB-273 166/9 PC **A04**/MF **A01**
Stahl (Fred I.), Woodside, N.Y.
Simulating Human Behavior in High-Rise Building Fires: Modeling Occupant Movement through a Fire-Floor from Initial Alert to Safe Egress,
F. I. Stahl. Aug 77, 55p NBS/GCR-77-92

Keywords: *Buildings, *Fires, *Human behavior, Fire safety, Decision making, Reaction time, Judgment, Mathematical models, *High rise buildings.

The objective of the current study is to present an alternative means through which to model the building fire system, predict human responses in building fires, and test safety policies and building design alternatives. Focusing on the case of the high-rise office building, the investigation develops a methodology, and explores its implications for building design, planning and policy evaluation, and theory.

701,732
PB-273 575/1 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Investigation of the Suitability of Light Duty Pipe Hangers for Use in Residential and Care Type Sprinkler Systems.
Final rept.,
W. D. Hayes, and R. L. P. Custer. Oct 77, 46p NBSIR-77-1282
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Energy, Building Technology, and Standards Div.

Keywords: *Residential buildings, *Pipes(Tubes), *Hangers, Mountings, Sprinkler systems, Loads(Forces), Fire safety.

Several sizes of various types of commonly available light duty hangers for pipe, cable and conduit were subjected to load failure tests and while under load to exposure to 70 to 140 pound (31.8 and 63.5 kg, respectively) crib fires. In addition, hangers made from thin strap metal were tested for effect on performance of undersized screws and for benefit obtained from the use of washers. All sizes of the two-hole or two-fastener hangers met the NFPA No. 13 Standard for the Installation of Sprinklers load requirement, while only the nominal 1-1/4 inch size of the one-hole hangers met the requirement. Washers improve the performance of hangers made of thin strap metal.

701,733
PB-273 576/9 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Analytical and Experimental Study of Evaporative Cooling and Room Fire Suppression by Corridor Sprinkler System.
Final rept.,
S. T. Liu. Oct 77, 59p NBSIR-77-1287
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Assistant Secretary for Policy Development and Research.

Keywords: *Sprinkler systems, *Fire safety, Evaporative cooling, Buildings, Mathematical models, Gas flow, Sprays, Tests, Fire suppression, Corridors, Water sprays.

Investigations, both theoretical and experimental, are conducted to evaluate the effects of a corridor sprinkler system on the cooling and suppression of a fire in an adjacent compartment connected by an open doorway. A simplified one dimensional mathematical model is presented to predict the net reduction of the corridor ceiling hot gas temperature by evaporative cooling. Scaling criteria based on the analysis of the motion of an evaporating droplet were developed for the correlation of full-scale and small-scale experimental results and the design requirements of a small-scale experiment. Representative test results from a full-scale and a one-quarter scale model experiments are presented. These tests demonstrate the effectiveness of water spray in reducing the corridor hot gas temperature to a level low enough for safe passage, and in causing a strong recirculating flow at the room doorway. This flow reduces the oxygen content around the fire significantly, and results in a much reduced burning rate of the fuel. The effect of the spray droplet size on the cooling and on fire suppression is discussed.

701,734
PB-273 589/2 PC **A09**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Annual Conference on Fire Research,
Final rept.,
C. Huggett. Oct 77, 200p NBSIR-77-1308

Keywords: *Fires, *Meetings, Fire protection, Fire resistant materials, Fire safety, Fire prevention, Fire detection systems, Human behavior, Flame propagation, Combustion, *Fire services, *Fire research.

This report contains extended abstracts of grants and contracts for fire research sponsored by the Center for Fire Research, National Bureau of Standards and descriptions of the internal programs of the Center for Fire Research. It was prepared as a preprint for use at a conference of contractors and grantees held at NBS on August 3-5, 1977.

701,735
PB-273 942/3 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Impact of a Room Fire on a Corridor with Considerations of Fuel Load, Ventilation and Scaling.
Final rept.,
J. Quintiere, B. McCaffrey, T. Kashiwagi, K. DenBraven, M. Harkleroad, J. Raines, and W. Rinkinen. Nov 77, 62p NBSIR-77-1318

Keywords: *Walls, *Fires, Heat transfer, Transport properties, Burning rate, Scale(Ratio), *Room fires, *Fire spread.

A study was conducted of heat transfer and temperature field imparted to a corridor by a room fire in order to assess the potential of fire spread along the corridor. Wood cribs were used as the fuel load which ranged from 20 to 120 kg. Also the effects of ventilation and fuel load location were examined. The results showed these effects to be significant. A corresponding scale model study was conducted using gas burners as a fuel supply. A scaling criteria was developed which emphasized the solid wall conductive and gas phase convective transport processes. As a result limitations were encountered at high temperature when radiation became more significant. In general the convective processes appeared to scale well and radiation limitations could be assessed through analysis.

701,736
PB-273 944/9 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Architectural Research Section.

Assessment of the Technical Literature on Emergency Egress from Buildings.
Final rept.,
F. I. Stahl, and J. Archea. Oct 77, 67p NBSIR-77-1313
Sponsored in part by Occupational Safety and Health Administration, Washington, D.C. and Department of Health, Education and Welfare, Washington, D.C.

Keywords: *Buildings, *Emergency procedures, Fire safety, Building codes, Fire protection, Human behavior, Group dynamics, Regulations, Assessments, Visibility, *Emergency exits, *Exits, Emergency egresses, Research needs.

An assessment was made of the literature on research related to current emergency egress regulations promulgated by the Occupational Safety and Health Administration (OSHA). The purposes of this assessment were to ascertain the extent to which these regulations were based upon empirical research, and to determine the adequacy of available research findings from which OSHA emergency egress regulations may be developed. Three areas of research on emergency egress were identified: research on (1) the carrying capacity of exitways, (2) signage, lighting, and visibility through smoke, and (3) occupant responses to, and experiences in building fires. Only research on the carrying capacity of exitways appears to have had direct impact on current OSHA regulations, which are based largely on empirical findings reported in 1935. Much of the available data on egress signage, lighting, visibility through smoke, and occupants' responses in real fire situations have appeared since the adoption of standards by OSHA. Consequently, these areas have had minimal impact on OSHA egress regulations. This study provides specific recommendations concerning the technical adequacy and range of applicability of the available empirical literature on emergency egress from buildings. In addition, it provides specific recommendations concerning directions and methodological requirements for future research.

701,737
PB-274 404/3 PC **A08**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of Housing and Building Technology.
Performance Criteria Resource Document for Innovative Construction,
T. K. Faison. Nov 77, 166p NBSIR-77-1316
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Assistant Secretary for Policy Development and Research.

Keywords: *Construction industry, *Technology innovation, Construction materials, Performance evaluation, Heating, Ventilation, Air conditioning, Building codes, Construction management, *Innovative construction.

Performance criteria for innovative construction are presented in this resource report in order to assist in the broad technical acceptance of new building products and materials. The levels of performance stated are intended to be equivalent to the Minimum Property Standards (MPS) which reflects acceptable performance of conventional building materials and designs for programs sponsored by the Department of Housing and Urban Development. The report is structured so that new performance criteria can be added in the future as additional technical data and evaluation methods become available.

701,738
PB-274 647/7 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Wind Tunnel Studies of RP-US Bayanihan Permanent School Building.
Final rept.,
R. D. Marshall. Dec 77, 29p NBSIR-77-1196
Sponsored in part by Agency for International Development, Washington, D.C. Office of Science and Technology. See also report dated Aug 77, PB-273 190-T.

Keywords: *School buildings, *Wind pressure, Wind tunnel models, Typhoons, Turbulent boundary layer, Surface roughness, Roofs, Walls, Philippines, Bayanihan school building.

Wind pressures measured on a 1:80 scale model of the RP-US Bayanihan Permanent School Building are compared with wind pressures used in the original design calculations. The wind tunnel studies were conducted in a tunnel fitted with spires and roughness elements to generate a thick, turbulent boundary layer. This boundary layer is believed to be a reasonable simulation of the lowest portion of the atmospheric surface layer developed over rolling countryside with scattered trees or over suburban areas. While the wind tunnel test results are in fair agreement with the overall design wind pressures, edges of the roof along the end walls can be subjected to pressures which substantially exceed the design values. It is recommended that the load capacity of certain roof elements be reexamined and that ridge ventilators be used in future construction to reduce the uplift loads on the roof structure.

701,739
PB-274 969/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Growth of Fire in Building Compartments.
Final rept.,
J. Quintiere. 1977, 37p
Pub. in American Society for Testing and Materials, Special Technical Publication 614, p131-167 1977.

Keywords: *Houses, *Fires, *Flashover, Heat transfer, Walls, Thermal resistance, Mathematical models, *Room fires, *Fire spread, Flammable materials, Reprints.

A review was made of both full-scale and scale model experiments concerned with fire growth and spread in building compartments. It appears that 'flashover', i.e. the rapid transition to a fully-developed room fire, could be initiated by a fully involved chair fire alone, or by a large waste container ignition source against a combustible lining material. Scale model results continue to provide valuable insight, but the validity of partial scaling results must be considered for each type of experiment. A quasi-steady idealized mathematical model was developed to analyze the various parameters of fire development in a room. These theoretical results show the significance of fuel properties, fire size and location, room and doorway dimensions, and wall thermal properties. The limitations of a mathematical approach are also discussed.

701,740
PB-274 971/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Buoyancy Driven Countercurrent Flows Generated by a Fire Source.
Final rept.,
B. J. McCaffrey, and J. G. Quintiere. 1977, 15p
Pub. in Proceedings of Seminar on Turbulent Buoyant Convection, Dubrovnik, Yugoslavia, Aug 76, Paper in Heat Transfer and Turbulent Buoyant Convection, v2 p457-472 1977.

Keywords: *Buildings, *Fires, *Convection, Flow fields, Heat transfer, Flow rate, Velocity measurement, *Fire spread, *Corridors, Reprints.

The velocity and temperature fields were determined for fire induced flows in corridors. The effects of scale, fire size, and doorway openings are presented. Detailed measurements illustrate the complex recirculating three dimensional character of the flow field. Mass flow rates are determined for the doorway openings and to determine the extent of entrainment. A critical Richardson number criterion was used to identify the mixed and stably stratified regions of the flow field.

701,741
PB-274 991/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reliability-Based Performance Criteria for Structures.
Final rept.,
B. Ellingwood, and J. Harris. 1977, 3p
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Assistant Secretary for Policy Development and Research.
Pub. in Proceedings of Annual Engineering Mechanics Division Specialty Conference (2nd), Raleigh, N.C. 23-25 May 77 p124-127 1977.

Keywords: *Structural design, *Design criteria, Loads(Forces), Safety engineering, Performance standards, Reliability.

The performance concept systematizes the development of design criteria by first identifying specific performance attributes and then posing a series of criteria that would indicate an acceptable level of performance. In this study, performance criteria to assure adequate structural safety are presented. Reliability analysis techniques are used to develop load and resistance factors which assure that required levels of safety are attained. The load side of the design equation is developed so as to be applicable for a wide range of materials. This approach affords the designer an increased degree of flexibility, as similar levels of performance should be achieved regardless of which material is selected.

701,742
PB-275 155/0 PC **A03**/MF **A01**
California Univ., Berkeley. Architecture Life Safety Group.
People in Fires: A Manual for Mapping,
L. Lerup. 1977, 48p NBS-GCR-77-106
Contract NBS-5-9016
Sponsored in part by Department of Health, Education, and Welfare, Washington, D.C.

Keywords: *Fires, *Human behavior, *Mapping, Diagrams, Fire safety, Performance, Psychological effects, Decision making, Instructional materials, *Fire spread, *Building fires.

Manual provides step by step instructions for the investigation, data gathering and organization, and graphic mapping procedures involved in graphically presenting the behavior patterns of fire development and persons exposed to fire in a building. The manual is intended to be used in conjunction with NBS-GCR-76-73, 'Mapping of Recurrent Behavior Patterns in Institutional Buildings under Fire: Ten Case Studies of Nursing Facilities', also prepared by Lars Lerup. The use of the mapping approach to fire reporting can provide better identification of an insight into both the development of fire and the reactions of persons to it.

701,743
PB-276 004/9 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Directions to Improve Application of Systems Approach to Fire Protection Requirements for Buildings.
Interim rept. Sep 75-Dec 76,
H. E. Nelson. Jul 77, 42p NBSIR-77-1273

Keywords: *Buildings, *Fire protection, Fire safety, Trees(Mathematics), Human behavior, Systems analysis, Statistical decision theory, *Fault tree analysis, *Fire spread.

This paper covers an examination of the recent and ongoing work in the development of systems' approaches for design of fire protection in buildings, as carried out in the United States. The scope of coverage includes: (1) a brief review of the development of fire safety systems' approaches in the United States, to the degree felt important to understanding the current situation; (2) an overview of the more extensive and pertinent fire growth systems' analysis approaches; (3) a discussion of systems for the analysis of building fire safety design directed at establishing building requirements; (4) a review of the directions and activities now underway to integrate the fire growth models and the total building performance models into a combined approach. This paper proposes a model of fire and its impact based on a 'states-transition' concept. The fire is viewed as two separate sequences (Fire Behavior and Human Behavior). Each sequence consisting of connected realms of consistent behavior. The concept views these sequences as interrelating, with a distinct rate consistent for each realm. The concept of 'states-conditions' is also evaluated. A matrix relating the factors, conditions, and development phase of fire is presented. Finally, a plan for the derivation of a viable fire protection engineering technology is presented.

701,744
PB-276 865/3 PC **A05**/MF **A01**
Worcester Polytechnic Inst., Mass. Dept. of Civil Engineering.
Development of Engineering Models and Design Aids to Predict Flame Movement and Fire Severity Within a Room.
Final rept.,
R. W. Fitzgerald. Dec 77, 100p NBS-GCR-78-119
Grant NBS-5-9019
Sponsored in part by Public Health Service, Washington, D.C.

Keywords: *Buildings, *Fire safety, *Design criteria, Barriers, Walls, Fire resistance, Structural design, Computerized simulation, *Fire spread.

This report presents a logical framework and engineering models for the determination of the probabilities of flame movement and fire severity within a room. The fire researcher is the intended audience for this report. The report describes the engineering application of the Goals Oriented Systems Approach. It identifies the data requirements needed to quantify engineering predictions of flame movement within a room. A model is presented that will translate results into a useable engineering form. A format for the display of results for use in engineering practice is suggested in Appendices B and C. A systems logic for barrier analysis and a philosophy for engineering design was necessary prerequisite to the fire severity levels. The logic presented in the report forms the basis of the conclusion that if the predictability of field performance of barriers is the objective of barrier analysis, refinement of the fire severity component alone will do little to accomplish the objective. A procedure for barrier analysis somewhat similar in concept to the structural design of floors is proposed. In this context, a method for establishing the energy impact (fire severity) component is suggested in Appendix D. An overview of the states-transition method of the Goals Oriented System Approach is presented in Appendix A. It is suggested that Appendix A be studied by those unfamiliar with this method before reading the body of the report.

701,745
PB-277 676/3 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of Building Standards and Codes Services.
Metric Dimensional Coordination - The Issues and Precedent.
Final rept.,
S. A. Berry, and H. J. Milton. Feb 78, 79p NBS-SP-504
Proceedings of Joint Conference Held in Washington, D.C. on June 6, 1977. Library of Congress Catalog Card no. 78-606001.

Keywords: *Construction industry, *Metric system, Construction management, Dimensional measurement, Standardization, Modular structures, *Metrication.

These edited proceedings are a summary of a Joint Conference of the Design Sector and Construction Products Sector of the Construction Industries Coordinating Committee of the American National Metric Council, which was held in Washington, D.C., on June 6, 1977. They may be used as a general reference document dealing with the background of and precedent in metric dimensional coordination. As the United States prepares to join the metric building world, both the issues and relevant precedent in dimensional coordination become significant as a basis for an effective and economical change. To this end, the papers presented at the Joint Conference address the following topics: (1) Dimensional Coordination - An Industrial Management Tool, which reviews the issues and application of dimensional coordination; (2) Building Standards Development in Sweden and in the Metric Building World, which outlines issues in national and international standardization in the context of building design, production and construction dimensions; and, (3) Metrication - The Opportunity for an Industry-wide System of Dimensional Coordination - Precedents and Issues, which reviews precedent in metrication and the simultaneous change to preferred building dimensions and preferred sizes in component production. The questions and answers emanating from the Joint Conference reflect the concerns of the United States' design and production communities at the outset of metrication and dimensional coordination.

701,746
PB-278 634/1 PC **A13**/MF **A01**
IIT Research Inst., Chicago, IL. Engineering Mechanics Div.
Fire Development in a Room - A Bibliography,
T. Waterman. Aug 76, 293p NBS/GCR-77-108
Grant NBS-5-9018
Sponsored in part by Department of Health, Education and Welfare, Washington, D.C. Report on Joint HEW-NBS Fire/Life Safety Program. See also report dated Jan 75, PB-240 693.

Keywords: *Fire safety, *Bibliographies, Fires, Fire tests, Fire hazards, Smoke, Gases, Flammability, Flashover, Flame propagation, *Room fires.

The bibliography presented in this report represents references collected by IIT Research Institute in preparation of a methodology to evaluate preflashover fire development in a room. Data on the generation of smoke and fire gases, material properties and performance in standard tests are included.

701,747
PB-278 643/2 PC **A05**/MF **A01**
IIT Research Inst., Chicago, IL. Engineering Mechanics Div.
Semistochastic Approach to Predicting the Development of a Fire in a Room from Ignition to Flashover. Program Documentation and Users Guide,
T. Waterman. Jun 76, 86p NBS/GCR-77-111
Grant NBS-5-9018
Report on HEW-NBS Fire/Life Safety Program. Sponsored in part by Department of Health, Education and Welfare, Washington, D.C. See also PB-278 64.

Keywords: *Houses, *Furniture, *Fires, Ignition, Flashover, Burning rate, Flame propagation, Computer programs, User needs, *Room fires, RFIRES computer program.

A computer program and a methodology which embodies the computer program is presented. The methodology is for evaluating the development of a room fire from ignition to flashover. The purpose of the methodology is to express fire characteristics probabilistically. The code is exercised for a series of possible room arrangements and furniture item burning actions, each case with an estimated probability of occurrence. The computercode computes the heat exchanges and performs the heat and mass balances for an enclosure (room) exposed to internal fire in a series of finite time steps.

701,748
PB-278 644/0 PC **A02**/MF **A01**
IIT Research Inst., Chicago, IL. Engineering Mechanics Div.
Semistochastic Approach to Predicting the Development of a Fire in a Room from Ignition to Flashover. Program Documentation and Users Guide (Addendum),
R. Pape, and T. Waterman. Aug 76, 22p NBS/GCR-77-112
Grant NBS-5-9018
Sponsored in part by Department of Health, Education and Welfare, Washington, D.C. Report on HEW-NBS Fire/Life Safety Program. See also PB-278 643.

Keywords: *Houses, *Furniture, *Fires, Ignition, Flashover, Burning rate, Flame propagation, Fire tests, User needs, *Room fires.

The basic report (Semistochastics Approach to Predicting the Development of a Fire in a Room From Ignition to Flashover, August 1976, IITRI-J6367) describes the computer program used in this study. This addendum provides a demonstration of the total methodology using the NBS 'Nike Fire Test Facility' test data as a test case.

701,749
PB-278 648/1 PC **A05**/MF **A01**
IIT Research Inst., Chicago, IL. Engineering Mechanics Div.
Study of the Development of Room Fires.
Final rept.,
T. E. Waterman, and R. Pape. Sep 76, 93p NBS/GCR-77-110
Grant NBS-5-9018
Sponsored in part by Department of Health, Education and Welfare, Washington, D.C. Report on HEW-NBS Fire/Life Safety Program.

Keywords: *Houses, *Furnitures, *Fires, Ignition, Flashover, Burning rate, Flame propagation, Computer programs, *Room fires, RFIRES computer program.

This report summaries the research performed under the NBS Grant No. 5-9018. Separate reports were released on the literature surveyed and categorized, the computer code and methodology developed, and a case study conducted. The report addresses the state-of-the-art of fire buildup to flashover in a room assuming an ignition has occurred. The authors suggest that the model for the development of a fire in a room from ignition to flashover should be considered a research tool and not a design tool. Several recommendations for model improvement are included.

701,750
PB-279 403/0 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
International Research--The FY 1977 Survey of CBT's International Programs,
M. Olmert. Mar 78, 85p NBSIR-77-1411

Keywords: *Buildings, *Construction management, *Research management, Technology transfer, International relations, Building codes, Standards, Energy conservation, Developing countries, Center for Building Technology.

This report presents the international research activities of the Center for Building Technology during the transition quarter and Fiscal Year 1977. In general, the objectives of this work were to spread the results of building research worldwide in hopes of creating a better built environment. Last year CBT continued working closely with less-developed countries to improve their building practices. The Center also continued cooperative research efforts with a number of countries that have acknowledged expertise in particular areas of building research, such as England, Israel, and France, to name but a few. On such projects, the Center pursued common research goals alongside the building researchers from other nations on studies of critical importance to all nations, such as energy and natural resources conservation.

701,751
PB-280 398/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characteristics of Fire Loads in Office Buildings.
Final rept.
C. G. Culver. Feb 78, 10p
Sponsored in part by General Services Administration, Washington, D.C.
Pub. in Fire Technology, v14 n1 p51-60 Feb 78.

Keywords: *Office buildings, *Fires, Fire resistance, Design, Fire safety.

A study was made to determine the effects of various parameters on the fire load characteristics of office buildings. This and future studies are expected to form the basis for improving fire resistant design requirements.

701,752
PB-280 585/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Scaling Study of a Corridor Subject to a Room Fire.
Final rept.,
J. Quintiere, B. McCaffrey, and T. Kashiwagi. Apr 78, 13p
Pub. in American Society of Mechanical Engineers, Pub77-HT-72 p1-13 Apr 78.

Keywords: *Buildings, *Passageways, *Fires, Thermal radiation, Heat transfer, Scale(Ratio), Convection, *Room fires, *Corridors.

A study was made of the thermal and flow environment within a corridor subject to a room fire of intensities of 300 to 1500 kW approximately. A corresponding model study was done under 1/7th geometry scale. Dimensionless groups were examined to maintain partial dynamic scaling between the model and prototype experiments. The scaling results demonstrate that radiant heat transfer does not scale, but an analysis of the data explains the lack of agreement in terms of dimensionless groups that were not preserved in scaling. A secondary result yielded corridor convective heat transfer coefficients which could be correlated by a general relationship.

701,753
PB-280 597/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Metrication - A Concrete Opportunity.
Final rept.,
H. J. Milton. Nov 77, 9p
Pub. in Jnl. of the American Concrete Inst., n11 pN13-N21, Nov 77.

Keywords: *Construction industry, *Metric system, Construction, Units of measurement, Technology assessment, Attitudes, *Metrication, Reprints.

This paper presents the impending change to metric (SI) measurement in the construction community as an 'opportunity' and a once-only chance for review, technical improvement and cost reduction. It deals with the analysis of precedent in the change to SI; defines some new terms, such as 'hard conversion' to preferred sizes and descriptions; discusses metrication for benefit; and focuses on the opportunities for ration-

alization associated with the change. Four principal opportunitites are identified: simplification, rationalization, harmonization and standardization, and each one is illustrated by a number of examples. The paper recommends that metrication should be regarded as a 'worthwhile challenge,' rather than as a 'problem,' so that the approach to change is a vigorous and positive one instead of a defensive and negative one. The benefits from opportunities realized should easily pay for the once only cost of the change.

701,754
PB-280 600/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Visualization of Room Fire Induced Smoke Movement and Flow in a Corridor.
Final rept.,
J. G. Quintiere, B. J. McCaffrey, and W. Rinkinen. 1978, 7p
Pub. in Fire Mater. 2, n1 p18-24 1978.

Keywords: *Buildings, *Passageways, *Fires, Smoke, Flow fields, Flow rate, Flow visualization, *Room fires, *Corridors.

A study was conducted of the smoke and flow field in a corridor subject to a room fire. The study was primarily conducted using a scale model of roughly 0.35 m in height. The effect of corridor exit doorway width was recorded while the room doorway and fire room temperature were maintained constant. Smoke was generated from cotton wads soaked with titanium tetrachloride which produces white particles of titanium dioxide. By this means, the smoke layer resulting from the room fire and the corridor flow characteristics were visualized. The results show the lowering interface of the corridor smoke layer with decreasing corridor exit door width. Also a four layer horizontal countercurrent flow pattern is displayed and shown to result from a restriction (e.g. soffit) at the corridor exit. The mixing of the incoming cold flow and exiting hot flow at the corridor exit is shown as shedding vortices swept into the cold floor jet. Based on velocity measurements and smoke observations, results are presented for the corridor smoke layer height and doorway neutral plane heights. The limitations of current predictive models are demonstrated for layer heights and flow rates for the room and corridor experiments.

701,755
PB-280 746/9 PC **A05**/MF **A01**
California Inst. of Tech., Pasadena.
Experimental Investigation of the Heat Transfer from a Buoyant Gas Plume to a Horizontal Ceiling - Part 2. Effects of Ceiling Layer.
Quarterly progress rept. Jun 75-Sep 75,
E. E. Zukoski, and T. Kubota. 1975, 77p NBS-GCR-77-98
Grant NBS-5-9004
See also PB-272 069.

Keywords: *Buildings, *Fires, *Plumes, *Heat transfer, Ceilings(Architecture), Fire tests, Gas flow, Temperature distribution, *Room fires.

This report contains the results of experiments carried out as part of a study of heat transfer to room ceilings under conditions similar to those encountered in the early stages of a room fire before the room becomes completely involved in flames. Part 1 of this study was concerned with heat transfer to a bare ceiling and scaling procedures were developed there which gave complete modeling rules for this example. The work reported here differs from this previous effort because side walls are used in the present experiments and they trap a thick layer of hot gas under the ceiling. This hot gas layer (the ceiling layer) will affect the temperature and momentum flux in the fire plume and hence the initial conditions for the ceiling jet formed by the impingement of the plume on the ceiling. It will also affect the temperature level in the ceiling jet since hot gas rather than cool air will be entrained. This report presents data obtained with two configurations of side walls, on axisymmetric Curtain Wall and a Model Room with a single (door) opening. Temperature and heat transfer data are presented and certain elements of a scaling model are discussed. A complete scaling model is still being developed and will be the subject of a later report.

701,756
PB-280 815/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Robust Bidirectional Low-Velocity Probe for Flame and Fire Application.
Final rept.,
B. J. McCaffrey, and G. Heskestad. 1976, 3p
Pub. in Combustion and Flame Brief Communications, v26 p125-127 1976.

Keywords: *Rooms, *Fires, *Flow measurement, Hot wire anemometers, Fluidic devices, Reynolds number.

A robust bidirectional flow measuring device has been evaluated and appears to have significant advantages over a pitot-static tube for use in fire research studies. Three different diameter probes were used to secure a low Reynolds number calibration needed for accurate assessment at very low velocities. The bidirectional capability is illustrated by an example of the use of the probe in a scale model corridor - burn room facility.

701,757
PB-281 918/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurements of Fire Loads and Calculations of Fire Severity.
Final rept.
D. Gross. 1977, 14p
Pub. in Proceedings of Symposium on Society of Wood Science and Technology, Trends in Fire Protection, Session II - Technology and Research, Madison, Wis., Apr 19-21, 1977, Wood Fiber 9, n1 p72-85 1977.

Keywords: *Buildings, *Fire tests, Fire safety, Office buildings, Residential buildings, Predictions, Computer applications, *Fire loads.

This talk provides (a) an update on the measurement of fire loads, particularly in office and residential occupancies, (b) a brief survey of the use of computer solutions to translate fire load data into predictions of compartment fire growth, and (c) a discussion of the meaning of fire severity.

701,758
PB-281 927/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of a Room Fire Test.
Final rept.,
I. A. Benjamin. 1977, 12p
Pub. in American Society for Testing and Materials, Special Technical Publication 614, p300-311 1977.

Keywords: *Buildings, *Fire tests, Ignition, Scale(Ratio), Tests, *Room fires, *Compartment fires.

This paper has attempted to indicate the reason for the need for full scale room and compartment tests at this time; indicated the two possible uses of the compartment test: for approval or for validating small scale tests; and finally has discussed a few of the factors which affect the design of the tests, using the choice of ignition source as an example of the problems involved in the test design. Reference is made to the Recommended Practice developed by the Task Group of ASTM Committee E-39.10.01.

701,759
PB-283 830/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Control of Smoke Movement in Buildings: A Literature Survey.
Final rept.,
B. F. Fung, L. Roth, and I. A. Benjamin. 1976, 53p
Pub. in Proceedings Joint Panel Meeting (2nd) The U.J.N.R. Panel on Fire Research and Safety, Tokyo, Japan, Oct. 19-22, 1976, pt1. General Report, p265-317 (Building Research Inst., Ministry of Construction, Tokyo, Japan, 1976).

Keywords: *Buildings, *Fires, *Smoke, Reviews, Computerized simulation, Experimental data, *Smoke movement, *Smoke control, State of the art.

A state-of-the-art review of efforts in smoke movement and smoke control is presented. Basic principles, experimental techniques and results, computer models, and smoke control methods which were used are presented. The paper covers all work in the area of smoke movement and smoke control, but emphasizes the work of NBS.

701,760
PB-283 831/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Directions to Improve Application of Systems Approach to Fire Protection Requirements for Buildings.
Final rept.,
H. E. Nelson. 1976, 33p
Pub. in Proc. Joint Panel Meeting (2nd) The U.J.N.R. Panel on Fire Research and Safety, Tokyo, Japan, Oct. 19-22, 1976, Pt. 1. General Report p119-151 (Building Research Inst., Ministry of Construction, Tokyo, Japan, 1976).

Keywords: *Buildings, *Fire protection, Fire safety, Human behavior, Models, *Fire behavior.

This paper covers an examination of the recent and ongoing work in the development of systems approaches for design of fire protection in buildings, as carried out in the United States. The scope of coverage includes: (1) a brief review of the development of fire safety systems approaches in the United States, to the degree felt important to understanding the current situation; (2) an overview of the more extensive and pertinent fire growth systems analysis approachs; (3) a discussion of systems for the analysis of building fire safety design directed at establishing building requirements; and, (4) a review of the directions and activities now underway to integrate the fire growth models and the total building performance models into a combined approach.

701,761
PB-284 042/9 PC **A06**/MF **A01**
Factory Mutual Research Corp., Norwood, MA.
Environments of Fire Detectors. Phase II: Effect of Ceiling Configuration. Volume II. Analysis.
Final rept.,
G. Heskestad, and M. A. Delichatsios. Jun 78, 114p
FMRC-22584-VOL-2, RC78-T-1, NBS-GCR-78-129
Grant NBS-6-9001
See also Volume 1, Phase 1, PB-272 882. Prepared in cooperation with Fire Detection Inst., Wilmington, Del.

Keywords: *Fire detection systems, *Ceilings(Architecture), *Fire tests, Wood, Fire safety, Beams(Supports), Gas flow, Optical detection, *Smoke detectors, *Fire detectors, *Room fires.

This volume contains an analysis of experimental data presented in Volume I on (1) the ceiling environment generated by flaming fires under extensive beamed ceilings and (2) the response to this environment by various types of fire detectors. Data on gas temperatures, gas velocities and optical densities have been presented in readily usable form for each of six beam configurations. These data have been converted to reduced forms which allow predictions to be made of the environmental variables for any combination of ceiling height and fire growth rate. The experimental response of fire detectors was generally found to conform with available response theories. With the aid of these theories and the data on the reduced variables, optimum spacing configurations of fire detectors have been determined as a function of ceiling height for each beam configuration. It is cautioned that the resulting spacing configurations pertain to large, unobstructed beamed ceilings and may be overly conservative in many practical situations.

701,762
PB-284 140/1 PC **A23**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Center for Building Technology.
Tentative Provisions for the Development of Seismic Regulations for Buildings.
Final rept.
Jun 78, 549p NBS-SP-510, NSF-78-8
Grant NSF-AG-464
Also pub. as Applied Technology Council, Palo Alto, Calif. rept. no. ATC 3-06. Prepared in cooperation with Applied Technology Council, Palo Alto, Calif. Sponsored in part by National Science Foundation, Washington, D.C. Library of Congress Catalog Card no. 78-606046.

Keywords: *Earthquake resistant structures, *Buildings, *Structural design, Building codes, Foundations, Construction materials, Quality assurance, Construction management, Design criteria, *Earthquake engineering, *Seismic design, *Soil structure interactions, Seismic risk.

This document contains tentative seismic design provisions for use in the development of seismic code regulations for design and construction of buildings. The provisions represent the result of a concerted effort by

a multidisciplinary team of nationally recognized experts in earthquake engineering. Design professionals, researchers, Federal agency representatives, staffs from the model code organizations and representatives from state and local governments from throughout the United States were involved. The provisions are comprehensive in nature and deal with earthquake resistant design of the structural system, architectural and non-structural elements and mechanical-electrical systems in buildings. Both new and existing buildings are included. They embody several new concepts which are significant departures from existing seismic design provisions. An extensive commentary documenting the basis for the provisions is included.

701,763
PB-284 462/9 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Fire Research Publications, 1977.
Final rept.,
N. H. Jason. Jul 78, 14p NBSIR-78-1504
See also report dated 1976, PB-269 965.

Keywords: *Fire safety, *Research projects, *Bibliographies, Meetings, Fire hazards, Fire prevention, Flammability, Technical reports, Fire detection systems, *Fire research, Building fires.

Contents:
Journal articles and conference proceedings;
National Bureau of Standards publications;
Contract and grant reports;
Author index.

701,764
PB-284 502/2 PC **A03**/MF **A01**
California Univ., Berkeley. Dept. of Civil Engineering.
Fire Response of Reinforced Concrete Slabs,
Z. Nizamuddin, and B. Bresler. Mar 77, 45p UCB/FRG/WP-77-1, NBS/GCR-78/114
Grants NSF-ERT70-01080, NBS-G7-9006

Keywords: *Buildings, *Concrete slabs, *Fires, Reinforced concrete, Structural analysis, Thermal analysis, Mathematical models, Finite element analysis, Computer programming, *Building fires, FIRES-SL computer program.

A mathematical procedure is described for predicting displacement and stress histories of reinforced concrete slabs in fire environments using a computer program, FIRES-SL (FIre REsponse of Structures - SLabs). The temperature distribution histories used in FIRES-SL are obtained either from experimental results or from a one-, two-, or three-dimensional thermal analysis based on selected fire models. In a fire environment, thermal gradients and dilatation are sources of internal stress from local restraints within the slab and global restraint from the overall structural system. Structural response is determined in terms of displacements, internal forces, stresses and strains in concrete and steel reinforcement, and current states of concrete (cracking and crushing) and steel reinforcement (yielding). FIRES-SL uses a nonlinear finite element approach coupled with time step integration. Within time steps, an iterative approach is used to find a deformed shape which results in equilibrium between forces associated with external loads and internal stresses. The solution method is general and can be used for any specified slab shape, specified boundary conditions, and placement of reinforcement. Numerical solutions are compared to available experimental results. Comparisons between solutions from computer program FIRES-SL and experimental results show that predicted response is accurate to within 5 to 15% of observed behavior.

701,765
PB-284 849/7 PC **A02**/MF **A01**
Loyola Univ. of Chicago, Ill. Fire and Human Behavior Research Center.
Exploration of Non-Sampling Error in Fire Incident Surveys.
Final rept.,
M. A. McDaniel, L. Bickman, P. Edelman, and E. Herz. Dec 77, 23p NBS-GCR-78-135
Grant NBS-6-9015
Sponsored in part by Department of Health, Education, and Welfare, Washington, D.C.

Keywords: *Fires, *Human behavior, Sampling, Fire departments, Reporting, Questionnaires.

Non-sampling error in fire incident surveys is a potential problem for fire and human behavior research. The report was prepared in an effort to examine fire victims' reporting biases concerning fire incidents. The telephone numbers of household fire victims in a midwestern city, during the months of September 1975 through August 1976, were obtained from the fire department. Also a sample of telephone numbers in the same area was randomly generated. All eligible and cooperative respondents were asked a series of questions concerning whether they experienced a fire during the target interval and, if they had a fire, they were questioned about it. Approximately one-half of the respondents who, according to fire department records, had had a fire failed to report it to the interviewer. Results indicated that respondents who had more serious fires, reported the incident to the interviewer significantly more often than respondents who had less serious fires. Also fires which occurred later in the 12 month reference period (i.e., closer to the time of the interview) were more often reported to the interviewer than those which occurred earlier in the reference period. Several analyses indicated that, in most cases, the fire reporters' responses agreed with fire department records concerning the characteristics of the fire incident; however, total agreement was seldom found. In addition, it was found that fire reporters tend to be similar to fire-nonreporters in terms of demographic characteristics and most survey responses although some statistically significant differences were obtained.

701,766
PB-284 959/4 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Environmental Design Research Div.
Human Response to Fire: Three Designs for Research.
Interim rept. Nov 77-Jan 78,
F. I. Stahl. 20 Mar 78, 34p NBSIR-78-1508

Keywords: *Fires, *Office buildings, *Human behavior, Factorials, Interpersonal relations, Fire safety, Experimental design, Research, Design, Specialized training, *Office building fires, Emergency behavior.

As a group, empirical investigators of the responses of building occupants to emergencies employ idiosyncratic, non-replicable techniques for research design, data acquisition, and data analysis. As a result, it has been difficult to explain the influence of many, often uncontrolled, variables. This shortcoming has frequently rendered research findings indeterminate and non-cumulative. This paper explores three exemplary research design strategies, each aimed at mitigating these problems by introducing a greater degree of rigor into the study of human responses to fires. Both exploratory and experimental designs are considered in various problem contexts.

701,767
PB-284 991/7 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Building Technology Publications 1977--Supplement 2,
J. R. Debelius. Aug 78, 124p NBS-SP-457-Suppl-2
Supplement to report dated 1977, PB-269 780.

Keywords: *Construction, *Technology, *Bibliographies, Documents, Abstracts, Subject index terms, Indexes(Documentation), Authors, Subject indexing, Information systems, Handbooks, Technical reports, Patents, Libraries, Buildings, Construction materials, *Building technology, Center for Building Technology.

This report presents the National Bureau of Standards' (NBS) Center for Building Technology (CBT) publications for 1977. It is the second supplement to Special Publication 457, Building Technology Publications 1965-1975 and covers the period from January 1, 1977 to December 31, 1977. It includes an abstract of each NBS publication, titles and abstracts of papers published in non-NBS media, key word and author indexes, and general information and instructions on how to order CBT publications. This report provides the primary means of communicating the results of CBT programs to its varied technical audiences, as well as to the general public.

701,768
PB-285 458/6 PC **A04**/MF **A01**
Loyola Univ. of Chicago, Ill. Fire and Human Behavior Research Center.
Survey of Fire Preparedness in a Midwestern City.
Final rept.,
M. A. McDaniel, L. Bickman, P. Edelman, and E. Herz. Dec 77, 53p NBS-GCR-78-136
Grant NBS-6-9015
Sponsored in part by Department of Health, Education, and Welfare, Washington, D.C. Report on the HEW/NBS Life/Fire Safety Program.

Keywords: *Fire safety, *Human behavior, Fire prevention, Sampling, Factor analysis, Fire protection, Questionnaires, Attitude surveys, *Building fires.

There is a lack of information regarding citizens' attitudes and knowledge in the area of fire safety. To help fill this gap, a survey was undertaken to explore the nature, extent and dimensions of fire preparedness in a mid-western city. The survey explored respondents' attitudes toward fire safety, their knowledge of appropriate behavior in fire emergencies, their fire preparation practices and hardware as well as other items relating to fire preparedness. The survey was administered to persons from a randomly selected sample of households as well as to a sample of persons known to have been victims of fires. It was concluded that there were no apparent response differences between the fire victims and the random sample of household respondents on the variables measured. While respondents report favorable attitudes toward training and prevention, a significant number show a lack of knowledge of appropriate behavior in fire emergencies as measured by responses to scenarios. The appropriateness of a respondent's answer to any one scenario was unrelated to the appropriateness of the response for either of the other scenarios. This seems to indicate that fire safety knowledge for respondents in this sample may be situationally bound.

701,769
PB-286 907/1 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Center for Building Technology.
Aseismic Design of Building Service Systems: The State-of-the-Art.
Final rept. Aug 75-Dec 76.
C. W. C. Yancey, and A. A. Camacho. Sep 78, 86p NBS-TN-970

Keywords: *Hospitals, *Earthquake resistant structures, Electric utilities, Water supply, Fire protection, Sanitation, Environmental engineering, Building codes, Health care facilities, *Earthquake engineering, *Seismic design, *Seismic risk, State of the art.

A search for information was conducted to define the state-of-the-art of aseismic design of building service systems and to identify areas of needed research. The study focused primarily on service systems essential to the continuous operation of hospital facilities in post-earthquake periods. A review of the literature pertaining to seismic performance of nonstructural systems is presented. An evaluation of code and standard regulations applicable to the aseismic design of service system components is also presented. Information obtained from direct contact with several federal agencies, the State of California, and practicing architects and engineers is summarized. The findings from a field visit of two hospitals currently under construction in earthquake-prone areas are reported. Deficiencies in current design/evaluation practice are identified and recommendations for research are presented.

701,770
PB-286 993/1 PC **A22**/MF **A01**
National Bureau of Standards, Washington, DC. Center for Building Technology.
Wind and Seismic Effects.
Final rept.
H. S. Lew. Sep 78, 522p NBS-SP-523
See also PB-267 316. Library of Congress Catalog Card no. 78-600082. Proceddings of the Joint Panel Conference of the U.S.-Japan Cooperative Program in Natural Resources (9th), Held at Tokyo, Japan in May 24-27, 1977.

Keywords: *Bridges, *Buildings, *Earthquakes, *Wind pressure, *Meetings, Earth movements, Seismic waves, Typhoons, Tornadoes, Design criteria, Dynamic structural analysis, *Earthquake engineering, *Seismic design, *Ground motion.

The Ninth Joint Meeting of the U.S.-Japan Panel on Wind and Seismic Effects was held in Tokyo, Japan on May 24-27, 1977. The proceedings of the Joint Meeting include the program, the formal resolutions, and

the technical papers. The subjects covered in the paper include (1) characteristics of strong winds; (2) wind loads on structures and design criteria; (3) earthquake prediction; (4) earthquake ground motions and soil failures; (5) seismic loads on structures and design criteria; (6) design of special structures; (7) earthquake hazard reduction program; and (8) quantitative evaluation of damages caused by winds and earthquakes. (Portions of this document are not fully legible)

701,771
PB-287 412/1 PC **A03**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Human Behavior in Fire - A Bibliography.
Final rept.
J. L. Bryan. Aug 78, 26p NBS-GCR-78-138
Grant NBS-7-9014

Keywords: *Fires, *Human behavior, *Bibliographies, Disasters, Fire safety, Evacuating(Transportation), Elderly persons, Emergency procedures, Stress(Psychology), Fire protection, High rise apartment buildings.

This bibliography was originally prepared for the Third Joint Panel Meeting, United States - Japan Natural Resources Panel on Fire Research at the Center for Fire Research, National Bureau of Standards, March 13-17, 1978. The bibliography was revised as the result of additional literature reviews during August, 1978. The previously developed bibliographies of Dr. Leonard Bickman, Fire and Human Behavior Research Center, Applied Social Psychology Program, Loyola University; Fred I. Stahl and John Archea of the Center for Building Technology, National Engineering Laboratory, National Bureau of Standards; J. L. Pauls of the Division of Building Research, National Research Council of Canada; and Dr. Tadahisa Jin, Fire Research Institute, Fire Defense Agency, Ministry of Home Affairs, Japan were valuable sources of citations.

701,772
PB-287 510/2 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Some Theoretical Aspects of Fire Induced Flows through Doorways in a Room-Corridor Scale Model.
Final rept.
J. G. Quintiere, and K. DenBraven. Oct 78, 37p NBSIR-78-1512

Keywords: *Rooms, *Passageways, *Fires, Air flow, Flow rate, Flow measurement, Doors, Orifice flow, Fire tests, *Corridors, *Room fires, Fire spread.

Fire induced flows were measured in a 1/7th scale model room-corridor by measuring velocity and temperature profiles in the room and corridor exit doorways. The corridor exit door width was varied by a factor of 10 as an experimental parameter while the average fire room temperature was held constant. The applicability of an orifice flow model to predict the doorway flows was examined. The ratio of measured to theoretical mass flow rate, defined as the flow coefficient, was found to vary with door width and flow direction. The coefficient ranged from 0.4 to slightly greater than 1. No explanation has been developed to account for this variation.

701,773
PB-287 570-T PC **A11**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Fire Resistance of Buildings, Second Edition, Revised and Supplemented.
V. P. Bushev, V. A. Pchelintsev, V. S. Fedorenko, and A. I. Yakovlev. c1978, 245p TT-73-52030
Trans. of mono. Ognestoikost' Zdanii, Moscow, 1970. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Buildings, *Fire resistance, Fire resistant materials, Construction materials, Fire safety, Walls, Reinforced concrete, Steel construction, Fire tests, USSR, Translations.

The book presents the methods for testing and calculating the fire resistance of most common structural elements of buildings, experimental data on the fire resistance of walls of panel-type buildings and recommendations for determining the specified fire resistance limits of structures on the basis of generalization of investigations carried out in these directions. The book is intended for engineering and technical staff in design organizations and fire services, students in the higher educational institutions of fire services, and research scholars studying labor safety measures.

701,774
PB-287 870/0 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Center for Fire Research.
Smoke Measurements in Large and Small Scale Fire Testing.
Final rept.
R. W. Bukowski. Oct 78, 40p NBSIR-78-1502

Keywords: *Fire tests, *Smoke, Measuring instruments, Ionization chambers, Photometers, Detectors, Light scattering, Rayleigh waves, Fire safety, *Smoke detectors, Smoke measurement.

The extinction beam photometer is the most widely used instrument for taking smoke measurements in fire testing. Most existing designs were found to be inaccurate and unreliable for measurements where smoke detection performance is evaluated due to the low levels of smoke present at activation. Accordingly, a new extinction beam photometer design was developed which will provide the stability and accuracy necessary for these measurements. The paper describes the new design and proposes its adoption as an industry standard. The paper also discusses the need for a reference ionization chamber instrument and a reference measurement which relates to gas sensing fire detectors.

701,775
PB-287 935/1 PC **A04**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at St. Joseph's Hospital, Philadelphia, PA. on August 10, 1977.
Final rept.
J. L. Bryan, and P. J. DiNenno. 31 May 78, 65p NBS-GCR-78/140
Contract NBS-7-9014
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Hospitals, *Fires, *Human behavior, Health care facilities, Patients, Nurses, Fire departments, Smoke, Fire safety, Death, Pennsylvania, Saint Joseph's Hospital, *Room fires, Philadelphia(Pennsylvania).

The fire incident at St. Joseph's Hospital on August 10, 1977 was detected by the nursing staff at approximately 8:45 p.m., at which time the fire had obtained a post flashover development in the area of origin, a bathroom on the second floor. The 130 year old, four-story building of ordinary construction had 171 patients. The fire extended from the second floor to the ceiling of the third floor through a pipe chase and the wall stud spaces. The fire department was notified automatically with the activation of the local fire alarm system within the facility at 8:48 p.m. through an auxiliary system arrangement with the public fire alarm system. The seven nursing staff assigned to the area of fire origin evacuated a total of thirty-four patients in a period of 6 to 7 minutes, with twenty-one of these patients being evacuated in less than three minutes. At the time of fire department arrival on the fire floor, all the patients had been evacuated from the fire area with the exception of two male patients. The fire department personnel using breathing apparatus removed both patients. One patient could not be revived, while the other died approximately one week later. Total evacuation of the hospital was accomplished by the staff, fire and police department personnel, with assistance from some citizens. The 171 patients were evacuated in a time period from 16 to 19 minutes.

701,776
PB-289 272/7 PC **A07**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Environmental Design Research Div.
Computer Simulation of Human Behavior in Building Fires: Interim Report.
Rept. for Feb 77-Feb 78.
F. I. Stahl. 13 Mar 78, 134p NBSIR-78-1514
Sponsored in part by Public Health Service, Washington, DC.

Keywords: *Buildings, *Fires, *Human behavior, Performance, Fire safety, Computerized simulation, Reaction time, Decision making, Fortran, Computer programs, *Building fires, BFIRES computer program, Fortran 5 programming language, UNIVAC 1108 computers.

The report presents the conceptual development, structure, and function of BFIRES, a computer program designed to simulate human movement behavior during building fires. The basic model underlying BFIRES is derived from a non-stationary, discrete time Markov Process. This model postulates that occupants construct their emergency responses and behavioral decisions dynamically, in response to continually changing social and environmental information fields. The simulation of this process is accomplished through BFIRES, a computer program written in Fortran V. Directions for further study are discussed.

701,777
PB-289 780/9 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC Center for Fire Research.
Calibration of a Burn Room for Fire Tests on Furnishings.
Final rept.
K. M. Tu, and V. Babrauskas. Dec 78, 62p NBS-TN-981

Keywords: *Furniture, *Flammability, *Fire tests, Ventilation, Heat loss, Heat balance, Heat transfer, Plumes, Fire safety, *Burn rooms, *Room fires.

A series of ten tests, using a diffusion flame gas burner as heat source, was conducted in a full-size room designed for furnishings flammability tests. The gas burner was used to release known heat rates and to permit steady state measurements of energy and mass flow. The gas burner fires simulated preflashover conditions, with peak temperatures outside the burner plume of around 300C. The measurements obtained were compared with available theoretical room fire descriptions and published heat transfer values. The results showed the importance of a precise determination of the inflow and exhaust velocities at the doorway. It was demonstrated that a large number of doorway velocity probes is required to accurately obtain a room heat and mass balance. A calculational procedure was developed for analyzing the results which should be useful for future analysis of furnishing experiments.

701,778
PB-289 781/7 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Center for Building Technology.
Selection of Preferred Metric Values for Design and Construction.
Final rept.
H. J. Milton. Dec 78, 86p NBS-TN-990
Sponsored in part by Naval Facilities Engineering Command, Alexandria, VA.

Keywords: *Construction industry, *Buildings, *Metric system, Series(Mathematics), Numbering systems, Rational numbers, Conversion, Decision making, Design, Construction, *Metrication, SI units.

This Technical Note contains a comprehensive examination of considerations involved in the selection of preferred metric values during the change to SI in the U.S. construction community. It has been prepared to assist those engaged in the conversion and rationalization of technical data for use in design and production to make informed judgments during the selection of metric values. The adoption of preferred metric values and the concomitant rationalization of the technical data base will be one of the main benefits of the change to metric (SI) units. The principal aim is to encourage the choice of simple, convenient, or preferred metric values and ranges of rational values, rather than exact or marginally rounded soft conversions of existing values which will generally require a second change to more workable numbers at a later stage. The Technical Note has three parts: (1) background information on number systems and properties of numbers, metric impact, and alternative conversion strategies; (2) alternative preferred number concepts for individual values, sets of related values, and series of preferred values; and, (3) a methodology for the determination and selection of preferred metric values in technical information by means of a manual or an automated approach.

701,779
PB-291 099/0 PC **A05**/MF **A01**

Notre Dame Univ., IN. Dept. of Aerospace and Mechanical Engineering.
One Dimensional Radiation Model for Surfaces and Non-Homogeneous Gases and Soot.
V. K. Liu, and J. R. Lloyd. 6 Mar 78, 100p TR-79002-78-1, NBS-GCR-78-151
Contract NBS-7-9002

Keywords: *Fires, *Thermal radiation, Computerized simulation, Finite difference theory, Fire safety, Heat flux, Mathematical models, *Fire spread, *Room fires, UNDSAFE computer program.

This report presents a detailed description of the one dimensional radiation model which is currently employed in the UNDSAFE code. The model includes surface, soot and gas radiation with adiabatic boundaries for the enclosure. Interactions between gas and soot radiation are accounted for as well as the effect of overlapping bands in the gaseous radiation. The soot radiation model does not consider scattering and the gas radiation model includes the 2.7 and 6.3 micrometer bands for H2O and the 2.7 and 4.3 micrometer bands for CO2. The overlap of the 2.7 micrometer bands is accounted for. Samples of the results of calculations for three limiting cases including no radiation in the calculation, surface and heavy soot radiation only in the calculation, and surface and gaseous radiation only in the calculation are presented to demonstrate the model.

701,780
PB-291 426/5 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC.
Characteristics of Incidental Fires in the Living Room of a Mobile Home.
Interim rept.
D. P. Klein. Sep 78, 69p NBSIR-78-1522
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Housing studies, *Trailers, *Furniture, *Fires, Fire safety, Burning rate, Heat flux, Smoke, Fire tests, *Room fires.

A series of fire tests was conducted in the corner of a mobile home living room. The corner was lined with interior finish materials which did not contribute to the fires. The test series was designed to examine the fire characteristics of typical incidental (low intensity) fires which may be used as the ignition source for tests to evaluate the effects of interior finish materials. This test series involved three types of source fires: standardized wood cribs ranging in weight from 2.3 kg to 13.6 kg (5 lb to 30 lb), identically constructed upholstered chairs and polyethylene waste containers filled with crumpled newsprint. Experimental measurements were made of burn rate, temperature, heat flux, flame height, smoke density, and concentrations of oxygen, carbon monoxide, and carbon dioxide. Under the test conditions employed, it was found that the fire severities for the several sizes of standardized wood cribs fell between those for the polyethylene waste containers filled with crumpled newsprint and the more severe incidental fires produced by the 16 kg (35 lb) upholstered chairs in terms of characteristics such as maximum temperature and heat flux levels, flame height, and changes in oxygen, carbon monoxide and carbon dioxide concentrations. Of the fires with wood cribs, it was found that the fires with 13.6 kg (30 lb) standardized wood cribs were most similar to the fires with 16 kg (35 lb) upholstered chairs, although the peak burning rate was generally higher for fires with upholstered chairs than for fires with wood cribs. It was also found that the time to reach the period of active burning was more reproducible for fires with wood cribs than fires with upholstered chairs.

701,781
PB-291 444/8 PC **A06**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Mobile Home Bedroom Fire Studies: The Role of Interior Finish.
Interim rept.
E. K. Budnick, D. P. Klein, and R. J. O'Laughlin. Sep 78, 109p NBSIR-78-1531
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Households, *Trailers, *Fires, Construction materials, Flame propagation, Furniture, Burning rate, Heat flux, Fire tests, *Room fires, *Mobile homes.

A series of nine full-scale fire tests was conducted in the master bedroom of a typically constructed single-wide mobile home to (1) evaluate the effect of a variety of combinations of wall and ceiling materials on fire growth and spread and the production of smoke and toxic gases when exposed to an incidental fire, and (2) determine the relationship between the surface flame spread properties of the interior finish material as determined by the ASTM E-84 Tunnel Test and behavior of the materials under actual full-scale conditions. The primary fire scenario selected was the exposure of the interior finish materials to an incidental fire from a burning upholstered chair in a corner in the master bedroom. Performance of the various combinations of wall and ceiling materials was evaluated on the basis of (1) whether and at what time flashover was reached, and (2) changes in the environment outside the bedroom which adversely affect life safety. Measurements included gas temperatures, irradiance, concentrations of carbon monoxide and carbon dioxide, oxygen depletion, and smoke densities. Supplemental testing indicated that while the fire properties of the interior finish materials played a dominant role in spreading an incidental fire from a chair, the impact of the interior finish materials was less evident when the exposure fire was from the burning of a polyurethane mattress, which provided an exposure fire of greater intensity. When a bed was used instead of the chair as the initial burning item, flashover occurred in the room from involvement of the mattress and bedding materials, with no apparent contribution from the low flame spread interior finish.

701,782
PB-291 516/3 PC **A08**/MF **A01**
Notre Dame Univ., IN. Dept. of Aerospace and Mechanical Engineering.
UNDSAFE-II - A Computer Code for Buoyant Turbulent Flow in an Enclosure with Thermal Radiation.
Technical rept.
V. K. Liu, and K. T. Yang. 15 Jul 78, 172p TR-79002-78-3, NBS-GCR-78-150
Grant NBS-G7-9002
See also report dated Mar 77, PB-267 278. Portions of this document are not fully legible.

Keywords: *Fires, *Buildings, *Computer programs, Temperature distribution, Pressure distribution, Turbulent flow, Gas flow, Two dimensional flow, Rectangular bodies, Ceilings, Floors, Mathematical models, Fortran, UNDSAFE-2 computer programs, Fire spread, Two-dimensional calculations, Boundary conditions.

In this report the numerical computer code known as UNDSAFE-II for describing the flow, temperature, and pressure fields in a two-dimensional rectangular enclosure due to a volumetric heat source is presented. It retains the basic rectangular configuration of the enclosure with a doorway, and still accommodates a variety of heat source conditions such as location, extent and strength and various thermal boundary conditions along the ceiling and the floor of the enclosure. In addition, the UNDSAFE-II code also incorporates a free boundary region outside the doorway, a more refined algebraic turbulence model, an error-control routine for satisfying mass continuity, an improved numerical tridiagonal matrix sweeping scheme, and one-dimensional radiation models for surface radiation, soot radiation, and non-gray gaseous radiation. This report gives the complete documentation of this code including input data format and options, available output options, and detailed flow charts. A complete numerical example with thermal radiation is presented.

701,783
PB-291 844/9 PC **A08**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Mobile Home Living Room Fire Studies: The Role of Interior Finish.
Interim rept.
E. K. Budnick. Sep 78, 163p NBSIR-78-1530
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Houses, *Trailers, *Fire tests, Fires, Flame propagation, Walls, Ceilings(Architecture), Construction materials, Smoke, Fire safety, *Mobile homes, *Room fires.

A series of sixteen full-scale fire tests was conducted in the living room of a typically constructed single-wide mobile home. These tests were designed (1) to evaluate the effect of a variety of combinations of wall and ceiling materials on fire growth and spread and the production of smoke and toxic gases when exposed to an incidental fire, and (2) to determine the relationship between the surface flame spread properties of the interior finish materials as determined by the ASTM E-84 Tunnel Test and the behavior of the materials as installed under actual full-scale conditions. The test procedure was based on a fire scenario in which the interior wall finish was exposed to an incidental fire from a standardized 6.4 kg (14 lb) wood crib or a 16 kg (35 lb) upholstered chair positioned in a corner in the living room. Performance of the various combinations of wall and ceiling materials was evaluated based on (1) the rate of fire buildup and extent of living room involvement, and (2) changes in the environment in the corridor and bedroom areas which may adversely affect the life safety of the occupants. Measurements utilized in the evaluation of changes in the environment due to fire growth and spread included gas temperatures, irradiance, concentrations of carbon monoxide, carbon dioxide and oxygen, and smoke densities. Under this set of conditions it was found that the fire properties of the interior finish materials directly affected the rate of fire growth and spread, the severity of the fire, and the resulting effects on life safety.

701,784
PB-291 889/4 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Sprinkler-Vent and Spray Nozzle Systems for Fire Protection of Openings in Fire Resistive Walls and Ceilings - The State-of-the-Art and a Plan for Future Research Work.
Final rept.
J. G. O'Neill. Dec 78, 29p NBSIR-78-1571
Sponsored in part by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Buildings, *Fire protection, Fire safety, Sprinkler systems, Spray nozzles, Building codes, Stairways, Ventilation, *Fire spread, State of the art.

A review of literature was conducted to determine the state-of-the-art of automatic sprinkler, sprinkler-vent and spray nozzle methods of protecting openings in fire resistive assemblies. A review of nationally used model building codes and standards indicated that they have varying provisions for these types of systems. Generally, the use of these systems is only applied to escalator openings in fully sprinklered buildings. Previous experimental work, however, demonstrated that these systems can also be effective in preventing passage of heat and smoke through other types of openings in structural assemblies. An outline of a planned research project and a description of the test facility are given. The project will develop design parameters for sprinkler-vent and spray nozzle methods for protecting stairways and other openings through floor ceiling assemblies. Results from this project may suggest improvements to current codes and standards involving these systems and possibly permit their wider use in unsprinklered buildings.

701,785
PB-291 930/6 PC **A10**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Annual Conference on Fire Research.
Final rept.
C. Huggett. Dec 78, 217p NBSIR-78-1526

Keywords: *Fire safety, *Meetings, Combustion, Fire protection, Combustion products, Toxicity, Fire fighting, Human behavior, Models, Flammability, *Fire research.

This report contains extended abstracts of grants and contracts for fire research sponsored by the Center for Fire Research, National Bureau of Standards and descriptions of the internal programs of the Center for Fire Research.

701,786
PB-292 273/0 PC **A07**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
System for Fire Safety Evaluation of Health Care Facilities.
Final rept.
H. E. Nelson, and A. J. Shibe. Nov 78, 147p NBSIR-78-1555
Sponsored in part by Department of Health, Education and Welfare, Washington, DC.

General

Keywords: *Buildings, *Fire safety, Fire prevention, Fire protection, Evaluation, Hospitals, Building codes, *Health care facilities, Nursing homes, Risk analysis.

A quantitative evaluation system for grading health care facilities in terms of fire safety is described. The system can be used to determine how combinations of widely accepted fire safety equipment and building construction features may provide a level of safety equivalent to that required by the widely accepted Life Safety Code of the National Fire Protection Association. The system will provide flexibility to both the designer of new facilities and to the renovator of existing health care facilities. Three major concepts form the basis for code equivalency: (a) Occupancy Risk - the number of people affected by a given fire, the level of fire they are likely to encounter, and their ability to protect themselves; (b) Building Safety Features - the ability of the building and its fire protection systems to provide measures of safety commensurate with the risk; (c) Safety Redundancy - in-depth protection, through the simultaneous use of alternative safety methodologies such as containment, extinguishment, and people movement methodologies. The design of the complete fire safety system is intended to ensure that the failure of a single protection device or method will not result in a major failure of the entire system. In this system, equivalency is judged to exist when the total impact of the occupancy risk factors and the compensating building safety features produce a level of safety equal to or greater than that achieved by rigid conformance to the explicit requirements of the NFPA Life Safety Code. In this evaluation, safety performance is gauged both in terms of overall safety impact and depth of redundance.

701,787
PB-292 521/2 PC **A02**/MF **A01**
Shelton (J. W.), Williamstown, MA.
Analysis of Fire Reports on File in the Massachusetts State Fire Marshal's Office Relating to Wood and Coal Heating Equipment.
J. W. Shelton. Nov 78, 12p NBS-GCR-78-149
Contract NB79NAAA1576
Sponsored in part by Department of Energy, Washington, DC. Div. of Fossil Fuel Utilization.

Keywords: *Residential buildings, *Fires, Heating equipment, Stoves, Wood, Coal, Fire safety, Statistical data, Massachusetts, Accident investigations, *Home fires.

An analysis of solid-fuel related fires reported by local fire departments to the Massachusetts State Fire Marshal's Office from late 1977 through June, 1978 indicates that of the fires attributed to specific causes, roughly 3/4 were attributed to unsafe installations, and about 1/4 were attributed to unsafe operation/maintenance. In less than 2 percent of the fires was the cause attributed to defects or poor design in the heating appliance itself. Thus, to the extent that the local fire department reports are complete and reliable, it appears that attention to installation, operation and maintenance is what has the most potential for reducing fires.

701,788
PB-293 082/4 PC **A07**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Building Research at the National Bureau of Standards 1968-1974.
Building science series.
N. Gallagher. Mar 79, 132p NBS-BSS-75
See also COM-71-00046. Library of Congress Catalog Card no. 79-600008.

Keywords: *Buildings, Research management, Construction management, Technology innovation, Housing studies, Technology transfer, Construction materials, Building codes, Standards, Energy conservation.

This report details the progress of building research at the Center for Building Technology from the year 1968 to 1974. Starting with the backlog of needed research in building techniques, components, and materials that faced researchers in the 60's, this history covers the evolution of the performance concept for building specifications, cooperation with states and codes-generating organizations, and specific technical accomplishments. The report continues with discussions of programs involving the building community, research on the needs of the building users, and technology transfer. A special chapter is devoted to energy conservation in buildings and how CBT's test methods and other programs - including solar - were pressed into this vital national struggle.

701,789
PB-293 527/8 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Mobile Home Fire Studies: Summary and Recommendations.
E. K. Budnick, and D. P. Klein. Mar 79, 96p NBSIR-79-1720
Sponsored by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Houses, *Trailers, *Fires, Fire tests, Fire safety, Construction materials, Finishes, Hazards, *Mobile homes, *Room fires.

This report provides a summary of the important findings from previously reported parts of the project which involved the conduct of full-scale fire tests in the kitchen, corridor, living room and bedroom areas of typical mobile homes. Also included in this summary are the findings from a previously unreported series of full-scale living room tests, which are discussed in some detail in Appendix A. This report describes the rationale upon which the overall experimental approach was based, and provides a series of recommendations, some in the form of design options, for possible changes to the standard. A limited impact assessment is included to provide a relative measure of the potential impact of each of three design options for flame spread requirements for interior wall and ceiling materials. This assessment is based on the likely effect of each option on fire severity, and does not include an economic analysis.

701,790
PB-294 684/6 PC **A12**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Theoretical Rationalization of a Goal-Oriented Systems Approach to Building Fire Safety.
J. Watts. 28 Feb 79, 266p NBS-GCR-79-163
Grant NBS-7-9007
Sponsored in part by Department of Health, Education and Welfare, Washington, DC.

Keywords: *Buildings, *Fire safety, Systems analysis, Probability theory, Fire protection, National government, Probability distribution functions, Management systems, Government agencies, Management by objectives.

The Goal Oriented Systems Approach to Building Fire Safety developed by the U.S. General Services Administration is presently the only probabilistic methodology for fire protection evaluation in use in the United States. This paper describes and analyzes the GSA approach and formulates a more scientific procedure by synthesizing GSA concepts with additional probability theory. Discussion of systems analysis and modeling concepts emphasizes the need for probabilistic considerations of fire safety. The revised model, identified by the hyphenated expression: Goal-Oriented, simplifies data requirements through parameter estimation techniques. The new approach is consistent with the GSA model for several example cases. A demonstrated advantage of the new methodology is the facility for sensitivity analysis of alternative fire protection strategies.

701,791
PB-295 063/2 PC **A09**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Environmental Design Research Div.
'BFIRES/Version 1' Computer Simulation of Emergency Egress Behavior During Fires: Calibration and Analysis.
Final rept.
F. I. Stahl. Mar 79, 179p NBSIR-79-1713
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Buildings, *Fires, *Human behavior, Fire safety, Group dynamics, Computerized simulation, Computer programs, BFIRES computer program, Building fires.

This report documents computer simulation experiments designed to calibrate and analyze BFIRES, a computer program which simulates building occupants' egress behavior during fires. This report demonstrates that emergency egress behavior under certain specified conditions can be systematically conceptualized, and simulated through the use of a digital computer. Important findings concerning the calibration and sensitivity of BFIRES are also discussed. In particular, it is shown that: (a) a variety of general egress situations may be simulated through the application of BFIRES; (b) every such event is unique, and is defined by the set of user-supplied input parameter values which describe the building, the threat, and the occupants; (c) BFIRES may be used in simulated environments of known (or desired) spatial dimension, and events of known (or desired) temporal duration; and (d) BFIRES simulation outcomes are sensitive to variations in a number of parameters of immediate interest to the building design and regulatory communities.

701,792
PB-295 176/2 PC **A06**/MF **A01**
Reliability Analysis Center, Griffis AFB, NY.
Reliability Modeling of Smoke Detectors.
Final rept.
H. C. Rickers. Mar 79, 110p NBS-GCR-79-160
Prepared in cooperation with IIT Research Inst., Chicago, IL. See also PB-295 177.

Keywords: *Residential buildings, *Fire alarm systems, Smoke, Fire protection, Safety devices, Reliability(Electronics), Failure, Mathematical models, *Smoke detectors, Residential fires, Fault tree analysis.

This report presented the results of a study to evaluate current reliability prediction methods for electronic devices and determine which of these methods can be best applied to residential smoke detectors. In addition, data collection efforts were initiated to establish a basis for more realistic reliability prediction models for the components employed in residential smoke detectors. This failure rate data was collected from smoke detector manufacturers, component manufacturers, and manufacturers of other electronic equipment employing similar devices used at similiar stress levels in residential type environments. The study found that Fault Tree Analysis (FTA) and Failure Mode Effects and Criticality Analysis (FMECA) techniques together with failure rate models for individual components, modified to better agree with the actual data, provides the best approach. A handbook was then prepared which includes the modified component models and data in the form of parts stress analysis prediction techniques, a description of how to conduct the FTA and FMECA procedures, and a discussion of component screening and test techniques. This handbook is available in two parts as NBS-GCR-79-161 and NBS-GCR-79-162.

701,793
PB-295 177/0 PC **A06**/MF **A01**
Reliability Analysis Center, Griffis AFB, NY.
Residential Smoke Detector Reliability Handbook. Section 2: System Reliability Evaluation Techniques. Section 3: Component Screening Test Techniques.
Final rept.
H. C. Rickers. Mar 79, 103p NBS-GCR-79-162
Prepared in cooperation with IIT Research Center, Chicago, IL. See also PB-295 176, and PB-295 178.

Keywords: *Residential buildings, *Fire alarm systems, *Handbooks, Smoke, Fire protection, Safety devices, Reliability(Electronics), Failure, Electric devices, Systems engineering, *Smoke detectors, *Residential fires, Failure rate.

This Residential Smoke Detector Reliability Handbook is designed to provide a means for the accurate prediction of smoke detector failure rates in a residential environment. The methodology developed by which a smoke detector critical failure rate can be determined is divided into three major sections. Section 1.0 contains the parts stress reliability prediction techniques for each major generic component type currently being used in residential smoke detectors, or exhibiting the potential for being in future designs. Section 2.0 through the application of FMECA and/or FTA techniques, presents the guidelines for the determination of those components, and their associated failure modes, which are considered critical to the audible warning capabilities of the detector. The process of applying the predicted failure rates of Section 1.0 to the FMECA/FTA guidelines of Section 2.0 will result in a critical failure rate for residential smoke detectors; i.e. the rate at which failures that will not trigger the audible alarm circuitry may occur, thus negating the protective characteristics of the unit. Finally, Section 3.0 discusses methods of screening for the predominant failure modes of those electronic components characterized as most critical to smoke detector oper-

ation, to efficiently detect and eliminate infant mortality failures.

701,794
PB-295 178/8 PC **A11**/MF **A01**
Reliability Analysis Center, Griffis AFB, NY.
Residential Smoke Detector Reliability Handbook. Section 1: Parts Stress Analysis.
Final rept.
H. C. Rickers. Feb 79, 226p NBS-GCR-79-161
Prepared in cooperation with IIT Research Inst., Chicago, IL. See also PB-295 177.

Keywords: *Residential fires, *Fire alarm systems, *Handbooks, Smoke, Fire protection, Safety devices, Reliability(Electronics), Failure, Electric devices, Stress analysis, *Smoke detectors, *Residential fires, Failure rate.

This Residential Smoke Detector Reliability Handbook is designed to provide a means for the accurate prediction of smoke detector failure rates in a residential environment. The methodology developed by which a smoke detector critical failure rate can be determined is divided into three major sections. Section 1.0 contains the parts stress reliability prediction techniques for each major generic component type currently being used in residential smoke detectors, or exhibiting the potential for being in future designs. Section 2.0 through the application of FMECA and/or FTA techniques, presents the guidelines for the determination of those components, and their associated failure modes, which are considered critical to the audible warning capabilities of the detector. The process of applying the predicted failure rates of Section 1.0 to the FMECA/FTA guidelines of Section 2.0 will result in a critical failure rate for residential smoke detectors; i.e. the rate at which failures that will not trigger the audible alarm circuitry may occur, thus negating the protective characteristics of the unit. Finally, Section 3.0 discusses methods of screening for the predominant failure modes of those electronic components characterized as most critical to smoke detector operation, to efficiently detect and eliminate infant mortality failures.

701,795
PB-295 395/8 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Fire Research Publications, 1978.
Final rept.
N. H. Jason. Apr 79, 16p NBSIR-79-1745
See also report dated Jul 78, PB-284 462.

Keywords: *Fire safety, *Research projects, *Bibliographies, Meetings, Fire hazards, Fire prevention, Flammability, Technical reports, Fire detection systems, *Fire research, Building fires.

Contents: Journal articles and conference proceedings; National Bureau of Standards publications; Dimensions/NBS; National Bureau of Standards interagency reports; National Bureau of Standards technical notes; Contract and grant reports; and Author index.

701,796
PB-295 504/5 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Fire Safety for High-Rise Buildings: The Role of Communications.
Building science series.
R. A. Glass, and A. I. Rubin. Apr 79, 50p NBS-BSS-115
Sponsored in part by Public Health Service, Washington, DC. Library of Congress catalog card no. 78-606165.

Keywords: *Skyscrapers, *Fire safety, Building codes, Voice communication, Human behavior, Building codes, *High rise buildings.

This literature survey reviews the communications requirements for fire safety in buildings from the standpoint of the building occupant and the control operator. It traces the development of the problem of communications in buildings and the specialized needs that exist today. An examination is made of the purposes of a communications system in buildings as well as some of the psychological design requirements necessary for such a system. The communications requirements of the building occupants are also covered, with emphasis on the type of information communicated by signals and the integration of those signals into an overall system design. Personnel requirements for staffing a control center are also discussed, along with common problems in several operational communications systems. Detailed examples of communications systems are provided. Portions of several model codes which cover communications systems are presented. Suggested areas for future research on fire safety in buildings are identified.

701,797
PB-296 113/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Technical Developments of Domestic Fire Detectors.
Final rept.
R. G. Bright. Aug 78, 8p
Pub. in Proceedings of the International Fire, Security and Safety Exhibition and Conference Held at London, England on April 24-28, 1978. Fire Survey of Mag. 74, p9-16, Aug 78.

Keywords: *Residential buildings, *Fire detection systems, Fire safety, Product development, Technology assessment, Forecasting, *Smoke detectors, Residential fires.

A review of some of the more significant technical developments in residential smoke detectors, in the past four years, is presented. In addition, some of the problems experienced, as well as forecasts of possible future technical developments, are also given.

701,798
PB-296 148/0 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
French Schools: A Report of the U.S. Team Visit to France from November 13 to 23, 1977.
P. Driscoll. Mar 79, 43p NBSIR-78-1521
Sponsored in part by Office of Education, Washington, DC.

Keywords: *School buildings, *France, Design, Architecture, Management planning, Management methods, Decision making, Education, Foreign countries, Building technology, Information exchange, Curricula.

The purpose of the trip was to observe and study French educational facility design, construction and utilization. The schools visited were of recent vintage and typified the several systems of construction. Each school possessed individual design differences that are significant and arise largely from unique combinations--site, building orientation, designer and builder.

701,799
PB-296 732/1 PC **A06**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Safety on Stairs.
Building science series.
D. H. Carson, J. C. Archea, S. T. Margulis, and F. E. Carson. Nov 78, 125p NBS-BSS-108
Prepared in cooperation with Georgia Inst. of Tech., Atlanta. Coll. of Architecture, and Carson Consultants, Inc., Milwaukee, WI. Sponsored in part by Consumer Product Safety Commission, Bethesda, MD. Library of Congress catalog card no. 78-600036.

Keywords: *Stairways, *Safety, *Residential buildings, Design, Psychology, Hazards, Behavior, Environmental impacts, Statistical analysis, Accidents, Standards, Construction, Habits, Surveys.

Stairways are commonplace in U.S. homes. Stairway design and construction standards are based on custom, common sense, and experience. Stairways, however, are hazardous. A large number of stairway accidents have been reported, raising questions about the adequacy of stairway design and construction standards. This study is a first attempt to rationalize stairway standards by applying well established statistical methods to a significant sample of stairways and people using them. A pilot study on a sample of 253 residences in Milwaukee County, Wisconsin, was undertaken. The study included a survey of stairway use and behavior and an inventory of residential stairways. The results of the pilot study include a description of existing stairways, inferences about interactions that produce accidents, and guidelines which address reasons for accidents (hence should result in a reduction of accidents). The best strategy for making stairways safer, according to the study, is to remove factors that influence accident rates. Specifically, by systematically reducing hazards, careless stairway habits, and frequency of use, patterns of factors responsible for accidents can be broken and accident rates can be reduced.

701,800
PB-297 150/5 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC.
Tests on the Performance of Automatic Fire Detectors in Health Care Occupancies - A Preliminary Report.
R. W. Bukowski. Apr 79, 30p NBSIR-79-1739
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Performance tests, *Fire detection systems, Hospitals, Bedding equipment, Fire alarm systems, Fire protection, Automation, Fire tests, Health care facilities, Fire detectors, Room fires.

The paper reports the results of the first series of eight full-scale fire tests to evaluate the response of automatic fire detectors in health care occupancies to flaming ignition mattress fires. Comparisons were made between three types of detectors (ionization, photoelectric, and heat) installed in the patient room versus in the corridors. For the fire scenario selected (flaming ignition of bedding and mattress), the results indicated that the ionization-type detectors in the patient room provided the maximum time for escape. The maximum time period available for either rescue of a non-ambulatory patient in the room of origin or for use of the corridor past the room of origin as a means of escape averaged only about five minutes. The times available for escape or rescue were based on the time provided between detector alarm and the time that one of several criteria selected for occupant tenability was exceeded.

701,801
PB-297 202/4 PC **A06**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Building Technology Project Summaries 1977-1978.
Final rept.
M. Olmert, and N. Raufaste. Jan 79, 111p NBS-SP-446-2
See also PB-272 855.

Keywords: *Construction industry, *Buildings, Technology assessment, Construction management, Building codes, Research projects, Management planning, Construction materials, Structural analysis, Solar energy, Safety, Economics, Energy conservation.

Contents: Energy conservation, Solar energy, Economics, Thermal studies, Mechanical systems, Plumbing, Environmental design, Materials, Safety, Structures, Geotechnical engineering, Codes and standards, and Housing and building technology.

701,802
PB-297 417/8 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Full-Scale Fire Tests with Automatic Sprinklers in a Patient Room.
Interim rept.
J. G. O'Neill, and W. D. Hayes. Jun 79, 52p NBSIR-79-1749
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Fire extinguishing agents, *Hospitals, Patients, Fire tests, Fire safety, Effectiveness, Control, Hazards, Smoke, Health care facilities, Room fires.

The Center for Fire Research is conducting a research program to examine the use of automatic sprinklers in patient rooms of health care facilities. This is an interim report of eight full-scale fire tests in which the effectiveness of automatic sprinklers was measured in terms of fire control and overall life safety. These fire tests simulated the scenario in which mattresses with bedding constituted the burning items. Analysis of test results indicate that prior to sprinkler operation, smoke obscuration reached critical levels in the burn room doorway and adjacent corridor such that rescue of patients in the burn room and the use of the corridor as an exit way would have been seriously impeded. Immediately following sprinkler operation, there was total obscuration from floor to ceiling throughout the corridor and lobby area. For several tests, a privacy curtain was installed between the sprinkler head and the bed and, despite the shielding action of the curtain, the overall cooling of the sprinkler spray prevented the fire

from spreading to the combustible wall finish. However, the shielding action delayed extinguishment and the carbon monoxide concentrations increased significantly. In these cases it was estimated that the carboxyhemoglobin level for a patient in an adjacent bed would reach levels considered hazardous. In other tests where the privacy curtain was not installed and this shielding did not occur, the estimated hazardous threshold was not reached.

701,803
PB-297 452/5 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
COMPF2 - A Program for Calculating Post-Flashover Fire Temperatures.
Final rept.
V. Babrauskas. Jun 79, 81p NBS/TN-991
See also report dated Jan 75, PB-242 346.

Keywords: *Buildings, *Fires, *Flashover, Fire tests, Temperature, Fire walls, Fortran, Computer programs, Pyrolysis, COMPF2 computer program, Room fires.

COMPF2 is a computer program for calculating the characteristics of a post-flashover fire in a single building compartment, based on fire-induced ventilation through a single door or window. It is intended both for performing design calculations and for the analysis of experimental burn data. Wood, thermoplastic, and liquid fuels can be treated. In addition to the capability of performing calculations for compartments with completely determined properties, routines are included for calculating fire behavior by an innovative variable abstraction method. A comprehensive output format is provided which gives gas temperatures, heat flow terms, and flow variables. The documentation includes input instructions, sample problems, and a listing of the program. The program is written in Fortran and constitutes an improved version of an earlier program, COMPF.

701,804
PB-297 479/8 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Stairwell Pressurization Systems.
Final rept.
I. A. Benjamin, and J. H. Klote. Jun 79, 32p NBSIR-79-1747

Keywords: *Buildings, *Fires, *Stairways, *Pressurizing, Air flow, Ducted fans, Damper valves, Air circulation, Fire tests, Fire safety, Stairway fires.

The use of stairwell pressurization systems has grown in the U.S. over the past few years. However, there are no accepted design procedures for the systems. The paper discusses several of the designs now being used in the U.S., with some of the assumptions used for design of the systems. In particular, single and multiple injection systems are discussed. A report is made on field tests on two systems. The testing is part of a continuous program to evaluate alternate systems, in an attempt to establish design recommendations for the future.

701,805
PB-297 914/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radioactivity (Radon and Daughter Products) as a Potential Factor for Building Ventilation.
Final rept.,
T. Kusuda, C. M. Hunt, and P. E. McNall. 1979, 5p
Pub. in American Society of Heating, Refrigeration and Air-Conditioning Engineers Jnl. 21, n7 p30-34 Jul 79.

Keywords: *Radon, *Ventilation, Concentration(Composition), Buildings, Radioactivity, Public health, Standards, *Daughter products, Energy conservation, Reprints.

Awareness has developed in the United States, particularly within the last five years, that traces of radioactive radon gas and its daughter products are present in varying amounts in the indoor air. Some of the existing literature on the subject is briefly reviewed and discussed. It is recommended that further attention be given to quantify radon concentration data pertinent to the environmental health aspects of ventilation requirements from the standpoint of indoor air quality consistent with building energy conservation.

701,806
PB-298 053/0 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC.
Linearized Finite Difference Computation of Fluid Heating in an Enclosure.
Interim rept.
R. G. Rehm, M. R. Cordes, H. R. Baum, and J. Lewis. May 79, 78p NBSIR-79-1754
Prepared in cooperation with Boeing Computer Services, Inc., Seattle, WA.

Keywords: *Fires, *Gas flow, *Convection, Heating, Finite difference theory, Differential equations, Boundary value problems, Flow fields, Fire research, Room fires, Buoyant convection.

In an earlier paper, approximate equations of motion were derived which are applicable to nondissipative, very nonadiabatic, buoyant flows of a perfect gas. In the present paper, these approximate equations are recast in a form in which they can be integrated by finite difference techniques. Results of some computations are presented using computer-generated plots. A discussion is given of the software required to generate these plots. The principal application of interest to the authors is buoyant convection induced in room fires.

701,807
PB-298 289/0 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Review of Fire Incidents, Model Building Codes, and Standards Related to Wood-Burning Appliances.
Final rept.
R. D. Peacock. May 79, 59p NBSIR-79/1731
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Residential buildings, *Stoves, *Fires, Accident investigations, Fire safety, Building codes, Space heaters, Wood, Accidents, Wood burning stoves.

As a part of the Department of Energy program to advance the technology for the utilization of fuel wood as an alternate energy source for applications ranging from single-family dwellings to apartment complexes and small industries, a review is presented of fire incidents and fire deaths attributable to wood-burning appliances. Initiated to establish accident patterns and to determine the risks involved with the use of wood-burning equipment, the survey represents a compilation of approximately 11,800 fire incidents including injuries and deaths associated with solid fuel burning appliances. In addition, a review of model building codes and of test methods currently used to test or certify wood-burning equipment is included to identify priorities for future research in wood-burning safety.

701,808
PB-299 451/5 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Environmental Design Research Div.
Preliminary Findings Concerning the Validity of 'BFIRES': A Comparison of Simulated with Actual Fire Events.
Final rept.
F. I. Stahl. Aug 79, 23p NBSIR-79-1796

Keywords: *Residential buildings, *Fires, Human behavior, Fire safety, Escape(Abandonment), Computerized simulation, *BFIRES computer program, *Fire exits, *Building fires.

This report presents preliminary findings regarding the validity of BFIRES/VERSION 1, a computer program developed at the National Bureau of Standards to simulate egress movement by building occupants during fires. A computer simulation experiment was conducted in order to compare outcomes from BFIRES runs with data selected from an archival file summarizing actual fire results. Findings from this experiment suggest that BFIRES is capable of reproducing such important fire outcomes as loss-of-life indices and numbers of persons ultimately escaping. In addition, patterns of egress behavior produced by BFIRES were compared with those found in the literature, with professional opinions, and with impressions gathered from anecdotal accounts. With few exceptions, these comparisons illustrate agreement between simulations and other data sources.

701,809
PB80-101249 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Building Technology Publications. Supplement 3: 1978,
J. R. Debelius. Jul 79, 110p NBS-SP-457-3
Library of Congress catalog card no. 79-600099. See also Supplement 2, PB-284 991.

Keywords: *Construction, *Technology, *Bibliographies, Documents, Abstracts, Subject index terms, Indexes(Documentation), Authors, Subject indexing, Information systems, Handbooks, Technical reports, Patents, Libraries, Buildings, Construction materials, *Building technology, Center for Building Technology.

The report presents the National Bureau of Standards' (NBS) Center for Building Technology (CBT) publications for 1978. It is a supplement to Special Publication 457, Building Technology Publications 1965-1975, and covers the period from January 1, 1978 to December 31, 1978. It includes an abstract of each NBS publication, titles and abstracts of papers published in non-NBS media, key work and author indexes, and general information and instructions on how to order CBT publications.

701,810
PB80-110240 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Conference on Fire Research, Third Annual.
Final rept.,
I. M. Martinez. Oct 79, 187p NBSIR-79-1916

Keywords: *Fire safety, *Meetings, Fire protection, Fire hazards, Fire resistant textiles, Combustion products, Toxicity, Flammability, Mathematical models, Research projects, *Fire research.

This report contains extended abstracts of grants and contracts for fire research sponsored by the Center for Fire Research, National Bureau of Standards, as well as descriptions of the internal programs of the Center for Fire Research. The following topics are covered: Hazard analysis and fire information; Fire chemistry research; Fire physics research; Fire toxicology research; Product flammability research; Furnishings flammability research; Construction fire research; Fire protection systems research; Design concepts research; Ad Hoc working group on mathematical fire modeling; Arson control project; and Large scale fire research facilities.

701,811
PB80-113780 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
EVACNET: Prototype Network Optimization Models for Building Evacuation,
R. L. Francis, and P. B. Saunders. Oct 79, 164p NBSIR-79-1738

Keywords: *Buildings, *Fires, *Evacuation, Dynamic programming, Network flows, Mathematical models, Fire safety, Fortran, Computer programs, *Building fires, *High rise buildings, Tall buildings, POSTPRO computer program, Computer aided analysis.

This report presents the results of a pilot project conducted to explore how the evacuation and 'evacuability' of buildings can be analyzed with the aid of mathematical network flow optimization models. As a research vehicle, Building 101, an eleven-floor building located on the Gaithersburg, Maryland campus of the National Bureau of Standards, has been studied; mathematical models pertinent to evaluating that building under a number of different circumstances have been developed and solved on the computer.

701,812
PB80-145204 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Building Technology Project Summaries 1978-1979.
Final rept.,
M. Olmert, and N. Raufaste. Feb 80, 85p NBS-SP-446-3
See also PB-297 202.

Keywords: *Construction industry, *Buildings, Technology assessment, Construction management, Building codes, Research projects, Management planning, Environmental engineering, Construction materials, Structural analysis, Solar energy, Earthquake resistant structures, Safety, Economics, Energy conservation, Earthquake engineering.

The Center for Building Technology provides the technical and scientific bases for criteria and standards that improve the usefulness, safety, and economy of buildings while conserving building materials and energy. The Center's activities support building technology programs of the Federal, State and local governments; assists design professions, building officials and the research community by developing design criteria that improve buildings; and assists manufacturers of building products by developing criteria for evaluating innovative building materials. This report summarizes the Center's projects for calendar years 1978-79. It enables individuals to get a clear impression of CBT research activities.

701,813
PB80-162803 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Static Pressures Produced by Room Fires.
Interim rept.,
J. B. Fang. Mar 80, 32p NBSIR-80-1984
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of the Assistant Secretary for Policy Development and Research.

Keywords: *Residential buildings, *Fires, Combustion products, Furniture, Air flow, Temperature distribution, Convection, Heat transfer, Basements, Static pressure, *Room fires.

The distributions and time-varying nature of the static pressures developed due to fires in residential recreation rooms were determined for a range of combustible load densities and different types of interior lining materials. The vertical pressure differentials with respect to the ambient static pressure for various fire sizes are satisfactorily correlated by a hydrostatic perfect gas model based on temperature measurements in enclosures and an orifice flow model, and the calculated doorway inflow and outflow gas velocities are in good agreement with the measured values. The pressure differentials are found to reflect the locations of the neutral plane at the doorway and the thermal discontinuity within the fire room reasonably well, and their magnitudes depend on the average upper gas temperature. Rates of mass flow in and out of the room calculated from the ceiling and the floor pressure differentials agree fairly well with those derived from the doorway gas velocity data.

701,814
PB80-169949 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
BFIRES/Version 2: Documentation of Program Modifications,
F. I. Stahl. Mar 80, 113p NBSIR-80-1982
See also report dated Mar 79, PB-295 063. Sponsored in part by Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Buildings, *Fires, *Human behavior, Fire safety, Group dynamics, Computerized simulation, Computer programs, BFIRES Version 2 Computer program, Building fires.

Several shortcomings of BFIRES/Version 1 are discussed. Chief among these are the program's inability to simulate rescue activities during fire events, and to simulate direct interactions between occupant behavior and toxic qualities of smoke filled environments. This report documents a revised program, BFIRES/Version 2, which contains new subroutines developed to mitigate these problems. These subroutines are grouped into two modules: (1) a 'smoke' module designed to simulate the experience of inhabiting a smoke filled environment, and (2) a 'rescue' module intended to permit the rescue of physically immobile occupants. Additional improvements incorporated into BFIRES/Version 2 include more efficient file management and data input facilities, and expanded output capabilities.

701,815
PB80-200249 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Building Technology Publications. Supplement 4: 1979,
K. Porterfield. Jun 80, 83p NBS-SP-457-4
See also Supplement 3 dated Jul 79, PB80-101249. Library of Congress catalog card no. 80-600086.

Keywords: *Construction, *Technology, *Bibliographies, Documents, Abstracts, Subject index terms, Indexes(Documentation), Authors, Subject indexing, Information systems, Handbooks, Technical reports, Patents, Libraries, Buildings, Construction materials, National government, *Building technology, Center for Buildng Technology.

The report presents the National Bureau of Standards' Center for Building Technology (CBT) publications for 1979. It is the fourth supplement to NBS Special Publication 457, Building Technology Publications 1965-1975 and lists CBT documents issued or recorded during the period January 1 to December 31, 1979. It includes titles and abstracts of each NBS publication and each paper published in non-NBS media, key word and author indexes, and general information and instructions on how to order CBT publications. This report communicates the results of CBT research to various technical audiences, as well as to the general public. This document is divided into three main sections. The first, Titles and Abstracts, provides the report title, author(s), date of publication, selected key words, and an abstract of each NBS publication and each paper published in an outside source. The Author Index cites each CBT author and gives the publication title and/or number referencing documents listed in this supplement. The Key Word Index is a subject index, listing word summaries of the building research topics for each publication and paper. By selecting a main word or subject, which are listed alphabetically, the user is able to locate reports of interest through the subject-related words found in the key word index.

701,816
PB80-203649 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Recommended Practice for Measuring Life-Cycle Costs of Buildings and Building Systems.
Final rept.,
R. T. Ruegg, S. R. Petersen, and H. E. Marshall. Jun 80, 77p NBSIR-80-2040

Keywords: *Buildings, *Cost analysis, Benefit cost analysis, Construction costs, Cost engineering, Maintenance management, Cash flow, Computer programs, BASIC programming language, *Life cycle costs, TLCC computer program.

Rising prices of labor, material, and particularly energy have forced builders, architects, engineers, building owners and operators, and code writers to identify building designs and building systems that will be cost effective in the long run. This report describes how to measure the life-cycle costs of buildings and building systems. Life-cycle cost analysis, when applied to building decisions, provides an economic evaluation of the net dollar effect, over time, of purchasing, constructing/installing, maintaining, operating, repairing, and replacing buildings or building systems. This recommended practice for making life-cycle cost evaluations will assist the private and public building communities in making cost-effective decisions.

701,817
PB80-207764
(Order as PB80-207707, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC.
Response of Smoke Detectors to Monodisperse Aerosols,
G. W. Mulholland, and B. Y. H. Liu. 28 Nov 79, 16p
Prepared in cooperation with Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
Included in Jnl. of Research of the National Bureau of Standards, v85 n3 p223-238, May-Jun 80.

Keywords: *Aerosols, Combustion products, Light scattering, Particle size, Performance evaluation, Design, Ionization, Concentration(Composition), *Smoke detectors.

The respose of three light scattering smoke detectors (photo-electric detectors) and three ionization smoke detectors were determined as a function of particle size and concentration for nearly monodisperse dioctyl phthalate aerosol (sigma sub g = 1.25). The range in particle diameter was about 25% to 1 (0.05 to 1.3 micrometers) while the range in concentration was about two orders of magnitude. Detailed descriptions of the aerosol generation system and the smoke detector test chamber are given.

701,818
PB80-224298 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Full-Scale Fire Tests with Automatic Sprinklers in a Patient Room. Phase II.
Final rept.,
J. G. O'Neill, W. D. Hayes, and R. H. Zile. Jul 80, 91p NBSIR-80-2097
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC. See also report dated Jun 79, PB-297 417.

Keywords: *Fire extinguishing agents, *Hospitals, Patients, Fire tests, Fire safety, Effectiveness, Control, Hazards, Smoke, Health facilities, Room fires.

The Center for Fire Research conducted a series of full-scale fire tests in a patient room and corridor arrangement to examine the use of automatic sprinklers in patient rooms of health care facilities. This is a report of twenty-one (21) fire tests in which either mattresses with bedding or clothing wardrobes served as the burning items. Test results indicated that actuation of both pendant and horizontal sidewall sprinklers in the patient room acted to cool and redistribute the combustion products in the patient room and in the corridor away from the flowing sprinkler. This phenomena resulted in total obscuration throughout the test area. It was demonstrated that the use of a fast response, (low thermal inertia) sprinkler resulted in significantly less smoke obscuration in the mattress and bedding fires. Sprinkler spray distribution measurements were made to develop criteria for the position of privacy curtains with respect to the automatic sprinklers in the patient room. Recommended installation criteria are provided. Analysis of the test results indicated that the combustible clothing wardrobe fire resulted in room flashover in a nonsprinklered test. In several tests with sprinklers, flashover did not occur, however, estimated hazardous thresholds for carbon monoxide were still exceeded in the test area. It was determined that the combustible construction of the wardrobe primarily contributed to the high concentrations of carbon monoxide.

701,819
PB80-600026 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Oxygen Consumption Technique for Determing the Contribution of Interior Wall Finishes to Room Fires.
D. L. Sensenig. 1980,87p NBS-TN-1128

Keywords: *Fire tests, Flame spread, Flashover, Heat release rate, Ignition, Interior finish, Oxygen depletion, Room fires.

An oxygen consumption technique was developed for determining the total rate of heat production in a room fire. This was accomplished by measuring the volume flow rate and the oxygen concentration of the exhaust gases flowing through a collection hood. This method can be used with unknown combinatins of burning materials including both interior finish and furnishing. By simultaneously measuring the rate of oxygen consumption and the rate of mass loss the effective heat of combustion of the wall linings were determined in a reduced-scale model room fire test. The average heat release rate per unit area of the wall linings was determined by recording the area of involvement during the test and dividing this area into the total rate of heat production at that time. The enthalpy of the exhaust gases passing out of the doorway was determined with the aid of an array of thermocouples located at the entrance to the exhaust duct. By subtracting the enthalpy flow through the doorway from the total rate of heat production in the room, the heat losses through the bounding surfaces were determined. Reduced scale and full-scale room fire tests and a bench test for heat release rate using the oxygen consumption technique are discussed in this report. Lateral flame spread rates on vertical surfaces measured in the model room fire tests and a laboratory bench test are also described.

701,820
PB81-100703 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Building Technology Project Summaries 1979-1980.
Final rept.
N. Raufaste, and M. Olmert. Jul 80, 80p NBS-SP-446-4
See also report dated Feb 80, PB80-145204. Library of Congress catalog card no. 80-600133.

Keywords: *Construction industry, *Buildings, Technology assessment, Construction management, Build-

ing codes, Research projects, Management planning, Environmental engineering, Construction materials, Structural analysis, Solar energy, Earthquake resistant structures, Safety, Economics, Energy conservation, Earthquake engineering.

The Center for Building Technology's (CBT) mission is to increase the usefulness, safety, and economy of buildings through the advancement of building technology and its application to the improvement of building practice. CBT's research activities support the building technology programs of Federal, state, and local governments; assist design professions, building officials, and the research community by developing improved design criteria; and assist manufacturers of building products by developing methods for evaluating innovative materials, components, and systems. This report summarizes CBT's research for 1979-1980. Each summary lists the project title, its progress, point of contact within CBT, and sponsor. The summaries presented in this report are arranged according to the 11 prime research areas that comprise the scope of work at CBT. This year the report also features a Building Community Index, which keys CBT research to individual segments of the industry.

701,821
PB81-103335 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire Research Publications, 1979.
Final rept.
N. H. Jason. Aug 80, 21p NBSIR-80-2114
See also report dated Apr 79, PB-295 395.

Keywords: *Fire safety, *Research projects, *Bibliographies, Meetings, Fire hazards, Fire prevention, Flammability, Technical reports, Fire detection systems, *Fire research, Building fires, Smoke detectors.

Contents: Journal articles and conference proceedings; National Bureau of Standards publications; National Bureau of Standards interagency reports; National Bureau of Standards technical notes; National Bureau of Standards special publications; National Bureau of Standards dimensions; and Contract and grant reports.

701,822
PB81-104408 Not available NTIS
National Bureau of Standards, Washington, DC.
Guidelines for Metric Training and the Transitional Period.
Final rept.
H. J. Milton. May 80, 10p
Pub. in AIA Metric Building and Construction Guide, ch10 p91-100 May 1980.

Keywords: *Metric system, *Construction industry, *Training, Construction materials, Maintenance, Buildings, Reprints.

The chapter deals with two aspects of metrication: the training of people in the construction community, and technical adaptation during the transition period. Formal metric training programs are contrasted with informal familiarization outside and within the work environment. Training needs of various groups and the scope for construction industry metric training programs are discussed. The value of metric recognition points and mental images as part of the familiarization program is stressed and some typical examples are given. Strategies are offered for the technical adaptation of materials and components during the transitional phase, both for design and construction. A matrix shows various degrees of complexity of adaptation, ranging from negligible (no or minimal change) to costly and practically impossible, and recommends courses of adaptive action for designers and contractors. The impact of metrification in relation to existing buildings and their maintenance, repair, rehabilitation, extensions and additions is examined and various strategies for the minimization of costs and problems are recommended. Legal and contractual implications of the change are addressed.

701,823
PB81-107393 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Wind and Seismic Effects.
Final rept.
H. S. Lew. Oct 80, 649p NBS-SP-560
Library of Congress catalog card no. 79-600134. See also report dated Sep 78, PB-286 993.

Proceedings of the Joint Panel Conference of the U.S. -Japan Cooperative Program in Natural Resources (10th) Held at Gaithersburg, aryland on May 23-26, 1978.

Keywords: *Bridges, *Buildings, *Earthquakes, *Wind pressure, *Meetings, Seismic waves, Gust loads, Earth movements, Dynamic structural analysis, Dynamic response, Hazards, Soil mechanics, *Seismic design, *Ground motion, Earthquake engineering.

This volume includes thirty eight technical papers presented at the Tenth Joint Meeting of the U.S.-Japan Panel's eight task committees. The subjects covered in the Joint Meeting include: (1) natural wind characterization and extreme wind records, (2) characterization of earthquake ground motions and strong-motion earthquake data, (3) engineering seismology, (4) response of hydraulic and earth structures to seismic forces, (5) structural responses to wind loading, (6) recent developments in seismic design criteria, (7) design and analysis of special structures, (8) damage evaluation, repair and retrofit, (9) earthquake hazard mitigation, and (10) storm surge and tsunami.

701,824
PB81-110447 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Conference on Fire Research, Fourth Annual.
Final rept.
I. M. Martinez, and S. M. Cherry. Oct 80, 160p NBSIR-80-2127
See also report dated Oct 79, PB80-110240.

Keywords: *Fire safety, *Meetings, Fire protection, Fire hazards, Flammability, Human behavior, Combustion, Flame propagation, Fire resistant textiles, Toxicity, Research projects, Mathematical models, *Fire research, *Fire spread.

This report contains descriptions of the internal programs of the Center for Fire Research as well as extended abstracts of grants and contracts sponsored by the Center for Fire Research, National Bureau of Standards.

701,825
PB81-110520 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Mathematical Modeling of Fires.
Final rept.
R. S. Levine. Sep 80, 46p NBSIR-80-2107

Keywords: *Fires, *Mathematical models, Fire safety, Flame propagation, Air flow, Smoke, Fire protection, Compartment fires.

This presentation has three technical parts, and ends with audience participation and recommendations. First, a brief discussion of fire growth in a compartment is presented, showing why we need full scale tests, or a mathematical model adequately stimulating such growth. The second part of the talk describes what several Federal agencies and their grantees are doing to bring about the necessary engineering and mathematical capability for this modeling. The third part illustrates some problems that may be of interest to fire protection engineers that can be solved relatively simply by using fragments of the modeling capability now available. Then a discussion was held with the audience to determine modeling needs. Should we provide a series of simple models, each applicable to a limited range of problems, or a major comprehensive model, accessible from a computer terminal, that will solve a very wide range of problems. The audience decided both were needed.

701,826
PB81-111908 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Metric Conversion in the Construction Industries - Technical Issues and Status.
Final rept.
H. J. Milton, and S. A. Berry. Oct 80, 150p NBS-SP-598

Keywords: *Construction industry, *Metric system, Construction management, Construction materials, Building codes, Decision making, Technology transfer, Bibliographies, *Metrication.

This Special Publication was prepared at the request of the Metric Symposium Planning Committee of the National Institute of Building Sciences (NIBS). It is intended to provide information on technical issues and status of metric conversion in the United States construction industries. It will be made available to attendees at the NIBS Symposium on 'Metric Conversion in the Construction Community' to be held December 2-3, 1980, in Chicago, IL. In addition, it will be available to other affected parties in the construction community. The report contains information on planning for the metric change, current metric activities of professional and industry groups, technical implications in the construction industries, dimensional coordination, metric building products and services, research issues, and timing. It is intended to provide assistance for informed decisionmaking relative to metric conversion for the U.S. construction industries. Also included in the report is a bibliography of relevant construction industries' metric technical information.

701,827
PB81-113482 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire Investigation Handbook.
Final rept.
F. L. Brannigan, R. G. Bright, and N. H. Jason. Aug 80, 200p NBS-HB-134
Sponsored in part by Fire Administration, Washington, DC. Prepared in cooperation with Maryland Univ., College Park. Fire and Rescue Inst. Library of Congress catalog card no. 80-600095.Color illustrations reproduced in black and white.

Keywords: *Fires, *Investigations, *Handbooks, Ignition, Combustion, Law(Jurisprudence), *Fire investigation, *Arson.

The handbook is a reference tool designed to be used by the beginning or by the experienced fire investigator. How each person uses this book will depend upon a particular need and level of experience. The broad areas covered are: Fire Ground Procedures; Post-fire Interviews; The Building and its Makeup; Ignition Sources; the Chemistry and Physics of Fire and Sources of Information. The appendices have sections on how to organize an arson task force; the expert witness; independent testing laboratories; and selective bibliography.

701,828
PB81-115222 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
International and National Standards on Dimensional Coordination, Modular Coordination, Tolerances and Joints in Building.
Final rept.
H. J. Milton. Oct 80, 157p NBS-SP-595
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research. Library of Congress catalog card no. 80-600147.

Keywords: *Buildings, *Standards, Design standards, Construction industry, Metric system, Modular structures, Construction joints, Dimensional measurement.

This publication lists international, multi-national (regional), and national standards from over 50 countries dealing with the principles and application of dimensional or modular coordination in building, including joints and tolerances. It is based on NBSIR 79-1791, with the same title, which was sent to national and multi-national standards organizations for review and comment. The document shows the widespread adoption of the internatinal building module of 100 mm (also designated as M) as a basis for dimensional rationalization in building design, production and construction. The listing includes international (ISO) standards, multi-national (COPANT, ICAITI, and CMEA) standards, and national standards from all major countries. Brief summaries of contents have been included where available and titles in English for documents printed in other languages. Appendixes illustrate international cooperation on the subject, a multi-lingual vocabulary of 20 key terms, and review comments received. The main purpose of the document is to assist the U.S. construction community by providing information on international precedent to facilitate decisionmaking relative to new standards for dimensional (modular) coordination in building, especially those to be developed in metric (SI) units. Key findings have been summarized. The document may also assist exporters of building products and/or services.

701,829
PB81-127565 PC **A05**/MF **A01**
Massachusetts Univ., Amherst.
Waking Effectiveness of Household Smoke and Fire Detection Devices.
E. H. Nober, H. Pierce, A. Well, C. C. Johnson, and C. Clifton. Oct 80, 87p NBS-GCR-80-284
Grant NBS-DA0001

Keywords: *Fire alarm systems, Effectiveness, Human factors engineering, Responses, Performance evaluation, Auditory perception, *Smoke detectors.

Normal-hearing, young adults were subjected to home smoke detector alarm signals of 85, 70, and 55 dBA while asleep in their own bedrooms under quiet background conditions. In addition, other adults received 70 and 55 dBA alarm signals masked by window air conditioner background noise. Each person, upon awakening from the alarm signal, was instructed to shut off the alarm and telephone the local fire department. The 85, 70, and 55 dBA alarm levels were all sufficient to awaken the subjects at varying hours of the night and days of the week, under quiet background conditions. While there were statistically significant differences in waking times between 55 dBA and the other two alarm levels, the total times never exceeded 115 seconds for the combined alarm shutoff and the fire department telephone call at any alarm level. With background noise, waking times for the 70 and 55 dBA alarm levels increased (85 dBA not tested). At 70 dBA, the total time for the alarm shutoff and the fire department telephone call ranged from 36 to 119 seconds. At 55 dBA, two persons failed to awaken and one person awakened after the four-minute test termination criteria. For the remaining seven persons, the total time for the combined alarm shutoff and the fire department telephone call ranged from 45 to 137 seconds.

701,830
PB81-141509 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire Development in Residential Basement Rooms.
Interim rept.
J. B. Fang, and J. N. Breese. Oct 80, 97p NBSIR-80-2120
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Residential buildings, *Floors, *Basements, *Fire resistance, Fire tests, Construction materials, Flammability, Heat flux, Fire safety, *Room fires.

A multi-phase study program has been established to develop a rational test procedure for evaluating the fire resistance of residential floor assemblies. The first phase of this research program was aimed at characterizing the severity of fires originating in residential rooms and developing a specified set of fire exposure conditions applicable for fire resistance testing of floor constructions. A totai of 16 burnout tests were conducted to investigate the fire behavior in typical residential recreation rooms of single family houses.

701,831
PB81-158305 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Annual Conference on Fire Research,/ /Fourth Annual.
Final rept.
I. M. Martinez, and S. M. Cherry. Dec 80, 169p NBSIR-80-2127-1

Keywords: *Fire safety, *Meetings, Fire protection, Fire hazards, Flammability, Human behavior, Combustion, Flame propagation, Fire resistant textiles, Toxicity, Research projects, Mathematical models, *Fire research, *Fire spread.

This report contains descriptions of the internal programs of the Center for Fire Research as well as extended abstracts of grants and contracts sponsored by the Center for Fire Research, National Bureau of Standards.

701,832
PB81-203317 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire Research Publications, 1980.
Final rept.
N. H. Jason. Apr 81, 22p NBSIR-81-2272
See also report for 1979, PB81-103335.

Keywords: *Fire safety, *Research projects, *Bibliographies, Meetings, Fire hazards, Fire prevention, Flammability, Technical reports, Fire detection systems, *Fire research, Building fires, Smoke detectors, NTISCOMNBS.

Contents: Journal articles and conference proceedings; National Bureau of Standards publications; National Bureau of Standards interagency reports; National Bureau of Standards technical notes; National Bureau of Standards special publications; National Bureau of Standards handbook; and Contract and grant reports.

701,833
PB81-239618 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Building Technology Publications. Supplement 5: 1980.
Final rept.
S. Webber. Jun 81, 97p NBS-SP-457-5
See also PB-261 216. Library of Congress catalog card no. 78-323849.

Keywords: *Buildings, *Construction, *Technology, *Bibliographies, Construction management, Building codes, Construction costs, Construction industry, Environmental engineering, Consumer affairs, Abstracts, Building technology, Energy conservation, Metrication.

This report presents the National Bureau of Standards' Center for Building Technology (CBT) publications for 1980. It is the fifth supplement to NBS Special Publication 457, Building Technology Publications 1965-1975, and lists CBT documents issued or recorded during the period January 1 to December 31, 1980. It includes titles and abstracts of each NBS publication and each paper published in non-NBS media, key word and author indexes, and general information and instructions on how to order CBT publications. This report communicates the results of CBT research to various technical audiences, as well as to the general public. Publications constitute a major end product to CBT's efforts and, in 1980, appeared in several NBS publication series.

701,834
PB82-106105 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Building Technology Project Summaries, 1980-1981.
N. Raufaste, and M. Olmert. Jul 81, 89p NBS-SP-446-5
See also report dated Jul 80, PB81-100703.

Keywords: *Construction industry, *Buildings, *Research projects, Technology assessment, Construction management, Building codes, Environmental engineering, Management planning, Construction materials, Structural analysis, Solar energy, Earthquake resistant structures, Safety, Economics, *Energy conservation, *Earthquake engineering.

The mission of the Center for Building Technology (CBT) is to increase the usefulness, safety, and economy of buildings through the advancement of building technology and its application to the improvement of building practice. CBT's research activities support the building technology programs of Federal, State, and local governments; assist the design professions, building officials, and the research community by developing improved design criteria; and assist manufacturers of building products by developing methods for evaluating innovative materials, components, and systems. CBT provides an objective source of technical information for national consensus standards and model code organizations. Close cooperation with these groups leads to standard practices that meet the needs of the regulatory authorities of State and local governments. Research providing the knowledge for these standard practices is conducted in cooperation with Government, university, and industry laboratories. This report summarizes CBT's research for 1980-1981. Each summary lists the project title, its progress, point of contact within CBT, and sponsor.

701,835
PB82-170648 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Recommended Practice for Measuring Benefit/Cost and Savings-to-Investment Ratios for Buildings and Building Systems.
Final rept.
H. E. Marshall, and R. T. Ruegg. Nov 81, 52p NBSIR-81-2397
See also PB80-203649.

Keywords: *Buildings, *Cost analysis, Benefit cost analysis, Cost effectiveness, Investments, Decision making, Guidelines, Savings to investment ratio, Benefit cost ratio.

This report describes how to calculate a benefit-cost ratio (B/C) and a savings-to-investment ratio (SIR) and how to use them in selecting building designs and building systems that will be cost effective in the long run. The B/C relates positive benefits, such as revenues, to project costs in the form of a ratio. The SIR, a variation of the B/C, relates project savings (i.e., cost reductions) to project costs in a ratio. It is used when there are few if any positive cash flows from a project. The B/C and SIR can be used to help answer such questions as: 'Is a project cost effective.' 'Which size and/or design of a project is most cost effective.' 'What priorities should be given individual projects competing for a limited budget.' The report addresses different formulations of the ratios and their implications for selecting cost-effective projects.

701,836
PB82-193418 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Study of the Electromagnetic Fields Distribution Inside Buildings with Apertures Excited by an External Source,
M. T. Ma, and M. G. Arthur. Feb 82, 124p NBSIR-82-1659
Sponsored in part by Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, AZ.

Keywords: *Buildings, *Field strength, Electromagnetic fields, Computer programs, Computation, FIELD computer program, CURRENT computer program.

Two special cases of the penetration of electromagnetic fields into a cavity, building or box are formulated and analyzed. One is to consider the case of a lossy cavity with small apertures in free space, based on an application of the equivalence principle and the use of a generalized network formulation. It is found that the field strength at the aperture center is approximately inversely proportional to the square-root of the conductivity of the cavity walls and that high field levels can exist inside the cavity under certain physical conditions. The second case is to treat the problem of large buildings with large apertures on a practical lossy ground by a combination of theoretical approach and measurement data. Field levels inside the building for this latter case depend on the transmitter power, the transmitter-to-building distance, the ground conductivity, and the measurement antenna height relative to that of the transmitter.

701,837
PB82-220104 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire Research Publications, 1981.
N. H. Jason. Apr 82, 17p NBSIR-82-2499
See also PB81-203317.

Keywords: *Fire safety, *Research projects, *Bibliographies, Meetings, Fire hazards, Fire prevention, Flammability, Technical reports, Fire detection systems, Fire tests, *Fire research, Building fires, Smoke detectors.

Contents:
Journal articles and conference proceedings;
National Bureau of Standards publications;
National Bureau of Standards interagency reports;
National Bureau of Standards special publications;
and Contract and grant reports.

701,838
PB83-112730 PC **A17**/MF **A01**
National Bureau of Standards, Washington, DC.
Fire Research and Safety.
Final rept.
J. E. Chidester. Sep 82, 397p NBS-SP-639
Proceedings of the Fifth Joint Panel Meeting of the U.S.-Japan Cooperative Program in Natural Re-

sources Held at the National Bureau of Standards, Gaithersburg, Maryland, October 15-24, 1980. See also PB81-203317. Library of Congress catalog no. 82-600580.

Keywords: *Fire safety, *Research projects, *Meetings, Fire losses, Fire hazards, Fire prevention, Fire detection systems, Sprinklers, Human behavior, Japan, United States, *Fire research, Arson, Building fires, Smoke detectors.

The Fifth Joint Panel Meeting of the United States - Japan Panel on Natural Resources (UJNR), Fire Research and Safety, was held at the National Bureau of Standards in Gaithersburg, MD, from October 15 through 24, 1980. The meeting consisted of in-depth technical sessions on arson and fire investigation, toxicity of combustion products, advances in sprinkler technology, and fire modeling. Progress reports briefly covered fire retardance, building design, smoke control, human behaviors in fires, and fire protection. Two days of informal sessions were held on toxicity, human behavior, detection and smoke properties, sprinklers, smoldering, and fire modeling. This meeting was held in conjunction with the Center for Fire Research's Annual Conference which included United States presentations of related technical subjects. The proceedings include the technical papers presented at the UJNR meeting along with the ensuing discussion and the summary reports prepared by each session chairperson.

701,839

PB83-117176 PC **A07**/MF **A01**

National Bureau of Standards, Washington, DC. National Engineering Lab.

Calculating Available Safe Egress Time (ASET) - A Computer Program and User's Guide.

Final rept.

L. Y. Cooper, and D. W. Stroup. Sep 82, 139p NBSIR-82-2578

Keywords: *Buildings, *Fire safety, Fire detection, Combustion products, Flame propagation, Hazards, Computer programs, *Building fires, ASET computer program.

In the event of a fire in a building compartment the time available for occupants to safely evacuate the compartment, the Available Safe Egress Time (ASET), depends on the time of fire detection and on the time of the onset of hazardous conditions. In order to estimate these two times a dynamic simulation of the developing fire environment in the compartment is required. Also required are specific criteria for the simulation of detection and onset of hazard. A user oriented computer program which carries out the required simulations and provides estimates for the ASET has been developed. This document provides a listing of the program and a manual for its use. For fire growth in a particular fuel assembly, a single program run can be used to evaluate the ASET from enclosures (which are assumed to contain the fuel assembly) of different heights and areas, and under a variety of different detection and hazard criteria. The program can be used in either an interactive or batch mode. It is written in ANSI Fortran and requires no computer specific subroutines.

701,840

PB83-118646 PC **A04**/MF **A01**

National Bureau of Standards, Washington, DC. National Engineering Lab.

Building Technology Project Summaries, 1981-1982.

Special pub.

N. Raufaste, and M. Olmert. Sep 82, 74p NBS-SP-446-6

See also report for 1980-81, PB82-106105.

Keywords: *Construction industry, *Buildings, *Research projects, Construction management, Structural design, Environmental engineering, Building codes, Service life, Quality assurance, Thermal analysis, Lighting equipment, Acoustics, Heating equipment, Plumbing, *Earthquake engineering, *Energy conservation.

Center for Building Technology programs address building construction productivity, structural and geotechnical engineering, building materials, building physics, and building equipment. Typical CBT activities include: investigating failures, such as the Kansas City Hyatt Regency Hotel skywalk collapse, to determine needs for improved design and construction practices; improving measurement techniques, such as development and calibration of a hot-box to accurately determine heat transfer in full-scale complex-work assemblies; defining characteristics of building performance, such as predicting service-life of polymers (a group of materials expected to see much more use during the 21st century); and developing methods to predict the energy performance of new refrigerant mixtures for heat pumps. This report summarizes CBT's research for 1981-1982. Each summary lists the project title, its progress, point of contact within CBT, and sponsor.

701,841

PB83-118869 PC **A05**/MF **A01**

National Bureau of Standards, Washington, DC. National Engineering Lab.

Building Technology Publications Supplement 6: 1981.

Final rept.

L. Beavers. Jun 82, 98p NBS-SP-457-6

See also rept. for 1980-1981, PB82-106105.

Keywords: *Construction industry, *Buildings, *Abstracts, Technology, Structural engineering, Solar energy, Structural design, Environmental engineering, Construction materials, Bibliographies, *Energy conservation, *Earthquake engineering.

This report presents NBS' Center for Building Technology (CBT) publications for 1981. It is the sixth supplement to NBS Special Publication 457, Building Technology Publications, and lists CBT reports issued during January 1 - December 31, 1981. It includes titles and abstracts of each CBT publication and those papers published in non-NBS media, key word and author indexes, and general information and instructions on how to order CBT publications.

701,842

PB83-150466 PC **A04**/MF **A01**

National Bureau of Standards, Washington, DC. National Engineering Lab.

Cost-Conscious Guide to Fire Safety in Health Care Facilities.

R. E. Chapman. Nov 82, 69p NBSIR-82-2600

Sponsored in part by Department of Health and Human Services, Washington, DC.

Keywords: *Fire safety, *Hospitals, Building codes, Computer programming, Cost analysis, *Health care facilities, Nursing homes.

The study focuses upon the use of the Fire Safety Evaluation System developed by the Center for Fire Research at the National Bureau of Standards for determining equivalence to the Life Safety Code for health care facilities. The Life Safety Code, a voluntary code developed by the National Fire Protection Association, is a widely used guide for providing fire safety in buildings. This study outlines the Fire Safety Evaluation System Cost Minimizer (FSESCM) computer program. The FSESCM program is intended for use as a management tool to identify a series of optimal compliance strategies which are equivalent to the prescriptive provisions of the Life Safety Code in health care facilities. The mathematical optimization techniques which form the basis of the FSESCM program make it possible to quantify the cost savings attributable to the use of the Fire Safety Evaluation System over prescriptive compliance to the Life Safety Code. An in-depth analysis of a typical health care facility is used as a case study to demonstrate that cost savings of 50 percent or more over those associated with prescriptive compliance to the Life Safety Code are possible.

701,843

PB83-192807 PC **A04**/MF **A01**

National Bureau of Standards, Washington, DC.

Documentation and Assessment of the GSA/PBS (General Services Administration/Public Buildings Service) Building Systems Program: Background and Research Plan.

F. T. Ventre. Feb 83, 68p NBSIR-83-2662

Sponsored in part by General Services Administration, Washington, DC. Errata sheet inserted.

Keywords: *Buildings, *Project management, National government, Evaluation, Technology innovation, Procurement.

The report documents the origins and conduct of the General Services Administration/Public Buildings Service (GSA/PBS) Building Systems Program (BSP) undertaken during the 1970s and recommends a research plan for assessing the effectiveness of the BSP. The report proposes specific methods for assessing two outcomes of the BSP: the delivery of specified levels of performance for four attributes in the six buildings completed under the BSP and the wider effects of the BSP on the building community.

701,844

PB83-214817 PC **A99**/MF **E04**

National Bureau of Standards, Washington, DC. National Engineering Lab.

Wind and Seismic Effects.

Final rept.

R. M. Chung, H. S. Lew, and W. D. Kovacs. Apr 83, 717p NBS-SP-651

Proceedings of the Joint Panel Conference of the U.S.-Japan Cooperative Program in Natural Resources (14th) Held at Washington, DC. on May 17-20, 1982. See also PB-286 993. Sponsored in part by National Science Foundation, Washington, DC. Library of Congress catalog card no. 83-600713.

Keywords: *Bridges, *Buildings, *Earthquakes, *Wind pressure, *Meetings, Earth movements, Seismic waves, Design criteria, Dynamic structural analysis, Aerodynamic forces, Tsunamis, *Earthquake engineering, *Ground motion, *Seismic design, *Liquefaction(Soils).

The 14th Joint Meeting of the U.S. - Japan Panel on Wind and Seismic Effects was held in Washington, D.C., United States from May 17 through 20, 1982. This publication, which is the proceedings of the Joint Meeting, includes the program, list of members, formal resolutions, technical papers, and the task committee reports. Subjects covered in the papers presented to the panel include: characteristics of strong winds, wind loads on structures and design criteria, earthquake ground motions and dynamic analysis of embankment dams, soil liquefaction study and methods to improve liquefaction resistance, seismic loads on structures and design criteria, stress analyses of pipelines during earthquakes, full-scale seismic experiments, earthquake hazard reduction program, use of microcomputer for earthquake studies, quantitative evaluation of damages caused by winds and earthquakes, and tsunami research projects.

701,845

PB83-238915 PC **A02**/MF **A01**

National Bureau of Standards, Washington, DC. National Engineering Lab.

Fire Research Publications, 1982.

N. H. Jason. May 83, 21p NBSIR-83-2706

See also PB82-220104.

Keywords: *Fire safety, *Research projects, *Bibliographies, Meetings, Fire hazards, Fire prevention, Flammability, Technical reports, Fire detection systems, Fire tests, *Fire research, Building fires, Smoke detectors.

Contents:

Journal articles and conference proceedings;
National Bureau of Standards publications;
National Bureau of Standards interagency reports;
National Bureau of Standards special publication;
Contract and grant reports;
Author index.

701,846

PB83-250241 PC **A05**/MF **A01**

National Bureau of Standards, Washington, DC. National Engineering Lab.

Building Technology Publications. Supplement 7: 1982.

Final rept.

L. Beavers. Jun 83, 79p NBS-SP-457-7

See also PB83-118869.

Keywords: *Construction industry, *Buildings, *Abstracts, Technology, Structural engineering, Solar energy, Structural design, Environmental engineering, Construction materials, Bibliographies, *Energy conservation, *Earthquake engineering.

This report presents NBS' Center for Building Technology (CBT) publications for 1982. It is the seventh supplement to NBS Special Publication 457, Building Technology Publications, and lists CBT reports issued during January 1 - December 31, 1982. It includes titles and abstracts of each CBT publication and those papers published in non-NBS media, key word and author indexes, and general information and instructions on how to order CBT publications.

701,847
PB83-252791 PC **A99**/MF **E04**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Wind and Seismic Effects.
Final rept.
H. S. Lew. Jul 83, 755p NBS-SP-658
Proceedings of the Joint Panel Conference of the U.S.-Japan Cooperative Program in Natural Resources (11th). See also PB81-107393. Library of Congress catalog card no. 83-600550.

Keywords: *Bridges(Structures), *Buildings, *Earthquakes, *Wind pressure, *Meetings, Seismic waves, Gust loads, Earth movements, Dynamic structural analysis, Dynamic loads, Dynamic response, Soil mechanics, Tsunamis, *Seismic design, *Ground motion, Earthquake engineering.

The Eleventh Joint Meeting of the U.S. - Japan Panel on Wind and Seismic Effects was held in Tsukuba, Japan on September 4-7, 1979. The proceedings of the Joint Meeting include the program, the formal resolution and the technical papers. The subjects covered in the paper include the engineering characteristics of wind, the characteristics of earthquake ground motions, the earthquake response of structures, the wind response of structures, recent design criteria against wind and earthquake disturbances, the design and analysis of special structures, the evaluation, repairing, and retrofitting for wind and earthquake disaster, earthquake disaster prevention planning, storm surge and tsunamis, and technical cooperation with developing countries.

701,848
PB83-259622 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Building Technology Project Summaries 1982-1983.
N. Raufaste, and M. Olmert. Jun 83, 140p NBS-SP-446-7
See also PB83-118646.

Keywords: *Construction industry, *Buildings, *Research projects, Construction management, Structural design, Environmental engineering, Building codes, Service life, Quality assurance, Earthquake resistant structures, Thermal insulation, Lighting equipment, Acoustics, Heating equipment, Plumbing, *Earthquake engineering, *Energy conservation.

The Center for Building Technology specialized laboratory facilities and equipment located at Gaithersburg, Maryland, have a replacement value estimated at $20 million. Among the variety of special facilities and equipment are the universal testing machine with a 12-million-pound capacity; a reaction wall for subjecting full-scale building systems to earthquake loading; seven environmental chambers, including a 30 x 40 x 60 ft chamber, for evaluating the thermal performance of buildings and components; a line heat source guarded hot-plate to characterize insulation to 12 inches thick; a calibrated hot-box test facility; a five-story plumbing research laboratory; reverberation and anechoic chambers; lighting research facilities; mobile laboratories; an outdoor solar-collector test-method development area, including a passive solar test house; a network of outdoor exposure sites; a scanning electron microscope and other instruments for material characterization; facilities for experiments on solar heating and cooling systems; and controls and equipment laboratories. This report summarizes CBT's research for 1982-1983.

701,849
PB84-129865 PC **A04**/MF **A01**
National Research Council, Washington, DC.
Workshop on Building Diagnostics Held at Pine Mountain, Georgia on March 5-8, 1983.
18 Aug 83, 70p
Contract NB83-SBCA-2040, Grant NSF-CEE82-13661

Keywords: *Buildings, *Management planning, *Meetings, Technology assessment, Environmental engineering, Diagnosis, Design criteria, Project planning.

This report presents the findings of a workshop on building diagnostics held March 5-8, 1983. Building diagnostics is defined as the use of contemporary methods of measurement and interpretation to improve the performance of buildings. The purpose of the workshop was to identify existing and new instrumentation and measurement technologies. The workshop was part of a larger study by a National Research Council Committee on Building Diagnostics to assess the state of the art of building diagnostics, to develop performance requirements for new diagnostic tools, and to make recommendations for needed research and development programs.

701,850
PB84-155894 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Documentation and Assessment of the GSA/PBS (General Services Administration/Public Buildings Service) Building Systems Program: Final Report and Recommendations.
F. T. Ventre. Dec 83, 85p NBSIR-83-2777
Sponsored in part by Public Buildings Service, Washington, DC. See also PB83-192807.

Keywords: *Buildings, *Project management, National government, Evaluation, Technology innovation, Procurement, Environments.

This report assesses the General Services Administration/Public Buildings Service's (GSA/PBS) Building Systems Program (BSP) and recommends methods for furthering the program's objectives. Lighting, air movement and temperature, acoustics, and the flexibility of interior space division in the six buildings completed under the BSP are evaluated by comparing field measurements made in February-April 1982 with the performance specifications for those four attributes at the time of procurement. The wider effects of the BSP innovations on the building community are qualitatively evaluated.

701,851
PB84-167758 PC **A23**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Wind and Seismic Effects. Proceedings of the Joint Panel Conference of the U.S.-Japan Cooperative Program in Natural Resources (12th) Held at Gaithersburg, Maryland on May 19-23, 1980.
E. V. Leyendecker, and R. M. Chung. Jan 84, 549p NBS-SP-665
Also available from Supt. of Docs. as SN003-003-02557-7. See also PB83-252791. Library of Congress catalog card no. 83-600593.

Keywords: *Bridges(Structures), *Buildings, *Earthquakes, *Wind pressure, *Meetings, Seismic waves, Gust loads, Earth movements, Dynamic structural analysis, Dynamic loads, Dynamic response, Soil mechanics, Tsunamis, *Seismic design, *Ground motion, Earthquake engineering.

The Twelfth Joint Meeting of the U.S.-Japan Panel on Wind and Seismic Effects was held in Gaithersburg, Maryland on May 19-23, 1980. The proceedings of the Joint Meeting include the program, the formal resolutions, the Task Committee Reports, and the technical papers. The subjects covered in the papers include: (1) the characterization of seismic ground motion, (2) the characterization of natural wind and extreme wind records, (3) structural response to earthquake loading, (4) storm surge and tsunamis, (5) recent developments in seismic design criteria, (6) technical cooperation with developing countries, (7) earthquake hazard mitigation, and (8) structural response to wind loading.

701,852
PB84-177146 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Thermal Actuation of Extinguishing Systems.
D. D. Evans. Mar 84, 29p NBSIR-83-2807

Keywords: *Fire extinguishers, Actuation, Fire detection systems, Sprinkler systems, Responses, Thermal actuation.

A brief review of the Response Time Index (RTI) method of characterizing the thermal response of commercial sprinklers and heat detectors is presented. Measured ceiling layer flow temperature and velocity histories from a bedroom fire test are used to illustrate the use of RTI in calculating sprinkler operation times. In small enclosure fires, a quiescent warm gas layer confined by the room walls may accumulate below the ceiling before sprinkler operation. The effects of this warm gas layer on the fire plume and ceiling-jet flows are accounted for by substitution of an equivalent point source fire. Relationships are given for the location and strength of the substitute source relative to a point source representation of the actual fire. Encouraging agreement was found between measured ceiling-jet temperatures from steady fires in a laboratory scale cylindrical enclosure put into dimensionless form based on parameters of the substitute fire source, and existing empirical correlations from fire tests in large enclosures in which a quiescent warm upper gas layer does not accumulate.

701,853
PB84-178847 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Directional Extreme Wind Speed Data for the Design of Buildings and Other Structures.
Building science series (Final).
M. J. Changery, E. J. Dumitriu-Valcea, and E. Simiu. Mar 84, 127p NBS-BSS-160
Library of Congress catalog card no. 84-601008. Prepared in cooperation with National Climatic Center, Asheville, NC.

Keywords: *Structures, *Wind velocity, *Meteorological data, Data acquisition, Climatology, Statistical data, Periodic variations, Wind direction, Aerodynamics.

The purpose of this report is to provide largest yearly fastest-mile wind speed data corresponding to winds blowing from each octant at 37 airport stations in the United States. Four sets of data are presented. The first set consists of largest yearly fastest-mile wind speeds at 24 stations as extracted from original records. The second set consists of largest yearly fastest-mile wind speeds at 13 stations as extracted from Local Climatological Data (LCD) summaries. The third and fourth sets consist of the data from the first and second sets reduced to a height of 10 m above ground. The report also provides information on possible differences between extreme data extracted from original records on the one hand and from LCD summaries on the other hand. Procedures for estimating extreme wind effects that take into account the directional characteristics of the extreme wind climate and of the aerodynamic behavior of the structure are briefly reviewed, and it is noted that additional research on sampling errors in the estimation of extreme wind effects appears to be warranted.

701,854
PB84-221258 Not available NTIS
National Bureau of Standards, Washington, DC.
CIB (Conseil International du Batiment) National Committees as a Mechanism for Communication: An Example.
Final rept.
N. J. Raufaste. May 84, 7p
Pub. in Proceedings of Build, Take Care What We Have Built With Limited Resources, Conseil International du Batiment 83, held at Stockholm, Sweden on August 15-19, 1983, paper on Making Use of Building Research 5, p355-361 May 83.

Keywords: *Communications, *Buildings, Assessments, Technology.

An example is given of the use of a National Committee as a mechanism to link a nation's building community to CIB. The newly focused goals, objectives, and activities of the U.S. National Committee for CIB are presented. The rationale for these are related to the needs of the U.S. building community for more effective information exchange with the international building community and to the roles of CIB. During the past two years this National Committee has made improvements in its coordination among U.S. building researchers to form linkages for information exchange and to assess building technology needs on a national and international scale.

701,855
PB84-222249 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
Building Technology Project Summaries, 1983-1984 (of the National Bureau of Standards (NEL) Center for Building Technology).
Final rept.
N. J. Raufaste, and M. Olmert. Jun 84, 141p NBS/SP-446-8
See also PB83-259622.

Keywords: *Construction industry, *Buildings, *Research projects, Structural engineering, Building codes, Earthquake resistant structures, Structural

design, Environmental engineering, Technology innovation, Solar energy concentrators, Cost effectiveness, Quality assurance, Construction materials, Thermal insulation, Acoustics, Earthquake engineering, Energy conservation, Cement hydration.

The Center for Building Technology (CBT) of the National Bureau of Standards (NBS) is the national building research laboratory. It works cooperatively with other organizations, private and public, to improve building practices. It conducts laboratory, field, and analytical research. It develops technologies to predict, measure, and test the performance of building materials, components, systems, and practices. This knowledge is required for responsible and cost-effective decisions in the building process and cannot be obtained through proprietary research and development. CBT provides technologies needed by the building community to achieve the benefits of advanced computation and automation. CBT does not promulgate building standards or regulations, but its technologies are widely used in the building industry and adopted by governmental and private organizations that have standards and codes responsibilities. CBT programs include: computer-integrated construction, structural safety, earthquake hazards reduction, building physics, building equipment, quality of building materials, and cement hydration.

701,856
PB84-237197 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
Building Technology Publications, Supplement 8: 1983.
Final rept.
L. Beavers. Jun 84, 92p NBS/SP-457/8
Also available from Supt. of Docs as SN003-003-02600-0. See also PB83-250241.

Keywords: *Abstracts, *Construction industry, Buildings, Technology, Structural engineering, Structural design, Solar energy, Construction materials, Bibliographies, *Energy conservation, *Earthquake engineering.

This report presents NBS' Center for Building Technology (CBT) publications for 1983. It is the eighth supplement to NBS Special Publication 457, Building Technology Publications, and lists CBT reports issued during January 1 - December 31, 1983. It includes titles and abstracts of each CBT publication and those papers published in non-NBS media, key word and author indexes, and general information and instructions on how to order CBT publications. This document is divided into three main sections. The first, Titles and Abstracts, provides the report title, author(s), date of publication, selected key words, and an abstract of each NBS publication and each paper published in an outside source. The Author Index cites CBT authors and their publication number which is listed in this supplement. The Key Word Index is a subject index, listing word summaries of the building research topics for each publication and paper. By selecting a main word or subject, the user is able to locate reports of interest through these subject-related words.

701,857
PB85-109130 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Model for the Transport of Fire, Smoke and Toxic Gases (FAST).
W. W. Jones. Sep 84, 66p NBSIR-84/2934

Keywords: *Fires, Smoke, Gases, Growth, Computerized simulation, Structural forms, Transport properties, Toxic hazards.

A numerical implementation of a zone model which will transport fire, smoke and toxic gases in a multi-compartment structure is described. The areas covered are the equations which are solved, the numerical technique for the solution of these equations, species transport and the other relevant physical phenomena which govern fire growth and spread, and the transport of smoke. Also included in the model are the calculations necessary for a toxic hazard evaluation of a structure with a specific material loading. Forced ventilation is not yet included (version 15). A machine readable copy of the model (FAST) is available through NTIS. The tape includes the data file listed in the appendices of this report.

701,858
PB85-120715 Not available NTIS
National Bureau of Standards, Washington, DC.
Influence of Degree Day Base Temperature on Building Energy Prediction.
Final rept.
D. Nall, and E. Arens. 1979, 15p
Pub. in American Society of Heating, Refrigerating and Air-Conditioning Engineers Transactions 85, pt. 1 p707-721 1979.

Keywords: *Buildings, Temperature, Analysis(Mathematics), Predictions, Climate, Standards, Reprints, *Energy consumption, *Energy forecasts, Degree days.

This report investigates the use of base temperatures other than the traditional 65F (18.3C) value as an improvement to the degree day method of predicting energy consumption in buildings. Evidence of building balance point temperatures other than 65F (18.3C) from monitored buildings is presented. Methods of calculating base temperatures are evaluated, and the thermal behavior of one building is analyzed for different climates. Finally, the application of degree days of varying bases to the creation of climate zones for use with building energy standards is discussed.

701,859
PB85-150555 CP **T05**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
FAST: A Model for the Transport of Fire, Smoke and Toxic Gases.
Model-Simulation.
W. W. Jones. Sep 84, mag tape NBSIR-84/2934, NBS/DF-85/004
Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation, PB85-109130.

Keywords: *Fires, *Models simulation, Fortran, Smoke, Gases, Structures, Transport properties, Mathematical models, Magnetic tapes, Toxic hazards, Compartment fires.

A numerical implementation of a zone model which will transport fire, smoke and toxic gases in a multi-compartment structure. The model includes the calculations necessary for a toxic hazard evaluation of materials. Software Description: The model is written in the FORTRAN programming language for implementation on a PERKIN-ELMER 3200 computer using the OS32/6.2 operating system. Memory requirement is 128 K bytes.

701,860
PB85-166759 PC **A02**/MF **A01**
Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
Negative Exponential Solution to an Evacuation Problem.
Research rept.
R. L. Francis. Dec 84, 21p RR-84-36, NBS/GCR-84/482
Grants NB81-NADA-2057, NSF-CEE82-15437

Keywords: *Evacuating(Transportation), *Buildings, Fire safety, Personnel, Applications of mathematics, *Fire models.

We consider a building evacuation problem for which the number of people inside a lobby affects the rate at which people exit the lobby. We model the problem as a linear functional optimization problem for which the number of people exiting the lobby is to be maximized. We use duality theory to establish the optimality of a solution for which the number of people exiting as a function of time is given by a negative exponential function.

701,861
PB85-177913 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Development of a Fire Evaluation System for Detention and Correctional Occupancies.
H. E. Nelson, and A. J. Shibe. Dec 84, 123p NBSIR-84/2976
Sponsored by Department of Justice, Washington, DC.

Keywords: *Fire safety, *Evaluation, Safety devices, Buildings, Sprinkler systems, Fire protection, Facilities, Requirements, Design, *Correctional institutions, Evacuation egress, Fire codes.

A Fire Safety Evaluation System for Detention and Correctional Occupancies has been developed. It can be used for determining if a facility has fire safety equivalent to that obtained by meeting the requirement of a given code. The system was calibrated for use with proposed chapters for detention and correctional occupancies of the Life Safety Code (1985). There are separate sets of requirements for each of four use conditions; one for zoned egress, one for zoned impeded egress, one for impeded egress, and one for contained. Within each set, there are two levels of evaluation: one for partially sprinklered and non-sprinklered buildings, and one for totally sprinklered buildings.

701,862
PB85-177962 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Preliminary Study of the Vertical Stack to Horizontal Drain Entry Condition as an Extension to the Modeling of Unsteady Partially Filled Pipe Flow.
J. A. Swaffield, and L. S. Galowin. Feb 85, 54p NBSIR-85/3108
Prepared in cooperation with Brunel Univ., Uxbridge (England).

Keywords: *Plumbing, *Drains, *Pipe flow, Design, Pipes(Tubes), Drainage, Vents, Mathematical models, Finite difference theory, Graphs(Charts), Discharge, Buildings.

The finite difference based method of characteristics model for unsteady partially filled pipe flow was extended to include the stack to horizontal drain entry boundary condition. The conditions at drain entry are defined in terms of the energy of the terminal annular flow velocity in the stack, together with an appropriate loss coefficient as the entry function. The hydraulic solutions link the branch drains, fittings, vertical soil stack and building drain. The analysis permits any combination of drainage load patterns from simultaneous, overlapping or sequence of discharge events. Preliminary simulations utilizing this model indicates that the modeling technique extends the existing horizontal network analysis program to a simulation of multistory building drainage systems. The sizing procedure determines the hydraulic capacity of drains for specified pipe sizes, pipe pitch and well roughness factors.

701,863
PB85-178077 PC **A07**/MF **A01**
American Inst. of Architects Foundation, Washington, DC.
Fire Emergency Evacuation Simulation for Multifamily Buildings.
Final rept.
D. M. Alvord. Dec 84, 132p NBS/GCR-84/483
Grant NB82-NADA-3043

Keywords: *Apartment buildings, *Fires, *Evacuating(Transportation), Computer programs, Computerized simulation, Residential buildings, Fire safety, Egress, Emergency escape, Fire models.

This report concerns the Fire Emergency Evacuation Simulation for Multifamily Buildings, a deterministic discrete event model for emergency evacuation from living areas of multifamily buildings. It is the final report of the project. It is written in such a fashion that those individuals who wish only general understanding of the model can easily find what they require, while those persons who require a deeper understanding can find all of the information that they need. A general introduction is first to appear. Next appears a section describing background information that a user would require to knowledgeably prepare input. A detailed description of the required input format is next to be given followed by a detailed discussion of the logic behind the various sections of the model as implemented in the program. Three example simulation runs, as well as a listing of the program, also are given.

701,864
PB85-178085 PC **A04**/MF **A01**
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Mechanical, Industrial and Aerospace Engineering.
Experimental Study of Negatively Buoyant Flows Generated in Enclosure Fires.
Y. Jaluria, and D. Goldman. Feb 85, 53p NBS/GCR-85/487
Grant NB83-NADA-4047

Keywords: *Enclosures, *Fires, Fluid flow, Buoyancy, Penetration, Smoke, Thermal measurements, Velocity

measurement, Air flow, Fire hazards, Flow rate, Compartment fires, Room fires.

An experimental investigation of the nature of the velocity and thermal fields in negatively buoyant flows generated in enclosure fires is carried out. The flow configuration considered is that of a negatively buoyant two-dimensional jet discharged adjacent to a vertical surface, as well as that discharged away from the boundaries of the region. Such flows are frequently encountered in enclosures due to the downward turning of the flow induced by the fire plume, at the corners of the ceiling. Similarly, wall flows generated in the upper stably stratified region in room fires penetrate into the cooler, lower region. In these cases, the buoyancy force is upward while the flow is downward, resulting in a negatively buoyant circumstance. An experimental system is developed to study the downward penetration of such jets in which the buoyancy force opposes the flow. The penetration distance is measured and related to the inflow conditions, particularly the temperature and velocity at the discharge location.

701,865
PB85-187573 PC **A04**/MF **A01**
Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
Network Models of Building Evacuation: Development of Software System. Final Report, March 1985.
T. M. Kisko, and R. L. Francis. Mar 85, 60p NBS/GCR-85/489
Grant NB81-NADA-2057
See also PB84-217520.

Keywords: *Buildings, *Evacuating(Transportation), Fire safety, Networks, Mathematical models, EVACNET computer program, Computer applications, Means of egress.

This report summarizes the efforts of the third and final year of a project to develop EVACNET+, a user friendly computer program that models building evacuations. When the evacuation of a building involves the flow of people through well defined passageways, it is natural to consider the evacuation problem to be a network flow problem. EVACNET+ is a user friendly interactive computer program that accepts a user defined network model of a building, converts that model to a time expanded dynamic 'transshipment' network, and solves the dynamic network problem using a capacitated minimum cost network flow algorithm. The solution obtained gives a time-dependent plan to evacuate the building in a minimum time, and identifies building evacuation bottlenecks. In the first year of the grant, EVACNET+ was developed to the point of preliminary testing. During the second year, the coding of EVACNET+ was completed and a user's manual was written. This final year of the grant concentrated on research related to extensions of the EVACNET+ concept. Areas of research included investigating: Time-varying extensions of EVACNET+; A model controlled adjustment option; Integration of EVACNET+ with other models; New solution procedures for EVACNET+; Expanded model input and editing functions; A result data base analysis system. A microcomputer version of EVACNET+ was also developed for the IBM PC or equivalent.

701,866
PB85-196541 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Research and Innovation in the Building Regulatory Process.
Final rept.
L. Beavers. Apr 85, 145p NBS/SP-694
See also PB85-196558 through PB85-196640 and PB81-219321. Proceedings of the NBS/NCSBCS Joint Conference (6th). Held at Denver, Colorado on September 11, 1984. Sponsored by National Conference of States on Building Codes and Standards, Inc., Herdon, VA. Also available from Supt. of Docs an SN003-003-02642-5. Library of Congress catalog card no. 85-600521.

Keywords: *Buildings, *Regulations, *Meetings, Building codes, Structures, Construction, Fires, Safety, Automation, Energy, Design, Warning systems, Compliance, Computer applications.

The Proceedings of the Sixth NBS/NCSBCS Joint Conference on Steamlined Administrative Procedures, Computers in Construction, and Fire Safety Technology contain 10 technical papers: Common Format for the Model Building Codes: An Application of Advanced Techniques for Standards Analysis, Synthesis and Expression; Structural Safety Assessment During the Construction Phase Automation of the Building Code Compliance; Microcomputer Design Tool to Aid Construction Professionals to Comply with the Florida Model Energy Efficiency Code; Automated Checking of Simply-Supported Prismatic Reinforced Concrete Beams for Compliance With Code Requirements; Emerging Engineering Methods Applied to Regulatory Fire Safety Needs; Survey of the State of the Art of Mathematical Fire Modeling; A Second Look at Fire Protection Code Criteria; Non-Evacuation in Compartmented Fire Resistive Buildings Can Save Lives and It Makes Sense; Telephone Connected Early Warning and Communication System.

701,867
PB85-196632
(Order as PB85-196541, PC **A07**/MF **A01**)
Travelers Insurance Co., Hartford, CT.
Non-Evacuation in Compartmented Fire Resistive Buildings Can Save Lives and It Makes Sense.
J. N. Macdonald. Apr 85, 14p
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology, and National Conference of States on Building Codes and Standards, Inc., Herndon, VA.
Included in Research and Innovation in the Building Regulatory Process: Proceedings of the NBS/NCSBCS Joint Conference (6th), Technical Seminar on Streamlined Administrative Procedures, Computers in Construction, and Fire Safety Technology held at Denver, Colorado on September 11, 1984, p117-130 Apr 85.

Keywords: *Fire resistance, *Buildings, Fire safety, Fires, *Evacuation, *Compartmentalization.

Compartmented fire resistive buildings are used for hotels, motels, apartments, condominiums, dormitories, hospitals, and other health care facilities. Several fires in compartmented fire resistive buildings were reviewed. Not all of those that were reviewed were used in this study, only those where reasonably accurate conclusions could be drawn as to whether the victims had evacuated or not.

701,868
PB85-199545 PC **A99**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Proceedings of the Joint Panel Meeting of the UJNR Panel on Fire Research and Safety (7th) Held at Gaithersburg, Maryland on October 24-28, 1983.
N. H. Jason, and K. Davis. Mar 85, 652p NBSIR-85/3118
See also N84-13341.

Keywords: *Meetings, *Fire safety, Risk, Measurement, Combustion, Flame propagation, Toxicity, Buildings, Construction materials, Hazards, Tests, Materials, *Fire research.

The 7th Joint Panel Meeting of the United States-Japan Panel on Fire Research and Safety was held jointly with the Combustion Toxicity and 2nd Expert Meeting of the U.S.-Japan-Canada Cooperative Research Group on Toxicity of Combustion Products from Building Materials and Interior Goods at the National Bureau of Standards, Gaithersburg, Maryland, October 24-28, 1983. Technical sessions were in the areas of: Fire Hazard/Risk Management Methods; Fire Growth Prediction; Materials Fire Properties and Test Methods; Measurement Methods; Combustion Toxicity. Progress reports were presented in each area, in addition to state-of-the-art papers. The next conference will be held in Japan in May 1985.

701,869
PB85-201770 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Computers in Building: A Strategy for Building Research.
Final rept.
R. N. Wright. 1984, 7p
Pub. in Building Research and Practice 12, n1 p14-20 Jan-Feb 84.

Keywords: *Buildings, Automation, Research, Computation, Construction, Reprints, *Computer applications, Computer aided design.

Advances in technologies of electronic computation are revolutionizing practices in all phases of building including design, on-site construction, and end use. These advances have potential for increasing the usefulness, safety and economy of buildings. Some current research, development and applications are cited to illustrate the advances in building practices that electronic computation can provide. Expectations are presented for computer-integrated building practices. Research, in traditional and in new areas, required to realize these expectations is described.

701,870
PB85-202729 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Computers in Buildings, Building and Building Research.
Final rept.
R. N. Wright. 1984, 17p
Pub. in Proceedings of Triennial Congress of the Int. Council for Building Research, Studies and Documentation, Stockholm, Sweden, August 1983, p77-93.

Keywords: *Buildings, Automation, Research, Computation, Construction, *Computer applications, Computer aided design.

Advances in technologies of electronic computation are revolutionizing practices in all phases of building including design, on-site construction, and end use. These advances have potential for increasing the usefulness, safety and economy of buildings. Some current research, development and applications are cited to illustrate the advances in building practices that electronic computation can provide. Expectations are presented for computer-integrated building practices. Research, in traditional and in new areas, required to realize these expectations is described.

701,871
PB85-202786 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Emerging Engineering Methods Applied to Fire Safety Design.
Final rept.
H. E. Nelson. 1985, 4p
Pub. in Proceedings of Research and Design 1985: Architectural Applications of Design and Technology Research at Los Angeles, CA., on March 14-18, 1985, p181-184.

Keywords: *Fire safety, Buildings, Design, Building codes, Fire protection, Tests, Safety engineering.

The development of fire science has progressed to a point where an analytical engineering methodology for fire protection design is emerging. This presentation outlines the elements of such a method and provides an example of one facet and a broad range of references for those interested in deeper examination.

701,872
PB85-225233 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD.
Workshop on Steel Research Needs for Buildings, Held at Gaithersburg, Maryland, March 5-6, 1985.
Final rept.
C. Culver, N. Iwankiw, and A. Kuentz. May 85, 93p NBS/SP-693
Library of Congress catalog card no. 85-600546. Sponsored by National Science Foundation, Washington, DC., American Inst. of Steel Construction, Chicago, IL., and Metal Building Mfrs. Association, Cleveland, OH.

Keywords: *Buildings, *Steel construction, Design, Construction, Fire safety, Loads(Forces), Structural engineering, Earthquake engineering.

This report identifies needed experimental and analytical research to advance the state-of-the-art and improve safety and economy in the design, fabrication and construction of steel buildings. A five year plan for a coordinated research program is included. Recommendations for research projects dealing with the following topics are presented: Total building systems, connections and members, frames, seismic design, load and resistance factor design, fire protection, and design loads. The recommendations were developed at a workshop involving participation by steel industry representatives, design professionals, Federal agency representatives and university researchers.

701,873
PB85-227486 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Workshops Convened by the Interagency Committee on Seismic Safety in Construction during 1984.
E. V. Leyendecker, G. E. Turner, and S. G. Fattal.
May 85, 44p NBSIR-85/3161
Also pub. as Interagency Committee on Seismic Safety in Construction rept. no. ICSSC/TR-9. Sponsored by Federal Emergency Management Agency, Washington, DC.

Keywords: *Safety, *Seismic waves, *Construction, *Meetings, Earthquakes, Design, Standards, Building codes, Buildings, Hazards, Earthquake engineering.

In an effort to inform Federal agencies about the most recent development on various earthquake hazards mitigation topics, informal workshops were convened by the Interagency Committee on Seismic Safety in Construction in Washington, DC during 1984. The report presents summaries of the workshop series which included the subjects of implementation of seismic provisions for Federal agencies, lifelines, seismic risk maps, and evaluation of existing buildings. The summaries provide an overview of the major topics discussed. Where applicable, recommendations that resulted are given.

701,874
PB85-227635 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Operations Research Div.
Life-Cycle Costing with the Microcomputer.
Final rept.
S. R. Petersen, and H. E. Marshall. Jun 85, 6p
Pub. in ASTM (American Society for Testing and Materials) Standardization News 13, n6 p36-41 Jun 85.

Keywords: *Buildings, Benefit cost analysis, Economic analysis, Investments, Rates(Costs), Return on investment, Revisions, Reprints, *Life cycle costs, *Energy conservation, Computer applications, Retrofitting, Microcomputers, User manuals(Computer programs), Modifications.

The Building Life-Cycle Cost (BLCC) microcomputer program and its user's guide are an adjunct to the standard economic methods developed by ASTM for evaluating buildings. The article describes how the program/user's guide can be used to facilitate application of the program to a real building investment problem involving envelope and equipment modifications for energy conservation.

701,875
PB85-236370 PC **A11**/MF **A01**
American Inst. of Architects Foundation, Washington, DC.
Status Report on the Escape and Rescue Model and the Fire Emergency Evacuation Simulation for Multifamily Buildings.
D. M. Alvord. Jun 85, 233p NBS/GCR-85/496
Contract NB82-NADA-3043

Keywords: *Fire safety, *Residential buildings, Computer programs, Computerized simulation, Rescue operations, *Building fires, *Emergency escape, *Health care facilities, Life safety, Evacuation, Means of egress, Group homes.

The report concerns changes made to the Escape and Rescue Model and the Fire Emergency Evacuation Simulation for Multifamily Buildings to enhance their portability and user-friendliness. Both model programs were changed from SIMSCRIPT II.5 to Fortran and were revised in order to permit interactive access. The report consists of a brief overview of the Escape and Rescue Model as well as an overview of the other model. Next appears a chapter detailing the changes performed to the model programs. User's guides to running the programs implementing each model are next to appear in the form of appendices. Finally, example computer runs and listings of each program are given.

701,876
PB85-240448 PC **A09**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Building Technology Project Summaries, 1985.
N. Raufaste, and M. Olmert. Jun 85, 177p NBS/SP-446/9
See also PB-261216.

Keywords: *Construction, Bibliographies, Technology, Projects, Abstracts, Buildings, Loads(Forces), Reliability, Thermal analysis, Thermal measurements, Acoustics, Illuminating, Plumbing, Construction materials, Roofing, Concretes, Refrigerants, *Building technology, Earthquake engineering, Solar equipment.

The report summarizes CBT's research for 1985, and is arranged according to CBT's research programs. Each summary lists the project title, its activities, point of contact in CBT, and sponsor. Contents: computer-integrated construction; Structural loads and reliability; Geotechnical engineering; Earthquake engineering; Thermal analysis and measurements; Acoustics; Lighting research; Building controls; Non-Azeotropic refrigerant mixtures research; Test procedures for energy appliances; Solar equipment; Plumbing research; Quality of building materials; Performance of roofing systems; Predicting the performance and service-life of concretes.

701,877
PB86-106002 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Performance of Interstitial Space Construction Systems.
J. R. Lawson. May 85, 165p NBSIR-85/3158
Errata sheet inserted. Sponsored by Veterans Administration, Washington, DC.

Keywords: *Fire tests, Steel structures, Fire resistance, Tests, Graphs(Charts), Structural members.

Two unique walk-on deck construction systems were exposed to the standard NFPA 251 time-temperature fire exposure for periods up to two hours in order to evaluate their fire performance. A large scale steel structure was used in the test program to simulate construction systems found in the field. The structure consisted of two large functional floors separated by an interstitial space in which a walk-on deck was suspended from the top functional floor. One of the walk-on deck systems was constructed from lightweight concrete, and the second was built with poured gypsum. Critical components evaluated were the top functional floor, unprotected steel work in the interstitial space, the walk-on deck system, and protection for a heavy steel column located in the center of each test bay. Test data were compared with the fire endurance test requirements of NFPA 251. Computer predictions also were made using the FIRES-T3 model to determine its ability to accurately predict the construction systems performance.

701,878
PB86-110905 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Building Technology Publications, Supplement 9: 1984.
Final rept.
L. Beavers. Aug 85, 76p NBS/SP-457/9
See also PB84-237197.

Keywords: *Construction industry, *Buildings, Abstracts, Structural engineering, Solar heating, Structural design, Construction materials.

The report is the ninth supplement to NBS Special Publication 457, Building Technology Publications, and lists the Center for Building Technology (CBT) documents published during 1984. It includes titles and abstracts of each NBS publication and each paper published in non-NBS media, key word and author indexes, and general information and instructions on how to order CBT publications.

701,879
PB86-111424 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Operations Research Div.
Applications of Equivalency Methodologies to Building Rehabilitation.
Final rept.
J. H. Pielert, and R. E. Chapman. 1982, 10p
Pub. in Performance Concept in Building: Advances in the Development of the Concept and Its Application in Rehabilitation, v1 p493-502 1982.

Keywords: *Buildings, *Renovating, Building codes, Windows, Doors, Mathematical models, Regulations, Computer aided analysis.

The paper presents the results of a pilot study on the application of an equivalency methodology in achieving regulatory compliance. A computerized procedure is developed which permits the least-cost means of achieving compliance with regulatory provisions applied to windows and doors in buildings being rehabilitated. Application of the methodology to a prototypical townhouse indicated potential savings ranging from 20 to 35 percent.

701,880
PB86-122876 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Harvard Fire Model.
Final rept.
H. E. Mitler. 1985, 10p
Pub. in Fire Safety Jnl. 9, p7-16 1985.

Keywords: *Fire tests, Fire safety, Mathematical models, Reprints, *Fire models, Computer applications.

The paper gives an overview of the Harvard Computer Fire Code. Some background on mathematical fire modeling in general is given and then some of the assumptions and approximations made in the Harvard Mark 5 model are outlined. The capabilities of the model are then discussed, as well as the two variants, Mark 5.3 and Mark 6. The validity and reliability of the model are considered, and its weakest features noted. The requirements in terms of machine size, CPU time, and data are considered, as well as the input/output for (from) the program. Finally, how the program can be modified, plus plans for its future development, are outlined.

701,881
PB86-136603 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Comparison of Several Compartment Fire Models: An Interim Report.
H. E. Mitler. Oct 85, 37p NBSIR-85/3233
Sponsored by Nuclear Regulatory Commission, Washington, DC.

Keywords: *Fire tests, Compartment analysis, Comparison, Mathematical models, Fire walls, Fire hazards, *Fire models.

A substantial number of mathematical models for compartment fires have been developed in the past decade. The report analyzes and compares in depth three such models. This is done with particular emphasis on the needs of the Nuclear Regulatory Commission and Sandia National Lab, for their Risk Methods Integration and Evaluation Program. The models examined are: (1) the Harvard family of models, Mark 5, 5.2, 5.3, and 6; (2) COMPBRN; and (3) FAST.

701,882
PB86-138625 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Multicompartment Model for the Spread of Fire, Smoke and Toxic Gases.
Final rept.
W. W. Jones. 1985, 25p
Pub. in Fire Safety Jnl. 9, p55-79 1985.

Keywords: Fire tests, Mathematical models, Smoke, Toxicity, Reprints, *Fire models.

A numerical implementation of a zone model which will transport fire, smoke and toxic gases in a multi-compartment structure is described. The areas covered are the equations which are solved, the numerical technique for the solution of these equations, species transport and the other relevant physical phenomena which govern fire growth and spread, and the transport of smoke. Also included in the model are the calculations necessary for a toxic hazard evaluation of a structure with a specific material loading.

701,883
PB86-139680 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Summaries of Center for Fire Research (of the National Bureau of Standards) Grants and In-House Programs - 1985.
S. M. Cherry. Nov 85, 150p NBSIR-85/3258
See also PB85-200202.

Keywords: *Fire tests, *Abstracts, Fire control, Combustion, Flame propagation, Soot, Smoke, *Fire studies, Fire models.

The report contains extended abstracts of grants and contracts for fire research sponsored by the Center for Fire Research, National Bureau of Standards, as well as descriptions of the Internal programs of the Center for Fire Research.

701,884
PB86-139755 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Establishment of a Catalog of Compartment Fire Model Algorithms and Associated Computer Subroutines.
D. W. Stroup. Nov 85, 52p NBSIR-85/3263

Keywords: *Catalogs(Publications), Algorithms, Computer programs, Mathematical models, *Compartment fires, *Fire models, Fire studies.

The Compartment Fire Model Research group of the Center for Fire Research, National Bureau of Standards has been charged with the development of a 'benchmark' compartment fire model. As part of this activity, a catalog of available fire model algorithms is being compiled. The paper presents a proposal for the organization, format, and use of the catalog.

701,885
PB86-166105 PC **A07**/MF **A01**
Factory Mutual Research Corp., Norwood, MA.
Experimental Fires in Multiroom/Corridor Enclosures.
Final rept.
G. Heskestad, and J. P. Hill. Jan 86, 132p NBS/GCR-86/502
Contract NB83-NADA-4046
Also pub. as Conseil International du Batiment pour la Recherche l'Etude et la Documentation, Rotterdam (Netherlands) rept. no. CIB/W-14/85/10(USA). Prepared in cooperation with Conseil International du Batiment pour la Recherche l'Etude et la Documentation, Rotterdam (Netherlands). Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Fires, Fire tests, Buildings, Flashpoint, *Fire studies, Fire models.

A series of 60 fire tests have been conducted in an enclosure consisting of a corridor and three attached rooms, one of which served as a burn room. The purpose was to establish validation data for theoretical fire models of multi-room fire situations with particular emphasis on health care facilities. Fire sources were propylene gas burners, producing steady fires at 56 and 522 kW as well as fires growing with the square of time at several growth rates up to a maximum output of 2MW.

701,886
PB86-193166 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Assessing Toxic Hazard as It Relates to Overall Fire Hazard.
Final rept.
A. J. Fowell. 1985, 14p
Pub. in Fire Technology 21, n3 p199-212 Aug 85.

Keywords: *Fires, *Buildings, Fire hazards, Toxicity, Combustion products, Furniture, Reprints, Fire models.

A framework is proposed for assessing hazards associated with the spread of smoke and hot gases from fires in buildings, and the current predictive capabilities for each component of that framework are described. Particular attention is given to the significance of the toxicity of the combustion products of a material in relation to its other fire properties.

701,887
PB86-203049 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
'Fireform' - A Computerized Collection of Convenient Fire Safety Computations.
H. E. Nelson. Apr 86, 101p NBSIR-86/3308
Sponsored by Department of Health and Human Services, Washington, DC., and Air Force Engineering and Services Center, Tyndall AFB, FL.

Keywords: *Fires, *Fire safety, Buildings, Computer programs, Smoke, Fire detection systems, Sprinkler systems, *Fire models, Fire studies.

A computerized system of convenient fire safety computations is presented. Subjects covered include smoke filling in a room, sprinkler/detector activation, smoke flow through (small) openings, temperatures and pressures developed by fires, flashover and fire severity prediction, fire propagation (in special cases), and simple egress estimation. All programs are based on established formulas and are programmed in BASIC for microcomputers.

701,888
PB86-209996 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Data for Room Fire Models.
Final rept.
J. A. Rockett. 1984, 15p
Pub. in Jnl. of Combustion Science and Technology 40, n1-4 p137-151 1984.

Keywords: *Fires, *Fire tests, Data, Reprints, *Room fires, Five models.

Data needs for state-of-the-art single room fire models are discussed using several examples. Three types of data are needed: geometric, thermal and chemical. Needed geometric data generally present no problem and are not discussed. Under thermal data those quantities which determine the transient surface temperature of objects in the room are considered.

701,889
PB86-210705 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Design Manual for Smoke Control.
Final rept.
J. H. Klote. 1984, 6p
Pub. in Fire Safety Jnl. 7, n1 p93-98 1984.

Keywords: *Smoke, Smoke abatement, Fire safety, Buildings, Reprints.

For many years smoke has been recognized as a major killer in fire situations. In response to the problem, the concept of controlling smoke movement in building fires has developed. The American Society of Heating, Refrigeration, and Air-Conditioning Engineers and the U.S. Veterans Administration have sponsored a design manual for smoke control systems. The paper provides an overview of the manual with emphasis on the principles of smoke control, stairwell pressurization, zone smoke control, and computer analysis.

701,890
PB86-223104 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Federal Building Life-Cycle Cost (FBLCC) Computer Program User's Guide.
S. R. Petersen. May 86, 91p NBS/TN-1222, NBS/SW/DK-86/007A
Contract DE-AI01-86CE73041
For system on diskette, see PB86-223112. Sponsored by Department of Energy, Washington, DC.

Keywords: *Buildings, National government, Prices, Computation, *Energy conservation, *Life cycle cost, Energy use, FBLCC computer program, User manuals(Computer programs).

The FBLCC Computer Program and the User's Guide provide computational tools and energy price data for performing life-cycle cost (LCC) analyses of Federal buildings and related subsystems. Two kinds of Federal building projects can be evaluated with FBLCC: (1) LCC analysis of projects directly related to energy conservation and renewable energy, and (2) LCC analysis of projects not directly concerned with energy conservation or renewable energy.

701,891
PB86-223112 CP **T99**
National Bureau of Standards, Gaithersburg, MD.
Federal Building Life-Cycle (FBLCC) Program Diskette.
Software.
S. R. Petersen, and W. Bethea. May 86, 1 diskette NBS/SW/DK-86/007
The software is contained on 5 1/4-inch diskette, double sided, double density compatible with the IBM PC microcomputer. Diskettes are in the ASCII format. Price includes documentation, PB86-223104.

Keywords: *Software, *Buildings, National government, Prices, Computation, *Energy conservation, *Life cycle costs, Energy use, Diskettes, L=BASIC, H=IBM PC.

The Federal Building Life-Cycle Cost Program provides computational tools and energy price data for performing life-cycle cost (LCC) analyses of Federal buildings and related subsystems. The methods and procedures used in these LCC analyses are based on rules set forth by the U.S. Department of Energy's Federal Energy Management Program and U.S. Office of Management and Budget. The 5-1/4 inch diskette contains the FBLCC programs and related data files in MD-DOS format. The documentation for the FBLCC program is contained in 'A User's Guide to the Federal Building Life-Cycle Cost (FBLCC) Program,' NBS-TN 1222. ...Software Description: The software is written in the BASIC programming language for implementation on an IBM PC-compatible microcomputer under the MS-DOS operating system. Memory requirement is 64K.

701,892
PB87-106019 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Design of Effective Water Spray Cooling in Stairwell-Sprinkler Systems.
Final rept.
L. Y. Cooper. 1981, 15p
Sponsored by Department of Labor, Washington, DC., and Department of Health and Human Services, Washington, DC.
Pub. in Proceedings of Engineering Applications of Fire Technology Workshop, Gaithersburg, MD., April 16-18, 1980, p89-103 1981.

Keywords: *Sprinkler systems, *Fire safety, Cooling, Stairwells.

The potential benefits of sprinkler protection of open stairways during fires are discussed. One of these benefits results from the cooling of products of combustion which pass through the stairwell penetration. An example scenario is introduced to illustrate this benefit. A relevant experimental study of the performance of stairwell-sprinkler systems is summarized. The results of the study are used to develop a guide for the design of stairwell-sprinkler systems with an objective of efficient evaporative cooling of flow through fire gases. Examples on the use of these design guides are presented.

701,893
PB87-113700 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Determination of Energy Reduction in Retrofitted Homes.
Final rept.
Y. M. Chang, and R. A. Grot. 1984, 1p
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Jnl. 26, n5 p39 1984.

Keywords: *Houses, *Weatherproofing, *Energy conservation, Low income housing, Demonstration projects, Case studies.

The report presents a technique for analyzing the effect of energy saving retrofits installed in low-income housing under a nationwide weatherization demonstration program. A tracking technique based on the calculated balance-point temperature of each home prior to the weatherization, was developed to predict the would-be fuel consumption over a period of time as if the house were not weatherized. Fuel reduction is reported for more than 100 homes using different fuels in seven cities across the nation, selected to represent various climate zones and geographical locations. It was found that the average saving in fuel consumption for dwellings in each city is about 30 percent.

701,894
PB87-113718 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.

General

Reference Building - One Approach in the Evolution of Building Energy Performance Criteria for Houses.
Final rept.
J. L. Heldenbrand, and S. R. Petersen. 1982, 13p
Sponsored by Department of Energy, Washington, DC.
Pub. in ASHRAE Transactions, v88 pt1 p387-399 1982.

Keywords: *Houses, *Energy, Performance, Criteria.

No abstract available.

701,895
PB87-120200 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Smoke Control and Fire Evacuation by Elevators.
Final rept.
J. H. Klote, and G. Tamura. 1986, 15p
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions 92, Pt 1A p231-245 1986.

Keywords: *Elevators(Lifts), Stairways, Reprints, *Evacuation, *Building fires, *Smoke control, Control systems.

In recent years, the possibility of using elevators as a means of fire escape has received considerable attention. The interest has been sparked by an increased awareness of life safety problems of the handicapped and also general fire evacuation problems of high-rise buildings. The use of elevators as a means of fire evacuation is a potential solution to the problem. The major technical obstacle to this is smoke contamination of elevator lobbies and shafts. The paper discusses elevator smoke control systems including criteria for evaluation and presents an analysis of airflow due to elevator car motion. Computer analysis of several elevator smoke control systems are included for several combinations of open and closed doors and for summer and winter conditions.

701,896
PB87-122362 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Chimney Fires: Intensity and Duration.
Final rept.
R. D. Peacock. 1986, 17p
Sponsored by Consumer Product Safety Commission, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Fire Technology 22, n3 p234-252 Aug 86.

Keywords: Fire safety, Stoves, Creosote, Fireplaces, Reprints, *Chimney fires, Wood burning appliances.

A series of tests was conducted in five instrumented chimneys to study the intensity and duration of chimney fires due to the ignition and burning of combustible deposits accumulated on chimney linings over a prolonged period of time. These tests were conducted: (1) to establish typical conditions including temperatures in the chimneys and on combustible surfaces nearby, and (2) to determine the duration of the burnout as evidenced by elevated temperatures within the chimney. The results of these tests point out some areas where the codes and standards covering residential wood heating appliances should be updated to better protect against failure due to chimney fires.

701,897
PB87-128088 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
NBS (National Bureau of Standards)/Harvard Mark 6 Multi-Room Fire Simulation.
Final rept.
J. A. Rockett, and M. Morita. 1985, 15p
Pub. in Fire Science Technology 5, n2 p149-163 1985.

Keywords: *Fires, *Computerized simulation, Mathematical models, Reprints, *Building fires, FORTRAN 77 programming language.

The NBS/HARVARD Mark VI multi-room fire simulation program structure is discussed and compared with Harvard V. In addition to the current, operating version of VI, a development version is being used to test enrichments which can be readily moved into the operational version as they mature. The program is written in ANSI standard FORTRAN 77 and is transportable to computers of various manufacture.

701,898
PB87-134300 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Safety Evaluation System for NASA (National Aeronautics and Space Administration) Office/ Laboratory Buildings.
H. E. Nelson. Nov 86, 38p NBSIR-86/3404
Sponsored by National Aeronautics and Space Administration, Washington, DC.

Keywords: *Fire safety, Laboratories, Office buildings, Evaluation, NASA, Risk assessment.

A fire safety evaluation system for office/laboratory buildings is developed. The system is a life safety grading system. The system scores building construction, hazardous areas, vertical openings, sprinklers, detectors, alarms, interior finish, smoke control, exit systems, compartmentation, and emergency preparedness.

701,899
PB87-140182 PC **A03**/MF **A01**
Factory Mutual Research Corp., Norwood, MA.
Calculated Interaction of Water Droplet Sprays with Fire Plumes in Compartments.
Final rept.
R. L. Alpert, and M. M. Delichatsios. Dec 86, 48p NBS/GCR-86/520
Contract NB83-NADA-4014
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: Computerized simulation, Drops(Liquids), Ceilings(Architecture), Gas flow, Plumes, *Building fires, *Fire suppression, Water sprays, Compartments.

The objective of the program is to analyze mathematically, through the use of computer solutions, the complex interaction between water droplet sprays and the buoyancy-driven gas flows induced by a building fire. The specific goal is to obtain scientific correlations relating spray penetration through the fire plume and cooling of the fire environment to a set of controlling parameters such as fire intensity, spray characteristics and geometric factors (i.e. compartment size or ceiling height). Such correlations could then be used in current zone models of compartment fires.

701,900
PB87-140216 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Building Technology Project Summaries 1986.
R. N. Wright. Dec 86, 68p NBSIR-86/3490
See also PB85-240448.

Keywords: Construction, Bibliographies, Technology, Projects, Abstracts, Buildings, Loads(Forces), Reliability, Thermal analysis, Thermal measurements, Acoustics, Illuminating, Plumbing, Construction materials, Roofing, Concretes, Refrigerants, *Building technology, Earthquake engineering, Solar equipment.

The Center for Building Technology (CBT) of the National Bureau of Standards (NBS) is the national building research laboratory. It works cooperatively with other organizations, private and public, to improve building practices. It conducts laboratory, field, and analytical research. It develops technologies to predict, measure, and test the performance of building materials, components, systems, and practices. This knowledge is required for responsible and cost-effective decisions in the building process and cannot be obtained through proprietary research and development. CBT provides technologies needed by the building community to achieve the benefits of advanced computation and automation. CBT does not promulgate building standards or regulations, but its technologies are widely used in the building industry and adopted by governmental and private organizations that have standards and codes responsibilities. The report summarizes the projects underway in the Center during 1986.

701,901
PB87-150538 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Wind Forces on a Mobile Home: An Assessment of Wind Tunnel Simulations.
Final rept.,
R. D. Marshall. 1985, 8p
Pub. in Proceedings of U.S. National Conference on Wind Engineering (5th), Lubbock, TX., November 6-8, 1985, p3B-9--3B-16.

Keywords: *Buildings, *Wind pressure, Wind tunnels, Simulation, Aerodynamics, *Mobile homes.

The paper presents a brief review of the experimental technique used and the results obtained from a wind loading study carried out on a full-scale mobile home. Subsequent to the completion of the study, several wind tunnel establishments have conducted model simulations of the mobile home with various degrees of success. The paper examines two of these simulations and offers some suggestions which may result in improved agreement between model and full-scale results for future simulations.

701,902
PB87-152252 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
How Accurate is Mathematical Fire Modeling,
H. E. Mitler, and J. A. Rockett. Dec 86, 51p NBSIR-86/3459

Keywords: *Fire tests, *Fire safety, Mathematical models, *Room fires, Fire codes.

It is important to be able to predict the development of a fire in an enclosure of arbitrary complexity. A mathematical model valid for a single room, with multiple vents and objects in it has been developed. The fifth version of the model has just been completed; it is the Harvard Computer Fire Code V, or Mark 5 for short. In 1977, Factory Mutual Research Corporation carried out a series of eight well-instrumented full scale room fires, against which the single room model can be tested. The test fire room was 2.4 m x 9.6 m x 2.4 m high, with an open doorway; a slab of polyurethane foam in one corner, and a polyurethane foam target in a facing corner. The primary slab was ignited at its center, and the fire followed. The other tests were variants of this one. The authors compare the results of the calculations with the results of two of the experiments: the standard configuration and the case with a window replacing the doorway. The model 'predictions' are in good to excellent agreement for most of the variables. The disagreements are discussed.

701,903
PB87-157087 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Some Factors Influencing Fire Spread Over Room Linings and in the ASTM (American Society for Testing and Materials) E-84 Tunnel Test.
Final rept.,
J. Quintiere. 1985, 10p
Pub. in Fire and Materials 9, n2 p65-74 1985.

Keywords: *Flammability testing, Reprints, *Room fires, Flame spread.

An examination of the correlative relationship between room fire intensity (temperature) and flammability data for materials, ASTM E-84 flame ratings and energy release rate from calorimetry devices, is presented. The results of the analysis show the significance of several modes of flame spread-wind aided and opposed flow spread. The factors important in these spread modes are considered from approximate solutions developed for turbulent flows. Also the importance of energy release rate in the tunnel test (E-84) and in upward or wind aided spread is illustrated. The results suggest the cause of extensive fire spread over very low density room lining materials and as the ASTM E-84 ratings may not be applicable.

701,904
PB87-165569 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Plan for the Development of the Generic Framework and Associated Computer Software for a Consolidated Compartment Fire Model Computer Code,
G. P. Forney, and L. Y. Cooper. Jan 87, 27p NBSIR-86/3500

Keywords: *Fire tests, Smoke, Fire hazards, Computerized simulation, *Room fires.

A plan is presented for the development of computer software to support the generic framework of a Consolidated Compartment Fire Model (CCFM) computer code. The several software modules which will make up particular application versions of the CCFM are identified. These modules are then classified as either generic or application-specific. The characteristics and a detailed plan for the development of the generic modules are outlined. Descriptions of the CCFM application products which will use the generic framework were presented. All of these will be designed in response to clear needs of the fire science and technology community. In terms of modeling sophistication of CCFM products, the prototype application will be at the simple end of the spectrum. It will provide simple guidance for engineering fire safety design. At the other extreme will be a benchmark-like compartment fire model computer code. At an intermediate level of sophistication will be an Application product which will be useful as an updated tool for Fire Hazard Assessment.

701,905
PB87-181996 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Summaries of Center for Fire Research (of the National Bureau of Standards) Grants and In-House Programs - 1986,
S. M. Cherry. Dec 86, 154p NBSIR-86/3498
See also report for 1985, PB86-139680.

Keywords: *Fire tests, Abstracts, Fire control, Combustion, Flame propagation, Toxicity, Smoke, Soot, *Fire studies, Fire models, US NBS.

The report contains extended abstracts of grants for fire research sponsored by the Center for Fire Research, National Bureau of Standards, as well as descriptions of the internal programs of the Center for Fire Research.

701,906
PB87-199956 PC **A09**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Thermal Performance of Masonry Chimneys and Fireplaces.
Final rept.,
R. D. Peacock. Apr 87, 176p NBSIR-87/3515
Sponsored by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Chimneys, *Fire tests, Masonry, Fireplaces, Flues, Wood, Stoves, Fire safety, Residential buildings, Linings, Standards, Solid fuels.

A series of tests was conducted in a masonry chimney and a masonry fireplace both constructed to current national standards in order to evaluate the effectiveness of recent changes to the building code requirements for residential masonry construction. Firing rates typical of normal homeowner use and of overfire condition resulted in temperature levels close to recommended limits established in nationally recognized standards for properly constructed solid fuel heating systems. In addition, several lining techniques for the masonry chimney and for the fireplace chimney connected to solid fuel burning fireplace inserts showed reductions in thermal hazard to exposed combustible construction when compared to the masonry construction alone. The results of these tests point out some areas where the codes and standards could be updated to provide for safer masonry chimneys and fireplaces.

701,907
PB87-201810 PC **A06**/MF **A01**
Maryland Univ., College Park. Dept. of Mechanical Engineering.
Transient Characteristics of Unconfined Fire-Plume-Driven Ceiling Jets.
Annual rept.,
C. H. Marks, and V. Motevalli. Apr 87, 115p NBS/GCR-87/529
Grant NANB-5H0551
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Ceilings, *Fire tests, Flames, Temperature measurement, Velocity measurement, Plumes, Room fires.

An instrumentation system to measure temperatures and velocities in ceiling jets has been constructed. This system employs thermocouples to measure both temperatures and velocities at eight locations from the ceiling simultaneously. In this way, velocity and temperature profiles can be obtained in the ceiling jet as a function of time. The velocities are obtained by using pairs of thermocouples, one located downstream of the other, and cross correlating their temperature-time records to obtain the length of time that it takes for fluid to flow from one thermocouple to the other. Preliminary results indicate that the system works well; measurements made thus far compare favorably with steady-state data in the literature. Calibration work on the instrument is continuing and further transient ceiling jet measurements will be obtained.

701,908
PB87-201828 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Engineering Analysis of the Early Stages of Fire Development - The Fire at the Dupont Plaza Hotel and Casino - December 31, 1986,
H. E. Nelson. Apr 87, 114p NBSIR-87/3560

Keywords: Flashover, Burning rate, Smoke, *Building fires, Puerto Rico.

The report presents the methods and results of an analytical analysis of the fire development through the first and second floors during the December 31, 1986 fire in the Dupont Plaza Hotel and Casino, San Juan, Puerto Rico. The analysis involved the use of fire growth models, engineering formula, and technical data. The report details the procedures and data used, the reason for those selected, and the results obtained. The analysis addressed mass burning rate, rate of heat release, smoke temperature, smoke layer depth, velocity of smoke/flame front, mass products in smoke layer, oxygen concentration in smoke layer, visibility in smoke layer, flame length/extension, flame spread, sprinkler response, smoke detector response, and fire duration. The areas of the building analyzed include the ballroom complex to the areas where most of the deaths occurred. The report does not address smoke movement above the first floor, the conditions that caused the deaths of three persons caught in an elevator, or the conditions that caused the death of one victim in a guest room on the fourth floor.

701,909
PB87-203006 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Measurements of the Transient Temperature and Velocity Profiles in Ceiling Jets (Extended Abstract).
Final rept.,
V. Motevalli, C. H. Marks, B. McCaffrey, and L. Y. Cooper. 1986, 4p
Pub. in Proceedings of Fall Technical Meeting Eastern Section of the Combustion Institute, San Juan, Puerto Rico, December 15-17, 1986, p38-1-38-4 1986.

Keywords: Ceilings(Architecture), Temperature measurement, Velocity measurement, *Room fires.

Experimental data is needed to support the development and verification of compartment fire models, especially models concerned with the early stages of fires. The research described herein constitutes the initial phase of an attempt to obtain the transient temperature and velocity distributions in ceiling jets above small fire (up to 2 KW). Some data exists for steady-state temperature distributions (1,2) and for transient temperature profiles in ceiling jets (3,4). There appears to be no data for the transient velocity profiles in these jets and the existing temperature data is insufficient.

701,910
PB87-203873 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Ceiling Jet-Driven Wall Flows in Compartment Fires (Extended Abstract).
Final rept.,
L. Y. Cooper. 1986, 4p
Pub. in Proceedings of the Fall Technical Meeting Eastern Section of the Combustion Institute, San Juan, Puerto Rico, December 15-17, 1986, p39-1-39-4 1986.

Keywords: Ceilings(Architecture), Fire tests, Walls, Models, *Room fires, Fire plumes.

Analytic estimates are developed for the early depth of penetration of and the lateral entrainment into negatively buoyant, ceiling jet-driven wall flows which are generic to compartment fire scenarios. When walls are not too far from the fire source, of the order of the fire-to-ceiling distance, it is found that the penetration of the downward flow near such walls is a large fraction of the fire-to-ceiling distance itself, and that this fraction is relatively independent of the details of fire size, spacings, etc. Also, net rate of entrainment into the wall flow as it is buoyed back upward to the ceiling elevation is found to be several times larger than the flow rate of the driving ceiling jet flow immediately upstream of ceiling jet - wall impingement. Data from five studies reported in the literature are being reviewed relative to the analytic results obtained. One of these involves numerical experiments with a field model of the problem of a buoyant source in an enclosure. Two laboratory experimental studies involve fires in enclosures with characteristic dimensions of the order of several meters. Two others involve saltwater plumes in freshwater tanks with characteristic dimensions of the order of several tenths of a meter.

701,911
PB87-203881 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
ASKBUDJr: A Precursor of an Expert System for the Evaluation of Fire Hazard.
Final rept.,
R. L. Smith. 1987, 14p
Pub. in Fire Technology 23, n1 p5-18 Feb 87.

Keywords: *Fire safety, Computerized simulation, Reprints, *Building fires, Expert systems.

The Center for Fire Research (CFR) has a long-term project to develop expert systems as a technology transfer mechanism. The goal of the project is to develop a computer program which will make an expert estimate of the firesafety of a building based on CFR's deterministic physical models, technical data, and the expert judgment of its staff. The first significant computer program to be developed by this project will be based on the expertise of Harold E. (Bud) Nelson. Thus, it will be called ASKBUD. In this article, the first exploratory steps taken to develop this program are described. Also, the progress made to date, as well as some of the major problems that must be solved, will be discussed. Since the system described in this article is in its infancy, the authors call it ASKBUDJr.

701,912
PB88-109863 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Building Technology Project Summaries 1987,
N. J. Raufaste. May 87, 90p NBSIR-87/3565
See also report for 1986, PB87-140216.

Keywords: Concretes, Construction materials, Technology, Projects, Buildings, Roofing, *Building technology, Earthquake engineering, Seismic design, Computer aided design.

The Center for Building Technology (CBT) of the National Bureau of Standards (NBS) is the national building research laboratory. It works cooperatively with other organizations, private and public, to improve building practices. It conducts laboratory, field, and analytical research. It develops technologies to predict, measure, and test the performance of building materials, components, systems, and practices. The knowledge is required for responsible and cost-effective decisions in the building process and cannot be obtained through proprietary research and development. CBT provides technologies needed by the building community to achieve the benefits of advanced computation and automation. CBT does not promulgate building standards or regulations, but its technologies are widely used in the building industry and adopted by governmental and private organizations that have standards and codes responsibilities. The report summarizes the projects underway in the Center during 1987.

701,913
PB88-110572 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

General

Overview of Smoke Control Technology,
J. H. Klote. Sep 87, 28p NBSIR-87/3626
Sponsored by Public Buildings Service, Washington, DC.

Keywords: *Smoke abatement, *Fire protection, Air conditioning, Computerized simulation, Elevators, Stairways.

Considerable advances in smoke control technology occurred in the last few decades. However, smoke control is just beginning to take its proper place as a fire protection tool. The paper provides an overview of this technology, including discussions of the fundamental principles, stairwell pressurization, zones smoke control, elevator smoke control, system activation and acceptance testing. In addition the problems of smoke purging are addressed.

701,914
PB88-110663 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Experimental Study of the Transient Thermal Response of Unconfined Ceilings above Fire Plumes.
Final rept.,
A. Woodhouse, C. H. Marks, and L. Y. Cooper. 1987, 8p
Pub. in Proceedings of ASME/JSME Thermal Engineering Conference Sessions on Heat and Mass Transfer in Compartment Fires, Honolulu, HI., March 22-27, 1987, p387-394 1987.

Keywords: Ceilings(Architecture), Heat transfer, Convection, Plumes, Fire tests, Reprints, *Foreign technology, *Room fires.

A database was developed for the transient thermal response of unconfined ceilings above small (up to 2kW) fires. The investigation concentrated on the response of ceilings under conditions of heating when convection is the main mode of heat transfer to the ceiling. The data obtained were the ceiling temperature as a function of time and position from the fire plume stagnation point. Three ceiling materials were used: Marinite-XL, fiberboard and cold-rolled steel.

701,915
PB88-110812 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Research Needs Identified by the NBS (National Bureau of Standards) Building Rehabilitation Technology Program.
Final rept.,
J. H. Pielert. 1983, 10p
Pub. in Proceedings of the American Society of Civil Engineers Conference Research Needs for Rehabilitation of Structures, Philadelphia, PA., May 18, 1983, 10p.

Keywords: *Buildings, *Rehabilitation, Research management, Standards, Reprints, *Foreign technology.

The rehabilitation of existing buildings has been given special consideration in the research program of the Center for Building Technology of the U.S. National Bureau of Standards. The identified needs and research results are discussed and tied to the formation of the ASCE Standards Committee on Condition Assessment of Existing Buildings. The Committee is developing consensus standards for determining the condition of materials in existing buildings and in other areas related to structural performance. Other related standards development activities currently underway will also be discussed. The paper will provide an overview of the latest thinking on structural research needs for building rehabilitation based on a three year program at NBS.

701,916
PB88-110861 PC **A10**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Catalog of Compartment Fire Model Algorithms and Associated Computer Subroutines,
D. W. Stroup. Aug 87, 204p NBSIR-87/3607

Keywords: *Fires, *Buildings, Subroutines, Algorithms, Catalogs(Publications), Fortran, Computerized simulation, *Compartment fire models.

The Compartment Fire Modeling Research group of the Center for Fire Research, National Bureau of Standards has been charged with the development of a 'benchmark' compartment fire model. As part of this activity, a catalog of available fire model algorithms has been compiled. The catalog contains algorithms which calculate various physical/chemical fire phenomena. The description of each algorithm includes the input(s), output(s), and calculations performed. In addition, each algorithm has a computer subroutine written for it in FORTRAN 77. The variables used as input and output throughout the catalog are cross-referenced. This enables a catalog user to determine which routines would be required to calculate a particular fire phenomena.

701,917
PB88-110911 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Building Technology Publications, Supplement 10: 1985-86.
Final rept.,
K. Hockey. Sep 87, 114p NBSIR-87/3631
See also report for 1984, PB86-110905.

Keywords: *Construction industry, *Buildings, Bibliographies, Abstracts, Structural engineering, Solar heating, Construction materials.

The report presents NBS' Center for Building Technology (CBT) publications for 1985-86. It is the tenth supplement to NBS' Building Technology Publications, and lists (CBT) reports issued during 1985-86. It includes titles of each CBT publication and those papers published in non-NBS media, keyword and author indexes, and general information and instructions on how to order CBT publications.

701,918
PB88-112438 PC **A14**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Investigation of L'Ambiance Plaza Building Collapse in Bridgeport, Connecticut,
C. G. Culver, C. F. Scribner, R. D. Marshall, F. Y. Yokel, and J. L. Gross. Sep 87, 318p NBSIR-87/3640
Sponsored by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Buildings, *Collapse, Investigations, Lift slab construction, Bridgeport(Connecticut).

Results from an investigation to determine the cause of the collapse of the L'Ambiance Plaza building on April 23, 1987 are presented. The building was being constructed using the lift-slab method; collapse occurred during construction. The investigation included on-site inspections immediately following the collapse, review of eyewitness accounts of the collapse, review of project documentation, laboratory and field tests and analyses of the structure. Several potential failure mechanisms were investigated. The most probable cause of the collapse was determined to be loss of support at a lifting jack in the west tower during placement of an upper level package of three floor slabs.

701,919
PB88-113741 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Test Results and Predictions for the Response of Near-Ceiling Sprinkler Links in a Full-Scale Compartment Fire,
L. Y. Cooper, and D. W. Stroup. Sep 87, 46p NBSIR-87/3633
Sponsored by Fire Administration, Emmitsburg, MD.

Keywords: *Fire tests, *Automatic sprinkler systems, Plumes, Smoke, Compartment fires.

The paper presents and analyzes a portion of the data acquired during a test program which involved full-scale, sprinklered, compartment fires. The work here focuses attention specifically on key features of the typical sprinkler link deployment/response problem. It is found that the elevated temperature, upper smoke layer which develops inevitably in compartment fires can have a major impact on the thermal response of sprinkler links. It is shown that traditionally accepted methods of predicting sprinkler link response which do not account for this upper layer can be totally inadequate. Link response predictions used here involve a new method of calculation which does take account of the smoke layer environment.

701,920
PB88-117726 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
In Case of Fire--Use the Stairwells, Elevators Aren't Safe.
Final rept.,
W. Schmidt, and J. Klote. 1982, 5p
Pub. in Specifying Engineer 47, n5 p82-86 May 82.

Keywords: *Fire safety, *Stairways, Elevators(Lifts), Reprints, *Foreign technology, Building fires.

No abstract available.

701,921
PB88-129895 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Economics of Fire Protection: Fast-Response Residential Sprinklers.
Final rept.,
R. T. Ruegg, and S. K. Fuller. 1985, 15p
Pub. in Construction Management and Economics 3, p43-57 1985.

Keywords: *Fire losses, *Benefit cost analysis, *Sprinkler systems, Residential buildings, Fire protection, Reprints.

The paper develops and applies in selected cases a benefit-cost model for evaluating the economic efficiency of providing fire loss mitigation through the use of a newly adapted technology: fast-response, residential sprinkler systems. The model calculates present value net benefits as they would accrue to the owner of a system. The nine selected hypothetical cases pertain to new, single-family dwellings in the United States. The results that are presented here, though based on hypothetical cases, have implications of interest to members of the research and building communities who are concerned about the economics of home fire protection.

701,922
PB88-137096 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
USA Adopts Standard Economic Analyses.
Final rept.,
H. E. Marshall. 1982, 1p
Pub. in Building Research and Practice/Research World, p336 Nov/Dec 82.

Keywords: *Buildings, *Economic analysis, Reprints.

No abstract available.

701,923
PB88-137104 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Subcommittee E06.81 on Building Economics.
Final rept.,
H. E. Marshall. 1982, 5p
Pub. in ASTM (American Society for Testing and Materials) Standardization News 10, n10 p26-30 Oct 82.

Keywords: *Buildings, *Cost effectiveness, Benefit cost analysis, Economic analysis, Reprints.

Subcommittee E06.81 on Building Economics was formed by ASTM in April 1979 to respond to a need by the building community for standard economic methods that would help make buildings more cost effective. The article gives an overview of the subcommittee, including its historical development and objectives, and describes through the words of subcommittee members how economic standards being developed by E06.81 are being used by their organizations.

701,924
PB88-138870 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Heat Transfer in Compartment Fires near Regions of Ceiling Jet-Wall Impingement.
Final rept.,
L. Y. Cooper. 1987, 5p
Sponsored by American Society of Mechanical Engineers, New York.
Pub. in Proceedings of National Heat Transfer Conference (24th), Pittsburgh, PA., August 9-12, 1987, p57-61.

Keywords: *Heat transfer, Ceilings(Architecture), Walls, Jets, Reprints, *Room fires.

The problem of heat transfer to walls from fire plume-driven ceiling jets during compartment fires is introduced. Estimates are obtained for the mass, momentum and enthalpy flux of the ceiling jet immediately upstream of the ceiling-wall junction. An analogy is drawn between the flow dynamics and heat transfer at ceiling jet-wall impingement and at the line impingement of a wall and a two-dimensional, plane, free jet.

701,925
PB88-147764 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Free Burning Fires.
Final rept.,
V. Babrauskas. 1986, 19p
Pub. in Fire Safety Jnl. 11, n1-2 p33-51 1986.

Keywords: Flammability testing, Fabrics, Bedding equipment, Reprints, *Building fires, Room fires.

A review is made of the data available for estimating the burning rates of free-burning fires. Free-burning, in the context, is taken to mean fires in an ambient, wind-free atmosphere, or in a room, but under such conditions that the presence of the room walls and air flow restrictions do not appreciably influence the burning rate. The scope is restricted to combustibles which burn at a sufficient rate to be hazardous in building fires.

701,926
PB88-153333 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Analytical Methods for Fire Safety Design,
J. G. Quintiere. Nov 87, 37p NBSIR-87/3675

Keywords: *Fire safety, *Buildings, Design, Models, Bibliographies, Reviews, Predictions.

The ability to predict aspects of fire and its impact on a building's structure, contents and people is discussed in terms of its application to safety design. It is presented from the perspective of how research has addressed the prediction of fire phenomena. A review of the state of the art on the capability for predicting the fire, its impact and response, is given. Examples are cited to illustrate the scope and accuracy of predictive methods and how they are being incorporated into some codes and standards.

701,927
PB88-153804 PC **A09**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Summaries of Center for Fire Research (of the National Bureau of Standards) In-House Programs and Grants - 1987,
S. M. Cherry. Oct 87, 180p NBSIR-87/3650
See also report for 1986, PB87-181996.

Keywords: *Combustion, Research, Programs, Grants, Smoke, Soot, Toxicity, Cellulose, Charring, Fire models, Flame spread, *Fire research, National Bureau of Standards.

The report was prepared for distribution at the Combined Meetings of the Eastern Section: The Combustion Institute and the Annual Conference on Fire Research, November 2-5, 1987. It contains descriptions of the internal programs of the Center for Fire Research as well as extended abstracts of grants for fire research sponsored by the Center for Fire Research.

701,928
PB88-153812 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Algorithm for the Mass-Loss Rate of a Burning Wall,
H. E. Mitler. Dec 87, 27p NBSIR-87/3682

Keywords: *Algorithms, *Burning rate, *Walls, *Fires, Computerized simulation, Room fires.

A derivation is given for a simple algorithm which yields the quasi-steady burning rate of a vertical panel of non-charring, non-melting material in an enclosure with stratification of temperature and oxygen concentration. The algorithm requires the solution of a transcendental equation; it is suggested that this be done by successive approximations. Among the thermophysical data which are needed, are the mean flame temperature and the height-dependent absorption coefficient K(Z). It is found from experiment that K(Z) is well described for PMMA by a two-parameter expression linear in 1/Z. Comparison with a transient experiment yields good agreement over much of the ranges.

701,929
PB88-156088 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
EXITT - A Simulation Model of Occupant Decisions and Actions in Residential Fires: Users Guide and Program Description,
B. M. Levin. Jul 87, 81p NBSIR-87/3591

Keywords: *Decision making, Behavior, Computerized simulation, Escape(Abandonment), Smoke, Human behavior, Response time, Residential buildings, *Building fires.

EXITT is a computer model that simulates the decisions and actions of occupants in a residence. This model can be used to determine the locations of the occupants during the progress of a given fire. The rules for the action choices of the occupants are based largely on studies of residential fires and to a lesser extent on relevant controlled experiments. These rules involve consideration of the smoke conditions, and the characteristics, capabilities and locations of the occupants. EXITT can be run on a personal computer and does not require user training-- the user controls the model by answering simple questions that appear on the screen. It can be run with pre-selected scenarios and, also, with buildings, fires and occupants selected by the user.

BUSINESS & ECONOMICS

Banking & Finance

701,930
PB81-103582 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Evaluating the Impact of Securities Regulation on Venture Capital Markets.
J. R. Barth, J. J. Cordes, and G. Tassey. Jun 80, 46p NBS-MONO-166
Prepared in cooperation with George Washington Univ., Washington, DC. Dept. of Economics. Library of Congress catalog card no. 80-600036.

Keywords: *Regulations, *Capital, Investments, Assets, Government policies, National government, Fixed investment, Working capital, Return on investment, Benefit cost analysis, Prices, Market value, Economic models, *Venture capital, *Securities Exchange Commission, Stocks(Finance), Bonds(Finance).

A detailed and analytical assessment is provided of the economic techniques used by researchers to evaluate the efficiency of capital markets. The application of these techniques to that portion of the capital market which supplies venture funds to small, technology-based firms is emphasized. The primary elements of such analysis are the efficient market hypothesis and the capital asset pricing model. The empirical analogue of the latter is commonly referred to as the market model. The important SEC regulations and the analytical approaches to assessing their impacts on capital market efficiency are discussed. Because such analysis cannot be effectively utilized by policymakers such as the SEC if it is conducted on an ad hoc basis or in isolation of the decision-making process, a monitoring system is described, which is based on the market model and which is designed to provide timely and decision-relevant information to the SEC.

701,931
PB84-114875 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Recommended Practice for Measuring Net Benefits and Internal Rates of Return for Investments in Buildings and Building Systems.
Final rept.
H. E. Marshall. Oct 83, 76p NBSIR-83-2657

Keywords: *Investments, *Return on investment, *Buildings, *Savings, Present worth, Cost effectiveness, Benefit cost analysis, Construction costs.

The report describes formulas for calculating net benefits and the internal rate of return, their applications in selecting cost-effective projects, and limitations in their use. This recommended practice for measuring net benefits and internal rates of return will assist the private and public building communities in making cost-effective decisions in the design, operation, maintenance, and retrofit of buildings.

Consumer Affairs

701,932
PB-264 919/2 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Experimental Technology Incentives Program.
Proceedings of a Symposium: Communicating for Product Improvement, October 13-14, 1976.
Final rept.,
C. Hulick. Feb 77, 52p NBSIR-77-1221
Sponsored in part by Federal Supply Service, Washington, D.C., National Association of State Purchasing Officials, Lexington, Ky., and National Inst. of Governmental Purchasing, Inc., Washington, D.C.

Keywords: *Product development, *Technology innovation, *Government procurement, *Meetings, Improvement, User needs, Federal supply items, Standards, Regulations, Research, Government policies, Guidelines, Cost effectiveness, Energy conservation, Industries, Communicating.

The general objective of the conference was to establish a continuing dialogue between private industry and government agencies on the ways and means of product improvement, placing particular emphasis on methods of communicating specific product needs to manufacturers and making purchasing offices more responsive to these needs at the Federal, state and local level. Workshops were organized to consider Product Improvement System, User Need and Industry Response, Procurement Incentives and Techniques, and The Role of Professional Organizations. Reports and recommendations of these Workshops are included.

701,933
PB-265 697/3 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Consumer Product Technology.
Life Cycle Costing: An Assessment of Practicability for Consumer Products.
Final rept. Jul 75-Sep 76,
S. W. Stiefel, S. J. Kim, and H. Hung. Dec 76, 67p NBSIR-77-1212

Keywords: *Consumer affairs, *Commodities, *Cost estimates, Service life, Performance tests, Policies, *Life cycle costs, *Consumer products, Life tests.

The report assesses the practicability for applying the life cycle costing (LCC) approach to consumer products. The report provides a basis for understanding the potential for application, benefits and effects of LCC; the basic concept of LCC; its interaction with performance, and the state-of-the-art of life testing as it relates to developing extended performance test methods for consumer products. The report reviews information now obtainable and barriers to labeling consumer products with LCC information. An observation is made that application of LCC to consumer products is not immediately practicable. The basic areas requiring futher investigation are identified, long term research goals are suggested and activities deserving immediate attention are described.

701,934
PB-265 961/3 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Human Factors Section.

Consumer Product Portability as Related to Warranty Rulemaking.
Final rept.,
J. J. Kramer, and P. G. Meguire. Jun 76, 92p NBSIR-76-1092
Sponsored in part by Federal Trade Commission, Washington, D.C. Div. of Special Statutes.

Keywords: *Consumer affairs, *Commodities, Regulations, Tests, Surveys, Recommendations, Mobility, *Product warranties, *Portability.

The Federal Trade Commission (FTC) has the responsibility for determining what may be reasonably expected of consumers in their fulfillment of the terms of a consumer product warranty. Such determination necessitates, in part, providing an empirical basis for defining and quantifying various factors influencing product portability. This report discusses the problem of defining consumer product portability within the context of a consumer product return activity, offers a working definition of product portability within this context, summarizes and discusses the results and utility of previous portability related studies, and describes the results of a controlled experiment which more directly relates to the task of establishing maximum reasonable product weight for a consumer product return activity. Statistically significant differences in maximum reasonable product weight were found for the variables of method of product carry and sex of customer. No statistically significant differences were found for the variables of consumer age and product size (at least for the sizes chosen for study). Distributions of maximum reasonable weight for product return are presented and recommendations for warranty rulemaking are given.

701,935
PB-266 861/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Product Safety: In What Direction Should We Be Going,
W. G. Leight. 1977, 3p
Pub. in Prof. Safety, v22 n5 p25-27 May 77.

Keywords: *Consumer affairs, *Commodities, *Safety, Industrial engineering, Economic factors, Technology, Human factors engineering, Public law, Surveys, Behavior, Research, Improvement, Consumer protection, *Product safety, Legal aspects, Reprints.

Product safety improvements entail interactions of legal, technical, and economic factors. The author explains 'where we are and should be headed' from the vantage point of a technical researcher.

701,936
PB-267 609/6 PC **A09**/MF **A01**
National Bureau of Standards, Washington, D.C. Product Systems Analysis Div.
Tabulation of Voluntary Standards and Certification Programs for Consumer Products.
Final technical note,
W. J. Slattery. Jun 77, 190p NBS-TN-948
See also report dated Mar 73, COM-73-50243.

Keywords: *Consumer affairs, *Product development, Standards, Product safety, Performance, Kitchen equipment and supplies, Heating equipment, Ventilators, Air conditioning equipment, Tools, Construction materials, Indexes(Documentation), *Consumer products, Household goods, *Product standards, Industrial standards, Certification.

The tabulation lists over 1000 product areas and over 2000 standards titles covering products found in and around the home. (The major consumer product areas not included are foods, beverages, and drugs.) The tabulation also indicates the applicable national, industrial, and international standards which deal primarily with either safety or performance or both aspects of the products listed. For some of the product areas, there are no applicable standards. Available information on certification programs and standards under development, and the Standard Industrial Classification (SIC) numbers for the products is also provided.

701,937
PB-268 536/0 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
Proceedings of a Workshop on Rare Event/Accident Research Methodology Held at Gaithersburg, Maryland on May 26-28, 1976.
Final rept.,
V. J. Pezoldt. Jul 77, 115p NBS-SP-482
Library of Congress catalog card no. 77-608110.

Keywords: *Consumer affairs, *Accidents, *Human factors engineering, *Meetings, Safety engineering, Research, Injuries, Methodology, Accident prevention, Simulation, Standards, Product safety.

The volume contains the formal papers presented at a Workshop on Rare Event/Accident Research Methodology sponsored by the Human Factors Section of the Center for Consumer Product Technology, National Bureau of Standards held at NBS May 26-28, 1976. The topics addressed at the workshop and reflected in the papers in this volume include system safety engineering, hypothesis generation in accident research, epidemiological approaches to injury research, observational techniques for studying complex tasks, accident simulation, and methodological considerations being forced by the law.

701,938
PB-268 902/4 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Measurement of Fabric Flammability Parameters in Movement Simulation Experiments.
Final rept.,
E. A. Zawistowski, J. F. Krasny, E. Braun, R. Peacock, and N. Williams. Jun 77, 27p NBSIR-77-1236

Keywords: *Accidents, *Fabrics, *Flammability, Clothing, Tests, Fires, Heat transfer, Injuries, Cotton fabrics, Apparel fabrics, Synthetic fibers.

The paper describes results of experiments simulating the phenomena occurring during burns of apparel items. Fabrics were burned near a semicylinder which was covered by 54 heat sensors. The areas which received various heat loads (corresponding to various depth of burn injury in real-life flammable garment accidents) were recorded. In most cases, the semicylinder was moved during the burn, so that the burning fabrics made contact with it, simulating movement by the victim during a garment burn. This caused rapid extinguishment in some but not all fabrics. Results are reported for 40 fabrics varying in fiber content, and fabric construction and weight.

701,939
PB-270 969/9 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
New Portable Tester for the Evaluation of the Slip-Resistance of Walkway Surfaces.
Final rept.,
R. J. Brungraber. Jul 77, 57p NBS-TN-953
See also report dated Jan 76, PB-248 985.

Keywords: *Houses, *Floors, *Skid resistance, *Test equipment, Accident investigations, Safety, Public buildings, Friction, Surface properties, Tests, Calibration.

The paper describes the available devices for testing the slip-resistance developed between walkway surfaces and shoe sole or heel materials. The limitations of available testers are detailed, and the need for a more reliable tester that can be used on actual floors under true field conditions, such as in the presence of water, is shown. The design and development of the new NBS-Brungraber Slip-Resistance Tester is described, including a discussion of the test programs that were employed to evaluate it.

701,940
PB-271 172/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
House That NBS Built.
Final rept.,
J. V. Fechter, and H. P. Van Cott. 1977, 8p
Pub. in Jnl. Consumer Studies and Home Econom., v1 n2 p101-108 Jun 77.

Keywords: *Test facilities, *Product safety, *Consumer affairs, Tests, Electric appliances, Ovens, Kitchen equipment and supplies, Human factors engineering, Energy conservation, Visual aids, Television systems, Monitors, Data acquisition, National Bureau of Standards.

In 1974 the National Bureau of Standards established the Center for Consumer Product Technology to conduct product performance, safety and energy research. The Center's Human Factors Section operates a laboratory in a homelike setting for its studies of consumer product use. Video, audio, direct visual observation and computer compatible appliance data monitoring are among the data collection techniques available. A study of the energy consumption used in cooking meals on gas and electric ovens illustrates how the facility is being used.

701,941
PB-273 120/6 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Comparison of Two Testers in Evaluating the Slip-Resistance of Bathtub and Shower Base Surfaces.
Interim rept.,
R. J. Brungraber, and T. J. R. Raper. Oct 77, 60p NBSIR-76-1005
Sponsored in part by Consumer Product Safety Commission, Bethesda, Md.

Keywords: *Test equipment, *Skid resistance, *Product safety, Standards, Safety engineering, Tests, Evaluation, Surface properties, *Bathtubs, *Showers, Kollsman testers, NBS-Brungraber testers.

The report describes a program of tests on Safety Standards for Bathtub and Shower Structures, conducted at the National Bureau of Standards for the purpose of comparing the NBS-Brungraber and the Kollsman tester with respect to their effectiveness in evaluating the slip-resistance of bathtub and shower base surfaces. The program represents a contribution by the National Bureau of Standards to the efforts of the American Society for Testing and Materials and the Consumer Product Safety Commission in developing safety standards for bathrooms and bathroom fixtures. Both testers employ the same material to simulate human skin, and the report concludes that both testers will satisfactorily discriminate between different bathroom surfaces on the basis of slip-resistance. The conclusion may be made that the NBS-Brungraber tester is considerably more convenient to use.

701,942
PB-273 933/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Human Factors Support of a Lawn Mower Safety Standard.
Final rept.,
V. J. Pezoldt, J. J. Persensky, and A. M. Ramey. 1977, 20p
Pub. in Proceedings of International System Safety Conference (3rd), Washington, D.C., 17-21 Oct 77 p3-22 1977.

Keywords: *Product safety, Standards, Controllers, Safety devices, Human factors engineering, *Lawn mowers, Safety standards.

Among the tasks performed by the National Bureau of Standards' Center for Consumer Product Technology is providing technical support to federal regulatory agencies. To illustrate this activity, three empirical studies performed by the Human Factors Section are summarized. Each of the studies was undertaken in support of the Consumer Product Safety Commission's development of a power lawn mower safety standard. The studies involve: (1) Determination of an ergonomically sound time for blade stopping after release of a dead-man control; (2) development of an objective measure of the subjective judgment of 'easy' as it relates to manually starting lawn mowers; and (3) evaluation of foot simulator probes for use in a blade contact performance test.

701,943
PB-275 435/6 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Resistance of Human Skin to Puncture and Laceration.
Interim rept. 27 Apr-30 Oct 72,
B. J. McGuire, J. R. Sorrells, and J. D. Moore. 10 Feb 73, 51p NBSIR-73-123
Sponsored in part by Food and Drug Administration, Bethesda, Md. Bureau of Product Safety.

Keywords: *Skin(Anatomy), *Product safety, *Hazardous materials, Mechanical properties, Tensile strength, Elastic properties, Puncture resistance, Impact strength, Wounds, Age, Tests, Materials handling, Humans, Children, Pigskin, *Toys.

In support of the Bureau of Product Safety's program to improve toy safety, the NBS Product Evaluation Technology Division has been studying the problem of determining the degree of hazard associated with the use of toys having points and edges of various degrees of sharpness. The final goal of this project is to

develop a definition of and a simple test method or device that will differentiate between 'hazardous' and 'non-hazardous' toy configurations. The present report, third in the series, provides further discussion of the general problem area, additional data on the physical properties of human skin and gives results of tests to measure hand-toy impact velocities and the cutting effects of sheared steel edges on pigskin at appropriate impact velocities. Some preliminary information on the puncture resistance of pigskin under dynamic conditions is also given.

701,944
PB-275 617/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Product Technology and the Consumer.
Final rept.,
G. F. Montgomery. Dec 77, 8p
Pub. in Scientific American, v237 n6 p47-54 Dec 77.

Keywords: *Consumer affairs, *Product safety, Human behavior, Performance, Technology, Expenses, Design, Reprints, *Consumer products, Consumer behavior, Energy consumption.

Performance of consumer products is the concern of buyer, manufacturer and government alike. There is new emphasis on product safety, energy use, and lifetime cost, and in providing the buyer with information that will help him to make rational product choices. Product designs that eliminate danger from surface burns and electric shock, for example, are well understood, as are many of the details of home appliance operation that affect energy use and operating costs. But knowledge concerning the safety and energy efficiency of many products is incomplete, as is the detailed understanding of the effects of user habits on safety and energy economy. New research is uncovering both questions and answers.

701,945
PB-281 537/1 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Full-Scale Burning Behavior of Curtains and Draperies.
Final rept.,
L. D. Moore. Mar 78, 45p NBSIR-78-1448
Prepared in cooperation with Pittsburgh Plate Glass Co., Pa.

Keywords: *Curtains, *Burning rate, *Fires, Flammability, Household fabrics, Flame propagation, Ignition, Walls, Smoke, Combustion products, Toxicity, Gases, Hazards, Heat flux, Research, Fire prevention.

To better understand the burning in room fire development, 38 full-scale drapery and curtain burn experiments were conducted in a 3 x 4.9 m (10 x 16 ft) room. The variables investigated included fabric and lining type, fabric weight, and position of the draperies (open vs closed). As each burning experiment progressed a number of conditions were continuously monitored such as rate of drapery consumption, air temperature increase, smoke and toxic gas generation, and radiant energy developed. Ignition of sample wall and ceiling panels was also monitored.

701,946
PB-281 628/8 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Product Systems Analysis Div.
Product Selection for the Voluntary Consumer Product Information Labeling Program.
Final rept.,
E. C. McDowell, E. M. Robertson, and S. M. Spivak. Mar 78, 57p NBSIR-78-1450
Prepared in cooperation with Maryland Univ., College Park. Dept. of Textiles and Consumer Economics.

Keywords: *Consumer affairs, *Labels, Project management, Selection, Product safety, Information, Design criteria, Product information, *Product labeling.

The U.S. Department of Commerce has commenced a voluntary consumer product information labeling program (CPILP). Any person may propose products to be labeled under that program. This document presents a method for screening proposed products to determine whether they are appropriate for labeling. The method also provides a foundation for documenting a finding of need for a label.

701,947
PB-281 878/9 PC **A09**/MF **A01**
National Measurement Lab. (NBS), Washington, D.C.
MFPG: Product Durability and Life,
T. R. Shives, and W. A. Willard. May 78, 188p NBS-SP-514
Proc of the Meeting of the Mechanical Failures Prevention Group (MFPG) (27th), Held at NBS, Gaithersburg, MD on Nov 1-3, 1977. Library of Congress Cat Card no 78-606044. Spons in part by Office of Naval Research, Arl, VA, Naval Air Develop. Cntr, Warminster, PA, NASA, Greenbelt, MD. Goddard Space Flight Cntr, and Dept of Energy, Wsh, DC. Fossil Energy. See also PB-272 848.

Keywords: *Consumer affairs, *Meetings, *Durability, Mechanical tests, Failure, Standards, Wear tests, *Consumer products, Product labeling.

These proceedings consist of a group of nineteen submitted papers from the 27th meeting of the Mechanical Failures Prevention Group which was held at the National Bureau of Standards in Gaithersburg, Maryland, on November 1-3, 1977. The central theme of the proceedings pertains to the durability of consumer products. Special emphasis is on durability technology, product testing, product performance, the economics of extending product life, and labeling products for durability.

701,948
PB-282 875/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Experimental Approach to Procurement Policy Research.
Final rept.,
C. Hulick, and J. Berke. Nov 76, 10p
Pub. in Proceedings of Annual DOD Procurement Research Conference (5th), Monterey, Calif. 17-19 Nov 76 p148-157 (Naval Postgraduate School, Monterey, Calif.) Nov 76.

Keywords: *Product development, *Technology innovation, *Government procurement, *Meetings, Incentives, Competition, Air conditioners, Water heaters, Refrigerators, Government policies, Industries, State government, Local government, Life cycle costs, Federal agencies, Lawn mowers.

The ETIP Procurement Program through procurement experiments with participating government agencies is testing the hypothesis that government procurement can stimulate private sector technological innovation by the use of procurement incentives such as life cycle costing, performance specifications and value incentive provisions. The products involved in these experiments are commercial in nature. Examples of participating agencies are, at the Federal level, GSA and VA, and at the state and local level respectively, the National Association of State Purchasing Officials (NASPO) and the National Institute of Government Purchasing (NIGP). Procurement experiments to date have used life cycle costing in the purchase of home appliances (window air conditioners, hot water heaters, refrigerators), printer ribbons, and performance specifications in the purchase of lawnmowers, oxygen producers, and reflective sheeting. Results thus far indicate that government's use of procurement incentives is an effective method of increasing competition and obtaining product innovation for the government market. The short term goal of the participating agencies, buying the most current technology available, has been met, and in doing so, the necessary climate for the long term ETIP goal, private sector technological innovation, has been created.

701,949
PB-282 884/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Procurement Incentives and the Innovation Process,
C. Hulick, and J. G. Berke. 1976, 4p
Pub. in Proceedings of 1976 International Conference on Procurement and Grants Management, Charlottesville, Va. 28-30 Apr 76 p165-168 1976.

Keywords: *Product development, *Technology innovation, *Government procurement, *Meetings, Incentives, Local government, State government, States(United States), Government policies, Purchasing, Cost plus contracts, Air conditioners, Refrigerators, Freezers, Water heaters, Electric stoves, Warranties, Life cycle costs.

The paper discusses the process of information interchange and industry-government interaction and its effects on new product innovation and technological change. Specifically, it reviews the philosophy and objectives of ETIP and how these are carried out through actual procurement experiments. Policies addressed include performance spec. purchasing, life cycle costing, value incentive clauses, plus such new incentives as warranties, innovative unsolicited proposals, and cost plus contracting for product improvement. References include studies on specific products as air conditioners, hot water heaters, gas and electric ranges and refrigerator-freezers.

701,950
PB-284 495/9 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Consumer Sciences Div.
Application of Life Cycle Costing to Hand-Held Hair Dryers: A Field Demonstration for Small Appliances.
Final rept.,
S. W. Stiefel, P. C. Goodman, and W. B. Beine. May 78, 51p NBSIR-78-1500

Keywords: *Electric appliances, *Consumer affairs, Utilization, Maintenance, Surveys, Service life, *Hair dryers, Life cycle costs.

The report describes a demonstration project on hair dryers which applied the life cycle costing technique to a small appliance where the consumer is a significant factor in its usage. The field data collection techniques described are: including an experiment to collect use, energy consumption and repair data from participants provided with specially instrumented hair dryers. Repair and repair cost data were also obtained from collecting used hair dryers for failure mode analysis and from repair agency surveys. The lessons learned provide insights into the application of the life cycle costing technique to other small appliances. This study indicated individuals recalled estimates for usage significantly exceed the metered values. It is important, therefore, that measurement instruments be used as much as possible to collect usage data. The importance of developing test methods based upon controlled field use experience was in part substantiated by the inability to obtain failure rate data. Some of the individuals who contributed failed hair dryers still under warranty did not want to be troubled by the nuisance, delay and expense involved with obtaining a repair. If such an attitude is pervasive, feedback of failure rate data for inexpensive appliances may be incomplete even during warranty periods.

701,951
PB-285 173/1 PC **A11**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Back-Up Report for the Proposed Standard for the Flammability (Cigarette Ignition Resistance) of Upholstered Furniture, PFF 6-76.
Final rept.,
J. J. Loftus. Jun 78, 232p NBSIR-78-1438

Keywords: *Flammability testing, *Upholstery, *Furniture, *Consumer affairs, Fire resistant textiles, Fabrics, Standards, Ignition, Fire safety, Cigarettes.

The report brings together data, information, and reports generated by the Center for Fire Research (CFR) at the National Bureau of Standards (NBS) and by others during four years of work on the development of the test method. All of this information was used in the preparation of a recommended Proposed Standard for the Flammability (Cigarette Ignition Resistance) of Upholstered Furniture, PFF 6-76.

701,952
PB-287 861/9 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Product Safety Technology Div.
Cutting Experiments with Plastic Edges.
S. K. Wakamiya. Jun 78, 40p NBSIR-78-1493
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Consumer affairs, *Product safety, *Plastics, *Cutting, Skin(Anatomy), Wounds and injuries, Swine, Experimental data, Hazards, Children, Toys.

An investigation was conducted to determine the skin lacerating ability of plastic edges. The purpose of this study was to obtain quantitative experimental data on which to base a test procedure and a safety criteria for identifying potentially hazardous plastic edges found on toys and children's articles. A variety of plastic edges including plastic replicas of edges taken from toys were used to cut excised, defatted pig skin. Cut-

ting experiments were performed at various forces and velocities and the depth of the resulting cuts were measured. Test results indicate that over the range 5 cm/s to 127 cm/s the relative velocity between the test edge and the skin sample apparently does not significantly affect the cutting of skin whereas the normal force exerted by the edge on the skin has a definite effect on the cutting performance of plastic edges. The experimental data obtained in this study shows that there are some types of plastic materials, which when broken, form edges with lacerating abilities similar to that of the reference sheared steel edges, which were judged 'marginally safe' when tested with the Consumer Product Safety Commission (CPSC) Metal Sharp Edge Test. However, the results of this study indicate that most plastic edges found on toys are less likely to cause laceration injuries than these reference steel edges. (Portions of this document are not fully legible)

701,953
PB-289 021/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Lawnmower Safety Research.
Final rept.
V. J. Pezoldt, J. J. Persensky, and A. M. RameySmith. 1978, 5p
Pub. in Proceedings Human Factors Society Annual Meeting (22nd), Held at Detroit, MI on Oct 16-19, 1978 p659-663 (Human Factors Society, Santa Monica, CA. 1978).

Keywords: *Consumer affairs, *Human factors engineering, *Power equipment, *Product safety, Standards, Evaluation, Requirements, Regulations, *Lawn mowers.

The Human Factors Group at the National Bureau of Standards (NBS) has supported the Consumer Product Safety Commission (CPSC) during the development and evaluation of a power lawn mower safety standard. The support provided CPSC with data concerning how lawn mower users interact with power mowers. Three studies assisted CPSC in resolving specific questions concerning requirements in the proposed safety regulation based on a report from Consumers Union.

701,954
PB-290 012/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Technical Support for a Slip-Resistance Standard.
Final rept.
R. J. Brungraber, and S. C. Adler. 1978, 9p
Pub. in Am. Soc. Test. Mater., Spec. Tech. Publ. 649, p40-48, 1978.

Keywords: *Skid resistance, *Consumer products, *Product safety, Friction, Surface properties, Standards, Performance evaluation, Performance tests, Safety engineering, *Bathtubs, Shower bases.

In the spring of 1975, ASTM Subcommittee F15.03.01--Specifications and Test Methods for Slip-Resistance of Bathing Facilities, requested technical assistance from the Building Safety Section (BSS) of the National Bureau of Standards (NBS) in developing a performance test for quantitatively establishing an acceptable level of slip-resistance for bathtubs and shower bases. Close cooperation between the subcommittee members and the BSS staff, coupled with financial support from the Consumer Product Safety Commission (CPSC), resulted in the development of a performance test which approximates the conditions that are likely to occur on bathtub or shower base surfaces, is reliable, repeatable, and adequately discriminates between currently available bathtub and shower base materials.

701,955
PB-297 641/3 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Human Factors Section.
Power Lawn Mowers: Time-to-Blade Access.
Final rept.
A. M. Ramey, and J. J. Persensky. May 77, 27p NBSIR-77-1299
Sponsored in part by Consumer Product Safety Commission, Washington, DC.

Keywords: *Consumer affairs, *Product safety, Blades, Stopping, Deceleration, Rotation, Standards, Tests, Protection, Reaction time, *Lawn mowers, Human factors.

The document is the final report for the Consumer Product Safety Commission of an investigation of time-to-blade access for walk-behind power mowers. The problem studied was: How long after the dead-man control is released should a lawn mower blade be allowed to rotate. The Human Factors Section at NBS performed this empirical study of operator movement time to determine an ergonomically sound recommendation for blade stopping time. One hundred participants were tested using a reaction time device designed to measure mower users' approach times to various areas of potential blade contact. The test apparatus permitted measurement of both reaction time--or time to release a simulated dead-man control at the onset of a cue light and, more importantly, movement time--or the time from the release of the dead-man control to activation of one of five switches in the blade access area. Analysis of the data reveal no statistically significant differences in reaction time as a function of movement distance. As expected, however, movement time does increase linearly as movement distance increases. The range of average movement times observed was from 0.6 to 3.3 seconds. The median movement time at the shortest and longest distances were 1.4 and 2.2 seconds respectively. An inspection of percentile information for movement time suggests a blade-stopping time of 0.7 seconds in order to protect the maximum number of people.

701,956
PB-297 705/6 PC **A08**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Decision Analysis of Strategies for Reducing Upholstered Furniture Fire Losses.
Final rept.
S. G. Helzer, B. Buchbinder, and F. L. Offensend. Jun 79, 158p NBS-TN-1101
Prepared in cooperation with SRI International, Menlo Park, CA. Decision Analysis Group.

Keywords: *Five protection, *Furniture, *Residential buildings, Detectors, Installation, Benefit cost analysis, Mathematical models, Evaluation, Upholstery, Standards, Consumer affairs, Fire prevention, Fire safety, Smoke detectors.

Decision analysis is used to evaluate alternative strategies for reducing residential upholstered furniture fire losses. Three alternatives are evaluated: no-action, mandatory smoke detector installation, and the proposed upholstered furniture standard under consideration by the Consumer Product Safety Commission. Quantitative models are developed to assess fire losses and costs under each alternative. The alternatives are evaluated on the basis of minimizing the total cost plus loss to society over time. The analysis shows that the detector alternative and the proposed standard are essentially equivalent and preferred to the no-action alternative. The proposed standard is more effective in saving lives, whereas the detector alternative is less costly to implement. The sensitivity of the results to key assumptions and input parameters is tested. The results are shown to be particularly sensitive to the cost of the proposed standard, the loss of life value assignment, and the upholstered furniture replacement pattern.

701,957
PB-300 573/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Technical Support for a Slip-Resistance Standard.
Final rept.
R. J. Brungraber, and S. C. Adler. 1978, 9p
Pub. in Proceedings of American Society for Testing and Materials Symposium on Walkway Surfaces: Measurement of Slip-Resistance, Denver, CO., June 30, 1977, American Society for Testing and Materials, Special Technical Pub. 649, p40-48 1978.

Keywords: *Skid resistance, Surface properties, Standards, Performance tests, Materials, Floors, Product safety, Consumer products, *Bathtubs, *Showers, Bathroom products.

In the spring of 1975, ASTM Subcommittee F15.03.01 on Specifications and Test Methods for Slip Resistance of Bathing Facilities, requested technical assistance from the Building Safety Section (BSS) of the National Bureau of Standards (NBS) in developing a performance test for establishing quantitatively an acceptable level of slip resistance for bathtubs and shower bases. Close cooperation between the subcommittee members and the BSS staff, coupled with financia support from the Consumer Product Safety Commission (CPSC), resulted in the development of a performance test which approximates the conditions that are likely to occur on bathtub or shower base surfaces is reliable and repeatable, and discriminates adequately between currently available bathtub and shower base materials.

701,958
PB77-600051 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Marking of Gold Filled and Rolled Gold Plate Articles Other Than Watchcases.
C. W. Devereux. 1977, 6p NBS-PS-67/76

Keywords: *Jewelry, *Labelling, *Gold filled, Gold Overlay, Gold Plate, *Rolled Gold Plate.

This voluntary Product Standard covers the marking of gold filled and rolled gold plate articles other than watchcases, as herin defined, offered for sale in the United States of America. Requirements include application of quality marks, 'Rolled Gold Filled,' 'Gold Overlay,' 'Gold Plate,' and/or 'Rolled Gold Plate' to articles made of other metals. Definitions of trade terms used and methods for identifying products that comply with the standard are included.

701,959
PB77-600052 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Marking of Articles Made of Silver in Combination With Gold.
C. W. Devereux. 1977, 6p NBS-PS-68/76

Keywords: *Jewelry, *Silver/Gold, *Labelling.

This voluntary Product Standard covers the marking of articles made of silver in combination with gold, as herein defined, offered for sale in the United States of America. Requirements are given for the marking of articles made of two metals. Definitions of trade terms used and methods for identifying products that comply with this standard are included.

701,960
PB77-600053 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Marking of Articles Made Wholly or in Part of Platinum.
C. W. Devereux. 1977, 6p NBS-PS-69/76

Keywords: Iridium, *Labelling, Jewelry, Osmium, Palladium, *Platinum, Rhodium, Ruthenium.

This Voluntary Product Standard covers the marking of articles made wholly or in part of platinum, as defined herin, offered for sale in the United States of America. Requirements given apply to marking of 'Platinum,' 'Iridum,' 'Palladium,' 'Ruthenium,' 'Rhodium,' and/or 'Osmium.' Definitions of trade terms used and methods for identifying products that comply with the standard are included.

701,961
PB77-600054 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Marking of Articles Made of Karat Gold.
C. W. Devereux. 1977, 6p NBS-PS-70/76

Keywords: *Jewelry, *Labelling, Karat, *Karat gold, Kt, Kt gold, K, K gold.

This voluntary Product Standard covers the marking of articles made of karat gold, as herein defined, offered for sale in the United States of America. Requirements are given for the marking of 'Karat,' 'Karat gold,' 'Kt,' 'Kt gold,' 'K,' or 'K gold,' preceded by a whole number. Definitions of trade terms used and methods for identifying products that comply with this standard are included.

701,962
PB77-600055 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Marking of Jewelry and Novelties of Silver.
C. W. Devereux. 1977, 11p NBS-PS-71/76

Keywords: Coin, Coin Silver, *Labelling, *Jewelry, *Silver, Novelties, Silver, Sterling Silver, Silver, Solid Silver.

This voluntary Product Standard covers the marking of jewelry and novelties of silver, as herein defined, (other than flatware, hollow-ware, and toilet ware) offered for sale in the United States of America. Requirements are given for marking of 'Sterling Silver,' 'Silver,' or 'Solid Silver' and for the marking of 'Coin' or 'Coin Silver.' Definitions of trade terms used and methods

for identifying products that comply with this standard are included.

701,963
PB77-600056 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Toy Safety.
J. M. Tascher. 1977, 30p NBS-PS-72/76

Keywords: Cautionary labeling for toys, Hazardous characteristics of toys, Safety, Toy, *Toy safety, Consumer affairs, Consumer affairs.

The purpose of this Voluntary Product Standard is to establish nationally recognized safety requirements for toys intended for use by children in age groups through 14 years. The standard relates to possible hazards that may not be readily recognized by the public, and which may be encountered in the normal use for which a toy is intended, or after reasonably foreseeable abuse. Requirements are included for material quality; flammability; toxicology; packaging film; strings and elastics; electrical/thermal energy; impulsive noise; edges; hazardous points; projections; wheels, tires, and axles, folding mechanisms and hinges; holes, clearances, and protection of mechanisms; stability of ride-on toys and seats; overload requirements for ride-on toys and seats; tipping of stationary floor toys; confined spaces; small objects; simulated protective devices, such as helmets, hats, and goggles; projectiles; and labeling, literature, and marking.

701,964
PB79-600052 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Methodology of Product Life Testing.
J. Cohen. 1978, 11p
Pub. in Proceedings 27th Meeting of the Mechanical Failures Prevention Group, Gaithersburg, MD, Nov. 1-3, 1977, p31-41 1978.

Keywords: *Consumer products, Reliability engineering, Testing methodology, useful life.

A methodology was formulated for estimating, through laboratory testing, useful life and associated performance of consumer products. Excerpts from two key parts--concepts of reliability engineering and procedure to guide the formulation of tests--are given here. Criteria for assessing tests are presented.

701,965
PB80-117922 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Bibliography on the Voluntary Standards System and Product Certification.
Final rept.,
C. A. Chapman. Oct 79, 29p NBSIR-79-1900

Keywords: *Standards, *Bibliographies, Regulations, Buildings, Building codes, Product safety, Furniture, Standardization, Environmental surveys, Pollution, Solar heating, Industries, Foreign countries, Product standards, Product liability, Certification, National Bureau of Standards, Energy conservation, Environment management.

The bibliography lists references accumulated by the NBS Office of Engineering Standards in the course of its research into the working of the voluntary standards system and the economic and legal effects of standards. The first portion of the bibliography lists references alphabetically by author. The second portion groups references by subject. Subject categories include: standards system reform, regulatory use of standards (buildings, safety, environment), certification and laboratory accreditation, solar heating and cooling, product liability, and international and foreign.

701,966
PB80-134265 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Applied Technology.
Methodology for Testing Life-Cycle Performance of Consumer Products.
Final rept.,
J. Cohen. Aug 76, 46p NBSIR-76-1157

Keywords: *Consumer affairs, Performance evaluation, Life cycles, Reliability, Tests, *Consumer products.

Life-cycle performance testing of consumer products attempts to predict a probable useful life and to assess the performance during that time duration. A methodology--working cocepts, terminology, rules, and procedures--to help accomplish this aim is presented. A glossary and an annotated bibliography are included.

701,967
PB80-157555 Not available NTIS
National Bureau of Standards, Washington, DC.
Life Cycle Performance of Clothes Dryers.
Final rept.,
J. Cohen. 1980, 4p
Pub. in Annual Reliability and Maintainability Symp., Held at San Francisco, CA on Jan 22-24, 1980, p91-94, (IEEE, New York, 1980).

Keywords: *Clothes dryers, *Service life, *Performance tests, Durability, Performance evaluation, Drying apparatus, Consumer affairs, Reliability, Life cycles, Mechanical measurement.

Laboratory tests were made of the life cycle performance of two popular makes of clothes dryer, with a view towards determining the feasibility of life testing major consumer products in general. The dryers were comparatively tested up to an age equivalent to 17 years of life in the field, and little or no significant differences in either reliability or energy efficiency were observed. Because of the small sample size and difficulties in correlation, these results are not final. Elements of the laboratory test planning and procedure are given, as are some of the problems and difficulties in testing, especially of a generic product (heterogeneous sample), and some remarks are made concerning the feasibility of life testing consumer products.

701,968
PB80-181001 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Economics of Consumer Product Information.
Final rept.,
R. Dardis. May 80, 55p NBSIR-80-2016

Keywords: *Information, *Consumers, Marking, Labels, Publicity, Consumer affairs, Decision making, Economic analysis, Data acquisition, Availability, Communications management, *Consumer products.

The major objective of this study was to examine the economic principles underlying the provision and acquisition of consumer product information. The direct and indirect benefits from product information and the economics of consumer information acquisition comprise the first part of the study. The existence of the consumer information gap within the past two decades is investigated in the second part of the study. Reasons for information failures in the marketplace are then examined leading to a dicussion of various methods for increasing the level of consumer product information. The analysis should provide an understanding of reasons for information failures in the marketplace and problems faced by policy makers in attempting to correct market deficiencies.

701,969
PB80-212293 Not available NTIS
National Bureau of Standards, Washington, DC.
Method for Predicting Product Life,
K. W. Yee, and D. P. Stokesberry. Aug 80, 4p
Pub. in Appliance 37, n8 p45-48 Aug 80.

Keywords: *Service life, Maintenance, Reliability, Product development, Life(Durability), Equipment.

A method is proposed for predicting product life in actual use based upon a laboratory operating life test result and a use distribution determined from field survey. The predicted life is based on a mathematical combination of the measured laboratory life distribution and the field use distribution. The technique is particularly applicable to products which exhibit wear out failures which are dependent on the amount of use and the use is intermittent. The results from a demonstration of the method are presented. A small motorized product was used in a laboratory life test and a field survey to determine use. Significant differences were found in predicted life for several models of the same product.

701,970
PB87-140588 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
DOE/NBS (Department of Energy/National Bureau of Standards) Forum on Testing and Rating Procedures for Consumer Products, October 2-3, 1985.
Final rept.
R. D. Dikkers. Jul 86, 68p NBSIR-86/3412
DE-AI01-86CE23842
Sponsored by Department of Energy, Washington, DC. Office of Buildings Energy R and D.

Keywords: Meetings, Consumer affairs, Tests, Heat pumps, Air conditioners, Furnaces, Boilers, Refrigerators, Heating equipment, Water heaters, *Consumer products.

One hundred thirty-four persons participated in a Forum on Testing and Rating Procedures for Consumer Products held at the National Bureau of Standards (NBS), Gaithersburg, Maryland, on October 2-3, 1985. The objectives of the forum, which was planned in cooperation with various industry associations, were: (1) to provide a line of communication between test procedure users and test procedure developers; (2) to provide an opportunity for participants to present technical and research issues concerning Department of Energy (DOE) test procedures that need to be addressed; and (3) to assist DOE and NBS in establishing a future agenda for the development and/or revision of testing and rating procedures. The report summarizes discussions, conclusions and recommendations developed by the forum participants for the following consumer products: heat pumps and air conditioners; furnaces, boilers, and household heaters; water heaters; refrigerators, refrigerator-freezers and freezers.

701,971
PB88-118484 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Index of Products Regulated by Each State,
M. Breitenberg. Aug 87, 29p NBSIR-87/3608

Keywords: *Certification, Grading, Inspection, State regulation, Testing, *Approved products.

The index summarizes information contained in a database on programs under which each of the 50 states regulates products sold within its borders. It can be used as the basis for requesting additional information contained in the database. Development of the database on state regulation of products was part of a continuing NBS effort to establish and maintain comprehensive information on standards, regulations, certification programs and related information. The material has been compiled to meet the needs of government, industry, and the public for information on programs operated by state agencies to regulate products sold to the public.

701,972
PB88-123740 PC **A15**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Report of the National Conference on Weights and Measures (72nd), 1987.
Special pub. (Final),
A. D. Tholen, C. S. Brickenkamp, and A. P. Heffernan. Sep 87, 328p NBS/SP-734
See also PB87-118840. Also available from Supt. of Docs. as SN003-003-02828-2.

Keywords: *Weight measurement, *Metrology, *Meetings, *Consumer affairs, Automotive fuels, Specifications, Tolerances(Mechanics), Education, Law(Jurisprudence), Regulations, Weights and measures.

These are the proceedings of the 72nd Annual Meeting of the National Conference on Weights and Measures, sponsored by the National Bureau of Standards, held in Little Rock, Arkansas July 19 through July 24, 1987, and attended by state, county and city weights and measures officials, and representatives of the Federal Government, business, industry and consumer organizations. Reports by the several standing and annual committees of the Conference comprise the major portion of the publication. Included also are papers presented by Conference officials and others. Major issues discussed at the Conference included the National Type Evaluation Program, the National Training Program, compliance test methods for products subject to moisture loss, and a new motor fuel inspection law and regulation.

Domestic Commerce, Marketing, & Economics

701,973
FIPS PUB 66 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Standard Industrial Classification (SIC) Codes. Federal General Data Standard Representations and Codes.
Federal information processing standards.
H. E. McEwen. 15 Aug 79, 28p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Industries, *Classifications, Coding, Standards, Standard industrial classification codes, SIC numbers, Federal Information Processing Standards.

This standard provides classifications, short titles, and codes for representing industries. The general concept of an industry is one of a group of establishments with similar economic activities. The SIC codes, initially developed by the Office of Management and Budget, are currently being maintained and published by the DOC Office of Federal Statistical Policy and Standards, the organization to which this function has been transferred. This standard is prescribed for the interchange of data among agencies and between agencies and the public including industry and State and local governments. Use within agency data systems is encouraged when such use contributes to operational benefits, efficiency, or economy.

701,974
PB-264 385-SET PC **E20**
Charles River Associates, Inc., Cambridge, MA.
Commodity Supply Restrictions Study.
Aug 76, 1993p-in 9v
Set includes PB-258 093 and PB-264 386 thru PB-264 393.

No abstract available.

701,975
PB-276 234/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effectiveness of Venture Capital Markets in the U.S. Economy.
Final rept.,
G. Tassey. 1977, 9p
Pub. in Public Policy 25, n4 p479-497 1977.

Keywords: *Investments, *Working capital, *Market surveys, Policies, Economic factors, Technology, Cash flow, Urban scciology, Resources, Allocation, *Venture capital, Risk capital, Stocks, Economic growth, New technology.

Two basic policy questions must be answered in order to evaluate the role of the U.S. venture capital market in economic growth. One is whether the level of funds supplied by this market is compatible with a set of social criteria which demands flows of new technology necessary to achieve acceptable rates of growth. Many arguments have been made which say, in essence, that a number of impediments have been created which have had the net effect of causing underinvestment in new technology. Several of the impediments are alledged to have their impact by directly restricting the flow of venture funds. A distinctly different question is whether, given the desired levels of technology and hence resources allocated, the relevant markets are efficiently producing the appropriate outputs (new technologies). In particular, does the venture capital market respond effectively to the existing incentives and disincentives, many of which are socially imposed. This paper attempts to characterize the elements of analysis required to answer each question. The major conclusion is that resource allocation in the venture capital market is currently a more serious and difficult policy problem than is the problem of market efficiency.

701,976
PB-282 876/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Price Stability in Unions of Markets.
Final rept.,
C. R. Johnson. 1977, 9p
Pub. in Proceedings of National Science Foundation - Conf. Board of Mathematical Sciences - Stability of Dynamical Systems: Theory and Applications, Mississippi State, MS, Jul 76 ch10 p127-135 1977.

Keywords: *Economic models, *Marketing, Prices, Stability, Equilibrium, Gersgorin theorem, Lyapunov theorem.

When two separate markets in the same set of commodities are joined into one, resulting equilibria are not necessarily locally stable even if all equilibria were stable in the predecessor markets. Considered are conditions under which a resulting equilibrium is stable.

701,977
PB-285 287-SET PC **E19**
Charles River Associates, Inc., Cambridge, MA.
Subsidies, Capital Formation, and Technological Change.
Jul 77, 1198-in 8v
Set includes PB-285 288 thru PB-285 295.

No abstract available.

701,978
PB-285 288/7 PC **A07**/MF **A01**
Charles River Associates, Inc., Cambridge, MA.
Subsidies, Capital Formation, and Technological Change: Municipal Wastewater Treatment Facilities. Volume 1.
Final rept.
Jul 77, 150p CRA-302.03, NBS-GCR-ETIP-78-40
Contract NBS-6-35744
See also Volume 2, PB-285 289.
Also available in set of 8 reports PC E19, PB-285 287-SET.

Keywords: *Federal assistance programs, *Economic impact, *Sewage treatment, Grants, Municipalities, Economic analysis, Economic development, Capital, Government policies, Incentives, Construction, Water quality, Legislation, Regulations, Waterways(Watercourses), Water supply, Water resources, *Technological change, *Technological development, Economic growth, *Sewage treatment plants, Innovations, *Water pollution control.

The study evaluates the economic impact of federal grants for the improvement of the quality of the nation's waterways. The analysis is confined to the single most important program in this area, namely federal grants to assist in the construction of municipal waste treatment plants as called for in the 1972 Water Quality Amendments. By comparison with this program's annual funding of $5 billion to $6 billion, other programs in this area are virtually insignificant. The program provides municipalities with 75 percent of the costs of constructing wastewater treatment facilities which meet EPA approval and it is often supplemented by additional construction grants from the states. The grant program is part of the broad body of federal legislation which sets forth the nation's water pollution control policy. This legislation provides a system for defining and enforcing effluent standards pertaining to all point source dischargers. Grants are available only to municipal dischargers except for an implicit, but smaller, subsidy to industries who tie into municipal systems. Of particular concern are the effects of the program both in the production of municipal waste treatment and on the rate of technological change in the industry. Attention is also given to the program's impact on the rate of growth in waste treatment plant construction and on its distributional implications.

701,979
PB-285 289/5 PC **A09**/MF **A01**
Charles River Associates, Inc., Cambridge, MA.
Subsidies, Capital Formation, and Technological Change: Mass Transit. Volume 2.
Final rept.,
Jul 77, 196p CRA-302.07, NBS-GCR-ETIP-78-41
Contract NBS-6-35744
See also Volume 1, PB-285 288, and Volume 3, PB-285 290.
Also available in set of 8 reports PC E19, PB-285 287-SET.

Keywords: *Federal assistance programs, *Economic impact, *Mass transportation, Economic analysis, Economic development, Capital, Government policies, Incentives, Rapid transit railways, Highways, Rail transportation, Highway transportation, Urban transportation, Elderly persons, Handicapped persons, Objectives, Grants, *Technological change, *Technological development, Economic growth.

This volume is one of seven case studies. The tools of microeconomic analysis are applied to assess the responsiveness of both the supplier and the user of the subsidized product or service. Particular attention is given to the effects of the subsidies on capital formation and technological change, but general efficiency effects are also considered. Because the bulk of the stimulus to technological change in the transit industry represents a secondary impact, the main focus of the study is on the ways in which the subsidies affect the demand for inputs into the provision of transit service.

701,980
PB-285 290/3 PC **A05**/MF **A01**
Charles River Associates, Inc., Cambridge, MA.
Subsidies, Capital Formation, and Technological Change: First Generation Nuclear Power Plants. Volume 3.
Final rept.
Jul 77, 97p CRA-302, NBS-GCR-ETIP-78-42
Contract NBS-6-35744
See also Volume 2, PB-285 289, and Volume 4, PB-285 291.
Also available in set of 8 reports PC E19, PB-285 287-SET.

Keywords: *Federal assistance programs, *Economic impact, *Nuclear power plants, Economic analysis, Economic development, Capital, Government policies, Incentives, Electric utilities, Nuclear electric power generation, *Technological change, *Technological development, Economic growth.

The study examines governmental assistance to, and subsidization of, the commercial development of nuclear power. The objectives of the study are to identify the principal forms of governmental aid to the first-generation nuclear power plants, to attempt an assessment of the contribution of each form of aid to the attainment of economical nuclear power, and to analyze the more important economic effects of the subsidies, particularly what effects there may have been on capital formation and technological change in the electric utility and the nuclear supplying industries.

701,981
PB-285 291/1 PC **A05**/MF **A01**
Charles River Associates, Inc., Cambridge, MA.
Subsidies, Capital Formation, and Technological Change: Maritime Transport. Volume 4.
Final rept.
Jul 77, 86p CRA-302.09, NBS-GCR-ETIP-78-43
Contract NBS-6-35744
See also Volume 3, PB-285 290, and Volume 5, PB-285 292.
Also available in set of 8 reports PC E19, PB-285 287-SET.

Keywords: *Federal assistance programs, *Economic impact, *Marine transportation, Economic analysis, Economic development, Capital, Government policies, Incentives, National defense, Commercial transportation, Merchant vessels, Shipbuilding, *Technological change, *Technological development, Economic growth.

The report discusses federal policy objectives regarding support of the U.S.-flag merchant marine engaged in foreign commerce, the ship-building industry, and seagoing labor. The costs of this support and its value to recipients as well as static and dynamic impacts of the subsidy program were analyzed. The program of subsidies is expensive -- ODS, CDS, and cargo preference together currently cost the federal government and shippers roughly two-thirds of a billion dollars a year -- and has had limited success in attaining major policy objectives as stated in the Merchant Marine Act of 1936 and the Merchant Marine Act of 1970. While the U.S.-flag liners have maintained a consistent share of U.S. liner trade in both volume and value terms, the composition of U.S. oceanborne foreign commerce has shifted toward the bulk trades where the U.S. share has been small and declining. Further, the commercial development goals of U.S. maritime policy encourage the adoption of developments in ship technology toward increasing specialization of ships while the military auxiliary capability of the U.S.-flag fleet would be better served by ships designed for flexibility of use.

701,982
PB-285 292/9 PC **A08**/MF **A01**
Charles River Associates, Inc., Cambridge, MA.

Subsidies, Capital Formation, and Technological Change: Journal Publishing. Volume 5.
Final rept.
Dec 77, 172p CRA-302.15, NBS-GCR-ETIP-78-44
Contract NBS-6-35744
See also Volume 4, PB-285 291, and Volume 6, PB-285 293.
Also available in set of 8 reports PC E19, PB-285 287-SET.

Keywords: *Federal assistance programs, *Economic impact, *Periodicals, *Publishing, Economic analysis, Economic development, Capital, Government policies, Incentives, Communications management, Information, Technology, Technology innovation, *Technological change, *Technological development, Economic growth.

The federal government has subsidized the publication of primary scientific and technical journals in order to stimulate the dissemination of scientific and technical information. A primary scientific and technical journal is one which conveys principally original scientific and technical knowledge. The federal government has also subsidized the publication of books, monographs, abstracts, and translations although subsidies for these types of publications were not considered in this study. The study has examined the economic effects of the subsidies on the publication of primary scientific and technical journals. The objectives of the study were to identify the major subsidies for the publication of primary scientific and technical journals; to assess the importance of these subsidies, individually and in total, to primary scientific and technical journal publishers; to analyze the economic effects of these subsidies on resource allocation, income distribution, and technological change; and to evaluate the efficiency and effectiveness of these subsidies in stimulating the dissemination of scientific and technical information.

701,983
PB-285 293/7 PC **A10**/MF **A01**
Charles River Associates, Inc., Cambridge, Mass.
Subsidies, Capital Formation, and Technological Change: Health Facilities. Volume 6.
Final rept.
Jan 78, 212p CRA-302.14, NBS-GCR-ETIP-78-45
Contract NBS-6-35744
See also Volume 5, PB-285 292, and Volume 7, PB-285 294.
Also available in set of 8 reports PC E19, PB-285 287-SET.

Keywords: *Federal assistance programs, *Economic impact, *Hospitals, Health care delivery organizations, Medical services, Economic analysis, Economic development, Capital, Government policies, Incentives, Funds, Health economics, Tables(Data), Health resources, Public health, Low income groups, Health care facilities, Health legislation, Programs, *Hill-Burton Act, *Technological change, *Technological development, Economic growth.

The report discusses the Hospital Construction Act of 1946 (the Hill-Burton Act) and its effects on the allocation of resources, market structure, investment by hospitals and the diffusion of technology. Its focus is on information already in the literature, although some new quantitative research was done.

701,984
PB-285 294/5 PC **A08**/MF **A01**
Charles River Associates, Inc., Cambridge, Mass.
Subsidies, Capital Formation, and Technological Change: Local Air Transport. Volume 7.
Final rept.
Jan 78, 171p CRA-302.17, NBS-GCR-ETIP-78-46
Contract NBS-6-35744
See also Volume 6, PB-285 293, and Volume 8, PB-285 295.
Also available in set of 8 reports PC E19, PB-285 287-SET.

Keywords: *Federal assistance programs, *Economic impact, *Air transportation, Economic analysis, Economic development, Capital, Government policies, Incentives, Airports, Air traffic control, *Technological change, *Technological development, Economic growth, General aviation, Air carriers.

The air transport system -- air carriers, airports and airways -- receives federal financial assistance through several federal programs. The total amount of funding is not a subsidy, since taxes are collected from system users, primarily in the form of fuel or passenger taxes. However, the portion of the funding which exceeds the taxes paid by users is a subsidy since this portion of the funding could have been used for other purposes and provides benefits in kind to users of the air system. These subsidies can change output levels, which can affect aircraft stock levels and consequently the level and possibly the rate of capital investment. This in turn can affect technological change. This study addresses the distribution of this subsidy among air transport user groups (general aviation, trunk and local carriers), and its impact, if any, on technological change.

701,985
PB-285 295/2 PC **A06**/MF **A01**
Charles River Associates, Inc., Cambridge, MA.
Subsidies Capital Formation, and Technological Change: Summary and Conclusions. Volume 8.
Final rept.
May 78, 114p CRA-302.19, NBS-GCR-ETIP-78-47
Contract NBS-6-35744
See also Volume 7, PB-285 294, and Volume 1, PB-285 288.
Also available in set of 8 reports PC E19, PB-285 287-SET.

Keywords: *Federal assistance programs, *Economic impact, *Industries, Air transportation, Marine transportation, Nuclear power plants, Mass transportation, Medical services, Sewage treatment, Public works, Economic analysis, Economic development, Capital, Government policies, Incentives, *Technological change, *Technological development, Sewage treatment plants, Economic growth.

The report is one of a series of eight volumes prepared for the Experimental Technology Incentives Program, National Bureau of Standards. The first seven volumes are case studies of the microeconomic impacts of subsidy programs in the following industries or segments of an industry: local service air transport, maritime transport, nuclear power, mass transit, health facilities, technical publishing, and municipal wastewater treatment facilities. Emphasis is placed on the impact of subsidies on technological change. The eighth volume provides a summary and analysis of the impact of the subsidies in the seven industries, and gives conclusions with respect to the differential effects of subsidy programs with different structures and methods of administration. It also provides operational guidelines for managers respecting the implementation and evaluation of subsidy programs when capital formation and technological change are either explicit objectives or important results of the programs.

701,986
PB-287 579/7 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Center for Consumer Product Technology.
Automation in the Marketplace.
Consumer information series rept.
S. M. Radack, G. E. Burns, and S. Halpin. Mar 78, 13p NBS-CIS-10

Keywords: *Office machines, Automation, Commerce, Banking business, Billing, Sales, Accounting, Coding, Optical scanning, Character recognition devices, Checkout, Computer applications, *Electronic funds transfer, *Universal product code, Point of sale.

The document describes the Universal Product Code (UPC), Electronic Funds Transfer (EFT), and the Optical Character Recognition (OCR) point-of-sale system.

701,987
PB-289 352/7 PC **A10**/MF **A01**
Sterling Hobe Corp., Washington, DC.
Impacts of Government Regulations on the Iron and Steel Industry.
I. Gutmanis. Aug 78, 208p NBS-GCR-ETIP/79-67
Sponsored in part by National Bureau of Standards, Washington, DC.

Keywords: *Iron and steel industry, *Regulations, *Technology innovation, Government policies, Economic impact, Marketing, Trends, Steel making, Technology, Air pollution control, Water pollution control, Health, Safety, Standards, Impact.

The report delves into the impact of federal regulations on but one aspect of the industry, that of innovation. Because of the modest resources and time allowed for this study, a number of limitations had to be imposed. First, only three basic types of federal regulations have been examined: (1) Environmental (mostly EPA); (2) health (mostly OSHA); and, (3) Internal Revenue Service. Second, the broad concept of innovation had to be reduced to three of its components: (1) Research and development activities; (2) PDE (Producers Durable Equipment) expenditures as these, apply to the 'vintage' of technology installed; and, (3) technology transfer, both inter-firm and international.

701,988
PB-292 179/9 PC **A16**/MF **A01**
National Bureau of Standards, Washington, DC.
Manufacturing a Competitive Advantage.
M. H. King. Feb 79, 353p NBS-SP-527
Library of Congress catalog card no. 78-600112. Proceddings of the Footwear Technology Symposium. Held at Gaithersburg, MD., on June 1-2, 1978.

Keywords: *Industries, *Shoes, *Footwear, *Meetings, Federal assistance programs, Planning, Exports, Promotion, Manufacturing, Marketing, Technology utilization, Technical assistance, Competition, Productivity, Cooperation, *Shoe industry, Retail trade.

The objective of this symposium was to assess manufacturing technologies which could be adapted or developed to provide a competitive advantage for the U.S. footwear industry, and to develop a specific plan for activities that would be appropriate for government and industry cooperation. The meeting was part of a three-year Department of Commerce Program to help restore the growth and vitality of the domestic footwear industry. Initial sessions presented technical and evaluative information as an input to the subsequent working group discussions of footwear industry representatives. Government staff described the results of their assessment of the problems and opportunities of the industry. To stimulate constructive dialogue, five private research organizations presented ideas and recommendations for future footwear technological development resulting from Commerce Department sponsored studies. The major new technologies and processes presented addressed materials development, leather technologies, customfitting and computer assistance in shoe design and manufacture (CAD/CAM). In other presentations, the President of the American Footwear Industry Association shared his concerns, a leading footwear designer explored design, marketing and the technology interfaces, and representatives of technologically advanced industries, (aerospace, automobiles, communications) shared their views on manufacturing technologies and applications to footwear industry problems. Preliminary symposium results were evidence of industry enthusiasm and support for government-industry cooperative activities, interest in establishing a footwear center to provide industry-wide technical assistance, and a desire to assess computer-aided design and manufacture (CAD/CAM). Reports by the consulting firms on new technologies and business strategies for the footwear industry are included as appendices.

701,989
PB-292 783/8 PC **A04**/MF **A01**
Delta Research Corp., Arlington, VA.
International Study of Economic Benefits Attributable to R and D, by Source and Sector of Performance.
Final rept.
R. U. Ayres, J. Lewis, and S. D. Collier. Jun 78, 71p NBS-GCR-ETIP-78/60
Contract NBS-8-04299

Keywords: *Research, *Economic impact, *Productivity, Performance evaluation, Benefits, United States, Foreign countries, Technology assessment, Industries, International trade, Manufacturing, Imports, Exports, Licensing, Royalties, Value, Government policies, Economic development, *Research and development, Labor, Voluntary agencies, Data bases.

The study reports evidence found in a study performed for the Experimental Technology Incentives Program on the nature of the interrelationships between public and private R&D and economic performance comparing the historical records of various countries.

701,990
PB80-117708 Not available NTIS
National Bureau of Standards, Washington, DC.
Tax Incentives for Historic Preservation: An Economic Analysis.
Final rept.,
S. F. Weber. 1979, 19p
Pub. in Jnl. of Real Estate Tax. 7, n1 p31-49 Fall 1979.

Keywords: *Taxes, *Incentives, *Buildings, Legislation, Accounting, Depreciation, Law(Jurisprudence),

Renovating, Maintenance, Preserving, Reconditioning, Demolition, Cost analysis, Economic analysis, *Historic preservation.

The Tax Reform Act of 1976 contains a number of provisions which affect the financial position of owners of income-producing historic buildings. Prior tax law tended to penalize historic preservation by allowing more rapid acceleration of depreciation schedules for new buildings and by permitting demolition costs to be deducted in the year in which they occur. TRA provided a more favorable tax environment for historic preservation by removing these tax penalties. The effect of the tax changes depends on the type of building (residential versus nonresidential) and on the legal form of ownership. TRA's tax incentives for the preservation of certified historic buildings were expanded by technical corrections enacted as part of the Revenue Act of 1978. This article analyzes the effect of the historic preservation provisions of both tax acts on the after-tax cost of two basic alternatives facing corporate owners of nonresidential historic buildings: (1) Rehabilitate the structure; or (2) demolish it and redevelop the site.

701,991
PB80-133960 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Guide to Papers Citing Antitrust Cases Involving Standards or Certification.
Final rept.,
C. C. Rawie. Dec 79, 22p NBSIR-79-1921

Keywords: *Standards, *Competition, Manufacturing, Packaging, Commerce, Litigation, Standardization, Size determination, Specifications, Law(Jurisprudence), Product development, *Antitrust laws, *Judicial decisions, Cases, Monopolies.

Since at least 1912, standards and certifications for products ranging from lumber to milk cans have been at issue in antitrust cases. Studying these cases may provide information about the economic effects of standards and certifications based on standards -- in particular, their impacts on competition and innovation. The paper describes several articles and reports which examine the antitrust history of standards. It is intended as a research tool to help economists and others decide which (if any) antitrust cases they should study to learn more about the economic effects of standards.

701,992
PB80-150675 MF **A01**
Temple, Barker and Sloane, Inc., Lexington, MA.
Regulatory Analysis Financial Model RAm Descriptive Documentation, Volume I and Usage and Evaluation.
Final rept.
Nov 79, 191p NBS-GCR-ETIP-79-73
Contract NBS-5-35894
Available Microfiche only because of poor quality.

Keywords: *Electric utilities, *Financial management, *Economic forecasting, Rates(Costs), Computer programming, Economic models, Fixed investment, Capital, Electric power demand, Operating costs, Maintenance, Revenue, Expenses, Economic analysis, Demand(Economics), Consumption, Economic factors, Electric power plants, Systems analysis, Documentation.

The Regulatory Analysis Model, known as RAm, is a computer based model for making financial projections for an electric utility, given a set of assumptions or projections concerning demand, capital expenditures, operating costs, and financial and regulatory policies. RAm can be used for industry or regional analysis as well as for individual electric utility projections. The model was developed as part of an Experimental Technology Incentives Program (ETIP) project involving other analytic and management tools designed to improve and accelerate rate case decisions as an incentive to technological innovation.

701,993
PB80-208861 PC **A05**/MF **A01**
Public Interest Economics Center, Washington, DC.
Economic Aspects of Joint Research and Development Ventures in the Private Sector.
Final rept.,
S. Buchanan. Aug 79, 78p NBS-GCR-ETIP-79-69
Contract NBS-4-36113

Keywords: *Technology innovation, Economic analysis, Investments, Product development, Competition, Patents, Marketing, Benefit cost analysis, *Research and development, *Joint ventures, Antitrust laws.

The study reviews the literature on the economics of technological innovation. It then lays out a methodological approach to evaluating the effects of permitting large firms to pool their R&D efforts. These include both the potential short-run benefit of increased innovation and the long-run costs of limited competition and decreased innovative capacity. The literature review summarizes knowledge on three areas: the innovative process, rationales for market failure to provide sufficient innovation, and the interrelation of firm size, market structure, and level of innovative activity. The study then outlines a cost-benefit approach to evaluating proposed R&D consortia. A three-page bibliography is included.

701,994
PB81-105009 PC **A18**/MF **A01**
Charles River Associates, Inc., Boston, MA.
Innovation, Competition, and Government Policy in the Semiconductor Industry.
Final rept.
Sep 80, 403p NBS-GCR-ETIP-80-91
Contract NBS-78-3600

Keywords: *Technology innovation, *Competition, *Government policies, Sales, Marketing, National governments, Electronics industry, Semiconductor devices, Commerce, Taxes, Manpower, Manufacturesrs, International trade, Demand(Economics), Consumptions, Regulations, Salaries, *Semiconductor industry, Industrial structure.

Federal policy with respect to technological change is currently a major issue due to the relationship of technological change to international competition, inflation, and economic growth. This volume presents a case study of the semiconductor industry that applies a framework for examining the impact of federal policy on innovation, competition, and performance in technology-based industries. Analyzing the actual and potential effects of government policy requires an understanding of the fundamental forces that shape industry behavior. To provide this understanding, the study presents detailed analyses of the environment and technology of the semiconductor industry, of innovative behavior by semiconductor firms, of strategies and competitive behavior, and of the performance of industrial firms and the industry as a whole. These analyses are the subject of Chapters 2, 3, 4, and 5, respectively. Chapter 1 presents an overview of the effects of government policies and Chapter 6 analyzes the impact of procurement, R&D funding, antitrust, trade, tax, and manpower policies on the semiconductor industry.

701,995
PB81-115784 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Need for Economic Information on Standards Used in Regulatory Programs: Problems and Recommendations.
Final rept.
M. Breitenberg. Sep 80, 63p NBSIR-80-2123

Keywords: Regulations, *Economic analysis, National government, Benefit cost analysis, Economic impact, Standards, Government policies, Environmental impacts.

A number of government regulatory agencies are increasing their use of standards developed by the private sector. Federal regulators are, however, being required to provide increasing justification for their regulations, especially information on their economic desirability. If regulators are to effectively use voluntary standards in their regulations rather than develop standards in-house, they will need the same types of economic information on the voluntary standards as they would have on their in-house standards. This paper describes the types of requirements and pressures that regulatory agencies are faced with in justifying their actions, and provides standards writers with guidelines on the types of economic information that may allow regulators to make greater use of voluntary standards.

701,996
PB81-163859 PC **A08**/MF **A01**
CAP GEMINI, Inc., Vienna, VA.
Computer Networking Status, Trends and Utility for the Federal Government.
Nov 80, 156p NBS-GCR-80-305
Contract NB80-SBCA-0341
Prepared in cooperation with Van Dyke (J. G.) and Associates, Inc., Bethesda, MD.

Keywords: *National government, *Technology assessment, *Market surveys, Economic factors, Demand(Economics), Utilization, Technology innovation, Procurement, Marketing, Manufacturers, Services, Telecommunication, *Computer networks.

The report examines current computer networking offerings and projects technological and economic trends for the industry. The products and services of the sixty suppliers included in the survey typify the computer networking resources currently available to users. Summaries and assessments of those products and services surveyed are included in this report. Management and procurement issues, as well as technological impact, are evaluated. The probable penetration of computer networking into the Federal Government environment is described, and the expected advantages and problems are presented.

701,997
PB81-171258 PC **A06**/MF **A01**
Sutron Corp., Fairfax, VA.
Survey and Market Forecast of Flexible Disks.
Final rept.
W. G. Dickamore, and I. K. Dampier. Nov 80, 110p
SCR-354-80-037B, NBS-GCR-80-306
Contract NB79-SBCA-0141

Keywords: *Market surveys, *Data storage devices, *Magnetic disks, Data processing equipment, Standards, Benefit cost analysis, Marketing, Technology assessment, Specifications, Data transmission, *Flexible disks.

The report includes the following information: division of a generic flexible disk system into its major addressable components, including the flexible disk cartridge, the drive, and the controller; identification of the system parameters affecting information interchange within each component; a survey of marketed systems to determine the most frequently occurring values within the identified parameters; compilation of parameters and associated values that should be considered in the design of a standard or family of standards for information interchange on the flexible disk cartridge; a survey of a future 5-year period identifying the volume of expected units that would support the proposed standards; a cost/benefit analysis of the Federal portion of the 5-year volume that would be influenced by the standards; and a description of positive and negative effects the proposed standards may have on flexible disk technology and the associated market.

701,998
PB81-215295 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Estimating Area Cost Factors for Military Construction Projects: A Computerized Approach.
R. E. Chapman, and B. E. Thompson. May 81, 77p
NBSIR-81-2250
Sponsored in part by the Department of the Navy, Washington, DC and the Department of the Air Force, Washington, DC.

Keywords: *Construction costs, *Computer programming, *Military facilities, *Cost estimates, Project management, Economic models, Prices, Materials estimates, Labor estimates, Fortran, Documentation, NTISCOMNBS.

The report describes a computerized procedure for estimating area cost factors for military construction projects. The empirical basis for this procedure rests upon the results of an econometric analysis of over 500 military construction projects. Technical and empirical evidence from a wide variety of published sources were also used to provide supplemental information on wage rates, material prices, and the level of construction activities in the localities where the projects were undertaken. This report is intended to serve as a user manual for military personnel concerned with the problem of periodically updating the area cost factors for each service's installations. A series of technical appendices are also included which describe the theoretical underpinnings of the econometric models which constitute the core of the computerized procedure as well as provide samples of computer output and a complete listing of the computer program.

701,999
PB81-241168 Not available NTIS
National Bureau of Standards, Washington, DC.

Role of Government in Influencing the Semiconductor Industry--Technological Aspects.
Final rept.
W. M. Bullis. Oct 79, 2p
Pub. in Proceedings of Electrochemical Society Meeting, Jnl. Electrochemical Society Extended Abstracts 79-2, Abstract No. 479, p1214-1215 Oct 79.

Keywords: *Government policies, *Technology innovation, *Semiconductor devices, *Electronics industry, Capital, Financing, National government, Research and development.

Technological aspects of interactions between the U.S. semiconductor industry and the Federal Government are reviewed. Perceived problems associated with research and development activities financed by foreign governments and basic changes in the nature and capitalization requirements of the industry are considered from the point of view of the appropriateness of responsive technological efforts by the Federal Government. Various mechanisms for such efforts - both in place and projected - are discussed.

702,000
PB82-116112 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: An Assessment and Forecast of ADP in the Federal Government.
Final rept.
M. M. Gray. Aug 81, 160p NBS-SP-500-79
Library of Congress catalog card no. 81-600094.

Keywords: *Data processing, *National government, *Market surveys, Expenses, Computer systems hardware, Contracted services, Programming languages, Computer programming, Computers, Data processing equipment, Operating systems(Computers), Software engineering, Data base management systems.

The report summarizes the findings of the International Data Corporation (IDC) on the current status of Federal ADP and projects ADP trends in the Federal Government for 1979 through 1985. Hardware areas included are computers and related peripheral equipment such as magnetic tape drives, disk drives, terminals, printers, modems, multiplexers, and word processors. Other areas included are: an analysis of programming languages; analysis of software spending; analysis of installation workload by mode of operation and by application; implementation of data base management systems; scope of contract services in the Federal Government; and the state of software and software development in selected Federal installations.

702,001
PB83-207522 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Economic Effects of Fracture in the United States. Part 1: A Synopsis of the September 30, 1982 Report to NBS by Battelle Columbus Laboratories.
Final rept.
R. P. Reed, J. H. Smith, and B. W. Christ. Mar 83, 23p NBS-SP-647-1
Library of Congress catalog card no. 83-600704.

Keywords: *Economic impact, *Fractures(Materials), Cracks, Cost analysis, Economic models, Damage, Losses, Defects, Preventive maintenance, Input output analysis.

The National Bureau of Standards and Battelle Laboratories (Columbus) have completed a study to assess the costs of material fracture to the United States for the year 1978. This exhaustive assessment used the econometric input-output model to identify contributions from the entire U.S. economy. The study included all materials and all types of structures and included both fracture occurrence and fracture prevention costs.

702,002
PB83-208751 PC **A16**/MF **A01**
Battelle Columbus Labs., OH.
Economic Effects of Fracture in the United States. Part 2. A Report to NBS by Battelle Columbus Laboratories.
Final rept.
J. J. Duga, W. H. Fisher, R. W. Buxbaum, A. R. Rosenfield, A. R. Buhr, E. J. Honton, and S. C. McMillan. Mar 83, 355p NBS/SP-647-2
Library of Congress catalog card no. 83-600705.

Keywords: *Economic impact, *Fractures(Materials), Cracks, Cost analysis, Economic models, Damage, Losses, Defects, Preventive maintenance, Input output analysis.

A study was conducted to determine the cost of material fracture in the U.S. economy and to identify means of reducing the cost. An Input/Output (I/O) model of the economy was used to assess the costs of fractur. Fracture costs were determined for all materials, all sectors of the economy, and all fracture modes. The costs were associated with both the occurence of fracture and the prevention of fracture. The total cost of fracture was determined to be $99 billion (1978 dollars). Full application of presently known technology through technology transfer could reduce this amount by $29 billion. Further research in fracture related technology could reduce the cost of fracture another $23 billion.

702,003
PB85-145167 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Role of Government in Supporting Measurement Standards for High-Technology Industries.
Final rept.
G. Tassey. 1982, 10p
Pub. in Research Policy 11, n5 p311-320 Oct 82.

Keywords: *Industries, *Government policies, Economic development, Investments, Standards, Measurement, Optical materials, Reprints, *Industrial growth, Technology utilization, Technology innovation.

The role of voluntary standards in industrial growth is discussed by characterizing standards as a public good and identifying the consequent determinants of underinvestment by the private sector. Underinvestment results from the nature of both the standard itself and the underlying technology. The focus is on measurement technologies which require capital-intensive research facilities, specialized equipment and labor, and concensus building among buyers as well as sellers in order to implement them. Standards and the underlying measurement technologies which have been instrumental in the emergence of the optical fiber industry are discussed as an example. Finally, some implications are drawn for industrial growth policy.

702,004
PB86-142098 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Impact of Energy Pricing and Discount Rate Policies on Energy Conservation in Federal Buidings.
Final rept.
S. K. Fuller, and R. T. Ruegg. Nov 85, 61p NBSIR-85/3262
Sponsored by Department of Energy, Washington, DC.

Keywords: Buildings, Fuels, Pricing, *Life-cycle cost, *Energy conservation, Government buildings, Federal Energy Management Program.

The study investigates how energy conservation projects for federal buildings would be affected by a change in energy pricing and discount rate policies. It focuses on the choice between marginal-cost prices versus average market prices and a 10 percent discount rate versus a 7 percent discount rate. Graphical and numerical comparisons of hypothetical cases in selected geographical areas illustrate the expected impact on selection, design and sizing, and priority of energy-saving projects.

702,005
PB86-142148 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Energy Prices and Discount Factors for Life-Cycle Cost Analysis: Annual Supplement to NBS (National Bureau of Standards) Handbook 135 and NBS Special Publication 709. 1985 Edition.
B. C. Lippiatt, S. F. Weber, and R. T. Ruegg. Nov 85, 97p NBSIR-85/3273
See also PB81-136269. Sponsored by Department of Energy, Washington, DC. Assistant Secretary for Conservation and Renewable Energy.

Keywords: Buildings, Fuels, *Energy conservation, *Life-cycle cost, Government buildings, Federal energy management program.

The report provides the 1985 annual edition of the energy price and discount factor tables used to supplement both the federal life-cycle costing methodology as described in NBS Handbook 135 (HB 135) and private sector life-cycle cost analysis as described as described in NBS Special Publication 709 (SP 709). Tables A (7%), Ba, and C represent revisions of Appendices A, B, and C, respectively, of HB 135. They should be used in life-cycle cost analyses of federal energy conservation projects. Tables A (10%), Bb, and C are to be used in life-cycle cost analyses of federal non-energy conservation projects that require energy price forecasts. The last section of the report, the supplement for private sector life-cycle cost analysis, is identical to Appendix B, Part I of SP 709 and is provided for the convenience of private sector analysts wishing to make use of federal energy price forecasts.

702,006
PB87-224309 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
ABC's of Standards-Related Activities in the United States.
Final rept.,
M. A. Breitenberg. May 87, 24p NBSIR-87/3576

Keywords: *Standards, *Standardization, Laboratories, Inspection, Tests, United States, Accreditation, Certification.

The report provides an introduction to voluntary standardization, product certification and laboratory accreditation for a reader who is not fully familiar with these topics. It highlights some of the more important aspects of these fields; furnishes the reader with both historical and current information on these topics; describes the importance and impact of the development and use of standards; and serves as background for using available documents and services.

Foreign Industry Development & Economics

702,007
PB-265 719/5 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of International Relations.
Report to AID on an NBS/AID Workshop on Standardization and Measurement Services.
Final rept.,
H. S. Peiser, J. Cornish, and C. C. Raley. Mar 77, 112p NBSIR-76-1152
Prepared in cooperation with Agency for International Development, Washington, D.C.

Keywords: *Meetings, *Standardization, *Measurement, Standards, Units of measurement, Developing countries, Federal assistance programs, Afghanistan, Brazil, Chile, Columbia, Dominican Republic, Egypt, Jordan, Republic of Korea, Nicaragua.

From September 20 to October 3, 1975, a Workshop was held at the National Bureau of Standards, Gaithersburg, under the sponsorship of AID. The object of the Workshop was to give standards officials of industrializing nations insight into the standards and measurement systems of the United States and the role of the National Bureau of Standards, so that these officials might consider what parts of the U.S. System might usefully be adapted to conditions in their home countries. An exchange of standardization experience in each of the participant's countries was presented by delivered papers which are reproduced here.

702,008
PB-277 984/1 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of International Relations.
Report to AID on an NBS/AID Workshop on Standardization and Measurement Services, Held October 16-30, 1976.
Final rept.,
H. S. Peiser, C. C. Raley, and C. A. Schroyer. Dec 77, 113p NBSIR-77-1385
Grant PASA-TA(CE)-6-71
See also report dated Mar 77, PB-265 719.

Keywords: *Meetings, *Standardization, *Measurement, National government, Standards, Units of measurement, Developing countries, Afghanistan, Bangladesh, Bolivia, Ecuador, Ghana, Guyana, India, Indonesia, Iran, Jordan, Kenya, Korea, Nigeria, Yemen, Metrology, Quality control, Commerce, Industrial stand-

ards, International standards, National Bureau of Standards.

From October 16-30, 1976, a Workshop was held at the National Bureau of Standards, Gaithersburg, and at selected universities, research institutes, standards developing organizations, test centers, and industrial companies, under the sponsorship of AID. The object of the Workshop was to give standards officials of industrializing nations insight into the standards and measurement systems of the United States and the role of the National Bureau of Standards, so that these officials might consider what parts of the U.S. system might usefully be adapted to conditions in their home countries. An exchange of standardization experience in each of the participant's countries was presented by delivered papers which are reproduced here. Countries represented included Afghanistan, Bangladesh, Bolivia, Ecuador, Ghana, Guyana, India, Indonesia, Iran, Jordan, Kenya, Korea, Nigeria, and Yemen.

702,009

PB-296 326/2 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. Office of International Relations.
Report to AID on an NBS/AID Workshop on Standardization and Measurement Services.
Final rept.
H. S. Peiser, C. C. Raley, and P. M. Odar. May 79, 157p NBSIR-78-1712
Grant PASA-TA(CE)-6-71
See also report dated May 78, PB-283 929, and report dated Mar 77, PB-265 719.

Keywords: *Standardization, *Measurement, *Meetings, Standards, Metrology, Developing countries, Argentina, Bangladesh, Bolivia, Egypt, Ghana, Indonesia, Iran, Kenya, Korea, Philippines, Thailand, National Bureau of Standards.

From October 1-18, 1977, a Workshop was held at the National Bureau of Standards, Gaithersburg, and at selected universities, research institutes, standards developing organizations, test centers, and industrial companies, under the sponsorship of AID. The object of the Workshop was to give standards officials of industrializing nations insight into the standards and measurement systems of the United States and the role of the National Bureau of Standards, so that these officials might consider what parts of the U.S. system might usefully be adapted to conditions in their home countries. An exchange of standardization experience in each of the participant's countries was presented by delivered papers which are reproduced here. Countries represented included Argentina, Bangladesh, Bolivia, Egypt, Ghana, Indonesia, Iran, Kenya, Korea, Philippines, and Thailand. In addition, there were representatives from the Arab Organization for Standardization and Metrology and the International Organization for Standardization.

702,010

PB-300 267/2 Not available NTIS
National Bureau of Standards, Washington, DC.
R and D for Developing Countries: I. The Role of Industrial R and D.
Final rept.
R. C. Sangster. 1979, 5p
Sponsored in part by Agency for International Development, Washington, DC. Office of Science and Technology.
Pub. in Research Management XXII, n3 p34-38 May 79.

Keywords: *Research, *Developing countries, Technology innovation, Cooperation, Technology assessment, Technological intelligence, Investments, Technology transfer, Industries, Government policies, *Industrial technology, *Research and development, Industrialization.

The report examines the role that the U.S. industrial research and development community can play for those less developed countries undergoing industrialization. New and existing approaches for linking this industrial R&D capability with the needs of developing countries are discussed.

702,011

PB80-181829 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Office of International Relations.
Report to AID on an NBS/AID Workshop on Standardization and Measurement Services.
Final rept.,
H. S. Peiser, C. C. Raley, and P. M. Odar. Apr 80, 67p NBSIR-80-2021
Grant PASA/TA(CE)6-71
Report on Workshop Held at Gaithersburg, MD on October 3-21, 1978. See also report dated Mar 77, PB-165 719.

Keywords: *Meetings, *Standardization, *Measurement, Standards, Developing countries, Federal assistance programs, International relations.

The object of the Workshop was to give standards officials of industrializing nations insight into the standards and measurement systems of the United States and the role of the National Bureau of Standards, so that these officials might consider what parts of the U.S. system might usefully be adapted to conditions in their home countries. During the Workshop, papers were presented to exchange standardization experience from each participant's country. (These papers were previously published in NBS SP-543, the report on the UNCSTD seminar.) The presentations of the special evening speakers for the Workshop are featured in this report and also a special contribution by the representative from the Arab Organization for Standardization and Metrology. The other participants were from Argentina, Barbados, Brazil, Guyana, India, Indonesia, Jordan, Kenya, Korea, Pakistan, Panama, Saudi Arabia, Sudan, Tanzania, and Tunisia.

702,012

PB85-203446 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Foreign National Organizations Which Accredit Laboratories that Provide Calibration Services.
Final rept.
J. W. Locke. 1983, 5p
Sponsored by National Conference of Standards Labs., Silver Spring, MD. Information and Directory Committee.
Pub. in A Directory of Standards Laboratories p78-82 1983.

Keywords: *Laboratories, *Calibrating, Reprints, *Foreign technology, Accreditation.

The article lists 13 foreign national laboratory accreditation systems which accredit laboratories that provide calibration services in their country.

International Commerce, Marketing, & Economics

702,013

PB-258 093/4 PC **A11**/MF **A01**
Charles River Associates, Inc., Cambridge, MA.
Commodity Supply Restrictions Study: A Framework for Analyzing Commodity Supply Restrictions.
Final rept.
Aug 76, 242p NBS-GCR-ETIP-76-24
Contract NBS-4-35960
Also available in set of 9 reports PC E20, PB-264 385-SET.

Keywords: *International trade, *Economic analysis, *Commodity management, *Supply(Economics), Economic impact, Policies, Exports, Foreign countries, Resources, Depletion, Crises, Resource exhaustion, Restrictions.

The study addresses commodity supply crises due to producer country export policies, and considers the issue of resource exhaustion only as it relates to this problem. The primary concern is with economic impacts and policies. Crises in commodity supplies may well have political impacts, but detailed treatment of such effects is beyond the scope of the study. Possible political and diplomatic constraints on U.S. policies are considered, but the primary concern is with economic impacts. The basic analytical approach is that of the applied microeconomist working in a supply and demand framework. This framework allows the use of available qualitative economic, econometric and engineering information. There has been no use of mathematical programming or input-output techniques as it is believed that the techniques employed are sufficient.

702,014

PB-264 386/4 PC **A05**/MF **A01**
Charles River Associates, Inc., Cambridge, MA.
Commodity Supply Restrictions Study: Cartelization in the World Cobalt Market: Economic Analysis and Policy Implications.
Final rept.
Aug 76, 96p NBS-GCR-ETIP-76-25
Contract NBS-4-35960
See also PB-259 093.
Also available in set of 9 reports PC E20, PB-264 385-SET.

Keywords: *International trade, *Commodity management, *Supply(Economics), *Policies, Marketing, Constraints, Organizations, Cobalt, Economic models, Economic analysis, Stockpiling, Demand(Economics), United States, Foreign countries, Metal industry, Cartels, Monopoly, Strategic planning, Options, Supply disruptions, World markets, Cobalt industry.

This volume applies the analytical framework to study supply, demand, and price formation in the cobalt market as a background for policy formation. It also analyzes the effects and likelihood of a producer country cartel or supply disruption. Finally, it presents policy and technological strategies in response to cartel formations or supply cutoffs.

702,015

PB-264 387/2 PC **A08**/MF **A01**
Charles River Associates, Inc., Cambridge, MA.
Commodity Supply Restrictions Study: Policy Implications of Producer Country Supply Restrictions: The World Platinum and Palladium Markets.
Final rept.
Aug 76, 153p NBS-GCR-ETIP-76-28
Contract NBS-4-35960
See also PB-264 386.
Also available in set of 9 reports PC E20, PB-264 385-SET.

Keywords: *International trade, *Commodity management, *Supply(Economics), *Policies, Foreign countries, Constraints, Platinum, Palladium, Economic impact, Demand(Economics), United States, Stockpiling, Prices, Economic models, Metal industry, Supply disruptions, Options, Alternatives, Cartels, World markets, Restrictions, Platinum industry, Palladium industry.

An analysis is made of the supply and demand conditions in the world markets for platinum and palladium and the nature of the U.S. dependence on foreign supplies. The objective is to evaluate the probability and consequences of disruptions in the supply of new platinum metals to the United States or of cartel sponsored increases in the prices of these metals. The analysis of the consequences of supply disruptions and cartelization of the platinum and palladium markets is based on both qualitative assessment of the characteristics of those industries and a theoretical model of firm behavior applied to the industries which use platinum metals as a capital good.

702,016

PB-264 388/0 PC **A10**/MF **A01**
Charles River Associates, Inc., Cambridge, MA.
Commodity Supply Restrictions Study: Policy Implications of Producer Country Supply Restrictions: The World Manganese Market.
Final rept.
Sep 76, 210p NBS-GCR-ETIP-76-29
Contract NBS-4-35960
See also PB-264 387.
Also available in set of 9 reports PC E20, PB-264 385-SET.

Keywords: *Policies, *International trade, *Commodity management, *Supply(Economics), Manganese, Marketing, Foreign countries, Constraints, Metalliferous minerals, Economic impact, Stockpiling, Metal industry, World markets, Supply disruptions, Restrictions, Cartels, Economic collusion, Manganese industry.

This volume analyzes the likelihood and the consequences for the United States of non-military disruptions in foreign supplies of higher grade manganese ores, materials which the U.S. does not mine domestically. Information about foreign producers is studied for indications of the probability and nature of potential non-military supply disruptions which would result either from formal cartels explicitly formed for economic gain, or from more tacit forms of collusion. Consider-

able attention is given to the demand of U.S. steelmakers for manganese at various prices, from which the economic cost which higher manganese prices would inflict can be inferred. Finally, economic policy options are investigated in terms of minimizing the total expected welfare loss for the economy. Stockpiling policy is investigated in detail both because it is a fundamental policy response, and because the most relevant analysis of other policy options, such as investment in technological projects, generally assumes a coordinated stockpile policy. A coordinated tariff policy is also considered.

702,017
PB-264 389/8 PC **A06**/MF **A01**
Charles River Associates, Inc., Cambridge, MA.
Commodity Supply Restrictions Study: Policy Implications of Producer Country Supply Restrictions: The World Copper Market.
Final rept.
Aug 76, 121p NBS-GCR-ETIP-76-30
Contract NBS-4-35960
See also PB-264 388.
Also available in set of 9 reports PC E20, PB-264 385-SET.

Keywords: *International trade, *Commodity management, *Supply(Economics), *Policies, Copper, Marketing, Constraints, Foreign countries, United States, Organizations, Imports, Stockpiling, Probability theory, Metal industry, World markets, Restrictions, Supply disruptions, Alternatives, Crises, Copper industry.

This volume examines the likelihood of future crises in copper supply and the policy alternatives available to the United States. The major conclusion is that supply crises are fairly unlikely and that the potential damage to the U.S. economy from such crises would be minimal. Even when very pessimistic assumptions are made about the ability of the United States and other countries to adapt to disruptive export policies of CIPEC (the organization of foreign copper producers), it appears that CIPEC does not have enough market power to cause severe economic damage to the principal consuming countries. The analysis addresses the likelihood of a number of potential supply crises.

702,018
PB-264 390/6 PC **A11**/MF **A01**
Charles River Associates, Inc., Cambridge, MA.
Commodity Supply Restrictions Study: Policy Implications of Producer Country Supply Restrictions: The World Chromite Market.
Final rept.
Aug 76, 248p NBS-GCR-ETIP-76-31
Contract NBS-4-35960
See also PB-264 389.
Also available in set of 9 reports of PC E20, PB-264 385-SET.

Keywords: *International trade, *Commodity management, *Supply(Economics), *Policies, Chromites, Marketing, Chromium, Economic analysis, Foreign countries, United States, Metal industry, Economic impact, Cost analysis, Tariffs, Investments, Stockpiling, Demand(Economics), World markets, Supply disruptions, Restrictions, Cartels, Crises, Options, Chromium industry.

This volume presents an analysis of the likelihood and the consequences for the United States of disruptions in our foreign supplies of chromium, a material which we do not mine domestically. Information about foreign producers is studied for indications of the probability and nature of potential supply disruptions, whether caused by cartels formed for economic gain or by actions of individual supplying countries. Considerable attention is given to assessing the market behavior of U.S. consumers of chromium, from which can be inferred the economic cost which higher chromium prices would inflict. Finally, economic policy options, particularly the standard tools of stockpiles and tariffs, are investigated in terms of minimizing the total expected welfare loss for the economy. Investments in technological projects which would ameliorate U.S. vulnerability to chromium supply disruptions are subjected to general analysis, assuming a coordinated stockpile and tariff policy. Finally, in a brief historical review, potential past crises in the chromite market are assessed for lessons relevant to possible future supply disruptions.

702,019
PB-264 391/4 PC **A13**/MF **A01**
Charles River Associates, Inc., Cambridge, MA.
Commodity Supply Restrictions Study: Policy Implications of Producer Country Supply Restrictions: The World Aluminum/Bauxite Market.
Final rept.
Mar 77, 277p NBS-GCR-ETIP-76-32
Contract NBS-4-35960
See also PB-264 390.
Also available in set of 9 reports of PC E20, PB-264 385-SET.

Keywords: *International trade, *Commodity management, *Supply(Economics), *Policies, Foreign countries, Bauxite, Aluminum, Organizations, Economic analysis, Economic impact, Technology innovation, Prices, Output, Losses, United States, Metal industry, Cartels, Supply disruptions, World markets, Alternatives, Behavior modification, Crises, Aluminum industry.

The report analyzes the impact on the world bauxite and aluminum markets of the recently formed International Bauxite Association (IBA), a cartel organized by the bauxite producing and exporting nations. It examines the probable price and output policies of the IBA and the potential effect of these policies on the U.S. economy. The resource loss to the United States resulting from the cartel's actions is estimated, and alternate U.S. government policies for modifying the IBA's behavior and reducing the resource loss resulting from cartel pricing and possible supply cutoffs are analyzed. Particular emphasis is given to the role of innovative technology.

702,020
PB-264 392/2 PC **A17**/MF **A01**
Charles River Associates, Inc., Cambridge, Mass.
Commodity Supply Restrictions Study: Policy Implications of Producer Country Supply Restrictions: The World Energy Market.
Final rept.
Nov 76, 382p NBS-GCR-ETIP-76-33
Contract NBS-4-35960
See also PB-264 391.
Also available in set of 9 reports of PC E20, PB-264 385-SET.

Keywords: *International trade, *Energy, *Supply(Economics), *Policies, Marketing, Crude oil, Foreign countries, United States, Imports, Economic analysis, Vulnerability, Prices, Commodity management, Synthetic oils, Benefit cost analysis, Planning, Organizations, Stockpiling, Tariffs, Research, World markets, Supply disruptions, Crises, Organization of Petroleum Exporting Countries, Alternatives.

A number of policies have been proposed to reduce U.S. dependence on imported oil or to reduce U.S. vulnerability in some other way. Among the policies proposed are stockpiling, quotas and tariffs, subsidies to domestic oil producers, accelerated development of nuclear power, and conversion of oil fired generating plants to coal. Of special concern is the proposal that U.S. government subsidize or offer other incentives to the development of synthetic fuels, since these technologies have not yet been significantly developed on a commercial scale in the United States. This study examines these different policies, their benefits and costs, and compares them as instruments to reduce the impact of future supply disruptions. The policy measures chosen for analysis are representative of types of actions currently under consideration to mitigate the effects of OPEC.

702,021
PB-264 393/0 PC **A12**/MF **A01**
Charles River Associates, Inc., Cambridge, Mass.
Commodity Supply Restrictions Study: Policy Implications of Producer Country Supply Restrictions: Overview and Summary.
Final rept.
Feb 77, 264p NBS-GCR-ETIP-77-36
Contract NBS-4-35960
See also PB-264 392.
Also available in set of 9 reports of PC E20, PB-264 385-SET.

Keywords: *International trade, *Commodity management, *Supply(Economics), *Policies, Foreign countries, Marketing, Government policies, United States, National government, Economic analysis, Economic impact, Stockpiling, Tariffs, Economic models, Economic impact, Cost analysis, Finance, Technology innovation, Summarizing, Metal industry, Alternatives, Restrictions, Supply disruptions, World markets, Strategic planning, Cartels, Monopoly, Options, Crises, Technological change.

This volume summarizes the other eight volumes of the study which seeks to evaluate alternative federal policies which deal with restrictions initiated by producer countries on supplies of major imported materials. A major premise of CRA's effort was that rational policy analysis must proceed from a realistic and market specific analysis of risks to a similarly concrete evaluation of potential damage, and then to consideration of a range of policy instruments including not only government encouragement of technological change, but also stockpiling, tariffs and quotas, subsidies, and other measures. The analytical approach combined an assessment of real dangers to the U.S. economy in various materials markets with an analysis of the costs of different policies designed to reduce the impacts of foreign supply restrictions.

702,022
PB82-263989 Not available NTIS
National Bureau of Standards, Washington, DC.
New Program to Help Identify Technical Barriers to Trade.
Final rept.
J. A. Koenig. Jun 82, 3p
Pub. in Stand. Engineering 34, n3 p55-56, 70 Jun 82.

Keywords: *International trade, *Standards, *Multilateral agreements, Regulations, Government policies, Commerce, Reprints.

This article describes a new program established as a result of the Multilateral Trade Negotiation (MTN) Agreement on Technical Barriers to Trade, which was implemented in the United States by Title IV of the Trade Agreements Act of 1979. Under the MTN Agreement (popularly known as the Standards Code) signatory countries are required to notify other signatories of proposed central government mandatory standards that might significantly affect trade. The National Bureau of Standards' procedures for making the required U.S. notifications and disseminating information on notices received from other countries are detailed.

702,023
PB83-179648 Not available NTIS
National Bureau of Standards, Washington, DC.
U.S. Government Certification Activities - Implementing the Standards Code.
Final rept.
J. L. Donaldson. Nov 82, 6p
Pub. in Proceedings of Annual Conference 1982 World Standards - Tools for Trade and Development (31st), Ottawa, Ontario (Canada), September 20-22, 1982, p67-72 Nov 82.

Keywords: *International trade, *Standards, *Tariffs, Reprints, *General Agreement on Tariffs and Trade, Foreign trade.

The Standards Code negotiated under the auspices of the General Agreement on Tariffs and Trade became effective on January 1, 1980. Its purpose is to eliminate the use of standards and certification rules as impediments to trade. To enhance its world trading position, the United States has passed legislation implementing the Code and authorizing the Department of Commerce to carry out certain functions required by the Code. This paper examines those aspects of the Code and the law bearing on certification and discusses OPSP's response to its assigned responsibilities.

702,024
PB83-203059 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
1982 GATT Notification Activities.
Final rept.
J. R. Debelius. Mar 83, 30p NBSIR-83-2681

Keywords: *International trade, *Agreements, *Tariffs, Government policies, Negotiations, *Foreign trade, *General Agreement on Tariffs and Trade.

This report describes the GATT notification activities performed by the Standards Code and Information program, National Bureau of Standards, for calendar year 1982. The U.S. Department of Commerce designated NBS as the official U.S. inquiry point for information on standards and certification activities. NBS' responsibilities include notifying the GATT Secretariat of proposed U.S. Federal Government standards-based rules that may significantly affect trade; maintaining information on similar notifications made by other signatories; and responding to inquiries on both foreign and U.S. notifications.

702,025
PB84-218379 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Office of Product Standards Policy.
GATT (General Agreement on Tariffs and Trade) Standards Code Activities of the National Bureau of Standards 1983.
Final rept.
J. R. Overman. May 84, 52p NBS-SP-678
Also available from Supt. of Docs as SN003-003-02586-1. Library of Congress catalog card no. 84-601051.

Keywords: *Standards, *International trade, Commerce, Technical assistance, Standardization, Regulations.

This report describes the GATT Standards Code activities performed by the Standards Code and Information program, National Bureau of Standards (NBS), for calendar year 1983. NBS responsibilities include operating the U.S. GATT inquiry point for information on standards and certification activities; notifying the GATT Secretariat of proposed U.S. Federal Government standards-based rules that may significantly affect trade; assisting U.S. industry with trade-related standards problems; and responding to inquiries on foreign and U.S. proposed regulations.

702,026
PB85-105740 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Benefits Perceived by U.S. Industry from Participating in International Standards Activities.
Final rept.
P. W. Cooke. Sep 84, 24p NBSIR-84/2886

Keywords: *International organizations, *Standardization, *Industries, *Benefit cost analysis, Exports, International trade, Recommendations.

This report describes the results of a limited study to assess the extent to which U.S. industry profits by virtue of participation in the committee activities of international standardization organizations. The substantial trade benefits that can accrue are identified and evaluated in terms of the needs of the firms surveyed and the potential opportunities for new or increased foreign trade. Recommendations are given for industry to become more aware of the cost-effectiveness of participation and to extend the potential benefits to other firms and industries.

702,027
PB85-224707 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
GATT (General Agreement on Tariffs and Trade) Standards Code Activities of the National Bureau of Standards 1984.
Final rept.
J. R. Overman. Apr 85, 43p NBSIR-85/3152
See also PB84-218379.

Keywords: *Standards, *International trade, Commerce, Technical assistance, Regulations, Standardization, US NBS, General Agreement on Tariffs and Trade, GATT standards, Certification, Foreign, Domestic.

This report describes the GATT Standards Code activities performed by the Standards Code and Information program, National Bureau of Standards (NBS), for calendar year 1984. NBS responsibilities include operating the U.S. GATT inquiry point for information on standards and certification activities; notifying the GATT Secretariat of proposed U.S. Federal government standards-based rules that may significantly affect trade; assisting U.S. industry with trade-related standards problems; and responding to inquiries on foreign and U.S. proposed regulations.

702,028
PB86-130044 PC **A07**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
Proceedings of Conference on International Standards, Gaithersburg, MD., August 1985.
E. A. Vadelund. Aug 85, 128p NBSIR-85/3228

Keywords: *Proceedings, *Meetings, *International trade, *Government procurement, Regulations, *Federal agencies, *Interagency coordination, *International standards, Voluntary standards, Imports.

The Overview of the Conference distills the main themes and points of discussion during the meeting. It identifies the strictures set forth in the OMB Circular A-119 which govern and give guidance to Federal agencies functioning in the international standards arena either as participants or users. Three areas of concern to Federal agencies are identified as suitable topics for the Interagency Committee on Standards Policy to pursue.

702,029
PB86-186715 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
Standards and the Economy Worldwide.
Final rept.
W. G. Leight. 1986, 4p
Pub. in ASTM (American Society for Testing and Materials) Standardization News 14, n1 p47-50 Jan 86.

Keywords: *Standards, *International trade, Developing countries, Reprints, *Product standards, *Engineering standards, *World trade markets, *Third World countries, Trade, Economy.

Product and engineering standards play a vital role in technological progress, especially for developing countries. Aid to less-developed nations may lead to better trade opportunities to the mutual benefit of both parties. Accordingly, many groups pursue programs to foster Third World development at the same time that the standards community promotes the widespread use and adoption of high quality domestic standards. The paper describes efforts at the National Bureau of Standards to relate U.S. standards activities to the needs of developing countries and to draw attention to corresponding programs at ASTM.

702,030
PB86-213675 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
GATT (General Agreement on Tariffs and Trade) Standards Code Activities of the National Bureau of Standards 1985.
Annual rept.
J. R. Overman. Apr 86, 39p NBSIR-86/3376

Keywords: *Standards, *International trade, Technical assistance, Regulations, US NBS, General Agreement on Tariffs and Trade, GATT standards, Foreign.

The report describes the GATT Standards Code activities conducted by the Standards Code and Information program, National Bureau of Standards (NBS), for calendar year 1985. NBS responsibilities include operating the U.S. GATT inquiry point for information on standards and certification activities; notifying the GATT Secretariat of proposed U.S. Federal government standards-based rules that might significantly affect trade; assisting U.S. industry with standards-related trade problems; and responding to inquiries about proposed foreign and U.S. regulations.

702,031
PB87-122222 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
Making Effective Use of ISONET and GATT Enquiry Points.
Final rept.
W. G. Leight. 1986, 9p
Pub. in Proceedings of Triennial IFAN Conference (5th), Annual SES Conference (35th), Applying the World's Standards, Philadelphia, PA., September 28-October 1, 1986, p1-9.

Keywords: *Standards, *Information systems, *International trade, Barriers, Subject indexing, Efficiency, Effectiveness, *Certification, *Trade, References(Standards), National Bureau of Standards, GATT system, ISONET system.

The National Center for Standards and Certification Information (NCSCI) at the National Bureau of Standards provides the Enquiry Points for both ISONET and GATT. The paper discusses the nature, scope, and size of the NCSCI reference collection and the services offered to domestic and foreign contacts. Based on the generic nature of search for information and NCSCI experience in attempting to provide efficient and effective responses to inquiries, several problem areas are identified. The proposed solutions will require the coordinated efforts of producers, conveyors, and users of standards and the information pertaining to them.

702,032
PB87-173415 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
GATT (General Agreement on Tariffs and Trade) Standards Code Activities of the National Bureau of Standards 1986.
Annual rept.,
J. R. Overman. Mar 87, 34p NBSIR-87/3538
See also report for 1985, PB86-213675.

Keywords: *Standards, *International trade, Technical assistance, Regulations, US NBS, General Agreement on Tariffs and Trade, GATT standards, Foreign.

The report describes the GATT Standards Code activities conducted by the Standards Code and Information program, National Bureau of Standards (NBS), for calendar year 1986. NBS responsibilities include operating the U.S. GATT inquiry point for information on standards and certification activities; notifying the GATT Secretariat of proposed U.S. Federal government standards-based rules that might significantly affect trade; assisting U.S. industry with standards-related trade problems; and responding to inquiries about proposed foreign and U.S. regulations.

702,033
PB87-214128 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
Proceedings of Conference of Standards and Trade, May 5, 1987,
W. G. Leight. Jun 87, 110p NBSIR-87/3573

Keywords: *International trade, *Meetings, Standards, Exports, Competition, Marketing, Requirements, Foreign trade.

The International Trade Administration and the National Buresu of Standards sponsored a one-day Conference on Standards and Trade on May 5, 1987. These Proceedings contain the texts of speeches by Government officials and representatives of the business and standards communities; summaries of question-and-answer periods; and reports of working groups that addressed participation in International standardization activities; test data acceptance; and adoption of U.S. standards.

702,034
PB88-153630 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Associate Director of Industry and Standards.
Barriers Encountered by U.S. Exporters of Telecommunications Equipment,
T. N. Troy. Oct 87, 65p NBSIR-87/3641

Keywords: *Telecommunication, *Equipment, *International trade, *Export, *Barriers, United States, Regulations, Standards, Licenses, Assessment, *Foreign technology, *Foreign trade, European economic community, Europe, Technical assistance, Businesses, Certification, Accreditation.

The report addresses the perceived institution of unreasonable technical trade barriers by major European trading partners to the export of telecom products and systems by U.S. companies. The DOC GATT technical office, which has responsibilities to assist U.S. exporters to take advantage of trade opportunities, informally contacted over a period of six months, telecom companies and agencies to assess the extent of unreasonableness in foreign national standards, regulations, testing and certification requirements, and accreditation procedures. In each country, examples of requirements and practices were identified that allegedly blocked U.S. exports and other non-domestic products. Promises from the authors trading partners to revise their systems have yielded little, and each country continues to support unique requirements and practices that constitute trade barriers. Many trade barriers instituted by EC countries would be eliminated if EC regional and international telecom standards were harmonized, their adoption made mandatory for all EC countries, and results of testing for conformity from one government accredited laboratory were required to be accepted throughout the Community. Consequently, the United States should consider as an option supporting the development and implementation of European regional requirements and practices that promote uniformity.

General

702,035
PB80-186034 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Economics Applied to Standards: A Guide to the Literature.
Final rept.,
S. F. Weber, and B. C. Cassard. Apr 80, 93p NBSIR-80-2015

Keywords: *Bibliographies, *Economic analysis, *Standards, National government, Standardization, Benefit cost analysis, Indexes(Documentation), Safety, Health, Environmental impacts, Quality of life, Regulations, Fire prevention, Energy conservation.

The report provides a guide to the available literature on the application of economics to the analysis of standards and standardization. One hundred eighty-nine relevant articles, reports, and books were found and organized into four major categories of interest: (1) General methods of economic evaluation; (2) Economics useful for standards analysis; (3) Evaluation of specific developed standards; and (4) Economics applied to the development of standards. The significant findings within each of these categories are briefly discussed in the text. The annotations which accompany the bibliographical entries provide more detailed information. The text includes a discussion of the approach followed in the literature search. An author index is also provided.

702,036
PB83-201418 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Selected Assessment Strategies Applied to Short-Term Energy Models.
P. B. Saunders. Mar 83, 154p NBSIR-83-2672
Sponsored in part by Energy Information Administration, Washington, DC.

Keywords: *Mathematical models, *Economic models, Forecasting, Reserves, Monte Carlo method, *Energy models, Natural gas deposits, Petroleum deposits, Energy consumption.

This report is one in a series focusing on the evaluation of complex mathematical models. The basic approach pursued in this document is patterned after an earlier analysis of the Department of Energy's Midterm Oil and Gas Supply Model (MOGSM). The technical content of the report is divided into three parts, reflecting three basic issues of model form, sensitivity and forecast performance. The first issue addressed related to the structure of STIFS. It includes not only the mathematical assumptions implicit in the model but also data and software considerations. The approach to the second issue focuses on the measurement of climatological uncertainties and uses as its basis a Monte-Carlo experiment. The final issue deals with several techniques for evaluating the predictive performance of a model. Both classical statistical methods and an information theoretic approach are used to illustrate how such an analysis would be carried out in practice.

702,037
PB85-122471 PC **A08**/MF **A01**
Ecosometrics, Inc., Bethesda, MD.
Technologies in the Service Sector. Volume 1. Economic and Technological Trends.
Final rept.
A. M. Lago, and E. E. Hamilton. 1 Oct 84, 166p RR-174-VOL-1, NBS/GCR-84/474/1
Contract NB83-SBCA-2084
See also Volume 2, PB85-122489.
Also available in set of 3 reports, PC E99, PB85-122463.

Keywords: *Economic analysis, *Technology, *United States, Forecasting, Productivity, Measurement, Barriers, Trends, Service sector.

In Volume I, the economic structure and trends in the U.S. service sector are reviewed as a basis for identifying and characterizing technology flows into this sector. The sources, transfer channels and utilization patterns are described as a basis for developing forecasts of the impacts of technology on the various components of the service sector. Characterization and forecasts of technology trends are used to assess technical and economic barriers to technology-driven productivity growth, including measurement- and standards-related barriers.

702,038
PB85-122489 PC **A06**/MF **A01**
Ecosometrics, Inc., Bethesda, MD.
Technologies in the Service Sector. Volume 2. A Case Study of Videotex/Teletext.
Final rept.
A. M. Lago, and E. E. Hamilton. 1 Oct 84, 114p RR-174-VOL-2, NBS/GCR-84/474/2
Contract NB83-SBCA-2084
See also Volume 1, PB85-122471, and Volume 3, PB85-122497.
Also available in set of 3 reports PC E99, PB85-122463.

Keywords: *Economic analysis, *Technology, *United States, Trends, Barriers, Communications, Forecasting, *Videotex/Teletext.

In Volume II, (Videotex/Teletext), the economic structure and trends in the U.S. service sector are reviewed as a basis for identifying and characterizing technology flows into this sector. The sources, transfer channels and utilization patterns are described as a basis for developing forecasts of the impacts of technology on the various components of the service sector. Characterization and forecasts of technology trends are used to assess technical and economic barriers to technology-driven productivity growth, including measurement- and standards-related barriers. Two case studies, Videotex/Teletext (Volume II) and Payment Technologies in Banking (Volume III), provide more detailed analyses of two of the more dynamic subsectors.

702,039
PB85-122497 PC **A06**/MF **A01**
Ecosometrics, Inc., Bethesda, MD.
Technologies in the Service Sector. Volume 3. A Case Study of Payment Technologies in Banking.
Final rept.
A. M. Lago, and E. E. Hamilton. 1 Oct 84, 117p RR-174-VOL-3, NBS/GCR-84/474/3
Contract NB83-SBCA-2084
See also Volume 2, PB85-122489.
Also available in set of 3 reports PC E99, PB85-122463.

Keywords: *Economic analysis, *Technology, *Payments, *United States, Barriers, Productivity, Trends, Forecasting, Communications, *Banking, Service sector.

In Volume III, (Payment Technologies in Banking), the economic structure and trends in the U.S. service sector are reviewed as a basis for identifying and characterizing technology flows into this sector. The sources, transfer channels and utilization patterns are described as a basis for developing forecasts of the impacts of technology on the various components of the service sector.

CHEMISTRY

Analytical Chemistry

702,040
AD-A170 328/9 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
New Techniques and Opportunities in High Temperature Mass Spectrometry.
J. W. Hastie. 1984, 19p ARO-18375.2-CH
Contract MIPR-102-84
Pub. in Pure and Applied Chemistry, v56 p1583-1600 1984.

Keywords: *Mass spectrometry, Laboratory procedures, High temperature, Flames, Molecular beams, Laser pumping, Electron impact spectra, Ionization, Cross sections, Thermal properties, Reprints, Knudsen effusion, LIVMS(Laser Induced Vaporization Mass Spectrometry).

In the present discussion, emphasis is given to recent developments and remaining problems in the application of mass spectrometry to high temperature materials chemistry. Examples of application areas discussed include: Knudsen effusion mass spectrometry of gas-solid reactions, with equilibrium or kinetic control; high-pressure molecular beam sampling mass spectrometry of flames and laser-vapor-plumes, and transpiration mass spectrometry of gas-liquid-solid and ceramic-slag-salt systems. Certain maxims are examined, including use of ionization cross-section approximations. Evidence of departure from the key assumption of a temperature-independent electron impact process is given, including temperature-dependent parent-ion fragmentation and cross section behavior. Errors arising from the use of cross section additivity and electron energy-scaling approximations are also examined.

702,041
PATENT-4 068 381 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Scanning Electron Microscope Micrometer Scale and Method for Fabricating Same.
Patent.
D. B. Ballard, F. Ogburn, and J. P. Young. Filed 29 Oct 76, patented 17 Jan 78, 6p PB78-600035, PAT-APPL-736 987

Keywords: *Electrodeposited metal layers, Gold-nickel layers, Micrometer scale, Scanning electron microscope scale.

A microscopic length scale typically about 50 micrometers long and graduated in several intervals ranging from 1 micrometer to 20 micrometers. The scale is useful in calibrating the magnification of scanning electron microscope (SEMs) and other electron imaging instruments. The scale comprises alternating layers of two metals deposited on a substrate. The two metals have substantially different electron emission coefficients to provide contrasting emission signals when scanned by an electron beam. One of the metals, preferably gold, is deposited in uniform layers about 40-80 nm thick. The other metal, preferably nickel, is deposited in several layers ranging from 1 micrometer or so thick near the substrate to 20 micrometers thick in the outermost layer. The resultant multilayer composite is cut into one or more samples and each sample is mounted on edge. The exposed edge is ground and metallographically polished and a microscopic indentation is made in the substrate near the first gold layer. The indentation defines a reference region, and the distances between the first gold layer and the subsequent gold layers in the reference region are measured. The measurement is made using a similar sample which was previously calibrated with the aid of a polarizing laser interferometer.

702,042
PATENT-4 281 246 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Continuous-Flow Solution Concentrator and Liquid Chromatograph/Mass Spectrometer Interface and Methods for Using Both.
Patent.
E. White, H. Hertz, and R. Christensen. Filed 12 Oct 79, patented 28 Jul 81, 7p PB81-600040, PAT-APPL-6-084 273

Keywords: *Elongated capillary tube, Interface, Liquid chromatograph, Liquid stream, Mass spectrometer, Tapered concentrator wire,

An interface between a liquid chromatograph and a mass spectrometer is provided for conducting a liquid stream from the chromatograph to the spectrometer. The stream passes from the chromatograph continuously along a tapered concentrator wire toward the narrow end of the wire. The stream is heated in order to evaporate solvent therefrom and to increase the concentration of the solute therein. When the stream reaches the narrow end of the wire, the vacuum created by the mass spectrometer draws the stream through an elongated capillary tube which has a pointed carrier wire positioned therein. A gap is provided in the tube where the tube and the carrier wire intersect the concentrator wire. The capillary tube is either formed with a reduced diameter at one end adjacent the spectrometer or the carrier wire has a ball of solder at that end in order to partially restrict the flow through the tube. The carrier wire is longitudinally movable within the tube in order to control the flow of material into the spectrometer. Other uses for the taperd and heated wires are contemplated for removing solvent from a liquid stream in order to diminish the stream's flow rate or to increase the concentration of the solute of such a stream. Methods for conducting liquid from a liquid chromatograph to a mass spectrometer and for removing solvent from a liquid stream are also disclosed.

702,043
PATENT-4 631 414 Not available NTIS
Department of the Army, Washington, DC.
Radiological Instrument.
Patent,
S. Kronenberg, W. L. McLaughlin, and C. R. Seibentritt. Filed 20 Sep 85, patented 23 Dec 86, 8p
PB87-150843, PAT-APPL-6-778 120
Supersedes AD-D011 946.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Radiation measuring instruments, *Patents, Angle of incidence, Radiation, Sensitivity, Transparence, Exposure(General), Refractive index, Ratios, *Critical angle effect, PAT-CL-250-474.1

The invention relates generally to instruments for measuring radiation and more particularly to such instruments which operate in accordance with changes in the refractive index of radiochromic materials as a result of anomolous dispersion upon being exposed to nuclear radiation. A radiological measuring instrument including an angularly variable radiation sensitive structure comprised of two blocks of material having a different index of refraction with one of the materials comprising a radiochromic substance whose refractive index changes through anomolous dispersion as a result of being exposed to radiation is described.

702,044
PB-252 734/9 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Fluorescence Measurements of Carcinogenic and Polycyclic Aromatic Hydrocarbons in Water.
Final rept.
F. P. Schwarz, and S. P. Wasik. 1976, 7p
Pub. in Proceedings of International Conference on Environmental Sensing and Assessment, Las Vegas, Nev., Sep 14-19, 1975, Paper in International Conference on Environmental Sensing and Assessment, v2 Session 30-2, p1-5 1976.

Keywords: *Aromatic polycyclic hydrocarbons, *Carcinogens, *Water analysis, Solutions, Fluorescence, Experimental design, Concentration(Composition), Meetings, *Fluorometric analysis, *Water pollution detection.

The application of spectrofluorimetry to the measurement and identification of polycyclic aromatic hydrocarbons (PAH) in aqueous solutions was investigated. At naperian absorbances < or = to 0.05, the fluorescence intensities of solutions containing naphthalene, anthracene, pyrene, and fluoranthene in water are a superposition of the component fluorescence spectra. At the higher PAH optical densities of the mg/l level and when viewed perpendicular to the excitation light, the fluorescence spectra vary unpredictably with the concentration. The PAH fluorescence intensity is unaffected by the presence of sodium chloride at sea water concentrations and by the presence of mg/l concentrations of iron, zinc, cobalt, or nickel cations in the water.

702,045
PB-262 610/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Standard Materials for Analysis and Testing.
Final rept.,
H. F. Beeghly, T. W. Mears, and R. E. Michaelis. 1976, 45p
Pub. in Paper in Treatise on Analytical Chemistry, n3 part III p1-45 1976.

Keywords: *Chemical analysis, Standards, Calibrating, Measuring instruments, Reprints, *Standard reference materials.

Emphasis in this chapter is on reference materials, with particular concern for carefully characterized materials, certified by a responsible, impartial agency or organization. Attention is given to materials useful in making meaningful measurements over the span of needs by science, industry, and government for 'benchmark' or reference point materials for calibrating and checking measuring instruments and methods.

702,046
PB-263 148/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Use of a Nematic Liquid Crystal for the Gas-Liquid Chromatographic Separation of Naphthalene Homologues.
Final rept.,
S. Wasik, and S. Chesler. 1976, 8p
Pub. in J. Chromatogr., v122 p451-458 1976.

Keywords: *Liquid crystals, *Gas chromatography, Molecular isomerism, Naphthalenes, Selectivity, Reprints, *Toluidine/N-N-bis(methoxy-benzylidene).

The gas-liquid chromatographic separations of methyl-, ethyl-, and dimethyl-naphthalene isomers on the nematic and supercooled regions of N,N'-bis(p-methoxybenzylidene)-alpha,alpha'-bi-p-toluidine are presented and compared with the results obtained on other materials. The unique selectivity of this liquid crystal, based upon differences in the molecular length-to-breadth ratio of the solute positional isomers, has enabled the complete separation of these naphthalene homologues.

702,047
PB-263 256/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Instrument for the Generation of Reactive Gases.
Final rept.,
W. Tsang, and J. A. Walker. Jan 77, 5p
Pub. in Anal. Chem., v49 n1 p13-17 Jan 77.

Keywords: *Gas generators, *Laboratory equipment, Acetaldehyde, Formaldehyde, Acroleins, Calibrating, Performance evaluation, Concentration(Composition), Reprints.

An instrument has been constructed which is capable of generating reactive gases over wide concentration ranges (from ppm on up). Its operational characteristics and performance have been evaluated with specific application to the generation of formaldehyde, acetaldehyde, and acrolein vapors at micrograms/minute rates.

702,048
PB-263 261/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Miniature Helical Stirrer.
Final rept.
D. S. Bright. Jan 77, 1p
Pub. in Anal. Chem., v49 n1 p191 Jan 77.

Keywords: *Laboratory equipment, *Stirrers, Spectrophotometry, Mixers, Samples, Reprints.

A novel and easily made helical stirring device is described that rapidly stirs small samples in long thin volumes, e.g., 1 cm spectrophotometric cuvettes. This stirring device overcomes some difficulties encountered with the conventional magnetic stirring device. Also described is a modified cuvette designed to enhance total mixing.

702,049
PB-263 268/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Opto-Galvanic Detection of Species in Flames.
Final rept.,
R. B. Green, R. A. Keller, P. K. Schenck, J. C. Travis, and G. G. Luther. 22 Dec 76, 2p
Pub. in Jnl. of the American Chemical Society, v98 n26 p8517-8518, 22 Dec 76.

Keywords: *Flames, *Galvanomagnetic effects, *Chemical analysis, Detection, Spectroscopy, Lasers, Absorption, Electric discharges, Electric current, Reprints.

A recently reported, opto-galvanic effect (OGE) in electrical discharges has been found to occur in flames. Specifically, if the current from a constant voltage source is passed through the flame, the current is found to change when the flame is irradiated by intense monochromatic radiation (laser) corresponding to an absorption of a species present in the flame. This change in current is easily detected by standard electrical measurement techniques and can be used for spectroscopy, analytical determinations, and flame analysis. As an example of the analytical application of this technique, the quantitative analysis of sodium in a flame is described.

702,050
PB-263 776/7 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, Colo. Cryogenics Div.
Cryogenic Fluids Density Reference System: Provisional Accuracy Statement,
B. A. Younglove, and J. D. Siegwarth. Jan 77, 31p
NBSIR-77-852
Sponsored in part by American Gas Association, Inc., Arlington, Va.

Keywords: *Liquefied natural gas, *Densimeters, Density(Mass/volume), Standards, Design criteria, Performance evaluation, Cryogenics, Error analysis, Temperature, Pressure, Chemical composition, Methane.

The measurement capability of the density reference system (DRS) of the National Bureau of Standards, Cryogenics Division, is described. This system measures density, pressure, and temperature of LNG mixtures for the purpose of testing densimeters which are contained in the liquid sample. Sample composition is determined by weighing the gas samples separately before condensing them into the sample. The DRS measures density by weighing a single-crystal of silicon immersed in the LNG mixture. This process is described and the equations used in the computation of density are discussed. At this time the estimate of sample standard deviation for a single density measurement made on this system is + or - 0.062% (at 0.4 g/cc). Using three times this standard deviation as a limit for random error and adding + or - 0.026% as an upper bound for known sources of possible systematic error, the uncertainty of a single determination by this system is + or - 0.21%. This statement of accuracy applies for the density range 380 to 430 kg/cu m and 1200 to 1400 kg/cu m, pressures to 7 bar, and temperatures from 80K to 140K. This statement is expected to be correct in the intermediate density range and for all temperatures up to 300K. Measurement uncertainties for temperature, pressure, and composition are discussed. Comparison of measurements for liquid argon densities with the results of other laboratories is given.

702,051
PB-265 030/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tris(hydroxymethyl)aminomethane Physiologic-pH Buffer-Liquid-Junction Error.
Final rept.,
R. A. Durst. 1977, 1p
Pub. in Clin. Chem., v23 n2 p298 1977.

Keywords: *Error analysis, *pH meters, Measuring instruments, Blood, Clinical medicine, Performance evaluation, Reprints.

Studies using clinical blood-pH instrumentation confirm the reported existence of a residual liquid junction potential which produces an error in the observed pH value. The magnitude of the effect depends on the type of liquid junction and may include contributions from errors in instrument temperature control. The buffer is useful as a secondary standard of pH for the detection of instrumental malfunctions in pH analyzers.

702,052
PB-265 776/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calibration of Gel Permeation Chromatography Columns Using Polydisperse Polymer Standards,
F. L. McCrackin. 1977, 8p
Pub. in J. Appl. Polymer Sci., v21 p191-198 1977.

Keywords: *Calibrating, *Column packings, Standards, Polymers, Molecular weight, Reprints, *Gel chromatography.

Two methods of calibrating Gel Permeation Chromatography columns are given. The first method uses polymer standards that may have broad molecular weight distributions. Either the weight, number or viscosity average molecular weight of each standard must be known. This method neglects column broadening. The second method requires polymer standards of moderately narrow molecular weight distributions for which both the weight and number average molecular weights are known. However, the second method determines both the column spreading and calibration of the column. The second method is applied to calibration of a column using polystyrene standard. The column spreading is found to be small and independent of molecular weight for this column.

702,053
PB-265 786/4 Not available NTIS

National Bureau of Standards, Gaithersburg, MD.
Chemical and Physical Considerations in the Use of Atomic Absorption Detectors Coupled with a Gas Chromatograph for Determination of Trace Organometallic Gases,
G. E. Parris, W. R. Blair, and F. E. Brinckman. Mar 77, 9p
Pub. in Analytical Chemistry, v49 n3 p378-386 Mar 77.

Keywords: *Trace elements, *Gas detectors, *Atomic spectroscopy, *Gas chromatography, *Metal containing organic compounds, Absorption spectra, Arsenic, Selenium, Tin, Furnaces, Thermodynamics, Reaction kinetics, Decomposition, Chemical reactions, Reprints.

A commercial atomic absorption spectrophotometer with a heated graphite-tube furnace atomizer (HGA) was adapted as a detector for a gas-liquid chromatograph. The combined system was applied to the determination of elements (i.e., As, Se, Sn) known to be methylated by microorganisms. The system was optimized by assessing the effects of varying the atomization temperature, the inner surface of the furnace (i.e., fused silica, alumina, bare graphite and pyrolytic carbon surfaces) and the carrier gas (i.e., pure argon and argon with hydrogen). Using conservative, statistically-based numerical techniques, the system detection limits for arsenic, selenium, and tin (introduced as trimethylarsine, dimethylselenium and tetramethyltin gas solutions with nitrogen diluent) were found to be 5 ng As, 7 ng Se, and 12 ng Sn. To obtain these limits, the bare graphite furnace was run continuously at about 1800C while the compounds were eluted from the chromatograph with argon to which 10% hydrogen was added. Optimization of the furnace conditions requires an understanding of the thermodynamics and kinetics associated with thermal and chemical decomposition of the analyte compounds.

702,054
PB-266 131/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Automation of a Thermogravimetry Apparatus with a Laboratory Computer,
B. Dickens, W. J. Pummer, and J. H. Flynn. 1977, 9p
Pub. in Proceedings of International Symposium on Analytical Pyrolysis (3rd), Amsterdam, The Netherlands, 6-10 Sep 76; Paper in Analytical Pyrolysis, p383-391 1977.

Keywords: *Thermogravimetry, *Laboratory equipment, *Automation, Computers, Design criteria, Performance evaluation.

The authors describe an automation scheme devised to implement 'factor-jump' thermogravimetry. Temperature, pressure and the flow rates of oxygen and nitrogen are presently controlled and humidity control and sample irradiation are easily added. A computer utilizes feedback and predetermined decision levels to decide the course of the experiment. The automation is comprised in the main of commercially available components and is modular in form. A new rapid response furnace has been constructed.

702,055
PB-268 545/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Surface Characterization of Catalysts Using Electron Spectroscopies: Results of a Round-Robin Sponsored by ASTM Committee D-32 on Catalysts,
T. E. Madey, C. D. Wagner, and A. Joshi. 1977, 30p
Pub. in Jnl. of Electron Spectrosc. Relat. Phenom., v10, p359-388 1977.

Keywords: *Catalysts, *Insulation, *Laboratory equipment, Auger electrons, X-ray analysis, Photoelectron spectroscopy, Surfaces, Performance evaluation, Standards, Cabibrating, Chemical analysis, Purification, Reprints, Auger electron spectroscopy, X-ray photoelectron spectroscopy.

The authors report the results of a round-robin of measurements designed to evaluate the utility of Auger Electron Spectroscopy (AES) and X-ray Photoelectron Spectroscopy (XPS or ESCA) in studies of powdered, insulating materials typically used as catalysts or catalyst supports. The round-robin was sponsored by ASTM Committed D-32 on Catalysts. Measurements were performed on high purity samples of silica gel (Si)(2) alumina (Al2O3) and a sodium activated type A zeolite. Data on these samples were received from 12 laboratories using XPS and 8 laboratories using AES. The results indicate that the standard deviation in reported AES and XPS absolute line positions is much greater than the precision of any one measurement, indicating a great need for standardization of static charge referencing. In addition, there was a large spread in reported intensity ratios for instruments having nominally the same transmission characteristics and even of the same manufacture. The results demonstrate a need for standard calibration procedures for voltage scales and intensity response in the instruments.

702,056
PB-270 315/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Raman Microprobe: A New Analytical Tool.
Final rept.,
G. J. Rosasco, and E. S. Etz. 1977, 16p
Sponsored in part by Air Force Technical Applications Center, Patrick AFB, Fla.
Pub. in Res./Develop., v28 n6 p20-35 Jun 77.

Keywords: *Raman spectra, *Probes, *Particles, *Microanalysis, Laboratory equipment, Dust, Cements, Design criteria, Performance evaluation, Minerals, Chemical analysis, Air pollution, Reprints, Air pollution detection.

A new Raman microprobe has been developed. This instrument enables routine measurement of the Raman spectra of individual, micrometer-sized particles. The essentials of the design of the instrument are briefly highlighted. Sample preparation and measurement techniques are outlined. The performance and practical utility of this new instrument are illustrated by results obtained on representative samples relevant to the characterization of airborne particulates. Preliminary results obtained in the study of urban dusts, microscopic fluid inclusions in minerals, and microparticles from cements are also highlighted.

702,057
PB-270 330/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Long Wavelength (K approximately equal to 0) IR Active Phonons of NaHF2 and KHF2.
Final rept.,
R. S. Singh, S. Trevino, and H. J. Prask. 1973, 2p
Pub. in J. Chem. Phys., v58 n10 p4703-4704, 15 May 73.

Keywords: *Sodium fluorides, *Potassium fluorides, *Infrared spectra, Far infrared radiation, Crystal structure.

Far-infrared reflection spectra (75-400/cm) of pressed pellets of NaHF2 and KHF2 have been obtained at room temperature. There are two well-resolved bands in the spectrum of each sample. Kramer-Kronig analysis yielded the transverse and longitudinal optical phonons and assignments were made in analogy with results obtained for isomorphic metal-azide salts.

702,058
PB-270 332/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS Glass Standards,
R. Mavrodineanu, and U. W. Drews. 1976, 1p
Pub. in Anal. Chem. Editors' Column 48, n7 p609A 1976.

Keywords: *Spectrophotometers, Performance evaluation, Standards, Transmittance, Glass, Filters, Accuracy, Reprints, Standard reference materials.

The transmittance accuracy of conventional spectrophotometers can be verified by means of transfer standards. Such standards are available from NBS in the form of glass filters (SRM 930). The integrity in time of the certified transmittance values depends on the stability of the glass and on the environmental conditions, including handling of the filters. Recently an unexpected instability of the glass was found in SRM 930b which produced, in approximately 20 percent of these filters, a decrease in transmittance by up to 1.5 percent at 440 nm and 465 nm over a period of about one year. The purchasers of SRM 930b have been informed of this fact and means have been suggested to remedy this situation.

702,059
PB-270 333/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effects of Sample Size on Chromatographic Behavior.
Final rept.,
B. E. Bowen, and S. P. Cram. 1974, 6p
Pub. in J. Chromatogr. Sci., v12 p579-584 Oct 74.

Keywords: *Gas chromatography, *Size determination, *Samples, Diffusion, Chemical analysis, Performance evaluation, Laboratory equipment, Reprints.

High precision vapor phase sampling valves under computer control were used to study the effect of sample size on chromatographic peak shapes and diffusion phenomena in open tubular and wall-coated open tubular columns. Molecular diffusion is treated in terms of axial and Taylor diffusion and velocity profiles are interpreted in terms of the data. Secondary flow effects are considered in detail and are shown to be negligible for these columns compared to molecular, radial, and viscous diffusion.

702,060
PB-270 344/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Binding of Dye to Albumin Studied by Ultrafiltration.
Final rept.,
W. T. Yap, and R. Schaffer. 1977, 4p
Pub. in Clin. Chem., v23 p986-989 1977.

Keywords: *Dyes, *Chemical bonds, Filtration, Cresols, Bromine organic compounds, Humans, Data analysis, Ultrafiltration, Reprints, *Cresol/bromo, *Albumins.

A procedure was developed that employs dynamic ultrafiltration for determining the binding of bromocresol green to human serum albumin. The procedure affords continuous data, instead of a few discreet points, for detailing the binding as a function of the concentration of the smaller molecule. The results are presented with a discussion of some of the major sources of uncertainties.

702,061
PB-271 579/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation of a Simple Static Method for Measuring Vapor Pressure.
Final rept.,
T. B. Douglas, and R. F. Krause. 1977, 12p
Sponsored in part by Air Force Office of Scientific Research, Arlington, Va.
Pub. in J. Chem. Thermodyn. 9, p511-522 1977.

Keywords: *Vapor pressure, *Laboratory equipment, Iodine, Error analysis, Molybdenum inorganic compounds, Laboratory tests, Performance evaluation, Design criteria, Fluorides, Reprints, Procedures, Molybdenum hexafluoride.

To complement transpiration and other methods when applied to partially dissociated or associated vapors, a direct static method was developed for measuring vapor pressures of the general order of magnitude of 1 kPa (=7.5 torr). A valve brings argon, originally at a little higher pressure, into direct contact with the pure vapor, whose pressure is very simply calculated from the reduction in pressure of the argon. Several types of systematic error were estimated; these include especially the effects of diffusion, viscosity, and steady-state gradients in gas temperature and molecular weight, and indicate suitable dimensions of the capillary admitting the argon such that the vapor will remain confined essentially to its original volume during the time required for total-pressure equilibration. To test the method and apparatus, the vapor pressures of I2 at 343 and 353K (using saturated vapor) and that of MoF6 at 237K (using 'superheated' vapor) were measured. The three mean values agree to better than 1 percent with the most reliable published values, which themselves probably have absolute uncertainties this great. Further refinement of the method to give a general accuracy of 0.1 percent seems feasible.

702,062
PB-272 168/6 PC **A08**/MF **A01**
National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
Standard Reference Materials: Certification and Use of Acidic Potassium Dichromate Solutions as an Ultraviolet Absorbance Standard-SRM 935.
Special pub.,
R. W. Burke, and R. Mavrodineanu. Aug 77, 163p
NBS-SP-260-54
Library of Congress catalog card no. 77-600027.

Keywords: *Ultraviolet spectroscopy, *Absorption spectra, Standards, Perchloric acid, Inorganic salts, Performance evaluation, Accuracy, Purity, Calibrating,

Potassium chromates, *Standard reference materials, *Potassium dichromate.

The apparent specific absorbances of 0.001N perchloric acid solutions of a high purity potassium dichromate salt, Standard Reference Material (SRM) 935, have been certified at four wavelengths in the ultraviolet-235, 257, 313 and 350 nm. This publication describes in detail the measurements leading to the certification, and discusses the use of this SRM as a transfer standard for verifying the accuracy of the absorbance scale of narrow bandpass absorption spectrometers in this important wavelength region. The apparent specific absorbances at 345 nm are sufficiently independent of concentration that absorbance measurements at this wavelength can be used for verifying absorbance linearity to about one part in a thousand.

702,063
PB-272 535/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Threshold Photoelectron-Photoion Coincidence Mass Spectrometer for Measuring Ion Kinetic Energy Release on Fragmentation.
Final rept.,
R. Stockbauer. 1977, 13p
Sponsored in part by Department of the Air Force, Washington, D.C., and National Aeronautics and Space Administration, Washington, D.C.
Pub. in International Jnl. of Mass Spectrometry and Ion Physics 25, p89-101 1977.

Keywords: *Mass spectrometers, *Fragmentation, Ions, Kinetic energy, Photoelectrons, Ionization, Design criteria, Performance evaluation, Acetone, Methane, Chemical analysis, Reprints, *Time of flight mass spectrometers.

A threshold photoelectron-photoion coincidence mass spectrometer has been constructed to measure ion fragmentation and kinetic energy release on fragmentation as a function of the internal energy of the parent ion. The threshold photoelectron analysis uses a drift tube analyzer followed by a 127 degree cylindrical plate analyzer for a nominal resolution of 20 meV. The ion mass and kinetic energy analysis uses a pulsed time-of-flight analyzer operated in a space focused mode. This insures that the spread in the flight time of ions of given mass is due primarily to the initial kinetic energy of the ion. The mass resolution is ca. 1 in 20. To illustrate the potential of this instrument, results are presented for kinetic energy release as a function of internal energy for the fragmentation of acetone and methane ions.

702,064
PB-273 935/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis of the Ingredients and Determination of the Residual Components of Acrylic Bone Cements.
Final rept.,
G. M. Brauer, D. J. Termini, and G. Dickson. 1977, 31p
Pub. in Jnl. of Biomedical Materials Research, v11 p577-607 1977.

Keywords: *Cements, *Methacrylates, Bones, Chemical analysis, Chemical composition, Polymers, Quantitative analysis, Chemical properties, Molecular weight, Reprints, *Biomaterials.

Rapid and reliable methods for the characterization and quantitative determination of ingredients usually present in self-curing methacrylate bone cements were developed using spectrophoto-metric, gas chromatographic (GC), and conventional gravimetric procedures. These procedures are applicable to noncrosslinked methacrylate resins. In the presence of some copolymers, polymer blends or crosslinking agents, or other ingredients which will result in the formation of insoluble methacrylate resins, some modification of the identification procedures and quantitative estimation of the resin components will be required. Molecular weight and molecular weight distribution of the powder and cured cement were obtained from viscosity and gel-permeation measurements. Residual low molecular weight materials in the cured cement were determined for various storage times. Residual and water-leachable monomer and residual dimethyl-p-toluidine (DMPT) were measured by GC.

702,065
PB-273 945/6 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Simulated Precipitation Reference Materials, II.
Final rept.,
J. K. Taylor, E. R. Deardorff, and T. C. Rains. Sep 77, 27p NBSIR-77-1315
Sponsored in part by Environmental Monitoring and Support Lab., Research Triangle Park, N.C.

Keywords: *Water analysis, *Rain, Chemical analysis, Precipitation(Meteorology), Acidity, Samples, pH, Anions, Conductivity, Cations, Sulfates, Inorganic nitrates, Fluorides, Chlorides, *Reference materials.

This report describes the preparation of a series of reference materials for chemical analysis of natural precipitation. This is the second series of such materials prepared by NBS, under the sponsorship of EPA, and will be distributed by the latter as a means to intercalibrate atmospheric monitoring stations. The materials consist of ampoules of concentrates which can be diluted to simulate natural rainwater. A separate reference sample, to be used undiluted, is provided for evaluation acidity measurements. The analytical measurements made to establish the composition of the samples are also described.

702,066
PB-274 347/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Performance of a Nitrogen Dioxide Permeation Device.
Final rept.,
E. E. Hughes, H. L. Rook, E. R. Deardorff, J. H. Margeson, and R. G. Fuerst. Oct 77, 7p
Pub. in Analytical Chemistry 49, n12 p1823-1829, Oct 77.

Keywords: *Nitrogen dioxide, *Permeameters, Standards, Performance evaluation, Stability, Reprints, Standard reference materials.

An in-depth study of the performance of a nitrogen dioxide permeation device, developed at NBS, has been conducted in cooperation with researchers at EPA. The study detailed conditions which would affect permeation rate and stability. Parameters such as temperature, humidity, nitrogen dioxide purity, and calibration procedures were investigated and their effect on rate characteristics was determined. Also, studies were conducted into the temperature memory effects so as to define the minimum temperature equilibration time necessary to obtain stable, reproducible rates. The results of this study have helped define the care necessary to use nitrogen dioxide permeation devices as primary gas standards.

702,067
PB-274 505/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Role of Reference Materials and Reference Methods in Chemical Analysis.
Final rept.,
G. A. Uriano, and C. C. Gravatt. 1977, 51p
Pub. in Crit. Rev. Anal. Chem. 6, n4 p361-411 Oct 77.

Keywords: *Chemical analysis, Standards, Performance evaluation, Experiments, Reprints, *Standard reference materials.

A critical review is made of the role of reference materials and reference methods in chemical analysis. Emphasis is placed on evaluating their use in achieving accurate and compatible measurements throughout large multi-laboratory networks rather than within individual analytical laboratories. The total systems approach to achieving measurement compatibility on a national scale is discussed in the context of recent applications in the fields of industrial, environmental, clinical and agricultural chemical analysis. The role of federal laboratories, regulatory agencies, voluntary standards organizations, professional societies and individual laboratories is examined in terms of their relationships to each other as well as to various components of the accuracy-based measurement system.

702,068
PB-274 517/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Difficulties Encountered in Speciation Studies of Arsenic.
Final rept.,
B. I. Diamondstone, and R. W. Burke. Aug 77, 2p
Pub. in Analyst Short Papers, v102 p613-614. Aug 77.

Keywords: *Arsenic, *Chemical analysis, Oxidation, Concentration(Composition), Biological extracts, Reprints.

Speciation studies of arsenic (III) and arsenic (V) can be carried out in aqueous mixtures of the two using a variety of techniques. However, with the acid systems studied to date, arsenic speciation cannot be measured in biological materials. These sudies, in which known amounts of arsenic (III) and arsenic (V) were added to botanical materials, show that the digestion of the sample results in an alteration of the original oxidation states of arsenic.

702,069
PB-274 983/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Application of a Liquid Chromatograph Coupled with a Flameless Atomic Absorption Detector for Speciation of Trace Organometallic Compounds.
Final rept.,
F. E. Brinckman, W. R. Blair, K. L. Jewett, and W. P. Iverson. Nov 77, 11p
Pub. in Jnl. of Chromatographic Science, v15 p493-503 Nov 77.

Keywords: *Trace elements, *Detectors, *Metal organic compounds, Chromatography, Chemical analysis, Performance evaluation, Separation, Arsenic, Lead(Metal), Mercury(Metal), Tin, Reprints, *Flameless atomic absorption analysis, Liquid chromatography.

Use of a commercial flameless (graphite furnace) atomic absorption detector (GFAA) automatically coupled to a high-pressure liquid chromatograph (HPLC) was demonstrated to provide element-specific separation and detection of organometallic compounds at nanogram concentrations in both protic and nonpolar solvents using conventional columns. Relative sensitivities of the HPLC-GFAA system for compounds of arsenic, lead, mercury, and tin were shown to be mainly functions of LC flow rate and relative AA sensitivity for each element. Separation of mixtures of organometal ions required both isochratic and -radient elution on reverse phase columns, but incorporation of certain charged or neutral ligand concentrations was necessary for achieving complete resolution of different organometal species. The GFAA detector can be operated in either a rapid sampling mode, providing higher resolution of the HPLC effluent, or in a batch survey mode which permits, with only slight (5-10%) loss of effluent, recovery of sample fractions for additional analyses.

702,070
PB-275 014/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Unusual Experimental Detectors for Liquid Chromatography.
Final rept.,
S. A. Wise, and W. E. May. Oct 77, 9p
Pub. in Research/Development, v28 n10 p54-62 Oct 77.

Keywords: *Detectors, Performance evaluation, Laboratory equipment, Chromatography, Sensitivity, Reprints, *Liquid chromatography.

A wide variety of detectors have been used in liquid chromatography to achieve both sensitivity and selectivity. This article examines some recent novel approaches in detection that might broaden LC applications in the future by providing alternatives to the commonly used detectors of today.

702,071
PB-275 017/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interlaboratory Calibration for the Analysis of Petroleum Levels in Sediment.
Final rept.,
S. A. Wise, S. N. Chesler, B. H. Gump, H. S. Hertz, and W. E. May. 1977, 6p
Pub. in Proceedings of Symposium on Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms, Seattle, Wash. 10-12 Nov 76; ch35 in Interlaboratory Calibration for the Analysis of Petroleum Levels in Sediment, p345-350 1977.

Keywords: *Chemical analysis, *Sediments, *Environment surveys, *Petroleum products, Katalla River, Comparison, Standards, Calibrating, Forecasting, Reprints.

The large number of environmental analyses to be performed in the future necessitates the existence of a common basis for comparing the data. Otherwise data that is obtained from different laboratories would be of

limited usefulness. Furthermore, unless the data can be put on an equivalent basis, environmental standards can neither be set nor enforced. A sample, split between NBS and one other laboratory, was analyzed in order to determine the suitability of the Katalla River sediment for a more extensive intercalibration exercise. The results of this limited intercomparison are discussed. Comparison of the interlaboratory data should provide a measure of the analytical variability among the participating laboratories.

702,072
PB-275 029/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chemically-Bonded Aminosilane Stationary Phase for the High-Performance Liquid Chromatographic Separation of Polynuclear Aromatic Compounds.
Final rept.,
S. A. Wise, S. N. Chesler, H. S. Hertz, L. R. Hilpert, and W. E. May. Dec 77, 5p
Sponsored in part by Environmental Protection Agency, Washington, D.C. Office of Energy, Minerals and Industry.
Pub. in Analytical Chemistry, V49 n14 p2306-2310 Dec 77.

Keywords: *Chemical analysis, *Column packings, *Aliphatic compounds, *Aromatic polycyclic hydrocarbons, Separation, Gas chromatography, Hydrocarbons, Adsorbents, Fluorescence, Emission spectra, Performance evaluation, Reprints, *Silane/amino, *Mu Bondapak NH2 packing material.

A commercially available, chemically-bonded aminosilane liquid chromatographic packing material, mu Bondapak NH2, was used as a substitute for silica or alumina for the normal-phase high-performance liquid chromatographic (HPLC) separation of aliphatic hydrocarbons and polynuclear aromatic compounds. The mu Bondapak NH2 provides a more distinct separation of polynuclear aromatic compounds than the classical adsorbents because the addition of alkyl groups to the aromatic ring has very little effect on the retention. The retention characteristics of polynuclear aromatic compounds on mu Bondapak NH2, classical adsorbents, and a reversed-phase packing material were compared. The application of mu Bondapak NH2 to isolate polynuclear aromatic compounds according to the number of condensed rings prior to analysis by gas chromatography-mass spectrometry (GC-MS) and/or reversed-phase HPLC with fluorescence emission spectral identification is described.

702,073
PB-275 450/5 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, Colo. Cryogenics Div.
Cryogenic Fluids Density Reference System: Provisional Accuracy Statement,
J. D. Siegwarth, B. A. Younglove, and J. F. LaBrecque. Nov 77, 31p NBS-TN-698
Sponsored in part by American Gas Association, Inc., Arlington, Va. See also PB-263 776.

Keywords: *Liquefied natural gas, *Density(Mass/volume), *Densimeters, Cryogenics, Standards, Process charting, Design criteria, Error analysis, Vapor pressure, Performance evaluation, Accuracy, Density reference systems.

The density reference system of the Cryogenics Division of the National Bureau of Standards is described. This system is used in making density measurements of cryogenic liquids. The methods of computation and the accuracy to which the density of the liquid can be measured are discussed in detail. At this time the estimate of sample standard deviation for a single density measurement made using this system is 0.016% (at 422.63 kg/cu m). Using three times this standard deviation as a limit for random error and using 0.028% as the bound for known sources of possible systematic error, the uncertainty of a single determination with this system is + or - 0.076%. This statement of accuracy applies for the density range 400 to 480 kg/cu m, pressures from 0 to 3 bar, and temperatures from 110 K to 125 K. Because of the densimeter design, this accuracy statement is expected to apply to the density range from 400 to 1000 kg/cu m and to the temperature range of 77 to 300 K at least, and to pressures of 7 bar, though these ranges of application have yet to be verified.

702,074
PB-276 020/5 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
National Measurement System for Spectrophotometry.
Final rept.,
W. H. Venable. Nov 77, 102p NBSIR-75-940

Keywords: *Spectrophotometry, Laboratory equipment, Performance evaluation, Sources, Economics, Remote sensing, Agricultural products, Photography, Warning systems.

A special study of the spectrophotometric measurement system was made in order to determine what could be done to improve these measurements and what benefits would result from the improvements. It was found that improvements in the measurements could make large contributions to productivity, health, and safety in the U.S., and that, because of the fragmented nature of this measurement community, the improvements in spectrophotometric measurements can be realized most efficiently through the efforts of a centralized agency such as NBS. With the aid of this study, the program in spectrophotometry at NBS has been revised in order to bring about these improvements more rapidly and effectively.

702,075
PB-276 132/8 PC **A13**/MF **A01**
National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
Procedures Used at the National Bureau of Standards to Determine Selected Trace Elements in Biological and Botanical Materials.
Special pub.,
R. Mavrodineanu. Nov 77, 297p NBS-SP-492
Sponsored in part by Environmental Protection Agency, Washington, D.C. and Energy Research and Development Administration, Washington, D.C. Library of Congress Catalog Card no. 77-608301.

Keywords: *Chemical analysis, *Trace elements, *Biological extracts, Atomic spectroscopy, Fluorescence, Absorption spectra, Polarography, Samples, Neutron activation analysis, Arsenic, Antimony, Copper, Platinum, Vanadium, Manganese, Mercury(Metal), Selenium, Chromium, Cadmium, Iron, Lead(Metal), Molybdenum, Nickel, Silver, Tellurium, Thallium, Zinc, Beryllium, Magnesium, Potassium, Rubidium, Sodium, Tissues, Flame emission spectroscopy, Spark source mass spectroscopy.

This volume consists of thirteen papers describing the analytical procedures selected at the National Bureau of Standards (NBS) for the determination of Ag, Al, As, Be, Bi, Ca, Cd, Cr, Cu, Fe, Hg, K, Mg, Mn, Mo, Na, Ni, Pb, Pt, Sb, Se, Te, Tl, V, and Zn in biological and botanical materials. These procedures are used at the present time for the certification of various substances issued by NBS as Standard Reference Materials, and belong to the following analytical disciplines: sample preparation, neutron activation analysis, spark source mass spectrometric isotope dilution, atomic absorption and flame emission spectrometry, molecular absorption spectrometry, fluorescence spectrometry, and polarography. Further details on the analytical methods including sample preparation, purity of reagents, and problems associated with blanks are given in sixteen additional papers which are reproduced in the Appendix to this volume.

702,076
PB-276 201/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Infrared-Active Lattice Vibrations in Alkali Azides.
Final rept.,
N. E. Massa, S. S. Mitra, H. Prask, R. S. Singh, and S. F. Trevino. 1 Jul 77, 7p
Grants DA-ARO(D)31-124-G1104, DA-ARO-D-31-124-70-G61
Sponsored in part by Grant DA-ARO-D-31-124-71-G151 and Grant DA-ARO-D-31-124-72-G172.
Pub. in Jnl. of Chemical Physics 67, n1 p173-179, 1 Jul 77.

Keywords: *Infrared spectra, *Far infrared radiation, *Inorganic azides, Sodium azides, Crystal structure, Lattice vibrations, Reprints, Lithium azides, Potassium azides, Rubidium azides, Cesium azides, Reststrahlen.

The far infrared reststrahlen spectra of lithium, sodium, potassium, rubidium, and cesium azides have been measured. The reflection spectra of monocrystalline and polycrystalline samples were analyzed by Kramers-Kronig and damped Lorentz oscillaior methods to obtain long wavelength optical mode frequencies and optical constants. It has been determined that the substances are quasicubic, which results in small anisotropy splittings. The similarity of the alkali azides with corresponding halides is pointed out.

702,077
PB-276 228/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Selection and Cleaning of Plastic Containers for Storage of Trace Element Samples.
Final rept.,
J. R. Moody, and R. M. Lindstrom. Dec 77, 4p
Pub. in Analytical Chemistry, v49 n14 p2264-2267 Dec 77.

Keywords: *Samples, *Trace elements, *Containers, Laboratory equipment, Plastics, Cleaning, Mass spectroscopy, Neutron activation analysis, Storage, Reprints.

Because the sample container represents one of the earliest and potentially one of the largest sources of sample contamination, much of the analytical accuracy will depend upon the choice of container materials and the method of cleaning containers. Twelve different plastics have been examined by gravimetry, isotope dilution mass spectrometry, and neutron activation analysis. The present study examines the levels of impurities present in the various plastics as well as the quantities of impurities leached from the plastics by acid cleaning. A suggested method of cleaning containers is presented.

702,078
PB-276 396/9 PC **A04**/MF **A01**
National Bureau of Standards, Boulder Colo. Cryogenics Div.
Evaluation of Commercial Densimeters for Use in LNG (Liquefied Natural Gas),
J. D. Siegwarth, B. A. Younglove, and J. F. LaBrecque. Oct 77, 52p NBS-TN-697
Sponsored in part by American Gas Association, Inc., Arlington, Va.

Keywords: *Densitometers, *Methane, Liquid phases, Density(Mass/volume), Performance evaluation, Cryogenics, Comparison, Liquefied natural gas, *Vibrating cylinder densimeters, *Vibrating plate densimeters, *Dielectric densimeters.

The cryogenic fluids density reference system has been used to evaluate three basic types of densimeters: the vibrating element type, the dielectric cell type and the displacement type. These meters were used to measure densities in liquid methane and liquid methane mixtures with ethane, propane, normal butane, and nitrogen. Measurements were made over the density range from 400 to 480 kg/cu m, temperatures from 108 K to 130 K, and pressures from 1 to 3 bar. A hundred measurements were made at various densities, temperatures, pressures, and compositions.

702,079
PB-278 633/3 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Instrument to Evaluate Installed Smoke Detectors.
Final rept.,
T. G. K. Lee. Feb 78, 39p NBSIR-78-1430

Keywords: *Aerosols, *Measuring instruments, Performance evaluation, Mobile equipment, Particle size distribution, Gas detectors, *Smoke detectors.

An inexpensive portable instrument has been constructed to test the sensitivity response of installed fire smoke detectors. The test stream consists of impactor-selected small particles from aerosol generated by a pneumatic nebulizer and dilution air. The flow rate of the test stream is 140 L/min and its aerosol concentration can be varied from 10 to 60 mg/cu m, sufficient to cover the sensitive ranges of the nine typical detectors tested. The aerosol mass median particle diameter of 0.46 micrometer and the breadth of the size distribution in terms of geometric standard deviation, is 1.5. The size distribution of the polydisperse aerosol at the output is independent of the aerosol concentration in the range of interest and is comparable to some fire smokes. Aerosol light obscuration as measured by a standardized photometer is linear with respect to the aerosol mass concentration (mg/cu m) and has a ratio 2.3 sq m/g for this aerosol compared to 1.5 sq m/g for cotton lampwick smoke in the UL 217 chamber.

702,080
PB-278 934/5 Not available NTIS

National Bureau of Standards, Gaithersburg, MD.
Full-Photon-Counting Rayleigh Spectrometer: A Correlation and/or Fast Fourier Transform Instrument.
Final rept.,
C. C. Han. 1978, 8p
Pub. in Review of Scientific Instruments 49, n1 p31-38 Jan 78.

Keywords: *Laboratory instruments, Rayleigh scattering, Performance evaluation, Design criteria, Minicomputers, Reprints, *Rayleigh spectrometers, Fast Fourier transforms.

A fast, flexible, and relatively inexpensive minicomputer based Rayleigh spectrometer has been constructed. This spectrometer can use photon pulses in a most efficient way by performing autocorrelation and/or FFT with any desired number of channels. Its capability has been demonstrated by measuring large latex particles, small sodium dodecyl sulfate micelles, and a polydisperse latex-gamma-globulin system. Detailed timing diagrams and circuit schematics are also included.

702,081
PB-280 389/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of the Size Distribution of Liquid and Solid Aerosols by Doppler Shift Spectroscopy.
Final rept.,
I. Chabay, and D. S. Bright. Feb 78, 6p
Pub. in Jn. of Colloid Interface Science, v63 n2 p304-309 Feb 78.

Keywords: *Particle size distribution, *Aerosols, Dopple effect, Calibrating, Laboratory equipment, Performance evaluation, Light scattering, Mie scattering, Reprints, *Doppler shift spectroscopy, Phthalate/dioctyl.

Particle Doppler shift spectroscopy (PDSS) is being used at NBS for measuring the size distribution of particles produced by aerosol generators, calibrating other types of particle sizing instruments, and studying the agglomeration, coalescence, evaporation, and condensation of liquid and solid aerosols. Size distributions of particles in the size range 0.5-50 micrometers can be measured in minutes or seconds. Number densities in the scattering volume from single particle to 10 to the 5th power/cc can be handled. The technique at present has a precision of 0.05 micrometers. Measured sizes are accurate to 0.08 micrometers. Calculations of the Mie scattering function for materials of known refractive index serve to normalize the size distributions and provide instrument calibration from first principles. Light scattered out of a horizontally propagating laser beam by falling particles is collected at one angle in the vertical scattering plane. Beat frequencies in the photocurrent of the detector due to the Doppler shift of the radiation scattered by the settling aerosol are analyzed to determine particle velocities. The slip-corrected Stokes Law settling velocity gives the particle's size, while the aplitude of the beat frequency component contains information on the number of particles of that size. Dioctylphthalate (DOP) aerosol produced by a Berglund-Liu vibrating orifice generator, polystyrene latex spheres, and powder samples have been studied thus far by the PDSS technique at NBS.

702,082
PB-280 422/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heating Microscopic Particles with Laser Beams.
Final rept.,
H. S. Bennett, and G. J. Rosasco. Feb 78, 8p
Pub. in Jnl. of Applied Physics, v49 n2 p640-647 Feb 78.

Keywords: *Fines, *Laboratory equipment, *Laser beams, Particles, Aerosols, Mathematical models, Temperature, Numerical analysis, Optical measurement, Performance evaluation, Reprints.

A number of recently developed techniques for fine particle and aerosol measurement employ focused high-irradiance (power per unit area) laser beams. A knowledge of the temperature profiles in the media surrounding microsamples and the temperature of the microsample is essential for the design and operation of these instruments. In this paper, the authors develop theoretical models to estimate the final temperature and temperature profiles associated with microscopic particles heated by intense laser beams. They conclude that a heat-sinking medium, such as sapphire, can be effective in maintaining sample temperatures at acceptable levels for nondestructive analysis. This paper also examines the time required for particle temperatures to reach a steady-state time-independent value. These results are useful for assessing the effectiveness of laser power modulation techniques in these instruments. The above results are used to calculate the optical path-length changes near the heated microparticle due to temperature rises in the host medium.

702,083
PB-280 426/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Probe Microanalyzers.
Final rept.,
K. F. J. Heinrich, and H. Yakowitz. 1978, 42p
Pub. in X-Ray Spectrometry, ch7 p163-204 1978.

Keywords: *Laboratory equipment, Electron probes, X ray analysis, Electron microscopes, Chemical analysis, Performance evaluation, *Electron probe microanalysis, Scanning electron microscopy.

Within the framework of a book on x-ray spectrometric analysis, this chapter describes the principles, instrumentation, quantitation theory and application of electron probe microanalysis. The common features and specific characteristics of both the electron probe microanalyzer and the scanning electron microscope are discussed, as are the advantages and limitations of energy-dispersive x-ray spectrometric analysis with the lithium-drifted silicon detector. A large selection of general and specific literature references is given.

702,084
PB-280 468/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Systematic Error in Chemical Analysis.
Final rept.,
L. A. Currie, and J. R. DeVoe. 1977, 26p
Pub. in Proceedings of Symposium on Division of Analytical Chemistry 171st Meeting of the American Chemical Society, New York, Apr. 5-6, 1976 p114-139 1977.

Keywords: *Chemical analysis, *Error analysis, Reprints.

Inaccurate analytical results, which sometimes lead to damaging societal decisions, are invariably the product of systematic error. This review focuses on four key aspects of systematic error in chemical analysis: (a) the serious consequences of inaccuracy in the external use of analytical results, (b) the essential requirement of systematic error detection or accuracy verification via laboratory or method intercomparison, (c) the systems analytic approach to the CMP as the only reliable, organized way to anticipate the origin, magnitude and flow of systematic error, (d) the power of numerical and graphical diagnostic techniques, which are rapid and relatively immune to assumptions and blunders, for exposing the particular nature of systematic errors following their detection.

702,085
PB-280 808/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characterization of Solids - Chemical Composition.
Final rept.,
W. W. Meinke. 1973, 49p
Pub. in Treatise on Solid State Chemistry ch7 v1 p387-435 1973.

Keywords: *Solids, *Chemical analysis, Atoms, Chemical composition, Reprints.

Determination of the chemical composition of solids, ie. information on the identity and location of the atoms in a particular material, is essential if one is to have confidence that the material can be reproduced. In this chapter an integrated summary of pertinent information on many different analytical techniques is presented. Summaries of sensitivities and precisions to be expected using these techniques are given. Applications to specific characterization problems are discussed and examples are given from the literature, of detailed studies of a number of high purity materials which illustrate the present state-of-the-art for the characterization of practical samples.

702,086
PB-281 046/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of Nanogram Per Gram Concentrations of Iron by Isotope Dilution Mass Spectrometry.
Final rept.,
E. L. Garner, and L. P. Dunstan. 1978, 5p
Pub. in Proceedings of Int. Mass Spectrometry Conference (7th), Florence, Italy, Aug 30-Sep 3, 1976, p481-485 1978.

Keywords: *Iron, *Chemical analysis, Concentration(Composition), Mass spectrometry, Samples, Error analysis, Blood analysis, Reprints.

Iron concentrations have been determined in blood serum, rhenium filament ribbons, high-purity reagents and high-purity molybdenum, rhenium and silver ingots by thermal ionization isotope dilution mass spectrometry. The concentration of iron in these materials has ranged from 0.1/ng for sub-boiling distilled reagents to approximately 1 micrograms/g for blood serum and high-purity metals. Known sources of error in the concentration determination are the calibration of the spike solution, the variability of the analytical blank, the isotopic ratio determination, and the natural iron contribution from the ionizing filament. The magnitufe and variability of the analytical blank were found to be the limiting factors in the measurement of nanogram quantities of iron. Although the blank has been controlled at less than 50 ng, there are still random factors which produce magnitudes and variabilities greater than 100 ng. Measures utilized to control the analytical blank include the chemical preparation of all samples in a Class 100 clean air environment, rigorous cleaning of apparatus, exclusive use of sub-boiling distilled reagents, thorough cleaning of ion exchange resin, and acid leaching of rhenium filament ribbons.

702,087
PB-281 056/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Lactate Dehydrogenase Inhibitors in NADH Preparations.
Final rept.,
S. A. Margolis, B. F. Howell, and R. Schaffer. 1977, 4p
Pub. in Clinical Chemistry 23, n9 p1581-1584 1977.

Keywords: *Chromatography, *Lactate dehydrogenase, Inhibitors, Cellulose, Oxidation, Chemical analysis, Reprints, *Adenosine pyrophosphate/(dihydro-ribofuranosylnicotinamide-ester), *High performance liquid chromatography, Adenosine pyrophosphates, Cellulose/amino-ethyl-diethyl.

The presence of a new lactate dehydrogenase inhibitor on the trailing edge of the NADH peak from chromatography on diethylaminoethyl-cellulose was verified. It was resolved from the NADH by high-performance liquid chromatography on mu Bondapak C18. When the new inhibitor was present in a reaction mixture to the extent that, of the initial 260-nm absorbance about 5% was contributed by the inhibitor, the rate of NADH oxidation by lactate dehydrogenase decreased by 65%. The inhibitor absorbs at 260 and 340 nm, and is different from the Strandjord-Clayson inhibitor by both types of chromatography. Because this new inhibitor has ultraviolet properties similar to those of NADH and chromatographs with the NADH on DEAE-cellulose, the high-performance liquid chromatographic method must be used to ensure its absence in preparations of NADH used for clinical assay.

702,088
PB-281 340/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Trace Organic Analysis.
Final rept.,
H. S. Hertz, W. E. May, S. A. Wise, and S. N. Chesler. Apr 78, 6p
Pub. in Analytical Chemistry, v50 n4 p428A-433A Apr 78.

Keywords: *Trace elements, *Organic compounds, *Chemical analysis, Performance evaluation, Methodology, Reprints.

Until recently the major emphasis in trace analysis has been in the analysis of inorganic substances. However, we are now coming to realize that many of our most pressing problems require competence in trace organic analysis. This report contains a discussion of the present state-of-the-art of trace organic analysis. Included are a discussion of the achievement of accuracy in trace organic measurements and current method-

ologies being used in performing these measurements.

702,089
PB-281 971/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermometry by Nuclear Quadrupole Resonance.
Final rept.,
D. B. Utton, and J. Vanier. Dec 76, 6p
Pub. in Instrum. Technol., v23 n12 p47-52 Dec 76.

Keywords: *Nuclear quadrupole resonance, *Temperature measurement, Performance evaluation, Design criteria, Reprints.

Although temperature measurement based on nuclear quadrupole resonance involves more sophisticated hardware than conventional techniques, it offers several advantages: universal calibration, ultrahigh precision and insensitivity to mechanical handling. The authors explain the principles of NQR thermometry, describe the temperature sensor and its associated control equipment, and then present some of the potential applications of this new method to industrial and scientic measurements.

702,090
PB-281 977/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quantitative Determination of Volatile Trace Elements in NBS Biological Standard Reference Material 1569, Brewers Yeast.
Final rept.,
H. L. Rook, and W. Wolf. Dec 77, 10p
Proceedings Univ. of Missouri's Annual Conference (11th) on Trace Substances in Environmental Health, Held at Univ. of Missouri, Columbia, Missouri, 7-9 June 1977.
Pub. in Trace Substances in Environmental Health, v11 p324-333 Dec 77.

Keywords: *Trace elements, *Chemical analysis, *Chromium, Standards, Yeast, Volatility, Distillation, Radioactivation analysis, Reprints, *Standard reference materials, *Brewers yeast.

In the past few years, a large body of analytical data has been reported on trace levels of chromium in biological samples. From data on standard materials, such as NBS Standard Reference Material 1577, Bovine Liver, and other IAEA standard materials, it is now apparent that much of the reported chromium data are in error. It has been suggested that part of the analytical problems may be due to the presence of a volatile organic complex of chromium in many biological matrices. A recent publication reported negative results in volatilization study involving Cr-51 tracers in brewers yeast. In an effort to resolve the question of chromium volatility, a series of experiments have been conducted on a new NBS Standard Reference Material--Brewers Yeast, SRM 1569, which has been certified for chromium content. The experimental design allowed for the quantitative collection of volatile species in a thermally-heated vacuum distillation system over a temperature range of 150-325C. A small fraction of the total chromium (about 5 ng), about 25 percent of the total mercury and about 50 percent of the total selenium, were trapped and quantified. The elements arsenic, silver, and gold were also observed in the trapped fraction.

702,091
PB-282 254/2 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Evaluation of New Portable X-Ray Fluorescent Lead Analyzers for Measuring Lead in Paint,
A. P. Cramp, and H. W. Berger. May 78, 60p NBSIR-78-1466
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Assistant Secretary for Policy Development and Research.

Keywords: *Lead(Metal), *Laboratory equipment, *X ray analysis, Performance evaluation, X ray fluorescence, Paint, Calibrating, Chemical analysis, Lead based paints.

Portable x-ray fluorescent lead analyzers offer the most cost-effective and adaptable means for the nondestructive detection and measurement of lead in paint in housing. However, commercially available portable lead analyzers have had poor accuracy and precision below lead levels of about 3.0 milligrams of lead per square centimeter of surface area. This is particularly serious because the current operational criteria for lead paint hazard abatement, 1.5 or 2.0 mg/cm of lead maximum (used in many communities) is in this range. They have also performed relatively unsatisfactorily with regard to serviceability and maintenance. Two new portable lead analyzers based on x-ray fluorescence have been developed under HUD contracts. The prototypes of one of these devices have shown considerable improvement over previously available instruments in terms of accuracy, portability, and user characteristics. This report discusses the performance and operating characteristics of the new lead analyzers.

702,092
PB-282 869/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Physical Basis for Quantitative Surface Analysis by Auger Electron Spectroscopy and X-ray Photoelectron Spectroscopy.
Final rept.,
C. J. Powell. Feb 78, 26p
Pub. in Proceedings of American Society for Testing and Materials Symposium on Quantitative Surface Analysis of Materials, Cleveland, Ohio, 2-3 Mar 77 (ASTM Special technical publication 643, p5-30 Feb 78).

Keywords: *Surface properties, *Quantitative analysis, Reviews, Auger electron spectroscopy, Xray photoelectron spectroscopy.

A review is given on the physical basis for quantitative surface analysis by Auger-electron spectroscopy (AES) and by X-ray Photoelectron Spectroscopy (XPS) or ESCA. The principal topics discussed are: the feasibility of surface analysis; approaches to surface analysis; description of models and data for surface analysis by AES and XPS; analytical methods; intensity measurements; practical considerations; applications; and reference materials.

702,093
PB-282 871/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of Iodine in Biological and Environmental Standard Reference Materials.
Final rept.,
H. L. Rook. 1977, 8p
Pub. in Jnl. of Radioanalytical Chemistry, v39 p351-358 1977.

Keywords: *Iodine, *Chemical analysis, Separation, Reprints, Standard reference materials, Procedures.

Iodine is an element with excellent intrinsic sensitivity when determined by thermal neutron activation. However, in most real samples, the preponderance of chlorine and bromine, relative to iodine, makes the direct determination of iodine virtually impossible. Over the past 20 years, there probably have been as many publications on the separation of iodine as there have been for any other radionuclide. Upon review, however, the methods are essentially the same. After irradiation, the samples are subjected to a rapid destructive process to free the iodine from the matrix and then the iodine is separated from the other halides either by liquid-liquid extraction or by liquid ion exchange. Both of these procedures are, however, rather complex and do not effect a complete separation of the halides in one pass. In the work presented here, a simple procedure is described for the quantitative separation of iodine from chlorine. The procedure uses a gas phase separation on hydrated manganese dioxide with iodine collected on silvered quartz wool. The described procedure has been used for the determination of iodine in numerous new and old SRM's at the NBS.

702,094
PB-282 878/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Probe Testing for Homogeneity of Standards (Abstract).
Final rept.,
K. F. J. Heinrich, R. B. Marinenko, and F. C. Ruegg. Aug 77, 4p
Pub. in Proceedings of International Conference on X-ray Optics and Microanalysis (8th) (Abstract) and Annual Conference of the Microbeam Analysis Society (12th), Boston, Mass. 18-24 Aug 77 p148A-148D Aug 77.

Keywords: *Electron probes, Standards, Performance evaluation, Laboratory equipment, *Standard reference materials.

Standard Reference Materials (SRM's) certified for composition by the National Bureau of Standards have occasionally been used to test the accuracy of microprobe techniques. Such use is justified only if these materials have been previously tested for homogeneity on a micrometer scale. Two research materials which were also tested for homogeneity on a micrometer scale.

702,095
PB-282 902/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
FRAME C: A Compact Procedure for Quantitative Energy-Dispersive Electron Probe X-ray Analysis (Abstract).
Final rept.,
R. L. Myklebust, C. E. Fiori, and K. F. J. Heinrich. Aug 77, 4p
Pub. in Proceedings of International Conference on X-ray Optics Microanalysis (8th) and Annual Conference of Microbeam Analysis Society, Boston, Mass. 18-24 Aug 77 p96A-96D Aug 77.

Keywords: *Chemical analysis, Electron probes, Laboratory equipment, X ray analysis, Performance evaluation, *Electron probe microanalysis, Computer applications, Procedures.

A correction procedure (FRAME C) for quantitative electron probe microanalysis with a lithium-drifted silicon detector was developed for use with a small computer. The procedure consists of a background correction calculated from two selected background regions of interest, a simple method of resolving overlapping peaks, and the ZAF matrix corrections. To save computation time, FRAME C uses small groups of adjacent channels (regions of interest) in the multi-channel analyzer rather than individual channels for the calculations. The method used for computing the overlap factors is also described. Examples of several different types of analyses are presented.

702,096
PB-282 918/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Role of Reference Materials and Reference Methods in the Measurement Process.
Final rept.,
G. A. Uriano, and J. P. Cali. 1977, 22p
Pub. in Proceedings of Symposium Div. of Analytical Chemistry (171st Meeting) American Chemical Society p140-161 1977.

Keywords: *Standard reference materials, Standards, Calcium, Chemical analysis, Nitrogen dioxide, Trace elements, Mercury(Metal), Water analysis, Chromium, Concentration(Composition).

Reference Materials (called Standard Reference Materials SRM's by the National Bureau of Standards, NBS) are two important mechanisms being used to assure the accuracy and compatibility of measurements in large measurement systems. SRM's are materials whose properties (compositional and/or physical) have been well-characterized and certified by NBS. Refernce Methods are analytical methods having high accuracy and precision, which have been vigorously demonstrated. A systems approach to establishing accurate measurement systems is presented. Reference materials and reference methods assist in the transfer of accuracy gained in the experimental realization of base measurement units to the performance of measurements in the field. The application of the systems approach to 'real world' situations is illustrated through the presentation of four examples: (1) The measurement of calcium in serum; (2) The determination of NO2 in ambient air; (3) The analysis of trace levels of mercury in water; and (4) The measurement of chromium in biological matrices.

702,097
PB-284 602/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quantitative Surface Analysis by Electron Spectroscopy.
Final rept.,
C. J. Powell. Apr 78, 15p
Pub. in Am. Lab., v10 n4 p17-31 Apr 78.

Keywords: *Surfaces, Mathematical models, Performance evaluation, Photoelectron spectroscopy, *Auger electron spectroscopy, X ray photoelectron spectroscopy, Reprints.

A brief review is given of the current status of quantitative surface analysis by Auger-elctron spectroscopy and X-ray photoelectron spectroscopy. Most methods

of analysis rely on a three-step model to describe the measurement process and tests are reported that confirm the validity of the model, associated data, and methods for intensity measurement. It is concluded that surface analyses of homogeneous single-phase samples are now possible but further work is needed to extend the procedures to more complex samples and to establish accuracies of measurement.

702,098
PB-284 623/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
System is Accurate, Precise for LNG Sampling.
Final rept.,
W. R. Parrish, J. M. Arvidson, and J. F. LaBrecque. Apr 78, 3p
Pub. in Hydrocarbon, Proc. 57 n4 p114-116 Apr 78.

Keywords: *Liquefied natural gas, *Sampling, Chemical analysis, Gas chromatography, Laboratory equipment, Field tests, Hydrocarbons, Reprints.

This paper describes a system for obtaining representative samples from flowing LNG systems. Laboratory and field tests showed that the total uncertainty in the computed heating value of samples taken with this sampling system could be routinely within + or - 0.2 percent; this included the + or - 0.1 percent uncertainty due to analysis by gas chromatography.

702,099
PB-284 627/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
State-of-the-Art of Quantitative Electron Probe Microanalysis.
Final rept.,
K. F. J. Heinrich. 1976, 6p
Pub. in Proceedings of Intern. Conf. on X-Ray Optics and Microanalysis (8th), Held at Moscow, U.S.S.R. on July 7-16, 1974 p187-192.

Keywords: *Electron probes, *Microanalysis, Chemical analysis, Performance evaluation, Error analysis, Standards, Standard reference materials, State of the art.

The theory of corrections for quantitative electron probe analysis has occupied the investigators for many years. However, the precision of measurement and the availability of reliable standard reference materials are now among the main factors limiting the accuracy of the procedure. Unless stable measurements are performed under controlled conditions of X-ray intensities from materials of known composition, there is little hope that theoretical considerations can provide significant improvement in the accuracy of analysis.

702,100
PB-284 730/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of Improved Portable X-ray Fluorescent Lead Paint Analyzers and Lead Paint Reference Standards.
Final rept.,
A. P. Cramp, and H. W. Berger. 1978, 6p
Sponsored in part by Department of Housing and Urban Development, Washington, D.C.
Pub. in Proceedings of Joint Conference (4th) on Sensing of Environmental Pollutants, New Orleans, La., Nov 6-11, 1977, p354-359 1978.

Keywords: *Lead(Metal), *Paints, *X ray fluorescence, *Detectors, Performance evaluation, Calibrating, Standard reference materials, Lead based paints.

Portable x-ray fluorescent lead analyzers offer the most cost-effective rapid and adaptable means for the non-destructive detection and measurement of lead paint in housing. Commercially available portable lead analyzers have had poor accuracy and precision below lead levels of about 2 milligrams lead per square centimeter of surface area. They have also performed relatively unsatisfactorily with regard to service-ability and maintenance. Two new portable lead analyzers, based on x-ray fluorescence, have been developed under HUD contracts. The prototypes of one of these devices have shown considerable improvement over previously available instruments in terms of accuracy, portability, and user characteristics. Lead paint reference materials containing 0.6, 1.5, and 3.0 mg sq cm lead have been developed for distribution to users of portable x-ray fluorescent lead analyzers for purposes of calibration and instrument performance assessment. This paper discusses the performance and operating characteristics of the lead analyzers developed under HUD contracts and the lead paint reference materials developed by the National Bureau of Standards.

702,101
PB-285 022/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Accuracy of Quantitative Analysis in Secondary Ion Mass Spectrometry - Round Robin Results,
D. E. Newbury. Jun 78, 9p
Pub. in Proceedings Annual Conf. Microbeam Analysis Society (13th), Held at Ann Arbor, Michigan on June 19-23, 1978 p6A-6I Jun 78.

Keywords: *Quantitative analysis, *Mass spectroscopy, Microanalysis, Accuracy, Secondary ion mass spectroscopy, Ion microprobes, Microprobe analysis.

Quantitative analysis by secondary ion mass spectrometry can be carried out with relative elemental sensitivity factors. The procedure yields good accuracy in tests on known samples. To evaluate the accuracy which can be expected in the analysis of unknowns, a round robin analysis has been carried out. Four laboratories performed qualitative and quantitative analyses on four multi-element glass samples. Quantitative analyses were performed with sensitivity factors derived from a suite of glasses previously prepared by NBS. The distribution in errors which was observed for all of the analyses was such that 57 percent of the analyses fell within 20 percent relative of the known compositional values, and 91 percent within a factor of two.

702,102
PB-285 024/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Secondary Ion Mass Spectrometry for Particle Analysis.
Final rept.,
D. E. Newbury. Jun 78, 4p
Pub. in unidentified jnl.

Keywords: *Mass spectroscopy, *Particles, Microanalysis, Lead inorganic compounds, Silicates, *Secondary ion mass spectroscopy, Microprobe analysis, Ion microprobes, *Lead silicates.

Secondary ion mass spectrometry is a powerful tool for particle analysis. Microanalysis at the micrometer scale is possible in the ion microprobe and ion microscope. Surface analysis can be carried out since the primary ion range is less than 50 nm and the secondary ion range is less than 5 nm. Studies of elemental distributions in depth can be made by sputtering the sample in a controlled fashion. Disadvantages of SIMS include the destructive nature of ion erosion, the strong matrix effects on secondary ion signals, the complicated spectra, and the local damage caused by ion bombardment. Limits of detection for a lead-silicate matrix are reported. The existence of a particle size effect on relative elemental sensitivity factors is reported.

702,103
PB-285 025/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Progress in Quantitation of Single-Particle Analysis with the Electron Probe.
Final rept.,
J. A. Small, K. F. J. Heinrich, C. E. Fiori, D. E. Newbury, and R. L. Myklebust. Jun 78, 11p
Pub. in Proceedings Annual Conf. Microbeam Analysis Society (13th), Held at Ann Arbor, Michigan on June 19-23, 1978, p56A-56K Jun 78.

Keywords: *Quantitative analysis, *Particles, *Electron irradiation, Continuous radiation, Electron probes.

The National Bureau of Standards is currently developing methods for the quantitative analysis of particles which are based on the energy distribution of the continuous x-rays generated as a result of the electron beam interaction within the sample. One method which is currently being developed in the use of the ratios between characteristic and continuous radiation, live-to-background ratios, to account for the difference between the volume of beam interaction within a particle and a bulk standard. The results of the live-to-background ratios are presented for bulk glass and glass microspheres. The results show good agreement between bulk glass and microspheres in the size range of 1.5 to 29 micrometers in diameter. In addition to the results, an iterative procedure for the quantitative analysis of particles is presented. This procedure makes use of the ratio of the continuum from the particle compared to the continuum from the standard to scale up the peak intensity of the particle to a value appropriate to bulk material.

702,104
PB-285 047/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Particle Analysis with the Laser-Raman Microprobe.
Final rept.,
E. S. Etz, G. J. Rosasco, J. J. Blaha, K. F. J. Heinrich, and W. C. Cunningham. Jun 78, 12p
Pub. in Proceedings Annual Conf. Microbeam Analysis Society (13th), Held at Ann Arbor, Michigan on June 19-23, 1978, p66A-66L.

Keywords: *Raman spectra, *Microanalysis, *Spectroscopic analysis, Reviews, Particles, Aerosols, Air pollution, *Microprobe analysis, Laser spectroscopy.

A review and results of current research are presented on the microanalytical applications of the laser-Raman microprobe developed at NBS. With the new instrument, Raman spectra can be obtained of single particles or sample regions of micrometer dimensions. These provide a molecular fingerprint and are useful in the qualitative analysis of microsamples for constituent molecular compounds. The microprobe is described and its capabilities are illustrated for the detection and spectroscopic characterization of major molecular components in microparticulate matter of mass down to 10 picogram. Examples include the measurement of inorganic species (e.g., sulfate, carbon) and of organic compounds (e.g. polynuclear aromatic hydrocarbons) of interest in environmental pollution studies. Results from the analysis of single particles (<10 micrometer in size) in urban airborne dusts and in fly ash from power plants are given. Work on the characterization of submicron air particulates collected at the South Pole shows the presence of atmospheric sulfate. Microanalysis of biological specimens has emphasized the investigation of thin (5-10 micrometer thickness) sections of tissue. Examples are the study of thin sections of bone and tooth to furnish new results on the process of calcification. In a study of samples of human biopsy tissue, silicone rubber particles have been identified that can be linked to complications from an implanted silicone rubber prosthetic device.

702,105
PB-285 330/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of Several Trace Metals in Simulated Fresh Water by Graphite Furnace Atomic Emission Spectrometry.
Final rept.,
M. S. Epstein, T. C. Rains, T. J. Brady, J. R. Moody, and I. L. Barnes. Jun 78, 7p
Pub. in Jnl. Anal. Chem., v50 n7 p874-880, Jun 78.

Keywords: *Atomic spectroscopy, *Spectrochemical analysis, *Trace elements, *Water analysis, Copper, Manganese, Barium, Aluminum, Molybdenum, Nickel, Beryllium, Reprints.

Copper, manganese, barium, aluminum, molybdenum, nickel, and beryllium are determined in the part-per-billion concentration range in Standard Reference Material (SRM) 1643 (Trace Elements in Water) using graphite furnace atomic emission spectrometry. The precision and accuracy of results are compared to analysis by graphite furnace atomic absorption spectrometry. The effect of chemical, physical, and spectral interferences on analytical results using both techniques is evaluated.

702,106
PB-285 452/9 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C.
Evaluation of X-Ray Fluorescence Analysis for the Determination of Arsenic, Vanadium, Cadmium, Lead and Mercury in Various Matrices.
Final rept. Jun 77,
P. A. Pella, R. L. Myklebust, M. M. Darr, and K. F. J. Heinrich. Oct 76, 32p NBSIR-77-1211
Sponsored in part by Environmental Protection Agency, Research Triangle Park, N.C.

Keywords: *X ray analysis, *Chemical analysis, *Arsenic, *Vanadium, *Cadmium, *Lead(Metal), *Mercury(Metal), Samples, Coal, Fly ash, Copper oxides, Iron oxides, Lead oxides, Concentration(Composition), Performance evaluation, Spectrochemical analysis, X ray analysis, *X ray fluorescence analysis.

Limits of detection for arsenic, vanadium, cadmium, lead and mercury have been determined with a wavelength-dispersive or energy-dispersive spectrometry, or with both, in various matrices consisting of cupric oxide, ferric oxide, lead oxide, coal and fly ash.

702,107
PB-286 529/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Free Cyanide Analyzer.
Final rept.,
R. A. Durst. 1978, 4p
Pub. in Proceedings Conference on Ion-Selective Electrodes, Budapest (Hungary), September 5-9, 1977, p359-362 1978.

Keywords: *Cyanides, *Gas analysis, Membranes, Permeability, Design, Gas detectors, Ion selective electrodes.

A continuous measurement system for free cyanide has been developed based on the principle of diffusion across a gas-permeable membrane to affect the separation of hydrogen cyanide from the acidified sample solution. The cyanide is subsequently analyzed using a silver ion-selective electrode indicator technique. The detection limit of this system is approximately 0.5 microgram CN(-)/L. In the concentration range of 30 to 400 microgram CN(-)/L, the accuracy and precision of this method is approximately two percent.

702,108
PB-286 789/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Accuracy and Precision: Evaluation and Interpretation of Analytical Results.
Final rept.,
J. Mandel. 1978, 56p
Pub. in Treatise on Analytical Chemistry, P1, SB, p243-298 (1978).

Keywords: *Chemical analysis, Methodology, Performance evaluation, Precision, Statistical analysis, Accuracy, Calibrating, Reprints.

This is a chapter on the use of statistical methodology in the analytical chemical laboratory. It deals primarily with statistical methods for the evaluation of the precision and accuracy of analytical methods, with calibration problems, and with the comparison of analytical methods.

702,109
PB-287 022/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Sources of Error and the Approach to Accuracy in Analytical Chemistry.
Final rept.,
L. A. Currie. 1978, 148p
Pub. in Treatise on Analytical Chemistry, Part I, Sec. B, Chapter 4, 1, p95-242 1978.

Keywords: *Chemical analysis, *Error analysis, Sources, Reprints.

This is a chapter on errors in chemical analysis, prepared for the Treatise on Analytical Chemistry, at the invitation of the editors. It begins with a brief assessment of the current state of the art including the accuracy requirements for various practical purposes and the consequent demands being placed on the analyst. The introductory section concludes with an evaluation of communication needs (terminology, reporting adequacy) and a survey of basic texts and review papers. The major part of the text is devoted to a systematic evaluation of the Chemical Measurement Process (CMP) with detailed examination of systematic and random error sources which may operate at each step of the CMP. Underlying assumptions concerning the structure of the CMP, including chemical components and physical and error models, are illustrated and discussed, together with means for testing such assumptions. The discussion culminates with a section on validation and the role of standard materials and standard methods. The chapter concludes with a presentation of simplified numerical and graphical techniques. The utility of such techniques for rapid and assumption-free error detection is illustrated with intercomparison and trace analysis data.

702,110
PB-287 978/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chemical Preparation of Biological Materials for Accurate Chromium Determination by Isotope Dilution Mass Spectrometry.
Final rept.
L. P. Dunstan, and E. L. Garner. 1977, 4p
Pub. in Proceedings Annual Conf. Trace Substances in Environmental Health (11th), Held at Columbia, MO. on Jun 6-10, 1977, p334-337.

Keywords: *Biological extracts, *Chemical analysis, *Chromium, Mass spectroscopy, Trace elements, Concentration(Composition), Performance evaluation, Accuracy, Sampling, Procedures.

The current interest in trace elements in biological materials has created a need for accurate methods of analysis. The source of discrepancies and variations in chromium concentration determinations is often traceable to inadequate methods of sample preparation. Any method of Cr analysis that requires acid digestion of a biological matrix must take into consideration the existence or formation of a volatile Cr component. In addition, because Cr is often present at concentrations less than 1 micrograms/g, the analytical blank becomes a potential source of error. Chemical procedures have been developed for the digestion of the biological matrix and the separation of Cr without either large analytical blanks or significant losses by volatilization. These procedures have been used for the analysis of NBS Standard Reference Material (SRM) 1569 Brewers Yeast; SRM 1577 Bovine Liver; SRM 1570 Spinach and other biological materials including human hair and nails. At this time, samples containing 1 microgram of Cr can be determined with an estimated accuracy of 2%.

702,111
PB-289 938/3 PC **A10**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Thermophysical Properties Div.
Development and Evaluation of an LNG Sampling Measurement System.
W. R. Parrish, J. M. Arvidson, and J. F. LaBrecque.
Jul 78, 201p NBSIR-78-887
Sponsored in part by LNG Sampling Measurement Supervisory Committee.

Keywords: *Liquefied natural gas, *Gas analysis, Chemical analysis, Sampling, Field tests, Gas chromatography, Design criteria, Hydrocarbons, Laboratory equipment, Mass spectroscopy, Comparison, Performance evaluation, Data analysis.

This report describes the development and evaluation of procedures and components for sampling and analyzing LNG from flowing streams. Laboratory and field test results showed the total uncertainty in the computed heating value of samples taken with the recommended sampling system could be routinely within + or - 0.3 percent; this included the + or - 0.1 percent uncertainty in analysis by gas chromatography. Three sample probes and two vaporizer designs were considered. Of the ten operating variables considered, six were found to be important in sampling. Test results were used to establish recommended design and operating criteria.

702,112
PB-290 048/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sources in Error in Ion-Selective Electrode Potentiometry.
Final rept.,
R. A. Durst. 1978, 28p
Pub. in Chapter 5 in Ion-Selective Electrodes in Analytical Chemistry, v1 p311-338 1978.

Keywords: *Error analysis, *Potentiometric analysis, Sources, Chemical analysis, Electrodes, *Ion selective electrodes, Reprints.

While the advantages and unique features of ion-selective electrodes are widely known and appreciated, the potential sources of error are numerous and the analyst must be aware of these pitfalls in order to be able to minimize their effects. The causes of these errors are almost as varied as the sensors and samples, but several common sources can be identified: interferences, and/or fouling of the indicator electrode, sample matrix effects, reference electrode instability, and improper calibration of the measurement system. These sources of error are discussed in some detail with suggestions for overcoming or minimizing the problems and their analytical effects. These sensors can be a useful and convenient means for the analysis of a variety of ionic, molecular and gaseous species, but only if the sources of error are recognized and eliminated. More than any other modern analytical technique, ion-selective electrode potentiometry require a sound knowledge of solution chemistry in order to achieve maximum effectiveness.

702,113
PB-291 713/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Potential Pitfalls in the Use of Ion-Selective Electrode - Reference Electrode Pairs.
Final rept.,
R. A. Durst. 1978, 12p
Pub. in Theory, Design, and Biomedical Applications of Solid State Chemical Sensors, p155-163 1978.

Keywords: Chemical analysis, Ions, Electrodes, Errors, *Ion selective electrodes, Reprints.

Ion-selective electrodes have demonstrated unique features for the measurement of a variety of ionic and gaseous species. While the advantages of these electrodes are widely known and appreciated, it is usually not until one is actually using these sensors that the problems and pitfalls become apparent and may result in serious errors and considerable aggravation. The causes of these problems are almost as varied as the sensors and the samples, but several common sources can be identified: interferences and/or fouling of the electrode, sample matrix effects, reference electrode instability, and improper calibration of the measurement system. These pitfalls are discussed in some detail with suggestions for overcoming or minimizing the problems and their associated errors. These sensors can be a useful and convenient means for the determination and monitoring of selected species, but only if the potential pitfalls are recognized and eliminated. More than any other modern analytical technique, ion-selective electrodes require a sound knowledge of solution chemistry in order to achieve the maximum effectiveness of these sensors.

702,114
PB-291 950/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation of LNG Sampling-Measurement Systems for Custody Transfer.
Final rept.
W. R. Parrish, J. M. Arvidson, and J. F. LaBrecque.
1978, 7p
Pub. in Proceedings of the American Gas Association Operating Section Transmission Conference, Montreal, Quebec, Canada, May 8-10, 1978 and Distribution Conference, Denver, Colorado, May 22-24, 1978 pT-236-T-242 1978.

Keywords: *Liquefied natural gas, *Gas analysis, Chemical analysis, Gas chromatography, Sampling, Field tests, Laboratory equipment, Sampling.

This paper describes the results of a systematic evaluation of equipment and procedures for sampling and determining composition of liquefied natural gas (LNG) from flowing streams. Laboratory and field test results show that the precision of the computed heating values of samples taken with the recommended sampling-measurement system could be within x or 0.15 percent; of this, + or - 0.06 percent is due to the random error in the composition analysis by gas chromatography. The accuracy of the composition measurement depends upon the accuracy of the gas analysis. The paper describes the recommended system and the proper operating conditions.

702,115
PB-291 976/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Trace Element Characterization of Thin Polymer Films by Proton-Induced X-ray Emission Spectrometry.
Final rept.,
D. N. Breiter, and M. L. Roush. Aug 77, 3p
Pub. in Macromolecules, v10 n4 p868-870 Aug 77.

Keywords: *Trace elements, *X ray analysis, *X ray fluorescence, *Polymeric films, Chemical analysis, Iron, Copper, Zinc, Concentration(Composition), Reprints.

Proton-induced x-ray fluorescence is a particularly well-suited technique for the simultaneous quantitative analysis of trace elements in thin polymer films. Since the sample is thin and of low atomic number, matrix effects due to proton energy loss and x-ray self absorption are small. Sensitivities are sufficient to allow

for the 5-10 minute analysis of films of 1 mg/sq cm areal density for iron, copper and zinc at concentration of several ng/sq cm.

702,116
PB-292 097/3 PC **A04**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Center for Materials Science.
Standard Reference Materials: Electron Paramagnetic Resonance Intensity Standard: SRM 2601; Description and Use.
Special pub.
T. Chang, and A. H. Kahn. Aug 78, 64p NBS-SP-260-59
Library of Congress catalog card no. 78-600064.

Keywords: *Electron paramagnetic resonance, *Standards, *Chemical analysis, Sampling, Ruby, Chromium, Concentration(Composition), Design criteria, Performance evaluation, Calibrating, *Standard reference materials.

This publication provides information concerning the use of ruby samples, of known Cr(+3) concentration, supplied as a Standard Reference Material (SRM) for intensity measurements in electron paramagnetic resonance (EPR) experiments. By comparing the measured intensities of EPR absorption lines of a test sample and of the SRM, it is often possible for the user to obtain a determination of the number of spins in the test sample. Procedures and data on ruby necessary for carrying out this process are presented. Examples of the use of the SRM in typical cases are offered.

702,117
PB-294 113/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Experiences in Developing an Automated Factor-Jump Method of Thermogravimetry.
Final rept.,
B. Dickens. 1979, 27p
Pub. in Thermochimica Acta 29, p87-113 1979.

Keywords: *Laboratory equipment, *Thermogravimetry, Automation, Activation energy, Polystyrene, Polyurethane resins, Polymethyl methacrylate, Computer aided analysis, Reprints.

The author has recently provided details of an apparatus and computer programs to implement the factor-jump method of thermogravimetry. This paper describes the refinement of the technique to the present status of quasi-automatic routine operation. The procedure was worked out using samples of polymethylmethacrylate, polystyrene and polyurethane polymers. The activation energies obtained are measured to 0.2 kcal/mole in favorable cases. This is adequate for diagnosis of changes in mechanism but may sometimes be inadequate for scaling temperature accelerated tests to room temperature.

702,118
PB-294 114/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Computer Program to Implement Automated Factor-Jump Thermogravimetry.
Final rept.,
B. Dickens. 1979, 29p
Pub. in Thermochimica Acta 29, p57-85 1979.

Keywords: *Laboratory equipment, *Thermogravimetry, Automation, Computer programs, Fortran, Activation energy, Design criteria, Polymers, Reprints.

The paper describes a computer program written to implement the factor-jump method on a thermogravimetry apparatus automated with an in-laboratory minicomputer. The program is written almost entirely in Fortran and constitutes a system of seven overlays. It determines activation energies during the course of the experiment and provides active feedback to pursue desired precision in experimental quantities and in the activation energy. The program is modular and can probably adapt to situations other than the apparatus and technique for which it was originally designed.

702,119
PB-294 123/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Automation of Factor-Jump Thermogravimetry for Active Computer Control.
Final rept.,
B. Dickens. 1979, 16p
Pub. in Thermochimica Acta 29, p41-56 1979.

Keywords: *Laboratory equipment, *Thermogravimetry, Automation, Performance evaluation, Polymers, Computer aided analysis, Reprints.

A scheme of automation of a thermogravimetry apparatus is described which was developed with the factor-jump method in mind. Temperature, pressure, and flow rates of two gases are controlled; all components except the furnace are commercially available. This paper describes the details of the automation scheme and provides data on the quality of its performance. The scheme includes a mini-computer; if no feedback is required, a recording computer terminal can be used instead.

702,120
PB-295 167/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Applications of Absolute Radiometers.
Final rept.
J. Geist. 1978, 8p
Pub. in Proceedings of the Annual Electro-Optics Laser 78 Conference (10th) Held at Boston, MA. on September 19-21, 1978, p277-284.

Keywords: *Radiometers, Radiometry, Technology.

The history of the application of absolute radiometers in science and technology is reviewed. The current growth of applications is described, and a possible role as the primary standard for all radiometric measurements is investigated.

702,121
PB-295 169/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Cadmium Analysis by Radiochemical Neutron Activation Analysis.
Final rept.,
R. R. Greenberg, M. Gallorini, and T. E. Gills. Feb 79, 4p
Pub. in Environmental Health Perspectives 28, p1-4, Feb 79.

Keywords: *Cadmium, *Neutron activation analysis, Radiochemistry, Solvent extraction, Ion exchangers, Chemical analysis, Separation, Copper, Procedures, Reprints.

Radiochemical neutron activation analysis (RNAA) has been routinely used at the National Bureau of Standards to analyze Cd in a variety of environmentally important matrices. The method used to separate Cd from other neutron-activated products is solvent extraction. Zinc diethyldithiocarbamate Zn(DDC)2 in chloroform will quantitatively extract Cd from an aqueou solution over a pH range from 1 to 12. In addition to the extraction of Cd, Zn(DDC)2 will also extract Cu, which can interfere with the Cd analysis by producing a high background level of radiation. This can be avoided by first extracting with Bi(DDC)3 in chloroform which removes Cu, but not Cd. Copper concentrations can, therefore, be determined in addition to Cd. This two extraction radiochemical separation procedure is very versatile and is often used as part of a larger multi-element analysis scheme. One such scheme involves the use of an inorganic-ion exchanger, Hydrated Manganese Dioxide (HMD), to retain As, Sb, Se, and Cr prior to extraction. The eluted fraction is then extracted with Bi(DDC)3 to remove Cu, and then with Zn(DDC)2 to remove Cd.

702,122
PB-296 440/1
(Order as PB-296 439/3, PC **A05**/MF **A01**)
National Measurement Lab. (NBS), Washington, DC. Center for Absolute Physical Quantities.
Novel Method for Analyzing Silver Sediment with High Precision,
R. S. Davis, and V. E. Bower. 25 Oct 78, 4p
Included in Jnl. of Research of the National Bureau of Standards, v84 n2 p157-160, Mar-Apr 79.

Keywords: *Silver, *Colorimetric analysis, Chemical analysis, Electrochemistry, Samples, Concentration(Composition), Accuracy, *Faraday.

A technique has been devised which is sufficiently accurate to aid in an electrochemical determination of the Faraday constant using the silver coulometer. The technique is used to recover the silver residue which falls from the anode during operation of the silver coulometer. In contrast to previous efforts at recovery, which involved weighing of the silver residue, the method here described is to convert the silver atoms to ions and then to plate the silver onto a cathode held at constant potential with respect to a reference electrode. The current involved in the electrolysis is integrated electronically. An overall standard deviation of 5 micrograms is achieved for samples ranging in size from 400 micrograms to 1.8 mg.

702,123
PB-296 978/0 PC **A99**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Trace Organic Analysis: A New Frontier in Analytical Chemistry.
Final rept.
H. S. Hertz, and S. N. Chesler. Apr 79, 788p NBS/SP-519
Proceedings of the Materials Research Symposium (9th) Held at Gaithersburg, Maryland on April 10-13, 1978. Library of Congress catalog card no. 79-600061.

Keywords: *Organic compounds, *Trace elements, *Chemical analysis, *Meetings, Electrochemistry, Sampling, Nutrients, Ecosystem, Drugs, Toxicity, Bioassay, Food additives, Gas chromatography, Mass spectroscopy, Biological extracts, Hormones, Environmental surveys, Gas analysis, Water analysis, Aromatic polycyclic hydrocarbons, Carbohydrates, Soil analysis, Chloromethanes, Pesticides, Pentanes, Concentration(Composition), Aerosols, Tissues(Biology), Air pollution detection, Water pollution detection, Liquid chromatography, State of the art, Polychlorinated biphenyls, Vitamin B, High performance liquid chromatography, Kepone.

Researchers in diverse areas must currently perform critical analyses on minute quantities of organic compounds in various matrices. It was the aim of this Symposium to bring together these scientists to discuss their common problems and to explore current and impending technology for organic analyses. Emphasis was placed on the total analysis, from collecting the sample through interpreting the results, rather than upon the measurement only. The Proceedings consist of a series of invited papers by experts as well as particularly appropriate contributed papers. Topics covered in the Proceedings are as follows: Sampling and Sampling Handling for Trace Organic Analysis, State-of-the-Art Analytical Systems, Analytical Techniques on the Horizon, Analysis of Nutrients, Analysis of Organic Pollutants and Their Metabolites in the Ecosystem, Analysis of Drugs in Body Fluid, Analysis of Food Toxicants, and Analysis of Hormones and Neurotransmitters.

702,124
PB-297 207/3 PC **A06**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.
Standard Reference Materials: A Reference Method for the Determination of Potassium in Serum.
R. A. Velapoldi, R. C. Paule, R. Schaffer, J. Mandel, L. A. Machlan, and J. N. Gramlich. May 79, 107p
NBS-SP-260-63
See also PB-294 666.

Keywords: *Potassium, *Blood chemical analysis, *Blood serum, Determination, Standards, Laboratory equipment, Samples, Calibrating, Concentration(Composition), Chemical properties, Physical properties, Performance evaluation, Mass spectroscopy, Comparison, Pipettes, Body fluids, *Standard reference materials, *Flame atomic absorption spectrometry.

Guided by a committee of experts in clinical chemistry, a reference method was established for the determination of serum potassium based on flame atomic emission spectroscopy (FAES). Its accuracy was evaluated by comparing the values obtained by use of the method in 12 laboratories against the results obtained by a definitive analytical method based on isotope dilution-mass spectrometry (IDMS). Seven serum pools with potassium concentrations in the range 1.319 to 7.326 mmol/L were analyzed. Manual and semiautomated pipetting alternatives were tested using sample sizes of 5.0 and 0.25 mL, respectively. With appropriate experimental design, the reference method may be used to establish the accuracy of field methods as well as to determine reference sodium values for pooled sera.

702,125
PB-297 904/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Analysis of Hydrogen Cyanide in Fire Environments.
Final rept.,
M. Paabo, M. M. Birky, and S. E. Womble. 1979, 10p
Pub. in Jnl. Combust. Toxicol. 6, p99-108 May 79.

Keywords: *Hydrogen cyanide, *Gas analysis, *Fires, Chemical analysis, Gas chromatography, Combustion products, Thermal degradation, Reprints.

A sensitive method for the direct gas chromatographic determination of environmental hydrogen cyanide resulting from the combustion or thermal degradation products of nitrogen containing polymeric materials is described. The gas chromatographic method uses an alkali flame (or thermionic) detector in conjunction with a Porapak Q column. The range of detection was 5-400 ppm HCN with an estimated uncertainty of + or - 5 ppm. The lower detection limit was about 50 picograms HCN (1 ppm per 50 microliter injection).

702,126
PB-298 663/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of Anion-Exchange Resin-Loaded Filters to the x-Ray Fluorescence Determination of Sulfate.
Final rept.,
B. Schreiber, and P. A. Pella. May 79, 2p
Pub. in Analytical Chemistry 51, n6, p783-784, May 79.

Keywords: *Chemical analysis, *Sulfates, *Ion exchange resins, *X ray fluorescence, Anions, Samples, Concentration(Composition), Reprints.

A method for the determination of sulfate by enrichment with SB-2 strongly basic anion exchange paper followed by x-ray fluorescence spectrometry is presented. Enrichment is performed by passing the sample solution through the filters several times. After washing, filters are equilibrated in a barium solution resulting in the stoichiometric up take of Ba by the sulfate, and the Ba L(B) x-ray line is measured. Optimum parameters are established for quantitative enrichment and measurement of amounts of 10-1000 micrograms S.

702,127
PB-299 767/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Analysis of Microscopic Samples with a Raman Microprobe: Applications to Particle Characterization.
Final rept.,
J. J. Blaha, E. S. Etz, and W. C. Cunningham. 1979, 10p
Pub. in Proceedings of Annual International Scanning Electron Microscopy Conference, Washington, DC., Apr 16-20, 1979, Scanning Electron Microscopy 11, p93-102 1979.

Keywords: *Probes, *Raman spectroscopy, *Particles, *Microanalysis, Aerosols, Air pollution, Chemical analysis, Gas analysis, Electric power plants, Combustion products, Industrial wastes, Fly ash, Mineralogy, Sampling, Air pollution detection.

A laser-Ramon microprobe, developed at the National Bureau of Standards, has been used to analyze individual microscopic particles in several investigations. Results are discussed for the detection and identification of the major compounds present in urban airborne dusts and in atmospheric aerosol particles collected at the South Pole. In related studies the microprobe has been applied to the molecular characteristics of fly ash particles from power plants with emphasis on the analysis of Stock particulates from an oil-fired power plant. A discussion of the identification of calcium-bearing microcrystals as a part of a feed utilization study for cattle is presented. In micromineralogical studies performed with the Raman microprobe, a number of common sheet and chain silicates have been investigated to determine possible spectral differences between their fibrous and nonfibrous morphologies. No unique differences could be found between spectra of the different characteristic spectrum. The usefulness of the Raman spectroscopic technique as a complement to the methods of electron and ion beam microanalysis is indicated. The discussion of results indicates the unique information that can be obtained through the use of the Raman microprobe.

702,128
PB-300 274/8
(Order as PB-300 272/2, PC **A03**/MF **A01**)
National Measurement Lab. (NBS), Washington, DC. Center for Analytical Chemistry.
Sample Preparation in Ion-Chromatography.
W. F. Koch. 22 Jan 79, 5p
Included in Jnl. of Research of the National Bureau of Standards, v84 n3 p241-245, May-Jun 79.

Keywords: *Samples, *Chemical analysis, Trace elements, Ion exchange resins, Oils, Oysters, Tissue(Biology), *Ion chromatography.

Ion-chromatography, a relatively new technique in analtyical chemistry, has already shown great promise toward solving complex trace analysis problems, in particular the speciation and quantitation of anions. It is especially attractive to the field of microanalysis. The method of sample preparation, however, is crucial in order to realize this capacity. Existing microanalytical methods nearly always must be modified to be compatible with ion-chromatography, and often, more extensive sample cleanup is required than is needed for 'single-species' methods. These considerations have been applied to the determination of chloride and bromide in waste oil, and to the analysis of oyster tissue. Pretreatment with polystyrene resin and ion-exchange resin is discussed.

702,129
PB-300 787/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Reference Materials in the Analytical Laboratory.
Final rept.,
J. P. Cali. 1979, 3p
Pub. in Fresenius' Zeitschrift fuer Analytische Chemie, n297, p1-3 1979.

Keywords: *Standards, *Chemical analysis, Laboratories, Reprints, *Reference materials.

The importance of reference materials (RM) in today's highly technological society is discussed with regard to their use in the analytical laboratory. How measurement compatibility is achieved through the use of RM's is shown. Formal definitions of both RM's and Certified Reference Materials (CRM), using ISO terminology are given. Six questions are posed as a guide for the analyst considering the use of CRM's for his work. Finally, six major uses of RM's in the analytical laboratory are outlined.

702,130
PB-301 250/7 PC **A13**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Quantitative Electron Probe Microanalysis.
Special pub.
K. F. J. Heinrich. Oct 78, 299p NBS/SP-298
Proceedings of a Seminar held at the National Bureau of Standards, Gaithersburg, Maryland, June 12-13, 1967. Library of Congress catalog card no. 68-60068.

Keywords: *Microanalysis, *Meetings, Electron probes, Chemical analysis, X ray analysis, X ray absorption, Fluorescence, Bioassay, Electron scattering, *Electron microprobe analysis, Numerical solution.

A seminar was held at the National Bureau of Standards in June 1967 to examine critically the factors involved in quantitative electron-probe microanalysis. Major consideration was given to proposed methods for data evaluation, and to requirements for further work in theory, in measurement, and in the preparation of standards. This volume contains a series of invited papers which formed the basis of discussion at the seminar. Topics covered include corrections for the atomic number effect, for x-ray absorption, and for fluorescence by characteristic lines and the continuum. The various ways to derive a simplified model of the complex electron-target interaction are critically analyzed by several authors, and the accuracy of several proposed methods is compared by error histograms constructed on the basis of hundreds of analyses of materials of known composition. Applications to the analysis of biological specimens and to problems of stereometric analysis are also discussed.

702,131
PB78-600031 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tables of Molecular Vibrational Frequencies--Part 9.
T. Shimanouchi, H. Matsuura, Y. Ogawa, and I. Harada. c1978, 122p
Included in Jnl. of Physical and Chemical Reference Data, v7 n4 p1323-1444 1978.

Keywords: *Force constants, Fundamental frequencies, Infrared spectra, Normal vibrations, Polyatomic molecules, Raman spectra, Vibrational frequencies.

Fundamental vibrational frequencies of 109 molecular forms of 38 polyatomic chain molecules consisting of the Ch3, CD3, CH2, CD2, CHD, O, and S groups are given as an extension of tables of molecular vibrational frequencies published in the NSRDS-NBS publication series an in this journal. On preparing the tables in this part, an approach, different from that in the previous parts, based on the calculations of normal vibration frequencies was adopted. A set of force constants which explains all the frequencies of small molecules for which the assignments had been established was obtained and then the frequencies of larger molecules were calculated and compared with the frequencies observed in the infrared and Raman spectra. The tables provide a convenient source of information for those who require vibrational energy levels and related properties in molecular spectroscopy, thermodynamics, analytical chemistry, and other fields of physics and chemistry.

702,132
PB78-600060 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Application of Auger-Electron Spectroscopy and X-Ray Photoelectron Spectroscopy to the Characterization of Particles.
C. J. Powell. 1978, 2p
Pub. in Proceedings 13th Annual Conf. Microbeam Analysis Society, Ann Arbor, MI, June 19-23, 1978, p64A-64B 1978.

Keywords: *Auger-electron spectroscopy, Characterization of particles, Spectroscopy, Auger-electron, X-ray photoelectron spectroscopy.

No abstract available.

702,133
PB80-104151 Not available NTIS
National Bureau of Standards, Washington, DC.
Artifacts Observed in Energy-Dispersive X-Ray Spectrometry in the Scanning Electron Microscopy.
Final rept.,
C. E. Fiori, and D. E. Newbury. 1978, 22p
Pub. in Scanning Electron Microsc. I, p401-422 1978.

Keywords: *Chemical analysis, *X ray spectroscopy, *Laboratory equipment, Performance evaluation, *Scanning electron microscopy.

X-ray spectra obtained with a lithium-drifted silicon detector attached to a scanning electron microscope often contain artifacts which limit the accuracy of qualitative and quantitative analysis. Three categories of artifacts are recognized: (1) artifacts which originate during the physical process of x-ray detection; (2) artifacts associated with the signal processing chain; and (3) artifacts which arise from the environment of the sample and detector.

702,134
PB80-104367 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibration of Combustion Calorimeters.
Final rept.,
C. Mosselman, and K. L. Churney. 1979, 21p
Pub. in Combustion Calorimetry, n1, Chapter 3, p35-55 1979.

Keywords: *Calorimeters, *Calibration, Laboratory equipment, Combustion, Temperature, Performance evaluation, Reprints.

The theory and design of combustion calorimeters has been reviewed in terms of recent improvements in the precision of the measurement theory of isoperibol calorimeters. Calculation of the adiabatic temperature rise is discussed in terms of the linear approximation for treatment of the temperature-time data of rating periods. Practical considerations dealing with the validity of a proper execution of calibration experiments using either a reference substance, whose energy of combustion is know, or electrical calibration equipment are outlined.

702,135
PB80-110307 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.

Frame C: A Compact Procedure for Quantitative Energy-Dispersive Electron Probe X-ray Analysis.
Final rept.,
R. L. Myklebust, C. E. Fiori, and K. F. J. Heinrich.
Sep 79, 115p NBS-TN-1106

Keywords: *X ray analysis, Electron microscopy, Electron probes, Radiation measuring instruments, Data processing, Computer programs, BASIC programming language, *Electron microprobe analysis, *FRAME C computer program, Li-drifted Si detectors, NOVA-2 computers.

A data evaluation procedure (FRAME C) for carrying out quantitative electron probe microanalysis with a lithium-drifted silicon detector was developed for use with a small computer. The procedure consists of a background correction calculated from two selected background regions of interest, a simple method of resolving overlapping peaks, and the matrix corrections for characteristic radiation. To save computation time, small groups of adjacent channels (regions of interest) in the multi-channel analyzer rather than individual channels are used for the calculations. The method for computing the overlap factors is described. Examples of several types of analyses are presented.

702,136
PB80-115496 Not available NTIS
National Bureau of Standards, Washington, DC.
Results of a Joint Auger/ESCA Round Robin Sponsored by ASTM Committee E-42 on Surface Analysis. Part I. ESCA Results.
Final rept.,
C. J. Powell, N. E. Erickson, and T. E. Madey. 1979, 43p
Pub. in Jnl. of Electron Spectroscopy and Related Phenomena 17, p361-403 1979.

Keywords: *Laboratory equipment, *Chemical bonds, *Electron energy, *X ray spectroscopy, Error analysis, Performance evaluation, Gold, Copper, Trends, Surface chemistry, Reprints, *Auger electron spectroscopy, *Binding energy.

The authors report results of a round robin involving binding-energy (BE) and relative-intensity measurements on high-purity samples of gold and copper by X-ray photoelectron spectroscopy. These results were obtained on 38 different instruments manufactured by 8 companies. The authors found that the spread in reported BE values was typically greater than 2 eV while the spread in intensity ratios from cleaned samples was typically a factor of ten. They have analyzed the observed trends and have developed a procedure to show the contributions of systematic errors, random errors, and mistakes on BE and intensity measurements made with different individual instruments. This procedure, which leads to a plot of instrumental response as a function of electron energy, can be used by any user to compare the performance of his instrument with those reported here and to monitor performance as a function of time. At least part of the observed spreads in the reported BE and intensity data can be ascribed to erratic instrumental performance. The results of this round robin clearly demonstrate the need for improved calibration methods and operating procedures to ensure that data of known accuracy can be obtained routinely.

702,137
PB80-117195 Not available NTIS
National Bureau of Standards, Washington, DC.
Complication in the Determination of Nitrite by Ion Chromatography.
Final rept.,
W. F. Koch. Aug 79, 3p
Pub. in Analytical Chemistry 51, n9, p1571-1573, Aug 79.

Keywords: *Nitrites, *Chemical analysis, Oxidation, Reprints, *Ion chromatography.

A serious problem in the determination of nitrite by ion-chromatography has been discovered. Evidence is presented to show that the problem is due to ion-exclusion and oxidation of nitrite on the suppressor column. Partial remedy can be achieved by deaeration of the eluent. It is suspected that a similar problem exists for all weak acids and/or easily oxidizable anions, such as sulfite.

702,138
PB80-117260 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Enhanced Ionization Spectrometry in Analytical Flames.
Final rept.,
G. C. Turk, J. C. Travis, J. R. DeVoe, and T. C. O'Haver. Oct 79, 7p
Pub. in Analytical Chemistry 51, n12, p1890-1896, Oct 79.

Keywords: *Chemical analysis, Molecular energy levels, Ionization, Excitation, Reprints, *Laser spectroscopy, Atomic fluorescence flame spectroscopy.

A new variety of analytical atomic flame spectrometry called laser enhanced ionization (LEI) has been developed. The method relies on the enhanced rate of thermal ionization of the analyte element following photoexcitation with a dye laser tuned to an appropriate transition wavelength. This enhanced ionization rate can be electrically measured directly in the flame, and therefore no optical detection system is required. Detection limits have been measured for 18 elements, showing order-of-magnitude superiority over other flame based spectroscopic methods in many cases. A variety of types of transitions have been successfully utilized, including ground state transitions, thermally excited state transitions, low transition probability transitions, and a two-photon transition. The strong dependence of LEI sensitivity on the ionization potential of the analysis element and the energy of the laser populated excited state is discussed. Other topics discussed include interference problems encountered and the application of LEI to the analysis of real samples.

702,139
PB80-119167 Not available NTIS
National Bureau of Standards, Washington, DC.
Raman Microprobe Analysis: Principles and Applications.
Final rept.,
E. S. Etz. 1979, 17p
Pub. in Scanning Electron Microsc. Part I, p67-82, 92, 1979.

Keywords: *Raman spectroscopy, *Probes, *Chemical analysis, *Microanalysis, Biological extracts, Air pollution, Gas analysis, Mineralogy, Sampling, Particles, Trace elements, Molecular structure, Tissues(Biology), Reprints, Air pollution detection.

The principles of normal (spontaneous) Raman scattering spectroscopy are extended to molecular analysis with laser-Raman microprobes. These instruments furnish information on the identity of the principal molecular constituents of micro-samples and their distribution in the solid phase. Specific examples are presented from the study of (1) airborne dust particles, (2) trace organic pollutants, (3) fluid inclusions in minerals, and (4) thin sections of biological tissues. Chief limitations of the method arise from the inherent weakness of the Raman effect, the possibility of localized sample heating, spectral interferences from fluorescence, and the lack of quantitation.

702,140
PB80-123318 Not available NTIS
National Bureau of Standards, Washington, DC.
Measuring Aerosol Particles.
Final rept.,
S. Bright, and D. I. Chabay. Nov 79, 6p
Pub. in Chemtech, p694-699, Nov 79.

Keywords: *Aerosols, *Particle size, *Optical measurement, Laboratory equipment, Light scattering, Doppler effect, Calibrating, Air pollution, Performance evaluation, Reprints.

Optical methods of aerosol particle size measurement are reviewed. Basic concepts of light scattering are outlined as the basis for understanding the many specific optical techniques. Problems of calibration and intercomparison of techniques are discussed and a new instrument, the particle Doppler shift spectrometer, which specifically addresses those problems is described. A table, which lists techniques grouped according to physical effect employed and cites references and size range, is given, along with a representative bibliography.

702,141
PB80-123326 Not available NTIS
National Bureau of Standards, Washington, DC.
Influence of Instrumental Sensitivity Variations on Quantitative Analysis by Secondary Ion Mass Spectrometry,
D. E. Newbury. 1979, 3p
Pub. in Proceedings of the Annual Microbeam Analysis Society/1979 Conference (14th) Held at San Antonio, TX. on August 13-17, 1979, p335-337 1979.

Keywords: *Mass spectrometers, Performance evaluation, Sensitivity, Laboratory equipment, *Secondary ion mass spectroscopy.

Physical models of ion emission used for quantitative analysis in secondary ion mass spectrometry compensate for matrix effects but ignore instrumental effects. Studies of relative elemental sensitivity factors measured by various SIMS instruments reveal a strong influence of instrumental factors on measured secondary ion signals. Analysis with the local thermal equilibrium (LTE) model produces compositional errors which follow the trends observed in the relative sensitivity factors. If a low relative sensitivity factor is measured, LTE analysis will generally underestimate the composition. A modified analytical approach based on relative sensitivity factors modified by matrix correction factors is proposed.

702,142
PB80-123342 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Particles and Rough Samples by FRAME P, a ZAF Method Incorporating Peak-to-Background Measurements,
J. A. Small, D. E. Newbury, and R. L. Myklebust. 1979, 4p
Pub. in Proceedings of the Annual Microbeam Analysis Society/1979 Conference (14th) Held at San Antonio, TX. on August 13-17, 1979, p243-246 1979.

Keywords: *Electron probes, *Microanalysis, *Error analysis, *Surface roughness, Samples, X ray analysis, Chemical analysis, Particles, *Electron microprobe analysis.

The ideal specimen for electron probe microanalysis has the form of a bulk solid with a flat, polished surface. When samples are analyzed which deviate from this condition, such as small particles or specimens with rough surface topography, large errors in the composition calculated from a ZAF method can arise, frequently exceeding 50% relative. Moreover, normalization of the results by forcing the sum of the elements to 100% can sometimes actually increase the relative errors. Providing instrumental conditions are kept constant, the x-ray intensities measured on a flat, bulk sample vary for compositional reasons only. In the case of a particle or rough surface, however, geometrical factors including size and shape of the sample relative to the electron interaction volume and x-ray emergence angle can also strongly affect the measured signals. Recently, a new method for compensation of the geometrical effects has been independently suggested by Small et al and Statham and Pawley. This method is based on the observation that to a first approximation the ratio of a characteristic x-ray peak to the continuum intensity of the same energy for a flat, bulk target is equivalent to the ratio from a particle or rough surface of the same composition.

702,143
PB80-123367 Not available NTIS
National Bureau of Standards, Washington, DC.
Microhomogeneity Studies for NBS Standards,
R. B. Marinenko, K. F. J. Heinrich, and F. C. Ruegg. 1979, 6p
Pub. in Proceedings of the Annual Microbeam Analysis Society/1979 Conference (14th) Held at San Antonio, TX. on August 13-17, 1979, p221-226 1979.

Keywords: *Microanalysis, *Electron probes, *Homogeneity, Sampling, Standards, Reprints, *Electron microprobe analysis, Standard reference materials.

A simple routine technique for studying homogeneity in the micrometer range with the electron microprobe has been developed. For graphic display, a digital periodic integrator is being used. In conjunction with scalers and a stepping motor on the sample stage, traces similar to industrial control charts based on a comparison of the experiment with the expected (Poisson) counting statistics are quickly obtained. A computer program has been developed to numerically evaluate sample homogeneity. Several Standard Reference Materials (SRM's) have been tested. These include the iron and steels (SRM's 661-664, 461, and 463), the

gold-copper and gold-silver alloys (SRM s 481 and 482), the tungsten-molybdenum alloys (SRM 480), cartridge brass (SRM 478), the iron 3-percent silicon alloy (SRM 483), and the iron-chromium-nickel alloy (SRM 479a). The Research Material, Glasses for Microanalysis (RM-30), has also been tested.

702,144
PB80-123391 Not available NTIS
National Bureau of Standards, Washington, DC.
Use and Abuse of a Quantitative Analysis Procedure for Energy Dispersive X-Ray Microanalysis,
R. L. Myklebust, and D. E. Newbury. 1979, 7p
Pub. in Proceedings of the Annual Microbeam Analysis Society/1979 Conference (14th) Held at San Antonio, TX. on August 13-17, 1979, p231-237 1979.

Keywords: *X ray analysis, *Microanalysis, *Error analysis, Samples, Surface roughness, Electron microprobe analysis.

FRAME C, a procedure for quantitative energy dispersive x-ray microanalysis, is capable of high relative accuracies when the proper required analytical conditions are observed. Evaluation of the errors introduced by poor spectral quality (poor statistics, high deadtime counting, and errors in the energy calibration), uncertainty in user-supplied parameters (beam energy, x-ray emergence angle, and background selection), and specimen roughness reveals that average relative errors increase by factors of 2 to 20. The most significant errors are introduced by surface roughness.

702,145
PB80-128168 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Assessing the Environmental Impact of Fossil-Fuel Based Energy Sources: Measurement of Organometal Species in Biological and Water Samples Using Liquid Chromatography with Electrochemical Detection.
Interim rept. Oct 76-May 78,
W. A. MacCrehan, and R. A. Durst. Nov 79, 67p
EPA-600/7-79-211

Keywords: *Metal containing organic compounds, *Chromatographic analysis, Laboratory equipment, Detectors, Mercury containing organic compounds, *Liquid chromatography, Electrochemical detection.

A new measurement approach for the determination of trace organometals in energy related environmental samples is described. The method is based on liquid chromatographic separation with electrochemical detection. A detailed description of the development of the electrochemical detection system, optimized for reducible analytes, is given. The conditions for the separation of methyl-, ethyl-, and phenylmercury in under 16 minutes by charge-neutralization reverse-phase chromatography are developed. Also, a separation of a number of organoleads, including trimethyl- and triethyllead, are described. The potential interferences in this type of organometal determination are investigated. Sample preparation methods and improvement in the detector selectivity are described that overcome these interferences. A significant improvement in the selectivity of the detection system has been investigated using a differential pulse waveform. Sample preparation methods for the determination of methylmercury in biological tissue are examined and measurements are made on two research materials: lyophilized tuna and shark meat. A column preconcentration procedure for methyl- and ethylmercury in natural water samples is developed.

702,146
PB80-138696 Not available NTIS
National Bureau of Standards, Washington, DC.
Energy-Dispersive X-Ray Spectrometric Analysis of NBS Standard Reference Material 1571 Orchard Leaves After Oxidation and Borate Fusion.
Final rept.,
E. C. Kuehner, and P. A. Pella. 1979, 3p
Pub. in Journal of Applied Spectroscopy 33, n6, p632-634 1979.

Keywords: *Leaves(Botany), *Spectrochemical analysis, X ray spectroscopy, Borates, Reprints, Standard reference materials.

An automated borate fusion procedure was investigated as a sample preparation method, after removal of organic matter, for the analysis of seven elements in NBS Standard Reference Material 1571 Orchard Leaves by energy-dispersive x-ray spectrometry. A 2.0 g sample was pretreated by oxidation with H_2SO_4-HNO_3 acid mixture and the residue was fused with 6.5 g of lithium tetraborate in the conventional manner. Relative errors on the order of 2 to 10% were obtained for K, Ca, Fe, Mn, Zn, and Pb.

702,147
PB80-154818 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Determination of the Calorific Value of Refuse-Derived-Fuels by Large-Bomb Calorimetry Summary of the 1978 Fiscal Year Results.
Interim rept. 1 Oct 77-30 Sep 78,
D. R. Kirklin, E. S. Domalski, and D. J. Mitchell. Jan 80, 38p NBSIR-80-1968
Sponsored in part by Department of Energy, Washington, DC. Div. of Buildings and Community Systems, and Municipal Environmental Research Lab., Cincinnati, OH. Solid and Hazardous Waste Research Div.

Keywords: *Heat measurement, *Calorimeters, *Refuse, Fuels, Sampling, Laboratory equipment, Calibrating, Combustion, *Refuse derived fuels.

An oxygen bomb calorimeter which can accommodate a 25 gram sample of refuse or a refuse-derived-fuel (RDF) has been designed and constructed at the National Bureau of Standards for the purpose of studying the effects of sample processing on the measured calorific value of such material. This large calorimeter is an enlarged and modified version of a conventional-size calorimeter also in use at NBS. The large calorimeter can handle samples ten times larger than the conventional-size calorimeter and therefore can be used to investigate RDF samples with either minimal or no processing. Calorimetric results are presented for calorific value measurements carried out on d(densified)-RDF in both calorimetric systems. The result of this investigation indicate that the calorific value of d-RDF is unaffected by the sample processing technique used at NBS.

702,148
PB80-154917 Not available NTIS
National Bureau of Standards, Washington, DC.
Quantitative Procedures in Ion-Probe Microanalysis.
Final rept.,
D. E. Newbury, and K. F. J. Heinrich. 1979, 22p
Pub. in Mikrochim. Acta Suppl. 8, p3-24 1979.

Keywords: *Quantitative analysis, Ions, Accuracy, Errors, Microanalysis, Sputtering, Reprints, *Ion microprobe analysis, Ion probes.

Quantitative analysis procedures for the ion microprobe can be based on theoretical or empirical approaches. The local thermal equilibrium model is examined as a representative of the theoretical models, and the relative sensitivity factor method is taken as a representative of the empirical methods. A comparison of the accuracy of the analysis of multi-element glasses by the two techniques reveals that the sensitivity factor approach yields the most accurate results. Sources of error to which all quantitative procedures are subject include (1) errors in the description of the sputtering process, (2) lack of accurate values of physical data, and (3) instrumental effects. Instrumental factors are found to affect measured relative secondary ion yields by as much as a factor of fifty and constitute one of the major difficulties for quantitative procedures. A combination of relative sensitivity factors measured on an instrument with theoretically determined matrix correction factors offers the most promise for practical analysis.

702,149
PB80-162597 Not available NTIS
National Bureau of Standards, Washington, DC.
Results of a Joint AUGER/ESCA Round Robin Sponsored by ASTM Committee E-42 on Surface Analysis. Part I. ESCA Results.
Final rept.,
C. J. Powell, N. E. Erickson, and T. E. Madey. 1979, 42p
Pub. in Jnl. of Electronics Spectro. Relat. Phenom. 17, p361-403 1979.

Keywords: *Laboratory equipment, *X ray analysis, *Copper, *Gold, Samples, Error analysis, Performance evaluation, Calibrating, Electron energy, Surface chemistry, Reprints, *X ray photoelectron spectroscopy, *Binding energy, Photoelectron spectroscopy.

The authors report results of a round robin involving binding-energy (BE) and relative-intensity measurements on high-purity samples of gold and copper by X-ray photoelectron spectroscopy. These results were obtained on 38 different instruments manufactured by 8 companies. The authors found that the spread in reported BE values was typically greater than 2 eV while the spread in intensity ratios from cleaned samples was typically a factor of ten. The authors have analyzed the observed trends and have developed a procedure to show the contributions of systematic errors, random errors, and mistakes on BE and intensity measurements made with different individual instruments. This procedure can be used by any user to compare the performance of his instrument with those reported here and to monitor performance as a function of time.

702,150
PB80-180342 Not available NTIS
National Bureau of Standards, Washington, DC.
Microanalytical Techniques with Inverted Solid State Ion-Selective Electrodes. I. Nanoliter Volumes.
Final rept.,
G. L. Vogel, L. C. Chow, and W. E. Brown. Feb 80, 3p
Grant PHS-DE-04385
See also Volume 2, PB80-180359. Prepared in cooperation with American Dental Association, Chicago, IL.
Pub. in Anal. Chem. 52, n2 p375-377 Feb 80.

Keywords: *Chemical analysis, *Fluorides, *Microanalysis, Electrodes, Sampling, Surfaces, Concentration(Composition), Reprints, *Ion selective electrodes.

A procedure is described for measuring the fluoride concentration in nanoliter sample volumes deposited on the surface of an inverted commercial fluoride electrode, using a reference microelectrode maneuvered into contact with the specimen via a micromanipulator. This technique permits the fluoride concentration of the microvolume to be measured with an accuracy approaching that of a conventionally used electrode. Since many specimens can be equilibrated simultaneously on the surface of the electrode, this method is rapid (20-30 specimens per hour). Furthermore, the technique may be used with other solid state electrodes.

702,151
PB80-180359 Not available NTIS
National Bureau of Standards, Washington, DC.
Microanalytical Techniques with Inverted Solid State Ion-Selective Electrodes. II. Microliter Volumes.
Final rept.,
G. L. Vogel, and W. E. Brown. Feb 80, 3p
Grant PHS-DE-04385
See also Volume 2, PB80-180342. Prepared in cooperation with American Dental Association, Chicago, IL.
Pub. in Anal. Chem. 52, n2 p377-379 Feb 80.

Keywords: *Chemical analysis, *Fluorides, *Microanalysis, Sampling, Solid state, Electrodes, Concentration(Composition), Reprints, *Ion selective electrodes.

The authors reported recently (1) how a commercial solid state electrode may be adapted for microvolumes by bringing a glass microreference electrode into contact with hemispherical microdrops of specimen deposited under mineral oil on the surface of the electrode mounted in an inverted position. While this method is fast (20 to 30 specimens per hour), and although specimens of microscopic size can be determined (300 pL and less), it is somewhat elaborate for routine laboratory use with specimens of 1 to 5 microliters. In this paper the authors describe a simple device that will, in a few minutes, adapt most solid state electrodes for the rapid determination of samples in this volume range.

702,152
PB80-180367 Not available NTIS
National Bureau of Standards, Washington, DC.
Telescopic Viewer in Syringe Calibration.
Final rept.,
F. E. Jones. Feb 80, 1p
Pub. in Anal. Chem. 52, p364 Feb 80.

Keywords: *Volumetric analysis, *Laboratory equipment, *Moisture content, *Calibrating, Dispensing, Methyl alcohol, Water, Mixtures, Reprints, *Telescopic viewers.

A telescopic viewer was used in the calibration of a syringe for volumetric dispensing of methanol-water mixtures and methanol blanks into Karl Fischer titrator reaction vessels for determination of moisture content of materials. Using a 'gas-tight' 1 cc syringe filled to the 0.500 graduation with water, the mean volume dispensed for 15 observations was 0.50142 cc with an estimate of the standard deviation of the mean of 0.00015 cc and an estimate of the relative standard deviation of the mean of 0.00030.

702,153
PB80-183627 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Sensitivity Nonlinear Spectroscopy using a Frequency-Offset Pump.
Final rept.,
J. J. Snyder, R. K. Raj, D. Bloch, and M. Ducloy. Apr 80, 3p
Prepared in cooperation with Centre National de la Recherche Scientifique, Paris (France).
Pub. in Jnl. Opt. Lett., v5 n4 p163-165 Apr 80.

Keywords: *Spectroscopy, *Laboratory equipment, *Noise, *Error analysis, Nonlinear systems, Reprints, Procedures.

The authors report the development of a simple method for eliminating coherent background noise and fluctuations from saturation-spectroscopy signals. With this technique, which the authors believe will also be effective in two-photon and other types of nonlinear spectroscopy, they have routinely observed background-free saturation signals in I2 at 514.5 nm with signal-to-noise ratios within an order of magnitude of the fundamental quantum limit.

702,154
PB80-197486 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Standard Reference Materials: Metal-On-Quartz Filters as a Standard Reference Material for Spectrophotometry - SRM 2031.
Final rept.,
R. Mavrodineanu, and J. R. Baldwin. Apr 80, 120p NBS-SP-260-68
Library of Congress catalog card no. 79-600192. See also report dated Apr 79, PB-294 666.

Keywords: *Filters, *Metals, *Silicon dioxide, *Spectrophotometry, Standards, Performance evaluation, Reflection, Polarization(Waves), Stability, Quartz, Designs, Laboratory equipment, *Standard reference materials.

This publication describes in detail the selection, production, testing, and certification of the semi-transparent evaporated metal-on-fused silica filters as a Standard Reference Material for spectrophotometry. Particular attention is given to various factors that can affect the accuracy of the transmittance values established for these filters, such as: reflections, polarization, angle of incidence, and stability in time. Adequate procedures were devised and are described for the protection of the exposed metal layer surface using optical contact, and for the protection of the filter aggregate, by the use of metal holders provided with shutters and of metal storage containers. The data from several interlaboratory tests are also discussed, together with the results obtained on transmittance measurements on 19 sets of chromium-on-fused silica filters, protected by optical contact, which were studied over a period of two years. An Appendix contains the reproduction of several publications relevant to the subject discussed in this work.

702,155
PB80-207749
(Order as PB80-207707, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC.
Low-Noise Potentiostat for the Study of Small Amplitude Signals in Electrochemistry,
R. W. Shideler, and U. Bertocci. 25 Jan 80, 7p
Included in Jnl. of Research of the National Bureau of Standards, v85 n3 p211-217, May-Jun 80.

Keywords: *Electrochemistry, Design, Amplitude, Laboratory equipment, Performance evaluation, Noise, *Potentiostats.

A low noise potentiostat, developed and built at NBS, is described. The instrument, which has built-in an ac current amplifier, is particularly suited for detecting small current fluctuations in the frequency range between 0.1 and 2000 Hz. The noise in the dc control voltage is of the order of 2.5 x 10 to the 8th power V/(H to the 1/2 power), and the instability of the ac amplifier corresponds to a signal of 3 x 10 to the 11th power A/(H to the 1/2 power). The performance characteristics of the instrument are fully described as well as its use in impedance measurements by means of a swept frequency signal. The instrument can also be used as a galvanostat.

702,156
PB80-209117 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Standard Reference Materials: A Reference Method for the Determination of Lithium in Serum.
Final rept.,
R. A. Velapoldi, R. C. Paule, R. Schaffer, J. Mandel, L. A. Machlan, E. L. Garner, and T. C. Rains. Jul 80, 119p NBS-SP-260-69
Library of Congress catalog card no. 80-600091. Prepared in cooperation with Hartford Hospital, CT., New England Deaconnes Hospital, Boston, MA., California Univ., Los Angeles. Dept. of Pathology, and Center for Disease Control, Atlanta, GA.

Keywords: *Lithium, *Blood chemical analysis, Concentration(Composition), Standards, Sampling, Electrolytes, Laboratory equipment, *Standard reference materials, Flame atomic absorption spectrometry.

A reference method was established for the determination of serum lithium based on flame atomic absorption spectroscopy (FAAS). Its accuracy was evaluated by comparing the values obtained by use of the method in 14 laboratories against the results obtained by a definitive analytical method based on isotope dilution-mass spectrometry (IDMS). Ten serum pools with lithium concentrations in the range 0.534 to 2.9554 mmol/L were analyzed. Manual and semiautomated pipetting alternatives were tested using sample sizes of 4.00 and 2.00 mL, respectively. The laboratories used several different FAAS instruments. The results showed that the standard error for a single laboratory's bias of about 2.0 percent over the range of serum lithium concentrations studied. These values are within the accuracy and precision goals that had been set. The calibration curve data showed excellent linearity over the total concentration range, with 24 of 25 curves having standard deviations of fit of 0.025 mmol/L or less. With appropriate experimental design, the reference method may be used to establish the accuracy of field methods as well as to determine reference lithium values for pooled sera.

702,157
PB80-211717 Not available NTIS
National Bureau of Standards, Washington, DC.
Automating Analytical Instrumentation.
Final rept.,
J. F. Barkley, and F. C. Ruegg. 1978, 4p
Pub. in Proceeding of the NBS-IEEE Microcomputer Based Instrumentation Conference., Gaithersburg, MD., June 12-13, 1978, p83-86 1978.

Keywords: *Laboratory equipment, Chemical analysis, Performance evaluation, Technology, Automation, Minicomputers, Microcomputers, Data processing, Reprints, Computer aided analysis, Computer applications.

The Analytical Chemistry Division at the National Bureau of Standards has the following requirements for the majority of the instrumentation systems; user programmable, data rates less than 50 per second, simple real-time computation, and temporary and archival data storage. Microcomputer systems with communication facilities to a large mainframe is one approach being used to meet these requirements. The current rapid pace in microcomputer technology implies premature obsolescence of microcomputer systems. The ability to make use of the latest microcomputer technology for new applications while maintaining existing systems is an important consideration. Two configurations of microcomputers may be used to automate an instrument, a data acquisition machine and a data processing machine. The data acquisition machine runs the experiment and serves as a buffer for the data and provides for minimum computation and display of results. The data processing machine performs the necessary realtime data reduction and temporary storage. A large mainframe provides major data reduction and archival storage.

702,158
PB80-223431 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of a Graphite Furnace Atomic Absorption Detector Automatically Coupled to a High-Performance Liquid Chromatograph for Speciation of Metal-Containing Macromolecules.
Final rept.
E. J. Parks, F. E. Brinckman, and W. R. Blair. 1979, 10p NBS-561
Sponsored in part by Office of Naval Research, Washington, DC. See also AD-A077 321.
Pub. in Jnl. of Chromatogr. 185, p563-572 1979.

Keywords: *Chromatographic analysis, *Atomic spectroscopy, *Metal containing organic compounds, Tin organic compounds, Reprints, *Liquid chromatography, High pressure liquid chromatography, Atomic absorption spectroscopy.

High-pressure liquid chromatography (HPLC) coupled with graphite furnace atomic absorption (GFAA) is capable of sensitive, nearly non-destructive, element-specific separation of a wide range of molecular species containing metals or metalloids. Applications of HPLC-GFAA techniques are discussed, including size exclusion chromatography for the analysis of experimental organometallic polymers containing chemically bonded biocidal organotin moieties, and reversed bonded phase chromatography for analysis of novel organotin silicates. In conjunction with variably sensitive optical refractive index/ultra violet absorption detection, GFAA demonstrates separation of the polymers into at least two tin-containing fractions of widely different molecular weight (MW). The relative proportions of high- and low-MW fractions have important implications with respect to performance specifications for these and similar controlled release materials. Tin-specific and silicon-specific analysis of an organotin silicate demonstrates co-elution of species containing each element.

702,159
PB80-227044 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Simulated Precipitation Reference Materials, III,
E. R. Deardorff, T. C. Rains, and W. F. Koch. Sep 80, 25p NBSIR-79-1953
See also Number 2, PB-273 945. Sponsored in part by Environmental Protection Agency, Research Triangle Park, NC., and Geological Survey, Denver, CO.

Keywords: *Rain, *Water analysis, Chemical analysis, Precipitation(Meteorology), Acidity, Sampling, Concentration(Composition), Cations, Sulfates, Inorganic nitrates, Fluorides, Reference materials.

This report describes the preparation of a third series of reference materials for the chemical analysis of natural precipitation samples. They will be used as a means of intercalibrating atmospheric monitoring stations. These materials consist of high and low concentrates which upon dilution simulate the range of anion and cation concentrations typically found in natural rainwater. Two separate reference samples which are to be used undiluted are provided for evaluation of acidity measurements.

702,160
PB81-104374 Not available NTIS
National Bureau of Standards, Washington, DC.
Study of the Dependence of Frequency Upon Microwave Power of Wall-Coated and Buffer-Gas-Filled Passive Rb87 Frequency Standards.
Final rept.
A. Risley, and S. Jarvis. 1979, 7p
Pub. in Proc. Annual Frequency Control Symposium (32nd), Atlantic City, NJ., May 3-June 1, 1979 p477-483 1979.

Keywords: *Rubidium frequency standards, Frequency, Radiofrequency power.

Previous studies of a commercial passive-gas-cell 87Rb frequency standard showed a strong dependence of the output frequency, upon the microwave power. A major conclusion of that work was that the dependence of output frequency upon microwave power was due to a line inhomogeneity effect. The line inhomogeneity interpretation suggested that substituting a wall coating for the usual buffer gas would reduce the dependence upon microwave power. As a part of the present work a wall coating (a form of paraffin) was used and a reduction of this dependence by a factor of 100 was obtained. The present work has led to a more convincing theoretical demonstration of the line inho-

mogeneity effect. The paper discusses some of the details of the analytical procedure. There are certain major requirements that a wall coating would have to satisfy if it were to be superior to the usual buffer gas and these are discussed in the text. The advantages demonstrated by the present work indicate that further studies are warranted to determine if an improved standard could be built based on a wall coating.

702,161
PB81-110645 Not available NTIS
National Bureau of Standards, Washington, DC.
Composition of Mixtures of Natural Gas Components Determined by Raman Spectrometry.
Final rept.
D. E. Diller, and R. F. Chang. 1980, 4p
Pub. in Applied Spectroscopy 34, n4 p411-414 1980.

Keywords: *Raman spectroscopy, *Natural gas, *Chemical analysis, Feasibility, Mixtures, Binary systems, Reprints.

The feasibility of using Raman spectrometry for determining the composition of mixtures of natural gas components was examined. Raman intensity measurements were carried out on eight, gravimetrically prepared, binary gas mixtures containing methane, nitrogen, and isobutane at ambient temperature and at pressures to 0.8 MPa. The repeatability of the molar intensity ratio, (I(2)/Y(2))/(I(1)/Y(1)), where Y(1) is the concentration of component 1 in the mixture, and I(1) is the intensity of the related line in the mixture spectrum, was examined. The compositions of two gravimetrically prepared methane-nitrogen-isobutane gas mixtures were determined spectrometrically with an estimated precision of about 0.001 in the mole fraction. Typical differences from the gravimetric concentrations were less than 0.002 in the mole fraction. The Raman spectrum of a gravimetrically prepared, eight component, hydrocarbon gas mixture was obtained to show that the Raman spectrometric method has potential for being applicable to natural gas type mixtures.

702,162
PB81-110702 Not available NTIS
National Bureau of Standards, Washington, DC.
Methods for Quantitative Analysis in Secondary Ion Mass Spectrometry.
Final rept.
D. E. Newbury. 1980, 9p
Pub. in Scanning 3, p110-118 1980.

Keywords: *Chemical analysis, Mass spectroscopy, Performance evaluation, Sensitivity, Reprints, *Secondary ion mass spectroscopy.

Methods for quantitative analysis in secondary ion mass spectrometry must be capable of correcting for strong matrix effects on emitted secondary ion intensities as well as strong instrumental effects on measured secondary ion intensities. Both empirical methods, based on sensitivity factors and working curves, and theoretical models for secondary ion emission are available. Future development of analytical methods may combine the relative sensitivity factor method (which minimizes the influence of instrument artifacts) with the theoretical description of secondary ion emission (to calculate matrix effects).

702,163
PB81-112997 Not available NTIS
National Bureau of Standards, Washington, DC.
Reverse Phase Liquid Chromatographic Analysis of the Impurities in Nicotinamide Adenine Dinucleotides.
Final rept.
S. A. Margolis, and R. Schaffer. 1979, 13p
Pub. in Jnl. of Liquid Chromatography 2, n6 p837-849 1979.

Keywords: *Chemical analysis, *Impurities, Nitrogen organic compounds, Reprints, *Liquid chromatography, *Nicotinamide adenine dinucleotide.

Commercial preparations of several different nicotine adenine dinucleotides were examined by liquid chromatography on an octadecylsilane column. Seven impurity peaks were detected in NADP(+) eight in NADPH, and five in NAD(+). The estimated purity of NADP(+) from different commercial suppliers varied from 89 to 95 percent. For NADPH the purity ranged from 77.5 to 96 percent. For NADPH the purity ranged from 77.5 to 96 percent and for NAD(+) from 90 to 93.5 percent. Preparations of NAD(+) contained AMP, ADPR, nicotinamide and two unidentified impurities. The impurities found in NADP(+) and NADPH preparations did not correspond to compounds that the authors could identify. Four of the impurity peaks found in NADPH form under acidic storage conditions. Five of the impurity peaks observed in NADP(+) and three of the impurity peaks in NAD(+) and three of the impurity peaks in NAD(+) form as products of alkali-catalyzed rearrangements.

702,164
PB81-116956 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrochemical Detection in Liquid Chromatography: Application to Organometallic Speciation.
Final rept.
W. A. MacCrehan, R. A. Durst, and J. M. Bellama. 1977, 14p
Sponsored in part by Environmental Protection Agency, Washington, DC.
Pub. in Analytical Letters 10, n14 p1175-1188 1977.

Keywords: *Metal containing organic compounds, *Electrochemistry, *Chemical analysis, Performance evaluation, Electrodes, Solvents, Reprints, *High performance liquid chromatography.

The development of a new technique for the measurement of organometallic species is presented. It combines the resolution of high performance liquid chromatography with sensitive electrochemical detection used in a reductive mode. Past difficulties with this detection system have been overcome including the choice of a suitable working electrode and purification of the solvent.

702,165
PB81-118481 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Purity 4-Nitrophenol: Purification, Characterization, and Specifications for Use as a Spectrophotometric Reference Material.
Final rept.
G. N. Bowers, R. B. McComb, R. G. Christensen, and R. Schaffer. 1980, 6p
Pub. in Clin. Chem. 26, n6 p724-729 1980.

Keywords: *Spectrophotometry, *Clinical medicine, *Blood analysis, Enzymes, Standards, Absorptivity, Reprints, *Standard reference materials, *Phenol/nitro, *Enzyme activity.

The authors describe specifications for high-purity 4-nitrophenol, which is suitable for spectrophotometric standardization. Such a reference material is needed in clinical enzymology to establish the proper molar absorptivity of 4-nitrophenol under final reaction conditions, particularly for measuring alkaline phosphatase activity in human serum. Some lots of 4-nitrophenol available commercially met these specifications, but several did not. The latter can be purified to meet our specifications by recrystallization or sublimation. The molar absorptivity of 4-nitrophenol (35 micromole/L) in 10 mmol/L NaOH at 25C at 401 nm is 18 380 plus or minus 90 L/mol/cm.

702,166
PB81-118580 Not available NTIS
National Bureau of Standards, Washington, DC.
Applications of a Low Noise Potentiostat in Electrochemical Measurements.
U. Bertocci. Sep 80, 4p
Pub. in Jnl. Electrochem. Soc. 127, n9 p1931-1934 Sep 80.

Keywords: *Potentiometers(Instruments), *Noise reduction, Performance evaluation, Copper, Aluminum, Pitting tests, Reprints.

Measurements on two electrochemical systems, copper in copper sulfate and aluminum in boric acid: sodium tetraborate buffer with and without chloride added, have been carried out employing a low-noise potentiostat developed and built at NBS by recording the amplitude spectrum of the fluctuations in the current density. In the case of copper, the current spectra resulted to be the deterministic response of the electrode to the noise voltage generated by the potentiostat. The electrode characteristics for charge-transfer and for diffusion could be obtained from the impedance plots derived from the measurements when the level of the applied signal was of the order of 10 to the -7 power V. In the case of aluminum, the deterministic response observed in the absence of pitting was overcome by random fluctuations in the current in conditions leading to pitting. It is shown that the onset of pit formation can be detected from noise measurements. The significance of the information obtained in electrochemical noise measurements is briefly discussed.

702,167
PB81-118606 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS Standard Reference Material Program: SRMs Today and Tomorrow,
G. A. Uriano. 1979, 6p
Pub. in Am. Soc. Test. Mater. Stand. News 7, n9 p8-13 1979.

Keywords: Standards, Measurement, Reprints, *Standard reference materials, National Bureau of Standards.

Some general concepts related to the development, certification and use of SRM's are presented. The role of SRM's together with reference methods of test or analysis in assuring the compatibility of measurements is discussed. The use of NBS thermal resistance SRM's for fiberglass insulating materials together with ASTM Standard Methods in the first National Laboratory Accreditation Program is given as an example of the systems approach to accurate measurement. The major changes in the NBS Standard Reference Materials (SRM's) inventory during the last decade are reviewed. The current status of the inventory is summarized as are future plans for the production of new SRM's.

702,168
PB81-120461 Not available NTIS
National Bureau of Standards, Washington, DC.
Estimation of Water Content by Kinetic Method in Karl Fischer Titration.
Final rept.
W. T. Yap, A. L. Cummings, S. A. Margolis, and R. Schaffer. Aug 79, 2p
Pub. in Analytical Chemistry 51, n9 p1595-1596 Aug 79.

Keywords: *Volumetric analysis, *Water, Samples, Sucrose, Reprints, *Karl Fischer reagent, Magnesium gluconate.

An analytical expression was derived for describing the titration curve obtained by the continuous Karl Fischer determination of water in slow-to-dissolve samples. By fitting the theoretical curve to the experimental results, the amount of water in the sample can be determined. The method is illustrated by the Karl Fischer titration of water in magnesium gluconate and in sucrose.

702,169
PB81-126237 Not available NTIS
National Bureau of Standards, Washington, DC.
Artifacts in Energy Dispersive X-Ray Spectrometry in the Scanning Electron Microscope (II).
C. E. Fiori, and D. E. Newbury. 1980, 8p
Pub. in Proceedings of Annual Review of Scanning Electron Microscopy, Chicago, IL., 20-24 Apr 80, Paper in Scanning Electron Microscopy, p251-258 1980.

Keywords: *X ray spectrometers, *Electron microscope, *Electromagnetic interference, Performance evaluation.

The quality of x-ray spectra obtained with an energy dispersive x-ray spectrometer on an electron beam instrument can be severely compromised by the presence of electromagnetic interference.

702,170
PB81-130171 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystal Efficiency Determination for Relative Line Intensity Measurements.
R. B. Marinenko, K. F. J. Heinrich, R. L. Myklebust, and C. E. Fiori. 1980, 3p
Pub. in Proceedings of the Annual Conference on Microbeam Analysis Society (15th) Held at Reno, NV., August 1980, Paper in Microbeam Analysis p56-58 1980.

Keywords: *Crystals, *X ray spectrometers, Calibration, Laboratory equipment, Performance evaluation, Efficiency, Line spectra, Numerical solution.

Extensive overlap occurs in the x-ray spectra of L-lines; for this reason energy dispersive spectrometry (EDS), where detector efficiency can be calculated, cannot be used to determine accurate relative L-line

ratios. The efficiency of a wavelength dispersive spectrometer (WDS), where L-line spectra are better-resolved is difficult to calculate.

702,171
PB81-132656 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrically Heated Sample/Injector Suitable for Use with High Efficiency Gas Chromatographic Columns,
S. N. Chesler, F. R. Guenther, and R. G. Christensen. 1980, 2p
Pub. in Jnl. of High Resolution Chromatographic and Chromatographic Communications Short Communications, p351-352 1980.

Keywords: *Gas chromatography, *Samplers, *Injectors, Efficiency, Laboratory equipment, Performance evaluation, Electric heating, Reprints.

The construction and performance of an electrically heating sampler/injector is described. The apparatus is found useful in collecting organic vapors and subsequently injecting these vapors rapidly onto wall coated open tubular columns. Little or no loss of chromatographic efficiency is observed with its use.

702,172
PB81-134645 Not available NTIS
National Bureau of Standards, Washington, DC.
Accurate Determination of Cholesterol in Serum by Isotope Dilution Gas Chromatography/Mass Spectrometry,
A. Cohen, H. S. Hertz, R. Schaffer, L. T. Sniegoski, T. Sun, and E. White. 1978, 3p
Pub. in Proceedings of the Conference on Mass Spectrometry and Applied Optics (26th), St. Louis, MO., May 28-June 2, 1978, p298-300 1978.

Keywords: *Blood analysis, *Cholesterol, Extraction, Isotopic labeling, Gas chromatography, Mass spectroscopy, Sampling.

A method for the accurate measurement of total cholesterol in serum has been developed to give values against which the accuracy of clinically appropriate reference methods can be judged. Labelled cholesterol (25,26,26,26,27,27,27-d7) was added to serum and the mixture subjected to alkaline hydrolysis. The eight measurements obtained on five different serum pools (1.3 to 3.4 mg cholesterol per ml serum) had an overall relative standard deviation of 0.33%.

702,173
PB81-138547 Not available NTIS
National Bureau of Standards, Washington, DC.
Particle Doppler Shift Spectrometry. Accurate Size Determinations of 5-15 Micrometers Aerosol.
D. S. Bright, R. A. Fletcher, and I. Chabay. 1980, 5p
Pub. in Jnl. of Physical Chemistry 84, n12 p1607-1611, 12 Jun 80.

Keywords: *Particle size, *Aerosols, *Spectrometers, Doppler effect, Light scattering, Reprints.

The authors have improved the particle doppler shift spectrometer (PDSS) to determine the diameters of 5 to 15 micrometers liquid aerosol to high accuracy: 0.05 micrometers. The diameters are determined from Stokes law and the gravitational settling velocities determined by the Doppler shifts of laser light scattered at one angle. This scattered light also shows intensity variations with diameter, predicted by Lorenz-Mie light scattering theory. Features of the intensity vs diameter profile are used as size calibration markers which vary only with the index of refraction of the aerosol material and the wavelength of the light. Stokes law without the slip correction factor agrees with the results better than Stokes law with the slip correction factor.

702,174
PB81-140253 Not available NTIS
National Bureau of Standards, Washington, DC.
Interlaboratory Comparison of Determinations of Trace Level Hydrocarbons in Mussels.
S. A. Wise, S. N. Chesler, F. R. Guenther, H. S. Hertz, L. R. Hilpert, W. E. May, and R. M. Parris. Oct 80, 6p
Pub. in Analytical Chemistry 52, n12 p1828-1833 Oct 80.

Keywords: *Hydrocarbons, *Mussels, *Chemical compounds, Trace elements, Tissue(Biology), Extraction, Gas chromatography, Reprints, Water pollution detection.

The results of the determination of trace-level hydrocarbons in mussel tissue homogenates from two different sites are compared among eight laboratories. The values for the concentrations of total extractable hydrocarbons, total hydrocarbons in the gas chromatographic elution range, and individual hydrocarbon compounds generally differed by less than a factor of four. Sample inhomogeneity, storage instability over a nine-month period, and analysis uncertainty contributed to an observed intralaboratory precision (I sigma) of + or - 40%. The results are discussed with regard to the reliability and comparability of data currently generated in environmental monitoring programs.

702,175
PB81-142838 Not available NTIS
National Bureau of Standards, Washington, DC.
Report on the United States - Japan Cooperative Analysis of Glasses by Secondary Ion Mass Spectrometry.
D. E. Newbury. 1980, 23p
Pub. in Proceedings of the Secondary Ion Mass Spectrometry Seminar, Tokyo, Japan, Oct 23-27, 1978, p52-74 1980.

Keywords: *Glasses, *Chemical analysis, Silicon, Microanalysis, *Secondary ion mass spectroscopy.

Measurements of two glasses by secondary ion mass spectrometry (SIMS) have been made by twenty-two laboratories in the United States, Japan, and Europe. Spectral intensities for positive ions normalized to the ion emission for silicon are reported for each laboratory. The normalized secondary ion yields are found to vary by as much as a factor of fifty when the date of all investigators is compared. For a particular type of instrument, the range is reduced to a factor of five. The range in the normalized yields does not arise because of variation in a single parameter such as primary ion energy. The results imply that quantitative analysis schemes in SIMS must rely on local measurements of relative sensitivity variations.

702,176
PB81-149270 Not available NTIS
National Bureau of Standards, Washington, DC.
Fingerprinting and Partial Quantification of Complex Hydrocarbon Mixtures by Chemical Ionization Mass Spectrometry.
L. W. Sieck. Jan 79, 5p
Pub. in Analytical Chemistry 51, n1 p128-132 Jan 79.

Keywords: *Hydrocarbons, *Chemical analysis, Fossil fuels, Mass spectroscopy, Reprints, *Chemical ionization mass spectroscopy.

A modification of chemical ionization mass spectrometry, which involves photoionization and cyclohexane as the source of the reagent ion, has been used to develop a technique for discriminatory 'finger-printing' of neat fossil fuels. The method provides a two minute turn-around time between samples and batch introduction, with no requirements for prior separation or fractionation. Depending upon the conditions chosen, the technique may also be extended to the quantification of aromatic and olefinic sample components.

702,177
PB81-149304 Not available NTIS
National Bureau of Standards, Washington, DC.
Fluorometric Determination of Partition Coefficients of Naphthalene Homologues in Octanol-Water Mixtures.
T. Krishnamurthy, and S. P. Wasik. 1978, 8p
Pub. in Jnl. Environmental Science and Health A13, n8 p595-602 1978.

Keywords: *Fluorometers, *Cycloalkane hydrocarbons, Octanol, Water, Mixtures, Reprints, *Partition coefficients.

The octanol/water partition coefficients of 12 naphthalene homologues have been measured using a newly developed fluorometric technique. The log P values of alkyl substituents obtained by this method were found to be in reasonable agreement with the literature values.

702,178
PB81-149320 Not available NTIS
National Bureau of Standards, Washington, DC.
Progress in the Development of the Peak-to-Background Method for the Quantitative Analysis of Single Particles with the Electron Probe.
J. A. Small, K. F. J. Heinrich, D. E. Newbury, and R. L. Myklebust. Apr 79, 10p
Pub. in Scanning Electron Microscopy II, p807-816 1979.

Keywords: *Chemical analysis, *X ray analysis, *Particles, Electron probes, Microanalysis, Monte Carlo method, Reprints, Numerical analysis.

A method is described for the quantitative analysis of particles with electron excitation. For this method, the ratios of the characteristic x-ray intensities to the continuous x-ray intensities of the same energy are used to eliminate major particle effects. In order to use the analytical procedure it is necessary to calculate a value of the continuous x-ray intensity for a hypothetical bulk material with the same composition as the unknown. To date, two methods have been used to calculate this value. The first method uses Kramer's law with Green's corrections. The second method uses an empirical equation derived at NBS to calculate the continuous x-ray intensity of the bulk. Results from the analysis of both glass and mineral particles with the particle program are in good agreement with the actual concentrations. Work is also being done with a Monte Carlo program in an effort to identify those conditions under which the correspondence of the peak-to-background ratio between particles and bulk material of the same composition breaks down.

702,179
PB81-149395 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Complex Aromatic Hydrocarbon Mixtures Using Solid Silver Nitrate Columns,
S. P. Wasik, and R. L. Brown. Dec 76, 3p
Pub. in Analytical Chemistry 48, n14 p2218-2220 Dec 76.

Keywords: *Gas chromatography, *Column packings, *Glass coatings, Aromatic hydrocarbons, Silver nitrate, Water vapor, Performance evaluation, Reprints.

A highly efficient chromatographic column consisting of glass beads coated with solid silver nitrate and modified by water vapor in the carrier gas can be used at room temperature to analyze in a reasonable time mixtures containing aromatic hydrocarbons having boiling points up to 180C. The construction of this column is described and its properties discussed. Its efficiency is compared with conventional gas-liquid chromatographic columns.

702,180
PB81-149403 Not available NTIS
National Bureau of Standards, Washington, DC.
Factors Influencing Precision and Accuracy of Analysis with Inductively Coupled Plasmas.
R. L. Watters, and J. A. Norris. 1978, 17p
Pub. in Proceedings of Eastern Analytical Symposium, New York, NY., November 31-December 2, 1977, p65-81 1978.

Keywords: *Chemical analysis, *Error analysis, Performance evaluation, *Standard reference materials, *Plasma spectroscopy.

In order to analyze Standard Reference Materials for certification, it is necessary to establish which instrumental factors contribute to the errors of the analysis technique. The first step is to attain adequate control of the random errors in the entire measurement process. Once this is achieved it becomes possible to evaluate the magnitude of the error and thereby to properly estimate accuracy. This paper describes some of the problems encountered in realizing adequate control of the random errors associated with the Inductively Coupled Plasma. The effects of some important instrumental parameters on the precision of the analytical signal will be described. Preliminary analysis data will be presented to demonstrate the possible magnitude of systematic errors which arise from instrumental sources.

702,181
PB81-149874 Not available NTIS
National Bureau of Standards, Washington, DC.

Assessment of the Accuracy of Spectrophotometric Measurements and Methodologies.
Final rept.
R. W. Burke, and R. Mavrodineanu. 1980, 21p
Pub. in American Society of Testing Materials Special Technical Publication 708, p45-65 1980.

Keywords: *Spectrophotometers, *Absorptance, *Transmittance, Assessments, Performance evaluation, Error analysis, Design criteria, Reprints, Standard reference materials.

Modern day spectrophotometers are used to perform both relative and absolute transmittance or absorbance measurements. In order to discuss these two distinct functions, this paper is divided essentially into two parts. The first part discusses the instrumental parameters that must be verified in order to assure that the measurement is accurate and outlines the several types of National Bureau of Standards (NBS) Standard Reference Materials (SRM) that are currently available, or in process, for performing these verifications. The second part of the paper focuses on analytical method accuracy and describes a number of spectrophotometric procedures that have been widely used at NBS with the belief that they produce accurate results. In instances where sufficient data exist, the accuracy of these procedures is reexamined by comparison of the spectrophotometric values with those obtained by the accepted definitive isotope dilution mass spectrometric method. The paper concludes with some projections on the possible future use of ultraviolet-visible absorption spectrophotometry as a practical, multielement technique.

702,182
PB81-154452 Not available NTIS
National Bureau of Standards, Washington, DC.
Certification of Clinical and Environmental Trace Organic RM's.
Final rept.
H. S. Hertz. 1980, 6p
Sponsored in part by Food and Drug Administration, Washington, DC., National Institutes of Health, Bethesda, MD., Environmental Protection Agency, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Proceedings of International Symposium on the Production and Use of Reference Materials, Bundesanstalt fuer Materialpruefung (BAM), Berlin, Germany, November 13-16, 1979, Paper in Production and Use of Reference Materials, p393-398 1980.

Keywords: *Organic compounds, *Trace elements, *Chemical analysis, Standards, Aromatic polycyclic hydrocarbons, Shale oil, Blood serum, Gas chromatography, Mass spectroscopy, Environmental surveys, *Foreign technology, *Standard reference materials.

The United States National Bureau of Standards has recently issued its first Standard Reference Material (SRM) for trace organic analysis (an RM for anticonvulsant drugs in serum). During the coming year, three additional trace organic SRMs will be issued: generator columns for producing saturated aqueous solutions of polynuclear aromatic hydrocarbons, a shale oil certified for several toxic organic compounds, and human serum certified for normal clinical analytes. The methods used for the accurate and precise trace organic analyses required for the certifications of these materials form the basis for this paper. The methods of greatest current utility include capillary column gas chromatography, high performance liquid chromatography, and isotope dilution gas chromatography-mass spectrometry.

702,183
PB81-164899 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of Isotope Dilution Mass Spectrometry for the Certification of CRM's.
Final rept.
I. L. Barnes. 1980, 4p
Pub. in Proceedings of the International Symposium on the Production and Use of Reference Materials. Bundesanstalt fuer Materialpruefung (BAM), Berlin, Germany, November 13-16, 1979. Paper in Production and Use of Reference Materials, p161-164 1980.

Keywords: *Chemical analysis, Concentration(Composition), *Standard reference materials.

The use of well characterized materials for the development of new analytical methodology is becoming ever more important as our knowledge of the effects of the concentration, both helpful and harmful, of a larger variety of trace elements increases. The requirement that these concentrations must be known in a standard with a level of precision three to ten times better than the expected use places a severe constraint on the analytical procedures used for certification. The further requirement that accuracy as well as precision is necessary so that all measurements fit into one measurement system, equally valid anywhere poses an even greater constraint.

702,184
PB81-178162 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Evaluation of Methods for the Assay of Radium-228 in Water.
J. R. Noyce. Feb 81, 23p NBS-TN-1137
Sponsored in part by Environmental Monitoring Systems Lab., Las Vegas, NV.

Keywords: *Radium isotopes, *Water analysis, *Radioactive isotopes, *Reviews, Assaying, Evaluation, Radium 228, *Water pollution detection, State of the art.

The technical literature from 1967 to May 1980 was searched for methods for assaying radium-228 in water. These methods were evaluated for their suitability as potential EPA reference methods for drinking water assays. The authors suggest the present EPA reference method (Krieger, 1976) be retained but improved, and a second method (McCurdy and Mellor, 1979), which employs beta-gamma coincidence counting, be added. Included in this report is a table that lists the principal features of 17 methods for radium-228 assays.

702,185
PB81-178824 Not available NTIS
National Bureau of Standards, Washington, DC.
Liquid Chromatograph/Mass Spectrometer Interface with Continuous Sample Preconcentration.
Final rept.
R. G. Christensen, H. S. Hertz, S. Meiselman, and E. White. Feb 81, 4p
Sponsored in part by Environmental Protection Agency, Washington, DC.
Pub. in Analytical Chemistry 53, n2 p171-174 Feb 81.

Keywords: *Mass spectroscopy, Sampling, Evaporation, Concentration(Composition), Aromatic polycyclic hydrocarbons, Phenols, Performance evaluation, Design criteria, Reprints, *Liquid chromatography.

A liquid chromatograph/mass spectrometer system which performs enrichment of the sample in the effluent of a conventional liquid chromatograph prior to its being introduced into a differentially pumped quadrupole mass spectrometer is described. The effluent from the liquid chromatograph is concentrated by evaporation of most of the solvent. Solvent evaporation is accomplished by allowing the effluent to flow down an electrically heated wire with the current to the wire controlled by a feedback loop from a volume-sensing photocell. The concentrated effluent flows through a very small needle valve which regulates the flow into and thereby the pressure inside the mass spectrometer. The valve is constructed such that liquid is sprayed into the ion source of the mass spectrometer. The application of the system to polynuclear aromatic hydrocarbon characterization and to quantitation of phenolic compounds in alternate fuels is shown.

702,186
PB81-179186 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Auto: A Real Time Diffractometer Control System.
R. L. Snyder, C. R. Hubbard, and N. C. Panagiotopoulos. Feb 81, 107p NBSIR-81-2229
Prepared in cooperation with Alfred Univ., NY.

Keywords: *X ray diffraction, *Computer programs, Spectrum analysis, Minicomputers, Fortran, Automation, Chemical analysis, Diffractometers, Real time operations, AUTO computer program, CONFIG computer program, Interdata 7/16 computers, Control systems.

Two x-ray powder diffractometers are independently driven by the program. The program provides the capability to scan an entire spectrum and to carefully measure the intensities of individual lines for quantitative analysis. For intensity measurements, an optimization routine is used to either minimize data collection time, or to minimize the estimated standard deviation of the net intensity. The data file structures are designed to permit complete data analysis without further data input. The automation program also provides for file handling, including opening, writing, transferring, and deleting.

702,187
PB81-199200 Not available NTIS
National Bureau of Standards, Washington, DC.
Optogalvanic Spectroscopy.
Final rept.
J. E. M. Goldsmith, and J. E. Lawler. 1981, 14p
Sponsored in part by Office of Naval Research, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Contemporary Physics 22, n2 p235-248 1981.

Keywords: *Chemical analysis, Reprints, *Optogalvanic spectroscopy, NTISCOMNBS, NTISDODN, NTISNSFG.

Applications of optogalvanic spectroscopy developed since the resurgence of interest in optogalvanic detection are reviewed. The optogalvanic effect is a change in the electrical properties of a discharge caused by illuminating the discharge with radiation having a wavelength corresponding to an atomic or molecular transition in the discharge. The general scheme of optogalvanic spectroscopy is presented, followed by a discussion of the gas discharge physics of the optogalvanic effect. Applications of optogalvanic detection in moderate resolution spectroscopy, in Doppler-free-spectroscopy, and in analytic studies are discussed.

702,188
PB81-205924 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Portable Calibration Densimeter for Use in Cryogenic Liquids,
J. D. Siegwarth, and J. F. LaBrecque. Mar 81, 20p NBS-TN-1035

Keywords: *Densitometers, *Liquefied natural gas, Calibrating, Portable equipment, Density(Mass/volume), Design criteria, Performance evaluation, Standards, Error analysis, NTISCOMNBS.

A portable densimeter designed specifically for calibrating liquefied natural gas densimeters but suitable for density measurement of a wide range of liquids, is described. The densimeter has been compared to the Density Reference System densimeter at the National Bureau of Standards and found to agree to well within the combined systematic error. The density results of this instrument and that of the DRS densimeter are statistically indistinguishable.

702,189
PB81-207276 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of Radiochromic Dye Films and Other Plastic Dose Meters under Radiaton Processing Conditions.
Final rept.
A. Miller, and W. L. McLaughlin. 1981, 20p
Pub. in Chapter in Technology Report No. 205: High-Dose Measurements in Industrial Radiation Processing, p119-138 1981.

Keywords: *Dosimeters, Plastics, Performance evaluation, Dyes, Reprints, NTISCOMNBS.

Selection of dose meters for industrial irradiation purposes is mainly based on the specific dosimetry needs of the individual irradiation processes, weighed against knowledge of the well-documented behaviour of the dose meters in question. These selection criteria are briefly discussed. A comprehensive study is made of radiochromic dye dose meters with respect to the data needed in making a meaningful evaluation of their merits and faults. Part of the programme has been carried out for several types of radiochromic dye films, as well as red, amber and clear Perspex dose meters, and the results of these measurements are given.

702,190
PB81-211583 Not available NTIS
National Bureau of Standards, Washington, DC.
Preconcentration of Trace Metals in Environmental and Biological Samples by Cation Exchange Resin Filters for X-Ray Spectrometry.
Final rept.
H. Kingston, and P. A. Pella. Feb 81, 5p
Pub. in Analytical Chemistry 53, n2 p223-227 Feb 81.

Keywords: *Chemical analysis, *Trace elements, Sea water, Particles, Coal, Urine, Concentration(Composition), Environmental surveys, Bioassay, Ion exchange resins, X ray spectroscopy, X ray fluorescence, Reprints, NTISCOMNBS.

A preconcentration method is described for the X-ray spectrometric analysis of several trace elements in seawater, NBS-SRM 1648 urban particulate, NBS-SRM 1632 trace elements in coal, and nickel in urine at concentrations as low as 1 ppb. The elements in the coal and urban particulate samples were loaded quantitively on cation exchange resin filters and subsequently analyzed by energy-dispersive X-ray fluorescence spectrometry using secondary targets for monochromatic excitation of the filter sample. Prior to the analysis of seawater and urine the trace elements from the matrix were separated with a chelating resin. Comparison of the results obtained with NBS-SRM certificate values and/or those of other workers indicated agreement within + or -. Detection and quantitation limits for this preconcentration method are also presented.

702,191

PB81-226334 PC **A19**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Energy Dispersive X-Ray Spectrometry.
K. F. J. Heinrich, D. E. Newbury, R. L. Myklebust, and C. E. Fiori. Jun 81, 443p NBS-SP-604
Library of Congress catalog card no. 81-600047. Prepared in cooperation with National Institutes of Health, Bethesda, MD.
Proceedings of a Workshop Held at Gaithersburg, Maryland on April 23-25, 1979.

Keywords: *X ray analysis, *Meetings, X ray fluorescence, Least squares method, Performance evaluation, Spectrochemical analysis, Chemical analysis, Design criteria, *Energy dispersive x ray spectroscopy, State of the art.

This volume contains the proceedings of a Workshop on Energy Dispersive X-ray Spectrometry. The three-day meeting involved participants from the United States and Europe. The workshop format consisted of invited talks on each topic followed by contributed papers and extensive discussions. The extensive development of electron beam instrumentation for microanalysis and microscopy has been greatly stimulated by the development of the energy dispersive x-ray spectrometer based on the silicon (lithium) detector. This publication provides a detailed view of the state-of-the-art of energy dispersive x-ray spectrometry, from the basics of the detection process to applications of the technique to quantitative x-ray microanalysis. The papers should be of wide interest to workers in many fields of science which utilize x-ray microanalysis.

702,192

PB81-227688 Not available NTIS
National Bureau of Standards, Washington, DC.
Precision Acoustic Measurements with a Spherical Resonator: Ar and C2H4.
Final rept.
J. B. Mehl, and M. R. Moldover. Apr 81, 16p
Pub. in Jnl. of Chemical Physics 74, n7 p4062-4077, 1 Apr 81.

Keywords: *Laboratory equipment, *Thermophysical properties, *Argon, *Ethylene, Performance evaluation, Reprints, *Spherical acoustic resonators, Virial coefficient.

The spherical acoustic resonator is a remarkably accurate and convenient tool for the measurement of thermophysical properties of gases at low and moderate densities. Their measured values of the bulk relaxation frequency of C2H4 are within the scatter of the more recent values of the literature. In the course of our 'calibration' measurements with argon, the authors have redetermined the leading acoustic virial coefficient of argon. Their values for the virial are in satisfactory agreement with those in the literature. The authors include several practical suggestions for increasing the accuracy and/or versatility of spherical resonators.

702,193

PB81-238453 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Mass Spectra and Isotopic Purity of Compounds Proposed for Use in the Master Analytical Scheme for the Analysis of Organic Compounds in Water,
E. White, V. J. M. Welch, and H. S. Hertz. Nov 80, 62p NBSIR-80-2160

Keywords: *Water analysis, *Organic compounds, *Mass spectroscopy, Tables(Data), Purification, Isotopes, Deuterium compounds, Chemical analysis, Concentration(Composition).

Mass spectra for 24 deuterated organic compounds are given in tabular and graphical form. The mole percent deuterium at labelled positions as determined by mass spectrometry for 23 compounds is given.

702,194

PB81-239717 Not available NTIS
National Bureau of Standards, Washington, DC.
Novel Cell for Light Scattering from Solutions.
Final rept.
F. W. Wang, and B. H. Zimm. 1981, 3p
Sponsored in part by National Institutes of Health, Bethesda, MD. Pub. in Biopolymers 20, p1333-1335 1981.

Keywords: *Laboratory equipment, *Light scattering, *Cells, Design criteria, Performance evaluation, Centrifuging, Reprints.

A novel cell for holding the sample in a light scattering apparatus is described. In this cell the usual glass window for the entrance of the incident beam is replaced by the free liquid surface. The cell is designed to be centrifuged in a swinging-bucket rotor. The Rayleigh ration of water determined with this cell is given.

702,195

PB81-244865 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Cryogenic Fluids Density Reference System: Provisional Accuracy Statement (1980).
J. D. Siegwarth, and J. F. LaBrecque. Apr 81, 61p NBS-TN-1041
Sponsored in part by Gas Research Inst., Chicago, IL.
See also PB-275 450.

Keywords: *Density(Mass/volume), *Cryogenics, Densitometers, Calibrating, Error analysis, Design criteria, Performance evaluation, Liquefied natural gas, Methane, Laboratory equipment, Standard reference materials, *Density reference systems.

The improved Density Reference System, the reference densimeter, and the method of determining sample density are described. The uncertainty of the density reference system is + or - 0.055%. The contribution from the estimated systematic error in density was + or - 0.022%. The estimated uncertainty caused by random error is three times the standard deviation of 0.011% and is based on sixty-three measurements of the densities of saturated liquid methane. The total density uncertainty is taken to be the sum of the systematic and random errors. This applies to the density range of 400 to 480 kg/cu m at pressures from 0.8 to 4 bar absolute and temperatures between 109 and 128 K. This accuracy statement is expected to apply over ranges of at least 400 to 1000 kg/cu m in density, 77 to 300 K in temperature and 0.8 to 7 bar in pressure though the accuracy over these ranges has not been verified. Compared to the original, this improved density reference system has greater accuracy, speed, reliability, and flexibility.

702,196

PB81-245839 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Vaporization and Chemical Transport Under Coal Gasification Conditions.
J. W. Hastie, D. W. Bonnell, E. R. Plante, and W. S. Horton. Dec 80, 114p NBSIR-80-2178-DOE
Contract DOE-EA-77-A-01-6010

Keywords: *Coal gasification, *Chemical analysis, *Alkali metals, *Slags, Mass spectroscopy, High temperature tests, Transport properties, Vaporization.

The present studies have resulted in the development of a new experimental technique, transpiration mass spectrometry, for the quantitative analysis of high vapor temperature gases and vapors. This technique has been applied to vapor transport and thermodynamic activity determinations for real and synthetic coal slag samples in reactive coal gas components at atmospheric pressure. The results indicate a highly non-ideal and non-monotonic (with temperature and composition variables) behavior for alkali metal vapor transport. Thus a priori predictions of alkali metal transport in coal gasifiers without actual activity data are virtually impossible at the present time. Surface segregation and diffusion limitations of alkali species in slags are also possible complicating effects.

702,197

PB81-248882 Not available NTIS
National Bureau of Standards, Washington, DC.
Sampling for Chemical Analysis.
Final rept.
B. G. Kratochvil, and J. K. Taylor. Jul 81, 15p
Pub. in Analytical Chemistry 53, n8 p924A-938A, Jul 81.

Keywords: *Chemical analysis, *Samples, Reprints.

A general discussion is given of the various factors that should be considered to provide valid samples for chemical analysis. Included are discussions of the common modes of sampling and the rational behind the development of sampling plans for both bulk and stratified materials. Guidance is provided in determining the necessary number and sizes of samples required to reduce uncertaincy due to sample variability to prescribed limits. Sampling of materials occurring in discrete units is also considered. While the discussion is directed primarily toward solid materials, the implications for other sampling situations are pointed out.

702,198

PB81-600010 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Levels of Sodium, Na I through Na XI.
W. C. Martin, and R. Zalubas. 1981, 44p
Included in Jnl. of Physical and Chemical Reference Data, v10 n1 p153-196 1981.

Keywords: *Atomic energy levels, Atomic ions, Atomic spectra, Electron configurations, Ionization potentials, Sodium.

Energy level data are given for the atom and all positive ions of sodium (Z=11). These data have been critically compiled, mainly from published material on measurements and analyses of the optical spectra. The authors have derived or recalculated the levels for a number of the ions. In addition to the level value in cm to the minus 1st power and the parity, the integral value and the configuration and term assignments are listed if known. Leading percentages from the calculated eigenvectors are tabulated wherever available. Ionization energies are given for all spectra.

702,199

PB82-100090 Not available NTIS
National Bureau of Standards, Washington, DC.
Color Test Reagents/Kits for Preliminary Identification of Drugs of Abuse.
Final rept.
R. A. Velapoldi. Jul 81, 13p
Sponsored in part by Department of Justice, Washington, DC.
Pub. in NIJ Standard-0605.00, 13p. Paper copy available from Supt. of Docs.

Keywords: *Colorimetric analysis, Chemical analysis, Reprints, *Drug abuse, *Forensic chemistry.

This document is a performance standard for color test reagents and field kits used for preliminary tests to establish presumptive evidence of drugs of abuse for later verification in a forensic laboratory. Performance requirements are given for such attributes as specificity, sensitivity, color development, and labeling.

702,200

PB82-100199 Not available NTIS
National Bureau of Standards, Washington, DC.
Optogalvanic Effect.
Final rept.
J. C. Travis, and J. R. DeVoe. 1981, 32p
Pub. in Lasers in Chemical Analysis Chapter 5, p93-124 1981.

Keywords: Chemical analysis, Reprints, *Laser spectroscopy, *Optogalvanic effect, Laser enhanced ionization.

This is a review article on the Optogalvanic Effect (OGE) which provides the reader with the necessary historical perspective to understand the basis of the technique. The OGE is compared with other methods

which use lasers to produce selective ionization of atoms and molecules. The review concludes with an up-to-date description of laser enhanced ionization in flames including the mechanism, sources of error, and potential of this new quantitative analytical technique.

702,201
PB82-100207 Not available NTIS
National Bureau of Standards, Washington, DC.
Particulates Formed by a Stabilized High Voltage Spark Discharge.
Final rept.
A. Scheeline, J. A. Norris, J. C. Travis, J. R. DeVoe, and J. P. Walters. 1981, 11p
Pub. in Spectrochimica Acta 36B, n4 p373-383 1981.

Keywords: *Electrical discharges, *Charged particles, Light scattering, Chemical analysis, Emission spectroscopy, Reprints.

Light scattering was used to demonstrate the presence of small less than or equal to 1 micrometer particles in the immediate surroundings of a stable spark discharge. Several parameters, including electrode composition and surface condition, which are of importance in emission spectrochemical analysis, were found to be of importance in affecting the scattering signal. Electron micrographs of the heaviest particles revealed two distinct types of particles. Analytical implications are discussed.

702,202
PB82-101221 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrode Technique for Measurement of Chloride Concentration in Microsamples.
Final rept.
R. K. Popp, J. D. Frantz, and G. L. Vogel. 1980, 3p
Grant PHS-DE-04385
Sponsored in part by National Science Foundation, Washington, DC., and Carnegie Institution of Washington, DC.
Pub. in American Mineralogist 65, p393-395 1980.

Keywords: *Chlorides, *Electrodes, *Laboratory equipment, Concentration(Composition), Sampling, Performance evaluation, Chemical analysis, Reprints.

A simple device is described for adapting a chloride solid-state electrode for microliter volumes. The device, which consists of a nylon cylinder in which 4 holes are drilled, is waxed onto the surface of an inverted chloride electrode. Samples of 1-5 microliter are deposited in the holes of the adapter and a KNO3-agar filled glass capillary is used to make contact between the samples and a reference electrode.

702,203
PB82-109851 PC **A17**/MF **A01**
National Bureau of Standards, Washington, DC.
User's Manual for Factor-Jump Thermogravimetry Apparatus, and Associated Programs, Including a General Plotting Program.
B. Dickens. Mar 81, 387p NBSIR-80-2102
Portions of this document are not fully legible.

Keywords: *Thermogravimetry, *Laboratory equipment, Computer programming, Plotting, Automatic equipment, Performance evaluation, Computer programs, Fortran, *User manuals(Computer programs).

The publication describes the operation of the computerized thermogravimetry apparatus. Detailed instructions are given to enable the user to bootstrap the computer and run the various programs. The items covered are (1) the thermogravimetry program TGRUNF, (2) the data file editing program TGEDIT, (3) estimation of trimmed means by TGTRIM, (4) general calculation of activation energy from rate data; probability plots by TGDEPG, (5) the generalized polynomial fitting program POLGEP, (6) publication tables by TABLEP, (7) the BASIC program BMPD which operates the computer interface in a general fashion and (8) user-directed and automated plotting using the generalized plotting program PABS. Appendices on cautionary remarks and cable diagrams are included.

702,204
PB82-124702 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Hydrocarbon Vapor Standards for Performance Evaluation of Combustible Gas Detectors.
J. E. Brown. Oct 81, 21p NBS-SP-480-43
Sponsored in part by National Inst. of Justice, Washington, DC.

Keywords: *Gas detectors, *Hydrocarbons, Calibrating, Performance evaluation, Standards, Concentration(Composition), Gas chromatography, Diffusion, Arson.

Calibration mixtures of hydrocarbon vapor were prepared for the calibration and performance evaluation of portable combustible gas detectors which are used to detect the presence of accelerant vapors in cases of suspected arson. The standards contained vapors of aliphatic and aromatic compounds common to petroleum distillates such as gasolines, which are frequently employed as accelerants in arson fires. These standards were prepared by a dynamic dilution technique in which the vapor evolving from diffusion tubes containing liquid hydrocarbons was diluted with air. The concentrations of the vapors were calculated from gravimetrically determined diffusion rates of the hydrocarbons and from measured flow of air at three temperatures: 30, 50, and 70C. Gas chromatographic analyses of the vapor-air mixtures generated at 30 and 50C showed that the vapor concentrations are essentially constant within measurement periods of 1 to 3 d and from one period to another, and that they agreed with calculated concentrations.

702,205
PB82-127754 Not available NTIS
National Bureau of Standards, Washington, DC.
Cryogenics.
Final rept.
K. D. Timmerhaus, and T. M. Flynn. 1981, 120p
Paper in Encyclopedia of Chemical Processing and Design 13, p261-381 1981.

Keywords: *Cryogenics, *Laboratory equipment, Pressure, Temperature, Reviews, Density(Mass/volume), Chemical engineering, Flow rate, Reprints.

Cryogenic instrumentation as a discipline is primarily concerned with the condition or thermodynamic state of cryogenic fluids, such as pressure and temperature. Such information is typically required for chemical process optimization and control. In addition, as cryogenic fluids have become of greater commercial importance, there is the question of quantity transferred or delivered. Accordingly, the instrumentation system must also be able to provide information concerning liquid level, density, and flow rate. This manuscript reviews the measurement tools and techniques that are currently used for the most common cryogenic measurements: pressure, temperature, liquid level, density and flow.

702,206
PB82-127812 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of the Torsionally Oscillating Quartz Crystal Viscometer to Compressed Gases and Liquids.
Final rept.
D. E. Diller, and W. M. Haynes. 1981, 13p
Pub. in Proceedings of DoE Gas Miscible Displacement Research Seminar, Tulsa, Oklahoma, January 8-9, 1981, p1X-1--1X-13.

Keywords: *Viscometers, *Gases, *Liquids, Density(Mass/volume), Standards, Laboratory equipment, Methane, Propane, Performance evaluation, Reprints, *Quartz crystal viscometers, Standard reference materials.

The torsionally oscillating quartz crystal viscometer method is being used on compressed gases and liquids at the National Bureau of Standards, Boulder, Colorado. The method actually measures the viscosity-density product and requires independent density data to obtain the shear viscosity coefficient. Recent applications of the method to compressed gaseous and liquid methane and liquid propane are discussed. The claimed inaccuracy is less than 2 percent, based on the repeatability and on comparisons with accurate capillary tube and oscillating disk measurements. The method does not require calibration with fluids of known viscosity. The simplest form of the theory of the instrument appears to be satisfactory (within the claimed accuracy) for use on fluids where shear rate effects are negligible. Compared to most viscosity measuring techniques, the torsionally oscillating quartz crystal can be used with relative ease over wide ranges of temperature and pressure. The NBS apparatus has been used on seven pure fluids at temperatures between 15 and 320K and at pressures to 35 MPa (5075 psia).

702,207
PB82-130006 Not available NTIS
National Bureau of Standards, Washington, DC.
Selective Quenchofluorometric Detection of Fluoranthenic Polycyclic Aromatic Hydrocarbons in High-Performance Liquid Chromatography.
Final rept.
P. L. Konash, S. A. Wise, and W. E. May. 1981, 11p
Sponsored in part by Environmental Protection Agency, Washington, DC.
Pub. in Jnl. Liq. Chromatog. 4, n8 p1339-1349 1981.

Keywords: *Aromatic polycyclic hydrocarbons, Fluorescence, Chemical analysis, Reprints, *High performance liquid chromatography, *Quenchofluorometric detection systems, *Fluoranthenes.

The phenomenon of fluorescence quenching was used for selective HPLC detection of fluoranthenic polycyclic aromatic hydrocarbons (PAH). Termed a 'Quenchofluorometric' detection system, it employs a filter fluorimeter or spectrofluorimeter and nitromethane in the mobile phase as the fluorescence quenching reagent. Chromatograms obtained with and without the quenching reagent are compared for PAH standards, a coal tar extract, and a shale oil sample. The quenchofluorometric detection system provides an inexpensive method to achieve selective detection for fluoroanthenic PAH as a group.

702,208
PB82-133877 Not available NTIS
National Bureau of Standards, Washington, DC.
Nitrogen Sensitivities of a Sample of Commercial Hot Cathode Ionization Gage Tubes.
Final rept.
K. E. McCulloh, and C. R. Tilford. Apr 81, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of the Vacuum Science and Technology 18, n3 p994-996 Apr 81.

Keywords: *Measuring instruments, *Tube cathodes, *Nitrogen, Ionization, Calibrating, Performance evaluation, Chemical analysis, Reprints.

In order to help assess the magnitude of errors that might arise from the use of uncalibrated ionization gage tubes and help select the best type of tube when accurate measurements are required the authors have determined the nitrogen sensitivities from 10-5 to 10-2 Pa for lots of from two to four each of five different types of commercial hot cathode gage tubes. Included were conventional triodes and B-A structures of four distinct types. Two types with tungsten filaments -- the triodes and tabulated B-A structures -- were markedly superior to the others with respect to agreement with manufacturer's sensitivity, linearity, and uniformity of sensitivity within a type. The least satisfactory results were obtained from the nude B-A structures, which showed significant nonlinearities, sensitivities ranging from 70%-110% of the manufacturer's value, and typical 25% differences in sensitivity between the two filaments of a dual-filament structure.

702,209
PB82-133950 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Polychlorinated Biphenyls in Waste and Lubricating Oils.
Final rept.
S. N. Chesler, W. E. May, P. A. White, R. M. Parris, and F. R. Guenther. Nov 80, 3p
Pub. in Proceedings of Joint Conference on Measurements and Standards for Recycled Oil/Systems Performance and Durability, Gaithersburg, Maryland, October 23-26, 1979, p295-297 Nov 80.

Keywords: *Chemical analysis, *Lubricating oils, Samples, Gas chromatography, *Polychlorinated biphenyls, *Liquid wastes, High performance liquid chromatography, Electron capture gas chromatography.

A new method is reported for the determination of polychlorinated biphenyls (PCB) in waste and lubricating oils. The method utilizes high-performance preparative scale liquid chromatography for sample clean up and glass capillary gas chromatography with electron capture detection for quantitation. The method was found superior to prior existing methods.

702,210
PB82-133976 Not available NTIS
National Bureau of Standards, Washington, DC.

Differential Pulse Detection in Liquid Chromatography and Its Application to the Measurement of Organometal Cations.
Final rept.
W. A. MacCrehan. Jan 81, 4p
Pub. in Analytical Chemistry 53, n1 p74-77 Jan 81.

Keywords: *Chemical analysis, *Metal containing organic compounds, Cations, Performance evaluation, Reprints, *Differential pulse polarography.

An examination is made of some advantages of differential pulse over amperometric electrochemical detection under certain measurement circumstances. The added selectivity, high sensitivity, and low base line drift of the differential mode are discussed. The separation and low level detection of organomercury and organotin cations are examined. Finally, the use of differential pulse detection for the elimination of electrode fouling problems is demonstrated.

702,211
PB82-135161 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Standard Reference Materials: Summary of the Clinical Laboratory Standards Issued by the National Bureau of Standards.
Final rept.
R. W. Seward, and R. Mavrodineanu. Nov 81, 180p
NBS-SP-260-71
Library of Congress catalog card no. 81-600149.

Keywords: *Clinical medicine, *Chemical analysis, Standards, *Standard reference materials.

This publication is a summary of the Clinical Laboratory Standards issued by NBS as Standard Reference Materials (SRM's). The material, composition, certification, use, and remarks concerning each of the SRM's described are presented in tabular form. Copies of the certificates for these SRM's are contained in the appendix for more detailed information.

702,212
PB82-140609
(Order as PB82-140575, PC **A05**/MF **A01**)
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Transient Hot Wire Thermal Conductivity Apparatus for Fluids,
H. M. Roder. 26 May 81, 37p
Contract NASA-C-32369-C
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Included in Jnl. of Research of the National Bureau of Standards, v86 n5 p457-493, Sep-Oct 81.

Keywords: *Thermal conductivity, *Fluids, Laboratory equipment, Design, Performance evaluation.

A new apparatus for measuring the thermal conductivity of fluids is described. This is an absolute method utilizing a transient hot wire. Measurements are made with a 12.7 micrometers diameter platinum wire at real times of up to 1 second. The data acquisition system includes a minicomputer and a digital voltmeter. The experimental core of the system incorporates a compensating hot wire in a Wheatstone bridge circuit. The cell containing the core of the apparatus is designed to accommodate pressures from 0 to 70 MPa and temperatures from 70 to 320 K. Oxygen was measured over a wide range of physical states including the dilute gas, the moderately dense gas, the near critical region, the compressed liquid states, and the vapor at temperatures below the critical temperature. Performance checks of the apparatus were conducted with nitrogen, helium and argon. Measurement of rare gases allows a direct comparison to the kinetic theory of gases through the viscosity. A second check looks at the variation of the measured thermal conductivity as a function of the applied power. The precision (2 sigma) of the new system is between 0.5 and 0.8 percent for wire temperature transients of 4 to 5 K, while the accuracy is estimated at around 1.5 percent.

702,213
PB82-144064 Not available NTIS
National Bureau of Standards, Washington, DC.
LNG Instrumentation for Custody Transfer.
Final rept.
J. D. Siegwarth, and J. A. Brennan. 1981, 4p
Pub. in Proceedings of American Gas Association 1981 Operating Section Distribution and Transmission Conferences, pT-119-T-123 1981.

Keywords: *Liquefied natural gas, *Densimeters, *Flowmeters, Calibrating, Performance evaluation, Laboratory equipment.

Recent work by NBS on measurement of density, liquid level, and liquid flow of Liquefied Natural Gas (LNG) is presented. The density work includes development methods and standards for calibrating densimeters and recent test work of some commercial densimeters. Commercial LNG level gages will be tested for accuracy in the liquid level gage program. The flow program involves testing of large (up to 81 cm dia) flowmeters for LNG service.

702,214
PB82-149840 Not available NTIS
National Bureau of Standards, Washington, DC.
Dual-Electrode, Liquid Chromatographic Detector for the Determination of Analytes with High Redox Potentials.
Final rept.
W. A. MacCrehan, and R. A. Durst. 1981, 5p
Pub. in Analytical Chemistry 53, p1700-1704 1981.

Keywords: Electrochemistry, Laboratory equipment, Performance evaluation, Design criteria, Electrodes, Cations, Tin organic compounds, Nitrogen organic compounds, Nitrobenzenes, Chemical reactions, Chlorine organic compounds, Reprints, *Liquid chromatography, *Dual electrode detectors, *Analytes, Dichlone, Benzene/nitro.

An electrochemical detection approach for liquid chromatography is described utilizing two sequential, generator/detector electrodes. Analytes are first electrolyzed, and the reaction products are then detected electrochemically at a second electrode. In some cases, this allows the detection of analytes with high redox potentials, with good sensitivity and selectivity. The technique is tested on several organic analytes: dichlone, nitrobenzene, and three organotin cations.

702,215
PB82-155193 Not available NTIS
National Bureau of Standards, Washington, DC.
Certification of Selected Polynuclear Aromatic Hydrocarbons in Standard Reference Material 1580, 'Organics in Shale Oil'.
Final rept.
W. E. May, J. M. Brown-Thomas, L. R. Hilpert, and S. A. Wise. 1981, 16p
Pub. in Proceedings of Polynuclear Aromatic Hydrocarbons: International Symposium Chemical Analysis and Biological Fate (5th), Held at Columbus, Ohio on October 27-29, 1980, p1-16 1981.

Keywords: *Aromatic polycyclic hydrocarbons, *Shale oil, *Chemical analysis, Gas chromatography, Mass spectroscopy, Sampling, *Standard reference materials, High performance liquid chromatography.

Two independent analytical methods were developed and used to certify the concentrations of five polynuclear aromatic hydrocarbons (PAH) in a shale oil sample (SRM 1580). In the sequential high-performance liquid chromatographic method, PAH are isolated from the matrix by chromatography on an aminosilane column. The individual analyte species were separated, identified, and quantified by chromatography on an octadecylsilane column with spectrofluorimetric detection. Dilution of the sample in methylene chloride was the only sample preparation step necessary prior to analysis by gas chromatography/mass spectrometry (GC/MS). The GC/MS determinations were performed using selected ion monitoring (SIM) and a standard addition technique for quantification. The polynuclear aromatic hydrocarbons of interest were separated on a 30 m SE-52 wall coated open tubular column interfaced to a quadrupole mass spectrometer through a 25 cm length of Pt/Ir tubing (0.15 mm i.d.). Excellent agreement was observed between the data obtained from these methods.

702,216
PB82-158783 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Programmable Sample Dryer for Thermal Ionization Mass Spectrometry.
Final rept.
J. W. Gramlich, and R. W. Shideler. Jan 82, 22p
NBS-TN-1154

Keywords: *Dryers, *Isotope separation, Samples, Laboratory equipment, Design, Performance evaluation, *Thermal ionization mass spectroscopy, Procedures.

A sample dryer has been designed which allows reproducible and automatic filament current and timing adjustments for up to five separate steps. Designed around inexpensive TTL logic, the dryer may be programmed by resistors on a plug-in card to provide the proper drying conditions, be programmed to stop and signal the operator after any step, or be allowed to continue uninterrupted through the entire drying sequence. A programmable 110 volt output is provided for controlling a heat lamp or other accessory.

702,217
PB82-198706 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Two Isotope Dilution/Mass Spectrometric Methods for Determination of Total Serum Cholesterol.
Final rept.
R. Schaffer, L. T. Sniegoski, M. J. Welch, E. White, V. A. Cohen, H. S. Hertz, J. Mandel, R. C. Paule, L. Svensson, I. Bjorkhem, and R. Blomstrand. 1982, 4p
Pub. in Clinical Chemistry 28, n1 p5-8 1982.

Keywords: *Cholesterol, *Mass spectroscopy, Comparison, Isotope effect, Blood serum, Chemical analysis, Reprints.

Isotope dilution/mass spectrometric methods for total serum cholesterol, developed separately at the Karolinska Institutet (KI) and the National Bureau of Standards (NBS), were compared by applying them to a common set of serum pools. A search for the cause of a systematic difference of a few percent in results from the two methods revealed that the KI cholesterol standard contained lathosterol, which interfered with the calculation of the method. With NBS Standard Reference Material cholesterol used for new analyses at the KI, the average difference in mean values dropped to 0.2 percent. The NBS results are more precise. This is attributed to the protocols NBS used for sample preparation and mass spectrometry. However, these protocols make the NBS method more complex and time-consuming. A recent critical article on the use of this technique for total cholesterol is also examined.

702,218
PB82-199449 Not available NTIS
National Bureau of Standards, Washington, DC.
Tertiary Interferograms in Fourier Transform Spectroscopy.
Final rept.
A. Baghdadi, and R. A. Forman. 1981, 3p
Pub. in Applied Spectroscopy 35, n5 p473-475 1981.

Keywords: *Interferometers, Samples, Infrared spectroscopy, Reprints, *Fourier transform spectroscopy.

Multiple passes, both within a semiconductor specimen and between the specimen surface and the interferometer, give rise to a series of extraneous 'tertiary' interferograms in a Fourier transform spectrophotometer. These tertiary interferograms can lead to a possible error on the order of 1 percent in the measurement of the impurity content of a silicon wafer. However, this effect can be eliminated by a straightforward manipulation of the interferogram prior to transformation.

702,219
PB82-209628 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Asbestos Standards: Materials and Analytical Methods.
Final rept.
J. Small, and E. Steel. Mar 82, 224p NBS-SP-619
Library of Congress catalog card no. 82-600506. Proceedings of the NBS/EPA Asbestos Standards Workshop Held at the National Bureau of Standards, Gaithersburg, MD, October 1-3, 1980.

Keywords: *Asbestos, *Meetings, Standards, Environmental surveys, Chemical analysis, Concentration(Composition), Sampling, Sources, Standard reference materials.

This publication contains the invited papers which were presented at a workshop on asbestos standards jointly sponsored by the Environmental Protection Agency and the National Bureau of Standards and held on October 1-3, 1980. The workshop was divided into five sections: (1) Bulk Materials for Preparation of Asbestos Standards---This section includes descriptions of natural and synthetic materials which have a potential use as standards for asbestos analysis. In

addition, it also includes a description of the NBS Standard Reference Materials Program. (2) Standards Preparation---The electron-microscopy preparation procedures for standards mimicking airborne and waterborne asbestos samples are described. (3) Asbestos Analysis for Standards Certification---This section describes analytical procedures and problems associated with the intra- and interlaboratory analyses of asbestos standards. (4) Error Analysis and Statistics---This section describes the statistical considerations which are involved in asbestos standards preparation and analysis. (5) EPA Provisional Method---Current developments and selected problems with the EPA Provisional Method for Electron Microscope Measurement of Airborne Asbestos Concentrations are discussed. The papers include general reviews on each of the subjects as well as specific papers detailing current research efforts.

702,220
PB82-210501 Not available NTIS
National Bureau of Standards, Washington, DC.
Vacuum Thin Layer Electrochemical Cell for Nonaqueous Spectroelectrochemistry.
Final rept.
E. A. Blubaugh, and L. M. Doane. Feb 82, 3p
Pub. in Analytical Chemistry 54, n2 p329-331 Feb 82.

Keywords: *Electrochemistry, *Electrolytic cells, Solvents, Vacuum chambers, Laboratory equipment, Reprints, Viologen/methyl, Carbonic acid/(propylene-ester).

A vacuum spectroelectrochemical cell for use with nonaqueous solvents is described. When used in conjunction with vacuum apparatus, the cell enables the preparation and maintenance of solutions in an oxygen and water-free environment. The cell is easily and rapidly converted from experiments in spectroelectrochemistry to use in thin layer or bulk electrochemistry. The electrochemistry and spectroelectrochemistry of methyl viologen in propylene carbonate is examined.

702,221
PB82-211012 Not available NTIS
National Bureau of Standards, Washington, DC.
On-Line Multidimensional Liquid Chromatographic Determination of Polynuclear Aromatic Hydrocarbons in Complex Samples.
Final rept.
W. J. Sonnefeld, W. H. Zoller, W. E. May, and S. A. Wise. Apr 82, 5p
Pub. in Analytical Chemistry 54,, n4 p723-727 Apr 82.

Keywords: *Aromatic polycyclic hydrocarbons, *Chemical analysis, Sampling, Reprints, *High performance liquid chromatography, Standard reference materials.

A method is described for the on-line coupling of a normal-phase high-performance liquid chromatographic (HPLC) system to a reversed-phase HPLC system. The method employs a diamine column for on-column concentration of a selected fraction from a normal-phase aminosilane column followed by a solvent exchange procedure and gradient elution focusing of the analyte species onto a reversed-phase octadecylsilane column. No loss of analyte of chromatographic resolution is observed by using this method. Several chromatographic packing materials were investigated for use as on-column concentrators of polynuclear aromatic hydrocarbons (PAH) from normal-phase chromatographic systems. The validity of this approach was verified by determining the concentration of several PAH in Standard Reference Material (SRM) 1580 - 'Organics in Shale Oil'.

702,222
PB82-221300 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Standard Reference Materials: Preparation and Characterization of K-411 and K-412 Mineral Glasses for Microanalysis - SRM 470.
Final rept.
R. B. Marinenko. Apr 82, 28p NBS-SP-260-74
Library of Congress catalog card no. 82-600511. See also PB82-138140.

Keywords: *Glasses, *Chemical analysis, *Microanalysis, Standards, *Standard reference materials, Wet methods.

The two mineral glasses in SRM 470, K-411 and K-412, were quantitatively analyzed for major constituents. The results of wet chemical analyses from two independent laboratories were in excellent agreement; therefore, these results were used for certification. Specimens were evaluated for micro- and macrohomogeneity with the electron microprobe by using random sampling and periodic integrator homogeneity trace techniques.

702,223
PB82-226267
(Order as PB82-226226, PC **A08**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Analysis of Read-Out Perturbations Seen on an Analytical Balance with a Swinging Pan,
M. E. Cage, and R. S. Davis. 8 Sep 81, 23p
Included in Jnl. of Research of the National Bureau of Standards, v87 n1 p23-45 Jan-Feb 82.

Keywords: *Weight indicators, *Error analysis, Laboratory equipment.

An analysis of the dynamic behavior of a single-pan mechanical balance is presented. In particular, errors caused by a swinging pan are analyzed in detail. Results point to a large effect which, though apparently not previously appreciated, is nevertheless easily verified experimentally. It is suggested that this effect can be reduced to insignificance in a balance whose beam is servo-controlled to an angle perpendicular to the local gravitational field.

702,224
PB82-226275
(Order as PB82-226226, PC **A08**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
30 kg Capacity High Precision Load Cell Mass Comparator,
R. M. Schoonover. 15 Apr 81, 2p
Included in Jnl. of Research of the National Bureau of Standards, v87 n1 p47-48 Jan-Feb 82.

Keywords: Laboratory equipment, Performance evaluation, Design criteria, *Mass comparators.

Described here are simple means to fabricate a 30 kg mass comparator based on an ordinary direct reading load cell. The mass comparator performs with a precision of 1 ppm.

702,225
PB82-236811 Not available NTIS
National Bureau of Standards, Washington, DC.
Computer-Controlled Gas Transmission Measuring Apparatus.
Final rept.
J. D. Barnes. 1982, 3p
Pub. in Proceedings of Annual Tech. Conference and Exhibition of the Society of Plastics Engineers, San Francisco Hilton, San Francisco, CA, May 10-13, 1982, p19-21 1982.

Keywords: *Manometers, *Polymer films, *Gases, Permeability, Performance evaluation, Design criteria, Helium, Carbon dioxide, Oxygen, Nitrogen, Laboratory equipment, Computer applications, State of the art.

This paper describes a state-of-the-art facility for measuring the gas transmission characteristics of polymer films. Sensitive electronic manometers are used to monitor the rate at which gas passes through a film into an initially evacuated receiving volume. Three films are tested simultanecusly. The minicomputer controls selection of the gas, setting the upstream pressure, opening and closing of all valves, and setting the experiment temperature. The experiment incorporates hard-wired logic to prevent damage from failures of films under test, failure of the gas controls, failure of the temperature controls, or computer failures. The facility can perform complex sequences of experiments in order to study such phenomena as partial immobilization, glass transition behavior, or activation energies. Human intervention is required only to change film specimens, to insert fresh data logging discs, or to initiate new sequences of experiments. Data reduction and analysis are performed on-line or over a network connection to a central computer. The recent recertification of SRM 1470 for permeances and time-lags of He, CO2, O2, and N2 is described to illustrate the capabilities of the apparatus.

702,226
PB82-261595 Not available NTIS
National Bureau of Standards, Washington, DC.
Heterodyne Detection of Phase-Conjugate Emission in an Ar Discharge with a Low-Power C.W. Laser.
Final rept.
D. Bloch, R. K. Raj, J. J. Snyder, and M. Ducloy. Jan 81, 4p
Pub in Jnl. of Physics Letters 42, n2 pL-31--L-34, 15 Jan 81.

Keywords: *Argon, Gas discharges, Laboratory equipment, Reprints, *Laser spectroscopy, *Heterodyne analyzers.

The authors report the observation of nearly degenerate four-wave mixing in Ar gas discharges at 867 nm (transition 1s3 - 2p7) using a low power c.w. laser. The weak phase-conjugate emission has been observed by means of a heterodyne detection technique at 30 MHz. This experimental scheme should be able to yield ultimate shot-noise limited signals, and thus could be used as a sensitive tool for phase-conjugation studies.

702,227
PB82-264177 Not available NTIS
National Bureau of Standards, Washington, DC.
Accurate Temperature-Controlled Polarimeter.
Final rept.
A. L. Cummings, and R. J. Hocken. Jan 82, 6p
Pub. in Precision Engineering 4, n1 p33-38 Jan 82.

Keywords: *Polarimeters, Calibrating, Standards, Design criteria, Performance evaluation, Sucrose, Laboratory equipment, Reprints.

A photoelectric polarimeter has been constructed for the purposes of calibrating polarimetric standards and for redetermining the value for the specific rotation of sucrose in solution. In this paper we present the design details of this polarimetric system. The design required the careful application of high precision manufacturing techniques coupled closely with metrology throughout the manufacturing process.

702,228
PB83-103739 Not available NTIS
National Bureau of Standards, Washington, DC.
Multilaboratory-Evaluated Reference Method for the Determination of Serum Sodium.
Final rept.
R. Schaffer, R. A. Velapoldi, R. C. Paule, J. Mandel, G. N. Bowers, B. E. Copeland, D. O. Rodgerson, and J. C. White. 1981, 5p
Sponsored in part by Food and Drug Administration, Rockville, MD.
Pub. in Clinical Chemistry 27, n11 p1824-1828 1981.

Keywords: *Blood analysis, *Blood serum, *Sodium, Chemical analysis, Performance evaluation, Reprints, *Flame atomic emission spectroscopy.

The authors carried out a statistically designed, multilaboratory study to evaluate a flame atomic emission spectroscopic (FAES) method for serum sodium as a Reference Method. The statistical results indicate that the precision criterion can be fulfilled with fewer than four replicate analyses.

702,229
PB83-115592 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Tests of Commercial Densimeters for LNG Service.
Technial note.
J. D. Siegwarth, and J. F. LaBrecque. Jun 82, 40p
NBS-TN-1055
Sponsored in part by Gas Research Inst., Chicago, IL.

Keywords: *Densitometers, *Liquefied natural gas, Performance evaluation, Methane, Propane, Nitrogen.

Densimeters for liquefied natural gas (LNG) from four manufacturers were tested in liquid methane and an LNG-like mixture of methane, propane, and nitrogen in the density reference system (DRS). The calibration and performance of one type tested for the first time are reported. The stability of the calibrations and performances of three densimeters of a type previously tested have been examined and are also reported here.

702,230
PB83-121616

(Order as PB83-121582, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Absorbed Dose Water Calorimeter: Theory, Design, and Performance,
S. R. Domen. 13 Jan 82, 25p
Included in Jnl. of Research of the National Bureau of Standards, v87 n3 p211-235, May-Jun 82.

Keywords: *Calorimeters, *Water, Design, Performance evaluation, *Absorbed dose.

The purpose of this paper is to describe an improved model of an absorbed dose water calorimeter previously reported. Many features of the present improved model that includes a unique and simple method for quickly bring temperature drifts under control are described in U.S. patent number 4,312,224. Those features will be described here in further detail along with results of investigations, tests, and experimental measurements.

702,231
PB83-126631 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Determination of Water in Plutonium Dioxide.
Final rept.
F. E. Jones. Apr 82, 8p NBSIR-82-2496
Sponsored in part by Department of Energy, Washington, DC, Office of Safeguards and Security.

Keywords: *Water, *Chemical analysis, *Volumetric analysis, *Moisture content, Karl Fischer reagent, *Plutonium dioxide.

Techniques developed to very effectively apply automatic Karl Fischer reagent titration to the determination of H2O in solids were used to determine the moisture content of samples of plutonium dioxide powder under the constraints imposed by the necessity of working in a glove box. The moisture contents of three samples were found to be 0.2934%, 0.7298%, and 0.4640%. The estimate of the relative standard deviation of the mean for three determinations on the 0.2934% H2O sample was 0.0091. The method apparently has potential as the basic reference method for determination of H2O in plutonium dioxide, as a means of standardizing other methods, and as a diagnostic tool.

702,232
PB83-131722 Not available NTIS
National Bureau of Standards, Washington, DC.
Separation of Peptides by High-Performance Liquid Chromatography on a Weak Anion-Exchange Bonded Phase.
Final rept.
M. Dizdaroglu, H. C. Krutzsch, and M. G. Simic. 1982, 10p
Pub. in Jnl. Chromatogr. 237, p417-428 1982.

Keywords: *Peptides, *Anion exchanging, Separation, Chemical analysis, Amino acids, Reprints, *High performance liquid chromatography.

Multicomponent peptide mixtures were separated by high-performance liquid chromatography on a Micro-Pak AX-10 column, a silica-based bonded-phase weak anion exchanger. A gradient of increasing 0.01 M triethylammonium acetate buffer (pH 6.0) into acetonitrile was usually used for elution. For peptides containing a number of acidic amino acids without compensating basic residues, such as delta sleep-inducing peptide, a dilute 0.04 M formic acid solution (pH 2.6) was employed as the eluent. Peptides of up to about 30 residues were successfully tested, including peptides such as somatostatin, neurotensin, ribonuclease s-peptide, x-endorphin, glucagon, and various angiotensins and bradykinins. Tryptic digests of horse heart cytochrome c, calmodulin and reduced and alkylated hen egg-white lysozyme were also successfully examined. Because of the volatility of the eluents used, peptides can be readily isolated for further investigation. Recoveries of over 80% were observed in those cases tested by comparative amino acid analysis.

702,233
PB83-131730 Not available NTIS
National Bureau of Standards, Washington, DC.
Separation of Angiotensins by High-Performance Liquid Chromatography on a Weak Anion-Exchange Bonded Phase.
Final rept.
M. Dizdaroglu, H. C. Krutzsch, and M. G. Simic. 1982, 4p
Pub. in Analytical Biochemistry 123, p190-193 1982.

Keywords: *Angiotensin, *Anion exchanging, Separation, Reprints, *High performance liquid chromatography.

A mixture of 12 angiotensins was separated by high-performance liquid chromatography on a weak anion-exchange bonded phase using a triethylammonium acetate buffer and acetonitrile as the eluant. An excellent separation of these compounds was obtained. Recoveries for all 12 were over 90% as determined by comparative amino acid analysis. A strong effect of temperature on retention was observed. The buffer used here allows sensitive detection of these peptides at wavelengths in the range 210-225 nm. Because the eluants are also volatile, isolation of separated compounds for reuse or further analysis is facilitated.

702,234
PB83-134395 Not available NTIS
National Bureau of Standards, Washington, DC.
Speciation of Trace di- and Triorganotins in Water by Ion-Exchange HPLC-GFAA.
Final rept.
K. L. Jewett, and F. E. Brinckman. Nov 81, 11p
Sponsored in part by Office of Naval Research, Arlington, VA. See also AD-A089 029.
Pub. in Jnl. of Chromatographic Science 19, p583-593, Nov 81.

Keywords: *Tin organic compounds, *Water analysis, *Ion exchanging, Water pollution, Chemical analysis, Industrial plants, Reprints, Water pollution detection, High performance liquid chromatography, Graphite furnace atomic spectroscopy.

On the basis of their known behavior as classic stable cations in saline media, a broad range of organotins representing current industrial and environmental interests have been speciated in trace quantities by a combination of an element-specific graphite furnace atomic absorption detector coupled with HPLC employing commercial bonded-phase strong cation exchange columns.

702,235
PB83-134916 Not available NTIS
National Bureau of Standards, Washington, DC.
Calculation of Solvent-Water Mixture Volumes.
Final rept.
F. E. Jones, and C. S. Brickenkamp. Feb 81, 2p
Pub. in Analytical Chemistry 53, n2 p562-563, Feb 81.

Keywords: *Volumetric analysis, Solvents, Mixtures, Water, Chemical analysis, Reprints.

A procedure has been developed which enables calculation of the ratio of the volume of a solvent-water mixture to the sum of the volumes the components would occupy separately. Expressions have been derived for the general case, and have been applied to the determination of water by Karl Fischer titration of water extracted from various substances into methanol which is then introduced into a titration vessel volumetrically from calibrated syringes.

702,236
PB83-135137 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of ESCA with Other Surface-Analysis Techniques.
Final rept.
C. J. Powell. 1982, 17p
Pub. in Proceedings of Symposium on Applied ESCA Annual FACSS Meeting (7th), Philadelphia, PA, 2 Oct 80, Chapter 2 in Applied Electron Spectroscopy for Chemical Analysis, p19-36 1982.

Keywords: *Electronic spectra, *Surfaces, *Chemical analysis, Comparison, *X ray photoelectron spectroscopy.

ESCA (Electron Spectroscopy for Chemical Analysis) or x-ray photoelectron spectroscopy (XPS) is used extensively to solve a wide variety of scientific and technical problems. A short review is presented in which ESCA is compared and contrasted with three other techniques for surface analysis, Auger-electron spectroscopy (AES), secondary-ion mass spectroscopy (SIMS), and ion-scattering spectroscopy (ISS). Particular attention is given to the accuracy of measurement for both qualitative and quantitative analyses.

702,237
PB83-139154 Not available NTIS
National Bureau of Standards, Washington, DC.
Preconcentration of Trace Metals in Environmental and Biological Samples by Cation Exchange Resin Filters for X-ray Spectrometry.
Final rept.
H. M. Kingston, and P. A. Pella. Feb 81, 5p
Pub. in Analytical Chemistry 53, n2 p223-227 Feb 1981.

Keywords: *Trace elements, *Metals, *Chemical analysis, *Bioassay, *Environmental surveys, X ray spectroscopy, Urine, Sampling, Reprints.

A preconcentration method is described for the x-ray spectrometric analysis of several trace elements in seawater, NBS-SRM 1648 Urban Particulate, NBS-SRM 1632 Trace Elements in Coal, and nickel in urine at concentrations as low as 1 ppb. The elements in the coal and urban particulate samples were loaded quantitatively on SA-2 cation-exchange resin filters and subsequently analyzed by energy-dispersive x-ray fluorescence spectrometry using secondary targets for monochromatic x-ray excitation of the filter sample. For the analysis of seawater and urine, a prior separation of the trace elements from the matrix with Chelex-100 resin was used. Comparison of the results obtained with NBS-SRM certificate values and/or those of other workers indicated agreement within + or - 10%. Detection and quantitation limits for this preconcentration method are also presented.

702,238
PB83-139378 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Simulated Precipitation Reference Materials, IV.
W. F. Koch, G. Marinenko, and J. W. Stolz. Jun 82, 22p NBSIR-82-2581
Sponsored in part by Environmental Research Center, Research Triangle Park, NC.See also Part 2, PB-273945.

Keywords: *Water analysis, *Rain, *Air pollution, Chemical analysis, Precipitation(Meteorology), Acidity, pH, Metals, *Reference materials.

This report describes work performed at the National Bureau of Standards under the sponsorship of the United States Environmental Protection Agency to establish the composition of a fourth series of reference materials intended to be used for the intercalibration of precipitation measurement stations, to evaluate the stability of the first three series of reference materials, to evaluate current methodologies for pH and acidity measurements, and to make recommendations to improve future reference materials and measurement protocols.

702,239
PB83-142992 Not available NTIS
National Bureau of Standards, Washington, DC.
Organic Electrochemical Techniques Having Potential Clinical Application.
Final rept.
R. A. Durst, E. A. Blubaugh, K. A. Bunding, M. L. Fultz, W. A. MacCrehan, and W. T. Yap. 1982, 9p
Pub. in Clinical Chemistry 28, n9 p1922-1930 1982.

Keywords: *Electrochemistry, *Organic compounds, *Clinical medicine, *Chemical analysis, Spectrochemical analysis, Electrodes, Raman spectroscopy, Surfaces, Mathematical models, Reprints, Liquid chromatography.

The Organic Electrochemistry Group at the National Bureau of Standards is pursuing several avenues of research of potential application to problems of clinical chemists. With one development, electrochemical detectors for liquid chromatography, organomercury species can be determined in biological tissues and other matrices. Spectroelectrochemistry is being used to characterize the redox behavior of metal complexes of bleomycin, an antitumor drug. Chemically modified electrodes are being developed as selective electrocatalytic sensors for organohalogen compounds and may lead to new sensors for clinically important analytes. Surface-enhanced Raman spectroscopy is helping characterize the polymer films used to modify the electrode surfaces. Another sensor is being developed for the detection of carboxylic acids: after the photocatalytic oxidation of the acids at a semiconductor electrode, the carbon dioxide produced is subsequently determined with a flow-through gas-sensing electrode. Finally, mathematical modeling may provide a better understanding of the fundamental processes involved in several of the above techniques.

702,240
PB83-143008 Not available NTIS
National Bureau of Standards, Washington, DC.
Liquid Chromatographic Determination of Valproic Acid in Human Serum.
Final rept.
W. F. Kline, D. P. Enagonio, D. J. Reeder, and W. E. May. 1982, 13p
Sponsored in part by National Inst. of Neurological and Communicative Disorders and Stroke, Bethesda, MD.
Pub. in Jnl. of Liquid Chromatography 5, n9 p1697-1709 1982.

Keywords: *Blood analysis, Blood serum, Freezing, Chemical analysis, Reprints, *High performance liquid chromatography, *Pentanoic acid/propyl, Standard reference materials.

The concentration of the antiepilepsy drug valproic acid (2-propylpentanoic acid) was determined in both a processed freeze dried human serum material and patient serum samples obtained from a clinical laboratory. The freeze dried material is being issued by the National Bureau of Standards as Standard Reference Material 1599. The analytical procedure developed involves organic extraction of valproic acid and an internal standard (cyclohexane-carboxylic acid) from the serum matrix; derivatization of the carboxylic acids to phenacyl esters; measurement of the analyte and internal standard species by reversed-phase high performance liquid chromatography. The results obtained on both types of samples compare favorably with results obtained using more conventional gas chromatographic approaches.

702,241
PB83-143529 Not available NTIS
National Bureau of Standards, Washington, DC.
Certification of Lead Concentration in Standard Reference Materials by Isotope Dilution Mass Spectrometry.
Final rept.
I. L. Barnes, T. J. Murphy, and E. A. I. Michiels. 1982, 4p
Pub. in Jnl. of the Association of Official Analytical Chemists 65, n4 p953-956 1982.

Keywords: *Lead(Metals), *Chemical analysis, Concentration(Composition), Mass spectroscopy, Environmental surveys, Food analysis, Reprints, *Standard reference materials, *Isotope dilution mass spectroscopy.

In response to needs for analytical standards by researchers studying the exposure of humans to lead, a wide variety of environmental and 'food' Standard Reference Materials have been prepared and certified for lead as well as for many other elements. Among the food types are SRM 1571, Orchard Leaves, 45 ppm; SRM 1575, Pine Needles, 10.8 ppm; SRM 1573, Tomato Leaves, 6.3 ppm; SRM 1566, Oyster Tissue, 0.48 ppm; SRM 1577, Bovine Liver, 0.34 ppm; SRM 1568, Rice Flour, 0.045 ppm; and SRM 1567, Wheat Flour, 0.020 ppm. These materials, intended for use in calibrating instruments and methods, have been certified by a definitive method, isotope dilution mass spectrometry. The advantages and disadvantages of this technique are discussed and some suggestions for the use of its isotopic selectivity in the study of lead in the human environment are presented.

702,242
PB83-143537 Not available NTIS
National Bureau of Standards, Washington, DC.
Sampling, Handling and Storage of Materials for Trace Analysis.
Final rept.
J. R. Moody. 1982, 12p
Pub. in Philosophical Transactions of the Royal Society of London A 305, p669-680 1982.

Keywords: *Trace elements, *Chemical analysis, Sampling, Storage, Materials handling, Reprints.

Trace and ultra-trace analyses require the most extreme care from the analyst. Too often this care is reflected in an inordinate amount of attention to the instrumentation and a corresponding inattention to sampling, sample stability, sample storage, and chemistry before analysis. For many elements, the control of contamination or sample stabilization, or both, may become the limiting factors in the accuracy of an analysis. Numerous sample handling problems in trace element analysis are described and suggestions are made for the control of these problems. Analogous arguments can be made for similar problems in trace organic analysis. Examples of successful methods of sample handling are taken from relevant research results at the National Bureau of Standards.

702,243
PB83-145573 Not available NTIS
National Bureau of Standards, Washington, DC.
Citrus Leaves (SRM 1572)--A New NBS Plant Tissue Standard Reference Material Certified for Trace Element Concentrations.
Final rept.
R. Alvarez. 1982, 5p
Pub. in Proceedings of Int. Plant Nutrition Colloq. (9th), Warwick University, England, August 22-27 1982, Paper in Plant Nutrition 1982, p22-26 1982.

Keywords: *Plant tissues, *Trace elements, *Nutrients, *Chemical analysis, Plant growth, Stress, Concentration(Composition), *Standard reference materials, Toxic substances.

Accurate values for nutrient and potentially toxic trace elements in plant tissues are necessary to formulate valid conclusions regarding the effects of these elements on plant growth and stress. Although several analytical methods are usually available for these analytical determinations, the results obtained are not always accurate. One approach towards validating methodology and experimental results is through the use of certified reference materials such as those issued by the U.S. National Bureau of Standards as Standard Reference Materials (SRM's). A number of SRM's have been developed for use in plant tissue and agricultural food product analysis. They are: Spinach, SRM 1570; Orchard Leaves, SRM 1571; Tomato Leaves, SRM 1573; Pine Needles, SRM 1575; Wheat Flour, SRM 1567; and Rice Flour, SRM 1568. Citrus Leaves, SRM 1572, is intended as a replacement for the latter. The Certificate of Analysis for each SRM contains such information as the homogeneity of the powdered materials, the minimum sample size to be used, and the certified values for the elements with their uncertainties. These certified values can serve as common reference points for comparison of data acquired over a long period by various investigators using a variety of methods.

702,244
PB83-145599 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal-Ionization Isotope-Dilution Mass Spectrometry as a Definitive Method for Determination of Potassium in Serum.
Final rept.
J. W. Gramlich, L. A. Machlan, K. A. Brletic, and W. R. Kelly. 1982, 5p
Pub. in Clinical Chemistry 28, n6 p1309-1313 1982.

Keywords: *Blood analysis, *Potassium, Chemical analysis, Mass spectroscopy, Reprints, *Thermal ionization isotope dilution mass spectroscopy.

Thermal-ionization isotope-dilution mass spectrometry is a highly precise and accurate method for the determination of potassium concentrations in serum. Although not suited for routine use because of the time and expense required, the technique provides an extremely valuable tool for the characterization of reference materials and for evaluating other analytical methods. The technique has recently been used to determine the concentration of potassium in a human serum standard, NBS Standard Reference Material 909. Seven vials of the serum were chemically processed and then analyzed by two spectroscopists independently, using different mass spectrometers. The results confirm previous work that indicates that a precision of 0.1% relative can be routinely achieved. The systematic errors in the method have been thoroughly evaluated. When the precise results are thus corrected, they are essentially bias free and hence definitive.

702,245
PB83-145615 Not available NTIS
National Bureau of Standards, Washington, DC.
Progress in NBS Gas Thermometry above 500 Degrees C.
Final rept.
L. A. Guildner, and R. E. Edsinger. 1982, 6p
Pub. in Proceedings of Int. Symposium on Temperature (6th), Washington, DC., March 15-18, 1982, Paper in Temperature - Its Measurement and Control in Science and Industry, p43-48 1982.

Keywords: *Temperature measurement, *Laboratory equipment, High temperature tests, Design criteria, Performance evaluation, *Gas thermometry.

Measurement of thermodynamic temperatures by gas thermometry above 500C requires the use of different apparatus than for lower temperatures. Extensive tests have been made of the thermostats and high temperature platinum resistance thermometers. Techniques to reduce the presence of hydrogen, caused by diffusion through the metals, have been established. After more than one thousand hours of operation at 962C, the thermostat was redesigned and rebuilt to improve its performance. Thermal expansion measurements of the bulb material by an interferometric technique are being carried out in a second thermostat designed to operate up to the gold point. Gas thermometer measurements have been made at low pressures over a considerable range of temperature, but especially at 660C to evaluate the attainable precision. Finally, a new gas thermometer has been built with a modified suspension system to improve temperature uniformity of the bulb. The measurement at an upper temperature limit of 337 K (the freezing point of gold) remains the final goal of this project.

702,246
PB83-145631 Not available NTIS
National Bureau of Standards, Washington, DC.
Ash Content and X-Ray Analysis of Selected RDF and Coal Samples as a Function of Temperature.
Final rept.
D. R. Kirklin, E. S. Domalski, R. V. Kelly, and C. R. Robbins. 1982, 15p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Res. Conserv. 9, p243-257 1982.

Keywords: *Fly ash, *Coal, *Chemical analysis, Air pollution, X ray diffraction, Temperature, X ray analysis, Reprints, *Refuse derived fuels, *Air pollution detection, Solid wastes.

The objectives of the study were to find out whether recommended ashing procedures which are to be used in proposed ASTM protocols for a particular form of refuse-derived fuel (RDF-3) or which are used in existing ASTM protocols for coal yield different ash content values at different temperatures and to select the optimum ashing temperature for RDF-3. The ash content was determined for three selected refuse-derived fuel (RDF) and four coal samples at 100 C intervals over the temperature range from 475 to 1175 C. X-ray diffraction analysis of these ash samples reveals sequential changes in the crystalline phases, suggesting which chemical reactions may be taking place at the various temperatures.

702,247
PB83-157032 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Photoacoustic Detection of Nitrogen Dioxide in the Gas-Phase Titration of Nitric Oxide with Ozone.
Final rept.
A. Fried, and J. Hodgeson. Feb 82, 5p
Pub. in Analytical Chemistry 54, n2 p278-282 Feb 82.

Keywords: *Volumetric analysis, *Nitrogen oxide(NO), *Nitrogen dioxide, Ozone, Concentration(Composition), Air pollution, Reprints, *Laser spectroscopy, *Air pollution detection.

Gas-phase titration (GPT) studies of nitric oxide (NO) with ozone (O3) were carried out over a 1 year time span. In these studies, NO and O3 concentrations were measured with conventional techniques of chemiluminescence and UV absorption photometry, respectively. Nitrogen dioxide concentrations (NO2) also measured during the course of titration were carried out by use of a photoacoustic detection system, a method in which NO2 was measured directly without an interfering response from NO. Excellent agreement in NO and NO2 concentration changes during titration has been demonstrated throughout this study. The corresponding O3 measurements, however, were found to average 3.6% lower. Additional studies, both experimental and photochemical modeling of air stream impurities, could not account for this discrepancy.

702,248
PB83-177048 Not available NTIS
National Bureau of Standards, Washington, DC.

NBS (National Bureau of Standards) Clean Laboratories for Trace Element Analysis.
Final rept.
J. R. Moody. Nov 82, 19p
Pub. in Analytical Chemistry 54, n13 p1358A-1376A Nov 82.

Keywords: *Laboratories, *Chemical analysis, *Trace elements, Clean rooms, Reprints.

Clean rooms been in use for more than 30 years, yet only in the last 10 years has clean air technology been applied to the chemistry laboratory. This report details the successful design and application of a NBS designed clean laboratory specifically for trace element analysis when low elemental contamination levels are necessary for successful analytical work. Details of construction are given where they are critical to the adequate long term performance of the laboratory. Other analytical applications of clean air technology are described.

702,249
PB83-177469 Not available NTIS
National Bureau of Standards, Washington, DC.
Purified Reagents for Trace Metal Analysis.
Final rept.
J. R. Moody, and E. S. Beary. 1982, 8p
Pub. in Talanta 29, p1003-1010 1982.

Keywords: *Chemical analysis, *Agents, *Metals, Distillations, Trace elements, Reprints.

Sub-boiling distillations have become a standard tool for the reduction of the inorganic analytical blank. More than 10 years of practical experience in the reagent acids is reviewed and a description is given of a new laboratory especially designed to permit trouble-free operation as well as ensure the continued high quality of the reagents produced.

702,250
PB83-179531 Not available NTIS
National Bureau of Standards, Washington, DC.
Kovats' Indices of Trimethysilylated Amino Acids on Fused-Silica Capillary Columns.
Final rept.
E. Gajewski, M. Dizdaroglu, and M. G. Simic. 1982, 15p
Pub. in Jnl. of Chromatography 249, p41-55 1982.

Keywords: *Amino acids, Separation, Gas chromatography, Alkanes, Proteins, Peptides, Standards, Reprints, *Kovats retention indices, Numerical solution, Lysozyme.

Trimethylsilyl derivatives of protein amino acids were separated by high-resolution gas chromatography on three fused silica capillary columns coated with SE-54, SP-2100 and Carbowas 20M, respectively. Kovats retention indices were also calculated by using n-paraffins as standards and tabulated. Excellent repeatability of the index values were achieved. The usefulness of the method in amino acid analysis of peptides and proteins was also demonstrated by separating the HC1-hydrolyzate of lysozyme.

702,251
PB83-179556 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Enchanced Ionization Spectrometry.
Final rept.
J. C. Travis, G. C. Turk, and R. B. Green. Aug 82, 13p
Sponosred in part by National Science, Foundation, Washington, DC.
Pub. in Analytical Chemistry 54, n10 p10064-1018A Aug 82.

Keywords: *Chemical analysis, Ionization, Performance evaluation, Reprints, *Laser spectroscopy, Laser induced ionization.

An overview is given of the five-year old analytical method of laser enhanced ionization (LEI) in flames. The photo-assisted collisional ionization process by which analyte atoms are selectively ionized is examined, with special attention to the conditions for achieving 100% ionization. A discussion of signal collection includes the motion of electrons and ions in an electric field, the electric field distribution in a flame under the influence of an applied potential, and considerations in electrode design. Sensitivity, selectivity, and ionization interference are described on the basis of experimental data with both simple and complex matrices. Speculations are given as to the ultimate potential of LEI and related methods.

702,252
PB83-179598 Not available NTIS
National Bureau of Standards, Washington, DC.
Limits to Sensitivity in Laser Enhanced Ionization.
Final rept.
J. C. Travis. Nov 82, 6p
Pub. in Jnl. Chemical Education 59, n11 p909-914 Nov 82.

Keywords: *Chemical analysis, Trace elements, Atomic spectroscopy, Samples, Reprints, *Laser induced ionization, *Laser spectroscopy.

Laser enhanced ionization (LEI) occurs when a tunable dye laser is used to resonantly excite a specific atomic population in a flame. Using LEI with analytical burners which spray fine mists of liquid samples into high temperature flames, we are able to detect 1 pg of Li per mL of water, and <5 micrograms/mL for some 24 elements. The process of ion production and collection may both be shown to approach 100% efficiency under optimum circumstances in LEI. The ultimate theoretical sensitivity may thus be derived from a knowledge of the limiting noise source. Assuming this source to be statistical fluctuation in the background current (shot noise) yields a theoretical sensitivity limit in good agreement with the best experimental value.

702,253
PB83-179663 Not available NTIS
National Bureau of Standards, Washington, DC.
Simultaneous Determination of Twelve Trace Elements in Estuarine and Sea Water Using Pre-Irradiation Chromatography.
Final rept.
R. R. Greenberg, and H. M. Kingston. 1982, 21p
Pub. in Jnl. of Radioanalytical Chemistry 71, n1-2 p147-167 1982.

Keywords: *Water analysis, *Sea water, *Estuaries, Neutron activation analysis, Trace elements, Transition metals, Reprints, Chelex 100 resin.

A procedure is described for the preconcentration of 100 ml of Estuarine and sea water into a solid sample using Chelex-100 resin. This solid sample weigh less than half of a gram and contains the transition metals and many other elements of interest, but is essentially free from the alkali metals, the alkaline earth metals, and the halogens. The concentrations of Co, Cr, Cu, Fe, Mn, Mo, Ni, Sc, Th, U, V, and Zn have been determined in sea water when this procedure was coupled to neutron activation analysis.

702,254
PB83-182717 Not available NTIS
National Bureau of Standards, Washington, DC.
How Well Are We Measuring Smoke.
Final rept.
G. W. Mulholland. 1982, 3p
Pub. in Fire and Materials 6, n2 p65-67 1982.

Keywords: *Smoke, *Measuring instruments, Error analysis, Performance evaluation, Light scattering, Calibrating, Electromagnetic absorption, Light(Visible radiation), Reprints.

Estimates of the errors in light extinction measurements of smoke resulting from forward scattered light entering the detector and from the spectral width of the light source are presented. A potential method for calibrating extinction instruments is described.

702,255
PB83-214536 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
Standard Reference Materials: Accuracy in Analytical Spectrophotometry.
Final rept.
R. W. Burke, and R. Mavrodineanu. Apr 83, 141p
NBS-SP-260-81
Library of Congress catalog card no. 83-600512.

Keywords: *Spectrophotometry, Standards, Laboratory equipment, Design criteria, Performance evaluation, Forecasting, *Standard reference materials.

This publication describes the activities undertaken since 1969 within the Center for Analytical Chemistry at the National Bureau of Standards (NBS) in the field of high-accuracy spectrophotometry. The first part of this work presents a summary of the Standard Reference Materials (SRM's) that have been developed for checking the proper functioning of ultraviolet and visible spectrophotometers and includes a description of the high-accuracy spectrophotometer specially constructed in the Center for Analytical Chemistry and subsequently used for performing all of the transmittance measurements. The second part of this publication is devoted to a critical discussion of the analytical factors that can affect the accuracy of selected spectrophotometric procedures that have been widely used at NBS in the characterization of various SRM's.

702,256
PB83-226746
(Order as PB83-226704, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Statistical Analysis of Some Gas Chromatography Measurements.
K. Kafadar, and K. R. Eberhardt. 3 Nov 82, 10p
Included in Jnl. of Research of the National Bureau of Standards, v88 n1 p37-46 Jan-Feb 82.

Keywords: *Gas chromatography, Chlorine organic compounds, Statistical analysis, Measurement, Chemical analysis, Insulating oil, Lubricating oil, Concentration(Composition), *Polychlorinated biphenyls, *Standard reference materials, *Toxic substances, Aroclor 1260.

The National Bureau of Standards has certified Standard Reference Materials (SRMs) for the concentration of polychlorinated biphenyls (PCBs) in hydrocarbon matrices (transformer and motor oils). The certification of these SRMs involved measurements of extremely small concentrations of PCBs made by gas chromatography. Despite the high accuracy of the measurement technique, the correlated data cannot be analyzed in a routine independent manner. A linear model for the measurements is described; its complexity encourages the use of simpler exploratory methods which reveal unexpected features and point the way towards obtaining valid statistical summaries of the data.

702,257
PB83-233908 Not available NTIS
National Bureau of Standards, Washington, DC.
Characterization of Organometallic Copolymers and Copolymerization by Size Exclusion Chromatography Coupled with Trace Metal- and Mass-Sensitive Detectors.
Final rept.
E. J. Parks, R. B. Johannesen, and F. E. Brinckman. 1983, 16p
Pub. in Jnl. of Chromatography 255, p439-454 1983.

Keywords: *Chemical analysis, *Metal containing organic compounds, *Copolymers, Tin organic compounds, Biocides, Adsorption, Reprints, *Size exclusion chromatography, *Slow release compounds, Graphite furnace atomic spectroscopy, Methacrylic acid/(tributyl-ester).

An important class of controlled-release, biocidal triorganotin-containing copolymers (OMPs) is produced by the free radical initiated addition of a triorganotin methacrylate (typically tributyltin methacrylate, TBTM) with methyl methacrylate (MMA). In earlier studies, the authors have demonstrated that size exclusion chromatography (SEC) on Styragel coupled with an in-line graphite furnace atomic absorption detector (GFAA) quantifies and associates bioactive tin with at least two well-resolved molecular weight fractions observed in many different commercial OMP formulations: a polymer fraction, and, probably unreacted TBTM. When THF is used as the eluent, a third component, believed to be an ionic tin-containing compound is absorbed and slowly eluted. The authors now verify that a dilute solution of acetic acid (HAc) in THF efficiently desorbs this species.

702,258
PB83-234229 Not available NTIS
National Bureau of Standards, Washington, DC.
On-Line Multidimensional Liquid Chromatographic Determination of Polynuclear Aromatic Hydrocarbons in Complex Samples.
Final rept.
W. J. Sonnefeld, W. H. Zoller, W. E. May, and S. A. Wise. Apr 82, 5p
Pub. in Analytical Chemistry 54,p723-727 Apr 82.

Keywords: *Chemical analysis, *Polycyclic compounds, *Complex compounds, Aromatic polycyclic hydrocarbons, Performance evaluation, Reprints, *High performance liquid chromatography.

A method is described for the on-line coupling of a normal-phase high-performance liquid chromatographic (HPLC) system to a reversed-phase HPLC system. The method employs a diamine column for on-column concentration of a selected fraction from a normal-phase aminosilane column followed by a solvent exchange procedure and gradient elution focusing of the analyte species onto a reversed-phase octadecylsilane column. No loss of analyte of chromatographic resolution is observed by using this method. Several chromatographic packing materials were investigated for use as on-column concentrators of polynuclear aromatic hydrocarbons (PAH) from normal-phase chromatographic systems. The validity of this approach was verified by determining the concentration of several PAH in Standard Reference Material (SRM) 1580 - 'Organics in Shale Oil'.

702,259
PB83-234799 Not available NTIS
National Bureau of Standards, Washington, DC.
Organometallic Geochemistry. Isolation and Identification of Organoarsenic Compounds from Green River Formation Oil Shale.
Final rept.
R. H. Fish, R. S. Tannous, W. Walker, C. S. Weiss, and F. E. Brinckman. 18 Jan 83, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of The Chemical Society, Chemical Communications 9, p490-492, 18 Jan 83.

Keywords: *Oil shale, *Chemical analysis, *Arsenic organic compounds, Solvent extraction, Gas chromatography, Mass spectroscopy, Geochemistry, Separation, Arsenates, Reprints, High performance liquid chromatography, Graphite furnace atomic spectroscopy, Natural emissions, Arsenic acid/methyl, Arsenic acid/phenyl, Green River Formation.

A Green River Formation Oil Shale sample was crushed and extracted with refluxing methanol. Analysis by high performance liquid chromatographic separation coupled with arsenic-specific graphite furnace atomic absorption detection provided initial evidence for the presence of methyl- and phenylarsenic acids, arsenate, and a neutral organoarsenic compound. Additionally, the derivatization of the separated organoarsenic acids with 3-methylcatechol, and of arsenate via trimethylsilylation, followed by gas chromatography-mass spectrometric analysis, provided unequivocal evidence for the aforementioned arsenicals. The authors conclude these organoarsenic acids and the inorganic arsenate are naturally-occurring products in Green River oil shale and have a biogeochemical origin in the process of oil shale formation.

702,260
PB83-235010 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultratrace Determination of Platinum in Biological Materials via Neutron Activation and Radiochemical Separation.
Final rept.
R. Zeisler, and R. R. Greenberg. 1982, 11p
Pub. in Jnl. of Radioanal. Chem. 75, n1-2 p27-37 1982.

Keywords: *Platinum, *Chemical analysis, *Neutron activation analysis, *Radioactive analysis, *Gold, Separation, Trace elements, Liver, Concentration(Composition), Reprints, *Biological samples, Standard reference materials.

A neutron activation analysis scheme based upon a radiochemical separation of the activation products has been developed. The analysis scheme is applied to gold and platinum determinations in biological Standard Reference Materials and human liver specimens. Gold and platinum are determined at concentrations of 5:10 to the -11th power g/g, and at higher levels.

702,261
PB83-235929 Not available NTIS
National Bureau of Standards, Washington, DC.
Standard Reference Materials for Accurate Analyses of PCBs in Oil.
Final rept.
S. N. Chesler, F. R. Guenther, W. E. May, and R. M. Parris. Jun 82, 6p
Pub. in American Society for Testing and Materials Standardization News 10, n6 p15-20 Jun 82.

Keywords: *Chemical analysis, *Lubricating oils, *Insulating oil, Gas chromatography, Standards, Reprints, *Standard reference materials, *Polychlorinated biphenyls, High performance liquid chromatography.

A hybrid technique utilizing both high-performance preparative-scale liquid chromatography and capillary column gas chromatography has been developed for the determination of polychlorinated biphenyls (PCBs) in hydrocarbon matrices, such as transformer coolant and motor oils. This procedure has been used in the certification of a Standard Reference Material entitled 'Polychlorinated Biphenyls in Oil' at the National Bureau of Standards.

702,262
PB83-235952 Not available NTIS
National Bureau of Standards, Washington, DC.
Accuracy of Calibration in X-ray Microanalysis, Particularly of Biological Specimens.
Final rept.
K. F. J. Heinrich. 1982, 7p
Pub. in Scanning Electron Microscopy 1, p281-287 1982.

Keywords: *Chemical analysis, *X ray analysis, *Microanalysis, Error analysis, Reprints, Biological processes.

The accuracy of results of microanalytical analyses depends on errors in the measurement, separation of the signal from interferences such as background, the quality of the theoretical assumptions underlying the evaluation process, the accuracy of constants and parameters used in the evaluation, the propagation of errors through the evaluation, the quality of the reference standards, the preparation of the speciment before analysis, and the damage inflicted upon it during analysis. The meaning of the results in turn is closely related to the expression of the results, and to the localization which can be achieved in microprobe analysis. The latter aspect includes the capability of the operator to orient the exciting beam towards the topographic features of interest on the specimen.

702,263
PB83-236018 Not available NTIS
National Bureau of Standards, Washington, DC.
Ignitability of Decomposed Transformer Fluids.
Final rept.
R. G. Gann, and M. J. Manka. Aug 82, 8p
Pub. in Fire Technology 18, n3 p251-258 Aug 82.

Keywords: *Insulating oils, *Ignition, *Chemical analysis, High temperature tests, Substitutes, Decomposition, Flammability, Chlorine organic compounds, Reprints, Polychlorinated biphenyls.

The effects of an electrical field (12 kV/cm) and elevated temperature (300 C) on the ignition potential of transformer fluids, which are candidate replacements for polychlorinated biphenyls (PCBs), have been studied. The combined results indicate that the chemical composition of the fluids were alerted, often in such a manner as to increase the ease of ignition.

702,264
PB83-236034 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS (National Bureau of Standards) Standard Reference Materials: Update 1982.
Final rept.
R. Alvarez, S. D. Rasberry, and G. A. Uriano. Oct 82, 9p
See also PB82-138140.
Pub. in Analytical Chemistry 54, n12 p1226A-1228A, 1235A-1244A Oct 82.

Keywords: *Chemical analysis, *Standards, Chemical properties, Physical properties, Reprints, *Standard reference materials.

In 1966, the National Bureau of Standards reported in ANALYTICAL CHEMISTRY (1) the rejuvenation of its Standard Reference Materials program. Ten years later an update, noting considerable progress, was reported in ANALYTICAL CHEMISTRY (2). Now, after only six years, so much has changed in this 76-year old program that readers of the JOURNAL may be interested in a status report. It is the purpose of this report to update the scope and results of this program to 1982 and to provide a glimpse of the future.

702,265
PB83-236414 Not available NTIS
National Bureau of Standards, Washington, DC.
Continuous Wave Excitation in Laser Enhanced Ionization Spectrometry.
Final rept.
G. J. Havrilla, S. J. Weeks, and J. C. Travis. Dec 82, 5p
Pub. in Analytical Chemistry 54, n14 p2566-2570 Dec 82.

Keywords: *Chemical analysis, Excitation, Reprints, *Laser enhanced ionization, *Laser spectroscopy, Continuous wave lasers.

Continuous wave excitation in Laser Enhanced Ionization (LEI) exhibits distinct advantages when compared to pulsed excitation. Limits of detection are given for eight elements determined by continuous wave excited LEI. The LEI signal responses for both pulsed and continuous wave excitation are compared. Results indicate a greater resistance to matrix effects for cw excitation than for pulsed excitation.

702,266
PB83-237149 Not available NTIS
National Bureau of Standards, Washington, DC.
Sampling and Storage of Materials for Trace Elemental Analysis.
Final rept.
J. R. Moody. May 83, 3p
Pub. in Trends in Analytical Chemistry 2, n5 p116-118 May 83.

Keywords: *Samples, *Sampling, *Chemical analysis, *Decontamination, Storage, Trace elements, Metals, Reprints.

Accurate analysis is predicated upon a valid, representative, and non-contaminated analytical sample. For many trace metals, contamination processes overwhelm the sample leading to inaccurate analytical data. Methods of controlling contamination and their implications for better methods of sampling and storage are discussed.

702,267
PB83-600022 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
International Tables of the Surface Tension of Water.
N. B. Vargaftik, B. N. Volkov, and L. D. Voljak.
c1983, 4p
Included in Jnl. Physical and Chemical Reference Data, v12, n3 p817-820 1983.

Keywords: *Critically evaluated data, Internationally agreed-upon data, Surface tension as a function of temperature, Surface tension of water.

This paper presents a table for the surface tension of water from 0.01 to 374 degree C and an Interpolating equation which represents the values in the table to well within their estimated uncertainties. The table of values and the interpolating equation are those recommended by the International Association for the Properties of Steam (IAPS) in its recent official release. The experimental measurements of the surface tension of water and their uncertainties are discussed, as is the development of the IAPS tables.

702,268
PB84-105659 Not available NTIS
National Bureau of Standards, Washington, DC.
Microanalytical Procedure for the Determination of Calcium, Phosphate and Fluoride in Enamel Biopsy Samples.
Final rept.
G. L. Vogel, L. C. Chow, and W. E. Brown. 1983, 9p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Caries Research 17, p23-31 1983.

Keywords: *Chemical analysis, *Calcium, *Inorganic phosphates, *Fluorides, *Enamels, *Teeth, Humans, Rats, Laboratory animals, Samples, Electrodes, Spectrophotometry, Performance evaluation, Biopsy, Reprints.

This paper describes analytical methods for the determination of calcium, phosphate and fluoride in successive layers of enamel removed from rat and human teeth by acid etching. These methods include: (i) simple, sensitive spectrophotometric methods for the determination of calcium and phosphate; (ii) an easily constructed miniature fluoride electrode, and (iii) an improved electrode adapter that permits one fluoride electrode to measure numerous microsamples very

rapidly. The high sensitivity and simplicity of the analytical techniques described allows many types of microsamples of interest in dental research to be analyzed with an accuracy and speed heretofore attainable only with much larger samples.

702,269
PB84-106053 Not available NTIS
National Bureau of Standards, Washington, DC.
Separation of Diastereomers and Analogues of Neurotensin by Anion-Exchange High-Performance Liquid Chromatography.
Final rept.
M. Dizdaroglu, M. G. Simic, F. Rioux, and S. St. Pierre. 1982, 5p
Pub. in Jnl. of Chromatography 245, p158-162 1982.

Keywords: *Chemical analysis, *Anion exchanging, Separation, Peptides, Hormones, Reprints, *High performance liquid chromatography, *Diastereomers, *Neurotensin.

Diastereomers and analogues of neurotensin were separated by anion-exchange high-performance liquid chromatography using a triethylammonium acetate buffer and acetonitrile as the eluent. Recoveries were over 90% as determined by comparative amino acid analysis. A strong effect of temperature on retention was observed. The buffer used is volatile and thus facilitates an easy isolation of separated peptides for futher use.

702,270
PB84-106285 Not available NTIS
National Bureau of Standards, Washington, DC.
Trace Element Analysis of Natural Water Samples by Neutron Activation Analysis with Chelating Resin.
Final rept.
R. R. Greenberg, and H. M. Kingston. Jun 83, 6p
Pub. in Analytical Chemistry 55, n7 p1160-1165 Jun 83.

Keywords: *Trace elements, *Water analysis, Neutron activation analysis, Chemical analysis, Chelating agents, Separation, Seawater, Fresh water, Transition metals, Reprints, Chelex 100 resins.

Procedures are described to preconcentrate the trace elements in 100, 200 or 500 ml of natural water into a solid sample of approximately half a gram by using a chelating resin. These procedures are applicable to both freshwater and seawater and leave the transition metals and other elements of interest essentially free from the alkall metals, the alkaline earth metals, and the halogens. The concentrations of 15 elements in one seawater sample have been determined by using this separation procedure coupled with the neutron activation analysis technique.

702,271
PB84-106665 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Picogram Quantities of Uranium in Biological Tissues by Isotope Dilution Thermal Ionization Mass Spectrometry with Ion Counting Detection.
Final rept.
W. R. Kelly, and J. D. Fassett. 1983, 5p
Pub. in Analytical Chemistry 55, n7 p1040-1044 1983.

Keywords: *Uranium, *Trace elements, *Tissues(Biology), *Chemical analysis, Mass spectroscopy, Livers, Cattle, Reprints, *Isotope dilution mass spectroscopy, *Anion exchange chromatography, Standard reference materials.

A procedure has been developed for the determination of picogram quantities of U in biological matrices by isotope dilution mass spectrometry that uses artificially produced (233)U (SRM 955) as the isotopic spike. The U is chemically purified by anion exchange chromatography and then loaded onto a single anion exchange bead. The procedure was applied to the determination of U in SRM 1577a, bovine liver, which was found to have a mean concentration of 709 + or - 13 pg of U/g (ts, 95% confidence limit), the lowest certified U concentration of any biological SRM.

702,272
PB84-107044 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS (National Bureau of Standards) Standard Reference Materials Certified for Arsenic.
Final rept.
R. Alvarez. 1983, 10p
Pub. in Proceedings of Arsenic Symposium, Arsenic Panel of Chemical Manufacturers Association and National Bureau of Standards held at Gaithersburg, Maryland on November 4-6, 1981, p112-121 1983.

Keywords: *Arsenic, *Standards, *Chemical analysis, Environmental surveys, Epidemiology, Nutrition analysis, Sampling, Industries, Calibrating, *Standard reference materials.

The accurate determination of arsenic concentrations is difficult but necessary to establish sound scientific data bases for industrial, environmental, epidemiological, and nutritional investigations. Interlaboratory studies in which identical samples have been analyzed frequently show unacceptably large variations among laboratories. This is true not only when different methods are used but even when the same method is used. One method of establishing the reliability of analytical data for arsenic is through the use of chemical composition Standard Reference Materials issued by NBS. SRM's are used worldwide to calibrate instrumentation, validate experimental data, develop methods of known accuracy, and to refer experimental data to a common base. The first such materials, issued by NBS in 1906, were cast irons certified for chemical composition. Today there are approximately 1000 different SRM's.

702,273
PB84-107200 Not available NTIS
National Bureau of Standards, Washington, DC.
X-ray Fluorescence Spectroscopy.
Final rept.
R. D. Deslattes. 1983, 4p
Pub. in Nuclear Instruments and Methods 208, n1-3 p655-658 1983.

Keywords: *X ray spectroscopy, *X ray fluorescence, Synchrotron radiation, Chemical analysis, Emission spectra, Absorption spectra, Samples, Reprints.

This is a general review of X-ray emission spectroscopy using synchrotron radiation from storage ring sources. Applications thus far have been to chemical analysis and to use of emission as a probe of absorption in dilute samples. One class of application combines the use of high resolution primary monochromator with a secondary spectrometer also having high resolution. This combination permits detailed examination of some complex inner shell which pertub both emission and absorption spectra.

702,274
PB84-107226 Not available NTIS
National Bureau of Standards, Washington, DC.
Quantitative Trace Analysis by Reversed-Phase Liquid Chromatography-Mass Spectrometry.
Final rept.
R. G. Christensen, E. White, V. S. Meiselman, and H. S. Hertz. 1983, 10p
Pub. in Jnl. of Chromatography 271, p61-70 1983.

Keywords: *Trace elements, *Chemical analysis, *Sprayers, Mass spectroscopy, Performance evaluation, Ultrasonic radiation, Water pollution, Blood analysis, Reprints, Liquid chromatography.

In order to overcome difficulties in spraying aqueous solvents into the vacuum of a mass spectrometer, an ultrasonic spraying device has been constructed. The vibration is achieved by means of magnetostriction in the nickel inlet tube itself. Applications to aliphatic acid determination in a shale oil process water and to determination of valproic acid, an anti-convulsant, in human serum (SRM 1599) are presented.

702,275
PB84-115757 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 88, Number 2, March-April 1983.
Bi-monthly.
Apr 83, 70p
See also PB84-115765 through PB84-115781 and Volume 88, Number 1, PB83-226704. Library of Congress catalog card no. 63-37059.

Keywords: *Research projects, Uranium, Colorimetric analysis, Volumetric analysis, Chemical analysis, Statistical analysis, Biweight.

Contents:
Ultrasonic continuous-wave beam-power measurements;
international inter-comparison;
The efficiency of the biweight as a robust estimator of location;
High precision coulometric titration of uranium.

702,276
PB84-115799 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 88, Number 3, May-June 1983.
Bi-monthly rept.
Jun 83, 83p
See also PB84-115807 through PB84-115831 and Volume 88, Number 3, PB84-115757. Library of Congress catalog card no. LCCCN-63-37059.

Keywords: *Research projects, Cyanides, Electrochemistry, Liquefied natural gas, Density(Mass/volume), Comparison, Accelerometers, Vibration meters, Chemical analysis, Performance evaluation, Temperature measurement, Cryogenics, Ion chromatography, Numerical solution, Nuclear orientation thermometry, Gamma ray anisotropy thermometry.

Contents:
The determination of trace levels of Cyanide by ion chromatography with electrochemical detection;
Estimated uncertainty of calculated liquefied natural gas density from a comparison of NBS and Gaz de France densimeter test facilities;
The application of back-to-back accelerometers to precision vibration measurements;
Nuclear Orientation thermometry.

702,277
PB84-115807
(Order as PB84-115799, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC.
Determination of Trace Levels of Cyanide by Ion Chromatography with Electrochemical Detection.
W. F. Koch. 22 Dec 82, 5p
Included in Jnl. of Research of the National Bureau of Standards, v88 n3 p157-161, May-Jun 83.

Keywords: *Cyanides, *Electrochemistry, *Chemical analysis, Laboratory equipment, Trace elements, Dust, Particles, Air pollution, *Ion chromatography, *Air pollution detection.

An improved method for the determination of trace quantities of free cyanide has been developed using ion chromatography with electrochemical detection. Detection limits of 1 micrograms/L have been achieved with linearity of response over the range 1 to 1000 micrograms/L. The precision of replicate injections is 0.6 percent, expressed as the relative standard deviation. The method has been applied to the analysis of dust samples.

702,278
PB84-133453 Not available NTIS
National Bureau of Standards, Washington, DC.
Investigation of Two Multichannel Image Detectors for Use in Spectroelectrochemistry.
Final rept.
M. L. Fultz, and R. A. Durst. 1983, 7p
Pub. in Talanta 30, n12 p933-939 1983.

Keywords: *Spectrochemical analysis, *Electrochemistry, Ultraviolet spectroscopy, Absorption, Performance evaluation, Photodiodes, Silicon, Vidicons, Visible spectroscopy, Reprints, Benzidine/dimethyl.

Two multichannel image detectors, a vidicon and a silicon photodiode array, were investigated for their performance as detectors in ultraviolet-visible absorption spectroelectrochemical experiments. Their spectral band-pass, dispersion, dynamic range, and precision of absorbance measurements were compared. O-tolidine was used as a model compound to study their performance in a spectropotentiostatic experiment using an optically transparent thin-layer electrode. Both detectors performed well, but the silicon photodiode array had twice the spectral resolution and dynamic absorbance range of the vidicon detector.

702,279
PB84-136290 Not available NTIS
National Bureau of Standards, Washington, DC.

Purge and Trap Flame Photometric Gas Chromatography Technique for the Speciation of Trace Organotin and Organosulfur Compounds in a Human Urine Standard Reference Material (SRM).
Final rept.
G. J. Olson, F. E. Brinckman, and J. A. Jackson.
1983, 13p
Pub. in International Jnl. of Environmental Analytical Chemistry 15, p249-261 1983.

Keywords: *Chemical analysis, *Urine, *Tin organic compounds, *Sulfur organic compounds, Toxicology, Flame photometry, Gas chromatography, Trace elements, Reprints, *Standard reference materials, *Trap flame photometric gas chromatography, *Purge flame photometric gas chromatography, Flame photometric detectors.

Ultratrace levels of organotin species and an organosulfur compounds were detected in a human urine standard reference material using a purge and trap system coupled to a gas chromatograph equipped with a flame photometric detector. This analytical technique should have useful applications in studies that are needed to develop a toxicological data base and monitoring programs for human organotin exposure.

702,280
PB84-136977 Not available NTIS
National Bureau of Standards, Washington, DC.
Clinical Standard Reference Materials from NBS (National Bureau of Standards).
Final rept.
R. Alvarez, R. W. Seward, and S. D. Rasberry. Aug 83, 13p
Pub. in Am. Clin. Prod. Review 2, n4 p12-25 Jul/Aug 83.

Keywords: *Clinical medicine, Chemical analysis, Standards, Laboratory equipment, Drugs, Reprints, *Standard reference materials.

The National Bureau of Standards (NBS), by act of Congress, issues Standard Reference Materials (SRM's) to assist investigators improve the accuracy of their tests. For the clinical laboratory, these well-characterized materials are developed to serve as accuracy-control materials for long-term, measurement quality assurance; to prepare primary calibrator solutions; and to evaluate and monitor the performance of instruments and devices. At present, three accuracy-control materials of lyophilized human serum are available. They are: SRM 909, Human Serum; SRM 900, Antiepilepsy Drug Level Assay; and SRM 1599, Anticonvulsant Drug Level Assay Standard. High-purity clinical SRM's are used to prepare primary calibrator solutions. Examples of these high-purity SRM's are: SRM 911a, Cholesterol; SRM 914, Creatinine; SRM 916, Bilirubin; and SRM 998, Angiotensin I (Human). Instrument-performance SRM's are available for evaluating and monitoring the performance of thermometers, spectrophotometers, spectrofluorimeters, and pH meters.

702,281
PB84-137793 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectrofluorimetric Determination of Polycyclic Aromatic Hydrocarbons in Aqueous Effluents from Generator Columns.
Final rept.
R. A. Velapoldi, P. A. White, W. E. May, and K. R. Eberhardt. 1983, 6p
Pub. in Analytical Chemistry 55, n12 p1896-1901 1983.

Keywords: *Aromatic polycyclic hydrocarbons, *Spectroscopic analysis, Concentration(Composition), Chemical analysis, Reprints, *Fluorometric analysis, *Standard reference materials, *Generator columns.

An on-stream, standards addition spectrofluorimetric technique has been used to determine the concentrations of anthracene, benz(a)anthracene, and benzo(a)pyrene in the effluents of generator columns (which yield saturated solutions) at temperatures between 10 and 30C. The method provides data that agree well with data from dynamic coupled column high-performance liquid chromatography and, together with these values, were used to certify the effluent PAH concentrations of the Standard Reference Material generator columns. The method can be used to determine PAH concentrations in aqueous effluents, aqueous solubilities, and octanol-water partition coefficients in a fast, easy procedure.

702,282
PB84-141316 Not available NTIS
National Bureau of Standards, Washington, DC.
New Directions for the Office of Product Standards Policy.
Final rept.
S. I. Warshaw. Sep 82, 1p
Pub. in NSCL Newslett. 22, n3 p7 Sep 82.

Keywords: *Standards, Laboratories, Law enforcement, Units of measurement, Reprints, Standard reference materials.

The Department of Commerce, Office of Product Standards Policy was reorganized and transferred within the Department to the National Bureau of Standards in May 1982. The office is now responsible for the formulation and implementation of policy on national and international standards, laboratory accreditation, and legal metrology. A top priority of the office is to promote the international competitiveness of american industry by assisting in efforts to reduce the number of technical barriers to trade in the form of standards or testing and certification programs.

702,283
PB84-143296 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Standard Reference Materials: A Standard Reference Material Containing 2.5 Percent Austenite (SRM 488).
Final rept.
G. E. Hicho, and E. E. Eaton. Dec 83, 26p NBS-SP-260-86
See also PB82-138140. Library of Congress catalog card no. 83-600613.

Keywords: *X ray diffraction, *Laboratory equipment, *Austenite, *Steels, *Chemical analysis, Calibrating, X ray fluorescence, Standards, Powder metallurgy, *Standard reference material, SRM 488.

This Standard Reference Material, SRM 488, is intended for the calibration of x-ray diffraction equipment used in determining the amount of retained austenite in hardened steels. The SRM was produced using powder metallurgical techniques and involved blending 2 1/2 percent by weight AISI type 310 stainless steel powder (austenitic) with AISI type 430 stainless steel powder (ferritic). From this blend, 389 compacts were produced and subsequently examined for nickel content by x-ray fluorescence spectrometry. A calibration curve was established using 13 compacts randomly selected from the population of 389. The curve relates the weight percent nickel obtained from x-ray fluorescence measurements to the volume percentage austenite as determined by quantitative microscopy measurements of the area percent. The curve was then used to assign the certified values to the remaining compacts. This SRM may be used as an x-ray diffraction standard for retained austenite or in very special cases as an x-ray fluorescence standard for nickel content.

702,284
PB84-149996 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Standard Reference Materials: SRM 1969: Rubidium Triple-Point Standard - A Temperature Reference Standard Near 39.30C.
Final rept.
B. W. Mangum. Dec 83, 40p NBS-SP-260-87
See also PB82-138140. Library of Congress catalog card no. 83-600621.

Keywords: *Rubidium, *Melting points, Standards, Calibrating, Clinical chemistry, Temperature, Chemical properties, Thermometers, *Standard reference materials.

Previous work has demonstrated the practicability of using the triple point of rubidium as a temperature reference point. As a result of that work, Standard Reference Material (SRM) 1969 - the Rubidium Triple-Point Standard, has been developed. This publication reports results of an investigation of 100 SRM 1969 cells; it describes SRM 1969, the tests which were performed on the cells, the conditions under which the cells were tested, the results of the tests, and the recommended procedure for the use of SRM 1969 in calibrating thermometers. The use of SRM 1969 in clinical and biomedical laboratory applications should significantly enhance the accuracy of temperature measurements in the region of body temperature.

702,285
PB84-151554 Not available NTIS
National Bureau of Standards, Washington, DC.
Separation of Structurally Similar, Biologically Active Peptides from Their Impurities.
Final rept.
S. A. Margolis, and P. J. Longenbach. May 79, 2p
Pub. in Jnl. High Resolution Chromatography and Chromatography Communications 2, p10092-10093 May 79.

Keywords: *Peptides, *Impurities, *Purification, *Angiotensin, Separation, Reprints, High performance liquid chromatography.

Angiotensin I and other biologically active peptides have been analyzed by HPLC. The solvent system developed was shown to separate closely related peptides and to resolve non-peptide impurities which accumulate during the purification process and which are dissolved from the serum stopper.

702,286
PB84-152487 Not available NTIS
National Bureau of Standards, Washington, DC.
Biodeterioration Potential of Standard Reference Materials (SRMs).
Final rept.
G. J. Olson, W. P. Iverson, and F. E. Brinckman. 1983, 11p
Pub. in Biodeterioration 5, p434-444 1983.

Keywords: *Biodeterioration, *Standards, Storage, Microorganisms, Humidity, Bacteria, Fungi, Reprints, *Standard reference materials.

Several National Bureau of Standards Standard Reference Materials have been examined for susceptibility to biodeterioration. Several of these materials were attacked by bacteria and fungi when stored at elevated humidity after exposure to outdoor air. Dry, powdered biological SRMs rapidly take up water from humid atmospheres but should not undergo biodeterioration if laboratory relative humidity is below 60%.

702,287
PB84-218338 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC.
Compilation of Elemental Concentration Data for NBS (National Bureau of Standards) Biological, Geological, and Environmental Standard Reference Materials, 1982.
Final rept.
E. S. Gladney, C. E. Burns, D. R. Perrin, I. Roelandts, and T. E. Gills. Mar 84, 235p NBS/SP-260/88
Also available from Supt. of Docs as SN003-003-02565-8. Library of Congress catalog card no. 84-601009. Prepared in cooperation with Los Alamos National Lab., NM., and Liege Univ. (Belgium).

Keywords: *Chemical analysis, *Geological surveys, *Environmental surveys, *Standards, Tables(Data), Concentration(Composition), *Standard reference materials, *Biological processes.

Concentration data on 88 constituents in 75 NBS Standard Reference Materials have been collected from over 850 journal articles and technical reports. These data are summarized into mean values with uncertainties expressed as +/- one standard deviation and compared with available certification data from NBS. Data are presented on the analytical procedures employed and all raw data are given in the Appendices.

702,288
PB84-218841 Not available NTIS
National Bureau of Standards, Washington, DC.
Pulsed Thermal Atom Source for Resonance Ionization Mass Spectrometry.
Final rept.
J. D. Fassett, L. J. Moore, R. W. Shideler, and J. C. Travis. Feb 83, 4p
Pub. in Analytical Chemistry, v56 n2 p203-206 Feb 84.

Keywords: *Chemical analysis, *Laboratory equipment, *Pulse transmitters, Mass spectroscopy, Iron, Reprints, *Resonance ionization mass spectrometry.

A pulsed thermal atom source has been developed for use with a resonance ionization mass spectrometer system based on a low-duty cycle-pulsed laser. The nature of the thermal atom pulse has been evaluated by temporal scanning of the atomization pulse relative to the laser ionization pulse. Changes in the design of the atomizing filament are required to achieve a sharp atomization pulse. The system has been tested by

using the element Iron. A 30-fold improvement in sample utilization efficiency was demonstrated for the pulsed thermal source relative to a continuous thermal source.

702,289
PB84-220003 Not available NTIS
National Bureau of Standards, Washington, DC.
Possibilities for Ultrasensitive Mass Spectrometry Based on Two-Photon, Sub-Doppler Resonance Ionization.
Final rept.
T. B. Lucatorto, C. W. Clark, and L. J. Moore. 15 Jan 84, 5p
Pub. in Optics Communications 48, n6 p406-410, 15 Jan 84.

Keywords: *Mass spectroscopy, *Ionization, *Doppler effect, Chemical analysis, Isotope separation, Strontium 90, Performance evaluation, Reprints, *Laser spectroscopy, *Resonance ionization spectrometry, Strontium 88.

An ultrasensitive mass spectrometer is proposed in which the chemical and isotopic selectivity possible with laser ionization is combined with the mass selectivity of a conventional mass spectrometer to achieve abundance sensitivities in the range of 10 to the 13th power. The ionization stage incorporates two-photon sub-Doppler resonance ionization in order to achieve optimum isotopic enhancement of the selected species and to provide high ionization efficiency for the entire maxwellian distribution of the sample. The limits on selectivity and sensitivity due to charge exchange and laser power broadening effects are discussed for the case of (88)Sr/(90)Sr, an example which is of practical interest and which poses a difficult test for any mass spectrometric technique.

702,290
PB84-221415 Not available NTIS
National Bureau of Standards, Washington, DC.
Summary of the Usefulness of Signal-to-Noise Treatment in Analytical Spectrometry.
Final rept.
M. S. Epstein, and J. D. Winefordner. Apr 84, 71p
Pub. in Prog. Anal. Atom. Spectrosc. 7, p67-137 Apr 84.

Keywords: *Atomic spectroscopy, *Chemical analysis, *Molecular spectroscopy, Noise, Performance evaluation, Reprints, *Signal detection.

The signal-to-noise ratio (S/N) of an analytical measurement is a most important 'figure-of-merit' which can be used to characterize an analytical technique for a specific application. This review article develops the significance of S/N characterization by summarizing the most useful concepts and conclusions resulting from S/N theory. The manner in which instrumental parameters influence (or do not influence) the S/N of atomic and molecular spectroscopic techniques is discussed and the current literature in this area is critically reviewed.

702,291
PB84-222058 Not available NTIS
National Bureau of Standards, Washington, DC.
Prompt Gamma-Ray Neutron Activation Analysis.
Final rept.
G. E. Gordon, D. L. Anderson, M. P. Failey, W. H. Zoller, W. B. Walters, and R. M. Lindstrom. 1978, 5p
Contract DOE-EY-76-S-05-5173
Pub. in Proceedings of Nuclear Methods in Environmental and Energy Research, Columbia, Missouri, October 10-13, 1977, p83-87 1978.

Keywords: *Chemical analysis, *Neutron activation analysis, *Gamma ray spectroscopy, Boron, Cadmium, Sampling, Environmental surveys, Geology, Irradiation, Forensic science, Biological processes.

The observation of prompt gamma rays during neutron irradiation of samples allows one to determine concentrations of some elements that are difficult or impossible to measure by off-line instrumental neutron and photon activation analysis (e.g., boron and cadmium). Furthermore, by bringing a beam out of the reactor to an external irradiation facility one can irradiate very large samples. Because of the very low fluxes and negligible heating, the technique is almost totally nondestructive and there should be no losses of volatile materials. As in the case of the off-line nuclear methods, self-absorption problems are usually negligible, but the in-beam method has the advantage of rapid turn-around time, as data can be reduced immediately after irradiations. A system for detailed investigation of the technique as applied to a wide range of environmental, biological, geological and forensic samples has been installed at the National Bureau of Standards reactor and is now being tested.

702,292
PB84-222082 Not available NTIS
National Bureau of Standards, Washington, DC.
Isotopic Analysis with the Laser Microprobe Mass Analyzer.
Final rept.
D. S. Simons. 1982, 3p
Pub. in Microbeam Analysis, p390-392 1982.

Keywords: *Isotopes, *Mass spectroscopy, Laboratory equipment, Performance evaluation, Sampling, Reprints, *Laser spectroscopy, *Laser microprobe mass analyzers, Osmium 187, Rhenium 187.

The capability of the laser microprobe mass analyzer (LAMMA) to perform isotopic ratio measurements has been investigated. The dynamic range is limited by the 8-bit resolution of the transient waveform recorder, but can be increased by using independent recording channels operated at different input sensitivities. An abundance sensitivity for uranium of 0.1% was measured on the low-mass side of the major peak. Measurement precision is limited by the finite number of ions in a pulse and by the dynamic bit resolution of the transient recorder. The major limitation for isotopic accuracy is a decrease in gain of the electron multiplier as the output pulse amplitude increases. This effect can be quantified using a calibration procedure. Isotopic ratio measurements were made on nanogram quantities of osmium with non-natural isotopic abundances. Relative accuracies better than 3% (1 sigma) were obtained for ratios larger than 0.2. These results give confidence that the LAMMA can be used to determine directly the radioactive decay constant of (187)Re by measuring the ingrowth of (187)Os.

702,293
PB84-222090 Not available NTIS
National Bureau of Standards, Washington, DC.
Isotopic Analysis with the Laser Microprobe Mass Analyzer.
Final rept.
D. S. Simons. Dec 83, 16p
Pub. in International Jnl. of Mass Spectrometry and Ion Processes 55, p15-30 Dec 83.

Keywords: *Isotopes, *Mass spectroscopy, Laboratory equipment, Performance evaluation, Sampling, Reprints, *Laser spectroscopy, *Laser microprobe mass analyzers, Osmium 187, Rhenium 187.

The capability of the laser microprobe mass analyzer (LAMMA) to perform isotopic ratio measurements has been investigated. The dynamic range is limited by the 8-bit resolution of the transient waveform recorder, but can be increased by using independent recording channels operated at different input sensitivities. An abundance sensitivity for uranium of 0.1% was measured on the low-mass side of the major peak. Measurement precision is limited by the finite number of ions in a pulse and by the dynamic bit resolution of the transient recorder. The major limitation for isotopic accuracy is a decrease in gain of the electron multiplier as the output pulse amplitude increases. This effect can be quantified using a calibration procedure. Isotopic ratio measurements were made on nanogram quantities of osmium with non-natural isotopic abundances. Relative accuracies better than 3% (1 sigma) were obtained for ratios larger than 0.2. These results give confidence that the LAMMA can be used to determine directly the radioactive decay constant of (187)Re by measuring the ingrowth of (187)Os.

702,294
PB84-222157 Not available NTIS
National Bureau of Standards, Washington, DC.
Cryogenic Homogenization of Biological Tissues.
Final rept.
R. L. Zeisler, J. K. Langland, and S. H. Harrison. Dec 83, 4p
Pub. in Analytical Chemistry, v55 n14 p2431-2434 Dec 83.

Keywords: *Tissues(Biology), *Neutron activation analysis, *Homogenizing, *Cryogenics, Sampling, Chemical analysis, Brittle fracturing, Reprints, Procedures.

Biological matrices frequently are inhomogeneous if small subsamples are taken for analysis. To obtain precise and accurate analytical data on a bulk sample, homogenization of the bulk sample is necessary. The cryogenic homogenization (brittle fracture) technique is a very effective method to obtain homogenates of biological matrices. A new high capacity mill made from Teflon is described and evaluated. Soft tissues can be homogenized in this mill at near liquid nitrogen temperatures, with minimal sample contamination, resulting in fine powders with 500 micrometers to smaller than 50 micrometer particles. Sampling uncertainty due to inhomogeneity of the bulk is less than 2% for 1 g subsamples.

702,295
PB84-222165 Not available NTIS
National Bureau of Standards, Washington, DC.
Trace Elements in Human Livers Using Quality Control in the Complete Analytical Process.
Final rept.
R. Zeisler, S. H. Harrison, and S. A. Wise. 1984, 19p
Pub. in Biological Trace Element Research 6, p31-49 1984.

Keywords: *Trace elements, *Livers, *Chemical analysis, Sampling, Humans, Clinical medicine, Quality control, Reprints, Standard reference materials.

The validity and intercomparability of data in research related to medical, environmental, and geochemical health problems is of utmost concern and requires specific consideration in the development of an analytical approach. The Environmental Protection Agency/National Bureau of Standards Pilot Environmental Specimen Bank Program provides a vehicle for developing the precise and accurate determination of trace constituents in human livers. This approach, when implemented, gives specific consideration to a valid relationship between the analytical result and the true value in the sample. This is accomplished by minimizing contamination of the sample and/or loss of constituents, and by assuring representative analytical test portions. The analysis of the liver specimens is performed under strict quality control. The applied analytical techniques (atomic absorbtion spectrometry, isotope dilution mass spectrometry, neutron activation analysis, and voltammetry) have been verified for accuracy through the analysis of Standard Reference Materials. In addition, several elements are determined using two or three of these independent techniques. The first year of the program provided results on 31 elements including Se and Pb in 36 human livers.

702,296
PB84-222199 Not available NTIS
National Bureau of Standards, Washington, DC.
Modification of Selectivity in Reversed-Phase Liquid Chromatography of Polycyclic Aromatic Hydrocarbons Using Mixed Stationary Phases.
Final rept.
S. A. Wise, L. C. Sander, and W. E. May. 1983, 13p
Pub. in Jnl. of Liquid Chromatography, v6 n14 p2709-2721 1983.

Keywords: *Aromatic polycyclic hydrocarbons, *Chromatographic analysis, Polymers, Surfaces, Concentration(Composition), Reprints, *Reversed phase liquid chromatography, Monomers.

Monomeric and polymeric C(18) materials provide significantly different selectivities for polycyclic aromatic hydrocarbons (PAH) in reversed-phase liquid chromatography. Selectivity factors vary in a regular manner with respect to surface concentration of C(18) groups on different C(18) columns. In this study, the authors investigated the feasibility of 'customizing' a C(18) column to provide an intermediate selectivity by mixing 5 micrometer polymeric C(18) material from two different lots with high and low C(18) surface concentrations. The use of mixed phase columns is illustrated for the analysis of a fraction containing five condensed ring PAH isomers (molecular weight 278) isolated from an air particulate sample.

702,297
PB84-222843 Not available NTIS
National Bureau of Standards, Washington, DC.
Oxygen Removal in Liquid Chromatography with a Zinc Oxygen-Scrubber Column.
Final rept.
W. A. MacCrehan, and W. E. May. 1984, 4p
Pub. in Analytical Chemistry, v56 n4 p625-628 1984.

Keywords: *Aromatic polycyclic hydrocarbons, *Nitrogen organic compounds, *Chromatographic analysis, *Oxygen, Performance evaluation, Chemical analysis, Fluorescence, Electrical measurement, Reprints, *Zinc oxygen scrubber column, *Liquid chromatography.

A simple and effective method has been developed for oxygen removal from liquid chromatographic eluents, based on a zinc scrubber column. The mechanism of the oxygen reduction has been verified by differential pulse polarography. The scrubber column has been applied to remove the oxygen interference in two liquid chromatographic detection systems, reductive amperometry and molecular fluorescence, and its advantages are demonstrated in the detection of nitro-polynuclear aromatic hydrocarbons.

702,298
PB84-222892 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Serum Urea by Isotope Dilution Mass Spectrometry as a Candidate Definitive Method.
Final rept.
M. J. Welch, A. Cohen, H. S. Hertz, F. C. Ruegg, R. Schaffer, L. T. Sniegoski, and E. White. 1984, 7p
Pub. in Analytical Chemistry, v56 n4 p713-719 1984.

Keywords: *Isotopic labeling, *Urea, *Blood analysis, Gas chromatography, Mass spectroscopy, Oxygen isotopes, Standards, Nitrogen organic compounds, Reprints, *Isotope dilution mass spectrometry, *Oxygen 18, Standard reference materials, Pyrimidine/methyl-bis((trimethyl-silyl)oxy).

An isotope dilution mass spectrometric (ID/MS) method for serum urea is described. The method utilizes urea-18O as the labeled internal standard and involves isolation of urea from serum, conversion to 6-methyl-1-2,4-bis((trimethyl-silyl)oxy) pyrimidine, capillary column gas chromatography for sample introduction, and measurement of the abundance ratio of the (M-15)(+1) ions from the labeled and unlabeled derivative. Quantitation is achieved by measurement of each sample between measurements of two standards whose unlabeled/labeled ratios bracket that of the sample. Results are of high precision, with coefficients of variation for a single measurement of 0.17 percent for NBS Standard Reference Material 909, a freeze-dried human serum pool, and 0.19 percent overall for five frozen serum pools, and have been shown to be free of measurement interferences. The method is therefore of sufficient accuracy and precision to be considered a 'definitive' method.

702,299
PB84-223288 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS (National Bureau of Standards) Standard Reference Materials for Quality Assurance of Food Analyses.
Final rept.
R. Alvarez. 1983, 16p
Pub. in Proceedings of International Flavor Conference Instrumental Analysis of Foods, Corfu, Greece, July 27-30, 1983. Paper in Instrumental Analysis of Foods 1, p213-228.

Keywords: *Food analysis, *Chemical analysis, *Standards, *Measuring instruments, *Quality assurance, Concentration(Composition), Sampling, Toxicology, Nutrition, Beverages, Trace elements, Calibrating, Metabolism, *Standard reference materials.

The National Bureau of Standards is responsible under Federal statute for issuing Standard Reference Materials (SRM's) to assist investigators improve the accuracy of their laboratory tests. For the food science laboratory, these well-characterized, certified materials are available to serve as accuracy-control materials; to prepare primary standard solutions; and to evaluate and monitor the performance of instruments and devices, such as polarimeters and spectrophotometers. Of the approximately 900 different SRM's listed in the current catalog, the biological matrix materials are especially suitable for long-term quality assurance of food analyses. Examples of these are: Oyster Tissue (SRM 1566), Bovine Liver (SRM 1577a), Wheat Flour (SRM 1577), Rice Flour (SRM 1568), and a Non-Fat Milk Powder (Proposed SRM 1549), expected to be issued in late 1983. The Certificate of Analysis for these SRM's include certified concentrations of nutritionally and toxicologically important elements. Other SRM's for food and beverage analysis include a stabilized wine and compounds of certified high purity, such as cholesterol. Additional SRM's have been developed for metabolic studies, such as Human Serum (SRM 909).

702,300
PB84-223320 Not available NTIS
National Bureau of Standards, Washington, DC.
Normal- and Reversed-Phase Liquid Chromatographic Separations of Polycyclic Aromatic Sulfur Heterocycles.
Final rept.
S. A. Wise, R. M. Campbell, W. E. May, M. L. Lee, and R. N. Castle. 1982, 20p
Pub. in Polynuclear Aromatic Hydrocarbons: Int. Symp. Formation Metabolism Measurement (7th), p1247-1266 1982.

Keywords: *Aromatic polycyclic hydrocarbons, *Sulfur organic compounds, *Chemical analysis, Reprints, *Reversed phase liquid chromatography, *Liquid chromatography, Coal liquids, Isomers.

Normal- and reversed-phase liquid chromatographic (LC) retention data are reported for 27 Kata-condensed four- and five-ring polycyclic aromatic sulfur heterocyclic (PASH) isomers and for ten pericondensed five-ring PASH isomers. The application of normal-phase LC prefractionation followed by reversed-phase LC is described for the analysis of a sulfur enriched fraction from a coal liquid.

702,301
PB84-225341 Not available NTIS
National Bureau of Standards, Washington, DC.
History of Quantitative Electron Probe Microanalysis.
Final rept.
K. F. J. Heinrich. Feb 84, 7p
Sponsored in part by Centre National d'Etudes Spatiales, Toulouse (France).
Pub. in Proceedings of Triennial Int. Cong. X-ray Opt. Microanalysis (IXCOM 10), Toulouse, France, September 5-9, 1983, Jnl. de Phys. Colloq. C2, n2 p3-8 Feb 84.

Keywords: *X ray analysis, *Microanalysis, *X ray fluorescence, *Chemical analysis, *Electron probes, Monte Carlo methods, Standards, Performance evaluation, *Standard reference materials.

Quantitative microanalysis is based on empirical adjustment of simple models of electron-target interaction. The accuracy of analysis depends on measurements of X-ray emission from homogeneous well-characterized standard materials. As better standards and larger and faster computers become available, simplistic models can be replaced and the quality of adjustment improved. It is also possible to include some secondary processes such as excitation of X-rays by high-energy secondary electrons which were overlooked in the past.

702,302
PB84-226281 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Spatial Averaging on the Compositional Analysis of Crystals by Absorption Spectroscopy.
Final rept.
R. A. Forman, M. I. Bell, S. Mayo, and A. H. Kahn. 15 Jan 84, 8p
Pub. in Jnl. of Applied Physics 55, n2 p547-554, 15 Jan 84.

Keywords: *Chemical analysis, *Crystals, *Absorption spectra, *Mathematical models, Semiconductors, Surfaces, X ray analysis, Crystal growth, Spatial distribution, Reprints, Gallium arsenide.

Calculations of optical absorption based on a model of a single crystal containing spatially periodic compositional variations are presented. These variations can contribute a significant source of systematic error in the analysis of composition by optical or surface techniques. The model is most appropriate for melt-grown crystals and in particular for striated semiconductor crystals, and the surface concentration profile which it predicts is confirmed by comparison with a published x-ray topographic study of silicon. Implications of the results for optical absorption studies of impurities in silicon crystals are discussed, and it is shown that significant measurement errors may occur.

702,303
PB84-239870 Not available NTIS
National Bureau of Standards, Washington, DC.
Modification of Centrifugal Filtration Device for Elimination of Sorption Losses.
Final rept.
W. A. MacCrehan. Apr 82, 2p
Pub. in Analytical Chemistry 54, n4 p838-839 Apr 82.

Keywords: *Centrifuges, *Filters, *Laboratory equipment, *Sorption, Liquids, Chemical analysis, Membranes, Performance evaluation, Reprints.

The preparation of many liquid samples for analysis frequently requires filtration to remove suspended solid matter. This is particularly true for samples prepared for liquid chromatography, where particles in the micrometer range can clog protective column frits. Several devices are commercially available for the filtration of liquid samples in the sub-milliliter range. Two approaches that we have used are syringe-membrane filters and centrifugation with withdrawal of the supernatant liquid. Although both approaches are effective for removing particles, each has disadvantages.

702,304
PB84-240936 PC A03/MF A01
National Bureau of Standards (NML), Washington, DC. Center for Analytical Chemistry.
Fortran Version of the Quantitative Energy-Dispersive Electron Beam X-ray Analysis Program FRAME C.
Technical note.
R. L. Myklebust, and B. B. Thorne. Jul 84, 46p NBS/TN-1200
Also available from Supt. of Docs as SN003-003-02603-4.

Keywords: *X ray analysis, *Microanalysis, *Computer programs, X ray spectra, Fortran, Chemical analysis, *Electron probe microanalysis, FRAME C computer program, Fortran 77 programming language, VAX-11/780 computer, Listings.

A Fortran listing of the quantitative electron microprobe analysis routine, FRAME C, is presented. The source code is extensively documented and there are short summaries of the various parts of the program. Examples are also presented to demonstrate the versatility of the program.

702,305
PB84-244623 Not available NTIS
National Bureau of Standards, Washington, DC.
Three-Beam Phase Modulation Technique for Coherent Raman Spectroscopy.
Final rept.
G. J. Rosasco, W. S. Hurst, and W. Lempert. Jan 84, 3p
Pub. in Optics Letters 9, p19-21 Jan 84.

Keywords: *Raman spectroscopy, *Gases, *Optical measuring instruments, Nitrogen oxides(NO), Nitrogen, Reprints, *Coherent Raman spectroscopy.

A new nonlinear optical technique is applied to coherent Raman spectroscopy of gases. Two orthogonal pump beams with relative phase modulation are generated in an electro-optic modulator and mixed with a linearly polarized probe. Shot noise limited detection and signals linear in either the real or imaginary parts of the third order susceptibility are demonstrated for NO and N2.

702,306
PB84-244854 Not available NTIS
National Bureau of Standards, Washington, DC.
Interlaboratory Isotopic Ratio Measurement of Nanogram Quantities of Uranium and Plutonium on Resin Beads by Thermal Ionization Mass Spectrometry.
Final rept.
J. D. Fassett, and W. R. Kelly. Mar 84, 7p
Pub. in Analytical Chemistry 56, n3 p550-556 Mar 84.

Keywords: *Uranium, *Plutonium, *Chemical analysis, *Standards, *Anion exchanging, *Isotopic separation, Sources, Laboratories, Reprints, *Thermal ionization mass spectroscopy, *Standard reference materials.

The use of high sensitivity thermal ionization mass spectrometry for the accurate and precise measurement of uranium and plutonium isotopic ratios for safeguards accountability has been evaluated by means of an interlaboratory analysis program (round robin). Nanogram amounts of isotopic Standards Reference Materials (SRM's) and unknown samples were loaded onto anion exchange resin beads and transported to

participating laboratories for measurement. U, Pu, and U plus Pu loaded beads were prepared and analyzed. It is concluded that isotopic fractionation is a major source of imprecision while the degree to which isotopic fractionation is a major source of imprecision while the degree to which isotopic fractionation is a major source of imprecision while the degree to which isotopic fractionation can be calibrated limits the measurement accuracy.

702,307
PB84-245885 Not available NTIS
National Bureau of Standards, Washington, DC.
Preparation and Analysis of Vinyl Chloride Standards.
Final rept.
E. E. Hughes, W. D. Dorko, S. M. Freund, and D. M. Sweger. 1976, 5p
Pub. in Proceedings of International Conference on Environmental Monitoring, Las Vegas, NV., September 15-19, 1975, IEEE (International Electrical and Electronics Engineers) Cat. No. CH1004-1, 1, Paper 2-5, 5p 1976.

Keywords: *Vinyl chloride, *Standards, *Chemical analysis, Air pollution, Stability, Gas chromatography, Sampling, Stark effect, *Air pollution detection, Laser spectroscopy.

Gaseous standards consisting of low concentration of vinyl chloride in air have been prepared in the range of 1000 to 2 ppmv. The standards were prepared in steel cylinders and an investigation was completed of the stability of the standards and on the accuracy with which they were prepared. The stability was studied by comparison of the gas chromatographic signal from vinyl chloride with the signal resulting from an internal standard of propane. A second check was made by comparison with freshly prepared standards. Accuracy was assessed by comparing replicate samples derived independently of each other using both gas chromatography and a recently developed analytical method using carbon monoxide and carbon dioxide lasers. Stark modulated absorption by vinyl chloride of the infrared laser radiation is the basis of this latter technique. The linearity of response of this technique, is excellent over at least four orders of magnitude of vinyl chloride concentrations ranging from 0.1 to 1000 ppm in air.

702,308
PB85-102150 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Hafnium in Zirconium Metal and Zircaloy 4 Metal Standard Reference Materials by Isotope Dilution Spark Source Mass Spectrometry.
Final rept.
L. J. Powell, and P. J. Paulsen. 1984, 3p
Pub. in Analytical Chemistry 56, n3 p376-378 1984.

Keywords: *Chemical analysis, *Standards, *Hafnium, Metals, Cation exchanging, Reprints, *Standard reference materials, *Isotope dilution techniques, *Spark source mass spectroscopy, Ion chromatography.

A procedure has been developed for the determination of microgram per gram concentrations of hafnium in zirconium metal and zircaloy 4 metal Standard Reference Materials (SRM's) by stable isotope dilution spark source mass spectrometry. The concentration of hafnium in these SRM's ranges from 200 micrograms/g in SRM 1236 to 32 micrograms/g in SRM 1237. One half-gram samples were spiked with (179) Hf and dissolved in a mixture of hydrofluoric and sulfuric acids and the isotopically altered Hf was separated from Zr by cation exchange chromatography using 0.32 M sulfuric acid as an eluant. The isotopically altered, purified hafnium was evaporated onto 200 mesh gold powder which was subsequently homogenized and pressed into electrodes. The altered isotopic ratios were determined by spark source mass spectrometry using electrical detection.

702,309
PB85-102168 Not available NTIS
National Bureau of Standards, Washington, DC.
Liquid Chromatography-Gas Chromatography Procedure to Determine the Concentration of Dibenzothiophene in a Crude Oil Matrix.
Final rept.
R. E. Rebbert, S. N. Chesler, F. R. Guenther, and R. M. Parris. 1984, 7p
Pub. in Jnl. of Chromatography 284, p211-217 1984.

Keywords: *Crude oil, *Chromatographic analysis, Hydrocarbons, Gas chromatography, Concentration(Composition), Chemical analysis, Reprints, *Dibenzothiophene, *Standard reference materials, *Matrix isolation techniques.

The concentration of dibenzothiophene in SRM 1582, Wilmington crude oil, was determined using a technique which combines liquid chromatography and gas chromatography. In particular, liquid chromatography was utilized for initial sample clean-up and separation of the thiophenes. A dual-flame photometric detector specific for sulfur-containing compounds was used as the detector for gas chromatography. In order to further minimize possible sources of error due to the natural hydrocarbon matrix of the oil, a standard addition method was also utilized.

702,310
PB85-102176 Not available NTIS
National Bureau of Standards, Washington, DC.
Implicit Apodization of Interferograms in Fourier Transform Spectroscopy.
Final rept.
A. Baghdadi. 1983, 4p
Pub. in Applied Spectroscopy 37, n6 p520-523 1983.

Keywords: *Infrared spectroscopy, *Chemical analysis, Spectrochemical analysis, Reprints, *Fourier transform spectroscopy, *Interferograms, Procedures.

The removal of secondary and tertiary interferograms from the main interferogram in Fourier transform spectroscopy can lead to an implicit apodization of the specimen interferogram. This effect can result in the generation of unwanted artifacts in the specimen's transmittance or absorption spectrum. One approach for avoiding this problem is to use an apodization function on the background and reference interferograms which matches the function used on the specimen interferogram.

702,311
PB85-115483 Not available NTIS
National Bureau of Standards, Washington, DC.
Finger-Printing and Partial Quantification of Complex Hydrocarbon Mixtures by Chemical Ionization Mass-Spectrometry.
Final rept.
L. W. Sieck. 1979, 5p
Pub. in Analytical Chemistry, v51 n1 p128-132 1979.

Keywords: *Mass spectroscopy, *Hydrocarbons, *Chemical analysis, Revisions, Cyclohexane, Aromatic compounds, Complex compounds, Separation, Mixtures, Distillation, Reprints, *Ion molecule interactions, *Chemical ionization mass spectroscopy, *Finger printing.

A modification of chemical ionization mass spectrometry, which involves photoionization and cyclohexane as the source of the reagent ion, has been used to develop a technique for discriminatory 'finger-printing' of neat fossil fuels. The method provides a two minute turn-around time between samples and batch introduction, with no requirements for prior separation or fractionation. Depending upon the conditions chosen, the technique may also be extended to the quantification of aromatic and olefinic sample components.

702,312
PB85-115582 Not available NTIS
National Bureau of Standards, Washington, DC.
Quality of Analytical Results, with Special Reference to Trace Analysis and Sociochemical Problems.
Final rept.
L. A. Currie. 1982, 40p
Pub. in Jnl. of Pure Applied Chemistry 54, n4 p715-754 1982.

Keywords: *Trace elements, *Chemical analysis, *Industrial wastes, *Environmental surveys, *Laboratory design, Technology, Laboratories, Reprints.

High quality trace analysis is becoming increasingly important for technological development, both with regard to the production and monitoring of high-purity technological materials and processes, and with respect to monitoring and understanding the environmental and societal impacts of industrial waste products. The analytical scientist faces an enormous challenge in meeting these requirements because of the range of concentrations (to less than 10 to the -12th power g/g) and complexity of matrices, as well as the importance of the results to the future of mankind. The quest for accuracy in trace analysis is best viewed in the framework of a structured Chemical Measurement Process (CMP), in which high quality is assured by (a) performing regular assays of known (Standard Reference Materials) and interlaboratory comparison samples, and (b) examining and bringing into control each constituent step. Illustrations are presented of assumptions and common pitfalls which are characteristic of each of the CMP steps, with special emphasis on contamination, losses and interference, calibration and model errors, and inadequate reporting of results and uncertainties. The question of hypothesis testing and detection limits is given special focus.

702,313
PB85-118255 Not available NTIS
National Bureau of Standards, Washington, DC.
Nuclear Safeguards and NBS (National Bureau of Standards) Standard Reference Materials Program.
Final rept.
W. P. Reed, and H. T. Yolken. 1978, 7p
Pub. in ACS (American Chemical Society) Symposium Series 1978, n79 p27-33 1978.

Keywords: *Chemical analysis, *Calibrating, *Nuclear material management, Standards, Reprints, *Standard reference materials.

The use of accounting type procedures to provide safeguards on the diversion of Special Nuclear Material puts a heavy demand on the use of analytical calibration materials. This demand, in part, is generated by regulations that require nuclear materials inventories to be determined to a specified level of accuracy. These regulations also require that measurement uncertainty be determined relative to national standards which in some cases, in turn, require that analytical measurements be traceable to NBS Standard Reference Materials. These requirements for a specific level of accuracy with demonstrated traceability are well defined in some cases, but in other cases no guidelines or only general guidelines are provided. Since the kind and quantities of Standard Reference Materials available are very limited, knowledge of the rational behind the correct uses of Standard Reference Materials and the concept of traceability are important factors. The NBS Standard Reference Materials program is currently issuing a limited number of 'primary' standards for use in nuclear safeguards measurement. In conjunction with the NBS Office of Measurement for Nuclear Safeguards this work is being expanded (with support from NRC and DOE) to include other areas of nuclear measurement where SRM's are not currently available.

702,314
PB85-120608 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibration of an EDXRF Spectrometer.
Final rept.
A. R. Stiles, T. G. Dzubay, R. M. Baum, R. L. Walter, R. D. Willis, L. J. Moore, E. L. Garner, J. W. Gramlich, and L. A. Machlan. 1976, 14p
Pub. in Advances in X-Ray Analysis 19, p473-486 1976.

Keywords: *Calibrating, *Standards, *Spectrometers, Laboratory equipment, X ray analysis, Mass spectroscopy, Performance evaluation, Chemical analysis, Reprints, Isotope dilution techniques, Proton induced x ray emission analysis.

The purpose of this work was to develop accurate calibration standards which were fully characterized in terms of uniformity and concentration using fundamental measuring methods. Three similar sets of vacuum deposits were commercially made, each set containing the deposits (Cu)S, KCl, Ca(F2), Cr, Fe, Cu, Rb(NO3), Sr(F2), Mo(O3), Ba(F2), and Pb. Thickness variations in each deposit were measured with PIXEA (proton induced x-ray excitation analysis) measurements taken at 6 to 8 positions along the foil diameters. Relative elemental concentrations on corresponding foils from each set were measured using multiple XRF intercomparisons. One set of deposits was destructively analyzed at the National Bureau of Standards with thermal ionization isotope dilution mass spectrometry. Elements of interest heavier than sulfur were linked to the twelve calibrated elements using solution deposited ratio standards. Attenuation corrections for the light elements and a smooth calibration curve were calculated. Error estimates were obtained for the calibrated spectrometer based on system error determinations and uncertainties in the calibration standards and procedures.

702,315
PB85-123677 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Resolution, Magic Angle Sample Spinning 13C NMR of Solid Cellulose - 1.
Final rept.
W. L. Earl, and D. L. Vanderhart. 1980, 2p
Pub. in Jnl. of the American Chemical Society 102, n9 p3251-3252 1980.

Keywords: *Nuclear magnetic resonance, *Cellulose, Isotopic labeling, Chemical analysis, Reprints, Carbon 13.

The peaks for carbons 1, 4, and 6 in the solid state, magic angle sampling spinning (13)C NMR spectrum of cellulose have been assigned. The transverse and longitudinal relaxation times have been investigated for a carefully dried sample of cellulose I. These relaxation times are interpreted to indicate that the mobility of the backbone carbons in cellulose is intermediate between a crystalline solid and glassy polymer, provided that there is no water remaining in the sample to cause relaxation by its own motion. Anomalies in the spectrum can be interpreted as arising from two possible environments for the glucose monomers, one of which exhibits a more rapid relaxation for carbon 6 than the other.

702,316
PB85-128825 Not available NTIS
National Bureau of Standards, Washington, DC.
Considerations in the Preparation and Certification of 'Pure Analyte' Reference Materials.
Final rept.
R. Schaffer, S. A. Margolis, and P. K. Longenbach. 1981, 6p
Pub. in Quality Control in Clinical Endrocrinology, p37-42 1981.

Keywords: *Chemical analysis, *Chemical compounds, Reprints, *Reference materials.

The development of reference methods of the kind that consist nominally of a single chemical compound requires the development of criteria defining the properties of the pure compound, specifications appropriate for a reference material, and the selection of appropriate analytical tests. Some special problems that may be found with the development of reference materials where only small quantities of material are available are considered.

702,317
PB85-128841 Not available NTIS
National Bureau of Standards, Washington, DC.
Interlaboratory Comparisons of Quantitative Analyses of Individual Compounds in Simple and Complex Mixtures.
Final rept.
W. E. May, J. M. Brown-Thomas, S. N. Chesler, F. R. Guenther, L. R. Hilpert, L. R. Hilpert, R. M. Parris, R. L. Richie, S. A. Wise, and H. S. Hertz. 1983, 21p
Pub. in Advanced Techniques in Synthetic Fuels Analysis, p381-401 1983.

Keywords: *Chemical analysis, *Laboratories, *Trace elements, Aromatic polycyclic hydrocarbons, Phenols, Nitrogen heterocyclic compounds, Fuels, Comparison, Organic compounds, Assessments, Standards, Amines, Reprints, *Alternate fuels, *Standard reference materials, State of the art.

In recent years, the Organic Analytical Research Division of the National Bureau of Standards (NBS) has been involved in a number of interlaboratory collaborative studies whose purpose was to assess the accuracy of data obtained from trace organic analytical methodologies. The first of these studies revealed the existance of large biases among laboratories involved in the measurement of polynuclear aromatic hydrocarbons (PAH), phenols, amino PAH, and N-heterocyclic compounds in environmental samples. In this paper we summarize the data obtained from a number of collaborative analytical studies conducted between 1975 and 1980, discuss the development and certification of a trace organic SRM, and reveal through reference to several recent publications, advances in the state of the art for trace organic analysis that can be at least in part attributed to the NBS/DOE analytical characterization program.

702,318
PB85-130748
(Order as PB85-130078, PC **A99**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
New Determination of the Atomic Weight of Silver and an Improved Value for the Faraday.
L. J. Powell, T. J. Murphy, and J. W. Gramlich. 1984, 2p
Included in Precision Measurement and Fundamental Constants II, p357-358 1984.

Keywords: *Silver, *Fundamental constants, *Atomic mass, *Faraday effect, Chemical analysis, Mass spectroscopy, Standards, Electrochemistry, *Silver 107, *Silver 109.

The atomic weight of a reference sample of silver has been determined by mass spectrometry with an uncertainty of one part in 10 to the 6th power. Accurately known quantities of chemically pure (107)Ag and (109)Ag were mixed to produce standards of known isotopic composition for calibration of the mass spectrometer. Recalculation of the Faraday using this atomic weight and the electrochemical equivalent of silver as determined by Bower and Davis leads to a value of (96486.18 + or - 0.13). A NBS/s/mol (68 percent CL).

702,319
PB85-134013 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Errors Observed in the Analysis of Particle Mixtures by Overscanning.
Final rept.
R. L. Myklebust, J. A. Small, and D. E. Newbury. 1981, 5p
Pub. in Scanning Electron Microscopy, n1 p477-481 1981.

Keywords: *Particles, *X ray analysis, Error analysis, Mixtures, Performance evaluation, Particle size, Chemical composition, Fluorescence, Absorption, Atomic properties, Reprints, Scanning electron microscopy.

The possible errors associated with analysis of x-ray spectra obtained by overscanning fields of mixed particles have been studied by the use of standard particles of known composition. Three different types of particle aggregates were analyzed: (1) spherical particles of homogeneous composition with a variable size; (2) irregularly shaped particles with a homogeneous composition; and (3) a mixture of spherical particles of two different compositions. A conventional matrix correction procedure (atomic number, absorption, fluorescence) followed by normalization produced large errors in all cases. A modified particle correction method yielded satisfactory results from fields of homogeneous particles. The analysis of particle mixtures gave large errors by both methods, frequently reaching a factor of two or more. Overscanning of particle mixtures should not be used, even for 'semi-quantitative' results.

702,320
PB85-137453 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Selectivity of Negative Ion Chemical Ionization Mass Spectrometry for Benzo(a)Pyrene.
Final rept.
L. R. Hilpert, G. D. Byrd, and C. R. Vogt. 1984, 5p
Pub. in Analytical Chemistry 56, n11 p1842-1846 1984.

Keywords: *Mass spectroscopy, *Gas chromatography, *Chemical analysis, Aromatic polycyclic hydrocarbons, Crude oil, Petroleum products, Concentration(Composition), Reprints, *Negative chemical ionization mass spectroscopy, *Benzopyrenes, *Standard reference materials, *Indenopyrene, *Benzoperylene.

Gas chromatography/negative ion chemical ionization mass spectrometry (GC/NICIMS) was used as a selective and sensitive technique for the detection of benzo(a)pyrene (BaP). Under optimized conditions, the molecular anion, M(-1), of BaP was more than 3 orders of magnitude more abundant than that of its isomer benzo(e)pyrene (BeP) using methane as the reagent gas. Quantities of BaP as low as 1 pg can easily be detected in the selected ion monitoring mode and response versus concentration was linear over a range of 3 orders of magnitude. The absolute sensitivity and selectivity for detection were found to depend on the pressure and temperature in the ion source of the mass spectrometer. NICIMS was used for the quantitative determination of BaP, indeno(1,2,3-cd)pyrene, and benzo(ghi)perylene in a sample of petroleum crude oil as part of the process of certifying the oil as a Standard Reference Material.

702,321
PB85-140671 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quality Assurance of Chemical Measurements.
Final rept.
J. K. Taylor. 1980, 14p
Pub. in Thalassia Jugoslavica 16, n2-4 p111-124 1980.

Keywords: *Quality assurance, *Chemical analysis, Quality control, Assessments, Sampling, Sources, Laboratories, Reprints, *Standard reference materials.

Quality assurance programs provide a mechanism to reduce analytical errors to tolerable limits and to produce evaluated data of requisite quality. They involve two concepts: quality control to minimize errors; and quality assessment to verify that the quality control procedure is effective. General principles involved in the development and operation of quality assurance programs are discussed. All aspects of the measurement and sampling process must be planned on the basis of tolerance limits for the end use of the data, using chemical and statistical considerations. Protocols for sampling, measurement, and calibration need to be developed and followed rigorously. Quality control involves adherence to good laboratory practices and the use of control charts to monitor statistical error. The quality assessment process makes use of reference samples obtained from external sources to evaluate the effectiveness of the quality control program. The use of Standard Reference Material for quality assessment is discussed together with the considerations involved in establishing sample measurements to measurements of SRMs.

702,322
PB85-140697 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Air Buoyancy Correction in High-Accuracy Weighing on Analytical Balances.
Final rept.
R. M. Schoonover, and F. E. Jones. 1981, 3p
Pub. in Analytical Chemistry 53, n6 p900-902 1981.

Keywords: *Weight indicators, *Buoyancy, Calibrating, Chemical analysis, Laboratories, Performance evaluation, Reprints.

In the context of the calculation and application of air buoyancy corrections in weighing, the calibration of single-pan direct-reading analytical balances is treated in detail. The resulting equations are applied to the calibration of syringes and to the weighing of granular or powdered materials or liquids in weighing bottles.

702,323
PB85-140788 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stepwise Excitation Laser Enhanced Ionization Spectrometry.
Final rept.
G. C. Turk, J. R. DeVoe, and J. C. Travis. 1982, 3p
Pub. in Analytical Chemistry 54, n4 p643-645 1982.

Keywords: *Chemical analysis, Excitation, Trace elements, Reprints, *Laser spectroscopy, *Laser enhanced ionization, Standard reference materials.

Laser stepwise excitation, utilizing two electronic transitions connected by a common intermediate level, is an effective technique for populating high energy electronic levels in an atom. Such excitation can be very useful for laser enhanced ionization (LEI) spectrometry, since sensitivity is often limited by the ability to populate an excited state which is close enough to the ionization limit to be efficiently ionized. Stepwise excitation LEI is demonstrated for seven elements, yielding improved detection limits over single-photon LEI. For the first time LEI detection of elements with ionization potentials greater than 9 eV is achieved at concentrations as low as 100 pg/mL. Selectivity is improved by the added dimension of a second excitation wavelength. Unalloyed copper and low alloy steel Standard Reference Materials are successfully analyzed.

702,324
PB85-141539 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Essential Features of a Laboratory Quality Assurance Program.
Final rept.
J. K. Taylor. 1984, 8p
Pub. in American Society for Testing and Materials, Special Technical Publication 845, p66-73 1984.

Keywords: *Laboratories, *Quality assurance, *Quality control, *Chemical analysis, Reprints.

Progress in the environmental sciences is vitally dependent on reliable data resulting from complex measurement processes. Because of this complexity, the measurement process must be well designed and operate in a state of statistical control. A quality assurance program, including quality control and quality assessment procedures, denotes those features that lead to the production of data under this condition. The rudimentary features are described together with the expected benefits. Parallelisms are drawn with a well designed manufacturing process.

702,325
PB85-142057 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Instrumental Aspects of Supercritical Fluid Chromatography.
Final rept.
T. J. Bruno. 1984, 8p
Pub. in Proceedings of Symposium on Energy Engineering Sciences, Research on Instrumentation, Testing and Evaluation (2nd), Argonne, IL., April 10-11, 1984, Conf-8404123, p78-85.

Keywords: *High pressure tests, *Laboratory equipment, Chemical analysis, Physicochemical process, *Supercritical fluid chromatography, High pressure liquid chromatography.

Supercritical fluid chromatography (SFC) offers many unique advantages as a tool for analytical and physicochemical studies. It logically is an intermediary between gas (GC) and liquid chromatography (LC). In this short review, the instrumental aspects of SFC will be discussed, after a short discussion on GC and LC to set the stage.

702,326
PB85-142255 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quality Assurance for a Measurement Program.
Final rept.
J. K. Taylor. 1984, 4p
Pub. in ACS (American Chemical Society) Symposium Series 267, p105-108 1984.

Keywords: *Quality assurance, *Laboratories, *Chemical analysis, Reprints, Reference materials.

The quality assurance practices for use in monitoring programs are discussed. Effective programs require the exclusive use of participating laboratories with their own sound quality assurance programs that will certify the quality of their data outputs, based on statistical evidence. The role of reference laboratories in monitoring programs is discussed.

702,327
PB85-142420 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of Iron in Serum and Water by Resonance Ionization Isotope Dilution Mass Spectrometry.
Final rept.
J. D. Fassett, L. J. Powell, and L. J. Moore. Oct 84, 6p
Pub. in Analytical Chemistry 56, n12 p2228-2233 Oct 84

Keywords: *Iron, *Blood analysis, *Water analysis, *Standards, Trace elements, Mass spectroscopy, Chemical analysis, Reprints, *Standard reference materials, *Isotope dilution mass spectrometry, *Resonance ionization spectroscopy, Laser spectroscopy.

Resonance ionization mass spectrometry has been used in conjunction with isotope dilution to determine the iron content of SRM 909 (Human Serum) and SRM 1643b (Trace Elements in Water). Iron was thermally vaporized from a filament at 1250 K. A one-wavelength, two-photon ionization scheme was employed utilizing UV light at 283.6 nm provided by a Nd:YAG pumped dye laser with frequency doubling. The linearity of the detection system was verified by the determination of the (57)Fe/(56)Fe ratios in a set of gravimetrically prepared isotopic calibration mixes. The precision and accuracy of the measurements were typically 2-3%. The mass spectrometric loading blank is presently the limiting source of error.

702,328
PB85-142453 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sampling, Storage, and Handling of Materials for Trace Element Analysis.
Final rept.
J. R. Moody. 1984, 19p
Pub. in Sample Preparation Technology (Zymark Corp., Hopkinton, MA 01748) p1-19 1984.

Keywords: *Trace elements, *Chemical analysis, Sampling, Materials handling, Reviews, Reprints.

This report is a review of current practices and methods for sampling, storage and sample handling of materials specifically for trace elements analysis. It is intended to serve as a chapter in an intermediate text series on sample handling. Special emphasis is placed upon generic means of controlling contamination in order to obtain a more valid sample.

702,329
PB85-142529 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Detecting Elevated Contamination by Comparisons with Background.
Final rept.
W. Liggett. 1984, 10p
Pub. in American Chemical Society Symposium Series 267, p119-128 1984.

Keywords: *Environmental surveys, *Soil analysis, Sampling, Tests, Comparison, Reprints, Heavy metals.

In the environmental studies this paper considers, the objective is detection of unusually high levels of an ubiquitous soil contaminant. This objective is achieved by comparison of measurements from a background region with measurements from the region where excess contamination is suspected. In its implications for study design, comparison differs from other approaches to soil-sampling objectives. In particular, comparisons are more sensitive to sampling and subsampling variations that have a positive skewness and an asymmetrical probability distribution with its upper tail more extended than its lower tail. This paper considers design requirements such as comparability of the two regions, uniformity in the execution of the sampling and subsampling procedures, and minimization of the skewness. Since asymmetry cannot always be eliminated, this paper presents a statistical method for detecting occasional high levels of contamination when the background measurements have a positive skewness. This method applies to background measurements that can be transformed to normality by a shift and a power (Box-Cox) transformation. The method accounts for the estimation of the transformation from the data. The method is illustrated with analogous data, blank measurements from a study of trace quantities of heavy metals.

702,330
PB85-142602 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Portable Organic Vapor Detectors.
Final rept.
J. E. Brown, and P. H. Krupenie. Jun 84, 9p
Sponsored by National Inst. of Justice, Washington, DC.
Pub. in National Inst. of Justice Standard-0606.00, 9p Jun 84.

Keywords: *Portable equipment, *Gas detectors, *Vapors, *Fire investigation, *Standards, Performance evaluation, Organic compounds, Reprints, Arsons.

The purpose of this standard is to establish the minimum performance criteria for portable organic vapor detectors, instruments which may be used by arson investigators to locate fire debris that may contain residues of a liquid accelerant. Reliable identification of a specific class of accelerants is possible only in a laboratory using more sophisticated equipment, and is not included in the performance criteria. The standard does present methods by which a detector's sensitivity to selected organic vapors may be determined. It also includes methods to compare the instrument's responses to fire debris with and without residues of a liquid accelerant.

702,331
PB85-142834 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Application of a Microwave-Induced Helium Plasma Detector at Atmospheric Pressure for Gas Chromatographic Capillary Columns.
Final rept.
S. P. Wasik, and F. P. Schwarz. 1980, 4p
Pub. in Jnl. of Chromatographic Science 18, n12 p660-663 1980.

Keywords: *Gas chromatography, *Chemical analysis, Performance evaluation, Comparison, Design criteria, Laboratory equipment, Mercury(Metal), Reprints, *Microwave induced plasma detectors, Flame ionization detectors.

The analytical performance of a modified version of Beenakker's cavity was evaluated as a microwave-induced plasma detector (MPD) for gas chromatographic capillary columns. The MPD compared favorably with the flame ionization detector (FID), with respect to peak resolution and ease of operation. The FID performance was superior in detection limits and linear range for compounds containing carbon. For compounds containing mercury, the MPD and the FID had the same sensitivity.

702,332
PB85-142909 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optogalvanic Spectroscopy - Application to Combustion Systems.
Final rept.
P. K. Schenck, and J. W. Hastie. 1981, 7p
See also PB81-199200.
Pub. in Optical Engineering 20, n4 p522-528 Aug 81.

Keywords: *Flames, *Combustion, *Chemical analysis, Ionization, Soot, Hydrocarbons, Reprints, *Optogalvanic spectroscopy, Laser spectroscopy.

Optogalvanic spectroscopy is a method of obtaining absorption spectra of atomic and molecular species in flames and electrical discharges by measuring voltage and current changes upon laser irradiation. This technique alleviates the problems associated with optically monitoring either small absorptions or weak fluorescence in the presence of strong laser light. Optogalvanic spectroscopy in discharges has been useful in characterizing laser linewidths as well as providing a convenient frequency calibration for tunable dye lasers. In addition, the optogalvanic signals have been used to frequency stabilize both continuous wave dye lasers. Optogalvanic spectroscopy has also been possible on some molecular species which exist only in flame or discharge environments. Analytical flame spectrometry utilizing the optogalvanic effect for trace metal detection shows significant promise for many metallic elements. The optogalvanic effect can also serve as a probe of ionization effects in flames. The ionization cross section as well as ion mobilities may be determined from an analysis of optogalvanic signals. This technique has been extended to include the determination of mobilities of soot precursor molecules in rich hydrocarbon flames. Flow velocities may also be determined in laminar flames by following the residual depletion of neutrals in the flame gas stream.

702,333
PB85-143915 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Amino Acid Analysis of Angiotensin I by Proton Nuclear Magnetic Resonance Spectroscopy.
Final rept.
S. A. Margolis, and B. Coxon. 1984, 6p
Pub. in Analytical Biochemistry 141, p355-360 1984.

Keywords: *Amino acids, *Chemical analysis, *Angiotensin, Nuclear magnetic resonance, Hormones, Reprints, *Chemical shifts(Nuclear magnetic resonance).

The chemical shifts of the isoleucine and histidine protons of angiotensin I were assigned and the chemical shifts of the protons of the other amino acids in this peptide were confirmed at a field strength of 400 MHz. These chemical shift assignments were used to determine the amino acid composition of angiotensin I. These data were then compared to the amino acid composition which was determined by chromatographic analysis of the peptide hydrolysate. The results obtained by the chromatographic method were similar to those obtained by the NMR method. The standard deviations of the results were similar, indicating that these methods are equally precise. The major advantages of the NMR method are that it permits the recovery of the peptide after completion of the analysis and improves the quantitation of amino acids which are

either partially destroyed by the hydrolysis procedure or require special derivatization methods for detection and quantitation.

702,334

PB85-144897 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Production Rates for Discharge Generated SOF2, SO2F2, and SO2 in SF6 and SF6/H2O Mixtures.
Final rept.
R. J. Van Brunt, W. E. Anderson, and T. C. Lazo. 1984, 10p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Proceedings of International Symposium on Gaseous Dielectrics (4th), Knoxville, TN., April 29-May 3, 1984, p276-285.

Keywords: *Sulfur dioxide, *Gas analysis, *Electric corona, Sulfur hexafluoride, Mixtures, Chemical equilibrium, Concentration(Composition), *Tracer techniques, *Fluoride/sulfuryl, *Fluoride/thionyl.

Production rates for SOF2, SO2F2, and SO2 have been measured by quantitive gas analysis during continuous corona discharges in compressed SF6 containing trace levels (10 to 200 ppm) of water vapor for total gas pressures between 100 and 300 kPa. The rates are expressed both in terms of moles-per-unit of energy dissipated in the discharge, and in moles-per-unit of charge transported in the gap. Variations in the absolute and relative concentrations of H2O and SOF4 respectively were also monitored. Determinations were made of the polarity, power, and pressure dependences of these rates. The time rates-of-production for SOf2 and SO2F2 are more nearly proportional to the discharge current than to the power dissipation. The results indicate that the equilibrium concentration of H2O is significantly affected by the discharge. The influence of O2 and H2O on oxyfluoride production is discussed.

702,335

PB85-145159 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Daguerreotypes: A Study of the Plates and the Process.
Final rept.
A. Swan, C. E. Fiori, and K. F. J. Heinrich. 1979, 13p
Pub. in Scanning Electron Microscopy, n1 p411-423 Apr 79.

Keywords: *Photographic emulsions, *Chemical analysis, X ray analysis, Photographic plates, Substrates, Reprints, *Daguerreotypes, Scanning electron microscopy.

Daguerreotypy was the first widely used photographic process. The pictures consist of silver mercury amalgam particles on a silver substrate. It was necessary to develop a description and explanation of the process, since this was not available in the literature. The results of a detailed electron microprobe analysis of both pristine and deteriorated daguerreotypes are presented. The studies have shown that multiple interdependent deterioration processes are present involving not only the plate surface but also the copper support, the cover glass and the microclimate in the case.

702,336

PB85-145308 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS (National Bureau of Standards): Current Work and Future Plans in Reference Materials.
Final rept.
S. D. Rasberry. 1982, 3p
Pub. in Analytical Proceedings 19, n1 p5-7 1982.

Keywords: *Chemistry, Forecasting, Reprints, *Standard reference materials.

This paper is an extended abstract (1,000-word summary) of a talk presented to the Royal Society of Chemistry in London on 4 February 1981. It describes the status of the NBS program in Standard Reference Materials and indicates the directions planned for the program over the next five years.

702,337

PB85-145357 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Performance Characteristics of a Broad Range Ionization Gage Tube.
Final rept.
C. R. Tilford, K. E. McCulloh, and H. S. Woong. 1982, 4p
Pub. in Jnl. of Vacuum Science and Technology 20, n4 p1140-1143 1982.

Keywords: *Ionization gages, Performance evaluation, Calibrating, High pressure tests.

Seven commercial 'broad range' Bayard-Alpert ionization gage tubes were calibrated for nitrogen, argon, hydrogen, deuterium, and helium. The data showed an inexplicable grouping of the gage tubes into two distinct groups, one with small voltage coefficient typical of Bayard-Alpert gages, the other with much larger coefficients, such as expected from conventional triode gages.

702,338

PB85-148070 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pilot Environmental Specimen Bank Program.
Final rept.
S. A. Wise, and R. Zeisler. Oct 84, 6p
Pub. in Environmental Science and Technology 18, n10 p302A-307A 1984.

Keywords: *Environmental surveys, *Chemical analysis, Feasibility, Trace elements, Sampling, Pesticides, Samples, Cryogenic, Humans, Reprints.

Since 1980, the National Bureau of Standards has been involved in a pilot study to evaluate the feasibility of long-term environmental specimen banking as an important part of environmental monitoring. Human liver was selected as the first environmental sample type for the pilot program. Sampling, homogenization, and storage procedures, which were designed to avoid contamination of either trace inorganic or trace organic constituents, were developed and implemented. Analytical results are discussed for the determination of trace elements and organochlorine pesticide residues in samples collected during the first three years of this program.

702,339

PB85-148492 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS (National Bureau of Standards) Standard Reference Materials for Food Analysis.
Final rept.
R. Alvarez. 1984, 15p
Pub. in Modern Methods of Food Analysis, Chapter 5, p85-99 1984.

Keywords: *Food analysis, *Chemical analysis, *Beverages, Standards, Toxicology, Nutrients, Trace elements, Quality assurance, Laboratories, Concentration(Composition), Calibrating, Reprints, *Standard reference materials.

The National Bureau of Standards is responsible under Federal statute for issuing Standard Reference Materials (SRM's) to assist investigators improve the accuracy of their laboratory tests. For the food science laboratory, these well-characterized, certified materials are available to serve as accuracy-control materials; to prepare primary standard solutions; and to evaluate and monitor the performance of instruments and devices, such as polarimeters and spectrophotometers. Of the approximately 900 different SRM's listed in the current catalog, the biological matrix materials are especially suitable for long-term quality assurance of food analyses. Examples of these are: Oyster Tissue (SRM 1566), Bovine Liver (SRM 1577a), Wheat Flour (SRM 1577), Rice Flour (SRM 1568), and a Non-Fat Milk Powder (Proposed SRM 1549), expected to be issued in late 1983. The Certificate of Analysis for these SRM's include certified concentrations of nutritionally and toxicologically important elements. Other SRM's for food and beverage analysis include a stabilized wine and compounds of certified high purity, such as cholesterol. Additional SRM's have been developed for metabolic studies, such as Human Serum (SRM 909).

702,340

PB85-164952 PC **A08**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD.
Technical Activities 1984, Center for Analytical Chemistry.
Final rept.
R. A. Velapoldi, H. S. Hertz, and J. K. Taylor. Dec 84, 156p NBSIR-84/2979

Keywords: *Chemical analysis, *Standards, *Research projects, Inorganic compounds, Organic compounds, Particles, Gases.

This report summarizes the technical activities of the Center for Analytical Chemistry at the National Bureau of Standards. It emphasizes activities over the Fiscal Year 1984 in the Inorganic Analytical Research Division, the Organic Analytical Research Division, and the Gas and Particulate Science Division. In addition, it describes certain special activities in the Center including quality assurance and voluntary standardization coordination.

702,341

PB85-165900 PC **A04**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Materials.
Methods and Procedures Used at the National Bureau of Standards to Certify Sulfur in Coal SRM's (Standard Reference Materials) for Sulfur Content, Calorific Value, Ash Content.
Final rept.
T. E. Gills. Dec 84, 55p NBS/SP-260/94
Also available from Supt. of Docs as SN003-003-02629-8. Library of Congress catalog card no. 84-601148.

Keywords: *Chemical analysis, *Standards, *Sulfur, *Ash content, *Calorific value, Performance evaluation, Sampling, Mass spectroscopy, *Standard reference materials, Procedures.

This Special Publication consists of a collection of analytical methods used at NBS for the determination of total sulfur, calorific value, and ash content in four different coals, SRM's 2682, 2683, 2684, and 2685, with nominal sulfur contents of 0.5, 2.0, 3.0, and 4.5 percent, respectively. Also, included are descriptions of methods and procedures used for providing noncertified values for approximately 30 elements including carbon, hydrogen, and nitrogen. These procedures were selected and often specifically developed, by the scientific staff members of NBS, to provide measurements with the best obtainable accuracy and precision. The materials for these SRM's were obtained and processed by Valley Forge Laboratories under a grant from the National Bureau of Standards. Material preparation of the four coal SRM's is described in NBS Special Publication 260-84, 'Sampling, Materials Handling, Processing, and Packaging of Standard Reference Coal Materials.'

702,342

PB85-177947 PC **A05**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Principles of Quality Assurance of Chemical Measurements.
J. K. Taylor. Feb 85, 81p NBSIR-85/3105

Keywords: *Quality assurance, *Chemical analysis, *Chemical properties, *Measurement, Calibrating, Methodology, Sampling, Inspection, Experimental design, Standards, Standard reference materials.

The general principles of quality assurance of chemical measurements are discussed. They may be classified as quality control -- what is done to control the quality of the measurement process, and quality assessment -- what is done to evaluate the quality of the data output. Quality assurance practices are considered as a hierarchy with levels progressing from the analyst, the laboratory, the project, to the program. The activities of each level are different and depend upon the ones beneath it. Recommendations are presented for developing credible quality assurance practices at each level. An appendix contains outlines that may be used to develop the various documents associated with a quality assurance program.

702,343

PB85-183515 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Validation of the Sulfur Concentration of Selected Iron-Base NBS (National Bureau of Standards) Standard Reference Materials by Isotope Dilution Spark Source Mass Spectrometry.
Final rept.
R. W. Burke, P. J. Paulsen, E. J. Maienthal, and G. M. Lambert. 1982, 5p
Pub. in Talanta 29, n10 p809-813 1982.

Keywords: *Chemical analysis, *Sulfur, *Iron containing alloys, Concentration(Composition), Equilibrium, Reprints, *Standard reference materials, *Isotopic dilution spark source mass spectroscopy.

An isotopic dilution spark source mass spectrometric procedure has been developed for the accurate determination of sulfur in iron-base alloys. A sealed tube dissolution technique is used to prevent volatilization losses and to effect isotopic equilibration. Application of this technique to the reanalysis of existing NBS Standard Reference Materials yields results that are generally in good agreement with the certified values.

702,344
PB85-184737 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optical Waveguide Photon Plumbing for the Chemistry Lab: Fiber Optics, Waveguides, and Evanescent Waves as Tools for Chemical Analysis.
Final rept.
I. Chabay. 1982, 10p
Pub. in Analytical Chemistry 54, n9 p1071-1080 1982.

Keywords: *Laboratories, *Chemical analysis, *Fiber optics, *Waveguides, Spectrochemical analysis, Reviews, Reprints, *Evanescent waves, *Optical waveguides.

The use of waveguide optics to facilitate and enhance spectroscopic chemical analysis is becoming increasingly important. In this paper, the basic concepts and terminology of fiber optics, other forms of waveguide, and evanescent waves are discussed. Recent developments which use waveguides and evanescent waves for chemical analysis are reviewed.

702,345
PB85-186963 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Materials.
New Developments in NBS (National Bureau of Standards) Biological and Clinical Standard Reference Materials.
Final rept.
R. Alvarez, and G. A. Uriano. 1985, 25p
Pub. in Chapter 2 in Biological References Materials: Availability, Uses, and Need for Validation of Nutrient Measurement, p19-43 1985.

Keywords: *Chemical analysis, *Laboratory equipment, *Clinical chemistry, *Standards, Food analysis, Nutrition, Calibrating, Blood analysis, Trace elements, Iodine, Performance evaluation, *Standard reference materials, *Biological processes.

The National Bureau of Standards is responsible under Federal statutes for issuing Standard Reference Materials (SRM's) to help improve and assure the accuracy of laboratory tests. For food science and clinical laboratories, three types of SRM's are available: control materials with certified concentrations of constituents for monitoring the accuracy and precision of methods and experimental data; certified high purity materials for preparing primary standard solutions; and instrument performance SRM's for evaluating the performance of devices and instruments, such as spectrophotometers and thermometers.

702,346
PB85-187300 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Characterization of Polycyclic Aromatic Hydrocarbon Mixtures from Air Particulate Samples Using Liquid Chromatography, Gas Chromatography, and Mass Spectrometry.
Final rept.
S. A. Wise, S. N. Chesler, L. R. Hilpert, W. E. May, R. E. Rebbert, and C. R. Vogt. 1983, 15p
Pub. in Polynuclear Aromatic Hydrocarbons: Proceedings of Int. Symposium on Mechanisms, Methods and Metabolism (8th), p1413-1427 1983.

Keywords: *Aromatic polycyclic hydrocarbons, *Chemical analysis, *Particles, Standards, Gas chromatography, Mass spectroscopy, Samples, Mixtures, Air pollution, *Standard reference materials, *Air pollution detection, Liquid chromatography.

Two Standard Reference Material (SRM) air particulate samples were analyzed for the determination of polycyclic aromatic hydrocarbons (PAH). The analytical methods included the combined use of liquid chromatography (LC), gas chromatography (GC), and mass spectrometry (MS) to characterize the major and minor PAH components in the samples. The analytical methods and results for these two samples are reported.

702,347
PB85-187763 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quality Assurance of Chemical Measurements.
Final rept.
J. K. Taylor. 1981, 9p
See also PB85-140671.
Pub. in Analytical Chemistry 53, n14 p1588A-1596A 1981.

Keywords: *Quality assurance, *Chemical analysis, Sampling, Tables(Data), Quality control, Reviews, Standards, Reprints, Standard reference materials.

This paper presents an overview of the practices that are considered to be essential for quality assurance of analytical chemical data. Proper attention must be given to planning the work, sampling, and the selection of the methodology, as well as the actual measurement process. Quality control and the development and use of control charts are discussed. The need for data review and adequate documentation are stressed. The role of SRM's for quality assurance is discussed.

702,348
PB85-189348 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Quality Assurance and Protocols in Sampling and Sample Preparation of Biological Samples.
Final rept.
R. Zeisler, and S. A. Wise. 1985, 23p
Pub. in Chapter 15 in Biological Reference Materials: Availability, Uses, and Need for Validation of Nutrient Measurement, p257-279 1985.

Keywords: *Samples, *Trace elements, *Quality assurance, *Environmental surveys, *Chemical analysis, Sampling, Concentration(Composition), Liver, Storage, Laboratories, *Biological processes.

The apparent concentrations of trace constituents in biological samples, as opposed to the true concentrations, can be critically influenced by sampling steps prior to analysis. A multilevel approach is required to preserve a valid subsample for subsequent analysis, which is representative of the original bulk materials. In the NBS/EPA pilot program for environmental specimen banking, sampling protocols, sample preservation techniques and subsampling procedures have been developed and evaluated. A sampling protocol for human livers based on the above considerations is presented as the core of the pre-analysis quality assurance plan. This protocol includes step-by-step instructions for sampling the liver specimens and it can easily be modified to the use in sampling other tissues. Features of the protocol include: Use of special implements and/or techniques to minimize contamination during sample excision; shipment and storage of the samples under clean conditions at cryogenic temperatures; sample preparation in clean laboratories; and homogenization by a cryogenic homogenization technique that uses Teflon mills. The above steps provide a controlled basis for the analytical measurements which results in more accurate and intercomparable data.

702,349
PB85-195949 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Raman Microprobe Spectroscopy.
Final rept.
G. J. Rosasco. 1980, 60p
Pub. in Advances in Infrared Raman Spectroscopy, p223-282 1980.

Keywords: *Raman spectroscopy, Reviews, Design criteria, Performance evaluation, Chemical analysis, Sampling, Laboratory equipment, Reprints, *Raman microprobe spectroscopy.

Developments in Raman microprobe spectroscopy are reviewed. Instrument design and performance are described, formulae which allow estimates of the limits in spatial resolution and detection are presented. Microanalytical applications in the fields of biology, pathology, mineralogy, geology, environmental analysis, industrial quality control and general chemical and materials characterization are reviewed. Formulae for estimating sample heating by absorption of the excitation laser probe beam are presented. Effective sampling volumes for microprobe collection optics are derived. The optical phonon modes of small particles and a theoretical treatment of inelastic scattering by the vibrational modes of small particles are discussed.

702,350
PB85-196087 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photoacoustic Detection of HCl.
Final rept.
A. Fried, and W. Berg. 1983, 3p
Pub. in Optics Letters 8, n3 p160-162 Mar 83.

Keywords: *Trace elements, *Hydrogen chloride, Performance evaluation, Laboratory equipment, Reprints, *Atmospheric chemistry, *Photoacoustic effect.

A sensitive photoacoustic detection system for trace atmospheric measurements of HCl is described. The results reported here suggest the capability of measuring HCl at the 50 ppb level with a prototype laboratory system. Further system improvements and atmospheric measurements considerations are discussed.

702,351
PB85-197515 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Preparation and Certification of Standard Reference Materials to Be Used in the Determination of Retained Austenite in Steels.
Final rept.
G. E. Hicho, and E. E. Eaton. 1983, 4p
Pub. in Advances in X-Ray Analysis 26, p137-140 1983.

Keywords: *Chemical analysis, *X ray fluorescence, *Austenite, *Steel constituents, *Stainless steels, Standards, X ray analysis, X ray diffraction, Calibrating, Reprints, *Standard reference materials.

X-ray Standard Reference Materials have been prepared to aid diffractionists in their determination of retained austenite in hardened steels. Using powder metallurgical techniques, two groups of powder compacts, containing nominally 5, and 30% austenite in a matrix of ferrite, were prepared from 310 austenitic stainless steel and 430 ferritic stainless steel powders. The compacts, approximately 21 mm diameter, 3 mm thick, were subsequently ground, polished, and characterized. The significant difference in nickel contents of each component, 20 weight percent in the 310 as compared to .09 in the 430, allowed the use of X-ray fluorescence to determine the weight percent nickel on each compact's surface. Compacts were then ranked from lowest to highest nickel content and a predetermined number of samples were selected from each population in order to establish calibration curves. Each calibration curve related the weight percent nickel, as determined by X-ray fluorescence, to the area percent austenite as determined by quantitative metallographic examination of a compact's stained surface. Using the calibration curve, the area percent austenite (i.e., volume percent) was subsequently assigned to each corresponding weight percent nickel. A number of specimens were selected from each group and the volume percent austenite was determined by X-ray diffraction. Results show good agreement with the value obtained from the calibration curve for these compacts.

702,352
PB85-201895 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Role of Fast Secondary Electrons in Degrading Spatial Resolution in the Analytical Electron Microscope.
Final rept.
D. C. Joy, D. E. Newbury, and R. L. Myklebust. 1982, 2p
Pub. in Jnl. of Microscopy 128, pt. 2, pRP1-RP2 Nov 82.

Keywords: *Chemical analysis, *X ray analysis, *Electron microscopes, Monte Carlo methods, Reprints.

Fast secondary electrons generated by high energy beam electrons scatter at angles which carry them lat-

erally through a thin foil. Monte Carlo electron trajectory simulation of this effect reveals that fast secondary electrons degrade the spatial resolution of analysis by means of analytical electron microscopy. The magnitude of the effect increases as the edge energy of the x-ray of interest decreases.

702,353
PB85-201911 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Karl Fischer Titration Equation on Mass Basis.
Final rept.
F. E. Jones. 1983, 1p
Pub. in Analytical Chemistry 55, n4 p793 1983.

Keywords: *Water, *Mass, *Volumetric analysis, *Karl Fischer reagent, Calibrating, Reprints, Numerical solution.

In a previously published paper on the application of automatic Karl Fischer titration to the determination of water, an equation used to calculate present H2O was presented. In this equation, advantage was taken of the precision and convenience of the use of calibrated syringes for measuring volume several quantities. It is the purpose of this correspondence to present an equation in which these quantities are measured on a mass basis.

702,354
PB85-201994 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Spectrograph with a Multichannel Optical Detector for the Raman Characterization of Microparticles.
Final rept.
F. J. Purcell, and E. S. Etz. 1982, 6p
Sponsored by Microbeam Analysis Society, Bethesda, MD.
Pub. in Proceedings of Annual Conference of the Microbeam Analysis Society (17th), Washington, DC., August 9-13, 1982, p301-306.

Keywords: *Raman spectroscopy, *Optical equipment, *Spectrographs, Laboratory equipment, Particles, Performance evaluation, Design criteria, *Laser spectroscopy, Air pollution detection, State of the art.

A new triple spectrograph, developed by a U.S. optical instrumentation firm, has been evaluated in a prototype instrument configuration for low light level Raman scattering experiments from single microparticles. In conjunction with an argon ion laser as a Raman excitation source, an advanced fore-optical microsampling system designed around a microscope, and a state-of-the-art optical multichannel analyzer utilizing a linear diode array detector, the system represents a new type of Raman microprobe. The basic configuration of the system is described with emphasis on the new spectroscopic advances embodied in the prototype instrument. The important performance characteristics are compared to currently used micro-Raman instrumentation employing monochannel, scanning systems. The spectral multiple advantage in the acquisition of micro-Raman spectra is demonstrated with examples from the measurement of laser radiation sensitive microparticles. Highlighted are the advantages of fast data acquisition under conditions of broad spectral coverage. Preliminary results are presented from the analysis of 'real-world' microsamples (e.g., power plant stack particulates). These are placed in the perspective of the current state of the field of micro-Raman spectroscopy.

702,355
PB85-202695 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Sample Dissolution Procedures on X-ray Spectrometric Analysis of Biological Materials.
Final rept.
P. A. Pella, H. M. Kingston, J. R. Sieber, and L. Y. Feng. 1983, 2p
Pub. in Analytical Chemistry 55, n7 p1193-1194 1983.

Keywords: *Bioassay, *X ray spectroscopy, *X ray fluorescence, Cation exchange, Liver, Trace elements, Solution, Comparison, Sampling, Separation, Chemical analysis, Reprints, *Standard reference materials.

X-ray fluorescence analysis of NBS-SRM 1577, 1577a, 1577b, Bovine liver and NBS-SRM 1575 pine needles was performed after separation and preconcentration of traces of Mn, Fe, Cu, and Zn or cation exchange resin filters. Sample dissolution techniques were modified to improve the iron recovery from 60 to 90%. Results were compared to NBS certificate values and were in agreement within 10%.

702,356
PB85-202851 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Performance Characteristics of a Continuum-Source Echelle Wavelength Modulated Atomic Absorption Spectrometer.
Final rept.
J. D. Messman, M. S. Epstein, T. C. Rains, and T. C. O'Haver. 1983, 4p
Pub. in Analytical Chemistry 55, n7 p1055-1058 1983.

Keywords: *Chemical analysis, Standards, Laboratory equipment, Design criteria, Performance evaluation, Continuum mechanics, Spectral lines, Reprints, *Atomic absorption spectrometers, Standard reference materials.

The operational features of a single-channel atomic absorption spectrometer based on a continuum source and an echelle monochromator modified for wavelength modulation (CEWM-AA) are described. Characteristic concentrations, detection limits, and upper concentration limits of approximately 100 spectral lines for 32 elements were experimentally determined by CEWM-AA using air-acetylene and nitrous oxide-acetylene flames. Detection limits of CEWM-AA are generally within an order of magnitude of line-source atomic absorption (AAL) detection limits for those elements with analysis lines above 240 nm. When using optimal lines for CEWM-AA, only Zn, Te, Sb, Cd, and Pd of the 32 elements investigated have detection limits which are inferior to AAL detection limits by more than an order of magnitude. Analyses of several NBS Standard Reference Materials (SRMs) using either flame or graphite electrothermal atomizers demonstrated comparable analytical performance between CEWM-AA and the AAL system operated in the background correction mode (AAL-BC).

702,357
PB85-203495 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Innovations in Atomic Absorption Spectrometry with Electrothermal Atomization for Determining Lead in Foods.
Final rept.
T. C. Rains, T. A. Rush, and T. A. Butler. 1982, 5p
Pub. in Jnl. of the Association of Official Analytical Chemists 65, n4 p994-998 1982.

Keywords: *Food analysis, *Lead(Metal), Chemical analysis, performance evaluation, Comparison, Reprints, *Atomic absorption spectroscopy, *Electrothermal atomization, Standard reference materials.

A simple and rapid method is described for the determination of lead in foods. The samples are digested in HNO3, HF, and HClO4 and then the lead is determined by atomic absorption spectrometry using an electrothermal atomizer with the L'vov platform. Interferences and ways to improve the precision and accuracy of the analysis were studied. Matrix modification using 1 percent ammonium phosphate was found to alleviate most interferences encountered. The precision and accuracy of the method was evaluated using NBS-SRM 1570 Spinach and SRM 1566 Oyster Tissue. The values obtained are in good agreement with the certified values.

702,358
PB85-203545 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Effects of Instrumental Artifacts on the Quantitative Determination of Oxygen in Silicon by FTIR (Fourier Transform Infrared).
Final rept.
A. Baghdadi. 1984, 15p
Pub. in American Society for Testing and Materials, Special Technical Publication 850, p343-357 1984.

Keywords: *Chemical analysis, *Oxygen, *Infrared spectroscopy, Silicon, Reprints, *Fourier transform spectroscopy.

The evolution of silicon processing technologies towards greater reliance on internal gettering by oxygen precipitates has led to the need for greater precision in the measurement of the interstitial oxygen content of silicon slices. This measurement is presently being carried out with the use of Fourier Transform Infrared (FTIR) spectrophotometers. This paper concerns the investigation of the effects of changing the apodization function and beam geometry on the quantitative determination of oxygen in silicon by FTIR. The apodization functions used include the boxcar, cosine, Happ-Genzel, and triangular functions. The beam geometry is varied by placing apertures between the interferometer and the silicon specimen. The effects of beam polarization and detector nonlinearity were also investigated.

702,359
PB85-203560 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Materials.
Standard Solutions and Certified Reference Materials.
Final rept.
R. Alvarez. 1984, 8p
Pub. in Official Methods of Analysis of the Association of Official Analytical Chemists, Chapter 50, p1002-1009 1984.

Keywords: *Standards, Solutions, Reprints, *Certified reference materials.

No abstract available.

702,360
PB85-205201 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Preparation of Gas Cylinder Standards for the Measurement of Trace Levels of Benzene and Tetrachloroethylene.
Final rept.
W. P. Schmidt, and H. L. Rook. 1983, 5p
Pub. in Analytical Chemistry 55, n2 p290-294 1983.

Keywords: *Trace elements, *Gas cylinders, *Standards, *Gravimetric analysis, *Chemical analysis, Performance evaluation, Mixtures, Reprints, *Benzene, *Ethylene/tetrachloro.

A procedure to prepare primary gas cylinder standards for benzene and tetrachloroethylene at trace levels (0.2-10 ppm) was developed. Gas mixtures prepared by this procedure were intercompared using GC-FID over a period of one year and were determined to be stable and accurate. Mixtures of these organics in nitrogen were generated dynamically using gravimetrically-calibrated permeation tubes and these mixtures were compared with the gas cylinder standards to further confirm the accuracy of the preparative technique.

702,361
PB85-205755 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reference Materials - What They Are and How They Should Be Used.
Final rept.
J. K. Taylor. 1983, 3p
Pub. in Jnl. of Testing and Evaluation 11, n6 p385-387 1983.

Keywords: *Chemical analysis, *Measurement, Reprints, Standard reference materials, Quality control.

The role of reference materials in monitoring the chemical measurement process is considered. Requirements for reliable reference materials are reviewed. The use of reference material data in estimating the uncertainties of the results of measurements on test samples is discussed.

702,362
PB85-205763 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Practical Limits of Precision in Inductively Coupled Plasma Spectrometry.
Final rept.
R. L. Watters. 1983, 10p
Pub. in American Laboratory 15, n3 p16-25 1983.

Keywords: *Chemical analysis, *Calibrating, Performance evaluation, Emission spectroscopy, Reprints, *Inductively coupled plasma spectroscopy.

Quantitative analysis using the Inductively Coupled Plasma (ICP) technique involves a series of measurement procedures. In order to evaluate the overall precision of the technique, non-random errors must be eliminated and the random error of each step in the measurement process must be considered. Calibration functions, spectral overlap corrections, blank corrections, and other factors are often treated as nonvariable quantities. Approaches to including the error associated with these steps are presented. Using these approaches will enable the analyst to construct realistic confidence limits on the final ICP results.

702,363
PB85-205854 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Look at the Electronic Analytical Balance.
Final rept.
M. Schoonover. 1980, 8p
Pub. in Analytical Chemistry 54, n8 p973-980 1982.

Keywords: *Weight indicators, *Electric equipment, Measuring instruments, Weight(Mass), Performance evaluation, Reprints.

Today electronic balances are being used for everything from counting batches of resistors to adjusting the component ratio of epoxy mixtures. Many of these balances are suitable for the most demanding analytical work while others are less precise but serve many purposes well. The paper describes the general principles of the modern electronic analytical balance.

702,364
PB85-205953 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Identification of Lead Sources in California Children Using the Stable Isotope Ratio Technique.
Final rept.
Y. Yaffe, C. P. Flessel, J. J. Wesolowski, A. del Rosario, G. N. Guirguis, V. Matias, J. W. Gramlich, W. R. Kelly, T. E. DeGarmo, and G. C. Coleman. 1983, 9p
Pub. in Archives of Environmental Health 38, n4 p237-245 1983.

Keywords: *Lead(Metal), *Isotopic labeling, *Public health, *Children, *Blood analysis, Paints, Soil analysis, Sources, Mass spectroscopy, Concentration(Composition), California, Chemical analysis, Reprints, *Environmental health, Oakland(California), Case studies.

Two case studies applying the lead isotope ratio method to the identification of lead sources in twelve Oakland, CA children are presented. One study examined lead sources in ten children, ages 3 to 15 years, living together as an extended family in dilapidated housing close to a busy freeway. A second case study examined two-year old male twins, both with elevated blood lead and erythrocyte protoporphrin levels, living in a modest but well maintained inner city duplex-apartment. Paint and surface soil samples collected in and around both households had high lead concentrations. The isotopic ratios of lead in the bloods of these children were close to the average lead ratios of paints from exterior walls and to the lead ratios of surface soils in adjacent areas where the children played. In both case studies, the data suggest that the lead in the soil was derived mainly from weathering of lead-based exterior paints and that the lead-contaminated soil was a proximate source of lead in the blood of the children.

702,365
PB85-206068 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
NBSGSC - A FORTRAN Program for Quantitative X-ray Fluorescence Analysis.
Technical note (Final).
G. Y. Tao, P. A. Pella, and R. M. Rousseau. Apr 85, 124p NBS/TN-1213
Also available from Supt. of Docs as SN003-003-02653-1. Prepared in cooperation with Geological Survey of Canada, Ottawa (Ontario).

Keywords: *X ray analysis, *Spectral energy distribution, *X ray fluorescence, Spectrometers, Chemical analysis, Oxides, Alloys, Minerals, Computation, Quantitative analysis, Fortran, Computer programs, Concentration(Composition), Standards, X ray tubes, Gamma radiation, *Alpha coefficients.

A FORTRAN program (NBSGSC) was developed for performing quantitative analysis of bulk specimens by x-ray fluorescence spectrometry. This program corrects for x-ray absorption/enhancement phenomena using the comprehensive alpha coefficient algorithm proposed by Lachance (COLA). NBSGSC is a revision of the program ALPHA and CARECAL originally developed by R.M. Rousseau of the Geological Survey of Canada. Part one of the program (CALCO) performs the calculation of theoretical alpha coefficients, and part two (CALCOMP) computes the composition of the analyte specimens. The analysis of alloys, pressed minerals, and fused specimens can currently be treated by the program. In addition to using measured x-ray tube spectral distributions, spectra from seven commonly used x-ray tube targets could also be calculated with an NBS algorithm included in the program. NBSGSC is written in FORTRAN IV for a Digital Equipment Corporation (DEC PDP-11/23) minicomputer using RLO2 firm disks and an RSX 11M operating system.

702,366
PB85-207157 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Picosecond Streak Camera Fluorometry: A Review.
Final rept.
A. J. Campillo, and S. L. Shapiro. 1983, 19p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Jnl. of Quantum Electronics QE-19, n4 p585-603 Apr 83.

Keywords: *Laboratory equipment, *Fluorometers, Reviews, Fluorescence, Design criteria, Performance evaluation, Chemical analysis, Reprints, *Picosecond pulses.

A general tutorial survey is presented describing the use of ultrafast streak cameras in picosecond fluorometry. Current instruments exhibit time resolutions of 1 to 10 ps with detection sensitivities of a few photoelectrons. When linear photoelectric recording is employed, a real-time direct display of optical transients is provided. Representative examples from the literature in physics, chemistry, and biology are given as well as an extensive bibliography.

702,367
PB85-207397 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Gravimetric Technique for the Preparation of Accurate Trace Organic Gas Standards.
Final rept.
G. C. Rhoderick, W. F. Cuthrell, and W. L. Zielinski. 1985, 8p
Sponsored by Air Pollution Control Association, Pittsburgh, PA. and American Society for Quality Control, Inc., Milwaukee, WI.
Pub. in Proceedings of APCA/ASQC (Air Pollution Control Association/American Society for Quality Control) Speciality Conf. on Quality Assurance in Air Pollution Measurements, Boulder, Co., October 14-18, 1984, p239-246 1985.

Keywords: *Trace elements, *Gravimetric analysis, *Standards, *Hazardous materials, *Organic compounds, Chemical analysis, Concentration(Composition), *Air pollution detection.

An accurate procedure based on micro-gravimetry has been used for the preparation of volatile, hazardous organic chemicals in a nitrogen matrix in pressurized gas cylinders at analyte concentrations ranging from 10 ppb to 10 ppm, by mole. In this technique, the organics of interest are individually weighed into separate glass capillary tubes using a micro-analytical balance. A number of these gravimetric primary mixtures have been prepared and analytically intercompared using gas chromatography (GC) with flame-ionization detection (FID). The paper will focus on a description of the micro-gravimetric technique and the analytical system, and will discuss the estimation of specific uncertainties associated with the preparation of these mixtures and how these uncertainties are used to assign a net uncertainty to the final analyte concentration. Particular attention will be given to mixtures at the 10 to 150 ppb level. A brief description of how the overall network of gravimetric primary standards is used to provide data quality consistency for trace organic gas mixtures over the long-term is included.

702,368
PB85-207439 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Systematics of Multielement Determination with Resonance Ionization Mass Spectrometry and Thermal Atomization.
Final rept.
L. J. Moore, J. D. Fassett, and J. C. Travis. Dec 84, 6p
Pub. in Analytical Chemistry 56, n14 p2770-2775 Dec 84.

Keywords: *Chemical analysis, Mass spectroscopy, Metastable state, Excitation, Atomizing, Photoionization, Atomic energy levels, Reprints, *Laser spectroscopy, *Thermal atomization, *Resonance ionization spectroscopy.

The systematics for multielement determination using resonance ionization mass spectrometry and thermal atomization is developed. The aspects of atomization, ionization, and detection are discussed and resonance ionization is demonstrated for 19 elements. The selective, sequential ionization of seven elements from a single sample is also demonstrated. A one-wavelength, two-photon ionization scheme generally is used in which the first photon excites a bound transition in the near-ultraviolet region and second photon promotes the electron into the ionization continuum. The wavelength-dependent ion formation from the thermally produced atom reservoirs is demonstrated for these elements by scanning a Nd: YAG-pumped dye laser across its tunable wavelength range. The observed wavelengths where ionization occurs have been correlated where possible with allowed transitions between known electronic energy levels. The elements accessible by using four common dyes are tabulated. More than 20 elements are accessible within the wavelength of each dye.

702,369
PB85-221901 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Validation of Analytical Methods.
Final rept.
J. K. Taylor. 1983, 9p
Pub. in Analytical Chemistry 55, n6 pA600-A608 1983.

Keywords: *Chemical analysis, *Laboratory equipment, Standards, Quality assurance, Reprints, *Reference materials, Procedures.

Chemical measurements are made using procedures which operationally describe the methodology employed. A valid method is one which is capable of producing data of adequate quality for the intended use. Such methods are based upon sound principles established as the result of research and development endeavors of the scientific and technical community. Methods based on such validated measurement principles are developed and tested by individual scientists and are frequently reduced to practical procedures by standardization bodies. Such procedures should clearly describe both their utility and limitations. However, it remains the responsibility of each individual analyst to validate the applicability of every method and procedure used in each measurement situation, since he, alone, is responsible for the validity of his data. The use of reference materials, as available, is an excellent way to accomplish the above purpose, but other approaches are possible. The rationale behind all of the above is described and discussed.

702,370
PB85-225688 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Determination of Nitro-Polynuclear Aromatic Hydrocarbons in Diesel Soot by Liquid Chromatography with Fluorescence and Electrochemical Detection.
Final rept.
W. A. MacCrehan, and W. E. May. 1985, 12p
Pub. in Proceedings of Int. Symp. Polynuclear Aromatic Hydrocarbons: Mechanisms, Methods, and Metabolism (8th), p857-869 1985.

Keywords: *Aromatic polycyclic hydrocarbons, *Exhaust emissions, *Fluorescence, *Electrochemistry, *Nitroaryl compounds, *Chemical analysis, *Soot, Distillation, Sampling, Air pollution, *Air pollution detection, *High performance liquid chromatography, *Diesel engine exhaust.

Two new detection approaches for the HPLC determination of nitro-polynuclear aromatic hydrocarbons (N-PAH) are described. The molecular fluorescence method is based on the reduction of the nitro group to the fluorescent amine using a post-column zinc reductor. Wavelength programming is used to improve the selectivity and sensitivity of the detection of N-PAH. The electrochemical detection method uses the reduction current of the nitro group for measurement of the N-PAH. A differential pulse waveform is used to enhance the selectivity of the detector. Sample preparation methods for N-PAH in diesel soot are described.

702,371
PB85-227593 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

Determination of Dibenzothiophene in Oils by Liquid Chromatography-Tandem Mass Spectrometry.
R. G. Christensen, and E. White. 1985, 4p
Pub. in Jnl. of Chromatography 323, p33-36 1985.

Keywords: *Trace elements, *Chemical analysis, *Fuel oil, *Crude oil, Chromatographic analysis, Mass spectroscopy, Sampling, Reprints, *Liquid chromatography, *Dibenzothiophene.

Quantitative trace analysis for organic compounds in complex matrices such as oils often requires time-consuming sample pretreatment. Two examples are shown of the use of a highly selective tandem mass spectrometer as a liquid chromatographic detector for the quantification of dibenzothiophene in a crude petroleum oil and in an alternate fuel oil. No sample preparation except an appropriate dilution was required. A preconcentrating liquid chromatography-mass spectrometry interface was used, allowing detection limits of ca. 20 microgram to be attained.

702,372
PB85-229458 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Software for Liquid Size Exclusion Chromatography Data Collection and Analysis.
Final rept.
J. D. Barnes, B. Dickens, and F. L. McCrackin. 1985, 8p
Pub. in Proceedings of the ACS (American Chemical Society) Division of Polymeric Materials: Science and Engineering, Miami Beach, Florida, v52 p291-298 Apr 85.

Keywords: *Chromatographic analysis, *Operating systems(Computers), *Data processing, Fortran, Molecular weights, Automation, Laboratories, *Liquid size exclusion chromatography, *Computer software, *Applications programs(Computers), *Computer aided analysis, Computer applications.

The paper describes software that is used for data collection and analysis from a size-exclusion liquid chromatograph. The chromatograph is a commercially available instrument that provides on board microprocessor control of the specimen injection functions. The authors use a commercially available microcomputer as a passive listener connected to the chromatograph output to collect, store, and analyze the data. The data collection and analysis software is written in FORTRAN. Maximum use is made of graphical displays to aid the user's judgement in interpreting the data. All operations are menu driven, so that the user does not need to be familiar with the computer's operating system. Data archiving functions are built in to facilitate after-the-fact retrieval of the data.

702,373
PB85-237360
(Order as PB85-237329, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Ways to Standardization in Electrophoresis Are Brought to Light.
1985, 4p
Included in Jnl. of Research of the National Bureau of Standards, v90 n3 p259-262 May-Jun 85.

Keywords: *Electrophoresis, *Standards, *Meetings, Bioassay, Chemical analysis, Laboratory equipment.

A workshop entitled Electrophoresis Standardization: Approaches and Needs, drew 54 participants to the National Bureau of Standards (NBS) June 25, 1984. Co-sponsored by NBS and the Electrophoresis Society of the Americas, the meeting was hosted by the NBS Center for Analytical Chemistry. The first series of talks discussed various needs for standardization. Subsequent talks described how different laboratories approach standardization. Summaries of some of the talks are given in the review. A monograph containing edited versions of the papers was scheduled for release this spring.

702,374
PB86-109956 PC **A04**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD.
Chlorine Content of Municipal Solid Waste from Baltimore County, MD. and Brooklyn, NY.
K. L. Churney, A. E. Ledford, S. S. Bruce, and E. S. Domalski. Sep 85, 66p NBSIR-85/3213
Contract DE-A101-83-CE30801
Sponsored by Department of Energy, Washington, DC., and New York City Dept. of Sanitation.

Keywords: *Chlorine, *Chemical analysis, *Sulfur, *Materials tests, Sampling, Sites, Concentration(Composition), Air pollution, Paper products, Composite materials, *Municipal wastes, Air pollution sampling, Air pollution detection, Solid wastes, Baltimore County(Maryland), Brooklyn(New York), Refuse derived fuels.

The total chlorine and water soluble chlorine contents of the components of municipal solid waste (MSW) have been determined from sampling studies carried out at two sites, Baltimore County, MD and Brooklyn, NY for a five-day period. The component which contributed the largest fraction to the chlorine content in Baltimore County, MD was the paper fraction while in Brooklyn, NY, the plastics fraction provided the major contribution (0.46 mass % or 52% of the total chlorine). Chemical analyses for sulfur content were performed on composite samples for each day of sampling at the two sites. American Society for Testing and Materials (ASTM) standard methods for sulfur, total chlorine, and water soluble chlorine contents, developed for refuse-derived fuel, were used in performing the analyses.

702,375
PB86-110129 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Investigation of Wood Pyrolysis Using Solid State (13)C Nuclear Magnetic Resonance.
Final rept.
W. L. Earl. 1982, 17p
Pub. in Proceedings of 1981 International Conference on Residential Solid Fuels, Environmental Impacts and Solutions, Portland, OR., June 1-4, 1981, p772-778 1982.

Keywords: *Nuclear magnetic resonance, *Wood, *Combustion, *Char, Pyrolysis, Carbon 13, Isotopic labeling, Chemical analysis, Heat transfer, Aromatic polycyclic hydrocarbons, *Air pollution detection.

The present state of the art in 13C NMR of solids yields spectra with narrow lines which are useful for obtaining chemical information in intractable solids. These NMR techniques have been applied to the analysis of a series of chars obtained by subjecting spruce and oak wood to temperatures between 550 and 660 K in nitrogen. The NMR spectra obtained indicate that the cellulose starts to decompose before lignin but by 615 K both components are decomposing. The solid char formed is highly aromatic, probably being composed of a large variety of poly-nuclear aromatics. It is suggested that the rate of pyrolysis is determined by the rate of heat transfer in woody samples.

702,376
PB86-110145 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Empirical Quantitation in Raman Microprobe Analysis.
Final rept.
E. S. Etz. 1981, 6p
Pub. in Proceedings of Annual Conference of Microbeam Analysis Society (16th), Vail, CO., July 13-17, 1981, p73-78.

Keywords: *Raman spectroscopy, *Microanalysis, *Probes, Chemical analysis, Calcium phosphates, Bioassay, Elastic scattering, Forecasting, Sampling.

A non-rigorous exposition of the problems of quantitation in Raman microprobe analysis is presented. The micro-Raman scattering characteristics are reviewed, highlighting analytical advantages and limitations as they apply to the considerations for quantitative analysis. The concepts of quantitation valid for bulk samples are extended to scattering from microscopic samples and the difficulties noted. The conclusions that can be drawn from the results of current on elastic scattering theories are formulated and taken as a basis for the argument that empirical approaches are likely to produce adequate quantitative data for present requirements. The case for calibration methods based on the use of standards is presented by a discussion of NBS results obtained in the quantitative estimation of carbonate contents on biological apatites. Future directions are noted that promise to advance the prospects for micro-Raman quantitation.

702,377
PB86-110830 PC **A07**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Summary of the Coal, Ore, Mineral, Rock, and Refractory Standards Issued by the National Bureau of Standards.
T. E. Gills, and R. Mavrodineanu. Sep 85, 137p NBS/SP-260/97
Also available from Supt. of Docs as SN003-003-02688-3. Library of Congress catalog card no. 85-600577.

Keywords: *Coal, *Nonmetalliferrous minerals, *Minerals, *Rocks, *Refractories, *Chemical analysis, *Metalliferous minerals, Standards, Beneficiation, *Standard reference materials, Listings.

The publication is a summary of the coal, ore, mineral, rock, and refractory standards issued by NBS as Standard Reference Material (SRM's). The material, composition, certification, use, and remarks concerning each of the SRM's described are presented in tabular form. Copies of the certificates of these SRM's are contained in the appendix for more detailed information.

702,378
PB86-110897 PC **A06**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Handbook for SRM (Standard Reference Materials) Users.
Final rept.
J. K. Taylor. Sep 85, 101p NBS/SP-260/100
Also available from Supt. of Docs as SN003-003-02689-1. Library of Congress catalog card no. 85-600576.

Keywords: *Handbooks, *Chemical analysis, *Guidelines, Performance evaluation, Quality assurance, Measurements, Calibrating, Statistical analysis, Laboratory equipment, *Standard reference materials.

The handbook was prepared to provide guidance for the use of Standard Reference Materials (SRM's) to provide an accuracy base for chemical measurements. The general concepts of precision and accuracy are discussed and their realization by quality assurance of the measurement process. General characteristics of SRM's are described and guidance is given for their selection for specific applications. Ways to effectively use SRM's are recommended, utilizing control charts to evaluate and monitor measurement accuracy. Appendices probide statistical guidance on the evaluation of measurement uncertainty.

702,379
PB86-111358 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Quantitative Electron Probe Microanalysis of Fly Ash Particles.
Final rept.
R. L. Myklebust, J. A. Small, and D. E. Newbury. 1982, 10p
Pub. in Proceedings of the American Nuclear Society Conference on Atomic and Nuclear Methods in Fossil Energy Research, Mayaguez, PR., December 1-4, 1980, p285-294 1982.

Keywords: *Fly ash, *Particles, *Chemical analysis, *Electron probes, X-ray analysis, Air pollution, *Air pollution detection, Standard reference materials.

Fly ash particles or other similar particles may be quantitatively analyzed with a flat sample matrix correction method that has been modified to include the peak-to-background ratio for each element as a normalizing factor. The effects of the different matrix corrections on particles is discussed. Examples of analyses of standard reference material glass particles by both a standard matrix correction program (FRAME C) and a modified correction program (FRAME P) are presented as well as analyses of fly ash (SRM-1633).

702,380
PB86-111762 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Round Robin Test on ELS (Electron Energy Loss Spectroscopy) Quantitation.
Final rept.
D. C. Joy, and D. E. Newbury. 1981, 3p
Pub. in Proceedings of Annual Conference of the Microbeam Analysis Society (16th), Vail, Co., July 13-17, 1981, p178-180 1981.

Keywords: *Carbon, *Chemical analysis, Electron microscopy, *Electron energy loss spectroscopy, *Scanning electron microscopy, *Transmission electron microscopy.

A round robin test has been performed for analysis by electron energy loss spectroscopy on the analytical electron microscopy. Carbon thin films were measured and several parameters were calculated from the spectrum, including the number of atoms per square centimeter of target, the pre-absorption and post-absorption edge, exporential background parameters, and the total spectrum intensity to zero-loss intensity ratio. Good agreement for these parameters among three of the participating laboratories was noted. Substantial disagreement in two other measurements is attributed to errors in data collection and/or reduction.

702,381
PB86-112034 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Further Developments in the High-Precision Coulometric Titration of Uranium.
Final rept.
T. Tanaka, G. Marinenko, and W. F. Koch. 1985, 6p
Pub. in Talanta 32, n7 p525-530 1985.

Keywords: *Uranium, *Chemical analysis, *Volumetric analysis, *Coulometers, Experimental design, Performance evaluation, Reprints.

An experimental study of the current efficiency in the coulometric generation of Ti(III), as a function of electrolyte composition, current density and electrode material, has been performed. The cathodes investigated include platinum, mercury and graphite. The first two are suitable for high-precision determination of uranium. The graphite surface is readily poisoned, rendering it useless for high-accuracy work. The use of mercury requires thorough removal of chloride from the system. The precision and error obtained are comparable for both the mercury and platinum cathodes, and are of the order of 50 ppm.

702,382
PB86-112067 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Factors Affecting the Reversed-Phase Liquid Chromatographic Separation of Polycyclic Aromatic Hydrocarbon Isomers.
Final rept.
S. A. Wise, and L. C. Sander. May 85, 8p
Pub. in Jnl. of High Resolution Chromatography and Chromatography Communications 8, p248-255 May 85.

Keywords: *Aromatic polycyclic hydrocarbons, *Chemical analysis, *Chromatographic analysis, Separation, Mathematical models, Polymers, Reprints, *Reversed phase liquid chromatography, Monmers.

Reversed-phase liquid chromatography (LC) on C18 stationary phases provides excellent selectivity for the separation of polycyclic aromatic hydrocarbons (PAH). Recent studies have shown that several factors affect selectivity for the LC separation of PAH including phase type (monomeric or polymeric), pore diameter and surface area of the silica substrate, and surface density of the C18 ligands. In this paper the separation of eleven PAH isomers of molecular weight 278 is used to further illustrate the effect of stationary phase characteristics and shape of the solute (length-to-breadth ratio, L/B) on retention and selectivity. Based on these studies, a model is proposed to describe the retention of PAH on polymeric C18 phases.

702,383
PB86-112141 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
High Sensitivity Neutron Activation Analysis of Environmental and Biological Standard Reference Materials.
Final rept.
R. R. Greenberg, R. F. Fleming, and R. Zeisler. 1984, 8p
Pub. in Environment International 10, p129-136 1984.

Keywords: *Neutron activation analysis, *Environmental surveys, Chemical analysis, Sampling, Trace elements, Laboratory equipment, Reprints, *Standard reference materials, *Biological processes.

Neutron activation analysis is a sensitive method with unique capabilities for the analysis of environmental and biological samples. Since it is based upon the nuclear properties of the elements, it does not suffer from many of the chemical effects that plague other methods of analysis. Analyses can be performed either with no chemical treatment of the sample (instrumentally), or with separations of the elements of interest after neutron irradiation (radiochemically). Typical examples of both types of analysis are discussed, and data obtained for a number of environmental and biological SRMs are presented.

702,384
PB86-112745 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Beam Broadening in a Strongly Scattering Target in the Analytical Electron Microscope.
Final rept.
A. D. Romig, D. E. Newbury, and R. L. Myklebust. 1982, 5p
See also DE82-014085. Sponsored by Microbeam Analysis Society, Bethesda, MD.
Pub. in Proceedings of Annual Conference of the Microbeam Analysis Society (17th), Washington, DC., August 9-13, 1982, p88-92.

Keywords: *Electron microscopy, *Electron scattering, *Uranium alloys, *X ray analysis, Experimental design, Beam width, Chemical analysis, Monte Carlo method.

Beam broadening has been studied in alloys of uranium-niobium and uranium-molybdenum. Profiles have been measured across interphase boundaries for which the solute element is located exclusively in one phase. Experimental measurements have been compared with calculated profiles obtained with a Monte Carlo electron trajectory simulation. Good agreement is obtained in the immediate region of the boundary. A long low intensity tail is indicated from the calculations but this tail is not observed experimentally. Studies of the effect of varying specimen and beam parameters indicate the difficulty in obtaining accurate experimental profiles.

702,385
PB86-112901 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Analytical Optogalvanic Spectroscopy in Flames.
Final rept.
J. C. Travis. 1985, 1p
Pub. in Analytical Laser Spectroscopy, p213-233 1985.

Keywords: *Chemical analysis, *Ionization, Excitation, Design criteria, Performance evaluation, Reprints, *Laser spectroscopy, *Optogalvanic spectroscopy, *Laser enhanced ionization, Flame spectroscopy.

Optogalvanic spectroscopy is based on changes in the impedance of a weakly ionized plasma in response to the optical excitation of an atomic or molecular species in the plasma. Though rooted in research of over five decades ago, optogalvanic spectroscopy has fluorished with the advent of tunable lasers. Optogalvanic spectroscopy in flames, or laser enhanced ionization, has been extensively developed as a flame spectrophotometric analytical method. This paper reviews the research into the theory and practice of laser enhanced ionization since the inception of the method in 1976. The mechanisms of ion production, ion transport, and signal generation are treated theoretically, and supported by experimental studies. The development of analytical LEI is presented, with discussions of instrumentation, sensitivity, and accuracy.

702,386
PB86-113669 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
General Purpose Atom Probe Field Ion Microscope.
Final rept.
A. J. Melmed, M. Martinka, and R. Klein. 1982, 6p
Pub. in Proceedings of International Field Emission Symposium (29th), Goteborg, Sweden, August 9-13, 1982, p243-248.

Keywords: Design criteria, Performance evaluation, Spectrochemical analysis, Mass spectroscopy, *Atom probe field ion microscopy.

A general purpose atom probe field ion microscope is described and the initial results are discussed. The UHV instrument combines the capabilities of a straight ToF Atom Probe and an Imaging Atom Probe, with a specimen-detector distance of 14 cm. Novel features are a variable aperture and a specimen quick-change which allows preservation of input pulse line integrity. Mass resolution is about 200 at 15% peak height and appears to be independent of probe anvular diameter between 15 and 65 deg.

702,387
PB86-124914 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of the Director.
How Good Are the Standard Atomic Weights.
Final rept.
H. S. Peiser. 1985, 6p
Pub. in Analytical Chemistry 57, n511A 1985.

Keywords: *Chemical elements, *Standards, Isotopes, Samples, Reprints, *Natural emissions, *Atomic weights.

The tables of atomic weights of the chemical elements as they are found in natural terrestrial sources are reviewed regularly and published by the International Union of Pure and Applied Chemistry. After a recent major revision of these tables, the author discusses the improvement and limitations in the reliability of these data as they affect analytical chemists. The uncertainty of these data are implied in the precision of the tabulated numerical values. Taken into account are both experimental uncertainties and natural variability of isotopic abundances. The 20 elements that have only one stable nuclide have atomic weights reliable to about 1 part in 10,000,000. An equal number of elements have experimental uncertainties of more than 1.5 parts in .0001 with no significant variability. Their atomic-weight determination remains a challenge to experimenters. About 11 elements are so variable that atomic weights of given samples can be measured more accurately than the atomic weight values have been tabulated. Radioactive decay affects appreciably only the atomic weights of daughter elements in some abnormal sources.

702,388
PB86-128121 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Use of Isotope Dilution Mass Spectrometry for the Certification of Standard Reference Materials.
Final rept.
L. J. Moore, H. M. Kingston, T. J. Murphy, and P. J. Paulsen. 1984, 5p
Pub. in Environment International 10, p169-173 1984.

Keywords: *Environmental surveys, *Trace elements, *Chemical analysis, Lead(Metal), Water analysis, Fly ash, Mercury(Metal), Uranium, Air pollution, Gas analysis, Concentration(Composition), Reprints, *Isotope dilution mass spectroscopy, *Standard reference materials, *Natural emissions, SRM 1643, SRM 1633a, SRM 1577a, SRM 1642.

Isotope dilution mass spectrometry (IDMS) has been used extensively at the U.S. National Bureau of Standards as an accurate method to determine trace element concentrations in natural materials. Thermal ionization mass spectrometry is a single element technique capable of high accuracy and precision, and has been used for 'definitive' measurements of trace elements in sera with 95% confidence limits less than 0.25%. Spark source mass spectrometry is a complementary multielement, high-sensitivity technique that has been used to determine up to 20 elements in a sample, with typical accuracies of 2%-5%. Together with appropriate chemical separations, such as anion and cation exchange, chelate resins, electrodeposition, and chemical extraction, IDMS has been applied to elemental concentration measurements ranging over eight orders of magnitude, from decigrams/gram to picograms/gram. Many of these applications have been used for the certification of a broad spectrum of biological and environmental Standard Reference Materials, including lead in Trace Elements in Water (SRM 1643), 15 elements in Coal Fly Ash (SRM 1633a), uranium in Bovine Liver (SRM 1577a), and mercury in water (SRM 1642).

702,389
PB86-128147 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Degradation of Poly(Vinyl Fluoride) and Poly(Vinylidene Fluoride).
Final rept.
T. Nguyen. 1985, 49p
Sponsored by Department of Energy, Washington, DC.

Pub. in Jnl. of Macromolecular Science - JMS-Rev. Macromol. Chem. Phys. C25, n2 p227-275 1985.

Keywords: *Degradation, *Polyvinyl fluoride, *Chemical analysis, *Construction materials, Comparison, Additives, Impurities, Copolymers, Reprints, *Vinylidene fluoride polymers.

Available literature on the degradation of vinyl fluoride and vinylidene fluoride homo- and copolymers has been reviewed. It is apparent from these data that the thermal and high-energy radiation degradation of these materials have been extensively investigated; however, other types of degradation have not been investigated in depth. The data reviewed reveal several problems for workers interested in these materials. (1) Lack of information on the combined effects of UV and temperature, UV and moisture, or of the combined three factors. (2) Methods used for the detection and characterization of the degradation varied from mechanical tests to spectral analysis, and the results of these analyses can not be compared from one to another. (3) Inability to compare the results of the various studies, due to differences in materials, preparation methods, test conditions and sample sizes used for the analyses by various authors. The presence of additives and impurities, and recent advancements in processing and method of preparation of these materials compound the problem of interpreting and comparing various studies. Research is needed to address the three key problems cited above.

702,390

PB86-128204 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Application of Atomic Absorption and Plasma Emission Spectrometry for Environmental Analysis.
Final rept.
T. C. Rains, R. L. Watters, and M. S. Epstein. 1984, 6p
Pub. in Environment International 10, p163-168 1984.

Keywords: *Environmental surveys, *Chemical analysis, Trace elements, Leaching, Urban areas, Wear metals, Lubricating oils, Reprints, *Standard reference materials, Inductively couple plasma emission spectroscopy, Flame atomic absorption spectrometry, Solid wastes, Air pollution detection, SRM 1648, SRM 1084, SRM 1085, Electrothermal atomization.

The application of flame atomic absorption (FAAS), electrothermal atomic absorption (ETAAS), inductively coupled plasma emission (ICP), and direct-current plasma emission spectrometry (DCP) for the determination of major, minor, and trace elements in Urban Particulates (SRM 1648), Wear Metals in Oil (SRM 1084 and 1085), and Simulated Solid-Waste Leachates is described. Interferences were encountered in the determination of the trace elements in SRM 1648 by ETAAS; however, these interferences were alleviated using a 1% solution of ammonium dibasic phosphate as a matrix modifier. The concentration of elements in SRM 1084 and 1085 and the simulated solid-waste leachates were significantly above the detection limits by FAAS or ICP and no analytical difficulty was encountered.

702,391

PB86-128931 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Materials.
Role of NBS (National Bureau of Standards) Standard Reference Materials In Quality Assurance of Environmental Measurements.
Final rept.
R. Alvarez. 1985, 14p
Pub. in Quality Assurance for Environmental Measurements, ASTM STP 867, p346-359 1985.

Keywords: *Quality assurance, *Environmental surveys, *Chemical analysis, Sampling, Gas analysis, Water analysis, Trace elements, Laboratory equipment, Fuels, Bioassay, Sediments, Halocarbons, Aromatic polycyclic hydrocarbons, Sampling, Reprints, *Standard reference materials, Water pollution detection, Air pollution detection.

Analyses of environmental samples of known homogeneity by different laboratories often disagree seriously. Discrepant data may result from poor methodology, improper instrument calibration, faulty experimental techniques, or from a combination of these factors. One approach towards obtaining accurate data is through the use of Standard Reference Materials (SRMs) issued by the National Bureau of Standards under federal statutes. SRMs are homogeneous, stable materials with certified chemical or physical properties and are used in calibrating instruments, validating laboratory data, developing methods of known accuracy, and referring data from different laboratories to a common base. Of the approximately 900 SRMs listed in the current SRM catalog, over 90 have been developed for use in improving the accuracy of environmental analyses. Environmental matrix SRMs certified for priority pollutants include gases, atmospheric dust, water, sediments, biological materials, and fuels. In addition, calibrator solutions of organic priority pollutants, such as halocarbons, and polycyclic aromatic hydrocarbons, are available for determining instrumental response factors, and adding accurate amounts of these compounds to samples.

702,392

PB86-129020 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reference Materials: Their Production, Certification and Use in Compatible Measurement Networks.
Final rept.
J. P. Cali. 1979, 20p
Pub. in Proceedings of Euroanalysis III, Reviews in Analytical Chemistry, p153-172 1979.

Keywords: *Measurements, *Chemical analysis, Laboratory equipment, *Reference materials, Certified reference materials, Standard reference materials.

In a world becoming increasingly interdependent in terms of trade, environmental protection, safeguarding of nuclear materials, and world health, among others, the importance of being able to make dependable and reliable measurements is self-evident. Measurement compatible networks are designed and their work implemented in a manner that assures that measurement results from one laboratory to another agree within predetermined uncertainties useful for some stated end-purpose. Networks that accomplish accurate measurements, (measurements free of systematic error and precise), produce results that are compatible. One important mode for achieving accurate measurements, especially useful for the determination of chemical composition, is based on the use of reference materials in the measurement process. The production and certification of reference materials (RM's) is a complex, time-consuming, and costly process requiring measurement resources of the highest order in terms of skilled manpower and sophisticated equipment. To describe and illustrate these, the author uses as his model the RM program of the U.S. National Bureau of Stan dards, a program now approaching its 80th anniversary. Of great importance, is the scientific integrity and credibility of the finished product. The three measurement modes used at NBS to arrive at certifiable values for its RM's are described in some detail. General principles involved in RM production are also discussed.

702,393

PB86-132495 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Precise Evaluation of Oxygen Measurements on Cz-Silicon Wafers. Comments.
Final rept.
A. Baghdadi. 1985, 1p
Pub. in Jnl. of the Electrochemical Society 132, n2 p510 1985.

Keywords: *Oxygen, *Chemical analysis, *Wafers, Infrared spectroscopy, Absorption, Performance evaluation, Silicon, Reprints.

This is a discussion of a paper by Graff, entitled 'Precise Evaluation of Oxygen Measurements on Cz-Silicon Wafers' which was published in the Journal of the Electrochemical Society, Vol. 130, No. 6, p. 1378. The equations used by Graff in his paper do not adequately represent the physical situation. This discussion points out the inconsistencies in Graff's approach to the problem.

702,394

PB86-132503 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Copper Standard Reference Materials (Benchmark Series).
Final rept.
I. L. Barnes, T. E. Gills, and W. P. Reed. 1984, 10p
Pub. in Sampling and Analysis of Copper Cathodes, ASTM (American Society for Testing and Materials) STP 831, p145-154 1984.

Keywords: *Copper, *Standards, Chemical analysis, Metals, Reprints, *Standard reference materials.

The Standard Reference Materials Program has experienced increasing demands for new kinds and types of standard materials. In order that the largest number of users be served by these materials and the available resources be used to best advantage, careful planning is required. The planning process helps to ensure that, among other factors, the fewest number of different materials will be produced, a widerange of needs will be met, and production and certification can be accomplished at a level consistent with the intended uses. One output of this process has been the concept of 'Benchmark Series' SRMs. These are usually a set of similaar materials with varying amounts of a number of elements covering a wide range of concentrations. Largely through the auspices of ASTM Committee E-2 on Emission Spectroscopy, more than 70 persons from NBS, ASTM, and from throughout the copper industry contributed to the planning of a series of Copper Benchmark Standard Reference Materials. As a result, 12 different materials issued as chips, rods, and cast solids and representing as many as 25 different SRMs have been prepared and certified for as many as 29 elements. The production and certification process and the certified values for this important series are described and the certified values are given.

702,395

PB86-133634 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Many Dimensions of Detection in Chemical-Analysis.
Final rept.
L. A. Currie. 1983, 1p
Pub. in Abstracts of Papers of the American Chemical Society 185, p63 Mar 83.

Keywords: *Chemical analysis, Chromatographic analysis, Spectrochemical analysis, Mathematical models, Error analysis, Sampling, Calibrating, Reprints.

Simple detection decisions generally involve the comparison of scalar quantities (gross signal, blank). Conventional chromatography and spectrometry, on the other hand, involve one-dimensional variables (time, mass, wavelength, energy) where signal and baseline traces may be examined to decide whether a peak is present at a given location. Linked techniques, such as GC-MS or two-parameter nuclear spectroscopy, raise the question of detection in two dimensions. Finally, problems wherein a set of samples is characterized by many independent chemical and physical observations raise the issue of multidimensional detection. All such problems have a common theoretical base in the statistical theory of hypothesis testing. Following a brief review of underlying assumptions and techniques for applying the theory to detection decisions and detection limits, primary attention is given to a one-dimensional (reduced from two) problem involving the calibration curve of the pesticide Fenvalerate. Other topics addressed include information-loss through faulty reporting (at trace levels) and its impact on regulatory issues, and chemometric quality assurance through standard interlaboratory test data sets.

702,396

PB86-138203 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Isotopic Variations in Commercial High-Purity Gallium.
Final rept.
J. W. Gramlich, and L. A. Machlan. 1985, 3p
Pub. in Analytical Chemistry 57, n8 p1788-1790 1985.

Keywords: *Gallium isotopes, *Mass spectroscopy, Purity, Sampling, Reprints, *Thermal ionization mass spectroscopy, Atomic weights.

The relative isotopic composition has been determined in 16 samples of gallium metal using highly precise thermal ionization mass spectrometry. The results show variations in the 69Ga/71/Ga ratio of up to 0.3% for the samples measured.

702,397
PB86-138567 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Preliminary Studies of the Effects of Semiconductor Reagents on Polymers Containing Fluorine and of Trace Metallic Leachate from Molded Fluorocarbon Resin.
Final rept.
J. F. Imbalzano, and J. R. Moody. 1985, 6p
Pub. in Jnl. of Environmental Sciences 28, p53-58 Jul/Aug 85

Keywords: *Semiconductors, *Trace elements, *Metals, *Chemical analysis, *Polymers, Leaching, Diffusion, Exposures, Physical properties, Reprints, Vinylidene fluoride resins.

Traces of undesired materials in semiconductor devices are a serious processing deficiency and their elimination is widely sought. To this end, the effects of semiconductor reagents on discs molded from commercial materials of construction-perfluoroalkoxy (PFA) fluorocarbon resin and polyvinylidene fluoride (PVDF)-were assessed by measuring retained physical properties and by analytical microscopic inspection. At the National Bureau of Standards, Center for Analytical Chemistry, ultrapure nitric acid was stored, in a class 10 environment, in a container molded from PFA, and the level of leachable selected trace metallics was determined by graphite furnace atomic absorption spectrometry, flame emission spectrometry with repetitive optical scanning, and isotope dilution spark source mass spectrometry. The results from the exposure tests indicated that PVDF was significantly affected in the exposures; PFA was essentially unaffected. The amounts of leachable metallics from PFA were at or below low part-per-billion levels, since they were indistinguishable from those in the extractant blank.

702,398
PB86-139979 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Decomposition Products from Corona in SF6/N2 and SF6/O2 Mixtures.
Final rept.
M. C. Siddagangappa, and R. J. Van Brunt. 1985, 4p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Proceedings of International Conference on Gas Discharges and Their Applications (8th), Oxford, England, September 16-20, 1985, p247-250.

Keywords: *Electric corona, *Decomposition reactions, Concentration(Composition), Nitrogen, Nitrogen oxides, Sulfur dioxide, Oxygen, Sulfur hexafluoride, Mixtures, Reaction kinetics.

Absolute concentrations of SOF4, SOF2, SO2F2, SO2, NO, N2O, and H2O produced from continuous, dc, point-plane negative corona at a current of 40 A were measured in SF6/N2 and SF6/O2 mixtures containing trace amounts of H2O and 1 to 95% N2 or 1 to 10% O2 for a total gas pressure of 200 kPa (about 2atm). The absolute and SF6-normalized charge rates-of-production for these by-products have been determined as a function of N2, or O2 content. The results are interpretted in terms of a model for electric-discharge-induced decomposition of SF6 discussed previously by Van Brunt. The presence of N2 accelerates the rate of SF6 decomposition by inhibiting the recombination of SF6 dissociation products. At levels up to 10%, O2 actually lowers the rates of oxyfluoride and SO2 production due to its effect in reducing the mean energy of electrons in the discharge and thus the dissociation rate of SF6.

702,399
PB86-142866 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Resonance-Ionization Mass Spectrometry of Carbon.
Final rept.
L. J. Moore, J. D. Fassett, J. C. Travis, T. B. Lucatorto, and C. W. Clark. Sep 85, 5p
Sponsored by Department of Energy, Washington, DC. Office of Health and Environmental Research.
Pub. in Jnl. of the Optical Society of America B 2, n9 p1561-1565 Sep 85.

Keywords: *Carbon, *Chemical analysis, Mass spectroscopy, Graphite, Reprints, *Resonance ionization mass spectroscopy.

Resonance-ionization mass spectrometry (RIMS) for carbon has been demonstrated. A two-photon-resonant, three-photon ionization scheme provided large ionization signals from carbon atoms obtained by heating microgram samples of graphite. These results show that elemental carbon vapor can be detected at densities at least as low as 10 to the 7th power/cc. The feasibility of efficient resonance ionization is a first step to the development of a RIMS-analysis capability for elemental and isotopic carbon.

702,400
PB86-159555 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Comprehensive Method for the Determination of Aquatic Butyltin Species at Ultratrace Levels Using Simultaneous Hydridization/Extraction with GC-FPD.
Final rept.
G. J. Olson, F. E. Brinckman, C. L. Matthias, and J. M. Bellama. Dec 85, 51p NBSIR-85/3295
Prepared in cooperation with Maryland Univ., College Park. Dept. of Chemistry. Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.

Keywords: *Water analysis, *Water pollution, *Biocides, Gas chromatography, Extraction, Chesapeake Bay, Concentration(Composition), Chemical analysis, Protective coatings, Toxicity, Metal containing organics compounds, Sampling, *Water pollution detection, *Tin/butyl, *Tin/butyl-methyl, *Tin/tributyl, *Tin/tetrabutyl, *Tin/dibutyl, Flame photometric detectors, Water pollution effects(Animals).

A method for the analysis of aquatic butyltin and mixed methylbutyltin species using simultaneous hydridization with sodium borohydride and extraction into dichloromethane is described. The detection limits are 7 ng Sn/L for tetrabutyltin, 7 ng Sn/L for tri-n-butyltin, 3 ng Sn/L for di-n-butyltin, and 16 ng Sn/L for mono-n-butyltin. The presence of tetrabutyltin in harbor waters is reported.

702,401
PB86-160082 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Determination of Nanogram Quantities of Vanadium in Biological Material by Isotope Dilution Thermal Ionization Mass Spectrometry with Ion Counting Detection.
Final rept.
J. D. Fassett, and H. M. Kingston. 1985, 5p
Pub. in Analytical Chemistry 57, n13, p2474-2478 Nov 85.

Keywords: *Vanadium, *Trace elements, *Bioassay, Isotopic labeling, Concentration(Composition), Chemical analysis, Mass spectroscopy, Separated, Leaves(Botany), Liver, Oysters, Tissue(Biology), Blood analysis, Reprints, *Biological processes, *Isotope dilution thermal ionization mass spectroscopy, Standard reference materials, Procedures.

A procedure has been developed for the determination of nanogram quantities of vanadium in biological matrices by isotope dilution mass spectrometry that uses a 50V spike enriched to 64 atom %. The V is chemically purified by a Chelex-100 separation and loaded onto a carburized Re filament. The procedure has been applied to the determination of V in various NBS Standard Reference Materials: Oyster Tissue, SRM 1566; Citrus Leaves, SRM 1572; Bovine Liver, SRM 1577a; and Human Serum, SRM 909. The certified concentration of V in the Human Serum SRM is the lowest of any Standard Reference Material.

702,402
PB86-162070 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Solid-State 13C NMR Determination of Methyltin(IV) Structure. Crystal and Molecular Structure of Dimethyltin(IV) Bis(1-Pyrrolidinecarbodithiate).
Final rept.
T. P. Lockhart, W. F. Manders, and E. O. Schlemper. 1985, 3p
Pub. in Jnl. of the American Chemical Society 107, n25 p7451-7453 1985.

Keywords: *Nuclear magnetic resonance, *Quantitative chemical analysis, Organometallic compounds, Reprints, *Methyltin.

Solid-state 13C NMR and X-ray crystallographic studies of the title compound, Me2Sn(S2CN(CH2)4)2, are reported. The magnitude of 1J(119Sn,13C), (1J), measured for a polycrystalline sample, is 705 Hz. When a previously described relationship between (1J) and the Me-Sn-Me angle was used, an angle of 138.6 degrees was predicted for the molecule. The discrepancy between the result and the published X-ray structure (Me-Sn-Me angle = 130 (2) degrees) led to a redetermination of the crystal structure by X-ray. Solution of the structure of the orthorhombic crystals in the Pmmn space group yielded a chemically reasonable structure (R=0.029, Rw=0.038) in which the pyrrolidine carbons C3 and C4 are disordered across the mirror plane at y=1/4. Similar to other dimethyltin(IV) bis(dithiocarbamates), Me2Sn(S2CN(CH2)4)2 adopts a distorted octahedral geometry: the Me-Sn-Me angle is 137.3(3), and the dithiocarbamate ligands are coplanar with tin but adopt an anisobidentate coordination geometry (Sn-S=2.518, 2.938 Angstroms). The presence of two mirror planes results in a simple solid-state 13C NMR spectrum. In contrast to the accurate NMR-derived prediction, published Mossbauer data led to a predicted Me-Sn-Me angle (123.5 degrees) 14 degrees in error.

702,403
PB86-163409 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Literature Review of the Chemical Nature and Toxicity of the Decomposition Products of Polyethylenes.
M. Paabo, and B. C. Levin. Jan 86, 68p NBSIR-85/3268
Sponsored by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Combustion products, *Polyethylene, *Toxicology, Pyrolysis, Literature surveys.

The literature on polyethylenes has been reviewed with an emphasis on the identification of gaseous products generated under various thermal decomposition conditions and the toxicity of those products. The review is limited to publications in English through 1984. The analytical chemical studies of the thermal decomposition products generated under vacuum, inert and oxidative experimental conditions are described. In oxidative atmospheres, which most closely simulate real fire conditions, carbon monoxide (CO) was found to be the predominant toxicant. Acrolein was another toxicant often noted in these reviewed studies. More acrolein was generated under non-flaming than under flaming conditions. Results from seven different test procedures were considered in assessing the acute inhalation toxicity of combustion products from various polyethylene formulation. The combustion products generated from the polyethylenes studied in the non-flaming mode appeared to be slightly more toxic than those produced in the flaming mode.

702,404
PB86-165784
(Order as PB86-165776, PC **A08**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Topical Issue: Chemometrics.
H. J. Oser. Dec 85, 1p
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p391 Nov-Dec 85.

Keywords: *Meetings, Chemical analysis, *Chemometrics.

The issue of the NBS Journal of Research is devoted entirely to one topic: Chemometrics. A conference by that title held earlier this year at NBS brought together experts in analytical chemistry and applied mathematics, disciplines which are the constitutents of this new field. This conference was probably the first one in the United States by that title. The roots of the interdisciplinary effort go back to the late Dr. William (Jack) Youden and the authors dedicate this issue to him. A brief description of Youden's career serves at the introduction to the collection of conference papers which the authors present in this volume of the Journal. The authors of this biographical sketch, Drs. Ku and DeVoe, worked very closely with Youden while he was at NBS. With the publication of the papers presented at this conference the authors hope to stimulate further work in the field of chemometrics. Special recognition goes to the organizers of the conference who also served as invited editors of this special issue of the NBS Journal of Research: Drs. Clifford H. Spiegelman of the Center for Applied Mathematics, Robert

L. Watters of the Center for Analytical Chemistry, and Jerome Sacks from the University of Illinois.

702,405
PB86-165800
(Order as PB86-165776, PC **A08**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Organizers' Goals.
C. H. Spiegelman, R. L. Watters, and J. Sacks. Dec 85, 2p
Prepared in cooperation with Illinois Univ. at Urbana-Champaign.
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p395-396 Nov-Dec 85.

Keywords: *Research projects, *Management planning, *Chemometrics.

The wide range of disciplines represented by the participants and attendees of the Chemometrics Research Conference held at the Gaithersburg Holiday Inn on May 20-22, 1985, exemplifies the depth and diversity of the chemometrics community. The Conference was sponsored by several important professional societies whose members are involved in chemometric activity. As organizers, the authors had two main goals in mind when deciding on the form and substance of the Conference. The first was to provide a forum for reporting on some of the most recent and important research activities in diverse areas relating to chemometrics. The second and more important goal can only be achieved gradually. This was to increase the willingness of chemists, statisticians, and probabilists to meet as colleagues and to solve problems as a team. This will necessarily involve the exercise of communication skills as well as combining scientific skills.

702,406
PB86-165834
(Order as PB86-165776, PC **A08**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Limitations of Models and Measurements as Revealed Through Chemometric Intercomparison.
L. A. Currie. 1 Jul 85, 14p
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p409-422 Nov-Dec 85.

Keywords: *Chemical analysis, Linear regression, Comparison, Mathematical models, Laboratories, Sampling, Measurement, Units of measurement, *Chemometrics, Intercomparison, Reference materials, Case studies.

Interlaboratory Comparisons using common (reference) materials of known composition are an established means for asessing overall measurement precision and accuracy. Intercomparisons based on common data sets are equally important and informative, when one is dealing with complex chemical patterns or spectra requiring significant numerical modeling and manipulation for component identification and quantification. Two case studies of 'Chemometric Intercomparison' using Simulation Test Data (STD) are presented, the one comprising STD vectors as applied to nuclear spectrometry, and the other, STD data matrices as applied to aerosol source apportionment. Generic information gained from these two exercises includes: (a) the requisites for a successful STD intercomparison (including the nature and preparation of the simulation test patterns); (b) surprising degrees of bias and imprecision associated with the data evaluation process, per se; (c) the need for increased attention to implicit assumptions and adequate statements of uncertainty; and (d) the importance of STD beyond the Intercomparison-i.e., their value as a chemometric research tool. Open research questions developed from the STD exercises are highlighted, especially the opportunity to explore 'Scientific Intuition' which is essential for the solution of the underdetermined, multicollinear inverse problems that characterize modern Analytical Chemistry.

702,407
PB86-165867
(Order as PB86-165776, PC **A08**/MF **A01**)
Amsterdam Univ. (Netherlands).
Use of Kalman Filtering and Correlation Techniques in Analytical Calibration Procedures.
H. C. Smit. 24 Jun 85, 11p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p441-451 Nov-Dec 85.

Keywords: *Chemical analysis, *Calibrating, Laboratory equipment, Correlation techniques, *Kalman filtering, *Chemometrics, Computer applications, Procedures.

Different chemometric methods to improve calibrations are described. A Kalman filter is applied for processing and predicting slowly varying parameters of a linear calibration graph. The results are used for the evaluation of unknown samples, and for deciding whether to calibrate again or to analyze the next unknown sample. Another approach of the calibration problem, particularly in chromatography, is the use of correlation techniques. The noise reduction property of correlation chromatography is used to extend the calibration graph to very low concentrations. Furthermore, an experimental technique to determine a calibration curve and the unknown sample simultaneously under exactly the same conditions is described.

702,408
PB86-165875
(Order as PB86-165776, PC **A08**/MF **A01**)
Texas Univ. at El Paso.
Intelligent Instrumentation.
A. M. Harper, and S. A. Liebman. 1 Jul 85, 12p
Prepared in cooperation with Aberdeen Proving Ground, MD. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p453-464 Nov-Dec 85.

Keywords: *Laboratory equipment, Feasibility studies, Statistical analysis, Gas chromatography, Mass chromatography, Pattern recognition, Pyrolysis, Expert systems, Computer applications.

Three areas of modern analysis will be discussed: (1) developments in the area of preprocessing and pattern recognition systems of pyrolysis gas chromatography and pyrolysis mass spectrometry; (2) methods projected for the cross interpretation of several analysis techniques such as several spectroscopies on single samples; and (3) the advantages of having well defined chemical problems for expert systems/pattern recognition automation.

702,409
PB86-165883
(Order as PB86-165776, PC **A08**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Regression Analysis of Collinear Data.
J. Mandel. 1 Jul 85, 14p
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p465-478 Nov-Dec 85.

Keywords: *Regression analysis, *Chemical analysis, Measurement, Collinearity.

The paper presents a technique based on the intuitively-simple concepts of Sample Domain and Effective Prediction Domain, for dealing with linear regression situations involving collinearity of any degree of severity. The Effective Prediction Domain (EPD) clarifies the concept of collinearity, and leads to conclusions that are quantitative and practically useful. The method allows for the presence of expansion terms among the regressors, and requires no changes when dealing with such situations.

702,410
PB86-165891
(Order as PB86-165776, PC **A08**/MF **A01**)
Houston Univ., TX.
Optimization.
S. N. Deming. 1 Jul 85, 6p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p479-485 Nov-Dec 85.

Keywords: *Experimental design, *Chemical analysis, *Optimization, Mathematical models, Screening.

Most research and development projects require the optimization of a system response as a function of several experimental factors. Familiar chemical examples are the maximization of product yield as a function of reaction time and temperature; the maximization of analytical sensitivity of a wet chemical method as a function of reactant concentration, pH, and detector wavelength; and the minimization of undesirable impurities in a pharmaceutical preparation as a function of numerous process variables. The 'classical' approach to research and development involves answering the following three questions in sequence: What are the important factors (Screening), In what way to these important factors affect the system, (Modeling), What are the optimum levels of the important factors. As R. M. Driver has pointed out, when the goal of research and development is optimization, an alternative strategy is often more efficient: What is the optimum combination of all factors levels, (Optimization), In what way do these factors affect the system, (Modeling in the region of the optimum), What are the important factors. The key to this alternative approach is the use of an efficient experimental design strategy that can optimize a relatively large number of factors in a small number of experiments. The theory of these techniques and applications to real situations will be discussed.

702,411
PB86-165958
(Order as PB86-165776, PC **A08**/MF **A01**)
Utah State Univ., Logan.
Automated Pattern Recognition: Self-Generating Expert Systems for the Future.
T. L. Isenhour. 1 Jul 85, 3p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p521-523 Nov-Dec 85.

Keywords: *Pattern recognition, *Chemical analysis, Artifical intelligence, *Chemometrics, *Expert systems, Relational data bases, Robotics.

Chemometrics and pattern recognition had their start in chemistry in the late 1960's. The most recent review of the area by Micheal DeLaney listed 438 journal articles and books. The three most important areas of future development will be Expert Systems, Relational Data Bases, and Robotics. It should now be possible to combine existing robotics and artifical intelligence software to create a system which will generate its own expert systems using relational data bases. The data will be in the chemical domain and the system I describe the authors are calling the Analytical Director. The Analytical Director will be an artificial intelligence/robotic expert system for the analytical laboratory. The Analytical Director will develop, test, implement and interpret chemical analysis procedures. It will learn from its own experience, the experience of others and communicate what it has learned to others. The Analytical Director will be a self-generating Expert System. The author believes that such systems will, in the future, provide all the advantages of pattern recognition, expert systems and relational data bases in experimental settings. Problems will continue to be defined by human beings, but more and more, the laboratory will design, execute and evaluate its own experiments.

702,412
PB86-165974
(Order as PB86-165776, PC **A08**/MF **A01**)
Lawrence Livermore National Lab., CA.
Measurement and Control of Information Content in Electrochemical Experiments.
S. P. Perone, and C. L. Ham. 1 Jul 85, 11p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p531-541 Nov-Dec 85.

Keywords: *Electrochemistry, *Chemical analysis.

One of the most important problems in chemical analysis is the interpretation of analytical data. The difficulty of this task has been further compounded by the data explosion. Chemical information relevant to the particular analysis problem is hidden within excessive amounts of data. This problem could be alleviated through knowledge and control of the information content of the data. Information theory provides a means for the definition, evaluation, and manipulation of quantitative information content measurements. This paper provides a general review of some of the basic concepts in information theory, including history, terminology, entropy, and other information content measures. The application of information theory to chemical problems requires some modifications. The analyst is usually only interested in a subset of the information (data) which has been collected. Also, this relevant chemical information is dependent upon not only the informational goals of the problem, but the completely specified procedure as well. This paper reviews chemical applications of information theory which have been reported in the literature including applications of information theory which have been reported in the literature including applications to qualitative analysis, quantitative analysis, structural analysis, and analytical techniques. Measures of information and information

content and figures of merit for performance evaluations are discussed. The paper concludes with a detailed discussion of the application of information theory to electrochemical experiments and the empirical determiantion of the information content of electroanalytical data.

702,413
PB86-165982
(Order as PB86-165776, PC **A08**/MF **A01**)
Pennsylvania State Univ., University Park.
Pattern Recognition Studies of Complex Chromatographic Data Sets.
P. C. Jurs, B. K. Lavine, and T. R. Stouch. 24 Jun 85, 7p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p543-549 Nov-Dec 85.

Keywords: *Pattern recognition, *Chromatographic analysis, *Spectrochemical analysis, Biochemistry, Classification, Assessments, Sampling, Biological processes.

Chromatographic fingerprinting of complex biological samples is an active research area with a large and growing literature. Multivariate statistical and pattern recognition techniques can be effective methods for the analysis of such complex data. However, the classification of complex samples on the basis of their chromatographic profiles is complicated by two factors: (1) confounding of the desired group information by experimental variables or other systematic variations, and (2) random or chance classification effects with linear discriminants. The authors will treat several current projects involving these effects and methods for dealing with the effects. Complex chromatographic data sets often contain information dependent on experimental variables as well as information which differentiates between classes. Previously, Monte Carlo simulation studies were carried out to assess the probability of chance classification for nonparametric and parametric linear discriminants. The level of expected chance classification as a function of the number of observations, the dimensionality, and the class membership distributions were examined. These simulation studies established limits on the approaches that can be taken with real data sets so that chance classifications are improbable.

702,414
PB86-178902 PC **A09**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Technical Activities 1985, Center for Analytical Chemistry.
R. A. Durst, H. S. Hertz, and J. K. Taylor. Dec 85, 188p NBSIR-85/3272
See also PB85-164952.

Keywords: *Chemical analysis, *Standards, *Research projects, Inorganic compounds, Organic compounds, Particles, Gases.

The report summarizes the technical activities of the Center for Analytical Chemistry at the National Bureau of Standards. It emphasizes activities over the Fiscal Year 1985 in the Inorganic Analytical Research Division, the Organic Analytical Research Division, and the Gas and Particulate Science Division. In addition, it describes certain special activities in the Center including quality assurance and voluntary standardization coordination.

702,415
PB86-185477 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Materials Div.
Graphite Furnace Atomic Absorption Spectrophotometers as Automated Element-Specific Detectors for High-Pressure Liquid Chromatography. The Determination of Arsenite, Arsenate, Methylarsonic Acid and Dimethylarsinic Acid.
Final rept.
F. E. Brinckman, K. L. Jewett, W. P. Iverson, K. J. Irgolic, and K. C. Ehrhardt. 1980, 16p
Sponsored by Environmental Protection Agency, Washington, DC.
Pub. in Jnl. of Chromatography 191, p31-46 1980.

Keywords: *Chromatographic analysis, *Arsenates, Chemical analysis, Arsenic organic compounds, Arsenic organic acids, Reprints, *Arsenites, *Arsonic acid/methyl, *Arsine oxide/dimethyl-hydroxy, High pressure liquid chromatography.

Techniques for the determination of trace element compounds at ppb and ppm levels (in contrast to the determination of the total element concentration) are a prerequisite for the study of the transformations of trace elements in biological systems and the interactions of trace element compounds with biologically important molecules. Two automated high-pressure liquid chromatography (HPLC) systems with element-specific detectors, capable of detecting, identifying and quantitating trace element compounds were developed independently in our laboratories. One of the detectors consists of a Perkin-Elmer graphite furnace atomic absorption spectrometer (GFAA) and a specially adapted autosampler, whereas a Hitachi-Zeeman GFAA, a sample valve, an injector and associated electronics to control the analysis sequence comprise the components of the other detector. The capability of these systems to speciate trace element compounds is demonstrated using arsenite, arsenate, methylarsonic acid (MAA) and dimethylarsinic acid (DMAA) as examples. The separation schemes developed for the four arsenic compounds were used to speciate these compounds in soil extracts and drinking waters. The separation efficiency achieved thus far can very likely be improved through development of better column materials and mobile phases. The work with arsenic compounds clearly shows the great potential of these HPLC-GFAA analytical systems in the area of environmental trace element chemistry, in the field of physiological chemistry and in trace element-related nutritional studies.

702,416
PB86-187028 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Laser-Enhanced Ionization Spectrometry for Trace Metal Analysis.
Final rept.
G. C. Turk, J. C. Travis, and J. R. DeVoe. c1983, 9p
Pub. in Jnl. de Physique, Colloque C7, p301-309 1983.

Keywords: *Chemical analysis, *Trace elements, Metals, Reprints, Laser spectroscopy, Flame spectroscopy.

Laser-enhanced ionization spectrometry is an application of optogalvanic spectroscopy for quantitative analysis of trace concentrations of metallic elements in flames. The paper reviews the scientific literature on the subject, and summarizes the performance of the method in its present state of development.

702,417
PB86-187689 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
High Resolution CPMAS 13C NMR of Organometallic Solids. Observations of 'J' Coupling to Tin.
Final rept.
W. F. Manders, and T. P. Lockhart. 1985, 5p
Pub. in Jnl. of Organometallic Chemistry 297, p143-147 1985.

Keywords: *Tin organic compounds, Organometallic compounds, Nuclear magnetic resonance, Reprints, *Stannanes/methyl, Coupling constants, Chemical shifts, Carbon 13.

Chemical shift and (sup 1)J (117,119)Sn (13)C data from cross polarization magic angle spinning (CPMAS) proton-decoupled solid-state (13)C NMR experiments are given for the methyltin carbon in (Me2SnS)3, Me3SnOAc, Me2Sn(acetylacetonate)2, Me2SnC(1)2(dimethylsulfoxide), and amorphous (Me2SnO)n. The relationship between the magnitude of the coupling constant and the coordination at tin is examined by reference to X-ray structure data. The tin-methyl (13)C chemical shift was sensitive to slight variations in bond angles and bond lengths. The presence of isotopically abundant NMR-active nuclei in the molecule broadens lines, and can prevent resolution of the J coupled interaction.

702,418
PB86-190717 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Determination of Trace-Level Chromium(VI) in the Presence of Chromium(III) and Iron(III) by Flow Injection Amperometry.
Final rept.
K. W. Pratt, and W. F. Koch. 1986, 4p
Pub. in Analytical Chemistry 58, n1 p124-127 Jan 86.

Keywords: *Chromium, *Iron, Speciation, Voltammetry, Reprints, *Amperometry, Flow injection.

Chromium(VI) is determined by flow injection amperometry at Au and Iodized Pd electrodes without prior chromatographic or other separation. Dissolved O2 and Cr(III) do not interfere. Use of H3PO4 as the supporting electrolyte suppresses the interference from Fe(III). Chloride ion interferes in the determination at Au electrodes but not at Pd electrodes. Decay in sensitivity of the electrodes with time has been eliminated by continuous preconditioning of the electrode with a pulsed-potential wave form in place of constant-potential amperometry. The detection limit for Cr(VI) is 5 ng/mL.

702,419
PB86-192119 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Optimization of Selectivity Using Sequentially Coupled Capillary Columns.
Final rept.
H. T. Mayfield, and S. N. Chesler. 1985, 7p
Pub. in High Resolution Chromotography and Chromatography Communications 8, p595-601 Sep 85.

Keywords: *Chromatography, Reprints, Selectivity.

The investigation lays groundwork for the development of an optimization system for sequentially coupled capillary column systems. Three methods for calculating effective capacity factors were obtained from the literature and were tested to determine suitability for optimization use, using four test analytes and two dissimilar columns. The work concentrates on the development of a method for the estimation of optimum column temperatures in sequentially coupled systems.

702,420
PB86-192994 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Observations on the Determination of Phi(rho z) Curves for Thin Films in the Analytical Electron Microscope.
Final rept.
D. E. Newbury, R. L. Myklebust, A. D. Romig, and K. W. Bieg. 1983, 3p
Pub. in Microbeam Anal. 18, p168-170 1983.

Keywords: *Electron microscopy, Thin films, Chemical analysis, Microanalysis, Gold foil, Depth, Distribution functions, X ray spectroscopy, Reprints, Electron trajectories, Microbeams, *Energy dispersive x ray spectroscopy.

The depth distribution of x-ray production in thin gold foils generated by a 100 keV electron beam has been studied by Monte Carlo electron trajectory simulation and binary thin foil experiments. For foils tilted at 45 degrees to the beam, the depth distribution function is strongly peaked for foils greater in thickness than 100 nm. Because of significant backscattering, binary foils with the tracor placed on the foil bottom do not yield an accurate depth distribution function.

702,421
PB86-193232 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Laser Microprobe Mass Spectrometry.
Final rept.
D. S. Simons. 1984, 6p
Pub. in Springer Ser. Chem. Phys. 36, nSIMS 4 p158-163 1984.

Keywords: *Mass spectroscopy, Reprints, *Laser microprobe analysis.

Laser microprobe mass spectrometry has been applied to a wide variety of problems in chemistry, biology, and materials science. The concept of the instrument is described, analytical features are discussed and several illustrative applications are presented.

702,422
PB86-193257 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Analytical Standards for the Analysis of Chrysotile Asbestos in Ambient Environments.
Final rept.
J. A. Small, E. B. Steel, and P. J. Sheridan. 1985, 5p
Sponsored by Environmental Protection Agency, Research Triangle Park, NC.
Pub. in Analytical Chemistry 57, n1 p204-208 1985.

Keywords: *Asbestos, *Standards, Chemical analysis, Reprints, Transmission electron microscopy, *Chrysotile.

Results of a program for the development of standard materials for the analysis of chrysotile asbestos in nonworkplace environments are presented. These standards consist of carbon-coated Nucleport filter sections which contain predictable loadings of chrysotile asbestos fibers mixed with an urban air particulate matrix so that they resemble field samples. One standard contains an ambient loading, approximately 9 asbestos fibers/0.01 square millimeter of filter. Because of the low fiber counts and large standard deviation in the average fiber loading, the standard does not have a certified value for the fiber loading. Instead the results are presented in an analysis report. The second standard contains a slightly higher loading of asbestos, approximately 30 fibers/0.01 square millimeter of filter. The standard includes a certified fiber loading with the uncertainty in the value expressed as a 95/95 tolerance interval about a five-count mean.

702,423
PB86-193265 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Fabrication of Metals and Metal Alloys as Particle Standards.
Final rept.
J. A. Small, J. A. Norris, and R. L. McKenzie. 1983, 2p
Pub. in Microbeam Anal. 18, p209-210 1983.

Keywords: *Particle size, *Microanalysis, Chemical analysis, Metals, Reprints, *Calibration standards.

Recently, in studying the mechanism of analyte excitation in spectro-chemical analysis it was noticed that the spark of the emission spectrometer very efficiently produced particles in the 5 nanometers-10 micrometers size range. These particles may be suitable to serve as standards which could provide a large number of pure metal or metal alloy particles in a broad size range. Since the particles can be produced in large numbers, they can be used as particle standards for both micro and bulk analytical techniques.

702,424
PB86-193935 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Studies of Physical Mechanisms in Laser-Enhanced Ionization in Flames.
Final rept.
P. K. Schenck, J. C. Travis, and G. C. Turk. 1983, 10p
Sponsored by Centre National de la Recherche Scientifique, Paris (France).
Pub. in J. Phys. Colloq., nC7 p75-84 1983.

Keywords: Reprints, *Laser enhanced ionization, *Flame spectroscopy, Atomic spectroscopy.

Laser enhanced ionization (LEI) mechanisms which result in locally large neutral atom depletions in flames are discussed. In addition, this results in a locally large perturbation of the ionization rate of the flame which can be observed by an imaging technique. Two theoretical models of the physical motion of the LEI electrons and ions in the flame and their applicability to experimental observations are discussed.

702,425
PB86-195575 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Rising Interest in Quality Assurance.
Final rept.
J. K. Taylor. 1984, 1p
Pub. in Trac-Trends in Analytical Chemistry 3, n4 p2 1984.

Keywords: *Quality assurance, Chemical analysis, Statistical analysis, Reprints, Standard reference materials.

There is an increasing awareness that data quality is enhanced if the data are produced by a measurement system in a state of statistical control. The basic elements of a quality assurance program to attain the objective are described, and the expected benefits are summarized.

702,426
PB86-195807 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Lithium-Activated Silicon Detector-Specimen Angles in an AEM (Analytical Electron Microscopy).
Final rept.
R. L. Myklebust. 1983, 3p
Pub. in Microbeam Anal. 18, p174-176 1983.

Keywords: *Electron microscopy, Trajectories, Simulations, Detectors, X rays, Quantitative analysis, Reprints.

For quantitative energy dispersive analysis in an AEM, the position of the detector with respect to the specimen and electron beam must be known. The angle of the detector with respect to the electron beam is generally a fixed instrumental parameter that is known for each system. The specimen tilt axis is also an easily obtained parameter for each microscope and the azimuthal angle of the detector with respect to the specimen tilt axis can be specified. The angle between the detector and the specimen surface (usually called the take-off-angle) can be easily determined if the specimen is tilted toward the detector (azimuthal angle = 90 degrees, detector axis at right angles to the tilt axis). However, in many instruments, this is not the case and calculating the take-off-angle is more complicated. In the following discussion, the angular relations between the detector and the axes of the specimen together with the take-off-angle are derived.

702,427
PB86-195997 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Post Column Solvent Trapping Technique for the Analysis of Very Volatile Halocarbons.
Final rept.
F. R. Guenther, and S. N. Chesler. 1983, 2p
Pub. in HRC amp CC, Jnl. of High Resolution Chromatography and Chromatography Communications 6, n12 p684-685 1983.

Keywords: *Aluminum oxide, *Gas chromatography, Halohydrocarbons, Reprints, *Water pollution detection, Post column trap.

A capillary gas chromatographic method is described by which volatile halocarbon analytes eluting under a methanol or water solvent peak can be analyzed. The method consists of injecting the analytes onto a thick film SE-52 capillary column. The exit end of the column enters a post column trap packed with activated alumina. The trap selectively adsorbes the methanol solvent, allowing the analytes to pass to the detector unhindered. Data is presented which show a standard deviation in the response factors relative to the vinyl chloride internal standard of less than 5%. A detection limit of 1 ug/mL chloromethane is estimated.

702,428
PB86-196037 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Rate of Calcium Hydroxide Precipitation Measured by Electrical Conductance.
Final rept.
P. W. Brown, K. Galuk, and G. Frohnsdorff. 1984, 4p
Pub. in Jnl. Cement and Concrete Research 14, n6 p843-846 1984.

Keywords: *Calcium hydroxide, *Precipitation, *Calorimetry, Conductance, Seeding, Reprints, Induction period.

The rates of calcium hydroxide precipitation from supersaturated solutions were measured. Precipitation rates were observed to depend on whether the solutions were seeded with Ca(OH)2 or with C-S-H, or were unseeded. Calorimetric measurements indicated the presence of solid Ca(OH)2 to be ineffectual in promoting the onset of the acceleratory period of C3S hydration. The suggests that Ca(OH)2 precipitation is not the rate determining phenomenon in the regard.

702,429
PB86-196458 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Trace Metal Analysis by Laser-Enhanced Ionization in Flames.
Final rept.
J. C. Travis, G. C. Turk, and J. R. DeVoe. 1983, 4p
Pub. in Clinical Chemistry 29, n9 p1683-1686 1983.

Keywords: *Chemical analysis, *Trace elements, Metals, Reprints, Laser spectroscopy, Atomic absorption flame spectroscopy.

A review is given of the atomic flame spectrometric method based on the selective laser-enhancement of atomic ionization rates. A discussion of basic principles, prior literature, and instrumentation is followed by an overview of analytical figures of merit for the method, and a look at the present status and future development areas of the method.

702,430
PB86-196847 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Analytical Formula for Direction Cosines of the Eckart Frame of a Planar Molecule.
Final rept.
G. A. Natanson. 15 Nov 85, 4p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Chemical Physics Letters 121, n4-5 p343-346, 15 Nov 85.

Keywords: Reprints, *Eckart frame, *Planar molecule.

An analytical formula is suggested for calculating direction cosines of the Eckart frame of a planar molecule. As one application of the formula, we give a simple way to find the matrix switching of the geometrical body-fixed axes of the formaldehyde molecule to axes of its Eckart frame.

702,431
PB86-199064 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Determination of Sulfur as Arsenic Monosulfide Ion by Isotope Dilution Thermal Ionization Mass Spectrometry.
Final rept.
P. J. Paulsen, and W. R. Kelly. 1984, 6p
Pub. in Analytical Chemistry 56, n4 p708-713 1984.

Keywords: *Sulfur, Chemical analysis, Labeled substances, Iron alloys, Sepaation, Reprints, Arsenic sulfides, *Isotope dilution techniques, Thermal ionization mass spectroscopy, Sulfur 32, Sulfur 34, Copper base alloys.

A new procedure has been developed for the determination of microgram quantities of sulfur in metals by isotope dilution thermal ionization mass spectrometry. Typically 1 g metal samples are spiked with (34)S enriched spike, dissolved in a closed system to prevent loss of volatile S compounds using a mixture of HCl/HNO3 acids which oxidizes all S to sulfate. The S is reduced to H2S which is converted to As2S3. The As2S3 is dissolved in an As (+3) - NH3 solution to yield a As/S atom ratio of two. A small portion of this solution equivalent to 1.5 micrograms S is placed on a Re-flat filament with silica gel and the (32)S/(34)S ratio is measured at 950 deg C as the thermally produced (75)As(32)S(+1) and 75AsS+ molecular ion. The ionization efficiency is about 0.1% and the precision of the (32)S/(34)S ratio is typically 0.1% (1s). This procedure has been applied to the determination of S in 11 Cu base and Fe base alloys ranging in S concentration from 2.8 to 80 ppm. At these S levels the chemical blank is the major source of uncertainty. The total uncertainties for these two materials were 0.2 and 1 ppm, respectively.

702,432
PB86-199072 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Analytical Algorithm for Calculation of Spectral Distributions of X-ray Tubes for Quantitative X-ray Fluorescence Analysis.
Final rept.
P. A. Pella, L. Feng, and J. A. Small. 1985, 11p
Pub. in X-ray Spectrometry 14, n3 p125-135 1985.

Keywords: *X ray fluorescence analysis, *X ray tubes, Spectrum analysis, Algorithms, Spectral lines, Reprints.

Fundamental parameter methods for quantitative x-ray fluorescence analysis require knowledge of the spectral distributions of x-ray tubes used for sample excitation. The theoretical models for calculation of the spectral distributions include a number of parameters which are not known with sufficient accuracy. Spectral

distributions have been measured for just a few x-ray tubes operated at 45-50 kV. The authors have developed an algorithm to calculate x-ray tube spectral distributions by utilizing extensive electron microprobe data obtained under various operating conditions with a Si(Li) detector. The algorithm includes the calculation of the continuum and the ratio of the characteristic line(s) to the underlying continuum intensity at the wavelength of the characteristic line(s).

702,433
PB86-200441 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
On-Line Multidimensional Chromatography Using Supercritical Carbon Dioxide.
Final rept.
R. G. Christensen. Dec 85, 5p
Pub. in Jnl. of High Resolution Chromatography and Chromatography Communications 8, p824-828 Dec 85.

Keywords: *Chromatographic analysis, *Aromatic polycylic hydrocarbons, Carbon dioxide, Coal tar, Gas flow, Reprints, *Supercritical flow, High resolution, Two dimensional.

A two-dimensional chromatographic separation is described which makes use of the unusual properties of supercritical carbon dioxide mobile phase. The solvent has the property of giving a separation of polycyclic aromatic hydrocarbons (PAH) on amine-bonded columns similar to that given by usual normalphase solvents, and on octadecylsilane-bonded columns similar to that given by usual reversed-phase solvents. Separations from fractions containing 16 and 18 aromatic carbon atoms are shown.

702,434
PB86-201829 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Measurement of the Oxygen and Carbon Content of Silicon Wafers by Fourier Transform IR (Infrared) Spectrophotometry.
Final rept.
A. Baghdadi. 1986, 22p
Pub. in Proceedings of the ACS (American Chemical Society) Symposium Series 295 - Microelectronics Processing: Inorganic Materials Characterization, St. Louis, MO., April 8-13, 1984, p208-229 1986.

Keywords: *Silicon, *Carbon, *Oxygen, Semiconductors(Materials), Infrared spectroscopy, Microelectronics, Fourier transform spectroscopy.

Fourier transform infrared (FT-IR) spectrophotometry is a rapid, nondestructive characterization technique which is being increasingly applied on a large scale to the routine measurement of the oxygen and carbon content of silicon wafers used for the fabrication of microelectronic devices. Control of the oxygen content is needed to achieve acceptable yields in modern device processing, particularly for those processes which utilize oxide precipitates to protect active regions of devices from contamination by metallic impurities during high-temperature processing. The interlaboratory reproducibility of the measurement is not adequate considering the degree of control of the oxygen that is required. This review focuses primarily on the measurement of oxygen and carbon in silicon and on methods for improving quantitative FT-IR absorption measurements on semiconductor wafers.

702,435
PB86-202033 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Performance Appraisal Studies of Laser-Enhanced Ionization in Flames - The Determination of Nickel in Petroleum Products.
Final rept.
G. C. Turk, G. J. Havrilla, J. D. Webb, and A. R. Forster. 1984, 5p
Sponsored by Oak Ridge National Lab., TN. Analytical Chemistry Div.
Pub. in Proceedings of the Conference on Analytical Chemistry in Energy Technology (26th), Knoxville, TN., October 11-13, 1983, v19 p63-67 1984.

Keywords: *Nickel, *Petroleum products, Chemical analysis, Laser enhanced ionization, Tunable lasers.

Laser-enhanced ionization (LEI) in flames is an ultrasensitive atomic flame spectrometric technique based on the efficient thermal ionization of atomic species which have been selectively excited by tunable laser radiation. The performance of LEI for real sample analysis is presently being evaluated. A successful determination of trace Ni concentrations in heavy oil flash distillate and Standard Reference Material Fuel Oil has been performed. One gram samples were diluted into 100-700 mL volumes of a xylene/n-butanol solvent mixture and aspirated directly into an air-acetylene flame. Stepwise laser excitation of Ni was performed using a Nd:YAG pumped dual-dye laser system. Accurate and reproducible results were obtained.

702,436
PB86-207180 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Microbeam Analysis of Samples of Unusual Shape.
Final rept.
D. E. Newbury. 1984, 6p
Pub. in Jnl. de Physique (Supplement), v45 n2 p775-780 1984.

Keywords: *Microanalysis, *Particle shape, Electron probes, Correction, Reprints, *Electron microprobe analysis.

Electron probe microanalysis of samples of unusual shape, e.g., particles and rough surfaces, requires correction for the influence of geometric effects on electron scattering, x-ray absorption, and fluorescence. Normalization of the analysis total to unity puts the calculated concentrations on a reasonable bulk basis, but does not uniformly correct the geometric effects as a function of x-ray energy. Peak-to-background ratios are found to be independent of geometric effects to a first order. Correction of measured intensities by use of the background can significantly improve quantitative analysis.

702,437
PB86-209665 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Visibility of Asbestos Fibers in the Scanning Electron Microscope.
Final rept.
J. Small, D. Newbury, and R. Myklebust. 1983, 3p
Pub. in Proceedings of Annual Conference of Microbeam Analysis Society (18th), Phoeniz, AZ., August 6-12, 1983, Microbeam Analysis-1983, p148-150.

Keywords: *Asbestos, Contrast, Visibility, *Chrysotile, *Scanning electron microscopy.

Calculations have been made of the contrast of asbestos fibers in a back-scattered plus secondary electron image produced in the scanning electron microscope. From the calculated contrast, the threshold beam current for visibility and the minimum beam diameter have been determined. For chrysotile asbestos on a low atomic number background, fibers below 200 nm diameter are not visible in a rapid scanned image.

702,438
PB86-227113 PC **A11**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Basic Tables for Chemical Analysis.
Technical note.
T. J. Bruno, and P. D. N. Svoronos. Apr 86, 233p
NBS/TN-1096
Also available from Supt. of Docs as SN003-003-02724-3. Prepared in cooperation with Queensborough Community Coll., Bayside, NY., and Georgetown Univ., Washington, DC. Dept. of Chemistry. Sponsored by Gas Research Inst., Chicago, IL., and Department of Energy, Washington, DC. Office of Basic Energy Sciences.

Keywords: *Chemical analysis, Tables(Data), Gas chromatography, Infrared spectroscopy, Ultraviolet spectroscopy, Mass spectroscopy, Nuclear magnetic resonance, Qualitative analysis, Liquid column chromatography.

Tables of important data for use in the analytical chemistry laboratory are provided. These tables contain information for use in gas chromatography, liquid chromatography, infrared and ultraviolet spectrophotometry, mass spectrometry, and wet chemical techniques. Tables relating to safe practice in the analytical laboratory are also included.

702,439
PB86-229978 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Comprehensive Method for Determination of Aquatic Butyltin and Butylmethyltin Species at Ultratrace Levels Using Simultaneous Hydridization/Extraction with Gas Chromatography-Flame Photometric Detection.
Final rept.
C. L. Matthias, J. Bellama, G. J. Olson, and F. E. Brinckman. Jun 86, 7p
See also PB86-159555. Sponsored by Office of Naval Research, Arlington, VA., and David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.
Pub. in Environmental Science and Technology 20, n6 p609-615 Jun 86.

Keywords: *Chromatographic analysis, Chemical analysis, Organometallic compounds, Biocides, Water pollution, Chesapeake Bay, Tin organic compounds, Reprints, *Tin/butyl, *Tin/butyl-methyl.

An ultratrace method for the analysis of aquatic anthropogenic butyltin and mixed methylbutyltin species using simultaneous hydridization with sodium borohydride and extraction into dichloromethane is described. The detection limits for a 100-mL sample are 7 ng of Sn/L for tetrabutyltin, 7 ng of Sn/L for tributyltin, 3 ng of Sn/L for dibutyltin, and 22 ng of Sn/L for monobutyltin. Detection limits of approximately 1-2 ng of Sn/L for tri- and tetrabutyltin and less than 1 ng of Sn/L for dibutyltin species were achieved with 800-mL samples. The presence of tetrabutyltin in harbor waters is reported.

702,440
PB86-230505 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Investigations of Selectivity in RPLC (Reversed-Phase Liquid Chromatography) of Polycyclic Aromatic Hydrocarbons.
Final rept.
L. C. Sander, and S. A. Wise. 1986, 80p
Pub. in Advances in Chromatography 25, p139-218 1986.

Keywords: *Chromatographic analysis, *Aromatic polycyclic hydrocarbons, Selectivity, Reprints, Reverse phase chromatography, Liquid chromatography.

Selectivity in reversed-phase liquid chromatography (LC) of polycyclic aromatic hydrocarbons (PAH) is affected by both stationary phase parameters (phase type, pore size, and C18 surface coverage) and solute parameters (shape and non-planarity). Polymeric C(18) phases have been shown to have greater selectivity for the separation of PAH than the more commonly used monomeric C(18) phases. In the chapter, the recent investigations of reversed-phase LC selectivity for PAH will be reviewed and discussed including: bonded phase syntheses, characterization of substrate and bonded phase properties, and the effect of such parameters on selectivity.

702,441
PB86-231560 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Software for Data Collection and Analysis from a Size-Exclusion Liquid Chromatograph.
Final rept.
J. D. Barnes, B. Dickens, and F. L. McCrackin. 1985, 10p
Pub. in Computer Applications in the Polymer Laboratory, Chapter 13, p130-139 1985.

Keywords: Molecular weight, Surveys, Exclusion, Fortran, Automation, *Liquid chromatography, Computer software, Separation processes, Computer applications.

The paper describes software that is used for data collection and analysis from size-exclusion liquid chromatograph. The chromatograph is a commercially available instrument that provides on board microprocessor control of the specimen injection functions. They use a commercially available microcomputer as a passive listener connected to the chromatograph output to collect, store, and analyze the data. The data collection and analysis software is written in FORTRAN. Maximum use is made of graphical displays to aid the user's judgement in interpreting the data. All operations are menu drive, so that the user does not need to be familiar with the computer's operating

system. Data archiving functions are built in to facilitate after-the-fact retrieval of the data.

702,442
PB86-239126 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Quality Assurance Techniques for Activation Analysis.
Final rept.
D. A. Becker. 1984, 10p
Pub. in Proceedings of Int. Conf. Nucl. Methods Environ. Energy Res. (5th), p657-666 1984.

Keywords: *Neutron activation analysis, Chemical analysis, Quality assurance, Standards, Data processing, Calibration.

The principles and techniques of quality assurance are applied to the measurement method of activation analysis. Quality assurance is defined to include quality control and quality assessment. Plans for quality assurance include consideration of: personnel; facilities; analytical design; sampling and sample preparation; the measurement process; standards; and documentation. Activation analysis concerns include: irradiation; chemical separation; counting/detection; data collection and analysis; and calibration. Types of standards discussed include calibration materials and quality assessment materials.

702,443
PB86-239373 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Vortex Cooling for Subambient Temperature Gas Chromatography.
Final rept.
T. J. Bruno. 1986, 1p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Analytical Chemistry 58, p1596 1986.

Keywords: *Gas chromatography, *Hilsch tube, Reprints, *Vortices.

There has been a good deal of recent interest in subambient temperature gas chromatography, especially for work involving priority pollutants present in air samples. The most popular method of achieving subambient temperatures in chromatographic ovens is through the use of a cryogenic fluid. The short note describes the use of the Ranque-Hilsch vortex tube as a simple and effective alternative to liquefied gases when column temperatures of between -40 and 0 deg C are required.

702,444
PB86-247632 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Computer Software for the Acquisition and Treatment of Calorimetric Data.
Technical note (Final).
D. K. Steckler, R. N. Goldberg, Y. B. Tewari, and T. J. Buckley. May 86, 45p NBS/TN-1224
Also available from Supt. of Docs as SN003-003-02748-1.

Keywords: *Calorimeters, *Heat measurement, Data acquisition, Data processing, Thermodynamic properties, Measuring instruments, Chemical analysis, *Computer software, Computer program documentation, Calorimetry.

The computer software used for the acquisition and treatment of data from both heat-conduction microcalorimeters and an isoperibol solution calorimeter is described. For each program contained there is documentation given which includes a listing of the program, comments, and an example of its use. The hardware used in the data acquisition is briefly described.

702,445
PB87-100194
(Order as PB87-100186, PC **A08**/MF **A01**)
National Bureau of Standards, Boulder, CO.
High Precision Microcalorimetry: Apparatus, Procedures, and Biochemical Applications.
D. K. Steckler, R. N. Goldberg, Y. B. Tewari, and T. J. Buckley. 25 Feb 86, 9p
Included in Jnl. of Research of the National Bureau of Standards, v91 n3 p113-121 May-Jun 86.

Keywords: *Chemical analysis, *Heat measurement, Biochemical reaction kinetics, Thermal measuring instruments, Chemical reactions, Enzymes, *Calorimetry.

Apparatus and procedures used for high-precision microcalorimeter is of the heat-conduction type and utilizes semi-conductor thermoelectric modules. The biocompartmental reaction vessel is made of high-density polyethylene and holds about 0.5 mL of solution in each compartment. Imprecision of heat measurement is 0.2 percent when measuring 300 mJ of heat produced by a rapid chemical reaction. Three microcalorimeters are operated simultaneously using a microcomputer and a data acquisition system. Theromchemical and kinetic applications are described. The acquisition of data from an isoperibol solution calorimeter is also described.

702,446
PB87-100202
(Order as PB87-100186, PC **A08**/MF **A01**)
National Bureau of Standards (NEL), Boulder, CO.
Standards Development for Differential Scanning Calorimetry.
J. E. Callanan, S. A. Sullivan, and D. F. Vecchia. Jun 86, 7p
Included in Jnl. of Research of the National Bureau of Standards, v91 n3 p123-129 May-Jun 86.

Keywords: *Heat measurement, *Thermal analysis, Enthalpy, Standards, Transition temperature, Calibration, Differential scanning calorimetry.

The article summarizes two studies made in preparation for standards development, by differential scanning calorimetry, for instruments such as scanning calorimeters, differential thermal analyzers, differential mechanical analyzers, and related thermal analysis devices. The first was an extensive study of the varability of differential scanning calorimeters when used for determining transition temperatures and enthalpies. The second was an evaluation of calibration procedures recommended by the American Society of Testing and Materials. These studies are described in detail in National Bureau of Standards Special Publication 260-99.

702,447
PB87-104261 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Miniature Mercury Contact Switch for Chromatographic Applications.
Final rept.
T. J. Bruno, and J. G. Shepherd. Mar 86, 1p
Sponsored by Gas Research Inst., Chicago, IL., and Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Analytical Chemistry 58, n3, p672 Mar 86.

Keywords: *Chemical analysis, *Temperature control, *Gas chromatography, *Electric switches, Mercury, Reprints.

A small mercury contact switch for use in temperature control of gas chromatographic equipment has been designed and constructed. The major features of the device are described, including its present limitations. The results of preliminary testing of the device are also given.

702,448
PB87-105813 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Chemometrics and Analytical Chemistry.
Final rept.
L. A. Currie. 1984, 32p
Pub. in NATO ASI Ser., Ser. C, Chemometrics 138, p115-146 1984.

Keywords: *Chemical analysis, Quality control, Measurement, Reprints, *Chemometrics.

Modern analytical chemistry has become intrinsically tied to the exposure, understanding, and resolution of many of today's sociotechnical problems, in areas ranging from medical diagnostics to guarding our climate. Chemometrics is central in deriving adequate responses to these needs in terms of the design, control, evaluation and validation of the analytical measurement process. In the two reprints which follow, the substance of the lecture is treated in the first (I) while the second (II) comprises a case study from the relatively new discipline of 'Chemometric Intercomparison', or interlaboratory (numerical) validation via simulated analytical data. The paragraphs which follow are offered to introduce the reprints and to summarize some recent observations on the subject of detection.

702,449
PB87-106118 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Application of Capillary Gas Chromatography-Mass Spectrometry to Chemical Characterization of Radiation-Induced Base Damage of DNA: Implications for Assessing DNA Repair Processes.
Final rept.
M. Dizdaroglu. 1985, 11p
Pub. in Analytical Biochemistry 144, n2 p593-603 1985.

Keywords: *Chromatographic analysis, *Deoxyribonucleic acids, Gas chromatography, Mass spectroscopy, Reprints, *Radiation effects, DNA damage, Biological repair.

The application of capillary gas chromatography-mass spectrometry (GC-MS) to the chemical characterization of radiation-induced base products of calf thymus DNA is presented. Samples of calf thymus DNA irradiated in N2O- saturated aqueous solution were hydrolyzed with HCOOH, trimethylsilylated and subjected to GC-MS analysis using fused silica capillary column. The trimethylsilyl derivatives of these products had excellent GC-properties and easily interpretable mass spectra, where an intense molecular ion M(1+) and a charateristic (M-CH3) ion were observed. Using the methodology, it was possible to show the formation of novel base products in irradiated DNA in addition to the products reported previously. All mass spectra obtained were discussed in detail. The capillary GS-MS using the methodology described here was suggested as a very suitable technique for investigation of DNA repairability by repair mechanisms of DNA lesions created by either ionizing radiation or other agents, e.g., chemical mutagens, oxidizing agents, etc.

702,450
PB87-106423 PC **A04**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Collection of Abstracts of Selected Publications Related to Quality Assurance of Chemical Measurements.
J. K. Taylor. Apr 86, 52p NBSIR-86/3352

Keywords: *Chemical analysis, *Quality assurance, Quality control, Accuracy, Precision, Reference materials.

The publication contains abstracts of 150 papers selected for their usefulness to analytical chemists, laboratory managers, and quality assurance officials when developing new or improving existing programs or for general guidance in producing reliable analytical chemical measurements. Definitions of some 75 terms used in describing the quality aspects of chemical measurements are included.

702,451
PB87-106704 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Materials.
Certified Reference Materials for Validating Spectroscopic Methods and Experimental Data.
Final rept.
R. Alvarez. 1986, 8p
Pub. in Fresenius Zeitschrift fuer Analytische Chemie 324, p376-383 1986.

Keywords: *Spectroscopic analysis, Chemical analysis, Calibrating, Standards, Reprints, *Standard reference materials, Certified reference materials.

Chemical analyses of the same homogeneous materials by different laboratories often disagree. Discrepant data may be caused by poor methodology, improper instrument calibration, faulty experimental techniques, impure reagents, or from a combination of these factors. For trace constituent determinations, the magnitude and evaluation of the method blank are often the main limitations toward obtaining accurate results. One approach towards improving the accuracy of analytical determinations is by the use of Certified Reference Materials (CRMs) issued by organizations throughout the world. A CRM is a homogeneous, stable material with certified chemical and/or physical properties used in calibrating instruments, validating experimental data, developing methods of known reliability, and referring data from different laboratories to

a common base. In the United States, the National Bureau of Standards has legal authority to issue CRMs, which for historical reasons are called Standard Reference Materials (SRMs).

702,452
PB87-107157 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Vortex Refrigeration of HPLC (High Performance Liquid Chromatography) Components.
Final rept.
T. J. Bruno. 1985, 2p
Sponsored by Department of Energy, Washington, DC.
Pub. in Liquid Chromatography 4, n2 p134-136 1985.

Keywords: *Chromatographic analysis, *Hilsch tubes, Cooling, Reprints, High pressure liquid chromatography.

Due to the recent interest in cooling the components of HPLC and SFC instrumentation, an approach to component cooling based on vortex refrigeration is presented. The refrigeration units described use the Ranque-Hilsh vortex tube to generate cold air with which to cool chromatographic components. A discussion of the operation of the refrigeration units is provided, and the problem of noise is addressed.

702,453
PB87-107298 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Two-Dimensional Proton Chemical Shift Correlated NMR Spectroscopy of Digitoxose.
Final rept.
B. Coxon. 1984, 19p
Pub. in J. Carbohydr. Chem. 3, n4 p525-543 1984.

Keywords: *Spectroscopic analysis, Chemical analysis, Nuclear magnetic resonance, Carbohydrates, Reprints, *Chemical shift, *Digitoxose, Two dimensional.

The hydroxyl proton coupled 1H NMR spectra of solutions of beta-D-digitoxopyranose and of an equilibrated mixture of the four ring forms of D-digitoxose in dimethyl-sulfoxide-d sub 6 have been assigned completely by two-dimensional, proton chemical shift correlated NMR spectroscopy and spin decoupling at 400 MHz. Analysis of resolution enhanced, one-dimensional (1)H NMR spectra yielded an almost complete set of CH and OH proton-proton coupling constants for the four ring forms. The free aldehydo form of D-digitoxose in dimethylsulfoxide-d sub 6 solution has been detected by means of its characteristic H-1 quartet at 9.687. Quantitative analysis of the equilibrated mixture of the five forms of D-digitoxose gave the composition: - alpha-pyranose, beta-pyranose, alpha-furanose, beta-furanose, aldehydo form, 11.2, 67.3, 8.4, 13.0, and 0.13 percent, respectively.

702,454
PB87-107306 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Two-Dimensional Proton J-Resolved NMR Spectroscopy of Neomycin B.
Final rept.
R. E. Botto, and B. Coxon. 1984, 19p
Pub. in J. Carbohydr. Chem. 3, n4 p545-563 1984.

Keywords: *Spectroscopic analysis, Chemical analysis, Nuclear magnetic resonance, Antibiotics, Reprints, *Chemical shift, *Neomycin B, Coupling constants, Two dimensional.

The (1)H NMR spectrum of a solution of neomycin B free base (Structure 1) in D2O has been assigned completely by two-dimensional, homonuclear J-resolved NMR spectroscopy and spin decoupling at 400 MHz. Proton chemical shifts and proton-proton couplings are reported for all glycoside residues in neomycin B along with their computer simulated spectra. The (4)C1, chair conformation has been assigned to the pyranose form of the 2,6-diamino-2,6-dideoxy-alpha L-idosyl (ring D) portion of the antibiotic (1b) by analysis of the proton coupling constants and chemical shifts. The beta-furanose form of the ribosyl portion (ring C) has been assigned. Vicinal proton couplings for the 2-deoxystreptaminyl group (ring B) are consistent with a chair conformation in which all ring substituents are equatorial, and proton chemical shift assignments are based on protonation studies. A computer simulated composite of the individual calculated spectra is presented for comparison with the experimental spectrum of neomycin B.

702,455
PB87-107322 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Nonlinear Effects of Digitizer Errors in FT-IR (Fourier Transform Infrared) Spectroscopy.
Final rept.
A. Baghdadi, W. K. Gladden, and D. R. Flach. 1986, 12p
Pub. in Applied Spectroscopy 40, n5 p617-628 1986.

Keywords: *Infrared spectrometers, *Spectroscopic analysis, *Analog to digital converters, Chemical analysis, Infrared spectroscopy, Accuracy, Errors, Reprints, Fourier transform spectroscopy, Nonlinear problems.

The paper is an investigation of the effects of errors in the analog-to-digital converter (ADC) of a Fourier transform infrared (FT-IR) spectrometer on the photometric accuracy of that spectrometer. The effect of ADC errors on the spectrum after Fourier transformation is calculated analytically for monochromatic, two-line, and wide square band emission spectra. Numerical modeling is used to extend the analysis to absorption spectra, and to include the effects of noise on the amplitude of absorbance bands. These analyses showed that ADC errors can generate artifacts throughout the spectrum, although the largest effects occur at sharp spectral features.

702,456
PB87-109492 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Mass Spectrometry of 2-Methylthio(Glyco)Oxazoline Derivatives of Pentoses and Hexoses.
Final rept.
G. D. Byrd, R. M. Davidson, E. White, V. B. Coxon, and S. A. Margolis. 1985, 5p
Pub. in Organic Mass Spectrometry 20, n7 p458-462 1985.

Keywords: *Chemical analysis, *Pentoses, *Hexoses, Mass spectroscopy, Carbohydrates, Metastable state, Reprints, *Oxazoline/(glyco)-methylthio.

The fragmentation of 2-methylthio(glyco)oxazolines under electron impact has been investigated by low and high resolution mass spectrometry. Field desorption was used in those cases where the molecular ion was weak or missing. Fragmentation pathways were determined by monitoring metastable transitions and through the use of labeled compounds. The results support the anticipated structure for these compounds and show the sensitivity of the mass spectra toward ring size.

702,457
PB87-109526 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Impact of Instrumentation on Analytical Chemistry.
Final rept.
J. K. Taylor. 1986, 10p
Pub. in the History and Preservation of Chemical Instrumentation, p1-10 1986.

Keywords: *Chemical analysis, Quality assurance.

The analytical chemist has always depended on instrumentation and has been limited by instrumental capability. Advances in instrumentation during recent times have led to new capabilities in trace analysis, high accuracy analysis, multicomponent analysis, and analytical process control that could hardly have been imagined only a few years ago. The impact on the analyst has resulted in his transition from a generalist to a specialist and the production of data from an individual to a sub-contractor mode of operation. The result has been the need for formalized quality assurance practices if data are to be compatible. Only in the most routine situations is the need for competent analysis decreasing. Rather, the complexity of modern analysis is requiring a higher-than-ever level of competence of analysts practicing at the highest levels of professionalism.

702,458
PB87-109534 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Validation of Analytical Data.
Final rept.
J. K. Taylor. 1986, 5p
Pub. in Marine Chemistry 18, p115-119 1986.

Keywords: *Chemical analysis, Proving, Marine atmospheres, Quality assurance, Environmental surveys, Reprints.

Valid data may be defined as those which result from a valid measurement process applied to valid samples, selected in accordance with a valid plan based on a valid model of the problem under investigation. The paper discusses the various aspects of the validation process.

702,459
PB87-109542 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Guidelines for Evaluating the Blank Correction.
Final rept.
J. K. Taylor. Jan 84, 2p
Pub. in Jnl. of Testing and Evaluation 12, n1 p54-55 Jan 84.

Keywords: *Chemical analysis, *Trace elements, Guidelines, Water, Reprints.

The statistical considerations in applying the blank correction in trace analysis are discussed. The question of acceptable limits for the blank is addressed. Unless sufficient measurements are made, the uncertainties in the blank correction may be the major source of uncertainty in ultra-trace analysis.

702,460
PB87-110169 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.
Techniques for the Calibration of Microscopic Particle Size Standards.
Final rept.
D. A. Swyt, T. R. Lettieri, A. W. Hartman, and S. W. Jensen. 1983, 12p
Pub. in Particulate Systems, p335-346 1983.

Keywords: *Particle size distribution, *Standards, *Chemical analysis, Calibration, Electron microscopy, Particle size, Reprints.

Three methods for the measurement of size distributions of microscopic spherical particles - light scattering, electron microscopy, and flow counting - form a complementary set of techniques under development for use at the National Bureau of Standards for calibration of polymer spheres as particle size standards.

702,461
PB87-111829 PC **A08**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Proceedings of the 1986 Meeting of the Americas Branch of the Electrophoresis Society, March 16-28, 1986.
D. J. Reeder. Mar 86, 172p NBSIR-86/3345

Keywords: *Meetings, *Chemical analysis, Peptides, Nucleic acids, Molecular weight, Staining, *Electrophoresis, Isoelectric focusing, Immobilized pH gradients.

The publication consists of submitted plenary papers and abstracts for the 1986 Meeting of the Americas Branch of the Electrophoresis Society. The plenary papers are in-depth reviews and comprise 80% of the document.

702,462
PB87-117701 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Application of Neutron Depth Profiling to Microelectronic Materials Processing.
Final rept.
R. G. Downing, J. T. Maki, and R. F. Fleming. 1986, 18p
Pub. in American Chemical Society Symposium Series 295, p163-180 1986.

Keywords: *Chemical analysis, Depth finding, Helium, Lithium, Beryllium, Boron, Sodium, Bismuth, Microelectronics, *Neutron depth profiling.

Thermal neutron depth profiling (NDP) provides an isotope specific, nondestructive technique for the measurement of concentration versus depth distributions in the near-surface region of solids. The profiles are generated in real-time, analyzing depths of up to tens of micrometers. The method is particularly sensitive for the investigation of He, Li, Be, B, Na and Bi profiles. Demonstrative applications are presented for the technique, including: ion implantation-anneal sequence profiling; diffusion studies in a number of microelectronic materials; and homogeneity analysis of thin glass film overcoats. Comparisons are made for NDP and other profiling techniques such as secondary ion mass spectrometry (SIMS), Rutherford backscattering (RBS) and spreading resistance profiling (SRP).

702,463
PB87-118568 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Determination of Pore Accessibility in Silica Microparticles by Small Angle Neutron Scattering.
Final rept.
C. J. Glinka, L. C. Sander, S. A. Wise, M. L. Hunnicutt, and C. H. Lochmuller. 1985, 6p
Pub. in Analytical Chemistry 57, n11 p2079-2084 1985.

Keywords: *Porosity, *Silica gel, *Chemical analysis, Neutron scattering, Absorbers(Materials), Silicon dioxide, Area, Reprints.

The size, surface area and, in particular, the accessibility of pores in silica particles used in liquid chromatography have been studied by small angle neutron scattering (SANS). From SANS measurements on dry silica samples, values from the specific surface area are obtained and have been compared with BET measurements. Pore accessibility has been studied by saturating the samples with an H2O/D2O solution whose neutron scattering length density matches that of silica. Any residual scattering observed under this condition can be attributed to closed (unfilled) pores. Results are reported for silica particles with nominal pore size ranging from 5 to 33 nm. In addition, other applications of SANS related to the use of porous silica in chromatography and catalysis are discussed.

702,464
PB87-118733 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Role of Neutron Activation Analysis in Trace Analysis.
Final rept.
H. L. Rook. 1985, 28p
Pub. in Jnl. of Trace and Microprobe Techniques 2, n3-4 p189-216 1984-85.

Keywords: *Neutron activation analysis, *Trace elements, Chemical analysis, Radioactivation analysis, Reprints.

Neutron activation analysis is a technique which has become widely accepted for trace element analysis. It combines the advantages of high sensitivity, minimal matrix dependence and relative simplicity in analytical procedure. The combination of instrumental neutron activation analysis and radiochemical neutron activation analysis now allows the analysis of more than fifty elements in real samples. To illustrate this, the capability of neutron activation is reviewed considering a series of NBS botanical, biological, and geochemical Standard Reference Materials from the perspective of elemental sensitivity, elemental coverage, and analytical accuracy.

702,465
PB87-122214 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Materials.
Nuclear Methods--An Integral Part of the NBS (National Bureau of Standards) Certification Program.
Final rept.
T. E. Gills. 1984, 10p
Pub. in Proceedings of International Conference on Nuclear Methods in Environmental and Energy Research (5th), Mayaguez, Puerto Rico, April 2, 1984, p634-643.

Keywords: Radioactivation analysis, Measurement, Accuracy, *Standard reference materials.

Within the past twenty years, new techniques and methods have emerged in response to new technologies that are based upon the performance of high-purity and well-characterized materials. The National Bureau of Standards, through its Standard Reference Materials (SRM's) Program, provides standards in the form of many of these materials to ensure accuracy and the compatibility of measurements throughout the U.S. and the world. These standards, defined by the National Bureau of Standards as Standard Reference Materials (SRM's), are developed by using state-of-the-art methods and procedures for both preparation and analysis. Nuclear methods-activation analysis-constitute an integral part of that analysis process.

702,466
PB87-122818 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
NBS (National Bureau of Standards) Standard Reference Materials for Improving the Accuracy of Priority Pollutant Analyses.
Final rept.
B. I. Diamondstone. 1981, 9p
Pub. in Proceedings of Seminar for Analytical Methods for Priority Pollutants, Hershey, PA., April 9-10, 1981, p186-194.

Keywords: *Chemical analysis, Standards, Accuracy, Quality assurance, Precision, Aromatic polycylic hydrocarbons, *Standard reference materials, *Priority pollutants.

The use of Standard Reference Materials or Quality Assurance Standards as part of an overall quality assurance program can contribute significantly to improvements in both precision and accuracy for many studies being carried out in the areas of environmental measurement and management. A considerable number of standards have been produced in which constituents, of interest to analysts in the environmental field, have been fully characterized. A considerable effort at NBS has gone into the determination of both organics and inorganics in a wide variety of matrices. Many of these constituents presently appear on the EPA list of priority pollutants and therefore, are of significant value to analysts involved with measurements in the area of hazardous wastes. Because of the increased need for standards in this field, long term planning is required in order to meet future demands.

702,467
PB87-122859 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
High Accuracy/High Precision Determination of (235)U in Nondestructive Assay Standards by Gamma-Ray Spectrometry.
Final rept.
R. R. Greenberg, and B. S. Carpenter. 1984, 13p
Pub. in Proceedings of International Conference on Nuclear Methods in Environmental and Energy Research (5th), Mayaguez, Puerto Rico, April 2, 1984, p644-656.

Keywords: *Chemical analysis, *Uranium 235, Standards, Accuracy, Precision, Reprints, *Standard reference materials, Gamma spectroscopy, Isotope abundance.

High precision gamma spectrometry measurements have been made on five sets of five uranium isotope abundance reference materials for nondestructive assay (NDA). These sets are intended for international safeguards use as primary reference materials for the determination of the (235)U abundance in homogeneous uranium bulk material by gamma spectrometry. The measurements are to determine the counting rate uniformity of the (235)U 185.7 keV gamma as well as the (235)U isotope abundance for each sample. The results of the study indicate that accuracy of (235)U determination via gamma spectrometry, in the range of few hundredths of a percent (2 sigma), is achievable. The main requirement for achieving this level of accuracy is a set of standards whose (235)U isotope abundance are known to within 0.01% (2 sigma).

702,468
PB87-128310 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Development of Standard Operating Procedures for Differential Scanning Calorimeters.
Final rept.
J. E. Callanan, and S. A. Sullivan. Oct 86, 9p
Pub. in Review of Scientific Instruments 57, n10 p2584-2592 Oct 86.

Keywords: *Chemical analysis, Standards, Calibrating, Operations, Data reduction, Reprints, *Differential scanning calorimetry, Procedures.

The paper describes an assessment of the behavior of a differential scanning calorimeter and the development of satisfactory calibration, operation, and data reduction procedures, which depend on performance characteristics of the individual instrument. Factors that contribute to thermal lag are identified; suggestions for evaluating and compensating for it are given.

702,469
PB87-131504 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Analysis of Nitrogen Heterocycles in Shale Oil by a Dual Capillary Column Heart Cutting Technique.
Final rept.
F. R. Guenther, S. N. Chesler, and R. M. Parris. 1986, 7p
Pub. in Jnl. of Chromatography 363, p199-205 1986.

Keywords: *Chromatographic analysis, *Shale oil, *Nitrogen heterocyclic compounds, Chemical analysis, Gas chromatography, Reprints.

The analysis of nitrogen heterocycles in a shale oil matrix is described. A dual column gas chromatograph is used for the analysis after a simple sample preparation scheme is used. Details of the apparatus, especially the intercolumn pneumatic microswitch, are given. Quantitation by the standard addition method using internal volume corrections is described. Future direction for further development of the technique is briefly discussed.

702,470
PB87-132080 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Surface Roughness Metrology by Angular Distributions of Scattered Light.
Final rept.
D. E. Gilsinn, T. V. Vorburger, E. C. Teague, M. J. McLay, C. Giauque, and F. E. Scire. 1985, 14p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in SPIE 525, p2-15 1985.

Keywords: *Surface roughness, *Chemical analysis, Surfaces, Mathematical models, Depth, Measurement, Reprints, Angular distribution.

On-line industrial inspection of batch manufactured parts requires fast measurement techniques for surface finish quality. In order to develop the measurement basis for these techniques, a system has been built to determine surface roughness by measuring the angular distributions of scattered light. The system incorporates data gathered from the angular distribution instrument and traditional surface stylus instruments. These data are used both as input and as comparison data in order to test various mathematical models of optical scattering phenomena. The object is to develop a mathematical model that uses the angular distribution of scattered light to deduce surface roughness parameters such as R(sub a) and surface wavelength. The paper describes the results of an experiment in which angular scattered data from surfaces with sinusoidal profiles was used to compute the surface R(sub a) and wavelength. Stylus measurements of these parameters were made separately. A comparative table is given of the computed and measured values. Estimates of uncertainties are also given.

702,471
PB87-132684 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Precise and Accurate Determination of the (241)Pu Half-Life by Mass Spectrometry.
Final rept.
W. R. Kelly. 1985, 6p
Pub. in International Jnl. of Mass Spectrometry and Ion Processes 64, n1 p85-90 1985.

Keywords: *Chemical analysis, *Mass spectroscopy, *Half life, Precision, Accuracy, Reprints, *Plutonium 241, Americium 241.

A mass spectrometric procedure is proposed and described which eliminates biases due to the isobaric interference of (241) Am and mass dependent fractionation effects in the determination of the (241) Pu half-life. An equal atom mixture of Pu isotopes is prepared and aliquots are spiked with high purity (243) Am after a Pu-Am chemical separation. The (241)AM(1+) contribution to the (241)Pu(1+) ion current is determined

by measuring the (243)Am(1+) ion current. The (244)Pu/(239)Pu ratio is used as an internal standard to correct the measured (241)Pu/(sup i)Pu ratios for mass fractionation. The use of these procedures will result in a determination that is under complete statistical control and will yield a highly accurate and precise value. It is estimated that the uncertainty using these techniques would be about 0.001 years (1 sigma(sub m) after a decay interval of only 3 years.

702,472
PB87-132692 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Supercritical Fluid Extraction Procedure for the Removal of Trace Organic Species from Solid Samples.
Final rept.
M. M. Schantz, and S. N. Chesler. 1986, 5p
Pub. in Jnl. of Chromatography 363, p397-401 1986.

Keywords: *Chromatographic analysis, *Aromatic polycyclic hydrocarbons, Chemical analysis, Gas chromatography, Extraction, Reprints, *Polychlorinated biphenyls, NBS sediments.

The supercritical extraction of polychlorinated biphenyls (PCBs) from sediments and poly aromatic hydrocarbons (PAHs) from an urban particulate sample (NBS SRM 1649) is described. A commercial supercritical fluid chromatograph, designed for use with packed columns, is employed for temperature and pressure control, and a gas chromatograph equipped with either an electron capture detector or flame ionization detector is used for the PCB or PAH analysis, respectively. The supercritical extraction is compared to Soxhlet extraction for the sediment material and to certified values for the urban dust.

702,473
PB87-132700 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Identification and Quantitation of the Impurities in Sodium Pyruvate.
Final rept.
S. A. Margolis, and B. Coxon. 1986, 7p
Pub. in Analytical Chemistry 58, n12 p2504-2510 Oct 86.

Keywords: *Chemical analysis, Impurities, Nuclear magnetic resonance, Reprints, *Pyruvic acid/(Sodium-salt), Carbon 13.

Sodium pyruvate has been resolved from its acyclic dimer and oligomers by chromatography on Sephadex G-15. The compositions of the monomer, the dimer, and the synthetic dimer have been characterized by means of their carbon-13 and proton NMR spectra. The ultraviolet spectra and the absorptivities were also measured. By use of the molar absorptivities, the levels of the acyclic dimer have been calculated from the chromatograms of several commercial preparations of sodium pyruvate. The purest sodium pyruvate sample was selected for certification as NBS Standard Reference Material 910, for use as a substrate for the assay of enzymes of clinical importance.

702,474
PB87-132726 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Precise and Accurate Determination of High Concentrations of Sulfur by Isotope Dilution Thermal Ionization Mass Spectrometry.
Final rept.
W. R. Kelly, and P. J. Paulsen. 1984, 6p
Pub. in Talanta 31, n12 p1063-1068 1984.

Keywords: *Sulfur, *Chemical analysis, Steels, Reprints, Isotope dilution.

An isotope dilution thermal ionization mass spectrometric procedure has been developed for the accurate and precise determination of S in steels and organic based materials. Samples are dissolved in a sealed tube to prevent loss of S and the S isotopes are measured as the As S (1+) molecular ion, using silica gel as an emitter. The technique has been applied to the determination of S in 13 SRM's. The total uncertainty is typically 0.5% (95% confidence interval) and is governed by the uncertainty in the spike calibration and sample homogeneity.

702,475
PB87-134771 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Characterization of Airborne Particulates by Pyrolysis/Mass Spectrometry and Carbon-14 Analysis.
Final rept.
K. J. Voorhees, S. M. Kunen, S. L. Durfee, L. A. Currie, and G. A. Klouda. 1981, 3p
Pub. in Analytical Chemistry 53, n9 p1463-1465 1981.

Keywords: *Chemical analysis, Carbon 14, Pyrolysis, Mass spectroscopy, Oil shale, Aerosols, Reprints, *Particulate sampling, Radiocarbon, Oil shale dusts.

Pyrolysis/mass spectromety (Py/MS) has been used to characterize the composition of organics in an ambient air particulate sample from the eastern Utah oil shale lands. The procedure involved collection of the individual contributors, pyrolysis of these samples, and finally a least-squares fitting of the individual contributor spectra to the pyrolysis mass spectrum of the ambient sample. The Py/MS results were verified by using (14) C analysis.

702,476
PB87-134789 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Accelerator Mass Spectrometry Sample Preparation: Methods for (14)C in 50-1000 Microgram Samples.
Final rept.
G. A. Klouda, L. A. Currie, D. J. Donahue, A. J. T. Jull, and T. H. Zabel. 1984, 7p
Pub. in Nuclear Instruments and Methods in Physics Research Section B-Beam Interactions WI 233, n2 p265-271 1984.

Keywords: *Chemical analysis, *Carbon 14, Concentration(Composition), Accuracy, Radioactive isotopes, Mass spectroscopy, Reprints, *Radiocarbon, Iron carbon alloy.

A joint project was undertaken by the National Bureau of Standards (NBS) Atmospheric Chemistry Group and University of Arizona (UoA) Tandem Accelerator Mass Spectrometer Group to develop and evaluate accelerator (14)C measurements of 50 to 1000 microgram carbon samples at a modest accuracy of 5 to 10% Fe-C alloy targets prepared from standards and samples averaged 1.6 microamps (12)C-current. (14)C measurements yielded 10% precision and accuracy, limited by a blank equivalent to 11% modern carbon for targets containing -100 mi carbon. The contamination level was estimated to be -15 mi contemporary carbon (current atmospheric (14)C). The results demonstrated that the Fe-C target is quite suitable for atmospheric and environmental studies that require measuring fossil/biogenic carbon in microgram samples.

702,477
PB87-134797 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Materials.
Standard Reference Materials (SRM) in Chemical Monitoring Systems.
Final rept.
W. P. Reed, and T. E. Gills. 1986, 4p
Pub. in Proceedings of OCEANS 86 Monitoring Strategies Symposium, Washington, DC., September 23-25, 1986, v3 p814-817.

Keywords: *Chemical analysis, Standards, Monitors, Oceanography, *Standard reference materials.

The need for standards for physical measurements has been recognized as far back as the days of the Egyptian pharaohs and the use of the cubit as a unit of length. Since that time, increased measurement sophistication has led to the need for accurate physical standards of measurement. The development of the metric system and subsequently the International System of Units (SI), has in many ways met the need for primary standards for physical measurements. The accurate measurement of chemical properties is a more recent need. The paper explores the use of chemical measurement systems and their role in obtaining and verifying highly accurate and precise measurements over a long period of time. Also included in the discussion is a review of currently available Standard Reference Materials appropriate to ocean science and monitoring.

702,478
PB87-137162
(Order as PB87-137154, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Temperature Dependence of Spectral Broadening in the Hg (6 singlet S(sub 0) - 6 triplet P(sub 1)) Multiplet at High Optical Densities.
W. Braun, M. D. Scheer, and V. Kaufman. 10 Jul 86, 9p
Included in Jnl. of Research of the National Bureau of Standards, v91 n6 p313-321 Nov-Dec 86.

Keywords: *Mercury(Metals), *Chemical analysis, Absorption, Calibration, Gases, *Temperature dependence.

A new method has been developed for determining rapidly changing translational temperatures in a gas that has been heated by such transient phenomenena as the passage of shock wave or the absorption of sub-microsecond pulses of radiation from an infrared laser. The method depends upon the use of trace amounts of Hg vapor and its absorption of radiation in the neighborhood of the 253.7 nm isotopic and hyperfine multiplet. As the Hg atoms sense changes in the translational temperature of the host gas, the absorption of 253.7 nm radiation also changes by virtue of the Doppler and Lorentz broadening of the multiplet lines. Emission spectra of a Hg discharge light source in the neighborhood of 253.7 nm were shown to be readily simulated by a two zone computer model even at large optical densities. This provided a means for obtaining the temperature calibration curves needed to monitor the changing translational temperature of a gas undergoing rapid heating or cooling.

702,479
PB87-140224 PC **A06**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Technical Activities 1986, Molecular Spectroscopy Division.
A. Weber. Nov 86, 108p NBSIR-86/3483
See also PB86-164381.

Keywords: *Molecular spectroscopy, Resolution, Chemical analysis, Research projects, Frequency standards, Quantum chemistry, Photochemical reactions.

The report summarizes the technical activities of the NBS Molecular Spectroscopy Division during the Fiscal Year 1986. The activities span experimental and theoretical research in high resolution molecular spectroscopy, quantum chemistry and laser photochemistry, and include the development of frequency standards, critically evaluated spectral data, applications of spectroscopy to important scientific and technological problems, and the advancement of spectroscopic measurement methods and techniques. A listing is given of publications and talks by the Division staff.

702,480
PB87-149498 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
GFAAS (Graphite Furnace Atomic Absorption Spectroscopy) Determination of Ultratrace Quantities of Organotins in Sea-Water by Using Enhancement Methods.
Final rept.,
E. J. Parks, W. R. Blair, and F. E. Brinckman. 1985, 7p
Pub. in Talanta 32, n8A p633-639 1985.

Keywords: Spectroscopic analysis, *Tin organic compounds, *Sea water, Chemical analysis, Concentration(Composition), Accuracy, Reprints, Graphite furnace atomic absorption spectroscopy.

Triorganotin species in sea water are of anthropomorphic origin, introduced increasingly in trace quantities but to unknown extent with increasing Naval use of controlled-release antifouling agents. The paper addresses the problems of extraction of organotin species from sea water and their quantitation by means of signal-enhanced Graphite Furnace Atomic Absorption Spectroscopy. Both tributyltin and dibutyltin are extracted quantitatively by toluene from spiked samples of sea water. Monobutyltin extraction requires the aid of a complexing agent such as tropolone. Signal enhancement is effected by adding ammonium dichromate either to aqueous or organic solutions of organotin, and supplemented by use of L'vov furnace tubes. These complementary techniques are approximately additive and allow detection limits of 0.1 ng, or 0.2 parts per billion of sea water, a concentration considerably lower than that at which sensitive sea organisms are affected by tributyltin.

702,481
PB87-149829 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Activation Analysis of Electronics Materials.
Final rept.,
R. M. Lindstrom. 1986, 14p
Pub. in American Chemical Society Symposium Series 295, p294-307 1986.

Keywords: *Neutron activation analysis, Chemical analysis, Semiconductor(Materials), Silicon, *Electronics materials.

Small quantities of impurity elements in semiconductors can have profound effects on device characteristics. Neutron activation analysis is one of a small number of methods capable of multi-elemental analysis of subnanogram quantities of contaminants. The principles and procedures involved in activation analysis are described, with stress placed on detectability in real samples and on the limits to accuracy which may be expected in practice. Milligram to gram-sized samples of silicon, quartz, graphite, or organic materials are nearly ideal for the method. The physics of the processes involved is simple, and qualitative analysis is automatic. Except for the need for access to a nuclear reactor (or isotopic neutron source, at much lower sensitivity) the equipment required is readily available commercially, and is comparable in cost and complexity to that used in other advanced analytical techniques.

702,482
PB87-149837 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Analytical Neutron-Capture Gamma-Ray Spectroscopy: Status and Prospects.
Final rept.,
R. M. Lindstrom, and D. L. Anderson. 1985, 10p
Pub. in American Institute of Physics Conference Proceedings 125, p810-819 1985.

Keywords: *Neutron activation analysis, Chemical analysis, Sensitivity, Gamma spectroscopy.

The use of neutron-capture gamma rays for elemental analysis has become an established technique, applicable for the measurement of a list of elements which complements conventional delayed-gamma neutron activation analysis. Three distinct areas of application of the prompt method have been laboratory-based analysis using reactor neutrons, field measurements (especially borehole logging for mineral exploration), and industrial process stream analysis, the latter two using neutron generators or isotopic neutron sources. Continued improvements in detector systems and the increasing availability of clean, high-intensity beams from cold-neutron guide tubes are opening quantitatively and qualitatively new analytical possibilities. This will increase the productivity of these facilities by a similar factor, and will make the use of capture gamma rays more nearly comparable in sensitivity to conventional neutron activation analysis whenever the sample may be brought to the neutrons.

702,483
PB87-149845 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Use and Abuse of Quantitative Wavelength Dispersive X-ray Microanalysis.
Final rept.,
R. B. Marinenko. 1984, 4p
Pub. in Proceedings of the Annual Conference - Microbeam Analysis Society (19th), Bethlehem, PA., July 16-20, 1984, p201-204.

Keywords: *Microanalysis, *X rays, Data reduction, Chemical analysis.

A few interesting electron microprobe quantitative analyses using wavelength dispersive procedures are described. These particular analyses were selected because of the unexpected erroneous results obtained from such problems as charging, peak shifts, and data reduction procedures. The reasons for the errors and the solutions to the problems are discussed. The purpose of the paper is to bring such situations to the attention of the novice or unsuspecting analyst thus making them aware of precautions required when accurate results are desired.

702,484
PB87-149860 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Stable Isotope Measurements with Thermal and Resonance Ionization Mass Spectrometry.
Final rept.,
L. J. Moore. 1984, 26p
Pub. in American Chemical Society Symposium Series, Stable Isotope Nutrition 258, p1-26 1984.

Keywords: *Mass spectroscopy, Chemical analysis, Isotopes, Ionization, Isotope dilution.

Stable isotopes are being used increasingly to trace metabolic processes in humans and to determine ultra-trace concentrations of nutritionally important elements in tissues and biological fluids. Recent and ongoing developments in high sensitivity thermal ionization mass spectrometry (TIMS), and resonance ionization mass spectrometry (RIMS) and chemical separations suggest that studies of trace element metabolism, bioavailability and many related problems will be addressable at levels of precision and sensitivity not previously possible. The current state of the technology is summarized for positive and negative ion TIMS, for RIMS, and for element- and elemental group -specific chemical separations. The collective impact of this technology is assessed for stable isotopes in nutrition, and examples are presented for typical isotope ratios and isotope dilution measurements.

702,485
PB87-150652 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
X-Ray Spectrometric Analysis of Ceria-Yttria Mixtures After Borate Fusion.
Final rept.,
P. A. Pella, G. Y. Tao, A. L. Dragoo, and J. M. Epp. 1985, 3p
Pub. in Analytical Chemistry 57, n8 p1752-1754 1985.

Keywords: *X ray fluorescence analysis, *Cerium, *Yttrium, Spectroscopic analysis, Binary mixtures, Fuel cells, Reprints.

X-ray fluorescence analysis after automated borate fusion of the analyte with lithium tetraborate was investigated as a potentially fast and accurate method to characterize ceria-yttria rare earth mixtures for fuel cell applications. Because ceria-yttria powder mixtures can be prepared in several ways which can lead to products of different particle sizes, fusion of the sample was chosen as a sample preparation method. In the way, x-ray analysis can be used to characterize the homogeneity as well as the chemical composition of the oxide mixture which is important to control in fuel cell applications. For best results the sample-to-flux ratio should be held constant, and a correction for infinite thickness should be applied if the Y-K alpha line is chosen for measurement. Analysis of Y2O3 (12-85%) and CeO2 (15-88%) in these mixtures was performed with a relative error of less than + or -1%.

702,486
PB87-150678 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Observations on the Calculation of k(sub AB) Factors for Analytical Electron Microscopy.
Final rept.,
D. E. Newbury, D. B. Williams, J. I. Goldstein, and C. E. Fiori. 1984, 3p
Pub. in Anal. Electron Microsc., p276-278 1984.

Keywords: Chemical analysis, *Electron spectroscopy, Energy dispersive x ray spectroscopy.

Two methods exist for calculating elemental sensitivity factors, k(sub AB), used for quantitative analysis in analytical electron microscopy: The first method relies on the fit to experimentally determined k(sub AB) values to select the most appropriate parameters for the physical equations which describe the physics of x-ray generation and detection. The second method relies on 'first principles' calculation of the parameters. Due to uncertainties in ionization cross sections, fluorescence yields, and detector response, it is concluded that the first method offers better accuracy for practical analysis.

702,487
PB87-150769 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Analytical Methods.
Final rept.,
C. W. Reimann, and R. A. Velapoldi. 1984, 22p
Pub. in Encyclopedia of Chemical Technology, p43-64 1984.

Keywords: *Chemical analysis, Trends, Accuracy, Chemometrics.

The article is a supplement to the chapter on Analytical Methods in Volume 2 of the Encyclopedia of Chemical Technology, published in 1978. It addresses recent developments in analytical chemistry as well as several topics not included in that chapter. Trends in chemical analysis such as improved sensitivities, determination of species information, spatial resolution on a micrometer scale, and chemical profiling of multicomponent samples are described in general outline. Also discussed are the powerful tools such as lasers used both as light sources and sample excitation devices, computers used for data accumulation and analysis, techniques such as coupled instrumentation used for separation and detection, and mathematical methods, 'chemometrics' used for optimization of analytical information. Ten specific methods reflecting recent developments in analytical chemistry are described along with areas of application of these methods.

702,488
PB87-150892 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Measurement and Calibration.
Final rept.,
J. K. Taylor. Dec 86, 8p
Pub. in CHEMTECH, p756-763 Dec 86.

Keywords: *Chemical analysis, Calibrating, Reprints.

Reliable chemical measurements require the use of appropriate methodology that has been adequately calibrated. Ways to judge validity and to select methodology that is appropriate for a given use are described. The important subject of adequate calibration and pitfalls that can be encountered are discussed. Guidelines are suggested for the selection of specific instrumentation and criteria are listed for use in deciding the feasibility of making measurements in-house as opposed to contracting them out to specialist laboratories.

702,489
PB87-150900 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Isotopic Measurement of Subnanogram Quantities of Rhenium and Osmium by Resonance Ionization Mass Spectrometry.
Final rept.,
R. J. Walker, and J. D. Fassett. Dec 86, 5p
Pub. in Analytical Chemistry 58, n14 p2923-2927 Dec 86.

Keywords: *Chemical analysis, *Osmium, *Rhenium, Concentration(Composition), Reprints, Resonance ionization mass spectroscopy, Isotope dilution.

Resonance ionization mass spectrometry has been used to measure the isotopic compositions of microgram and picogram quantities of Re and Os. The high sensitivity required for these measurements was achieved through the optimization of sample atomization and efficient ionization from the resulting gas-phase reservoir. Re and Os are absorbed from chloride solutions onto anion exchange beads as a means of purifying and concentrating the sample and then loaded onto a miniaturized Ta filament. Measurements of microgram quantities of spike-standard mixtures are reported to precisions and accuracies of about 1%. Measurement precision and accuracy of picogram quantities of Os range from 1 to 5% and are primarily limited by counting statistics.

702,490
PB87-151486 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Tools for the Automated Handling of Evaluated Data.
Final rept.,
B. B. Molino. 1985, 6p
Pub. in the Role of Data in Scientific Progress, p489-494 1985.

Keywords: *Data processing, Automation, Data retrieval.

Advances in the computer industry have affected all aspects of automated handling of evaluated data, from the early stages of data acquisition through the final stages of data dissemination. These technological advances have provided many tools with obvious advantages in the handling of these unique data. At the same time, however, problems have arisen during the automation process, many of which are still being solved today. Both the advantages offered and the problems incurred in all phases of automated tools for handling evaluated data will be discussed, with examples presented of projects under way in the Office of Standard Reference Data.

702,491

PB87-152021 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Characterization of the Polycyclic Aromatic Hydrocarbons from Two Standard Reference Material Air Particulate Samples.
Final rept.,
S. A. Wise, B. A. Benner, S. N. Chesler, L. R. Hilpert, C. R. Vogt, and W. E. May. 1986, 11p
Pub. in Analytical Chemistry 58, n14 p3067-3077 Dec 86.

Keywords: *Aromatic polycyclic hydrocarbons, *Chromatographic analysis, Chemical analysis, Reprints, *Standard reference materials, Particulates, Air sampling.

Polycyclic aromatic hydrocarbon (PAH) mixtures were isolated from two air particulate materials, which are available from the National Bureau of Standards as Standard Reference Materials. High-resolution liquid chromatography (LC), gas chromatography (GC), and gas chromatography-mass spectrometry were used to provide a detailed characterization of these two samples. By use of the multidimensional chromatographic approach, quantitative information on over 180 PAH was obtained for these two samples. The extensive qualitative and quantitative information obtained for these two materials is extremely useful because these samples are available to other laboratories for use in the comparison of analytical methods and results.

702,492

PB87-161212 PC **A03**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Characterization of Long Term Controlled Release Dynamics and Identification of Butyltin Species Released from OMP (Organometallic Polymers) Impregnated Wood Pilings.
Final rept.,
W. R. Blair, G. J. Olson, and F. E. Brinckman. Jan 87, 27p NBSIR-87/3518
Contract N68305-82-MP-20019
Sponsored by Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Chemical analysis, Tin organic compounds, Gas chromatography, Extraction, Concentration(Composition), *Butyltin, *Wood pilings, Leaching.

The report describes a method for determining rates of release of organotin species leaching from wood pilings impregnated with organotin-containing copolymers and discusses short and long term results. The analytical method consists of simultaneous extraction/hydridization of aqueous leachate samples, followed by organotin speciation by gas chromatography coupled with tin selective flame photometric detection (GC-FPD). The detection limit for the butyltin family of organotins is 0.1 to 0.2 ng, depending on the species. The butyltins (mono- through tetrabutyltin) are speciated within a 15 min chromatogram, which also provides speciation of any methylbutyltin compounds that may be present in the sample. Water samples were collected from the leaching tanks immediately upon immersion of the wood pilings and at intervals thereafter for approximately 1 year.

702,493

PB87-161717 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Carbon Determination for the Study of Bonded Phases in Liquid Chromatography.
Final rept.,
B. I. Diamondstone, S. A. Wise, and L. C. Sander. 1985, 6p
Pub. in Jnl. of Chromatography 321, n2 p319-324 1985.

Keywords: *Chromatographic analysis, *Carbon, Liquid chromatography, Chemical analysis, Reprints, Carbon loading.

A procedure is described that permits carbon analyses to be performed on a variety of samples using a carbon analyzer originally intended for use with metal samples. By mixing small quantities of a relatively high carbon sample with low carbon steel, the problems of explosive combustion and inductive coupling are overcome. In addition, the technique permits highly reproducible measurements to be made that might not be possible using other methods. Several applications of the method are described for the measurement of carbon loading in chemically bonded stationary phases.

702,494

PB87-162038 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Role of Collaborative and Cooperative Studies in Evaluation of Analytical Methods.
Final rept.,
J. K. Taylor. 1986, 3p
Pub. in Jnl. of Association of Official Analytical Chemists 69, n3 p398-400 1986.

Keywords: *Chemical analysis, Standards, Reprints.

A method proposed as a standard or for use in a regulatory process must be reliable and its typical performance characteristics would be stated and verified. Collaborative testing is the most acceptable way to accomplish the latter but its function should not be misunderstood. Such testing can verify performance characteristics and experimentally demonstrate that the methodology can be used successfully by a representative group of laboratories.

702,495

PB87-162111 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Accuracy of Transmission Electron Microscopy for the Analysis of Asbestos in Ambient Environments.
Final rept.,
E. B. Steel, and J. A. Small. 1985, 5p
Pub. in Analytical Chemistry 57, n1 p209-213 1985.

Keywords: *Chemical analysis, *Asbestos, Accuracy, Chrysotile, Reprints, *Electron microscopy, Air pollution detection.

Errors associated with the analytical electron microscope analysis of trace amounts of chrysotile asbestos in ambient-type samples have been investigated. The microscope can be the source of order-of-magnitude size errors in the reported chrysotile concentration if the mechanical stage, image quality, and electron diffraction capabilities do not meet the demanding requirements of asbestos analysis. Using a verified counting procedure, it was determined that most operators of the microscope have less than approximately a 50% chance of finding and counting chrysotile fibers less than one micrometer in length. But that accuracies, greater than 90% can be achieved on chrysotile fibers longer than one micrometer when using the analytical electron microscope.

702,496

PB87-163986 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Optimization of Secondary Chemical Equilibria in Liquid Chromatography: Theory and Verification.
Final rept.,
J. P. Foley, and W. E. May. 1 Jan 87, 8p
Pub. in Analytical Chemistry 59, n1 p102-109, 1 Jan 87.

Keywords: *Liquid chromatography, Precision, Reprints.

A general theory for the optimization of secondary chemical equilibria in liquid chromatography (SCE-LC) is presented. Equations that predict the optimum mobile phase conditions are derived explicitly for the equilibrium. The selectivity of SCE-LC has been substantially underestimated because nonoptimum mobile phase conditions were employed in previous selectivity estimates. The self-selectivity, or ratio of capacity factors, K' (sub AX) / K' (sub A), determines the mobile phase optimum and the overall chromatographic selectivity which can be achieved. The theory is experimentally verified for acid-base equilibria.

702,497

PB87-163994 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Optimization of Secondary Chemical Equilibria in Liquid Chromatography: Variables Influencing the Self-Selectivity, Retention, and Efficiency in Acid-Base Systems.
Final rept.,
J. P. Foley, and W. E. May. 1 Jan 87, 6p
Pub. in Analytical Chemistry 59, n1 p110-115, 1 Jan 87.

Keywords: *Chemical analysis, Liquid chromatography, Precision, Reprints.

The effects of several chromatographic variables on the self-selectivity, retention, and efficiency in secondary chemical equilibria liquid chromatography (SCE-LC) are reported. The self-selectivities were measured for numerous ionogenic compounds using pH-buffered mobile phases. Only the type of stationary phase employed affected the self-selectivity by more than a factor of 2. Data from the plots used to measure the self-selectivities are included and serve as additional verification of the SCE-LC retention model discussed in the preceding paper. When greater than or equal to 4% 1-propanol is used, the resulting efficiencies are equal to those obtained in conventional liquid chromatography. An approach for the optimization of resolution is summarized.

702,498

PB87-164133 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Determination of Phenols in Petroleum Crude Oils Using Liquid Chromatography with Electrochemical Detection.
Final rept.,
W. A. MacCrehan, and J. M. Brown-Thomas. 1 Feb 87, 3p
Pub. in Analytical Chemistry 59, n3 p477-479, 1 Feb 87.

Keywords: *Chromatographic analysis, *Phenol, *Crude oil, Chemical analysis, Liquid chromatography, Accuracy, Concentration(Composition), Reprints.

A new method for the determination of phenolic compounds in unrefined petroleum products is presented. The method is based on alkaline solvent extraction of the oil, purification with a solid-phase extraction column, and determination by reverse-phase liquid chromatography with oxidative electrochemical detection. Phenol and 2-methylphenol, as well as 1- and 2-naphthol, have been determined in two National Bureau of Standards (NBS) Standard Reference Materials: SRM 1582 petroleum crude oil and SRM 1580 organics in shale oil. Agreement between the new liquid chromatography (LC) method and independent (gas chromatography (GC) and gas chromatography/mass spectrometry (GC/MS)) methods is good. The detection limits are below 100 ng/g for the phenols/naphthols in the oil.

702,499

PB87-164158 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Effects of Resistance and Capacitance on the Chronoamperometry of Polymer-Coated Electrodes as Modeled by a Finite Elements Digital Simulation.
Final rept.,
W. T. Yap, and R. A. Durst. 1987, 9p
Pub. in Jnl. of Electroanalytical Chemistry 216, p11-19 1987.

Keywords: Electrochemistry, Chemical analysis, Electrodes, Reprints, *Chronoamperometry.

A finite elements digital simulation of chronoamperometry with polymer-coated electrodes is presented. The model takes account of mass transport by diffu-

sion and migration, and the effects of the uncompensated resistance and capacitance of the system. A graphical method for the analysis of experimental data was introduced and applied to electrodes coated with poly(Ru(II)(bipy)2(4-vpy)2)(1+) PF6(1-).

702,500
PB87-167193 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Survey of Elements Detected Using Resonance Ionization Mass Spectrometry with Thermal Vaporization.
Final rept.,
J. C. Travis, J. D. Fassett, and L. J. Moore. 1984, 10p
Pub. in Institute of Physics Conference Series 71, p97-106 1984.

Keywords: *Chemical analysis, Mass spectroscopy, Reprints, Photoionization, Multielement analysis.

Since its inception, resonance ionization spectroscopy has held the promise of applicability to nearly every element of the periodic table. The rate of experimental verification of this expectation has been greatly accelerated by the independent development, in several laboratories, of a resonance ionization variant of thermal ionization mass spectrometry. Resonance ionization has been observed for at least twenty six elements in resonance ionization mass spectrometry devices employing thermal vaporization. The elemental survey data provide insights into special considerations which accompany the hybridization of resonance ionization and thermal vaporization mass spectrometry. These considerations relate to the composition of the vapor plume above the thermal filament, the energy level distribution of atoms in the plume, the choice of resonance ionization scheme, and the spectral response of the ionization signal.

702,501
PB87-167391 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Use of Ionization Cross Sections in Analytical Electron Microscopy.
Final rept.,
D. B. Williams, D. E. Newbury, J. I. Goldstein, and C. E. Fiori. 1984, 10p
Pub. in Jnl. of Microscopy-Oxford 136, p209-218 Nov 84.

Keywords: X ray analysis, Reprints, *Electron microscopy, Ionization cross section.

Quantitative analysis by the sensitivity factor method in analytical electron microscopy requires the use of an ionization cross section for the calculation of sensitivity factors which cannot be conveniently measured from multi-element standards. The Williams relativistic version of the Bethe formula with modifications due to Zaluzec is considered for use in calculating sensitivity factors.

702,502
PB87-172698 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Improved Procedure for the Determination of Iodide by Ion Chromatography with Electrochemical Detection.
Final rept.,
K. Han, W. F. Koch, and K. W. Pratt. 1 Mar 87, 6p
Pub. in Analytical Chemistry 59, n5 p731-736, 1 Mar 87.

Keywords: *Chromatographic analysis, *Iodides, Chemical analysis, Procedures, Reprints, Ion chromatography, Electrochemical detection.

An improved procedure for the determination of iodide using ion chromatography with electrochemical detection has been developed. The advantages of the good selectivity of ion chromatography and the highly sensitive response of iodide at a Pt electrode have been combined to establish a new method with enhanced detection limits and improved linearity. The use of an eluent consisting of nitric acid and sodium nitrate has eliminated the severe tailing of iodide. The detection limit has been estimated to be 10 ng/mL. The effect of other anions in solution has been determined. The method has been applied to the determination of iodide in cadmium sulfide, potassium fluoride, and iodized sodium chloride.

702,503
PB87-179339 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Determination of Sulfide at the Parts-per-Billion Level by Ion Chromatography with Electrochemical Detection.
Final rept.,
K. Han, and W. F. Koch. 1 Apr 87, 5p
Pub. in Analytical Chemistry 59, n7 p1016-1020, 1 Apr 87.

Keywords: *Chemical analysis, Absorption, Ion exchanging, Concentration(Composition), Reprints, *Ion chromatography, *Sulfides, Electrochemical detection.

An improved procedure for the determination of sulfide using ion chromatography with electrochemical detection has been developed. Detection limits have been extended down to 0.1 ng/mL, with linear response up to 1000 ng/mL. Several factors affecting the response of the system to sulfide have been investigated, including condition of the columns, the arrangement of the columns, purity of reagents, composition of eluent, condition of the working electrode, stability of sulfide solutions, mechanism of retention, and temperature of the system. The two main sources of error in the determination of sulfide are impurities in the eluent and adsorption of sulfide on the columns. Metal impurities in the eluent and on the column must be removed to achieve sensitivities below 20 ng/mL. To accomplish this, a new column cleaning procedure has been developed and a rearrangement in the positioning of the columns is recommended.

702,504
PB87-179347 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Silver Sulfonates: A Novel Calibration Material for Field Desorption Mass Spectrometry.
Final rept.,
R. Espinosa-Leniz, and E. White. 1987, 4p
Pub. in Organic Mass Spectrometry 22, p169-172 1987.

Keywords: *Mass spectroscopy, *Desorption, Precision, Accuracy, Concentration(Composition), Reprints, *Silver methane sulfonate, *Silver trifluoromethanesulfonate, Calibration.

An equimolar mixture of silver methanesulfonate and silver trifluoromethanesulfonate has been investigated as a calibration material for exact mass determination in field desorption mass spectrometry. The mass scale was established using only field desorption by double exposure of the calibration material and the sample on a photographic plate. The precision and the accuracy of the method were tested by recording the mass spectra of a variety of peptides of known composition at a resolution of about 4000. The results indicate that the mass scale established is useful for the determination of the exact masses of field desorbed ions over the mass range examined: m/z 294-1147.

702,505
PB87-181681 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Materials.
Standard Reference Materials. ASTM (American Society for Testing and Materials) and NBS (National Bureau of Standards) Cooperate to Assist Analytical and Testing Labs.
Final rept.,
S. D. Rasberry. Mar 87, 4p
Pub. in ASTM (American Society for Testing and Materials) Standardization News, p30-33 Mar 87.

Keywords: Standards, Reprints, *Standard reference materials.

No abstract available.

702,506
PB87-199261 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Ultratrace Elemental and Isotopic Analysis of Osmium and Rhenium Using Resonance Ionization Mass Spectrometry and Thermal Vaporization.
Final rept.,
J. D. Fassett, and R. J. Walker. 1986, 6p
Pub. in Proceedings of Resonance Ionization Mass Spectrometry Conference, Swansea, Wales, September 7-12, 1986, p115-120 1986.

Keywords: *Mass spectrometry, Osmium, Resonance ionization, Rhenium, Thermal atomization, *Isotope ratios, *Laser ionization.

Aspects of atomization and optical spectroscopy are described for resonance ionization of the elements osmium and rhenium. Picogram sensitivities have been developed with 1-5% precisions and accuracies in isotopic ratio measurement.

702,507
PB87-202966 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Rotational and Hyperfine Constants of Vibrationally Excited NH (a sup 1 Delta;nu=1).
Final rept.,
E. C. C. Vasconcellos, S. A. Davidson, J. M. Brown, K. R. Leopold, and K. M. Evenson. 1987, 4p
Contract NASA-W-15047
Sponsored by National Aeronautics and Space Administration, Washington, DC., and Conselho Nacional de Pesquisas, Rio de Janeiro (Brazil).
Pub. in Jnl. of Molecular Spectroscopy 122, p242-245 1987.

Keywords: *Hyperfine, *Imidogen, Laser magnetic resonance, Reprints, NH singlet delta, Rotational spectroscopy, Vibrationally excited.

The authors report the observation of the lowest rotational transitions of NH (a1 delta; upsilon=1) using low magnetic resonance spectroscopy. From this spectra the authors obtain rotational and hyperfine constants.

702,508
PB87-202982 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Cross-Linked Poly(vinylferrocene)-Modified Reference Electrode for Nonaqueous Electrochemistry.
Final rept.,
R. M. Kannuck, J. M. Bellama, E. A. Blubaugh, and R. A. Durst. 1987, 3p
Pub. in Analytical Chemistry 59, n10 p1473-1475, 15 May 87.

Keywords: Reprints, *Chemically modified electrode, *Nonaqueous electrochemistry, Polymer film electrode, Reference electrode.

A thermally initiated crosslinking procedure is applied to polyvinylferrocene electrodes in order to stabilize these films in organic solvents. The crosslinked film electrodes can then be used as reference electrodes for reporting electromative force (emf) data in nonaqueous solutions. This type of reference electrode is advantageous for nonaqueous electrochemistry in that it does not give rise to the irreproducible aqueous/nonaqueous liquid junction potential formed when conventional aqueous reference electrodes are used in aprotic solvents.

702,509
PB87-203030 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Far-Infrared Laser Magnetic Resonance Spectrum of the (17)OH Radical: Determination of Nuclear Hyperfine Parameters.
Final rept.,
K. R. Leopold, K. M. Evenson, E. R. Comben, and J. M. Brown. 1987, 15p
Contract NASA-W-15047
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 122, p440-454 1987.

Keywords: *Electronic structure, *Far infrared, Hyperfine parameters, Lasers, Magnetic resonance, Reprints, Rotational spectroscopy.

The far-infrared (FIR) Laser Magnetic Resonance (LMR) spectrum of the 17OH radical in the upsilon = 0 level of the X2II state has been studied in detail. The measurements have been analyzed and, in combination with some earlier EPR measurements, subjected to a single least-squares fit using an effective Hamiltonian. A full set of (17)O nuclear hyperfine parameters has been determined. Some implications of these parameter values for the electronic wavefunction of OH are considered.

702,510
PB87-203048 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Far-Infrared Spectrum of Sodium Hydride.
Final rept.,
K. R. Leopold, L. R. Zink, K. M. Evenson, and D. A. Jennings. and R. Shull. 1987, 7p
Contract NASA-W-15047
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 122, p150-156 1987.

Keywords: *Alkali hydride, Sodium hydride, Reprints, Born Oppenheimer approximation, Dunham coefficients, *Far infrared spectrum, Rotational spectrum.

Rotational spectra in the upsilon = 0, 1, 2, and 3 levels of the ground 1 sigma state of sodium hydride have been observed using tunable far-infrared radiation generated from the difference frequency between two CO2 lasers. The Dunham coefficients, which have been determined without the use of optical data or isotopic scaling relations are Y(01) = 146 999.138(38) MHz, Y(02) = -10.29481(54) MHz, Y(03) = 6.243(49) X 10 to the minus four power MHz, Y(11) = -4109.912(68) MHz, Y(12) = 0.14695(68) MHz, Y(21) = 33.341(34) MHz, Y(22) = -2.69(20) X 10 to the minus three power MHz, and Y(31) = -1.0517(55) MHz. The constants are typically an order of magnitude more accurate than the best values previously available, and where comparison is possible, agreement is found to be excellent.

702,511
PB87-213518
(Order as PB87-213476, PC **A05**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Center for Chemical Physics.
Instrument-Independent CAD (Collisionally-Activated Dissociation) Spectral Databases: Absolute Cross-Section Measurements in QQQ (Triple Quadrupole) Instruments,
R. I. Martinez, and S. Dheandhanoo. 5 Feb 87, 9p
Included in Jnl. of Research of the National Bureau of Standards, v92 n3 p229-237 May-Jun 87.

Keywords: *Charge-exchange reactions, *Argon ions, *Ion-molecule collisions, Tandem mass spectrometry, Calibration, Data bases.

The energy dependence of the cross section for the symmetric (resonant) charge transfer reaction Ar(1+) (Ar,Ar) Ar(1+) was measured in the triple quadrupole (QQQ) tandem mass spectrometer. Results are discussed.

702,512
PB87-216230 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Biological Reference Materials from the U.S. National Bureau of Standards--An Update.
Final rept.,
S. D. Rasberry. 1987, 4p
Pub. in Fresenius' Zeitschrift fuer Analytische Chemie 326, p609-612 1987.

Keywords: *Chemical analysis, *Food, *Plants, Reprints, *Biological reference materials, *National Bureau of Standards.

The paper provides an update covering the change in availability of NBS Biological Reference Materials between the First and the Second Symposium on Biological Reference Materials. In the intervening 30-month period, 15 new reference materials of biological interest have been issued by NBS and 8 more are being prepared. Newly issued reference materials that are described include: corn kernel, corn stalk, lead in blood, trace elements in human serum, inorganic constituents in bovine serum, PCB's in human serum, blood gases, toxic elements in urine, dioxin in isooctane, ethanol-water solutions, chlorinated pesticides and chlorinated biphenyls in isooctane. Several new Standard Reference Materials have been introduced to aid analysis in testing instrument performance. These are intended to provide a baseline of instrument performance, independent of the matrix analyzed. Described are 36 solution standards for spectrometric methods, a wavelength standard for spectrophotometers, a temperature standard, and one for evaluating GC/MS system performance.

702,513
PB87-230819 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Apparatus for the Rapid Equilibration of Moisture-Sensitive Materials.
Final rept.,
J. R. Moody, and E. S. Beary. 1987, 3p
Pub. in Analytical Chemistry 59, n10 p1481-1483, 15 May 87.

Keywords: *Humidity, Environment simulation, Moisture, Equilibrium, Sensitivity, Reprints, *Standard reference materials, Dry weight.

A simple apparatus is described for the rapid testing of Standard Reference Materials for sensitivity to humidity changes. Circulating air with controlled humidity and temperature air can achieve sample equilibration in a few minutes to 1 or 2 hours. A cyclic humidification dehumidification process has been used to achieve in a few hours effects which have been known to take one or more years for SRM 332.

702,514
PB87-230991
(Order as PB87-230975, PC **A04**/MF **A01**)
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Catalytic Cracking as the Basis for a Potential Detector for Gas Chromatography,
T. J. Bruno. 18 Feb 87, 5p
Sponsored by Gas Research Inst., Chicago, IL.
Included in Jnl. of Research of the National Bureau of Standards, v92 n4 p261-265 Jul-Aug 87.

Keywords: *Detectors, *Catalytic cracking, *Gas chromatography, Catalysts, Silicon dioxide, Aluminum oxides, Zeolites, Hydrocarbons, Temperature measurement, Thermocouples.

The paper describes the design, construction and preliminary experimental results obtained with a potential new detector for the gas chromatographic analysis of hydrocarbon species. The functional principle of the detector is the measurement of the temperature change of a catalyst as catalytic cracking occurs on its surface. The catalyst is a silicon dioxide-aluminum oxide-zeolite mixture similar to the materials used commercially in industrial riser crackers. The temperature drop which occurs at the onset of cracking is measured using two opposed thermocouple junctions. The first prototype, described in the paper, consists of a single pair of junctions. After appropriate signal conditioning (using a commercially available filter-amplifier), the thermocouple output is logged using an electronic integrator.

702,515
PB87-231528 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
High-Resolution Infrared Spectrum of the Fundamental Band of LiCl at a Temperature of 830 C.
Final rept.,
G. A. Thompson, A. G. Maki, W. B. Olson, and A. Weber. 1987, 9p
Pub. in Jnl. of Molecular Spectroscopy 124, p130-138 1987.

Keywords: *Infrared, Reprints, *High temperature, Lithium chloride, Molecular spectroscopy, Potential functions.

High-resolution Fourier transform spectra of 6LiCl and 7LiCl have been recorded at 830 C. A total of 2522 lines have been measured at 0.006 per cm resolution in the 500- to 730-per cm region. The data for all four isotopic species have been fit with a standard deviation of 0.00027 per cm using 19 isotopically invariant rovibrational constants including five delta correction terms to the usual Dunham Y terms. Comparison is made with the constants derived from a direct fit of the observed transitions to a Dunham potential function with only 13 coefficients including four delta correction terms. The gas phase band center for the upsilon = 1-0 transition of 7Li35Cl is 634.0753(7) per cm.

702,516
PB88-109087 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Laboratory Design for the Safe Distillation of Acids.
Final rept.,
E. S. Beary, and J. R. Moody. 1983, 1p
Pub. in Industrial Hygiene News Report 26, n11 p3 Nov 83.

Keywords: *Distillation, *Exhaust systems, *Polyvinyl chloride, *Laboratories, Design, Safety, Reprints, *Acids.

Two basic requirements governed the design of the laboratory: (1) the provision of high volume, single pass, class 100 air supply through a polyvinyl chloride (PVC) chamber and an all PVC exhaust system, and (2) careful control of the balance of air flows, removing acid fumes at their source without introducing fumes into the laboratory or permitting fumes to escape to the area outside the laboratory. The primary concern within the laboratory was to eliminate those materials which contained metal (as a source of contamination) or which could be attacked by contact with acids or their fumes.

702,517
PB88-110788 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Limits of Visibility for Chrysotile Asbestos in the Scanning Electron Microscope.
Final rept.,
J. A. Small, and D. E. Newbury. 1982, 8p
Pub. in Proceedings of International Colloquium on Dust Measuring Technique and Strategy (4th), Edinburgh, Scotland, September 1982, p425-432.

Keywords: *Air pollution, *Asbestos, *Fibers, Serpentine, Resolution, Instruments, Performance evaluation, Claims, *Foreign technology, *Scanning electron microscopy, *Air pollution detection.

Most manufacturers of scanning electron microscopes (SEMs) claim resolutions on the order of 5-10 nm for their instruments. With this level of resolution it appears that these instruments are capable of imaging single-fibril chrysotile which has a diameter range from 10-30 nm. The resolution, however, can only be expected for a high contrast sample with the instrument operating at a beam current and scan speed suitable for high resolution microscopy. In analyzing a low contrast sample such as chrysotile asbestos on a filter, where it may be necessary to search the filter surface for fibers at a rapid scan speed, the parameters which affect the visibility of the fibers are far from ideal. As a result, the best obtainable resolution will be several times that stated by the manufacturer.

702,518
PB88-117510 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Sub-Doppler Infrared Spectrum of the Carbon Dioxide Trimer.
Final rept.,
G. T. Fraser, A. S. Pine, W. J. Lafferty, and R. E. Miller. 1987, 7p
Pub. in Jnl. of Chemical Physics 87, n3 p1502-1508, 1 Aug 87.

Keywords: *Molecular spectroscopy, *Carbon dioxide, Infrared spectra, Van de Waals equation, Reprints, Laser spectroscopy.

A spectrum of the carbon dioxide trimer van der Waals species has been recorded near 3614/cm at sub-Doppler resolution using an optothermal (bolometer-detected) molecular-beam color-center laser spectrometer. A planar, cyclic structure with C3h symmetry has been determined for the complex with a carbon-carbon separation of 4.0382(3) A. The observed perpendicular band, corresponding to an in-plane E'-symmetry vibration of the trimer, has been attributed to a localized excitation of the 2v2o+v3 combination mode of a CO2 subunit by virtue of its small blue shift (approx. 0.98 cm-1) from that of the isolated monomer.

702,519
PB88-117528 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

High-Resolution Measurements of the (nu sub 2) and 2 (nu sub 2-nu sub 2) Bands of SO2.
Final rept.,
L. Coudert, A. G. Maki, and W. B. Olson. 1987, 6p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 124, p437-442 1987.

Keywords: *Air pollution, *Sulfur dioxide, Infrared spectra, Reprints, High resolution.

Infrared measurements have been made on SO2 between 450 and 602/cm with a resolution of 0.005/cm. The B-type bands due to the bending mode transitions 010-000 and 020-010 have been assigned and analyzed for the SO2 molecule. A total of 3007 transitions were measured and fit for SO2 with a standard deviation of 0.0004/cm. Ro-vibrational constants are given that fit the current measurements and the pure rotational transitions reported in the literature.

702,520
PB88-117635 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Affinity Chromatography and Metal Chelate Affinity Chromatography.
Final rept.,
A. J. Fatiadi. 1987, 44p
Pub. in CRC Critical Reviews in Analytical Chemistry 18, n1 p1-44 1987.

Keywords: *Chromatography, Reprints.

No abstract available.

702,521
PB88-122049 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Collisional Broadening of HCl Rotational Transitions Using Tunable Far-Infrared Radiation.
Final rept.,
K. V. Chance, I. G. Nolt, L. Zink, D. A. Jennings, K. M. Evenson, M. D. Vanek, and J. V. Radostitz. 1986, 3p
Pub. in Proceedings of the International Conference on Infrared and Millimeter Waves (11th), Tirrenia, Pisa, Italy, October 20-24, 1986, p277-279.

Keywords: *Hydrogen chloride, *Hydrochloric acid, Far infrared radiation, *Foreign technology.

Using tunable far-infrared radiation, the authors have measured pressure broadening coefficients and pressure-induced lineshifts for several rotational transitions of HCl. Results are presented here for the 83.39/cm R3 line of H(35)Cl, broadened and shifted by N2 and O2.

702,522
PB88-129747 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Viscosity Measurements Near Critical Points Using a Novel Torsion Oscillator.
Final rept.,
R. F. Berg, and M. R. Moldover. 1986, 12p
Pub. in International Jnl. of Thermophysics 7, n3 p675-686 May 86.

Keywords: *Liquid phases, *Fluids, *Viscosity, *Viscometers, Measurement, Methanol, Cyclohexane, Reprints.

A torsion oscillator viscometer has been constructed for the measurement of the viscosity of fluids near both liquid-vapor and liquid-liquid critical points. The viscometer was used to measure the temperature dependence of the viscosity anomaly near the consolute point of mixtures of methanol and cyclohexane along paths of constant pressure and paths of constant volume at temperatures spanning the range $0.00001 < ((T-T_c)/T_c) < 0.01$.

702,523
PB88-134572 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Excitation Mechanisms in Vibrational Spectroscopy of Molecules on Surfaces.
Final rept.,
J. W. Gadzuk. 1987, 55p
Pub. in Vibrational Spectroscopy of Molecules on Surfaces, Chapter 2, p49-103 1987.

Keywords: *Vibrational spectra, *Spectroscopy, Molecular vibration, Elementary excitations, Surfaces, Reprints, *Foreign technology.

Under the heading of introductory remarks, the why's of vibrational spectroscopy are considered, followed by a qualitative overview of the various techniques covered in the volume. A number of possible theoretical strategies for understanding the spectroscopies are then introduced. Section 2 deals with simple models of the excitation process. Similarities and differences between direct electron and photon vibrational excitation are presented.

702,524
PB88-134689 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of the Director.
Simple Correction Procedure for Continuum Fluorescence.
Final rept.,
K. F. J. Heinrich. 1987, 1p
Pub. in Proceedings of the Annual Conference of the Microbeam Analysis Society (22nd) and the Pacific Workshop on Analytical Electron Microscopy, Microbeam Analysis, Kona, HI., July 13-17, 1987, p24.

Keywords: *Microanalysis, Fluorescence, Chemical analysis, Data reduction, Errors, *Electron microscopy, X ray fluorescence.

Corrective procedures for fluorescence excited by the continuum have been proposed by Henoc and by Springer. In most analyses the effect of continuum fluorescene does not exceed a few percent and tends to compensate between specimen and standard. However, in the case of high-energy primary radiation, particularly in a matrix of low average atomic number, such as ZnKa in soft biological tissue, its neglect in the data reduction procedure may lead to serious errors. By chaning the integration procedure, eliminating the need for sorting edges and entering absorption edge jumps, the system can be simplified without sacrifice in accuracy and used in routine data reduction procedures.

702,525
PB88-134697 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of the Director.
General Correction for Fluorescence from Characteristic Lines.
Final rept.,
K. F. J. Heinrich. 1987, 1p
Pub. in Proceedings of the Annual Conference of the Microbeam Analysis Society (22nd) and the Pacific Workshop on Analytical Electron Microscopy, Microbeam Analysis, Kona, HI., July 13-17, 1987, p23.

Keywords: *Microanalysis, Fluorescence, Data reduction, *Electron microscopy, X ray fluorescence.

The fluorescence caused by characteristic lines was first described in Castaing's thesis; it is applied in a complete form in the program COR, but in most other procedures the abbreviated version due to Reed and Long is used. Both versions describe the fraction of radiation absorbed by the element which is secondarily excited by means of the absorption jump ratios, for which expressions exist for some absorption edges only. The version by Reed and Long uses simplifications which further restrict the range of applicability. The algorithm described in the publication permits an automatic application of the exact fluorescent correction to all situations, without the use of the jump ratios.

702,526
PB88-138995 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
New Experiments on the Langmuir Film Balance.
Final rept.,
G. Morrison, and I. L. Pegg. 1987, 7p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Symposium on Energy Engineering Sciences Instrumentation, Diagnostics, and Material Behavior (5th), Argonne, IL., June 17-19, 1987, p45-51.

Keywords: *Materials tests, Instruments, Measurement, Liquids, *Liquid-vapor interfaces.

The authors describe here the design and construction of a wide-range, automated film balance and a set of experiments on a well-documented material to test the instrument during its development. The balance can be operated in the temperature range 5 - 50 degrees C. The measurements of the liquid-expanded (LE)-liquid-compressed (LC) and the liquid-vapor transitions in pentadecanoic acid monolayers on water to confirm recent suggestions that long-standing ideas about these two transitions might be in error and that a thorough re-examination of many 'classic' measurements will be necessary.

702,527
PB88-141288 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Determination of Total Carbon in Biological Materials.
Final rept.,
B. I. Diamondstone, and R. C. Gauer. 1986, 3p
Pub. in Analyst 111, n8 p955-957 1986.

Keywords: *Botany, Carbon, Concentration(Composition), Combustion, Analytical chemistry, Reprints, *Standard reference materials.

Nine botanical Standard Reference Materials (SRM's) from the National Bureau of Standards (NBS) were analyzed for total carbon concentration on combustion analysis instrumentation primarily intended for the determination of carbon and sulfur in metals. 'Combustion Analysis' is a method for elemental analysis that involves the combustion of a sample followed by the measurement of evolved gases by a technique such as infrared absorption photometry. The method is popular for the rapid determination of total carbon in steels and other metal alloys and provides highly sensitive and reliable data when known standards are used for instrument calibration. In some cases metal combustion analysis instrumentation can accomodate nonmetallic (organic) samples for carbon analysis. Carbon was determined in the SRM's listed above and the accuracy and precision of the results are compared to values obtained with alternate procedures such as prompt gamma activation analysis, and commercial C, H, and N analyzers. The practicality of using a combustion analyzer intended for metals analysis for the analysis of a variety of botanical materials is discussed.

702,528
PB88-147194 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Complete Assignment of the (13)C NMR Spectra of the Ring Forms of Digitoxose by DEPT Spectrum Editing and Two-Dimensional CH Chemical Shift Correlation Spectroscopy.
Final rept.,
B. Coxon. 1986, 5p
Pub. in Magnetic Resonance in Chemistry 24, n11 p1008-1012 1986.

Keywords: *Spectrum analysis, *Proton spectra, Methyl sulfoxide, Editing, Nuclear magnetic resonance, Molecular structure, Chemical bonds, Reprints, *Digitoxose, *Pyranose, Two dimensional, DEPT system, Carbon 13.

The 13C chemical shifts of Beta-D-digitoxopyranose and its three isomeric ring forms in dimethylsulfoxide-d(-6) solution have been assigned completed by DEPT (13)C NMR spectrum editing and two-dimensional CH chemical shift correlation spectroscopy. The (13)C chemical shifts are discussed in terms of their dependence on ring size and on anomeric configuration. The equilibrated mixture of four ring forms of D-digitoxose in dimethylsulfoxide-d(-6) solution has been analyzed quantitatively by (13)C NMR spectroscopy, and the results compared with those obtained previously by (1)H NMR.

702,529
PB88-147202 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Two-Dimensional DEPT CH J-Resolved (13)C NMR Spectrum Editing.
Final rept.,
B. Coxon. 1986, 10p
Pub. in Jnl. of Magnetic Resonance 66, n2 p230-239, 1 Feb 86.

Keywords: *Spectrum analysis, Data acquisition, Nuclear magnetic resonance, Editing, Automation, Data processing, Experimentation, Reprints, Computer software, Interactive systems, PASCAL programming lan-

guage, Computer applications, Two dimensional, DEPT system.

An experimental method has been developed for editing 2D CH J-resolved (13)C NMR spectra obtained by the DEPT technique. The method involves the automated acquisition of three phase comparable 2D data matrices using disk interactive software with the proton polarization transfer pulses theta = pi/6, pi/2, and 5pi/6rad. Two software methods have been investigated for the automated construction of J-resolved sub-spectra from simple linear combinations of the data matrices. In a first approach, a sequence of microprograms has been used to combine the matrices by sequential handling of files. In a more efficient approach, a Pascal program was used to compute the CH2 and CH3 2D sub-spectra within a single compound statement. The method has been tested by generation of CH, CH2, and CH3 2D J-resolved subspectra from methyl 2,3-anhydro-4,6-0-benzylidene-alpha-D-mannopyranoside.

702,530
PB88-152715 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Surface Tension of Liquid Gallium.
Final rept.,
S. C. Hardy. 1985, 5p
Pub. in Jnl. Cryst. Growth 71, n3 p602-606 May/Jun 85.

Keywords: *Gallium, *Liquid metals, Interfacial tension, Auger spectroscopy, Reprints.

The surface tension of liquid gallium has been measured using the sessile drop technique in an Auger spectrometer. The samples were cleaned by Argon ion sputtering and were free of impurities to the sensitivity of Auger spectroscopy. The Surface tension of liquid gallium is found to decrease linearly with increasing temperature.

702,531
PB88-153697 PC **A07**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
System of Hardware and Software Developed for Size Exclusion Chromatography,
B. Dickens, and F. L. McCrackin. Dec 87, 134p
NBSIR-87/3669

Keywords: *Chromatography, User manuals(Computer programs), Computer systems hardware, Data acquisition, Data processing, Quality control, Computer software, IBM PC/XT computers, BASIC programming language.

A series of computer programs to carry out data collection and processing for size exclusion chromatography has been written in BASIC for an IBM XT type computer. The manual documents version 1.0, which uses a single detector. The detector is assumed to measure the concentration of the eluting species. Some provision is provided for quality control by comparing a measured chromatograms with the standard chromatogram for its class immediately after the chromatogram has been measured. There is no limit on the number of classes allowed. The measured chromatogram is automatically processed in the same way as the standard chromatogram was processed.

702,532
PB88-154570 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Silicon Photodiode Detector for Fluorescence EXAFS (Extended X-ray Absorption Fine-Structure).
Final rept.,
C. E. Bouldin, R. A. Forman, and M. I. Bell. 1987, 4p
Pub. in Review of Scientific Instruments 58, n10 p1891-1894 Oct 87.

Keywords: *X ray fluorescence, *Photodiodes, Gas ionization, Comparison, Reprints, *X-ray detection.

A large-area silicon diode is used as a fluorescence detector for extended x-ray absorption fine-structure (EXAFS) measurements. A direct comparison of the diode detector relative to a gas ionization fluorescence detector is made. Advantages of the diode detector include: higher signal for a given photon flux (due to higher quantum efficiency), vacuum and cryogenic compatibility, freedom from microphonic noise, good linearity, extremely wide dynamic range, operation without high voltage or gas connections, very simple electronics, and low cost. A brief comparison with other detection methods for fluorescence EXAFS is given. Use of photodiodes for transmission EXAFS is discussed.

Basic & Synthetic Chemistry

702,533
PATENT-4 224 279 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reactive Gas Generator.
Patent.
W. Tsang, J. Walker, and D. Cornell. Filed 8 Jun 78, patented 23 Sep 80, 6p PB80-600030, PAT-APPL-913 918

Keywords: *Diffusion cell, Organic parent compound, Pyrolyzing tube, Reactive gas.

A dilute mixture of a large organic parent compound in an inert diluent is formed using a specially designed diffusion cell to control the amount of parent compound that is taken up by the diluent gas. The dilute mixture flows through a hot-pyrolyzing tube where the parent compound is decomposed solely and totally by a gas phase unimolecular reaction into equimolar amounts of reactive gas and a stable reaction product. The method produces an internal standard for determining the concentration of the reactive gas since the stoichiometry of the reaction requires that the concentration of the reactive gas be equal to the concentration of the other reaction product, which can be easily calibrated by standard methods.

702,534
PB-264 310/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Preparation of Nitrides by Active Nitrogen. II. Si3N4.
Final rept.,
M. Shiloh, B. Gayer, and F. E. Brinckman. Feb 77, 6p
Pub. in Jnl. of the Electrochemical Society, v124 n2 p295-300 Feb 77.

Keywords: *Synthesis(Chemistry), *Nitrides, Nitrogen, Thermodynamics, Chemical reactions, Enthalpy, Silicon inorganic compounds, Reprints, Chemical reaction mechanisms, Silicon nitrides.

A general method for the preparation of nitrides is described by which active nitrogen, excited in a microwave cavity, is subsequently reacted with SiI4 vapors formed in situ by passing iodine vapors over heated silicon powder. The temperature dependence of the deposition of Si3N4 on polished Si wafers was measured and compared with calculated thermodynamic data of similar reactions with nonactive nitrogen. The kinetic measurements were related to the special flow characteristics of the system. The over-all reaction 4(N)g + 3(SiI4)g goes to (Si3N4)s + 6(I2)g was found to be exothermic. The calculated temperature dependence of the enthalpy change of the corresponding reaction with nonactive nitrogen was shown to be almost constant in the range studied. Similar values of negative activation energy were obtained for the assumed second-order rate-determining reaction: N + SiI4 goes to SiN + 2I2.

702,535
PB-272 526/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reactions of Transition Metal Ions with the Dithiotungstate(2-) Ion.
Final rept.,
A. R. Siedle, T. Negas, and J. Broussalian. 1975, 2p
Pub. in Jnl. of Inorganic and Nuclear Chemistry, Notes, v37 p2024-2025 1975.

Keywords: *Chemical reactions, *Transition metals, Ions, Tungstates, Decomposition, Hydrolysis reactions, Reprints, *Tungstate/dithio.

The reaction between Cu(+3), Dy(+3) or Eu(+3) with (NH4)2WO2S2 in water leads to the formation of the corresponding transition metal tungstates Cr2(WO4)3.3H2O, Dy2(WO4)3.6H2O and Eu2(WO4)3.17H2O. On heating at 985C., Cr2(WO4)3.3H2O decomposes to Cr2WO6 and WO3 while the rare earth tungstate hydrates lost water without decomposition.

702,536
PB-272 533/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Activation of Molecular Hydrogen by a nido-Metalloborane.
Final rept.,
A. R. Siedle. 1975, 3p
Pub. in Jnl. Organometallic Chemistry 97, pC4-C6 1975.

Keywords: *Quaternary ammonium salts, *Boranes, *Deuterium compounds, *Isotope exchange, Ions, Chemical reactions, Iridium inorganic compounds, Reprints.

Reaction of quaternary ammoniumsalts of the ((B10H12)Ir(CO)(PPh3)2)-ion with dideuterium at ambient temperature and pressure leads to H-D exchange at two terminal B-H sites in the B10H12 ligand.

702,537
PB-272 539/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dicarbollide Complexes of Rhodium and Ruthenium.
Final rept.,
A. R. Siedle. 1975, 8p
Pub. in Jnl. Organometallic Chemistry 90, p249-256 1975.

Keywords: *Complex compounds, *Rhodium organic compounds, *Ruthenium organic compounds, *Carboranes, *Synthesis(Chemistry), Chemical reactions, Reprints, Chemical reaction mechanisms.

The 7,8-B9C2H11(-2) ion (1) reacted with (Ph3P)2Rh(CO)Cl to form (7,8-B9C2H11)Rh(Cl)(PPh3)2 (2). Subsequent reaction of (2) with Na(C6H5)4B afforded (7,8-B9C2H11)Rh(PPh3)(BPh4) (3). The new metallocarboranes ((7,8-B9C2H11)Rh(PPh3)(C6H6))2 (4) and (7,8-B9C2H11)Rh(H)(PPh3) (5) were produced in the reaction of (1) with (Ph3P)3RhCl. The metallocarboranes (7,8-B9C2H11)Ru(CO)(PPh3)2 (6) and (7,8-B9C2H11Ru)(CO)3.1/2C6H6 were prepared from (PPh3)2Ru(CO)2Cl2 and (Ru(CO)3Cl2)2 respectively.

702,538
PB-272 540/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Oxidation of Organometallic Compounds with Tetracyanoquinodimethan.
Final rept.,
A. R. Siedle. 1975, 1p
Pub. in Jnl. American Chemical Society 97, p5931 1975.

Keywords: *Oxidation, *Metal containing organic compounds, Complex compounds, Chemical reactions, Chromium organic compounds, Nitriles, Molybdenum organic compounds, Reprints, *Cyclohexadiene-dimalononitrile.

Reaction of (CH3C6H5)Cr(CO)3 and (C7H8)Mo(CO)4 with tetracyanoquinodimethan (TCNQ) leads to Cr(CH3CN)2(TCNQ)2 and Mo(CO)2(CH3CN)2(TCNQ) respectively in acetonitrile solvent. These materials are formulated as derivatives of the TCNQ dianion.

702,539
PB-278 408/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Copper Derivatives of Tetrathiafulvalene.
Final rept.,
A. R. Siedle, G. A. Candela, T. F. Finnegan, R. P. Van Duyne, T. Cape, G. F. Kokoszka, and P. M. Woyciesjes. 1978, 2p
Sponsored in part by American Chemical Society, Washington, D.C., National Science Foundation, Washington, D.C., and Northwestern Univ., Evanston, Ill. Materials Research Center.
Pub. in Jnl. Chem. Soc. Chem. Commun., n2 p69-70, 18 Jan 78.

Keywords: *Copper organic compounds, *Synthesis(Chemistry), Complex compounds, Raman spectroscopy, Reprints, Fluvalene/tetrathia.

The donor-acceptor complex (TTF)2(CuCl2)3 is formed from tetrathiafulvalene and cupric chloride in ethanol. It is converted to (TTF)2CuCl4 by recrystallization from acetonitrile. Oxidation in acetonitrile produces (TTF)CuCl4. Resonance Raman spectroscopy was used to determine the oxidation state(s) of TTF in

these materials. The TTF chlorocuprates exhibit three-dimensional magnetic exchange fields.

702,540
PB-282 124/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Isotopically Selective CO2 Transverse Excitation Laser Induced Chemical Reactions of Cl2CF2 and Br2CF2 with Olefins.
Final rept.,
J. J. Ritter. 12 Apr 78, 4p
Contract ERDA-EA-77-A-01-6010
Pub. in Jnl. Am. Chem. Soc. 100 n8 p2441-2444, 11 Apr 78.

Keywords: *Synthesis(Chemistry), Isotopic labeling, Fluorine organic compounds, Lasers, Chemical reactions, *Carbene/difluoro, *Cyclopropane/difluoro-dimethyl, *Laser enhanced reactions, Methane/dichloro-difluoro, Methane/dibromo-difluoro, Reprints.

The CO2 TE laser induced chemical reactions of Cl2 CF2 and Br2 CF2 with isobutylene, propylene and ethylene have been investigated. In the (H3C)2C=CH2/Br2CF2 system, evidence for the initial presence of laser produced difluorocarbene was provided by the discovery of the CF2-olefin addition compound 1,1-difluoro 2,2-dimethylcyclopropane in the product array. The yield of this product from the (H3C)2C=CH2/Cl2CF2 system was dependent upon the laser irradiation frequency. No analogous gem-difluorocyclo-propanes were detected in the Br2CF2/H3C-CH=CH2 and Br2CF2/C2H4 systems. Carbon isotopic segregation was noted in all experiments and constitutes evidence for the direct utilization of laser energy within the vibrational structure of the halomethanes. The complex nature of these reaction systems is examined in some detail. The concept of using a laser produced, isotopically specific reactive intermediate such as CF2 for direct synthesis of labeled compounds is presented.

702,541
PB-282 882/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Synthesis of 1.3-(Dicyanomethylene)Croconate Salts, New Bond-delocalized Dianion, 'Croconate Violet'.
Final rept.,
A. J. Fatiadi. 12 Apr 78, 2p
Pub. in Jnl. of the American Chemical Society, v100 n8 p2586-2587, 12 Apr 78.

Keywords: *Synthesis(Chemistry), *Molecular structures, *Croconates, Chemical bonds, Salts, Esters, Nitrogen organic compounds, Anions, Reprints, *Croconic acid/(dicyanomethylene)-(dipotassium-salt).

A new croconate dianion analoy was prepared whose physical and chemical behavior are reported. The preparation of new electron-acceptors from croconic esters is also described. The new dipotassium salt of 1.3-(dicyanomethylene)-2-0x0-5-cyclopentene-4, 5-diol is assigned a symmetrical, bond-delocalized structure.

702,542
PB-282 883/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Applications of Malononitrile in Organic Chemistry. Part I and Part II.
Final rept.,
A. J. Fatiadi. Mar 78, 118p
Pub. in Synthesis: Int. J. Methods Synth. Org. Chem., n3 p163-282 Mar 78.

Keywords: *Synthesis(Chemistry), *Reviews, Nitriles, Trends, Organic chemistry, Reprints, *Malononitrile, *Chemical reaction mechanisms.

Recent applications of malononitrile to organic chemistry are reviewed; an overview of the chemistry of substituted malononitriles is also included. New trends, mechanisms, and synthetic methods employing malononitrile are discussed.

702,543
PB-287 019/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Aldehyde Methacrylates Derived from Hydroxybenzaldehydes.
Final rept.,
J. M. Antonucci. 1978, 6p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. of Dental Research 57, n3 p500-505 Mar 78.

Keywords: *Synthesis(Chemistry), *Methacrylates, *Aldehydes, Condensation reactions, Monomers, Reprints.

Aldehyde methacrylates were synthesized from the 3 isomeric hydroxybenzaldehydes by facile condensation reactions. The 3 monomers are relatively low-melting crystalline solids which can be liquefied by simple admixture of the isomers.

702,544
PB-298 040/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation of Commercial and Newly-Synthesized Amine Accelerators for Dental Composites.
Final rept.,
D. M. Dulik. Apr 79, 9p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. of Dental Research 58, n4 p1308-1316 Apr 79.

Keywords: *Amines, *Synthesis(Chemistry), *Dental materials, Composites, Nitrogen organic compounds, Toluidine/N-N-dimethyl, Toluidine/N-N-dihydroxyethyl, Xylidine/N-N-dimethyl, Acetic acid/amino-dimethyl-phenyl, Reprints, Acetic acid/amino-dimethyl-(methyl-ester)-phenyl, Glutethimide/N-N-dimethyl-amino, Benzaldehyde/dimethylamino, Benzoic acid/amino-dimethyl, Benzoic acid/amino-dimethyl-(lithium-salt), Benzoic acid/amino-dimethyl-(tetramethyl ammonium-salt).

Many amines have been suggested as accelerators for dental resins, but esthetic and biocompatible requirements have greatly limited the number of compounds that can be used for this application. The amines evaluated in this investigation were either used commercially in composite resins (dimethyl-p-toluidine (DMPT, dihydroxyethyl-p-toluidine (DHEPT) and dimethyl-symxylidine (DMSX)), those predicted to be highly reactive based on structure-property relationships and synthesized in this study dimethylaminophenylacetic acid (DMAPAA) and its methyl ester (MDMPAA) and dimethylaminoglutethimide (DMAG) and a number of other amines, some previously synthesized in this laboratory, such as 4-dimethaminobenzaldehyde, 4-dimethylamino-benzoic acid and its lithium (LDMAB) and tetramethylammonium (TMADMAB) salts. The overall characteristics of composites (hardening time, compressive and tensile strength and color stability) containing DMAPAA, MDMAPAA or DMAG compare favorably to restorative resins cured with commonly used tertiary amines or other accelerators evaluated in this study.

702,545
PB79-600015 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electrical Resistivity of Alkali Elements.
T. C. Chi. c1979, 100p
Included in Jnl. of Physical and Chemical Reference Data, v8 n2 p339-438 1979.

Keywords: *Alkali elements, Cesium, Electrical resistivity, Francium, Lithium, Magnetic flux density dependence, Potassium, Pressure dependence, Rubidum, Sodium, Temperature dependence.

This paper presents and discusses the available data and information on the electrical resistivity of alkali elements (lithium, sodium, potassium, rubidum, cesium, and francium) and contains recommended reference values (or provisional or typical values). The compiled data include all the experimental data available from the literature and cover the temperature dependence, pressure dependence, and maganetic flux density dependence. The temperature range covered by the compiled data is from cryogenic temperatures to above the critical temperature of the elements. The recommended values are generated from critical evaluation, analysis, and synthesis of the available data and information and are given for both the total electrical resistivity and the intrinsic electrical resistivity. For most of the elements, the recommended values cover the temperature range from 1 K to 2000 K.

702,546
PB79-600016 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electrical Resistivity of Alkaline Earth Elements.
T. C. Chi. c1979, 60p
Included in Jnl. of Physical and Chemical Reference Data, v8 n2 p439-498 1979.

Keywords: *Alkaline earth elements, Barium, Beryllium, Calcium, Electrical resistivity, Magnesium, Radium, Strontium, Temperature dependence.

This paper presents and discusses the available data and information on the electrical resistivity of alkaline earth elements (beryllium, magnesium, calcium, strontium, barium, and radium) and contains recommended or provisional reference values. The compiled data include all the experimental data available from the literature. The temperature range covered by the compiled data is from cryogenic temperatures to abaove the melting temperature of the elements. The recommended values are generated from critical evaluation, analysis, and synthesis of the available data and information and are given for both the total electrical resistivity and the intrinsic electrical resistivity. For most of the elements, the recommended values cover the temperature range from 1 K to 1000 K.

702,547
PB79-600024 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Molecular Structures of Gas-Phase Polyatomic Molecules Determined by Spectroscopic Methods.
M. D. Harmony, V. W. Laurie, R. L. Kuczkowski, R. H. Schwendeman, D. A. Ramsay, F. J. Lovas, W. J. Lafferty, and A. G. Maki. c1979, 104p
Included in Jnl. of Physical and Chemical Reference Data, v8 n3 p619-722 p1979.

Keywords: *Bond angles, Bond distances, Gas-phase polyatomic molecules, Gas-phase spectroscopy, Microwave spectroscopy, Molecular conformation, Molecular spectroscopy, Molecular structure, Molecules, Structure.

Spectroscopic data related to the structures of polyatomic molecules in the gas phase have been reviewed, critically evaluated and compiled. All reported bond distances and angles have been classified as equilibrium (re), average (rz), substitution (rs), or effective (ro) parameters, and have been given a quality rating which is a measure of the parameter uncertainty. The surveyed literature includes work from all of the areas of gas-phase spectroscopy from which precise quantitative structural information can be derived. Introductory material includes definitions of the various types of parameters and a description of the evaluation procedure.

702,548
PB80-132749 Not available NTIS
National Bureau of Standards, Washington, DC.
Mathematical Modeling of Tricalcium Silicate Hydration.
Final rept.,
J. M. Pommersheim, and J. R. Clifton. 1979, 6p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Cem. Concr. Res. 9, p765-770 1979.

Keywords: *Calcium silicates, *Hydration, *Mathematical models, Chemical reactions, Performance, Cements, Reprints, Calcium silicon oxides.

Based on conceptual models for the stages in the hydration of tricalcium silicate, a mathematical model was developed. The separate resistances in the mathematical model correspond to the phenomenological stages of the conceptual model. Comparison of model output with available hydration data gave a reasonable fit between the model and the data.

702,549
PB80-185044
(Order as PB80-185036, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC.
Pseudo-Oxocarbons. Synthesis of 2,1,3-Bis-, and 1,2,3-Tris (Dicyanomethylene) Croconate Salts. New Bond-Delocalized Dianions, 'Croconate Violet' and 'Croconate Blue',
A. J. Fatiadi. 24 Oct 79, 14p
Included in Jnl. of Research of the National Bureau of Standards, v85, n2 p73-86 Mar-Apr 80.

Keywords: *Organic salts, *Synthesis(Chemistry), Aromatic compounds, Anions, Chemical bonds, Chemical reactions, Physical properties, Chemical properties, *Croconic acid, *Methylene/bis(dicyano), *Methylene/tris(dicyano).

Synthesis and characterization of new bond-delocalized dianions, e.g., 2,1,3-bis-, 1,2,3-tris (dicyanomethylene) croconate salts have been described. The dian-

ions reported represent a new class of aromatic, nonbenzenoid compounds, named pseudo-oxocarbons. A study of their physical, analytical and chemical properties offer a new direction in the chemistry of oxocarbons.

702,550
PB80-600011 Not Available NTIS
National Bureau of Standards, Gaithersburg, MD.
Refractive Index of Silicon and Germanium and its Wavelength and Temperature Derivatives.
H. H. Li. c1980,98p
Included in Jnl. of Physical and Chemical Reference Data, v9, n3 p561-658.

Keywords: *Germanium, Optical constants, Refractive index, Silicon, Temperature coefficient of refractive index.

Refractive index data for silicon and germanium were searched, compiled, and analyzed. Recommended values of refractive index for the transparent spectral region were generated in the ranges 1.2 to 14 micrometers and 100-750 K for silicon, and 1.9 to 16 micrometers and 100-550 K for geramanium. Generation of these values was based on a dispersion equation which best fits selected data sets covering wide temperature and wavelength ranges. Temperature derivative of refractive index was simply calculated from the first derivative of the equation with respect to temperature. The results are in concordance with the existing dn/dT data.

702,551
PB80-600015 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Solubility of Some Sparingly Soluble Lead Salts: An Evaluation of the Solubility in Water and Aqueous Electrolyte Solution.
H. L. Clever, and F. J. Johnston. c1980,34p
Included in Jnl. of Physical and Chemical Reference Data, v9, n3 p751-784.

Keywords: *Aqueous solubility of lead salts, Lead carbonate, Lead halides, Lead nitrate, Lead phosphates, ead sulfate, Lead sulfide, Solubility, Solubility product, Sparingly soluble lead salts.

The literature on the solubility of sparingly soluble lead salts in water and in aqueous electrolyte solution was reviewed. Solubility data were compiled and evaluated. Recommended and tentative values of the solubilities are presented. A partial compilation of solubility products and of complex ion formation constants are given. Where possible the solubility product values have been checked for consistency against thermodynamic data sources other than solubility measurements.

702,552
PB80-600052 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hydrogen: A Workshop on Societal Aspects of Energy Systems.
L. A. Currie, and R. Kropschot. 1978, 152p
Pub. in Foresight--Volume I. Societal Aspects of Hydrogen Energy Systems, Part A, p9-161 Dec 1978.

Keywords: *Barrier/incentives, Hydrogen energy systems, Impacts of hydrogen fuel, Policy options, Societal aspects, Workshop.

A workshop to outline the important Societal Aspects of Hydrogen Energy Systems was arranged by the National Bureau of Standards at the request of the Honorable Olin E. Teague, Chairman, Committee on Science and Technology, U.S. House of Representatives. The objectives were to study the conditions under which hydrogen can emerge as a major (negligible fuel of the future, identify barriers/incentives to implementation, make comparisons with alternate fuels and outline policy changes which would speed or deter hydrogen use. About seventy invited participants met in Reston, Virginia, June 4-7, 1978, and with the input from six parallel interdisciplinary working groups have provided the basis for response to the U.S. Congress.

702,553
PB81-118473 Not available NTIS
National Bureau of Standards, Washington, DC.
Pseudooxocarbons. Synthesis of 1,2,3-tris (Dicyanomethylene) Croconate Salts. A New Bond-Delocalized Dianion, Croconate blue.
Final rept.
A. J. Fatiadi. Mar 80, 2p
Pub. in Jnl. Organ. Chem. 45, n7 p1338-1339 Mar 80.

Keywords: *Synthesis(Chemistry), Nitrogen organic compounds, Organic salts, Chemical bonds, Anions, Reprints, *Croconic acid/tris(dicyanomethylene).

The synthesis and characterization of new bond-delocalized dianions, e.g., 1,2,3-tris(dicyanomethylene) croconate salts have been described. The dianions reported are new additions to the aromatic oxocarbons, and represent a new class of aromatic, nonbenzenoid compounds, named pseudo-oxocarbons.

702,554
PB81-132649 Not available NTIS
National Bureau of Standards, Washington, DC.
Synthesis and N. M. R. Spectroscopy of Derivatives of 6-amino-6-deoxy-D-galactose-6-(15)N,
B. Coxon, and R. C. Reynolds. 1980, 17p
Pub. in Carbohydr. Res. 78, p1-16 1980.

Keywords: *Synthesis(Chemistry), *Nuclear magnetic resonance, Molecular structure, Reprints, *Galactose/amino-deoxy.

Derivatives of 6-amino-6-deoxy-D-galactose-6-(15)N have been synthesized by reaction of the 6-deoxy-6-iodo (1) or 6-O-p-tolylsulfonyl derivative of 1,2:3,4-di-O-isopropylidene-alpha-D-galactopyranose with potassium phthalimide-(15)N. The structures of the 6-amino-6-deoxy-D-galactose derivatives and their precursors were characterized by proton- and (13)C-n.m.r. spectroscopy, with confirmation of the (13)C assignments by selective, proton decoupling.

702,555
PB81-145526 Not available NTIS
National Bureau of Standards, Washington, DC.
Synthesis and Antitumor Activity of Cyclophosphamide Analogs. 3. Preparation, Molecular Structure Determination, and Anticancer Screening of Racemic cis- and trans-4-Phenylcyclophosphamide.
V. L. Boyd, G. Zon, V. L. Himes, J. K. Stalick, A. D. Mighell, and H. V. Secor. 1980, 3p
Sponsored in part by National Intitutes of Health, Bethesda, MD., and Food and Drug Administration, Washington, DC.
Pub. in Jnl. of Medical Chemistry 23, n4 p372-375 1980.

Keywords: *Synthesis(Chemistry), *Molecular structure, Nuclear magnetic resonance, Infrared spectroscopy, X ray analysis, Nitrogen organic compounds, Antineoplastic agents, Reprints, *Cyclophosphamide/phenyl, Molecular conformations.

Cyclization of racemic 3-amino-3-phenyl-1-propanol with bis(2-chloroethyl) phosphoramidic dichloride gave a diastereomeric mixture of 4-phenylcyclophos-phamide which was chromatographically separated into the faster and slower eluting components. A combination of (1)H/(31)P NMR and IR spectral data indicated that the fater a slower racemates correspond to cis-3 (mp 129-130C) and trans-3 (mp 112-114.5C), respectively. The molecular structure of the former compound was determined by X-ray crystalography, and thereby unambiguously established the cis relationship between equatori disposed phenyl and P=0 substituents in a chair conformation. These results confirm stereochemical assignments for cis- and trans-3 which have been independently deduced Shih, et al. Anticancer screening tests against L121 lymphoid leukemia in mice have revealed that while both diastereomers of 3 afford toxmetabolites, trans-3 led to therapeutic activity (T/C = 149, 250 mg/kg) and cis-3 did (T/C less than 125, 500-15.63 mg/kg). The relevance of these findings to results reported fo 4-methylcyclophosphamide and cyclosphamide is briefly discussed.

702,556
PB81-245912 Not available NTIS
National Bureau of Standards, Washington, DC.
Slow-acting Amine Polymerization Accelerators: Para-dimethylaminobenzoic Acid and Its Ethyl Ester.
Final rept.
J. M. Antonucci, R. J. Peckoo, C. Schruhl, and E. E. Toth. Jul 81, 6p
Pub. in Jnl. of Dental Research 60, n7 p1325-1330 Jul 81.

Keywords: *Dental materials, *Synthesis(Chemistry), Tensile strength, Polymerization, Nitrogen organic compounds, Reprints, *Benzoic acid/dimethyl-amino, *Benzoic acid/dimethyl-amino-(ethyl-ester), Monomers.

From theoretical considerations both paradimethylaminobenzoic acid and its ethyl ester would be expected to be slow-acting polymerization accelerators. Using these relatively slow-acting amine accelerators with a fast-polymerizing monomer system, it was possible to formulate composite materials having acceptable setting times at 37C and excellent diametral tensile strengths.

702,557
PB81-245953 Not available NTIS
National Bureau of Standards, Washington, DC.
4-N, N-Dialkylaminophenethanols,-Alkanoic Acids and Esters: New Accelerators for Dental Composites.
Final rept.
G. M. Brauer, J. W. Stansbury, and J. M. Antonucci. Jul 81, 6p
Pub. in Jnl. of Dental Research 60, n7 p1343-1348 Jul 81.

Keywords: *Dental materials, *Synthesis(Chemistry), Composite materials, Polymerization, Nitrogen organic compounds, Esters, Reprints, *Phenethanol/N-N-dialkyl-amino, *Phenal Kanoic acid/N-N-dialkyl-amino.

The newly synthesized 4-N,N-dialkylaminophenethanol, 4-N,N-dialkylaminophenalkanoic acid and ester are highly reactive accelerators for the polymerization of composites. With low amine concentration, nearly colorless restorations having good color stability are obtained.

702,558
PB81-600022 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heat Capacity and Other Thermodynamic Properties of Linear Macromolecules. III. Polyoxides.
U. Gaur, and B. Wunderlich. c1981, 49p
Included in Jnl. of Physical and Chemical Reference Data, v10 n4 p1001-1049 1981.

Keywords: *Crystal, Crystallinity, Density, Enthalpy, Entropy, Fusion, Gibbs energy, Glass transition, Heat capacity, Linear macromolecule, Poly(oxymethylene)s, Poly(oxyphenylene)s, Poly(oxypropylene).

The heat capacity of poly(oxymethylene, poly(oxyethylene), poly(oxytrimethylene), poly(oxytetramethylene), poly(oxyoctamethylene), poly(oxypropylene), poly(oxymethylleneoxyethylene), poly(oxymethyleneoxytetramethylene), poly(oxy-1,4-phenylene), poly(oxy-2,6-dimethyl-1,4-phenylene), poly(oxy-2,6-diphenyl-1,4-phenylene) and poly(oxy-2,2-bis(chloromethyl)trimethylene) is reviewed on the basis of measurements on 35 samples reported in the literature. The crystallinity dependence is critically evaluated and a set of recommended data for each polyoxide is derived. Entropy, enthalpy, and Gibbs energy functions are calculated. The data have been compared to that of polyethylene and the contribution of O-group has been evaluated. The paper is the third in a series which will ultimately covered all heat capacity measurements on linear macromolecules.

702,559
PB81-600023 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heat Capacity and Other Thermodynamic Properties of Linear Macromolecules. IV. Polypropylene.
U. Gaur, and B. Wunderlich. c1981, 14p
Included in Jnl. of Physical and Chemical Reference Data, v10 n4 p1051-1064 1981.

Keywords: *Atactic, Crystal, Crystallinity, Density, Enthalpy, Entropy, Fusion, Gibbs energy, Glass transition, Heat capacity, Isotactic, Linear macromolecule, Melt, Polypropylene, Syndiotactic.

The heat capacity of polypropylene from 0 K to 600 K is reviewed on the basis of measurements on 20 samples reported in the literature. The crystallinity dependence is critically evaluated and a set of recommended data for completely crystalline and amorphous polypropylene are derived. The effect of tacticity on the heat capacity is also evaluated. Entropy, enthalpy and Gibbs energy functions are calculated. The paper is the fourth in a series of publications which will ultimately cover all heat capacity measurements on linear macromolecules.

702,560
PB81-600027 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Critical Review of Henry's Law Constants for Chemicals of Environmental Interest.
D. Mackay, and W. Y. Shiu. 1981, 25p
Included in Jnl. of Physical and Chemical Reference Data, v10 n4 p1175-1199 1981.

Keywords: *Alkanes, Aromatics, Critical review, Evaluated data, Gases, Halogenated hydrocarbons, Henry's law constants, Liquids, Pesticides, Solids, Solubility, Vapor pressure.

The Henry's law constants (air-water partition coefficients) of hydrophobic organic compounds of environmental concern are reviewed. An outline of the thermodynamic principles which govern the relationships between vapor pressure, solubility and Henry's law constant for solid and liquid compounds is presented and experimental techniques for obtaining these quantities with the required accuracy are discussed. Vapor pressure, solubility, and Henry's law constant data are tabulated and reviewed for a total of 150 compounds in 12 tables consisting of gaseous, liquid and solid alkanes, cycloalkanes, alkenes, alkynes, monoaromatics, polynuclear aromatics, halogenated alkanes, alkenes anf aromatics, and selected pesticides.

702,561
PB82-212069 Not available NTIS
National Bureau of Standards, Washington, DC.
Cyclobutane Production via the O3-Thiolane Reaction.
Final rept.
R. I. Martinez, and J. T. Herron. 1982, 7p
Pub. in International Jnl. of Chemical Kinetics 14, p439-445 1982.

Keywords: *Synthesis(Chemistry), *Cyclobutane, Reprints.

Cyclobutane (c-C4H8) was found to be a product of the reaction of ozone with thiolane.

702,562
PB83-135178 Not available NTIS
National Bureau of Standards, Washington, DC.
Dioxirane: Its Synthesis, Microwave Spectrum, Structure and Dipole Moment.
Final rept.
R. D. Suenram, and F. J. Lovas. 2 Aug 78, 6p
Pub. in Jnl. of The American Chemical Society 100, p5117-5122, 2 Aug 78.

Keywords: *Synthesis(Chemistry), *Microwave spectroscopy, *Molecular structure, *Dipole moments, Oxygen organic compounds, Air pollution, Reprints, *Dioxirane, CAS 157-26-6.

Dioxirane has been identified in the reaction of ozone with ethylene at low temperature. The methods employed in synthesizing several isotopic forms of dioxirane and measurement of their rotational spectrum are described. The electric dipole moment was determined from Stark effect measurement.

702,563
PB83-156976 Not available NTIS
National Bureau of Standards, Washington, DC.
Synthesis of 2-Naphthalene-d7-Sulfonic Acid.
Final rept.
L. T. Sniegoski, E. White, and P. L. Konash. 1982, 8p
Sponsored in part by Environmental Protection Agency, Washington, DC.
Pub. in Jnl.of Labelled Compounds. Radiopharmaceutials XIX, n9 p1081-1087 1982.

Keywords: *Synthesis(Chemistry), *Standards, *Chemical analysis, Gas chromatography, Mass spectroscopy, Reprints, *Naphthalene sulfonic acid, High performance liquid chromatography.

2-Naphthalene-d7-sulfonic acid, required as an internal standard for the analysis of organic compounds in water by gas chromatography/mass spectrometry, was synthesized in one step from commercially available naphthalene-d8 and sulfuric acid-d2. A high-performance liquid chromatographic method was developed to separate 1- and 2-naphthalene-d7-sulfonic acids. The electron impact mass spectrum and isotopic purity of the 2-naphthalene-d7-sulfonic acid were determined.

702,564
PB83-179507 Not available NTIS
National Bureau of Standards, Washington, DC.
New Facile Synthesis of 2-Amino-(Pento- and Hexo-Furano)Oxazoline Derivatives.
Final rept.
R. M. Davidson, S. A. Margolis, E. White, B. Coxon, and N. J. Oppenheimer. 1983, 4p
Sponsored in part by the National Institutes of Health, Bethesda, MD.
Pub. in Carbohydrate Research 111, pC16-C19 1983.

Keywords: *Synthesis(Chemistry), Isotopic labeling, Mass spectroscopy, Reprints, *Oxazoline/amino-(pento-furanosyl), *Oxazoline/amino-(hexo-furanosyl).

The authors have developed a new, facile synthesis of pento- and hexo-furanosyl 2 double prime-amino oxazoline derivatives including examples in the D-ribose, D-arabinose, D-xylose, D-glucose, and L-sorbose series. This new procedure has been used to introduce 15N-labels into these derivatives.

702,565
PB83-234211 Not available NTIS
National Bureau of Standards, Washington, DC.
Synthesis of 1-Dodecyl-d25 Phosphate.
Final rept.
L. T. Sniegoski, and E. White. 1983, 7p
Pub. in Jnl. of Labelled Compounds and Radiopharmaceuticals 20, n2 p303-309 1983.

Keywords: *Synthesis(Chemistry), *Isotopic labeling, Deuteration, Deuterium compounds, Reprints, *Phosphoric acid/(dodecyl-ester).

1-Dodecyl-d(25) phosphate was prepared from commercially available 1-dodecanol-d(26). The 1-dodecanol-d(26) reacted with diphenyl phosphorochloridate to produce 1-dodecyl-d(25) diphenyl phosphate, which was reduced with hydrogen in the presence of Adams catalyst to give a 58.9 percent yield of 1-dodecyl-d(25) phosphate with 98.4 atom percent deuterium.

702,566
PB85-102226 Not available NTIS
National Bureau of Standards, Washington, DC.
O-Iminyl Esters of N,N-Bis(2-chloroethyl)phosphorodiamidic Acid. Synthesis, X-Ray Structure Determination, and Anticancer Evaluation.
Final rept.
S. M. Ludeman, V. L. Himes, K. L. Shao, G. Zon, A. D. Mighell, S. Takagi, and K. Mizuta. 1983, 3p
Grants PHS-CA-21345, PHS-DE-05030
Pub. in Jnl. of Medicinal Chemistry 26, n12 p1788-1790 1983.

Keywords: *Antineoplastic agents, *Synthesis(Chemistry), Nitrogen organic compounds, Drugs, Enzymes, X ray analysis, Crystal structure, Laboratory animals, Reprints, *Phosphorodiamidic acid/(iminyl-ester)-N-N-bis(chloroethyl).

Nine representatives of the title series of compounds ((ClCH2CH2)2NP(O)(NH2)ON=CCR') were synthesized as potential anticancer prodrugs, based on the possibility of enzymatic reduction of the N-O bond to release the known cytotoxic agent phosphoramide mustard (1,(ClCH2CH2)2NP(O)(NH2)OH). The dimethyl derivative (2, R = R' = CH3) exhibited a statistically significant albeit low-level of anti-L1210 activity in mice. A single crystal X-ray study of 2 revealed, inter alia, an unusual hydrogen bonding 'ladder' and an isosteric relationship for the N-CH2-CH2-Cl and O-N=C-CH3 moieties.

702,567
PB85-141901 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reaction of the Vanadate Ion with Chlorpromazine and the Chlorpromazine Free Radical with the Vanadyl Ion.
Final rept.
R. E. Huie, and P. Neta. 1984, 2p
Pub. in Inorganica Chimica Acta 93, pL27-L28 1984.

Keywords: *Chlorpromazine, *Free radicals, *Oxidation, Chemical reactions, Acid treatment, Reprints, *Vanadate ions.

The oxidation of chlorpromazine by the vanadate ion was found to proceed only in strongly acid solutions (pH < 2), contrary to previously published reports. The reverse reaction was observed at higher pH. These results are discussed in terms of the possible physiological effects of chlorpromazine and vanadium.

702,568
PB86-186756 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Alkenoxy Radicals in Gas-Phase Reactions of Alkenes with Oxygen Atoms or Ozone.
Final rept.
R. I. Martinez. 1983, 4p
Pub. in Jnl. of Chemical Physics Letters 98, n5 p507-510 1983.

Keywords: *Alkene compounds, *Ozone, Chemical radicals, Reaction kinetics, Reprints, *Oxygen atoms, *Free radicals, Chemical reaction mechanisms.

Observations in the O3-trans-2-butene reaction system and in the O+trans-2-butene+O2 reaction system suggest the intermediacy of alkenoxy radicals. A mechanism is proposed for the production of Cn and Cm(m<n) alkenoxy radicals by the reaction of CnH2n alkenes with oxygen atoms or with ozone.

702,569
PB86-189875 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
International Butyltin Measurement Methods Intercomparison: Sample Preparation and Results of Analyses.
W. R. Blair, G. J. Olson, and F. E. Brinckman. Feb 86, 58p NBSIR-86-3321
Sponsored by Office of Naval Research, Arlington, VA.

Keywords: *Tin organic compounds, Chemical analysis, Environmental impact assessments, Quantitative analysis, Water pollution, Molecular structure, *Stannane/tributyl.

A comparison of prevalent organotin measurement methods has been conducted on an international scale with a new tri-n-butyltin research material distributed to over 40 participating laboratories worldwide. A description of background research into the behavior and manipulation of low-concentration (ppm) aqueous organotin solutions, chromatographic production and packaging of the stable speciated butyltin research material in water, and quantitative results from the international methods intercomparison are reported here along with recommendations for future work.

702,570
PB86-190626 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Coordination Compounds of Benzotriazole and Related Ligands.
Final rept.
J. Reedijk, A. R. Siedle, R. A. Velapoldi, and J. A. M. VanHest. 1983, 10p
Pub. in Inorganica Chimica Acta 74, p109-118 1983.

Keywords: *Coordination compounds, *Ligands, *Corrosion prevention, Complex compounds, Transition metals, Reprints, *Benzotriazoles.

The coordination chemistry of benzotriazole towards several transition-metal compounds has been studied. Upon reaction of neutral benzotriazole (BTAH) with metal compounds under varying conditions, both neutral (BTAH) ligands and anionic, depronated ligands (BTA)(1-) may be coordinated to the metal. The compounds have the general formula M(BTAH)(sub n)(K sub m), with M = Cu,Zn,Cd,Hg,Pd,Ti,Sn,n=1, 2,3,4,X = Cl,Br and m = 2 or 4. Similar compounds of formula Cu(ligand)(sub n)(X sub), (X = Cl,Br; n = 1,2) with 5-nitrobenzotriazole and N-methylbenzotriazole, were obtained. Structures of the compounds have been proposed based on infrared and far-infrared spectroscopy, ligand-field and UV spectroscopy, EPR spectroscopy, conductivity data and NMR-spectroscopy. The bonding modes for the mono-, bi-, and tridentate species are discussed. Polymeric structures using BTA and BTAH as bridging ligands are discussed in relation to the corrosion-inhibiting properties of benzotriazole.

702,571
PB86-192168 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Fourier Transform Infrared Study of the Gas-Phase Reactions of (18)O3 with trans-CHCl=CHCl in (16)O2-Rich Mixtures. Branching Ratio for O-Atom Production via Dissociation of the Primary Criegee Intermediate.
Final rept.
H. Niki, P. D. Maker, C. M. Savage, L. P. Breitenbach, and R. I. Martinez. 1984, 4p
Pub. in Jnl. of Physical Chemistry 88, n4 p766-769 1984.

Keywords: Chemical reactions, Infrared spectroscopy, Reprints, *Criegee intermediate, *Oxygen atoms, Unimolecular reactions, Fourier transform spectroscopy, Oxygen 18.

Using the FTIR spectroscopic method, the authors identified (16)O3 among the products formed in the gas-phase reaction of (18)O3 with trans-CHCl=CHCl in (16)O2-rich mixtures. The primary yield of (16)O3 was determined to be (17 + or - 3)% of the reactants consumed in the presence of a Cl-atom scavenger such as C2H6 or n-C4H10. The finding can be explained by the formation of atomic oxygen in the unimolecular dissociation of the Criegee intermediate H(Cl)COO, i.e., (18)O3 + trans-CHCl=CHCl -> H(Cl)C(18)O(18)O + H(Cl)C=(18)O (1); H(Cl)C(18)O(18)O -> (18)O(3P) + H(Cl)C=(18)O (2); (18)O (2); (18)O + (16)O2 -> (16)O + (16)O9180O (5); and (16)O + (16)O2 (+M) -> (16)O3 (+M) (3).

702,572
PB86-192531 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Calculated Proton Affinities for Some Molecules Containing Group VIA Atoms.
Final rept.
P. G. Jasien, and W. J. Stevens. 1985, 6p
Pub. in Jnl. of Chemical Physics 83, n6 p2984-2989, 15 Sep 85.

Keywords: Molecules, Sulfur, Selenium, Tellurium, Reprints, *Proton affinity, Oxygen atoms.

The proton affinities and structures of a series of small molecules containing group VIA atoms are calculated via ab initio electronic structure techniques. The series under study included CX, OCX, XCX, and H2CX, where X = O, S, Se, and Te. In those cases where multiple protonation sites are available, a definitive assignment of the most stable site is reported. Excellent agreement with the experimentally known proton affinities is found in almost all cases. The results indicate that the general trend which one would expect upon moving down a column of the periodic table is born out, with a particularly large change on going from the first to the second row. Calculations were performed at both the SCF and correlated levels with compact effective potentials used to replace the core electrons. Complete structural optimizations via analytic gradients were performed utilizing basis sets of at least double zeta plus polarization quality.

702,573
PB86-193042 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Novel Synthesis of Methyltin Triiodide with Environmental Implications.
Final rept.
W. F. Manders, G. J. Olson, F. E. Brinckman, and J. M. Bellama. 1984, 3p
Pub. in Jnl. of the Chemical Society, Chemical Communications n8, p538-540 1984.

Keywords: *Tin organic compounds, *Environments, Reaction kinetics, Methylation, Reprints, *Stannanes/methyl, Stannane/methyl-triiodide, Sulfur/methyl.

Methyltin triiodide and methylsulfur species are produced by an unusual heterogeneous reaction between methyliodide with stannous sulfide in water at room temperature which may bear on ubiquitous occurrence of methylstannanes in the environment.

702,574
PB86-193075 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Chemical Physics.
Structures and Reactions of C3H6 (1+) Ions Generated in Cyclopropane.
Final rept.
S. G. Lias, and T. J. Buckley. 1984, 15p
Pub. in Int. J. Mass Spectrom. Ion Processes 56, n2 p123-137 1984.

Keywords: Ionization, Isomerization, Proton affinity, Reprints, *Charge transfer, *Cyclopropane, Ion cyclotron resonance.

Ions of the formula C3H6+ have been generated by charge transfer to cyclopropane from C6F6+ (recombination energy, 9.91 eV), CS2+ (recombination energy, 10.08 eV), COS+ (recombination energy, 11.18 eV), and Xe+ (recombination energy, 12.127 eV). From a determination of the charge transfer equilibrium constant in the c-C3H6:C6F6 mixture a value for the 300 K ionization energy of cyclopropane of 9.86 eV is obtained. In addition to the characteristic CH2NH2+ and CH2NH3+ products formed in reactions of c-C3H6+ with ammonia, ions formed with no excess energy transfer a proton to ammonia. The probability of the occurrence of the proton transfer channel is about 30% for ions formed by charge transfer from C6F6+, CS2+, or COS+, but increases to 50% for ions formed by charge transfer from Xe+, which indicates that about 30% of the C3H6+ ions formed by charge transfer from Xe+ have undergone the isomerization process: c-C3H6+-> CH3CH=CH2.

702,575
PB86-193711 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Alkoxide Precursor Synthesis and Characterization of Phases in the Barium-Titanium Oxide System.
Final rept.
J. J. Ritter, R. S. Roth, and J. E. Blendell. 1986, 8p
Pub. in Jnl. of the American Ceramic Society 69, n2 p155-162 Feb 86.

Keywords: *Synthesis(Chemistry), *Barium, X rays, Diffraction, Reprints, Alkoxide precursors, Barium monotitanate.

Barium titanate precursors with Ba/Ti ratios ranging from 2:1 to 1:9 were prepared by controlled hydrolysis of mixed barium and titanium species in an alcohol medium. Details of the synthesis and characterization of the resultant products are given. Amorphous powders precipitated by hydrolysis from ethanol solutions of barium and titanium alkoxides crystallize to single- or tw0-phase 1:2 and 1:5 compounds at approximately 700 C. These compounds transform at higher temperatures to other known crystalline phases, the 1:5 phase being maintained metastably to approximately 1100 C.

702,576
PB86-193927 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Study of the Collisional Activation of Cyclobutanone by the Transient Heating of Tetrafluorosilane.
Final rept.
M. D. Scheer, J. R. McNesby, and W. Braun. 1984, 5p
Pub. in Jnl. of Physical Chemistry 88, n9 p1850-1854 1984.

Keywords: Decomposition, Interactions, Reprints, *Tetrafluorosilane, *Cyclobutanone, Unimolecular reactions, Laser heating.

The unimolecular decomposition of cyclobutanone has been used to study the behavior of SiF4 as a heat bath gas. Temperatures in the neighborhood of 1050 K were obtained by rapid flow through a heated tube and by the absorption of the pulsed infra-red radiation emitted by a CO2 TEA laser tuned to 1033/cm. The effective reaction times of these two heating methods were approximately one millisecond and 100 microseconds respectively. The two separate decomposition channels of cyclobutanone were studied by means of a comparative method that is insensitive to the non-uniform temperatures inherent in all transient heating methods.

702,577
PB86-196441 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Iodomethane as a Potential Metal-Mobilizing Agent in Nature.
Final rept.
J. S. Thayer, G. J. Olson, and F. E. Brinckman. 1984, 4p
Pub. in Environmental Science and Technology 18, n9 p726-729 1984.

Keywords: Chemical reactions, Environments, Metals, Sulfur organic compounds, Reprints, *Methane/iodo.

Iodomethane, an ubiquitous biogenic metabolite, has been found to release metals from polluted anoxic sediments, and also from certain metal compounds. Reactions of metal sulfides with iodomethane gave methylsulfur compounds. Kinetic investigations upon the dissolved Na2S/CH3I system, using proton NMR spectroscopy, showed a second-order reaction having the rate constant K = 0.001 L/mo1.s. Naturally occurring iodomethane may react with metal sulfides or metals under certain environmental conditions to generate water-soluble and/or volatile derivatives.

702,578
PB86-201431 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Solid-State 13C NMR Probe for Organotin(IV) Structural Polymorphism.
Final rept.
T. P. Lockhart, and W. F. Manders. 1986, 3p
Pub. in Inorganic Chemistry 25, n4 p583-585 1986.

Keywords: *Polymorphism, *Tin organic compounds, Stannates, Nuclear magnetic resonance, Crystal structure, Reprints, *Stannanes/methyl, Carbon 13.

Solid-state (13) C NMR spectra are reported for three methyltin(IV) compounds which display two types of structural polymorphism. Date for (Me2SnS)3 and Me2Sn(S2CNEt2)2, both of which are known to exist in two or more crystalline forms, demonstrate the ability of the NMR experiment to distinguish between different crystalline modifications of a single compound. The two methyl (13) C resonances in the solid-state NMR of pure, crystalline MeSnPh3 require the presence of more than one structural form in the sample; evidence is cited which indicates that MeSnPh3 adopts two forms within a single crystalline modification. General comments on the use of solid-state NMR for determining the occurrence of structural polymorphism are made.

702,579
PB86-208402 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Fourier Transform Spectrum of the Torsional Band of Hydrazine.
Final rept.
N. Ohashi, W. J. Lafferty, and W. B. Olson. 1986, 15p
Pub. in Jnl. of Molecular Spectroscopy 117, p119-133 1986.

Keywords: Vibrations, Spectral fit, Torsional band, Infrared, Reprints, *Fourier transform, *High resolution, *Hydrazine.

The far-infrared torsional band of hydrazine has been studied by Fourier transform spectroscopy with an apodized resolution of 0.011 per cm. As a result of torsional as well as inversion tunneling, large splittings are observed in this b-type band. About 700rRk and pPk transitions of 22 subbands with delta k.k' from -10 to + 11 were assigned. The A-B, B-A, and E-E transitions were assigned for all subbands except for the delta K.K =-2 and -1 subbands, for which only the nondegenerate transitions were observed. A global fitting, which includes all available ground state microwave data, was made using Hougen's group theoretical formalism. Several fitting constants, i.e., B-C, the trans torsional tunneling constant ht3v, and the inversion tunneling constant h5v, were found to exhibit large changes upon torsional excitation. The values of these constants in the torsional fundamental state are: B-C = 184.52(30) MHz, ht3v = -912.0(21) MHz, and h5v =1994.1(16) MHz, where the numbers in parentheses are 1 O. (Copyright (c) 1986, Academic Press, Inc.)

702,580
PB86-208485 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Ion Thermochemistry: Summary of the Panel Discussion.
Final rept.
S. G. Lias. 1984, 6p
Pub. in Ionic Processes in the Gas Phase, p355-360 1984.

Keywords: *Thermochemistry, Reprints, *Ion thermochemistry.

The Panel on Ion Thermochemistry included a discussion by Dr. Tomas Baer of the problems inherent in detecting an ionization onset, results on ionization potentials of radicals from the laboratories of Dr. J. L. Beuchamp and of Dr. J. M. Dyke (presented in his absence by S. G. Lias), new experimental data on the proton affinity scale in the region below water from Dr. T. B. McMahon, and a presentation of information about the dissociation of protonated dimers by Dr. R. E. March. In addition, Drs. S. G. Lias, J. L. Holmes, and J. E. Bartmess gave details of a comprehensive evaluation of hearts of formation of ions in progress at the time of this writing. Synopse of these presentations are given below.

702,581
PB86-209160 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Solid State 13C NMR Molecular Structure of Microcrystalline, Polymeric Me2SnHPO4.
Final rept.
T. P. Lockhart, and W. F. Manders. 1986, 3p
Pub. in Inorganic Chemistry 25, n7 p1068-1070, 26 Mar 86.

Keywords: *Molecular structure, Nuclear magnetic resonance, Reprints, *Dimethyltin hydrogen phosphates, Carbon 13.

No abstract available.

702,582
PB86-209178 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Structure Determination by NMR Spectroscopy. Correlation of (sup 2)J ((119)Sn, (1)H) and the Me-Sn-Me Angle in Methyltin(IV) Compounds.
Final rept.
T. P. Lockhart, and W. F. Manders. 1986, 4p
Pub. in Inorganic Chemistry 25, n7 p892-895, 26 Mar 86.

Keywords: *Molecular structure, Tin organic compounds, Nuclear magnetic resonance, Organometallic compounds, Reprints, *Stannanes/methyl, Methyltin compounds.

Isotone regression techniques are reinterpreted and extended to include upper and lower bounds on the ordered sequences in question. This amounts to solving the shortest distance problem for the order simplex (S sup n) in (R sup n). An 0(n) algorithm is presented for this problem, verified via the Kuhn-Tucker conditions, and explained geometrically in terms of the Lagrange multipliers. In this context, isotone regression techniques are interpreted in terms of orthogonal projections onto faces of the order simplex (S sup n). These projections provide a succinct characterization of the descent directions required for the design of gradient projection methods for minimizing differentiable functions on (S sup n). The latter problem arises in parameterized curve fitting. The authors conclude by considering generalizations of these techniques.

702,583
PB86-232758 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chemical Thermodynamics of Actinide Elements and Compounds. Part 8. The Actinide Halides.
Final rept.
J. Fuger, V. B. Parker, W. N. Hubbard, and F. L. Oetting. 1983, 267p
Pub. in Chemical Thermodynamics of Actinide Elements and Compounds. Part 8 - The Actinide Halides, 267p 1983.

Keywords: *Thermodynamics, *Actinide series, Americium, Curium, Neptunium, Plutonium, Protactinium, Uranium, Thorium, Enthalpy, Entropy, Temperature, Oxygen halides, Specific heat, Heat capacity.

Chemical thermodynamic properties of halides, oxyhalides, etc. of thorium, protactinium, uranium, neptunium, plutonium, americium and curium are reviewed, evaluated and tabulated. Properties covered are enthalpy of formation, Gibbs energy of formation, entropy, heat capacity and enthalpy, as a function of temperature.

702,584
PB86-239753 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Electronic and Geometric Structures of Pt(NH3)2 (2+) Pt(NH3)2 Cl2, Pt(NH3)3 X, and Pt(NH3)2 XY (X,Y=H2O, OH(1-)).
Final rept.
H. Basch, M. Krauss, W. J. Stevens, and D. Cohen. 1985, 5p
Pub. in Inorganic Chemistry 24, n21 p3313-3317 1985.

Keywords: *Molecular structure, Stereochemistry, Molecular isomerism, Ligands, Reprints, *Electronic structure, *Cis trans isomerization, *Pt diamine complexes.

Isomeric energies and conformations for Pt(NH3)2(2+) (DP), Pt(NH3)2(2+)Cl2 (DDP) Pt(NH3)3 x and Pt(NH3)2 XY (X=NH3, H20, OH-; Y=H2O, OH-) have been calculated by ab initio molecular orbital theory using energy gradient methods. The trends in metal-ligand bond lengths follow a consistent pattern which permits the development of a trans influence ordering of ligands. The OH(1-) ligand is predicted to be in an unusual position in the ordering. However, the experimentally derived ordering schemes may not have been examining the bare hydroxy species, which is found to seek out hypervalent hydrogen bonded attachments. The Pt(NH3)2 2+ fragment is found to have a locally stable 'cis' conformation but the trans DP and all the trans Pt(NH3)2XY complexes with X,Y=H2O, OH(1-) are lower in energy than the cis.

702,585
PB87-107942 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Spectrum and Energy Levels of Y VI.
Final rept.
W. Persson, and J. Reader. Jul 86, 30p
Sponsored by Department of Energy, Washington, DC. Office of Magnetic Fusion Energy.
Pub. in Jnl. of the Optical Society of America B 3, n7 p959-988 Jul 86.

Keywords: *Atomic energy levels, Atomic spectra, Excitation, Reprints, *Yttrium atoms, Ionization energy.

The spectrum of the five-times-ionized yttrium atom (Y VI), excited in a sliding-spark discharge, was studied in the 160-2500-A range. About 900 Y VI lines were classified as transitions between 101 odd and 69 even energy levels. The energy-level system established includes almost all levels of the 4s2 4p4, 4s 4p5, 4s2 4p3 4d, 5d, 5s, 6s, and 5p configurations and a number of levels of the 7s, 4f, and 4s 4p4 4d configurations.

702,586
PB87-109666 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
4s2 4p-4s 4p2 and 4s2 4p-4s2 5s Transitions of Galliumlike Ions from Rb VII to In XIX.
Final rept.
J. Reader, N. Acquista, and S. Goldsmith. Jun 86, 5p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of the Optical Society of America B 3, n6 p874-878 Jun 86.

Keywords: *Atomic orbitals, Excitation, Atomic energy levels, Plasma radiation, Far ultraviolet radiation, Reprints, Galliumlike ions, Ionization energy.

Spectra of the galliumlike ions Rb VII-In XIX excited by low-inductance sparks and laser-produced plasmas were observed with a 10.7-m grazing-incidence spectrograph. Wavelengths for the 4s2 4p doublet P(sub 0)-4s 4p2 doublet P and 4s2 4p doublet P(sub 0) - 4s2 5s doublet S multiplets, energy levels for the 4s2 4p doublet P(sub 0), 4s 4p2 doublet P, and 4s2 5s doublet S terms, and ionization energies are given for each ion.

702,587
PB87-109955 Not available NTIS
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
Critical Review of Aqueous Solubilities, Vapor Pressures, Henry's Law Constants, and Octanol-Water Partition Coefficients of the Polychlorinated Biphenyls.
W. Y. Shiu, and D. Mackay. c1986, 19p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n2 p911-929 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036-9976.

Keywords: *Solubility, *Vapor pressure, Henry's law, Physical properties, *Polychlorinated biphenyls.

Relationships between the environmentally relevant physical chemical properties of the polychlorinated biphenyls, namely, aqueous solubility, vapor pressure, Henry's law constant, and octanol-water partition coefficient are discussed. Reported experimental data are tabulated and critically reviewed. Recommended values are given for 42 of the 209 congeners; however, procedures are suggested for estimating the properties of the other congeners. Properties of mixtures are not treated.

702,588
PB87-113692 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Lipid-Peroxidation Model for Halogenated Hydrocarbon Toxicity - Kinetics of Peroxyl Radical Processes Involving Fatty-Acids and Fe(111) Porphyrins.
Final rept.
D. Brault, P. Neta, and L. K. Patterson. 1985, 9p
Pub. in Chemico Biological Interactions 54, n3 p289-297 1985.

Keywords: *Free radicals, *Toxicity, *Porphyrins, *Iron, Chemical radicals, Carbon tetrachloride, Bromoalkanes, Chloroalkanes, Fluoroalkanes, Reprints, *Chemical reaction kinetics, Peroxyl radicals.

The toxicity of halogenated hydrocarbons is believed to originate from cytochrome-P450-Mediated generated of peroxyl radicals with subsequent attack on biological targets, especially unsaturated lipid moieties. Carbon tetrachloride and the anesthetic agent halothane (CF3CHClBr), responsible for acute or incidental toxicity, respectively, are important examples. Fe(3+)-deuteroporphyrin has been used as a model for cytochrome P450, and its reactions with the peroxyl radicals CCl3O2 radicals and CF3CHClO2 radicals, derived from carbon tetrachloride and halothane, have been reported. From a study of an extended model system, the authors wish to report rate constants for reactions of CCl3O2 radicals and CF3CHClO2 radicals with unsaturated fatty acids as well as cholesterol. Rate constants for reactions of the fatty acid peroxyl radicals with the Fe(3+)-porphyrin are also presented. The model for halogenated hydrocarbon toxicity is discussed in terms of these new findings, which represent the first quantitative kinetic approach.

702,589
PB87-114922 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Elucidation of Medium Effects on Molecular Structure by Solid-State and Solution 13C NMR. Identification and X-ray Structure of the Orthorhombic Modification of Dimethyltin (4) Bis(N,N-diethyldithiocarbamate).
Final rept.
T. P. Lockhart, W. F. Manders, E. O. Schlemper, and J. J. Zuckerman. 1986, 5p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of the American Chemical Society 108, n14 p4074-4078 1986.

Keywords: *Molecular structure, Nuclear magnetic structure, Stannates, Tin organic compounds, Structural analysis, *Crystal structure, X ray analysis, Reprints.

Solid-state and solution (13)C NMR has been used to investigate medium effects on the molecular structures of Me2Sn(acac)2(acac = acetylacetonate) and Me2Sn(S2CNEt2)2. The magnitude of the Me-Sn-Me angle in different phases is obtained from analysis of the tin-carbon J coupling (sup 3 J ((119)Sn,(13)C)) data. The Me-Sn-Me angle of Me2Sn(acac)2 changes from 180 degs in the solid state (known from X-ray) to about 158 degs in benzene and 161 degs in CDCl3 (estimated from the solution (sup 3 J ((119) Sn, (13) Cl)/values). Two explanations, that a single molecule (with Me-Sn-Me = ca. 160 degs exists in solution or that rapid conflict with the molecular structures of two X-ray characterized crystalline modifications one of which contains two symmetry-independent molecules of Me2Sn(S2CNEt2)2. The suggestion that this is a third crystalline form was confirmed by X-ray analysis. The new, orthorthombic modification (space group Pbca) of SnS4N2C12H26 has a = 9.929 (2) A,b = 31.176 (5) A,C = 12.852 (1) A,Z = 8.R was refined to 0.020. The solid-state NMR-derived estimate of the

Me-Sn-Me angle, 136 degs, was confirmed by X-ray analysis 135.6 (2) degs. In solution, Me2Sn(S2CNEt2)2 appears to adopt a conformation similar to that of the orthorhombic modification described here.

702,590
PB87-119616 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
New Applications of Tetracyanoethylene in Organic Chemistry.
Final rept.
A. J. Fatiadi. 1986, 36p
Pub. in Synthesis-Stuttgart, n4 p249-284 1986.

Keywords: *Chemical reactions, Chemical properties, Synthesis(Chemistry), Chemical reaction kinetics, Organic compounds, Reprints, *Ethylene/tetracyano.

Recent applications of tetracyanoethylene in organic chemistry are reviewed; the survey is mainly concerned with selected reactions of tetracyanoethylene which have use or potential use in organic synthesis. Among other topics, the survey includes new information on molecular complexes, solute-solvent interaction, ozonation of alkenes and acetylenes (the Criegee reaction); also dehydrogenation and tricyanovinylation reactions, and reactions of tetracyanoethylene oxide; also reactions with ketones and diketones, the synthesis of heterocycles, the cationic polymerization reaction, and industrial and analytical applications. The cycloaddition reactions and reactions of tetracyanoethylene with organometallics are not included in the survey.

702,591
PB87-126435 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Substituted N,N-Dialkyl Anilines: Relative Ionization Energies and Proton Affinities through Determination of Ion-Molecule Reaction Equilibrium Constants.
Final rept.
S. G. Lias, J. A. A. Jackson, H. Argentar, and J. F. Liebman. 1985, 6p
Pub. in Jnl. of Organic Chemistry 50, n3 p333-338 1985.

Keywords: Anilines, Ionization potentials, Chemical reactions, Reaction kinetics, Reprints, *Aniline/N-N-dialkyl, Ion-molecule collision, Charge transfer, Proton affinity.

The relative ionization energies and proton affinities of N,N-dimethyl-, N,N-diethyl-, and N,N-di-n-propylaniline, and meta- and para-methyl substituted analogues, (as well as N,N,3,5-tetramethylaniline and 4-chloro-N,N-diethylaniline) have been determined in the gas phase through measurements of the equilibrium constants of charge transfer and proton transfer reactions in an ion cyclotron resonance spectrometer. Absolute values are assigned to the ionization energies and proton affinities generated in these experiments taking as standard an evaluated ionization (7.12 eV) and proton affinity (223.4 kcal/mol) for N,N-dimethylaniline from the literature. Further, it is demonstrated that variations in both the ionization energy and the proton affinity values upon changes in ring substitution can be predicted from the appropriate Hammett sigma-values, but not from the corresponding (sigma) (1+) values; changes brought about by differing N-substituents correlate with (sigma) sup * not equal to 1 values.

702,592
PB87-149399 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Heterodyne Frequency Measurements on the 12(sup 0)0-00(sup 0)0 Band of OCS.
Final rept.,
A. G. Maki, J. S. Wells, and A. Hinz. 1986, 9p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in International Jnl. of Infrared and Millimeter Waves 7, n6 p909-917 1986.

Keywords: Reprints, *Carbonyl sulfides, Heterodyne frequency measurements.

Heterodyne frequency measurements have been made on the 12(sup 0)0-00(sup 0)0 band of carbonyl sulfide in the wavenumber range from 1866 to 1915/cm. Frequency measurement techniques reported earlier are used to measure the OCS absorption lines by means of a tunable diode laser, a CO laser local oscillator, and two CO2 lasers used as secondary frequency standards. A table of calculated absorption frequencies is given for OCS from 1866 to 1919/cm.

702,593
PB87-149431 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Disproportionation-Recombination Rate Ratios for Hydroaromatic Radicals.
Final rept.,
M. J. Manka, and S. E. Stein. 1984, 6p
Pub. in Jnl. of Physical Chemistry 88, n24 p5914-5919 1984.

Keywords: *Chemical radicals, *Aromatic hydrocarbons, Chemical reactions, Disproportionation, Reprints, Rate constants.

Relative rates for radical disproportionation and recombination have been determined in the liquid phase at 150 deg C for a series of reactions involving resonance-stabilized hydroaromatic radicals. Self-reactions were studied for the 1-tetralyl, 1-indanyl, 9,10-dihydro-9-phenanthryl and 9,10-dihydro-9-anthryl radicals. Four cross-radical reactions involving benzyl, diphenylmethyl and 1-tetralyl radical as H-atom acceptors were also examined. Results suggest that when disproportionation reaction exothermicity is sufficiently small, - Delta H(sub d) approx < 50 kcal/mol (210 kJ/mol), disproportionation rate constants decrease with decreasing exothermicity.

702,594
PB87-149456 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
One-Electron Redox Reactions Involving Sulfite Ions and Aromatic Amines.
Final rept.,
P. Neta, and R. E. Huie. 1985, 5p
Pub. in Jnl. of Physical Chemistry 89, n9 p1783-1787 1985.

Keywords: *Chemical radicals, *Oxidation reduction reactions, *Amines, *Sulfites, Chemical reactions, Reprints, *Chemical reaction kinetics, Peroxysulfite radicals, Sulfite radicals.

The one-electron oxidation of aromatic amines by SO4(-1) and of sulfite and bisulfite by aromatic amine radical cations have been investigated. p-Phenylenediamine and N,N,N',N'-tetramethyl-p-phenylenediamine were oxidized by SO3(-1) with rate constants of 5.0 x 10 to the 7th and 5.2 x 10 to the 8th/M s, respectively, in basic solutions. Aniline radical cation also oxidized SO(-2) rapidly (k=4 x 10 to the 9th M s) and HSO3(-1) less rapidly (k=4.8 x 10 to the 6th/M s). The aniline neutral radical reacted too slowly to measure with either. A secondary product was observed in acid solution of TMPD with an absorption maximum at 455 nm. This was ascribed to a reaction between the SO3(-1) and TMPD(+1) radicals.

702,595
PB87-151296 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Mg-like Spectrum of Cu XVIII.
Final rept.,
J. Sugar, and V. Kaufman. Nov 86, 1p
Pub. in Optical Society of America B 3, p1612 Nov 86.

Keywords: *Atomic energy levels, *Copper, Atomic orbitals, Reprints.

The transition arrays 3p(2) - 3p3d and 3s3d-3p3d were analyzed, and the levels of the 3p3d configurations were derived. This is an extension of the analysis of Cu XVIII reported in a paper by Sugar and Kaufman (J.Opt. Soc. Am. B 3,701(1986)).

702,596
PB87-151668 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Stable Hydrogen-Bonded Isomers of Covalent Ions. Association of Carbonium Ions with N-Donors.
Final rept.,
M. Mautner, M. M. Ross, and J. E. Campana. 1985, 7p
Pub. in Jnl. of the American Chemical Society 107, n17 p4839-4845 1985.

Keywords: Clustering, Chemical reactions, Entropy, Reprints, *Carbonium ions.

Association reactions of the oxocarbonium ions CH3CH(+1)OCH3 and (CH3)2C(+1)OCH3 with H2O and CH3OH are exothermic by 11-13 kcal mol 1. Although the association products could be covalently bonded protonated acetals or hemiacetals, e.g., CH3CH(OH)OCH3H+, the entropy changes of the association reactions, -19 to -23 cal/mol K are substantially smaller than the -31 to -40 cal mol K expected for covalent condensation. Therefore, reaction thermochemistry is more consistent with the formation of clusters which in these cases involves (sup sigma(+))...O-type unconventional ionic hydrogen bonds, in analogy with recently observed N(+1)(CH3)4...OH2 clusters. Entropy terms due to the loose structure of the cluster would favor clustering over condensation, even if condensation is more exothermic by 2-4 kcal/mol. Similar considerations may apply to the association of s-C3H7(+1) and t-C4H9(+1) with H2O and HCN.

702,597
PB87-152856 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Spectral Intensities in the Fundamental Bands of HF and HCl.
Final rept.,
A. S. Pine, A. Fried, and J. W. Elkins. 1985, 16p
Pub. in Jnl. of Molecular Spectroscopy 109, n1 p30-45 1985.

Keywords: *Hydrogen chloride, *Hydrogen fluoride, *Molecular spectroscopy, Reprints, Tunable lasers.

The transition intensities of the fundamental bands of natural isotopic HF and HCl vapors have been measured with Doppler-limited resolution using a tunable difference-frequency laser spectrometer. Precise values for the band intensities, vibrational moments and Herman-Wallis F-factors have been obtained for H(19)F, H(35)Cl and H(37)Cl.

702,598
PB87-152872 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
High-Resolution Infrared Spectra of the nu(sub 2) and nu(sub 3) Bands of HOCl.
Final rept.,
W. J. Lafferty, and W. B. Olson. 1986, 15p
Pub. in Jnl. of Molecular Spectroscopy 120, p359-373 1986.

Keywords: *Infrared spectra, *Oxygen chlorides, Molecular spectroscopy, Reprints.

The infrared spectra of the a-type transitions of the nu(sub 2) and nu(sub 3) bands of HO(35)Cl and HO(37)Cl have been obtained under high resolution. Line assignments of both bands have been made, and the spectroscopic constants have been obtained for both bands using a Watson Hamiltonian. Lines of the K(sub a) = 5 subband of the nu(sub 2) band of the HO(35)Cl molecule were found to be slightly shifted by an interaction with the K(sub a) = 4 level of the 2nu(sub 3) vibrational state. The b-type transitions permitted for both bands were too weak to observe. Relative intensities of selected lines of both bands have been measured, and empirical Herman-Wallis factors have been determined.

702,599
PB87-167227 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Single Pulse Shock Tube Study on the Thermal Stability of Ketones.
Final rept.,
W. Tsang. 1984, 14p
Pub. in International Jnl. of Chemical Kinetics 16, n12 p1543-1556 1984.

Keywords: *Ketones, Decomposition, Reprints, *Chemical reaction kinetics.

5-Methyl-hexanone-2, 3-methyl-pentanone-2 and hexanone-2 have been decomposed in comparative rate single pulse shock tube experiments. The mechanism of decomposition involves the breaking of carbon-carbon bonds as well as molecular processes involving 6-center complexes. The obtained results lead to delta H(sub f)(CH3CO) = -13.8 kJs and delta H(sub

f)(CH3COCH2.) = -12.6 kJs at 300 K. They are compared with existing literature values and some generalizations are made with regard to the stability of carbonyl compounds.

702,600
PB87-167235 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Stability of Alkyl Radicals.
Final rept.,
W. Tsang. 1985, 9p
Pub. in Jnl. of the American Chemical Society 107, n10 p2872-2880 1985.

Keywords: *Chemical radicals, *Stability, Decomposition, Heats of formation, Reprints, *Alkyl radicals.

All the data on the decomposition of simple alkyl radicals have been reviewed. Together with results on the reverse addition reactions, alkyl radical combination rates and the entropies of the alkyl radicals are given. These values are fully consistent with determinations based on the decomposition of aliphatic compounds and combination of radicals. They lead to D(nC3H7-H) = 422.5 kJ, D(iC3H7-H) = 415.3 kJ, D(sC4H9-H) = 414.2 kJ, D(tC4H9-H) = 404.6 (zero barrier) and D(tC5H11-H) = 402.5 kJ. These numbers are all significantly higher than generally used values recommended in a recent review. It appears that previous rejection of measured alkyl radical decomposition rates is due to an uncritical acceptance of the earlier bond energies.

702,601
PB87-224135 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Synthesis of 2-Amino-1,5-Dihydro-1-(Methyl-(13)C)-4H-Imidazol-4-One-5-(13)C (Creatinine-(13)C2).
Final rept.,
A. Cohen, H. S. Hertz, R. Schaffer, M. J. Welch, and E. White. 1986, 11p
Sponsored by Food and Drug Administration, Rockville, MD.
Pub. in Jnl. of Labelled Compounds and Radiopharmaceuticals 24, n5 p587-597 1986.

Keywords: *Synthesis(Chemistry), *Carbon 13, *Creatinine, Spectrometry, Reprints, Sarcosine, Glycine.

2-Amino-1,5-dihydro-1-(methyl-13C)-4H-imidazol-4-one-5-13C (creatinine-13C2) (8) is synthesized as follows. Glycine-2-13C (1) is tosylated; the product (2) is treated with iodomethane-13C; and the resultant doubly-labeled product (3) is detosylated to yield sarcosine-13C2 (4). Creatine-13C2 (7) is obtained by treating 4 with 2-methylisothiourea monohydriodide (5) or cyanamide (6). Dehydration of 7 under vacuum sublimation conditions gives 8.

702,602
PB87-224176 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Chemistry of Molecular Growth Processes in Flames.
Final rept.,
K. C. Smyth, and J. H. Miller. 1987, 7p
Pub. in Science 236, p1540-1546, 19 Jun 87.

Keywords: *Methane, Models, Production rates, Temperature, Velocity, *Diffusion flames, Production rates.

Chemical mechanisms of pyrolysis, growth, and oxidation processes in flames have traditionally been inferred from spatial profile measurements of species concentrations. Experimental investigations now include the detection of numerous minor species such as reactive radicals and intermediate hydrocarbons. In assessing a proposed mechanism important new constraints can be established when the detailed species profile data are combined with velocity and temperature measurements and analyzed to determine production and destruction rates for specific molecules. Recent results on hydrocarbon diffusion flames provide new information on the interplay between chemical and transport processes. These measurements have led to direct tests of proposed routes for the formation of aromatic hydrocarbons and the first, small soot particles.

702,603
PB87-224234 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Unconventional Ionic Hydrogen Bonds. 1. CHdelta+...X. Complexes of Quarternary Ions with n- and pi-Donors.
Final rept.,
M. Mautner, and C. A. Deakyne. 1985, 6p
See also PB87-224242.
Pub. in Jnl. of the American Chemical Society 107, n2 p469-474 1985.

Keywords: *Hydrogen bonds, Reprints, *Quaternary ions, Onium ions.

CH sigma- X interaction energies are obtained from the clustering of quaternary onium ions with n-donor solvent molecules. The dissociation energies (delta degrees of Me4N+ clustered with the n-donors H2O, MeOH, MeNH2, and Me3N and with the pi donors benzene and toluene range between 8 and 10 kcal/mol. With the weak, bulky n-donor MeCl the interaction is weaker (6.5 kcal/mol) while the more popular ligands Me and MeCONMe2 attach strongly (14.6 and 18.0 kcal/mol, respectively) to Me4N+. Strong interactions, 20-23 kcal/mol, are also smaller by 2 kcal/mol than those to Me4N+. Ab initio calculations show that in the Me4N2O, MeOH, MeNH2, and MeCl complexes the ligands attach electrostatically to a cavity created by protons of three CH3 groups rather than hydrogen bonding to one proton or to one CH3 group. Both experiment and theory indicate that a second solvent molecule (H2O or CH3OH) attaches preferentially to the first solvent molecule rather than to Me4N+.

702,604
PB87-224242 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Unconventional Ionic Hydrogen Bonds. 2. NH+...pi. Complexes of Onium Ions with Olefins and Benzene Derivatives.
Final rept.,
C. A. Deakyne, and M. Mautner. 1985, 6p
See also PB87-224234.
Pub. in Jnl. of the American Chemical Society 107, n2 p474-479 1985.

Keywords: *Hydrogen bonds, Reprints, *Olefins, *Benzene, *Onium ions.

Unconventional strong ionic hydrogen bonds of the -XH+ pi type, where the electron donor is a pi bond or an aromatic pi-system, are formed in the clustering reactions of NH4+ and MeNH3+ with C2H4 and benzene derivatives. The interaction energies range from 10 to 22 kcal/mol. The experimental results and ab initio calculations on C2H4NH4+, C6H6NH4+, and C6H5FNH4+ indicate that the interaction is primarily electrostatic in nature with little pi-donation into the bond. The most stable structure of C2H4NH4+ is the conformer where one N-H+ bond points at the center of the double bond. For C6H6NH4+ and C6H5FNH4+, the lowest energy pi-dimers have two NH4+ hydrogens directed toward the ring. The F-H-NH3+ sigma-complex was studied also for C6H5FNH4+. The latter complex is the more stable of the two at this level of calculation.

702,605
PB87-231536 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Break-Junction Tunneling Measurements of the High-Tc Superconductor Y1Ba2Cu3O(9-delta).
Final rept.,
J. Moreland, J. W. Ekin, L. F. Goodrich, T. E. Capobianco, A. F. Clark, J. Kwo, M. Hong, and S. H. Liou. 1987, 2p
Contracts DE-AI01-84ER52113, N00014-86-F-0109
Sponsored by Department of Energy, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Physical Review B 35, n16 p8856-8857, 1 Jun 87.

Keywords: *Superconductors, Reprints, *Break junctions, Energy gap, Tunneling spectroscopy, Vacuum tunneling.

Current-voltage tunneling characteristics in a high-critical-temperature superconducting material containing predominately Y1Ba2Cu3O9-delta have been measured using the break-junction technique. Sharp gap structure was observed, with the largest superconductive energy gap measured to be delta = 19.5 plus or minus 1 meV, assuming a superconductor-insulator-superconductor junction. The energy gap corresponds to 2delta/KbTc=4.8 at T=4 K, for a critical temperature of 93 K (midpoint of the resistive transition).

702,606
PB87-232005 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Precipitation Diagrams and Solubility of Uric Acid Dihydrate.
Final rept.,
V. Babic-Ivancic, H. Furedi-Milhofer, W. E. Brown, and T. M. Gregory. 1987, 7p
Sponsored by American Dental Association, Chicago, IL.
Pub. in Jnl. of Crystal Growth 83, p581-587 1987.

Keywords: *Uric acid, Reprints, *Phase diagram, *Precipitation diagram, Renal fluids, *Solubility.

The solubility of uric acid dihydrate (UA-2H2O) and the precipitation of UA-2H2O and anhydrous uric acid (UA) from solutions containing sodium hydroxide and hydrochloric acid have been investigated. For the solubility studies, crystals of pure UA-2H2O were prepared and equilibrated with water and with solutions of HCl or NaOH for 60 min or 20 h, respectively. The equilibrium pH (pH = 2-6.25) and uric acid concentration were determined. For the precipitation experiments, commercial UA was dissolved in NaOH in a 1:1.1 molar ratio and UA-2H2O and/or UA were precipitated with hydrochloric acid. The precipitates and/or supernatants were examined 24 h after sample preparation. The results are represented in the form of tables, precipitation diagrams and 'chemical potential' diagrams. Solubility measurements with 60 min equilibration times yielded the solubility products of UA-2H2O K(sp)(298 K) = (0.926 plus or minus 0.025) times 10 to the minus 9th power sq. mol. minus 6 dm. and K(sp (310 K) = (2.25 plus or minus 0.05) times 10 to the minus 9th power sq. mol. minus 6 dm. and the first dissociation constants of uric acid, K1(298 K) = (2.45 plus or minus 0.07) times 10 to the minus 6 th power mol. minus 3 dm. and K1(310 K) = (3.63 plus or minus 0.08) times 10 to the minus 6 th power mol. minus 3 dm. Precipitation diagrams show that under the given experimental conditions, at 298 K, UA-2H2O is stable for 24 h while at 310 K this was true only for precipitates formed from solutions of high supersaturations. At lower supersaturations, mixtures of UA-2H2O and UA formed. Consequently, while the K(sp) value determined from precipitation data obtained at 298 K (K(sp) = 1.04 times 10 to the minus 9th power sq. mol. minus 6 dm.) was consistent with the respective solubility product, the 310 K precipitation boundary yielded an ion activity product, AP, the value of which fulfills the conditions K(sp)(UA) < AP < K(sp)(UA-2H2O). Similar ion activity products were obtained from solubility measurements in pure water at 20 h equilibration time.

702,607
PB87-233698 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Classical Permanganate Ion: Still a Novel Oxidant in Organic Chemistry.
Final rept.,
A. J. Fatiadi. 1987, 43p
Pub. in Synthesis, n2 p85-127 1987.

Keywords: *Oxidation, *Synthesis(Chemistry), Reagents, Reprints, *Permanganate ions.

Recent synthetic applications of permanganate to organic chemistry are reviewed. The usefulness of the reagent as a classical oxidant and as a new reagent, being transferred into an organic phase or incorporated on to solid supports, or being applied as an organic salt are surveyed. Recent views on the mechanism of the permanganate oxidation of organic compounds are also discussed.

702,608
PB87-233946 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Gas and Surface Processes Leading to Hydrogenated Amorphous Silicon Films.
Final rept.,
A. Gallagher, and J. Scott. 1987, 6p
Sponsored by Solar Energy Research Inst., Golden, CO.
Pub. in Solar Cells 21, p147-152 1987.

Keywords: *Semiconducting films, Surfaces, Silanes, Hydrogen, Reprints, *Amorphous silicon, Silicon solar cells, Hydrogenation.

A qualitative model is given for gas and surface reactions in silane discharges, leading to a-Si:H films and gas constituents. Several experiments are described.

702,609
PB88-100672 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Analysis of Dielectric Strength Data for Binary Electronegative Gas Mixtures.
Final rept.,
T. Aschwanden, R. J. Van Brunt, and M. E. Bieber. 1987, 2p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of International Conference on Phenomena in Ionized Gases (18th), Swanwea, United Kingdom, July 13-17, 1987, p102-103.

Keywords: *Argon, *Carbon dioxide, Critical field, Dielectric strength, Gas mixtures, Helium, Neon, Hexafluoride/sulfur.

The consistency among dielectric strength, electron swarm, and collision cross section data for ionization, attachment, and momentum transfer have been determined for the binary gas mixtures SF6/He, SF6/NE, SF6/Ar, and SF6/CO2 using a theoretical approach recently developed by Van Brunt. Dielectric strength data for SF6/Ar and SF6/CO2 measured by Aschwanden can be accurately described by the model calculation and exhibit a high degree of consistency with swarm and cross section data. The model also appears to successfully desribe preliminary electrical breakdown data for SF6/Ne mixtures. The theoretical model fails for SF6/He because it does not allow for the important effect of Penning ionization which is possible in this case.

702,610
PB88-100698 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Transfer of F(1-) in Collisions of SF6(1-) with Fluorinated Gases andSO2 at Thermal Energies.
Final rept.,
L. W. Sieck, and R. J. Van Brunt. 1987, 1p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of the International Conference on the Physics of Electronic and Atomic Collisions (15), Brighton, United Kingdom, July 22-28, 1987, p710.

Keywords: *Collisions, *Corona discharge, Reaction rates, Temperature dependence.

Measured temperature dependencies of F transfer rates for collisions of SF6 with SOF2, SO2F2, SOF4, SO2, SF4, and SIF4 are reported. The results are used to interpret the complex aniomic chemistry that occurs during electrical discharges to SF6.

702,611
PB88-109079 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Structural Model for Octacalcium Phosphate-Succinate Double Salt.
Final rept.,
M. Mathew, and W. E. Brown. 1987, 3p
Grant PHS-DE-05030
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Bulletin of the Chemical Society of Japan 60, p1141-1143 1987.

Keywords: *Crystal structure, *Calcium phosphates, Succinates, Reprints, *Octacalcium phosphate, *Octacalcium phosphate-succinate salt, *Phosphate-succinate salt.

A new structural model for octacalcium hydrogenpentakis(phosphate) succinate pentahydrate, Ca8H(PO4)5-(C2H4(COO)2) H2O, a reaction product of octacalcium dihydrogenhexakis(phosphate) pentahydrate, Ca8H2- (PO4)-5H2O,, OCP, and succinate ions, is proposed on the basis of similarities in the unit cell dimensions and structures of OCP and calcium succinate trihydrate. The model can be used to develop information on the mode of incorporation of dicarboxylate ions into OCP and hydroxyapatite and its possible effects on biological mineralization processes.

702,612
PB88-112529 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Thermochemical Data on Gas Phase Compounds of Sulfur, Fluorine, Oxygen, and Hydrogen Related to Pyrolysis and Oxidation of Sulfur Hexafluoride,
J. T. Herron. c1987, 6p
Included in Jnl. of Physical and Chemical Reference Data, v16 n1 p1-6 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Fluorine, *Hydrogen, *Thermochemistry, Oxygen, Sulfur, Sulfur hexafluoride, Data, Evaluation.

Thermochemical data on selected gas phase compounds containing sulfur, fluorine, oxygen, and hydrogen are evaluated. These are of particular relevance to plasma chemistry and SE6 dielectric breakdown. Values of the enthalpies of formation and the entropy are provided at 298 K. Where no experimental data are available, methods for estimation have been developed for deriving the enthalpy of formation. Data are tabulated for 36 substances.

702,613
PB88-112537 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Chemical Physics.
Thermochemical Measurements on Rubidium Compounds: A Comparison of Measured Values with Those Predicted from the NBS (National Bureau of Standards) Tables of Chemical and Thermodynamic Properties,
V. B. Parker, W. H. Evans, and R. L. Nuttall. c1987, 53p
Included in Jnl. of Physical and Chemical Reference Data, v16 n1 p7-59 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Data evaluation, *Documentation, Thermochemical measurements, Rubidium compounds, Reaction catalog, *Enthalpy, Entropy, *Gibbs energy.

The report presents the assessed thermochemical measurements on rubidium compounds upon which the property values, delta(f)H, delta(f)G, S, C(P), and H(T)-H(0) at 298.15 K and delta(f)H(0 K) recommended in the 'NBS Tables of Chemical Thermodymanic Properties' are based. Included in this set of thermochemical measurements, or thermochemical reaction catalog, is a comparison of the observed values for the processes in question with those predicted (calculated) from the recommended property values in the forementioned tables. The evaluator's initially assigned uncertainties on the experimental measurements and final estimated reliabilities on the recommended process values are given. The paper illustrates the evaluation procedure used in preparing the full set of recommended data in the 'NBS Tables of Chemical Thermodynamic Properties'.

702,614
PB88-112545 Not available NTIS
Hebrew Univ. of Jerusalem (Israel). Dept. of Inorganic and Analytical Chemistry.
Standard Thermodynamic Functions of Gaseous Polyatomic Ions at 100-1000 K,
A. Loewenschuss, and Y. Marcus. c1987, 29p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n1 p61-89 1987. Available from American Chemical Society, 1155 Sixteenth St., NW,Washington, DC 20036.

Keywords: Heat capacity, Polyatomic ions, Thermodynamic functions, *Enthalpy, *Entropy, *Gibbs energy.

The standard thermodynamic functions--heat capacity at constant pressure C(p), its ratio to that at constant volume, the entropy S, the enthalpy minus that at absolute zero (H - H(0))/T were calculated for 131 gaseous ions in the temperature interval 100-1000 K, and are presented in tables. The input data included structural information (bond lengths and angles), vibrational spectroscopic information (vibrational frequencies and degeneracies), and electronic level occupation and degeneracies for ions having unpaired electrons. These were taken mainly from a recent review by the authors, and supplemented by further data from the literature, updated to the end of 1985.

702,615
PB88-112552 Not available NTIS
Center for Information and Numerical Data Analysis and Synthesis, Lafayette, IN.
Thermodynamic Properties of Manganese and Molybdenum,
P. D. Desai. c1987, 18p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n1 p91-108 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Thermodynamic properties, *Manganese, *Molybdenum, Fusion, Vaporization, Heat capacity, *Critical evaluation, *Data analysis, Enthalpy, Gibbs energy function.

The work reviews and discusses the data on the various thermodynamic properties of manganese and molybdenum available through March 1985. These include heat capacity, enthalpy, enthalpy of transitions and melting, vapor pressure, and enthalpy of vaporization. The existing data have been critically evaluated and anlyzed. The recommended values for the heat capacity, enthalpy, entropy, and Gibbs energy function from 0.5 to 2400 K for manganese and from 0.4 to 5000 K for molybdenum have been generated, as have heat capacity values for supercooled beta-Mm and for gamma-Mn below 298.15 K. The recommended values for vapor pressure cover the temperature range from 298.15 to 2400 K for manganese and from 298.15 to 5000 K for molybdenum. Thee values are referred to temperatures based on IPTS-1968. The uncertainties in the recommended values of the heat capacity range from + or - 3% to + or - 5% for manganese and from + or - 1.5% to + or - 3% for molybdenum.

702,616
PB88-112560 Not available NTIS
Center for Information and Numerical Data Analysis and Synthesis, Lafayette, IN.
Thermodynamic Properties of Selected Binary Aluminum Alloy Systems,
P. D. Desai. c1987, 16p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n1 p109-124 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Thermodynamic properties, *Aluminum alloys, Activity coefficient, Enthalpy, Entropy, Gibbs energy, Heat capacity, Phase diagram.

This work reviews the data and information available through March 1985 on the various thermodynamic properties of five binary aluminum alloy systems: Al-Fe, Al-Mn, Al-Ni, Al-Si, and Al-Ti. The thermodynamic properties covered in this work are heat capacity, Gibbs energy, enthalpy, and entropy of formation. Existing data have been evaluated and analyzed. The values for heat capacity and room-temperature enthalpy of formation for a large number of alloys have been generated. For each of the binary alloy systems, the recommended values for integral Gibbs energy, enthalpy, and entropy of formation as well as the partial quantities, activity coefficients for each component covering the entire composition range have been reported. These values are reported for both solid and liquid alloys.

702,617
PB88-112578 Not available NTIS
A.T. and T. Bell Labs., Murray Hill, NJ.
13C Chemical Shieldings in Solids,
T. M. Duncan. c1987, 27p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n1 p125-151 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Chemical shielding, *Chemical shift anisotropy, Critical review, Nuclear magnetic resonance, Solid state.

Analogous to the importance of 13C is isotropic shieldings for chemical analysis of liquids with nuclear magnetic resonance spectroscopy, 13C chemical shielding

anisotropies are proving to be valuable in the characterization of solids. Specifically, molecular geometry is revealed by the full shielding anisotropy and molecular motion may be characterized by changes in the powder pattern. In particular, the principal components of the shielding reveal differences in bonding geometry which may not be correlated to monotonic changes in the isotropic shift. The report is a comprehensive, critical compilation of 13C chemical shieldings in solids, organized by carbon functionality. From these data, representative shieldings of common carbon functionalities are calculated.

702,618
PB88-112586 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 16, Number 2, 1987.
Quarterly rept.
c1987, 392p
See also PB88-112594 through PB88-112677, and PB88-112511. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Research projects, *Chemical industry, Viscosity, Thermodynamic properties, *Foreign technology, Binary excess, Enthalpy, Absorption spectra, Chemical kinetics.

Contents: The Mark-Houwink-Sakurada relation for poly(methyl methacrylate); The viscosity of carbon dioxide, methane, and sulfur hexafluoride in the limit of zero density; The viscosity of normal deuterium in the limit of zero density; Standard chemical thermodynamic properties of alkanethiol isomer groups; Evaluation of binary excess volume data for the methanol+hydrocarbon systems; Evaluation of binary excess enthalpy data for the methanol+hydrocarbon system; Extinction coefficients of triplet-triplet absorption spectra of organic molecules in condensed phases: A least-squares analysis; Evaluated chemical kinetic data for the reactions of atomic oxygen O(3P) with unsaturated hydrocarbons; Spectral data for molybdenum ions, Mo VI-Mo XLII.

702,619
PB88-112594 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mark-Houwink-Sakurada Relation for Poly(Methyl Methacrylate),
H. L. Wagner. c1987, 9p
Included in Jnl. of Physical and Chemical Reference Data, v16 n2 p165-173 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Benzene, Molecular weight, Toluene, Viscosity, *Butanone, *Chloroform, Mark-Houwink, Methyl ethyl ketone, Furan/tetrahydro.

In this third review of a series, the literature values for the viscosity-molecular weight relationship (Mark-Houwink-Sakurada) for poly(methyl methacrylate) have been critically evaluated. Although most of the studies have been concerned with conventionally produced poly(methyl methacrylate), some work has also been done with the isotactic polymer. The Mark-Houwink relations for the following solvents are discussed: benzene, toluene, acetone, chloroform, 2-butanone, and tetrahydrofuran, as well as for several other infrequently used solvents. The values of the coefficient K in the relation (n)=KM(0.5) for several theta solvents are also reported.

702,620
PB88-112602 Not available NTIS
Imperial Coll. of Science and Technology, London (England). Dept. of Chemical Engineering and Chemical Technology.
Viscosity of Carbon Dioxide, Methane, and Sulfur Hexafluoride in the Limit of Zero Density,
R. D. Trengove, and W. A. Wakeham. c1987, 13p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n2 p175-187 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Carbon dioxide, *Methane, *Sulfur hexafluoride, Transport properties, Viscosity, Gases, *Corresponding states.

The paper contains accurate representations for the viscosity of the three polyatomic gases, carbon dioxide, methane, and sulfur hexafluoride, in the limit of zero density. These gases were studied because they posses permanent multipole moments of increasing order 4, 6, and 8, respectively. The correlations have associated uncertainties of + or - 0.3% around room temperature rising to + or - 1.5% at the low-temperature extreme and to a maximum of + or - 2.0% at the high-temperature extreme. The correlating equation for carbon dioxide is valid for the temperature range 200-1500 K, that for methane from 110-1050 K and that for sulfur hexafluoride from 220-900 K. It is shown that a two-parameter law of corresponding states is inadequate for the representation of the data over these wide ranges of temperature.

702,621
PB88-112610 Not available NTIS
Thessaloniki Univ., Salonika (Greece). Dept. of Chemical Engineering.
Viscosity of Normal Deuterium in the Limit of Zero Density,
M. J. Assael, S. Mixafendi, and W. A. Wakeham. c1987, 4p
Prepared in cooperation with Imperial Coll. of Science and Technology, London (England). Dept. of Chemical Engineering and Chemical Technology. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n2 p189-192 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Correlation, *Deuterium, *Viscosity.

The paper contains a new representation of the viscosity of normal deuterium in the limit of zero density as a function of temperature. The correlation is based upon the semiclassical kinetic theory of polyatomic gases and a body of critically evaluated experimental data. The similarity of the intermolecular pair potentials of normal hydrogen and normal deuterium is employed to extrapolate the correlation for deuterium beyond the range of the experimental data. In the temperature range 250-350 K the accuracy of the representation of the viscosity is estimated to be + or - 1%, which deteriorates to + or - 2% at the lowest temperatures and to + or - 4% at the highest temperatures.

702,622
PB88-112628 Not available NTIS
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
Standard Chemical Thermodynamic Properties of Alkanethiol Isomer Groups,
R. A. Alberty, E. Burmenko, T. H. Kang, and M. B. Chung. c1987, 16p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n2 p193-208 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Thermodynamic properties, Heat capacity, *Alkanethiols, Benson method, Enthalpy, Entropy, Gibbs energy.

The chemical thermodymanic properties of alkanethiol (RSH where R is an alkyl group) isomer groups from CH4S to C4H10S in the ideal gas phase have been calculated from 298.15 to 1000 K from tables of Stull, Westrum, and Sinke. In the absence of literature data on all isomers of higher isomer groups, the properties of isomers of C5H12S to C8H18S have been estimated using Benson group values. Equilibrium mole fractions within isomer groups have been calculated for the ideal gas state from 298.15 to 1000 K. For isomer group properties, increments per carbon atom have been calculated to show the extent to which thermodynamic properties of higher isomer groups may be obtained by linear extrapolation. Values of C(P), S, delta(f)H, and delta(f)G are given for all species of alkanethiols from CH4S to C8H18S in SI units for a standard state pressure of 1 bar.

702,623
PB88-112636 Not available NTIS
Washington Univ., St. Louis, MO. Thermodynamics Research Lab.
Evaluation of Binary Excess Volume Data for the Methanol+Hydrocarbon Systems,
R. Srivastava, and B. D. Smith. c1987, 10p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n2 p209-218 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Hydrocarbons, *Methanol, Mixing, *Excess volume.

The volume change of mixing data for the methanol+hydrocarbon binary mixtures have been compiled and the best sets of data identified. The needs for a new experimental data have been defined.

702,624
PB88-112644 Not available NTIS
Washington Univ., St. Louis, MO. Thermodynamics Research Lab.
Evaluation of Binary Excess Enthalpy Data for the Methanol+Hydrocarbon Systems,
R. Srivastava, and B. D. Smith. c1987, 19p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n2 p219-237 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Hydrocarbons, *Methanol, *Enthalpy, *Mixing heat.

The heat of mixing data for the methanol+hydrocarbon binary mixtures have been compiled and the best sets of data identified. The needs for new experimental data have been identified.

702,625
PB88-112651 Not available NTIS
Notre Dame Univ., IN. Radiation Chemistry Data Center.
Extinction Coefficients of Triplet-Triplet Absorption Spectra of Organic Molecules in Condensed Phases: A Least-Squares Analysis,
I. Carmichael, W. P. Helman, and G. L. Hug. c1987, 22p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n2 p239-260 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Condensed phase, *Data compilation, *Extinction coefficients, Least squares method, Solution.

A global least-squares technique is developed to assist in the critical evaluation of data consisting of large sets of measurements. The technique is particularly designed to handle sets of data where many of the measurements are relative measurements. A linearlization procedure is used to reduce the inherently nonlinear problem to a traditional multivariate linear regression. The technique developed here is used to evaluate extinction coefficients, epsilon's, of triplet-triplet absorption (TTA) spectra of organic molecules in condensed phases. A previous assumption, that there are no solvent effects on the TTA spectra, is investigated and modified so that a group of compounds measured in benzene is treated separately. The set of 445 epsilon's obtained from the global least-squares fit, including these solvent effects, is presented in the accompanying tables. How these least-squares results can be used in a hierarchy of TTA epsilon standards is discussed. Further solvent effects such as the separation of polar and nonpolar media and the influence of temperature are probed.

702,626
PB88-112669 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Evaluated Chemical Kinetic Data for the Reactions of Atomic Oxygen O(3P) with Unsaturated Hydrocarbons,
R. J. Cvetanovic. c1987, 76p
Included in Jnl. of Physical and Chemical Reference Data, v16 n2 p261-326 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Chemical kinetics, Alkenes, Alkynes, Aromatic hydrocarbons, Arrhenium parameters, *Atomic oxygen.

Chemcial kinetic data for reactions of O(3P) atoms with unsaturated hydrocarbons are compiled and critically evaluated. Specifically, the reactions considered include the interactions of the ground electronic state of oxygen atoms, O(3P), with alkenes, cycloalkenes, halogen substituted alkenes and ketenes, alkynes, halogen substituted alkynes, aromatic hydrocarbons, halogen substituted aromatic hydrocarbons and pyridine. All kinetic data considered were restricted to gas phase reactions. 'Recommended' values of the rate parameters have been assessed and conservative uncertainty limits assigned to them.

702,627
PB88-112701 Not available NTIS
SRI International, Menlo Park, CA.
High-Temperature Vaporization Behavior of Oxides II. Oxides of Be, Mg, Ca, Sr, Ba, B, Al, Ga, In, Tl, Si, Ge, Sn, Pb, Zn, Cd, and Hg,
R. H. Lamoreaux, D. L. Hildenbrand, and L. Brewer. c1987, 25p
Prepared in cooperation with California Univ., Berkeley. Dept. of Chemistry. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n3 p419-443 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Vaporization, High temperature, Oxide, *Enthalpy increment, Entropy, Gibbs energy function.

In order to assess the high-temperature vaporization behavior and equilibrium gas phase compositions over the condensed oxides of Be, Mg, Ca, Sr, Ba, B, Al, Ga, In, Tl, Si, Ge, Sn, Pb, Zn, Cd, and Hg, the relevant thermodynamic and molecular constant data have been compiled and critically evaluated. Selected values of the Gibbs energy functions of condensed and vapor phases are given in the form of equations valid over wide temperature ranges, along with the standard entropies and enthalpies of formation. These data were used to generate plots of equilibrium partial pressures of vapor species as functions of temperature for representative environmental conditions ranging from reducing to oxidating. The calculated partial pressures and compositions agree, for the most part, with experimental results obtained under comparable conditions. Maximum vaporization rates have been calculated using the Hertz-Knudsen equation. Literature references are given.

702,628
PB88-112719 Not available NTIS
Brown Univ., Providence, RI. Div. of Engineering.
Equilibrium and Transport Properties of Eleven Polyatomic Gases at Low Density,
A. Boushehri, J. Bzowski, J. Kestin, and E. A. Mason. c1987, 22p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n3 p445-466 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: Equilibrium properties, Transport properties, *Corresponding states, *Isotopic thermal diffusion, *Polyatomic gases.

The study presents a computer programmable, thermodynamically consistent representation of the second virial coefficient B, viscosity n, self-diffusion coefficient D, and isotipic thermal diffusion factor a of the eleven gases: N2, O2, NO, CO, N2O, CO2, CH4, CF4, SF6, C2H4, and C2H6, all at low density. Limited thermodynamic consistency is acheived by the use of four scaling parameters (sigma, epsilon, Vo, p) in addition to the molecular weight. In terms of these parameters, the collision integrals for the transport properties obey a single law of corresponding states. Furthermore, omega(2,2) (T) is the same as that for the universal correlation of the monatomic gases (J. Phys. Chem. Ref. Data 13, 229 (1984)), whereas omega(1,1) (T) is only slightly modified. The same parameters nearly correlate the spherical part Bo(T)=B(T)-Bns(T) of the second virial coefficient corrected for the most important nonspherical influences; its dimensionless form Bo(T) differs from that for the monatomic gases and also, somewhat, for each of the eleven gases, except that one form suffices for N2, O2, NO, CO. The correlations embrace the reduced temperature range $1<T<10$ with the parameters sigma and epsilon, and the range $T>10$ with the parameters Vo and p derived from high-energy beam experiments. The accuracy achieved is carefully specified, and the correlation can be used in a predictive mode.

702,629
PB88-112727 Not available NTIS
University of Southern California, Los Angeles. Loker Hydrocarbon Research Inst.
Thermochemistry of Inorganic Solids. 4. Enthalpies of Formation of Compounds of the Formula MX(a)Y(b),
M. W. M. Hisham, and S. W. Benson. c1987, 4p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n3 p467-470 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: Metals, Maximum deviation, Relation, *Additivity, *Average deviation, *Binary salts, Double salts.

It is found that the standard enthalpies of formation delta(f)H298 of double salts of the type MXaYb are related by a simple additivity relation to delta(f)H298 of their binary salts MXc and MYd. For divalent metals M this relation takes the form, delta(f)H298(MXY) = 1/2 delta(f)H298(MX2) + 1/2 delta(f)H298(MY2) + C, with C = -13.4 or -17.6 kJ/mol giving equally good fits to the data. From a lesser number of data for trivalent and tetravalent metals M, one finds again a simple additivity relation of the form delta(f)H298(MXaYb) = (ax/z)delta(f)H298(MXz/x) + (by/z)delta(f)H298(MYz/y) + C, where x,y, and z are the formal valences of X, Y, and M, respectively, so that z = ax + by, and C = 0. For 16 divalent metal compounds average deviations are 5.5 kJ/mol with a maximum deviation of 10.7 kJ/mol. For five tetravalent compounds, the average deviations are 3.5 kJ/mol with a maximum of 6.3 kJ/mol.

702,630
PB88-112735 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Chemical Kinetic Data Base for Combustion Chemistry. Part 2. Methanol,
W. Tsang. c1987, 38p
Included in Jnl. of Physical and Chemical Reference Data, v16 n3 p471-508 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Combustion, *Data base, Evaluation, Gas kinetics, Hydroxymethyl, *Methanol, Rate expressions.

The publication contains evaluated and estimated data on the kinetics of reactions involving methanol and hydroxymethyl radicals and various small inorganic and organic species which are of importance for the proper understanding of methanol combustion and pyrolysis. It is meant to be used in conjunction with the kinetic data given in an earlier publication pertaining to methane pyrolysis and combustion, but which also contains a large volume of data that are applicable to the methanol system. The temperature range covered is 300-2500 K and the density range 1 times 10 to the 16th power to 1 times 10 to the 21st power molecules per cu. cm.

702,631
PB88-112743 Not available NTIS
Montreal Univ. (Quebec).
Phase Diagrams and Thermodynamic Properties of the 70 Binary Alkali Halide Systems Having Common Ions,
J. Sangster, and A. D. Pelton. c1987, 53p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n3 p509-561 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: Thermodynamic properties, *Alkali halides, *Molten salts, *Phase diagrams.

A very extensive literature survey of all available phase diagram and thermodynamic data has been carried out for all 40 possible common-anion binary systems (AX-BX) and all 30 possible common-cation binary systems (AX-AY) involving the alkali halides (A,B = Li, Na, K, Rb, Cs; X, Y = F, Cl, Br, I). A critical analysis and evaluation of these data have been performed with a view to obtaining a 'best' evaluated phase diagram and a set of'best' evaluated thermodynamic parameters for each system. To this end, a computer-assisted coupled analysis of the phase diagram data and the thermodynamic properties of all known phases have been obtained which are consistent with the measured thermodynamic properties and phase diagrams as well as with established thermodynamic principles and theories of solution behavior. The parameters of these expressions are reported here and have been used to generate the computer-calculated diagrams in the compilation.

702,632
PB88-117536 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Holistic Molecular Conformation and Total Surface Area Calculations as Predictors for Solution Properties and Chromatographic Parameters.
Final rept.,
E. Eng, R. B. Johannesen, E. J. Tierney, J. M. Bellama, and F. E. Brinckman. 1987, 9p
Pub. in Jnl. of Chromatography 403, p1-9 1987.

Keywords: *Organic compounds, Separation, Solutions, Surface properties, Salvation, Chromatographic analysis, Computation, Carbinols, Water, Antimony, Arsenic, Bismuth, Reprints, Triphenyl derivatives, Methanol.

Group VA triphenyl derivatives, (C6H5)3M, were separated using a reversed-phase bonded C sub 18 column with a methanol-water (70:30, v/v) mobile phase. The SAREA program was used to calculate holistic total surface area (TSA) values for the compounds in various conformations. A significant linear correlation was obtained between the natural logarithms of the capacity factor and the TSA values for only one particular set of conformers implying preferred solute-column chemistry based on preferred C-M bond rotations. The advantages of using a holistic approach for the calculation of TSA values are that it distinguishes the local carbon and metal geometries and weights their contribution to the overall TSA predictor which is not possible using a fragment approach. This is particularly significant for organometallic systems due to the ability of the central metal or metalloid atom to expand its coordination number. This effectively would increase the range of geometries which is not the case for organic molecules.

702,633
PB88-121074 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Infrared Spectrum of the Delta v=2 Transitions of Lead Sulfide (PbS).
Final rept.,
A. G. Maki, and F. J. Lovas. 1987, 8p
Pub. in Jnl. of Molecular Spectroscopy 125, p188-195 1987.

Keywords: Molecular spectroscopy, Reprints, *Absorption spectrum, *High temperature, Infrared, Lead sulfide.

High-resolution absorption measurements of the Delta v = 2 transitions of lead sulfide (PbS) are given between 830 and 863 cm-1. The measurements were made with PbS in the gas phase at temperatures between 1100 and 1325 K and involved vibrational transitions ranging from v = 2-0 to v=8-6. Transitions for the three most abundant isotopic species (208Pb32S, 207Pb32S, and 206Pb32S) have been measured. The fitted parameters related to the breakdown of the Born-Oppenheimer approximation (or a so-called nuclear field shift) are quite large for vibration as well as for rotation. The band centers for the 1-0 transitions are computed from these measurements as follows: v0(208Pb32S) = 426.63239(12)cm-1, v0(207Pb32S) = 426.76880(12)cm-1, and V0(206Pb32S) = 426.90658(12).

702,634
PB88-129713 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Hydration of Tricalcium Aluminate and Tetracalcium Aluminoferrite in the Presence of Calcium Sulfate.
Final rept.,
P. W. Brown. 1986, 11p
Pub. in Mater. Struct., n110 p137-147 Mar/Apr 86.

Keywords: Aluminum inorganic compounds, Hydration, Chemical reactions, Reaction kinetics, Calcium

sulfates, Aluminates, Reprints, Calcium aluminates, Calcium aluminoferrites.

The hydration of C3A, C4AF in the presence of calcium sulfate is reviewed. Mechanisms and kinetics of hydration are discussed.

702,635
PB88-134671 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Coronene as a Model of Charcoal: Calibration of the Carbon-13 NMR Shift Tensor to Count Carbon Atoms at the Plane Edge.
Final rept.,
H. A. Resing, and D. L. VanderHart. 1987, 19p
Pub. in Zeitschrift fur Physikalische Chemie Neue Folge, Bd. 151, S., p137-155 1987.

Keywords: Charcoal, Carbon, Molecular structure, Calibration, Nuclear magnetic resonance, Reprints, *Foreign technology, Coronene.

The principal values of the carbon-13 NMR chemicak shift tensors have been measured for each of the three sorts of carbon atoms of coronene. The innermost six carbon atoms show (within ca. 3 ppm) axially symmetric chemical shift tensors, which imply threefold electronic symmetry at each of their sites, as in graphite. The outer 18 carbon atoms do not show axial symmetry, but are like the carbon atoms of solid ben/ene in chemical shift anisotropy, these represent the edge carbon atoms in the charcoal aromatic fused ring system, and the conclusion is that the edge has a thickness of two carbon atoms.

702,636
PB88-140884 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Slit Jet IR Absorption Spectroscopy of Molecular Complexes.
Final rept.,
D. J. Nesbitt. 1987, 24p
Grants NSF-PHY82-00805, NSF-CHE86-05970
Sponsored by National Science Foundation, Washington, DC.
Pub. in Structure and Dynamics of Weakly Bound Molecular Complexes, p107-130 1987.

Keywords: Reprints, *IR laser spectroscopy, Slit supersonic expansion, van der Waals molecules.

The combination of high resolution (<10 -3 per. cm) cw tunable difference frequency generation, high sensitivity (< 10-6/sq. root of Hz) direct absorption methods, and long path length (2.54 cm) pulsed slit expansions provide a powerfully general technique for studying weakly bound complexes in a cold molecular beam environment. Transient absorption of the narrow band laser provides a nonintrusive probe of the quantum state, velocity, temporal and spatial dependence of cluster formation in the pulsed molecular beam. High resolution fundamental, combination and hot band spectra of ArHF, HFN2 and HFCO2 complexes are presented. Detailed information on the molecular structure is determined for vibrationally excited states which sample the potential energy surface far from the ground state, near equilibrium geometry.

702,637
PB88-140991 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Vibrational Anomalies and Dynamic Coupling in Hydrogen-Bonded Van Der Waals Molecules.
Final rept.,
A. S. Pine. 1987, 13p
Pub. in Structure and Dynamics of Weakly Bound Molecular Complexes, p93-105 1987.

Keywords: Reprints, *High resolution spectroscopy, *Hydrogen bonding, *Intermolecular potentials, Tunable infrared lasers, Tunneling, van der Waals.

High-resolution infrared spectra of the hydrogen halide dimers and the rare gas-hydrogen halide complexes have been recorded under thermal equilibrium conditions in a long path coolable White cell using a tunable difference-frequency laser. Detailed and comprehensive structural and dynamical information has been obtained from the fully resolved rotational transitions between the ground and vibrationally excited levels. Empirical potential energy surfaces have been determined to explain dynamical phenomena such as rotational and vibrational predissociation, vibrational shifts and large-amplitude librational and tunneling motions. A number of these features, strongly influenced by the large excursions of the light hydrogen atoms involved in the van der Waals bond, are quite anomalous and require close attention to dynamic coupling.

702,638
PB88-141007 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Structure and Dynamics of Weakly Bound Molecular Complexes.
Final rept.,
A. Weber. 1987, 651p
Pub. in Structure and Dynamics of Weakly Bound Molecular Complexes, 651p 1987.

Keywords: *Meetings, *Molecules, van der Waals molecules, *Hydrogen bonded molecules, High resolution spectroscopy, Molecular beam scattering.

The book represents the proceedings of a NATO Advanced Research Workshop on Structure and Dynamics of Weakly Bound Molecular Complexes, held in Acquafredda di Maratea, Italy, September 21-26, 1987. The book is composed of 44 contributions representing up to date research results at the time of the Workshop. The papers deal with the properties of van der Waals and hydrogen bonded molecules obtained from experimental spectroscopic and molecular beam scattering investigations as well as theory. High resolution microwave pure rotation, infrared rotation-vibration as well as visible and near ultraviolet spectra are analyzed and interpreted as are the results of molecular beam scattering and photodissociation experiments. Various effects especially prominent in van der Waals and hydrogen bonded molecules, such as large amplitude motions, tunneling, predissociation, dynamics and lifetimes of excited states, are treated. Papers also deal with theoretical calculations of these effects as well as the dervations of intermolecular potential energy function. One paper is an extensive bibliography, through Dec. 1987, of rotation spectra of van der Waals and hydrogen bonded molecules. Additional entries extend the compilation by including relevant work on rotation-vibration spectra.

702,639
PB88-147293 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Chemical Physics.
Mechanism of the Reactions of Alkyl Ions with Alkylamines: Competing Proton Transfer and Condensation Reactions.
Final rept.,
P. Ausloos, and S. G. Lias. 1986, 5p
Pub. in Jnl. of the American Chemical Society 108, n8 p1792-1796 1986.

Keywords: *Condensation, Reprints, *Alkyl ion, *Amine, Ion cyclotron resonance spectrometer, Proton transfer, Ion molecule reaction mechanism.

The reactions of ethyl, isopropyl, and t-butyl ions with alkylamines have been examined in an ion cyclotron resonance spectrometer (ICR). Use of deuterium-labelled reactant ions permitted a detailed examination of the relative probabilities of the two competing reaction channels demonstrated previously by Meot-Ner. Even though for all reaction pairs both b1 and b2 are energetically allowed, the weaker C-N bond in the condensation ion predominantly undergoes scission to give a complex of an alkyl ion and the corresponding amine, followed by proton transfer in the complex.

702,640
PB88-147350 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Equation of State for Isobutane-Isopentane Mixtures with Corrections for Impurities.
Final rept.,
J. S. Gallagher. 1986, 11p
Pub. in International Jnl. of Thermophysics 7, n4 p923-933 1986.

Keywords: Mixtures, Reprints, *Dew bubble curves, *Geothermal energy, *Impurity effects, Isobutane, Isopentane, Thermodynamic surface.

A global Helmholtz function accurately representing the thermodynamic properties of isobutane-isopentane mixture over a wide range of temperatures and pressures has been developed. The Helmholtz function has been used for the generation by computer of tables and charts of properties of interest to designers of power cycles. The Helmholtz function has also been extended to allow for additional components in the mixture, thus enabling the accurate calculation of corrections to the thermodynamic properties when impurities are present in significant amounts.

702,641
PB88-147517 Not available NTIS
National Bureau of Standards (NML), Gaithersburg MD. Molecular Spectroscopy Div.
Cation Binding Effect on Hydrogen Bonding.
Final rept.,
H. Basch, M. Krauss, and W. J. Stevens. 1985, 5p
Pub. in Jnl. of the American Chemical Society 107, n25 p7267-7271 1985.

Keywords: Reprints, *Cation binding, *Hydrogen bonds, *Imidazole, *Dimer.

Cation binding effects on nearby H-bonds is studied for the imidazole dimer. The binding of the cations, H+, Na+, Zn(OH)+, and Zn(2+), is found to have a significant effect on both the H-bond energy and the equilibrium internuclear separation of the H-bond. The net stabilization energy ranges from 8.0 kcal for Na+ to 28.0 kcal for Zn(2+). The polarization of the dimer is also appropriate to increase the binding of another imidazole. Proton transfer is also studied for the dimer itself and the cation perturbed dimer. Double wells are found in all cases in the energy curve for proton transfer with a fixed N-N' distance between the imidazole monomers. With the exception of Zn(2+) a substantial barrier is calculated for the proton transfer reaction. Compact effective potentials (CEP) were used in the calculations. Comparisons of the orbital energies and gradient optimized geometry of the CEP calculation for imidazole with a GTO 4-31G all-electron calculation is quite satisfactory.

702,642
PB88-147525 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Vibrational Predissociation Dynamics of the Nitric Oxide Dimer.
Final rept.,
M. P. Casassa, J. C. Stephenson, and D. S. King. 1987, 12p
Pub. in Structure and Dynamics of Weakly Bound Molecular Complexes, p513-524 1987.

Keywords: Reprints, *Nitric oxide dimer, Picoseconel, *Product state distribution, Unimolecular reaction, van der Waals, *Vibrational predissociation.

Details of experimental measurements of the total energy distribution and time dependence of the vibrational predissociation of the nitric oxide dimer are presented. Energy disposal measurements following epsilon 1 excitation at 1870 cm-1 indicated the fragments to be described by an average rotational energy (ER)=75 cm-1, full equilibration of the lambda doublet species, approximately equal populations in both spin-orbit states, no significant degree of alignment, an isotropic flux distribution, and an average kinetic energy of (EK)=400 cm-1 per fragment. Although approximately 75% of the available energy goes into fragment translation, picosecond laser pump - probe experiments showed that upsilon 1 decayed exponentially with a 880 ps lifetime. Excitation of upsilon at 1789 cm-1 gave a 39 ps predissociative lifetime.

702,643
PB88-152103 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Analysis of the 3-Micrometer Bands of Benzene.
Final rept.,
J. Pliva, and A. S. Pine. 1987, 17p
Pub. in Jnl. of Molecular Spectroscopy 126, p82-98 1987.

Keywords: *Absorption spectra, *Benzene, *Molecular spectroscopy, Reprints, *Laser spectroscopy, High resolution.

A comprehensive rovibrational analysis is reported for the 3-Micrometer absorption bands of the benzene molecule measured on a difference-frequency laser spectrometer and deconvolved to an effective linewidth of 0.0010-0.0015 1/cm.

702,644
PB88-152558 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Absolute OCS Wavenumbers and Analysis of Bands in the Region of the Lowest Fundamental (nu sub 2).
Final rept.,
K. Jolma, V. M. Horneman, J. Kauppinen, and A. G. Maki. 1985, 8p
Pub. in Jnl. of Molecular Spectroscopy 113, n1 p167-174 Sep 85.

Keywords: *Absorption spectra, *Carbonyl compounds, *Molecular spectroscopy, Reprints, *Carbonyl sulfide.

The high resolution infrared spectrum of carbonyl sulfide (OCS) in the region 490-560 1/cm has been recorded with a Fourier transform spectrometer at a resolution of about 0.005 1/cm.

702,645
PB88-152806 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Halomethylenes: Effects of Halogen Substitution on Absolute Heats of Formation.
Final rept.,
S. G. Lias, Z. Karpas, and J. F. Liebman. 1985, 8p
Pub. in Jnl. of the American Chemical Society 107, n21 p6089-6096 1985.

Keywords: Halogens, Heat of formation, Thermochemistry, Reprints, *Halomethylenes, *Carbenes, *Proton transport, Ion cyclotron resonance spectrometer, Substitutions.

New values for the heats of formation of CF2, CCl2, CCIF, CFH, and CCIH have been derived from estimations of the thermochemistry of the reaction(s): (CXYH+ + B -> CXY + BH(1+) where X and Y are F and/or Cl and B is a molecule for which an absolute value of the gas phase basicity (or proton affinity) is available. The experiments were carried out in an ion cyclotron resonance spectrometer. Results are presented.

Industrial Chemistry & Chemical Process Engineering

702,646
PATENT-4 327 233 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Method for Producing Carbocyclic Compounds from Cyclic Sulfide.
Patent.
R. I. Martinez, and J. T. Herron. Filed 26 Mar 81, patented 27 Apr 82, 8p PB82-600037, PAT-APPL-6-247 684

Keywords: *Carbocyclic compound, Cyclic sulfide, Ozone, Vapor phase reaction.

A method is provided for producing a carbocyclic compound by contacting an organic compound containing a 4-8 membered cyclic sulfide with ozone, in the vapor phase, and recovering a product containing a 3-7 membered carbocyclic ring.

702,647
PATENT-4 351 810 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Method for Removing Sulfur Dioxide from a Gas Stream.
Patent.
R. I. Martinez, and J. T. Herron. Filed 9 Jul 81, patented 28 Sep 82, 10p PB82-600039, PAT-APPL-6-281 745

Keywords: *Gas phase reaction, Stabilized Criegee intermediate, Sulfur dioxide removal.

A method is provided for removing SO2 from gas streams by its gas-phase reaction with a stabilized Criegee intermediate under conditions where a very large excess of water vapor is avoided, resulting in efficient scavenging of SO2 by the Criegee intermediate to form an adduct. The adduct reacts with water vapor to convert it directly to sulfuric acid, which is then separated from the gas stream. The Criegee intermediate may be generated in a variety of ways.

702,648
PB-265 552/0 PC **A11**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Prevention of Failures in Coal Conversion Systems: Proceedings of the Meeting of the Mechanical Failures Prevention Group (24th) Held at Battelle, Columbus Laboratories, Columbus, Ohio on April 21-23, 1976,
T. R. Shives, and W. A. Willard. Apr 77, 237p NBS-SP-468
Sponsored in part by Office of Naval Research, Arlington, Va., Frankford Arsenal, Philadelphia, Pa., Federal Aviation Administration, Washington, D.C. and Energy Research and Development Administration, Washington, D.C. Library of Congress Catalog Card No. 77-608043.

Keywords: *Coal gasification, *Coal liquefaction, *Materials, *Corrosion prevention, *Meetings, Erosion, Failure, Coking, Quality control, Particles, Fractures(Materials), Degradation, Metals, Nondestructive tests, Steels, Solvent-refined coal, Refractory materials, Carbon dioxide acceptor process, Consol synthetic gas process, Synthane process, Cost analysis.

These Proceedings consist of a group of twenty submitted papers and discussions from the 24th meeting of the Mechanical Failures Prevention Group which was held at Battelle, Columbus Laboratories in Columbus, Ohio on April 21-23, 1976. Prevention of failures in coal conversion systems is the central theme of the Proceedings. A series of overview lectures dealing with reliability problems in coal conversion systems, economics of failures in energy generating systems, corrosion, and gaps in engineering data are presented. In addition, failure analysis, materials problems, and related materials research are discussed.

702,649
PB-266 925/7 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. Physical Chemistry Div.
Second Appraisal of Methods for Estimating Self-Reaction Hazards.
Final rept. Jan-Dec 75,
E. S. Domalski. Mar 77, 160p NBSIR-76-1149, DOT/MTB/OHMO-76/6
See also report dated Jun 74, COM-74-11658.

Keywords: *Thermochemical properties, *Hazardous materials, Organic compounds, Tables(Data), Enthalpy, Thermal stability, Tests, Decomposition reactions, Sensitivity, Performance evaluation, Heat of combustion, Thermal analysis, Dimerization, Inhibition, Mechanical tests, Power testing, Polymerization, Chemical reactions, Oxidation, Alkene hydrocarbons, *Hazard analysis, CHETAH computer program, Monomers, Thermal explosion theory.

A literature survey was carried out to collect and evaluate test methods and test data on hazardous materials which undergo self-decomposition. Some thermal tests are regarded as valuable because they give quantitative data indicating the limit of thermal stability for specified materials. With the assistance of the CHETAH predictive scheme, a hazard evaluation was conducted on a selected group of compounds normally considered safe. Results showed a tendency to identify these safe materials as hazardous so as not to err in evaluating a truly hazardous compound. In a study of accidental polymerization of bulk chemicals, free radical polymerization involving olefins was considered the polymerization process most likely to occur inadvertently during transport. A calorimetric test procedure appeared to offer the promise of yielding data from which an unambiguous reactivity scale could be developed. The test procedure should have a firm relationship to the theory of thermal explosion.

702,650
PB-269 878/5 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Applied Technology.
Evaluation of Metal Volumetric Standards Used in the Measurement of Liquid Hydrocarbons: A Report of a U.S. National Bureau of Standards and American Petroleum Institute Research Associate Project.
Final rept. Apr 70-Jul 75,
D. J. Hine. Apr 77, 203p NBSIR-77-1214
Prepared in cooperation with American Petroleum Inst., Washington, D.C.

Keywords: *Hydrocarbons, *Volumetric analysis, *Chemical analysis, Standards, Calibrating, Laboratory equipment, Accuracy, Experiments, Performance evaluation, Field tests, Data analysis, Design criteria, Gravimetric analysis, Procedures, *Standard reference materials.

Weights and measures jurisdictions and the petroleum industry have, for many years, used metal volumetric standards in the measurement of petroleum liquid hydrocarbons. As a result of several surveys, it was learned that a need existed to establish uniform application procedures and investigate measurement accurary. To answer this need, a joint project under the Research Associate Program of the U.S, National Bureau of Standards was established with the American Petroleum Institute as the sponsoring agency, Equipment and techniques were evaluated and the program resulted in an equipment specification, a recommended procedure for inspection, and a recommended procedure for the calibration of metal volumetric standards used by weights and measures jurisdictions and the petroleum industry.

702,651
PB-291 952/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hydrogen Safety: An Annotated Bibliography of Regulations, Standards and Guidelines.
Final rept.
J. Hord. 1978, 2p
Pub. in Proceedings of the World Hydrogen Energy Conference, Zurich, Switzerland, August 21-24, 1978 p2247-2248 1978.

Keywords: *Hydrogen, *Safety, *Bibliographies, Regulations, Standards, Guidelines, National government, Manufacturing, Equipment.

Current federal regulations applicable to the manufacture and maintenance of hydrogen equipment and to the distribution of gaseous and liquid hydrogen in the United States are summarized and presented in a table of regulatory references. A similar table of references is presented for nonmandatory standards and guidelines pertinent to hydrogen safety and hydrogen facilities/equipment specifications. These two tables concisely summarize the best available information that has been published in industry, universities, and government agencies for the safe production, storage and handling of hydrogen.

702,652
PB77-600025
(Order as PB-276 557, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Investigation of Calcium Aluminate Cement Phases Under High Gaseous Pressure.
J. L. Waring, R. S. Roth, W. S. Brower, and C. A. Harding. 1977, 6p
Included in Jnl. of Research of the National Bureau of Standards, v82 n3 p167-172 1977.

Keywords: *Coal gasification, *Refractory cements, Alumina cements, CaO.Al2O3.H2O.

The chemical degradation of refractory cement castable liners is important in the coal gasification process. The system CaO-Al2O3-H2O has been investigated at high temperature and pressure. A pseudobinary reaction diagram was constructed for the system CaO-Al2O3-H2O in steam at 1000 psig. Several experiments were conducted in the CaO-Al2O3-H2O system in CO2, CH4, and CO.

702,653
PB80-157944 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Device for Controlling Sulfiding Process (Ustroistvoistvo dlya Kontrolya Lrotsessa Sul'fidirovaniya),
E. A. Sinebokov. 1979, 6p DMDC-18892, TT-79-58159
Edited trans. of Patent (USSR) 45344 n.d. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Chemical industry, *Sulfides, *Equipment, *Patents, Monitoring, Design criteria, Automation, Technology, Performance evaluation, Translations, *Foreign technology.

This patent describes a technique for monitoring the process of sulfiding in the chemical process industry.

702,654
PB81-115990 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Slag Characterization: Viscosity of Synthetic Coal Slag in Steam.
W. S. Brower, J. L. Waring, and D. H. Blackburn. Oct 80, 34p NBSIR-80-2124
Contract DOE-EA-77-A-01-6010

Keywords: *Slags, *Coal gasification, *Viscometers, *Viscosity, Design criteria, Performance evaluation, High temperature tests, High pressure tests.

A rotating cylinder apparatus has been designed and constructed for measuring the viscosity of molten slags under steam pressure in the range of 15 to about 300 psi and up to about 1400C. Two synthetic coal slags, one high in alkali, and the other lower in alkali but higher in calcia were studied with this apparatus. In the high alkali slag equilibrium was probably not achieved and the viscosity appeared to increase with time. In the low alkali slag although the viscosity appeared to be increased with increasing steam pressure the ambient and higher pressure curves appear to tend to coalesce with increasing temperature.

702,655
PB81-600028 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography.
E. H. Eisenhower. 1981, 19p NBS-HB-136

Keywords: *Classification criteria, Gamma radiography, National standard, Performance tests, Radiation source, Safety standard.

The standard applies to the design and construction of apparatus used for industrial gamma radiography which employs radioactive material as the energy source. It established the criteria to be used in the proper design and construction of the various components to ensure a high degree of radiation safety at all times. This includes the classification and labeling criteria for the exposure device, and factors which should be considered in the design and construction of exposure devices, controls, and source assemblies. The testing procedures and equipment for the various classifications of the exposure devices and source assemblies are detailed.

702,656
PB82-153321 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Modelling of Oil Shale Retorts for Electromagnetic Sensing Techniques.
Final rept.
H. Chew. Nov 81, 48p NBSIR-81-1653
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Retorts(Reactors), Oil shale, Computerized simulation, Computer programs, Remote sensing, Electromagnetic scattering, In-situ retorting.

Work is reported on the modelling of oil shale retorts for electromagnetic sensing techniques. The aim is to obtain useful information about the contents of the retort (e.g., rubble size, void ratio, etc.) by means of electromagnetic probes. In this work, the retort is modelled by a spheroid with an average dielectric constant which depends on the void ratio. The near field due to a radiating dipole source in the vicinity of a spheroidal retort is computed using the Extended Boundary Condition Method due to Waterman, Barber, and Yeh. Numerical results are given at 4 MHz for a retort with major axis 45.7 (150 ft), minor axis 25.1 m (82.5 ft), bulk dielectric constant 8.8 + 3.7, and various void ratios. The results indicate feasibility of determining the void ratio by remote electromagnetic measurements. It is also believed that this work may be of interest beyond the immediate context of oil shale retort modelling.

702,657
PB82-253527 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
NBS and Industrial Biotechnology: Technical Developments and Future Measurement Needs.
Planning rept. no. 12.
T. C. O'Brien. Jul 82, 180p NBSIR-82-2549

Keywords: *Biomass, *Industrial plants, *Research, Technology, Forecasting, Chemical industry, Organic compounds, Trends, Ethyl alcohol, Fuels, *Biotechnology, Chemical feedstocks, Solid wastes.

Biotechnology will be a significant industrial technology in the future. NBS's role with respect to this technology is examined; and infrastructure support requirements needed by future biotechnology based industries are identified in this report. This report also describes steps NBS could take to meet future industry infrastructure support needs in biotechnology by: examining commodity organic chemical industry trends; identifying R&D opportunities and barriers to commercialization of biotechnology products; and evaluating current NBS capabilities in relation to long-term industry needs. Report conclusions indicate that: (a) the commodity organic chemical industry will undergo structural changes in the next two decades; (b) early applications of biotechnology will be in higher value added products; (c) 'traditional' commodity chemicals synthesized from petroleum feedstocks will be difficult to displace via biotechnological process; (d) biotechnology offers significant opportunities for production of 'non-traditional' commodity organic chemicals; (e) biomass may become an important feedstock for production of organic chemicals; and (f) existing NBS capabilities could meet many of industry long-term infrastructure support needs in biotechnology. This report provides a framework for possible short- and long-term actions NBS could take to meet industry needs in biotechnology. Report includes an extensive bibliography.

702,658
PB82-264276 Not available NTIS
National Bureau of Standards, Washington, DC.
Membrane Separations.
T. M. Flynn, and J. D. Way. Jun 82, 4p
Pub. in Energy Progress 2, n2 p79-82 Jun 82.

Keywords: *Membranes, *Energy conservation, Separation, Technology, Chemical industry, Operating costs, Reprints.

Rapidly rising energy and operating costs have underscored the need for novel energy efficient separation processes, such as membrane processes, which avoid the energy consuming phase change step of many conventional separations (e.g., distillation, absorption, stripping). It is well known that membrane separation is the most energy efficient separation technique thermodynamically possible, since it does not rely upon vaporization and condensation to effect fractionation. Recent developments in solid polymer, hollow fiber and liquid membranes give excellent promise for industrial application. Hence, because of recent technological developments of these new membranes, and because of its great energy savings potential, research is being conducted on the fundamentals determining separation rates, separation factors, and selectivity of new types of solid and liquid membranes with potential application to the chemical process industry.

702,659
PB83-164343 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Sensors for Efficient Energy Utilization in the Paper Industry.
Final rept.
J. R. Whetstone, and E. G. Johnsen. Feb 83, 47p NBSIR-83-2640
Contract DOE-EA-77-A-01-6010

Keywords: *Paper industry, *Control equipment, *Detectors, Assessments, Design criteria, Performance evaluation, Sulfate pulping, Pulp mills, Paper mills, Surveys, Technology, Manufacturing.

A survey of the on-line process measurement needs of the paper industry has been completed. The survey focused on pulp and paper mills with one corporate Instrumentation and Control group and one instrumentation and control systems manufacturer included. The results of the survey strongly indicate the need for new measurement technology at the pulping end of the process. Important unit processes identified are: (1) chemical recovery (recovery boiler and lime kiln combustion measurements); (2) digestion (lignin concentration measurement in the pulp or spent liquor); and (3) thermomechanical pulping (consistency measurement). All of the processes are energy intensive and cannot be controlled either partially or completely due to the lack of measurement of specific process parameter.

702,660
PB83-165068 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Membrane Separations in Chemical Processing.
T. M. Flynn, and J. D. Way. Dec 82, 28p NBSIR-82-1675
See also PB82-264276.

Keywords: *Membranes, *Energy conservation, Separations, Chemical industry, Technology, Operating costs.

Rapidly rising energy and operating costs have underscored the need for novel energy efficient separations processes, such as membrane processes, which avoid the energy consuming phase change step of many conventional separations (e.g., distillation, absorption, stripping). It is well known that membrane separation is the most energy efficient separation technique thermodynamically possible, since it does not rely upon vaporization and condensation to effect fractionation. Recent developments in solid polymer, hollow fiber and liquid membranes give excellent promise for industrial application. Hence, because of recent technological developments of these new membranes, and because of its great energy savings potential, research is being conducted on the fundamentals determining separation rates, separation factors, and selectivity of new types of solid and liquid membranes with potential application to the chemical process industry.

702,661
PB85-141380 Not available NTIS
National Bureau of Standards, Boulder, CO.
Prediction of Transport Properties: Application of Basic Theory.
Final rept.
H. J. M. Hanley. 1983, 9p
Contract DE-A101-76PR06010
Pub. in Rev. Portuguese Chem. 25, p27-35 1983.

Keywords: *Transport properties, Viscosity, Computerized simulation, Mixtures, Reprints, *Basic theory, Enskog theory.

The transport prediction procedure of Ely and Hanley is discussed in this paper as an example of how theory can contribute to practical usable methods required by industry. The procedure is outlined and one particular failure of the original approach is isolated, i.e., that the procedure failed to predict correctly the viscosity of a mixture whose components differ substantially in size. A companion computer simulation molecular dynamic study is discussed, the results of which give insight into the problem of the real system. A correction based on the Enskog theory as introduced and suggested by Ely is proposed. The modified prediction procedure is shown to give excellent results.

702,662
PB85-151652 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cryogenic Processes.
Final rept.
T. M. Flynn. 1984, 12p
Pub. in Perry's Chemical Engineer's Handbook, 6th Edition, Section 12, p12-47--12-58 1984.

Keywords: *Chemical engineering, *Cryogenics, Distillation, Heat transfer, Adsorption, Low temperature tests, Reprints.

Cryogenic processes are described as the traditional unit operations of chemical engineering, taking place in an extreme environment (at temperatures below 200K). This paper discusses distillation. adsorption, and heat transfer at low temperatures.

702,663
PB85-151751 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Snapshot of the NBS (National Bureau of Standards) Center for Chemical Engineering.
Final rept.
J. Hord. 1983, 9p
Pub. in Proceedings of the National Conference of Standards Laboratories 1983 Workshop and Symposium, Boulder, CO., July 18-21, 1983, pI-3.1--I-3.9.

Keywords: *Chemical engineering, Standards, Thermophysical properties, Fluids, Solids, Standards.

The Center for Chemical Engineering was formed two years ago by the National Bureau of Standards to meet the changing needs of the U.S. chemical process industry. The goal of the Center is to provide U.S. indus-

try with measurement and data bases that enable improved innovation, design, and control of chemical processes, assure equity in domestic and international trade, and strengthen the competitiveness of U.S. industry in the world market. This paper provides an overview of selected research efforts within the Center and of its test and calibration services and research products. Emphasis is placed on chemical process metrology, thermophysical properties of fluids and solids, and chemical engineering science.

702,664
PB85-178069 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO.
Center for Chemical Engineering Technical Activities: Fiscal Year 1984.
Research summary rept. Oct 83-Sep 84.
J. Hord. Feb 85, 130p NBSIR-84/3019
Sponsored by National Research Council, Washington, DC.

Keywords: *Chemical engineering, *Research projects, Fluid mechanics, Thermophysical properties, Measurement.

Technical research activities performed by the Center for Chemical Engineering during the Fiscal Year 1984 are summarized herein. These activities fall within the general categories of process measurement, thermophysical properties data, and chemical engineering science. They embody: development and improvement of measurement principles, measurement standards, and calibration services such as volumetric and mass flow rates, volume, density, and humidity; generation (via accurate measurement and advanced predictive models) of reliable reference data for thermophysical properties of pure fluids, fluid mixtures, and solids of vital interest to industry; and development of improved correlations, models, and measurement techniques for solid-fluid slurry flows, heat and mass transport, mixing, and chemically reacting flows of interest in modern unit operations.

702,665
PB85-182749 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pore Pressure Buildup in Resonant Column Tests.
Final rept.
R. M. Chung, F. Y. Yokel, and H. Wechsler. 1984, 15p
Pub. in Jnl. Geotech. Eng. 110, n2 p247-261 Feb 84

Keywords: *High pressure tests, *Column packings, *Liquefaction, Density(Mass/volume), Columns(Process engineering), Shear strain, Sands, Reprints.

Resonant column tests were performed on fully saturated and dry hollow cylindrical and fully saturated solid cylindrical specimens of Monterey No. 0 sand of 60% relative density subjected to 96 kPa confining pressure. The hollow specimens were tested by torsional excitation and the solid specimens by longitudinal excitation. All specimens, whether previously shaken or not, liquefied at the threshold strain of .012% which was previously identified to be the shear strain below which gross particle displacement is frictionally blocked. The effect of previous shaking on damping ratios and shear moduli was also investigated.

702,666
PB85-207348 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Characterization of Fracture Behavior of Adhesive Joints.
Final rept.
D. L. Hunston, S. S. Wang, and A. J. Kinloch. 1982, 6p
Pub. in Proceedings of American Chemical Society Meeting (184th), Kansas City, MO., September 12-17, 1982, Organic Coatings and Applied Polymer Science 74, p408-413.

Keywords: *Adhesives, *Composites, Fracture, Epoxy, Stress analysis, Viscoelasticity.

The desire to use adhesives and composites in structural applications has led to a need for a failure prediction capability for the polymers used in such systems. Unfortunately, this task is greatly complicated by the failure load being dependent not only upon the specimen geometry but also on the previous history of loading, temperature, environment, etc. For the tough, rubber-modified polymers that are of most interest for structural applications the effects of previous history can be dramatic. As a result, predictions based on measurements at a single set of conditions can lead to dangerous over or under estimates of the fracture behavior. In an effort to understand this problem the present work has studied the fracture behavior of various polymer formulations using bulk and adhesive joint specimens tested over a wide variety of different thermal and loading histories.

702,667
PB85-230639 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Two-Dimensional Permeate Transport with Facilitated Transport Membranes.
Final rept.
R. D. Noble. 1984, 10p
Pub. in Separation Science and Technology 19, n8/9 p469-478 1984.

Keywords: *Membranes, *Mathematical models, *Transport properties, *Permeability, *Mass transfer, Experimental design, Comparison, Diffusion, Separation, Physical properties, Reprints, *Hollow fiber membranes.

An analytical model has been developed for steady-state permeate transport with facilitated transport membranes. The model contains no adjustable parameters. The model accounts for both axial permeate transport parallel to the membrane and facilitated permeate transport through the membrane. The model predicts the fraction of permeate separated through the membrane as a function of physical properties and operating conditions. The model was derived for a cylindrical geometry but can be applied to a planar geometry. Also, the model could be used for the simple diffusion case when no facilitation is present. Reasonable agreement with experimental data is presented.

702,668
PB86-105269 PC **A10**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Tables of Industrial Gas Container Contents and Density for Oxygen, Argon, Nitrogen, Helium, and Hydrogen.
B. A. Younglove, and N. A. Olien. Jun 85, 203p NBS/TN-1079
Also available from Supt. of Docs as SN003-003-02659-0. Sponsored by Compressed Gas Association, Arlington, VA.

Keywords: *Industrial plants, *Density(Mass/volume), *Gas cylinders, *Standards, *Fluids, Tables(Data), Oxygen, Argon, Nitrogen, Helium, Hydrogen, Concentration(Composition), Thermophysical properties, Temperature, Pressure, Standard reference materials.

Custody transfer tables are presented for oxygen, argon, nitrogen, helium, and hydrogen. The tables are based on standard reference data previously compiled by the National Bureau of Standards. Two sets of tables are provided for each fluid. Tables in engineering units cover the range -40 to 130F with pressures from 100 to 10,000 psig. Tables in SI units (density versus pressure and temperature) cover the range 200 to 370 K with pressures from 0.5 to 70 MPa. The tables in engineering units are designed to provide a means of determining the volume of gas at standard conditions contained in a tank given the volume of the tank and the pressure and temperature of the gas within the tank. The publication also includes four examples of use of the tables in calculating tank quantities.

702,669
PB86-110848 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Center for Chemical Engineering.
Survey of Measurement Needs in the Chemical and Related Industries.
Technical note.
J. Hord. Jul 85, 107p NBS/TN-1087
Also available from Supt. of Docs as SN003-003-02671-9.

Keywords: *Information systems, *Chemical industry, *Measurement, *Surveys, Drug industry, Electronic industry, Measuring instruments, Calibrating, Food industry, Temperature measurement, Flow measurement, Plastics industry, Petroleum industry, Concentration(Composition), Marketing, Tables(Data).

A survey of measurement needs in the chemical and related process industries has been completed, a data base established and reported herein. Sixty-five people responded to the survey, representing the chemical, oil and gas, pharmaceutical, electronic chemicals, energy, instrument manufacturer, food plastics, and other segments of American industry. The respondents identified: 133 measurement problems of which 106 are defined in detail; 27 measurement needs where no current measurement capability exists (or is known); and three generic measurement areas (flow, composition/concentration, and temperature) in need of improvement. The survey revealed strong demands for improved in-line and in-reactor measurements, in a processing plant environment, to improve process/product quality and to reduce costs. The data base includes instrument (sensor) technical specifications, service conditions, calibration and maintenance requirements, and marketing information.

702,670
PB86-122959 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Equilibria in Aqueous Solutions: Industrial Applications.
Final rept.
N. C. Scrivner, and B. R. Staples. 1983, 14p
Sponsored by American Inst. of Chemical Engineers, New York.
Pub. in Proceedings of World Congress of Chemical Engineering (2nd), Montreal, Canada, October 4-9, 1981, p349-362 1983.

Keywords: *Industrial plants, *Chemical equilibrium, *Solutions, Thermodynamics, Mathematical models, Gypsum, Solubility, Activity coefficient, pH, Calcium sulfate, Chromium hydroxide, Sodium chloride, Pitzer equations.

The paper discusses industrial applications of thermodynamic theories and empirical developments. The predicted solubility of gypsum as a function of ionic strength (added salts) and as a function of temperature is compared by calculations using 2 models, one using a speciation approach (a commercial computer code) and the other a nonspeciation model (the Pitzer equations). The solubility data of Marshall and Slusher for added NaCl has selected and recommended as a test data set for model calculations of gypsum solubility. The effects of common ion, neutral ion, and H(+1) on the solubility of gypsum is illustrated. The effect of pH and ionic strength on the solubility of chromium hydroxide complexes is discussed for another industrial application.

702,671
PB86-128170 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Thermophysical Property Data Generated by the NBS (National Bureau of Standards) Center for Chemical Engineering.
Final rept.
N. A. Olien, and H. J. Raveche. 1984, 7p
Pub. in AIChE (American Institute of Chemical Engineers) Symposium Series 80, n237 p101-107 1984.

Keywords: *Thermophysical properties, *Chemical engineering, *Research projects, Thermodynamics, Forecasting, Phase transformation, Chemical equilibrium, Fluid mechanics, Reprints, *Reference materials.

The paper describes the current and recent past research of the National Bureau of Standards (NBS) Center for Chemical Engineering (CCE) in the area of thermophysical properties. Included is a description of the approach used which integrates experimental, theoretical, and data evaluation efforts. There is also a summary of the impact of data and its accuracy on the chemical process industry. The major portion of the paper is a detailed description of the property research, especially the publications, of the Center over the past ten years. The results are presented in four tables, listing references of importance in the following areas: Pure Fluid Data, Fluid Mixture Data, Handbooks, Bibliographies, Computer Programs, and Solid Property Data. The paper concludes with a brief description of the future direction to be taken by the NBS-Center for Chemical Engineering in thermophysical properties.

702,672
PB86-130978 PC **A07**/MF **A01**

National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Development of a Performance Test Procedure and Measurement Technique in a Batch Mixing System.
D. M. Ginley. Jul 85, 145p NBSIR-85/3030

Keywords: *Mixing, Batching, Tests, Measurement.

A performance test procedure and measurement technique for a batch mixing system is described using conductivity probes. The design of the automated experimental apparatus is described, and experimental procedures are given. Data collected from the experiments are explained, and a mixtime analysis of the data is performed. Conductivity probe response curves provide a good representation of the system dynamics. Mixtime analysis allows for probe response comparisons to evaluate system geometry and probe location.

702,673
PB86-137957 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Alkali Vapor Transport in Coal Conversion and Combustion Systems.
Final rept.
J. W. Hastie, E. R. Plante, and D. W. Bonnell. 1982, 58p
See also PB81-221319. Sponsored by Department of Energy, Morgantown, WV. Morgantown Energy Technology Center.
Pub. in ACS (American Chemical Society) Symposium Series 179, p543-600 1982.

Keywords: *Alkali resistant tests, *Corrosion tests, *Coal, *Combustion chambers, Fuel additives, Transport properties, Mass spectroscopy, Reprints, *Synthetic fuels.

Alkali metal containing vapor species are ubiquitous in combustion systems. These species originate from coal mineral and atmospheric impurities (organic and inorganic), ceramic construction materials, or as additives, such as with potassium seeding for MHD or with bulk glass as a particle absorbing medium. Alkali vapor transport over representative slag, glass, and simple halide, hydroxide and sulfate systems is discussed in relation to materials and process limitations in coal-supported energy systems. Measurement problems associated with vapor transport measurements are also considered.

702,674
PB86-139995 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Selection of Supports for Immobilized Liquid Membranes.
Final rept.
J. D. Way, R. D. Noble, and B. R. Bateman. 1985, 10p
Pub. in American Chemical Society Symposium Series n269, St. Louis, Missouri, April 8-13, 1984, Chapter 6, Materials Science of Synthetic Membranes, p119-138 1985.

Keywords: *Membranes, *Supports, Separation, Chemical properties, Molecular structure, Diffusion, Surface chemistry.

Criteria for immobilized liquid membrane (ILM) support selection can be divided into two categories: structural properties and chemical properties. Structural properties include geometry, support thickness, porosity, pore size distribution and tortuosity. Chemical criteria consist of support surface properties and reactivity of the polymer support toward fluids in contact with it. The support thickness and tortuosity determine the diffusional path length, which should be minimized. Porosity determines the volume of the liquid membrane and therefore the quantity of carrier required. The mean pore size determines the maximum pressure difference the liquid membrane can support. The support must be chemically inert toward all components in the feed phase, membrane phase, and sweep or receiving phase.

702,675
PB86-160124 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Influence of Preparation Parameters on Internal Droplet Size Distribution of Emulsion Liquid Membranes.
Final rept.
G. J. Hanna, and K. M. Larson. 1985, 6p
Pub. in Industrial and Engineering Chemistry, Product Research and Development 24, n2 p269-274 1985.

Keywords: *Drops(Liquids), *Membranes, *Surface areas, Mass transfer, Sedimentation, Emulsions, Lubricating oils, X-ray analysis, Solvents, Toluene, Decanes, Reprints.

Droplet-size distributions and the corresponding surface areas for emulsions prepared for emulsion liquid membranes were measured by differential X-ray sedimentation. The water-in-oil emulsions were prepared with toluene, decane, and an isoparaffnic solvent. The surface area was measured as a function of hydrocarbon solvent, emulsifier speed, time of emulsification, and aqueous weight loading. The surface area increased with increasing speed and time of emulsification, and it decreased with aqueous weight loading. Speed, time, and weight loading were all significant at the 95% level or better. Several interactions between variables were also significant. Emulsions formed with the lube-oil base were quite viscous at high aqueous loadings which limited the creation of surface area. Typical values of the surface area ranged from 3.0 to 8.0 cu m/cu cm of aqueous phase. The effect of surface area on mass transfer rate was demonstrated with a copper extraction system.

702,676
PB86-160587 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Diffusion Model for Reversible Consumption in Emulsion Liquid Membranes.
Final rept.
A. L. Bunge, and R. D. Noble. 1984, 17p
Pub. in Jnl. of Membrane Science 21, p55-71 1984.

Keywords: *Mathematical models, *Diffusion, *Membranes, Emulsion, Extraction, Absorption, Solutes, Chemical reactions, Reprints.

The work extends previous diffusion models for emulsion globules in which a solute reacts with an internal reagent. The model allows for reversible consumption of the solute by the internal reagent. Local concentration of the internal reagent is nonzero and satisfies reaction and phase equilibria within the reacted zone. Predicted solute absorption rates are lower for the reversible consumption model than for irreversible models.

702,677
PB86-166295 PC **A08**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Center for Chemical Engineering Technical Activities: Fiscal Year 1985.
Research summary rept. Oct 84-Sep 85.
J. Hord. Feb 86, 170p NBSIR-85/3039
See also PB85-178069. Sponsored by National Research Council, Washington, DC.

Keywords: *Chemical engineering, *Research projects, Fluid mechanics, Thermophysical properties, Measurement.

Technical research activities performed by the Center for Chemical Engineering during the Fiscal Year 1985 are summarized herein. These activities fall within the general categories of process measurement, thermophysical properties data, and chemical engineering science.

702,678
PB86-185279 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Measurement of the Dielectric Constant of Slurries in Pipes.
Final rept.
A. K. Gaigalas, and J. R. Whetstone. 1986, 11p
Pub. in Chemical Engineering Communications 40, p85-95 1986.

Keywords: *Slurries, Pipes, Attenuation, Radio transmission, Dielectric properties, Reprints, *Dielectric constant, *Ionic conductivity.

The dielectric constant and the ionic conductivity are measured for a slurry flowing in a conducting pipe. These properties are determined from a measurement of the wavelength, frequency and attenuation of radio waves propagating inside the pipe. A mixing model is used to infer the solids fraction of the slurry.

702,679
PB86-196045 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Kinetic Modeling of Hydration Processes.
Final rept.
P. W. Brown, J. M. Pommersheim, and G. Frohnsdorff. 1983, 16p
Pub. in Cement Research Progress 1983, p245-260.

Keywords: *Cement, *Diffusion, Growth, Hydration, Kinetics, Nucleation, Reprints.

Kinetic models that may be used for the hydration of cement compounds are discussed.

702,680
PB86-196052 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Kinetic Model for the Hydration of Tricalcium Silicate.
Final rept.
P. W. Brown, J. Pommersheim, and G. Frohnsdorff. 1985, 7p
Pub. in Jnl. Cement and Concrete Research 15, n1 p35-41 1985.

Keywords: Growth, Diffusion, Hydration, Nucleation, Reprints, *Tricalcium silicate, Kinetics.

A kinetic model describing the hydration of C3S has been developed. The model is predicated on the assumption that the formation of a final hydrate phase initiates in transient hydrate layers which surround the anhydrous grains. The transformation results in the onset of the acceleratory period. The model predicts C-S-H formation to be controlled by interfacial processes during the acceleratory period and by diffusional processes thereafter and that the growth of particles is essentially one-dimensional throughout the course of both the acceleratory and post-acceleratory periods.

702,681
PB86-197340 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Critical Point Measurements on Nearly Polydisperse Fluids.
Final rept.
G. Morrison, and J. M. Kincaid. 1984, 6p
Pub. in AIChE (American Institute of Chemical Engineers) Jnl. 30, n2 p257-262 1984.

Keywords: *Critical points, *Hydrocarbons, Measurements, Reprints, Van der Waals.

The critical temperatures, pressures, and volumes of several mixtures containing CO2, C2H6, C3H8, and C4H10 have been measured using a heavy walled, variable volume, cylindrical glass vessel. In each mixture the relative proportions of the three hydrocarbon solutes to one another were changed; total solute mole fraction never exceeded 0.1. A detailed study of the mixture CO2+C3H8 shows that the critical temperature exhibits a minimum at a C3H8 mole fraction of 0.0265. The mixture data is analyzed using a polydisperse model of dilute solutions.

702,682
PB87-110151 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Producing Liquid-Solid Mixtures (Slushes) of Oxygen or Hydrogen Using an Auger.
Final rept.
R. O. Voth. Sep 85, 7p
Sponsored by National Aeronautics and Space Administration, Cocoa Beach, FL. John F. Kennedy Space Center.
Pub. in Cryogenics 25, p511-517 Sep 85.

Keywords: *Oxygen, *Hydrogen, *Augers, Cryogenics, Production, Reprints, Binary mixtures.

An auger rotating inside a brass tube refrigerated with liquid helium was used to produce liquid-solid (slush) mixtures of hydrogen and of oxygen. The auger produced small particles from the cryogens so that the resulting slush mixture could be transferred and

stored. The auger could produce slush continuously in an appropriate system; it could produce slush at pressures higher than the triple point pressure of the cryogen, and the energy required to produce the slush was less than the energy required to produce slush using the freeze-thaw process.

702,683
PB87-118956 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Amorphous Silicon Deposition Rates in Diode and Triode Discharges.
Final rept.
A. Gallagher. 1986, 6p
Sponsored by Solar Energy Research Inst., Golden, CO.
Pub. in Jnl. of Applied Physics 60, n4 p1369-1373, 15 Aug 86.

Keywords: *Silicon, Deposition, Photovoltaic cells, Electric discharges, Reprints, Amorphous materials.

The relative rates of radical deposition on discharge electrodes and substrate surfaces are calculated for two-and three-electrode discharges. The reaction rate, diffusion coefficient, screen-electrode transparency, and surface sticking coefficient are parameters in the general solution. The parameters are then chosen to describe typical silane discharges used for alpha-Si:H photovoltaic production, and the effect of screen transparency and other parameters on substrate deposition rates is evaluated. The authors then show that a measurement of deposition rate versus screen-substrate spacing in a three-electrode discharge has been misinterpreted as due to gas reactions, whereas it is primarily due to screen deposition. Finally, they note some possibilities for measuring deposition parameters and for varying the mix of depositings species.

702,684
PB87-134862 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Convective Instability in Packed Beds with Throughflow.
Final rept.
M. C. Jones, and J. M. Persichetti. 1986, 3p
Pub. in AIChE (American Institute of Chemical Engineers) Jnl. 32, n9 p1555-1557 Sep 86.

Keywords: *Fluid flow, Instability, Convection, Porosity, Temperature distribution, Reprints.

Linear stability limits are calculated numerically for convection in fluid-saturated packed beds in horizontal layers. Subject to a destabilizing temperature gradient, the effect of a net vertical throughflow is studied for various boundary condition combinations and flow direction.

702,685
PB87-165155 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO.
Center for Chemical Engineering Technical Activities: Fiscal Year 1986.
Research summary rept. Oct 85-Sep 86,
J. Hord. Feb 87, 115p NBSIR-86/3059
See also PB86-166295. Sponsored by National Research Council, Washington, DC.

Keywords: *Chemical engineering, *Research projects, Fluid mechanics, Thermophysical properties, Calibrating, Measurement.

Technical research activities performed by the Center for Chemical Engineering during the Fiscal Year 1986 are summarized herein. These activities fall within the general categories of process measurement, thermophysical properties data, and chemical engineering science. They embody: development and improvement of measurement principles, measurement standards, and calibration services such as volumetric and mass flow rates, liquid volume, liquid density, and humidity; generation (via accurate measurement and advanced predictive models) of reliable reference data for thermophysical properties of pure fluids, fluid mixtures, and solids of vital interest to industry; and development of improved correlations, models, and measurement techniques for complex flows, heat and mass transport, mixing, and chemically reacting flows of interest in modern unit operations.

702,686
PB87-216222 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Laser Tomography for Simultaneous Concentration and Temperature Measurement in Reacting Flows.
Final rept.,
S. R. Ray, and H. G. Semerjian. 1984, 25p
Pub. in Progress in Astronautics and Aeronautics, v92 p300-324 1984.

Keywords: *Absorption, *Lasers, Combustion, Diagnosis, Spectroscopy, Multiangular, Reprints, *Tomography.

Laser tomography, a new optical diagnostic technique based upon multiangular absorption spectroscopy has been developed. This technique allows the rapid measurement of both species concentration and temperature throughout a two-or three-dimensional nonuniform flow field. Laser tomography involves making absorption measurements along M parallel rays at N equally spaced angles. These M x N measurements are used to reconstruct the spatially resolved two-dimensional property field. Experimental results using two optical geometries are reported for measurements of sodium concentration in a seeded premixed flat flame. Computer simulations of a complete tomography system are presented, including the effects of noise based upon the experimental measurements. Results indicate that within the flame zone both the concentration of absorbing species and temperature can be recovered to within plus or minus 3% without noise filtering and to plus or minus 1.7% with filtering.

702,687
PB87-231494 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Before the Smoke Clears--Heat and Mass Transfer in Fires and Controlled Combustion.
Final rept.,
L. A. Kennedy, and L. Y. Cooper. 1987, 6p
Pub. in Mechanical Engineering 109, n4 p62-67 Apr 87.

Keywords: *Combustion, *Chemical reactions, Flows, Reprints, Compartment fires, Heat transfer, Mass transfer.

Combustion phenomena are often arbitrarily divided into two broad topics depending upon whether it is controlled or uncontrolled. Controlled combustion will normally imply the consumption of a fuel to liberate heat which subsequently will result in useful work. Uncontrolled combustion which is referred to as fire, implies the unintended destruction of a fuel source. In a discussion more or less divided along these lines, the paper outlines current technical issues in the context of some key areas of research and development related to heat and mass transfer-related phenomena.

702,688
PB87-231502 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Low Temperature Magnetic Properties of F.C.C. (Face Centered Cubic) Fe-Cr-Ni Alloys: Effects of Manganese and Interstitial Carbon and Nitrogen.
Final rept.,
E. R. Jones, T. Datta, C. Almasan, D. Edwards, and H. M. Ledbetter. 1987, 8p
Grant NSF-ISP80-11451
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy, and National Science Foundation, Washington, DC.
Pub. in Materials Science and Engineering 91, p181-188 1987.

Keywords: Low temperatures, Magnetic suceptibility, Reprints, *Alloying effects, *Austenitic steels, Iron alloys, Neel transition.

The authors have measured the low temperature magnetic susceptibility of two series of f.c.c. Fe-Cr-Ni alloys: one series contained varied amounts of interstitial carbon and nitrogen; the other contained varied amounts of manganese. Characteristic of antiferromagnets, all specimens displayed a distinct peak in magnetic susceptibility as a function of temperature. Above the transition temperature the behavior of all specimens could be well described by a modified Curie-Weiss law. In the first series the position of the susceptibility maximum decreased from 47.9 plus or minus 0.5 to 35.0 plus or minus 0.5 K as the carbon-plus-nitrogen content increased from 0.080 to 0.359 wt.%. In the second series the position of the susceptibility maximum increased from 46 plus or minus 0.5 to 86.5 plus or minus 0.5 K as the manganese content was increased from 1.02 to 5.80 wt.5. A linear relationship was found to predict the Neel temperature from the alloy composition with an r.m.s. deviation of 1 K.

702,689
PB87-231635 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Transport of Aniline, Chloroaniline, Nitroaniline, and Urea through Perfluorosulfonated Ionomer Membranes.
Final rept.,
P. G. Glugla, and H. Dindi. 1986, 7p
Pub. in Jnl. of Membrane Science 28, p311-317 1986.

Keywords: *Amines, *Membranes, Reprints, Ionomer membranes, Membrane separations, Urea.

The permeabilities of aniline, p-chloroaniline, p-nitroaniline, and urea were measured in a perfluorosulfonated ionomer membrane. Permeabilities for these compounds were of the order of 2 times 10 to the minus 10 power sq. m./sec when the external solutions were pH 7. Permeabilities for these compounds were of the order of 6 times 10 to the minus 9th power sq. m./sec when the sink solution was pH 1 and the source solution was pH 7. These results indicate that the rate at which these amines exit the isonomer is the rate-limiting step in the transport process.

702,690
PB87-233839 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Preparation of Ultrapure Acids from Small to Large Scale.
Final rept.,
J. R. Moody, E. S. Beary, and P. J. Paulsen. 1987, 14p
Pub. in Proceedings of the International Congress of Pure and Applied Chemistry (31st), Sofia, Bulgaria, July 13-18, 1987, p118-131.

Keywords: *Acids, Analysis, *Trace metals, Inductively coupled plasma, Mass spectrometers, Ultrapure, Subboiling.

Methods in use at NBS and elsewhere for the preparation of ultrapure acids are described in a historical context as well as the present recommended procedures. A new apparatus capable of distilling more than 20x the rates of other commercial/times sub-boiling stills has been designed and evaluated at NBS. A new analytical procedure utilizing the ICP/Mass Spectrometer has been developed to assist in evaluating reagent quality.

Photo & Radiation Chemistry

702,691
AD-A119 040/4 Not available NTIS
National Bureau of Standards, Washington, DC. National Measurement Lab.
Photodecomposition of Methyl Nitrite Trapped in Solid Argon.
M. E. Jacox, and F. L. Rook. 11 Dec 81, 7p ARO-17710.2-CH
Contract ARO-27-82
Availability: Pub. in Jnl. of Physical Chemistry, p2899-2904, 22 Jul 82 (No copies furnished by DTIC/NTIS).

Keywords: *Photodecomposition, *Methyl radicals, *Nitrates, Solids, Argon, Reprints, Methyl nitrite.

No abstract available.

702,692
DE83014301 MF **A01**
Boston Univ., MA.
Fluorescence Excitation Studies of Molecular Photoionization in External Electric Fields.
E. D. Poliakoff, J. L. Dehmer, A. C. Parr, and G. E. Leroi. 1983, 4p CONF-830821-2
Contract W-31-109-ENG-38
International conference on vacuum ultraviolet radiation physics, Jerusalem, Israel, 8 Aug 1983.
Microfiche only, copy does not permit paper copy reproduction.

Keywords: *Nitrogen, Photoionization, Fluorescence, Excitation, Electric Fields, Cross Sections, ERDA/ 640303.

With molecular nitrogen used as an example, it is shown that partial photoionization cross-sections for gas samples in external electric fields can be obtained through fluorescence excitation spectroscopy. (ERA citation 08:042497)

702,693
PB-263 260/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Gas-Phase Photodecomposition of Carbon Tetrachloride.
Final rept.,
R. E. Rebbert, and P. J. Ausloos. 1977, 12p
Pub. in J. Photochem., v6 p265-276 1976/77.

Keywords: *Carbon tetrachloride, *Photolysis, Photochemical reactions, Ultraviolet spectroscopy, Dissociation, Troposphere, Atmospheric chemistry, Stratosphere, Absorption cross sections, Quantum efficiency, Chlorine, Atoms, Air pollution, Reprints, Chlorine atoms.

The gas-phase photolysis of CCl4 was investigated at 213.9, 163.3 and 147.0 nm in the presence of HCl, HBr, and C2H6. Quantum yields of the products measured in these mixtures at a temperature of 300K led to the conclusion that at 213.9 nm over 90% of the photodecomposition can be attributed to the photodissociative process. Contrary to earlier suggestions, CCl2 is unreactive towards CCl4. Combination with other radicals and insertion into HCl are the major modes of reaction of CCl2. Experiments carried out at 313.0 nm show evidence for the occurrence of photodissociation of CCl4. The result indicates that photodecomposition of CCl4 in the troposphere is of minor importance as compared to other processes including diffusion up to the earth's stratosphere.

702,694
PB-265 409/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mechanism of Alkyl Halide Photolysis by a Pulsed CO2 TEA Laser,
W. Braun, and W. Tsang. 1976, 6p
Pub. in Chem. Phys. Lett., v44 n2 p354-359, 1 Dec 76.

Keywords: *Photolysis, *Haloalkanes, Helium, Carbon dioxide lasers, Dissociation, Photochemistry, Reprints.

A CO2-TEA laser has been used to photolyze dilute samples of various alkyl halides in helium. The mechanism of the high intensity infrared photolysis of these molecules involves the decomposition of molecules into molecular or radical fragments. The reaction pathway is always dissociation into the lowest thermal dissociation channel(s) of the molecule photolyzed. Products from the initial process are also photo-dissociated by the laser pulse and their decomposition pathways are similarly governed. The molecules being photolyzed are not thermally equilibrated with the bath or with each other and the molecular-specific nature of the laser excitation is demonstrated.

702,695
PB-265 871/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pulsed High Intensity Monoenergetic Low Energy X-Ray Source and Absolute X-Ray Monitor,
J. H. Sparrow, and C. E. Dick. 1977, 10p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Nucl. Instrum. Methods, v141 p283-292 1977.

Keywords: *X rays, *Radiation counters, Excitation, Calibrating, Standards, Pulse transmission, Electrons, Reprints, Sources.

An X-ray source of 1.5, 4.5, or 8.0 keV with 10 ns durations has been produced using pulsed electron source to excite the characteristic K-line radiation of elemental targets. A parallel plate ionization chamber was calibrated in the NBS standard monoenergetic K X-ray beams and used with Ross filters to measure the pulsed source K X-ray fluence. Typical measured peak X-ray flux intensities are 10 to the 18th power - 10 to the 19th power K X-rays per sr per s. The pulsed source contains four identical ports for simultaneous measurement of the K X-ray intensity by the ionization chamber and detectors being calibrated. The pulsed K X-ray source and the NBS standard steady state K X-ray source, which differ in intensity by 10 orders of magnitude, have been used to determine the responses of a photoelectric diode, a scintillator-vacuum photodiode combination, and a silicon PIN diode.

702,696
PB-266 866/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Gas Cell for Photochemical Studies,
A. E. Ledford, and W. Braun. 1977, 2p
Pub. in Rev. Sci. Instrum., v48 n5 p537-538 May 77.

Keywords: *Cells, *Laboratory equipment, *Gas chromatography, Photochemistry, Infrared analysis, Visible radiation, Ultraviolet radiation, Design criteria, Reprints.

A cell design suitable for chromatographic sampling of products is integrated into an apparatus suitable for performing I.R., visible and U.V. photochemical studies. The design of the cell and a schematic of the apparatus are presented and described.

702,697
PB-268 699/6 PC **A99**/MF **A01**
Notre Dame Univ., Ind. Radiation Chemistry Data Center.
Biweekly List of Papers on Radiation Chemistry. Volume 9. Annual Cumulation with Keyword and Author Indexes,
A. B. Ross. Dec 76, 713p
Sponsored in part by National Bureau of Standards, Washington, D.C. Office of Standard Reference Data and Energy Research and Development Administration, Washington, D.C. Div. of Physical Research. See also Volume 8 dated Aug 76, PB-257 025.

Keywords: *Radiation chemistry, *Indexes(Documentation), Polymers, Luminescence, Radiobiology, Electron paramagnetic resonance, Authors, Hot atom chemistry, Pulse radiolysis, Photochemistry.

This document is the annual edited cumulative list of references to the published literature on radiation chemistry and related fields. References are drawn from 55 journals published throughout the world. The list is generated from the Biweekly List of Papers on Radiation Chemistry and contains the literature references and an author and subject index. The publication represents one of the continuing data activities of the Radiation Chemistry Data Center (RCDC) at the University of Notre Dame.

702,698
PB-280 459/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Role of Neutron Activation Analysis in the Evaluation of Sampling, Storage, and Analysis of Samples for the National Environmental Banking System.
Final rept.,
T. E. Gills, and L. T. McClendon. 1977, 7p
Sponsored in part by Environmental Protection Agency, Washington, D.C.
Pub. in Jnl. of Radioanalytical Chemistry 39, p285-291 1977.

Keywords: *Neutron activation analysis, *Tissues(Biology), Evaluation, Chemical analysis, Sampling, Storage, Radioactivation analysis, Reprints, *Organs.

Some problems inherent to the sampling, storage and analysis of whole organs or tissue biopsies were studied. The method used to evaluate the proper conditions of these, was neutron activation analysis.

702,699
PB-281 828/4 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Structures and Materials Div.
Studies on the Photodegradation of Poly(Methyl Methacrylate),
M. Abouelezz, and P. F. Waters. May 78, 61p
NBSIR-78-1463

Keywords: *Polymethyl methacrylate, *Photodegradation, Ultraviolet spectroscopy, Degradation, Molecular weight, Glass transition temperature, Polymers, Infrared spectroscopy, Chemical reaction mechanisms.

Although poly(methyl methacrylate), PMMA, is known to degrade when exposed to ultraviolet radiation, studies at wavelengths other than 253.7 nm have not been done. The lack of knowledge about the mechanism of degradation of PMMA at wavelengths other than 253.7 nm hinders efforts to develop short-term test methods for predicting the longterm performance of PMMA in applications in which it is exposed to sunlight. This study was performed to determine the effect of ultraviolet radiation on PMMA and to identify mechanisms of degradation induced by radiation. Thin films of PMMA of two different molecular weights were irradiated with radiation nominally of 253.7 nm and 300 nm. The irradiations were conducted in air and under vacuum. Exposure at 253.7 nm caused a rapid decrease in molecular mass and loss of a small amount of volatile products, which is a characteristic of random chain scission. The quantum yield was greater in air than in vacuum. Changes in the molecular mass and the glass transition temperature as well as weight loss data indicating that wavelengths bands at greater than 253.7 nm also cause degradation. The data further indicate that the degradation at the longer wavelengths may not be completely random scission.

702,700
PB-285 327/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pulsed CO2 Laser Photolysis of CF2Cl2.
Final rept.,
G. Folcher, and W. Braun. 1978, 14p
Contract DOE-EA-77-A-01-6010
Pub. in Jnl. Photochem., v8 p341-354, 1978.

Keywords: *Photolysis, *Halohydrocarbons, Fluorine aliphatic compounds, Chlorine aliphatic compounds, Laser beams, Free radicals, Reprints, *Methane/dichloro-difluoro, Chemical reaction mechanisms.

The pulsed infrared laser photolysis of CF2Cl2 yields primarily (more than 85%) the CF2Cl free radical and atomic chlorine. Somewhat smaller amounts (less than 15%) of CF2 and molecular chlorine are produced in a competing primary process. Depending on experimental conditions, e.g. pressure and intensity, secondary processes can occur that can obscure the primary chemistry. For example, at low intensity the CF2Cl radical can thermally dissociate to yield CF2 plus chlorine atoms while at high intensity the CF2Cl radical can undergo reaction with chlorine atoms to yield CF2 and molecular chlorine. Quantitative measurements can be made of the relative importance of the primary atomic or molecular chlorine elimination channels under conditions where secondary removal of CF2Cl is entirely eliminated. Under these conditions, the relative importance of these two channels does not depend on the intensity of the laser or on the laser wavelength. The overall chemistry occurring in this complex system is evaluated in the absence as well as in the presence of atomic and free-radical scavengers using conventional end-product analysis techniques.

702,701
PB-287 147/3 PC **A18**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Center for Thermodynamics and Molecular Science.
Proceedings of the Informal Conference on Photochemistry (12th).
Special pub.
M. J. Kurylo, and W. Braun. Oct 78, 409p NBS-SP-526
Held at the National Bureau of Standards, Gaithersburg, Maryland on June 28-July 1, 1976. Sponsored in part by Department of Transportation, Washington, DC., Department of Energy, Washington, DC., and National Science Foundation, Washington, DC. Library of Congress catalog card no. 78-600105.

Keywords: *Photochemistry, *Meetings, Environmental surveys, Solar energy, Lasers, Isotope separation, Chemiluminescence, Inorganic compounds, Actionometry, Radiometry, Fluorescence, Reaction kinetics, Energy transfer, Laser induced fluorescence.

The 12th Informal Conference on Photochemistry was held at the National Bureau of Standards Laboratories in Gaithersburg, Maryland, from June 28-July 1, 1976. Nearly 300 members of the international scientific community attended the 123 individual research papers presented. Extended abstracts of these presentations (many revised after the Conference) comprise the present proceedings. The wide range of highly specialized topics include Environmental Chemistry (both Photochemical Smog and Upper Atmosphere/Ozone Layer), Laser Photochemistry, Photochemical Isotope Separation, Photochemical Conversion of Solar Energy, Actinometric and Radiometric Measurements, Chemiluminescent Processes, Primary Photochemical and Photophysical Processes, Inorganic Photochemistry, and Elementary Reaction Processes.

702,702
PB-290 086/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photochemistry of Methyl Chloride.
Final rept.,
D. M. Shold, and R. E. Rebbert. 1978, 19p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC. Upper Atmospheric Research Office.
Pub. in Jnl. of Photochemistry 9, p499-517 1978.

Keywords: *Chloromethanes, *Deuterium compounds, *Photochemical reactions, Photolysis, Decomposition reactions, Reprints.

Methyl chloride and CH3Cl-CD3Cl, CH3Cl-Br2 and CD3Cl-HI mixtures have been photolyzed at 163.3, 147.0 and 123.6 nm in the gas phase and for methyl chloride at 147.0 nm also in the liquid phase. Over this range of wavelengths, there are four principal primary processes: CH3Cl + hnu yields CH3 + Cl (1), yields CH2Cl + H (2), yields CH2 + HCl (3), yields CHCl + H2 (4). At 163.3 nm, process (1) is almost exclusively responsible for the photodecomposition. However, at shorter wavelengths there is an increasing amount due to processes (2), (3), and (4) while process (1) decreases in importance. At all wavelengths these four processes account for a total quantum yield of 0.75-1.0.

702,703
PB-291 876/1 PC **A99**/MF **A01**
Notre Dame Univ., IN. Radiation Chemistry Data Center.
Biweekly List of Papers on Radiation Chemistry. Annual Cumulation with Keyword and Author Indexes, Volume 10, 1977.
A. B. Ross. 1977, 700p
See also Volume 9 dated Jan-Jun 1971, COM71-01103. Sponsored in part by National Bureau of Standards, Washington, DC., and Department of Energy, Washington, DC.

Keywords: *Chemistry, *Bibliographies, Radiation chemistry, Radiolysis, Polymers, Radiobiology, Luminescence, Photochemistry, Authors, Electron spin resonance, Indexes(Documentation), Subject index terms, Author indexes, Hot atoms.

This document is the annual edited cumulative list of references to the published literature on radiation chemistry and related fields. References are drawn from 55 journals published throughout the world. The list is generated from the Biweekly List of Papers on Radiation Chemistry and contains the literature references and an author and subject index. The publication represents one of the continuing data activities of the Radiation Chemistry Data Center (RCDC) at the University of Notre Dame.

702,704
PB77-600011 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photodecomposition of Chloromethanes Adsorbed on Silica Surfaces.
P. Ausloos, R. E. Rebbert, and L. Glasgow. 1977, 8p
Included in Jnl. of Research of the National Bureau of Standards, v82 n1 p1-8 1977.

Keywords: *Chloromethanes, *Photochemistry, Quantum yields, Quartz, Sand, Surface reactions, Tropospheric sink.

Irradiation of CCl4, CFCl3, and CF2Cl2 in the presence of C2H6 in vessels containing silica sand or fused quartz tubing results in the formation of chlorine-containing products. The formation of these compounds occurs at wavelengths extending up to approximately 400 nm, that is, at wavelengths well beyond the absorption threshold of the chloromethanes in the gas phase. It is suggested that CCl4 adsorbed on silica surfaces photodissociates to yield CCl3 and Ccl2 species. The poor material balance obtained in these experiments indicates that several of the chlorine-containing fragments are strongly adsorbed on the surface. At a CCl4 pressure of 13 Pa (0.1 torr), photolysis with 366 nm light in the presence of sand results in the decomposition of one molecule for every 10 to the 4th power photons striking the surface. Under otherwise identical conditions, the photo-induced breakdown of CFCl3 and CF2Cl2 is respectively only 10 percent or 3 percent as efficient.

702,705
PB80-120868 Not available NTIS
National Bureau of Standards, Washington, DC.
Photochemistry of Bromacetylene: Formation of HBr and Quenching of Excited Br(4 doublet P 0 (1/2)),
A. H. Laufer. 1979, 4p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC. Planetary Atmospheres Program.
Pub. in Jnl. Physical Chemistry 83, n21 p2683-2686 1979.

Keywords: *Photolysis, Hydrogen bromide, Excitation, Reaction kinetics, Molecular energy levels, Spectroscopy, Heat of formation, Reprints, *Acetylene/bromo, *Chemical reaction mechanisms.

The photolysis of C2HBr has been investigated in the region above 155 nm by the flash photolysis-kinetic spectroscopy technique. HBr has been observed as a secondary product and its rate of formation has been monitored and a mechanism for its formation suggested. The probability of another primary process C2HBr + h(nu) yields H + C2Br is discussed. The heats of formation of several C-Br species required for mechanistic considerations are derived.

702,706
PB80-212392 Not available NTIS
National Bureau of Standards, Washington, DC.
Intensity Dependence of Photochemical Reaction Rates for Photoresists,
J. Albers, and D. B. Novotny. Jun 80, 4p
Pub. in Jnl. of the Electrochemical Society 127, n6 p1400-1403 Jun 80.

Keywords: *Photochemical reactions, *Reaction kinetics, *Mathematical models, Exposure, Reprints, Photoresist techniques.

The intensity dependence of photochemical reaction rates, and thus the exposure reciprocity, is investigated in terms of a kinetic model. This model assumes a two step photochemical reaction, and reactions that are first order in the concentrations of each of the various species. The model is applicable to both positive and negative photoresists. It is specifically applied to the photo-active species of a typical negative photoresist with the efficiency of the polymer cross-linking assumed constant. The model predicts that there is a saturation effect at high intensities which serves as a rate-limiting step, thus limiting the applicability of exposure reciprocity. Calculations using this model indicate that exposure reciprocity should be obeyed for exposure times of 10 microseconds or greater.

702,707
PB80-223498 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser-Induced Gas Phase Chain Chemistry.
Final rept.,
D. J. Nesbitt, and S. R. Leone. 1979, 9p
Contract DOE1EA-77-A-01-6010, Grant NSF-CHE76-22600
Pub. in Proceedings of Electro-Optics/Laser 79 Conference, Anaheim, CA, October 23-25, 1979, p281-289 1979.

Keywords: *Chain reactions, Reaction kinetics, Reprints, *Laser induced reactions, Chemical reaction mechanisms.

A detailed kinetic and experimental analysis is presented for chemical chain reaction processes initiated by well-controlled, low power laser pulses. Realtime evolution of the chain reaction is followed by direct detection of infrared chemiluminescence from vibrationally excited HCl product molecules produced by one of the propagation reactions in the chain. By appropriate choice of conditions, the chain reactions may be analyzed separately for pseudo first-order, radical-reagent processes as well as for second-order, radical events. The pulsed laser initiation technique is applied to the Cl2/H2S system; detailed rate constant data are obtained for the fundamental chain propagation steps, and appropriate chain termination steps are assigned from the observations. The results is a powerful, new, and general technique for the quantitative study of chemical chain reactions and related combustion processes.

702,708
PB81-137192 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Photochemical Oxidants on Materials.
J. R. McNesby. 1977, 29p
Sponsored in part by National Academy of Sciences, Washington, DC.
Pub. in Chapter 13, in Ozone and Other Photochemical Oxidants, p643-671 1977.

Keywords: *Ozone, *Materials tests, *Air pollution, Photochemistry, Test chambers, Elastomers, Paints, Dyes, Textiles, Economics.

In the context of this review, the term 'photochemical oxidants' is considered to be synonymous with 'ozone.' In test chambers that have external ozone generators and that operate at or near atmospheric pressure, ozone is the only likely oxidizing species. In ambient air, however, ground-state atomic oxygen, hydroxyl radicals, and especially hydroperoxy radicals can compete with ozone in attacking materials, such as rubber, that contain olefinic bonds. The most economically important materials with respect to ozone damage are paint, elastomers (rubber), and textile fiber-dye systems. Damage to polyethylene by ozone is considered to be negligible. The ozone-specific damage in 1970 to materials has been assessed in economic terms and is approximately as follows: paint, $540 million; elastomers, $569 million; and textile fibers and dyes, $84 million. Total material damage attributable to ozone is, therefore, $1.22 billion. This is to be compared with Waddell's estimate of total air pollutant material damage of $2.2 billion. It is clear that ozone is a very important molecule in pollutant damage to materials.

702,709
PB81-144743 Not available NTIS
National Bureau of Standards, Washington, DC.
Photochemistry of Ethyl Chloride,
D. M. Shold, and P. J. Ausloos. 1979, 13p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Photochemistry 10, p237-249 1979.

Keywords: *Chloroethanes, *Photochemistry, *Deuterium compounds, Chemical bonds, Reprints.

Ethyl chloride and deuterium labeled ethyl chlorides have been photolyzed at 184.9, 163.3, 147.0, and 123.6 nm in the gas phase and at 163.3 and 147.0 nm in the liquid phase. The use of NO, O2, and HI as radical scavangers has permitted a determination of the quantum yields of primary photodecomposition processes as a function of wavelength. At low energies, excitation of an electron into an antibonding sigma* orbital leads primarily to C-Cl bond cleavage, while at higher energies this process is largely replaced by loss of HCl and hydrogen. Both 1,1- and 1,2 HCl eliminations are observed. The absence of significant amounts of H atom production at 163.3 nm and at low pressures suggests that one excited state may be responsible for HCl elimination, and a second for Cl atom loss, in agreement with the mechanism of Tschuikow-Roux et al.

702,710
PB81-178592 Not available NTIS
National Bureau of Standards, Washington, DC.
Photodissociation of Nitric Acid and Water in the Vacuum Ultraviolet; Vibrational and Rotational Distributions of OH2 Doublet Sigma(+).
Final rept.
H. Okabe. 15 Jun 80, 9p
Pub. in Jnl. of Chemical Physics 72, n12 p6642-6650, 15 Jun 80.

Keywords: *Nitric acid, *Photochemical reactions, *Dissociation, Far ultraviolet radiation, Molecular energy levels, Reprints, Hydroxyl ion.

The absorption cross sections of nitric acid have been measured in the 1100-1900 A region. The process HONO2 to OH(doublet Sigma) + NO2 occurs below 1475 A, much shorter than the thermochemical threshold at 2040 A. The vibrational and rotational distributions of OH(doublet Sigma) from HONO2 photolysis at 1236 A have been measured and compared with those from H2O and H2O2 photolysis. The excess energy beyond that required to dissociate the molecule and to excite ground state OH to OH(doublet Sigma) is converted to rotation and much less to vibration of OH(doublet Sigma) in contrast with linear cyanogen molecules where the excess energy appears as vibration and much less as rotation of a CN product. The results of internal energy partitioning have been compared with calculations based on a simple quasidiatomic impulsive model. The deviation from the model is attributed to either a process involving a large change in bond angle or in bond length. The extent of rotational excitation is expressed in terms of an impact param-

eter. The large impact parameter is found for H2O and H2O2 photolysis while for HONO2 photolysis the impact parameter is small.

702,711
PB81-600014 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Atomic Transition Probabilities for Iron, Cobalt, and Nickel (A Critical Data Compilation of Allowed Lines).
J. R. Fuhr, G. A. Martin, W. L. Wiese, and S. M. Younger. c1981, 262p
Included in Jnl. of Physical and Chemical Reference Data, v10 n2 p305-566 1981.

Keywords: *Allowed transitions, Cobalt, f-values, Iron, Isoelectronic sequence, Line strengths, Nickel, Oscillator strengths, Systematic trends, Transition probabilities.

Atomic transition probabilities for about 5100 spectral lines of the elements iron, cobalt, and nickel in all stages of ionization have been critically evaluated and compiled. All available literature sources have been considered. Systematic trends along isoelectronic sequences have been exploited to predict oscillator strengths (f-values) whenever no data were available in the literature. The data are presented in separate tables for each element and stage of ionization and are arranged according to multiplets and, where appropriate, also according to transition arrays and increasing quantum numbers. For each line the transition probability for spontaneous emission, the absorption oscillator strength, and the line strength are given, along with the spectroscopic designation, the wavelength, the statistical weights, and the energy levels (when available) of the upper and lower atomic states. In addition, the estimated accuracy and the literature reference are indicated. In short introductions which precede the tables for each spectrum, the main justifications for the choice of the adopted data and for the accuracy ratings are discussed. A general introduction contains additional details on the evaluation procedure.

702,712
PB81-600026 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Levels of Cobalt, Co I through CO XXVII.
J. Sugar, and C. Corliss. c1981, 78p
Included in Jnl. of Physical and Chemical Reference Data, v10 n4 p1097-1174 1981.

Keywords: *Atomic energy levels, Atomic spectra, Cobalt, Cobalt energy levels, Spectra.

The energy levels of the cobalt atom in all of its stages of ionization, derived from analyses of atomic spectra, have been critically compiled. In cases where only line classifications are reported in the literature, level values have been derived. Electron configurations, term designations, J-values, experimental g-values, leading percentages and ionization energies are included.

702,713
PB81-600048 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of Lithium and Lithium-6 in Solutions by the Nuclear Track Technique.
B. S. Carpenter, and L. J. Pilione. 1980, 3p
Pub. in Anal. Chem. 52, p2452-2454 1980.

Keywords: *Abundances, Alpha particles, Cellulose nitrate detector, Isotopic, Lithium, Nuclear track technique, Triton particles.

The study demonstrates that the nuclear track technique coupled with absorbers can be used to determine the concentration or isotopic abundance of solutions containing lithium. These measurements are made by registering, in cellulose nitrate detectors, the triton particle produced in the 6Li(n,alpha)3H nuclear reaction. In addition, the study illustrates that the use of the absorbers eliminates interferences from alpha particles produced from other nuclides during the irradiation of the samples.

702,714
PB82-261546 Not available NTIS
National Bureau of Standards, Washington, DC.
Photolysis and Radiolysis of Cyclopentane in the Liquid Phase.
Final rept.
P. Ausloos, S. G. Lias, and R. E. Rebbert. Aug 81, 7p
Pub. in Jnl. Phys. Chem. 85, n16 p2322-2328, 6 Aug 81.

Keywords: *Cyclopentane, *Photolysis, *Radiolysis, Liquid phases, Reprints.

The liquid phase photolysis of cyclopentane has been investigated at energies below (7.6, 8.4 eV) and above (10.0, 11.6 eV) the ionization threshold (8.7 eV). The molecules excited by photon absorption and by charge recombination undergo four major dissociation processes. By comparing the relative abundances of these fragmentation channels with their quantum yields in the photolysis experiments at different energies, it is found that the average excitation energy of the cyclopentane molecules formed by charge recombination is in excess of 10 eV. Partial retention of the internal energy of the parent ions at the time of return of the geminate electron is suggested.

702,715
PB83-131573 Not available NTIS
National Bureau of Standards, Washington, DC.
Accuracy in Activation Analysis: Count Rate Effects.
Final rept.
R. M. Lindstrom, and R. F. Fleming. 1980, 11p
Pub. in Proceedings International Conference on Nuclear Methods in Environmental and Energy Research (4th), Columbia, Missouri, April 14-17, 1980, DOE CONF-800433 p25-35 1980.

Keywords: *Radioactivation analysis, *Counting, Performance evaluation, Error analysis.

The accuracy inherent in activation analysis is ultimately limited by the uncertainty of counting statistics. When careful attention is paid to detail, several workers have shown that all systematic errors can be reduced to an insignificant fraction of the total uncertainty, even when the statistical limit is well below one percent.

702,716
PB83-234864 Not available NTIS
National Bureau of Standards, Washington, DC.
Photochemistry of Acetylene at 1849 A.
Final rept.
H. Okabe. Feb 83, 6p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Physics 78, n3 p1312-1317, 1 Feb 83.

Keywords: *Photochemistry, *Acetylene, Ultraviolet spectroscopy, Reprints.

The photochemistry of acetylene at 1849 A has been studied over the pressure range from 13 to 2660 N/Sq m (0.1 to 20 torr).

702,717
PB83-239566 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Applied Technology.
Radiation Curing of Inks and Coatings.
Annual rept. 1 Oct 81-30 Sep 82.
G. A. Senich, and R. E. Florin. Jun 83, 133p NBSIR-83-2722
Sponsored in part by Bureau of Engraving and Printing, Washington, DC

Keywords: *Curing agents, *Radiation, *Inks, *Coatings, Electron beams, Excitation, Molecular energy levels, Ultraviolet radiation, Electron beams, Infrared radiation, Microwaves, High frequencies, Chemical reactions, Photochemistry, Drying, Polymerization, Chemical reaction mechanisms.

The science and technology of curing organic materials with radiation is reviewed. Electron beam, ultraviolet, infrared, microwave, and high frequency radiation sources and the resin systems suitable for use with these sources are considered. Equipment necessary to affect a radiation cure is discussed and some practical problems unique to each radiation method are indicated. The application of radiation curing to industrial processes which employ inks and coatings is covered, with particular emphasis given to printing with radiation curable formulations. Included are discussions of the advantages and disadvantages of radiation curing inks, some typical ink components and formulations, the specialized machinery required, and the influence of parameters unique to radiation curing methods on the printing process. Other nonprinting but related industrial operations utilizing radiation for treating thin films and coatings are also considered. Some costs, examples, and market statistics are given for these commercial procedures. New nonconventional, but also nonradiation, alternative curing methods are discussed briefly. A bibliography of recommended further reading and a list of over two hundred fifty references are included.

702,718
PB83-600001
(Order as PB84-115757, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
High Precision Coulometric Titration of Uranium.
G. Marinenko, W. F. Koch, and E. S. Etz. 1983, 8p
Included in Jnl. of Research of the National Bureau of Standards, v88 n2 p117-124 1983.

Keywords: *Amperometry, Coulometric titration, Electrogeneration, high-precision coulometry, Hydrogen peroxide, Standard reference material, Titanium, Titanous ion, Uranium, Uranium oxide.

An improved method for the coulometric assay of uranium and uranium oxide has been developed based on the electrogeneration of Ti(III) in H2SO4, using Fe(II) as a catalyst. The endpoint is determined amperometrically, Hydrogen peroxide is used as the oxidant in the dissolution of the uranium to avoid interferences from nitrate. The precision of the method as indicated by the standard deviation of an individual observation ranged from 0.008 weight percent for the analysis of the metal to 0.02 weight percent for the analysis of the oxides.

702,719
PB83-600018 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Small-Angle Rayleigh Scattering of Photons at High Energies: Tabulations of Relativistic HFS Modified Atomic Form Factors.
D. Schaupp, M. Schumacher, F. Smend, and P. Rullhusen. c1983, 46p
Included in Jnl. of Physical and Chemical Reference Data, v12, n3 p467-512 1983.

Keywords: *Atomic form factor, Cross sections, Gamma rays, Photons, Rayleigh scattering, Tabulations, X-rays.

Tabulations are presented of relativistic Hartree-Fock-Slater modified atomic form factors from x=0 to 100 Angstrom to the minus first power for all elements from Z=1 to Z=100. These modified form factors represent the atomic Rayleigh scattering amplitudes with good accuracy at energies well above the K-shell binding energies and small momentum transfers and therefore should be used instead of the normal relativistic atomic form factors in the MeV energy range.

702,720
PB83-600028 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Transport Properties of Liquid and Gaseous D2O Over a Wide Range of Temperature and Pressure.
N. Matsunaga, and A. Nagashima. c1983, 34p
Included in Jnl. of Physical and Chemical Reference Data, v12, n4 p933-966 1983.

Keywords: *Critically evaluated data, Deuterium oxide, Diffusion coefficient, Heavy water, Kinematic viscosity, Prandtl number, Thermal conductivity, Thermal diffusivity, Transport properties viscosity.

Data for the viscosity and thermal conductivity of dense gaseous and liquid heavy water (D20) have been reviewed and critically evaluated. Selected data were fitted to equations, from which tables of values were generated from temperatures up to 500 degrees C and for pressures up to 100 MPa for the viscosity and up to 550 degrees C and 100MPa for the thermal conductivity. The uncertainties of the tabular values were estimated. The present paper is intended to explain the background of the International Representations of the viscosity and thermal conductaivity of heavy water substance of the International Association for the Properties of Steam. With the aid of the present correlations the kinematic viscosity, thermal diffusivity, and Prandtl number have been calculated. The present status of the gaseous diffusion coefficient is also briefly reviewed.

702,721
PB83-600041 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Determination of Trace Metals in Biological Materials by Stable Isotope Dilution.
C. Veillon, and R. Alvarez. 1983, 20p
Pub. in Metal Ions in Biological Systems, Chap. 5, p103-122 1983.

Keywords: *Biological materials, Mass spectrometry, NBS standard reference materials, Stable isotope dilution, Trace analysis, Tracer studies.

The general principle of stable isotopic dilution (ID) methods for determining trace metals in biological systems is described; and the advantages and disadvantages of specific instrumentation used with ID methods are reviewed. The general method involves equilibration of the trace element with a stable isotope of the element and a determination of the altered isotopic ration, generally by mass spectrometry. Compared to other methods, the advantages of ID methods are better accuracy, precision, and sensitivity. In addition, quantitative or known recovery of the elements being determined is not required. The main limitation is the analytical or method blank. A section describes contamination control measures. Applications of ID procedures are described. At NBS, ID mass spectrometric procedures are used to determine accurately trace elements in biological materials subsequently issued as Standard Reference materials. A table lists chemical compositions of these SRM;s.

702,722
PB84-107051 Not available NTIS
National Bureau of Standards, Washington, DC.
Gamma-Ray Dosimetry Using Pararosaniline Cyanide in Dimethyl Sulfoxide Solutions.
Final rept.
N. B. El-Assy, H. M. Roushdy, M. Rageh, and W. L. McLaughlin, and H. Levine . 1982, 5p
Pub. in International Jnl. of Applied Radiation and Isotopes 33, n8 p641-645 1982.

Keywords: *Chemical dosimeters, *Gamma rays, *Dosimetry, Radiation chemistry, Absorption, Solvents, Methyl sulfoxide, Reprints, *Pararosaniline cyanide.

A chemical radiochromic dosimeter using pararosaniline cyanide in dimethyl sulfoxide can be used over a wide absorbed dose range. Experiments show that the dosimeter has a main optical absorption maximum at 554 nm, which is higher than that of other polar solvents.

702,723
PB84-107085 Not available NTIS
National Bureau of Standards, Washington, DC.
Dosimetry by Means of the Radiation Reduction of Hemin in Aprotic Solvents.
Final rept.
W. L. McLaughlin, M. G. Simic, and A. Miller. 1982, 7p
Pub. in Proceedings of International Symposium on Nucleur Chemistry (3rd) held at University of Mexico on December 8-10, 1980, p195-201 Dec 82.

Keywords: *Chemical dosimeters, *Band spectra, *Solvents, Radiation chemistry, Chemical reactions, Absorption, Methyl sulfoxide, *Radiation reduction, *Aprotic liquids, *Hemin binding, Iron porphyrins, Chemical shifts(Nuclear magnetic resonance), Formamide/N-N-dimethyl.

Iron (III) porphyrins when dissolved in certain polar organic solvents are reduced by ionizing radiation. This results in a stable shift of both the Soret (B) and visible (Q) absorption bands, as long as the solution is maintained in a deaerated state, thus affording a means of radiation dosimetry.

702,724
PB84-221779 Not available NTIS
National Bureau of Standards, Washington, DC.
Chemical Dosimetry by UV Spectrophotometry of Aqueous Ascorbic Acid Solutions.
Final rept.
A. Alian, N. B. El-Assy, F. Abdel-Rehim, N. Amin, W. L. McLaughlin, and H. Roushdy. 1984, 6p
Pub. in Radiation Physics and Chemistry, v23 n4 p435-440 1984.

Keywords: *Ultraviolet spectroscopy, *Chemical dosimeters, *Ascorbic acid, Solutions, Additives, Stability, Gamma radiation, Performance evaluation, Reprints, Chemical reaction mechanisms, Hydroxyl radicals.

The decrease in the ultraviolet absorption of aqueous solutions of ascorbic acid brought about by large doses of gamma radiation has been investigated as a means of developing a new chemical dosimeter. Because of spontaneous ring opening under various conditions after dissolution in water, some additives were examined as possible stabilizers against such denaturing of aqueous ascorbic acid. A mechanism of radiation chemistry has been proposed based on hydroxyl radical and hydroxyl adduct intermediates, leading to dehydroascorbic acid through the ascorbate complex.

702,725
PB84-221878 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiochemical Isolation and Radioactivity Calibration of Radium-228 by Liquid-Scintillation Counting and Gamma-Ray Spectrometry.
Final rept.
J. R. Noyce, and J. M. R. Hutchinson. 1983, 9p
Pub. in Jnl. of Radioanal. Chem. 79, n1 p5-13 1983.

Keywords: *Radiochemistry, *Radium isotopes, *Separation, Radioactivity, Ion exchanging, Extraction, Gamma ray spectroscopy, Reprints, *Radium 228, Thorium 232.

Radium-228 was separated from aged thorium nitrate by liquid - liquid, two-phase extration and extensively purified, principally by ion-exchange chromatography. The radioactivity concentration of the purified radium-228 was measured by means of liquid-scintillation beta-particle measurements of the (228)Ac daughter (Corrected for progeny ingrowth). The results were confirmed by Ge(Li) well-detector intercomparison with radium-228 in equilibrium with its thorium-232 precursor which had been measured gravimetrically. Three hundred ampoules were provided to the U.S. Environmental Protection Agency, Las Vegas, for distribution.

702,726
PB85-102242 Not available NTIS
National Bureau of Standards, Washington, DC.
Charge Transfer and Neutralization Mechanisms Involving Saturated Hydrocarbon Cations.
Final rept.
P. Ausloos. 1982, 11p
Pub. in Radiation Physics and Chemistry 20, n1 p87-97 1982.

Keywords: *Hydrocarbons, *Cations, *Radiolysis, Mass spectroscopy, Excitation, Charging, Radiation chemistry, Reprints.

Charge transfer reactions occurring in saturated hydrocarbons in both the gas and condensed phases are discussed in light of results from recent mass spectrometric and pulse radiolytic investigations. It is concluded that in both phases, electron transfer from a hydrocarbon molecule to a molecular cation occurs at every encounter except when the reaction is close to thermoneutral. The mechanism of the charge recombination process for solvent and solute cations is examined for both solvent and solute cations in binary mixtures of saturated hydrocarbons using results from recent studies on the photofragmentation of highly excited hydrocarbon molecules. It is concluded that while the mechanism of neutralization of the solute cation can be predicted from the photochemical results, that of the solvent cation can not. It is suggested that solvent cations are produced with excess vibrational and electronic energy which is not entirely dissipated at the time of charge recombination. These findings are consistent with pulse radiolysis findings, which showed that the G-value of thermally relaxed singlet excited molecules produced by charge recombination is quite low.

702,727
PB85-123644 Not available NTIS
National Bureau of Standards, Washington, DC.
Counters, Accelerators, and Chemistry.
Final rept.
L. A. Currie, and G. A. Klouda. 1982, 27p
Pub. in American Chemical Society Symposium Series 176, p159-185 1982.

Keywords: *Radioactive age determination, *Radioactive isotopes, Sampling, Accelerating(Chemistry), Sampling, Chemical analysis, Reprints.

Important advances in radioactive dating techniques are extending our measurement frontiers to very much smaller samples and smaller radioisotope ratios (greater ages). These advances promise major progress in our understanding of both anthropogenic and natural processes provided that we pay strict attention to: (a) the inherent accuracy and precision of the respective techniques, and (b) the tremendous increase in information content and sample reliability which may come about through the selective addition of microchemical or physical observations (or operations). Following a brief discussion of the comparative performance of small sample liquid scintillation counting, gas proportional counting and direct atom (accelerator) counting (with respect to precision, sample size and destruction, and non-Poisson error components), the authors shall illustrate the critical role that serial and parallel chemical information has played in the modeling and interpretation of environmental radiocarbon data. (Serial data have included selective sampling (<10 mg-C samples), followed by the determination of (14)C in specific compounds or classes of compounds as well as in volatile/non-volatile and size-selected particle fractions; parallel data have included isotopic ((13)C), elementary and organic composition.)

702,728
PB85-202141 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pulse-Radiolysis and Gamma-Ray-Radiolysis of Cyclohexane - Ion Recombination Mechanisms.
Final rept.
P. Ausloos, R. E. Rebbert, F. P. Schwarz, and S. G. Lias. 1983, 17p
Pub. in Radiation Physics and Chemistry 21, n1-2 p27-43 1983.

Keywords: *Cyclohexane, *Radiolysis, Ions, Ethylene, Butadiene, Neutralization, Reprints, *Pulse radiolysis, *Gamma ray radiolysis, Ion molecule interactions, Chemical reaction mechanisms, Ion fragmentation.

The products formed in the gamma-radiolysis and pulse-radiolysis of gaseous cyclohexane have been interpreted in terms of the ion fragmentation, ion-molecule reaction, and ion recombination mechanisms. It is shown that the fragmentation of the parent ion is partly quenched at a pressure of 55 torr. Ethylene and 1,3-butadiene are the major products resulting from electron neutralization of these ions. Fragmentation is strongly reduced when the neutralization process involves an atomic- or polyatomic-anion rather than an electron. For instance, addition of CCl4 to cyclohexane results in a sharp drop of the yield of 1,3-butadiene, and a concurrent rise in the yield of 2-C4H8.

702,729
PB86-161015 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Kinetics of the Early Hydration of Tricalcium Aluminate in Solutions Containing Calcium Sulfate.
Final rept.
P. W. Brown, L. O. Liberman, and G. Frohnsdorff. 1984, 13p
Pub. in Jnl. of the American Ceramic Society 67, n12 p793-795 Dec 84.

Keywords: *Reaction kinetics, *Hydration, Solutions, Surface areas, Concentration(Composition), Reprints, *Tricalcium aluminate, *Calcium sulfate, Hydroxyl ions.

The rates of reaction of 3CaO:A12O3 in sulfate containing solutions was investigated. It was observed that the rates of calcium sulfoaluminate hydrate formation from a mixed solution containing calcium hydroxide and calcium sulfate are much lower than those from calcium sulfate solution. In a further experiment using sulfate solution buffered with NaOH, it was established that the kinetics of calcium sulfoaluminate hydrate formation are strongly dependent on the hydroxyl ion concentration. It was also determined that the rate of sulfate ion consumption per unit surface of 3CaO:Al2O3 is constant during the period in which a calcium sulfoaluminate hydrate is the reaction product.

702,730
PB86-161064 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Accurate Quantum Yields by Laser Gain vs Absorption Spectroscopy: Investigation of Br/Br* Channels in Photofragmentation of Br2 and IBr.
Final rept.
H. H. Haugen, E. Weitz, and S. R. Leone. 1985, 11p
Contract NAG1-437, Grant NSF-CHE79-11340
Sponsored in part by Grant NSF-PHY82-00805. Sponsored by National Aeronautics and Space Administra-

tion, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 83, n7 p3402-3412, 1 Oct 85.

Keywords: *Bromine, *Quantum efficiency, Reprints, *Iodine bromides, Color center lasers.

A two-laser pulse-and-probe technique is used to study photofragmentation of Br2 and IBr over the wavelength range 450-530 nm. The metastable Br(doublet P(1/2)-doublet P(3/2) transition is probed by time-resolved laser gain vs absorption spectroscopy using a tunable color center laser. The new approach to the measurement of quantum yields provides highly accurate absolute values for Br*(P1/2)production. The peak quantum yield for Br2 photodissociation is phi 87% at lambda = 500 nm. the difference between the spectral variation of phi and the total absorption spectrum characterizes the A state of bromine, which contributes 14% to the absorption spectrum at lambda = 510nm. The peak in the Br* yield from photofragmentation of IBris about 73% at lambda = 500 nm. The present absolute IBr data together with the previous molecular beam studies suggest a reassessment of the contributions of the continuum states in IBr. The laser gain vs absorption method for obtaining quantum yields is readily generalized to other atoms and molecules.

702,731
PB86-162211 PC **A13**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Technical Activities 1985 - Center for Radiation Research.
C. E. Kuyatt. Oct 85, 288p NBSIR-85/3232
See also PB85-164952.

Keywords: *Research projects, *Radiation chemistry, *Nuclear physics, *Plasma radiation, Nuclear radiation, Laboratory equipment, Sources, Ionizing radiation, Atomizing.

The report summarizes research projects, measurement method development, calibration and testing, and data evaluation activities that were carried out during Fiscal Year 1985 in the NBS Center for Radiation Research. These activities fall in the areas of atomic and plasma radiation, radiation physics, radiometric physics, radiation sources and instrumentation, ionizing radiation, and nuclear physics.

702,732
PB86-187721 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Application of an InGaAsP Diode Laser to Probe Photodissociation Dynamics: I* Quantum Yields from n-and i-C3F7I and CH3I by Laser Gain versus Absorption Spectroscopy.
Final rept.
W. P. Hess, S. J. Kohler, H. K. Haugen, and S. R. Leone. 15 Feb 86, 7p
Contract NAG1-437, Grant NSF-CHE84-08403
Sponsored in part by Grant NSF-PHY82-00805. Sponsored by National Science Foundation, Washington, DC., and National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Physics 84, p2143-2149, 15 Feb 86.

Keywords: Photochemistry, Quantum efficiency, Aliphatic compounds, Semiconductor lasers, Photochemical reactions, Reprints, *Iodine atoms, Laser applications.

No abstract available.

702,733
PB86-192978 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Radiolytic Studies of the Cumyloxyl Radical in Aqueous-Solutions.
Final rept.
P. Neta, M. Dizdaroglu, and M. G. Simic. 1984, 4p
Pub. in Israel Jnl. of Chemistry 24, n1 p25-28 1984.

Keywords: *Chemical radicals, Free radicals, Reaction kinetics, Reprints, *Pulse radiolysis, *Hydroperoxide/dimethylbenzyl.

Formation and reactions of the cymyloxyl radical in aqueous solutions were studied by steady-state and pulse radiolytic techniques. Cumene hydroperoxide reacts with e (sup minus) (sub aq) (k - 4.4 x 10 to the 9th power/Ms) to yield the cumyloxyl radical. The spectrum recorded after the pulse indicates formation of a species absorbing at 250 nm. This product was identified as acetophenone, formed by the fragmentation of the cymyloxyl radical. By comparison of the pseudo-first order rates of e (sup minus) (sub aq) decay at 600 nm with the rate of production of acetophenone at 245 nm at increasing concentrations of cumene hydroperoxide, it was possible to derive a rate constant of 1.0 x 10 to the 7th power/s for the cleavage of cumyloxyl to acetophenone and methyl radical. This value is higher than that measured previously in organic solvents, as expected. Product analysis (of acetophenone and cumyl alcohol) by HPLC permitted determination of rate constants for hydrogen abstraction by the cumyloxyl radical, in competition with the fragmentation. The rate constants for i-PrOH, EtOH, and MeOH were 9,900,000, 3,800,000, and 850,000/Ms, respectively.

702,734
PB86-196516 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Variational Determination of Self-Consistent Interactions in Atomic Collisions.
Final rept.
D. A. Micha. 1983, 9p
Pub. in International Jnl. of Quantum Chemistry 17, p153-161 1983.

Keywords: *Particle collisions, *Atomic properties, Collisions, Reprints.

State-to-state transition amplitudes are obtained from a variational functional, for two colliding atomic systems whose states are self-consistently coupled. Specifying classical center-of-mass trajectories, the approach leads to an extension of the time-dependent self-consistent field approximation; which requires iterative solutions of equations for forward and backward motions in time. The variational procedure is described for trial wave functions and trial transition densities. It is briefly illustrated with a model of two interacting two-state atoms.

702,735
PB86-202835 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Reactivities of Organic Oxygen (Oxy) Radicals.
Final rept.
M. G. Simic, and E. P. L. Hunter. 1984, 3p
Pub. in Proceedings of Oxygen Radicals in Chemistry and Biology, Neuherberg, Munich, Germany, July 10-15, 1983, p19-21 1984.

Keywords: *Chemical radicals, *Oxygen, *Free radicals, Reaction kinetics, Organic compounds, Peroxy radicals, Alkoxy radicals, Pulse radiolysis.

Pulse radiolytic generation of peroxy, HROO, alkoxy, HRO and aroxy, ArO radicals in aqueous and nonpolar media has been exploited in the study of the properties of these organic oxygen (oxy) radicals. Special attention has been given to the formation and radical-radical disappearance of certain aroxy radicals such as phenoxy, naphthoxy, and chromanoxy radicals. Their generation by OH, O(1-) and CO3(1-), and the simplest organic oxy radical, was compared and the advantages of using CO3(1-) for 100 percent yield of aroxy radicals pointed out.

702,736
PB86-229382 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Radiolysis of Bromophenol Blue in Aqueous Solutions.
Final rept.
F. A. Rahim, S. A. Eid, N. Souka, and W. L. McLaughlin. 1986, 7p
Pub. in Jnl. of Radiation Physics and Chemistry 27, n3 p211-217 1986.

Keywords: *Radiation effects, Radiolysis, Bromine aromatic compounds, Dosimetry, Gamma rays, Reprints, *Bromophenol blue, Chemical reaction kinetics, Rate constants.

The effect of gamma radiation on the color intensity of aerated and oxygenated aqueous solution of bromophenol blue (BPB) was investigated. Ionizing radiation at increasing absorbed doses (D) brought about gradual bleaching (i.e. decrease in optical absorbance, -delta A) of bromophenol blue solutions. The molar extinction coefficients of acidic, neutral, and alkaline solutions were measured and found to be independent of temperature during spectrophotometry between 20 and 40 deg C. Aerated and oxygen-saturated acidic solutions showed a linear response (-delta A vs D) up to doses of 2.4 and 2.1 kGy, respectively. Aerated alkaline solutions on the other hand showed a linear response up to 4.8 kGy. The degree of decoloration of bromophenol blue in acidic solutions was found to decrease upon the addition of ethanol, G(-BPB) decreasing from 0.24 to 0.088 upon the addition of ethanol at a concentration of .01M. Suggestions are made for possible radiation dosimetry in the dose range (0.1-5kGy) by means of spectrophotometric analysis of absorption spectra.

702,737
PB86-229390 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Response of Radiation Monitoring Labels to Gamma Rays and Electrons.
Final rept.
F. A. Rahim, A. Miller, and W. L. McLaughlin. 1985, 9p
Pub. in Jnl. of Radiation Physics and Chemistry 25, n4-6 p767-775 1985.

Keywords: *Dosimeters, *Labels, *Chemical indicators, Gamma rays, Electrons, Quality control, Reprints, Radiation monitoring, Radiation doses, Radiochromatography.

Many kinds of coated or impregnated reflecting papers change color or become colored by large radiation doses. Such papers or 'labels' do not generally supply dosimetry information, but may give useful inventory information, namely a visual indication of whether or not an industrial product or location has been irradiated to high doses. Tests of stability, sensitivity of ambient light, and differences in dose rate and radiation type (gamma rays and electron beams) were made on 15 kinds of labels. The results show that, for many types of indicators, diverse effects may give misleading conclusions unless countermeasures are taken. For example, some of the most commonly used labels, which contain dyes that indicate changes of pH due to release of halogen from halogenated substrates, have limited shelf life and must be protected from extreme environmental conditions.

702,738
PB86-232956 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Photodissociation of Ions Generated by Soft Ionization Techniques.
Final rept.
M. J. Welch, R. Sams, and E. White. Apr 86, 5p
Pub. in Analytical Chemistry 58, n4 p890-894 Apr 86.

Keywords: Argon lasers, Reprints, *Photodissociation, Ion lasers, Cesium ions.

Photodissociation with visible light of ions generated by the soft ionization techniques cesium ion bombardment, field desorption, and field ionization has been demonstrated. An argon ion laser was used to irradiate ions in the first field-free region of a Mattauch-Herzog geometry mass spectrometer. Ions that dissociated in the region were detected by means of a linked scan at a constant ratio of the magnetic field to the electric field. The photodissociations of (M+H)+ ions from methyl red and bilirubin are used to illustrate the potential of the technique for providing structural information.

702,739
PB87-105896 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Radiation-Induced Crosslinking of Pyrimidine Oligonucleotides.
Final rept.
M. Dizdaroglu, and M. G. Simic. 1985, 8p
Pub. in Radiation Physics and Chemistry 26, n3 p309-316 1985.

Keywords: *Crosslinking, *Pyrimidines, Deoxyribonucleic acids, Chromatographic analysis, Radiation chemistry, Chemical radicals, Reprints, *Thymine, *Gamma radiation, Chemical reaction mechanisms, Nucleotides.

Small oligonucleotides of thymine and cytosine form crosslinks on gamma-irradiation in N2O-saturated aqueous solution. Products of crosslinking were separated and isolated by high-performance liquid chromatography and characterized by capillary gas chromatography-mass spectrometry. Quantitative measurements revealed that approximately 50% of primary water radicals account for the crosslinking. Mechanisms of product formation are presented.

702,740
PB87-105904 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Radiation-Induced Crosslinking of Cytosine.
Final rept.
M. Dizdaroglu, and M. G. Simic. 1984, 8p
Pub. in Radiation Research 100, n1 p41-48 1984.

Keywords: *Cytosine, *Crosslinking, Dimerization, Chromatographic analysis, Radiation chemistry, Gas chromatography, Chemical radicals, Reprints, *Gamma radiation, Deoxycytidine, Monophosphate/deoxycytidine.

Formation of dimers upon gamma-irradiation of cytosine, 2'-deoxycytidine and 2'-deoxycytidine-5'-monophosphate in N2O-saturated aqueous solutions was found to be a major process. Quantitative measurements revealed that more than 50% of OH adduct radicals of cytosine undergo dimerization. Derivatized dimers and monomeric products were separated and identified by combined capillary gas chromatography-mass spectrometry.

702,741
PB87-106126 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Triply Differential Photoelectron Studies of Resonances in Molecular Photoionization.
Final rept.
J. L. Dehmer, S. H. Southworth, and A. C. Parr. 1985, 6p
Pub. in Nuclear Instruments and Methods in Physics Research B10-11, n1 p247-252 1985.

Keywords: *Molecular structure, Resonance, Excitation, Ionization, Synchrotron radiation, *Photoelectrons, Reprints.

Shape and autoionizing resonances are central to the study of molecular photoionization for various reasons, the most obvious one being that they are usually displayed prominently against nonresonant behavior in such observables as the total photoionization cross section, photoionization branching ratios, and photoelectron angular distributions. More importantly, the study of resonant features has repeatedly led to a deeper physical insight into the mechanisms of excitation, resonant trapping of the photoelectron, and decay of the excited complex that occur during the photoionization process. A major impetus has been provided in the area by the ability to freely probe resonances throughout the ionization continuum with synchrotron radiation and to perform angle-resolved photoelectron spectrometry on the ejected electrons. Selected examples will serve to illustrate the recent progress and the prospects of the stream of work.

702,742
PB87-110250 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Ratio of Positron to Electron Bremsstrahlung Energy Loss: An Approximate Scaling Law.
Final rept.
L. Kim, R. H. Pratt, S. M. Seltzer, and M. J. Berger. 1986, 8p
Grant NSF-PHY84-20845
Sponsored by National Science Foundation, Washington, DC., Office of Naval Research, Arlington, VA., and Department of Energy, Washington, DC.
Pub. in Physical Review A 33, n5 p3002-3009 May 86.

Keywords: *Positrons, Electromagnetic radiation, Cross sections, Electrons, Kinetic energy, Bremsstrahlung, Reprints, *Electron-atom collisions, *Energy losses, EV range 10-100, EV range 100-1000, *Positron-atom collisions.

The authors have calculated the total energy loss of an incident electron or positron due to the bremsstrahlung radiation from various atoms during a scattering. The kinetic energies considered for the incident electrons and positrons were 10, 50, and 500 keV. The calculations were performed with our relativistic partial-wave multipole-expansion numerical code. The differences between the radiative energy loss of positrons and electrons are considerable and cannot be disregarded. The authors observe that the ratio of the radiative energy loss for positrons to that for electrons obeys a simple scaling law, being expressible fairly accurately as a function only of the quantity T(1)/(Z squared), where T(1) is the incident-particle kinetic energy and Z is the atomic number of the scatterer. The scaling law makes it possible to obtain the energy loss for positrons from existing electron bremsstrahlung data. The scaling is exact in the case of the point Coulomb potential, both in the classical bremsstrahlung formula and the nonrelativistic dipole Sommerfeld formula, not only for the ratio of total energy losses but also for the separate energy losses and even for the radiation energy spectrum.

702,743
PB87-114948 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Stark Broadening of Singly Ionized Neon Lines.
Final rept.
N. Konjevic, and T. L. Pittman. 1986, 5p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 35, n6 p473-477 1986.

Keywords: Ionization, Reprints, *Line broadening, *Stark broadening, *Neon ions, Stark effect, Plasma spectroscopy.

Stark profiles of 21 Ne II lines from 10 multiplets were measured in a low-pressure, pulsed arc. An electron density of 1.4 x 10 to the 23rd power/cu m was determined by laser interferometry and an electron temperature of 28000 K was measured using relative intensities of O II impurity lines. These experimental data are compared with a previous experiment, with semiclassical theoretical results, and with semiempirical calculations. They agree well, within experimental uncertainties, with both the experimental and the semiclassical results. However, systematic discrepancies exist when compared with the semiempirical results and these exceed the uncertainties of both the calculation and experiments. Also, the experimental Ne II Stark widths show good agreement with a recent study of regularities in plasma-broadened spectral line widths.

702,744
PB87-122750 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Enhancement of Lyoluminescence by Radiation Sensitization and Chemical Dopants.
Final rept.
R. E. Hanig. 1984, 3p
Pub. in International Jnl. of Applied Radiation and Isotopes 35, n10 p987-989 1984.

Keywords: Radiation chemistry, Dosimetry, Disaccharides, Reprints, *Lyoluminescence, *Trehalose, Augmentation, Chemical radiation effects.

Enhancement of the lyoluminescent effect has been accomplished by radiation sensitization of solutions of trehalose, using doses of about 30, 100, and 300 krad. The disaccharide, along with associated radiolysis products, is then recrystallized from solution. Preliminary comparison of these doped sugars with untreated sugar, irradiated at doses of 1, 5, and 10 rads, indicate they give a better signal-to-background ratio for lyoluminescence dosimetry. A promising reaction model is postulated which assumes a two-component exponential decay of light, multiplied by a first-order buildup term for the dissolving factor. The model seems to fit both the ordinary and the luminol-enhanced lyoluminescent glow-curves.

702,745
PB87-128450 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Quantum Yield of Vinylidene ((3)B2) from the Vacuum UV Photolysis of Acetylene and Ethylene.
Final rept.
A. Fahr, and A. H. Laufer. 1986, 6p
Pub. in Jnl. of Photochemistry 34, p261-266 1986.

Keywords: *Ethylene, *Acetylene, *Vinylidene resins, Photolysis, Quantum yield, Reaction kinetics, Thermoplastic resins, Chemical radicals, Ultraviolet radiation, Reprints, *Photochemistry, Vinylidene radicals, Vinyl radicals.

The primary processes in the photodecomposition in the vacuum UV of the unsaturated hydrocarbons acetylene and ethylene have been investigated. The formation of electronically excited triplet vinylidene (H2C = C) radicals is shown to be a major process. The quantum yields of vinylidene production are equal to 0.4 and 0.75 from acetylene and ethylene respectively. Vinyl radical formation in the ethylene photolysis is discussed.

702,746
PB87-130506 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Spin Dependence in Superelastic Electron Scattering from Excited Sodium.
Final rept.
M. H. Kelley, R. J. Celotta, and J. J. McClelland. 1986, 3p
Pub. in Proceedings of DOE (Department of Energy) Atomic Physics Program Contractors' Workshop, Boulder, CO., April 14-15, 1986, 3p.

Keywords: Excitation, *Sodium atoms, Elastic scattering, Electron scattering.

Spin asymmetries are presented for superelastic scattering of spin-polarized electrons from spin-polarized M sub L = +1 and M sub L = -1 states of the Na 3P (sub 3/2) atom. The incident energy dependence at a scattering angle of 30 degrees is shown for energies of 1.26 eV to 11.76 eV. In addition, angular dependencies over the range 5 to 40 degrees are given at 2.0 and 9.26 eV. Large differences are seen between the spin asymmetries for the two M sub L-sublevels of the excited state, with the M sub L = -1 asymmetry reaching a value of 100% at 2 eV and 35 degrees scattering angle, corresponding to pure singlet scattering.

702,747
PB87-134474 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Experimental Study of Stark Broadened N II Lines from States of High Orbital Angular Momentum.
Final rept.
T. L. Pittman, and N. Konjevic. 1986, 6p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 36, n4 p289-294 1986.

Keywords: Atomic energy levels, Ionization, Reprints, *Nitrogen ions, *Stark broadening, *Line broadening, Plasma spectroscopy.

In the paper, the authors report experimental electron impact widths for six spectral lines belonging to 3d-4f transitions of singly ionized nitrogen. Line profiles were measured in a low pressure pulsed arc. An electron density in the range 5.9-7.5x10 to the -22nd power cc m was determined from the Stark width of the He II 4686 A line, while electron temperatures of 28,300-32,300 K were measured using relative intensities of O II impurity lines. Comparison with semiempirical theoretical results does not resolve which coupling scheme, LS or LK, is better to describe atomic states in Stark broadening calculations of certain N II lines.

702,748
PB87-134680 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Angular Distribution of Fluorescence from Photoionization-Produced He(1+) (n=2).
Final rept.
J. Jimenez-Mier, C. D. Caldwell, and D. L. Ederer. 1986, 4p
Pub. in Physical Review Letters 57, n18 p2260-2263, 3 Nov 86.

Keywords: *Fluorescence, *Helium, Angular distribution, Excitation, Reprints, Photoionization, Synchrotron radiation.

The authors report the first measurement of the angular distribution of the 304-A He(1+) (n=2) radiation following photoionization. The distribution reflects the alignment of the ion, which is related to the fraction epsilon-sigma(2p,kd)/(sigma(2p,ks)+sigma(2p,kd)) of d component in the electron wave. The experimental angular distributions correspond to alignments of -0.62 + or - 0.03 and -0.62 + or - 0.02 at photon energies of 65.5 and 66.5 eV, respectively. These translate into ratios epsilon-0.25 + or - 0.04 and 0.25 + or - 0.03, in good agreement with close-coupling calculations.

702,749
PB87-137170
(Order as PB87-137154, PC **A04**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Absolute Isotopic Abundance Ratio and Atomic Weight of a Reference Sample of Gallium.
L. A. Machlan, J. W. Gramlich, L. J. Powell, and G. M. Lambert. 25 Jun 86, 9p
Included in Jnl. of Research of the National Bureau of Standards, v91 n6 p323-331 Nov-Dec 86.

Keywords: *Gallium, *Chemical analysis, Atomic mass, Gallium isotopes, Mass spectroscopy, *Isotope ratio, *Reference materials, Gallium 69, Gallium 71.

An absolute value has been obtained for the isotopic abundance ratio of a reference sample of gallium (Standard Reference Material 994), using thermal ionization mass spectrometry. Samples of known isotopic composition, prepared from nearly isotopically pure separated gallium isotopes, were used to calibrate the mass spectrometers. The resulting absolute (69)Ga/(71)Ga ratio is 1.50676 + or - 0.00039, which yields atom percents of (69)Ga=60.1079 + or - 0.0062 and (71)Ga=39.8921 + or - 0.0062. The atomic weight calculated from this isotopic composition is 69.72307 + or - 0.00013. The indicated uncertainties are overall limits of error based on two standard deviations of the mean and allowances for the effects of known sources of possible systematic error.

702,750
PB87-140232 PC **A14**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Technical Activities 1986, Center for Radiation Research.
C. E. Kuyatt. Nov 86, 313p NBSIR-86/3441
See also PB86-162211.

Keywords: *Research projects, *Radiation chemistry, *Nuclear physics, *Plasma radiation, Nuclear radiation, Laboratory equipment, Sources, Calibrating.

The report summarizes research projects, measurement method development, calibration and testing, and data evaluation activities that were carried out during Fiscal Year 1986 in the NBS Center for Radiation Research. These activities fall in the areas of atomic and plasma radiation, radiation physics, radiometric physics, radiation sources and instrumentation, ionizing radiation, and nuclear physics.

702,751
PB87-148367 Not available NTIS
Argonne National Lab., IL.
Rate Constants for Reactions of Radiation-Produced Transients in Aqueous Solutions of Actinides.
S. Gordon, J. C. Sullivan, and A. B. Ross. c1986, 12p
Prepared in cooperation with Notre Dame Univ., IN. Radiation Chemistry Data Center. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n4 p1357-1368 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Actinide series compounds, Radiation chemistry, Chemical reactions, *Rate constants.

Rate constants have been critically compiled for reactions of ions of the actinides Am, Cf, Cm, Np, Pu, Th, and U, as well as the element Tc, in different oxidation states with various chemical species in aqueous solution. The reactants include products of the radiolysis of water (hydrated electrons, hydrogen atoms, hydroxyl radicals, hydrogen peroxide) and transient species derived from other solutes (e.g., carbonate radical). The data are useful in the estimation of migration properties of actinides, which are relevant to waste management studies.

702,752
PB87-162178 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Positive Charge Transfer in the UV Photolysis and beta Radiolysis of trans-Decalin Solutions.
Final rept.,
F. P. Schwarz. 1985, 13p
Pub. in Radiation Physics and Chemistry 26, n4 p401-413 1985.

Keywords: *Photolysis, *Radiolysis, Energy transfer, Toluene, Benzene, Reprints, *Decalin, Benzene/fluoro, Benzene/difluoro.

Dilute solutions of benzene, fluorobenzene, o-difluorobenzene, m-difluorobenzene, p-difluorobenzene, and toluene in trans-decalin have been irradiated with UV light and with beta radiation. Fluorescence measurements on the additive aromatic species permit a determination of the efficiency of energy transfer from the lowest excited singlet state of trans-decalin, and, above the ionization onset, of charge transfer from the trans-decalin radical cation. The aromatic ions generated in the charge transfer process undergo recombination with electrons, resulting in excited species with fluorescence; this recombination fluorescence is shown to give an indication of the relative importance of the charge transfer reaction. Although the factors which influence the efficiencies of the observed charge transfer processes are not completely understood, a general trend is observed of increasing efficiency of charge transfer as the reaction is increasingly energetic.

702,753
PB87-163788 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Observation of Radiative Transfer of Polarized Light.
Final rept.,
M. Belsley, A. Streater, K. Burnett, P. Ewart, and J. Cooper. 1986, 11p
Grant NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 36, n2 p163-173 1986.

Keywords: Polarization, Reprints, *Polarized light, Radiative transfer.

The results of an experiment sensitive to polarization and angle-dependent effects of resonance line radiation transport in a collisional environment are presented. Having measured both the excited atomic state population and alignment as a function of distance from the initial excitation, considerable anisotropy in the alignment is found. Included in the discussion are the results of an angle-average model calculation, which allows us to point out, in a qualitatively way, some of the important physics of the problem.

702,754
PB87-197778 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Comparison of the Electronic Energy Levels of Diatomic Molecules in the Gas Phase and in Inert Solid Matrices.
Final rept.,
M. E. Jacox. 1987, 17p
Pub. in Jnl. of Molecular Structure 157, p43-59 1987.

Keywords: *Diatomic molecules, Matrix isolation, Vibrational structure, Reprints, *Charge transfer, Electronic band origins, Rydberg states.

Electronic band origins and vibrational band spacings in excited electronic states have been compared for the approximately 230 electronic transitions of diatomic molecules which have been observed both in the gas phase and in rare-gas or nitrogen matrices. With few exceptions, valence transitions and the associated vibrational band spacings are shifted by less than about 1% in neon matrices. Somewhat larger shifts, often to longer wavelengths, result from isolation of the molecule in a heavier rare-gas or a nitrogen matrix. The perturbation of Rydberg transitions by the matrix, the effects of charge-transfer interaction with the heavier rare-gas matrices, and the behavior of the potential curve of the matrix-isolated molecule in the vicinity of the dissociation continuum are discussed.

702,755
PB87-197919 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Quantification of Pulsed Ion Currents Produced in Resonance Ionization Mass Spectrometry.
Final rept.,
J. D. Fassett, R. J. Walker, J. C. Travis, and F. C. Ruegg. 1987, 16p
Pub. in International Jnl. of Mas Spectrometry and Ion Processes 75, p111-126 1987.

Keywords: *Ion detection, Mass spectrometry, Osmium, Resonance ionization, Rhenium, Reprints, *Isotope ratio, *Laser ionization.

An evaluation is made of a measurement system that quantifies the pulsed ion currents produced in resonance ionization mass spectrometry. An electron multiplier detector operated at intermediate gain has been combined with a preamplifier and a transient digitizer. The output of the transient digitizer is processed in real time so that no ionization information is lost. The linearity, pulse height distributions, and gain of the detector system have been examined. Operation of the detector in pulse counting and analog modes is demonstrated. Ratio measurements representative of these detection modes are presented for 185Re/187Re and 184Os/192Os.

702,756
PB87-201596 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Optical Studies of Product State Distributions in Thermal Energy Ion-Molecule Reactions.
Final rept.,
V. M. Bierbaum, and S. R. Leone. 1987, 33p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and National Sanitation Foundation, Ann Arbor, MI.
Pub. in Structure/Reactivity and Thermochemistry of Ions, p23-55 1987.

Keywords: *Auroras, Chemiluminescence, Optical properties, Fluorescence, *Ion-molecule interactions.

Product state distributions of thermal energy ion-molecule reactions are determined by the sensitive optical methods of infrared chemiluminescence and laser-induced fluorescence detection. Experiments to obtain detailed vibrational state populations are carried out in a flowing afterglow reaction vessel, and measurements to extract rotational state distributions are performed in a single-collisions crossed-beam apparatus that uses a flowing afterglow ion source. Product state information is obtained for a series of proton transfer reactions and charge transfer reactions, which reveals many aspects of the dynamical behaviors of these processes. Measurements are also presented for polyatomic ion-molecule reactions, for optically-determined rates of ion collisional excitation, and deactivation, and on visible chemiluminescence yields and branching fractions for reactions important in the aurora.

702,757
PB87-223764 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Effect of Closed Classical Orbits on Quantum Spectra: Ionization of Atoms in a Magnetic Field.
Final rept.,
M. L. Du, and J. B. Delos. 27 Apr 87, 3p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review Letters 58, n17 p1731-1733, 27 Apr 87.

Keywords: *Absorption spectra, Magnetic fields, Reprints, *Photoionization, Rydberg states, Chaos.

Measurements of the absorption spectrum near the ionization threshold for an atom in a strong magnetic field showed that the spectrum is a superposition of many oscillatory terms ('quasi-Landau oscillations'). The authors have developed a quantitative theory which shows that each classical closed electron orbit which begins and ends near the nucleus contributes an oscillatory term to the average oscillator strength. The theory gives new understanding of the behavior under combined Coulomb and Lorentz forces, and it elucidates the role of isolated closed orbits in chaotic systems. The first results of the theory are shown to be in good agreement with experimental results.

702,758
PB87-233490 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Importance of Multiple Scattering in X-ray Photoelectron and Auger Electron Diffraction in Crystals (Summary Abstract).
Final rept.,
W. F. Egelhoff. Aug 87, 1p
Pub. in Jnl. of Vacuum Science and Technology A 5, n4 p1684 Jul/Aug 87.

Keywords: *Auger spectroscopy, *Epitaxy, Copper, Forward scattering, Multiple scattering, Nickel, Reprints, Photoelectron spectroscopy.

Angle resolved x-ray photoelectron and Auger electron spectra of sandwich structures of epitaxial Ni on Cu on Ni have been used to assess the importance of multiple scattering of the electron wave in XPS and Auger diffraction. It is found that multiple scattering is very important for the part of the wave that travels down a row of atoms for more than about three atomic spacings.

702,759
PB87-233938 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Collision-Induced Dissociation of Laser-Excited Br2 (B Triplet Pi(O+, sub u);v',J'): Formation of Br*(doublet P(1/2))+Br(doublet P(3/2)) at Energies 1-5 kT Below Dissociation.
Final rept.,
J. E. Smedley, H. K. Haugen, and S. R. Leone. 1987, 12p
Grants NSF-PHY86-04504, NSF-CHE84-08403
Sponsored by National Science Foundation, Washington, DC., and Army Research Office, Research Triangle Park, NC.
Pub. in Jnl. of Chemical Physics 86, n12 p6801-6812, 15 Jun 87.

Keywords: *Bromine, *Dissociation, Excitation, Reprints, *Photodissociation, Atom-molecule collisions, Molecule-molecule collisions, Laser radiation.

Absolute rate constants are measured for the title problem by thermal energy collisions with Br2(X singlet (Sigma sub g)(1+)), Xe, and Ar at 297 K. A 0.04/cm etalon-narrowed pulsed dye laser populates specific rovibrational levels of isotopic Br2 which are 1-5 kT below the B-state dissociation limit; in addition the laser directly photodissociates molecules which are in thermally excited vibrational levels. The method used to determine the absolute rate constants combines four sets of experimental determinations, which include infrared detection of Br*, visible Br2(B) fluorescence lifetimes, absorption spectroscopy of Br2 (B<-Y), and transient gain-vs-absorption spectroscopy on Br/Br*.

702,760
PB88-110705 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Yields of Excited States of Aromatic Derivatives in the Radiolysis of Hydrocarbon Solutions.
Final rept.,
F. P. Schwarz, and D. Smith. 1985, 10p
Pub. in Radiation Physics and Chemistry 26, n3 p257-266 1985.

Keywords: *Hydrocarbons, *Aromatic compounds, *Radiolysis, Fluorescence, Solutions, Radiation chemistry, Cations, Emittance, Scavenging, Reprints.

The yields of aromatic excited singlet states produced in the steady state beta radiolysis of solutions of the aromatics in cis-decalin, decane, cyclohexane, cyclopentane, isopentane, and 2,2,4-trimethylpentane are determined from fluorescence measurements. The aromatic solutes are toluene, 1-methylnaphthalene (1-methylnaphthalene is also an electron scavenger), and aniline, which can scavenge positive charge from the solvent cations produced in the radiolysis.

702,761
PB88-112677 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Spectral Data for Molybdenum Ions, Mo VI-Mo XLII,
T. Shirai, Y. Nakai, K. Ozawa, K. Ishii, and J. Sugar. c1987, 51p
Prepared in cooperation with Japan Atomic Energy Research Inst., Tokai, Kyoto Univ. (Japan), and Japan Information Center of Science and Technology, Tokyo. Included in Jnl. of Physical and Chemical Reference Data, v16 n2 p327-377 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Atomic data, *Energy levels, Molybdenum, Spectra.

Wavelengths, intensities, and classifications for the molybdenum ions Mo VI to Mo VLII are compiled. A short review of the work on each stage of ionization is included. The data are critically evaluated and the best results are quoted.

702,762
PB88-120977 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Office of Nondestructive Evaluation.
Measurement and Analysis of the Far Infrared Absorption Spectrum of the Gaseous Mixture H2-CH4.
Final rept.,
G. Birnbaum, A. Borysow, and H. G. Sutter. 1987, 11p
Contract NSF-AST83-10786
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 38, n3 p189-199 1987.

Keywords: Reprints, *Bandshape, *Absorption, *Far infrared, Planetary atmosphere, Spectral moments.

The collision-induced absorption of H2-CH4 mixtures was measured from approx. 20 to 900 per cm. at 195 and 297 K. By subtracting the absorption due to H2-H2 and CH4-CH4 collisions from that of the mixture, the absorption due to H2-CH4 collisions was obtained. This spectrum was analyzed using the BC model line shape to provide a way of estimating the far-i.r. spectrum of H2-CH4 for various concentrations of H2 and CH4. Theoretical spectral moments were computed with different potential functions and compared with experimental values.

702,763
PB88-152186 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Photodissociation Dynamics of Small Molecules.
Final rept.,
W. M. Jackson, and H. Okabe. 1986, 94p
Pub. in Advances in Photochemistry 13, p1-94 1986.

Keywords: *Photodissociation, Photochemical reactions, Molecules, Fluorescence, Reprints, Time of flight spectrometers, Radicals.

The manuscript is a recent review on photochemistry primary processes of about 60 small molecules. The review emphasizes the detection of photofragments (free radicals and small molecules) by laser induced fluorescence (LIF), time of flight, coherent anti-Stokes Raman spectroscopy (CARS), and other recent techniques, by which the internal and translational energies of the photofragments can be accessed.

702,764
PB88-152988 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Use of an Optical Multi-Channel Analyzer for Recording Absorption Spectra of Short-Lived Transients.
Final rept.,
E. P. L. Hunter, M. G. Simic, and B. D. Michael. 1985, 6p
Pub. in Review of Scientific Instruments 56, n12 p2199-2204 Dec 85.

Keywords: *Pulse height analyzers, *Absorption spectra, *Photolysis, *Radiolysis, Signal to noise ratio, Resolution, Reprints, Transients.

Characteristics of an adapted commercial optical multichannel analyzer system for recording of transient absorption spectra in single shot pulse radiolysis and flash photolysis are described. The features discussed include temporal (2 microsec) and spectral (1nm) resolution, signal-to-noise ratio and its improvement, linearity of response, and wavelength coverage (300-650 nm). The system is intermediate in both cost and capabilities compared to two other methods: (1) recording transient spectra by repetitive pulsing and (2) using an image converter streak camera. The system is convenient for discrimination of small differences in fine structured absorption spectra of short lived species.

Physical & Theoretical Chemistry

702,765
AD-A029 876/0 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Potential Function for Axial-Equatorial Fluorine Atom Exchange in PF5, AsF5, and VF5.
L. S. Bernstein, S. Abramowitz, and I. W. Levin. 22 Dec 75, 11p AFOSR-TR-76-1049
Availability: Pub. in The Jnl. of Chemical Physics, v64 n8 p3228-3236, 15 Apr 76.

Keywords: *Fluorides, *Vibrational spectra, Raman spectroscopy, Phosphorus compounds, Arsenic compounds, Vanadium compounds, Barriers, Fluorine, Stereochemistry, Gases, Room temperature, Transitions, Reprints, Phosphorus fluorides, Vanadium fluorides, Arsenous fluorides.

Gas-phase Raman spectra of the Nu sub 7 fundamentals of AsF5 and VF5 were recorded for spectral resolutions approaching 1.5 reciprocal cm. The vibrational transitions associated with Nu sub 7 for these systems, as well as for PF5, were interpreted in terms of a two-dimensional anharmonic potential function constrained to a double minimum form for the motions leading to axial-equatorial fluorine atom exchange. The intramolecular exchange barrier heights, determined by the double minimum potentials, lie between 1139 and 995 reciprocal cm (3.26 to 2.84 kcal/mol where 1 kcal/mol= 4.184 kJ/mol) for PF5, 864 and 755 reciprocal cm (2.47 and 2.16 kcal/mol) for AsF5, and 593 and 428 reciprocal cm (1.54 and 1.22 kcal/mol) for VF5. A discussion of the dynamics of the fluorine atom interchange pathways suggest that these trigonal bipyramidal (D sub 3h) molecules form C sub 4-Nu intermediates by initially displacing the equatorial fluorine atoms and then by mixing in the axial fluorine distortions as the intramolecular exchange proceeds. (Author)

702,766
AD-A037 269/8 PC **A02**/MF **A01**
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Quenching of Optically Pumped O2(b 1-Sigma(+) sub g) by Ground State O2 Molecules.
S. A. Lawton, S. E. Novick, H. P. Broida, and A. V. Phelps. 7 Oct 76, 2p
Contract N00014-76-C-0123, Grant DAAG29-76-G-0236
Availability: Pub. in The Jnl. of Chemical Physics, v66 n3 p1381-1382, 1 Feb 77.

Keywords: *Optical pumping, *Oxygen, Ground state, Molecular states, Quenching(Inhibition), Reprints, Photoluminescence, Lasers, Molecular energy levels.

Measurements of quenching of the b 1-sigma(+) sub g state of O2 by ground state oxygen molecules have yielded rate coefficients which differ widely. Very recent measurements by Martin, Cohen, and Schatz using pulsed laser excitation and photoluminescence of the atmospheric A band of O2 agree with the lowest of the previously measured rate coefficients. The present experiment confirms their results at near atmospheric O2 pressures and extends the measurements to much lower O2 pressures. In addition, we were able to excite the O2 using absorption at the more readily available wavelengths of the B band of O2 and to observe the photoluminescence at the well-separated A band of O2. Attempts to produce photoluminescence in O2 using other absorption bands were unsuccessful.

702,767
AD-A039 987/3 PC **A02**/MF **A01**
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Improved Model for Parallel-Plate Drift-Tube Experiments.
J. H. Whealton, D. S. Burch, and A. V. Phelps. 15 Nov 76, 11p
Availability: Pub. in Physical Review A, v15 n4 p1685-1695 Apr 77.

Keywords: *Drift tube mass spectroscopy, *Diffusion theory, Electron beams, Transport properties, Monte Carlo method, Cathodes, Adsorption, Green's function, Reprints.

The validity of analysis of parallel-plate drift-tube experiments by use of diffusion theory is examined. Monte Carlo simulations demonstrate the inadequacy of such analyses for electron motion near an absorb-

ing cathode . However, diffusion theory results are verified for situations in which cathodic absorption is negligible, provided that a parameter beta, the ratio of energy relaxation distance to drift-tube length, is much smaller than unity. For experimental circumstances in which cathode effects may be distinguished from those of anodic absorption, circuit time constant, and ionization, the Monte Carlo results can be used to augment diffusion theory for interpretation of the observed transients in terms of transport coefficients. (Author)

702,768
AD-A050 492/8 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
X-ray Photoemission Study of Physically Adsorbed SF6.
Technical rept.
G. B. Fisher, N. E. Erickson, T. E. Madey, and J. T. Yates. 23 Dec 76, 22p Rept no. TR-8
Contract N00014-77-F-0008
Availability: Pub. in Surface Science, v65 p210-228 1977.

Keywords: *X ray photoelectron spectroscopy, *Adsorption, Sulfur compounds, Fluorides, Surface energy, Relaxation, Substrates, Ruthenium, Reprints, *Sulfur hexafluorides.

The physical adsorption of octahedral SF6 on Ru(001) has been studied with X-ray photoelectron spectroscopy (XPS) in an attempt to see effects on the energy levels resulting from the conformation of the molecule on the surface. Near 80 K, surface coverages up to a monolayer have been studied at various steady state pressures of SF6. Kinetic studies, core level binding energies, and peak areas indicate that the surface species studies was a physically adsorbed monolayer of SF6. A multilayer structure was observed at the highest pressures of SF6. The binding energy of the F(1s) peak for monolayer coverage is centered at 688.2 = 0.2 eV relative to the Ru Fermi level, while the multilayer F(1s) peak is shifted more than 3.5 eV to higher binding energy. The F(1s) linewidth of the multilayer peak narrows with increasing coverage. Its narrowest observed linewidth was 1.35 eV + or - 0.1 eV or approximately the same as that found in the gas phase. One of the mechanisms which may account for the F(1s) linewidth with monolayer coverage is a difference in F(1s) binding energy between those F atoms in contact with the substrate and those further away. This may be due to the variation in chemical environment and relaxation effects as a function of distance from the substrate.

702,769
AD-A054 820/6 PC **A02**/MF **A01**
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Pressure Dependence of Na Resonance Line Broadening by Kr and Xe.
W. P. West, and A. Gallagher. 3 Oct 77, 8p
Contract N00014-76-C-0123, Grant AFWL-77-010
Availability: Pub. in Physical Review A, v17 n4 p1431-1438 Apr 78.

Keywords: *Emission spectroscopy, *Sodium, Fluorescence, Pressure, Reprints, Krypton, Xenon.

No abstract available.

702,770
AD-A069 532/0 Not available NTIS
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Metal Vapor Excimers.
A. Gallagher. 1979, 21p
Contract N00014-76-C-0123
Availability: Pub. in Topics in Applied Physics, v30 p135-174 1979 (No copies furnished by DDC).

Keywords: Lasers, *Metal vapors, Excitation, Diatomic molecules, Ground state, Rare gases, Reprints, *Excimers.

No abstract available.

702,771
AD-A070 029/4 PC **A04**/MF **A01**
National Engineering Lab (NBS) Washington DC
Radiation-Induced Acoustic Cavitation; Threshold Versus Temperature for Some Liquids.
Final rept. 30 Mar 78-30 Mar 79.
M. Greenspan, and C. E. Tschiegg. 10 May 79, 58p
Rept no. NBSIR-79-1753
Contract N00014-78-F-0007

Keywords: *Cavitation, *Neutrons, *Sound waves, Temperature, Fission, Threshold effects, Alcohols, Pentanes, Ethyl ethers, Fluorinated hydrocarbons, Water, *Acoustic cavitation.

Neutron thresholds at various temperatures were measured for methanol, ethanol, 1-propanol, 2-propanol, n-pentane, diethyl ether, fluorocarbon 113 and fluorocarbon 11, and fission thresholds were similarly measured for water, 1-propanol and 2-propanol. The work was done in 1969, but not reported then. It is presented here. A copy of a paper in which it was shown, among other things, that reproducible data on acoustic cavitation could be got by the substitution of nuclei of cavitation produced by ionizing radiation for those highly variable ones which occur naturally and often adventitiously.

702,772
AD-A095 136/8 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Use of Angle-Resolved Electron and Photon Stimulated Desorption for Surface Structural Studies.
Technical rept.
T. E. Madey. 1 Feb 81, 27p Rept no. TR-12
Contract N00014-81-F-0021

Keywords: *Desorption, *Molecular structure, *Electrons, *Photons, Surface chemistry, Auger electron spectroscopy, Stimulation(General), Absorption, Angles, Ions, Low energy, Electron diffraction, Mass spectroscopy, Detectors, Statistical analysis, Models, Crystal structure, Experimental data, Oxygen, Distribution, Single crystals, Monolayer, Channeltron multipliers, Ion desorption, Molecular axis, Ion cones.

We review recent experiments and models related to desorption processes induced by electrons and photons incident on surfaces. The utility of angle-resolved electron and photon-stimulated desorption of ions for studies of molecular structure at surfaces is emphasized. (Author)

702,773
AD-A108 221/3 PC **A02**/MF **A01**
Wisconsin Univ.-Madison.
Reconstructed Domains on a Stepped W(100) Surface.
Technical rept.
T.-M. Lu, and G.-C. Wang. 11 Mar 80, 12p Rept no. TR-11
Contract N00014-76-C-0727
Pub. in Surface Science, v107 p139-147 1981.

Keywords: *Surface properties, *Tungsten, Chemisorption, Phase transformations, Electron diffraction, Low energy, Reprints.

No abstract available.

702,774
AD-A110 179/9 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Passive Films, Surface Structure and Stress Corrosion and Crevice Corrosion Susceptibility.
Annual rept. Aug 80-Aug 81.
J. Kruger, J. J. Ritter, J. J. Carroll, and A. J. Melmed. Aug 81, 68p Rept nos. NBSIR-81-2396(ONR), TR-11

Keywords: *Electrochemistry, *Substrates, *Coatings, *Ellipsometers, *Metal films, *Corrosion inhibition, Measurement, Computerized simulation, Metals, Organic coatings, Paints, Thickness, Iron compounds, Chlorides, Passive systems, Ions, Chromates, Surfaces, Corrosion, Computer models.

Transparent organic coatings on iron are used to simulate painted metal surfaces for simultaneous ellipsometric and electrochemical measurements. These studies show that significant changes occur both in the metal oxide film and in the sub-coating environment during prolonged immersion in dilute Cl(-) media. The relationship of these changes to phenomena such as metal passivation, coating delamination, and inhibitor behavior are addressed.

702,775
AD-A111 919/7 PC **A02**/MF **A01**
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Nascent Product Vibrational State Distributions of Ion-Molecule Reactions: The Proton Transfer Reactions F(-)+HX Yields HF(v)+X(-), X=Cl, Br, and I.
J. C. Weisshaar, T. S. Zwier, and S. R. Leone. 4 May 81, 14p AFOSR-TR-82-0173
Grant AFOSR-78-3565
Pub. in Jnl. of Chemical Physics, v75 n10 p4873-4884, 15 Nov 81.

Keywords: *Hydrogen fluoride, *Molecular vibration, Charge transfer, Reaction kinetics, Chemiluminescence, Infrared radiation, Afterglows, Reprints, Ion molecule interactions.

No abstract available.

702,776
AD-A121 915/3 Not available NTIS
National Bureau of Standards (NML), Washington, DC. Molecular Spectroscopy Div.
Time Scale and Product Energy for the IRMPD of CF2HC1 at Steady State.
J. C. Stephenson. 9 Jun 82, 3p ARO-17710.4-CH
Pub. in Jnl. of Chemical Physics, v77 n6 p3283-3284, 15 Sep 82 (No copies furnished by DTIC/NTIS).

Keywords: *Halogenated hydrocarbons, *Methanes, *Fluorides, *Chlorides, *Infrared radiation, *Carbon dioxide lasers, *Photolysis, Laser induced fluorescence, Laser beams, Photochemical reactions, Reprints, *Methane/chloro-difluoro.

No abstract available.

702,777
AD-A128 140/1 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Resonant Electron Emission in Ti and TiO2.
Technical rept.
E. Bertel, R. Stockbauer, and T. E. Madey. 21 Sep 82, 6p Rept no. TR-34
Contract N00014-83-F-0002
Pub. in Physical Review B, v27 n3 p1939-1942, 1 Feb 83.

Keywords: *Emission spectra, *Resonance radiation, *Photoelectron spectra, *Titanium oxides, *Excitation, Energy levels, Valence, Titanium, Auger electron spectroscopy, Ultraviolet spectroscopy, Emission spectroscopy, Photon beams, Valence bands, Reprints, OVB(Oxide Valence Band), ELS(Electron Energy loss Spectroscopy), Interatomic resonance, Autoionization.

No abstract available.

702,778
AD-A129 931/2 Not available NTIS
Colorado Univ. at Boulder. Dept. of Chemistry.
Excimer Laser Photolysis Studies of Translational-to-Vibrational Energy Transfer in Collisions of H and D Atoms with CO.
C. A. Wight, and S. R. Leone. 3 Dec 82, 13p ARO-18660.2-PH
Contract DAAG29-82-K-0030
Pub. in Jnl. of Chemical Physics, v78 n8 p4875-4886, 15 Apr 83 (No copies furnished by DTIC/NTIS).

Keywords: *Photolysis, *Particle collisions, *Energy transfer, Atoms, Hydrogen, Deuterium, Carbon monoxide, Excitation, Excimers, Lasers, Vibrational spectra, Reprints, Laser chemistry.

No abstract available.

702,779
AD-A132 741/0 PC **A02**/MF **A01**
National Bureau of Standards (NML), Washington, DC. Polymer Science and Standards Div.
Rigorous Bounds for the Calculated Dielectric Constants of Ferroelectric Polymers.
Technical rept.
M. G. Broadhurst. Aug 83, 14p Rept no. TR-21
Contract N00014-83-F-0013
Also Pub. in Ferroelectics V49, p159-167.

Keywords: *Polymers, *Ferroelectric materials, *Dielectrics, Polyvinylidenes, Fluorides, Anisotropy, Tensors, Constants, Electric moments, Crystals, Orientation(Direction), Dielectric constants, Vinylidene fluoride polymers.

A theory is presented for calculating rigorous upper and lower bounds for the dielectric constant of a semicrystalline polymer in terms of the volume fraction of crystalline phase, the dielectric constant of the liquid phase and the anisotropic dielectric tensor of the crystalline phase. Also required are two orientation functions (cos to the 2nd power theta) and (cos to the 2nd power alpha) where theta defines the tilt of crystal lamellae and alpha the orientation of the electric moment of each crystal with respect to the measuring field. Bounds are presented for polyvinylidene fluoride for a variety of orientations.

702,780

AD-A133 344/2 PC **A02**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Interaction Energy for Open-Shell Systems.
Technical rept.
D. B. Neumann, and M. Krauss. 1 Jul 81, 6p AFOSR-TR-83-0788
Grant AFOSR-ISSA-82-0017
Pub. in Jnl. of Chemical Physics, v75 n1 p315-319, 1 Jul 81.

Keywords: *Atomic energy levels, *Potential energy, *Ground state, Hartree Fock approximation, Damping, Nuclear shell models, Coupling(Interaction), Reprints.

General expressions necessary for direct calculation of damped multipolar atomic interaction energies are presented. The ab initio method requires the computation of the zeroth and first order wave functions of each atom and can be easily applied to the interaction of open-shell atoms. Applications of this technique are given here for the case of the dipole-dipole interaction of O ('S) with O ('S, 'D, and 3P) and, using effective core potentials, Hg ('S) with Hg ('S) with Hg ('S and 3P).

702,781

AD-A137 765/4 PC **A02**/MF **A01**
Colorado Univ. at Boulder. Dept. of Chemistry.
Laser-Induced Fluorescence Studies of Ion Collisional Excitation in a Drift Field: Rotational Excitation of N2+ in Helium.
M. A. Duncan, V. M. Bierbaum, B. B. Ellison, and S. R. Leone. 1 Dec 83, 11p AFOSR-TR-84-0076
Contract F49620-83-C-0013
Prepared in cooperation with Joint Inst. for Lab. Astrophysics, Boulder, CO. Pub. in Jnl. of Chemical Physics, v79 n11 p5448-5456, 1 Dec 83.

Keywords: *Laser induced fluorescence, *Ions, *Nitrogen, Photochemical reactions, Drift, Tubes, Electric fields, Molecular ions, Mobility, Collisions, Excitation, Helium, Molecular states, Electron transitions, Molecular rotation, Distribution, Molecules, Reaction kinetics, Energy transfer, Reprints.

Initial results are presented for a new method of studying collisional excitation and deactivation processes of molecular ions. Translationally excited ions are prepared in the uniform electric field of a drift tube. Collisions with the inert buffer gas lead to rotational and vibrational excitation (T-V,R). Laser-induced fluorescence (LIF)is used as a direct optical probe of the internal states of N2+ using the B2 epsilon(u)(+)-X2 epsilon(g)(+) transition at 391.4 nm. In this initial experiment, rotational excitation is observed for N2+ in collisions with helium at energies up to 0.054 eV (c.m.). The rotational state distribution can be described by a Boltzmann temperature corresponding to the center-of-mass collision energy, in good agreement with theory. Approximately ten collisions or less are required to obtain full equilibration of the rotational distribution. Applications of this new technique to the interpretation of ion-molecule reaction rates in drift tubes and to the study of ion-neutral energy transfer processes are discussed.

702,782

AD-A141 636/1 PC **A02**/MF **A01**
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Vibrational Energy Disposal in Polyatomic Ion-Molecule Reactions: SF6(-) + H,D Yields SF5(-) + HF(v),DF(v).
C. E. Hamilton, V. M. Bierbaum, and S. R. Leone. 1 Mar 84, 10p AFOSR-TR-84-0411
Contract F49620-83-C-0013
Pub. in Jnl. of Chemical Physics, v80 n5 p1831-1838, 1 Mar 84.

Keywords: *Polyatomic molecules, *Ions, *Chemical reactions, *Vibrational spectra, Hydrogen, Chemiluminescence, Afterglows, Energy transfer, Reaction kinetics, Infrared spectra, Reprints, Sulfur hexafluoride, *Hydrogen fluoride.

No abstract available.

702,783

AD-A167 157/7 PC **A02**/MF **A01**
Vanderbilt Univ., Nashville, TN. Dept. of Chemistry.
Simple Sum Rule for Total Radiative Decay Rates--Comparison of Quantal and Classical Methods for Diatomics,
J. Tellinghuisen, and P. S. Julienne. 15 Dec 84, 8p
AFOSR-TR-86-0213
Grant AFOSR-83-0110
Pub. in Jnl. of Chemical Physics, v81 n12 pt 1 p5779-5785, 15 Dec 84.

Keywords: *Diatomic molecules, *Electron transitions, Quantum theory, Coefficients, Mass, Moments, Reduction, Reprints, Molecular vibration, Sum rules.

Total radiative decay coefficients for electronic transitions in diatomic molecules are evaluated by means of an initial state expectation value < V-cubed(R)(mu sub e)squared(R)>(V = difference potential, micron = transition moment function) in place of the usual sum over final states. This exception value is calculated by quantal and classical methods and compared with the exact expression as a function of reduced mass and initial vibrational state for several combinations of initial and final potentials and transition moment functions. The errors in both the sum rule and its classical implementation seldom exceed 1%, and then only for hydrogenic reduced mass. Keywords: Radiative decay coefficients electronic transitions; Diatomic molecules; and Reprints.

702,784

AD-A182 285/7 PC **A09**/MF **A01**
National Bureau of Standards (NML), Washington, DC.
International Conference on Chemical Kinetics: Program and Abstracts Held in Gaithersburg, Maryland on 17-19 June 1985.
Final rept. 15 Mar-30 Sep 85,
J. T. Herron, W. Tsang, S. E. Stein, and D. M. Golden. Jun 85, 189p AFOSR-TR-87-0707
Grant AFOSR-ISSA-85-0062

Keywords: *Abstracts, *Reaction kinetics, *Chemical reactions, International, Symposia, Laboratories, Research facilities, Molecules, Biomolecules, Ions, Universities.

This meeting held at the National Bureau of Standards, Gaithersburg, MD, brought together leading investigators from universities, research laboratories, and industrial organizations to review the progress and problems in theoretical and experimental chemical kinetics. The scope of the meeting was broadened to include ion-molecule reactions and processes occurring in the condensed phase. Other topics covered unimolecular and biomolecular reactions, energy transfer, and a symposium in honor of Professor Sidney W. Benson. Keywords: kinetics, reactions, energy transfer.

702,785

DE83007670 PC **A02**/MF **A01**
Argonne National Lab., IL.
Structure and Conductivity of the NASICON Analog Na sub 3 SC sub 2 (PO Sub 4) sub 3.
S. Susman, C. J. Delbecq, T. O. Brun, and E. Prince. 1982, 3p CONF-820508-8
Contract W-31-109-ENG-38
Spring meeting of the Electrochemical Society, Montreal, Canada, 9 May 1982, Portions are illegible in microfiche products.

Keywords: *Sodium phosphates, *Scandium phosphates, Crystal structure, X-ray diffraction, Neutron diffraction, Electric conductivity, Correlations, Experimental data, Medium temperature, High temperature, Monoclinic lattices, Hexagonal lattices, ERDA/400201.

Neutron and x-ray diffraction data of Na sub 3 SC sub 2 (PO sub 4) sub 3 are presented that show the transition from an ordinary-conducting, high temperature phase to a still higher temperature, superionic conducting phase. There are at least four polymorphic modifications. At room temperature, the refined neutron diffraction data confirm the Cc space group reported by Efremov and Kalinin but with a = 16.0449(24), b = 8.9225(15), c = 9.0656(13)A, beta = 126.918(21), R/sub weighted pattern/ = 17.5%, and R/sub expected/ = 7%. Between 25 exp 0 C and 64 exp 0 C, a second polymorph appears. The structure is monoclinic but has not yet been refined. At 64 exp 0 C, a third polymorph C appears. It is rhombohedral R3c. Using hexagonal axes, a = 8.9273(2), c = 22.3668A, R/sub wp/ = 6.28% and R/sub e/ = 3.83% at 100 exp 0 C. At 166 exp 0 C, the high temperature polymorph D appears. It is the superconducting phase of NASICON(Sc). It, too, is rhombohedral R3c with a = 8.9274(1), c = 22.5493(6)A, R/sub wp/ = 5.81% and R/sub e/ = 3.87% at 225 exp 0 C. The diffraction data are correlated with ionic conductivity measurements as a function of temperature. (ERA citation 08:024058)

702,786

DE83008648 PC **A02**/MF **A01**
National Bureau of Standards (NML), Washington, DC.
Effects of Resonances in Molecular Photoionization Measured with Triply Differential Photoelectron Spectroscopy.
A. C. Parr, D. M. P. Holland, D. L. Ederer, and J. L. Dehmer. 1982, 5p CONF-820883-3
Contract W-31-109-ENG-38
International mass spectrometry conference, Vienna, Austria, 29 Aug 1982, Portions are illegible in microfiche products.
Pub. in International Journal of Mass Spectrometry and Ion Physics 46, 285-288 (1983).

Keywords: *Carbon dioxide, *Polyatomic molecules, Photoionization, Resonance, Photoelectron spectroscopy, Autoionization, Franck-condon principle, Molecules, Radicals, Molecular ions, ERDA/640304.

A variable wavelength angle resolving photoelectron spectrometer has been used to study the effects of autoionization and shape resonances upon molecular photoionization. Such resonance phenomena produce non-Franck-Condon effects in the vibrational intensity distributions and significant variations in the asymmetry parameters. Results are presented for C sub 2 N sub 2 and CO sub 2 . Constant Photoelectron Energy (CPE) spectroscopy has been performed on C sub 2 H sub 2 and spectra are shown at four kinetic energies. The information concerning energy absorption in molecules gained from these studies is discussed. (ERA citation 08:024519)

702,787

DE83013583 PC **A02**/MF **A01**
Los Alamos National Lab., NM.
Mechanism of the Optogalvanic Effect in a Hollow-Cathode Discharge.
R. A. Keller, B. E. Warner, E. F. Zalewski, P. Dyer, and R. Engleman. 17 Jun 83, 12p UCRL-88533, CONF-830646-1
Contract W-7405-ENG-48
Optogalvanic spectroscopy and application meeting, Aussois, France, 20 Jun 1983.
Pub. in J. de Phys. Colloq. C7, 44, n11 pC7-23-C7-33 Nov 83.

Keywords: *Hollow Cathodes, *Uranium, Laser Isotope Separation, Galvanomagnetic Effect, Magneto-Optical Effects, Photoemission, Electric Discharges, Ionization, Excitation, Laser Radiation, Neon, ERDA/640301, ERDA/050503.

There are two significantly different mechanisms proposed for the origin of the optogalvanic effect in a hollow-cathode discharge: (1) laser excitation of atoms to higher electronic states leads to an increased cross section for electron impact ionization, with the result that the excited atom becomes ionized and the conductivity of the discharge increases; and (2) laser excitation of atoms to higher electronic states perturbs the equilibrium established between the electron temperature and the atomic excitation temperature. Superelastic collisions between the electrons and the laser-excited atoms restore the equilibrium, with the excess energy ending up in an increased electron temperature and therefore an increased conductivity of the discharge. Both mechanisms undoubtedly proceed simultaneously and what needs to be determined is their relative importance at different discharge conditions and different excitation conditions. This is important because laser isotope enrichment schemes have been proposed using selective excitation in a hollow-cathode discharge. In order for these schemes to work, (1) must be the predominant mechanism. We have measured the optogalvanic signal, concentration of uranium atoms, impedance of the discharge, and electron temperature as a function of the discharge current in a neon-filled uranium hollow-cathode discharge. The hollow cathode operating characteristics are used as input parameters in a simple discharge model. Predictions of electron density, changes in electron temperature, and discharge impedance compare well with experimental observations. Our model and experimental observations yield a qualitative understanding of the optogalvanic effect in a hollow-cathode discharge and estimate the relative importance of the two optogalvanic mechanisms. (ERA citation 08:039521)

702,788
N80-14257/3 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Thermophysical Properties Div.
Thermodynamic Properties of Nitrogen Gas Derived from Measurements of Sound Speed.
B. Younglove, and R. D. Mccarty. Dec 79, 56p
NASA-RP-1051, NBSIR-79-1611
NASA ORDER L-55450-A, NASA ORDER L-69159-A

Keywords: *Acoustic velocity, *Cryogenic wind tunnels, *Nitrogen, *Thermodynamic properties, Density (Mass/volume), Equations of state, Gases, Pressure gradients.

A virial equation of state for nitrogen was determined by use of newly measured speed-of-sound data and existing pressure-density-temperature data in a multiproperty-fitting technique. The experimental data taken were chosen to optimize the equation of state for a pressure range of 0 to 10 atm and for a temperature range of 60 to 350 K. Comparisons are made for thermodynamic properties calculated both from the new equation and from existing equations of state.

702,789
N82-30551/7 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Thermoelectric Refrigeration for Temperatures Below 100 K: A Study of Titanium Sesquioxide.
R. Radebaugh, D. Linenberger, and E. Spellicy. May 82, 14p NAS 1.26:166343, NBSIR-82-1665, NASA-CR-166343
Contract NBS-A-6-3249B(DDA)

Keywords: *Electrical resistivity, *Refrigerating, *Specific heat, *Thermal conductivity, *Titanium oxides, Cryogenics, Figure of merit, Thermoelectric cooling, Thermophysical properties, Vanadium.

Previous measurements of the specific heat of V-doped Ti2O3 at low temperatures were explained by a model which also suggested the material would have a high thermoelectric figure-of-merit. The sample preparation, experimental apparatus, and the results of measurements on the thermal conductivity, thermoelectric power, and electrical resistivity of a single crystal Ti2O3 - 4% V sample are described. The results are used to derive the thermoelectric figure-of-merit between 5 and 300 K. The figure-of-merit is much smaller than expected and of little practical value because of the very high phonon thermal conductivity.

702,790
N83-24800/5 PC **A05**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Transport Properties of Oxygen.
H. M. Roder. Apr 83, 86p NAS 1.61:1102, NBSIR-82-1672, NASA-RP-1102
NASA ORDER C-32369-C

Keywords: *Oxygen, *Thermal conductivity, *Thermal diffusivity, *Viscosity, Equations of state, Prandtl number, Tables (Data).

Tables of viscosity, thermal conductivity, and thermal diffusivity of oxygen as a function of temperature and pressure from the triple point to 320 K and at pressures to 100 MPa are presented. Auxiliary tables in engineering units are also given. Viscosity and thermal conductivity are calculated from published correlations. Density and specific heat at constant pressure, required to calculate thermal diffusivity, are obtained from an equation of state. The Prandtl number can be obtained quite easily from the values tabulated.

702,791
PATENT-4 148 586 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Apparatus for Galvanic Detection of Optical Absorptions.
Patent.
R. B. Green, R. A. Keller, G. G. Luther, P. K. Schenck, and J. C. Travis. Filed 23 Jun 77, patented 10 Apr 79, 7p PB79-600042, PAT-APPL-809 334

Keywords: *Opto-galvanic effect, Predetermined frequency, Spectroscopic and analytic determinations, Variable wavelength monochromatic light.

An apparatus and method for utilizing the opto-galvanic effect to perform spectroscopic or analytic investigations of atomic or molecular species. A sample of the substance to be analyzed is vaporized in an analytical flame, gas discharge tube, high temperature furnace or the like, and the vapor is irradiated with coppped or pulsed variable wavelength monochromatic light. The electrical-resistance of the vapor is monitored as the frequency of the radiation is tuned through one or more electronic transition frequencies of the substance. The residtance spectrum resembles the optical absorption spectrum of the species in the vapor. The opto-galvanic effect may also be used to frequency lock a laser to a transition frequency of a substance in a gas discharge cell.

702,792
PATENT-4 558 218 Not available NTIS
Department of Commerce, Washington, DC.
Heat Pipe Oven Molecular Beam Source.
Patent.
R. E. Drullinger. Filed 1 Aug 84, patented 10 Dec 85, 7p PB86-137239, PAT-APPL-6-636 769
Supersedes PB85-108132.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Molecular beams, *Patents, Sources, Atomic beam sources, Heat pipes, PAT-CL-250-251

A heat pipe oven molecular beam source wherein a hollow porous metal, metalloid or ceramic body with at least one opening is nearly saturated with the working material and heated to just above the melting point of the working material, generating a thin liquid layer of the working material on the internal surface of the body. Material passing the length of the bore of the body without striking a wall will escape and form the beam. Material striking the liquid layer covering the inside of the body will condense and be conveyed by capillary action back to the closed end of the body.

702,793
PATENT-4 654 279 Not available NTIS
Department of the Navy, Washington, DC.
Interpenetrating-Network Polymeric Electrolytes.
Patent.
B. J. Bauer, C. K. Chiang, and G. T. Davis. Filed 10 Jul 86, patented 31 Mar 87, 6p PB87-182580, PAT-APPL-6-884 143
Supersedes AD-A012 485.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Patent applications, *Polymers, *Solid electrolytes, Conductivity, Crosslinking(Chemistry), Electrolytes, Poly(oxide/ethylene), Poly(oxide/propylene), Poly(imine/ethylene).

A solid polymeric electrolyte which is a two phase interpenetrating network of a mechanically supporting phase of a continuous network of a crosslinked polymer and an ionic conducting phase comprising a metal salt complexing liquid polymer which is a liquid poly(ethylene oxide), poly(propylene oxide), or poly(ethylene imine) complexed with a suitable metal salt. The mechanically supporting phase forms a matrix which supports the interpenetrating ionic conducting liquid polymer phase which provides continuous paths of high conductivity in all directions throughout the matrix.

702,794
PB-246 532/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Matrix Isolation Study of the Infrared Spectrum of Thioformaldehyde.
Final rept.
M. E. Jacox, and D. E. Milligan. 1975, 16p
Pub. in Jnl. of Molecular Spectroscopy, v58 n1 p142-157 1975.

Keywords: *Infrared spectra, *Photolysis, *Sulfones, Pyrolysis, Organic polysulfides, Molecular vibration, *Formaldehyde/thio, Disulfide/dimethyl, Trithianes, Chemical reaction mechanisms, Reprints, Matrix isolation techniques.

H2CS has been trapped in argon and nitrogen matrices at 14K as a product of the pyrolysis of s-trithiane or (CH3S)(2) and of the ultraviolet or vacuum ultraviolet photolysis of CH3SH. A small concentration of H2CS has also been observed upon vacuum ultraviolet photolysis of a mixture of CH4 and H2S in an argon matrix. The isotopic data support the assignment of absorptions at 993 and at 1063/cm to the out-of-plane deformation and the C=S stretching fundamentals of H2CS. Absorptions in the CH stretching region which were assigned to H2CS in an earlier gas-phase study were confirmed in the matrix experiments. Studies of the vacuum ultraviolet photolysis of CD3SH have provided information on the mechanism of the photolysis process.

702,795
PB-255 186/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Atomic Energy Levels of Rare Earth Elements.
Final rept.
R. Zalubas, and L. Hagan. 1974, 7p
Pub. in Proceedings of Rare Earth Research Conference (11th), Traverse City, MI, October 7-10, 1974, V1 p411-416 1974.

Keywords: *Rare earth elements, *Atomic energy levels, Spectroscopic analyses, Ions, Atoms, Gas ionization, Ionization potentials.

The report discusses briefly work done at the National Bureau of Standards by members of the Spectroscopy Section. They are investigating rare earth spectra and are working on a critical compilation of rare earth energy levels. Also a number of people in other laboratories are working on these spectra. The compilation will include all experimentally known levels of free atoms and ions of lanthanum through lutetium (Z=57-71).

702,796
PB-262 613/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photoabsorption in Inner-Shells of Atoms.
Final rept.,
D. L. Ederer. 1976, 21p
Pub. in Proceedings of International Conference on Inner Shell Ionization Phenomena (2nd), Freiburg, Germany, Mar 29-Apr 2, 1976, p145-165 1976.

Keywords: *Excitation, *Photochemistry, Absorption, Atoms, Atomic orbitals, Gas ionization, Auger electrons, Rare gases, Metal vapors, Autoionization, Exchange interactions.

Inner-shell optical photon excitations in atomic gases are discussed in this paper. Special emphasis is given to electron correlations arising from configuration interaction and the exchange interaction. Because these interactions are largest at photon energies = or < 200 eV the scope of the paper is limited to this part of the spectrum. The subject is approached from the point of view of experimental physics emphasizing excitations in noble gases and metal vapors. The first section of the paper deals with excitations to discrete states that decay by an Auger or an autoionization process, and the next section explores the role exchange and correlation plays in the continuum photoionization cross section of gaseous systems. Finally recent measurements are reviewed that use the technique of photoelectron spectroscopy to measure the partial photoionization cross section of each group of subshell electrons.

702,797
PB-262 614/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Revised Classification of Mg II Levels Between 59 and 63 eV.
Final rept.,
G. Mellman, A. W. Weiss, and J. M. Esteva. 15 Oct 76, 2p
Pub. in Astrophysics Jnl., n209 p640-641, 15 Oct 76.

Keywords: *Magnesium, *Ultraviolet spectra, Absorption spectra, Line spectra, Reprints.

A total of 68 new resonances in the absorption spectrum of magnesium were previously identified by two of the authors. The tentative classification proposed for ten of the Mg II levels was erroneous. A revised labeling is proposed in this note for these lines.

702,798
PB-263 137/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Energy Curve of XeF, X(2) Sigma(+).
Final rept.,
M. Krauss, and B. Liu. 1 Dec 76, 4p
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Div. of Laser Fusion.
Pub. in Chem. Phys. Lett., v44 n2 p257-260 1 Dec 76.

Keywords: *Reaction kinetics, Coulomb interactions, Molecular energy levels, Xenon halides, Van der Waals equation, Dissociation, Reprints, *Xenon fluorides.

The energy curve of the ground state of XeF is obtained theoretically assuming that the energy is represented by the sum of the 'first order energy' and the dispersion energy. Since the inverse power expansion of the dispersion energy is not valid when the atoms overlap significantly, the dispersion energy is estimated in the overlap region by noting that the Coulomb integrals now vary exponentially with internuclear distance. The onset of overlap was chosen to occur over a range of distances which then permits a range of well depths to be determined. Comparison with recent experimental results indicates that the sigma of the analogous van der Waals well provides agreement with the well depth. The energy curve has an unusual shape which suggests that the region around the minimum is determined by a small mixing of charge transfer into the ground state. Since this study is intended to determine the qualitative electronic basis of the binding in molecules like XeF, no attempt was made to calculate the vibrational spectrum but it is clear from the curve shape that the spectrum could be fit only with a large anharmonicity coefficient.

702,799
PB-263 139/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theoretical Study of Low-Energy Electron-CO2 Scattering.
Final rept.,
M. A. Morrison, L. A. Collins, and N. F. Lane. 1 Sep 76, 5p
Pub. in Chem. Phys. Lett., v42 n2 p356-360 1 Sep 76.

Keywords: *Carbon dioxide, Elastic scattering, Numerical analysis, Electrons, Molecules, Reprints, *Electron molecule interactions, Electron scattering.

A study of electron collisions with ground-state CO2 molecules in the energy range 0.07-10.0 eV is reported. An accurate static potential is augumented with a local exchange potential and induced polarization terms, and coupled radial equations are solved in a spherical coordinate system. Converged total and momentum-transfer cross sections are presented and discussed, and comparison is made with existing experimental measurements.

702,800
PB-263 147/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quantum-Mechanical Calculations of Rotational-Excitation Cross Sections for HCl, DCl, DF and HF in Slow Collisions with He.
Final rept.,
L. A. Collins, and N. F. Lane. Oct 76, 10p
Pub. in Phys. Rev. A, v14 n4 p1358-1367 Oct 76.

Keywords: *Helium, *Hydrogen chloride, *Hydrogen fluoride, *Deuterium compounds, Molecular energy levels, Quantum mechanics, Numerical analysis, Cross sections, Excitation, Reprints, *Atom molecule interactions, Molecular rotation.

Low-energy-rotational-excitation cross sections have been calculated for collisions between ground-state helium atoms and the diatomic molecules HCl, DCl, DF, and HF from model-potential surfaces. Solutions of the coupled radial equations are obtained in the close-coupling coupled-channels (CC) formulation and the conserving coupled-states (CS) approximation, including as many channels (open and closed) as needed for convergence. Trends in the behavior of the cross sections with respect to variations in the potential surface and the spacing of rotational levels are discussed with particular emphasis on the isotope effects. In addition, cross sections calculated for various CS approximations are compared with CC results and comment is made on the influence of the closed channels.

702,801
PB-263 151/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD

Refractive Index of High Purity KCl and KI Doped KCl.
Final rept.,
M. J. Dodge, and I. H. Malitson. Feb 76, 8p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, Va.
Pub. in Proceedings of Conference on Infrared Laser Window Materials (5th), Held at Las Vegas, Nevada, on December 1-4, 1975, p216-223 (Air Force Materials Laboratory, Wright-Patterson AFB, Ohio, Feb 76).

Keywords: *Potassium chloride, Refractivity, Additives, Iodides, Temperature, Wave dispersion, *Refractive index.

The refractive indexes of a sample of potassium chloride made by reactive atmosphere processing (RAP) and a sample of potassium chloride doped with potassium iodide were determined from 0.25 micrometer to 15.5 micrometers. Measurements were made by means of the minimum-deviation method on both samples at a controlled room temperature near 20C and on the RAP specimen near 34C. Each set of experimental data was fitted to a Sellmeier-type dispersion equation which permits refractive index interpolation within several parts in 10 to the - 5th power. Temperature coefficients of index as a function of wavelength are also given. A comparison of these data with values of commercially grown KCl is presented.

702,802
PB-263 198/4 PC **A07**/MF **A01**
National Standard Reference Data System.
Selected Specific Rates of Reactions of Transients from Water in Aqueous Solution. III. Hydroxyl Radical and Perhydroxyl Radical and Their Radical Ions,
F. Ross, and A. B. Ross. Jan 77, 126p NSRDS-NBS-59
Prepared by Notre Dame Univ., Ind. Radiation Chemistry Data Center. See also COM-75-10617.

Keywords: *Solutions, *Reaction kinetics, Organic compounds, Rates(Per time), Ions, Inorganic compounds, Molecules, Photochemistry, Tables(Data), Radiation chemistry, *Reaction rates, *Hydroxyl radical, *Perhydroxyl radical.

Rates of reactions of OH and HO2 with organic and inorganic molecules, ions, and transients in aqueous solution have been tabulated, as well as the rates for the corresponding radical ions in aqueous solution (O-) and O2(-). Most of the rates have been obtained by radiation chemistry methods, both pulsed and steady-state; data from photochemistry and thermal methods are also included. Rates for over one thousand reactions are listed.

702,803
PB-263 199/2 PC **A10**/MF **A01**
National Bureau of Standards, Washington, D.C. Optical Physics Div.
Bibliography on Atomic Energy Levels and Spectra.
Special pub. Jul 71-Jun 75,
L. Hagan. Jan 77, 190p NBS-SP-363-Suppl-1
Library of Congress catalog card no. 72-600009.

Keywords: *Atomic energy levels, *Atomic spectra, *Bibliographies, Atoms, Ions, Spectral lines, Zeeman effect, Stark effect, Wavelengths, Hyperfine structure, Ionization potentials, Isotope effect, Tables(Data).

This is the first supplement to the NBS Special Publication 363, 'Bibliography on Atomic Energy Levels and Spectra, July 1968 through June 1971,' and it covers the most recent literature from July 1971 through June 1975. It contains approximately 2150 references classified by subject for individual atoms and atomic ions. A number index identifies the references. An author index is included. References included contain data on energy levels, classified lines, wavelengths, Zeeman effect, Stark effect, hyperfine structure, isotope shift, ionization potentials, or theory which gives results for specific atoms or atomic ions.

702,804
PB-263 265/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
S-Carboxymethyl-L-Cysteine Sulfoxide (Configuration 2R:4R).
Final rept.,
J. A. Staffa, C. Zervos, A. D. Mighell, and C. R. Hubbard. Nov 76, 4p
Pub. in Acta Crystallographica, B32 pt11 p3132-3135 Nov 76.

Keywords: *Crystal structure, Sulfoxides, X ray analysis, Least squares method, Fourier analysis, Hydrogen bonds, Reprints, Zwitterion, *Sulfoxide/S-carboxymethyl-cysteinyl.

C5H9SO5N, orthorhombic, P212121; a=4.786 (2), b=8.312 (1), c=18.914 (5) A; Z=4, D(x)=1.723, D(m)=1.732 (5)g/cc (flotation at 21C). The structure has been determined by standard Fourier techniques from X-ray diffractometer data and refined by least-squares methods to R=0.035 for 924 independent reflections. As found by X-ray analysis, the title compound exists as an 'apparent' zwitterion. The cysteine carboxyl and the methyl carboxyl groups of adjacent molecules are involved in a very strong hydrogen bond (O...O 2.449 (3) A).

702,805
PB-263 266/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Spectrum of Acetylene-d2.
Final rept.,
W. J. Lafferty, R. D. Suenram, and D. R. Johnson. 1977, 10p
Pub. in Jnl. of Molecular Spectroscopy, v64 p147-156 1977.

Keywords: *Microwave spectra, *Acetylene, *Deuterium compounds, Stark effect, Molecular energy levels, Vibration, Reprints, Chemical shifts(Nuclear magnetic resonance).

Eight P-branch transitions from the nu(5) - nu(4) difference band of C2D2 have been observed in the microwave region. Significant improvements in the spectroscopic constants for the two states involved in the difference band have been obtained by combining infrared and microwave data. The Stark shifts for the observed C2D2 lines are discussed in some detail.

702,806
PB-263 271/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theory of Laser-Induced Inelastic Collisions.
Final rept.,
S. Geltman. 1976, 6p
Pub. in Jnl. of Physics, B. Letter to Editor v9 n18 pL569-L574 1976.

Keywords: *Inelastic scattering, Selection rules(Physics), Molecular energy levels, Lasers, Cross sections, Excitation, Reprints, *Laser induced fluorescence, Electron cross sections.

A theory of laser-induced inelastic collisions is presented, containing atomic selection rules and specific intensity and velocity dependences. It is applied to the case of the process Sr(4p(4) P(0)) + Ca(4s(2) singlet s) + h omega (6408.6A) goes to Sr(5s(2) singlet S) + Ca(4d(1) D), for which the intensity and wavelength dependence of the cross section is evaluated.

702,807
PB-263 528/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tests of INDO/1s and INDOXI/1s Methods for the Calculation of the Static Potential for Electron Scattering by CO.
Final rept.,
D. G. Truhlar, and F. A. Van-Catledge. 15 Dec 76, 3p
Sponsored in part by National Science Foundation, Washington, D.C.
Pub. in Jnl. of Chemical Physics, v65 n12 p5536-5538, 15 Dec 76.

Keywords: *Carbon monoxide, Dipole moments, Electrons, Molecular energy levels, Numerical analysis, Molecular orbitals, Quantum theory, Reprints, *Electron scattering.

The authors have previously used semiempirical molecular orbital theory (INDO, INDO/ls and INDOXI methods to calculate the equilibrium-geometry ground state static potential V(s)(r,theta;R(e)) for N2 and CO as functions of r and theta; where V(s)(r,theta;R(e)) is the interaction energy of a fixed electron with the unperturbed ground-state charge distribution of a molecule fixed at its equilibrium internuclear distance, r is the magnitude of the vector r vector is identically equal to (r,theta,phi) from the center-of-mass of the molecule to the electron, and theta is measured with respect to the internuclear axis. The static potential is useful for electron scattering calculations and for estimating the reactivity of molecules with electrophilic reagents.

702,808
PB-263 530/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Generalized Hydrodynamics.
Final rept.,
R. D. Mountain. 1976, 67p
Pub. in Advances in Molecular Relaxation Processes, v9 p225-291 1976.

Keywords: *Molecules, Hydrodynamics, Fluid dynamics, Equations of motion, Density(Mass/volume), Light scattering, Neutron scattering, Correlation, Critical point, Ultrasonic tests, Reprints.

Equations of motion for time correlation functions of molecular quantities, such as the density-density correlation function, can be obtained in the form of generalized hydrodynamic equations. The generalization considered here leads to wave vector dependent generalizations of thermodynamic coefficients and to wave vector and frequency dependent generalizations of transport coefficients in linear equations of motion for the correlation functions. The motivation for this way of describing collective effects in fluids at the molecular level is discussed in this review and several ways of deriving such equations of motion are compared. An explicit derivation is carried out for the density-density correlation function, the quantity studied by neutron and light scattering studies. The intent of this discussion, and in the consideration of examples of the theory, is to provide a perspective view of the subject. Several applications of the theory are described. These include molecular dynamics, neutron scattering and light scattering studies of density-density correlations, molecular dynamics and light scattering studies of transverse current correlations, hydrodynamic studies of long time tails in molecular correlation functions of the currents of the hydrodynamic variables and ultrasonic studies of fluids in the critical region and in the rarified gas region. Some unresolved aspects of the theory are considered in the last section.

702,809
PB-264 314/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hydrogen-Bonded Dimers in Tin(II) Hydrogen Phosphate.
Final rept.,
L. W. Schroeder, and E. Prince. Dec 76, 3p
Grant PHS-DE-00572
Sponsored in part by American Dental Association, Chicago, Ill.
Pub. in Acta Crystallographica, B32 Pt12 p3309-3311 Dec 76.

Keywords: *Hydrogen bonds, Neutron diffraction, Crystal structure, Phosphorus inorganic compounds, Tin inorganic compounds, Reprints, *Tin hydrogen phosphate.

SnHPO4, monoclinic, P2(1)/c, a=4.608, b=13.603, c=5.823 A, beta=98.76, Z=4. This neutron diffraction study has shown that the HPO4(-2) ions are linked together by two asymmetric hydrogen bonds (d(O--O)=2.560, d(O-H)=1.017 A, angle O-H--O=178.1 degrees) to form dimers. Tin-phosphate-oxygen coordination takes place primarily in layers with the hydrogen bonds occurring between these layers.

702,810
PB-264 317/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Angle Resolved Auger Surface Spectroscopy.
Final rept.,
J. W. Gadzuk. 1976, 9p
Pub. in Surface Science, v60 p76-84 1976.

Keywords: *Surface chemistry, *Auger electrons, Mathematical models, Chemisorption, Reprints, Auger electron spectroscopy.

The angular distribution of electrons ejected in core-valence-valence Auger transitions of atoms chemisorbed on metal surfaces is considered theoretically. Since the valence electrons participating in the Auger transition are also involved in chemical bonding to the surface, these initial states contain information pertaining to the chemisorption bonding geometry. The role of the initial state symmetry in determining the angle resolved Auger surface spectrum (ARASS) is investigated through model calculations and is found to be small.

702,811
PB-264 320/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Vibrational Excitation in Photoemission Spectroscopy of Condensed Molecules.
Final rept.,
J. W. Gadzuk. 1976, 8p
Pub. in Phys. Rev. B, v14 n12 p5458-5465, 15 Dec 76.

Keywords: *Photoelectron emission, *Ultraviolet spectroscopy, Experimental design, Carbon monoxide, Molecules, Band spectrum, Reprints, Franck-Condon principle.

Photoelectron spectra of gas-phase molecules display sharp vibrational structure. The envelope of the spectrum is determined by the Franck-Condon factor. On the other hand, photoelectron spectra of the same molecules, adsorbed or condensed onto metal surfaces show a broad band whose shape resembles the gas-phase Franck-Condon envelope but with no sharp structure. The smearing out of the vibrational structure is usually attributed to lifetime effects or site inhomogeneities. A new mechanism involving intrinsic phonon sidebands in photoemission from condensed molecules is suggested and the details of the theory are worked out. Experimental ultraviolet photoelectron spectra from condensed CO are considered in the light of this theory.

702,812
PB-264 321/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mercury-Melting-Line Determination by Latent Heat Method.
Final rept.,
J. C. Houck. 1977, 5p
Pub. in J. Appl. Phys. v48 n2 p605-609 Feb 77.

Keywords: *Mercury, *Melting points, *Freezing points, Latent heat, Detection, Least squares method, Chemical equilibrium, Thermodynamic properties, Reprints.

The equilibrium pressure for the melting and freezing of mercury was observed for the temperature range of -38.834C - 0.023C by latent heat detection. The corresponding pressure range was 0.14-757.32 MPa (MPa = 10 to the 6th power N/sq m). A least-squares fit was obtained for this range of pressure with a standard deviation of the residuals of 0.055 MPa for pressure expressed as a third-order polynomial in temperature.

702,813
PB-264 341/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Homogeneous Anionic Polymerization of Unsaturated Monomers.
Final rept.,
M. Morton, and L. J. Fetters. 1967, 43p
Pub. in Macromolecular Reviews, v2 p71-113 1967.

Keywords: *Polymerization, Reviews, Anions, Unsaturated organic compounds, *Homogeneous reactions, *Monomers, Block copolymers.

This review discusses the polymerization of unsaturated monomers by carbanionic mechanisms. Particular emphasis is placed on the synthetic possibilities of these systems, i.e., monodisperse polymers, block copolymers, and polymers having reactive end-groups.

702,814
PB-264 344/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quantum Mechanical and Crossed Beam Study of Vibrational Excitation of N2 by Electron Impact at 30-75 eV.
Final rept.,
D. G. Truhlar, M. A. Brandt, S. K. Srivastava, S. Trajmar, and A. Chutjian. 1977, 9p
Pub. in J. Chem. Phys., v66 n2 p655-663, 15 Jan 77.

Keywords: *Nitrogen, *Excitation, Molecular energy levels, Elastic scattering, Differential cross sections, Mathematical models, Ultraviolet spectroscopy, Vibration, Rotation, Inelastic scattering, Electron scattering, Reprints.

The ratios of differential cross sections for excitation of the first excited vibrational state and for elastic scattering for electron impact on N2 have been measured at scattering angles ranging from 20 degrees to 135 degrees at 30, 35, 40, 45, and 75 eV impact energies and from 25 degrees to 90 degrees scattering angle at 20 eV impact energy. The results at 20 eV are in good agreement with two previous sets of measurements. Using previously measured and normalized elastic differential cross sections for N2, the ratios have been converted to inelastic cross sections. Calculations using a four-state vibrational-rotational basis set and an effective interaction potential developed previously are reported at the five energies in the 30-75 eV region. It is shown that the potentialscattering model can account for themagnitude and the qualitative behavior of the cross sections at 35-75 eVbut there are some significant quantititative differences between theory and experiment. The most striking of these is the way the theoretical model overestimates the scattering at scattering angles less than about 50 degrees. Core-excited resonances apparently make an appreciable contribution to the vibrationally inelastic scattering at 30 eV.

702,815
PB-264 435/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Noble-Gas Broadening of the 6 doublet P(1/2)-7 doublet S(1/2) (377.6 nm) 6 doublet P(3/2)-7 doublet S(1/2) (535 nm) Thallium Lines.
Final rept.,
B. Cheron, R. Scheps, and A. Gallagher. Feb 77, 10p
Contract N00014-76-C-0123
Sponsored in part by Air Force Weapons Lab., Kirtland AFB, N. Mex.
Pub. in Physical Review, A. General Physics, v15 n2 p651-660 Feb 77.

Keywords: *Thallium, *Line width, *Rare gases, Molecular energy levels, Spectrum analysis, Visible spectra, Xenon, Reprints, Chemical shifts(Nuclear magnetic resonance).

The shapes of the thallium (Tl) 535- and 377.6-nm resonance lines broadened by 500-1500 Torr of noble gases have been measured at 743 K. The reported normalized emission intensities yield absorption coefficients in absolute units for all portions of the line. The shift and broadening of the Lorentzian-shaped line cores, the wavelengths of the transition to non-Lorentzian wings, wing shapes, and satellite positions, shapes, and intensities are reported. As an example, a pair of excited and ground-state interaction potentials are given for the Xe case to explain the shift, width, and intensities in all portions of the line wings.

702,816
PB-264 930/9 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
FORTRAN Program for Desmearing Small-Angle X-Ray Scattering Curves.
Final rept.,
J. Mazur. Apr 77, 86p NBS-TN-936

Keywords: *X ray analysis, *Computer programs, Copolymers, Numerical analysis, Molecular structure, Fortran, Volterra equations, Computation, Algorithms, *X ray scattering.

Measurement of small angle scattering of x-rays is an extremely valuable tool for the study of macromolecular systems. In recent years, these measurements have been extensively employed in order to determine the three dimensional structure of triblock copolymers. These copolymers form domains whose size is ideally suited for small angle x-ray scattering studies. A Fortran program is presented that corrects for collimation effects in small angle x-ray scattering measurements. The method employed in calculations is based on numerical solution of an integral equation, which is written as a Volterra equation of the first kind. This equation is reduced to a system of simultaneous equations, which can be solved by back substitution. Several different algorithms are tried, based on different interpolating polynomials for I(x), the true scattering intensity, which is expressed as a function of the scattering angle x. The problem of numerical stability, which is inherent to the computational algorithms employed in the algebraic solution equation is discussed and exemplified with actual computations.

702,817
PB-265 032/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Application of Hole Theory to Estimate the Pressure-Induced Densification of Polymers.
Final rept.,
J. E. McKinney. 1976, 6p
Pub. in Ann. N.Y. Acad. Sci., v279 p88-93, 15 Oct 76.

Keywords: *Polymers, *Densification, Density(Mass/volume), Thermodynamics, Compressibility, Reprints, Hole theory, Glass transition properties.

Forming a glass by isobaric cooling at an elevated pressure produces a larger density than that obtained by cooling at the same rate at atmospheric pressure. Simple phenomenological theory is used to obtain a relation to estimate the densification from glass transition properties obtained by experiment. It is shown how the hole theory of Simha and Somcynsky may be used to facilitate the estimation of densification through the application of a universal reduced function which replaces the quantity most difficult to obtain experimentally in this relation.

702,818
PB-265 034/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stored Energy in Poly(Vinyl Chloride) from Pelletizing Process.
Final rept.,
S. S. Chang. 1977, 9p
Pub. in J. Chem. Thermodyn., v9 p189-197 1977.

Keywords: *Polyvinyl chloride, *Specific heat, Glass transition temperature, Thermodynamic properties, Energy storage, Pelleting, Reprints.

From the heat capacities measured from 5 to 375 K on three poly(vinyl chloride) samples, evidence of residual strain energies stored in the sample appeared near the glass-transition temperature in the pelletized materials. The three samples were derived from suspension- and bulk-polymerized powder stocks and were measured either pelletized or as received. The stored energies began to be released at temperatures about 30 to 40 K below the glass-transition temperature of about 355 K.

702,819
PB-265 054/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Saturated Absorption with Spatially Separated Laser Fields: Observation of Optical 'Ramsey' Fringes.
Final rept.,
J. C. Bergquist, S. A. Lee, and J. L. Hall. 24 Jan 77, 4p
Grant NSF-PHY76-04761
Pub. in Phys. Rev. Lett., v38 n4 p159-162, 24 Jan 77.

Keywords: *Spectroscopy, Optical properties, Atomic beams, Absorption spectra, Reprints, *Ramsey fringes.

The authors have observed Ramsey's interference fringes in the optical region using saturated absorption techniques in a fast atomic beam. They discuss their physical origin and describe an optical configuration that guarantees fringes of high symmetry. This technique, with its high-resolution potential, should lead to dramatic improvements in spectral measurements.

702,820
PB-265 238/6 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Electron Factor in Catalysis on Metals.
Final rept.,
L. H. Bennett. Apr 77, 221p NBS-SP-475
Library of Congress catalog card no. 77-600009. Prepared in cooperation with National Science Foundation, Washington, D.C. Div. of Materials Research, and Energy Research and Development Administration, Washington, D.C. Div. of Conservation Research and Technology. Proceedings of Workshop Held at Gaithersburg, Maryland on December 8-9, 1975.

Keywords: *Reviews, *Catalysis, *Metals, *Surfaces, *Meetings, Experimental design, Alloying, Electrons, Chemisorption, X ray analysis, Electron energy levels, Heat of formation, Chemical bonding, Mathematical models, Hamiltonian functions.

This book presents the proceedings of a Workshop on the Electron Factor in Catalysis on Metals held at the National Bureau of Standards, Gaithersburg, Maryland, on December 8-9, 1975. The Workshop was sponsored by the Institute for Materials Research, NBS, the Division of Materials Research of the National Science Foundation, and the Division of Conservation Research and Technology of the Energy Research and Development Administration. The purpose of the Workshop was to review the most recent experimental and theoretical investigations on catalysis on metals and related topics, and to bring together chemists, chemical engineers, surface scientists, and solid state physicists and chemists involved in research related to this topic. These proceedings summarize the four panel sessions into which the Workshop was organized: Experimental Techniques, Effect of Alloying, Geometrical Effects, and Electronic Structure.

702,821
PB-265 372/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Metastable States in the Lennard-Jones Fluid.
Final rept.,
H. J. Raveche. 1976, 7p
Pub. in Ann. N.Y. Acad. Sci., v279 p36-42, 15 Oct 76.

Keywords: *Metastable states, *Phase transformations, Liquid phases, Solid phases, Monte Carlo method, Statistical mechanics, Thermodynamic properties, Reprints, *Lennard-Jones system.

Metastable states associated with the fluid-solid transition in the classical Lennard-Jones system are simulated by means of the Monte Carlo algorithm in statistical mechanics. The simulations are concerned with both the thermal and structural properties of undercooled or overcompressed monatomic fluids.

702,822
PB-265 373/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Monte Carlo Simulation of Ion Motion in Drift Tubes.
Final rept.,
S. L. Lin, and J. N. Bardsley. 1977, 11p
Pub. in J. Chem. Phys., v66 n2 p435-445, 15 Jan 77.

Keywords: *Ions, Monte Carlo method, Electric fields, Atoms, Velocity measurement, Particle collisions, Kinetic reactions, Reprints, Atom ion interactions, Drift tubes.

The motion of a swarm of ions in a uniform electric field is studied by simulating the motion of a single ion through many collisions with neutral atoms, in order to obtain the drift velocity, average energy and velocity distribution for the ions. For K(+) ions in He at low field strengths the results agree well with the solutions of the Boltzmann equation by Kumar and Robson, and for K(+) in Ar at all field strengths the computed mobilities demonstrate that the Viehland-Mason moment method can give useful results, especially if carried through to third order. The velocity distributions computed for O(+) ions in He and Ar are used in the accompanying paper by Albritton et al. to analyze drift tube measurements of O(+) reaction rates. Significant deviations from the Maxwell-Boltzmann form are found which have important effects in that application. Velocity distributions have also been obtained for Li(+) in He. The sensitivity of ionic mobilities to changes in the ion-atom interaction potential is examined, with particular reference to K(+) ions in Ar.

702,823
PB-265 405/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Flash Photolysis Resonance Fluorescence Investigation of the Temperature Dependencies of the Reactions of Cl(doublet p) Atoms with CH4, CH3Cl, CH3F, CH3F(*) and C2H6,
R. G. Manning, and M. J. Kurylo. 1977, 6p
Pub. in J. Phys. Chem, v81 n4 p291-296 1977.

Keywords: *Reaction kinetics, *Methane, *Chloromethanes, *Ethane, Fluorine organic compounds, Chemical reactions, Chemical analysis, Chlorine, Atoms, Temperature, Fluorescence, Reprints, *Methane/fluoro, Chlorine atoms, Flash photolysis.

The flash photolysis resonance fluorescence technique was employed to investigate the temperature dependencies of the reactions: Cl + CH4 to HCl + CH3; Cl + CH3Cl to HCl + CH2Cl; Cl + CH3F to HCl + CH2F; Cl + CH3F(*) to HCl + CH2F; and Cl + C2H6 to HCl + C2H5. The rate expressions are discussed.

702,824
PB-265 407/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photodissociation of Thiophosgene,
H. Okabe. 1977, 5p
Pub. in J. Chem. Phys., v66 n5 p2058-2062, 1 Mar 77.

Keywords: *Photolysis, Molecular energy levels, Dissociation, Phosgene, Chlorine, Fluorescence, Excitation, Atoms, Photochemistry, Ultraviolet spectra, Reprints, Chlorine atoms, *Thiophosgene.

The photolysis of thiophosgene produces CS(A(1) Pi) below the incident wavelength (1270 A) from which delta Hf (SCCl2) < or = to 7.92 plus or minus 1 kcal/mol (33.1 plus or minus 4 kJ/mol) is derived. The quantum yield for the production of Cl atoms has been determined from the amounts of HCl produced from the photolysis of thiophosgene-heptane mixtures. At 2537 A the yield is unity over the pressure region 0.4-80 torr (0.05-10 kPa) of thiophosgene, indicating that the primary photochemical process is almost entirely SCCl+Cl. From the pressure dependence of the quantum yield the lifetime of the excited state (1)A2 is estimated to be about 55 nsec at 4058 A and about 6 nsec at 3660 A. The photochemistry of thiophosgene is compared with that of phosgene and formaldehyde. A new method of Cl isotopic enrichment is suggested.

702,825
PB-265 408/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Grain Boundary Groove Measurement of the Surface Tension Between Ice and Water.
Final rept.,
S. C. Hardy. 1977, 14p
Pub. in Philos. Mag., v35 n2 p471-484 Feb 77.

Keywords: *Surfaces, *Interfacial tension, *Water, Ice, Grain structures, Liquid phases, Solid phases, Surface energy, Heat flow, Thermal conductivity, Reprints, *Ice water interfaces.

The surface tension between ice and water has been measured by observations of the equilibrium shape of grain boundary grooves at an interface stabilized by an imposed temperature gradient. The experiments have been designed to minimize the perturbing effects of heat flow in the cell walls which contain the samples. The observed grooves are in agreement with the theory of Nash and Glicksman (1971) which predicts groove shapes for the case of unequal thermal conductivities in the two phases.

702,826
PB-265 424/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison between Electron Beam and Optically Produced Mercury Excimer Fluorescence,
M. Stock, R. E. Drullinger, and M. M. Hessel. 1977, 3p
Pub. in Chem. Phys. Lett., v45 n3 p592-594, 1 Feb 77.

Keywords: *Mercury, Electron beams, Fluorescence, Excitation, Reprints, *Excimers, Time resolved spectroscopy.

Significant differences have been observed between the mercury excimer fluorescence produced by electron beam and optical excitation. The authors have used time resolved (10 nsec) fluorescent spectroscopy to study the evolution of the excimer system following a 4 nsec optical excitation pulse. The results indicate the visible fluorescence produced by e-beam pumping is probably from cascading transitions and not related to the normal mercury 485 nm transition.

702,827
PB-265 425/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calculations of Rotational Linewidths in HC Perturbed by Argon,
E. W. Smith, and M. Giraud. 1977, 3p
Pub. in J. Chem. Phys, v66 n4 p1762-1764, 15 Feb 77.

Keywords: *Hydrochloric acid, Line widths, Spectrum analysis, Argon, Reprints.

Calculations of rotational line widths in HCl perturbed by Argon are calculated using a recently developed theory for the broadening of linear molecules by atoms. Calculations are made with a semiempirical potential and with a recent purely theoretical potential and comparisons are made with experimental data measured for the 0-0 and 0-1 vibrational bands. The inaccuracy of potentials extracted solely from line profile data is discussed and the importance of high order anisotropic contributions to the interaction is stressed.

702,828
PB-265 430/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Prediction of the Viscosity and Thermal Conductivity Coefficients of Mixtures,
H. J. M. Hanley. 1976, 9p
Pub. in Cryogenics, v16 n11 p643-651 Nov 76.

Keywords: *Viscosity, *Thermal conductivity, *Nitrogen, *Ethane, *Propane, *Butane, *Carbon dioxide, *Mixtures, Transport properties, Equations of state, Predictions, Reprints.

A corresponding states procedure to predict the viscosity and thermal conductivity coefficients of a pure fluid or mixture is discussed. The authors show the transport properties of a given fluid or mixture can be calculated to within experimental error given only corresponding values for a reference fluid and equation of state data. With methane as the reference fluid, they consider nitrogen, ethane, propane, butane, carbon dioxide, and mixtures of these fluids. LNG is also included. It is shown that the conventional corresponding states approach is not sufficient to predict correctly the transport properties. The effect of internal degrees of freedom on the thermal conductivity coefficient and the enhancement in the critical region for this coefficient is discussed briefly.

702,829
PB-265 538/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Time-Resolved Spectroscopy of Laser-Initiated Metal Combustion,
J. C. Moulder, and A. F. Clark. 1976, 9p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, D.C.
Pub. in Proceedings of Unconventional Spectroscopy, San Diego, Calif., August 24-25, 1976, SPIE, v82 p66-74 1976.

Keywords: *Emission spectra, Line width, Visible spectroscopy, Luminescence, Calcium, Magnesium, Titanium, Titanium alloys, Zirconium, Laser spectroscopy, Laser induced fluorescence, Laser target interactions.

A rapid-scan spectrometer employing a silicon-target vidicon detector was used to study the time-resolved emission spectra of laser-ignited metals. Bulk specimens of Ca, Mg, Zr, Ti and several Ti alloys were ignited with a 90 W cw CO2 laser in air or under a gentle flow of oxygen. Line and band emissions observed between 300 and 1100 nm during combustion help to identify vapor phase reactants and products and their locations in the flame. Disappearance of discrete spectra during the transient combustion of Ti and Zr gives information on the accumulation of molten oxide products. Observations of the continuum radiation emitted by laser-irradiated flames indicate a laser-stimulated luminescence from condensed metal oxide particles.

702,830
PB-265 768/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Monte Carlo Trajectory Study of Ar + H2 Collisions. II. Vibrational and Rotational Enhancement of Cross Sections for Dissociation,
N. C. Blais, and D. G. Truhlar. 1977, 7p
Pub. in J. Chem. Phys., v66 n2 p772-778, 15 Jan 77.

Keywords: *Argon, *Hydrogen, *Dissociation, Vibration, Rotation, Potential energy, Surfaces, Atomic energy levels, Molecular association, Inelastic cross sections, Monte Carlo method, Reprints, Van der Waals forces.

Integral cross sections and properties of the dissociated trajectories were calculated for the reactions Ar + H2 yields Ar + H + H and Ar + H2(qb) yields Ar + H + H where H2(qb) is a quasibound H2. Integral cross sections were also calculated for Ar + H2 yields (reversible reaction) Ar + H2(qb). Twenty-four different (21 bound, 3 quasibound) initial vibrational-rotational states of H2 are considered. The potential surface is based on modified statistical calculations at small distances and dissociates to an accurate potential in the van der Waals region and to accurate diatomic curves.

702,831
PB-265 770/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evidence for the Distortion of C2H4 and C2H2 Chemisorbed on W(100),
T. V. Vorburger, B. J. Waclawski, and E. W. Plummer. 1977, 6p
Pub. in Chem. Phys. Lett., v46 n1 p42-47, 15 Feb 77.

Keywords: *Ethylene, *Acetylene, *Surface chemistry, *Molecular structure, Chemisorption, Tungsten, Ultraviolet spectroscopy, Atomic energy levels, Chemical bonds, Spectroscopic analysis, Dehydrogenation, Photoelectrons, Distortion, Reprints.

The adsorption of C2H4 on W(100) has been studied by ultraviolet photoemission spectroscopy with h(nu) = 21.22 eV. The spectrum measured after an initial saturation exposure at 80 K exhibits structure which correlates well with energy levels recently calculated by Demuth and Eastman (DE) for s triplet p 3 rehybridized C2H4. Dehydrogenation of the adsorbate, either by subsequent heating to 295 K or direct adsorption at 295 K, yields a spectrum which correlates with DE's calculation for s doublet p rehybridized C2H2. These results suggest that C2H4 and C2H2 may be distorted from their planar and linear structures respectively and that the C-C bonds on these molecules are stretched by adsorption on W(100). Qualitative arguments suggest that the bonding site for both molecules is directly over a W atom and that the Dewar-Chatt model for pi-d bonding in organometallic compounds is applicable.

702,832
PB-265 773/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Secondary-Electron Energy Distribution in High-Energy Photoemission,
D. R. Penn. 1977, 3p
Pub. in J. Vac. Sci. Technol, v14 n1 p300-302 Jan/Feb 77.

Keywords: *Aluminum, *Photoelectric emission, *Electron energy, Inelastic scattering, Reprints, Electron scattering.

The authors have calculated the energy distribution of secondary electrons observed in core-level XPS or core-level synchrotron photoemission experiments on Al. The secondary electrons are produced when the photoexcited primary electrons scatter inelastically from the valence electrons via the mechanisms of bulk and surface plasmon production and electron-hole production. The scattering cross sections for these events are determined from the Lindhard dielectric function, although the plasmon dispersion and broadening are taken from experimental measurements. Multiple scattering is taken into account by means of the Wolff-Spencer-Fano integral equation for the electron-energy distribution. The calculated results are compared to experiment.

702,833
PB-265 774/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of the Vapor Pressures of TNT, 2, 4-DNT, 2, 6-DNT, and EGDN,
P. A. Pella. 1977, 5p
Pub. in J. Chem Thermodyn., v9 p301-305 1977.

Keywords: *Vapor pressure, *Trinitrotoluene, *Dinitrotoluene, Explosives, Gas chromatography, Reprints, Electron capture detectors, *Ethylene glycol/dinitrate.

The vapor pressures of 2,4,6 trinitrotoluene (TNT), 2,4 dinitrotoluene (2,4 DNT), 2,6 dinitrotoluene (2,6 DNT), and ethylene glycol dinitrate (EGDN) have been measured by an electron capture gas chromatographic method in the temperature range from 287.15 to 329.65 K for TNT, 277.15 to 344.15 K for 2,4 DNT, 277.15 to 323.15 K for 2,6 DNT, and 240.15 to 298.15 K for EGDN.

702,834
PB-265 775/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave and Infrared Spectra of Isotopically Substituted Carbonyl Selenide (OCSe),
A. G. Maki, R. L. Sams, and R. Pearson. 1977, 8p
Pub. in J. Mol. Spectrosc., v64 p452-459 1977.

Keywords: *Spectrum analysis, *Molecular energy levels, Carbonyl compounds, Selenides, Infrared spectroscopy, Microwave spectroscopy, Rotation, Chemical bonds, Isotopes, Reprints, *Carbonyl selenide.

Infrared and microwave spectral measurements are given for three isotopically enriched species of carbonyl selenide. The high resolution infrared measurements (made near 2000/cm and 2600/cm) provide constants for the certain transitions. Microwave measurements are given for the J=4 to 3, and 3 to 2 transitions. Equilibrium rotational constants are given for all three isotopic species and the equilibrium bond distances are determined.

702,835
PB-265 779/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Monte Carlo Trajectory Study of Ar+H2 Collisions. I. Potential Energy Surface and Cross Sections for Dissociation, Recombination, and Inelastic Scattering.
1976, 22p
Pub. in J. Chem. Phys., v65 n12 p5335-5356, 15 Dec 76.

Keywords: *Argon, *Hydrogen, Dissociation, Inelastic cross sections, Recombination reactions, Potential energy, Surfaces, Atomic energy levels, Molecular association, Monte Carlo method, Reprints, Van der Waals forces.

Modified statistical electron-gas calculations using the methods of Gordon, Kim, Rae, Cohen and Pack are carried out to obtain the interaction-energy of Ar with H2 as a function of geometry. The results are combined with accurate pairwise interactions, the long-range nonpairwise interaction, and the potential LeRoy and van Kranendonk fit to spectral data on the van der Waals' complex to obtain a potential energy surface which is as accurate as possible at all geometries.

702,836
PB-265 781/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
He(2(super 3)S) Bubble in Liquid Helium,
J. Wisdom, T. W. Hartquist, and N. F. Lane. 1 Nov 76, 4p
Pub. in Physical Review B, Comments and Addenda, v14 n9 p4205-4208, 1 Nov 76.

Keywords: *Liquid helium, *Atomic structure, Energy levels, Electron transitions, Reprints.

Using the phenomenological model of Padmore and Cole, the authors have re-investigated the nature of the 'bubble' surrounding a 2 triplet S metastable helium atom in liquid helium. The principle result of this work is that a reasonable 2 triplet S to 2 triplet P absorption line shift is obtained in good agreement with the model of Hickman, Steets and Lane, and with experiment, and that a local liquid helium density function is obtained in good agreement with that determined in a very different manner by Hansen and Pollock.

702,837
PB-265 785/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Kinetic Energies and Angular Distributions of Oxygen Atom Photofragments Produced by Photodissociation of O(2) and N(2)O in the Vacuum Ultraviolet,
E. J. Stone, G. M. Lawrence, and C. E. Fairchild. 15 Dec 76, 10p
Pub. in Jnl. of Chemical Physics, v65 n12 p5083-5092, 15 Dec 76.

Keywords: *Oxygen, *Gas ionization, *Nitrogen oxides, Atoms, Photochemical reactions, Reaction kinetics, Molecular energy levels, Detection, Angular distribution, Reprints, Time of flight mass spectroscopy.

A gas phase chemi-ionization process is used to detect O atoms produced by photodissociation of O2 and N2O. For the photon energies used here the accessible O atoms states are within the ground triplet P levels and the metastable singlet D and singlet S levels. Kinetic energies of the O atom photofragments are determined using an atomic beam time-of-flight technique, and the O atom angular distributions are determined by varying the angle between the direction of the photon beam and the atomic beam flight path. Dissociative transitions within the Schumann-Runge continuum of O2 and the principal vacuum ultraviolet absorption continuum of N2O yield results in agreement with previous predictions. Using existing theories of photofragment, angular distributions, an asymmetry parameter having a value of -0.61 + or - 0.05 is obtained for predissociation in O2 at the 10.0 and 10.3 eV absorption features.

702,838
PB-265 787/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Triple-differential Three-dimensional Cross Sections for Low-energy Electron Impact Ionization of Helium,
E. C. Beaty, K. H. Hesselbacher, S. P. Hong, and J. H. Moore. 1977, 10p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics, v10 n4 p611-620 1977.

Keywords: *Helium, *Differential cross sections, *Gas ionization, Electron irradiation, Reprints.

Measurements are reported of the triple-differential cross section for ionization of helium by electron impact. Experimental conditions were chosen to clarify a situation in the theory of ionization. Data are presented for primary energies of 100, 105, 125 and 165 eV. Unlike previous measurements in this energy regime, data are included for the circumstance where the three electron trajectories are not in a plane.

702,839
PB-265 866/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of the Be-Auger-Electron Attenuation Length in Be Using 160-keV Protons,
P. B. Needham, T. J. Driscoll, C. J. Powell, and R. J. Stein. 1977, 3p
Sponsored in part by Bureau of Mines, College Park, Md.
Pub. in Appl. Phys. Lett., v30 n7 p357-359, 1 Apr 77.

Keywords: *Beryllium, *Surface properties, *Electron scattering, Proton irradiation, Auger electrons, Attenuation, Reprints.

The authors report the first results of a method for determining the inelastic attenuation length of low-energy electrons in the surface region of a solid from the yield of characteristic Auger electrons excited by proton bombardment. Samples of evaporated beryllium were bombarded by 160 keV protons and the attenuation length of 105 eV electrons in Be was found to be 5.1 A.

702,840
PB-265 868/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Displacement of Hydrogen by Carbon Monoxide on the (100) Face of Tungsten: A Photoemission and Thermal Desorption Study,
T. V. Vorburger, D. R. Sandstrom, and B. J. Waclawski. 1976, 20p
Sponsored in part by Office of Naval Research, Arlington, Va.
Pub. in Surface Sci., v60 p211-230 1976.

Keywords: *Hydrogen, *Surfaces, *Desorption, *Chemisorption, *Carbon monoxide, Photoelectric emission, Ultraviolet spectroscopy, Tungsten, Displacement reactions, Reprints, *Atom molecule interactions.

Photoelectron spectra (hnu = 21.22 eV) and thermal desorption data were obtained for CO and H coadsorbed on W(100) at 80 K. When the clean surface is exposed to a saturation dose of H2, subsequent exposure to CO results in the formation of a state whose emission spectrum is similar to that of molecular alpha-CO. Upon heating to approximately 280 K, a structural rearrangement occurs in which most of the adsorbed CO is converted to the strongly bound beta form as the hydrogen is simultaneously desorbed. These data plus the observation that H2 cannot be adsorbed to any significant degree on a saturated layer of beta-CO suggest that adsorbed beta-CO and H occupy the same atomic sites on the W(100) surface. The distinction between long and short range repulsive CO-H interactions is discussed. For CO adsorbed on clean W(100), the range of activation energies for virgin to beta conversion is calculated from the UPS data to be 45-62 kJ/mol.

702,841
PB-266 030/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sources of Atomic and Molecular Data for Applications of Lasers in Chemistry,
D. R. Lide. 1977, 4p
Pub. in Laser Focus, v13 n2 p53-56 Feb 77.

Keywords: *Laser beams, *Atomic spectra, *Molecular spectra, Atomic energy levels, Laser materials, Tables(Data), Photon cross sections, Infrared spectra, Visible spectrum, Ultraviolet spectra, Dyes, Reprints, Electron cross sections.

Sources of data on atomic and molecular properties of interest to research workers in the field of laser chemistry are listed. Data on atomic energy levels and spectra; atomic transition probabilities; infrared, visible, and ultraviolet spectra of molecules; electron and photon cross sections; and spectra of dyes are included.

702,842
PB-266 129/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quenching of Chlorine Fluorescence in the Gas Phase,
R. E. Huie, N. J. T. Long, and B. A. Thrush. 15 Dec 76, 3p
Pub. in Chemical Physics Letters, v44 n3 p608-610, 15 Dec 76.

Keywords: *Chlorine, Molecular energy levels, Fluorescence, Dissociation, *Laser induced fluorescence, Reprints.

Laser induced fluorescence has been observed from the B triplet Pi (O(+)(u)) state of chlorine. Lifetimes have been measured from 19 to 208 Pa, but the radiative lifetime is too long to be extracted from the data. A rate coefficient of 3.2 x 10 to the 13th power cc/mol s was measured for quenching by Cl2 or Ar, the removal process being collision induced predissociation of the triplet Pi(O(+2)(u)) state.

702,843
PB-266 135/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reaction between Triplet Methylene and CO2: Rate Constant Determination,
A. H. Laufer, and A. M. Bass. 15 Feb 77, 5p
Pub. in Chemical Physics Letters, v46 n1 p151-155, 15 Feb 77.

Keywords: *Reaction kinetics, *Methane, *Carbon dioxide, Gas chromatography, Vibration, Carbon monoxide, Formaldehyde, Chemical reactions, Photolysis, Reprints.

The rate constant (k3) for the reaction (3)CH2 + CO2 HCHO + CO has been measured using flash photolysis in conjunction with both gas chromatography and kinetic spectroscopy. k3 was found to be (3.9 + or - 1.9) x 10 to the -14th power cc/molecule s. CO, vibrationally excited to at least nu = 2 is a product of the reaction. The rate constant for the abstraction by triplet CH2 from CH2N2 to produce CH3 was determined to be 1.0 x 10 to the -12th power cc/molecule s.

702,844
PB-266 136/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Elastic Electron Scattering from the Isotopes (super 36)Ar and (super 40)Ar,
J. M. Finn, H. Crannell, P. L. Hallowell, J. T. O'Brien, and S. Penner. 1976, 17p
Sponsored in part by National Science Foundation, Washington, D.C.
Pub. in Nuclear Physics, A274 p28-44 1976

Keywords: *Argon isotopes, *Elastic scattering, Phase shift, Reprints, *Electron scattering, *Argon 36, *Argon 40.

The charge structure of 36Ar and 40Ar has been investigated using the technique of elastic electron scattering. Data were collected at the National Bureau of Standards Linear Accelerator with incident electron energies ranging from 65 to 115 MeV and a scattering angle of 110. The data span a range of sq q between 0.29 and 0.92/fm. Phase shift fits to a 2-parameter Fermi distribution yield model dependent rms charge-radius values of 3.33 + or - 0.02 fm for 36 Ar and 3.39 + or - 0.02 fm for 40Ar. These values are compared with the results of previous experiments on these nuclei.

702,845
PB-266 481/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Time and Spectral Resolution in Resonance Scattering and Resonance Fluorescence,
E. Courtens, and A. Szoeke. Apr 77, 16p
Pub. in Phys. Rev. A 15 n4 p1588-1603 Apr 77.

Keywords: *Fluorescence, *Resonance scattering, Rayleigh scattering, Raman spectra, Excitation, Laser materials, Reprints, Raman scattering, Two photon absorption.

The theory of resonance Raman effect, resonantly enhanced two-photon absorption, and resonance fluorescence -- valid also for strong fields -- is treated in a unified and simplified way. Dressed states, Bloch equations and perturbation theory are used to calculate line positions, and integrated intensities both for steady state and transient excitation. The case of adiabatic following is solved explicitly; it occurs when an off-resonance incident pulse is tuned on and off slowly. It leads to the identification of Raman scattering, two-photon absorption, and Rayleigh scattering with an adiabatic process while fluorescence and consecutive two-photon absorption with non-adiabaticity. Time-dependent spectra are defined in a rigorous way and it is shown that all our formulas agree in the various limits with all the others that appear in the literature.

702,846
PB-266 485/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Liquid + Vapor Equilibria in Methane + Ethene and in Methane + Ethane from 150.00 to 190.00 K,
R. C. Miller, A. J. Kidnay, and M. J. Hiza. 1977, 12p
Pub. in Jnl. Chem Thermodyn. v9 n2 p167-178 1977.

Keywords: *Chemical equilibrium, *Methane, *Ethane, *Ethene, Liquid phases, Vapor phases, Experimental design, Isotherms, Reprints.

Liquid + vapor equilibrium compositions and pressures are reported for the methane + ethane system at 160.00 and 180.00K and for the methane + ethene system at 150.00, 160.00, 170.00, 180.00 and 190.00K. Liquid phase G(E) values have been estimated from the experimental data. Equimolar liquid mixture G(E) values are compared with the results of previous investigations at temperatures less than 190K. For methane + ethane, G(E) values from ten of the fifteen isotherms analyzed agree within approximately + or - 20 J/mol. Eleven of the thirteen available methane + ethene isotherms yield equimolar G(E) values that agree within the same limits.

702,847
PB-266 488/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theoretical Transition Dipole Moments and Lifetimes for the A1 Sigma(+)u yields X1 Sigma (+)g System of Na2,
W. J. Stevens, M. M. Hessel, P. J. Bertoncini, and A. C. Wahl. 15 Feb 77, 6p
Pub. in Jnl. Chem Phys. v66 n4 p

Keywords: *Sodium, *Dipole moments, Numerical analysis, Potential energy, Vibration, Rotation, Molecular energy levels, Reprints, *Lifetimes(Electrons), Multiconfiguration self-consistent-field.

Multiconfiguration self-consistent-field (MCSCF) calculations have been carried out on the X(1)epsilon(g)(+), A(1)epsilon(u)(+), and B(1)Pi(u) states of Na2. The calculated potential energy curves are in good agreement with the experimental X and A RKR curves of Hessel and Kusch. Both the A-X and B-X transition moments have been calculated as a function of nuclear separation using MCSCF wavefunctions. Our calculations are in excellent agreement with the recent experimental determinations of the B goes to X transition moment. A-values and lifetimes of several A-state vibrational and rotational levels for the A goes to X transition have been calculated using the theoretical transition moment and the experimental potential curves of Hessel and Kusch. These are in excellent agreement with the recently measured lifetimes.

702,848
PB-266 489/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurements of the Orthobaric Liquid Densities of Methane, Ethane, Propane, Isobutane, and Normal Butane.
Rept. for Jan 74-Jan 76,
W. M. Haynes, and M. J. Hiza. Feb 77, 9p
Sponsored in part by American Gas Association, Inc., Arlington, Va. LNG Density Project Steering Committee.
Pub. in Jnl. Chem Thermodyn. v9 n2 p179-187 Feb 77.

Keywords: *Methane, *Ethane, *Propane, *Butanes, *Density(Mass/volume), Natural gas, Liquid phases, Tables(Data), Reprints.

The orthobaric liquid densities of the major components of natural gas have been determined with a magnetic suspension densimeter. This paper reports results for methane (105 to 160K), ethane (100 to 270K), propane (100 to 288K), isobutane (115 to 300K), and normal butane (135 to 300K). The imprecision of the measured densities is approximately 0.015 per cent; the estimated overall uncertainty is 0.1 per cent at low temperatures and decreases to 0.06 per cent at 300K. A simple expression has been used to represent the densities as a function of temperature.

Comprehensive comparisons with the experimental results of other investigators are presented.

702,849
PB-266 579/2 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, Colo. Cryogenics Div.
Predicted Values of the Viscosity and Thermal Conductivity Coefficients of Nitrous Oxide.
Final technical note,
H. J. M. Hanley. Mar 77, 68p NBS-TN-693

Keywords: *Nitrogen oxide(N2O), *Viscosity, *Thermal conductivity, Numerical analysis, Mixtures, Carbon dioxide, Transport properties, Thermodynamics, Accuracy, Tables(Data), Statistical mechanisms.

The viscosity and thermal conductivity coefficients of nitrous oxide are calculated for temperatures between 180 and 900K (330 to 1600R) for pressures to 23 MPa (approximately 3500 psi). Tables of values are presented. Two mixtures with carbon dioxide are also discussed. These transport coefficients (for the pure fluid and for the mixtures) were predicted from thermodynamic data. Details of the prediction procedure are presented. Estimates of the accuracy of the tabular values are + or - 6% for the viscosity and + or - 8% for the thermal conductivity.

702,850
PB-266 611/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Collisional Redistribution and Saturation of Near-Resonance Scattered Light,
J. L. Carlsten, A. Szoke, and M. G. Raymer. Mar 77, 17p
Contract N00014-76-C-0611, Grant NSF-MPS72-05169
Pub. in Physical Review A, v15 n3 p1029-1045 Mar 77.

Keywords: *Laser beams, *Light scattering, Dye lasers, Strontium, Visible spectra, Fluorescence, Rayleigh scattering, Planetary atmospheres, Stellar atmospheres, Reprints.

This paper reports on studies of near-resonant scattering of laser light in a collisional environment. A pulsed dye laser with a peak power of 55 MW/sq. cm was tuned near the 460.73 nm resonance line of strontium and the side emission was observed from an oven containing both strontium vapor and argon buffer gas. By measuring the ratio of the intensities of the fluorescence and Rayleigh components, the authors were able to directly measure the collisional redistribution function, important in the study of radiative transfer in stellar and planetary atmospheres.

702,851
PB-266 859/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ionization of a Model Atom by a Pulse of Coherent Radiation,
S. Geltman. 1977, 10p
Grant NSF-MPS72-05169
Pub. in J. Phys. B: Atom. Molec. Phys., v10 n5 p831-840 1977.

Keywords: *Gas ionization, *Atoms, Mathematical models, Electron tunnelling, Photons, Absorption, Schrodinger equation, Wave equations, *Laser induced fluorescence, Reprints.

The time evolution of the ionization probability of a simple one-dimensional model atom under the influence of harmonic electric field is studied by the numerical solution of the time-dependent Schrodinger equation. The conditions are clarified under which tunnelling or multiphoton absorption may be regarded as appropriate mechanisms. The standard tunnelling formulas are found to give poor quantitative estimates of ionization probability. The length of the radiation pulse is found to be of critical importance, as multiphoton absorption is seen to require a certain minimal time to develop. The overall behavior predicted is consistent with measurements on the laser-induced breakdown of gases.

702,852
PB-267 227/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Spectrum and Molecular Structure of Methylenimine (CH2NH),
R. Pearson, and F. J. Lovas. 1 May 77, 8p
Pub. in Jnl. of Chemical Physics, v66 n9 p4149-4156, 1 May 77.

Keywords: *Molecular structures, Isotopes, Deuterium compounds, Numerical analysis, Microwave spectroscopy, Pyrolysis, Rotation, *Methylenimine, Reprints.

The microwave spectra of five new isotopic species of CH2NH have been measured in the pyrolysis products of aqueous solutions of methyamine and 1,2-diaminoethane. Rotational constants and moments of inertia have been determined for (13)CH2(14)NH, (12)CH2(15)NH, (12)CH2(14)ND, (12)CD2(14)NH, and (12)CD2(14)ND.

702,853
PB-268 201/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High-Resolution Measurements of Molecular Absorption Line Profiles at 10 Micrometers,
H. J. Raterink, H. van de Stadt, and H. J. Frankena. 1977, 3p
Pub. in Optics Communications, v20 n3 p415-417 Mar 77.

Keywords: *Carbon dioxide, *Ethylene, *Ammonia, Absorption spectra, Infrared spectroscopy, Line spectra, Profiles, Intermediate infrared radiation, Reprints.

Absorption line profiles of CO2, C2H4 and NH3 have been measured around a wavelength of 10 micrometers and under various conditions using a passive heterodyne detection technique with a resolution of 0.0006/cm.

702,854
PB-268 204/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Angle-Resolved Photoemission from Crystal-Field-Split Adatom Levels,
J. F. Herbst. 15 Apr 77, 11p
Pub. in Phys. Rev. B, v15 n8 p3720-3730, 15 Apr 77.

Keywords: *Photoelectric emission, Surfaces, Angular distribution, Metals, Atomic energy levels, Adsorption, Xenon, Mercury(Metal), Tungsten, Reprints, *Adatom surface interactions.

The author investigated the angular distribution of photoelectrons emitted from atoms physisorbed on the surface of a metal. The crystalline electric field of the surface is represented by a small number of point charges in the vicinity of the adatom, and the splittings of p and d adatom levels in the crystal field are calculated. The spin-orbit splitting of the adatom states is assumed to be large in comparison with the crystal-field effects. For adatom p levels, both fourfold and bridge sites on a (100) surface of an fcc or bcc metal are considered. Results are included for d states in the fourfold configuration. Within the dipole approximation, photoelectron distributions are calculated for these cases assuming normally incident, unpolarized light. The results demonstrate that the angular distributions are sensitive to substrate geometry. Implications of this work for recent ultraviolet photoemission experiments involving xenon and mercury adsorbed on a tungsten surface are discussed.

702,855
PB-268 206/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effective Crystal Fields in the Rare Earth Pnictides,
J. F. Herbst, P. Bak, and R. E. Watson. 1977, 8p
Prepared in cooperation with Energy Research and Development Administration, Washington, D.C.
Pub. in Physica, v86-88 B and C, pt. 1, p123-124, Jan-Mar 77.

Keywords: *Atomic energy levels, *Rare earth compounds, Electrostatic fields, Ligands, Reprints, *Pnictides, Crystal fields.

Various contributions to the effective 4f electron crystal fields in the rare earth pnictides are estimated and compared. These include the direct interaction with the ligand electrostatic field and effects associated with the 5d band electrons.

702,856
PB-268 208/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Importance of Isotope-Dependent Transmission Coefficients in Calculating Low-Temperature Isotope Effects,
D. G. Truhlar, A. Kupperman, and J. Dwyer. 1977, 6p
Pub. in Mol. Phys., v33 n3 p683-688 1977.

Keywords: *Isotope effect, Low temperature tests, Hydrogen, Deuterium, Transition probabilities, Reprints.

The authors compared conclusions which may be drawn from their previous work on the collinear H + H2 reaction concerning practical calculations of isotope effects with conclusions drawn by Wu, Johnson, and Levine. They present calculations designed to elucidate the difference in conclusions. They suggest that one should not assume that accurate isotope effects for reactions involving H and D can be calculated from transition state theory using transmission coefficients equal to unity, especially at room temperature and lower temperatures.

702,857
PB-268 209/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
4-Hydroxy-4H-Furo(3,2-c)Pyran-2(6H)-one (DL-Patulin),
C. R. Hubbard, A. D. Mighell, and G. M. Ware. 1977, 4p
Pub. in Acta Cryst. B33, p928-931 1977.

Keywords: *Crystal structure, Chemical bonds, Molecular structure, Least squares method, Hydrogen bonds, X ray diffraction, Reprints, *Pyranone/hydroxyfuran.

DL-Patulin, C7H6O4, M. W. 154.1, Monoclinic, P2I/n, a=9.008(2), b=9.549(2), c=7.786(2)A, beta=94.80(2), Z=4, D(m)=1.527, D(x)=1.535. The structure has been solved by direct methods and refined by least-squares techniques to a final R value of 0.05. The centrosymmetrically related molecules form dimers via a pair of hydrogen bonds connecting the OH hydrogen atom to the pyran ring oxygen atom. The hydrogen bond O...O distance is 2.810(2)A and the O-H...O angle is 167(2) degrees.

702,858
PB-268 210/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Intensity Distribution in the Na2 and Li2 A-X Bands,
L. K. Lam, A. Gallagher, and M. M. Hessel. 15 Apr 77, 7p
Contract E(49-1)-3800
Pub. in Jnl. of Chem. Phys., v66 n8 p3550-3556, 15 Apr 77.

Keywords: *Sodium, *Lithium, *Band spectrum, Intensity, Emission spectra, Fluorescence, Electron transitions, Molecular properties, Quantum mechanics, Reprints, Franck-Condon principle.

The accuracy of the quasistatic or classical Franck-Condon approximation for unresolved bound-bound molecular bands is investigated by comparison with appropriately averaged quantum mechanical calculations. Wavelength-averaged absorption and stimulated emission cross sections are calculated for the A-X bands of Na(2) and Li(2) representing low resolution or collision broadened spectra and comparisons are made with experimental spectra. These A-X bands exhibit a red edge, due to a head of heads or the classical satellite, and a comparison of quantum mechanical, classical and semiclassical satellite shapes is made. The overall quantum mechanical band shapes agree with the classical calculation, except for approximately periodic band structures and nonclassical behavior at the satellites. The emission spectrum resulting from white-light or electron excitation of Na(2), is also calculated and compared to that observed in an electrical discharge. Finally, emission spectra of Na2 for thermal distributions at various temperatures are compared to the fluorescence spectrum observed from excited dimers formed by an atom-molecule excitation transfer process.

702,859
PB-268 211/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of the Kinetic Constants in a Two-Substrate Enzymatic Reaction,
W. T. Yap, B. F. Howell, and R. Schaffer. Apr 77, 2p
Pub. in Jnl. of Chem. Ed., n54 p254-255 Apr 77.

Keywords: *Reaction kinetics, *Enzymes, Graphic methods, Substrates, Concentration(Composition), Reprints.

A graphical method is presented for the analysis of the initial velocity data in a two-substrate reaction. The reciprocal of the initial velocity is plotted versus a linear combination of the reciprocals of the two substrate concentrations. From the two extrapolated lines, at infinite concentration of each of the two substrates, the

two Michaelis constants and the maximum velocity were determined. The method was illustrated, using data from the reaction of pyruvate with NADH, catalyzed by LDH.

702,860
PB-268 212/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
ac Stark Effect in Multiphoton Ionization,
S. E. Moody, and M. Lambropoulos. Apr 77, 5p
Pub. in Phys. Rev. A 15, n4 p1497-1501 Apr 77.

Keywords: *Stark effect, *Sodium, Atoms, Ionization, Reprints.

Multiphoton ionization of atomic sodium has been studied experimentally for near resonance between the radiation field and several bound-bound transitions of the atom. It was found that the atom-field interaction must be treated in a highly nonlinear way to successfully describe the observations, even when the absolute spectral power densities are relatively modest. Rabi frequencies as high as 10 GHz are found to be directly observable with simple flashlamp pumped tunable dye lasers.

702,861
PB-268 543/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hyperfine Fields at Impurity Sites in Iron,
R. E. Watson, and L. H. Bennett. 1977, 2p
Pub. in Physica 86-88B, p435-436 1977.

Keywords: *Iron, *Hyperfine structure, Electronegativity, Ferromagnetic materials, Atomic structure, Valence, Reprints.

Controversy has recently revived concerning the correlation of hyperfine fields at impurity atom sites in ferromagnetic iron with atomic volume or with valence. Using a scheme to normalize to the free atom hyperfine field, the authors inspect the correlations of volume, valence and electronegativity with new normalized values.

702,862
PB-268 544/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Desorption Methods as Probes of Kinetics and Bonding at Surfaces,
T. E. Madey, and J. T. Yates. 1977, 29p
Pub. in Surface Science 63, p203-231 1977.

Keywords: *Surface chemistry, *Desorption, *Chemical bonds, *Angular distribution, Chemisorption, Oxygen, Ions, Tungsten, Reprints.

This paper is divided into two parts. Firstly, a review of desorption methods is presented, with emphasis on the use of temperature programmed desorption (TPD) and electron stimulated desorption (EDS) for understanding the bonding of adsorbed species to surfaces. Secondly, recent studies of the angular distribution of ESD ions from adsorbed layers on W(011) are discussed. The EDS of O(+) ions from oxygen adsorbed on a stepped W(011) surface is shown to be sensitive to the presence of atom steps.

702,863
PB-268 630/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calculation of Atomic Hyperfine-Field Coupling Constants,
R. E. Watson, and L. H. Bennett. 1 Jan 77, 2p
Pub. in Phys. Rev. B 15, n1 p502-503, 1 Jan 77.

Keywords: *Atomic energy levels, *Hyperfine structure, Nuclear magnetic resonance, Numerical analysis, Atoms, Mossbauer effect, Reprints.

The hyperfine fields characteristic of the free atom valence s electron are calculated to form a consistent set of values for normalization of hyperfine fields obtained by NMR, Mossbauer and other techniques in solids.

702,864
PB-268 946/1 Not available NTIS
National Bureau of Standards, Washington, D.C.
Electronic and Catalytic Properties of Refractory Hard Metals,
L. H. Bennett, A. J. McAlister, J. R. Cuthill, N. E. Erickson, and R. E. Watson. 1977, 7p
Pub. in Jnl. Mol. Catalysis, v2 p203-209 1977.

Keywords: *Refractory metals, *Catalysis, X ray analysis, Photoelectric emission, Molybdenum organic compounds, Tungsten compounds, Electron transitions, Fermi surfaces, Valence bands.

It has been observed experimentally that the compounds WC and MO2C are catalytically active for hydrogen, whereas the host metals are inactive. The authors have previously studied the valence bands of W and WC by x-ray photoemission and found that the density of electron states at the Fermi level, N(EF), of WC is materially higher than that of W. They report here that a similar study of the valence bands of Mo and Mo2C; again, the compound is found to have higher N(EF) than the metal. X-ray photoemission data relevant to the surface properties of WC are also presented.

702,865
PB-269 732/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Orbital Level Splitting in Octahedral Symmetry and SF(6) Rotational Spectra. I. Qualitative Features of High J Levels.
Final rept.,
W. G. Harter, and C. W. Patterson. 1 Jun 77, 14p
Pub. in Jnl. of Chemical Physics, v66 n11 p4872-4885, 1 Jun 77.

Keywords: *Molecular energy levels, *Sulfur hexafluoride, Mathematical models, Crystallography, Splitting, Reprints, Ligand fields.

The interesting qualitative features of octahedral symmetry splitting of orbital levels with large angular momentum are derived, using a simple quantum mechanical model. The clustering of certain octahedral group representations, which has recently been observed in high resolution SF6 spectra, is explained in detail. Semiquantitative formulas for splitting of the clusters are derived. An analogy with electron energy bands and Bloch waves is shown. The ground work is laid for quantitative theory which is given in the following article.

702,866
PB-269 733/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Spin Coherence of Kramers Ions in Solids in Zero External Static Magnetic Field.
Final rept.,
M. D. Kemple. 1976, 4p
Pub. in Proceedings of Congress Ampere (19th), Heidelberg, W. Germany 27 Sep-1 Oct 76, Paper in Magnetic Resonance and Related Phenomena, p423-426 1976.

Keywords: *Neodymium compounds, Spin lattice relaxation, Magnetic fields, Crystals, Ions, Cryogenics, Lanthanum chlorides, Neodymium chlorides, *Kramers ions.

Observations of nutation, adiabatic passage, free induction decay, spin echoes, and spin locking, at temperatures 1.3 - 4.2 K, of the near 2 GHz zero applied static magnetic field magnetic resonance transition of (143)Nd(+3) ions dilutely substituted for La(+3) in crystals of LaCl3 are described.

702,867
PB-269 737/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measured Stark Widths and Shifts for Neutral Phosphorus Lines.
Final rept.,
P. A. Voigt, and J. R. Roberts. Mar 77, 4p
Pub. in Physical Review, vA15 n3 p1006-1009 Mar 77.

Keywords: *Phosphorus, Ultraviolet spectra, Visible spectrum, Stark effect, Line widths, Debye-Scherer method, Reprints.

Stark widths and shifts have been measured for six uv lines and three visible lines of neutral phosphorus in a wall stabilized arc. The phosphorus is introduced into the arc in three forms: PC13 vapor, atomized H2PO3, and PF5 gas. The results agree well with theory for both widths and shifts of the visible lines. It is suggested that the discrepancy for the widths may be due to the neglect of Debye shielding in the theory.

702,868
PB-269 742/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Orbital Level Splitting in Octahedral Symmetry and SF6 Rotational Spectra. II. Quantitative Treatment of High J Levels.
Final rept.,
C. W. Patterson, and W. G. Harter. 1 Jun 77, 7p
Pub. in Jnl. of Chemical Physics, v66 n11 p4886-4892, 1 Jun 77.

Keywords: *Molecular energy levels, *Sulfur hexafluoride, Rotation, Angular momentum, Splitting, Reprints.

The authors gave a quantitative analysis for the clusters of octahedral terms which appear in the high resolution rotational spectra of SF6 for large angular momentum. They derived approximate expressions for the cluster energies and the splittings within each cluster which obviate the diagonalization of the octahedral deformation potential.

702,869
PB-269 952/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Adiabatic Perturbation Approximation for Time Dependent Collision Processes.
Final rept.,
J. C. Light. 1 Jun 77, 2p
Grant NSF-CHE76-11809
Pub. in Jnl. of Chemical Physics, v66 n11 p5241-5242, 1 Jun 77.

Keywords: *Perturbation theory, Time measurements, Reprints, *Collision theory.

The authors show that unitary perturbation theory on an adiabatic basis set in an interaction representation yields quite accurate semiclassical transition probabilities over the entire range of the adiabaticity parameters.

702,870
PB-270 045/8
(Order as PB-270 044/1, PC **A11**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Atomic Weight of Gallium,
G. Marinenko. 1977, 4p JNBAAR-81A(1)-1
Included in Jnl. of Research of the National Bureau of Standards, Section A, Physics and Chemistry, v81A n1 p1-4 Jan-Feb 77, PB-270 044.

Keywords: *Atomic weights, *Gallium, Stoichiometry, Reprints, Coulometry.

Accurate measurement of stoichiometry of GaAs provides new data which are used for calculation of the atomic weight of Ga. Using the IUPAC accepted value for the atomic weight of As (74,9216), the atomic weight of Ga based on this work is 69,737 + or - 0.006. The mean of two independent chemical values for the atomic weight of Ga, on obtained by Lundell and Hoffman and the other in this work, is 69,735.

702,871
PB-270 046/6
(Order as PB-270 044/1, PC **A11**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Vapor Pressure Formulation for Ice,
A. Wexler. 1977, 16p JNBAAR-81A(1)-2
Included in Jnl. of Research of the National Bureau of Standards, Section A, Physics and Chemistry, v81A n1 p5-20 Jan-Feb 77, PB-270 044.

Keywords: *Vapor pressure, *Ice, Critical point, Thermal properties, Thermodynamics, Reprints.

A new formulation is presented for the vapor pressure of ice from the triple point to -100C based on thermodynamic calculations. Use is made of the definitive experimental value of the vapor pressure of water at its triple point recently obtained by Guildner, Johnson, and Jones. A table is given of the varpor pressure as a function of temperature at 0.1-degree intervals over the range 0 to -100C, together with the values of the temperature derivative at 1-degree intervals. The formulation is compared with published experimental measurements and vapor pressure equations. It is estimated that this formulation predicts the vapor pressure of ice with an overall uncertainty that varies from 0.016 percent at the triple point to 0.50 percent at -100C.

702,872
PB-270 048/2

(Order as PB-270 044/1, PC **A11**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Atlas of the I2 Spectrum from 19 000 to 18 000/cm,
J. D. Simmons, and J. T. Hougen. 1977, 56p JNBAAR-81A(1)-4
Included in Jnl. of Research of the National Bureau of Standards, Section A, Physics and Chemistry, v81A n1 p25-80 Jan-Feb 77, PB-270 044.

Keywords: *Iodine, *Visible spectrum, Laboratory equipment, Standards, Tables(Data), Line spectra, Reprints.

A line identification band atlas is presented for a 1000/cm segment, from 19,000 to 18,000/cm, of the molecular iodine absorption spectrum. Each page of the atlas covers a 20/cm region of the spectrum and contains a CALCOMP produced photodensitometer trace of the spectrum together with accompanying tabular identification data. The tabular data includes: line identification numbers, observed wavenumbers, calculated wavenumbers, and rotational and vibrational assignments.

702,873
PB-270 051/6
(Order as PB-270 044/1, PC **A11**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Frequency Dependence of Intrinsic Stress and Birefringence Tensor of Bead/Spring Model of Polymer Solutions,
A. Peterlin, and J. T. Fong. 1977, 12p JNBAAR-81A(1)-7
Included in Jnl. of Research of the National Bureau of Standards, Section A, Physics and Chemistry, 81A n1 p97-107 Jan-Feb 77, PB-270 044.

Keywords: *Polymers, Solutions, Hydrodynamics, Diffusion, Mathematical models, Matrices(Mathematics), Tensor analysis, Frequency response, Reprints, Bead spring model.

The recently obtained complete solution of the simultaneous diagonalization of matrices HA and H in the hydrodynamic diffusion equation has basically changed the diagonal values nu(P) of the symmetric matrix H of hydrodynamic interaction between all the beads of the elastic random coil model of the isolated macromolecule in solution. Since these values enter explicitly the expressions for the intrinsic stress and refractive index tensor in an alternating flow field if based on the concept of internal viscosity of the model one had to recalculate all values obtained formerly by using the then generally accepted erroneous set of nu(P) data. The new nu(P) equal unity independent of p while the old values were larger than 1 for small p and smaller for large p. Hence their too large contributions in the former range are partially compensated by their too small contributions in the latter region. As a consequence in the whole range investigated, between 3 and 300 chain links, the differences in rheological and rheooptical effects are relatively small, up to a factor of 2, although at higher link number the differences tend to grow with the logarithm of this number.

702,874
PB-270 200/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
13C Magnetic Resonance Evidence for Anisotropic Molecular Motion in Collagen Fibrils.
Final rept.,
D. A. Torchia, and D. L. VanderHart. 1976, 7p
Pub. in Jnl. Mol. Biol., v104 p315-321 1976.

Keywords: *Nuclear magnetic resonance, *Collagens, *Molecular structure, Isotopic labeling, Carbon isotopes, Reprints, Carbon 13.

Relaxation times and integrated intensities have been obtained from dipolar decoupled (13)C magnetic resonance spectra of reconstituted fibrils of chick calvaria collagen enriched at the glycine C(alpha) and C' positions. The data obtained are consistent with a model in which collagen molecules reorient about the long axis of the helix with a rotational diffusion constant (R1) of ca. 10 to the 6th power/sec, a value close to that expected for the helix in solution. Data obtained from natural abundance (13)C spectra of native (cross-linked calf achilles tendon and rat tail tendon provide evidence of rapid anisotropic reorientation for at least 75% of the carbons in these tissues. Hence, our preliminary data indicate that, in these materials, the intermolecular interactions in the fibrilar collagen lattice can accomodate rapid axial reorientation at a majority of carbon sites.

702,875
PB-270 201/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of U I Relative Oscillator Strengths.
Final rept.,
P. A. Voight, and R. L. Kornblith. 1976, 2p
Pub. in Jnl. Opt. Soc. Am., v66 n5 p492-493 May 76.

Keywords: *Uranium, Isotope separation, Uranium 235, Lasers, Ultraviolet spectroscopy, Reprints, Uranium 238, *Oscillator strengths, Laser isotope separation.

Relative oscillator strengths have been measured for ten strong lines of U I which may be useful in laser isotope separation of (238)U and (235)U. The U I spectra was generated in a flow stabilized arc, which is essentially a free burning arc stabilized by streaming an inert buffer gas around one of the electrodes which is formed from a molten ball of uranium held in a tungsten cup. The relative oscillator strengths were placed on an absolute scale employing a recent lifetime determination for the 27 887/cm level of U I.

702,876
PB-270 204/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Atomic Oxygen on the Surface Morphology of Polyethylene.
Final rept.,
D. H. Reneker, and L. H. Bolz. 1976, 10p
Pub. in J. Macromol. Sci.-Chem., vA10 n3 p599-608 1976.

Keywords: *Surface chemistry, *Polyethylene, Oxygen, Atoms, Electrical discharges, Crystals, *Oxygen atoms, Reprints.

This paper characterizes the attack of atomic oxygen on polymer surfaces, using electron microscopic observations of known morphological features of polyethylene to observe the changes produced by atomic oxygen. Lamellar polyethylene crystals were attacked both at the edges and the fold surfaces. Layers many microns thick were removed from spherulitic samples and replicas obtained from the surfaces thus exposed. Thick samples were thinned to the point at which they were transparent to an electron beam and interior morphological features were directly observed.

702,877
PB-270 317/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stability of Liquid Zones.
Final rept.,
S. R. Coriell, S. C. Hardy, and M. R. Cordes. 1977, 11p
Contract NASA-W-13475
Pub. in J. Colloid Interface Sci., v60 n1 p126-136, 1 Jun 77.

Keywords: *Zone melting, Liquid phases, Surface tension, Gravity, Stability, *Space processing.

The criterion for the stability of a liquid zone of volume V and length L between the two parallel circular coaxial plates of radius R and R(u) is formulated based on the calculus of variations. The liquid in the zone is static or uniformly rotating with angular velocity omega and is subject to a gravitational acceleration g along the axis of the plates. Experimental and theoretical results for horizontal liquid zones (gravitational field perpendicular to the axis of the plates) show that for small Epsilon horizontal zones are more stable than vertical zones.

702,878
PB-270 326/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Towards a Molecular Theory of Freezing II: Study of Bifurcation as a Function of Density.
Final rept.,
H. J. Raveche, and C. A. Stuart. 1976, 8p
Pub. in J. Chem. Phys., v65 p2305-2312, 15 Sep 76.

Keywords: *Freezing, *Molecular theory, *Density(Mass/volume), Liquid phases, Metastable state, Potential energy, Bifurcation, Reprints.

The authors studied as a function of density, crystalline solutions for the single particle density which bifurcate in a hard sphere fluid. The BBGKY equation is used to describe the fluid phase, with its closure taken from computer simulations. The existence of bifurcation is shown to be a characteristic of metastable states. When compared to the known hard disk and sphere isotherms, the bifurcation points are seen to be remarkably consistent with the density at which the metastable extension of the crystalline branch meets the equilibrium fluid branch of the isotherm. Metastable crystalline arrays are also predicted in one dimension. The controversial Kirkwood instability criterion is interpreted in terms of our theory. They showed that bifurcation is possible with a rather large class of potential energy functions. The possibility of bifurcation at densities near the jamming densities observed in the amorphous packing of incompressible spheres and disks is also discussed.

702,879
PB-270 327/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nuclear Hyperfine Effects / Overview.
Final rept.,
L. H. Bennett, L. J. Swartzendruber, and R. C. Reno. 1976, 15p
Pub. in Proceedings of Workshop on Nondestructive Evaluation of Residual Stress, San Antonio, Texas, August 13-14, 1975, p247-261 1976.

Keywords: *Hyperfine structure, *Chemical analysis, Residual stress, Nuclear magnetic resonance, Mossbauer effect, Perturbation, Quantum theory, Perturbed angular correlation.

An overview of nuclear hyperfine techniques (nuclear magnetic resonance, Mossbauer effect, and perturbed angular correlation) was presented at a recent U.S. Air Force Workshop held in San Antonio, Texas on Nondestructive Evaluation (NDE) of Residual Stress in Materials.

702,880
PB-270 328/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chemical Factors Influencing Metal Alkylation in Water.
Final rept.,
K. L. Jewett, F. E. Brinckman, and J. M. Bellama. 1975, 15p
Pub. in ACS Sump. Series 18, Marine Chemistry in the Coastal Environment, Paper 17, p304-318 1975.

Keywords: *Metals, *Alkylation, Reaction kinetics, Water, Mercury, Tin, Photolysis, Metal containing organic compounds, Complex compounds, Reprints.

Understanding the role of metals in the environment requires examination of those factors involved in the dynamics of metal transformations. One such influence, ligand interactions, is involved in abiotic transalkylation between heavy metal species in aqueous solution. Another factor influencing metal transformations is photoalkylation. The photolysis of CH3HgAc (Ac = acetate), T1Ac and unsuccessful attempts to photolyze NaAc are discussed, and implications for environmental chemistry are considered.

702,881
PB-270 346/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Volume-Corrected Isomer Shifts of Transition Metal Impurities: An Orbital Electronegativity Scale.
Final rept.,
R. E. Watson, and L. H. Bennett. 1977, 5p
Pub. in Phys. Rev. B, v15 n11 p5136-5140, 1 Jun 77.

Keywords: *Mossbauer effect, *Transition metals, *Electronegativity, Iron, Gold, Ruthanium, Tantalum, Iridium, Platinum, Alloys, Isotopes, Impurities, Reprints.

It is shown that, once volume effects are accounted for, a universal curve describes the Mossbauer isomer shifts of (57)Fe, (99)Ru, (181)Ta, (193)Ir, (195)Pt, and (197)Au impurity nuclei in a variety of hosts. The curve defines an 'orbital' electronegativity associated with non-d electron charge flow on or off these transition metal atoms in alloys. The shape of the curve is remarkable in the extent to which it agrees with the 'total' electronegativity scales of Pauling, Gordy-Thomas and others. This agreement suggests that d and non-d charge flow are simply proportional to one another to an extent we find surprising.

702,882
PB-270 347/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Combination and Disproportionation of Allylic Radicals at Low Temperatures.
Final rept.,
R. Klein, and R. D. Kelley. 1975, 5p
Pub. in J. Phys. Chem., v79 p1780-1784 1975.

Keywords: *Free radicals, *Aliphatic compounds, Temperature, Recombination reactions, Reprints.

The disproportionation-combination ratio for several allylic type radicals has been measured in the condensed phase at 90K. Pairs of allylic radicals react exclusively by combination, with no disproportionation found within the limits of the analytical technique. Cross combination and disproportionation occurs between an allylic radical and an alkyl radical. In the cross disproportionation, the allylic radical acts exclusively as a hydrogen donor. This effect is attributed to the delocalization of the free spin, the hydrogen acceptor function being completely inhibited. Because of this, two allylic type radicals (or any radicals in which the density of the free spin is sufficiently delocalized) can only combine. The contribution of the resonant components of the allylic radicals to the combination products is found to be greatly dependent on steric effects.

702,883
PB-270 367/6 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
Bibliography of Sources of Experimental Data Leading to Activity or Osmotic Coefficients for Polyvalent Electrolytes in Aqueous Solution.
Final rept.,
R. N. Goldberg, B. R. Staples, R. L. Nuttall, and R. Arbuckle. Jul 77, 58p NBS-SP-485
Library of Congress Catalog Card no. LCCCN-77-24537.

Keywords: *Bibliographies, *Electrolytes, *Activity coefficients, *Osmosis, Solutions, Electrochemistry, Water, Thermochemistry, Experimental data, Documents, Sources, Numerical analysis, Electric potential, Vapor pressure, Diffusion.

Contained herein is a bibliography of sources of experimental data that can be used to calculate either activity or osmotic coefficients in water. The data types included are electromotive force measurements on cells with and without transference, vapor pressure data (relative and absolute), ultracentrifuge measurements, diffusion measurements, and other miscellaneous techniques. The compounds are given according to the standard thermochemical order of arrangement and references to the primary literature are included.

702,884
PB-270 579/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Energy-Loss Analysis of Carbon Tetrafluoride and Carbon Tetrachloride (Extended Abstract),
R. H. Huebner, R. J. Celotta, and S. R. Mielczarek. 1976, 3p
Sponsored in part by Argonne National Lab., Ill.
Pub. in Argonne National Laboratory Report No. ANL-76-88, Part I. Radiological and Environmental Research Division Annual Report, p1-3 Jun 75-Sep 76.

Keywords: *Carbon tetrafluoride, *Carbon tetrachloride, Energy dissipation, Electron energy, *Oscillator strengths.

Oscillator strength distributions for CF4 and CCl4 were derived from the electron energy-loss spectra of 100 eV incident electrons scattered at 0 degrees.

702,885
PB-270 580/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Apparent Oscillator Strengths for Water Vapor (Extended Abstract),
R. H. Huebner, M. E. O'Connor, R. J. Celotta, and S. R. Mielczarek. 1976, 6p
Sponsored in part by Argonne National Lab., Ill.
Pub. in Argonne National Laboratory Report No. ANL-76-88, Part I. Radiological and Environmental Research Division Annual Report, p4-9 Jun 75-Sep 76.

Keywords: *Water vapor, Electron energy, Energy dissipation, *Oscillator strengths.

Electron energy loss data are presented for 100-220 eV incident energies and oscillator strengths are obtained from the data.

702,886
PB-270 582/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theory of the Electron Energy-Loss Spectrum in Core-Level X-Ray Photoemission from Solids.
Final rept.,
D. R. Penn. 1977, 4p
Pub. in Phys. Rev. Lett., v38 n24 p1429-1432, 13 Jun 77.

Keywords: *Aluminum, *Sodium, *Magnesium, *Photoelectric emissions, Numerical analysis, Atomic energy levels, Surfaces, Emission spectra, X rays, Reprints.

The authors presents a theory of the electron energy-loss spectra observed in x-ray photo-emission from the core levels of solids and report on calculations for the 2s and 2p core levels of Al, Mg, and Na. The calculation takes intrinsic as well as extrinsic plasmons into account, and in all cases the agreement between theory and experiment is very good.

702,887
PB-270 584/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Investigation of Densities and Thermal Expansion Coefficients Applicable to Petroleum Measurement.
Final rept.,
A. H. Hall, J. A. Simpson, and J. R. Whetstone. 1975, 12p
Sponsored in part by American Petroleum Inst., Washington, D.C.
Pub. in Proceedings World Petroleum Congress, (9th) Tokyo, Japan, May 11-16, 1975, p291-302 1975.

Keywords: *Crude oils, *Density(Mass/volume), *Petroleum products, *Thermal expansion, Numerical analysis, Physical properties.

Measurement of bulk petroleum requires knowledge of the density and thermal expansion coefficient in order that volume at standard temperature can be calculated. The United States Bureau of Standards and the American Petroleum Institute are cooperating in a project to investigate these physical properties of current sources of crude petroleum and finished products. The measurements obtained at the Bureau will have an accuracy of better than ten parts per million and will tie to the 'Systeme International' units for mass, length and temperature. Results are to be compared with the data base of the ASTM-IP-API Petroleum Measurement Tables.

702,888
PB-270 652/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Low-Energy Electron-Molecule Scattering: Application of Coupled-Channel Theory to e-CO2 Collisions.
Final rept.,
M. A. Morrison, N. F. Lane, and L. A. Collins. 1977, 16p
Contract E849-1)-3800
Pub. In Phys. Rev. A, v15 n6 p2186-2201 Jun 77.

Keywords: *Carbon dioxide, Numerical analysis, Scattering cross sections, Momentum transfer, Reprints, *Electron molecule interactions.

A theoretical coupled-channels investigation of e-CO2 scattering is reported for incident electron energies from 0.07 to 10.0 eV. The fixed-nuclei approximation is made with the molecule in the ground X(1) sigma (+)(g) state and the nuclei frozen at their equilibrium positions. The e-CO2 interaction potential consists of an ab initio electrostatic Hartree potential, and approximate local exchange potential, and a semiempirical polarization potential. The coupled-channel equations are formulated in a body-fixed reference frame using single-center coordinates and are solved by means of an integral-equations algorithm. Convergence of the highly anisotropic interaction potential and of the expansion of the scattering function are discussed. The asymptotic decoupling approximation and the Born approximation are also studied and found to be unsatisfactory methods for computing quantitatively accurate cross sections for low-energy e-CO2 collisions. Converged coupled-channel total integrated, momentum-transfer and differential cross sections are presented, and the former are compared with experimental results, with special attention given to low scattering energies (approximately less than 0.1 eV).

702,889
PB-270 653/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Low-Energy Electron Collisions with Highly Polar Molecules: LiF.
Final rept.,
L. A. Collins, and D. W. Norcross. 1977, 8p
Grant NSF-AER74-20552
Pub. in Phy. Rev. Lett., v38 n21 p1208-1211, 23 May 77.

Keywords: *Lithium fluorides, *Elastic cross sections, *Inelastic cross sections, Numerical analysis, Momentum transfer, Polarity, Reprints, *Electron molecule interactions.

Close coupling calculations of rotational elastic and inelastic cross sections have been performed using the full static Hartree potential surface plus a local approximation to the exchange interaction. The results for this typical highly polar molecule (D=6.58 Debye) suggest that while simpler approximations to the interaction potential are adequate for the total integrated cross section, accurate treatment of short-range interactions may be essential for the momentum transfer cross section. In particular, the authors found a resonance with pi symmetry in the momentum transfer cross section at about 2 eV only in the static model-exchange calculations.

702,890
PB-270 868/3 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Air Density Equation and the Transfer of the Mass Unit.
F. E. Jones. Jul 77, 33p NBSIR-77-1278
Discusses an equation that could be used to calculate air density for the air buoyancy determination in the transfer of the mass by comparison of two mass artifacts on a balance.

Keywords: *Air, *Density(Mass/volume), *Atmospheric density, Weight measurement, Standards, Equations of state, Compressibility, Pressure, Temperature, Carbon dioxide, Water vapor, Humidity, Virial coefficients, Mass unit transfers.

A new formulation of the equation used for the calculation of air density has been developed. The Quinn, Colclough and Chandler value of the gas constant, currently accepted values of the atomic weights, and recent determinations of the abundances of the various constituents of air have been used. The abundance of carbon dioxide has been treated as a variable and a factor enabling convenient adjustment of the apparent molecular weight of air for deviation of carbon dioxide abundance from a background value has been derived. A new table of compressibility factor for the range of pressure and temperature of interest in standards laboratories has been calculated using recently determined values of virial coefficients. The enhancement factor, which has usually been ignored in air density equations, has been explicitly included in the equation; a table of enhancement factor has been calculated using a simple equation fitted to values in the range of pressure and temperature of interest. A table of the saturation water vapor pressure has been included; a simple equation for the calculation of saturation water vapor pressure has been fitted. Uncertainties, random and systematic, in the parameters and in the measurement of environmental variables and consequent uncertainties in calculated air density have been estimated. Application of the equation to air buoyancy determination and the transfer of the mass unit at the various national standards laboratories has been made.

702,891
PB-270 972/3 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Nitrogen Oxychlorides: A Bibliography on Data for Physical and Chemical Properties of ClNO, ClNO2, and ClNO3.
Special pub.,
F. Westley. Aug 77, 58p NBS-SP-478
Library of Congress catalog card no. 77-2757. Sponsored in part by Federal Aviation Administration, Washington, D.C., and National Aeronautics and Space Administration, Washington, D.C.

Keywords: *Bibliographies, Physical properties, Chemical properties, Reaction kinetics, Nitrogen inorganic compounds, Chlorine inorganic compounds, Thermo-

dynamic properties, *Chlorine nitrate, *Nitrosyl chloride, *Nitryl chloride.

A data oriented list of references is provided for published papers and reports containing measured or calculated data for the physical and chemical properties of nitrosyl chloride, nitryl chloride, and chlorine nitrate with particular emphasis on the chemistry and chemical kinetics of these compounds. More than 387 papers are listed. The period covered extends from 1874 through 1977.

702,892
PB-271 165/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Disproportionation and Pyrolysis of p-Toluenesulfonylhydrazine.
Final rept.,
H. S. Hertz, B. Coxon, and A. R. Siedle. 1977, 2p
Pub. in J. Organ. Chem., v42 n14 p2508-2509 1977.

Keywords: *Pyrolysis, Hydrazines, Reprints, *Toluenesulfonylhydrazine.

A disproportionation of p-toluenesulfonylhydrazine, under acid conditions to give 1,2-di(p-toluenesulfonyl)hydrazine was observed. Pyrolysis of p-toluenesulfonylhydrazine at 140 degrees produced ammonium p-toluenesulfonate, di-p-tolyldisulfide-l, l-dioxide, and p-toluenesulfonamide.

702,893
PB-271 166/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Infrared Spectrum of 12C32S and 12C34S.
Final rept.,
T. R. Todd. 1977, 6p
Pub. in J. Mol. Spectrosc., v66 p162-167 1977.

Keywords: *Sulfur isotopes, Infrared spectra, Molecular vibration, Molecular rotation, Reprints, *Carbon sulfide, Dunham coefficients.

The 2 - 0 vibration-rotation bands of (12)C(32)S and (12)C(34)S near 2530/cm have been measured with a high resolution spectrometer. The spectroscopic constants for these bands are given as well as an improved set of Dunham coefficients for the X(1)Sigma(+) state of (12)C(32)S.

702,894
PB-271 169/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of Temperature Dependence of Solubilities of Polycyclic Aromatic Hydrocarbons in Aqueous Solutions by a Fluorescence Method.
Final rept.,
F. P. Schwarz. 1977, 5p
Pub. in J. Chem. Eng. Data, v22 n3 p273-277 Jul 77.

Keywords: *Heat of solution, *Aromatic polycyclic hydrocarbons, *Solubility, Fluorescence, Enthalpy, Temperature, Naphthalene, Anthracene, Phenanthrene, Pyrenes, Reprints, Napthalene/methyl, Napthalene/ethyl, Benz(e)pyrene.

The fluorescence intensities of saturated aqueous polycyclic aromatic hydrocarbon (PAH) solutions equilibrated at temperatures between 281 and 303 K are proportional to the PAH concentration. The fluorescence measurements are put on an absolute solubility scale by UV absorption measurements at 298.2 K. This method was applied to the determination of the solubilities of naphthalene, 1-methylnaphthalene, 1-ethylnaphthalene, phenanthrene, anthracene, pyrene, and benz(e)pyrene in water and in 0.5 mol/L sodium chloride solution. Enthalpies of solution of the PAH were calculated.

702,895
PB-271 178/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photon Mass Attenuation and Mass Energy-Absorption Coefficients for H, C, N, O, Ar, and Seven Mixtures 0.1 keV to 20 MeV.
Final rept.,
J. H. Hubbell. 1977, 24p
Pub. in Radiat. Res., v70 p58-81 1977.

Keywords: *Hydrogen, *Carbon, *Nitrogen, *Oxygen, *Argon, Mass, Attenuation, Energy absorption, Coherent scattering, Incoherent scattering, Photon cross sections, Compton cross sections, Numerical analysis, Reprints, *Atom photon interactions, *Mass attenuation coefficients.

Mass attenuation coefficients mu/rho for H, C, N, O and Ar, developed at the National Bureau of Standards by the X-Ray and Ionizing Radiation Data Center from the latest theoretical and experimental cross section data, are tabulated for photon energies 0.1 keV to 20 MeV, including the cesium-137 and cobalt-60 energies explicitly. Cross sections are listed, for the above elements, for the principal photon-atom interactions: coherent and incoherent scattering, atomic photoeffect, and positron-electron pair and triplet production, also the energy-absorption cross sections for these interactions.

702,896
PB-271 181/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hydrostatic Pressure Dependence of the Doublet Transitions of Ruby.
Final rept.,
R. A. Forman, B. A. Weinstein, and G. Piermarini. 1977, 7p
Pub. in Proc. Colloq. Int. du Centre National de la Recherche Scientifique, Lyon (France), June 28-July 3, 1976. Paper in Spectroscopie des Elements de Transition et des Elements Lourds dans les Solides, n255 p51-57 1977.

Keywords: *Ruby, *Hydrostatic pressure, *Atomic energy levels, Optical spectra, Line spectra, Excitation, Crystal fields.

The authors studied the pressure dependence of the doublet transitions (2)E, (2)T1, and (2)T2 in ruby to hydrostatic pressures of 100 k bars. All measurements were performed in the diamond-anvil pressure cell using a metal gasket and methanol-ethanol pressure fluid to insure a hydrostatic environment.

702,897
PB-271 184/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Adhesive Bonding of Various Materials to Hard Tooth Tissues. 11. Chemisorption of an Adduct (of the Diglycydyl Ether of Bisphenol A with N-Phenylglycine) on Hydroxylapatite.
Final rept.,
D. N. Misra, and R. L. Bowen. 1977, 5p
Grant PHS-DE-02494
Pub. in J. Phys. Chem., v81 n9 p842-846 1977.

Keywords: *Chemisorption, *Teeth, *Dental materials, Tissues(Biology), Reaction kinetics, Chelates, Surface chemistry, Reprints, *Phenol/(diglycydyl-ether)-bis, *Glycine/N-phenyl, Hydroxylapatite.

Adsorption of a prototype synthetic dental varnish, a short-chain molecule with a chelating group on each end, was studied on synthetic hydroxylapatite from methylene chloride solution. The adsorption of the adduct is irreversible and the adsorbed amount remains constant from different concentrations of the solution. A rate law, based on an increasingly difficult gradual folding of the adsorbed molecules with an eventual fixation of the two chelating rings side by side, appears to explain all the kinetic features of the adsorption process. The tensile strength of polymer filled with hydroxylapatite was not changed by the presence of the adduct on the surface of the filler.

702,898
PB-271 186/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theory of Microwave Eddy Currents and Paramagnetic Resonance in Materials of Intermediate Conductivity.
Final rept.,
A. H. Kahn. 1977, 9p
Pub. in Phys. Rev. B, v16 n1 p64-72, 1 Jul 77.

Keywords: *Eddy currents, *Paramagnetic resonance, Microwaves, Sulfur organic compounds, Aliphatic hydrocarbons, Reprints, *Methane/quino-tetracyano-di, *Methylenebicyclopentadienylidene/tetrathio.

An analysis has been made of the eddy currents in a conducting solid in the shape of a long rectangular prism, with the applied rf magnetic field perpendicular to the length. The results are expressed in terms of a complex susceptibility. This, in turn, is related to the changes in resonant frequency and quality factor of a microwave cavity when the sample is introduced at the site of a magnetic field antinode. The calculations are performed for conductivities in the range of values for which the skin depth is comparable to the transverse dimensions of the sample. Solution is by the Rayleigh-Ritz method applied to a variational expression for the dipole moment of the sample. Several representative rectangular cross sections are treated. Also, the results for the cylinder in a transverse field are presented in closed form. In addition to the eddy-current loss and resonant-frequency shift, results are given for the modulation of the loss by paramagnetic resonance. The integrated resonance absorption intensity and the line shape anisotropy for Lorentzian lines are presented. The results are applied to the case of tetrathiafulvalinium-tetracyanoquinodimethane (TTF-TCNQ).

702,899
PB-271 190/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cross Section for Production of the 3s State of Atomic Hydrogen in Dissociative Excitation of H2 by Electrons.
Final rept.,
G. A. Khayrallah, and S. J. Smith. 1977, 5p
Grant NSF-MPS72-05169
Pub. in Chem. Phys. Lett., v48 n2 p289-293, 1 Jun 77.

Keywords: *Hydrogen, Emission spectra, Electron irradiation, Atomic energy levels, Dissociation, Excitation, Reprints, *Electron molecule interactions.

A few measurements have been made on the relative contribution to the Balmer-alpha emission of the 3s state of hydrogen atoms resulting from the dissociative excitation of H2 by electrons in the energy range 20 to 500 eV. Therefore measurements, however, are mutually inconsistent except between two measurements, one using the equilibrium technique and the other using the short-electron pulse technique. The authors have used the pulsed-electron-equilibrium method coupled with the time-delayed-observation technique to measure the contribution of the 3s state of hydrogen atoms.

702,900
PB-271 191/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Gallium Melting-Point Standard: A Determination of the Liquid-Solid Equilibrium Temperature of Pure Gallium on the International Practical Temperature Scale of 1968.
Final rept.,
D. D. Thornton. 1977, 6p
Pub. in Clin. Chem., v23 n4 p719-724 1977.

Keywords: *Gallium, *Melting points, Fixed points, Thermistors, Temperature measurement, Standards, Reprints, International Practical Temperature Scale.

The sharpness and reproducibility of the gallium melting point were studied, and the melting temperature of gallium in terms of IPTS-68 were determined. Small melting point cells meant for use with thermistors are described. Nine gallium cells including three levels of purity were used in 68 separate determinations of the melting point.

702,901
PB-271 195/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comments on 'Entropy Change in Ion-Molecule Equilibria'.
Final rept.,
S. G. Lias, and P. Ausloos. 1977, 3p
Pub. in J. Am. Chem. Soc. Commun. to Ed., v99 n14 p4831-4833, 6 Jul 77.

Keywords: *Entropy, *Chemical equilibrium, Reaction kinetics, Thermochemistry, Reprints, *Ion molecule interactions.

It is shown that for ion-molecule equilibria in which thermochemical information is derived from equilibrium constants determined at a single temperature, the estimation of (delta S) must include the term R ln(Z sub f/Z sub r) where Z sub f and Z sub r are, respectively, the rate constants for the ion-molecule collisions in the forward and reverse directions. Representative ion-molecule equilibrium constants and forward and reverse rate constants illustrating the point are presented.

702,902
PB-271 571/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Electrical and Thermal Magnetoconductivities of Single Crystal Beryllium at Low Temperatures and Its Use as a Heat Switch.
Final rept.,
R. Radebaugh. 1977, 15p
Contract NAonr-1-75
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in J. Low Temp. Phys., v27 n1/2 p91-105 1977.

Keywords: *Beryllium, *Electrical conductivity, *Thermal conductivity, Magnetic fields, Magnetoresistivity, Cryogenics, Thermal switches, Single crystals, Reprints.

The effects of transverse magnetic fields up to 955 kA/m (12 kOe) on the electrical and thermal conductivities of single crystal beryllium have been measured between 2 and 300 K. Most of the measurements were made on a sample with a resistance ratio of 1340. This sample was pure enough so that the intrinsic electronic thermal resistivity could be measured for the first time. The use of single crystal beryllium as a heat switch for temperatures below about 30 K is discussed.

702,903
PB-271 577/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation of Capacitance Densitometry for LNG Mixtures with Low Nitrogen Composition.
Final rept.,
P. J. Giarratano, and R. S. Collier. 1977, 7p
Sponsored in part by Maritime Administration, Washington, D.C.
Pub. in Ind. Eng. Chem. Process Des. Dev., v16, n3 p330-336 1977.

Keywords: *Density(Mass/volume), Nitrogen, Numerical analysis, Dielectric properties, Chemical composition, Hydrocarbons, Solutions, Mixtures, Natural gas, Reprints, *Liquefied natural gas.

Densities of typical LNG mixtures under saturation and subcooled conditions were calculated using a computer program which uses the method of corresponding states. The dielectric constant for each mixture was determined from the Clausius-Mosotti relationship assuming the excess CM function is zero. Examination of the resulting density-dielectric constant plots shows that for fixed nitrogen composition a nearly linear relationship exists between saturation density and dielectric constant under isobaric or isothermal conditions, independent of the hydrocarbon mixture. The results show, however, that the effect of the nitrogen composition on this linear relationship may be taken into account partially by a measurement of the mixture temperature. For the range of mixtures of this study it is possible to determine density to + or - 0.3% independent of knowledge of the hydrocarbon composition from an exact measurement of dielectric constant and temperature. Further improvements can be made if the fraction of nitrogen is known.

702,904
PB-271 578/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Experimental Studies of Mercury Molecules.
Final rept.,
R. E. Drullinger, M. M. Hessel, and E. W. Smith. 15 Jun 77, 11p
Contract E(49-1)-3800, ARPA Order-891
Pub. in J. Chem. Phys. 66, n12 p5656-5666, 15 Jun 77.

Keywords: *Mercury, Ultraviolet spectroscopey, Fluorescence, Absorption spectra, Excitation, Reprints, Dimers.

Optically-excited fluorescence spectra in pure mercury vapor have been studied over the spectral range 240-600 nm for temperatures between 400-1000 K and densities between 5 x 10 to the 16th power - 2 x 10 to the 19th power/cc. Absorption measurements were made over the spectral range 253-334 nm and both structured and continuum bands were observed. Several types of two photon experiments were also performed in order to probe the excited states of the mercury dimer. In addition, the mercury spectrum from mercury vapor-noble gas mixtures has also been studied for noble gas pressures up to one atmosphere.

702,905
PB-271 581/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Collision-Induced I(2P1/2) Emission in Argon and Xenon.
Final rept.,
M. Krauss, and P. S. Julienne. 15 Jul 77, 5p
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Div. of Laser Fusion.
Pub. in J. Chem. Phys. 67, n2 p669-673, 15 Jul 77.

Keywords: *Iodine, *Dipole moments, Molecular energy levels, Argon, Xenon, Numerical analysis, Perturbation theory, Transitions, *Atom atom interactions, Reprints.

Long range perturbation theory is used to estimate the magnitude of the dipole transition moment leading to iodine (2)P(1/2) to (2)P(3/2) emission during a collision with a rare gas atom. The lead term in the induced transition moment varies as R to the (-4 power) due to the dipole-quadrupole term in the interaction potential. The two-body rate coefficient for collision-induced radiative decay of I (2)P(1/2) is calculated using approximate model potentials for XeI and ArI. The coefficients are estimated for (2)P(1/2) in 300K Ar and Xe, respectively.

702,906
PB-271 583/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Speed of Sound in Saturated and Compressed Fluid Ethane.
Final rept.,
R. Tsumura, and G. C. Straty. 1977, 6p
Pub. in Cryogenics 17, n4 p195-200 Apr 77.

Keywords: *Ethane, *Acoustic velocity, Compressibility, Specific heat, Liquid phases, Reprints.

The speed of sound in saturated and compressed fluid ethane has been measured in the temperature range 91 to 323.15 K and at Pressures to 35 MPa. These data were combined with newly available P(rho)T data to obtain the isentropic compressibility and the ratio of the specific heats. The quality of the P(rho)T data has been examined by comparison of speeds calculated from these data with the measured sound speeds.

702,907
PB-271 592/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theoretical Analysis of Mercury Molecules.
Final rept.,
E. W. Smith, R. E. Drullinger, M. M. Hessel, and J. Cooper. 1977, 15p
Pub. in J. Chem. Phys., v66 n12 p5667-5681, 15 Jun 77.

Keywords: *Mercury, Lasers, Electron transitions, Reprints, Mercury lasers.

A theoretical analysis of experimental observations on bound-free electronic transitions in mercury molecules is presented. Potential curves and A values are derived for these transitions and the possibility of emission from a mercury trimer is also discussed briefly. Based on these data, a table of parameters for an optically pumped 335 nm mercury laser is derived.

702,908
PB-271 598/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermal Desorption Study of Methyl Formate from W(100) and Its Relevance to the Catalytic Production of Methane.
Final rept.,
S. D. Worley, and J. T. Yates. 1977, 9p
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Div. of Physical Research.
Pub. in J. Catal., v48 p395-403 1977.

Keywords: *Desorption, *Tungsten, *Thermal analysis, Catalysis, Methane, Surfaces, Chemisorption, Reprints, *Formic acid/(Methyl-ester).

Previous work has suggested that methyl formate was a possible intermediate in the catalytic production of methane from formaldehyde on a tungsten (100) single crystal. To test this hypothesis, a study of methyl formate interaction with W(100) has been performed. The major products desorbed upon heating a saturated layer of methyl formate on W(100) were hydrogen and carbon monoxide. However, a significant yield of formaldehyde and small amounts of methane, carbon dioxide, and several organic products believed to be methyl formate, glycolaldehyde, and methyl alcohol were observed also. The thermal desorption products and their desorption kinetics from methyl formate adsorbed on W(100) were very similar to those from formaldehyde on W(100). A sequence of reactions which might account for this similar behavior is suggested.

702,909
PB-271 626/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Metallic Shifts in NMR. A Review of the Theory and Comprehensive Critical Data Compilation of Metallic Materials.
Final rept.,
G. C. Carter, L. H. Bennett, and D. J. Kahan. 1977, 3p
Pub. in Progress in Materials Science, v20 pts I-IV 2350p 1977.

Keywords: *Nuclear magnetic resonance, Metals, Alloys, Reviews, Physical properties, Solid state, Melting points, Phase diagrams, Superconductivity, Temperature, Transition temperature, Compressibility, *Chemical shifts(Nuclear magnetic resonance).

A review of the pertinent theory on Knight shift and the critically evaluated sets of shift data on metallic materials is given. Related solid state physical properties data, such as structural data, phase diagrams, melting points, superconducting transition temperatures, magnetic transition temperatures, paramagnetic Pauli susceptibilities and compressibilities are also given. Each system, element, or alloy is considered separately, giving the data, a discussion of the rationale for their selection, and the pertinent references from which the data are taken. The elements are reviewed first, after which the alloys are considered. The fourth volume of the book contains an addendum to the references published after each critical evaluation was completed. These references are annotated to describe the NMR properties contained in the paper. An alphabetical index of metals and alloys in which a particular nuclear resonance is observed or discussed in the evaluation is also given.

702,910
PB-271 630/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fluorescence Method for the Measurement of the Partition Coefficients of Naphthalene, 1-Methylnaphthalene, and 1-Ethylnaphthalene in Water.
Final rept.,
F. P. Schwarz, and S. P. Wasik. 1977, 3p
Pub. in J. Chem. Eng. Data, v22 n3 p270-273 Jul 77.

Keywords: *Cycloalkane hydrocarbons, Fluorescence, Solubility, Water, Chemical equilibrium, Reprints, *Naphthalene, *Naphthalene/methyl, *Naphthalene/ethyl, *Partition coefficients.

A method is described for the determination of the partition coefficients of aromatic hydrocarbons in water by fluorescence measurements. The partition coefficients of water solutions of naphthalene, 1-methylnaphthalene, and 1-ethylnaphthalene between 8 and 31C were determined by this method. The solubilities of naphthalene in water over this temperature range were calculated from its partition coefficients.

702,911
PB-271 631/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rydberg Constant Measurement Using CW Dye Laser and H Atomic Beam.
Final rept.,
R. L. Barger. 1976, 3p
Pub. in Chapter in Atomic Masses and Fundamental Constants, n5 p565-570 1976.

Keywords: *Spectral lines, Molecular energy levels, Hyperfine structure, Excitation, *Laser induced fluorescence, *Rydberg series.

An experiment is in progress to determine an accurate value of the Rydberg constant by measuring the wavelength of the Balmer alpha line. A high intensity atomic beam of 2S hydrogen atoms will be used to reduce perturbations to a negligible level. Laser saturated absorption of the 2S - 3P transition will be produced with a cw dye laser having a frequency stability of 6 x 10 to the -13th power, and the saturation peak will be detected by observing the Lyman alpha decay from an E-field quenching region. RF pumping between the 3P and 3S levels, as suggested by Roberts and Fortson, should give resolution of hyperfine structure and pre-

vent systematic errors due to overlapping components. With the dye laser locked to the Balmer alpha transition, the wavelength will be measured with the frequency-controlled Fabry-Perot interferometer which was used for the CH4 3.39 micrometer - Kr 6057 A comparison. The authors expect to obtain an accuracy of about 10 to the -10th power with this experiment.

702,912
PB-271 632/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ratio of the Shear and Young's Moduli for Polycrystalline Metallic Elements.
Final rept.,
H. M. Ledbetter. 1977, 3p
Pub. in Mater. Sci. Eng., v27 p133-136 1977.

Keywords: *Shear modulus, *Modulus of elasticity, Elastic properties, Face centered cubic lattices, Reprints.

By considering an aggregate of face-centered-cubic crystals and a general two-body central-force interatomic potential, it is shown that the shear modulus and Young's modulus of a crystalline aggregate are proportional. Their calculated ratio is 0.396, close to the empirical value of 0.375.

702,913
PB-271 633/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chemiluminescence from Mixtures of Ba+CO2 and Ba+CO.
Final rept.,
J. B. West, and H. M. Poland. 1977, 3p
Pub. in J. Chem. Phys., v66 n5 p2139-2141, 1 Mar 77.

Keywords: *Chemiluminescence, *Barium, *Spectrochemical analysis, Chemical reactions, Carbon dioxide, Carbon monoxide, Heat pipes, Infrared spectroscopy, Reprints.

Broad banded chemiluminescence has been detected from the reaction of Ba + CO2 and Ba + CO in a heat pipe. Extending from 500 to 1150 nm, the spectrum of this flame exhibits several prominent peaks. The emitting species has not been identified, however evidence favors a polyatomic molecule.

702,914
PB-271 634/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis of the A(1) Sigma (u)(+)-X(1) Sigma(g)(+) Band System of (7)Li2.
Final rept.,
P. Kusch, and M. M. Hessel. 1977, 3p
Pub. in J. Chem. Phys., v67 n2 p586-589, 15 Jul 77

Keywords: *Lithium, *Electron transitions, Dissociation energy, Infrared spectroscopy, Band spectrum, Molecular properties, Reprints, Franck-Condon principle.

A new analysis of the A(1) Sigma (u) (+) - X(1) sigma(g) (+) band system has been made. It extends from v' = 0 to v' = 25 and from v double prime = 0 to v double prime = 14 and to J=78. The dissociation energy of the A state is found to be 8940/cm, considerably less than any earlier estimate of that energy. The RKR potential curves for the A and X states are given, together with the Franck Condon Factors and the A-X transition.

702,915
PB-272 127/2 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Physical Chemistry Div.
Standard Reference Materials: Enthalpy and Heat Capacity Standard Reference Material: Molybdenum SRM 781, from 273 to 2800 K.
Final rept.,
D. A. Ditmars, A. Cezairliyan, S. Ishihara, and T. B. Douglas. Sep 77, 83p NBS-SP-260-55
Library of Congress Catalog Card no. 77-608175.

Keywords: *Enthalpy, *Specific heat, *Molybdenum, Error analysis, Calorimetry, High temperature tests, Thermodynamic properties, Spectrochemical analysis, Samples, Comparison, *Standard reference materials, Procedures.

The relative enthalpy of NBS Standard Reference Material No. 781 (99.95 mass-percent pure, polycrystalline molybdenum: a metallic, high-temperature enthalpy and heat-capacity standard) has been measured with two differently designed, receiving-type calorimeters in the temperature ranges 273 to 1173 K and 1173 to 2100 K, respectively. The smoothed enthalpy data derived from these measurements are believed to have an inaccuracy not exceeding 0.6 percent at any temperature in these ranges. The heat capacity of Standard Reference Material No. 781 has also been measured in the temperature range 1500 to 2800 K using a millisecond - resolution pulse technique with resistive self-heating. A bibliography of all known publications on the enthalpy and heat capacity of molybdenum has been compiled. The NBS-measured enthalpy and heat-capacity data for molybdenum have been compared with those of all the principal investigators and compilers reported in the literature.

702,916
PB-272 184/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
AC Stark Effect and Multiphoton Processes in Atoms.
Final rept.,
J. S. Bakos. 1977, 27p
Pub. in Physics Reports (Sec. C Physics Lett.), v31 n3 p209-235 1977.

Keywords: *Stark effect, Atoms, Laser beams, Atomic spectra, Absorption, Photons, Reprints, Laser induced fluorescence.

The strong light field of a laser induces multiphoton processes in atoms. Simultaneously, this light field causes distortion of the atomic spectra--it shifts, splits, broadens the levels. These phenomena have to be taken into account in interpreting experimental results multiphoton processes. The basic phenomenon of level distortion in a light field is reviewed and the effects caused by the level distortions in some multiphoton processes is discussed.

702,917
PB-272 185/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Individual Bead Contribution to Intrinsic Viscosity of Polymers.
Final rept.,
A. Peterlin. 1977, 3p
Pub. in Polymers Lett. 18, p747-749 Jul 77.

Keywords: *Polymers, *Intrinsic viscosity, Numerical analysis, Reprints.

The intrinsic viscosity calculation on the basis of the conventional necklace model of linear macromolecule completely neglects the contribution of the single beads. Actually each bead contributes the same amount as a rigid sphere. This adds to intrinsic viscosity a constant term 2.5/rho with rho = (M/V) = mass/volume of the segment represented by the bead. Actual interaction between the polymer and the solvent will modify the numerical value of this term which under specific conditions may even become negative.

702,918
PB-272 193/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Resolution Infrared Spectrum of the 2nu2 + nu3 and nu1 + nu2 + nu3 Bands of 14N16O2. Vibration and Vibration-Rotation Constants of the Electronic Ground State of 14N16O2.
Final rept.,
W. L. Lafferty, and R. L. Sams. 1977, 15p
Pub. in Jnl. of Molecular Spectroscopy 66,p478-492 1977.

Keywords: *Nitrogen dioxide, *Vibrational spectra, *Rotational spectra, Infrared spectroscopy, Reprints, Laser induced fluorescence.

The A-type bands, 2nu2 + nu3 and nu1 + nu2 + nu3, with band centers at 3092 and 3638/cm respectively of 14N16O2 have been measured with resolution or 0.03/cm or better. Spectroscopic constants have been derived for the upper states of both bands. Infrared determined band constants have been combined with laser-excited resonance fluorescence data to obtain a set of vibration and vibration-rotation constants for the ground state of 14N16O2.

702,919
PB-272 197/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Excitation of Thallium 7(2)S1/2 and 6(2)D3/2,5/2 Levels.
Final rept.,
S. T. Chen, and A. Gallagher. Mar 77, 8p
Grant NSF-MPS72-05169
Pub. in Physical Review A15, p888-895 Mar 77.

Keywords: *Thallium, *Atomic energy levels, Electron transitions, Excitation, Reprints.

The authors have measured the relative optical excitation function of the 3776-A (7(2)S1/2 yields 6(2)P1/2), 2768-A (6(2)D3/2 yields 6(2)P1/2), 3529-A (6(2)D3/2 yields 6(2)P3/2), and 3519-A (6(2)D5/2 yields 6(2)P3/2) lines, and the polarization function of the 2768-A line, using crossed beams of electrons and thallium atoms, for electron energies from thresholds to 1500 eV. By normalizing the resonance-line excitation functions to Born theory in the high-energy limit the 7(2)S1/2, 6(2)D3/2 and 6(2)D5/2 level-excitation cross sections are obtained.

702,920
PB-272 200/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Relaxation of the Aspherical Shapes of Random-Coil Polymer Chains.
Final rept.,
D. E. Kranbuehl, and P. H. Verdier. 1 Jul 77, 5p
Sponsored in part by Petroleum Research Corp., New York.
Pub. in Jnl. of Chemical Physics 67, n1 p361-365, 1 Jul 77.

Keywords: *Polymers, *Molecular structure, *Molecular relaxation, Physical properties, Relaxation time, Monte Carlo method, Reprints, *Molecular conformations.

The conformations of random-coil polymer chains are known to be appreciably more aspherical than might have been expected intuitively. However, this instantaneous asphericity will only affect the measured physical properties of flexible chains in solution if the relaxation of the asphericity requires a time longer than the inherent sampling time of the experiment. It is therefore important, in the analysis of phenomena which depend upon chain shape, to know the time scale over which deviations from spherical symmetry persist. In this paper the authors extend their previous work on the relaxation of asphericity in chains without excluded volume interactions and present corresponding results for chains with excluded volume. Autocorrelation functions for the radius of gyration squared, its principal components, and the moments of inertia are determined using a dynamical model for linear polymer chains which simulates excluded volume effects. The results suggest that the asphericity of a random-flight chain is increased by the introduction of excluded volume interactions, and that the segment distribution will appear spherically symmetric only when it is averaged over a time comparable with or longer than the longest times in the relaxation-time spectrum of the chain.

702,921
PB-272 201/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Stark Spectroscopy of FCN.
Final rept.,
A. B. Maki, and S. M. Freund. 1977, 7p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Jnl. of Molecular Spectroscopy 66, p493-499 1977.

Keywords: *Stark effect, Dipole moments, Infrared spectroscopy, Reprints, *Cyanogen fluoride.

Using a CO2 laser, Stark shifted resonances have been measured for the C-F stretching fundamental (nu 3) of FCN near 9.3 micrometer, and for two nearby hot bands. The ground state dipole moment of FCN is found to be 2.1203 + or - 0.0010 debyes and dipole moments are also given for the other states observed.

702,922
PB-272 207/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Infrared Spectrum of the nu(1) and nu(4) Bands of (28)SiH3D.
Final rept.,
W. B. Olson, and R. W. Lovejoy. 1977, 17p
Pub. in Jnl. Molecular Spectroscopy, v66 p314-330 1977.

Keywords: *Deuterium compounds, *Silanes, *Infrared spectra, Vibrational spectra, Rotational spectra, Band spectra, Reprints.

The spectrum of the nu 1 and nu 4 SiH stretching bands of (28)SiH3D have been recorded and ana-

lyzed. The degenerate stretching mode is at 2188.504/cm, only 1.103/cm above the symmetric stretching mode. Several accidental and essential resonances affect these bands but all have been successfully analyzed by diagonalization of the secular determinant complete through the second order of the transformed Hamiltonian. One accidental resonance leads to a number of forbidden transitions through which a value of the rotational constant A(o) has been obtained.

702,923
PB-272 208/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Impact Excitation of Be+: A Benchmark Study.
Final rept.,
M. A. Hayes, D. W. Norcross, J. B. Mann, and W. D. Robb. 1977, 6p
Contract E(49-1)-3800
Pub. in Jnl. Phys. B: Atom. Molec. Phys. Lett. 10, n11 pL429-L434 1977.

Keywords: *Beryllium, *Excitation, Electron scattering, Ions, Atomic energy levels, Scattering cross sections, Numerical analysis, Reprints, *Beryllium ions, Electron cross sections.

Calculations of the cross section for excitation of the 2p state of Be+ and for the polarization of the emitted radiation, have been performed using Coulomb-Born and close-coupling approximations. The results are compared with recent absolute measurements.

702,924
PB-272 212/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theoretical Model for the Equation of State for the System Carbon Dioxide and Water.
Final rept.,
L. Haar, G. Powell, M. Klein, J. Wardell, and G. Wilmot. 1976, 14p
Sponsored in part by Naval Surface Weapons Center, White Oak Lab., Silver Spring.
Pub. in Proceedings JANNAF Combustion Meeting (13th), Monterey, California, September 13-17, 1976, I, p199-212 1976.

Keywords: *Equations of state, *Carbon dioxide, *Water, Ideal gas, Thermodynamic properties, Mixtures, Gun propellants, Combustion products, Virial coefficients.

The real-gas equation of state for mixtures containing water and carbon dioxide are reported. Results for the compressibility factor are given for the pressure range 0 = or < P = or < 10,000 bars and for values of temperature 850 K = or < T = or < 4000 K. The model is shown to be consistent with experimental data to within the accuracy of the data. The model is a logical extension of the theory for pure fluids, which was developed from a density expansion around a hard-core repulsion. The parameters are well-defined physical quantities. These include the molecular volumes and the second virial coefficients for each of the interactions. Values for the second virial coefficient for the water-carbon dioxide interaction were derived from the experimental mixture data, using the theoretical model and fitting the result to a Lennard-Jones 6-12 potential. The results are applied to assess the real-gas corrections to the thermodynamic properties for gun propellant combustion gases.

702,925
PB-272 355/9 PC **A11**/MF **A01**
National Bureau of Standards, Boulder, Colo. Cryogenics Div.
Provisional Thermodynamic Functions of Propane, from 85 to 700 K at Pressures to 700 Bar,
R. D. Goodwin. Jul 77, 240p NBSIR-77-860
Sponsored in part by American Gas Association, Inc., Arlington, Va. See also rept. no. NBS-TN-653 dated Apr 74, COM-74-50637.

Keywords: *Propane, *Thermophysical properties, Equations of state, Physical properties, Thermodynamic properties, Vapor pressure, Heat of vaporization, Specific heat, Ideal gas, Numerical analysis, Isobars(Pressure), Enthalpy, Isotherms, Joule-Thomson effect, Critical points, Density(Mass/volume), Virial coefficients.

Thermophysical properties of propane are tabulated at integral temperatures over the entire range of fluid states from 85 to 700 K along isobars to 700 bar. A modified form of the nonanalytic equation of state is employed for the first time. Thermodynamic functions for the compressed liquid are obtained by use of heats of vaporization from the boiling point to the critical point, such that the free energies of saturated liquid and vapor are equal.

702,926
PB-272 532/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Gain Without Population Inversion in Two-Level Atoms.
Final rept.,
H. K. Holt. 1977, 5p
Pub. in Physical Review, A 16, n3 p1136-1140 Sep 77.

Keywords: *Atoms, Gain, Laser beams, Atomic energy levels, Reprints, *Population inversion(Energy levels).

For the case in which laser radiation interacts with two levels of an atom, it is shown that there can be gain even when there is no population inversion, because of recoil effects. How recoil can affect certain precision measurements is also shown.

702,927
PB-272 534/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Flash Photolysis Resonance Fluorescence Investigation of the Reaction of O(3p) Atoms with ClONO2.
Final rept.,
M. J. Kurylo. 1977, 4p
Sponsored in part by National Aeronautics and Space Administration, Washington, D.C. Upper Atmospheric Research Office.
Pub. in Chemical Physics Letters 49, n3 p467-470, 1 Aug 77.

Keywords: *Reaction kinetics, *Photochemical reactions, Fluorescence, Oxygen, Atoms, Chlorine inorganic compounds, Inorganic nitrates, Photolysis, Stratosphere, Reprints, *Oxygen atoms, *Chlorine nitrate, *Atmospheric chemistry.

The flash photolysis resonance fluorescence technique has been used to measure the rate constant for the reaction of O(triplet P) atoms with ClONO2 at 10 torr total pressure over the temperature range 225-273K. The values obtained can be fit to an Arrhenius equation. A composite Arrhenius expression is calculated from the combined results of the present study and a recent investigation by Molina et al. Because of the expanded data base this equation is considered more reliable and is recommended over the temperature range 213-295K. The uncertainties expressed are the standard deviation taken from a least squares analysis of the data and take into account the 95% confidence limits (+ or - 2 delta) of the individual points. Comparison of the loss rate for ClONO2 by oxygen atom reaction with the solar photolysis rate indicates that chemical reaction accounts for less than 15% of the ClONO2 removal at stratospheric altitudes between 20 and 30 km.

702,928
PB-272 538/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electronic Structure of Rare Gas Halide Excimers.
Final rept.,
M. Krauss. 1977, 8p
Contract E(49-1)-3800
Pub. in Jnl. Chemical Physics 67, n4 p1712-1719, 15 Aug 77.

Keywords: *Rare gases, Atomic energy levels, Excitation, Perturbation theory, Dipole moments, Halides, Reprints, *Excimers.

The rare gas halide excimer states are analyzed in terms of an electrostatic model that includes mixing between the ionic excimer and neutral ground configurations. The energy splitting between the 2 Sigma and 2 Pi excimer states is strongly affected by this configuration mixing. A Rittner type energy expression is derived and parameterized for the KrF* excimer energy curves which are found in good agreement with the ab initio curves of Dunning and Hay. Perturbation expressions are also derived for the dipole and transition moments of this system. The long-range formula are compared with the available ab initio literature. These expressions are then applied to a qualitative analysis of the transition moments of KrF*.

702,929
PB-272 541/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reduction of the 1, 3-Dithiolium Cation with Hexacarbonylvanadate(1-).
Final rept.,
A. R. Siedle, and R. B. Johannesen. 1975, 1p
Pub. in Jnl. of Organic Chemistry, v40 p2002 1975.

Keywords: *Reduction(Chemistry), Cations, Nuclear magnetic resonance, Isotopic labeling, Reprints, Dimers, *Dithiolium.

Reductive coupling of the 1,3-dithiolium cation with sodium hexacarbonyl-vanadate(1-) afforded 2,2'-bi(1,3-dithiolyl). This dimer was characterized by 13C and 1H NMR spectroscopy.

702,930
PB-272 545/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photoionization of Dimethyl Ether and Diethyl Ether.
Final rept.,
R. Botter, J. M. Pechine, and H. M. Rosenstock. 1977, 19p
Pub. in International Jnl. of Mass Spectrometry and Ion Physics 25, p7-25 1977.

Keywords: *Ethyl ether, *Methyl ether, *Photochemistry, *Ionization, Heat of formation, Ionization potentials, Autoionization, Reprints.

The ionization and fragmentation of dimethyl and diethyl ether have been studied by means of photoionization at room temperature and low temperature. The parent ion thresholds show evidence of hot band effects, and the adiabatic ionization potentials have been determined to be 10.01 + or - 0.01 eV for dimethyl ether and 9.60 + or - 0.01 eV for diethyl ether. The temperature dependence of thresholds for the primary fragmentation processes in both molecules can be accounted for by rotational and vibrational hot band effects. Heats of formation at absolute zero have been obtained for the species CH3O=CH2+, CH3CH2O=CHCH3(+) and CH2=OCH2CH3(+). Evidence is obtained for important contributions of autoionization to ionization and fragmentation at higher energies.

702,931
PB-273 080/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Luminescence in Metal Flames Irradiated with CO2 Laser.
Final rept.,
J. C. Moulder, and A. F. Clark. 1977, 4p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, D.C.
Pub. in Chemical Physics Letters 49, n3 p471-474, 1 Aug 77.

Keywords: *Calcium, *Magnesium, *Flames, Luminescence, Carbon dioxide lasers, Reprints, *Laser enhanced fluorescence, Heterogeneous reactions.

Rapid-scan spectrometry of calcium and magnesium flames ignited in air with a CO2 laser reveals luminescence excited by heterogeneous reactions on condensed metal oxide particles. The luminescence is stimulated by laser radiation. An explanation for this effect is proposed.

702,932
PB-273 083/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Vibrational Spectra and Barrier to Internal Rotation of BC12SH and BC12SD.
Final rept.,
D. R. Kirklin, J. J. Ritter, and S. Abramowitz. 1977, 14p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, D.C.
Pub. in Jnl. of Molecular Spectroscopy 67, p322-335 1977.

Keywords: *Molecular vibration, *Molecular rotation, Deuterium compounds, Infrared spectra, Thermodynamic properties, Raman spectroscopy, Boron inorganic compounds, Chlorine inorganic compounds, Sulfur inorganic compounds, *Boron chlorides, Reprints.

Recent interest in SH(D) derivatives of BCl3 prompted a vibrational study of BCl2SH and BCl2SD. Raman spectra of the liquid and gas phases were recorded from 100 to 2700/cm. Infrared spectra of the vapors

were recorded from 200 to 2700/cm. All nine fundamentals were observed and assigned for both molecules. The observation of 7 polarized and 2 depolarized Raman bands confirm the planar configuration. The infrared vapor spectra showed the fundamental and three hot bands of the SH(D) torsional vibration. A comparison of our spectral results with an earlier study is presented. The structure of the infrared torsional band allowed calculation of the barrier toward internal rotation. Thermodynamic functions were also calculated.

702,933
PB-273 084/4 Not available NTIS
National Bureau of Standards, Boulder, CO.
Broadening of He I Lines Including Ion Dynamic Corrections, with Application to lambda 4471 A.
Final rept.,
A. J. Barnard, J. Cooper, and E. W. Smith. 1974, 53p
Grants NGR-06-003-057, NSF-GP-39308
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 14, p1025-1077 1974.

Keywords: *Line width, *Helium, Line spectra, Stark effect, Numerical analysis, Iodine inorganic compounds, Reprints.

A theory is developed for the broadening of He I lines with forbidden components which is valid at low densities (where the forbidden line is reasonably well isolated). This theory takes into account the effects of dynamic ion broadening. Application to lambda 4471 A gives good agreement with experiment and with a recent calculation of Lee; reasons for agreement with Lee are discussed in detail. Comprehensive tables for 4471 A are presented. These have been extended further into the line wings than previous tabulations. Static ion theory is found to be adequate for densities greater than approximately 5 x 10 to the 15 power/cc. A simple numerical profile for allowed lines, taking into account dynamic ion effects, is also presented.

702,934
PB-273 086/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Voltage Microscopy of the Reduction of Hematite to Magnetite.
Interim rept. 1971-73,
P. R. Swann, and N. J. Tighe. 1977, 9p
Grant EOOAR-69-0067
Pub. in Metallurgical Transactions 8B, p479-487 Sep 77.

Keywords: *Iron oxides, *Reduction(Chemistry), Electron microscopy, Microstructure, Hematite, Magnetite, Diffusion, Reprints.

The microstructural changes associated with the formation of magnetite in hematite have been studied in specimens which have been partially reduced outside the microscope, thinned until electron transparent, and then examined in the normal way. Three types of structure have been observed in varying proportions which depend on the reduction temperature. At low temperatures, magnetite grows by the propagation of a cellular interface, the gas phase being transported to the cell boundary by a network of tunnels. At intermediate temperatures, magnetite plates are formed, whereas at high temperatures, both plate magnetite and blocky magnetite appear. It is proposed that the factor controlling the morphology which develops is the ratio of the cell boundary to volume diffusivity of ferrous ions. It is noted that the decomposition morphologies of hematite and austenite have many similarities. The basic reason for this similarity is that both transformations involve substantial redistribution of elements in the solid state and the microstructures which develop are those that perform this redistribution the most efficiently at the temperatures involved.

702,935
PB-273 095/0 Not available NTIS
National Bureau of Standards, Boulder, CO.
Correlation Effects in the Theory of Combined Doppler and Pressure Broadening. I. Classical Theory.
Final rept.,
J. Ward, J. Cooper, and E. W. Smith. 1974, 36p
Grant NGR-06-003-057
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 14, p555-590 1974.

Keywords: *Line width, *Doppler effect, Reprints.

A Classical Fourier amplitude theory of combined Doppler and pressure broadening in the impact approximation is developed which treats phase changes due to translation and collision on an equal basis. Radiator motion is accounted for properly by including speed dependence in the collision frequency and velocity dependence in the distribution function for phase shifts and final velocities as the result of a collision. The resulting theory is shown to be equivalent to a previous kinetic equation formulation of the problem. The one-perturber and classical analogue of the quantum one-interacting-level approximations are derived.

702,936
PB-273 126/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electronic Structure of the Ground and Excited States of Mg2(+) and Mg2.
Final rept.
W. J. Stevens, and M. Krauss. 1977, 13p
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Div. of Laser Fusion.
Pub. in Jnl. of Chemical Physics 67, n5 p1977-1989, 1 Sep 77.

Keywords: *Magnesium, Ions, Molecular energy levels, Excitation, Lasers, Reprints, *Magnesium ions.

The ground and excited valence states of Mg+2 and Mg2 are calculated using the multiconfiguration self-consistent-field method. The Mg2 states were calculated to provide a model of the Group II excimer systems, which are candidates for the active media of lasers.

702,937
PB-273 171/9 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C.
Computer-Assisted Evaluation of the Thermochemical Data of the Compounds of Thorium,
D. D. Wagman, R. H. Schumm, and V. B. Parker.
Aug 77, 94p NBSIR-77-1300
Prepared in cooperation with International Atomic Energy Agency, Vienna (Austria).

Keywords: *Thorium inorganic compounds, *Thermochemical properties, Thermodynamic properties, Enthalpy, Gibbs free energy, Entropy, Tables(Data), Least squares method, Computer aided analysis.

Selected values are given for the thermochemical properties of the compounds of thorium. They are obtained from a computer-assisted least sums-least squares approach to the evaluation of thermodynamic data networks. The properties given, where data are available, are enthalpy of formation, Gibbs energy of formation, and entropy at 298.15 K (delta Hf (298), delta Gf (298), and S (298)). The values are consistent with the CODATA Key Values for Thermodynamics. The reaction catalog from which this self consistent set of values is generated is given with a statistical analysis. Some thermal functions are also given, as well as detailed comments when necessary.

702,938
PB-273 929/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theoretical Determination of Bound-Free Absorption Cross-Sections in Ar2(+),
W. J. Stevens, M. Gardner, A. Karo, and P. Julienne.
15 Sep 77, 8p
Contract E(49-1)-3800
Pub. in Jnl. of Chemical Physics, v67 n6 p2860-2867, 15 Sep 77.

Keywords: *Potential energy, *Transition points, Numerical analysis, Absorption cross sections, Argon, Ions, Energy transfer, Reprints, *Argon ions.

Ab initio calculations have been carried out for the potential energy curves and transition moments of the 2 sigma u(+), 2 Pi g, 2 Pi u, and 2 Sigma g(+) states of Ar2(+) which arise from the doublet P + singlet S ion-atom asymptote. These data have been used in a theoretical calculation of the dissociative absorption cross-sections.

702,939
PB-273 938/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Activity of Tungsten as a Methanation Catalyst.
Final rept.,
R. D. Kelley, T. E. Madey, and J. T. Yates. 1977, 5p
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Div. of Physical Research.
Pub. in Jnl. of Catalysis, v50 p301-305 1977.

Keywords: *Catalysts, *Tungsten, *Methanation, Synthesis(Chemistry), Reprints.

The catalytic activity of tungsten has been investigated for the methane synthesis from H2 and CO. Starting with atomically clean tungsten, the activity for catalytic methanation rivals that of Ni, with tungsten being active at lower temperatures than Ni. These observations of high catalytic activity for tungsten suggest that the low activity seen in previous studies on tungsten catalysts may have been due to inadequate cleaning procedures.

702,940
PB-273 952/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Vibrational Chemiluminescence from Ion-Molecule Reactions: O(-) + CO yields CO2(+) + e(-).
Final rept.,
V. M. Bierbaum, G. B. Ellison, J. H. Futrell, and S. R. Leone. 1 Sep 77, 2p
Grant NSF-PHY76-04761
Sponsored in part by Rome Air Development Center, Hanscom AFB, Mass.
Pub. in Jnl. of Chemical Physics Letters, v67 n5 p2375-2376, 1 Sep 77.

Keywords: *Molecular vibrations, *Carbon dioxide, Chemiluminescence, Infrared spectroscopy, Ions, Reprints, Ion molecule interactions.

Vibrational emission has been observed from the CO2 molecules produced in the associative detachment reaction, O(-) + CO yields CO2(+) + e(-) (4.2 eV exothermic). The O(-) ions were produced from O2 in a modulated ion source of a flowing afterglow at densities approaching 10 to the 8th power/cc. Following injection of CO downstream, infrared chemiluminescence was detected from the CO2 product at 4.3 micrometers in the infrared. Over a wide range of emission currents and O2 pressures, the CO2 product vibrational emission intensity correlates well with the O(-) density. Initial estimates indicate that a substantial fraction of the CO2 molecules are born into excited vibrational states higher than (001). Reliable measurements can be made on vibrational deactivation rates of molecular ions and on vibrational population distributions in ion-molecule reactions using this technique.

702,941
PB-273 954/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
4s-4p Resonance Transitions in Highly Charged Cu- and Zn-like Ions.
Final rept.,
J. Reader, and N. Acquista. 25 Jul 77, 4p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Physical Review Letters, v39 n4 p184-187, 25 Jul 77.

Keywords: *Atomic energy levels, *Molybdenum, *Niobium, *Rubidium, *Yttrium, *Zirconium, Zinc, Ions, Line widths, Ultraviolet spectroscopy, Copper, Reprints.

The 4s-4p resonance transitions in the copperlike and zinclike ions from Rb to Mo have been observed by means of a low-inductance open spark and a 10.7-m grazing-incidence spectrograph. Lines belonging to highly charged ions could be distinguished by their abnormally large widths. The observations confirm the identification of the resonance lines of Mo XIII and Mo XIV in the Princeton University ST tokamak by Hinnov, Johnson, Meservey, and Dimock.

702,942
PB-273 959/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Excimer Densities and Destruction Mechanisms in a High Pressure Pure Mercury Positive Column.
Final rept.,
E. R. Mosburg, and M. D. Wilke. 15 Jun 77, 12p
Contract E(49-1)-3800
Pub. in Jnl. of Chemical Physics, v66 n12 p5682-5693, 15 Jun 77.

Keywords: *Mercury, *Density(Mass/volume), Atomic energy levels, Vapor phase, Excitation, Electric discharges, Reprints, *Excimers.

A study of a pure mercury vapor DC discharge at gas densities of 0.75 x 10 to the 18th power to 10 to the

19th power/cc and currents of 30-100 mA has enabled the authors to determine the densities of the atomic 6 triplet PO(1/1) and 7 triplet S1 levels and the dimer 31u level as well as the density of free electrons.

702,943
PB-273 960/5 Not available NTIS
National Bureau of Standards, Boulder, CO.
Vibrational Relaxation of NO X(2) II(v = 1) in the Temperature Range 100-300 deg K.
Interim rept.,
J. C. Stephenson. Jun 74, 6p
ARPA Order-891
Pub. in Jnl. of Chemical Physics, v60 n11 p4289-4294 Jun 74.

Keywords: *Molecular relaxation, *Molecular vibration, *Nitrogen oxides, Deactivation, Fluorescence, Reprints, Laser induced fluorescence, Molecule molecule interactions.

Laser-excited fluorescence measurements have given rate constants for the vibrational deactivation of NO(upsieon = 1) by NO, He, and N2, and for the V-V exchange between CO(upsieon = 1) and NO(upsieon = 1) in the temperature region 100-300K. Relaxation was caused entirely by bimolecular collisions. Deactivation rates of NO(upsieon = 1) by H2O, D2O, NO2, CH4, C2H4, C2H6, and C4H10, and of N2(upsieon = 1) by NO and CO(upsieon = 1) by NO2 and N2O4 were measured at T=298K.

702,944
PB-273 961/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Relaxation of the Mercury 6 Triplet P0 and 6 Triplet P1 States.
Final rept.,
M. Stock, E. W. Smith, R. E. Drullinger, and M. M. Hessel. 15 Sep 77, 7p
Contract E(491-1, ARPA Order-891
Pub. in Jnl. of Chemical Physics, v67 n6 p2463-2469, 15 Sep 77.

Keywords: *Atomic energy levels, Relaxation time, Mercury, Reprints, *Mercury atoms, Atom atom interactions.

The relaxation of 6 triplet P(0) mercury atoms excited by a laser pulse was measured for densities ranging from 2 x 10 to the 17th power/cc to 8 x 10 to the 18th power/cc. The decay of the 253.7 nm resonance line was also measured for densities ranging from 5 x 10 to the 16th power/cc to 10 to the 18th power/cc. The decay coefficients were analyzed to yield rate coefficients for three body molecular formation, triplet P(1) yields triplet P(0) collision rate and a collisional quenching rate for the triplet P(0) state. Small loss rates due to diffusion and radiation were also observed and found to be consistent with theoretical estimates of these quantities.

702,945
PB-274 036/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Infrared Spectra of Matrix Isolated FeO sub 2: Evidence for a Cyclic Iron-Oxygen Complex.
Final rept.,
S. Abramowitz, N. Acquista, and I. W. Levin. 15 Sep 77, 4p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, D.C.
Pub. in Chemical Physics Letters, v50 n3 p423-426, 15 Sep 77.

Keywords: *Iron oxides, *Infrared spectra, *Synthesis(Chemistry), Molecular vibrational, Molecular structure, Reprints.

Infrared matrix isolation techniques were used to study the reaction of Fe (vapor) with oxygen molecules. For various isotopically enriched oxygen samples, spectral transitions at 945.9, 930.8 and 911.4/cm were assigned on the basis of their relatively large frequency shifts to the O-O stretching modes of Fe(16)02, Fe(16)0(18)0 and Fe(18)02, respectively. The low frequency Fe-O stretching modes were assigned to features at 517.1, 508.1 and 494.0/cm for the same three isotopically substituted dioxygen complexes. Both the frequency behavior and intensity patterns involving the dioxygen ligand indicate a cyclic isosceles model for the FeO2 system.

702,946
PB-274 186/6 PC **A02**/MF **A01**
National Bureau of Standards, Boulder, Colo. Cryogenics Div.
Thermodynamic Properties of Slush Hydrogen and Oxygen.
Final rept.,
H. M. Roder. Nov 77, 44p NBSIR-77-859
Sponsored in part by National Aeronautics and Space Administration, Houston, Tex. Lyndon B. Johnson Space Center.

Keywords: *Thermodynamic properties, *Hydrogen, *Oxygen, Numerical analysis, Pressure, Density(Mass/volume), Enthalpy, Entropy, Liquified gases, Equations of state, Phase transformations, Computer programs, Cryogenics, Solidified gases, Slush, *Slush hydrogen, *Slush oxygen.

The thermodynamic properties of hydrogen and oxygen have been calculated for temperatures both below and above the triple point. Values of the various physical properties required for the computations are either taken from the literature, or are extrapolated. If extrapolated, the extrapolations are based on the known behavior of other simple fluids. The results are presented in the form of computer programs which cover two regions of the phase diagram, solid-vapor, and solid-liquid. Input to the programs is temperature and quality. The properties returned include pressure, density, enthalpy, entropy and internal energy. The present programs for slush hydrogen and slush oxygen are an extension of and depend upon the equations of state developed previously for these gases.

702,947
PB-274 326/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Induced Fluorescence of CFCl and CCl2 in the Gas Phase.
Final rept.,
R. E. Huie, N. J. T. Long, and B. A. Thrush. 1977, 4p
Pub. in Chemical Physics Letters 51, n2 p197-200, 15 Oct 77.

Keywords: *Fluorescence, Molecular energy levels, Excitation, Chlorine organic compounds, Fluorine organic compounds, Laser enhanced fluorescence, *Methylene/dichloro, *Methylene/chloro-fluoro, Reprints.

The fluorescence of CFCl and CCl2 excited by a tunable dye laser has been observed in the gas phase. The radiative lifetimes are 644 + or - 18 and 3810 + or - 300 ns respectively consistent with matrix results. The quenching rate CCl2 is greater than for CFCl and varies with the wavelength of excitation.

702,948
PB-274 346/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hartree-Fock Line Strengths for the Lithium, Sodium and Copper Isoelectronic Sequences.
Final rept.,
A. W. Weiss. 1977, 10p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 18, n5-B p481-490 1977.

Keywords: *Lithium, *Sodium, *Copper, Hartree-Fock approximation, Ions, Atomic spectroscopy, Reprints.

Hartree-Fock line strengths have been computed for the lowest delta n=0 transitions of ions in the lithium, sodium and copper isoelectronic sequences. Excitation energies were collected relativistically to lowest order in the Pauli approximation, and line strengths were corrected semiempirically using the Dirac correction factors of hydrogen-like ions. Systematic trends have been established and new data are presented for very highly ionized species.

702,949
PB-274 349/0 Not available NTIS
National Bureau of Standards, Boulder, CO.
Influence of Ion Dynamics on H alpha and H beta at Low Densities.
Final rept.,
J. Cooper, E. W. Smith, and C. R. Vidal. 1974, 4p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 7, n4 pL101-L105 Mar 74.

Keywords: *Hydrogen, *Stark effect, Numerical analysis, Reprints.

Calculations for the Stark broadening of H(alpha) and H(beta) using a unified theory for both ions and electrons are presented in the density range 10 to the 14th power to 10 to the 15th power/cc at a temperature of 10,000 K. Although the theory is of marginal validity at these densities, it shows quite conclusively the influence of ion dynamics in reducing the dip at the center of the H(beta) profile and the peak in the center of the H(alpha) profile.

702,950
PB-274 350/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Scaling Theory of Solids Under Hydrostatic Pressure.
Final rept.,
R. G. Munro. 1 Oct 77, 5p
Pub. in Jnl. of Chemical Physics 67, n7 p3146-3150, 1 Oct 77.

Keywords: *Solids, *Hydrostatic pressure, Aluminum oxides, Frequency shift, Reprints, *Scaling laws.

A scaling theory is proposed for solids under hydrostatic pressures which do not undergo structural phase transitions or symmetry distortions or for which distortions may be neglected. The theory is tested with two adjustable parameters by computing the linear frequency shifts (dv/dP) for the optical transitions 4A(2) (F) yields 2E, 2T2, 4T(2)(F), 4T(1)(F), 2T(1) of Cr(+3) ions in Al2O3. These results are further applied to Al2O3:Ti(+3), V(+3) with no additional parameter adjustments. Good agreement is found with all the data, including occurrences of both red and blue shifts. A general discussion of impurity ions isoelectronic to Cr(+3) in Al2O3 is given. The evolution of the scaling theory into an effective potential representation of the externally applied pressure is also indicated.

702,951
PB-274 362/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Plasmon Satellites in X-Ray Photoemission Spectra.
Final rept.,
J. W. Gadzuk. 1977, 7p
Pub. in Jnl. of Electron Spectroscopy and Related Phenomena 11, p355-361 1977.

Keywords: *Plasmons, Electrons, Photoelectric emission, Reprints.

Controversy exists whether plasmon satellite structure observed in core level photoemission spectra should be done to so-called intrinsic or extrinsic plasmon production. Owing to 'interference' processes in which virtual plasmons produced by electrons (holes) are absorbed by holes (electrons), the hole-plasmon coupling constant is significantly reduced in a way, predicted by Langreth, which varies inversely with the velocity of the photoexcited electron. Using synchrotron radiation, this coupling constant can be varied continuously with h(nu). An experiment is proposed for sorting out the role of intrinsic vs extrinsic processes in plasmon satellites.

702,952
PB-274 363/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evidence for the Absence of Complex Formation Between Oxygen and Olefins or Fluorocarbons.
Final rept.,
C. L. Manger, J. H. Moore, and M. H. Alexander. 1976, 8p
Sponsored in part by National Science Foundation, Washington, D.C., and Maryland Univ., College Park.
Pub. in Physiolog. Chem. 8, n6 p559-562 Dec 76.

Keywords: *Oxygen, *Fluorine organic compounds, *Hydrocarbons, Mixtures, Fatty acids, Complex compounds, Reprints, Virial coefficients.

Second virial coefficients are measured for oxygen/hydrocarbon and oxygen/fluorocarbon mixtures. The results indicate that the reversible oxygenation of fluorocarbon emulsions and olefinic fatty acids does not depend strongly upon attractive complex formation.

702,953
PB-274 365/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Surface Relaxation Energies in Core Level Spectroscopies of Adsorbed Atoms and Molecules.
Final rept.,
J. W. Gadzuk. 1977, 12p
Pub. in Surface Science 67, p77-88 1977.

Keywords: *Adsorption, Surfaces, Emission spectra, Atoms, Molecules, Reprints.

Core level holes which are created in electron emission spectroscopies of atoms and molecules adsorbed or condensed onto metal surfaces, induce a screening charge at the surface. The Coulomb interaction between the induced and the hole charge, called the extra-atomic relaxation energy, shifts the apparent binding energy of the ejected electron from the value inferred from an orbital energy. In this paper, linear response screening shifts are calculated for a number of different response functions which also allow for the polarizability of the adsorbed layers. The relation between classical image potential shifts and those obtained here is quantitatively compared.

702,954
PB-274 500/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chemisorptive Luminescence from Ba and Mg Films.
Final rept.,
P. I. Cohen, S. Abramowitz, and H. P. Broida. 1977, 4p
Grant NSF-DMR75-21379
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, D.C.
Pub. in Surface Sci. 69, p601-604 1977.

Keywords: *Chemisorption, *Barium, *Magnesium, Films, Surfaces, Reprints.

The chemiluminescent reactions of Ba and Mg films, adsorbed on a gold plated copper surface maintained at liquid hydrogen temperature, with the oxidants O2, O3, N2O, NO2, and SF6 have been observed. Some spectral analysis of the glow emissions have been made.

702,955
PB-274 507/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Unified Theory of Stark Broadening for Hydrogenic Ions - I. A General Theory (Including Time Ordering).
Final rept.,
R. L. Greene, J. Cooper, and E. W. Smith. 1975, 12p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 15, p1025-1036 1975.

Keywords: *Stark effect, Hydrogen, Ions, Line width, *Hydrogen ions, Reprints.

The formalism of the Unified Classical Path Theory of Stark broadening is extended (by use of a technique developed by Lisitsa and Sholin) to include the effects of time-ordering in the calculation of the required time-development operator. In addition, hyperbolic classical paths are considered so that the theory is valid for hydrogenic ions (as well as for the straight line paths of neutral hydrogen).

702,956
PB-274 511/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Scattering of Light by Uniformly Curved Rods--A Model of Semi-Rigid Rod Macromolecules.
Final rept.,
P. H. Verdier. Oct 77, 6p
Pub. in Macromolecules, v10 p913-918 Sep/Oct 77.

Keywords: *Light scattering, Molecules, Error analysis, Molecular weight, Reprints, Form factors.

Uniformly curved rods may be used as a model of rod-like macromolecules which are not rigid enough to be straight rods in solution. The dependence of scattered light intensity upon scattering angle (form factor) has been obtained numerically for curved rods with angles of bend form 0 degrees (straight rod) to 150 degrees. The results have been used to synthesize 'experimental' scattering data for rods with lengths from 1500 A to 5000 A, over the range of scattering angles accessible to conventional light-scattering photometers. The errors incurred in extrapolation of the inverse form factors to zero scattering angle are shown to be not excessive. Further, it is shown that in some circumstances the ratio of the scattered intensities at two supplementary angles is a function primarily of the contour length of the rod, and does not depend strongly upon the angle of bend. Measuring such a ratio therefore gives an estimate of contour length and, if the relation between contour length and molecular weight is known, of molecular weight.

702,957
PB-274 512/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theory of Gain and Saturation for Collision-Induced Lasing Transitions.
Final rept.,
P. S. Julienne. Oct 77, 9p
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Div. of Laser Fusion.
Pub. in Jnl. of Applied Physics, v48 n10 p4140-4148 Oct 77.

Keywords: *Emission spectra, Oxygen, Argon, Atoms, Metastable state, Excitation, Reprints, *Atom atom interactions.

Theoretical expressions are given for the inversion density, small signal gain coefficient, and saturation energy flux which pertain to stimulated collision-induced emission, that is, the free-free and free-bound dipole emission from unbound excited states formed during a collision of an atomic metastable species and another atom. The probability of stimulated emission during a collision is assumed to remain much less than unity so that a Maxwellian velocity distribution of excited atoms is maintained. The gain and saturation are described in terms of a profile function k(ni), a frequency-dependent two-body rate coefficient per unit frequency. The final expressions are analogous to those for a homogeneously broadened two-level atoms. The theory is applied to the collision-induced green continuum from oxygen singlet S(0) in argon.

702,958
PB-274 513/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystallographic Studies of the Role of Mg as a Stabilizing Impurity in beta-Ca3(PO4)2. II. Refinement of Mg-Containing beta-Ca3(PO4)2.
Final rept.,
L. W. Schroeder, B. Dickens, and W. E. Brown. 1977, 10p
Sponsored in part by American Dental Association, Chicago, Ill.
Pub. in Jnl. of Solid State Chemistry, v22 p253-262 1977.

Keywords: *Crystal structure, *Calcium phosphates, Least squares method, Magnesium inorganic compounds, Inorganic phosphates, Reprints.

The crystal structures of five samples of Mg-containing beta-tricalcium orthophosphate, beta-Ca3(PO4)2, have been refined and the Mg-impurity distribution has been examined. Typically, approximately 7500 reflections were measured and merged into a unique set of approximately 2500. Least-squares refinements with anisotropic temperature factors (and third cumulants for some atoms) produced weighted residuals, Rw(F), in the region of 0.02 to 0.04. Three of the five cation sites are always completely filled with calcium ions, a fourth site with Ca and Mg ions, and the fifth site contains Ca, Mg, and vacancies. Local order may exist because the sizes of the coordinations about the two Mg-containing cation sites are directly related by the orientation of phosphate group P(2)O4 such that a small ion in one site favors the incorporation of a small ion in the other site.

702,959
PB-274 516/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Branching and Molecular Weight Distribution of Polyethylene SRM 1476.
Final rept.,
H. L. Wagner, and F. L. McCrackin. 1977, 13p
Pub. in Jnl. of Applied Polymer Science, v21 p2833-2845 1977.

Keywords: *Molecular weight, *Polyethylene, Least squares method, Distillation, Viscosity, Chromatography, Gels, Reprints, Standard reference materials, *Polymer branching, Gel chromatography.

A method of determining the distribution of branching in a polymer is developed employing limiting viscosity numbers (intrinsic viscosity), gel permeation chromatography (GPC), and absolute molecular weight determinations of fractions of the whole polymer. A molecular weight calibration of the GPC column set is first determined employing these fractions. From the limiting viscosity number measurements of these fractions and their molecular weight distribution determined from the GPC chromatogram, the viscosity-molecular weight relationship is determined by a nonlinear least squares fitting procedure. For the same molecular weight, the limiting viscosity number of the branched polymer is less than the limiting viscosity number of the linear polymer. From the ratio of the two, the number of branches per unit molecular weight of the branched polymer is calculated. This method was applied to SRM 1476, the standard reference branched polyethylene issued by the National Bureau of Standards. The branching density for the constituents of SRM 1476 rise from zero at molecular weights less than 10,000 to about 6 to 8 x 10 to the -5th power at molecular weights of 50,000 and above. The branching of SRM 1476 was also determined by the method of Drott and Mendelson giving a result in fair agreement with the above method.

702,960
PB-274 827/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Measured Regularities in the Stark Broadening of Neutral Nitrogen Lines.
Final rept.,
V. Helbig, D. E. Kelleher, and W. L. Wiese. 1976, 4p
Pub. in Proceedings of Int. Summer School and Symp. on the Physics of Ionized Gases (8th), Dubrovnik, Yugoslavia, p412-415 1976.

Keywords: *Stark effect, *Nitrogen, *Line width, Reprints.

No abstract available.

702,961
PB-274 828/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Regularities in the Stark Widths of Isolated Lines.
Final rept.,
W. L. Wiese, and N. Konjevic. 1976, 5p
Pub. in Proceedings of Int. Summer School and Symp. on the Physics of Ionized Gases, Dubrovnik, Yugoslavia, p416-420 1976.

Keywords: *Stark effect, *Line width, Reprints.

No abstract available.

702,962
PB-274 968/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Coagulation of Aerosols with Broad Initial Size Distribution.
Final rept.,
G. W. Mulholland, T. G. Lee, and H. R. Baum. Dec 77, 15p
Pub. in Jnl. of Colloid Interface Science, v62 n3 p406-420 Dec 77.

Keywords: *Aerosols, *Coagulation, *Particle size distribution, Reprints.

The effect of coagulation on an aerosol with a broad initial size distribution was calculated analytically for large and small particle sizes for arbitrary time with the assumption of a constant coagulation collision frequency. It was found for the class of algebraic initial distributions that in general there is no selfpreserving size distribution though for the special case of a Junge like algebraic size distribution there is a quasi self-preserving form. The calculation also demonstrates that coagulation alone leads to dynamic equilibrium for large particle size without the need of additional physical processes such as particle sedimentation. The relevance of the calculations to real aerosols was tested by measuring the size distribution of smoke generated from smoldering 'punk' and flaming alpha-cellulose. The size distributions of both smoke aerosols are not only self-preserving but also are very similar. There is quantitative agreement between the measured size distribution and the calculated quasi self-preserving form, psi = 0.1/(eta + 0.1)squared, where psi and eta are the reduced number distribution and reduced particle volume respectively.

702,963
PB-274 978/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mean Lives and gf Values in U I.
Final rept.,
J. Z. Klose, and P. A. Voight. Nov 77, 6p
Sponsored in part by Energy Research and Development Administration, San Francisco, Calif. San Francisco Operations Office.
Pub. in Physical Review A, v16 n5 p2032-2037 Nov 77.

Keywords: *Uranium, Mean, *Lifetimes(Energy levels), *Gf values, Reprints.

Determinations of the mean lives of the 27887- and 16900-cm levels in U I have been made, each at a single vapor density, using electronic excitation and a method of delayed coincidence. The lifetime values were obtained by optically detecting the decays of the 3584.9- and 5915.4-A resonance transitions, respectively.

702,964
PB-274 980/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mechanisms of C6H6 Ionization and Fragmentation.
Final rept.,
H. M. Rosenstock, K. E. McCulloh, and F. P. Lossing. 1977, 15p
Pub. in International Jnl. of Mass Spectrometry and Ion Physics, v25 p327-341 1977.

Keywords: *Benzene, *Photochemistry, *Ionization, Ions, Pyridines, Butanes, Isomers, Reprints, Autoionization, Hexadiyne, *Chemical reaction mechanisms.

Photoionization and electron monochromator studies have been carried out on benzene, 1,5-hexadiyne, 2,4-hexadiyne, pyridine and some C4H4 isomers to develop new information concerning the details of benzene ion fragmentation. Present results, together with those of other workers, indicate that a number of C6H6(+) ion isomers have energies comparable to that of the first excited state of the benzene ion. These could act as intermeditate states in skeletal fragmentation of the benzene ion and account for the observed small kinetic shift. Results on vinyl acetylene and butatriene indicate that these ion structures are not formed at the fragmentation threshold in benzene. Results on 1,5-hexadiyne and pyridine indicate the formation of a new C4H4(+) ion structure, more stable than the two linear isomers. The evidence for lack of competition between hydrogen loss and skeletal fragmentation in the benzene ion is reviewed. Photoionization of benzene reveals autoionization contributions to parent ion and fragment ion production; assignments of the autoionizing levels are given. The photoionization behavior of 1,5-hexadiyne suggests that this also fragments via two pairs of non-competing reactions, as postulated for benzene.

702,965
PB-274 981/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Phase Equilibria in the Critical Region: An Application of the Rectilinear Diameter and '1/3 Power' Laws to Binary Mixtures.
Final rept.,
M. R. Moldover, and J. S. Gallagher. 1977, 12p
Pub. in Proceedings, Phase Equilibria and Fluid Properties in the Chemical Industry. Estimation and Correlation, Asilomar Conference Grounds, Pacific Grove, Calif. 16-21 Jan 77, p498-509 1977.

Keywords: *Critical points, *Binary systems(Materials), *Equilibrium, Thermodynamics, Mixtures, Phase transformation, Transition points.

A model describing the VLE surface for mixtures in the critical region is described using the familiar '1/3 power law' and 'law of rectilinear diameters'. The success of this model is based upon the use of coefficients in these familiar laws which are function of a thermodynamic variable which has the same value in both the vapor and liquid phases. This differs from conventional thermodynamic models for mixtures which use coefficients which are functions of 'x', the mole fraction of the mixture.

702,966
PB-275 013/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Transition Probabilities for the 3s-4p Transitions of Ne I.
Final rept.,
A. Czernichowski, A. Holys, and J. R. Roberts. Sep 77, 5p
Sponsored in part by Maria Curie-Sklodowska Foundation.
Pub. in Jnl. of Physics, v38 p1065-1069 Sep 77.

Keywords: *Molecular energy levels, *Neon, Atomic spectra, Excitation, Reprints, Lifetimes(Energy levels).

Transition probabilities for the lines of the 3s-4p transition array of Ne I were measured in a wall-stabilized arc. The arc operated in neon (<5%H2) at one atmosphere pressure and the relative transition probabilities of 27 lines emitted from this arc plasma were placed on an absolute scale using lifetimes of two different upper levels. The results are compared to other theoretical results and were checked with the J-file sum rule. The results presented here are inconsistent with the J-file sum rule.

702,967
PB-275 015/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Critical Behavior in Fluids.
Final rept.,
J. M. H. L. Sengers. 1977, 91p
Pub. in High Pressure Technology, ch5 v2 p161-251 1977.

Keywords: *Fluids, *Thermodynamic properties, *Transport properties, *Criticality, Van der Waals' equation, Ising model.

A survey of critical-region anomalies of thermodynamic and transport properties is given. The critical behavior of Van der Waals' equation and of the Ising model is discussed. The concepts of critical exponents, scaling and universality of critical behavior are introduced. The use of these concepts in the description of critical behavior in one-component fluids is illustrated. The generalization to critical behavior in fluid mixtures is outlined.

702,968
PB-275 020/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interstitial Compounds.
Final rept.,
L. H. Bennett, A. J. McAlister, and R. E. Watson. Sep 77, 7p
Pub. in Physics Today, v30 n9 p34-40 Sep 77.

Keywords: *Interstitials, Molecular structure, Physical properties, Chemical properties, Chemical bonds, Technology, Reprints.

The structure, properties, and bonding of interstitial compounds are reviewed, with tutorial emphasis on the many gaps in our knowledge and understanding of many of these properties, and their many potential technological applications.

702,969
PB-275 021/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser-Induced Ionising Collisions in Alkali Vapours.
Final rept.,
S. Geltman. 1977, 18p
Grant NSF-PHY76-05169-A02
Pub. in Jnl. of Physics B: Atomic and Molecular Physics, v10 n15 p3057-3074 1977.

Keywords: *Gas ionization, Atoms, Excitation, Vapor phases, Perturbation theory, Sodium, Reprints, *Atom atom interactions, Laser induced ionization.

The semiclassical theory is developed for a simultaneous collisional and radiative process, and applied to the laser-induced ionization in a collision of two excited alkali atoms (in their lowest n doublet P states) in a laser field. Perturbation theory is used to evaluate the probability for this process in the case or straight-line paths at large impact parameter. The collision perturbation is taken to be the dipole-dipole interaction between the two atoms, which together with the dipole interaction with the radiation leads to the occurrence of s and d intermediate atomic states and p and f final states for the ejected electron. The laser-induced ionizing collision process helps explain certain experimental observations in resonantly irradiated Na vapor.

702,970
PB-275 023/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Charge Flow in Transition Metal Carbides.
Final rept.,
A. J. McAlister, and R. E. Watson. 1977, 12p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Semiconductor Insulators, v2 p231-242 1977.

Keywords: *Transition metals, *Carbides, Transferring, X ray analysis, Tungsten carbides, Molybdenum carbides, Reprints, Chemical shifts(Nuclear magnetic resonance), Charge transfer.

To date, attempts to deduce transferred charge, delta, in transition metal carbides from chemical shifts, delta E(B), of x-ray photoemission core lines have relied on analysis of delta E(B) in terms of interaction of delta with the core shell and the Madelung term consequent to charging of the remainder of the lattice when delta is not equal to 0. Values of delta deduced on this basis were of plausible magnitude and of a sign consistent with much current thinking. But this approach is admittedly oversimplified. In the present work, the authors consider the consequences of going to a more complete analysis. Admitting the complications leads in the case of the carbides to an ill conditioned expression for delta E(B) and to poorly determined values of delta. Application of this expression to literature values of core shifts as well as new data obtained by us for WC and Mo2C leads to values of delta opposite in sign and smaller in magnitude than previously obtained.

702,971
PB-275 030/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Kinetics of the Reaction of HO2 with NO.
Final rept.,
C. J. Howard, and K. M. Evenson. Oct 77, 4p
Sponsored in part by Manufacturing Chemists Association, Washington, D.C. Technical Panel on Fluorocarbon Research.
Pub. in Geophysical Research Letters, v4 n10 p437-440 Oct 77.

Keywords: *Reaction kinetics, *Nitrogen oxide(NO), Free radicals, Chemical reactions, Reprints, *Hydroperoxyl radicals.

The gas phase reaction of HO2 radicals with NO was studied using a discharge-flow system and laser-magnetic resonance detection. Concentrations of HO2 down to 2 to 3 x 10 to the 9th power molecules/cc were detectable, thus allowing the reaction to be studied under pseudo-first-order kinetic conditions. The rate constant was measured using three independent kinetic schemes, one of which involved the detection of the reaction products OH and NO2. The three schemes gave results in excellent agreement. The measurements also indicate that the rate constants for two other exothermic channels of the reaction are less than 2% of k1.

702,972
PB-275 037/0 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards. Section A: Physics and Chemistry. Volume 81A, Numbers 2 and 3, March-June 1977.
Bi-monthly rept.
Jun 77, 100p JNBAAS-81A(2/3)
Library of Congress Catalog Card no. 62-37059. See also PB-266 483.

Keywords: *Chemistry, *Physics, *Standards, Diffusion, Thermophysical properties, Alloys, Drops(Liquid), Evaporation, Cations, Isotope effect, Solubility, Calcium phosphates, Polymers, Glasses, Iodine organic compounds, Methane/iodo, Ethane/iodo, Titanium alloy 6Al 4V.

This section of the Journal of Research contains papers of interest primarily to scientists working in the fields of Physics and Chemistry. This section covers a broad range of physical and chemical research, with major emphasis on standards of physical measurement, fundamental constants, and properties of matter. Papers presented include the following: (1) Diffusion with discontinuous swelling. III. Type II diffusion as a particular solution of the conventional diffusion equation, Anton Peterlin; (2) Thermophysical measurements on 90Ti-6Al-4V alloy above 1450 K using a transient (subsecond) technique, A.Cezairliyan, J.L.McClure, R. Taylor; (3) Evaporation of liquid droplet. R.Kayser, Jr., H.S. Bennett; (4) Isotope effects in the association reactions of methyl and ethyl iodide cations, L.W. Sieck; (5) Solubility of Ca5(PO4)3OH in the system Ca(OH2-H3PO4-H2O) at 5, 15, 25, and 37 C, H.McDowell, T.M. Gregory, W.E. Brown; (6) Thermodynamics of the densification process for polymer glasses, J.E. McKinney, R. Simha.

702,973
PB-275 123/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Observation of Coherent Excitation Processes in e - H Collisions.
Final rept.,
A. H. Mahan, and S. J. Smith. Nov 77, 4p
Grant NSF-GP-39308
Pub. in Physical Review A, v16 n5 p1789-1792 Nov 77.

Keywords: *Hydrogen, *Deuterium, Excitation, Electron irradiation, Spectral lines, Stark effect, Reprints, *Atom electron interactions, Hydrogen atoms.

In a measurement of emission of Balmer-alpha flux from atomic hydrogen or deuterium excited by electron impact in a crossed beam experiment, a longitudinal electric field which enhances the Balmer-alpha flux by Stark mixing components of like M(J) within the n = 3 shell, does so asymmetrically depending on whether the field is applied parallel or anti-parallel to the electron beam. The effect is attributed to coherent excitation of states of opposite parity.

702,974
PB-275 130/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Momentum Transfer Cross Sections for Polar Molecules.
Final rept.,
L. A. Collins, and D. W. Norcross. Aug 77, 5p
Grant NSF-AER74-20552
Pub. in Proceedings of Conference on High Temperature Sciences Related to Open-Cycle, Coal-Fired MHD Systems, Argonne, Ill. 4-6 Apr 77 (Argonne National Lab., Ill. rept. no. ANL-77-21), p86-90 Aug 77.

Keywords: *Momentum transfer, Magnetohydrodynamic generators, Plasmas(Physics), Molecule rotation, Polarity, Water, Sulfur dioxide, Potassium hydroxides, Reprints, *Electron molecule interactions, Electron cross sections.

Rotational-excitation collisions between electrons and polar molecules such as H2O, SO2 and KOH are thought to play an important role in determining the plasma conductivity of MHD generators. The molecule KOH, even in small concentrations, may make a significant contribution to the total plasma reactivity due to its very large momentum transfer cross section. Our approach to developing general methods for calculating excitation and momentum transfer cross sections for electron collisions with strongly polar systems has been to carry out an exhaustive study using the close-coupling formulation for a typical molecule, LiF, in order to test the validity of approximating the full potential surface by simple model potentials; and should one or more of the potentials give accurate cross sections, to develop a systematic procedure for generating such model potentials. This is being performed in parallel with a study of the validity of various simpler approaches to the solution of the scattering problem.

702,975
PB-275 133/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evidence for the Conformation of H2O Adsorbed on Ru(001).
Final rept.,
T. E. Madey, and J. T. Yates. 1 Oct 77, 7p
Pub. in Chemical Physics Letters, v51 n1 p77-83, 1 Oct 77.

Keywords: *Water, Adsorption, Chemisorption, Desorption, Angular distribution, Reprints, Molecular conformation, ESDIAD method.

The Electron Stimulated Desorption Ion Angular Distribution (ESDIAD) method has been used to study the adsorption of H2O by Ru(001). The results indicate that chemisorbed, undissociated H2O is bonded to Ru via the oxygen atom, and that interactions between neighboring molecules occur as coverage increases. The Utility of ESDIAD for structure determination in the absence of long range order is demonstrated.

702,976
PB-275 136/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ramsey Fringes in Saturation Spectroscopy.
Final rept.,
J. C. Bergquist, S. A. Lee, and J. L. Hall. 1977, 7p
Grant NSF-PHY76-04761
Pub. in Proceedings of International Conference on Laser Spectroscopy (3rd), Jackson, Wyo. 3-6 Jul 77, Paper in Springer Series in Optical Sciences, v7: Laser Spectroscopy 3, p142-148 1977.

Keywords: *Spectrum analysis, Phase shift, Phase modulation, Reprints, *Ramsey fringes, Saturation spectroscopy.

Optical Ramsey fringes were observed in saturation spectroscopy with spatially separated light fields. The phase evolution of the Ramsey-type interaction between the atoms and the light fields, and the symmetry of the fringes are discussed. Techniques for application of the Ramsey method in precision spectroscopy by phase shift and modulation of the fringes are described.

702,977
PB-275 138/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rayleigh-Schrodinger and Green's Function Calculations of Ionization Potentials and Electron Affinities.
Final rept.,
A. J. Hernandez, and P. W. Langhoff. 1 Aug 77, 6p
Pub. in Chemical Physics Letters, v49 n3 p421-426, 1 Aug 77.

Keywords: *Ionization potentials, Numerical analysis, Green's function, Atoms, Molecules, Perturbation theory, Reprints, Electron affinity.

Connections between first-quantized Rayleigh-Schrodinger perturbation-theory and one-particle Green's function calculations of the ionization potentials and electron affinities of atoms and molecules are reported.

702,978
PB-275 140/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photoabsorption in Atomic Lithium.
Final rept.,
P. W. Langhoff, C. T. Corcoran, and J. S. Sims. Oct 77, 8p
Pub. in Physical Review A, v16 n4 p1513-1520 Oct 77.

Keywords: *Lithium, Excitation, Dipole moments, Photochemistry, Ionization, Reprints, Lithium atoms.

Theoretical investigation employing the recently devised Stieltjes-Tchebycheff procedure and variational calculations in Hilbert space are reported of the photoexcitation and ionization cross sections in atomic lithium.

702,979
PB-275 153/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Bands, Clusters, and Crystal Field Splitting: Understanding SF(6) Rotational Levels.
Final rept.,
W. G. Harter, and C. W. Patterson. 1977, 14p
Pub. in International Jnl. of Quantum Chemistry: Quantum Chemistry Symposium, v11 p479-492 1977.

Keywords: *Molecular rotation, *Sulfur hexafluoride, Reprints.

The elementary theory of electron bands for one-dimensional lattices is compared with a new approach to the theory of crystal-field splitting. Nomograms are given for determining the qualitative features of orbital levels spectra for anisotropic crystal fields having polygonal (D(n)) or octahedral (0) symmetry. The methods described are becoming an important part of the analysis of the ro-vibrational fine structure of SF6 and other symmetric molecules.

702,980
PB-275 613/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
H plus H2: Potential Energy Surfaces and Elastic and Inelastic Scattering.
Final rept.,
D. G. Truhlar, and R. E. Wyatt. 1977, 53p
Pub. in Advances in Chemical Physics, v36 p141-204 1977.

Keywords: *Hydrogen, Potential energy, Elastic scattering, Inelastic scattering, Surfaces, Reaction kinetics, Numerical analysis, Excitation, Reprints, Atom molecule interactions, Hydrogen atoms, Potential energy surfaces.

The H + H2 reaction has long been considered an important prototype for chemical reactions with activation barriers. The authors have recently reviewed the history of H3 kinetics, with emphasis on experimental and theoretical studies of the reactive dynamics in the ground electronic state. This review and the previous one, taken together, constitute a review of all work concerned with gas-phase collisions of H with H2. (Includes 250 entry bibliography)

702,981
PB-275 619/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Novel Acylative Degradation of Uric Acid. Carbon-13 NMR Studies of Uric Acid and its Degradation Products.
Final rept.,
B. Coxon, A. J. Fatiadi, L. T. Sniegoski, H. S. Hertz, and R. Schaffer. 1977, 9p
Sponsored in part by Food and Drug Administration, Washington, D.C.
Pub. in Jnl. of Organic Chemistry, v42 p3132-3140 1977.

Keywords: *Isotopic labeling, *Uric acid, *Degradation, Carbon 14, Nuclear magnetic resonance, Infrared spectroscopy, Mass spectroscopy, Molecular structure, Reprints, Carbon 13, Chemical shifts(Nuclear magnetic resonance), Nitrogen 15.

Treatment of uric acid with boiling isobutyric anhydride causes cleavage and rearrangement of the pyrimidine and imidazole rings to give a new heterocyclic derivative, 2-(1-methylethyl)-4-(1-hydroxy-2-methylpro pyl)-aminoimidazole-5-carboxylic acid, 5,1; lactone. The structures of the lactone and related derivatives have been elucidated by infrared spectroscopy, proton and carbon-13 NMR, and mass spectrometry. Experiments with uric acids labeled with carbon-14 at either C-2, C-6, or C-8 confirmed that C-2 and C-8 were eliminated during the cleavage process. Uric acid, its 1,3(15)N2 labeled derivative, and a series of degradation products and related model compounds have been studied by carbon-13 NMR spectroscopy, and the carbon-13 chemical shifts and coupling constants correlated with molecular structure.

702,982
PB-275 620/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ternary Systems Containing an Acidic Copolymer, a Basic Copolymer, and a Solvent. I. Phase Equilibria.
Final rept.,
S. Djadoun, R. N. Goldberg, and H. Morawetz. Oct 77, 6p
Pub. in Macromolecules, v10 n5 p1015-1020 Oct 77.

Keywords: *Phase transformations, Chemical equilibrium, Polystyrene, Polymethyl methacrylate, Solvents, Copolymers, Methacrylicacid, Styrene, Separation, Reprints, Methyl metacrylate, Pyridine/vinyl.

Ternary phase diagrams were determined for systems consisting of polystyrene or a styrene-4-vinylpyridine copolymer, poly(methyl methacrylate) or a methyl metacrylate-methacrylic acid copolymer, and a solvent (dioxane, butanone, or chloroform). While the polystyrene-poly(methyl methacrylate) solvent systems all exhibit two coexisting dilute phases, each containing predominantly one of the polymeric species, introduction of a small concentration of the acidic and basic comonomer leads to solutions containing both polymers. At higher concentrations of strongly interacting comonomers, a different type of phase separation is observed where a concentrated phase containing both copolymers is in equilibrium with a highly dilute solution. The solvent dependence of the phase diagrams is discussed in relation to polymer-solvent interaction parameters (derived from intrinsic viscosities) and in the light of calorimetric data of the enthalpy of mixing of low molecular weight analogues of themonomer residues in the copolymers.

702,983
PB-275 622/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Absolute Cross Sections for 2s-2p Excitation of C(3+) by Electron Impact.
Final rept.,
P. O. Taylor, D. Gregory, G. H. Dunn, R. A. Phaneuf, and D. H. Crandall. 14 Nov 77, 4p
Contract E(49-1)-3800
Pub. in Physical Review Letters, v39 n20 p1256-1259, 14 Nov 77.

Keywords: *Cross sections, Atomic energy levels, Carbon, Ions, Excitation, Electrons, Reprints, *Carbon ions, Electron cross sections.

Absolute cross sections have been measured for excitation of the doublet s doublet S(1/2) - doublet p doublet P(1/2), (3/2) resonance doublet in Li-like C(+3) by electron impact for energies ranging from below

threshold (8.0 eV) to 530 eV. The measurements agree with recent unpublished Coulomb-Born and close-coupling calculations over the entire range of electron energies. The e-C(+3) system represents the first reported example of electron excitation of an ion target for which theory agrees well with experiment in the critical near-threshold energy region. The data reported here are also the first completed cross section measurements of electron impact excitation of a resonance line for a multiply charged ion.

702,984
PB-276 005/6 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Heat Div.
Equation of State for Ammonia.
Interim rept.,
L. Haar, and J. Gallagher. Dec 77, 24p NBSIR-77-1409
See also Interim rept. dated Sep 75, COM-75-11370.

Keywords: *Ammonia, *Thermodynamic properties, Equations of state, Gases, Numerical analysis, Computer programs, Pressure, Temperature, Fortran, Liquid ammonia.

An outline is presented of the basic results of the extensive correlation for the thermodynamic properties of ammonia recently completed at this laboratory. Computer programs are presented for the calculation of thermodynamic properties in the range including the triple point temperature to 5/3 the critical temperature and pressures from the dilute gas to 8000 bar.

702,985
PB-276 047/8 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, Colo. Cryogenics Div.
Comparison of Mathematical Models for the Prediction of LNG (Liquefied Natural Gas) Densities,
R. D. McCarty. Oct 77, 65p NBSIR-77-867
Sponsored in part by American Gas Association, Arlington, Va.

Keywords: *Mathematical models, *Density(Mass/volume), *Liquefied natural gas, Comparison, Numerical analysis, Tables(Data), Liquid phases, Methane, Ethane, Propane, Butanes, Nitrogen, Computer programs, Revisions, Mixtures, Hard sphere model, Cell model, Corresponding states model.

Four mathematical models of the equation of state for LNG like mixtures are compared. Each model has been optimized to the same experimental data set. The experimental data consist of over 175 new PVTx data points taken in this laboratory. The objective of the study was to obtain a mathematical model which would predict LNG densities to within 0.1% of the true value. The extent to which the objective has been achieved is not clear at this time. Additional experimental data are needed to resolve some discrepancies between the present data and all models investigated to date. Computer program listings for all four models are presented.

702,986
PB-276 203/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermophysical Properties of Matter - The TPRC Data Series. Volume 13. Thermal Expansion - Nonmetallic Solids.
Final rept.,
Y. S. Touloukian, R. K. Kirby, R. E. Taylor, and T. Y. Lee. 1977, 1787p
Sponsored in part by Center for Information and Numerical Data Analysis and Synthesis, West Lafayette, Ind.
Pub. in Book of Thermophysical Properties of Matter-The TPRC Data Series. Thermal Expansion - Nonmetallic Solids, v13 1787p 1977.

Keywords: *Thermophysical properties, *Nonmetallic compounds, Thermal expansion, Solid phases, Numerical analysis, Reprints.

This volume of Thermophysical Properties of Matter comprises two major sections: the front text on theory and measurement, together with its bibliography, and the main body of numerical data and its references. The main body of numerical data is the result of a comprehensive survey of the literature. The scope of coverage includes data on the thermal expansion of the nonmetallic elements and compounds. All data were extracted directly from their original sources and have been critically evaluated and analyzed and recommended reference values, provisional values, or typical values, are presented.

702,987
PB-276 204/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Henry's Law and Diffusion Constants of Vinyl Chloride in Poly(vinyl Chloride) at High Temperature.
Final rept.,
D. W. Brown, and R. E. Lowry. 1977, 17p
Pub. in Jnl. of Polymer Science, Polymer Chemistry Edition 15, p2623-2639 1977.

Keywords: *Vinyl chloride, *Henrys law, *Diffusion coefficient, High temperature tests, Desorption, Polyvinyl chloride, Reprints.

The Henry's law and diffusion constants of vinyl chloride in polyvinyl chloride were determined at temperatures of 24, 90, 120, 150 and 170C for weight fractions of vinyl chloride between .0002 and .0008. The heat of desorption is about 15 kJ/mol. At 24C the observed Henry's law constant was smaller than would have been obtained by extrapolating the values found at higher temperature. The activation energy for diffusion is about 110 kJ/mol over the temperature range studied. Although all values were determined in the absence of air it is likely that they apply to polymer in air. They may, therefore, be used to calculate the vinyl chloride content in the gas above polyvinyl chloride under specific processing conditions.

702,988
PB-276 206/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermal Degradation of Polystyrene: Effect of End Groups Derived from Azobisisobutyronitrile.
Final rept.,
C. N. Cascaval, S. Straus, D. W. Brown, and R. E. Florin. 1976, 8p
Pub. in Jnl. of Polymer Science, Symposia, n57 p81-88 1976.

Keywords: *Polystyrene, *Thermal degradation, Chemical bonds, Infrared spectroscopy, Gas chromatography, Pyrolysis, Reprints, Butyronitrile/azo-bis.

Polystyrenes containing end groups derived from azobisisobutyronitrile (AIBN) were subjected to thermal degradation at 280-350C and the rates of volatilization compared with those of thermally and anionically prepared polystyrene. At 330-350C the AIBN polymer resembled thermal polymer and differed from anionic. At 280-320 its behavior was complex; infrared and pyrolysis gas chromatography results suggest weak bond involvement in some cases.

702,989
PB-276 208/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Spectra of Mo XXX, XXXI, and XXXII from a Laser-Produced Plasma.
Final rept.,
P. G. Burkhalter, J. Reader, and R. D. Cowan. Nov 77, 5p
Sponsored in part by Department of Energy, Washington, D.C. Div. of Magnetic Fusion Energy.
Pub. in Jnl. of Optical Society of America 67, n11 p1521-1525, Nov 77.

Keywords: *Molybdenum, Ions, Line spectrum, Molecular energy levels, Excitation, Ultraviolet spectroscopy, Reprints, Laser produced plasmas.

Spectra of highly charged Mo ions generated in a laser-produced plasma were observed from 10 to 190 A with a 3 m grazing-incidence spectrograph. Line identifications in Mo XXX-XXXII were made with the help of relativistic Hartree-Fock calculations. These values support the recent identifications of these lines in the Princeton ST tokamak by Hinnov. The density-sensitive 3p doublet P(3/2) - 3d doublet D(5/2) transition in Mo XXXII is at 126937 A. At shorter wavelengths, the 3s-4p transitions of Mo XXXII are at 14.384 and 14.565 A.

702,990
PB-276 224/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Resonance Lines in the Ag I and Pd I Isoelectronic Sequences: Cs IX through Sm XVI and Cs X through Nd XV.
Final rept.,
J. Sugar. Nov 77, 4p
Pub. in Jnl. of the Optical Society of America, v67 n11 p1518-1521 Nov 77.

Keywords: *Spectrochemical analysis, Ions, Atomic energy levels, Barium, Cerium, Cesium, Lanthanum, Praseodymium, Samarium, Neodymium, Reprints.

Spectra of Cs, Ba, La, Ce, Pr, Nd, and Sm ions were obtained with a low-temperature triggered spark produced with a 14.2 microfarad capacitor charged to voltages of 3-15 KV. They were photographed with a 10.7 m grazing incidence spectrograph in the range of 60-600 A. Resonance lines in the Pd I isoelectronic sequences 4d(10)-4d(9) 5p and 4d(10)-4d(9) 4f were identified. In the Ag I sequences, spectral lines arising from 5s-5p, 5p-5d, 4f-5d, and 4f-5g transitions were identified.

702,991
PB-276 227/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Collision-Induced Absorption in Atomic Electronic Transitions.
Final rept.,
A. Gallagher, and T. Holstein. Dec 77, 19p
Pub. in Physical Review, vA16 n6 p2413-2431 Dec 77.

Keywords: *Atomic energy levels, Selection rules(Physics), Emission spectra, Absorption, Reprints, *Atom atom interactions.

The collision-induced absorption and emission coefficients for electric-dipole forbidden atomic transitions are calculated for weak radiation fields. The approximations used are valid for h(omega) near h(omega (0)), the atomic energy differences. The example case of S-D transitions induced by a spherically symmetric perturber (e.g., a noble gas atom) is treated in detail and compared to measurements. The case of 'radiative collisions,' in which both colliding atoms change their state, is included in the theory and is also compared to experiment.

702,992
PB-276 230/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Longitudinal Acoustic Modes of Polytetrafluoroethylene Copolymers and Oligomers.
Final rept.
J. F. Rabolt, and B. Franconi. Dec 77, 7p
Pub. in Polymer, v18 p1258-1264 Dec 77.

Keywords: *Raman spectroscopy, *Tetrafluoroethylene resins, Molecular structure, Fluorine organic compounds, Copolymers, Numerical analysis, Reprints, *Molecular conformations, *Propylene copolymers/hexafluoro, *Oligomers.

Raman active longitudinal acoustic modes (LAM's) have been observed in the perfluoro n-alkanes and in a copolymer of tetrafluoroethylene and hexafluoropropylene (TFE-HFP). The low frequency bands were found in both the melt and solid phases of the oligomers; and their comparison indicates that regular extended helical conformations exist in the melt phase of perfluoro n-alkanes below n-C12F26. Good agreement is found between the lamellar long spacings of the copolymer and that calculated from the LAM frequencies. Normal mode calculations, using available force fields, have been performed on the infinite homopolymer (PTFE) and n-C16F34. It was found that the helix reversal type of chain defect does not affect LAM frequencies and intensities.

702,993
PB-276 231/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Far Infrared Absorption in H(sub 2) and H(sub 2)-He Mixtures.
Final rept.,
G. Birnbaum. 1978, 12p
Contracts NAS2-0820, NAS9-53284
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer, v19 p51-62 1978.

Keywords: *Hydrogen, *Helium, *Infrared spectroscopy, Far infrared radiation, Mixtures, Absorption, Reprints, *Molecule molecule interactions.

Collision induced absorption in the translation rotation band of H2 and H2-He mixtures is measured from 20 to 900/cm at 77.4, 195 and 292K. To establish the accuracy of the results various sources of error are investigated. The zeroth and first spectral moments are evaluated from experiment and theory for H2 at the various temperatures. To obtain theoretical moments consistent with the experimental values, the quantum pair distribution function must be used. The major por-

tion of the experimental moments can be accounted for by quadrupole induced dipoles in H2 pairs. The remaining portion is attributable to an anisotropic overlap ateraction, although its magnitude depends on the value of the molecular parameters required to calculate the quadrupole contribution.

702,994
PB-276 235/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Identification of Dioxirane (H2COO) in Ozone-Olefin Reactions via Microwave Spectroscopy.
Final rept.,
F. J. Lovas, and R. D. Suenram. 1 Nov 77, 4p
Pub. in Chemical Physical Letters 51, n3 p453-456, 1 Nov 77.

Keywords: *Microwave spectra, Chemical reactions, Ozone, Ethylene, Reprints, *Dioxirane, Chemical reaction mechanisms.

Dioxirane (H2COO) has been identified as a reaction product in the low temperature reaction of ozone with ethylene. The identification comes as the result of a microwave experiment in which the ozonolysis reaction is carried out at -196C in a waveguide reactor.

702,995
PB-276 236/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Influence of the Potential Function on the Determination of Multipole Moments from Pressure-Induced Far-Infrared Spectra.
Final rept.,
E. R. Cohen, and G. Birnbaum. 15 Mar 77, 5p
Pub. in Jnl. of Chemical Physics 66, n6 p2443-2447, 15 Mar 77.

Keywords: *Infrared spectroscopy, Far infrared radiation, Nitrogen, Oxygen, Methane, Reprints, *Potential functions, *Molecule molecule interactions, Methane/tetrafluoro.

The effect of the potential function is investigated on the evaluation of molecular multipole moments from pressure-induced far-infared spectra at low densities where collisions are predominantly bimolecular. The quadrupole and hexadecapole moments of N2 and O2, and the octupole and hexadecapole moments of CH4 and CF4 are evaluated from far-infrared data using potential models consisting of a spherically symmetric part represented by the Lennard-Johnes, Kihara, and m-6-8 potentials, and an anisotropic part representing the electrostatic interactions of the permanent multipole moments. In general, although different values of the multipole moments are obtained with different potentials, the variation is not great. On the basis of limited temperature variation data for N2 and CH4, the use of the Lennard-Jones potential gives multipole moments more independent of temperature than the more flexible potential models.

702,996
PB-276 556/8 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards. Volume 82, Number 2, September-October 1977.
Bimonthly rept.
1977, 58p
Library of Congress catalog card no. 62-37059. See also Volume 81A, Numbers 2 and 3, PB-275 037.

Keywords: *Chemistry, *Physics, Heat transfer, Fires, Static pressure, Titanium, Melting points, Electrical resistivity, Numerical analysis, Polymers, Linear systems, Eigenvectors, Virial coefficients, National Bureau of Standards.

Contents:
- Fundamentals of building heat transfer;
- Static pressure measurements of enclosure fires;
- Melting point, normal spectral emittance (at the melting point), and electrical resistivity (above 1900K) of titanium by a pulse heating method;
- A method for the numerical evaluation of the second virial coefficient for polyatomic molecules;
- Minimum polynomials and control in linear systems;
- Eigenset generalizations of the eigenvalue concept.

702,997
PB-276 557/6 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards. Volume 82, Number 3, November-December 1977.
Bimonthly rept.
Dec 77, 105p
See also Volume 82, Number 2, PB-276 556. Library of Congress Catalog Card no. 62-37059.

Keywords: *Chemistry, *Physics, Chemical equilibrium, Phase rule, Rubidium compounds, Mathematical models, High pressure tests, Bremsstrahlung, Droplets(Liquid), Fuels, Electrons, Ions, Thermal conductivity, Viscosity, Numerical analysis, Heat transmission, Rubidium niobates, Rubidium tantalates, Electron ion interactions, Calcium aluminates, Enclaveless sets, MK systems, National Bureau of Standards.

Contents:
- Phase equilibria and crystal chemistry of rubidium niobates and rubidium tantalates;
- Investigation of calcium aluminate cement phases under high gaseous pressure;
- Stimulated multiphoton bremsstrahlung in electron-ion collisions;
- Transport coefficients in the one-fluid approximation;
- Mathematical models of the transient heat flow to fuel droplets;
- Enclaveless sets and MK-systems.

702,998
PB-277 173/1 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of Standard Reference Materials.
Standard Reference Materials: Guide to United States Reference Materials.
Special pub.,
J. P. Cali, and T. Plebanski. Feb 78, 57p NBS-SP-260-57
Prepared in cooperation with Polish Committee of Standardization and Measures, Warsaw. Library of Congress Catalog Card no. 77-28819.

Keywords: *Standard reference materials, Standards, Tables(Data), Chemical composition, Physical properties, Technology, Biochemistry, Manufacturers, United States.

Summarized is a list of reference materials produced and distributed by U.S. manufacturers, both public and private. Extensive tables are indexed by use to which reference materials may be put. Properties covered include: chemical composition (analytical chemical purposes), chemical composition (high purity), physical properties, engineering and technological properties, and biochemical properties. Names and addresses of 93 U.S. producers and/or distributors are included.

702,999
PB-277 299/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Continuous Determination of Free Cyanide by Means of Membrane Diffusion of Gaseous HCN and an Electrode Indicator Technique.
Final rept.,
R. A. Durst. 1977, 18p
Pub. in Analytical Letters 10, n12 p961-978 1977.

Keywords: *Cyanides, Diffusion, Separation, Membranes, Performance evaluation, Electrodes, Concentration(Composition), *Ion selective electrodes, Reprints.

A continuous measurement system for free cyanide has been developed based on the principle of diffusion across a gas-permeable membrane to affect the separation of hydrogen cyanide from the acidified sample solution. The cyanide adsorbed in the alkaline indicator solution is subsequently analyzed by an indirect technique using a silver ion-selective electrode. In the concentration range of 30 to 400 micrograms CN(-)/L, the accuracy and precision of this method is approximately two percent. The detection limit of this system is approximately 0.5 micrograms CN(-)/L.

703,000
PB-277 301/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Alternative Techniques for Fiber Characterization: Particulate Size Distribution Measurement by Doppler Shift Spectroscopy and Chemical Identification by Micro Raman Spectroscopy.
Final rept.,
I. Chabay, G. J. Rosasco, and E. S. Etz. 1977, 8p
Pub. in Proceedings of Symposium on Electron Microscopy of Microfibers, University Park, Pa., August 23-25, 1976, Section V. Alternate Techniques in First FDA Office of Science Summer Symposium on Electron Microscopy of Microfibers, p181-188 1977.

Keywords: *Particle size distribution, Raman spectroscopy, Doppler effect, Aerosols.

Descriptions of two new techniques for measurement of particle properties are presented. Raman spectroscopy to characterize chemically individual micrometer-size particles can be routinely performed with an instrument designed and constructed at NBS. Data obtained by Drs. Rosasco and Etz on their micro-Raman instrument is discussed. The spectra of individual micrometer-sized particles of anhydrite in urban dust, cholesterol and a comparison of the spectra of ammonium, sodium, and calcium sulfate are included. A Doppler shift spectrometer has been developed which can measure the size distribution of liquid or solid aerosols from 0.5 to 50 micrometers radius. The Stokes Law settling velocity and the scattered light intensity are used together to determine the size distribution of an aerosol with a minimum of perturbation of the sample. This technique is rapid, inherently calibrated without external standards, and independent of assumptions regarding the width or shape of the size distribution. Both techniques discussed can in principle be applied readily to microfibers. As yet, this has not been attempted. The Doppler shift light scattering technique could also provide information on the axial ratios of microfibers.

703,001
PB-277 316/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Triple Point of Mercury as a Thermometric Standard.
Final rept.,
G. T. Furukawa, and W. R. Bigge. 1976, 7p
Pub. in Proceedings Session Comite Consultatif de Thermometrie (11th), Comite Inst. des Poids et Mesures, Sevres, France, June 15-16, 1976, Paper T 14 in Comite Consultatif de Thermometrie, pT138-T144 1976.

Keywords: *Mercury, Freezing point, Standards, Purification, Reprints, *Triple point.

Mercury can readily be made purer than 99.9999 percent by chemical washing followed by multiple distillation. The range of the freezing points of mercury from three sources was found to be 0.1 mK. The total impurity of one of the samples, SRM-743, is estimated to be less than 20 parts per billion. The second sample was a part of the NBS 'density standard' mercury. The third sample was a part of a large lot purified for manometry at the NBS. The triple point of mercury was found to be close to 234.308 32K (-38.841 68 C). The triple point of mercury is expected to be as reproducible as the triple point of water.

703,002
PB-277 320/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamic Properties of Molybdenum Pentafluoride Vapor.
Final rept.,
T. B. Douglas. 1977, 15p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, D.C.
Pub. in Jnl. of Chemical Thermodynamics 9, p1165-1179 1977.

Keywords: *Thermodynamic properties, Molybdenum halides, Fluorides, Vapor phases, Enthalpy, Entropy, Gibbs free energy, Reprints, *Molybdenum pentafluoride.

There are calculated, for 298 K and higher temperatures, the standard entropies of the liquid and the important gas species (monomer, dimer, and trimer) of MoF5, and their differences in enthalpy and Gibbs energy. Besides estimated mean heat capacities, the input data are: the vapor pressure at one temperature and the saturated-vapor density at two temperatures (based on measurements in this laboratory); the standard entropies of the three gas species (estimated from published spectroscopic data on the crystal and monomer); and an ion-abundance proportion (from a published mass-spectral study). This ion proportion is corrected for fragmentation after demonstrating that changes in the ion proportions for a similar fluoride, RhF5, can be explained by assuming that the rates of fragmentation of the dimer and trimer are equal. For those input data considered most uncertain (the vapor

pressure, the entropies of dimer and trimer, and the ratios of mass-spectral ionization efficiencies) several sets of values covering their respective estimated ranges of uncertainty are used alternatively in the calculations.

703,003
PB-277 322/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Automated Instrumentation for Air Infiltration Measurements in Buildings.
Final rept.,
D. T. Harrje, C. M. Hunt, S. J. Treado, and N. J. Malik. 1975, 33p
Grant NSF-SIA72-03516-A02
Pub. in Princeton University Center for Environmental Studies Report No. 13, 33p Apr 75.

Keywords: *Buildings, *Gas detectors, *Ventilation, *Fluid infiltration, Sulfur hexafluoride, Gas chromatography, Concentration(Composition), Electron capture, Performance evaluation, Electron capture detectors.

Automated instrumentation, using sulfur hexafluoride as a tracer gas in residential housing to determine rates of air infiltration in housing, is described. The principles of operation, the necessary calibration procedures, and the early field data, are discussed in detail. Concentration levels of SF6 are maintained at the parts per billion level in the buildings, and are measured by sensitive electron capture detectors in conjunction with a gas chromatograph.

703,004
PB-277 325/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theory of Rare Gas-Group VI1S-1D Collision-Induced Transitions.
Final rept.,
P. S. Julienne. 1978, 10p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Jnl. of Chemical Physics 68, n1 p32-41 Jan 78.

Keywords: *Molecular energy levels, *Mathematical models, *Group 6A compounds, *Group 6B compounds, *Rare gases, Perturbation theory, Oxides, Sulfides, Selenides, Numerical analysis, Reprints, Molecule molecule interactions.

The collision-induced (1)S-(1) emission of a Group VI metastable (1)S atom in the presence of a rare gas background is investigated theoretically. Approximate model potentials are constructed for the Group VI(1)S-rare gas interaction based on the mixed rare gas ground state potentials. The model is supplemented by ab initio calculations for ArO and by the RKR potential for XeO. Long range perturbation theory is used for the induced dipole transition moment, supplemented at short range by the available ab initio calculations on Ar, Kr, and Xe oxides. The model gives a satisfactory account of the measured emission coefficients for the rare gas oxides and sulfides and predicts emission coefficients for the rare gas selenides.

703,005
PB-277 326/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Melting Temperature, Vapor Density, and Vapor Pressure of Molybdenum Pentafluoride.
Final rept.,
R. F. Krause, and T. B. Douglas. 1977, 15p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, D.C.
Pub. in Jnl. of Chemical Thermodynamics 9, p1149-1163 1977.

Keywords: *Melting point, *Vapor pressure, *Density(Mass/volume), Molybdenum halides, Fluorides, Thermodynamic properties, Reprints, *Molybdenum pentafluoride.

A sample of MoF5 was prepared by reaction of MoF6(g) and Mo(c). Melting curves of temperature against time established the melting temperature at zero impurity to be 318.85 K, the enthalpy of fusion to be 6.1 kJ/mol (+ or - 5 per cent), and the cryoscopic impurity of the sample to be 0.15 mole per cent. In the presence of MoF6(g), which was added to suppress disproportionation, the vapor density of MoF5 over the liquid was measured by the transpiration method at 343, 363, and 383 K, the total MoF5 that evaporated being determined by permanganate titration. The total vapor pressure of MoF5 oligomers over the liquid was measured by a simple static method at 373 and 392 K, while melting temperatures were taken alternately to monitor possible contamination of the sample. Although the vapor pressures were adjusted for disproportionation, solution of MoF6 in MoF5, and wall adsorption of MoF6, their percentage uncertainty is probably several times that of the vapor densities. A combination of the two properties indicates the average extent of association of the saturated vapor to be near 2, which is the value for the dimer species (MoF5)2.

703,006
PB-278 397/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High-Resolution 1H and 11B NMR Studies of 1,2- and 1,7-B10C2H12.
Final rept.,
A. R. Garber, G. M. Bodner, L. J. Todd, and A. R. Siedle. 1977, 8p
Pub. in Jnl. of Magnetic Resonance 28, p383-390 1977.

Keywords: *Carboranes, *Nuclear magnetic resonance, *Boron organic compounds, Reprints, *Dodecacarborane(10)/dicarba-closo.

The 70.6-MHz(11)B NMR spectrum of 1,2-B10C2H12 has been assigned by use of labeled derivatives. The assignments are, in order of increasing field, B(9,12), B(8,10), B(4,5,7,11) and B(3,6). Resonances in 1,7-B10C2H12 are due, in order of increasing field, to B(5,12), B(9,10), B(4,6,8,11) and B(2,3). The (1)H NMR spectrum of 1,2-D(2)1,2-B10C2H10 in C6D6 contains four quartets at -2.7,-2.5,-2.1, and -1.7 ppm due to H(8,10), H(9,12), H(4,5,7,11) and H(3,6), respectively. Confirmation of the assignment was achieved by double-resonance experiments.

703,007
PB-278 399/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Orthobaric Liquid Densities and Excess Volumes for Binary Mixtures of Low Molar-Mass Alkanes and Nitrogen between 105 and 140 K.
Final rept.,
M. J. Hiza, W. M. Haynes, and W. R. Parrish. 1977, 24p
Contract AGA-BR-50-11
Pub. in Jnl. of Chemical Thermodynamics 9, n9 p873-896 1977.

Keywords: *Binary systems(Materials), *Density(Mass/volume), *Alkanes, *Nitrogen, Liquid phases, Methane, Ethane, Propane, Butanes, Hydrocarbons, Organic compounds, Liquefied natural gas, Reprints.

A magnetic suspension densimeter has been used to determine orthobaric liquid densities of gravimetrically prepared binary mixtures of the major components of liquefied natural gas (LNG) i.e. nitrogen, methane, ethane, propane, i-butane, and n-butane, generally between 105 and 140 K. All binary combinations were included in this study, with the exception of nitrogen + i-butane and nitrogen + n-butane. Uncertainties in the reported liquid-mixture densities are discussed in detail. Comparisons are made between excess volumes computed from the present results and comparable values from the literature. It was found that the volumetric properties of binary liquid mixtures of the heavy hydro-carbons (those mixtures not containing nitrogen or methane) are closely approximated by ideal mixing. Some observations are included on the use of excess volumes of the heavy hydrocarbon systems to determine effective molar volumes of n-butane in liquid mixtures below its triple-point temperature. For mixtures containing nitrogen or methane, approximate total vapor pressures are given.

703,008
PB-278 402/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD
Further Assignments for the Far-Infrared Laser Transitions of HCN and HC15N.
Final rept.,
A. G. Maki. 1978, 5p
Pub. in Jnl. of Applied Physics 49, n1 p7-11 Jan 78.

Keywords: *Infrared spectroscopy, Excitation, Molecular energy levels, Molecular rotation, Far infrared radiation, Reprints, *Laser spectroscopy.

Assignments are given for the 13 H12C14N and 4 H12C15N laser transitions that have not yet been identified. Although 10 different vibrational systems give rise to 27 laser transitions for H12C14N and H12C15N combined, all follow the same basic pattern involving a particular Coriolis interaction and a population inversion between stretching and bending vibrational manifolds. The laser transitions involve rotational state up to J=48, which is higher than has been observed in room-temperature spectra.

703,009
PB-278 404/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystal Chemistry of Cerium Titanates, Tantalates and Niobates.
Final rept.,
R. S. Roth, T. Negas, H. S. Parker, D. B. Minor, and C. Jones. 1977, 10p
Pub. in Materials Research Bulletin 12, p1173-1182 1977.

Keywords: *Cerium oxides, *Oxidation reactions, Tantalates, Crystal structure, Niobates, Reprints, Cerium titanates.

Cerium dioxide has been found to react with other oxides at high temperatures in an open air environment with the formation of Ce(+3), Ce(+4) or mixed valence phases. Single crystals of Ce(+3)Ta7O19 reveal that this compound is hexagonal. Another phase which is also light yellow is formed by oxidizing at 350C for long periods of time and corresponds to CeTaO(4.50).

703,010
PB-278 407/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Oxidation-Reduction Reactions of CeMO4+x (M=Ta or Nb) Phases.
Final rept.,
T. Negas, R. S. Roth, C. L. McDaniel, H. S. Parker, and C. D. Olson. 1977, 11p
Pub. in Materials Research Bulletin 12, p1161-1171 1977.

Keywords: *Oxidation reduction reactions, *Cerium oxides, X ray analysis, Chemical equilibrium, X ray diffraction, Reprints.

Phase equilibrium methods, single crystal and powder x-ray diffraction analyses, thermogravimetric analysis, and magnetic susceptibility measurements were used to define subsolidus phase relations in air for the systems cerium oxide - Ta2O5 and cerium oxide - Nb2O5. Stoichiometric CeTaO4 is stable in air (P(O2)=0.21 atm) only above 1265C.

703,011
PB-278 415/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
What's New in LNG Measurement Methods and Instrumentation.
Final rept.,
D. B. Mann. 1976, 4p
Pub. in Int. Pipe Line Ind. 45, n6 p21-24 Dec 76.

Keywords: *Liquefied natural gas, *Measuring instruments, Cryogenics, Flowmeters, Densimeters, Density(Mass/volume), Temperature, Pressure, Reprints.

The progress of the past and current research programs at the National Bureau of Standards is presented. A review of cryogenic flowmetering and the applications to liquefied natural gas (LNG) are described with particular emphasis on current moderate scale LNG flowmetering gas industry supported projects. Measurements of density, both inferred and direct, are reviewed and the results of a gas industry supported density reference system are previewed by indicating performance of dielectric, vibrating element and displacement densimeters. The role of accurate and precise property data is pivotal to the instrumentation and measurements of LNG in respect to flow, density, temperature, pressure, and liquid level.

703,012
PB-278 416/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
LNG Density Determination.
Final rept.,
D. E. Diller. 1977, 3p
Sponsored in part by American Gas Association, Inc., Arlington, Va.
Pub. in Hydroc. Proc. 56, n4 p142-144 Apr 77.

Keywords: *Liquefied natural gas, *Density(Mass/volume), Densimeters, Measuring instruments, Mathematical models, Reprints.

Accurate LNG densities are required for equitable custody transfer contracts and operations. Mathematical models and direct reading densimeters for use on LNG type mixtures are being evaluated at the National Bureau of Standards. Accurate (0.1%) orthobaric liquid density data have been obtained for LNG components and their mixtures and are being used to optimize and evaluate four published mathematical models. A density reference system has been constructed and is being used to evaluate commercially available densimeters. Recent progress on these tasks is summarized and discussed.

703,013
PB-278 420/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Recent Applications of Matrices and Isotropic Tensors to Continuum Physics at U.S. National Bureau of Standards.
Final rept.,
J. T. Fong. 1977, 12p
Pub. in Proceedings of Annual Meeting of the Society of Engineering Science, Inc. (14th), Bethlehem, PA., November 14-16, 1977, Paper in Recent Advances in Engineering Science, p655-666 1977.

Keywords: *Polymers, *Piezoelectricity, Mathematical models, Mechanical properties, Potential theory, Decomposition, Viscoelasticity, Matrices(Mathematics), Numerical analysis, Reprints.

Three recent applications of matrix and tensorial methods to the modeling of mechanical and piezoelectric properties of polymeric materials are described. The first problem deals with a three-term decomposition of a nonlinear potential function which characterizes the mechanical properties of a class of compressible viscoelastic fluids. The problem was solved by applying a mathematical result known as Schur's lemma (1909) on irreducible sets of matrices. The second application resulted in an upgrading of the well-known Zimm's eigenvalue problem (1956) which models a polymer molecule in a solvent as a necklace with a large number of beads and springs. The new solution was obtained by applying some elementary properties of symmetric matrices traceable to Kelvin-Tait (1867) and Cayley (1872). The final example in this expository paper is taken from the nonlinear theory of piezoelectricity where the coupling between large strains and electric field can no longer be neglected. The solution to this problem was made possible by applying some earlier work of Capelli (1887) and Cisotti (1930) on isotropic tensors.

703,014
PB-278 723/2 PC **A02**/MF **A01**
National Bureau of Standards, Boulder, Colo.
Producing Liquid-Solid Mixtures of Hydrogen Using an Auger,
R. O. Voth. Feb 78, 21p NBSIR-78-875
Contract NASA-CC-62530A

Keywords: *Liquid hydrogen, *Slush, Cryogenics, Augers, Laboratory equipment, Design criteria, Technology, *Slush hydrogen.

An auger rotating inside a brass tube refrigerated with liquid helium was used to produce liquid-solid (slush) mixtures of hydrogen. The auger produced small particles of solid hydrogen so that the resulting mixture could be transferred and stored. The auger could produce slush continuously in an appropriate system; it could produce slush at pressures higher than the triple point pressure of the hydrogen; and the energy required to produce the slush was less than the energy required to produce slush hydrogen using the freeze-thaw process.

703,015
PB-278 931/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Excitation of the Resonance Lines of the Alkali-Metal Atoms.
Final rept.,
S. T. Chen, and A. C. Gallagher. 1978, 10p
Grant NSF-PHY76-04761
Pub. in Physical Review A 17, n2 p551-560 Feb 78.

Keywords: *Alkali metals, *Polarization, Excitation, Atomic energy levels, Atoms, Potassium, Rubidium, Cesium, Reprints, *Atom electron interactions, *Electron cross sections.

The authors have measured the relative optical-excitation functions and polarizations of the K, Rb, and Cs resonance lines, using crossed electron and atom beams, for electron energies from threshold to 1500 eV. The electron energy resolution was about 0.25 eV for energies below 13 eV, and the atom beam was optically thin. The atomic resonance-level (n2P) excitation functions have been normalized to the Born theory in the high-energy limit. Comparisons are made with other measurements and calculations. The polarizations and total cross sections for H, Li, Na, K, Rb, and Cs are also compared with each other in reduced units to investigate systematic behavior.

703,016
PB-278 933/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Time-Resolved Spectroscopy of Laser-Initiated Metal Combustion.
Final rept.,
J. C. Moulder, and A. F. Clark. 1977, 6p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, D.C.
Pub. in Opt. Eng. 16, n4 p393-398 Jul-Aug 77.

Keywords: *Metals, *Emission spectra, Laser beams, Combustion, Calcium, Magnesium, Zirconium, Titanium, Titanium alloys, Laser spectroscopy, Reprints, Laser target interactions, Laser heating.

A rapid-scan spectrometer employing a silicon-target vidicon detector was used to study the time-resolved emission spectra of laser-ignited metals. Bulk specimens of Ca, Mg, Zr, Ti and several Ti alloys were ignited with a 90 W cw CO2 laser in air or under a gentle flow of oxygen. Line and band emissions observed between 300 and 1100 nm during combustion help to identify vapor phase reactants and products and their locations in the flame. Disappearance of discrete spectra during the transient combustion of Ti and Zr gives information on the accumulation of molten oxide products. Observations of the continuum radiation emitted by laser-irradiated flames indicate a laser-stimulated luminescence from condensed metal oxide particles.

703,017
PB-278 936/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Influence of Salts on Michaelis-Constant Values for NADH.
Final rept.,
B. F. Howell, S. McCune, and R. Schaffer. 1977, 7p
Pub. in Clinical Chemistry 23, n12 p2231-2237 1977.

Keywords: *Enzyme inhibitors, Inorganic salts, Inorganic phosphates, Buffers, Reprints, *Michaelis constant, Dehydrogenases/lactate, *Adenosine pyrophosphate/(dihydro-ribofuranosylnicotinamide-ester), Adenosine pyrophosphates.

Values of the Michaelis constant for NADH for the conversion of pyruvate to lactate with lactate dehydrogenase (E.C. 1.1.1.27) in the presence of 0.1 mol/liter buffers at 25C were found to show first order dependence on enzyme concentration. This effect, previously unexplained, is now recognized to be due to an inhibitory influence exerted by buffers, e.g., NH4HCO3, tris(hydroxymethyl) aminomethane (tris), and phosphate, or salts, e.g. (NH4)2SO4 and NaCl, present in the reaction mixtures. Inhibition constants for the enzyme inhibitor complexes formed with these substances are approximately 0.3 mol/liter for competition of NH4HCO3 with NADH, 0.4 mol/liter for competition of NH4HCO3 with pyruvate; and 0.6 mol/liter for NaCl, 1.0 mol/liter for sodium phosphate, 0.3 mol/liter for (NH4)2SO4, and 0.08 mol/liter for tris when these substances compete with NADH. Because of the large molar ratio of buffer to substrate in enzymatic assays, the buffer concentration significantly influences the Michaelis constant, despite the large value for the inhibition constant.

703,018
PB-278 937/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
PVT Surface of Simple Liquids at Densities Near Melting.
Final rept.,
H. M. Roder. 1977, 5p
Sponsored in part by National Aeronautics and Space Administration, Washington, D.C.
Pub. in Proceedings of Biennial International Conference on CODATA (5th), Boulder, CO., June 28-July 1, 1976, p445-449 1977.

Keywords: *Density(Mass/volume), Melting point, Liquid phases, Temperature, Equations of state, Solutions, Surfaces, *PVT surfaces.

Experimental data establish the temperature and density dependence of the PVT surface for this range of densities. A general feature is that the pressure along an isotherm increases as the density increases. A number of equations of state are examined in light of the behavior expected. Several widely used equations are shown to exhibit incorrect curvature along isotherms at densities near melting. The direct result, namely systematic deviations from experimental PVT data, is often obscured by the uncertainty inherent in the PVT data. That the curvatures are incorrect can be seen by the failure of the equations to correctly predict the specific heats. Extrapolation of incorrect behavior to densities beyond the melting line is shown to be the cause of a very vexing problem, non-unique solutions in density. It is recommended that a check near the melting line be included as part of the procedure in correlating a PVT surface.

703,019
PB-278 945/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Momentum Transfer Cross-Sections and Conductivity Integrals for Gases of MHD Interest.
Final rept.,
F. E. Spencer, and A. V. Phelps. 1976, 12p
Pub. in Proceedings of Symposium on Engineering Aspects of Magnetohydrodynamics (15th), Philadelphia, PA., May 24-26, 1976, Session IX, pIX.9.1-IX.9.12 1976.

Keywords: *Magnetohydrodynamics, *Gases, *Momentum transfer, Plasmas(Physics), Conductivity, Electrical properties, *Electron electron interactions.

The authors present their best estimates for the electron momentum-transfer collision cross-sections for the principal gases occurring in present laboratory and demonstration scale MHD generators of the closed cycle type, and of those open cycle generators running on ash-free combustion plasmas. Also, they give the integrals of these cross-section functions for direct incorporation into the algorithm of Demetriades for calculating electrical properties of gas mixtures.

703,020
PB-278 946/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Multiphoton Absorption in the Presence of Two Finite-Bandwidth Lasers.
Final rept.,
N. C. Wong, and J. H. Eberly. 1977, 3p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Opt. Lett. 1, n6 p211-213 Dec 77.

Keywords: *Line width, Laser beams, Absorption, Reprints, Multiphoton absorption.

Interactions between a three-level atom and two amplitude-fluctuating lasers are studied theoretically. One interesting feature of the interactions is the influence of the finite laser bandwidth and the two-laser cross-bandwidth on the absorption rate into the third level. As an example, it is shown how the partially saturated absorption process depends on both the autocorrelated and crosscorrelated laser bandwidths.

703,021
PB-278 947/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Critical-Point Universality and Fluids.
Final rept.,
A. L. Sengers, R. Hocken, and J. V. Sengers. 1977, 10p
Pub. in Phys. Today 30, n12 p42-51 Dec 77.

Keywords: *Critical points, *Liquid phases, Light scattering, Optical interferometers, Reprints.

Critical-point physical and model systems are introduced. The concepts of power laws, critical exponents, homogeneity, and scaling are discussed. Critical-point universality is defined in the framework of the Renormalization Group approach. A persistent difficulty, namely fluid critical exponents not obeying universality has been recently resolved by three new experiments; optical interferometry in pure fluids, by Hocken and Moldover; magnetic densimetry in binaries, by Greer; and light scattering in binaries by Chang et al.

703,022
PB-278 948/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Some New Transition Probabilities for Mercury I.
Final rept.,
E. R. Mosburg, and M. D. Wilke. 1978, 13p
Contract E(49-1)-3800
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 19, n1-F p69-81 1978.

Keywords: *Mercury(Metal), *Gas discharges, Spectrochemical analysis, Electron transitions, Temperature, Excitation, Density(Mass/volume), Line spectra, Reprints, Oscillator strengths, Transition probabilities.

Detailed studies of a pure mercury positive column have enabled the authors to determine the densities and effective temperatures which characterize the discharge. From this knowledge of the discharge conditions, a series of transition probabilities is derived for 70 lines in the neutral mercury spectrum in the wavelength range 238-1530 nm, including many lines for which transition probabilities have not previously been published.

703,023
PB-278 949/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Auger Electron Spectroscopy.
Final rept.,
C. J. Powell. 1978, 3p
Pub. in ASTM Stand. News 6, n2 p15-17 Feb 78.

Keywords: *Electron spectroscopy, Industrial plants, Standards, Auger electrons, Reprints, *Auger electron spectroscopy.

A description is given of Auger-electron spectroscopy, its industrial applications, and of the development of standards by subcommittee E-42.03 on Auger Electron Spectroscopy.

703,024
PB-278 950/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Equation of State for Thermodynamic Properties of Pure Fluids.
Final rept.,
R. D. Goodwin. 1977, 4p
Pub. in Proceedings of Biennial International Conference on CODATA (5th), Boulder, CO, June 28-July 1, 1976, p441-444 1977.

Keywords: *Equations of state, *Thermodynamic properties, Liquid phases, Vapor phases, Critical point, Specific heat.

This equation originates on a given, liquid-vapor coexistence envelope, thus eliminating the long-standing problem of continuity at this boundary of the P(rho, T) surface. Curvatures of this surface vs. T are consistent with the known behavior of specific heats. The present non-analytic equation of state yields a maximum in the isochoric specific heats, C(nu)(rho T), at the critical point. It has only five coefficients to be found by least squares from experimental P-rho-T data. The consistency obtained by constraint to the liquid-vapor coexistence boundary does not alleviate difficulties arising from inaccurate orthobaric densities and P-rho-T data in the all-important critical region.

703,025
PB-278 953/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Century of Cryogenics.
Final rept.,
R. P. Hudson. 1977, 11p
Pub. in Jnl. of the Washington Academy of Sciences, v67 n4 p119-130 1977.

Keywords: *Cryogenics, Reviews, Reprints.

In the 100 year period since the first liquefaction of oxygen and nitrogen, cryogenics has developed into a broad area of scientific research - with many exciting discoveries along the way - and also a substantial industrial activity in most of the advanced nations. A superficial, historically-framed survey is presented of the major topics of scientific interest, supplemented by a few remarks on recent technological developments.

703,026
PB-278 959/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Coexistence Curve of D20 + Deuterated Isobutyric Acid.
Final rept.,
S. C. Greer. 1977, 3p
Pub. in Ber. Bunsengesllh. Physkh. Chem. 81, n10 p1079-1081 1977.

Keywords: *Deuterium compounds, *Butyric acid, Critical points, Heavy water, Liquid phases, Density(Mass/volume), Reprints.

The author reports precise data on the densities of the coexisting liquid phases near the liquid-liquid critical point in D2O + deuterated isobutyric acid. The result for the critical exponent beta (0.315 + or - 0.008) is consistent with our earlier work on H2O + isobutyric acid, with other work on critical points in fluids, and with current theoretical predictions. The effect of deuteration is to increase the miscibility gap.

703,027
PB-280 378/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Matrix Isolation Spectroscopy of Stable Organic Molecules in the Far Infrared Region.
Final rept.,
E. Knozinger, and M. E. Jacox. 1978, 4p
Pub. in Berichte der Bunsengesellschaft fuer Physikalische Chemie 82, p57-60 1978.

Keywords: *Infrared spectroscopy, *Acetonitrile, Molecular vibrations, Organic compounds, Esters, Reprints, *Matrix isolation techniques, *Formic acid/(methyl-ester).

The potential of the matrix isolation technique for providing heretofore inaccessible information on the torsional vibrations of organic compounds and on the structures of dimers of polar molecules is illustrated by far infrared studies of methyl formate and of acetonitrile isolated in argon and nitrogen matrices.

703,028
PB-280 380/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Synthesis, Structure, and Spectral Properties of (TTF)(HgC13), an Unusual Metallotetrathiaethylene.
Final rept.,
T. J. Kistenmacher, 5. Rossi, C. C. Chiang, R. P. Van Duyne, T. Cape, and A. R. Seidle. 15 Mar 78, 2p
Pub. in Jnl. of the American Chemical Society 100, n6 p1958-1959, 15 Mar 78.

Keywords: *Synthesis(Chemistry), *Crystal structure, *Raman spectroscopy, X ray analysis, Metal containing organic compounds, chlorine inorganic compounds, Reprints, *Methylene bicyclopentadienylidene/tetrathio, *Mercury/chloro.

The X-ray crystal structure of (TTF)HgCl3 demonstrates the presence of two chloromercurate species, (HgCl3)2(-2) and a polymeric (HgCl3)n(-n) and of two types of TTF species. The thiacarbon is present as ring-over-bond columns and eclipsed dimers. The resonance Raman spectrum shows two bonds in the nu3 region, in agreement with the X-ray data.

703,029
PB-280 386/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Matrix-Isolation Study of the Reaction of H Atoms with NO. The Infrared Spectrum of HNO.
Final rept.,
M. E. Jacox, and D. E. Milligan. Dec 73, 24p
Pub. in Jnl. of Molecular Spectroscopy 48, n3 p536-559, Dec 73.

Keywords: *Infrared spectroscopy, Photolysis, Thermodynamic properties, Deuterium compounds, Solidified gases, Nitrogen inorganic compounds, Hydrides, Reprints, *Matrix isolation techniques, *Nitrosyl hydride, Force constants.

Studies of the reaction with NO in an argon or a nitrogen matrix at 4 or 14 K of H and D atoms produced either photolytically or in a microwave discharge have confirmed the previous identification of the ground-state NO stretching fundamental of HNO and of DNO but have dictated a reassignment of the deformation fundamental of these two species. An absorption at 1153/cm has been assigned as the deformation fundamental of DNO, and evidence is presented suggesting that the deformation fundamental of HNO lies very close to 1500/cm. The assignment of an absorption at 2717/cm as the NH stretching fundamental of HNO and of an absorption at 2043/cm as the corresponding fundamental of DNO is consistent with the previous report of an exceptionally long NH bond for ground-state HNO. Detailed isotopic studies support this revised vibrational assignment, which is shown to be consistent with previous gas-phase studies. The force constants and thermodynamic properties of ground-state HNO derived from the matrix data are presented.

703,030
PB-280 387/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Matrix Isolation Study of the Interaction of Excited Argon Atoms with CF2C1Br2. Infrared Spectra of the CF2C1+ and CF2Br+ Molecular Ions.
Final rept.,
M. E. Jacox. 15 Feb 78, 5p
Pub. in Chemical Physics Letters 54, n1 p176-180, 15 Feb 78.

Keywords: *Infrared spectroscopy, *Halogen organic compounds, Ions, Atoms, Matrix methods, Fluorine organic compounds, Chlorine organic compounds, Bromine organic compounds, Reprints, *Atom molecule interactions, *Matrix isolation techniques, Methane/dichloro-difluoro, Methane/bromo-chloro-diffuoro, Methane/dibromo-difluoro.

The infrared absorptions associated with the two C-F stretching fundamentals of CF2Cl(+) and CF2Br(+) have been identified in studies of the matrix-isolated products of the interaction of excited argon atoms with CF2Cl2, CF2ClBr, and CF2Br2. The exceptionally high values of the C-F stretching frequencies obtained in these experiments are consistent with the implications of previous experimental and theoretical studies.

703,031
PB-280 393/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chemisorptive Luminescence from Ba and Mg Films.
Final rept.,
P. I. Cohen, S. Abramowitz, and H. P. Broida. 1977, 4p
Grant NSF-DMR75-21379
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, D.C.
Pub. in Surface Science, v69 p601-604 1977.

Keywords: *Barium, *Magnesium, *Chemiluminescence, *Surface chemistry, *Chemisorption, Films, Reaction kinetics, Vapor phases, Liquid phases, Reprints, Chemical reaction mechanisms.

Chemiluminescence has been used to study the mechanisms and kinetics of gas and liquid phase reactions for many years. Recently, several workers trying to extend such studies to surfaces have reported luminescence during the chemisorption of O2 onto W (1), Si (2), Mg (3), Al (3), and ThO2 (4,5); O2, CO, and acetone onto NiO, Cr2O3, and ZnO (6); and Br2, Cl2, and I2 onto Na (7,8). This luminescence is not well understood but since it occurs in such diverse systems there is probably more than one mechanism involved. The light intensity is quite weak with only 10 to the -5 power to 10 to the 9 power photons produced per molecule adsorbed. Only crude spectral information is available because of low light intensity. The authors purpose was to survey several possible surface reactions, guided by gas phase reactions known to produce strong chemiluminescence (9,10) to find surface reactions with more efficient photon yields and therefore more amenable to spectral analysis.

703,032
PB-280 395/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fluoride Penetration and Retention (Discussion).
Final rept.,
L. C. Chow. 1977, 8p
Sponsored in part by American Dental Association, Chicago, Ill.
Pub. in Caries Research, v11 suppl1 p191-198 1977.

Keywords: *Fluorides, Calcium fluorides, Histology, Penetration, Enamels, Teeth, Apatite/fluoro, Reprints, Retention, *Cariostatic agents.

The penetration of fluoride into enamel produced by topical treatments may occur at three levels: (1) F(-) penetration accompanied by histological changes in enamel, (2) F(-) penetration into the inner zones of enamel via intercrystalline pores, and (3) F(-) penetration into the interior of the apatite crystals. Although CaF2 may be a more potent source of fluoride, the poor retention in the oral environment greatly limits the effectiveness of CaF2 as a cariostatic agent. Fluorapatite is believed to be the most desirable form of fluoride incorporation both because it is stable in normal oral environments and because its dissolution under cariogenic conditions would give rise to kinetic behavior that would tend to diminish caries activity. The forma-

tion of fluorapatite in teeth by a recrystallization process is described.

703,033
PB-280 400/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Solubility Product Variability at Constant Pressure and Temperature.
Final rept.,
W. E. Brown. 1976, 1p
Sponsored in part by American Dental Association, Chicago, Ill.
Pub. in Jnl. of Physical Chemistry, v80 p2708 1976.

Keywords: *Solubility, *Calcium fluorides, Free energy, Reprints, Gibbs Duhem equation.

The conclusion of Stearns and Berndt that the solubility product constant of CaF2 varies with solution composition is refuted on the basis that it could lead to a process involving a spontaneous increase in free energy. The Gibbs-Duhem equation is used to show that the equilibrium free energy of calcium fluoride should be invariant as long as the composition is nearly stoichiometric.

703,034
PB-280 401/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Bonding Information from Fluorine NMR for Alkoxy Tungsten Pentafluorides.
Final rept.,
F. E. Brinckman, R. B. Johannesen, R. F. Hammerschmidt, and L. B. Handy. 1975, 10p
Pub. in Jnl. of Fluorine Chemistry, v6 p427-436 1975.

Keywords: *Tungsten fluorides, *Chemical bonds, *Nuclear magnetic resonance, Fluorides, Reprints, *Chemical shifts(Nuclear magnetic resonance), Nuclear magnetic resonance(Fluorine 19).

The (19)F chemical shifts have been measured for the fluorines bound to tungsten in the compounds ROWF5 where R is CH3, ClCH2CH2, Cl2CHCH2, Br3CCH2, Cl3CCH2, F3CCH2, F2CH(CF2)3CH2, F3CCF2CH2, and (CF3)2CH. For the series as written, both the axial and equatorial fluorines resonate at progressively lower field, and the change in resonant position from one compound to another is twice as great for the axial as for the equatorial fluorines. These results are interpreted in terms of delta- and pi-bonding contributions.

703,035
PB-280 403/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calcium Pyrophosphate Crystal Chemistry.
Final rept.,
W. E. Brown, and T. M. Gregory. Jun 76, 17p
Grant PHS-DE-00572
Sponsored in part by American Dental Association, Chicago, Ill.
Pub. in Proceedings of Conference on Pseudogout and Pyrophosphate Metabolism, Santa Ynez, Calif. 19-22 Oct 75. Paper in Arthritis and Rheumatism, v19 n3 p446-462 May-Jun 76.

Keywords: *Solubility, Calcium phosphates, Inorganic phosphates, Phase diagrams, Mathematical models, Forecasting, Reprints, *Calcium pyrophosphates.

Theoretical considerations governing the solubilities of calcium pyrophosphates are presented in terms of phase diagrams and calculations based on an ionic model, and the reliability of reported solubility data is examined in terms of the model. The solubility product constant, (Ca(+2) (P2O7(-4)), of Ca2P2O7.2H2O appears to be in the vicinity of 3 x 10 to the -18th power, but some of the data indicate that it may be as high as 10 to the -14th power to 10 to the -13th power. Recommendations are given for the future experimental measurements.

703,036
PB-280 405/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Universality, Revisions of and Corrections to Scaling in Fluids.
Final rept.,
F. W. Balfour, J. V. Sengers, M. R. Moldover, and J. M. H. L. Sengers. 6 Mar 78, 3p
Grant NSF-DMR76-82345
Pub. in Physics Letters, v65A n3 p223-225, 6 Mar 78.

Keywords: *Critical point, *Steam, Thermodynamic properties, Scaling, Equations of state, Liquid phases, Reprints.

PVT and internal energy data in the critical region of steam are accurately described by a thermodynamic potential based on renormalization group calculations for Ising-like spin systems. The potential includes both 'corrections-to-scaling' and 'mixing-of-variables' terms.

703,037
PB-280 407/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rotation and Inversion of Normal and Deuterated Ammonia in Inert Matrices.
Final rept.,
L. Abouaf-Marguin, M. E. Jacox, and D. E. Milligan. Sep 77, 28p
Pub. in Jnl. of Molecular Spectroscopy, v67 n1 p34-61 Sep 77.

Keywords: *Infrared spectra, *Ammonia, Molecular rotation, Deuterium compounds, Reprints, Matrix isolation techniques.

Infrared spectra have been recorded for all of the vibrational fundamental regions of NH3 in argon, krypton, and xenon matrices, for the nu2 fundamental region of NH3 in neon and nitrogen matrices, and for the nu2, nu4(') and nu4('') fundamental regions of the deuterated ammonias in an argon matrix. Detailed studies of the temperature and time dependence of absorptions attributed to rotational structure in the vibrational transitions have led to an assignment consistent with almost free rotation of the ammonia molecule in rare gas matrices. The theory of Devonshire has been used to evaluate a barrier to rotation of NH3 in these matrices. The inversion splittings observed for the nu2 fundamentals of NH3, NH2D, and NHD2 are somewhat smaller than for the gas-phase molecules, but the calculated inversion potential barrier is increased by only about 10% in the rare gases. No structure in the nu2 spectral region can be attributed to the rotation or inversion of NH3-d(n) in a nitrogen matrix. However, rotation of the molecule about its C3 axis may occur in the nitrogen matrix.

703,038
PB-280 408/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chemical Thermodynamics in Biology: Applications and Compiled Sources of Evaluated Data.
Final rept.,
G. T. Armstrong, and R. N. Goldberg. 1977, 10p
Pub. in Proceedings of Biennial International Conference on CODATA (5th), Boulder, Colo. 28 Jun-1 Jul 76 p339-348 1977.

Keywords: *Thermodynamic properties, *Organic compounds, *Electrolytes, pH, Metals, Ions, Concentration(Composition), Thermochemistry, Reprints, *Biological material.

Thermodynamic data needs for biological applications in many cases are similar to the general needs for data on organic substances and aqueous electrolyte systems. The literature in the field is rapidly growing. Much thermodynamic data specifically determined on systems of biological interest is determined under special conditions of ionic strength, pH, and metal ion concentrations, and is difficult to relate directly to the well known thermodynamic standard states. Because of the variet conditions necessary for study of individual substances, much existing data on similar systems is not easily correlated. The thermodynamic significance of some equilibrium data is partially obscured by the common practice of using concentrations rather than activities, which is done because it is difficult to visualize obtaining activities in many cases. Recommendations for standard practices have recently been made by a joint IUPAC-IUB-IUPAB Commission on Biothermodynamics.

703,039
PB-280 418/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pulsed Kinetic Studies of Laser Excited Molecular States.
Final rept.,
M. Braithwaite, and S. R. Leone. 1977, 7p
Grant NSF-PHY76-04761
Pub. in Proceedings of Electro-Optics/Laser 1977 Conference and Exposition, Anaheim, Calif. 25-27 Oct 77 p582-588 1977.

Keywords: *Atomic energy levels, *Molecular energy levels, *Reaction kinetics, Hydrogen sulfide, Hydrogen chloride, Hydrogen bromide, Fluorescence, Reprints, *Laser induced fluorescence, *Atom molecule interactions, Chlorine atoms.

A tunable pulsed dye laser is used to study reactions of atoms and molecules in their ground and electronically excited states. Infrared detection of vibrational fluorescence serves to monitor reaction rates and branching ratios of reaction exothermicity. Studies of the reaction Cl + H2S have been carried out using Cl2 and S2Cl2 as photodissociation sources of Cl atoms. The reaction with Cl2 as a source of Cl is shown to proceed via a further chain reaction. The HCl product of the Cl + H2S reaction is vibrationally excited to (v=1), while the HS product is not. The analogous reaction of Br*(doublet P(1/2)) + H2S is found to produce HBr(v=1) predominantly. Studies of this kind provide a wealth of new information about the dynamics of the reactive collisions in simple systems.

703,040
PB-280 427/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Bonding Information in Tungsten(VI) Compounds from Directly Bonded Fluorophenoxy Substituents.
Final rept.,
L. B. Handy, C. Benham, F. E. Brinckman, and R. B. Johannesen. 1976, 13p
Pub. in Jnl. of Fluorine Chemistry, v8 p55-67 1976.

Keywords: *Chemical bonds, *Tungsten fluorides, *Nuclear magnetic resonance, Oxygen organic compounds, Stereochemistry, Reprints, *Chemical shifts(Nuclear magnetic resonance).

The series of compounds (FC6H4O)nWF(6-n), where n = 1-6 and F is meta or para to oxygen, has been prepared and all fluorine nmr chemical shifts determined. The W-F, para-F, and meta-F resonances all shift upfield as a function of n with approximate relative sensitivities of 1, 1/20, and 1/30, respectively. All chemical shifts are also found to be sensitive to molecular stereochemistry, with substituents trans to oxygen shifted to higher field than those trans to fluorine. (19)F data is also reported for the complete series (C6H5O)nWF(6-n).

703,041
PB-280 428/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation and Compilation of Reaction Rate Data.
Final rept.,
R. F. Hampson, and D. Garvin. 1977, 3p
Pub. in Jnl. of Physical Chemistry, v81 n25 p2317-2319 1977.

Keywords: *Reaction kinetics, Mathematic models, Ozone, Chlorine, Catalysis, Stratosphere, Reprints, Atmospheric chemistry, Data evaluation.

Recently chemists have been attempting to analyze very complex chemically reacting systems in terms of the individual elementary chemical reactions. There is an attempt to reproduce the observed behavior of the complex system by mathematical simulations, that is, models. The validity of the analysis is limited by the reliability of the input data including rate constant values for the large number of elementary reactions. Recent activities in the areas of compilation and critical evaluation of rate data have produced extensive tables of preferred values of rate parameters. This paper provides a guide to these sources of evaluated rate data. The importance of the use of evaluated data in models is discussed along with factors that must be considered in the evaluation of published rate data. Current gaps in the kinetic data base for one particular system, namely the chlorine-catalyzed destruction of stratospheric ozone, are indicated.

703,042
PB-280 438/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Non-Statistical Excitation of the Magnetic Substates of the 1P1 Level of Group II Metal Atoms in Collision with 800eV Helium Atoms.
Final rept.,
D. W. Fahey, and L. D. Schearer. 6 Mar 78, 2p
Pub. in Physics Letters 65A, n3 p215-216, 6 Mar 78.

Keywords: *Emission spectra, *Alkaline earth compounds, Strontium, Calcium, feasibility, Reprints, *Atom atom interactions, *Strontium atoms, *Calcium atoms, Hydrogen atoms.

A large polarization has been observed for the emission lines of strontium and calcium excited by a beam of neutral helium atoms with 800 eV lab energy. The measured value of 15% indicates a preferential population of the magnetic substates of the target species. Depolarization of the emission in a magnetic field has been observed demonstrating the feasibility of Hanle-type lifetime measurements.

703,043

PB-280 440/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dynamics of a Polymer Attached to a Surface: Bead and Spring Model.
Final rept.,
E. A. DiMarzio, and R. J. Rubin. 1978, 10p
Pub. in Jnl. of Polymer Science, Polymer Physics Edition 16, p457-466 1978.

Keywords: *Surfaces, *Polymers, Friction, Mechanical properties, Numerical analysis, Viscosity, Reprints, Force constants.

The Smoluchowski formalism is used to solve the problem of a bead of frictional resistance beta attached to a surface with a spring of force constant kappa over which a linear shear field of strength alpha flows. The power dissipation is given by beta sq alpha kT/kappa. k and T have their usual meanings. The result is generalized to an n-bead polymer. It is found that the intrinsic viscosity of a Rouse model polymer attached to a surface at one end is twice that of an identical polymer flowing freely in solution. The same relationship holds also for the dynamic viscosity. It is argued that a net circulation is roughly comparable to that which exists in a polymer freely rotating in solution under a shear field of the same magnitude.

703,044

PB-280 441/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Insights into the Order Parameter Theory of Glasses: A Response to a Comment by Goldstein.
Final rept.,
E. A. DiMarzio. 1977, 2p
Pub. in Macromol. Notes 10, p1407-1408, Nov-Dec 77.

Keywords: *Glasses, *Kinetics, Freezing, Numerical analysis, Reprints.

The implications of the Davies-Jones assumption of a freezing in of order parameters are ascertained. It is found that certain sets of frozen in parameters are incompatible with the time dependent equations. It is observed that it is in general impossible for two different intersecting histories to result in the same set Zi(t) at the intersection. Finally, an example of the Prigogine-Defay ratio r being less than 1 is given.

703,045

PB-280 442/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Configurational Packing Statistics of Polymers Near a Surface. I. The Generalization of the Rigid Rod Case to Include Both Orientation Dependence and Spatial Variation.
Final rept.,
E. A. DiMarzio. 1 Feb 77, 10p
Pub. in Jnl. of Chemical Physics 66, n3 p1160-1169, 1 Feb 77.

Keywords: *Polymers, Surfaces, Adsorption, Liquid crystals, Crystal latticos, Reprints, *Molecular configuration, Orientation(Position).

The following problem is solved. What is the total number of ways to pack rigid rod molecules together given that the number density f(omega, r) at each point r and each orientation omega are specified. This constitutes a generalization of previous work which allowed for only omega dependence. The problem is first solved for a cubic lattice and then generalized to a continuous variation of both position and orientation. The problem of minimizing the associated free energy is solved. The results are applicable to determination of the adsorption properties of rigid rod molecules near a surface as well as liquid crystal behavior.

703,046

PB-280 443/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comments on a Paper Entitled 'Prigogine-Defay Ratio for Systems with More Than One Order-Parameter'.
Final rept.,
E. A. DiMarzio. 1 Sep 77, 2p
Pub. in Jnl. of Chemical Physics 67, n5 p2393-2394, 1 Sep 77.

Keywords: *Glass, Thermodynamic properties, Reprints, Order parameter.

A recent paper by Gupta and Moynihan claims to show that order-parameter theory (OPT) can be used to prove that the Prigogine-Defay ratio, gamma, is greater than 1. They also claim to show that a previous paper in which the relation gamma = 1 is derived is in error. This comment is a response to the Gupta-Moynihan paper.

703,047

PB-280 445/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
X-Ray Photoemission Spectra from Adsorbed Layers on Metal Substrates.
Final rept.,
J. W. Gadzuk. Sep 77, 4p
Pub. in Proceedings of the International Vacuum Congress (7th) and the International Conference on Solid Surfaces (3rd), Vienna, Austria, 12-16 Sep 77 v1 p715-718 Sep 77.

Keywords: *Metals, *Chemisorption, *X ray spectroscopy, Substrates, Photoelectric emission, Surfaces, Atoms, Reprints.

Photoelectron spectra from atoms adsorbed onto surfaces are modified in several important ways compared to gas phase spectra. In this work, the focus is on those changes falling under the generic heading of extra-atomic relaxation effects. For adsorbed atoms, the x-ray photoelectron spectrum from core states is characterized by an upward 'image potential shift,' balanced by surface plasmon shake-up satellites. Theories exist in which the spectrum has been obtained for a single adsorbed atom. In this paper, core state photoelectron spectra for adsorbates forming a uniform film are calculated. The modifications to the substrate response function and the surface plasmon dispersion relations due to the presence of the adsorbed film are included as is intra-adsorbate polarization (approximately). The consequent effects on the relaxation shifts and satellite line shapes are calculated.

703,048

PB-280 447/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Data Requirements in Properties of Solids - Past, Present and Future.
Final rept.,
H. P. R. Frederikse. 1977, 7p
Pub. in Proceedings of Biennial Internation Conference on CODATA (5th), Boulder, Colo, 28 Jun-1 Jul 76, p607-613 1977.

Keywords: *Solid state, *Chemical properties, *Physical properties, Forecasting, Data sources, Reprints.

The need for numerical data and information concerning the properties of solids depends to a great extent on the point-of-view from which solids (or materials) are being considered. During the last 10-20 years this viewpoint has changed notably from a disciplinary, research-oriented approach to one in which the application (energy, environment, communication, defense, etc.) and the supply of materials are playing the dominant roles. Among the three groups of solid state properties - structural, chemical and physical - the emphasis is shifting from the latter to the first two categories. This paper briefly reviews existing data compilations and data centers and suggests a few areas of materials properties where new and expanded data collections are urgently needed.

703,049

PB-280 451/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermogravimetric Analysis and Differential Thermal Analysis.
Final rept.,
J. H. Flynn. 1978, 31p
Pub. in Aspects of Degradation and Stabilization of Polymers, ch12 p573-603 1978.

Keywords: *Polymers, *Thermal analysis, *Differential thermal analysis, *Thermogravimetry, Calorimetry, Degradation, Temperature, Laboratory equipment, Reaction kinetics, Stability, Heat transmission, Reprints, Differential scanning calorimetry.

This chapter is a description and a critical review, including sixty-six references, on the fundamentals and experimental techniques of thermogravimetry differential scanning calorimetry and differential thermal analysis as they may be applied to the study of the degradation of polymeric materials. Problems related to temperature measurement, instrumental lags and heat flow are defined and analyzed. The discussion of techniques deals with quantitative aspects, especially kinetic analysis of degradation reactions. Most of the present techniques of applied nonisothermal kinetic analysis are found to be insufficient to cope with these complex systems. It is predicted that quantitative equipment, automated and interfaced with computers and combined with other analytical techniques, will be exploited to develop new methods of programming and data analysis. Some new directions of kinetic analysis--jump methods, isokinetic techniques, and relaxation methods--are presented.

703,050

PB-280 452/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultraviolet Photoemission Studies of Methanol Adsorbed on Ru(110).
Final rept.,
G. B. Fisher, T. E. Madey, B. J. Waclawski, and J. T. Yates. Sep 77, 4p
Pub. in Proceedings of International Vacuum Congress (7th) and International Conference on Solid Surfaces (3rd), Vienna, Austria 12-16 Sep 77, v2 p1071-1074 1977.

Keywords: *Surface chemistry, *Chemisorption, *Methyl alcohol, *Ruthenium, Adsorption, Substrates, Photoelectric emission, Ultraviolet spectroscopy, Desorption, Molecular orbitals, Reprints.

Methanol (CH3OH) adsorbed on Ru(110) has been studied under UHV conditions by angle-integrated ultraviolet photoemission (UPS) as part of a search for surface complexes related to intermediates present during the methanation reaction on Ru. For low exposures at 80 K, the UPS spectra indicate that the methanol chemisorbs non-dissociatively. In the initial layer, the work function drops linearly with exposure while the orbitals of adsorbed methanol remain fixed in binding energy relative to the Ru Fermi level. The relative spacings of the orbitals suggest that bonding to the substrate occurs via oxygen-derived orbitals. Of the two major desorption products, H2 and CO, hydrogen leaves the surface at lower temperatures. Upon heating the adsorbed methanol, the UPS spectra indicate that methanol decomposes on the surface before significant desorption occurs.

703,051

PB-280 463/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Combined Least Sums and Least Squares Approach to the Solution of Thermodynamic Data Networks.
Final rept.,
D. Garvin, V. B. Parker, D. D. Wagman, and W. H. Evans. 1977, 9p
Pub. in Proceedings of Biennial Intl. Conf. on CODATA (5th), Boulder, CO, June 28-July 1, 1976, p567-575.

Keywords: *Thermodynamic properties, *Least squares method, Enthalpy, Chemical equilibrium, Entropy, Numerical analysis, Reprints, *Least sums method, CATCH computer program.

A description is given of a system for computer-based evaluation of interrelated thermodynamic measurements of enthalpies of reaction, equilibria and entropies. This system is an extension of the CATCH program developed by J. B. Pedley, University of Sussex. In the new system linear least sums and least squares techniques are used to solve networks of thermodynamic equations to obtain the enthalpies and free energies of formation and the entropies of chemical substances. The least sums technique is shown to be useful in assessing the consistency of the data. A method has been developed for combining least sums and least squares solutions. It provides a weighted solution that reproduces closely the solutions that are obtained by a detailed analysis of the data using the customary sequential procedure. The results from tests on four large networks are discussed. These networks are the thermodynamic data for compounds of B, U, Th and Rb. It is anticipated that the methods described

here will be useful in the development of an international cooperative program for the evaluation of thermodynamic data. Such a program will require development of a computer-based data bank of experimental measurements contributed and evaluated by many scientists throughout the world.

703,052
PB-280 467/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Model Uncertainty and Bias in the Evaluation of Nuclear Spectra. I. The Smoothest Consistent Baseline.
Final rept.,
L. A. Currie. 1977, 15p
Pub. in Jnl. of Radioanalytical Chemistry, 39 p223-237 1977.

Keywords: *Mathematical models, *Gamma ray spectra, *X ray spectra, Numerical analysis, Error analysis, Reprints, *Baseline measurements.

Unbiased analysis of gamma-ray and X-ray spectra is impossible in the absence of a complete physical or mathematical model. Partial model knowledge may be supplemented by simple assumptions or by various heuristic schemes in order to effect a solution. Assessment of limits for bias, based upon the properties of the surrogate model and physical-chemical knowledge of the measurement system, is the principal target of this work. The Smoothest Consistent Baseline (SCB) approach has been introduced in an attempt to weaken assumptions and minimize bias in the extraction of a spectral peak from a baseline of uncertain shape. The bias matrix, which results directly from the numerical analysis, permits limiting baseline profiles to be simply converted into bounds for systematic model error.

703,053
PB-280 525/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Group-Theoretical Selection Rules and Experimental Determination of Lattice Modes in NaNO3 via Inelastic Neutron Scattering.
Final rept.,
S. F. Trevino, H. Prask, and R. C. Casella. 15 Jul 74, 6p
Pub. in Physiological Reviews B10, n2 p739-744, 15 Jul 74.

Keywords: *Sodium nitrates, *Lattice vibrations, Neutron scattering, Inelastic scattering, Selection rules(Physics), Reprints.

The general group-theoretical selection rules of Casella and Trevino for characterizing the harmonic vibrations of molecular crystals within the rigid-molecule model via inelastic neutron scattering are applied to NaNO3. For a given reciprocal lattice vector the experimental resonances are classified not only according to the irreducible representation to which the eigenmode belongs, but also as to whether the interaction proceeds via the translational or rotational character of the mode (or both). The structure functions (i.e., sums of structure factors) belonging to each representation at Gamma and a and along Lambda in the Brillouin zone are calculated explicitly. The results of experimental measurements at Gamma are presented and compared with theory.

703,054
PB-280 531/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Volume-Corrected Isomer Shifts of Transition Metal Atoms: Charge Flow and Electronegativity Scales in Alloys.
Final rept.,
R. E. Watson, and L. H. Bennett. 1978, 5p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Hyperfine Interact. 4, p806-810 1978.

Keywords: *Alloys, *Electronegativity, *Mossbauer effect, *Isomers, Iron, Gold, Rubidium, Tantalum, Iridium, Platinum, Transition metals, Atoms, Electron charge, Reprints, Iron 57, Rubidium 99, Tantalum 181, Iridium 193, Platinum 195, Gold 197.

It is shown that, once volume effects are accounted for, a universal curve describes the Mossbauer isomer shifts of (57)Fe, (99)Ru, (181)Ta, (193)Ir, (195)Pt, and (197)Au impurity nuclei in a variety of hosts. The curve defines an 'orbital' electronegativity associated with non-d electron charge flow on or off these transition metal atoms in alloys. The shape of the curve is remarkable in the extent to which it agrees with the 'total' electronegativity scales of Pauling, Gordy-Thomas and others. This agreement suggests that d and non-d charge flow are simply proportional to one another to an extent the authors found surprising.

703,055
PB-280 535/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Spectrum of Ethyl Hypochlorite.
Final rept.,
R. D. Suenram, F. J. Lovas, and D. R. Johnson. 1978, 15p
Pub. in Jnl. of Molecular Spectroscopy 69, p458-472 1978.

Keywords: *Microwave spectra, Molecular energy levels, Excitation, Dipole moments, Molecular vibration, Molecular rotation, Reprints, *Hypochlorite/ethyl.

The microwave spectrum of ethyl hypochlorite has been analyzed in detail in the region of 20-60 GHz. Observed transitions for C2H5O(35)Cl in the ground state have been fit to a Hamiltonian model which includes p4 centrifugal distortion terms. The lowest vibrationally excited state of C2H5O(35)Cl and the ground and vibrationally excited state of C2H5O(37)Cl were analyzed with a rigid rotor model. This lowest vibrational mode lies at 125 + or - 23/cm and is most likely the torsional motion about the C-O bond. The dipole moment has been measured and found to have two non-zero components. No A-E torsional splittings were observed in either the ground state or the v = 1 state implying a lower limit for the barrier to internal rotation of approximately equal to 3.0 kcal/mole. Ethyl hypochlorite was synthesized in the waveguide by the reaction of chlorine nitrate with ethanol.

703,056
PB-280 541/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Spectrum of Chlorine Nitrate (ClNO3).
Final rept.,
R. D. Suenram, and D. R. Johnson. 1977, 10p
Pub. in Jnl. of Molecular Spectroscopy 65, p239-248 1977.

Keywords: *Microwave spectra, Molecular energy levels, Dipole moments, Excitation, Inorganic nitrates, Reprints, *Chlorine nitrate(ClNO3).

Microwave spectra of chlorine nitrate (35ClNO3 and 37ClNO3) in the ground and first excited vibrational states have been analyzed in detail. Rotational constants and centrifugal distortion parameters are reported for each species. The permanent electric dipole moment in ClNO3 was found to have two components.

703,057
PB-280 549/7 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Reaction Rate and Photochemical Data for Atmospheric Chemistry - 1977,
R. F. Hampson, and D. Garvin. May 78, 111p NBS-SP-513
Sponsored in part by Federal Aviation Administration, Washington, D.C., and National Aeronautics and Space Administration, Washington, D.C. Library of Congress Catalog Card Number: 78-606033.

Keywords: *Reaction kinetics, *Air pollution, *Quantum yield, *Photochemistry, Tables(Data), Atmospheric composition, Thermodynamic properties, Chemical reactions, Enthalpy, Gibbs free energy, Entropy, Specific heat, Cross sections, *Atmospheric chemistry, *Photoadsorption cross sections.

A table of data for gas phase chemical reactions and photochemistry of neutral species is presented. Specifically, it gives preferred values for reaction rate constants, photoabsorption cross sections, and quantum yields of primary photochemical processes and also cites recent experimental work (to December 1977). It is intended to provide the basic physical chemical data needed as input data for calculations modelling atmospheric chemistry. An auxilliary table of thermochemical data for the pertinent chemical species is given in the appendix.

703,058
PB-280 582/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Gas Phase Photolysis of CHFCl(sub 2).
Final rept.,
R. E. Rebbert, S. G. Lias, and P. Ausloos. 1978, 11p
Pub. in Jnl. of Photochemistry, v8 p17-27 1978.

Keywords: *Photolysis, Chlorine organic compounds, Ultraviolet spectrum, Dissociation, Photochemical reactions, Reprints, *Methane/dichloro-fluoro.

The 300K photolysis of CHFCl2 has been investigated at 213.9, 163.3, and 147 nm. Methane, Br2, HBr, and HCl were added as free radical interceptors in order to unravel the primary photodecomposition processes. Analysis of the data shows that at 213.9 and 163.3 nm, the photodissociative process: CHFCl2 + hnu yields CHFCl + Cl occurs with a quantum yield of 0.9-1.0, giving stable CHFCl radicals. At shorter wavelengths, the quantum yield of CHFCl shows a drastic decrease with concurrent appearances of species such as CFCl, CHF, and CF. The laboratory experiments indicate that CF is mainly formed via the dissociative process: CHFCl* yields CF + HCl. The CF radicals react with CH3 to yield C2H2 (CF + CH3 yields C2H2 + HF) while the CHF species insert readily into HCl to yield CH2FCl. In the presence of Br2, CF and CHF undergo reactions which result in the formation of CFBr3 and CHFBr2, respectively.

703,059
PB-280 583/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Surface Studies Using Spin Polarized Electrons.
Final rept.,
D. T. Pierce, R. J. Celotta, and W. N. Unertl. Sep 77, 4p
Sponsored in part by Office of Naval Research, Arlington, Va. and Air Force Office of Scientific Research, Bolling AFB, D.C.
Pub. in Proceedings of International Vacuum Congress (7th) and International Conference on Solid Surfaces (3rd) Held in Vienna, Austria, 12-16 Sep 77 v2 p1297-1300 Sep 77.

Keywords: *Surfaces, *Electrons, Polarization(Spin alignment), Electron diffraction, Photoelectric emission, Detectors, Laboratory equipment, Reprints, Electron scattering, Low energy electron diffraction.

Photoemission from negative electron affinity GaAs irradiated with circularly polarized light provides an electron beam with a spin polarization which can be modulated from -50% to +50%. The spin dependence in electron scattering can be measured simply by monitoring the modulated component of the scattered intensity. The experimental requirements on the electron source for polarized low energy electron diffraction (PLEED) are discussed. The authors also discuss applications of PLEED to the development of a low energy high efficiency polarization detector, to the determination of surface parameters, and to the determination of the effects of multiple scattering and phonon scattering on spin polarization.

703,060
PB-280 587/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quantitative Surface Analysis by X-Ray Photoelectron Spectroscopy.
Final rept.,
C. J. Powell, and P. E. Larson. 1978, 6p
Sponsored in part by GCA/McPherson Instrument Corp., Acton, Mass.
Pub. in Appl. Surface Science, v1 n2 p186-201 1978.

Keywords: *X ray spectra, *Indium, *Lead(Metal), *Aluminum oxide, Photoelectric emission, Line spectra, Numerical analysis, Comparison, Mathematical models, Reprints, *X ray photoelectron spectroscopy.

Measurements have been made of the relative intensities of the principal features in x-ray photoelectron spectra of indium, lead, and aluminum oxide and compared with those expected from a simple model for the photoemission process. Systematic effects in the determination of line intensities are discussed and a suitable procedure for determining intensities is described. The satisfactory agreement between computed and measured intensities confirms the validity and utility of the photoemission model and associated data and indicates that quantitative analyses of homogeneous single-phase surfaces can be obtained by x-ray photoelectron spectroscopy.

703,061
PB-280 588/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Surface Characterization: Present Status and the Need for Standards.
Final rept.,
C. J. Powell. 1978, 27p
Pub. in Appl. Surface Science, v1 n2 p143-169 1978.

Keywords: *Surface chemistry, *Standards, Surface properties, Atomic structure, Technology, Industrial plants, Reprints.

A summary is given of the present status and use of surface-characterization measurements in the United States. Attention is primarily devoted to those properties needed to characterize a solid surface, specifically the determination of surface composition, surface atomic structure, surface electronic structure, and atomic motions on surfaces; these characteristics directly affect many important surface properties or processes that occur on surfaces (e.g., electrical and optical properties, adhesion bonding, catalytic activity, plating, durability, corrosion, decoration, segregation, lubrication, and reactivity). The above four forms of surface characterization are widely utilized in surface-science experiments while measurements of surface composition are routinely made to solve a wide variety of problems in the semiconductor, chemical, petroleum, and metals industries for applications ranging from process and device development, process control, process evaluation, to failure analysis. Surface-characterization measurements in government laboratories support a variety of agency missions. Surface science and surface technology have both grown rapidly in the past ten years, and further growth is expected. At this time, there is an almost complete lack of standards, standard procedures, and standard materials to support surface-characterization measurements. A new Committee on Surface Analysis has been recently formed by the American Society for Testing and Materials to develop standards for all methods of surface analysis in common use. Examples are given of the standards that need to be developed.

703,062
PB-280 589/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Relative Yields of KLL and LVV Auger Electrons from Aluminum.
Final rept.,
C. J. Powell. Sep 77, 4p
Pub. in Proceedings of International Vacuum Congress (7th) and the International Congress (3rd) and the International Conference on Solid Surfaces (3rd) held in Vienna, Austria 12-16 Sep 77, v3 p2319-2322 1977.

Keywords: *Aluminum, *Auger electrons, *Surfaces, Electron energy, Electron distribution, Reprints, Auger electron spectroscopy.

Measurements have been made of the relative yields of KLL and LVV Auger electrons from aluminum to check the validity of a simple model for surface analysis by Auger-electron spectroscopy and of data for the several parameters. Data were obtained for incident electron energies of 2, 3, 4, and 5 keV and with evaporated aluminum films. The secondary-electron energy distributions were measured with a cylindrical-mirror analyzer operated in the dc mode (i.e., without applied modulation) so that the current for each Auger transition could be easily determined. Excellent agreement has been obtained between experiment and the predictions of the model.

703,063
PB-280 592/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Intrinsic Viscosity According to Elastic Necklace Model with Hydrodynamic Interaction.
Final rept.,
A. Peterlin. 1977, 3p
Pub. in Macromolecules 10, n5 p975-977, Sep-Oct, 1977.

Keywords: *Intrinsic viscosity, Numerical analysis, Hydrodynamics, Reprints, *Necklace model.

The exact calculation of intrinsic viscosity for the necklace model with up to 300 links and hydrodynamic interaction parameter h* between 0 and .4 shows how slowly with increasing M one reaches the limiting case of impenetrable coil where (eta) is proportional to M(1/2). Hence according to the model, a finite a>.5 can be interpreted as a sign of good solvent only if the measurements are extended over so large a molecular weight range that one is certain that one has already reached the limit of impenetrable coil. The limitation of h*=(3/pi) (1/2) a sub h/b sub o to values below .25 caused most likely by the inadequacy of the linear approximation of Oseen's tensor of hydrodynamic interaction interferes with molecular interpretation of a sub h/b sub o ratio derived from (eta) as soon as h* is close to .25.

703,064
PB-280 595/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Resolution Photoemission Study of Condensed Layers of Nitrogen and Carbon Monoxide.
Final rept.,
P. R. Norton, R. L. Tapping, H. P. Broida, J. W. Gadzuk, and B. J. Waclawski. 1 Feb 78, 6p
Pub. in Chemical Physics Letters 53, n3 p465-470, 1 Feb 78.

Keywords: *Nitrogen, *Carbon monoxide, *Molecular energy levels, Solidified gases, Photoelectric emissions, Excitation, Reprints.

High resolution (0.09 eV) UPS spectra have been obtained of condensed films of N2 and CO. All spectral features are broadened by > or - 0.6 eV upon condenstation. The origin of this broadening is discussed. The difference in linewidths for all equivalent levels, delta epsilon CO-N2 approx. 0.1 to 0.2 eV can be understood in terms of a hole-dipole multiphonon excitation mechanism. Photoemission from what is believed to be the a(3)pi excited neutral state of CO has been detected in the solid phase for the first time.

703,065
PB-280 736/0 PC **A13**/MF **A01**
Science Applications, Inc., Englewood, CO.
Bibliography on Atomic Transition Probabilities (1914 through October 1977),
J. R. Fuhr, B. J. Miller, and G. A. Martin. Apr 78, 286p NBS-SP-505
Supersedes AD-701614, AD-730356, and COM-74-50034. Library of Congress Catalog Card no. 76-604227.

Keywords: *Bibliographies, *Atomic energy levels, *Transition probabilities, Excitation, Atomic spectroscopy, Oscillator strength, Numerical analysis.

A revised and updated annotated bibliography on atomic transition probabilities covering the literature from 1914 through October 1977 is presented. It contains approximately 2400 references and is divided into four main sections, with each article assigned a number. The first section contains a listing, by number, of articles of general interest. The second section lists by number all articles containing numerical data; it is arranged by element and stage of ionization and is further subdivided according to theoretical and experimental methods, comments, and compilations. The third section contains a listing of all articles, including number, authors, title, and journal reference; it is arranged by year of publication and alphabetically by authors' names within the year. All foreign language papers are identified, and their titles are translated into English. The final section contains a listing of all authors and the numbers of the papers they have authored or co-authored.

703,066
PB-280 797/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron-Energy-Loss Spectra of Condensed Hydrocarbons: Abstract.
Final rept.,
R. J. Stein, and C. J. Powell. Feb 77, 1p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Jnl. of Vacuum Science and Technology, v14 n1 p481 Jan/Feb 77.

Keywords: *Hydrocarbons, *Energy dissipation, *Electrons, *Meetings, Ethane, Butanes, Propane, Acetylene, Ethylene, Propylene, Butylene, Butenes, Butadienes, Reprints, Energy loss spectra.

An abstract of a talk presented at the 1976 symposium of the American Vacuum Society is presented which describes measurement of the energy loss spectra of 100 eV electrons striking condensed hydrocarbons. The samples investigated were films of ethane, propane, butane, isobutane, acetylene, ethylene, propylene, isobutylene, 1-butene and 1,3-butadiene.

703,067
PB-280 802/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reflective Index and Density Changes in a Phase-Separated Borosilicate Glass.
Final rept.,
J. H. Simmons. 1977, 12p
Contract NAonr-12-73
Pub. in Jnl. of Non-Crystalline Solids, v24 p77-88 1977.

Keywords: *Borosilicate glass, *Density(Mass/volume), *Refractivity, Phase transformations, Separation, Heat treatment, Temperature, Reprints.

The refractive index and density of a soda-borosilicate glass are measured at successive stages of phase separation. Two effects are observed which consist of a structural rearrangement of the homogeneous glass reflecting changes in the heat-treatment temperature, followed by a volume increase as phase separation progresses. The structural rearrangement is analyzed by a volume relaxation model originated by O. S. Narayanaswamy, and the observed increase in volume resulting from the phase separation is discussed.

703,068
PB-280 803/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Formation of Singlet Oxygen from Aromatic Excimers and Monomers.
Final rept.,
D. M. Shold. 1978, 10p
Pub. in Jnl. of Photochemistry, v8 p39-48 1978.

Keywords: *Oxygen, Molecular energy levels, Excitation, Reprints, Monomers, Excimers.

Singlet oxygen singlet delta g formation is sensitized by excimers of aromatic hydrocarbons as well as by monomers. In methanol the pyrene excimer is a somewhat less efficient sensitizer than is pyrene itself, while the excimer of naphthalene is more efficient than the monomer. An explanation invoking involvement of upper triplet states in oxygen-enhanced intersystem crossing is suggested.

703,069
PB-280 804/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Methyl and Halogen Substituents on the Decay of Singlet Excited Benzenes.
Final rept.,
D. M. Shold. 15 Jul 77, 4p
Pub. in Chemical Physics Letters, v49 n2 p243-246, 15 Jul 77.

Keywords: *Benzene, Halogen organic compounds, Molecular energy levels, Fluorescence, Toluene, Benzene/methyl, Reprints, Nonradiative transitions.

Radiative and nonradiative decay constants for singlet excited states of halogen- and methyl-substituted benzenes were determined in solution. The effect of halogen substitution on the nonradiative decay is much greater than that of methyl substitution, which is obscured by effects of the solvent.

703,070
PB-280 805/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Study of the Low-Temperature Phase Transition in Hg(2)Cl(2).
Final rept.,
G. J. Rosasco, H. S. Parker, R. S. Roth, R. A. Forman, and W. S. Brower. 1978, 10p
Pub. in Jnl. of Physics C: Solid State Physics, v11 p35-44 1978.

Keywords: *Phase transformations, Raman spectra, X ray diffraction, Crystal structure, Reprints, *Mercury chlorides.

Studies of the temperature dependence of the x-ray powder diffraction and single-crystal Raman spectra of Hg2Cl2 are reported for temperatures from 300 K to below the phase transition at approximately 180 K. From the x-ray data it is established that the crystal class changes from tetragonal in the high-temperature phase to monoclinic in the low-temperature phase. The Raman spectra at low temperatures are explained by a primitive monoclinic cell of doubled content. The temperature dependence of the Raman spectrum of a 'soft' acoustic branch is observed above the phase transition and used to suggest a mechanism for the transition.

703,071
PB-280 806/1 Not available NTIS

National Bureau of Standards, Gaithersburg, MD.
Energetics of Defect Motion Which Transports Polyethylene Molecules Along Their Axis.
Final rept.,
D. H. Reneker, B. M. Fanconi, and J. Mazur. Oct 77, 11p
Pub. in Jnl. of Applied Physics, v48 n10 p4032-4042 Oct 77.

Keywords: *Polyethylene, Defects, Chemical bonds, Diffusion, Numerical analysis, Reprints.

Defect energy was calculated as a function of dihedral angles of the bonds in a point dislocation for sequences of conformations that resulted in motion of the dislocation along the polyethylene chain. Paths that presented low barriers to diffusive motion of the defect were found by incrementing, in a particular sequence, selected dihedral angles around two separated bonds near the opposite ends of the defect as the computer searched for the lowest energy conformation of all the other parts of the defect. Thus, the diffusion of a point dislocation provides a plausible mechanism for diffusion of the chain along its axis.

703,072
PB-280 809/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of the Aqueous Solubility of Polynuclear Aromatic Hydrocarbons by a Coupled Column Liquid Chromatographic Technique.
Final rept.,
W. E. May, S. P. Wasik, and D. H. Freeman. Jan 78, 5p
Pub. in Analytical Chemistry, v50 n1 p175-179 Jan 78.

Keywords: *Aromatic polycyclic hydrocarbons, *Solubility, Chromatography, Reprints, Liquid chromatography.

A coupled column liquid chromatographic method for determining the aqueous solubility and related parameters of polynuclear aromatic hydrocarbons (PAHs) is discussed. The method is designed to avoid problems with adsorption onto container walls and offers the potential of generating known concentrations of slightly soluble organic compounds in water. The method is based on pumping water through a column containing glass beads coated with the compound being studied and has been used to measure solubilities and the temperature dependencies of the solubility of some PAHs. The precision of replicate measurements and day to day reproducibility are better than + or - 3%.

703,073
PB-280 818/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Span of a Random-Flight Model of a Star-Branched Polymer Chain.
Final rept.,
R. J. Rubin, and G. H. Weiss. 1977, 3p
Pub. in Macromolecules 10, n2 p332-334, Mar-Apr 77.

Keywords: *Polymers, *Mathematical models, Numerical analysis, Distribution functions, Reprints.

An expression is derived for the probability distribution function of the span of a random-flight model of a star-branched polymer molecule. The model consists of f random flight chains, each containing N steps, which emanate from a common point. Numerical results showing the form of the distribution function as a function of the number of branches are presented.

703,074
PB-280 820/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Spans of Polymer Chains Measured with Respect to Chain-Fixed Axes.
Final rept.,
R. J. Rubin, and J. Mazur. 1977, 11p
Sponsored in part by National Aeronautics and Space Administration, Washington, D.C.
Pub. in Macromolecules 10, n1 p139-149, Jan-Feb 77.

Keywords: *Polymers, Random walk, Monte Carlo method, Numerical analysis, Reprints, *Molecular configuration.

An N-step random walk on a cubic lattice is adopted as a model of a polymer chain. The spans of each random walk configuration are measured with respect to two different sets of orthogonal axes determined by the configuration itself. For each set of axes, a smallest right prism is determined whose edges are parallel to the chain-fixed axes and which contains all the steps of the random walk. A Monte Carlo procedure is used to estimate the average largest, intermediate, and smallest spans, or prism dimensions. Both the simple unrestricted random walk with N = 50, 100, 200 and the self-avoiding random walk with N = 50, 75, 100, 150 are treated. The distribution of steps inside the spanning right prisms is investigated by dissecting them in two different ways. First, the prism is cut in ten equal sections by a set of parallel, equally-spaced planes which are normal to an edge of the prism. Second, a symmetric oval (the ellipsoid is a special case) is inscribed in the prism with its axes parallel to those of the prism. Four similar and successively smaller nested ovals are also introduced. For each random walk configuration, the fraction of steps contained in each oval shell is determined.

703,075
PB-281 048/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Unusually Broad X-Ray Emission Lines: L(gamma) sub 2,3(L sub 1 N sub 2,3) Spectra of 50Sn, 52Te, and 53I.
Final rept.,
R. E. LaVilla. Mar 78, 3p
Pub. in Physical Review A 17, n3 p1018-1020, Mar 78.

Keywords: *Iodine, *Tin, *Tellurium, *Emission spectra, Molecular energy levels, X ray spectra, Reprints.

The L(gamma) sub 2,3(L sub 1 N sub 2,3) X-ray emission spectra from Sn(50), Te(52) and I(53), excited by direct electron bombardment, were measured with a double crystal monochromator. The spectral profiles are similar to their 4p energy level region XPS spectra, with base widths of about 50 eV. The origin of these unusual line profiles is attributed to many body effects in their final states which are comparable to their respective XPS final states.

703,076
PB-281 052/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Collisional Deactivation of Laser-Excited Br*(doublet P(1/2)) atoms with Halogen and Interhalogen Molecules.
Final rept.,
H. Hofmann, and S. R. Leone. 1 Mar 78, 6p
Grant NSF-CHE76-22600
Pub. in Chemical Physics Letters 54, n2 p314-319, 1 Mar 78.

Keywords: *Iodine, *Bromine, *Carbon, Infared spectroscopy, Atomic energy levels, Halogens, Mathematical models, Reprints, *Atom molecule interactions, *Bromine atoms.

Deactivation rates of spin-orbit excited Br*(doublet P(1/2)) atoms by halogens I2, Br2, and C2 and interhalogens IBr, IC and BrC have been measured by laser-excited, time-resolved infrared emission techniques. The results are effectively explained in terms of a collision complex formation model.

703,077
PB-281 311/1 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards. Volume 83, Number 1, January-February 1978.
Bi-monthly pub.
1978, 119p

Keywords: *Physical chemistry, *Mathematics, Units of measurement, Approximation, Curve fitting, Entire functions, Linear differential equations, Reaction kinetics, Ytterbium, Tables(Data), Ultraviolet spectra, Molecular energy levels, Zeeman effect, Magnetism, Norms.

Contents:
Tubular flow reactors with first-order kinetics;
Comments on units in magnetism;
The first spectrum of ytterbium (YbI);
Norm approximation problems and normal statistics;
Vector-valued entire functions of bounded index satisfying a differential equation.

703,078
PB-281 341/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Decomposition of H2CO and CH3OH on Ru(110) and Ni(100).
Final rept.,
J. T. Yates, D. W. Goodman, and T. E. Madey. Sep 77, 4p
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Div. of Physical Research.
Pub. in Proceedings of the International Vacuum Congress (7th) and the International Conference on Solid Surfaces (3rd), Vienna (Austria) 12-16 Sep 77, v2 p1133-1136 Sep 77.

Keywords: *Surface chemistry, *Formaldehyde, *Methyl alcohol, *Decomposition, Adsorption, Nickel, Methanation, Rubidium, Reprints.

The coadsorption of H2 + CO as well as the adsorption and decomposition of H2CO and CH3OH on Ru(110) and Ni(100) have been studied using temperature programmed description methods. CH4 is observed as a minor product in the thermal decomposition of H2CO on Ru(110), but is not detected as a desorption product from the other adsorbate-substrate combinations. The results suggest that oxygenated hydrocarbon complexes may be of importance in the catalytic methanation reaction on Ru surfaces, but not on Ni surfaces.

703,079
PB-281 351/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Critical Phenomena in Classical Fluids.
Final rept.,
J. V. Sengers, and J. M. H. L. Sengers. 1978, 72p
Grant NGR-21-002-344
Sponsored in part by Maryland Univ., College Park. Center for Materials Research.
Pub. in Progress in Liquid Physicx, ch4 p103-174 1978.

Keywords: *Fluids, Thermodynamic properties, Equations of state, Critical point, Scaling laws, Reprints.

A status report is presented on current concepts and methods for describing equilibrium critical phenomena in fluids. The authors review the predictions of three theoretical models for a critical-point phase transition in fluids, namely the classical equations with third-degree, that with fifth-degree isotherm, and the lattice gas. They also discuss the nature of the gravity effects and how they affect critical-region experimentation in fluids. The behavior of the thermodynamic properties and the correlation function is formulated in terms of scaling laws. The predictions of these scaling laws and of the hypothesis of universality of critical behavior are compared with experimental data for one-component fluids and it is indicated how the methods can be extended to describe critical phenomena in fluid mixtures. For one-component fluids and its is indicated how the methods can be extended to describe critical phenomena in fluid mixtures. For one-component fluids, the authors relate the scale factor of the correlation length to the two scale factors of the thermodynamic functions. The report concludes with a discussion of the relationship between correlation length and equation of state of one-component fluids near the critical point.

703,080
PB-281 354/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chain Structure, Polymerization and Conformation of Polyisocyanates.
Final rept.,
A. J. Bur, and L. J. Fetters. Dec 76, 20p
Pub. in Chemical Reviews, v76 n6 p727-746 Dec 76.

Keywords: *Isocyanates, *Molecular structure, *Polymerization, Chemical properties, Physical properties, Degradation, Dielectric properties, Intrinsic viscosity, Light scattering, *Molecular conformation, Monomers, Reprints.

The chemical and physical properties of the poly(n-alkyl isocyanate) (PAIC) are reviewed. The review of the chemical properties includes a description of the anionic polymerization of the monomer, a determination that the main chain grows via the C-N bond rather than the C-O bond, and a qualitative description of the degradation of the polymer as an unzipping process which yields mostly monomer and trimer products. Synthesis and properties of other polyisocyanates, e.g. phenyl isocyanate, diisocyanates, optically active d-beta phenylpropyl isocyanate, and copolymerization of monoisocyanates, are discussed. The review of the

physical properties concentrates on the solution measurements of the PAIC's because the molecule displays extraordinary rigidity in solution. Quantitative analysis of the solution measurements is limited to experiments carried out with well-characterized polymer fractions. The measurements on PAIC solution include dielectric relaxation time, static dielectric constant, intrinsic viscosity, light scattering, electric birefringence, and electric dichroism. The picture of the PAIC molecule in solution is that of a rigid helix with a large dipole moment parallel to the main chain and with a persistence length in the range 500 A to 1000 A depending on the polarity of the solvent. Dilatometer measurements on bulk poly(n-butyl isocyanate) showed that decomposition occurs at 140 C.

703,081
PB-281 361/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Kinetic Energy Release in the Fragmentation of Methane and Ketene Ions.
Final rept.,
R. Stockbauer. 1977, 10p
Sponsored in part by National Aeronautics and Space Administration, Washington, D.C.
Pub. in International Jnl. of Mass Spectrometry and Ion Physics, v25 p401-410 1977.

Keywords: *Methane, *Ketenes, *Ions, *Kinetic energy, Mass spectrometers, Photochemical reactions, Ionization, Reprints.

A threshold photoelectron-photoion coincidence mass spectrometric technique has been developed to measure the kinetic energy of ions formed by photoionization. The kinetic energy released upon fragmentation of a molecular ion can be measured. The coincidence technique allows the measurement to be made as a function of parent ion internal energy. Results are presented for CH3(+) and CH2(+) from methane, CD3(+) and CD2(+) from methane-d4 and CH2(+) from ketene. The results show a near zero (<30meV) kinetic energy release for these fragments at threshold. Above threshold, the slope of the kinetic energy release vs. internal energy curve for CH2(+) (CD2(+)) is a factor of 2 greater than the slope for the CH3(+) (CD3(+)) curve. This does not agree with theoretical calculations which predict that the slopes should be nearly equal.

703,082
PB-281 363/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Double-Group Theory on the Half-Shell and the Two-Level System. I. Rotation and Half-Integral Spin States.
Final rept.,
W. G. Harter, and N. dos Santos. Mar 78, 13p
Pub. in American Jnl. of Physics, v46 n3 p251-263 Mar 78.

Keywords: *Quantum theory, Spinor groups, Group theory, Reprints.

A geometrical construction by Hamilton is used to simplify the quantum mechanics of half-integral spin. A slide rule is described which can be used to: (a) compute products of half-integral or integral spin rotation operators, (b) convert between the Euler-angle and 'axis-angle' rotation operator parameters, and (c) calculate the time evolution of a spin-1/2 state for a constant Hamiltonian operator. A type of nomogram is developed which suggests ways to simplify the 'double-group' theory of half-integral spin in molecular point symmetry, as well as the 'ordinary' group theory for integral spin systems. Cubic and icosahedral symmetry group characters are derived for half-integral spin operators.

703,083
PB-281 364/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ionic Recombination of Rare-Gas Atomic Ions X(+) with F(-) in a Dense-Gas X.
Final rept.,
M. R. Flannery, and T. P. Yang. 1 Mar 78, 3p
Contract E(940-1)-5002
Pub. in Applied Physics Letters, v32 n5 p327-329, 1 Mar 78.

Keywords: *Reaction kinetics, *Recombination reactions, Numerical analysis, Helium, Neon, Argon, Xenon, Krypton, *Ion ion interactions, Charge transfer, Reprints.

Rates for the recombination processes X(+) + F(-) + X yields XF* + X, (X = He, Ne, Ar, Kr, Xe) at 300 K are calculated for pressures of the background gas X in the range approximately 0.1-50 atm. Rates as high as (2-7) X 10 to the -6th power cc/sec are obtained for pressures 1-5 atm of Xe yields He, and in general decrease with increasing ionic mass, except at low gas densities.

703,084
PB-281 365/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of Charge or Polarization Distribution across Polymer Electrets by the Thermal Pulse Method and Fourier Analysis.
Final rept.,
A. S. DeReggi, C. M. Guttman, F. I. Mopsik, G. T. Davis, and M. G. Broadhurst. 6 Feb 78, 4p
Sponsored in part by Office of Naval Research, Arlington, Va.
Pub. in Physical Review Letters, v40 n6 p413-416, 6 Feb 78.

Keywords: *Electrets, *Polymers, *Polarization(Charge separation), Fourier analysis, Vinylidene resins, Fluorides, Piezoelectricity, *Thermal pulse method, Vinylidene fluoride polymers, Reprints.

Fourier analysis, applied to the recently introduced thermal pulse yields new and unique relations between the time-dependent, inhomogeneous-temperature, pyroelectric response of a thin specimen and the Fourier coefficients of the charge or polarization distribution across its thickness. The new analysis is applied illustratively to thermal pulse data for a vinylidenefluoride copolymer electret.

703,085
PB-281 392-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Experiments on Determination of Average Range of Recoil of Nuclei in Solid Halides of Lead (Opete po Opredeleniu Srednego Probega Yader Otdachi v Tverdekh Galogenidakh Svintsa),
A. Murin, B. Lurie, and V. Pavalov. 1974, 11p DMDC-8324, TT-53236
Trans. of Akademiya Nauk SSSR. Doklady, v77 p245-247 1951. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Lead(Metal), *Lead halides, Collisions, Metals, Mathematical analysis, Translations, USSR, Recoils, Stopping power, Lead chloride, Lead iodide.

This brief paper describes the experiments performed and theory developed for recoil phenomena in lead chloride and iodide.

703,086
PB-281 398/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ionic Recombination of Rare-Gas Molecular Ions X2(+) with F(-) in a Dense Gas X.
Final rept.,
M. R. Flannery, and T. P. Yang. 15 Mar 78, 2p
Contract E(40-1)-5002
Pub. in Applied Physics Letters, v32 n6 p356-357, 15 Mar 78.

Keywords: *Reaction kinetics, *Recombination reactions, Numerical analysis, Helium, Neon, Argon, Xenon, Krypton, *Ion ion interactions, Charge transfer, Reprints.

Rates for the recombination processes X2(+) + F(-1) + X yields (X(2)F)* + X, (X = He, Ne. Ar, Kr, Xe) are calculated at 300 K for pressures of the background gas X up to 50 atm. The authors found rates as high as (2 - 6) (10 to the -6th power)cc/sec for pressures (1 - 8) atmospheres as the gas is varied from Xe to He. The rates are somewhat smaller than those for the corresponding cases involving atomic ions.

703,087
PB-281 432/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Observation of Natural Abundance, (super 13)C-(super 13)C Dipolar Satellites in Ultraoriented Polyethylene.
Final rept.,
D. L. VanderHart. 1976, 4p
Pub. in Jnl. of Magnetic Resonance, Communications, v24 p467-470 1976.

Keywords: *Polyethylene, Dipoles, Carbon isotopes, Chemical bonds, Molecular structure, Nuclear magnetic resonance, *Carbon 13, Reprints.

It is shown that very weak (13)C-(13)C dipolar satellites may be observed in an oriented organic solid such as highly drawn polyethylene. In polyethylene, one can observe three different satellites corresponding to (13)C pairs which are one, two, or three bonds separated. Since the dipolar interaction depends on orientation as well as internuclear distance, structural information may be deduced from these satellites. The satellite splittings are not totally consistent with the assumed polyethylene structure. This discrepancy is discussed.

703,088
PB-281 433/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis of the Aromatic Content of Whole Coals by High Power Proton Decoupled C-13 NMR.
Final rept.,
D. L. VanderHart, and H. L. Retcofsky. 1976, 17p
Pub. in Proceedings of 1976 Coal Chemistry Workshop, Menlo Park, Calif. 26-27 Aug 76, p202-218 1976. (Stanford Research Inst., Menlo Park, Calif.)

Keywords: *Coals, *Nuclear magnetic resonance, *Aromatic compounds, Carbon isotopes, Polarization(Lpin alignment), Reprints, Carbon 13.

The H-C(13) cross polarization experiment is described and its applicability to solid coals is discussed. Results indicate that the aromatic content of bituminous and anthracitic coals may be determined to an accuracy + or - 4% using this cross polarization technique. Results also show that coal does not contain any significant concentration of large, unprotonated-carbon domains. Limitations of the method are also discussed.

703,089
PB-281 434/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fourier Transform NMR Spectroscopy Nitrogen-15 Studies of Amino Sugars.
Final rept.,
B. Coxon. 1977, 18p
Pub. in Pure and Applied Chemistry, v49 p1151-1168 1977.

Keywords: *Synthesis(Chemistry), *Nuclear magnetic resonance, Molecular structure, Stereochemistry, Sugars, *Glucose/amino-deoxy, *Galactose/amino-deoxy, *Ribose/amino-deoxy, Fourier transform spectroscopy, Chemical shifts(Nuclear magnetic resonance), Nitrogen 15, Carbon 13, Reprints.

The synthesis and nuclear magnetic resonance (n.m.r.) spectroscopy of (15)N-labeled derivatives of 6-amino-6-deoxy-D-glucose, 6-amino-6-deoxy-D-galactose, and 5-amino-5-deoxy-D-ribose are reviewed. The use of these derivatives in the measurement of (15)N coupling constants, (15)N nuclear Overhauser effects, and (15)N spin-lattice relaxation times is described. Integration of the natural abundance (15)N n.m.r. spectra of aqueous solutions of the common 2-amino sugar hydrochlorides and their N-acetyl derivatives has given ratios of alpha and beta anomers for the equilibrated solutions that are in good agreement with published data from proton n.m.r. with the exception of 2-amino-2-deoxy-D-galactose hydrochloride, for which a discrepancy was noted. The equilibria of this amino sugar in aqueous solution have been reinvestigated by proton n.m.r. spectroscopy at 60 and 220 MHz, and by (13)C n.m.r., and the alpha-pyranose anomer found to be predominant. Correlations of the (15)N chemical shifts with molecular structure and stereochemistry have been made.

703,090
PB-281 435/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Charge Transfer Equilibria Involving Aromatic Compounds.
Final rept.,
P. Ausloos, and S. G. Lias. 1978, 5p
Pub. in Proceedings of International Mass Spectrometry Conference (7th), Florence, Italy 30 Aug-3 Sep 76 p321-325 1978.

Keywords: *Chemical equilibrium, *Aromatic compounds, *Ions, Mass spectroscopy, Thermodynamics, Thermochemistry, Ionization potentials, *Charge transfer.

Equilibria involving charge transfer between aromatic molecules and the parent ions of aromatic compounds have been examined in a pulsed ion cyclotron resonance mass spectrometer. Thermochemical information has been inferred from the observed equilibrium constants, and a self-consistent thermodynamic network which can be related to the corresponding ionization potentials of the various molecules is derived. A discussion is presented about the assumptions which are made in such a derivation. The ionization potential scale determined in this way is compared with a corresponding scale based on well-established ionization potentials from the literature.

703,091
PB-281 526/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evidence for the Structures of Adsorbed NH3 and H2O on Ru(001).
Final rept.,
T. E. Madey, and J. T. Yates. Sep 77, 4p
Sponsored in part by Office of Naval Research, Arlington, Va.
Pub. in Proceedings of the International Vacuum Congress (7th) and the International Conference on Solid Surfaces (3rd), Vienna, Austria 12-16 Sep 77, II, p1183-1186 Sep 77.

Keywords: *Ammonia, *Water, *Molecular structure, *Surface chemistry, Chemisorption, Chemical bonds, Rubidium, Electron stimulated desorption ion angular distribution method, ESDIAD method.

The adsorption of NH3 and H2O on Ru(001) have been studied using the Electron Stimulated Desorption Ion Angular Distribution (ESDIAD) method, in conjunction with thermal desorption spectroscopy and LEED. The results suggest that chemisorbed NH3 and H2O are bonded to Ru via the N and O atoms, respectively, with H atoms pointed away from the surface. The utility of ESDIAD for determination of structures of adsorbed molecules is indicated.

703,092
PB-281 625/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Flash Photolysis Resonance Fluorescence Investigation of the Reaction of C1(super 2P) Atoms with D1ONO(2).
Final rept.,
M. J. Kurylo, and R. G. Manning. 1 Jun 77, 5p
Sponsored in part by National Aeronautics and Space Administration, Washington, D.C. Upper Atmospheric Research Office.
Pub. in Chemical Physics Letters, v48 n2 p279-283, 1 Jun 77.

Keywords: *Reaction kinetics, *Photolysis, Fluorescence, Atomic energy levels, Stratosphere, Reprints, *Chlorine atoms, *Chlorine nitrates, Atmospheric chemistry.

Rate constants for the removal of Cl(doublet P) atoms by homogeneous gas phase reaction with ClONO2 were measured using the flash photolysis resonance fluoresence technique at 224, 250, and 273 K. The values obtained have been used to derive an Arrhenius equation. The results indicate that destruction of chlorine nitrate by reaction with chlorine atoms is perhaps the least important of the atmospheric reactive channels and at least three orders of magnitude slower than calculated photodissociation rates at all stratospheric altitudes.

703,093
PB-281 897/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comments Concerning the Structures and Reactions of C7H8(+) Ions.
Final rept.,
P. Ausloos, and S. G. Lias. 1 May 78, 4p
Pub. in Chemical Physics Letters, v47 n3 p495-498, 1 May 78.

Keywords: *Toluene, *Molecular structure, Ions, Molecules, Organic nitrates, Chemical reactions, *Ion molecule interactions, Reprints.

Toluene ions do not abstract NO2 from alkyl nitrates, as has been reported. Rather, solvated NO2(+) ions formed in alkyl nitrates transfer NO2(+) to aromatic compounds, accounting for the formation of the C7H8NO2(+) product ions in toluene-alkyl nitrate mixtures. Information about the structures of fragment C7H8(+) ions in butyl benzenes has been derived from the rates of their charge transfer reactions.

703,094
PB-281 898/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Equilibrium Isotope Effects on the Proton Transfer Reactions of Methylbenzenes.
Final rept.,
P. Ausloos, and S. G. Lias. 1977, 2p
Pub. in Jnl. of the American Chemical Society, v99 p4198-4199 1977.

Keywords: *Chemical equilibrium, *Isotope effects, Protons, Deuterium, Ions, Molecules, *Ion molecule interactions, *Benzene/methyl, Reprints.

A recent paper (J. F. Wolf, J. L. Devlin, III, D. J. DeFrees, R. W. Taft, and W. J. Hehre, J. Am. Chem. Soc., 98, 5097 (1976)) reported large deuterium isotope effects (delta G = 0.2 to 0.3 kcal/mole) on proton transfer equilibria in mixtures of alkylbenzenes with their partially deuterated analogues. This was interpreted as evidence for hyperconjugative stabilization of the protonated species. This note reports a careful redetermination and evaluation of such equilibrium measurements, showing that the reported isotope effects are non-existent within experimental error (+ or - 0.05 kcal/mole).

703,095
PB-281 905/0 Not available NTiS
National Bureau of Standards, Gaithersburg, MD.
Entropy Changes for the Protonation of Alkenes.
Final rept.,
P. Ausloos, and S. G. Lias. 15 Mar 78, 2p
Pub. in Jnl. of the American Chemical Society, v100 n6 p1953-1954, 15 Mar 78.

Keywords: *Alkene hydrocarbons, *Entropy, Chemical equilibrium, Temperature, Heat of formation, Hydrides, Protons, Cyclotron resonance, Ions, Reprints.

Equilibrium constants have been determined as a function of temperature for several proton transfer equilibria involving branched C4-C6 olefins. From the measured entropy changes for the reactions it has been deduced that there is an entropy change associated with the loss of an internal rotation of a methyl group in going from a t-alkyl ion to the corresponding olefin. Relative values for the heats of formation of the t-C4Hg(+), t-C5H11(+), and t-C6H13(+) ions deduced from these results agree with those derived from hydride transfer equilibria.

703,096
PB-281 906/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Proton Affinity of Ketene and the Heat of Formation of CH3CO(+).
Final rept.,
P. Ausloos, and S. G. Lias. 1 Oct 77, 4p
Pub. in Chemical Physics Letters, v51 n1 p53-56, 1 Oct 77.

Keywords: *Ketenes, *Acetone, *Heat of formation, Ions, Protons, Chemical equilibrium, Cyclotron resonance, Reprints.

The equilibrium for proton transfer involving acetone and ketene (CH3COCH3H(+) + CH2CO yields CH3CO(+) + CH3CO(H3)) has been studied in a pulsed ion cyclotron resonance spectrometer. Values of 193.6 + or - 1 and 194.1 + or - 1 kcal/mole (1 kcal/mole = 4.18 kjoules) are obtained for the proton affinities of acetone and ketene, respectively (based on a proton affinity of 193.5 + or - 1 kcal/mole for isobutene). A value of 161.5 + or - 1 kcal/mole for (delta H(f)(CH3CO(+)) is derived from these results.

703,097
PB-281 919/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electronic Spectra and Structure of the Hydrogen Halides. States Associated with the (sigma(2)pi(3))c(sigma) and (sigma(2)pi(3))c(pi) Configurations of HI and DI.
Final rept.,
M. L. Ginter, S. G. Tilford, and A. M. Bass. 1975, 13p
Sponsored in part by National Aeronautics and Space Administration, Washington, D.C.
Pub. in Jnl. of Molecular Spectroscopy 57, p271-283 1975.

Keywords: *Absorption spectra, *Hydrogen iodide, Deuterium compounds, Ultraviolet spectroscopy, Electronic transitions, Iodides, *Deuterium iodide, *Electronic structure, Molecular configurations, Reprints.

The high resolution absorption spectra of HI and DI have been investigated in the approximately 1425A to 1570A region. The majority of the bands observed in the region are assigned to transitions from X(1)sigma(+) to states associated with the excited configurations (sigma(2)pi(3))c(sigma) and (sigma(2)pi(3))c(pi). This region also contains bands assigned to transitions from X(1)sigma(+) to states associated with more highly excited configurations and to excited vibrational levels of the V(1)sigma(+), b(3)pi and C(1)pi states. The states associated with the (sigma(2)pi(3))c(sigma) and c(pi) configurations exhibit Omega,omega coupling. Effective molecular constants are presented for the bands observed within the above wavelength region.

703,098
PB-281 920/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dissociative Recombination Cross Sections for NH4(+) Ions and Electrons.
Final rept.,
R. D. Dubois, J. B. Jeffries, and G. H. Dunn. Apr 78, 7p
Grant NSF-ATM76-23101
Pub. in Physical Review A 17, n4 p1314-1320, Apr 78.

Keywords: *Recombination reactions, Reaction kinetics, Numerical analysis, Ions, Ammonium compounds, *Electron cross sections, *Ammonium ions, Reprints.

Cross sections for electron-NH4 (+) recombination have been measured for an electron energy range of 0.065 = or < E = or < 2.00 eV using a trapped-ion technique with an ion temperature of approximately 340 K. The cross section sigma deduced from these measurements can be represented by 4.30 x (10 to the -16th power) (E to the -1.40 power) for 0.050 = or < E = or < 0.3 eV and by 3.73 x (10 to the 17 power)(E to the -3.43 power) for E > 0.3 eV. There is a total uncertainty in the measurements of + or - 60%. Using a Maxwellian electron-velocity distribution, recombination-rate coefficients were calculated and compared with measurements of Huang, Biondi, and Johnsen.

703,099
PB-281 921/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rate of Resonant Two-Photon Ionization in the Presence of a Partially Coherent Radiation Field.
Final rept.,
J. L. F. de Meijere, and J. H. Eberly. Apr 78, 15p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Physical Review A 17, n4 p1416-1430, Apr 78.

Keywords: *Ionization, Photons, Laser beams, Coherent radiation, Numerical analysis, Comparison, *Two photon ionization, *Multiphoton ionization, Reprints.

A treatment is given of two-photon ionization in which particular attention is paid to the influence of the bandwidth of the ionizing light on the ionization rate. The model adopted for the atom is a common one, including two bound levels and a continuum. The model of the laser is general enough to allow short-term temporal fluctuations of amplitude or phase, and these fluctuations give rise to the laser bandwidth. It is found that the fluctuations have the most interesting effects on the ionization rate when the laser coherence time is shorter than the atomic memory time, as could be expected. In addition to laser bandwidth, the authors consider the influence on the ionization rate of the detuning of the laser from the intermediate-state resonance, the laser power, and the finite lifetime of the intermediate state. Comparisons with related earlier calculations are made and similarities and differences are pointed out.

703,100
PB-281 959/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystal Structure of 3,7-Diacetyl-1,3,5,7-tetraazabicyclo(3,3,1)nonane (DAPT).
Final rept.,
C. S. Choi, A. Santoro, and J. E. Abel. 1976, 5p
Pub. in Acta Crystallographica, B32 p354-358 1976.

Keywords: *Explosives, *Crystal structure, X ray analysis, X ray diffraction, Least squares method, Nitrogen organic compounds, *Tetraazabicyclononane/diacetyl, Molecular conformation, Reprints.

The crystal structure of 3,7-diacetyl-1,3,5,7-tetraazabicyclo(3,3,1)nonane (DAPT), C9H16N4O2,

has been determined by single-crystal X-ray diffraction techniques. The structure has been solved by direct methods and has been refined by least-squares analysis to a conventional R value of 0.052 (R(w)=0.04) based on 1708 observed reflections. The molecule of DAPT has a twin-chair conformation similar to that of the molecule of 3,7-dinitro-1,3,5,7-tetraazabicyclo(3,3,1)nonane (DPT). The heavy atoms of the acetamide groups are essentially coplanar with the ring carbon atoms adjacent to each group. The bicyclononane ring of the DAPT molecule possesses two pseudo-symmetry planes almost perpendicular to one another. Short intermolecular contacts of 3.28, 3.39 and 3.47 A have been observed. The molecules having these contacts are stacked along the unique b axis to form a linear chain. The lateral links between chains are weak with contacts between heavy atoms longer than 3.5 A.

703,101
PB-281 961/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Angular Distribution of Electron-Stimulated-Desorption-Ions: Oxygen on W(100).
Final rept.,
J. J. Czyzewski, T. E. Madey, and J. T. Yates. 8 Apr 74, 4p
Pub. in Physical Review Letters,v32 n14 p777-780, 8 Apr 74.

Keywords: *Angular distribution, *Oxygen, *Surface chemistry, Electrons, Desorption, Ions, Tungsten, Reprints.

Ions liberated from an adsorbed layer by electron-stimulated desorption are shown to have sharply peaked, symmetric angular distributions which are in registry with the substrate. The authors proposed a new method for investigation of the symmetry of binding sites for adsorbed species.

703,102
PB-281 962/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Elastic Moduli and Their Pressure and Temperature Derivatives for Calcium Oxide.
Final rept.,
A. L. Dragoo, and I. L. Spain. 1977, 6p
Sponsored in part by Maryland Univ., College Park. Center of Materials Research.
Pub. in Jnl. of Physics and Chemistry of Solids, v38 p705-710 1977.

Keywords: *Calcium oxides, *Modulus of elasticity, Pressure, Temperature, Reprints.

The room temperature adiabatic elastic moduli of CaO were obtained using a pulse superposition technique to measure the ultrasonic velocities. The pressure derivatives of the elastic moduli, which were measured at and below room temperature, decrease with decreasing temperature. The temperature derivatives of the elastic moduli were also obtained for several temperatures below room temperature.

703,103
PB-281 965/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Non-Linear Behavior of Polyethylene in Torsion.
Final rept.,
L. J. Zapas. 1976, 2p
Pub. in Proceedings of International Congress on Rheology (7th), Gothenburg, Sweden 23-27 Aug 76 p662-663 1976. (Tages-Anzeiger/Regina-Druck, Zurich, Switzerland).

Keywords: *Polyethylene, *Torsion tests, Strain tests, Numerical analysis, Stress relaxation tests, Mechanical tests, BKZ theory.

The non-linear mechanical behavior in torsion of a polyethylene rod was studied at various strain histories. A modified BKZ theory was used to correlate successfully the stress response on single and multistep stress relaxation experiments. Constant rate of strain experiments were performed in the form of triangular strain history and the calculated results were in very good agreement with the experimental values. This modified BKZ theory is a fluid theory with a memory, which depends on the passed strain history.

703,104
PB-281 966/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Atomic Data Compilation and Evaluation Programs at NBS Pertinent of Fusion Research.
Final rept.,
W. L. Wiese. 1977, 6p
Pub. in Proceedings of an Adv. Group Meeting, Abingdon, UK 1-5 Nov 76; Paper in Atomic and Molecular Data for Fusion, p535-540 1977. (International Atomic Energy Agency, Vienna, Austria.)

Keywords: *Atomic energy levels, *Nuclear fusion, Numerical analysis, Thermonuclear reactions, *Standard reference materials.

The US National Bureau of Standards operates, under the National Standard Reference Data System (NSRDS), a number of data centers in various fields of the physical sciences. Among them three centers compile atomic data of interest to Thermonuclear Fusion Research. These centers are the Atomic Energy Levels Data Center at NBS, the Data Center on Atomic Transition Probabilities and Line Shapes at Washington, DC, and the Joint Institute for Laboratory Astrophysics (JILA) Atomic Collision Information Center, at Boulder, CO.

703,105
PB-281 968/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Estimation of Coal Aromaticities by Proton-Decoupled Carbon-13 Magnetic Resonance Spectra of Whole Coals.
Final rept.,
D. L. VanderHart, and H. L. Retcofsky. 1976, 3p
Pub. in Fuel, v55 p202-204 1976.

Keywords: *Coal, *Aromatic compounds, Nuclear magnetic resonance, Protons, Isotopic labeling, Carbon 13, Reprints.

A recently developed nuclear magnetic resonance (n.m.r.) cross-polarization technique has been applied to obtain high-resolution carbon-13 spectra of vitrains from two coals. The method, which overcomes the problem of dipolar line broadening by protons, permits estimates of the carbon aromaticities of solid coals. Preliminary results support the classical views that coals are highly aromatic materials and that the aromaticity of coal increases with increasing rank. Limitations of the technique, the accuracy of representation of the distribution of carbons in the sample, and consequently the reliability of the resulting f(a) values are discussed.

703,106
PB-281 972/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Proton Magnetic Relaxation and Internal Rotations in Tetramethylammonium Cadmium Chloride.
Final rept.,
T. Tsang, and D. B. Utton. 1 May 76, 4p
Pub. in Jnl. Chem. Phys., v64 n9 p3780-3783 1 May 76.

Keywords: *Proton magnetic resonance, *Molecular relaxation, *Molecular rotation, Nitrogen organic compounds, Crystal structure, Mathematical models, Phase transformations, *Tetramethylammonium cadmium chloride.

Proton spin-lattice relaxation times (T(1)) and second moments (M(2)), at 14.7 MHz, have been investigated for tetramethylammonium cadmium chloride. Discontinuities in T1 at 119K and 104K indicate the occurrence of crystallographic transformations. It is proposed that, in the low temperature phase below 104K, the correlation time for hindered motion of one of the methyl groups is somewhat different from that of the other three. Using this model, the calculated T(1) and M(2) values are in satisfactory agreement with this experimental data. For the low temperature phase, the activation energies of the tetramethylammonium ion, 2.0 + or - 0.3 and 1.6 + or - 0.3 kcal/mole (8.4 + or - 1.3 and 6.7 + or - 1.3 kJ/mole), are considerably lower than the values 5.5-11 kcal/mole observed for the tetramethylammonium halides. In the high temperature phase, the activation energy decreases even further to 0.7 + or - 0.2 kcal/mole (2.9 + or - 0.8 kJ/mole). This decrease is in accordance with other order-disorder phase transitions involving tetrahedral ions.

703,107
PB-281 973/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Correspondence on 'Ionic Equilibrium Constants of Aqueous Alkaline Earth Salts.'
Final rept.,
B. R. Staples. Mar 78, 4p
Pub. in Environ. Sci. Technol., v12 n3 p339-342 Mar 78.

Keywords: *Alkaline earth compounds, *Electrolytes, *Chemical equilibrium, Ions, Tables(Data), Salts, Thermodynamic properties, Cations, Anions, Numerical analysis, Reprints, *Water quality.

The calculation of ionic equilibrium constants for aqueous electrolytes from available tables of critically evaluated data is discussed with reference to needs in water quality applications. Sample calculations are given and tables of selected equilibrium constants and Gibbs energies of formation of aqueous ionic species at 298.15 K are presented. A table of equilibrium constants for aqueous solutions of the alkaline earth salts, along with tables of Gibbs energies of formation for selected common cations and anions are provided.

703,108
PB-281 975/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Core-Excited Molecular States: Theoretical and Experimental Investigation of the Li2 Molecule.
Final rept.,
W. H. E. Schwarz, W. Butscher, D. L. Ederer, T. B. Lucatorto, B. Ziegenbein, W. Mehlhorn, and H. Prompeler. 1978, 12p
Pub. in Jnl. Phys. B, v11 n4 p591-602 1978.

Keywords: *Lithium, *Molecular energy levels, Excitation, Ultraviolet spectra, Numerical analysis, Far ultraviolet radiation, Reprints, Autoionization.

The excitation and decay of core-excited molecular lithium has been investigated by experimental and theoretical methods. The associated far-uv photoabsorption spectrum, which was observed with partly resolved vibrational structure, was interpreted on the basis of configuration-interaction (CI) calculations. In addition, the autoionization of these states was investigated by ejected-electron spectroscopy and explained through the use of a stationary Born-Oppenheimer model. A theoretical determination of the related potential curves and the ionisation potential is presented along with a discussion of the electronic structure of the core-excited states.

703,109
PB-281 976/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nature of the Phase Transition in KCN at 168 K.
Final rept.,
J. M. Rowe, J. J. Rush, N. J. Chesser, K. H. Michel, and J. Naudts. 13 Feb 78, 4p
Pub. in Phys. Rev. Lett., v40 n7 p455-458 13 Feb 78.

Keywords: *Potassium cyanides, *Phase transformations, *Lattice dynamics, Phonons, Neutron scattering, Inelastic scattering, Models, Temperature, Reprints.

Neutron inelastic scattering line shapes for (100) TA phonons in KCN have been measured for temperatures between 169 and 300K. The results are compared to the predictions of a model incorporating a strong indirect (CN)(-) - (CN)(-) ion interaction mediated by elastic strains. The present experiments confirm the essential features of the model and elucidate the nature of the mode softening which leads to the phase transition at 168K. In particular, the softening is shown to exist even for wave vectors one-half the distance to the Brillouin zone boundary.

703,110
PB-281 980/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Number of Carboxyl Groups on Liquid Density of Esters of Alkylcarboxylic Acids.
Final rept.,
J. C. Phillips, and G. J. Mattamal. Jan 78, 6p
Pub. in Jnl. Chem. Eng. Data 23, n1 p1-6 Jan 78.

Keywords: *Density(Mass/volume), *Carboxylic acid esters, Numerical analysis, Liquids, Reprints.

Liquid-density data for esters covering a molecular weight range of 88-939 (monocarboxylics; dialkyl esters series; triglyceride esters series; and oligomeric ester series) and a temperature range of 0-242.8C have been empirically fitted to about 1% to an equation of the form rho=lambda + K(lambda

squared)+1'(T), where lambda is a function of the absolute temperature, T, number of carboxyl groups, Ncoo, and the molecular weight, M; K is a function of T, Ncoo, and N2 (number of methylene groups). The equation in its limiting form may be used to estimate densities of poly(carboxylic esters) from a knowledge of the structure of the repeating unit. Data for the monocarboxylics were obtained from published values, those of the sebacate series and triglyceride series were measured dilatometrically and that of the oligomeric ester series was measured by a capillary method. The results show a rather strong dependence of the density on Ncoo.

703,111
PB-281 981/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Models of Internal Viscosity of Polymers.
Final rept.,
A. Peterlin. 1977, 17p
Pub. in Croatica Chemica Acta, v50 p253-269 1977.

Keywords: *Viscosity, *Polymers, *Mathematical models, Intrinsic viscosity, *Necklace models, Reprints.

One introduces the tensor phi of internal viscosity as a diagonal tensor in normal coordinate space of necklace model with Z ideally elastic links and Z + 1 beads. One has a substantial freedom in the choice of diagonal values. Four models are presented. If the diagonal terms are proportional to those of diagonalized link force tensor (model M2) the resistance to deformation rate of necklace model is confined to resistance to single link deformation. Such a model represents a necklace where each link consists of an ideal spring and ideal dashpot in parallel. Any other choice of diagonal elements introduces resistance forces against deformation rate of distance between any two beads. If the relative coefficients phi P/phiZ are smaller than those of model M2 one obtains the unrealistic situation of deformation rate enhancement by the negative values of internal viscosity coefficients between nonadjacent beads. Hence the majority of phiP/phiZ must be larger than, or equal to, the corresponding values of model M2. For Z between 3 and 300 h = .25 (impermeable coil), phi/f = 2 the frequency dependence of intrinsic viscosity and birefringence is shown for models M1 and M2.

703,112
PB-281 986/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Matrix Isolation Study of the Products of the Interaction of Electrons and of Argon Atoms in Excited Rydberg States with HCCIF2.
Final rept.,
M. E. Jacox, and D. E. Milligan. 1976, 12p
Pub. in Chemical Physics, v16 p381-392 1976.

Keywords: *Infrared spectroscopy, Chlorine organic compounds, Electron capture, Argon, Atoms, Electrons, Absorption, Photolysis, Surfaces, Cryogenics, *Atom electron interactions, *Methane/chloro-difluoro, *Matrix isolation techniques, Argon atoms, Rydberg series, Reprints.

Infrared absorptions of the (ClCF)...H-F(-) and HCF(-) and HCF2(2) anions have been identified in the spectrum of the products of the photolysis of HCCIF2 isolated in an argon matrix at 14K using radiation in the 147-105 nm spectral range. These anions are also produced in matrix experiments in which the Ar:HCCIF2 sample is codeposited with an atomic beam of sodium and charge transfer processes are induced by mercury arc radiation, as well as in experiments in which the sample is codeposited with a beam of argon that has been passed through a microwave discharge. Both the spectral data and molecular orbital calculations for HCF2(-) indicate that this molecule has an exceptionally weak C-H bond and that its apex angle is considerably more acute than that of the uncharged HCF2 radical. The high threshold for ion production from HCCIF2 dictates consideration of the role played by highly excited Rydberg states of argon in the discharge experiments. It appears probable that charge transfer occurs between these excited argon atoms and HCCIF2. The high ion yield typical of the discharge experiments is also consistent with product formation resulting from collision of matrix-isolated HCCIF2 with free excitons formed by the impact of highly excited argon atoms at the surface of the solid deposit.

703,113
PB-281 997/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interaction of Hydrogen, Carbon Monoxide, and Formaldehyde with Ruthenium.
Final rept.,
D. W. Goodman, T. E. Madey, M. Ono, and J. T. Yates. 1977, 12p
Pub. in Jnl. of Catalysis, v50 p279-290 1977.

Keywords: *Hydrogen, *Carbon monoxide, *Formaldehyde, *Surface chemistry, Ruthenium, Desorption, Absorption, Methanation, Catalysts, Reprints.

The interaction of H2, CO and H2CO with a clean (110) Ruthenium surface has been studied using temperature programmed desorption methods. Although Ru is known to be an excellent catalyst for methane production via hydrogenation of CO, no observable CH4 was produced over Ru(110) at H2(+) CO pressures up to about 0.001. Torr, due to kinetic limitations. Also, no CH4 was observed to desorb from coadsorbed H2(+) CO. Formaldehyde dissociates upon adsorption on Ru(110) and yields H2 and CO as the dominant desorption products. In addition, a small (about 1% of a monolayer) amount of CH4 was also seen following H2CO adsorption. This CH4 presumably originates from the thermal decomposition of a low-concentration oxygenated hydrocarbon complex. The relationship between this complex and the catalytic intermediate in the methanation reaction is explored.

703,114
PB-281 998/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interaction of Methanol with Ruthenium.
Final rept.,
D. W. Goodman, J. T. Yates, and T. E. Madey. 1 Feb 78, 4p
Pub. in Chemical Physics Letters, v53 n3 p479-482, 1 Feb 78.

Keywords: *Methyl alcohol, *Surface chemistry, Ruthenium, Desorption, Isotopic labeling, Deuterium compounds, Reprints.

The interaction of methanol with a clean (110) Ruthenium surface has been studied using temperature programmed desorption methods. Methanol dissociates upon adsorption at 300K and yields H2(g) and chemisorbed CO as the dominant products. Randomization of evolved hydrogen was shown to occur during methanol adsorption and also upon subsequent thermal desorption using isotopically labeled methanol, CH3OD. In addition to hydrogen and CO, small amounts of H2CO, CH3OH, CO2, and H2O3, are also observed upon thermal desorption. In contrast with a previous study of formaldehyde on Ru(110), no detectable CH4 product is found upon methanol desorption.

703,115
PB-282 000/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stopped-Flow Studies of the Mechanisms of Ozone-Alkene Reactions in the Gas-Phase. Ethylene.
Final rept.,
J. T. Herron, and R. E. Huie. 3 Aug 77, 6p
Pub. in Jnl. of the American Chemical Society, v99 n16 p5430-5435, 3 Aug 77.

Keywords: *Ozone, *Ethylene, Mass spectrometers, Concentration(Composition), Upper atmosphere, Alkenes, Free radicals, *Chemical reaction mechanisms, Atmospheric chemistry, Reprints.

The reaction of ozone with ethylene has been studied in the gas phase at 298K and 1.1kPa (8Torr), using a stopped-flow reactor coupled to a beam-sampling mass spectrometer. The concentrations of C2H4 and the products CO2, H2O, CH2O, HCOOH, CH3OH, and an unidentified product at mass 43 were measured as a function of reaction time. Using a computer model, the role of free radicals in the reaction was quantitatively assessed, and a complex free-radical mechanism proposed.

703,116
PB-282 004/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ion Cyclotron Resonance Study of the Structure of C7H7(+) Ions.
Final rept.,
J. A. Jackson, S. G. Lias, and P. Ausloos. 9 Nov 77, 7p
Pub. in Jnl. of the American Chemical Society, v99 n23 p7515-7521, 9 Nov 77.

Keywords: *Toluene, *Cyclotron resonance, Laboratory equipment, Reaction kinetics, Ions, Isomerization, Hydrides, Halogen organic compounds, *Ion molecule interactions, Reprints.

The C7H7(+) fragment ions formed in toluene, and the chlorinated, brominated, and iodinated toluenes, as well as the C7H6F(+) fragment ions in fluorinated toluenes have been studied in an ion cyclotron resonance spectrometer. In all these systems, it is seen that there are two populations of C7H7(+) ions, one of which reacts with the parent compound and other compounds, and one of which is totally unreactive. Because the reactive C7H7(+) ions from the different precursors all undergo the same reactions and at the same rate as the C7H7(+) ions in toluence and benzyl chloride, which have previously been shown to have the benzyl structure, this structure is assigned to the reactive C7H7(+) populations; the unreactive C7H7(+) ions are assigned the tropylium structure. The relative abundance of the unreactive tropylium ion is low (greater than 15%) in the chloro-,bromo-, and iodotoluenes, and decreases with decreasing energy of the ionizing electrons. This is interpreted to mean that the rearrangement to the seven-membered ring structure occurs after the fragment ion is formed. In toluene and fluorotoluenes, the unreactive component comprises 30-60% of the C7H6X(+)(X=H,F) ions, and decreases with increasing energy of the ionizing electrons, indicating that rearrangement occurs prior to the fragmentation of the parent ion. Rate constants for the hydride transfer to the benzyl ion from cyclopentane, cyclohexane, 3-methylpentane, and 3-methylhexane are reported.

703,117
PB-282 005/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Matrix Isolation Study of the Products of the Interaction of Electrons and Metastable Argon Atoms with HCCl(2)F.
Final rept.,
M. E. Jacox, and D. E. Milligan. 1976, 14p
Pub. in Chemistry and Physics, v16 p195-208 1976.

Keywords: *Infrared spectroscopy, Atoms, Argon, Absorption, Ultraviolet radiation, Electron capture, Ions, Metastable state, Excitation, Cryogenics, Atom electron interactions, *Methane/dichloro-fluoro, Electron molecule interactions, Argon atoms, Chemical reaction mechanisms, Reprints.

Two groups of infrared absorptions common to experiments in which samples of HCCl2F isolated in an argon matrix at 14K are exposed to vacuum ultraviolet radiation or to electrons produced by ultraviolet irradiation of an alkali metal, as well as to experiments in which the Ar:HCCl2F sample is codeposited with a beam of argon atoms excited in a microwave discharge, have been assigned to anions produced upon associative and dissociative electron capture by HCCl2F. Detailed isotopic substitution studies suggest that these anions are (Cl2C)...H-F, representing a unique type of hydrogen bonding, and HCClF(-). The HCClF(-)2 anion photodecomposes in the 345-250 nm spectral region, but the products of its photodecomposition have not been identified. Both CCl2 and Cl2CF are also produced in the discharge experiments, but there is no evidence for the production of HCF. Mechanisms for the formation of ion products by electron capture and by exposure of HCCl2F to radiation or to excited argon atoms of energy equal to or less than 11.8 eV are considered.

703,118
PB-282 007/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hexakis(imidazole) Nickel(II) Chloride Tetrahydrate.
Final rept.,
J. P. Konopelski, C. W. Reimann, C. R. Hubbard, A. D. Mighell, and A. Santoro. Oct 76, 3p
Pub. in Acta Crystallographica B32 pt10 p2911-2913 Oct 76.

Keywords: *Crystal structure, Hydrates, Nickel organic compounds, Chemical bonds, Hydrogen, *Nickel/chloro-hexakis(imidazole), Reprints.

Ni(C3H4N2)6(Cl)2.4H2O, Mw = 610.1 triclinic, a = 9.084(2), b = 8.808(2), c = 10.556(2) A, alpha = 83.16(2), beta = 104.89(2), lambda = 118.28(2) degrees, V = 721.13 A cubed, Z = 1, Dc = 1.40, Dm = 1.407 g/cc. Final R = 0.043. The crystal structure

consists of six planar imidazole rings coordinated to nickel with an extensive network of hydrogen bonding.

703,119
PB-282 008/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chemisorption and Decomposition of Nitric Oxide on Ruthenium.
Final rept.,
R. Klein, and A. Shih. 2 Dec 77, 25p
Pub. in Surface Science, v69 n2 p403-427, 2 Dec 77.

Keywords: *Nitrogen oxide(NO), *Surface chemistry, Ruthenium, Chemisorption, Decomposition, Catalysis, Reprints.

Nitric oxide, strongly chemisorbed on ruthenium, is desorbed almost completely as oxygen and nitrogen. Oxygen, nitrogen, and nitric oxide were observed singly on ruthenium with field emission microscopy. Thermal desorption spectroscopy from Ru (1,0,-1,0) showed that molecular nitrogen is only physisorbed but nitrogen from NO decomposition is strongly chemisorbed. Nitrogen from NO shows three binding states, the most strongly bound being present to only a small extent. NO shows three and two binding states when adsorbed at 120K and 295K respectively. Work function measurements gave delta phi = 1.3 eV for a monolayer of NO. NO is dissociatively adsorbed above 250K but a lower temperature limit was not established. The desorption of NO as N2 and O2 from Ru (1,0,-1,0) under high vacuum conditions is catalytic in that no oxides of ruthenium were observed to form in the process.

703,120
PB-282 009/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Kinetics of Carbon Monoxide Hydrogenation on a Polycrystalline Nickel Ribbon Catalyst.
Final rept.,
R. D. Kelley, T. E. Madey, K. Revesz, and J. T. Yates. 1978, 12p
Pub. in Applied Surface Science, v1 p266-277 1978.

Keywords: *Carbon monoxide, *Reaction kinetics, *Surface chemistry, Hydrogenation, Catalysis, Nickel, Methanation, Methane, Reprints.

Ultrahigh vacuum procedures have been employed to highly purify reactant gases and to prepare a clean Ni ribbon for use as a methanation catalyst in a static reactor. The kinetics of CO-hydrogenation to produce CH4 have been studied over a Ni catalyst temperature range of 600K - 740K using 4 H2:1 CO at a total pressure of 120 Torr. Under these conditions, the reaction was found to be highly selective (less than 1% higher hydrocarbons produced). Small amounts of CO2 were also produced continuously during methanation. The initial rate of CH4 production was used to estimate the activation energy (66 kJ/mole) in this temperature range. Satisfactory agreement was observed between our rate measurements (turnover numbers) made on a 10 sq cm Ni ribbon and other kinetics studies made on supported Ni catalysts of much larger surface area. A comparison of data from different laboratories suggests that the methanation activation energy falls as the Ni temperature is raised, and that raising the reaction temperature also produces enhanced selectivity towards CH4 production.

703,121
PB-282 014/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Adiabatic Ionization Energies from Charge Transfer Equilibrium Constants; Experimental Determinations of Entropy Changes for Charge Transfer Equilibria.
Final rept.,
S. G. Lias. 15 Feb 78, 7p
Pub. in Chemical Physics Letters, v54 n1 p147-153, 15 Feb 78.

Keywords: *Aromatic compounds, *Chemical equilibrium, *Entropy, Cyclotron resonance, Ionization potentials, Nitrogen oxide(NO), Temperature, Reprints, Charge transfer.

Equilibrium constants have been measured as a function of temperature for the charge transfer equilibria in mixtures of NO with aromatic compounds, and mixtures of aromatic compounds. The experimentally determined entropy changes are in good agreement with entropy changes calculated from statistical mechanical considerations provided an intermolecular component is included. The enthalpy changes for the charge transfer reactions correspond to the differences in the adiabatic ionization potentials of the compounds.

703,122
PB-282 015/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ion-Molecule Reactions Involving Fluorine Containing Organic Compounds,
S. G. Lias. 1978, 36p
Pub. in Proceedings of Symposium Division of Physical Chemistry Meeting of the American Chemical Society (169th), Philadelphia, Pa. 7-11 Apr 75, Paper 6 in ACS Symposium Ser66, Fluorine-Containing Free Radicals Kinetics and Dynamics of Reactions, p152-187 1978.

Keywords: *Fluorine organic compounds, Ions, Molecules, Mass spectroscopy, Reaction kinetics, *Ion molecule interactions.

This chapter presents a review of ion-molecule reactions occurring in fluorinated or partially-fluorinated systems. Also included is a brief discussion of the information about the heats of formation of fluorinated ions derived from studies of ion-molecule reactions.

703,123
PB-282 016/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ion-Molecule Reactions Involving Halomethyl Ions; Heats of Formation of Halomethyl Ions.
Final rept.,
S. G. Lias, and P. Ausloos. 1977, 20p
Pub. in (Intl) Jnl. of Mass Spectrometry and Ion Physics, v23 p273-292 1977.

Keywords: *Halogen organic compounds, *Heat of formation, Ions, Cyclotron resonance, Protons, Reaction kinetics, Deuterium compounds, Mass spectroscopy, *Ion molecule interactions, Reprints.

This study examines the reactions of CH5(+)(CD5(+)) and C2H5(+)(C2D5(+)) ions generated in CH4 or CD4, and of C3H7(+) ions generated in neopentane or propane with CH3Cl, CH2Cl2, CHCl3, CCl4, CH3F, CH2F2, CHF3, CF4, CH2FCl, CHF2Cl, CHFCl2, CFCl3, CF2Cl2, and CF3Cl. In addition, the reactions of the various halomethyl ions with the halomethanes are investigated. Rate constants were determined for all reactions observed using a pulsed ion cyclotron resonance mass spectrometer. The CH5(+) CD5(+) ion transfers a proton to all of these molecules. The protonated halomethanes (except CH3ClH(+), CH2F2H(+), CHF3H(+), and CF4H(+)) dissociate by losing HX. The ethyl, sec-propyl ions, and halomethyl ions, abstract chloride or fluoride from the halomethanes. Chloride transfer always predominates over fluoride transfer when both channels are exothermic. Ethyl and sec-propyl ions do not undergo hydride transfer reactions with any of these molecules.

703,124
PB-282 019/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ion Angular Distributions in Electron Stimulated Desorption: Adsorption of O2 and H2 on W(100).
Final rept.,
T. E. Madey, J. J. Czyzewski, and J. T. Yates. 1975, 32p
Pub. in Surface Science, v49 p465-496 1975.

Keywords: *Angular distribution, *Oxygen, *Hydrogen, *Surface chemistry, Tungsten, Electrons, Desorption, Chemisorption, Ions, Reprints.

The angular distributions of ions liberated by electron stimulated desorption (ESD) of H(+) and O(+) from adsorbed layers of oxygen and hydrogen on the (1) surface of tungsten have been examined. The resultant patterns of ion emission are observed visually in a display-type apparatus. Two types of ESD angular distribution patterns are observed: (1) hazy patterns with ill-defined boundaries, and (2) patterns in which the ions are liberated in well-defined cones of emission whose direction are correlated with the symmetry of the underlying substrate. These latter patterns are postulated to arise from ESD from a directionally-bonded adsorbate in which the directionality of the ground state adsorbate-substrate bond is preserved in ion desorption.

703,125
PB-282 067/8 PC **A18**/MF **A01**
National Standard Reference Data System.
Atomic Energy Levels - The Rare-Earth Elements. The Spectra of Lanthanum, Cerium, Praseodymium, Neodymium, Promethium, Samarium, Europium, Gadolinium, Terbium, Dysprosium, Holmium, Erbium, Thulium, Ytterbium, and Lutetium.
W. C. Martin, R. Zalubas, and L. Hagan. cApr 78, 422p NSRDS-NBS-60
Library of Congress Catalog Card no. 77-12195. See also report dated Dec 71, COM-72-50283.

Keywords: *Atomic energy levels, *Atomic spectra, *Rare earth elements, Tables(Data), Ionization potentials, Lanthanum, Cerium, Praseodymium, Neodymium, Promethium, Samariam, Europium, Gadolinium, Terkium, Dysprosium, Holmium, Erbium, Thulium, Ytterbium, Lutetium.

Energy level data are given for 66 atoms and atomic ions of the 15 elements lanthanum (Z=57) through lutetium (Z=71). These data have been critically compiled from published and unpublished material. Only experimentally determined energy levels are included, the energies being restricted to excitations of outer-shell electrons and to inner-shell excitations up to the soft x-ray range. The levels were taken from analyses of the spectra of atomic gases wherever possible; however, the levels for several of the triply ionized rare earths are from analyses of the spectra of the ions in crystals or solutions. In addition to the level value (usually in units of reciprocal cm) and the parity, the J value, configuration and term assignments, and the experimental g value are listed wherever available. Leading percentages from the calculated eigenvector are also tabulated for each level if available. The levels are grouped into spectroscopic terms of appropriate coupling schemes where such groups appear meaningful. Ionization potentials are tabulated for most of the spectra. Complete references for the tabulated data are given for each spectrum. Copyright (c) 1978 by the Secretary of Commerce on Behalf of the United States Government.

703,126
PB-282 122/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Two-Scale-Factor Universality Near the Critical Point of Fluids.
Final rept.,
J. V. Sengers, and M. R. Moldover. 17 Apr 78, 3p
Contract NASA-C-62861-C
Pub. in Phys. Lett., v66A n1 p44-46, 17 Apr 78.

Keywords: *Critical point, *Fluids, Vapor phases, Liquid phases, Carbon dioxide, Sulfur hexafluoride, Xenon, Reprints.

Experimental evidence is presented in support of the validity of the hypothesis of two-scale-factor universality for the correlation function of fluids near the gas-liquid critical point. For Xe, SF6, and CO2, the dimensionless quantity R= (Xi sub 0)((B squared)(P sub c)/ Gamma (k sub B)(T sub c)) to the 1/3 power is universal within the experimental accuracy of 10% and agrees with the value predicted by theory.

703,127
PB-282 125/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Enhanced Chemical Reaction Between O3(001) and NO.
Final rept.,
S. M. Freund, and J. C. Stephenson. 1 Jul 76, 3p
Contract AT(49-1)-3719
Pub. in Chem. Phys. Lett., v41 n1 p157-159, 1 Jul 76.

Keywords: *Nitrogen dioxide, *Oxygen, Ozone, Nitrogen oxide(NO), Reaction kinetics, *Laser enhanced reactions, Reprints.

A CO2 TE laser excited fluorescence experiment demonstrated that ozone in the (001) vibrational state causes the enhancement in the T = 298 K rate constant recently observed for the reaction O3' + NO yields NO2*(2B1) + O2. Rate constants for vibrational deactivation of O3' by NO2 and O2 were measured by observing the 10 micrometer fluorescence from O3'. The total deactivation rate of O3' by NO was determined from NO2* fluorescence measurements and agrees with the value currently in the literature.

703,128
PB-282 126/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Matrix Isolation Study of the Infrared Spectrum and Structure of the CH3 Free Radical.
Final rept.,
M. E. Jacox. 1977, 16p
Pub. in Jnl. Mol Spectrosc., v66 p272-287 1977.

Keywords: *Free radicals, *Methane, *Infrared spectroscopy, *Molecular structure, Molecular energy levels, Molecular rotational, Molecular vibrational, Reprints, *Atom molecule interactions, Matrix isolation techniques.

A reproducibly good yield of CH3 has been obtained in matrix isolation studies of the products of the interaction of CH4 with electronically excited argon atoms produced in a microwave discharge. Detailed observations have been conducted in the nu2 vibrational fundamental region of all of the CH3-d(n) species isolated in an argon matrix at temperatures between 11 and 20 K. The temperature dependence of the CH3-d(N) band structures is in good agreement with that calculated for the superposition of low-J rotational transitions on the nu2 vibrational absorption of the planar molecule; the rotational energy levels do not undergo major perturbation in the argon matrix environment, and there is no evidence for the occurrence of inversion splitting. Rotational structure has also been observed in the nu4 absorption of CH3. The argon matrix observations have confirmed that the previously reported quartic anharmonicity of CH3 is a molecular property rather than a result of matrix interactions.

703,129
PB-282 131/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Infrared Laser Enhanced Reactions: Chemistry of NO(v=1) with O3.
Final rept.,
J. C. Stephenson, and S. M. Freund. 15 Nov 76, 8p
Grant AT(49-1)-3719
Pub. in Jnl. Chem. Phys. v65 n10 p4303-4310 15 Nov 76.

Keywords: *Nitrogen oxide(NO), *Ozone, Infrared spectroscopy, Chemical reactions, Excitation, Reaction kinetics, Molecular vibrations, Fluorescence, *Laser enhanced reactions, Laser induced fluorescence, Reprints.

Vibrationally excited nitric oxide, produced by absorption of CO laser radiation, was found to react significantly faster with T = 298 K than does thermal NO in its reaction with ozone. The modulation in visible fluorescence from the NO2* product, following laser excitation of NO was measured. The exponential decay time of NO(v=1) infrared fluorescence following the laser excitation was also monitored and related to the vibrational deactivation process. The rate enhancement occurs even though the excited NO bond does not break during the reaction.

703,130
PB-282 138/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
XPS Study of Formaldehyde and Related Molecules Adsorbed on the Surface of a Tungsten (100) Single Crystal.
Final rept.,
S. D. Worley, N. E. Erickson, T. E. Madey, and J. T. Yates. 1976, 16p
Pub. in Jnl. Electron Spectrosc. Relat. Phenom. v9 p355-370 1976.

Keywords: *Surface chemistry, *Formaldehyde, X ray analysis, Tungsten, Carbon dioxide, Carbon monoxide, Oxygen, Decomposition, Adsorption, Reprints.

X-ray Photoelectron Spectroscopy has been used to study the adsorption and catalytic decomposition of formaldehyde on a W(100) single crystal. Comparison with the O(1s) spectra of CO(ads), CO2(ads) and O(ads) has been carried out in an attempt to understand the surface complexes formed from H2CO. It has been shown that H2CO dissociates at 100 K upon adsorption up to ca. 1/2 monolayer. Above this coverage, condensation of undissociated H2CO occurs. A surface complex leading to the liberation of CO2 from the formaldehyde layer has been detected by XPS. However, no complex uniquely related to an intermediate which yields a small quantity of CH4 has been detected by XPS.

703,131
PB-282 141/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Scattering with 1 meV Resolution.
Final rept.,
R. J. Van Brunt, and A. Gallagher. 1978, 14p
Grant NSF-PHY76-04761
Pub. in Invited papers and progress reports from the International Conference on the Physics of Electronic and Atomic Collisions (10th), Orsay, France, Jul 77. Paper in Electronic and Atomic Collisions, p129-142 1978.

Keywords: *Electron scattering, Elastic scattering, Nitrogen, Oxygen, Argon, Neon, Helium, Resolution, Photoionization.

The advantages of higher energy resolution in resonant electron scattering measurements are examined with regard to possible improvements in accuracy of determining resonance profiles and natural widths. A technique is described that employs a photoionization electron source together with scattering from a supersonic atomic beam which is capable of achieving a net energy resolution approaching 1 meV. Results obtained by this method for sharp Feshbach resonances observed in differential elastic scattering of electrons from N2, O2, Ar, Ne and He are reported. A careful examination of the well-known 19.3 eV He 2S resonance in forward angle scattering (theta = 22 degrees) with a net energy resolution (including residual Doppler broadening) of 7 to 12 meV has revealed possible serious difficulties with the simple partial wave description used in previous analyses of the resonance profile.

703,132
PB-282 144/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High-Flux Beam Source of Fast Neutral Helium.
Final rept.,
D. W. Fahey, L. D. Schearer, and W. F. Parks. Apr 78, 4p
Sponsored in part by Office of Naval Research, Arlington, Va.
Pub. in Review of Scientific Instruments, v49 n4 p503-506 Apr 78.

Keywords: *Helium, *Molecular beams, Flux rate, Reprints.

A high flux beam source of fast neutral helium has been constructed by extending the designs of previous authors. The source is a dc or pulsed electric discharge in an expanding gas nozzle. The beam produced has a flux on the order of 10 to the 15th power atoms/sec-sr and a mean velocity on the order of 10 to the 7th power cm/sec. The composition of the beam has been determined by the use of the particle detectors and by the observation of the excitation of certain target gases.

703,133
PB-282 194/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Critical Points of Mixtures - An Analogy with Pure Fluids.
Final rept.,
M. R. Moldover, and J. S. Gallagher. Mar 78, 12p
Pub. in AIChE Jnl., v24 n2 p267-278 Mar 78.

Keywords: *Critical point, *Vapor phases, *Liquid phases, *Fluids, Thermodynamic properties, Equations of state, Binary systems(Materials), Mixtures, Octanes, Carbon dioxide, Ethane, Sulfur hexafluoride, Propane, Reprints.

The thermodynamic properties of vapor-liquid equilibrium (VLE) states near the critical locus of mixtures are correlated in very close analogy with the techniques used to correlate the properties of pure fluids near a critical point. The only mixture parameters used in the correlation are the values of pressure, volume, temperature and mole fraction (PVTx) along the physical critical locus. The authors illustrate the power of the present approach by correlating the rather extensive PVTx data that exist near the critical loci of the binary mixtures: CO2 - C2H6, SF6 - C3H8, and C8H18 - C3H8. Nearly all the data within 10% of the critical temperature may be described within their accuracy despite the occurrence of critical azeotropy or large regions of retrograde condensation.

703,134
PB-282 195/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Temporal Coherence in Multiphoton Absorption. Far Off-Resonance Intermediate States.
Final rept.,
P. W. Milonni, and J. H. Eberly. 15 Feb 78, 12p
Pub. in Jnl. of Chemical Physics, v68 n4 p1602-1613, 15 Feb 78.

Keywords: *Coherence, *Absorption spectra, Molecular energy levels, Atomic energy levels, Stark effect, Dipole moments, Multiphoton absorption, Reprints.

The authors developed a consistent formalism for the treatment of temporal atomic or molecular coherence in multiphoton absorption. The formalism is fully quantum mechanical under the assumption that the exciting laser fields are well-described by coherent states. They made use of the language and methodology of resonance physics to the extent possible, but deliberately avoid the rotating-wave approximation, and do not restrict the allowed atomic states to be finite in number or the electric field strengths to be small in magnitude.

703,135
PB-282 198/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Excitation and Ionization in a Dense Li Vapor: Observation of the Even-Parity, Core-Excited Autoionizing States.
Final rept.,
T. J. McIlrath, and T. B. Lucatorto. 13 Jun 77, 4p
Pub. in Physical Review Letters, v38 n24 p1390-1393, 13 Jun 77.

Keywords: *Lithium, *Atomic energy levels, Ionization, Reprints, *Autoionization, Laser induced fluorescence.

The first optical spectrum of autoionizing core-excited levels from excited states has been obtained in lithium. A 1-MW dye laser tuned to the (1 doublet s)(2s) yields (1 doublet s)(2p) resonance produced approximately 10 to the 16th power excited atoms/sq cm in a heat-pipe oven. Far uv absorption spectra of Li*(2p) and Li(+) were obtained. A curve of the evolution from excited neutrals to approximately 95% ions is presented, and the significance of the Li observations for understanding the ionization mechanism is discussed.

703,136
PB-282 200/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Collective Modes in Classical Monoatomic Liquids.
Final rept.,
R. D. Mountain. 1977, 29p
Pub. in Ch6 in Topics in Current Physics, v3 Dynamics of Solids and Liquids by Neutron Scattering, p301-329 1977.

Keywords: *Liquids, *Hydrodynamics, Argon, Neon, Helium, Rubidium, Sodium, Transport properties, Neutron spectra, Reprints.

Recent developments in the study of collective motions in monoatomic liquids by neutron spectroscopy are discussed within the framework of generalized hydrodynamics. The formal representation of the scattering law is discussed and specific experimental results for argon, neon, helium, rubidium, and sodium as well as molecular dynamics studies are examined. From these studies it is possible to gain new insight into the physical process in liquids at the molecular level. The theoretical efforts to calculate the generalized transport coefficients are examined and the most promising techniques are identified.

703,137
PB-282 202/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Catalysis by Solid Surfaces.
Final rept.,
T. E. Madey, J. T. Yates, D. R. Sandstrom, and R. J. H. Voorhoeve.1976, 124p
Sponsored in part by Office of Naval Research, Arlington, Va.
Pub. in Ch1 in Treatise on Solid State Chemistry, v6B p1-124 1976.

Keywords: *Catalysis, *Surfaces, Chemisorption, Reprints.

This chapter gives an overview of current concepts in catalysis of predominantly simple reactions. Catalysts covered are metals, semiconducting oxides, and sulfides. The emphasis is on the connections between solid-state chemistry/physics, spectroscopy, and sur-

face physics in ultrahigh vacuum on the one hand and catalysis on the other hand. For physicists and materials scientists of various plumage, the chapter is expected to serve as a concise (but not oversimplified) primer.

703,138
PB-282 487/8 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, Colo. Cryogenics Div.
Modified Benedict-Webb-Rubin Equation of State for Gaseous and Liquid Oxygen,
L. A. Weber. Apr 68, 38p NBSIR-78-882

Keywords: *Oxygen, *Liquid oxygen, *Equations of state, Thermodynamic properties, Enthalpy, Entropy, Density(Mass/volume), Specific heat, Numerical analysis, Triple point.

New PVT data on oxygen at pressures to 800 atmospheres have been recently reported. These data, along with other NBS data on oxygen, have been fitted with a 32 term modified Benedict-Webb-Rubin equation of state. This equation is valid for gaseous and liquid oxygen at temperatures from the triple point (54.36 K) to 300 K and for pressures up to 800 atm. Thermophysical properties calculated via this equation are compared with the most reliable values available. The vapor pressure equation has also been updated to be consistent with more recent experimental work near the triple point. A computer program is available which calculates the thermophysical properties of oxygen.

703,139
PB-282 872/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comment on 'High Temperature Thermodynamics of Palladium-Hydrogen. II. Temperature Dependence of Partial Molar Properties of Dilute Solutions of Hydrogen in the Range 500-700K.'
Final rept.,
J. J. Rush, and J. M. Rowe. 15 Apr 78, 1p
Pub. in Jnl. of Chemical Physics, v68 n8 p3954, 15 Apr 78.

Keywords: *Palladium, *Thermodynamics, *Hydrogen, Phase transformations, Reprints, Palladium hydrides.

No abstract available.

703,140
PB-282 880/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Densities of LNG for Custody Transfer.
Final rept.,
W. M. Haynes, M. J. Hiza, and R. D. McCarty. 1977, 34p
Pub. in Proceedings of International Conference on Liquefied Natural Gas (5th), Duesseldorf, Germany, 29 Aug-1 Sep 77, LNG 5, 2, Session III, Paper 11 1977.

Keywords: *Liquefied natural gas, *Density(Mass/volume), Mixtures, Laboratory equipment, Mathematical models, Numerical analysis.

Part I. Experimental measurements--W. M. Haynes, M. J. Hiza. An accurate knowledge of the density of LNG is required to provide a basis for equitable custody transfer. A project has been carried out to provide experimental density data for liquefied natural gas components and their mixtures with a total uncertainty of less than 0.1%. The apparatus, data, experimental procedures, etc. are described. The assessment of the accuracy of the data has been propagated into estimates of financial inequities (bias) in the custody transfer of LNG. Part II. The prediction of LNG densities--R. D. McCarty. Several mathematical models for the calculation of LNG densities for custody transfer have been optimized, tested and compared. An assessment of the accuracy of the resulting models is given. The models optimized and tested include an extended corresponding states method, a hard sphere model, a cell model and an empirical model due to Klosek and McKinley. The extent to which the objective of predicting LNG densities within 0.1% of the true value from an input of pressure, temperature and composition has been achieved is discussed.

703,141
PB-282 904/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Channel for the Formation of Hydrogen Cyanide In CH2-N2 Systems.
Final rept.,
A. H. Laufer, and A. M. Bass. 1978, 4p
Pub. in Combustion and Flame, v32 p215-218 1978.

Keywords: *Hydrogen cyanide, *Photolysis, Reaction kinetics, Reprints.

Hydrogen cyanide has been observed as a product from the photolysis of the CH2CO-N2 and CH2N2 systems. The rate constant for the reaction of CH2(chi sup 3) (B sub 1) with N2 has been determined to be 10 to the - 16th power cc/molecule/S. A time history of the HCN production has been obtained and a hypothesis is advanced to explain its production.

703,142
PB-282 906/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Brief History of the International Committee on Rheology.
Final rept.,
R. S. Marvin. 1976, 6p
Pub. in Proceedings of International Congress on Rheology (7th), Gothenburg, Sweden 23-27 Aug 76 p31-36 1976. (Swedish Society of Rheology, Chalmers Univ. of Technology, Gothenburg, Sweden. Dept. of Polymeric Materials. S-402-20).

Keywords: *Rheology, Reprints.

The formal recognition of rheology as a separate branch of science occurred in 1929 with the formation of the Society of Rheology in the United States. During the next eleven years rheological activities continued to grow, and new organizations were formed in Holland and in Great Britain. Immediately after the Second World War the International Council of Scientific Unions formed a Joint Committee on Rheology which evolved in 1953 into our present International Committee on Rheology. At the same time rheologists in Holland and Great Britain initiated the series of International Congresses which has continued to the present. The International Committee has now grown to include eleven member organizations and has been granted affiliate status by the International Unions of Pure and Applied Chemistry and of Theoretical and Applied Mechanics.

703,143
PB-282 907/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Monte Carlo Procedure Employing Single and Multiple Scattering.
Final rept.,
D. E. Newbury, R. L. Myklebust, and K. F. J. Heinrich. Aug 77, 7p
Pub. in Proceedings of International Conference X-ray Optical Microanalysis (8th) and Annual Conference Microbeam Analysis Society, Boston, Mass. (12th) 18-24 Aug 77 p27A-27G Aug 77.

Keywords: *Electron scattering, Monte Carlo method, Numerical analysis, Elastic scattering, Procedures.

A Monte Carlo procedure for the calculation of electron trajectories in solid specimens with incident beam energies in the range 1-50 keV is described. The procedure employs a detailed single-scattering description of elastic scattering for the initial five percent of the energy loss and then calculates the remainder of the trajectory with a multiple-scattering approximation. This hybrid model realizes a savings of a factor of ten in time spent per trajectory calculation while achieving a good description of the electron interaction. The energy distribution of the backscattered electrons calculated by the hybrid model is more accurate than the distribution determined when the multiple-scattering model is employed exclusively.

703,144
PB-282 913/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurements of the Triple-Differential Cross Section for Low-Energy Electron-Impact Ionization of Helium.
Final rept.,
E. C. Beaty, K. H. Hesselbacher. S. P. Hong, and J. H. Moore. May 78, 8p
Pub. in Phys. Rev. A 17, n5 p1592-1599 May 1978.

Keywords: *Helium, *Gas ionization, Electron irradiation, Cross sections, Electron energy, *Electron molecule interactions, Reprints.

The triple-differential cross section for ionization of helium by low energy electron impact is investigated over the energy and angular variables. Measurements have been made for primary electron energies near 100 eV, ejected electron energies of 5, 10, 20 eV and scattering angles 15 degrees, 20 degrees, and 30 degrees. The forward lobe of the triple-differential cross section is found to be approximately cylindrically symmetric.

703,145
PB-282 922/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Polarization Dependence in Three-Level Atom Resonance Fluorescence.
Final rept.,
R. Kornblith, and J. H. Eberly. 1978, 12p
Sponsored in part by Department of Energy, Washington, D.C.
Pub. in Jnl. of Physics B, v11 n9 p1545-1556 1978.

Keywords: *Fluorescence, Atomic energy levels, Excitation, Resonance, *Laser induced fluorescence, Resonance fluorescence technique, Reprints.

The resonance fluorescence from a three-level atom irradiated by a monochromatic laser is studied. Detailed spectra are calculated by using the Heisenberg source-field approach, and introducing Liouvillian space techniques. It is predicted that in the steady state limit, the fluorescence from an atom having two closely spaced excited states will have an anisotropically polarized seven-line spectrum. Graphs are shown of the predicted spectrum in the case of on-resonance excitation and of far off-resonance excitation.

703,146
PB-282 935/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electronic Green's Function for a Linear Crystal in a Thermal Gradient.
Final rept.,
W. L. Greer, and J. W. Haus. 1 May 78, 6p
Pub. in Jnl. Chem. Phys., v68 n9 p4238-4243 1 May 78.

Keywords: *Green's function, Electron transitions, Crystal structure, Excitons, Thermal conductivity, Mathematical analysis, Reprints.

By using a modification to Lloyd's exactly solvable model (P. Lloyd, J. Phys. C 2, 1717 (1969), the authors have evaluated exactly the configuration-averaged Green's function for an electron (or exciton) in a one-dimensional crystal subjected to a thermal gradient. The authors formalism is applied both to a continuous lattice in which the otherwise free electron experiences a randomly fluctuating potential at all points in the crystal, and to the discrete lattice in which the thermal fluctuations are confined to specified sites. The thermal gradient is incorporated by requiring that the root mean square potential fluctuation varies linearly with position. The authors compare the spectral density A(k,omega) so obtained with that appropriate to thermal equilibrium. Comments on transport properties are also included.

703,147
PB-282 936/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
X-Ray Photoemission Studies and Bonding in Amorphous Chalcogens.
Final rept.,
G. B. Fisher, and R. B. Shalvoy. 1976, 5p
Pub. in AIP Conference Proceedings No. 31 on Structure and Excitations of Amorphous Solids, Held at Williamsburg, Va. on March 25-27, 1976, p48-52.

Keywords: *Chemical bonds, Photoelectric emission, Atomic energy levels, Sulfur, Selenium, Telurium, Trends, *X ray photoelectron spectroscopy, *Chalcogens.

Trends in x-ray photoelectron (XPS) spectra of chalcogens which relate to their bonding are discussed. Valence band spectra of disordered S are reported along with measurements in the same apparatus of amorphous Se and Te. Each chalcogen's spectrum has a minimum about 7 eV below E sub F, between the largely p-derived states nearer E sub F and the s-derived states. The p states are split into a largely nonbonding level near E sub F and a bonding peak an energy delta E sub P below it. The splitting delta E sub P grows with decreasing atomic number, Z, and is found to scale with Pauling's bond energies. The s states exhibit an apparent bonding-antibonding splitting, delta E sub S, which also grows with decreasing Z and scales with the increasing overlap of the s orbitals. Although the s states overlap, comparisons with calculated valence levels in the free atom suggest that most of the cohesive energy in the chalcogens is gained by

the bonding of the p electrons, with no major contribution from the s electrons.

703,148
PB-283 487/7 PC **A05**/MF **A01**
National Standard Reference Data System.
Compilation of Rate Constants for the Reactions of Metal Ions in Unusual Valency States,
G. V. Buxton, and R. M. Sellers. cJun 78, 83p
NSRDS-NBS-62
Prepared in cooperation with Cookridge Radiation Research Centre, Leeds (England). Library of Congress Catalog Card no. 78-816.

Keywords: *Reaction kinetics, Metals, Ions, Radiolysis, Photolysis, *Metal ions.

Kinetic data have been compiled for reactions of uncommon oxidation states of metals which are produced by radiolysis of aqueous solutions of metal ions. Most of the reaction rates are for transient species, and the rates were determined by pulse radiolysis; some data were obtained by flash photolysis and gamma radiolysis. Metal ions from Groups IB, IIB, IIIA, IVA, VIB, VIIB, VIIIB, and the lanthanides are included in the compilation. Copyright (c) 1978 by the Secretary of Commerce.

703,149
PB-283 538/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Absorption Spectrum of Water Vapour in the Region of 23 cm(-1) at Low Temperatures.
Final rept.,
R. A. Bohlander, H. A. Gebbie, and G. W. F. Pardoe. 10 Oct 70, 2p
Pub. in Nature, v228 p156-157, 10 Oct 70.

Keywords: *Water vapor, *Infrared spectroscopy, Absorption spectra, Reprints.

New atmospheric and laboratory measurements have given further evidence for the existence of water dimers in the atmosphere.

703,150
PB-283 540/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of the Dielectric Relaxation Time in a Debye Binary Liquid by Pulse Measurements.
Final rept.
R. P. Bagozzi, W. R. Ives, and N. S. Nahman. 1971, 9p
Pub. in Proceedings of General Assembly of the International Union of Radio Science (16th)(URSI), Ottawa, Canada, Aug 69, Paper in Progress in Radio Science 1966-69, v2 p257-265 (International Union of Radio Science, Brussels, Belgium) 1971.

Keywords: *Dielectric properties, *Heptane, Solutions, Binary systems(Materials), Relaxation time, Transmission lines, *Heptanone, *Dielectric relaxation, Debye theory.

The dispersive properties of a lossy coaxial transmission line were used to deduce the Debye relaxation time for dilute solutions of (polar) 2-heptanone in (nonpolar) normal heptane. The step responses of a liquid filled coaxial line were measured and compared with the Debye model in order to deduce the relaxation time tau. Over the concentration range of 0.1 to 1.1 molal, 1 kHz capacitance measurements showed that the static dielectric constant varied linearly with increasing concentration from 1.98 to 2.54; also, the deduced relaxation time varied from 1.36 to 5.4 picoseconds.

703,151
PB-283 543/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermal Diffusivity of Methane in the Critical Region.
Final rept.,
B. J. Ackerson, and H. J. M. Hanley. 1 Feb 78, 3p
Pub. in Chemical Physics Letters, v53 n3 p596-598, 1 Feb 78.

Keywords: *Methane, *Critical point, *Thermal diffusivity, Thermodynamic properties, Rayleigh scattering, Light scattering, Reprints.

Rayleigh light scattering results for the thermal diffusivity of methane along the critical isochore at temperatures to within 0.001 K of the critical temperature are reported. The results, corrected to zero wave vector are compared with values from an expression introduced previously. Agreement is within 10%. Some possible reasons for this discrepancy are given.

703,152
PB-283 812/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comment on Volume-Corrected Isomer Shifts of Transition-Metal Impurities.
Final rept.,
R. E. Watson, and L. H. Bennett. 1 May 78, 4p
Sponsored in part by Energy Research and Development Administration, Washington, D.C., and Brookhaven National Lab., Upton, N.Y.
Pub. in Physical Review B 17, n9 p3714-3717, 1 May 78.

Keywords: *Transition metals, Isomers, Mossbauer effect, Reprints, *Isomer shifts.

Using newly-available Mossbauer isomer-shift data, it is found that a universal curve still can describe all the results for transition metal impurities in all hosts for which data are available.

703,153
PB-283 813/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of HgXe Excimer Potentials.
Final rept.,
L. K. Lam, A. Gallagher, and R. Drullinger. 15 May 78, 6p
Pub. in Jnl. of Chemical Physics 68, n10 p4411-4416, 15 May 78.

Keywords: *Excimers, Potential energy, Molecular energy levels, Excitation, Fluorescence, Reprints, *Mercury xenon.

The HgXe excimer band at 270 nm has been studied in fluorescence following optical excitation of the Hg 3P singlet level. From the temperature dependence of the normalized fluorescence band shape, the potential curves of the 3O(+) excimer state and the 1O(+) ground state are inferred. A binding energy of 1400 + or - 100/cm is found for the 3O(+) state.

703,154
PB-283 814/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stabilization of Reaction Intermediates in an Argon Matrix in Discharge Sampling Experiments.
Final rept.,
M. E. Jacox. 1978, 2p
Pub. in Berichte der Bunsengesellschaft fuer Physikalische Chemie (West Germany) 82, p12-13 1978.

Keywords: *Free radicals, *Ions, Halohydrocarbons, Argon, Infrared spectroscopy, Solidified gases, Chemical reactions, Reprints, *Matrix isolation techniques.

A discharge configuration suitable for the trapping of free radicals and molecular ions in an argon matrix is described, and processes which occur in these experiments are characterized. Infrared spectral data are reported for CF2Cl+ and CF2Br+.

703,155
PB-283 841/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Double Monochromator Systems for the Study of Multiple Vacancy Processes.
Final rept.,
R. D. Deslattes, R. E. LaVilla, and A. Henins. 1978, 5p
Pub. in Nucl. Instrum. Methods 152 p179-183 1978.

Keywords: *X ray spectra, *X ray fluorescence, *X ray monochromators, Excitation, Reprints.

In order to study fluorescent X-ray spectra under tunable excitation, the authors installed two double monochromator systems at the Stanford storage ring. Characteristics of these systems and results obtained during two experimental periods are described.

703,156
PB-283 844/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quantitative Analysis for Hydrogen with a Microwave Plasma Detector.
Final rept.,
F. P. Schwarz. Jun 78, 4p
Pub. in Anal. Chem., v50 n7 p1006-1009 Jun 78.

Keywords: *Hydrogen, *Chemical analysis, Visible spectrum, Concentration(Composition), Deuterium, Plasmas(Physics), Microwave spectra, Reprints.

Effuent hydrocarbons from a chromatographic column have been analyzed spectroscopically for elemental hydrogen composition. A low pressure microwave discharge through the carrier gas, with added trace amounts of molecular oxygen, resulted in fragmentation of the hydrocarbon and generation of intense atomic hydrogen emission in the visible spectrum. The emission intensity exhibits a 1.5 + or - 0.1 power dependence on the atomic hydrogen concentration independent of plasma pressure, carrier gas, oxygen concentration, and hydrocarbon composition. At the measurement conditions of 0.5 to 1.5 percent oxygen concentration in helium carrier gas and a plasma pressure of 5 torr, the microwave plasma detector covered a concentration range of almost three orders of magnitude with a minimum detectable level of 10 to the -11th power gm/sec. An octane vapor in hulium mixture was isotopically diluted with perdeuterated octane and analyzed at 6562.8 A for hydrogen composition and at 6561.0 A for deuterium composition.

703,157
PB-283 846/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Strength Functions for Isobaric Analog Resonances.
Final rept.,
W. M. MacDonald. 17 Apr 78, 5p
Sponsored in part by Maryland Univ., College Park. Computer Science Center.
Pub. in Phys. Rev. Lett., v40 n16 p1066-1070, 17 Apr 78.

Keywords: *Line width, Pressure, *Strength functions, *Analog resonances, Reprints.

A new strength function continuous in energy and a smoothing parameter is constructed which arbitrarily closely approximates the discontinuous strength function for line broadening defined by A. M. Lane. The functional form of the Lane strength function is then derived for a fragmented isobaric analog resonance. Its non-Lorentzian form is explicitly and qualitatively different from that assumed in a recent analysis of isobaric analog resonances.

703,158
PB-283 853/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Experimental Studies of Mercury Excimers in a Constricted Positive Column.
Final rept.,
E. R. Mosburg, and M. D. Wilke. 1977, 6p
Pub. in Proceedings of Annual Summer Colloq. on Electronic Transition Lasers (3rd), Snowmass Village, Colorado, 7-10 Sep 76, Paper in Electronic Transition Lasers, v2 p224-229 (MIT Press, Cambridge, Mass.) 1977.

Keywords: *Mercury, *Lasers, Excitation, Mathematical models, Reaction kinetics, Dissociation, Electron beams, Density(Mass/volume), *Excimer lasers, Electron electron interactions.

Current efforts to produce a dissociation laser based on excited dimers such as Hg2 rely heavily on high power, pulsed excitation such as that provided by electron beam machines. It is clear that a better knowledge of the excimer production and loss mechanisms and their rate coefficients is badly needed. In particular, information about the destruction of excimers in electron collisions is lacking. For this reason a high density (N approximately equal to 10 + to the 18th power to 10 to the 19th power/cc) constricted positive column discharge 1 approximately 30 to 400 Ma in pure mercury vapor has been studied using fractional absorption measurement techniques as well as absolute emission measurements in order to establish the approximate densities and spacial profiles of the major atomic and molecular species. At certain pressures and currents the spacial profiles of the 335 nm dimer band emission exhibit very distinctive shapes which can provide information about the reactions involved. Using a simple model for the excimer production and loss mechanisms which includes dimer to trimer conversion and subsequent loss of trimers, these shapes can be semiquantitatively reproduced by proper adjustment of three parameters from the model such a fit is not possible. In this manner a new technique emerges in which the observed spacial profiles, independent of any amplitude or density measurements can be made to provide information about the excimer production and loss mechanisms and their rates.

703,159
PB-283 855/5 Not available NTIS

National Bureau of Standards, Gaithersburg, MD.
Assignment of the Hydrocarbon Flame Bands. The C-X Transition of HCO.
Final rept.,
M. E. Jacox. 15 May 78, 4p
Pub. in Chemical Physics Letters, v56 n1 p43-46, 15 May 78.

Keywords: *Formaldehyde, Ultraviolet spectroscopy, Hydrocarbons, Absorption, Argon, *Matrix isolation techniques, *Flame spectroscopy, Reprints.

The analysis previously offered for the absorption counterpart of the hydrocarbon flame bands of HCO, observed in an argon matrix at 14 K, has been extended, providing supporting evidence for the identification of the C-X transition of HCO. The absorption bands can be fitted to the relationship nu(1/cm)=41280 + 1200 nu'(3). Most of the previously unassigned, diffuse B bands of the flame spectrum can also be assigned to this transition, with nu'(1)=1 and an extended progression in the ground-state CO stretching vibration.

703,160

PB-283 981/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Flow-Induced Desorption for He-CO, He-N2O and He-N2 Systems.
Final rept.,
W. G. Steward, R. O. Voth, J. Hord, C. F. Sindt, and J. M. Arvidson. 1976, 11p AFWL/LRL-75-177
Pub. in Proceedings of Conference on Two Phase Flow and Cavitation in Power Generation Systems, Grenoble, France 30 Mar-2 Apr 76 p255-265 (Societe Hydrotechnique de France, Grenoble, France) 1976.

Keywords: *Desorption, *Absorption, *Carbon monoxide, *Nitrogen, *Nitrogen oxide(N2O), Flow rate, Phases, Chemical equilibrium.

The effects on flow of the liquids CO, N2O and N2 due to helium absorption and subsequent flow-induced desorption were investigated experimentally. Friction losses attributable to helium desorption in long channels proved to be negligible both in experimental measurements and in calculations based on assumed equilibrium of liquid and gas. The assumption of phase equilibrium led to gross miscalculations of flows in cavitating or near cavitating nozzles or venturis, actual flow rates being fifty times the theoretical equilibrium choking flow rates. However, definite mass flow rate reductions due to helium desorption were measured in venturi flows, ranging from four percent for nitrogen to twelve percent for nitrous oxide.

703,161

PB-283 989/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theoretical Simulation of Beam-Foil Decay Curves for Resonance Transitions of Heavy Ions.
Final rept.,
S. M. Younger, and W. L. Wiese. Jun 78, 12p
Sponsored in part by Department of Energy, Washington, D.C.
Pub. in Physical Review A17, n6 p1944-1955, Jun 78.

Keywords: *Ions, *Atomic energy levels, Excitation, Copper, Isoelectronic sequence, Reprints, *Beam foil excitation.

A systematic study of the influence of cascades on heavy-ion beam-foil decay curves has been made. Using theoretical data for the lifetimes and initial populations of excited states, decay curves simulating beam-foil excitation conditions have been constructed for the resonance transition of three ions in the copper isoelectronic sequence. Various models for the initial population distribution were tested by comparison with a detailed beam-foil decay curve available for KrVIII. We found that customary exponential-fitting methods were not able to extract the primary lifetimes from the simulated curves used in constructing them, although the replenishment ratios were close to zero. General implications of this subtle masking of the primary lifetime by numerous cascades for the accuracy of experimental beam-foil data are discussed, especially for delta n = 0 transitions in heavy ions.

703,162

PB-283 996/7 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards. Volume 83, Number 2, March-April 1978.
Bi-monthly pub.
1978, 115p
See also Volume 83, No. 1, PB-281 311.

Keywords: *Physical chemistry, Aluminum oxide, Viscosity, Mathematical models, Lasers, Dissociation, Ethylene, Thermodynamics, Phase transformation, Ruby, Light scattering, Osmometers, Molecular weights, Titanium, Standards, Electron paramagnetic resonance, Polymers, Density(Mass/volume), Polyethylene, Standard reference materials.

Contents:
- TEA laser induced multiphoton dissociation of ethylene in a collisional regime, Model and experiment;
- Thermodynamic study of the alpha goes to beta phase transformation in titanium by a pulse heating method;
- An intensity standard for electron paramagnetic resonance using chromium-doped corundum (Al2O3-Cr(+3));
- Behavior of an isolated polymer chain residing in a density gradient of segments;
- The characterization of linear polyethylene SRM's 1482, 1483, and 1484. I. Introduction;
- The characterization of linear polyethylene SRM's 1482, 1483, and 1484. II. Number-average molecular weights by membrane osmometry;
- The characterization of linear polyethylene SRM's 1482, 1483, and 1484. III. Weight-average molecular weights by light scattering;
- The characterization of linear polyethylene SRM's 1482, 1483, and 1484. IV. Limiting viscosity numbers by capillary viscometry.

703,163

PB-284 121/1 PC **A04**/MF **A01**
Keio Univ., Yokohama (Japan). Dept. of Mechanical Engineering.
Data Survey on the Equilibrium Properties of Ordinary Water Substance,
K. Watanabe, and M. Uematsu. 1974, 55p NBS-GCR-78-132
Sponsored in part by International Association for the Properties of Steam.

Keywords: *Water, *Thermodynamic properties, *Surveys, *Chemical equilibrium, Pressure, Critical point, Enthalpy, Specific heat, Joule-Thomson effect, Acoustic velocity, Isobars(Pressure), Heavy water, Volume, Temperature, PVT properties.

This paper contains a compilation of the references available in the literature for the PVT properties, saturation pressure, critical parameters, specific enthalpy, isobaric specific heat capacity, Joule-Thomson coefficient, and acoustic velocity of ordinary water substance. The available data sets in the literature are discussed in terms of range of coverage and author's stated uncertainty and are compared with one another and with four comprehensive formulations for the properties of water.

703,164

PB-284 250/8 PC **A02**/MF **A01**
Karlsruhe Univ. (West Germany). Inst. fuer Physikalische Chemie und Elektrochemie.
Survey on Experimental PVT Data for Water in the Pressure Range Between 1 and 10 kbar,
K. Toedheide, and R. Hilbert. 4 Apr 75, 10p NBS-GCR-78-133
Sponsored in part by International Association for the Properties of Steam.

Keywords: *Water, *High pressure tests, *Bibliographies, Thermodynamic properties, Tables(Data), Surveys, *PVT properties.

This paper contains a compilation of the references available in the literature for experimental measurements of PVT data for ordinary water between 1 and 10 kbar. Information is given on the temperature and pressure ranges covered, the method used, and the claimed experimental accuracy.

703,165

PB-284 581/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Vapor Pressure, Critical Pressure, and Critical Isochore of Ethylene.
Final rept.,
J. R. Hastings, and J. M. H. L. Sengers. 1977, 13p
Pub. in Proceedings of Symposium on Thermophysical Properties (7th), Gaithersburg, Maryland, 10-12 May 77.

Keywords: *Ethylene, *Vapor pressure, Critical point, Pressure, Temperature, Numerical solutions.

Accurate measurements are reported of the vapor pressure of ethylene (C2H4) from -53.5 C to 9.2 C (Tc) and of the pressure-temperature relation on several near-critical isochores from 9.2 C to 30 C. Values of the critical pressure and temperature are also reported. For two samples of slightly different purity the vapor pressures generally agree to within .0001 MPa (1 millibar). The vapor pressures are in substantial agreement with those recently presented by Douslin and Harrison. The data have been analyzed using various scaled equations including revisions and corrections to scaling. The critical exponent theta characterizing the divergence of sq d P(delta)/d sq T is in the range 0.085-0.125 independent of sample purity, fill density, range of the fit, and scaled equation used. It equals the specific-heat exponent alpha to within combined error and differs from the much higher values recently reported by several authors.

703,166

PB-284 582/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Can Theory Contribute: Transport Properties.
Final rept.,
H. J. M. Hanley. 1977, 14p
Pub. in Proceedings ACS Symp., Held at Pacific Grove, California on January 1977, Paper 17, ACS Symposium Series, p330-343 (American Chemical Society, Washington, D.C. 1977).

Keywords: *Transport properties, Numerical solutions, Mixtures, Fluids, Viscosity, Thermal conductivity.

A very brief outline of theoretical calculations of the transport coefficients is given. A method to predict the viscosity and thermal conductivity coefficients of pure fluids and mixtures is presented.

703,167

PB-284 595/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystal Chemistry and Oxidation-Reduction of Phases in Rare Earth Tantalate-Niobate Systems.
Final rept.,
R. J. Cava, T. Negas, R. S. Roth, H. S. Parker, D. B. Minor, and C. D. Olson. 1978, 7p
Pub. in Proceedings Rare Earth Research Conference (13th), Held at Olgebay, West Virginia on October 16-20, 1977. Paper in The Rare Earths in Modern Science and Technology, p181-187 1978.

Keywords: *Crystal structure, *Oxidation reduction reactions, Phase transformations, X ray diffraction, Solids, Temperature, Rare earth compounds, *Cerium niobium oxides, *Cerium tantalum oxides, Praseodymium tantalum oxides, Lanthanum tantalum oxides.

The data on crystal chemistry and oxidation-reduction phenomena of CeTaO(4+x) and CeNbO(4+x) have been extended. Phase transition temperatures were determined by high temperature x-ray diffraction for LaTaO4, CeTaO4, and PrTaO4 and for solid solutions of PrTaO4-NdTaO4. The oxidation/reduction behavior of CeTaO(4+x) and CeNbO(4+x) was studied.

703,168

PB-284 597/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystal Growth of the Solid Electrolyte (C5H5NH)2Cu5Br7 from the Melt.
Final rept.,
P. M. Skarstad, and H. S. Parker. Jun 78, 5p
Pub. in Jnl. Cryst. Growth 43, n5 p613-617 Jun 78.

Keywords: *Electrolytes, *Crystal growth, Bromine organic compounds, Crystallization, *Copper/bromopyridinio, Reprints.

The solid electrolyte pyridinium cuprous bromide, (C5H5NH)2Cu5Br7, has been found to melt incongruently with no appreciable degradation of the organic component. Single crystals in sizes up to 6 mm in diameter and 25 mm long have been grown by the Bridgman technique from a melt containing excess pyridini-

um bromide. The fastest drop rate at which reasonable quality growth could be maintained was 0.4 mm/h. Two phenomena were observed: (1) the recrystallization into a single crystal of a polycrystalline aggregate layer on the surface of the single crystal; (2) the periodic deposition of small crystals of another phase within a single crystal near the end of the growth field.

703,169
PB-284 626/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comment on Intermolecular Forces in Mixtures of Helium with the Heavier Noble Gases.
Final rept.,
M. J. Hiza, and R. L. Robinson. 15 May 78, 2p
Pub. in Jnl. Chem. Phys., v68 n10 p4768-4769, 15 May 78.

Keywords: *Helium, *Rare gases, *Intermolecular forces, Mixtures, Reprints.

This paper is a comment on the paper 'Intermolecular Forces in Mixtures of Helium with the Heavier Noble Gases.'

703,170
PB-284 633/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cd2* Excimer: Fluorescence Band Shape and Decay Rates.
Final rept.,
R. E. Drullinger, and M. Stock. 1 Jun 78, 2p
Pub. in Jnl. Chem. Phys., v68 n11 p5329-5330, 1 Jun 78.

Keywords: *Cadmium, Gas lasers, Fluorescence, Visible spectrum, Decay, *Excimers, Mercury cadmium lasers, Metal vapor lasers, Reprints.

Recent interest in HgCd as an excimer laser molecule has created a need for better knowledge of the Cd2 excimer. In this Note the authors report the visible fluorescence spectra and discuss its temperature and pressure dependence as well as some preliminary measurements of the decay rate for this fluorescence.

703,171
PB-284 725/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Production of Cl(-):HCl Cluster Ions in HCl-N2 Mixtures.
Final rept.,
R. J. Corbin, K. J. Nygaard, W. R. Snow, and L. D. Schearer. 15 May 78, 3p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, D.C.
Pub. in Jnl. of Chemical Physics 68, n10 p4373-4375, 15 May 78.

Keywords: *Hydrogen chloride, *Nitrogen, Clustering, Reaction kinetics, Mass spectroscopy, Dissociation, *Ion molecule interactions, *Chlorine ions, Reprints.

A drift tube-mass spectrometer apparatus has been used to study the production of Cl(-).HCl cluster molecules in HCl-N2 mixtures. The concentration of HCl was 730 ppm and the total pressure ranged from 0.1 to 5 Torr. The primary ion Cl(-) is produced mainly by dissociative attachment of HCl and is converted to a cluster ion in a three-body collision. The rate of formation of the cluster ions is k(2)=10 to the -25th power cm to the 6th power/sec at E/N=12 Td.

703,172
PB-284 728/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Isotopic Vibration-to-Vibration Energy Transfer.
Final rept.,
A. B. Horwitz, and S. R. Leone. 1977, 7p
Grant NSF-PHY76-04761
Sponsored in part by Petroleum Research Fund, Washington, D.C.
Pub. in Proceedings of Society of the Photo Optical Instrumentation Engineers, Bellingham, Wash., Aug. 14-15, 1977, p114-120.

Keywords: *Molecular vibrations, *Energy transfer, *Hydrogen bromide, *Hydrogen chloride, *Deuterium compounds, Isotope separation, Excitation, Mathematical models, Infrared spectroscopy, Emission spectroscopy.

An isotopically specific transverse discharge chemical laser is used to excite single isotopes of HBr (78-81), DBr (79-81), HCl (35-37), or DCl (35-37). Resonant energy transfer rates between the isotopic species are studied by time resolved infrared emission. Such rates are important for isotope separation schemes using lasers. All of the rates are rapid. Direct comparisons can be made to theoretical models for resonant energy transfer processes.

703,173
PB-284 729/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analytic Approximations in Multi-Level Excitation Theory.
Final rept.,
B. W. Shore, and J. H. Eberly. Jan 78, 2p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Optics Communications 24, n1 p83-84, Jan 78.

Keywords: *Molecular energy levels, *Atomic energy levels, Excitation, Reprints.

The authors discuss applicability of simple single-term analytic approximation formulas, based upon infinite-level excitation sequences, to the description of time-dependent populations of resonantly excited N-level atoms or molecules.

703,174
PB-285 026/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Phase Relationships and Crystal Chemistry of Compounds Containing Cerium Oxide.
Final rept.,
R. S. Roth, T. Negas, H. S. Parker, D. B. Minor, C. D. Olson, and C. Skarda. 1978, 9p
Pub. in Proceedings Rare Earth Research Conf. (13th), Held at Olgebay, West Virginia on October 16-20, 1977. Paper in The Rare Earths in Modern Science and Technology, p163-171 1978.

Keywords: *Cerium compounds, *Phase transformations, Ceramics, Oxides, Tantalates, Niobates, Electrodes, *Cerium niobates, *Cerium tantalates.

The crystal chemistry and oxidation-reduction behavior of CeTaO(4+x) and CeNbO(4+x) suggest that ceramics based on these materials could be exploited as electrodes in high temperature applications. However, these systems are so complex that useful materials could be developed only after considerable modification and control of chemical features. Nevertheless, the Ce(+3) = Ce(+4) couple offers promise for electronic conduction in cerium oxide-based phases provided that a suitable host structure can be found. This paper reviews the efforts underway to develop such a host material from systems containing rare earth oxides, niobium and tantalum oxides and Fe2O3.

703,175
PB-285 030/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Relaxation of the First Excited 1u State of Hg2.
Final rept.,
M. Stock, E. W. Smith, R. E. Drullinger, and M. M. Hessel. 1 May 78, 9p
Pub. in Jnl. Chem. Phys. 68 n9 p4167-4175, 1 May 78.

Keywords: *Mercury(Metal), *Fluorescence, Diatomic molecules, Excitation, Relaxation time, Molecular vibration, Reprints, Laser induced fluorescence.

The decay of the 335 nm Hg2 fluorescence band was measured with 1 nsec time resolution for the first 200 nsec following optical excitation by a 10 nsec laser pulse. Measurements of the decay rates for various wavelengths in this band can be used to analyze the relaxation of the vibrational levels in the 1(u) state. Collisional relaxation rates and radiative transition rates were derived from several different wavelengths. Since there are no mercury trimers formed at these early times, the 485 nm fluorescence band is not present. It was therefore possible to evaluate the repulsive wall of the 1(u) potential curve for small internuclear distances corresponding to wavelengths in the red wing of the 335 nm band which are normally overlapped by the 485 nm band.

703,176
PB-285 043/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Magnetic Resonance (LMR) Spectroscopy of Gaseous Free Radicals.
Final rept.,
P. B. Davies, and K. M. Evenson. 1975, 12p
Pub. in Proceedings Int. Cong. on Laser Spectroscopy (2nd), Held at Megeve, France, on June 23-27, 1975 p132-143.

Keywords: *Magnetic resonance, *Free radicals, Gases, Sensitivity, Spectrometers, *Laser magnetic resonance.

A short review of laser magnetic resonance (LMR) techniques and a short discussion of some of the free radicals observed by LMR techniques is presented. Also discussed for the first time is the sensitivity of the LMR spectrometer in relation to the experimental parameters.

703,177
PB-285 051/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Observations on the Sequential Simplex Method and Its Application to Peak Fitting in Energy-Dispersive X-Ray Spectrometry.
Final rept.,
C. E. Fiori, and R. L. Myklebust. Jun 78, 6p
Pub. in Proceedings Annual Conf. Microbeam Analysis Society (13th), Held at Ann Arbor, Michigan on June 19-23, 1978, p52A-52F.

Keywords: *X ray spectroscopy, Curve fitting, Electron microscopy, Electron probes, Microprobe analysis, Scanning electron microscopy.

A method is described for the fitting of Gaussian profiles to the pulse-height distributions of overlapping X-ray peaks measured with an energy-dispersive detector. The desired result is the determination of areas under individual X-ray peaks in a spectrum in which the peaks overlap. A sequential simplex procedure for selection of the parameters in a mathematical expression which describes a spectral peak, as suggested by Spendly, et.al, is employed. Starting and Stopping criteria for the procedure are discussed, a computer program is outlined, and examples of the method applied to peaks obtained from a lithium-drifted silicon detector are provided.

703,178
PB-285 140/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Opto-Galvanic Spectroscopy of a Neon Discharge: Mechanism Studies.
Final rept.,
K. C. Smyth, and P. K. Schenck. 1 May 78, 7p
Pub. in Chem. Phys. Lett., v55 n3 p466-472, 1 May 78.

Keywords: *Neon, *Gas ionization, Gas discharges, Electric potential, Electron transitions, Glow discharges, Atomic energy levels, Reprints, Laser induced ionization, *Photoionization.

Irradiation of gaseous discharges with a tunable laser produces easily observed voltage changes at wavelengths which correspond to electronic transitions for species in the discharge. This work reports observations made in the 572-654 nm region on a neon glow discharge, which is operated at 5 torr (670 Pa) pressure and 2-25 mA current. A wide variety of absorption transitions have been detected which originate in the 1s(n) (triplet P (2, 1, 0), singlet P (1)) and 2p(n) excited states. The resulting voltage signals are both positive and negative, and some transitions exhibit sign changes as a function of discharge current. Some of the results can be interpreted in terms of processes which directly affect the neon metastable atom concentration (triplet P(2), triplet P(0)) and thus ionization in the discharge, in agreement with previous suggestions. Transitions which originate in radiating electronic states also produce voltage changes which can be explained in terms of processes which either enhance or decrease ionization.

703,179
PB-285 141/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photon-Induced Ionization Changes in a Neon Discharge.
Final rept.,
K. C. Smyth, R. A. Keller, and F. F. Crim. 1 May 78, 5p
Pub. in Chem. Phys. Lett., v55 n3 p473-477, 1 May 78.

Keywords: *Neon, *Gas ionization, Gas discharges, Electron transitions, Electric potential, Glow discharges, Reprints, *Photoionization, Laser induced ionization.

Photon-induced voltage changes occur upon irradiation of a gaseous discharge with a tunable dye laser whose wavelength corresponds to an electronic transition of an atomic species in the discharge. The impor-

tant, and likely dominant, role of ionization changes in producing these voltage changes is demonstrated directly for the first time using a hollow cathode lamp with neon fill gas coupled to a mass spectrometer. Changes in the Ne(+) concentration are found to correlate with the observed changes in voltage across the discharge when a number of excited state absorption transitions of neutral neon are irradiated.

703,180
PB-285 146/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Isotopic Fractionation Model for the Multiple Filament Thermal Ion Source.
Final rept.,
L. J. Moore, E. F. Heald, and J. J. Filliben. 1978, 27p
Pub. in Proceedings Int. Mass Spectrometry Conf., (7th), Florence, Italy, Aug 30-Sep 3, 1976), Paper in Advances in Mass Spectrometry, v7A p448-474 1978.

Keywords: *Mass spectroscopy, *Isotopes, Accuracy, Ratios, Thermal ionization, Multiple filaments.

Particularly within the last decade, the precise and accurate measurement of stable isotope ratios by thermal ionization mass spectrometry has become well established. With the proper analytical system it is possible to attain a precision of less than one part in 10,000 for selected elements. The technique has therefore become widely used is isotopic geochronology, high-accuracy isotopic dilution analyses, and the analysis of nuclear fuels and their by-products. It is well known that the isotopic ratio observed in thermal ionization mass spectrometry is 'fractionated'. That is, it changes during analysis and is not the same as the actual isotopic ratio of the sample on the filament. Corrections for fraction can be made, and are usually based on the analysis of known mixtures of individual isotopes. However, isotopic fractionation still limits the accuracy of many isotopic analyses. There have been a few systematic studies of isotopic fractionation, mostly limited to the single filament source. The widely used multiple filament thermal ionization source (MFTIS), which provides efficient ionization of the sample under relatively gentle vaporization conditions, has not received much attention. This paper concentrates on isotopic fractionation in the MFTIS. A refined theoretical model for fractionation in the MFTIS is developed and treated against some of the most accurate isotopic ratio data available. As well as explaining a variety of seemingly anomalous fractionation effects, the theory indicated a number of ways fractionation can be controlled or minimized.

703,181
PB-285 149/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Frame Transformation Relations and Multipole Transitions in Symmetric Polyatomic Molecules.
Final rept.,
W. G. Harter, C. W. Patterson, and F. J. da Paixao. Jan 78, 48p
Pub. in Rev. Mod. Phys., v50 n1 pt1 p37-84 Jan 78.

Keywords: *Electron transitions, *Molecular energy levels, Coriolis effect, Molecular vibration, Reprints, Born-Oppenheimer approximations, Selection rules.

The theory of transformation relations between states of Born Oppenheimer and weak coupling approximations is developed for polyatomic molecules. The relations are a generalization of frame transformation relations used by Chang and Fano for symmetric-top molecules, and they lead to a more convenient symmetry labeling system than was previously available. A key internal symmetry label (named soul) is defined so that it remains a constant label for frame transformation relations, and is conserved during vibronic transitions, ionization, and even dissociation provided the nuclear spin-rotation interaction is relatively small. Various nomograms, graphs, and tableaus associated with the soul label make it easy to predict and visualize the form of many types of complex high-resolution spectra. Simplified procedures are given for obtaining selection rules, statistical weights, and matrix elements of multipole operators for common molecules having various point symmetries. Simplifications of computational theory using the new level cluster bases for high J are discussed.

703,182
PB-285 156/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effects of Multiperturber Interactions on the Sodium-Rare Gas Excimer Bands.
Final rept.,
W. P. West, P. Shuker, and A. Gallagher. 15 Apr 78, 14p
Contract N00014-76-C-0123
Sponsored in part by Air Force Weapons Lab., Kirtland AFB, N. Mex. and Defense Advanced Research Projects Agency, Arlington, Va.
Pub. in Jnl. Chem. Phys., v68 n8 p3864-3877, 15 Apr 78.

Keywords: *Sodium, *Fluorescence, Line width, Interactions, Atoms, Reprints, *Excimers, Line broadening, Collision broadening.

The extreme wing (600 < lambda < 820 nm) of the sodium D lines perturbed by xenon and krypton has been measured in fluorescence at perturber densities between 2x10 to the 19th power and 3x10 to the 20th power cu/cm. At these perturber densities the observed fluorescence results mostly from the NaXe*(NaKr*) molecule in the wavelength range of 600 < lamba < 720 nm (600 < lambda < 680 nm) and from the NaXe2*(NaKr2*) molecule in the range 740 < lambda < 820 nm (700 < lambda 820 nm). The fluorescence emission coefficient is obtained in normalized units, allowing quantitative comparison to theory. The quasistatic line-broadening theory, including multiple-perturber interactions, is used to calculate the density dependence of the spectra which would result from trimer potential surfaces given by scalarly additive pair interactions. This approximation explains some of the observations; discrepancies between this model and the experimental results are discussed.

703,183
PB-285 219/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cross Sections for the Photoionization of H2(X singlet Sigma(+)(g), V(i) = 0-14) with the formation of H2(+)(X doublet Sigma(g)(+), V(f) = 0-18), and Vibrational Over-Laps and R sup n-Centroids for the Associated Vibrational Transitions.
Final rept.,
M. R. Flannery, H. Tai, and D. L. Albritton. Dec 77, 23p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Jnl. Atomic Data and Nucl. Data Tables, v20 n6 p563-585, Dec 77.

Keywords: *Hydrogen, *Gas ionization, Molecular energy levels, Cross sections, *Photoionization cross sections, Reprints.

Cross sections for the photoionization of H2(X singlet Sigma (+)(g)), initially in vibrational levels v(i)=0-14, with the production of H2(+) (X doublet Sigma (+)(g)) in vibrational levels v(f)=0-18 are tabulated for the full Franck-Condon array at 24 photon wavelengths ranging from 912 A to 450 A. The associated Franck-Condon factors <V(i)/V(f)> and R-Centroids are also presented together with accurate curve fits of the bound-free (H2-H2(+)e) electronic matrix elements.

703,184
PB-285 220/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Alkali Negative Ion. III. Multichannel Photodetachment Study of Cs(-) and K(-).
Final rept.,
J. Slater, F. H. Read, S. E. Novick, and W. C. Lineberger. Jan 78, 13p
Grant NSF-PHY76-04761
Pub. in Jnl. Phys. Rev., vA17 n1 p201-213, Jan 78.

Keywords: *Potassium, Ions, Cross sections, Gas ionization, Reprints, *Photodetachment, Photoionization cross sections.

A crossed ion-laser beam apparatus has been used to obtain Cs(-) and K(-) cross sections for photodetachment into the ground (doublet S) and first excited state (doublet P) of the neutral atom in the photon energy range near the threshold for production of (doublet P) neutrals. A total cross section is determined from the cross section for production of neutral atoms and the partial cross sections are obtained from the cross section for production of photoelectrons transmitted through a low-pass kinetic energy filter. The filter characteristics are determined empirically and the discrimination between ground and excited state detachment channels is approximately 1000. It is apparent from the data that the detachment channels are strongly coupled in the threshold region, a result attributed to long range forces between the detached electron and the neutral atom. The data are compared to a semiempirical multichannel photodetachment model developed by Lee; the model is quite successful in its prediction of the energy dependent cross section for production of Cs doublet P(1/2, 3/2) from knowledge of the previously measured Cs-total photodetachment cross section.

703,185
PB-285 226/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Moment-Trace Calculations of Atomic and Molecular Photoabsorption Cross Sections.
Final rept.,
P. M. Johnson, P. W. Langhoff, S. V. O'Neil, C. T. Corcoran, and W. P. Reinhardt. 1 Dec 77, 5p
Contract E(49-1)-3800, Grant NSF-CHE74-19605
Sponsored in part by Grant NSF-PHY76-04761.
Pub. in Jnl. Chem. Phys. Lett., v52 n2 p380-384, 1 Dec 77.

Keywords: *Gas ionization, Cross sections, Atoms, Molecules, Reprints, *Photoionization cross sections, *Photoabsorption cross sections.

Regularization procedures employing positive integer spectral power moments are described for calculation of atomic and molecular photoionization cross sections. Use of positive moments avoids matrix diagonalizations, and thus appears to have substantial computational advantages.

703,186
PB-285 304/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Revised and Extended Scaled Equation of State for Steam in the Critical Region.
Final rept.
F. W. Balfour, J. V. Sengers, M. R. Moldover, and J. M. H. L. Sengers. 1977, 8p
Pub. in Proc. Symp. Thermophysical Properties (7th), Gaithersburg, Md., May 10-12, 1977, p786-793, (American Society Mechanical Engineers, New York, N.Y., 1977).

Keywords: *Liquids, *Critical point, Thermodynamics, Potential energy, Equations of state, Steam.

The anomalous thermodynamic behavior of fluids in the vicinity of the critical point can be described in terms of a thermodynamic potential which is analytic everywhere except at the critical point and which incorporates the so-called 'scaling laws.' An example frequently used is the potential that implies a linear model parametric equation of state. In this paper the authors formulate a thermodynamic potential which leads to a 'revised' and 'extended' linear model equation of state. They then use it to analyze experimental PVT data obtained by Rivkin and coworkers in the critical region of steam. The 'revision', in the language of Mermin and Rehr accounts for an asymmetric behavior of the gas and liquid branches of the coexistence curve. It incorporates a coexistence curve diameter which deviates from the critical isochore and thus enables us to increase the range of empirical validity of the scaled equation of state. The 'extension' consists of adding a correction-to-scaling term with a new critical exponent whose presence is predicted by theory.

703,187
PB-285 312/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ac Stark Splitting in Resonant Multiphoton Ionization with Broadband Lasers.
Final rept.,
P. B. Hogan, S. J. Smith, A. T. Georges, and P. Lambropoulos. 24 Jul 78, 4p
Grant NSF-PHY76-04761
Pub. in Jnl. Phys. Rev. Lett., v41 n4 p229-232, 24 Jul 78.

Keywords: *Sodium, *Gas ionization, Electron transitions, Reprints, Line broadening, Rabi splitting.

An intense laser and a probe laser in near resonance with the sodium triplet S(1/2) to triplet P(1/2) and triplet P(1/2) to quadruplet D(3/2) transitions, respectively, produce a three-photon ionization current used to study the broadening and Rabi splitting of the triplet P(1/2) intermediate state as a function of probe-laser tuning. The authors find a narrow, intense-laser detuning region where the peak-heights ratio of the Rabi-split triplet P(1/2) doublet is reversed from that predict-

ed for a monochromatic laser field. This is attributed to the finite (approximate GHz) laser linewidth.

703,188
PB-285 322/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurements of the Triple-Differential Cross Section for Low-Energy Electron-Impact Ionization of Argon.
Final rept.,
S. P. Hong, and E. C. Beaty. Jun 78, 8p
Pub. in Jnl. Phys. Rev., vA 17 n6 p1829-1836, Jun 78.

Keywords: *Argon, *Gas ionization, Electron bombardment, Atoms, Cross sections, Reprints, Atom electron interactions.

The triple differential cross section for electron impact ionization of argon has been investigated for the primary electron energies near 100 eV and scattering angle 15 degrees. The in-plane and out-of-plane measurements show that the forward lobe has a true minimum in the full three dimensional sense when the ejected electron energy is 5 eV. However, such a minimum is not observed when the ejected electron energy is 20 eV. The cross section has much more structure than that of helium. No simple symmetry has been found common to all the cases for argon.

703,189
PB-285 324/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurements of the Viscosity of Compressed Gaseous and Liquid Oxygen.
Final rept.,
W. M. Haynes. 1977, 14p
Pub. in Jnl. Physica, v89A p569-582, 1977.

Keywords: *Liquid oxygen, *Viscosity, Shear properties, Liquefied gases, Accuracy, Measurement, Pressure, Reprints.

The coefficient of shear viscosity of fluid oxygen has been determined at temperatures from 75 to 300K at pressures up to 34MPa with a torsionally oscillating quartz crystal. The estimated accuracy and precision of these measurements are 2% and 0.5%, respectively. Dilute gas viscosities and first-density coefficients were obtained from a statistical analysis of the gaseous isotherms at temperatures from 110 to 300K using expansions in density. An empirical equation that represents the complete set of measurements as a function of density and temperature is presented. Comprehensive comparisons are made with previous experimental data and predicted values.

703,190
PB-285 334/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Bifurcation in Onsager's Model of the Isotropic-Nematic Transition.
Final rept.,
R. F. Kayser, and H. J. Raveche. Jun 78, 6p
Pub. in Phys. Rev., vA17 n6 p2067-2072, Jun 78.

Keywords: *Phase transformations, Eigenvalues, Equations of state, Liquid crystals, Theories, Reprints, Bifurcation, Onsager model, Nematic phase.

In this paper Onsager's theory of the orientational order in three-dimensional system of hard rods is reanalyzed as a nonlinear eigenvalue problem. Bifurcation is found and the equation of state is calculated from the orientational distribution function for a nematic phase. The authors also investigate the corresponding two-dimensional system of hard lines. The existence and order of a phase transition are shown to depend on both the direction of bifurcation and on properties of the global solutions. The analysis can be adapted to other nonlinear equations obtained in theories of liquid crystals.

703,191
PB-285 335/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Collisional Excitation Transfer Between Na and Na2.
Final rept.,
L. K. Lam, T. Fujimoto, and A. C. Gallagher. 15 Apr 78, 9p
Contracts E(49-1)-3800, N00014-76-C-0123
Pub. in Jnl. Chem. Phys., v68 n8 p3353-3561, 15 Apr 78.

Keywords: *Sodium, *Electron transitions, *Fluorescence, Atoms, Diatomic molecules, Relaxation time, Interactions, Quenching(Extinguishing), Energy transfer, Reprints, Laser induced fluorescence.

The authors have excited Na(3s) to Na(3p) with a pulsed dye laser at Na densities of 10 to the 14 to 10 to the 16 power/cu cm with typically approximately 2% Na2. From the decay time constants, intensities and spectra of the Na and Na2 fluorescences we have identified several collisional and radiative processes in the excited sodium atom-dimer system. Comparing the solutions of coupled equations to the density dependence of the decay constants and fluorescence intensities yields a rate coefficient for the excitation transfer process: Na*(3p)+Na2(X singlet sigma) to Na(3s)+Na2*(A singlet sigma and a triplet Pi). This indicates that some kind of long-range interaction is operative. Other rate coefficients are determined less accurately; e.g., nonradiative Na(3p) quenching rate coefficients due to dimer collisions and due to atom collisions are obtained.

703,192
PB-285 337/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Equation of State of Liquid Sodium and Potassium. A Nearly 1st Principles Calculation.
Final rept.,
R. D. Mountain. Jul 78, 4p
Pub. in Proc. Symp. on Thermophysical Properties (7th), Washington, D.C. May 10-12, 1977, p878-881 (The American Society of Mechanical Engineers, New York, N.Y., Jul 78).

Keywords: *Equations of state, *Liquid metals, *Sodium, *Potassium, Monte Carlo method, Pseudopotential theory.

A nearly first principles calculation of the equation of state of liquid sodium and of liquid potassium is presented. The thermodynamic states considered cover that portion of the liquid region characterized by pressures up to 1,000 MPa and by temperatures from melting up to 500 K. The calculations employ the Monte Carlo simulation technique to determine the pressure implied by the pseudopotentials for sodium and potassium developed by Dagens, Rasolt and Taylor. The reliability of the PVT estimates obtained in this way is checked by comparing the theoretical predictions against the recently reported experimental results of Makarenko, et al. The possibility of theoretically determining the high-pressure-high temperature properties of the liquid alkali metals is examined.

703,193
PB-285 338/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Molecular Dynamics of Liquids-Neutrons and Computers.
Final rept.,
R. D. Mountain. 1978, 13p
Pub. in Proc. European Congress on Molecular Spectroscopy (13th), Proctaw, Poland, Sept. 12-16, 1977. Jnl. Mol. Struct., v46 p381-393, 1978.

Keywords: *Liquids, Theories, Dynamics, Molecules, Neutron scattering, Reprints.

The dynamics of liquids has been studied by a variety of techniques; the techniques of neutron scattering and of molecular dynamics (computer simulation) are examined here as complementary methods. While emphasis is placed on monatomic fluids, recent developments for molecular liquids are also considered. The discussion is in terms of generalized hydrodynamics, a theory which makes it possible to identify collective dynamical variables in liquids at the molecular level. This theory is used to provide a unified description of dynamical processes in liquids.

703,194
PB-285 344/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Towards a Molecular Theory of Freezing: The Equation of State and Free Energy from the First BBGKY Equation.
Final rept.,
H. J. Raveche, and R. F. Kayser. 15 Apr 78, 12p
Pub. in Jnl. Chem. Phys., v68 n8 p3632-3643, 15 Apr 78.

Keywords: *Phase transformations, *Freezing, Equations of state, Free energy, Reprints, BBGKY equations, Bifurcation.

The authors determine crystalline solutions of a closed BBGKY equation for the local density in a classical hard sphere system. The inhomogeneous solutions, which bifurcate from the fluid phase, are applied to calculate the equation of state and free energy. A first order phase change is found in two and three dimensions and its existence is shown to depend on the direction of bifurcation and on global properties of the solutions. The results are discussed in terms of the closure.

703,195
PB-285 351/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis of the Decay of Molecular Fluorescence in Optically Excited Mercury Vapor.
Final rept.,
M. Stock, E. W. Smith, R. E. Drullinger, M. M. Hessel, and J. Pourcin. 15 Feb 78, 9p
Contracts E(49-1)-3800, ARPA Order-891
Pub. in Jnl. Chem. Phys., v68 n4 p1785-1793, 15 Feb 78.

Keywords: *Mercury(Metal), *Fluorescence, Electron transitions, Relaxation time, Metal vapors, Diatomic molecules, Reprints, Laser induced fluorescence, Triatomic molecules.

The decay of the 485 and 335 nm molecular fluorescence bands in optically excited mercury vapor is studied. A 10 nsec laser pulse at 256 nm is used to excite the vapor and the subsequent fluorescence intensity between 1 and 2000 microsec was recorded for each band. At late times following the laser pulse, both bands decay at the same exponential rate. This exponential decay coefficient was measured as a function of gas density from 10 to the 17th to 10 to the 19th power/cu cm and as a function of temperature from 473 to 1048K. These decay data, as well as data on the relative intensities of the two bands, are analyzed in terms of a simple kinetic model for the mercury vapor system and various kinetic rates are determined. Some decay rates for the 6 triplet P atomic manifold are also obtained and compared with previous measurements.

703,196
PB-285 353/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Lattice Dynamics of the Deuterium Peroxide Crystal.
Final rept.,
S. F. Trevino, M. K. Farr, P. A. Giguere, and J. L. Arnau. 1 May 78, 6p
Pub. in Jnl. Chem. Phys., v68 n9 p4260-4265, 1 May 78.

Keywords: *Hydrogen peroxide, *Phonons, Crystal lattices, Deuterium compounds, Neutron scattering, Single crystals, *Deuterium peroxide, Lattice dynamics, Reprints.

The phonons propagating along the unique fourfold axis in the D2O2 crystal have been measured by coherent inelastic neutron scattering. The measurements covered all branches below 250/cm (31 meV), which include all the motions of the rigid molecule, except rotation about the minor axis (close to the O-O axis of the molecule). The sample consisted of a single crystal of 99% isotopically pure D2O2 in the form of a cylinder 1.5 cm diam and 4 cm long. Group-theoretical selection rules for the observation of the phonons were calculated and used extensively as an aid in the classification and measurement of the phonons. Agreement with previously observed gamma point modes in infrared absorption and Raman scattering was fairly good, but necessitated reassignment of one E mode. A covalent force model, developed in an attempt to reproduce the observations, was only partly successful. The model served to describe the character of the phonon as librational or translational. It is reasonably consistent with the observed intensities of the phonons. The limit success of the model indicates the need for longer range forces than those described as stretching and bending of hydrogen bonds.

703,197
PB-285 370/3
(Order as PB-281 311/1, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Tubular Flow Reactors with First-Order Kinetics.
R. L. Brown. 19 Sep 77, 8p
Included in Jnl. of Research of the National Bureau of Standards, v83 n1 p1-8, Jan-Feb 78.

Keywords: Reaction kinetics, Chemical reactors, Gas phase, *Flow reactors, Numerical solution.

A method is presented for automatically calculating true first order rate constants for gas phase and wall reactions from experimentally observed decay parameters in tubular flow reactors. It includes the effects of axial and radial diffusion and Poiseuille flow.

703,198

PB-285 372/9

(Order as PB-281 311/1, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
First Spectrum of Ytterbium (YbI).
W. F. Meggers, and J. L. Tech. 15 Sep 77, 59p
Included in Jnl. of Research of the National Bureau of Standards, v83 n1 p13-70, Jan-Feb 78.

Keywords: *Ytterbium, Molecular energy levels, Zeeman effect.

Wavelengths and estimated intensities for 1791 lines of neutral ytterbium in the region 2155 to 31 308 A are reported. The Zeeman effect has been investigated for 249 of these lines. Analysis of the data has resulted in classification of 787 lines as transitions between 102 even and 77 odd levels. Even levels have been assigned to electron configurations. Many odd levels are still unassigned.

703,199

PB-285 385/1

(Order as PB-283 996/7, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
TEA Laser Induced Multiphoton Dissociation of Ethylene in a Collisional Regime: Model and Experiment.
N. C. Peterson, R. G. Manning, and W. Braun. 18 Aug 77, 9p
Contract ERDA-EA-77-A-01-6010
Paper presented at the Physics of Quantum Electronics Winter Colloquium on Laser Induced Chemistry (2nd), held at Park City, UT, on Feb. 13-16, 1977.
Included in Jnl. of Research of the National Bureau of Standards, v83 n2, p 117-126, Mar-Apr 78.

Keywords: *Dissociation, *Ethylene, Mathematical models, Reaction kinetics, Photolysis, Laboratory equipment, *Laser enhanced reactions.

The focused beam of a pulsed CO2 TEA laser was used to photodissociate ethylene gas at total pressures of 100-300 torr. The laser pulse induces molecular hydrogen elimination to yield primarily C2H2 and H2 in a large excess of helium to eliminate heating. An investigation was made of the dependence of product yield on wavelength, inert gas pressure, ethylene pressure and intensity. Photochemical yield was followed over a 10,000 fold range. Its dependence was investigated employing alternate methods of focusing the laser beam, one of which results in a constant volume geometry. A photometric method of characterizing this focal zone is described. A 'structureless' computer model of the laser pumping process involving coupled rate equations and phenomenological absorption and stimulated emission coefficients is described. The model assumes rapid intramolecular energy transfer between the various vibrational modes throughout the entire vibrational manifold, and rapid equilibration of rotational states. The model includes stimulated emission and deactivating collisions, and predicts a product yield versus intensity dependence that does not exhibit threshold behavior in agreement with experiment. Calculated dependences of product yield on laser power for various parameters are given in order to relate the model to various photolysis experiments.

703,200

PB-285 387/7

(Order as PB-283 996/7, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Intensity Standard for Electron Paramagnetic Resonance Using Chromium-Doped Corundum (Al2O3:Cr3+).
T. T. Chang, D. Foster, and A. H. Kahn. 5 Oct 77, 32p
Included in Jnl. of Research of the National Bureau of Standards, v83 n2, p 133-164, Mar-Apr 78.

Keywords: *Electron paramagnetic resonance, Intensity, Standards, Additives, Chromium, Ruby, Surfaces, Comparison, *Standard reference materials.

The authors report on the preparation of a standard reference material (SRM), made of single-crystal chromium-doped corundum (synthetic ruby), for use as an intensity standard in electron paramagnetic resonance (EPR) experiments. The SRM can be used to measure, by comparison, the number of spins in an unknown test sample.

703,201

PB-285 388/5

(Order as PB-283 996/7, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Behavior of an Isolated Polymer Chain Residing in a Density Gradient of Segments.
E. A. DiMarzio, and C. M. Guttman. 29 Nov 77, 3p
Included in Jnl. of Research of the National Bureau of Standards, v83 n2, p 165-168, Mar-Apr 78.

Keywords: *Polymers, Density(Mass/volume), Surfaces, Spatial distribution, Wiener integrals, *Molecular conformations, Numerical solution, Monomers.

The Wiener integral (path integral, functional integral) technique is used to determine the equation describing the probability distribution of a polymer molecule immersed in a non-uniform distribution of monomer units. This result should be useful whenever there is a spatial variation of polymer density, such as at an interface or surface.

703,202

PB-285 389/3

(Order as PB-283 996/7, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Characterization of Linear Polyethylene SRM's 1482, 1483 and 1484. I. Introduction.
P. H. Verdier, and H. L. Wagner. 19 Oct 77, 9p
Included in Jnl. of Research of the National Bureau of Standards, v83 n2, p 169-178, Mar-Apr 78.

Keywords: *Polyethylene, Molecular weight, Viscosity, Standards, *Standard reference materials.

The National Bureau of Standards has issued a series of three linear polyethylene Standard Reference Materials, SRM 1482, 1483, and 1484. These polyethylenes have molecular weights of the order of 10,000, 30,000, and 100,000 g/mol, respectively, and ratios M(w)/M(n) of weight- to number-average molcular weight of the order of 1.2. Their number-average molecular weights (by membrane osmometry), weight-average molecular weights (by light scattering), and limiting viscosity numbers in two solvents (by capillary viscometry) are certified; the procedures employed are described in subsequent papers in this series. In the present paper, the authors describe the preparation of the materials and some of their general properties.

703,203

PB-285 390/1

(Order as PB-283 996/7, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Characterization of Linear Polyethylene SRM's 1482, 1483, and 1484. II. Number-Average Molecular Weights by Membrane Osmometry.
H. L. Wagner, and P. H. Verdier. 19 Oct 77, 6p
Included in Jnl. of Research of the National Bureau of Standards, v83 n2, p 179-184, Mar-Apr 78.

Keywords: *Polyethylene, *Molecular weight, Standards, Osmometers, Membranes, Viscosity, *Standard reference materials.

Linear polyethylene Standard Reference Materials SRM 1482, 1483, and 1484 are certified for number-average molecular weight M(n). In this paper the experimental procedures employed for the determination of M(n) for these materials by membrane osmometry are described, and the techniques used to analyze the data and to estimate limits of systematic error are discussed.

703,204

PB-285 391/9

(Order as PB-283 996/7, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Characterization of Linear Polyethylene SRM's 1482, 1483, and 1484. III. Weight-Average Molecular Weights by Light Scattering.
C. C. Han, P. H. Verdier, and H. L. Wagner. 13 Oct 77, 9p
Included in Jnl. of Research of the National Bureau of Standards, v83 n2, p 185-194, Mar-Apr 78.

Keywords: *Polyethylene, *Molecular weight, Light scattering, Standards, *Standard reference materials.

Linear polyethylene Standard Reference Materials SRM 1482, 1483, and 1484 are certified for weight-average molecular weight M(w). In this paper the experimental procedures employed for the determination of M(w) for these materials by light scattering are described, and the techniques used to analyze the data and to estimate limits of systematic error are discussed.

703,205

PB-285 392/7

(Order as PB-283 996/7, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Characterization of Linear Polyethylene SRM's 1482, 1483, and 1484. IV. Limiting Viscosity Numbers by Capillary Viscometry.
H. L. Wagner, and P. H. Verdier. 19 Oct 78, 37p
Included in Jnl. of Research of the National Bureau of Standards, v83 n2, p 195-202, Mar-Apr 78.

Keywords: *Polyethylene, *Viscosity, Standards, Viscometers, Molecular weight, *Standard reference materials, Benzene/trichloro, Naphthalene/chloro.

Linear polyethylene Standard Reference Materials SRM 1482, 1483, and 1484 are certified for limiting viscosity number in 1,2,4-trichlorobenzene and 1-chloronaphthalene at 130C. In this paper the experimental procedures employed for the determination of limiting viscosity numbers for these materials by capillary viscometry are described, and the techniques used to analyze the data and to estimate limits of systematic error are discussed.

703,206

PB-285 399/2

(Order as PB-285 398/4, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Spectrum and Energy Levels of Triply Ionized Ytterbium.
J. Sugar, V. Kaufman, and N. Spector. 19 Jan 78, 13p
Prepared in cooperation with Soreg Nuclear Research Center, Yavne (Israel).
Included in Jnl. of Research of the National Bureau of Standards, v83 n3 p233-246, May-Jun 78.

Keywords: *Ytterbium, *Spectroscopic analysis, Energy levels, Ionization.

Spectra of Yb IV produced with a low voltage sliding spark discharge were photographed in the range of 700-2200 A with a 10.7 m normal incidence spectrograph. Wavelengths for 944 spectral lines identified as Yb IV were measured. Of these, 535 were classified as transitions between 95 even and 51 odd energy levels of the 4f(13), 4f(12)5d,4f(12)6s, and 4f(12)6p configurations. Values for the interaction parameters were derived by a least squares fit to the known levels.

703,207

PB-285 651/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tellurium Valence-Band X-Ray Spectrum L gamma sub 4 (L1 O2, 3).
Final rept.,
R. E. LaVilla. 1978, 4p
Pub. in Physical Rev. B 18, n2 p644-647, 15 Jul 78.

Keywords: *Tellurium, *X ray spectra, Emission spectra, Valence bands, Reprints.

The profile of the Te L gamma 4 (L1 O2,3) X-ray emission has been obtained and found to differ from previous measurements. Comparison of this valence band X-ray spectrum with recent band calculations and photoemission spectrum are in general agreement. Differences are noted between the observed profile and that expected on the basis of symmetry weighted density of states. This departure is attributed to the quasi-atomic character of the X-ray emission process and demonstrates the limitation to the general practice of obtain-

ing density of states from X-ray emission spectra. An emission line was observed also at 4898.9 + or - .4 eV, which has tentatively been identified as the quadrupole transition Te L1N4,5.

703,208
PB-285 652/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Gas Burner Conditions on Lithium Tetraborate Fusion Preparations for X-Ray Fluorescence Analysis.
Final rept.,
P. A. Pella. 1978, 2p
Pub. in Analytical Chemistry 50, n9 p1380-1381 Aug 78.

Keywords: *X ray analysis, Fluorescence, Burners, Iron, Calcium carbonates, Iron oxides, Lithium inorganic compounds, *X ray fluorescence analysis, *Lithium tetraborate, Reprints.

The effect of gas burner conditions on lithium tetraborate fusion preparations for x-ray fluorescence analysis was studied by varying the propane/air gas mixture fed into the burner. It was observed that in fusing ternary mixtures of CaCO3, Fe2O3, and flux under two different gas burner conditions, the relative differences found in the determination of iron were as large as 20 percent.

703,209
PB-285 653/2 Not available NTIS
National Bureau of Standards, Boulder, CO.
Accurate Rotational Constants, Frequencies, and Wavelengths from 12C16O2 Lasers Stabilized by Saturated Absorption.
Final rept.,
F. R. Petersen, D. G. McDonald, J. D. Cupp, and B. L. Danielson. 1975, 5p
Pub. in Proceedings Laser Spectroscopy Conference, Vail, Colorado, June 25-29, 1973, p555-569 1975.

Keywords: *Molecular rotation, Infrared spectroscopy, Absorption spectra, Carbon dioxide lasers, Laser beams, Josephson junctions, Laser induced fluorescence.

New experimental measurements of the frequency separations of 30 pairs of (12)C(16)O2 laser lines in the 10.4 micrometer band and 26 pairs in the 9.4 micrometer band have been made with lasers stabilized to Lamb-dip-type resonances observed in the 4.3 micrometer fluorescent radiation. The use of a Josephson junction as the frequency mixing element simplified the measurements. Uncertainties in existing rotational constants for the laser vibrational levels were reduced 20 to 30 times and an additional rotational constants, H(v), was determined for the first time. Frequency and wavelength tables with estimated uncertainties are calculated for both bands with the new constants.

703,210
PB-285 887/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evidence for Strongly Temperature-Dependent A Factors in Alkane Decomposition and High Heats of Formation for Alkyl Radicals.
Final rept.,
W. Tsang. 1978, 17p
Pub. in International Jnl. of Kinetics, v10, p821-837 1978.

Keywords: *Alkanes, *Decomposition, *Heat of formation, *Free radicals, Temperature, Pyrolysis, Spectrochemical analysis, Shock tubes, Reprints.

The experimental data on alkane decomposition from shock-tube and radical buffer studies and radical combination from very-low-pressure pyrolysis and modulation spectroscopy are shown to be consistent. They lead to experimental A factors which decrease by factors of 10-2000 from 300 to 1100K. Heats of formation for ethyl, isopropyl, and t-butyl radicals have been found to be 10, 10 and 20 kj higher than currently accepted numbers from metathesis reactions.

703,211
PB-285 888/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermal Decomposition of Cyclopentane and Related Compounds.
Final rept.,
W. Tsang. 1978, 19p
Pub. in International Jnl. of Kinetics, v10, p599-617 1978.

Keywords: *Cyclopentane, *Decomposition, Reaction kinetics, Shock tubes, Prolysis, Heat of formation, Chemical reaction mechanisms, Reprints.

Cyclopentane has been decomposed in comparative-rate single-pulse shock-tube experiments. The pyrolytic mechanism involves isomerization to 1-pentene and also a minor pathway leading to cyclopropane and ethylene. This is followed by the decomposition of 1-pentene and cyclopropane. The rate expressions over the temperature range of 1000-1200K are given. Details of the cyclopentane decomposition processes are considered, and it appears that if the trimethylene radical is an intermediate, then delta H(f) (trimethylene) < or = to kj/ mol at 300K.

703,212
PB-285 889/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermal Stability of Primary Amines.
Final rept.,
W. Tsang. 1978, 26p
Pub. in International Jnl. of Kinetics, v10, p41-66 1978.

Keywords: *Amines, *Thermal stability, *Decomposition, Reaction kinetics, Shock tubes, Free radicals, Recombination reactions, Chemical bonds, Reprints.

Tertiary-amyl amine has been decomposed in single-pulse shock-tube experiments. Rate expressions for several of the important primary steps are given. The present and earlier comparative rate single-pulse shock-tube data when combined with high-pressure hydrazine decomposition results (after correcting for fall off effects through RRKM calculations) are also given. This suggests that in this context amino radical behavior is analogous to that of alkyl radicals. Rate expressions for the primary step in the decomposition of a variety of primary amines have been computed. In the case of benzyl amine, where data exist, the agreement is satisfactory.

703,213
PB-285 890/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermal Stability of Intermediate Sized Acetylenic Compounds and the Heats of Formation of Propargyl Radicals.
Final rept.,
W. Tsang. 1978, 25p
Pub. in International Jnl. of Kinetics, v10, p687-711 1978.

Keywords: *Acetylene, *Thermal stability, *Heat of formation, *Decomposition, Reaction kinetics, Shock tubes, Chemical bonds, *Propargyl radicals, Hexyne/methyl, Hexynes, Reprints, Heptyne/methyl.

4-Methylhexyne-1, 5-methylhexyne-1, hexyne-1, and 6-methylheptyne-2 have been decomposed in comparative-rate single-pulse shock-tube experiments. Rate expressions for the initial decomposition reactions at 1100K and from 2 to 6 atm pressure are given. In combination with previous results, rate expressions for propargyl C-C bond cleavage are related to that for the alkanes.

703,214
PB-286 289/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theory for the Isotropic Raman Line Shape in the Condensed State.
Final rept.,
D. C. Knauss. 1978, 15p
Pub. in Jnl. Mol Phys., v36 n2 p413-427 1978.

Keywords: *Raman spectroscopy, *Line spectra, Nitrogen, Argon, Mixtures, Liquid phases, Solid phases, Line width, Reprints.

A theory for the isotropic Raman line shape (width and shift in particular) of diatomic molecules in the condensed state (liquid or solid) within the linear response formalism is presented. The prototypic system considered is that of a nitrogen argon mixture in any proportion. The two much discussed mechanisms which effect the lineshape (the vibrational modulation and the resonance transfer effects) appear naturally. The explicit concentration dependence of the width and shift is found while only the qualitative temperature dependence is determined. In particular, it is shown that the different temperature dependences of the line width in the liquid and solid states are simply related to the different types of collective modes which exist in the two states. It is also shown that the contributions to the width and shift of the above two mechanisms depend differently upon concentration and so can be separated experimentally.

703,215
PB-286 290/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quenching and Reactions of Laser-Excited I (5 doublet P(1/2)) Atoms with Halogen and Interhalogen Molecules.
Final rept.,
H. Hofmann, and S. R. Leone. 15 Jul 78, 6p
Grants NSF-PHY76-04761, NSF-CHE76-22600
Pub. in Jnl. Chem. Phys., v69 n2 p641-646, 15 Jul 78.

Keywords: *Halogens, Atomic energy levels, Fluorescence, Reaction kinetics, Excitation, *Atom molecule interactions, *Laser induced fluorescence, *Iodine atoms, Reprints.

Rate constants for the collisional deactivation of spin-orbit excited I(5 doublet P(1/2)) atoms with the halogens I2, Br2, Cl2 and interhalogens IBr, ICl and BrCl have been determined using laser excited, time-resolved infrared fluorescence techniques. These results are discussed in terms of a collision complex formation model in which reactive-type collisions predominate in the deactivation process under investigation. With an appropriate analysis of the kinetics involved, the fractions of the total deactivation rate constants attributed to these reactive channels are 15% + or - 5% and 13% + or - 5% respectively.

703,216
PB-286 530/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hydrogen Fine-Structure Effects at Low Electron Densities.
Final rept.,
H. Ehrich, and D. E. Kelleher. 1978, 4p
Pub. in Physical Review A 17, n5 p1686-1689 May 78.

Keywords: *Hydrogen, Line widths, Reprints, Line broadening, Collision broadening, Fine structure.

Measurements of the plasma-broadened H(alpha) line shape in a wall-stabilized arc show considerable differences between experimental and theoretical line profiles at electron densities below 10 to the 16th/cu cm. The half-width of the experimental profile is up to three times larger than predicted theoretically. At low electron densities, part of such discrepancies can be attributed to the neglect of fine-structure splitting in current Stark-broadening calculations, especially for H(alpha), L(alpha), and hydrogenic-ion lines.

703,217
PB-286 537/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Behavior of Different Nuclear Probes for Detection of Cancer by Nuclear Magnetic Resonance.
Final rept.,
L. R. Maxwell, and L. H. Bennett. 1978, 4p
Pub. in Jnl. Physiolog. Chem. and Physics, v10 p59-62 1978.

Keywords: *Nuclear magnetic resonance, *Probes, *Malignant neoplasms, Samples, Phosphorus isotopes, Spin lattice relaxation, Phosphorus 31, Reprints.

A physical explanation is given for the finding that the spin-lattice relaxation time T1, obtained by nuclear magnetic resonance from equivalent malignant and non-malignant samples, is greater for the phosphorus isotope 32P than for the proton 1H. The nuclear relaxation of the phosphorus proceeds by way of its interaction with associated cell water. Within limits determined by other variables, T1 is expected to vary inversely as the square of the gyromagnetic ratio.

703,218
PB-286 542/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Matrix Isolation Study of the Reaction of Carbon Atoms with Molecular Nitrogen. Electron Transitions of the CNN Free Radical in the 2600-1900-A Spectral Region.
Final rept.,
M. E. Jacox. 1978, 10p
Pub. in Jnl. Mol. Spectrosc., v72 p26-35 1978.

Keywords: *Nitrogen, *Ultraviolet spectroscopy, Carbon, Free radicals, Cyanides, Atomic energy levels,

Molecular energy levels, *Matrix isolation techniques, *Carbon atoms, Reprints.

Previous matrix isolation studies have demonstrated that ground-state carbon atoms react with molecular nitrogen to form CNN, for which the esr spectrum, the three ground-state vibrational fundamentals, and a prominent electronic transition near 4200 A have been reported. Extension of the ultraviolet absorption studies to shorter wavelengths has permitted the assignment to CNN of two new band systems, between 2500 and 2150 A and near 2060 A. These band systems, observed using several different photolytic sources of carbon atoms, correspond well with the valence transitions of CNN predicted by molecular orbital theory. Assignments of the band structures, involving excitation of the upper-state stretching vibrations of CNN, are proposed.

703,219
PB-286 727/3 Not Available NTIS
National Bureau of Standards, Washington, DC.
Conformation of Gamma-Globulin Adsorbed on Polystyrene Latices Determined by Quasielastic Light Scattering.
Final rept.,
B. W. Morrissey, and C. C. Han. Jul 78, 9p
Sponsored in part by National Heart, Lung, and Blood Institute, Washington, DC.
Pub. in Jnl. Colloid Interface Science, v65, no. 3, p423-431 (July 1978).

Keywords: *Gamma globulin, *Polystyrene, Surface properties, Light scattering, Flocculating, Stabilization, Reprints, *Molecular conformation.

Measurements of the conformation of gamma-globulin adsorbed on monodisperse polystyrene latices, and the subsequent rates of flocculation of the latices, have been carried out in situ using quasielastic light scattering. The molecular extension was found to depend on the protein solution concentration, with end-on adsorption indicated at high surface coverage. Application of the Deutch-Felderhof model for the translation friction coefficient of microscopic multisubunit assemblies established, through a comparison of calculated with experimental values of the molecular extension, the possibility of a flattening in the adsorbed conformation at low surface concentration. Changes in adsorbed conformation were also found as a function of pH. Although the initial rate of flocculation was too great to measure, the particle radius at a given time varied with the concentration exhibiting a maximum at approximately 0.05 mg/ml final protein concentration.

703,220
PB-286 783/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radiation Pressure Cooling of Bound Resonant Absorbers.
Final rept.,
D. J. Wineland, R. E. Drullinger, and F. L. Walls. 19 Jun 78, 4p
Grant N00014-77-F-0046
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Physical Review Letters, v40, no. 25, p1639-1642 (June 19, 1978).

Keywords: *Cooling systems, *Radiation pressure, Laboratory equipment, Doppler effect, Atomic spectroscopy, Cryogenics, Reprints.

The authors report the first observation of radiation pressure cooling on a system of resonant adsorbers which are elastically bound to a laboratory fixed apparatus. Mg II ions confined in a Penning electromagnetic trap are cooled to $< 40K$ by irradiating them with the 8 microwatt output of a frequency doubled, single mode dye laser. Cooling to apprixmately 0.001/degree K should be possible.

703,221
PB-286 786/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photoabsorption in Molecular Nitrogen: A Moment Analysis of Discrete-Basis-Set Calculations in the Static-Exchange Approximation.
Final rept.,
T. N. Rescigno, C. F. Bender, B. V. McKoy, and P. W. Langhoff. 1 Feb 78, 13p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. Chem. Phys. v68, no. 3, p970-982, (Feb. 1, 1978).

Keywords: *Nitrogen, *Photoabsorption, Excitation, Ionization, Hartree-Fock approximation, Reprints.

Theoretical investigations of photoexcitation and ionization cross sections in molecular nitrogen are reported employing the recently devised Stieltjes-Tchebycheff moment-theory technique in the static-exchange approximation. The coupled-channel equations for photoabsorption are separated approximately by identifying the important physically distinct excitation processes associated with formation of the three lowest electronic states of the parent molecular ion.

703,222
PB-286 788/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Monte Carlo Study of the Structure of Expanded Fluid Rubidium.
Final rept.,
R. D. Mountain. 1978, 6p
Pub. in Jnl. Physics, F. Metal Physics, v8, no. 8 p1637-1642 (1978).

Keywords: *Rubidium, *Liquid metals, Monte Carlo method, Equations of state, Pseudopotential theory, Gruneisen parameter, Reprints.

The liquid structure factors for four high temperature states of fluid rubidium are constructed using the Monte Carlo method and the pseudopotential developed by Price. The calculations are compared with the measured structure factors of Block et al and are found to differ significantly in the vicinity of the principal maximum. The prescription used to construct this pseudopotential does not appear to provide the necessary density dependence. Some details of procedures used to construct the structure factors are included in the discussion.

703,223
PB-287 307/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Excitation of the b Singlet Sigma(+)(g) State of O2 by Low Energy Electrons.
Final rept.,
S. A. Lawton, and A. V. Phelps. 1 Aug 78, 14p
Contract N00014-76-C-0123
Sponsored in part by Air Force Cambridge Research Labs., Hanscom AFB, MA. and Defense Nuclear Agency, Washington, DC.
Pub. in Jnl. Chemical Physics, v69 n3 p1055-1068, 1 Aug 78.

Keywords: *Oxygen, *Reaction kinetics, Excitation, Electrons, Molecular energy levels, Comparison, Metastable state, Ionization, Diffusion, Emission spectroscopy, Reprints.

A drift tube technique was used. The time dependence of the absolute intensity of the 762 nm band emission was measured for O2 densities between 10 to the 16th power and 2 x 10 to the 18th power molecules/cc.

703,224
PB-287 310/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rotational Relaxation within the 1B(2u)(S1) State of Benzene.
Final rept.,
R. A. Coveleskie, and C. S. Parmenter. 1 Aug 78, 6p
Sponsored in part by National Science Foundation, Washington, DC, and Joint Inst. for Lab. Astrophysics, Boulder, CO.
Pub. in Jnl. Chemical Physics, v69 n3 p1044-1054, 1 Aug 78.

Keywords: *Benzene, *Molecular rotation, Excitation, Molecular energy levels, Argon, Boltzmann equation, Molecule molecule interactions, Reprints.

Relaxation from nonequilibrium rotational distributions to a Boltzmann-like distribution within the zero point level of S(1) benzene vapor was studied using ground state benzene and argon as collision partners.

703,225
PB-287 457/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rayleigh Scattering from Methane.
Final rept.,
B. J. Ackerson, and G. C. Straty. 1 Aug 78, 6p
Pub. in Jnl. Chem. Phys., v69 n3 p1207-1212, 1 Aug 78.

Keywords: *Methane, *Rayleigh scattering, Critical point, Thermal diffusivity, Thermal conductivity, Comparison, Reprints.

The decay rate of spontaneous thermal fluctuations in methane has been determined from Rayleigh scattering experiments. Measurements have been made in a broad region about the critical point along the coexistence curve, the critical isochore and an isotherm 0.8 K above the critical temperature. Values of thermal diffusivity obtained from the data are compared with other available data. In the immediate critical region the measured thermal diffusivity is compared with calculated thermal diffusivity values based on a recent prediction of the anomalous thermal conductivity of methane. The comparison involves assumptions concerning the scattered wave vector dependence of the decay rate in the critical region but no adjustable parameters. In addition, the critical isochore data are also fitted by other theoretically predicted forms for the decay rate to estimate parameters in these theories. Good agreement between measurement and prediction is found.

703,226
PB-287 458/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Empirical Excess Volume Model for Estimating Liquefied Natural Gas Densities.
Final rept.,
M. J. Hiza. Aug 78, 12p
Sponsored in part by American Gas Association, Inc., Arlington, VA.
Pub. in Fluid Phase Equilib., v2 n1 p27-38 Aug 78.

Keywords: *Liquefied natural gas, *Mathematical models, *Density(Mass/volume), Mixtures, Nitrogen, Methane, Ethane, Propane, Butanes, Comparison, Reprints.

The mathematical model presented herein was developed to represent excess volumes at saturation for multicomponent liquid mixtures of nitrogen and the low molecular weight alkanes between 105 and 120 K. Parameters of the model were determined from experimental excess volumes for binary liquid mixtures of nitrogen, methane, ethane, propane, isobutane, and normal butane. Comparisons made with selected experimental excess volumes reported in the literature for multicomponent liquid mixtures of the above components demonstrate the predictive capability of the model in two simple forms. An extension of the model to include mixtures containing isopentane and normal pentane is also proposed. Pure component molar volumes are given at 0.5 K intervals from 105 to 116 K to facilitate the use of the present model in estimating liquefied natural gas (LNG) densities.

703,227
PB-287 460/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Transfer Kinetics in the Excimer States of Mercury.
Final rept.
M. Stock, R. E. Drullinger, and M. M. Hessel. 1977, 5p
Pub. in Proc. Summer Colloquium on Electronic Transition Lasers (3rd), Held at Snowmass Village, CO., on Sep 7-10, 1976. Paper in Electronic Transition Lasers II, p219-223.

Keywords: *Energy transfer, *Reaction kinetics, *Mercury(Metal), Fluorescence, *Excimers, Laser induced fluorescence.

Significant differences have been observed between electron beam pumping and optical pumping of Hg Excimers. The authors have used the frequency doubled output of a nitrogen laser pumped dye laser to produce mercury diatomic excimers directly in a bound excimer state. The use of time resolved fluorescence spectroscopy has allowed the direct observation of both vibrational and electronic thermalization within the manifold of excimer states. This technique avoids the complicating presence of electron collisions and population in highly excited states which can both absorb and radiate. The results are inconsistent with the interpretation of e-beam produced mercury excimer fluorescence. The authors discuss the time evolution of these systems, and the mechanism leading to excimer fluorescence emission.

703,228
PB-287 461/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Experimental Molar Volumes for Some LNG-Related Saturated Liquid Mixtures.
Final rept.,
R. C. Miller, and M. J. Hiza. Aug 78, 9p
Pub. in Fluid Phase Equilib., v2 n1 p49-57 Aug 78.

Keywords: *Liquefied natural gas, *Concentration(Composition), Liquid phase, Mixtures, Methane, Ethane, Propane, Butanes, Nitrogen, Comparison, Reprints.

Saturated (orthobaric) liquid molar volumes are reported for some methane-rich mixtures containing ethane, propane, isobutane, normal butane, and nitrogen at temperatures between 100 and 115 K. These data were obtained with a gas-expansion system calibrated against pure methane orthobaric liquid molar volumes. Comparisons are shown between the experimental molar volumes and results of some recent calculational methods. Discrepancies between experimental and calculated values are all within + or - 0.15 percent. The more accurate correlations generally predict the molar volumes within + or - 0.1 percent.

703,229
PB-287 689/4 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards. Volume 83, Number 4, July-August 1978.
Bi-monthly rept.
1978, 87p
See also Volume 83, Number 3, PB-285 398.

Keywords: *Physical chemistry, Equations of motion, Density(Mass/volume), Scaling, Enthalpy, Heat measurement, Heat of formation, Critical point, Molybdenum halides, Nucleic acids, Pyrolysis, Polymers, Styrene resins, Adenine, Molybdenum fluorides, Poly(Styrene/methyl), Molecular configuration.

Contents:
- Modification of the nonanalytic equation of state for the limit of low densities;
- Implementation of scaling and extended scaling equations of state for the critical point of fluids;
- The enthalpy of formation of MoF6(l) by solution calorimetry;
- Enthalpies of solution of nucleic acid bases--Adenine in water;
- Pyrolysis of monodisperse poly-alpha-methylstyrene;
- The configurational statistics of a polymer confined to a wedge of interior angle alpha.

703,230
PB-287 690/2
(Order as PB-287 689/4, PC **A05**/MF **A01**)
National Bureau of Standards, Boulder, CO. Inst. for Basic Standards.
Modification of the Nonanalytic Equation of State for the Limit of Low Densities.
R. D. Goodwin. 4 Apr 78, 3p
Prepared in cooperation with American Gas Association, Inc., Arlington, VA.
Included in Jnl. of Research of the National Bureau of Standards, v83 n4 p325-328, Jul-Aug 78.

Keywords: *Equations of state, *Density(Mass/volume), Revising, Thermodynamic properties.

As described in previous reports, this equation is constrained to the liquid-vapor coexistence boundary. Integration of the 'thermodynamic equation of state' along isotherms involves a term for the compressibility factor of saturated vapor in the limit of low densities, which in previous work was not adequately defined. The present, brief report assumes familiarity with previous work, and presents a solution for the problem, which is to describe saturated-vapor densities in terms of the compressibility factor for saturated vapor, using a given, vapor-pressure equation.

703,231
PB-287 691/0
(Order as PB-287 689/4, PC **A05**/MF **A01**)
National Measurement Lab. (NBS), Washington, DC.
Implementation of Scaling and Extended Scaling Equations of State for the Critical Point of Fluids.
M. R. Moldover. 21 Feb 78, 6p
Included in Jnl. of Research of the National Bureau of Standards, v83 n4 p329-334, Jul-Aug 78.

Keywords: *Equations of state, *Fluids, Scaling, Critical point, Computer programs.

An explicit practical procedure is suggested for transforming from the laboratory variables density rho and temperature (T) into the parametric variables r and theta which occur in various scaled representations of equations of state and of transport properties of fluids near critical points. A reasonably efficient and versatile computer program illustrating this procedure is provided. With this program, the parametric equations of state which occur in several formulations of simple, extended, and/or revised scaling are as easy to use as any other equation of state for which T and rho are the independent variables.

703,232
PB-287 692/8
(Order as PB-287 689/4, PC **A05**/MF **A01**)
National Measurement Lab. (NBS), Washington, DC. Center for Thermodynamics and Molecular Science.
Enthalpy of Formation of MoF6(l) by Solution Calorimetry.
R. L. Nuttall, K. L. Churney, and M. V. Kilday. 9 Mar 78, 11p
Included in Jnl. of Research of the National Bureau of Standards, v83 n4 p335-346, Jul-Aug 78.

Keywords: *Enthalpy, Heat of formation, Molybdenum halides, Heat measurement, Solutions, *Molybdenum fluorides.

Enthalpies of reaction of MoF6(l) in NaOH solutions, of MoO3(cr) in NaOH solutions, of NaF(cr) in MoO3-NaOH solutions, and of NaF(cr) in H2O(l) were measured to obtain the enthalpy of reaction of MoF6(l) in infinity dilute NaOH solution. From the measurements of NaF(cr) in H2O, values for apparent molal enthalpy were tabulated at concentrations from 0 to 0.2 mol/kg-1.

703,233
PB-287 693/6
(Order as PB-287 689/4, PC **A05**/MF **A01**)
National Measurement Lab. (NBS), Washington, DC. Center for Thermodynamics and Molecular Science.
Enthalpies of Solution of Nucleic Acid Bases. 1. Adenine in Water.
M. V. Kilday. 6 Apr 78, 24p
Included in Jnl. of Research of the National Bureau of Standards, v83 n4 p347-370, Jul-Aug 78.

Keywords: *Adenine, *Enthalpy, Solutions, Nucleic acids, Water, Heat measurement.

An adiabatic solution calorimeter was used to measure the enthalpy of solution in water of various adenine samples for which a large amount of analytical information is reported. The experimental imprecision of the measurements was 1.1 percent. However, it was necessary to assign an overall uncertainty of 3 percent because of impurity uncertainties.

703,234
PB-287 694/4
(Order as PB-287 689/4, PC **A05**/MF **A01**)
National Measurement Lab. (NBS), Washington, DC.
Pyrolysis of Monodisperse Poly-alpha-Methylstyrene.
9 Mar 78, 10p
Prepared in part by American Univ., Washington, DC. Dept. of Chemistry, and Okron Univ., OH. Inst. of Polymer Science.
Included in Jnl. of Research of the National Bureau of Standards, v83 n4 p371-380, Jul-Aug 78.

Keywords: *Pyrolysis, Decomposition, Thermogravimetric analysis, Molecular weight, *Poly(Styrene/methyl), Gel permeation chromatography.

Pyrolysis of monodisperse poly-alpha methylstyrene of wide molecular weight range (M:25,000-5,000,000) was studied isothermally under vacuum in the temperature range 240-280C. Thermogravimetric analysis was used for measuring the rate of degradation, and gel permeation chromatography for analyzing the molecular weight and molecular weight distribution as a function of conversion.

703,235
PB-287 971/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Prediction of the Thermal Conductivity of Fluid Mixtures.
Final rept.
H. J. M. Hanley. 1977, 6p
Pub. in Proceedings Symp. on Thermophysical Properties (7th), Held at Gaithersburg, MD. on 10 May 77, p668-673.

Keywords: *Thermal conductivity, *Fluids, Mixtures, Transport properties, Thermodynamics, Critical point.

A corresponding states method, introduced previously, to predict transport coefficients of a pure fluid or mixture over a wide range of experimental conditions is expanded in this work. The thermal conductivity coefficient is discussed in detail. It is shown that this coefficient can be predicted given only values for a reference fluid and thermodynamic data. Comparisons between calculated results and data are satisfactory. The effect of internal degrees of freedom is discussed. The behavior of the thermal conductivity coefficient at the critical point (for a pure fluid) or the plait point (for a mixture) is also mentioned briefly.

703,236
PB-287 972/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
2,3,7,8-Tetrachlorodibenzofuran.
Final rept.,
C. R. Hubbard, A. D. Mighell, and I. H. Pomerantz. Jul 78, 4p
Pub. in Jnl. Acta Cryst., vB34 n7 p2381-2384 Jul 78.

Keywords: *Crystal structure, Chlorine organic compounds, Benzofuran/tetrachloro-di, Reprints.

The structure has been determined by direct methods and refined to an R=0.037 for 1863 independent reflections. The molecule is essentially planar. A crystallographic 2-fold axis bisects a C-C bond and passes through the oxygen atom of the five-member furan ring. The two unique C-Cl distances are 1.725(2) and 1.732(2)A, the C-O distance is 1.385(2)A, and the C-C distances range between 1.366(2) and 1.404(2)A. The longest C-C bond distance within the benzenoid rings, joins the carbon atoms to which the chlorine atoms are attached. The title compound is closely related in structure to the highly toxic 2,3,7,8-tetrachloro-dibenzo-p-dioxin.

703,237
PB-287 974/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quenching of N2 (A(3) Sigma(+) sub u, V=0,1) by N2, Ar, and H2.
Final rept.,
D. Levron, and A. V. Phelps. 1 Sep 78, 3p
Contract N00014-76-C-0123
Pub. in Jnl. Chem. Phys., v69 n5 p2260-2262, 1 Sep 78.

Keywords: *Reaction kinetics, *Nitrogen, *Argon, *Hydrogen, Molecular vibration, Excitation, Metastable state, Reprints.

This note presents improved measurements of rate coefficients for the quenching of the v=0 and v=1 levels of the A(3 sigma (+) sub u) metastable state of N2 by N2, Ar and H2 using very low levels of excitation and high gas purity. Designating the v=1 and v=0 vibrational levels of the A 3 sigma (+) sub u state by A(1) and A(0), respectively, our rate coefficients or their upper limits vary from agreement with published values for N2 A(0) and N2 A(1) quenching by H2 to 100 times smaller than published values for N2 A(0) and N2 A(1) quenching by Ar.

703,238
PB-287 977/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Bulk Viscosity of a Fluid: The Inverse Power Potential.
Final rept.,
J. C. Rainwater, and H. J. M. Hanley. 1 Sep 78, 4p
Pub. in Chem. Phys. Lett., v58 n1 p39-42, 1 Sep 78.

Keywords: *Viscosity, *Fluids, Numerical solutions, Reprints.

The bulk viscosity coefficient of a moderately dense gas has been evaluated numerically for an inverse power potential. The calculation, to order density squared, is based on the microscopic theory of Snider, Curtiss and McCourt. The results are compared to those from the corresponding expression of the modified Enskog theory. Agreement between the sets of values is within 1%.

703,239
PB-288 032/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Boundaries of Constrained Random Flight Polymer Chains.
Final rept.,
R. J. Rubin, and G. H. Weiss. Oct 78, 4p
Pub. in Macromolecules, v11 n5 p1046-1049 Sep/Oct 78.

Keywords: *Polymers, Density(Mass/volume), Molecular structure, *Hollingsworth radius, Molecular configuration, Reprints.

The authors call the radius of the smallest sphere which contains all segments of a random flight chain and is centered at the starting point of the chain the Hollingsworth radius of the chain R. In this paper, they consider two cases in which the configurations of random flight chains are constrained. In each case, they calculate the probability density of the Hollingsworth radius for the constrained chains. In the first case, the end-to-end distance of the chains is constrained to the value r. In the second case, all segments of the chain are constrained to lie on one side of an impenetrable plane through the starting point.

703,240
PB-288 092/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Helium Storage at High Density and Discharge at High Flow Rates.
Final rept.
D. E. Daney. 1978, 10p
Sponsored in part by Air Force Weapons Lab., Kirtland AFB, NM.
Pub. in Proceedings Cryogenic Engineering Conf., Boulder, CO., Aug 2-5, 1977. Paper K-2 in Adv. Cryog. Eng., v23 p486-495, 1978.

Keywords: *Helium, *Storage, Density(Mass/volume), Flow rates, Design criteria.

Equipment to store supercritical helium at high density and to demonstrate pulsed discharge at high flow rates has been designed, fabricated and successfully demonstrated. A storage density of 193 kg/cu m (12.03 lb/cu ft) at 8.3 MPa (81 atm) was achieved in a 135 liter (35 gal) dewar. Pulsed discharges of 2 seconds and 4 seconds duration were demonstrated at a flow rate of 1.0 kg/s (2.2 lb/s), and flow fluctuations of less than + or - 1 percent were achieved without feedback control. In general, the system operated in a very stable and well behaved manner.

703,241
PB-288 093/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Liquid Mixture Excess Volumes and Total Vapor Pressures Using a Magnetic Suspension Densimeter with Compositions Determined by Chromatographic Analysis: Methane Plus Ethane.
Final rept.
M. J. Hiza, and W. M. Haynes. 1978, 8p
Sponsored in part by American Gas Association, Inc., Arlington, VA.
Pub. in Proceedings Cryogenic Engineering Conf., Boulder, CO., Aug 2-5, 1977. Paper M-6 in Adv. Cryog. Eng., v23 p594-601, 1978.

Keywords: *Methane, *Ethane, *Vapor pressures, *Density(Mass/volume), Mixtures, Feasibility, Densimeters, Liquid phases, Samples, Binary system, Isotherms.

The experimental results discussed in this paper demonstrate the feasibility of using a magnetic suspension densimeter to obtain isothermal phase equilibria and liquid density data simultaneously. In this study, densities and total vapor pressures for methane + ethane liquid mixtures were measured between 35 and 75 mole percent methane at 135 K and at 50 mole percent methane at 125 K, with compositions determined by chromatographic analysis of liquid samples. Derived excess volumes are in excellent agreement with those from densities of gravimetrically prepared mixtures obtained with the same apparatus. Excess pressures, derived from the total vapor pressures, are in good agreement with comparable values from phase equilibria data in the literature. The predominant source of error in the present experimental procedure clearly results from problems in obtaining representative liquid mixture samples from the equilibrium cell for analysis.

703,242
PB-288 095/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nonanalytic Equation of State for Propane.
Final rept.
R. D. Goodwin. 1978, 16p
Sponsored in part by American Gas Association, Inc., Arlington, VA.
Pub. in Proceedings Cryogenic Engineering Conf., Boulder, CO., Aug 2-5, 1977. Paper M-8 in Adv. Cryog. Eng., v28 p611-618, 1978.

Keywords: *Propane, *Equations of state, Thermodynamic properties, Specific heat, Critical point.

This type of equation is advantageous for computing thermodynamic properties because it originates on a given, liquid-vapor coexistence boundary, and yields a maximum in the isochoric specific heats at the critical point. With only five least-squares coefficients to be adjusted from experimental P-rho-T data, it describes a P(rho,T) surface free of irregularities, and consistent with the known behavior of specific heats at all densities. Following its application to methane and ethane, small but essential modifications for propane now are reported, together with all constants for the vapor-pressure equation, the orthobaric-densities equations, and the equation of state, as needed for computations.

703,243
PB-288 096/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radiative Lifetime Measurement of the 31S, 31D, 31F, and 51F Excited States of Helium.
Final rept.,
G. A. Khayrallah, and S. J. Smith. Aug 78, 8p
Grant NSF-MPS72-05169
Pub. in Phys. Rev. A 18 n2 p559-570 Aug 78.

Keywords: *Helium, *Molecular energy levels, Excitation, Reprints.

The lifetimes of the 3 singlet S, 3 singlet D, 4 singlet D, 4 singlet F, and 5 singlet F states of He have been determined experimentally to be 54.5 + or - 0.8, 16.7 + or - 0.8, 36.4 + or - 1.2, 67 + or - 10, and 142 + or - 20 nsec respectively. The measurements were made at several incident electron energies using a pulsed-electron time-delayed-coincidence technique.

703,244
PB-288 097/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Collisions with Highly Polar Molecules: Comparison of Model, Static and Static-Exchange Calculations for Alkali-Halides.
Final rept.,
L. A. Collins, and D. W. Norcross. Aug 78, 12p
Grant NSF-AER74-20552
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Phys. Rev. A 18 n2 p467-498 Aug 78.

Keywords: *Electron scattering, Potassium iodides, Lithium fluorides, Mathematical models, Comparison, Elastic scattering, *Electron molecule interactions, Alkali halides, Cesium fluorides, Reprints.

Calculations of cross sections for (vibrationally and electronically) elastic collisions of electrons with several alkali-halides were performed for energies in the range of 0.13 eV to 20.0 eV. The applicability of the adiabatic (fixed-nuclei) approximation for strongly polar systems is investigated by model calculations on CsF, KI, and LiF. The authors demonstrate that integrated, momentum transfer, and differential cross sections for polar systems can be reliably generated and entirely within the body-frame, adiabatic approximation. They also suggest resolutions of several discrepancies between the results of earlier calculations and between these results and measurements. Close-coupling calculations, based on the adiabatic approximation and an alternative form of the frame transformation, were performed for electron-LiF collisions using the full static and static-model exchange surface. The results of the static and static-exchange calculations were compared with the results of calculations using simpler model potentials and other approaches to the collision problem.

703,245
PB-288 099/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Raman Spectroscopic Evidence for Conformational Deformation in the High Pressure Phase of Polytetrafluoroethylene.
Final rept.,
J. F. Rabolt, G. Piermarini, and S. Block. 15 Sep 78, 5p
Pub. in Jnl. Chemical Physics, v69 n6 p2872-2876, 15 Sep 78.

Keywords: *Raman spectroscopy, High pressure tests, Crystal structure, X ray analysis, Phase transformations, *Molecular conformation, *Poly(Ethylene/tetrafluoro), *Poly(Propylene/hexafluoro), Reprints.

An investigation of PTFE, nC20F42 and a random copolymer of tetrafluoroethylene and hexafluoropropylene (TFE-HFP) under pressure has been carried out using Raman spectroscopy in conjunction with a diamond anvil cell. Both nC20F42 and the TFE-HFP copolymer were found to undergo a phase transition in the 7-9 kbar range similar to PTFE as evidenced by the observation of the 625/cm Raman band characteristic of phase III. With increasing pressure in the 10-52 kbar range, a continual variation in intensity of the bands at 285 and 395/cm was observed and found to differ for the three fluorocarbon materials studied. By correlating a change in the I(285)/I(395) ratio with a change in sample crystallinity (as determined by x-ray) it has been determined that an increase in trans planar content with pressure is responsible for the observed band intensity changes in the high pressure phase of PTFE.

703,246
PB-288 280/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Spectroscopic Investigations in 209 Bi I Using Tunable cw Dye Laser Spectroscopy.
Final rept.,
O. Poulsen, and J. L. Hall. Sep 78, 8p
Grant NSF-PHY76-04761
Pub. in Phys. Rev. A 18 n3 p1089-1096 Sep 78.

Keywords: Bismuth, Atomic energy levels, Hyperfine structure, *Laser spectroscopy, *Bismuth 209, Lifetimes(Energy levels), Reprints.

Tunable cw dye laser spectroscopy of an atomic beam sample, combined with interferometric wavelength measurements, has been applied to the measurement of energy levels, hyperfine structure, and lifetimes of 209 Bi I.

703,247
PB-288 282/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser-Initiated Chemical Reactions: Cl + H2S Yields HCl + HS: Rate Constant, Product Energy Distribution, and Direct Detection of a Chain Mechanism.
Final rept.,
M. Braithwaite, and S. R. Leone. 15 Jul 78, 7p
Grants NSF-PHY76-04761, NSF-CHE76-22600
Sponsored in part by Rome Air Development Center, Griffiss AFB, NY.
Pub. in Jnl. Chem. Phys. v69 n2 p839-845, 15 Jul 78.

Keywords: *Reaction kinetics, *Chlorine, *Hydrogen sulfide, Chemical reactions, Hydrogen chloride, Chemiluminescence, Molecular vibration, Photolysis, Chemical reaction mechanisms, Laser induced reactions, Chain reactions, Reprints.

Laser-initiated, time-resolved infrared chemiluminescense techniques are used to study the detailed kinetics of chlorine/hydrogen sulfide systems. Measurements on the Cl + H2S yields HCl + HS reaction are carried out by the pulsed laser photolysis of S2Cl2 yields S2Cl+ Cl in a flowing mixture with H2S, while detecting vibrational chemiluminescence from the HCl product. The chain mechanism and its realtime development are observed directly from the product chemiluminescence signal.

703,248
PB-288 303/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Pure Long-Range Molecules.
Final rept.,
W. C. Stwalley, Y.-H. Uang, and G. Pichler. 23 Oct 78, 4p
Sponsored in part by National Science Foundation, Washington, DC., and Petroleum Research Fund, Washington, DC.
Pub. in Physical Review Letters 41, n17 p1164-1167, 23 Oct 78.

Keywords: *Chemical bonds, *Molecular vibration, *Molecular energy levels, Electron transitions, Sodium, Numerical solution, Reprints.

The authors describe a new type of molecular electronic state in which all vibrational levels occur entirely at internuclear distances large compared to ordinary chemical-bond lengths. They present explicit calculations for two such electronic states of 0'g) (-) and 1u symmetry in the Na2 molecule. They feel experimental observation of such levels is possible.

703,249
PB-288 304/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Ionic Recombination of Kr+ and Kr2+ with F- in Dense Buffer Rare Gases.
Final rept.,
M. R. Flannery, and T. P. Yang. 1 Oct 78, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Applied Physics Letters 33, n7 p574-576, 1 Oct 78.

Keywords: *Reaction kinetics, Krypton, Ions, Fluorine, Recombination reactions, Rare gases, *Ion ion interactions, Krypton ions, Fluorine ions, Reprints.

Rates, alpha for the recombination of Kr+ and Kr2(+) with F(-) in various buffer rare gases (He, Ne, Ar, Kr, Xe) at 300 K are calculated for a wide range of gas pressures. For pressures 1-5 atm, the population of KrF* via recombination is greatest for Ne and Ar as third bodies, yielding alpha is approximately equal to 3 x 10 to the -6 power cc/sec, while for pressure approximately = or > 10 atm, He is to be preferred as a buffer gas.

703,250
PB-288 529/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Free Radicals in Stretched Vinylidene Chloride Copolymer.
Final rept.,
R. E. Florin. Oct 78, 1p
Pub. in Jnl. of Polymer Science, Polymer Physics Edition 16, n10 p1877, Oct 78.

Keywords: *Free radicals, *Vinylidene chloride resins, Copolymers, Reprints.

Free radicals were observed in filaments of vinylidene chloride copolymer, stretched to breaking, with the aid of chloranil as a free-radical trap.

703,251
PB-288 530/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stopped-Flow Studies of the Mechanisms of Ozone-Alkene Reactions in the Gas Phase Propene and Isobutene.
Final rept.,
J. T. Herron, and R. E. Huie. 1978, 23p
Pub. in International Jnl. of Chemical Kinetics, v10, p1019-1041 1978.

Keywords: *Ozone, *Alkene hydrocarbons, Chemical reactions, Gas phase, Test chambers, Mass spectroscopy, *Chemical reaction mechanisms, Flow reactors, Reprints.

The reactions of ozone with propene and isobutene have been studied in the gas phase at 298K and 530 Pa (4 torr) using a stopped-flow reactor coupled to a photoionization mass spectrometer. Reactant and product concentrations were followed as a function of reaction time. The major reaction products monitored were CH2O, CH3CHO, CO2, and H2O from the propene reaction, and CH2O, (CH3)2CO,CO2, and H2O from the isobutene reaction. The observations were interpreted on the basis of the Criegee mechanism for ozonolysis in solution. In the gas phase the carbene peroxy radical is postulated to isomerize and decompose into molecular and free-radical products.

703,252
PB-288 535/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
13C-1H Cross-Polarization Nuclear Magnetic Resonance Spectra of Macerals from Coal.
Final rept.,
H. L. Retcofsky, and D. L. VanderHart. Jul 78, 3p
Pub. in Fuel, v57 p421-423 Jul 78.

Keywords: *Bituminous coal, *Molecular structure, Aromatic compounds, Polarization, Nuclear magnetic resonance, Vitrinite, Exinite, Micrinite, Fusinite, Reprints.

The carbon aromaticities (f(a)) of vitrinite, exinite, micrinite and fusinite from a high volatile A bituminous coal have been determined by (13)C-(1)H cross-polarization nuclear magnetic resonance spectrometry. Values of f(a) for the four macerals were found to decrease in the order: fusinite > micrinite > vitrinite > exinite. Crude estimates of the average ring size using the f(a) value and the elemental composition of each maceral indicated that the fusinite contained the largest polynuclear condensed aromatic ring system (>5 rings) whereas the mean structural unit of the vitrinite contains 3-4 condensed rings.

703,253
PB-288 538/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
XO4(n-) Ion Hydration. The Crystal Structure of Mg3(PO4)2.22H2O.
Final rept.,
L. W. Schroeder, M. Mathew, and W. E. Brown. 1978, 6p
Pub. in Jnl. Phys. Chem. v82 n21 p2335-2340 1978.

Keywords: *Crystal structure, Hydrates, *Magnesium phosphates, Reprints.

Mg3(PO4)2.22H2O is triclinic, space group P(1 bar), with a=6.902(2), b=6.961(2), c=15.982(4) A, alpha=87.66(2), beta=85.22(2), and gamma=60.81(2). The structure was refined to R(w)=0.033, R=0.058 for 1317 observed reflections. The most interesting feature of the structure is that all cations and anions are completely surrounded by water molecules.

703,254
PB-288 539/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Volumetric Data and Virial Coefficients for Helium, Krypton and Helium-Krypton Mixtures.
Final rept.,
D. D. Dillard, M. Waxman, and R. L. Robinson. Oct 78, 6p
Pub. in Jnl. Chem. Eng. Data v23 n4 p269-274 Oct 78.

Keywords: *Helium, *Krypton, *Volumetric analysis, Mixtures, *Virial coefficients, Reprints.

Volumetric data for helium, krypton, and three mixtures of helium and krypton (24.8, 49.7, and 74.6 mole percent helium) were obtained by the Burnett technique. Measurements were made at temperatures of -50, 0, and 50C at pressures between 7 and 150 bar. Compressibility factors and virial coefficients are presented for the pure substances and mixtures, as are the interaction second virial coefficients, B(12).

703,255
PB-288 542/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron Quasielastic Scattering Study of ND+4 Orientational Fluctuations in beta-phase ND4Br.
Final rept.,
J. J. Rush, and J. M. Rowe. 15 Sep 78, 3p
Pub. in Jnl. Chem. Phys. v69 n6 p2928-2930, 15 Sep 78.

Keywords: Neutron scattering, Elastic scattering, Ammonium halides, Phase transformation, *Ammonium bromide, Numerical solution, Reprints.

The ND4(+) orientational fluctuations of ND4Br have been studied in the beta (C(S) Cl) phase by coherent and incoherent neutron scattering. Correlation time for individual ND4(+) reorientations were derived to be 2.5 x 10 to the -11th power sec. and 5 x 10 to the -11th power sec at 252 and 232 K, respectively. The corresponding times for cooperative fluctuations of ND4(+) ion clusters was found to be = or > 10 times longer, in agreement with theoretical predictions.

703,256
PB-289 000/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Flash Photolysis Resonance Fluorescence Investigation of the Reaction of OH Radicals with Dimethyl Sulfide.
Final rept.,
M. J. Kurylo. 15 Sep 78, 5p
Pub. in Chem. Phys. Lett., v58 n2 p233-237, 15 Sep 78.

Keywords: *Reaction kinetics, Photolysis, Fluorescence, Transport properties, Sulfur, Atmospheric diffusion, Free radicals, *Hydroxyl radicals, Sulfide/dimethyl, Chemical reaction mechanisms, Reprints.

Rate constants for the reaction of OH radicals in a homogeneous gas phase reaction with dimethyl sulfide have been determined, using the flash photolysis resonance fluorescence technique over the temperature range 273-400K. The data (combined with the results of another recent study) can be fit to an Arrhenius expression. The results are discussed in terms of reaction mechanisms and in light of recent suggestions that dimethyl sulfide plays an important role in the transport of natural sulfur to the earth's atmosphere.

703,257
PB-289 001/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Four-State Model of Optical Collisions: Sr + Ar.
Final rept.,
J. Light, and A. Szoke. Oct 78, 10p
Pub. in Phys. Rev. A 18, n4 p1363-1372 Oct 78.

Keywords: *Mathematical models, Excitation, Lasers, Atoms, *Atom atom interaction, Reprints.

The semiclassical theory of electronic excitation of an atom in a strong non-resonant laser field due to a collision with another atom is presented. It is shown that in the presence of asymptotic degeneracy of the excited state the Landau-Zener two-state model is inaccurate, the exact solution of a two-state model is inaccurate, and both differ qualitatively from the accurate solutions of the equations when all (four) states are included. Depolarization predominates at high field strengths.

703,258
PB-289 002/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Flash Photolysis Resonance Fluorescence Investigation of the Reactions of OH Radicals with OCS and CS2.
Final rept.,
M. J. Kurylo. 15 Sep 78, 5p
Pub. in Chem. Phys. Lett., v58 n2 p238-242, 15 Sep 78.

Keywords: *Reaction kinetics, Free radicals, Fluorescence, Photolysis, Inorganic sulfides, *Hydroxyl radicals, Reprints.

Rate constants for the reaction of OH radicals with OCS and CS2 were determined at 296K using the flash photolysis resonance fluorescence technique. The values derived from this study are given.

703,259
PB-289 016/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tunable Laser Photodissociation of HgI2: Quantum Yield for Formation of Excited I(5 doublet P (1/2)) Atoms.
Final rept.,
H. Hofmann, and S. R. Leone. 15 Oct 78, 7p
Contract N00014-77-C-0115, Grant NSF-CHE76-22600
Pub. in Jnl. Chem. Phys., v69 n8 p3819-3825, 15 Oct 78.

Keywords: *Atomic energy levels, *Dissociation, Mercury halides, Excitation, Fluorescence, *Iodine atoms, Atom molecule interactions, *Mercury iodide, Laser induced fluorescence, Reprints.

Tunable-laser, infrared fluorescence techniques are used to study the detailed photodissociation dynamics of the linear triatomic molecule HgI2. The quantum yield of excited I(5 doublet P(1/2)) atoms has been measured in the first long wave-length absorption band of HgI2 and 265 to 320 nm. From quantitative measurements of the yield of excited I atoms it is shown that the total absorption cross section in this region is actually composed of two distinct components. These components correspond to states leading to both excited and ground state I atoms according to the processes. From the time decay of the excited I atoms as a function of HgI2 pressure, the collisional deactivation rate of I by the parent HgI2 molecule has been obtained.

703,260
PB-289 018/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Doppler-Free Two-Photon Transitions to Rydberg Levels: Convenient, Useful and Precise Reference Wavelengths for Dye Lasers.
Final rept.,
S. A. Lee, J. Helmcke, J. L. Hall, and B. P. Stoicheff. Oct 78, 3p
Contract N00014-77-C-0656, Grant NSF-PHY76-04761
Pub. in Opt. Lett., v3 n4 p141-143 Oct 78.

Keywords: *Atomic energy levels, *Photons, Excitation, Forecasting, *Rydberg series, Dye lasers, Laser spectroscopy, Laser induced fluorescence, Reprints.

The authors showed that with a tuneable cw dye laser two-photon transitions to alkali atom Rydberg levels may be easily observed in real time using a simple ionization cell of appropriate construction. The two-photon transition wavelengths to rubidium s levels were measured up to n = 50 with better than 1 x 10(-7) absolute accuracy and can be represented to within the experimental precision by a simple function of the principal quantum number. Other related transitions and future possibilities are considered.

703,261
PB-289 022/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comments on the Closure Problem in the Statistical Theory of Fluids.
Final rept.,
R. F. Kayser, H. J. Raveche, and W. W. Wood. 15 Nov 78, 4p
Pub. in Jnl. Chem. Phys. v69 n10 p4617-4620, 15 Nov 78.

Keywords: *Fluids, *Statistical analysis, Particles, Closures, Reprints.

It is shown that if the BBGKY hierarchy is truncated by the approximation for the quadruplet correlation function g(1234) = g(123)g(124)g(134)g(234)/(g(12)g(13)g(14)g(23)g(24)g(34)), the resulting system of equations yield solutions for g(123) which are path dependent. This result is consistent with an earlier argument by Raveche and Green that the closure leads to a nonconservative force on a particle in a fixed triplet of particles. The magnitude of the path dependence is investigated and its consequences are discussed.

703,262
PB-289 025/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Absolute Emission Cross Section for Electron Impact Excitation of Li(+) to the (2 triplet P) Level.
Final rept.,
W. T. Rogers, J. O. Olsen, and G. H. Dunn. Oct 78, 10p
Contract E(49-1)-3800
Pub. in Phys. Rev. A 18 n4 p1353-1362 Oct 78.

Keywords: *Atomic energy levels, *Electron bombardment, Excitation, Ions, Emission spectroscopy, *Lithium ions, Threshold effects(Electron energy), Reprints.

Crossed beams of electrons and Li(+) ions have been used to measure the absolute emission cross section for the process from below the threshold at 61.26 eV to 162 eV. The cross section exhibits the sharp onset at threshold characteristic of positive ion excitation. Pronounced structure is observed in the near threshold region. From about 1.5 times the threshold energy to the highest energies measured, the cross section follows the generally predicted E(-3) behavior for the singlet S to triplet P transitions. Theoretical predictions of the cross sections differ from one another by up to a factor of tw, and none appears to fit the data really well.

703,263
PB-289 026/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Application of Extended Two-Level Model Theory to Doppler-, Laser- and Collision-Broadened Bound-Bound Multiphoton Absorption.
Final rept.,
J. H. Eberly. 1978, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. Phys. B 11, n20 pL611-L614, 1978.

Keywords: *Mathematical models, *Doppler effect, *Photons, Absorption, Line width, Reprints.

It is pointed out that recent observations allow the first quantitative tests of the ability of theories of multiphoton-resonant processes to deal with Doppler, laser and collisional broadening in bound-bound transitions. The author compared the predictions of a certain extended two-level (ETL) model of multiphoton-resonant phenomena with these observations.

703,264
PB-289 027/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis of Lead Level Measurements Obtained in a Survey of Dwelling Units in Pittsburgh, Pennsylvania.
Final rept.
I. H. Billick, W. G. Hall, and D. R. Shier. 1978, 4p
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Assistant Secretary for Policy Development and Research.
Pub. in Proceedings Joint Conf. on Sensing of Environmental Pollutants (4th), Held at New Orleans, LA on Nov 6-11, 1977, p810-813 (Amer. Chem. Soc., New York, NY. 1978).

Keywords: *Lead(Metal), *Paints, *Houses, *Surveys, Residental buildings, Concentration(Composition), X ray fluorescence, X ray analysis, Lead poisoning, Pennsylvania, *Pittsburgh(Pennsylvania).

This paper presents statistical analyses carried out using lead paint levels from approximately 3300 dwelling units, randomly selected from the city of Pittsburgh, Pennsylvania. The primary purpose of the survey was to assess (using a detailed series of lead level measurements) the extent, magnitude and distribution of lead-based paint within the dwelling units. In addition, measurements of lead levels were recorded for exterior surfaces of some of the dwelling units. The lead level measurements (in mg Pb/sq cm) were obtained using a portable x-ray fluorescence lead detector. Measurements typically were taken from walls, ceilings, windows, doors and baseboards in all accessible rooms of the dwelling unit. Statistical analyses of the x-ray fluorescence measurements confirmed and quantified certain expected relations: namely, that older dwelling units exhibit considerably greater lead levels than newer housing units and that exterior surfaces show higher levels than corresponding interior surfaces. In addition, the variation of lead levels by occupancy class, room type, surface type, and surface condition were analyzed. The relations between such variables and observed lead levels can prove useful in focusing on which dwelling unit types (and at which locations in dwelling units) excessive lead levels are likely to be found.

703,265
PB-289 093/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Magnetic Susceptibility of Cerium Tantalate Compounds.
Final rept.
G. A. Candela, A. H. Kahn, T. Negas, and C. L. McDaniel. 1978, 6p
Pub. in Proceedings of Rare Earth Research Conference (13th), Olgebay Park, WV 16-20 Oct 77, Paper in The Rare Earths in Modern Science and Technology, p441-446 1978 (Plenum Press, New York, NY.)

Keywords: *Magnetic permeability, Cerium compounds, Crystals, Oxidation reduction reactions, Crystallography, Tantalates, *Cerium tantalates.

The cerium oxide-Ta2O5 system contains three trivalent Ce compounds, CeTa3O9 (perovskite-type), CeTaO4 (LaTaO4 structure-type), and CeTa7O19. Preparation of single crystals, crystallographic properties, and several unusual oxidation-reduction reactions were detailed in the Proceedings of the 12th Rare Earth Research Conference, 1976. An analysis of the susceptibility gives a good fit to the data over the complete temperature range. An orbital reduction of the Ce(+3) magnetic moment of 8% was found for the CeTa3O9.

703,266
PB-289 098/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Metallotetrathioethylenes.
Final rept.
A. R. Siedle, G. A. Candela, T. Finnegan, R. P. Van Duyne, T. Cape, G. F. Kokoszka, P. M. Woyciesjes, J. A. Hashmall, M. Glick, and W. Ilsley. 1978, 5p
Pub. in Proceedings of Synthesis and Properties of Low-Dimensional Materials, New York, NY., 29 Sep 78; Paper in Annals of the New York Academy of Sciences, v313 p377-381 1978.

Keywords: *Metal containing organic compounds, *Complex compounds, X ray analysis, Raman spectroscopy, Infrared spectroscopy, Conductivity, Magnetic permeability, Electron paramagnetic resonance, *Fulvalene/tetrathia, *Fulvalene/tetrahydro-tetra thia.

Recent results describing the chemistry of metal complexes of tetrathiafulvalene (TTF) and tetrahydrotetrathiafulvalene (H4TTF) are reviewed. Three broad classes of materials have been prepared: crystal complexes, donor-acceptor complexes, and salts. Crystal complexes include (H4TTF) (HgCl2)3, characterized by a single crystal X-ray diffraction study, and (TTF)(Pd(acac)2). The donor acceptor complexes include (TTF)2MX2 (M = Pd, Pt; X = Cl, Br) which have been studied by X-ray photoelectron, electronic, Raman and infrared spectroscopy and by measurement of electrical conductivity. Evidence for sulfur lone pair - metal interaction is presented. Electron spin resonance and magnetic susceptibility data indicate the presence of three dimensional magnetic exchange fields in the new chlorocuprate salts (TTF)2CuCl4 and (TTF)CuCl4.

703,267
PB-289 139/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Spectroscopy of Excited Yellow Exciton States in Cu2O by Forbidden Resonant Raman Scattering.
Final rept.,
M. A. Washington, A. Z. Genack, H. Z. Cummins, R. H. Bruce, A. Compaan, and R. A. Forman. 15 Feb 77, 9p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Phys. Rev., vB15 n4 p2145-2153, 15 Feb 77.

Keywords: *Copper oxides, *Raman spectroscopy, *Excitons, Molecular energy levels, Mathematical models, Reprints.

The Raman-scattering spectrum of Cu2O at 4K was measured with a tunable cw dye laser as the exciting source. The dye laser was tuned to several hundred frequencies in the range 17135-17600/cm which spans the range of the excited states of the yellow exciton series. At each laser frequency, the cross section for normally forbidden Raman scattering from the strongest odd-parity phonons T(12) to the-1 power (109/cm) and T(15) to the -1 power (LO -154.5), was determined. The authors considered two potential microscopic models for those resonances: (1) optical quadrupole, dipole Frohlich, optical dipole; (2) optical dipole, quadrupole Frohlich, optical dipole. The predicted behavior of these two models is compared with polarization measurements, and with the dependence of the Raman intensity on scattering angle, electric field, and laser frequency. It is found that neither model is consistent with all of the data.

703,268
PB-289 140/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Temperature Dependence of Szigeti Effective Charge of Aikali Halides.
Final rept.,
C. K. Kim, A. Feldman, D. Horowitz, and R. M. Waxler. 1978, 3p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Solid State Commun., v25 p397-399 1978.

Keywords: *Halides, Temperature, Dipole moments, Ions, Solids, *Szigeti effective charge, Alkali halides, Reprints.

The second Szigeti relation was used to obtain the temperature dependence of the Szigeti effective charge, es. The results are discussed in the framework of the deformation dipole model. Recent experimental data are used to show that the volume derivatives of es of most ionic solids are positive, thus providing evidence that the deformation dipole model is qualitatively valid.

703,269
PB-289 815/3 PC **A05**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.

Bibliography on Atomic Line Shapes and Shifts (June 1975 through June 1978).
Interim rept.
J. R. Fuhr, B. J. Miller, and G. A. Martin. Dec 78, 86p NBS-SP-366-SUPPL-3
See also report dated Nov 75, PB-246 714. Library of Congress Catalog Card no. 72-600147.

Keywords: *Atomic spectra, *Bibliographies, Line width, Stark effect, Van der Waals equation, Doppler effect, *Line broadening, Chemical shifts(Nuclear magnetic resonance).

This is the third supplement to the NBS Special Publication 366, Bibliography on Atomic Line Shapes and Shifts (1889 through March 1972). It contains about 600 references and covers the literature from June 1975 through June 1978. As before, the bibliography contains five major parts: (1) All general interest papers are catalogued according to the broadening mechanisms (and, further, according to special topics under several of the mechanisms) and as to whether the work is a general theory, a general review, a table of profiles or parameters, a comment on existing work, a study of general experimental measurement techniques, or an experimental effort of general importance. Also included are selected papers on important applications of line broadening and on miscellaneous topics relating to atomic spectral line shapes and shifts. (2) In Part 2 all papers containing numerical data are ordered as to element, ionization stage, and broadening mechanism (in the case of foreign gas broadening the perturbing species are listed), and it is indicated whether the data are experimentally or theoretically derived. (3) While in the two preceding parts of the bibliography the references are listed for brevity by identification numbers only, in Part 3 all references are listed completely by journal, authors, and title and are generally arranged by year of publication and alphabetically by authors' names within the year. (4) This section contains a list of all authors and their papers. (5) A final section provides corrections or additions to the second supplement to the original bibliography.

703,270
PB-289 869/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High-Resolution 11B NMR Study of the ((B10H12)2Ni) 2- Ion.
Final rept.,
A. R. Siedle, G. M. Bodner, A. R. Garber, R. F. Wright, and L. J. Todd. 1978, 4p
Pub. in Jnl. Magn. Reson., v31 p203-206, 1978.

Keywords: *Boron hydrides, *Nuclear magnetic resonance, *Nickel inorganic compounds, Ultraviolet spectroscopy, Ions, Reprints.

The 70.6 MHz 11B NMR spectrum of the ((B10H12)2Ni)(-2) ion has been assigned.

703,271
PB-289 918/5 PC **A05**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.
Summary Report on the Workshop on High Temperature Chemical Kinetics: Applications to Combustion Research.
Special pub.
D. Garvin, R. L. Brown, R. F. Hampson, M. J. Kurylo, and W. Tsang. Dec 78, 93p NBS-SP-531
Sponsored in part by Department of Energy, Washington, DC. Library of Congress Catalog Card no. 78-600125.

Keywords: *Reaction kinetics, *High temperature tests, *Combustion, *Meetings.

The proceedings at a workshop on the applications of high temperature chemical kinetics to combustion research are summarized. This workshop provided a forum for the exchange of views on the needs for kinetics research during the next five to ten years. Experimental techniques, measurements, theoretical developments, and data evaluation were treated in four review papers and two discussion sessions. This report contains the program of the meeting, abstracts of the review papers, a commentary by the organizers of the meeting, summaries of the discussions, formal comments submitted by the participants, and an attendance list.

703,272
PB-290 001/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Induced Fluorescence of the PH2 Radical.
Final rept.,
R. E. Huie, N. J. T. Long, and B. A. Thrush. 1978, 9p
Sponsored in part by Royal Society, London (England).
Pub. in Jnl. Chem. Soc. Faraday Trans. v2 p1253-1262, 1978.

Keywords: *Free radicals, *Phosphine, Fluorescence, Excitation, Absorption spectra, *Laser induced fluorescence, Reprints.

A pulsed dye laser has been used to excite PH2 radicals from the (2)B1 to the (2)A1 state. The radiative lifetime of the excited state if 4 plus or minus 1 microsecond for nu'2= 0-3 and decreases to 0.35 microsecond for nu'2 = 4. Weak, short lived fluorescence excited at higher frequencies could not be positively assigned to nu'2 = 5. Below 22,000 cm the rotational and vibrational structure corresponds to that expected on the basis of the known absorption spectrum of PH2.

703,273
PB-290 002/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Differential Cross Sections for the Elastic Scattering of Intermediate-Energy Electrons from Sodium.
Final rept.,
P. J. O. Teubner, S. J. Buckman, and C. J. Noble. 1978, 10p
Sponsored in part by Australian Research Grants Committee, Melbourne.
Pub. in Jnl. Phys. B. v11 n13 p2345-2354, 1978.

Keywords: *Sodium, *Differential cross sections, Electron scattering, Elastic scattering, EV range 10-100, Optical models, Born approximation, Glauber theory, Quantum chemistry.

Differential cross sections for the elastic scattering of electrons from sodium have been measured with high angular resolution for incident energies of 54.4, 75, 100 and 150 eV and over an angular range of 12 degrees to 140 degrees. The experimental data are compared with calculations based on the First Born approximation, the Glauber approximation and a close coupling impact parameter calculation. Calculations have been carried out for an optical model using the prescription of Vanderpoorten for localizing the absorptive part of the potential. Of the theoretical calculations the optical model is found to best reproduce the general features of the cross section at all energies.

703,274
PB-290 007/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photofragment Spectroscopy of Ozone in the uv Region 270-310 nm and at 600 nm.
Final rept.,
C. E. Fairchild, E. J. Stone, and G. M. Lawrence. 1978, 7p
Sponsored in part by National Science Foundation, Washington, DC. Atmospheric Sciences Section, and National Aeronautics and Space Administration, Washington, DC.
Pub. in Nature, v275 p389-394, 5 Oct 78.

Keywords: *Ozone, *Ultraviolet spectroscopy, *Infrared spectroscopy, Molecular energy levels, Atomic spectroscopy, Numerical solution, Reprints.

Both O(triplet P) and O(singlet D) atom fragments are observed in the photofragment spectroscopy of O3 in the Hartley band absorption region 270-300 nm. The quantum yield for O(triplet P) is 0.1 at 274 nm. In the Chappuis bands at 600 nm the O2(X3sigma(g)(-)) photofragment is produced principally with nu = 0, 1. Photofragment angular distributions are measured in the uv for both O atom dissociation products at each wavelength of bombardment. A theoretical angular distribution for O(singlet D) is derived and the resultant prediction is in good agreement with the experimental results.

703,275
PB-290 008/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ionization Dynamics of a Model Atom in an Electrostatic Field.
Final rept.,
S. Geltman. 1978, 15p
Grant NSF-PHY76-04761
Pub. in Jnl. Phys. B, v11 n19 p3323-3337, 1978.

Keywords: *Ionization, *Electric discharges, Stark effect, Electron tunneling, Spectral energy distribution, Field emission, Schrodinger equation, One-dimensional calculations, Quantum chemistry, Reprints.

The time evolution of the ionization probability of a simple one-dimensional model atom under the influence of an electrostatic field is evaluated by an exact solution of the time-dependent Schroedinger equation. It is shown that in the low-field, long-time limit, the decay of the bound state is exponential in time with decay constant identical to that obtained in the quasiclassical tunneling theories. For shorter times, however, there are large departures from exponential decay, which lead to ionization probabilities much higher than expected on the basis of the quasiclassical theories. The potential importance of this in the analysis of dc discharge phenomena is pointed out.

703,276
PB-290 009/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radiative Lifetimes of the First Excited States of BO and BO2.
Final rept.,
R. E. Huie, N. J. T. Long, and B. A. Thrush. 1978, 3p
Pub. in Chem. Phys. Lett., v55 n4 p404-406, 1 May 78.

Keywords: *Boron oxides, Fluorescence, Excitation, *Laser induced fluorescence, Reprints.

A pulsed dye laser has been used to study the fluorescence of BO and BO2 in the gas phase at low pressure. Radiative lifetimes of 87.2 + or - 2.6 and 76.3 + or - 1.4 ns were obtained for the (000) and (100) levels of BO2(A(2)pi sub u) and of 131 + or - 15 and 103 + or - 6 ns for levels nu' = 1 and 2 of BO(A(2) pi). Unlike BO2(A(2) pi sub u), BO(A(2) pi) is strongly quenched by the oxygen carrier.

703,277
PB-290 020/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of Maximum Entropy to Nonequilibrium Statistical Mechanics.
Final rept.
B. Robertson. 1978, 32p
Pub. in Proceedings of Maximum Entropy Formalism Conference, Held at Cambridge, MA. on May 2-4, 1978, p289-320 1978.

Keywords: *Statistical mechanics, Entropy, Differential equations, Integral equations, *Maximum entropy method, *Nonequilibrium thermodynamics, Nonequilibrium conditions, Liouville equations, Projection operators, Correlation functions.

This paper reviews the use of the maximum entropy formalism (MEF) on an isolated system that may be arbitrarily far from thermodynamic equilibrium. Information for one instant of time is collected because it gives the entire equilibrium thermodynamic formalism for a system far from equilibrium. In particular, the MEF entropy is then a suitable expression for the thermodynamic entropy for a nonequilibrium system. The MEF yields a general expression for a projection operator. This is used with the Liouville equation to derive an exact expression for the nonequilibrium statistical density. This immediately gives exact closed equations of motion for the time dependence of the expectations that appear as constraints in the MEF. The equations are integro-differential equations whose kernels are generalizations of rate-rate time-correlation functions. The equations are also written using flux operators satisfying conservation equations, and the memory-retaining nonlocal generalizations of the equations of nonequilibrium thermodynamics are obtained. The kernels in these equations are flux-flux time-correlation functions. The appearance of the projection operator in the correlation functions has important consequences for their asymptotic time dependence. References to specific applications of the formalism and to related work are given.

703,278
PB-290 021/5 Not available NTIS
National Bureau of Standards, Washington, DC.
UV Photoemission for Rare Gases Implanted in Ge.
Final rept.,
B. J. Waclawski, J. W. Gadzuk, and J. F. Herbst. 21 Aug 78, 4p
Pub. in Physical Review Letters 41, n8, p583-586, 21 Aug 78.

Keywords: *Rare gases, *Photoelectron emission, *Atomic energy levels, Ultraviolet spectra, Germanium, Ultraviolet spectroscopy, *Amorphous germani-

um, Binding energy, Atomic radii, Ion implantation, Amorphous materials, Reprints.

The first ultraviolet photoemission spectra of the valence electrons of rare-gas atoms, implanted by ion bombardment into an amorphous Ge matrix, are presented here. The positions of the peaks in the observed spectra are shifted relative to gas-phase spectra, consistent with a final-state screening-energy shift which varies inversely with the radius of the particular implant, as predicted by a linear-response relaxation model described herein.

703,279
PB-290 044/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optimized Measurement of Aluminum in High-Purity Silicon.
Final rept.
R. M. Lindstrom, and R. F. Fleming. 1978, 9p
Pub. in Proceedings Nuclear Methods in Environmental and Energy Research, Columbia, MO., October 10-13, 1977, p90-98 1978.

Keywords: *Aluminum, *Neutron activation analysis, Concentration(Composition), Silicon, Semiconductors, Optimization, Fast neutrons, Neutron reactions, Interference.

Measurement of small quantities of aluminum in semiconducting silicon of solar grade is complicated by production of 28Al by an (n,p) reaction on the matrix, in competition with the (n,gamma) reaction on the trace aluminum sought. In selecting the optimum irradiation facility, the conflicting requirements of high thermal flux for greatest signal and of low fast flux for smallest noise must be balanced. The present work outlines a simple experimental procedure for assessing and correcting for interferences. No explicit knowledge of fast fluxes or cross sections is required; these are often poorly known. The procedure is generally applicable to other cases of competing reactions.

703,280
PB-290 045/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ionization Energies of Organic Compounds by Equilibrium Measurements.
Final rept.,
S. G. Lias, and P. Ausloos. 1978, 8p
Pub. in Jnl. American Chemical Society 100, n19 p6027-6034 1978.

Keywords: *Organic compounds, *Ionization potentials, Chemical equilibrium, Entropy, Nitrogen oxide(NO), Benzene, Furans, Enthalpy, Gibbs free energy, Reprints.

The determination of the equilibrium constants for a number of charge transfer equilibria has generated a scale of relative values of delta G for the charge transfer reactions. The factors contributing to delta S for these reactions were elucidated by carrying out experimental determinations of the entropy changes for some of the equilibria. The values of delta H were used to generate a scale of relative ionization energies of 41 organic compounds and NO. Standardization of the scale using the spectroscopically determined values of the ionization potentials of NO, benzene, and furan was accomplished by calculating the relationship between adiabatic ionization potentials and the 'enthalpies of ionization' measured in these experiments. The spectroscopically determined IPs of six of the compounds were reproduced in this way, thus verifying the technique.

703,281
PB-290 078/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reactions of NO2+ and Solvated NO2+ Ions with Aromatic Compounds and Alkanes.
Final rept.,
P. Ausloos, and S. G. Lias. 1978, 11p
Pub. in International Jnl. of Chemical Kinetics 10, p657-667 1978.

Keywords: *Nitrogen oxides, *Aromatic compounds, *Alkanes, *Reaction kinetics, Ions, Mass spectrometers, Chemical reactions, Exothermic reactions, Ion molecule interactions, Reprints.

The rate constants and modes of reaction of NO2(+) and C2H5ONO2NO2(+) with aromatic compounds and alkanes have been determined in a pulsed ion cyclotron resonance mass spectrometer.

703,282
PB-290 079/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Proton Affinity of Dichlorocarbene.
Final rept.,
P. Ausloos, and S. G. Lias. 5 Jul 78, 2p
Pub. in Jnl. of the American Chemical Society 100, n14, p4594-4595, 5 Jul 78.

Keywords: Protons, Reaction kinetics, Exothermic reactions, *Carbene/dichloro, *Proton affinity, Ion molecule interactions, Reprints.

It is demonstrated that the recently reported value for the proton affinity of CCl2 determined through the well known bracketing technique, is too high by approximately 14 kcal/mole. The assignment of a value for this proton affinity was based on the observation or non-observation of proton transfer from CCl2H(+) to selected bases of known proton affinity (CCl2H(+) + B yields CCl2 + BH(+)). It is shown that in some experiments described in the recent study, exothermic proton transfer reactions were in competition with energetically more favorable reaction channels which strongly predominated, usually to the exclusion of proton transfer. This letter expands our earlier exhaustive study of proton transfer and competing reactions of CCl2H(+) to include the bases used by Levi, Taft, and Hehre (J. Am. Chem. Soc. 99, 8454 (1977)). All reaction channels as well as rate constants have been determined, and some of our earlier measurements have been refined.

703,283
PB-290 080/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calorimetry.
Final rept.,
G. T. Armstrong, and A. Cezairliyan. 1978, 26p
Pub. in Kirk-Othmer Encyclopedia of Chemical Technology 3rd Ed., n4, p449-474 1978.

Keywords: *Heat measurement, Thermodynamics, Laboratory equipment, Calorimeters, Trends, *Calorimetry, Reprints.

Calorimetry is defined on the basis of its historical origins and in terms of the first law of thermodynamics. The technological and scientific applications of calorimetry are described: fuel technology, the properties of materials (heat capacities, internal energies, enthalpies, entropies, Gibbs energies), changes during reaction, the calorimetry of physical processes (radioactive decay, electromagnetic radiation), the application to process design, and industrial process control. Calorimetric instruments are discussed in terms of the theoretical basis of calorimetry, optional modes of operation, and kinds of processes to be measured. Calorimeters for reacting systems and their principles are described: bomb calorimeters, continuous-flow gas-combustion calorimeters, solution calorimeters and microcalorimeters. Calorimeters for non-reacting systems are described: including isothermal (Bunsen) calorimeter, isoperibol calorimeter, adiabatic calorimeter (low temperature and medium temperature), receiving calorimeter (using conventional furnace or levitation), high-speed calorimeter, and modulation calorimeter. Trends are discussed. A reading list of 19 entries and a bibliography of 96 entries are provided.

703,284
PB-290 083/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Absorption Spectra of Metal Oxides Using Opto-Galvanic Spectroscopy.
Final rept.,
P. K. Schenck, W. G. Mallard, J. C. Travis, and K. C. Smyth. 1 Dec 78, 4p
Pub. in Jnl. of Chemical Physics 69, n11, p5147-5150, 1 Dec 78.

Keywords: *Absorption spectra, Electron transitions, Yttrium oxides, *Optogalvanic spectroscopy, Lanthanum oxides, Scandium oxides, Reprints.

The absorption spectra of neutral flame species may be detected by measuring current changes induced by photon irradiation at wavelengths corresponding to electronic transitions. This paper presents the first results using this optogalvanic spectroscopy to study molecular absorption. Numerous transitions have been detected for ScO, YO, and LaO in the 360-630 nm wavelength region. The most extensive data have been obtained for LaO, where we observe a total of at least four electronic states and 18 sequences. Five of the sequences have not been seen in previous emission studies.

703,285
PB-290 518/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Refraction Correction for Fluorescence Spectra of Aqueous Solutions.
Final rept.,
K. D. Mielenz. 15 Sep 78, 2p
Pub. in Applied Optics 17, n18 p2875-2876, 15 Sep 78.

Keywords: *Refractivity, *Water, Emission spectroscopy, Fluorescence, Solutions, Reprints.

A closed expression is given for the refractive index of water at 20C for the wavelength region 0.235 micrometer to 1.028 micrometers. This expression is accurate to + or - 0.0001, and can be used for the refraction correction of fluorescence emission spectra of aqueous solutions.

703,286
PB-290 520/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Generation and Measurement of Pressure.
Final rept.
P. L. M. Heydemann. 1978, 49p
Pub. in Proceedings of NATO Summer School for High Pressure Held at Corfu, Greece on September 26-October 7, 1977, p1-49 1978.

Keywords: *Pressure, Calibrating, Measurement, Reviews, High pressure.

This is a review of methods used to establish the primary pressure scale of transfer gages and of the most common fixed points on the pressure scale. The major types of pressure generators and some important components like pumps, electrical feedthroughs and windows are discussed. The review is generally limited to the hydrostatic environment.

703,287
PB-290 661/8 PC **A99**/MF **E08**
National Standard Reference Data System.
EPA/NIH Mass Spectral Data Base. Molecular Weights 30-1674 and 1978 Indexes.
S. R. Heller, and G. W. A. Milne. Dec 78, 4654p
NSRDS-NBS-63
Prepared in cooperation with Environmental Protection Agency, Washington, DC. Office of Planning and Management, and National Heart, Lung, and Blood Inst., Bethesda, MD. Library of Congress catalog card no. 78-606175.
To be sold only as a 5 volume set.

Keywords: *Mass spectra, *Organic compounds, Tables(Data), Molecular weight, Molecular structure.

This publication presents a collection of 25,556 verified mass spectra of individual substances compiled from the EPA/NIH mass spectral file. The spectra are given in bar graph format over the full mass range. Each spectrum is accompanied by a Chemical Abstracts Index substance name, molecular formula, molecular weight, structural formula, and Chemical Abstracts Service Registry Number.

703,288
PB-290 704/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Non-Uniform Poling and Pyroelectric Response in a PVDF-TFE Copolymer.
Final rept.
G. T. Davis, A. S. DeReggi, and M. G. Broadhurst. 1979, 5p
Pub. in Proceedings of the 1977 Annual Report Conference on Electrical Insulation and Dielectric Phenomena Held at Colonie, NY. on October 17-29, 1977, p209-213.

Keywords: *Polymeric films, *Polyvinyl fluoride, *Pyroelectricity, Dipole moments, Polarization(Charge separation), Copolymers, Electric fields.

The transient pyroelectric response following a thermal pulse reveals that dipole alignment in a poled film of vinylidenefluoride-tetrafluoroethylene copolymer is non-uniform across its thickness. Charge migration on a time scale of minutes occurs within the unpoled region of the film after a step-change in temperature. The time constant for the charge motion becomes longer at lower temperatures and depends upon the poling history of the sample. Non-uniform poling is at-

tributed to a non-uniform electric field within the polymer film resulting from the motion of charges under the influence of the voltage applied during the poling process. Poly-(vinylidenefluoride) becomes poled much more uniformly and shows no evidence for charge motion following a step-change in temperature. The effect of charge motion and redistribution of electric field is demonstrated by the reduced pyroelectric response from poly(vinylchloride) poled with mica as a blocking electrode.

703,289

PB-290 706/1 Not available NTIS
National Bureau of Standards, Washington, DC.
ASTM Committee E-42 on Surface Analysis: Its History, Scope, Activities, and Objectives.
Final rept.,
J. R. Cuthill. Feb 78, 6p
Pub. in American Society for Testing and Materials, Standard News 6, n2, p8-11, p59-60, Feb 78.

Keywords: *Surface chemistry, Forecasting, Laboratory equipment, Reprints.

The history, purpose, scope, activities, aims, and objectives of ASTM Committee E-42 on Surface Analysis are summarized. The organization of E-42 is given and specific examples of activities are described including the symposia that have either been held already or will be held in the near future. The use of 'surface' and 'analysis' are defined in terms of the scope of E-42. An estimate of the number of surface analysis instruments in the United States, and a distribution of industrial representation at our organizational meeting is presented to show both the magnitude and the breadth of interest in surface analysis.

703,290

PB-290 707/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Critical Review of Vibrational Data and Force Field Constants for Polyethylene.
Final rept.,
J. Barnes, and B. Fanconi. 1978, 13p
Pub. in Jnl. of Physical and Chemical Reference Data 7, n4, p1309-1321 1978.

Keywords: *Polyethylene, *Molecular vibrations, Raman spectroscopy, Alkanes, Reprints, *Force field constants, Numerical solution.

The results of a critical review of vibrational data, their assignments, and force field constants of polyethylene and the related homologous series of n-alkanes are presented.

703,291

PB-290 984/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanisms of Decomposition of Mixtures of Ethyl Acetate and Isopropyl Bromide Subjected to Pulsed Infrared Laser Irradiation.
Final rept.,
W. Tsang, J. A. Walker, W. Braun, and J. T. Herron. 1 Dec 78, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Chemical Physics Letters 59, n3, p487-491, 1 Dec 78.

Keywords: *Decomposition reactions, *Ethyl acetate, Propylene, Ethylene, Acetic acid, Reaction kinetics, Chemical equilibrium, Bromine organic compounds, *Chemical reaction mechanisms, *Propane/bromo, Laser heating, Reprints.

The infrared laser induced decomposition of mixtures of ethyl acetate and isopropyl bromide has been studied. The ratio of the yields of products ethylene and propylene, arising from the unimolecular decomposition reactions: ethyl acetate yields ethylene + acetic acid, and isopropyl bromide yields propylene + hydrogen bromide, were measured as a function of the ratio of ethyl acetate to isopropyl bromide and pressure of added helium. The results indicate clearly that in these systems non-equilibrium behavior is found up to the highest pressures used (about one atmosphere). A two level kinetic model is suggested which qualitatively explains the observations.

703,292

PB-290 985/1 Not available NTIS
National Bureau of Standards, Washington, DC.
High Intensity Infrared Laser Irradiation Calorimetry: Direct-Determination of Heat Input to Chlorodifluoromethane and Ethyl Acetate.
Final rept.,
W. Braun, J. T. Herron, W. Tsang, and K. Churney. 1 Dec 78, 6p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Chemical Physics Letters 59, n3, p492-497, 1 Dec 78.

Keywords: *Heat measurement, *Ethyl acetate, High pressure tests, Carbon dioxide lasers, *Methane/chloro-difluoro, Laser heating, Reprints.

The heat absorbed when chlorodifluoromethane (CF2HCl) and ethyl acetate were irradiated with a pulsed infrared CO2-TEA laser was measured using a laser calorimeter. The measurements show that CF2HCl at high pressure (less than 10 torr) was completely thermally equilibrated during the laser pulsed, while at low pressure (greater than 2 torr) this system deviated considerably from thermal equilibrium. Ethyl acetate, however, was found to be non-thermal over the entire pressure range studied (0.5 to 20 torr). Implications of these observations to infrared unimolecular decompositions and molecular energy transfer are discussed.

703,293

PB-291 160/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
3a,6a-Dimethylglycouril (3a,6a-Dihydro-3a,6a-Dimethylimidazo(4,5-d)imidazole-2,5(1 H,6H)-dione).
Final rept.,
V. L. Himes, C. R. Hubbard, and A. D. Mighell. 1978, 3p
Sponsored in part by Food and Drug Administration, Washington, DC.
Pub. in Acta Crystallographica, B34 p3102-3104 1978.

Keywords: *Crystal structure, X ray diffraction, Chemical bonds, *Imidazole-dione/dimethylglycouril-(dihydro-dimethylimidazo), Reprints.

Crystallographic symmetry requires the molecule to have point symmetry 2mm. In the molecule are two planar five-membered rings with a 65.0 degree angle between the plane normals of the rings. Each molecule is hydrogen bonded to four neighboring molecules by eight N-H...O hydrogen bonds (dN...O = 2.869 A).

703,294

PB-291 241/8 PC **A05**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Center for Materials Science.
Algorithm and BASIC Computer Program for Calculating Simple Coal Gasification Equilibria.
W. S. Horton. Aug 78, 81p NBSIR-78-1509

Keywords: *Coal gasification, *Chemical equilibrium, Algorithms, Methane, Carbon monoxide, Carbon dioxide, Hydrogen, Water, Computer programs, Gibbs free energy, Phase rule, Thermodynamics, BASIC programming language, Numerical solution, COLGAS computer program.

Calculation of the equilibrium composition for the gases CH4, CO, CO2, H2, and H2O is treated by minimizing the Gibbs energy, G. Minimization is constrained by the conservation of chemical elements. With the use of Lagrangian multipliers, the minimum is found by setting the partial derivatives of G with respect to the amount of each substance equal to zero. The resulting non-linear equations are solved iteratively by the Newton-Raphson method. This algorithm is implemented with an interactive computer program written in the BASIC language and named COLGAS. The aim of this work was to provide people who test materials in coal-gasification-like atmospheres an easy way to obtain the equilibrium composition of their gas mixtures. A knowledge of computer programming is not required in order to use the program. A listing of the program is given and also six sample computer calculations. The phase rule is applied to the C-H-O system and two ternary diagrams are shown illustrating the condensation of solid carbon and liquid water.

703,295

PB-291 252/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Nuclear Magnetic Resonance Studies of Diffusion in FeTiHx.
Final rept.
R. C. Bowman, G. C. Carter, and Y. Chabre. 1977, 8p
Pub. in Proceedings of the International Congress on Hydrogen in Metals (2nd), Held at Paris, France on June 6-11, 1977, 8p.

Keywords: *Hydrides, *Nuclear magnetic resonance, Diffusion, Molecular relaxation, Frequency shift, Spin lattice relaxation, Iron alloys, Titanium alloys, *Iron titanium hydrides.

Proton NMR of FeTiHx has been studied for x values in the beta and gamma hydride phases. Knight shifts, linewidths, spin-lattice relaxation times, and spin-spin relaxation times were measured and a temperature of sudden hydrogen loss was observed. Activation energies were deduced from these measurements.

703,296

PB-291 518/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Scattering Study of the Methyl-Group Reorientations and the Low Temperature Phase Transition in (CH3)2SnF2.
Final rept.,
C. Steenbergen, and J. J. Rush. 1 Jan 79, 7p
Pub. in Jnl. of Chemical Physics 70, n1 p50-56, 1 Jan 79.

Keywords: *Phase transformations, *Neutron scattering, Elastic scattering, Activation energy, Tin organic compounds, *Tin/dimethyl-difluoro, Reprints.

The reorientation of the methyl groups in solid (CH3)2SnF2 has been investigated by neutron quasielastic scattering. It is found that a phase transition occurs in the solid at about 70K, which might be of second order. The shape of the measured quasielastic lines can be described by instantaneous threefold jumps of the methyl groups. From the derived residence times as a function of temperature below the phase transition, an activation energy E(a)/k(B) = 250K and a residence time at infinite temperatures (tau sub 0)=0.10 ps have been determined. Above the phase transition, the activation energy is at least a factor 2 smaller.

703,297

PB-291 707/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis of the Spectrum of Four-Times-Ionized Lutetium (Lu v).
Final rept.,
V. Kaufman, and J. Sugar. Nov 78, 13p
Pub. in Jnl. of the Optical Society of America 68, n11 p1529-1541, Nov 78.

Keywords: *Ultraviolet spectra, Lutetium, Ions, Atomic energy levels, *Lutetium ions, Reprints.

Spectra of Lu obtained with a sliding spark discharge at peak currents of 50-500A were recorded with a 10.7m normal incidence spectrograph in the range of 500-2100 A. Intercomparison of spectra revealed a distinct separation of Lu III, IV, and V, the first two of which have already been analyzed. The present work contains an interpretation of Lu V in which 419 lines are classified as transitions among 136 energy levels of the 4f(13), 4f(12)5d, 4f(12)6s, and 4f(126p configurations. Calculated energy levels and eigenvectors, obtained with fitted values for the radial integrals, are given.

703,298

PB-291 710/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Systematic Trends for the Oscillator Strengths of Resonance Transitions in the Cu and Zn Isoelectronic Sequences.
Final rept.,
S. M. Younger, and W. L. Wiese. Nov 78, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review, A. General Physics 18, n5 p2366-2368, Nov 78.

Keywords: Atomic energy levels, Ions, Copper, Zinc, *Isoelectronic sequences, *Oscillator strengths, Heavy ions, Energy-level transitions, Isoelectronic atoms, Copper isoelectronic sequence, Zinc isoelectronic sequence, Reprints.

New systematic trend curves for the oscillator strengths of the 4s-4p resonance transitions of Cu- and Zn-like ions have been derived from a critical analysis. This analysis takes into account recent theoretical results as well as a simulation study of cascade effects in beam-foil experiments which showed that the currently available experimental data for high ions may be too low by as much as 40-70%. The new analysis yields reliable interpolated data for many ions within the Cu and Zn isoelectronic sequences.

703,299
PB-291 712/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Recent Advances in Analytical Laser Spectroscopy.
Final rept.
R. A. Keller, and J. C. Travis. 1979, 46p
Pub. in Analytical Laser Spectroscopy, Ch8, p493-538 1979.

Keywords: Lasers, Spectroscopy, Fluorescence, Absorption, Isotopes, Chemical analysis, *Laser applications, *Laser spectroscopy, Isotope ratio, Laser induced fluorescence.

A review of new, potentially analytical applications of lasers is presented. Topics include: description of laser properties, direct absorption measurement, frequency modulation, intracavity absorption, fluorescence measurements, saturation spectroscopy, isotope analysis, CARS, flame fluorescence, condensed phase fluorimetry, energy state population distribution, and microfluorescence.

703,300
PB-291 717/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Emission and Absorption X-Ray Edges of Li.
Final rept.,
T. A. Callcott, E. T. Arakawa, and D. L. Ederer. 15 Dec 77, 8p
See also report dated Sep 77, CONF-770935-1.
Pub. in Phys. Rev. B, v16 n12 p5185-5192, 15 Dec 77.

Keywords: *Lithium, *X ray spectra, Absorption spectra, Emission spectra, Lattice vibrations, Phonons, Reprints.

The K X-ray emission edge of Li is measured between 85 K and 490 K and analyzed to obtain the temperature dependences of the edge position and of a Gaussian edge broadening function. Full width at half maximum (FWHM) edge widths range from 0.22 + or - 0.05 eV at 85 K to 0.38 + or -0.05 eV at 440 K. Edge positions shift from 54.81 + or - 0.02 eV at 85 K to 54.86 + or - 0.02 eV at 440 K and to 54.01 + or - 0.02 eV after melting. Emission and absorption spectra measured with the same spectrometer establish a 0.10 + or - 0.02 eV separation between the emission and absorption edges. These results are compared with recent theories describing incomplete lattice relaxation about the core hole. The authors conclude that for a core hole lifetime of 0.02 to 0.03 eV the theories give a satisfactory explanation of the premature peak in the emission spectra. They suggest also that phonon-core hole interactions provide the dominant edge broadening mechanism, and that many body effects are small.

703,301
PB-291 914/0 PC **A03**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Office of Standard Reference Data.
Selected Tables of Atomic Spectra. A-Atomic Energy Levels - Second Edition. B-Multiplet Tables. O VI, O VII, O VIII.
C. E. Moore. Jan 79, 35p NSRDS-NBS-3-SECT-8
Library of Congress catalog card no. 64-60074. See also report dated Apr 76, PB-253 231.

Keywords: *Atomic spectra, *Atomic energy levels, Oxygen, Ions, Wavelengths, Tables(Data), *Oxygen ions, *Multiplet energies.

The present publication is the eight Section of a series being prepared in response to the need for a current revision of two sets of the author's tables containing data on atomic spectra as derived from analyses of optical spectra. As in the previous Sections, Part A contains the atomic energy levels and Part B the multiplet tables. Section 8 includes these data for O VI, O VII, and O VIII, thereby completing the spectra of oxygen. The form of presentation is described in detail in the text to Section 1.

703,302
PB-291 951/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
LNG Custody Transfer Research at National Bureau of Standards.
Final rept.
W. R. Parrish, J. A. Brennan, and J. D. Siegwarth. 1978, 7p
Pub. in Proceedings of the American Gas Association Operating Section Transmission Conference, Montreal, Quebec, Canada, May 8-10, 1978 and Distribution Conference, Denver, Colorado, May 22-24, 1978 pT-243-T-249 1978.

Keywords: *Liquefied natural gas, Thermophysical properties, Density(Mass/volume), Densimeters.

This paper outlines the current activities of the National Bureau of Standards which relate to the custody transfer of liquefied natural gas. The paper describes the results of the thermophysical properties work, including the LNG density project. The paper summarizes the results of the flowmeter and densimeter tests. It discusses briefly the results of the LNG Sampling Measurement Project.

703,303
PB-291 954/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Scattering from Ozone.
Final rept.
R. J. Celotta, N. Swanson, and M. Kurepa. 1978, 2p
Sponsored in part by Institute of Physics, Belgrade (Yugoslavia).
Pub. in Proceedings of the International Conference on the Physics of Electronic and Atomic Collisions, Paris, France, July 21-27, 1977, p656-657 1978.

Keywords: *Electron scattering, *Ozone, Excitation, Molecular vibration.

The authors present recent electron scattering measurements in ozone which (1) resolve vibrational structure in the energy loss range of 1.3-2.4 eV, and (2) exhibit resonances in the incident energy range of 0.9-1.9 eV.

703,304
PB-291 967/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Differential Scanning Calorimetry Studies of Some Analogs for the Lipid Component of Biological Membranes.
Final rept.,
J. T. Joseph, A. Hybl, and J. H. Flynn. 1978, 5p
Sponsored in part by National Science Foundation, Washington, DC., National Institutes of Health, Bethesda, MD., and Maryland Univ., College Park.
Pub. in Chemistry and Physics of Lipids 22, p239-243 1978.

Keywords: *Heat measurement, *Glycerides, *Membranes, Sampling, X ray diffraction, Melting points, Crystallization, Reprints.

The melting behavior of members of newly synthesized series of rac-1,2-diglycerides with substituted phenyl groups or a benzyl group on the 3-position was investigated with differential scanning calorimetry (DSC). Solution crystallized samples had single melting temperatures, higher than those of the quenched or annealed specimens. Quenched samples exhibited polymorphic behavior; some melted and recrystallized during slow heating. This behavior is similar to that of lecithins and suggests that X-ray diffraction studies of the substituted diglycerides may be useful for understanding membrane structure and functions.

703,305
PB-291 968/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Elastic Scattering and Rotational Excitation in Ion-Molecule Collisions. II. Li(+)-H2 and H(+)-H2 Collisions.
Final rept.,
K. J. McCann, and M. R. Flannery. 15 Dec 78, 13p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 69, n12, p5275-5287, 15 Dec 78.

Keywords: *Elastic scattering, *Molecular rotation, *Lithium, *Hydrogen, Ions, *Ion molecule interactions, Reprints.

A general semiclassical treatment of elastic scattering and of rotational excitation in ion-molecule collisions is presented. When the orbits associated with the different channels corresponding to the internal modes do not differ significantly, simplification occurs and the internal degrees of freedom can then be coupled to the relative motion via the introduction of an optical potential (which in turn depends on the transition amplitudes). Total energy is consequently conserved. An expression is derived for the inelastic scattering amplitude which acknowledges various interference effects and possible rainbow scattering. With all phase-information suppressed, the procedure, when compared with the full quantum-mechanical results, reproduces the background elastic and inelastic scattering in Li(+)-H2 and in H(+)-H2 collisions. Restoration of the phases, particularly of the eikonal or action phases associated with the different classical paths that contribute to a specified scattering angle, produces the interference oscillations present in the differential cross section for scattering angles less than the rainbow angle. The method, when compared with the full quantal procedure, is remarkably efficient and accurate.

703,306
PB-291 969/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Mulliken Electronegativity Scale and the Structural Stability of Simple Compounds.
Final rept.,
R. E. Watson, and L. H. Bennett. 1978, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Physics and Chemistry of Solids 39, p1235-1242 1978.

Keywords: *Chemical compounds, *Electronegativity, Stability, Atomic energy levels, Reprints.

A new electronegativity scale is derived, in the spirit of Mulliken's original scheme, in terms of neutral atom spectroscopic data. The effect of changing the atomic configuration for C from covalent (singlet s triplet p) to metallic (coublet s doublet p) is considered. Structural stability maps are presented for many different compounds.

703,307
PB-291 973/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Recommended Reference Materials for Realization of Physicochemical Properties.
Final rept.,
R. A. Durst, and J. P. Cali. 1978, 33p
Pub. in Pure and Applied Chemistry, v50 p1485-1517, 1978.

Keywords: *pH, *Activity coefficient, Ions, Tables(Data), *Reference materials, Reprints.

This report is a survey and compilation of pH and ionic activity reference materials in use throughout the world. An introductory section discusses the differences in the national pH scales and provides a brief review of the equations which define these operational scales. The major part of this report tabulates the reference materials (composition and values as a function of temperature) used to realize the pH scales presently being employed in Germany, Hungary, Japan, Poland, Rumania, USSR, UK, and the USA. Data sheets are also included for the pD and ionic activity reference materials used in the United States. This report was prepared under the auspices of the IUPAC Commission I.4 Subcommittee on Calibration and Test Materials.

703,308
PB-291 974/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heat Capacity and Thermodynamic Properties of Solid Synthetic Sapphire, alpha-Al2O3.
Final rept.
S. S. Chang. 1977, 8p
Pub. in Proceedings Symp. on Thermophysical Properties (7th), Held at Gaithersburg, MD. on May 10-12, 1977 p83-90 (Amer. Soc. of Mech. Engineers, New York, NY, 1977).

Keywords: *Aluminum oxide, *Thermodynamic properties, Specific heat, Enthalpy, Heat measurement, Sapphire, Standard reference materials.

Heat capacity of the National Bureau of Standards calorimetric Standard Referenece Material 720, synthetic Sapphire alpha-Al2O3), for heat capacity and enthalpy, has been measured from 8 to 375 K with a fully-automated adiabatic calorimeter. By combining the results from this work and those from NBS high-temper-

ature drop calorimetry on the same sample, thermodynamic functions of alpha-Al2O3, from 0 to 2250 K, based entirely on NBS experimental measurements on SRM 720, are derived.

703,309
PB-291 975/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Automated Adiabatic Calorimetric System for Heat Capacity Measurement.
Final rept.
S. S. Chang. 1977, 8p
Pub. in Proceedings Symp. on Thermophysical Properties (7th), Held at Gaithersburg, MD. on May 10-12, 1977 p75-82 (Amer. Soc. of Mechanical Engineers, New York, NY, 1977).

Keywords: *Heat measurement, *Specific heat, Thermodynamic properties, Performance evaluation, *Calorimetry.

A fully automated adiabatic calorimetric system for heat capacity measurements from 2 to 380 K is described. The system includes both automatic analog adiabatic shield control and automatic digital data acquisition and experimental control. The system incorporates a self-balancing, high resolution potentiometric system as the main instrument. The automated system is capable of making continuous, unattended calorimetric measurements over long periods of time. The precision of the heat capacity measurements is about 0.02% when the temperature increment of each measurement is greater than 1 K. For higher temperature resolutions the precision of the present system is apparently limited by an uncertainty of 0.2 mK in the estimation of the temperature increment.

703,310
PB-291 978/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser-Excited Resonant Isotopic V yields V Energy Transfer: H35Cl-H37Cl, H79Br-H81Br, D35Cl-D37Cl, and D79Br-D81Br.
Final rept.,
A. B. Horwitz, and S. R. Leone. 15 Dec 78, 10p
Pub. in Jnl. Chemical Physics, v69 n12 p5319-5328, 15 Dec 78.

Keywords: *Energy transfer, Molecular vibration, Hydrogen chloride, Hydrogen bromide, Deuterium compounds, Reaction kinetics, *Laser induced fluorescence, Reprints.

An isotopically selective transverse discharge chemical laser coupled with infrared fluorescence techniques is used to measure vibration-to-vibration energy transfer rates between v = 1 levels of the isotopic species H35Cl--H37Cl, H79Br--H81Br, D35Cl--D37Cl, and D79Br--D81Br. All of the processes are nearly resonant and the rates for the hydrogenated species are on the order of one-tenth gas-kinetic. The rates for DCl and DBr are found to be 1.6 and 1.8 times slower than the corresponding hydrogen halides. Direct comparison of the results with theoretical predictions for such resonant energy transfer processes shows disagreement, indicating the further development of theoretical methods for these systems is desirable.

703,311
PB-292 163/3 PC **A05**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Center for Thermodynamics and Molecular Science.
Bibliography of Sources of Experimental Data Leading to Thermal Properties of Binary Aqueous Electrolyte Solutions.
Special pub.
D. Smith-Magowan, and R. N. Goldberg. Mar 79, 93p
NBS-SP-537
Sponsored in part by Department of Energy, Washington, DC. Div. of Energy Storage Systems. Library of Congress catalog card no. 79-600010.

Keywords: *Electrolytes, *Thermal properties, *Bibliographies, Binary systems, Solutions, Enthalpy, Specific heat, Heat measurement, Vapor pressure, Temperature, Electric potential.

Contained herein is a bibliography of sources of experimental data that can be used to calculate either relative apparent molal enthalpies or apparent molal heat capacities for aqueous electrolyte solutions. The data types included are calorimetric heat capacity measurements, enthalpies of solution as a function of molality, enthalpy of dilution measurements, electromotive force measurements as a function of temperature, and vapor pressure measurements as a function of temperature. Approximately 900 references to the primary literature are included.

703,312
PB-292 196/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Monotectic Composite Growth.
Final rept.,
J. W. Cahn. Jan 79, 3p
Pub. in Metallurgical Transactions A 10A, p119-121, Jan 79.

Keywords: *Composite materials, Eutectics, Mixtures, Wetting, Growth, Reprints, Monotectics.

The theoretical factors in monotectic composite growth are re-examined. Perfect wetting of the solid by the monotectic liquid occurs whenever the monotectic temperature is close to the critical temperature. According to Chadwick, composite growth is impossible whenever such perfect wetting occurs. However, since the disjoining pressure is expected to be small, composite growth may instead be determined by the critical velocity necessary to overcome the disjoining pressure. Experience that high velocities are needed to form monotectic composites tends to support this alternate proposal. Applied pressure and ternary additions are suggested as additional ways for altering the factors that mediate composite growth.

703,313
PB-292 203/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamic Flow Birefringence and Flow Dichroism of Block-Copolymer Molecules in Solution with Application to the Free-Draining Limit.
Final rept.,
F. W. Wang. 1978, 8p
Pub. in Macromolcules 11, n6, p1198-1205, Nov-Dec, 1978.

Keywords: *Copolymers, *Dichroism, *Birefringence, Solutions, Mathematical models, *Zimm theory, Numerical solution, Reprints.

The dynamic flow birefringence and the flow dichroism of block-copolymer molecules in solution have been calculated by modifying the bead-spring model theory of Zimm to take into account the existence of dissimilar segments in block copolymers. The expressions for the birefringence and the dichroism properties have been found to be the same as those for homopolymers except that the contributions of normal modes are weighted by generally different factors. Some calculated results in the free-draining limit are given to illustrate how the inhomogeneity in segmental optical properties is expected to affect the flow birefringence and the flow dichroism.

703,314
PB-292 361/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Transition Metals: d-Band Hybridization, Electronegativities and Structural Stability of Intermetallic Compounds.
Final rept.,
R. E. Watson, and L. H. Bennett. 15 Dec 78, 11p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review, B. Solid State 18, n12, p6439-6449, 15 Dec 78.

Keywords: *Transition metals, *Intermetallic compounds, *Electronegativity, Hybridization, Molecular structure, Stability, Reprints.

An electronegativity scale is derived for the nobel and transition metals, based on their electron band theory description. The tendency of d-band electron and hole states to hybridize is used to estimate the propensity for a particular metal to gain or lose d-electron count and this, in turn, is used to provide the basis of the electronegativity scale. Overall agreement of this scale with Miedema's and Pauling's electronegativity is remarkably good, granted the widely divergent bases of the three scales. The results, combined with an average electron vacancy count, are then used in structural maps of transition metal-transition metal alloy systems.

703,315
PB-292 367/0 Not available NTIS
National Bureau of Standards, Washington, DC.
L23 Soft X-Ray Emission and Absorption Spectra of Na.
Final rept.,
T. A. Callcott, E. T. Arakawa, and D. L. Ederer. 15 Dec 78, 9p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review, B. Solid State 18, n12, p6622-6630, 15 Dec 78.

Keywords: *Sodium, *X ray analysis, Emission spectra, Absorption spectra, Spin lattice relaxation, Reprints.

The L23 soft x-ray emission (SXE) and soft x-ray absorption (SXA) edges have been measured. SXE edges were measured at temperatures between 85 K and 380 K and analyzed to obtain edge positions and widths. The widths increase from gamma(SXE) = 100 meV at 85 K to 150 meV at 320 K and to 180 meV above the melting point at 380 K.

703,316
PB-292 578/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Lactate-to-Pyruvate or Pyruvate-to-Lactate Assay for Lactate Dehydrogenase: A Re-Examination.
Final rept.,
B. F. Howell, S. McCune, and R. Schaffer. 1979, 4p
Pub. in Clinical Chemistry 25, n2, p269-272 1979.

Keywords: *Pyruvates, *Assaying, *Lactate dehydrogenase, Chemical reactions, Enzymes, Stability, Optical density, Spectrophotometry, Cost analysis, Solutions, *Lactates, Reprints.

As good linearity can now be obtained for the pyruvate to lactate assay for lactate dehydrogenase (E.C.1.1.1.27) as with the lactate to pyruvate assay. In addition, there are significant advantages to the pyruvate to lactate reaction: (a) a greater change in optical density per unit time which allows more accurate spectrophotometric readout, (b) a need for lower reactant concentrations which significantly reduces the cost per assay, (c) the use of only solid reagent materials for assay solution preparation, and (d) a greater stability of reagents once they are placed in solution.

703,317
PB-293 447/9 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards. Volume 83, Number 6, November-December 1978.
1978, 81p
See also Volume 83, Number 4, PB-287 689. Library of Congress catalog card no. 62-37059.

Keywords: *Physical chemistry, Enthalpy, Water, Nucleic acids, Solutions, Cytosine, Uracils, Neutron counters, Neutron flux, Comparison, Algorithms, Reviews, Phase shift, Van der Pol differential equation, Matrices(Mathematics), Thermodynamic properties, Thymine, Hadamard product matrices, Partitioned matrices.

Contents:
- Enthalpies of solution of the nucleic acid bases. 2-Thymine in water;
- Enthalpies of solution of the nucleic acid bases. 3-Cytosine in water;
- Enthalpies of solution of the Nucleic acid bases. 4-Uracil in water;
- Neutron flux intercomparison at NBS;
- A critical review of comparisons of mathematical programming algorithms and software;
- Partitioned and hadamard product matrix inequalities;
- The phase-shifting limit cycles of the van der Pol equation.

703,318
PB-293 448/7
(Order as PB-293 447/9, PC **A05**/MF **A01**)
National Measurement Lab. (NBS), Washington, DC. Center for Thermodynamics and Molecular Science.
Enthalpies of Solution of the Nucleic Acid Bases. 2. Thymine in Water,
M. V. Kilday. 19 Jun 78, 9p
Included in Jnl. of Research of the National Bureau of Standards, v83 n6 p529-537, Nov-Dec 78.

Keywords: *Enthalpy, Solutions, Water, Nucleic acids, Specific heat, Thermodynamic properties, *Thymine.

An adiabatic solution calorimeter was used to measure enthalpies of solution in water of 8 samples of thymine for which analytical data are reported.

703,319
PB-293 449/5
(Order as PB-293 447/9, PC **A05**/MF **A01**)
National Measurement Lab. (NBS), Washington, DC. Center for Thermodynamics and Molecular Science.
Enthalpies of Solution of the Nucleic Acid Bases. 3. Cytosine in Water,
M. V. Kilday. 11 Jun 78, 8p
Included in Jnl. of Research of the National Bureau of Standards, v83 n6 p539-546, Nov-Dec 78.

Keywords: *Enthalpy, *Cytosine, Water, Nucleic acids, Solutions, Thermodynamic properties, Specific heat.

An adiabatic solution calorimeter was used for measuring enthalpies of solution in water of seven samples of cytosine for which analytical data are given.

703,320
PB-293 450/3
(Order as PB-293 447/9, PC **A05**/MF **A01**)
National Measurement Lab. (NBS), Washington, DC. Center for Thermodynamics and Molecular Science.
Enthalpies of Solution of the Nucleic Acid Bases. 4. Uracil in Water,
M. V. Kilday. 6 Jun 78, 8p
Included in Jnl. of Research of the National Bureau of Standards, v83 n6 p547-554, Nov-Dec 78.

Keywords: *Enthalpy, *Uracils, Water, Solutions, Nucleic acids, Thermodynamic properties, Specific heat.

An adiabatic solution calorimeter was used to measure enthalpies of solution in water of 7 uracil samples in a concentration range of 3 to 45 mmol kg and over a temperature range of 298 K to 325 K. Analytical data for the samples are given.

703,321
PB-294 112/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Cation Ordering in Ca2La8 (SiO4) 6O2.
Final rept.,
L. W. Schroeder, and M. Mathew. 1978, 5p
Grant PHS-DE-00572
Pub. in Jnl. of Solid State Chemistry 26, p383-387 1978.

Keywords: *Lanthanum, *Calcium, *Cations, Silicates, X ray diffraction, Thermodynamics, Crystal structure, Calcium lanthanum oxide silicate, Ising model, Reprints.

The distribution of La(+3) and Ca(+2) over the cation sites in Ca2La8(SiO4)6O2 was determined by single-crystal X-ray diffraction. Ca2La8(SiO4)6O2 has the apatite structure, and all available evidence indicates that the space group is P6(3)/m, thus precluding a completely ordered structure. The 6h lattice sites are occupied by La(+3). In contrast, the 4f sites are occupied equally by La(+3) and Ca(+2) ions. Consideration of the properties of the La(+3) and Ca(+2) ions suggests that the distribution is thermodynamically favored for this composition. A simple Ising model suggests ordered columns. These would not be precluded by space group P6(3)/m, if the correlation between adjacent columns were random.

703,322
PB-294 115/1 Not available NTIS
National Bureau of Standards, Washington, DC.
X-Ray Scatter Data for Diagnostic Radiology.
Final rept.,
C. E. Dick, C. G. Soares, and J. W. Motz. 1978, 10p
Pub. in Physics in Medicine and Biology 23, n6, p1076-1085 1978.

Keywords: *X ray analysis, Polystyrene, Monte Carlo method, Diagnosis, Scattering, Reprints.

The ratio of the scattered to the total X-ray fluence (scatter fraction) at the centre of the image plane for X-rays transmitted through polystyrene phantoms has been measured for X-ray energies of 32 and 69 keV, X-ray beam diameters from 4 to 40 cm, phantom thicknesses from 5 to 30 cm and phantom-to-image-plane separations from 0.3 to 40 cm. The experimental values for this ratio have less than a 10% variation for these two X-ray energies and the experimental data show good agreement with Monte Carlo calculations and available experimental results for low atomic number materials. Based on these results, simple curves are generated which give estimates (plus or minus 10%) of the scatter fraction for all combinations of the geometric parameters encountered in diagnostic radiology.

703,323
PB-294 157/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Critical Phenomena Experiments in Space.
Final rept.,
J. V. Sengers, and M. R. Moldover. 1978, 9p
Contract NASA-C-62861, Grant NSF-DMR76-82345
Pub. in Z. Flugwiss. Weltraumforsch 2, p371-379 1978.

Keywords: *Critical point, Phase transitions, Aerospace environment, Gravity, Space processing, Spacelab, Reprints.

Earth-bound experiments near the critical point of fluids are severely affected by the presence of the earth's gravitational field. Some estimates of the gravitational limitations are presented and it is indicated how these limitations could be reduced by performing critical phenomena experiments in an orbiting laboratory. Because of the 'universal' features of critical phenomena, such experiments will contribute to our understanding of the nature of critical-point phase transitions in a large number of systems, including solids as well as fluids.

703,324
PB-294 159/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Virial Theorem and Stress Calculation in Molecular Dynamics.
Final rept.,
D. H. Tsai. 1 Feb 79, 8p
Sponsored in part by Army Research Office, Arlington, VA.
Pub. in Jnl. of Chemical Physics 70, n3, p1375-1382, 1 Feb 79.

Keywords: Molecules, Pressure, Stresses, Thermodynamics, Chemical equilibrium, *Virial theorem, Numerical solution, Reprints.

In molecular dynamics, the pressure in a homogeneous system in equilibrium may be calculated by two different methods. The first is based on the virial theorem of Clausius and gives the pressure at the boundary of the system. The second is based on the notion of stress, which is the sum of the appropriate components of the interatomic forces intercepted by an area, and of the components of momentum flux across the area, averaged over the area and over time. The author shows by means of a detailed comparison of the forces involved that the two methods are equivalent in the thermodynamic limit. In a small system with arbitrary boundary conditions, the neglect of a part of the interactions between the system and the wall results in some error in the pressure calculated by the virial method. In the special case of a system with periodic boundaries, there is no external 'wall,' and the internal pressures calculated by the two methods are the same. However, with comparable effort in computation, the stress method makes more efficient use of the data and yields a result of greater precision than does the virial method. In a system not in equilibrium or not homogeneous, the stress method remains valid but the virial method leads to ambiguous results. These considerations indicate that the method of stress calculation is more general than the virial method.

703,325
PB-294 162/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Evidence for Atom Exchange in OH Reactions with Carbonyl Compounds: 18OH + CO2 yields 18OCO + OH; 18OH + CO yields 18OC + OH.
Final rept.,
M. J. Kurylo, and A. H. Laufer. 15 Feb 79, 2p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC. Atmospheric Research Office.
Pub. in Jnl. of Chemical Physics Letters to Ed. 70, n4, p2032-2033, 15 Feb 79.

Keywords: *Exchange reactions, *Carbon dioxide, *Carbon monoxide, Isotopic labeling, Chemical reactions, Tracer studies, *Hydroxyl radical, Oxygen 18, Chemical reaction mechanisms, Reprints.

The reactions between OH and both CO2 and CO have been investigated using 18O as a tracer. Evidence for exchange was observed. The properties of the intermediate adducts are discussed.

703,326
PB-294 164/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Statistical Broadening and Population Loss in Strongly Excited Three-Level Systems.
Final rept.,
J. R. Ackerhalt, J. H. Eberly, and B. W. Shore. Jan 79, 16p
Pub. in Physical Review, A. General Physics 19, n1, p248-263, Jan 79.

Keywords: *Lasers, Energy dissipation, Population(Statistics), Statistics, Quantum theory, Excitation, *Population inversion, Line broadening, Population loss, Energy level transitions, Rabi frequencies, Few level systems, Reprints.

The effects of statistical broadening and population loss on the dynamics of strongly excited three-level quantum systems are studied. The results of both analytic and numerical treatments of the three-level Schrodinger equation are displayed. In order to allow for statistical broadening, solutions are required for arbitrary detuning of the two very intense monochromatic lasers. The most efficient statistically averaged population depletion occurs when the Rabi frequency of the second transition is greater than that of the first.

703,327
PB-294 165/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Penning Ionization of the Minor Species in a Neon Hollow Cathode Discharge.
Final rept.,
K. C. Smyth, B. L. Bentz, C. G. Bruhn, and W. W. Harrison. 14 Feb 79, 3p
Pub. in Jnl. of the American Chemical Society 101, n4, p797-799, 14 Feb 79.

Keywords: *Ionization, *Neon, Gas discharges, Atomic energy levels, Excitation, Cathodes, *Penning effect, Reprints.

Using a tunable dye laser, a neon hollow cathode discharge was irradiated at wavelengths corresponding to 1S(n) goes to 2p(n) neon transitions, and thereby the neon metastable atom population was perturbed. At these wavelengths, changes were detected in both the voltage across the discharge and in the ion signals for the various neon species, as well as for minor (including sputtered) species in the discharge. Attention is focused on the several possible ionization mechanisms for the minor species. Our results suggest that Penning ionization by metastable neon atoms plays the most important role at low discharge currents, but only a minor role at high currents.

703,328
PB-294 167/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Photochemistry of Acetylene: Bimolecular Rate Constant for the Formation of Butadiyne and Reactions of Ethynyl Radicals.
Final rept.,
A. H. Laufer, and A. M. Bass. 1979, 4p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC. Planetary Atmospheres Program.
Pub. in Jnl. of Physical Chemistry 83, n3, p310-313 1979.

Keywords: *Reaction kinetics, *Photolysis, Free radicals, *Chemical reaction mechanisms, *Butadiyne, Reprints.

The vacuum-ultraviolet flash photolysis of acetylene has been investigated and the mechanisms and rate constant for butadiyne production have been measured.

703,329
PB-294 168/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Multistate Semiclassical Orbital Treatment of Li(+)-H2 and H(+)-H2 Collisions.
Final rept.,
K. J. McCann, and M. R. Flannery. 15 Jan 79, 5p
Pub. in Chemical Physics Letters 60, n3, p523-527, 15 Jan 79.

Keywords: *Elastic scattering, *Lithium, *Hydrogen, *Molecular rotation, *Ion molecule interactions, Lithium atoms, Hydrogen atoms, Reprints.

A semiclassical orbital description of elastic scattering and of rotational excitation in ion-molecule collisions is presented. Specific account is taken of interference effects between the classical trajectories that contribute to a given scattering angle, and of rainbow scattering. Excellent agreement with full quantal differential cross sections is obtained.

703,330
PB-294 304/1 PC **A03**/MF **A01**
National Standard Reference Data System.
Rate Coefficients for Ion-Molecule Reactions. Organic Ions Other Than Those Containing Only C and H.
L. W. Sieck. Feb 79, 31p NSRDS-NBS-64
Prepared in cooperation with National Measurement Lab. (NBS), Washington, DC. Library of Congress catalog card no. 78-10710.

Keywords: *Reaction kinetics, Organic compounds, Ions, Tables(Data), *Ion molecule interactions.

A compilation is presented of all experimentally determined bimolecular and termolecular rate coefficients for the reactions of organic ions (other than those containing only C and H) with neutral molecules in the vapor phase. The literature covered is from 1960 to the present, and both positive and negative ions are considered. Five hundred and seventy-seven separate reaction-partners are tabulated, and experimental conditions are specified wherever possible. Preferred values are suggested for a number of these processes.

703,331
PB-295 135/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Influence of Environmental Parameters on Transmethylation Between Aquated Metal Ions.
Final rept.,
K. L. Jewett, F. E. Brinckman, and J. M. Bellama. 1978, 30p
Pub. in Organometals and Organometalloids Chapter 11. Occurrence and Fate in the Environment, ACS Symposium Series No. 82, p158-187, 1978.

Keywords: Reaction kinetics, Temperature, pH, Nuclear magnetic resonance, Chemical reactions, Tin organic compounds, Mercury organic compounds, Ions, *Tin/trimethyl, *Mercury/trimethyl, *Water chemistry, Chemical reaction mechanisms, CHEMSPECIES computer program, Chlorine ions, Ion molecule interactions, Bronsted-Debye-Huckel theory, Reprints.

The transmethylation reaction between trimethyltin and mercury (II) species in water, was examined under varying conditions of temperature, ionic strength, and chloride ion concentrations to establish the influence of environmental parameters on the rate and pathways for the reaction. A computer program, CHEMSPECIES, was developed to apply available formation constants in calculating net and relative concentrations of reactant methyltin and Hg(+2) species, as well as product ions and molecules formed, during course of kinetic runs. Input data included observed pH, (Cl(-)), and (methylmetal species) observable by proton NMR. Biomolecular total reaction rates k(2) (obs) were observed for all runs. Direct extension of Bronsted-Debye-Huckel concepts for ion-molecule reactions in water, provided a coherent estimation of concurrent individual reaction rates for six biomolecular pathways all contributing to k(2) (obs). These individual rate constants could be applied to transmethylation at diverse ion strengths using simple correction factors consistent with modern theory and reasonable views on the nature of principal reaction pairs. Prospects for encountering such reactions mechanisms in natural waters are briefly discussed.

703,332
PB-295 136/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectrum and Energy Levels of Singly Ionized Aluminum (Al II).
Final rept.,
V. Kaufman, and L. Hagan. Feb 79, 7p
Pub. in Jnl. of the Optical Society of America 69, n2, p232-238, Feb 79.

Keywords: *Aluminum, *Atomic energy levels, Atomic spectra, Ionization, Aluminum ions, Reprints.

New wavelength measurements in the spectrum of singly ionized aluminum (8640-683 A) have been combined with some previous observations to re-evaluate all of the known energy levels of that ion. The designations of the previously known 3p3d triplet D and triplet P terms have been changed and newly found terms have been identified as 3p3d triplet D and 3 doublet P singlet S. The ionization energy is 151 862.7(4)/cm or 18.828 73(5) eV.

703,333
PB-295 138/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Wavelength of the W K alpha sub 1 X-ray Line.
Final rept.,
E. G. Kessler, R. D. Deslattes, and A. Henins. Jan 79, 4p
Pub. in Physical Review, A. General Physics 19, n1, p215-218, Jan 79.

Keywords: *Tungsten, *X ray spectra, Anodes, X ray spectroscopy, Wavelengths, Measurement, Helium neon lasers, Reprints.

The wavelength of the K alpha sub 1 line from an electron-bombarded natural W anode has been measured in terms of that of an I sub 2-stabilized HeNe laser. This visible laser is a reference point for current Rydberg determinations and for the present-day definition of length. The resulting wavelength value, namely 0.20901349 A (0.90ppm)(energy=59.319233 keV) appears to resolve historical inconsistencies in the x-ray route to gamma wavelengths.

703,334
PB-295 146/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectrum and Energy Levels of Four-Times Ionized Zirconium (Zr V).
Final rept.,
J. Reader, and N. Acquista. Feb 79, 15p
Pub. in Jnl. of the Optical Society of America 69, n2, p239-253, Feb 79.

Keywords: *Zirconium, *Atomic energy levels, Atomic spectra, Ionization potentials, Ions, *Zirconium ions, Energy spectra, Reprints.

The spectrum of zirconium was observed in the region from 200 to 2670 A with a sliding-spark discharge on the 10.7-m normal- and grazing-incidence spectrographs at NBS. About 580 lines were assigned to Zr V.

703,335
PB-295 147/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectrum and Energy Levels of Thirteen-Times Ionized Molybdenum (Mo XIV).
Final rept.,
J. Reader, G. Luther, and N. Acquista. Jan 79, 6p
Pub. in Jnl. of the Optical Society of America 69, n1, p144-149, Jan 79.

Keywords: *Molybdenum, *Atomic energy levels, Atomic spectra, Ionization potentials, Ions, *Molybdenum ions, Energy spectra, Laser produced plasma, Reprints.

The spectrum of Mo XIV was observed with a low-inductance spark and a laser-produced plasma in the region from 70 to 630 A on the 10.7-m grazing-incidence spectrograph at NBS. From the identification of 35 lines, a system of 22 energy levels was determined. The level system (Cu I isoelectronic sequence, 3d(10) nl) includes the series ns(n=4-6), np(n=4-6), nd(n=4-5), nf(n=4-6), and ng(n=5-7). The observed energy levels are compared with Hartree-Fock calculations. The ionization energy is determined from the ng series (n=5-7) to be 302.60 + or - 0.04 eV.

703,336
PB-295 149/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron-Impact Ionization-Rate Coefficients for Lithiumlike Nitrogen and Oxygen.
Final rept.,
W. L. Rowan, and J. R. Roberts. Jan 79, 9p
Pub. in Physical Review, A. General Physics 19, n1, p90-98, Jan 79.

Keywords: *Nitrogen, *Oxygen, *Ionization coefficients, Gas ionization, Electron irradiation, Electron ion collisions, Collisional plasmas, High temperature plasmas, Nitrogen ions, Oxygen ions, Reprints.

The electron-impact ionization-rate coefficients for lithiumlike nitrogen and oxygen are obtained from the time evolution of spectral lines emitted by a hot plasma. The plasma is produced in a 37-kJ theta pinch. The rate coefficients measured here and all other measurements of lithiumlike ionization rate coefficients are compared to calculations of the ground-state ionization-rate coefficient and the total-ionization-rate coefficient.

703,337
PB-295 151/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Formation of Cuprous Benzotriazole.
Final rept.,
A. R. Siedle, R. A. Velapoldi, and N. Erickson. 1979, 4p
Pub. in Inorganic and Nuclear Chemistry Letters 15, n14, p33-36 1979.

Keywords: *Surface chemistry, *Copper organic compounds, Nitrogen organic compounds, Excitation, Complex compounds, *Benzotriazoles, Fluorometric analysis, Reprints.

Intense, visible luminescence, attributed to charge transfer excited states, was observed in Cu(I) complexes of benzotriazole but not in the Cu(II) analogues. Microspectrofluorimetry was used to characterize cuprous benzotriazole, a surface phase formed from bulk copper and benzotriazole in dichloromethane.

703,338
PB-295 152/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Identification of 5g and 6g Terms and Revised Ionization Energies in the Yb II 4f(14)nl Isoelectronic Sequence.
Final rept.,
J. Sugar, and V. Kaufman. Jan 79, 3p
Pub. in Jnl. of the Optical Society of America 69, n1 p141-143, Jan 79.

Keywords: *Ionization potentials, Atomic energy levels, Hafnium, Lutetium, Tungsten, Tantalum, Osmium, Rhenium, Ytterbium, Ions, Reprints.

The 5f-5g transitions in Lu III through Os VIII and the 5f-6g transitions in Hf IV through W VI were identified and used to redetermine the ionization energies of Yb II, Lu III, W VI, Re VII, and Os VIII. Complete line-lists and energy levels are given for the one-electron spectra Hf IV, W VI and Os VIII.

703,339
PB-295 153/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Even-Parity Autoionizing States in Neutral Sodium (350-400 A).
Final rept.,
J. Sugar, T. B. Lucatorto, T. J. McIlrath, and A. W. Weiss. Apr 79, 3p
Pub. in Opt. Lett. 4, n4, p109-111, Apr 79.

Keywords: *Sodium, Parity, Excitation, Atomic energy levels, Ionization, *Autoionization, Neutral particles, Atomic excitation, Reprints.

A recently developed laser-excitation technique has been used in the first photoabsorption studies of the even-parity 2p(5) 3s3p and 2p(5) 3s4p autoionizing levels of Na I. The observed-level values are compared, where applicable, with those previously obtained by ejected-electron spectroscopy of collisionally excited Na, and the identifications are confirmed by ab initio calculations.

703,340
PB-295 154/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Theoretical Simulation of Beam Foil Decay Curves for Resonance Transitions of Heavy Ions.
Final rept.,
W. L. Wiese, and S. M. Younger. Feb 79, 3p
Pub. in Jnl. of Physics 2, n40, pC1-146-C1-148, Feb. 79.

Keywords: *Line spectra, Krypton, Excitation, Ions, Atomic energy levels, Lifetime(Energy levels), *Beam foil spectroscopy, Beam foil excitation, Reprints.

The authors have made a theoretical study of the influence of cascades on heavy ion beam-foil lifetimes concentrating on the resonance line of Kr VIII. Using theoretical data for the lifetimes and initial populations of excited states, they have constructed decay curves simulating beam foil excitation conditions. The theoretical decay curve producing the best fit with experimental decays yielded the same lifetime as the experiments when subjected to the same cascade analysis, but customary exponential fitting techniques were not

able to extract the theoretical primary lifetime actually used in its construction.

703,341
PB-295 158/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Internal Friction Study of Polycrystalline n-Paraffins.
Final rept.,
J. M. Crissman. Oct 74, 14p
Pub. in Jnl. of Applied Physics 45, n10, p4190-4203, Oct 74.

Keywords: *Alkanes, *Relaxation(Mechanics), Isomers, Internal friction, Low temperature tests, Dielectric properties, *Eicosane, Polycrystals, Reprints.

Recent measurements have shown that mechanical relaxation peaks commonly observed in n-paraffins are absent in single crystals of n-eicosane (C2OH42). This work has now been extended to include polycrystalline samples of several highly pure long-chain hydrocarbons. Internal friction data obtained for a variety of n-paraffins, pure or otherwise, have revealed no low-temperature gamma relaxation. Moreover, the alpha relaxation peak is suppressed completely by purification. In attempts to induce an alpha or gamma loss peak, several dilute mixtures of other n-paraffins in pure C2OH42 have been examined. Only the addition of odd-numbered shorter chains induced loss peaks. On the other hand, the presence of a branched impurity, in this case the C2OH42 isomers 2-methylnonadecane and 10-methylnonadecane, did induce loss peaks, one of which correlates very well to the alpha process found in as-received C2OH42. It is proposed here that isomer impurities are an important factor in the mechanics of many of the loss processes in long-chain hydrocarbons observed both mechanically and dielectrically.

703,342
PB-295 159/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamic Mechanical Behavior of Polyethylene During Creep to Failure in Uniaxial Extension.
Final rept.,
J. M. Crissman, and L. J. Zapas. Oct 77, 3p
Pub. in Jnl. of Applied Physics 48, n10, p4049-4051, Oct 77.

Keywords: *Polyethylene, Mechanical measurement, Failure analysis, Creep tests, Thermoplastics, Reprints.

Dynamic mechanical measurements in torsion superposed on large uniaxial creep strains have been obtained on two types of polyethylene resins. At creep strains of about 10% it is observed that tan delta goes through a minimum and rises sharply thereafter.

703,343
PB-295 160/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Rydberg Values of X- and gamma-Rays.
Final rept.
R. D. Deslattes. 1978, 6p
Pub. in Japanese Jnl. of Applied Physics, Supplement 17, Part 2, p1-6 1978. Proceedings of the International Conference on X-Ray and XUV Spectroscopy Held at Sendai, Japan on August 28-September 1, 1978.

Keywords: *X rays, *Gamma rays, Hydrogen, Atomic energy levels, Hartree-Fock approximation, *Rydberg series.

An improved connection chain has been established between the hydrogen Rydberg (i.e., H Balmer alpha) and gamma-ray lines to which mesic X-ray transitions are compared. This new gamma-ray scale, together with improved comparisons between muonic spectra and the gamma-ray lines, appears to have resolved the long-standing problem of vacuum polarization in high Z muonic atoms. It now becomes of interest to turn to high Z electronic spectra where accurate relativistic calculations are recently available. Direct remeasurement of these spectra is underway; meanwhile, however, there are already some results available. This report describes the H Balmer alpha to gamma-ray comparisons and summarizes the results of initial comparisons between re-evaluated X-ray transition energies and those which follow from recent relaxed-orbital relativistic Hartree-Fock-Slater calculations.

703,344
PB-295 164/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Systematic Trends in the Inelastic Cross Sections and Form-Factors for nl - n'l' Direct Collisional Transitions.
Final rept.,
M. R. Flannery, and K. J. McCann. 1979, 19p
Pub. in Jnl. of Physics, B 12, n3, p427-445 1979.

Keywords: *Electron transitions, *Inelastic scattering, Angular momentum, Inelastic cross sections, Hydrogen, Plasmas(Physics), *Atomic collisions, Orbital angular momentum, Form factors, Excited states, Reprints.

Certain theoretical predictions are presented for the preferential population of final states with angular momentum l' in collisions involving an initially excited atom. Varying l', we find that the maxima of both the inelastic form factors and cross sections for the nl yields n'l' transitions in hydrogen, induced by collision with electrons and heavy particles, in general oscillate on a background which rises as l' is increased, until they both attain a pronounced peak at a unique value l' sub max which is strongly dependent on only the initial principal quantum number n and which is fairly insensitive to changes in l and n'. An expression for l' sub max is derived. For l' $>$ l' max, the form factors and associated cross sections exhibit a dramatic decline, resulting in negligible population of those states. The predictions differ from those suggested by the Bethe high-energy asymptotic limit which favours dipole transitions, and assume significance in situations where excited states are important as in laser modelling, astrophysical and fusion plasmas, and in laboratory studies of excited Rydberg states. For heavy-particle (nl yields n'l') collisional transitions the additional undulations which appear in the cross sections over a wide energy range are predicted and explained.

703,345
PB-295 165/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Far-Wing Line Broadening.
Final rept.,
A. Gallagher. 1978, 5p
Pub. in Acta Physiologica Polonica A54, n6, p761-765 1978.

Keywords: *Line width, Spectral lines, Atomic energy levels, Rare gases, Reprints.

Some of the history and applications of the quasi-static theory of line broadening are discussed, as is its relationship to molecular radiation theory. Interaction potentials of alkali-noble gas diatomic pairs in the ground and first excited state, obtained from application of this theory, are given.

703,346
PB-295 166/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Two-Frequency Separated Oscillating Fields Technique for Atomic and Molecular Beam Spectroscopy.
Final rept.,
R. M. Garvey, H. W. Hellwig, S. Jarvis, and D. J. Wineland. Dec 78, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-27, n4, p349-354, Dec 78.

Keywords: *Atomic spectroscopy, *Molecular spectroscopy, Molecular beams, Atomic beams, Cavities, Phase shift, Cavity resonators, Electromagnetic fields, Frequencies, Reprints.

The authors report on a novel method to reduce the effects of cavity phase shift upon atomic beam interrogation in Ramsey cavity configurations. Two distinct cavities driven at different frequencies are employed to produce a cavity phase shift which advances (or recedes) at a constant rate.

703,347
PB-295 171/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Concentration Dependence of the Diffusion Coefficient of Polystyrene at Theta-Condition.
Final rept.,
C. C. Han. Feb 79, 3p
Pub. in Polymer Notes 20, p259-261, Feb 79.

Keywords: *Polystyrene, *Diffusion coefficient, Transport properties, Concentration(Composition), Polymers, Mathematical models, Theta condition, Theta temperature, Reprints.

Despite many experimental and theoretical studies, the concentration dependence of diffusion coefficient, k sub D, of polymers at their theta-conditions still remain an unsettled problem. Many investigators found experimentally that k sub D has a negative value; furthermore, Cantow found that the diffusion coefficient D is independent of the concentration at theta temperature. Meanwhile, theoretical investigations have been carried out by Yamakawa and Imai and also by Pyun and Fixman. The Pyun and Fixman (P-F) approach uses a spherical model instead of the more realistic beads and spring model which was employed by Uamakawa and Imai (Y-I). But it has been pointed out by Pyun and Fixman that Yamakawa's earlier approach is incorrect due to the approximation made by assuming independent inter-and intra-molecular distributions and consequently resulting in the neglect of correlations due to the intermolecular interactions. In the later work of Yamakawa, a negative concentration dependence of D was introduced through the change of coordinate system from actual polymer velocity to the drift velocity. Even though this model leads to a different magnitude for the k sub D than the one obtained from P-F model, nonetheless both theories predict a negative and molecular weight independent k sub D at the theta condition.

703,348
PB-295 585/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Collisional Redistribution and Emission Line Shapes.
Final rept.,
M. G. Raymer, J. L. Carlsten, and G. Pichler. 1979, 6p
Contract N00014-76-C-0611, Grant NSF-PHY76-04761
Pub. in Jnl. of Phys. B Lett. to Ed. 12, n4, pL119-L124 1979.

Keywords: *Thallium, *Fluorescence, *Atomic spectra, Emission spectra, Raman spectra, Line width, Spectral lines, Resonance, Argon, *Atom atom collisions, Laser induced fluorescence, Reprints.

Collisional redistribution of near-resonance radiation in thallium vapor caused by collisions with argon buffer gas has been studied. Electronic Raman scattering and collision-induced fluorescence has been resolved, both to the weakly populated metastable 6 doublet P(3/2) level in thallium. Thus the problem with radiative trapping encountered in previous experiments has been partially avoided. By measuring the total collision-induced fluorescence as a function of the incident laser frequency, the absolute collisional redistribution line shape has been obtained. This line shape has been compared with the emission line shape measured by Cheron, Scheps and Gallagher.

703,349
PB-296 106/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Triple Differential Cross Sections for the Electron Impact Ionization of Helium at 35 eV Collision Energy.
Final rept.,
E. Schubert, A. Schuck, K. Jung, and S. Geltman. 1979, 12p
Pub. in Jnl. of Physics, B 12, n6, p967-978 1979.

Keywords: *Helium, *Ionization, Differential cross sections, Scattering cross sections, Momentum transfer, Gas ionization, *Electron atom collisions, Born approximation, Reprints.

In a coincidence experiment with coplanar geometry, angular correlations of the two outgoing electrons have been studied for the ionization of helium atoms by electrons with an impact energy 10.5 eV above the first ionization threshold. The measured angular dependencies of the triple differential cross section are compared with calculated results of the Coulomb-projected Born approximation including exchange. The measured data as well as the calculated ones do not show the features that have been found at medium and high impact energies. The momentum transfer vector K sub 0a looses its importance as a means of classification.

703,350
PB-296 107/6 Not available NTIS
National Bureau of Standards, Washington, DC.

Formation of a New Crystal Form (alpha p) of Poly(Vinylidene Fluoride) Under Electric Field.
Final rept.,
D. Naegele, D. Y. Yoon, and M. G. Broadhurst. Dec 78, 2p
Pub. in Macromolecules 11, n6, p1297-1298, Dec 78.

Keywords: *Polymeric films, *Crystal structure, *Piezoelectric crystals, X ray diffraction, X ray spectra, Electric fields, Fluorine organic compounds, Molecular conformation, *Vinylidene fluoride polymers, Reprints.

Polyvinylidene films were prepared in the alpha crystal form by stretching at 145C. The x-ray diffraction spectra of films which were subjected to an electric field of 1500 kV/cm at room temperature were compared to those of films which were not subjected to changes are consistent with the assumption that the electric field changes the normally anti polar alpha phase into a polar phase having the same chain conformation and unit cell dimensions.

703,351

PB-296 109/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Mean Life of the 4s(2)S(1/2) Resonance Level in Al I.
Final rept.,
J. Z. Klose. Feb 79, 4p
Pub. in Physical Review, A. General Physics A19, n2, p678-681, Feb 79.

Keywords: *Aluminum, Atomic energy levels, Atomic properties, Resonance, Life(Durability), Near ultraviolet radiation, Lifetime, Tunable lasers, Dye lasers, Reprints.

The mean life of the 4s doublet S(1/2) resonance level in Al I has been measured at seven different vapor densities using a tunable dye laser for excitation and a method of delayed coincidence for detection. The lifetime values, obtained by exciting the level with radiation at the resonance wavelength of 3944.01 A and observing its decay by means of the transition at 3961.52 A, increase with increasing vapor density. This vapor density dependence was interpreted as being due to the imprisonment of the 3962-A radiation. Imprisonment theory at low densities was applied to the experimental data to yield the following results: tau sub 0 = 6.78 + or - 0.06 ns, f sub 3944 = 0.115 + or - 0.001, and f sub 3962 = 0.116 + or - 0.001. Experimental and theoretical results of other works are presented for comparison with the results of the present work.

703,352

PB-296 116/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Weight and Polydispersity Measurements of Polystyrene by Quasielastic Light Scattering.
Final rept.,
C. C. Han, and F. L. McCrackin. 1979, 6p
Pub. in Polymer 20, p427-432 1979.

Keywords: *Polystyrene, Molecular weight, Chemical properties, Diffusion, Inelastic scattering, Elastic scattering, Light scattering, Polymers, Polydispersity, Reprints.

The molecular weight and polydispersity of a polydisperse polystyrene sample was measured by quasielastic light scattering. The molecular weight distribution of the polymer was represented by the Schultz distribution. The weight average molecular weight and polydispersity of distribution was adjusted until the quasielastic light scattering spectra calculated for the distribution agreed with the measured spectra. The calculation was repeated using the logarithmic normal distribution for the polymer. The calculated value of the weight average molecular weight is accurate and insensitive to the assumed molecular distribution function. However, the calculated values of the polydispersity are only of fair accuracy. Thus quasielastic light scattering gives values of the weight average molecular weight at least as accurate as elastic light scattering and gives a crude estimate of the polydispersity of the polymer.

703,353

PB-296 280/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Collisions with Highly Polar Molecules: Integrated and Momentum Transfer Cross Sections and Conductivity Integrals for KOH and CsOH.
Final rept.,
L. A. Collins, D. W. Norcross, and G. B. Schmid. 1979, 12p
Contract E(49-1)-3800
Sponsored in part by Department of the Air Force, Washington, DC.
Pub. in Jnl. of Physics, B. Atomic and Molecular Physics 12, n6, p1019-1030 1979.

Keywords: *Potassium hydroxides, Cesium inorganic compounds, Hydroxides, Momentum transfer, Scattering cross sections, Dipoles, Polarization(Charge separation), *Electron molecule collisions, *Cesium hydroxides, EV range 01-10, Milli eV range, Reprints.

The authors report close-coupling calculations of the total integrated and momentum transfer cross sections for the scattering of electrons from KOH and CsOH in the energy range 0.01 to 10 eV. A cut-off dipole potential is used to account for the long-range interaction.

703,354

PB-296 299/1 PC **A03**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Polymer Science and Standards Div.
Influence of Polymer Membrane Properties on the Performance of Dissolved Oxygen Sensors.
Final rept.
J. D. Barnes. Jun 79, 35p NBSIR-79-1740

Keywords: *Membranes, *Polarimeters, *Oxygen, Polarographic analysis, Gas detectors, Dissolved gases, Performance evaluation, Transport properties, Monitoring, Cathodes, Electrolytes, Electrochemistry, Mathematical models, Polymers, Laboratory equipment, Design, Error analysis, Numerical solution.

This report examines polarographic dissolved oxygen sensors using a polymer membrane in order to design experiments aimed at minimizing the contribution of the polymer membrane to instabilities observed during the testing of these sensors. A mathematical model is presented that links the transport properties of the membrane layer and the electrolyte layer to the overall performance of the sensor. The confounding effects of other elements of the measuring system are so severe that the most satisfactory experiments are those which directly measure the transport properties of the polymer membrane. In view of other uncertainties found in the polarographic method for measuring dissolved oxygen it is unlikely that processes in the polymer membrane make an important contribution to the observed instabilities. A critical examination of the effect of membrane permeance on sensor performance should be undertaken so that optimum choices of membrane materials can be made.

703,355

PB-296 338/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Double-Vacancy Transitions in the Copper K beta sub (1,3) Emission Spectrum.
Final rept.,
R. E. LaVilla. Feb 79, 4p
Pub. in Physical Review, A. General Physics 19, n2, p717-720, Feb 79.

Keywords: *Copper, *Emission spectra, Atomic spectra, Atomic energy levels, Line width, Electron transitions, Reprints.

The beta prime and beta double prime satellites in the measured Cu K beta sub (1,3) emission spectrum are shown to be due to the double-vacancy transitions 1s3p(6)3d(91,3)D yields 1s(2)3p(5)3d(91,3) PDF. This assignment is consistent with an earlier analysis of a highly resolved Cu K alpha sub (1,2) spectrum. The M sub 2 and M sub 3 level widths are estimated to be 1.68 eV, in agreement with 2.0 + or - 0.3 eV and 1.6 + or - 0.3 eV, respectively, from photoelectron spectroscopy, and a calculated width of 2.0 eV. Comparison of the calculated double-vacancy transition array with the neighboring elements 30 < or = Z < or = 32 suggest a similar identification to the beta prime and beta double prime satellites in their K beta sub (1,3) spectra.

703,356

PB-296 734/7 PC **A04**/MF **A01**
Notre Dame Univ., IN. Radiation Chemistry Data Center.
Rate Constants for Reactions of Inorganic Radicals in Aqueous Solution.
A. B. Ross, and P. Neta. cJun 79, 64p NSRDS-NBS-65
Library of Congress catalog card no. 79-607030.

Keywords: *Free radicals, *Inorganic compounds, *Reaction kinetics, Radiolysis, Photolysis, Solutions, Carbonates, Sulfates, Inorganic phosphates, Inorganic nitrates, Ions, Halides, Selenium inorganic compounds.

Rate constants have been compiled for reactions of various transient inorganic radicals produced by radiolysis or photolysis in aqueous solution. Data are included for the carbonate radical, sulfate radical, phosphate radical, nitrate radical and other nitrogen-, sulfur- and selenium-containing radicals, and the halide and pseudohalide radicals Cl2(-), Br2(-), I2(-), and (SCN)2(-). The radicals react with other inorganic ions, as well as aliphatic, aromatic and heterocyclic compounds.

703,357

PB-296 736/2 PC **A06**/MF **A01**
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Bibliography of Low Energy Electron and Photon Cross Section Data.
Rept. for Jan 75-Dec 77.
J. W. Gallagher, J. R. Rumble, and E. C. Beaty. Jun 79, 118p NBS/SP-426/SUPPL-1
See also report dated Mar 76, PB-252 687. Library of Congress catalog card no. 78-600156.

Keywords: *Photon cross sections, *Positrons, *Bibliographies, Tables(Data), Atoms, Ions, Molecules, Electrons, Elastic scattering, Ionization, Dissociation, Excitation, Molecular vibration, Molecular rotation, Absorption, Fluorescence, *Electron cross sections.

A bibliography of original reports of measurements or calculations of electron, positron, and photon cross sections for atoms, small molecules, and their ions is presented. A detailed index to the bibliography facilitates retrieval of cross section data for specific processes and associated atomic or molecular species. A comprehensive author index is included. The bibliography covers the calendar years 1975-1977. This work supplements a previous bibliography which covered the literature through 1974.

703,358

PB-296 924/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Polarization Selective Optical Heterodyne Detection for Dramatically Improved Sensitivity in Laser Spectroscopy.
Final rept.,
M. D. Levenson, and G. L. Eesley. 1979, 17p
Pub. in Jnl. Appl. Phys., v19 n1 p1-17, 1979.

Keywords: Demodulation, Polarization(Waves), Electromagnetic absorption, Saturation, Spectroscopy, Signal to noise ratio, *Laser spectroscopy, Laser Raman spectroscopy, Nonlinear optics, Coherent optical radiation, Reprints.

The noise characteristic of available laser sources limits the sensitivity of many types of nonlinear spectroscopy. It is shown how to maximize the sensitivity by optimizing the strength of a local oscillator wave in a heterodyne detection scheme without altering the amplitude of the wave being detected. The intensity profile of the optimum intensity is much less than that of the probe under realistic conditions. A general signal-to-noise analysis applicable to all nonlinear spectroscopy techniques is presented along with specific applications to coherent Raman spectroscopy, two-photon absorption, saturation spectroscopy, and optical coherent transient techniques. A simple optimization procedure employing polarization selection rules is described. Detailed calculations are performed for the case of TEM(00) waves interacting via a third-order nonlinear susceptibility and for the case where the sample is simultaneously probed at many different frequency combinations.

703,359

PB-296 930/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Application of Infrared Lasers to the Selective Detection of Trace Organic Gases.
Final rept.,
D. M. Sweger, and J. C. Travis. 1979, 6p
Pub. in Jnl. Appl. Spectrosc., v33 n1 p46-51, 1979.

Keywords: *Gas analysis, *Trace elements, *Vinyl chloride, *Vinylidene chloride, *Acrylonitriles, *Methyl alcohol, Stark effect, Dipole moments, Chemical analysis, Absorption spectra, Infrared spectroscopy, Concentration(Composition), *Laser spectroscopy, Reprints.

For molecules possessing a permanent electric dipole moment the Stark effect may be used to perturb the molecular energy levels and to 'tune' some absorption lines into coincidence with fixed frequency lasers. The same perturbation may also be used to modulate the absorption and allow the use of sensitive ac detection techniques. In this paper the authors report quantitative results for four organic gases of industrial importance: vinyl chloride, vinylidene chloride, acrylonitrile, and methanol. All have overlapping absorption bands in the CO2 laser region. Because of the modulation techniques used, the observed signal as a function of electric field is the first derivative of the absorption line profile, and the peak-to-peak intensity of the derivative is the measured analytical signal. The analytical curve is a straight line over several orders of magnitude in concentration. In all cases, parts per million or subparts per million concentrations of the gases in air and/or nitrogen have been measured using a CO2 laser. The paper includes a discussion of interferences and selectivity of the technique.

703,360
PB-296 935/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tunable Diode Laser Study of the Reactions of Nitric and Nitrous Acids: HNO3 + NO and HNO2 + O3.
Final rept.,
G. E. Streit, J. S. Wells, F. C. Fehsenfeld, and C. J. Howard. Apr 79, 5p
Pub. in Jnl. Chem Phys., v70 n7 p3439-3443, Apr 79.

Keywords: *Nitric acid, *Nitrous acid, *Reaction kinetics, Lasers, *Laser enhanced reactions, Reprints.

This study of the reactions of nitrous and nitric acids demonstrates a new application of tunable diode laser technology. The diode laser is used for the direct detection of HNO2 and HNO3 in a chemical kinetic system. The authors have established an upper limit for the rate constant for HNO3 + NO yields HNO2 + NO2 and have confirmed that nitrous acid is a product of this reaction. They have also established an upper limit for the rate constant for HNO2 + 03 yields HNO3 + O2.

703,361
PB-296 941/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Molecular Weight and Temperature Dependence of Polymer Dimensions in Solution.
Final rept.,
A. Z. Akcasu, and C. C. Han. Apr 79, 5p
Pub. in Macromolecules, v12 n2 p276-280, Mar/Apr 79.

Keywords: *Polymers, *Molecular weight, Temperature, Reprints.

The molecular weight (Mw) and temperature (T) dependence of the radius of gyration (RG) and hydrodynamic radius (RH) of a polymer in a dilute solution are investigated. The theoretical predictions are compared with experimental results on polystyrene in various solvents as functions of Mw and T. It is concluded that a power law fit to data would yield nu' < nu in this region, even though the theory predicts nu' = nu in the asymptotic region. The quantitative aspects of the blob theory are also discussed and compared in some cases to the modified Flory theory.

703,362
PB-297 905/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Monte Carlo Electron Trajectory Simulation of Beam Spreading in Thin Foil Targets.
Final rept.
D. E. Newbury, and R. L. Myklebust. 1979, 5p
Pub. in Proceedings of Cornell Meeting on Analytical Electron Microscopy (2nd), Ithaca, NY., July 24-26, 1978, Ultramicroscopy 3, p391-395 1979.

Keywords: *Electron scattering, *X rays, *Microanalysis, X ray analysis, Beam width, Foils(Materials), Thin films, Monte Carlo method, Mathematical models, *Beam foil spectroscopy.

The spatial resolution of x-ray microanalysis of thin foils is limited by beam spreading caused by elastic scattering of electrons. A simple analytical model with a single scattering approximation which has been used by other workers to calculate the magnitude of beam spreading is reviewed. Monte Carlo electron trajectory simulation techniques are developed to study beam spreading. Equations are given to calculate the three major parameters of a Monte Carlo simulation: step length between scattering points, elastic scattering angle, and azimuthal angle. Monte Carlo results compare well with analytical model calculations for thin films. For thick films, Monte Carlo values of beam spreading are 10% to 40% less than corresponding analytical model values. Beam tailing and the effects of specimen inclination can also be studied by Monte Carlo simulation.

703,363
PB-297 936/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Level Cluster Analysis for E(v2) Vibration Rotation Spectrum of Spherical Top Molecules.
Final rept.,
W. G. Harter, H. W. Galbraith, and C. W. Patterson. 1 Dec 78, 8p
Pub. in Jnl. Chem. Phys., v69 n11 p4888-4895, 1 Dec 78.

Keywords: *Molecules, Molecular rotation, Molecular vibration, Hamiltonian functions, Raman spectroscopy, Reprints.

The theory of level clusters, originally developed for ground state (A1) and weakly coupled infrared active (F(2), Nu(3)) excited states, is extended to include the Raman-active (E) states of vibration-rotation. Simple approximate formulas are given for the eigenvalue spectrum of the dominant second order vibration-rotation Hamiltonian, and the results are compared with exact computer reductions.

703,364
PB-297 938/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Centrifugal and Coriolis Effects on Level Cluster Patterns for T(nu sub 3) Rovibrational Bands in Spherical Top Molecules.
Final rept.,
W. G. Harter, C. W. Patterson, and H. W. Galbraith. 1 Dec 78, 12p
Pub. in Jnl. Chem. Phys., v69 n1 p4896-4907, 1 Dec 78.

Keywords: *Molecules, Centrifuging, Coriolis force, Molecular vibration, Molecular rotation, Reprints.

Fundamental T(nu sub 3) type high-J rovibrational fine structure is derived for a range of values of the Coriolis and (2x2) sup 4 centrifugal constants. The theory of level clusters is developed further. Correlations are made between cluster states corresponding to well separated P(+), Q(0), and R(-) branches, and the opposite case in which Pi(+ or -) and sigma (0) labels are appropriate.

703,365
PB-298 000/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
United-Atom Approximation in the Problem of Sigma-pi Transitions during Close Atomic Collisions.
Final rept.,
Y. N. Demkov, C. V. Kunasz, and V. N. Ostrovskii. Nov 78, 10p
Pub. in Physical Review A18, n5 p2097-2106 Nov 78.

Keywords: Elastic scattering, Atoms, Phase shift, Electron transitions, *Atom atom interactions, Reprints.

The authors consider a very simple approximation, in which the splitting of the energy of a P state in a united atom into Sigma and Pi quasimolecular terms for small internuclear distances R depends quadratically on R, and the colliding atoms pass one another along a straight or a hyperbolic trajectory. In this case the transition probability for a given scattering angle or impact parameter depends on only one parameter--the Massey parameter. This probability is computed numerically along with the elastic scattering phase shifts.

703,366
PB-298 003/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pyrolysis Gas Chromatography of Some Fluorine-Containing Polymers.
Final rept.,
C. N. Cascaval, and R. E. Florin. 1979, 6p
Pub. in Jnl. Fluorine Chem., v13 p65-70 1979.

Keywords: *Gas chromatography, *Pyrolysis, *Fluorine organic compounds, Polymers, Copolymers, Chemical reaction mechanisms, Pentene/heptafluoro, Propene/tetrafluoro, Ethylene/tetrafluoro, Reprints.

Pyrolysis gas chromatography of the polymers of 1,3,3,3-tetrafluoropropene, 3,3,4,4,5,5,5-heptafluoropentene-1 and of the copolymers of tetrafluoroethylene with the above and with 3,3,3-trifluoropropene and with isobutene in all instances gave only 3 to 19% of volatiles below C16, distributed among many peaks. This and the absence of significant char indicate predominantly a random scission mechanism of decomposition.

703,367
PB-298 005/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Iridium(I) and Rhodium(I) Complexes of Benzotriazole. Structure of Bis(triphenylphosphine) carbonyl (benzotriazenido) iridium(I).
Final rept.,
L. D. Brown, J. A. Ibers, and A. R. Siedle. 1978, 5p
Pub. in Jnl. Inorganic Chem., v17 n11 p3026-3030 1978.

Keywords: *Complex compounds, *Molecular structure, *Synthesis(Chemistry), Metal containing organic compounds, Iridium organic compounds, Rhodium organic compounds, *Iridium/bis(triphenylphosphine) carbonyl (benzotriazenido), *Rhodium/bis(triphenylphosphine) carbonyl (benzotriazenido), Benzotriazenides, Reprints.

Thallium benzotriazenide has been prepared from benzotriazole, thallium(I) acetate, and triethylamine in ethanol. The compound serves as a convenient starting material for the synthesis of organometallic benzotriazenides. It reacts with (Ir(CO)(acetone)(PPh3)2)(PF6) to yield the tetramer (Ir(BTA)(CO)(PPh3))4, where Ph = phenyl and BTA = benzotriazenido. A similar reaction with RhCl(CO)(PPh3)2 yields the hexamer (Rh(BTA)(CO)(PPh3))6. Direct reaction of Tl(BTA) with IrCl(CO)(PPh3)2 yields Ir(BTA)2(CO)(PPh3)Tl.C6H6. The structure has been refined by full-matrix least-squares methods to a final R index of 0.035 for 199 variables, based on 6321 observations.

703,368
PB-298 006/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interlayering of Crystalline Octacalcium Phosphate and Hydroxylapatite.
Final rept.,
W. E. Brown, L. W. Schroeder, and J. S. Ferris. 1979, 4p
Contract PHS-DE-05030
Pub. in Jnl. Phys. Chem., v83 n11 p1385-1388 1979.

Keywords: *Calcium phosphates, Phosphorus organic compounds, X ray diffraction, Teeth, Bones, Spectrochemical analysis, Crystal structure, *Hydroxylapatite, Chemical shifts(Nuclear magnetic resonance), Reprints.

Hydroxylapatite (OHAp), Ca10(PO4)6(OH)2, and octacalcium phosphate (OCP), Ca8H2(PO4)6.5H2O, form interlayered mixtures in which some of their h00 X-ray diffraction peaks interact to form combination peaks. Calculations reveal that the d(200)(OCP)--d(100)(OHAp) peak shifts toward lower spacings from 9.34 A, the d(200) of OCP, to 8.16 A, the d(100) of OHAp, as the Ca/P ration increases from 1.33 to 1.67. The d(500)(OCP)--d(200)(OHAp) and the d(700)(OCP)--d(300)(OHAp) combination peaks shift to higher spacings as the Ca/P ratio of the interlayered mixture increases. The calculated shifts in the d(200)(OCP)--d(100)(OHAp) peak are corroborated by experimental data in the literature. Although shifts in the X-ray diffraction peaks are common in clays, this is the first time this phenonmenon has been observed in calcium phosphates; it provides a new approach to the study of tooth and bone mineral in their formative stages when OCP is most likely to be present.

703,369
PB-298 009/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Two-State Approximation in the Adiabatic and Sudden-Perturbation Limits.
Final rept.,
Y. N. Demkov, V. N. Ostrovskii, and E. A. Solov'ev. Nov 78, 8p
Pub. in Jnl. Phys. Rev. A18, n5 p2089-2096 Nov 78.

Keywords: Atoms, Elastic scattering, Phase shift, Electron transitions, Perturbation theory, *Atom atom interactions, Reprints.

The properties of the two-state approximation are considered from the point of view of atomic collision theory in the limit of large and small values of a characteristic collision time T. For large T (the adiabatic limit) asymptotically exact expressions are obtained for the elastic-scattering phase shifts and for the nonadiabatic transition probability due to the pseudocrossing of terms. This approximation is carried out under fairly general assumptions about the Hamiltonian, enabling us to consider such processes as transitions between sigma-pi terms caused by rotation of an internuclear axis. Such general problems of the adiabatic approximation as the applicability of adiabatic perturbation theory, the introduction of a dynamical basis, and the properties of the electronic wave functions in the pseudocrossing region are discussed. For small T (the sudden-perturbation limit) the evolution operator to zeroth and first order in T is calculated. A general and unambiguous definition of an adiabatic basis is given as a basis of eigenvectors of the evolution matrix to zeroth order in T.

703,370
PB-298 011/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Atomic Transition Probabilities and Lifetimes,
W. L. Wiese. 1979, 55p
Pub. in Progress in Atomic Spectroscopy, ch25 ptB p1101-1155 1979.

Keywords: *Atoms, *Electron transitions, Surveys, Transition probabilities, Oscillator strengths, Reprints.

A survey of the new atomic transition probability literature, covering the period late 1975 to late 1978, is given.

703,371
PB-298 039/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Free Radical Studies by Excimer Laser Ultraviolet Photolysis.
Final rept.
S. L. Baughcum, and S. R. Leone. 1978, 4p
Contract N00014-77-C-0115, Grant NSF-CHE76-22600
Pub. in Proc. Int. Tech. Symp. and Instrument Display (22nd), University of Arizona, Tuscon, AZ, Aug 4-5, 1978, Laser Spectrosc. 158, 29-32 (1978).

Keywords: *Free radicals, Photolysis, Ultraviolet radiation, Excitation, Infrared spectroscopy, Fluorescence, *Laser spectroscopy, Methane/diiodo, Laser induced fluorescence, Excimers.

A promising new technique for studying vibrational and low-lying electronic states of radicals has been developed. Infrared emission from vibrationally excited radicals is observed following ultraviolet photolysis of several small polyatomics with a rare gas-halide excimer laser. Strong emission from the C-H stretches of the CH2I radical is directly detected following photolysis of CH2I2 at 248 nm. Photolysis of CH2I2 at 308 nm and CH3I at 248 nm does not produce excitation of the C-H stretches in the radicals generated. In all three cases, strong emission from excited I* (doublet P(1/2)) atoms is observed. With the techniques described, infrared fluorescence is monitored as a function of both wavelength and time, allowing information to be obtained about the initial vibrational state distribution of radicals following photolysis. Subsequent vibrational deactivation, energy transfer, and reaction kinetics may also be studied. By using low resolution, continuously variable interference filters, measurements of the gas phase vibrational frequencies of the radical can be obtained, since the temporal resolution allows radical emission to be readily distinguished from that of the parent molecules.

703,372
PB-298 041/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Durability of the Bond Between Mineralized Tissues and Potential Adhesives.
Final rept.
G. M. Brauer, D. J. Termini, and J. A. Jackson. 1979, 18p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD.
Pub. in Proc. 176th National Meeting of the American Chemical Society, Miami, FL, Sept. 11-14, 1978. ACS Symp. Series 95, Durability of Macromolecular Materials, R. K. Eby, Ed., Paper 27, 393-410 (American Chemical Society, Washington, DC, 1979).

Keywords: *Chemical bonds, *Adhesives, *Surface chemistry, Storage, Tissues(Biology), Polyacrylates, Polymethyl methacrylate, Stability, Dental materials, Acrylic acid/cyano, *Tissue adhesives, Acrylic acid/(butyl-ester)-cyano.

The strength of adhesive joints between bone-bone and dentin-poly(methyl methacrylate) decreases on prolonged storage in water. With 2-cyanoacrylate esters debonding is greatly reduced by increasing the length of the ester group. Thermocycling tests give the same ranking for the decrease in the adhesive bond strength as those of the long-term isothermal storage studies. The bonding of 2-cyanoacrylates to mineralized tissues in an aqueous environment appears to be superior to that of other adhesives. The higher homologues of 2-cyanoacrylates may be useful clinically where an intermediate-term bone adhesive is desired. The isobutyl ester is the most effective 2-cyanoacrylate for bonding dentin to acrylic resin. Pretreatment of the dentin with dilute acid, addition of 2-cyanoacrylate polymer to the adhesive or application of the protective coating to the bonded surface increases the hydrolytic stability of the bond.

703,373
PB-298 649/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Hyperfine and Superfine Levels in Symmetric Polyatomic Molecules. Trigonal and Tetrahedral Molecules: Elementary Spin-1/2 Cases in Vibronic Ground States.
Final rept.,
W. G. Harter, and C. W. Patterson. Jun 79, 27p
Pub. in Physical Review A. General Physics 19, n6, p2277-2303, Jun 79.

Keywords: *Molecules, *Hyperfine structure, *Molecular energy levels, Excitation, Mathematical models, Molecular rotation, Reprints.

A simple approximate scheme for treating molecular hyperfine structure is developed by taking account of energy-level clusters. Unitary tableau and frame transformation techniques are reintroduced. Model Hamiltonians for XY3 and XY4 (X spin-zero, Y spin -1/2) molecules are developed and solved in cluster bases which are appropriate for highly excited rotational states. Two cases emerge: Case (1) for which hyperfine splittings are smaller than the 'superfine' cluster splittings and case (2) for which superfine splittings are negligible or zero. The problem of correlating energy levels and states between cases (1) and (2) is solved. Since the XY4 problem in the elementary cluster bases reduces to (2X2) matrices at the worst, the physical interpretation of solutions is not difficult.

703,374
PB-298 653/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Monte Carlo Studies of Lattice-Model Polymer Chains. IV. Equilibrium Dimensions and Distributions in Rouse Coordinates.
Final rept.,
P. H. Verdier. 15 Jun 79, 6p
Pub. in Jnl. of Chemical Physics 70, n12, p5708-5713, 15 Jun 79.

Keywords: *Polymers, Mathematical models, Monte Carlo method, Rouse coordinates, Reprints.

Distributions in the squares of the seven lowest Rouse coordinates for simple lattice models of polymer chains of up to 64 beads, with and without excluded volume, have been obtained by dynamical simulation on a digital computer. The expansion of the mean-square values of the coordinates is found to depend primarily, though not entirely, upon the ratio of the number of beads in the chain to the index of the Rouse coordinate. The distribution functions for the squares of the Rouse coordinates for chains both with and without excluded volume contraints are close to Gaussian with the sole exception of the lowest Rouse coordinate for chains with excluded volume, which exhibits a pronounced depletion at small values. This depletion is very similar to that previously observed in distributions in the square of end-to-end length.

703,375
PB-298 658/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Species-Specific Raman Spectroscopic Measurements of Concentration Fluctuations in Unsteady Flow.
Final rept.,
I. Chabay, G. J. Rosasco, and T. Kashiwagi. 1 May 79, 6p
Pub. in Jnl. of Chemical Physics 70, n9, p4149-4154, 1 May 79.

Keywords: *Raman spectroscopy, *Fourier transformation, Fourier analysis, Concentration(Composition), Turbulence, Flow distribution, Reprints.

Concentration fluctuations of specific chemical species in unsteady mixed gas flow were studied by fast Fourier transform (FFT) analysis of Raman intensity. Average concentration and the amplitude and frequency distribution of fluctuations about that average (at a specific Raman shift) can be determined by the FFT/Raman technique. The fluctuation spectra can be modeled to yield information on the lifetimes, periodicity, amplitudes, and the statistical distribution of these in unsteady or turbulent motion. A simple burner with a concentric outer air sheath and inner CH4 jet was used in the preliminary experiments for both cold gas and flame studies. Interference from flame emission (uncorrelated to Raman scattering) was minimized by chopping the Raman exciting beam and observing the FFT signal near the chopper frequency. Peak height at the chopper frequency indicates average concentration, while the sidebands around this frequency contain information on the fluctuations in concentration of the species under observation. With the present system, fluctuations in the frequency range of 0-1 kHz having an amplitude of 5% of the average concentration of certain species whose average partial pressure is as little as 1% of atmospheric pressure could be measured. The fluctuations are observed from sampling volumes as small as approximately equal to 1/104 cu mm at any position in the flow. Improvements in the technique and extensions to other systems are discussed.

703,376
PB-298 659/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of the Orthobaric Liquid Densities of Argon (100-120 K) and Ethylene (105-200 K).
Final rept.,
W. M. Haynes. Oct 78, 3p
Pub. in Cryogenics 18, n10, p621-623, Oct 78.

Keywords: *Argon, *Ethylene, *Density(Mass/volume), Densimeters, Magnetic permeability, Liquefied gases, Reprints.

Orthobaric liquid densities of argon (100 to 120 K) and ethylene (105 to 200 K) have been measured using a magnetic suspension densimeter. A correlation of the present results has been used to make comparisons with experimental data from other investigations.

703,377
PB-298 664/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Novel Bimetallic Sulfur Cluster. Crystal and Molecular Structure of a Dimer of Bis (methyldiphenylphosphinesilver)-tetrathiotungsten, ((C6H5)2PCH3)4Ag4W2S8.
Final rept.,
J. K. Stalick, A. R. Siedle, A. D. Mighell, and C. R. Hubbard. 23 May 79, 5p
Pub. in Jnl. of the American Chemical Society 101, n11, p2903-2907, 23 May 79.

Keywords: *Crystal structure, *Molecular structure, Nuclear magnetic resonance, Silver organic compounds, Density(Mass/volume), Chemical reaction mechanisms, *Silver/bis(methyl-diphenyl-phosphine)-tetrathio-tungsten, Reprints.

The title compound, I, is formed from ((C6H5)2PCH3)4Ag2WS4(II) with loss of phosphine in polar solvents. The crystal and molecular structure of I has been determined from three-dimensional X-ray data collected by counter methods. Based on (31)P NMR data for II and the structures of this closely related ((C6H5)2-PCH3)2Au2MS4 compounds (M = Mo, W), a mechanism for the formation of I from II is proposed.

703,378
PB-299 289/9 PC **A24**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.

Compendium of Gas Phase Basicity and Proton Affinity Measurements.
K. N. Hartman, S. Lias, P. Ausloos, H. M. Rosenstock, S. S. Schroyer, C. Schmidt, D. Martinsen, and G. W. A. Milne. Jul 79, 563p NBSIR-79-1777
Sponsored in part by National Heart, Lung, and Blood Inst., Bethesda, MD. Prepared in cooperation with Fein-Marquart Associates, Inc., Baltimore, MD.

Keywords: *Vapor phase, *Organic chemical compounds, Ammonia, Heat of formation, Protons, Gases, Ions, Tables(Data), *Proton affinity, *Basicity, Numerical solution.

Literature values of experimental measurements, calculations, and estimations of gas phase basicities and proton affinities are presented. Where appropriate, they are recalculated to common values for the proton affinity of ammonia and the heat of formation of the proton. The annotated information is ordered by molecular formula following the Hill System. Indices are given to permit location of information of by numerical value of the measurement(s), the compound formula, name and synonym, and CAS Registry Number. The literature coverage is essentially complete through 1977.

703,379
PB-299 361/6 PC **A09**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Thermophysical Properties Div.
Isobutane: Provisional Thermodynamic Functions from 114 to 700 K at Pressures to 700 Bar.
R. D. Goodwin. Jul 79, 191p NBSIR-79-1612
Sponsored in part by Gas Research Inst., Chicago, IL.

Keywords: *Butanes, *Thermophysical properties, Enthalpy, Entropy, Equation of state, Specific heat, Density(Mass/volume), Isotherms, Pressure, Temperature, Comparison, Liquid phase, Vaporization, Joule-Thomson effect, Isobars(Pressure), Tables(Data), Vapor pressures, Liquefied natural gas, Computer programs, Virial coefficients, IBUTHRM computer program.

Isobutane not only is a component of liquefied natural gas (LNG), but also may become an important heat-exchange fluid for geothermal cycles. The present report is fifth in a series on the pure component of LNG, namely methane, ethane, propane, n-butane, and isobutane. Thermophysical properties of isobutane are tabulated at integral temperatures along isobars over the entire range of fluid states. Results for the compressed liquid, from the triple- to the boiling-point, have been estimated by use of the highly constrained, nonanalytic equation of state, because experimental P-rho-T data are lacking in this region.

703,380
PB-299 368/1 PC **A99**/MF **A01**
Notre Dame Univ., IN. Radiation Chemistry Data Center.
Biweekly List of Papers on Radiation Chemistry. Annual Cumulation with Keyword and Author Indexes, Volume 11, 1978.
A. B. Ross. Dec 78, 772p
See also Volume 10 dated 1977, PB-291 876. Sponsored in part by National Bureau of Standards, Washington, DC. Office of Standard Reference Data, and Department of Energy, Washington, DC.

Keywords: *Chemistry, *Bibliographies, Radiation chemistry, Indexes(Documentation), Subject index terms, Reaction kinetics, Optical spectra, Thermodynamics, Electron spin resonance, Excitation, Energy levels, Photochemistry, Polymers, Author indexes.

This document is the annual edited cumulative list of references to the published literature on radiation chemistry and related fields. References are drawn from 55 journals published throughout the world. The list is generated from the Biweekly List of Papers on Radiation Chemistry and Photochemistry and contains the literature references and an author and subject index. The publication represents one of the continuing data activities of the Radiation Chemistry Data Center (RCDC) at the University of Notre Dame. Volume II also contains a 112-page 'Thesaurus for Radiation Chemistry' which lists indexing terms which make up the group of keywords used in the RCDC computer-readable bibliographic data base.

703,381
PB-299 760/9 Not available NTIS
National Bureau of Standards, Washington, DC.
2-Ethoxy-1,7,9-Triethyl-7,9-Dihydro-1H-Purine-6,8-Dione; a Tetraethyl Derivative of Uric Acid.
Final rept.,
A. D. Mighell, C. R. Hubbard, and A. Cohen. 1979, 3p
Pub. in Acta Crystallographica, Section B35, p1280-1282 1979.

Keywords: *Crystal structures, Nitrogen organic compounds, Reprints, *Purine dione/ethoxy-triethyl-dihydro.

Uric acid was ethylated and four isomers of tetraethyluric acid were isolated. One isomer, m.p. 387:2-387:7 K, was analyzed.

703,382
PB-299 765/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Resolution of Photon-Recoil Structure of the 6573-A Calcium Line in an Atomic Beam with Optical Ramsey Fringes.
Final rept.,
R. L. Barger, J. C. Bergquist, T. C. English, and D. J. Glaze. 1979, 2p
Pub. in Applied Physics Letters 34, n12 p850-852, 15 Jun 79.

Keywords: *Calcium, *Visible spectrum, Photons, Line widths, Optical spectra, Reprints, *Ramsey fringes.

The photon-recoil components of the Ca 6573-A line have been resolved using the three-zone optical Ramsey interference technique with an atomic beam. Linewidths as narrow as 3 kHz HWHM (line Q of 8 x 10 to the 10th power) are reported for zone separations up to 7 cm. An indication of the light-shift-induced contraction of the recoil splitting predicted by C.J. Borde is obtained. Techniques are discussed which should lead to an optical wavelength/frequency standard with an accuracy of better than 10 to the -14 power.

703,383
PB-299 766/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Mode-to-Mode Vibrational Energy Flow in S1 Benzene. V-V Resonant Energy Transfer, Microscopic Reversibility, and the Role of Level Degeneracies.
Final rept.
G. H. Atkinson, C. S. Parmenter, and K. Y. Tang. 1979, 5p
Pub. in Jnl. of Chemical Physics 71, n1 p68-72, 1 Jul 79.

Keywords: *Benzene, *Molecular vibration, *Energy transfer, Reaction kinetics, Reprints.

The pattern of mode-to-mode vibrational energy flow from the level nu 6' = 522/cm in the Singlet S state of benzene has been studied with OCS as a collision partner. Measurements of V-T,R transfer rates from other Singlet S benzene levels with added CO have been used to demonstrate microscopic reversibility and to show the control of transfer rates by the degeneracies of the final level.

703,384
PB-299 777/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Stopping Power and Energy Degradation for Electrons in Water Vapor.
Final rept.
H. G. Paretzke, and M. J. Berger. 1978, 10p
Pub. in Proceedings of Symposium on Microdosimetry (6th), Brussels, Belgium, May 22-26, 1978, II, p749-758 1978.

Keywords: *Electrons, *Energy dissipation, Water vapor, Degradation.

This paper is concerned with electron energy loss and degradation phenomena in water vapor at energies below a few keV where the Bethe theory is no longer applicable. There is practically no experimental information on low-energy stopping power and on degradation spectra in gases, s that these quantities must be obtained by calculation. The required cross sections for the ionization and excitation of water molecules are not well known, and various assumptions and extrapolations have to be made in order to obtain input data which include all the important processes and all energies of interest. Three such data sets for water vapor are available which are based on somewhat different assumptions and approximations. One set has been published by Olivero, Stagat and Green and the other two sets are from more recent analysis made by the authors. They compare in their paper various quantities derived from these data sets, in order to obtain an indication how sensitively the stopping-power and energy degradation calculations depend on the cross section input.

703,385
PB-299 785/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Intermolecular Potential Well Depths in Collision-Induced State Changes.
Final rept.,
H. M. Lin, M. Seaver, K. Y. Tang, A. E. W. Knight, and C. S. Parmenter. 1979, 16p
Pub. in Jnl. of Chemical Physics 70, n12 p5442-5457, 15 Jun 79.

Keywords: *Reaction kinetics, *Cross sections, Phase transformations, Free radicals, Reprints, *Ion ion interactions.

A relationship is developed from two distinct theoretical approaches to correlate the rate constants k(M) or cross sections sigma M for a series of added gasesf M which collisionally induce a state transformation A* yields B. The correlation is shown to be general. It works for electronic state deactivation in atoms, intersystem crossing and internal coversion in S(1) polyatomics, rotational and also vibrational relaxation in S(1) polyatomics, predissociation in diatomics and polyatomics, and vibrational relaxation in a free radical as well as in a molecular ion. The theory is appropriate only when attractive forces dominate the interaction, and this seems consistent with the experimental data. The correlation thus provides a simple means to distinguish between attractive and repulsive interactions. The correlation also reveals that collision partners do not substantially modify the intrinsic S(1)-T mixing during collision-induced intersystem crossing.

703,386
PB-299 788/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Graphite as a Standard Reference Material.
Final rept.,
J. G. Hust. 1978, 7p
Pub. in Proceedings of International Thermal Conductivity Conference (15th), Ottawa, Ontario, Canada, August 24-26, 1977, Paper in Thermal Conductivity 15, p161-167 1978.

Keywords: *Graphite, Temperature, Stability, Density(Mass/volume), Electrical resistivity, Thermal conductivity, Standards, *Standard reference materials, Numerical solution.

The Cryogenics Division (Boulder, Colorado) in conjunction with the Office of Standard Reference Materials (Gaithersburg, MD) of the National Bureau of Standards has been investigating graphite as a potential, extended temperature range, Standard Reference Material (SRM). A large number of isotropic, fine-grained graphite rods in various diameters have been obtained for homogeneity and stability investigations. Electrical resistivity and density measurements have been performed on numerous rods at temperatures from 4 to 300 K. Thermal conductivity measurements have been performed on thirteen specimens at about 20 C. These measurements show that transport property variations both between and within these rods is relatively large (approximately 10%). However, a correlation between these variables is shown to exist which will allow the calculation of thermal conductivity from simple and inexpensive electrical resistivity and density measurements to within about plus or minus 2%.

703,387
PB-299 809/4 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Resolution Spectroscopy by Radiative Cooling of Bound Resonant Absorbers.
Final rept.
D. J. Wineland, F. L. Walls, and R. E. Drullinger. 1978, 1p
Pub. in Jnl. of Opt. Sci. Am. 68, p648 1978.

Keywords: *Absorbers(Materials), *Optical spectra, Magnesium, Doppler effect, Ions, Magnesium ions.

A method for obtaining high resolution spectra of bound resonant absorbers is discussed. The Doppler width and Doppler frequency shifts are nearly eliminated by cooling the absorbers using radiation pressure. Experiments to test this principle use Mg(+) ions

which are contained in a Penning ion trap. Theoretical and experimental details are discussed.

703,388

PB-299 814/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Dependence of Rotational Linewidths in HCl Perturbed by Argon.
Final rept.,
E. W. Smith, and M. Giraud. 15 Feb 79, 2p
Pub. in Jnl. of Chemical Physics Letter to Ed. 70, n4, p2027-2028, 15 Feb 79.

Keywords: *Hydrochloric acid, *Line width, *Temperature, Molecular rotation, Molecular vibration, Reprints, Line spectra.

The temperature dependence of several rotational linewidths in HCl perturbed by Argon is studied. Comparison of theoretical and experimental data indicate that there may be a vibrational effect (i.e. an increase in halfwidth due to distortion of the molecular potential curves for higher vibrational levels) which is strongest at low temperatures.

703,389

PB-299 822/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultralow-Temperature Physics in Japan.
Final rept.,
R. Radebaugh. Jun 78, 6p
Pub. in Off. Nav. Res. (Tokyo) Science Bulletin 3, n2, p1-6, Apr-Jun 78.

Keywords: *Cryogenics, *Japan, History, Reviews, Reprints, *Foreign technology, Ultralow temperature.

This paper traces the progress of ultralow-temperature (ULT) physics in Japan from about 1970 to 1977. Ultralow temperatures are defined as those below 1 K. The progress is based on visits to various laboratories during this period of time. Laboratories at Tohoku University, University of Tokyo, and Osaka City University are discussed in some detail. The paper points out that in 1970 Japan was behind many other countries in the field of ULT physics but rapid progress has brought them up to an equal plane. Suggested reasons for the rapid progress are given. The paper also gives a summary of the recent International Symposium on Physics at Ultralow Temperatures held in Hakone, Japan, September 5-9, 1977.

703,390

PB-299 824/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Method to Estimate Intermolecular Potential Well Depths for Species in Both Ground and Excited Electronic States.
Final rept.,
C. S. Parmenter, and M. Seaver. 15 Jun 79, 5p
Pub. in Jnl. of Chemical Physics 70, n12, p5458-5462, 15 Jun 79.

Keywords: *Molecular energy levels, *Atomic energy levels, Excitation, Sodium, Neon, Argon, Iodine, Sulfur dioxide, Methyl alcohol, Benzene, Xenon, Reprints, Glyoxal, Propiolaldehyde, Virial coefficients.

The relationship ln sigma sub M = lnC + ((epsilon sub (A*A*) (epsilon sub (MM)) to the 1/2 power/kT correlates the cross sections sigma sub M for a state change A* yields B induced by a series of added M gases with the intermolecular potential well depths for A* yields B to deduce epsilon sub (A*A*) for electronically excited atoms (Na, Ne, Ar, Xe) and electronically excited molecules (I 2, SO2, CH3OH, glyoxal, propynal, benzene). The well depths are generally observed to exceed the ground state values by factors of 2-10. Large well depths are alsc observed for sec-butyl radicals and for the C5H9(+) ion with high vibrational excitation. The correlation also provides an alternate means to measure ground state well depths epsilon sub (MM). In cases where secure comparisons are available, the well depths so derived usually lie within 20% of values found from transport measurements or virial coefficients. The correlation seems a useful alternative to empirical procedures when data from conventional methods are not available.

703,391

PB-299 828/4 Not available NTIS
National Bureau of Standards, Washington, DC.
S-Carboxymethyl-L-Cysteine.
Final rept.,
A. D. Mighell, C. R. Hubbard, J. Harris, J. A. Staffa, and C. Zervos. 1979, 4p
Pub. in Acta Crystallographica, Section B. Structural Crystallography and Crystal Chemistry B35, p1258-1261 1979.

Keywords: *Crystal structures, Hydrogen bonds, Reprints, *Cysteine/carboxymethyl, Zwitterions.

The structure has been determined by direct methods and refined to R = 0.021 for 720 independent reflections. The compound exists as a zwitterion. The H atom in this bond was found to be covalently bonded to the carboxyl group in the carboxymethyl moiety. The -NH3(+) group is involved in three hydrogen bonds.

703,392

PB-300 272/2 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 84, Number 3, May-June 1979.
Bi-monthly rept.
1979, 47p
See also Volume 84, Number 1, PB-295 736. Library of Congress catalog card no. 63-37059.

Keywords: *Research chemistry, Enthalpy, Samples, Nucleic acids, Adenines, Superconductivity, Circuits, Ion chromatography, Striplines.

Contents:
Enthalpies of solution of the nucleic acid bases. 5. Adenine in aqueous hydrochloric acid, aqueous sodium hydroxide, methanol, and ethanol;
Sample preparation in ion-chromatography;
Miniaturization of normal-state and superconducting striplines.

703,393

PB-300 273/0
(Order as PB-300 272/2, PC **A03**/MF **A01**)
National Measurement Lab. (NBS), Washington, DC. Center for Thermodynamics and Molecular Science.
Enthalpies of Solution of the Nucleic Acid Bases. 5. Adenine in Aqueous Hydrochloric Acid, Aqueous Sodium Hydroxide, Methanol, and Ethanol.
M. V. Kilday. 3 Jan 79, 10p
See also Volume 83, Number 6, PB-293 447.
Included in Jnl. of Research of the National Bureau of Standards, v84 n3 p231-240, May-Jun 79.

Keywords: *Enthalpy, *Nucleic acids, Adenine, Numerical solution.

Values were obtained from measurements of the enthalpy of solution of a well characterized sample of crystalline adenine in various solvents. Using these measured values the following enthalpies of protonation and proton dissociation were calculated.

703,394

PB-300 275/5
(Order as PB-300 272/2, PC **A03**/MF **A01**)
National Engineering Lab. (NBS), Boulder, CO. Center for Electronics and Electrical Engineering.
Miniaturization of Normal-State and Superconducting Striplines.
R. L. Kautz. 19 Dec 78, 14p
Included in Jnl. of Research of the National Bureau of Standards, v84 n3 p247-259, May-Jun 79.

Keywords: *Superconductivity, *Circuits, Surfaces, *Striplines, Numerical solution.

The properties of normal-state and superconducting striplines are calculated as a function of miniaturization. For normal conductors the Reuter-Sondheimer theory is applied in order to account for the effects of finite film thickness and mean free path. For superconductors the Mattis-Bardeen theory is used in order to include effects due to the energy gap. Calculations for three example conductors, copper at 295 K and 4.2 K and niobium at 4.2 K, examine the attenuation, dispersion, and characteristic impedance of striplines as a function of frequency and dielectric thickness. Simulations of pulse transmission are used to evaluate the utility of the example striplines for high-speed digital applications.

703,395

PB-300 554/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Photopotentials on Copper and Copper Alloy Electrodes.
Final rept.,
U. Bertocci. Oct 78, 5p
Pub. in Jnl. of Electrochemical Society 125, n10, p1598-1602, Oct 78.

Keywords: *Copper, *Copper alloys, *Electrodes, Potentiometric analysis, Surfaces, Anodic coatings, Reprints, *Photopotentiometry.

The effect of white light illumination on the Current-potential relationships of pure copper and of Cu-Ni and Cu-Al alloys in neutral solutions was examined, both under galvanostatic and potentiostatic conditions. The results obtained show that the photoresponse is only weakly affected by the addition of alloying elements to copper, but that it is influenced by the method of formation of the oxide film on the metal surface. Depending on whether or not the Cu2O film was formed by reaction with a copper solution, the amplitude of the signal response could be strongly affected and the sign of the photopotential at open circuit reversed, indicating a change in the nature of the majority carriers. Polarization of the electrode can also vary the photoresponse, but its rapid following of the potential does not support the view that the structure of the oxide film is altered. Impedance measuements on electrodes under illumination and in the dark indicate that the charge-transfer reactions, rather than the resistivity of the oxide film, are affected by light.

703,396

PB-300 555/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Spin Resonance Spectra of Polymers During Fluorination.
Final rept.,
R. E. Florin. 1979, 10p
Pub. in Jnl. of Fluorine Chemistry 14, p253-262 1979.

Keywords: *Electron spin resonance, *Free radicals, Polymers, Fluorine organic compounds, Reprints, *Peroxy radicals.

ESR spectra characteristic of peroxy radicals appeared rapidly in all of eleven hydrogen-containing polymers examined when treated with dilute fluorine. These radicals presumably result from the reaction of hydrocarbon and fluorocarbon radicals, existing at undetectably low stead-state concentrations, with the oxygen impurity content of commercial fluorine. In poly(vinylidene fluoride) films of thickness 11 and 58 micrometers the radical contents were nearly proportional to surface area rather than volume, in agreement with earlier reports of a shallow depth of penetration. Some polymers exhibited also or exclusively a broad spectral component, varying in character with the polymer; examples are polystyrene, polyethylene, poly (vinyl chloride), poly(vinylidene chloride), polyoctafluoropentadiene, polyhexafluoropropene, and a fluorinated graphite. The broad spectral component did not react with ordinary radical scavengers such as propylene and oxygen, and is probably not due to a fluorocarbon radical but to known transition metal fluorides.

703,397

PB-300 563/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Dielectric Loss of Polypropylene Films and Polypropylene-Polyurethane Laminates at Cryogenic Temperatures.
Final rept.,
F. I. Mopsik, F. Khoury, S. J. Kryder, and L. H. Bolz. 1979, 12p
Pub. in Proc. ICMC Symp. on Nonmetallic Materials and Composites at Low Temperatures, Munich, W. Germany, July 10-11, 1978, Paper in Nonmetallic Materials and Composites at Low Temperatures, p85-96 1979.

Keywords: *Polymeric films, *Polypropylene, *Polyurethane resins, *Dielectric properties, Laminates, Cryogenics, Temperature.

Dielectric loss measurements were made on six commercial polypropylene films as well as on polypropylene-polyurethane laminates from 4.2K to 323K at 100Hz and 1KHz. Loss peaks were observed in the polypropylene films at <4.2K, 30K, and 125-150K. The magnitudes of the peaks varied among these films. The <4.2K peak is attributed to the presence of antioxidant in the polypropylene. The magnitude of the dielectric loss in the polypropylene films in the temperature range of interest for use of this polymer as elec-

tric insulation in superconducting AC cables depends on the relative magnitudes of the <4.2K and 30K peaks whose respective high temperature tail and low temperature tail overlap in the temperature range at which the cables will be operated, namely 6-9K. The polypropylene-polyurethane laminates exhibit a broad loss peak at 150K which is due to the polyurethane. The results of experiments carried out to determine the relative contributions of the polypropylene and polyurethane layers to the dielectric loss of the laminates in the range 4.2K-10K are discussed.

703,398
PB-300 566/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Formation of Polymer Fibrils by Flow-Induced Crystallization.
Final rept.,
J. D. Hoffman. Sep 79, 7p
Pub. in Polymer 20, n9 p1071-1077 Sep 79.

Keywords: *Polymers, *Crystallization, *Fibrils, Solutions, Nucleation, Reprints.

A theory of the formation of the core fibril ('shish') that is produced by flow-induced crystallization in undercoold polymer solutions is given. Multiple nucleation events on a flow-elongated molecule produce an embryonic fibril that is a connected set of bundle-like nuclei. End surface stress resulting from the repulsion of the 'amorphous' chains in the regions between these nuclei builds up cumulatively as the nuclei mature, leading ultimately to volume strain in the body of each crystallite in the core fibril. This causes the diameter and length of the crystallites to be limited in a thermodynamic sense. The dependence of this diameter and length are calculated in terms of the driving force for the crystallization. Annealing and melting effects are discussed. The theory leads to a thin (about 150 to about 500 A) core fibril that is a set of concatenated and substantially extended-chain crystallites of stable diameter that is interrupted at long intervals (about 1000 to about 3000 A) by short and highly strained amorphous regions. Most of the chain molecules pass through these amorphous zones from one crystallite to another. Expanded lattice spacings are predicted for the crystallites comprising the core fibril under certain circumstances.

703,399
PB-300 705/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Cross Sections for 2s-2p Excitation of N4+ by Electron Impact.
Final rept.,
D. Gregory, G. H. Dunn, R. A. Phaneuf, and D. H. Crandall. 1979, 11p
Contract E(49-1)-3800
Pub. in Physical Review A 20, n2 p410-420 Aug 79.

Keywords: *Nitrogen, *Atomic energy levels, *Cross sections, Ions, Excitation, Reprints, *Nitrogen ions, Electron-ion collision, Numerical solution.

Absolute cross sections have been measured for 1 doublet S 2 doublet S doublet (S1/2) - 1 doublet S 2 doublet P doublet P(1/2, 3/2) excitation of lithiumlike N(+4) by electron impact. For this process, which has a threshold at 10 eV, relative cross sections measured at several energies between 4 and 52 eV were normalized to a single absolute measurement taken at 15.5 eV. Similar data for Li-like C(+3) have been previously reported and are presented for comparison. In both cases, allowing for the experimental electron energy spread, the measurements agree within experimental uncertainties with published Coulomb-Born and close-coupling calculations over the entire experimental energy range. Rate coefficients as a function of electron temperature are also presented for the N(+4) transition.

703,400
PB-300 777/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Atomic Transition Probabilities.
Final rept.,
W. L. Wiese, and G. A. Martin. 1979, 29p
Pub. in General Chemical in CRC Handbook of Chemistry and Physics. Section D, p112-140 1979.

Keywords: *Atomic energy levels, *Line spectra, Excitations, Ionization, Reprints.

These tables were prepared under the auspices of the Committee on Line Spectra of the Elements of the National Academy of Sciences-National Research Council. They contain critically evaluated atomic transition probabilities A for about 4000 selected lines of elements from hydrogen to nickel. The material is largely for neutral and singly ionized spectra, but includes a number of prominent lines of more highly charged ions.

703,401
PB-300 778/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Regularities in Plasma-Broadened Line Widths.
Final rept.,
W. L. Wiese, and N. Konjevic. 1979, 4p
Pub. in Proceedings of International Symposium on Physics of Ionized Glass (9th), Dubrovnik, Yugoslavia, August 28-September 2, 1978. Paper in the Physics of Ionized Gases, p257-260 1978.

Keywords: *Line width, *Atomic spectra, Plasmas(Physics), Atomic energy levels.

Certain regularities in plasma-broadened line widths are expected on account of the atomic structure involved. A search for such regularities is reported, which was concentrated on those within a given spectrum, i.e., the behavior of line widths in multiplets and transition arrays. Several examples are presented, and it is shown that variations of line widths of supermultiplets follow regular patterns closely correlated with the positions of perturbing energy levels and the strengths of relevant level interactions.

703,402
PB-300 781/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Soft X-Ray Emission and Absorption Spectra of Simple Metals.
Final rept.
T. A. Callcott, E. T. Arakawa, and D. L. Ederer. 1978, 5p
Pub. in Proceedings of the International Conference on X-Ray and XUV Spectroscopy, Sendai, Japan, 1978. Paper in Japan Journal of Applied Physics 17, Suppl. 17-2, p149-153 1978.

Keywords: *Metals, *X ray analysis, *Emission spectroscopy, *Absorption spectra, Density(Mass/volume), Molecular relaxation, Lithium, Beryllium, Sodium, Magnesium, Aluminum.

The soft X-ray emission and absorption spectra of simple metals provide information about transition density of states, any body effects, and lattice relaxation dynamics. It was found that many body effects are negligible for the K spectra of lithium and beryllium, but play an important role at threhold for the L(2.3) spectra of sodium, magnesium, and aluminum. Many body threshold exponents may be derived from the data for these materials. Lattice relaxation processes are found to have an important effect on the emission edges of sodium and lithium. The shape width and separation of these materials have been analyzed to obtain core hole lifetimes.

703,403
PB-300 782/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Conformational Analysis of Peracetylated Hexononitriles.
Final rept.,
L. M. Sweeting, B. Coxon, and R. Varma. 1979, 13p
Pub. in Carbohydrate Research 72, p43-55 1979.

Keywords: *Proton magnetic resonance, *Nitriles, Molecular structure, Reprints, *Molecular conformation, *Fourier transform spectroscopy.

The conformations of six peracetylated hexononitriles in solution have been investigated by Fourier-transform, proton n.m.r. spectroscopy at 90 MHz, with iterative analysis and simulation of many of the spectra. The conformation of tetra-O-acetyl-L-arabinononitrile has been re-examined by the same methods. A shift reagent (Eu(fod)3-d(30)) and spectra at 220 MHz were used to improve spectral dispersion, where necessary. For practically all of the derivatives studied, the vicinal, proton-proton coupling-constants are consistent with a zigzag conformation in which the cyano group lies in the plane of the other carbon atoms of the chain, unless this conformation contains a parallel 1,3-interaction of substituents. Other conformers that are also consistent with the coupling constants observed are discussed, including rotamers about chain-terminal, carbon-carbon bonds.

703,404
PB-300 783/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Decomposition of Hexamethylethane in a Flow System.
Final rept.,
J. A. Walker, and W. Tsang. 1979, 16p
Pub. in International Journal of Chemical Kinetics XI, p867-882 1979.

Keywords: *Pyrolysis, Reaction kinetics, Heat of formation, Reprints, *Ethane/hexamethyl, Chemical reaction mechanisms.

Hexamethylethane has been decomposed in a flow system in the temperature range of 700-900 K. The mechanism involves carbon-carbon bond cleavage at the most highly substituted position and rapid formation of isobutene from the t-butyl radical. The rate expression is K((tC4H9)2 yields 2tC4H9:)=10 to the 17.4 power exp (-36,000/T)/Sec and is completely consistent with deducations from radical buffer, shock-tube, and direct recombination studies. Of special importance is experimental evidence for large decreases of the A factor with increasing temperature and a high heat of formation for the t-butyl radical.

703,405
PB-300 785/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Observations in Solid Polyethylenes by Carbon-13 Nuclear Magnetic Resonance with Magic Angle Sample Spinning.
Final rept.,
W. L. Earl, and D. L. VanderHart. 1979, 7p
Pub. in Macromolecules 12, n4, p762-767, Aug 79.

Keywords: *Polyethylene, *Nuclear magnetic resonance, Samples, Solids, Isotopic labeling, Reprints, Chemical shift(Nuclear magnetic resonance), Carbon 13, Molecular conformation.

It is shown that the (13)C NMR resonance lines of the crystalline component (CC) and the noncrystalline component (NCC) in polyethylene (PE) are chemically shifted from one another. This usually produces an upfield shoulder on the CC resonance line in a 'cross-polarization with magic angle sample spinning' (CPMASS) experiment. Two peaks were resolved in a low crystallinity, high molecular weight sample, the NCC peak being 2.36 + or - 0.1 ppm upfield from the CC peak.

703,406
PB-300 970/1 Not available NTIS
National Bureau of Standards, Washington, DC.
260 nm Absorption Spectrum of Benzene: Remeasured Band Positions and Refined Assignments.
Final rept.,
G. H. Atkinson, and C. S. Parmenter. 1978, 11p
Sponsored in part by National Science Foundation, Washington, DC., and Petroleum Research Fund, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 73, p20-30 1978.

Keywords: *Benzene, *Absorption spectra, *Ultraviolet spectroscopy, Molecular vibration, Reprints.

The positions and intensities of most of the band maxima in the 1 B(2W yields A(1g) absorption system of benzene vapor have been remeasured at 300K. Particular attention has been given to the measurement of the positions of component maxima which are present on account of vibrational angular momentum splitting. Weak O2 absorptions included in the original listings of benzene band maxima have been identified. Assignments of the benzene maxima are given. They offer some revision and substantial extension of previous assignments. The general basis and specific details of assignments are given in papers 2 and 3.

703,407
PB-300 971/9 Not available NTIS
National Bureau of Standards, Washington, DC.
260 nm Absorption Spectrum of Benzene: Vibronic Analysis.
Final rept.,
G. H. Atkinson, and C. S. Parmenter. 1978, 44p
Sponsored in part by National Science Foundation, Washington, DC., and Petroleum Research Fund, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 73, p52-95 1978.

Keywords: *Benzene, *Ultraviolet spectroscopy, Absorption spectra, Molecular vibration, Angular momentum, Excitation, Molecular energy levels, Reprints.

The supporting details for assingment of band maxima in the one-photon absorption spectra of benzene vapor are given. Over 90% of the intensity is assigned and a consistent pattern of Herzberg-Teller activity is found. Variation in the separation between progression members suggests that small (and unidentified) perturbations of upper state vibronic levels are ubiquitous. Revised or new values of nine fundamentals in the 1 B(2u) state and two in the 1A(1g) state are given.

703,408
PB-300 972/7 Not available NTIS
National Bureau of Standards, Washington, DC.
260 nm Absorption Spectrum of Benzene: Selection Rules and Band Contours of Vibrational Angular Momentum Components.
Final rept.,
G. H. Atkinson, and C. S. Parmenter. 1978, 21p
Sponsored in part by National Science Foundation, Washington, DC., and Petroleum Research Fund, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 73, p31-51 1978.

Keywords: *Benzene, *Absorption spectra, *Ultraviolet spectroscopy, Angular momentum, Molecular vibration, Reprints, Herzberg bands.

The role of vibrational degeneracies and vibrational angular momentum in the 260 nm absorption spectrum of benzene is further examined. Degenerate Herverg-Teller terms are set down through third order with specific identification of vibrational symmetries capable of inducing intensities (Table II). These terms provide a basis for predicting the delta nu selection rules, the signed vibrational angular momentum selection rules, and the vibrational angular momentum component energy splittings for all vibronic transitions. A new parameter, chi, is developed which can be used to predict the rotational band contour of any vibronic component transition. These developments underlie the systematic reexamination of assignments which is given in Paper 3 of this series.

703,409
PB77-600001
(Order as PB-275 037, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Diffusion With Discontinuous Swelling. III. Type II Diffusion as a Particular Solution of the Conventional Diffusion Equation.
A. Peterlin. 1977, 7p
Included in Jnl. of Research of the National Bureau of Standards, v81A n2 and 3 p243-250 1977.

Keywords: Concentration dependent diffusion coefficient, Concentration front, Discontinuous swelling, Unconventional diffusion, Velocity of concentration front propagation, *Type II Diffusion.

Very often a non-solvent diffuses into a glassy polymer with a steep concentration profile proceding at an almost constant rate nu yielding a weight gain proportional to time. Such a diffusion is called type II diffusion in order to distinguish it from the more usual Fickian diffusion proceeding without such a constant concentration front and yielding, at least in the beginning, a weight gain proportional to the square root of time. It turns out that the conventional diffusion equation without any special new term but with a diffusion coefficient rapidly increasing with concentration has a series of solutions representing exactly such type II diffusion with nu as a completely free parameter which determines the steepness of concentration front. With the usual boundary conditions and infinite medium the diffusion coefficient has to become infinite at the highest penetrant concentration. This case can be considered as an extreme limit which is approached to a high degree in an actual experiment. The finite sample thickness, however, requires only a very large but not an infinite diffusion coefficient. Hence type II diffusion processes compatible with the conventional diffusion equation without any need for new terms if only the diffusion coefficient increases sufficiently fast with penetrant concentration.

703,410
PB77-600003
(Order as PB-275 037, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Evaporation of a Liquid Droplet.
R. Kayser, and H. Bennett. 1977, 10p
Included in Jnl. of Research of the National Bureau of Standards, v81A n2 and 3 p257-266 1977.

Keywords: Confluent hypergeometric functions, *Droplet, Moving boundary problem, Preheat, *Transient heat conduction.

Two idealized models for the preheat stage of liquid droplets are analyzed theoretically. These models contain the effects of transient heat conduction and evaporation. It is assumed that the droplet surface area decreases linearly with time. This assumption necessitates the solution of moving boundary problems. These models, however, do not consider gas-phase mass transport. In the finite-gradient model, the temperatures of both the droplet and surrounding hot gases vary spatially and temporally. In the zero-gradient model the gas temperature varies spatially and temporally but the droplet temperature varies only temporally, i.e., the droplet temperature is spatially uniform. Numerical examples, which require extensive calculations of confluent hypergeometric functions, are presented for typical values of the droplet latent heat and evaporation rate constant. The temperature profiles given by the finite-gradient and zero-gradient models agree to within 20 percent of each other for all cases examined.

703,411
PB77-600004
(Order as PB-275 037, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Isotope Effects in the Association Reactions of Methyl and Ethyl Iodide Cations.
L. Sieck. 1977, 5p
Included in Jnl. of Research of the National Bureau of Standards, v81A n2 and 3 p267-271 1977.

Keywords: *Alkyl iodides, Ion-molecule reactions, *Isotope effects, Mass spectrometry, Photoinization, Rate constants.

Rate coefficient for production of stabilized dimetric parent cations at 295 K have been determined in CH3I, CD3I, CH3I-CD3I mixtures, C2H5I, CH3CD2I, CD3CH2I, and C2D5I. These processes are the most rapid reported for association reactions, the various individual values falling within the limits 0.33 X 10 to the minus 24th power cm(6molecule to the minus 2nd power) (sec to the minus first power) (C2H5I). The temperature dependence of the stabilization coefficients in CH3I and CD3I was also measured over the range 220

703,412
PB77-600005
(Order as PB-275 037, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Solubility of ((Ca5)(P(O4)3)OH) in the System (Ca((OH)2)-((H3)P(O4))-(H2)O) at 5,15,25, and 37 degrees C.
H. McDowell, T. M. Gregory, and W. E. Brown. 1977, 9p
Included in Jnl. of Research of the National Bureau of Standards, v81A n2 and 3 p273-281 1977.

Keywords: Dissolution, *Hydroxyapatite, Ion pairs, Solubility, *Solubility isotherms, Solubility product, Thermal coefficient of solubility, Thermodynamics, Tooth mineral.

Solubility isotherms of hydroxyapatite, ((Ca5)(P(O4)3)OH) (OHAp), prepared by titrating a boiling aqueous suspension of Ca((OH)2) with 0.5 M (H3)(PO4), were determined in the ternary system (Ca((OH)2)-((H3)P(O4))-(H2)O) at 5,15,25,and 37 degree C in the pH range 3.7-6.7 by equilibration with dilute (H3)(PO4) solutions.. The solubility product K subs, determined as a function of temperature by generalized least-squares procedure from 41 experimental points, is given by the equation log K sub 5 = -- 8219.41T -- 1.667 -- 0.098215T. The values of K sub 5 and its dispersion at 25 and 37 degree C are 3.04 (0.25) and 2.35 (0.27) x 10 to the minus 59th power. There is a maximum in K sub near 16 degree C, which may be due to the form of temperature dependence found earlier for the stability constants of the ion pairs (Ca(H2)(P(O4)(+))) and (CaH(P(O4)(degree))). The relative positions of the isotherms show that OHAp has a negative thermal coefficient of solubility. Thermodynamic functions for the dissolution of the salt are reported. The solubility data previously reported by others for OHAp at 25 degree C were reviewed. The solubility products obtained by three of these investigators were comparable with our value of 3.0 x 10 to the minus 59th power, their data were reevaluated by the method described here. We conclude that the best value for the solubility product at 25 degree C is 4.7 (2.0) x 10 to the minus 59th power.

703,413
PB77-600013 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Enthalpy of Solution of Sodium Nitrite.
J. C. Cases, V. B. Parker, and M. V. Kilday. 1977, 10p
Included in Jnl. of Research of the National Bureau of Standards, v82 n1 p19-28 1977.

Keywords: Calorimetry, NaNo2, *Enthalpy of dilution, NaNO2, Enthalpies of transition and fusion, NaNO2, melting temperature, *Sodium nitrite.

An adiabatic solution calorimeter was used to measure enthalpies of solution and dilution of sodium nitrite in water in the concentration range of 5 to 200 mmol.kg to the minus 1 power. For the solution reaction where molality, m = 100 mmol.kg to the minus 1 power, Delta c sub p = -- 1.394 plus or minus 0.014 J.g to the minus 1 power.K to the minus 1 power (--23.0 plus or minus 0.2 cal.mol to the minus 1 power K to the minus 1 power). Other Delta C sub p values for some dilution reactions were also measured. The value selected for the enthalpy of solution at infinite dilution is Delta H degrees varies as(298.15 K) = 14.006 plus or minus 0.015kj.mol to the minus 1 power =3.347 plus or minus 0.004 kcal.mol to the minus 1 power Values for the relative apparent molal heat content phi sub l, are tabulated and the enthalpy of transition and of fusion derived from differential thermal analysis measurements are also given.

703,414
PB77-600021
(Order as PB-276 556/8, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Method for the Numerical Evaluation of the Second Virial Coefficient for Polyatomic Molecules.
P. M. Holland, J. F. Ely, and H. J. M. Hanley. 1977, 5p
Included in Jnl. of Research of the National Bureau of Standards, v82 n2 p123-127 1977.

Keywords: Dipolar gas, Numerical integration, *Polyatomic molecule, Pople expansion, Quadrupolar gas, *Second Virial coefficient.

A numerical integration procedure to calculate the second virial coefficient polyatomic molecules is proposed. The inter-molecular pair potential is assumed to be a sum of a spherically symmetric contribution and an unsymmetric, angular dependent, contribution. The method is based on evaluating the possible different numerical values for this latter term. Quadrupolar and dipolar molecules are considered. Calculations for the virial coefficient for quadrupolar molecules are judged to be correct to within one part in 2500 or better, and to within one part in 300 or better for polar molecules. Results from the method are compared to corresponding results from the well-known Pople expansion procedure. It is shown that care must be taken to ensure this latter technique yields a convergent answer.

703,415
PB77-600024
(Order as PB-276 557, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Phase Equilibria and Crystal Chemistry of Rubidium Niobates and Rubidium Tantalates.
D. B. Minor, R. S. Roth, H. S. Parker, and W. S. Brower. 1977, 15p
Included in Jnl. of Research of the National Bureau of Standards, v82 n3 p151-165 1977.

Keywords: *Crystal chemistry, Ionic Conductivity, Nonstoichiometry, Phase equilibria, *Rubidium niobate, Rubidium.

The phase equilibria relations and crystal chemistry of portions of the Rb20-Nb2O-Ta2O5 systems were investigated for structures potentially useful as ionic conductors. A hexagonal tungsten bronze-type (HTB) structure was found in both systems as well as three hexagonal phases with mixed HTB-pyrochlore type structures. Ion exchange experiments between various alkali ions are described for several phases. Unit cell dimensions and x-ray diffraction powder patterns are reported.

703,416
PB77-600026
(Order as PB-276 557, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Stimulated Multiphoton Bremsstrahlung in Electron-ion Collisions.
S. Geltman. 1977, 7p
Included in Jnl. of Research of the National Bureau of Standards, v82 n3 p173-179 1977.

Keywords: *Bremsstrahlung, *Electron-ion collisions, free-free transitions, Multiphoton processes, Plasma absorption.

A review is presented of the basic classical mechanism whereby an electron can absorb energy from an electromagnetic field while undergoing a collision with an atom or ion. The process is also described for a quantum mechanical collision and the absorption or emission of photons. The appropriate formulations are described for weak and strong applied fields. A brief review is given for the resulting plasma absorption coefficients.

703,417
PB77-600027
(Order as PB-276 557, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Transport Coefficients in the One-fluid Approximation.
H. J. M. Hanley. 1977, 3p
Included in Jnl. of Research of the National Bureau of Standards, v82 n3 p181-182 1977.

Keywords: Critical point, Mixture, *One-fluid theory, Plait point, *Thermal Conductivity coefficient, *Viscosity coefficient.

Some comments of the justification of writing the viscosity and thermal conductivity coefficients of a mixture in the one-fluid approximation are presented. Anomalous behavior in the critical region is discussed.

703,418
PB77-600028
(Order as PB-276 557, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Mathematical Models of the Transient Heat Flow to Fuel Droplets.
H. S. Bennett, and R. Kayser. 1977, 13p
Included in Jnl. of Research of the National Bureau of Standards, v82 n3 p183-195 1977.

Keywords: Combustion, Emulsified fuel droplet, *Fuel droplet, *Heat flow, Micro-explosion, Preheat.

Two models for the preheat stage of conventional liquid fuel droplets and of emulsified fuel droplets in combustion gases are analyzed theoretically. These models contain the effects of transient heat conduction to the droplets. In the first model, the droplet and gas temperatures vary temporally but only the gas temperature varies spatially: i.e., the droplet temperature is spatially uniform. Numerical examples, computed from this model, for both the droplet and gas temperatures are given. In the second model, both the droplet and gas temperatures vary spatially and temporally. Numerical examples computed from this second model for the surface and average temperature of the droplet are given. These analyses show that the temperature gradients inside droplets of oil and water are small compared to those in the combustion gases near the droplet; that temperature profiles given by both models are very similar. In particular the predicted times at which micro-explosions are expected to occur agree within 10 percent of each other.

703,419
PB77-600031 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calculated Thermodynamic Properties of Superfluid Helium-4.
J. S. Brooks, and R. J. Donnelly. c1977, 54p
Included in Jnl. of Physical and Chemical Reference Data, v6 n1 p51-104 1977.

Keywords: Computed thermodynamic properties, Entropy, Equation of state, Excitation spectrum, Helium-4, Normal fluid helium-4, Phonons, Protons, Specificheat, *Superfluid helium-4.

Comprehensive tables of the primary thermodynamic properties of superfluid helium-4, such as the specific heat and entropy, are presented as computed from the Landau quasiparticle model, with the aid of inelastic neutron scattering data. The neutron data are represented by continuous functions of temperature pressure and wave number and certain excitation properties such as number density, normal and superfluid densities are calculated directly from it. a discussion of the methods used in our computations is included, and comparisons of computed and experimental results are made where applicable. Certain inadequacies of present theoretical methods to describe the thermodynamic properties are reported, and the use of an effective spectrum is introduced to offset some of the difficulties.

703,420
PB77-600032 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamic Properties of Normal and Deuterated Methods.
S. S. Chen, R. C. Wilhoit, and B. J. Zwolinski. c1977, 8p
Included in Jnl. of Physical and Chemical Reference Data, v6 n1 p105-112 1977.

Keywords: Enthalpy of formation, Gibbs energy of formation, *Ideal gas thermodynamic properties, Intermolecular association, *Normal and Deuterated methanols, Potential barrier to internal rotation, Principal and reduced moments of inertia, Structural parameters, Vibrational fundamentals, Virial coefficients of the equation of state.

Structural and spectroscopic data on C(H3)OH, C(H3)OD, C(D3)OH, and C(D3)OD were reviewed. The selected values were utilized to calculate the ideal gas thermodynamic properties in the temperature range of 0 to 1500 K, using the rigid-rotor and harmonic-oscillator model. Experimental data for the standard enthalpy of formation at 298.15 K, the heat capacities, and the third-law entropies at elevated temperatures are availaable only for C(H3)OH in the vapor phase where intermolecular association occurs. The agreement between the observed thermal data and our calculated values is satisfactory within the experimental uncertainties. Finally the standard chemical thermodynamic values for Standard Enthalpy of formation, Standard Gibbs energy of formation, and log Kf were generated in the temperature range of 0 to 1500 K.

703,421
PB77-600033 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Spectrum of Molecular Nitrogen.
A. Lofthus, and P. H. Krupenie. c1977, 195p
Included in Jnl. of Physical and Chemical Reference Data, v6 n1 p113-307 1977.

Keywords: Critical review, Franck-Codon integrals, Molecular constants, *Molecular nitrogen, Potential energy curves, Radiative lifetimes.

This is a critical review and compilation of the observed and predicted spectroscopic data on the molecule (N2) and its ions (N2(-)), (N2(+)), (N2(2+)), and the molecule (N3). Each electronic band system is discussed in detail, and tables of band origins and heads are given. In addition to the gas phase electronic, electron and Raman spectra, there are also examined the spectra of condensed molecular nitrogen as well as the pressure- and field-induced infrared and microwave absorption. Dissociation energy of (N2), predissociations, and perturbations are discussed. Potential energy curves are given, as well as radiative lifetimes, f-values, and Frank-Condon integrals. Molecular constants are listed for the known electronic states. Electronic structure and theoretical calculations are reviewed.

703,422
PB77-600035 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Activity and Osmotic Coefficients of Aqueous Calcium Chloride at 298.15 K.
B. R. Staples, and R. L. Nuttall. c1977, 24p
Included in Jnl. of Physical and Chemical Reference Data, v6 n2 p385-408 1977.

Keywords: Activity coefficient, *Calcium chloride, Critical evaluation, Electrolyte, Excess free energy, *Osmotic coefficient, Solutions, Thermodynamic properties.

A critical evaluation of the mean activity, gamma plus or minus, and osmotic coefficients, phi, of aqueous calcium chloride at 298.15 K is presented for the concentration range of 0 to 10 mol.kg to the minus 1 power. Osmotic coefficients were calculated from direct vapor pressure measurements, from isopiestic measurements or from freezing point depression measurements. Activity coefficients were calculated from electro-motive force measurements of galvanic cells, both without liquid-junction and with transference, and from diffusion data. A nonlinear least-squares program was used to fit data from all sources using both phi and ln gamma plus or minus, as a function of molality. An eight-parameter extended Debye-Huckel equation describes the osmotic coefficient, the mean activity coefficient, and the excess free energy as a function of molality. The scientific literature has been covered through July, 1976.

703,423
PB77-600036 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Molten Salts: Volume 4, Part 3. Bromides and Mixtures; Iodides and Mixtures. Electrical Conductance, Density, Viscosity, and Surface Tension Data.
G. J. Janz, R. P. T. Tomkins, C. B. Allen, J. R. Downey, and S. K. Singer. c1977, 88p
Included in Jnl. of Physical and Chemical Reference Data, v6 n2 p409-596 1977.

Keywords: *Bromides, Data compilation, Density, *Electrical conductance, *Iodides, *Molten salt mixtures, Standard reference data, *Surface tension, Viscosity.

Data on the electrical conductance, density, viscosity, and surface tension of bromide mixtures and iodide mixtures have been systematically collected and evaluated. Results are given for eighty-five binary mixtures over a range of compositions and temperatures. Values of the above properties for twenty-three single bromide and iodide salts are also given.

703,424
PB77-600037 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Viscosity and Thermal Conductivity Coefficients for Dense Gaseous and Liquid Methane.
H. J. M. Hanley, W. M. Haynes, and R. D. McCarty. c1977, 14p
Included in Jnl. of Physical and Chemical Reference Data, v6 n2 p597-610 1977.

Keywords: Correlation, Critical point anomaly, *Methane, Tables, *Thermal conductivity coefficient, *Viscosity coefficient.

Data for the viscosity and thermal conductivity coefficients of dense gaseous and liquid methane have been evaluated. Selected data were fitted to a function derived in our previous work and tables of values were generated for temperatures from 95 to 500 K and for pressures up to 50 MPa (approximately 500 atm). The uncertainties of the tabular values are estimated to be approximately 3 and 5 percent for the viscosity and thermal conductivity coefficients, respectively. The contribution for the thermal conductivity enhancement in the critical region is included in the tables. Care has been taken to ensure that the calculated values are consistent with reliable equation-of-state data and also with dilute gas transport coefficients determined previously.

703,425
PB77-600040 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Levels of One Electron Atoms.
G. W. Erickson. c1977, 40p
Included in Jnl. of Physical and Chemical Reference Data, v6 n3 p831-870 1977.

Keywords: Atomic structure, Electron structure, *Energy levels, Fine structure, Hydrogenic atoms, Lamb shift, Level shifts, Quantum electrodynamics, Radiative corrections, Relativistic corrections.

The table of precise one-electron atomic energy levels given by Garcia and Mack in 1965 is expanded to include all atomic numbers and more energy levels, updated by using more recent values of fundamental constants and radiative corrections, and extended to the maximum precision allowed by quantum electrodynamics (QED) calculations. All levels with n equal to or less than 11 are given for Z equal to or less than 15, with n equal to or less than 5 for Z equal to or less than 39, and with n equal to or less than 3 for Z equal to or less than 105. In addition, the S sub 1/sub 2 and P sub 1/sub 2 and j less than n - 1/2 levels with n less than 20 are given for Z less than 15, and with n less than 13

for Z less than 39. The uncertainty in the QED calculations is given for each level, and the leel is given to that precision. Conversions to different units and corrections for changing the Rydberg or nuclear mass values are pointed out. The paper includes a comprehensive listing and brief discussions of all effects considered and of the uncertainties for the calculated and neglected terms. The Fine Structure Interval (difference between the j = l plus or minus 1/2 levels for given n and l) and its reduced mass and QED contributions are discussed in detail. All known measurements of Lamb shifts and other fine structure differences are compared with calculated values.

703,426
PB77-600041 Not availabale NTIS
National Bureau of Standards, Gaithersburg, MD.
Rate Constants for Reactions of Chlorine Oxides of Atmospheric Interest.
R. T. Watson. c1977, 48p
Included in Jnl. of Physical and Chemical Reference Data, v6 n3 p871-918 1977.

Keywords: Absorption spectra, Chemical kinetics, Chlorine, *Chlorine oxides, Chlorocarbon, Chlorofluorocarbon, Data compilation and evaluation, Nitrosyl, Chloride, *Rate constant.

Chemical kinetics measurements on 82 gas phase reactions of chlorine containing species are reviewed. Recommended rate constants are given. The principal species of interest are Cl, Cl2, ClO, (Cl2)O, ClOO, OClO, ClNO, HCl and halo derivatives of methane and etane. Absorption spectra are given for 21 species. In addition the chemical kinetics methods used to obtain these data are discussed with regard to their applicabiity and reliability.

703,427
PB77-600042 Not available NTiS
National Bureau of Standards, Gaithersburg, MD.
NMR Spectral Data: A compilation of Aromatic Proton Chemical Shifts in Mono-and Di-Substituted Benzenes.
B. L. Shapiro, and L. E. Mohrmann. c1977, 74p
Included in Jnl. of Physical and Chemical Reference Data, v6 n3 p919-982 1977.

Keywords: *NMR Spectral data, *Benzenes.

NMR chemical shifts for protons directly attached to mono- and di-substituted benzenes are compiled from the literature. Data for 1053 sets of data are presented. The data have been examined for reliability using criteria which include high spectral quality, rigorous experimental technique, and sufficient description to assure correct interpretation of results. The data, presentd in tabular form, include compound name and formula solvent employed, concentration, temperature, chemical shift, and observation frequency. other NMR-related data are not given. An author index is included. The data and references cover the literature to June 1976.

703,428
PB77-600043 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tables of Molecular Vibrational Frequencies - Consolidated Volume II.
T. Shimanouchi. c1977, 110p
Included in Jnl. of Physical and Chemical Reference Data, v6 n3 p993-1102 1977.

Keywords: Fundamental frequencies, Infrared spectra, *Polyatomic molecules, Raman Spectra, *Vibrational frequencies.

The compilations of fundamental vibrational frequencies of molecules previously published as Tables of Molecular Vibrational Frequencies Part 5, Part 6, Part 7, and Part 8, which apeared in the Journal of Physical and Chemical Reference Data in 1972, 1973, and 1974, have been revised. This consolidated Volume II includes data on a total of 212 molecules in addition to those on 223 molecules included in Volume I (NSRDS-NBS 39). Selected values of the fundamental vibrational frequencies are given for each molecule, together with observed infrared and Raman spectral data and citations to the original literature. The selection of vibrational fundamentals has been based on careful studies of the spectral data and comprehensive normal-coordinate analyses. An estimate of the accuracy of the selected values is included. The tables provide a convenient source of information for those who require vibrational energy levels and related properties in molecular spectroscopy, thermodynamics, analytical chemistry, and other field of physics and chemistry.

703,429
PB77-600044 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effects of Isotopic Composition, Temperature, Pressure, and Dissolved Gases on the Density of Liquid Water.
G. S. Kell. c1977, 32p
Included in Jnl. of Physical and Chemical Reference Data, v6 n4 p1109-1132 1977.

Keywords: Aqueous solutions of gases, Compressibility, Equation of state, Heavy water, *Isotopic waters, Partial molar volume of aqueous gases, PVT, Thermal expansivity, Water.

A review is made of measurements of the effect of temperature, pressure, isotopic composition, and dissolved atmospheric gases on the density of liquid water at temperatures to 100 degree C. The molar volume is expanded as a multiple power series in the variables, and the coefficients determined. A number of gaps become evident in our knowledge of properties that are within the capacity of current measurements. For example, there appears to be no measurement of the effect of oxygen isotopes on the compressibility. Data on the thermal expansion of D2O are strikingly inconsistent. The partial molar volumes of disolved gases are only sketchily known. At O degree C, equilibration with the oxygen, nitrogen, and argon of the atmosphere lowers the density abaout 3 p.p.m. while atmospheric carbon dioxide raises it about 0.3 p.p.m. Appendix I discusses the care needed to obtain various degrees of precision in practical density measurements and the effect of isotopic uncertainities on them. Appendix II treats the representation of the equation of state of water at slightly higher pressures.

703,430
PB77-600045 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Viscosity of Water Substance - New International Formulation and its Background.
A. Nagashima. c1977, 34p
Included in Jnl. of Physical and Chemical Reference Data, v6 n4 p1133-1166 1977.

Keywords: Critically evaluated data, International Formulation, Steam, *Viscosity, *Water.

The paper traces the development of our knowledge of the viscosity of water and steam over the last decade, that is over the period of intense experimental and analytic activity which separates the promulgation of the 1964 Supplementary Release on Transport Properties of the Sixth ICPS from the recently announced Release on Dynamic Viscoity of Water Substance. As a result of this work, which was largely stimulated by the activities of the International Association for the Properties of Steam, the new internationally recognized skeleton table and the internationally recommended interpolation equations cover the wide range of pressures and temperatures of 0-100 MPa and 0-800 degrees C.

703,431
PB77-600046 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Correlation of the Existing Viscosity and Thermal Conductivity Data of Gaseous and Liquid Ethane.
H. J. M. Hanley, K. E. Gubbins, and S. Murad. c1977, 13p
Included in Jnl. of Physical and Chemical Reference Data, v6 n4 p1167-1180 1977.

Keywords: Critical point enhancement, Data evaluation, *Ethane, *Thermal conductivity coefficient, *Viscosity coefficient.

Data for the viscosity and thermal conductivity coefficients of ethane have been evaluated and represented by an empirical function. Tables of values have been prepared for the range 200-500 K, for pressure to 75 MPa (approximately 750 atm). The tables include an estimate of the anomalous contribution to the thermal conductivity in the neighborhood of the critical point. The estimated uncertainties of the tabular values are plus or minus 5 percent and plus or minus 8 percent for the viscosity and thermal conductivity coefficient, respectively.

703,432
PB77-600048 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Behavior of the AB-Type Compounds at High Pressures and High Temperatures.
L. Merrill. c1977, 48p
Included in Jnl. of Physical and Chemical Reference Data, v6 n4 p1205-1252 1977.

Keywords: *AB-type compounds, Calibration, Critically evaluated data, Crystallographic data, Experimental melting curves, High pressure, *Solid-solid phase boundaries.

The results of the published work on the high pressure-high temperature properties of the AB-type compounds have been compiled and evaluated. All pressure studies above the rage of 1 kilobar have been included with an emphasis on the accurate characterization of the solid-solid phase boundaries and the experimental melting curves. Whenever x-ray diffraction data are available for the high pressure phases, they have also been reviewed. Phase diagrams are included for all compounds in which measurement of more than one point along the phase boundary was made. This review discusses a total of 87 compounds and 212 distinct high pressure-high temperature phases.

703,433
PB77-600049 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Levels of Manganese, Mn I Through Mn XXV.
C. Corliss, and J. Sugar. c1977, 78p
Included in Jnl. of Physical and Chemical Reference Data, v6 n4 p1253-1330 1977.

Keywords: *Atomic energy levels, Atomic spectra, *Manganese.

The energy levels of the manganese atom in all of its stages of ionization, as derived from the analyses of atomic spectra, have been compiled. In cases where only line classifications are given in the literature, level values have been derived. The percentages for the two leading components of the calculated eigenvectors of the levels are given where available. Ionization energies and g-values are also given.

703,434
PB78-600005 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microprocessor Controlled Potentiostat for Electrochemical Measurements.
M. I. Cohen, and P. A. Heimann. 1978,15p
Included in Jnl. of Research of the National Bureau of Standards v83 n5 p429-443 Sep-Oct 1978.

Keywords: *Control, Converter(Digital and analog), Electrochemical measurements, Microcomputer, Microprocessor, Potentiostat.

A system, utilizing a microprocessor, intended for the control and unattended operation of a standard laboratory potentiostat is described. The system consists of a central processing unit, 16 kilobytes of random access memory, peripheral interfacing, a timer and digital to analog and analog to digital converters. It allows flexible operation of the potentiostat by programming of the central processor.

703,435
PB78-600007 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Specific Heats of Saturated and Compressed Liquid Propane.
R. D. Goodwin. 1978, 9p
Included in Jnl. of Research of the National Bureau of Standards, v83 n5 p449-458 Sep-Oct 1978.

Keywords: *Constant volume, Heat capacities, Liquid, Propane, Saturated liquid, Specific heats.

Experimental specific heats for saturated liquid propane, along the coexistence path, have been determined from the triple-point temperature (approximately 85 K) to 289 K. Specific heats for the compressed liquid at constant molal volume have been determined along isochores at nine different densities ranging from near the triple-point liquid density to about twice the critical-point density (at pressures up to 300 bar). Comparisons with previous experimental- and/or derived-data show agreement within combined uncertainties of about three percent.

703,436
PB78-600010 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Tables of Atomic Spectral Lines for the 10000 Angstrom to 40000 Angstrom Region.
M. Outred. c1978, 262p
Included in Jnl. of Physical and Chemical Reference Data, v7 n1 p1-262 1978.

Keywords: *Atomic spectra, Infrared spectra, Optical spectra.

This compilation of atomic spectral lines for the 10000 Angstrom to 40000 Angstrom region tabulates 8885 selected lines, belongint to 57 elements, extracted from computer based data records. The tables are divided into three sections. In section 1 the strong lines in the 10000 Angstrom to 250000 Angstrom range are listed for 27 elements. Section 2 is a table of classified and unclassified lines, arranged in order of increasing vacuum wavenumber. Section 3 consists of vacuum wavenumber tables, with appropriate energy level and (J) values for the classified lines, listed by element. Detailed explanation of the data and sources used for the compilation are given.

703,437
PB78-600011 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluated Activity and Osmotic Coefficients for Aqueous Solutions: The Alkaline Earth Metal Halides.
R. N. Goldberg, and R. L. Nuttall. c1978,48p
Included in Jnl. of Physical and Chemical Reference Data, v7 n1 p263-310 1978.

Keywords: *Activity coefficient, Alkaline earth metal halides, Critical evaluation, Electrolyte, Excess Gibbs energy, Osmotic coefficients, Solutions, Thermodynamic properties.

A critical evaluation of the mean activity and osmotic coefficients in aqueous solutions of the alkaline earth metal halides at 298.15 K is presented. Osmotic coefficients were calculated from direct vapor pressure measurements, from isopiestic measurements, and from freezing point depression measurements. Activity coefficients were calculated from electromotive force measurements on galvanic cells, both with and without transference, and from diffusion data. Given are empirical coefficients for three different correlating equations, obtained by a weighted least squares fit of the experimental data, and tables consisting of the activity coefficients of the halides, the osmotic coefficients and activity of water, and the excess Gibbs energy of the solution as a function of the molality for each electrolyte system. The literature coverage is through September 1976.

703,438
PB78-600013 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ideal Gas Thermodynamic Properties of Methanoic and Ethanoic Acids.
J. Chao, and B. J. Zwolinski. c1978, 16p
Included in Jnl. of Physical and Chemical Reference Data, v7 n1 p363-378 1978.

Keywords: *Dimer, Enthalpy, Entropy, Equilibrium constant of formation, Ethanoic (acetic) acid, Gibbs energy of formation, Heat capacity, Ideal gas thermodynamic properties, Internal rotational barrier height, Methanoic (formic) acid, Monomer, Torsional frequencies.

The thermodynamic properties (Enthalpy increment, the Gibbs Energy function, Enthalpy function, Entropy, Heat capacity, Standard enthalpy of formation, the Gibbs Energy of Formation, the log of the equilibrium constant of formation) for methanoic (formic) and ethanoic (acetic) acid monomers and dimers in the ideal gaseous state over the temperature range from 0 to 1500 K at 1 atm have been calculated by the statistical thermodynamic method using the most recent and reliable molecular and spectroscopic constants. The internal rotational contributions of -OH and -CH3 rotors to the thermodynamic properties were evaluated based on internal rotation partition functions formed by summation of calculated internal rotation energy levels. On an assumption that the vapor contains only monomers and dimers, the thermodynamic properties for the monomer-dimer equilibrium mixture of methanoic and ethanoic acids in ideal gaseous state were derived. The results are in agreement with available experimental data.

703,439
PB78-600014 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Critical Review of Hydrolysis of Organic Compounds in Water Under Environmental Conditions.
W. Mabey, and T. Mill. c1978, 34p
Included in Jnl. of Physical and Chemical Reference Data, v7 n2 p383-416 1978.

Keywords: *Acid, Base, Environmental conditions, Freshwater systems, Hydrolysis, Organic compounds, Rate constants.

This review examines the rate constants for hydrolysis in water of 12 classes of organic compounds with the objects of using these data to estimate the persistence of these compounds in freshwater aquatic systems. Primary data were obtained by literature review through most of 1975 and some of 1976. These data, which include values for acid, base and water promoted rate constants (kA, kB, kN) and temperature coefficients are presented in 18 tables in section 4. Estimated rate constants for hydrolysis under environmental conditions are presented in 13 tables in section 5, including rate constants at 298 K and pH 7 for acid, base, and water promoted reactions together with values for the estimated rate constant (kh) and the half-life (t1/2).

703,440
PB78-600015 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ideal Gas Thermodynamic Properties of Phenol and Cresols.
S. A. Kudchadker, A. P. Kudchadker, R. C. Wilhoit, and B. J. Zwolinski. c1978,7p
Included in Jnl. of Physical and Chemical Reference Data, v7 n2 p417-424 1978.

Keywords: *Ideal gas thermodynamic properties, Internal rotation, M-cresol, O-cresol, P-cresol, Phenol, Potential barrier heights, Rotational isomers, Torsional frequencies.

The standard chemical thermodynamic properties of phenol, o-cresol, m-cresol, and p-cresol were calculated by use of the rigid rotor harmonic oscillator approximation. The partition functions for internal rotation of -OH and -CH3 groups were calculated as a direct sum over the internal rotation energy levels. It was assumed that o-cresol is a mixture of two rotational isomers. Values of molecular parameters, fundamental frequencies, potential barriers to internal rotation and enthalpies of formation were selected from among those reported in the literature and from some additional molecular orbital calculations.

703,441
PB78-600016 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Densities of Liquid CH4-aXa(X=Br,I) and CH4-(a+b+c+d)FaClbBrcId Halomethanes.
A. P. Kudchadker, S. A. Kudchadker, P. R. Patnaik, and P. P. Mishra. c1978, 16p
Included in Jnl. of Physical and Chemical Reference Data, v7 n2 p425-440 1978.

Keywords: *Critically evaluated data, Halomethanes, Liquid density.

The available density data for the air-saturated liquid and for the liquid at its saturation vapor pressure have been critically reviewed and the 'best' data selected for the following halomethanes: CHF2Cl, CHFCl2, CF3Cl, CF3Br, CF2Cl2, CFCl3, (data up to the critical point are available for these compounds); CH3Br, CH2Br2, CHBr3, CBr4, CH3I, CH2I2, CH2FCl, (data up to the normal boiling point are available for these compounds); CHCl2Br (data over a small temperature range); CHI3, CI4, CH2FI, CH2ClBr, CH2CII, CHF2Br, CHF2I, CHFBr2, CHFI2, CHCl2I, CHClBr2, CHCII2, CF3I, CF2Br2, CFBr3, CCl3Br, CCl3I, (few scattered data points are available for these compounds). The literature survey is complete up to June 1974. Selection of 'best' data was arrived at by carefully evaluating each set of data for its accuracy, method of experimentation, sample purity, etc. The selection procedure is discussed. The uncertainty in the selected values is reported. For interpolation and limited extrapolation, the selected density data for each compound have been correlated through simple equations in temperature. The regression errors and the computed regression constants are reported in tables 2 and 4, respectively.

703,442
PB78-600020 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamic Properties of Ammonia.
L. Haar, and J. S. Gallagher. c1978, 161p
Included in Jnl. of Physical and Chemical Reference Data, v7 n3 p635-792 1978.

Keywords: *Ammonia, Correlation, Equation of state, Gas, Liquid, Phase equilibria, Thermodynamic properties.

An analytic thermodynamic surface has been fitted to the experimental data for ammonia for the temperature range extending from the triple point to 750 kelvins and for the pressure range extending from the dilute gas to 500 MPa (5000 bar). Values for the thermodynamic properties are tabulated at closely spaced intervals. A major part of the correlation was devoted to a study of the extent to which thermodynamic inconsistencies degrade the accuracy of the derived properties. This study focused as much on methods for correlating the data as on the data themselves. As a consequence, we are able to assign close tolerances to the tabulated thermodynamic properties over the range of the surface, including properties for the coexisting phases and even close to the liquid-vapor critical point.

703,443
PB78-600021 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
JANAF Thermochemical Tables, 1978 Supplement.
M. W. Chase, J. L. Curnutt, R. A. McDonald, and A. M. Syverud. c1978, 148p
Included in Jnl. of Physical and Chemical Reference Data, v7 n3 p793-940 1978.

Keywords: *Critically evaluated data, Enthalpy, Entropy, Equilibrium constant of formation, Free energy of formation, Gibbs energy function, Heat capacity, Heat of formation, Thermochemical tables.

The thermodynamic tabulations previously published in NSRDS-NBS 37, the 1974 Supplement (J. Phys. Chem. Ref. Data 3, 311 (1974), and the 1975 Supplement (J. Phys. Chem. Ref. Data 4, 1 (1975) are extended by 131 new and revised tables. The JANAF Thermochemical Tables cover the thermodynamic properties over a wide temperature range with single phase tables for the crystal, liquid, and ideal gas state. The properties given are heat capacity, entropy, Gibbs energy function, enthalpy, enthalpy of formation, Gibbs energy of formation, and the logarithm of the equilibrium constant for formation of each compound from the elements in their standard reference states. Each tabulation lists all pertinent input data and contains a critical evaluation of the literature upon which these values are based. Literature references are given.

703,444
PB78-600023 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Molar Volume (Density) of Solid Oxygen in Equilibrium with Vapor.
H. M. Roder. c1978,9p
Included in Jnl. of Physical and Chemical Reference Data, v7 n3 p949-958 1978.

Keywords: *Density, Molar volume, Oxygen, Phase transition, Solid.

Data from the literature on the molar volume of solid oxygen have been compiled and critically analyzed. A correlated and thermodynamically consistent set of molar volumes, including the volume changes at the various solid phase transitions, is presented. Evidence for the existence of a gamma-solid phase is reviewed. Uncertainties in the data and in the recommended set of values are discussed.

703,445
PB78-600025 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Semi-empirical Extrapolation and Estimation of Rate Constants for Abstraction of H from Methane by H, O, HO, and O2R.
R. Shaw. c1978, 12p
Included in Jnl. of Physical and Chemical Reference Data, v7 n3 p1179-1190 1978.

Keywords: *Estimated rate constants, Hydrogen abstraction, Methane combustion.

It has been concluded that for extrapolating rate constants of atom transfer reactions to and from high temperatures, a useful form of the rate constant is k = A squared (-C/T), where A and C are fitted constants. For k/cu cm(mol s) and T/K, on the basis of previous

experimental data, the values of log A and C for the following reactions are: H + CH4 = H2 + CH3, log A = 7.15, C = 4449; O + CH1 = OH + CH3, log A = 6.71, C = 3240; HO + CH4 = H2O + CH3, log A = 6.93, C = 1485 and O2 = CH4 = O2H + CH3, log A = 693, C = 26153. At all temperatures, abstraction by HO is faster than by O. The form of the rate constant is equivalent to assuming that the heat capacity at the constant pressure of activation is zero. When the heat capacity at the constant pressure of activation was estimated and assumed to be constant (in principle, a more accurate assumption than the heat capacity at the constant pressure of activation = 0), the fit to the experimental data was slightly worse. It is confirmed that at 400 to 700 K, the kinetic and thermodynamic equilibrium constants for the reaction H + CH4 = H2 + CH3 are significantly different. (At 1340 K, they are in agreement.)

703,446
PB78-600026 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Levels of Vanadium, V I through V XXIII.
J. Sugar, and C. Corliss. c1978, 71p
Included in Jnl. of Physical and Chemical Reference Data, v7 n3 p1191-1262 1978.

Keywords: *Atomic energy levels, Atomic spectra, Vanadium.

The energy levels of the vanadium atom in all of its stages of ionization, as derived from the analyses at atomic spectra, have been critically compiled. In cases where only line classifications are given in the literature, level values have been derived. The percentages for the two leading components of the calculated eigenvectors of the levels are given where available. Ionization energies and experimental g-values are also given.

703,447
PB78-600028 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Recommended Atomic Electron Binding Energies, 1s to 6p3/2, for the Heavy Elements Z = 84 to 103.
F. T. Porter, and M. S. Freedman. c1978, 18p
Included in Jnl. of Physical and Chemical Reference Data, v7 n4 p1267-1284 1978.

Keywords: *Atomic electron binding energies, Binding energies, Core electron binding energies, Heavy elements, Transuranic elements.

Recent experimental measurements of atomic electron binding energies, 1s to 6p3/2, for certain of the transuranic elements are incorporated into interpolation and extrapolation procedures yielding new recommendations for the electron binding energies from Z = 84 to 103.

703,448
PB78-600029 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ideal Gas Thermodynamic Properties of CH4-(a+b+c+d)FaClbBrcId Halomethanes.
S. A. Kudchadker, and A. P. Kudchadker. c1978, 24p
Included in Jnl. of Physical and Chemical Reference Data, v7 n4 p1285-1308 1978.

Keywords: *Critically evaluated data, Estimated enthalpies of formation, Estimated molecular parameters, Ideal gas thermodynamic properties, Mixed halomethanes.

The available molecular parameters, fundamental frequencies, and enthalpies of formations at 298.15K (standard enthalpy of formation (298)) for halomethanes of the type CH4-(a+b+c+d)FaClbBrcId have been critically evaluated and recommended values selected. Molecular parameters and standard enthalpy of formation (298) for some halomethanes have been estimated as the experimental values for these compounds are not available. This information has been utilized to calculate the ideal gas thermodynamic properties Heat capacity, Enthalpy function, Enthalpy increment, the Gibbs Energy function, Standard enthalpy of formation, the Gibbs Energy of formation, and the log of the equilibrium constant of formation, and log Kf from 0 to 1500 K and at a pressure of one atmosphere using the rigid rotor-harmonic oscillator approximation for the following compounds: CH2FBr,CH2ClBr, CH2ClI, CH2BrI, CHF2Br, CHFClBr, CHFBr2, CHCl2Br, CHClBr2, CF3Br, CF3I, CF2ClBr, CF2Br2, CF2I3, CFCl2Br, CFClBr2, CFBr3, CCl2Br, CCl3I, CCl2Br2, CClBr3.

703,449
PB78-600032 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Spectral Tables. II. Triatomic Molecules.
F. J. Lovas. c1978, 306p
Included in Jnl. of Physical and Chemical Reference Data, v7 n4 p1445-1750 1978.

Keywords: *Dipole moments, Hyperfine structure, Internuclear distance, Microwave spectra, Rotational constants, Rotational spectral lines, Triatomic molecules.

All of the rotational spectral lines observed and reported in the open literature for 54 triatomic molecules have been tabulated. The isotopic molecular species, assigned quantum numbers, observed frequency, estimated measurement uncertainty and reference are given for each transition reported. In addition to correcting a number of misprints and errors in the literature cited, the spectral lines for approximately 15 molecules have been refit to produce a comprehensive and consistent analysis of all the data extracted from various literature sources. Both measured and predicted transition frequencies are listed for several isotopic forms of HCN, H2O, H2S, OCS, SO2, and O3. The derived molecular properties, such as rotational and centrifugal distortion constants, hyperfine structure constants, electric dipole moments, and rotational g-factors are listed with one standard deviation uncertainty for all values.

703,450
PB78-600058 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Apparent Oscillator Strengths for Mercury Vapor.
R. H. Huebner, R. J. Celotta, and S. R. Mielczarek. 1977, 5p
Pub. in Argonne Natl. Lab. Rept. ANL-77-65, p11-15 1977.

Keywords: *Electron energy loss, Oscillator strengths, Photoabsorption, Water.

Energy-loss measurements for mercury show many interesting excitation phenomena commonly occurring in complex atomic systems. This system has been studied extensively by Lassettre and co-workers. We have obtained energy-loss spectra for mercury vapor for zero-angle scattering of 100 eV incident electrons. These data were analyzed to yield the apparent oscillator strength distribution shown in Figure 1. The analysis was carried out using the small-angle method described in detail elsewhere. The spectra were normalized to yield an f value of 1.11 for the intense 6(1)P(1) <- 6(1)S(0) transition observed at 6.71 eV.

703,451
PB78-600059 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Oscillator-Strength Distribution of Water. A Comparison of New Photoabsorption and Electron Energy-Loss Measurements.
J. C. Person, R. H. Huebner, R. J. Celotta, and S. R. Mielczarek. 1977, 3p
Pub. in Argonne Natl. Lab. Rept. ANL-77-65, p16-18 1977.

Keywords: *Electron energy loss, Mercury vapor, Oscillator strengths, Photoabsorption.

Oscillator strengths for mercury vapor are determined by electron energy loss measurements. They are compared to previous determinations, where available, over the energy range of 4-20 eV.

703,452
PB79-600007 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Levels of Titanium Ti I Through Ti XXII.
C. Corliss, and J. Sugar. c1979, 62p
Included in Jnl. of Physical and Chemical Reference Data, v8, n1 p1-62 1979.

Keywords: *Atomic energy levels, Atomic spectra, Titanium.

The energy levels of the titanium atom in all of its stages of ionization, as derived from the analyses of atomic spectra, have been critically compiled. In cases where only line classifications are reported in the literature, level values have been derived. Term designations, experimental g-values, and ionization energies are included. Calculated percentages of the two leading components of the eigenvectors of the levels are given.

703,453
PB79-600008 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Spectrum and Energy Levels of the Neutral Atom of Boron (BI).
G. S. Odintzova, and A. R. Striganov. c1979, 5p
Included in Jnl. of Physical and Chemical Reference Data, v8 n1 p63-68 1979.

Keywords: *Atomic energy levels, Atomic spectra, Boron.

The published data on the spectrum of the neutral atom of boron are compiled and presented. In one table 164 lines in the range 36010-993 Angstrom are listed with their intensities and classifications. A second table gives 92 levels with the numerical values of the energy.

703,454
PB79-600013 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Atomic Radiative and Radiationless Yields for K and L Shells.
M. O. Krause. c1979, 21p
Included in Jnl. of Physical and Chemical Reference Data, v8 n2 p307-328 1979.

Keywords: *Atomic properties, Auger yield, Coster-Kronig yield, Effective fluorescense yield, Fluorescence yield, K shell, L shell, Non-radiative yield, Partial level width, Radiative yield.

The available body of information on (a) fluorescence, Auger, and Coster-Kronig yields, (b) radiative and radiationless transition rates, (c) level widths, (d) x-ray and Auger line widths, (e) x-ray and Auger spectra, and (f) Coster-Kronig energies has been used to generate an internally consistent set of values of atomic radiative and radiationless yields for the K shell and the L subshells. Values of fluorescence yields, Coster-Kronig yields, Auger yields, and effective fluorescence yields are presented in tables and graphs. Estimates of uncertainties are given. Updated and expanded graphs of partial and total widths of K, L1, L2, and L3 levels are presented as well as a reference list of papers published since about 1972.

703,455
PB79-600014 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Natural Widths of Atomic K and L Levels, K alpha X-ray Lines and Several KLL Auger Lines.
M. O. Krause, and J. H. Oliver. c1979, 9p
Included in Jnl. of Physical and Chemical Reference Data, v8 n2 p329-338 1979.

Keywords: *Auger effect, Auger line width, K shell, Level width, Line width, L shell, Natural width, X-ray line width.

Semi-empirical values of the natural widths of K, L sub1, L sub2, and L sub3 levels, K alpha sub 1 and K alpha sub 2 x-ray lines, and KI1L1, KL1L2 and KL2L3 Auger lines for the elements 10-Z-110 are presented in tables and graphs. Level width is obtained from using the theoretical radiative rate from Scofield's relativistic, relaxed Hartree-Fock calculation and the fluorescence yield from Krause's evaluation X-ray and Auger line widths are calculated as the sums of pertinent level widths. This tabulation of natural level and line widths is internally consistent, and is compatible with all relevant experimental and theoretical information. Present semi-empirical widths, especially those of K alpha sub 1 and K alpha sub 2 x-rays, are compared with measured widths. Uncertainties of semi-empirical values are estimated.

703,456
PB79-600017 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Vapor Pressures and Boiling Points of Selected Halomethanes.
A. P. Kudchadker, R. P. Shukla, and P. R. Patnaik. c1979, 20p
Included in Jnl. of Physical and Chemical Reference Data, v8 n2 p499-518 p1979.

Keywords: *Antoine equation, Enthalpy of vaporization, Halomethanes, Vapor pressure-boiling point data, Wagner equation.

This critical review is a study of the vapor pressure-boiling point data from the triple point to the critical point for CH4 to the minus a X a (X=Br, I) and CH4 to the minus(a+b+c+d) FaClbBrcId halimethanes. The available data are carefully analyzed and the 'best' data selected. The selection procedure is discussed. Uncertainties in the selected temperatures and pressures are reported. The selected data were fitted to the Antoine equation for data up to 1500 mm Hg pressure and the Wagner equation for data up to the critical point. Antoine constants for nineteen compounds and the Wagner constants for five compounds are reported. The enthalpy of vaporization at 298.15 K and at the normal boiling point have been computed.

703,457
PB79-600025 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Critically Evaluated Rate Constants for Gaseous Reactions of Several Electronically Excited Species.
K. Schofield. c1979, 76p
Included in Jnl. of Physical and Chemical Reference Data, v8 n3 p723-798 p1979.

Keywords: *Activation energies, Electronically excited states, Evaluation, Gaseous interactions, Molecular correlations, Quenching, Radiative lifetimes, Rate constants, Reactive channels, Recommended data, Relaxation processes, Review.

An extensive evaluation is presented of the available gas phase chemical kinetic rate constants for the interactions of the low lying electronic states of several atoms and molecules with numerous collision partners. Wherever possible, recommended values are suggested. Much of the data refers only to room temperature. To facilitate the evaluation, collision-free radiative lifetimes often have been required. These also have been evaluated and are presented. The mechanisms of the interactions and the various potential kinetic channels are discussed. These include such processes as chemical reactions, electronic quenching to the ground electronic state, electronic cross relaxation to an adjacent excited state, and for molecules, vibrational and rotational relaxation processes within the excited state. A complete coverage of the literature published prior to 1978 has been attempted.

703,458
PB79-600026 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Review, Evaluation, and Correlation of the Phase Equillibria Heat of Mixing, and Change in Volume on Mixing for Liquid Mixtures of Methane + Ethane.
M. J. Hiza, R. C. Miller, and A. J. Kidnay. c1979, 18p
Included in Jnl. of Physical and Chemical Reference Data, v8 n3 p799-816 1979.

Keywords: *Binary mixtures, Data correlation, Excess volumes, Heat of Mixing, Liquid-vapor, Equilibria, Methane + Ethane.

The available experimental data for liquid equilibria, heat of mixing, and change in volume on mixing for the methane + ethane system have been reviewed and where possible evaluated for consistency. The derived properties chosen for analysis and correlation were liquid mixture excess Gibbs energies, Henry's constants, and K values. Data sets, selected on the basis of the consistency tests applied, were correlated as functions of temperature and composition to provide internally consistent sets of property values suitable for engineering design calculations.

703,459
PB79-600031 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluated Activity and Osmotic Coefficients for Aqueous Solutions: Iron Chloride and the Bi-Univalent Compounds of Nickel and Colbalt.
R. N. Goldberg, R. L. Nuttall, and B. R. Staples. c1979, 82p
Included in Jnl. of Physical and Chemical Reference Data, v8 n4 p923-1004 1979.

Keywords: *Activity coefficient, Cobalt, Critical evaluation, Electrolyte, Excess Gibbs energy, Iron, Nickel, Osmotic coefficients, Solutions, Thermodynamic properties.

A critical evaluation of the mean activity and osmotic coefficients in aqueous solutions of iron chloride, nickel chloride, perchlorate, and nitrate and twenty-nine bi-univalent compounds of cobalt at 298.15 K is presented. Osmotic coefficients were calculated from direct vapor pressure measurements, from isopiestic measurements, from freezing point depression measurements, and from vapor pressure osmometry measurements. Given are empirical coefficients for three different correlating equations, obtained by a weighted least squares fit of the experimental data, and tables consisting of the activity coefficients of the compounds, the osmotic coefficients and activity of water, and the excess Gibbs energy of the solution as functions of the molality for each electrolyte system. The literature coverage is through the computerized version of Chemical Abstracts of April 1979.

703,460
PB79-600032 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluated Activity and Osmotic Coefficients for Aqueous Solutions: Bi-univalent compounds of lead, copper, manganese, and uranium.
R. N. Goldberg. c1979, 46p
Included in Jnl. of Physical and Chemical Reference Data, v8, n4 p1005-1050 1979.

Keywords: *Activity coefficient, Copper, Critical evaluation, Electrolyte, Excess Gibbs energy, Lead, Manganese, Osmotic coefficients, Solutions, Thermodynamic properties, Uranium

A critical evaluation of the mean activity and osmotic coefficients in aqueous solutions of twelve bi-univalent compounds of lead, copper, manganese and uranium at 298.15 K is presented. Osmotic coefficients were calculated from direct vapor pressure measurements, from isopiestic measurements and from freezing point depression measurements. Activity coefficients were calculated from electromotive force measurements on galvanic cells without transference. Given are empirical coefficients for three different correlating equations, obtained by a weighted least squares fit of the experimental data, and tables consisting of the activity coefficients of the compounds, the osmotic coefficients and activity coefficients of the compounds, the osmotic coefficients and activity coefficients of the compounds, the osmotic coefficients, and activity of water, and the excess Gibbs energy of the solution as functions of the molality for each electrolyte system. The literature coverage is through the computerized version of Chemical Abstracts of April 1979.

703,461
PB79-600034 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Levels of Potassium K I through K XIX.
C. Corliss, and J. Sugar. c1979, 37p
Included in Jnl. of Physical and Chemical Reference Data, v8, n4 p1109-1145 1979.

Keywords: *Atomic energy levels, Atomic spectra, Potassium energy levels.

Data on the energy levels of the potassium atom in all of its stages of ionization, as derived from the analyses of atomic spectra, have been critically compiled. In cases where only the classifications are reported in the literature, level values have been derived. Electron configurations, term designations, J-values, experimental g-values, and ionization energies are included.

703,462
PB80-100712 Not available NTIS
National Bureau of Standards, Washington, DC.
Improved 100 Degrees S Point and Pol.
Final rept.,
A. L. Cummings, B. Coxon, H. P. Layer, and R. J. Hocken. 1979, 14p
Pub. in Proceedings of the Technical Session on Cane Sugar Refining Research (1978) Held at Washington, DC. on September 17-19, 1978, p191-204 1979.

Keywords: *Sucrose, *Polarimetry, Sugars, Lasers, Standards, Forecasting, Technology, Carbohydrates.

A newly constructed polarimeter, and highly purified sucrose were used to redetermine the hundred degree point of the saccharimeter scale at 546 nm wavelength. The result differs from previously reported results by 140 to 500 ppm. In addition to the low pressure mercury discharge lamp, lasers at 546 nm and 633 nm wavelengths have been advantageously employed as polarimeter light sources. Lasers improved the sensitivity, accuracy and reproducibility of measurements and decreased the measurement time. These and related investigations open the door to future improvements in the determination of the pol of technical sugars.

703,463
PB80-100720 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical Behavior of a Highly Oriented Polyethylene Rod.
Final rept.,
J. M. Crissman, and L. J. Zapas. 1977, 9p
Pub. in Jnl. of Polymer Science 15, p1685-1693 1977.

Keywords: *Polyethylene, *Mechanical properties, Stress relaxation, Torsion tests, Rods, High pressure tests, Reprints.

Dynamic mechanical and single step stress relaxation data are presented for a highly oriented linear polyethylene rod as produced by a high pressure extrusion technique. The results indicate that both major relaxation processes normally observed in unoriented polyethylene are virtually absent in torsion, whereas they are present in flexure. Stress relaxation in torsion data show a very highly nonlinear behavior when compared to similar data for an unoriented polyethylene rod.

703,464
PB80-100761 Not available NTIS
National Bureau of Standards, Washington, DC.
Revision, By Proton, Carbon-13, and Nitrogen-15 N.M.R. Spectroscopy, of the Structure Assigned a Bis(hexopyranosyl)-Amine Derivative.
Final rept..
B. Coxon, and L. Hough. 1979, 11p
Pub. in Carbohydrate Research 73, p47-57 1979.

Keywords: *Molecular structure, *Nuclear magnetic resonance, Reprints, Isotopic labeling, *Amine/bis(hexopyranosyl), Molecular conformation.

Structural analysis of the acetylated, minor product of the reaction of methyl 2,3-anhydro-4,6-O-benzylidene-alpha-D-mannopyranoside with ammonia by high-field proton- and 13C-n.m.r. spectroscopy, and also 15N-n.m.r. spectroscopy, has shown that this acetyl derivative is bis(methyl 2-O-acetyl-4,6-O-benzylidene-3-deoxy-alpha-D-altropyranosid-3-yl)amine, and not the N-acetyl derivative reported previously. The configuration and conformation of the bis(altropyranosid-3-yl)amine derivative have been determined, and its unusually large 1J(15NH) coupling constant is discussed.

703,465
PB80-100837 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Strong Excitation-Phonon Coupling on Mixed Crystal Spectra: Diphenylmethylene in Benzophenone.
Final rept.,
R. J. M. Anderson, B. E. Kohler, and J. M. Stevenson. 15 Aug 79, 5p
Pub. in Jnl. of Chemical Physics 71, n4, p1559-1563, 15 Aug 79.

Keywords: *Absorption spectra, *Emission spectra, *Crystal structure, Temperatures, Excitation, Phonons, Reprints, *Methylene/diphenyl.

Low temperature absorption and emission spectra are presented of diphenylmethylene in benzophenone. Although the spectra are broad at temperatures greater than about 20K, considerable structure appears at lower temperatures. The spectra and their temperature dependence are readily explained by a large excitation-phonon coupling which is expected for this type of mixed-crystal system.

703,466
PB80-101058 Not available NTIS
National Bureau of Standards, Washington, DC.
Fluorine Flame Calorimetry.
Final rept.,
G. T. Armstrong, and R. C. King. 1979, 27p
Sponsored in part by International Union of Pure and Applied Chemistry, Washington, DC.
Pub. in Combustion Calorimetry, n1, Chapter 15, p333-359 1979.

Keywords: *Fluorine, *Heat measurement, Flames, Enthalpy, Laboratory equipment, Thermochemistry, Hydrofluoric acid, Hydrochloric acid, Chlorine fluorides, Oxygen fluorides, Reprints, *Calorimetry, Amine oxide/trifluoro, Procedures.

Procedures and instruments for fluorine flame calorimetry are reviewed in their application to thermochemical measurements. Gaseous fluorine and fluorina-

ceous oxidizers are made to react with a reducer (often hydrogen) in a constant pressure flame in a calorimetric reaction vessel and the products are effluent as gases in the one-phase procedure. In the two-phase procedure gaseous products are dissolved in water to form aqueous hydrofluoric acid or other hydrohalic acid solutions depending on the composition of the oxidizer. Inaccuracies in the method amount to about 0.1 per cent, with the largest contribution to the uncertainty being unidentified corrosion reactions involving the metals of the reaction vessels. The method has been applied successfully to establishing the enthalpy of formation of aqueous hydrofluoric and hydrochloric acids, three chlorine fluorides, trifluoramine oxide, oxygen difluoride and other fluorinaceous substances.

703,467
PB80-103773 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectrum and Energy Levels of Triply Ionized Lanthanum (La IV).
Final rept.,
G. L. Epstein, and J. Reader. Apr 79, 10p
Pub. in Jnl. of the Optical Society of America 69, n4, p511-520, Apr 79.

Keywords: *Lanthanum, *Atomic energy levels, *Ultraviolet spectroscopy, Ionization, Excitation, Hartree-Fock approximation, Least squares method, Reprints.

The spectrum of La IV has been observed in a sliding spark discharge with the NBS 10.7-m normal incidence vacuum spectrograph and the NBS 10.7-m Eagle spectrograph in air. A total of 368 lines have been observed in the region from 300 to 5000 A. Because of the greatly contracted 4f orbital, the lowest excited configuration is 5p 5 4f. All configurations have been theoretically interpreted. The energy parameters determined from least-squares fits to the observed levels are compared with Hartree-Fock calculations. Some new measurements for La III are presented that confirm the 1967 results of Odasbasi.

703,468
PB80-103815 Not available NTIS
National Bureau of Standards, Washington, DC.
Energetics of Methyl Branches in Hydrocarbon Crystals.
Final rept.,
B. L. Farmer, and R. K. Eby. Mar 79, 4p
Pub. in Polymer 20, p363-366, Mar 79.

Keywords: *Crystal structure, *Energy transfer, Hydrocarbons, Molecular relaxation, Reprints, *Methyl radicals, Polymer branching.

Semi-empirical energy calculations are reported for methyl branched hydrocarbon molecules in orthorhombic and monoclinic crystalline arrays of linear molecules. The 19 molecules in the array are flexible and twenty methylene units long. Two modes of packing the defect molecule in the crystals are found and for each the mechanical relaxation criterion of there being two or more sites available to the molecule is met. However, there is no significant relaxation strength because the differences in site energies are too large. This results for all cases because the unfavorable orientation of the molecular stem in one of the sites makes the energy too much greater than in the other site which has a favorable orientation. The defect energies show that methyl branches could be incorporated in the crystals in at least one of the cases. For that case, the unit cell dimensions are comparable to those found experimentally for the same methyl group concentration. Drawings showing the molecular distortion are presented.

703,469
PB80-103856 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Dependence of the Electro-Optic Kerr Coefficient of Nitrobenzene.
Final rept.,
R. E. Hebner, and M. Misakian. Sep 79, 2p
Pub. in Jnl. of Applied Physics 50, n9, p6016-6017, Sep 79.

Keywords: *Kerr electrooptical effect, *Nitrobenzenes, Temperature, Reprints, *Temperature dependence.

The Kerr coefficient of nitrobenzene was measured over the temperature range 285-340 K. To within experimental error, the data indicate that the Kerr coefficient can be expressed as a quadratic function of reciprocal temperature. Fitting the data to this quadratic function yields an equation which can be used to correct the response of a pulse-voltage measuring system based on the Kerr effect for variations in the ambient temperature.

703,470
PB80-103872 Not available NTIS
National Bureau of Standards, Washington, DC.
Simulation of the Relaxation of Random-Coil Polymer Chains by Lattice Models with Excluded Volume: The Effect of Bead Movement Rules.
Final rept.,
D. E. Kranbuehl, and P. H. Verdier. 15 Sep 79, 9p
Pub. in Jnl. of Chemical Physics 71, n6, p2662-2670, 15 Sep 79.

Keywords: *Molecular relaxation, *Mathematical models, Reprints, *Polymer chains, *Bead movement rules.

Earlier work showed that excluded volume constraints lengthen the long relaxation times of lattice-model polymer chains using single-bead elementary motions by a factor proportional to about the first power of chain length. This paper reports the extension of this work to chains employing double-bead elementary motions and to chains employing random mixtures of both kinds of motion. For pure two-bead motion, the chain-length dependence of the lengthening of relaxation time is essentially identical with that previously obtained for pure single-bead motion. For models using both kinds of move, this chain-length dependence is suppressed at shorter chain lengths. However, for chains longer than about 30 beads, contrary to the prediction of Deutch and others, the lengthening of the relaxation time by excluded volume again becomes proportional to about the first power of chain length. Other studies that have not exhibited this first power dependence have either examined relaxation from highly nonequilibrium configurations or have not employed sufficiently long chains for the effect to be observed.

703,471
PB80-104193 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Dielectric and Refractive Virial Coefficients and Collision Induced Absorption Bands.
Final rept.,
G. Birnbaum, and T. K. Bose. 1 Jul 79, 3p
Sponsored in part by Ministry of Education, Quebec (Canada), and National Research Council of Canada, Ottawa (Ontario).
Pub. in Jnl. of Chemical Physics 71, n1, p17-19, 1 Jul 79.

Keywords: Dielectric properties, Refractivity, Comparison, Infrared spectroscopy, Carbon dioxide, Ethane, Methane, Sulfur hexafluoride, Absorption spectra, Reprints, *Viral coefficients.

The second dielectric virial coefficient minus the second refractive virial coefficient is equal to the Kramers-Kroning contributions arising from the far-infrared and infrared pressure induced absorption bands due to bimolecular interactions. The usefulness in comparing such results is illustrated for CO2, C2H4, CH4, and SF6. It is shown that for SF6 there may be as yet unmeasured collision induced bands and for C2H4 the far-infrared collision induced absorption is anomalously large.

703,472
PB80-104201 Not available NTIS
National Bureau of Standards, Washington, DC.
Discussion on the Paper Ionic Conductivity of Some Lithium Silicates and Aluminosilicates by I. D. Raistrick, C. Ho, and R. A. Huggins.
Final rept.,
A. D. Franklin, and K. F. Young. Jun 77, 2p
Pub. in Jnl. of the Electrochemical Society 124, n6, p871-872, Jun 77.

Keywords: *Aluminum silicates, Ion currents, Electrodes, Reprints, *Lithium silicates, *Ionic conductivity.

It is shown that the impedance data of Raistrick et. al. (J. Electrochem. Soc. 123, 1469, 1976) can be well represented by an equivalent circuit in which grain boundary effects are represented by a modified Cole-Cole distribution of impedance, and electrode effects by a similar distribution of admittance. Physical models are discussed.

703,473
PB80-104235 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamic Properties of Nitrogen Gas from Sound Velocity Measurements.
Final rept.,
B. A. Younglove. 1979, 6p
Pub. in Proceedings of the International Symposium on Cryogenic Wind Tunnels (1st), Held at Southampton, England, on April 3-5, 1979, p16.1-16.6 1979.

Keywords: *Nitrogen, *Thermodynamic properties, Acoustic velocity, Acoustic measurements, Temperature, Pressure, Density(Mass/volume), Temperature dependence, Pressure dependence.

Thermodynamic properties of nitrogen gas have been calculated from 80 K to 350 K and at pressures to 10 bar from sound velocity measurements and existing P-V-T data using multiproperty fitting techniques. These new data are intended to improve existing predictive capability of the equation of state in the low density region needed for use with the NASA-Langley National Transonics Facility.

703,474
PB80-104284 Not available NTIS
National Bureau of Standards, Washington, DC.
Field-Induced Redistribution Processes in Adsorption Layers of Hydrogen on Ruthenium.
Final rept.,
G. Greiner, D. Menzel, and R. Klein. 1979, 12p
Pub. in Surface Science 84, p129-140 1979.

Keywords: *Surface chemistry, *Ruthenium, *Hydrogen, Adsorption, Reprints.

The field-induced effects in hydrogen layers on ruthenium field emitters, which had been observed before, have been investigated in more detail in two laboratories. Raising the field causes an increase of emission, due to a decrease of work function, on certain planes and vicinals (mostly on and around the (110)) of the Ru field emitter. The extent and rate of appearance of this effect depends on field, coverage and temperature. It is shown that the cause is mainly the disappearance of hydrogen from these areas, which is probably due to a field-induced decrease of the adsorption energy on these areas relative to others. Possible mechanisms are discussed.

703,475
PB80-104326 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Initiated Afterglow in a High Pressure K-Kr Mixture.
Final rept.,
L. K. Lam, and L. D. Schearer. 15 Dec 78, 5p
Pub. in Chemical Physics Letters 60, n1, p130-134, 15 Dec 78.

Keywords: *Potassium, *Krypton, *Optical spectra, *Afterglows, Mixtures, Ionization, Fluorescence, Emission spectra, Reprints, *Laser induced fluorescence, *Atom electron interactions.

The potassium atoms in a K-Kr mixture ((K) = 6 x 10 to the 14th power/cc : (Kr) = 10 to the 19th power/cc) are ionized with a 140 mu joule, 4 nsec laser pulse in a resonant 2 photon absorption via the K(5p) level. The optical emission spectra in the afterglow of the laser pulse is monitored as a function of time. A fast initial decay of the fluorescence (about 20 nsec) due to collisional excitation of the potassium by the hot photoelectrons and a slow decay tail (about 10 mu sec) due to collisional-radiative recombination is observed.

703,476
PB80-104342 Not available NTIS
National Bureau of Standards, Washington, DC.
Coherent Optical Transients Observed by Polarization Switching.
Final rept.,
M. D. Levenson. 15 Jul 79, 4p
Pub in Chemical Physics Letter 64, n3, p495-498, 15 Jul 79.

Keywords: *Iodine, *Absorption spectra, *Polarization(Waves), Circular polarization, Deactivation, Laser beams, Reprints.

A transient signal analogous to the optical free induction decay is observed when a laser beam tuned to an absorption line of I2 is switched from left to right circular polarization. The polarization transient amplitude decays at a rate equal to twice the usual transverse

decay rate, and can be detected with sensitivity similar to that achieved in polarization spectroscopy.

703,477
PB80-104391 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Selective Laser Excitation on the Ionization of Atomic Species in Flames.
Final rept.,
J. C. Travis, P. K. Schenck, G. C. Turk, and W. G. Mallard. Aug 79, 5p
Pub. in Analytical Chemistry 51, n9, p1516-1520, Aug 79.

Keywords: *Flames, *Atomic spectroscopy, *Mathematical models, Least squares method, Laboratory equipment, Ions, Electrons, Reprints, Laser induced ionization, Electron ion interaction, *Laser spectroscopy.

Laser enhanced ionization of atomic species in flames, also known as the optogalvanic effect, has been used as the basis for a new spectrometric technique. A simple model is formulated here to help explain the production of electron-ion pairs by the combination of optical and collisional processes. The model yields an analytical expression for the relative enhanced ionization sensitivity of a given transition of any element, and also predicts possible sources of bias in spectrometric applications. The theoretical function is fitted to experimental data by the least-squares adjustment of two parameters. The fitted function may be used, with appropriate caution, to predict the potential LEI sensitivity of further elements and transitions in a similar flame. The model should provide a durable foundation for the further development of methodology and instrumentation for atomic spectrometry by laser enhanced ionization in flames.

703,478
PB80-104441 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of the B(1)Il(u)-X(1)sigma(+)g Band System of Na2.
Final rept.,
P. Kusch, and M. M. Hessel. 15 Mar 78, 16p
Sponsored in part by Air Force Office of Scientific Research, Arlington, VA.
Pub. in Jnl. of Chemical Physics 68, n6, p2591-2606, 15 Mar 78.

Keywords: *Sodium, *Band spectra, Fluorescence, Excitation, Dissociation energy, Reprints, Laser induced fluorescence, Franck-Condon principle.

A critical analysis of the B 1 Pi(u) - X 1 Sigma(g)(+) band system of the Na2 molecule has been made. The body of data on which the present analysis is based is much more extensive than that used in any previous analysis. The data for the analysis were obtained by a laser-induced fluorescence technique in which many collisionally induced satellite fluorescence series were observed in addition to the directly excited series.

703,479
PB80-104482 Not available NTIS
National Bureau of Standards, Washington, DC.
Chain Deformations in Rubber.
Final rept.,
J. A. Hinkley, C. C. Han, B. Mozer, and H. Yu. 1978, 3p
Pub. in Macromolecules 11, n4, p836-838 1978.

Keywords: *Elastomers, *Molecular structure, Deuterium compounds, Neutron scattering, Reprints, *Polymer chains, Small angle scattering, Polybutadienes.

Small angle neutron scattering measurements were performed on mixtures of poly-(butadiene-d6) at 3% or less in polybutadiene and on uniform networks containing 3% deuterated chains over the range of extension ratios 1 = or < lambda = or < 1.55. The chain dimensions of poly(butadiene-d6) in the mixtures and in the unstrained networks (lambda=1) are found to be the same within the experimental uncertainty. The increase of the chain dimension with extension ratio is in qualitative accord with that predicted for the affine deformation of crosslink junctions.

703,480
PB80-104490 Not available NTIS
National Bureau of Standards, Washington, DC.
Transport Properties of a Binary Mixture at the Gas-Liquid Critical Point.
Final rept.,
B. J. Ackerson, and H. J. M. Hanley. 1978, 1p
Pub. in Am. Phys. Soc. Bull. 23, p315 1978.

Keywords: *Binary systems, *Critical point, *Transport properties, *Methane, *Ethane, Vapor phases, Liquid phases, Rayleigh scattering, Light scattering, Entropy, Mixtures, Reprints.

Experimental Rayleigh light scattering measurements were made on a 70% (molar) methane-30% ethane mixture close to the gas-liquid critical point. The rate of decay for both concentration and entropy fluctuations were determined together with the critical temperature, critical pressure, and the dielectric constant. The decay rate of the concentration fluctuations showed anomalous behavior similar to that found at a consolute point, as expected. The decay rate of the entropy fluctuations, however, appeared well-behaved or, at most, weakly anomalous. A one-fluid model was used to estimate quantitatively the decay rate (thermal diffusivity) for the entropy fluctuations. Agreement between theory and experiment is excellent.

703,481
PB80-104516 Not available NTIS
National Bureau of Standards, Washington, DC.
Liquid-Liquid Critical Phenomena.
Final rept.,
S. C. Greer. Nov 78, 6p
Pub. in Accounts of Chemical Research 11, p427-432, Nov 78.

Keywords: *Liquid phases, *Binary systems, *Critical point, Mixtures, Reprints.

The theories and experiments on liquid-liquid critical phenomena are reviewed and compared. It is found that the experiments confirm the scaling and renormalization group theories.

703,482
PB80-104680 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultraviolet Photoemission Studies of Formaldehyde and Related Molecules Adsorbed on Ru(110).
Final rept.,
G. B. Fisher, T. E. Madey, and J. T. Yates. Apr 78, 5p
Prepared in cooperation with Office of Naval Research, Washington, DC.
Pub. in Jnl. of Vac. Sci. Technol. 15, n2 p543-547, Mar/Apr 78.

Keywords: *Ruthenium, *Surface chemistry, *Chemisorption, Ultraviolet spectroscopy, Formaldehyde, Hydrogen, Carbon monoxide, Photoelectric emission, Adsorption, Reprints.

The adsorption of formaldehyde (H2CO), hydrogen, and carbon monoxide on Ru(110) has been studied using angle-integrated ultraviolet photoemission spectroscopy (UPS) and temperature programmed desorption (TPD). The UPS spectra for low exposures of H2CO at 80 K indicate that H2CO dissociates to a substantial degree. These spectra are compared with UPS spectra for the sequential adsorption of hydrogen and CO. Whereas there are similarities between these spectra, the differences in the UPS, work function change, and TPD results are sufficient to suggest that a portion of the dissociated H2CO may exist as a surface molecular complex containing H and CO. This is apparently the first reported example, based on a UPS study, of an oxygen-containing organic molecule which dissociates upon adsorption on a metal surface at 80 K. For high exposures at 80 K, adsorption of a condensed layer of molecular H2CO is observed.

703,483
PB80-107261 Not available NTIS
National Bureau of Standards, Washington, DC.
Atomic Spectra Reports, Reports of Observatories of Astronomical Society.
Final rept.,
L. Hagan. 1977, 5p
Pub. in Bulletin of the American Astron. Society 7, n1, p165-169 1975, and 8, n1, p210-214 1976, and 9, n1, p189-193 1977.

Keywords: *Atomic spectra, Atomic energy levels, Molecular spectra, Transition probabilities, Reprints, Line broadening.

Research at the National Bureau of Standards in spectroscopy pertinent to astronomy is summarized. Publications on atomic spectra, atomic transition probabilities and line broadening, and molecular spectra are referenced, and work in progress is discussed.

703,484
PB80-107295 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of the Thermal and Infrared Laser Induced Unimolecular Decompositions of Allylmethylether, Ethylacetate, and Isopropylbromide.
Final rept.,
D. Gutman, W. Braun, and W. Tsang. 1 Nov 77, 6p
Pub. in Journal of Chemical Physics 67, n9, p4291-4296, 1 Nov 77.

Keywords: *Thermal decomposition, *Infrared radiation, Reaction kinetics, Comparison, Reprints, *Laser induced reactions, *Acetic acid/ethyl, *Ether/allylmethyl, *Propane/bromo.

The thermal and the infrared laser-induced unimolecular decompositions of three molecules, allylmethylether, ethylacetate, and isopropylbromide, have been studied. The thermal decompositions were studied using a single-pulse shock tube and the laser-induced reactions using a 0.63 cm i.d. gas cell with NaCl windows with radiation at 9.28 micrometers from a Lumonics 203 TEA laser and modest energy fluences (4.5J/cu cm). In both studies the molecules were used in pairs (allylmethylether with ethylacetate and isopropylbromide with ethylacetate) so that relative unimolecular rate constants could be accurately determined. A closer adherence to the 'thermal' rate constants were observed in the analogous study of the decomposition of the two molecules which both absorbed the laser light (allylmethylether with ethylacetate). Details of the experiment, the data obtained, and the extent to which multiphoton decomposition of large molecules occur under these 'mild' conditions are discussed.

703,485
PB80-107410 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Density Lipoprotein Recombinants; Evidence for a Bicycle Tire Micelle Structure Obtained by Neutron Scattering and Electron Microscopy.
Final rept.,
A. Wlodawer, J. P. Segrest, B. H. Chung, R. Chiovetti, and J. N. Weinstein. Aug 79, 5p
Pub. in FEBS Lett. 104 n2 p231-235, Aug 79.

Keywords: *Lipoproteins, *Electron microscopy, *Neutron scattering, Density(Mass/volume), Reprints.

High-density lipoprotein recombinants were studied by neutron low-angle scattering and electron microscopy. The shape of molecules was discoidal, with the diameter 100 A and thickness 33 A. Analysis of models based on radii of gyration of recombinants containing both hydrogerated and deuterated lipids shows that best agreement between the neutron and microscopic results can be obtained by postulating separation of protein from polar lipid heads, with protein on the outside of the recombinants.

703,486
PB80-107485 Not available NTIS
National Bureau of Standards, Washington, DC.
Stabilization and Spectra of Free Radicals and Molecular Ions in Rare Gas Matrices.
Final rept.,
M. E. Jacox. 1978, 36p
Pub. in Review Chem. Intermediates, v2 p1-36, 1978.

Keywords: *Free radicals, *Ions, *Infrared spectroscopy, *Ultraviolet spectroscopy, *Rare gases, Argon, Reprints, *Matrix isolation techniques, Ion molecule interactions.

Characteristics of the infrared and ultraviolet spectra of molecules isolated in rare-gas matrices are reviewed, and the roles played by the cage effect and by secondary photodecomposition in determining the products observed in matrix isolation experiments are discussed. The use of charge transfer processes to obtain molecular anions trapped in an argon matrix is considered, and the results of experimental studies of the spectra of molecular anions are summarized. The use of argon atoms excited in a microwave discharge for the production of free radicals and molecular ions on collision with small molecules is reviewed, with emphasis on the processes which are important in these discharge experiments.

703,487
PB80-108525 Not available NTIS
National Bureau of Standards, Washington, DC.

Matrix Isolation Study of the Vacuum Ultraviolet Photolysis of Methyl Cyanide. Vibrational and Electronic Spectra of the CNC Free Radical.
Final rept.,
M. E. Jacox. 1978, 17p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 71, p369-385 1978.

Keywords: *Acetonitrile, Vibrational spectra, Electronic spectra, Nitriles, Free radicals, Infrared spectra, Ultraviolet spectra, Visible spectrum, Reprints.

Visible-ultraviolet spectra of CH3CN deposited in an argon matrix at 14 K with concurrent 1216-A photolysis show prominent absorptions of CN and CNC and weak absorption of CCN. The far infrared spectra of deposits made using similar experimental conditions show a peak at 134/cm which has tentatively been assigned to the lowest frequency component of the bending fundamental of ground-state CNC, split by strong Renner-Teller interaction. Detailed isotopic substitution studies have confirmed the assignment of a prominent absorption at 1453/cm to the previously unidentified antisymmetric stretching fundamental, nu sub 3, of CNC. The stretching force constant for this molecule is estimated to lie between 800 N/m and 850 N/m and the stretching-interaction force constant between 250 N/m and 300 N/m. Consideration of the photoprocesses important in these experiments suggests that CNC is formed primarily by photodissociation of CCN and cage recombination of the resulting C + CN.

703,488
PB80-114119 Not available NTIS
National Bureau of Standards, Washington, DC.
Line Spectra of the Elements.
Final rept.,
J. Reader, and C. H. Corliss. 1979, 133p
Pub. in CRC Handbook of Chemistry and Physics, Section E. General Physical Constants. pE217-E349, 1978-1979.

Keywords: *Line spectra, *Elements, Tables(Data), Ionization, Infrared spectroscopy, Ultraviolet spectroscopy, Reprints.

Tables of the outstanding spectral lines of all neutral, singly ionized, doubly ionized, triply ionized, and quadruply ionized atoms for which data are available are given. Listed are lines that appear in emission from the vacuum ultraviolet to the far infrared. These lines have been selected from much larger lists in such a way as to include the stronger observed lines in each spectra region. In a few cases, prominent monoxide band heads are also given.

703,489
PB80-114127 Not available NTIS
National Bureau of Standards, Washington, DC.
Reaction of F Atoms with Methane in an Argon Matrix.
Final rept.,
M. E. Jacox. 1979, 16p
Pub. in Chemical Physics 42, p133-148 1979.

Keywords: *Chemical reactions, *Infrared spectroscopy, Complex compounds, Absorption spectra, Reprints, *Fluorine atoms, *Matrix isolation techniques.

A microwave discharge through an Ar:CF4 or Ar:NF3 sample flowing through an Al2O3 tube provides a suitable source of F atoms for studies of the infrared spectra of the products of their reaction with CH4 trapped in an argon matrix at 14 K. Prominent infrared absorptions of isolated CH3 and HF appeared in these experiments. The further reaction of F atoms in the solid deposit leads to the stabilization of the H3C...H--F complex, for which two infrared absorptions have been identified. Detailed isotopic studies of this complex are presented.

703,490
PB80-114135 Not available NTIS
National Bureau of Standards, Washington, DC.
B singlet Pi(u)-X singlet Sigma(g)(+) Band System of the (7)Li2 Molecule.
Final rept.,
M. M. Hessel, and C. R. Vidal. 15 May 79, 21p
Pub. in Jnl. of Chemical Physics 70, n10, p4439-4459, 15 May 79.

Keywords: *Lithium, *Absorption spectra, Fluorescence, Quantum mechanics, Reprints, *Laser induced fluorescence, *Laser spectroscopy, Franck-Condon principle.

The laser induced fluorescence and absorption spectra of the B singlet Pi(u) - X singlet Sigma(g)(+) band system of the 7Li2 molecule has been photographed at high resolution and high dispersion. Over 14,000 spectral lines have been assigned to this band system for a wide range of rotational quantum numbers (J = 0 - 80) and vibrational quantum numbers (v prime = 0 - 14 and v double prime = 0 - 20). Quantum mechanical potential curves have been generated for this system using a novel variational procedure and Franck-Condon factors for different rotational quantum numbers have been determined over the range of vibrational levels observed. A review of the literature on the Li2 molecule is given.

703,491
PB80-115488 Not available NTIS
National Bureau of Standards, Washington, DC.
Addendum to 'Photoabsorption by Cesium'.
Final rept.,
D. W. Norcross. Sep 79, 2p
Pub. in Physical Review A. General Physics 20, n3 p1285-1286 Sep 79.

Keywords: *Cesium, Atomic energy levels, Excitation, Reprints, *Photoabsorption cross sections, *Oscillator strengths.

The results of earlier calculations are used to obtain oscillator strengths for high principal-series transitions in cesium, in terms of the coefficients in an interpolation formula for principal quantum numbers 17 < n < infinity.

703,492
PB80-115504 Not available NTIS
National Bureau of Standards, Washington, DC.
Evidence of Tumbling Multiplets in Saturation Absorption Spectra of SiF4.
Final rept.,
W. G. Harter, H. P. Layer, and F. R. Petersen. Mar 79, 3p
Pub. in Optics Letters 4, n3 p90-92 Mar 79.

Keywords: *Absorption spectra, *Silicon fluorides, Molecular energy levels, Reprints.

Some implications of tumbling quartets, triplets, and doublets seen in high-resolution spherical-top spectra are discussed. Some of the first observed cluster splittings are shown in SiF4 spectra and compared with the predictions of the quantum theory of clusters. Further potentially interesting spectroscopic experiments are proposed.

703,493
PB80-115512 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Dependence of Resonant Isotopic Vibrational Energy Transfer in H35Cl-H37Cl.
Final rept.,
A. B. Horwitz, and S. R. Leone. 1979, 8p
Sponsored in part by Petroleum Research Fund, Washington, DC.
Pub. in Jnl. of Chemical Physics 70, n11 p4916-4923, 1 Jun 79.

Keywords: *Hydrogen chloride, *Energy transfer, *Molecular vibration, Chlorine isotopes, Reprints, Laser induced fluorescence, *Temperature dependence, Chlorine 35, Chlorine 37.

No abstract available.

703,494
PB80-115546 Not available NTIS
National Bureau of Standards, Washington, DC.
Charge Overlap Effects in Dispersion Energies.
Final rept.,
M. Krauss, and D. B. Neumann. 1979, 6p
Pub. in Jnl. of Chemical Physics 71, n1 p107-112, 1 Jul 79.

Keywords: *Polarization(Charge separation), *Energy transfer, Dispersion, Helium, Hydrogen, Beryllium, Reprints, *Atom atom interactions, *Dispersion coefficient, Numerical solution, Dispersion equations.

Charge overlap effects in dispersion energies are calculated using frequency dependent atomic polarizabilities. The dispersion energy is expanded in the usual multipole interaction series but the dispersion coefficients are found to be given as a product, C(LA,LB) chi (LA,LB;R) where C(LA,LB) is the usual coefficient for nonoverlapping fragments and chi is called a damping function which equals one asymptotically. The results are used to analyze qualitatively the extent of the dispersion contribution to the energy of interactions at either the equilibrium separation or the critical distance for orbiting collisions.

703,495
PB80-115553 Not available NTIS
National Bureau of Standards, Washington, DC.
Variational Calculation of Dynamic Polarizabilities.
Final rept.,
M. Krauss, and D. Neumann. 1977, 3p
Pub. in Chemical Physics Letters 52, n3 p600-602, 15 Dec 77.

Keywords: *Polarization(Charge separation), *Hydrogen, *Helium, Potential energy, Dipole moments, Van der Waals equation, Hartree-Fock approximation, Reprints.

The finite field method of obtaining static multipole polarization is extended to the calculation of dynamic polarizabilities. The results are applied to the approximation of the dynamic polarizability at imaginary frequencies. These are then used to calculate the coefficients for the inverse power series representation of the interatomic potential energy. The method has been applied to two simple cases, hydrogen and helium. For hydrogen the present method yields results close to the exact values for the static dipole polarizability and the dipole--dipole van der Waals coefficient. In the case of helium a simple Hartree-Fock function was perturbed but the results are still encouraging with the dipole--dipole van der Waals coefficient, calculated to within 7% of the accurate value.

703,496
PB80-115561 Not available NTIS
National Bureau of Standards, Washington, DC.
Electronic Structure and Radiative Transitions of Excimer Systems.
Final rept.,
M. Krauss, and F. H. Mies. 1979, 42p
Pub. in Topics in Applied Physics, Chapter 2, 30, p5-46 1979.

Keywords: *Atomic energy levels, *Rare gases, Energy transfer, Reprints, *Excimers, Franck-Condon principle.

The electronic structure and radiative transitions of excimer molecules are reviewed. Diatomic systems are briefly analyzed for rare gas-rare gas, rare gas with Group I through VII, and Group II-Group II atomic interactions in terms of the energy curve and transition moment behavior. The gain cross section for these systems is also proportional to a continuum line shape factor which is the Franck-Condon factor for a bound to continuum transition. This line shape factor is analyzed in terms of two limiting cases where the ground state repulsive curve is flat or steep at the transition.

703,497
PB80-115579 Not available NTIS
National Bureau of Standards, Washington, DC.
Dielectric Constant of Water and Steam.
Final rept.,
J. V. Sengers. Sep 79, 2p
Pub. in Mechanical Engineering 101, p44-45 Sep 79.

Keywords: *Water, *Steam, Dielectric properties, Reprints, Temperature dependence, Pressure dependence, High temperature, Medium temperature, High pressure, Very high pressure.

The International Association for the Properties of Steam has adopted a recommended interpolating equation to represent the static dielectric constant of water substance in a substantial range of temperatures (0 degrees C-550 degrees) and pressures (0-500 MPa). A description of this recommended equation is presented.

703,498
PB80-115603 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoabsorption Spectrum of Mg I in the Range 226-170 A (54-70 eV).
Final rept.,
D. L. Ederer, T. B. Lucatorto, and G. Mehlman. Apr 79, 5p
Pub. in Jnl. of the Optical Society of America 69, n4 p520-524 Apr 79.

Keywords: *Magnesium, *Absorption spectra, Excitation, Synchrotron radiation, Reprints, Autoionization, *Photoabsorption.

The photoabsorption spectrum of Mg I has been observed in the spectral region 226-170 A (54-70 eV) using synchrotron radiation as a background source. A critical analysis of the one-electron excitation spectrum was made and classifications for all the multiple electron excitations have been suggested on the basis of their quantum defects to known limits in Mg(II).

703,499
PB80-115645 Not available NTIS
National Bureau of Standards, Washington, DC.
Extension of Absolute-Frequency Measurements to the Visible: Frequencies of Ten Hyperfine Components of Iodine.
Final rept.,
K. M. Baird, K. M. Evenson, G. R. Hanes, D. A. Jennings, and F. R. Petersen. Sep 79, 4p
Pub. in Optics Letters 4, n9 p263-264 Sep 79.

Keywords: *Iodine, *Hyperfine structure, Frequency measurement, Light(Visible radiation), Laser beams, Reprints, Iodine 127, Second harmonic generation, Neon lasers, Lithium niobates.

Direct-frequency measurements have been extended into the visible region of the electromagnetic spectrum. The visible frequencies were synthesized by generating the second harmonic of the recently measured 260-THz20Ne, 1.15 micrometers laser with a LiNbO3 crystal. The absolute frequencies of ten hyperfine components of 127I2 near 520 THz are reported.

703,500
PB80-115652 Not available NTIS
National Bureau of Standards, Washington, DC.
Observation of Pure Rotational Transitions in the HBr(+) Molecular Ion by Laser Magnetic Resonance.
Final rept.,
R. J. Saykally, and K. M. Evenson. 1979, 4p
Pub. in Physical Review Letters 43, n7 p515-518, 13 Aug 79.

Keywords: *Hydrogen bromide, *Molecular rotation, Ions, Hyperfine structure, Infrared spectroscopy, Reprints, *Laser magnetic resonance, *Laser spectroscopy.

A molecular ion (HBr(+)) has been observed for the first time by laser magnetic resonance spectroscopy. Pure rotational transitions have been detected with five different far-infrared laser lines. Assignment of the hyperfine patterns has produced values for the magnetic hyperfine constants.

703,501
PB80-115660 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Magnetic Resonance Measurement of the 2(3)P(2)-2(3)P(1) Splitting in Atomic Oxygen.
Final rept.,
R. J. Saykally, and K. M. Evenson. 1979, 17p
Pub in Jnl. of Chemical Physics 71, n4 p1564-1566, 15 Aug 79.

Keywords: Oxygen, Atoms, Excitation, Methyl alcohol, Atomic energy levels, Reprints, *Laser spectroscopy, *Laser magnetic resonance, *Oxygen atoms.

The J = 2 goes to 1 fine-structure splitting in the ground state of atomic oxygen has been measured by laser magnetic resonance employing an intracavity dc glow discharge to generate the atom. The splitting, observed with the 63.1 micrometers laser line of 13CH3OH pumped by a CO2 laser is 158.30298/cm.

703,502
PB80-115678 Not available NTIS
National Bureau of Standards, Washington, DC.
Energy Level Clusters for nu2 + nu3 Type Combination Bands of Tetrahedral Molecules.
Final rept.,
C. W. Patterson, H. W. Galbraith, B. J. Krohn, and W. G. Harter. 1979, 17p
Pub. in Jnl. of Molecular Spectroscopy 77, n3 p457-473 1979.

Keywords: *Molecular energy levels, Molecular vibration, Reprints.

Clustering of tetrahedral levels is shown to occur in nu c + nu 3 type combination bands of spherical top molecules due to Coriolis and vibrational anharmonic interactions. Cluster correlation diagrams are shown for cases where the vibrational splitting is both large and small compared to the Coriolis splitting, and cluster approximations are given for both cases.

703,503
PB80-115843 Not available NTIS
National Bureau of Standards, Washington, DC.
High Resolution Spectroscopy of Vibrationally Excited 13CH3OH by Frequency Measurement of FIR Laser Emission.
Final rept.,
J. O. Henningsen, J. C. Petersen, F. R. Petersen, D. A. Jennings, and K. M. Evenson. 1979, 12p
Sponsored in part by Danish Natural Science Research Council, Copenhagen.
Pub. in Jnl. Mol. Spectroscopy, v77 p298-309, 1979.

Keywords: *Methyl alcohol, *Molecular vibration, Carbon isotopes, Chemical bonds, Excitation, Reprints, *Laser spectroscopy, *Carbon 13.

High resolution spectroscopic data on vibrationally excited 13CH3OH have been obtained by combining the technique of optically pumped FIR lasers with accurate frequency measurements. The frequencies of 20 torsion-rotation transitions in the C--O stretch fundamental were measured and spectroscopically assigned. From these measurements, 13CH3OH molecular constants were determined.

703,504
PB80-117179 Not available NTIS
National Bureau of Standards, Washington, DC.
1,2,3-Triaminoguanidinium Nitrate by Neutron Diffraction.
Final rept.,
C. S. Choi, and E. Prince. 1979, 3p
Pub. in Acta Crystallographica B35, p761-763 1979.

Keywords: *Crystal structure, *Neutron diffraction, Nitrogen organic compounds, Reprints, *Nitric acid/guanidinium-triamino.

CH9N6(+).NO3(-), orthorhombic, Pbcm, a = 8.389,b = 12.684, c = 6.543 A,Z = 4,D(m) = 1.60, D(c) = 1.594 Mg cu m. The structure is made up of an infinite three-dimensional network of N--H...O hydrogen bonds linking the 1,2,3-triaminoguanidinium ions to the nitrate ions. The librational motions of the nitrate ion have a particularly large amplitude about an axis which is close to the perpendicular to the plane of the ion.

703,505
PB80-117229 Not available NTIS
National Bureau of Standards, Washington, DC.
Shape of Collision Broadened Lines from Resonance to the Far Wings.
Final rept.,
G. Birnbaum. 1979, 11p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 21, p597-607 1979.

Keywords: *Line spectra, *Line width, *Infrared spectroscopy, Carbon dioxide, Absorption, Reprints, *Molecule molecule interactions, Numerical solution.

A line shape for collision-broadened lines applicable from the resonance region to the far wings is developed. An empirical correlation function is used to represent the known short and long time behavior of the true correlation function and to interpolate the unknown intermediate time regime. The effect of overlapping lines, also variations in the model correlation function on the line shape are considered. The theory is applied to the absorption in the high-frequency far wing of the 4.3 micrometer band in CO2.

703,506
PB80-117351 Not available NTIS
National Bureau of Standards, Washington, DC.
Coherence Versus Incoherence: Time-Independent Rates for Resonant Two-Photon Ionization.
Final rept.,
J. H. Eberly, and S. V. O'Neil. Mar 79, 8p
Pub. in Physical Review A: General Physics 19, n3, p1161-1168, Mar 79.

Keywords: *Ionization, Photons, Band spectra, Reprints.

The authors studied three ways in which two-photon ionization, at high light intensities and near an intermediate-state resonance, may be described. They calculated the instantaneous ionization rate, the total ion count, and a saturable rate constant. They found that the total ion cunt, which is the experimentally interesting quantity in most cases, is very closely modelled by the saturable rate constant. The instantaneous ioniza tion rate bears no useful relation to the total ion count in many cases. In comparing these three descriptions of ionization, the authors have included the effects of detuning from resonance, finite light bandwidth, finite intermediate-state lifetime, and light intensity. They have varied all of these parameters independently over several orders of magnitude. The conclusions are in good agreement with, and extend the findings of, Ackerhalt and Shore.

703,507
PB80-117369 Not available NTIS
National Bureau of Standards, Washington, DC.
Extended Two-Level Theory of the Exponential Index of Multiphoton Processes.
Final rept.,
J. H. Eberly. 16 Apr 79, 4p
Pub. in Physical Review Letters 42, n16, p1049-1052, 16 Apr 79.

Keywords: *Ionization, Atoms, Photons, Reprints.

A non-perturbative expression is given for the r-photon-resonant, (r+p)-photon ionization rate of an atom. From this expression the exponential index K is derived. A comparison with experimental data of Morellec et al. appears satisfactory.

703,508
PB80-117427 Not available NTIS
National Bureau of Standards, Washington, DC.
Standard Reference Materials for Thermophysical Properties.
Final rept.,
R. K. Kirby. 1977, 17p
Pub. in Proceedings of the Symposium on Thermophysical Properties Held at Gaithersburg, MD. on May 10-12, 1977, p949-965 1977.

Keywords: Thermophysical properties, Standards, Temperature, Measurement, Materials, *Standard reference materials, Temperature scales.

The National Bureau of Standards has prepared over 70 certified reference materials for use in the area of thermophysical properties of solids including those that define fixed and secondary-reference points of the International Practical Temperature Scale of 1968. These reference materials are described in detail. The procedures that the Office of Standard Reference Materials follows in certifying these materials are also described. Standard Reference Materials (SRM's) can be used to develop test methods and to calibrate measurement equipment thereby insuring the compatibility of measurements among laboratories and assuring the long-term integrity of quality control in manufacturing processes. Used in these ways SRM's form an important part of the national measurement system.

703,509
PB80-117823 Not available NTIS
National Bureau of Standards, Washington, DC.
Observation of One-Dimensional Reorientation and Tunnel Splitting of the Ground and First Excited State in a Low Barrier System: Solid Nitromethane.
Final rept.,
S. F. Trevino. 15 Aug 79, 2p
Pub. in Jnl. Chem. Phys., v71 n4 p1973-1974, 15 Aug 79.

Keywords: *Molecular structure, Dynamic properties, Excitation, Molecular energy levels, Molecular rotation, Reprints, *Methane/nitro.

In this Communication the author reported the complete characterization of the structural and dynamical properties of a simple one dimensional rotor with the lowest known barrier to rotation in the solid state.

703,510
PB80-117831 Not available NTIS
National Bureau of Standards, Washington, DC.
Phase Transition Behavior of the Isolated Polymer Chain.
Final rept.,
I. C. Sanchez. Oct 79, 9p
Pub. in Macromolecules, v12 p980-988, Sep/Oct 79.

Keywords: *Phase transformations, *Polymers, Binary systems, Temperature, Reprints, *Polymer chains, *Viral coefficients, *Mean field theory.

A mean field theory of chain dimensions is formulated which is very similar to the van der Waals theory of a simple fluid. In the limit of infinite chain length, the chain undergoes a Landau-type second-order phase transition. For finite chains, the transition is pseudo-second-order. At high temperatures, only binary interactions are important, but at low temperatures, many of the higher order terms contribute.

703,511
PB80-117849 Not available NTIS
National Bureau of Standards, Washington, DC.
Present and Future Sources of Fluid Property Data.
Final rept.,
N. A. Olien. 1979, 7p
Pub. in Proc. American Society of Mechanical Engineers Winter Annual Meeting, New York, NY. Dec 2-7, 1979, Paper No. 79-WA/HT-19, 7p.

Keywords: *Liquids, *Thermodynamic properties, *Chemical engineering, Fluid mechanics, Data acquisition, Data processing.

Fluid Property calculations for the design and operation of large process systems require that the data used by the engineer be in a computer compatible form. This in turn places complex demands on those of us in the data generation and correlation field. The responsibility of the producers of data, i.e., experimentalists, theorists or correlators, to the ultimate users of the data such as design engineers is discussed, because the efficient transfer of data from the originator to the ultimate user is absolutely essential. The specific requirements for data in the future will be for 'black box' type computer-compatible routines to calculate broad ranges of thermophysical properties for pure fluids and mixtures. Although calculational packages are very useful tools, reliance on them by the uninformed can lead to costly design errors and there is some evidence that the existence of the packages may tend to reduce future research in fluid properties. Generic solutions to the future data requirements of the chemical process and energy industries will place heavy reliance on theoretical approaches. Illustrations of the future data requirements of specific industries are given as examples.

703,512
PB80-118052 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectrum and Energy Levels of Ten-Times Ionized Yttrium (Y XI).
Final rept.,
J. Reader, and N. Acquista. Sep 79, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in J. Opt. Soc. Am. 69, n9 p1285-1288 Sep 79.

Keywords: *Atomic energy levels, Yttrium, Ions, Ionization potentials, Ultraviolet spectroscopy, Hartree-Fock approximation, Reprints, *Yttrium ions, *Laser spectroscopy.

The spectrum of Y XI was observed with a low-inductance vacuum spark and a laser-produced plasma in the region from 70 to 630 A on the 10.7-m grazing incidence spectrograph at NBS. From the identification of 40 lines, a system of 29 energy levels was determined. The observed energy levels are compared with Hartree-Fock calculations.

703,513
PB80-118078 Not available NTIS
National Bureau of Standards, Washington, DC.
High Resolution Infrared Spectrum of the nu1 Band of HOCl.
Final rept.,
J. S. Wells, R. L. Sams, and W. J. Lafferty. 1979, 16p
Pub. in J. Mol. Spectrosc. 77, p349-364 1979.

Keywords: *Infrared spectroscopy, *Band spectra, Molecular rotation, Dipole moments, Reprints, *Hypochlorous acid, Chlorine 35, Chlorine 37.

The nu(1) of HO35Cl and HO37Cl have been recorded. Both the A- and B-type rotational transitions of these hybrid bands have been completely assigned, and spectroscopic constants have been obtained for both the ground and upper state.

703,514
PB80-118094 Not available NTIS
National Bureau of Standards, Washington, DC.
Excitation of the C(3)pi(u) State of N2 by Low Energy Electrons.
Final rept.,
K. Tachibana, and A. V. Phelps. 15 Oct 79, 3p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA, and Office of Naval Research, Arlington, VA.
Pub. in Jnl. Chem. Phys. 71, n8 p3544-3546, 15 Oct 79.

Keywords: *Nitrogen, *Excitation, Cross sections, Mathematical models, Gas discharges, Ionosphere, Molecular energy levels, Reprints, *Electron molecule interactions, Electron cross sections, Atmospheric chemistry.

Electron excitation rate coefficients for N2 are important to the development of models of N2 lasers, gas discharges and ionospheric phenomena and in determining electron collision cross sections. Although cross sections for the excitation of the N2(C(3)Pi(u)) state have been measured by a number of authors, there are only a few measurements of excitation rate coefficients. This Note presents measurements of this excitation rate coefficient. It also recommends a set of electron-N2 collision cross sections.

703,515
PB80-118102 Not available NTIS
National Bureau of Standards, Washington, DC.
Two-Photon Ionisation of Caesium.
Final rept.,
C. E. Theodosiou, and L. Armstrong. 1979, 5p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. of Phys. B Lett. to Ed. 12, n3 L87-L91 1979.

Keywords: *Cesium, *Gas ionization, Perturbation theory, Reprints.

The authors studied the time dependence of the two-photon ionization rate for atomic cesium calculated using a sudden approximation. They showed that for pulse lengths similar to the ones used in the measurements by Granneman and Van der Wiel second-order perturbation theory gives results different from those obtained with their model. Finally they used molecular data to resolve the discrepancy still outstanding between theory and experiment.

703,516
PB80-118128 Not available NTIS
National Bureau of Standards, Washington, DC.
5(Pi sub u) - 5(Sigma sub g, sup (+)) Transition in N2.
Final rept.,
M. Krauss, and D. B. Neumann. 1979, 11p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Mol. Phys. 37, n6 p1661-1671 1979.

Keywords: *Nitrogen, *Molecular energy levels, Excitation, Wave functions, Molecular orbitals, Reprints.

Accurate electronic energy curves and wave functions of the 1(5 Pi sub u) and 1(5 sigma sub g(+) states of N2 have been calculated using the multi-configuration self-consistent-field (MC-SCF) method.

703,517
PB80-118193 PC **A08**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Normal Butane: Provisional Thermodynamic Functions from 135 to 700 K at Pressures to 700 Bar,
R. D. Goodwin. Sep 79, 172p NBSIR-79-1621
Sponsored in part by Gas Research Inst., Chicago, IL.

Keywords: *Butanes, *Thermophysical properties, Pressure, Tables(Data), Equations of state, Boiling points, Temperature, Isobars(Pressure), Thermodynamics, Numerical solution.

Thermophysical properties of n-butane are tabulated at integral temperatures along isobars over the entire range of fluid states. Results for the compressed liquid, from the triple- to the boiling-point, have been estimated by use of the highly-constrained, nonanalytic equation of state, because experimental P-rho-T data are lacking in this region. Only available, published physical properties data are used in this work.

703,518
PB80-118284 Not available NTIS
National Bureau of Standards, Washington, DC.
High Resolution Two-Photon Spectroscopy of Rb Rydberg Levels,
S. A. Lee, J. Helmcke, and J. L. Hall. Oct 79, 12p
Grants N00014-77-C-0656, NSF-PHY76-04761
Pub. in Laser Spectroscopy, IV, p130-141, Oct 79.

Keywords: *Rubidium, *Molecular energy levels, Excitation, *Laser spectroscopy, Ramsey patterns, Rydberg series.

In this paper the author's report on their investigation of the interesting features, and problems, associated with ultrahigh resolution two-photon spectroscopy, using a frequency controlled dye laser to study the 5 doublet S-n doublet S transitions in rubidium. The optical Ramsey technique of separated interactions is used to reduce transit broadening. Narrow resonances of 17 kHz full width half maximum are observed.

703,519
PB80-118292 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Excitation of Li S and D States.
Final rept.,
A. Zajonc, and A. Gallagher. Oct 79, 5p
Grant NSF-PHY76-04761
Pub. in Physical Review, A. General Physics 20, n4, p1393-1397, Oct 79.

Keywords: *Lithium, *Molecular energy levels, Excitation, Emission spectroscopy, Scattering cross sections, Reprints, *Electron impact spectra, Threshold effects(Electron energy).

Electron-impact excitation of the Li 35, 4S, 3D, and 4D states have been measured from threshold to 1200-eV impact energy. The intensities of emission lines from these states have been measured relative to the 2P-2S resonance line, and cross sections are obtained by normalizing to the resonance-line cross section and correcting for branching ratios. Cascade corrections to these total cross sections have been made at the higher energies, using available Born cross sections. The resulting direct cross sections show a uniform convergence at high energy to available Born cross sections and to 1/E behavior. At lower energies the S- and D-state cross sections have very different forms: the S states rise abruptly at threshold and drop rapidly past a narrow peak, while the D states rise gradually to a very broad maximum. Comparisons are made to available cross section calculations.

703,520
PB80-118300 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamics of Vaporization of Molybdenum Pentafluoride.
Final rept.,
R. F. Krause. 1978, 11p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Proceedings of the Symposium on High Temperature Metal Halide Chemistry, The Electrochemical Society Meeting, Held at Princeton, NJ. on October 9-14, 1977, Proceedings v78-1, p199-209 1978.

Keywords: *Thermodynamics, *Vaporizing, Enthalpy, Entropy, Sampling, Molybdenum halides, *Molybdenum fluorides.

The delta H and delta S at 298.15 K for 2 MoF5(l) = (MoF5)2(g) were evaluated as 66.79 kj/mol and 13.53 J/K(mol), respectively. These values were derived from vapor density data which were obtained by the entrainment method at 343, 363, and383 K.

703,521
PB80-118672 Not available NTIS
National Bureau of Standards, Washington, DC.
Matrix Isolation Study of the Interaction of Excited Argon Atoms with Methyl Cyanide. Vibrational and Electronic Spectra of Ketenimine.
Final rept.,
M. E. Jacox. 1979, 16p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC. Planetary Atmospheres Program.
Pub. in Chemical Physics 43, p157-172 1979.

Keywords: *Infrared spectroscopy, *Ultraviolet spectroscopy, Acetonitrile, Excitation, Absorption, Least

squares method, Reprints, *Matrix isolation techniques, *Ketenimine, Argon atoms, Chemical reaction mechanisms.

When methyl cyanide mixed with an excess of argon is codeposited at 14 K with a beam of argon atoms that has been excited by a low power microwave discharge, infrared and ultraviolet absorptions of several previously unidentified products appear. The most prominent set of absorptions is assigned to ketenimine, previously tentatively identified as the product of the reaction of NH with C2H2 in an argon matrix. Using a molecular geometry resulting from a recent ab initio calculation and a valence force field with four interaction constants, it has been possible to obtain a satisfactory least-squares force constant fit to the infrared data for seven isotopic species of ketenimine. Two electronic band systems are also reported for ketenimine, which is photodissociated by 2537-A radiation. The mechanism by which ketenimine is formed may involve an initial electron transfer from excited argon to methyl cyanide. Spectroscopic data are also considered for the other products, one of them tentatively identified as CH2CN, which differ in their behavior on mercury-arc photolysis of the sample.

703,522
PB80-118680 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Bandwidth Effect on Two-Photon Two-Channel Ionisation in Caesium.
Final rept.,
L. Armstrong, and J. H. Eberly. 1979, 6p
Sponsored in part by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Jnl. of Physics, B. Atomic and Molecular Physics, Lett. to Ed. 12, n10, pL291-L296 1979.

Keywords: *Cesium, *Ionization, Band spectra, Reprints, *Laser spectroscopy.

The authors have considered the influence of finite laser bandwidth on the theory of coupled-channel two-photon ionization of cesium. The results of a detailed model calculation suggest that the existence of laser bandwidth may well explain the discrepancy between theory and experiment. In this short note the authors sketch their approach to the problem, and summarize their findings.

703,523
PB80-119092 Not available NTIS
National Bureau of Standards, Washington, DC.
Gas Phase Laser Induced Fluorescence Spectroscopy of Chlorofluoromethylene.
Final rept.,
S. E. Bialkowski, D. S. King, and J. C. Stephenson. 15 Nov 79, 5p
Pub. in Jnl. of Chemical Physics 71, n10, p4010-4014, 15 Nov 79.

Keywords: *Free radicals, *Infrared spectroscopy, *Photolysis, Vapor phases, Fluorescence, Excitation, Metastable state, Reprints, *Methylene/chloro-fluoro, *Laser induced fluorescence.

The CFCl radical has been produced in the gas phase by both IR multiphoton photolysis of C2F3Cl and He metastable reaction with C2F3Cl. Single vibronic level fluorescence and excitation spectra taken of this species have yielded sufficient information to determine certain vibronic constants.

703,524
PB80-119175 Not available NTIS
National Bureau of Standards, Washington, DC.
Additional cw FIR Laser Lines from Optically Pumped CH2F2.
Final rept.,
A. Scalabrin, and K. M. Evenson. Sep 79, 3p
Pub. in Optics Letter 4, n9, p277-279, Sep 79.

Keywords: *Infrared spectroscopy, *Line spectra, Far infrared radiation, Reprints, *Methane/difluoro, *Laser spectroscopy.

Twenty-five new, cw FIR lines from CH2F2, optically pumped by a CO2 laser, have been found, using a variable-coupling, open-structure resonator. Accurate wavelength measurements have been made on the 47 known CH2F2 lines. The new lines are fairly uniformly distributed over a wide range, from 105 to 1448 micrometers.

703,525
PB80-119183 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Weight and Temperature Dependence of Intrinsic Viscosity of Polymer Solutions.
Final rept.,
C. C. Han. Sep 79, 4p
Pub. in Polymer 20, p1083-1086, Sep 79.

Keywords: *Polymers, *Intrinsic viscosity, Solutions, Molecular weight, Temperature, Gyration, Hydrodynamic configurations, Temperature dependence, Numerical solution.

The molecular weight and temperature dependence of the intrinsic viscosity of polymer solutions have been predicted by combining the calculated radius of gyration, RG, and hydrodynamic radius, RH with either the static empirical approach of Mandelkern-Flory or the dynamic argument of Weill-des Cloizeaux. It is found that experimental results can be successfully represented by the dynamic model for a range of five decades of molecular weight and temperature. The discrepancy between the calculated and experimental data at N approximately equal to (N sub tau) reveals the crudeness of the discontinuity at the temperature cut-off assumed by current temperature blob theory.

703,526
PB80-120892 Not available NTIS
National Bureau of Standards, Washington, DC.
Collision Strengths and Gaunt Factors for Highly Ionized Atoms of the Copper Isoelectronic Sequence.
Final rept.,
S. M. Younger. 1979, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 22, p155-159 1979.

Keywords: *Copper, *Atomic energy levels, *Collision cross sections, Excitation, Scattering cross sections, Reprints, *Electron ion interactions, *Gaunt factor, Born approximation.

Collision strengths have been computed in three approximations for electron-impact excitation of the 4s-4p resonance transition of ions in the copper isoelectronic sequence. Good agreement is observed between distorted wave and Coulomb-Born results at energies from two to twenty times threshold. In this range (g bar) is close to unity and a slowly varying function of energy.

703,527
PB80-120934 Not available NTIS
National Bureau of Standards, Washington, DC.
Assessment of the Effective Gaunt Factor Approximation.
Final rept.,
S. M. Younger, and W. L. Wiese. 1979, 10p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 22, p161-170 1979.

Keywords: *Atomic energy levels, *Collision cross sections, Assessments, Ions, Reprints, *Gaunt factor, *Ion ion interactions.

Based on comparisons with recent theoretical data, it is shown that the effective Gaunt factor for delta n = 0 transitions in alkali-like ions is within 25 percent of unity in most cases and is slowly varying function of energy. A more complex energy dependence is noted for some non-alkali-like spectra, and especially for delta n not equal to 0 excitations. A method for the approximation of important correlation effects in the target is discussed for transitions of the type nS(2) singlet S-nsnp singlet P(0).

703,528
PB80-121288 Not available NTIS
National Bureau of Standards, Washington, DC.
Dielectronic Recombination Rate of Mo(XXXIII).
Final rept.,
L. J. Roszman. Sep 79, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Phys. Rev. A 20, n3 p673-676 Sep 79.

Keywords: *Molybdenum, Reprints, *Recombination rate, Numerical solution.

The total rate of dielectronic recombination of Mo(XXXIII) to form Mo(XXXII) is computed by means of the fundamental atomic physics of the process and atomic data calculated for this problem. Agreement with a simple analytic expression suggested by Burgess for the total rate is good in the temperature range 1.0-6.0 keV, but poor below 1.0 keV. Considerable disagreement exists with the analytic expression when the details of the process are examined.

703,529
PB80-121312 Not available NTIS
National Bureau of Standards, Washington, DC.
Heats of Formation of Transition-Metal Alloys.
Final rept.,
R. E. Watson, and L. H. Bennett. 8 Oct 79, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Phys. Rev. Lett. 43, n15 p1130-1134, 8 Oct 79.

Keywords: *Heat of formation, Transition metals, Alloys, Mathematical models, Energy bands, Reprints, *Transition element alloys.

This Letter proposes a scheme for obtaining the d-electron energy-band parameters to be used in a simple analytic model of the alloy heat of formation (delta H). The scheme employs, as an intermediate step, the equalization of the local chemical potentials of the two sites. Calculations for 3d, 4d, and 5d metal alloys yield (delta H) in accord with experimental trends, but, unlike earlier estimates, with d charge transfer in the direction indicated by experiment.

703,530
PB80-122856 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Bandwidth and Intensity Effects in Multiphoton Ionization of Sodium.
Final rept.,
S. J. Smith, and P. B. Hogan. Oct 79, 8p
Pub. in Proc. Int. Conf. on Laser Spectroscopy (4th), Rottach-Egern, Germany, June 11-15, 1979 p360-367 Oct 79.

Keywords: *Mathematical models, *Bandwidth, *Sodium, Ionization, Stark effect, *Laser spectroscopy, *Laser enhanced ionization.

Recently there has been interest in the development of theoretical methods for incorporating the effects of finite laser bandwidth in the treatment of the ac Stark effect in the two-level atom approximation, and in the extension of this model to approximate descriptions of 'weak probe' double resonance experiments. In this paper, the authors briefly describe some experimental observations which have played a role in motivating recent developments in the mathematical framework for treating finite laser bandwidth effects in phase diffusion models and, more recently, in chaotic field models which include the effects of amplitude fluctuations.

703,531
PB80-122872 Not available NTIS
National Bureau of Standards, Washington, DC.
High Resolution Spectroscopy of Rydberg States.
Final rept.,
G. Leuchs, S. J. Smith, and H. Walther. Oct 79, 9p
Pub. in Proc. Int. Conf. on Laser Spectroscopy (4th), Rottach-Egern, Germany, June 11-15, 1979 p255-263 1979.

Keywords: Sodium, Excitation, Angular distributions, Absorption, Photoelectrons, *Rydberg series, *Laser spectroscopy, *Sodium atoms.

Quantum beat measurements of the fine structure of the sodium 2D states for n = 21 to n = 31 are reported. These high-lying states were populated by a resonant two-step excitation using linearly polarized dye lasers pumped simultaneously by a nitrogen laser. They were detected by applying a voltage pulse across the atom beam immediately after excitation and detecting the emitted field electrons. In this paper it is also shown that in the absence of an electric field, the excitation of 6D to 10D states can be detected by observing the photoelectron due to absorption of a third photon. Angular distributions of photoelectrons I(theta) with respect to the direction of laser polarization, measured in a plane perpendicular to the laser beam axis, were found to contain even powers of (cos (sup 6) theta) depending quite sensitively on the intermediate states in the three-step process. This could provide a basis for detecting microwave resonances between high-lying states.

703,532
PB80-122898 Not available NTIS
National Bureau of Standards, Washington, DC.
Test for Ion Dynamic Dependence of Plasma Red Shifts in Neutral Hydrogen.
Final rept.,
D. E. Kelleher, N. Konjevic, and W. L. Wiese. Sep 79, 2p
Pub. in Phys. Rev. A 20, n3 p1195-1196 Sep 79.

Keywords: *Hydrogen, *Deuterium, *Line spectra, Reprints.

The plasma red shifts of H(alpha) and D(alpha) were measured in an atmospheric-pressure wall-stabilized arc, which was operated in argon with a small admixture of either hydrogen or deuterium. The measurements have yielded, within the experimental uncertainties, the same red shifts for H(alpha) and D(alpha), i.e., zero mass dependence.

703,533
PB80-123201 Not available NTIS
National Bureau of Standards, Washington, DC.
Diagrammatic Many-Body Perturbation Theory Applied to Highly Ionized Atoms of the Copper Isoelectronic Sequence.
Final rept.,
S. M. Younger. Sep 79, 13p
Pub. in Physical Review, A. General Physics 20, n3, p951-963, Sep 79.

Keywords: *Perturbation theory, *Many body problem, Ionization potential, Atomic energy levels, Hartree-Fock approximation, Reprints, *Copper atoms, Isoelectronic sequences, Numerical solution.

Many-body diagrammatic perturbation theory has been applied to the calculation of ionization energies and multiplet strengths for two highly ionized atoms of the copper isoelectronic sequence. A unified Hartree-Fock zeroth-order Hamiltonian the eigenfunctions of which include both open- and closed-shell orbitals has been contructed for systems with a single open shell. Correlated multiplet strengths for the 4s doublet S 4p doublet P resonance transition were computed, including first-order corrections to the Hartree-Fock zeroth-order wave functions for both initial and final states. The results of these calculations are in excellent agreement with those of recent multiconfiguration Hartree-Fock calculations.

703,534
PB80-123219 Not available NTIS
National Bureau of Standards, Washington, DC.
Working Group 4: Structure of Atomic Spectra A. Compilations and Bibliographies on Energy Levels, Wavelengths, and Line Classifications,
W. C. Martin. 1979, 5p
Pub. in Trans. of the International Astronomical Union, vXVIIA, Part I, Reports on Astronomy, Commission 14, Fundamental Spectroscopic Data, p56-60 1979.

Keywords: *Atomic spectra, *Atomic energy levels, Reviews, Bibliographies, Wavelengths, Line spectra.

Recent compilations, bibliographies, reviews, and research papers on atomic energy levels and spectra of astrophysical interest are summarized (93 references).

703,535
PB80-123292 Not available NTIS
National Bureau of Standards, Washington, DC.
Improved Sensitivity for Laser Enhanced Ionization Spectrometry in Flames by Stepwise Excitation.
Final rept.,
G. C. Turk, W. G. Mallard, P. K. Schenck, and K. C. Smyth. Dec 79, 3p
Pub. in Analytical Chemistry 51, n14, p2408-2410, Dec 79.

Keywords: *Ionization, Excitation, Sensitivity, Performance evaluation, Flames, Atomic energy levels, Reprints, *Laser enhanced ionization, Tunable lasers, Dye lasers.

The enhanced rate of thermal ionization of excited state atoms produced by the absorption of laser radiation forms the basis for a recently developed method of analytical flame spectrometry called laser enhanced ionization (LEI). Detection sensitivity for a particular element is strongly dependent on the energy gap between the excited state being populated and the ionization limit of the element, with sensitivity increasing as the gap narrows. This paper describes the use of two tunable dye lasers, pumped by a sngle N2 laser, to populate high lying atomic levels by stepwise excitation using two atomic lines connected by a common intermediate level. Closer proximity of the excited state to the ionization limit is thus achieved and sensitivity is improved accordingly. Sensitivities and detection limits were measured for seven elements using both single and dual laser excitation. Enhancements of sensitivities resulting from the use of the second laser ranging from one to three orders of magnitude were observed.

703,536
PB80-123334 Not available NTIS
National Bureau of Standards, Washington, DC.
Monte Carlo Calculations of Absolute X-Ray Generation from Solid Targets,
D. E. Newbury, and R. L. Myklebust. 1979, 3p
Pub. in Proceedings of the Annual Microbeam Analysis Society/1979 Conference (14th) Held at San Antonio, TX. on August 13-17, 1979, p51-53 1979.

Keywords: *X rays, *Monte Carlo method, *Electron probes, *Microanalysis, Ionization, *Electron microprobe analysis, Numerical solution.

Monte Carlo electron trajectory calculations of the absolute characteristic yield x-ray generated in solid targets bombarded by electrons with energies in the range 5 - 25 keV are reported. Four different cross sections for inner shell ionization have been tested: Bethe (Mott-Massey), Green-Cosslett, Fabre, and Worthington-Tomlin. Comparison of the calculated absolute x-ray yield with recent experimentally determined values reveals differences of a factor of two or more for some of the cross sections. In general, the Bethe (Mott-Massey) gives the closest correspondence to the experiment.

703,537
PB80-123375 Not available NTIS
National Bureau of Standards, Washington, DC.
Reaction of Anthranilic Acid with Cupric Ion-Containing Hydroxyapatite Surface,
D. N. Misra, and R. L. Bowen. 1979, 9p
Grant PHS-DE-05129
Pub. in Surface Contamination, n2, p983-991 1979.

Keywords: *Surfaces, *Chemisorption, Adsorption, Copper, Chemical bonds, Reaction kinetics, Reprints, *Anthranilic acid, *Hydroxyapatite, Copper ions.

Equal amounts of anthranilic acid (o - aminobenzoic acid) are irreversibly adsorbed on hydroxyapatite surface with or without pretreatment of the surface with cupric ions. Cupric ions enhance the strength of the bonding between anthranilic acid and the hydroxyapatite surface by effecting chemisorption of the acid molecules at their sites. This result, in itself, is of considerable interest to the chemistry of adhesion; but it is also shown that the chemisorption process is followed by a desorption of cupric anthranilate molecules and the formation of its crystals as a separate phase. A kinetic analysis of the latter process is of interest, because it is consistent with a model in which the rate is controlled by the concentration of the unreacted cupric ions remaining on the surface of the hydroxyapatite.

703,538
PB80-124548 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 84, Number 4, July-August 1979.
Bi-monthly rept.
1979, 77p
See also Volume 84, Number 3, PB-300 272. Library of Congress catalog card no. 62-37059.

Keywords: *Research, *Periodicals, Enthalpy, Solutions, Potassium bromide, Potassium iodides, Fluid mechanics, Van der Pol differential equation, Mathematical models, Papers, Fourier transformation, Electric fields, Integral calculus, Potassium iodates, Iodic acid/(potassium-salt).

Contents:
- Enthalpies of solution of KBr, KI, KIO3, and KIO4 in H2O;
- A preliminary study of the fluid mechanics of liquid penetrant testing;
- Exact coefficients for the limit cycle in Van der Pol's equation;
- Tensile behavior of some mathematical models of paper networks;
- A class of double integrals involving Gaussian and trigonometric factors.

703,539
PB80-124555
(Order as PB80-124548, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Enthalpies of Solution of KBr, KI, KIO3, and KIO4 in H2O,
M. E. Efimov, G. N. Klevaichuk, V. A. Medvedev, and M. V. Kilday. 7 Mar 79, 14p
Prepared in cooperation with Akademiya Nauk SSSR, Moscow.
Included in Jnl. of Research of the National Bureau of Standards, v84 n4 p273-286, Jul-Aug 79.

Keywords: *Enthalpy, *Potassium bromide, *Potassium iodides, Solutions, Heat measurement, Endothermic reactions, *Potassium iodates, Iodic acid/(Potassium-salt).

Enthalpy of solution measurements of four potassium salts in H2O were made in either an adiabatic or an esoperibol calorimeter or both. The measured and recommended values are given.

703,540
PB80-126444 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Cooling of Atoms.
Final rept.,
D. J. Wineland, and W. M. Itano. Oct 79, 20p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in The Physical Review, A. General Physics 20, n4, p1521-1540, Oct 79.

Keywords: *Atoms, *Cooling, Kinetic energy, Energy dissipation, Light scattering, Raman spectra, Coherent electromagnetic radiation, Reprints, *Photon-atom collisions, Laser applications.

Various aspects of the laser cooling of atoms are investigated theoretically. More generally, the authors investigate a process through which the kinetic energy of a collection of resonant absorbers can be reduced by irradiating these absorbers with near-resonant electromagnetic radiation. The process is described here as anti-Stokes spontaneous Raman scattering. Cooling mechanisms, rates, and limits are discussed for both free and bound atoms.

703,541
PB80-128531 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Table of Recommended Rate Constants for Chemical Reactions Occurring in Combustion.
Final rept. 1950-75,
F. Westley. Nov 79, 169p NBSIR-79-1941
Contract DOE-EA-77-A-01-0610

Keywords: *Combustion, *Reaction kinetics, Free radicals, Chemical reactions, Tables(Data), Oxidation, Decomposition, Oxygen, Hydrogen, Water, Sulfur, Hydrogen peroxide, Nitrogen oxides, Nitrogen, Sulfur oxides.

A table of recommended rate constants for gas phase chemical reactions occurring in combustion is presented. Specifically, it gives in tabular form the values of the parameters for the modified Arrhenius equation k = A(T sup B)exp(-E/RT). The table covers reactions occurring in the combustion, oxidation and decomposition of aliphatic saturated or unsaturated C(1) to C(10) hydrocarbons, alcohols, aldehydes, ketones, thiols, ethers, peroxides, amines, amides and their free radicals, as well as the reactions of O, O2, H, H2, OH, H2O, H2O2, N, N2, NO, N2O, NO2, N2O4, N2O5, S, S2, SH, SO, SO2, SOH, NS, with each other. The table includes 169 first order reactions, 782 second order reactions, and 57 third order reactions. There are 1770 entries covering 1008 distinct chemical reactions. These recommendations have been taken from eleven evaluations and critical reviews published between 1970 and 1976. The papers examined by the evaluators extend from the nineteen fifties up to - and including - 1975.

703,542
PB80-131014 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of the Triple-Point Temperature of Gallium.
Final rept.
B. W. Mangum, and D. D. Thornton. 1979, 15p
Pub. in Metrologia 15, n4, p201-215 1979.

Keywords: *Gallium, Phase transformations, Melting points, Boiling points, Temperature measurement, Errors, Reprints, *Triple point, Pressure dependence.

The triple-point temperature of high-purity gallium has been determined to be 29.77406 degrees C using three standard platinum resistance thermometers calibrated on the IPTS-68 and using samples of gallium from three commercial sources.

703,543
PB80-131048 Not available NTIS
National Bureau of Standards, Washington, DC.
Correlation of the Glass Transition and the Pressure Dependence of Viscosity in Liquids.
Final rept.,
R. G. Munro, S. Block, and G. J. Piermarini. Nov 79, 5p
Pub. in Jnl. of Applied Physics 50, n11, p6779-6783, Nov 79.

Keywords: *Liquids, *Viscosity, Chlorobutanes, Ethanols, Methyl alcohol, Ethyl alcohol, Propanols, Glass, Phase transformations, Reprints, Pressure dependence.

The determination of the glass-transition pressure by the ruby R1 line-broadening method is quantitatively confirmed to within 10% by an independent method. The procedure uses a model which describes the pressure dependence of the viscosity and contains the glass-transition pressure as a parameter. The two methods are compared for three liquids, n-butyl chloride, 4:1 methanol-ethanol, and isopropyl alcohol. Data from earlier works are used for 4:1 methanol-ethanol and isopropyl alcohol. The viscosity of n-butyl chloride at room temperature is measured as a function of pressure to 36 kbars in a diamond-anvil falling-sphere viscometer, and the glass-transition pressure is determined by a separate measurement using the ruby R1 line-broadening method.

703,544
PB80-131097 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiance Temperature (at 653 nm) of Palladium at Its Melting Point.
Final rept.,
A. P. Miiller, and A. Cezairliyan. 1979, 7p
Pub. in High Temperature Science 11, p41-47 1979.

Keywords: *Palladium, *Melting points, Temperature measurement, Radiance, Reprints.

The radiance temperature (at 653 nm) of palladium at its melting point was measured using a subsecond-duration pulse-heating techique. Specimens in the form of strips with initially different surface roughnesses were used. The results do not indicate any dependence of radiance temperature (at the melting point) on initial surface or system operational conditions. The average radiance temperature (at 653 nm) at the melting point for 12 specimens is 1688 K on IPTS-68, with a standard deviation of 0.5 K and a maximum absolute deviation of 0.9 K. The total error in the radiance temperature is estimated to be not more than + or - 5 K.

703,545
PB80-131766 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 84, Number 6, November-December 1979.
Bi-monthly rept.
1979, 89p
See also Volume 84, Number 4, PB-300 272.

Keywords: *Periodicals, Rubidium, Liquid metals, Curve fitting, Polynomials, Graph theory, Scheduling, Dynamics, Vinylidene fluoride polymers.

Contents:
- Molecular dynamics study of liquid rubidium and the Lennard-Jones fluid;
- Room temperature poling of poly(vinylidene fluoride) with deposited metal electrodes;
- Generators for discrete polynomial L1 approximation problems;
- A graph coloring algorithm for large scheduling problems.

703,546
PB80-131774
(Order as PB80-131766, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Molecular Dynamics Study of Liquid Rubidium and the Lennard-Jones Fluid,
R. D. Mountain, and S. W. Haan. 11 Jul 79, 8p
Included in Jnl. of Research of the National Bureau of Standards, v84 n6 p439-446, Nov-Dec 79.

Keywords: *Rubidium, *Liquid metals, Dynamics, Liquids, Molecular theory, Computerized simulation, Monte Carlo method, *Lennard-Jones potential, Price potential, Interatomic forces.

Molecular dynamics calculations were made for three thermodynamic states of a model of liquid rubidium and for two states of the Lennard-Jones fluid in order to investigate the influence of density, temperature and interatomic potential on the spectra of density fluctuations in these fluids. Here the results for the intermediate scattering function, the radial distribution function, the velocity autocorrelation function and the transverse momentum autocorrelation function are presented in tabular form. The procedures employed in this study are discussed and the major features of these functions are described.

703,547
PB80-131782
(Order as PB80-131766, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Room Temperature Poling of Poly(Vinylidene Fluoride) with Deposited Metal Electrodes,
J. M. Kenney, and S. C. Roth. 21 May 79, 7p
Included in Jnl. of Research of the National Bureau of Standards, v84 n6 p447-453, Nov-Dec 79.

Keywords: *Electrochemistry, *Electrodes, *Polarization(Charge separation), Pyroelectricity, Piezoelectricity, Temperature, Electrets, *Vinylidene fluoride polymers.

High values of pyroelectric and piezoelectric activity in fully-electroded films of poly(vinylidene fluoride) were obtained by 'conventional' (non-corona) poling at room temperature with sufficiently high fields. The avoidance of breakdown while obtaining high activity requires an understanding of the time dependence of both breakdown and activity. Time-to-breakdown as a function of field, and room-temperature pyroelectric activity (7-14 days after poling at 23.5C) as a function of poling time and field were obtained for 25-micrometers biaxially stretched films with evaporated aluminum electrodes. The highest activities were obtained by poling at the highest fields and poling to breakdown. These values are comparable with the highest that have been reported for this material using any poling temperature or using corona poling.

703,548
PB80-132764 Not available NTIS
National Bureau of Standards, Washington, DC.
One-Electron Spectrum of Xe VIII.
Final rept.,
J. R. Roberts, E. J. Knystautas, and J. Sugar. Nov 79, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Opt. Soc. Am. Lett. 69, n11, p1620-1622, Nov 79.

Keywords: *Xenon, *Atomic energy levels, *Line spectra, Reprints.

The spectrum of Xe(VIII) has been observed in a theta-pinch discharge. New line identifications were made that determine the energies of the 6s, 7s, 6p, and 5f terms relative to the 5s doublet S ground state and confirm the previously known 5p and 5d terms.

703,549
PB80-134927 Not available NTIS
National Bureau of Standards, Washington, DC.
Atomic Transition Probabilities.
Final rept.,
W. L. Wiese. 1979, 6p
Sponsored in part by International Astronomical Union General Secretary at Observatoire de Geneve (Switzerland).
Pub. in Transactions of the International Astronomical Union, vXVIIA, Part 1, p38-43 1979.

Keywords: *Atomic energy levels, Transition probabilities, Surveys, Reprints, Oscillator strengths.

A survey of the new atomic transition probability literature, covering the period late 1975 to late 1978, is given.

703,550
PB80-135320 MF**$7.00**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Characterization of High Temperature Vapors and Gases. Volume 1,
J. W. Hastie. Sep 79, 800p NBS-SP-561-VOL-1
See also PB-275 008, and Volume 2, PB80-135338.
Proceedings of the Materials Research Symposium (10th) Held at Gaithersburg, Maryland on September 18-22, 1978. Library of Congress catalog card no. 79-600152.
Available from Supt. of Docs. as a two volume set PC$20.00.

Keywords: *High temperature tests, *Vapors, *Gases, *Meetings, Atomic energy levels, Germanium oxides, Effusion, Angular distribution, Knudsen flow, Orifices, Data acquisition, Torsion tests, Mathematical models, Chemical bonds, Potassium, Sulfur, Lasers, Phase transformations, Equations of state, Laboratory equipment, Melts, Vaporization, Praseodymium, Titanium oxides, Knudsen cells, Chemical equilibrium, Thermodynamics, Reaction kinetics, Silicon carbides, Sampling, Heat pipes, Mass spectroscopy, Crystal growth, Coal, Flames, Thermochemistry, Ions, Plasmas(Physics), Temperature measuring instruments, Molecular structure, Infrared spectroscopy, Electron diffraction, Photoelectrons, Molecular orbitals, Mathematical models, State of the art, Heterogeneous reactions, Matrix isolation techniques.

This book is based on the proceedings of the 10th Materials Research Symposium. The aim of the symposium was to assess the state-of-the-art and future directions and characterization methods for high temperature vapors including, where appropriate, gases and, to a lesser extent, plasmas. A total of eighty-six papers (invited and contributed) or chapters representing nine countries are contained in these volumes. The discussion, which followed most of the delivered papers, is also included. Volume 1 includes the following topic areas: Classical vaporization methods; Mass spectrometric techniques--Knudsen effusion; Mass spectrometric techniques--high pressure sampling; Molecular structure determination--matrix isolated species; Molecular structure determination--vapor species.

703,551
PB80-135338 MF**$7.00**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Characterization of High Temperature Vapors and Gases. Volume 2,
J. W. Hastie. Sep 79, 895p NBS-SP-561-VOL-2
Proceedings of the Materials Research Symposium (10th) Held at Gaithersburg, Maryland on September 18-22, 1978. Library of Congress catalog card no. 79-600152. See also PB-275 008, and Volume 1, PB80-135320.
Available from Supt. of Docs. as a two volume set PC$20.00.

Keywords: *High temperature tests, *Vapors, *Gases, *Meetings, Pyrolysis, Optical measurement, Flames, Absorption, Concentration(Composition), Rayleigh scattering, Atom spectroscopy, Methane, Reaction kinetics, Molecular vibration, Molecular rotation, Fluorescence, Lithium, Flames, Galvanometers, Vapor deposition, Probes, Oxidation, Heat transfer, Thermocouples, Silicon chlorides, Raman spectroscopy, Combustion, Exhaust emissions, Plumes, Sampling, Hydrocarbon, Mathematical models, Diboranes, Water vapor, Diffusion, Carbon dioxide, Thermodynamic properties, Transport properties, Halides, Chromates, Catalysis, Potassium, Chemical reaction mechanisms, Laser induced reactions, Homogeneous reactions, Heterogeneous reactions, Matrix isolation techniques.

This book is based on the proceedings of the 10th Materials Research Symposium, held at the National Bureau of Standards, Gaithersburg, Maryland, September 18-22, 1978. The aim of the symposium was to assess the state-of-the-art and future directions and characterization methods for high temperature vapors including, where appropriate, gases and, to a lesser extent, plasmas. The second volume includes the following topic areas: Spectroscopic diagnostic techniques--species concentration; Spectroscopic diagnostic techniques and temperature measurement; Rate processes in gases--homogeneous systems; Rate processes in gases--heterogeneous systems; Thermodynamic data and applications.

703,552
PB80-138688 Not available NTIS
National Bureau of Standards, Washington, DC.
Long-Range Interactions in Low-Lying States of Li2.
Final rept.,
D. D. Konowalow, W. J. Stevens, and M. E. Rosenkrantz. 15 Sep 79, 5p
Pub. in Journal of Chemical Physics Letters 66, n1, p24-28, 15 Sep 78.

Keywords: *Lithium, Diatomic molecules, Ions, Potential energy, Reprints, *Atom ion interactions.

The long-range portions of the potential energy curves for the states of Li2(+) which correspond to the interaction of Li(+)(1s2 singlet S) with either Li(1s2 2s doublet S) or Li(1s2 2p doublet P) are analyzed to deduce their exchange and ion-multipole interaction components.

703,553
PB80-138704 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Freezing Temperatures of the National Bureau of Standards SRM-740 Zinc Standards.
Final rept.,
G. T. Furukawa, and J. L. Riddle. 1979, 3p
Pub. in Proceedings of the Session Comite Consultatif De Thermometrie Meeting (12th), Sevres, France, May 9-10, 1978, Annexe T 23, pT133-T135.

Keywords: *Zinc, *Melting points, Temperature measurement, Accuracy, Metrology, Standard reference materials.

Freezing-point cells prepared with National Bureau of Standards SRM-740 zinc standards of 99.9999 percent nominal purity were intercompared. The results show that the freezing points agree within about 0.1 mK.

703,554
PB80-138712 Not available NTIS
National Bureau of Standards, Washington, DC.
Realization of Triple Point of Argon in a Transportable Sample Cell.
Final rept.,
G. T. Furukawa. 1979, 3p
Pub. in Proceedings of the Session Comite Consultatif De Thermometrie Meeting (12th), Sevres, France, May 9-10, 1978, Annexe T 13, p-T100-T102.

Keywords: *Argon, Melting points, Boiling points, Phase transformations, Cryogenics, Temperature measurement, *Triple point.

An argon sample of stated purity of 99.9999 percent was sealed in a miniature pressure cell and the triple point was investigated by melting-point measurements. The triple point of argon was found to be 83.8003(8) K. The results of the measurements show that the exchange of miniature pressure cells of argon should permit the definition of the argon triple-point temperature to within 0.1 mK or smaller.

703,555
PB80-140916 Not available NTIS
National Bureau of Standards, Washington, DC.
Proposed Role for the Triple-Point Temperature of Gallium in the Definition of the International Practical Temperature Scale.
Final rept.,
B. W. Mangum, and D. D. Thornton. 1979, 3p
Pub. in Proceedings Comite Consultatif de Thermometrie Meeting (12th), Held at Sevres, France on May 9-10, 1978, Annexe T22 pT130-T132 (Bureau International des Poids et Mesures, Pavillon de Breteuil, F-92310, Sevres, France, 1979).

Keywords: *Gallium, Temperature measurement, Transition temperature, Phase transformations, Boiling, Freezing, Melting, Metrology, *Triple point, International Practical Temperature Scale.

The authors found that as a temperature fixed point the triple point of gallium at 29.77406 degrees C is superior in many regards to the triple point of water which presently plays a key role in the IPTS. In this submission, the authors propose that the national standards laboratories undertake appropriate testing of the gallium triple point as a thermometric fixed point and if it is found to be suitable, that the triple point of gallium displace the triple point of water from its role in the IPTS.

703,556
PB80-141666 Not available NTIS
National Bureau of Standards, Washington, DC.
Unreliable Data - Its Impact in Modelling MHD Power-Generating Devices.
Final rept.,
J. R. Rumble, E. C. Beaty, and L. C. Pitchford. 1979, 4p
Prepared in cooperation with Air Force Aero Propulsion Lab., Wright-Patterson AFB, OH.
Pub. in Proceedings International Conf. on CODATA (6th), Held at Santa Aavia, Italy on May 1978, p243-246 (Pergamon Press, New York, 1979).

Keywords: *Magnetohydrodynamics, *Plasmas(Physics), Electrical properties, Electrical resistivity, Electron scattering, Scattering cross sections, Errors.

A promising method of advanced utilization of coal as an energy source is power generation by coal-fired magnetohydrodynamics (MHD). This involves burning pulverized coal, adding an easily ionized metal salt, expanding the ionized gas through a nozzle and passing it through a high magnetic field. Electric current is extracted as the free electrons to migrate to the walls. Resistance in the circuit results from electron collisions with the gas atoms and molecules. The conductivity is the relevant physical characterization of the gas, and the electron scattering cross section is the measure of resistance. The authors have calculated the conductivity of typical MHD gases, using their best estimates of the cross-sections for all species present. The authors then recalculated the conductivity using the high and low estimates reflecting the experimental uncertainties for the cross-sections. The results show that the conductivity and hence, the electric current extractable, varied by as much as a factor of two. The implications of this variance are obvious in (1) the design of large scale MHD plants and (2) the basic physics research that must provide better cross-section data. It is clear that ignoring this possible large error can have potentially major effects in the success of MHD power generation.

703,557
PB80-141674 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared and Ultraviolet Absorption Spectra of PO and HPO Isolated in an Argon Matrix.
Final rept.,
M. Larzilliere, and M. E. Jacox. 1980, 19p
Prepared in cooperation with National Aeronautics and Space Administration, Washington, DC. Planetary Atmospheres Program.
Pub. in Jnl. Mol. Spectrosc., v79 p132-150, 1980.

Keywords: *Phosphorus oxides, Molecular energy levels, Infrared spectra, Ultraviolet spectra, Reprints, Matrix isolation techniques.

Upon vacuum ultraviolet photolysis of Ar:PH3:N2O deposits at 14 K, PO is formed in sufficient concentration for observation of its vibrational fundamental absorption and of bands associated with three of its electronic transitions, and HPO is formed in sufficient concentration for the identification of both of its ground-state stretching fundamental absorptions. The infrared identifications are supported by studies of the products of the codeposition at 14K of an Ar:PH3 sample with an Ar:O2 sample that had been passed through a microwave discharge. Detailed isotropic substitution studies have confirmed the assignment of the PH stretching fundamental of ground-state HPO near 2100/cm, implying a relatively weak and long PH bond. A four-constant valence force potential has been derived for HPO. Tentative infrared identifications of PO stretching absorptions of PO2 and (PO)2 are suggested.

703,558
PB80-141708 Not available NTIS
National Bureau of Standards, Washington, DC.
Alignment of Ions in Penning Collisions.
Final rept.,
D. W. Fahey, L. D. Schearer, and W. F. Parks. Oct 79, 4p
Prepared in cooperation with Office of Naval Research, Washington, DC.
Pub. in Jnl. Phys. Rev. vA20 n4 p1372-1375 Oct 79.

Keywords: Strontium, Ions, Atomic energy levels, Alignment, Reprints, *Strontium ions, *Penning ionization, Atom ion interactions.

The authors have observed the alignment of the 5p doublet P(3/2) state of strontium ions produced in Penning collisions between an unpolarized beam of helium metastable atoms and a strontium vapor target. The alignment is shown by a linear polarization of the optical emission from the excited ion. For a 66-meV beam of helium metastable atoms a 3.5% linear polarization of the emission relative to the beam axis was measured. It is shown how the alignment may be used to determine the probabilities for populating the various final quasimolecular states of the ion-atom pair. The alignment of the Penning ions is an important new parameter in the description of these reactions.

703,559
PB80-142953 Not available NTIS
National Bureau of Standards, Washington, DC.
Site Selection Spectroscopy.
Final rept.,
B. E. Kohler. 1979, 23p
Pub. in Journal of Paper in Chemical and Biochemical Applications of Lasers, p31-53 1979.

Keywords: *Absorption spectra, *Emission spectra, Sites, Line width, Spectral lines, Reprints, *Laser spectroscopy.

Laser based techniques for reducing inhomogeneous broadening in condensed phase optical absorption and emission spectra are reviewed. The various laser site selection techniques are interpreted in terms of a model which adapts the basic theory of mixed crystal spectra to systems with inhomogeneous broadening.

703,560
PB80-144256 Not available NTIS
National Bureau of Standards, Washington, DC.
State-of-the-art Determination of the Second Virial Coefficient of Ethylene for Temperatures from 0 to 175C.
Final rept.,
M. Waxman, and H. A. Davis. 1979, 20p
Pub. in Proc. Symp. Meeting of the American Chemical Society (176th), Miami Beach, FL, Sep 11-14, 1978, ACS Somp. Series 182, Equations of State in Engineering and Research, Paper 16, p285-304 1979.

Keywords: *Ethylene, Coefficients, Gas laws, Gases, Pressure, Temperature, Volume, *Virial coefficients, Virial equation.

Values of the second virial coefficient of ethylene for temperatures between 0 degrees and 175 degrees C have been determined to an estimated accuracy of 0.2 cc/mol or less from low-pressure Burnett PVT measurements. Our values, from -167 to --52 cc/mol, agree within an average of 0.2 cc/mol with those recently obtained by Douslin and Harrison from a distinctly different experiment. This close agreement reflects the current state of the art for the determination of second virial coefficient values. The data and error analysis of the Burnett method are discussed.

703,561
PB80-146566 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 85, Number 1, January-February 1980.
Bi-monthly rept.
1980, 75p
See also Volume 84, Number 6, PB80-131766. Library of Congress catalog card no. 62-37059.

Keywords: *Physical chemistry, Thallium, Atomic mass, Aqueous electrolytes, Enthalpy, Dilution, Iridium isotopes, Gamma flux density, Weight measurement, Atmospheric density.

Contents:
- Absolute isotopic abundance and the atomic weight of a reference sample of thallium;
- Enthalpies of dilution of aqueous electrolytes-sulfuric acid, hydrochloric acid, and lithium chloride;
- Standardization of iridium-192 gamma-ray sources in terms of exposure;
- A practical test of the air density equation in standards laboratories at differing altitude;
- Publications of the National Bureau of Standards.

703,562
PB80-146574
(Order as PB80-146566, PC **A04**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.

Absolute Isotopic Abundance and the Atomic Weight of a Reference Sample of Thallium,
L. P. Dunstan, J. W. Gramlich, I. L. Barnes, and W. C. Purdy. 8 Aug 79, 10p
Prepared in cooperation with McGill Univ., Montreal (Quebec).
Included in Jnl. of Research of the National Bureau of Standards, v85 n1 p1-10, Jan-Feb 80.

Keywords: *Thallium, *Atomic mass, Thallium isotopes, Chromates, Isotope ratio, Chromium thallium oxides, Thallium chromates, Thallium 203, Thallium 205.

The new mass spectrometric determination of the atomic weight of thallium has been completed. A high precision assay technique was developed so that accurately known quantities of the 203Tl and 205Tl separated isotopes could be mixed to produce standards for calibration of the mass spectrometer. This assay technique involved the gravimetric determination of 99.3 percent of the thallium as Tl2CrO4. The soluble thallium was then aliquoted and determined by isotope dilution mass spectrometry. Before making up the final solutions from which the assay and calibration samples would be withdrawn, the separated isotopes were purified by solvent extraction and electrodeposition. A tungsten filament surface ionization techniuque was developed for the determination of precise isotopic abundance measurements for thallium. This technique allowed isotopic analysis of the separated isotopes, calibration standards, and a natural thallium reference standard with precisions of better than 0.1 percent.

703,563
PB80-146582
(Order as PB80-146566, PC **A04**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Enthalpies of Dilution of Aqueous Electrolytes: Sulfuric Acid, Hydrochloric Acid, and Lithium Chloride,
T. C. Wu, and T. F. Young. 8 Aug 79, 9p
Prepared in cooperation with Chicago Univ., IL. George Herbert Jones Lab.
Included in Jnl. of Research of the National Bureau of Standards, v85 n1 p11-17, Jan-Feb 80.

Keywords: *Aqueous electrolytes, *Enthalpy, Sulfuric acid, Hydrochloric acid, Lithium chloride, Dilution, Dissolving, Concentration(Composition).

Calorimetric measurements at 25 degrees C of the enthalpies of dilution of aqueous H2SO4 (0.00090 to 6.4 mol/kg), LiCl(0.026 to 6.7 mol/kg), and HCl(0.018 to 1.6 mol/kg) have been performed using two different isothermal calorimeters. The results of this work and that of three earlier calorimetric investigations and one Raman spectral investigation have been used to calculate values of the relative apparent molal enthalpies, and relative partial molal enthalpies for these electrolytes.

703,564
PB80-147093 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectrum and Energy Levels of Eleven-Times Ionized Zirconium (Zr XII).
Final rept.,
J. Reader, and N. Acquista. Dec 79, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Journal of the Optical Society of America 69, n12, p1659-1662, Dec 79.

Keywords: *Atomic energy levels, *Ultraviolet spectra, Zirconium, Ions, Optical spectrum, X ray spectra, Reprints, *Zirconium ions.

The spectrum of Zr (XII) was observed with a low-inductance spark and a laser-produced plasma in the region from 70 to 630 A on the 10.7-m grazing incidence spectrograph at NBS. From the identification of 36 lines, a system of 28 energy levels was determined.

703,565
PB80-147119 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Temperature Specific Heat of Crystals.
Final rept.,
R. A. MacDonald, R. D. Mountain, and R. C. Shukla. 15 Nov 79, 6p
Sponsored in part by National Research Council of Canada, Ottawa (Ontario).
Pub. in Journal of Physical Review B 20, n10, p4012-4017, 15 Nov 79.

Keywords: *Rubidium, *Specific heat, Monte Carlo method, Perturbation theory, Crystals, Reprints, Temperature dependence, Anharmonic crystals.

The Monte Carlo method is used to estimate the specific heat of a model of rubidium. Both the specific heat at constant volume, and the specific heat at constant pressure, are obtained for a range of temperatures up to the instability point of this lattice. These results for the fully anharmonic perfect crystal are compared with those obtained by perturbation theory to lowest order in the anharmonicity, (i.e., only cubic and quartic anharmonic contributions to the Helmholtz free energy are considered).

703,566
PB80-147127 Not available NTIS
National Bureau of Standards, Washington, DC.
New Line Classifications and Energy Levels in the Triplet System of Xe VII.
Final rept.,
E. J. Knystautas, J. Sugar, and J. R. Roberts. Dec 79, 2p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Journal of the Optical Society of America 69, n12, p1726-1727, Dec 79.

Keywords: Xenon, Ions, Atomic energy levels, Ionization potentials, Ultraviolet spectra, Far ultraviolet radiation, Reprints, *Xenon ions.

A number of VUV lines, produced in a theta-pinch plasma, have been identified in the triplet system of Cd-like Xe(VII). They serve to establish the positions of all the 5s5p triplet P(0), 5p(2) triplet P, 5s6s triplet S, and 5s5d triplet D levels.

703,567
PB80-150477 Not available NTIS
National Bureau of Standards, Washington, DC.
Test of Mean-Field Behavior by Light Scattering in Three Phases of a Fluid Mixture Near Its Tricritical Point.
Final rept.,
M. W. Kim, W. I. Goldburg, P. Esfandiari, and J. M. H. L. Sengers. 15 Dec 79, 11p
Pub. in Journal of Chemical Physics 71, n12, p4888-4898, 15 Dec 79.

Keywords: *Light scattering, *Liquid phases, Critical point, Angular distribution, Luminous intensity, Correlation, Magnetic permeability, Temperature, Reprints, *Mean field theory, Sum rules, Magnetic susceptibility, Temperature dependence.

Measurements are reported of the angular dependence of intensity and spectral width of light scattered quasielastically from three coexistent liquid phases near a tricritical point. From the data, the susceptibilities and correlation lengths in each of the phases were calculated. Two predictions from mean-field theory were tested, namely Griffiths' first sum rule and 'Griffiths' second sum rule. The second sum rule is found to hold within the accuracy of our data. The first sum rule is violated for the correlation lengths. It is found to hold for the susceptibilities, but only after the scattered intensities are properly corrected for differences, between phases, in the derivative of the dielectric constant with respect to order parameter.

703,568
PB80-150519 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamic Behavior of Pairs of Atoms in Simple Liquids.
Final rept.,
S. W. Haan. Dec 79, 5p
Pub. in Journal of Physical Review A 20, n6, p2516-2520, Dec 79.

Keywords: *Liquids, Distance, Atoms, Liquid metals, Rubidium, Molecules, Dynamics, Potential energy, Reprints, *Molecular models, Lennard-Jones potential.

The microscopic dynamic behavior of some simple liquids has been investigated by observing the time evolution of the separation between members of pairs of atoms. The distribution function for this process was calculated in molecular-dynamics studies of several states of two model fluids: Lennard-Jones and simulated rubidium. The overall features of the results are described quite well by a simple model in which the distribution of pair separations satisfies Smoluchowski's equation with a potential of mean force. The model uses a nonlinear time scale determined from the single-particle motion.

703,569
PB80-151509 Not available NTIS
National Bureau of Standards, Washington, DC.
Formation of Polymer Fibrils by Flow-Induced Crystallization.
Final rept.,
J. D. Hoffman. Sep 79, 7p
Pub. in Polymer 20, p1071-1077 Sep 79.

Keywords: *Crystallization, *Polymers, Solutions, Reprints, *Fibrils, *Polymeric chains.

A theory of the formation of the core fibril ('shish') that is produced by flow-induced crystallization in undercooled polymer solutions is given. Multiple nucleation events on a flow-elongated molecule produce an embryonic fibril that is a connected set of bundlelike nuclei. End surface stress resulting from the repulsion of the 'amorphous' chains in the regions between these nuclei builds up cumulatively as the nuclei mature, leading ultimately to volume strain in the body of each crystallite in the core fibril. This causes the diameter and length of the crystallites to be limited in a thermodynamic sense. The dependence of this diameter and length are calculated in terms of the driving force for the crystallization. Annealing and melting effects are discussed.

703,570
PB80-154909 Not available NTIS
National Bureau of Standards, Washington, DC.
Opto-Galvanic Spectroscopy in Uranium Hollow Cathode Discharge.
Final rept.,
R. A. Keller, R. Engleman, and E. F. Zalewski. May 79, 4p
Pub. in J. Opt. Soc. Am. 69, n5 p738-742 May 79.

Keywords: *Uranium, *Cathode sputtering, Electric discharges, Spectroscopy, Sputtering, Electron energy, Isotopes, Concentration(Composition), Electrooptics, Reprints, Isotope ratio, Optogalvanic spectroscopy, Oscillator strengths.

Laser induced impedance changes in a hollow cathode discharge containing sputtered uranium atoms were used for standard spectroscopic measurements, the determination of oscillator strengths, the measurement of the electron temperature of the discharge, isotope ratio analysis, and obtaining information about the sputtering process. Concentrations of uranium atoms as small as 10 to the 8th power/cc could be detected.

703,571
PB80-156870 Not available NTIS
National Bureau of Standards, Washington, DC.
Platinum Thiotungsten Compounds. Crystal and Molecular Struction of Bis(Triethylphosphine) Platinum Tetrathiotungsten.
Final rept.,
A. R. Siedle, C. R. Hubbard, A. D. Mighell, R. M. Doherty, and J. M. Stewart. 1980, 6p
Pub. in Journal of Inorganic Chimica Acta 38, p197-202 1980.

Keywords: *Crystal structure, *Molecular structure, Complex compounds, X ray diffraction, Reprints, *Platinum tungsten sulfide, *Phosphine/triethyl.

Reaction of (Ph3P)2PtCl2 with Ph3P and (Ph3PCH3)2WO2S2 produced (Ph3P)2PtWS4 and (Ph3P)2PtWOS3. ((C2H5)3P)2PtWS4 was similarly synthesized from ((C2H5)3P)2PtCl2 and its structure determined by X-ray diffraction (R = 0.026). The molecule consists of an approximately tetrahedral WS4 unit bridged on one edge by ((C2H5)3P)2Pt.

703,572
PB80-156888 Not available NTIS
National Bureau of Standards, Washington, DC.
Synthesis and Crystal and Molecular Struction of (C7H7)3P 4Cu4W2O2S6, a Dimer of Bis (Tri-p-tolylphosphine) Copper Oxotrithiotungsten.
Final rept.,
R. Doherty, C. R. Hubbard, A. D. Mighell, A. R. Siedle, and J. Stewart. Nov 79, 5p
Pub. in Inorganic, p2991-2995, Nov 79.

Keywords: *Crystal structure, *Molecular structure, X ray diffraction, Complex compounds, Reprints, *Copper tungsten sulfides, *Phosphine/tritolyl.

Reaction of tri-p-tolylphosphine, cuprous chloride, and (Ph3PCH3)2WO2S2 produced ((C7H7)3P)4Cu4W2S8

and ((C7H7)3P)4Cu4W2O2S6. The X-ray structure (R = 0.067) revealed a 12-atom Cu4W2S6 cage which may be viewed as consisting of two approximately tetrahedral WOS3 units bridged on adjacent edges by ((C7H7)3PCu) groups.

703,573
PB80-156896 Not available NTIS
National Bureau of Standards, Washington, DC.
Broadening of the Sodium D Lines by Rare Gases.
Final rept.,
R. H. Chatham, A. Gallagher, and E. L. Lewis. 1980, 5p
Grant NSF-PHY76-04761
Pub. in Journal of Physics B 13, pL7-L11 1980.

Keywords: *Sodium, Spectral lines, Rare gases, Line width, Reprints, *Line broadening, Laser spectroscopy.

Broadening of the sodium resonance lines by noble gases has been measured by observing fluorescence while scanning a laser across the lines. The impact-broadened Lorentzian linewidth is determined from the normalized absorption, detected as fluorescence, in the 5-20 GHz region of the line wings. Comparison with theory indicates reasonable overall agreement, but the increased precision of these measurements indicates many discrepancies of as much as 25%.

703,574
PB80-157464 Not available NTIS
National Bureau of Standards, Washington, DC.
Kinetic Shift in Chlorobenzene Ion Fragmentation and the Heat of Formation of the Phenyl Ion.
Final rept.,
H. M. Rosenstock, R. Stockbauer, and A. C. Parr. 1979, 7p
Pub. in Jnl. Chem. Phys., v71 n9 p3708-3714, 1 Nov 79.

Keywords: *Heat of formation, *Reaction kinetics, Ions, Photoionization, Mathematical models, Fragmentation, Reprints, *Benzene/chloro.

The fragmentation of chlorobenzene ion has been studied by photoelectron-photoion coincidence techniques. By varying the residence time it is possible to obtain breakdown curves as a function of residence time. The parent-daughter transition region shifts to lower energies as the residence time is increased (kinetic shift). The shift is of the order of 0.4 eV in going from 0.7 to 8.9 microsecond. A systematic analysis of the breakdown curves and residence time effects has been carried out using quasiequilibrium theory. The sensitivity of the QET model has been studied, and the limitations to the determination of activated complex parameters is critically discussed. The parameters obtained in this work are rather similar to those of an analogous neutral process, i.e., thermal decomposition of bromobenzene.

703,575
PB80-157472 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Mass Transport Coefficients and Vibrational Relaxation Rates of Species Formed in Laser Photolysis Experiments.
Final rept.,
S. E. Bialkowski, D. S. King, and J. C. Stephenson. 15 Jan 80, 5p
Pub. in Jnl. Chem. Phys., v72 n2 p1156-1160, 15 Jan 80.

Keywords: *Mass transfer, *Molecular relaxation, Lasers, Photolysis, Excitation, Reprints, *Laser induced fluorescence, *Methane/chloro-difluoro, *Ethane/chloro-trifluoro.

A simple analytical solution of the equations which govern the formation, collisional relaxation, and mass transport rates of species produced in radially symmetric laser-induced processes is given. These equations are specifically applied to the CO2 laser-induced dissociations of CF2HCl and C2F3Cl dilute in argon. The concentration of the vibrational ground state of the CF2 radical product was probed as a function of time and pressure both during and after the photolyzing laser pulse by the laser-excited fluorescence technique. From these measurements, the vibrational relaxation rate of X CF2 in argon was determined to be k(VT) = 2.0 x 10 to the -15 power cc/sec sq cm and its diffusion coefficient was found to be D = 90 sq cm Torr/sec in argon.

703,576
PB80-157480 Not available NTIS
National Bureau of Standards, Washington, DC.
Viscosity of a Mixture of Soft Spheres.
Final rept.,
D. J. Evans, and H. J. M. Hanley. Oct 79, 7p
Pub. in Jnl. Phys. Rev. A v20 n4 p1648-1654 Oct 79.

Keywords: *Viscosity, Kinetic theory, Spheres, Particle size, Mass, Force, Mixtures, Computerized simulation, Reprints, Van der Waals forces.

The viscosity of a 50% mixture of soft spheres has been simulated by applying nonequilibrium molecular dynamics to a system of 108 particles. Results for several size and mass differences are given and compared with the predictions of a conformal-solution Van der Waals 1 theory. To construct this theory, it was necessary to derive a mixing rule for the mass. It is pointed out that nonequilibrium molecular dynamics is a powerful technique and appears well suited to this particular application.

703,577
PB80-157506 Not available NTIS
National Bureau of Standards, Washington, DC.
Ionization Potential of Allene.
Final rept.,
R. Stockbauer, K. E. McCulloh, and A. C. Parr. 1979, 3p
Pub. in International Jnl. Mass Spectro. Ion Phys., v31 p187-189, 1979.

Keywords: *Allene, *Ionization potentials, Molecular energy levels, Photoelectrons, Reprints, *Photoelectron spectroscopy.

Nonuniform vibrational spacings in the threshold photoelectron spectra (TPES) and a large population of thermally excited neutral allene molecules suggest that the first one or two peaks in the photoelectron spectra may be due to thermally excited molecules. If so, then the ionization potential taken as the first peak in the TPES is in error. To investigate this possibility, the photoionization spectra was obtained at two different temperatures. The near identity of the two spectra indicate that the first peak in the TPES is indeed the 0-0 transition and after correction for peak shift may be used as the adiabatic ionization potential (9.692 + or - 0.002 eV).

703,578
PB80-157514 Not available NTIS
National Bureau of Standards, Washington, DC.
Threshold Photoelectron Spectra of Atmospheric Molecules. 1: Description of Method and Application to H2, D2, and N2.
Final rept.,
R. Stockbauer. 1 Mar 79, 7p
Pub. in Jnl. Chem. Phys., v70 n05 p2108-2114, 1 Mar 79.

Keywords: *Molecular energy levels, Hydrogen, Deuterium, Nitrogen, Photoelectrons, Molecular vibration, Reprints, *Photoelectron spectroscopy.

Threshold photoelectron spectra (TPES) are presented for H2, D2, and N2 with a resolution of 28 meV full width at half maximum. The results are compared with Franck-Condon transition probabilities, previous TPES and electron attachment threshold photoelectron spectra. Peaks in the TPES not predicted by Franck-Condon calculations are explained by autoionization processes. These processes in N2 make possible the observation of vibrational levels of the ions not visible spectroscopically or in photoelectron spectra.

703,579
PB80-157522 Not available NTIS
National Bureau of Standards, Washington, DC.
Technique for Wideband, Rapid, and Accurate Diode-Laser Heterodyne Spectroscopy: Measurements on 1,1-Difluoroethylene.
Final rept.,
J. P. Sattler, T. L. Worchesky, K. J. Ritter, and W. J. Lafferty. Jan 80, 3p
Pub. in Opt. Lett., v5 n1 p21-23, Jan 80.

Keywords: *Infrared spectroscopy, Performance evaluation, Fluorine organic compounds, Laboratory equipment, Line spectra, Reprints, *Laser spectroscopy, Ethylene/difluoro.

Refinements in the instrumentation of a diode-laser heterodyne spectrometer permit the rapid and routine measurement of infrared absorptions lying within 6.5 GHz of a CO2 laser emission to a precision and accuracy well within 10 MHz. Measurements on 1,1-difluoroethylene, which is used in optically pumped submillimeter-wave lasers, illustrate the technique.

703,580
PB80-157530 Not available NTIS
National Bureau of Standards, Washington, DC.
Cd*2 as a 470-nm Absorber.
Final rept.,
W. J. Stevens. 15 Nov 75, 2p
Pub. in Appl. Phys. Lett., v35 n10 p751-752, 15 Nov 79.

Keywords: *Cadmium, *Absorption, Visible spectroscopy, Excitation, Lasers, Reprints, Dimers, Numerical solution, Ryderg series.

Multiconfiguration self-consistent-field calculations have been carried out on all the valence states, low-lying rydberg states, and charge-transfer states of Cd2. Like the other Group IIb dimers studied thus far, the lowest excimer level was found to be a (3)Pi(g) metastable state that acts as a reservoir for molecular excitation energy. Strong absorptions between this reservoir state and a bound (3)Pi(u) charge-transfer state are predicted in the vicinity of 470 nm. Weaker, but still significant absorptions, are predicted between the laser state ((3)sigma(+)(u)) and a repulsive 3 sigma(+)(g) state at the same wavelength. The predicted absorptions could seriously impair laser applications of Cd*2 and CdHg*.

703,581
PB80-157563 Not available NTIS
National Bureau of Standards, Washington, DC.
Reneutralization in Electron Stimulated Desorption.
Final rept.,
W. L. Clinton. 1978, 4p
Pub. in Surf. Sci., v75 pL796-L799, 1978.

Keywords: *Desorption, Electron scattering, Neutralizing, Reprints.

A comment is made on the non-adiabatic curve crossing interpretation of reneutralization in electron stimulated desorption.

703,582
PB80-157878 Not available NTIS
National Bureau of Standards, Washington, DC.
Resonant Multiphoton Ionisation with Intense Monochromatic Lasers.
Final rept.,
S. Geltman. 1980, 19p
Grant NSF-PHY76-04761
Pub. in Jnl. Phys. B: Atom. Molec. Phys., v13 p115-133, 1980.

Keywords: *Ionization, Laser beams, Hydrogen, Sodium, Cesium, Reprints, Photon-atom collisions.

A theoretical procedure is presented for the evaluation of resonant multiphoton ionization rates for atoms interacting with intense monochromatic lasers. The essence of the procedure is to treat first the strong coupling by solution of the truncated Schrodinger equation to obtain a time-dependent superposition state. This is then used as the lowest order approximation to iterate the full time-dependent Schrodinger equation to obtain the transition amplitude to the continuum. A model-atom study of the time evolution of the ionization probability is carried out and the approach to rate behaviour in the long-time limit is demonstrated. Ionization rates are evaluated for a variety of resonant processes in H, Na, and Cs involving one or two lasers, as a function of intensities and detunings. Comparison with experiment is still in a fragmentary stage, and some large discrepancies are found to exist.

703,583
PB80-157910 Not available NTIS
National Bureau of Standards, Washington, DC.
Electric Discharge Excitation of Thallium in High-Pressure Xenon.
Final rept.,
L. W. Schumann, D. W. Wildman, and A. C. Gallagher. Dec 79, 6p
Grant AFOSR-78-036
Pub. in Jnl. Appl. Phys., v50 n12 p7965-7970, Dec 79.

Keywords: *Thallium, *Electric discharges, Xenon, Gas lasers, Reprints, Pressure dependence, Excimer lasers.

Data obtained in pulsed 1.5-280-MW/l electric discharges in thallium-doped xenon gas at thallium densities of (1.5-26) times 10 to the 15th power/cc and xenon densities of (1-4) times 10 to the 19th power/cc are reported. Stable steady-state discharges were obtained without the use of preionization or sustainers. Steady-state E/N, J/N, and Tl and Xe excited-state populations were determined for the positive column of the discharge. The homogeneity of a 9-cm-long transverse discharge and the effects of this discharge on a laser beam propagating through the thallium-xenon medium were investigated. The implications of these results for a discharge-pumped Tl-Xe excimer laser are discussed.

703,584
PB80-159155 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Shape Resonances on Vibrational Intensity Distributions in Molecular Photoionization.
Final rept.,
R. Stockbauer, B. E. Cole, D. L. Ederer, J. B. West, A. C. Parr, and J. L. Dehmer. 1979, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review Letters 43, n11 p757-761, 10 Sep 79.

Keywords: *Carbon monoxide, *Molecular vibration, Photochemical reaction, Ionization, Molecular spectra, Reprints, *Photoionization, Franck-Condon principle.

Striking non--Franck-Condon vibrational intensity distributions associated with the shape resonance in the 5 sigma photoionization channel of CO is reported. This example confirms the recent theoretical prediction that shape resonances will couple significantly with vibrational motion, leading to different resonance energies and profiles, and non--Franck-Condon intensities in alternative vibrational channels. Analogous effects are expected in connection with the widespread occurrence of shape resonances in both inner shell and outer shell molecular photoionization spectra.

703,585
PB80-162555 Not available NTIS
National Bureau of Standards, Washington, DC.
Softness Expansion of Gaseous Transport Properties. I. Dilute Gases.
Final rept.,
J. C. Rainwater. 15 Dec 79, 12p
Pub. in Journal of Chemical Physics 71, n12, p5171-5182, 15 Dec 79.

Keywords: *Gases, *Transport properties, Chemical equilibrium, Reprints.

Transport properties of dilute gases are studied both analytically and numerically for an inverse power interparticle potential. The mathematical dependence of transport properties on the softness parameter x = 1/n is emphasized, and nonanalytic dependences in x, of the form (x squared) ln x, are found. The derivation uses Gislason's series expansion for the scattering angle, and confirms and extends a previous result of Baroody. Equilibrium properties are also shown to be nonanalytic in x, but there the nonanalytic contributions are normally insignificant. The results cast doubt on the utility of effective hard-sphere diameter methods for transport theory. In addition, new insight is gained into classical scattering by inverse power potentials.

703,586
PB80-162563 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoionization and Threshold Photoelectron-Photoion Coincidence Study of Propyne from Onset to 20 eV.
Final rept.,
A. C. Parr, A. J. Jason, R. Stockbauer, and K. E. McCulloh. 1979, 12p
Pub. in International Journal of Mass Spectrometry and Ion Physics 30, p319-330 1979.

Keywords: *Photoionization, *Allene, Photoelectrons, Ions, Mass spectroscopy, Ionization potentials, Reprints, *Acetylene/methyl, *Threshold effects(Electron energy), Time of flight mass spectroscopy.

Photoionization efficiency curves are obtained for propyne and its fragments C3H3(+), C3H2(+), and C3H(+) from threshold to 20 eV. Threshold photoelectron spectra and breakdown curves are given over the same energy range. The adiabatic ionization potential of the parent molecule, the appearance potentials of the fragments and the derived heats of formation of the ionic species are determined. The breakdown curve is almost identical to that obtained previously for allene when the different heats of formation of the neutral molecules are taken into account. This suggests that the propyne ion isomerizes to the allene ion before fragmentation.

703,587
PB80-162571 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Anions: The Ground and Excited States of LiF.
Final rept.,
W. J. Stevens. 1 Feb 80, 7p
Pub. in Journal of Chemical Physics 72, n3, p1536-1542, 1 Feb 80.

Keywords: *Molecular energy levels, *Anions, *Lithium fluorides, Ground state, Excitation, Polarization(Charge separation), Reprints.

Ab initio single configuration self-consistent-field calculations have been carried out for the electronic states of LiF(-) arising from the Li(doublet S) + F-(singlet S) and Li(doublet P) + F-(singlet S) asymptotes.

703,588
PB80-162605 Not available NTIS
National Bureau of Standards, Washington, DC.
Nonanalytic Equation of State for Pure Fluids Applied to Propane.
Final rept.,
R. D. Goodwin. 1979, 18p
Sponsored in part by American Gas Association, Arlington, VA.
Pub. in Proceedings of the Conference on Equations of State in Engineering and Research, Miami Beach, Florida, September 10, 1978, Paper 19 in Advances in Chemistry Series No. 182, p345-362 1979.

Keywords: *Propane, *Equations of state, Fluid dynamics, Specific heat, Critical point, Least square methods, Isotherms, Density(Mass/volume).

An isochoric equation is designed for computing thermodynamic functions of fluids. It has its origin on the liquid-vapor coexistence boundary, and it yields a maximum in isochoric specific heats at the critical point. Its basic structure is similar to that of the Beattie-Bridgeman equation. With only five least-squares coefficients, it describes a P(rho,T) surface free of irregularities. A modified function in the equation is presented, for the problem of behavior in the limit of low densities, especially as required for integration of the thermodynamic equation of state, to obtain the change of internal energy along isotherms. Recently derived vapor pressures for propane at low temperatures also have been introduced. Constants are reported for all equations, as needed for computations on propane.

703,589
PB80-162613 Not available NTIS
National Bureau of Standards, Washington, DC.
Vibrational Spectroscopy of Adsorbed Species on Nickel by Neutron Inelastic Scattering.
Final rept.,
R. D. Kelley, J. J. Rush, and T. E. Madey. 15 Sep 79, 6p
Sponsored in part by American Gas Association, Arlington, VA.
Pub. in Journal of Chemical Physics Letter 66, n1, p159-164, 15 Sep 79.

Keywords: *Molecular vibration, *Surface chemistry, Adsorption, Inelastic scattering, Nickel, Catalysts, Hydrogen, Carbon monoxide, Reprints, *Raney nickel catalysts.

In a test of the utility of neutron inelastic spectroscopy (NIS) for studying molecular vibration in surface reactions, the authors have examined the adsorption, coadsorption, and reaction of hydrogen and carbon monoxide on Raney nickel catalysts.

703,590
PB80-162621 Not available NTIS
National Bureau of Standards, Washington, DC.
Coupled-Harmonic-Oscillator Model for the Vibrational Modes of an Adsorbed Diatomic Molecule.
Final rept.,
J. W. Gadzuk. 15 May 79, 5p
Pub. in Journal of Physics Review B, 19, n10, p5355-5359, 15 May 79.

Keywords: *Molecular vibration, *Diatomic molecules, *Adsorption, Surfaces, Chemisorption, Chemical bonds, Electron energy, Energy dissipation, Line width, Reprints, Harmonic oscillators.

The normal vibrational modes for a diatomic molecule adsorbed on a surface are obtained in terms of the free-space intramolecular and bound-rigid-molecule surface modes. The consequences on both eigenfrequencies and damping rates of surface-induced coupling of these modes are pointed out. A set of self-consistency conditions relating the line positions and widths are derived. With these relations, it is demonstrated how shifts in intramolecular vibrational energies due to chemisorption bond formation can be extracted from total observed shifts resulting from both bond formation and coupling with the rigid-molecule modes. Electron-energy-loss data due to Anderson for CO adsorbed on Ni are analyzed in the light of the ideas put forth here.

703,591
PB80-162639 Not available NTIS
National Bureau of Standards, Washington, DC.
Relaxation Shifts, Satellites and Sum Rules in Electron Spectroscopies of Adsorbed Atoms.
Final rept.,
J. W. Gadzuk. 1979, 13p
Pub. in Journal of Surface Science 86, p516-528 1979.

Keywords: *Surface chemistry, *Molecular relaxation, *Adsorption, Atoms, Molecules, Metals, Reprints, *Photoelectron spectroscopy, Sum rules.

Further ramifications of a recently proposed model treating the electronic relaxation processes associated with core level photoelectron spectroscopy of atoms or molecules adsorbed on metal surfaces are explored. Extra-atomic relaxation occurs via two mechanisms, displacement and excitation of surface plasmons (image potential screening) and substrate to adparticle electron transfer into unfilled orbitals of the adparticle. Both processes are treated on an equal footing here. Model photoelectron spectra are presented for combinations of parameters likely to be relevant for real adsorbate--substrate systems and the relative importance of the two screening mechanisms is assessed.

703,592
PB80-162647 Not available NTIS
National Bureau of Standards, Washington, DC.
Vibrational Excitation, Hole Delocalization, and Photoelectron Line Shapes of Molecules.
Final rept.,
J. W. Gadzuk. 15 Jul 79, 14p
Pub. in Journal of Physics Review B 20, n2, p515-528, 15 Jul 79.

Keywords: *Molecular vibration, Absorption spectra, X ray analysis, Excitation, Reprints, Franck-Condon principle, Photoelectron spectroscopy.

Certain aspects of hole dynamics in electron spectroscopies of quasilocalized states in the condensed phase define the area of concern in this paper. Of special interest are the possible interference effects between low-energy shakeup satellite (electron-hole pairs, phonons, etc.) production and hole decay processes which determine the observed line shapes. As a specific example, the role and interplay of gas-phase Franck-Condon factors and substrate-induced hole delocalization in determining the photoemission line shape from nonchemisorption bonding-valence orbitals in adsorbed and free-space molecules are considered here. The present theory is discussed in the light of recent theoretical work on phonon broadening and hole decay in core-level x-ray emission, adsorption, and photoelectron spectroscopy.

703,593
PB80-163876 Not available NTIS
National Bureau of Standards, Washington, DC.
Evidence for 'Inclined' CO on Pd(210).
Final rept.,
T. E. Madey, J. T. Yates, A. M. Bradshaw, and F. M. Hoffman. 1979, 11p
Sponsored in part by Office of Naval Research, Washington, DC. See also AD-A068 192.
Pub. in Journal of Surface Science 89, p370-380 1979.

Keywords: *Surface chemistry, *Carbon monoxide, *Palladium, Chemisorption, Chemical bonds, Reprints, *Molecular configuration.

The ESDIAD method (Electron Stimulated Desorption Ion Angular Distributions) has been used to verify an unusual bonding configuration for CO adsorbed on the rather open Pd(210) surface.

703,594
PB80-163983 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoillumination Effect on Silicon Field Ion Microscopy.
Final rept.,
T. Sakurai, R. J. Culbertson, and A. J. Melmed. Apr 79, 3p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Journal of Vacuum Science and Technology 16, n2, p626-628, Apr 79.

Keywords: *Silicon, Light(Visible radiation), Ion microscopes, Illuminating, Silicon oxides, Surfaces, Potential energy, Reprints, *Field ion microscopy, Ion microscopy, Red.

The photoillumination effect which occurs during the field ion microscopy of silicon is investigated in detail using an UHV magnetic-sector atom-probe field ion microscope equipped with a retarding potential energy analyzer. It is shown that the observed enhancement of image intensity and field evaporation rate which occurs upon illumination with red light is due to the presence of an oxide layer. Measurements of energy deficits indicate that (1) the oxide layer causes a large potential drop at the emitter cap and (2) red light illumination drastically reduces or completely eliminates the reduction in potential.

703,595
PB80-163991 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser-Initiated Chemical Chain Reactions.
Final rept.,
D. J. Nesbitt, and S. R. Leone. Feb 80, 11p
Contract DOE-EA-77-A-01-6010, Grant NSF-CHE76-22600
Pub. in Journal of Chemical Physics 72, n3, p1722-1732, Feb 80.

Keywords: *Reaction kinetics, *Chain reactions, Chemical reactions, Chlorides, Hydrogen sulfide, Hydrogen, Combustion, Hydrogen chloride, Reprints, *Laser induced reactions.

A detailed kinetic and experimental analysis is presented for chemical chain reaction processes initiated by well-controlled, low power laser pulses. The pulsed laser initiation technique is applied to three sample chain systems which exhibit distinctly different chain lengths, rates, and termination behaviors. These systems are Cl2/H2S, Cl2/H2, and Cl2/CH3SH. In the case of Cl2/H2S, detailed rate constant data are obtained for the fundamental chain propagation steps, and appropriate chain termination steps are assigned from the observations. The results demonstrate a new, general technique for the quantitative study of chemical chain reactions and related combustion process.

703,596
PB80-165707 Not available NTIS
National Bureau of Standards, Washington, DC.
Thorium Field Ion Microscopy.
Final rept.,
J. J. Carroll, R. Klein, and A. J. Melmed. 1980, 5p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Journal Surf Science Letter 93, pL93-L97 1980.

Keywords: *Thorium, Surfaces, Samples, Adsorption, Feasibility, Reprints, *Field ion microscopy.

A method of preparing and imaging thorium specimens for field ion microscopy is presented. Micrographs indicate that impurity constituents of the 99.9% material are readily imaged. Application of the electrotransport purification technique significantly reduces the concentration of imaged impurity constituents. Field electron emission micrographs obtained from previously field evaporated surfaces at 30K demonstrate feasibility of field emission studies involving surface adsorption and migration.

703,597
PB80-165715 Not available NTIS
National Bureau of Standards, Washington, DC.
Time-Dependent Spectrum of Resonance Fluorescence.
Final rept.,
J. H. Eberly, C. V. Kunasz, and K. Wodkiewicz. 1980, 23p
Grant NSF-PHY76-04761
Pub. in Journal of Physics B: Atomic Molecular Physics 13, p217-239 1980.

Keywords: *Emission spectroscopy, Excitation, Stark effect, Fluorescence, Reprints, *Laser induced fluorescence.

Time-dependent features of the resonance fluorescence spectrum are studied. Attention is focused on the dynamic evolution of the emission spectrum following abrupt excitation of a near-resonant two-level absorber by a strong laser field. The multiphoton character of the absorption-emission process is evident in the AC Stark splitting of the spectrum, which begins approximately half an atomic lifetime after excitation, if the laser field is strong enough.

703,598
PB80-165764 Not available NTIS
National Bureau of Standards, Washington, DC.
Accuracy of Realizing Thermodynamic Temperatures by Gas Thermometry.
Final rept.,
L. A. Guildner. 1980, 7p
Pub. in PTB Mitteilungen. Amts- und Mitteilungsblatt der Physikalisch-Technischen Bundesanstalt 90, n1/80, p41-47 1980.

Keywords: *Temperature measurement, *Gases, Thermodynamics, Performance evaluation, Reprints.

The status of gas thermometry as a means of accurately realizing thermodynamic temperatures is considered in terms of the NBS gas thermometer. Following a discussion of the accuracies attained over the present temperature range, an appraisal of the optimum conditions for operating the gas thermometer up to the gold point and of the resulting uncertainties is given.

703,599
PB80-165798 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of Solid-State 13 C NMR in Structural Studies of Humic Acids and Humin from Holocene Sediments.
Final rept.,
P. G. Hatcher, D. L. VanderHart, and W. L. Earl. 1980, 6p
Pub. in Journal of Organic Geochemistry 2, p87-92 1980.

Keywords: *Nuclear magnetic resonance, *Carbon 13, *Isotopic labeling, Humic acids, Lipids, Reprints, Humin.

(13)C NMR spectra of solid humic substances in Holocene sediments have been obtained using cross polarization with magic-angle sample spinning technique. The results demonstrate that this technique holds great promise for structural characterizations of complex macromolecular substances such as humin and humic acids. Quantifiable distinctions can be made between structural features of aquatic and terrestrial humic substances. The aliphatic carbons of the humic substances are dominant components suggestive of input from lipid-like materials. An interesting resemblance is also noted between terrestrial humic acid and humin spectra.

703,600
PB80-170186 Not available NTIS
National Bureau of Standards, Washington, DC.
Nuclear Magnetic Resonance in LaNi5.
Final rept.,
M. Rubinstein, L. J. Swartzendruber, and L. H. Bennett. Mar 79, 3p
Pub. in Jnl. of Applied Physics 50, n3 p2046-2048 Mar 79.

Keywords: *Nuclear magnetic resonance, Diffusion, Lanthanum compounds, Reprints, *Lanthanum nickel hydrides, *Lanthanum nickel.

Proton and La(139) nuclear magnetic resonance measurements have been performed on LaNi5, LaNi5 hydrides, and LaNi5H(x) with ternary additions. With ternary additions, the activation energy for proton diffusion remained unchanged, but the motionally narrowed linewidth broadened. The quadrupole interaction on the La site has been determined in LaNi5 and LaNi5H(x).

703,601
PB80-170194 Not available NTIS
National Bureau of Standards, Washington, DC.
Near-Wing Asymmetries of the Self-Broadened First Rb and Cs Resonance Lines.
Final rept.,
K. Niemax, M. Movre, and G. Pichler. 1979, 6p
Sponsored in part by Deutsche Forschungsgemeinschaft, Bonn-Bad Godesberg (Germany, F.R.).
Pub. in Jnl. of Physics B 12, n21 p3503-3509 1979.

Keywords: *Rubidium, *Cesium, *Line spectra, Line width, Comparison, Reprints.

The authors have measured small asymmetries in the near wings of the self-broadened first resonance lines of Rb and Cs. The transitions from the impact to the quasi-static profile were observed. A comparison with recent calculations by Movre and Pichler reveals satisfactory agreement.

703,602
PB80-170269 Not available NTIS
National Bureau of Standards, Washington, DC.
Interaction of Nitrous Oxide with Ruthenium (1010).
Final rept.,
R. Klein, and R. Siegel. 1980, 13p
Pub. in Surface Science 92, p337-349 1980.

Keywords: *Ruthenium, *Nitrogen oxide(N2O), *Surface chemistry, Chemisorption, Chemical bonds, Reprints.

The reactions of nitrous oxide with ruthenium as observed on the Ru(1010) surface occur in two modes. Scission of the O-N2 bond with chemisorption of oxygen and release of molecular nitrogen to the gas phase is one, and breaking of both the O-N and N-N bonds in O-N-N with chemisorption of both O and N is the other. Energetic considerations lead to the conclusion that the latter mode is a concerted reaction. Site exclusion by preadsorption of oxygen or carbon monoxide inhibits the reaction, and where sufficient amounts of either of these two adsorbates are present, the activity of the surface can be reduced to zero. N2O can produce ruthenium oxide on the surface at sufficiently high temperatures, pressures, and contact times.

703,603
PB80-171101 Not available NTIS
National Bureau of Standards, Washington, DC.
Hyperfine Splitting of the (13)CH4 Line at 3.39 micrometers Observed by Laser-Saturated Absorption.
Final rept.,
K. Uehara, and J. L. Hall. Jul 79, 2p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Journal of Optical Letter 4, n7, p214-215, Jul 79.

Keywords: *Methane, *Hyperfine structure, Line spectra, Reprints, *Laser spectroscopy.

The hyperfine splitting and the recoil doubling of the F2 component in the P(6) line of the nu(3) band of (13)CH4 was resolved with a narrow linewidth of less than 1 kHz (HWHM). Positions of the hyperfine components were precisely determined and related to the absolute frequency frame.

703,604
PB80-178023 Not available NTIS
National Bureau of Standards, Washington, DC.
Oxide Formation on Ruthenium Observed by TDS and ESCA.
Final rept.,
R. Klein, R. Siegel, and N. E. Erickson. Apr 79, 3p
Pub. in Journal of Vac. Science Technology 16 n2 p489-491 Apr 79.

Keywords: *Oxidation, *Ruthenium, Oxygen, Adsorption, Surface chemistry, Desorption, Reaction kinetics, Sulfur, Chemisorption, Reprints, Temperature dependence, Electron spectroscopy.

Oxygen adsorbed at room temperature on a Ru(101-bar 0) surface shows a single peak in its thermal desorption curve, the peak maximum shifting to lower temperature with higher initial concentration in accord-

ance with second order kinetics. Additional peaks in the thermal desorption spectrum of oxygen from Ru(101-bar 0) were observed after exposure of the ruthenium above 600 K to oxygen. These peaks, desorbing with first order kinetics, are attributed to oxide formation. The change in the size of the peaks with respect to the temperature of the surface during oxygen exposure is correlated with an oxygen sticking coefficient that is constant up to 850 K and decreases thereafter. The ESCA spectrum of a surface with the 'oxide' showed an increase in the height of the 0(1s) peak but no chemical shift. Sulfur adsorbed on Ru(101-bar 0) prevents the adsorption of oxygen.

703,605
PB80-178130 Not available NTIS
National Bureau of Standards, Washington, DC.
K-edge Photoabsorption Cross Section of Lithium Vapour.
Final rept.,
G. Mehlman, D. L. Ederer, E. B. Saloman, and J. W. Cooper. 1978, 4p
Pub. in Jnl. Phys. B: Atom. Molec. Phys., v11 n22 pL689-L692 1978.

Keywords: *Lithium, *X ray absorption, Metal vapors, Absorption cross sections, Absorption spectra, Reprints.

The photoabsorption cross section of lithium vapor has been measured between 200 and 172 A. The average cross section is about 2 Mb in this region. Preliminary estimates of branching ratios for absorption leaving the ion in each of the n = 2 states are obtained from the data. The resonance structure in this region, which is compatible with earlier work, is discussed.

703,606
PB80-178429 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Heating Rate Upon the Coupling of Complex Reactions. I. Independent and Competitive Reactions.
Final rept.,
J. H. Flynn. 1980, 14p
Sponsored in part by Naval Air Systems Command, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of North American Thermal Analysis Society Meeting (7th), St. Louis, MO, September 27, 1977, Thermochim. Acta 37, p225-238 1980.

Keywords: *Chemical reactions, *Heating, *Reaction kinetics, Activation energy, Thermal analysis, Temperature.

Theoretical curves of the rate of conversion vs. temperature at constant heating rate for first-order reactions with activation energies of 80, 160, 240 and 320 kJ/mole are compared over a range of heating rates from 10 to the -9 power to 10 to the 5th power K/s for independent and competitive reactions. Independent reactions with differnet activation energies may be separated from one another by either increasing or decreasing the rate of heating. The spectrum of derivative peaks for two competing reactions at various heating rates has a dispersion effect in the region of change from low to high activation energy reactions. The practical range of heating rates in thermal analytical experiments and the application of these model cases to the understanding of the kinetics of complex systems at high and low temperatures are discussed.

703,607
PB80-180334 Not available NTIS
National Bureau of Standards, Washington, DC.
Experimental Investigation of Plasma-Broadened Hydrogen Balmer Lines at Low Electron Densities.
Final rept.,
H. Ehrich, and D. E. Kelleher. Jan 80, 16p
Pub. in Phys. Rev. A 21, n1 p319-334 Jan 80.

Keywords: *Spectral lines, Electron density(Concentration), Temperature, Line width, Plasmas(Physics), Hydrogen, Reprints, *Balmer lines, Line broadening.

The central regions of the plasma-broadened Balmer lines H(alpha), H(beta), and H(gamma) have been measured in a wall-stabilized arc over an electron density range between approximately 4 x 10 to the 14th power and 2 x 10 to the 16th power/cc. Results are presented.

703,608
PB80-180375 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Photoabsorption Cross Section of Core Excited Electrons in Lithium Vapor.
Final rept.,
G. Mehlman, D. L. Ederer, E. B. Saloman, and J. W. Cooper. 1978, 3p
Pub. in Proc. Int. Conf. on X-Ray and XUV Spectroscopy, Sendai, Japan 1978, Jpn. J. Appl. Phys. 17, Suppl. 17-2, p167-169 1978.

Keywords: *Lithium, Vapor phase, Excitation, Absorption, Cross sections, Reprints.

The photoabsorption cross section of lithium vapor has been measured between 200 and 172 A using a heat pipe absorption cell with aluminum windows. An average cross section of about 2 Mb was observed in this region. Preliminary estimates indicate that 70% of the ions produced are in the 1s2s singlet triplet S states. The resonance structure in this region, which is compatible with earlier work, is discussed.

703,609
PB80-182298 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectrum and Energy Levels of Twelve-Times Ionized Niobium (Nb XIII).
Final rept.,
J. Reader, and N. Acquista. Mar 80, 5p
Sponsored in part by Department of Energy, Washington, DC. Div. of Magnetic Fusion Energy.
Pub. in Jnl. Opt. Soc. Am., v70 n3 p317-321 Mar 80.

Keywords: *Niobium, Ionization potentials, Ions, Spectral lines, Atomic energy levels, Reprints, *Niobium ions.

The spectrum of Nb XIII was observed with a low-inductance spark and a laser-produced plasma in the region from 70-630 A on the 10.7-m grazing incidence spectrograph at NBS. From the identification of 38 lines, a system of 29 energy levels was determined. The level system (Cu I isoelectronic sequence, 3d(10)nl) includes the series ns(n = 4-6), np(n = 4-7), nd(n = 4-6), nf(n = 4-7), and ng(n = 5-8). The observed energy levels are compared with Hartree-Fock calculations. The ionization energy is determined from the nf and ng series.

703,610
PB80-183593 Not available NTIS
National Bureau of Standards, Washington, DC.
Mercury Melting Line up to 1200 MPa.
Final rept.,
G. F. Molinar, V. Bean, J. Houck, and B. Welch. 1980, 9p
Pub. in Metrol., v16 p21-29 1980.

Keywords: *Mercury(Metal), *Melting points, Pressure, Solid phases, Liquid phases, Temperature, Reprints.

The mercury melting line has been determined for pressures up to 1200 MPa. The change of electrical resistance in the mercury sample was used for detecting the equilibrium between the solid and liquid phases. Pressure measurements were made with highly stable manganin gages calibrated against two controlled clearance piston gages. The experimental results are compared with previous melting lines. The experimental data were fitted to a third order polynomial; this equation fits the melting line data much more closely than the Simon type heretofore recommended and can be used up to 1200 MPa to increase the accuracy of a practical pressure scale based on the melting line of mercury.

703,611
PB80-183635 Not available NTIS
National Bureau of Standards, Washington, DC.
First-Row Diatomic Molecules and Local Density Models.
Final rept.,
B. I. Dunlap, J. W. D. Connolly, and J. R. Sabin. 15 Dec 79, 7p
Pub. in Jnl. Chem. Phys., v71 n12 p4993-4999, 15 Dec 79.

Keywords: *Diatomic molecules, *Density(Mass/volume), Mathematical models, Dissociation energy, Hartree-Fock approximation, Hydrogen, Carbon, Boron, Oxygen, Carbon monoxide, Fluorine, Reprints.

The total X(alpha) energy accurate to 0.3 eV is computed for H2, B2, C2, N2, O2, CO, and F2. Relative to experiment, the X(alpha) model (alpha = 0.7) is accurate to within delta R(e) = 0.1 bohr, delta D(e) = 2 eV, and delta omega(e) = 300/cm for these molecules. Except for the lightest first-row diatomic molecules, the X(alpha) and experimental dissociation energies are bracketed by those of the Hartree-Fock model (from below) and the Local Spin Density model (from above).

703,612
PB80-183643 Not available NTIS
National Bureau of Standards, Washington, DC.
Fragmentation of C2F6.
Final rept.,
M. G. Inghram, G. R. Hanson, and R. Stockbauer. 1980, 9p
Pub. in Int. Jnl. Mass Spectrom. Ion Phys., v33 p253-261 1980.

Keywords: *Mass spectroscopy, Photoelectrons, Ionization, Fragmentation, Reprints, *Ethane/hexafluoro, Threshold effects(Electron energy), Photoelectron spectroscopy, Field ionization mass spectroscopy.

The fragmentation of C2F6(+) has been studied by threshold photoelectron-photoion coincidence mass spectrometry and field-ionization mass spectrometry. Four types of data were obtained with the coincidence apparatus: threshold photoelectron spectra, fragmentation breakdown curves, time-dependent breakdown curves and kinetic energy release on fragmentation. The results indicate that the CF3(+) and C2F5(+) fragments are formed independently, probably from separate electronic states which do not internally convert to the ground electronic state. The field-ionization data show that these fragments are formed in less than 5 x 10 to the -13th power s. Quasi-equilibrium calculations could not reproduce the experimental results.

703,613
PB80-183650 Not available NTIS
National Bureau of Standards, Washington, DC.
Recent Progress in Quantification of Surface Analysis Techniques.
Final rept.,
C. J. Powell. 1980, 18p
Pub. in Jnl. Appl. Surf. Sci., v4 p492-509 1980.

Keywords: *Surface chemistry, *Reviews, Mass spectroscopy, Sampling, Laboratory equipment, Reprints, Auger electron spectroscopy, X ray photoelectron spectroscopy, Secondary ion mass spectroscopy, Ion scattering spectrometry.

A short review is presented of recent developments and remaining problems in the quantification of the four techniques in common use for surface analysis (Auger-electron spectroscopy, X-ray photoelectron spectroscopy or ESCA, secondary-ion mass spectroscopy, and ion-scattering spectroscopy). The particular topics discussed include: the homogeneity of the sample; the tradeoffs between spatial resolution, accuracy and precision, sensitivity, and beam damage to the sample; the analytical methods; the measurement of spectral intensities and corrections for interferences; the 'response function' of the particular instrument; and the advantages and disadvantages of instrument computerization.

703,614
PB80-184690 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Calculations of Moments of the Induced Spectra for N2, O2, and CO2.
Final rept.,
W. A. Steele, and G. Birnbaum. 15 Feb 80, 10p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Journal of Chemical Physics 72, n4 p2250-2259, 15 Feb 80.

Keywords: *Nitrogen, *Oxygen, *Carbon dioxide, *Absorption spectra, Dipole moments, Reprints, Virial coefficients.

Two moments of the induced absorption spectra for gaseous N2, O2, and CO2 are calculated and compared with experiment. The theoretical expressions evaluated are those for spectra due to quadrupole-induced dipoles in molecules with anisotropic polarizability. The intermolecular interaction functions used include the effects of nonspherical shape by modelling the potential as a sum of quadrupolar plus atom-atom energies with parameters that are known to give realistic values for a number of other measured properties. Satisfactory agreement between the calculation and experiment was obtained in the binary interaction limit

if hexadecapolar contributions are assumed to be present in the case of O2. These intermolecular potentials are then used together with an approximate theory for the requisite correlation functions in an evaluation of the spectral moments for liquid N2 and O2. It was found that the agreement between experiment and theory for the liquid improved dramatically when three-body contributions to the spectral moments were included in the calculation.

703,615
PB80-184716 Not available NTIS
National Bureau of Standards, Washington, DC.
Interaction of Hydrogen, Carbon Monoxide, and Methanol with Ni(100).
Final rept.,
D. W. Goodman, J. T. Yates, and T. E. Madey. 1980, 8p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Journal of Surface Science 93 pL135-L142 1980.

Keywords: *Surface chemistry, *Nickel, Hydrogen, Carbon monoxide, Methyl alcohol, Adsorption, Reprints.

The interaction of H2, CO, and methanol with a clean Ni(100) surface has been studied using temperature programmed desorption methods. Formation of a new surface entity has been shown to occur upon interacting CO with preadsorbed H(ads). This species, designated as the Sigma-state, is formed in significant quantities and exhibits new bonding states of CO and H2 desorbing in the same temperature region near 200K. Upon adsorption of CH3OH at 77K and subsequent desorption, an adsorbed alcoholic 'COH' species is formed and decomposes at 500K into CO and H2.

703,616
PB80-185036 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 85, Number 2, March-April 1980.
Bi-monthly rept.
1980, 105p
See also Volume 84, Number 6, PB80-131766. Library of Congress catalog card no. 63-37059.

Keywords: *Physical chemistry, Research, Synthesis(Chemistry), Chemical bonds, Anions, Crystal structure, High pressure tests, High temperature tests, Aluminum, Thermal properties, Monte Carlo method, Elastic properties, Mathematical models, Methylene/tris(dicyano), Methyleno/bis(dicyano), Croconic acid, Radial distribution functions, Pseudopotential theory.

Contents:
Pseudo-oxocarbons. Synthesis of 2, 1, 3-bis-, and 1, 2, 3-tris(dicyanomethylene) croconate slats. New bond-delocalized dianions, 'croconate violet' and 'croconate blue';
New-bond-delocalized dianions--The crystal structure of 1, 3-bis(dicyanomethylene) croconate salt. (C11N4O3K2.2H2O);
Radial distribution studies under highly constrained conditions;
High temperature elastic constants and the evaluation of effective pair potentials.

703,617
PB80-185051
(Order as PB80-185036, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC.
New Bond-Delocalized Dianions: The Crystal Structure of 1, 3-Bis(dicyanomethylene) Croconate Salt (C11N4O3K2.2H2O),
V. L. Himes, A. D. Mighell, C. R. Hubbard, and A. J. Fatiadi. 7 Nov 79, 11p
Prepared in cooperation with Catholic Univ. of America, Washington, DC. Dept. of Chemistry.
Included in Jnl. of Research of the National Bureau of Standards, v85, n2 p87-97 Mar-Apr 80.

Keywords: *Crystal structure, *Organic salt, Aromatic compounds, Anions, Chemical bonds, *Croconic acid, *Methylene/bis(dicyano).

C11N4O3K2.2HO crystallizes in the triclinic space group Pl. The structure was solved by direct methods and was refined by full-matrix least-squares procedures to a final R of 0.074 for 1989 observed reflections. The five-membered ring is planar and pentagonal. The two =C(CN)2 groups define separate planes which form angles of 3.36 and 6.30 degrees with the plane of the five-membered ring. The dianions form stacks along the a-axis. In a given stack, there is an alternating sequence of perpendicular distances (3.32, 3.42A) between the planes defined by the ring atoms.

703,618
PB80-185069
(Order as PB80-185036, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC.
Radial Distribution Studies Under Highly Constrained Conditions,
R. G. Munro. 5 Sep 79, 10p
Included in Jnl. of Research of the National Bureau of Standards, v85 n2 p99-108 Mar-Apr 80.

Keywords: High pressure tests, X ray scattering, Fourier transformation, Eigenvectors, Distribution functions, *Radial distribution functions.

The consequences of limited scattering data are considered for the determination of radial distribution functions. Such considerations are important, e.g., when substances are held at extreme pressure in a pressure vessel like the diamond anvil cell. By means of formal relations, alternatives to the direct Fourier inversion of the scattering data are considered, but it is found that they do not usefully circumvent the problems resulting from the truncation of data. Using an ideal set of data, five numerical procedures for inverting the data are compared as a function of the degree of data limitation. An extended-integral method is found to be the most reliable.

703,619
PB80-185077
(Order as PB80-185036, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC.
High Temperature Elastic Constants and the Evaluation of Effective Pair Potentials,
R. D. Mountain, and D. C. Knauss. 17 Oct 79, 4p
Included in Jnl. of Research of the National Bureau of Standards, v85 n2 p109-112 Mar-Apr 80.

Keywords: *Elastic properties, *Aluminum, High temperature tests, Thermal properties, Mathematical models, Monte Carlo Method, *Pseudopotential theory.

It is shown by example that the predicted temperature dependence of the elastic constants is a useful measure of the ability of an effective pair potential to estimate the high temperature thermal properties of a metal. Our example is based on a model pair potential constructed for aluminum. This potential predicts the low temperature elastic constants and phonon dispersion relations with good accuracy (+ or - a few percent). The high temperature elastic constants for this model potential are determined using the Monte Carlo method and are found to be approximately independent of temperature. Since the elastic constants of aluminum are strongly decreasing functions of temperature, this potential is seen to be a poor one for determining the properties of aluminum. We conclude that the temperature dependence of the elastic constants is a useful further test of pair potentials which satisfy the low temperature tests currently employed.

703,620
PB80-188493 Not available NTIS
National Bureau of Standards, Washington, DC.
Interface Phase Transition: Complete to Partial Wetting.
Final rept.,
M. R. Moldover, and J. W. Cahn. 7 Mar 80, 3p
Pub. in Science 207 p1073-1075, 7 Mar 80.

Keywords: *Phase transformations, *Liquid phases, Critical point, Methyl alcohol, Cyclohexane, Blends, Interfaces, Reprints.

When two fluid phases are near a critical point, one of them will be excluded from contact with any third phase that happens to be present by a wetting film of the other critical phase. A simple and quite general strategy that may be used to induce a phase transition from complete wetting of the third phase to incomplete wetting is to add a new component to the fluid phases chosen to drive the two phases away from their critical point. This strategy is illustrated for methanol-cyclohexane mixtures.

703,621
PB80-188808 Not available NTIS
National Bureau of Standards, Washington, DC.
Applications and Needs.
Final rept.,
A. V. Phelps. 1979, 26p
Pub. in Electron-Molecule Scattering (3rd) p81-106 1979.

Keywords: *Electron scattering, Air, Technology, Isotope separation, Lasers, Reviews, Reprints, *Electron molecule interactions, Magnetohydrodynamic generators.

This is a review of the state of knowledge of the electron-molecule scattering with particular attention to the applications of that knowledge to technology. For convenience, the review is divided into three main parts. The first is a discussion of applications and the state of knowledge involving air and its constituent gases. The second part is concerned with the role of electron-molecule scattering in the area of energy generation, e.g., MHD generators and isotope separation. The third part discusses some of the applications and needs in the area of gaseous lasers using electron excitation of molecules.

703,622
PB80-188816 Not available NTIS
National Bureau of Standards, Washington, DC.
Population Trapping during Laser Induced Molecular Excitation and Dissociation.
Final rept.,
J. D. Stettler, C. M. Bowden, N. M. Witriol, and J. H. Eberly. 17 Sep 79, 3p
Pub. in Phys. Lett. 73A, n3 p171-173, 17 Sep 79.

Keywords: *Excitation, Molecules, Molecular vibration, Molecular rotation, Dissociation, Reprints, Laser induced excitation.

A four-level model is solved analytically and used to show that laser induced excitation can result in population trapping in excited states under quasi-steady state conditions, even when chemical reactivity and/or dissociation occurs from higher states.

703,623
PB80-190689 Not available NTIS
National Bureau of Standards, Washington, DC.
Resonance Lineshape and Photoelectron Spectrum in Power Broadened Two-Photon Ionisation.
Final rept.,
L. Armstrong, and S. V. O'Neil. 1980, 17p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in J. Phys. B: Atom Molec. Phys. 13, p1125-1141 1980.

Keywords: *Photoelectric emission, *Line width, Ionization, Photoelectrons, Atomic energy levels, Resonance, Reprints, Laser spectroscopy.

The resonance lineshape in two-photon ionization of atoms when the power broadening due to the bound--bound transition is by far the dominant broadening mechanism is studied. The effect on the lineshape of turn-on of the laser--atom interaction, spontaneous emission and laser linewidth is considered, and it is shown that several different types of lineshapes can result depending on the conditions involved. The photoelectron spectrum is also considered, and it is shown that it is also sensitive to these same parameters.

703,624
PB80-190697 Not available NTIS
National Bureau of Standards, Washington, DC.
Nitrogen-15 NMR Evidence for the Structures of N-9H-Xanthen-9-y1- and N,N'-Di-9H-Xanthen-9-y1-Ureas.
Final rept.,
B. Coxon, A. J. Fatiadi, A. Cohen, H. S. Hertz, and R. Schaffer. 1980, 6p
Sponsored in part by Food and Drug Administration, Washington, DC.
Pub. in Org. Magn. Resonance 13, n3 p187-192 1980.

Keywords: *Molecular structure, Nuclear magnetic resonance, Isotopic labeling, Reprints, Chemical shifts(Nuclear magnetic resonance), Carbon 13, Nitrogen 15, *Urea/N-xanthenyl, *Urea/N-N-dixanthenyl.

A new monoxanthen-9-yl derivative of urea has been synthesized and the structure of this product (N-9H-xanthen-9-ylurea) and that of the previously known N,N'-di-9H-xanthen-9-ylurea have been proved by (15)N NMR and other spectroscopic techniques. A series of (13)C and (15)N labeled urea derivatives has

been prepared and the utility of their (13)C and (15)N chemical shifts and coupling constants in the structural analysis of urea derivatives has been investigated.

703,625
PB80-191133 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Analysis of Liquid Volume and Liquid Mass Fractions at Coexistence for Pure Fluids,
L. J. Van Poolen. May 80, 64p NBSIR-80-1631

Keywords: *Liquid phases, *Density(Mass/volume), *Vapor phases, Critical point, Ethylene, Mass, Volume, Fluids, Temperature.

An analysis of the behavior of liquid volume and liquid mass fractions at coexistence for pure fluids is made. Scaled equations for the saturation liquid and vapor densities are analyzed and relationships between various exponents and among constant coefficients are presented. Inequalities which exist among the saturation densities and their derivatives are developed. A procedure to correlate saturation data with the critical point is applied to ethylene. An experimental procedure to determine, simultaneously, saturated liquid and vapor densities at a given temperature is presented.

703,626
PB80-191372 Not available NTIS
National Bureau of Standards, Washington, DC.
Hydrogen Molecular Ion in a High Magnetic Field.
Final rept.,
J. M. Peek, and J. Katriel. Feb 80, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Phys. Rev. A21, n2 p413-417 Feb 80.

Keywords: *Molecular energy levels, Magnetic fields, Ions, Hydrogen, Field strength, Dissociation energy, Reprints, *Hydrogen ions, Molecular ions.

The ground and several excited states of the hydrogen molecular ion in a homogeneous magnetic field aligned along the molecular axis are studied. A pair of self-consistent equations is derived in prolate spheroidal coordinates and solved numerically. The results are exact at the limit of vanishing magnetic field and more accurate than previous results up to about 10 to the 9th power G. The equilibrium internuclear separation and binding energy for a number of electronic states are reported as functions of the magnetic field strength. The dissociation energy is deduced from the study of the hydrogen atom in the same coordinate system.

703,627
PB80-191398 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Approximations in Applications of X-alpha Theory.
Final rept.,
B. I. Dunlap, J. W. D. Connolly, and J. R. Sabin. 15 Oct 79, 7p
Pub. in J. Chem. Phys. 71, n8 p3396-3402, 15 Oct 79.

Keywords: *Molecular energy levels, *Charge density, Nickel, Hydrogen, Reprints, LCAO method.

An approximate X alpha functional is proposed from which the charge density fitting equations follow variationally. LCAO X alpha calculations on atomic nickel and diatomic hydrogen show the method independent of the fitting (auxiliary) bases to within 0.02 eV. Variational properties associated with both orbital and auxiliary basis set incompleteness are used to approach within 0.2 eV the X alpha total energy limit for the nitrogen molecule.

703,628
PB80-191414 Not available NTIS
National Bureau of Standards, Washington, DC.
Absorbed Dose Distributions in Small Copper Wire Insulation Due to Multiple-Sided Irradiations by 0.4 MeV Electrons.
Final rept.,
A. Miller, W. L. McLaughlin, W. B. Pedersen, and K. Pejtersen. 1979, 6p
Pub. in Radiat. Phys. Chem. 13, p181-186 1979.

Keywords: *Polymers, *Electrical insulation, *Electron irradiation, Wires, Electron beams, Absorption, Crosslinking, Dosimeters, Polyethylene resins, Dosage, Reprints.

When scanned electron beams are used to crosslink polymeric insulation of wire and cable, an important goal is to achieve optimum uniformity of absorbed dose distributions. Accurate measurements of dose distributions in a plastic dosimeter simulating a typical insulating material (polyethylene) surrounding a copper wire core show that equal irradiations from as few as four sides give approximately isotropy and satisfactorily uniform energy depositions around the wire circumference. Electron beams of 0.4 MeV maximum energy were used to irradiate wires having a copper core of 1.0 mm dia. and insulation thicknesses between 0.4 and 0.8 mm. The plastic dosimeter simulating polyethylene insulations was a thin radiochromic polyvinyl butyral film wrapped several times around the copper wire, such that when unwrapped and analyzed optically on a scanning microspectrophotometer, high-resolution radial and depth-dose profiles could be determined.

703,629
PB80-195878 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoionization Cross Sections Using the Multiconfiguration Hartree-Fock and Its Extensions.
Final rept.,
L. Armstrong, and W. R. Fielder. 1980, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physica Scripta 21, p457-461 1980.

Keywords: *Photoionization, *Chlorine, *Rare gases, Hartree-Fock approximation, Wave equations, Reprints.

The authors discuss the use of the multiconfiguration Hartree-Fock (MCHF) to obtain initial state wave functions for photoionization calculations. An extension of the MCHF, a multiconfiguration V sup (N-1)LS, can be used to obtain final state wave functions such that most intrachannel corrections to these wave functions vanish. Application of these techniques to the rare gases and the Cl are discussed. In the case of Cl, the strong interchannel interactions are included through use of the K-matrix. Excellent agreement between theory and experiment is obtained for the rare gases.

703,630
PB80-197460 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Selected Tables of Atomic Spectra. A: Atomic Energy Levels - Second Edition. B: Multiplet Tables - OV.
C. E. Moore. May 80, 25p NSRDS-NBS-3-SECT-9
See also report dated Jan 79, PB-291 914. Library of Congress catalog card no. 64-60074. Sponsored in part by Naval Research Lab., Washington, DC.

Keywords: *Atomic spectra, *Atomic energy levels, Oxygen, Tables(Data), Spectrochemical analysis, Ions, Multiplet energies.

The present publication is the ninth section of a series being prepared in response to the need for a current revision of two sets of the author's tables containing data on atomic spectra as derived from analysis of optical spectra. As in the previous Sections, Part A contains the atomic energy levels and Part B the multiplet tables. Section 9 includes these data for O V. The form of the presentation is described in detaill in the text to Section I.

703,631
PB80-199847 Not available NTIS
National Bureau of Standards, Washington, DC.
Atomic Many-Body Perturbation Theory Using Radially Restricted Basis Functions.
Final rept.,
S. M. Younger. 1980, 12p
Pub. in Physical Review A 21, n5 p1364-1375 May 80.

Keywords: *Atomic structure, Many body problem, Perturbation theory, Reprints, Hydrogen ions

The construction of a potential barrier around an atom such that a chosen zeroth-order state is left unaffected results in a square-integrable virtual basis set with rapid convergence properties for use in atomic many-body perturbation theory. Encouraging results have been obtained using this technique for calculations of the correlation energies and transition probabilities of small atoms and ions. In the case of H- it is shown that the conventional formulation of many-body perturbation theory involving continuum functions produces classes of energy diagrams which diverge with order, although the total summation remains finite. No such divergence is present in a properly constructed contracted basis set.

703,632
PB80-199854 Not available NTIS
National Bureau of Standards, Washington, DC.
Observation of the OH+ Fragment Threshold Photoelectron Spectra of Water.
Final rept.,
R. Stockbauer. 1980, 3p
Pub. in Jnl. of Chemical Physics 72, n9 p5277-2579, 1 May 80.

Keywords: *Water, *Deuterium compounds, Mass spectroscopy, Photoelectrons, Reprints, *Hydroxyl radical, *Photoelectron spectroscopy.

A step in the threshold photoelectron spectra of H2O and D2O is observed at the onset for the OH(+) and OD(+) fragmentations. The coincident ion mass spectrum shows that the step is associated with the fragmentation process. This is explained in terms of a change in the competition between formation of charged and neutral products brought about by the opening of the fragmentation channel.

703,633
PB80-199938 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
National Measurement Laboratory 1979 - Technical Highlights,
J. D. Hoffman. 1979, 122p NBS-SP-572

Keywords: *Research, Physical properties, X ray analysis, Gamma rays, Ions, Radiochemistry, Thermodynamics, Trace elements, Environmental surveys, Electrochemistry, Fuels, Particle size, *National Measurement Laboratory, Listings, Rydberg series, Laser spectroscopy.

This publication gives selected highlights of research and other technical activities in the National Measurement Laboratory of the National Bureau of Standards during calendar year 1979. Comprehensive overviews provide the introductions to the activities in the five centers and seven programs of the Laboratory. Listings of the Professional staff in each of these units are also provided.

703,634
PB80-200371 Not available NTIS
National Bureau of Standards, Washington, DC.
Theoretical Simulation of the Decay of the 4s4p 1P 1/degree Level in Kr VII Following Beam-Foil Excitation.
Final rept.,
S. M. Younger, W. L. Wiese, and E. J. Knystautas. May 80, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. Phys. Rev. A 21, n5 p1556-1560 May 80.

Keywords: *Atomic energy levels, *Krypton, Excitation, Reprints, Beam foil spectroscopy.

The decay of the 4s4p singlet P sub (1) degree level in Kr VII following beam-foil excitation has been simulated using theoretical initial-state populations and calculated transition probabilities. It was found that the decay curve was substantially influenced by cascading from higher levels and that such cascades dominate the decay in the region beyond three times the lifetime of the 4s4p singlet P sub (1) degree level. The simulation is in good agreement with an experimental decay curve at short decay times, but is unable to reproduce the long-time behavior of the experimental data. However, recent spectroscopic evidence indicates that line blending is responsible for this aspect. Complications due to core-excited states and other complex cascade mechanisms are discussed.

703,635
PB80-200405 Not available NTIS
National Bureau of Standards, Washington, DC.
Photofragmentation Dynamics and Reactive Collisions of Laser-Excited Electronic States.
Final rept.,
S. L. Baughcum, H. Hofmann, S. R. Leone, and D. J. Nesbitt. 1979, 10p
Contract N00014-77-C-0115, Grant NSF-PHY76-04761
Sponsored in part by Grant NSF-CHE76-22600.
Pub. in Jnl. Faraday Discuss. Chem. Soc. 67, n1 p306-315 1979 (Proc. Faraday Symp. 67, Held at Birmingham (England) on Apr 4-11, 1979.

Keywords: *Molecular energy levels, Excitation, Dissociation, Photochemical reactions, Halogens, Molecular vibration, *Laser induced fluorescence.

Tunable laser excitation followed by observation of infrared fluorescence provides a means of readily studying electronically excited photoproducts and their reactions. A number of specific examples involving the production of I* 5 doublet P(1/2) and Br* (4 doublet p(1/2)) upon molecular photodissociation are considered. The quantum yield of I* production from HgI2 is obtained as a function of wavelength. An inconclusive search was made for unobserved states in IBr which lead to I* product atoms and for states of BrCl which lead to Br*. Vibrationally excited HBr product molecules are observed in 10% of the quenching collisions of Br* with H2S.

703,636
PB80-200660 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Ionisation Cross Sections of Excited Atoms and Ions.
Final rept.,
J. A. Kunc. 1980, 16p
Pub. in Jnl. of Physics, B (London). Atomic and Molecular Physics 13, p587-602 1980.

Keywords: *Ionization, *Electron irradiation, *Cross sections, Atomic energy levels, Excitation, Hydrogen, Helium, Lithium, Carbon, Nitrogen, Oxygen, Neon, Reprints, *Atom electron interactions, *Electron ion interactions.

A general approach for calculating cross sections for electron impact ionization of atoms and ions with a single valence electron in either the ground or an excited state is presented. The differential energy exchange cross sections are based on the semiclassical treatments of Burgess and Vriens. The model takes into account direct as well as electron exchange collisions, and also includes interference effects. The motion of an atomic electron in the nl state is represented by the semiclassical energy distribution function. The criterion of validity of the method is given, from this it follows that the theory is applicable to the calculation of the electron impact ionization cross sections for H I, He II, Li III, C IV, N V, O VI, Ne VIII and Ne X. The present results are compared both with experimental data and with other theoretical calculations.

703,637
PB80-201247 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Impact Excitation of the Resonance Transitions of Highly Ionized Atoms of the Be-, Mg-, and Zn-Isoelectronic Sequences.
Final rept.,
S. M. Younger. 1980, 10p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 23, p489-498 1980.

Keywords: Electron irradiation, Atomic energy levels, Beryllium, Magnesium, Zinc, Excitation, Ionization, Collision cross sections, Scattering cross sections, Reprints, *Electron ion interactions, Isoelectronic sequences.

Electron impact excitation collision strengths for the n doublet S singlet S-nsnp singlet P resonance transitions of highly ionized Be, Mg, and Zn-like ions have been computed in the distorted wave approximation, including the effects of exchange and target state correlation. Good agreement is observed between these data and collision strengths computed in the Coulomb-Born and Born approximations at high incident energies. Analytic fits to the distorted wave data are presented.

703,638
PB80-201288 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Single Chain Neutron Scattering in Concentrated Polymer Solutions.
Final rept.,
A. Z. Akcasu, G. C. Summerfield, S. N. Jahshan, C. C. Han, C. Y. Kim, and H. Yu. 1980, 7p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. of Polymer Science, Polymer Physics Edition 18, p863-869 1980.

Keywords: *Neutron scattering, Polyiscoprenes, Small angle scattering, Polyisoprenes.

For some time there have been measurements of single-chain form factors for small-angle neutron scattering (SANS) in bulk polymers and in concentrated solutions. These were done by mixing a fraction of completely deuterated polymer with the normal polymer. Until recently, it was believed that these experiments had to be performed using a small fraction of deuterated polymer to avoid interchain interference effects. However, the work of Williams et al. has shown that these experiments are better if one uses large fractions of marked polymer and determines both the single chain and interference contributions to the SANS cross section. The authors generalize the technique of Williams et al. somewhat and apply it to the measurement of the radius of gyration of polyisoprene in the bulk.

703,639
PB80-203037 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of the Relative Enthalpy of Tungsten Between 273.15 and 1173.15 K; Derived Electronic Heat-Capacity Coefficient.
Final rept.,
D. A. Ditmars. 1979, 10p
Pub. in High Temperatures - High Pressures. International Jnl. of Research 11, p615-624 1979.

Keywords: *Tungsten, *Enthalpy, Specific heat, Samples, Thermodynamics, Heat measurement.

The enthalpy relative to the enthalpy at 273 K of two tungsten samples, one single-crystal (>99.99% pure) and one polycrystalline sintered (>99.9% pure), has been measured between 273 and 1173 K in a precision Bunsen ice calorimeter. The enthalpy values are believed to have an overall inaccuracy = or < 0.3%. The enthalpy of the single-crystal sample is uniformly 0.3% above that of the sintered samples. The heat capacity is found to be in good agreement with literature for tungsten. The value of 1.9 mJ/mol/sq K for the electronic heat-capacity coefficient of tungsten derived from the measured data is about twice as large as currently accepted values for this coefficient derived from heat-capacity data below 20 K.

703,640
PB80-203045 Not available NTIS
National Bureau of Standards, Washington, DC.
Millimeter Wave Spectrum of Glycine.
Final rept.,
R. D. Suenram, and F. J. Lovas. 1978, 11p
Pub. in Jnl. of Molecular Structure 72, p372-382 1978.

Keywords: *Glycine, *Microwave spectra, Millimeter waves, Molecular energy levels, Amino acids, Hydrogen, Chemical bonds, Molecular vibration, Dipole moments, Reprints, Hydroxyl radical.

The millimeter wave spectrum of glycine (NH2CH2COOH), the simplest amino acid, is reported. The observed alpha-type transitions have been fit to a centrifugal distortion model for both the ground and first excited vibrational state. Based on qualitative arguments, a lower limit of about 3 Debye has been determined for the mu(a) component of the molecular electric dipole moment. The spectral data are consistent with the compact conformation as the source of the observed spectrum. This conformer involves a hydrogen bond between the lone pair of electrons of the amino group and the hydrogen atom of the hydroxyl group.

703,641
PB80-203060 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Plasmon Relaxation Energies for CO Adsorbed on Jellium.
Final rept.,
B. J. Dunlap, and J. W. Gadzuk. 1980, 16p
Pub. in Surface Science 94, p89-104 1980.

Keywords: *Carbon monoxide, *Chemisorption, Molecular orbitals, Plasmons, Surfaces, Relaxation(Mechanics), Reprints.

Substrate induced screening or extra-atomic relaxation energies are calculated for molecular orbital (MO) hole states of CO adsorbed on jellium surfaces, within a previously elucidated linear response model.

703,642
PB80-204605 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
Thermochemical Properties of the Uranium-Halogen Containing Compounds.
Interim rept.,
V. B. Parker. Jul 80, 173p NBSIR-80-2029
Sponsored in part by International Atomic Energy Agency, Vienna (Austria).

Keywords: *Halogen inorganic compounds, *Uranium inorganic compounds, *Thermochemical properties, Enthalpy, Gibbs free energy, Entropy, Specific heat, Thermodynamic properties, Tables(Data).

A detailed analysis and evaluation of the thermochemistry of the uranium-halogen containing compounds is presented, with a tabular summary of the thermochemical properties given. The properties given, where data are available, are in the enthalpy of formation, delta Hf, Gibbs energy of formation, delta Gf, entropy, S, Heat capacity C(p), all at temperature 298.15K, and the enthalpy of formation at K 0, delta Hf (0), and the enthalpy difference, H (298)-H (0). The values are consistent with the CODATA Key Values for thermodynamics. The analysis of the uranium-halogen containing compounds includes some vaporpressure equations and C(p) equations. Some thermal functions which are not readily available in the accessible open literature are presented in the Appendix for compounds that required their use. The tabular summary of delta Hf, delta Gf, includes the values for those uranium compounds which were necessary for this evaluation.

703,643
PB80-204753 Not available NTIS
National Bureau of Standards, Washington, DC.
Perturbed Rydberg Series: Relationship Between Quantum-Defect and Configuration-Interaction Theory.
Final rept.,
F. H. Mies. Nov 79, 11p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review, A. General Physics 20, n5 p1773-1783 Nov 79.

Keywords: *Atomic spectroscopy, Ionization, Perturbation theory, Cadmium, Reprints, *Rydberg series.

In this paper theory of a single Rydberg series perturbed by an interloping state is examined. General analytic expressions are presented which apply both to the bound-state regions and to the autoionizing regions above the Rydberg ionization limit. The parameters are expressed in terms of configuration-interaction matrix elements, which can be calculated a priori. There is no restriction to weak-perturbation theory, and the wave function and all its associated properties, such as transition moments, can be extracted. Explicit calculations are presented for the Cd(5s nd)1(D)2 series perturbed by the Cd(5 double p) 1(D)2 valence state, and excellent results are obtained.

703,644
PB80-205065 Not available NTIS
National Bureau of Standards, Washington, DC.
Oscillator Strengths for Thallium Calculated Using a Semiempirical Relativistic One-Electron Central-Field Model Potential.
Final rept.,
J. N. Bardsley, and D. W. Norcross. 1980, 9p
Contract DOE-EA-77-A-01-6010
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 23, p575-583 1980.

Keywords: *Thallium, Electron oscillations, Mathematical models, Excitation, Reprints, *Oscillator strengths.

The results of calculations for oscillator strengths, radiative transition probabilities, and excited state lifetimes are presented and compared with those of other calculations and measurements. The agreement with measured oscillator strengths is generally quite good. The importance of core polarization effects for the diffuse series is demonstrated. The significance of the results for measurements of parity-nonconserving effects due to weak neutral currents is discussed.

703,645
PB80-205081 Not available NTIS
National Bureau of Standards, Washington, DC.

Charge Distribution of 12C.
Final rept.,
L. S. Cardman, J. W. Lightbody, S. Penner, S. P. Fivozinsky, X. K. Maruyama, W. P. Trower, and S. E. Williamson. 7 Apr 89, 4p
Sponsored in part by Department of Energy, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Physics Letters 91B, n2 p203-206, 7 Apr 80.

Keywords: *Carbon 12, Elastic scattering, Electron scattering, Ground state, Reprints.

The authors report the results of a precision absolute elastic electron scattering experiment on carbon from which they determined the shape of the ground-state charge distribution and the rms charge radius to an accuracy significantly better than heretofore achieved.

703,646
PB80-205107 Not available NTIS
National Bureau of Standards, Washington, DC.
Direct Detection of the Product Vibrational-State Distribution in the Associative Detachment Reaction Cl + H yields HCl(nu)+e.
Final rept.,
T. S. Zwier, M. M. Maricq, C. J. S. M. Simpson, V. M. Bierbaum, G. B. Ellison, and S. R. Leone. 21 Apr 80, 4p
Grants NSF-CHE76-22600, NSF-PHY-79-04928
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Physical Review Letters 44, n16 p1050-1053, 21 Apr 80.

Keywords: *Molecular vibration, *Chemiluminescence, Excitation, Hydrogen chloride, Infrared spectroscopy, Reprints, *Ion molecular interactions.

The initial product vibrational-state distribution is obtained for the thermal associative-detachment reaction, Cl(-) + H yields HCl(nu = 0,1,2) + e, produced by infrared chemiluminescence in a flowing afterglow. The ratio of HCl(nu = 2) to HCl(nu = 1) population formed in the reaction is (N sub nu) = 2/(N sub nu) = 1 = 0.60 + or - 0.03. Comparison of the total emission intensity to that from a reaction of similar exothermicity suggests that HCl(nu = 0) formation may be small.

703,647
PB80-205115 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectroscopy and Photophysics of CF2A 1B1-X 1A1 System.
Final rept.,
D. S. King, P. K. Schenck, and J. C. Stephenson. 1979, 15p
Contract DOE-EA-72-A-01-6010
Pub. in Jnl. of Molecular Spectroscopy 78, p1-15 1979.

Keywords: *Ultraviolet spectroscopy, Excitation, Fluorescence, Reprints, *Carbene/difluoro, *Laser induced fluorescence.

Laser excited single vibronic level (SVL) fluorescence and SVL fluorescence excitation spectra of the low pressure vapor phase CF(2) A-X transition are reported.

703,648
PB80-205123 Not available NTIS
National Bureau of Standards, Washington, DC.
Vibrational Product State Distributions of Ion-Molecule Reactions by Infrared Chemiluminescence: Cl(-)+HBr,HI yields HCl(nu)+Br(-),1(-).
Final rept.,
T. S. Zwier, V. M. Bierbaum, G. B. Ellison, and S. R. Leone. 15 May 80, 11p
Grants NSF-CHE76-22600, NSF-PHY79-04928
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 72, n10 p5426-5436, 15 May 80,

Keywords: *Molecular vibration, *Chemiluminescence, Infrared spectroscopy, Excitation, Hydrogen bromide, Hydrogen chloride, Reprints, *Ion molecule interactions.

The initial vibrational product state distribution is obtained for the thermal associative detachment reaction, Cl(-) + H yields HCl(v=0,1,2) + e, using infrared chemiluminescence in a flowing afterglow. The ratio of HCl(v=2) to HCl(v=1) population formed in the reaction is N(v=2)/N(v=1) = 0.60 + or - 0.03. Comparison of the total emission intensity to that from a reaction of similar exothermicity suggests that HCl(v=0) formation may be small.

703,649
PB80-205149 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Resolution Infrared Spectrum of the 859- and 1711-cm-1 Bands of Carbony1 Sulfide (OCS).
Final rept.,
A. G. Maki, W. B. Olson, and R. L. Sams. 1980, 17p
Contract NASA-L-81242A
Pub. in Jnl. of Molecular Spectroscopy 81, p122-138 1980.

Keywords: *Infrared spectroscopy, Carbonyl compounds, Absorption, Reprints, *Carbonyl sulfide, Laser spectroscopy.

The nu(1) and 2 nu(1) bands of OCS have been measured using grating spectrometers and a tunable diode laser spectrometer. Preliminary wavenumbers for OCS absorption lines useful for calibrating tunable laser systems are given for the wavenumber intervals 825 to 885/cm and 1665 to 1737/cm. Effective band constants are given for these bands.

703,650
PB80-205891 Not available NTIS
National Bureau of Standards, Washington, DC.
Reaction of F Atoms with CO in an Argon Matrix. Vibrational and Electronic Spectra of FCO.
Final rept.,
M. E. Jacox. 1980, 15p
Pub. in Jnl. of Molecular Spectroscopy 80, p257-271 1980.

Keywords: *Infrared spectroscopy, *Molecular vibration, Isotopic labeling, Argon, Dissociation, Photochemical reactions, Ultraviolet spectroscopy, Reprints, *Carbonyl fluorides, *Matrix isolation techniques.

Upon codeposition at 14K of an AR:CO sample with an Ar:NF3 sample that had been passed through a low-power microwave discharge in an Al2O2 tube, very prominent infrared absorptions of FCO and F2CO were observed. Overtone bands of FCO were identified at 2032 and 3690/cm, and their assignment was confirmed by both carbon-13 and oxygen-18 isotopic substitution. Further data were also obtained on the vibrational fundamentals of isotopically substituted F2CO. A six-constant valence force potential has been derived for FCO using a least-squares force constant adjustment to the isotopic data and assuming a recently calculated structure. The photodissociation of FCO into F + CO was assuming a recently calculated structure. The photodissociation of FCO into F + CO was observed with a threshold near 2800 A. The assignment of two overlapping electronic transitions of FCO between 3400 and 2300 A is discussed.

703,651
PB80-205925 Not available NTIS
National Bureau of Standards, Washington, DC.
Bond Directions in Adsorbed Molecules Determined Using High Resolution Electron Energy Loss Spectroscopy (EELS): Acetylene and Ethylene on Tungsten(100).
Final rept.,
J. C. Hamilton, N. Swanson, B. J. Waclawski, and R. J. Celotta. 1980, 1p
Pub. in Proceedings on the Physical Elctronics Conf., Ithaca, NY, pE7, 16-18 Jun 80.

Keywords: *Acetylene, *Ethylene, *Surface chemistry, Tungsten, Chemical bonds, Chemisorption, Dipole moments, Molecular vibration, Adsorption.

The authors have used high resolution electron energy loss spectroscopy in both specular and non-specular directions to identify the vibrational modes of acetylene and ethylene on the tungsten (100) surface. At low coverages several of the vibrational modes were detectable only in the non-specular direction. Analysis of relative intensities of the specular and non-specular losses allows determination of the orientation of molecular dipole moments and thus of bond directions in the adsorbed species, for both acetylene and ethylene initial adsorption was found to be dissociative.

703,652
PB80-205933 Not available NTIS
National Bureau of Standards, Washington, DC.
Logarithmic Terms in the Softness Expansion of Dilute Gas Transport Properties.
Final rept.,
R. F. Kayser. 15 May 80, 11p
Pub. in Jnl. of Chemical Physics 72, n10 p5458-5468, 15 May 80.

Keywords: *Gases, *Transport properties, Perturbation theory, Viscosity, Thermal conductivity, Logarithm functions, Reprints, Self-diffusion.

The author considers the dilute gas coefficients of viscosity and thermal conductivity for the inverse power potential.

703,653
PB80-205941 Not available NTIS
National Bureau of Standards, Washington, DC.
Quantum Beats Observed in Photoionization.
Final rept.,
G. Leuchs, S. J. Smith, and E. Khawaja. Dec 79, 4p
Pub. in Optics Communications 31, p313-316 Dec 79.

Keywords: *Sodium, *Hyperfine structure, *Photoionization, Angular distribution, Atomic energy levels, Reprints, *Quantum beats.

Quantum beats of the hyperfine levels of the 3 doublet P(3/2) state of sodium have been observed in photoionization. The atoms are ionized stepwise with two pulsed lasers. The photoelectron angular distribution, measured as a function of the delay between the two laser pulses, exhibits a periodic variation due to the quantum beat effect. The hyperfine splitting of the intermediate state estimated from these measurements is in good agreement with literature values.

703,654
PB80-205958 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Electron Collision Cross Sections from Swarm Data.
Final rept.,
A. V. Phelps. 1980, 10p
Pub. in Proceedings on the Int. Seminar on the Swarm Experiments in Atomic Collision Research, Tikky Univ., Tokyo, Japan, p23-32, 6-7 Sep 79.

Keywords: *Electron scattering, *Collision cross sections, Transport properties, Diffusion coefficients, Rare gases, Electric fields, Boltzmann equation, Inelastic scattering, *Swarm data.

Electron collision cross sections have been determined from swarm data, such as mobility and diffusion coefficients, since the early studies of Townsend and coworkers. Work through the 1940's provided (a) still useful measurements of electron transport coefficients and approximate momentum transfer cross sections in a wide variety of gases: (b) the recognition of the unique ability of swarm measurements to provide cross sections for very low energy processes such as rotational excitation; and (c) rigorously formulated, lowest order solutions to the Boltzmann equation for electrons in gases in a uniform electric field. The application of high speed computers and the development of techniques for precision measurement of electron transport coefficients in the 1960's made possible the serious determination of electron collision cross sections from swarm data.

703,655
PB80-207715
(Order as PB80-207707, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC.
Electrochemical Equivalent of Pure Silver - A Value of the Faraday,
V. E. Bower, and R. S. Davis. 30 Jan 80, 17p
Included in Jnl. of Research of the National Bureau of Standards, v85 n3 p175-191, May-Jun 80.

Keywords: *Faraday effect, *Silver, *Electrochemistry, Coulometers, Mass spectroscopy, Purity.

Oxygen-free high-purity samples were used in a precise determination of the electrochemical equivalent of silver. A comprehensive mass spectrometric analysis for impurities was performed. The value agrees well with prior measurements of the same quantity at the National Bureau of Standards (NBS) by Craig and coworkers.

703,656
PB80-207731

(Order as PB80-207707, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC.
Dixanthylurea (N, N'-di-9H-Xanthen-9-ylurea),
C. R. Hubbard, A. D. Mighell, and A. J. Fatiadi. 20 Jul 79, 6p
Included in Jnl. of Research of the National Bureau of Standards, v85 n3 p205-210, May-Jun 80.

Keywords: *Crystal structure, Chemical bonds, Nitrogen organic compounds, X ray diffraction, *Urea/N-N-xanthenyl.

The structure has been determined by direct methods and refined to R = 0.045 based on 1419 independent reflections. No crystallographic symmetry element is present in the dixanthylurea molecule. In fact, the molecule is considerably distorted from any possible mirror symmetry. The molecules are hydrogen bonded in an infinite chain along the a-axis. The compound is of interest because of its role in the analytical determination of urea.

703,657
PB80-207756
(Order as PB80-207707, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC.
In-Tank Measurement of Solution Density,
F. E. Jones, R. M. Schoonover, and J. F. Houser. 5 Feb 80, 3p
Included in Jnl. of Research of the National Bureau of Standards, v85 n3 p219-221, May-Jun 80.

Keywords: *Solutions, *Density, Feasibility, Pressure, Samples, Nuclear materials management.

This paper presents the results of an experiment which established the feasibility of in-tank determination of the density of nuclear process solutions in the field with a precision competitive with the precision claimed for laboratory determinations of the density of samples taken from a tank. The in-tank determination is made by inferring the density from the differential pressure measured between two probes immersed at different heights in the tank. The differential pressure was measured using a null-operated quartz bourdon type electromanometer. The work provided a calibration factor, with a precision (estimate of the relative standard deviation of the mean) of 2.2 parts in 10,000, which can be used to infer density from differential pressure measurements in the particular accountability tank. The technique eliminates one error in the laboratory determinations of density and minimizes another. It also can be used to indicate the homogeneity of the tank solution and thus determine when a sample should be taken for determination of the concentration of nuclear material in the solution.

703,658
PB80-208259 Not avaliable NTIS
National Bureau of Standards, Washington, DC.
Phosphate Ion with Three 'Symmetric' Hydrogen Bonds: The Structure of Ca2(NH4)H7(PO4)4.2H2O.
Final rept.,
S. Takagi, M. Mathew, and W. E. Brown. 1980, 6p
Pub. in Acta Cryst. B36, p766-771 1980.

Keywords: *Crystal structure, *Calcium phosphates, Inorganic phosphates, Least squares method, Chemical bonds, Reprints, *Ammonium phosphates.

The structure was refined by the method of least squares to R(F)=0.048; R(w)(F)=0.050 for 904 reflections with ((F)(0)). The structure contains (CaH2PO4)(+) chains held together by Ca...O bonds to form corrugated Ca-P(2)O4 sheets analogous to those found in CA(H2PO4)2. H2O and several other calcium phosphates.

703,659
PB80-208275 Not available NTIS
National Bureau of Standards, Washington, DC.
Core-Level Satellite Structure in Photoemission Spectra of Transition Metals.
Final rept.,
J. Tersoff, L. M. Faklicov, and D. R. Penn. 1979, 3p
Pub. in Solid State Communications 32, p1045-1047 1979.

Keywords: *Transition metals, *Molecular energy levels, *Emission spectroscopy, Photoelectric emission, Paramagnetism, Ferromagnetism, Reprints.

A theory of the satellite structure of the core-level photoemission spectrum of transition metals is presented. It is applied to the doublet p(3/2) level of metallic nickel. The calculation is carried out for both the paramagnetic and ferromagnetic states and is based on two scattering parameters, one intraband and one interband. Agreement with experiment is very good.

703,660
PB80-208887 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Table of Recommended Rate Constants for Chemical Reactions Occurring in Combustion,
F. Westley. Apr 80, 123p NSRDS-NBS-67
Sponsored in part by Department of Energy, Washington, DC. Library of Congress catalog card no. 79-607159.

Keywords: *Reaction kinetics, *Combustion, Tables(Data), Chemical reactions, Free radicals, Oxidation, Decomposition, Hydrocarbons, Aldehydes, Alcohols, Ketones, Thiols, Ethers, Amines, Amides, Oxides.

A table of recommended rate constants for gas phase chemical reactions occurring in combustion is presented. Specifically, it gives in tabular form the values of the parameters for the modified Arrhenius equation k = AT sup B exp (-E/RT). The table covers reactions occurring in the combustion, oxidation, and decomposition of aliphatic saturated or unsaturated C1 to C10 hydrocarbons, alcohols, aldehydes, ketones, thiols, ethers, peroxides, amines, amides and their free radicals, as well as the reactions of O, O2, H, H2, OH, H2O, H2O2, N, N2, NO, N2O, NO2, N2O4, N2O5, S, S2, SH, SO, SO2, SOH, NS, with each other. The table includes 169 first order reactions, 782 second order reactions, and 57 third order reactions. There are 1770 entries covering 1008 distinct chemical reactions. These recommendations have been taken from eleven evaluations and critical reviews published between 1970 and 1976. The papers examined by the evaluators extend from the nineteen fifties up to - and including - 1975.

703,661
PB80-210818 Not available NTIS
National Bureau of Standards, Washington, DC.
Preparation of Pt-Fe Alloy Foils by Electrodeposition of Fe.
Final rept.,
A. D. Franklin, and J. Epp. 1979, 1p
Pub. in Jnl. of the Electrochemical Society 126, n12 p2162 1979.

Keywords: *Electrodeposition, *Platinum alloys, Iron containing alloys, Surfaces, Iron, X ray diffraction, Reprints.

A technique is described in which Pt-rich Fe-Pt foils are prepared by electrodeposition of Fe onto Pt foils from a 50;50 molar mixture of KCl:FeCl2 at 500C under reducing conditions. Subsequent annealing at 1600C in a 5:95 H2:He atmosphere produced well-annealed homogeneous alloy foils of controlled composition. X-ray diffraction of annealed specimens containing up to 10 atom percent Fe revealed disordered fcc structures for which the lattice parameter accurately obeyed Vegard's law and agreed with literature data.

703,662
PB80-211691 Not available NTIS
National Bureau of Standards, Washington, DC.
Transient of the Intrinsic Birefringence and Light Scattering of a Suspension of Rigid Spheroids in the Linear Laminar Jet Flow.
Final rept.,
A. Peterlin. 1980, 8p
Pub. in Jnl. of Physical Chemistry 84, n12 p1650-1657 1980.

Keywords: *Birefringence, *Light scattering, *Jet flow, Optical measurement, Spheroidal structure, Particles.

For the laminar jet flow with a constant longitudinal gradient gamma one has calculated the time dependence of the averages of the second and fourth power of the cosine of the angle theta between the symmetry axis of the spheroid and the flow direction. These averages are needed for the intrinsic birefringence and light scattering of a dilute suspension of rigid spheroids subjected to such a flow. The effects depend on the parameter sigma = 3 gamma beta/4D where the coefficient beta is a function of the particle shape and the rotational diffusion coefficient D of the symmetry axis of the spheroid is a function of the particle size and shape. The time dependence of both optical effects is the sum of exponential functions of -lambda(2p)Dt with lambda(2p) the eigenvalues of the subsequent terms of the infinite series the distribution function of the orientation of the symmetry axis of the particle is expanded in. It turns out that the transient of the averages contributing to the optical effects mainly depend on the lowest eigenvalue lambda(2) as long as the parameter sigma is not extremely high.

703,663
PB80-211709 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Spectroscopic Study of the Reaction of H Atoms with CF2 in Argon and Nitrogen Matrices.
Final rept.,
M. E. Jacox. 1980, 7p
Pub. in Jnl. of Molecular Spectroscopy 81, p349-355 1980.

Keywords: *Infrared spectroscopy, *Fluorine organic compounds, Samples, Absorption spectra, Atoms, Reprints, *Hydrogen atoms, *Matrix isolation techniques.

The concurrent generation of CF2 and of H atoms upon exposure of samples containing CF2N2 and either HI or H2S isolated in an argon or a nitrogen matrix at 14 K to 2537-A mercury-arc radiation leads to the appearance of prominent infrared absorption of HCF2, demonstrating that this species is the primary product of the H + CF2 reaction. Infrared absorptions assigned to HCF2, DCF2, CF2I, and CF2S in previous studies on other reaction systems are confirmed in the experimental studies here reported.

703,664
PB80-211725 Not available NTIS
National Bureau of Standards, Washington, DC.
Averaged Ionization Cross Sections and Rate Coefficients in a Partially Ionized Gas for Small and High Electron Energy.
Final rept.,
J. Kunc. 5 Feb 79, 5p
Pub. in Physics Letters 70A, n1 p12-16, 5 Feb 79.

Keywords: *Electron scattering, *Reaction kinetics, Electron energy, Gases, Ionization, Atomic energy levels, Reprints, *Ionization cross sections.

Averaged (with Maxwell's and Druyvestcyn's electron velocity distribution functions) electron collisional ionization cross-sections and rate coefficients are given for the atoms in the ground state in the form of analytical formulas. These formulas work well either for small or for high values of mean electron energy in the partially ionized gas.

703,665
PB80-211899 Not available NTIS
National Bureau of Standards, Washington, DC.
Perturbations in the Vibration-Rotation-Torsion Energy Levels of an Ethane Molecule Exhibiting Internal Rotation Splittings,
J. T. Hougen. 1980, 25p
Pub. in Jnl. of Molecular Spectroscopy 82, p92-115 1980.

Keywords: *Ethane, *Perturbation theory, Molecular vibration, Molecular rotation, Molecular energy levels, Torsion, Reprints.

Various examples of perturbations in the vibration-rotation-torsion energy levels of an ethane molecule exhibiting internal rotation splittings are discussed, both from the point of view of the point group D(3d), appropriate when internal rotation tunneling effects cannot be observed, and from the point of view of the group G(36)(+), appropriate when internal rotation tunneling in ethane leads to observable splitting in the spectrum. It is found for perturbations allowed in both D(3d) and G(36)(+), that each of the two torsional components of the perturbed D(3d) vibration-rotation level can in principle interact with a 'corresponding' torsional component in the perturbing vibration-rotation level. It is found for perturbations forbidden in D(3d) but allowed in G(36)(+), which all occur between D(3d) vibrational levels of different g,u parity, that only one of the two torsional components of the perturbed D(3d) vibration-rotation level can interact with a corresponding torsional component in the perturbing vibration-rotation level. Some of the perturbations examined give intensity to otherwise forbidden transitions in such a way that perturbation-induced transitions can be used in conjunction with normally allowed transitions to determine the sum of the internal rotation splittings for two rotational levels differing in K by three units.

703,666
PB80-211907 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Molecular Constants from Collision-Induced Far-Infra-Red Spectra and Related Methods.
Final rept.,
G. Birnbaum. 1980, 35p
Pub. in Intermolecular Spectroscopy and Synamical Properties of Dense Systems, p111-145 1980.

Keywords: *Molecules, *Electric moments, Birefringence, Infrared spectroscopy, Absorption spectra, Reprints, *Molecule molecule interactions, Virial coefficients.

This paper describes how quantitative information on molecular parameters, particularly the electric multipole moments, can be obtained from collision-induced absorption spectra. Also discussed are related methods based on the second dielectric virial coefficient and birefringence induced by an externally applied electric field.

703,667
PB80-211915 Not available NTIS
National Bureau of Standards, Washington, DC.
Collision-Induced Vibrational Spectroscopy in Liquids,
G. Birnbaum. 1980, 19p
Pub. in Vibrational Spectroscopy of Molecular Liquids and Solids, p147-165 1980.

Keywords: *Molecular vibration, *Liquids, Dipole moments, Infrared spectroscopy, Raman spectroscopy, Absorption spectra, Rayleigh scattering, Reprints, *Molecule molecule interactions.

Pressure or collision induced absorption arises from transient dipoles produced by distortion of the electronic distribution of molecules in binary, ternary and higher order interactions. The induced dipole is modulated by the vibration and rotation of the colliding molecules and, because of its strong dependence on the intermolecular separation, by their relative translational motion. Thus a variety of pressure-induced spectra are known ranging from pure translation and rotation in the microwave and far infrared regions to fundamental and overtone rotation-vibration spectra in the infrared region. Such spectra have been observed in pure substances and in mixtures in the gaseous, liquid and solid phases. Collisions also induce anisotropic polarizability in atoms and spherical molecules producing depolarized Rayleigh spectra. Most recently, vibrational Raman bands have been studied which are forbidden by symmetry in the isolated molecule but are produced by intermolecular fields. The aim here is to discuss collision-induced vibrational spectra in liquids observed in infrared absorption and Raman scattering.

703,668
PB80-211964 Not available NTIS
National Bureau of Standards, Washington, DC.
Excited-Neutral-Metastable SO2 Formation in the O3-CH2CH2S, O3-Olefin-SO2, and Active Nitrogen-SO2 Systems,
R. I. Martinez, and J. T. Herron. 15 May 80, 6p
Pub. in Chemical Physics Letters 72, n1 p77-82, 15 May 80.

Keywords: *Sulfur dioxide, Metastable state, Isomers, Excitation, Ozone, Nitrogen, Alkene hydrocarbons, Reprints, Thiiranes.

Long-lived (pi > .001s), electronically-excited (E* > 4 eV) neutral metastables, whose formation was attributed to the presence of SO2, were observed in the three titled systems. Their possible identity as collisionally-accessed ,netastable states of the normal (O sup S O), cyclic (O sup S O), or superoxide (S sup O O) isomers of SO2 is discussed.

703,669
PB80-212152 Not available NTIS
National Bureau of Standards, Washington, DC.
Stopped-Flow Study of the Gas-Phase Reactions of Ozone with Organic Sulfides: Thiirane,
R. I. Martinez, and J. T. Herron. 15 May 80, 3p
Pub. in Chemical Physics Letters 72, n1 p74-75, 15 May 80.

Keywords: *Ozone, *Reaction kinetics, Organic sulfides, Vapor phases, Chemical reactions, Ethane, Sulfur dioxide, Carbon dioxide, Formaldehyde, Reprints, *Thiiranes, Chemical reaction mechanisms.

The autocatalytic reaction of ozone with thiirane has been studied at 296 K and 1.1 kPa (8 torr). The specific rate of primary attack of ozone on thiirane is immeasurably slow (k < 10,000 cu cm/mol sec). The major products observed are C2H4, SO2, H2CO and CO2. A free-radical chain mechanism is suggested to account for these observations.

703,670
PB80-212285 Not available NTIS
National Bureau of Standards, Washington, DC.
Specialist Workshop on Energy Dispersive X-Ray Spectrometry National Bureau of Standards - April 23-25, 1979,
D. E. Newbury, R. L. Myklebust, K. F. J. Heinrich, and C. E. Fiori. 1980, 3p
Pub. in Scanning-3, n1 p43-45 1980.

Keywords: *X ray spectroscopy, Laboratory equipment, X ray spectrometers, X ray fluorescence, X ray analysis, Reprints, State of the art.

A specialist workshop to discuss the state-of-the-art of energy dispersive x-ray spectrometry was held at the National Bureau of Standards April 23-25, 1979, topics considered included advances in (1) measuring the properties of solid state energy dispersive x-ray detectors, (2) windowless x-ray detectors, (3) electronics for energy dispersive spectrometers, (4) spectral processing techniques, (5) quantitative x-ray microanalysis, (6) artifacts in electron-excited energy dispersive spectra, and (7) applications to x-ray fluorescence.

703,671
PB80-213739 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Bibliography on Atomic Transition Probabilities (November 1977 through March 1980).
Interim rept. Nov 77-Mar 80,
B. J. Miller, J. R. Fuhr, and G. A. Martin. Aug 80, 125p NBS/SP-505/1
Supplement to report dated Apr 78, PB-280 736. Library of Congress catalog card no. 80-600119.

Keywords: *Bibliographies, *Atomic energy levels, *Transition probabilities, Excitation, Atomic spectroscopy, Oscillator strength.

This is the first supplement to the NBS Special Publication 505, Bibliography on Atomic Transition Probabilities (1914 through October 1977), and it covers the literature on the subject from November 1977 through March 1980. It contains approximately 600 references, with each article assigned a number, and is divided into five main sections. The first section contains a listing, by number, of articles of general interest. The second section lists by number all articles containing numerical data; it is arranged by element and stage of ionization and is further subdivided according to theoretical and experimental methods, comments, and compilations. The third section contains a listing of all articles, including numbers, authors, title, and journal reference; it is arranged by year of publication and alphabetically by authors' names within the year. All foreign language papers are identified, and their titles are translated into English. The fourth section contains a listing of all authors and the numbers of the papers they have authored or co-authored. A final section provides corrections or additions to the preceding bibliography.

703,672
PB80-215668 Not available NTIS
National Bureau of Standards, Washington, DC.
Pyrolysis of Ethylamine. II. Synthesis and Microwave Spectrum of Ethylidenimine (CH3CH=NH).
F. J. Lovas, R. D. Suenram, D. R. Johnson, F. O. Clark, and E. Tiemann. 1 May 80, 9p
Pub. in Jnl. of Chemical Physics, v72 n9 p4964-4972, 1 May 80. See also Part 1, COM-75-50619. Sponsored in part by National Science Foundation, Washington, DC.

Keywords: *Microwave spectroscopy, *Synthesis(Chemistry), Pyrolysis, Hyperfine structure, Molecular rotations, Stark effect, Dipole moments, Reprints, *Ethylidenimine.

Microwave rotational spectra assignable to gas phase cis- and trans-ethylidenimine (CH3CH=NH) have been detected in the pyrolysis decomposition products from several alkylamines and from the ring trimer, (CH3CHNH)3. Stark effects, hyperfine and internal rotation splittings have aided the assignment of the observed spectra and allowed the determination of rotational distortion constants, 14N nuclear electric quadrupole coupling constants, internal rotation barriers, and electric dipole moments. Limited structural information was also obtained.

703,673
PB80-215676 Not available NTIS
National Bureau of Standards, Washington, DC.
Double-Resonance and Optical-Pumping Experiments on Electromagnetically Confined, Laser-Cooled Ions,
D. J. Wineland, J. C. Bergquist, W. M. Itano, and R. E. Drullinger. Jun 80, 3p
Pub. in Optics Letters, v5 n6 p245-247 Jun 80. Sponsored in part by Air Force Office of Scientific Research, Arlington, VA. Office of Naval Research, Arlington, VA.

Keywords: *Optical pumping, Ions, Reprints, *Laser spectroscopy.

Experiments illustrating advantages and unique features of double-resonance and optical pumping on electromagnetically confined, laser-cooled ions are discussed. In certain cases, scattered light from the cooling transition can be used as a monitor in double-resonance experiments to give nearly 100% detection efficiency. Nonradiative relaxation rates are extremely small for stored ions, permitting nearly complete optical pumping, even in extremely weak pumping schemes.

703,674
PB80-215825 Not available NTIS
National Bureau of Standards, Washington, DC.
Observation of the Infrared Spectrum of the Helium-Hydride Molecular Ion 4HeH+.
Final rept.,
D. E. Tolliver, G. A. Kyrala, and W. H. Wing. 3 Dec 79, 4p
Pub. in Physical Review Letters 43, n23 p1719-1722, 3 Dec 79.

Keywords: *Infrared spectroscopy, *Ions, Molecular vibration, Molecular rotation, Doppler effect, Reprints, *Helium hydrides, Laser spectroscopy.

The authors have made the first observation of the vibrational-rotational spectrum of the electronic ground state of the helium-hydride molecular ion (4)HeH(+). The Doppler-tuned ion-beam laser-spectroscopic technique was used. The frequencies of five transitions between 1700 and 1900 cm have been measured to + or - 0.002 cm (+ or - 1 ppm). The experimental values deviate from current theory by typically 0.2/cm, and are two orders of magnitude more precise than the theoretical values.

703,675
PB80-215833 Not available NTIS
National Bureau of Standards, Washington, DC.
Transitions in Lambda/Doublets of Molecules Induced by Collisions with Ions. II.
Final rept.,
D. Bouloy, and A. Omont. 1979, 18p
Pub. in Astronomy and Astrophysics Supplement 38, n1 p101-118 1979.

Keywords: *Molecular energy levels, Excitation, Reprints, *Ion molecule interactions, Numerical solution.

The results of a preceding paper extended to other values of J and thoroughly discussed. The different multipolar relaxation rates due to ions inside alpha-doublets are calculated exactly by a semi-classical solution of the closed-couple collision equations. The J-dependence of the results is analyzed. A detailed discussion is given of the conditions of validity of the model, and of the possible importance of deviations from straight line trajectory and of rotational excitation by ions. In order to compare neutral and charged particle rates, rough estimates are given of alpha-doublet rates for neutral particles in the instellar medium and in the atmospheres of comets. Both rates are comparable when the ionization rate is .00001 in the interstellar medium, and .0001 in comets.

703,676
PB80-215890 Not available NTIS
National Bureau of Standards, Washington, DC.

Frequencies of cw FIR Laser Lines from Optically Pumped CH2F2.
Final rept.,
F. R. Petersen, A. Scalabrin, and K. M. Evenson. 1980, 5p
Pub. in International Jnl. of Infrared Millimeter Waves 1, n1 p111-115 1980.

Keywords: *Infrared spectroscopy, Fluorine organic compounds, Reprints, *Laser spectroscopy, *Methane/difluoro.

The frequencies of 48 optically pumped cw FIR CH2F2 laser lines have been measured relative to stabilized CO2 lasers. Uncertainties are estimated to be about 5 parts in 10 to the 7th power.

703,677
PB80-216427 Not availble NTIS
National Bureau of Standards, Washington, DC.
Electron-Impact Ionization Cross Sections for Highly Ionized Hydrogen- and Lithium-Like Atoms.
Final rept.,
S. M. Younger. Jul 80, 7p
Pub. in Physical Review A 22, n1 p111-117 Jul 80.

Keywords: *Electron bombardment, *Atoms, Electron transitions, Electron scattering, Reprints, Atom electron interactions, Ionization cross sections.

Electron ionization cross sections for highly ionized atoms in the hydrogen and lithium isoelectronic sequences have been computed in several variants of the Coulomb-Born and distorted-wave approximation. Electron exchange in the transition matrix element and Coulomb distortion of the partial waves were found to be important. The results are compared to recent crossed-beam experimental data and to other theoretical predictions.

703,678
PB80-216450 Not available NTIS
National Bureau of Standards, Washington, DC.
Resonance Fluorescence and Resonance Raman Lineshapes in Strong Radiation Fields.
Final rept.,
Y. Rabin, and A. Ben-Reuven. 1980, 15p
Pub. in Jnl. Phys. B 13, n10 p2011-2025 1980.

Keywords: *Fluorescence, *Raman spectra, Resonance scattering, Electron transitions, Reprints.

Lineshapes of three-level resonance Raman scattering and two-level resonance fluorescence, homogeneously broadened by collisions, in the presence of arbitrarily strong coherent radiation, are studied by means of a tetradic (density-matrix) scattering theory. In particular it is shown that relaxation through intermediate non-resonant levels can considerably alter the lineshape in resonance fluorescence. In the case of strong coupling the collision rates are modified by the applied field (optical collisions). It is shown that, whereas in self attenuation spectra optical collision rates can be obtained only from line intensity or line wing measurements, in resonance scattering these rates are directly obtained from linewidth measurements.

703,679
PB80-216468 Not available NTIS
National Bureau of Standards, Washington, DC.
Dual Melting Curves and Metastability of Carbon Tetrachloride.
Final rept.,
V. E. Bean, and S. D. Wood. 1980, 4p
Pub. in Jnl. Chem. Phys. 72, n11 p5838-5841, 1 Jun 80.

Keywords: *Carbon tetrachloride, *Melting, *Phase transformations, Chlorine aliphatic compounds, Reprints.

Carbon tetrachloride has three known solid phases at atmospheric pressure: Ia (face-centered cubic), Ib (rhombohedral), and II (mononucleic). Both Ia and Ib melt directly at temperatures some 5 K apart. These phase changes have been traced as a function of hydrostatic pressure up to 350 MPa. Between atmospheric pressure and 100 MPa, CCl4 has dual melting curves; one for Ia, and a few degrees higher, one for Ib. The two curves diverge with increasing pressure. Above 100 MPa it was not possible to detect the Ia phase. There appears to be no Ia-Ib-liquid triple point. The metastability associated with these phases is discussed.

703,680
PB80-216518 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of the Double Resonance Raman Amplifier.
Final rept.,
Y. Rabin, M. Berman, and A. Ben-Reuven. 1980, 10p
Pub. in Jnl. Phys. B 13, p2127-2136 1980.

Keywords: *Raman spectra, Resonance scattering, Mathematical models, Reprints.

A model is presented for steady-state three-level resonance Raman amplification, based on an algebraic expression for single-molecule amplification (including independently variable relaxation rates) with arbitrarily strong radiative couplings, combined with a numerical solution of non-linear equations governing macroscopic collinear propagation.

703,681
PB80-216963 Not available NTIS
National Bureau of Standards, Washington, DC.
Na 32P-32D Line Broadening by Ne, Ar, and Xe.
Final rept.,
D. W. Wildman, L. W. Schumann, and A. C. Gallagher. 1980, 5p
Sponsored in part by Department of Defense, Washington, DC.
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 24, n1 p19-23 1980.

Keywords: *Sodium, *Line width, Neon, Argon, Xenon, Reprints.

The normalized emission intensity in the wings of the optically thin Na (3 doublet P-3 doublet) lines broadened by Ne, Ar, and Xe has been measured in emission from a high-pressure discharge. A blended satellite occurs about 80/cm into the Na-Xe red wing and a progression of increasing red wing intensity from Ne to Ar to Xe is observed. Xe densities of 2.5 and 9.1 10 to the +19 power/cc were used, and the pressure dependence of the NaXe line shape indicates that multiple perturber interactions are important in the higher noble gas densities.

703,682
PB80-216989 Not available NTIS
National Bureau of Standards, Washington, DC.
Emission of a Mg-Xe Discharge and the MgXe Excimer Band.
Final rept.,
L. Schumann, D. Wildman, and A. Gallagher. 1 Jun 80, 4p
Grant N00014-76-C-0123
Pub. in Jnl. of Chemical Physics 72, n11 p6081-6084, 1 Jun 80.

Keywords: *Magnesium, *Molecular energy levels, Excitation, Reprints, *Magnesium xenon, Excimers.

The emission intensities and excited-state densities of a Mg-doped high-pressure Xe discharge are reported. The normalized emission of the MgXe excimer band associated with the Mg 3 singlet P(1)-3 singlet S0 resonance transition is obtained from the data, as well as a 320-380 nm band attributed to XeMg+. The Mg2 A-X band is not seen in emission under an discharge conditions in Mg doped Xe or Ne. This Mg-Xe mixture does not appear to be a reasonable candidate for a discharge-excited excimer laser due to the large excitation energies associated with the Mg and Mg+ resonance transitions.

703,683
PB80-218506 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Relaxation in a Liquid Under Shock Compression.
Final rept.,
D. H. Tsai, and S. F. Trevino. 1980, 3p
Pub in Proceedings of the VIIth International AIRAPT Conference, Le Creusot, France, Jul 30-Aug 3, 1979, Paper in High Pressure Science and Technology, B. Vodar and Ph. Marteau, Eds., 2, p1051-1053, Pergamon Press, Oxford, England 1980.

Keywords: *Liquids, Relaxation time, Mechanical shock, Lennard-Jones potential.

The authors have studied the shock compression of a dense Lennard-Jones liquid by means of detailed, molecular-dynamical calculations. The results show the structure of the shock front as well as the dynamical process of thermal relaxation behind the shock front. The shock front profiles are qualitatively similar to those obtained by Hoover who solved the Navier-Stokes equations for a continuum, and by Klimenko and Dremin who also studied the molecular dynamics of this problem. In addition, they found that thermal equilibration in the shock profile occurs at a rate lower than the propagation of the shock front itself.

703,684
PB80-218530 Not available NTIS
National Bureau of Standards, Washington, DC.
Kinetics of Carbon Deposition from CO on Ru(110) and Ni(100): Summary Abstract.
Final rept.,
D. W. Goodman, R. D. Kelley, T. E. Madey, and J. M. White. 1979, 1p
Pub. in Jnl. of Vacuum Science and Technology 17, n1 p143 Jan-Feb 80.

Keywords: *Carbon, *Reaction kinetics, Deposition, Carbon monoxide, Nickel, Rubidium, Catalysis, Reprints.

The kinetics of carbon formation on Ru(110) and Ni(100) upon heating in CO have been studied and compared with the kinetics of CO hydrogenation to methane. The apparatus used for these studies allows for an in vacuum transfer of the crystal of interest from a high pressure reactor to a UHV surface characterization chamber. For Ru(110) and Ni(100) heating at 600K in high pressure, CO leads to rapid formation of a carbidic-like carbon (as characterized by AES for both Ni and Ru, despite interference in the case of Ru) which saturates at $<1/2$ monolayer. Reaction at lower temperatures produces a similar carbon species at levels $<1/2$ monolayer. This carbidic carbon reacts rapidly when exposed to high pressure hydrogen. A graphite-like carbon, which is unreactive toward hydrogenation, can be formed by reaction with CO at temperature <650K. The kinetics associated with the hydrogenation of the carbidic carbon have also been investigated. Th specific rates and activation energies of th carbon formation in CO and its subsequent removal in hydrogen are comparable. Furthermore, for Ru(110) and Ni(100) the specific rates and activation energies of these two processes compare with the specific rates and activation energies measured for the catalytic CO hydrogenation to methane. These data support an active carbon mechanism for the catalytic methanation reaction.

703,685
PB80-218548 Not available NTIS
National Bureau of Standards, Washington, DC.
Li2 and Na2 3Sigma(g)(+)-3Sigma(u)(+) Excimer Emission.
Final rept.,
D. D. Konowalow, and P. S. Julienne. 1 Jun 80, 3p
Pub. in Jnl. of Chemical Physics 72, n11 p5815-5817, 1 Jun 80.

Keywords: *Lithium, *Sodium, Ions, Gas lasers, Emission spectra, Infrared radiation, Molecular energy levels, Reprints, *Excimers, Dimers.

Ab initio calculations show the triplet Sigma(g)(+) to triplet Sigma(u)(+) in Li2 and Na2 dimers to be primarily a near-infrared continuum with respective $v' = 0$ lifetimes of 62 and 15 nsec. The peak stimulated emission cross sections are given. These calculations suggest a tunable high gain, near-infrared laser excimer if the triplet Sigma(g)(+) state can ge populated sufficiently rapidly.

703,686
PB80-221468 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Active Carbon on Ruthenium (110): Relevance to Catalytic Methanation.
Final rept.,
D. W. Goodman, and J. M. White. 1979, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Surface Science 90, p201-203 1979.

Keywords: *Surface chemistry, *Ruthenium, *Catalysts, *Hydrogenation, Carbon, Reaction kinetics, Single cyrstals, Reprints, *Methanation, Auger electron spectroscopy.

A technique is described for the quantitative measurement by Auger Electron Spectroscopy (AES) of carbon on a Ru(110) surface. Previously, the detection of carbon on Ru, even qualitatively, has been difficult because of the interference between the Ru (273 eV) and C (272 eV) transitions. The lineshape of the AES feature associated with the carbon formed by heating in CO is carbidic in nature. This form of carbon is shown

to be active toward hydrogenation. The specific rate of its formation in pure CO compares with the rate of methanation in a H2/CO mixture.

703,687
PB80-221476 Not available NTIS
National Bureau of Standards, Washington, DC.
New Upper Bound for a Critical Anomaly in the Dielectric Constant of SF6.
Final rept.,
B. J. Thijsse, T. Doiron, and J. M. H. L. Sengers. 15 Jun 80, 5p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Chemical Physics Letters 72, n3 p546-550, 15 Jun 80.

Keywords: *Sulfur hexafluoride, Dielectric properties, Fluorides, Reprints.

The dielectric constant of SF6 on the critical isochore was measured under conditions of high thermal stability and low gravitational disturbance. No direct evidence of a t sup (1-alpha)-type anomaly was found; an upper bound for its amplitude is presented.

703,688
PB80-221484 Not available NTIS
National Bureau of Standards, Washington, DC.
Kinetics of the Hydrogenation of CO Over a Single Crystal Nickel Catalyst.
Final rept.,
D. W. Goodman, R. D. Kelley, T. E. Madey, and J. T. Yates. 1980, 9p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Catalysis 63, p226-234 1980.

Keywords: *Nickel, *Surface chemistry, *Catalysts, *Hydrogenation, Carbon monoxide, Single crystals, Reaction kinetics, Reprints, *Methanation, Chemical reaction mechanisms.

A specially designed ultrahigh vacuum system has been used to examine the effect of surface chemical composition on the kinetics of the catalytic methanation reaction over a single crystal Ni(100) catalyst. The surface is characterized using Auger Electron Spectroscopy (AES) in an ultrahigh vacuum chamber, and reaction kinetics are determined following an in vacuo transfer of the sample to a catalytic reactor contiguous to the AES chamber. The kinetics of CO hydrogenation on a clean Ni(100) surface at 450-800 K are compared with kinetic data reported for high-area supported nickel catalysts. The dependence of the specific rate on total pressure (1-1500) and on H2 and CO partial pressures as well as the product distribution are also reported. These data are consistent with a mechanism in which an active surface carbon species is the dominant route to product.

703,689
PB80-221492 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Carbide Build-Up and Removal Kinetics on Ni(100).
Final rept.,
D. W. Goodman, R. D. Kelley, T. E. Madey, and J. M. White. 1980, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Catalysis Notes 64, p479-481 1980.

Keywords: *Nickel, *Surface chemistry, *Catalysts, *Hydrogenation, Carbides, Carbon monoxide, Reaction kinetics, Single crystals, Reprints, *Methanation.

The rate of carbide build-up on a Ni(100) crystal is shown to be the same as the rate of methane formation in an H2 + CO mixture. Hydrogenation of a surface carbide appears to be the dominant route to product in the catalytic hydrogenation of CO over Ni catalysts.

703,690
PB80-221518 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Collisions with Polar Molecules: Exchange and Polarization in Elastic Scattering by HCl.
Final rept.,
L. A. Collins, R. J. W. Henry, and D. W. Norcross. Jun 80, 9p
Contract DOE-EA-77-A-01-6010
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Jnl. of Physics, B: Atom. Molec. 13, n11 p2299-2307 Jun 80.

Keywords: *Molecules, *Electron bombardment, Hydrogen chloride, Reprints, Electron molecule interactions.

The local free-electron-gas exchange potential is shown to be not only superior to the orthogonalisation approximation to exchange, but also to yield results in good agreement with those from an essentially exact treatment of exchange. The imposition of orthogonalisation in addition to the local exchange potential yields a further small improvement in the results. The use of these two approximations in combination appears to be a promising technique. The elastic differential cross section has a strong peak in the backward direction, with important implications for resonant vibrational excitation.

703,691
PB80-221526 Not available NTIS
National Bureau of Standards, Washington, DC.
Excited State of Acetylene: Photochemical and Spectroscopic Evidence.
Final rept.,
A. H. Laufer. 1 Jul 80, 4p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Physics 73, n1 p49-52, 1 Jul 80.

Keywords: *Acetylene, Ultraviolet spectra, Far ultraviolet radiation, Absorption spectra, Alkyne hydrocarbons, Excitation, Reprints, Ketenes.

Absorption spectra of a long-lived transient in the 140 and 157 nm region have been observed as the result of direct excitation of C2H2. The strongest features also are seen as the result of CH2CO photolysis. The carrier is identified as C2H3. A possible alternate assignment of the transient carrier to a geometrical isomer, such as H2C=C(vinylidene) radical is discussed.

703,692
PB80-223449 Not available NTIS
National Bureau of Standards, Washington, DC.
Stopping Power and Energy Degradation for Electrons in Water Vapor.
Final rept.,
H. G. Paretzke, and M. J. Berger. 1978, 12p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of a Symposium on Microdosimetry (6th), Brussels, Belgium, May 22-26, 1978, p749-758 1978.

Keywords: *Water vapor, *Electrons, *Energy dissipation, Gas ionization, *Stopping power.

This paper is concerned with electron energy loss and degradation phenomena in water vapor at energies below a few keV where the Bethe theory is no longer applicable. There is practically no experimental information on low energy stopping power and on degradation spectra in gases, so that these quantities must be obtained by calculation. The required cross sections for the ionization and excitation of water molecules are not well known, and various assumptions and extrapolations have to be made in order to obtain input data which include all the important processes and all energies of interest. Three such data sets for water vapor are available which are based on somewhat different assumptions and approximations. One set has been published by Olivero, Stagat and Green and the other two sets are from more recent analysis made by the authors. They compare in this paper various quantities derived from these data sets, in order to obtain an indication how sensitively the stopping power and energy degradation calculations depend on the cross section input.

703,693
PB80-225410 Not available NTIS
National Bureau of Standards, Washington, DC.
Resonances in Atoms and Molecules.
Final rept.,
M. A. Biondi, A. Herzenberg, and C. E. Kuyatt. Oct 79, 6p
Pub. in Physics Today, p44-49 Oct 79.

Keywords: *Electron scattering, Atoms, Molecules, Electron bombardment, Resonance, Reprints.

The history of electron scattering resonances is reviewed, with special emphasis on the work of the late George Schulz.

703,694
PB80-227663 Not available NTIS
National Bureau of Standards, Washington, DC.
Room Temperature Adsorption of Oxygen, Hydrogen and Carbon Monoxide on (1120) Ruthenium: An Ellipsometry--LEED Characterization.
Final rept.,
J. J. Carroll, T. E. Madey, A. J. Melmed, and D. R. Sandstrom. 1980, 21p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Surface Science 96, p508-528 1980.

Keywords: *Surface chemistry, *Adsorption, *Ruthenium, Oxygen, Hydrogen, Carbon monoxide, Single crystals, Polarimetry, Reprints, Ellipsometry.

Experiments involving the room temperature adsoprtion of oxygen, hydrogen and carbon monoxide on a single crystal (1120) ruthenium surface were performed in ultra-high vacuum by monitoring the accumulation of adsorbates using ellopsometry while simultaneously observing the adsorbates' periodicity (or lack of it) with LEED. Measurements of relative carbon monoxide coverages were made using a temperature programmed desorption (flash desorption) method, and these results correlated well with coverages determined using ellipsometry.

703,695
PB80-227697 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Cross Sections and Polarization for Electron-Impact Excitation of the Resonance Multiplet of the Be+ Ion.
Final rept.,
P. O. Taylor, R. A. Phaneuf, and G. H. Dunn. Aug 80, 10p
Contract DOE-EA-77-A-01-6010
Pub. in Physical Review A 22, n2 p435-444 Aug 80,

Keywords: *Beryllium, Atomic beams, Electron bombardment, Excitation, Polarization, Ions, Reprints, Atom electron interactions.

Crossed beams of electrons and ground state Be(+) ions have been used to measure absolute cross sections for electron-impact excitation of the 313.1-nm resonance radiation corresponding to the transition Be(+)(2p) to Be(+)(2s). Polarization fractions of the emitted light were also measured. Cross sections are absolute in the sense that all measurables including photon flux at 313 nm have been compared to relevant standards.

703,696
PB80-227705 Not available NITS
National Bureau of Standards, Washington, DC.
Absolute Photoionization Cross-Section Measurements of the Excited 4D and 5S States of Sodium.
Final rept.,
A. V. Smith, J. E. M. Goldsmith, D. E. Nitz, and S. J. Smith. Aug 80, 5p
Grant NSF-PHY76-04928
Pub. in Physical Review A 22, n2 p577-581 Aug 80.

Keywords: *Sodium, Atoms, Gas ionization, Cross sections, Reprints, *Photoionization.

The authors have measured the absolute cross section for photoionization of the 4D and 5S excited states of sodium for 1.06 mm radiation. The method of measurement is based on saturation of ionization probability at high intensity of the ionizing radiation. The measured cross sections for ionization of unaligned atoms are both in excellent agreement with calculated values.

703,697
PB80-600003 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Spectra of Molecules of Astrophysical Interest. XVIII. Formic Acid.
E. Willemot, D. Dangoisse, N. Monnanteuil, and J. Bellet. c1980,102p
Included in Jnl. of Physical and Chemical Reference Data, v9, n1 p59-160, 1980.

Keywords: *Formic acid, Intrstellar molecules, Line strengths, Microwave spectra, Molecular constants, Radioastronomy, Rotational transitions.

The available data on the microwave spectrum of formic acid are critically reviewed for information apli-

cable to radioastronomy. Molecular data such as the derived rotational constants, centrifugal distortion constants and electric dipole moment are tabulated. The observed rotational transitions are presented for the astronomically interesting isotopic forms. Calculated rotational transitions up to 300 GHz are presented for the ground vibrational state of H12C16O16OH, H12C16O16OD, D12C16O16OH and H13C16O16OH. Some observed transitions are also listed for H12C16O18OH and H12C18O16OH. Estimated error limits have been reported for all measured transitions.

703,698
PB80-600004 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Refractive Index of Alkaline Earth Halides and Its Wavelength and Temperature Derivatives.
H. H. Li. c1980,130p
Included in Jnl. of Physical and Chemical Reference Data, v9, n1 p161-290 1980.

Keywords: *Alkaline earth halides, Optical constants, Refractive index, Temperature coefficient of refractive index.

Available data on the refractive index and its temperature derivative for alkaline earth halides were exhaustively surveyed, compiled, and analyzed. The most probable values of the refractive index at 293 K for the transparent region were generated for the materials for which experimental data were sufficiently abundant and reliable. Provisional values were also generated for the wavelength regions where available data were less abundant. Reasonable estimations of refractive index for the very scantily measured materials were made by incorporating the dielectric constants and wavelengths of absorption peaks into a simplified dispersion equation. It was found that of the twenty alkaline earth halides only seven, namely, MgF2, CaF2, SrF2, BaF2, CaCl2, SrCl2, and BaCl2, appear in the open literature with refractie index measurements. Most of the available data are for the first four of the sevent materials. Temperature derivatives of refractive index for most of the alkaline earth halides were unavailable. As a result, data analysis on dn/dT was limited to CaF2, SrF2, and BaF2.

703,699
PB80-600006 Not available in NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluated Kinetic and Photochemical Data for Atmospheric Chemistry.
D. L. Baulch, R. A. Cox, R. F. Hampson, J. A. Kerr, J. Troe, and R. T. Watson. c1980,178p
Included in Jnl. of Physical and Chemical Reference Data, v9, n2 p295-472.

Keywords: *Air pollution, Atmospheric chemistry, Chemical kinetics, Data evaluation, Gas phase, Photoabsorption cross section, Photochemistry, Quantum yield, Rate coefficient.

This paper contains a critical evaluation of the kinetics and photochemistry of gas phase chemical reactions of neutral species involved in middle atmosphere chemistry (10-55 km altitude). The work has been carried out by the authors under the auspices of the CODATA Task Group on Chemical Kinetics. Data sheets have been prepared for 148 thermal and photochemical reactions, containing summaries of the available experimental data with notes giving details of the experimental procedures. For each reaction a preferred value of the rate coefficient at 298 K is given together with a temperature dependency where possible. The selection of the preferred value is discussed, and estimates of the accuracies of the rate coefficients and temperature coefficients have been made for each reaction. The data sheets are intended to provide the basic physical chemical data needed as input for calculations which model atmospheric chemistry. A table summarizing the preferred rate data is provided, together with an Appendix listing the available data on enthalpies of formation of the reactant and product species.

703,700
PB80-600008 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Revised Values of the Osmotic Coefficients and Mean Activity Coefficients of Sodium Nitrate in Water at 25 Degrees C.
Y. C. Wu, and W. J. Hamer.c1980,6p
Included in Jnl. of Physical and Chemical Reference Data, v9, n2 p513-518.

Keywords: *Activity coefficients, Critically evaluated data, Excess Gibbs energy for electrolytes, Osmotic coefficients, Sodium nitrate.

Additional data on the freezing point depression of NaNO3 are taken into consideration to obtain an improved data for the osmotic and activity coefficients of this substance.

703,701
PB80-600010 Not Available NTIS
National Bureau of Standards, Gaithersburg, MD.
Compilation of Kinetic Parameters for the Thermal Degradation of n-Alkane Molecules.
D. L. Allara, and R. Shaw.c1980,38p
Included in Jnl. of Physical and Chemical Reference Data, v9, n3 p523-560.

Keywords: *Addition, Chemical kinetics, Decomposition, Disproportionation, H-transfer, Initiation, Isomerization, N-alkane pyrolysis, Rate constants, Recombination.

A list of serveral hundred free-radical reactions which occur during the low temperature (700-850 K) pyrolysis of small n-alkane molecules has been assembled and a set of reliable, self-consistent Arrhenius rate parameters has been assigned on the basis of experiment, theory, thermochemical estimates and structural analogy. Rate parameters have been recommended for the following types of reactions, with the number of each type in parentheses: initiation (32), recombination (135), disproportionation (108), H-transfer (112), decomposition (41), addition (58), and isomerization (11), giving a total of 505 reactions. This compilation is intended for use in assembling reaction matrices in computational modeling studies of the thermal reactions of hydrocarbon molecules.

703,702
PB80-600012 Not Available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Spectra of Molecules of Astrophysical Interest. XIX. Methyl Cyanide.
D. Boucher, J. Burie, A. Bauer, A. Dubrulle, and J. Demaison.c1980,62p
Included in Jnl. of Physical and Chemical Reference Data, v9, n3 p659-720.

Keywords: *Interstellar molecules, Line strengths, Methyl cyanide, Microwave spectra, Molecular constants, Radio astronomy, Rotational transitions.

The microwave spectrum of methyl cyanide is critically reviewed for information applicable to radio-astronomy. Molecular data such as the derived rotational constants, centrifugal distortion parameters, hyperfind coupling constants, electric dipole moment and molecular structure are tabulated. The observed rotational transitions are presented for the astronomically interesting isotopic forms and the lowest lying vibrational state of methyl cyanide. Calculated rotational transitions are presented for the ground vibrational state of 12CH(3)12C14N, 13CH(3)12C14N, 12CH(3)13C14N, 12CH(3)12C15N, and for the vibrationally excited state v8 of 12CH(3)12C14N.

703,703
PB80-600013 Not Available NTIS
National Bureau of Standards, Gaithersburg, MD.
Review, Evaluation, and Correlation of the Phase Equilibria, Heat of Mixing, and Change in Volume on Mixing for Liquid Mixtures of Methane + Propane.
R. C. Miller, A. J. Kidnay, and M. J. Hiza.c1980,14p
Included in Jnl. of Physical and Chemical Reference Data, v9, n3 p721-734.

Keywords: *Binary mixtures, Data correlation, Excess volumes, Heat of mixing, Liquid-vapor equilibria, Methane + propane.

The available experimental data for liquid-vapor equilibria, heat of mixing, and change in volume on mixing for the methane + propane system have been reviewed and where possible evaluated for consistency. Th derived properties chosen for analysis and correlation were liquid mixture excess Gibbs free energies, Henry's constants, and K values. Data sets, selected on the basis of the consistency tests applied, were correlated as a function of temperature and composition to provide internally consistent sets of property values suitable for engineering design calculations.

703,704
PB80-600014 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Saturation States of Heavy Water.
P. G. Hill, and R. D. C. MacMillan. c1980,16p
Included in Jnl. of Physical and Chemical Reference Data, v9, n3 p735-750

Keywords: *Enthalpy of water, Heavy water, PvT, Saturation states, Thermodynamic properties of water, Vapor pressure, Virial coefficients, Water.

A study has been made of the saturation properties of D2O from the triple point temperature to 325 degree C, in the light of information on the saturation properties of H2O. Saturated liquid volumes have been determined by extrapolation to saturation pressure of reliatively abundant liquid phase data (corrected to 100% D20). Saturated liquid enthalpy has been determined by extrapolation of liquid phase specific heat data, and integration along the saturation line, allowing for the compressibility effect. Saturated vapor volumes have been determined by use of an extended virial equation formulated for H2O and corrected for D2O. Saturated vapor enthalpies have been determined by use of the Clapeyron equation, and compared to vapor enthalpies calculated from the extended virial equation. Saturated liquid and vapor volumes have been extrapolated to the critical temperature to allow an inference of the critical density.

703,705
PB80-600017 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Molten Salts Data as Reference Standards for Density, Surface Tension Viscosity and Electrical Conductance: KNO3 and NaCl.
G. J. Janz. c1980,40p
Included in Jnl. of Physical and Chemical Reference Data, v9, n4 p791-830.

Keywords: *Calibration-quality standards, Density, Electrical conductance, Molten salts, Potassium nitrate, Sodium chloride, Surface tension, Viscosity.

Accuracy estimates for physical property measurements are usually based on somewhat subjective quality judgements, and the difficulties encountered in interpreting accuracy statements in the literature are frequently compounded through lack of details on the methods of measurements, chemical purity, and related experimental aspects. In the present communication we report the results of a Standards Program initiated in 1973 with participating laboratories in Czechoslovakia, German Democratic Republic-DDR, Japan, Norway, Poland, Rumania, and USA. Potassium nitrate (m. 335 deg C) and sodium chloride (m 800 deg C) were selected as the two reference salts for the properties: density, surface tension, viscosity, and electrical conductance. The results of the measurements have been critically examined, and are reported herewith. It has been possible to resolve some of the difficulties encountered in accuracy estimates through this 'round-robin' series of measurements, and up-grade some of the data-sets to calibration-quality reference standards.

703,706
PB80-600018 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Molten Salts: Volume 5, Part 1-Additional Single and Multi-Component Salt Systems. Electrical Conductance, Density, Viscosity, and Surface Tension Data.
G. J. Janz, and R. P. T. Tomkins. c1980,192p
Included in Jnl. of Physical and Chemical Reference Data, v9, n4 p831-1022.

Keywords: *Carbonates, Density, Electrical conductance, Hexafluoraluminates, Metaphosphates, Molten salts, Molybdates, Sulfates, Sulfides, Surface tension, Tungstates, Viscosity.

Data on the electrical conductance, density, viscosity, and surface tension of more than ninety additional multi-component salt systems have been systematically collected and evaluated. Results are given for mixtures over a range of compositions and temperatures. Values of the above properties for some sixty single salt systems are also reported.

703,707
PB80-600023 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Compilation and Evaluation of Solubility Data in the Mercury (I) Chloride-Water System.
Y. Marcus. c1980, 24p
Included in Jnl. of Physical and Chemical Reference Data, v9, n4 1307-1330.

Keywords: *Compilation of Solubility data, Disproportionation of mercury (I), Electromotive force measurements, Mercury (I), Chloride, Solubility, Solubility product, Standard electrode potentials, Standard thermodynamic functions.

The more than one dozen papers dealing with the solubility of mercury (I) chloride in water or in aqueous chloride solutions have been compiled in the format set by the IUPAC Solubility Data Project, and have been evaluated. Mercury (I) chloride dissolves in water, forming the folling species: Hg(OH)2, HgCl2, HgOH(+), in addition to H(+) and Cl(-). In excess chloride solutions it dissolves to give, mainly, HgCl3(-) and HgCl4(2-). Thus, many homogeneous equilibria have to be considered beside the two heterogeneous ones. The papers in which the total solubility (sum of all the mercury containing aqueous species) and the solubility product (derived from e.m.f. data) are reported do not give as accurate and reliable quantities as are obtained from the appropriate standard electrode potentials.

703,708
PB80-600049 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Implantation Predeposition Technique for the Introduction of Deep-Level Chemical Impurities.
D. R. Myers, R. Y. Koyama, and W. E. Phillips. 1980, 6p
Pub. in Rad. Effects 48, p145-150 1980.

Keywords: *Chemical impurities, Deep level studies, Ion implantation, Predeposition technique, Sulful impurities in silicon, Thermally-stimulated measurements.

The characterization of deep-level chemical impurity centers in semiconductors requires the controlled introduction of known impurities. A technique is described which employs ion implantation as a predeposition step for the introduction of deep-level chemical impurities into silicon, yet prevents immplantation-related damage from interfering with the measured deep-level response of the implanted species. The utility and versatility of this method are demonstrated by its application to the characterization of sulfur defect centers in silicon.

703,709
PB80-600058 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Structure and Kinetics of Surface Species.
T. E. Madey, D. W. Goodman, G. B. Fisher, and J. Yates. 1980, 5p
Pub. in Proceedings Fourth Symp. on Fluid/Solid Surface Interactions, Gaithersburg, MD, Oct. 18-20, 1978, p239-243 1980.

Keywords: *Catalysis, Catalytic methanation, Electron stimulated desorption, Surface kinetics, Surface structure.

The ONR-supported research in the Surface Science Division at the National Bureau of Standards has been concentrated in two areas: (a) the characterization of the structure of adsorbed species using the Electron Stimulated Desorption Ion Angular Distribution (ESDIAD) method, and (b) kinetic and spectroscopic studies of surface species, with particular emphasis on molecular species of catalytic interest. Examples from each of these efforts will be discussed.

703,710
PB81-103954 Not available NTIS
National Bureau of Standards, Washington, DC.
Reinvestigation of the Temperature Dependence of the Rate Constant for the Reaction O + O2 + M Yielding O3 + M (for M = O2, N2, and Ar) by the Flash Photolysis Resonance Fluorescence Technique.
Final rept.
O. Klais, P. C. Anderson, and M. J. Kurylo. 1980, 22p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in International Jnl. of Chemical Kinetics 12, p469-490 1980.

Keywords: *Temperature, *Reaction kinetics, *Oxygen, Fluorescence, Nitrogen, Argon, Photolysis, Reprints, *Atom molecule interactions, Flash photolysis.

The flash photolysis resonance fluorescence technique has been used to reinvestigate the kinetics of the oxygen atom-oxygen molecule combination reaction. Third-order rate constants for O2, N2, and Ar as deactivant molecules were determined over the temperature range of 219-368 K. The results presented herein are the most extensive data sets available for atmospheric modeling and are used to formulate a recommendation for such purposes.

703,711
PB81-104341 Not available NTIS
National Bureau of Standards, Washington, DC.
Line Spectra of the Elements.
Final rept.
J. Reader, and C. H. Corliss. 1980, 130p
Pub. in CRC Handbook of Chemistry and Physics, 61st Edition, Section E, General Physical Constants Line Spectra of the Elements, pE-219--E-348 1980.

Keywords: *Line spectra, Tables(Data), Atomic spectra, Reprints.

These tables contain the outstanding spectral lines of neutral (I), singly ionized (II), doubly ionized (III), triply ionized (IV), and quadruply ionized (V) atoms. Listed are lines that appear in emission from the vacuum ultraviolet to the far infrared. For most atoms the lines were selected from much larger lists in such a way as to include the stronger observed lines in each spectral region. In a few cases prominent monoxide band heads are also given. Literature references for each spectrum are collected at the end of the entire set of tables. The wavelengths range from 40 to 40000 A. Many of the intensities represent quantitative estimates of relative line strengths that take account of varying detection sensitivity at different wavelengths. They are on a linear scale. For nearly all of the other lines the intensities represent qualitative estimates of the relative strengths of lines not greatly separated in wavelength.

703,712
PB81-104424 Not available NTIS
National Bureau of Standards, Washington, DC.
Series Formulas for the Spectrum of Atomic Sodium (Na I).
Final rept.
W. C. Martin. Jul 80, 5p
Pub. in Jnl. Opt. Soc. Am., 70 n7 p784-788 Jul 80.

Keywords: *Sodium, *Atomic energy levels, Atomic spectra, Reprints.

The available data on the energy levels of Na I yield Ritz quantum-defect formulas predicting all one-electron (nl) levels with an uncertainty of plus or minus 3s sub 2 S sub 1/2 ground level. Such formulas are given here for the ns through nl series as expressions for the quantum defect delta in inverse even powers of n -- delta sub 0 with delta sub 0 constant for each of nl series. These formulas are usually more convenient for calculations than the formulas in powers of n -- delta and core-polarization formulas given previously. Term differences or quantum defects predicted by the ns through nh formulas are compared with a number of more recent experimental determinations in the range n = 13--41.

703,713
PB81-105074 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Tables of Rate Constants for Gas Phase Chemical Reactions of Sulfur Compounds (1971-1979).
Interim rept.
F. Westley. Jul 80, 61p NBSIR-80-2118

Keywords: *Reaction kinetics, *Sulfur organic compounds, *Sulfur inorganic compounds, Tables(Data), Vapor phases, Chemical reactions, Free radicals.

A table of rate constants for gas phase chemical reactions of sulfur compounds is presented. Specifically, it gives in tabular form the values of the parameters for the modified Arrhenius equation k = AT sup B exp(-E/RT). The table covers the reactions of sulfur containing molecules and free radicals - S, S2, SO, SO2, SO3, S2O, SH, H2S, CS, CS2, COS, CH3S., CH3SH, cy-CH2CH2S, CH3SCH2. and a number of thiols, thioethers and thioesters - with other compounds. The table includes 16 unimolecular, 187 biomolecular, and 11 termolecular reactions totalling 214 district chemical reactions. There are 348 distinct entries, distributed as follows: 26 for first order reactions, 294 for second order reactions and 28 for third order reactions. The kinetic data were compiled from 109 experimental papers and 6 critical reviews published between 1970 and 1979.

703,714
PB81-106551
(Order as PB81-106536, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Polymer in a Cone - A Model for the Surface Free Energy of Polymer Crystal with Emergent Cilia,
C. M. Guttman, E. A. DiMarzio, and J. D. Hoffman.
12 Mar 80, 11p
Included in Jnl. of Research of the National Bureau of Standards, v85 n4 p273-282 Jul-Aug 80.

Keywords: *Polymers, *Surface energy, *Mathematical models, Crystals, *Molecular configurations.

A model is proposed to estimate the surface free energy of a small polymer crystal with numerous emergent cilia. For such a model the partition function of a polymr constrained to remain in a cone is computed. The partition function of the polymer in a cone is found to behave similarly to the polymer in a wedge discussed by Lauritzen and DiMarzio. The estimated end surface free energy per unit area for the small extended chain crystal is found to increase with increasing area, implying the presence of cumulative surface stress in such crystals. The forces between the cilia are reduced if folds are inserted in the surface.

703,715
PB81-110637 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectrum and Energy Levels of Triply Ionized Zirconium (Zr IV).
Final rept.
N. Acquista, and J. Reader. Jul 80, 3p
Pub. in Jnl. Opt. Soc. Am. 70, n7 p789-791 Jul 80.

Keywords: *Ultraviolet spectra, Atomic energy levels, Atomic spectra, Zirconium, Reprints, *Zirconium ions.

The spectrum of Zr(IV) was observed with a sliding spark in the region from 440 to 2670 A on the 10.7-m normal- and grazing-incidence spectrographs at NBS. About 30 new lines were observed. The level system (RbI isoelectronic system, 4p(6)nl was extended to include the series ns (n = 5-8), np (n = 5-7), nd(n = 4-6), nf (n = 4-6), and ng (n - 5-9). The nf series exhibits irregular fine-structure splittings and quantum defects. The ionization energy was determined from the ng series to be 277605.8 + or - 1.5/cm (34.4190 + or - 0.0002 eV). New wavelengths were determined for the 4s(2)4p(5)-4s4p(6) transitions of Zr(VI).

703,716
PB81-110660 Not available NTIS
National Bureau of Standards, Washington, DC.
Equilibrium and Non-Equilibrium Radial Distribution Functions in Mixtures.
Final rept.
H. J. M. Hanley, and D. J. Evans. 1980, 4p
Pub. in Molecular Physics 39, n4 p1039-1042 1980.

Keywords: *Mixtures, Reprints, *Radial distribution analysis, *Conformal solution theory.

The equilibrium and nonequilibrium radial distribution functions of a binary 50 percent mixture of soft spheres have been estimated using nonequilibrium molecular dynamics on a system of 108 particles. The variation of the functions with size and mass difference of the particles is discussed. It is remarked that this study provides a direct test of conformal solution theory.

703,717
PB81-110678 Not available NTIS
National Bureau of Standards, Washington, DC.
Orthobaric Liquid Densities and Excess Volumes for Multicomponent Mixtures of Low Molar-Mass Alkanes and Nitrogen between 105 and 125 Ka.
Final rept.
M. J. Hiza, and W. M. Haynes. 1980, 10p
Pub. in Jnl. Chem. Thermodynamics 12, n1 p1-10 1980.

Keywords: *Density(Mass/volume), *Liquefied natural gas, *Liquid phases, Chemical composition, Mixtures, Binary systems, Mathematical models, Laboratory equipment, Comparison, Vapor pressures, Tempera-

ture, Alkanes, Nitrogen, Methane, Ethane, Propane, Butanes, Reprints.

A magnetic suspension densimeter has been used to determine orthobaric liquid densities of gravimetrically prepared multicomponent mixtures containing the major components of liquefied natural gas, i.e. nitrogen, methane, ethane, propane, isobutane, and normal butane, between 105 and 125 K. These results were obtained to provide a test of the capability of mathematical models to predict the densities of liquefied natural-gas mixtures. Combinations of the subject components were chosen to provide the most severe test of the models and the possibility of using the measured densities to optimize parameters of the models. Deviations are given between the experimental densities for each mixture and values predicted with an extended corresponding-states model optimized to binary-mixture and pure-component orthobaric liquid densities obtained with the same apparatus. Uncertainties of the present results are discussed in relation to the experimental technique, the knowledge of the compositions of the liquid mixtures, and the comparisons between the experimenal and predicted results. Approximate total vapor pressures are also given for each mixture at the temperatures studied.

703,718
PB81-112377 Not available NTIS
National Bureau of Standards, Washington, DC.
Angle-Resolved Photon-Stimulated Desorption of Oxygen Ions from a W(111) Surface.
Final rept.
T. E. Madey, R. L. Stockbauer, J. F. van der Veen, and D. E. Eastman. 1980, 4p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Phys. Rev. Lett. 45, n3 p187-190, 21 Jul 80.

Keywords: *Desorption, *Tungsten, Oxygen, Surfaces, Chemisorption, Reprints, *Oxygen ions.

A definitive determination of angle-resolved photon-stimulated desorption of ions from a well-characterized adsorbate, and a direct comparison with electron-stimulated desorption are reported. Ion angular distributions, energy distributions, and photon excitation spectra for O(+) desorption from W(111) have been measured for oxygen coverages ranging from a fractional monolayer to a multilayer oxide.

703,719
PB81-113680 PC **A99**/MF **A01**
Notre Dame Univ., IN. Radiation Chemistry Data Center.
Biweekly List of Papers on Radiation Chemistry and Photochemistry. Annual Cumulation with Keyword and Author Indexes, Volume 12, 1979.
A. B. Ross. Dec 79, 748p
See also Volume 11 dated 1978, PB-299 368. Sponsored in part by National Bureau of Standards, Washington, DC., and Department of Energy, Washington, DC.Portions of this document are not fully legible.

Keywords: *Chemistry, *Bibliographies, Radiation chemistry, Indexes(Documentation), Subject index terms, Reaction kinetics, Optical spectra, Polymers, Thermodynamics, Electron spin resonance, Excitation, Energy levels, Photochemistry.

This document is the annual edited cumulative list of references to the published literature on radiation chemistry, photochemistry, and related fields. References are drawn from 55 journals published throughout the world. The list is generated from the Biweekly List of Papers on Radiation Chemistry and Photochemistry and contains the literature references and an author and subject index. The publications represents one of the continuing data activities of the Radiation Chemistry Data Center (RCDC) at the University of Notre Dame. Volume 12 also contains a 90-page 'Thesaurus for Radiation Chemistry' which lists indexing terms which make up the group of keywords used in the RCDC computer-readable bibliographic data base.

703,720
PB81-116782 Not available NTIS
National Bureau of Standards, Washington, DC.
Wavelengths and Energy Levels of Quadruply Ionized Magnesium (Mg v).
Final rept.
V. Kaufman, and M. C. Artru. Sep 80, 5p
Pub. in Jnl. Opt. Soc. Am. 70, n9 -1135-1139 Sep 80.

Keywords: *Molecular energy levels, Ions, Magnesium, Ultraviolet spectroscopy, Reprints, *Magnesium ions.

The spectrum of Mg(+4) was observed between 95 and 400 A. New wavelengths result in revised-energy level values and some resolved term structure. Parametric calculations with configuration interaction were made for the 2s 2 quintuplet p,2 doublet s 2 triplet p 3s, and 2 doublet s 2 triplet p 3d configurations. These support rejection of some levels and some new identifications.

703,721
PB81-116964 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Inelastic Scattering Study of C2H4 Adsorbed on Raney Nickel.
R. D. Kelley, R. R. Cavanagh, J. J. Rush, and T. E. Madey. 1980, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Surface Science 97, pL335-L338 1980.

Keywords: *Ethylene, *Surface chemistry, *Chemisorption, Catalysts, Inelastic scattering, Neutron scattering, Vibrational spectra, Reprints, *Raney nickel catalysts.

The authors report here the use of neutron inelastic scattering (NIS) in a study of the chemisorption of ethylene on a high area Raney Ni catalyst. In this preliminary account, a reduced Raney Ni sample was exposed to C2H4 at 143K, warmed to 300K, and subsequently cooled to 77K for the measurement of the vibrational loss spectrum.

703,722
PB81-116972 Not available NTIS
National Bureau of Standards, Washington, DC.
What's Special About Transition Metals in Alloy Phase Formation.
Final rept.
R. E. Watson, and L. H. Bennett. Jun 80, 26p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the Symposium of the AIME Annual Meeting (108th) Held at New Orleans, LA. on Feb 19-20,1979, Paper in Theory of Alloy Phase Formation, p425-450 Jun 80.

Keywords: *Transition metals, *Molecular energy levels, *Alloys, Hybridization, Coulomb interactions, Mossbauer effect, Phase transformations, Chemical shifts(Nuclear magnetic resonance).

The d-electrons are, of course, special, though their bonding properties remain to be completely understood. It has been recognized, since the work of the Friedel school, that d band broadening is the dominant term contributing to transition metal cohesion. Similarly, it is generally recognized that in compound formation between transition-metals and polyvalent metals, hybridization between d-bands and polyvalent atom p bands is of energetic significance (for example there is such a term in Miedema's scheme). What is less generally realized is that d-band hybridization leads to changes in d-electron counts at a transition metal site which are opposite in sign to the net charge transfer on or off the site. In this paper the authors review the 'renormalized atom' picture of cohesion of the pure transition metals and consider the experimental evidence and the theoretical understanding of d charge transfer going the 'wrong way'. A picture of the electronegativity of transition metals based on this trend developed. Charge transfer associated with equalizing the local chemical potentials in alloys is estimated. The implications of the experimental charge transfer information from Mossbauer isomer shifts to model alloy calculations and to the strength of the Coulomb energy associated with charge transfer is considered.

703,723
PB81-118465 Not available NTIS
National Bureau of Standards, Washington, DC.
Wavelength and Vibrational-State Dependence of Photoelectron Angular Distributions. Resonance Effects in 5 sigma Photoionization of CO.
Final rept.
B. E. Cole, D. L. Ederer, R. Stockbauer, K. Codling, A. C. Parr, J. B. West, E. D. Poliakoff, and J. L. Dehmer. Jun 80, 3p
Pub. in Jnl. Chem. Phys. 72, n11 p6308-6310 Jun 80.

Keywords: *Carbon monoxide, *Angular distribution, Vibrational spectra, Photoelectric emission, Photoionization, Reprints, Autoionization.

Vibrationally resolved photoelectron angular distributions are reported for the 5 sigma channel of CO. The wavelength dependence of the angular distributions of the first four vibrational levels were obtained at 0.5 eV intervals over a photon energy range of 16 to 26 eV. The instrument used monochromatized from the light NBS synchrotron storage ring (SURF) to photoionize CO molecules in the gas phase. The photoelectron angular distributions were measured by rotating a spherical analyzer. The variation in the angular distributions of the different vibrational states as a function of photon energy is interpreted as arising from autoionization in the low energy range and from shape resonance effects in the high energy range.

703,724
PB81-118499 Not available NTIS
National Bureau of Standards, Washington, DC.
Additions to the Analysis of Al VI.
Final rept.
M. C. Artru, and V. Kaufman. Sep 80, 6p
Pub. in Jnl. Opt. Soc. Am. 70, n9 -1130-1135 Sep 80.

Keywords: *Molecular energy levels, Ions, Aluminum, Sodium, Reprints, *Aluminum ions.

The spectrum of five-times ionized aluminum was investigated in the 85-113 A and 100-1500 A wavelength regions. New energy levels were found in the 2 doublet s 2 triplet p3s 3p, and 3d configurations. Parametric calculations were made for the 2 doublet s 2 triplet p 3p configuration. They were also done for the interacting 2 doublet s 2 triplet p 3s, and 2 doublet s 2 triplet p 3d configurations in both Na IV and Al VI. The results are compared with similar calculations in Mg V.

703,725
PB81-120487 Not available NTIS
National Bureau of Standards, Washington, DC.
Shape-Resonance-Induced Non-Franck-Condon Vibrational Intensities in 3 sigma (g) Photoionisation of N2.
Final rept.
J. B. West, A. C. Parr, B. E. Cole, D. L. Ederer, R. Stockbauer, and J. L. Dehmer. 1980, 4p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics, Letter to the Editor 13, pL105-L108 1980.

Keywords: *Nitrogen, *Photochemistry, *Ionization, *Molecular vibration, Band spectra, Intensity, Molecular properties, Reprints, Franck Condon principle.

The authors report a broad pattern of non-Franck-Condon vibrational intensities extending over about 25 eV of the 3 sigma (g) photoionization continuum of N2. The effect was recently predicted theoretically to arise from shape-resonance-enhanced coupling between electronic and nuclear motion. Here experiment and theory are directly compared for the first time. Qualitative agreement verifies the basic theoretical concept, yet significant quantitative differences indicate the need for further work.

703,726
PB81-120537 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoelectron-Photoion Coincidence Study of the Bromobenzene Ion.
Final rept.
H. M. Rosenstock, R. Stockbauer, and A. C. Parr. Jul 80, 5p
Pub. in Jnl. of Chemical Physics 73, n2 p773-777, 15 Jul 80.

Keywords: *Mass spectroscopy, Ionization, Photochemical reactions, Reaction kinetics, Ions, Reprints, *Benzene/bromo.

The technique of variable time photoelectron-photoion coincidence mass spectrometry has been applied to the fragmentation of bromobenzene ion producing a phenyl ion. A detailed analysis of the variation of the breakdown curve with parent ion residence time was performed.

703,727
PB81-120628 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectra of Mo XIII-XVIII from a Laser-Produced Plasma and a Low-Inductance Vacuum Spark.
P. G. Burkhalter, J. Reader, and R. D. Cowan. Aug 80, 8p
Sponsored in part by Department of Energy, Washington, DC. See also report dated Nov 77, PB-276 208.

Pub. in Jnl. of Optical Society of America 70, n8 p912-919 Aug 80.

Keywords: *Molybdenum, Molecular energy levels, Line spectra, Ultraviolet spectroscopy, Hartree-Fock approximation, Reprints, Laser produced plasmas, Numerical solution.

The spectrum of Mo from 20 to 90 A was obtained with a laser-produced plasma and low-inductance vacuum spark. Wavelengths and line identifications were determined for transitions of the type 3d-4p and 3d-4f in Mo XIII-XVI and for 3p-3d type transitions in Mo XVI-XVIII. The line identifications were obtained with the aid of relativistically corrected Hartree-Fock calculations.

703,728
PB81-121030 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectra of Very Highly Charged Cu- and Zn-Like Ions.
Final rept.
J. Reader, and G. Luther. Aug 80, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review Letters 45, n8 p609-613, 25 Aug 80.

Keywords: *Atomic energy levels, *ULtraviolet spectroscopy, Ions, Line spectra, Reprints, *Copper ions, *Zinc ions, Laser produced plasmas.

The 4s-4p, 4p-4d, and 4d-4f transitions of ten copperlike and zinclike ions from Ba(+26) to W(+45) have been observed by means of a laser-produced plasma and a 2.2-m grazing-incidence spectrograph. The spectra are accompanied by a prominent continuum lying just below the 4p doublet P(1/2) - 4d doublet D(3/2) transitions in the copperlike ions. The results support the identification of the resonance lines of Xe(+24) and Xe(+25) in the Princeton University ST tokamak by Hinnov.

703,729
PB81-121519 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Chemically Assisted Fracture Part 2 Atomic Models of Crack Growth.
Final rept.
E. R. Fuller, and R. Thomson. 1980, 8p
Pub. in Jnl. of Material Science 15, p1027-1034 1980.

Keywords: *Diatomic molecules, *Crack growth, *Mathematical models, Fracture, Surface chemistry, Reprints.

In this concluding paper of a two-paper series, the author has applied the one-dimensional model of a crack to the problem of the simple form of chemically assisted fracture when the external atmosphere is composed of diatomic molecules. Predictions of the stress dependence can be made on the basis of this model which show a power law dependence whose exponent varies from 3/2 to 2 depending on the form of the atomic bonds of the solid. General conclusions are that chemical activity accentuates and extends the intrinsic slow crack growth phenomenon because of the surface adsorption activation barrier, and that the 'chemical' and 'mechanical' contributions to the activation energy for slow crack growth are not separable.

703,730
PB81-123655 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystal Structure of the Cation-Disordered Phase (Tl0.75Pb0.25)4Cl5,
P. M. Skarstad, C. R. Hubbard, R. S. Roth, and H. S. Parker. Oct 79, 14p
Sponsored in part by National Research Council, Washington, DC.
Pub. in Jnl. of Solid State Chemistry 30, n1 p65-78 Oct 79.

Keywords: *Crystal structure, *Cations, Lead inorganic compounds, Optical materials, Reprints, *Thalium lead chloride.

The 3:1 compound in the TlCl-PbCl2 system crystallizes in the noncentrosymmetric space group P4(1)2(1)2 (D sub 4 sup 4) or its enantiomorph P4(3)2(1)2 (D sub 4 sup 6). Lattice constants are a = 8.450(1)A and c = 14.972(1)A. In the structure the twelve Tl(I) and four Pb(II) ions are disordered over two eightfold sites. The formula is therefore appropriately written as (Tl(0.75)Pb(0.25))4Cl5. Although the distribution cations over the two sites was not determined, a difference in size of the two positions suggests a preferential concentration of Pb(II) in the smaller site. Because (Tl(0.75)Pb(0.25)4Cl5 is both highly dense and noncentrosymmetric it may be of interest for nonlinear optics applications.

703,731
PB81-125809 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Interactive Fortran IV Computer Programs for the Thermodynamic and Transport Properties of Selected Cryogens (Fluids Pack).
Technical note.
R. D. McCarty. Oct 80, 116p NBS-TN-1025
Sponsored in part by National Aeronautics and Space Administration, Houston, TX. Lyndon B. Johnson Space Center.

Keywords: *Cryogens, *Thermodynamic properties, *Transport properties, Fortran, Computer programs, Hydrogen, Helium, Neon, Nitrogen, Oxygen, Argon, Methane, Enthalpy, Entropy, Equations of state, Density(Mass/volume), Specific heat, Numerical solution.

The thermodynamic and transport properties of selected cryogens have been programmed into a series of computer routines. Input variables are any two of P, rho or T in the single phase regions and either P or T for the saturated liquid or vapor state. The output is pressure, density, temperature, entropy, enthalpy for all of the fluids and in most cases specific heat capacity and speed of sound. Viscosity and thermal conductivity are also given for most of the fluids. The programs are designed for access by remote terminal; howeve, they have been written in a modular form to allow the user to select either specific fluids or specific properties for particular needs. The program includes properties for hydrogen, helium, neon, nitrogen, oxygen, argon, and methane. The programs include properties for gaseous and liquid states usually from the triple point to some upper limit of pressure and temperature which varies from fluid to fluid. Computer listings of the Fortran four codings are presented. Copies of the programs may be obtained from either the Thermophysical Properties Division of the National Bureau of Standards at Boulder, Colorado, or from Walter Scott at the NASA-Johnson Space Center in Houston, Texas.

703,732
PB81-125833 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Bibliography on Atomic Energy Levels and Spectra.
Interim rept. Jul 75-Jun 79.
R. Zalubas, and A. Albright. Oct 80, 124p NBS/SP-363-SUPPL-2
Errata sheet inserted. See also report dated Jan 77, PB-263 199. Library of Congress catalog card no. 80-600055.

Keywords: *Atomic energy levels, *Atomic spectra, *Bibliographies, Atoms, Ions, Spectral lines, Wavelengths, Zeeman effect, Hyperfine structure, Ionization potentials, Isotope effect, Tables(Data).

This is the second supplement to NBS Special Publication 363, Bibliography on Atomic Energy Levels and Spectra, July 1968 through June 1971. Supplement 1 covered the period from July 1971 through June 1975, and this bibliography covers the literature from July 1975 through June 1979. It contains approximately 1200 references classified by subject for individual atoms and atomic ions. A number index identifies the references. An author index is included. References included contain data on energy levels, classified lines, wavelengths, Zeeman effect, Stark effect, hyperfine structure, isotope shift, ionization potentials, or theory which gives results for specific atoms or atomic ions.

703,733
PB81-126070 Not available NTIS
National Bureau of Standards, Washington, DC.
Calculations of Electron Beam Spreading in Composite Thin Foil Targets.
D. E. Newbury, and R. L. Myklebust. 1980, 3p
Pub. in Proceedings of Annual Conference of the Microbeam Analysis Society (1980), Reno, NV., August 4-8, 1980, Paper in Microbeam Analysis, p173-175 1980.

Keywords: *Electron beams, *Composites, Spreading, Electron scattering, Monte Carlo method, Error analysis, *Beam foil spectroscopy, *Matrix technique, Numerical solution.

Electron beam spreading limits the spatial resolution of analysis in thin foils by analytical electron microscopy. The interpretation of recent experimental evidence which suggests that beam spreading is not as severe as previously predicted by electron scattering models is shown to be in error. The experiment in question involved measurement of a thin slab of material in a matrix. Adaptation of a simple model for scattering to this specimen configuration gives a closer agreement to the observed experimental signal profiles. Exact calculations of the configuration with a Monte Carlo electron trajectory simulation give close agreement with the experimental profiles. It is further demonstrated that beam spreading can produce errors of a factor of two or more in the apparent concentration when the object of interest is smaller than the interaction volume.

703,734
PB81-126096 Not available NTIS
National Bureau of Standards, Washington, DC.
Quantum Yield of Silicon in the Visible,
J. Geist, and E. F. Zalewski. Oct 79, 4p
Pub. in Applied Physics Letters 35, n7 p503-506 Oct 79.

Keywords: *Silicon, *Photodectors, Quantum efficiency, Photoconductivity, Visible spectrum, Reprints.

Extremely high accuracy measurements of the internal quantum efficiency of shallow-junction silicon photodetectors were fit with various theoretical models.

703,735
PB81-126120 Not available NTIS
National Bureau of Standards, Washington, DC.
Low Reynolds Number Fluid Flow Induced by Settling Aerosol and Detected by the Particle Doppler Shift Spectrometer.
R. A. Fletcher, D. S. Bright, and I. Chabay. 1980, 4p
Pub. in Jnl. Physical Chemistry 84, n12 p1611-1614 1980.

Keywords: *Particle size, *Aerosols, *Doppler effect, *Fluid flow, *Reynolds number, Velocity, Spectrometers, Reprints.

The generation of uniform fluid flow by gravitationally settling 5-15 micrometers diameter aerosol has been observed. The magnitude of the flow phenomena is derived from measurements of the particle settling velocities using the optical particle Doppler shift spectrometer (PDSS) which can determine particle velocity and size with high accuracy due to the inherent internal calibration characteristic of the instrument. The fluid flow velocity is dependent on the particle number concentration. Experimental evidence verifying the flow pattern is presented.

703,736
PB81-126138 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Experimental Problems in the Raman Analysis of Microsamples.
J. J. Blaha, and E. S. Etz. 1980, 2p
Pub. in Proceedings of the Microbeam Analysis Society Conference (15th), San Francisco, CA., August 4-8, 1980, Paper in Microbeam Analysis, p183-184 1980.

Keywords: *Raman spectroscopy, Samples, Microanalysis.

The Raman microprobe, developed at the National Bureau of Standards, has been shown to be an effective tool for the analysis of microsamples. Some of the more common problems in analyzing samples arise from excessive heating of the sample when the laser beam is absorbed and the sample is not able to dissipate the excess energy. Common methods of circumventing these problems are to decrease the laser power in the sample or change the frequency of the exciting laser beam. These are not always successful. Chemical reactions of microsamples, especially with water vapor, also complicate the analysis. In these cases, special sample handling is necessary. A number of other techniques have been utilized to protect samples from adverse effects of the measurement process. These are expected to aid in further analyses of microsamples.

703,737
PB81-126153 Not available NTIS
National Bureau of Standards, Washington, DC.
Statistical Thermodynamics of Bulk and Surface Properties of Polymer Mixtures.
I. C. Sanchez. 1980, 25p
Pub. in Jnl. Macromol. Sci.-Phys. B17, n3 p565-589 1980.

Keywords: *Thermodynamics, *Surface chemistry, *Polymers, Mixtures, Solutions, Stability, Equations of state, Binary systems, Reprints.

A generalized version of the lattice fluid theory of solutions is considered. Necessary and sufficient conditions for phase stability in a binary mixture are defined by a spinodal inequality. From the general properties of the spinodal, the necessary conditions for polymer/polymer miscibility and bimodal behavior of the spinodal are defined. A general theory of interfacial tension in phase separated multi-component mixtures is formulated. The interfacial tension theory can be combined with lattice fluid theory to obtain a unified theory of bulk and interfacial properties.

703,738
PB81-126161 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Tension Theory of Pure Liquids and Polymer Melts.
C. I. Poser, and I. C. Sanchez. May 79, 10p
Pub. in Jnl. Colloid Interface Science 69, n3 p539-548 May 79.

Keywords: *Interfacial tension, *Liquids, *Polymers, *Melts, *Entropy, Molecular weight, Density(Mass/volume), Reprints, Numerical solution.

Using the lattice fluid model in conjunction with the Cahn-Hilliard theory of inhomogeneous systems, an accurate method has been developed for calculating the surface tension of nonpolar and slightly polar liquids of arbitrary molecular weight. For low molecular weight liquids, the surface tension can be computed from the triple point to 0.7 of the gas-liquid critical temperature with an error of less than 5%. The theory is somewhat less accurate for polymer melts because it tends to overestimate the surface entropy. The molecular weight dependence of the surface tension and entropy is closely related to the dependence of liquid density on molecular weight.

703,739
PB81-126187 Not available NTIS
National Bureau of Standards, Washington, DC.
Lowest Laser-Raman Active Accordion (ALR) Type Oscillations in Crystalline Polymers,
A. Peterlin. 1979, 5p
Pub. in Jnl. Mater. Sci. 14, p2994-2998 1979.

Keywords: *Raman spectroscopy, *Polymers, *Crystals, Reprints, *Laser spectroscopy.

The longitudinal accordion-type mode (LAM) frequencies of crystals of linear polymers with the chains perpendicular to the lamella surface are imagined as corresponding to the longitudinal eigenfrequencies of an ideally elastic rod of length D having the maximum amplitude at its ends.

703,740
PB81-126195 Not available NTIS
National Bureau of Standards, Washington, DC.
Configurational Properties of Star-Branched Polymers.
J. Mazur, and F. McCrackin. 1977, 7p
Pub. in Macromolecules 10, n2 p326-332 Mar-Apr 77.

Keywords: *Polymers, Gyration, Solvents, Reprints, *Molecular configuration, *Branched polymers, Numerical solution.

Mean-square radii of gyration were computed for star-branched polymers simulated by a lattice model that incorporated both excluded volume and attractive energies between nonbonded segments of the polymer. The ratios, g, of the radius of gyration of a star polymer to that of a linear polymer of the same molecular weight were 6 to 15% (for star polymers of 3 to 9 branches) greater at the theta point than the corresponding ratios calculated by the unrestricted random-walk model of the polymer. The g ratios were smaller in good solvents than in theta solvents. The expansion factors, the ratios of the radius of gyration of a molecule in a good solvent to its radius of gyration in a theta solvent, were also calculated. The expansion factor decreased with the degree of branching, which is at variance with perturbation theory applied to the random walk model of star-branched polymers.

703,741
PB81-126211 Not available NTIS
National Bureau of Standards, Washington, DC.
Adsorption of a Polyfunctional Surface-Active Amine Accelerator on Hydroxyapatite.
D. N. Misra, R. L. Bowen, J. M. Antonucci, and W. F. Cuthrell. Sep 79, 8p
Pub. in Jnl. Colloid Interface Science 77, n1 p143-150 Sep 79.

Keywords: *Chemisorption, *Amines, *Surface chemistry, Adsorption, Polymerization, Reprints, *Hydroxylapatite.

Adsorption of a polyfunctional surface-active amine polymerization accelerator ('PolySAM-1') from chloroform solutions on synthetic hydroxyapatite is exhaustive and completely irreversible from very dilute solutions. The adsorption is irreversible until the formation of a 'monomolecular layer,' at which point the additional adsorption is reversible. At relatively low equilibrium concentrations the adsorption is not exhaustive and the isotherm is linear. Adsorption isotherms of the adsorbate which is reversibly bound and of the adsorbate on a hydroxyapatite sample containing a preadsorbed monolayer of the same are identical and follow the Langmuir plot. Evidence shows that the irreversibly adsorbed material is probably chemisorbed. The tensile strength of a polymer, filled with synthetic hydroxyapatite having an adsorbed monolayer of PolySAM-1, did not exceed that of the polymer filled with untreated apatite for any of the polymerization-initiating systems that were studied. This implies that tertiary aromatic amine accelerators of this type do not form free radical sites capable of initiating or terminating significant graft polymerization under these conditions after their reaction with benzoyl peroxide.

703,742
PB81-126229 Not available NTIS
National Bureau of Standards, Washington, DC.
Instrumental Effects on Quantitative Analysis by Secondary Ion Mass Spectrometry.
D. E. Newbury. 1979, 5p
Pub. in Proceedings of the Int. Symp. on Secondary Ion Mass Spectrometry (2nd) Held at Stanford University, Stanford, CA. on 27-30 Aug 79, Paper in Secondary Ion Mass Spectrometry, p53-57 1979.

Keywords: *Quantitative analysis, *Error analysis, Laboratory equilibrium, Mathematical models, Samples, Performance evaluation, *Secondary ion mass spectroscopy, Local thermodynamic equilibrium.

Quantitative analysis procedures for secondary ion mass spectrometry (SIMS) have been primarily designed to correct for the strong matrix effects on secondary ion intensities. Experimental results obtained on glass samples by 22 different SIMS instruments reveal the existance of strong instrumental effects on relative secondary ion signals. Instrumental discrimination against high atomic number elements is not compensated in an existing quantitation procedure based on the local thermal equilibrium model.

703,743
PB81-126252 Not available NTIS
National Bureau of Standards, Washington, DC.
Raman Scattering from Finite Polytetrafluoroethylene Chains and a Highly Oriented TFE-HFP Copolymer Monofilament.
J. F. Rabolt, and B. Fanconi. 1978, 6p
Pub. in Macromolecules 11, n4 p740-745 Jul-Aug 78.

Keywords: *Raman spectroscopy, Copolymers, Band spectra, Reprints, *Ethylene/tetrafluoro, *Propylene/hexafluoro.

Raman polarization studies on a highly oriented tetrafluoroethylene-hexafluoropropylene (TFE-HFP) copolymer have been used to make band assignments for the PTFE homopolymer.

703,744
PB81-126294 Not available NTIS
National Bureau of Standards, Washington, DC.
Oxidation-Reduction Reactions of CeMO4+X (M=Ta or Nb) Phases.
T. Negas, R. S. Roth, C. L. McDaniel, H. S. Parker, and C. D. Olson. 1976, 10p
Pub. in Proceedings of the Rare Earth Research Conference (12th) Held at Vail, CO. on 18-22 Jul 76, Session J-T, p747-756 1976.

Keywords: *Oxidation reduction reactions, Cerium compounds, X ray diffraction, Crystal growth, Thermogravimetry, Low temperature tests, *Cerium niobates, *Cerium tantalates.

Phase equilibrium methods, single crystal and powder x-ray diffraction analyses, thermogravimetric analysis and magnetic susceptibility measurements were utilized to define subsolidus phase relations in air for the systems cerium oxide - Ta2O5 and cerium oxide - Nb2O5.

703,745
PB81-126336 Not available NTIS
National Bureau of Standards, Washington, DC.
Impact of Instrumental Sensitivity Variations on Analysis with the Local Thermal Equilibrium Model in Secondary Ion Mass Spectrometry,
D. E. Newbury. 1980, 2p
Pub. in Electron. Micros. 1980, 3, p212-213 1980.

Keywords: *Error analysis, Mathematical models, Reprints, *Local thermodynamic equilibrium, *Secondary ion mass spectroscopy.

Errors in quantitative analysis with the local thermal equilibrium model in secondary ion mass spectrometry have been attributed in the past to failure of the physical model or a lack of accurate input parameters. Experimental evidence suggests that instrumental discrimination has a great deal of influence on the errors observed in the analysis of heavy elements. A strong correlation is found between the relative elemental sensitivity factor and the error factor from LTE analysis.

703,746
PB81-130163 Not available NTIS
National Bureau of Standards, Washington, DC.
Solution Properties of Polymers.
A. Peterlin. 1978, 23p
Pub. in Contemporary Topics in Polymer Science 1, p209-231 1978.

Keywords: *Polymers, *Intrinsic viscosity, Plastic deformation, Crystals, Reprints.

This thesis work was concerned with the intrinsic viscosity of a suspension of rigid spheroids with symmetry axis a1 and perpendicular axis 8(2).

703,747
PB81-132599 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystal Chemistry of Cerium Titanates, Tantalates and Niobates.
R. S. Roth, T. Negas, H. S. Parker, D. B. Minor, and C. Jones. 1976, 10p
Pub. in Proceedings of the Rare Earth Research Conference (12th) Held at Vail, CO. on July 18-22, 1976, Session J-T, p605-614 1976.

Keywords: *Crystallography, Cerium compounds, Oxidation, *Cerium titanates, *Cerium tantalates, *Cerium niobates.

The crystal chemistry and extent of oxidation of cerium titanates, tantalates, and niobates have been studied as a function of their solid solution formation with corresponding lanthanum, praseodymium and neodymium compounds.

703,748
PB81-132615 Not available NTIS
National Bureau of Standards, Washington, DC.
Plastic Deformation of Crystalline Polymers.
A. Peterlin. Mar 77, 11p
Pub. in Polymer Engineering and Science 17, n3 p183-193 Mar 77.

Keywords: *Polymers, *Crystals, *Plastic deformation, Crystal structure, Reprints.

Under uniaxial tensile load the plastic deformation of unoriented crystalline polymers first transforms the lamellae into fibrous structure. The drawing of polymers with liquid crystals structure with very few chain folds

and an exceptionally high elastic modulus and strength. But the axial connection of individual highly oriented and ordered domains is effected by a relatively small fraction of tie molecules which is responsible for the reduction of elastic modulus below the value of ideal crystal lattice.

703,749
PB81-132631 Not available NTIS
National Bureau of Standards, Washington, DC.
(13)C NMR Rotating Frame Relaxation in a Solid with Strongly Coupled Protons: Polyethylene.
D. L. VanderHart, and A. N. Garroway. Oct 79, 15p
Pub. in Jnl. of Chemical Physics 71, n7 p2773-2787, 1 Oct 79.

Keywords: *Polyethylene, *Nuclear magnetic resonance, *Molecular relaxation, Dipoles, Protons, Reprints, *Carbon 13.

The validity of interpreting measured rotating frame relaxation times, T(1 rho)sup C in terms of molecular motion is investigated for crystalline, oriented, linear polyethylene (PE) as a representative rigid organic solid with reasonably strong dipolar couplings.

703,750
PB81-133357 Not available NTIS
National Bureau of Standards, Washington, DC.
Piezo- and Pyroelectric Properties.
M. G. Broadhurst, and G. T. Davis. 1979, 32p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Chapter 5 in Topics in Applied Physics 33, p285-319 1979.

Keywords: *Polymers, *Piezoelectricity, *Pyroelectricity, Electric fields, Crystals, Dipole moments, Reprints.

Some polymers can be made both piezo- and pyroelectric by suitable application of a large electric field. This effect is true piezo- and pyroelectricity rather than electrostriction, conduction, electromechanical effects, or the motion of conductors in the field of space charges. Some of the models presented here were developed along with the writing and were used as a framework for the presentation in order to make the chapter more coherent. It is hoped that these ideas, some largely untested, will provide direction and stimulation for further work in this field.

703,751
PB81-133423 Not available NTIS
National Bureau of Standards, Washington, DC.
Degradation Kinetics Applied to Lifetime Predictions of Polymers.
J. H. Flynn. Jul 80, 3p
Sponsored in part by Naval Air Systems Command, Washington, DC., and Office of Naval Research, Washington, DC.
Pub. in Polymer Engineering and Science 20, n10 p675-677 Jul 80.

Keywords: *Polymers, *Reaction kinetics, *Degradation, Temperature, Durability, Aging tests(Materials), Reprints.

The prediction of the lifetime of a polymer by extrapolation from weight-loss data requires a thorough analysis of degradation kinetics over a wide temperature range. Techniques are described in which entire kinetic spectra are compared among experiments performed at heating rates from 6 deg/min to 9 deg/day. These comparisons permit diagnosing shifts in reaction mechanism, uncoupling of competing processes and more reliably predicting the rate-limiting process at service conditions. These techniques and a method for obtaining initial kinetic parameters are illustrated for several polymers.

703,752
PB81-133449 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Effects on the Infrared Spectrum of Chemisorbed CO.
P. R. Antoniewicz, R. R. Cavanagh, and J. T. Yates. Oct 80, 4p
Contract N00014-78-F-0008
Pub. in Jnl. of Chemical Physics 73, n7 p3456-3459, 1 Oct 80.

Keywords: *Carbon monoxide, *Infrared spectroscopy, Chemisorption, Temperature, Reprints.

The temperature dependence of the infrared spectrum of CO chemisorbed on Rh supported by Al2O3 has been measured. A shift in the CO stretching frequency of 1.4 x 10 to the -2nd power/cm K to higher frequency is observed on cooling. An electrodynamic model of the surface interactions is presented. The model accounts for both the magnitude and direction of the observed shift.

703,753
PB81-133464 Not available NTIS
National Bureau of Standards, Washington, DC.
Solubility of Cyclopropane in Aqueous Salt Solutions Title Changed to: Solubility of Cyclopropane in Aqueous Solutions of Potassium Chloride,
C. O. Zerpa, P. B. Dharmawardhana, W. R. Parrish, and E. D. Sloan. 1979, 3p
Grant NSF-ENG76-18805
Pub. in Jnl. of Chemical and Engineering Data 24, n1 p26-28 1979.

Keywords: *Cyclopropane, *Solubility, Solutions, Dissolved gases, Potassium chloride, Henrys law, Reprints.

An experimental apparatus was designed for measuring the solubility of gases in liquids at low pressure and temperatures. Accurate data for the solubility of gaseous cyclopropane in aqueous potassium chloride are reported.

703,754
PB81-133472 Not available NTIS
National Bureau of Standards, Washington, DC.
Partial-Discharge Pulse Height Distributions and Frequencies for Positive and Negative DC Corona in SF6 and SF6-N2 Mixtures.
R. J. Van Brunt, J. S. Hilten, and D. P. Silver. 1980, 9p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the International Symposium on Gaseous Dielectrics (2nd) Held at Knoxville, TN. on Mar 9-13, 1980, Paper in Gaseous Dielectrics II, p303-311 1980.

Keywords: *Sulfur hexafluoride, *Nitrogen, *Electric corona, Mixtures, Pressure, Electric potential.

The voltage and pressure dependence of partial-discharge pulse height distributions and pulse repetition rates have been investigated for compressed SF6 and SF6-N2 mixtures using a fast multichannel analyzer. Positive and negative dc corona were generated using a point-plane stainless steel electrode geometry with a gap spacing of 1.25 cm and a tip radius of 0.07 mm. For SF6 the positive corona pulses are typically an order of magnitude larger in amplitude than negative corona pulses although their repetition rate is lower. The tendency for SF positive corona pulses to develop as bursts with a burst length that increases with increasing voltage and decreasing pressure is clearly exhibited by the pulse height spectra. The negative corona in SF tends to begin as large pulses which eventually give way to a near glow condition as voltage is increased, although a steady glow, such as occurs in pure N2, was never observed. The observed pulse height spectra appears to be sensitive to gas composition as is evident from measurements made with gases containing varying relative concentrations of SF6 and N2. Attempts are underway to correlate observed changes in pulse height spectra with corona-induced chemical changes in the gas using a gas chromatograph-mass spectrometer system.

703,755
PB81-133480 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Cooling of Ions Bound to a Penning Trap.
R. E. Drullinger, and D. J. Wineland. 1979, 7p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Proceedings of the International Conference (4th) Held at Rottach-Egern, Federal Republic of Germany on Jun 11-15, 1979, Paper in Laser Spectroscopy IV, p66-72 1979.

Keywords: *Magnesium, Doppler effects, Atomic energy levels, Isotopes, *Laser spectroscopy.

MgII ions which are confined in a room temperature Penning trap have been cooled to < 0.5 K by scattering photons which are nearly resonant with the 3 doublet s S(1/2) yields 3 doublet P P(3/2) transition. The magnesium loaded into the trap has a natural isotopic abundance consisting of about 80% (24)Mg, and about 10% each (25)Mg and (26)Mg. Experiments using two lasers are reported where one laser is fixed in frequency and provides the cooling source and the other laser is swept in frequency. By monitoring the scattered light from the second laser, an optical spectrum of MgII ions is obtained. Because the Doppler width of the cooled ions is reduced, the three isotopic lines are clearly resolved.

703,756
PB81-133498 Not available NTIS
National Bureau of Standards, Washington, DC.
Heterodyne Frequency Measurements with a Tunable Diode Laser-CO2 Laser Spectrometer: Spectroscopic Reference Frequencies in the 9.5 Micrometer Band of Carbonyl Sulfide.
J. S. Wells, F. R. Petersen, and A. G. Maki. Nov 79, 7p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Applied Optics 18, n21 p3567-3573, 1 Nov 79.

Keywords: *Absorption spectra, Reprints, *Sulfide/carbonyl, *Laser spectroscopy.

The frequencies of 12 carbonyl sulfide absorption lines near 9.5 micrometers have been measured by means of a heterodyne frequency measuring technique which uses a frequency stabilized CO2 laser and a tunable diode laser.

703,757
PB81-133514 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron-Impact-Ionization Cross Sections for Highly-Ionized Heliumlike Atoms.
S. M. Younger. Oct 80, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review A. 22, n4 p1425-1428 Oct 80.

Keywords: *Atomic energy levels, *Electron scattering, Ionization, Reprints, *Helium ions, *Isoelectronic sequences.

Cross sections for electron-impact ionization from the ground states of four ions in the helium isoelectronic sequence have been calculated in the distorted-wave Born-exchange approximation. The results are in good agreement with available experimental data. Exchange in the scattering matrix element was found to be important in the determination of accurate cross sections. An isoelectronic plot of the scaled cross section permits ready interpolation of the nonrelativistic ionization cross section for any ion in the helium sequence in the incident electron energy range 1-5 times threshold.

703,758
PB81-133944 Not available NTIS
National Bureau of Standards, Washington, DC.
Theoretical Study of Spectra of Depolarized Light Scattered from Dense Rare-Gas Fluids.
B. Guillot, S. Bratos, and G. Birnbaum. Nov 80, 8p
Pub. in Physical Review, A. General Physics 22, n5 p2230-2237 Nov 80.

Keywords: *Light scattering, *Depolarization, *Rare gases, Mathematical models, Brownian movement, Reprints, Zwanzig-Mori theory.

A theory is presented to study the depolarized light scattered by dense rare-gas fluids. This theory is based on the Zwanzig-Mori theory of Brownian motion; the transport matrix is estimated by a lattice-gas model. Two modes are theoretically predicted, a dissipative mode due to the translational diffusion of rare-gas atoms and an oscillatory mode associated with their oscillations around a given site in the fluid. The resulting profile has a Lorentzian shape at low frequencies and non-Lorentzian wings at high frequencies. The electron-overlap effect modified the integrated intensity of the scattered light but has only a minor influence on its spectral density.

703,759
PB81-133951 Not available NTIS
National Bureau of Standards, Washington, DC.
Studies of Ribonuclease-A by X-ray and Neutron Diffraction.
A. Wlodawer. 1980, 6p
Pub. in Acta Cryst. B36, p1826-1831 1980.

Keywords: *Ribonuclease, *X ray diffraction, *Neutron diffraction, *Molecular structure, Proteins, Reprints.

The structure of monoclinic bovine ribonuclease-A (P21, a = 30.18(12), b = 38.4(10), C = 53.32(15)A, B = 105.85 (8)) has been studied by a combination of X-ray and neutron diffraction techniques. A model based on X-ray data to 2.5 A resolution has been refined by restrained least squares, with a final R = 25.2% for 951 non-hydrogen atoms and one phosphate molecule. Partially refined coordinates of ribonuclease-S were initially used. A good fit between the model and difference Fourier maps was obtained. Several maps based on neutron diffraction intensities at 2.8 A resolution and various phasing schemes were calculated and they are discussed in terms of their usefulness in further refinement of the structure.

703,760
PB81-133969 Not available NTIS
National Bureau of Standards, Washington, DC.
Energy Levels, Wavelengths and Transition Probabilities for the First Five Spectra of Fe, Co and Ni.
W. L. Wiese. 1980, 15p
Pub. in Proceedings of the Workshop on Atomic Physics and Spectroscopy for Supernovae Spectra, La Jolla Institute, La Jolla, CA., Jan 10-12, 1980, Paper in AIP Conference Proceedings No. 63, Supernovae Spectra, p103-117 1980.

Keywords: *Atomic energy levels, *Iron, *Cobalt, *Nickel, *Wavelengths, *Transition probabilities, Tables(Data).

Atomic energy level, wavelength and transition probability data for the first five spectra of Fe, Co and Ni are reviewed, and lists of recent comprehensive data tables are presented. The source material for transition probabilities, both for allowed and forbidden lines, is critically discussed, since these data contain large uncertainties.

703,761
PB81-133985 Not available NTIS
National Bureau of Standards, Washington, DC.
Formation of High Vibrational States of Ions by Photoionization,
R. Stockbauer. 1980, 11p
Pub. in Advances in Mass Spectrometry 8, p79-89 1980.

Keywords: *Ions, *Photoionization, Hydrogen, Deuterium, Nitrogen, Oxygen, Nitrogen oxide(NO), Carbon monoxide, Carbon dioxide, Nitrogen dioxide, Nitrogen oxide(N2O), Water, Heavy water, Reprints, Electron spectroscopy, Threshold effects(Electron energy).

Threshold photelectron spectroscopy measures the distribution of ion states formed when photoionization is accompanied by a zero kinetic energy (threshold) electron. Such spectra are presented in this paper for the following molecules: H2, D2, N2, O2, NO, CO, CO2, N2O, NO2, H2O, and D2O. The structure observed in these spectra show that in these molecules, autoionization processes populate vibrational states of the ion not normally accessible by direct ionization. Thus, vibrational states of the ion not visible in HeI photoelectron spectra due to unfavorable Franck-Condon factors are observed in the TPES. In addition, a step is observed in the TPES of H2O (D2O) at the OH(+) (OD(+)) fragment onset. This step is probably due to a change in the competition between ion and neutral fragmentation processes at the onset of this ion fragmentation channel.

703,762
PB81-134009 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoionization and Fragmentation Study of Cyclopropene.
A. C. Parr, A. Jason, R. Stockbauer, and K. McCulloh. 1980, 9p
Pub. in Proceedings of the International Mass Spectrometry Conference, Oslo, Norway, August 12-18, 1979, Paper in Advances in Mass Spectrometry 8, p62-70 1980.

Keywords: *Cyclopropene, *Photoionization, Heat of formation, Ionization potentials, Threshold effects(Electron energy).

The photoionization efficiency curves have been obtained for cyclopropene and its fragments C3H3(+1), C3H2(+1), and C3H(+1) from threshold to 20ev. The threshold photoelectron spectra and breakdown curves are given over the same energy range. The adiabatic ionization potential of the parent molecule and the derived heats of formation of the ionic species were determined. The breakdown curve will be compared to those of allene and propyne which were measured earlier.

703,763
PB81-134025 Not available NTIS
National Bureau of Standards, Washington, DC.
Adsorption and Dissociation of Nitric Oxide on Ni(111).
S. Lehwald, J. T. Yates, and H. Ibach. 1980, 4p
Pub. in Proceedings of the International Conference on Solid Surfaces (4th) and the European Conference on Surface Science (3rd), Cannes, France, September 22-26, 1970, Supplement a la Revue, LesVide, Les Couches Minces, 201, II p221-224 1980.

Keywords: *Surface chemistry, *Chemisorption, *Dissociation, *Nitrogen oxide(NO), Adsorption, Nickel, Auger spectroscopy, Electron energy loss spectroscopy.

The adsorption and dissociation of NO on a Ni(111) single crystal surface have been studied by electron enery loss spectroscopy (EELS). LEED and Auger spectroscopy (AES) were used in addition to characterize different adsorption phases. From the vibrational spectra the authors concluded that at 150 K NO is molecularly adsorbed in twofold bridging sites: at low coverages in a bent configuration, and at higher coverages in a perpendicular one, concomitant with the appearance of a c(4x2) LEED pattern. Upon warming to 250-350 K the NO dissociates into adsorbed N and O atoms. These exhibit different LEED patterns and vibrational frequencies depending on coverage.

703,764
PB81-134637 Not available NTIS
National Bureau of Standards, Washington, DC.
Avogadro Constant,
R. D. Deslattes. 1980, 27p
Pub. in Annual Review of Physical Chemistry 31, p435-461 1980.

Keywords: Fundamental constants, Reprints, *Avogadro constant.

This review of the Avogadro Constant is prepared in response to an invitation from the Editor of the Annual Reviews of Physical Chemistry. It attempts to deal with some aspects of the history in this field of certain conceptual problems and the present state of experimental measurement.

703,765
PB81-134660 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical Properties of Fibrous Structure.
A. Peterlin. 1979, 42p
Pub. in Proceedings of the Mechanical Structure Ultra-high Modulus Polymers Symposium, Santa Margherita Ligure, Italy, May 23-27, 1977, Chapter 10 in Ultra-High Modulus Polymers, p279-320 1979.

Keywords: *Mechanical properties, *Fibers, *Polymers.

The drawing of a more or less isotropic semicrystalline polymer solid usually produces a fibrous material with high anisotropy of physical properties. This anisotropy is closely connected with the orientation of chains in crystalline and amorphous regions and with the direction in which the two regions alternate.

703,766
PB81-135253 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of the Solubilities of Slightly Soluble Organic Liquids in Water by Elution Chromatography.
F. P. Schwarz. 1980, 6p
Pub. in Analytical Chemistry 52, p10-15 1980.

Keywords: *Organic compounds, *Solubility, Solutions, Water, Reprints, *Elution chromatography.

A simple method based on liquid phase elution chromatography is presented for determining the solubilities of organic liquids in water. An inert solid support in a transparent tube is coated with the organic liquid. As this solute is eluted with water, a solute depleted zone develops which is different in color than that of the remainder of the support. Measurement of the rate of progress of the boundary of this zone, the flow rate of water, and the mass of solute coated on the support are sufficient to determine the solubility.

703,767
PB81-135261 Not available NTIS
National Bureau of Standards, Washington, DC.
Aspects of Reaction Dynamics at Metal Surfaces.
J. W. Gadzuk, and H. Metiu. 1980, 4p
Pub. in Proceedings of the International Conference on Solid Surfaces (4th) and the European Conference on Surface Science (3rd) Held at Cannes, France on Sep 22-26, 1980, p168-171 1980.

Keywords: *Surface chemistry, *Reaction kinetics, *Metals, Excitation.

Key features are presented of a theory of chemical reaction dynamics at metal surfaces which include: (1) diabatic electronic transitions between internal states of an incident beam of atoms or molecules; (2) irreversibility and dissipation through substrate electron-hole pair excitation, (3) quantum modifications to classical trajectories via appropriate Franck-Condon factors.

703,768
PB81-135519 Not available NTIS
National Bureau of Standards, Washington, DC.
(p,V,T) of Compressed Fluid Ethene.
G. C. Straty. 1980, 8p
Pub. in Jnl. of Chemical Thermodynamics 13, p709-716 1980.

Keywords: *Ethylene, *Pressure, *Volume, *Temperature, *Melting points, Reprints.

New measurements of the melting line and (p,V,T) of fluid ethene are reported. (p,V,T) determinations have been made in the amount-of-substance density range from about 13 mol/cu dm to greater than 23 mol/cu dm at pressures to 33 MPs. About 250 (p,V,T) points have been determined. Melting pressures to 21 MPa are reported.

703,769
PB81-135535 Not available NTIS
National Bureau of Standards, Washington, DC.
Herbert P. Broida, the Washington Years.
A. M. Bass. 1979, 19p
Pub. in Proceedings of the Int. Symp. Free Radical (14th) Held at Sanda, Hydogo-ken, Japan on Sep 3-7, 1979, Paper in Free Radicals, p3-21 1979.

Keywords: *Combustion, *Research, District of Columbia, Free radicals, *Herbert P Broida, *Flame spectroscopy, National Bureau of Standards.

The professional career of Herbert P. Broida in the period 1949 to 1963 is reviewed. This represents the period of his association with NBS in Washington, D.C. His activities in combustion and flame spectroscopy and medical physics are described. His direction of the Free Radicals Research Program is discussed.

703,770
PB81-135543 Not available NTIS
National Bureau of Standards, Washington, DC.
Instrumental Effects on the Generation of Continuum from Pure Element Targets.
J. A. Small, D. E. Newbury, and R. L. Myklebust. 1980, 3p
Pub. in Proceedings of the Annual Conference of Microbeam Analysis Society (15th) Held at Reno, NV. on Aug 1980, Paper in Microbeam Analysis-1980, p53-55 1980.

Keywords: *Continuum mechanics, *Electron beams, *Elements, Comparison, Laboratory equipment.

The authors discuss a comparison of the continuum intensities from pure element targets measured on three different electron beam instruments at two different accelerating voltages. The results indicate: (1) One expression can be used to describe the dependence of the continuum for the different experimental setups over the range of accelerating voltages 17-25 keV. (2) The energy dependence of the continuum is not the same for the different experimental setups. Investigation of the existing correction procedures is necessary before an expression for the energy dependence of the continuum can be derived.

703,771
PB81-135550 Not available NTIS
National Bureau of Standards, Washington, DC.

Diffusion with Discontinuous Swelling. IV. Type II Diffusion into Spherical Particles.
A. Peterlin. Mar 80, 4p
Pub. in Polymer Engineering and Science 20, n4 p238-241 Mar 80.

Keywords: *Glass, *Gels, *Diffusion, Transport properties, Reprints.

In the last few years some new features of the so-called type II diffusion have been established which confirm the first theoretical description of such a material transport into a semi-infinite glassy medium which at a certain concentration of the sorbate is transformed into a gel. The boundary between the glass and the gel progresses at a constant velocity into the interior of the sample thus yielding linear term in the weight gain.

703,772
PB81-135592 Not available NTIS
National Bureau of Standards, Washington, DC.
Diffusion with Discontinuous Swelling. V. Type II Diffusion into Sheets and Spheres.
A. Peterlin. 1979, 16p
Pub. in Jnl. of Polymer Science, Polymer Physics Edition 17, p1741-1756 1979.

Keywords: *Glass, *Gels, *Diffusion, Transport properties, Reprints.

Type II diffusion into uniform spheres (radius R) and sheets (thickness 2) is calculated under the assumption that the glass-gel boundary proceeds at a constant velocity nu from the surface towards the interior of the sample, that the diffusion coefficient D(g) in the glass is constant and that the diffusion coefficient D(r) of the rubbery gel is so much higher than nu R or nu l that practically no sorbate gradient is needed for the transport through the gel of the sorbate. The diffusion process is completed when this boundary reaches the center of the sample.

703,773
PB81-136806 Not available NTIS
National Bureau of Standards, Washington, DC.
Low-Energy Collisions of Electrons with Highly Polar Molecules: Orthogonalization and Model Exchange Potentials.
L. A. Collins, W. D. Robb, and D. W. Norcross. Nov 79, 3p
Contract DE-EA-77-A-01-6010
Pub. in Physical Review A, v20 n5 p1838-1840 Nov 79.

Keywords: *Mathematical models, Lithium hydride, Lithium fluorides, Polarization(Charge separation), Wave functions, Reprints, *Electron molecule interactions, Numerical solution.

The importance of imposing orthogonality constraints on the continuum wave functions calculated from model-exchange potentials for electron collisions with the highly polar systems LiH and LiF is demonstrated. The epsilon and pi resonance features in e-LiF collisions, found in earlier model-exchange calculations, disappear upon imposing orthogonality; no evidence for these features is observed in exact static-exchange calculations.

703,774
PB81-136863 Not available NTIS
National Bureau of Standards, Washington, DC.
Inert Gas Collisional Broadening and Shifts of Two-Photon Rydberg States in Rb.
W. U. L. Brillet, and A. Gallagher. Sep 80, 6p
Grant NSF-PHY76-04761
Pub. in Physical Review A, v33 n3 p1012-1017 Sep 80.

Keywords: *Rubidium, *Line width, Doppler effect, Absorption, Fluorescence, Reprints, *Chemical shifts(Nuclear magnetic resonance).

The broadening and shift of several Rb 3S-nS and 3S-nD transitions perturbed by inert gases have been measured by Doppler-free two-photon absorption and fluorescence detection. The measured shifts are in reasonable agreement with the theoretical predictions whereas the measured broadening rates are found to be much larger.

703,775
PB81-136871 Not available NTIS
National Bureau of Standards, Washington, DC.
Transient (Subsecond) Technique for Measuring Heat of Fusion of Metals,
A. Cezairliyan, and A. P. Miiller. 1980, 21p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Int. Jnl. Thermophys. 1, n2 p195-215 1980.

Keywords: *Heat of fusion, *Metals, *Dynamics, High temperature tests, Thermodynamics, Reprints.

A transient technique is described for measuring the heats of fusion of metals with melting temperatures above 1500 K. Measurements on several tantalum-niobium-tantalum specimens yield a value of 31.5 k/J:mol for the heat of fusion of niobium with an estimated maximum inaccuracy of plus or minus 5%.

703,776
PB81-136889 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of the Instability and Failure of Viscoelastic Materials in Tension.
B. D. Coleman, and L. J. Zapas. 1979, 10p
Sponsored in part by National Science Foundation, Washington, DC., Petroleum Research Fund, Washington, DC., and American Chemical Society, Washington, DC.
Pub. in Jnl. of Polymer Science, Polymer Physics Edition 17, p2215-2224 1979.

Keywords: *Materials tests, *Viscoelasticity, *Tensile test, Failure analysis, Reprints.

In a tensile test of a bar or fiber formed from a transversely isotropic viscoelastic material, the initial motion in regions away from the clamps is a homogeneous uniaxial extension. The critical time tc is the 'failure time' of the specimen, i.e., the time at which the motion first changes character; tc precedes, often by a constant factor, the time at which neck-down is easily visible. The problem of calculating tc for a given loading program is here treated within the framework of the general theory of nonlinear simple materials with fading memory. It is shown that at a time at which the instantaneous modulus vanishes one cannot arbitrarily assign the rate of change of tensile stress and have the motion remain in the class of tame homogeneous extensions.

703,777
PB81-137150 Not available NTIS
National Bureau of Standards, Washington, DC.
Self-Broadening of the Thallium 377.6 nm Resonance Line.
G. Pichler, and J. L. Carlsten. 1978, 6p
Contract N00014-76-C-0611, Grant NSF-PHY76-04761
Pub. in Jnl. of Physics, B: Atom. Molec. Phys. 11, n14 pL483-L488 1978.

Keywords: *Thallium, *Line width, *Ultraviolet spectroscopy, Reprints.

The authors report preliminary studies on the self-broadening of the 377.6 nm thallium line. In the short wavelength wing they observe asymmetries and a satellite at about 377.1 nm. In the long wavelength quasistatic wing the authors clearly observe the transition from the Lorentzian to the van der Waals type wing.

703,778
PB81-137226 Not available NTIS
National Bureau of Standards, Washington, DC.
Chlorine Isotope Enrichment in CO2-TEA Laser Photolysis of CF2Cl2.
R. E. Huie, J. T. Herron, W. Braun, and W. Tsang. May 78, 4p
Contract DOE-EE-77-A-01-6010
Pub. in Chemical Physics Letters 56, n1 p193-196, 15 May 78.

Keywords: *Photolysis, *Isotope separation, *Chlorine, Mass spectroscopy, Reprints, *Laser spectroscopy, *Chlorine 35, *Chlorine 37, Methane/trichloro-trifluoro.

A number of lines from a CO2-TEA laser have been used to photolyze CF2Cl2. Enrichments of the Cl(35) and Cl(37) isotopes among the molecular chlorine formed during the photolysis have been observed using a mass spectrometer. Maximum enrichment is about 1.8. The dependence of the enrichment on wavelength, reactant concentration, inert gas pressure, and the presence of SiF4 have been determined. Of particular interest is evidence for significant enrichments at pressures up to several hundred torr. Aside from its practical significance, this also provides evidence for important contributions from isotope specific interactions after the laser pulse.

703,779
PB81-137861 Not available NTIS
National Bureau of Standards, Washington, DC.
Raman Spectra of N-Alkanes. I. Raman Intensities of Longitudinal Acoustic Modes.
J. Mazur, and B. Fanconi. Dec 79, 12p
Pub. in Jnl. of Chemical Physics 71, n12 p5069-5080, 15 Dec 79.

Keywords: *Alkanes, *Raman spectroscopy, Acoustic measurement, Perturbation theory, Reprints, Molecular conformations, Numerical solution.

Raman intensities are calculated for longitudinal acoustic modes of n-alkanes which coupled through methyl interaction with transverse acoustical modes. Calculated intensities from normal mode analysis and perturbation theory compare favorably with observed intensities. The results lend support to the method of calculating intensities of longitudinal acoustic modes of chains with structural defects in which the intensity is proportional to the square of the dot product of the atomic displacements of the LAM of the all trans conformation chain and the displacement of modes calculated for defect conformations.

703,780
PB81-137903 Not available NTIS
National Bureau of Standards, Washington, DC.
Collisional Redistribution of Radiation in the Non-Impact Region of Spectral Lines.
J. Cooper, R. J. Ballagh, and E. W. Smith. 1978, 5p
Pub. in Acta Physiologica Polonica A54, n6 p729-733 1978.

Keywords: *Line spectra, *Collision cross sections, Emission spectroscopy, Absorption spectra, Reprints.

The theory for collisional redistribution of scattered radiation is outlined starting from its origins in early line shape theories for emission and absorption. Recent developments are discussed including redistribution from the impact region to the far line wings, the effect of m-degeneracy, the influence of a strong driving field, and a consistent treatment of radiative damping.

703,781
PB81-138265 Not available NTIS
National Bureau of Standards, Washington, DC.
Diffraction from Nonperiodic Structures: The Molecular Conformation of Polytetrafluoroethylene. Phase II.
E. S. Clark, J. J. Weeks, and R. K. Eby. 1980, 10p
Pub. in Chapter 10 in ACS Symposium Series No. 141, Fiber Diffraction Methods, p183-192 1980.

Keywords: *Electron diffraction, Fluorine organic compounds, Reprints, *Molecular conformations, *Poly(ethylene/tetrafluoro).

Remarkable electron diffraction patterns of the low temperature from (Phase II) of polytetrafluoroethylene have been obtained which exhibit layer lines sharply resolved to the 26th order. These patterns permit accurate measurements of the layer line heights. Equations are developed to relate the layer line heights to a molecular conformation defined in terms of an incommensurable helix of ratio, r = u/t, defining a conformation of u motifs regularly spaced along t turns of the helix.

703,782
PB81-138273 Not available NTIS
National Bureau of Standards, Washington, DC.
Continuum Formulation of Spreading Resistance Correction Factors.
J. Albers. Oct 80, 5p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Jnl. of the Electrochemical Society 127, n10 p2259-2263 Oct 80.

Keywords: Nonlinear differential equations, Electrical resistivity, Correction, Reprints, *Spreading resistance, Laplace equation.

A continuum formulation of spreading resistance correction factors is derived from the Choo et al. recursion relation for the kernel of the spreading resistance correction factor integral. Specifically, a differential equation for the kernel of the correction factor integral is

derived in the limit as the layer thickness approaches zero. The resulting differential equation is nonlinear and inhomogeneous but can be transformed into a linear second order equation which can be solved analytically in several cases. The continuum form of the correction factor is compared with correction factor generated from the finite-layer thickness version of the Laplace equation description for the case of an exponentially varying resistivity.

703,783
PB81-138281 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrostatic Trapping of Neutral Atomic Particles.
W. H. Wing. Aug 80, 5p
Sponsored in part by Petroleum Research Fund, Washington, DC.
Pub. in Physical Review Letters 45, n8 p631-634, 25 Aug 80.

Keywords: *Atoms, *Electric fields, *Stark effect, Reprints.

Excited neutral atoms having positive Stark energies may be trapped near magnitude minima of electrostatic fields. At moderate field strengths Rydberg atoms have trap depths comparable to ambient kT and as much as 100 times those of recently-proposed optical-field traps. Polar molecules and metastable hydrogen and positronium atoms also can be trapped. A slow nondegenerate atom in a quadrupole field is harmonically bound. Sustained trapping and cooling should be possible, allowing doppler-free few-atom spectroscopy and novel collision studies.

703,784
PB81-138299 Not available NTIS
National Bureau of Standards, Washington, DC.
Ro-Vibronic Species, Overall Allowed Species, and Nuclear Spin Statistical Weights for Symmetric Top Molecules Belonging to the (D sub nd) and (D sub nh) (n is less than or equal to 6) Point-Groups.
A. Weber. Oct 80, 2p
Pub. in Journal of Chemical Physics 73, n8 p3952-3972, 15 Oct 80.

Keywords: *Molecular energy levels, *Molecular rotation, *Group theory, Reprints, Numerical solution.

Nuclear spin statistical weight factors have been calculated for the rotational energy levels of symmetric top molecules belonging to the Dnd (n = 2,3,4,5,6) and Dnh (n = 3,4,5,6) point groups. The rovibronic species for the levels have been calculated on the basis of Hougen's classification scheme, using the full point-group of the molecule. The Longuet-Higgins permutation-inversion-group was used to determine the overall allowed species permitted by the Pauli exclusion principle and the ramifications of inversion symmetry.

703,785
PB81-138315 Not available NTIS
National Bureau of Standards, Washington, DC.
Benchmark Cross Sections for Electron Impact Excitation of n1S Levels of He.
B. VanZyl, G. H. Dunn, G. Chamberlain, and D. W. O. Heddle. Nov 80, 14p
Pub. in Physical Review A, 22, n5 p1916-1929 Nov 80.

Keywords: *Helium, *Molecular energy levels, Electron scattering, Reprints.

Absolute total emission cross sections have been measured for electron impact excitation of He giving radiation from the 6 singlet S - 2 singlet P - 5 singlet S - 2 singlet P - 4 singlet S - 2 singlet P and 3 singlet S - 2 singlet P transitions. The measured emission cross sections are modified to account for branching and cascade to give level excitation cross sections, and results are compared with other experimental data and theoretical predictions. At 2000 eV, the measurements average 2.5% below Born approximation calculations.

703,786
PB81-138323 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Stability of Cyclohexane and 1-hexene.
W. Tsang. 1978, 20p
Pub. in International Jnl. of Chemical Kinetics X, p1119-1138 1978.

Keywords: *Cyclohexane, *Hexenes, *Decomposition reactions, Reaction kinetics, Heat of formation, Thermal stability, Reprints.

The mechanism and initial rates of decomposition of cyclohexane and 1-hexene have been determined from single pulse shock tube experiments. The main initial processes involve isomerization of cyclohexane to 1-hexene, followed by decomposition of 1-hexene. There appears to be general relations relating the rate expressions for the decomposition of alkynes, alkanes, and alkenes. Studies on the induced decomposition of cyclohexane have also been carried out.

703,787
PB81-138596 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared-Laser Photolysis/Mass Spectrometry: A Technique for the Real-Time Study of Free-Radical Kinetics and its Application to the Reaction 2CF2 - C2F4.
R. I. Martinez, R. E. Huie, J. T. Herron, and W. Braun. 1980, 12p
Pub. in Jnl. of Chemical Physics 84, n19 p2344-2347 1980.

Keywords: *Free radicals, *Reaction kinetics, Mass spectroscopy, Photolysis, Reprints, *Methane/difluoro, *Ethane/tetrafluoro, Laser spectroscopy.

Infrared-laser photolysis/mass spectometry is a general method for the production of selected free radicals and for the study of their chemical kinetics in real time. The method was applied to the multiphoton infrared photolysis of CF2HC1 and the subsequent recombination reaction of CF2.

703,788
PB81-138604 Not available NTIS
National Bureau of Standards, Washington, DC.
Pressure Broadening of the O2 Microwave Spectrum.
E. W. Smith, and M. Giraud. Dec 79, 9p
Pub. Jnl. of Chemical Physics 71, n11 p4209-4217, 1 Dec 79.

Keywords: *Oxygen, *Microwave spectroscopy, Pressure, Reprints.

The pressure broadened halfwidths of the 60 GHz microwave spectrum 2 have been calculated for low pressures where the lines do not overlap. Both self broadening and foreign gas broadening by noble gases have been calculated using various semiempirical potential surfaces. Agreement with experimental results is quite good. Differences with various other theoretical calculations are discussed.

703,789
PB81-138612 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Magnetic Resonance Detection of Rotational Transition in CH2.
J. A. Mucha, K. M. Evenson, D. A. Jennings, G. B. Ellison, and C. J. Howard. Oct 79, 4p
Pub. in Chemical Physics Letters 66, n2 p244-247, 1 Oct 79.

Keywords: *Molecular rotation, Methane, Free radical, Reprints, *Methylene radical, *Laser spectroscopy.

Laser magnetic resonance spectra observed at 163.0 micrometers have been identified as pure rotational transitions in the ground electronic state (triple B(1)) of the methylene radical. The identification was based on the observation of hyperfine spin triplets and by isotopic substitutions involving deuterium and (13)C, as well as other chemical and spectroscopic evidence. A low-pressure flame produced by reacting discharged fluorine with methane was found to be an excellent new spectroscopic source of ground-state CH2 radicals.

703,790
PB81-138653 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of the Rate of the Reaction N + H + M Yields NH + M,
R. L. Brown. 1973, 5p
Pub. in International Jnl. of Chemical Kinetics V, p663-667 1973.

Keywords: *Reaction kinetics, Atoms, Chemical reactions, Reprints, *Hydrogen atoms, *Nitrogen atoms.

The combination reaction between N and H atoms has been studied in a flow system by mixing H atoms produced by thermal dissociation of H2 with active nitrogen produced by a microwave discharge.

703,791
PB81-138695 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Vibrations of Polymers.
B. Fanconi. 1980, 27p
Pub. in Ann. Rev. Phys. Chem. 31, p265-291 1980.

Keywords: *Molecular vibrations, *Polymers, Raman spectroscopy, Infrared spectroscopy, Mathematical models, Reprints, Molecular conformations, Numerical solution.

Recent developments in theoretical and experimental techniques applied to molecular vibrations of polymers are reviewed. Methods for calculating the normal vibrations of polymers in both the isolated chain and lattice models are given. Calculations of approximate vibrational frequencies of conformationally irregular chains are reviewed in the context of the coupled oscillator method, the Green's function approach, and various numerical methods.

703,792
PB81-140196 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoemission Studies of a Mixed Valent Ytterbium-Aluminum Alloy.
W. F. Egelhoff, and G. G. Tibbetts. Jun 80, 3p
Pub. in Proceedings of the International Conference on Vacuum Ultraviolet Radiation Physics (6th), University of Virginia, Charlottesville, VA., June 2-6, 1980, Paper I-20 in VUV Lasers, Synchrotron Radiation, and Applications III, p1-3 1980.

Keywords: *Photoelectric emission, *Aluminum alloys, Atoms, Auger spectroscopy, *Ytterbium alloys, Autoionization.

A valence change from f(13) to f(14) occurs in ytterbium atoms in a mixed-valent ytterbium-aluminum alloy during autoionization and Auger-electron emission. In both of these emission processes the 4f-shell occupancy increases when the shell becomes more tightly bound under the influence of the core hole. The quenching of the core hole, which terminates the process, occurs after the valence change, so that the f(13) initial state is not manifest in the spectra.

703,793
PB81-140204 Not available NTIS
National Bureau of Standards, Washington, DC.
Chain Folding in Lamellar Crystals.
A. Peterlin. Aug 80, 6p
Pub. in Macromolecules 13, n4 p777-782 Jul-Aug 80.

Keywords: *Polyethylene, *Neutron scattering, *Mathematical models, Crystallization, Reprints, *Small angle scattering.

Small-angle neutron scattering yields a gyration radius and a segment distribution of the linear polyethylene molecule which can be best interpreted by a model based on the original suggestion by Frank and the analysis by Flory of chain folding on the boundary between the crystal core and the amorphous surface layer. In order to provide space for the amorphous chains half the stems in the crystal lattice must be connected by regular loops with adjacent reentry. One third of all the stems must be connected by random loops in order to reproduce the small-angle neutron-scattering data on samples quenched from the melt.

703,794
PB81-140246 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Chemically Assisted Fracture. Part 1. General Reaction Rate Theory and Thermodynamics.
Final rept.
R. Thomson. 1980, 13p
Pub. in Jnl. of Material Science 15, p1014-1026 1980.

Keywords: *Materials tests, *Fractures(Materials), *Reaction kinetics, *Thermodynamics, Reprints.

In this first of a two-paper series, the author develops a theoretical formulation for chemically assisted fracture in materials. The external environmental is assumed to be a diatomic gas, and the chemical attack is at the crack tip. The crack is presumed to be atomically sharp, and the adsorbing chemical species lowers the energy of bond breaking at the crack tip. The formalism is couched in the language of chemical absolute reaction rate theory, and the results bear a close resemblance to the reaction rate theory of atomic diffusion in solids. Expressions are derived for thermally activated crack growth. The thermodynamic limit is de-

rived, and the connection made to previous macroscopic mechanical treatments. A qualitative discussion is given of more complex forms of fracture chemistry. General conclusions are that atmospherically assisted fracture should be associated with changes in adsorbed surface energy; that details of kinetics will vary widely from one chemical system and material to another; and, that cleavage experiments should be a quantitative tool for surface and interfacial energy measurements. Finally, bridging reactions at the crack tip are shown to lead to possibilities for chemical toughening of the material.

703,795
PB81-140261 Not available NTIS
National Bureau of Standards, Washington, DC.
PVTx Properties and Equation of State for Compressed and Liquefied Nitrogen-Methane Mixtures.
G. C. Straty, D. E. Diller, and R. D. McCarty. 1980, 6p
Pub. in Proceedings of the International Conference on Phase Equilibria and Fluid Properties in the Chemical Industry (2nd), Berlin, West Germany, March 17-21, 1980, p18-23 1980.

Keywords: *Equations of state, *Nitrogen, *Methane, Mixtures, Critical point, Mathematical models, *PVT properties.

The PVTx properties of compressed and liquefied nitrogen-methane mixtures have been measured at three fixed compositions (X = 0.3, 0.5 and 0.7), at temperatures between 80 and 320 K, at densities between 0.8 and 28.5 mol/L, and at pressures to 35 MPa, with an estimated inaccuracy less than 0.2% in density. The measurements were compared with the extended corresponding states model, giving density differences which are generally within experimental error, except in an extended region about the critical point (at temperatures between 0.95 and 1.3 T(c) and at densities between 0.5 and 1.5 rho(c). The deviations in this region suggest needed improvements in the model.

703,796
PB81-140279 Not available NTIS
National Bureau of Standards, Washington, DC.
Evidence of Superelastic Effects in Laser-Induced Ionization of Na Vapor.
F. Roussel, P. Breger, G. Spiess, C. Manus, and S. Geltman. 1980, 6p
Pub. in Jnl. of Physics B, Atomic Molecular Physics Letter to Ed 13, pL631-L636 1980.

Keywords: *Sodium, Ionization, Atomic energy levels, Reprints, *Laser applications, *Superelastic.

The authors report the direct observation of an intense ion yield when Na vapor in the wide range of densities 10 to the +12 power - 10 to the +15 power/cu cm is irradiated by a tuned to the 3S(1/2)-3P(3/2) resonance and with intensities in the range 3,000 - 400,000 W/cm. Evidence of superelastic e-Na(3p) collisions is shown above 10 to the +13 power/cu cm. A critical discussion of possible electron seeding and heating mechanisms and a simple theoretical model for the observed ion yields are given.

703,797
PB81-140303 Not available NTIS
National Bureau of Standards, Washington, DC.
Monomolecular Adsorption Isotherms.
D. N. Misra. Oct 80, 5p
Grant PHS-DE-05129-01
Pub. in Jnl. Colloid Interface Science 77, n2 p543-547 Oct 80.

Keywords: *Isotherms, *Molecules, Adsorption, Reprints, Jovanovich equation, Numerical solution, Langmuir equation.

There is a mathematical similarity between Jovanovich and Langmuir isotherms. Nonlinear regression analyses show that the other equations fit as well as Jovanovich's and Langmuir's to a set of experimental data.

703,798
PB81-140311 Not available NTIS
National Bureau of Standards, Washington, DC.
Equations of State.
R. D. Mountain. 1980, 2p
Pub. in Encyclopedia of Physics, p290-291 Nov 80.

Keywords: *Equations of state, Thermodynamics, Reprints.

The concept of an equation of state is introduced and discussed in terms of equations of state for fluids and solids. The need for thermal information, to augment the equation of state when constructing a complete, local thermodynamic description of a system is mentioned.

703,799
PB81-140360 Not available NTIS
National Bureau of Standards, Washington, DC.
Matrix Isolation Study of the Reaction of Fluorine Atoms with the Trifluoromethyl Halides. Infrared Spectroscopic Evidence for the CF3XF Free Radicals.
M. E. Jacox. 1980, 8p
Pub. in Chemical Physics 5, p69-76 1980.

Keywords: Infrared spectroscopy, Free radicals, Halogen organic compounds, Reprints, *Matrix isolation technique, *Fluorine atoms, *Methane/chloro-trifluoro, *Methane/bromo-trifluoro, *Methane/iodo-trifluoro.

When F atoms produced by a microwave discharge through NF3 in argon carrier gas were codeposited with CF3Cl, CF3Br, or CF3I in an argon matrix at 14 K, prominent infrared sorptions, assigned to the CF3XF reaction intermediate, resulted.

703,800
PB81-140378 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Transition Probabilities of Neutral Titanium Lines.
A. Holys, and J. R. Fuhr. 1980, 4p
Grant NBS/GI-181
Sponsored in part by Maria Sklodowska Curie Foundation, Warsaw (Poland).
Pub. in Astron. Astrophysics 90, p14-17 1980.

Keywords: *Transition probabilities, *Titanium, *Line spectra, Visible spectrum, Reprints.

Transition probabilities for 21 lines of TiI have been measured in emission with a wall-stabilized arc. These lines cover a wavelength range of 3600-6300 A and originate from either the y(3)G upper level. Weak as well as strong lines were measured, and the resulting relative A-values were converted to the absolute scale of Bell et al. (1975). The uncertainties of the absolute transition probabilities are estimated to be within 20-30%. Comparisons of this work with other recent experiments show excellent agreement.

703,801
PB81-142762 Not available NTIS
National Bureau of Standards, Washington, DC.
Proton Transfer Reactions Involving Alkyl Ions and Alkenes; Rate Constants, Isomerization Processes, and the Derivation of Thermochemical Data.
S. G. Lias, D. M. Shold, and P. Ausloos. Apr 80, 9p
Pub. in Jnl. of American Chemical Society 102, n8 p2540-2548, 9 Apr 80.

Keywords: *Reaction kinetics, *Alkenes, Thermochemistry, Isomerization, Ions, Reprints, *Alkyl ions, Chemical reaction mechanisms, Ion molecule interactions.

Rate constants and mechanisms have been determined for proton transfer reactions of the type AH(+) + M yields MH(+) + A, where A is propylene, isobutene, trans-2-butene, cyclopentene and cyclohexene. In order to avoid competing side effects the AH(+) reactant ions are generated in alkanes and alkylhalides. It is observed that the rate constants for exothermic direct proton transfer reactions, from AH(+) to M or from MH(+) to A, are equal to the collision rate only when the total rotational, vibrational and electronic entropy change associated with the reaction is positive, and when the exothermicity of the reaction exceeds 2-4 kcal/mole. On the basis of rate constants in the forward and reverse direction for multiple reaction pairs, internally consistent values are obtained for the proton affinities of propylene, isobutene and cyclopentene.

703,802
PB81-142796 Not available NTIS
National Bureau of Standards, Washington, DC.
Monte Carlo Studies of Polymer Chain Dynamics: Lattice Dependence.
D. E. Kranbuehl, and P. H. Verdier. Aug 80, 2p
Pub. in Polymer Preprints 21, n2 p195-196 1980.

Keywords: *Polymers, *Monte Carlo method, *Dynamics, *Lattice parameters, Molecular relaxation, Mathematical models, Reprints.

The effects of excluded volume interactions upon the limiting long-time relaxation behavior of vector end-to-end length have been obtained by direct computer simulation for lattice-model chains on simple cubic, body-centered cubic, and face-centered cubic lattices. Results have been obtained for chains employing single-bead moves, double-bead moves, and a mixture of both types of move. The chain-length dependence of the lengthening of the longest relaxation times by excluded volume appears to be very similar for all three lattices. For models employing only single-bead or only double-bead move rules, the lengthening is proportional to about the 6/5 power of chain length; for models employing a mixture of both types of move, the lengthening is proportional to about the 3/5 power of chain length. At a given chain length, the lengthening of the longest relaxation time by excluded volume decreases with increasing lattice coordination number.

703,803
PB81-142812 Not available NTIS
National Bureau of Standards, Washington, DC.
Backscatter Loss in the X-Ray Continuum.
R. L. Myklebust, D. E. Newbury, and J. A. Small. 1980, 2p
Pub. in Proceedings of the Annual Conference of the Microbeam Analysis Society, Reno, NV., Aug 1980, Paper in Microbeam Analysis, p49-50 1980.

Keywords: *X rays, *Electron scattering, *Elements, Backscattering, Monte Carlo method.

The continuum x-ray loss due to backscattered electrons, R(continuum) has been computed for a large number of elements with the NBS Monte Carlo program for predicting electron trajectories in solids. The results compare favorably with other determinations of R(continuum) appearing in the literature. An empirical expression has been fitted to the R(continuum) values as a function of atomic number and overvoltage that predicts R(continuum) with better than 2% accuracy.

703,804
PB81-142846 Not available NTIS
National Bureau of Standards, Washington, DC.
Energy Flow and Thermal Conductivity in One-Dimensional Harmonic, Isotopically Disordered Crystals.
R. J. Rubin. Nov 80, 11p
Pub. in Chapter 7 in Studies in Statistical Studies, p112-122 Nov 80.

Keywords: *Crystals, *Thermal conductivity, Monte Carlo method, Mathematical models, Reprints, Numerical solution.

Rubin and Greer established that as the number of defect particles increases, the thermal conductivity increases at least as fast as N(1/2). Subsequently, Verheggen established that the limiting dependence is exactly N(1/2). It appears from the Monte Carlo calculations plotted in fig 2 for the fixed boundary model that the thermal conductivity decreases with increasing N for greater than 800. However, no well-defined power law dependence on N is evident in the range 800 less than N less then 3200 - it is definitely not N(1/2).

703,805
PB81-142879 Not available NTIS
National Bureau of Standards, Washington, DC.
Reactions of Benzyl Ions with Alkanes, Alkenes, and Aromatic Compounds.
P. Ausloos, J.-A. A. Jackson, and S. G. Lias. 1980, 15p
Pub. in International Jnl. of Mass Spectrometry and Ion Physics 33, p269-283 1980.

Keywords: *Alkanes, *Alkenes, *Aromatic compounds, Chemical reactions, Ions, Reprints, *Benzyl ions, *Ion molecule interactions.

Biomolecular chemical reactions of benzyl ions with hydrocarbons and halogenated hydrocarbons have been examined in an ion cyclotron resonance spectrometer. Benzyl ions undergo hydride transfer reactions with linear, branched, and cyclic alkanes. The probability that a collision will lead to reaction is generally low, and is directly dependent on the exothermicity of the reaction.

703,806
PB81-142895 Not available NTIS
National Bureau of Standards, Washington, DC.

Atomic Resonance - Line Lasers: New Sources for Analytical Atomic Spectrometry.
D. J. Ehrlich, R. M. Osgood, G. C. Turk, and J. C. Travis. Jul 80, 3p
Pub. in Analytical Chemistry 52, n8 p1354-1356 Jul 80.

Keywords: *Atomic spectroscopy, *Metals, *Halides, Spectrochemical analysis, Sources, Performance evaluation, Line spectra, Reprints, *Laser spectroscopy, Laser enhanced ionization, Flame spectroscopy.

Atomic resonance-line lasers based on photodissociation of metal-halide molecules have important implications for spectrochemical analysis. Analytical curves of growth and limits of detection have been obtained by laser enhanced ionization (LEI) for two (Tl and Na) of the eight atomic resonance line lasers which have been demonstrated to date. The fixed frequency lasers offer a significant simplicity advantage over tunable dye lasers. In addition, the presence of additional atomic laser lines permits the excitation of high energy electronic levels by means of sequential excitation. Such two-wavelength excitation demonstrated by the Na LEI result reported here, has important implications for both selectivity and sensitivity. Although general applicability will depend on further development of the lasers, they are presently appropriate for many special, dedicated applications.

703,807
PB81-142903 Not available NTIS
National Bureau of Standards, Washington, DC.
Interpretation of Dynamic Scattering from Polymer Solutions.
A. Z. Akcasu, M. Benmouna, and C. C. Han. Aug 80, 25p
Sponsored in part by American Chemical Society, Washington, DC.
Pub. in Polymer 21, p866-890 Aug 80.

Keywords: *Polymers, *Neutron scattering, *Light scattering, Solutions, Reprints, Numerical solution.

The theoretical results available for the intepretation of the dynamic scattering from polymer solutions have been re-examined.

703,808
PB81-142937 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Spectra of Methyl Isocyanide Chemisorbed on Rhodium.
R. R. Cavanagh, and J. T. Yates. 1980, 3p
Pub. in Surface Science 99, pL381-L383 1980.

Keywords: *Infrared spectroscopy, *Chemisorption, *Acetonitrile, Supports, Reprints.

The chemisorption of CH3NC on dispersed Rh supported on Al2O3 has been investigated using transmission infrared spectroscopy. Evidence for the chemisorption of undissociated CH3NC is presented. It is shown that at 300K the isomerization of CH3NC to CH3CN does not occur on Rh. The spectra obtained for adsorbed CH3NC suggest an analogous chemistry of the Rh surface sites to that found in organometallic chemistry.

703,809
PB81-143208 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Electron-Hole Pair Excitations in Unimolecular Processes at Metal Surfaces. I. X-Ray Edge Effects.
J. W. Gadzuk, and H. Metiu. Sep 80, 11p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Physical Review B, 22, n6 p2603-2613, 15 Sep 80.

Keywords: *Surface chemistry, *Metals, *X ray analysis, Dynamics, Excitation, Excitons, Reprints.

A theory of the dynamics of molecular processes at solid surfaces must necessarily deal with those aspects of the solid which provide dissipative or irreversible reaction channels, thus giving the particular process a direction in time. While the heatbath aspects of the solid are often considered from the phonon point of view, there is increasing speculation that the substrate electron-hole pair excitations may be a significant rate determing factor, at least for metals. This belief is supported by various conclusions which have emerged from theoretical studies of time dependent perturbations acting on extended Fermi systems, as physically realized in core level spectroscopies of solids. The authors present here one phase of a study of surface reaction dynamics, focusing on the irreversible coupling of nuclear motion of an incident beam of atoms or molecules with the substrate electrons. For the cases in which the incident particle undergoes a substrate-induced diabatic transition in its internal electronic state, a sudden localized perturbation on the electrons is turned on. In analogy with the x-ray edge problem, an infrared divergent spectrum of electron-hole pairs is created which could give rise to irreversibility. Specific examples are considered and the ramifications on such observable quantities as sticking coefficients are detailed.

703,810
PB81-143216 Not available NTIS
National Bureau of Standards, Washington, DC.
Transport Properties of Annealed, Drawn Low-Density Polyethylene (LDPE).
Final rept.
F. De Candia, R. Russo, V. Vittoria, and A. Peterlin. 1980, 14p
Sponsored in part by National Council of Research, Milan (Italy).
Pub. in Jnl. of Polymer Science, Polymer Physics Edition 18, p2083-2096 1980.

Keywords: *Polyethylene, *Transport properties, Concentration(Composition), Diffusion, Fibers, Reprints.

The specific concentration c(a) of methylene chloride, the zero-concentration diffusion coefficient D(0), and the concentration coefficient gamma (D) of the diffusivity in drawn and annealed LDPE were measured. The influence of the drawing rate, of annealing with the ends of the sample free and fixed and the effects of time of standing at room temperature after annealing were investigated. The observed transport properties are in good agreement with the microfibrillar model of fibrous structure, its relaxation during annealing, and the slow crystallization of relaxed tie-molecules upon standing at room temperature.

703,811
PB81-143240 Not available NTIS
National Bureau of Standards, Washington, DC.
Molybdoarsinate Heteropoly Complexes. Structure of the Hydrogen Tetramolybdodimethylarsinate(2-) Anion by X-Ray and Neutron Diffraction.
K. M. Barkigia, L. M. Rajkovic-Blazer, M. T. Pope, E. Prince, and C. O. Quicksall. 1980, 7p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Inorganic Chemistry 19, n9 p2531-2537 1980.

Keywords: *Crystal structure, *Complex compounds, *Molybdenum organic compounds, X ray analysis, Neutron diffraction, Arsenic organic compounds, Reprints.

Seven salts of the heteropoly molybdate anions R2AsMo4O15H(-2) (R=CH3, C2H5, C6H5) have been synthesized and characterized by spectroscopic measurements.

703,812
PB81-143596 Not available NTIS
National Bureau of Standards, Washington, DC.
Critical-Region Equation of State of Ethene and the Effect of Small Impurities,
J. R. Hastings, J. M. H. L. Sengers, and F. W. Balfour. Nov 80, 37p
Pub. in Jnl. of Chemical Thermodynamics 12, n11 p1009-1045 Nov 80.

Keywords: *Equations of state, *Ethylene, Critical density, Temperatures, Impurities, Mathematical models, Critical points, Reprints.

Accurate measurements are reported of the equation of state of ethene on 16 isochores within + or - 40 per cent of the critical density and at temperatures from 220 to 303 K. Two samples, one of 99.993 and one of 99.999 moles per cent C2H4, have been used. The principal source of experimental error is found to be impurity. A model for predicting the effect of known small impurities is developed and used to explain qualitatively the observed differences between the results for our two samples as well as those between our own and other recently-reported accurate measurements. The critical-point parameters resulting from the fit are presented. Comparisons are made with two other sets of measurements recently published. The agreement is generally satisfactory.

703,813
PB81-143604 Not available NTIS
National Bureau of Standards, Washington, DC.
Longitudinal Acoustic Mode in Helical Polymers: Poly/oxymethylene/ and Isotactic Polypropylene.
J. F. Rabolt, and B. Fanconi. 1977, 7p
Pub. in Polymer Letters 15, p121-127 1977.

Keywords: *Acetal resins, *Polypropylene, *Raman spectroscopy, Polymers, X-ray analysis, Modulus of elasticity, *Longitudinal acoustic modes.

A longitudinal acoustic mode (LAM) characteristic of polymer crystalline lamellae has been observed in the low frequency Raman spectra of melt crystallized polyoxymethylene and isotactic polypropylene. The shift in peak frequency of the LAM is correlated with an increase in lamella thickness resulting from annealing. Assuming the applicability of the uniform elastic rod model to helical polymers, values of the elastic modulus are derived and found to be much larger than those obtained from x-ray measurements. The possible origins of this discrepancy are discussed.

703,814
PB81-144230 Not available NTIS
National Bureau of Standards, Washington, DC.
Fracture of Fibrous Polymers.
A. Peterlin. Nov 78, 6p
Pub. in Polymer Engineering and Science 18, n14 p1062-1067 Nov 78.

Keywords: *Fibers, *Polymers, *Fracture properties, Modulus of elasticity, Strain tests, Reprints.

The fibrous material obtained by drawing or extrusion exhibits a more than linear increase in the axial elastic modulus with draw ratio, a much slower increase in tensile strength and a decrease in strain to break. The reason for such a behavior is found in the existence of structural defects of fibrous material, which is composed of very long and narrow microfibrillar elements. The process is favored by a high elastic modulus of microfibrils which is practically identical with that of the drawn or extruded sample. Hence the fibrous polymer fails at lower strain the higher its axial elastic modulus, i.e., the higher the draw ratio.

703,815
PB81-144248 Not available NTIS
National Bureau of Standards, Washington, DC.
Rapid Solidification.
J. W. Cahn, S. R. Coriell, and W. J. Boettinger. 1980, 15p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings of Laser and Electron Beam Processing of Materials, Boston, MA., November 27-30, 1979, Paper in Laser and Electron Beam Processing of Materials, p89-103 1980.

Keywords: *Solidification, Thermodynamics, Solutes, Separation.

Rapid solidification phenomena are described in terms of a hierarchy of increasing deviation from equilibrium. Results of morphological stability theory applied to silicon regrowth indicates that factors outside of conventional constitutional supercooling can explain the observed absence of lateral segregation. A model for interface response functions applicable to solute trapping is presented and a thermodynamic limit to the amount of solute trapping, which seems to be operating in some systems, is proposed.

703,816
PB81-144263 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoionization and Threshold Photoelectron-Photoion Coincidence Study of Allene from Onset to 20 eV.
A. C. Parr, A. J. Jason, and R. Stockbauer. 1978, 24p
Sponsored in part by Alabama Univ. Research Grants Committee.
Pub. in International Jnl. of Mass Spectrometry and Ion Physics 26, p23-38 1978.

Keywords: *Allene, *Photoionization, Mass spectroscopy, Reprints, *Threshold effects(Electron energy), Autoionization.

The photoionization efficiency curves for allene and its fragments C3H3(+1), C3H2(+1) and C3H(+1) are

given from threshold to 20 eV. The threshold photoelectron spectra and breakdown curves are given over the same energy span. The adiabatic ionization potential is determined to be 9.69 + or - .01 eV and the heats of formation of the fragments are derived from the appearance potentials. Autoionization is found to be an important factor in the parent ionization and fragmentation.

703,817
PB81-144271 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoionization and Threshold Photoelectron-Photoion Coincidence Study of Cyclopropene from Onset to 20 eV.
A. C. Parr, A. J. Jason, and R. Stockbauer. 1980, 9p
Sponsored in part by Alabama Univ. Research Grants Committee.
Pub. in International Jnl. of Mass Spectrometry and Ion Physics 33, p243-251 1980.

Keywords: *Cyclopropene, *Photoionization, Reprints, *Threshold effects(Electron energy).

The photoionization efficiency curves have been obtained for cyclopropene and its fragments C3H3(+1), C3H2(+1), and C3H(+1) from threshold to 20 eV. The threshold photoelectron spectra and breakdown curves are given over the same energy range. The breakdown curve is almost identical to those obtained previously for allene and propyne when put on a common energy scale. This suggests that all three ions isomerize to a common structure before fragmentation.

703,818
PB81-144305 Not available NTIS
National Bureau of Standards, Washington, DC.
Elastic Modulus and Strength of Fibrous Material.
A. Peterlin. Feb 79, 7p
Pub. in Polymer Engineering and Science 19, n2 p118-124 Feb 79.

Keywords: *Polymers, *Modulus of elasticity, *Strength, Mechanical properties, Reprints.

As a rule the large increase of elastic modulus with increasing draw ratio obtainable in highly drawn or extruded semicrystalline polymers is not reflected in a similarly large increase of strength. This is closely connected with the well-known fact that with increasing plastic deformation one obtains fibrous material with decreasing strain to break. These effects are the consequence of fibrous morphology. The axial elastic modulus is mainly caused by the many taut tie molecules which bridge the amorphous layers between consecutive crystal blocks and thus provide an efficient axial force transmission through the sample. The defects at the ends of microfibrils interrupt this transmission because they contain very few if any taut tie molecules connecting the end of microfibril with adjacent fibrillar elments of the sample. As a consequence of the small number of such ends, they only marginally reduce the elastic modulus. But as the mechanically weakest areas of the fibrous material, they drastically depress the strength. They fail as soon as the strain concentration upon them reaches their strain to break. The growth and coalescence of resulting microcracks finally leads to the fracture of the bulk sample as the growing crack reaches critical dimensions.

703,819
PB81-144313 Not available NTIS
National Bureau of Standards, Washington, DC.
Accordion-Type Laser-Raman (ALR) Oscillations in Crystalline Polymers.
A. Peterlin. Feb 79, 7p
Pub. in Jnl. of Applied Physics 50, n2 p838-844 Feb 79.

Keywords: *Polymers, *Raman spectroscopy, Absorption spectra, Oscillators, Reprints, *Laser spectroscopy, Molecular Conformations.

If one interprets the ALR absorption lines of crystalline polymers in terms of oscillating elastic rods of length equal to the thickness L of the crystalline lamellae, or the thickness D of the crystalline core of the lamellae, one obtains for the elastic modulus of these rods values which are substantially higher than the axial elastic modulus E(c) of the crystal lattice. The effect is particularly conspicuous with polymers which in the crystalline state exhibit a helical-chain conformation. The explanation of this effect seems to be the elastic coupling of longitudinal oscillations of chain stems of subsequent lamellae by the intervening amorphous layers. The apparent increase of the ALR oscillation frequency by such coupling is particularly large if the elastic modulus E(a) of the amorphous layers is equal or even higher than that of the crystal lattice. The high value of E(a) derived from such an analysis is a consequence of the very high ALR frequency (about 0.3 THz), which makes the amorphous layer react as a rigid glass.

703,820
PB81-144677 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermochemical Equilibrium of Multiphase Solids Under Stress.
F. C. Larche, and J. W. Cahn. 1978, 11p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Acta Metallurgica 26, p1579-1589 1978.

Keywords: *Chemical equilibrium, *Solid phases, *Stresses, Interfaces, Surfaces, Reprints.

The internal and interface equilibrium of a multiphase multicomponent solid under non-uniform nonhydrostatic stress is examined at solid-fluid and two kinds of solid-solid interfaces, and in the presence or absence of mobile vacancies. Gibbs' solid-fluid equilibrium is not obtained unless vacancies are absent, or if one can assume that vacencies reach equilibrium that is localized at each interface. The two kinds of solid-solid surfaces called coherent and incoherent differ in the constraints imposed on allowed variations and lead to quite different equilibrium conditions.

703,821
PB81-144685 Not available NTIS
National Bureau of Standards, Washington, DC.
ToF Atom-Probe Mass Spectra of GaAs.
T. T. Tsong, S. N. Yee, and A. J. Melmed. 1978, 6p
Grant NSF-DMR76-11418
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Surface Science Letter 77, pL187-L192 1978.

Keywords: *Gallium arsenides, Mass spectroscopy, Reprints, *Time of flight mass spectroscopy.

Time-of-flight mass analysis is applied to GaAs. Analyses are done in the presence of hydrogen and argon, as well as in vacuum. Significant differences are found in the spectra obtained under these conditions. Particularly interesting is the apparent specificity of hydrogen to react with As compared to Ga. The existence of the molecular ion As2(+1) is established.

703,822
PB81-144693 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure of (3-Chloro-2-hydroxy-5-nitrophenyl)-(2'-chlorophenyl)iodonium hydroxide, Inner Salt,
S. W. Page, E. P. Mazzola, V. L. Himes, A. D. Mighell, and C. R. Hubbard. Sep 79, 3p
Sponsored in part by Food and Drug Administration, Washington, DC.
Pub. in Jnl. of American Chemical Society 101, n19 p5858-5860, 12 Sep 79.

Keywords: *Molecular structure, *X ray analysis, Iodine organic compounds, Organic salts, Reprints, *Iodonium hydroxide/(chloro-hydroxy-nitrophenyl)-(chlorophenyl), Chemical reaction mechanisms.

C12H6NO3Cl2I6 MW = 409.98; monoclinic, P2(1/n); a = 15.928(9); b = 18.271(6); c = 4.623(2)A, gamma = 105.58, z = 4; Dc = 2.106 g/cm; D(m) = 2.11 (floatation); final R = 0.060 (1787 observed reflections). The molecule exists as a zwitterion with an intramolecular I...O distance of 2.768(8)A. The I-C bond distances were found to be 2.08(1) and 2.11(1)A, with a C-I-C angle of 97.8(4). Intermolecular ionic attraction between I and O causes the formation of infinite chains along the z-axis of the cell. This zwitterion is the first reported example of a phenoxide-iodonium betaine. The title compound is a key intermediate in the synthesis of O-diphenyl ethers. A reaction mechanism based on the zwitterion formation is proposed.

703,823
PB81-144750 Not available NTIS
National Bureau of Standards, Washington, DC.
Collisional Effects in the Multi-Photon Dissociation of CF2CFCl.
J. Stone, E. Thiele, M. F. Goodman, J. C. Stephenson, and D. S. King. Sep 80, 12p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 73, n5 p2259-2270, 1 Sep 80.

Keywords: Reaction kinetics, Fluorescence, Dissociation, Chlorine organic compounds, Reprints, *Molecule molecule interactions, *Laser spectroscopy, *Ethylene/chloro-trifluoro, Laser induced fluorescence.

The authors report results of a combined experimental and theoretical study of the effects of collisions with an inert buffer gas, on the CO2 laser induced MPD of CF2CFCl to form CF2 and CFCl. Rates of formation of the primary product CF2 have been determined, in real time using the laser excited fluorescence technique, at four IR laser intensities I(max)= 35, 47, 73 220 MW/square centimeter. Using only parameters determined in the MPD fit, the authors predict as a function of laser intensity and buffer gas pressure the energy absorbed from the light field. This prediction can be tested in an experiment that measures absorbed energy by the acousto-optic technique.

703,824
PB81-144768 Not available NTIS
National Bureau of Standards, Washington, DC.
Geometry of CO on Ru(001): Evidence for Bending Vibrations in Adsorbed Molecules,
T. E. Madey. 1979, 14p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Surface Science 79, p575-588 1979.

Keywords: *Carbon monoxide, *Nitrogen oxide(NO), *Surface chemistry, *Molecular structure, Adsorption, Chemisorption, Molecular vibrations, Ultraviolet spectroscopy, Temperature, Reprints, *Electron stimulated desorption ion angular distributions.

As a test of the utility of the ESDIAD method (Electron Stimulated Desorption Ion Angular Distributions) in studies of the geometry of adsorbed molecules, the chemisorption of CO on Ru(001) has been examined. Data previously reported using UPS (ultraviolet photoemission spectroscopy) and EELS (electron energy loss spectroscopy) have indicated that CO is terminally bonded to the Ru surface through the C atom, with the CO axis perpendicular to the surface. The widths of the ion beams are temperature dependent; for both O(+1) + CO(+1) and approximately 12 degrees, the half widths at half maximum, alpha, of the ion cones are approximately 16 degrees at 300 K, and approximately 12 degrees at 90 K. This temperature dependence, coupled with a simple model calculation, indicates that the dominant factors contributing to the width of the ESD ion beams are the CO surface bending vibrations, i.e, initial state effects. Thus, the data suggest that both the directions and widths of ESDIAD beams are determined largely by the structure and dynamics of the initial adsorbed state.

703,825
PB81-144776 Not available NTIS
National Bureau of Standards, Washington, DC.
Adsorption of Cycloparaffins on Ru(001) as Studied by Temperature Programmed Desorption and Electron Stimulated Desorption,
T. E. Madey, and J. T. Yates. 1978, 18p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Surface Science 76, p397-414 1978.

Keywords: *Cycloalkane hydrocarbons, *Surface chemistry, *Adsorption, Desorption, Molecular structure, Temperature, Reprints, *Electron stimulated desorption ion angular distributions.

The adsorption of C2H6, and the cycloparaffins C3H6, C6H12, and C8H16 on Ru(001) at 80 K has been studied using LEED. The temperature was programmed for desorption and ESDIAD (Electron Stimulated Desorption Ion Angular Distributions). An aim of these studies has been to examine the relationship between ESDIAD ion desorption angles and bond angles in weakly adsorbed species having known internal structure.

703,826
PB81-144784 Not available NTIS
National Bureau of Standards, Washington, DC.
Virial Series of the Ideal Bose Gas,
R. M. Ziff, and J. M. Kincaid. Jan 80, 5p
Sponsored in part by National Science Foundation, Washington, DC., and American Chemical Society, Washington, DC.
Pub. in Jnl. of Math. Phys. 21, n1 p161-165 Jan 80.

Keywords: *Ideal gas, Equations of state, Phase transformations, Reprints, *Virial coefficients.

The radius of convergence Rho(R) of the virial series of the d-dimensional ideal Bose gas is estimated by the method of Pade approximants, using at least thirty virial coefficients, which were numerically determined. A finite Rho(R) is found for d = 1 and 2, even though no phase transition occurs for these d. For d = 3, Rho(R) is consistent with Fuchs' analytical bounds, and for d = 4, 5, and 6, Rho(R) is equal to the critical density Rho(C). These results are supported by some analytic results for the equation of state.

703,827
PB81-145468 Not available NTIS
National Bureau of Standards, Washington, DC.
Value of the Faraday via 4-aminopyridine.
Final rept.
W. F. Koch. 1980, 16p
Pub. in Proceedings of the Atomic Masses and Fundamental Constants, East Lansing, MI., September 18-21, 1979, Paper in Atomic Masses and Fundamental Constants 6, p157-172 1980.

Keywords: *Coulometers, *Volumetric analysis, Nitrogen organic compounds, *Pyridine/amino, *Faraday.

In 1833, Michael Faraday of the Royal Institution in London formulated the laws of electrolysis revealing the relationship between electric current, time, and chemical equivalent weight (mole). The constant of proportionality, F, has of course been named the Faraday constant and its value is the subject of this presentation. At the last meeting (AMCO-5), preliminary results were reported on the determination of the Faraday constant by way of coulometric titration of 4-aminopyridine performed at Iowa State University. Additional titrations of the same material have since been conducted at the National Bureau of Standards, taking advantage of improved standards of mass, time, voltage and resistance. A reappraisal of the error analysis has also been undertaken in light of further evidence and is reported herein.

703,828
PB81-145492 Not available NTIS
National Bureau of Standards, Washington, DC.
Refinement of the Structure of Solid Nitromethane.
S. F. Trevino, E. Prince, and C. R. Hubbard. Sep 80, 6p
Pub. in Jnl. of Chemical Physics 73, n6 p2996-3000, 15 Sep 80.

Keywords: *Nitromethane, *Crystal structure, X ray diffraction, Solid phases, Neutron diffraction, Chemical bonds, Reprints.

The complete determination of the crystal structure of solid nitromethane has been obtained from single crystal x-ray diffraction and neutron powder diffraction data.

703,829
PB81-145500 Not available NTIS
National Bureau of Standards, Washington, DC.
Study of Methyl Reorientation in Solid Nitromethane by Neutron Scattering,
S. F. Trevino, and W. H. Rymes. Sep 80, 16p
Pub. in Jnl. of Chemical Physics 73, n6 p3001-3006, 15 Sep 80.

Keywords: *Nitromethane, *Neutron scattering, X ray analysis, Solid phases, Reprints, *Methyl radical.

The geometrical and dynamical properties of the reorientation of the methyl group of nitromethane in the solid state have been studied by inelastic neutron scattering.

703,830
PB81-145534 Not available NTIS
National Bureau of Standards, Washington, DC.
Kinetic Perturbation Theory for Dilute Gases.
J. M. Kincaid, and R. F. Kayser. Aug 80, 2p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physics Letters 78A, n3 p215-216 Aug 80.

Keywords: *Perturbation theory, *Gases, *Kinetics, Transport properties, Boltzmann equation, Reprints.

The authors proved for two classes of smooth, repulsive interparticle potentials phi(r) = phi sub 0 (r) + lambda phi sub 1 (r), that the collision integrals of the linearized Boltzmann equation are analytic functions of lambda in the neighborhood of lambda = 0. It then follows, for example, that the first Enskog approximation for the transport coefficients can be represented by a Taylor series in lambda.

703,831
PB81-145575 Not available NTIS
National Bureau of Standards, Washington, DC.
Stokes-Einstein Diffusion of Critical Fluctuations in a Fluid.
H. C. Burstyn, P. Esfandiari, and J. V. Sengers. Jul 80, 3p
Grant NSF-DMR79-10819
Pub. in Physical Review A 22, n1 p282-284 Jul 80.

Keywords: *Fluids, *Critical point, *Diffusion, Viscosity, Reprints.

The theory of dynamic critical phenomena predicts that the diffusion coefficient associated with the order-parameter fluctuations near the critical point of fluids should vanish asymptotically as D=RKT/6pi eta sigma, where eta is the shear viscosity, sigma the correlation length and R a universal constant.

703,832
PB81-145583 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Steps and Defects in Electron Stimulated Desorption:Oxygen on Stepped W (110) Surfaces,
T. E. Madey. 1980, 24p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Surface Science 94, p483-506 1980.

Keywords: *Surface chemistry, *Desorption, *Oxygen, Electrons, Chemisorption, Adsorption, Reprints.

In order to examine the role of atomic steps and defects on electron stimulated desorption (ESD) phenomena, the author has studied the adsorption of oxygen on a polyhedral tungsten crystal containing a W(100) flat and 4 flats having orientations 6 and 10 degrees off the (110) plane with rows of steps parallel to the (100) and (110) directions. Adsorption at low coordination sites appears to be a key factor in producing high ESD ion yields.

703,833
PB81-149254 Not available NTIS
National Bureau of Standards, Washington, DC.
Characterization of the Emission from Atomic Hydrogen in a Microwave Induced Plasma.
F. P. Schwarz. Aug 79, 5p
Pub. in Analytical Chemistry 51, p1508-1512 Aug 79.

Keywords: Emission spectroscopy, Reprints, *Hydrogen atoms, *Microwave induced plasma detectors.

Microwave induced plasma detectors (MPD) are typically operated with small amounts of oxygen added to the helium or argon plasma gas in order to keep the plasma cell walls clean. It is shown, however, that the presence of oxygen in the plasma gas causes a nonlinear response in the hydrogen emission dependence on concentration, as well as the appearance of hydrogen emission upon passage of deuterium through the MPD. Both effects diminish with increasing plasma pressure and disappear in the absence of oxygen. A kinetic scheme, based on radiative charge recombination between protons and electrons and generation of the protons and electrons via the metastable He 2s triplet S state, is presented to account for these effects. It is suggested that oxygen affects the hydrogen emission through a charge transfer reaction between protons and molecular oxygen.

703,834
PB81-149262 Not available NTIS
National Bureau of Standards, Washington, DC.
Liquidons and Gasons: Controversies About the Continuity of States.
J. M. H. L. Sengers. 1979, 40p
Grant NATO-1065
Pub. in Physica 98A, p363-402 1979.

Keywords: *Liquid phases, *Vapor phases, *Critical point, Van der Waals equation, Condensation, Diffusion, Transition points, Reprints, Andrew.

Two basic ideas about the nature of the gas-liquid transition were voiced around 1870: that in the supercritical state vapor and liquid are indistinguishable (Andrews), and that condensation and critical behavior can be understood on the basis of a simple assumption about molecular interaction (Van der Waals). This paper describes the controversies that raged between proponents and opponents of the Andrews-Van der Waals view between 1880 and 1907, and how they were fanned by erroneous or incorrectly interpreted experiments carried out all over Europe. Kamerlingh Onnes and his staff in Leiden repeated a number of the controversial experiments in the period 1892-1907 and discovered that impurity was by far the largest source of error. By 1907 the controversy was rather unequivocally decided by the Leiden group in favor of the Andrews-Van der Waals view. A replay of the old controversy took place in the period 1933-1952.

703,835
PB81-149312 Not available NTIS
National Bureau of Standards, Washington, DC.
Parametrization for Solids Under Hydrostatic Pressures,
R. G. Munro. Jun 78, 3p
Pub. in Physics Letters 66A, n5 p392-394, 12 Jun 78.

Keywords: *Hydrostatic pressure, *Ruby, Frequency shifts, Reprints, *Chromium ions, Knight shift.

A newly developed parametrization successfully used to calculate the hydrostatic pressure dependence of the Cr3+ spectra of ruby is shown to be useful also for describing some cases of hydrostatic pressure shifts of Van Vleck susceptibilities and Knight shifts.

703,836
PB81-149346 Not available NTIS
National Bureau of Standards, Washington, DC.
Correlation of Thermodynamic Properties of Aqueous Polyvalent Electrolytes.
B. R. Staples. 1979, 8p
Pub. in Proceedings of International Conference on the Properties of Steam (9th), Technische Universitat, Munchen, Germany, September 10-14, 1979, Paper in Water and Steam, Their Properties and Current Industrial Applications, p608-615 1979.

Keywords: *Thermodynamic properties, *Electrolytes, Inorganic salts, *Electrolyte data center.

The techniques used in the critical evaluation and correlation of thermodynamic properties of aqueous polyvalent electrolytes will be described. The Electrolyte Data Center at the U.S. National Bureau of Standards is engaged in the correlation of activity and osmotic coefficients, enthalpies of dilution and solution, heat capacities, and ionic equilibrium constants for aqueous salt solutions. Current results for about 100 correlations will be compared and observed periodic trends and trends according to charge-type will be discussed.

703,837
PB81-149353 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Enhanced Ionization for Trace Metal Analysis in Flames.
J. C. Travis, G. C. Turk, and R. B. Green. 1978, 11p
Pub. in Proceedings of ACS, Division of Analytical Chemistry at the Meeting of the American Chemical Society (175th), Anaheim, CA., March 14-15, 1978, Paper No. 6 in New Applications of Lasers to Chemistry, ACS Symposium Series 85, p91-101 1978.

Keywords: *Trace elements, *Metals, Ionization, *Laser enhanced ionization, *Flame spectroscopy, Laser spectroscopy.

A new laser-based flame analytical method, requiring no optical detection, promises to outperform traditional methods in many applications. Detection is based on the enhanced flame ionization of analyte atoms maintained in an excited state by a laser tuned to the desired electrical probes located at the outer edges of the flame. This configuration yeilds ng/ml detection of Cr, Fe, Ga, In, K, Mg, Mn, Na, Pb, and Tl, with negligible probe deterioration over days of operation. Less impressive results for the few remaining elements studied to date are attributed to the role of the ionization potential, and more appropriate transitions are being explored.

703,838
PB81-149361 Not available NTIS
National Bureau of Standards, Washington, DC.

Analytical Flame Spectrometry with Laser Enhanced Ionization.
G. C. Turk, J. C. Travis, J. R. DeVoe, and T. C. O'Haver. 1978, 4p
Pub. in Analytical Chemistry 50, n6 p817-820 1978.

Keywords: Copper, Magnesium, Manganese, Sodium, Lead(Metal), Ionization, Reprints, *Laser enhanced ionization, *Flame spectroscopy.

A new flame spectrometric technique using laser-enhanced ionization is described. The method is based on the increase in flame conductivity resulting from the enhanced thermal ionization of an element following the absorption of laser radiation at a transition wavelength for that element. Detection limits are reported for Cu, Mg, Mn, Na and Pb. In most cases the detection limits are comparable or better than the best reported values for other flame spectrometric techniques. Also discussed is the unique ability of laser-enhanced ionization to use non-resonance or weak resonance lines, often with sensitivity comparable or better than the traditional lines used in other flame spectrometric techniques.

703,839
PB81-149387 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Transition Temperatures on Sodium Stearate Using Gas Chromatography.
S. P. Wasik. Nov 76, 3p
Pub. in Jnl. of Chromatographic Science 14, p516-518 Nov 76.

Keywords: *Gas chromatography, *Transition temperature, *Molecular structure, Solvents, Reprints, *Sodium stearate.

A gas chromatographic method is presented for detecting structural changes in a solvent by observing the solubility behavior of a 'probe' solute molecule. The transition temperatures of solid and liquid sodium stearate were determined at this point on the log V(g) - 1/T plot where the slope changes abruptly. The observed transition temperature were compared with differential scanning calorimetry measurements on the same compound and the results of other investigators using different physical methods.

703,840
PB81-149411 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron-Microscope Study of Crystal Structures of Mixed Oxides in the Systems Rb(2)0-Ta(2)0(5), Rb(2)0-Nb(2)0(5) and K(2)0-Ta(2)0(5) with Composition Ratios Near 1:3. II. Various Intergrowth Phases and Two-Dimensional Ordering of Pentavalent Ions.
K. Yagi, and R. S. Roth. 1978, 9p
Pub. in Acta Crystallographica A34, p773-781 1978.

Keywords: *Crystal structure, *Mathematical models, *Electron microscopy, Niobates, Tantalates, Rubidium oxides, Potassium oxides, Reprints.

In part I, the preceding paper, structural models were proposed on the basis of high-resolution electron microscopy for phases previously designated as 11L, 9L and 16L, which were found to exist in the title systems. Two types of blocks were found, which are composed of five and six layers of octahedra. In the present paper, various intergrowth phases which are composed of the two types of blocks are described. A new notation is proposed to denote these intergrowth phases as well as the 11L, 9L and 16L structures. Two-dimensional ordering of pentavalent ions in the six-layer block is found, giving rise to diffuse scattering in electron diffraction patterns. Two-dimensional images, calculated on the basis of the proposed model, are found to reproduce the observed images.

703,841
PB81-149429 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Spectroscopic Study of Activated Surface Processes; CO Chemisorption on Supported Rh.
J. T. Yates, T. M. Duncan, and R. W. Vaughan. Nov 79, 8p
Pub. in Jnl. Chemical Physics 71, n10 p3908-3915, 15 Nov 79.

Keywords: *Surface chemistry, *Carbon monoxide, *Infrared spectroscopy, Chemisorption, Reprints.

The infrared spectrum of CO chemisorbed on alumina-supported Rh surfaces has been studied following chemisorption at cryogenic temperatures.

703,842
PB81-149452 Not available NTIS
National Bureau of Standards, Washington, DC.
NMR Study of Diffusion of Butane in Linear Polyethylene.
I. Zupancic, G. Lahajnar, R. Blinc, D. H. Reneker, and A. Peterlin. 1978, 9p
Pub. in Jnl. of Polymer Science, Polymer Physics Edition 16, p1399-1407 1978.

Keywords: *Nuclear magnetic resonance, *Butanes, Diffusion, Transport properties, Polythylene, Reprints.

The diffusion coefficient of butane in linear polyethylene at room temperature as a function of the vapor pressure of butane was measured by the spin echo method with a pulsed magnetic field gradient.

703,843
PB81-149817 Not available NTIS
National Bureau of Standards, Washington, DC.
Atomic Transition Probabilities.
Final rept.
W. L. Wiese, and G. A. Martin. 1980, 36p
Pub. in Section E in CRC Handbook of Chemistry and Physics, 61st Ed., pE349-383 1980.

Keywords: *Atomic energy levels, *Transition probabilities, Tables(Data), Reprints.

A table of selected, critically evaluated transition probabilities is presented, which comprises about 4000 prominent lines of the lighter elements from hydrogen through iron. For the sake of convenience, a compact handy format is used which contains only the bare minimum of information.

703,844
PB81-149833 Not available NTIS
National Bureau of Standards, Washington, DC.
Multiangular Absorption Measurements in a Methane Diffusion Jet.
Final rept.
R. J. Santoro, H. G. Semerjian, P. J. Emmerman, R. Goulard, and R. Shabahang. 1980, 6p
Pub. in Proceedings of the Symposium of the Meeting of the American Chemical Society (178th), Washington, DC., September 9-14, 1979, Chapter 36 in Laser Probes for Combustion Chemistry, ACS Symposium Series 134, p427-433 1980.

Keywords: *Absorption, *Methane, Concentration(Composition), Diffusion.

A multiangular absorption approach is used to measure the concentration profile of methane across a diffusion jet. The results have been used to assess the applicability of tomography to gas phase species analysis. Comparisons of the center line concentration and jet position have shown excellent agreement with the known experimental values. The effect of the number of angles for which data is obtained has also been addressed and found to agree with previous analytical studies.

703,845
PB81-151474 PC **A17**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Ion Energetics Measurements. Part I. 1971-1973.
H. M. Rosenstock, D. Sims, S. S. Schroyer, and W. J. Webb. Sep 80, 379p NSRDS-NBS-66-PT-1
Library of Congress catalog card no. 80-607942.
Sponsored in part by National Inst. of General Medical Sciences, Bethesda, MD.

Keywords: *Ions, *Ionization potentials, Photoionization, Electronic spectra, Tables(Data).

The present publication tabulates measurement information on energetics of gaseous positive ions published in 1972 and 1973 along with some information from 1971. It is intended to supplement the information previously compiled and evaluated in 'Energetics of Gaseous Ions.' Approximately five thousand measurements are tabulated, drawn from over six hundred published papers.

703,846
PB81-154460 Not available NTIS
National Bureau of Standards, Washington, DC.

Photodetachment Spectroscopy of C2(-) Autodetaching Resonances.
Final rept.
P. L. Jones, R. D. Mead, B. E. Kohler, S. D. Rosner, and W. C. Lineberger. 1980, 14p
Grants NSF-CHE78-18424, NSF-PHY79-04928
Pub. in Jnl. of Chemical Physics 73, n9 p4419-4432, 1 Nov 80.

Keywords: *Carbon, Ultraviolet spectroscopy, Molecular vibration, Ions, Reprints, *Autoionization, *Carbon ions.

The cross section for photodetachment of C2(-1) is investigated in the photon energy range 14000-20000 cm (1.75-2.5 eV). Sharp resonances due to autodetachment are observed at photon energies corresponding to transitions between high vibrational levels of the C2(-1) X 2 sup sigma (+)(g) state and high vibrational levels of the C2(-1) B 2 sup sigma (+)(u) states.

703,847
PB81-155657 Not available NTIS
National Bureau of Standards, Washington, DC.
What Really Does Happen to Electronically Excited Atoms in Flames.
Final rept.
K. C. Smyth, P. K. Schenck, and W. G. Mallard. 1980, 7p
Pub. in Proceedings of the American Chemical Society Symposium Series No. 134, Laser Probes of Combustion Chemistry, Washington, DC., September, 1979, p175-181 1980.

Keywords: *Flames, *Atomic energy levels, Excitation, Atoms, Ionization, *Sodium atoms.

In this paper the authors compare experimental results on the opto-galvanic spectra of high-lying d states in sodium with model calculations which incorporate ionization and quenching rates. The main conclusions are: (1) Hollander's 'low' rate constant for sodium ionization is sufficient to model the opto-galvanic signal magnitudes as a function of excitation energy. Abnormally high rates are not required. (2) Essentially all (greater than 90%) of the sodium atoms excited to n greater than or = to 7d are ionized at a flame temperature of 2000K. For n = 7 the energy needed for ionization 2249/cm, which is approximately 2kT (kT = 1390/cm).

703,848
PB81-155665 Not available NTIS
National Bureau of Standards, Washington, DC.
Prospectives for Surface Chemistry.
Final rept.
J. T. Yates, and T. E. Madey. 1980, 29p
Pub. in ONR-37, Science, Technology, and the Modern Navy, Thirtieth Anniversary 1946-1976, p415-432 1976. Proceedings of Symposium on Fluid/Solid Surface Interactions, National Bureau of Standards, Gaithersburg, MD., October 18-20, 1978, p121-149 1980.

Keywords: *Surface chemistry, Forecasting, Technology.

Recent historical developments in the field of surface chemistry are reviewed as a basis for future work within the field. The relationship of basic studies in surface chemistry and surface physics to technological applications is outlined.

703,849
PB81-155715 Not available NTIS
National Bureau of Standards, Washington, DC.
Shear Induced Phase Transitions in Simple Fluids.
Final rept.
D. J. Evans, and H. J. M. Hanley. 29 Sep 80, 3p
Pub. in Jnl. Physics Letter 79A, n2-3 p178-180, 29 Sep 80.

Keywords: *Phase transformations, *Fluids, Thermodynamics, Pressure, Strain rate, Critical point, Shear strain, Reprints, Lennard-Jones systems.

Computer simulation indicates that the pressure of a fluid under shear is a function of the strain rate. The phase diagram will be dependent on the shear and, in particular, the critical point will be shifted. The effect is shown quantitatively for a Lennard-Jones fluid.

703,850
PB81-155723 Not available NTIS
National Bureau of Standards, Washington, DC.

Computer Simulation of an m-6-8 Fluid Under Shear.
Final rept.
D. J. Evans, and H. J. M. Hanley. Sep 80, 11p
Pub. in Jnl. Physica (Utrecht) A 103, n1-2 p343-353 Sep 80.

Keywords: *Shear tests, *Fluids, Viscosity, Density(Mass/volume), Pressure, Dynamics, Phase transformations, Reprints, Lennard-Jones systems.

A homogeneous shear nonequilibrium molecular dynamics algorithm has been applied to a system of 108 particles interacting with an m-6-8 potential. The viscosity was calculated at three densities corresponding approximately to the triple point, two-thirds melting and critical density. Comparing the results to argon data it appears that three body effects need to be considered at the higher densities. The variation of the viscosity and pressure with shear was noted. The viscosity behavior reinforces previous work with a Lennard-Jones fluid; the pressure behavior has not been reported before.

703,851
PB81-155764 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectroscopic Studies of the Products of Reactions of Yttrium and Scandium Atoms with Halogen Molecules. I. The Origin of Chemiluminescence.
Final rept.
H. C. Brayman, D. R. Fischell, and T. A. Cool. 1 Nov 80, 13p
Pub. in Jnl. of Chemical Physics 73, n9 p4247-4259, 1 Nov 80.

Keywords: *Halogens, *Chemiluminescence, Atoms, Reprints, *Laser induced fluorescence, *Yttrium atoms, *Scandium atoms.

Observations of laser induced fluorescence from the products of the reactions of yttrium and scandium atoms with halogen molecules have shown that chemiluminescence does not originate from electronically excited metal monohalide molecules, as previously suggested, but instead arises from electronically excited dihalide molecules, MX(*)(2) Production of the metal dihalides appears to require the formation of vibrationally excited metal monohalides, (MX(+)), in a precursor reaction. Radiative lifetime measurements for chemiluminescent bands are presented.

703,852
PB81-155772 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Two-Atom Coherence in Gases. I. Master Equations.
Final rept.
A. Ben-Reuven. Dec 80, 13p
Pub. in Jnl. Physical Review A 22, n6 p2572-2584 Dec 80.

Keywords: *Gases, Excitation, Atoms, Line spectra, Reprints, *Atom atom interactions.

The response of a collision-broadened gas sample to driving coherent radiation is studied theoretically, taking into account effects of coherent excitations of two or more atoms (or molecules). In analogy to the Bloch-type master equation for one-atom coherences, describing the motion of a single atom 'dressed' by the relevant (incident and detected) field modes, a master equation is derived for two-atom coherences, including an effective interaction of the Bethe-Salpeter-type, accounting for the mutual interaction of the coherently driven pair. The master equation includes also all symmetrization effects owing to resonance exchange between identical atoms, and is limited to nonreactive gas atoms (or molecules) undergoing binary collisions, including otherwise all (internal and translational) relaxation effects. The self-energy kernels are expressed in a nonperturbative fashion, in terms of binary-collision scattering amplitudes, and include renormalization effects due to coincidence of radiative couplings with the collisions (optical and radiative collisions). The concept of two-atom coherences is generalized to higher coherence ranks by constructing a hierarchy of master equations, including vertex operators that upgrade or downgrade the coherence rank, as a prelude to a diagrammatic method for calculating continuous-wave spectra. This hierarchy is compared with prevalent Agarwal-type master equations, based on the Dicke pseudospin method, and used in the study of two-level atoms.

703,853
PB81-155780 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Two-Atom Coherence in Gases. II. Continuous-Wave Spectra.
Final rept.
A. Ben-Reuven. Dec 80, 13p
Pub. in Jnl. Physical Review A 22, n6 p2585-2597 Dec 80.

Keywords: *Gases, Excitation, Atoms, Line spectra, Reprints, *Atom atom interactions.

General expressions are derived for the spectral line shapes of resonance absorption and scattering of coherent radiation in collision-broadened gases, taking into account effects of coherent excitation of two or more atoms (or molecules), as steady-state solutions of a hierarchy of master equations described in a previous publication (paper I). Coupling between the coherent motions of the atoms, provided by a Bethe-Salpeter-type effective interaction, in the binary-collision approximation, forms the essential mechanism for introducing cooperative coherent effects into the steady-state spectra. Explicit expressions are given for the effects of two-atom coherence in the binary-collision approximation, in which the Bloch-type dressed-atom self-energy superoperator is modified by the presence of collisions in which both atoms retain memory of their coherent propagation before the collision. The self-energies include the effects of resonance exchange symmetrization in self-broadening, and are renormalized by the coincidence of radiative transitions during the collisions. The impact (near-resonance) and the quasistatic (line-wing) limits of the applied-frequency detunings are discussed. In the quasistatic limit, coherent many-atom excitations become irrelevant; however, interactions of both collision partners with the radiation during the collision accounts for such phenomena as collision-induced absorption or radiative collisions. In the impact limit, the inclusion of the Bethe-Salpeter interactions allows for the appearance of two-atom resonances. Magnitude estimates of these effects are discussed. Effects of higher-rank (many-body) coherences are formally discussed with the help of a diagrammatic method, leading into implicit bootstrap equations that can be solved by iterative or other procedures.

703,854
PB81-155798 Not available NTIS
National Bureau of Standards, Washington, DC.
Rayleigh Scattering from a Methane-Ethane Mixture.
Final rept.
B. J. Ackerson, and H. J. M. Hanley. 15 Oct 80, 5p
Pub. in Jnl. Chemical Physics 73, n8 p3568-3572, 15 Oct 80.

Keywords: *Rayleigh scattering, *Methane, *Ethane, Mixture, Concentration(Composition), Thermal diffusion, Light scattering, Reprints.

The Rayleigh linewidth of a methane (71.07%)-ethane mixture was measured by dynamic light scattering near the plait point. Results are reported for the concentration diffusivity and (preliminary only) for the thermal diffusivity. It was found that a large background contribution is present in the concentration diffusivity, in agreement with theoretical predictions. The thermal diffusivity is compared to a one-fluid model introduced previously. A critical temperature of 236.36 + or - 0.03 K and a critical pressure of 6.66 + or - 0.02 MPa was determined for the mixtue.

703,855
PB81-156291 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystal Structure of Tritin (II) Hydroxide Oxide Phosphate, Sn3O(OH)PO4.
Final rept.
T. H. Jordan, B. Dickens, L. W. Schroeder, and W. E. Brown. Sep 80, 6p
Pub. in Inorganic Chemistry 19, n9 p2551-2556 Sep 80.

Keywords: *Crystal structure, X ray diffraction, Reprints, *Tin hydroxide oxide phosphate.

Sn3O(OH)PO4 crystallizes in the monoclinic cell a = 4.8851 (7) A,b =11.465 (2) A,c = 12.362 (2) A, and Bbeta = 105.81 (1) at 25 C with space group P2 1/c and Z = 4. The structure has been solved and refined to R(w) = 0.047 and R = 0.055 by using 1938 observed X-ray diffraction data collected from a single crystal by a counter method theta-2 theta scans.

703,856
PB81-156358 Not available NTIS
National Bureau of Standards, Washington, DC.
Reaction of F Atoms with O2 in an Argon Matrix.
Final rept.
M. E. Jacox. 1980, 15p
Pub. in Jnl. Mol. Spectrosc. 84, p74-88 1980.

Keywords: *Oxygen, Infrared spectroscopy, Absorption, Dissociation, Photochemical reactions, Reprints, *Matrix isolation technique, *Fluorine atoms, *Oxygen fluorides, Photodissociation.

When F atoms produced by a microwave discharge through NF3 in argon carrier gas are codeposited with O2 in an argon matrix at 14K, prominent infrared absorptions--including several overtone and combination bands--of FO2 and of O2F2 result. Also present is a peak at 1548/cm, contributed either by (O2)2 or by O2 perturbed by a nearby F2 molecule. Upon exposure of the sample to radiation of wavelength longer than 650 nm, this peak disappears, with the concurrent appearance of absorptions assigned to O2F2 trapped in a different type of site in the argon lattice. Detailed isotopic substitution studies support the previous vibrational assignments for FO2. The behavior of the OF-stretching overtone absorptions of O2F2 suggests that the unobserved OO-stretching fundamental lies in the 1250-1300/cm spectral region, resulting in Fermi resonance interaction between it and the two OF-stretching overtones. The normal coordinate analysis of O2F2 is refined to include the vibrational data for (16)O(18)OF2. No discrete electronic absorptions are observed between 220 and 870 nm. However, photodissociation of FO2 is observed with a threshold near 490 nm, and photodissociation of O2F2 occurs rapidly at wavelengths near 300 nm.

703,857
PB81-156366 Not available NTIS
National Bureau of Standards, Washington, DC.
Lead Alkali Apatites Without Hexad Anion: The Crystal Structure of Pb8K2(PO4)6.
Final rept.
M. Mathew, W. E. Brown, M. Austin, and T. Negas. 1980, 8p
Pub. in Jnl. of Solid State Chemistry 35, p69-76 1980.

Keywords: *Crystal structure, Lead inorganic compounds, X ray diffraction, Reprints, *Lead potassium apatite.

The crystal structure of Pb8K2(PO4)6 has been determined by single-crystal X-ray diffraction. The presence of lone pairs of electrons from the lead atoms in the vicinity of the hexad site may explain why this site remains empty.

703,858
PB81-158719 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Technical Activities 1980--Surface Science Division.
Final rept.
C. J. Powell. Oct 80, 64p NBSIR-80-2166

Keywords: *Surface chemistry, Standards, Fuels, Catalysis, Chemisorption, Electron spectra, Desorption, Atomic structure, Adsorption, Synthetic fuels.

This report summarizes technical activities of the NBS Surface Science Division during Fiscal Year 1980. These activities include experimental and theoretical research in surface science, the development of improved measurement methods, the provision of needed data, the development of reference materials, applications to important scientific and national problems, and surface-standards work. A listing is given of publications, talks, professional committee participation, and professional interactions by the Division staff.

703,859
PB81-160913 Not available NTIS
National Bureau of Standards, Washington, DC.
Reactions of (CO2)2+ and (CO)2+ Association Ions.
Final rept.
L. W. Sieck. 1978, 32p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in International Jnl. of Chemical Kinetics 10, p335-366 1978.

Keywords: *Carbon dioxide, *Carbon monoxide, Ions, Photoionization, Mass spectroscopy, High pressure tests, Reaction kinetics, Reprints, *Ion molecule interactions.

The reactions of (CO2)2(+1) and (CO)2(+1) with various additives have been investigated using the NBS high-pressure photoionization mass spectrometer at total pressures of 0.4-1.0 torr of either CO2 or CO. The additives include CH4, CD4, C2H2, O2, H2O, 15,14N2O, and CO in both CO2 and 13CO(2).

703,860
PB81-160947 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectroscopic Studies of the Products of Reactions of Yttrium and Scandium Atoms with Halogen Molecules. II. Laser Induced Fluorescence from Yttrium and Scandium Monohalides.
Final rept.
D. R. Fischell, H. C. Brayman, and T. A. Cool. 1 Nov 80, 13p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 73, n9 p4260-4272, 1 Nov 80.

Keywords: *Yttrium, *Scandium, *Halogens, Fluorescence, Chemiluminescence, Electron transitions, Reprints, *Laser induced fluorescence, *Atom molecule interactions, Franck-Condon principle.

Excitation spectra from the monohalides of yttrium and scandium were recorded with the laser induced fluorescence method. Spectroscopic constants and radiative lifetimes were determined for several previously unobserved electronic states. Computer generated spectral simulations were used for the determination of spectroscopic constants and Franck-Condon factors associated with the fluorescence band systems.

703,861
PB81-160954 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamics of Metastable Equilibria.
Final rept.
J. W. Cahn. Nov 80, 11p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proc. of Rapid Solidification Processing (2nd): Principles and Technologies, Reston, VA, Mar. 23-26, 1980, p24-34 Nov 80.

Keywords: *Thermodynamics, *Metastable state, Phase diagrams, Chemical equilibrium, *Phase equilibrium.

The thermodynamics of metastable phase equilibrium is closely related to that of stable phase equilibrium. Metastable phase equilibrium can often be presented by extensions of the curves on phase diagrams that represent stable phase equilibria. Thermodynamic principles rank phase equilibria but not phases in a hierarchy of increasing stability. Thermodynamics imposes precursor rules in multicomponent systems in which a prior reaction is required before a phase can appear. A given hierarchy persists over a domain on the phase diagram bounded by surfaces on which the ranking of two equilibria changes. Multicomponent phases per sec. do not form a hierarchy because a given phase can disappear and reappear in a sequence of spontaneous processes. Processing for producing metastable phases must place the system within a domain in which the desired phases can form spontaneously from the available phases.

703,862
PB81-163057 Not available NTIS
National Bureau of Standards, Washington, DC.
Vibrational Spectroscopic Studies of Chemisorbed Species on Metal Surfaces.
Final rept.
J. T. Yates, and R. R. Cavanagh. 1980, 4p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of International Conference on Solid Surfaces (4th) and the European Conference on Surface Science (3rd), Cannes, France, September 22-26, 1980, Supplement a la Revue, Les Vide, Les Couches Minces, n201, II, p750-753 1980.

Keywords: *Carbon monoxide, *Chemisorption, *Vibrational spectra, Infrared spectroscopy, Surface chemistry.

The use of transmission infrared spectroscopy to investigate the chemisorption of CO and an electronic analog to CO is described.

703,863
PB81-163073 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of the Spectrum of Four-Times-Ionized Uranium (UV).
Final rept.
J. F. Wyart, V. Kaufman, and J. Sugar. 1980, 8p
Pub. in Physica Scripta 22, p389-396 1980.

Keywords: *Uranium, *Ultraviolet spectroscopy, Molecular energy levels, Reprints.

Wavelengths for 261 lines of four-times-ionized uranium between 443 A and 2325 A are reported.

703,864
PB81-163115 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Coherence Effects in Photoinduced Auger Events: Resonant Satellites in Metals with Filled 'd' Bands.
Final rept.
S. M. Girvin, and D. R. Penn. 1980, 4p
Pub. in Physical Review B 22, n8 p4081-4084, 15 Oct 80.

Keywords: *Auger electrons, *Metals, *Atomic energy levels, *Mathematical models, Excitation, Reprints.

This paper describes a theory of the Auger effect which treats the entire process of core-level excitation followed by decay of the core hole as a coherent sequence of events. The authors present an approximate analytic solution to the model recently introduced and solved numerically by Davis and Feldkamp. Their model offers an explanation of the resonance behavior of photoemission satellites in metals with filled d bands. The authors analytic results help clarify the physics of the resonant satellite phenomena.

703,865
PB81-163149 Not available NTIS
National Bureau of Standards, Washington, DC.
Photofragmentation Infrared Emission Studies of Vibrationally Excited Free Radicals CH3 and CH2I.
Final rept.
S. L. Baughcum, and S. R. Leone. 1980, 15p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 72, n12 p6531-6545, 15 Jun 80.

Keywords: *Free radicals, *Infrared spectroscopy, *Methane, Excitation, Emission spectroscopy, Reprints, *Laser spectrosccpy, *Methane/iodo.

Time and wavelength-resolved infrared fluorescence techniques are used to study the photofragmentation dynamics of CH2I2 and CH2I at the excimer laser wavelengths of 248 and 308 nm.

703,866
PB81-163164 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory Versus Experiment: The Case of Glycine.
Final rept.
L. Schafer, H. L. Sellers, F. J. Lovas, and R. D. Suenram. 1980, 3p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. of the American Chemical Society 102, p6566-6568 1980.

Keywords: *Molecular structure, *Glycine, Vapor phases, Molecular energy levels, Comparison, Reprints, Numerical solution, Molecular conformation.

A comparison of theoretically calculated structures with experimentally determined rotational constants has led to excellent agreement of theory with experiment on the structures of two low energy conformers of gas phase glycine. The results have resolved an earlier apparent contradiction as to which conformer was the lowest energy in the gas phase. The lowest energy conformer is one which has bifurcated hydrogen bonds of the amine hydrogen to the carbonyl oxygen and a hydrogen bond between the hydroxyl hydrogen and the carbonyl oxygen. A second conformer which is approximately equal to 490/cm higher in energy has a ring-like structure with the hydroxyl hydrogen forming a hydrogen bond to the lone pair of electrons on the amine nitrogen.

703,867
PB81-164527 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Technical Activities 1980--Office of Standard Reference Data.
S. P. Fivozinsky. Dec 80, 57p NBSIR-81-2206

Keywords: *Information systems, *Physical properties, *Chemical properties, *Standard reference materials, National reference data system.

The Office of Standard Reference Data is one of six program offices in the National Measurement Laboratory, National Bureau of Standards. The Standard Reference Data Program develops and disseminates data bases of critically evaluated physical/chemical properties of substances. These data bases are available through NBS and private publications, on magnetic tape, and from on-line retrieval systems. The Office of Standard Reference Data is responsible for management and coordination of the program. Work is carried out through a decentralized network of data centers and projects referred to as the National Standard Reference Data System (NSRDS). This volume summarizes the activities of the Program for the year 1980.

703,868
PB81-167025 PC **A03**/MF **A01**
Notre Dame Univ., IN. Radiation Chemistry Data Center.
Catalog of Data Compilations on Photochemical and Photophysical Processes in Solution,
J. G. Brummer, W. P. Helman, and A. B. Ross. Nov 80, 27p NBS-SP-578
Library of Congress catalog card no. 80-600117. Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Solutions, *Photochemistry, *Catalogs(Publications), Reviews.

References to compilations and reviews of data on photochemical and photophysical processes in solution have been annotated to indicate subject and data content. Indexes are included for data types, keywords, and authors.

703,869
PB81-169971 Not available NTIS
National Bureau of Standards, Washington, DC.
Speed-of-Sound Measurements for Nitrogen Gas at Temperatures from 80 to 350K and Pressures to 1.5 MPa.
Final rept.
B. A. Younglove, and R. D. McCarty. 1980, 8p
Pub. in Jnl. of Chemical Thermodynamics 12, n12 p1121-1128 1980.

Keywords: *Nitrogen, *Acoustic velocity, Reprints, Pressure dependence, Temperature dependence.

Speeds of sound for nitrogen gas have been measured at pressures from 0.03 to 1.5 MPa on 16 isotherms from 80 to 350K. Measurements were made in a fixed-path acoustic cavity using variable-frequency electrostatic transducers operating between 1 and 30 kHz. Correction for boundary-layer effects were made using existing values of thermodynamic properties.

703,870
PB81-171431 Not available NTIS
National Bureau of Standards, Washington, DC.
VLAM, A Program for Computing the Electron-Molecule Static Interaction Potential from a Legendre Expansion of the Molecular Charge Density.
Final rept.
G. B. Schmid, D. W. Norcross, and L. A. Collins. 1980, 12p
Contract DOE-EA-77-A-01-6010
Pub. in Jnl. of Computer Physics Communication 21, p79-90 1980.

Keywords: *Collision cross sections, Electron irradiation, Molecules, Potential energy, Legendra functions, Reprints, *Electron molecule interactions, VLAM computer program.

The electron-molecule static interaction potential is of central importance to calculations of cross sections for electron-molecule collisions. This paper describes a program, VLAM, which enables the efficient numerical evaluation of this potential from a Legendre expansion of the molecular charge density. A complementary

program for the calculation of the charge density is provided in an accompanying paper. When used together, these two programs provide for a more efficient and flexible evaluation of the static interaction potential than hitherto available. In section 1, the basic physics upon which our code rests is described. Section 2 outlines the program structure. A description of the test run is presented in section 3.

703,871
PB81-171456 Not available NTIS
National Bureau of Standards, Washington, DC.
Scattering Theory of Diatomic Molecules Expansion in Adiabatic Electronic-Rotational States.
Final rept.
F. H. Mies. 1980, 14p
Pub. in Jnl. Molecular Physics 41, n5 p973-986 1980.

Keywords: *Diatomic molecules, *Wave functions, Molecular energy levels, Scattering cross sections, Reprints, Born-Oppenheimer approximation.

In this paper we perform an orthogonal transformation on the channel states and expand the total wavefunction in a complete set of adiabatic electronic-rotational states. These states are implicit, analytical functions of the interatomic coordinate R and progressively change from one Hund's electronic rotational coupling case to another as R is varied. The coupled equations are developed, using the adiabatic representation, and the exact solutions are expressed in terms of the regular and irregular solutions of the adiabatic interaction potentials.

703,872
PB81-171480 Not available NTIS
National Bureau of Standards, Washington, DC.
Behavior of the Dielectric Constant of Fluids Near a Critical Point.
Final rept.
J. V. Sengers, D. Bedeaux, P. Mazur, and S. C. Greer. 1980, 22p
Pub. in Physica 104A, p573-594 1980.

Keywords: *Critical point, Dielectric properties, Fluids, Reprints.

Thermodynamic and statistical mechanical arguements indicate that the temperature derivative of the dielectric constant of fluids diverges weakly at the critical point. Following a thermodynamic procedure proposed by Mistura, the authors derive an expansion for the static dielectric constant of fluids near the gas-liquid critical point and of binary liquids near the critical point of mixing, which includes correction terms to the asymptotic critical behavior. The relationship with the statistical mechanical derivation of the critical behavior of the dielectric constant is discussed. The paper concludes with an assessment of the current experimental situation.

703,873
PB81-171506 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of the High-Resolution Infrared Spectrum of the v2 Bending Mode of HOCl at 1238 cm-1.
Final rept.
R. L. Sams, and W. B. Olson. 1980, 11p
Pub. in Jnl. of Mol. Spectrosc. 84, p113-123 1980.

Keywords: Infrared spectra, Reprints, *Hypochlorous acid.

The infrared spectrum of hypochlorous acid (HOCl) has been investigated in the 1238/cm, (V2), region with the recently completed 3.81 meter Ebert spectrometer. Description of this instrument is included. Spectroscopic constants for V2 have been obtained.

703,874
PB81-171514 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Beta Values and Branching Ratios in the Region of the 3s3p(6)4p singlet P(1) Resonance in Ar and the 5s5p(6)6p singlet P(1) Resonance in Xe.
Final rept.
K. Codling, J. B. West, A. C. Parr, J. L. Dehmer, and R. L. Stockbauer. 1980, 5p
Sponsored in part by Office of Naval Research, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Jnl. of Physics B: Atomic and Molecular Physics Letter to Ed. 13, pL693-L697 1980.

Keywords: *Xenon, Gas ionization, Asymmetry, Reprints, *Photoionization cross sections.

Variations in asymmetry parameter, beta, and the ratio of partial photoionization cross sections sigma(doublet P(3/2)): sigma(doublet P(1/2)) have been determined in the region of the 3s3p(6)4p singlet P(1) resonance in Ar and the 5s5p(6)6p singlet P(1) resonance in Xe.

703,875
PB81-171878 Not available NTIS
National Bureau of Standards, Washington, DC.
Reaction of F Atoms with C2H2 Vibrational Spectrum of the T-2-Fluorovinyl Free Radical Isolated in Solid Argon.
Final rept.
M. E. Jacox. 1980, 16p
Pub. in Chemical Physics 53, p307-322 1980.

Keywords: *Acetylene, Mass spectroscopy, Chemical bonds, Chemical reactions, Argon, Free radicals, Reprints, *Fluorine atoms, *Matrix isolation technique.

When the products of the reaction of F atoms produced in a microwave discharge with acetylene are frozen in a large excess of argon at 14K, several new infrared absorptions appear which can be assigned to a product that photodecomposes at wavelengths shorter than 280 nm. A reasonable fit of the isotopic data to a diagonal valence-force potential has been obtained using a molecular structure for t-2-fluorovinyl derived from theoretical calculations for closely related molecules, consistent with the conclusion from previous EPR studies that this radical is the principal product of the F + C2H2 reaction. Some ambiguity remains in the assignment of the deformation fundamentals. Studies at higher F-atom concentrations support the conclusion from earlier mass spectrometric studies that HCCF results from the fragmentation of the excited C2H2F2 formed on secondary F-atom reaction. The HF stretching absorptions of the (C2H2+HF) and (HCCF+HF) hydrogen-bonded complexes have been identified. Some evidence has also been obtained for the stabilization of the (HC2+HF) complex on photodecomposition of the t-2-fluorovinyl radical in solid argon.

703,876
PB81-171886 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Correlated Jumps and Vacancy Wind Interactions on Atom Jump Frequencies and Diffusion Fluxes in a Driving Force.
Final rept.
J. R. Manning. 1981, 6p
Pub. in Scripta Metallurgica 15, p1-6 1981.

Keywords: *Atoms, *Diffusion coefficient, Reprints, *Atom jump frequencies.

Relations between the actual, basic and effective atom jump frequencies resulting from diffusion in a driving force are derived. Here the basic jump frequencies are the product of an average vacancy concentration and the atom-vacancy exchange frequency. The effective jump frequencies are the frequencies of independent uncorrelated jumps. When the number of jumps to the left in the driving force does not equal the number to the right, both the basic and effective jump frequencies will differ from the actual frequencies of atom jumps to the left and right. Use of improper jump frequencies in kinetic diffusion expressions can lead to derivation of significantly incorrect equations for the atom flux.

703,877
PB81-171894 Not available NTIS
National Bureau of Standards, Washington, DC.
Kinetics and Spectroscopy of Near-Resonant Optical Pumping in Intense Fields.
Final rept.
F. H. Mies, and Y. B. Aryeh. 1 Jan 81, 15p
Pub. in Jnl. of Chemical Physics 74, n1 p53-67, 1 Jan 81.

Keywords: *Raman spectroscopy, *Kinetics, *Optical pumping, Strong interactions, Reprints.

The resonant Raman scattering in a three level system produces an optical pumping of molecules from the initial to the final states which are radiatively coupled to the intermediate resonant state. The authors consider the pumping that is produced by an intense, pulsed, monochromatic radiation field that is near-resonant with the initial resonance fluorency. The Heitler-Ma damping theory is solved exactly for the case when the resonance fluorescence is weak compared to the Raman scattering, or any other processes which might cause irreversible decay of the resonant state. In particular, they examine the usefulness of dressed states to describe the intense field limit. The spectral lineshape for the Raman scattering is obtained. The transient behavior following the onset of the laser pulse is examined and a careful analysis of the pumping rate and its relationship to both weak and strong field theories is presented.

703,878
PB81-171928 Not available NTIS
National Bureau of Standards, Washington, DC.
Photodissociation of CH2I2: Production of Electronically Excited I2.
Final rept.
H. Okabe, M. Kawasaki, and Y. Tanaka. 15 Dec 80, 5p
Pub. in Jnl. of Chemical Physics 73, n12 p6162-6166, 15 Dec 80.

Keywords: Dissociation, Fluorescence, Emission spectroscopy, Reprints, *Methane/diiodo, *Photodissociation.

The primary photodissociation process of CH2I2 leading to the formation of electronically excited I2 (3 sup Pi(2g)) has been studied.

703,879
PB81-171951 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Stability of Long Range Order in Oxides.
Final rept.
R. S. Roth. 1980, 34p
Pub. in Progress in Solid State Chemistry 13, n2 p159-192 1980.

Keywords: *Oxides, *Thermal stability, *Diffraction, High temperature tests, X ray diffraction, Electron diffraction, Neutron diffraction.

Diffraction effects have been observed in many oxide phases which have led researchers to believe that unusual long range order many occur. Much of the confusion occurs because the diffraction effects are often non-intergral or non-rational by the classic crystallographic definitions. It is the purpose of this paper to examine some of the effects that are produced in oxides as a result of high temperature equilibration processes, how these effects are manifested by x-ray, neutron and electron diffraction and how these effects change under changing thermal conditions.

703,880
PB81-171969 Not available NTIS
National Bureau of Standards, Washington, DC.
Low-Current Electric Discharges in H2-He Mixtures.
Final rept.
C. H. Muller, and A. V. Phelps. Dec 80, 8p
Pub. in Jnl. of Applied Physics 51, n12 p6141-6148 Dec 80.

Keywords: *Hydrogen, *Helium, *Electric discharges, Mixtures, Ionization, Density(Mass/volume), Reprints.

Tests are made of the ability of currently available theory to predict experimental ratios of the electric field to gas density E/N required for the steady-state operation of low-current, moderate-pressure discharges in hydrogen-helium mixtures. The authors conclude that except at low gas densities the simple theory gives a good description of low-current discharges in this gas mixture.

703,881
PB81-171977 Not available NTIS
National Bureau of Standards, Washington, DC.
Scattering Theory of Diatomic Molecules General Formalism Using the Channel State Representation.
Final rept.
F. H. Mies. 1980, 20p
Pub. in Molecular Physics 41, n5 p953-972 1980.

Keywords: *Diatomic molecules, Inelastic scattering, Molecular rotation, Wave functions, Reprints, *Atomic scattering, *Bound states.

The authors present a unified theory of diatomic molecules which reconciles bound state spectroscopy and atomic scattering theory. The total wave-function is expanded in a complete set of atomic channel states which is entirely equivalent to an expansion in Hund's case (e) electronic-rotational states. An analysis of the coupled radial, that is vibrational, functions places strong constraints on the asymptotic properties of the

molecular wave-functions. These are presented in terms of the reactance K and scattering S matrices of atomic scattering theory which offers a uniform treatment for open channels (inelastic scattering and continuum spectroscopy), closed channels (bound state spectroscopy) and mixtures of both (predissociation). The normalization of the total wavefunction is derived and related to the asymptotic boundary conditions both for continuum and bound states.

703,882
PB81-171985 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoionization and Threshold Photoelectron-Photoion Coincidence Study of Propyne from Onset to 20 eV.
Final rept.
A. C. Parr, A. J. Jason, R. Stockbauer, and K. E. McCulloh. 1979, 12p
Pub. in International Jnl. of Mass Spectrometry and Ion Physics 30, p319-330 1979.

Keywords: *Photoionization, Ionization potentials, Heat of formation, Reprints, *Propynes, Threshold effects(Electron energy).

Photoionization efficiency curves are obtained for propyne and its fragments C3H3(+1), C3H2(+1) and C3H(+1) from threshold to 20 eV. Threshold photoelectron spectra and breakdown curves are given over the same energy range. The adiabatic ionization potential of the parent molecule, the appearance potentials of the fragments and the derived heats of formation of the ionic species are determined. The breakdown curve is almost identical to that obtained previously for allene (II) when the different heats of formation of the neutral molecules are taken into account. This suggests that the propyne ion isomerizes to the allene ion before fragmentation.

703,883
PB81-172090 Not available NTIS
National Bureau of Standards, Washington, DC.
Cross Sections and Excitation Rates for Electron Collisions with Heliumlike Ions.
Final rept.
A. K. Pradhan, D. W. Norcross, and D. G. Hummer. Feb 81, 13p
Contract DOE-EA-77-01-6010
Pub. in Physics Review A 23, n2 p619-631 Feb 81.

Keywords: *Atomic energy levels, Excitation, Plasmas(Physics), Helium, Reprints, *Electron ion interactions, Autoionization, Electron cross sections.

The authors describe the techniques and the approximations used in extensive calculations for cross sections and reactionrate parameters for electron-impact excitation of a number of heliumlike ions. All transitions involving the ground state and the n=2 states are considered. Calculations are made in the distorted-wave approximation using configuration-interaction wave functions to represent the target states. Autoionizing resonances in the scattering cross sections are included through bound-channel correlation-type functions and through quantum-defect-theory analysis of the reactance matrices. The resonances are shown to make considerable contributions to the cross sections and thereby, in many cases, to enhance the excitation-rate coefficients by a significant factor. This should have important consequences for practical applications in the analysis of laboratory and astrophysical plasmas. The accuracy of our approximations is also discussed.

703,884
PB81-172124 Not available NTIS
National Bureau of Standards, Washington, DC.
Rate Constants at 298k for the Reactions SO + SO + M yields (SO)2 + M and SO + (SO)2 yeilds SO2 +S2O.
Final rept.
J. T. Herron, and R. E. Huie. 1 Dec 80, 3p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Chemical Physics Letter 76, n2 p322-324, 1 Dec 80.

Keywords: *Reaction kinetics, *Sulfur monoxide, Mass spectroscopy, Reprints, Chemical reaction mechanisms.

The decay of SO generated in the reaction O+OCS yields CO+SO in the absence of O2 has been studied at 298 K from 2 to 8 Torr, using a tubular flow reactor coupled to a mass spectrometer. The products of the decay of SO are S, SO2, S2O, and (SO)2. The kinetics of the decay of SO could be accounted for on the basis of the mechanism: SO+SO+M yields (SO)2+M (3), SO+SO yields SO2+S (4), SO+(SO)2 yields SO2+S2O (5), and SO yields products (6), where the latter represents either a wall reaction or a slow bimolecular reaction with OCS.

703,885
PB81-174351 Not available NTIS
National Bureau of Standards, Washington, DC.
Approximate Response of a Two-Level System to Intense Multimode Radiation.
Final rept.
S. Geltman. 5 Jan 81, 4p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Physical Letters 81A, n1 p27-30, 5 Jan 81.

Keywords: *Atomic energy levels, Irradiation, Photons, Excitation, Reprints, Two level atoms.

The rotating wave solution for a two-level atom in an intense monochromatic radiation field is extended by an approximation to the case of a multimode radiation field. Expressions for the resultant average excitation probability of the upper state are presented for rectangular and triangular pulses.

703,886
PB81-174385 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of the Viscosity of Compressed Gaseous and Liquid Methane.
Final rept.
D. E. Diller. Dec 80, 10p
Pub. in Physica (Utrecht) A 104, n3 p417-426 Dec 80.

Keywords: *Methane, *Liquefied gases, *Viscosity, Shear properties, Reprints.

The shear viscosity coefficient of compressed gaseous and liquid methane has been measured at temperatures between 100 and 300 K and at pressures up to 30 MPa (4350 psia) with a torsionally oscillating quartz crystal viscometer. The estimated precision and accuracy of the measurements are about 0.5% and 2%, respectively. The measurements have been compared with an equation previously proposed for calculating the viscosity of gaseous and liquid methane. Most of the differences between the equation and the measurements reported here are within our experimental error. Larger differences (up to 6%) are reported at the lowest temperature (100 K) and high pressures, and along a supercritical isotherm at 200 K.

703,887
PB81-178584 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Spectra of 12C32S, 12C34S, 13C32S, and 12C33S.
Final rept.
T. R. Todd, and W. B. Olson. 1979, 13p
Pub. in Jnl. Mol. Spectrosc. 74, p190-202 1979.

Keywords: Infrared spectra, Molecular energy levels, Sulfides, Reprints, *Carbon sulfide.

Using a tunable diode laser spectrometer, the infrared absorption spectra of four isotopic species of carbon monosulfide have been observed in the positive column of a dc discharge of CS2 and Ar. The wavenumbers of 115 vibration-rotation transitions between 1180.5 and 1266.1/cm have been measured. These lines were assigned to the 1-0,2-1,3-2, and 4-3 bands of 12C32S, the 1-0 and 2-1 bands of 12C34S and 13C32S, and the 1-0 band of 12C33S. These new data have been combined with the previous infrared and microwave results to determine Dunham coefficients, the Dunham potential expansion constants, and the classical turning points by the RKR method.

703,888
PB81-178600 Not available NTIS
National Bureau of Standards, Washington, DC.
Model Calculation of the Electronic Structure and Spectroscopy of Hg2.
Final rept.
F. H. Mies, W. J. Stevens, and M. Krauss. 1978, 29p
Pub. in Jnl. Mol. Spectrosc. 72, p303-331 1978.

Keywords: *Mercury(Metal), *Molecular energy levels, Diatomic molecules, Electron transition, Ultraviolet spectra, Reprints, Spin orbit interactions.

Energy curves and transition moments of the excited valence states of Hg2 were obtained in a model calculation based on calculated Mg2 energy levels and the assumption that the asymptotic spin-orbit matrix elements for the Hg atom are applicable to the molecular states. The spin-orbit and orbital-rotational interaction of the excited states of Hg2 is analyzed in both a Hund's case (c) and (a) representation. The intermediate (a) - (c) transition moments are obtained as a function of the internuclear distance. The effect of the orbital-rotational interaction which introduces Hund's case (b) and (e) couplings is found to be small for transitions among excited states under the conditions normally encountered for populating excimer states. Using the energy level positions and transition moments, the observed spectra and predicted spectra are compared for both radiative transitions including the ground state and among the excited states.

703,889
PB81-178618 Not available NTIS
National Bureau of Standards, Washington, DC.
Microwave Spectrum of CH2DOH.
Final rept.
C. R. Quade, and R. D. Suenram. 1 Aug 80, 5p
Pub. in Jnl. of Chemical Physics 73, n3 p1127-1131, 1 Aug 80.

Keywords: *Methyl alcohol, Microwave spectra, Deuterium compounds, Molecular energy levels, Molecular rotation, Radio astronomy, Reprints.

The torsional-rotational spectrum of CH2DOH has been investigated in order to gain fuller understanding of the internal rotation parameters as well as to provide molecular radio astronomers with a set of measured transition frequencies which can be used for an interstellar search for the molecule. a- and b-dipole transitions have been assigned within the three substates of the torsional ground state and c-dipole transitions have been assigned from the e1 to the 01 substate. The potential energy coefficient has been determined with V2 constrained to zero. Although the torsional wave functions are by no means sharp, the molecule does localize to symmetric and asymmetric form.

703,890
PB81-178634 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectroscopic Analysis of the D Singlet Sigma(+) to A Singlet Sigma(+) and D Singlet Sigma(+) to B Singlet Pi Green Band Systems of XeO.
Final rept.
J. D. Simmons, A. G. Maki, and J. T. Hougen. 1979, 32p
Pub. in Jnl. Mol. Spectrosc. 74, p70-101 1979.

Keywords: *Xenon compounds, Molecular energy levels, Dissociation, Chemical bonds, Reprints, Xenon oxides, Bond lengths.

A comprehensive high resolution spectroscopic analysis has been made on the XeO green bands photographed in emission from an RF discharge source. Rotation-vibration constants derived from the analysis of the spectrum of the isotopically enriched species 129Xe16O and 129Xe18O were used to give RKR potential curves for the d singlet Sigma(+) and b singlet Pi states. The bond distances and dissociation energies of the states were found. The observations are consistent with a fairly deep well, in agreement with the latest ab initio calculations which give a well depth of 0.7 eV.

703,891
PB81-178642 Not available NTIS
National Bureau of Standards, Washington, DC.
Dipole Polarizabilities of the Group IIB Atoms Obtained from Compact Variational Trial Functions.
Final rept.
M. E. Rosenkrantz, W. J. Stevens, M. Krauss, and D. D. Konowalow. 15 Feb 80, 7p
Sponsored in part by Department of Energy, Washington, DC., and Office of Naval Research, Washington, DC.
Pub. in Jnl. of Chemical Physics 72, n4 p2525-2531, 15 Feb 80.

Keywords: *Atomic energy levels, Hartree-Fock approximation, Zinc, Mercury(Metal), Polarization, Cadmium, Reprints.

In order to optimize basis sets for future molecular calculations, the energies and dipole polarizabilities of singlet S, triplet P, and singlet P states of Zn, Cd, and Hg have been determined from Hartree-Fock (HF) and multiconfiguration calculations. These utilize either

empirically fitted pseudopotentials or ab initio effective core potentials (ECP). Our calculated polarizabilities for ground state atoms agree within 10% with recommended values so long as either the empirical pseudopotentials or the ECP based on relativistic HF calculations are used. Our calculations agree with the measured anisotropy of the polarizability of triplet P(1) Hg, but disagree with measured values of the triplet P(2) state anisotropy.

703,892

PB81-178667 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Resolution Measurement and Analysis of the Infrared Spectrum of Nitric Acid Near 1700 cm minus 1.
Final rept.
A. G. Maki, and J. S. Wells. 1980, 8p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC. Langley Research Center.
Pub. in Jnl. Mol. Spectrosc. 82, p427-434 1980.

Keywords: *Nitric acid, Infrared spectra, Vibrational energy levels, Reprints.

The infrared spectrum of the v2 band of nitric acid (HNO3) has been measured with a tunable diode laser in the frequency interval from 1690 to 1727/cm. A total of 430 assigned transitions have been analyzed to yield a set of nine rovibrational constants for the upper state with a standard deviation of 0.0012/cm. The band is primarily B type. Because of the absence of perturbations, the band constants can be used to calculate transition frequencies and relative intensities with a high degree of accuracy.

703,893

PB81-178816 Not available NTIS
National Bureau of Standards, Washington, DC.
Intrinsic Isotopic Selectivity Factors: CO2 TEA Laser Photolysis of CF2Cl2.
Final rept.
D. S. King, and J. C. Stephenson. 8 Nov 78, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of the American Chemical Society 100, n23 p7151-7155, 8 Nov 78.

Keywords: *Infrared spectroscopy, *Photolysis, *Isotopic labeling, Chlorine organic compounds, Reprints, *Methane/dichloro-difluoro, *Freon 12, *Laser spectroscopy, Laser induced fluorescence, Carbon 12, Carbon 13.

The first real-time determination of isotopic selectivities in a pulsed IR photolysis is reported. In situ detection of nascent CF2 photofragments by UV laser-excited fluorescence gave the probability of CF2 production from CF2Cl2 samples of natural (98.9%(12)C) and enriched (92.0%(13)C) carbon-13 abundance. These measurements gave the probability, 12P or 13P, of a 12CF2Cl2 or 13CF2Cl2 reactant dissociating into a (12)CF2 or (13)CF2 photofragment, as a function of IR laser wavelength and fluence, prior to any energy exchange or scrambling processes.

703,894

PB81-179665 Not available NTIS
National Bureau of Standards, Washington, DC.
Dispersion Damping Functions and Interaction Energy Curves for Xe-Xe.
Final rept.
M. Krauss, W. J. Stevens, and D. B. Neumann. 1 May 80, 3p
Pub. in Chemical Physics Letters 71, n3 p500-502, 1 May 80.

Keywords: *Xenon, *Potential energy, Hartree-Fock approximation, Molecular energy levels, Reprints, Numerical solution.

Ab initio potential energy curves have been calculated for the ground state of Xe2 including dispersion interactions. The total interaction energy has been approximated by a sum of the repulsive Hartree-Fock interaction plus the attractive dispersion interaction which is appropriately damped to take account of charge overlap.

703,895

PB81-179673 Not available NTIS
National Bureau of Standards, Washington, DC.
Photodissociation of HgCl.
Final rept.
P. S. Julienne, D. D. Konowalow, M. Krauss, M. E. Rosenkratz, and W. J. Stevens. 15 Jan 80, 3p
Sponsored in part by Stategic Technology Office, Washington, DC.
Pub. in Applied Physics Letters 36, n2 p132-134, 15 Jan 80.

Keywords: *Dissociation, Mercury halides, Reprints, *Mercury chlorides, *Photodissociation.

Transition moments and energies have been calculated for the X-A, bound to continuum, transition in HgCl. The photodissociation cross section at the peak (approximately equal to 20,000/cm or 500 nm) is 1.2 x 10 to the -18th power sq cm at 600K. The laser energy 17921/cm or 558 nm for the B-X transition is close to the peak energy, and a significant absorption will result from a buildup in the concentration of X state HgCl in the course of exciting the laser media. This absorption is suggested as an explanation for the low extraction efficiencies observed for HgCl lasers.

703,896

PB81-179681 Not available NTIS
National Bureau of Standards, Washington, DC.
Double Group Considerations, Jahn-Teller Induced Rovibronic Effects, and the Nuclear Spin-Electron Spin Hyperfine Hamiltonian for a Molecule of Symmetry C3v in an Electronic 2E State.
Final rept.
J. T. Hougen. 1980, 20p
Pub. in Jnl. Mol. Spectrosc. 81, p73-92 1980.

Keywords: *Carbon, Molecular energy levels, Nuclear spin, Electron spin, Hamiltonian functions, Hyperfine structure, Reprints, Numerical solution, Jahn-Teller effect.

Two different double groups of the point group C(3 nu) are compared. These double groups arise for molecules in a 2 sup E state, and are associated with the half-integral electron spin, and with a half-integral vibronic quantum number, respectively. For many aspects of molecular energy level calculations, the use of these double groups can be avoided if desired.

703,897

PB81-179715 Not available NTIS
National Bureau of Standards, Washington, DC.
Vibrational Relaxation of A CF2 (v2=1-6) in Non-Reactive Collisions.
Final rept.
D. L. Akins, D. S. King, and J. C. Stephenson. 15 Aug 79, 4p
Pub. in Chemical Physics Letters 65, n2 p257-260, 15 Aug 79.

Keywords: *Reaction kinetics, *Molecular relaxation, *Free radical, Fluorine organic compounds, Molecular energy levels, Reprints, Laser induced fluorescence.

Rate constants have been measured for collisional energy transfer as a function of vibrational quantum number in the first excited singlet state of the CF2 radical. These results are generally consistent with the principles of vibrational energy transfer found previously for ground electronic state molecules.

703,898

PB81-179764 Not available NTIS
National Bureau of Standards, Washington, DC.
Submillimeter-Wave Emission Assignments for 1,1-Difluoroethylene.
Final rept.
J. P. Sattler, T. L. Worchesky, M. S. Tobin, K. J. Ritter, T. W. Daley, and W. J. Lafferty. 1980, 12p
Pub. in International Jnl. of Infrared and Millimeter Waves 1, n1 p127-138 1980.

Keywords: *Infrared spectroscopy, Reprints, *Ethylene/difluoro, *Laser spectroscopy.

Many of the known submillimeter wave emissions of 1,1-difluoroethylene are assigned by using new data from infrared diode laser heterodyne spectroscopy. Six new submillimeter lines are also reported and assigned.

703,899

PB81-181059 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 85, Number 6, November-December 1980.
Bi-Monthly rept.
1980, 94p
See also Volume 85, Number 2, PB80-185036. Library of Congress catalog card no. 63-37059.

Keywords: *Physical chemistry, *Research, Aluminum, Electrical resistance, Wire, Binary systems(Materials), Liquid phases, Vapor phases, Error analysis, Calorimeter, Enthalpy, Potasssium chloride, Standards, Numerical solution, Standard reference materials.

Contents:
- Observations on the mechanisms of high resistance junction formation in aluminum wire connections;
- On the calculation of critical liquid-vapor lines of binary mixtures;
- Systematic errors in an isoperibol solution calorimeter measured with standard reference reactions;
- The enthalpy of solution of SRM 1655 (KCl) in H2O;
- Publications of the National Bureau of Standards.

703,900

PB81-181067
(Order as PB81-181059, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Observations on the Mechanisms of High Resistance Junction Formation in Aluminum Wire Connections.
D. Newbury, and S. Greenwald. 19 Jun 80, 12p
Included in Jnl. of Research of the National Bureau of Standards, v85 n6 p429-440, Nov-Dec 80.

Keywords: *Aluminum, *Electrical resistance, *Electric connectors, X ray analysis, Wires, Scanning electron microscopy.

The basic mechanism of high resistance junction formation in duplex connectors wired with aluminum was investigated. Laboratory experiments to simulate loose connections were made both in actual duplex connectors and in an experimental apparatus. Microstructural observations were made by scanning electron microscopy and x-ray microanalysis of the structures formed at the interfaces between the circuit components during high resistance junction formation. At the iron screw/alumium wire interface, the arcing process which occurs in a loose connection causes high temperatures in excess of 1500C and material transport between the components. Under these conditions, aluminum and iron react to form intermetallic compounds such as Fe3Al and FeAl3. The formation of an extensive zone of these compounds adjacent to the iron-aluminum interface in duplex connectors was revealed by electron metallography. In duplex connectors tested to glow failure, the formation of intermetallic compounds such as CuAl2 and Cu2ZnAl was observed at the brass plate/aluminum wire interface. These intermetallic compounds have a resistivity of the order of .0001 ohm-cm or higher which may provide sufficient resistance at the current-carrying interface to lead to significant I(sup 2)R heating losses at the interface.

703,901

PB81-181075
(Order as PB81-181059, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC.
Calculation of Critical Liquid-Vapor Lines of Binary Mixtures,
P. Wielopolski. 25 Jun 80, 8p
Prepared in cooperation with Polish Academy of Sciences, Warsaw. Inst. of Physical Chemistry.
Included in Jnl. of Research of the National Bureau of Standards, v85 n6 p441-448, Nov-Dec 80.

Keywords: *Binary systems(Materials), *Liquid phases, *Vapor phases, Van der waals equation, Gibbs free energy, Critical point, Mixtures, Numerical solution.

The critical lines of binary mixtures of conformal fluids are calculated on the basis of the one-fluid Van der Waals theory. The condition for the existence of the gas/gas equilibrium of the first and second type are shown and discussed. The analytical expressions for partial derivatives of Gibbs free energy with respect to concentration, up to the third order, are given in the appendix.

703,902
PB81-181083
(Order as PB81-181059, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Systematic Errors in an Isoperibol Solution Calorimeter Measured with Standard Reference Reactions.
M. V. Kilday. 23 Jul 80, 17p
Included in Jnl. of Research of the National Bureau of Standards, v85 n6 p449-465, Nov-Dec 80.

Keywords: *Error analysis, *Calorimeters, *Potassium chloride, Standards, Solutions, Enthalpy, Thermochemistry, Exothermic reactions, *Standard reference materials.

Systematic errors in an isoperibol calorimeter of a widely-used design, amounting to about 0.5 percent of the endothermic enthalpy of solution of SRM 1655 (KCl) in H2O, were found to be the result of errors in heat leak corrections due to inadequate stirring and commonly used calorimetric procedures. Other systematic errors were found in measurements of the enthalpy of solution of the exothermic reaction of tris(hydroxymethyl)aminomethane in aqueous HCl solution. Recommended procedures are summarized.

703,903
PB81-181091
(Order as PB81-181059, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Enthalpy of Solution of SRM 1655 (KCl) in H2O.
M. V. Kilday. 11 Jul 80, 15p
Included in Jnl. of Research of the National Bureau of Standards, v85 n6 p467-481, Nov-Dec 80.

Keywords: *Enthalpy, *Potassium chloride, Solutions, Heat measurement, Endothermic reactions, Thermochemistry, *Standard reference materials.

The value for the enthalpy of solution of SRM 1655 (KCl), delta H(500 H2O, 298.15 K)=(235.86 + or - 0.23)J/g-1 or (17.584 + or - 0.017)kJ/mol-1, was obtained from measurements in an adiabatic calorimeter, and confirmed by measurements in an isoperibol calorimeter.

703,904
PB81-182834 Not available NTIS
National Bureau of Standards, Washington, DC.
Revised 6p 2P1/2 Level of Mo XIV.
Final rept.
J. Reader, G. Luther, and N. Acquista. Feb 81, 1p
Pub. in Jnl. of Optical Society of America 71, n2 204p Feb 81.

Keywords: *Molybdenum, *Molecular energy levels, Reprints.

New observations of the 4s-6p transitions of Mo XIV have led to a revised identification for the 4d doublet D(3/2)-6p doublet P(1/2) transition and a revised value for the 6p doublet P(1/2) level.

703,905
PB81-182842 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Spectrum of 31P14N Near 1300 cm-1,
A. G. Maki, and F. J. Lovas. 1981, 7p
Pub. in Jnl. Mol. Spectrosc. 85, p368-374 1981.

Keywords: *Infrared spectroscopy, Phosphorus inorganic compounds, Absorption spectra, Reprints, *Phosphorus nitride, *Laser spectroscopy.

The infrared absorption spectrum of the PN molecule has been measured at temperatures between 800 and 1050C with a tunable diode laser.

703,906
PB81-182891 Not available NTIS
National Bureau of Standards, Washington, DC.
Br*(2P1/2) + H2(v=0,1): Laser Studies of the Competition between Reactive Pathways and Inelastic Energy Transfer Channels.
Final rept.
D. J. Nesbitt, and S. R. Leone. 15 Dec 80, 9p
Grants NSF-CHE76-22600, NSF-PHY79-04928
Pub. in Jnl. of Chemical Physics 73, n12 p6182-6190, 15 Dec 80.

Keywords: *Boron, *Infrared spectroscopy, Inelastic scattering, Reaction kinetics, Reprints, *Laser spectroscopy.

A systematic experimental study has been made on inelastic and reactive processes in the Br*(doublet P(1/2) + H2 nu = 0,1) system.

703,907
PB81-187080 Not available NTIS
National Bureau of Standards, Washington, DC.
Adsorptive Bonding to Hydroxyapatite I: Adsorption of Anthranilic Acid--the Effect of Solvents. Search for Surface Bonding Groups for Coupling Agents to Teeth.
Final rept.
D. N. Misra, and R. L. Bowen. Jan 81, 5p
Contract PHS-DE-05129-03
Pub. in Biomaterials 2, p28-32 Jan 81.

Keywords: *Adsorption, Chemical bonds, Chemisorption, Teeth, Surfaces, Reprints, *Hydroxylapatite, *Anthranilic acid, Monomers.

A study was initiated to explore the nature of surface-active groups of model compounds that might cause chemisorption of comonomers used in the polymerization of dental resins on hydroxyapatite (the main constituent of bone) and thus effect a strong and durable bond between the resins and hard tooth tissues.

703,908
PB81-187098 Not available NTIS
National Bureau of Standards, Washington, DC.
Vibrationally Induced Nuclear Quadrupole Coupling in Tetrahedral and Octahedral Molecules.
Final rept.
J. T. Hougen, and T. Oka. 1 Feb 81, 10p
Pub. in Jnl. of Chemical Physics 74, n3 p1830-1839, 1 Feb 81.

Keywords: *Hyperfine structure, *Molecular vibration, Molecular energy levels, Dipole moments, Molecular rotation, Reprints.

Hyperfine splittings arising from the presence of a quadrupolar nucleus at the center of a molecule belonging to the point group T(d) or O(h)(e.g., (189)OsO4 or (235)UF6) are symmetry forbidden to a high degree of approximation. Nevertheless, quadrupole splittings can be induced by either vibrational or rotational distortions of the molecule, i.e., by distortions similar to those responsible for inducing electric dipole moments in T(d) molecules. Such hyperfine splittings have recently been observed in several laboratories using laser saturation spectroscopy. In this paper the authors investigate theoretically the quadrupole splittings induced by excitation of doubly and triply degenerate vibrations in T(d) and O(h) molecules. We find that much of the vibration-rotation formalism already present in the methane literature can be applied with only minor changes to the induced-quadrupole-coupling problem, and that rather simple theoretical relationships can be derived between the quadrupole splitting and the tetrahedral vibration-rotation splitting of a given level.

703,909
PB81-187106 Not available NTIS
National Bureau of Standards, Washington, DC.
Effective Pair Potentials from Structure Factors.
Final rept.
R. D. Mountain. Aug 80, 4p
Pub. in Proceedings of the International Conference on Liquid and Amorphous Metals (4th) Held at Grenoble, France on Jul 7-11, 1980, Paper in Jnl. De Physique C8, No. 41, Suppl. No. 8, C8-297-C8-300 Aug 80.

Keywords: *Metals, *High temperature tests, *Density(Mass/volume), Monte Carlo method, Percus Yevick equation.

A procedure based on the Percus-Yevick equation for extracting pair potentials from structure factor data for liquid metals at elevated temperatures and reduced densities is described and applied to fluid rubidium. Monte Carlo results are used to establish the limits of the validity of the procedure.

703,910
PB81-187486 Not available NTIS
National Bureau of Standards, Washington, DC.
Collision-Induced Absorption in a Highly Symmetric Molecule--SF6.
Final rept.
G. Birnbaum, and H. Sutter. 1981, 12p
Pub. in Molecular Physics 42, n1 p21-32 1981.

Keywords: *Sulfur hexafluoride, *Infrared spectroscopy, Absorption spectra, Light scattering, Vapor phases, Liquid phases, Reprints, *Molecule molecule interactions.

The far-infrared absorption spectra of gaseous (298 K) and liquid (273 K, 233 K)SF6 obtained by Rosenberg and Birnbaum are analysed in terms of recent theoretical developments. Analysis of the band shape in the gas and liquid phases indicates that hexadecapole-induced absorption accounts only for the low frequency portion of the collision-induced band. The major part of the absorption can be attributed to a much shorter range mechanism such as anisotropic overlap. The resulting induced dipole which varies very rapidly with intermolecular separation and is consistent with a (7-28) interaction energy gives a good description of the liquid spectra. Collision-induced absorption and depolarized light scattering in SF6 are compared.

703,911
PB81-187528 Not available NTIS
National Bureau of Standards, Washington, DC.
How Close is 'Close to the Critical Point.'.
Final rept.
J. M. H. L. Sengers, and J. V. Sengers. 1981, 31p
Pub. in Chapter 14 in Perspectives in Statistical Physics, p241-271 1981.

Keywords: *Critical point, *Fluids, Thermodynamic properties, Reprints.

This chapter traces the path the authors walked with Melville S. Green towards and understanding of the static critical behavior of fluids. Particular attention is given to the range of asymptotic scaling behavior and the structure of the corrections to the asymptotic behavior of the thermodynamic properties of fluids near the critical point.

703,912
PB81-187536 Not available NTIS
National Bureau of Standards, Washington, DC.
Observation of the Infrared Spectrum of the Triatomic Deuterium Molecular Ion D3+.
Final rept.
J. T. Shy, J. W. Farley, W. E. Lamb, and W. H. Wing. 18 Aug 80, 2p
Pub. in Physical Review Letters 45, n7 p535-536, 19 Aug 80.

Keywords: *Infrared spectroscopy, *Deuterium, Molecular vibration, Molecular rotation, Ions, Isotopes, Reprints.

The infrared vibrational-rotational spectrum of the D3(+) isotope of the simplest polyatomic molecule is observed. Eight intervals between 1750 and 1850/cm have been measured to an error of 0.0005/cm or 0.3 ppm (at 70% confidence level). Four have been identified as members of the fundamental degenerate vibrational band. The rest apparently involve unidentified higher vibrational-rotational levels.

703,913
PB81-187809 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Octacalcium Phosphate in the Incorporation of Impurities into Apatites.
Final rept.
W. E. Brown, M. S. Tung, and L. C. Chow. Feb 81, 13p
Contracts PHS-DE-05030, PHS-DE-05354
Pub. in Proceedings of the International Congress on Phosphorus Compounds (2nd), Boston, Massachusetts, April 21-25, 1980, p59-71 Feb 81.

Keywords: *Calcium phosphates, Molecular structure, Chemical properties, Physical properties, Hydrolysis, Impurities, Hydroxylapatite, Apatites.

Octacalcium phosphate (OCP) is structurally related to hydroxyapatite (OHAp) and is frequently a precursor in the formation of OHAp. The authors present evidence showing that hydrolysis of OCP to OHAp is a major mechanism for incorporation of impurities and structural defects which, in turn, greatly affect the chemical and physical properties of the resulting apatites.

703,914
PB81-187817 Not available NTIS
National Bureau of Standards, Washington, DC.

Phase Equilibria Research in Portions of the System K2O-MgO-Fe2O3-Al2O3-SiO2.
Final rept.
R. S. Roth. 1980, 18p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Symposium on Solid State Chemistry: A Contemporary Overview, Laramie, Wyoming, July 30-August 4, 1978, Paper in Advances in Chemistry Series n186, p391-408 1980.

Keywords: *Phase diagrams, *Chemical equilibrium, *Crystal growth, Potassium oxides, Magnesium oxides, Iron oxides, Silicon oxides.

Preliminary phase equilibria diagrams are given for some binary and ternary joins and cuts through the five-component system K2O-MgO-Fe2O3-Al2O3-SiO2. The diagrams are those that are most pertinent to the chemical reactions taking place between potassium seed and the four-component synthetic slag of importance in corrosion studies of a magnetohydrodynamics system. Although the systems KalO2-SiO2,-KFeO2-SiO2, and K2MgSiO4-SiO2 are apparently true binary joins, other pseudobinary cuts involving only kalsilite types of end members are generally not binary. The phase K2MgSi3O8 dissociates at low temperatures into a second kalsilite-like phase plus leucite. Thus leucite is a major component even just below liquidus temperatures of magnesia containing ternary and quaternary compositions that might be expected to exhibit only kalsilite-like phases.

703,915
PB81-187833 Not available NTIS
National Bureau of Standards, Washington, DC.
Triply-Differential Photoelectron Studies of Molecular Autoionization Profiles: The 710-730 A Region of the N2 Spectrum.
Final rept.
A. C. Parr, D. L. Ederer, B. E. Cole, J. B. West, R. Stockbauer, K. Codling, and J. L. Dehmer. 5 Jan 81, 4p
Sponsored in part by Office of Naval Research, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Physical Review Letter 46, n1 p22-25, 5 Jan 81.

Keywords: *Photoelectrons, *Nitrogen, *Ultraviolet spectroscopy, Molecular vibration, Ionization, *Autoionization.

Photoelectron studies of molecular autoionization resolved into position within the resonance profile, photoelectron ejection angle, and final vibrational state are reported. By using the first members of prominent window and absorption series converging to N2(+1) B(2) Sigma (u) (+1) as an example, striking variations of vibrational branching ratios and photoelectron asymmetry parameters within autoionizing profiles are demonstrated. Such triply differential data represent a very detailed characterization of the rovibronic interactions governing molecular autoionization.

703,916
PB81-196198 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 86, Number 1, January-February 1981.
Bimonthly rept.
1981, 169p
See also Volume 85, Number 2, PB80-185036. Library of Congress catalog card no. 63-37059.

Keywords: *Research, Curve fitting, Atmospheric refraction, Elastic theory, Finite element analysis, Elastostatics, NTISCOMNBS.

Contents:
- Fitting curves and surfaces with monotonic and non-monotonic four parameter equations;
- The refractivity of air;
- The configurations 3d(n)4p + 3d(n-1)4s4p + 3d(n-2) 4 doublets 4p in the first spectra of the iron group;
- An isoparametric finite element model for large-strain elastostatics.

703,917
PB81-196222
(Order as PB81-196198, PC **A08**/MF **A01**)
McGill Univ., Montreal (Quebec). Dept. of Mathematics.

Configurations 3d(n) 4p + 3d(n-1) 4s4p + 3d(n-2) 4 doublet s 4p in the First Spectra of the Iron Group,
C. Roth. 1 Sep 80, 45p
Sponsored in part by National Bureau of Standards, Washington, DC.
Included in Jnl. of Research of the National Bureau of Standards, v86 n1 p33-77 Jan-Feb 81.

Keywords: *Iron, *Molcular energy levels, *Molecular spectroscopy, Least squares method, Tables(Data), Hartree-Fock approximation, Lande factors, Numerical solution, G factors, NTISCOMNBS, NTISFNCA.

Energy levels and Lande g-factors for the configurations 3d(n) 4p + 3d(n-1) 4s 4p + 3d(n-2) 4 doublet s 4p in the first spectra of the iron group were calculated and compared with experimental values, in both general and individual treatments.

703,918
PB81-197444 Not available NTIS
National Bureau of Standards, Washington, DC.
High Resolution Spectra of Symmetric Molecules: Understanding Rotation and Permutation Dynamics.
Final rept.
W. G. Harter, and C. W. Patterson. 1978, 9p
Pub. in Proceedings of Advances in Laser Chemistry Held at Pasadena, CA., on March 20-22, 1978, Paper in Advances in Laser Chemistry, p455-463 1978.

Keywords: *Molecular spectroscopy, *Hyperfine structure, Molecular rotation, Polymers, Numerical solution, NTISCOMNBS.

Until recently, analysis of rovibronic fine structure of polyatomic molecules has involved complicated computations, and most researchers have ignored it or regarded it as something akin to the plague. However, rapidly increasing spectroscopic resolution has led to some surprising improvements in our understanding of molecular rovibronic dynamics for certain cases. It appears that new understanding of rotational effects in XY4 and XY6 spherical top molecules greatly simplifies the spectroscopic calculations and may have simple applications for laser chemistry as well. The authors review here the elements of the recently developed quantum theory of level clusters, and speculate on what implications it might have for high resolution photomchemistry.

703,919
PB81-197485 Not available NTIS
National Bureau of Standards, Washington, DC.
Kinetics of Dye Formation by Pulse Radiolysis of Pararosaniline Cyanide in Aqueous or Organic Solution.
Final rept.
W. L. McLaughlin, M. M. Kosanic, V. M. Markovic, M. T. Nenadovic, J. Holcman, and K. Sehested. Nov 79, 32p
Pub. in Riso-M-2202, 32p Nov 79.

Keywords: *Reaction kinetics, *Isomers, *Radiolysis, Dyes, Nitrogen organic compounds, Reprints, *Acetonitrile/tris(aminophenyl), NTISCOMNBS.

The radiation-induced conversion of the leucocyanide of pararosaniline dye highly colored salt-isomer of the dye in acidic aqueous solution (wavelength of maximum absorption (lambda(max) = 540 nm) or polar organic solution (lambda(max) = 550 nm), takes place in two separate processes. The first is very fast (within less than 50ns), and the second much slower following first-order kinetics as the acidity or concentration of an oxidizing agent increases. In oxygen-free acidic aqueous or organic solutions (argon saturated) there is an unstable transient species (lambda(max) = 380 nm).

703,920
PB81-197543 Not available NTIS
National Bureau of Standards, Washington, DC.
Shielded Thermionic Diode Detector for Precision Spectroscopy.
Final rept.
K. C. Harvey. Feb 81, 3p
Pub. in Review of Scientific Instruments 52, n2 p204-206 Feb 81.

Keywords: *Laboratory equipment, *Photons, Absorption, Design criteria, Zeeman effect, Stark effect, Reprints, NTISCOMNBS.

A thermionic diode with a shielded auxiliary compartment has been constructed to detect Doppler-free two-photon absorption. The shielded compartment prevents Zeeman and Stark broadening from external fields. The detector's construction and mode of operation are discussed.

703,921
PB81-197790 Not available NTIS
National Bureau of Standards, Washington, DC.
(p,V,T) of Saturated and Compressed Fluid Nitrogen.
Final rept.
G. C. Straty, and D. E. Diller. 1980, 10p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Thermodynamics 12, n10 p927-936 1980.

Keywords: *Liquid nitrogen, Density(Mass/volume), Reprints, *pVT properties, NTISCOMNBS, NTISNASA.

The results of (p,V,T) measurements on compressed fluid N2 at amount-of-substance densities from about 11 mol/cu dm to greater than 28 mol/dm at pressures to near 35.0 MPa are reported.

703,922
PB81-197808 Not available NTIS
National Bureau of Standards, Washington, DC.
Oscillatory Excimer Emission: An Analytic Model.
Final rept.
F. H. Mies, and P. S. Julienne. May 79, 9p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Jnl. of Quantum Electronics QE-15, n5 p272-280 May 79.

Keywords: *Mathematical models, *Harmonic generators, *Oscillators, *Excimers, NTISCOMNBS, NTISDE.

An analytic quantum mechanical model is given for the line shape of the continuum emission from a model harmonic oscillator excimer state to a flat lower state. The model permits a qualitative characterization of the excimer emission profile for more realistic potentials and provides an estimate of bounds on excimer gain cross sections. The model is best on the red wavelength side of the spectrum, and it gives a good account of the McLennan bands of I2. The appendix discusses semiclassical approximations to the spectrum in a unified way. The stationary phase approximation is shown to lead to an expression very similar to the exact quantum result, and a new nondivergent approximation is derived for the red limit of the spectrum.

703,923
PB81-197832 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Rate Processes at Metal Surfaces. II. The Role of Substrate Electronic Excitations.
Final rept.
H. Metiu, and J. W. Gadzuk. 15 Feb 81, 13p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 74, n4 p2641-2653, 15 Feb 81.

Keywords: *Surface chemistry, *Metals, Electrons, Excitation, Electron transition, Molecular properties, Reprints, Feschbach states, Franck Condon principle, NTISCOMNBS, NTISNSFG.

A theoretical description of reactive molecular processes at metallic surfaces is formulated, following the Feschbach theory of nuclear reactions. Special attention is directed towards: (1) the role of substrate electron-hole pair excitations, both as a heat bath and as an entity permitting access to reaction channels not open in the absence of an excitation continuum; (2) the importance of nuclear Franck-Condon factors; (3) substrate induced quasiadiabatic electronic transitions on the incident atoms or molecules; and (4) incorporation of substrate dynamic structure factors into the theory. Simple illustrative examples are presented which demonstrate the physical content of the formal theory and its relationship to various simplified models.

703,924
PB81-197857 Not available NTIS
National Bureau of Standards, Washington, DC.

Electric Field Distribution Associated with Prebreakdown Phenomena in Nitrobenzene.
Final rept.
E. F. Kelley, and R. E. Hebner. Jan 81, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Applied Physics 52, n1 p191-195 Jan 81.

Keywords: *Nitrobenzenes, *Electric fields, Kerr electrooptical effect, Electrical faults, Reprints, NTISCOMNBS, NTISDE.

The electric field distribution between a prebreakdown tree and the electrode toward which it is propagating is determined. The electric field is measured in nitrobenzene, using the electro-optic Kerr effect. High-speed photography is used to provide a 10-ns resolution of the transient, prebreakdown events. The measurements show that to predict the Kerr fringe pattern, and thus the electric field distribution, it is sufficient to model the prebreakdown tree as a spherical conductor about the same size as the tree and at the potential of the electrode from which the tree is propagating.

703,925
PB81-199150 Not available NTIS
National Bureau of Standards, Washington, DC.
Factors Affecting the Retention of Polycyclic Aromatic Hydrocarbons in Gas Chromatography.
Final rept.
K. D. Bartle, M. L. Lee, and S. A. Wise. Feb 81, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Chromatographia 14, n2 p69-72 Feb 81.

Keywords: *Aromatic polycyclic hydrocarbons, *Gas chromatography, Vapor pressure, Boiling point, Liquid crystals, Reprints, NTISCOMNBS, NTISDE.

The retention index of a planar polynuclear aromatic hydrocarbon on the GC phases OV-101, SE-52, and OV-17 is strictly related only to the logarithm of vapour pressure, and therefore indirectly to the boiling point, and less closely to the relative molecular mass. The very approximate relation with connectivity index is only a consequence of the latter. On a nematic liquid crystal phase, a variation of activity coefficient, expressed in terms of a shape factor, also influences the retention of PAH.

703,926
PB81-199168 Not available NTIS
National Bureau of Standards, Washington, DC.
Microwave Spectrum, Structure and Dipole Moment of 1,4-Pentadiyne.
Final rept.
R. L. Kuczkowski, F. J. Lovas, R. D. Suenram, R. P. Lattimer, K. W. Hillig, and A. J. Ashe. 1981, 10p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. of Molecular Structure 72, p143-152 1981.

Keywords: *Microwave spectroscopy, *Molecular structures, *Dipole moments, Chemical bonds, Reprints, *Pentadiynes, NTISCOMNBS, NTISNSFG.

The microwave spectra of 1,4-pentadiyne and 1,4-pentadiyne-1,5d(2) are assigned and rotational and centrifugal distortion constants obtained. A unique structure could not be determined. However, analysis of the moments of inertia indicates that the bond distances in C5H4 are close to typical values found in other related compounds. An interaction involving the acetylene moieties is evidenced by the derived bond angles. The data are consistent with either the central CCC angle being close to the tetrahedral value with the acetylene groups pushed away from linearity by approximately 3-4 degrees or opening the central CCC angle to about 113 degrees along with linear acetylene groups. A range of structures between these two is also possible. The dipole moment is determined to be 0.516(5) D.

703,927
PB81-199671 Not available NTIS
National Bureau of Standards, Washington, DC.
Feasibility of ToF Atom-Probe Analysis of Silicon.
Final rept.
A. J.Melmed, T. Sakurai, Y. Kuk, and E. I. Givargizov. 1981, 4p
Pub. in Surface Science 103, n2-3 pL139-L142 1981.

Keywords: *Silicon, *Probes, *Mass spectroscopy, Reprints, NTISCOMNBS.

It is demonstrated, for the first time, that silicon can be mass analyzed with high resolution in an energy-compensated ToF atom-probe. For the instrument used, having a 17 ns pulse width, the practical upper limit of specimen resistivity is shown to be of the order of 10 ohm-cm.

703,928
PB81-199689 Not available NTIS
National Bureau of Standards, Washington, DC.
Resonances in HF.
Final rept.
D. Spence. 1981, 8p
Pub. in Jnl. of Physics B: Atomic Molecular Physics 14, n3 pL107-L114 1981.

Keywords: *Hydrogen fluoride, *Electron spectra, Reprints, *Feshbach states, NTISCOMNBS.

The author discusses a probable explanation of the totally inconsistent nature of some previously published Feshbach resonance spectra of hydrogen fluoride which has been provided by the recent work of Brion and Hitchcock. He has obtained new electron transmission spectra of HF in the energy range 12.8 to 16.0 eV, which confirm the earlier HF resonance data of Spence and Noguchi and which reveal several previously unobserved resonance structures. Finally, he points out a possible mechanism for a Lyman alpha laser.

703,929
PB81-204760 PC **A15**/MF **A01**
National Bureau of Standards, Washington, DC.
Data Index for Energy Transfer Collisions of Atoms and Molecules--1970-1979.
J. W. Gallagher, J. Van Blerkom, E. C. Beaty, and J. R. Rumble. Apr 81, 348p NBS-SP-593
Library of Congress catalog card no. 80-600177.

Keywords: *Atoms, *Molecules, Excitation, Molecular rotation, Molecular vibration, Electrons, Energy losses, Tables(Data), Reaction kinetics, *Ion molecule interactions, *Molecule molecule interactions, NTISCOMNBS.

An index to sources of data describing processes which occur when atoms, molecules or ions collide with each other at energies between 0 and 10 keV and gain or lose internal energy or change charge state is presented. The index facilitates retrieval of cross sections and reaction rate data for specific processes involving atomic or molecular species. It includes data published during the years 1970 through 1979. A comprehensive author list is included.

703,930
PB81-206120 PC **A18**/MF **A01**
National Standard Reference Data System.
Wavelengths and Transition Probabilities for Atoms and Atomic Ions: Part I. Wavelengths, Part II. Transition Probabilities.
J. Reader, C. H. Corliss, W. L. Wiese, and G. A. Martin. Dec 80, 416p NSRDS-NBS-68
Library of Congress catalog card no. 80-607997.

Keywords: *Atoms, *Ions, *Wavelengths, *Transition probabilities, Tables(Data), Intensity, Atomic energy levels, NTISCOMNBS.

Wavelengths for about 47,000 spectral lines of atoms and atomic ions, as well as transition probabilities A for about 5000 lines, are tabulated. The data were selected in such a way as to include the prominent lines over a wide spectral region. Part I contains wavelengths of lines of neutral through quadruply ionized atoms in the range 40 to 40,000 A. This information is presented in two different ways: (1) separate line lists grouped according to chemical element and further subdivided according to stage of ionization; and (2) a general table of wavelengths ordered numerically, with relative intensity, chemical element, and stage of ionization indicated for each line. Part II contains transition probability data for atoms in various stages of ionization, with emphasis on the neutral and singly ionized species. This table is arranged according to the chemical element and is further subdivided according to stage of ionization. Estimates of the accuracies of the A-values are provided. Wavelengths, energy levels, and statistical weights serve to identify the lines and to provide useful data for plasma spectroscopy applications.

703,931
PB81-207144 Not available NTIS
National Bureau of Standards, Washington, DC.

Angular Dependence of Scattered Electron Spectra of Neon and Argon in the Region of Quasidiscrete Autoionizing States.
Final rept.
M. A. Dillon, and D. Spence. 15 Feb 81, 2p
Pub. in Jnl. of Chemical Physics 74, n4 p2654-2655, 15 Feb 81.

Keywords: *Neon, *Argon, *Inelastic scattering, *Angular distributions, Electron scattering, Excitations, Reprints, *Autoionization, NTISCOMNBS.

The authors measured the angular dependence of inelastically scattered electrons in neon and argon in the energy region of quasi-discrete autoionizing states. Their spectra, obtained for incident electron energies of 200 eV, show that both singly and doubly excited autoionizing states exhibit angular distributions of the scattered electrons which are qualitatively as predicted by the Born approximation. Our results demonstrate that measured angular distributions of electrons scattered from quasi-discrete states can yield information on the symmetries and term symbols of these states, in a manner analogous to the well-known propensity rules for excitation of bound states.

703,932
PB81-207169 Not available NTIS
National Bureau of Standards, Washington, DC.
3p63d8-3p53d9 Transitions in Sr XIII, Y XIV, Zr XV, Nb XVI, and Mo XVII.
Final rept.
J. Reader, and A. Ryabtsev. Mar 81, 7p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of the Optical Society of America 71, n3 p231-237 Mar 81.

Keywords: *Molecular energy levels, *Molybdenum, *Niobium, *Strontium, *Yttrium, Hartree-Fock approximation, Ionization, Excitation, Reprints, Molecular configurations, Numerical solution, NTISCOMNBS, NTISDE.

The 3p sextets 3d octexts - 3p quintets 3d heptexts transitions in Sr XIII, Y XIV, Zr XV, Nb XVI, and Mo XVII have been newly measured by means of a low-inductance vacuum spark and a 10.7-m grazing-incidence spectrograph. The measurements have led to an improved analysis of this complex transition group in these ions. All levels of the combining configurations have been established. The energy parameters determined from least-squares fits to the observed levels are compared with Hartree-Fock calculations. The effective interaction alpha L(L + 1) for the 3p sextets 3d octexts configuration decreases markedly with increasing ionization. The effective electrostatic interactions D sup 1 (3p3d) and X sup 2 (3p3d) for the 3p quintets 3d heptexts configuration are practically constant through the sequence.

703,933
PB81-207177 Not available NTIS
National Bureau of Standards, Washington, DC.
Distorted-Wave Electron-Impact-Ionization Cross Sections for Highly Ionized Neonlike Atoms.
Final rept.
S. M. Younger. Mar 81, 9p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review A 23, n3 p1138-1146 Mar 81.

Keywords: *Neon, *Scattering cross sections, Electrons, Ionization, Comparison, Atoms, Reprints, *Atom electron interactions, Numerical solution, NTISCOMNBS, NTISDE.

Electron-impact-ionization cross sections have been computed for several neonlike ions in a distorted-wave Born exchange approximation. For lower ionization stages the total cross section was found to be sensitive to the details of the distorted potential in which the partial waves were calculated. Ionization from the 2 doublet s core subshell increased in importance for higher charge states. Isoelectronic curves are presented which allow the interpolation of nonrelativistic electron-impact-ionization cross sections for any ion in the neon sequence in the incident electron energy range of one to three times threshold. A comparison to available experimental and semiempirical formulas is made.

703,934
PB81-207185 Not available NTIS
National Bureau of Standards, Washington, DC.

Raman Spectrum from a Single Crystal of SnHPO4.
Final rept.
L. W. Schroeder, T. H. Jordan, and W. E. Brown.
1981, 9p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD.
Pub. in Spectrochimica Acta 37A, p21-29 1981.

Keywords: *Raman spectroscopy, Crystals, Chemical bonds, Reprints, *Tin hydrogen phosphate, Molecular configuration, NTISCOMNBS, NTISNIHIDR.

The polarized Raman spectrum of a single crystal of SnHPO4 has been obtained in order to ascertain the vibrational characteristics of HPO4(-2) dimers in a known configuration. Bands due to hydroxyl, OH, stretching, POH bending and the hydrogen bond were observed in addition to most of the predicted lattice modes. The OH stretching mode was observed at 2730/cm, the in-plane POH bend at 1275/cm and the out-of-plane POH bend at 818/cm. A band of 55/cm is assigned, on the basis of its deuterium shift, to a deformation of the hydrogen bond. Very low frequency bands at 18 and 30/cm reflect the layer structure of SnHPO4 in which intra-layer forces are strong and inter-layer (hydrogen bonds) forces are weak.

703,935
PB81-207235 Not available NTIS
National Bureau of Standards, Washington, DC.
Pair Production in the Field of Atomic Electrons.
Final rept.
L. C. Maximon, and H. A. Gimm. Jan 81, 14p
Pub. in Physical Review A 23, n1 p172-185 Jan 81.

Keywords: *Pair production, *Electron scattering, Hydrogen, Deuterium, Comparison, Reprints, NTISCOMNBS.

The total cross section for pair production in the field of atomic electrons (triplet production) is considered in detail. A discussion of the relevant theoretical papers is presented; the more familiar cross section for pair production in the Coulomb field of the nucleus serves for comparison. The effect of exchange and gamma-e interactions, atomic binding, and radiative corrections are all considered. Earlier expressions for the recoil distribution have been simplified considerably. Numerical values for screening corrections, exchange and gamma-e contributions, and total cross sections are given. Comparison is made with experimental cross sections for pair production on hydrogen and deuterium.

703,936
PB81-207284 Not available NTIS
National Bureau of Standards, Washington, DC.
Two-Photon Excitation of Indium Atoms by Photodissociation of InCl and InBr.
Final rept.
T. A. Cool, and J. B. Koffend. 15 Feb 81, 6p
Pub. in Jnl. of Chemical Physics 74, n4 p2287-2292, 15 Feb 81.

Keywords: *Photolysis, *Molecular energy levels, Excitation, Reprints, *Laser spectroscopy, *Indium chloride, *Indium bromide, NTISCOMNBS.

Measurements are presented of two-photon dissociative excitation cross sections for InCl and InBr for photolysis with a 248 nm KrF laser source.

703,937
PB81-207292 Not available NTIS
National Bureau of Standards, Washington, DC.
Optical Bistability from Three-Level Atoms.
Final rept.
D. F. Walls, P. Zoller, and M. L. Steyen-Ross. Mar 81, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Jnl. of Quantum Electronics QE-17, n3 p380-384 Mar 81.

Keywords: *Atomic energy levels, Doppler effect, Reprints, *Optical bistability, Laser spectroscopy, NTISCOMNBS.

A novel mechanism is proposed for optical bistability utilizing the population trapping which may occur in a coherent superposition of sublevels in a three-level system. The resulting bistability does not require atomic saturation and is insensitive to Doppler and laser bandwidth effects.

703,938
PB81-207755
(Order as PB81-207748, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Velocity of Sound in Liquid Propane.
B. A. Younglove. 19 Nov 80, 6p
Included in Jnl. of Research of the National Bureau of Standards, v86 n2 p165-170, Mar-Apr 81.

Keywords: *Propane, *Acoustic velocity, *Thermodynamic properties, *Transport properties, Liquefied natural gas, Tables(Data), Specific heat, Pressure, Temperature, Density(Mass/volume), NTISCOMNBS.

Sound velocity measurements on liquid propane from 90 to 300 K and for pressures to 34 MPa are reported. Also included are saturated liquid sound velocities from 90 to 290 K. The data were combined with P(Q)T data to compute compressibility and specific heat ratio. Comparisons were made to computed values of sound velocity of Goodwin and to the data of Lacam.

703,939
PB81-207771
(Order as PB81-207748, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Transition Temperatures of the Hydrates of Na2SO4, Na2HPO4, and KF as Fixed Points in Biomedical Thermometry.
R. L. Magin, B. W. Mangum, J. A. Statler, and D. D. Thornton. 19 Nov 80, 12p
Included in Jnl. of Research of the National Bureau of Standards, v86 n2 p181-192, Mar-Apr 81.

Keywords: *Transition temperature, *Hydrates, Temperature measurement, Sodium sulfates, Potassium fluorides, Sodium phosphates, NTISCOMNBS.

The hydrate transition temperatures of Na2SO4:10H2O to Na2SO4, KF:2H2O to KF, and Na2PHO4:7H2O to Na2HPO4:2H2O were established using ACS grade salts as 32.374C, 41.422C, and 48.222C, respectively. A simple and reliable procedure involving inexpensive materials was used to realize these transitions as temperature fixed points. Each transition temperature was attained within 30 minutes of hydrate initiation and remained constant to within + or - 0.002C for more than 10 hours if the mixture was stirred. The established transition temperatures were sensitive at the 0.001C level to the amount of impurities, so the materials used should be of the highest quality available. These systems fill a gap in the existing spectrum of temperature standards and should be useful in biomedical laboratories for calibrating thermometers.

703,940
PB81-210395 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Analysis of the Shape of the Far-Infrared Spectra of H2-H2 and H2-He Collisions.
E. R. Cohen, and G. Birnbaum. Apr 81, 28p NBSIR-80-2175
Sponsored in part by Jet Propulsion Lab., Pasadena, CA. Prepared in cooperation with Rockwell International, Thousand Oaks, CA. Science Center.

Keywords: *Infrared spectroscopy, *Hydrogen, *Helium, Molecule molecule interactions, Numerical solution, NTISCOMNBS.

The collision-induced far-infrared spectra due to H2-H2 and H2-He collisions have been previously measured in the range 20 to 900/cm-1 at -77.4, 194.7 and 292.4 K. These spectra are fitted with a semi-empirical line shape and the parameters in the shape function are evaluated. The accuracy of these fittings is discussed. The zeroth and first spectral moments for the isotropic overlap translational spectrum due to H2-He collisions are obtained and given a value for the range parameter in the induced-dipole function in good agreement with that given by an ab initio calculation.

703,941
PB81-211492 PC **A22**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Selected Properties of Hydrogen (Engineering Design Data).
Final rept.
R. D. McCarty, J. Hord, and H. M. Roder. Feb 81, 525p NBS-MONO-168
Library of Congress catalog card no. 80-600195.

Keywords: *Hydrogen, Thermophysical properties, Chemical properties, Combustion, Tables(Data), Physical properties, Fuels, Liquid phases, Vapor phases, Solid phases, NTISCOMNBS.

The National Bureau of Standards has been engaged in the compilation, review, analytical and experimental derivation, and publication of hydrogen properties for over 20 years. The properties data presented herein are compiled largely from those accumulated data; of course, pertinent data and work of other researchers in the field are also included. The general interests of scientists and engineers engaged in energy systems studies were given top priority in choosing the properties material presented in this book. Thermophysical properties of liquid, liquid-vapor, vaporous, and gaseous hydrogen are presented in Chapter 1 and the solid-liquid, solid-vapor, and solid phase properties are compiled in Chapter 2. Ortho-para modifications of the hydrogen molecule and attendant property variations are considered in both chapters. Combustion and safety data, pertinent to hazard analysis of hydrogen systems, is collected in Chapter 3. Important miscellaneous properties are compiled in Chapter 4, data figures are compiled in Chapter 5, data tables are collected in Chapter 6, and Chapter 7 summarizes symbols, units, and conversion factors used throughout the book.

703,942
PB81-211575 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoelectron-Photoion Coincidence Study of Benzonitrile.
Final rept.
H. M. Rosenstock, R. Stockbauer, and A. C. Parr. 1980, 6p
Pub. in Jnl. of Chemical Physics 77, n7/8 p745-750 1980.

Keywords: *Benzonitrile, *Photoionization, Reaction kinetics, Reprints, *Electron ion interactions, NTISCOMNBS.

The technique of photoelectron-photoion coincidence with variable ion source residence times has been applied to a study of benzonitrile ion fragmentation. The breakdown curve of the parent ions shows a strong dependence on residence time. Detailed analysis of this dependence shows that the ion fragments from its electronic ground state via a 'tight' activated complex, in agreement with the conclusions of Chesnavich and Bowers. The rate-energy dependence agrees with that determined by Eland and Schulte, and the fragmentation threshold is in reasonable agreement with the threshold observed in electron impact at very long ion source residence times. The results lead to delta H(fsub0) (C6H4(+1)) = 1321 + or - 10k J/mol. The energetics of additional neutral and ionic C6H4 isomers is estimated and discussed.

703,943
PB81-211641 Not available NTIS
National Bureau of Standards, Washington, DC.
Electronic Structure of the Negative Ion of HCl.
Final rept.
M. Krauss, and W. J. Stevens. 1 Jan 81, 8p
Pub. in Jnl. of Chemical Physics 74, n1 p570-577, 1 Jan 81.

Keywords: *Hydrogen chloride, *Atomic energy levels, Ions, Transition, Dipole moments, Electron transitions, Reprints, Numerical solution, NTISCOMNBS.

The negative ion states of HCl(-1) that go asymptotically to the Cl(-1) + H and H(-1) + Cl asymptotes have been studied as a function of the internuclear distance using first-order configuration interaction wave functions. The 1 doublet sigma (+1), 2 doublet signa (+1), and 1 doubtlet Pi states all cross the neutral HCl energy curve. To the right of the crossing all three curves are bound relative to their asymptotes and exhibit energy minima. The crossings occur on the left hand limbs of the negative ion curves. To the left of the crossing the lowest negative ion curve mimics the neutral and the attached electron is in an orbital which is as diffuse as the basis set permits. Several roots of the FOCI were examined in the unstable region. A root that has a large component of the 'tight' wave function appears in a number of the calculations and possibly can be attributed to a broad resonance. Transition and dipole moments of the bound energy curves exhibit the behavior expected of charge transfer interaction and polarizarion among these states.

703,944
PB81-211666 Not available NTIS
National Bureau of Standards, Washington, DC.
Electronic Structure and Dipole Moment Function of PbO (X Singlet Sigma(+)).
Final rept.
H. Basch, W. J. Stevens, and M. Krauss. 15 Feb 81, 3p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 74, n4 p2416-2418, 15 Feb 81.

Keywords: *Dipole moments, *Lead oxides, *Atomic energy levels, Carbon monoxide, Comparison, Reprints, Numerical solution, NTISCOMNBS, NTISDODAF.

Valence multiconfiguration self-consistent-field (MCSCF) calculations of the energy and dipole moment function curves of PbO(X singlet Sigma (+)) have been performed using effective core potentials (ECP) to replace the core electrons in the Hamiltonian. The present results are encouraging considering the small basis set and configuration list. This list is identical to that obtained in previous calculations on CO, and should be adequate for all other Group IV/VI molecules. The agreement of the calculated dipole moment at R(e), for PbO with the experimental value for the ground vibrational state is good. The shape of the dipole moment function for a molecule with a heavy atom has been obtained and this shape is seen to be comparable to that for CO.

703,945
PB81-211674 Not available NTIS
National Bureau of Standards, Washington, DC.
Theoretical Line Strengths for the 4d10 1S - 4d94f 1P0 Resonance Transition in the Palladium Isoelectronic Sequence.
Final rept.
S. M. Younger. Dec 80, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review A 22, n6 p2682-2689 Dec 80.

Keywords: *Palladium, *Line spectra, Atomic energy levels, Hartree-Fock approximation, Many body problem, Perturbation theory, Reprints, Numerical solution, NTISCOMNBS, NTISDE.

Theoretical line strengths for the 4 d sup 10 singlet S - 4d sup 9 4fsup singlet P(0) resonance transition in the palladium isoelectronic sequence have been computed in three approximations: configuration-averaged Hartree-Fock, term-dependent Hartree-Fock, and many-body perturbation theory.

703,946
PB81-211682 Not available NTIS
National Bureau of Standards, Washington, DC.
Experimental and Theoretical Research on Atomic Data for Highly Ionized Species at the National Bureau of Standards.
Final rept.
W. L. Wiese. 1981, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physica Scripta 23, p194-196 1981.

Keywords: *Atoms, *Ionization, Standards, Atomic energy levels, Line width, Excitation, Transition probabilities, Cross sections, Reprints, *Standard reference materials, NTISCOMNBS, NTISDE.

At NBS, a broad research effort is under way to produce, experimentally as well as theoretically, critically needed atomic data for magnetic fusion energy research. This program encompasses the determination of atomic energy levels, line wavelengths, transition probabilities, ionization and dielectronic recombination rates and excitation and ionization cross sections. It also includes fundamental theoretical studies on ionization cross sections and on the density dependence of dielectronic recombination rates, as well as critical compilations of some of the above-mentioned atomic quantities.

703,947
PB81-214165 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Computer Program for the Prediction of Viscosity and Thermal Conductivity in Hydrocarbon Mixtures,
J. F. Ely, and H. J. M. Hanley. Apr 81, 80p NBS-TN-1039

Keywords: *Viscosity, *Thermal conductivity, *Computer programming, *Hydrocarbons, *Density(Mass/volume), Mixtures, Methane, Mathematical models, Fluids, Equations of state, Thermodynamics, TRAPP computer program, Numerical solution, NTISCOMNBS.

A model for the prediction of the density, viscosity and thermal conductivity of non-polar fluid mixture over the entire range of pVT states is presented. The model is based on the extended corresponding states model and covers molecular weight ranges including C20. Only pure component equilibrium data such as the critical constants are required as input to the calculation procedure--no transport data are required. Extensive comparisons with experimental data for pure fluids and binary mixtures are presented. The average percentage deviation for both the viscosity and thermal conductivity was observed to be less than 8 percent. A computer program (TRAPP) which performs the calculations reported in this manuscript is described and listed in the Appendices.

703,948
PB81-215717 Not available NTIS
National Bureau of Standards, Washington, DC.
Structural Investigation of Th6Mn23D16 by Neutron Diffraction.
Final rept.
K. Hardman, J. J. Rhyne, K. Smith, and W. E. Wallace. 1980, 6p
Pub. in J. Less-Common Met. 74, p97-102 1980.

Keywords: *Neutron diffraction, *Crystal structure, Manganese inorganic compounds, Reprints, Thorium manganese deuterides, NTISCOMNBS.

The compound Th6Mn23D16 was studied at 295 K by neutron diffraction profile refinement methods. Low temperature scans (4 K) of Th6Mn23D16 revealed that the compound undergoes a crystallographic phase change from f.c.c. symmetry to orthorhombic symmetry.

703,949
PB81-215741 Not available NTIS
National Bureau of Standards, Washington, DC.
Delta-Function Expansion of Mayer Function with Application to Virial Coefficients.
Final rept.
J. C. Rainwater. 1978, 13p
Pub. in J. Stat. Phys. 19, n2 p177-189 1978.

Keywords: Reprints, *Viral coefficients, *Mayer theory, NTISCOMNBS.

The Mayer cluster integrals of a fluid with smooth, repulsive interactions are expanded in orders of a well-defined softness parameter. To first but not second order in softness, all virial coefficients are given by their hard-sphere forms with an effective diameter. A closed asymptotic expression is derived for the third virial coefficient which gives excellent results for the inverse power and exponential potentials.

703,950
PB81-216640 Not available NTIS
National Bureau of Standards, Washington, DC.
MCSCF Pseudopotential Calculations for the Alkali Hydrides and Their Anions.
Final rept.
W. J Stevens, A. M. Karo, and J. R. Hiskes. 1 Apr 81, 11p
Pub. in Jnl. of Chemical Physics 74, n7 p3989-3998, 1 Apr 81.

Keywords: Lithium hydride, Sodium Hydride, Anions, Reprints, *Multiconfiguration self-consistent-field, *Pseudopotential theory, Potassium hydride, Numerical solution, Rubidium hydride, Cesium hydride.

Multiconfiguration self-consistent-field calculations have been carried out on the X singlet Sigma (+) and a triplet Sigma (+) states of LiH, NaH, KH, RbH, and CsH, and on the X doublet Sigma (+) states of their respective anions. Pseudopotentials, including core polarization terms, have been used to replace the core electrons, resulting in simple two- and three-electron calculations. Comparisons of the neutral potential curves with experiment and other ab initio calculations (where available) show very good agreement. The agreement with ab initio calculations on LiH(-1) and NaH(-1) is also very good. Adiabatic electron affinities have been calculated for LiH (0.293 ev), NaH (0.316 eV), KH (0.437 eV), RbH (.422 eV), and CsH (0.438 eV).

703,951
PB81-216657 Not available NTIS
National Bureau of Standards, Washington, DC.
Hydrogen Spillover on Alumina--A Study by Infrared Spectroscopy.
Final rept.
R. R. Cavanagh, and J. T. Yates. 1981, 5p
Pub. in Jnl. of Catalysis 68, p22-26 1981.

Keywords: *Deuterium, *Aluminum oxide, *Infrared spectroscopy, Chemisorption, Hydrogen isotopes, Carbon monoxide, Rhodium, Reprints, Hydroxyl radical.

Infrared spectroscopy has been used to monitor the exchange of D2 (g) with OH groups chemisorbed on Al2O3. It has been shown that near 300K, the rate of the exchange process is rapid in the presence of supported Rh particles on the Al2O3. A qualitative model for hydrogen 'spillover' is presented in which dissociative adsorption of dihydrogen by the metal is a key step. It is shown that CO chemisorption on the supported Rh leads to a marked reduction in the 'spillover' rate due to site blockage on the Rh. This is consistent with recent studes of behavior of the CO and H coadsorbed on Rh (111).

703,952
PB81-216665 Not available NTIS
National Bureau of Standards, Washington, DC.
Dielectric Friction and Dielectric Dispersion in Electrolyte Solutions with Spin.
Final rept.
J. B. Hubbard, and R. F. Kayser. 15 Mar 81, 11p
Pub. in Jnl. of Chemical Physics 74, n6 p3535-3545, 15 Mar 81.

Keywords: *Mathematical models, *Dielectric properties, *Friction, *Dispersions, *Ions, Reprints.

A self-consistent continuum model of dielectric friction on a moving ion is developed in which the only adjustable parameters are the hydrodynamic boundary conditions and a 'rotational viscosity' eta (R).

703,953
PB81-216681 Not available NTIS
National Bureau of Standards, Washington, DC.
Viscosity-Temperature Relationships at 1 ATM in the System Diopside-Anorthite.
Final rept.
C. M. Scarfe, D. Cronin, J. Wenzel, and D. Kauffman. 1980, 4p
Pub. in Carnegie Institution of Washington Year Book 79. Annual Report of the Director Geophysical Laboratory, n1825 p315-318 1980.

Keywords: *Viscosity, *High temperature tests, Reprints, *Diopside, *Anorthite, Arrhenius equations, Fulcher equations.

The viscosity as a function of temperature has been measured for six melts in the diopside-anorthite system in the range 1175-1625 C. The results are fitted to Arrhenius and Fulcher equations.

703,954
PB81-216707 Not available NTIS
National Bureau of Standards, Washington, DC.
4 doublet s 4 triplet p-4s 4 quadruplet p and 4 doublet s 4 triplet p-4 doublet s 4 doublet p 5s Transitions in Y VII Zr VIII, Nb IX, and Mo X.
Final rept.
J. Reader, and N. Acquista. Apr 81, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of the Optical Society of America 71, n4 p434-441 Apr 81.

Keywords: *Yttrium, *Zirconium, :Molybdenum, *Niobium, *Molecular energy levels, Reprints.

Spectra of ionized Y, Zr, Nb, and Mo have been observed in sliding-spark and triggered-spark discharges on 10.7-m normal-and grazing-incidence spectrographs at the National Bureau of Standards in Washington, DC. From these observations the 4 doublet s 4 triplet p - 4s 4 quadruplet p transitions in Y VII, Zr VIII,

Nb IX, and Mo X have been identified. The 4 doublet s 4 triplet p - 4 doublet s 4 doublet p 5s transitions in Y VII-Mo X, previously identified by Rahimullah et al.

703,955
PB81-216723 Not available NTIS
National Bureau of Standards, Washington, DC.
Adsorption of N-(2-Hydroxy-3-Methacryloxypropyl)-N-Phenylglycine (NPG-GMA) on Cupric Ion-Enriched Hydroxyapatite Surface to Improve Chemical Bonding between Dental Resins and Teeth.
Final rept.
D. N. Misra, and R. L. Bowen. Apr 81, 5p
Contract PHS-DE-05129-01
Pub. in Biomaterials 2, p78-82 Apr 81.

Keywords: *Dental materials, Nitrogen organic compounds, Chemical bonds, Isotherms, Adsorption, Reprints, *Glycine/N-(hydroxy-methacryloxypropyl)-N-phenyl, Hydroxyapatite.

In continued studies of chemical bonding between a polymer and teeth through the mediation of coupling agents, the adsorption of N-(2-hydroxy-3-methacryloxypropyl)-N-phenylglycine (NPG-GMA) from ethanol solution was studied on cupric ion-treated synthetic hydroxyapatite in order to discriminate the adsorptive behaviour of the 'mordanted' as against the unmordanted (or pure) apatite.

703,956
PB81-216749 Not available NTIS
National Bureau of Standards, Washington, DC.
Dielectric Constant of SF6 Near the Critical Point.
Final rept.
B. J. Thijsse. 15 Apr 81, 15p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Physics 74, n8 p4678-4692, 15 Apr 81.

Keywords: *Sulfur fluorides, *Critical point, *Dielectric properties, Density(Moss/volume), Temperture, Reprints.

Measurements are reported of the dielectric constant of SF6 at the critical density (+ or - %) over a temperture range of - .001 less than (T-T(c))/T(c) less than + . 01 The experimental cell was especially designed to suppress spurious effects resulting from temperature gradients and gravity. Temperature stability was better than + or - 20 muK and capacitance stability better than 0.5 ppm over several days. The critical temperature was determined as 318.718 + or - 0.002 K and was completely free of drift. Capacitance data were reproduced within a few ppm over the duration of the experiment. No direct evidence of a (T-T(c))sup(1-a) anomaly was found; an upper bound of 5ppm is established. Effects of fluid stratification and phase separation were clearly seen and are well understood. We find a value of 0.325 + or - 0.005 for the critical exponent beta.

703,957
PB81-216764 Not available NTIS
National Bureau of Standards, Washington, DC.
Site Distribution Studies of Rh Supported on Al2O3--An Infrared Study of Chemisorbed CO.
Final rept.
R. R. Cavanagh, and J. T. Yates. 1 Apr 81, 6p
Sponsored in part by Office of Naval Research, Washington, DC. See also report dated May 80, AD-A-084 852.
Pub. in Jnl. of Chemical Physics 74, n7 p4150-4155, 1 Apr 81.

Keywords: *Aluminum oxide, *Rhodium, *Carbon monoxide, *Infrared spectroscopy, Chemisorption, Surfaces, Reprints.

Using infrared spectroscopy, chemisorbed CO has been employed as a surface probe to observe differences in Rh site distributions on Al2O3-supported Rh.

703,958
PB81-220303 Not available NTIS
National Bureau of Standards, Washington, DC.
Recent Developments in Line Shape Theory.
Final rept.
A. Ben-Reuven. 1981, 18p
Proceedings of International Conf. Spectral Line Shapes (5th), Berlin, Germany on July 7-11, 1980.
Pub. in Spectral Line Shapes, p867-884 1981.

Keywords: *Line width, *Line spectra, Spectral lines, Doppler effect, Ionization, Atom molecule interactions, Molecule molecule interactions, Atom atom interactions.

General explicit expressions for spectral line shapes are present assuming only (a) broadening by binary collisions (neglecting 're-collisions,' or triple-collision effects), involving (b) stable atoms or molecules (neglecting chemical reactions and ionization effects and considering, at most, (c) combined coherent propagation of two atoms or molecules (weak coherence coupling). This theory is otherwise valid for all field strengths, and incorporates both impact and quasistatic limits. Implicit equations evolving from the collision-induced many-atom coherence effects are also discussed. The theory can be adapted to both the Doppler-limited domain, where the collision integrals can be presented as velocity-changing kernels, and the homogeneously-broadened domain, where the collision integrals may be approximately replaced by velocity-averaged relaxation parameters.

703,959
PB81-220360 Not available NTIS
National Bureau of Standards, Washington, DC.
Studies of the O2 (3)Pi(g)(V) Valence State and (3)Pi(g)(R) Rydberg State in the Schumann-Runge Continuum from Ejected and Scattered Electron Spectra.
Final rept.
D. Spence. 1 Apr 81, 7p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 74, n7 p3898-3904, 1 Apr 81.

Keywords: *Oxygen, *Molecular energy levels, *Electron scattering, Reprints, Rydberg series, Feshbach states.

Electron-impact energy-loss spectra are obtained in O2 in the energy-loss range of 7 to 10 eV. Theses spectra contain some discrete features resulting from scattered electrons following excitation of Rydberg states, and other features from ejected electrons following the decay of O2(-1) Feshbach resonances into valence elelectronic states in the continuum via the reaction.

703,960
PB81-220394 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystal Structure of Synthetic Chukhrovite Ca4AlSi(SO4)F13.12H2O.
Final rept.
M. Mathew, S. Takagi, K. R. Waerstad, and A. W. Frazier. 1981, 6p
Contract PHS-DE-05030-02
Pub. in American Mineralogist 66, p392-397 1981.

Keywords: *Crystal structure, Calcium inorganic compounds, Chemical bonds, Silicon inorganic compounds, Reprints, *Chukhrovite.

Synthetic chukhrovite, Ca(4)AlSi(SO(4))F(13).12H(2)O crystallizes in the cubic space group Fd3 with a(O) = 16.710(2) A and Z = 8. The structure was refined to R(w) = 0.028 and R = 0.025 using 481 non-zero reflections.

703,961
PB81-221434 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Mass Spectrometric Studies of MHD Slag Thermochemistry.
J. W. Hastie, and E. R. Plante. Jun 81, 36p NBSIR-81-2293

Keywords: *Mass spectroscopy, *Thermodynamics, *Slags, *Plasmas(Physics), Magnetohydrodynamics, Economic analysis, Potassium inorganic compounds, Thermochemistry, Tables(Data), Vaporization.

The economic viability of open cycle coal-fired magnetohydrodynamics (MHD) is closely linked to the thermodynamic conditions of seed potassium, both in the plasma and slag phase. Previous attempts to model plasma conductivity and slag retention of seed have been highly inaccurate due to the limited thermodynamic data base available. These limitations have mainly included vapor pressure, enthalpy of formation, and solution activity data for slag phases. Results of an extensive systematic experimental program of measurements on these and related properties are presented. The following potassium-containing systems were studied: binary mixtures of K2O with SiO2, Al2O3, Fe2O3, and ZrO2; a series of more complex synthetic slags containing K2O, SiO2, CaO, MgO, Al2O3, and Fe2O3; and MHD channel slag (Illinois No. 6 coal); and several slag-NaCl mixtures. Data were obtained over a sufficiently wide range of component-type, composition and temperature to reveal systematic trends in slag activities from which empirical predictions are possible. However, anomalous behavior was also noted, mainly in the form of nonequilibrium effects. Application of the vaporization and activity data to plasma-slag interaction and to the recovery of potassium seed from slag is also considered.

703,962
PB81-221731 Not available NTIS
National Bureau of Standards, Washington, DC.
Current Research at NBS Using Synchrotron Radiation at SURF-II.
Final rept.
A. C. Parr, G. Rakowsky, D. L. Ederer, and R. L. Stockbauer. J. B. West, and J. L. Dehmer. Apr 81, 5p
Sponsored in part by Department of Energy, Washington, DC., and Office of Naval Research, Washington, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-28, n2 p1210-1214 Apr 81.

Keywords: *Synchrotron radiation, *Ultraviolet spectroscopy, Carbon monoxide, Nitrogen, Argon, Xeon, Molecular vibrations, Reprints, *Standard reference materials, Autoionization.

The National Bureau of Standards (NBS) Synchrotron Ultraviolet Radiation Facility (SURF-II) is used in conjunction with a high flux normal incidence monochromator for angle resolved wavelength dependent photoelectron studies. The recent work has concentrated on studies of the effect of shape resonances on molecular vibrational intensity distributions as well as the effects of autoionization upon the vibrational intensity distributions over narrow wavelength regions. Results for CO, N2, Ar and Xe will be discussed.

703,963
PB81-221749 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Resolution Measurement of the Helium 1s2s22S Resonance Profile.
Final rept.
R. E. Kennerly, R. J. Van Brunt, and A. C. Gallagher. May 81, 13p
Grant NSF-PHY79-04928
Pub. in Physical Review, A 23, n5 p2430-2442 May 81.

Keywords: *Helium, *Electron scattering, Doppler effect, Ionization, Reprints.

The 19.37-eV helium scattering resonance profile has been measured with an instrumental width less than the natural width and much less than that attained in any previously published study. The electron beam was produced by photoionization and scattered from a He beam from a supersonic nozzle.

703,964
PB81-221756 Not available NTIS
National Bureau of Standards, Washington, DC.
Nonradiative Transport of Atomic Excitation of Na Vapor.
Final rept.
A. G. Zajonc, and A. V. Phelps. May 81, 9p
Contract N00014-76-C-0123
Pub. in Physical Review, A 23, n5 p2479-2487 May 81.

Keywords: *Sodium, *Atomic energy levels, Fluorescence, Visible spectroscopy, Excitation, Vapor phases, Reprints, Laser spectroscopy.

Measurements are reported which show the effect of nonradiative losses at a gas/window interface on the backscattered fluorescence intensity for Na vapor at frequencies in the vicinity of the resonance lines near 589 nm. The Na 3P(1/2, 3/2) states are excited with low-intensity, single-mode, tunable dye-laser at high Na densities and the frequency integral of the backscattered fluorescence intensity in the D1 and D2 lines is measured. The agreement between theory and experiment is remarkably good when one considers that the theory contains only one unknown coefficient, i.e., the reflection coefficient for excited atoms at the windows. In the authors case the excited atoms are assumed to be completely destroyed at the window.

703,965
PB81-221764 Not available NTIS
National Bureau of Standards, Washington, DC.
Energy Curves and Moments for PbHe and PbXe.
Final rept.
H. Basch, P. S. Julienne, M. Krauss, and M. E. Rosenkrantz. 15 Dec 80, 12p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 73, n12 p6247-6258, 15 Dec 80.

Keywords: *Dipole moments, *Molecular energy levels, Absorption, Reprints, *Lead helium, *Lead xenon, *Molecule molecule interactions, Numerical solution.

Collision induced absorption at either the pump or Stokes wavelength could reduce the efficiency of Raman scattering of XeCl pump radiation in Pb vapor. Calculation of the collision induced absorption requires a knowledge of the different energy curves between the ground and upper states and the transition moment as a function of the internuclear distance. These curves were obtained in a first-order configuration interaction calculation of the PbHe(+1), PbXe, and PbXe(+1) valence states. The energy defect for the pump wavelength is estimated to be so large that no significant absorption is expected for either PbXe or PbHe collision partners. There are also no calculated curve crossings at an energy lower than 0.25 eV, which indicates a very small probability for deactivation of Pb(triplet P(2)) by rare gas collision.

703,966
PB81-223463 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Selected Values of Chemical Thermodynamic Properties: Compounds of Uranium, Protactinium, Thorium, Actinium, and the Alkali Metals.
Final rept.
D. D. Wagman, W. H. Evans, V. B. Parker, R. H. Schumm, and R. L. Nuttall. May 81, 153p NBS-TN-270-8
See also report dated Apr 73, COM-73-50435.

Keywords: *Thermodynamic properties, *Chemical compounds, Tables(Data), Enthalpy, Heat of formation, Gibbs free energy, Entropy, Specific heat, Uranium, Protactinium, Thorium, Actinium, Lithium, Sodium, Potassium, Rubidium, Cesium, Francium.

This publication contains tables of recommended values for the standard enthalpies (heats) of formation, Gibbs (free) energies of formation, entropies, enthalpy contents and heat capacities at 298.15 K, and enthalpies of formation at O K for compounds of uranium, protactinium, thorium, actinium, lithium, sodium, potassium, rubidium, cesium, and francium.

703,967
PB81-227514 Not available NTIS
National Bureau of Standards, Washington, DC.
(p,V,T) of Compressed and Liquefied (nitrogen + methane).
Final rept.
G. C. Straty, and D. E. Diller. 1980, 17p
Sponsored in part by the National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Thermodynamics 12, p937-953 1980.

Keywords: *Nitrogen, *Methane, *Pressure, *Volume, *Temperature, Mixtures, Density(Mass/volume), Compressing, Reprints.

The results of (p,V,T) measurements on 3 gravimetrically prepared mixtures of nitrogen-methane are reported.

703,968
PB81-227522 Not available NTIS
National Bureau of Standards, Washington, DC.
Bonding Geometry of CO on Planar and Stepped Single Crystal Surfaces.
Final rept.
T. E. Madey, J. E. Houston, and S. C. Dahlberg. Sep 80, 4p
Sponsored in part by the Office of Naval Research, Arlington, VA.
Pub. in Proceedings of International Conference, Solid Surface (4th), Cannes, France, Sep 22, 1980, Jnl. Fr. Vac. Soc. 1, p205-208 Sep 80.

Keywords: *Carbon monoxide, *Surface chemistry, *Chemical bonds, Crystal structure, Adsorption, Molecular structure, Electron stimulated desorption ion angular distribution method.

The structures of molecular CO adsorbed on a planar W(110) surface and on stepped surfaces containing W(110) terraces have been studied using the electron stimulated desorption ion angular distribution (ESDIAD) method. For CO adsorbed on the close packed W(110) surface, the dominant bonding mode is via the carbon atom, with the CO molecular axis perpendicular to the plane of the surface. For CO adsorbed at step sites on 4 different surfaces vicinal to W(110), the axis of the molecule is 'tilted' or inclined away from the normal to the surface. The ESDIAD method, in which ion desorption angles are related to surface bond angles, provides a direct determination of the structures of adsorbed molecules and molecular complexes on surfaces.

703,969
PB81-227589 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of the Heat Capacities Cv of Dense Gaseous and Liquid Nitrogen and Nitrogen Trifluoride.
Final rept.
L. A. Weber. 1981, 15p
Sponsored in part by the Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Thermodynamics 13, p389-403 1981.

Keywords: *Specific heat, *Nitrogen, *Nitrogen fluorides, Density(Mass/volume), Equations of state, Calorimetry, Reprints.

Heat capacities at constant volume are reported for nitrogen and nitrogen trifluoride in both the single-phase and two-phase regions. The measurements cover the range in temperature from 78 to 250 K for nitrogen and from 67 to 300 K for NF3. Pressures ranged up to about 30 MPa and densities varied from somewhat less than the critical density to near the triple-point density. Comparisons are made with values calculated from the equation of state. The heat capacity of the saturated liquid is derived from the two-phase results and compared with earlier measurements.

703,970
PB81-227597 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Resolution Optical Spectra of Laser Cooled Ions.
Final rept.
R. E. Drullinger, D. J. Wineland, and J. C. Bergquist. 1980, 4p
Sponsored in part by the Office of Naval Research, Arlington, VA. and the Air Force Office of Scientific Research, Washington, DC.
Pub. in Applied Physics 22, p365-368 1980.

Keywords: *Ions, *Optical spectra, Doppler effect, Magnesium isotopes, Reprints, *Laser spectroscopy, *Magnesium ions.

The authors obtain essentially Doppler free spectra of the naturally occurring isotopes of Mg- which are bound in a Penning trap, by using a frequency stabilized laser to continuously cool the ions, while the scatter rate from a second, frequency swept laser is monitored. They showed that the magnetron motion as well as the cyclotron and axial motion can be minimized. Line position measurements yielding resonance transition energy isotope and hyperfine shifts are reported.

703,971
PB81-227613 Not available NTIS
National Bureau of Standards, Washington, DC.
Softness Expansion of Gaseous Transport Properties II. Moderately Dense Gases.
Final rept.
J. C. Rainwater. 1 Apr 81, 14p
Pub. in Jnl. of Chemical Physics 74, n7 p4130-4143, 1 Apr 81.

Keywords: *Gaseous, *Transport properties, *Softening points, Density(Mass/volume), Reprints, Snider Curtiss theory.

The first density corrections to gaseous transport properties for the inverse power potential phi=phi(0)(sigma/r)sup n are evaluated according to the theory of Curtiss, Snider, and co-workers. A linear softness expansion predicts that the first density corrections are positive for large n but negative for small n, and that the changes of sign occur at n=32.75 and n=8.42 for the viscosity and thermal conductivity, respectively. It is shown that some of the Snider-Curtiss (collisional transfer) collision integrals may be simplified, one of them being the usual dilute gas omega integral with Smith's collision lifetime included in the integrand.

703,972
PB81-229171 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Compilation of Thermodynamic and Transport Properties of Aqueous Sulfuric Acid,
B. R. Staples, and T. F. Wobbeking. Aug 80, 27p NBSIR-81-2276
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Sulfuric acid, *Thermodynamic properties, *Transport properties, *Bibliographies.

A detailed compilation of sources of data for the thermodynamic and transport properties of aqueous sulfuric acid is presented. All ranges of temperature, concentration, and pressure are included.

703,973
PB81-233769 Not available NTIS
National Bureau of Standards, Washington, DC.
Microwave Spectrum, Structure and Dipole Moment of Sulfuric Acid.
Final rept.
R. L. Kuczkowski, R. D. Suenram, and F. J. Lovas. 1981, 6p
Pub. in Jnl. of the American Chemical Society 103, p2561-2566 1981.

Keywords: *Sulfuric acid, *Microwave spectra, Deuterium compounds, Molecular rotation, Dipole moments, Reprints, Molecular conformation.

The microwave spectra of the normal, 34S, D1 and D2 isotopic species of gaseous sulfuric acid have been assigned. Rotational and centrifugal distortion constants were obtained. A conformation with C2 symmetry has been identified. The dipole moment was determined to be 2.725(10) Debye. A comparison of the derived structural parameters with related species is presented and the possibility of the undetected existence of other stable conformations of sulfuric acid is discussed.

703,974
PB81-233777 Not available NTIS
National Bureau of Standards, Washington, DC.
Millimeter Wave Spectrum of Glycine: A New Conformer.
Final rept.
R. D. Suenram, and F. J. Lovas. 1980, 5p
Pub. in Jnl. of the American Chemical Society 102, n24 p7180-7184, 19 Nov 80.

Keywords: *Glycine, *Millimeter waves, *Infrared spectroscopy, Amino acids, Molecular structure, Reprints, Molecular configuration.

More sensitive observations on the vapor of glycine, the smallest amino acid, have been made in the millimeter region. This work has led to the identification of a second conformer in the gas phase. This conformer has the amino hydrogens hydrogen bonded to the carbonyl oxygen and the hydroxyl hydrogen in the normal cis configuration with respect to the carbonyl group. This new conformer is approximately equal to 490(150) 1/cm lower in energy than the conformer originally reported. Its spectrum is weaker due to the smaller dipole moment (mu(a) approximately 1.00(15) Debye). The distortion fit transitions yield A' = 10341.76(17)MHz, B' = 3876.195(9), MHz, and C' = 2912.361(10) MHz for the ground state. The excellent agreement between experiment and theory is discussed.

703,975
PB81-234676 Not available NTIS
National Bureau of Standards, Washington, DC.
Low-Frequency Raman Study of Drawn Polyethylene.
Final rept.
R. G. Snyder, J. R. Scherer, and A. Peterlin. 1981, 6p
Pub. in Macromolecules 14, p77-82 1981.

Keywords: *Raman spectroscopy, *Polyethylene, Samples, X ray analysis, Crystals, Reprints, Small angle scattering.

The low-frequency Raman spectrum of unannealed, drawn (20X, 60C) polyethylene displays a LAM-1 band whose shape and breadth are extraordinary relative to LAM-1 for other forms of crystalline polyethylene. From the shape of this band a distribution of lengths of straight-chain segments was derived. A value of 90 A was obtained for the most probable length of an extended segment. This value is about one-half that of the long period determined for similar drawn samples using small-angle X-ray scattering. Part of the difference between the Raman and SAXS values may be accounted for in terms of the breadth and asymmetry of the distribution of straight-chain segment lengths. The presence of a large concentration of straight-chain segments having lengths less than 100 A and the unusual breadth of the distribution relative to the most probable length indicate a fundamental difference between the morphology of the unannealed drawn sample and that of solution- or melt-crystallized samples. The distribution of lengths displays a tail that is probably associated with tie chains. Annealing the sample moves the distribution curve to longer lengths and broadens it although its general shape and the high degree of alignment of chains parallel to the fiber axis are preserved.

703,976
PB81-234726 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectroscopy of a Single Mg+ Ion.
Final rept.
D. J. Wineland, and W. M. Itano. 1981, 4p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Physics Letters 82A, n2 p75-78, 9 Mar 81.

Keywords: Magnesium, Doppler effect, Reprints, *Laser spectroscopy, *Magnesium ions, *Double resonance spectroscopy.

A single 24Mg+ ion has been laser cooled in a Penning trap and its optical spectrum observed by a double resonance technique. Residual Doppler line broadening implies a cyclotron-magnetron temperature of 50 + or - 30 mK.

703,977
PB81-235335 Not available NTIS
National Bureau of Standards, Washington, DC.
Review of Atomic Structure Calculations.
Final rept.
A. W. Weiss. Mar 81, 13p
Pub. in Proceedings of the Workshop Foundations of the Relativistic Theory of Atomic Structure, held at Argonne National Laboratory, Argonne, IL., on December 4-5, 1980, ANL-80-125, p166-178 Mar 81.

Keywords: *Atomic structure, *Reviews, Numerical solution.

The current status of ab initio atomic structure calculations is summarized for both the non-relativistic and relativistic cases. The relative advantages and disadvantages of the principal methods of calculation are described, and the prospects for further developments are discussed.

703,978
PB81-235376 Not available NTIS
National Bureau of Standards, Washington, DC.
Reflection Properties of Pressed Polytetrafluoroethylene Powder.
Final rept.
V. R. Weidner, and J. J. Hsia. Jul 81, 6p
Pub. in Jnl. of the Optical Society of America 71, n7 p856-861 Jul 81.

Keywords: *Reflection, *Standards, Optical properties, Fluorescence, Physical properties, Fluorine organic compound, Reprints, *Poly(ethylene/tetrafluoro), *Standard reference materials.

The reflection properties of pressed polytetrafluoroethylene powder have been under investigation by the Radio-metric Physics Division at the National Bureau of Standards for the past five years. This material has a great potential use, both as a standard of diffuse reflectance and as a coating for integrating spheres for applications in reflectance spectrophotometry and other signal-averaging devices. It possesses certain physical and optical properties that make it ideal for use in these applictions. Techniques are given for preparing reflection standards and coating integrating spheres with the pressed powder. The effects of powder density and thickness on its reflectance are reported, and observations of possible problems with fluorescence that are due to the presence of contaminants in the powder are discussed.

703,979
PB81-236218 Not available NTIS
National Bureau of Standards, Washington, DC.
Vibrational Lineshapes of Adsorbates: The Role of Substrate Electronic Excitations.
Final rept.
J. W. Gadzuk. 5 May 81, 6p
Pub. in Chemical Physics Letters 80, n1, p5-10, 15 May 81.

Keywords: *Vibrational spectra, *Adsorption, *Molecules, *Atoms, *Surface chemistry, Line spectrum, Metals, Excitations, Electrons, Reprints, Numerical solution.

The vibrational spectrum of an atom or molecule adsorbed on a metallic surface is influenced by the dynamic interaction between the localised oscillator and the continuum of electron-hole pair excitations in the solid. Features of an exactly soluble model for this interacting system are presented, the local spectral function is obtained in terms of calculable level shift and broadening functions, and some prototypical numerical results are displayed and discussed.

703,980
PB81-236259 Not available NTIS
National Bureau of Standards, Washington, DC.
High Resolution Spectroscopy of Calcium Atoms.
Final rept.
J. C. Bergquist, R. L. Barger, and D. J. Glaze. 1979, 10p
Pub. in Proceedings of the International Conference on Laser Spectroscopy (FICOLS) (4th), held at Rottach-Egeren, Germany, F.R., on July 1979, p120-129 1979.

Keywords: Atomic energy levels, Calcium, Line width, Atoms, *Calcium atoms, *Laser spectroscopy.

The recent results on saturated absorption optical interference spectroscopy of calcium are presented. The photon recoil splitting of the Ca singlet S0 - triplet P1 intercombination line at 657 nm has been fully resolved. Linewidths as narrow as 3 kHz half width half maximum intensity (HWHM) are reported for radiation beams spatially separated by up to 3.5 cm. Second order Doppler is shown to be the present limitation to the accuracy of this technique. Methods are discussed which could lead to an optical wavelength/frequency standard with an accuracy of better than 10 to the -14th power.

703,981
PB81-236325 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Beam Damage in Auger Electron Spectroscopy.
Final rept.
C. G. Pantano, and T. E. Madey. 1981, 27p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Applications of Surface Science 7, 115-141 1981.

Keywords: *Auger electrons, *Decomposition, Excitation, Electron beams, Reprints, *Auger electron spectroscopy.

The damaging effects of electronic excitation, charging and beam heating during Auger electron spectroscopy (AES) are treated. The fundamental origin, manifestation and practical consequences of the phenomena are reviewed. A damage threshold, or critical dose, for beam damage due to electronic excitation is derived and related to experimental parameters. The close correlation between the predicted thresholds and the critical doses for damage observed in typical AES analyses indicates that primary excitation processes dominate the beam damage mechanism. Charging and the electromigration of ions in glasses is also discussed in detail. It is suggested that AES analyses of materials with potential susceptibility to beam damage be executed and interpreted with caution.

703,982
PB81-236549 Not available NTIS
National Bureau of Standards, Washington, DC.
Stark Effect on Autoionising Resonances in the Rare Gases.
Final rept.
B. E. Cole, J. W. Cooper, D. L. Ederer, G. Mehlman, and E. B. Saloman. 1980, 5p
Pub. in Jnl. of Physics B: Atom. Molec. Phys. Lett. Ed. 13, pL175-L179 1980.

Keywords: *Stark effect, *Rare gases, Molecular energy levels, Reprints, *Autoionization.

The effects of electric fields of intensity up to about 10 kV cm on the autoionising resonances lying between the doublet P(3/2) and doublet P(1/2) ionisation limits in Xe have been studied in absorption. Fields of this strength produce pronounced effects on series members for n greater than 11. The major effects are a decrease in transmission in the neighbourhood of the resonances and a lowering of the classical field ionisation potential.

703,983
PB81-236572 Not available NTIS
National Bureau of Standards, Washington, DC.
Rheological Properties of Simple Fluids by Computer Simulation.
Final rept.
D. J. Evans. Apr 81, 10p
Pub. in Physical Review A 23, n4 p1988-1997 Apr 81.

Keywords: *Rheological properties, *Fluids, Computerized simulation, Reprints, *Lennard-Jones systems, Numerical solution.

The author presents results of nonequilibrium molecular-dynamics calculations for the triple-point Lennard-Jones fluid undergoing shear flow. The calculations show that this simple fluid exhibits a wide variety of non-Newtonian behavior ranging from viscoelasticity, to shear dilatancy and flow birefringence. It is shown that the constitutive relations describing these phenomena are consistent with nonanalytic functional forms. For every property so far studied these functional forms agree with those predicted by long-time tail theories. However, the size of each effect is found to be several orders of magnitude greater than theoretical predictions.

703,984
PB81-236614 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of the Specific Heat, Cv, of Dense Gaseous and Liquid Nitrogen.
Final rept.
L. A. Weber. 1980, 5p
Pub. in Proceedings of International Institute of Refrigeration Conference (15th), Venice, Italy, September 23-29, 1979, Session B 1, Paper 7, 5p 1980.

Keywords: *Specific heat, *Gases, *Liquid nitrogen, Density(Mass/volume), Comparison, Equations of state.

The specific heats at constant volume have been measured for nitrogen in both the single-phase and two-phase regions. The data range in temperature from 78-250 K and in pressure up to 300 bar. Comparisons are made with values calculated via the equation of state. The two-phase measurements are used to make comparisons with the curvature of existing vapor pressure equations. Specific heats of the saturated liquid are derived and compared with earlier measurements.

703,985
PB81-236622 Not available NTIS
National Bureau of Standards, Washington, DC.
Coupling of Kinetic and Potential Contributions to Transverse Collective Modes in Fluids.
Final rept.
D. J. Evans. 1981, 4p
Pub. in Molecular Physics Res. Notes 42, n1 p231-234 1981.

Keywords: *Fluids, *Shear properties, Viscosity, Kinetics, Reprints, Numerical solution.

Conventional projection operator techniques are used to calculate exact expressions for the coupling of kinetic and potential terms in the Kubo-Green expressions for shear viscosity. The resulting expressions are valuable aids in the interpretation of non-equilibrium computer simulations of shear viscosity.

703,986
PB81-240251 Not available NTIS
National Bureau of Standards, Washington, DC.
Catalytic Methanation Over Single Crystal Nickel and Ruthenium; Reaction Kinetics and Different Crystal Planes.
Final rept.
R. D. Kelley, and D. W. Goodman. 1980, 10p
Pub. in Proceedings of American Chemical Society, Division of Fuel Chemistry, Houston, TX., March 24-28, 1980, 25, n2 p43-52 1980.

Keywords: *Methanation, *Catalysis, *Reaction kinetics, Nickel, Ruthenium, Surfaces, Concentration(Composition).

A specially designed ultrahigh vacuum system has been used to study the kinetics of the hydrogenation of CO over low surface area, single crystal catalysts. In a recent publication (1), the authors have reported reaction rate measurements for a Ni(100) catalyst and compared those results with kinetic data, derived from the literature, for small particle Ni supported on Al2O3. There was remarkable agreement between the two catalyst systems in regard to specific reaction rates (the rate normalized to the number of surface metal atoms), the activation energy, and the product distribution. In the present report, they compared reaction rates measured on two crystal planes of Ni--the (100) and the close-packed (111)--and two crystal planes of Ru--the zig-zag, open (110) and the close packed (001). They also report the variation of the reaction rate and the surface carbon concentration with total pressure and with the H2:CO ratio. The surface carbon concentration (an active 'carbidic' carbon species) varies with the total pressure and with the reactant gas ratio. A striking correlation has been found between the surface carbide level and the catalytic reaction rate.

703,987
PB81-240293 Not available NTIS
National Bureau of Standards, Washington, DC.
Partition of Organoelements in Octanol/Water/Air Systems.
Final rept.
S. P. Wasik. 1978, 13p
Pub. in Symposium of Division of Inorganic Chemistry 175th Meeting, American Chemical Society, Anaheim, CA, March 13-17, 1978 and Chapter 19 in American Chemical Society (ACS) Symposium Series 82, Organometals and Organometalloids. Occurrence and Fate in the Environment, American Chemical Society, Washington, DC. p314-326 1978.

Keywords: *Solubility, *Temperature, *Organometallic compounds, Gas chromatography, Air, Water, Octanol, Reprints, *Partition coefficient.

A head-space method is presented for measuring the solubilities, the partition coefficients (air/water and octanol/water), and their temperature dependencies of organo-elements. A mixture of air and solute vapor is introduced into a closed-loop containing a stainless-steel bellows pump, a gas mixing chamber, and two gas sampling values. The first value is used to inject a small volume of head-space into a gas chromatograph for analysis. The second value connects the circulating gas phase with an equilibration cell containing a known amount of water or water-octanol mixture. The air and solute vapors are circulated in the closed-loop until the solute concentrations are constant. The gas phase is then circulated through the equilibration cell and the head-space sample is analyzed after equilibration is reached. The partition coefficients are calculated from the ratio of the solute concentrations to the volume of the gas phase and of the liquid phase. The advantages of the method are that the measurements are taken at infinite solute dilution and that several solutes may be measured simultaneously. The values for the partition coefficients for (CH3)2Hg in fresh and sea water are given.

703,988
PB81-244121 PC **A99**/MF **A01**
National Standard Reference Data System.
Physical Properties Data Compilations Relevant to Energy Storage. IV. Molten Salts: Data on Additional Single and Multi-Component Salt Systems.
G. J. Janz, and R. P. T. Tomkins. Jul 81, 873p
NSRDS-NBS-61-PT-4
Library of Congress catalog card no. 77-10824. Prepared in cooperation with Rensselaer Polytechnic Inst., Troy, NY. See also Part 3, PB-297 847.

Keywords: *Energy storage, *Electrochemistry, *Fused salts, Physical properties, Safety, Corrosion, Tables(Data), Melting points, Phase diagrams, Eutectics, Density(Mass/volume), Surface tension, Viscosity, Specific heat, Thermal conducitivity, Aluminum, Solid electrolytes, *Thermal energy.

The present work provides selected data with value judgements for an additional set of 107 salt systems of interest as candidate materials for thermal energy storage sub-systems, for electrochemical energy storage systems, and in electrochemical aluminum production. The physical properties assessed are: melting points; phase diagrams; eutectic compositions; density; surface tension; viscosity; electrical conductivity; diffusion constants for ions; heat of fusion; heat capacity; volume change on fusion; vapor pressure; thermal conductivity (liquid and solid); and cryoscopic constant. The status of corrosion studies in the form of annotated bibliographic summaries, and salient observations on safety and hazards are also reported. A summarizing series of tables is provided as index to the data-gaps status for this set of candidate materials.

703,989
PB81-245094 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure Relationships Affecting the Stability of A15- and Ti3P-Type Compounds.
Final rept.
R. M. Waterstrat. 1981, 13p
Pub. in Jnl. Solid State Chemistry, n37 p370-382 1981.

Keywords: *Molecular structure, *Aluminum, *Titanium inorganic compounds, Phosphorus inorganic compounds, Stability, Reprints.

Observed interatomic distances in A15- and Ti3P-type compounds are analyzed as deformations of ideal atomic rigid spheres. The analysis suggests that structural instabilities may develop in A15 compounds when the atomic size of the B element becomes approximately 10% smaller than that of the A element. These instabilities apparently originate from strong repulsize interactions along the atom chains. The internal strains associated with these interactions may be relieved by martensitic transformations, deviations from the ideal A3B stoichiometry, addition of ternary elements, and transformation to a Ti3P-type structure. Instability apparently develops in the Ti3P-type compounds when the A- and B- element atoms are nearly equal in size. The instability in this case would result primarily from repulsive forces associated with a strong compression of the B-element atoms.

703,990
PB81-245904 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of Diffusion in Polymers by Inverse Gas Chromatography.
Final rept.
G. A. Senich. Aug 81, 2p
Pub. in Proceedings of American Chemical Society Division of Polymer Chemistry, New York, NY., September 24-28, 1981, Polymer Preprint 22, n2 p343-344 Aug 81.

Keywords: *Polymers, *Diffusion, Gas chromatography, Polyethylene, Plastics, , *Inverse gas chromatography.

The diffusivity of a volatile compound or probe in a polymer can be derived from nonequilibrium inverse gas chromatography (IGC) experiments conducted at rapid carrier gas flow rates. The van Deemter equation is commonly used to relate experimentally measured peak broadening to the probe-polymer diffusion coefficient. This relation neglects variations in the local carrier gas flow velocity and diffusive processes in the gas phase, two factors which can have a significant effect on the magnitude of the diffusivity found by IGC studies. Another significant parameter is the diffusion path length in the polymer phase. Two extremes in polymer geometry are possible within the column, a thin, uniformly distributed covering over the entire surface of the spherical column packing or annulus-like regions collected at the contact points between spheres, each with a different diffusion path length. The influence of these factors on probe-polymer diffusivity determinations is illustrated with results from an experimental IGC study of octadecane diffusion in high density polyethylene.

703,991
PB81-245946 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanism of Ozone-Alkene Reactions in the Gas Phase: A Mass Spectrometric Study of the Reactions of Eight Linear and Branched-Chain Alkenes.
Final rept.
R. I. Martinez, J. T. Herron, and R. E. Huie. 1981, 14p
Pub. in Jnl. of the American Chemical Society 103, p3807-3820 1981.

Keywords: *Ozone, *Alkene hydrocarbons, *Mass spectroscopy, Vapor phases, Chemical reactions, Reprints, *Chemical reaction mechanisms.

The stable products of the low-pressure (4-8 torr (1 torr = 133.33 Pa)) gas-phase reactions of ozone with ethene, propene, 2-methylpropene, cis-2-butene, trans-2-butene, trans-2-pentene, 2,3-dimethyl-2-butene, and 2-ethyl-1-butene have been identified by using a photoionization mass spectrometer coupled to a stirred-flow reactor. A general mechanism has been proposed to account for the observations.

703,992
PB81-247017 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 86, Number 4, July-August 1981.
Bi-monthly rept.
1981, 64p
See also Volume 85, Number 2, PB80-185036. Library of Congress catalog card no. 63-37059.

Keywords: *Research, Electron tunneling, Reaction kinetics, Quantum theory, Solubility, Octanol, Water, Water pollution, Organic compounds, Enthalpy, Solutions, Guanines, Heat measurement, Game theory, Hydrophobic, Eckart potentials, Numerical solution, High pressure liquid chromatography, Partition coefficient, Guanine hydrochlorides.

Contents:
- A method of calculating tunneling corrections for Eckart potential barriers;
- Generator columns and high pressure liquid chromatography for determining aqueous solubilities and octanol-water partition coefficients of hydrophobic substances;
- Enthalpies of solution of the nucleic acid bases. 6. Guanine in aqueous HCl and NaOH, and guanine hydrochlorides in aqueous HCl;
- Player aggregation in noncooperative games, II.

703,993
PB81-247025
(Order as PB81-247017, PC **A04**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Method of Calculating Tunneling Corrections for Eckart Potential Barriers,
R. L. Brown. 18 Feb 81, 3p
Included in Jnl. of Research of the National Bureau of Standards, v86 n4 p357-359, Jul-Aug 81.

Keywords: *Tunneling electrons, Quantum theory, *Eckart potentials, Numerical solution.

A method is presented for the direct calculation of tunneling corrections for unsymmetrical Eckart type potential barriers. It is based on a modified 6-point Gaussian quadrature formula. Accuracy is better than 1 percent over a wide range of tunneling parameter values.

703,994
PB81-247041
(Order as PB81-247017, PC **A04**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Enthalpies of Solution of the Nucleic Acid Bases. 6. Guanine in Aqueous HCl and NaOH, and Guanine Hydrochlorides in Aqueous HCl.
M. V. Kilday. 28 Jan 81, 16p
Included in Jnl. of Research of the National Bureau of Standards, v86 n4 p367-382, Jul-Aug 81.

Keywords: *Enthalpy, *Guanines, Solutions, Calorimeters, *Foreign technology, *Guanine hydrochlorides.

The values of the enthalpy of solution of well-characterized samples of guanine were obtained from measurements in an adiabatic solution calorimeter.

703,995
PB81-247322 Not available NTIS
National Bureau of Standards, Washington, DC.
Absorption and Dispersion in the O2 Microwave Spectrum at Atmospheric Pressures.
Final rept.
E. W. Smith. 15 Jun 81, 16p
Pub. in Jnl. of Chemical Physics 74, n12 p6658-6673, 15 Jun 81.

Keywords: *Oxygen, *Microwave spectra, Absorption, Perturbation theory, Excitation, Reprints, Numerical solution.

Calculations are performed for absorption and phase dispersion at various frequencies within the 60 GHz band of O2 for low pressures where the spectral lines are isolated, to atmospheric pressures where they merge to form a continuum band. A perturbation theory proposed by Rosenkranz was tested and found to be valid for pressures up to 100 kPa (1 atm). The 'line coupling coefficients', which describe the transfer of excitation from one radiating state to another, are also studied and various methods for evaluating these coefficients are analyzed and compared with experimental data. It is found that dispersion measurements are extremely sensitive to these coefficients and an experimental procedure for systematically measuring them is outlined; it is shown that such measurements can provide a very sensitive test for theoretical calculations of inelastic transition amplitudes.

703,996
PB81-247348 Not available NTIS
National Bureau of Standards, Washington, DC.
Microwave Optical Double Resonance of Chi(1) Sigma(+) of NaK.
Final rept.
R. F. Wormsbecher, M. M. Hessel, and F. J. Lovas. 15 Jun 81, 3p
Pub. in Jnl. of Chemical Physics 74, n12 p6983-6985, 15 Jun 81.

Keywords: *Molecular energy levels, Sodium inorganic compounds, Dipole moments, Reprints, *Sodium potassium, *Microwave optical double resonance.

A microwave optical double resonance (MODR) study of the ground state, Chi(1) Sigma(+) of NaK is reported. Improved Dunham coefficients for the Chi(1) Sigma(+) state are obtained by a weighted merged fit of the previous optical data with the three transitions obtained in the present work.

703,997
PB81-247355 Not available NTIS
National Bureau of Standards, Washington, DC.
Observation of Critical Dynamics in ND4Br by High-Resolution Neutron Spectroscopy.
Final rept.
J. M. Rowe, J. J. Rush, R. Pynn, A. Heidemann, and K. H. Michel. 1 May 81, 2p
Pub. in Jnl. of Chemical Physics 74, n9 p5323-5324, 1 May 81.

Keywords: *Neutron scattering, *Neutron spectroscopy, Elastic scattering, Deuterium compounds, Reprints, *Ammonium bromine.

The coherent quasielastic critical scattering in ND4Br has been measured by high resolution neutron scattering. The results do not agree with the predictions of simple theory.

703,998
PB81-247397 Not available NTIS
National Bureau of Standards, Washington, DC.
Influence of Second-Order Doppler Effect on Optical Ramsey Fringe Profiles.
Final rept.
R. L. Barger. Mar 81, 3p
Pub. in Optics Letters 6, n3 p145-147 Mar 81.

Keywords: *Doppler effect, *Calcium, Reprints, *Laser spectroscopy, *Ramsey fringes.

Resolution sufficient to resolve second-order Doppler broadening (3.9 kHz) has been obtained for the Ca singlet S(0)-triplet P(1) transition (657 nm) by using an atomic beam and optical Ramsey fringe techniques. Laser-beam separations up to 21 cm yield Ca linewidths (HWHM) as narrow as 1 kHz. As resolution is increased to approach, then exceed, the second-order linewidth, large asymmetries, shifts, and shape changes occur in the Ramsey fringe profile.

703,999
PB81-247777 Not available NTIS
National Bureau of Standards, Washington, DC.
Database for Enthalpies of Formation of Binary Transition Metal Alloys.
Final rept.
L. H. Bennett, and R. E. Watson. 1981, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Calphad 5, n1 p19-23 1981.

Keywords: *Enthalpy, *Binary systems, *Alloys, Thermodynamic properties, Reprints.

Experimental values of the enthalpy of formation are listed for the 61 of the 276 binary alloys formed from pairs of Sc to Ni, Y to Pd and Lu to Pt for which data is available.

704,000
PB81-247785 Not available NTIS
National Bureau of Standards, Washington, DC.
Heterodyne Frequency Measurements on the 11.6-Micrometer Band of OCS: New Frequency/Wavelength Calibration Tables for 11.6- and 5.8-Micrometer OCS Bands.
Final rept.
J. S. Wells, F. R. Petersen, A. G. Maki, and D. J. Sukle. 1 May 81, 9p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Applied Optics 20, n9 p1676-1684, 1 May 81.

Keywords: *Carbonyl compounds, Calibrating, Isotopes, Reprints, *Laser spectroscopy, *Carbonyl sulfide.

Heterodyne frequency measurements between a (13)CO2 laser and tunable diode laser (either tuned or locked to various carbonyl sulfide absorption peaks) have been made on a number of 100-000 band transitions in the isotopic species of carbonyl sulfide: OC(34)S, O(13)CS, OC(33)S, (18)OCS, and O(13)C(34)S. The (13)CO2 laser frequencies primarily resulted from either normal high-J or recently measured hot band transitions. These OCS frequency measurements have been combined with existing microwave data and new sets of molecular constants obtained. These constants will be used later to form part of a frequency calibration compendium based on OCS.

704,001
PB81-247801 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure of NH3 on Ni(111).
Final rept.
T. E. Madey, J. E. Houston, C. W. Seabury, and T. N. Rhodin. Mar 81, 5p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Jnl. of Vacuum Science and Technology 18, n2 p476-480 Mar 81.

Keywords: *Ammonia, *Nickel, *Molecular structure, Surface chemistry, Electron diffraction, Adsorption, Chemical bonds, Reprints, Electron stimulated desorption ion angular distribution method.

In a recent study of the adsorption of NH3 on Ni(111) at T approximately equal to 190 K using angle resolved UPS, it was concluded that NH3 is molecularly adsorbed, and is bonded to the surface via the N atom with the H atoms oriented away from the surface. To study the bonding configuration using a direct and independent technique, the authors examined NH3 on Ni(111) using the electron stimulated desorption ion angular distribution (ESDIAD) method coupled with temperature programmed desorption (TPD) and low energy electron diffraction (LEED).

704,002
PB81-247835 Not available NTIS
National Bureau of Standards, Washington, DC.
Branching Ratios and Photoelectron Angular Distributions Through the Hopfield Bands in N2 between 650 and 730 A.
Final rept.
J. B. West, K. Codling, A. C. Parr, D. L. Ederer, B. E. Cole, R. Stockbauer, and J. L. Dehmer. 1981, 11p
Sponsored in part by Office of Naval Research, Arlington, VA., North Atlantic Treaty Organization, and Department of Energy, Washington, DC.
Pub. in Jnl. of Physics, B: Atomic and Molecular Physics 14, p1791-1801 1981.

Keywords: *Nitrogen, *Ultraviolet spectroscopy, Angular distribution, Reprints, Autoionization, Photoelectron spectroscopy.

Vibrationally and angularly resolved photoelectron spectra have been recorded in the wavelength range 650-730 A for N2, in the region of the autoionizing resonances leading to the Beta(2) Sigma(u)(+1) state of the N2(+1) ion. The influence of these resonances on both the partial cross sections to the Alpha(2) Pi(u) state and the Chi(2) Sigma(g)(+1) state (the branching ratios) and the angular distribution of the photoemitted electrons is clearly demonstrated.

704,003
PB81-248593 Not available NTIS
National Bureau of Standards, Washington, DC.
Free Radicals and New End Groups Resulting from Chain Scission. I. Gamma-Irradiation of Polyethylene.
Final rept.
K. L. DeVries, R. H. Smith, and B. M. Fanconi. Aug 80, 8p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Polymer 21, p949-956 Aug 80.

Keywords: *Polyethylene, Electron paramagnetic resonance, Infrared spectroscopy, Chemical bonds, Reprints, *Free radicals, *Fourier transform spectroscopy.

Measurements of the concentrations of free radicals by electron spin resonance (ESR) and of new chemical species by Fourier transform infrared (FTIR) were carried out on polyethylene specimens exposed to gamma-irradiation at dosages from 3 to 50 Mrads both in the presence and absence of oxygen. The improved signal-to-noise capability of the FTIR method permitted a direct comparison of the free radical concentration and the resultant concentration of new chemical groups. It was found that approximately 10 carbonyl groups and 2 carbon-carbon double bonds were formed per free radical. These results are comparable with previous estimates and form the basis for an investigation of chemical species formed during mechanical deformation and fracture which will be discussed in the second paper of this series.

704,004
PB81-248932 Not available NTIS
National Bureau of Standards, Washington, DC.
L3VV Auger-Electron Line Shapes and Peak Positions for Near-Threshold Electron Excitation in Nickel and Copper.
Final rept.
T. Jach, and C. J. Powell. 6 Apr 81, 4p
Contract DOE-EA-77-A-01-6010
Pub. in Physical Review Letters 46, n14 p953-956, 6 Apr 81.

Keywords: *Nickel, *Copper, *Auger electrons, Line spectra, Atomic energy levels, Excitation, Reprints, Threshold effects(Electron energy).

Measurements of the L(3)VV Auger-electron lineshapes for Ni and Cu at incident electron energies near the threshold for L3-subshell ionization are shown to be substantially free of perturbing satellite effects. The L(3)VV Auger spectrum of Ni consists of two features, one of which is identified as due to atomic final states and the other as due to band effects. Shifts in the position of the L(3)VV features as a function of incident energy imply a systematic difference in core-electron binding energies measured under adiabatic and sudden conditions.

704,005
PB81-248940 Not available NTIS
National Bureau of Standards, Washington, DC.
Unwinding the Double Helix: Complete Equation for Chemical Equilibrium.
Final rept.
T. H. Benzinger, and C. Hammer. 1981, 11p
Sponsored in part by National Library of Medicine, Washington, DC., and National Aeronautics and Space Administration, Washington, DC.
Pub. in Current Topics in Cellular Regulation, Volume 18 chapter 27 p475-485 1981.

Keywords: *Chemical equilibrium, *Nucleotides, *Proteins, Endothermic reactions, Thermodynamics, Chemical bonds, Specific heat, Phase transformations, Reprints, *Helix molecular structures, Numerical solution.

The energy that is required to unwind the double helix and to drive all other endothermic reactions in living matter is the 'thermal work function.'

704,006
PB81-248965 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectrum and Energy Levels of Nine-times Ionized Strontium (Sr X).
Final rept.
N. Acquista, and J. Reader. May 81, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of the Optical Society of America 71, n5 p569-573 May 81.

Keywords: *Strontium, *Atomic energy levels, *Ultraviolet spectroscopy, Excitation, Ions, Reprints.

The spectrum of the copper-like ion Sr X was observed with a low-inductance spark in the region 70-630 A on the 10.7-m grazing incidence spectrograph at NBS.

704,007
PB81-248999 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Autoionisation on Vibrational Branching Ratios and Photoelectron Angular Distributions in Molecular Photoionization: The Formation of the Ground State of O2(+) Between 574 and 600 A.
Final rept.
K. Codling, A. C. Parr, D. L. Ederer, R. Stockbauer, J. B. West, B. E. Cole, and J. L. Dehmer. 1981, 10p
Sponsored in part by Department of Energy, Washington, DC., and Office of Naval Research, Washington, DC.
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 14, p657-666 1981.

Keywords: *Oxygen, *Ultraviolet spectroscopy, Ions, Molecular energy levels, Angular distributions, Photochemical reactions, Ionization, Reprints, *Autoionization, Rydberg series.

The partial cross sections (branching ratios) for leaving the O2(+1) ion in the ground X doublet Pi(g) state have been determined in the region of the nu=0 and nu=1 components of the neutral excited Rydberg state (1/2 sigma sub u) 3so at 594.3 and 589.0 A by photoelectron spectroscopy.

704,008
PB81-249005 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Diluent Monomer on the Physical Properties of BIS-GMA Based Composites.
Final rept.
D. Dulik, R. Bernier, and G. M. Brauer. Jun 81, 7p
Sponsored in part by Army Medical Research and Development Command, Washington, DC.
Pub. in Jnl. of Dental Research 60, n6 p983-989 Jun 81.

Keywords: *Dental materials, *Composites, *Physical properties, Viscosity, Surface tension, Molecular weight, Methacrylates, Reprints, Monomer.

The high viscosity of 'BIS-GMA,' the major monomeric ingredient of dental composites, requires incorporation of a polymerizable diluent into the formulations of clinically useful restoratives. The objective of this study was to determine the effect of monomeric diluents on the properties of the liquid component of the resin and of the cured composite. Viscosity and surface tension of the liquid increase with decreasing concentration and increasing molecular weight of the diluent. The setting time of the composite is lowered the larger the number of methacrylate groups in the diluent molecule. Strength of the cured material varies somewhat with the type of diluent employed. The coefficient of thermal expansion increases with the chain length of the polymethylene glycol dimethacrylate diluent. Composites containing diluents with more than one methacrylate group in the molecule have low water sorption, because of the highly crosslinked nature of the cured material. Addition of dimethacrylate diluents containing -(CH2)- recurring units generally yield composites with more desirable properties than those containing ethoxy ether (CH2CH2O)n groups.

704,009
PB81-249013 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystal Chemistry of Octacalcium Phosphate.
Final rept.
W. E. Brown, M. Mathew, and M. S. Tung. 1981, 29p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD.
Pub. in Progress in Crystal Growth Characterization 4, p59-87 1981.

Keywords: *Crystallography, Calcium phosphates, Crystal structure, Hydrolysis, Reprints, *Octacalcium phosphate, Hydroxylapatite.

The chemical and crystallographic properties of octacalcium phosphate (OCP), Ca8H2(PO4)6:5H2O, are reviewed. Special emphasis is placed on its structural relationship to hydroxyapatite, Ca5(PO4)3OH, and apatitic biominerals. OCP is a well established phase in dental calculus, renal stones, and bone, and there is considerable evidence that it plays an important role as the initial phase in enamel and may participate in the crystal growth process throughout the formation of the enamel mineral. OCP provides a basis for visualizing structures of the materials referred to as 'amorphous calcium phosphate,' 'tricalcium phosphate hydrate,' and 'cryptocrystalline apatite.' The formation of non-stoichiometric apatites and the incorporation of impurities are thought to be a consequence of the irreversibility of the hydrolysis of OCP to OHAp. Since three mechanisms have been proposed for the formation of OHAp, there should be three corresponding kinds of defect apatites and impure apatites. Several mechanisms involving OCP that could lead to non-stoichiometric OHAp are described.

704,010
PB81-600002
(Order as PB81-220899, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Absolute Determination of the Thermal Conductivity of Argon at Room Temperature and Pressures up to 68 MPa.
C. A. N. deCastro, and H. M. Roder.1981,10p
Included in Jnl. of Research of the National Bureau of Standards, v86 n3 p293-307 1981.

Keywords: *Ambient temperature, Argon, Critical enhancement, Hard sphere, Hot wire, Thermal conductivity, Transient.

The thermal conductivity of argon at room temperature and for pressures up to 68 MPa has been measured with a transient hot-wire technique in order to assess the accuracy of an instrument of this type. The data are presented for a nominal temperature of 300.65 K and comparison with other authors shows that the data is accurate to within plus or minus 1 percent, and it is the most accurate set of data for pressures above 35 MPa. Experimental evidence of a thermal conductivity enhancement near the critical density for a temperature about twice the critical temperature is herein reported. The experimental data were compared with the values predicted by the hard sphere model and it has been found that the theory gives values that are about 4 percent lower than the experimental ones in the density range 0-400 kg/cu m and about 1 to 2 percent lower in the high density region 400-825 kg/cu m.

704,011
PB81-600004 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 10, Number 1, 1981.
c1981, 291p
See also PB81-600005 through PB81-600011.

Keywords:

The journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source of the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature.

704,012
PB81-600005 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluated Activity and Osmotic Coefficients for Aqueous Solutions: Bi-Univalent Compounds of Zinc, Cadmium, and Ethylene Bis(trimethylammonium) Chloride and Iodide.
R. N. Goldberg. c1981, 57p
Included in Jnl. of Physical and Chemical Reference Data, v10 n1 p1-56 1981.

Keywords: *Activity coefficient, Cadmium, Critical evaluation, Electrolyte, Ethylene bis(trimethylammonium) chloride, Ethylene bis(trimethylammonium) iodide, Excess Gibbs energy, Osmotic coefficient, Solutions, Thermodymanic properties, Zinc.

A critical evaluation of the mean activity and osmotic coefficients in aqueous solutions of eleven bi-univalent compounds of zinc and cadmium and ethylene bis(trimethylammonium) chloride and iodide at 298.15 K is presented. Osmotic coefficients were calculated from direct vapor pressure measurements, from isopiestic measurements and from freezing point depression measurements. Activity coefficients were calculated from electromotive force measurements on galvanic cells with and without transference. Given are empirical coefficients for three different correlating equations, obtained by a weighted heat squares fit of the experimental data, and tables consisting of the activity coefficients of the compounds, the osmotic coefficients and activity of water, and the excess Gibbs energy of the solution as functions of the molality for each electrolyte system. The literature coverage is through the computerized version of Chemical Abstracts of September 1979.

704,013
PB81-600006 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tables of the Dynamic and Kinematic Viscosity of Aqueous KCl Solutions in the Temperature Range 25-150 Degrees C and the Pressure Range 0.1-35 MPa.
J. Kestin, H. E. Khalifa, and R. J. Correia. c1981, 14p
Included in Jnl. of Physical and Chemical Reference Data, v10 n1 p57-70 1981.

Keywords: *Aqueous solutions, Compilation, Potassium chloride, Reference data, Viscosity.

Tabulated values of the dynamic and kinematic viscosity of potassium chloride solutions are given. The tables cover the temperature range 25-150 degrees C, the pressure range 0.1-35 MPa and the concentration range 0-5 molal. It is estimated that the accuracy of the tabulated values is plus or minus 1 percent. The correlations from which the tables were generated are also given.

704,014
PB81-600007 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tables of the Dynamic and Kinematic Viscosity of Aqueous NaCl solutions in the Temperature Range 20-150 Degrees C and the Pressure Range 0.1-35 MPa.
J. Kestin, H. E. Khalifa, and R. J. Correia. c1981, 18p
Included in Jnl. of Physical and Chemical Reference Data, v10 n1 p71-88 1981.

Keywords: *Aqueous solutions, Compilation, Reference data, Sodium chloride, Viscosity.

Tabulated values of the dynamic and kinematic viscosity of aqueous sodium chloride solutions are given. The tables cover the temperature range 20-150 degrees C, the pressure range 0.1-35 MPa and the concentration range 0-6 molal. It is estimated that the accuracy of the tabulated values is plus or minus 5 percent. The correlating equations from which the tables were generated are given.

704,015
PB81-600008 Not Available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heat Capacity and Other Thermodynamic Properties of Linear Macromolecules.
U. Gaur, H. C. Shu, A. Mehta, and B. Wunderlich. c1981, 30p
Included in Jnl. of Physical and Chemical Reference Data, v10 n1 p89-118 1981.

Keywords: *Calorimetry, Crystal, Enthalpy, Entropy, Floor temperature, Fusion, Gibbs energy, Glass transition, Heat capacity, Linear macromolecule, Melt, Selenium.

The heat capacity of selenium from 0 K to 1000 K is reviewed using measurements on 20 samples reported in the literature. A set of recommended data for trigonal, monoclinic, glassy, and molten selenium is derived. Ring-chain equilibrium parameters are critically evaluated. Entropy, enthalpy, and Gibbs energy functions are calculated. Selenium is a model compound for a monoatomic, linear macromolecule. The paper is first in a series which will ultimately cover all heat capacity measurements on linear macromolecules.

704,016
PB81-600011 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Levels of Nickel, Ni I through Ni XXVIII.
C. Corliss, and J. Sugar. c1981, 94p
Included in Jnl. of Physical and Chemical Reference Data, v10 n1 p197-290 1981.

Keywords: *Atomic energy levels, Atomic spectra, Nickel energy levels.

The energy levels of the nickel atom in all of its stages of ionization, as derived from the analyses of atomic spectra, have been critically compiled. In cases where only line classifications are reported in the literature, level values have been derived. Electron configurations, term designations, J-values, experimental g-values, and ionization energies are included.

704,017
PB81-600013 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ion Product of Water Substance, 0-1000 Degrees C, 1-10,000 Bars. New International Formulation and Its Background.
W. L. Marshall, and E. U. Franck. c1981, 10p
Included in Jnl. of Physical and Chemical Reference Data, v10 n2 p295-304 1981.

Keywords: *Equation, Formulation, High pressure, High temperature, IAPS, International Association for the Properties of Steam, Ionization, Ionization constant, Ion product, Review, Water, Water substance.

The paper is the background for a new international formulation for the ion product of water substance (May 1980) issued by the International Association of the Properties of Steam. The ion product of water (K sub w) is represented by an equation, based on density and two quadratic functions of reciprocal absolute temperature, for use from 0-1000C and 1-10,000 bars pressure. The equation is believed to describe within plus or minus 0.01 units of log K sub w (where K sub w equals K sub w/mol kg(-1)(+2)) many of the measurements at saturated vapor pressure up to 200C and to within plus or minus 0.02 units up to the critical temperature (375C). It also describes within the experimental uncertainty the several sets of measurements at high pressures and should provide values within plus or minus 0.05 and 0.30 units at low and high temperatures, respectively.

704,018
PB81-600016 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamic Tabulations for Selected Phases in the System CaO-Al2O3-SiO2-H2O at 101.325 kPa (1 atm) Between 273.15 and 1800 K.
J. L. Haas, G. R. Robinson, and B. S. Hemingway. c1981, 96p
Included in Jnl. of Physical and Chemical Reference Data, v10 n3 p575-670 1981.

Keywords: *Enthalpy, Enthalpy of formation, Entropy, Equilibrium constant for formation, Gibbs energy function, Gibbs energy of formation, Heat capacity, Lime-alumina-silica-water, Minerals, Thermodynamic data.

The standard thermodynamic properties of phases in the lime-alumina-silica-water system between 273.15 and 1800 K at 101.325 kPa (1 atm) were evaluated from published experimental data. Phases included in the compilation are boehmite, diaspore, gibbsite, kaolinite, dickite, halloysite, andalusite, kyanite, sillimanite, Ca-Al cliniopyroxene, anorthite, gehlenite, grossular, prehnite, zoistie, margarite, wollastonite, cyclowollastonite (=pseudowollastonite), larnite, Ca olivine, hatrurite, and rankinite. The properties include heat capacity, entropy, relative enthalpy, and the Gibbs energy function of the phases and the enthalpies, Gibbs energies, and equilibrium constants for formation both from the elements and the oxides. Tabulated values are given at 50 K intervals with the 2-sigma confidence limit at 250 K intervals. Summaries for each phase give the temperature-dependent functions for heat capacity, entropy, and relative enthalpy and the experimental data used in the final evaluation.

704,019
PB81-600019 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Activity and Osmotic Coefficients of Aqueous Sulfuric Acid at 298.15 K.
B. R. Staples. c1981, 20p
Included in Jnl of Physical and Chemical Reference Data, v10 n3 p779-798 1981.

Keywords: *Activity coefficients, Aqueous, Critical evaluation, Electrolytes, Excess free energy, Free energy, Ionic, Osmotic coefficients, Solutions, Sulfuric acid, Standard reference data, Thermodynamic properties.

A critical evaluation of the mean activity coefficient, gamma plus or minus, and osmotic coefficients, Phi, of aqueous sulfuric acid at 298.15 K is presented for the molality range of 0-28 mol-kg to the minus 1st power. Osmotic coefficients were calculated from direct vapor pressure measurements, from isopietic measurements or from freezing point depression measurements. Activity coefficients were calculated from electromotive force measurements of galvanic cells. A least-squares program was used to fit data from all sources using both Phi and 1n gamma plus or minus as functions of molality. A nine parameter equation describes the osmotic coefficient, the mean activity coefficient, and the excess Gibbs energy as a function of the one-half power of molality. The scientific literature has been covered through January, 1979.

704,020
PB81-600021 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rate Constants for the Decay and Reactions of the Lowest Electronically Excited Singlet State of Molecular Oxygen In Solution.
F. Wilkinson, and J. G. Brummer. c1981, 191p
Included in Jnl. of Physical and Chemical Reference Data, v10 n4 p809-999 1981.

Keywords: *Chemical kinetics, Data compilation, Oxidation, Photochemistry, Rates, Review, Singlet oxygen, Solution.

The available rate of data on the reactivity and physical deactivation of molecular oxygen in its first electronic excited state (1 delta g) in liquid solution have been critically compiled. Where possible, relative rates reported in the literature have been normalized to standard values selected by a statistical analysis of the experimental data. Second-order rate constants for the deactivation and chemical reaction of singlet oxygen are reported for 670 compounds. Additionally, pseudo first order rate constants (k4) for solvent deactivation of singlet oxygen are reported for 50 different solvents.

704,021
PB81-600049 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Spin Polarized Electron Scattering Studies of W(100).
D. T. Pierce, R. J. Celotta, and G. C. Wang. 1980, 4p
Pub. in Le Vide, les Couches Minces 2, n201, p1060-1063 1980.

Keywords: *Polarized LEED, Spin detector, Spin polarization, Surface resonance, Surface structure.

Abstract not available.

704,022
PB81-600056 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Use of Angle-Resolved Electron and Photon Stimulated Desorption for Surface Structural Studies.
T. E. Madey. 1981, 24p
Pub. in Springer Series in Chemical Physics, Vol. 17: Inelastic Particle-Surface Collisions, p80-103 1981.

Keywords: *Chemisorption, Electron stimulated desorption, Ion angular distribution, Ion desorption, Surface structure.

The authors review recent experiments and models related to desorption processes induced by electrons and photons incident on surfaces. The utility of angle-resolved electron and photon stimulated desorption of ions for studies of molecular structure at surfaces is emphasized.

704,023
PB82-100108 Not available NTIS
National Bureau of Standards, Washington, DC.
Tunable Laser Photodissociation: Quantum Yield of I*(doublet P(1/2)) from CH(2)I(2).
Final rept.
J. B. Koffend, and S. R. Leone. Jul 81, 6p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Chemical Physics Letters 81, n1 p136-141 Jul 81.

Keywords: Iodine organic compounds, Photochemical reactions, Dissociation, Reprints, *Laser spectroscopy, *Methylene iodide.

Tunable laser I (doublet P (1/2)) quantum yield measurements are presented for CH2I2 in the wavelength range 248-340 nm. The results suggest that a curve crossing mechanism is operative in the dissociation.

704,024
PB82-100116 Not available NTIS
National Bureau of Standards, Washington, DC.
Optimized Prediction for Heats of Formation of Transition Metal Alloys.
Final rept.
R. E. Watson, and L. H. Bennett. 1981, 6p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in CALPHAD 5, n1 p25-40 1981.

Keywords: *Heat of formation, *Transition metals, *Alloys, *Mathematical models, Molecular energy levels, Electron density(Concentration), Reprints.

A simple electron band theory model of transition metal alloys is used to predict the heat of formation for 276 transitions metal alloys at equiatomic composition. The model employs a rectangular d-band electron density of states. Some of the input parameters, namely bandwidth, Fermi level position, and number of electrons in the band, are allowed to vary within certain constraints, to closely approximate any known value of the heat of formation. The resulting predictions are considered to have errors of the same order as the experiments.

704,025
PB82-100124 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Studies of Electronic Excitation Transfer in Atomic Calcium: Ca(4s5p singlet P(1)) + Ar yields Ca(4s5p triplet P(2,1,0)) + Ar.
Final rept.
W. H. Pence, and S. R. Leone. 1981, 11p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 74, n10 p5707-5717, 15 May 81.

Keywords: *Calcium, *Atomic energy levels, Reprints, *Laser spectroscopy.

Time-resolved nsec kinetic methods are used to measure state specific electronic excitation transfer for the near-resonant process. In stimulated emission experiments it is found that the Ca(4s5p triplet P(2)) level is preferentially populated. These results are discussed in terms of near-resonant spin changing collision mechanisms.

704,026
PB82-100132 Not available NTIS
National Bureau of Standards, Washington, DC.
Discovery of an Electrical Post-pulse in the Surroundings of a High Voltage Spark Discharge.
Final rept.
A. Scheeline, J. C. Travis, J. R. DeVoe, and J. P. Walters. 1981, 9p
Pub. in Spectrochimica Acta 36, n3 p153-161 1981.

Keywords: *Electric discharges, *Electrode, Reprints, Laser enhanced ionization.

In the vicinity of a high voltage spark, an electrical pulse of negative polarity was observed, using a floating electrode. The pulse's behavior with respect to spark cathode composition, gas flow, spatial distribution, and related parameters was characterized. Suggestions as to the origin of the pulse are made. Attempts at observing laser enhanced ionization in the post-discharge time period are described.

704,027
PB82-100140 Not available NTIS
National Bureau of Standards, Washington, DC.
Reaction of F Atoms with C(2)H(4). Vibrational Spectrum of the C(2)H(4)F Intermediate Trapped in Solid Argon.
Final rept.
M. E. Jacox. 1981, 14p
Pub. in Chemical Physics 58, p289-302 1981.

Keywords: *Ethylene, Infrared spectroscopy, Deuterium compounds, Reprints, *Matrix isolation techniques, *Fluorine atoms, Chemical reaction mechanisms.

When the products of the reaction between F atoms produced in a microwave discharge and C2H4 are frozen in a large excess of argon at 14 K, new infrared absorptions appear which can be assigned to the 2-fluoroethyl radical. Studies of the dependence of the product distribution on the F-atom concentration have confirmed that the stabilization of C2H4F2 plays only a minor role under the sampling conditions typical of these experiments. Isotopic substitution experiments have demonstrated that the steric configuration about the C=C bond is randomized as a result of the F-atom reaction. Upon irradiation of the sample with the full light of a medium-pressure mercury arc, absorptions of vinyl fluoride and acetylene and of the acetylene-HF complex grow in intensity, while those of FCD2CH2 and of FCD2CD2 diminish in intensity and those of FCH2CH2 and of FCH2CD2 are unchanged. The F-atom reactions and photolysis processes which occur in these experiments are discussed, and a tunneling mechanism is proposed to explain the isotopic selectivity in the 2-fluoroethyl photodecomposition. The vibrational spectrum of FCH2CH2 is compared with that derived in a recent ab initio calculation.

704,028
PB82-100215 Not available NTIS
National Bureau of Standards, Washington, DC.
Diode Laser Heterodyne Spectroscopy on the (nu sub 4) and (nu sub 9) Bands of 1,1-Difluoroethylene.
Final rept.
W. J. Lafferty, J. P. Sattler, T. L. Worchesky, and K. J. Ritter. 1981, 13p
Pub. in Jnl. Mol. Spectros. 87, n416-428 1981.

Keywords: Fluorine organic compounds, Reprints, *Laser spectroscopy, *Ethylene/difluoro.

Portions of the nu(4) and nu(9) bands of 1,1-difluoroethylene have been studied with a diode laser spectrometer. Line measurements were made by using markers produced by beating the output of the diode laser with the radiation from a CO2 laser. With a dual trace oscilloscope presentation, frequencies of infrared lines could be rapidly determined with a precision of better than + or - 6 MHz. Ground state constants were derived by combining microwave data with 10 combination differences obtained in this work. Upper state constants were obtained for both bands by combining the infrared measurements of this work with excited state microwave data and heterodyne measured submillimeter laser frequencies.

704,029
PB82-100280 Not available NTIS
National Bureau of Standards, Washington, DC.
Kinetics of Gas Phase Reactions of Methylene.
Final rept.
A. H. Laufer. 1981, 33p
Pub. in Rev. Chem. Intermed. 4, p225-257 1981.

Keywords: *Reaction kinetics, Vapor phases, Chemical reactions, Inorganic compounds, Organic compounds, Reprints, *Methylene radicals.

Kinetic parameters of methylene radicals in reaction with organic and inorganic substrates are reviewed. Preferred values for the parameters are discussed.

704,030
PB82-100561 Not available NTIS
National Bureau of Standards, Washington, DC.
Diode Laser Spectra of the nu sub 2 band of H(2) to the twelfth CO and H(2) to the thirteenth CO.
Final rept.
D. M. Sweger, and R. L. Sams. 1981, 11p
Sponsored in part by Defense Nuclear Agency, Washington, DC.
Pub. in Jnl. Mol. Spectros. 87, p18-28 1981.

Keywords: *Formaldehyde, *Isotopic labeling, Infrared spectroscopy, Reprints, *Laser spectroscopy.

The Q-branches of the nu(2) (CO stretch) band of H2(12)CO and H2(13)CO have been studied in high resolution using an infrared diode laser.

704,031
PB82-100579 Not available NTIS
National Bureau of Standards, Washington, DC.
3d-4p Transitions in the Zinclike and Copperlike Ions Y X, XI; Zr XI, XII; Nb XII, XIII; and Mo XIII, XIV.
Final rept.
J. F. Wyart, J. Reader, and A. Ryabtsev. Jun 81, 7p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of the Optical Society of America 71, n6 p692-698 Jun 81.

Keywords: *Atomic energy levels, *Yttrium, *Molybdenum, *Niobium, *Zirconium, Ultraviolet spectroscopy, Line spectra, Reprints.

Lines occurring as satellites on the long-wavelength side of the 3d sup 10-3d sup 9 4p resonance lines of Ni-like ions have been investigated with a low-inductance vacuum spark and a 10.7-m spectrograph for the elements Y, Zr, Nb, and Mo. The lines are interpreted as 3d sup 10 4s-3d sup 9 4s 4p and 3d sup 10 4p-3d sup 9 4 doublet p transitions in the Cu-like ions Y XI, Zr XII, Nb XIII, and Mo XIV and 3d sup 10 4 doublet s-3d sup 9 4 doublet s 4p transitions in the Zn-like ions Y X, Zr XI, Nb XII, and Mo XIII. The spectra of the Cu-like ions were interpreted by generalized least-squares fits for the energy levels of the sequence of four ions. Thirty-nine levels of 3d sup 9 4s 4p were interpreted simultaneously with a root-mean-square deviation of 122/cm; forty-four levels of 3d sup 9 4 doublet p were interpreted in the same way with a root-mean-square deviation of 200/cm. Line identifications and energy levels were obtained for the 3d sup 10 7p configuration of the Cu-like ions Y XI-Mo XIV.

704,032
PB82-101262 Not available NTIS
National Bureau of Standards, Washington, DC.
Unimolecular Kinetics of Pyridine Ion Fragmentation.
Final rept.
H. M. Rosenstock, R. Stockbauer, and A. C. Parr. 1981, 9p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in International Jnl. of Mass Spectrometry and Ion Physics 38, p323-331 1981.

Keywords: *Hydrogen cyanide, *Kinetics, Nitrogen organic compounds, Ions, Ionization, Mass spectroscopy, Molecular vibrations, Reprints, *Pyridine ions.

The fragmentation of pyridine ion to form C4H4(+1) and HCN has been studied by means of photoelectron-photoion coincidence mass spectrometry with variable ion source residence time. A detailed analysis of the time-dependent breakdown curves leads to a OK fragmentation threshold of 12.15 + or - 0.02 eV, a tight transition state, and the energy dependence of the fragmentation rate. The results were somewhat higher than the value reported by Eland et al. There is some disagreement with earlier work on the energy dependence of the fragmentation rate. It is suggested that this may be due to distortion of the thermal vibrational population distribution of the molecule on vertical ionization.

704,033
PB82-101270 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser-Induced Ionization and Mobility Measurements of Very Small Particles in Premixed Flames at the Sooting Limit.
Final rept.
K. C. Smyth, and W. G. Mallard. 1981, 7p
Pub. in Combustion Science and Technology 26, p35-41 1981.

Keywords: *Soot, Ionization, Air pollution, Particles, Reprints, *Laser induced ionization.

Laser-induced ionization signals are observed in a premixed C2H2/air flame at the sooting limit and are attributed to thermoionization of very small particles. The mobilities of these species are derived from ion velocity measurements and compared with the mobility of Na(+1) for identical flame conditions. From a series of measured mobilities estimates are made for the particle mass (2300-6100 amu) and diameter (1.8-2.2 nm). This experimental method is thus a new optical means for probing the early stages of soot formation.

704,034
PB82-101296 Not available NTIS
National Bureau of Standards, Washington, DC.
Reduction of Matrix Ionization Interference in Laser Enhanced Ionization Spectrometry.
Final rept.
G. C. Turk. 1981, 4p
Pub. in Analytical Chemistry 53, p1187-1190 1981.

Keywords: Sampling, Ionization, Reprints, *Laser spectroscopy, *Laser enhanced ionization, Flame spectroscopy.

Despite many attractive features, Laser Enhanced Ionization (LEI) Spectrometry has been difficult to apply to the analysis of many complex samples because of a susceptibility to severe ionization interference. The interference is a consequence of changes in the distribution of the electric field in the flame which occur when the concentration of charged species is increased by the unassisted thermal ionization of matrix elements. The effect of these changes can be minimized by aligning the laser beam as close to the surface of the cathode as possible. However, previously used LEI electrode configurations have utilized cathodes external to the flame, thus precluding the possibility of laser alignment near the cathode surface. A new water-cooled cathode has been designed which can be used directly inside the flame, very close to the laser beam. Tolerance of LEI signal collection to a matrix of sodium in an air-acetylene flame has been improved from less than 300 microgram/mL to over 3000 microgram/mL.

704,035
PB82-107673 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Equation of State for Fluid Ethylene.
Technical note.
R. D. McCarty, and R. T. Jacobsen. Jul 81, 164p
NBS-TN-1045

Keywords: *Equations of State, *Ethylene, Liquid phases, Vapor pressure, Specific heat, Thermodynamic properties, Tables(Data), Numerical solution.

A thermodynamic property formulation for ethylene, developed as a part of a joint industry-government project, is presented. The formulation includes an equation of state, vapor pressure equation, and equation for the ideal gas heat capacity. The coefficients were determined by a least squares fit of selected experimental data. Comparisons of property values calculated using the equation of state with measured values are given. The equation of state is not valid in the critical region rho(c) + or - 0.3 rho(c) for temperatures of T(c) + or - 0.05 T(c). Errors on the order of 20 percent for derived properties and 10 percent for density may be encountered near the critical point. Tables of the thermodynamic properties of ethylene for the liquid and vapor phases for temperatures from the freezing line to 450 K with pressures to 40 MPa are presented. The equation of state and its derivative and integral functions for calculating thermodynamic properties are included. Estimates of the accuracy of calculated properties are given. A guide for use of computer programs for the calculation of thermodynamic properties of ethylene with listings of subprograms and a sample program to illustrate the use and results of the program are included.

704,036
PB82-108010 Not available NTIS
National Bureau of Standards, Washington, DC.
Inner Shell Energies: Experimental Problems.
Final rept.
R. D. Deslattes, and E. G. Kessler. Mar 81, 21p
Pub. in Proceedings of the Workshop on Foundations of the Relativistic Theory of Atomic Structure held at Argonne, IL., on December 4-5, 1980, p215-235 Mar 81.

Keywords: *Atomic energy levels.

Progress in theoretical estimates of single vacancy atomic term values has challenged available experimental data. The authors purpose in this brief survey of the experimental situation is to indicate both conceptual and technical problems which are currently faced. Although these interpretational difficulties are formidable, the emergence of systematic trends in the comparison of theory and experiment appears to invite a (possibly) simple explication.

704,037
PB82-108028 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamic Structure Factor, S(q,omega), of Polymers in Dilute Solution.
Final rept.
C. C. Han, and A. Z. Akcasu. 1981, 7p
Pub. in Polymer 22, p1019-1025 1981.

Keywords: *Polymers, *Dynamic structural analysis, Solutions, Light scattering, Neutron scattering, Reprints.

In principle, interpretation of dynamic scattering experiments requires theoretical calculation of either intermediate scattering functions S(q,t) or dynamic structure factors S(q,omega). Although dynamic scattering experiments can be interpreted through the use of the 'characteristic frequency' (or 'first cumulant') omega(q). The precision of extracting omega(q) is greatly improved by using a normalized shape function. Due to the difficulty in obtaining analytical results, in this paper the authors present numerical calculations of the normalized shape function in the frequency domain. These results can be used to facilitate the extraction of omega(q) from S(q,omega) directly both in light and neutron dynamic scattering experiments.

704,038
PB82-108044 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Markovian Model Microfield Methods for Stark Broadening.
Final rept.
E. W. Smith, B. Talin, and J. Cooper. 1981, 33p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 26, n3 p229-242 1981.

Keywords: *Stark effect, Mathematical models, *Markovian models, *Model microfield method.

Stark broadening theories which concentrate on the statistics of the plasma electric microfield rather than the dynamics of collisions have come to be known as Model Microfield Methods. In the present paper, the authors present an analysis of Stark broadening problems based on Markovian model microfield statistics. Our derivation permits an easy comparison with traditional Stark broadening theories such as the impact and unified theories; this comparison is used to clarify the physical nature of the approximations employed by Markovian models. The strength and weaknesses of various models are discussed, emphasizing the kangaroo process of Brissaud and Frisch, and methods are suggested for improving the current model microfield approach.

704,039
PB82-108051 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoemission Studies on Thulium (Summary Abstract).
Final rept.
W. F. Egelhoff, G. G. Tibbetts, I. Lindau, and M. H. Hecht. Mar 81, 1p
Pub. in Jnl. of Vacuum Science and Technology 18, n2 p599 Mar 81.

Keywords: *Thulium, *Photoelectric emissions, Reprints, Autoionization.

The authors have studied the autoionizing resonances found in the metal thulium. The type of resonance is 4d yields 4f and its general character appears to be determined by the shape of the 4f potential energy surface.

704,040
PB82-109141 PC **A08**/MF **A01**
National Standard Reference Data System.
Optical Spectra of Nonmetallic Inorganic Transient Species in Aqueous Solution.
G. L. Hug. c1981, 169p NSRDS-NBS-69
Prepared in cooperation with Notre Dame Univ., IN. Radiation Chemistry Data Center. Library of Congress Catalog card no. 80-606826.

Keywords: *Optical spectra, *Inorganic compounds, *Atlases, *Free radicals.

Optical absorption spectra are presented for 77 nonmetallic, inorganic radicals and radical ions, produced by radiolysis or photolysis in aqueous solution. This atlas results from the compilation, evaluation, and replotting of spectra from the literature. Additional information is included such as extinction coefficients, initial chemical conditions, methods of transient generation and spectral acquisition, references, mechanisms of transient formation, and notes on dosimetry.

704,041
PB82-112541 Not available NTIS
National Bureau of Standards, Washington, DC.
Angular Distribution of Photoelectrons in Multiphoton Ionization.
Final rept.
T. Hellmuth, G. Leuchs, S. J. Smith, and H. Walther. 1981, 15p
Pub. in Proceedings of the International Conference on Multiphoton Processes (2nd) held at Budapest, Hungary on April 14-18, 1980, p1-15 1981.

Keywords: *Angular distribution, *Photoelectrons, *Sodium, Ionization, Excitation.

In resonant multiphoton ionization of sodium, with absorption of n successive photons, photoelectron angular distributions are characterized by polynomials in the even spherical harmonic up to P(2n).

704,042
PB82-112566 Not available NTIS
National Bureau of Standards, Washington, DC.
Multiphoton Ionization of Atoms.
Final rept.
T. Hellmuth, G. Leuchs, S. J. Smith, and H. Walther. 1981, 10p
Pub. in Proceedings of the Sergio Porto Memorial Symposium held at Rio de Janeiro, Brazil on June 29-July 3, 1980, Paper in Springer-Series in Optical Sciences, Laser and Applications 26, p194-201 1981.

Keywords: *Angular distribution, *Sodium, *Photoelectrons, Ionization, Excitation.

In resonant multiphoton ionization of sodium, with absorption of n successive photons, photoelectron angular distributions are characterized by polynomials in the even spherical harmonic up to P(2n).

704,043
PB82-112582 Not available NTIS
National Bureau of Standards, Washington, DC.
Electric Discharge Excited TlI-Xe Mixtures.
Final rept.
D. W. Wildman, L. W. Schumann, and A. C. Gallagher. May 81, 5p
Pub. in Jnl. of Applied Physics 52, n5 p3264-3268 May 81.

Keywords: *Electric discharges, *Xenon, Thalium halides, Mixtures, Excitation, Reprints, *Thalium iodide.

Pulsed, high-power, nonequilibrium discharges have been operated in TlI-Xe mixtures at typical TlI densities of 10 to the 15th power-10 to the 17th power/cc, Xe densities of approximately equal to 10 to the 19th power/cc, and power densities of 100,000-1,000,000/cc W. The steady-state emission spectrum was measured for the wavelength region 275-850 nm, and it was used to obtain the populations of the Tl and Xe excited states. The fraction of TlI dissociated in the discharge is also reported as a function of TlI, Xe, and current density. A phenomenological model for the results is discussed.

704,044
PB82-112590 Not available NTIS
National Bureau of Standards, Washington, DC.
Rate Coefficients for Electron Impact Excitation of Helium-Like Ions.
Final rept.
A. K. Pradhan, D. W. Norcross, and D. G. Hummer. 15 Jun 81, 9p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Astrophysical Jnl. 246, p1031-1039, 15 Jun 81.

Keywords: *Atomic energy levels, Excitation, Beryllium, Carbon, Oxygen, Neon, Silicon, Calcium, Iron, Reprints, *Electron ion interactions.

Accurate rate coefficients are presented for the excitation of all transitions involving the round state and the n=2 levels in a number of helium-like ions: Be III, C v, O VII, Ne IX, Si XIII, Ca XIX, and Fe XXV. The results are tabulated in the temperature range 10 to the 4th power-10 to the 9th power K, depending upon the ionization stage. Effects of autoionizing resonances in the inelastic scattering cross sections have been included, and it is shown that for most transitions these effects result in a very significant enhancement of the excitation rates. The present results, in many cases, are considerably different from previous calculations of collision strengths neglecting resonance effects. Some applications of the present data in the analysis of line intensities from laboratory and astrophysical plasmas are pointed out. General criteria for evaluating theoretical electron-ion scattering data and their accuracy are also briefly discussed.

704,045
PB82-112608 Not available NTIS
National Bureau of Standards, Washington, DC.
Photon-Stimulated Desorption from Covalently Bonded Species: CO Absorbed on Ru(001).
T. E. Madey, R. Stockbauer, S. A. Flodstrom, J. F. van der Veen, J. J. Himpsel, and D. E. Eastman. 15 Jun 81, 4p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Physical Review B 23, n12 p6847-6850, 15 Jun 81.

Keywords: *Carbon monoxide, *Surface chemistry, Excitations, Chemisorption, Chemical bonds, Reprints, *Photon stimulated desorption.

The authors report the first angle-resolved photon stimulated desorption (PSD) study of a covalent molecule bonded to a metal surface, CO on Ru (001). The mechanisms for ion desorption involve intramolecular excitations, not substrate atom excitations.

704,046
PB82-112616 Not available NTIS
National Bureau of Standards, Washington, DC.
Oxygen-Sensitive Electrode Impedance in Sr-Doped LaCrO3.
Final rept.
J. R. Bethin, C. K. Chiang, A. D. Franklin, and R. A. Snellgrove. Jun 81, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Applied Physics 52, n6 p4115-4117 Jun 81.

Keywords: *Oxygen, Electrodes, Additives, Surface chemistry, Oxidation, Reprints, *Ion selective electrodes, Lanthanum chromite.

Barrier layers are apparently formed on Sr-doped LaCrO3 that give rise to an appreciable electrode impedance with electrodes of Au or Pt. The corresponding electrode resistance is quite sensitive to the oxygen activity in the atmosphere, following atmospheric changes at temperatures near room temperature with time constants of the order of minutes or days. The electrical properties of these barrier layers at room temperature do not conform to the models of simple Schottky layers on semiconductors, but exhibit a pattern of changing oxidation states at the interface region.

704,047
PB82-112673 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Binding of an Electronic Analog to CO: Infrared Evidence for CH3NC Chemisorption on Rh/Al2O3.
Final rept.
R. R. Cavanagh, and J. T. Yates. 1 Aug 81, 9p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Jnl. of Chemical Physics 75, n3 p1551-1559, 1 Aug 81.

Keywords: *Surface chemistry, Chemisorption, Infrared spectroscopy, Aluminum oxide, Chemical bonds, Reprints, *Methyl isocyanides.

The chemisorption of methyl isocyanide by Al2O3-supported Rh has been investigated using transmission infrared spectroscopy. Evidence for the absence of dissociation or isomerization upon chemisorption is presented. The identification of various surface binding sites is possible and is in agreement with the site distribution previously demonstrated for such samples using CO. Samples which are exposed to methyl isocyanide following saturation coverage with CO exhibit a 100/cm decrease in the C triple bond O stretching mode due to the presence of the isocyanide. This shift is interpreted in terms of a sigma donor-Pi acceptor interaction between the isocyanide and CO adsorbates.

704,048
PB82-112699 Not available NTIS
National Bureau of Standards, Washington, DC.
Bandwidth-Induced Reversal of Asymmetry in Optical-Double-Resonance Amplitudes.
Final rept.
D. E. Nitz, A. V. Smith, M. D. Levenson, and S. J. Smith. Jul 81, 6p
Grant NSF-PHY79-04761
Pub. in Physical Review A 24, n1 p288-293 Jul 81.

Keywords: *Sodium, Stark effect, Atomic energy levels, Reprints, *Optical double resonance spectroscopy.

Optical-double-resonance measurements using ionization detection have been carried out in the 3S(1/2)-3P(1/2)-4D atomic-sodium system. Asymmetries observed in production of 4D atoms from the two components of the Stark-split 3P(1/2) state are found to be controlled by the far, very weak wings of the 17-MHz full-width-at-half-maximum laser line which is used to drive the 3S(1/2)-3P(1/2) transition at detunings in the range 0-70 GHz. Suppression of the wings with a Fabry-Perot filter causes a pronounced reversal of the asymmetry.

704,049
PB82-118118 Not available NTIS
National Bureau of Standards, Washington, DC.
Hydrogen-Atom Abstraction by Atomic Fluorine. Vibrational Spectrum of the F+CH3F Reaction Products Trapped in Solid Argon.
Final rept.
M. E. Jacox. 1981, 4p
Pub. in Jnl. of Chemical Physics 59, p199-212 1980.

Keywords: Molecular vibrations, Chemical reactions, Photolysis, Absorption, Ultraviolet spectroscopy, Reprints, *Matrix isolation techniques, *Atom molecule interactions, *Fluorine atoms, *Methane/fluoro, Hydrogen atoms.

When the products of the interaction between methyl fluoride and F atoms, produced in a microwave discharge, are frozen in a large excess of argon at 14K, infrared absorptions previously assigned to CH2F, HCF, and (CH3F+HF) appear. The reaction of F atoms in the solid also leads to the appearance of prominent absorptions of the (CH2F+HF) hydrogen-bonded complex. At higher F-atom concentrations, absorptions of CH2F2 and of (CH2F2+HF) become prominent. A revised assignment is proposed for CD2F. At wavelengths shorter than 280 nm, CH2F photodecomposes, producing CF. The photodecomposition of (CH2F+HF), which has a somewhat higher energy threshold, leads to the appearance of (CF+HF). A detailed discussion of the chemical reactions and photodecomposition processes characteristic of these experiments is presented.

704,050
PB82-118407 Not available NTIS
National Bureau of Standards, Washington, DC.
Reaction of Excited Argon Atoms and of F Atoms with Methanol. Vibrational Spectrum of CH2OH Isolated in Solid Argon.
Final rept.
M. E. Jacox. 1981, 8p
Pub. in Jnl. Chemical Physics 59, p213-230 1981.

Keywords: *Methyl alcohol, Excitation, Hydrogen fluoride, Infrared spectroscopy, Photolysis, Vibrational spectra, Reprints, *Matrix isolation technique, Argon atoms, Fluoride atoms.

When the products of the interaction between methanol and either excited argon atoms or F atoms, produced in a discharge, are frozen in a large excess of argon at 14K, prominent infrared absorptions of CH2OH appear. Detailed isotopic substitution studies have permitted the derivation of a set of valence-force potential constants for this species. There is some evidence for the stabilization of CH3O, previously identified as a product of these two reactions, but the reaction channel producing CH2OH predominates. Secondary H-atom abstraction and photodecomposition lead to the stabilization of H2CO, with no evidence for an HCOH intermediate. HCO also appears. The highest frequency fundamental of DCO stabilized in solid argon agrees considerably more closely with the recently reported gas-phase band center than does the corresponding absorption in a carbon monoxide matrix. In the F-atom reaction studies the (CH2OH+HF) hydrogen-bonded complex is also stabilized. The infrared absorption spectrum of this complex suggests that the HF is hydrogen-bonded to the lone pair electrons on the oxygen atom.

704,051
PB82-119769 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of the Unitarised Born Approximation in Electron Collisions with Polar Molecules,
N. T. Padial, D. W. Norcross, and L. A. Collins. 1981, 5p
Contract DOE-EA-77-A-01-6010
Pub. in Jnl. of Physics, B. At. Mol. Phys. 14, p2901-2909 1981.

Keywords: *Scattering cross sections, Dipole moments, Angular momentum, Reprints, *Electron molecule interactions.

The validity of the unitarised Born (B II) approximation for representing the T-matrix elements for electron-polar-molecule collisions is investigated for a number of polar systems. For intermediate and high values of the angular momentum (usually l greater than or equal to 5), the B II results are in excellent agreement with those of a more elaborate close-coupling calculation. The method provides an efficient, economical means for calculating the higher angular momenta T-matrix elements that are needed in the completion formulae for polar-molecule cross sections. The methods have an advantage over such comparable schemes as the fixed-point-dipole technique in that contributions from potential moments above the dipole can be simply included.

704,052
PB82-119777 Not available NTIS
National Bureau of Standards, Washington, DC.
Depolarization of Poled PVF2 Samples with 'Thick' Electrodes.
Final rept.
A. J. Bur, and A. K. Tsao. 1981, 9p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Ferroelectrics 32, p185-189 1981.

Keywords: *Depolarization, *Electrodes, Samples, Piezoelectricity, Pyroelectricity, Fluorine organic compounds, Thickness, Reprints, *Vinylidene fluoride resins.

Twenty-six poled biaxially oriented PVF2 samples which were prepared with electrode thickness ranging from 750 A to 3100 A were investigated in three experiments: (1) the hydrostatic piezoelectric coefficient d(p) and the pyroelectric coefficient P(y) were measured for the original samples; (2) d(p) and P(y) were measured after the thick electrodes were removed; and (3) the depolarization charge was measured by detecting the discharge as the samples were subjected to an abrupt temperature rise through the melting point. The results of these measurements are: (1) the values of d(p) and P(y) for the as received samples were lower, the thicker the electrode; (2) with the thick electrodes removed from the samples, the values of d(p) and P(y) were the same as those for the thick electrodes in place; and (3) the depolarization charge decreased as the original electrode thickness increased. The authors have concluded that the decrease in d(p) and P(y) as a function of electrode thickness is essentially due to the decreases in polarization of the thick electroded specimens and that thick electrodes mechanically constrain the sample during poling so that optimum poling cannot be achieved. Previous measurements on these samples showed that the d(31) coefficient was inversely related to electrode thickness.

704,053
PB82-119793 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Photoelectron Spectrometry of Sc- and Y-: A Determination of the Order of Electron Filling in Transition-Metal Anions.
Final rept.
C. S. Feigerle, Z. Herman, and W. C. Lineberger. 1981, 10p
Grants NFS-PHY79-04928, NSF/CHE78-18424
Pub. in Jnl. of Electron Spectroscopy and Related Phenomena 23, p441-450 1981.

Keywords: *Scandium, *Yttrium, Photoelectrons, Anions, Transition metals, Atomic energy levels, Reprints, *Laser spectroscopy.

The photoelectron spectra of Sc(1-1) and Y(1-1) have been obtained in a crossed ion- and laser-beam experiment.

704,054
PB82-119801 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Effective Thermal Conductivity of a Glass Fiberboard Standard Reference Material.
Final rept.
D. R. Smith, and J. G. Hust. Jul 81, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Cryogenics 21, n7 p408-410 Jul 81.

Keywords: *Thermal conductivity, *Glass, *Fiberboards, Insulating boards, Reprints, *Standard reference materials.

This paper describes the results of thermal conductivity measurements on NBS SRM 1450 glass fiberboard insulation (1970 lot) at temperatures from 87 K to 340 K. The measurements were performed in an atmosphere of dry nitrogen at a pressure near 84 kPa (630 mm Hg). The results are analyzed and compared to NBS certification data and to literature data for similar material.

704,055
PB82-119819 Not available NTIS
National Bureau of Standards, Washington, DC.
Soft-Disc Melting in Small Systems.
Final rept.
D. J. Evans, and H. J. M. Hanley. 15 Jun 81, 3p
Pub. in Physical Letters, A (83), n7 p344-346, 15 Jun 81.

Keywords: *Melting, *Molecules, *Thermodynamics, Reprints, *Soft disk melting.

The location of melting for a soft-disc system of 32,50 and 98 particles (N), respectively, is determined by molecular dynamics.

704,056
PB82-119843 Not available NTIS
National Bureau of Standards, Washington, DC.
Auger Line Shapes Analysis for Characterization of Molecular Surface Reaction Products.
Final rept.
F. P. Netzer. 1981, 23p
Pub. in Applications of Surface Science 7, p289-311 1981.

Keywords: *Auger electrons, *Surface chemistry, Adsorption, Transition metals, Carbonyl compounds, Reprints, *Auger spectroscopy.

The literature of Auger line shape analysis of gas-phase, condensed-phase and adsorbed molecules is complied and briefly reviewed, and the use of high-resolution Auger spectroscopy to probe the local electronic structure and the chemical environment of atoms involved in the Auger process is emphasized. Exemplifying results are presented and discussed for transition metal carbonyl complexes, as models of adsorbate-metal surface systems, and for FVV Auger spectra of several carbon oxygen and nitrogen containing molecules adsorbed on metal surfaces.

704,057
PB82-119868 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoelectron Spectrum of Xe3 by the Photoelectron-Photoion Coincidence Technique.
Final rept.
E. D. Poliakoff, P. M. Dehmer, J. L. Dehmer, and R. Stockbauer. 1 Aug 81, 2p
Pub. in Jnl. of Chemical Physics 75, n3 p1568-1569, 1 Aug 81.

Keywords: *Xenon compounds, *Mass spectroscopy, Photoelectrons, Ionization potential, Molecular energy levels, Reprints.

The photoelectron spectrum of Xe3 found in a mixed beam of cluster molecules from a supersonic free jet expansion of Xe has been measured using photoelectron-photoion coincidence. The technique energy-analyzes the electron and mass-analyzes the ion from single photoionization events. The vertical ionization potential of Xe3 is 11.47 (9) and the adiabatic ionization potential is 10.84 (4) eV.

704,058
PB82-120080 Not available NTIS
National Bureau of Standards, Washington, DC.
Orientation of Histidine Residues in RNase A: Neutron Diffraction Study.
Final rept.
A. Wlodawer, and L. Sjolin. May 81, 3p
Sponsored in part by North Atlantic Treaty Organization.
Pub. in Proceedings of National Sci. USA 78, n4 p2853-2855 May 81.

Keywords: *Histidine, *Ribonuclease, *Neutron diffraction, X ray analysis, Chemical bonds, Residues.

Difference Fourier maps have been calculated at 2.8-A resolution by using neutron diffraction data obtained from a single crystal of RNase A. The phases were derived from a model resulting from the joint refinement of x-ray and neutron data at 2.0-A and 2.8-A resolution, respectively. The orientation of histidine-48 assumed during the refinement of the x-ray model at 2.5 A was confirmed, whereas the other three histidines had to be rotated around C(beta)-C(gamma) bonds in order to agree with the neutron difference Fourier maps. In the final model, histidine-12 is clearly hydrogen bonded to the carbonyl oxygen of threonine-45 and to the oxygen of the inorganic phosphate, and histidine-119 is bonded to another oxygen of the phosphate and to the oxygen OD1 of aspartic acid-121.

704,059
PB82-120528 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Equation of State of Isobutane: An Interim Assessment.
Final rept.
M. Waxman, H. A. Davis, J. M. H. L. Sengers, and M. Klein. Sep 81, 45p NBSIR-79-1715
Sponsored in part by Department of Energy, Washington, DC. Div. of Geothermal Energy.

Keywords: *Equations of state, *Butanes, Assessments, Vapor pressure, Thermodynamics, Isotherms, Critical point, Numerical solution.

New and very accurate measurements of the vapor pressure and two PVT isotherms of isobutane below critical are presented. The vapor pressure data have been correlated to within parts per 10,000 using a scaled vapor pressure equation. The Beattie data in the critical region has been correlated using a scaling law approach. This required a shift in the critical temperature of 0.3 K from that published by Beattie. The significance of this shift in an overall correlation is not yet clear. The two PV isotherms are compared with literature data and the results of Sage and Lacy shown to be inaccurate. Those of Connolly appear to be sufficiently accurate for including in future correlations. Two correlations of Starling et al. and that of Das et al. are intercompared and are compared with these new results. As might be expected, these correlations, being based on inaccurate data, are not of sufficient accuracy for use as representations of the properties of isobutane. A program is presented for the completion of a correlation of the properties of isobutane to engineering accuracy.

704,060
PB82-122995 PC **A99**/MF **A01**
Notre Dame Univ., IN. Radiation Chemistry Data Center.
Biweekly List of Papers on Radiation Chemistry and Photochemistry: Annual Cumulation with Keyword and Author Indexes. Volume 13, 1980.
A. B. Ross. Dec 80, 717p
See also Volume 12, PB81-113680. Sponsored in part by Department of Energy, Washington, DC, and National Bureau of Standards, Washington, DC.Portions of this document are not fully legible.

Keywords: *Chemistry, *Bibliographies, Radiation chemistry, Indexes(Documentation), Subject index terms, Reaction kinetics, Optical spectra, Polymers, Thermodynamics, Electron spin resonance, Excitation, Energy levels, Photochemistry.

This document is the annual edited cumulative list of references to the published literature on radiation chemistry, photochemistry, and related fields. References are drawn from 60 journals published throughout the world. The list is generated from the Biweekly List of Papers on Radiation Chemistry and Photochemistry and contains the literature references and an author and subject index. The publication represents one of the continuing data activities of the Radiation Chemistry Data Center (RCDC) at the University of Notre Dame. Volume 13 also contains a 94-page 'Thesaurus for Radiation Chemistry' which lists indexing terms which make up the group of keywords used in the RCDC computer-readable bibliographic data base.

704,061
PB82-124710 Not available NTIS
National Bureau of Standards, Washington, DC.
Expressions for Computer-Evaluation of the Four Kernel Functions for Line Formation with Doppler and Lorentz Profiles.
Final rept.
D. G. Hummer. 1981, 9p
Grant NSF-AST80-19874
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 26, n3 p187-195 1981.

Keywords: *Doppler effects, *Lorentz transformations, Line spectra, Reprints, *Kernel functions, Pade approximants, Radiation transfer.

Rational approximations for the kernel functions K1(tau), K2(tau), M1(tau) and M2(tau) that describe the transfer of radiation scattered with complete redistribution over Doppler and Lorentz profiles, have been obtained from their series and asymptotic expressions by the techniques of Pade approximants with a maximum relative error of less than 0.0001.

704,062
PB82-124744 Not available NTIS
National Bureau of Standards, Washington, DC.
Melting Point of Palladium by a Pulse Heating Method.
Final rept.
A. P. Miiller, and A. Cezairliyan. 1981, 8p
Pub. in Int. Jnl. Thermophys. 2, n1 p63-70 1981.

Keywords: *Palladium, *Melting points, Pulse heating, Samples, Reprints.

The melting point of 99.95(+)% pure palladium was measured by means of a subsecond duration pulse heating technique. The average temperature at the melting point for three specimens was 1827K with an average absolute deviation from the mean of 0.1K. The total error in temperature is estimated to be not more than + or - 4K.

704,063
PB82-127820 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamic Properties of FCC Metals at High Temperatures.
Final rept.
R. A. MacDonald, and W. M. MacDonald. 1981, 10p
Pub. in Physical Review B 24, n4 p1715-1724, 15 Aug 81.

Keywords: *Thermodynamic properties, *Metals, High temperature tests, Specific heat, Helmholtz free energy, Crystals, Perturbation theory, Reprints, *FCC metals, Numerical solution.

The authors have carried out an exact and consistent calculation of the thermodynamic properties of monatomic fcc crystals at high temperatures. These properties are obtained from the Helmholtz free energy of the crystal F(V,T) by means of the appropriate thermodynamic relations. It is crucial to the success of the calculation that we have been able to obtain the volume dependence of the free energy. F(V,T) includes the static lattice energy and the vibrational contributions from the harmonic and lowest-order (cubic and quartic) anharmonic terms in perturbation theory evaluated in the high-temperature limit. The atoms interact via an effective nearest-neighbor central-force potential phi (r). They have calculated the specific heat at constant volume and at constant pressure, the thermal expansion, the coefficient of linear expansion, the isothermal and adiabatic bulk moduli, and the Gruneisen parameter for the following fcc metals: Cu, Ag, Ca, Sr, Al, Pb, and Ni. Good agreement with experiment with experiment is obtained in all cases. They discuss the implications of these results for further studies of the properties of metals.

704,064
PB82-127838 Not available NTIS
National Bureau of Standards, Washington, DC.
Phase Behavior in the Nitrogen + Ethylene System from 120 to 200 K.
Final rept.
K. A. M. Gasem, M. J. Hiza, and A. J. Kidnay. Jun 81, 9p
Pub. in Fluid Phase Equilibrium 6, n3-4 p181-189 Jun 81.

Keywords: *Phase transformations, *Chemical equilibrium, *Nitrogen, *Ethylene, Temperature, Pressure, Reprints.

Liquid-vapor and liquid-liquid-vapor equilibria were measured for the N2+C2H4 system between 120 and 200K and at pressures to 93 bar (9,300,000 Pa). The data at 200K are compared with existing measurements and show excellent agreement. At lower temperatures (120-140K), the system exhibits a liquid phase separation. The pressures and temperatures corresponding to the appearance of two liquid phases were also determined from 105 to 135K for the N2+C2H6 system.

704,065
PB82-127846 Not available NTIS
National Bureau of Standards, Washington, DC.
Prediction of the Transport Properties of Natural Gas and Similar Mixtures.
Final rept.
J. C. Rainwater, and H. J. M. Hanley. 1978, 5p
Pub. in Proceedings of Cryogenic Engineering Conference, Boulder, Colorado, August 2-5, 1977, Paper in M-2 Advances in Cryogenic Engineering 23, p561-565 1978.

Keywords: *Transport properties, *Natural gas, Mathematical models, Viscosity, Thermal conductivity, Mixtures, Thermodynamics.

This paper presents a procedure to calculate the viscosity coefficient, nu, and the thermal conductivity coefficient, lambda, of a pure fluid or mixture from thermodynamic data. The procedure incorporates the extended corresponding states approach to the thermodynamic properties of nonconformal fluids. Details have been reported elsewhere.

704,066
PB82-128349 Not available NTIS
National Bureau of Standards, Washington, DC.
Breadths of Resonant Photoemission Satellites and Electron-Excited Direct-Recombination Emission.
Final rept.
J. A. D. Matthew, and S. M. Girvin. 1981, 5p
Pub. in Physical Review B 24, n4 p2249-2253, 15 Aug 81.

Keywords: *Electrons, *Photoelectric emissions, Excitations, Resonance, Auger spectroscopy, Reprints.

Resonant photoemission involving core hole excitation and electron emission arising from direct recombination of electron excited resonant states are compared. At fixed photon energy the resonant emission has an energy distribution which is not broadened by the finite lifetime of the core hole and is therefore narrower than the corresponding Auger emission process. Electron excited resonant states give rise to emission which can be isolated only if it is at a different energy from that of the main Auger channel as in the rare earths, but this emission is core hole broadened. A coincidence experiment monitoring the energy loss of the incident electron and the energy distribution of the emitted electron is equivalent in resolution to resonant photon excitation.

704,067
PB82-128372 Not available NTIS
National Bureau of Standards, Washington, DC.
Hydrogen-Ion Activity.
Final rept.
R. A. Durst, and R. G. Bates. 1981, 12p
Pub. in Encyclopedia Chemical Technology, 3rd Edition, 13, p1-12 1981.

Keywords: *pH, Reviews, Buffers(Chemistry), Electrodes, Solutions, Reprints, *Hydrogen ions.

The concept of hydrogen-ion activity and its related parameter, pH, is reviewed. Also discussed are the operational definition of pH, the pH scale, and the method of assignment of pH values to reference buffer solutions. Practical information is included on pH measurement procedures, interpretation of measured

pH values and characteristics of the instrumentation and electrodes used for laboratory and industrial pH measurements.

704,068
PB82-129982 Not available NTIS
National Bureau of Standards, Washington, DC.
Excitation-Autoionization Contributions to Electron Impact Ionization.
Final rept.
R. A. Falk, G. H. Dunn, D. C. Griffin, C. Bottcher, D. C. Gregory, D. H. Crandall, and M. S. Pindzola. 1981, 4p
Contract DOE-EA-77-A-01-6010
Pub. in Physical Review Letters 47, n7 p494-497, 17 Aug 81.

Keywords: Excitation, Ions, Reprints, *Autoionization, Titanium ion, Zirconium ion, Hafnium ion, Electron cross sections.

Experimental measurements of electron impact ionization cross sections for the transition-series ions Ti+3, Zr+3, and Hf+3 demonstrate that excitation-autoionization increases the cross sections by more than an order of magnitude over that anticipated for direct ionization. Theoretical predictions of both the energies and approximate magnitudes of these excitation cross sections provide confidence that this important indirect contribution to the total ionization can be estimated for many cases.

704,069
PB82-130014 Not available NTIS
National Bureau of Standards, Washington, DC.
Photochemistry of Acetylene at 1470 A.
Final rept.
H. Okabe. 1981, 7p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. Chemical Physics 75, n6 p2772-2778, 15 Sep 81.

Keywords: *Acetylene, *Photolysis, Absorption cross sections, Pressure, Reprints.

The photolysis of acetylene at 1470 A has been studied over the pressure region from 13 to 1330 N/sq m (0.1 to 10 Torr). The quantum yield of diacetylene formation has been measured as a function of C2H2 pressure and the partial pressures of He and H2. The quantum yields of acetylene disappearance and of ethylene and hydrogen formation were also briefly studied. Absorption cross sections of diacetylene have been measured in the 1200 and 1800 A region. The role of acetylene photolysis in the Jovian atmosphere is briefly discussed.

704,070
PB82-130253 Not available NTIS
National Bureau of Standards, Washington, DC.
Rotational Hamiltonian for the Ground Vibrational State of Hydrazine.
Final rept.
J. T. Hougen. 1981, 32p
Pub. in Jnl. Mol. Spectrosc. 89, p296-327 1981.

Keywords: *Hydrazine, *Hamiltonian functions, Molecular vibration, Molecular energy levels, Reprints.

A Hamiltonian matrix suitable for fitting rotational energy levels of the hydrazine molecule in its ground vibrational and electronic states was obtained. Preliminary fits indicate that the model developed can be used to fit the hydrazine microwave data in a consistent fashion, and a full treatment of such data has been undertaken.

704,071
PB82-130287 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Spectrum of the gamma(1) Band of SiD3H.
Final rept.
C. Frommer, R. W. Lovejoy, R. L. Sams, and W. B. Olson. 1981, 7p
Pub. in Jnl. Mol. Spectrosc. 89, p261-267 1981.

Keywords: *Infrared spectroscopy, *Silanes, Molecular energy levels, Reprints.

High-resolution spectra of the gamma(1) stretching band of SiD3H were recorded and analyzed, yielding values for ground- and upper-state constants and the band center.

704,072
PB82-131525 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Thermodynamic Properties of Solid Alkali Aluminosilicates at Elevated Temperatures.
Final rept.
R. H. Schumm. Oct 81, 52p NBSIR-81-2343
Sponsored in part by Department of Energy, Morgantown, WV. Morgantown Energy Technology Center.

Keywords: *Thermodynamic properties, *High temperature tests, *Aluminum silicates, Solid phases, Specific heat, Entropy, Enthalpy, Heat of formation, Tables(Data), Gibbs free energy, Silicates/alumino.

This report presents selected heat capacities, entropies, enthalpies, standard enthalpies of formation, standard free energies of formation and the equilibrium formation constants for solid sodium aluminate, solid potassium aluminate and solid aluminosilicates of lithium, sodium, and potassium. Values are listed in 28 tables for 17 different compositions (13 pure compounds and their polymorphs; 4 mixtures, each in low- and high-temperature configurations) from 298K to temperatures ranging up to 2000K.

704,073
PB82-133851 Not available NTIS
National Bureau of Standards, Washington, DC.
Excitation of the O(2)(a sup 1 delta(g)) State by Low Energy Electrons.
Final rept.
K. Tachibana, and A. V. Phelps. 1981, 6p
Sponsored in part by Air Force Weapons Lab., Kirtland AFB, NM.
Pub. in Jnl. Chemical Physics 75, n7 p3315-3320, 1 Oct 81.

Keywords: *Oxygen, Excitation, Electrons, Argon, Mixtures, Atomic energy levels, Reprints, Electron electron interactions.

Coefficients for the excitation of the a sup 1 delta(g) metastable state of O2 by low energy electrons in O2-Ar mixtures have been measured using a drift tube technique. The experimental electron excitation coefficients agree satisfactorily with values calculated using previously derived sets of electron collision cross sections for O2 and Ar.

704,074
PB82-133893 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamic Technique for Measurements of Thermophysical Properties at High Temperatures.
Final rept.
A. Cezairliyan. 1980, 17p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in High Temperature Science 13, p117-133 1980.

Keywords: *Thermophysical properties, *High temperature tests, Samples, Thermodynamics, Specific heat, Electrical resistivity, Emittance, Melting point, Phase transformation, Reprints.

A technique is described for the dynamic measurement of selected thermophysical properties of electrically conducting substances in the range 1500 K to the melting temperature of the specimen. The technique is based on rapid resistive self-heating of the specimen from room temperature to any desired high temperature in less than one second by the passage of an electrical pulse through it and on measuring the pertinent quantities, such as current, voltage, and temperature, with millisecond resolution. The technique was applied to the measurement of heat capacity, electrical resistivity, hemispherical total emittance, normal spectral emittance, melting temperature, and temperature and energy of solid-solid phase transformations. Recent preliminary studies have indicated the applicability of the technique to the measurements of heat of fusion and thermal expansion.

704,075
PB82-133901 Not available NTIS
National Bureau of Standards, Washington, DC.
Bifurcations and Multistability in Two-photon Processes.
Final rept.
D. F. Walls, C. V. Kunasz, P. D. Drummond, and P. Zoller. Jul 81, 4p
Pub. in Physical Review A 24, n1 p627-630 Jul 81.

Keywords: *Photons, Stability, Absorbers(Materials), Electromagnetic fields, Reprints, *Bifurcations.

The authors considered an intracavity nonlinear medium interacting with two modes of the electromagnetic field via a two photon process. The cavity is coherently driven at the frequencies of the two modes. They considered as the intracavity medium (a) a two photon absorber, (b) N three level atoms. These systems display a new class of bifurcations and in the case of the two photon absorber optical tristability is possible.

704,076
PB82-133919 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron-Ion Collisions.
Final rept.
G. H. Dunn. 1980, 47p
Pub. in Proceedings of the Physics of Ionized Gasses, Dubrovnik, Yugoslavia, August 25-30, 1980, p49-95.

Keywords: Cross sections, Excitation, Ionization, Recombination reactions, Dissociation, Reaction kinetics, Plasmas(Physics), Reprints, *Electron ion interactions, Numerical solution.

Worldwide interest in and excitement over both controlled thermonuclear fusion and space physics coupled with advancing technology have generated significant efforts to determine cross sections for electron collisions with ions. Early work in various laboratories dates from the late 1950's, but it was not until 1961 that a successful measurement was reported. Since that time much work has been done and a number of reviews have been written on experimental techniques and results as well as on theory. This paper will emphasize experimental results and methods, with an attempt to update the excellent review of Dolder and Peart, which has a similar emphasis. Some overlap occurs with the Dolder and Peart paper; since some issues facing the field remain the same, and methods and examples for orientation and clarification may be the same. Processes of high interest in electron-ion collisions include: excitation, ionization, recombination, dissociation, and detachment. Only the first three will be discussed here. Rate measurements in plasmas also, of course, give valuable information about the processes in question and rate coefficients are -- in many cases -- what the user community ultimately needs for modelling and diagnostics. However, the author confines the discussion here to cross sections from which rate coefficients may be calculated and which make a more meaningful test of theory. An extensive bibliography is included.

704,077
PB82-134362 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Standard Reference Data Publications, 1964-1980.
G. B. Sherwood. Nov 81, 125p NBS-SP-612

Keywords: Standards, Molecular structure, Reaction kinetics, Thermodynamic properties, Transport properties, Bibliographies, *Standard reference materials.

This document provides a comprehensive list of the outputs of the National Standard Reference Data System (NSRDS) with author, materials, and property indexes for the years 1964-1980. NSRDS data centers prepare evaluated data bases of physical and chemical properties of substances. The program is managed by the National Bureau of Standards' Office of Standard Reference Data. Data bases are available in printed form, on magnetic tapes, and through online computer networks.

704,078
PB82-137340 Not available NTIS
National Bureau of Standards, Washington, DC.
Cross Sections and Rates for Direct Electron-Impact Ionization of Sodiumlike Ions.
Final rept.
S. M. Younger. Sep 81, 6p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review A 24, n3 p1272-1277 Sep 81.

Keywords: *Reaction kinetics, *Scattering cross sections, *Electrons, Ionization, Excitation, Reprints, *Electron impact spectra, *Sodium ions, Autoionization, Numerical solution.

Cross sections and rate coefficients for the direct electron-impact ionization of sodiumlike ions have been calculated in a distorted-wave Born exchange approximation. For higher charge states the cross section is dominated by inner-shell ionization of the 2p sup 6 subshell. Analytic fits to the data allow rapid calculation of cross sections and rate coefficients over a wide

range of incident electron energies. The importance of electron-impact excitation to autoionizing states is discussed.

704,079
PB82-137357 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Impact Ionization Cross Sections and Rates for Highly Ionized Atoms.
Final rept.
S. M. Younger. 1981, 9p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 26, n4 p329-337 1981.

Keywords: *Electrons, Ionization, Cross sections, Atoms, Reprints, Hydrogen ions, Helium ions, Lithium ions, Threshold effects(Electron energy), *Electron impact spectra.

Electron impact ionization cross sections and rates for hydrogen-, helium- and lithium-like ions are presented in simple analytical form, based on a set of parameters used in the formulae allow rigid generation of cross sections and rates for any ion in these sequences with a minimum of computational effort. The use of accurate Bethe slopes in the cross section-fitting algorithm yields good accuracy both in the near threshold and high energy regions. The rate coefficient is given in the form of a correction to the commonly used Seaton formula and is thus readily adaptable to existing plasma modeling computer codes. Comparisons of the present results with other theoretical and experimental data are made.

704,080
PB82-137373 Not available NTIS
National Bureau of Standards, Washington, DC.
Adsorption of NO on Ni (111): An ESDIAD/LEED Study.
Final rept.
F. P. Netzer, and T. E. Madey. 1981, 10p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Surface Science 110, p251-260 1981.

Keywords: *Nitrogen oxides(NO), *Nickel, *Surface chemistry, Adsorption, Chemisorption, Reprints, *Electron stimulated desorption ion angular distributions, Low energy electron diffraction, *LEED(Low Energy Electron Diffraction).

The ESDIAD method (electron stimulated desorption ion angular distributions) has been combined with LEED (low energy electron diffraction) in a study of the adsorption of NO on Ni(111). For adsorption at 80 K, NO appears to be bonded with its molecular axis perpendicular to the Ni(111) surface at all coverages. Heating the 80 K layer leads to a striking structural change which the authors interpret as the formation of inclined or bent NO in the range 120 less than or equal to T less than or equal to 250 K. Upon adsorption at 150 K, only the bent form of NO is present at low coverages; at higher coverages at 150 K, the perpendicular form appears, in agreement with recent electron energy loss spectroscopy (EELS) data of Lehwald, Yates, and Ibach. When NO is coadsorbed with p(2 x 2) oxygen, the perpendicular form of NO dominates at all coverages and temperatures studied. Dissociated NO adsorbed at steps and defect sites on Ni(111) produces a well-defined hexagonal ESDIAD pattern.

704,081
PB82-137407 Not available NTIS
National Bureau of Standards, Washington, DC.
4f(13)5f Configuration in the Isoelectronic Sequence of Yb III.
Final rept.
J. F. Wyart, V. Kaufman, and J. Sugar. 1981, 10p
Pub. in Physica Scripta 23, p1069-1078 1981.

Keywords: *Molecular energy levels, *Lutetium, *Hafnium, *Tantalum, *Tungsten, Spectrochemical analysis, Reprints.

Energy levels of the configuration 4f(13)Sf have been observed for the first time in the spectra of Lu IV, Hf V, Ta VI, and W VII and have been interpreted by means of the Slater-Condon theory. The relative positions of two perturbing configurations 4f(12)Sd(2) and 4f(14)5p(5)5f are discussed. The jj coupling scheme provides the best average purity for the labeling of the levels. Three hundred seventy-seven lines have been classified in these four spectra.

704,082
PB82-137423 Not available NTIS
National Bureau of Standards, Washington, DC.
Behavior of a Nonconformal Mixture via Computer Simulation.
Final rept.
H. J. M. Hanley, and D. J. Evans. 1981, 19p
Sponsored in part by Fulbright Foundation, Washington, DC.
Pub. in Int. Jnl. Thermophys. 2, n1 p1-19 1981.

Keywords: Binary systems, Conformity, Methane, Decane, Van der Waals equation, Reprints, *Conformal solution theory, *Molecular dynamics.

A binary 50% mixture of soft spheres is studied via nonequilibrium molecular dynamics, and the equilibrium and nonequilibrium radial distribution functions for a nonconformal mixture with a mass ratio of 10 and a size ratio of about 2 are examined. This model system is related to the real methane/decane mixture, and it is shown that apparently anomalous properties of this mixture, especially the viscosity, could perhaps be understood in terms of the local or ambient mole fraction. In addition, the postulates of the Van der Waals one fluid conformal solution theory are discussed, and a mixing rule for the mass is derived.

704,083
PB82-140575 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 86, Number 5, September-October 1981.
1981, 94p
See also Volume 86, Number 4, PB81-247017, PB82-140583, PB82-140591, PB82-140609, PB82-140617, PB82-140625 and PB82-140633. Library of Congress catalog card no. 63-37059.

Keywords: *Research, Binary systems, Critical point, Density(Mass/volume), Mathematical models, Fluids, Thermal conductivity, Laboratory equipment, Calorimeters, Standards, Cobalt 60, Coulomb potential, Numerical solution.

Contents:
- Prediction of the critical line of a binary mixture: evaluation of the interaction parameters;
- Propagation of density fluctuations in nonuniform fluids: simple models;
- A transient hot wire thermal conductivity apparatus for fluids;
- The graphite calorimeter as a standard of absorbed dose for Cobalt-60 gamma radiation;
- Upper limits for the number of bound states associated with the Yukawa potential;
- A 'Uniformity Principle' for evacuation route allocation.

704,084
PB82-140583
(Order as PB82-140575, PC **A05**/MF **A01**)
Colorado Univ. at Boulder. Dept. of Chemical Engineering.
Prediction of the Critical Line of a Binary Mixture: Evaluation of the Interaction Parameters.
B. E. Eaton, J. Stecki, P. Wielopolski, and H. J. M. Hanley. 23 Mar 81, 9p
Prepared in cooperation with Polish Academy of Sciences, Warsaw. Inst. of Physical Chemistry. Sponsored in part by National Bureau of Standards, Boulder, CO. and National Science Foundation, Washington, DC.
Included in Jnl. of Research of the National Bureau of Standards, v86 n5 p419-427, Sep-Oct 81.

Keywords: *Critical point, *Binary systems, Gibbs free energy, Van der Waals equation, Vapor phases, Liquid phases, Chemical equilibrium.

The critical line of the binary mixture methane-ethane is calculated via the extended corresponding states Van der Waals one fluid theory. The Gibbs free energy criticality criteria are solved numerically. The numerical derivatives are compared with the exact analytical results derived previously for the special case of the shape factors of the extended corresponding states set equal to unity. Binary interaction parameters are adjusted to give a best fit of the critical line to experimental data. These interaction parameters are then used to evaluate vapor liquid equilibrium data away from the critical region. It appears that a fit of the critical line is not sufficient to obtain binary interaction parameters of general applicability. Optimization of the critical point predictions for the pure components is also discussed.

704,085
PB82-140591
(Order as PB82-140575, PC **A05**/MF **A01**)
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Propagation of Density Fluctuations in Nonuniform Fluids: Simple Models.
J. C. Rainwater. 4 May 81, 27p
Included in Jnl. of Research of the National Bureau of Standards, v86 n5 p429-455, Sep-Oct 81.

Keywords: *Density(Mass/volume), *Mathematical models, *Fluids, Rayleigh scattering.

As a first step toward the understanding of Rayleigh-Brillouin scattering from a fluid with a temperature gradient, the author analyzes the initial value problem for certain prototype one-dimensional nonuniform systems. For sufficiently short times and localized initial pulses, it is not necessary to impose actual physical boundaries on the linearly nonuniform system. By a straightforward, though unconventional, application of Fourier and Laplace transform methods, explicit and physically reasonable solutions are constructed for the propagation of fluctuation pulses in space and time according to the nonuniform wave and diffusion equations and a special case of the nonuniform damped wave equation. The analog of the dynamic structure factor is also constructed for the latter two cases.

704,086
PB82-140849 Not available NTIS
National Bureau of Standards, Washington, DC.
Observations of Prebreakdown and Breakdown Phenomena in Liquid Hydrocarbons. II. Point-Plane Geometry.
Final rept.
E. O. Forster, G. J. FitzPatrick, R. E. Hebner, and E. F. Kelley. 1981, 13p
Pub. in Proceedings of Conference on Electrical Insulation and Dielectric Phenomena, White Haven, Pennsylvania, October 26-28, 1981, IEEE Annual Report No. 81CH1668-3, p377-389 1981.

Keywords: *Hydrocarbons, *Liquid phases, Hexane, Cyclohexane, Toluene, Dielectric properties, Electrodes, Optical measurement, Pentane/trimethyl.

Prebreakdown and breakdown phenomena have been measured optically in n-hexane, cyclohexane, isooctane and toluene using a point-plane electrode geometry. The voltage and electrode spacing were adjusted so that breakdown occurred either on the initial high voltage pulse or, in the case of a cathode point, on the positive overshoot following the initial negative pulse. The field strength for breakdown after voltage reversal is about one-third the strength determined using sphere-sphere electrodes and a unipolar pulse. The use of highly purified liquids and the point-plane electrode geometry serves to separate this study from previous ones.

704,087
PB82-140922 Not available NTIS
National Bureau of Standards, Washington, DC.
Prediction of the Viscosity and Thermal Conductivity in Hydrocarbon Mixtures - Computer Program TRAPP.
Final rept.
J. F. Ely, and H. J. M. Hanley. 1981, 10p
Pub. in Proceedings of Gas Processors Association Annual Convention (60th), San Antonio, Texas, March 23-25, 1981, p20-29.

Keywords: *Thermal conductivity, *Hydrocarbons, *Viscosity, *Density(Mass/volume), *Mathematical models, Mixtures, Critical point.

A model for the prediction of the density, viscosity and thermal conductivity of non-polar fluid mixtures over the entire range of pVT states is presented. The model is based on the extended corresponding states model and covers molecular weight ranges including C20. Only pure component equilibrium data such as the critical constants are required as input to the calculation procedure--no transport data are required. Extensive comparisons with experimental data for pure fluids and binary mixtures are presented. The average percentage deviation for both the viscosity and thermal conductivity was observed to be less than 8%. A computer

program (TRAPP) which performs the calculations described in this manuscript is available from GPA.

704,088
PB82-140955 Not available NTIS
National Bureau of Standards, Washington, DC.
Accurate Calculation of Dynamic Stark Shifts and Depopulation Rates of Rydberg Energy Levels Induced by Blackbody Radiation: Hydrogen, Helium, and Alkali-Metal Atoms.
Final rept.
J. W. Farley, and W. H. Wing. May 81, 28p
Pub. in Physical Review A 23, n5 p2397-2424 May 81.

Keywords: *Stark effect, *Blackbody radiation, *Hydrogen, *Helium, *Alkali metals, Atoms, Atomic energy levels, Reprints, *Rydberg series, Numerical solution.

A highly excited (Rydberg) atom bathed in blackbody radiation is perturbed in two ways. A dynamic Stark shift is induced by the off-resonant components of the blackbody radiation. Additionally, electric-dipole transitions to other atomic energy levels are induced by the resonant components of the blackbody radiation. This depopulation effect shortens the Rydberg-state lifetime, thereby broadening the energy level. Calculations of these two effects in many states of hydrogen, helium and the alkali-metal atoms Li, Na, K, Rb and Cs are presented for T = 300 K. Contributions from the entire blackbody spectrum and from both discrete and continuous perturbing states are included. The accuracy is considerably greater than that of previous estimates.

704,089
PB82-141797 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Octanol/Water Partition Coefficients and Aqueous Solubilities of Organic Compounds.
S. P. Wasik, Y. B. Tewari, M. M. Miller, and D. E. Martire. Dec 81, 68p NBSIR-81-2406

Keywords: *Solubility, *Organic compounds, *Water, Gas chromatography, *Partition coefficients, *Octanols, High pressure liquid chromatography, Numerical solution.

A generator column method for measuring the octanol/water partition coefficient, K(o/w) and the aqueous solubility, C sup w sub s, is described. When water is pumped through a generator column packed with solid support coated with an organic stationary phase, an aqueous solution is generated that is in equilibrium with the stationary phase. The solute concentration in the eluted aqueous phase was measured either by high pressure liquid chromatography or by solvent extraction followed by gas chromatographic analysis. Aqueous solubilities and octanol/water partition coefficients of organic solutes, falling into 7 general chemical classes, have been systematically determined using the modified generator column method. From thermodynamics an equation is derived relating K(o/w) to the volume-fraction-based solute activity coefficient in water gamma sup w sub s, the latter being determinable from C sup w sub s. For each class of compounds, excellent linear correlations are found between log K(o/w) and log gamma sup w sub s with slopes close to the theoretical value of unity.

704,090
PB82-143934 Not available NTIS
National Bureau of Standards, Washington, DC.
Configuration Properties of Comb-Branched Polymers.
Final rept.
F. L. McCrackin, and J. Mazur. 1981, 7p
Pub. in Macromolecules 14, n5 p1214-1220 Sep-Oct 81.

Keywords: *Polymers, Gyration, Monte Carlo method, Perturbation theory, Expansion, Reprints, *Molecular configuration, *Branched polymers.

Mean-square radii of gyration were computed for comb-branched polymers simulated by chains on a cubic lattice that incorporated both excluded volume and attractive energies between nonbounded segments of the polymer. The ratios g of the radius of gyration of comb-branched polymer to that of a linear polymer of the same molecular weight at the theta point were found to be larger than the g ratios calculated by the unrestricted random walk model of the polymer. The calculated g ratios were compared with experimental measurements. For the comb-branched polymers, the radii of gyration of the backbones and the expansion factors were also calculated. The radii of gyration of the backbones at the theta conditions were greater than those of linear polymers, in contradiction to the random walk model, which requires that they be equal. The calculated expansion factors were less than those of linear polymers, also in contradiction to perturbation theories based on the random walk model, which predict greater expansion factors for branched polymers than for linear polymers.

704,091
PB82-143983 Not available NTIS
National Bureau of Standards, Washington, DC.
Observation of Prebreakdown and Breakdown Phenomena in Liquid Hydrocarbons.
Final rept.
R. E. Hebner, E. F. Kelley, E. O. Forster, and G. J. FitzPatrick. 1981, 5p
Pub. in Proceedings of International Conference on Conduction and Breakdown in Dielectric Liquids (7th), Berlin, Germany, F.R., July 27-31, 1981, p177-181.

Keywords: *Hydrocarbons, *Liquid phases, *Optical measurement, Hexane, Cyclohexane, Toluene, Cathodes, Anodes, Surfaces, Electrochemistry, Dielectric properties, Pentane/trimethyl.

Prebreakdown and breakdown events under quasi-uniform fields in n-hexane, isooctane, cyclohexane, and toluene have been photographed. For each liquid, two types of breakdown patterns are observed. One pattern is characteristic of growth from the cathode while the other is characteristic of growth from the anode. The measured postbreakdown phenomena were identical in all cases. In addition to the optical studies, microscopic observations showed that organic films were produced on the electrode surface and that lead accumulates preferentially in the area of the electrode surface where breakdown occurs.

704,092
PB82-144031 Not available NTIS
National Bureau of Standards, Washington, DC.
Kirchhoff's and Planck's Radiation Laws for Small Particles in Scattering Atmospheres or Flames.
Final rept.
H. P. Baltes, and J. Geist. 1981, 2p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 26, n6 p535-536 1981.

Keywords: *Flames, *Fundamental constants, Mie scattering, Reprints.

Size and shape effects that modify Planck's radiation law for small enclosures and the emission cross section for small particles do not affect the validity of Kirchhoff's radiation laws when applied to macroscopic collections of small particles such as in scattering atmospheres or flames.

704,093
PB82-144049 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystal Structure of the Low Temperature Phase (II) of Polytetrafluoroethylene.
Final rept.
J. J. Weeks, E. S. Clark, and R. K. Eby. Nov 81, 7p
Pub. in Polymer 22, p1480-1486 Nov 81.

Keywords: *Crystal structure, *Low temperature tests, X ray diffraction, Fluorine organic compounds, Reprints, *Poly(ethylene/tetrafluoro), *Helix molecular structures, Molecular conformation.

An electron diffraction pattern from polytetrafluoroethylene in Phase II was analyzed to determine a chain conformation of 2.1598 CF2 units per turn of the helix. A structure was established from a combination of electron and X-ray diffraction data. The structure contains an ordered repeating pattern of a left-right-handed pair of chain stems. Although the structure is ordered in three dimensions, it cannot be described meaningfully in terms of classical space group nomenclature because very small changes in the structure result in very large changes in the cell parameters. The structure has a volume of 0.03542 cu nm per CF2 group, corresponding to a density of 2344 kg/cu m.

704,094
PB82-144114 Not available NTIS
National Bureau of Standards, Washington, DC.
Kinetic Isotope Effect in the Heterogeneous Reaction of Graphite with H2O (D2O).
Final rept.
J. T. Yates, and D. W. McKee. 15 Sep 81, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 75, n6 p2711-2714, 15 Sep 81.

Keywords: *Graphite, *Water, Surface chemistry, Catalysts, Deuterium compounds, Isotope effect, Reaction kinetics, Reprints, Chemical reaction mechanisms, Heterogeneous reactions.

Thermogravimetric studies have been carried out for the reaction of H2O (D2O) with pure graphite surfaces and with graphite surfaces containing BaCO3 catalyst. At temperatures near 1200 K the kinetic isotope effect has been measured to be about a factor of 2 for both pure graphite and BaCO3-graphite. This value of the ratio of rates for H2O compared to D2O is consistent with zero point energy differences between the two isotopic reactants, and suggests that the transition state in the rate determining step involves a complex in which an O-H bond is being broken. The similarity of the magnitude of the isotope effect for both the catalyzed and the uncatalyzed reaction suggests that in both cases a similar O-H bond breaking mechanism is operative in the rate determining step.

704,095
PB82-144171 Not available NTIS
National Bureau of Standards, Washington, DC.
Resistivity and Piezoelectric Measurements on Oriented and Unoriented Thick PVF2 Films.
Final rept.
A. J. Bur. Sep 81, 2p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Polymer 22, p1288-1289 Sep 81.

Keywords: *Piezoelectricity, *Polymeric films, *Electrical resistivity, Fluorine organic compounds, Electrical faults, Reprints, *Vinylidene fluoride polymers, Thick films.

Poling of unoriented specimens of PVF2 produced unsatisfactory results because the breakthrough (0.5 MV/cm) was too low to allow significant permanent polarization. For oriented specimens, however, it was observed that poling fields of 1 MV/cm and higher could be achieved without experiencing breakdown. With these higher fields oriented thick specimens of PVF2 could be made into piezoelectrically active specimens. In order to investigate the electrical properties of oriented and unoriented PVF2, resistivity measurements were carried out. It was observed that the resistivity for oriented PVF2 was at least an order of magnitude higher than that for unoriented PVF2.

704,096
PB82-144189 Not available NTIS
National Bureau of Standards, Washington, DC.
Heterodyne Frequency Measurements (at 11.6 Micrometers) On Isotopic Species of Carbonyl Sulfide, OC34S, O13CS, OC33S, 18OCS, and O13C34S.
Final rept.
J. S. Wells, F. R. Petersen, A. G. Maki, and D. J. Sukle. 1981, 9p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. Mol. Spectrosc. 89, p421-429 1981.

Keywords: *Isotopes, Molecular energy levels, Absorption spectra, Reprints, *Carbonyl sulfide, Heterodyne spectroscopy, Laser spectroscopy.

Heterodyne frequency measurements between a (13)CO2 laser and tunable diode laser (either tuned or locked to various carbonyl sulfide absorption peaks) have been made on a number of 10 degrees 0-00 degrees 0 band transitions in the isotopic species of carbonyl sulfide: OC(34)S, O(13)CS, OC(33)S, (18)OCS, and O(13)C(34)S. The (13)CO2 laser frequencies primarily resulted from either normal high-J or recently measured hot band (01 sup 11-11 sup 10)I transitions. These OCS frequency measurements have been combined with existing microwave data and new sets of molecular constants obtained. These constants will be used later to orm part of a frequency calibration compendium based on OCS.

704,097
PB82-144197 Not available NTIS
National Bureau of Standards, Washington, DC.

Heterodyne Frequency Measurements of 13CO2 Laser Hot Band Transitions.
Final rept.
F. R. Petersen, J. S. Wells, A. G. Maki, and K. J. Siemsen. 15 Oct 81, 6p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Applied Optics 20, n20 p3635-3640, 15 Oct 81.

Keywords: *Carbon dioxide, *Isotopes, Molecular energy levels, Absorption spectra, Least square method, Molecular vibration, Reprints, *Heterodyne spectroscopy, *Laser spectroscopy, Carbon 13, Oxygen 16.

The frequencies of twenty-eight lines in the P-branch of the 01 sup 1-(11 sup 10, 03 sup 10)I band of 13C16O2, observed in laser emission, and three lines in the R-branch, observed in absorption with a diode laser, have been carefully measured with stabilized CO2 lasers. A significant improvement in the ro-vibrational constants has been obtained from a least squares fit to these data. The laser lines stabilized by saturated absorption techniques provide convenient, accurate (uncertainty less than 0.1 MHz) frequency references near 11.7 micrometers.

704,098
PB82-149071 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Impact Ionization Cross Sections and Rates for Highly Ionized Berylliumlike Ions.
S. M. Younger. Sep 81, 8p
Pub. in Physical Review A 24, n3 p1278-1285 Sep 81.

Keywords: *Beryllium, *Atomic energy levels, Ions, Metastable states, Reprints, *Electron cross sections, Isoelectronic sequences, Numerical solution.

Electron impact ionization cross sections and rates have been calculated for several berylliumlike ions in the 1 doublet S 2 doublet S 1S ground state and the 1 doublet S 2s 2p 3p metastable state using a distorted wave Born-exchange approximation. The ground state cross section showed only minor deviations from classical scaling along the isoelectronic sequence. The 2s2p (3)p cross section was more than twice that of the ground state at carbon III, decreasing to a factor of 1.35 greater at Ar XV. Dominant ground state configuration interaction of the form 2 doublet s + 2 doublet p changed the total cross section by only a few percent. An analytic fit to the distorted wave data is given which allows calculation of non-relativistic electron impact ionization cross sections and rates for berylliumlike ions. A comparison to available experimental data shows good agreement between measurements and distorted wave calculations.

704,099
PB82-149097 Not available NTIS
National Bureau of Standards, Washington, DC.
Optical Heterodyne Saturation Spectroscopy.
Final rept.
J. L. Hall, L. Hollberg, T. Baer, and H. G. Robinson. Nov 81, 3p
Contract N00014-77-C-0656, Grant NSF-PHY79-04928
Pub. in Applied Physics Letters 39, n9 p680-682, 1 Nov 81.

Keywords: *Optical spectra, Absorption, Reprints, *Laser spectroscopy, *Optical heterodyne spectroscopy.

The authors discuss a refined, hybrid rf/optical technique for studying sub-Doppler saturated absorption/dispersion resonances with excellent precision and symmetry. Sensitivity is limited mainly by fundamental noise in the signal. Resonance profiles obtained in I2 are in remarkable agreement with theory. The method promises a new level of accuracy for laser locking to an optical resonance. Nonequilibrium response is also discussed.

704,100
PB82-149113 Not available NTIS
National Bureau of Standards, Washington, DC.
Accurate Wave-Number Measurements of Uranium Spectral Lines.
B. A. Palmer, R. A. Keller, F. V. Kowalski, and J. L. Hall. Aug 81, 5p
Contract N00014-77-C-0656, Grant NSF-PHY79-04928
Pub. in Jnl. Opt. Soc. Am. 71, n8 p948-952 Aug 81.

Keywords: *Uranium, *Thorium, *Wavelengths, Reprints, *Laser spectroscopy.

Wave number measurements made on 10 uranium and 2 thorium transitions using the optogalvanic effect in a hollow cathode discharge to a position in a single-frequency, cw dye laser to the peak of a transition. The wavenumber of the dye laser was measured by comparing it to the wave number of an iodine-stabilized He-Ne laser. The accuracy of the wave number measurements was + or - 0.002/cm with previously reported uranium and thorium measurements whose estimated accuracy was + or - 0.003/cm.

704,101
PB82-149162 Not available NTIS
National Bureau of Standards, Washington, DC.
Energy Calculations of the Crystal Structure of the Low Temperature Phase (II) of Polytetrafluoroethylene.
Final rept.
B. L. Farmer, and R. K. Eby. Nov 81, 9p
Pub. in Polymer 22, p1487-1495 Nov 81.

Keywords: *Crystal structure, *Molecular energy levels, Fluorine organic compounds, Low temperature tests, Reprints, *Poly(ethylene/tetrafluoro), Molecular conformations, Numerical solution.

Energy analysis is used to determine the low energy crystal structure for polytetrafluoroethylene molecules in the 13/6 and 54/25 conformations. The structure for the 54/25 conformation contains an ordered repeating pattern of a left- and right-handed pair of molecules in a unit cell having projected parameters, a', b', and gamma' of 9.60 A, 5.62 A, and 91.4 degrees, respectively. These results, the relative orientations of the molecules, and the relative translations of the molecules are in good agreement with results obtained in a concurrent and independent analysis of diffraction data. Energies calculated for rotational and translational displacements in various modes suggest that a range of structures and a fairly large amount of disorder may be present, also in agreement with experiment.

704,102
PB82-149188 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamic Anomalies at Critical Points of Fluids.
Final rept.
S. C. Greer, and M. R. Moldover. 1981, 33p
Pub. in Annual Review of Physical Chemistry 32, p233-265 1981.

Keywords: *Critical point, *Thermodynamic properties, *Fluids, Reviews, Density(Mass/volume), Phase transformations, Equations of state, Specific heat, Thermal expansion, Reprints.

Recent measurements of the thermodynamic properties of fluids near critical points are reviewed in the context of current theory. Measurements near liquid-vapor and liquid-liquid critical points (consolute points) are considered. The thermodynamic properties reviewed include: the density and composition of coexisting phases in equilibrium, thermal expansion, heat capacity, equation-of-state, and finally the dependence of the density of pure fluids upon height extremely near the critical temperature. Some remarks are made concerning future directions for research. A list of 203 references to relevant literature is included.

704,103
PB82-149204 Not available NTIS
National Bureau of Standards, Washington, DC.
Concentration Dependence of Diffusion Coefficient at Various Molecular Weights and Temperatures.
Final rept.
C. C. Han, and A. Z. Akcasu. Sep 81, 4p
Pub. in Polymer 22, p1165-1168 Sep 81.

Keywords: *Polystyrene, *Diffusion coefficient, Molecular weight, Temperatures, Concentration(Composition), Light scattering, Reprints.

The effect of temperature on the concentration dependence of the diffusion coefficient D(c) is investigated experimentally by light scattering using polystyrene with Mw = 179,000 and 900,000 in toluene and cyclohexane at several temperatures. It is found that D(c) decreases with concentration under theta condition, and increases in good solvents. The continuous transition from theta to good solvent behavior is explored, and the results are compared to the existing theoretical predictions.

704,104
PB82-149790 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamic Light Scattering of Dilute Polymer Solutions in the Nonasymptotic q Region.
Final rept.
C. C. Han, and A. Z. Akcasu. 1981, 5p
Pub. in Macromolecules 14, p1080-1084 Jul-Aug 81.

Keywords: *Light scattering, *Polystyrene, Solutions, Dynamic response, Reprints.

Polystyrene solutions in the dilute region have been studied by dynamic light scattering experiments.

704,105
PB82-149816 Not available NTIS
National Bureau of Standards, Washington, DC.
Comment on Chemical Potentials in Solids.
Final rept.
W. C. Johnson, and J. W. Cahn. 1981, 6p
Pub. in Scripta Metallurgica 15, p1259-1264 1981.

Keywords: *Solids, Free energy, Thermodynamics, Reprints, *Chemical potential, Numerical solution.

In a pair of recent Scripta Metallurgica articles (1,2), Nolfi claims that chemical potentials can be defined for both solid (substitutional) and fluid (interstitial) components in nonhydrostatically stressed materials. This is accomplished assuming that at equilibrium the combined form of the first and second laws of thermodynamics for a closed stressed system can be extended directly to an open system. Unfortunately, the resulting equation is improper for it does not represent correctly the work done by the system. It is the intent of this note to clarify the basic postulates employed by Nolfi in defining equations for chemical potentials in stressed solids and to illustrate that extension from a closed to an open system is not necessarily straightforward.

704,106
PB82-149857 Not available NTIS
National Bureau of Standards, Washington, DC.
Interaction of Zinc Ions with Hydroxylapatite.
D. N. Misra, and R. L. Bowen. Oct 81, 14p
Contract PHS-DE-05129-03
Pub. in Adsorption from Aqueous Solutions, p179-192 Oct 81.

Keywords: *Zinc, *Dental materials, Ions, Teeth, Bones, Adhesives, Reaction kinetics, Chemical bonds, Surface chemistry, Reprints, *Ion molecule interactions, *Hydroxylate.

The interaction between zinc ions in aqueous nitrate solutions and hydroxylapatite, the structural prototype for the principal inorganic constitutent of tooth and bone was studied. The nature of this interaction may be important in elucidating the role of zinc oxide commonly dissolved in the phosphoric acid solutions used to etch hard tooth tissues prior to the application of dental resins. This study also has a direct bearing on the suitability of zinc ions as candidate 'mordants' for use with surface-active comonomers that promote adhesion between restorative resins and hard tooth tissues.

704,107
PB82-149873 Not available NTIS
National Bureau of Standards, Washington, DC.
Tensile Failure of Crystalline Polymers.
A. Peterlin. 1981, 19p
Pub. in Jnl. Macromol. Sci.-Phys. B19, n3 p401-419 1981.

Keywords: *Polymers, *Crystal structure, *Tensile properties, Failure, Reprints.

In the creep experiment the brittle fracture of the unoriented semicrystalline polymers at very small and very high tensile load with the intermediate ductile region may be explained by the competition between the crazing and the shear band formation during the microcrack growth phase. The former type of microcrack growth leads to brittle fracture while the latter type yields the necking which transforms the original lamellar into the final fibrous structure. The actual fate of the strained sample depends on the growth time of the craze, t(g), and of the shear band formation time, ts. If T(g) less than t(s) the material will break in a brittle manner and if t(g) greater than t(s) the material will deform plastically. The failure of the fibrous material seems to occur when the ratio between the average

distance and diameter of the microcracks reaches a value about 3. The microcracks seem to form primarily at the defects of the microfibrillar structure, i.e., at the ends of microfibrils where the axial connection of subsequent crystal blocks through the amorphous layers by a great many taut tie molecules is either completely interrupted or at least drastically reduced. The stress concentration resulting from the opening of these defects into microcracks ruptures some of the adjacent microfibrils. Such nucleation and the subsequent lateral growth of the microcrack ruptures the taut tie molecules in its path. The ruptured molecules yield free radicals which can be monitored by the electron spin resonance.

704,108

PB82-151465 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Characterization of Organometallic Polymers by Chromatographic Methods and Nuclear Magnetic Resonance.
E. J. Parks, R. B. Johannesen, and F. E. Brinckman. Dec 81, 41p NBSIR-81-2424
Sponsored in part by Naval Ship Research and Development Center, Annapolis, MD.

Keywords: *Metal containing organic compounds, *Chromatography, *Nuclear magnetic resonance, Polymers, Antifouling coatings, Line width, Reaction kinetics, Fourier transform spectroscopy, Size exclusion chromatography, Chemical shift(Nuclear magnetic resonance).

Organometallic polymers (OMP) are an increasingly important class of marine surface antifouling agent undergoing intensive development by the U.S. Navy. Candidate OMP's have been characterized at NBS by size exclusion chromatography (SEC) coupled with tin-specific graphite furnace atomic absorption spectroscopy (GFAA) as well as by Fourier transform nuclear magnetic resonance (FT-NMR). The key molecular parameters of many OMP's, the kinetics of formation of a typical copolymer, and the effects of different concentrations of free radical initiators on the formation of a copolymer in a well-stirred reaction system have all been characterized by means of SEC-GFAA chromatograms. FT-NMR spectra of 119Sn have given kinetic information in good agreement with that obtained by SEC-GFAA. Both chemical shift and linewidth of the tin NMR signal have been shown to have an unusually large solvent and temperature dependence. Directions for future research on OMP's are discussed.

704,109

PB82-152034 Not available NTIS
National Bureau of Standards, Washington, DC.
Vibrational State Dependence of Partial Cross Sections and Photoelectron Angular Distributions through Autoionizing Resonances: The n=3 Rydberg State Converging to the B(2) sigma(+1) State of CO(+1).
D. L. Ederer, A. C. Parr, B. E. Cole, R. Stockbauer, J. L. Dehmer, J. B. West, and K. Codling. 1981, 14p
Grants NATO-1735, NATO-1939
Sponsored in part by Office of Naval Research, Arlington, VA., Department of Energy, Washington, DC.
Pub. in Proceedings of the Royal Society (London) A378, p423-435 1981.

Keywords: *Carbon monoxide, *Molecular vibration, Angular distribution, Ions, *Autoionization, *Rydberg series, Franck-Condon principle.

The branching ratios for leaving the CO(+1) ion in a particular vibrational level of the ground X(2) sigma(+) state have been determined as functions of photon energy through the n=3 autoionizing Rydberg state converging to the B(2) sigma(+) state of CO(+) there are substantial differences between theoretical and experimental Franck-Condon factors when 'on' resonance. The branching ratios have been converted into absolute partial cross sections by normalizing to existing data obtained by using line sources. The asymmetry parameter beta has also been determined for each vibrational level in this spectral range. Considerable variations in both have been observed in the region of this resonance.

704,110

PB82-152042 Not available NTIS
National Bureau of Standards, Washington, DC.
II Fluorescence from Barium Atoms Resonantly Photoionized by 584A Radiation.
B. E. Cole, E. B. Saloman, and D. L. Ederer. Dec 81, 5p
Grant NATO-1735
Pub. in Jnl. of the Optical Society of America 71, n12 p1458-1462 Dec 81.

Keywords: *Fluorescence, *Ultraviolet spectroscopy, Photoionization, Excitation, Reprints, *Barium atoms, Autoionization.

The first reported study of fluorescence spectrum of a metal vapor resonantly excited by vacuum-ultraviolet radiation has been made in Ba II. Seven Ba II fluorescent transitions have been identified for Ba vapor excited by 584A radiation. The intensities of these transitions are consistent with the population distribution of excited Ba II observed by using photoelectron spectroscopy. No detectable Ba II fluorescence was observed when 736-742 A excitation was used.

704,111

PB82-152059 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Magnetic Resonance Measurement of Rotational Transitions in the Metastable a(1) delta(g) State of Oxygen.
A. Scalabrin, R. J. Saykally, K. M. Evenson, H. E. Radford, and M. Mizushima. 1981, 8p
Pub. in Jnl. Mol. Spectros. 89, p344-351 1981.

Keywords: *Molecular energy levels, *Oxygen, *Molecular rotation, Excitation, Metastable state, Reprints, *Laser spectroscopy, *Laser magnetic resonance.

Laser magnetic resonance (LMR) for five rotational transitions, of the oxygen molecule (16)O(16)O in its metastable state, a(1)delta(g), nu=0, are observed using six fir laser lines.

704,112

PB82-152067 Not available NTIS
National Bureau of Standards, Washington, DC.
Optical Bistability by an Atomic Vapor in a Focusing Fabry-Perot Cavity.
W. J. Sandle, and A. Gallagher. Oct 81, 12p
Pub. in Physical Review A 24, n4 p2017-2028 Oct 81.

Keywords: *Optical properties, *Sodium, Absorption, Atoms, Mathematical modes, Reprints, *Fabry-Perot surfaces, *Sodium atoms.

The authors report exprimental observations of dispersive- and absorptive-optical bistability due to saturation of the D(1) line of atomic sodium in a tigh-focused Fabry-Perot cavity. Under the conditions of large optical power broadenig and substantial collisional broadening by argon buffer gas used for part of the data, the sodium very nearly behaves as a two-level homogeneously broadened absorber. It thus yields a test of the two-level mean-field optical-bistability model. That model, including homogeneous broadening, fails to account quantitatively for the power levels and power dependencies of the cavity transmission. In particular, this model predicts too rapid an onset of atomic saturation with cavity power. In contrast, predictions of a two-level Gaussian-field optical-bistability model for the dependence of transmitted power as a function of laser power and frequency are confirmed by the experimental data. However, there is a remaining discrepancy in the absolute value of the cavity power.

704,113

PB82-152372 Not available NTIS
National Bureau of Standards, Washington, DC.
Atomic Spectroscopy.
W. L. Wiese, and G. A. Martin. 1981, 10p
Pub. in Physics Vade Mecum AIP 50th Anniversary (Chapter 5), p96-105 1981.

Keywords: *Atomic spectroscopy, Tables(Data), Reprints.

A compendium of definitions of atomic spectroscopic quantities, along with formulae and tables of data which are frequently used by atomic spectroscopists and by scientists who are interested in applications of atomic spectroscopic data to other fields of physics, is presented. Topics covered include the following: Description of spectra, spectroscopic notation and electron coupling schemes; Photon energies and spectral line positions; Wavelength standards; Selection rules for discrete transitions; Atomic wave functions; Spectral line intensities, transition probabilities, f-values, and line strengths; Atomic lifetimes; Hydrogenic (1-electron) spectra; Atoms and ions with two or more electrons; Spectral line shapes, widths and shifts; Spectral continuum radiation.

704,114

PB82-152380 Not available NTIS
National Bureau of Standards, Washington, DC.
Relationship between Reversed-Phase C18 Liquid Chromatographic Retention and the Shape of Polycyclic Aromatic Hydrocarbons,
S. A. Wise, W. J. Bonnett, F. R. Guenther, and W. E. May. Sep 81, 9p
Pub. in Jnl. Chromatographic Science 19, p457-465 Sep 81.

Keywords: *Aromatic polycyclic hydrocarbons, Reprints, *Liquid chromatography, Numerical solution.

A relationship between the shape, particularly the calculated length-to-breadth ratios, of polycyclic aromatic hydrocarbons (PAH) and their reversed-phase C18 liquid chromatographic (LC) retention is described. In general, when isomeric PAH are compared, the LC retention increases with increasing length-to-breadth ratio. Retention data and length-to-breadth ratios for 100 PAH are compared. The elution orders for methyl-substituted fluorenes, anthracenes, phenanthrenes, pyrenes, fluoranthenes, benzo(c)phenanthrenes, benz(a)anthracenes, chrysenes, and benzo(a)pyrenes are reliably predicted from the calculated length-to-breadth ratios.

704,115

PB82-152398 Not available NTIS
National Bureau of Standards, Washington, DC.
Disorder in the Crystal Structures of Phases I and II of Copolymers of Tetrafluoroethylene and Hexafluoropropylene.
J. J. Weeks, R. K. Eby, and E. S. Clark. Nov 81, 4p
Pub. in Polymer 22, p1496-1499 Nov 81.

Keywords: *Crystal structures, *X ray diffraction, Copolymers, Fluorine organic compounds, Reprints, *Ethylene/tetrafluoro, *Propylene/hexafluoro.

X-ray diffraction patterns for oriented and unoriented copolymers of tetrafluoro-ethylene and hexafluoropropylene are presented. They show a transition between 229 and 256K for a copolymer with about 3.4 CF3 per hundred main chain carbon atoms. The lower temperature phase (II) appears to be similar to that of the homopolymer. A primary difference is the presence in the copolymer crystals of small random longitudinal displacements of the molecules caused by the CF3 groups. The displacements increase with increasing CF3 concentration. The higher temperature phase (I) is similar to that of the homopolymer with a difference again being the longitudinal disorder of the copolymer. The difference disappears at higher temperatures as longitudinal disorder is introduced thermally in the homopolymer. At 296K (phase I) the molecular stems in a copolymer with about 3.4 CF3 per hundred main chain carbon atoms are at an angle of 37.1 deg with respect to the normal to the basal plane of the lameilas. In phase II, this number is the same within the limits of error.

704,116

PB82-152463 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of the Viscosity of Compressed Gaseous and Liquid Ethane.
Final rept.
D. E. Diller, and J. M. Saber. 1981, 10p
Pub. in Physica 108A, p143-152 1981.

Keywords: *Viscosity, *Ethane, Temperature, Pressure, Vapor phases, Liquid phases, Isotherms, Reprints, Numerical solution.

The shear viscosity coefficient of compressed gaseous and liquid ethane has been measured at temperatures between 95 and 320 K and at pressures up to 30 MPa (4350 psia) with a torsionally oscillating quarts crystal viscometer. The estimated precision and accuracy of the measurements are about 1 percent and 2 percent respectively. The measurements have been compared with an equation previously proposed for calculating the viscosity of gaseous and liquid ethane. Differences between the equation and the measurements reported here are less than 6 percent. The largest differences are found at low temperatures and high pressures, and along a supercritical isotherm at 320 K (T approximately equal to 1.05 T(c).

704,117
PB82-152471 Not available NTIS
National Bureau of Standards, Washington, DC.
Prediction of Transport Properties. I. Viscosity of Fluids and Mixtures.
Final rept.
J. F. Ely, and H. J. M. Hanley. Nov 81, 10p
Pub. in Ind. Eng. Chem. Fundam. 20, n4 p323-332 Nov 81.

Keywords: *Transport properties, *Viscosity, *Fluids, *Mathematical models, Mixtures, Critical point, Binary systems, Reprints.

A model for the prediction of the viscosity of non-polar fluid mixtures over the entire range of PVT states is presented. The model is an extension of an earlier version (Hanley, 1976) to molecular weights which roughly correspond to that of C20. The proposed model is based on an extended corresponding states principle and requires only critical constants and Pitzer's acentric factor for each component as input. Extensive comparisons with experimental data for pure fluids and binary mixtures are presented. The average deviation between experiment and prediction is 8 percent for pure species and 7 percent for mixtures.

704,118
PB82-152513 Not available NTIS
National Bureau of Standards, Washington, DC.
Pressure as an Important Variable in Thermogravimetric Studies of Polymer Degradations.
Final rept.
B. Dickens. 1981, 4p
Pub. in Proceedings of the European Symposium on Thermal Analysis (2nd), University of Aberdeen, United Kingdom, September 1-4, 1981, p219-222.

Keywords: *Polymers, *Degradations, *Pressure, Thermogravimetry, Activation energy.

Application of the recently developed method of factor-jump thermogravimetry to the study of polymer degradation has provided monitoring of the apparent activation energy during the degradation of a single sample without the necessity of knowing the initial or final sample weight (except to relate the activation energy to extent of reaction). Investigation of the degradation of several polymers in vacuo and under an atmosphere of N2 has shown that bubbles formed in the polymers in vacuum are supressed under N2. The phenomenon is related to that of normal boiling.

704,119
PB82-152596 Not available NTIS
National Bureau of Standards, Washington, DC.
Coadsorption-Induced Azimuthal Ordering in Molecular Adsorbate Layers: H2O and NH3 on Oxygen-Precovered Ni(111).
F. P. Netzer, and T. E. Madey. Sep 81, 4p
Sponsored in part by Office of Naval Research, Arlington, VA., and Max Kade Foundation, New York.
Pub. in Physical Review Letters 47, n13 p928-931, 28 Sep 81.

Keywords: *Surface chemistry, *Molecular structure, *Reaction kinetics, *Nickel, *Ammonia, *Water, Chemisorption, Oxygen, Desorption, Azimuth, Reprints, Electron stimulated desorption ion angular distributions, Low energy electron diffraction.

The structure and kinetics of NH3 and H2O interacting with oxygen predosed on a Ni(111) surface have been studied using ESDIAD (electron stimulated desorption ion angular distributions), LEED (low energy electron diffraction) and thermal desorption methods. The adsorption of either NH3 or H2O onto clean Ni(111) produces adsorption geometries in which the orientation of the H ligands in a fractional monolayer is random. When either NH3 or H2O is adsorbed on Ni(111) predosed with traces of oxygen, a three-fold symmetric ESDIAD pattern results, indicating a high degree of azimuthal ordering in the adsorbed NH3 and H2O in the absence of long-range order. The azimuths of the H ligands are in (112) directions.

704,120
PB82-152604 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Initiated Chain Reactions: A Generalized Extension to Complex Chemical Chain Systems.
D. J. Nesbitt, and S. R. Leone. Nov 81, 11p
Contract DOE-EA-77-A-01-6010, Grant NSF-PHY79-04928
Sponsored in part by National Science Foundation, Washington, DC. Grant NSF-CHE79-11340.
Pub in Jnl. of Chemical Physics 75, n10 p4949-4959, 15 Nov 81.

Keywords: *Reaction kinetics, Chemical reactions, Vapor phases, Halogens, Reprints, *Laser photolysis spectroscopy, Free radicals, Laser spectroscopy.

The authors present a generalized extension of the detailed kinetic and experimental analysis for studying rapid gas phase chemical chain reactions initiated by short pulse laser photolysis.

704,121
PB82-152620 Not available NTIS
National Bureau of Standards, Washington, DC.
Excimer Laser Photolysis Studies of Translational-to-Vibrational Energy Transfer.
F. Magnotta, D. J. Nesbitt, and S. R. Leone. Oct 81, 5p
Grants NSF-PHY79-04928, NSF-CHE79-11340
Pub. in Chemical Physics Letters 83, n1 p21-25 Oct 81.

Keywords: *Molecular vibrations, *Energy transfer, Photolysis, Excitations, Reprints, *Laser photolysis spectroscopy, Laser spectroscopy.

A new technique is presented to study translation-to-vibrational (T-V) energy transfer and translationally enhanced reactive events. The method utilizes excimer laser photolysis to produce translationally 'hot' atoms and time-resolved infrared detection of specific excited states.

704,122
PB82-152638 Not available NTIS
National Bureau of Standards, Washington, DC.
Precision Measurement of the Ground-State Hyperfine Constant of 25Mg+.
W. M. Itano, and D. J. Wineland. Sep 81, 10p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC., Office of Naval Research, Arlington, VA., and National Research Council, Washington, DC.
Pub. in Physical Review A 24, n3 p1364-1373 Sep 81.

Keywords: *Magnesium, *Hyperfine structure, Ions, Atomic energy levels, Reprints, Laser spectroscopy.

The ground-state hyperfine constant A and the nuclear to electronic g factor ratio, g(I)/g(J), of (25)Mg(+1) have been measured by a laser optical-pumping double-resonance technique.

704,123
PB82-152695 Not available NTIS
National Bureau of Standards, Washington, DC.
Nascent Product Vibrational State Distributions of Ion-Molecule Reactions: The H + F- yields HF(v) + e- Associative Detachment Reaction.
T. S. Zwier, J. C. Weisshaar, and S. R. Leone. Nov 81, 8p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC., and National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 75, n10 p4885-4892, 15 Nov 81.

Keywords: *Hydrogen fluoride, *Molecular relaxation, Chemical reactions, Vibrational spectra, Excitation, Reprints, *Ion molecule interactions.

The nascent product vibrational state distribution is obtained for the thermal energy associative detachment reaction H + F(1) yields HF(v) less than or equal to 5) + e(-), delta H = -57.0 kcal/mole. The release of the very light electron as one of the reaction products places severe angular momentum constraints on the reaction system. A simple kinematic model predicts a highly non-Boltzmann HF rotational state distribution which increases with increasing J up to some cut-off level. The high degree of vibrational excitation in the HF product suggests an HF(-1) autodetachment lifetime which is short compared to an HF vibrational period.

704,124
PB82-152703 Not available NTIS
National Bureau of Standards, Washington, DC.
Study of Temperature and Hydrogen Induced Reconstruction and Reordering of W(100) by Polarized Electron Scattering (Summary Abstract).
G. C. Wang, D. T. Pierce, and R. J. Celotta. Mar 81, 3p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Vacuum Science and Technology 18, n2 p647-648 Mar 81.

Keywords: *Tungsten, *Electron scattering, Hydrogen, Polarization, Chemisorption, Temperature, Reprints.

The intense polarized electron beam obtained by photoemission from negative electron affinity GaAs(100) was used to scatter electrons from the W(100) high temperature (1x1) phase, the (square root of 2 x square root of 2) R45 phase (produced by cooling below 370K), and the room temperature hydrogen chemisorbed C(2x2) and (1x1) phases in order to study the structure changes due to hydrogen chemisorption and temperature variation.

704,125
PB82-152752 Not available NTIS
National Bureau of Standards, Washington, DC.
Radical Redistribution of the 4d Oscillator Strength Observed in the Photoabsorption of the Ba, Ba+, and Ba++ Sequence.
T. B. Lucatorto, T. J. McIlrath, J. Sugar, and S. M. Younger. Oct 81, 5p
Pub. in Physical Review Letters 47, n16 p1124-1128, 19 Oct 81.

Keywords: *Barium, *Ultraviolet spectroscopy, *Atomic energy levels, Oscillations, Ionization, Reprints, *Barium ions.

The vacuum ultraviolet absorption spectra of isolated Ba, Ba(+1), and Ba(+2) have been measured. In Ba and Ba(+1) most of the 4d absorption oscillator strength is in the continuum, but in Ba(+2) several very strong discrete transitions are observed. Such behavior has never before been observed in the 4d photoabsorption of vapors, solids, or compounds. An interpretation is given in terms of the partial collapse of the nf bound state in Ba(+2).

704,126
PB82-155201 Not available NTIS
National Bureau of Standards, Washington, DC.
High Polymer Physics.
Final rept.
R. K. Eby, M. G. Broadhurst, S. S. Chang, G. T. Davis, E. A. DiMarzio, B. M. Fanconi, C. C. Han, F. A. Khoury, H. Markovitz, J. E. McKinney, F. I. Mopsik, E. Passaglia, I. C. Sanchez, D. L. VanderHart, and I. J. Zapas. Oct 81, 14p
Pub. in AIP Anniversary Physics Vade Mecum (5th), Chapter 13, p196-209 Oct 81.

Keywords: *Polymers, Molecular weight, Nuclear magnetic resonance, Crystal structure, Chemical bonds, Mechanical properties, Optical properties, Electrical properties, Diffusion, Specific heat, Reprints.

This is the High Polymer Physics Chapter of a Physics Handbook which will be published by the American Institute of Physics in 1981 or 1982 to commemorate the 50th Anniversary of the AIP. Dr. Herbert Anderson of Los Alamos is the editor of the Handbook. In agreement with the other chapters, this chapter gives important formulas, equations, and numerical data on defined systems. It also gives data useful for experimental design. Some of the latter data are on less well designed systems. The sections of the chapter are Introduction, Polymer Molecules, Molecular Weight Averages, Chain Dimensions, Theta Solvents and Temperatures, Molecular Weight Characterization, Characterization in Solution by NMR, Crystal Structures, Bond Lengths and Bond Angles, Melting and Crystallization, Optical Properties, Heat Capacity, Glass Transition, Densification of Polymeric Glasses, Stress sigma(ij) and Displacement uj at Crack Tips, Internal Friction Peaks in Semicrystalline Polymers, Mechanical Properties of Some Common Structural Polymers, Rheology, Electrical Properties, and Diffusion and Permeation. The chapter gives references to sources of more detailed information. The Handbook is aimed at physicists not engineers or non-physicist specialists. It is not intended to be instructional with derivations or explanations beyond those absolutely necessary to explain the formulas, data, and equations.

704,127
PB82-171091 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.

Compilation of Thermodynamic and Transport Properties of Aqueous Potassium Hydroxide.
Interim rept.
R. E. Joseph, and B. R. Staples. Jun 81, 20p NBSIR-81-2356
Contract DOE-EW-78-X-03-0509
Prepared in cooperation with California Univ., Berkeley. Lawrence Berkeley Lab.

Keywords: *Potassium hydroxides, *Thermodynamic properties, *Transport properties, Temperature, Concentration(Composition), Pressure, Sources, Solutions.

A detailed compilation of sources of data for the thermodynamic and transport properties of aqueous potassium hydroxides are presented. All ranges of temperature, concentration, and pressure are included.

704,128
PB82-192493 Not available NTIS
National Bureau of Standards, Washington, DC.
Heterodyne Frequency Measurements on Carbonyl Sulfide Near 1050 cm-1.
Final rept.
J. P. Sattler, T. L. Worchesky, A. G. Maki, and W. J. Lafferty. 1981, 6p
Sponsored in part by Harry Diamond Labs., Adelphi, MD.
Pub. in Jnl. of Mol. Spectrosc. 90, p460-466 1981.

Keywords: Infrared spectroscopy, Reprints, *Sulfide/carbonyl, *Laser spectroscopy.

Heterodyne techniques have been used to measure the frequency differences between carbonyl sulfide (OCS) absorption lines and CO2 laser transitions. A tunable diode laser was used to both scan the OCS absorption spectrum and provide a beat signal against a CO2 laser. Frequency differences as great as 8.6 GHz have been measured. Many different OCS hot-band transitions were measured near 1050/cm-1, and the measurements on the 02 degree 0-00 degree 0 band have been extended to such high J levels (J=86) that higher order centrifugual distortion terms are needed to fit the data.

704,129
PB82-194150 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Thermal Conductivity of a Polyurethane Foam from 95 K to 340 K.
L. L. Sparks. Mar 82, 23p NBSIR-82-1664
Sponsored in part by Gas Research Inst., Chicago, IL.

Keywords: *Thermal conductivity, *Polyurethane resins, Foam, Laboratory equipment, Numerical solution.

Values of thermal conductivity for a 32 kg/cum, CCl3F blown polyurethane foam are presented in the temperature range from 95 to 340 K. These data were obtained using a guarded-hot-plate apparatus (ASTM C 177). The apparent conductivity is discussed in terms of contributions from radiation and solid and gas conduction. Heat transfer via gas convection is not significant when the cell diameters are less than approximately 3 mm; cell dimensions of the thermal conductivity specimen are on the order of 0.5 mm.

704,130
PB82-195181 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrical Impedance Spectra of Trans-Polyacetylene.
Final rept.
C. K. Chiang, and A. D. Franklin. Feb 82, 5p
Pub. in Solid State Communications 40, n8 p775-779 Feb 82.

Keywords: *Polyacetylene, Transport properties, Reprints, *Electrical impedance spectroscopy.

The electrical impedance spectra of trans-polyacetylene were studied. Using an equivalent circuit model, the impedance could be separated into two components. One component was identified as involving an intrinsic conduction which showed classical semiconductor behavior; the other component was identified as an inhomogeneity contribution. The results are discussed in terms of various transport experiments and models.

704,131
PB82-195231 Not available NTIS
National Bureau of Standards, Washington, DC.
Comments on the Requirements for a General Stark Broadening Theory.
Final rept.
R. L. Greene. 1982, 6p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 27, n2 p185-190 1982.

Keywords: *Stark effect, *Line width, Reprints, Kangaroo process model.

An analysis is made of requirements for a general theory of Stark broadening applicable to both strong and weak collisions. It is pointed out in particular that inclusion of the static and weak interaction limits is not sufficient to obtain a generally valid theory. At least one other condition is necessary - a dynamic correction for strong, primarily static, collisions. The kangaroo process model microfield method is examined from this point of view, and it is shown that the model conditional probability leads to an incorrect functional form for the lowest order dynamic correction.

704,132
PB82-195249 Not available NTIS
National Bureau of Standards, Washington, DC.
Copper Isoelectronic Sequence: Ba27+-W45+.
Final rept.
J. Reader, and G. Luther. 1981, 6p
Pub. in Physica Scripta, v24 p732-737 1981.

Keywords: *Barium, *Dysprosium, *Erbium, *Gadolinium, *Neodymium, *Samarium, *Tantalum, *Tungsten, *Ytterbium, Atomic energy levels, Ionization potentials, Reprints, Laser spectroscopy.

The spectra of the copper-like ions Ba(27+), La28+), Nd(31+), Sm(33+), Gd(35+), Dy(37+), Er(39+), Yb(41+), Ta(44+), and W(45+) have been observed with a laser-produced plasma and a 2.2m grazing incidence spectrograph. Wavelengths, energy levels, and ionization energies are presented for each of these ions.

704,133
PB82-195256 Not available NTIS
National Bureau of Standards, Washington, DC.
Pyroelectricity and Charge Transport in a Copolymer of Vinylidene Fluoride and Tetrafluorethylene.
Final rept.
M. G. Broadhurst, G. T. Davis, A. S. DeReggi, S. C. Roth, and R. E. Collins. Jan 82, 8p
Sponsored in part by Sydney Univ. (Australia).
Pub. in Polymer 23, p21-28 Jan 82.

Keywords: *Pyroelectricity, *Piezoelectricity, Copolymers, Reprints, *Ethylene/tetrafluoro, *Vinylidene fluoride polymers.

A copolymer of vinylidene fluoride and tetrafluoroethylene shows pyroelectric and piezoelectric effects after poling. Thermal pulsing measurements indicate that the polarization in this material is highly nonuniform. The piezo/pyroelectric response of this nonuniformly poled copolymer consists of two parts: a rapid response that is the result of changes in internal polarization, and a delayed response due to reversible motion of real charge through the bulk of the material. This model explains previously reported observations of the independence of pyroelectric response over a wide range of poling conditions.

704,134
PB82-198631 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Relaxation in a Dense Liquid Under Shock Compression.
Final rept.
D. H. Tsai, and S. F. Trevino. Nov 81, 15p
Sponsored in part by Army Armament Research and Development Command, Dover, NJ.
Pub. in Physical Review A24, n5 p2743-2757 Nov 81.

Keywords: *Shock tests, *Liquid phases, Density measurement, Reprints, *Thermal relaxation, Lennard-Jones system.

The authors have studied the molecular dynamics of the propagation of a planar shock wave in a dense, three-dimensional column of a simple Lennard-Jones liquid. The column is 18 unit cells (fcc) in cross-section, 144 unit cells in length and contains about 10,000 atoms. The column is initially in equilibrium at a density of .85/delta to the third power and temperature of 1.16 epsilon/k. Shock compression is effected by causing the column to move in the longitudinal direction with a velocity of -U(p) and to collide with its mirror image across a mirror located at the origin. From the motion of the atoms in response to this kind of excitation, we calculate the shock velocity and the shock front structure in the liquid, as well as the profiles of mass density, stress distribution and energy density behind the shock front. Their shock front structure agrees well with that obtained from the Navier-Stokes equations, but they also find important differences between their shock profiles and those postulated or computed from the continuum theory. In particular, they find that in 4.1 x 10 to the -11th power s, the longest time of their calculations, the stress components did not relax to a hydrostatic condition, but the corresponding kinetic temperature profile showed a relaxation process similar to what they found earlier in a crystalline solid. They examine the atomistic mechanisms of the various relaxation processes, and discuss their implications on the shock compression of dense systems of solids and liquids as opposed to rare systems of gases.

704,135
PB82-198649 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Conductivity of Liquid Propane.
Final rept.
H. M. Roder, and C. A. Nieto de Castro. Jan 82, 4p
Pub. in Jnl. of Chemistry and Engineering Data 27, n1 p12-15 Jan 82.

Keywords: *Thermal conductivity, *Propane, Liquid phases, Reprints, Numerical solution.

The paper presents new experimental measurements of the thermal conductivity of liquid propane for seven isotherms from 110 to 300 K with pressures to 70 MPa, i.e., a total density range of 11 to 16.5 mol/L (484-726 kg/cu m). It is estimated that the overall uncertainty in the thermal conductivity is 1.5 percent. The data can be represented with an equation which is based on an existing correlation. The data are compared to the experimental measurements of others in the liquid state. Values for the saturated liquid are established using the equation.

704,136
PB82-198680 Not available NTIS
National Bureau of Standards, Washington, DC.
Accordion Type Laser-Raman (ALR) Scattering by Drawn Linear Polyethylene (LPE).
Final rept.
A. Peterlin, and R. G. Snyder. 1981, 11p
Pub. in Jnl. Polym. Sci., Polym. Phys. Ed. 19, p1727-1737 1981.

Keywords: *Raman spectroscopy, *Polyethylene, Reprints, *Laser spectroscopy.

The ALR scattering of LPE samples as drawn may be interpreted as corresponding to straight all trans conformation stems in the crystal blocks which are obtained after introducing one randomly located gauche defect per about 5 straight stems of the ideal lattice of the crystal blocks. The gauche defects seem to be created by the drawing process. The number of such defects decreases during the annealing. The gauche defect interrupts the LAM oscillation of the all trans sequences so that instead of the ALR scattering of the full stem length of the block one observes the independent scattering of the two straight sections on both sides of the defect. As a consequence the ALR scattering intensity extends to high wave numbers corresponding to much shorter straight chain stems as one would expect from the thickness of the crystalline core of the folded chain blocks of the fibrous material.

704,137
PB82-198722 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Transfer to and from Molecules with Interacting Multiple Redox Centers.
Final rept.
W. T. Yap, and R. A. Durst. 1981, 6p
Pub. in Jnl. of Electroanalytical Chemistry 130, p3-8 1981.

Keywords: *Molecules, Voltmeters, Oxidation reduction reaction, Reprints, *Electron transfer.

A theoretical analysis is given for electron transfer in molecules with interacting multiple redox centers such as dimers, oligomers and polymers, and for voltammetric techniques such as dc polarography and rotating disk voltammetry. The analysis takes account of the interactions between nearest-neighboring centers

only. The determination of the interaction energies from the experimental current-potential curves is illustrated.

704,138
PB82-199233 Not available NTIS
National Bureau of Standards, Washington, DC.
Bound-State and Finite-Collision-Time Effects in the Binary Collision Approximation.
Final rept.
M. C. Marchetti, and J. W. Dufty. Oct 81, 19p
Pub. in Physical Review A24, n4 p2116-2134 Oct 81.

Keywords: *Binary systems(Materials), *Collision cross sections, Potential theory, Reprints, *Atom atom interactions, *Bound particles, Finite element analysis.

The kinetic theory for time-correlation functions at low density is studied for potentials with bound states and finite collision times. The contribution to the binary-collision operator from bound pairs of atoms with arbitrarily large interaction times is shown to exist and to vanish for times large compared to the characteristic scattering time, justifying the Boltzmann limit for potentials with attractive parts. The effects of such bound states and finite collision times on the short-time behavior of correlation functions are illustrated by a detailed calculation of the velocity-autocorrelation function for a square-well potential. Good agreement with the corresponding results from molecular dynamics is obtained.

704,139
PB82-199241 Not available NTIS
National Bureau of Standards, Washington, DC.
Photon-Stimulated Desorption and Other Spectroscopic Studies of the Interaction of Oxygen with a Titanium (001) Surface.
D. M. Hanson, R. L. Stockbauer, and T. E. Madey. 15 Nov 81, 9p
Pub. in Physics Review B24, n10 p5513-5521, 15 Nov 81.

Keywords: *Oxygen, *Surface chemistry, *Titanium, Adsorption, Reprints, Photon stimulated desorption, Electron stimulated desorption, Ultraviolet photoemission spectroscopy.

Synchrotron radiation at the NBS SURF II facility has been employed to study the adsorption of oxygen on a ti(001) surface using photon stimulated desorption (PSD), electron stimulated desorption (ESD), and ultraviolet photoemission spectroscopy (UPS). The dominant ESD and PSD products observed for oxygen exposures greater than one Langmuir are 0(+) ions having a most probable kinetic energy of about 3eV. The photon energy dependence of the PSD ion yield is similar to the major features of the constant final state secondary electron yield although there are some differences in detail. This similarity is consistent with the 0(+) desorption being initiated by the production of a Ti 3p core hole as suggested by the Knotek - Feibelman Auger decay mechanism. The dependence of the 0(+) ion yield on oxygen exposure and surface temperature is compared with UPS and work function measurements. These data indicate that surface oxidation occurs at temperatures as low as 90K and that at least a fraction of the surface oxide is electronically similar to the maximal valency compound TiO2.

704,140
PB82-199290 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Resolution Infrared Spectrum and Structure Determination for Carbon Diselenide (CSe2).
Final rept.
A. G. Maki, and R. L. Sams. 1981, 7p
Pub. in Jnl. Mol. Spectrosc. 90, p215-221 1981.

Keywords: *Infrared spectroscopy, *Molecular structure, Chemical bonds, Reprints, *Carbon diselenide.

Measurements are given for the 2(nu1+nu3) and 2(nu2+nu3) bands (at 2031 and 1922/cm, respectively) of an isotopically enriched sample of C80Se2. Band centers and rotational constants are given for the two bands. The ground-state rotational constant is found to be B(0)=0.0367831 + or - 0.0000100/cm and the equilibrium C-Se bond length is determined to be 1.6917 + or - 0.0015 A, slightly smaller than that in OCSe.

704,141
PB82-199316 Not available NTIS
National Bureau of Standards, Washington, DC.
Series Formulae for the He I-Like Spectra Na X Through Ar XVII (Z=11-18).
Final rept.
W. C. Martin. 1981, 7p
Pub. in Physica Scripta v24 p725-731 1981.

Keywords: *Atomic energy levels, *Atomic spectra, Sodium, Magnesium, Aluminum, Silicon, Phosphorus, Sulfur, Chlorine, Argon, Reprints, Isoelectronic sequences.

The constants in Rydberg-Ritz formulae have been evaluated for 1snl series by fitting the lowest few terms. Each formula allows prediction of the energies of all terms of a particular type in a particular spectrum.

704,142
PB82-199340 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Stress and the Chemical Equilibrium of Small Crystals. II. Solid Particles Embedded in a Solid Matrix.
Final rept.
J. W. Cahn, and F. Larche. 1982, 6p
Pub. in Acta. Metallurgica 30, p51-56 1982.

Keywords: *Chemical equilibrium, *Surfaces, *Crystals, Thermodynamics, Reprints.

The equilibria of small solid particles embedded in a solid matrix are considered. Three interface quantities of significance, an interfacial free energy representing the work of creating the interface and two interfacial stresses. One represents the work of stretching the interface while the other represents the work of stretching one crystal holding the other fixed and thereby altering the structure of the interface. The isotropic case is developed in detail. Several new effects result from the partial accommodation in the matrix of the stress field due to interfacial stress. An elastic accommodation factor modifies the capillary contribution to the pressure in the particle, the chemical potentials and the Gibbs-Thomson effect. Diffusion potentials but not chemical potentials are constant throughout the system. Coherent and incoherent nucleation is reexamined.

704,143
PB82-199399 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Silicon Dioxide Surface-Layer Thickness on Boron Profiles for Directly Aligned Implants into (100) Silicon.
Final rept.
D. R. Myers, J. Comas, and R. G. Wilson. May 81, 3p
Sponsored in part by Naval Research Lab., Washington, DC., and Hughes Research Labs., Malibu, CA.
Pub. in Jnl. of Applied Physics 52, n5 p3357-3359 May 81.

Keywords: *Silicon dioxide, *Surfaces, *Semiconductor doping, *Silicon, Profiles, Boron, Reprints, *Ion implantation.

The authers report boron profiles as determined by secondary ion mass spectrometry that result from implantation into (100) silicon at (0.0 + or - 0.1) degrees through various thicknesses of thermal grown silicon dioxide. The implants were performed at room temperature at 150 keV to a fluence of 4.0 x 10 to the 13th power/sq cm. The oxide surface layers examined were 7.6, 33.6, 101.5, or 140.0 nm thick as determined by ellipsometry. The boron profile for implantation through the 7.6-nm oxide surface layer was only slightly degraded from that seen for accurately aligned implantations into bare (100)-oriented silicon, while implantation through the three thicker oxides results in profiles similar to those obtained from random equivalent implantations into crystalline silicon. The systematics of the dechanneling of the implanted boron as a function of the thickness of the amorphous surface layer are analyzed and discussed.

704,144
PB82-199407 Not available NTIS
National Bureau of Standards, Washington, DC.
Direct Detection of Vibrational Excitation in the CO2 Product of the Oxidation of CO on a Platinum Surface.
Final rept.
S. L. Bernasek, and S. R. Leone. Dec 81, 5p
Grants NSF-PHY79-04928, NSF-CHE79-11340
Pub. in Chemical Physics Letters 84, n2 p401-404 1 Dec 81.

Keywords: *Carbon monoxide, *Surface chemistry, Chemiluminescence, Platinum, Oxidation, Reprints.

Infrared chemiluminescence techniques are applied to the study of vibrationally excited surface reaction products. The method is demonstrated by the detection of infrared emission from highly excited CO2 product molecules in the reaction of CO with O on a platinum surface.

704,145
PB82-199423 Not available NTIS
National Bureau of Standards, Washington, DC.
Disappearance of Impurity Levels in Silicon and Germanium Due to Screening.
Final rept.
J. R. Lowney, A. H. Kahn, J. L. Blue, and C. L. Wilson. Jun 81, 5p
Pub. in Jnl. of Applied Physics 52, n6 p4075-4080 Jun 81.

Keywords: *Silicon, *Germanium, Semiconductors, Impurities, Atomic energy levels, Finite element analysis, Reprints, Eigenvalues, Eigenfunctions.

The authors studied the disappearance of impurity levels in Si and Ge due to free-carrier screening of the Coulomb field of the impurity ions. The ground state eigenfunctions and eigenvalues have been calculated for electrons described by an ellipsoidal effective-mass Hamiltonian. A two-dimensional finite element analysis was used to obtain the solutions. Only moderate carrier densities (10 to the 19th power/cc for Si and 10 to the 18th power/cc for GE) are needed to cause the impurity levels to disappear into the conduction band, the result at high doping densities being simply a degenerate semiconductor.

704,146
PB82-199464 Not available NTIS
National Bureau of Standards, Washington, DC.
Structural Factor in Chemisorption and Heterogeneous Catalysis: A Review.
Final rept.
J. T. Yates. 1981, 8p
Pub. in Vacuum 31, n10-12 p715-722 1981.

Keywords: *Catalysis, *Chemisorption, Surface chemistry, Reaction kinetics, Mathematical models, Reprints, *Heterogeneous reactions.

The authors have now entered an era where the influence of surface structure on the kinetics of catalytic processes may be directly investigated using single crystal substrates. Catalytic processes whose rates are sensitive to substrate structure, and those which seem to be structure insensitive have now been studied, and several examples are described here. It is shown that there may be large differences in both reactivity and reaction mechanism for ordered and disordered chemisorbed species. It is also shown that structure insensitive heterogeneous reactions may occur in cases where the coverage of a reactant is below one monolayer--suggesting that the leveling of crystallographic differences between different planes by an adsorbate is not a useful general model for explaining rate insensitivity to substrate structure. Conversely, structural sensitivity may occur in cases where a high coverage of adsorbate is present, again in violation of the general model. Because of the many complex factors known to be involved in governing the rate of a heterogeneous catalytic reaction, it is concluded that there may be a number of system-dependent explanations for the common occurrence of structural insensitivity, and that a general model for this surprising behavior may not exist.

704,147
PB82-199480 Not available NTIS
National Bureau of Standards, Washington, DC.
Elasticity Coefficients of Nematic Liquid Crystals.
Final rept.
I. Pardowitz, and S. Hess. Feb 82, 5p
Pub. in Jnl. of Chemical Physics 76, n3 p1485-1489 Feb 82.

Keywords: *Liquid crystals, *Elastic properties, Gibbs free energy, Reprints, *Nematic phase.

A Ginsburg-Landau type ansatz for the Gibbs free energy is introduced which involves the alignment tensors of rank 2 and 4 and their spatial derivatives. It is applicable to both the isotropic and nematic phases. The Frank elasticity coefficients of the nematic phase are expressed in terms of the equilibrium order param-

eters and phenomenological coefficients which are related to bare correlation length coefficients. The full anisotropy of the elasticity coefficients is obtained and their experimentally observed temperature dependence can be reproduced for all the ten substances which have been analyzed.

704,148
PB82-199506 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamic Properties of the Chemical Elements.
Final rept.
D. Garvin. 1981, 3p
Pub. in Bulletin Alloy Phase Diagrams 2, n2 p261-262 1981.

Keywords: *Thermodynamic properties, *Elements, Entropy, Specific heat, Enthalpy, Reprints.

A table is provided of entropies and heat capacities at 298.15 K enthalpy differences between 298.15 K and O K and enthalpies of sublimation at O K for the chemical elements. The values are drawn from major critical evaluations of chemical thermodynamic properties.

704,149
PB82-199522 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Spectrum of Boron Chloride (BCl).
Final rept.
A. G. Maki, F. J. Lovas, and R. D. Suenram. 1982, 6p
Pub. in Jnl. Mol. Spectrosc. 91, p424-429 1982.

Keywords: *Infrared spectroscopy, Reprints, *Boron chloride, *Laser spectroscopy.

The spectrum of the delta v = 1 band of BCl has been measured between 828 and 870/cm with a tunable diode laser.

704,150
PB82-199530 Not available NTIS
National Bureau of Standards, Washington, DC.
Ag I Isoelectronic Sequence: Wavelengths and Energy Levels for I VII through La XI.
Final rept.
V. Kaufman, and J. Sugar. 1981, 4p
Pub. in Physica Scripta 24, n4 p738-741 1981.

Keywords: *Molecular energy levels, *Wavelengths, Barium, Cesium, Iodine, Xexon, Lanthanum, Reprints, Isoelectronic sequence.

New and more complete observations of the Ag I isoelectronic sequence from I VII through La XI are used to derive energy levels and ionization energies for these ions. Predictions are obtained from these data for the positions of the 4 double f F levels based on estimated values for the 5g effective quantum number n.

704,151
PB82-210113 Not available NTIS
National Bureau of Standards, Washington, DC.
Extended Analysis of Doubly Ionized Thorium (Th III).
Final rept.
J. F. Wyart, and V. Kaufman. 1981, 12p
Pub. in Physica Scripta 24, n6 p941-952 1981.

Keywords: *Thorium, *Ultraviolet spectroscopy, Ionization, Molecular energy levels, Reprints.

The sliding spark spectrum of thorium has been observed and measured in the range 500-1500A. This has led to the classification of 488 lines as transitions between 98 new levels and 77 previously known levels of Th III.

704,152
PB82-210147 Not available NTIS
National Bureau of Standards, Washington, DC.
Dielectronic Recombination in Collision of Electrons with Multicharged Ions.
Final rept.
L. J. Roszman. 1982, 20p
Pub. in Proceedings of International Conference on the Physics of Electronic and Atomic Collisions (12th), Gatlinburg, TN, July 15-21, 1981, Paper in Physics of Electronic and Atomic Collisions, p641-653 1982.

Keywords: *Electron ion interactions, Autoionization.

This paper was one of the invited papers of the XII International Conference on the Physics of Electronic and Atomic Collisions, held at Gatlinburg, Tennessee, 15-21 July, 1981.

704,153
PB82-210220 Not available NTIS
National Bureau of Standards, Washington, DC.
A.C. Induced Corrosion: The Effect of an Alternating Voltage on Electrodes under Charge - Transfer Control.
U. Bertocci. May 79, 5p
Contract E(49-1)-3800
Pub. in Corrosion 35, n5 p211-215 May 79.

Keywords: *Alternating current, *Corrosion, *Electrodes, Electrochemistry, Reaction kinetics, Reprints.

The equation relating current to voltage for an electrode under charge-transfer control has been solved for a sinusoidal modulation of the electrode potential. The rectified faradaic component has been obtained, so as to derive its value as a function of the Tafel parameters and of the amplitude of the modulating voltage, as well as of average electrode potential. The case where one electrode reaction is under diffusion control also has been treated. The amplitude and phase characteristics of the harmonic components have been derived, and their use for determing the kinetic properties of the electrode have been discussed. The capacitative current generated by the alternating voltage also has been investigated, and the conditions under which it can be separated from the faradaic current have been given. The implications of these results on the corrosion due to a.c. leakage have been examined.

704,154
PB82-210246 Not available NTIS
National Bureau of Standards, Washington, DC.
Refined Crystal Structure of Ribonuclease A at 2.0 A Resolution.
Final rept.
A. Wlodawer, R. Bott, and L. Sjoelin. 10 Feb 82, 8p
Sponsored in part by Natinal Institutes of Health, Bethesda, MD., and National Inst. of Arthritis, Diabetes, and Digestive and Kidney Diseases, Bethesda, MD.
Pub. in Jnl. of Biological Chemistry 257, n3 p1325-1332, 10 Feb 82.

Keywords: *Crystal structure, *Ribonuclease, Enzymes, Reprints, This paper describes the structure of bovine pancreatic ribonuclease A, refined by a restrained parameter least squares procedure at 2.0 A resolution, and rebuilt using computer graphics.

No abstract available.

704,155
PB82-210295 Not available NTIS
National Bureau of Standards, Washington, DC.
Kinetic Models for the Generalized Enskog Equation.
Final rept.
J. W. Dufty, M. J. Lindenfeld, and G. E. Garland. Dec 81, 14p
Pub. in Physical Review A 24, n6 p3212-3225 Dec 81.

Keywords: *Mathematical models, Reaction kinetics, Reprints, *Enskog equation.

The generalized Enskog equation is used to describe the dynamic structure factor, S (k, omega), for a hard sphere gas. The problem of constructing kinetic models for the calculation of S(k, omega) is considered and the minimum set of matrix elements of the exact collision operator required by hydrodynamics is identified. The source of existing discrepancies between kinetic model calculations and light scattering experiments is also found and removed. Sensitivity of S(k, omega) to the parameters of kinetic models is discussed and a simple model proposed. A preliminary comparison of the hard sphere S(k, omega) calculated from this model with neutron scattering data from gaseous krypton is given.

704,156
PB82-210311 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Tunnel States in Solid CH3NO2 and CD3NO2.
Final rept.
B. Alefeld, I. S. Anderson, A. Heidemann, A. Magerl, and S. F. Trevino. 1 Mar 82, 2p
Pub. in Jnl. of Chemical Physics 76, n5 p2758-2759, 1 Mar 82.

Keywords: *Nitromethane, *Deuterium compounds, *Electron tunneling, Neutron scattering, Reprints.

The splitting of the ground librational state of the methyl group in CH3NO2 and CD3NO2 in the solid has been measured by inelastic neutron scattering. The value of the splitting is 35 microev in CH3NO2 and 1.7 microev in CD3NO2.

704,157
PB82-210337 Not available NTIS
National Bureau of Standards, Washington, DC.
Microanalysis and Microscopy: An Overview.
Final rept.
K. F. J. Heinrich. 1981, 11p
Pub. in Proceedings of National Conference of the Microbeam Analysis Society (1981), Vail, Colorado, July 13-17, 1981, Analytical Electron Microscopy, p1-10 1981.

Keywords: *Electron microscopy.

Microanalysis by physical techniques has replaced the chemical technique of elementary microanalysis by chemical techniques. The microbeam techniques used at present are closely related to and complementary to microscopic procedures. The techniques of microscopy and microanalysis thus converge into a single group of techniques for materials characterization.

704,158
PB82-210352 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Chloride-Doped Cadmium Sulfide by Ion Chromatography.
Final rept.
W. F. Koch, and J. W. Stolz. Feb 82, 3p
Pub. in Analytical Chemistry 54, n2 p340-342 Feb 82.

Keywords: *Cadmium sulfides, *Additives, Chlorides, Superconductivity, Reprints, Ion chromatography.

Cadmium sulfide, doped with chloride, is gaining increased attention as a possible super-conductor at non-cryogenic temperatures. Chemical composition and stoichiometry are critical parameters to the effectiveness of the compound for this use. Procedures are described for the characterization of chloride-doped cadmium sulfide for its anionic components. Alkaline hydrogen peroxide is used to dissolve the material and ion chromatography to profile and quantitate the anions. Data are presented showing the determination of total chlorine and sulfur, as well as extractable chloride and sulfate. Extension of the method to bromide-doped cadmium sulfide is proposed.

704,159
PB82-210394 Not available NTIS
National Bureau of Standards, Washington, DC.
Carbon Monoxide Chemisorption on Ni(100) - Direct Detection of Adsorbate-Adsorbate Interactions by Desorption Kinetic Measurements.
Final rept.
J. T. Yates, and D. W. Goodman. 15 Nov 80, 5p
Pub. in Jnl. of Chemical Physics 73, n10 p5371-5375, 15 Nov 80.

Keywords: *Carbon monoxide, *Surface chemistry, Chemisorption, Isotopic labeling, Temperatures, Flux(Rate), Reprints.

Temperature programmed desorption has been used in conjunction with molecular beam methods to measure the influence of high incident CO fluxes on the desorption rate of CO from a Ni(100) surface.

704,160
PB82-210402 Not available NTIS
National Bureau of Standards, Washington, DC.
PLEED Study of Temperature and Hydrogen Induced Reconstruction and Reordering of W(100).
Final rept.
G. C. Wang, J. Unguris, D. T. Pierce, and R. J. Celotta. Mar 82, 8p
Pub. in Surface Science Letters 114, pL35-L42 Mar 82.

Keywords: *Tin, Hydrogen, Chemisorption, Electron scattering, Temperature, Reprints, *Polarized low energy electron diffraction.

The structure of the high temperature (1x1), low temperature c(2x2), and hydrogen induced c(2x2)-H and (1x1)-H phases of W(100) were studied by polarized low energy electron scattering. At certain diffraction conditions the measured strength of the spin dependent scattering, S(E), shows large differences between the various phases even though there are only slight changes in the measured intensity profiles, I(E). The

largest differences in S(E) were between the clean and hydrogen covered phases.

704,161
PB82-210436 Not available NTIS
National Bureau of Standards, Washington, DC.
Vibrational-State Dependence of Partial Cross Sections and Photoelectron Angular Distributions through Autoionizing Resonances: The n=3 Rydberg State Converging to the B 2 sup epsilon(+) State of CO(+1).
Final rept.
D. L. Ederer, A. C. Parr, B. E. Cole, R. Stockbauer, J. L. Dehmer, J. B. West, and K. Codling. 1981, 13p
Pub. in Proceedings of the Royal Society (London) Series A 378, p423-435 1981.

Keywords: *Molecular vibration, *Angular distribution, *Carbon monoxide, Ions, Autoionization, Rydberg series.

The branching ratios for leaving the CO(+1) ion in a particular vibrational level of the ground Epsilon (+) state have been determined as functions of photon energy through the n=3 autoionizing Rydberg state converging to the B 2sup epsilon (+) state of CO(+1) there are substantial differences between theoretical and experimental Franck-Condon factors when 'on' resonance. The branching ratios have been converted into absolute partial cross sections by normalizing to existing data obtained by using line sources. The asymmetry parameter beta has also been determined for each vibrational level in this spectral range. Considerable variations in both have been observed in the region of this resonance.

704,162
PB82-210444 Not available NTIS
National Bureau of Standards, Washington, DC.
Current Theoretical Problems in the Electron Impact Ionization of Positive Ions.
Final rept.
S. M. Younger. 1982, 16p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Comments on Atomic and Molecular Physics 11, n3-5 p193-209 1982.

Keywords: *Cations, Atoms, Ionization, Ions, Reprints, *Electron impact ionization.

This report summarizes the main discussions of a workshop on the theory of electron ionization of atoms and ions held at the National Bureau of Standards in November, 1980. The applicability of partial wave methods to the ionization problem is discussed, as are several promising new theoretical approaches.

704,163
PB82-210451 Not available NTIS
National Bureau of Standards, Washington, DC.
Ag I Isoelectronic Sequence: Wavelengths and Energy Levels for Ce XII through Ho XXI and for W XXVIII.
Final rept.
J. Sugar, and V. Kaufman. 1981, 5p
Pub. in Physica Scripta 24, n4 p742-746 1981.

Keywords: *Molecular energy levels, Cesium, Europium, Gadolinium, Holmium, Neodymium, Praseodymium, Samarium, Terbium, Reprints, Isoelectronic sequence.

An earlier analysis of the spectra of Ce XII, Pr XIII, Nd XIV, and Sm XVI has been significantly expanded. Wavelengths are presented for the first time for Eu XVII through Ho XXI.

704,164
PB82-210477 Not available NTIS
National Bureau of Standards, Washington, DC.
Defining Critical Point Experiments for a Space Laboratory.
Final rept.
M. R. Moldover. 1981, 7p
Pub. in Proceedings of a Workshop on Spacecraft Dynamics as Related to Laboratory Experiments in Space, Marshall Space Flight Center, Huntsville, AL, May 1-2, 1979, NASA Conference Publication 2199, p11-17 1981.

Keywords: *Critical point, Phase transformation, Space environment simulation, Thermodynamics, Chemical equilibrium.

The authors are defining three representative low gravity experiments for a fluid near its liquid-vapor critical point. Two of these experiments require very careful measurements of properties of the fluid in thermodynamic equilibrium while the third experiment is a series of optical observations of the phenomena which occur as a fluid is changed from one phase to two phases, either by cooling through the critical point, or by adiabatic expansion. They are concerned with spacecraft dynamics insofar as residual spacecraft motions may complicate the interpretation of the data from the proposed experiments. It is possible that the spacelab environment will render certain desirable experiments impractical.

704,165
PB82-210519 Not available NTIS
National Bureau of Standards, Washington, DC.
Absorption and Emission of Radiation by the Collision Complex.
Final rept.
A. Gallagher. 1982, 9p
Pub. in Proceedings of International Conference on the Physics of Electronics and Atomic Collisions (12th), Gatlinburg, TN, July 15-21, 1981, Paper in Physics of Electronic and Atomic Collisions, p403-411 1982.

Keywords: *Line width, *Emission spectroscopy, *Absorption spectra, *Atom atom interactions, Atom molecule interactions.

The absorption and emission of radiation by interacting atoms has been used for many years to study atomic collisions. Generally called line broadening, it is actually a study of the diatomic collision complex. It is also a form of molecular spectroscopy, but it involves free rather than bound states, so it requires the study of intensity information rather than the wavelengths of bound-bound lines. This field is now approaching a very exciting prospect of studying the collision complex in reactive collisions. It has long been recognized that the same ideas and principles normally applied to two interacting atoms can also be applied to an atom-molecule or triatomic interaction. However, the complexity is very much greater. Thus, whereas line broadening by two colliding atoms has been studied for many decades in many laboratories, triatomics are just beginning to be studied in only a few laboratories. Yet this type of measurement holds great promise as a powerful diagnostic os chemical reactions and other atom-molecule collision processes.

704,166
PB82-210550 Not available NTIS
National Bureau of Standards, Washington, DC.
Reaction of F Atoms with C6H6. Vibrational Spectrum of the C6H6F Intermediate Trapped in Solid Argon.
Final rept.
M. E. Jacox. 3 Apr 82, 6p
Pub. in Jnl. Physical Chemistry 86, n5 p670-675, 4 Mar 82.

Keywords: *Benzene, *Infrared spectroscopy, Reprints, *Fluorine atoms, Chemical reaction mechanisms.

When the products of the reaction between F atoms produced in a microwave discharge and benzene are frozen in a large excess of argon at 14 K, new infrared absorptions appear which can be assigned to the 1-fluorocyclohexadienyl radical.

704,167
PB82-210584 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Ablation and Resonance Ionization Spectrometry for Trace Analysis of Solids.
Final rept.
S. Mayo, T. B. Lucatorto, and G. G. Luther. 1982, 4p
Pub. in Analytical Chemistry 54, p553-556 1982.

Keywords: *Solids, Evaporation, Sodium, Impurities, Reprints, *Trace techniques, *Resonance ionization spectroscopy, *Laser spectroscopy.

The first application of resonance ionization spectrometry to trace analysis of solids is demonstrated by using laser ablation to evaporate small amounts of single-crystal silicon and detecting sodium in the evaporated material. Sodium is detected by using two tunable laser probes to induce reasonably enhaced multiphoton ionization. Several samples, both Czochralski and float-zoned silicon, were analyzed. Using certain simplifying assumptions about the laser-evaporated plume, they estimated that the sodium contamination density in the purest sample was of the order of 10 to the 11th power atoms/cc. For further development of this technique for absolute quantitative measurements, the various processes involved in laser evaporation of solids should be more completely understood. Generalization of this technique to other contaminant species in metals, semiconductors, and insulators is subject to laser availability.

704,168
PB82-210881 Not available NTIS
National Bureau of Standards, Washington, DC.
First Order Kinetic Titrimetry Solution.
Final rept.
R. G. Rehm, and D. S. Bright. Mar 82, 4p
Pub. in Analytical Chemistry 54, p398-401 Mar 82.

Keywords: *Volumetric analysis, *Reaction kinetics, Reprints, Numerical solution.

The equations describing a first order kinetic titration are reduced to single non-linear ordinary differential equation. When the rate of addition of titrant is constant, the equation depends on two parameters, one being the ratio of the reverse to forward rates of the titration reaction. An exact analytical solution giving the titrand concentration as a function of time and the two parameters is found in terms of parabolic cylinder functions. The exact solution, together with simpler analytical solutions in special cases, provides a method for determining the overall character of this chemical kinetics system for all values of the parameters. Direct numerical solution of the single nonlinear equation is found to be a convenient method for determination of the solution for most values of the parameters, however. Simple analytical approximations for the concentration at the equivalence point are found when these parameters are very small; in this parametric range numerical integration becomes much less convenient. The parametric regions are noted in which each approximation is valid, and methods (including BASIC programs) for computing the concentration on a microcomputer are given.

704,169
PB82-210923 Not available NTIS
National Bureau of Standards, Washington, DC.
Mass Spectrometric Observation of the Stable Negative Molecular Ions HI(-) and H2I(-).
Final rept.
D. Spence, W. A. Chupka, and C. M. Stevens. 1 Mar 82, 3p
Pub. in Jnl. of Chemical Physics 76, n5 p2759-2761, 1 Mar 82.

Keywords: *Mass spectroscopy, *Hydrogen iodide, Ions, Reprints.

Using a 100 in. radius double focusing mass spectrometer, the authors have detected the negative molecular ions HI(-1) and H2I(-1) produced in a Penning ionization discharge source. The ions are identified by an absolute precision mass measurement, and their flight time through the machine is about .0001 sec, indicating the ions are stable with respect to autodetachment. This observation determined the electron affinity of HI to be positive and greater than 0.007 eV.

704,170
PB82-211004 Not available NTIS
National Bureau of Standards, Washington, DC.
Saturation Spectroscopy and Resonant Degenerate Four-Wave Mixing in Hg at 546.1 nm.
Final rept.
M. Kroll. Apr 82, 3p
Pub. in Optics Letters 7, n4 p151-153 Apr 82.

Keywords: *Mercury(Metal), *Visible spectrum, Excitation, Reprints.

Doppler-free saturation spectroscopy performed in an r.f. discharge in mercury vapor has made it possible to identify clearly all the central components of the 546.1 nm transition. Resonant degenerate four-wave mixing has also been observed in this system at this wavelength.

704,171
PB82-211087 Not available NTIS
National Bureau of Standards, Washington, DC.

Results of a Joint Auger/ESCA Round Robin Sponsored by ASTM Committee E-42 on Surface Analysis. Part II. Auger Results.
Final rept.
C. J. Powell, N. E. Erickson, and T. E. Madey. 1982, 32p
See also PB80-115496.
Pub. in Jnl. of Electron Spectroscopy and Related Phenomena 25, p87-118 1982.

Keywords: *Surfaces, *Copper, *Gold, Samples, Reprints, *Auger electron spectroscopy, ESCA(Electron Spectroscopy for Chemical Analysis).

The authors report results of a round robin involving kinetic-energy (K.E.) and relative-intensity measurements on high-purity samples of copper and gold by Auger-electron spectroscopy. These results were obtained on 28 different instruments or analyzers manufactured by four companies. Until suitable standards are available, interested individuals may find it useful to compare measurements on their own Auger or ESCA instruments with the group results and the trends found in the round robins.

704,172
PB82-211111 Not available NTIS
National Bureau of Standards, Washington, DC.
Doppler-Limited Spectrum and Analysis of the 2nu(i) + nu(3) Band of SF6.
Final rept.
A. S. Pine, and C. W. Patterson. 1982, 15p
Prepared in cooperation with Los Alamos National Lab., NM.
Pub. in Jnl. Mol. Spectrosc. 92, p18-32 1982.

Keywords: *Sulfur hexafluoride, *Doppler effect, Reprints, *Laser spectroscopy.

The Doppler-limited spectrum of the 2nu(i) + nu(3) band of SF6 was recorded at 16 and 295 K using a tunable laser difference-frequency spectrometer.

704,173
PB82-211137 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Fluorescence Studies of Intramolecular Vibrational Relaxation in C1-C4 Hydrocarbons Following Pulsed Laser Excitation of the First CH Stretch Overtone.
Final rept.
D. J. Nesbitt, and S. R. Leone. 19 Mar 82, 5p
Contract DOE-EA-77-A-01-6010, Grant NSF-PHY79-04928
Sponsored in part by National Science Foundation, Washington, DC. Grant NSF-CHE79-11340.
Pub. in Chemical Physics Letters 87, n2 p123-127, 19 Mar 82.

Keywords: *Hydrocarbons, *Molecular vibration, *Molecular relaxation, Infrared spectroscopy, Fluorescence, Reprints.

A dramatic reduction in infrared fluorescence quantum yield with increasing molecular size is observed for directly excited first CH stretch overtones in a series of C1-C4 hydrocarbons. Ethane and larger molecules rho(vib) greater than or equal to 15 states/cm appear to undergo rapid intramolecular relaxation within the 1 microsec detector rise-time.

704,174
PB82-211160 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of Activity and Osmotic Coefficients for Electrolyte Solutions: Applications to Real Systems.
Final rept.
R. N. Goldberg. 1981, 20p
Pub. in Proceedings of the Workshop on Techniques for Measurement of Thermodynamic Properties, Albany, OR., Aug 21-23, 1979, Bur. Mines Info. Circ. 8853, p293-304 1981.

Keywords: *Solutions, *Osmosis, Electrolytes, *Activity coefficients, State of the art, Numerical solution.

Some of the philosophy that has guided the evaluation efforts in which the author has recently been engaged is presented. Consideration is given to the accuracy and the state of the art with which activity and osmotic coefficients for aqueous electrolyte solutions can be calculated using the following methods of measurement: vapor pressure measurements, direct and relative (isopiestic); electromotive force measurements with and without transference; freezing point depression measurements; vapor pressure osmometry measurements; diffusion measurements; solvent extraction measurements; and ultracentrifuge measurements. The role of the choice of the correlating equation(s) and the difficult problem of the proper merging of the experimental data with the Debye-Huckel limiting law are discussed.

704,175
PB82-211178 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of Activity and Osmotic Coefficients for Electrolyte Solutions, Basic Methodology.
Final rept.
B. R. Staples. 1981, 7p
Pub. in Proceedings of the Workshop on Techniques for Measurement of Thermodynamic Properties, Albany, OR., Aug 21-23, 1979, Bur. Mines Info. Circ. 8853, p286-292 1981.

Keywords: *Solutions, *Osmosis, Electrolytes, Thermodynamic properties, Mathematical models, *Activity coefficients.

A number of models and associated correlating equations used in electrolyte theory and critical evaluations of thermodynamic properties of aqueous solutions are discussed. The methodology and philosophy used in critical evaluation schemes are summarized.

704,176
PB82-211269 Not available NTIS
National Bureau of Standards, Washington, DC.
Configurational Effects in the Adsorption of HD on ZnO.
Final rept.
G. L. Griffin, and J. T. Yates. Mar 82, 3p
Pub. in Chemical Physics Letters 87, n2 p201-203, 19 Mar 82.

Keywords: *Chemisorption, *Surface chemistry, Adsorption, Infrared spectroscopy, Zinc oxide, Reprints, *Hydrogen deuteride, Molecular configuration.

HD adsorption on ZnO surfaces has been studied by infrared spectroscopy as a function of ZnO temperature. It is shown that at 300K, the configuration Zn(H)-O(D) is preferred, as expected on thermodynamic grounds. As the temperature is lowered, the configuration Zn(D)-O(H) becomes preferred on kinetic grounds. The authors demonstrate that configuration reversal on heating must proceed via HD desorption and subsequent re-adsorption. This behavior is consistent with a model in which the transition state for HD adsorption is characterized by nearly complete dissociation of the H-D bond.

704,177
PB82-212085 Not available NTIS
National Bureau of Standards, Washington, DC.
Carbon-Hydrogen Bond Dissociation Energies in Alkylbenzenes. Proton Affinities of the Radicals and the Absolute Proton Affinity Scale.
Final rept.
M. M. N. Mautner. 1982, 6p
Pub. in Jnl. American Chemical Society 104, n1 p5-10 1982.

Keywords: *Chemical bonds, *Reaction kinetics, Reprints, *Free radicals, *Ion molecule interactions, *Benzenes, Proton affinities.

Rate constants (k) were measured for proton transfer reactions from alkylbenzene ions RH(+) to a series of reference bases B, i.e., RH(+) + B yields BH(+) + R.

704,178
PB82-212184 Not available NTIS
National Bureau of Standards, Washington, DC.
LNG Densities for Custody Transfer.
Final rept.
R. D. McCarty. 1982, 3p
Sponsored in part by American Gas Association, Inc., Arlington, VA.
Pub. in Proceedings of International School of Hydrocarbon Measurement (57th), Norman, OK, April 13-15, 1982, p417-419.

Keywords: *Liquefied natural gas, *Density(Mass/volume), Mathematical models, Comparison, Reference materials.

Work has been carried out over the past nine years at the National Bureau of Standards to provide alternate methods for the accurate determination of the density of liquefied natural gas (LNG) that would serve as a basis for equitable custody transfer.

704,179
PB82-212200 Not available NTIS
National Bureau of Standards, Washington, DC.
Phonons in the Graphite-Potassium Intercalation Compound C(36)K.
Final rept.
A. Magerl, and H. Zabel. Feb 81, 3p
Contract DE-AC02-76ER01198
Prepared in cooperation with Illinois Univ. at Urbana-Champaign. Loomis Lab. of Physics and Materials Research.
Pub. in Physical Review Letters 46, n6 p444-446, 9 Feb 81.

Keywords: *Graphite, *Potassium organic compounds, *Phonons, Neutron scattering, Inelastic scattering, Reprints, *Intercalation compounds.

An inelastic-neutron-scattering study of the (001) L phonons in C(36)K shows, for the first time, zone-folding effects along with frequency gaps between acoustic and optic modes. Phonon dispersion and structure factors can be modeled by a linear chain with two different masses and two force constants: psi(1)=3450 dyn/cm for the coupling of graphite and potassium planes, and psi(2)=2850 dyn/cm for the coupling between two adjacent graphite planes.

704,180
PB82-212218 Not available NTIS
National Bureau of Standards, Washington, DC.
Multipole-Extracted Adiabatic-Nuclei Approximation for Electron-Molecule Collisions.
Final rept.
D. W. Norcross, and N. T. Padial. Jan 82, 13p
Contract DOE-EA-77-A-01-6010
Pub. in Physical Review A 25, n1 p226-238 Jan 82.

Keywords: Dipole moments, Reprints, *Electron molecule interactions, *Multipole extracted adiabatic nuclei approximation.

An extension of the adiabatic-nuclei approximation appropriate for electron collisions with polar molecules is discussed. The method will find most useful application, but is not restricted, to molecules with large permanent dipole moments. Treatment of molecules with small or negligible dipole moments but significant quadrupole moments and/or dipole polarizabilities is also within its purview. The essence of the method consists of extracting the effects of the long-range interactions from the usual adiabatic-nuclei expressions, and reintroducing them in the laboratory frame in a self-consistent manner. The first Born approximation is the simplest, but not the only possible, vehicle for this approach. The method is closely related to the angular frame transformation method. Illustrative applications are presented.

704,181
PB82-212226 Not available NTIS
National Bureau of Standards, Washington, DC.
Transport of Resonance Excitation in Na Vapor Excited by White Light.
Final rept.
T. Fujimoto, and A. V. Phelps. Jan 82, 11p
Contract N00014-76-C-0123
Sponsored in part by Defense Documentation Center, Alexandria, VA.
Pub. in Physical Review A25, n1 p322-332 1982.

Keywords: *Sodium, *Backscattering, *Forward scattering, *Line width, Density(Mass/volume), Resonance absorption, Excitation, Reprints.

Experimental line profiles and integrated intensities for backscattered and forward-scattered resonance radiation using white-light excitation are compared with theory for Na densities between 10 to the 19th power and 10th to the 22th power atoms/cu m.

704,182
PB82-212259 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamics for a System Under Shear.
Final rept.
H. J. M. Hanley, and D. J. Evans. Mar 82, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. Chemical Physics 76, n6 p3225-3232, 15 Mar 82.

Keywords: *Fluids, *Shear tests, *Thermodynamics, Reprints, Numerical solution.

A thermodynamics is introduced for fluids subjected to a constant shear. The theory is based primarily on the results of computer simulations using the technique of homogeneous shear nonequilibrium molecular dynamics applied to a system of 108 Lennard Jones particles. It is supported qualitatively by the results of several authors for other systems. The criteria indicate that phase changes are influenced by the shear rate when the system is subjected to the shear.

704,183
PB82-212267 Not available NTIS
National Bureau of Standards, Washington, DC.
Dispersion Relation Approach to the X-Ray Edge Problem.
Final rept.
D. R. Penn, S. M. Girvin, and G. D. Mahan. Dec 81, 13p
Grant NSF-DMR80-16883
Pub. in Physical Review B 24, n12 p6971-6983, 15 Dec 81.

Keywords: *Dispersion, *Many body problem, Perturbation theory, Reprints, *X ray edge.

The authors present a dispersion relation formulation of the open-line amplitude for the x-ray edge problem within the contact potential model. Using both multiple-scattering and determinant techniques, they find that to a very good approximation the many-body effects can be described within a single-particle transition-rate expression using a renormalized matrix element. This renormalized matrix element may be expressed exactly in terms of a frequency integral over the scattering phase shift for the core-hole potential. There are small corrections to the transition rate due to multiple particle-hole-pair final states, and a systematic series expansion for these is presented. This series is summed at threshold to yield an exact expression for the critical amplitude multiplying the power-law singularity. Their analytic results given an exact description at threshold and are shown to be quite accurate away from threshold. Comparison with the asymptotic expression of Nozieres and De Dominicis is made.

704,184
PB82-212283 Not available NTIS
National Bureau of Standards, Washington, DC.
Reply to Comments on 'Does Chemisorbed Carbon Monoxide Dissociate on Rhodium, by D. G. Castner, L. H. DuBois, B. A. Sexton, and G. A. Somorjai.
Final rept.
J. T. Yates, E. D. Williams, and W. H. Weinberg. 1982, 3p
Grant NSF-CHE77-16314
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Surface Science 115, pL93-L95 1982.

Keywords: *Carbon monoxide, *Chemisorption, Rhodium, Reprints.

No abstract available.

704,185
PB82-214438 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Oxidation of Sulfite Ion by Oxygen in Aqueous Solution: A Bibliography.
Final rept.
F. Westley. Mar 82, 37p NBS-SP-630
Library of Congress catalog card no. 82-600507. Sponsored in part by Department of Energy, Morgantown, WV.

Keywords: *Oxidation, *Bibliographies, Solutions, Catalysts, Reaction kinetics, *Sulfite ions, Listings.

A list of references is provided for published papers and reports containing rate constants or mechanisms for the oxidation of S(IV) by oxygen in aqueous solution, with or without catalysts. Three hundred and twenty papers are listed, the period covered extending from 1897 to 1981.

704,186
PB82-214487 PC **A23**/MF **A01**
Notre Dame Univ., IN. Radiation Lab.
Biweekly List of Papers on Radiation Chemistry and Photochemistry: Annual Cumulation with Keyword and Author Indexes. Volume 14.
A. B. Ross. 1981, 538p
See also Volume 13, PB82-122995. Sponsored in part by National Bureau of Standards, Washington, DC., and Department of Energy, Washington, DC.

Keywords: *Chemistry, *Bibliographies, Radiation chemistry, Photochemistry, Indexes(Documentation), Subject index terms, Polymers, Reaction kinetics, Optical spectra, Thermodynamics, Electron paramagnetic resonance, Excitation, Solar energy.

This document is the annual edited cumulative list of references to the published literature on radiation chemistry, photochemistry, and related fields. References are drawn from 60 journals published throughout the world. This list is generated from the Biweekly List of Papers on Radiation Chemistry and Photochemistry and contains the literature references and an author and subject index. The publication represents one of the continuing data activities of the Radiation Chemistry Data Center (RCDC) at the University of Notre Dame. Volume 14 also contains a 46-page 'Thesaurus for Radiation Chemistry' which lists indexing terms which make up the group of keywords used in the RCDC computer-readable bibliographic data base.

704,187
PB82-215401 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Tables of Rate Constants for Gas Phase Chemical Reactions of Sulfur Compounds (1971-1980).
F. Westley. c1982, 46p NSRDS-NBS-72
See also PB81-105074. Sponsored in part by Department of Energy, Morgantown, WV. Morgantown Energy Technology Center. Library of Congress catalog card no. 82-2094.

Keywords: *Reaction kinetics, *Sulfur organic compounds, *Sulfur inorganic compounds, Tables(Data), Vapor phases, Chemical reactions, Free radicals.

A table of rate constants for gas phase chemical reactions of sulfur compounds is presented. Specifically, it gives in tabular form the values of the parameters for the modified Arrhenius equation k = ATsupB exp(-E/RT). The table covers the reactions of sulfur containing molecules and free radicals and a number of thiols, thioethers, and thioesters, with other compounds. The table includes 19 unimolecular, 208 bimolecular, and 13 termolecular reactions totaling 240 distinct chemical reactions. There are 441 rate constants associated with these reactions, distributed as follows: 30 for first order reactions, 377 for second order reactions, and 34 for third order reactions. The kinetic data were compiled from 145 experimental papers and 8 critical reviews published between 1971 and 1980.

704,188
PB82-225988 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
Thermophysical Properties of Isobutane from 114 to 700 K at Pressures to 70 MPa.
R. D. Goodwin, and W. M. Haynes. Jan 82, 198p NBS-TN-1051

Keywords: *Thermophysical properties, *Butanes, Equations of state, Tables(Data), Enthalpy, Entropy, Density(Mass/volume), Specifical heat, Vapor pressure, Dielectric properties, Joule-Thomson effect, Virial coefficients.

Using a modified version of the nonanalytic equation of state, thermophysical properties of isobutane are derived from physical properties data and are tabulated at integral temperatures over the entire range of fluid states from 114 to 700 K along isobars at pressures to 70 MPa. Results include dielectric constants, densities, enthalpies, entropies, equation of state, internal energies, isobars, isochores, isotherms, Joule-Thomson inversion, heats of vaporization, melting line, orthobaric densities, specific heats, sound velocities, vapor pressures, and virial coefficients. In addition to the equation of state, equations are given for vapor pressures, orthobaric vapor and liquid densities, ideal gas properties, second virial coefficients, dielectric constants, heats of vaporization, melting pressures, and orthobaric liquid specific heats, enthalpies, and entropies. Several new sets of data have been used in this correlation; comparisons between experimental and calculated values are given.

704,189
PB82-226234
(Order as PB82-226226, PC **A08**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Absolute Isotopic Abundance Ratios and Atomic Weight of a Reference Sample of Strontium.
L. J. Moore, T. J. Murphy, I. L. Barnes, and P. J. Paulsen. 15 Jul 81, 8p
Included in Jnl. of Research of the National Bureau of Standards, v87 n1 p1-8 Jan-Feb 82.

Keywords: *Atomic mass, *Strontium isotopes, *Strontium, Samples, Mass spectroscopy, Calibrating, *Standard reference materials.

Absolute values have been obtained for the isotopic abundance ratios of a reference sample of strontium using solid sample thermal ionization mass spectrometry. Samples of independently known isotopic composition prepared from chemically pure and nearly isotopically pure separated strontium isotopes were used to calibrate the mass spectrometry.

704,190
PB82-226242
(Order as PB82-226226, PC **A08**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Absolute Isotopic Abundance and Atomic Weight of a Reference Sample of Silver,
L. J. Powell, T. J. Murphy, and J. W. Gramlich. 12 Aug 81, 11p
Included in Jnl. of Research of the National Bureau of Standards, v87 n1 p9-19 Jan-Feb 82.

Keywords: *Silver, *Atomic mass, *Silver isotopes, Sampling, Mass spectroscopy, Calibrating, *Standard reference materials.

The atomic weight of a reference sample of silver has been determined by mass spectrometry, with an uncertainty of one part in 10 to the 6th power, using a single filament silica gel procedure. Accurately known quantities of chemically pure 107 Ag and 109 Ag were mixed to produce standards of known isotopic composition for calibration of the mass spectrometer.

704,191
PB82-226259
(Order as PB82-226226, PC **A08**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Recalculation of the Faraday Constant Due to a New Value for the Atomic Weight of Silver.
V. E. Bower, R. S. Davis, T. J. Murphy, P. J. Paulsen, J. W. Gramlich, and L. J. Powell. 16 Sep 81, 2p
Included in Jnl. of Research of the National Bureau of Standards, v87 n1 p21-22 Jan-Feb 81.

Keywords: *Silver, *Atomic mass, *Coulometers, *Faraday, Numerical solution.

A report of the Faraday constant as determined at NBS via silver coulometry and atomic weight measurements is presented. The uncertainty of the reported result represents a five-fold improvement over measurements made at NBS 20 years ago. The result should contribute to an analysis of the self-consistency of several other fundamental constants measurements. Experimental details have been reported in other publications which are cited in the text.

704,192
PB82-226283
(Order as PB82-226226, PC **A08**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Electron Impact Ionization of Lithium.
S. M. Younger. 18 Aug 81, 3p
Included in Jnl. of Research of the National Bureau of Standards, v87 n1 p49-51 Jan-Feb 82.

Keywords: *Ionization, *Electron scattering, Wave functions, Electron energy, *Lithium atoms, *Atom electron interactions.

The electron impact ionization cross section of the neutral lithium atom has been calculated in a distorted-wave exchange approximation. The total cross section is in good agreement with available experimental data at incident electron energies above 10 eV. Analytic fits are provided for the 1s and 2s subshell partial cross section.

704,193
PB82-226333 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.

Journal of Research of the National Bureau of Standards. Volume 86, Number 6, November-December 1981.
Bi-monthly rept.
1981, 187p
See also PB82-226341 through PB82-226416 and PB81-247017. Library of Congress catalog card no. 63-37059.

Keywords: *Research, Product development, Galacitic structure, Semiconductor devices, Light scattering, Polymers, Liquid crystals, Viscosity, Mass, Mixture, Reaction kinetics, Hydrogen, Computer programs, Enthalpy, Cellulose, Combustion, Error functions, Computer networks, Biological processes, Spiral galaxies, Enskog-Thome theory, Bond energy bond order method, Solid wastes, ALOHA system.

Contents:
- Turbulence, Plasma Containment, and Galaxies;
- Highlights in Semiconductor Device Development;
- Applicationof Light Scattering to Polymers, Liquid Crystals, and Biological Systems;
- Computer Networks--The ALOHA System;
- An Enskog Correction for Size and Mass Difference Effects in Mixture Viscosity Prediction;
- Rate Constants for H-Atom Transfer Reactions by the BEBO Method;
- Enthalpy of Combustion of Microcrystalline Cellulose;
- Automatic Computing Methods for Special Functions. Part IV. Complex Error Function, Fresnel Integrals, and Other Related Functions.

704,194
PB82-226366
(Order as PB82-226333, PC **A09**/MF **A01**)
Wisconsin Univ.-Madison.
Application of Light Scattering to Polymers, Liquid Crystals, and Biological Systems.
H. Yu. 10 Aug 81, 20p
Included in Jnl. of Research of the National Bureau of Standards, v86 n6 p571-590 Nov-Dec 81.

The applications of elastic and quasielastic light scattering techniques to polymers in dilute solution, themotropic liquid crystals and biological membrane vesicles are presented. It is focused on how we extract specific structural features or dynamic processes of these condensed medium samples through the light scattering methods.The paper reviews the light scattering studies that were carried out a the author's laboratory in Wisconsin from 1973 until 1980.

704,195
PB82-226382
(Order as PB82-226333, PC **A09**/MF **A01**)
National Bureau of Standards, Boulder, CO.
Enskog Correction for Size and Mass Difference Effects in Mixture Viscosity Prediction,
J. F. Ely. 26 May 81, 8p
Included in Jnl. of Research of the National Bureau of Standards, v86 n6 p597-604 Nov-Dec 81.

A method is presented which corects the one-fluid conformal solution viscosity model for size and mass difference effects. This correction, which is based on the Enskop model for hard sphere mixtures, is empirical as applied to transport but has a rigorous basis in equilibrum theory. Comparisons of presictions and experimental viscosities for 24 binary mixtures are presented.

704,196
PB82-226390
(Order as PB82-226333, PC **A09**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Rate Constants for H-atom Transfer Reactions by the BEBO Method.
R. L. Brown. 17 Mar 81, 50p
Included in Jnl. of Research of the National Bureau of Standards, v86 n6 p605-654 Nov-Dec 81.

A detailed discussion of the calculation of rate constants for hydrogen atom transfer reactions based on the BEBO method is presented. Linear transition state models are uased. A computer program using this method for determining rate constants is provided.

704,197
PB82-233594 Not available NTIS
National Bureau of Standards, Washington, DC.
Study of Amorphous-Crystal Interfaces in Polymers Using the Wicket Model: Estimates of Bounds on Degree of Adjacent Reentry.
Final rept.
E. A. DiMarzio, C. M. Guttman, and J. D. Hoffman.
Dec 80, 6p
Pub. in Polymer 21, 1379-1384 Dec 80.

Keywords: *Polymers, *Lamellar structure, Crystal structure, Reprints, Wicket model.

An attempt to ascertain the structure of the crystal-amorphous interface in polycrystalline polymers of lamellar morphology is made by discussion of an idealization of loops called wickets. Equations which arise from the constraints of density at the interface are obtained that relate the various kinds of wickets to their lengths and to interface thickness. A measure of the degree of adjacent reentry is defined and bounds on the extent of adjacent reentry are obtained. It is found that the larger the assumed value of average loop size the larger the amount of adjacent reentry: infinite average loop size results in complete adjacent reentry.

704,198
PB82-233602 Not available NTIS
National Bureau of Standards, Washington, DC.
Calculation of Lamellar Thickness in a Diblock Copolymer, One of Whose Components Is Crystalline.
Final rept.
E. A. DiMarzio, C. M. Guttman, and J. C. Hoffman.
1980, 5p
Pub. in Macromolecules 13, n5 p1194-1198 Sep-Oct 80.

Keywords: *Lamellar structure, *Copolymers, Crystal structure, Phase transformation, Reprints.

The authors treat a diblock copolymer of lamellar morphology where one of the blocks is amorphous and one is crystalline (amphiphilic copolymers). The proposed models allow for the stretching of polymer chains, the change in packing entropy arising from changes in orientation of bonds, and the space filling properties of the chains.

704,199
PB82-233610 Not available NTIS
National Bureau of Standards, Washington, DC.
Equilibrium Theory of Glasses.
Final rept.
E. A. DiMarzio. Oct 81, 21p
Pub. in Annals of the New York Academy of Sciences 371, p1-20, 26 Oct 81.

Keywords: *Glass, *Thermodynamic equilibrium, Crystal structure, Equations of state, Transition points, Polymers, Reprints.

It is shown that certain kinds of molecules cannot even in principle pack together in regular array (crystallize). This means that their low temperatures, T (high pressure, P) equilibrium state is an amorphous (glassy) state. The equilibrium amorphous state properties at low T as well as at high T were obtained using a lattice model for a system composed of asymmetric molecules. The effects of both intra and inter molecular energetics were (crudely) incorporated. A second-order transition in the Ehrenfest sense was predicted which is due to the configurational entropy (packing entropy) S(c) approaching zero at finite T, P as we lower the temperature. The variation of glass temperature was successfully predicted as a function of molecular weight, diluent concentration (plasticizer), copolymer composition, and of degree of cross-linking and stretch ratio in a rubber. The PVT and EVT equations of state are also successfully (semiquantitatively) modeled. In short, assemblies of molecules that form glasses do have equilibrium properties, and the author has calculated what they are. Kauzmanns paradox is resolved.

704,200
PB82-233628 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Plasmon Contribution to SERS.
Final rept.
R. Dornhaus, R. E. Benner, R. K. Chang, and I. Chabay. 1980, 7p
Contract N00014-76-C-0643, Grant EPA-R-805458
Pub. in Surface Science 101, p367-373 1980.

Keywords: *Plasmons, Surfaces, Raman spectroscopy, Reprints, *Surface enhanced Raman spectroscopy.

The contribution of surface plasmon excitation to SERS has been experimentally investigated with molecules adsorbed on 5 nm and 57 nm evaporated Ag films coated on a hemicylindrical prism which enabled direct excitation of surface plasmons in the Kretschmann configuration. Surface plasmon excitation increases SERS intensities by at least 10X while metal islands of Ag give much larger SERS intensities.

704,201
PB82-234709 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Cooling of Ions Stored in Harmonic and Penning Traps.
Final rept.
W. M. Itano, and D. J. Wineland. Jan 82, 20p
Pub. in Physical Review A 25, n1 p35-54 Jan 82.

Keywords: *Ion traps(Instrumentation), *Atomic spectroscopy, *Harmonic analyzers, Reprints, *Laser spectroscopy.

Laser (light pressure) cooling of two-level ions stored in a Penning trap is treated theoretically, in the limit that the frequencies of motion of the ions are much smaller than the natural linewidth of the optical transition.

704,202
PB82-234725 Not available NTIS
National Bureau of Standards, Washington, DC.
Energy Conservation in Pigment Milling via Particle Size Instrumentation.
Final rept.
D. B. Blanchard, and R. C. Ross. Aug 81, 6p
Pub. in TAPPI 64, n8 p79-84 Aug 81.

Keywords: *Particle size, *X ray spectroscopy, Monitoring, Performance evaluation, Reprints, *Energy consumption.

To minimize energy consumption of the pigment milling step, a computer controlled SEM/EDXA instrumental system, designated as a Chemical Particulate Pattern Recognition System (CPPRS), is reviewed for monitoring particle size reduction. Discussed are the system fundamentals and applications of the system for evaluation of milling energy consumption using a single and multicomponent pigment system.

704,203
PB82-234774 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Dependence of the Rate Constant for the Reaction of Hydroxyl Radicals with Nitric Acid.
Final rept.
M. J. Kurylo, K. D. Cornett, and J. L. Murphy. 20 Apr 82, 5p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC. Upper Atmospheric Research Office.
Pub. in Jnl. of Geophysical Research 87, nC4 p3081-3085, 20 Apr 82.

Keywords: *Nitric acid, *Reaction kinetics, Temperature, Fluorescence, Reprints, *Hydroxyl radicals, Atmospheric chemistry.

The flash photolysis resonance fluorescence technique has been used to measure the rate constant for the reaction OH + HONO2 yields (k1) Products over the temperature range 225-443 K.

704,204
PB82-234824 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of the Quantum Yield of the Ferrioxalate Actinometer with Electrically Calibrated Radiometers.
Final rept.
J. N. Demas, W. D. Bowman, E. F. Zalewski, and R. A. Velapoldi. Sep 81, 5p
Grants NSF-CHE74-17916, NSF-CHE77-20379
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC. Grant AFOSR-78-3590.
Pub. in Jnl. of Physical Chemistry 85, n19 p2766-2771, 17 Sep 81.

Keywords: *Radiometers, *Quantum efficiency, *Actinometers, Calibrating, Reprints, Laser spectroscopy.

Amplitude-stabilized laser sources and electrically calibrated radiometers were used for the absolute calibra-

tion of the quantum yield (phi) Fe(+2) of the ferrioxalate actinometer at three laser lines.

704,205
PB82-234931 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoionization.
Final rept.
D. L. Ederer. 1976, 2p
Pub. in Encycl. Phys. p748-749 1976.

Keywords: *Photoionization, Cross sections, *Electron ion interactions.

Photoionization is a process where a photon of frequency nu and energy h nu interacts with an atom or molecule to produce ion ion-electron pair. The probability of ionization is represented by the photoionization cross sections given in terms of an area. At the ionization threshold, the cross section typically has a value of 10 to the -17th power sq cm.

704,206
PB82-234949 Not available NTIS
National Bureau of Standards, Washington, DC.
Alkali-Metal-Atom Doublet Anomalies and the Relation between Relativistic and Non-Relativistic Theories.
Final rept.
J. Detrich, and A. W. Weiss. Feb 82, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review A 25, n2 p1203-1205 Feb 82.

Keywords: *Dirac equation, *Relativity theory, Spectroscopy, Reprints.

The Dirac-Fock treatment of doublet splittings in alkali-like spectra is examined and it is shown that a single configuration relativistic calculation is equivalent to a multi-configuration, core polarization non-relativistic treatment. Both approaches are capable of representing the anomalous doublet splittings of non-penetrating states in alkali-like systems. Some further observations are made pertaining to the non-relativistic limit of Dirac-Fock approach.

704,207
PB82-234956 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Impact Spectroscopy: An Overview of the Low-Energy Aspects.
Final rept.
R. J. Celotta, and R. H. Huebner. 1979, 85p
Pub. in Chapter 2 in Electron Spectroscopy: Theory, Techniques and Applications 3, p41-125 1979.

Keywords: *Electronic spectra, Excitation, Electron scattering, Ionization, Atoms, Molecules, Energy dissipation, Reprints.

An overview is presented of the area of low impact energy (less than 1000 eV) electron scattering from free atoms and molecules. Topics covered include electron energy-loss spectra, excitation function measurements, ionization measurements, and the determination of generalized oscillator strengths from electron impact data. Recent multiparameter experiments are discussed as well as the application of electron spectroscopy to quantitative analysis.

704,208
PB82-234964 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamic Viscosity of Polymer Solutions.
Final rept.
A. Peterlin. Mar 82, 6p
Pub. in Colloid and Polymer Science 260, n3 p278-293 Jun 82.

Keywords: *Dynamic viscosity, *Polystyrene, Solutions, Intrinsic viscosity, Reprints, *Aroclor.

The experimental data of Schrag and coworkers on dilute solutions of polystyrene and its derivatives in Aroclor are treated. The extrapolation to infinite dilution is possible in both Newtonian ranges at low and high frequency of the shear flow. The model of internal viscosity can be applied to these limiting cases. The experimental data are best fit by the model of internal viscosity between beads on the same link. The agreement is worse if the internal viscosity acts against any rate of distance change between all the different beads. The segment length must not change with the molecular weight. By accepting these consequences one may derive the parameters of the polymer system, i.e., the constant segment length and the coefficient of internal viscosity. In the intermediate range of frequencies a master curve for all measured data exists. But it does not yield any molecular parameter because it is obtained at too high concentration which cannot be described by the intrinsic viscosity. The intrinsic viscosity considers hydrodynamic interactions between segments of the same molecule while at any finite concentration one has to consider also the interactions between segments of adjacent macromolecules.

704,209
PB82-234972 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron-Impact Ionization of Zn+ and Ga+.
Final rept.
W. T. Rogers, G. Stefani, R. Camilloni, G. H. Dunn, A. Z. Msezane, and R. J. W. Henry. Feb 82, 12p
Contract DOE-EA-77-A-01-6010
Pub. in Physical Review A 25, n2 p737-748 Feb 82.

Keywords: *Ionization, Excitation, Reprints, *Zinc ions, *Gallium ions, Autoionization, Electron impact spectra.

Absolute cross sections for electron-impact ionization of Zn(+1) and Ga(+1) have been measured from below threshold to 2 keV, using the crossed-charged-beams technique. Excitation-autoionization was shown to be of major importance in both ions for the region between one and two times threshold, leading to enhancement of the cross sections by factors of up to about 2.5. Discrepancies between experiment and the well-known semi-empirical formula of Lotz were up to 70%, but reduction of Lotz' a(3d) coefficient by a factor of two leads to satisfactory agreement at high energies. Comparison is also made with scaled Born approximation calculations.

704,210
PB82-234980 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Emission Cross Sections for Electron Impact Excitation of Zn+ (4p 2p) and (5s 2S) Terms.
Final rept.
W. T. Rogers, G. H. Dunn, J. O. Olsen, M. Reading, and G. Stefani. Feb 82, 11p
Contract DOE-EA-77-A-01-6010
Pub. in Physical Review A 25, n2 p681-691 1982.

Keywords: *Zinc, *Atomic energy levels, Excitation, Cross sections, Reprints.

Absolute emission cross sections for electron-impact excitation of the 3d sup 10 4p doublet P and 3d sup 10 5s doublet S terms of Zn(+1) have been measured from below threshold to about 790 eV (doublet P) and 388 eV (doublet S) using the crossed-charged-beams technique. Both transitions have the abrupt onset at threshold characteristic of positive-ion excitation.

704,211
PB82-234998 Not available NTIS
National Bureau of Standards, Washington, DC.
Time Development of Resonant Multiphoton Ionization of Sodium.
Final rept.
S. L. Haan, and S. Geltman. 1982, 13p
Grant NSF-PHY79-04928
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 15, p1229-1241 1982.

Keywords: *Sodium, *Ionization, Atomic energy levels, Perturbation theory, Reprints, *Sodium atoms.

The time evolution of the ionization probability of a sodium atom irradiated by linearly polarized light with frequency near the 3s-3p transition frequency is theoretically studied by the following method: strongly coupling the 3s and 3p states using the rotating-wave approximation and then using the resulting strongly coupled wave function as the lowest order approximation in applying second-order perturbation theory to obtain the ionization probability. The photoelectron energy spectrum and total ionization probability are studied for various laser detunings and turn-on forms. The ionization probability is found to exhibit plateau behavior and to have interesting line shapes before reaching rate behavior in the long-time limit.

704,212
PB82-235003 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Cross Section Measurements for Electron Impact Ionization of Na-like Ions - Mg(+1), Al(+2), Si(+3).
Final rept.
D. H. Crandall, R. A. Phaneuf, R. A. Falk, D. S. Belic, and G. H. Dunn. Jan 82, 11p
Contract DOE-EA-77-A-01-6010
Pub. in Physical Review A 25, n1 p143-153 Jan 82.

Keywords: *Ionization, *Magnesium, *Aluminum, *Silicon, Excitation, Cross sections, Reprints, *Electron impact spectra, Autoionization.

Measured cross sections for single ionization of Mg(+1), Al(+2), and Si(+3) by electron impact are reported. Crossed beams of electrons and ions have been employed to study the absolute cross sections as a function of energy in detail. Near threshold the cross sections for Mg(+1) and Al(+2) are roughly 70% of the predicted direct ionization cross sections, while Si(+3) is in reasonable agreement with the predictions. Contributions to the total cross section by indirect processes, principally inner shell excitation-autoionization, are specifically identified in each case and compared with theoretical results. These comparisons demonstrate specific failures of the predictions which rely on addition of excitation cross sections to the direct ionization cross section.

704,213
PB82-235011 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of the Adiabatic-Nuclei Approximation to Energy-Loss Cross Sections for Collisions with Molecules.
Final rept.
D. W. Norcross. Feb 82, 9p
Contract DOE-EA-77-A-01-6010
Pub. in Physical Review A 25, n2 p764-772 Feb 82.

Keywords: Molecular vibration, Molecular rotation, Energy dissipation, Nuclear cross sections, Reprints, *Molecule molecule interactions, Adiabatic approximation, Numerical solution.

A general expression is derived for the energy-loss, or stopping, cross section for particles incident on linear or symmetric-top molecules, within the context of the adiabatic-nuclei approximation for vibration and/or rotation. The form standard fixed-nuclei scattering calculations. The derivation is an alternative to that of Shimamura, and confirms his proof that the cross section is, when summed over all final rotor states, independent of the initial rotor state. The derivation involves a sum rule for Clebsch-Gordon coefficients that, if not newly derived here, is certainly unfamiliar. Application near threshold and/or for polar molecules is discussed, and illustrated for electron collisions with CO.

704,214
PB82-235037 Not available NTIS
National Bureau of Standards, Washington, DC.
New Optically Forbidden Rydberg Series on O2 Converging to the O2(+1)Csup4sigma(u)(-1) Limit.
Final rept.
M. A. Dillon, and D. Spence. Jun 81, 5p
Pub. in Jnl. of Chemical Physics 74, n11 p6070-6074, 1 Jun 81.

Keywords: *Oxygen, *Angular distributions, Inelastic scattering, Energy dissipation, Reprints, Rydberg series.

The authors have measured the angular dependence of inelastically scattered electrons in O2 in the energy-loss range 16 to 26 eV for incident electron energies between 75 eV and 400 eV, and for scattering angles between 2 and 12. For high incident energy and low scattering angles our energy loss spectra correspond to the known optical absorption spectrum. A consideration of the propensity rules for excitation of forbidden transitions by high energy electron impact suggest the term symbol of the new Rydberg states to be (3) sigma (u)(-1).

704,215
PB82-235060 Not available NTIS
National Bureau of Standards, Washington, DC.

Interaction of H2O with a Ti(001) Surface as Studied by Photon Stimulated Desorption and Ultraviolet Photoemission Spectroscopy (Summary Abstract).
Final rept.
R. L. Stockbauer, D. M. Hanson, S. A. Flodstrom, and T. E. Madey. Mar 82, 2p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Vacuum Science and Technology 20, n3 p562-563 Mar 82.

Keywords: *Surface chemistry, *Water, *Titanium, Adsorption, Ultraviolet spectroscopy, Reprints, Ultraviolet photoemission spectroscopy, Photon stimulated desorption, Electron stimulated desorption.

Synchrotron radiation at the NBS SURF II facility (15 eV less than hv less than 75 eV) has been employed to study the adsorption of H2O on a stepped Ti crystal, oriented within 4 degrees of Ti(001). The adsorption behavior was characterized using ultraviolet photoemission spectrascopy (UPS), photon stimulated desorption (PSD) and electron stimulated desorption (ESD). A cylindrical mirror analyzer was used for energy analysis of both electrons and ions, as well as for ion mass analysis using a time-of-flight method. (T) The UPS measurements indicate that H2O dissociates at 300K to form a mixed layer of H, O and OH; emission from orbitals characteristic of molecular H2O is not seen. At 90K, the UPS results show that H2O dissociates on Ti(001) at exposures less than 1 Langmuir, but features due to molecular H2O grow in at higher exposures.

704,216
PB82-235086 Not available NTIS
National Bureau of Standards, Washington, DC.
Triply Differential Photoelectron Studies of Non-Franck-Condon Behavior in the Photoionization of Acetylene.
Final rept.
A. C. Parr, D. L. Ederer, J. B. West, D. M. P. Holland, and J. L. Dehmer. 1 May 82, 7p
Grant NATO-1939
Sponsored in part by Office of Naval Research, Arlington, VA., and Department of Energy, Washington, DC.
Pub. in Jnl. Chem. Phys. 76 n9 p4349-4355, 1 May 82.

Keywords: *Acetylene, *Angular distribution, *Photoionization, Excitation, Molecular vibration, Reprints.

Vibrational branching ratios and photoelectron angular distribution for alternative vibrational levels of (2H2(+1) X sup 2 Pi(nu) have been measured in the range 13 eV less than or equal to h nu less than or equal to 25 eV using synchrotron radiation. Below h nu about 16 eV, these data exhibit strong non-Franck-Condon effects, namely, wavelength-dependent vibrational branching ratios, and bivrational-state-dependent photoelectron asymmetry parameters. The non-Franck-Condon behavior is attributed to resonant photoionization processes, whose identification is discussed in the framework of several recent theoretical and experimental studies on acetylene and related molecules.

704,217
PB82-236076 Not available NTIS
National Bureau of Standards, Washington, DC.
Probe Spacing Experiment Simulation and the Relation Between Spreading Resistance and Sheet Resistance.
Final rept.
J. Albers. Mar 82, 7p
Pub. in Jnl. Electrochem. Soc. v129 n3 p599-605 Mar 82.

Keywords: *Spreading, *Electrical resistance, *Mathematical models, Diffusion, Probes, Reprints.

Model spreading resistance data has been generated for diffusion and implant structures in order to access the validity of the relation between spreading resistance and sheet resistance. It is found that the spreading resistance for junction-type structures is linear in the logarithm of the probe spacing with a slope proportional to the sheet resistance. The relation between the intercept and the probe radius is, in general, not valid.

704,218
PB82-236084 Not available NTIS
National Bureau of Standards, Washington, DC.
Sputter Depth Profiles of Ni/Cr Thin-Film Structures Obtained from the Emission of Auger Electrons and X-Rays.
Final rept.
J. Fine, B. Navinsek, F. Davarya, and T. D. Andreadis. Mar 82, 4p
Pub. in Jnl. of Vacuum Science and Technology v20 n3 p449-452 Mar 82.

Keywords: *Auger electrons, *Nickel, *Chromium, *Thin films, X ray analysis, Deposition, Reprints.

Multilayered thin-film Ni/Cr/Ni/Cr...structures, prepared by sputter deposition, were depth profiled by argon ion sputtering at energies of both 1 and 3 keV. Compositional depth profiles were obtained by simultaneously detecting the characteristic emission of Auger electrons and x-rays that result from bombardment with 5 keV primary electrons. Both Auger and x-ray measurements indicate that each sputtered film is completely resolved, that little degradation in the interface widths is observed in sputtering through all nine layers of the structure, and that determinations of sputtering times based on Ni/Cr periodicity as well as on single film removal are remarkably consistent. The well-defined repetitive profiles indicate that this multilayered material may be well suited for use in sputter depth calibration. In combining x-ray analysis with Auger spectroscopy, the additional information obtained can be very effective in thin-film analysis.

704,219
PB82-236100 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Fe on the Reactivity of Ni (100).
Final rept.
S. Semancik, and R. D. Kelley. Mar 82, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Vacuum Science and Technology v20 n3 p823-826 Mar 82.

Keywords: *Iron, *Nickel, *Surface chemistry, *Catalysis, High pressure tests, Carbon monoxide, Reprints.

High pressure reaction methods have been combined with ultrahigh vacuum techniques to investigate the influence of low level Fe on the catalytic activity of the Ni(100) surface. CO dissociation and hydrocarbon formation from H2/CO mixtures are the specific reactions which have been considered. Reactivity changes observed in the presence of surface Fe can be attributed to the different local chemistry involved in CO-Fe and CO-Ni interactions.

704,220
PB82-236142 Not available NTIS
National Bureau of Standards, Washington, DC.
Five-Photon Non-Resonant Photoionization of Atomic Sodium: The Angular Distribution of Photoelectrons.
Final rept.
G. Leuchs, and S. J. Smith. 1982, 9p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics, v15 n7 p1051-1059 1982.

Keywords: *Sodium, *Angular distribution, *Photoionization, Atoms, Atomic energy levels, Reprints.

The authors report the first measurement of the photoelectron angular distribution in nonresonant multiphoton ionization. Linearly polarized Nd:YAG laser radiation was used to ionize ground (3 doublet S(1/2) state sodium atoms in a nonresonant five-photon process. The angular distribution observed contains significant contributions of trigonometric functions of the type cos(2mx) up to m = 5. The absolute ionization cross section is compared with previous measurements.

704,221
PB82-236159 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparative Calculations of Electron-Swarm Properties in N2 at Moderate E/N Values.
Final rept.
L. C. Pitchford, and A. V. Phelps. Jan 82, 15p
Pub. in Physical Review A v25 n1 p540-554 Jan 82.

Keywords: *Nitrogen, Boltzmann equation, Monte Carlo method, Comparison, Transport properties, Excitation, Reprints, Numerical solution.

Recently developed density gradient and multiterm spherical harmonic expansion techniques for the numerical solution of the electron Boltzmann equation are compared with solutions obtained using the conventional two-term spherical harmonic technique and with results obtained using Monte Carlo techniques. Comparisons are made of electron energy distributions, transport coefficients and excitation coefficients for electrons in N2 at moderate electric field to gas density ratios E/N where the large cross section for vibrational excitation leads to significant errors when using conventional solutions of the Boltzmann equation.

704,222
PB82-236209 Not available NTIS
National Bureau of Standards, Washington, DC.
Raman Microprobe Characterization of Urea: n-Paraffin Inclusion Compounds.
Final rept.
J. J. Blaha, and G. J. Rosasco. 1981, 6p
Pub. in Raman Spectrosc. 11 n2 p75-80 1981.

Keywords: *Raman spectroscopy, *Alkanes, *Urea, Reprints, *Molecular conformation.

Urea:n-paraffin inclusion compounds have been formed through sonification of urea with pure paraffin liquids. Raman microprobe spectra of individual microcrystals (5 to 50 micrometers in size) of these materials are interpreted in terms of a non-planor conformation for the included paraffins. A series of trans and gauche bonds is shown to yield a conformation of the included alkane that has the full symmetry of the hexagonal urea host. The urea host lattice spectrum thereby shows additional sharp bands consonant with a more highly ordered host lattice. These observations are contrasted to the case of the trans-planor conformation normally encountered and verified in this work for urea:n-paraffin inclusion compounds prepared from solution.

704,223
PB82-236241 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Impact Ionization Rate Coefficients and Cross Sections for Highly Ionized Iron.
Final rept.
S. M. Younger. 1982, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. Quant. Spectrosc. Radiat. Transfer 27 n5 p541-544 1982.

Keywords: *Iron, Ionization, Atomic energy levels, Cross sections, Reprints, *Electron impact spectra, *Electron ion interaction.

Electron impact ionization cross sections for the ions Fe XVII-XXVI have been computed in a distorted wave exchange approximation. Analytic fits are provided for the cross section data, as well as for the rate coefficients assuming a Maxwellian electron velocity distribution. For ejection of a 2p ground state electron, the scaled ionization rate was found to depend linearly on the number of 2p electrons in the ion.

704,224
PB82-236712 Not available NTIS.
National Bureau of Standards, Washington, DC.
Field-Induced Autoionization in Rare Gas Absorption Spectra Near the Ionization Threshold.
Final rept.
B. E. Cole, J. W. Cooper, and E. B. Saloman. Sep 80, 4p
Pub. in Physical Review Letters 45, n11 p887-890 15 Sep 80.

Keywords: *Absorption spectra, *Electric fields, *Argon, *Krypton, *Xeon, Ionization potentials, Stark effect, Reprints, *Autoionization.

The effect of electric fields on the absorption spectra of Ar, Kr and Xe has been studied near the first ionization potential. In Ar a new peak in the absorption spectra appears below the threshold for field strengths of about 8 kv/cm whose shape is similar to the absorption resonances above the threshold. It is shown that the peak represents the oscillator strength distribution below the threshold and is observed due to the lowering of the ionization potential by the field. Similar results are obtained for Kr and Xe.

704,225
PB82-236761 Not available NTIS
National Bureau of Standards, Washington, DC.

New Geometry for Field Enhancement in Surface-Enhanced Spectroscopy.
Final rept.
P. K. Aravind, R. W. Rendell, and H. Metiu. Jan 82, 8p
Grant NSF-CHE79-18773
Pub. in Chemical Physics Letters 85, n4 p396-403, 22 Jan 82.

Keywords: *Infrared spectroscopy, *Surfaces, Reprints, *Surface enhanced spectroscopy, Numerical solution.

The authors present calculations that indicate that for well-chosen materials a system consisting of a small sphere (diameter less than or equal to 400A) suspended above a planar surface, is a good laser intensity amplifier and an interesting candidate for surface-enhanced spectroscopy. Use of SiC and doped InSb extends the frequency range of surface-enhanced spectroscopy to the infrared (about 200 to about 1100/cm).

704,226
PB82-236910 Not available NTIS
National Bureau of Standards, Washington, DC.
Theoretical Study of Collision-Induced Far-Infrared Absorption of Dense Rare Gas Mixtures.
Final rept.
B. Guillot, S. Bratos, and G. Birnbaum. Feb 82, 9p
Pub. in Physical Review A 25, n2 p773-781 Feb 1982.

Keywords: *Absorption spectra, *Rare gases, Infrared spectroscopy, Mixtures, Density(Mass/Volume), Concentration(Composition), Atomic mass, Reprints, *Atom atom interactions.

A theory investigating collision-induced absorption in dense rare gas mixtures is presented. The basic assumption of the theory is that the collision-induced dipole moment of a pair of dissimilar atoms is proportional to the force acting between them. Spectral behavior is shown to depend on density, concentration and atomic masses of two components of the mixture and is discussed in detail.

704,227
PB82-239104 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoemission Studies of a Mixed Valent Ytterbium-Aluminum Alloy.
Final rept.
W. F. Egelhoff, and G. G. Tibbetts. 1980, 3p
Pub. in Proceedings of International Conference on Vacuum Ultraviolet Radiation Physics (6th), Charlottesville, VA, June 2-6, 1980, I-20, p1-3.

Keywords: *Photoelectric emission, Auger electrons, *Aluminum ytterbium alloy, Autoionization.

A valence change from f(13) to f(14) occurs in ytterbium atoms in a mixed-valent ytterbium-aluminum alloy during autoionization and Auger-electron emission. In both of these emission processes the 4f-shell occupancy increases when the shell becomes more tightly bound under the influence of the core hole. The quenching of the core hole, which terminates the process, occurs after the valence change, so that the f(13) initial state is not manifest in the spectra.

704,228
PB82-239146 Not available NTIS
National Bureau of Standards, Washington, DC.
Fragmentation Mechanism and Energetics of Some Alkyl Halide Ions.
Final rept.
H. M. Rosenstock, R. Buff, M. A. A. Ferreira, S. G. Lias, A. C. Parr, R. L. Stockbauer, and J. L. Holmes. May 82, 9p
Prepared in cooperation with Ottawa Univ. (Ontario). Dept. of Chemistry.
Pub. in Jnl. of the American Chemical Society 104, n9 p2337-2345, 1 May 82.

Keywords: Metastable state, Halogen organic compounds, Fragmentation, Reprints, *Electron ion interactions, *Proton affinity, Ethane/iodo, Propane/bromo, Propane/iodo.

Halogen loss from iodoethane, 1-bromopropane, 2-bromopropane, 1-iodopropane and 2-iodopropane has been studied by means of electron-ion coincidence techniques and by observation of metastable transition. Analysis of the breakdown curves and the study of residence times gave the zero-kelvin thresholds for halogen loss and indicated the size of the kinetic shift. The fragmentation onset for iodoethane was located in a Franck-Condon gap. The zero-kelvin thresholds for the propyl halides were found to lie at or just above the upper spin-orbit level of the parent ion. All of the propyl halides exhibited a unimolecularmetastable transition. At fragmentation onset the 2-halopropane ions have negligible fragment kinetic energy while the 1-halopropane produce secondary propyl ions with 100-200 meV kinetic energy. It was established that a potential barrier must be surmounted in this fragmentation-isomerization process and analysis suggests a dynamic mechanism other than conventional QET, for example, weak couplings of vibrational modes. Analysis of the 2-halopropane fragmentation thresholds leads to an accurate absolute value for the proton affinity of propylene, 751.4+ or - 2.9kJ/mol at room temperature. This value reconciles some differences inherent in the proton affinity scale based on various relative measurements.

704,229
PB82-239187 Not available NTIS
National Bureau of Standards, Washington, DC.
Slow Metastable Atomic Hydrogen Beam by Optical Pumping.
Final rept.
K. C. Harvey. May 82, 4p
Pub. in Jnl. of Applied Physics 53, n5 p3383-3386 May 82.

Keywords: *Optical pumping, Atomic energy levels, Metastable states, Atoms, Reprints, *Hydrogen atoms.

A beam of atomic hydrogen is described which produces metastable atoms in the 2S(1/2) state by optical pumping. A beam of 10 to the 16th power atoms/sec is generated in the ground state by optical pumping. The atoms pass in front of a VUV lamp producing Lyman-beta (1026A) radiation. The atoms are excited to the 3P level and then cascade to the 2 S(1/2) state. The metastable atoms are measured by quenching them with an electric field and detecting the emitted Lyman-alpha radiation. Beams of 10 to the 6th power atoms/sec were obtained. Using the Bethe-Lamb theory for the quenching process, a metastable-beam effective temperature of 100K was measured.

704,230
PB82-239195 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrochemical Oxidation of Several Oxocarbon Salts in N,N-Dimethylformamide.
Final rept.
L. M. Doane, and A. J. Fatiadi. 1982, 17p
Pub. in Jnl. Electroanalytical Chemistry 135, p193-209 1982.

Keywords: *Oxidation, Organic salts, Electrochemistry, Chemical reactions, Nitrogen organic compounds, Reprints, *Formamide/N-N-dimethyl, Croconates, Methylene/dicyano.

The oxocarbon salts of croconic acid and its dicyanomethylene derivatives have been shown to undergo two consecutive reversible one-electron transfers in N,N-dimethylformamide to produce stable radical anions and the neutral croconates. Disproportionation equilibrium constants were found to be quite small for all the croconate radical anions investigated. Following chemical reactions accompanied the second oxidation process of dicyanomethylene-substituted croconates. Substituent effects were shown to be ring position-independent and are discussed with respect to the unique resonance structure of the croconates.

704,231
PB82-239203 Not available NTIS
National Bureau of Standards, Washington, DC.
Structures of Biological Minerals.
Final rept.
R. A. Young, and W. E. Brown. 1982, 41p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL. Prepared in cooperation with Georgia Inst. of Tech., Atlanta.
Pub. in Proceedings of Dahlem Konferenzen, Berlin, Germany, October 18-23, 1981, Paper in Biological Mineralization and Demineralization, p101-141 1982.

Keywords: *Crystal structure, Chemical properties, Physical properties, Calcium phosphates, Calcium carbonates, Biological processes, Calcium oxalates, Hydroxylapatites.

The basic chemical and physical properties of ionic crystals reside in their structures. Structures of the following compounds of biological interest are described: calcium phosphates, a urate, calcium carbonates, and calcium oxalates. To a considerable degree their properties are affected by the presence of impurities and lattice defects in the crystals.

704,232
PB82-239229 Not available NTIS
National Bureau of Standards, Washington, DC.
Importance of Impurity States in Doped Trans-Polyacetylene.
Final rept.
G. W. Bryant, and A. J. Glick. 1982, 6p
Pub. in Jnl. of Physics, C: Solid State Physics 15, pL391-L396 1982.

Keywords: *Acetylene, *Additives, Impurities, Absorption, Assessments, Reprints, *Polyacetylene.

The authors assess the importance of the impurity states of a doped trans-polyacetylene chain. The impurity potential is modeled by a point charge that is located off the chain and screened phenomenologically with the bulk dielectric constant. The common assumption that the impurity levels of a dimerized chain closely approximate the hydrogenic levels of a point charge impurity is invalid when the impurity is not on the chain. Additional non-hydrogenic states occur. One of the new states is much deeper in the gap. The formation energies for charged soliton and charged polaron lattice distortions are found by solving the Su, Schrieffer, Heeger model for polyacetylene with an impurity added. The impurity states severely modify the structure of the soliton distortion. The charged polaron distortion, not the charged soliton distortion, is the most stable distortion that can be formed during doping with gap states consistent with the observed midgap absorption.

704,233
PB82-240243 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure of CO on Ni(111).
Final rept.
F. P. Netzer, and T. E. Madey. Jan 82, 6p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Chemical Physics 76, n1 p710-715, 1 Jan 82.

Keywords: *Surface chemistry, *Carbon monoxide, *Nickel, Adsorption, Reprints, Electron stimulated desorption ion angular distributions, Temperature programmed thermal desorption, LEED(Low Energy Electron Diffraction).

Electron stimulated desorption ion angular distributions (ESDIAD), low energy electron diffraction (LEED), and temperature programmed thermal desorption (TPD) have been used to study the adsorption of CO on Ni(111) in the temperature range 80-300K. A model is proposed involving resonance charge exchange between adsorbed CO molecules to account for the observed variations of the O(+1) yield with surface coverage.

704,234
PB82-243106 Not available NTIS
National Bureau of Standards, Washington, DC.
Collisional Redistribution of Radiation in Strong Fields; Modification of the Collision Dynamics.
Final rept.
K. Burnett, J. Cooper, P. D. Kleiber, and A. Ben-Reuven. Mar 82, 13p
Grants NSF-PHY79-04928, NGL-06-003-057
Pub. in Physical Review A 25, n3 p1345-1357 Mar 82.

Keywords: *Laser beams, Light scattering, Reprints, *Atom atom interactions.

The authors extend the theory of light scattering from an atom undergoing collisions to the case of strong laser fields, where the expansion in power of omega tau (c) that was used formerly in a series of papers by Burnett et al. (I to III) breaks down. In particular we consider in detail the conditions necessary to relate the observable quantities to intense field collisional rate constants in a dressed state basis (such as those calculated by Light and Szoke). They also show (following Rabin and Ben-Reuven) that by studying the spectrum emitted by the atoms in the presence of a strong field one may measure the collisional rates for transfer between the dressed states of atom plus radiation field.

704,235
PB82-243122 Not available NTIS
National Bureau of Standards, Washington, DC.
Photofragmentation Dynamics of CH3I at 248 and 266 nm: Vibrational Distributions in the CH3(nu2) 'Umbrella' Mode.
Final rept.
H. W. Hermann, and S. R. Leone. May 82, 9p
Contract DOE-EA-77-A-01-6010, Grant NSF-PHY79-04928
Sponsored in part by National Science Foundation, Washington, DC. Grant NSF-CHE79-11340.
Pub. in Jnl. of Chemical Physics 76, n10 p4766-4774, 15 May 82.

Keywords: *Infrared spectroscopy, *Molecular vibration, Excitation, Dissociation, Iodine organic compounds, Reprints, *Methane/iodo.

Vibrational population distributions in the nu(2) out-of-plane bending mode of CH3 when produced by photofragmentation of CH3I at 266 and 248 nm are analyzed by infrared emission spectroscopy. The infrared emission spectra suggest that there is no additional rotational excitation in the radical over the ambient rotational temperature of the parent CH3I. In addition, there is no detectable excitation in other vibrational modes, produced either directly in the dissociation or upon collisions.

704,236
PB82-243130 Not available NTIS
National Bureau of Standards, Washington, DC.
Photofragment Infrared Emission Spectroscopy: Vibrational Progression and Potential Parameters of the CH3(nu2) 'Umbrella' Mode.
Final rept.
H. W. Hermann, and S. R. Leone. May 82, 7p
Contract DOE-EA-77-A-01-6010, Grant NSF-PHY79-04928
Sponsored in part by National Science Foundation, Washington, DC. Grant NSF-CHE79-11340.
Pub. in Jnl. of Chemical Physics 76, n10 p4759-4765, 15 May 82.

Keywords: *Infrared spectroscopy, *Molecular vibration, *Free radicals, Excitation, Dissociation, Iodine organic compounds, Reprints, *Methane/iodo.

The out-of-plane bending vibration (nu 2) of the free radical CH3 has been detected by time and wavelength-resolved infrared emission spectroscopy following dissociation of CH3I with a pulsed laser at lambda = 266 nm. The vibrational assignment is important to studies of radical excitation originating from photodissociation, which is considered in the accompanying paper.

704,237
PB82-243148 Not available NTIS
National Bureau of Standards, Washington, DC.
Angular Distribution Parameters of Argon, Krypton and Xenon for Use in Calibration of Electron Spectrometers.
Final rept.
D. M. P. Holland, A. C. Parr, D. L. Ederer, J. L. Dehmer, and J. B. West. 1982, 7p
Sponsored in part by Department of Energy, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Nuclear Instruments and Methods 195, p331-337 1982.

Keywords: *Angular distribution, *Calibrating, *Electronic spectra, *Laboratory equipment, Argon, Krypton, Xenon, Reprints.

Measurements are presented of the angular distribution parameter for the photoejected valence electrons of argon, krypton and xenon, from threshold to h nu about 25 eV. The experimental arrangement at the NBS (SURF II) storage ring is described and the method of data analysis discussed. The results are compared with other experimental data and theoretical predictions.

704,238
PB82-246703 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 87, Number 2, March-April 1982.
Bi-monthly rept.
1982, 46p
See also PB82-246711 through PB82-246737, Volume 86, Number 5, PB82-140575 and Volume 86, Number 3, PB81-220899. Library of Congress catalog card no. 63-37059.

Keywords: *Research, Solubility, Organic compounds, Enthalpy, Specific heat, Sapphire, Standards, Buoyancy, Mathematical models, Fires, Numerical solution, Standard reference materials.

Contents:
Calculations of aqueous solubility of organic compounds;
Enthalpy and heat-capacity standard reference material:
synthetic sapphire (alpha-Al2O3) from 10 to 2250 K. Buoyant convection computed in a vorticity, stream-function formulation.

704,239
PB82-246711
(Order as PB82-246703, PC **A02**/MF **A01**)
National Bureau of Standards, Washington, DC.
Calculation of Aqueous Solubility of Organic Compounds.
Y. B. Tewari, M. M. Miller, and S. P. Wasik. 26 Aug 81, 4p
Included in Jnl. of Research of the National Bureau of Standards, v87 n2 p155-158, Mar-Apr 82.

The aqueous solubility of 14 organic solutes has been calculated from their octanol/water partition coefficient and from their slute activity coefficient in octanol at infinite dilution. The solute activity coefficients were calculated from th Flory-Huggins and Hildebrand-Scatchard (FH-HS) equations and were found to be in good agreementwith the activity coefficients determined from GC specific retention volume measurements. The calculated solubilities were in good agreement with the experiemental solubilities.

704,240
PB82-246729
(Order as PB82-246703, PC **A02**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Enthalpy and Heat-Capacity Standard Reference Material: Synthetic Sapphire (Alpha-Al2O3) from 10 to 2250 K.
D. A. Ditmars, S. Ishihara, S. S. Chang, G. Bernstein, and E. D. West. 14 Oct 81, 5p
Prepared in cooperation with Calorimetrics, Inc., Boulder, CO.
Included in Jnl. of Research of the National Bureau of Standards, v87 n2 p159-163, Mar-Apr 82.

Hereofore unpublished enthalpy data which were used in the derivation of smooth enthalpy and heat-capacity data for NBS SRM 720 (a-A12)3, heat capacity and enthalpy standard) are presented along with some details of the high-temperature experiemnts. Recent NBS low-temperature measurements on SRM 720 are smoothed by a least-squareds spline technique and a revised table of certified values for enthalpy and heat capacity of a-A1203 from 10 K to near the melting point (2250 K) is presented.

704,241
PB82-248188 Not available NTIS
National Bureau of Standards, Washington, DC.
Nitrogen-15 N.M.R. Study of Some Dehydro-L-Ascorbic Acid Bisphenylhydrazone Derivatives.
Final rept.
H. S. El Khadem, and B. Coxon. 1981, 5p
Pub. in Carbohyurate Research 89, p321-325 1981.

Keywords: *Nuclear magnetic resonance, *Ascorbic acid, Oxygen organic compounds, Reprints, *Hydrazone/bisphenyl, *Chemical shifts(Nuclear magnetic resonance).

The structures of two bisphenylhydrazone derivatives of ascorbic acid have been analyzed by natural abundance, nitrogen-15 n.m.r. spectroscopy at high field. The acetylated oxidation product of dehydro-L-ascorbic acid bisphenylhydrazone is shown to be a phenylazo, phenylhydroazono derivative, whereas the acetylated cyclization product of dehydro-L-ascorbic acid bisphenylhydrazone is proved to be a single keto tautomer of a 1-phenyl-4-phenylhydrazono-pyrazolin-5-one derivative.

704,242
PB82-249632 PC **A09**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Thermophysical Properties of Normal Butane from 135 to 700 K at Pressures to 70 MPa.
Final rept.
W. M. Haynes, and R. D. Goodwin. Apr 82, 200p
NBS-MONO-169
Library of Congress catalog card no. 82-600512.

Keywords: *Thermodynamic properties, Equations of state, Tables(Data), Butanes, *Butane.

Using a modified version of the nonanalytic equation of state, thermophysical properties of normal butane are derived from physical properties data and are tabulated at integral temperatures from 135 to 700 K along isobars at pressures to 70 MPa. These isobar tables, along with a table for the saturated liquid, give values for densities, compressibility factors, internal energies, enthalpies, entropies, heat capacities, fugacities, sound velocities, dielectric constants, and isochore and isotherm derivatives. Equations, whose coefficients are determined from a least squares fit to selected experimental data, are also presented for vapor pressures, orthobaric liquid and vapor densities, ideal gas properties, second virial coefficients, dielectric constants, heats of vaporization, melting pressures, and orthobaric liquid specific heats, enthalpies, and entropies. Comparisons between experimental and calculated values for all properties considered here are reported in detail.

704,243
PB82-252040 PC **A12**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Thermophysical Properties of Propane from 85 to 700 K at Pressures to 70 MPa.
Final rept.
R. D. Goodwin, and W. M. Haynes. Apr 82, 252p
NBS-MONO-170
Library of Congress catalog card no. 82-600514.

Keywords: *Propane, *Thermophysical properties, Tables(Data), Equations of state, Density(Mass/volume), Enthalpy, Entropy, Specific heat, Vapor pressure, Least square method, Dielectric properties, Virial coefficients.

Thermophysical properties of propane are tabulated at integral temperatures over the entire range of fluid states from 85 to 700 K along isobars to 70 MPa by using a modified form of the nonanalytic equation of state. These tables, along with a table for the saturated liquid, include values for density, compressibility factor, internal energy, enthalpy, entropy, heat capacities, fugacity, sound velocity, dielectric constant, and isochore and isotherm derivatives. In addition to the equation of state, equations are presented for vapor pressures, orthobaric vapor and liquid densities, ideal gas properties, virial coefficients, dielectric constants, heats of vaporization, melting pressures, and orthobaric liquid specific heats, enthalpies, and entropies. Coefficients were determined by a least squares fit of selected experimental data, including several new sets of data not included in previous propane correlations. Comparisons between experimental and calculated values are given, including those for sound velocities, heat capacities, P-rho-T data, etc.

704,244
PB82-261470 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure and Orientation of NH3 on Clean and Oxygen-Precovered Al(111).
Final rept.
F. P. Netzer, and T. E. Madey. May 82, 6p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Chemical Physics Letters 88, n3 p315-320, 7 May 82.

Keywords: *Ammonia, *Surface chemistry, Chemisorption, Molecular structure, Chemical bonds, Reprints, Electron stimulated desorption ion angular distribution.

On clean Al(111) bonding of molecular NH3 occurs via the N atom with a wide distribution of tilt angles of the molecular axis with respect to the surface normal and with random azimuthal orientation. Fractional monolayers of chemisorbed oxygen induce a high degree of local azimuthal orientation of the H atoms in adsorbed NH3, in the absence of long range order. Azimuthal orientation and increased bonding strength of NH3 on the oxygen-covered surface are associated with hy-

drogen-bonding interactions within the coadsorbed layer.

704,245
PB82-261512 Not available NTIS
National Bureau of Standards, Washington, DC.
Numerical Evaluation of the Dielectric Polarization Distribution from Thermal-Pulse Data.
Final rept.
F. I. Mopsik, and A. S. DeReggi. Jun 82, 7p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Applied Physics 53, n6 p4333-4339 Jun 82.

Keywords: *Fourier analysis, Piezoelectricity, Polarization(Charge separation), Dielectric properties, Reprints, *Thermal pulse method, Numerical solution.

A method for numerically carrying out the Fourier analysis for the thermal-pulse experiment is given. It is shown that it is possible to obtain the polarization distribution across the thickness of a thin film (25 micrometers) to within the limits set by the experimental data. For such films, resolution of the distribution to within 0.1 of the film thickness is possible. Results are given for the experiment by using a charge measurement rather than a voltage measurement. The effect of a finite-width pulse is shown to cut off the Fourier coefficients in such a way as to smooth any distribution. Pulsing the sample alternately on both sides is shown to greatly increase the resolution of the experiment. Results for a PVF2 film and a P(VF2-TFE) copolymer film show that interesting details can be found by the experiment.

704,246
PB82-261520 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoelectron-Photoion Coincidence Spectroscopy of Gas-Phase Clusters.
Final rept.
E. D. Poliakoff, P. M. Dehmer, J. L. Dehmer, and R. Stockbauer. Jun 82, 11p
Sponsored in part by Department of Energy, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Chemical Physics 76, n11 p5214-5224, 1 Jun 82.

Keywords: *Photoelectrons, *Ionization, *Mass spectroscopy, Laboratory equipment, Xenon, Reprints.

A photoelectron-photoion coincidence technique for obtaining the photoelectron spectrum of a single component of a gas-phase mixture has been developed. It utilizes a newly designed instrument which measures the ion mass in coincidence with the photoelectron kinetic energy. Initial experiments were carried out on Xe2 and Xe3 produced in a mixture of clusters (plus monomer) in a free-jet supersonic expansion.

704,247
PB82-261538 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectra of the Cobaltlike Ions Sr XII, Y XIII, Zr XIV, Nb XV, and Mo XVI.
Final rept.
A. N. Ryabtsev, and J. Reader. Jun 82, 7p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of the Optical Society of America 72, n6 p710-716 Jun 82.

Keywords: *Strontium, *Yttrium, *Zirconium, *Niobium, *Molybdenum, *Ultraviolet spectroscopy, Ions, Hartree-Fock approximation, Least squares method, Reprints.

Spectra of the cobaltlike ions Sr XII, Y XIII, Zr XIV, Nb XV, and Mo XVI have been observed by means of a low-inductance vacuum spark and a 10.7-m grazing incidence spectrograph in the region 40-95 A.

704,248
PB82-261561 Not available NTIS
National Bureau of Standards, Washington, DC.
Review of Halocarbon and Halogen Adsorption with Particular Reference to Iron Surfaces.
Final rept.
M. Grunze, and P. A. Dowben. 1982, 31p
Sponsored in part by IBM Research Lab., San Jose, CA.
Pub. in Applications of Surface Science 10, p209-239 1982.

Keywords: *Halogen organic compounds, *Surface chemistry, *Reviews, Adsorption, Iron, Tables(Data), Physical properties, Chemical properties, Chemisorption, Reprints.

In this communication, a comprehensive review on halocarbon adsorption on solid surface is presented. The physical and chemical properties of surfaces, for which adsorbed halocarbons readily dissociate, are dominated by the respective halogens; hence, the published data on halogen adsorption are also presented in a tabulated form. A complete reference list on halogen overlayers is provided. The adsorption of halocarbons is discussed with reference to their surface chemistry while technological as well as some environmental aspects are also mentioned. The available results are discussed according to the substrate surfaces used. In general, one can distinguish between substrates where some halocarbons adsorb without complete fragmentation and those surfaces where the halocarbons dissociate completely and the atomic fragments remain adsorbed or absorb in the selvedge.

704,249
PB82-261579 Not available NTIS
National Bureau of Standards, Washington, DC.
Disorders in the Crystal Structures of Homo- and Copolymers of Polytetrafluoroethlyene.
Final rept.
R. K. Eby. Jul 82, 1p
Pub. in Proceedings of Int. Union of Pure and Applied Chemistry--28th Macromolecular Symp., Amherst, MA, July 13, 1982, p592.

Keywords: *Crystal structure, Copolymers, Phase diagrams, X ray diffraction, Fluorine organic compounds, *Poly(ethylene/tetrafluoro).

The phase diagram of polytetrafluoroethylene and some copolymers of tetrafluoroethylene with hexafluoropropylene exhibits four solid crystal phases (1). The effect of comonomer units on these have been investigated by x-ray diffraction techniques.

704,250
PB82-261603 Not available NTIS
National Bureau of Standards, Washington, DC.
Monte Carlo Calculation of SANS for Various Models of Semi-Crystalline Polyethylene.
Final rept.
C. M. Guttman, J. D. Hoffman, and E. A. DiMarzio. 1979, 13p
Pub. in Faraday Discussions of the Chemical Society 68, p297-309 1979.

Keywords: *Polyethylene, *Neutron scattering, *Mathematical models, Crystal structure, Monte Carlo method, Reprints, *Small angle scattering.

Small angle neutron scattering (SANS) of semi-crystalline polyethylene is computed using a Monte Carlo technique similar to that used by Yoon and Flory. Models of polymer chains with substantial amounts of chain folding (with a probability of adjacent re-entry of 0.6 to 0.8) are shown to give the following: (1) proper density in the crystalline and amorphous regions, (2) the experimentally obtained radius of gyration, (3) scattering close to the experimentally obtained scattering. While SANS alone cannot decisively distinguish between the Yoon and Flory 'switchboard' model and models with folds, present indications are that only models with a substantial amount of folding satisfactorily meet all conditions (1-3). The 'switchboard' model used by Yoon and Flory to explain the SANS of semi-crystalline polyethylene is shown not to meet criteria (1) above.

704,251
PB82-261611 Not available NTIS
National Bureau of Standards, Washington, DC.
Calculation of SANS Intensity for Polyethylene: Effect of Varying Fold Planes and Fold Plane Roughening.
Final rept.
C. M. Guttman, E. A. DiMarzio, and J. D. Hoffman. May 81, 12p
Pub. in Polymer 22, p597-608 May 81.

Keywords: *Polyethylene, *Neutron scattering, Crystal structure, Reprints, *Small angle scattering.

The intensity of the small angle neutron scattering (SANS) for polyethylene crystallized in the lamellar habit from the melt at large supercoolings is calculated for mu = 0.01 to mu = 0.14 (mu = (4 pi/lambda) sin (theta/2)). Computations are made on models which allow various amounts and types of chain folding and varying degrees of 'tight' or 'regular' folds. The models that fit the SANS data best have folding along lattice plans in which the stem separation is larger than 5 A or which allow for fold plane roughening on a variety of fold planes. The best models fit not only the SANS data, but also simultaneously the liquid and crystal density, degree of crystallinity, and characteristic ratio (or radius of gyration).

704,252
PB82-261629 Not available NTIS
National Bureau of Standards, Washington, DC.
Modeling the Amorphous Phase and the Fold Surface of a Semicrystalline Polymer - The 'Gambler's Ruin' Method.
Final rept.
C. M. Guttman, E. A. DiMarzio, and J. D. Hoffman. Nov 81, 14p
Pub. in Polymer 22, p1466-1479 Nov 81.

Keywords: *Polymers, *Mathematical models, Crystal structure, Surfaces, Reprints, *Gambler's ruin method, Amorphous phase.

A semicrystalline polymer with lamellar morphology consists of alternating amorphous and crystalline regions; if sufficiently long, each molecule in this system traverses both the crystalline and amorphous zones. The amorphous portion is comprised of portions of a molecule that form loops that re-enter the same lamella at some distance from the point of emergence, and bridges that form connections between two different crystal lamellae. (A tight fold is not considered to be a loop.) The statistics of loops and bridges are shown to be identical to the classical 'Gamblers Ruin' problem in Mathematical Statistics. This is a useful observation because the extensive existing literature on the Gamblers Ruin Problem allows us to immediately transcribe results to the polymer problem. Using this approach the ratio of the number of loops to the number of bridges is determined to be M, where M is the plate separation (i.e., the thickness of the amorphous zone) is unit statistical steps. Also, the average number of steps comprising the amorphous run is determined to be 3M + 1 for a simple cubic lattice in three dimensions. This modeling leads to a calculation of the minimal fraction of crystal stems involved in tight folding in a semicrystalline polymer. For a simple cubic lattice this is found to be 2/3. The effects of crystal structure and stiffness of the chain in the melt on this bound are discussed.

704,253
PB82-261637 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Reptation in the Rate of Crystallization of Polyethylene Fractions from the Melt.
Final rept.
J. D. Hoffman. May 82, 15p
Pub. in Polymer 23, p656-670 May 82.

Keywords: *Polyethylene, *Crystallization, Melts, Reprints, Monomers.

The theory of polymer crystallization with chain folding is extended to include the effect of reptation in the melt on the rate of crystallization GI and GII in Regimes I and II. The result is that the pre-exponential factors for GI and GII contain a factor 1/n, where n is the number of monomer units in the pendant chain being reeled onto the substrate by the force of crystallization; n is proportional to the molecular weight. The data analysis on the fractions confirms the detailed applicability of Regime theory. The growth rate theory presented allows the possibility that the growth front may be microfaceted in Regime I.

704,254
PB82-261678 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Molecular Constants from Collision-Induced Far-Infrared Spectra and Related Methods.
Final rept.
G. Birnbaum. 1980, 35p
Pub. in Intermolecular Spectroscopy and Dynamical Properties of Dense Systems LXXV, p111-145 1980.

Keywords: *Absorption spectra, *Infrared spectra, Electric moments, Dipole moments, Reprints, *Molecule molecule interactions, Virial coefficients.

This paper describes how quantitative information on molecular parameters, particularly the electric multipole moments, can be obtained from collision-induced absorption spectra. Also discussed are related meth-

ods based on the second dielectric virial coefficient and birefringence induced by an externally applied electric field.

704,255
PB82-261850 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron-Hole Pairs, Molecular Vibrations, and Rate Processes at Metal Surfaces.
Final rept.
J. W. Gadzuk, and H. Metiu. 1982, 22p
Pub. in Vibrations at Surfaces, p519-540 1982.

Keywords: *Surface chemistry, *Metals, *Vibrational spectra, Excitations, Reprints, Franck-Condon principle, Electron transitions.

Consequences of the coupling of nuclear motion of an atom or molecule near a metal surface with the electron-hole pair excitations of the metal are considered from the point of view of vibrational spectroscopy. Special emphasis is placed on the interrelationship between pair excitation, surface localized vibrational structure, and rate processes. Specific realizations discussed here in terms of vibrational spectroscopy include: Pair renormalization of intramolecular vibrational modes; Desorption rates; Pair excitation, trajectory theories, and vibrational modes; and Reaction rate theory at surfaces.

704,256
PB82-261884 Not available NTIS
National Bureau of Standards, Washington, DC.
Deformation Analysis of a Polyethylene Crystal Subjected to End Forces of Stretching and Lattice Expansion.
Final rept.
J. T. Fong. Sep 80, 6p
Pub. in Proceedings of International Congress on Rheology (8th), Naples, Italy, September 1980, p287-292.

Keywords: *Polyethylene, *Crystallization, *Deformation methods, Mathematical models, Elasticity.

In a recent paper by Hoffman (Polymer, 20 1071-1077 (1979)) on the formation of polymer fibrils by flow-induced crystallization, several assumptions were made in deriving a suitable form of the end surface free energy of a typical crystallite. One of the assumptions was an assertion that the deformation within the crystal as its end surfaces underwent stretching and biaxial expansion, would be approximately uniform. In this paper, a deformation analysis of an idealized square parallelepiped under the combined action of two types of end forces, namely, stretching and lattice-expansion, is performed to assess the validity of the uniform deformation assumption. Taking advantage of the symmetry of the problem and applying the classical solution of a beam on elastic foundation due to Hetenyi (1936, 1946) and Timoshenko (1956), a general result on the ratio of the displacements at the end and the center of the crystal along its line of symmetry can be expressed in terms of the aspect ratio of the crystal, the degree of anisotropy, and the longitudinal strain in the crystal due to stretching. For polyethylene fibril crystal of aspect ratio equal to 6, anisotropy ratio equal to .003, and a longitudinal strain of 3.6% (maximum to break), the assumption of a uniform deformation throughout the crystal is found to be reasonable as a first approximation.

704,257
PB82-261900 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Collision-Induced Line Shapes - Absorption and Light Scattering at Low Density.
Final rept.
G. Birnbaum, B. Guillot, and S. Bratos. 1982, 64p
Pub. in Adv. Chem. Phys. 51, p49-112 1982.

Keywords: *Absorption, *Light scattering, *Line spectra, Reprints, *Molecule molecule interactions.

The great emphasis given to line shape calculations in collision-induced absorption (CIA) and collision-induced light scattering (CILS) has produced an amazing variety of results exploring, it would seem, almost every nuance of the subject. In one of the first calculations based on eliminating the potential, which produced a shape in very good agreement with experiment, the conclusion was reached that collision-induced line shapes may be rather insensitive to the form of the potential function. This conclusion has been strengthened by many subsequent investigations. But this is not to say, however, that studies of collision-induced shapes cannot yield information regarding the potential function. Since the absolute line shape is much more sensitive to the induction model than the potential function, line shape calculations are very useful for investigating the form of the induction function provided one uses the best potential functions that are available. Since, however, the 'best' potential for describing n phenomena may not necessarily be the best for the n+1st, the authors recommend that future attempts to parametrize potential models might be aided by including collision-induced spectral data.

704,258
PB82-263948 Not available NTIS
National Bureau of Standards, Washington, DC.
Exactly Soluble X-ray Edge Model for Non-adiabatic Scattering from Metal Surfaces.
Final rept.
J. W. Gadzuk. 15 Aug 81, 6p
Pub. in Physical Review B 24, n4 p1866-1871, 15 Aug 81.

Keywords: *Surfaces, *Inelastic scattering, *Mathematical models, Static structural analysis, Dynamic structural analysis, Comparison, X rays, Reprints, Anderson orthogonality theorem.

One implication of the Anderson Orthogonality Theorem is that a particle cannot elastically scatter from a metallic surface with unit probability. A simple, but exactly soluble model (within the usual bonds of X-ray edgeology) is presented which enables transparent and analytic calculation of the no-loss line intensity. Comparison between the dynamic properties of the scattering event and the static properties of the coupled substrate particle system are made.

704,259
PB82-263963 Not available NTIS
National Bureau of Standards, Washington, DC.
Double Resonant Charge Exchange in Ion-ion Collisions.
Final rept.
R. K. Jane, and D. S. Belic. 10 May 82, 3p
Pub. in Physics Letters 89A, n4 p190-192, 10 May 82.

Keywords: Ions, Coulomb interactions, Cross sections, Reprints, *Ion ion interactions, *Resonant double charge exchange.

The process of resonant double charge exchange in low energy ion-ion collisions is considered. The effects of the Coulomb interaction of the nuclei are taken into account. Cross section calculations are performed both for completely and partially stripped projectile ions with 3 less than or equal to Z less than or equal to 10.

704,260
PB82-264037 Not available NTIS
National Bureau of Standards, Washington, DC.
Rotational Isomeric Modeling of a Polyethylene-Like Polymer between Two Plates - Connection to Gambler's Ruin Problem.
Final rept.
C. M. Guttman, and E. A. DiMarzio. Apr 82, 7p
Pub. in Macromolecules 15, n2 p525-531, Mar-Apr 82.

Keywords: *Polyethylene, *Molecular rotation, *Mathematical models, Polymers, Monte Carlo method, Density(Mass/volume), Reprints, *Gambler's ruin, Amorphous materials.

Monte Carlo simulation of the rotational isomeric state model of a polyethylene-like polymer chain has been performed for the polymer between two plates with absorbing boundary conditions. Calculations using Flory's real chain parameters for a polyethylene chain give a density for the amorphous phase of 2.5 gm/cm for a switchboard model of polyethylene when the density of the crystal is assumed to be one. This amorphous density is 2.8 times the measured density of the melt of polyethylene showing the unreality of the switchboard model. The Monte Carlo results show that the simple concept of statistical length appropriate to unconfined polymers is also appropriate to bulk polymer chains that are confined by plane surfaces. Thus, as suggested previously Gambler's Ruin Methods used to obtain quantities such as the length of a run, the length of a loop or tie, and the probability of a loop or tie are valid for stiff chains if the statistical length is used as the fundamental step length.

704,261
PB82-264045 Not available NTIS
National Bureau of Standards, Washington, DC.
Hydrogen Exchange in RNase A: Neutron Diffraction Study.
Final rept.
A. Wlodawer, and L. Sjolin. Mar 82, 5p
Pub. in Proceedings of the National Academy of Science 79, p1418-1422 Mar 82.

Keywords: *Ribonuclease, *Neutron diffraction, Pancreatic extracts, Hydrogen, Chemical bonds.

Hydrogen exchange has been studied in a single crystal of RNase A (ribonuclease (pancreatic), EC 3.1.27.5) in the course of a neutron structure investigation. Refinement of the occupancies of amide hydrogens provided information about the kind of isotope present in each site and also provided estimates of the errors associated with the measurement.

704,262
PB82-264052 Not available NTIS
National Bureau of Standards, Washington, DC.
Procedure for Joint Refinement of Macromolecular Structures with X-ray and Neutron Diffraction Data from Single Crystals.
Final rept.
A. Wlodawer, and W. A. Hendrickson. 1982, 5p
Pub. in Acta Crystallographica A38, p239-247 1982.

Keywords: *Molecular structure, *X ray diffraction, *Neutron diffraction, Crystals, Reprints.

A procedure is presented for the stereochemically restrained least-squares refinement of macromolecular structures with neutron and X-ray diffraction data from single crystals. This procedure has been tested by refining a model of ribonuclease A using neutron data to minimal spacings of 2.8 A and X-ray data from within 2.0 A spacings. Joint X-ray and neutron refinement is well conditioned and tends to avoid false minima that may occur when a medium -resolution structure is refined solely with the neutron structure factors.

704,263
PB82-264102 Not available NTIS
National Bureau of Standards, Washington, DC.
Soluble Relaxation Model for Core Level Spectroscopy on Adsorbed Atoms.
Final rept.
J. W. Gadzuk, and S. Doniach. 1978, 22p
Sponsored in part by Army Research Office, Durham. NC.
Pub. in Surface Science 77, p427-448 1978.

Keywords: *Photoelectric emission, *Atoms, *Relaxation, *Mathematical models, Adsorption, Many body problem, Reprints.

The photoelectron spectrum of core levels in adsorbed atoms is calculated taking into account the screening of the core hole due to both displaced surface plasmons (image charges) and actual transfer of screening charge into the lowest unfilled valence levels of the adsorbate. The theory is detailed on a simplified but exactly soluble model, permitting parametric numerical studies of the spectrum while maintaining close contact with physical understanding. Recent theory on adsorbate relaxation effects due to Gumhalter and Newns, Gunnarsson and Schonhammer, Lang and Williams, and others are considered in the light of this model.

704,264
PB82-264110 Not available NTIS
National Bureau of Standards, Washington, DC.
Origin of H+ in Electron Stimulated Desorption of Condensed CH3OH.
Final rept.
R. Stockbauer, E. Bertel, and T. E. Madey. 1 Jun 82, 3p
Pub. in Jnl. of Chemical Physics 76, n11 p5639-5641, Jun 82.

Keywords: *Isotopic labeling, *Methyl alcohol, Mass spectroscopy, Deuterium compounds, Reprints, *Hydrogen ions, Electron stimulated desorption ion angular distributions.

Using deuterium labelling (CH3OD and CD3OH) it was determined that H(+1) in electron stimulated desorption (ESD) from condensed methanol multilayers is removed from the carbon rather than the oxygen atom. The peak in the ion kinetic energy distributions shifted toward lower energy as the energy of the incident electron was lowered consistent with the Franck-Condon

model of ESD. The effects of hydrogen bonding on the desorbed ion mass spectra are discussed.

704,265
PB82-264144 Not available NTIS
National Bureau of Standards, Washington, DC.
Observations of Pre- and Post-Breakdown Events in Polydimethylsiloxanes.
Final rept.
E. F. Kelley, R. E. Hebner, E. O. Forster, and G. J. Fitzpatrick. Jun 82, 4p
Pub. in Proceedings of Conference 1982 IEEE Int. Symposium on Electrical Insulation, Philadelphia, PA, June 7-9, 1982, p255-258 Jun 82.

Keywords: *Viscosity, *Electrical measurement, *Poly(siloxane/dimethyl).

The effect of viscosity and rate of voltage application on the electrical breakdown process in four polydimethylsiloxane fluids has been investigated under non-uniform field conditions using a high-speed image converter camera.

704,266
PB82-264284 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectrum and Energy Levels of Triply Ionized Yttrium (Y IV).
Final rept.
G. L. Epstein, and J. Reader. Apr 82, 17p
Pub. in Jnl. of the Optical Society of America 72, n4 p476-492 Apr 82.

Keywords: *Yttrium, *Ultraviolet spectroscopy, Atomic energy levels, Ionization, Reprints.

The spectrum of Y IV was observed in the region from 300 to 5000 A with the 10.7-m normal incidence vacuum spectrograph and the 10.7-m Eagle spectrograph in air at the National Bureau of Standards.

704,267
PB82-264300 Not available NTIS
National Bureau of Standards, Washington, DC.
Fluctuation Expressions for Fast Thermal Transport Processes: Vortex Viscosity.
Final rept.
D. J. Evans, and H. J. M. Hanley. Mar 82, 4p
Pub. in Physical Review A 25, n3 p1771-1774 Mar 82.

Keywords: *Transport properties, *Fluids, *Diatomic molecules, Nonequilibrium flow, Reprints, *Vortex viscosity, Kubo-Green relation.

The vortex viscosity of a model diatomic fluid is calculated using both equilibrium and nonequilibrium molecular dynamics. The two calculations agree within statistical uncertainties. The results show that vortex viscosity does not have a conventional Kubo-Green relation. An argument as to why this is so is presented.

704,268
PB82-264318 Not available NTIS
National Bureau of Standards, Washington, DC.
Distortion of the Structure of a Simple Fluid.
Final rept.
S. Hess, and H. J. M. Hanley. Mar 82, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review A 25, n3 p1801-1804 Mar 82.

Keywords: *Fluids, *Molecular structure, Reprints, Computer applications.

The distortion of the structure of a simple fluid of spherical particles when subjected to a shear is analyzed. The orientational distribution of particles around a central particle is examined via the radial distribution function. General symmetry arguments are advanced. Computer simulation results using the technique of homogeneous shear nonequilibrium molecular dynamics are reported for the inverse-12 soft sphere system. It is shown that the fluid displays nonNewtonian behavior.

704,269
PB82-264342 Not available NTIS
National Bureau of Standards, Washington, DC.
Activity and Osmotic Coefficients of Aqueous Nickel (II) Nitrate Solutions.
Final rept.
M. Sarbar, A. K. Covington, R. L. Nuttall, and R. N. Goldberg. 1982, 9p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Thermodynamics 14, p537-545 1982.

Keywords: *Osmosis, *Activity coefficients, Solutions, Reprints, *Nickel nitrate.

The osmotic coefficients of aqueous nickel (II) nitrate have been measured at 298.15 K by the isopiestic method at molalities ranging from 0.052 to 5.5 mol/kg. The measured osmotic coefficients were used to calculate activity coefficients using four different correlating equations. Error estimates and comparisons with previous literature values are given.

704,270
PB82-264359 Not available NTIS
National Bureau of Standards, Washington, DC.
Activity and Osmotic Coefficients of Aqueous Potassium Carbonate.
Final rept.
M. Sarbar, A. K. Covington, R. L. Nuttall, and R. N. Goldberg. 1982, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Thermodynamics 14, p695-702 1982.

Keywords: *Activity coefficients, *Osmosis, *Potassium carbonates, Thermodynamics, Solubility, Reprints, *Isopiestic method.

The isopiestic method has been used to determine the osmotic coefficients of aqueous potassium carbonate at molalities ranging from 0.13 to 8.1 mol/kg at 298.15 K. The solubility has been measured both by the isopiestic method and by titration of the saturated solution with hydrochloric acid and is (8.102 + 0.008)mol/kg. The measured osmotic coefficients were used to calculate activity coefficients using four different correlating equations. The authors give an error estimate and a comparison with previous literature results.

704,271
PB82-264409 Not available NTIS
National Bureau of Standards, Washington, DC.
Equation of State of Ethylene Vapor Between 223 and 273 K by the Burnett Method.
Final rept.
J. M. H. L. Sengers, and J. R. Hastings. Sep 81, 20p
Pub. in Int. Jnl. of Thermophysics 2, n3 p 269-288 Sep 81.

Keywords: *Equations of state, *Ethylene, Vapor phases, Isotherms, Reprints, *Burnett method, Virial coefficients.

Measurements are reported of the equation of state of ethylene in the vapor phase between 223 and 273 K by the Burnett method. (P, rho, T) values are reported on six isotherms at 10 K intervals. Virial coefficients have been obtained in this range both for ethylene and for helium. The Burnett isotherms were coupled isochorically, revealing a small but noticeable adsorption effect. Isochoric intersections with the phase boundary were performed, resulting in values for the vapor pressure and the vapor density. Again, clear indications of surface effects were found. The results have been compared with recent work by Douslin and Harrison, and by Thomas and Zander. The agreement with the work of Douslin and Harrison is striking; better than 2 parts in 10,000 in pressure and than 1 cc/mol in the second virial coefficient. The agreement with the McCarty - Jacobsen formulation is somewhat less satisfactory. A discussion of the various factors determining the reliability of the results is given.

704,272
PB82-264425 Not available NTIS
National Bureau of Standards, Washington, DC.
Prediction of Dense Fluid Viscosities in Hydrocarbon Mixtures.
Final rept.
J. F. Ely. 1982, 9p
Contract NASA-C-60875
Sponsored in part by Gas Research Inst., Chicago, IL.
Pub. in Proceedings of Gas Processors Association Annual Convention (61st), Dallas, TX. March 15-17, 1982, p9-17 1982.

Keywords: *Viscosity, *Hydrocarbons, *Thermal conductivity, Mathematical models, Mixtures, Equations of state, Comparison, Enskog-Thome theory.

Recently, Ely and Hanley (Ind. Eng. Chem. Fundam. 20, 323, 1981) have proposed a corresponding states model for the prediction of the viscosity and thermal conductivity of hydrocarbon mixtures. The model, which is the basis for the computer program TRAPP which is currently distributed by the Gas Processors Association, uses a methane reference fluid with corrections for noncorrespondence and size difference effects in mixtures. This manuscript reports the preliminary results of some recent modifications which have been made to the corresponding states model in an effort to improve its predictions. In particular, a propane reference fluid has been adopted and a correction for size and mass difference effects in the mixture viscosity coefficient based on the Enskog theory for hard spheres has been developed. Comparisons of the predictions of the revised model with experimental data for both pure fluid and mixture viscosity are presented.

704,273
PB82-264441 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiance Temperature (at 653 nm) of Tungsten at its Melting Point.
Final rept.
A. Cezairliyan, and A. P. Miiller. 1982, 11p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Int. Jnl. of Thermophysics 3, n1 p89-99 1982.

Keywords: *Tungsten, *Melting points, Radiance, Temperature, Reprints.

The radiance temperature (653 nm) of tungsten at its melting point was measured using a subsecond-duration pulse-heating technique. Specimens in the form of strips with initially different surface roughnesses were used. The results do not indicate any dependence of radiance temperature (at the melting point) on initial surface or system operational conditions. The average radiance temperature (at 653 nm) at the melting point for 23 specimens is 3208 K on IPTS-68 with a standard deviation of 0.8 K and a maximum absolute deviation of 1.9 K. The total error in the radiance temperature is estimated to be not more than + or - 10 K.

704,274
PB82-265638 Not available NTIS
National Bureau of Standards, Washington, DC.
Direct Observation of Hot-Electron Spectra from Laser-Excited Sodium Vapor.
Final rept.
J. L. LeGouet, J. L. Picque, F. Wuilleumier, J. M. Bizau, P. Dhez, P Koch, and D. L. Ederer. Mar 82, 6p
Grant NATO-1735
Sponsored in part by Centre National de la Recherche Scientifique, Orsay (France).
Pub. in Physical Review Letters 48, n9 p600-603, 1 Mar 82.

Keywords: *Photoelectrons, Gas ionization, Atomic beams, Laser beams, Sodium, Reprints, *Atom electron interactions, Energy spectra.

A sodium atomic beam with density 10 to the 13th power/cc was illuminated by cw dye laser radiation (a few watts per square centimeter) tuned to the D2 resonance line. In the energy spectrum of the emitted electrons, several lines were observed between 4 and 7 eV. Their positions and intensities indicate that seed electrons are produced either via associative ionization or via collisional ionization from excited states populated by energy-pooling collisions. These electrons are then heated through successive superelastic collisions with excited 3p atoms.

704,275
PB82-600001
(Order as PB83-164533, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Thermal Conductivity of Oxygen.
H. M. Roder. 1982, 31p
Included in Jnl. of Research of the National Bureau of Standards, v87 n4 p279-310 1982.

Keywords: *Hot wire, Oxygen, Pressure temperature, *Thermal conductivity, Transient.

The paper presents new experimental measurements of the thermal conductivity of oxygen for thirteen isotherms at temperatures from 78 to 310 K with pressures to 70 MPa and densities from 0 to 40 mol/L. The measurements were made with a transient hot wire apparatus and they cover a wide range of physical states including the dilute gas, the moderately dense gas, the near critical region, the compressed liquid states, and the vapor at temperatures below the critical tempera-

ture. The thermal conductivity surface is represented with an equation that is based in part on an existing correlation of the dilute gas. The data are compared with the experimental measurements of others through the new correlation. The new measurements show that the critical enhancement extends to quite high temperatures, about 300 K. The precision (2 sigma) of the oxygen measurements is between 0.5 and 0.8 percent for wire temperature transients of 4 to 5 K, while the accuracy is estimated to be 1.5 percent.

704,276
PB82-600002
(Order as PB83-164533, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Measurements of the Octanol/Water Partition Coefficient by Chromatographic Methods.
S. P. Wasik, Y. B. Tewari, M. M. Miller, and J. H. Purnell. 1982, 5p
Included in Jnl. of Research of the National Bureau of Standards, v87 n4 p311-315 1982.

Keywords: *Activity coefficients, Alkylbenzenes, Gas chromatography, Octanol/water partition coefficients.

A theoretical relationship is developed to provide a quantitative definition of hydrophobicity using established theoretical and semi-empirical relationships. A method of predicting partition coefficients of relatively water-insoluble third components between water and an immiscible second component is devised and tested. Comparison with experimental data for four classes of compounds in the water/n-octanol system at 25C shows excellent agreement, indicating that values for substances for which direct determination is experimentally precluded can be calculated with confidence.

704,277
PB82-600008 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fundamental Equation of State for Heavy Water.
P. G. Hill, R. D. C. MacMillan, and V. A. Lee. c1982, 14p
Included in Jnl. of Physical and Chemical Reference Data, v11 n1 p1-14 1982.

Keywords: *Enthalpy, Equation of state, Heavy water, Helmholtz function, PVT, Specific heats, Speed of sound, Thermodynamic properties, Vapor pressure.

A fundamental equation of state has been formulated for heavy water in the form psi=psi(p,T) in which psi=Helmholtz free energy, p=density, T=thermodynamic temperature. The complete range of single phase states in the range up to 100 MPa and 600C is covered by a single equation which is fitted both to PVT values, for saturated and unsaturated states, and to enthalpy values for saturation states only. The equation is constrained to fit the critical point conditions determined by Blank. It represents all thermodynamic properties of D2O, in the above range of states.

704,278
PB82-600009 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Volumetric Properties of Aqueous Sodium Chloride Solutions.
P. S. Z. Rogers, and K. S. Pitzer. c1982, 67p
Included in Jnl. of Physical and Chemical Reference Data, v11 n1 p15-81 1982.

Keywords: *Apparent molal volume, Aqueous sodium chloride solutions, Compressibility, Density, Equation of state, Expansivity, Pitzer's equations, PVT, Volume, Volumetric properties.

Literature data for the volumetric properties of sodium chloride solutions to concentrations of 5.5 molal have been compiled and critically evaluated. A semi-empirical equation of the same type found to be effective in describing the thermal properties of NaCl solutions has been used to reproduce the volumetric data from 0C to 300C and 1 bar to 1000 bar. Tables of values are given for the specific volume, expansivity, and compressibility. Equations also are given for calculating the pressure dependence of the free energy, enthalpy, and heat capacity. These equations can be combined with a treatment of thermal properties to form a complete equation of state for sodium chloride solutions.

704,279
PB82-600010 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ideal Gas Thermodynamic Properties of CH3, CD3, CD4, C2D2, C2D4, C2D6, C2H6, CH3N2CH3, and CD3N2CD3.
K. M. Pamidimukkala, D. Rogers, and G. B. Skinner. c1982, 17p
Included in Jnl. of Physical and Chemical Reference Data, v11 n1 p83-99 1982.

Keywords: *Acetylenes, Azomethanes, Critically evaluated data, Diazine dimethyles, Enthalpy of formation, Entropy, Ethane, Ethylene, Gibbs energy of formation, Ideal gas thermodynamic properties, Internal rotation, Methane, Methyl radical.

Ideal gas thermodynamic properties for CH3, CD3, CD4, C2D2, C2D4, C2D6, C2H6, CH3N2CH3 and CD3N2CD3 in the temperature range 0-3000 K and at 1 atmosphere have calculated by statistical thermodynamic methods employing spectroscopic and other molecular constants. The rigid rotorharmonic oscillator model has been used. Estimated uncertainties in the thermodynamic properties due to uncertainties in the molecular properties and estimates of the effects of vibrational anharmonicities are also reported for each compound at three temperatures.

704,280
PB82-600011 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Peak Absorption Coefficients of Microwave Absorption Lines of Carbonyl Sulphide.
Z. Kisiel, and D. J. Millen. c1982, 17p
Included in Jnl. of Physical and Chemical Reference Data, v11 n1 p101-117 1982.

Keywords: *Absorption coefficients, Carbonyl sulphide, Intensities, Microwave transitions, Rotational transitions.

Peak absorption coefficients alpha max for the J=1 arrow 0, J=2 arrow 1, and J=3 arrow 2 rotational transitions in carbonyl sulphide have been calculated for the different isotopic molecular species in natural abundance and in each case for a range of vibrational states. The results are tabulated for convenience both in order of values of alpha max and in order of transition frequencies. Calculations have also been made, on a less extensive basis, for transitions from J=4 arrow 3 to J=25 arrow 24, and peak absorption coefficients have been tabulated, in order of values of alpha max for each of these transitions. The tables provide a frequency coverage of approximately 10 to 300 GHz. Comparison with available experimental results shows satisfactory agreement.

704,281
PB82-600012 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Vibrational Contributions to Molecular Dipole Polarizabilities.
D. M. Bishop, and L. M. Cheung. c1982, 15p
Included in Jnl. of Physical and Chemical Reference Data, v11 n1 p119-133 1982.

Keywords: *Atomic polarization, Dipole polarizabilities, Infrared intensities, Molecular polarizabilities, Vibrational polarizabilities.

An often overlooked, but nonetheless important, contribution to molecular dipole polarizabilities is that which comes from molecular vibration. This contribution, which was formerly called the atomic polarization, may be related to the intensities of the infrared-active bands. In this paper we have collected the best available intensity data for some hundred or so molecules and evaluated their vibrational polarizabilities. We have also given estimates of the probable errors of the final numbers.

704,282
PB82-600013 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Levels of Iron, Fe I Through Fe XXVI.
C. Corliss, and J. Sugar. c1982, 107p
Included in Jnl. of Physical and Chemical Reference Data, v11 n1 p135-241 1982.

Keywords: *Atomic energy levels, Atomic spectra, Fe, Iron, Iron energy levels.

This is a revision of the compilation of energy levels of iron for all ionization stages made in 1975 by Reader and Sugar. New material has since been provided for all but two of these ions. The present compilation includes electron configurations, energy levels, term designations, calculated leading percentages for most ions, experimental g-values, and ionization energies.

704,283
PB82-600015 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Spectra of Molecules of Astrophysical Interest. XXI. Ethanol (C2H5OH) and Propionitrile (C2H5CN).
F. J. Lovas. c1982, 62p
Included in Jnl. of Physical and Chemical Reference Data, v11 n2 p251-312 1982.

Keywords: *Ethanol, Intensities, Interstellar molecules, Microwave spectra, Molecular constants, Propionitrile, Radio astronomy, Rotational spectrum.

The microwave spectra of ethanol (C2H5OH) and propionitrile (ethyl cyanide, C2H5CN) are critically reviewed and supplemented with spectral frequency calculations which include rotational and centrifugal distortion terms in the molecular Hamiltonian. The primary objective of this review is to provide the microwave transition frequencies applicable to molecular radio astronomy for the ground vibrational state of the most abundant isotopic forms, namely, 12C2H516OH and 12C2H512C14N. Since the internal rotation and hyperfine splittings for these species have not been resolved in most of the reported laboratory studies and also not detected in the molecular clouds observed by radio astronomers, these splittings have been ignored in the present calculations. All measured rotational transitions are included, however, the predicted transition frequencies were limited to J=25 for ethanol and J=30 for propionitrile over the range of 1 GHz to 300 GHz. A complete summary of the laboratory studies of both species is included for all isotopic forms with references to all prior studies.

704,284
PB82-600016 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heat Capacity and Other Thermodynamic Properties of Linear Macromolecules. V. Polystyrene.
U. Gaur, and B. Wunderlich. c1982, 13p
Included in Jnl. of Physical and Chemical Reference Data, v11 n2 p313-325 1982.

Keywords: *Atactic, Crystal, Crystallinity, Density, Enthalpy, Fusion, Glass transition, Heat capacity, Isotactic, Linear macromolecule, Melt, Polystyrene.

The heat capacity of polystyrene from 0 K to 600 K is reviewed on the basis of measurements on 29 samples reported in the literature. A set of recommended data for amorphous polystyrene is derived. The effect of tacticity on the heat capacity is also evaluated. Entropy and enthalpy functions are calculated. This paper is the fifth in a series of publications which will ultimately cover all heat capacity measurements on linear macromolecules.

704,285
PB82-600019 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Molten Salts Data: Diffusion Coefficients in Single and Multi-Component Salt Systems.
G. J. Janz, and N. P. Bansal. c1982, 189p
Included in Jnl. of Physical and Chemical Reference Data, v11 n3 p505-693 1982.

Keywords: *Diffusion, Diffusion coefficients, Diffusion techniques, Fused salts, Molten salts, Self-diffusion coefficients.

The property of diffusion is one of the basic properties of fluid systems. In molten salts, more than 700 studies have been reported to August, 1980, with more than 15 diffusion measurement techniques. A critical examination of these studies with a review of the techniques is presented. The results for more than 140 salt systems are reported in this communication as a series of data tables, with numerical values, value judgements, and literature citations. Silicates, slags, and oxide melts are excluded.

704,286
PB82-600020 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
JANAF Thermochemical Tables, 1982 Supplement.
M. W. Chase, J. L. Curnutt, J. R. Downey, R. A. McDonald, A. N. Syverud, and E. A. Valenzuela. c1982, 246p
Included in Jnl. of Physical and Chemical Reference Data, v11 n3 p695-940 1982.

Keywords: *Critically evaluated data, Enthalpy, Entropy, Equilibrium constant of formation, Free energy of formation, Gibbs energy function, Heat capacity, Heat of formation, Thermochemical tables.

The thermodynamic tabulations previously published in four collections are extended by 227 new and revised tables. The JANAF Thermochemical Tables cover the thermodynamic properties over a wide temperature range with single phase tables for the crystal, liquid, and ideal gas state. In addition some multiphase tables are given. The properties given are heat capacity, entropy, Gibbes energy function, enthalpy, enthalpy of formation, Gibbs energy of formation, and the logarithm of the equilibrium constant for formation of each compound from the elements in their standard reference states. Each tabulation lists all pertinent input data and contains a critical evaluation of the literature upon which these values are based. Literature references are given.

704,287
PB82-600021 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Critical Evaluation of Vapor-liquid Equilibrium, Heat of Mixing, and Volume Change of Mixing Data. General Procedures.
B. D. Smith, O. Muthu, A. Dewan, and M. Gierlach. c1982, 11p
Included in Jnl. of Physical and Chemical Reference Data, v11 n3 p941-951 1982.

Keywords: *Equations of state, Heat of mixing, Liquid density, Mixtures, Second viral coefficients, Vapor-liquid equilibrium, Vapor pressure, Volume change of mixing.

This paper is the first in a series of reports on the critical evaluation of vapor-liquid equilibrium, heat of mixing, and volume change of mixing data for binary liquid mixtures of nonelectrolytes. The specific evaluation procedures for each property will be covered in subsequent articles. This paper describes the general procedures used to support the mixture evaluation work. The areas covered include the procedures used to cover the primary and secondary literature, the computer program libraries developed for pure compound and mixture data processing, the procedures used to evaluate and correlate the pure compound property data for use by the mixture programs, and the efforts made to make the best equation of state available to the vapor-liquid equilibrium data reduction programs. Improvements are suggested for the presentation of mixture data in the literature.

704,288
PB82-600022 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rate Coefficients for Vibrational Energy Transfer Involving the Hydrogen Halides.
S. R. Leone. c1982, 44p
Included in Jnl. of Physical and Chemical Reference Data, v11 n3 p953-996 1982.

Keywords: *Energy transfer, Hydrogen halide, Molecular relaxation, Vibration.

A comprehensive compilation of rate coefficients for vibration-to-vibration (V-V) and vibration-to-translation (V-T) energy transfer processes involving hydrogen halide molecules is presented. The literature has been surveyed from 1966 to July 1981. Rate coefficients are grouped according to room temperature and low and high temperature results. Measured results are identified according to the type of process: V-V, V-T, or the sum of V-V and V-T processes. The method of measurement is identified along with the energy discrepancy, percent error, authors, and year of publication. The results are seen to be in excellent agreement when multiple measurements are available.

704,289
PB82-600024 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Behavior of the AB2 Type Compounds at High Pressures and High Temperatures.
L. Merrill. c1982, 60p
Included in Jnl. of Physical and Chemical Reference Data, v11 n4 p1005-1064 1982.

Keywords: *AB2-type compounds, Calibrations, Critically evaluated data, Crystallographic data, Experimental melting curves, High pressure, High temperature, Polymorphism, p T phase diagrams, Solid-solid phase boundaries.

Data on the polymorphic phase transformations of known compounds and new synthetic compounds of the type AB2 have been compiled and evaluated. All available pressure studies have been included and referenced. Pressure-temperature phase diagrams showing first order solid-solid phase boundaries and/or melting curves showing the best fit to the experimental data are included. For some materials which can be produced only by chemical synthesis techniques at high pressures and high temperatures, reaction-product diagrams have been employed to estimate the region of thermodynamic stability. Crystallographic data of all the known phases of each material have been tabulated and evaluated. This review covers 168 compounds and 332 phases including the room temperature atmospheric pressure phase for each compound when it exists.

704,290
PB82-600025 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heat Capacity and Other Thermodynamic Properties of Linear Macromolecules. VI. Acrylic Polymers.
U. Gaur, S. Lau, B. B. Wunderlich, and B. Wunderlich. c1982, 25p
Included in Jnl. of Physical and Chemical Reference Data, v11 n4 p1065-1089 1982.

Keywords: *Enthalpy, Entropy, Glass transition, Heat capacity, Linear macromolecule, Polyacrylate, Polyacrylonitrile, Polymethacrylamide, Polymethacrylate, Poly(methacrylic acid).

Heat capacity of poly(methyl methacrylate), polyacrylonitrile, poly(methyl acrylate), poly(ethyl acrylate), poly(n-butyl acrylate), poly(iso-butyl acrylate), poly(octadecyl acrylate), poly(methacrylic acid), poly(ethyl methacrylate), poly(n-butyl methacrylate), poly(isobutyl methacrylate), poly(hexyl methacrylate), poly(docecyl methacrylate), poly(octadecyl methacrylate) and polymethacrylamide is reviewed on the basis of measurements on 35 samples reported in the literature. A set of recommended data are derived for each acrylic polymer in the amorphous state. Enthalpy and entropy functions are calculated for poly(methyl methacrylate) and polyacrylonitrile. This is the sixth paper in a series of publications which will ultimately cover all heat capacity measurements on linear macromolecules.

704,291
PB82-600026 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Molecular Form Factors and Photon Coherent Scattering Cross Sections of Water.
L. R. M. Morin. c1982, 8p
Included in Jnl. of Physical and Chemical Reference Data, v11 n4 p1091-1098 1982.

Keywords: *Coherent scattering, Cross section, Form factor, Rayleigh scattering, Tabulation, Water, X rays.

Tabulations are presented of molecular form factors F(x), for values of x=sin(theta/2)/lambda from 0 to 1.25 angstrom(-1), for liquid water at eight temperatures between 4C and 200C and for the free water molecule. For liquid water, x=0 to 1.25 angstrom(-1), the tabulated values are interpolated from experimental values of Narten and Levy (1971). For the free water molecule, x=0 to 1.25 angstrom(-1), the tabulated values are interpolated from calculated values of Blum (1971). For x=1.25 to 10 to the 9th power angstrom(-1), the independent atomic scattering hypothesis is assumed and the water molecular form factor F(x) is calculated from the hydrogen and oxygen atomic form factors given by Hubbell and Overbo (1979). Tables of coherent scattering cross sections, obtained by numerical integration of the Thomson formula, weighted by F(Q)(x), are presented for liquid water at eight temperatures between 4C and 200C and for the free water molecule, for photon energies 5 keV to 1 MeV.

704,292
PB82-600027 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation of Binary PTxy Vapor-Liquid Equilibrium Data for C6 Hydrocarbons. Benzene + Cyclohexane.
B. D. Smith, O. Muthu, A. Dewan, and M. Gierlach. c1982, 29p
Included in Jnl. of Physical and Chemical Reference Data, v11 n4 p1099-1127 1982.

Keywords: *Activity coefficients, Benzene, Cyclohexane, Evaluation procedures, Excess Gibbs function, Vapor-liquid equilibrium.

The methods used to evaluate subcritical binary PTxy vapor-liquid equilibrium data are described. The evaluation results for the benzene+cyclohexane system are presented. The needs for new experimental data are defined.

704,293
PB82-600028 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation of Binary Excess Enthalpy Data for C6 Hydrocarbons. Benzene+Cyclohexane.
B. D. Smith, O. Muthu, A. Dewan, and M. Gierlach. 1982, 23p
Included in Jnl. of Physical and Chemical Reference Data, v11 n4 p1129-1151 1982.

Keywords: *Benzene, Cyclohexane, Evaluation procedures, Excess enthalpy, Heat of mixing.

The methods used to evaluate excess enthalpy data are described. The evaluation results for the benzene+cyclohexane system are presented. The needs for new experimental data are defined.

704,294
PB82-600029 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation of Binary Excess Volume Data for C6 Hydrocarbons. Benzene+Cyclohexane.
B. D. Smith, O. Muthu, A. Dewan, and M. Gierlach. c1982, 19p
Included in Jnl. of Physical and Chemical Reference Data, v11 n4 p1153-1171 1982.

Keywords: *Benzene, Cyclohexane, Evaluation procedures, Excess volume, Volume change of mixing.

The methods used to evaluate excess volume data are described. The evaluation results for the benzene+cyclohexane system are presented. The needs for new experimental data are defined.

704,295
PB82-600031 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 11, Supplement No. 1, 1982. Thermophysical Properties of Fluids. I. Argon, Ethylene, Parahydrogen, Nitrogen, Nitrogen Trifluoride, and Oxygen.
B. A. Younglove. c1982, 354p
Included in Jnl. of Physical and Chemical Reference Data, Supplement 1, v11, 1982.

Keywords: *Argon, Critically evaluated data, Density, Ethylene, Heat capacity, Nitrogen, Nitrogen trifluoride, Oxygen, Parahydrogen, Thermodynamic properties, Thermophysical properties.

The thermophysical properties of argon, ethylene, parahydrogen, nitrogen, nitrogen trifluoride and oxygen are presented. Properties are given in tables and a standard set of equations is described. The tables list pressure, density, temperature, internal energy, enthalpy, entropy, heat capacity at constant volume, heat capacity at constant pressure, and sound velocity. Also included are viscosity, thermal conductivity, and dielectric constant, for some of the fluids. The equation and related properties of this report represent a compilation from the cooperative efforts of two research groups: the NBS Thermophysical Properties Division and the Center for Applied Thermodynamics Studies of the University of Idaho.

704,296
PB82-600032 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 11, Supplement No. 2, 1982. NBS Tables of Chemical Thermodynamic Properties.
D. D. Wagman, W. H. Evans, V. B. Parker, R. H. Schumm, I. Halow, S. M. Bailey, K. L. Churney, and R. L. Nuttall. c1982, 394p
Included in Jnl. of Physical and Chemical Reference Data, v11, Supplement 2, 1982.

Keywords: *Chemical thermodynamics, Enthalpy, Entropy, Evaluated data, Gibbs energy, Inorganic chemistry, Thermochemistry.

Recommended values are provided for chemical thermodynamic properties of inorganic substances and for organic substances usually containing only one or two carbon atoms. Where available, values are given for the enthalpy of formation, Gibbs energy of formation,

entropy, and heat capacity at 298.15 K (25C), the enthalpy difference between 298.15 and 0 K and the enthalpy of formation at 0 K. All values are given in SI units and are for a standard state pressure of 100 000 pascal. This volume is a new collective edition of 'Selected Values of Chemical Thermodynamic Properties', which was issued serially as National Bureau of Standard Technical Notes 270-1 (1965) to 270-8 (1981). Values are given for properties of gaseous, liquid, and crystalline substances, for solutions in water, and for mixed aqueous and organic solutions. Values are not given for alloys or other solid solutions, fused salts, or for substances of undefined composition. Compounds of the transuranium elements are not included.

704,297
PB82-600033 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Absorbed Dose Water Calorimeter.
S. R. Domen. Filed 29 Feb 80, patented 26 Jan 82, 8p PAT-APPL-6-126 108, PATENT-4 312 224

Keywords: *Absorbed dose, Adiabatic, Calorimeter, Polyethylene film, Thermistor, Water calorimeter.

An absorbed dose water calorimeter that takes advantage of the low thermal diffusivity of water and the water-imperviousness of polyethylene film. An ultrasmall bead thermistor is sandwiched between two thin polyethylene films stretched between insulative supports in a water bath. The polyethylene films insulate the thermistor and its leads, the leads being run out from between the films in insulated sleeving and then to junctions to form a Wheatstone bridge circuit. Convection barriers may be provided to reduce the effects of convection from the point of measurement. Controlled heating of different levels in the water bath is accomplished by electrical heater circuits provided for controlling temperature drift and providing adiabatic operation of the calorimeter. The absorbed dose is determined from the known specific heat of water and the measured temperature change.

704,298
PB82-600044 Not available NTIS
National Bureau of Standards, Gaithersburg, MD
Reactions of Ethynyl Radicals. Rate Constants with CH4, C2H6, and C2D6.
A. H. Laufer. 1981, 4p
Pub. in Jnl. Phys. Chem. 85, n25 p3828-3831 Dec 1981.

Keywords: *Abstraction, Ethane, Ethane-d6, Ethynyl radicals, Rate constants.

The rate constants for the abstraction of H atoms from CH4, C2H6, and D atoms from C2D6 by C2H(ethynyl) radicals have been determined by using a flash photolysis-kinetic spectroscopic technique. The values obtained, at 297 K, are (1.2 + or - 0.2) x 10 to the minus 12th power, (6.5 + or - 0.4) x 10 to the minus 12th power, and (3.1 + or - 0.5) x 10 to the minus 12th power cu cm molecule to the minus 1st power s to the minus 1st power, respectively. The rate constants are independent of added helium over the pressure range 20-700 torr. The kinetic parameters were determined by monitoring the acetylene product spectroscopically using C2H-CF3 as the source of ethynyl radicals.

704,299
PB82-600045 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calculation of Activation Energies for Hydrogen-Atom Abstractions by Radicals Containing Carbon Triple Bonds.
R. L. Brown, and A. H. Laufer. 1981, 3p
Pub. in Jnl. Phys. Chem. 85, n25 p3826-3828 Dec 1981.

Keywords: *Abstraction reactions, Activation energies, Bond-energy-bond-order, CN, Ethynyl, Radicals.

Activation energies are calculated by the bond-energy-bond-order (BEBO) and the bond-strength-bond-length (BSBL) methods for the reactions of C2H radicals with H2, CH4, and C2H6 and for the reactions of CN radicals with H2 and CH4. The BSBL technique accurately predicts the activation energies for these reactions while the BEBO method yields energies averaging 9 kcal higher than those observed. A possible reason for the disagreement is considered.

704,300
PB82-600046 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Temperature, High Resolution Infrared Spectral Measurements on the HNC-HCN Equilibrium System.
A. G. Maki, and R. L. Sams. 1981, 5p
Pub. in Jnl. Phys. Chem. 75, n9 p4178-4182 Nov 1981.

Keywords: *Absorption, High temperature, Hydrogen isocyanide, Infrared, Molecular structure, Potential functions, Spectroscopy.

Spectral measurements have been made on HNC in equilibrium with HCN at temperatures ranging from 900 to 1250 K. From measurements of absorption intensity vs temperature it is determined that the ground state of HNC is 10.3 + or - 1.1 kcal/mol (43.1 + or - 4.6 kJ/mol) above the ground state of HCN. High resolution data are given on the following vibrational transitions for HNC near 3650 cm to the minus 1st power: 10(0)0-00(0)0, 11(1)0-01(1)0, 12(0)0-02(0)0, and 12(2)0-02(2)0. Measurements near 2780 cm to the minus 1st power are also given for the 10(0)0-00(0)0 and 11(1)0-01(1)0 transitions for DNC. Aside from the low bending force constant, these measurements show nothing unusual about the bending potential function.

704,301
PB82-600047 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Formation of the Vinylidene Radical as an Intermediate in the Combination of Triplet Methylene.
A. H. Laufer. 1982, 4p
Pub. in Jnl. Chem. Phys. 76, n2 p945-948 15 Jan 1982.

Keywords: *Energetics, Excited states, Kinetics, Methylene, Radicals, Vinylidene.

The vinylidene radical (H2C=C) is proposed as an intermediate in the combination reaction of triplet methylene. The conclusion is based upon the distribution of isotopic acetylenes produced from a 1:1 mixture of CD2 and CH2. The path of the reaction and the energetics of the intermediate species are discussed.

704,302
PB82-600048 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser UV Photofragmentation of Halogenated Molecules. Selective Bond Dissociation and Wavelength-Specific Quantum Yields for Excited I(2P1/2) and Br(2P1/2) Atoms.
W. H. Pence, S. L. Baughcum, and S. R. Leone. 1981, 8p
Pub. in Jnl. Phys. Chem. 85, n25 p3844-3851 Nov 1981.

Keywords: *Br(2P1/2), I(2P1/2), Laser, Photofragmentation, Photolysis, Ultraviolet.

Quantum yields for excited I(2P1/2) and Br(2P1/2) atom formation are measured for CH3I, CH2I2, C2F5I, C2F5Br, 1,2-C2F4IBr, CF3Br, C6H5I, and C6H5CH2I at selected laser wavelengths, 193, 248, 268, and 308 nm. The quantum yield results are discussed in terms of selective bond dissociation mechanisms and wavelength-specific electronic excitation and curve-crossing pathways.

704,303
PB82-600049 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Multichannel Distorted-Wave Approximation.
P. S. Julienne, and F. H. Mies. 1981, 13p
Pub. in Jnl. Phys. B: At. Mol. Phys. 14, p4335-4347 1981.

Keywords: *Adiabatic electronic-rotational states, Atomic scattering, Distorted wave approximation, Fine structure transitions, Hund's coupling, WKB approximation.

A multichannel distorted-wave approximation for atom-atom scattering based on an expansion of the total diatomic wavefunction in adiabatic electronic-rotational (AER) states is studied through a numerical example involving the 3P1->3P0 fine-structure transitions in excited Zn, Cd and Hg. The AER states are those which diagonalise the full electronic-rotational Hamiltonian continuously as a function of R. In the limit of weak interaction the coupled equations for the exact wavefunctions in the AER representation suggest a simple distorted-wave approximation. The scattering matrix element is evaluated using the single-channel radial wavefunctions obtained from the adiabatic potentials, and its magnitude depends on the R variation of the orthogonal matrix which diagonalises the complete multichannel interaction energy. The approximation retains the simplicity of requiring only single-channel radial functions while going beyond the Born-Oppenheimer approximation and permitting treatment of the case where the Hund's coupling case of angular momentum varies strongly in the region of inelastic coupling. It is especially useful for including the effect of distant closed channels. The approximation is shown to work well for the model considered. Furthermore, it readily lends itself to a simple second-order correction through the WKB random-phase approximation and suggests a WKB formulation of the close-coupling equations.

704,304
PB82-600050 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Resonance Effects in Multichannel Free-Free Transitions of an Electron Scattering from a Hydrogen Atom.
M. J. Conneely, and S. Geltman. 1981, 18p
Pub. in Jnl. Phys. B: At. Mol. Phys. 14, p4847-4864 1981.

Keywords: *Angular distributions, Close-coupling approximation, CO2 laser, Elastic and inelastic, Electron-hydrogen scattering, Feshbach resonances, Free-free transitions, Nd laser, Photon-assisted transitions.

We present here the results of the first detailed theoretical calculation of differential cross sections for free-free transitions which involve electrons at real target-atom scattering resonances in a laser field. The scattering resonances included, which may occur in the initial or final state (or both) of the free-free absorption, are the lowest (1)S(super e), (1)P(super o), (3)S(super e), and (3)P(super o) Feshbach resonances of hydrogen occurring at incident electron energies just below the n=2 excitation threshold. We evaluate differential cross sections involving initial (1)S(super e) and (3)P(super o) resonances and radiation at the CO2 laser wavelength (h omega = 0.117 eV), the double resonances between (1)S(super e) and (1)P(super o) (h omega=0.630 eV) and between (3)P(super o) and (3)S(super e) (h omega=0.383 eV), and the processes going from (1)S(super e) and (3)P(super o) resonances to a final state above the n=2 threshold by means of radiation at the Nd laser wavelength (h omega=1.17 eV). The latter process has three possible final atomic states (1s, 2s, 2p) and corresponds to the joint electron-photon excitation of the hydrogen atom. It is found that the presence of the electron scattering resonances can enhance the background free-free absorption in the forward direction by as much as four orders of magnitude, but has a relatively minor effect in the backward direction.

704,305
PB82-600056 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Lineshapes and Dipole Moments in Collision-Induced Absorption.
G. Birnbaum, M. S. Brown, and L. Frommhold. 1981, 11p
Pub. in Can. Jnl. Phys. 59, n10 p1544-1554 1981.

Keywords: *Argon, Binary mixtures, Collision-induced absorption, Potential functions, Spectral moments, Translational spectrum, Wave mechanical lineshapes.

Wave mechanical lineshapes of collision-induced absorption spectra are computed for binary mixtures of argon with helium, neon, and krypton using theoretical dipole moments as input. Comparison with measured spectra shows satisfactory agreement except for the neon-argon mixture, for which either theory or measurement is seen to be in substantial error. Empirical models of the collision-induced dipole moment which reproduce the experimental spectra more closely than the fundamental theory are also given. Best agreement between computed and experimental lineshapes is obtained when potential models which are accurate in the repulsive region are used.

704,306
PB83-103713 Not available NTIS
National Bureau of Standards, Washington, DC.
Specific Heat and Virial Coefficient Measurements with a Spherical Acoustic Resonator.
Final rept.
J. B. Mehl, and M. R. Moldover. Jul 82, 11p
Pub. in Proceedings of the Symposium on Thermophysical Properties (8th), National Bureau of Standards,

Gaithersburg, Maryland, June 15-18, 1981, p134-141 Jul 82.

Keywords: *Specific heat, Equations of state, Acoustic velocity, Ethylene, Precision, Accuracy, *Virial coefficients.

The ideal gas specific heat CP (T), and the acoustic virial A1(T) can be determined extremely accurately from speed of sound c(P,T) data obtained with a spherical resonator. At each temperature, T, the ratio of the speed of sound of a test gas to the speed of sound of a reference gas can be determined with a precision of a few parts in a million by successive measurements of the frequencies and widths of the radial resonances of both gases in the same spherical shell. Molecular relaxation effects are minimized by working at frequencies on the order of 5 kHz. From measurements over a range of temperature and pressure, CP (T) can be determined with an accuracy on the order of 0.01%. We have combined two direct measurements of the density virial, B(T), of ethylene near 270 K with our own acoustic data to determine B(T) from 273-373 K. The maximum difference between these acoustic values and independent, highly accurate direct measurements of B(T) is 0.8 cc/mole at 373 K.

704,307
PB83-103747 Not available NTIS
National Bureau of Standards, Washington, DC.
Shift of Doublet S (1/2) Hyperfine Splittings Due to Blackbody Radiation.
Final rept.
W. M. Itano, L. L. Lewis, and D. J. Wineland. Feb 82, 3p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Physical Review A 25, n2 p1233-1235 Feb 82.

Keywords: *Hyperfine structure, Frequency standards, Stark effect, Zeeman effect, Atomic clocks, Blackbody radiation, Cesium, Barium, Mercury, Reprints.

Frequency shifts of hyperfine splittings of doublet S (1/2) states due to the blackbody radiation field are calculated. It is shown that they can be estimated from the dc hyperfine Stark shifts, which have previously been measured in the ground states of hydrogen and the alkali atoms. The shift at 300 K is large enough to be significant in primary Cs atomic beam frequency standards, and should be measurable. A simple method of calculating the hyperfine Stark shifts is described, which is based on the Bates-Damgaard method for determining radial matrix elements and the Fermi-Segre formula for determining the contact hperfine matrix elements. It is applied to Ba and Hg, for which no experimental data are yet available, and which are currently of interest for frequency standards.

704,308
PB83-106088 Not available NTIS
National Bureau of Standards, Washington, DC.
Kinetic Perturbation Theory for Fluids and Fluid Mixtures.
Final rept.
J. M. Kincaid, and R. F. Kayser. Jul 82, 2p
Pub. in Proceedings of Symposium on Thermophysical Properties (8th), Gaithersburg, Maryland, June 15-18, 1981, I, p189-190 Jul 82.

Keywords: *Fluids, *Kinetic theory, Boltzmann equation, Transport properties, Perturbation theory, Anallytic functions, Taylors series, Mixtures.

It is proven, for two classes of smooth, repulsive interparticle potentials phi(r) = (phi sub 0)(r) + lambda(phi sub 1)(r), that the collision integrals of the linearized Boltzmann equation are analytic functions of lambda in the neighborhood of lambda = 0. It then follows, for example, that the first Enskog approximations for the transport coefficients can be represented by a Taylor series in lambda. The extension to fluid mixtures is discussed briefly.

704,309
PB83-106187 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of the Specific Heat, Cv, of Ethylene.
Final rept.
L. A. Weber. Apr 82, 5p
Pub. in Jnl. of Chemical and Engineering Data 27, n2 p203-207 Apr 82.

Keywords: *Ethylene, *Specific heat, Reprints.

The specific heat, (C sub v), of gaseous and liquid ethylene was determined in both the single and two phase regions, at pressures to 30 MPa. Temperatures varied from the triple point to 338 K and densities varied from 0.6 to 2.8 times the critical value. The specific heats of the saturated liquid are derived. The results are compared with values calculated via the extended Benedict-Webb-Rubin equation of state.

704,310
PB83-111005 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
Thermodynamic Properties of Isobutane.
Final rept.
M. Waxman, M. Klein, J. Gallagher, and J. M. H. Levelt Sengers. Feb 82, 180p NBSIR-81-2435
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Butanes, *Thermodynamic properties, Tables(Data), Surfaces, Helmholtz free energy.

A thermodynamic surface is presented for the thermodynamic properties of isobutane for temperatures from 250 to 600 K and pressures up to 40 MPa, exclusive of the critical region. The surface expressed analytically is in the form of the Helmholtz free energy as a function of temperature and density. The Helmholtz free energy is based upon three contributions: that of the ideal gas, of a physically based function incorporating the effects of molecular repulsion and attraction, and of a sum of residual terms that compensate for inadequacies of the physically based function. The surface is in accord with selected validated pressure-density-temperature data to within an average density tolerance of 0.1 percent and the liquid region with the exception of the critical region. Thermodynamic tables of isobutane expressed in three different unit systems and the computer programs for generating the properties are presented in the paper.

704,311
PB83-117523 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Interactive FORTRAN Program to Calculate Thermophysical Properties of Six Fluids.
Technical note.
B. A. Younglove. Jul 82, 56p NBS-TN-1048

Keywords: *Thermophysical properties, *Fluids, *Computer programs, Argon, Ethylene, Hydrogen, Nitrogen, Fortran, Equations of state, Nitrogen fluorides, Density(Mass/volume), Enthalpy, Specific heat.

An interactive FORTRAN IV computer program is given for computing thermophysical properties of argon, ethylene, parahydrogen, nitrogen, nitrogen trifluoride, and oxygen. The program is designed for use with a computer terminal accessing a large computer in an interactive mode. The program provides prompting for selection of several options including: (1) choice of fluid, (2) choice of SI or engineering units, (3) choice of the single phase or liquid-vapor phase, and (4) a table of properties or a single value. Properties are computed for the single phase region from input of two of the variables, temperature, pressure, and density. Values on the liquid-vapor boundary are computed from an entry of temperature or pressure. The program returns values for pressure, temperature, density, internal energy, enthalpy, entropy, specific heats at constant volume and pressure, and sound velocity. Viscosity, thermal conductivity, and dielectric constant are given for some of the fluids.

704,312
PB83-118422 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Thermodynamic Surface for the Critical Region of Ethylene.
Technical note.
J. M. H. L. Sengers, J. W. Gallagher, F. W. Balfour, and J. V. Sengers. Oct 82, 90p NBS-TN-1165

Keywords: *Ethylene, *Thermodynamic properties, Surfaces, Critical point, Density(Mass/volume), Enthalpy, Entropy, Specific heat, Equations of state, Tables(Data), Computer programs.

Tables are presented of thermodynamic properties of ethylene in the range 279-300 K in temperature, 5.75-10.5 mol/cu dm in density, which range includes the critical point. The tables presented here are based on the critical-point scaling laws and incorporate the critical anomalies in a proper fashion. The tables thus complement the formulation of the equation of state of fluid ethylene by McCarty and Jacobsen (NBS Tech. Note 1045, 1981) which does not claim accuracy near the critical point. The predictions of the present formulation are compared with four sets of recent PVT data, and with speed-of-sound data. Tables are presented of pressure, energy, enthalpy, entropy, specific heats and speed of sound as function of temperature along finely-spaced isochores. The computer program required for table generation is included. Even if the surface were perfect, the reliability of densities calculated at experimental pressures and temperatures of limited accuracy declines rapidly as the critical point is approached. Contour plots in P-T space are presented of regions to be avoided in custody transfer for given uncertainties in pressure, temperature and sample composition.

704,313
PB83-121582 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 87, Number 3, May-June 1982.
Bi-monthly rept.
1982, 84p
See also Volume 87, Number 1, PB82-226226. Library of Congress catalog card no. 62-37059.

Keywords: *Research projects, Density(Mass/volume), Doppler effect, Electrical resistivity, Solids, Ethane, Heat measurement, Simple float method.

Contents: The density determination of small solid objects by a simple float method--I, Randal M. Schoonover; The density determination of small solid objects by a simple float method--II, R. S. Davis; An absorbed dose water calorimeter: theory, design, and performance, Steve R. Domen; Torsional splittings and assignments of the doppler-limited spectrum of ethane in the C-H stretching region, A. S. Pine and W. J. Lafferty; Mechanism of the electrical conductivity in potassium croconate violet, Lawrence M. Doane and Alexander J. Fatiadi.

704,314
PB83-121590
(Order as PB83-121582, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Density Determination of Small Solid Objects by a Simple Float Method-I,
R. M. Schoonover. 20 Jan 82, 10p
Included in Jnl. of Research of the National Bureau of Standards, v87 n3 p197-206, May-Jun 82.

Keywords: *Density(Mass/volume), *Solids, Samples, *Simple float method.

The density determination of a small solid object with a mass of only a few hundred milligrams is always a difficult and often an elusive measurement. The advent of highly accurate hydrostatic weighing techniques and the density scale based on solid objects are utilized in a two liquid float method presented here that incorporates the advantages of this technology. The instrument was used to measure the variation in the alloy density of nickel with respect to phosphorus content and to determine the density of optical fiber glass.

704,315
PB83-121608
(Order as PB83-121582, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Density Determination of Small Solid Objects by a Simple Float Method-II,
R. S. Davis. 18 Jan 82, 3p
Included in Jnl. of Research of the National Bureau of Standards, v87 n3 p207-209, Jun 81.

Keywords: *Density(Mass/volume), *Solids, Samples, *Simple float method.

The measurement of density changes in solid samples of less than one gram is often of practical interest. We describe here such relative measurements having a precision of a few parts in 10 to the 4th power using a newly reported apparatus. Comparisons of results with theory are presented.

704,316
PB83-121624

(Order as PB83-121582, PC **A05**/A01)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Torsional Splittings and Assignments of the Doppler-Limited Spectrum of Ethane in the C-H Stretching Region.
A. S. Pine, and W. J. Lafferty. 18 Nov 81, 20p
Included in Jnl. of Research of the National Bureau of Standards, v87 n3 p237-256, May-Jun 82.

Keywords: *Ethane, *Infrared spectroscopy, *Absorption spectra, Doppler effect, Chemical bonds, Torsion, Laser spectroscopy.

The Doppler-limited absorption spectrum of the C-H stretching region of ethane has been recorded at T approx. 119 K with a tunable difference-frequency laser spectrometer. The strong torsional hot band structure at room temperature is eliminated at 119 K, and the enhanced resolution from the Doppler width reduction allows us to observe small torsional splittings. The two fundamentals in the region, nu 7, a perpendicular band and, nu 5, a parallel band have been essentially completely assigned as have a large number of transitions in the parallel component of the nu 8 + nu 11 combination band. A number of perturbations of both global and local nature have been observed. The complete spectrum and a listing of transition wavenumbers, intensities and assignments are presented here to facilitate identification and quantitative analysis of ethane in a variety of monitoring applications. Precise ground state rotational constants have been determined from combination differences.

704,317
PB83-121632
(Order as PB83-121582, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Mechanism of the Electrical Conductivity in Potassium Croconate Violet.
L. M. Doane, and A. J. Fatiadi. 9 Sep 81, 4p
Included in Jnl. of Research of the National Bureau of Standards, v87 n3 p257-260, May-Jun 82.

Keywords: *Electrical resistivity, Crystal structure, *Potassium croconate violet, *Chemical reaction mechanisms.

Based on crystallographic analysis and results of the solution electronchemistry, a mechanism for electron conduction is proposed.

704,318
PB83-127613 Not available NTIS
National Bureau of Standards, Washington, DC.
Corona-Induced Decomposition of SF6.
Final rept.
R. J. Van Brunt, and D. A. Leep. 1982, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of International Symposium on Gaseous Dielectrics (3rd), Knoxville, Tennessee, March 7-11, 1982, Paper in Gaseous Dielectrics III, p402-409 1982.

Keywords: *Sulfur hexafluoride, *Decomposition, Electric corona, Gas chromatography, Mass spectroscopy, Concentration(Composition).

The stable, neutral decomposition products resulting from positive point-plane dc-corona in static SF6 gas have been identified with a gas chromatograph-mass spectrometer.

704,319
PB83-127647 Not available NTIS
National Bureau of Standards, Washington, DC.
Time Evolution of the Electric Field Associated with Breakdown Phenomena in Liquids.
Final rept.
E. F. Kelley, and R. E. Hebner. 1979, 9p
Pub. in Proceedings Conference on Electrical Insulation and Dielectric Phenomena, Whitehaven, Pennsylvania, October 21-24, 1979, p203-211.

Keywords: *Electric fields, *Molecular structure, *Electrooptics, Liquids, Nitrogen organic compounds, *Nitrobenzenes.

This paper describes electro-optic measurements of the electric field distribution in the vicinity of prebreakdown structures in nitrobenzene. The measurements indicate that the prebreakdown structures are conducting. This conclusion was reached by modeling the structures as conducting spheres and observing that the fringe patterns calculated using the model spheres are well correlated with those photographed during breakdown.

704,320
PB83-127654 Not available NTIS
National Bureau of Standards, Washington, DC.
K Absorption-Edge Spectrum of Sodium Vapor.
Final rept.
R. E LaVilla. May 79, 3p
Pub. in Physical Review A19, n5 p1999-2001 May 79.

Keywords: *Sodium, Absorption, Atomic energy levels, Reprints, Autoionization, Auger spectroscopy.

Using a heat-pipe furnace as an absorption cell to contain the sodium vapor, the sodium K absorption edge spectrum was measured on a double crystal monochromator. The primary features were a prominent resonance line at 1073.2 eV, a shoulder at 1074.3 eV, a weak peak at 1076.5 eV and broad lesser features above the threshold.

704,321
PB83-127662 Not available NTIS
National Bureau of Standards, Washington, DC.
Unusually Broad X-Ray Emission Lines:L gamma 2,3 (L1 N2,3) Spectra of 50Sn, 52Te, and 53I.
Final rept.
R. E. LaVilla. Mar 78, 3p
Pub. in Physical Review A17, n3 p1018-1020 Mar 78.

Keywords: *X ray spectroscopy, *Emission spectroscopy, *Crystal structure, Tin, Tellurium, Iodine, Photoelectric emission, Reprints, X ray photoelectron spectroscopy.

The L gamma (2,3) (L1N2,3) x-ray emission spectra from (50)Sn, (52)Te, and (53)I, excited by direct electron bombardment, were measured with a double-crystal monochromator. The spectral profiles are similar to their 4p energy-level-region x-ray photoelectron spectra (XPS), with base widths of about 50 eV. The origin of these unusual line profiles is attributed to many-body effects in their final states which are comparable to their respective XPS final states.

704,322
PB83-127670 Not available NTIS
National Bureau of Standards, Washington, DC.
Double Electronic Excitations in Sodium Above the 2s Threshold.
Final rept.
R. E. LaVilla, G. Mehlman, and E. B. Saloman. 1981, 4p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 14, pL1-L4 1981.

Keywords: *Sodium, Excitation, Atomic energy levels, Reprints.

The transmission spectrum in the 2s region of sodium vapour contained in a heat pipe was obtained with a 3 m monochromator using synchrotron radiation from SURF II as a source. In the continuum at photon energies greater than the 2s threshold, a number of spectral lines were observed and attributed to doubly excited transitions. A tentative classification of these lines is presented that is in close correspondence with the Mgl spectrum. Previously observed resonances, due to single-electron excitation below the 2s threshold, are confirmed. In addition, structure attributed to higher members of the single-electron excitation series was observed.

704,323
PB83-131540 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Poling Field and Time on Pyroelectric Coefficient and Polarization Uniformity in Polyvinyl Fluoride.
Final rept.
S. B. Lang, A. S. DeReggi, M. G. Broadhurst, and G. T. Davis. 1981, 7p
Pub. in Ferroelectrics 33, p119-125 1981.

Keywords: *Polyvinyl fluoride, *Pyroelectricity, *Polarization(Charge separation), Samples, Reprints.

Electroded films of polyvinyl fluoride (PVF) were polarized with DC electric fields as high as 315 MV/m for periods between 60 and 7200 seconds at room temperature. Thermal pulse data to determine the depth of polarization and pyroelectric coefficients were obtained on all samples. Mathematical techniques were developed for the computation of fraction poled from the thermal pulse data using a nonlinear least squares analysis.

704,324
PB83-131615 Not available NTIS
National Bureau of Standards, Washington, DC.
Kinetics and Energetics of the Criegee Intermediate in the Gas Phase. II: The Criegee Intermediate in the Photooxidation of Formaldehyde, in Alkyldioxy Disproportionation and 0 + Oxoalkane Addition Reactions.
Final rept.
J. T. Herron, R. I. Martinez, and R. E. Huie. 1982, 12p
Pub. in Jnl. of Chemical Kinet. 14, p225-236 1982.

Keywords: *Reaction kinetics, *Formaldehyde, *Oxidation, Photochemical reactions, Reprints, *Chemical reaction mechanisms, *Criegee intermediate.

The gas-phase kinetics and energetics of the Criegee intermediate deduced from studies of O3-alkene systems, suggest that a hydroxy-substituted Criegee intermediate probably participates in the photooxidation of formaldehyde. In contradistinction, the existing evidence suggests that the Criegee intermediate and its isomers are probably not involved in alkyldioxy disproportionation reactions.

704,325
PB83-131623 Not available NTIS
National Bureau of Standards, Washington, DC.
Kinetics and Energetics of the Crigee Intermediate in the Gas Phase. I: The Crigee Intermediate in Ozone-Alkene Reactions.
Final rept.
J. T. Herron, R. I. Martinez, and R. E. Huie. 1982, 24p
Pub. in Jnl. of Chemical Kinet. 14, p201-224 1982.

Keywords: *Ozonolysis, *Alkenes, *Reaction kinetics, Laboratory equipment, Chemical reactions, Reprints, *Chemical reaction mechanisms, *Criegee intermediate, Numerical solution.

The chemistry and energetics of the Criegee intermediate, a primary product of the ozonolysis of alkenes, are discussed in terms of recent ab initio calculations and laboratory studies.

704,326
PB83-131664 Not available NTIS
National Bureau of Standards, Washington, DC.
Synthesis and Structure of Cu5(BTA)6(t-C4H9NC)4, a Mixed-Valent Copper-Nitrogen Cluster Containing eta3-Benzotriazolate.
Final rept.
V. L. Himes, A. D. Mighell, and A. R. Siedle. 14 Jan 81, 2p
Pub. in Jnl. The American Chemical Society 103, p211-212, 14 Jan 81.

Keywords: *Synthesis(Chemistry), *Crystal structure, *Complex compounds, *Copper organic compounds, Reprints.

The structure solution revealed a unique tridentate bonding mode for the benzotriazole anion (BTA-). The structure consists of neutral 3-dimensional complexes with crystallographic 4 symmetry. A central Cu(II) ion is coordinated to six different BTA- ligands in an undistorted, compressed octahedral configuration. The Cu(II) ion is surrounded by four Cu(I) ions each of which is tetrahedrally coordinated to three different BTA- ligands and one t-butylisocyanide ligand. The six BTA- ligands bridge each Cu(I) ion to three symmetry-related Cu(I) ions and to the central Cu(II) ion.

704,327
PB83-131672 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure of Carbamazepine 5H-Dibenz (b,f) Azepin-5-Carboxamide.
Final rept.
V. L. Himes, A. D. Mighell, and W. H. DeCamp. 1981, 4p
Pub. in Acta Crystallogr. B37, p2242-2245 1981.

Keywords: *Crystal structure, Reprints, *Carbamazepine, *Dibenzazepine carboxamide, Molecular conformation.

In the tricyclic framework of carbamazepine, the central azepine ring has a boat conformation and the dihedral angle between the experimentally planar benzene

moieties is 126.6 degrees. Intermolecular hydrogen bonding between carboxamide groups forms centrosymmetric dimers.

704,328
PB83-131680 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of the III 1/2 - II 1/2 Transition in Rare Gas Halide Kinetics.
Final rept.
P. S. Julienne, and M. Krauss. 1 Jul 79, 3p
Pub. in Applied Physics Letters 35, n1 p55-57, 1 Jul 79.

Keywords: *Rare gases, *Halides, *Reaction kinetics, Molecular energy levels, Fluorescence, Reprints, Laser spectroscopy.

Rare gas halide spectra have previously been analyzed in terms of the strong 3 1/2 - 1 1/2 lasing transition and the weaker 2 3/2 - 1 3/2 broad continuum. However, the 3 1/2 - 1 1/2 transition is also a broad continuum that strongly overlaps the 2 3/2 - 1 3/2 transition and has an Einstein coefficient of a similar magnitude. The existence of this transition requires a reinterpretation of previous kinetic data on ArF, KrF, XeF, and XeCl. Simultaneous energy extraction from both the 3 1/2 and 2 3/2 states should be possible for lasing in the broad continuum.

704,329
PB83-131698 Not available NTIS
National Bureau of Standards, Washington, DC.
Ro-vibronic Species, Overall Allowed Species, and Nuclear Spin Statistical Weights for Symmetric Top Molecules. II. Point Groups Cleta v and Cleta h (less than or equal to 6).
Final rept.
A. Weber. 1 Apr 82, 5p
Pub. in Chemical Physics 76, n7 p3694-3698, 1 Apr 82.

Keywords: *Molecules, *Nuclear spin, Reprints, *Ro-vibronic species.

The method described in (I) (A. Weber, J. Chem. Phys. 73, 3952 (1980); 74 4754 (1981)) was used to derive the ro-vibronic species, overall allowed species, and the nuclear spin statistical weights for symmetric top molecules belonging to the point groups C(etav) or C(eta h) with n less than or equal to 6. Rules are presented by means of which the ro-vibronic species of C(eta v) and C(eta h) molecules are obtained from the results given in (I). The overall species and the nuclear spin statistical weights are given in a new set of tables.

704,330
PB83-131706 Not available NTIS
National Bureau of Standards, Washington, DC.
Direct Verification of Hydrogen Termination of the Semiconducting Diamond (111) Surface.
Final rept.
B. J. Waclawski, D. T. Pierce, N. Swanson, and R. J. Celotta. Aug 82, 3p
Pub. in Jnl. of Vacuum Science and Technology 21, n2 p368-370 Jul/Aug 82.

Keywords: *Hydrogen, *Surface chemistry, *Diamonds, Semiconductors(Materials), Molecular vibration, Reprints, *Electron energy loss spectroscopy.

Low-energy, high resolution electron energy loss spectroscopy has been used to identify the vibrational modes of hydrogen on the semiconducting diamond surface providing the first direct evidence that the (111) 1x1 surface is terminated by hydrogen. The vibrational loss spectrum from the 'as polished' surface shows two major losses near 160 meV (CH3 deformation), a major loss at 360 meV (CH3 stretch), and two minor losses at 520 and 720 meV (combinations and overtones). All of these losses disappear from the spectrum after heating the sample to about 1000C (which has been established by other experiments to be sufficient to reconstruct the surface to 2x2/2x1). The loss spectrum for the reconstructed surface is indicative of a 2D-metallic state of the dangling bond surface states for clean diamond. Exposure of this reconstructed surface to atomic hydrogen results in a loss spectrum which is essentially identical to that for the 'as polished' surface. Further verification that the loss spectrum results from hydrogen is provided by the shift of the structure to lower loss energies when deuterium is adsorbed.

704,331
PB83-131714 Not available NTIS
National Bureau of Standards, Washington, DC.
Comment on 'the Effect of Radiation Trapping of High-Intensity Scattered Radiation on Multiphoton Ionization Rates and Resonance Fluorescence'.
Final rept.
T. J. McIlrath, and T. B. Lucatorto. 1980, 4p
Pub. in Jnl. of Physics B: Atom. Molec. Phys. 13, pL641-L644 1980.

Keywords: *Ionization, *Fluorescence, *Metal vapors, *Resonance radiation, Laser beams, Reprints.

Recent claims have been made that the trapping of resonance radiation explains both the efficient ionisation of dense metal vapours irradiated by intense resonant laser radiation and previous experiments concerning anomalous behavior of resonance fluorescence. The authors examine these claims and show that they are incorrectly developed and that basic physical arguements show that resonance trapping cannot explain the phenomena mentioned above.

704,332
PB83-131748 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Excitation and Ionization of Dense Atomic Vapors.
Final rept.
T. B. Lucatorto, and T. J. McIlrath. 1 Dec 80, 9p
Pub. in Applied Optics 19, n23 p3948-3956, 1 Dec 80.

Keywords: *Ionization, *Resonance radiation, *Vapor phases, Lithium, Sodium, Calcium, Barium, Strontium, Reprints, *Laser spectroscopy.

It has been shown that a dense ($>$ 10 to the 14th power-cm/cc) atomic vapor, irradiated by a saturating pulse of resonance radiation, will ionize on a time scale of $<$ 10 to the -6th power sec. The ionization can be 95% complete and has been observed in Li, Na, Ca, Sr, and Ba. A large number of physical processes contribute to the ionization with different processes dominating at different stages in the ionization. These processes are discussed, and two models for calculating the ionization are described. The results of the various experiments and the applications to the spectroscopy of ions and to atomic physics studies in general are reviewed.

704,333
PB83-132944 Not available NTIS
National Bureau of Standards, Washington, DC.
Absorption in the Triatomic Excimer, Xe2Cl.
Final rept.
W. J. Stevens, and M. Krauss. 1 Aug 82, 3p
Contract N00014-82-F-0041
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Applied Physics Letter 41, n3 p301-303, 1 Aug 82.

Keywords: *Emission spectroscopy, Xenon halides, Absorption, Fluorescence, Reprints, *Xenon chloride, Excimers.

The equilibrium internuclear geometry has been calculated for the excimer state of Xe2Cl. At this geometry absorption and emission transition probabilities have been calculated for transitions that bear on the gain of the Xe2Cl excimer transition and of the XeCl C-A transition. The total lifetime of the Xe2Cl excimer state is found to be 330 ns for a fluorescence peak at 495 nm. Significant absorption is found to peak at 438 nm which would preclude tuning a laser over the entire fluorescence band. A very strong absorption from the Xe2Cl excimer state is also found at 339 nm which practically coincides with the broad band XeCl C-A transition.

704,334
PB83-132951 Not available NTIS
National Bureau of Standards, Washington, DC.
Electronic Structure and Photodissociation of HCl.
Final rept.
W. J. Stevens, and M. Krauss. 1 Aug 82, 5p
Contract N00014-82-F-0041
Sponsored in part by Defense Advanced Research Project Agency, Arlington, VA.
Pub. in Jnl. of Chemical Physics 77, n3 p1368-1372, 1 Aug 82.

Keywords: *Hydrogen chloride, *Molecular energy levels, Absorption, Excitation, Dissociation, Reprints, Multiconfiguration self-consistent-field.

Continuous absorption is possible from the ground state of HCl to the repulsive states that also arise from the ground state asymptote. Under conditions where vibrational excitation of the HCl is possible, continuum absorption can occur from an onset near 345 nm to 100 nm in the ultra-violet. The possible impact of this process on the operation of the XeCl UV laser which uses HCl as a fuel would not be significant since the cross-section at 310 nm never exceeds a few times 10 to the -19th power sq cm.

704,335
PB83-132969 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure of Xanthomegnin.
Final rept.
V. L. Himes, A. D. Mighell, S. W. Page, and M. E. Stack. 1981, 4p
Sponsored in part by Food and Drug Administration, Rockville, MD.
Pub. in Acta Crystallographica B37, p1932-1935 1981.

Keywords: *Crystal structure, X ray diffraction, Nitrogen organic compounds, Reprints, *Binaphtho(pyran)hexone/tetrahydro-dihydroxy-dimethoxy-dimethyl.

X-ray analysis has revealed that xanthomegnin is a naphtho-(2,3-cl)pyran-8-yl dimer. A crystallographic twofold axis relates the two halves of the molecule. In each half of the molecule there is one intramolecular hydrogen bond.

704,336
PB83-134031 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Photodissociation of Hg(CH3)2: Infrared Emission Studies of Vibrational and Rotational Excitation in the CH3 Fragments.
Final rept.
S. L. Baughcum, and S. R. Leone. 18 Jun 82, 6p
Contract DE-AC02-79-ER10396
Pub. in Chemical Physics Letters 89, n3 p183-188, 18 Jun 82.

Keywords: *Infrared spectroscopy, Dissociation, Molecular vibration, Molecular rotation, Mercury organic compounds, Reprints, *Laser spectroscopy, *Mercury/dimethyl, Methyl radical.

Single photon dissociation of Hg(CH3)2 at 248 and 193 nm produces CH3 radicals with substantial excitation in the nu(2) out-of-plane bend and the nu(3) antisymmetric stretch. At 248 nm the antisymmetric stretch excitation is characterized by a 1200-1500 K rotational temperature and a vibrational distribution v=1:v=2:v=3 of 1.0:0.2 + or - 0.1:0.05 + or - 0.05.

704,337
PB83-134064 Not available NTIS
National Bureau of Standards, Washington, DC.
Vibrational Spectra of Methyl and Methyl-d3 Nitrite.
F. L. Rook, and M. E. Jacox. 1982, 6p
Contract ARO-36-81
Pub. in Jnl. of Molecular Spectroscopy 93, p101-116 1982.

Keywords: *Infrared spectroscopy, *Nitromethane, *Vibrational spectra, Least squares method, Reprints, *Matrix isolation technique.

The infrared spectra of methyl and methyl-d3 nitrite have been observed between 400 and 4000/cm both in the gas phase and in an argon matrix. The very strong absorptions associated with the vibrations of the ONO group have also been observed for the carbon-13 and nitrogen-15 substituted methyl nitrites, produced by the photolysis of the corresponding nitromethane isolated in solid argon. The assignment of individual bands to the cis- and trans- rotamers has been facilitated by studies of the relative rates of photolysis of the two species trapped in solid argon. The vibrational assignments for the two rotamers are discussed in relation to a least-squares fit of the observed vibrational frequencies to a relatively simple set of valence force potential constants.

704,338
PB83-134072 Not available NTIS
National Bureau of Standards, Washington, DC.

Interaction of Methanol with a Titanium (001) Surface Investigated Using Photon Stimulated Desorption and UV Photoemission Spectroscopy.
Final rept.
D. M. Hanson, R. Stockbauer, and T. E. Madey. 1 Aug 82, 7p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Chemical Physics 77, n3 p1569-1575, 1 Aug 82.

Keywords: *Methyl alcohol, *Surface chemistry, *Titanium, Ultraviolet spectroscopy, Synchrotron radiation, Reprints, *Photon stimulated desorption.

Synchrotron radiation at NBS SURF II has been utilized to study the interaction of methanol with a stepped Ti(001) single crystal surface at about 90K and 300K. The techniques of photon stimulated desorption (PSD) and ultraviolet photoemission spectroscopy (UPS) were employed.

704,339
PB83-134080 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Vibrational Spectroscopy of Hydrogen and Deuterium on Raney Nickel.
Final rept.
R. R. Cavanagh, R. D. Kelley, and J. J. Rush. 1 Aug 82, 23p
Sponsored in part by Department of Energy, Washington, DC. Office of Basic Energy Science.
Pub. in Jnl. of Chemical Physics 77, n3 p1540-1547, 1 Aug 82.

Keywords: *Hydrogen, *Deuterium, *Chemisorption, *Vibrational spectra, Surface chemistry, Inelastic scattering, Reprints, Raney nickel catalysts.

Incoherent neutron inelastic scattering has been applied to the study the chemisorption of hydrogen on Raney nickel (a high surface area nickel powder). The binding sites have been identified by comparing the vibrational frequencies and intensities provided by the inelastic scattering with calculations for model structures of different geometries, force constants and symmetries. We conclude that, on Raney nickel above 150K, hydrogen chemisorbs predomenately in sites of three fold symmetry with a Ni-H bond distance of 1.89A and with a force constant of 0.58 mdyn/A. In addition, we have observed lateral adsorbate interactions, deuterium isotope shifts, and temperature dependent binding sites.

704,340
PB83-134106 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of the Spin-Orbit Branching Ratios and the Angular Asymmetry Parameter in the Region of the 4s4p(6)5p Resonances in Krypton and the 5s5p(6)6p Resonances in Xenon.
Final rept.
D. L. Ederer, A. C. Parr, J. B. West, D. Holland, and J. L. Dehmer. Apr 82, 6p
Grant NATO-1939
Sponsored in part by Office of Naval Research, Arlington, VA. and Department of Energy, Washington, DC.
Pub. in Physical Review A 25, n4 p2006-2011 Apr 82.

Keywords: *Krypton, *Xenon, *Spin orbit interactions, Molecular energy levels, Photoionization, Reprints, *Autoionization, *Photoelectron spectroscopy.

Variation of the ratio of partial photoionization cross sections R = sigma (doublet P(3/2)) sigma (doublet P(1/2)) and the asymmetry parameter beta have been determined in the region of the 4s4p sup 6 5p resonances in krypton and 5s 5p sup6 6p resonances in xenon. In both cases these resonances are affected by the interaction with a configuration involving two excited outer p electrons. This admixture influences the number of resonances present, and the value of beta and R. Large variations in beta and R are observed in the region of these resonances.

704,341
PB83-134114 Not available NTIS
National Bureau of Standards, Washington, DC.
Characterization of Some Autoionization Resonances in C0(2) Using Triply Differential Photoelectron Spectroscopy.
Final rept.
A. C. Parr, D. L. Ederer, J. L. Dehmer, and D. M. P. Holland. 1 Jul 82, 7p
Grant NATO-1939
Sponsored in part by Office of Naval Research, Arlington, VA. and Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 77, n1 p111-117, 1 Jul 82.

Keywords: *Carbon dioxide, *Photoionization, Angular distribution, Reprints, *Autoionization, *Photoelectron spectroscopy.

The authors report vibrationally resolved branching ratios and asymmetry parameters for two sets of autoionizing resonances in CO2 near 680 and 750A. These resonances were excited with monochromatized synchrotron radiation from the National Bureau of Standards storage ring and the energy and angle of ejection of the photoelectron were analyzed. The results show striking non-Franck-Condon behavior.

704,342
PB83-134130 Not available NTIS
National Bureau of Standards, Washington, DC.
Li2 and Na2 Triplet sigma (g) (+1)-Triplet sigma (u) (+1) Excimer Emission.
Final rept.
D. D. Konowalow, and P. S. Julienne. 1 Jun 80, 4p
Pub. in Jnl. of Chemical Physics 72, n11 p5815-5818, 1 Jun 80.

Keywords: *Lithium, *Sodium, Infrared spectroscopy, Excitation, Reprints, *Laser spectroscopy, Excimers, Numerical solution.

Ab initio calculations show the triplet sigma(g)*+1)-triplet sigma(u)(+1) in Li2 and Na2 dimers to be primarily a near-infrared continuum with respective nu' = lifetimes of 62 and 15 nsec. The peak stimulated emission cross section for nu' = 0 is 4.5 x 10 to the -16th power at 1.3 micrometers for Li2 and 1.8 x 10 to the -15th power sq cm at 0.83 micrometers for Na2. These calculations suggest a tunable high gain, near-infrared laser eximer if the triplet sigma(g)(+1) state can be populated sufficiently rapidly.

704,343
PB83-134148 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectral Characteristics of Signals in the Optical Hanle Effect.
Final rept.
P. Ananthalakshmi, and G. S. Agarwal. Jun 82, 3p
Pub. in Physical Review A 25, n6 p3379-3381 Jun 82.

Keywords: Electron transitions, Excitation, Spectroscopic analysis, Reprints, *Hanle effect.

The results of an earlier investigation by the authors (Phys. Rev. A23, 2553 (1981)) are extended to study the spectral features of the signals in optical Hanle effect with regard to the various directions of observations and the polarizations of the emitted and the exciting radiation. The asymmetries in the spectra are found to be critically dependent on each of these parameters.

704,344
PB83-134163 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Emission Cross Section for Electron Impact Excitation of Ga(+) to the (4(1)P) Level.
Final rept.
G. Stefani, R. Camilloni, G. H. Dunn, and W. T. Rogers. Jun 82, 7p
Pub. in Physical Review A 25, n6 p2996-3002 1982.

Keywords: *Gallium, Molecular energy levels, Ions, Excitation, Reprints, *Electron ion interactions, *Absolute emission cross sections.

Crossed beams of electrons and Ga(+1) ions have been used to measure the absolute emission cross section for the process e + Ga(+1)(4 singlet S) yields e + Ga(+1)(4 singlet P) from below threshold (8.77 eV) to 400 eV. Total uncertainties at 68% confidence level are typically 16%. The cross section exhibits the sharp onset at threshold characteristic of positive ion excitation processes. Evidence of structure is observed from just above threshold to 15 eV. The semiempirical Gaunt-factor formula is in reasonable agreement with the measurements over the energy range measured. A lower limit for the lifetime of the 4 triplet P(0,2) Ga(+1) metastable state has been established at tau greater than or equal to 0.4 sec.

704,345
PB83-134213 Not available NTIS
National Bureau of Standards, Washington, DC.
Theoretical Investigation of the Origins of the Green and Red Spectra of Ca2.
Final rept.
M. E. Rosenkrantz, M. Krauss, and W. J. Stevens. 4 Jun 82, 5p
Pub. in Chemical Physics Letter 89, n1 p4-8, 4 Jun 82.

Keywords: *Calcuim, *Electronic spectra, Molecular energy levels, Potential energy, Electron transition, Reprints.

The potential energy curves and transition moments of the ground state of Ca2 and 1 sigma (u)(+1) states correlating with the Singlet S+ Singlet P and Singlet S + Singlet D calcium atoms have been calculated. The calculations support the assignment of the observed emission spectra of Ca2 in the red and in the green to transitions between the ground state and the 1, 2 1 sigma (u)(+1) states. Predissociation of the 1 sigma (u)(+1) state is also shown to be possible from an interaction with the 1 (3) Pi(u) state.

704,346
PB83-134288 Not available NTIS
National Bureau of Standards, Washington, DC.
Multiple Ionization and X-Ray Emission Accompanying the Cascade Decay of Inner-Shell Vacancies in Fe.
Final rept.
V. L. Jacobs, J. Davis, B. F. Rozsnyai, and J. W. Cooper. Jun 80, 10p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Physical Review A 21, n6 p1917-1926, Jun 80.

Keywords: *Iron, *X ray analysis, *Ionization, Mathematical models, Emission spectroscopy, Molecular energy levels, Reprints.

A model has been developed which predicts the relative abundances of the differently charged ions and the x-ray emission spectra resulting from the cascade decay of an arbitrary distribution of inner-shell vacancies created in atoms by energetic charged-particles or x-rays. The multiple ionization and x-ray production cross sections are defined in terms of the populations of the single- and multiple-vacancy states occurring in the atomic reorganization process. All allowed radiative, Auger, and Coster-Kronig transitions are taken into account in the determination of these populations. The x-ray spectra are classified in terms of characteristic lines which are due to the radiative decay of single vacancies and satellites which are associated with transitions from multiple-vacancy states. Results of calculations are presented for the creation of the initial vacancy distribution by single inner-shell electron ionization of neutral Fe with electrons and photons. Multiple ionization is found to represent only 10% of the total for electron impact ionization but is predicted to be predominant during K- and L-shell photoionization, in agreement with experimental results obtained for the rare gases. The intensity of the L(alpha) satellites is always less than the L(alpha) characteristic line intensity for electron impact ionization but can substantially exceed the characteristic line intensity during K-shell photoionization, in agreement with previous results obtained for medium-Z elements.

704,347
PB83-134296 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface-Enhanced Raman Spectrum of N-Methylpyridinium Ion on a Silver Electrode.
Final rept.
K. A. Bunding, M. I. Bell, and R. A. Durst. 4 Jun 82, 5p
Pub. in Chemical Physics Letters 89, n1 p54-58, 4 Jun 82.

Keywords: *Raman spectroscopy, Electrodes, Ions, Halogen organic compounds, Surfaces, Reprints, *Pyridinium iodide/N-methyl, *Pyridinium chloride/N-methyl.

The surface-enhanced Raman spectrum of N-methylpyridinium iodide, an organic cation with no unshared pair of electrons available for interaction with the silver electrode surface, is reported. Both Raman and infrared bands are observed with small shifts in frequency. No spectrum is observed for N-methylpyridinium chloride until trace amounts of iodide are added. It is not yet clear whether the role of the iodide is the enhancement of the polarizability cross section, formation of a surface complex, an ion pair or simply a coadsorption phenomenon.

704,348
PB83-134353 Not available NIS
National Bureau of Standards, Washington, DC.
(3-Chloro-2-hydroxy-5-nitrophenyl) (2-chlorophenyl) Iodonium hydroxide, Inner Salt.
Final rept.
C. R. Hubbard, V. L. Himes, A. D. Mighell, and S. W. Page. 1980, 4p
Pub. in Acta Crystallographica Section B36, p2819-2821 1980.

Keywords: *Crystal structure, Chlorine organic compounds, X ray diffraction, Reprints, *Iodonium/(chloro-oxo-nitrophenyl)-(chlorophenyl).

C12H6NO3Cl2I, MW = 409.98; monoclinic, P2(1)/n; a = 15.928(9), b = 4.623(2), c = 18.271(6)A, beta = 105.58(2); Z = 4, rho(calc) = 2.106 g/cu cm, rho (obs) = 2.16 (flotation); final R = 0.055 (2301 contributing reflections). The molecule exists as a zwitterion with an intramolecular I(+1)...O(-1) distance of 2.756(4)A. The I-C bond distances were found to be 2.106(6) and 2.105(5)A, with a C-I-C angle of 98.4(2) degrees. Intermolecular ionic attraction between I(+1) and O(-1) causes the formation of infinite chains along the z-axis of the cell.

704,349
PB83-134403 Not available NTIS
National Bureau of Standards, Washington, DC.
Far Infrared Laser Magnetic Resonance Spectrum of CH.
Final rept.
J. T. Hougen, J. A. Mucha, D. A. Jennings, and K. M. Evenson. 1978, 21p
Pub. in Jnl. of Molecular Spectroscopy 72, p463-483 1978.

Keywords: Moleculer energy levels, Zeeman effect, Hyperfine structure, Reprints, *Laser spectroscopy, *Methyl radical.

Laser magnetic resonance spectra between 0 and 17 kG have been recorded and analyzed for transitions in the CH molecule, using the optically pumped for infrared lasers.

704,350
PB83-134890 Not Available NTIS
National Bureau of Standards, Washington, DC.
Recommended Conventions for Defining Transition Moments and Intensity Factors in Diatomic Molecular Spectra.
Final rept.
E. E. Whiting, A. Schadee, J. B. Tatum, J. T. Hougen, and R. W. Nicholls. Apr 80, 8p
Pub. in Jnl. of Molecular Spectroscopy 80, n2 p249-256, Apr 80.

Keywords: *Diatomic molecules, Atomic energy levels, Transition points, Molecular rotation, Reprints.

Two recommendations are made that can eliminate persistent confusion in the study of diatomic spectroscopy by providing uniform and consistent definitions of the electronic transition moments and the rotational line intensity factors. First, it is recommended that the equation for the line strength of a single rotational line be adopted to specify the relationship between the electronic transition moment and the rotational line intensity factor. Second, it is recommended that the electronic transition moment operator for perpendicular transitions be defined as (1/sq root 2) (nu(x) + or - i nu(y)). The adoption of these conventions results in a value of (2S+1) (2J+1) for the sum rule of the rotational line intensity factor for sigma + or - yields sigma + n- transitions and value of 2(2S+1) (2J+1) for the sum rule for all other spin-allowed transitions.

704,351
PB83-134940 Not available NTIS
National Bureau of Standards, Washington, DC.
Problem of Crystallization of Polymers from the Melt with Chain Folding.
Final rept.
J. D. Hoffman, C. M. Guttman, and E. A. DiMarzio. 1979, 19p
Sponsored in part by Cambridge Univ. (England).
Pub. in Faraday Discussions of the Chemical Society 68, p178-197 1979.

Keywords: *Polyethylene, *Crystallization, Polymers, Melts, Reaction kinetics, Reprints.

It is shown that the 'reptation' process proposed by deGennes allows molecules to be reeled from the melt onto the crystal surface with chain folding by the force associated with crystallization at a rate that is comparable to that demanded by the observed crystallization kinetics for polyethylene fractions n = number of C atoms = 1290 to 5310. Hence, the rate of transport in the melt is sufficient to permit a considerable amount of chain folding, and an objection due to Flory and Yoon is thereby countered for the range of n noted.

704,352
PB83-134957 Not available NTIS
National Bureau of Standards, Washington, DC.
Influence of Spontaneous Emission on Laser-Induced Autoionization.
Final rept.
G. S. Agarwal, S. L. Haan, K. Burnett, and J. Cooper. 26 Apr 82, 4p
Contract NSF-PHY79-04928
Pub. in Physical Review Letters 48, n17 p1164-1167, 26 Apr 82.

Keywords: *Emission spectroscopy, Reprints, *Autoionization, *Laser spectroscopy, Numerical solution.

A master equation that describes the effect of spontaneous emission on laser induced autoionization is formulated and its solution is obtained for arbitrary laser strengths. The radiative decay is shown to affect drastically the nature of spectra near confluence. Analytic expressions for widths and positions are given to demonstrate the new features of spectra.

704,353
PB83-134965 Not available NTIS
National Bureau of Standards, Washington, DC.
Slag and Metal Oxide Vaporization in Reactive Atmospheres.
Final rept.
J. W. Hastie, D. W. Bonnell, and E. R. Plante. 1980, 21p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in High Temperature Science 13, p257-277 1980.

Keywords: *Slags, *Mass spectroscopy, Vaporization, High temperature tests, Ceramics, High pressure tests, Thermochemical properties, Reprints, *Metal oxides.

Metal oxides, whether they are present in the form of refractory ceramics or slags, are key components of high temperature energy systems. Planned magnetohydrodynamic (MHD) and coal gasifier systems are particularly dependent on the thermochemical properties of ceramic and slag materials. However, almost no basic thermochemical data exist for oxides in the presence of high temperature-high pressure reactive gases such as H2O. The present study utilizes a modification of the now classical Knudsen effusion mass spectrometric technique and a new technique, transpiration mass spectrometry, for molecular-level thermochemical analysis of MgO and a potassium enriched MHD coal slag in the presence of H2O vapor and related gases.

704,354
PB83-134973 Not available NTIS
National Bureau of Standards, Washington, DC.
Computer Studies of Dynamics in One Dimension: Hard Rods.
Final rept.
J. W. Haus, and H. J. Raveche. 1 Jun 78, 8p
Pub. in Jnl. of Chemical Physics 68, n11 p4969-4976, 1 Jun 78.

Keywords: *Molecular relaxation, Chemical equilibrium, Distribution functions, Reprints, *Hard rods.

Results of molecular dynamics simulations are reported with emphasis on the relaxation of an initially ordered array of hard rods in one dimension. It is found that at high densities the pressure accurately approaches its equilibrium value before the singlet and pair configuration space distribution functions have completely relaxed to equilibrium, which is the fluid phase. The velocity autocorrelation function is computed over a wide range of times, which includes the region where it is negative, and compared to the exact solution for the infinite system.

704,355
PB83-134999 Not available NTIS
National Bureau of Standards, Washington, DC.
Energy Partitioning in CO2 Laser Induced Multiphoton Dissociations: Energy of X CF2 and X CFC1 from CF2CFC1.
Final rept.
J. C. Stephenson, S. E. Bialkowski, and D. S. King. 15 Jun 80, 9p
Pub. in Jnl. of Chemical Physics 72, n2 p1161-1169, 15 Jan 80.

Keywords: Molecular vibration, Molecular rotation, Molecular energy levels, Dissociation, Chlorine organic compounds, Reprints, *Ethylene/chloro-trifluoro, *Laser excited fluorescence.

The authors have measured the vibrational (v), rotational (J,K), and translational energy, ET), of the X CF2 and X CFCl fragments formed in the CO2 laser induced multiphoton dissociation of CF2CFCl (Chlorotrifluoroethylene).

704,356
PB83-135004 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Intensity Effects in the IR Multiphoton Dissociation of CF2HCl.
Final rept.
D. S. King, and J. C. Stephenson. 15 Sep 79, 6p
Pub. in Chemical Physics Letters 66, n1 p33-38, 15 Sep 79.

Keywords: Excitation, Dissociation, Chlorine organic compounds, Reprints, *Methane/chloro-difluoro, *Laser induced fluorescence.

The authors report the results of experiments performed to examine the relative importance of laser intensity versus laser fluence on the rate of CO2 laser-induced dissociation of CF2HCl. The laser excited fluorescence method was used during CO2 laser pulses of known fluence and temporal profile. For the dissociation of CF2HCl there are major intensity dependent effects: (1) for pulses of constant fluence, e.g., 1 J/sq cm, the dissociation yield increases by approximately 400 as the average intensity increases by a factor of 6, from 6.5 to 40 MW/sq cm; (2) for pulses of constant fluence, modelocked pulses produce 5-10 times more product than do non-modelocked pulses; (3) for pulses of low intensity there are induction times of up to 200 ns between the leading edge of the CO2 pulse and any observable reaction; (4) the presence and duration of these induction times suggest a critical fluence of ca 0.8 plus or minus 0.4 J/sq cm required for CF2HCl dissociation for all intensities studied (although it appears that the actual fluence requirement is somewhat lower for very intense pulses, the variations fall within the narrow range given). When high pressure of an inert buffer gas (e.g., 300 torr argon) is added, however, the effects of laser intensity on the dissociation process are substantially reduced, and the reaction becomes largely fluence dependent.

704,357
PB83-135038 Not available NTIS
National Bureau of Standards, Washington, DC.
Procedure for Estimating the Heats of Formation of Aromatic Compounds: Chlorinated Benzenes, Phenols and Dioxins.
Final rept.
W. M. Shaub. 1982, 15p
Pub. in Thermochimica Acta 55, p59-73 1982.

Keywords: *Heat of formation, *Aromatic compounds, *Chlorine organic compounds, Chlorobenzenes, Phenols, Reprints, Dioxins.

A method for estimating the gas phase heats of formation of some aromatic organic compounds is applied. A critical comparison of the gas phase heats of formation predicted by this method with the gas phase heats of formation reported experimentally for several aromatic organic compounds is presented. Practical applications of this method are illustrated for chlorinated dioxins, chlorinated phenols and chlorinated or fluorinated benzene molecules. The limitations and practical extensions of the methods are discussed. The method is shown to be simple and of practical usefulness, particularly when required experimental data are unavailable.

704,358
PB83-135061 Not available NTIS
National Bureau of Standards, Washington, DC.

Evidence for Sequential Reactions in the CO2 Laser Induced Multiphoton Dissociation of Acetic Anhydride and Acetic Acid.
Final rept.
A. J. Grimley, and J. C. Stephenson. 1 Jan 81, 6p
Pub. in Jnl. of Chemical Physics 74, n1 p447-452, 1 Jan 81.

Keywords: *Acetic acid, *Acetic anhydride, Dissociation, Reprints, *Laser spectroscopy, *Laser induced fluorescence.

The CO2 laser induced multiphoton dissociation of acetic acid and acetic anhydride has been investigated.

704,359
PB83-135087 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Spectroscopy.
Final rept.
D. R. Lide. 1981, 21p
Pub. in Encycl. Phys., p613-618 1981.

Keywords: *Molecular spectroscopy, Molecular structure, Reprints.

An elementary description of molecular spectroscopy is presented. The correlation of types of spectra observed in different wavelength regions with features of molecular structure is described. A bibliography of other information sources is given.

704,360
PB83-135160 Not available NTIS
National Bureau of Standards, Washington, DC.
Observation of Prebreakdown and Breakdown Phenomena in Liquid Hydrocarbons.
Final rept.
R. E. Hebner, E. F. Kelley, E. O. Forster, and G. J. FitzPatrick. 1982, 9p
Pub. in Jnl. of Electrostatics 12, p265-283 1982.

Keywords: *Hydrocarbons, *Optical measurement, *Dielectric properties, Liquids, Hexane, Cyclohexane, Toluene, Cathodes, Anodes, Electrodes, Surface chemistry, Reprints, Pentane/trimethyl.

Prebreakdown and breakdown events under quasi-uniform fields in n-hexane, isooctane, cyclohexane, and toluene have been photographed. For each liquid, two types of breakdown patterns are observed. One pattern is characteristic of growth from the cathode while the other is characteristic of growth from the anode. The measured postbreakdown phenomena were identical in all cases. In addition to the optical studies, microscopic observations showed that organic films were produced on the electrode surface and that lead accumulates preferentially in the area of the electrode surface where breakdown occurs.

704,361
PB83-135194 Not available NTIS
National Bureau of Standards, Washington, DC.
Microwave Spectrum and Dipole Moment of BH3NH3.
Final rept.
R. D. Suenram, and L. R. Thorne. 15 Feb 81, 4p
Pub. in Chemical Physics Letters 78, n1 p157-160, 15 Feb 81.

Keywords: *Microwave spectroscopy, *Boron isotopes, Chemical bonds, Stark effect, Dipole moments, Boron inorganic compounds, Reprints, *Boron ammoniate.

No abstract available.

704,362
PB83-135228 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Multiphoton Excitation and Dissociation.
Final rept.
D. S. King. 1982, 85p
Pub. in Dynamics of the Excited State, p105-189 (John Wiley and Sons Ltd., New York, 1982).

Keywords: *Infrared spectroscopy, *Molecular energy levels, Excitations, Reviews, Reprints, *Laser spectroscopy.

Critical review of advances made in 1979-1980 in field of molecular excitation in intense infrared laser fields.

704,363
PB83-135244 Not available NTIS
National Bureau of Standards, Washington, DC.
Dissipative Trajectory Theory for Reactive Scattering at Surfaces.
Final rept.
J. W. Gadzuk. 1982, 9p
Pub. in Surface Science 118, p180-192 1982.

Keywords: *Surface chemistry, Vibrational spectroscopy, Reprints, *Trajectory theory, State of the art.

The Tully-Preston 'surface-hopping trajectory model' originally constructed for gas phase reactive-scattering events is adapted to a class of automic scattering processes at solid surfaces involving a substrate-induced diabatic transition on the incident atom. The role of energy dissipation due to substrate excitations is shown to drastically influence the reaction probability. Within the context of the trajectory theory, dissipation places upper limits on the number of trajectories leading to non-reactive events and hence on the reaction proability. This is illustrated by example, using sticking as a prototypical event. A criterion for large sticking coefficients is given in terms of vibrational frequencies and linewidths and of desorption energies, all quantities being experimentally accessible with current state-of-the-art measurement techniques. An experiment, based on the present theory, is proposed which could differentiate between electronic and phonon dissipation.

704,364
PB83-135277 Not available NTIS
National Bureau of Standards, Washington, DC.
Dependence of 3p Electron-Energy Loss Spectra of Nickel on Momentum Transfer.
Final rept.
T. Jach, and C. J. Powell. 1982, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Applications of Surface Science 11/12, p385-389 1982.

Keywords: *Nickel, Molecular energy levels, Reprints, *Electron energy loss spectroscopy.

The Fano lineshape of the threshold region in nickel 3p electron energy loss spectra is observed to change as the incident electron energy is lowered from 1000 to 150 eV. This change is attributed to changes in momentum transfer over the energy range investigated. The lineshape changes are consistent with a change of Fano's parameter q from 0.95 to 1.2, with significant deviations from the predicted Fano lineshape at the lowest incident energy. A satellite peak about 12 eV above the 3p threshold is observed to decrease in intensity relative to the principle line.

704,365
PB83-135285 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystalline Forms in a Copolymer of Vinylidene Fluoride and Trifluoroethylene (52/48 mol %).
Final rept.
A. J. Lovinger, G. T. Davis, T. Furukawa, and M. G. Broadhurst. Apr 82, 6p
Sponsored in part by Office of Naval Research, Arlington, VA. See also AD-A107809.
Pub. in Macromolecules 15, n2 p323-328, Mar-Apr 82.

Keywords: *Crystal structure, *X ray diffraction, Fluorine organic compounds, Reprints, *Vinylidene fluoride polymers, *Ethylene/trifluoro.

The structure of a 52/48 mol % copolymer of vinylidene fluoride and trifluoroethylene has been investigated at various temperatures by X-ray diffraction. Melt-solidified samples consist of a mixture of two disordered crystalline phases, one trans planar, the other 3/1 helical. Samples may be transformed to either phase by appropriate means to reveal a hexagonal (or pseudohexagonal) molecular packing. The all-trans phase may be obtained by drawing or poling at low temperatures; both treatments cause a transformation of the disordered mixture of phases into a well-ordered planar-zigzag phase. Isolation of the disordered 3/1-helical phase is achieved by heating to high temperatures, whereupon all samples, irrespective of orientation or polarization, undergo transformation to a poorly ordered helical structure analogous to that of trifluoroethylene homopolymer; upon cooling, the original, disordered mixture of phases is recovered.

704,366
PB83-135293 Not available NTIS
National Bureau of Standards, Washington, DC.
F I and O I Isoelectronic Sequences: Observations of 2sm2pn-2sm-12pn+1 Intersystem Transitions and Improved Measurements for C1, K, Ca, Sc, Ti, and V.
Final rept.
V. Kaufman, J. Sugar, and D. Cooper. 1982, 4p
Sponsored in part by the Department of Energy, Washington, DC.
Pub. in Physica Scripta 25, n5 p623-626 1982.

Keywords: *Molecular energy levels, Chlorine, Potassium, Calcium, Scandium, Vanadium, Titanium, Hartree-Fock approximation, Reprints, *Isoelectronic sequences.

Spectra of Cl through V (excluding Ar) were produced with a GW (15 ns) pulse from a Nd-glass laser impinging on solid targets and observed with a 10.7 m grazing incidence spectrograph. Hartree-Fock calculations of the radial integrals were compared with those obtained from least squares fits of the newly derived energy levels to obtain improved predictions in the oxygen sequence by means of scaled Hartree-Fock integrals.

704,367
PB83-135319 Not available NTIS
National Bureau of Standards, Washington, DC.
Structural and Dielectric Investigation on the Nature of the Transition in a Copolymer of Vinylidene Fluoride and Trifluoroethylene (52/48 mol %).
Final rept.
G. T. Davis, T. Furukawa, A. J. Lovinger, and M. G. Broadhurst. Apr 82, 5p
Sponsored in part by the Office of Naval Research, Arlington, VA. See also AD-A107846.
Pub. in Macromolecules 15, n2 p329-333, Mar/Apr 82.

Keywords: *Crystal structure, *Dielectric properties, Temperature, Fluorine organic compounds, Copolymers, Pyroelectricity, Reprints, *Vinylidene fluoride polymers, *Ethylene/trifluoro.

The effect of temperature on the structure and dielectric properties of a 52/48 mol % copolymer of vinylidene fluoride and trifluoroethylene has been investigated at temperatures up to 140C. Undrawn or unpoled specimens contain an intimate mixture of two disordered crystalline phases, both of which undergo a large increase in d spacing at 65-70C, with eventual transformation to a single phase in which the chains assume a disordered 3/1-helical conformation above 90C. The changes in crystal phase and dipole orientation upon poling result in a reduction of the dielectric constant at room temperature, a shift of the dielectric anomaly to approximately 80C, stability of the all-trans crystal phase to somewhat higher temperatures, and a discrete change in d spacing to that of the disordered 3/1-helical conformation at the transition region.

704,368
PB83-135327 Not available NTIS
National Bureau of Standards, Washington, DC.
Ab Initio Effective Spin-Orbit Operators for Use in Atomic and Molecular Structure Calculations: Results for CH, OH, SiH, CO+, CO, and SiO.
Final rept.
W. J. Stevens, and M. Krauss. 1 Apr 82, 3p
Contract AFSOR-ISSA-82-0017
Pub. in Jnl. of Chemical Physics 76, n7 p3834-3836, 1 Apr 82.

Keywords: *Carbon, *Silicon, *Atomic structure, *Molecular structure, Spin orbit interactions, Reprints, Numerical solution.

Ab initio effective spin-orbit operators (AESOP) for carbon and silicon are derived from relativistic effective core potentials based on Dirac-Fock atomic wavefunctions. The general transferability of these operators to electronic states other than the one used in the original derivation is treated by calculating the spin-orbit splitting of various neutral and ionic atomic states.

704,369
PB83-135335 Not available NTIS
National Bureau of Standards, Washington, DC.
Ab Initio Effective Spin-Orbit Operators for Use in Atomic and Molecular Structure Calculations: Results for Carbon and Silicon.
Final rept.
W. J. Stevens, and M. Krauss. 19 Feb 82, 5p
Pub. in Chemical Physics Letters 86, n3 p320-324, 19 Feb. 82.

Keywords: *Carbon, *Silicon, *Atomic structure, *Molecular structure, Spin orbit interactions, Reprints, Numerical solution.

Ab initio effective spin-orbit operators (AESOP) for carbon and silicon are derived from relativistic effective core potentials based on Dirac-Fock atomic wavefunctions. The general transferability of these operators to electronic states other than the one used in the original derivation is treated by calculating the spin-orbit splitting of various neutral and ionic atomic states.

704,370
PB83-137364 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Ionization Potential and Appearance Potential Measurements, 1971-1981.
Final rept.
R. D. Levin, and S. G. Lias. Oct 82, 637p NSRDS-NBS-71
Contract DOE-EA-77-A-01-6010

Keywords: *Ionization potentials, Potential energy, Molecular structure, Tables(Data).

A compilation is presented of the ionization potential and appearance potential measurements which appeared in the refereed literature in the time period 1971-1981. The data are sorted according to the identity of the ionic species formed in the ionization process. Precursor molecules or radicals are identified by a structural formula and, in the case of compounds containing rings, by name according to the Chemical Abstracts system of nomenclature. Chemical Abstracts Registry Numbers are provided where available. A complete bibliography and author index are provided.

704,371
PB83-138990 Not available NTIS
National Bureau of Standards, Washington, DC.
Quantum Theory of Atomic Collisions in Intense Laser Fields.
Final rept.
F. H. Mies. 1980, 72p
Pub. in Theoret. Chem.: Adv. Perspectives 6B, p127-198 1980.

Keywords: *Inelastic scattering, *Quantum theory, Lasers, Reprints, *Atom atom interactions.

Quantum theory of laser-induced inelastic atomic collisions is developed. Multiphoton transitions and the properties of the laser-field are carefully analyzed and the close-coupled equations for the scattering are derived. Both stimulated and spontaneous emission is treated in the weak-field limit, and the non-linear behavior of the cross-sections in strong-fields is discussed. Particular care is given to the conservation laws that can be expected in the presence of radiation.

704,372
PB83-139014 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of H2O on the Behavior of SF6 Corona.
Final rept.
R. J. van Brunt. 1982, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of International Conference on Gas Discharges and Their Applications (7th), London, UK, August 31-September 3, 1982, p255-258.

Keywords: *Water vapor, *Sulfur hexafluoride, *Electric corona, Gas chromatography, Mass spectroscopy.

The effects of trace amounts of H2O vapor (<300 ppm) on point-to-plane dc-corona inceptions and corona pulse characteristics in SF6 were investigated. Corona discharges were generated in short gaps, 1.0 to 3.0 cm, for sharp point electrodes of diameter about 0.1 mm, and for gas pressures in the range of 100 to 400 kPa. Trace levels of H2O were introduced by electrical heating of a wire in the gas, and its concentration was monitored with a gas chromatograph-mass spectrometer. Water vapor was found to significantly enhance the intensity of corona at a given voltage, as indicated by an order of magnitude or more increase in average discharge current and corona pulse rate. The presence of small quantities of H2O greatly inhibits formation of positive streamer burst pulses and significantly modifies the shape of the corona pulse height distribution. On the other hand, introduction of H2O results in only a slight reduction in the overall dielectric strength of SF6.

704,373
PB83-139030 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Energy Splitting of Highly Excited States in the Two-Coulomb-Center Problem.
Final rept.
R. K. Janev, C. J. Joachain, and N. N. Nedeljkovic. Jul 82, 9p
Pub. in Physical Review A, n1 p116-124 Jul 82.

Keywords: Excitation, Molecular energy levels, Reprints, *Two Coulomb center problem.

Using the comparison equation method, asymptotically exact analytical expressions are derived for the molecular energy splittings of highly excited states of the one-electron two-Coulomb-center system (Z1 e Z2). Both the symmetrical (Z1 = Z2) and nonsymmetrical (Z1 not equal to Z2) cases are studied. The physical implications of the results are discussed, and their relationship with the expressions corresponding to low-lying states is analyzed.

704,374
PB83-139089 Not available NTIS
National Bureau of Standards, Washington, DC.
Inequivalent C-H Oscillators of Gaseous Alkanes and Alkenes in Laser Photoacoustic Overtone Spectroscopy.
J. S. Wong, and C. B. Moore. Jul 82, 13p
Contract W-7405-ENG-48, Grant NSF-CHE79-16250
Sponsored in part by Army Research Office, Research Triangle Park, NC.
Pub. in Jnl. of Chemical Physics 77, n2 p603-615, 15 Jul 82.

Keywords: *Alkanes, *Alkene hydrocarbons, *Relaxation oscillators, Chemical bonds, Reprints, *Laser photoacoustic spectroscopy.

The overtone spectra of the C-H stretching vibrations of several gaseous alkanes and alkenes were observed using laser photoacoustic spectroscopy. Resolvable peaks are seen for each chemically or sterically equivalent C-H bond and are assigned using the local mode model. The fifth overtone transition energies decrease linearly with increasing C-H bond lengths. Spectral shifts corresponding to 0.001 A bond length differences are observed. Linear correlations of bond length and anharmonicity with fundamental C-H stretching frequency allow a Morse potential for CH bonds to be defined in terms of a single parameter. The integrated cross section per C-H oscillator for the fifth overtone spectra varied mostly within a factor of 2 about an average value.

704,375
PB83-139097 Not available NTIS
National Bureau of Standards, Washington, DC.
Search for Long-Lived Doubly Charged Atomic Negative Ions.
Final rept.
D. Spence, W. A. Chupka, and C. M. Stevens. Jul 82, 4p
Pub. in Physical Review A 26, n1 p654-657 Jul 82.

Keywords: *Mass spectroscopy, *Anions, Reprints.

Using the Argonne 100 inch radius double focusing mass spectrometer the authors have searched for long-lived (> or equal to .00001 sec) doubly charged atomic negative ions using electron impact and Penning ionization sources. Their source operating conditions are similar to those of previous experiments which claim the existence of such ions. In contrast to all previous experiments, their mass resolution is sufficient to absolutely identify any impurity ion from its mass-defect, and the machine design is such that artifact peaks (Aston Peaks) caused by collisional dissociation of molecular negative ions do not occur. They found no evidence of any doubly charged atomic negative ion.

704,376
PB83-139113 Not available NTIS
National Bureau of Standards, Washington, DC.
Relaxation Theory of Stark Broadening by Ions.
Final rept.
R. L. Greene. 1982, 13p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 27, n6 p639-651 1982.

Keywords: *Stark effect, *Ions, *Line width, Plasmas(Physics), Relaxation(Mechanics), Reprints.

A theory of Stark broadening in plasmas is presented in which the effects of broadening by ion perturbers are treated in a manner similar to the relaxation theory or unified theory for electrons. An expression is derived for Fano's broadening operator M(omega) which does not contain the projection operators or cumulants of previous forms. To obtain a calculable expression for M(omega), an approximation is made in which small, second-order fluctuation terms are replaced by their adiabatic limits. Sample calculations are presented for the first two members of the Lyman and Balmer series of hydrogen which show reasonable agreement with experiment, although the 'dip' of the beta lines is still too pronounced.

704,377
PB83-139121 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron-Impact-Ionization Cross Sections for Highly Ionized Chlorinelike Ions.
Final rept.
S. M. Younger. Jun 82, 3p
Pub. in Physical Review A 25, n6 p3396-3398 Jun 82.

Keywords: *Scattering cross sections, Ionization, Argon, Potassium, Scandium, Iron, Reprints, *Electron impact spectra, Born approximation.

Electron-impact-ionization cross sections have been computed for ArII, KIII, ScV, and FeX in a distorted-wave Born exchange approximation. For ArII, the theoretical results are in good agreement with available experimental data. An analytic fit to the data is provided.

704,378
PB83-139147 Not available NTIS
National Bureau of Standards, Washington, DC.
Regularities and Similarities in Plasma Broadened Spectral Line Widths (Stark Widths).
Final rept.
W. L. Wiese, and N. Konjevic. 1982, 14p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 28, n3 p185-198 1982.

Keywords: *Line width, *Stark effect, Plasmas(Physics), Reprints.

Regularities and similarities in plasma broadened line widths have been studied by a comprehensive analysis of existing experimental data. Regularities are expected on the basis of general atomic structure considerations, and should be evident for spectral series, for corresponding transitions in homologous atoms and in isoelectronic sequences. Furthermore, similarities of line widths are expected for multiplets, supermultiplets and, to a lesser degree, for transition arrays. A comprehensive examination of literature data has been undertaken, which shows generally a close adherence of the measured data to the expected regularities. A few notable exceptions are also given.

704,379
PB83-139188 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Diffusion Coefficients by Chronoamperometry with Unshielded Planar Stationary Electrodes.
Final rept.
W. T. Yap, and L. M. Doane. Jul 82, 3p
Pub. in Analytical Chemistry 54, n8 p1437-1439 Jul 82.

Keywords: *Diffusion coefficients, *Electrodes, Reprints, *Chronoamperometry.

Several methods of determining the diffusion coefficient from chronoamperometric data of unshielded planar stationary electrodes are examined. It is concluded that none of the methods completely account for the deviation of it (1/2) vs. t(1/2) curves and that all the methods employed are accurate within 5 percent.

704,380
PB83-139220 Not available NTIS
National Bureau of Standards, Washington, DC.
Resonance Phenomena in Molecular Photoionization: Impact of Synchrotron Radiation.
Final rept.
R. P. Madden, and A. C. Parr. 15 Jan 82, 10p
Pub. in Applied Optics 21, n2 p179-188, 15 Jan 82.

Keywords: *Photoionization, *Synchrotron radiation, Atoms, Molecules, Reviews, Resonance, Photoelectrons, Reprints, Autoionization.

The nature of resonance phenomena in atomic and molecular systems is reviewed along with a discussion of the utilization of synchrotron radiation in studying resonance phenomena. The effects of autoionization and shape resonances on the branching ratios and asymmetry parameters for several systems are discussed. The potential and current status of threshold photoelectron spectroscopy and ion coincidence techniques are discussed.

704,381
PB83-139238 Not available NTIS
National Bureau of Standards, Washington, DC.
2s(2)2p(5)-2s2p(6) Transitions in the Fluorinelike Ions Sr(29+) and Y(30+).
Final rept.
J. Reader. Jul 82, 3p
Pub. in Physical Review A 26, n1501-503 Jul 82.

Keywords: *Strontium, *Yttrium, Molecular energy levels, Reprints, Numerical solution.

The 2 doublet s 2p sup 5 2 singlet s 2p sup 6 transitions in Sr(+29) and Y(+30) have been observed by means of a laser-produced plasma and a 2.2-m grazing-incidence spectrograph. Comparison of the observed 2 doublet s 2p sup 5 doublet P(3/2-1/2) fine-structure intervals with values calculated by the Dirac-Fock method allows accurate wavelengths to be predicted for the 2 doublet s 2p sup 5 doublet P(3/2) doublet P(1/2) magnetic-dipole transitions in the isoelectronic series of ions Kr(+27)-Mo(+33).

704,382
PB83-142828 Not available NTIS
National Bureau of Standards, Washington, DC.
Chromatographic Studies of Diffusion in Polymers.
Final rept.
G. A. Senich. 1982, 1p
Pub. in Proceedings of Int. Union of Pure and Applied Chemistry, 28th Macromolecule Symposium, Amherst, MA., July 12-16, 1982, p740 1982.

Keywords: *Gas chromatography, *Diffusion coefficient, *Polymers, Polyethylene, Alkanes.

The method of inverse gas chromatography is considered as a means for obtaining diffusion coefficients of volatile organic materials or probes in polymers. Experimental studies of the chromatographic peak broadening dependence on carrier gas flow rate allow the diffusivity of the probe in the polymer to be determined. The results of previous studies on octadecane diffusion in high-density polyethylene (HDPE) are summarized. Methods for studying the diffusivity of a probe relative to that of a reference probe in a polymer of interest are discussed. Results are presented for the diffusion of several normal and branched alkanes from tridecane through octadecane in HDPE.

704,383
PB83-142927 Not available NTIS
National Bureau of Standards, Washington, DC.
Photon-Stimulated Desorption and Ultraviolet Photoemission Spectroscopic Study of the Interaction of H2O with a Ti(001) Surface.
Final rept.
R. Stockbauer, D. M. Hanson, S. A. Flodstrom, and T. E. Madey. 15 Aug 82, 8p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Physical Review B 26, n4 p1885-1892, 15 Aug 82.

Keywords: *Water, *Surface chemistry, *Synchrotron radiation, Titanium, Adsorption, Reprints, *Ultraviolet photoemission spectroscopy, Electron stimulated desorption.

The adsorption of H2O on a stepped Ti(001) single crystal, oriented within 4 degrees of Ti(001) has been studied using synchrotron radiation from the NBS Synchrotron Ultraviolet Radiation Facility at NBS. The species formed upon adsorption of H2O were identified through variable wavelength Ultraviolet Photoemission Spectroscopy.

704,384
PB83-142935 Not available NTIS
National Bureau of Standards, Washington, DC.
Inelastic-Scattering Measurements of 1.5-15 eV Neutrons.
Final rept.
R. G. Johnson, and C. D. Bowman. 13 Sep 82, 4p
Pub. in Physical Review Letters 49, n11 p797-800, 13 Sep 82.

Keywords: *Inelastic scattering, *Neutron scattering, Liquid nitrogen, Benzene, Reprints.

Measurements of inelastically scattered electronvolt neutrons have been completed with a pulsed neutron source and neutron time-of-flight techniques in combination with a resonant-neutron-capture detector. Measurements are presented on liquid nitrogen and benzene for incident neutron energies in the range 1.5 to 15 eV and for q values from 13 to 120/A. These are the first measurements of inelastic neutron scattering in this energy range.

704,385
PB83-142984 Not available NTIS
National Bureau of Standards, Washington, DC.
Mediator Compounds for the Electrochemical Study of Biological Redox Systems: A Compilation.
Final rept.
M. L. Fultz, and R. A. Durst. 1982, 18p
Pub. in Analytica Chimica Acta 140, p1-18 1982.

Keywords: *Oxidation reduction reactions, *Electrochemistry, Electron transfer, Surfaces, Reprints, *Biological processes, Heterogeneous reactions.

Many biological compounds exhibit irreversible redox behavior as a result of slow heterogeneous electron transfer at electrode surfaces. In order to study the electrochemical behavior of these biocomponents, redox mediators are used to facilitate the electron transfer process. In this review the characteristics of ideal mediators are discussed and structural information on previously reported mediator compounds is provided. The electrochemical literature has been extensively surveyed to provide an up-to-date compilation of mediators suitable for use in potentiometric and coulometric titrations and in various types of voltammetric studies of biological redox systems. The compilation provides information on the formal potentials of the mediators as well as their previous applications and references. This review is intended to provide a current survey of compounds having suitable redox mediation characteristics.

704,386
PB83-143016 Not available NTIS
National Bureau of Standards, Washington, DC.
Co-Adsorption Studies of CO and H2 on ZnO.
Final rept.
G. L. Griffin, and J. T. Yates. 1 Oct 82, 8p
Pub. in Jnl. of Chemical Physics 77, n7 p3751-3758, 1 Oct 82.

Keywords: *Carbon monoxide, *Hydrogen, Zinc oxides, Adsorption, Infrared spectroscopy, Desorption, Reprints.

The authors have studied the adsorption of pure CO and CO:H2 mixtures on powdered ZnO using the combined techniques of transmission infrared spectroscopy and temperature programmed desorption (TPD).

704,387
PB83-143024 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of the Microwave Spectrum of Hydrazine.
Final rept.
S. Tsunekawa, T. Kojima, and J. T. Hougen. 1982, 20p
Pub. in Jnl. of Molecular Spectroscopy 95, p133-152 1982.

Keywords: *Hydrazine, *Microwave spectroscopy, Molecular energy levels, Molecular rotation, Molecular vibration, Reprints.

Microwave measurements in the interval from 6 to 133 GHz, consisting of 444 rotational transitions in the vibrational ground state of hydrazine with J less than or equal to 31 and K (a) less than or equal to 6 have been fit to an effective rotational Hamiltonian containing 9 asymmetric rotor constant.

704,388
PB83-143040 Not available NTIS
National Bureau of Standards, Washington, DC.
Triple Point of Gallium as a Temperature Fixed Point.
Final rept.
B. W. Mangum. 1982, 11p
Pub. in Proceedings of Int. Symposium on Temperature (6th), Washington, DC., March 15, 1982, Paper in Temperature - Its Measurement and Control in Science and Industry, p299-309 1982.

Keywords: *Gallium, *Temperature measurement, Standards, *Triple point.

The triple-point temperature of high-purity gallium has been determined to be 29.77398C using five standard platinum resistance thermometers (SPRTs), recently dried and then calibrated on the IPTS-68, and using ten samples of gallium from three commercial sources. All data obtained on the highest-purity sample have a standard deviation of + or - 0.00014C and the systematic uncertainty is estimated to be + or - 0.0006C. Three of the samples investigated were in all-plastic cells and seven samples were in steel cells with Teflon containers for the gallium and with Teflon-coated stainless-steel thermometer wells. Intercomparison of the triple-point temperatures of all ten samples, each of a different lot, were made for several different gallium mantles of each sample.

704,389
PB83-143057 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature and Thermodynamics of Living Matter.
Final rept.
T. H. Benzinger. 1982, 7p
Pub. in Proceedings of Int. Symposium on Temperature (6th), Washington, DC., March 15-18, 1982, Paper in Temperature - Its Measurement and Control in Science and Industry, p1389-1395 1982.

Keywords: *Temperature, *Thermodynamics, *Organic compounds, Proteins, Membranes, Nucleotides, Chemical equilibrium, Chemical bonds, *Biological process.

In this paper the driving energies of chemical reactions are identified as the constructive, bond-forming chemical bond energy delta H syp 0 (0) and the disruptive, bond-breaking, 'Thermal Work Function'. Use of the complete equation permits thermodynamic treatment and comprehension of the multiple functions of living matter, the genetically coded macromolecules of proteins, polynucleotides and membranes, their weak interactions and reversible conformational changes at moderate temperatures. Two numerical examples, the unfolding of a protein and unwinding of a polynucleotide double helix, are shown. For necessary background information, structures and functions of living matter are briefly discussed.

704,390
PB83-143065 Not available NTIS
National Bureau of Standards, Washington, DC.
Adsorption Studies of H2 Isotopes on ZnO: Coverage-Induced IR Frequency Shifts and Adsorbate Geometry.
Final rept.
G. L. Griffin, and J. T. Yates. 1 Oct 82, 7p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Chemical Physics 77, n7 p3744-3750, 1 Oct 82.

Keywords: *Surface chemistry, *Hydrogen isotopes, Adsorption, Chemisorption, Infrared radiation, Deuterium compounds, Zinc oxides, Reprints.

The coverage dependence of the IR stretching frequencies for dissociative Type I adsorption of H2 and D2 on ZnO powders has been measured using transmission IR spectroscopy. By comparing the frequency shifts observed when the isotopic composition of the adsorbate is varied at constant total coverage with the shifts observed when the total coverage of either pure component is varied, the authors can separate the dynamic and static contributions to the coverage induced frequency shifts. The ZnH and ZnD shifts are due primarily to electrodynamic interactions. The observed shifts are in good agreement with the Hammaker model for dynamic dipole-dipole interactions, if adsorption is assumed to occur on (2x2) reconstructed ZnO (0001) surface planes. In contrast, the OH and OD shifts are due to electrostatic and inductive interactions. The electrostatic contribution can be estimated using a modification of Buckingham's treatment of local environment effects. A qualitative model, based on electron localization effects, is presented to explain the observed inductive contribution.

704,391
PB83-143354 Not available NTIS
National Bureau of Standards, Washington, DC.

Simple Extension of Suzuki's Scaling Approach to the Onset Time of an Unstable State: Application to Supercooled Liquid.
Final rept.
Y. M. Wong, and P. H. E. Meijer. Jul 82, 6p
Contract N00014-78-C-0518
Pub. in Physical Review A 26, n1 p611-616, July 1982.

Keywords: *Supercooling, *Liquid phases, Quenching(Cooling), Revisions, Stability, Reprints, *Suzuki scaling method.

Physically motivated by the experimental findings in the onset time of a supercooled liquid, the authors extend the Suzuki's scaling method to include the case of a time-dependent externally controlled growth rate. The simple application of this modified nonlinear time scale transformation leads to the following predictions: the deeper one quenches the sample or, the longer one waits before heating the sample, or, the more the heating of the sample, the shorter the onset time of the freezing process. Its inadequacy to explain the quench rate dependence of the onset time suggests that a similar examination of a two-mode theory may be the key to the behavior of the fusion phenomenon of supercooled liquid.

704,392
PB83-143420 Not available NTIS
National Bureau of Standards, Washington, DC.
Investigation of the Freezing Temperature of Cadmium.
Final rept.
G. T. Furukawa, and E. R. Pfeiffer. 1982, 6p
Pub. in Proceedings of the International Symposium on Temperature (6th), Washington, DC., March 15-18, 1982. Paper in Temperature - Its Measurement and Control in Science and Industry, p355-360 1982.

Keywords: *Cadmium, *Freezing, *Melting points, Resistance thermometers, Platinum, Calibrating, Standards, Fixed points.

The freezing points of five cadmium cells, which were prepared using samples from two different sources, were found to agree within + or - 0.1 mC. Measurements with eight standard platinum resistance thermometers (SPRT's) gave an average freezing-point temperature of 321.1082C. The results show that the cadmium point is suitable for testing the consistency of calibration of SPRT's on the International Practical Temperature Scale of 1968.

704,393
PB83-143438 Not available NTIS
National Bureau of Standards, Washington, DC.
Triple-Point of Rubidium: A Temperature Fixed Point for Biomedical Applications.
Final rept.
J. M. Figueroa, and B. W. Mangum. 1982, 11p
Pub. in Proceedings of the International Symposium on Temperature (6th), Washington, DC., March 15-18, 1982. Paper in Temperature - Its Measurement and Control in Science and Industry, p327-337 1982.

Keywords: *Rubidium, Temperature measurement, Melting, Freezing, *Triple point, Fixed points, Biomedicine.

In order to test the feasibility of using the triple point of rubidium as a thermometric fixed point in biomedical applications, a study of the melting and freezing behavior of this metal was conducted. An investigation of the reproducibility of the melting plateau temperatures of a group of six rubidium cells, filled under vacuum, was made. The triple-point temperature of pure rubidium was estimated by fitting the experimental data to a hyperbolic equation under the hypothesis of the theory of dilute solutions. The triple-point temperature was established to be 39.265 + or - 0.014 C, at the 99.7% confidence interval.

704,394
PB83-143446 Not available NTIS
National Bureau of Standards, Washington, DC.
Reproducibility of Some Triple Point of Water Cells.
Final rept.
G. T. Furukawa, and W. R. Bigge. 1982, 5p
Pub. in the Proceedings of the International Symposium on Temperature, (6th), Washington, DC., March 15-18, 1982. Paper in Temperature - Its Measurement and Control in Science and Industry, p291-287 1982.

Keywords: *Water, *Calibrating, Resistance thermometers, Platinum, Reproducibility, Temperature measurement, *Triple point, Fixed points.

The reproducibility of some triple point of water cells was investigated by platinum resistance thermometry. The standard deviation of measurements with a single cell was found to be better than + or -0.01 mK. The range of temperature observed with different cells was about 0.2 mK. The cells with more residual air tended to give lower temperatures. The cells of high quality gave temperatures within the range 0.05 mK.

704,395
PB83-143461 Not available NTIS
National Bureau of Standards, Washington, DC.
Reproducibility of the Triple Point of Argon in Sealed Transportable Cells.
Final rept.
G. T. Furukawa. 1982, 10p
Pub. in Proceedings of the International Symposium on Temperature (6th), Washington, DC., March 15-18, 1982. Paper in Temperature - Its Measurement and Control in Science and Industry, p239-248 1982.

Keywords: *Argon, *Calibrating, Temperature measurement, Reproducibility, *Triple point, Fixed points.

The reproducibility of the triple point of argon sealed in miniature pressure cells was investigated in calorimetric apparatus. The results obtained with samples of 99.9999 percent purity sealed in three cells of different designs, using two calorimetric cryostats, show that the triple point of argon can be reproduced well within + or -0.1 mK. Measurements with six thermometers demonstrate that calibrations can be obtained consistent within the reproducibility of the fixed point.

704,396
PB83-143511 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Excited Electronic States in Ion Fragmentation: C6H6(+).
Final rept.
H. M. Rosenstock, J. Dannacher, and J. F. Liebman. 1982, 22p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Radiation Physics and Chemistry 20, n1 p7-28 1982.

Keywords: *Benzene, Ions, Atomic energy levels, Excitation, Reprints.

The present article presents a critical review of our understanding of the fragmentation behavior of the electronically excited C6H6(+) system. This system produces a number of primary ionic fragments at low excitation energy. The determination of the structure of these fragments is discussed. The evidence for structural isomerization is reviewed, both for fragmenting and nonfragmenting C6H6(+) ions. The energetics of various ionization and fragmentation processes is established and presented, leading to conclusions about the relative stability of various C6H6(+) isomer states. The competition between fragmentation, internal conversion, and reradiation of electronic excitation energy is examined. Lastly, the methodology for estimating heats of formation of molecules and ions of unusual structure is briefly discussed.

704,397
PB83-143552 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of Orthobaric Liquid Densities of Multicomponent Mixtures of LNG Components (N2, CH4, C2H6, C3H8, CH3CH(CH3)C2H5, C4H10, C4H10, and C5H12) between 110 and 130 K.
Final rept.
W. M. Haynes. 1982, 10p
Pub. in Jnl. of Chemical Thermodynamics 14, n7 p603-612 1982.

Keywords: *Liquefied natural gas, *Density(Mass/volume), *Chemical composition, Reprints.

A magnetic suspension densimeter has been used to measure the orthobaric-liquid densities of 17 multicomponent mixtures of the major components of liquefied natural gas (LNG) at temperatures from 110 to 130 K.

704,398
PB83-143560 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Cooling and Double Resonance Spectroscopy of Stored Ions.
Final rept.
W. M. Itano, and D. J. Wineland. 1981, 8p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of the International Conference on Laser Spectroscopy (5th), Jasper Park Lodge, Alberta, Canada, June 29-July 3, 1981. Paper in Laser Spectroscopy V, 30, p361-368 1981.

Keywords: *Optical pumping, Hyperfine structure, *Magnesium ions, *Double resonance spectroscopy, Trapped particles.

Experiments are described in which Mg(+1) ions stored in a Penning trap are cooled by resonant light pressure and optically pumped. Double resonance detection of transitions with high efficiency is described. Applications of these techniques to frequency and time standards are discussed.

704,399
PB83-143586 Not available NTIS
National Bureau of Standards, Boulder, CO.
Transport Properties of Monatomic Carbon.
Final rept.
L. Biolsi, J. C. Rainwater, and P. M. Holland. 1 Jul 82, 7p
Grant NsG-1369
Pub. in Jnl. of Chemical Physics 77, n1 p448-454, 1 Jul 82.

Keywords: *Transport properties, *Carbon, Vapor phases, Reprints, *Atom atom interaction, Hulburt-Hirschfelder potentials.

Transport properties of monatomic gases depend on the two-body atom-atom interaction potential. When two ground state carbon atoms interact, they can follow any of 18 potential energy curves corresponding to the C2 molecule. Accurate representations of these curves have been obtained for each of the 18 states and transport collision integrals have been calculated for each state. Those states with an attractive minimum in the potential have been represented by the Hulburt-Hirschfelder potential and the purely repulsive states have been represented by the exponential repulsive potential. The collision integrals are compared with results obtained in previous studies. The effects of the details of the potential on the resulting transport collision integrals are discussed.

704,400
PB83-143750 Not available NTIS
National Bureau of Standards, Washington, DC.
Tunable Diode Laser Study of the nu(3) Band of SiF4 Near 9.7 Micrometers.
Final rept.
C. W. Patterson, R. S. McDowell, N. G. Nereson, B. J. Krohn, J. S. Wells, and F. R. Petersen. 1982, 8p
Pub. in Jnl. Molecular Spectroscopy 91, p416-423 1982.

Keywords: *Silicon fluorides, Dipole moments, Vibration spectra, Reprints, *Laser spectroscopy, *Silicon tetrafluoride.

Doppler-limited tunable-diode laser spectra of the stretching fundamental nu(3) of 28SiF4 near 1031/cm were analyzed and the spectroscopic constants determined. The nu(3) vibrational dipole moment derivative was determined for several rovibrational lines.

704,401
PB83-143792 Not available NTIS
National Bureau of Standards, Washington, DC.
Interaction of NH3 with Oxygen-Predosed Ni (111).
Final rept.
F. P. Netzer, and T. E. Madey. 1982, 11p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Surface Science 119, p422-432 1982.

Keywords: *Ammonia, *Chemisorption, *Surface chemistry, Nickel, Reaction kinetics, Molecular structure, Reprints, Electron stimulated desorption ion angular distribution method, Low energy electron diffraction.

The authors have used ESDIAD (Electron Stimulated Desorption Ion Angular Distributions), LEED and thermal desorption to study the structure and kinetics of NH3 interacting with preadsorbed oxygen on a Ni(111)

surface. They postulate that the NH3 interacts with 0 atoms via a hydrogen bond, leading to local azimuthal ordering in the absence of long range order. This new observation of steric effects in coadsorption may have a direct bearing on the mechanisms by which catalyst promotors and poisons function.

704,402
PB83-145607 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Diode Laser Spectra of the Delta v = 1 Band of AlF and Delta v = 2 Band of KF.
Final rept.
A. G. Maki, and F. J. Lovas. 1982, 12p
Pub. in Jnl. of Molecular Spectroscopy 95, p80-91 1982.

Keywords: Aluminum halides, Potassium halides, Ultraviolet spectroscopy, Reprints, *Laser spectroscopy, *Aluminum fluoride, *Potassium fluoride.

High resolution diode laser spectra of AlF and of KF have been measured between 827/cm and 855/cm.

704,403
PB83-145623 Not available NTIS
National Bureau of Standards, Washington, DC.
Monte Carlo Calculation of the Hydrodynamic Radius at the Theta Point, Deviations from Analytical Gaussian Behavior.
Final rept.
C. M. Guttman, F. L. McCrackin, and C. C. Han. 1982, 3p
Pub. in Macromolecules, p1205-1207 Jul-Aug 82.

Keywords: *Polymers, *Monte Carlo method, *Hydrodynamic configurations, Reprints, Kirkwood theory, Numerical solution.

The hydrodynamic radius of polymers is computed using Kirkwood's formula for polymer chains at the theta point created by Monte Carlo simulation in which both volume exclusion and the energetics of nearest neighbor interactions are taken into account.

704,404
PB83-145664 Not available NTIS
National Bureau of Standards, Washington, DC.
Dielectric Constants of Saturated Liquid Propane, Isobutane, and Normal Butane.
Final rept.
W. M. Haynes, and B. A. Younglove. 1982, 9p
Pub. in Proceedings of Cryogenic Engineering Conference (1981), San Diego, California, August 11-14, 1981, Paper in Advances in Cryogenic Engineering 27, p883-891 1982.

Keywords: *Dielectric properties, *Propane, *Butanes, Liquefied gases, Clausius-Mossotti function.

Measurements of the dielectric constants of saturated liquid propane (90-300 K), isobutane (115-303.15 K) are presented. The overall uncertainty of these measurements is estimated to be approximately 0.01 percent. By combining these dielectric constant data with density data previously obtained with a magnetic suspension densimeter in the same laboratory, the Clausius-Mossotti (CM) function is determined. A simple analytical expression is used to represent the CM function over wide ranges of temperature and density. Comprehensive comparisons with other experimental data are given.

704,405
PB83-145680 Not available NTIS
National Bureau of Standards, Washington, DC.
Binary Collision Dynamics and Numerical Evaluation of Dilute Gas Transport Properties for Potentials with Multiple Extrema.
Final rept.
J. C. Rainwater, P. M. Holland, and L. Biolsi. 1 Jul 82, 14p
Pub. in Jnl. of Chemical Physics 77, n1 p434-447, 1 Jul 82.

Keywords: *Binary systems, *Transport properties, Vapor phases, Reprints, Hulburt-Hirschfelder potentials, Numerical solution.

Prediction of gaseous transport properties requires calculation of Chapman-Enskog collision integrals which depend on all possible binary collision trajectories. The interparticle potential is required as input, and for a variety of applications involving monatomic gases the Hulburt-Hirschfelder potential is useful since it is determined entirely from spectroscopic information and can accommodate the long-range maxima and minima found in many systems. Hulburt-Hirschfelder potentials are classified into five distinct types according to their qualitative binary collision dynamics, which in general can be quite complex and can exhibit 'double orbiting', i.e., a pair of orbiting impact parameters for a single energy of collision. The collision integral program of O'Hara and Smith has been revised extensively to accommodate all physical cases of the Hulburt-Hirschfelder potential, and the required numerical methods are described and justified. The revised program substantially extends the range of potentials for which collision integrals can be calculated.

704,406
PB83-146423 Not available NTIS
National Bureau of Standards, Washington, DC.
Reaction of F Atoms with Acetaldehyde and Ethylene Oxide. Vibrational Spectra of the CH3CO and CH2CHO Free Radicals Trapped in Solid Argon.
Final rept.
M. E. Jacox. 1982, 16p
Pub. in Chemical Physics 69, p407-422 1982.

Keywords: *Acetaldehyde, *Ethylene oxide, *Vibrational spectra, Hydrogen fluoride, Absorption, Infrared spectroscopy, Chemical bonds, Reprints, *Fluorine atoms, *Matrix isolation technique, Free radicals, Methane/formyl.

When the products of the reaction with acetaldehyde of F atoms produced in a microwave discharge are frozen in a large excess of argon at 14 K, infrared absorptions of the CH3CO and CH2CHO free radicals and of their hydrogen-bonded complexes with HF appear. The CH2CHO absorptions are also present in similar studies of the reaction of F atoms with ethylene oxide. The products of secondary F-atom reactions play minor roles under the conditions of these experiments. Detailed isotopic substitution studies support the free radical and HF complex identifications and demonstrate that the chemical bonding in the ground state of CH2CHO is appropriate to the formyl methyl (H2C-CH:O) rather than the vinoxyl (H2C:CH-O) structure. The vibrational assignment of formyl methyl is compared with that of vinyl fluoride. The acetyl radical photodecomposes into CH3 + CO in the visible spectral region. The photodecomposition threshold of the formyl methyl radical lies between 280 and 300 nm, with CH3 and CO as the products.

704,407
PB83-146464 Not available NTIS
National Bureau of Standards, Washington, DC.
New Approach for Analysis and Prediction of Liquid-Vapor Coexistence Densities Including the Critical Region.
Final rept.
L. J. Van Poolen, and W. M. Haynes. 1982, 9p
Pub. in Proceedings of Cryogenic Engineering Conference (1981), San Diego, California, August 11-14, 1981, Paper in Advances in Cryogenic Engineering 27, p839-847 1982.

Keywords: *Density(Mass/volume), *Critical density, *Liquid phases, *Vapor phases.

The use of the liquid volume fraction to analyze the internal consistency of saturated liquid and vapor densities in relation to the critical density is described. Its use in calculating saturation densities in regions in which accurate data are unavailable and in determining a critical density consistent with available coexistence boundary data is also reported. Applications of this new approach to available literature data are presented.

704,408
PB83-146498 Not available NTIS
National Bureau of Standards, Boulder, CO.
Thermal Conductivity of Argon at 300.65 K. Evidence for a Critical Enhancement.
Final rept.
C. A. Nieto de Castro, and H. M. Roder. 1982, 6p
Grant NATO-1874
Pub. in Proceedings of Symposium on Thermophysical Properties (8th), National Bureau of Standards, Washington, DC., June 15-18, 1981, p241-246 1981.

Keywords: *Argon, *Thermal conductivity, Critical point.

Recent measurements of the thermal conductivity of argon at room temperature and pressures up to 70 MPa have shown an unexpected behavior of the thermal conductivity versus density plot, a small abnormality around the critical density.

704,409
PB83-146506 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of the Viscosity of Saturated and Compressed Liquid Methane, Ethane and Propane.
Final rept.
D. E. Diller. 1982, 8p
Pub. in Proceedings of Symposium on Thermophysical Properties (8th), National Bureau of Standards, Washington, DC., June 15-18, 1981, p219-226 1982.

Keywords: *Viscosity, *Methane, *Ethane, *Propane, Liquid phases.

The shear viscosity coefficients of saturated and compressed liquid methane, ethane and propane have been measured at temperatures between 90 and 300 K, and at pressures to 30 MPa (4350 psia) with a torsionally oscillating quartz crystal viscometer.

704,410
PB83-146514 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Fluids via Computer Simulation: Structure Under Shear.
Final rept.
H. J. M. Hanley, D. J. Evans, and S. Hess. 1982, 5p
Pub. in Proceedings of Symposium on Thermophysical Properties (8th), National Bureau of Standards, Washington, DC., June 15-18, 1981, p326-330 1982.

Keywords: *Shear tests, *Molecular structure, Chemical equilibrium, *Radial diffusion coefficients.

The technique of nonequilibrium molecular dynamics is used to simulate the structure of a binary mixture of soft spheres in equilibrium and in nonequilibrium under shear. Radial distribution functions are reported for the system at two-thirds melting for mixtures with a large difference in the mass and size of the species. Results are also given for the radial distribution function under shear for the pure soft sphere fluid close to melting. NonNewtonion and normal pressure difference phenomena are observed.

704,411
PB83-146530 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of the Viscosity of Saturated and Compressed Liquid Propane.
Final rept.
D. E. Diller. Jul 82, 3p
Pub. in Jnl. of Chemical Engineering Data 27, n3 p240-243 Jul 82.

Keywords: *Viscosity, Density(Mass/volume), Reprints, *Liquid propane.

The shear viscosity coefficient of saturated and compressed liquid propane has been measured with a torsionally oscillating quartz crystal viscometer at temperatures between 90 and 300 K and at pressures up to 30 MPa (4350 psia).

704,412
PB83-146548 Not available NTIS
National Bureau of Standards, Washington, DC.
Redistribution and the Equations for Radiative Transfer.
Final rept.
J. Cooper, R. J. Ballagh, K. Burnett, and D. G. Hummer. 1 Sep 82, 18p
Grants NGL-06-003-057, NSF-PHY79-04928
Pub. in Astrophysical Jnl. 260, n1 p299-316, 1 Sep 82.

Keywords: *Frequency distribution, Line width, Reprints, *Radiative transfer, Numerical solution.

The authors outline the derivation of the equations of statistical equilibrium, starting from the quantum density-matrix equations, drawing particular attention to the approximations and assumptions used in the development of tractable expressions. Then, using the quantum-fluctuation-regression theorem, they obtained emission and absorption coefficients for multilevel atomic systems which are nondegenerate except for m-substates (thus excluding hydrogen). These coefficients are valid to first order in the incident intensity. The authors also suggest possible extensions to higher intensity broadband incoherent fields.

704,413
PB83-146555 Not available NTIS
National Bureau of Standards, Washington, DC.

Numerical Calculation of Gaseous Transport Properties from the Hulbert-Hirschfelder Potential with Applications to Planetary Entry Thermal Protection.
Final rept.
J. C. Rainwater, P. M. Holland, and L. Biolsi. 1982, 14p
Grant NsG-1369
Pub. in Progress in Astronautics and Aeronautics 82, p3-16 1982.

Keywords: *Transport properties, *Thermal conductivity, Planetary atmospheres, Carbon, Gases, Reprints, *Hulburt-Hirschfelder potential, Numerical solution.

Transport properties of dilute monatomic gases have been evaluated by means of the Hulburt-Hirschfelder (H-H) potential, which contains non-adjustable parameters determined completely from spectroscopic data. The H-H potential is shown to encompass five distinct patterns of binary collision dynamics, some of which include double orbiting. Since the collision dynamics are more complicated than those of commonly used potentials like the Lennard-Jones, the numerical routines to evaluate Chapman-Enskog collision integrals have been extensively revised. For applications to thermal protection during entry into atmospheres of the outer planets, transport properties of monatomic carbon gas at T about 1,0000 K have been evaluated.

704,414
PB83-146571 Not available NTIS
National Bureau of Standards, Washington, DC.
Microsecond Resolution Pulse Heating Technique for Thermophysical Measurements at High Temperatures.
Final rept.
A. Cezairliyan, M. S. Morse, G. M. Foley, and N. E. Erickson. 1982, 6p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Symposium on Thermophysical Properties (8th), National Bureau of Standards, Washington, DC., June 15-18, 1981, p45-50 1982.

Keywords: *Thermophysical properties, *Electric conductors, High temperature tests, Solid phases, Liquid phases, Phase transformation, Specific heat, Electrical resistivity.

The status of the development is presented of a dynamic technique for the accurate measurement of selected thermophysical properties (such as heat capacity, electrical resistivity, temperature and energy of phase transformations) of electrically conducting materials in their solid and liquid phases at high temperatures (above 2000 K).

704,415
PB83-154542 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Chemical Thermodynamic Data Banks.
D. Garvin, V. B. Parker, and D. D. Wagman. Aug 81, 32p NBSIR-81-2341

Keywords: *Thermodynamic properties, *Inorganic compounds, *Information systems, High temperature tests, Forecasting, *Methanes, *Ethanes.

A substantial critical evaluation of chemical thermodynamic measurements on inorganic and C1-C2 organic compounds has recently been completed. This provides selected values for some 14300 substances, based on a collection of 250,000 measurements. This work is placed in a historical context of three earlier comprehensive evaluations of thermochemical data. During the course of this work data banks of several types have been developed: bibliography, extracted unevaluated data, evaluated measurements (catalogs of reactions) and selected chemical thermodynamic properties for individual substances. The design, structure and use of those data banks are described. The course of modern data evaluation, based on these files, is discussed briefly in terms of tests for intermeasurement consistency and autmoated solutions of large networks of data. A complementary thermodynamic data system developed at the Institute for High Temperatures, Moscow, USSR is described briefly. Proposed international activities are outlined.

704,416
PB83-157040 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Chemical Impurities on Prebreakdown Events in Toluene.
Final rept.
G. J. Fitzpatrick, E. O. Forster, E. F. Kelley, and R. E. Hebner. Oct 82, 9p
Pub. in Proceedings of 1982 Annual Report of Conference on Electrical Insulation and Dielectric Phenomena (1982), Amherst, Massachusetts, October 17-21, 1982, p464-472 1982.

Keywords: *Toluene, Impurities, Sampling.

Effects of chemical impurities on the breakdown process in toluene have been investigated under non-uniform field conditions using a high-speed image converter camera. The resistivity of the four samples investigated ranged from 10 to the 9th power to 10 to the 13th power ohm cm and the rate of rise of the approximately trapezoidal voltage pulse varied from 9 to 50 kV/microseconds.

704,417
PB83-157065 Not available NTIS
National Bureau of Standards, Washington, DC.
Recent Developments in the Theory of Electron Collisions with Polar Molecules.
Final rept.
D. W. Norcross. 1982, 6p
Pub. in Proceedings of Daresbury Study Weekend, Daresbury, Warrington, England, March 26-27, 1982, p64-69 1982.

Keywords: Perturbation theory, Polarity, *Electron molecule interactions.

This paper discusses recent advances in theory that have occurred on several fronts: in applications and extensions of perturbation theory, semiclassical methods, and the adiabatic-nuclei approximation; in the development of more realistic and complete representations of the interaction at short as well as long range; in computational techniques for carrying out ever more elaborate and precise calculations; and in the application of these advances to more complicated collision processes such as vibrational excitation.

704,418
PB83-162172 Not available NTIS
National Bureau of Standards, Washington, DC.
Slow Chain Reactions of Br2 and Cl2 with HI: Multiple State Analysis and Vibrational Relaxation of HBr(v=2) and HCl(v=1-4).
Final rept.
D. A. Dolson, and S. R. Leone. Oct 82, 13p
Grant NSF-PHY79-04928, Contract DE-AC02-79ER10396
Sponsored in part by Department of Energy, Washington, DC. and National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 77, n7 p4009-4021, 15 Oct 82.

Keywords: *Hydrogen bromide, *Hydrogen chloride, *Molecular relaxation, *Chain reactions, Excitation, Reaction kinetics, Reprints, *Laser spectroscopy.

Two chain reactions of the general form X+HI yields (K1) HX(nu less than or equal to nu(max)+I,I+X2 yields(K2)IX+X(X=Br, Cl) are studied by realtime detection of infrared chemiluminescence from the vibrationally excited HX(v) products. Both are characterized by K2<K1. These reactions are initiated by pulsed UV laser photolysis of the diatomic halogens at 355 nm in a flow cell apparatus at 295 K.

704,419
PB83-162206 Not available NTIS
National Bureau of Standards, Washington, DC.
Method of Evaluating the Thermal Stability of the Pyroelectric Properties of Polyvinylidene Fluoride: Effects of Poling Temperature and Field.
Final rept.
D. DeRossi, A. S. DeReggi, M. G. Broadhurst, S. C. Roth, and G. T. Davis. Oct 82, 6p
Pub. in Jnl. of Applied Physics 53, n10, p6520-6525 Oct 82.

Keywords: *Thermal stability, *Pyroelectricity, Temperature, Reprints, *Vinylidene fluoride polymers.

The ac pyroelectric response of a number of differently poled polyvinylidene fluoride films has been measured while the temperature was varied at a constant rate about 5C/min for room temperature to near the melting temperature. The response first increases with increasing temperature, which is attributed to an increase of the thermal expansion coefficient and eventually decreases due to melting and/or loss of electric dipole orientation. The details of the temperature dependence are influenced in a reproducible manner by the poling variables, especially the poling temperature. The measurement is therefore proposed as a way of evaluating the effect of processing variables on the thermal stability of the pyroelectric properties.

704,420
PB83-162255 Not available NTIS
National Bureau of Standards, Washington, DC.
13C NMR in Organic Solids: Limits to Spectral Resolution and to Determination of Molecular Motion.
Final rept.
A. N. Garroway, D. L. VanderHart, and W. L. Earl. 1981, 19p
Sponsored in part by Naval Research Lab., Washington, DC.
Pub. in Phil. Trans. R. Lond. A 299, p609-628 1981.

Keywords: *Nuclear magnetic resonance, *Solid phases, *Organic compounds, Isotopic labeling, Molecular relaxation, Reprints.

The history of high resolution NMR in solids has been, inter alia, a quest for narrow spectral lines. Yet, with few exceptions, solid state resonances have not been sharpened to the degree of liquid resonances. To aid in the appraisal of the status of NMR in solids, we identify and summarize, for the particular case of 13C NMR in organic solids, those effects which can degrade resolution. Some of these mechanisms are under the experimenter's control; for example, certain are exacerbated at high magnetic field. Others, however, represent fundamental limitations imposed by the specimen and are valid reflections of the complexity of a solid as contrasted to a liquid. In solids, magnetic dipolar spin-spin couplings can not only degrade resolution but also complicate, hopelessly in some cases, the determination of spin-lattice relaxation rates from which one seeks information about molecular motions. The consequences of this competition between spin-spin and spin-lattice effects are examined, as well as criteria and strategies to isolate the motional contributions to relaxation rates.

704,421
PB83-164533 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 87, Number 4, July-August 1982.
Bi-monthly rept.
1982, 101p
Library of Congress catalog card no. 63-37059.

Keywords: *Research projects, Curve fitting, Approximation, Interpolation, Thermal conductivity, Oxygen, Water, Chromatographic analysis, Clothoids, Partition coefficients.

Contents: The thermal conductivity of oxygen; Measurements of the octanol/water partition coefficient by chromatographic methods; Curve fitting with clothoidal splines.

704,422
PB83-164954 PC **A06**/MF **A01**
Notre Dame Univ., IN. Radiation Chemistry Data Center.
Rate Constants for Reactions of Aliphatic Carbon-Centered Radicals in Aqueous Solution.
A. B. Ross, and P. Neta. Oct 82, 106p NSRDS-NBS-70
Library of Congress catalog card no. 82-2096.

Keywords: *Reaction kinetics, *Aliphatic hydrocarbons, Solutions, Chemical reactions, Free radicals.

Rate constants have been compiled for reactions of various transient aliphatic radicals produced mostly by radiolysis in aqueous solutions. In certain cases the radicals have been produced by photolysis or by a thermal chemical reaction. Data are included for aliphatic carbon-centered radicals only, i.e., substituted alkyl radicals in the broad sense, but not for oxyl or aminyl radicals. Reactions of the aliphatic radicals with inorganic and organic compounds are included.

704,423
PB83-174045 PC **A08**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.

Phase Equilibria: An Informal Symposium.
Technical note.
B. E. Eaton, J. F. Ely, H. J. M. Hanley, R. D. McCarty, and J. C. Rainwater. Jan 83, 157p NBS-TN-1061
Prepared in cooperation with Colorado Univ., Boulder. Dept. of Chemical Engineering, and Polish Academy of Sciences, Warsaw. Inst. of Physical Chemistry.

Keywords: *Phase transformation, *Chemical equilibrium, *Meetings, Forecasting, Binary systems, Critical point.

This Technical Note reports an informal conference on phase equilibria held at the National Bureau of Standards, Boulder, in October 1980. Talks were given on extended corresponding states, critical behavior, mixing rules and, in general, the prediction of the phase behavior of simple mixtures. A survey of methods used in industry was also presented. Suggested work for the future is given.

704,424
PB83-176800 Not available NTIS
National Bureau of Standards, Washington, DC.
Mid-to-High-Z Precision X-ray Measurements.
Final rept.
E. G. Kessler, R. D. Deslattes, D. Girard, W. Schwitz, L. Jacobs, and O. Renner. Nov 82, 11p
Pub. in Physical Review A 26, n5 p2696-2706 Nov 82.

Keywords: *X ray analysis, *Line width, *Elements, Comparison, Atomic properties, Reprints, *High atomic numbers.

New X-ray wavelength (energy) and width measurements are reported for a number of elements from 47 = or < Z < 92. The X-rays were produced using an electron Van de Graaff and the measurements were made using a two-axis flat crystal transmission spectrometer equipped with angle measuring interferometers. The new measurements reported here, combined with other high precision X-ray wavelengths, form a moderately extensive data base for comparison with theoretical calculations. Comparison with recent revisions of a previously available all-Z calculation reveals improved patterns of general agreement with, however, important exceptions. The newly measured line widths are in agreement with widths derived from radiative rates and fluorescence yields.

704,425
PB83-176826 Not available NTIS
National Bureau of Standards, Washington, DC.
Impurity States in Doped Trans-Polyacetylene.
Final rept.
G. W. Bryant, and A. J. Glick. Nov 82, 12p
Sponsored in part by United States-Israel Educational Foundation.
Pub. in Physical Review B 26, n10 p5855-5866, 15 Nov 82.

Keywords: *Acetylene, *Additives, Polymers, Impurities, Molecular structure, Mathematical models, Reprints, *Polyethynylene.

The authors assess the importance of the impurity states of a doped trans-polyacetylene chain. The impurity potential is modeled by a point charge that is located off the chain and is screened phenomenologically. The common assumption that the dopant levels of a dimerized chain closely approximate the hydrogenic levels of a point charge is invalid if the impurity is not on the chain, even if the dopant is screened by the bulk dielectric constant. The nature of doping in polyacetylene must remain unclear until a realistic model for the dopant and its interaction with polyacetylene has been developed.

704,426
PB83-176842 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoemission Spectra in Intense Laser Field Induced Autoionization.
Final rept.
G. S. Agarwal, S. L. Haan, K. Burnett, and J. Cooper. Oct 82, 4p
Grant NSF-PHY79-04928
Pub. in Physical Review A 26, n4 p2277-2280 Oct 82.

Keywords: *Photoelectric emission, Reprints, *Autoionization, *Laser spectroscopy.

Photoemission spectra from autoionizing states in the presence of a strong laser field are calculated. Such spectra have very sharp features near 'confluence' (at the Fano minimum) and are very similar, in structure, to photoelectron spectra. The total intensity, as a function of laser intensity or detuning, has a peak near 'confluence,' which can be used, among other things, for the accurate determination of Fano asymmetry parameter q.

704,427
PB83-176859 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface-Enhanced Raman Scattering in Two-Oscillator Electromagnetic Model.
Final rept.
G. S. Agarwal, and S. S. Jha. Oct 82, 9p
Sponsored in part by Joint Inst. for Lab. Astrophysics, Boulder, CO.
Pub. in Physical Review B 26, n8 p4013-4021, 15 Oct 82.

Keywords: *Mathematical models, *Surface chemistry, *Oscillators, *Electromagnetic fields, *Raman spectroscopy, Reprints.

A two oscillator model is considered to investigate the effect of a metal substrate of dielectric function epsilon (omega) on the Raman scattering from a molecule absorbed on the metal surface. In the presence of the metal and an external electric field, the linear motion of the electronic and ionic oscillators in the molecule get coupled, in general. For obtaining Raman scattering at the Stokes frequency, a phenomenological nonlinear force term, which is bilinear in the oscillator amplitudes, is introduced in the equation of motion. The whole problem is considerably simplified when we use the fact that the ionic mass is much larger than the electronic mass and the ionic vibration frequency is much smaller than the electronic and optical frequencies. It is shown that because of different renormalization factors the frequency-dependence of the enhancement factor F, taken to be the ratio of Raman intensity with and without the metal, is quite different than that calculated by using the familiar polarizability-derivative theory. Applying the well known fluctuation-dissipation theorem, the new Raman line shape is also calculated to contrast it with the corresponding line shape in the absence of the metal.

704,428
PB83-176867 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of the Far Infrared H2-He Spectrum.
Final rept.
E. R. Cohen, L. Frommhold, and G. Birnbaum. Nov 82, 9p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Physics 77, n10 p4933-4941, 15 Nov 82.

Keywords: *Infrared spectroscopy, *Hydrogen, *Helium, Dipoles, Reprints, *Molecule molecule interactions.

Previous measurements of the far infrared adsorption due to H2-He collisions at the temperatures of 77K, 195K and 292K are analyzed. The spectra are fitted by a semi-empirical line shape representing the isotropic induced overlap and combined anisotropic quadrupolar and overlap components. The experimental spectral moments are evaluated and compared with theory for several induced dipole and potential models. From the isotropic contribution the range and strength of the induced dipole is evaluated at the temperatures of the measurement and compared with the results of ab initio calculations. Parameters are obtained with physically plausible temperature dependences, which allow simple representation of the spectra at different temperatures.

704,429
PB83-176875 Not available NTIS
National Bureau of Standards, Washington, DC.
Rydberg States of Li2 and Molecular Constants of Li2(+).
Final rept.
R. A. Bernheim, L. P. Gold, and T. Tipton. Oct 82, 3p
Pub. in Chemical Physics Letters 92, n1 p13-15, 8 Oct 82.

Keywords: *Lithium, Excitation, Molecular energy levels, Reprints, *Lithium ions, *Laser spectroscopy, *Ryberg series.

A pulsed optical-optical double resonance spectroscopic study of the Rydberg excited states of (7) Li2 has been performed which reveal three series.

704,430
PB83-176883 Not available NTIS
National Bureau of Standards, Washington, DC.
Quasi-Resonant Charge Exchange Collisions between Multiply Charged Ions.
Final rept.
R. K. Janev, and D. S. Belic. 1982, 9p
Sponsored in part by Department of Energy, Washington, DC., and International Atomic Energy Agency, Vienna (Austria).
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 15, p3479-3487 1982.

Keywords: Elementary excitations, Ions, Reprints, *Ion ion interactions.

Cross section calculations of the quasi-resonant ion-ion charge-exchange reaction A(+Z) + B(Z+1) yields A(Z+1)+1 + B(+Z) + delta epsilon (1<or=Z<or=5, delta epsilon << 1) are performed for some tokamak-plasma impurity ions.

704,431
PB83-176909 Not available NTIS
National Bureau of Standards, Washington, DC.
Synthesis of Nitrogen-15 Labeled Amino Sugar Derivatives by Addition of Phthalimide-15N to a Carbohydrate Epoxide.
Final rept.
B. Coxon, and R. C. Reynolds. 1982, 11p
Pub. in Carbohydrate Research 110, p43-54 1982.

Keywords: *Synthesis(Chemistry), *Isotopic labeling, *Molecular structure, Nuclear magnetic resonance, Sugars, Nitrogen organic compounds, Reprints, *Altropyranoside/methyl-amino-deoxy, *Glucopyranoside/methyl-amino-deoxy, Molecular configurations, Molecular conformations, Nitrogen 15.

Derivatives of methyl 2-amino-2-deoxy-alpha-D-altropyranoside-2-(15)N and methyl 3-amino-3-deoxy-alpha-D-glucopyranoside-3-(15)N have been synthesized by addition of phthalimide-(15)N to methyl 2,3-anhydro-4,6-0-benzylidene-alpha-D-allopyranoside. The structures of the phthalimido derivatives that resulted have been proved chemically, by conversion into known aminodeoxy derivatives, and spectroscopically, by (1)H- and (13)C-n.m.r. spectroscopy. (1)H-N.m.r. spectroscopy at 360 MHz also allowed definition of the configurations and conformations of the labeled and unlabeled phthalimido derivatives.

704,432
PB83-176925 Not available NTIS
National Bureau of Standards, Washington, DC.
Nonadiabatic Theory of Collision-Broadened Atomic Line Profiles.
Final rept.
P. S. Julienne. Dec 82, 18p
Pub. in Physical Review A 26, n6 p3299-3317 Dec 82.

Keywords: *Line width, *Profiles, Reprints, *Nonadiabatic theory, *Atomic scattering, Born-Oppenheimer approximation.

The close-coupled theory of atomic scattering in a radiation field can be used to calculate nonadiabatic effects on collision-broadened atomic line profiles.

704,433
PB83-176966 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Dynamics Study of Liquid Rubidium.
Final rept.
R. D. Mountain. Nov 82, 10p
Pub. in Physical Review A 26, n5 p2859-2868 Nov 82.

Keywords: *Rubidium, Supercooling, Liquid phases, Reprints, *Molecular dynamics.

Molecular dynamics has been used to investigate the properties of supercooled liquid states for a model of liquid rubidium. The energy-temperature relation for the reduced density n*=0.95 for liquid, amorphous solid and bcc crystal phases is presented along with the pair correlation function, the self-diffusion coefficient and the transverse current correlation as functions of temperature for the liquid. The self-diffusion coefficient is found to vary with temperature in a way which correlates with the temperature evolution of the pair correlation function. The power spectra of the transverse current correlation function are used to determine the minimum length required for the decay of fluctuations to be describable by linearized hydrodyna-

mics. This length grows rapidly as the amount of supercooling increases and becomes significantly larger than the dimensions of the cube to which periodic boundary conditions are applied.

704,434
PB83-176990 Not available NTIS
National Bureau of Standards, Washington, DC.
Comments on the Measurement of Thermal Conductivity and Presentation of a Thermal Conductivity Integral Method.
Final rept.
J. G. Hust, and A. B. Lankford. 1982, 11p
Pub. in Int. Jnl. Thermophys. 3, n1 p67-77 1982.

Keywords: *Thermal conductivity, Reprints, Spatial temperature gradient approximation.

A discussion is presented regarding the significance of the spatial temperature gradient approximation normally used in thermal conductivity measurement. Examples are presented illustrating the magnitude of temperature differences allowed for conductivity integral (TCI) method of analysis is presented as an alternative method which totally eliminates the need to impose temperature difference restrictions on the measurement process, so long as other errors, such as radiative heat losses, do not become excessive.

704,435
PB83-177022 Not available NTIS
National Bureau of Standards, Washington, DC.
Distorted-Wave Electron-Impact Ionization Cross Sections for the Argon Isoelectronic Sequence.
Final rept.
S. M. Younger. Dec 82, 10p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review A 26, n6 p3177-3186 Dec 82.

Keywords: *Argon, Ions, Cross sections, Reprints, *Isoelectronic sequences, *Electron impact spectra, Numerical solution.

Electron impact ionization cross sections have been calculated in a distorted wave exchange approximation for seven ions in the argon isoelectronic sequence. For neutral argon, target configuration interaction and term-dependence in the ejected electron continuum were found to be significant influences on the cross section. Similarities of electron ionization and photoionization are discussed. An analytic fit is given which accurately reproduces the distorted wave cross sections and rate coefficients of argonlike ions with Z > or = 20.

704,436
PB83-177295 Not available NTIS
National Bureau of Standards, Washington, DC.
Stark Effect on the Oscillator-Strength Distribution of Helium near the Ionization Limit.
Final rept.
J. W. Cooper, and E. B. Saloman. Sep 82, 14p
Pub. in Physical Review A 26, n3 p1452-1465 Sep 82.

Keywords: *Helium, *Stark effect, Absorption, Mathematical models, Ionization potentials, Reprints, *Oscillator strength.

The effect of electric fields of strengths up to 30 kV/cm on the absorption spectra of helium near the ionization limit has been investigated in detail with the use of synchrotron radiation from the SURF-II storage ring. In contrast to previous work on the heavier noble gases, the results show a strong dependence on the polarization of the source. A simple theoretical model is developed to explain the results. The relationship between the work reported here and previous theoretical and experimental studies is discussed.

704,437
PB83-177329 Not available NTIS
National Bureau of Standards, Washington, DC.
Study of Measurement Interference in the Optoacoustic Detection of NO2 by Argon-Ion Laser Excitation.
Final rept.
A. Fried. 1982, 4p
Pub. in Applied Spectroscopy 36, n5 p562-565 1982.

Keywords: *Nitrogen dioxide, *Optical measurement, *Acoustic measurement, Metastable state, Excitation, Reprints, *Laser spectroscopy.

Optoacoustic Measurements of NO2 excited by an Ar(+1) Laser were performed in the presence of NO, N2, H2O, and O2 Matrix gases. Identical sensitivities were measured in all but the latter, where the effect of energy transfer from NO2 to the metastable O2 ('delta) state resulted in a dramatic decrease in sensitivity.

704,438
PB83-177345 Not available NTIS
National Bureau of Standards, Washington, DC.
N I Isoelectronic Sequence: Observations of 2s(m)2p(n)-2s(m-1)2p(n+1) Intersystem Transitions and Improved Measurements for Cl XI, K XIII, Ca XIV, Sc XV, Ti XVI, and V XVII.
Final rept.
V. Kaufman, J. Sugar, and D. Cooper. 1982, 5p
Pub. in Physica Scripta 26, n3 p163-167 1982.

Keywords: *Molecular energy levels, Least square method, Chlorine, Potassium, Calcium, Scandium, Titanium, Hartree-Fock approximation, Reprints, *Isoelectronic sequence.

Spectra of C1 through V (excluding Ar) were produced with 1 GW (15 ns) pulses from a Nd-glass laser impinging on solid targets and observed with a 10.7-m grazing incidence spectrograph. Hartree-Fock calculations of the radial integrals were compared with values obtained from least squares fits of the energy levels of this sequence.

704,439
PB83-177386 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Reconstruction of Clean (001)W.
Final rept.
A. J. Melmed, and W. R. Graham. 1982, 15p
Pub. in Applied Surface Science 11/12, p470-478 1982.

Keywords: *Tungsten, *Surface chemistry, *Atomic structure, Reprints.

After more than a decade of experimental and theoretical research relating to the atomic structure of (001)W, considerable controversy still remains regarding the clean surface structure of (001)W. This paper addresses the conflicts associated with primarily experimental aspects of the reconstruction problem and attempts to show that the majority of extant results are mutually compatible.

704,440
PB83-177394 Not available NTIS
National Bureau of Standards, Washington, DC.
Flash Photolysis Resonance Fluorescence Investigation of the Reaction OH + H2O2 Yields HO2 + H2O.
Final rept.
M. J. Kurylo, J. L. Murphy, G. S. Haller, and K. D. Cornett. 1982, 13p
Prepared in cooperation with Chemical Manufacturers Association.
Pub. in International Jnl. of Chemical Kinetics 14, p1149-1161 1982.

Keywords: *Hydrogen peroxide, *Water, *Reaction kinetics, Fluorescence, Reprints, Arrhenius parameters.

The flash photolysis resonance fluorescence technique has been used to measure the rate constant for the reaction OH + H2O2 (yields k1) HO2 + H2O over the temperature range 250-370 K. A summary of our computer simulation of this reaction system is presented. The results of the computations indicate the absence of secondary reaction complications in the present work while revealing significant problems in the earlier (pre 1980) studies of the title reaction.

704,441
PB83-177451 Not available NTIS
National Bureau of Standards, Washington, DC.
Activity and Osmotic Coefficients of Aqueous Sodium Bicarbonate Solutions.
Final rept.
M. Sarbar, A. K. Covington, R. L. Nuttall, and R. N. Goldberg. 1982, 10p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Thermodynamics 14, p967-976 1982.

Keywords: *Sodium carbonates, *Osmosis, *Activity coefficients, Chemical equilibrium, Electrolytes, Reprints.

The authors have used the isopiestic technique to measure the osmotic coefficients of mixed aqueous solutions of NaHCO3 and Na2CO3 at 25C. During the isopiestic equilibration, the systems were pressurized with CO2(g) to minimize the loss of CO2 from the initially pure NaHCO3 solutions and the consequent conversion of bicarbonate to carbonate. Following equilibration, a differential titration was performed to determine the quantities of carbonate and bicarbonate in the solutions.

704,442
PB83-177543 Not available NTIS
National Bureau of Standards, Washington, DC.
C I Isoelectronic Sequence: Observations of 2s(m)2p(n)-2s(m-1)2p(n+1) Intersystem Transitions and Improved Measurements for Cl XII, K XIV, Ca XV, Sc XVI, Ti XVII, and V XVIII.
Final rept.
J. Sugar, V. Kaufman, and D. Cooper. 1982, 8p
Pub. in Physica Scripta 26, n3 p189-193 1982.

Keywords: *Molecular energy levels, Chlorine, Potassium, Calcium, Scandium, Titanium, Vanadium, Least square method, Hartree-Fock approximation, Reprints, *Isoelectronic sequence, *Laser spectroscopy.

Spectra of Cl through V (excluding Ar) were produced with a 1 GW (15 ns) pulse from a Nd-glass laser impinging on solid targets and observed with a 10.7-m grazing incidence spectrograph. Hartree-Fock calculations of the radial integrals were compared with those obtained from least squares fits of the energy levels of this sequence.

704,443
PB83-177550 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Photoabsorption Cross Section of the K Shell of Atomic Lithium.
Final rept.
G. Mehlman, J. W. Cooper, and E. B. Saloman. Apr 82, 10p
Pub. in Physical Review A 25, n4 p2113-2122 Apr 82.

Keywords: *Lithium, *Atomic structure, *Cross sections, Photoionization, Reprints, Autoionization.

The absolute cross section of atomic lithium has been measured in the spectral range from 175 to 110 A thus extending previous work to shorter wavelengths. Good agreement is found with theoretical predictions. The autoionizing-resonant-structure excitation between 176 and 160 A has been measured and line-profile parameters obtained for several of the resonances. A discussion of the total oscillator strength for K-shell excitation in lithium is given and the results obtained from the present and previous work are compared with the Thomas-Reiche-Kuhn sum-rule value.

704,444
PB83-178681 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Advances in the SEC (Size Exclusion Chromatography) Characterization of Organometallic Copolymers and Copolymerization: Desorption of Charged Species by Injected Dilute Acetic Acid.
E. J. Parks, R. B. Johannesen, and F. E. Brinckman. Sep 82, 32p NBSIR-82-2577
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.

Keywords: *Tin organic compounds, *Antifouling coatings, Desorption, Chromatography, Protective coatings, Copolymers, Reaction kinetics, Adsorption, Acetic acid, *Slow release chemicals, Chemical reaction mechanisms, Size exclusion chromatography.

The chemical characterization of controlled-release, biocidal triorganotin-containing copolymers (organometallic polymers, OMPs) is necessary for predicting the in-service performance of these important materials. An OMP investigated in the present research was prepared by the free radical copolymerization of tributyltin methacrylate (TBTM) and methylmethacrylate (MMA). Size exclusion chromatography (SEC) on muStyragel, coupled with an in-line graphite furnace atomic absorption detector (GFAA) quantitates the bioactive tin in at least two well-resolved fractions: a polymer fraction, and, probably, unreacted TBTM. However, THF slowly elutes a third component, now believed to be an adsorbed ionic tin-containing compound.

704,445
PB83-179374 Not available NTIS

National Bureau of Standards, Washington, DC.
Pulsed Optical-Optical Double Resonance Spectroscopy of the Gerade Excited States of 7Li2.
Final rept.
R. A. Bernheim, L. P. Gold, and T. Tipton. 1982, 6p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Proceedings of the International Conference on Lasers 1981, New Orleans, LA, Dec 14-18, p193-198 1982.

Keywords: *Lithium, *Molecular energy levels, *Laser spectroscopy.

The technique of pulsed optical-optical double resonance spectroscopy is described.

704,446
PB83-179382 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamic Properties of Diatomic Molecules at Elevated Temperatures: Role of Continuum and Metastable States.
Final rept.
F. H. Mies, and P. S. Julienne. 15 Dec 82, 6p
Contract AFOSR-ISSA-80-0012
Pub. in Jnl. of Chemical Physics 77, n12 p6162-6167 Dec 82.

Keywords: *Diatomic molecules, *Thermodynamic properties, High temperature tests, Metastable states, Equations of state, Lithium, Sodium, Reprints, Virial coefficient.

A complete quantum formulation of diatomic partition functions uses the energy-variation of the elastic scattering phase-shift to represent the phase space associated with the molecular continuum states. The resonance structure in the phase-shift, due to tunnelling through rotational barriers, gives a rigorous interpretation of the metastable states which lie behind the barrier, and the authors can justify the need to include such states in the evaluation of thermodynamic properties. However, they also find that it is inconsistent to merely include the metastable phase-space without considering the remaining contributions from the continuum. Explicit calculations are presented for Li2 and Na2.

704,447
PB83-179473 Not available NTIS
National Bureau of Standards, Washington, DC.
Study of Atomic and Molecular Interaction from Collision-Induced Spectra.
Final rept.
G. Birnbaum. 1982, 10p
Pub. in Proceedings of the Symposium on Thermophysical Properties, National Bureau of Standards, Washington, DC, June 15-18, 1981, p8-17 1982.

Keywords: *Infrared spectroscopy, *Light scattering, Dipole moments, Diffusion coefficients, *Atom molecule interactions, Potential functions.

It is shown how the analysis of collision-induced phenomena, in particular, far infrared absorption and depolarized light scattering, may be used to obtain information about intermolecular interactions. The basic analytical methods use spectral moments and molecular band shapes, and accurate quantum mechanical calculations of translational bands. These methods may be used to evaluate multipole moments, estimate diffusion coefficients and test potential functions.

704,448
PB83-179515 Not available NTIS
National Bureau of Standards, Washington, DC.
Photon Stimulated Desorption of Ions: A New Probe of Surface Bonding and Structure.
Final rept.
R. Stockbauer, D. M. Hanson, S. A. Flodstrom, E. Bertel, and T. E. Madey. 1983, 4p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in International Jnl. of Mass Spectrometry and Ion Physics 47, p51-54 1983.

Keywords: *Surface chemistry, *Desorption, *Photons, *Ions, Chemical bonds, Oxygen, Reprints, Electron stimulated desorption.

A brief review is given of some of the work at the National Bureau of Standards using photon stimulated desorption of ions from adsorbed molecules. Ion desorption mechansims for ionically and covalently bonded absorbates are discussed. Selected results are presented for O on Ti(001), Nb(001) and W(111), Co on Ru(001), and H2O, CH3OH and C6H12 on Ti(001).

704,449
PB83-179580 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Profile Refinement of the Structures of Li2Sn03 and Li2Zr03.
Final rept.
J. L. Hodeau, M. Marezio, A. Santoro, and R. S. Roth. 1982, 10p
Pub. in Jnl. Solid State Chemistry 45, p170-179 1982.

Keywords: *Crystal structure, Neutron diffraction, Reprints, *Lithium stannates, *Lithium zirconate, *Rietveld method.

The crystal structures of the compounds Li2SnO3 and Li2ZrO3 have been refined with the Rietveld method (H. M. Rietveld, J. Appl. Crystallogr. 2, 65 (1969)) using neutron powder diffraction data collected at room temperature.

704,450
PB83-179630 Not available NTIS
National Bureau of Standards, Washington, DC.
Conditioning: Reduction of Secondary- and RF-Field Emission by Electron, Photon or Helium Impact.
Final rept.
J. Halbritter. Sep 82, 4p
Pub. in Jnl. of Applied Physics 53, n9 p6475-6478 Sep 82.

Keywords: *Radio frequencies, *Electron emission, Adsorption, Electrons, Photons, Helium, Inelastic scattering, Excitation, Reprints, *Rf conditioning, *Electron impact spectra.

Rf conditioning is a well known procedure by which the electron emission in rf cavities is reduced, thereby permitting the attainment of higher field strengths. The reduction of electron emission in rf conditioning is explained by electron impact, which causes hydrocarbon adsorption and dehydrogenation and polymerization of adsorbed hydrocarbons. These newly formed radiation resistant compounds show strong inelastic scattering for slow electrons, which reduces the secondary emission and field emission out of excited states (rf field emission) very much.

704,451
PB83-181610 Not available NTIS
National Bureau of Standards, Washington, DC.
Density Effect for the Ionization Loss of Charged Particles in Various Substances.
Final rept.
R. M. Sternheimer, S. M. Seltzer, and M. J. Berger. 1 Dec 82, 10p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review B 26, n11 p6067-6076, 1 Dec 82.

Keywords: *Elements, *Ion density(Concentration), *Chemical compounds, *Liquid hydrogen, Ions, Excitation, Metals, Absorption, Reprints, Numerical solution.

The density effect correction sigma (beta) for the ionization energy loss of charged particles has been evaluated for 72 substances (34 metallic elements + 26 compounds + 11 gases + liquid hydrogen), using up-to-date values of the mean excitation potential I and of the atomic absorption edges h(nu sub 1), which were employed as input data for the general equations for sigma (beta) previously derived by Sternheimer.

704,452
PB83-181651 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Arrhenius Parameters for Unimolecular Reactions of Chloroalkanes by IR Laser Pyrolysis.
Final rept.
H. L. Dai, E. Specht, M. R. Berman, and C. B. Moore. 1 Nov 82, 13p
Sponsored in part by Department of Energy, Washington, DC., and Army Research Office, Durham, NC.
Pub. in Jnl. of Chemical Physics 77, n9 p4494-4506, 1 Nov 82.

Keywords: *Gases, *Chlorine organic compounds, Excitation, High temperature tests, Reaction kinetics, Reprints, *Arrhenius parameters, Homogenous reactions, Silicone tetrafluoride.

A simple and reliable method is elaborated for accurate measurements of thermal rate constants of homogeneous gas phase unimolecular reactions. A pulse of CO2 laser radiation was used to multiphoton excite SiF4 sensitizer molecules and consequently produce temperatures in the range 1100-1400 K. Expansion of the heated gas column quenches pyrolysis reactions on a 10 microsec time scale. There are no hot surfaces to induce chemistry. The method is generally useful for kinetics at high temperature.

704,453
PB83-182402 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Passive Films, Surface Structure and Stress Corrosion and Crevice Corrosion Susceptibility.
J. Kruger, J. J. Ritter, and G. G. Long. Nov 82, 73p
NBSIR-83-2551
Contract NAonr-18-69
See also AD-A078596.

Keywords: *Stress corrosion, *Surfaces, *Oxidation, Organic coatings, Electrochemistry, Polarimetry, Passivity, Chemical composition, Steels, Iron alloys.

Parts I and II: Transparent organic coatings on iron and steel are used to simulate painted metal surfaces for simultaneous ellipsometric and electrochemical measurements. The studies have revealed that significant changes in the interfacial oxide layer occur as corrosion proceeds. Parts III and IV: The bonding, structure, and composition of passive films are still controversial subjects. A new surface EXAFS technique, capable of probing a passive film on iron in its native aqueous environment has been applied to this problem.

704,454
PB83-182626 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoelectron Branching Ratios and Angular Distributions for the Valence Levels of SF6 in the Range 16 < or = h nu < or = 30 eV.
Final rept.
J. L. Dehmer, A. C. Parr, S. Wallace, and D. Dill. Dec 82, 10p
Sponsored in part by Office of Naval Research, Arlington, VA., Department of Energy, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Physical Review A 26, n6 p3283-3292 Dec 82.

Keywords: *Molecular energy levels, *Sulfur hexafluoride, *Angular distributions, *Photoelectrons, Synchrotron radiation, Reprints, *Branching ratios.

Photoelectron branching ratios and angular distributions have been measured for the six outermost levels of SF6 in the range 16<or=h nu <or=30 eV with the use of synchrotron radiation. These results are discussed in the framework of the large variety of experimental and theoretical studies of SF6 with the dual objective of resolving the long-standing problem of the ordering of the valence shells and of gaining some insight into the role of shape-resonant behavior in the low-energy photoionization continue of SF6.

704,455
PB83-182659 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser-Initiated Cl2/Hydrocarbon Chain Reactions: Time-Resolved Infrared Emission Spectra of Product Vibrational Excitation.
Final rept.
D. J. Nesbitt, and S. R. Leone. 1982, 12p
Contract DE-AC02-79-ER10396, Grant NSF-PHY79-04928
Pub. in Jnl. of Physical Chemistry 86, n25 p4962-4973 1982.

Keywords: *Infrared spectroscopy, *Chlorination, *Hydrocarbons, *Chain reactions, Reaction kinetics, Reprints, *Laser spectroscopy.

Rapid gas-phase chain reactions of Cl2/hydrocarbon mixtures are initiated by selective laser photodissociation of Cl2 and investigated by time-resolved infrared emission spectra of chain products.

704,456
PB83-182691 Not available NTIS
National Bureau of Standards, Washington, DC.

Nonlocal Gravity-Induced Density Profiles in Gases near the Critical Point.
Final rept.
J. V. Sengers, and J. M. J. van Leeuwen. 1982, 23p
Pub. in Physica 116A, p345-367 1982.

Keywords: *Density(Mass/volume), *Gases, *Critical point, Thermodynamics, Gravity, Chemical equilibrium, Van der Waals equation, Temperature, Reprints.

The gravitational field induces density gradients in gases near the critical point. These density gradients are usually evaluated with the assumption that the relationship between the local density and local chemical potential is the same as for a macroscopic system in thermodynamic equilibrium. Very close to the critical point the assumption of local equilibrium ceases to be valid. In this paper the authors obtain the actual density profiles including nonlocal effects. For this purpose we extend the theory of van der Waals and of Fisk and Widom for the interfacial density profile below the critical temperature to the one-phase region above the critical temperature. The nonlocal effects in the density profiles are found to be significant in temperature intervals that are accessible with currently available experimental techniques for temperature control.

704,457
PB83-182709 Not available NTIS
National Bureau of Standards, Washington, DC.
Spreading Resistance Probe-Spacing Experiment Simulations: Effects of Probe-Current Density and Layer Thickness.
Final rept.
J. Albers. Dec 82, 8p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Jnl. of the Electrochemical Society 129, n12 p2788-2795 Dec 82.

Keywords: *Spreading, *Mathematical models, *Electron probes, *Current density, Harmonic functions, Electrochemistry, Layers, Reprints.

Model spreading resistance data were calculated using three forms of the probe-current density: the original Schumann and Gardner version, the Choo uniform current density, and the ring delta function current density in order to determine whether probe-spacing experiment simulations are sensitive to the specific form of the probe-current density. Further, since the probes of the spreading resistance and of the four-probe sheet resistance apparatus view the material as a continuum, the dependence of the results of the probe-spacing simulation on the number of layers used in the calculation was also investigated. The variable that has the strongest influence on the outcome of the probe-spacing experiment is the substrate resistivity. Hence, for junction-isolated layers and for heavily doped layers over substrates of the same conductivity type, probe-spacing experiments will yield the correct sheet resistance in the surface region.

704,458
PB83-182725 Not available NTIS
National Bureau of Standards, Washington, DC.
Q Branch of the 2 nu sub 1 + nu sub 4 Band of CF4.
Final rept.
A. S. Pine. 1982, 9p
Pub. in Jnl. of Molecular Spectroscopy 96, p395-403 1982.

Keywords: Doppler effect, Fluorine organic compounds, Reprints, *Freon 14, *High resolution spectroscopy, Methane/tetrafluoro, Laser spectroscopy.

The Q branch of the 2 nu sub 1 + nu sub 4 band of CF4 has been recorded with Doppler-limited resolution at T = 296 and 77K using a tunable difference-frequency laser spectrometer. The low temperature spectrum is fit to within 1.1 x .00011 rms/cm for J < or = 40 using the simple diagonal approximation terms, m, v and g, without centrifugal distortion. Extrapolation to higher J for the room temperature measurement is moderately successful.

704,459
PB83-182741 Not available NTIS
National Bureau of Standards, Washington, DC.
Vibrationally Elastic Scattering of Electrons by HCl.
Final rept.
N. T. Padial, D. W. Norcross, and L. A. Collins. Jan 83, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review A 27, n1 p141-148 Jan 83.

Keywords: *Hydrogen chloride, *Elastic scattering, *Molecular vibration, Reprints, *Electron interactions.

Results of close-coupling calculations are reported, in which several models of the interaction potential are investigated. Cross sections for rotational transitions involving the lowest ten levels are obtained in the first detailed application of the MEAN approximation. The results are subject to a strong cooperative effect involving exchange and polarization. Significant enhancement of cross sections at low energies and in the vicinity of a broad resonance at about 2.0 eV is noted. No structure indicative of a resonance or virtual state at very low enrgies is, however, obtained. Total differential, momentum transfer, and integrated cross sections are in satisfactory agreement with measured values.

704,460
PB83-182774 Not available NTIS
National Bureau of Standards, Washington, DC.
Two-Photon Ionization Processes of PO in a C2H2/Air Flame.
Final rept.
K. C. Smyth, and W. G. Mallard. 15 Aug 82, 9p
Pub. in Jnl. of Chemical Physics 77, n4 p1779-1787, 15 Aug 82.

Keywords: *Phosphorus oxides, Flames, Photoionization, Excitation, Ultraviolet spectroscopy, Ethylene, Molecular energy levels, Reprints, *Laser induced ionization, Autoionization, Laser spectroscopy, Franck-Condon principle.

Laser-induced two-photon ionization processes are observed for PO in a premixed C2H2/air flame in the 302-334 nm wavelength region. Several new bands are assigned on the basis of calculated spectra. The intensities of the observed ion signals vary dramatically for transitions which reach the same vibrational level of the resonant intermediate state. Further analysis indicates that absorption of the second photon makes a significant contribution to the overall intensity of the observed band heads. This result is attributed to the presence of autoionizing states which lie close to the ionization limit, despite some uncertainties encountered in calculating Franck-Condon factors for absorption of the first photon.

704,461
PB83-182782 Not available NTIS
National Bureau of Standards, Washington, DC.
B I Isoelectronic Sequence: Observation of 2s2p2-2p3 Intersystem Lines in Sc XVII and Improved Measurements for Cl XIII, K XV, Ca XVI, Sc XVII, and Ti XVIII.
Final rept.
J. Sugar, V. Kaufman, and D. Cooper. 1982, 3p
Pub. in Physica Scripta 26, n4 p293-295 1982.

Keywords: *Molecular energy levels, Calcium, Chlorine, Potassium, Scandium, Titanium, Reprints, *Isoelectronic sequence.

Spectra of Cl through Ti (excluding Ar) were produced with 1 GW 15 ns) pulses from a Nd-glass laser impinging on solid targets, and observed with a 10.7 m grazing incidence spectrograph. Transition arrays 2s sup m 2p sup n - 2s sup (m-1) 2p sup (n+1) in the B I isoelectronic sequence were recorded.

704,462
PB83-183525 Not available NTIS
National Bureau of Standards, Washington, DC.
Pseudo-Optical Absorption Spectra in HgCl2 and HgBr2 from 4 to 14 eV.
Final rept.
D. Spence, R. G. Wang, and M. A. Dillon. 1 Dec 82, 3p
Pub. in Applied Physical Letters 41, n11 p1021-1023, 1 Dec 82.

Keywords: *Absorption spectra, *Mercury halides, Optical spectra, Comparison, Energy dissipation, Reprints, *Mercury chloride, *Mercury bromide, *Electron impact spectra.

Using a high-resolution electron-impact energy-loss spectrometer we have measured the energy-loss spectra of electrons scattered near the forward direction from HgCl2 and HgBr2, for incident energies of 200 eV and energy-loss between 4 to 14 eV. Under these conditions the energy-loss spectra correspond closely to optical-absorption spectra.

704,463
PB83-202499 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Calculation of Compressibility Factor for Air Over the Ranges of Pressure, Temperature, and Relative Humidity of Interest in Flowmeter Calibration.
Final rept.
F. E. Jones. Mar 83, 9p NBSIR-83-2652

Keywords: *Compressibility, *Flowmeters, Pressure, Temperature, Humidity, Equations of state, Calibrating, Density(Mass/volume), Numerical solution.

A simple yet precise equation has been developed to enable calculation (using programmable calculators) of the compressibility factor, Z, for air from measurements of pressure, temperature, and humidity. The compressibility factor, a factor which accounts for the non-ideality of air in real-gas equations of state, is conventionally computed using virial coefficients. In the present paper, an equation is fitted to tabulated values of Z. The deviation between calculated and tabulated values is of the order of 0.01% or less; this does not imply, however, that the accuracy of calculated values is of this order.

704,464
PB83-203638 PC **A19**/MF **A01**
Notre Dame Univ., IN. Radiation Lab.
Biweekly List of Papers on Radiation Chemistry and Photochemistry. Annual Cumulation with Keyword and Author Indexes. Volume 15. 1982.
A. B. Ross. 1982, 434p
See also Volume 14, PB82-214487.Portions of this document are not fully legible.

Keywords: *Chemistry, *Bibliographies, Radiation chemistry, Photochemistry, Indexes(Documentation), Subject index terms, Reaction kinetics, Electron paramagnetic, Thermodynamics, Excitation, Optical spectra, Polymers, Solar energy, Biological processes.

This document is the annual edited cumulative list of references to the published literature on radiation chemistry, photochemistry, and related fields. References are drawn from 60 journals published throughout the world. The list is generated from the Biweekly List of Papers on Radiation Chemistry and Photochemistry and contains the literature references and an author and subject index. The publication represents one of the continuing data activities of the Radiation Chemistry Data Center (RCDC) at the University of Notre Dame. Volume 15 also contains a 54 page 'Thesaurus for Radiation Chemistry' which lists indexing terms which make up the group of keywords used in the RCDC computer-readable bibliographic data base.

704,465
PB83-208942 PC **A02**/MF **A01**
National Standard Reference Data System.
Selected Tables of Atomic Spectra: A. Atomic Energy Levels - Second Edition. B. Multiplet Table - O IV. Data Derived from the Analyses of Optical Spectra.
C. E. Moore. c1983, 23p NSRDS-NBS-3-SEC-10
Sponsored in part by Naval Research Lab., Washington, DC. E.O. Hulbert Center for Space Research. Library of Congress catalog card no. 64-60074. See also PB80-197460.

Keywords: *Atomic spectra, *Atomic energy levels, Tables(Data), Oxygen, Multiplet energies.

The present publication is the tenth section of a series being prepared in response to the need for a current revision of two sets of the author's tables containing data on atomic spectra as derived from analyses of optical spectra. As in the previous Sections, Part A contains the atomic energy levels and Part B the multiplet tables. Section 10 includes these data for O IV. The form of the presentation is described in detail in the text to Section I.

704,466
PB83-222471 PC **A99**/MF **E04**
National Bureau of Standards, Washington, DC.

Electrical Properties of Interfaces - Compilation of Data on the Electrical Double Layer on Mercury Electrodes.
J. Lyklema, and R. Parsons. May 83, 847p NBSIR-83-2714

Keywords: *Electrodes, *Mercury(Metal), *Electrical properties, *Electric double layer, Electrolytes, Tables(Data).

This paper contains data on the electrical double layer on a pure mercury electrode in contact with a solution which contains at least one electrolyte and, in some cases, a non-electrolyte as well. The quantities covered are the double-layer capacity and the interfacial tension. The search of the literature was carried through 1978. The tables have been made as complete as possible subject to certain criteria of reliability relating to the purity of substances used, the probability that equilibrium had been reached, the control of ambient conditions and geometrical and electrical conditions specific to the type of measurement. Estimates are given for the reliability of the data.

704,467
PB83-233890 Not available NTIS
National Bureau of Standards, Washington, DC.
Equivalence of Vinylidene and C2H2*: Calculated Rate Constant for Vinylidene Abstraction from Ch4.
Final rept.
A. H. Laufer, and Y. L. Yung. 1983, 3p
Sponsored in part by National Aeonautics and Space Administration, Washington, DC.
Pub. in Jnl. of Physical Chemistry 87, n1 p181-183 1983.

Keywords: *Reaction kinetics, Chemical bonds, Decomposition, Reprints, *Vinylidene radicals, *Vinyl radicals, Chemical reaction mechanisms.

The structure of the long-lived intermediate, C2H2*, has been shown to be equivalent to the vinylidene radical (H2C = C) in the case of the acetylene photosensitized decomposition of CH4. Rate constants for abstraction from CH4 by both vinylidene and vinyl radicals have been calculated using the semi-empirical bond energy-bond order (BEBO) and bond strength-bond length (BSBL) techniques.

704,468
PB83-233916 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Photon Stimulated Dissociation of Gas Phase and Chemisorbed CO.
Final rept.
D. E. Ramaker. Mar 83, 16p
Pub. in Jnl. of Chemical Physics 78, n6 pt1 p2998-3013, 15 Mar 83.

Keywords: *Carbon monoxide, *Chemisorption, *Surface chemistry, Excitation, Atomic energy levels, Comparison, Reprints, *Electron electron interactions, *Electron ion interactions, Electron stimulated desorption.

Theoretical interpretation of electron-electron and electron-ion coincidence data for CO in the gas phase indicates 1 hole, 2 hole, and 2 hole - 1 electron excited states contribute to molecular dissociation.

704,469
PB83-233932 Not available NTIS
National Bureau of Standards, Washington, DC.
Identification of Some OH Radical-Induced Products of Lysozyme.
Final rept.
M. Dizdaroglu, E. Gajewski, M. G. Simic, and H. C. Krutzsch. 1983, 9p
Pub. in International Jnl. Radiat. Biol. 43, n2 p185-193 1983.

Keywords: *Gamma irradiation, *Synthesis(Chemistry), *Radiation damage, *Proteins, Gas chromatography, Mass spectrometry, Reprints, *Hydroxyl radicals, *Lysozyme, Threonine, Butyric acid/amino, Tyrosines, Tyrosine/hydroxy.

OH radical reactions with lysozme in gamma-irradiated N2O saturated aqueous solutions caused formation of allo-threonine, alpha-amino-n-butyric acid, o- and m-tyrosines, and 2- and 3- hydroxytyrosines. These identified radiolytic products were characterized by capillary gas chromatography-mass spectrometry as their trimethylsilyl derivatives after HCl-hydrolysis of irradiated lysozyme. Their initial G-values were also determined using gas chromatography. The possible use of these radiolytic products as monitors of radiation-induced damage to proteins and the sites of attack are also discussed.

704,470
PB83-233957 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Fluorescence: A Versatile Probe of State-Selected Chemical Dynamics.
Final rept.
S. R. Leone. Feb 83, 8p
Pub. in Accounts of Chemical Research 16, n1 p88-95 Feb 83.

Keywords: *Infrared spectroscopy, *Fluorescence, *Energy transfer, Reprints, Laser spectroscopy, State of the art.

The state-of-the-art in infrared detection skills has clearly advanced in the last ten years. Improvements in fabrication of large area detectors and in amplifier electronics now make it possible to detect emissions that are 10-100 times weaker than before. Similarly the response time of these sensitive detection systems has been improved an order of magnitude or more. Coupling such detectors with other new tools, such as powerful lasers, has qualitatively changed the types of experiments that are possible. Impressive new experiments can be carried out on all kinds of phenomena which were previously accessible only by more classical techniques. In this account, examples will be given in which state-of-the-art infrared fluorescence is used to study a broad spectrum of problems in chemical dynamics.

704,471
PB83-234278 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Chemiluminescence from Vibrationally Excited NO+: Product Branching in the N(+)+O2 Ion-Molecule Reaction.
Final rept.
M. A. Smith, V. M. Bierbaum, and S. R. Leone. 28 Jan 83, 6p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC., and National Science Foundation, Washington, DC.
Pub. in Chemical Physics Letters 94, n4 p398-403, 28 Jan 83.

Keywords: *Nitrogen oxide(NO), *Ions, *Chemiluminescence, *Infrared spectroscopy, Molecular vibration, Reprints, *Ion molecule interactions, Flowing afterglow.

Vibrational chemiluminescence is detected from the reaction N(+1)(Sup 3P) + O2(X sup 3 sigma(-) sub g) in a flowing afterglow. The atom-transfer product, NO(+1)(X sup 1 sigma (+), v) displays a bimodal vibrational distribution spanning the range V = 1-14. Excited N(2D) is found to be the major charge transfer product by observation of its further reaction with O2 to produce NO(X sup 2 pi, v=1-12).

704,472
PB83-234286 Not available NTIS
National Bureau of Standards, Washington, DC.
Product Vibrational Analysis of Ion-Molecule Reactions by Laser-Induced Fluorescence in a Flowing Afterglow: O(-) + HF yields OH(v=0,1) + F(-).
Final rept.
C. E. Hamilton, M. A. Duncan, T. S. Zwier, J. C. Weisshaar, G. B. Ellison, V. M. Bierbaum, and S. R. Leone. 7 Jan 83, 6p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC., and National Science Foundation, Washington, DC.
Pub. in Chemical Physics Letters 94, n1 p4-9, 7 Jan 83.

Keywords: *Molecular vibration, Ionization, Excitation, Hydrogen fluoride, Fluorescence, Reprints, *Ion molecule interactions, *Laser induced fluorescence, *Hydroxyl radical, Flowing afterglow.

Laser-induced fluorescence is coupled to a flowing afterglow to obtain product state distributions of thermal energy ion-molecule reactions. For OH produced in the 0 (-1) + HF yields OH (v=0,1) + F(-1) reaction, v=0/v=1 is 1.0/0.22. Ion vibrational relaxation and obscurring Penning ionization reactions preclude accurate measurements for the N(+) + CO yields CO (+1) (v=0, 1,2) + N.

704,473
PB83-234294 Not available NTIS
National Bureau of Standards, Washington, DC.
Low Pressure Collisional Narrowing in CO(2).
Final rept.
R. Roy, D. S. Elliott, D. Meschede, F. M. Pipkin, and S. J. Smith. Dec 82, 5p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Chemical Physics Letter 93, n6 p603-607 Dec 82.

Keywords: *Carbon dioxide, *Raman spectroscopy, *Line width, Low pressure tests, Molecular energy levels, Reprints, Molecule molecule interactions.

The authors report the observation of collisional narrowing of the Q branch of the Raman spectrum for the (000) yields (100) transition in CO2 at very low pressures. The minimum line width is reached at about 250 torr. An estimate for the difference in rotational constants of the (100) state and the ground state is obtained. The narrowing of the line width and the changes in line shape are interpreted in terms of velocity changing collisions and rotationally inelastic collisions between the CO2 molecules.

704,474
PB83-234302 Not available NTIS
National Bureau of Standards, Washington, DC.
Assignment and Presentation of Uncertainties of the Numerical Results of Thermodynamic Measurements.
Final rept.
G. Olofsson, S. Angus, G. T. Armstrong, and A. N. Kornilov. 1981, 20p
Pub. in Jnl. of Chemical Thermodynamics 13, p603-622 1981.

Keywords: *Thermodynamic properties, Error analysis, Tables(Data), Reprints, Numerical solution.

In 1972 the IUPAC Commission on Thermodynamics and Thermochemistry published its 'Guide to procedures for the publication of thermodynamic data' (herein after referred to as the Guide), which sets out in detail the requirements to be met in the detailed description of experiments. In that document, the requirements for reporting the uncertainty of experimental results are given as follows: 'In addition to the presentation of the data themselves, estimates of the precision indices and probably accuracy of the data should be given by the authors. The various sources of uncertainty should be rigorously described with clear separation of measurement imprecisions, numerical analysis deviations, and possible systematic biases. The methods and assumptions for the statistical analyses should be indicated. Possible sources and magnitudes of systematic errors should be identified and enumerated.' The purpose of this report is to amplify and, where necessary, to modify this paragraph. It will be assumed that the reader is already familiar with the other recommendations of the Guide.

704,475
PB83-234401 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Conductivity of Oxygen in the Critical Region.
Final rept.
L. A. Weber. 1982, 9p
Pub. in International Jnl. of Thermophys. 3, n2 p117-135 1982.

Keywords: *Oxygen, *Thermal conductivity, *Critical point, Comparison, Rayleigh scattering, Reprints.

The thermal conductivity of oxygen has been measured in a broad region around the critical point by means of Rayleigh light scattering. Measurements were made on two isochores and on the saturation boundary. The results are compared with current methods of predicting the anomalous thermal conductivity in the critical region.

704,476
PB83-234468 Not available NTIS
National Bureau of Standards, Washington, DC.
Resonance Lines in the Pd I Isoelectronic Sequence: I VIII to Ho XXII.
Final rept.
J. Sugar, and V. Kaufman. 1982, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physica Scripta 26, p419-421 1982.

Keywords: *Molecular energy levels, *Palladium, *Resonant frequency, Eigenvectors, Reprints, *Isoelectronic sequences.

Identification of resonance lines of 4(dsup9) 4f and 4(dsup9)5p configurations of the Pd I isoelectronic sequence is extended from Nd XV through Ho XXII and for Xe IX. Spectra were obtained with a high voltage spark and photographed with a 10.7 m grazing incidence spectrograph. Calculations of the levels and eigenvectors confirm the identifications and the observed relative intensities of the lines.

704,477
PB83-234476 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectrum of Neutral Sulfur (S I) in the Vacuum Ultra-Violet.
Final rept.
V. Kaufman. 1982, 4p
Pub. in Physica Scripta 26, p439-442 1982.

Keywords: *Sulfur, *Ultraviolet spectroscopy, Molecular energy levels, Far ultraviolet radiation, Reprints.

Observations and measurements were made of 114 lines of SI between 1157 A and 2169 A in the first, second and third orders of the NBS 10.7-m normal incidence vacuum spectrograph. Energy levels and their uncertainties derived from these data are given.

704,478
PB83-234492 Not available NTIS
National Bureau of Standards, Washington, DC.
Fluorescence Polarization as a Probe of Molecular Autoionization.
Final rept.
E. D. Poliakoff, J. L. Dehmer, A. C. Parr, and G. E. Leroi. Nov 82, 3p
Sponsored in part by Department of Energy, Washington, DC., Department of Naval Research, and the National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 77, n10 p5343-5345, 15 Nov 82.

Keywords: *Fluorescence, *Polarization(Charge separation), *Carbon dioxide, Excitation, Reprints, *Autoionization.

The polarization of fluorescence from the CO2(+1) A 2 sup Pi sub U to CO2(+1) X 2sup Pi sub g state was used. The National Bureau of Standards SURF II storage ring was used to obtain monochromatic photons from 720A to 690A as an excitation source. The polarization of fluorescence shows pronounced variations in autoionization resonance regions.

704,479
PB83-234567 Not available NTIS
National Bureau of Standards, Washington, DC.
Vibrationally Resolved Photoelectron Angular Distributions for H2.
Final rept.
E. D. Poliakoff, J. L. Dehmer, P. M. Dehmer, and A. C. Parr. 25 Mar 83, 5p
Pub. in Chemical Physics Letters 96, n1 p52-56, 25 May 83.

Keywords: *Hydrogen, *Photoionization, *Molecular vibration, *Angular distribution, Reprints, Autoionization.

The photoelectron asymmetry parameter, beta, is reported for individual vibrational levels of H2(+2) (kappa sup 2 Sigma sup (+) sub g) formed by photoionization of H2 (kappa sup 1 sigma sup (+) sub g) at wavelengths of 736, 584, 461 and 304A. At 584A, beta exhibits a monotonic increase with vibrational quantum number (decreasing photoelectron kinetic energy) confirming the trend predicted by Itikawa.

704,480
PB83-234591 Not available NTIS
National Bureau of Standards, Washington, DC.
Rydberg States of 7Li2 by Pulsed Optical-Optical Double Resonance Spectroscopy: Molecular Constants of 7 Li2+.
Final rept.
R. A. Bernheim, L. P. Gold, and T. Tipton. 15 Mar 83, 12p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 78, n6 pt 11 p3635-3646, 15 Mar 83.

Keywords: *Lithium, Dissociation energy, Reprints, *Laser spectroscopy, *Rydberg series.

Three Rydberg series of electronic states of 7Li2 have been characterized by pulsed optical-optical double resonance spectroscopy.

704,481
PB83-234617 Not available NTIS
National Bureau of Standards, Washington, DC.
Self-Broadening of the Sodium Resonance Lines and Excitation Transfer between the 3P3/2 and 3P1/2 Levels.
Final rept.
J. Huennekens, and A. Gallagher. Apr 83, 14p
Grant NSF-PHY79-04928
Pub. in Physical Review A27, n4 p1851-1864 Apr 83.

Keywords: *Sodium, *Molecular energy levels, *Line width, Rayleigh scattering, Excitation, Energy transfer, Reprints.

Sodium vapor, in the density range 10 to the 13th power to 5 x 10 to the 14th power/cc, was excited by a cw dye laser, tuned 20-150 GHz from either the D1 or D2 resonance line. The results are compared to other experiments and to theory.

704,482
PB83-234625 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Capture into Excited States in Collisions of Highly Charged Ions with Atoms: A Theoretical and Experimental Challenge.
Final rept.
R. K. Janev. 1983, 24p
Sponsored in part by International Atomic Energy Agency, Vienna (Austria).
Pub. in Comments on Atomic and Molecular Physics 12, n5-6 p277-300 1983.

Keywords: Excitation, Energy transfer, Ions, Atoms, Reprints, *Atom ion interactions, *Electron capture, Electron charge.

The current status of the studies on creation of excited states by charge transfer collisions of multiply charged ions with atoms is discussed. Both theoretical and experimental problems involved in these studies are considered and suggestions are made for resolving some of them.

704,483
PB83-234641 Not available NTIS
National Bureau of Standards, Washington, DC.
Momentum-Transfer Dependence of Fano Line shape in Electron-Energy-Loss Spectra of Nickel.
Final rept.
T. Jach, and S. M. Girvin. Feb 83, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review B 27, n3 p1489-1492, 1 Feb 83.

Keywords: *Nickel, *Momentum transfer, Electron energy, Inelastic scattering, Metals, Atomic energy levels, Hartree-Fock approximation, Line width, Reprints, *Electron energy loss spectroscopy, Numerical solution, Fano factor.

The authors have calculated the dependence on momentum transfer of Fano lineshapes in inelastic electron scattering from nickel metal at the 3p excitation threshold. Using Hartree-Fock Roothaan wave functions for the 3p, 3d, and epsilon(f) continuum wave functions, they find a momentum transfer dependence of the lineshapes which should be observable by high energy electron energy loss spectroscopy. The lineshape dependence is sensitive to the screening model used in the nickel metal.

704,484
PB83-234807 Not available NTIS
National Bureau of Standards, Washington, DC.
Direct Frequency Measurements of Transitions at 520 THz (576 nm) in Iodine and 260 THz (1.15 micrometers) in Neon.
Final rept.
C. R. Pollock, D. A. Jennings, F. R. Petersen, J. S. Wells, R. E. Drullinger, E. C. Beaty, and K. M. Evenson. Mar 83, 3p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Optics Letters 8, n3 p133-135 Mar 83.

Keywords: *Iodine, *Neon, *Visible spectrum, Reprints.

The o hyperfine component of the 127 I2 17-1P(62) transition at 520 THz (567 x 10 to the -9th m power m) in iodine was measured with respect to the 88 THz laser via a 26 THz CO2 laser, a color center laser at 130 THz, and a He-Ne laser at 260 THz, all used as transfer oscillators. The measured I2 frequency was 520 206 808.547 MHz with a total uncertainty of 1.6 x 10 to the -10th power. The 1.15 micrometers (20)2Ne Lamb-dip stabilized laser was measured to be 260 103 249.26 MHz, with a total uncertainty of 3.1 x 10 to the -10th power.

704,485
PB83-235028 Not available NTIS
National Bureau of Standards, Washington, DC.
Chronoamperometry of Polymer-Modified Electrodes: Charge Transport by Diffusion and Migration.
Final rept.
W. T. Yap, R. A. Durst, E. A. Blubaugh, and D. D. Blubaugh. 1983, 7p
Pub. in Jnl. of Electroanalytical Chemistry 144, p69-75 1983.

Keywords: *Electrodes, *Polymers, Diffusion, Reprints, *Chronoamperometry, *Charge transport.

A theoretical analysis of charge-transport phenomena due to both diffusion and electrostatic migration in a polymer-modified electrode is presented for chronoamperometry. Concentration distributions and current-time curves were derived for the simple case of a constant electric field in the polymer film.

704,486
PB83-235069 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Dehydration Kinetics of Disaccharides.
Final rept.
M. D. Scheer. 1983, 9p
Pub. in International Jnl. of Chemical Kinetics 15, p141-149 1983.

Keywords: *Sucrose, *Cellobiose, *Dehydration, *Reaction kinetics, Disaccharides, Decomposition, High temperature tests, Reprints, Chemical reaction mechanisms.

The vacuum decomposition of sucrose and cellobiose has been observed in the 150-250 C temperature range. The predominant decomposition product of both sugars is H2O with less than 5% CO, CO2, CH2O, CH3CHO, CH3OH, and C2H5OH formed. The detailed rates and temperature dependences suggest that with the possible exception of C2H5OH, the minor products are formed in secondary reactions of the dehydration products. Further it is shown that the so-called 'melting with decomposition' of a sugar is in reality a high-temperature dissolution of the disaccharide in the eliminated water.

704,487
PB83-235077 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Band Strengths of Halocarbons F-11 and F-12 in the 8 - 16um Region.
Final rept.
R. H. Kagann, J. W. Elkins, and R. L. Sams. 20 Feb 83, 5p
Contract NASA-W15032
Pub. in Jnl. of Geophysical Research 88, nC2 p1427-1432, 20 Feb 83.

Keywords: *Infrared spectroscopy, *Band structure of solids, Chlorine organic compounds, Dichlorodifluoromethane, Reprints, *Fourier transform spectroscopy, *Freon 11, *Freon 12, Methane/chloro-trifluoro.

The infrared strengths of three vibrational band systems of halocarbon F-11 and four vibrational band systems of halocarbon F-12 in the 'atmospheric window' between 8 and 16 micrometers were measured using a Fourier transform spectrometer. These results were obtained at a maximum instrumental resolution of 0.06 cm. Our measurements of the total infrared band strengths for F-11 and F-12 would indicate approximately 17% and approximately 5% greater absorbance than those strengths used in recent greenhouse warming calculations by Ramanathan (1975), Wang et al., (1976) and Lacis et al. (1981) and consequently a corresponding increase in the possible atmospheric warming effect by these halocarbons.

704,488
PB83-235085 Not available NTIS
National Bureau of Standards, Washington, DC.

Measurement of the Contribution of Excitation-Autoionization to Electron-Impact Ionization of Ions: Ti3+, Zr3+, Hf3+, and Ta3+.
Final rept.
R. A. Falk, G. H. Dunn, D. C. Gregory, and D. H. Crandall. Feb 83, 9p
Contract DOE-EA-77-A-01-6010
Pub. in Physical Review A 27, n2 p762-770 Feb 83.

Keywords: *Transition metals, *Ions, Ionization, Excitation, Hafnium, Titanium, Zirconium, Tantalum, Reprints, *Electron ions interactions, *Autoionization, Threshold effects(Electron energy).

Measurements were made of the cross section for electron impact single ionization of the transition element ions, Ti (+3), Zr (+3), Hf (+3), and Ta (+3), for an electron energy range from threshold to 1000 eV. Comparisons with recent theoretical predictions show reasonable agreement between measured and predicted positions of the autoionization states; however the magnitudes of the theoretical cross sections are greater than the experimental values by a factor of approximately 2.5.

704,489
PB83-235093 Not available NTIS
National Bureau of Standards, Washington, DC.
Cross Sections for Energy Transfer in Collisions between Two Excited Sodium Atoms.
J. Huennekens, and A. Gallagher. Feb 83, 14p
Grant NSF-PHY79-04928
Pub. in Physical Review A 27, n2 p771-784 February 83.

Keywords: *Energy transfer, *Sodium, Excitation, Atomic energy levels, Cross sections, Reprints, *Atom atom interactions, *Sodium atoms.

The authors have measured cross sections, sigma(eta L), for the excitation transfer process Na(3P) + Na(3P) + Na(eta L), where eta L is the 4D or 5S level. To obtain these cross sections we have measured the spatial distribution of excited atoms resulting from radiation diffusion, as well as the excited atom density as a function of time. Additionally, we have accounted for (time dependent) radiation trapping of 3P and eta L level radiation and for the resulting anisotropies of these fluorescence emissions. Comparisons of our results with theory have been made and their relevance to other experiments is discussed.

704,490
PB83-235101 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron-Impact Ionization of Be+.
Final rept.
R. A. Falk, and G. H. Dunn. Feb 83, 8p
Contract DOE-EA-77-A-01-6010
Pub. in Physical Review A 27, n2 p754-761 Feb 83.

Keywords: *Beryllium, Ions, Atomic energy levels, Ionizations, Reprints, *Electron ion interactions, Autoionization.

The electron-impact ionization cross section for Be(+1) has been measured from threshold to 1600 eV with an absolute uncertainty of 8%. The cross section has a peak value of 46.5 x 10 to the -18th power sq cm at an energy of about 50 eV, and structure ascribed to the excitation autoionization of the 1s2s2p state at 118.5 eV is observed. Calculations using the semiempirical formula for Lotz for direct ionization and the semiempirical effective Gaunt-factor formula for excitation autoionization give summed cross-section values which agree well with the experiment over the entire energy range. Comparisons are also made with other calculations and cross sections in the literature.

704,491
PB83-235119 Not available NTIS
National Bureau of Standards, Washington, DC.
Local Hydrogen Vibrations in Nb in the Presence of Interstitial (N,O) and Substitutional (V) Impurities.
Final rept.
A. Magerl, J. J. Rush, J. M. Rowe, D. Richter, and H. Wipf. 15 Jan 83, 8p
Sponsored in part by North Atlantic Treaty Organization.
Pub. in Physical Review B 27, n2 p927-934, 15 Jan 83.

Keywords: *Hydrogen, *Niobium inorganic compounds, *Vibrational spectra, Impurities, Phase shift, Excitations, Reprints.

The authors have measured the hydrogen vibrations in NbV(0.008)H(0.005), NbN(0.004)H(0.003), and NbO(0.010) between 295 and 4 K.

704,492
PB83-235127 Not available NTIS
National Bureau of Standards, Washington, DC.
Reinvestigation of the Cl + ClONO2 Reaction by Flash Photolysis Resonance Fluorescence.
Final rept.
M. J. Kurylo, G. L. Knable, and J. L. Murphy. 18 Feb 83, 4p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Chemical Physics Letters 95, n1 p9-12, 18 Feb 83.

Keywords: *Reaction kinetics, *Fluorescence, Chemical reactions, Stratosphere, Reprints, *Chlorine atoms, *Chlorine nitrate, *Flash photolysis, Atmospheric chemistry.

The reaction of Cl atoms with chlorine nitrate has been reinvestigated by flash photolysis resonance fluorescence over the temperature range 220-296 K. The new results can be fit to the Arrhenius expression K(1) = 7.3 x 10 to the -12th power exp(165/T) cc/molecsec in good agreement with another recent study but significantly different from our earlier work. Reasons for these differences are suggested and their significance discussed.

704,493
PB83-235135 Not available NTIS
National Bureau of Standards, Washington, DC.
Rate Constant Measurements for the Reaction of Cl Atoms with Nitric Acid Over the Temperature Range 240-300 K.
Final rept.
M. J. Kurylo, J. L. Murphy, and G. L. Knable. 21 Jan 83, 4p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC. Prepared in cooperation with Chemical Manufactures Association, Washington, DC.
Pub. in Chemical Physics Letters 94, n3 p281-284, 21 Jan 83.

Keywords: *Reaction kinetics, *Nitric acid, Stratosphere, Reprints, *Chlorine atoms, Atmospheric chemistry.

Rate constants for the reaction between Cl atoms and HONO2 were measured at 243, 264, and 298 K by the flash photolysis resonance fluorescence technique. The data can be fit to the Arrhenius expression K1=5.1 x 10 to the -12th power exp (-1700/T) cc/molecule S) and indicate that the reaction is unimportant in stratospheric Cl atom removal. Sources of measurement error in this and earlier studies are discussed.

704,494
PB83-235143 Not available NTIS
National Bureau of Standards, Washington, DC.
Rotational Structure and Vibrational Predissociation in the HF Stretching Bands of the HF Dimer.
Final rept.
A. S. Pine, and W. J. Lafferty. 1 Mar 83, 9p
Pub. in Jnl. of Chemical Physics 78, n5 p2154-2162, 1 Mar 83.

Keywords: *Hydrogen fluoride, *Molecular rotation, Chemical bonds, Doppler effect, Low temperature tests, Low pressure tests, Reprints, *Laser spectroscopy.

The rotational structure in the HF stretching bands of the HF dimer has been recorded with nearly Doppler-limited resolution using a tunable difference-frequency laser spectrometer and a long-path cell held at low temperatures and pressures.

704,495
PB83-235168 Not available NTIS
National Bureau of Standards, Washington, DC.
Rovibrational Excitation within the Infinite Conical Well: Desorption of Diatomic Molecules.
Final rept.
J. W. Gadzuk, U. Landman, E. J. Kuster, C. L. Cleveland, and R. N. Barnett. 1983, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Electron Spectroscopy and Related Phenomena 30, p103-110 1983.

Keywords: *Molecular rotation, *Diatomic molecules, *Desorption, Adsorption, Reprints.

An analytic model for the hindered rotational states of a diatomic molecule adsorbed upright on a solid surface is discussed. Various model dynamics situations, within the sudden approximation, designed to simulate desorption are presented and rotational state distributions are calculated including both rotational and translational degrees of freedom. Criterion are established for observing rotationally cool desorbed molecules.

704,496
PB83-235184 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Intensity Effects in the IR Multiphoton Dissociation of CF2HCl and CF2CFCl.
Final rept.
J. C. Stephenson, and D. S. King. 15 Feb 83, 9p
Sponsored in part by Army Research Office, Research Triangle Park, NC. and Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Chemical Physics 78, n4 p1867-1875, 15 Feb 83.

Keywords: *Dissociation, Chlorine organic compounds, Fluorescence, Reprints, *Methane/chloro-difluoro, *Methene/chloro-trifluoro, *Laser induced fluorescence.

CO2 laser pulses of 2, 10, and 50 ns duration, for which the temporal profile was approximately rectangular, were used in the multiphoton dissociation of low pressure CF2HCl and CF2CFCl. Probing a region of well defined CO2 laser intensity, laser excited fluorescence determined the yield of CF2 formed in the v = 0 and in the high vibrationally excited v(2) = 5 (E(vib) = 3335/cm) levels as a function of fluence (F), and intensity (I) over a factor of 100 variation.

704,497
PB83-235424 Not available NTIS
National Bureau of Standards, Washington, DC.
State of the Critical State of Fluids.
Final rept.
J. M. H. L. Sengers. 1983, 16p
Pub. in Pure and Applied Chemistry 55, n3 p437-453 1983.

Keywords: *Fluids, *Critical point, Nucleation, Binary systems(Materials), Reprints, Wegner expansion.

A review is given of recent progress in the understanding of critical phenomena in fluids and fluid mixtures. The topics discussed are: critical exponent values; the Wegner expansion for corrections to scaling, and its application in pure fluids and binary liquid mixtures; weak critical anomalies in binary liquid mixtures; symmetric and asymmetric tricritical points; interfaces and nucleation.

704,498
PB83-235432 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Properties of Hydroxyapatite in Flouride Solution.
Final rept.
M. S. Tung. 1983, 3p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Colloids and Surfaces 6, p283-285 1983.

Keywords: *Surface properties, Adsorption, Solutions, *Hydroxylapatite, Apatite/fluoro.

The error in a published report is pointed out and a new mechanism is proposed for the fluoride effect on the surface charge of hydroxyapatite slurry.

704,499
PB83-235606 Not available NTIS
National Bureau of Standards, Washington, DC.
Observations of the Effect of Increasing Core Charge on Rydberg Spectra in the Xe Isoelectronic Sequence.
Final rept.
T. J. McIlrath, and T. B. Lucatorto. Nov 82, 8p
Pub. in Jnl. of Phys. Colloq. C2, n11 p255-263 Nov 82.

Keywords: *Xenon, Reprints, *Isoelectronic sequences, *Rydberg series, Barium ions, Autoionization.

The Rydberg spectra and autoionizing levels of atoms can show large variations along an isoelectronic sequence. These variations reflect the effect of core structure on high lying levels. The authors have ob-

tained the spectrum of BA(+2) in absorption and compare it with the isoelectronic Xe spectrum. The dramatic decrease in autoionization width with increasing core charge is explained through an analysis based on MQDT. The autoionizing widths are shown to be an especially sensitive indicator of the importance of correlations and term dependence along the isoelectronic sequence.

704,500
PB83-235622 Not available NTIS
National Bureau of Standards, Washington, DC.
Solvent Effects on Bonding Organo-Silane to Silica Surfaces.
Final rept.
T. M. Chen, and G. M. Brauer. Dec 82, 5p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. of Dental Research 61, n12 p1439-1443 Dec 82.

Keywords: *Silicon dioxide, *Infrared spectroscopy, *Solvents, Chemical bonds, Stability, Dental materials, Tensile strength, Reprints, *Silane/methacryl-oxypropyl-trimethoxy.

Interfacial bonding and stability of gamma-methacryloxypropyltrimethoxysilane with silica surfaces have been studied by means of infrared spectroscopy. The addition of n-propylamine enhances silanization of gamma-methacryloxypropyltrimethoxysilane to silica surfaces in normal aliphatic hydrocarbons, and cyclohexane yields a more water-resistant silica-silane bond, and improves the diametral tensile strength of the composite.

704,501
PB83-235796 Not available NTIS
National Bureau of Standards, Washington, DC.
Glaserite-Type Structure: Calcium Tripotassium Hydrogenbis (phosphate), CaK3H(PO4)2.
Final rept.
S. Takagi, M. Mathew, and W. E. Brown. 1983, 4p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL. Research Inst.
Pub. in Acta Cryst. C39, p166-169 1983.

Keywords: *Crystal structure, Chemical bonds, Phosphorus inorganic compounds, Inorganic phosphates, Reprints, *Diphosphoric acid/(calcium potassium-salt), Calcium potassium phosphates.

The structure consists of columns of cations, Ca and K(1), and columns of cations and anions, K(2) and PO4. The arrangement of these columns in a pseudo-hexagonal form is similar to that of glaserite, K3Na(SO4)2, e.g. alpha-Ca3 (PO4)2 (Mathew, Schroeder, in a symmetric hydrogen bond across a crystallographic center of inversion to form a dimeric (H(PO4)2) unit.

704,502
PB83-235846 Not available NTIS
National Bureau of Standards, Washington, DC.
Translational-Rotational Absorption Spectrum of Hydrogen.
Final Rept.
G. Bachet, E. R. Cohen, P. Dore, and G. Birnbaum. 1983, 5p
Pub. in Canadian Jnl. of Physics 61, n4 p591-603 1983.

Keywords: *Hydrogen, *Absorption spectra, Molecular rotation, Line width, Reprints.

The collision-induced translational-rotational spectrum of H2 has been accurately measured in the region from about 30 to 2000/cm at 195 and 297K. A very weak feature due to the hexadecapole-induced dipole, the U(o)(1) line, has been detected at 195 K in the region around 1622/cm. These spectra can be accurately represented by a simple, semi-empirical line shape. The effect of double transitions are considered and explicit expressions for these are given. Spectral integrals proportional to the zero and first moments are determined experimentally and compared with the theoretical moments computed on the basis of quadrupole induction for several potentials. The difference between the experimental and theoretical values, in the order of 20%, is attributed to anisotropic overlap induction, but the inferred magnitude of this component is strongly dependent on the assumed potential.

704,503
PB83-235895 Not available NTIS
National Bureau of Standards, Washington, DC.
Product Vibrational State Distributions in Thermal Energy Associative Detachment Reactions: F(-) + H, D yields HF(v), DF(v) + e(-).
Final rept.
M. A. Smith, and S. R. Leone. 1 Feb 83, 10p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 78, n3 p1325-1334, 1 Feb 83.

Keywords: *Hydrogen fluoride, *Molecular vibration, *Entropy, Deuterium compounds, Infrared spectroscopy, Angular momentum, Chemiluminescence, Reprints, *Ion molecule interactions.

Nascent product vibrational state distributions are obtained by the method of spectrally resolved infrared chemiluminescence for the associative detachment reactions: F(-1) + H yields HF(nu < or = 5) + e(-) delta H = -238.3 KJ/mol and F(-1) + D yields DF (nu < or =7) + e(-), delta H = -245.3 KJ/mol. Simple kinematic effects based on angular momentum constraints are not able to explain the broader distribution observed for DF as compared to HF. Several possibilities for this difference are discussed. In an argon buffer, which is much less effective than helium for rotational relaxation, the DF emission exhibits highly nonthermal rotational excitation.

704,504
PB83-235903 Not available NTIS
National Bureau of Standards, Washington, DC.
Microwave Spectrum, Torsional Barrier, and Structure of BH(3)NH(3).
Final rept.
L. R. Thorne, R. D. Suenram, and F. J. Lovas. 1 Jan 83, 5p
Pub. in Jnl. of Chemical Physics 78, n1 p167-171, 1 Jan 83.

Keywords: *Microwave spectra, *Deuterium compounds, *Boranes, Dipole moments, Molecular structure, Molecular rotation, Torsion, Reprints, *Borane/ammonia, Ammonia/borane.

The microwave spectra of nine isotopic species of borane monoammoniate (11)BH3NH3, (10)BH3NH3, (11)BH3ND3, (10)BH3ND3, (11)BD3NH3, (11)BH3(15)NH3, (10)BH3, (11)BD2HNH3, (11)BH3ND2H) have been observed. The rotational constants, centrifugal distortion constants, dipole moment, torsional barrier and molecular geometry of borane monoammoniate were determined from these spectra.

704,505
PB83-236000 Not available NTIS
National Bureau of Standards, Washington, DC.
Dielectronic Recombination: A Crossed-Beams Observation and Measurement of Cross Section.
Final rept.
D. S. Belic, G. H. Dunn, T. J. Morgan, D. W. Mueller, and C. Timmer. 31 Jan 83, 4p
Contract DOE-EA-77-A-01-6010
Pub. in Physical Review Letters 50, n5 p339-342, 31 Jan 83.

Keywords: *Cross sections, Reprints, *Magnesium ions, *Dielectronic recombination.

Dielectronic recombination has been directly observed during crossed beams of electrons and Mg(+1) ions. Measurements were made of delayed coincidences between the stabilizing photon at 280 nm and the resultant neutral atom, and cross sections were determined. Theoretical cross sections are an order of magnitude smaller than those measured. It is believed these are the first ever cross section measurements for this important phenomenon.

704,506
PB83-236026 Not available NTIS
National Bureau of Standards, Washington, DC.
New Struvite-Type Compound, Magnesium Sodium Phosphate Heptahydrate.
Final rept.
M. Mathew, P. Kingsbury, S. Takagi, and W. E. Brown. 1982, 5p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD.
Pub. in Acta Crystallographica B38, p40-44 1982.

Keywords: *Crystal structure, *Hydrates, X ray diffraction, Reprints, *Magnesium sodium phosphates.

The crystal structure of MgNaPO4. 7H2O, a new struvite analog, has been determined by single-crystal X-ray diffraction study.

704,507
PB83-236042 Not available NTIS
National Bureau of Standards, Washington, DC.
Thickness of the Liquid-Vapor Wetting Layer.
Final rept.
O. Kwon, D. Beaglehole, W. W. Webb, and B. Widom. J. W. Schmidt, J. W. Cahn, M. R. Moldover, and B. Stephenson. Jan 82, 4p
Sponsored in part by Cornell Univ., Ithaca, NY. Materials Science Center., and National Aeronautics and Space Administration, Washington, DC.
Pub. in Physical Review Letters 48, n3 p185-188, 18 Jan 82.

Keywords: *Binary systems(Materials), *Liquid phases, *Boundary layer, Polarimetry, Reprints.

In certain binary solutions the lower of the two liquid phases forms a layer which intrudes between the upper liquid phase and the vapor. The intruding layer's thickness (measured by ellipsometry) was between 70 and 400 A.

704,508
PB83-236059 Not available NTIS
National Bureau of Standards, Washington, DC.
Phase Equilibria in Polydisperse Fluids.
Final rept.
J. A. Gualtieri, J. M. Kincaid, and G. Morrison. Jul 82, 16p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 77, n1 p521-536 1 Jul 82.

Keywords: *Chemical equilibrium, *Liquid phases, Thermodynamics, Temperature, Density(Mass/volume), Critical point, Surfaces, Reprints, Numerical solution.

The authors present a new approach for solving phase equilibria problems in multicomponent systems together with several applications. A mathematical framework is developed that provides a method for generalizing the thermodynamics of a finite-component system to that of a system with an infinite number of components - a polydisperse system. They illustrate the utility of our approach by solving, for a polydisperse generalization of the van der Waals model, three phase-equilibria problems: (1) the fractionation of a polydisperse impurity dissolved in a solvent; (2) the shift of the critical temperature and density due to the presence of a polydisperse impurity; (3) the calculation of the cloud-point surface and critical point of a completely polydisperse system.

704,509
PB83-236216 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Ionization Rate Coefficients for Highly Ionized Iron and Scandium.
Final rept.
S. M. Younger. 1983, 6p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 29, n1 p61-66 1983.

Keywords: *Iron, *Scandium, *Scattering cross sections, *Reaction kinetics, Atomic energy levels, Quantum theory, Reprints.

Cross sections and rate coefficients for the electron ionization of Fe(IX)-(XV) and Sc(IV)-(X) have been computed in a distorted wave Born exchange approximation. The scaled cross section for ejection of a 3p electron was found to be roughly linear in the number of 3p electrons in the ion. Analytic fits to the distorted wave cross sections and rate coefficients are included.

704,510
PB83-236224 Not available NTIS
National Bureau of Standards, Washington, DC.
Adsorption of Water on Clean and Oxygen-Dosed Ru(001).
Final rept.
D. L. Doering, and T. E. Madey. 1982, 33p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Surface Science 123, p305-337 1982.

Keywords: *Water, *Adsorption, *Surface chemistry, Ruthenium, Reprints, Thermal desorption, Auger electron spectroscopy, LEED(Low Energy Electron Diffraction), Electron stimulated desorption ion angular distributions.

Water adsorption on clean and oxygen-dosed Ru(001) has been examined using thermal desorption spectroscopy (TDS), AES, LEED, and electron stimulated desorption ion angular distributions (ESDIAD).

704,511
PB83-236273 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic-Dipole Transitions Observed in Highly Ionized GA, Ge, As and Kr.
Final rept.
J. R. Roberts, V. Kaufman, J. Sugar, T. L. Pittman, and W. L. Rowan. Mar 83, 3p
Pub. in Physical Review A 27, n3 p1721-1723 Mar 83.

Keywords: *Magnetic dipoles, *Gallium, *Germanium, *Arsenic, *Krypton, Plasmas(Physics), Atomic energy levels, Reprints, Isoelectronic sequence.

The Texas Experimental Tokamak (TEXT) was used to observe magnetic-dipole radiation arising from transitions within the 3 doubler s ground-state configurations of highly stripped ions heavier than Ni. This device generates a plasma of 3 x 10 to the 13th power/cc electron density and about 1.5-keV temperature, ideally suited for ionization of these atoms to the n = 3 shell. Wavelength and transition-rate predictions were made with scaled Hartree-Fock radial energy integrals.

704,512
PB83-236364 Not available NTIS
National Bureau of Standards, Washington, DC.
Atomic Ion Formation and Measurement with Resonance Ionization Mass Spectrometry.
Final rept.
J. D. Fassett, J. C. Travis, L. J. Moore, and F. E. Lytle. Apr 83, 6p
Pub. in Analytical Chemistry 55, n4 p765-770 Apr 83.

Keywords: Mass spectroscopy, Reprints, *Molybdenum ions, *Rhenium ions, *Vanadium ions, *Resonance mass spectroscopy, Laser spectroscopy.

Resonance ionization mass spectrometry has been used to study the formation of the atomic ions of molybdenum, rhenium, and vanadium. Wavelength dependent ion formation from a thermally produced atom reservoir was demonstrated for these elements by scanning a Nd/YAG-pumped tunable dye laser across specific resonant electronic transitions and recording the mass-selected ion intensities in a single magnetic sector mass spectrometer. Limitations on potential analytical sensitivity and selectivity appear to result from two-photon backgrounds of atomic and molecular ions and from the appearance of non-resonant spectral features.

704,513
PB83-236398 Not available NTIS
National Bureau of Standards, Washington, DC.
Nitric Oxide Reduction.
Final rept.
W. F. Egelhoff. 1982, 30p
Pub. in Chemical Physics of Solid Surfaces and Heterogeneous Catalysis (Chapter 9), 4, Fundamental Studies of Heterogeneous Catalysis, p397-426 1982.

Keywords: *Nitrogen oxide(NO), *Reduction(Chemistry), *Catalysts, Chemical reactions, Surface chemistry, Dissociation, Reprints.

This article provides a review of the recent literature on the subject of nitric oxide reduction by catalytic reactions. It covers both the most notable research on nitric oxide reduction by supported catalysts and the research on nitric oxide interactions with single crystal surfaces. The research on supported catalysts has made it clear that nitric oxide reduction is a complex set of interwoven chemical reactions which are poorly understood. Among the major outstanding problems are the necessity of using rare, expensive elements such as rhodium, the lack of any nitric oxide reduction catalysts which can operate in excess oxygen, and the commonly observed production of ammonia by the catalysts actually in use.

704,514
PB83-236430 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface and Bulk Analysis of a Deactivated Raney Nickel Methanation Catalyst.
Final rept.
R. D. Kelley, G. A. Candela, T. E. Madey, D. E. Newbury, and R. R. Schehl. 1983, 14p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Catalysis 80, p235-248 1983.

Keywords: *Catalysts, *Methanation, *Surface chemistry, Chemical properties, Pilot plants, Performance evaluation, Reprints, *Raney nickel catalysts.

In a joint PETC-NBS experiment, a Raney Nickel methanation catalyst in a hot gas recycle (HGR) bench scale reactor has been examined with a wide range of modern analytical techniques sensitive to both surface and bulk chemical properties of the catalyst. The reactor was specially designed to allow both the sampling at various positions along the catalyst bed and the introduction of the samples into the various analytical instruments under inert atmospheric conditions (i.e., without exposure to oxygen, water, etc.). The purpose of this work was to explore the reasons for the premature failure of the catalyst in pilot plant lifetime tests.

704,515
PB83-236448 Not available NTIS
National Bureau of Standards, Washington, DC.
Lifetime Ratios for Ar I 4p Levels.
Final rept.
K. Musiol, D. W. Jones, and W. L. Wiese. 1983, 7p
Pub. in Jnl. of Quantitive Spectroscopy and Radiative Transfer 27, n4 p321-327, 1983.

Keywords: *Argon, *Atomic energy levels, Transition probabilities, Reprints, *Lifetimes(Energy levels).

Relative transition probabilities of 13 transitions between the 3p (sup5) 4s and 3p (sup5) 4p configurations in Ar I have been measured in emission with a wall-stabilized arc. These data have been combined to yield relative lifetimes which are compared with recent direct lifetime measurements. An important consideration in our experiment was to minimize effects of radiation imprisonment since this effect may have played an important role in lifetime measurements by other methods. The results agree well with most previously published lifetime data and emission measurements.

704,516
PB83-236471 Not available NTIS
National Bureau of Standards, Washington, DC.
Excitation of the O2 (a(sup 1) delta(sub g)) State by Low Energy Electrons in O2-N2 Mixtures.
Final rept.
C. Yamabe, and A. V. Phelps. Mar 83, 6p
Sponsored in part by Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH.
Pub. in Jnl. of Chemical Physics 78, n6 pt1 p2984-2989, 15 Mar 83.

Keywords: *Oxygen, *Molecular energy levels, *Infrared spectroscopy, Nitrogen, Argon, Mixtures, Excitation, Metastable state, Reprints, *Low energy electrons.

Coefficients for the excitation of the a(sup 1) delta(sub g) state of O2 by low energy electrons in mixtures of O2-N2-Ar and O2-N2 and in pure O2 have been determined using a drift tube technique.

704,517
PB83-236489 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Free-Free Emission from Low Energy Electron Collisions with Ar.
Final rept.
C. Yamabe, S. Buckman, and A. V. Phelps. Mar 83, 8p
Sponsored in part by Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH.
Pub. in Physical Review A 27, n3 1345-1352 Mar 83.

Keywords: Excitation, Argon, Visible spectrum, Atoms, Infrared spectroscopy, Momentum transfer, Reprints, *Atom electron interactions, *Low energy electrons, *Argon atoms.

The production of free-free radiation in collisions of low energy electrons with Ar atoms has been measured using the drift tube technique. The excitation coefficients were obtained from measurements of the absolute intensity of continuum radiation at wavelengths of 500, 650 and 1300 micrometer. The experimental excitation coefficients are in good agreement with calculations using theoretical free-free emission cross sections and electron energy distributions and serve to demonstrate the usefulness of simple formulas relating the free-free emission cross section to measured momentum transfer cross sections.

704,518
PB83-236604 Not available NTIS
National Bureau of Standards, Washington, DC.
Dielectronic Recombination Rate Coefficients for Highly Ionized Helium Like Ions.
Final rept.
S. M. Younger. 1983, 7p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 2, n1 p67-73 1983.

Keywords: *Reaction kinetics, Helium, Ionization, Aluminum, Argon, Reprints, *Helium ions, *Isoelectronic sequence, *Dielectronic recombination.

Dielectronic recombination rate coefficients have been calculated in a distorted wave approximation for several highly ionized helium like ions. Special attention is given the role of intercombination stabilizing transitions. The results are in reasonable agreement with the simple formula of Burgess.

704,519
PB83-236612 Not available NTIS
National Bureau of Standards, Washington, DC.
Triplet-to-Singlet Cyclopropylidene-Allene Rearrangement. A Molecular Example of Spin Angular Momentum Coupling in Orthogonal pi Systems.
Final rept.
Y. N. Chiu. 1982, 6p
Pub. in Jnl. of the American Chemical Society 104, n25 p6937-6942 1982.

Keywords: *Spin orbit interactions, *Allene, *Angular momentum, Feasibility, Reprints, *Cyclopropylidene.

Valence-bond and molecular-orbital theories are used to support each other in showing the feasibility of triplet-to-singlet cyclopropylidene-allene rearrangement. It is shown that the symmetry of the orbitals involved and the symmetry of the spin-orbit interaction operators demand an orbitally rotated state corresponding to an orthogonal allene, so as to have a nonvanishing spin-orbit matrix element.

704,520
PB83-236620 Not available NTIS
National Bureau of Standards, Washington, DC.
Correlation Corrections to Energy Levels of Fe XXI.
Final rept.
A. W. Weiss. 1982, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 15, p4331-4338 1982.

Keywords: *Iron, *Atomic energy levels, *Correlation, Pauli exclusion principle, Dirac equation, Excitation, Reprints.

L-shell correlation energies are computed for the nonrelativistic states of 2 doublet s 2 doublet p, 2s 2 triplet p and 2p(sup 4) of Fe (+20). These results are combined with Pauli approximation intermediate coupling calculations to derive residual correlation corrections to relativistic multiconfiguration Dirac-Fock calculations. The excitation energies are significantly improved, and it is concluded that such hybrid schemes may be considered reliable to within 2000 cm, at least for ions at this stage of ionization.

704,521
PB83-236679 Not available NTIS
National Bureau of Standards, Washington, DC.
Preparation and Characterization of Block Copolymers of Ordinary and Deuterated Styrenes.
Final rept.
Y. Matsushita, H. Furuhashi, H. Choshi, I. Noda, M. Nagasawa, T. Fujimoto, and C. C. Han. 1982, 5p
Sponsored in part by Ministry of Education, Science and Culture, Tokyo (Japan).
Pub. in Polymer Jnl. 14, n6 p489-493 1982.

Keywords: *Polymerization, *Deuterium compounds, *Styrenes, *Neutron scattering, Molecular weight, Reprints, *Small angle scattering, Block copolymers.

Polymers containing deuterated segments, such as the block copolymers of ordinary and deuterated styrenes, are in demand for use in small angle neutron scattering techniques in polymer science. The samples should have narrow distributions with respect to both molecular weight and composition. However, the deuterated polymer samples used so far in neutron scattering measurements appear to have distributions broader than ordinary hydrogen polymer samples. In this work, an attempt was made to obtain polystyrenes containing a styrene-d8 sequence as a block by the anionic polymerization technique, but the preparation of di-block and tri-block copolymers of styrene and styrene-d8 was found to be much more difficult than that of ordinary block copolymers. The reason for this stemmed from the particular kind of impurities contained in commercially available styrene-d8. It seems worth-while to report in detail our method of preparation, since no deuterated styrene block copolymers of sufficiently narrow molecular weight distribution has yet been reported in the literature.

704,522
PB83-236687 Not available NTIS
National Bureau of Standards, Washington, DC.
Cooperative and Self-Diffusion of Polymers in Semidilute Solutions by Dynamic Light Scattering.
Final rept.
E. J. Amis, and C. C. Han. Sep 82, 4p
Pub. in Polymer 23, p1403-1406 Sep 82.

Keywords: *Polymers, *Diffusion coefficient, *Solutions, Dynamic tests, Light scattering, Polystyrene, Reprints, Furan/tetrahydro.

The quasielastic light scattering from semidilute solutions of polystyrene in tetrahydrofuran has been measured and the authors observe two distinct exponential decays separated by several orders of magnitude.

704,523
PB83-237115 Not available NTIS
National Bureau of Standards, Washington, DC.
Laboratory Measurement of the 4(04)(-)3(13) 70 GHz Transition of Ground State Methylene (CH(2)).
Final rept.
F. J. Lovas, R. D. Suenram, and K. M. Evenson. 15 Apr 83, 3p
Pub. in Astrophysical Jnl. 267, pLI31-LI33, 15 Apr 83.

Keywords: *Methylene, *Molecular rotation, *Microwave spectra, Hyperfine structure, Electron spin, Reprints.

Measurement of the NKK = 4(sup 04)(-) 3(sup(13) rotational transition of X sup 3 B sub 1 CH2 is reported. The rotational transition is split into three fine structure components due to electron spin and spin-rotation interactions. These were observed at 68.37 GHz, 59.01 GHz and 70.68 GHz, within 20 MHz of the values predicted from a prior analysis of the far-infrared rotational spectrum. Also, the triplet hyperfine structure due to the proton nuclear spin was well resolved.

704,524
PB83-237123 Not available NTIS
National Bureau of Standards, Washington, DC.
Threshold Studies of Multivacancy Process in the K(beta) Region of Argon.
Final rept.
R. D. Deslattes, R. E. LaVilla, P. L. Cowan, and A. Henins. Feb 83, 11p
Pub. in Physical Review A 27, n2 p923-933 Feb 83.

Keywords: *Argon, *X ray spectra, Ionization, Synchrotron radiation, Fluorescence, Reprints, *Threshold effects(Electron energy).

Threshold region measurements are reported for the production of multivacancy configurations of atomic argon by monochromatic X-ray photons in the region of the Is ionization threshold. The experiment used monochromatized synchrotron radiation produced in the seven-pole wiggler at the Stanford Synchrotron Radiation Laboratory with 3.2 GeV electrons at circulating currents of 20-30 mA. This multiplet model permitted extraction of partial cross-sections for the production of KMI and KMII,III configurations. This report also contains new data on details of absorption fine structure in the region of principal double-vacancy thresholds as well as some preliminary results on scattering.

704,525
PB83-238196 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Laser-Cooled and Trapped Atoms.
Final rept.
W. D. Phillips. Jun 83, 176p NBS-SP-653
Proceedings of the Workshop on Spectroscopic Applications of Slow Atomic Beams Held at the National Bureau of Standards, Gaithersburg, MD. on April 14-15, 1983. Library of Congress catalog no. 83-600451. Sponsored in part by Office of Naval Research, Arlington, VA.

Keywords: *Meetings, *Atomic beams, *Spectroscopy, Frequency standards, Gases, Electric fields, Magnetic fields, Atomic clocks, Atomic spectroscopy, *Laser cooling, *Atom trapping, *Trapping(Charged particles), Laser applications.

The proceedings of the Workshop on Spectroscopic Applications of Slow Atomic Beams contain papers on laser cooling of atomic beams, gases, and trapped particles and papers on trapping of neutral atoms in laser, electric, and magnetic fields. These and other papers discuss possible applications of cooled atoms to spectroscopy and to time and frequency standards. The present status and directions of research in time and frequency standards is also discussed.

704,526
PB83-244715 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Transport of Acetic Acid in Polyethylene.
J. C. Phillips. Jul 83, 25p NBSIR-83-2716

Keywords: *Ethylene, *Transport properties, *Acetic acid, Sorption, Desorption, Density(Mass/volume), Diffusion, Solubility, Permeability.

This report describes the mass loss and sorption/desorption of Acetic Acid (HAc) in polyethylene of different densities at various temperatures. Mass loss for a mixture of HAc and H2O of three concentrations were also done at the highest temperature used.

704,527
PB83-249789 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Thermodynamic Surface for Water: The Formulation and Computer Programs.
L. Haar, J. S. Gallagher, and G. S. Kell. Jun 83, 39p NBSIR-81-2253
Prepared in cooperation with National Research Council of Canada, Ottawa (Ontario).

Keywords: *Thermodynamic properties, *Water, *Surfaces, Equations of state, Computer programs, Computer programming, Vapor phase, Liquid phase, Enthalpy, Entropy, Specific heat, Sound, Pressure, Temperature, Fortran, Critical point, Thermal expansion, Virial coefficients.

A FORTRAN 77 program is given with which thermodynamic properties for liquid and gaseous states for water can be calculated for the temperature and pressure range, 250 < or = T(K) < or = 4000 and O < or = P < or = Pmax, where Pmax is the lesser of the pressure of melting ice or 4 G Pa (40,000 bar). The program yields values for enthalpy, entropy, heat capacity, speed of sound, Joule-Thomson Coef., second virial coef., isothermal compressibility coef., coef. of thermal expansion, and PoT relations that are everywhere in accord with accurate data for water. Included is a brief outline of the derivation of the equations.

704,528
PB83-600003 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamic Properties of Steam in the Critical Region.
J. M. Levelt Sengers, B. Kamgar-Parsi, F. W. Balfour, and J. V. Sengers. c1983, 28p
Included in Jnl. of Physical and Chemical Rreference Data, v12, n1 p1-28 1983.

Keywords: *Critical parameters, *Critical region, Energy, Equation of state, Latent heat, Scaling laws, Specific heat, Speed of sound, Steam, Thermodynamic function, Theromodynamic tables, Vapor pressure, Water.

An analysis is presented of the experimental data on thermodynamic properties in the critical region of steam. The model used is that of revised and extended scaling, as given by the modern theory of critical phenomena. All thermodynamic properties are given in closed (parametric) form. The model has, in addition to three universal constants that are given by theory, sixteen adjustable parameters that were obtained by least-squares fit to PVT and speed-of-sound data. It is valid in the range 200-420 kg/m3 in density and 644-693 K in temperature. It accurately represents the experimental data for equation of state, vapor pressure, latent heat, specific heats Cp and C (nu) and speed of sound. Our analysis permit new estimates of the critical parameters of steam, and has led to a number of conclusions regarding the mutual consistency of the experimental data. Tabulated values of the thermodynamic properties of steam are appended to the paper.

704,529
PB83-600007 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Annotated Compilation and Appraisal of Electron Swarm Data in Electronegative Gases.
J. W. Gallagher, E. C. Beaty, J. Dutton, and L. C. Pitchford. c1983, 44p
Included in Jnl. of Physical and Chemical Reference Data, v12, n1 p109-152 1983.

Keywords: *Air, Carbon dioxide, Electron diffusion, Electron drift velocity, Electronegative gases, Electron swarm, Coefficients, Electron transport, Halogenated hydrocarbons, Nitrogen oxides, Nitrogen trifluoride, Oxygen, Sulphur hexafluoride, Water.

Availabale data on the electron transport properties and electron swarm coefficients are discussed for the following electronegative gases, SF6, CF4, C2F6, C3F8, C4F10, CCl2F2, O2, air, H2O, CO2, F2, NF3, Cl2, Br2, I2, N2O, NO, HCl, NH3. Graphical presentations comparing measured and calculated data are given for the electron drift velocity, the ratio of diffusion to mobility, the electron attachment and ionization coefficients, and the electron growth constant as functions of E/N, the reduced field strength, for each gas. Graphs of the detachment and excitation coefficients are presented where these data are available. Data originally reported in terms of rate coefficients as functions of mean electron energy are graphically presented in that form. Recommendations concerning reliability are made.

704,530
PB83-600009 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Solubility of Oxygen and Ozone in Liquids.
R. Battino, T. R. Rettich, and T. Tominaga. c1983, 16p
Included in Jnl. of Physical and Chemical Reference Data, v12, n2 p163-178 1983.

Keywords: *Aqueous solutions, Biological fluids, Gas solubility, Hydrocarbons, Mixed solvents, Organic solvents, Oxygen, Ozone, Seawater, Water.

This review covers the solubility of oxygen and ozone in liquids as a function of temperature and pressure. Solubility data for individual systems were critically evaluated and recommended or tentative values presented in many cases. The trend of solubilities in homologous series or related solvents is discussed. Liquids include water; seawater; aqueous salt solutions; mixed solvents; hydrocarbons; organic compounds containing oxygen, halogen, sulfur, nitrogen, or silicon; olive oil; and human blood. For ozone, only its solubility in water is presented.

704,531
PB83-600013 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation of Binary PTxy Vapor-Liquid Equilibrium Data for C6 Hydrocarbons. Benzene+Hexane.
B. D. Smith, O. Muthu, and A. Dewan. c1983, 7p
Included in Jnl. of Physical and Chemical Reference Data, v12, n2 p381-387 1983.

Keywords: *Activity coefficients, Benzene, Excess Gibbs function, Hexane, Vapor-liquid equilibrium.

The binary PTxy vapor-liquid equillibrium data for the benzene+hexane system are evaluated. The needs for new experimental data are defined.

704,532
PB83-600014 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Evaluation of Binary Excess Enthalpy Data for C6 Hydrocarbons. Benzene+Hexane.
B. D. Smith, O. Muthu, and A. Dewan. c1983, 5p
Included in Jnl. of Physical and Chemical Reference Data, v12, n2 p 389-393 1983.

Keywords: *Benzene, Excess enthalpy, Heat of mixing, Hexane.

The excess enthalpy data for the benzene+hexane system are eveluated. The needs for new experimental data are defined.

704,533
PB83-600015 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation of Binary Excess Volume Data for C6 Hydrocarbons. Benzene+Hexane.
B. D.Smith, O. Muthu, and A. Dewan. c1983, 7p
Included in Jnl. of Physical and Chemical Reference Data, v12, n2 p395-401 1983.

Keywords: *Benzene, Excess volume, Hexane, Volume change of mixing.

The excess volume data for the benzene+hexane system are evaluated. The needs for new experimental data are defined.

704,534
PB83-600017 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Atlas of the High-Temperature Water Vapor Spectrum in the 3000 to 4000 cm -1.
A. S. Pine, M. J. Coulombe, C. Camy-Peyret, and J. M. Flaud. c1983, 53p
Included in Jnl. of Physical and Chemical Reference Data, v12, n3 p413-465 1983.

Keywords: *Difference-frequency laser, Dopppler-limited resolution, High temperatures, Infrared spectrum, OH stretching fundamentals, Water vapor.

An atlas of the high-temperature (1200 K) absorption spectrum of water vapor in the 3000 to 4000 cm to the minus 1st power region is presented. The infrared spectrum was recorded at Doppler-limited resolution using a tunable difference-frequency laser spectrometer. The spectral region scanned encompasses the strong OH stretching fundamentals, nu1 and nu3, and the bending overtone, 2nu2, as well as associated hot bands. Almost all the lines have been assigned using a model Hamiltonian which yields very satisfactory agreement between calculated and observed line positions for J up to 27 or Ka up to 14. The calculated eigenvectors applied to the transition moment operator predict the measured line intensities quite closely. This work should serve as a reference for analyzing spectra from hih-temperature sources such as combustion exhausts and cool stars.

704,535
PB83-600019 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamic Properties of D2O in the Critical Region.
B. Kamgar-Parsi, J. M. H. Levelt Sengers, and J. V. Sengers. c1983, 17p
Included in Jnl. of Physical and Chemical Reference Data, v12, n3 p513-529 1983.

Keywords: *Critically evaluated data, Critical parameters, Critical region, Energy, Enthalpy entropy, Equation state, Heavy steam, Heavy water, Sound velocity, Specific heat, Thermodynamic properties.

An analysis is presented of the thermodynamic properties of D2O in the critical region. It is shown that the data can be represented by the same revised and extended scaled fundamental equation formulated earlier for the thermodynamic properties of H20 in critical region. The equation is valid in the range 220-465 kg/m3 in density and 638-683 K in temperature. Tabulated values of the thermodynamic properties of D20 in the critical region are presented. A comparison with a comprehensive analytic fundamental equation, recently formulated by Hill and co-workers, is included in the paper.

704,536
PB83-600020 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chemical Kinetic Data Sheets for High-Temperature Chemical Reactions.
N. Cohen, and K. R. Westberg. c1983, 60p
Included in Jnl. of Physical and Chemical Reference Data, v12, n3 p531-590 1983.

Keywords: *Chemical kinetic data, Data compilation and evaluation, Rate coefficient, Rate constant, Reaction rate, Review.

A new program for the compilation and evaluation of chemical kinetic data is described. Rate coefficient measurements are assessed for probable accuracy and pecision. Transition-state theory is often used to extrapolate measurements to higher temperatures. For every reaction reviewed, a recommended rate coefficient is given in the form K=ATn x exp(-B/T). Pertinent data and conclusions are summarized on a two-page Data Sheet, each sheet covering one reaction or occasionally two or three closely related reactions. Twenty-seven Data Sheets are presented for reactions important in modeling and understanding chemical lasers, hydrogen-oxygen combustion, hydrocarbon oixidation and aluminum or boron propellant systems.

704,537
PB83-600021 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Molten Salts: Volume 5, Part 2, Additional Single and Multi-Component Salt Systems. Electrical Conductance, Density, Viscosity and Surface Tension Data.
G. J. Janz, and R. P. T. Tomkins. c1983, 225p
Included in Jnl. of Physical and Chemical Reference Data, v12, n3 p591-815 1983.

Keywords: *Density, Electrical conductance, Fused salts, Molten salts, Phase diagrams, Surface tension, Viscosity.

Evaluated data for the four properties, density, surface tension, viscosity, and electrical conductance are reported for salt systems in which both the anionic and cationic species may differ. This contrasts with the systems in the preceding publications in this series in which the anionic species were, in general, the same in the binary mixtures. The results are reported in equation form, with brief tables of numerical values. A cross index by salt system was compiled and is included for ease of accessing the data tables.

704,538
PB83-600024 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluated Theoretical Cross Section Data for Charge Exchange of Multiply Charged Ions with Atoms. I. Hydrogen Atom-Fully Stripped Ion Systems.
R. K. Janev, B. H. Bransden, and J. W. Gallagher. c1983, 44p
Included in Jnl. of Physical and Chemical Reference Data, v12, n4 p829-872 1983.

Keywords: *Charge exchange, Cross sections, Hydrogen atom, Fully stripped ions, Multiply charged ions.

The existing theoretical cross section data for the charge exchange process of multiply charged fully stripped ions with hydrogen atoms are eveluated in the energy range from the difference 10eV/u to the difference 10(3) keV/u. The evaluation has been performed on the basis of both pure theoretical arguments and comparison with the most accurate experimental cross sections. The ionic charge state ranges from Z equal to 2 to Z equal to 54. The theoretical methods for calculation of the charge exchange cross sections are briefly discussed, and their regions of validity and the accuracy of the produced data are assessed.

704,539
PB83-600025 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluated Theoretical Cross Section Data for Charge Exchange of Multiply Charged Ions with Atoms, II. Hydrogen Atom-Partially Stripped Ion Systems.
J. W. Gallagher, B. H. Bransden, and R. K. Janev. c1983, 18p
Included in Jnl. of Physical and Chemical Reference Data, v12, n4 p873-890 1983.

Keywords: *Charge exchange, Cross section, Ions, Multiply charged ions, Partially stripped ions.

The existing theoretical cross section data for charge exchange of partially stripped ions on atomic hydrogen are evaluated in the energy range from the difference 10eV/u to the difference 10(3)keV/u. The evaluation has been carried out by using both pure theoretical arguments and comparison with the most accurate experimental data. Ions with atomic numbers Z=3-8, 10, 12, 13, 14, 16, 18, 22, 26, 30, 36, 41, 42, 48, 54, 73, and 74 in charge states q between q=2 and q=(Z-1), have been examined. A brief discussion of the evaluation criteria is also given.

704,540
PB83-600026 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Recommended Data on the Electron Impact Ionization of Light Atoms and Ions.
K. L. Bell, H. B. Gilbody, J. G. Hughes, A. E. Kingston, and F. Smith. c1983, 26p
Included in the Jnl. of Physical and Chemical Reference Data, v12, n4 p891-916 1983.

Keywords: *Cross sections, Electron impact ionization, Isoelectronic sequence, Rate coefficients.

Experimental and theoretical cross section data for electron impact ionization of light atoms and ions have been assessed. Based on this assessment and, in some cases, on the classical scaling laws, a recommended cross section has been produced for each species. This has been used to evaluate recommended Maxwellian rate coefficients over a wide range of temperatures. Convenient analytical expressions have been obtained for the recommended cross sections and rate coefficients. The data are presented in both graphical and tabular form and estimates of the reliability of the recommended data are given.

704,541
PB83-600027 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Correlation of the Viscosity and Thermal Conductivity Data of Gaseous and Liquid Ethylene.
P. M. Holland, B. E. Eaton, and H. J. M. Hanley. c1983, 16p
Included in Jnl. of Physical and Chemical Reference Data, v12, n4 p917-932 1983.

Keywords: *Critical point enhancement, Correlated data, Data evaluation, Ethylene, Thermal conductivity coefficient, Viscosity coefficient.

Data for the viscosity and thermal conductivity coefficient of gaseous and liquid ethylene have been evaluated and represented by an empirical function, developed in previous work. Tables of values are presented for the range 110-500K for pressures to 50 MPa(or nearly equal to 500atm). Both the viscosity and thermal conductivity coefficients are estimated to have uncertainties of about plus or minus 5% increasing to 10% in the dense liquid. It is stressed that the data base could be improved. As in our work with other fluids, the anamalous contribution to the thermal conductivity in the vicinity of the critical point is included.

704,542
PB83-600029 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermochemical Data for Gaseous Monoxides.
J. B. Pedley, and E. M. Marshall. c1983, 65p
Included in Jnl. of Physical and Chemical Reference Data, v12, n4 p967-1031 1983.

Keywords: *Computer methods, Critically evaluated data, Dissociation energies, Enthalpy functions, Free energy functions, Gaseous diatomic monoxides, Molecular parameters, Standard enthalpies of formation.

Values for standard enthalpies of formation and dissociation energies for gaseous diatomic monoxides have been selected by critical assessment of experimental data from the literature. Gibbs energy functions, (-(G degree T-H degree 298)/T), and enthalpy functions, (H degree T-H degree 298), have been calculated from literature values f or molecular parameters. Computer methods of storage, processing and retrieval are described and the resulting data are given in tables 4 to 11.

704,543
PB83-600030 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Vapor Pressure of Coal Chemicals.
J. Chao, C. T. Lin, and T. H. Chung. c1983, 31p
Included in Jnl. of Physical and Chemical Reference Data, v12, n4 p1033-1063 1983.

Keywords: *Aromatic hydrocarbons, Benzene derivatives, Coal chemicals, Cox equation, Cycloalkanes, Cycloalkenes, Heterocyclic nitrogen compounds, Heterocyclic oxygen compounds, Heterocyclic sulfur com-

pounds, Naphthalene derivatives, Vapor pressure, Vapor pressure equation.

The vapor pressure data on 324 coal compounds are collected and analyzed. The adopted data sets for each substance are weighted and combined to fit into a Cox vapor pressure equation, log10P=(1-D/T)x10(A+BT+CT2) by the least-squares methods. The results of the literature review and the evaluated values of coefficients for the vapor pressure equations are presented in separate tables. For ease of presentation, the coal compounds are divided into seven groups, based upon their molecular structures. They are (1) benzene and its derivatives, (2) naphthalene and its derivatives, (3) saturated ring compounds, (4) unsaturated ring compounds, (5) heterocyclic sulfur compounds, (6) heterocyclic nitrogen compounds, and (7) heterocyclic oxygen compounds.

704,544
PB84-103225 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibration of Molecular Drag Vacuum Gages.
Final rept.
K. E. McCulloh. Jun 83, 4p
Pub. in Jnl. of Vacuum Science and Technology A1, n2 p168-171 Jun 83.

Keywords: *Measuring instruments, Calibrating, Performance evaluation, Reprints, *Molecular drag.

In spinning-ball molecular drag gages, the logarithm of the rotational frequency responds linearly to the time integral of the applied pressure under conditions of free molecular motion. Conditions and procedures affecting the performance characteristics of these gages have been investigated, including magnetization of the ball, baking and other conditioning of its surface, and degradation of gas purity by surface contaminants in an unbaked flow system.

704,545
PB84-103233 Not available NTIS
National Bureau of Standards, Washington, DC.
First-Order Wetting Transition at a Liquid-Vapor Interface.
Final rept.
J. W. Schmidt, and M. R. Moldover. 1 Jul 83, 9p
Pub. in Jnl. of Chemical Physics 79, n1 p379-387, 1 Jul 83.

Keywords: *Wettability, *Surface properties, *Binary systems(Materials), Phase transformation, Fluids, Temperature, Liquid phases, Vapor phases, Reprints.

In certain binary solutions the lower of the two liquid phases forms a layer which intrudes between the upper liquid phase and the vapor. We find that such intruding layers form above binary solutions of a fluorocarbon (C7F14) and several alcohols (e.g., i-C3H7OH). Both the temperature dependence of the layer's thickness and the temperature dependence of the three phase contact are consistent with a first-order wetting transition at Tw.

704,546
PB84-103241 Not available NTIS
National Bureau of Standards, Washington, DC.
Reliability of High Vacuum Measurements.
Final rept.
C. R. Tilford. Jun 83, 11p
Pub. in Jnl. of Vacuum Science and Technology A1,N2 p152-162 Jun 83.

Keywords: *Measuring instruments, *High vacuum, Standards, Calibrating, Performance evaluation, Reprints, *Molecular drag.

In order to allow the users of vacuum measurements to assess the reliability of their measurements the current state of high vacuum measurements is reviewed. The discussion includes several types of high vacuum primary standards currently in use, an assessment of probable errors for several types of hot filament ion gages and user controlled factors that may serve to increase the errors, and the information available to date on the performance of a commercially available molecular drag gage. Problems associated with the application of vacuum gages are illustrated with a discussion of pump speed measurements.

704,547
PB84-103431 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of Extended Permutation-Inversion Groups to Internal Rotation of a Symmetric Rotor Top in a Symmetric or Asymmetric Rotor Molecule.
Final rept.
J. T. Hougen, and B. M. DeKoven. 1983, 17p
Pub. in Jnl. of Molecular Spectroscopy 98 p375-391 1983.

Keywords: *Molecular rotation, *Rotational spectra, Reprints, *Asymmetric rotors.

By applying the concept of extended groups to the internal rotation problem in molecules with unequal halves, it has proved possible to construct a consistent formalism involving groups which correspond to very high, but finite multiples of the original Longuet-Higgins permutation-inversion group of the molecule. This formalism thus bridges the gap between the infinite extended groups used for linear molecules and the double groups used for molecules with two identical coaxial rotors.

704,548
PB84-103480 Not available NTIS
National Bureau of Standards, Washington, DC.
Contribution of Surface Analysis and Surface Science to Technology.
Final rept.
C. J. Powell. 1982, 9p
Pub. in Australian Jnl. of Physics 35, p769-775 1982.

Keywords: *Surfaces, Technology, Surface chemistry, Reprints.

Surface science is a rapidly growing field offering many scientific and technological challenges. New experimental and theoretical tools have been developed which can be used to probe, at a fundamental atomic and molecular level, the physics and chemistry of complex processes at solid surfaces. Surface characterization, particularly surface analysis, is now an integral part of many technologies and industries (e.g., catalysis, coatings, corrosion, semiconductor devices, computer, automobile, communications) for many different applications (e.g., failure analysis, quality control, process and device development). Characterization of surface properties and processes is similarly important in many areas of public concern (e.g., energy, environment). The concepts and techniques found useful for surface characterization are currently being extended to the characterization of solid-solid, solid-liquid, and solid-gas interfaces. It is therefore expected that there will be significant developments in interface science and additional opportunities for technological applications in the coming decade.

704,549
PB84-103498 Not available NTIS
National Bureau of Standards, Washington, DC.
Difference Between Linear and Non-Linear Models in Bracketing Procedures in Isotope Dilution/Mass Spectrometry.
Final rept.
W. T. Yap, R. Schaffer, H. S. Hertz, E. White, and M. J. Welch. 1983, 3p
Pub. in Biomedical Mass Spectrometry 10, p262-264, 1983.

Keywords: *Mathematical models, *Isotopes, Mass spectroscopy, Interpolation, Reprints, *Isotope dilution mass spectrometry, Numerical solution.

The difference in the calculated values of the weight ratio, determined by isotope dilution/mass spectrometry, using bracketing procedures based on a linear or a non-linear model of interpolation was examined. Equations are developed for calculating this difference, and results are also presented in graphs.

704,550
PB84-103506 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Dependence of the Dynamic Structure Factor and Stability of a Supercooled Liquid: A Molecular Dynamics Study of Liquid Rubidium.
Final rept.
R. D. Mountain, and P. K. Basu. Jul 83, 3p
Pub. in Physical Review A28, n1 p370-372, July 1983.

Keywords: *Rubidium, *Liquid phases, *Temperature, *Dynamic structural analysis, Diffusion, Neutron scattering, Stability, Reprints.

A molecular dynamics study of the temperature dependence of the dynamic structure factor for liquid rubidium was made in order to clarify the role of density fluctuations in determining the stability limit of the supercooled liquid. Neutron scattering measurements on supercooled liquid gallium and on supercooled mixtures of lead and tin have lead to conflicting interpretations of the temperature variation of the dynamic structure factor. The molecular dynamics results for supercooled liquid rubidium indicate that the temperature variation of the dynamic structure factor correlates with the self-diffusion coefficient. By re-examining the data for liquid gallium we show that the experimental and the molecular dynamics results can be given a common interpretation and that the density fluctuations are not an indicator of the limit of stability of a supercooled liquid.

704,551
PB84-103514 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical and Transport Properties of Drawn Semicrystalline Polymers.
Final rept.
A. Peterlin. 1983, 31p
Pub. in Chapter 3 in the Strength and Stiffness of Polymers, p97-127, 1983.

Keywords: *Mechanical properties, *Transport properties, *Polymers, Annealing, Elastic modulus, Strength, Density(Mass/volume), Drafting(Staple fibers), Crystal structure, Polyethylene, Polypropylene, Polyethylene terephthalate, Reprints.

The microfibrillar model of the fibrous structure assuming highly aligned microfibrillar bundles with intra- and interfibrillar ttm explains well the data observed on the elastic modulus, strength, density and transport properties of drawn semicrystalline polymers as drawn and after annealing with free and fixed ends. Most of the checks were made on linear PE and PP, to a minor extent on nylon 6 and PET. In spite of the fact that most of the correlations are formulated in a more qualitative manner that one would like on must not forget that a quantitative formulation will be only possible after more data become available on the number of tie molecules of the dimensions of microfibrils and fibrils and their change with the draw ratio and temperature of drawing or annealing. The same applies to their dependence on the morphology, the molecular weight, and molecular weight distribution of the initial material. As the situation presently is, one has no reliable method for the exact determination of any of those quantities.

704,552
PB84-103589 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Absorption Intensities of Nitrous Acid (HONO) Fundamental Bands.
Final rept.
R. H. Kagann, and A. G. Maki. 1983, 8p
Pub. in Jnl. Quant. Spectrosc. Radiat. Transfer 30, n1 p37-44 1983.

Keywords: *Nitrous acid, *Infrared spectroscopy, *Band spectra, Absorption spectra, Reprints, *Fourier transform spectroscopy.

Using a Fourier transform spectrometer with 0.06/cm resolution, the absorption intensities of the four in-plane fundamental bands (nu(1), nu(2), nu(3), and nu(4) of trans-nitrous acid (HONO) and two in-plane fundamental bands (nu(2) and nu(4) of cis-nitrous acid have been measured. Interferences from overlapping absorptions of NO2, H2O, and other species were digitally subtracted from the spectra.

704,553
PB84-103597 Not available NTIS
National Bureau of Standards, Washington, DC.
Benchmark Measurement of Iodobenzene Ion Fragmentation Rates.
Final rept.
J. Dannacher, H. M. Rosenstock, R. Buff, A. C. Parr, R. L. Stockbauer, R. Bombach, and J. P. Stadelmann. 1983, 13p
Sponsored in part by Department of Energy, Washington, DC. Office of Environment.
Pub. in Chemical Physics 75, p23-35, 1983.

Keywords: *Ions, *Photoionization, *Fragmentation, *Heat of formation, Photoelectric emission, Harmonic generators, Reprints, *Benzene/iodo.

The unimolecular fragmentation rate of iodobenzene ion has been studied by variable residence time pho-

toelectron-photoion coincidence techniques. The techniques employed variable wavelength with threshold photoelectron detection and fixed (58.4 nm) wavelength with variable energy photoelectron detection, respectively. The resulting rate-energy dependences and fragmentation threshold values were in excellent agreement with one another. Some remaining uncertainties regarding the transition state model are discussed.

704,554
PB84-103647 Not available NTIS
National Bureau of Standards, Washington, DC.
Stark Widths and Shifts for Some Ar I 4s-4p Transitions.
Final rept.
D. W. Jones, K. Musiol, and W. L. Wiese. 1983, 12p
Pub. in Spec. Line Shapes 2, p125-136, 1983.

Keywords: *Argon, *Atomic energy levels, *Stark effect, Emission spectroscopy, Chemical shifts(Nuclear magnetic resonance).

The authors have measured the Stark widths and shifts of 13 lines of the Ar I 4s-4p transition array in emission with a wall-stabilized arc source. The electron density and temperature have been determined from the line profile of the hydrogen line H sub beta, using the well-known Stark broadening technique and assuming local thermodynamic equilibrium. For the diagnostic measurements a trace of hydrogen was added to the plasma. Furthermore, for the study of the strong 4s-4p argon lines, nitrogen gas was used as the principal plasma component, with only a small admixture of argon, in order to minimize self-absorption effects. The principal results for the Ar I Stark widths, i.e., the full widths at half maximum intensity, and Stark shifts are presented in several tables.

704,555
PB84-103696 Not available NTIS
National Bureau of Standards, Washington, DC.
Utilization of MeV Van de Graaff Electrons to Produce Characteristic X-Rays for Precision Measurements.
Final rept.
E. G. Kessler, and R. D. Deslattes. Apr 83, 4p
Pub. in Proceedings of the Conference of Application Accelerators in Research Industry, Denton, Texas. Nov 8-10, 1982, Institute of Electrical and Electronics Engineers Nuclear Science NS-30, n2, p991-994, Apr 83.

Keywords: *X rays, *Standards, Wavelengths, Precision, X ray spectrometers, Electron accelerators, Van der Graaff accelerators, Atomic energy levels, Elements, *Characteristic X rays.

Precision systematic studies of characteristic X-rays for elements spaced throughout the periodic table require intense convenient sources. Such sources are available from existing electron accelerators (e.g., Van de Graaff) operating in the one to several MeV region. Our studies of K series X-rays from the mid to high Z are favored by electron energies in the 2.5 MeV region where one encounters near maximum yield. The X-ray wavelengths are measured using a two-axis flat crystal transmission spectrometer. The angle measuring capability of the spectrometer is a few tenths of a milli arcsec which permits wavelength measurements with an uncertainty less than 1 ppm. However for X-ray lines (as contrasted with gamma-ray lines) the accuracy is limited to 3 to 5 ppm by the intrinsic line width. Measurements on a number of elements from Z=47 to 92 have been completed. These serve as tests of recent theoretical calculations and as wavelength standards in the 20 to 100 keV region.

704,556
PB84-103712 Not available NTIS
National Bureau of Standards, Washington, DC.
Doppler-Limited Spectrum and Analysis of the 3nu3 Manifold of SiF4.
Final rept.
A. S. Pine, and C. W. Patterson. 1982, 18p
Sponsored in part by the Department of Energy, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 96, p404-421, 1982.

Keywords: *Silicon tetrafluoride, *Doppler effect, *Molecular vibration, *Infrared spectroscopy, Harmonic analysis, Reprints, *Laser spectroscopy.

The two infrared-active vibrational bands of the 3 nu(3) manifold of SiF4 have been recorded at upsilon 155 K with Doppler-limited resolution using a tunable laser difference-frequency spectrometer. Although all branches of the l=1 band were seen, only portions of the P-branch of the weaker l=3 band were recorded. Some 192 lines with J < or = 36 have been fitted to a model Hamiltonian with allows the l=1 and l=3 bands to interact. This analysis allows us to determine the effective harmonic frequency, omega sup 0 sub 3, and the three anharmonic coefficients X(33), G(33), and T(33) with high precision, so that the vibrational levels in the eta nu sub 3 ladder can be predicted accurately for several values of eta. In contrast with SF6, the I-basis is found to be the best representation for the vibrational sublevels.

704,557
PB84-105139 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Excitation in Atoms and Molecules by Neutron-Nucleus Scattering.
Final rept.
S. W. Lovesey, C. D. Bowman, and R. G. Johnson. 1982, 11p
Sponsored in part by Science and and Engineering Research Council, Chilton (England). Rutherford Appleton Lab.
Pub. in Zeitschrift fuer Physik (Sektion) B: Condensed Matter and Quanta 47, p137-147 1982.

Keywords: *Atoms, *Molecules, *Neutron scattering, *Atomic energy levels, Excitation, Scattering cross sections.

The electronic excitation of atoms and diatomic molecules arising from neutron-nucleus scattering is examined. Both center-of-mass recoil and the coupling between electrons and nucei arising from non-adiabatic terms neglected in the Born-Oppenheimer approximation are considered. A significant cross-section from center-of-mass recoil is predicted for single atoms for sufficiently large changes in the wavevector of the neutron. The non-adiabatic terms give rise to small cross-sections for molecules unless the spacing of the electronic states is comparable with the rotational energy constant, which is possible for transitions between excited states.

704,558
PB84-105154 Not available NTIS
National Bureau of Standards, Washington, DC.
Influence of Configuration Mixing in Intermediate States on Resonant Multiphoton Ionization.
Final rept.
E. Matthias, P. Zoller, D. S. Elliott, N. D. Piltch, and S. J. Smith. Jun 83, 4p
Grants NSF-PHY82-00805, NSF-INT81-20128
Pub. in Physical Review Letters 50, n24 p1914-1917 Jun 83.

Keywords: *Barium, *Photoionization, Angular distribution, Photons, Photoelectrons, Spectroscopic analysis, Reprints, Rydberg series.

The authors performed resonant three-photon ionization of Ba to a structureless continuum via 6snd Rydberg states in the range 19 < or = n < or = 30. It is shown that state mixing in the Rydberg states strong affects the photon and photoelectron yields as well as the angular distributions of the photoelectrons. The experimental results can be understood on the basis of a three-channel quantum defect theory for the perturbed Rydberg series.

704,559
PB84-105667 Not available NTIS
National Bureau of Standards, Washington, DC.
3p(6)3d(9)-3p(5)3d(10) Transitions in Cobaltlike Ions from Ba(+29) to Yb(+43).
Final rept.
J. Reader. Jan 83, 3p
Pub. in Jnl. of the Optical Society of America 73, n1 p63-65 Jan 83.

Keywords: *Atomic energy levels, *Ions, *Ultraviolet spectroscopy, Excitation, Barium, Dysprosium, Erbium, Gadolinium, Lanthanum, Neodymium, Samerium, Ytterbium, Dipole moments, Magnetic moments, Reprints.

The 3psup6 3dsup9- 3psup5 3dsup10 transitions in the cobaltlike ions Ba(+29), La(+30), Na(+33), Sm(+35), Gd(+37), Dy(+39), Er(+41), and Vb(+43) were observed with a laser-produced plasma and a 2.2-m grazing-incidence spectrograph. Predicted wavelengths were obtained for the 3psup6 3dsup9 2supDsub5/2-2supDsub3/2 magnetic dipole transitions in Mo(+15), Xe(+27), and W(+47).

704,560
PB84-105691 Not available NTIS
National Bureau of Standards, Washington, DC.
Low Shear High-Temperature Rotational Viscometer: The Viscosity of Ultra High Molecular Weight Polyethylene.
Final rept.
H. L. Wagner, and J. G. Dillon. 1983, 14p
Pub. in Polymer Characterization - Spectroscopic, Chromatographic, and Physical Instrument, Chapter 9, p165-178 1983.

Keywords: *Polyethylene, *Viscosity, *Viscometers, High temperature tests, Molecular weight, Reprints.

A low or zero shear rate viscometer has been developed for high temperature use to measure polymers such as ultra-high-molecular weight polyethylene, which are insoluble at room temperature. The viscometer is based on the original design of Zimm-Crothers as modified by Tsai, Meyers, and McIntyre with additional changes necessitated by problems associated with high temperature operation.

704,561
PB84-105709 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Scattering from Adsorbates on Platinum Black.
Summary abstract.
J. J. Rush, R. R. Cavanagh, and R. D. Kelley. Jun 83, 2p
Pub. in Jnl. of Vacuum Science and Technology A 1, n2 p1245-1246 Jun 83.

Keywords: *Neutron scattering, *Adsorbates, *Catalysts, *Surface chemistry, Hydrogen, Acetylene, Ethylene, Comparison, Electron scattering, Reprints, *Platinum black.

Neutron spectra have been measured for hydrogen, acetylene, and ethylene on a platinum black catalyst. Measurements are compared in some detail with electron scattering results.

704,562
PB84-105717 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Dynamical Studies of the Dissociation of a Diatomic Molecular Crystal. Part 1: Energy Exchange in Rapid Exothermic Reactions.
Final rept.
D. H. Tsai, and S. F. Trevino. Aug 83, 14p
Sponsored in part by Army Armament Research and Development Command, Dover, NJ.
Pub. in Jnl. of Chemical Physics 79, n4 p1684-1697, 15 Aug 83.

Keywords: *Dissociation, *Crystals, *Diatomic molecules, *Exothermic reactions, *Energy transfer, *Mathematical models, Kinetic energy, Reaction kinetics, Reprints, *Molecular dynamics, Chemical reaction mechanisms.

The authors discuss the results of a model study of the exothermic dissociation of a diatomic molecular crystal. Our main purpose is to investigate the dynamics of energy transport and energy sharing in this system during the dissociation process. During the dissociation process, they found that the sharing of the potential energy released by the metastable molecules with the rest of the system, and the sharing of the kinetic energy of the dissociated fragments with the kinetic energy of the molecules in the translational degrees of freedom, were rather efficient.

704,563
PB84-105865 Not availabel NTIS
National Bureau of Standards, Washington, DC.
Heterodyne Frequency Measurements of Carbonyl Sulfide Transitions at 26 and 51 THz; Improved OCS, O13CS and OC34S Molecular Constants.
Final rept.
J. S. Wells, F. R. Petersen, and A. G. Maki. 1983, 13p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in. Jnl. of Molecular Spectroscopy 98, p404-412.

Keywords: *Infrared spectroscopy, Absorption, Calibrating, Reprints, *Carbonyl sulfide, *Heterodyne spectroscopy.

Heterodyne frequency measurements were made on selected absorption features of carbonyl sulfide (OCS) near 26 THz (860/cm) and 51 THz (1700/cm). Frequency differences were measured between a tunable diode laser (TDL) locked to carbonyl sulfide absorption lines and either a stabilized 13 CO2 laser or CO laser which was referred to stabilized CO2 lasers. These measurements are combined with conventional TDL measurements and published microwave measurements to obtain new, more reliable molecular constants for OCS, O(13)CS, and OC(34)S. New frequency measurements are given for nine CO laser transitions between 1686 and 1726/cm.

704,564

PB84-105873 Not available NTIS
National Bureau of Standards, Washington, DC.
Measured Electron Impact Ionization of Be-Like Ions: B(+1), C(+2), N(+3), O(+4).
Final rept.
R. A. Falk, G. Stefani, R. Camilloni, G. H. Dunn, R. A. Phaneuf, D. C. Gregory, and D. H. Crandall. Jul 83, 8p
Contract DOE-EA-77-A-01-6010
Pub. in Physical Review A 28, n1 p91-98 Jul 83.

Keywords: *Ionization, Atomic energy levels, Metastable states, Carbon, Nitrogen, Oxygen, Boron, Comparison, Reprints, *Electron impact spectra.

Electron impact ionization cross sections have been measured from threshold to about 20 times threshold for Be-like ions B(+1), C(+2), N(+3) and O(+4) using the crossed beams technique. The measured cross sections are compared with a variety of predictions. Distorted wave calculations compare most favorably but discrepancies up to 40% are found. The metastable/ground state mixture complicates the comparisons for these beam experiments and is probably an issue for all environments where light (> or = 15) Be-like ions occur.

704,565

PB84-105881 Not available NTIS
National Bureau of Standards, Washington, DC.
Reactions of He(+1), Ne(+1), and Ar(+1) with CH4, C2H6, SiH4, and Si2H6.
Final rept.
H. Chatham, D. Hils, R. Robertson, and A. C. Gallagher. Aug 83, 11p
Sponsored in part by Solar Energy Research Inst., Golden, CO.
Pub. in Jnl. of Chemical Physics 79, n3 p1301-1311 Aug 83.

Keywords: *Reaction kinetics, Chemical reactions, Ethane, Methane, Disilane, Ions, Reprints, *Ion molecule interactions, Helium ions, Neon ions, Argon ions.

The rate coefficients and product-ion distributions for the reactions of He(+1) and Ar(+1) with silane and disilane have been measured in a drift tube, typically for collision energies of 0.01 - 1 eV. These product-ion distributions bear no resemblance to the product-ion distributions of either photoionization or electron collisional ionization.

704,566

PB84-105923 Not available NTIS
National Bureau of Standards, Washington, DC.
Diffraction and NMR Studies of Proteins: An Uneasy Alliance.
Final rept.
J. S. Cohen, and A. Wlodawer. 1982, 3p
Pub. in Trends in Biochemical Sciences 7, n11 p389-391 1982.

Keywords: *Proteins, *Diffraction, *Nuclear magnetic resonance, *Molecular structure, Comparison, Ribonuclease, Reprints, Serine proteases.

Results of structural studies of proteins by diffraction and nuclear magnetic resonance have been analyzed and compared. Both techniques have been successfully used for this purpose in the past and the results obtained with each have seldom been compared. This lead to possible misinterpretations. Ribonuclease and serine proteases have been analyzed by both methods and this paper compares the results and points to the possible pitfalls in their interpretation.

704,567

PB84-105949 Not available NTIS
National Bureau of Standards, Washington, DC.
Extent of Polymerization of Dental Resins by Differential Scanning Calorimetry.
Final rept.
J. M. Antonucci, and E. E. Toth. Feb 83, 5p
Pub. in Jnl. of Dental Research 62, n2 p121-125 Feb 83.

Keywords: *Polymerization, *Calorimetry, *Dental materials, Enthalpy, Performance evaluation, Oxygen organic compounds, Esters, Reprints, *Differential scanning calorimetry, *Monomers, Free radicals, Propenoic acid/methyl-ethanediylbis(oxy-ethanediyl)ester, Propenoic acid/methyl-(methylethylidene)bis(phenyleneoxy(hydroxy-propanediyl))ester.

The traditional infrared spectroscopic methods for assessing the degree of polymerization of dental monomers are often hampered by the difficulties of sample preparation and, in the case of composites, by interference from the filler component. These difficulties may be circumvented by the use of another technique, differential scanning calorimetry (DSC). In this preliminary investigation, DSC was used to ascertain the degree of vinyl polymerization of an experimental monomer system consisting of 7 parts BIS-GMA and 3 parts TEGDMA (triethylene glycol dimethacrylate). Experimental difficulties are encountered in observing an exotherm with the very reactive accelerators unless the other parameters (e.g., BP or inhibitor content) involved in the reaction are adjusted accordingly. As a method for evaluating the performance of various dental monomers, initiator systems and inhibitors, DSC has great potential utility.

704,568

PB84-106004 Not available NTIS
National Bureau of Standards, Washington, DC.
Recent Developments in Atomic Transition Probabilities.
Final rept.
W. L. Wiese. 1983, 5p
Pub. in Proceedings of Trans. Int. Astronomical Union, Patras, Greece, August 17-26, 1982, Paper in Highlights of Astronomy 6, p795-799 1983.

Keywords: *Atomic energy levels, *Transition probabilities, *Stellar spectra, Astrophysics, Comparison, Numerical solution.

Recent developments in atomic transition probabilities have been reviewed and developments of special interest to astrophysical applications have been emphasized. The remarkable progress with regard to higher accuracy of the data is demonstrated by a few representative cases. Since large sets of data are often needed for modeling studies of stellar spectra, large-scale calculational work has been reviewed in some detail and the reliability of the theoretical results has been tested by various comparisons with the best laboratory data. It is seen that large random errors still occur for many transitions of low or moderate strength.

704,569

PB84-106012 Not available NTIS
National Bureau of Standards, Washington, DC.
Atomic Transition Probabilities and Lifetimes of Argon.
Final rept.
W. L. Wiese. Dec 82, 24p
Pub. in Proceedings of Int. Symposium on Ionized Gases (11th), Dubrovnik, Yugoslavia, August 23-27, 1982, Paper in the Physics of Ionized Gases, p435-456 1982.

Keywords: *Atomic energy levels, *Argon, *Spectral lines, *Spectrum analysis, *Transition probabilities, Reviews, Emission spectroscopy, *Lifetimes(Energy levels).

Numerous emission experiments and atomic lifetime measurements have been carried out on the prominent spectral lines of Ar I and Ar II. Differences between various sets of data have remained surprisingly large, often outside the mutually estimated error limits. A critical analysis is undertaken, which points to several very definite causes of the disagreements. With appropriate corrections, the data can be made significantly more consistent.

704,570

PB84-106020 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of the Vapor Pressure, Aqueous Solubility and Octanol-Water Partition Coefficient of Hydrophobic Substances by Coupled Generator Column/Liquid Chromatographic Methods.
Final rept.
S. P. Wasik, M. M. Miller, Y. B. Tewari, W. E. May, W. J. Sonnefeld, H. DeVoe, and W. H. Zoller. 1983, 14p
Pub. in Residue Review 85, p29-42 1983.

Keywords: *Solubility, *Vapor pressure, *Organic compounds, Performance evaluation, Physical properties, Reprints, *High performance liquid chromatography, *Partition coefficients, *Hydrophobic compounds.

A dynamic coupled column liquid chromatographic method for measuring the aqueous solubility, octanol-water partition coefficient and vapor pressure of hydrophobic compounds is presented. Several organic compound classes are amenable to this technique. The precision and accuracy of the method are in good agreement with literature values. The measurement of these three physical properties is critically discussed.

704,571

PB84-106046 Not available NTIS
National Bureau of Standards, Washington, DC.
Improved Measurement of the 4He I 3 1D-3 3D Separation: Confirmation of Predicted Mass-Polarization Isotopic Shift.
Final rept.
W. C. Martin, and C. J. Sansonetti. 1983, 3p
Pub. in Physical Review A 28, n1 p502-504 1983.

Keywords: *Atomic energy levels, *Helium, *Atomic spectra, *Isotope effect, Polarization(Charge separation), Mass.

From new measurements of the (4)He 1s2p-1s3d lines, we have determined the 3 1supDsub2-3 3supDsub2 separation to be 102 459(15) MHz. The corresponding nonrelativistic 1s3d singlet-triplet separation is 102 196(15) MHz, as compared with the value 102 116(5) MHz previously determined for the equivalent (3)He separation. The difference of 80(16) MHz agrees with the predicted isotopic difference of these separations, the main contribution being a mass-polarization difference of 79 MHz as recently calculated by Drake. The experimental difference for 1s3d is consistent with the rough trend of such isotopic differences of 1snd singlet-triplet separations determined in previous experiments. The authors infer that mass-polarization shifts probably contribute significantly to the previously observed differences, at least up to n approximately 8.

704,572

PB84-106095 Not available NTIS
National Bureau of Standards, Washington, DC.
5 doublet s 5psup4-5s 5psup5 Transitions in Cs IV, Ba V, and La VI.
Final rept.
J. Reader. Mar 83, 4p
Pub. in Jnl. of the Optical Society of America 73, n3 p349-352 Mar 83.

Keywords: *Atomic energy levels, *Ions, *Ultraviolet spectroscopy, Barium, Cesium, Lanthanum, Hartree-Fock approximation, Reprints.

The 5 doublets 5psup4-5s5psup5 transitions of Cs IV, Ba v, and La VI were observed with a sliding spark discharge and a 10.7-m normal-incidence spectrograph. The region of observation was 539-1282 A. The energy parameters derived from least-squares fits to the experimental levels are compared with Hartree-Fock (HF) calculations. The fitted/HF ratios for the 5 doublets 5psup4 configurations of the ions Te I-La VI are compared with the fitted/HF ratios for the 4 doublets 4psup4 configurations of the ions Se I-Mo IX.

704,573

PB84-106103 Not available NTIS
National Bureau of Standards, Washington, DC.
Liquids: Surface Tension, Compressibility, and Invariants.
Final rept.
I. C. Sanchez. 1 Jul 83, 11p
Pub. in Jnl. of Chemical Physics 79, n1 p405-415, 1 Jul 83.

Keywords: *Interfacial tension, *Compressibility, *Invariance, *Fluids, *Liquids, Isotherms, Organic compounds, Polymers, Inorganic compounds, Precious metals, Reprints, *Mass density, Lennard-Jones potential, Numerical solution.

A new equation has been derived which related the surface tension (sigma) to a liquids isothermal compressibility (kappa) and mass density (rho). The derivation is based on a generalized square-gradient approximation for the free energy density of a non-uniform fluid. The equation is sigma(kappa/rho)sup1/2 = AsupV2sub0 = constant in the normal liquid range. Except for water, A0 is temperature independent for a variety of inorganic, organic, and polymer liquids. The result implies that (epsilon sub0 sigma0 sub0 sup2/M) is an invariant for certain classes of molecules and has been confirmed for a Lennard-Jones potential. It appears that this surprising observation has never been made before; its physical implications remain unclear.

704,574
PB84-106194 Not available NTIS
National Bureau of Standards, Washington, DC.
Structural Maps and Parameters Important to Alloy Phase Stability.
Final rept.
R. E. Watson, and L. H. Bennett. 1983, 6p
Pub. in Proceedings of Materials Research Society Symposium, Boston, Massachusetts, October 31-November 4, 1982, 19, p99-104 1983.

Keywords: *Molecular structure, *Alloys, *Transition metals, Phase transformations, Electronegativity, *Phase stability, *Structural maps.

Alloy properties are often summarized on two-dimensional maps. For instance, Darken and Gurry related the terminal solubilities of alloy systems to two coordinates (the differences in electronegativities and in atomic radii of the alloy constituents). Maps are considered here which correlate the structures in which the compounds form as well as providing some indication of whether a compound forms at some given composition in the first place. This class of map involves one coordinate which is the difference in an atomic parameter (here it will be taken to be the electronegativity) while the other is an average (in this case the d band hole count). This contrasts with Darken Gurry Maps and Gressen's maps related to glass forming ability (elsewhere in this volume) where both coordinates are differences. The situation for 50/50 transition metal alloys is reviewed and results are presented for systems off 50/50 composition.

704,575
PB84-106228 Not available NTIS
National Bureau of Standards, Washington, DC.
ESR (Electron Spin Resonance) Studies of Polymer Films Containing Leucodyes Irradiated with 60Co Gamma Rays.
Final rept.
R. M. Uribe, M. C. Pina, and W. L. McLaughlin. Dec 80, 9p
Pub. in Proceedings of International Symposium on Nuclear Chemistry (3rd), Mexico City, December 8-10, 1980, p202-211 1982.

Keywords: *Electron paramagnetic resonance, *Polymeric films, *Plastics, *Dosimetry, Dyes, Gamma rays, Cobalt 60, Cyanides, Oxygen organic compounds, Radiation chemistry, Methane/triphenyl, Free radicals, Leucocyanides, Leucodyes, Triphenylmethane dyes.

When plastic films containing leucocyanide of triphenylmethane dyes are irradiated with large dose of (60) Co gamma rays, free radicals are formed that are sufficiently stable for analysis at room temperature. Preliminary studies about the effect of Co-60 gamma rays on the ESR signal of radiochromic dye films are discussed, in order to investigate practicality of this technique in dosimetry. Not only can dosimetry be achieved at higher doses than are normally used with spectrophotometry of this films, but also information about the radiation chemistry of dye formation can be derived.

704,576
PB84-106236 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of the 4d sup9-4d sup8 5p Transitions in Nine Times Ionized Xenon (Xe X).
Final rept.
V. Kaufman, J. Sugar, and J. L. Tech. 1983, 3p
Pub. in Jnl. of the Optical Society of America 73, p691-693 1983.

Keywords: *Atomic energy levels, *Xenon, *Far ultraviolet radiation, *Ultraviolet spectroscopy, Least square method, Hartree-Fock approximation, Line spectra, Reprints, *Xenon ions.

The 4dsup9-4dsup8 5p transition array of nine-times ionized xenon at 130-160 A was photographically observed with the National Bureau of Standards 10.7-m grazing-incidence vacuum spectrograph. The spectral source was a high-voltage spark between carbon electrodes triggered by insertion of a small quantity of xenon. Forty-seven lines were classified as transitions from 34 levels of the 4dsup8 5p configuration to the two levels of the 4dsup9 2 sub D ground term. An excellent correlation was found between the observed and calculated relative intensities. Least-squares-fitted parameter values and their ratios to the Hartree-Fock values are given.

704,577
PB84-106319 Not available NTIS
National Bureau of Standards, Washington, DC.
Free Radical Mechanisms in Autoxidation Processes.
Final rept.
M. G. Simic. Feb 81, 7p
Pub. in Jnl. of Chemical Education 58, p125-131 Feb 81.

Keywords: *Reaction kinetics, *Spectroscopic analysis, *Food analysis, Radiolysis, Reprints, *Free radicals, *Chemical reaction mechanisms, *Autoxidation, *Biological processes.

Free radical processes operating in autoxidation processes in food components and biological systems as well as interactions of autoxidants were reviewed. Special emphasis was given to the spectroscopy and kinetics of transient species obtained by pulse radiolysis.

704,578
PB84-106327 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamic Models for Fluid Mixtures Near Critical Conditions.
Final rept.
J. C. Rainwater, and M. R. Moldover. 1983, 21p
Pub. in Chemical Engineering at Supercritical Fluid, Chapter 10, p199-219 1983.

Keywords: *Thermodynamic properties, *Mathematical models, *Binary systems(Materials), *Fluids, Butanes, Methane, Octane, Nitrogen, Propane, Critical point, Interpolation, Reprints, Vapor liquid equilibrium.

The authors use model thermodynamic potentials for correlating VLE data for mixtures in near critical conditions. The model potentials are obtained by 'interpolation' between the thermodynamic potentials of the pure components. The interpolation is carried out parallel to the critical locus using 'field' variables which are ratios of fugasities. This contrasts with more conventional schemes in which 'density' variables such as mole fractions play a key role. Our model potentials are tested with data for the systems CH4-N2, C3H8-C8H18, and C4H10-C8H18.

704,579
PB84-106343 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermochemical Values for Cu-Ni Surface and Interface Segregation Deduced from Core-Level Binding-Energy Shifts.
Final rept.
W. F. Egelhoff. Feb 83, 4p
Pub. in Physical Review Letters 50, n8 p587-590, 21 Feb 83.

Keywords: *Thermochemistry, *Surfaces, *Copper nickel alloys, Binary systems(Materials), Photoelectrons, Emission spectroscopy, Reprints, *Electronic structure.

A new semi-empirical method for extracting thermochemical values of surface segregation in binary alloys from shifts in core electron binding energies is applied to the case of Cu-Ni. The results agree well with the calculated value of the heat of Cu surface segregation. In addition to providing important thermochemical values this approach provides new insights into the relationship between the thermochemistry and the electronic structure of binary alloys.

704,580
PB84-106376 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Electrons Produced by Ionization on Calculated Electron Energy Distributions.
Final rept.
S. Yoshida, A. V. Phelps, and L. C. Pitchford. 1983, 10p
Sponsored in part by Army Research Office, Research Triangle Park, NC.
Pub. in Physical Review A 27, n6 p2858-2867 1983.

Keywords: *Electrons, *Ionization, *Energy transfer, Nitrogen, Distribution(Propertey), Reprints, *Electron energy, Numerical solution.

The effects of the form of the distribution in energy of the electrons produced by ionization on electron energy distributions and transport coefficients are investigated theoretically at high values of the ratio of the electric field to gas density E/n. The calculations are carried out for N2 at E/n from 1 to 3 x 10 to the -21th power V sq m using previously determined electron collision cross sections and secondary energy distributions. As the energy of the secondary electrons and the energy lost by the higher energy scattered electrons is increased, the relative number of electrons at very low energies and at high energies in the calculated steady-state distributions decreases. These changes are accompanied by decreases in the calculated ionization coefficients, drift velocities and mean energies and by an increase in the characteristic energy. A simplified secondary electron energy distribution is proposed which gives distribution functions and transport coefficients in satisfactory agreement with those obtained using the published experimental distributions.

704,581
PB84-106392 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of the Collision Stopping Power of Elements and Compounds for Electrons and Positrons.
Final rept.
S. M. Seltzer, and M. J. Berger. 1983, 54p
Sponsored in part by Department of Energy, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in International Jnl. of Applied Radiation and Isotopes 33, p1189-1218 1983.

Keywords: *Elements, *Chemical compounds, *Electrons, *Positrons, Excitation, Stopping, Density(Number/volume), Reprints, *Electron position interactions, Bethe theory.

This paper gives tables of material properties needed for the evaluation of the collision stopping power for electrons and positrons according to the Bethe theory. The key quantity is the mean excitation energy, which has been derived for many materials by a critical analysis of experimental data. Also given are the density-effect parameters of the theory of Sternheimer. The material properties are given for the elements and for 180 compounds and mixtures, and the rules are described by which they could be obtained for other materials. Auxiliary tables of energy-dependent quantities are included which -- together with the main tables -- make possible the quick-and-easy evaluation of the collision stopping power.

704,582
PB84-106418 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoemission Spectra from Autoionizing States under Recycling Conditions.
G. S. Agarwal, S. L. Haan, and J. Cooper. Aug 83, 3p
Grant NSF-PHY79-04928
Pub. in Physical Review A 28, n2 p1154-1156 Aug 83.

Keywords: *Photoelectric emission, *Emission spectra, Radioactive decay, Reprints, *Autoionization, Laser induced autoionization.

Spectral features of the radiation emitted by autoionizing states in the presence of a strong laser field are calculated under the condition of multiple photon absorption and emissions. The method is based on the exact solution of the master equation for the recycled system. The decay spectra are found to exhibit sharp maxima at the laser frequency, and for large values of the Fano q value, side-bands which are reminiscent of the triplet and one finds in the context of a two-level atom.

704,583
PB84-106426 Not available NTIS

National Bureau of Standards, Washington, DC.
Effect of Hydrodynamic Dispersion of the Metal on Surface Plasmons and Surface Enhanced Phenomena in Spherical Geometries.
Final rept.
G. S. Agarwal, and S. V. O'Neil. Jul 83, 7p
Grant NSF-PHY82-00805
Pub. in Physical Review B 28, n2 p487-493 Jul 83.

Keywords: *Hydrodynamics, *Dispersion, *Metals, *Plasmons, *Surface chemistry, Greens function, Excitation, Reprints.

The authors investigate the effect of the hydrodynamic dispersion of the metal on various electromagnetic related surface effects in spherical geometries by calculating the general expression for the electromagnetic Green's function. The Green's function yields the multipolar polarizabilities for the metallic sphere and the dispersion relation for surface plasmons. The hydrodynamic dispersion is shown to lead to considerable shift of the surface plasmon frequencies, which are pushed into the region in which they would not occur had the metal been characterized by the local dielectric function. The Green's function is further used to study the decay of an excited molecule near the metal surface and the molecular polarizability renormalizations. Various resonances in the decay characteristics of the excited molecule are shown to correspond to the shifted surface plasmon frequencies.

704,584

PB84-106541 Not available NTIS
National Bureau of Standards, Washington, DC.
3 doublet s(2)-3s3p and 3s3p-3s3d Transitions in Magnesiumlike Ions from Sr(+26) to RH(+33).
Final rept.
J. Reader. Jun 83, 4p
Pub. in Jnl. of the Optical Society of America 73, n6 p796-799 Jun 83.

Keywords: *Atomic energy levels, *Ions, *Spectroscopic analysis, Krypton, Molybdenum, Niobium, Ruthenium, Rhodium, Strontium, Yttrium, Zirconium, Reprints.

The 3 doublets 1supSsub0-3s3p 1supPsub1, 3s3p 1supPsub1-3s3d 1supDsub2 and 3s3p 3supPsub2-3s3d 3supDsub3 transitions in seven Mg-like ions from Sr(+26) to Rh(+33) were observed with a laser-produced plasma and a 2.2-m grazing-incidence spectrograph. The wavelengths of the 3doublets 1supSsub0-3s3p 1supPsub1 transition are compared with tokamak observations and with theoretical values obtained with the relativistic random phase approximation.

704,585

PB84-106582 Not available NTIS
National Bureau of Standards, Washington, DC.
Ionic Character of Polar Crystals: An Extended Mulliken Scheme for Electronegativities.
Final rept.
R. E. Watson, L. H. Bennett, and J. W. Davenport.
May 83, 11p
Pub. in Physical Review B 27, n10 p6428-6438, 15 May 83.

Keywords: *Atomic energy levels, *Crystals, *Electronegativity, Semiconducting materials, Insulation, Spectroscopic analysis, Transition metals, Reprints, *Mulliken scheme.

The total energy of an atom can be expressed in terms of the charge q on the atom as E(q) = E(O) + alpha q + beta qsup2 + gamma qsup3. It is shown that the expected charge transfer, q, which brings the intra-atomic energy of the atoms to a minimum, between otherwise isolated noninteracting atoms is proportional to the difference in the alpha of the constituent elements, q = c delta alpha. Thus alpha provides a well-defined electronegativity scale, and if the third-order term qsup3 may be neglected, alpha=phi(m), the original Mulliken scale. The extended Mulliken scheme is relevant to the energetics of charge transfer, and hence of ionic character of insulating and semiconducting compounds, allowing baseline estimates to be made of such character. Other factors contribute to charge transfer and some of the complications associated with transition metal compounds are explored.

704,586

PB84-106590 Not available NTIS
National Bureau of Standards, Washington, DC.
Theoretical Study of the Far Infrared Absorption Spectrum of Dense Nitrogen.
Final rept.
B. Guillot, and G. Birnbaum. Jul 83, 6p
Pub. in Jnl. of Chemical Physics 79, n2 p686-691, 15 Jul 83.

Keywords: *Nitrogen, *Infrared spectroscopy, Absorption, Density(Mass/volume), Molecular rotation, Intermolecular forces, Reprints.

The far infrared absorption spectrum of dense nitrogen is calculated by assuming that the induction mechanism is quadrupolar and that the intermolecular potential is predominantly isotropic. The profile is then described as the convolution of a translational spectrum and a rotational spectrum. The latter expresses the free rotations of the molecules whereas the former, calculated from the Zwanzig-Mori theory of Browian motion, is characterized by two translational models, a diffusive low frequency mode and an oscillatory high frequency mode. The translational spectrum is found to be responsible for the density dependence of the absorption spectrum, contributing significantly to the profile at high densities and for all frequencies. The parameters of the theory are analytically given and the influence on the profile of a small anistropy in the intermolecular potential is estimated by a perturbation approach.

704,587

PB84-106608 Not available NTIS
National Bureau of Standards, Washington, DC.
Summary Abstract: Internal Energy Distributions in Thermally Desorbed Molecules.
Final rept.
R. R. Cavanagh, and D. S. King. Jun 83, 2p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Vacuum Science and Technology A 1, n2 p1267-1268 Apr/Jun 83.

Keywords: *Desorption, *Surface chemistry, *Nitrogen oxide(NO), Doppler effect, Temperature, Molecular rotation, Reprints, *Laser induced fluorescence, *Laser spectroscopy.

Laser excited fluorescence has been employed to examine the quantum state populations of NO thermally desorbed from clean and oxidized Ru surfaces. The rotational and spin populations observed are found to be Boltzmann, yet the observed rotational temperature varies from being equivalent to the surface temperature, to being 50% less than the surface temperature depending on the details of sample preparation. Laser Doppler Spectroscopy has also been applied to the thermally desorbed NO. These measurements provide information on both the angular flux distribution and the spread in translational kinetic energy.

704,588

PB84-106640 Not available NTIS
National Bureau of Standards, Washington, DC.
Synthesis of Nitrogen-15-Labeled 2-Amino(glycofurano)oxazolines via Glycosylamine Intermediates.
Final rept.
R. M. Davidson, E. White, S. A. Margolis, and B. Coxon. 1983, 16p
Pub. in Carbohydrate Research 116, p239-254 1983.

Keywords: *Synthesis(Chemistry), *Isotopic labeling, Radioactive isotopes, Nucleosides, Clinical chemistry, Reprints, *Chemical reaction mechanisms, *Oxazoline/amino-(glycofurano), Nitrogen 15, Glycosylamine, Pyrimidine anhydronucleosides.

A new efficient synthesis of doubly (15)N-labeled 2-amino-oxazoline derivatives of pentoses and hexoses has been delineated that involves treatment either of unprotected or 0-isopropylidenated glycosylamines with cyanamide-(15)N2 in methanol to give 2-amino (glycofurano) oxazolines-(15)N2. A probable mechanism for these reactions is presented. These techniques provide a practical means by which a variety of stable or radioactive isotopes can be introduced into any of several known, clinically significant pyrimidine anhydronucleosides, such as 2,2'-anhydro(1-beta-D-arabinofuranosylcytosine)(cyclo-C).

704,589

PB84-106657 Not available NTIS
National Bureau of Standards, Washington, DC.
Regularities of Stark Widths and Shifts in an Ar I Transition Array.
Final rept.
D. W. Jones, K. Musiol, and W. L. Wiese. 1982, 8p
Pub. in Proceedings of Symposium on Physics Ionized Gases (11th), p457-464 1982.

Keywords: *Stark effect, *Spectral lines, *Argon, *Line width, *Molecular energy levels, Excitation, *Chemical shifts(Nuclear magnetic resonance), *Plasma spectroscopy.

A study of the Stark width and shifts for lines of the Ar I 4s-4p transition array has been carried out with a wall stabilized arc. Systematic variations of the widths and shifts have been found, which are correlated with the excitation energies of the upper level.

704,590

PB84-106681 Not available NTIS
National Bureau of Standards, Washington, DC.
Mean Excitation Energies for Use in Bethe's Stopping-Power Formula.
Final rept.
M. J. Berger, and S. M. Seltzer. Jan 83, 19p
Pub. in Proceedings of Seminar Charge States and Dynamic Screening Swift Ions Solids, Honolulu, HI, January 25-29, 1982, Report CONF-820131, p57-74 Jan 83.

Keywords: *Gases, *Solids, *Nuclear energy, Bragg angle, Reviews, Excitation, Atomic energy levels, Elements, Chemical compounds, Dipole moments, *Stopping power, Oscillator strength.

A review has been made of the mean excitation energies that can be derived from the analysis of stopping-power and range measurements, and from semi-empirical dipole oscillator-strength distributions for gases and dielectric-response functions for solids. On the basis of this review, mean excitation energies have been selected for 43 elemental substances and 54 compounds. Additivity rules have also been considered which allow one to estimate the mean excitation energies for compounds for which no direct data are available. These additivity rules are based on the use of mean excitation energies for atomic constituents which, to a certain extent, take into account the effects of chemical binding and physical aggregation.

704,591

PB84-106699 Not available NTIS
National Bureau of Standards, Washington, DC.
Reaction of F Atoms with CH3SH. Vibrational Spectroscopy and Photochemistry of CH3S and CH2SH Hydrogen-Bonded to HF.
Final rept.
M. E. Jacox. 1983, 8p
Pub. in Canadian Jnl. of Chemistry 61, n5 p1036-1043 1983.

Keywords: *Chemical reactions, *Photochemistry, *Vibrational spectra, *Infrared spectroscopy, *Hydrogen bonds, Isotopic labeling, Synthesis(Chemistry), Solid solutions, Photolysis, Reprints, *Fluorine atoms, *Methane thiol, *Chemical reaction mechanisms, *Matrix isolation techniques.

When the products of the reaction between F atoms formed in a microwave discharge and methanethiol are frozen in a large excess of argon at 14 K, prominent absorptions of isolated and hydrogen-bonded HF appear, indicating that hydrogen abstraction occurs both in the deposition beam and in the solid. Secondary F-atom reactions play only a minor role. Studies of the partially deuterium-substituted methane thiols support the assignment of peaks at 3515 and 3672/cm to the HF-stretching modes of HF hydrogen-bonded to CH3S and CH2SH, respectively, and indicate that CH2SH was formed with enough excess energy to surmount the barrier for rearrangement to CH3S. A prominent, structured absorption at 424/cm is assigned to the H2CS 'umbrella' deformation of CH2SH, consistent with a recent ab initio calculation. The photodecomposition threshold of CH2SH lies between 260 and 280 nm.

704,592

PB84-106855 Not available NTIS
National Bureau of Standards, Washington, DC.

Solution Thermodynamics of Some Slightly Soluble Hydrocarbons in Water.
Final rept.
W. E. May, S. P. Wasik, M. M. Miller, Y. B. Tewari, R. N. Goldberg, and J. M. Brown-Thomas. 1983, 4p
Pub. in Jnl. of Chemical and Engineering Data 28, p197-200 1983.

Keywords: *Thermodynamics, *Hydrocarbons, *Water, Solubily, Gibbs free energy, Specific heat, Solutions, Benzanthracenes, Anthracene, Benzene, Pyrenes, Triphenylene, Aromatic polycyclic hydrocarbons, Phenanthrene, Fluorenes, Naphthalene, Reprints, High pressure liquid chromatography, Benz(a)pyrene, Benzene/hexyl, Chrysene, Fluoranthene, Phenanthrene/methyl, Anthracene/methyl.

This paper summarizes a series of measurements of the solubilities of fourteen hydrocarbons in water at temperatures ranging from 275 to 304 K using a generator column, high-pressure liquid-chromatography method. The compounds investigated were benz(a)pyrene, benz(a)anthracene, anthracene, hexylbenzene, benzene, chrysene, pyrene, triphenylene, fluoranthene, 1-methylphenanthrene, 2-methylanthracene, phenanthrene, fluorene, and naphthalene. The authors have calculated values of delta G, delta H, and delta Csub p at 298.15 K for the process: compound (liquid or solid) = compound (aqueous) using the model of Clarke and Glew. They have also calculated these same thermodynamic parameters from the information available on these compounds in the literature.

704,593
PB84-106871 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical and Transport Properties of Drawn Low Pressure Low Density Polyethylene.
Final rept.
F. deCandia, A. Perullo, V. Vittoria, and A. Peterlin. 1983, 3p
Pub. in Jnl. of Applied Polymer Science 28, p1815-1817 1983.

Keywords: *Mechanical properties, *Transport properties, *Polyethylene, Modulus of elasticity, Density(Mass/volume), Low pressure research, Drafting(Staple fibers), Reprints.

The new low density polyethylene obtained under low pressure in the reactor has a great many side branches which are short in contrast to the material obtained at high pressure of the reactor with a few very long branches. The mechanical and transport properties shift a little from those of the usual low density material towards those of the linear polyethylene.

704,594
PB84-106889 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Dynamics Study of Homogeneous Nucleation for Liquid Rubidium.
Final rept.
R. D. Mountain, and P. K. Basu. 15 Jun 83, 5p
Pub. in Jnl. of Chemical Physics 78, n12, p7318-7322 1983.

Keywords: *Nucleation, Crystallization, Quenching(Cooling), Metastable state, Crystal structure, Rubidium, Reprints, *Molecular dynamics, *Liquid rubidium.

Molecular dynamics has been used to study the dependence of homogeneous nucleation of the crystal on the rate with which the liquid is quenched, the initial state of the liquid and on the depth of the quench. A total of 54 simulations of quenching for a liquid rubidium system were performed and the dependence of the time required for the onset of nucleation, the rate with which nucleation procedes and the symmetry of the resulting crystal were determined. With the exception of the onset times slow quenches, the results show an element of randomness in the growth rates and the development of bcc or fcc structures do not correlate with quench rates, etc. For slow quench rates, the onset times show the C-shaped profile found experimentally in time-temperature trajectory studies of nucleation in strongly supercooled liquids.

704,595
PB84-106897 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Equilibria of Sparingly Soluble Crystals.
Final rept.
W. E. Brown, and L. C. Chow. 1983, 14p
Sponsored in part by the American Dental Association Health Foundation, Chicago, IL.
Pub. in Colloids and Surfaces 7, p67-80 1983.

Keywords: *Surface chemistry, *Solutions, *Ions, *Crystals, *Mathematical models, Electrochemistry, Stoichiometry, Phase transformations, Crystal lattices, Equilibrium, Crystal growth, Reprints, Ion selective electrodes.

The chemical interactions between an ionic solid, its interfacial compartments, and a saturated solution are of major interest in surface chemistry. The authors divide the chemical reactions into two types: (1) 'stoichiometric' reactions involving crystal growth--dissolution occurring at kink sites, and (2) 'electrochemical' reactions involving random impingement and ejection of ions at crystal faces. Transport of neutral Gibbsian' components as such across the phase boundary appears not to represent an actual mechanism, but instead derives from the electrochemical equations. According to this model, equilibrium is not attained between inner lattice and outer layer via solid-state reactions, but only through the aqueous phase. This model has major implications regarding the mechanism by which specific ion electrodes function.

704,596
PB84-106913 Not available NTIS
National Bureau of Standards, Washington, DC.
Line Interference Effects in the Vibrational Q-Branch Spectra of N(2) and C0.
Final rept.
G. J. Rosasco, W. Lempert, W. S. Hurst, and A. Fein. 27 May 83, 6p
Pub. in Chemical Physics Letters 97, n4-5, p435-440, 27 May 83.

Keywords: *Line width, *Nitrogen, *Carbon monoxide, *Raman spectroscopy, Spectral line, Molecular rotation, Reprints.

Self-broadened (about 20-200 kPa) Q-branch spectra are measured by high resolution CW stimulated Raman spectroscopy. Line overlap in these spectra is described in a relaxation matrix formalism and a first order (in density) solution to the resulting equation is used to fit the data. The parameters of this model are analyzed in terms of rates of rotational energy transfer.

704,597
PB84-106988 Not available NTIS
National Bureau of Standards, Washington, DC.
Morphological and Convective Instabilities during Solidification.
Final rept.
S. R. Coriell, R. F. Boisvert, J. I. Mickalonis, and M. E. Glicksman. 1983, 7p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Adv. Space Res. 3, n5 p95-101 1983.

Keywords: *Solidification, *Cylinders, *Hydrodynamics, *Morphology, Temperature, Stability, Melts, Crystals, Reprints, Linear stability theory, Succinonitrile, Numerical solution.

The stability of the flow between two vertical, infinite rigid, coaxial cylinders held at different temperatures is analyzed by linear stability theory. When the rigid outer cylinder-fluid interface is replaced by a crystal-melt interface which can change shape, two new modes of instability occur at lower Grashof numbers. These calculations were motivated by and are in general agreement with our recent experiments on succinonitrile.

704,598
PB84-106996 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiation Diffusion and Saturation in Optically Thick Na Vapor.
Final rept.
J. Huennekens, and A. Gallagher. Jul 83, 10p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Physical Review A 28, n1 p238-247 Jul 83.

Keywords: *Sodium, *Molecular energy levels, *Spectral lines, Fluorescence, Doppler effects, Radioactive decay, Saturation, Optical density, Reprints, *Radiation diffusion, Laser applications.

The authors have measured the time-dependent fluorescence of the sodium D lines following pulsed excitation of one D line, in the presence of radiation trapping with optical depths k(0)L of about 10 to 2000. When collisional coupling of the 3P(1/2) and 3P(3/2) levels and different radiative-escape probabilities for each D line are taken into account, we obtain excellent agreement with Holstein's theory for the effective radiative decay rates in the Doppler region (k(0)L about 10-300) and in the redistributed Lorentzian region (k(0)L> 1000). They suggest that the previously reported 'anomalous' approaches to saturation may be explained in terms of the laser beam burning through the optically thick vapor. Laser-beam spatial intensity variations and self-focusing also contribute to fluorescence signals that deviate from the usual single-atom saturation behavior.

704,599
PB84-107002 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Configuration Interaction on Dielectronic Recombination of Fe XXIV.
Final rept.
L. J. Roszman, and A. W. Weiss. 1983, 5p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 30, n1 p67-71 1983.

Keywords: *Iron, *Recombination reactions, Ionization, Excitation, Plasmas(Physics), Reprints, *Autoionization, *Dielectronic recombination, *Configuration interaction method.

The rate of dielectronic recombination for Fe(+23) has been computed in the non-relativistic approximation, with and without configuration interaction. All possible doubly excited states with n=3-6, and l=0-4 were included in the calculation. The rate of recombination for this manifold of states was found to be insensitive to the effects of configuration interaction, although contributions from any given LS symmetry were changed by as much as 40%.

704,600
PB84-107036 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin Polarization by Selective Laser-Induced Interference.
Final rept.
G. Alber, and P. Zoller. Mar 83, 4p
Pub. in Physical Review A 27, n3 p1713-1716 Mar 83.

Keywords: *Polarization(Spin alignment), *Photoionization, *Atomic energy levels, Excitation, Reprints, *Laser induced autoionization.

States behaving like autoionizating states can be selectively induced by laser radiation into one of the continuum spin channels in the photoionization of polarized excited alkali atoms. As a result of destructive or constructive interference between the direct ionization channel and those introduced by the dressing laser radiation, the cross section of this specific spin component is completely suppressed or enhanced, while leaving the other spin channel unaffected. The q parameter which determines the line shape of the Fano-type resonance can be resonantly tuned as a function of the dressing laser frequency.

704,601
PB84-107101 Not available NTIS
National Bureau of Standards, Washington, DC.
Observation of Ionization of Laser Excited Sodium Atoms by Synchrotron Radiation.
Final rept.
J. M. Bizau, F. Wuilleumier, P. Dhez, D. L. Ederer, J. L. Picque, J. L. Le Gouet, and P. Koch. 1982, 16p
Pub. in Proceedings of Conference on Laser Techniques Extreme Ultraviolet Spectroscopy held at Boulder, Colorado on March 8-12, 1982, Paper in Laser Techniques for Extreme Ultraviolet Spectroscopy 90, n2 p331-346 1982.

Keywords: *Photoionization, *Atomic energy levels, *Synchrotron radiation, Excitation, Electronic spectra, Ionization, Absorption spectra, *Laser enhanced ionization, *Sodium atoms, Autoionization.

In a triple, orthogonal crossed beam experiment, the authors have studied photoionization of excited Na atoms. Monochromatized synchrotron radiation from the ACO storage ring provided the photoionizing radiation. A cylindrical mirror electron spectrometer was used to measure photoelectron spectra. Decay of autoionizing resonances to the 2psup5 ionic channel were observed.

704,602
PB84-107135 Not available NTIS
National Bureau of Standards, Washington, DC.

Transport of Small Molecules in Polymers.
Final rept.
A. Peterlin. 1983, 37p
Pub. in Controlled Drug Delivery, Volume 1: Basic Concepts, Chapter 2, p15-51 1983.

Keywords: *Membranes, *Transport properties, Nuclear magnetic resonance, Permeability, Diffusion, Absorption, Sorption, Reprints, *Crystalline polymers.

The article is intended to survey the field treated in the book 'controlled drug delivery' edited by S.D. Bruck. It covers the transport properties of the half space, plane, cylindrical and spherical membrane. A chapter is devoted to biological membranes which may be approximated by a trilayer membrane. The crystalline structure requires some modifications due to the fact that the transport takes place though the amorphous component while the crystalline lamellae act as obstacles to the transport. The theory of the transport properties is based on the fractional free volume concept. The measurements are partially based on the sorption transient and on the steady state transport. The sorption maybe followed by the weight gain or loss and by the optical absorption. The diffusivity is deduced from the sorption, steady state transport and from the decay of the spin echo in a plsed magnetic gradient NMR.

704,603
PB84-107176 Not available NTIS
National Bureau of Standards, Washington, DC.
Atomic Physics of Negative Ions: A Report on the U.S.-Mexico Joint Workshop.
Final rept.
T. J. Morgan. 1983, 7p
Pub. in Comments on Atomic and Molecular Physics 12, n5-6 p319-326 1983.

Keywords: *Atomic physics, *Ion beams, *Meetings, Hydrogen, Plasmas(Physics), Nuclear fusion, Reprints, *Negative ions.

A workshop on the Atomic Physics of Negative Ions was held recently in Galindo, Mexico. Forty physicists from six countries participated, and twenty-six invited presentations reviewed the field. This report summarizes the motivation for such a workshop and outlines some of the highlights.

704,604
PB84-107192 Not available NTIS
National Bureau of Standards, Washington, DC.
Fixed Points for Pressure Metrology.
Final rept.
V. E. Bean. 1983, 22p
Sponsored in part by Applied Science Publishers Ltd., London (England).
Pub. in Chapter 3 in High Pressure Measurement Techniques, p93-124 1983.

Keywords: *Phase transformations, *Fixed points(Mathematics), *Metrology, *High pressure tests, Reprints.

This is Chapter 4 of the reference book Practical High Pressure Measurement, G.N. Peggs, Editor. The chapter is a review of the experimental research on high pressure fixed points and contains a summary table of 'best' values. An appendix contains a list of phase transitions that have not yet been carefully characterized but may have potential as fixed points in the future. 134 references.

704,605
PB84-109883 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Ozone Reactions in Aqueous Solutions: A Bibliography.
Final rept.
F. Westley. Aug 83, 24p NBS-SP-655
Library of Congress catalog card no. 83-600538.

Keywords: *Ozone, *Reaction kinetics, *Solutions, Chemical reactions, Bibliographies, Oxidation, Catalysis, *Chemical reaction mechanisms.

A reaction oriented list of references is provided for published papers and reports containing rate data or information on mechanism for reactions of ozone with various substrates in aqueous solutions. Catalyzed, as well as uncatalyzed, reactions are included. One hundred and sixty-four papers are listed. The period covered extends from 1913 to 1981.

704,606
PB84-115039 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Library Div.
Discovery of Heavy Hydrogen and Heavy Water.
Internal rept.
C. P. Saylor. Oct 83, 11p NBSIR-83-2778

Keywords: *Deuterium, *Heavy water, Hydrogen isotopes, Separation.

This report is a brief account prepared by request of Walter Weinstein for Dr. C. P. Saylor some years prior to his death in April 1982. It has been carefully reviewed by several present and former staff members, including former NBS scientis, Dr. F. G. Brickwedde, who participated with Dr. Harold C. Urey and others in the experiments and events described by Saylor. In his review Dr. Brickwedde, now Evans Pugh Research Professor of Physics emeritus at Pennsylvania State University, stated that 'Dr. Saylor's paper covers an important part of the history of the discovery of deuterium that is not so well known ... and contains information important for the chemical historian.

704,607
PB84-115849 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 88, Number 4, July-August 1983.
Bi-monthly rept.
Aug 83, 65p
See also PB84-115856 through PB84-115872 and Volume 88, Number 3, PB84-115799. Library of Congress catalog card no. 63-37059.

Keywords: *Research projects, Laboratory equipment, Density(Mass/volume), Dielectric properties, Pressure, Standards, Cryogenics, Pipe flow, Solids flow, Pressure gages.

Contents:
- Apparatus for density and dielectric constant measurements to 35 MPa on fluids of cryogenic interest;
- An intercomparison of pressure standards between the Istituto di Metrologia 'G. Colonnetti' and the National Bureau of Standards;
- Analysis of liquid flow-induced motion of a discrete solid in a partially filled pipe.

704,608
PB84-115856
(Order as PB84-115849, PC **A04**/MF **A01**)
National Bureau of Standards, Boulder, CO.
Apparatus for Density and Dielectric Constant Measurements to 35 MPa on Fluids of Cryogenic Interest.
W. M. Haynes, and N. V. Frederick. 11 Mar 83, 12p
Included in Jnl. of Research of the National Bureau of Standards, v88 n4 p241-252, Jul-Aug 83.

Keywords: *Laboratory equipment, *Density(Mass/volume), *Dielectric properties, *Fluids, Cryogenics, Liquefied natural gas, Mixtures, Archimedes' principle.

An apparatus has been developed for simultaneous measurements of fluid densities and dielectric constants at temperatures from 70 to 320 K and at pressures to 35 MPa. A magnetic suspension technique, based on an application of Archimedes' principle, is employed in the density determination, while a concentric cylinder capacitor is used for obtaining the dielectric constant data. The apparatus can be used not only for determining densities and dielectric constants of compressed gases and liquids (including mixtures), but for saturated liquid and vapor properties as well. Also included is the capability for acquiring liquid-vapor equilibrium data for mixtures.

704,609
PB84-122704 PC **A09**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Hydrogen Sulfide Provisional Thermophysical Properties from 188 to 700 K at Pressures to 75 MPa.
R. D. Goodwin. Oct 83, 177p NBSIR-83-1694
Sponsored in part by Gas Research Inst., Chicago, IL.Portions of this document are not fully legible.

Keywords: *Hydrogen sulfide, *Thermophysical properties, Pressure, Physical properties, Equations of state, Vapor pressure, Density(Mass/volume), Computer programs, Tables(Data), Compressibility, Enthalpy, Entropy, Specific heat, Joule-Thompson effect, Virial coefficients.

Thermophysical properties of hydrogen sulfide are derived from physical properties data by using our nonanalytic equation of state, and are tabulated along isobars at integral temperatures. Results include vapor pressures, orthobaric densities, the second virial coefficient, the equation of state, the ideal gas state functions, compressibility factors, densities, derivatives of the P(rho,T) surface, heats of vaporization, internal energies, enthalpies, entropies, specific heats, fugacity coefficients, speeds of sound, and the Joule-Thomson inversion. Thermofunctions by another author are compared with present results.

704,610
PB84-133529 Not available NTIS
National Bureau of Standards, Washington, DC.
Transport Properties of Ground State Nitrogen Atoms.
Final rept.
J. C. Rainwater, L. Biolsi, K. J. Biolsi, and P. M. Holland. 1 Aug 83, 7p
Pub. in Jnl. of Chemical Physics 79, n3 p1462-1468, 1 Aug 83.

Keywords: *Atomic energy levels, *Nitrogen, *Transport properties, Viscosity, Potential energy, Reprints, *Atom atom interactions, *Nitrogen atoms.

Transport properties of dilute monatomic gases depend on the two body atom-atom interaction potential. When two ground state ((4)S) nitrogen atoms interact, they can follow any of four potential energy curves corresponding to the N2 molecule; the X 1sup sigma(+) sub g, A 3sup sigma(+) sub g, 5sup sigma(+) sub g, and 7sup sigma(+) sub u curves. The collision integrals are compared with results obtained in previous studies.

704,611
PB84-133545 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Excited, State Detected Calcium-Rare Gas Collisional Energy Transfer: Ca(4s5p (1)P(1)) Spin Changing and Ca(4s5p (3)P(1)) Fine Structure Changing Cross Sections.
Final rept.
M. O. Hale, and S. R. Leone. 1 Oct 83, 11p
Pub. in Jnl. of Chemical Physics 79, n7 p3352-3362, 1 Oct 83.

Keywords: *Calcium, *Rare gases, *Energy transfer, Cross sections, Electron energy, Atomic energy levels, Spin orbit interactions, Excitation, Fluorescence, Reprints, *Laser induced excitation, *Laser induced fluorescence, *Molecule molecule interactions, Fine structure.

Pulsed dye laser excitation along with time and wavelength-resolved fluorescence detection techniques are used to measure cross sections for state changing collisions of Ca(4s5p singlet P sub 1) and Ca(4s5p triplet P sub 1) with the rare gases He, Ne, Ar, Kr, and Xe. The results are discussed in terms of the competing effects of velocity and interaction strengths on the curve crossing probabilities.

704,612
PB84-134956 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanism of the Reaction of Oxygen Atoms, O((3)P) with Dimethyl Disulfide.
Final rept.
D. L. Singleton, R. S. Irwin, and R. J. Cvetanovic. 1983, 7p
Pub. in Canadian Jnl. of Chemistry 61, n5 p968-974 1983.

Keywords: *Reaction kinetics, Atomic energy levels, Chemical reactions, Sulfur organic compounds, Reprints, *Chemical reaction mechanisms, *Methane sulfonic acid/thio-(methyl-ester), Methane thiosulfonate, Methane/thio.

The mechanism of the reaction of ground state oxygen atoms, O(triplet P), with CH3SSCH3 was studied by analysis of the final products. The only detected product was CH3S(O2)SCH3, which accounted for close to 70% of the oxygen atoms reacted. The results are consistent with the primary reaction O3 + CH3SSCH3 yields CH3SO + CH3S. The effect of small amounts of CH3SH and H2S on the yields of CH3S(O)2SCH3 and the products formed provide further information on the nature of the secondary chemistry. A comprehensive reaction mechanism has been proposed.

704,613
PB84-134964 Not available NTIS
National Bureau of Standards, Washington, DC.
Adsorption and Dissociation of Methyl Isocyanide on Rh(111).
Final rept.
S. Semancik, G. L. Haller, and J. T. Yates. 1 Jun 83, 12p
Pub. in Jnl. of Chemical Physics 78, n11 p6970-6981, 1 Jun 83.

Keywords: *Adsorption, *Dissociation, Surface chemistry, Nitrogen organic compounds, Reprints, *Isocyanide/methyl, *Electron energy loss spectroscopy.

High resolution electron energy loss spectroscopy and thermal desorption measurements have been used to characterize the interaction of methyl isocyanide with the surface of a Rh(111) crystal. Studies have included adsorption at 120 K as well as investigation of thermally-induced changes that occur in the overlayer.

704,614
PB84-134972 Not available NTIS
National Bureau of Standards, Washington, DC.
Invariant Formulation of Multicomponent Diffusion in Crystals.
Final rept.
J. W. Cahn, and F. C. Larche. 1983, 6p
Pub. in Scripta Metallurgica 17 p927-932 1983.

Keywords: *Crystals, *Diffusion, Potential energy, Reprints.

The authors give a phenomenological formulation of multicomponent diffusion in crystalline solids that is consistent with their ability to use the lattice as a reference frame and their inability to define chemical potentials of individual chemical potentials, and has some invariances with respect to specie relabelling.

704,615
PB84-134998 Not available NTIS
National Bureau of Standards, Washington, DC.
Location of Internal Hydrogen Atoms in the Paradodecatungstate Polyanion by Neutron Diffraction.
Final rept.
H. T. Evans, and E. Prince. 13 Jul 83, 2p
Pub. in Jnl. of the American Chemical Society p4838-4839, 13 Jul 83.

Keywords: *Neutron diffraction, *Crystal structure, Anions, Reprints, *Hydrogen atoms, *Dodecatungstate.

In previous chemical, x-ray diffraction, and nmr studies, it had been inferred that the paradodecatungstate polyanion, (H2W12O42)(-10) contained two internal hydrogen atoms. A neutron diffraction study of the ammonium salt (NH4)5H2W12O42:4H2O was undertaken in order to get direct confirmation of this observation and to determine the configuration of the anion complex.

704,616
PB84-135060 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Photon Stimulated Dissociation of Gas Phase, Solid, and Chemisorbed Water.
Final rept.
D. E. Ramaker. 1983, 10p
Pub. in Chemical Physics 80 p183-202 1983.

Keywords: *Water, *Vapor phases, *Solid phases, *Chemisorption, Dissociation, Adsorption, Photoionization, Hydrogen bonds, Excitation, Atomic energy levels, Reprints, Photon stimulated desorption, *Electron stimulated desorption.

Recent ESD/PSD data for H2O in the condensed phase and chemisorbed on GaAs(110) and Ti(001) are interpreted utilizing previously published photoemission, electron coincidence, and Auger data along with theoretical calculations. Comparison with fragmentation data from the gas phase indicates that only two hole-one electron type states are effective for desorption in condensed or molecularly chemisorbed hydrogen bonded water. The core level PSD spectrum from solid D2O is also interpreted. All of the results are found to be comparable to previously reported results for CO.

704,617
PB84-135086 Not available NTIS
National Bureau of Standards, Washington, DC.
Large Final-State Effects in the Core-Level Electron Energy Loss Spectra of Vanadium at Low Incident Electron Energies.
Final rept.
C. J. Powell, and N. E. Erickson. 4 Jul 83, 4p
Pub. in Physical Review Letters 51, n1 p61-64, 4 Jul 83.

Keywords: *Chromium, *Titanium, *Vanadium, *Atomic energy levels, Excitation, Electron energy, Reprints, *Electron energy loss spectroscopy, Threshold effects(Electron energy).

The authors have observed large final-state effects in the 3p, 3s, and 2p electron energy-loss spectra of Ti, V, and Cr as the incident electron energy was reduced from 1500 eV to about 20-50 eV above the core threshold. Changes in the line-shapes for the onset of 2p (3/2) excitation and changes in measured threshold energies for 2p (3/2), 3s, and 3p excitation are largely manifestations of the transition from sudden to adiabatic excitation. They also observe strong excitations due to exchange effects in the 3p spectra at low incident energies.

704,618
PB84-135094 Not available NTIS
National Bureau of Standards, Washington, DC.
Diffusion of Ethyl Acetate Vapor in Strained Low Density Polyethylene.
Final rept.
J. C. Phillips, and A. Peterlin. Nov 83, 8p
Pub. in Polymer Engineering and Science 23, n13 p735-742 Nov 83.

Keywords: *Polyethylene, *Diffusion, Desorption, Transport properties, Ethyl acetate, Vapor pressure, Reprints, Low density polyethylene.

At a fixed vapor pressure p of the penetrant and constant temperature of the experiment, the sorption S = c/p or concentration c of the ethylacetate vapor in the uniaxially strained low density polyethylene (LDPE) increases most rapidly at low strains.

704,619
PB84-135920 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of the Heat Capacity of Molybdenum (Standard Reference Material) in the Range 1500 to 2800 K by a Pulse Heating Technique.
Final rept.
A. Cezairliyan. 1983, 13p
Pub. in Int. Jnl. Thermophys. 4, n2 p159-171 1983.

Keywords: *Molybdenum, *Specific heat, High temperature tests, Reprints, Standard reference materials.

Measurement of the heat capacity of molybdenum (Standard Reference Material 781 of the National Bureau of Standards) in the temperature range 1500 to 2800 K by a subsecond-duration, pulse-heating technique is described.

704,620
PB84-136001 Not available NTIS
National Bureau of Standards, Washington, DC.
Relative Quantum Yield of I*(doublet P 1/2) in the Tunable Laser UV Photodissociation of i-C3F7I and n-C3F7I: Effect of Temperature and Exciplex Emission.
Final rept.
J. E. Smedley, and S. R. Leone. 15 Sep 83, 9p
Contract NAG1-170
Pub. in Jnl. of Chemical Physics 79, n6 p2687-2895, 15 Sep 83.

Keywords: *Iodine, *Atomic energy levels, Dissociation, Photochemical reactions, Temperature, Infrared spectroscopy, Lasers, Reprints, Laser spectroscopy, Sun pumped lasers, Iodine lasers.

Wavelength-specific relative quantum yields of I* from pulsed laser photodissociation of i-C3F7I and n-C3F7I in the range 265-336 nm are determined by measuring the time-resolved infrared emission (lambda = 1.315 micrometers) from the atomic I((doublet P (1/2)) yields (doublet P (3/2))) transition. The quantum yields of I* from i-C3F7I and n-C3F7I are constant and appear to be unity from 265-298 nm but decrease to 0.57 and 0.40, respectively, at 336 nm. The lower quantum yields suggest the existence of two distinct bands in this region of the absorption continua. To determine the quantum yields a correction is made for enhanced emission due to formation of exciplexes between I* and the parent (i- or n-C3F7I) species. The exciplex emission increases linearly with parent gas pressure, but decreases with increases temperature. For both molecules the integrated absorption in the long wavelength region (>290 nm stet) increases substantially with temperature, while at selected wavelengths the quantum yields are found to remain constant. The results are discussed in terms of the development of solar-pumped iodine lasers.

704,621
PB84-136019 Not available NTIS
National Bureau of Standards, Washington, DC.
Radical Species in Silane Discharges.
Final rept.
R. Robertson, D. Hils, H. Chatham, and A. Gallagher. 15 Sep 83, 3p
Sponsored in part by Solar Energy Research Inst., Golden, CO.
Pub. in Applied Physics Letters 43, n6 p544-546, 15 Sep 83.

Keywords: *Silanes, Mass spectroscopy, Density(Mass/volume), Reprints, Free radicals.

SiH sub n radical densities at the surface of discharges in silane-Ar mixtures have been measured by low-energy, electron-collisional ionization and mass spectrometer detection of SiH sub n (+1). The principal radical seen at the substrate surface of a dc-proximity discharge is SiH3.

704,622
PB84-136035 Not available NTIS
National Bureau of Standards, Washington, DC.
Collisional Dependence of Spectral Line Shapes in CO2 at Low Pressures.
Final rept.
R. Roy, D. S. Elliott, D. Meschede, F. M. Pipkin, and S. J. Smith. 1983, 12p
Grant PHS-PHY79-04928
Pub. in Proceedings of International Conference on Spectral Line Shapes (6th) Held at Boulder, CO. on July 12-16, 1983, 2, p651-662 1983.

Keywords: *Carbon dioxide, Low pressure tests, Line width, Vibrational spectra, Rotational spectra, *Raman spectroscopy.

The shape of the nu sub 1 symmetry stretch line of CO2 has been studied as a function of gas pressure using stimulated Raman gain spectroscopy with a resolution of approximately 20 MHz. At low pressures (10 Torr) the shape of the line leads to a new value of the ground state rotational constant B(000) = 0.390168(2)/cm. At high pressures a pronounced collisional narrowing occurs. Velocity changing collisions and Q-branch collapse may both be present in a statistically interdependent way not yet treated in the theoretical literature.

704,623
PB84-136050 Not available NTIS
National Bureau of Standards, Washington, DC.
Resonance Broadening of the Sodium D Lines.
Final rept.
J. Huennekens, and A. Gallagher. 1983, 14p
Grant NSF-PHY79-04928
Pub. in Proceedings of International Conference on Spectral Line Shapes (6th) Held at Boulder, CO. on July 12-16, 1983, 2, p665-678 1983.

Keywords: *Sodium, *Line width, Vapor phases, Resonant frequency, Excitation, Fluorescence, *Laser spectroscopy, Laser induced fluorescence, Fine structure.

Sodium vapor, in the density range 10 to the 13th power -5 x 10 to the 14th power cc m was excited by a cw dye laser, tuned 20-140 GHz from either the D1 or D2 resonance line. We observed the three peak scattered spectrum, consisting of the Rayleigh component at the laser frequency, and the two fluorescence components (direct and sensitized) at the atomic resonance-line frequencies. Asymmetry in the Rayleigh scattering, as a function of detuning, was also observed, due to interference between the two fine structure levels. In addition, the measured intensity ratio of the D-lines combined with pulsed measurements of the effective radiative decay rate in the presence of radiation trapping yields the fine structure collisional mixing cross section. The results are compared to other experiments and to theory.

704,624
PB84-136076 Not available NTIS
National Bureau of Standards, Washington, DC.
Recombination Effects in Autoionization.
Final rept.
S. L. Haan, and G. S. Agarwal. 1983, 20p
Grant NSF-PHY79-04928
Pub. in Proceedings of International Conference on Spectral Line Shapes (6th) Held at Boulder, CO. on July 12-16, 1983, p1013-1032 1983.

Keywords: *Emission spectra, Fluorescence, Recombination reactions, Photoelectric emission, Photoelectrons, Reprints, *Autoionization.

Effects of the radiative decay of the unperturbed free-electron continuum on autoionization are investigated using the Moller operator approach. Results for photoelectron and photoemission spectra beyond the usual pole approximation are presented. The modifications of Fano profiles and various spectra due to the recombination are discussed. The authors found that the minimum in the Fano profiles is restored if the q values corresponding to the initial and final states are equal.

704,625
PB84-136274 Not available NTIS
National Bureau of Standards, Washington, DC.
Pre-Existing Polarization and Influence of Electrode Material on PVF2 Electrets as Determined by Thermal Pulse and Pyroelectric Methods.
Final rept.
S. B. Lang, A. S. DeReggi, F. I. Mopsik, and M. G. Broadhurst. Oct 83, 5p
See also AD-A132 896. Sponsored in part by Army Research Office, Arlington, VA., and Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Allied Physics 54, n10 p5598-5602 Oct 83.

Keywords: *Electrets, Electrodes, Polarization(Charge separation), Reprints, *Vinylidene fluoride polymers, Thermal pulse method, Pyroelectric effect.

A number of polyvinylidene fluoride (PVF2) electrets were prepared with different permutations of gold and aluminum electrodes and poled with DC field up to 160 MV/m at room temperature. Polarization distributions were measured by the thermal pulse method and pyroelectric coefficients were determined. Quantitative measurements were made of a significant level of polarization in nominally unpoled PVF2 and a contact electrification mechanism was proposed. No consistent effects of electrode materials on polarization distribution were found. PVF2 poled at room temperature has its highest polarization near the center of the thickness in contrast to the results on samples poled at elevated temperatures and cooled inhomogeneously with the field applied.

704,626
PB84-136308 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron and Photon Stimulated Desorption: Benefits and Pitfalls.
Final rept.
T. E. Madey, D. L. Doering, E. Bertel, and R. Stockbauer. 1983, 12p
See also AD-A128 239.
Pub. in Ultramicroscopy 11, p187-198 1983.

Keywords: *Chemisorption, *Surface chemistry, Electrons, Photons, Desorption, Molecular structure, Excitations, Impurities, Electron irradiation, Reprints, *Electron stimulated desorption, *Photon stimulated desorption, Electron stimulated desorption ion angular distributions.

Electron beam irradiation of solids often results in damage-producing events along with information-producing events. In the present paper the authors explore mechanisms of beam damage in solids, as well as examples of the benefits of electron (and photon) stimulated processes to study molecules at surfaces. The method of Electron Stimulated Desorption Ion Angular Distributions (ESDIAD) has proven particularly useful in characterizing local molecular structure at surfaces in the absence of long range order; recent measurements of bonding configurations stabilized by impurities or by lateral interactions are discussed. Photon stimulated desorption (PSD) studies using synchrotron radiation are providing new insights into fundamental electronic excitation processes at surfaces. Mechanisms for the excitation and desorption of ions are examined (valence, shallow core level and deep core level excitations), and examples include ion desorption from adsorbed monolayers, as well as ion formation and desorption processes in condensed molecular films.

704,627
PB84-136316 Not available NTIS
National Bureau of Standards, Washington, DC.
Low Temperature Ordering of Sodium Overlayers on Ru(001).
Final rept.
D. L. Doering, and S. Semancik. 1983, 15p
Pub. in Surface Science 129, p177-191 1983.

Keywords: *Sodium, *Surface chemistry, *Adsorption, Ruthenium, Alkali metals, Transition metals, Chemical bonds, Reaction kinetics, Molecular structure, Reprints, *Low energy electron diffraction.

The adsorption of alkali metals on transition metals can produce several technologically important effects, but only limited results have been reported on the geometrical structure of such adlayers, especially for adsorption temperatures below 300K. The authors have examined the adsorption of Na on Ru(001) as a function of coverage and temperature using LEED to determine the adlayer structure and thermal desorption spectroscopy to characterize binding kinetics and relative Na coverages.

704,628
PB84-136324 Not available NTIS
National Bureau of Standards, Washington, DC.
Small-Angle X-ray Study of Particulate Reinforced Composites.
Final rept.
W. L. Wu. Dec 82, 6p
Pub. in Polymer 23, p1907-1912 Dec 82.

Keywords: *Composite materials, *X ray analysis, *Particulate composites, Correlation, Reprints, *Small angle scattering, *Microvoids.

Small-angle X-ray scattering technique can be used to quantify the microvoids structure within a particulate reinforced composite. An expression for the correlation function of three-phase systems has been derived in terms of the correlation function of the individual phases. By using this expression and the scattered intensities from the damaged and the undamaged composites; it has been show that the volume fraction and the chord length of the microvoids can be obtained, provided no damage occurs to the reinforcement particles. In cases where the microvoids are preferentially oriented within the composites, an approximation scheme based on a linear transformation method has also been developed to measure the aspect ratio of the microvoids provided the volume fraction of these microvoids is much smaller than the other two phases.

704,629
PB84-136332 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystallographic Changes Characterizing the Curie Transition in Three Ferroelectric Copolymers of Vinylidene Fluoride and Trifluoroethylene: 2. Oriented or Poled Samples.
Final rept.
A. J. Lovinger, T.Furukawa, G. T. Davis, and M. G. Broadhurst. Oct 83, 7p
Pub. in Polymer 24, p1233-1239 Oct 83.

Keywords: *Crystal structure, *Ferroelectric crystals, *Phase transformation, Copolymers, Fluorine organic compounds, X ray diffraction, Piezoelectric crystals, Pyroelectricity, Reprints, *Vinylidene fluoride polymers, *Ethylene/trifluoro.

The effects of uniaxial drawing or poling on the structural changes involved in the ferroelectric-to-paraelectric phase transition in copolymers of vinylidene fluoride and trifluoroethylene were examined and compared to the behavior of as-crystallized films. Contrary to the previously described behavior of a 52/48 mol% copolymer, orientation did not induce any significant changes in the structure of these copolymers or in its variation with temperature, primarily because these already crystallize directly from the melt in well-ordered, compact unit cells. The Curie temperature was found to exhibit hysteresis between heating and cooling parts of the thermal cycle, to extend over a broad range of temperatures, and to involve intramolecular changes to the same disordered conformation found in melt-crystallized samples. The results have allowed reasonable implications to be made concerning the existence and nature of a Curie transition in the piezoelectric beta-phase of poly (vinylidene fluoride).

704,630
PB84-136357 Not available NTIS
National Bureau of Standards, Washington, DC.
Far Wing Radiation from Atom-Molecule Collisions.
Final rept.
A. Gallagher. 1983, 13p
Grant NSF-PHY79-04928
Pub. in Proceedings of International Conference Spectral Line Shapes (6th) Held at Boulder, CO. on July 12-16, 1983, 2, p755-767 1983.

Keywords: *Line width, *Line spectra, Nitrogen, Hydrogen, Excitation, Energy transfer, Collision integral, Molecular vibration, *Atom molecule interactions, *Sodium atoms, Atom atom interactions.

The study of collisional lineshapes has concentrated so far on atom-atom collisions, especially on elastic atom-atom collisions. In the present talk the author would like to discuss how the theory of line-wing shapes and atom-atom collisions can be expanded to the topic of atom-molecule collisions. The author will then go on to discuss the particular example that he is studying in the laboratory, which is the electronic-to-vibrational energy transfer process of an excited sodium atom colliding with nitrogen or hydrogen molecules. The discussion of this example should bring out both the strengths and difficulties encountered in applying the collisional theory of lineshapes to the atom-molecule collisions.

704,631
PB84-136365 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Field Fluctuations in Nonlinear Absorption.
Final rept.
D. S. Elliott, R. Roy, and S. J. Smith. 1983, 10p
Contract DOE-EA-77-A-01-6010
Pub. in Proceedings of International Conference on Spectral Line Shapes (6th) Held at Boulder, CO. on July 12-16, 1982, 2, p989-998 1983.

Keywords: *Laser beams, Electrooptics, Frequency modulation, Bandwidth, Nonlinear systems, Line width, Atomic absorption, Acoustooptics.

A technique for producing statistically characterized fluctuations on initially monochromatic (well-stabilized) laser beam is described. Acousto-optic and electro-optic modulators are used to produce linewidths of up to 35 MHz FWHM and controlled wings to CTRL + W) GHz from line center. The lineshapes produced may be fully Lorentzian, or may have essentially Gaussian characteristics beyond designated cutoff points in the wings. The system is being developed for studies of the role of fluctuations in nonlinear atomic absorption processes.

704,632
PB84-136449 Not available NTIS
National Bureau of Standards, Washington, DC.
Final State Symmetry for the n=2 States in Photoionized Helium Determined by Theory and Experiment.
Final rept.
J. M. Bizau, F. L. Wuilleumier, P. Dhez, D. Ederer, T. N. Chang, S. Krummacher, and V. Schmidt. 1 Mar 82, 4p
Pub. in Physical Review Letters 48, n9 p588-591, 1 Mar 82.

Keywords: *Photoionization, Photoelectrons, Helium, Reprints, *Helium ions.

Experiment and theory have been used to determine the final-state symmetry for the n = 2 state in photoionized helium. The angular asymmetry parameter beta has been measured as a function of photon energy by means of angle-resolved photoelectron spectroscopy.

704,633
PB84-136993 Not available NTIS
National Bureau of Standards, Washington, DC.

Photoelectron Asymmetry Parameters and Branching Ratios for Sulfur Dioxide in the Photon Energy Range 14-25 eV.
Final rept.
D. M. P. Holland, A. C. Parr, and J. L. Dehmer. 1983, 7p
Sponsored in part by Office of Naval Research, Arlington, VA., Department of Energy, Washington, DC., and North Atlantic Treaty Organization.
Pub. in Jnl. of Electron Spectroscopy and Related Phenomena 32, p237-243 1983.

Keywords: *Sulfur dioxide, Photoionization, Fluorescence, Reprints, *Photoelectron spectroscopy.

Triply differential photoelectron spectroscopy has been performed in the photon energy range 14-25 eV for sulfur dioxide. The results are presented in the form of electronic branching ratios and asymmetry parameters, and rediscussed briefly in the context of similar data for CO2 and of the inner-shell spectra of SO2.

704,634
PB84-137009 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystallographic Changes Characterizing the Curie Transition in Three Ferroelectric Copolymers of Vinylidene Fluoride and Trifluoroethylene: 1. As-Crystallized Samples.
Final rept.
A. J. Lovinger, T. Furukawa, G. T. Davis, and M. G. Broadhurst. Oct 83, 8p
Pub. in Polymer 24, p1225-1232 Oct 83.

Keywords: *Crystallography, *Curie temperature, Fluorine organic compounds, Copolymers, Ferroelectric crystals, X ray diffraction, Crystal structure, Reprints, *Vinylidene fluoride polymers, *Ethylene/trifluoro.

Copolymers of vinylidene fluoride/trifluoroethylene of molar composition 65/35, 73/27 and 78/22% respectively, are ferroelectric and undergo a Curie transition to the paraelectric state at high temperatures. The Curie transitions were found to occur over a broad temperature range, encompassing about 30C, and in the case of the 78/22 mol% copolymer to extend into the melting region; they were also found to exhibit hysteresis by occurring at much lower temperatures upon cooling than upon heating.

704,635
PB84-137041 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Impurities on Positive Streamer Propagation in n-Hexane.
Final rept.
R. E. Hebner, E. F. Kelley, G. J. FitzPatrick, and E. O. Forster. Oct 83, 9p
Pub. in Proceedings of 1983 Annual Report Conference of Electrical Insulation and Dielectric Phenomena Held at Buck Hill Falls, PA. on October 16-20, 1983, p26-34 Oct 83.

Keywords: *Hexane, *Impurities, *Electric discharges, *Electrical faults.

This extended abstract of an oral presentation describes some effects of electrode spacing and chemical purity on the propagation of prebreakdown streamers in n-hexane. One impurity used was dimethyl aniline, a material with low ionization potential, which produced a more hemispherical streamer than was observed in a pure fluid. In addition, the DMA also suppressed the transition to faster propagation modes. The ASA-3, an antistatic additive which reduces the low frequency conductivity, had little effect on the streamer propagation.

704,636
PB84-137058 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamic Coupled-Column Liquid Chromatographic Determination of Ambient Temperature Vapor Pressures of Polynuclear Aromatic Hydrocarbons.
Final rept.
W. J. Sonnefeld, W. H. Zoller, and W. E. May. Feb 83, 6p
Pub. in Analytical Chemistry 55, n2 p275-280 Feb 83.

Keywords: *Aromatic polycyclic hydrocarbons, *Vapor pressure, Temperature, Organic compounds, Reprints, High performance liquid chromatography.

A method is described for the direct coupling of a gas saturation system to a high-performance liquid chromatograph for the determination of the vapor pressure of organic compounds in the range of 100 - .000001 Pa. The method has been used to determine the vapor pressures of selected polynuclear aromatic hydrocarbons in the ambient temperature range between 10 and 50C. These values are generally in good agreement with values extrapolated from determinations made at higher temperatures reported in the literature.

704,637
PB84-137066 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of the Viscosity of Compressed Gaseous and Liquid Nitrogen + Methane Mixtures.
Final rept.
D. E. Diller. 1982, 13p
Pub. in Int. J. Thermophys. 3, n3 p237-249 1982.

Keywords: *Viscosity, *Nitrogen, *Methane, Mixtures, Compressibility, Performance evaluation, Density(Mass/volume), Liquid phases, Vapor phases, Reprints.

The shear viscosity coefficients of three compressed gaseous and liquid nitrogen + methane mixtures have been measured at temperatures between 100 and 300 K and at pressures to about 30 MPa (4350 psia) with a piezoelectric quartz crystal viscometer. The measurements have been compared with an extended corresponding states model, previously proposed for calculating the viscosities of fluid mixtures. Differences between the measured and calculated viscosities are discussed.

704,638
PB84-137090 Not available NTIS
National Bureau of Standards, Washington, DC.
Gravity-Induced Density and Concentration Profiles in Binary Mixtures Near Gas-Liquid Critical Lines.
Final rept.
R. F. Chang, J. M. H. Levelt Sengers, T. Doiron, and J. Jones. 15 Sep 83, 9p
Pub. in Jnl. of Chemical Physics 79, n6 p3058-3066, 15 Sep 83.

Keywords: *Density(Mass/volume), *Equations of state, *Binary systems, *Critical point, Carbon dioxide, Ethane, Helium 3, Helium 4, Azeotropes, Vapor phases, Liquid phases, Reprints.

The authors have calculated gravity-induced density and concentration gradients using scaled equations of state fashioned after that of Leung and Griffiths for binary mixtures near gas-liquid critical lines. The mixtures considered here are those of helium-3 and helium-4 and of carbon dioxide and ethane. Their calculations show that the density profiles for all mixtures are similar to those of pure fluids. On the other hand, the concentration profiles may vary greatly from one mixture to another depending on the type of mixture and its composition. Moreover, the temperature at which a mixture separates into two phases is slightly different from that expected for the mixture in the absence of gravity. The authors have also examined the case where a mixture is subjected to a large gravitational field and found that, although the density gradient is unremarkable in all the mixtures, the concentration gradients in the mixtures of carbon dioxide and ethane have complex features related to the presence of critical azeotropy.

704,639
PB84-137124 Not available NTIS
National Bureau of Standards, Washington, DC.
Revised 3p sup 6 3d sup 8 sup 1 S sub 0 Level of Sr XIII, Y XIV, Zr XV, Nb XVI and Mo XVII.
Final rept.
J. Reader, and A. Ryabtsev. Sep 83, 2p
Pub. in Jnl. of the Optical Society of America 73, n9 p1207-1208 Sep 83.

Keywords: *Atomic energy levels, *Molybdenum, *Niobium, *Strontium, *Yttrium, *Zirconium, Ions, Spectrochemical analysis, Reprints.

Following an observation by Wyart Phys. Scr. 26, 114 (1982), we have revised the position of the 3p sup 6 3d sup 8 Singlet S sub 0 level in Sr XIII, Y XIV, Zr XV, Nb XVI, and Mo XVII and have redetermined the 3p sup 6 3d sup 8 energy.

704,640
PB84-137132 Not available NTIS
National Bureau of Standards, Washington, DC.
Characterization of Thermally-Produced Metastable Excited-State Atomic Species Using Resonance Ionization Mass Spectrometry.
Final rept.
J. D. Fassett, L. J. Moore, J. C. Travis, and F. E. Lytle. 1983, 16p
Pub. in International Jnl. of Mass Spectrometry Ion Processes 54, p201-216 1983.

Keywords: *Atoms, *Iron, *Nickel, *Molybdenum, *Rhenium, Excitation, Metastable state, Reprints, *Resonance ionization mass spectroscopy, *Laser spectroscopy, Thermal vaporization.

Resonance ionization mass spectrometry (RIMS) has been used to study atom plumes produced by thermal vaporization. Experimental results are presented for the elements Fe, Ni, Mo and Re. Ion intensity vs. laser wavelength spectra consistently demonstrate that low-level energy states are significantly populated in the interaction volume of the mass spectrometer. The experimental results are explained by assuming a Boltzmann distribution of states for atoms leaving the heated surface. Since collisional relaxation does not occur in the high-vacuum thermal atom source and the transitions from the excited state to ground state are not radiatively allowed, the Boltzmann distribution of states is maintained in the atom plume. Since many elements possess low-level energy states, both spectroscopic sensitivity and selectivity will be reduced. However, the greater number of intense lines per element allows an increased range of elements to be studied by RIMS in a given wavelength region and opens the possibility of multi-element capabilities. The implications for more energetic atomization techniques such as ion sputtering or laser ablation are discussed.

704,641
PB84-137744 Not available NTIS
National Bureau of Standards, Washington, DC.
Bulk and Interface Thermodynamics of Polymer Alloys.
Final rept.
I. C. Sanchez. 1983, 26p
Pub. in Annual Review of Materials Science 13, p387-412 1983.

Keywords: *Thermodynamics, *Polymers, *Interfacial tension, Equations of state, Mixtures, Critical temperature, Phase transformation, Reprints, Spinodal decomposition.

In this review attention is focused on the thermodynamic aspects of polymer alloys (blends) in the liquid state. Three general areas are reviewed: phase behavior, phase separation by spinodal decomposition, and interfacial properties. Only physical blends of homopolymers are considered: alloys involving block or graft copolymers are not reviewed. A major conclusion of this review is that theoretical developments are in general slightly ahead of the experiments. The experimental areas that seem to be lagging behind include measurements of the: phase behavior of oligomeric mixtures, thermodynamic and kinetic parameters that govern spinodal decomposition, interfacial tension and thickness near a critical temperature, and effects of solvent on interfacial properties. Specific suggestions have been made for experimental studies in these deficient areas.

704,642
PB84-137769 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of the 4d9-4d85p Transitions in Eleven-Times Ionized Barium (Ba XII).
Final rept.
J. Sugar, J. L. Tech, and V. Kaufman. 1983, 3p
Pub. in Jnl. of the Optical Society of America 73, n8 p1077-1079 1983.

Keywords: *Barium, *Atomic energy levels, *Ionization, Excitation, Least squares method, Hartree-Fock approximation, Ions, Ultraviolet spectroscopy, Reprints, *Barium ions.

The spectrum of eleven-times ionized barium was generated in a triggered, high-voltage, vacuum spark and photographed with the National Bureau of Standards 10.7-m grazing-incidence spectrograph. Radial energy integrals were fitted to the observed levels of 4 dsvp 8, and the relative intensities in the array were calculated with fitted eigenvectors. These intensities were in good qualitative agreement with the relative intensities that had been visually estimated on the photographic plate. Least-squares-fitted values for the energy parameters

and their ratios to the calculated Hartree-Fock (HF) values are given.

704,643
PB84-137777 Not available NTIS
National Bureau of Standards, Washington, DC.
Coadsorption and Reaction of H2 and CO Raney Nickel: Neutron Vibrational Spectroscopy.
Final rept.
R. D. Kelley, R. R. Cavanagh, and J. J. Rush. 1983, 5p
Pub. in Jnl. of Catalysis 83, p464-468 1983.

Keywords: *Carbon monoxide, *Hydrogen, *Neutron spectra, *Neutron scattering, Adsorbates, Chemical reactions, Adsorption, Vibrational spectra, Catalysis, Reprints, *Raney nickel catalysts.

Neutron inelastic scattering has been used to monitor adsorbate vibrational modes on Raney nickel. Evidence for a temperature dependent hydrogen/CO intereration is observed. The NIS data indicate that the adsorbed layer present under conditions of substantial (about 50%) conversion of CO to hydrocarbons (450K) is dominated by the same adsorbates which are found under non reactive (300K) conditions.

704,644
PB84-137827 Not available NTIS
National Bureau of Standards, Washington, DC.
High Values of delta K- (sub a) in the Fluorescence of Nitrogen Dioxide and an Improved Fit of Ground State Inertial Constants.
Final rept.
J. L. Hardwick, and W. J. Lafferty. 1983, 10p
Pub. in Jnl. of Molecular Spectroscopy 100, p358-367 1983.

Keywords: *Nitrogen dioxide, Molecular energy levels, Fluorescence, Excitation, Spin orbit interactions, Molecular vibration, Reprints, *Laser induced fluorescence, *Laser spectroscopy, Laser induced excitation.

Fluorescence of nitrogen dioxide excited by the 4545 A line of the Ar(+1) laser has been dispersed and recorded at high resolution. The result is unexpected on the basis of the near-prolate symmetric top description of the molecule and the heretofore presumed lack of large perturbations to these levels of the excited electronic state. A simultaneous fit has been performed of virtual spin-free combination differences of the ground vibrational state of NO2 taken from infrared and microwave spectra. This simultaneous fit yields inertial constants with smaller statistical uncertainty and superior predictive ability than constants dervied from any single spectrum and is able to reproduce the fluorescence line positions to within experimental accuracy.

704,645
PB84-137850 Not available NTIS
National Bureau of Standards, Washington, DC.
Single Collision Ion-Molecule Reactions at Thermal Energy: Rotational and Vibrational Distributions from N(+1) + CO Yields N + CO(+1).
Final rept.
D. R. Guyer, L. Huwel, and S. R. Leone. 1 Aug 83, 13p
Grants NSF-PHY82-00805, NSF-CHE79-11340
Pub. in Jnl. of Physical Chemistry 79, n3 p1259-1271, 1 Aug 83.

Keywords: *Molecular rotation, *Molecular vibration, *Laboratory equipment, *Carbon monoxide, Fluorescence, Reprints, *Ion molecule interactions, *Laser spectroscopy.

A new apparatus is developed and used to obtain nascent vibrational and rotational distributions in the ground electronic state of CO(+1) formed from the charge transfer reaction. This represents a fractional energy disposal into rotation of only 2%. Nearly all of the reaction exothermicity is therefore released into translational recoil. These results are considered in terms of simple dynamical models of the charge transfer process.

704,646
PB84-137868 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of C18 Surface Coverage on Selectivity in Reversed-Phase Liquid Chromatography of Polycyclic Aromatic Hydrocarbons.
Final rept.
S. A. Wise, and W. E. May. Aug 83, 7p
Pub. in Analytical Chemistry 55, n9 p1479-1485 Aug 83.

Keywords: *Aromatic polycyclic hydrocarbons, Surfaces, Separation, Reprints, *Reverse phase liquid chromatography, Liquid chromatography.

Recent studies have reported selectivity differences for polycyclic aromatic hydrocarbons (PAH) on different octadecylsilane (C18) reversed-phase liquid chromatographic column. In this paper the differences in liquid chromatographic selectivity for various C18 columns were correlated with differences in C18 surface coverage data (as determined from elemental analysis and specific surface area measurements on the C18 modified silica). Significant differences in selectivity were observed for selected PAH and polyphenyl arenes on monomeric vs. polymeric C18 materials. Selectivity factors for 50 PAH, alkyl-substituted PAH, polyphenyl arenes, and polycylic aromatic sulfur heterocycles were determined on columns from the same manufacturer from seven different lots of C18 material with different C18 surface concentrations. In addition to providing information concerning the contribution of C18 surface coverage to retention and selectivity in the LC separation of these compounds, these studies provide useful information regarding the selection of the appropriate column to optimize the separation of selected polycylic aromatic compounds.

704,647
PB84-137876 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron and X-Ray Diffraction Study on Polymorphism in Lithium Orthotantalate Li3TaO4.
Final rept.
M. Zocchi, M. Gatti, A. Santoro, and R. S. Roth. 1983, 11p
Pub. in Jnl. of Solid State Chemistry 48, p420-430 1983.

Keywords: *Neutron diffraction, *X ray diffraction, *Polymorphism, Low temperature tests, Revisions, Reprints, *Lithium tantalates.

The structures of the low-and high-temperature modifications of lithium orthotantalate, Li3TaO4, have been determined by neutron and x-ray diffraction methods. Its structure can be generated from the low-temperature modification by means of a complex pattern of shifts of the Ta(+5) ions.

704,648
PB84-137900 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Dependent Ferroelectric Hysteresis Study in Polyvinylidene Fluoride.
Final rept.
R. B. Olsen, J. C. Hicks, M. G. Broadhurst, and G. T. Davis. Jul 83, 3p
See also AD-A 132675.
Pub. in Applied Physics Letters 43, n1 p127-129, Jul 83.

Keywords: *Ferroelectric materials, *Hysteresis, Temperature, Fluorine organic compounds, Coercive force, Reprints, *Vinylidene fluoride polymers.

A joint experimental and theoretical study of temperature dependent ferroelectric hysteresis phenomena of polyvinylidene fluoride is presented. The temperature dependence of the remanent polarization and coercive field was measured from saturated ferroelectric (D versus E) hysteresis curves with a temperature range from 60C to 130C. This data was then compared to a 2-site and 6-site ferroelectric switching model.

704,649
PB84-138304 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface-Enhanced Raman Spectroscopy of N-Methylpyridinium Cation and Pyridine: Identification of Surface Species.
Final rept.
K. A. Bunding, R. A. Durst, and M. I. Bell. 1983, 10p
Pub. in Jnl. of Electroanalytical Chemistry 150, p437-446 1983.

Keywords: *Raman spectroscopy, *Pyridines, *Cations, *Surface chemistry, Nitrogen organic compounds, Anions, Samples, pH, Potential energy, Electrochemistry, Reprints, *Pyridinium/N-methyl, *Surface enhanced raman spectroscopy.

In this paper are described the results of a series of experiments undertaken to clarify the role of the anion in surface-enhanced Raman scattering (SERS) measurements involving the N-methylpyridinium cation (NMP(+1)) and to identify the actual surface species observed in such experiments. The authors have studied the effects of varying the anion, pH and electrochemical potential, have performed competition experiments in which both pyridine and (NMP(+1)) were present in the electrolyte and have compared the ordinary Raman spectrum of the solid silver-pyridine complex, Ag(py)2NO3, with the various SER spectra obtained. By these experiments, we have demonstrated that different pyridine (NMP(+1)) species are responsible for the observed spectra. In addition, it appears that surface-induced and/or photochemical reactions may produce species not originally present in the sample solution. Consequently, care must be exercised in the assignment of SER bands to sample components without consideration of possible decomposition to other species capable of producing SERS.

704,650
PB84-138312 Not available NTIS
National Bureau of Standards, Washington, DC.
Reaction Products from a Discharge of N2 and H2S. The Microwave Spectrum of NH2SH.
Final rept.
F. J. Lovas, R. D. Suenram, and W. J. Stevens. 1983, 16p
Pub. in Jnl. of Molecular Spectrscopy 100, p316-331 1983.

Keywords: *Spectrochemical analysis, *Microwave spectra, Nitrogen organic compounds, Deuterium compounds, Isotopic labeling, Molecular structure, Dipole moments, Reprints, *Hydroxylamine/thio, Molecular conformation.

Thiohydroxylamine has been identified as one of the reaction products from the discharge reaction of N2 + H2S. Both cis and trans-conformers have been observed. The rotational spectra have been studied from 56 GHz to 170 GHz for the normal species and several deuterated isotopic species of each conformer. The electric dipole moments of both conformers have been determined. Ab initio calculations using a 4-31G basis set both with and without polarization functions have been carried out to aid in the analysis and to provide a final structural comparison with the microwave results.

704,651
PB84-138320 Not available NTIS
National Bureau of Standards, Washington, DC.
Reaction of F Atoms with Nitromethane. Vibrational Spectra of the Addition Complex and of the Nitromethyl Free Radical.
Final rept.
M. E. Jacox. 4 Aug 83, 10p
Pub. in Jnl. of Physical Chemistry 87, n16 p3126-3135, 4 Aug 83.

Keywords: *Vibrational spectra, *Nitromethane, Chemical reactions, Infrared spectroscopy, Hydrogen bonds, Photolysis, Reprints, *Matrix isolation techniques, *Free radicals, *Fluorine atoms.

When the products of the reaction between F atoms formed in a microwave discharge and CH3NO2 are frozen in a large excess of argon at 14 K, new infrared absorptions appear which, with the help of detailed isotopic substitution studies, have been assigned to the nitromethyl free radical. A large fraction of the nitromethyl is hydrogen-bonded to HF trapped in an adjacent site. Analysis of the infrared spectrum for the HF complex indicates that the hydrogen bonding is relatively strong.

704,652
PB84-138387 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Dependence of Dynamic Light Scattering in the Intermediate Momentum Transfer Region.
Final rept.
T. P. Lodge, C. C. Han, and A. Z. Akcasu. 1983, 3p
Pub. in Macromolecules 16, n7 p1180-1183 1983.

Keywords: *Light scattering, *Polystyrenes, Solution, Temperature, Laboratory equipment, Dynamic characteristics, Reprints, Numerical solution.

Dynamic light scattering measurements have been made on dilute solutions of very high molecular weight polystyrenes in cyclohexane at 35.4C, 45.0C, and 55.2C. The temperature dependence of the experimental results is found to be in excellent agreement with the theoretical calculations, although the magnitude of omega(q) at each temperature falls consistent-

ly slightly below (about 15%) the theory, as reported previously for both good solvent and theta conditions.

704,653
PB84-138411 Not available NTIS
National Bureau of Standards, Washington, DC.
Succinonitrile Triple-Point Standard: A Fixed Point to Improve the Accuracy of Temperature Measurements in the Clinical Laboratory.
Final rept.
B. W. Mangum. 1983, 4p
Pub. in Clinical Chemistry 29, n7 p1380-1384 1983.

Keywords: *Temperature measurement, *Clinical medicine, Nitrogen organic compounds, Standards, Performance evaluation, Reprints, *Succinonitrile.

The author reports results of our investigation of the melting and freezing behavior of succinonitrile. The value of the triple-point temperature of succinonitrile was determined to be 58.0805 plus or minus 0.0015C. The use of this material as a temperature fixed point is evaluated and some clinical laboratory applications of this fixed point are proposed.

704,654
PB84-138445 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Conductivity of Crystals: A Molecular Dynamics Study of Heat Flow in a 2-Dimensional Crystal.
Final rept.
R. D. Mountain, and R. A. MacDonald. 15 Sep 83, 4p
Pub. in Physical Review B: Condensed Matter 28, n6 p3022-3025, 15 Sep 83.

Keywords: *Crystal structure, *Heat transmission, *Thermal conductivity, Reprints, *Molecular dynamics, Lennard-Jones potentials.

The authors have studied steady-state heat flow in a 2-dimensional crystal by the method of molecular dynamics. The model system contains 1000 particles on a triangular lattice interacting via the Lennard-Jones potential. The results for the fluid were in good agreement with earlier calculations but for the fcc solid system 16 unit cells in length, k was independent of temperature. To escape the boundary limited regime, the length of the 3-dimensional crystal needs to be increased by a factor of three. It is feasible to simulate a system of this size using modern computers.

704,655
PB84-138452 Not available NTIS
National Bureau of Standards, Washington, DC.
Phase Relations and Properties of Lithium via Molecular Dynamics.
Final rept.
R. G. Munro, and R. D. Mountain. 15 Apr 83, 3p
Pub. Physical Review B: Condensed Matter 28, n4 2261-2263, 15 Aug 83.

Keywords: *Lithium, *Phase diagrams, Chemical properties, Physical properties, Phase transformation, Reprints, *Molecular dynamics.

The phase diagram of lithium in the region 295 < or = T < or = 600 K and O < or = P < or = 12 GPa has been studied theoretically using the recently developed molecular dynamics formalism of Parrinello and Rahman. Excellent agreement between theory and experiment has been obtained for (1) the room temperature bcc-fcc structural phase transition; (2) the temperature dependence of the bcc-fcc phase boundary; (3) the room temperature compression curves for the bcc and fcc phases; and (4) the bcc-liquid melting curve. Additionally, a theoretical prediction has been made for the isobaric thermal expansion from 400 K to 600 K at 5.0 GPa pressure.

704,656
PB84-139120 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Space Charge Shift of Ion Cyclotron Resonance Frequencies.
Final rept.
J. B. Jeffries, S. E. Barlow, and G. H. Dunn. 1983, 18p
Grant NSF-PHY82-00805
Pub. in International Jnl. of Mass Spectrometry 54, p169-187 1983.

Keywords: *Mass spectroscopy, Ion traps(Instrumentation), Antenna radiation patterns, Reprints, *Ion cyclotron resonance mass spectroscopy, Penning effect, Ion density(Concentration).

A theory of ion space charge influence on the observed ion cyclotron resonance frequency in static field ion traps is presented. The dependence of this influence on ion density, ion cloud shape, and trapping geometry is investigated. Four trapping geometries are specifically analyzed: the Penning trap, the cubical ICR cell, the common rectangular ICR cell, and an elongated ICR cell. This treatment is readily extended to other geometries. The theory applies to common situations where the exciting or detecting antennae fields are not homogeneous, and individual particle motions are excited/detected as opposed to center of mass motions.

704,657
PB84-139138 Not available NTIS
National Bureau of Standards, Washington, DC.
Low Density Isochoric (P,V,T) Measurements on (Nitrogen + Methane).
Final rept.
W. M. Haynes, and R. D. McCarty. 1983, 5p
Sponsored in part by Gas Research Inst., Chicago, IL.
Pub. in Jnl. of Chemical Thermodynamics 15, p815-819 1983.

Keywords: *Nitrogen, *Methane, *Binary systems, *Density(Mass/volume), Mixtures, Compressed gas, Comparison, Pressure Volume, Temperature, Reprints, *Isochore, *PVT properties.

Isochoric pressure-volume-temperature measurements have been made on three mixtures of nitrogen and methane (0.29 N2 + 0.71 CH4, 0.50 N2 + 0.50 CH4, 0.68 N2 + 0.32 CH4) at densities between one and six mol.cu dm. The three isochores for each mixture cover a temperature range from approximately 150 to 320 K to a maximum pressure of 16 MPa. Comparisons with other experimental data and with calculated values from an extended corresponding states model are discussed.

704,658
PB84-139153 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of Densities and Dielectric Constants of Liquid Normal Butane from 140 to 300 K at Pressures to 35 MPa.
Final rept.
W. M. Haynes. 1983, 5p
Pub. in Jnl. of Chemical Thermodynamics 15, p801-805 1983.

Keywords: *Butanes, *Liquid phases, *Density(Mass/volume), *Dielectric properties, Temperature, Pressure, Reprints, *Butane, Clausius - Mossotti function.

Results of density and dielectric-constant measurements on compressed liquid normal butane at temperatures from 140 to 300 K and pressures of 36 MPa are reported. Simultaneous measurements of these properties were carried out using a magnetic-suspension densimeter and a concentric-cylinder capacitor. Also presented are computed values of the Clausius - Mossotti function.

704,659
PB84-139161 Not available NTIS
National Bureau of Standards, Washington, DC.
Threshold Behavior for Ionization by Electrons and Positrons.
Final rept.
S. Geltman. 1983, 4p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 16, n17 pL525-L528 1983.

Keywords: *Positrons, *Ionization, Scattering cross sections, Reprints, *Threshold effects (Electron energy), *Coulomb approximation.

The threshold laws for atomic ionization by electron and positron impact are derived in the Coulomb-projected Born approximation, and compared with other theories. There is a very large difference between the resulting threshold forms for electron and positron impact.

704,660
PB84-141613 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Fluorescence Mass Spectroscopy.
Final rept.
D. J. Wineland, J. J. Bollinger, and W. M. Itano. 28 Feb 83, 4p
Pub. in Physical Review Letters 50, n9 p628-631, 28 Feb 83.

Keywords: *Resonant frequency, Mass spectroscopy, Atomic spectroscopy, Fluorescence, Beryllium, Reprints, *Laser fluorescence mass spectroscopy, Laser spectroscopy.

Measurements of ion cyclotron-resonance frequencies in a Penning trap, by a laser fluorescence technique, are described. This technique has been applied to indirect measurements of the proton-to-electron mass ratio and the (9)Be(+1) electron (g sub J) factor.

704,661
PB84-141670 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of Densities and Dielectric Constants of Liquid Propane from 90 to 300 K at Pressures to 35 MPa.
Final rept.
W. M. Haynes. 1983, 6p
Pub. in Jnl. of Chemical Thermodynamics 15, p419-424 1983.

Keywords: *Propane, *Density(Mass/Volume), *Dielectric properties, Reprints, *Liquid propane, Clausius-Mossotti function.

Results of density and dielectric constant measurements on compressed liquid propane are reported. These data cover a temperature range from 90 to 300 K at pressures to 35 MPa. The experimental densities and dielectric constants have been used to compute values for the Clausius-Mossotti function.

704,662
PB84-151547 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of the Viscosity of Compressed Gaseous and Liquid Nitrogen.
Final rept.
D. E. Diller. 1983, 9p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physica 119A, p92-100 1983.

Keywords: *Viscosity, *Nitrogen, *Liquid nitrogen, Shear tests, Reprints, *Compressed gaseous nitrogen, *Compressed liquid nitrogen.

The shear viscosity coefficients of compressed gaseous and liquid nitrogen have been measured with a piezoelectric quartz crystal viscometer at temperatures between 90 and 300 K and at pressures up to 30 MPa (4350 psia). Differences between our measurements, other experimental data, the correlating equation and the extended corresponding states model are discussed.

704,663
PB84-151596 Not available NTIS
National Bureau of Standards, Washington, DC.
Intermediate State in Hydrolysis of Amorphous Calcium Phosphate.
Final rept.
M. S. Tung, and W. E. Brown. 1983, 8p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Calcified Tissue International 35, p783-790 1983.

Keywords: *Hydrolysis, *Calcium phosphates, Solutions, Thermodynamics, Reprints, Apatite.

The hydrolysis of previously prepared amorphous calcium phosphate (ACP) was studied in a solution 'saturated' with ACP; this eliminated the initial consumption of acid due to ACP dissolution. The procedure established that conversion of a high-concentration ACP slurry to an apatite involves two processes. The thermo-dynamic analysis of the solution composition data suggests that ACP converts into a nonstoichiometric apatite when the OCP-like intermediary is formed, and stoichiometric apatite is formed when no OCP-like intermediary is formed, and a stoichiometric apatite is formed when no OCP-like intermediary is involved.

704,664
PB84-151851 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Expansion.
Final rept.
A. F. Clark. Jun 83, 58p
Pub. in Materials at Low Temperatures Chapter 3, p75-132 Jun 1983.

Keywords: *Thermal expansion, *Materials tests, Alloys, Metals, Glasses, Ceramics, Polymers, Composite materials, Reprints.

The thermal expansion behavior of materials at low temperature is reviewed. The tutorial chapter describes the theory, experimental methods, typical data, and sources and applications of data for thermal expansion. Materials covered are metals and alloys, nonmetallic compounds, glasses and ceramics, polymers, and composites.

704,665
PB84-151869 Not available NTIS
National Bureau of Standards, Washington, DC.
Overview of Fluid Thermophysical Property Research at the National Bureau of Standards.
Final rept.
J. F. Ely, and N. A. Olien. Mar 83, 7p
Pub. in Proceedings of Gas Processors Association Convention (62nd), San Francisco, CA, Mar 14-19, 1983 p249-255.

Keywords: *Thermophysical properties, *Fluid mechanics, *Research projects, Standards, Hydrocarbons, Carbon dioxide, Hydrogen, Hydrogen sulfide, Ethylene, Mixtures, High temperature tests, High pressure tests, *National Bureau of Standards.

Accurate fluid property measurements and predictive techniques are essential in high volume fluid processing and metering. A prime example of this importance is that of custody transfer of fluids where uncertainties of a few tenths of one percent in density can translate into millions of dollars of annual billing errors. The Chemical Engineering Science Division and Thermophysics Division of the National Bureau of Standards are currently engaged in a long range program aimed at the development of a general, highly accurate capability for predicting the thermophysical properties of fluid mixture. The program is comprised of an integrated effort in basic fluid theory, benchmark experimental measurements and advanced correlation techniques. Currently, systems of interest include hydrocarbons, carbon dioxide, hydrogen, hydrogen sulfide and ethylene and their mixtures, especially at elevated temperatures and pressures. This presentation will summarize recent results of this program, the current activities and plans for future work.

704,666
PB84-151877 Not available NTIS
National Bureau of Standards, Washington, DC.
Observation of Energy Level Shifts of Rydberg Atoms Due to Thermal Fields.
Final rept.
L. Hollberg, and J. L. Hall. Oct 83, 5p
Contract N00014-77-C-0656, Grant NSF-PHY82-00805
Pub. in Proceedings of Int. Conf. Laser Spectroscopy (6th), Interlaken, Switzerland, June 27-July 1, 1983, p229-232 1983.

Keywords: *Atomic energy levels, *Laser spectroscopy, *Chemical shifts(Nuclear magnetic resonance), Rydberg series, Ramsey fringes.

The authors report the first observation of level shifts of Rydberg states due to their coupling with thermal radiation fields. The Rydberg level positions were measured relative to the atomic ground state using two photon optical Ramsey fringe techniques in an atomic beam apparatus. The level shifts were isolated by chopping the blackbody radiation source. The runs analyzed are consistent with the expected T sup 2 dependence and much data remains to be analyzed.

704,667
PB84-152230 Not available NTIS
National Bureau of Standards, Washington, DC.
Hf-Os Constitution Diagram.
Final rept.
R. M. Waterstrat. 1983, 10p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Less-Common Metals 95, p335-344 1983.

Keywords: *Hafnium compounds, *Osmium intermetallics, *Phase diagrams, Intermetallic compounds, Reprints.

The hafnium-osmium constitution diagram has been determined by metallographic, X-ray diffraction and electron microprobe studies. Three new compounds have been discovered. One of these (eta phase) has a cubic Ti2Ni-type structure, but the other two (zeta and theta phases) have not yet been identified. The eta and zeta phases form by sluggish peritectic reactions which are easily suppressed in cast alloys by formation of the stable CsC1-type (delta phase) dendrites and metastable theta phase. Metastable theta phase, formed in this manner is remarkably stable during solid-state annealing at relatively high temperatures (approximately 1800C), and this can strongly inhibit the formation of the equilibrium eta and zeta phases. A glassy phase was produced by ultra-rapid quenching of the liquid alloy containing approximately 25 at. % Os.

704,668
PB84-152248 Not available NTIS
National Bureau of Standards, Washington, DC.
Relation between the Correction Factor and the Local Slope in Spreading Resistance.
Final rept.
J. Albers. Oct 80, 5p
Pub. in Jnl. of Electro. Chem. Soc. 130, n10 p2076-2080 Oct 80.

Keywords: *Electrical resistance, Correction, Reprints, *Spreading resistance, *Local slope method, *Correction factors, Numerical solution.

Dickey has proposed a technique, known as the local slope method, for the calculation of the correction factor which is used to obtain resistivity profiles from spreading resistance data. The technique is founded upon two asymptotic models for the conduction process involved in the spreading resistance measurement for the cases of (1) conducting layer over an insulating substrate, and (2) a high resistivity layer over a low resistivity, i.e., a conducting substrate. It is shown that the asymptotic models adequately describe the behavior of the correction factor for a thin uniform layer over insulating or conducting boundaries. The local slope results qualitatively follow the multilayer results thus making the technique a usable one for the calculation of approximate correction factors. A comparison of the two correction factor vs local slope relations provides a basis for the behavior of the interpreted resistivities when they are compared with the input resistivities.

704,669
PB84-152453 Not available NTIS
National Bureau of Standards, Washington, DC.
Condensation of PAH (Polycyclic Aromatic Hydrocarbons) during the Soot Formation Process.
Final rept.
J. H. Miller, W. G. Mallard, and K. C. Smyth. 1982, 7p
Pub. in Proceedings of Polynuclear Aromatic Hydrocarbons: International Symposium on Formation, Metabolism and Measurement (7th), held at Columbus OH. on October 26-28, 1982, p921-927.

Keywords: *Aromatic polycyclic hydrocarbons, *Soot, *Condensation, Potential energy, Air pollution, Dispersion relations.

Methods of calculating the dispersive part of the intermolecular potential of biomolecular systems of circularly symmetric polycyclic aromatic hydrocarbons are examined. A new, semi-empirical method is utilized to generate the angle dependent dispersive potentials. These dispersive potentials are summed with the electrostatic potentials which arise from quadrupole-quadrupole interactions, and the resulting total potential is used to predict the angle between the planes of the molecules in the most stable dimer configuration for the homologous series benzene, coronene, and circumcoronene.

704,670
PB84-153063 Not available NTIS
National Bureau of Standards, Washington, DC.
State-Dependent Hyperfine Coupling of HF Studied with a Frequency-Controlled Color-Center Laser Spectrometer.
Final rept.
C. Breant, T. Baer, D. Nesbitt, and J. L. Hall. Oct 83, 6p
Grants N00014-77-C-0656, NSF-PHY82-00805
Pub. in Proceedings of International Conference of Laser Spectroscopy (6th), Interlaken, Switzerland, Jun 27-Jul 1, 1983 p138-143.

Keywords: *Hydrogen fluoride, *Hyperfine structure, Infrared lasers, Near infrared radiation, *Laser spectroscopy, Color center lasers.

The frequency-offset locking technique makes it possible to stabilize a color-center laser (about 2.6 micrometers) to a line width of 1 or 2 kHz while providing a precision frequency-scanning capability. With the high sensitivity afforded by optical heterodyne saturation spectroscopy, we have recorded the complete hyperfine spectrum of HF from R(0) to P(6). Analysis of these hfs data shows dramatic changes of the spin-rotation constants with vibrational excitation, +17% for C(Fluorine) and -3% for C(Hydrogen). Smaller changes are observed for rotational excitation. Theoretical estimates of the changes of hyperfine constants, based on the work of Muenter and Klemperer, are in semiquantitative agreement with our results.

704,671
PB84-153105 Not available NTIS
National Bureau of Standards, Washington, DC.
Inner-Shell Photoemission Studies of Lithium and Sodium Vapour.
Final rept.
S. Krummacher, V. Schmidt, J. M. Bizau, D. L. Ederer, P. Dhez, and F. Wuilleumier. 1982, 12p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 15, p4363-4374 1982.

Keywords: *Lithium, *Sodium, *Vapor phases, *Photoelectric emission, Synchrotron radiation, Far ultraviolet radiation, Photoionization, Atomic energy levels, Reprints, Photoelectron spectroscopy.

The complete electron spectra caused by photoionization of Li and Na vapor in the 1s and 2p shells respectively, have been investigated in the region from 5 eV above threshold up to about twice the binding energy of the ionized electron. Even though the contribution of molecules to the vapor pressure was only of the order of a few per cent, molecular features are found in the experimental spectra with intensities comparable with the atomic structures. The interpretation of all features observed in the spectrum is given. In specific energy regions, where the molecular contributions do not disturb the atomic ones, a detailed study of the fine-structure branching ratio and of the satellite structure accompanying these ionization processes has been made. The results of this investigation are compared with other experimental and theoretical data.

704,672
PB84-153121 Not available NTIS
National Bureau of Standards, Washington, DC.
Associative Ionization in Collisions between Two Na(3P) Atoms.
Final rept.
J. Huennekens, and A. Gallagher. Sep 83, 12p
Grant NFS-PHY82-00805
Pub. in Physical Review A 28, n3 p1276-1287 Sep 83.

Keywords: *Ionization, *Reaction kinetics, Excitation, Atoms, Spatial distribution, Density(Mass/volume), Reprints, *Atom atom interactions, Sodium atoms, Laser enhanced ionization.

The authors have measured the rate coefficient (k = 5.6 x 10 to the -12 power cc/s + or - 37% for associative ionization occurring in collisions between two Na (3P) atoms, by measuring the current resulting from cw-laser excitation of Na vapor. The major source of uncertainty in measurements of this type is in the determination of the number density and spatial distribution of excited atoms. Here we have measured the excited atom density by three methods, and we have studied the spatial distribution of excited atoms in detail. Our rate coefficient at T about 650 K is compared to other experimental results.

704,673
PB84-153139 Not available NTIS
National Bureau of Standards, Washington, DC.
Photolysis of Concentrated Perchloric Acid Solutions.
Final rept.
R. E. Huie, and N. C. Peterson. 1983, 4p
Pub. in Jnl. of Photochemistry 21, p31-34 1983.

Keywords: *Chlorine oxides, *Photolysis, Perchloric acid, Absorption, Reprints, *Chlorine dioxide.

The production of ClO2 after the photolysis of 6 M perchloric acid (HClO4) has been identified on the basis of its absorption spectrum. Using 3 M HClO4, no absorption corresponding to ClO2 was observed, but rather a weaker absorption at around 300 nm attributed to ClO(-1) was identified.

704,674
PB84-153279 Not available NTIS
National Bureau of Standards, Washington, DC.
Chemical Shift Correction to the Knight Shift in Beryllium.
Final rept.
W. M. Itano. 1 Feb 83, 2p
Pub. in Physical Review B 27, n3 p1906-1907, 1 Feb 83.

Keywords: *Beryllium, Liquid phases, Frequency shifts, Nuclear magnetic resonance, Reprints, *Chemical shifts(Nuclear magnetic resonance), *Knight shift, Beryllium ions.

The Knight shift in beryllium has previously been measured to be small and negative, when referred to an aqueous solution of BeCl2 . Theoretical calculations assume a reference consisting of a bare nucleus shielded by the core electrons. Using a recent measurement of the shielded nuclear magnetic moment in free Be(+1) ions and published Hartree-Fock wave functions of Be and Be(+1), it is shown that 20(4) ppm should be added to the experimental shifts in order to compare them with theory. The uncorrected shifts are -25(6) ppm and -10(3) ppm.

704,675
PB84-153287 Not available NTIS
National Bureau of Standards, Washington, DC.
Polarization of Fluorescence Following Molecular Photoionization.
Final rept.
E. D. Poliakoff, J. L. Dehmer, D. Dill, A. C. Parr, K. H. Jackson, and R. N. Zare. 6 Apr 81, 4p
Pub. in Physical Review Letters 46, n14 p907-910, 6 Apr 81.

Keywords: *Photoionization, *Fluorescence, *Polarization(Charge separation), Dipole moments, Reprints, *Nitrogen ions.

With use of the Beta sup 2 Sigma sub u sup (+1) state of N2(+1) as an example, this Letter presents the first measurements demonstrating that fluorescence from molecular ions formed by photoionization is partially polarized. Furthermore, it is shown that the degree of polarization reflects the alignment of the molecular ion and the ratio of the dipole strengths for the degenerate channels producing the ionic state. The wavelength-dependent measurements are compared with both quantum mechanical and classical calculations. Temperature-dependent effects are predicted.

704,676
PB84-153295 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Conductivity of Normal Hydrogen.
Final rept.
H. M. Roder. 1983, 8p
Pub. in Proceedings of Thermal Conductivity 17, Gaithersburg, MD, June 15-18, 1981, p257-264 1983.

Keywords: *Thermal conducitivity, *Hydrogen, Isotherms.

The paper presents new experimental measurements of the thermal conductivity of normal hydrogen for eight isotherms from 78 to 300 K with pressures to 70 MPa, i.e., a total density range of 0 to 40 mol/L. The data set is represented with an equation which is based in part on an existing correlation of the dilute gas. The data are compared to the experimental measurements of others through the new correlation. It is estimated that the overall uncertainty of both experimental and correlated thermal conductivity is 1.5 percent.

704,677
PB84-153303 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements and Data for Carbon Dioxide in the Near Critical and Supercritical Region.
Final rept.
J. F. Ely, and N. A. Olien. Apr 83, 4p
Pub. in Proceedings of Int. School Hydrocarbon Measurement (58th), Norman, OK, Apr 12-14, 1983, p146-149.

Keywords: *Carbon dioxide, *Critical point, *Thermophysical properties, Oil recovery, Equations of state, Mixtures, Tables(Data), Enhanced recovery.

Large-scale use of carbon dioxide in enhanced oil recovery and supercritical extraction processes has given rise to a need for accurate thermophysical properties of this fluid and its mixtures. This is also true for metering associated with CO2 pipelines. Due to the proximity of the critical point of CO2 to ambient temperatures (304 K or 88F), most engineering models are not of sufficient accuracy to be used in this custody transfer calculation. The capability of modeling the behavior and properties of CO2 and its mixtures in the extended critical region is essential to the development of efficient and scalable supercritical processes. An accurate model or equation of state does not presently exist. To overcome some of these problems a consortium of industrial companies has been formed to sponsor research at the National Bureau of Standards on near critical CO2 mixtures. This paper outlines the general problem being addressed at NBS and the anticipated results of the program.

704,678
PB84-153311 Not available NTIS
National Bureau of Standards, Washington, DC.
Prediction of Transport Properties. 2. Thermal Conductivity of Pure Fluids and Mixtures.
Final rept.
J. F. Ely, and H. J. M. Hanley. Feb 83, 8p
See also PB82-152471.
Pub. in Ind. Eng. Chem. Fund. 22, n1 p90-97 Feb. 1983.

Keywords: *Transport properties, *Fluids, *Thermal conductivity, Mixtures, Binary systems, Critical point, Alkenes, Aromatic compounds, Cycloalkane hydrocarbons, Reprints, Numerical solution.

A technique for the prediction of the thermal conductivity of nonpolar pure fluids and mixtures over the entire range of PVT states is presented. The model is analogous to the extended corresponding states viscosity model reported previously by Ely and Hanley in 1981. Calculations for the thermal conductivity require only critical constants, molecular weight, Pitzer's acentric factor and the ideal gas heat capacity as a function of temperature for each mixture component as input. Extensive comparisons with experimental data for pure fluids and nonpolar binary fluid mixtures including paraffins, alkenes, aromatics, and naphthenes with molecular weights to that of C24 are presented. The average absolute deviation between experiment and prediction is less than seven percent for both pure species and mixtures.

704,679
PB84-153337 Not available NTIS
National Bureau of Standards, Washington, DC.
Triply Differential Photoelectron Studies of the Four Outermost Valence Orbitals of Cyanogen.
Final rept.
D. M. P. Holland, A. C. Parr, D. L. Ederer, J. B. West, and J. L. Dehmer. 1983, 14p
Pub. in International Jnl. of Mass Spectrometry and Ion Physics 52, p195-208 1983.

Keywords: *Cyanogen, *Synchrotron radiation, *Photoelectrons, Reprints, Autoionization.

Photoelectron measurements, differential in incident wavelength, photoelectron energy and photoelectron ejection angle, have been performed on cyanogen, C2N2, from threshold to a photon energy of 24 eV, using synchrotron radiation. The results are presented in the form of photoionization branching ratios and photoelectron angular distributions, including vibrationally resolved results for the outermost orbital, 1(pi sub g). Some evidence for resonant processes is observed and discussed within the framework of recent work on related molecules. However, reliable assignments require further theoretical guidance with regard to the location and identifies of possible shape resonances and autoionizing intravalence transitions in the C2N2 spectrum.

704,680
PB84-153345 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of High Resolution Fourier Transform and Diode Laser Spectra of the Nu (sub 9) Band of Ethane.
Final rept.
L. Henry, A. Valentin, W. J. Lafferty, J. T. Hougen, V. M. Devi, P. P. Das, and K. N. Rao. 1983, 10p
Pub. in Jnl. of Molecular Spectroscopy 100, p260-289 1983.

Keywords: *Ethane, Hamiltonian functions, Molecular rotation, Aerospace environment, Planetary atmospheres, Reprints, *Laser spectroscopy, *Fourier transform spectroscopy.

Fourier transform measurements with an apodized apparatus function of 0.002/cm and an absolute accuracy of 0.0002/cm for isolated lines are reported for the nu (sub 9) band (e sub 9 u) of ethane in the 12 micrometer region, together with an integrated band strength obtained from intensity measurements on selected Q branch lines recorded using a diode laser spectrometer. Since the nu sub g band falls in an atmospheric window, these data may be useful in studies of the ethane concentration in the atmosphere of Jupiter and other outer planets.

704,681
PB84-153378 Not available NTIS
National Bureau of Standards, Washington, DC.
Critical Behavior in Fluids and Fluid Mixtures.
Final rept.
J. M. H. Levelt Sengers, G. Morrison, and R. F. Chang. 1983, 26p
Pub. in Fluid Phase Equilibria 14, p19-44 1983.

Keywords: *Critical point, *Fluids, Mixtures, Thermodynamics, Ethylene, Butanes, Reprints.

The authors introduce the concepts of universality, critical exponents, scaling laws, 'field' and 'density' variables, 'strong' and 'weak' directions. Experimental evidence for the presence of nonclassical critical behavior in fluids and fluid mixtures is presented. A scaled thermodynamic potential represents the thermodynamic data of steam, ethylene and isobutane accurately. It is valid up to 1.07 T(c), and + or - 30% from rho sub c. Methods for joining it to an analytic equation are discussed. The generalization to a nonclassical description of fluid mixtures is described, and applications are given. The engineer may require the nonclassical description in custody transfer, design of supercritical power cycles and supercritical extraction. The classical approach is used here to explain peculiarities of dilute mixtures recently reported by several experimenters.

704,682
PB84-153626 Not available NTIS
National Bureau of Standards, Washington, DC.
Decay of the Spin Echo in a Pulsed Magnetic Field Gradient NMR.
Final rept.
A. Peterlin. Nov 83, 24p
Pub. in Makromolekuare Chemie 184, p2377-2390 Nov 83.

Keywords: *Nuclear magnetic resonance, *Melts, *Polyethylene, Diffusion coefficients, Reprints, *Spin echoes.

The additional attenuation of the spin echo of a pulsed magnetic field gradient NMR caused by this gradient is calculated for a time dependent diffusion coefficient as it seems to occur in a polymer melt. The cases of a constant D (sub 0), of an exponential decay with time, and an abrupt drop from D (sub 0) to zero at time T (sub 0) are considered. In all cases the time dependence of the experimentally observed attenuation is less steep than that of D.

704,683
PB84-153675 Not available NTIS
National Bureau of Standards, Washington, DC.
Finite-Field SCF Calculations of the Dipole Polarizabilities of Heavy Atoms Using Relativistic Effective Potentials.
Final rept.
W. J. Stevens, and M. Krauss. 1983, 12p
Pub. in Jnl. of Physics B Atomic and Molecular Physics 16, p2921-2930 1983.

Keywords: *Dipoles, *Polarization(Charge separation), Spin orbit interactions, Reprints, *Self consistent field wave functions, *Relativistic effects, *Heavy atoms, Numerical solution.

The static dipole polarizabilities of Xe, Lu, Hg(+1), Hg, Tl, and At have been determined from finite-field SCF calculations within a valence-electron relativistic effective potential formalism. The results suggest that self-consistent inclusion of spin-orbit coupling is far more important for the particle states than for the hole states.

704,684
PB84-154616 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamics of Solid and Fluid Surfaces.
Final rept.
J. W. Cahn. 1979, 21p
PUb. in Proceedings of ASM Seminar Interfacial Segregation, Chicago, IL., Oct 22-23, 1977, Chapter 1 in Segregation to Interfaces, p3-23 1979.

Keywords: *Thermodynamics, *Solids, *Fluids, *Surfaces, Grain boundaries, Phase rule, Eutectics, Adsorption, Gradients, Metals.

The thermodynamics of planar solid and fluid surfaces is re-examined. A new notation is developed in which surface excess quantities are expressed as determinants and as such as obviously invariant to arbitrary choices of what constitutes a surface-affected region. The notation is generalized to interfaces such as grain boundaries in which the same phase occurs on both sides. A Gibbs adsorption equation, augmented by solid state terms, surface stress and torque is derived. It leads to twelve Maxwell-type relations, nine of which are new, among surface variables. The Gibbs adsorption equation is also extended to systems containing more than two phases. Rigorous equations for surface quantities along isosteres and along critical curves are also given. Gradient thermodynamics is briefly discussed.

704,685
PB84-154673 Not available NTIS
National Bureau of Standards, Washington, DC.
Rb and Cs Broadening of the Na Resonance Lines.
Final rept.
B. Kamke, W. Kamke, K. Niemax, and A. Gallagher. Oct 83, 10p
Grant NSF-PHY79-04928
Pub. in Physical Review A 28, p2254-2263 Oct 83.

Keywords: *Line width, *Sodium, *Rubidium, *Cesium, Reaction kinetics, Fluorescence, Density(Mass/volume), Diffusion, Reprints, *Molecule molecule interactions, *Line broadening, *Collision broadening.

The broadening of the Na resonance lines, due to collisions with Rb and with Cs, has been measured using the normalized fluorescence-intensity method of Chatham, Lewis, and Gallagher. Several Na resonance-radiation diffusion and absorption corrections were necessary in the Rb case, due to an unavoidable excess of Na density in the Rb vapor. The leading dipole-dipole long-range dispersion forces for the Na-Rb and Na-Cs interactions are calculated, and used in the impact theory formula to obtain theoretical line-broadening rate coefficients. These are in very poor agreement with the measurements, indicating that as suggested by Vadla the higher order dispersion terms are also important at the very long range responsible for this line-broadening.

704,686
PB84-154921 Not available NTIS
National Bureau of Standards, Washington, DC.
Shape Factors in Facilitated Transport Through Membranes.
Final rept.
R. D. Noble. Feb 83, 7p
Pub. in Industrial and Engineering Chemistry Fundamentals, 22, n1 p138-144 Feb 83.

Keywords: *Membranes, *Cylindrical bodies, Transport properties, Flux density, Chemical equilibrium, Reprints.

The steady-state flux of permeate is calculated for spherical and cylindrical membrances by use of a nonvolatile carrier to facilitate transport under two limiting conditions, reaction equilibrium and reaction-limited conditions. This result is used in conjunction with similar results for flat-plate membranes to obtain a shape factor for each geometry. The shape factor demonstrates the limits of transport in spherical and cylindrical membranes compared to flat plate membranes of equivalent thickness under identical conditions. For reaction equilibrium, the shape factor is found to depend only on geometry. For the reaction-limited or 'frozen' condition, the shape factor is a function of transport and kinetic properties as well as geometry. The results can be used to predict the change in facilitated flux of the volatile species with a change in geometry. Since experimental flux measurements are often performed in flat membrances, the results of this work can be combined with experimental results to predict the total flux obtained in a tubular or a spherical configuration.

704,687
PB84-154939 Not available NTIS
National Bureau of Standards, Washington, DC.
Nonlinear Noise Fields and Strongly Driven Atomic Transitions.
Final rept.
P. Zoller, and J. Cooper. 1 Oct 83, 8p
Grant NSF-PHY82-00805
Pub. in Physical Review A 28, n4 p2310-2317 Oct 83.

Keywords: *Atomic energy levels, *Stark effect, Absorption spectra, Nonlinear systems, Reprints, Fokker-Planck equations.

A theory of the interaction of an atom with an intense nonlinear (nonGaussian) noise field is developed, emphasizing the connection with the underlying physics of laser coherence. The authors point out the possibility of obtaining exact solutions for the stochastically averaged atomic density matrix in terms of (matrix) continued fractions for a large class of nonlinear noise fields by generalizing the techniques developed by Risken and coworkers to solve nonlinear Fokker-Planck equations. As an example, they discuss the absorption spectrum of an atom strongly driven by noisy phase locked radiation.

704,688
PB84-154947 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure of a Binary Mixture under Shear: Non-Newtonian Effects from Computer Simulation.
Final rept.
H. J. M. Hanley, D. J. Evans, and S. Hess. 1 Feb 83, 7p
Pub. in Jnl. of Chemical/Physics 78, n3 p1440-1446, 1 Feb 83.

Keywords: *Binary systems, *Shear properties, *Fluids, Reprints, Molecular dynamics.

A binary equimolar dense fluid mixture is subjected to a shear. The orientational distribution of particles of type i around particle of type j (i,j=1,2) and the distortion of the radial distribution function is discussed for planar Couette flow. Results are presented in terms of a mixture of soft spheres, for which one species differs substantially in size and mass from the other, simulated on the computer using the technique of homogeneous shear nonequilibrium molecular dynamics. Transport coefficients, including those associated with normal pressure differences, are given for mixture and for the species in the mixture. Non-Newtonian phenomena are observed.

704,689
PB84-154988 Not available NTIS
National Bureau of Standards, Washington, DC.
Electronic Structure of UH, UF, and Their Ions.
Final rept.
M. Krauss, and W. J. Stevens. 1983, 9p
Pub. in Jnl. of Computational Chemistry 4, n2 p127-135 1983.

Keywords: *Uranium fluorides, Angular momentum, Hartree-Fock approximation, Ions, Reprints, *Electronic structure, *Uranium atoms, *Uranium hydrides, Self consistant field wave functions.

A relativistic effective core potential (REP) has been generated for the uranium atom and used in self-consistent-field calculations of the lambda states of UH, UF, and their ions. Energy curves were calculated at the base configuration level which insures the dissociating atoms are described by Hartree-Fock wavefunctions. The electronic bonding of these molecules is found to be similar to that of comparable alkaline-earth hydrides and fluorides. The uranium 6p, 6d, and 5f orbitals retain their atomic character but the orbitals extend into the bonding region and are distorted by overlap repulsion and electrostatic effects. Non the less the atomic energetic coupling determines that low energy states will have the maximum spin multiplicity and maximum orbital angular momentum projection consonant with the charge-transfer bonding.

704,690
PB84-155332 PC **A08**/MF **A01**
Washington Univ., St. Louis, MO. Thermodynamics Research Lab.
Definition of Recommended Values of Certain Thermodynamic Properties for the Ketones.
Final rept.
B. D. Smith, and O. Muthu. Jan 84, 170p NBSIR-84-2811
Contract NB80-NADA-1047
Sponsored in part by National Science Foundation, Washington, DC.

Keywords: *Thermodynamic properties, *Ketones, Vapor pressure, Density(Mass/volume), Equations of state, Melting point, Boiling point, Critical point, Heat vaporization, Virial coefficients.

Experimental data for the vapor pressure, liquid density, second virial coefficient, and certain compound constants for the ketones were retrieved in a comprehensive sweep of the literature. The vapor pressure and liquid density data were subjected to an intensive selection-deletion process to identify the best available experimental data points for each compound. Those data were carefully correlated with reliable equations in order to put the selected data into a form convenient for use in computer data banks. The second virial coefficient data were not subjected to such an intensive evaluation process; that predictive correlation equation which provided the best overall representation of the literature data sets for each compound was chosen for use in the data bank. Values of the compound constants were selected subject to the requirement that those constants related to the vapor pressure and liquid density be consistent with the selected correlations for those properties. Whenever possible, the parameters for the best available equations of state are provided. The correlation equations can be used to provide tabulations of vapor pressure, saturated liquid density, second virial co-efficients, heat of vaporization, and saturated vapor volume to the extent permitted by the available good experimental data.

704,691
PB84-161892 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Review of Supercritical Fluid Extraction.
Technical note.
J. F. Ely, and J. K. Baker. Dec 83, 77p NBS-TN-1070
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Supercritical flow, *Fluids, *Extraction, Reviews, Reaction kinetics, Chromatographical analysis, Industrial plants, Phase transformations, Chemical equilibrium, Chemical industry, Separation, Critical point, Fuels, *Supercritical fluid extraction.

During the past ten years there has been intense interest in the application of dense gas separation techniques to various chemical processing problems. An example is known as supercritical fluid extraction. The purpose of this report is to summarize various aspects of supercritical fluid extraction including a definition of the phenomena, current industrial applications, technical difficulties and, where possible, the identification of areas where further research would be of value. In addition, processing aspects which impact on the cost effectiveness of supercritical fluid extraction are considered. Current research which bears upon the development of supercritical fluid extraction is presented and recommendations for certain high risk research activities are summarized. In addition, a brief review of supercritical fluid chromatography is presented and chemical kinetics in supercritical phases are briefly discussed.

704,692
PB84-183599 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Characterization of Organometallic Polymers by Chromatographic Methods and Nuclear Magnetic Resonance. Part 2.
Rept. for 1 Oct 82-30 Sep 83.
E. J. Parks, W. F. Manders, R. B. Johannesen, and F. E. Brinckman. Feb 84, 56p NBSIR-83-2802
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.

Keywords: *Chromatographic analysis, *Polymers, *Nuclear magnetic resonance, *Metal containing organic compounds, *Chemical analysis, *Coatings, Spectrochemical analysis, Tin organic compounds, Samples, Isotopic labeling, Molecular weight, *Chemical reaction mechanisms, Slow release chemicals.

Continuing research into the analytical methodology for characterization of organometallic polymers (OMPs) has produced improved methods of characterization by size exclusion chromatography (SEC) and Fourier transform nuclear magnetic resonance (FTNMR). Molecular weight (MW) and MW dispersion (MWD), as well as the amount of tin associated with fractions of various MW can now be reliably determined by SEC coupled with various detectors: differential refractive index (delta RI), ultra-violet (UV), and graphite furnace atomic absorption (GFAA) spectroscopy. Configurational sequencing in terms of both tacticity and sequencing of monomer units can be determined by FTNMR, as well as certain tin-containing impurities. Removal of tributyltin groups to produce a metal-free copolymer allows much more informative FTNMR spectra to be obtained. All of the polymers examined are approximately 80 percent racemic (r) and 20 percent meso (m) in tacticity (i.e., predominantly syndiotactic). The growing chain end in the copolymer adds either of the monomer units approximately in proportion to its instantaneous concentration in the mixture (i.e., at random).

704,693

PB84-216951 Not available NTIS
National Bureau of Standards, Washington, DC.
Relation between Two-Probe and Four-Probe Resistances on Nonuniform Structures.
Final rept.
J. Albers, and H. Berkowitz. Feb 84, 7p
Pub. in Jnl. of the Electrochemical Society, v131 n2 p392-398 Feb 84.

Keywords: *Probes, *Electrical resistance, Electrochemistry, Spreading, Separation, Calibrating, Reprints, Numerical solution.

A general relation between the two-probe resistance (spreading resistance) and the four-probe resistance on nonuniform structures is derived. Numerical techniques are presented and discussed for the evaluation of these equations for nonuniform structures. The relation between the four-probe resistance, Z(x,S), and the incremental sheet resistance, R(x), is shown to arise in the limit as the probe spacing becomes large compared to the distance to an insulating boundary. Specific examples are drawn from calculations on implant-type structures into substrates having insulating boundaries near the end of the implanted region (junction isolation) as well as those where the insulating boundary is far from the implanted region (emulating the back surface of a same conductivity type substrate). Also presented is a method for the self-consistent calibration of spreading resistance profiles utilizing Z(x,S).

704,694

PB84-217009 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Collision-Induced Translation-Rotation Spectra; H2-He.
Final rept.
G. Birnbaum, S. Chu, A. Dalgarno, L. Frommhold, and E. Wright. Feb 84, 10p
Pub. in Physical Review (Section) A: General Physics, v29 n2 p595-604 Feb 84.

Keywords: *Hydrogen, *Helium, *Molecular rotation, Absorption spectra, Dipole moments, Reprints, Ab initio calculations, Numerical solution.

An adiabatic quantal theory of spectral line shapes in collision-induced absorption and emission is presented which incorporates the induced translation-rotation and translational-vibration spectra. The generalization to account for the anisotropy of the scattering potential is given. Calculations are carried out of the collision-induced absorption spectra of He in collisions with H2 using ab initio electric dipole functions and realistic potentials. The anisotropy of the interaction potential is small and is not included in the calculations. The predicted spectra are in satisfactory agreement with experimental data though some deviations occur which may be significant. The rotational lines shapes have expoential wings and are not Lorentzian. The connection of the quantal and classical theories is written out explicitly for the isotropic overlap induction.

704,695

PB84-217140 Not available NTIS
National Bureau of Standards, Washington, DC.
Collision-Induced Far-Infrared Absorption Band of Gaseous Methane in the Region 30-900/cm.
Final rept.
G. Birnbaum, L. Frommhold, L. Nencini, and H. Sutter. 9 Sep 83, 5p
Pub. in Chemical Physics Letters, v100 n3 p292-296, 9 Sep 83.

Keywords: *Methane, *Infrared spectroscopy, *Molecular rotation, Dipole moments, Line width, Reprints, Dimers.

The collision-induced rotational band of CH4 has been measured at 195K from about 30 to 900/cm. These results have been analyzed with a quantum mechanical line shape which show that this spectrum can be understood on the basis of octupole and hexadecapole induced dipoles. However, this analysis has revealed the role of bound and predissociating dimers in the spectrum.

704,696

PB84-217157 Not available NTIS
National Bureau of Standards, Washington, DC.
Collision-Induced Dipoles of Rare Gas Mixtures.
Final rept.
G. Birnbaum, M. Krauss, and L. Frommhold. 15 Mar 84, 6p
Pub. in Jnl. of Chemical Physics, v80 n6 p2669-2674, 15 Mar 84.

Keywords: *Rare gases, *Dipole moments, Mixtures, Absorption spectra, Hartree-Fock approximation, Helium, Argon, Neon, Krypton, Reprints, Ab initio calculations, Numerical solution.

New ab initio calculations of the collision-induced dipole moment of the rare gas systems He-Ar, Ne-Kr and Ar-Kr are obtained on the basis of a molecular Hartree-Fock treatment. With these and recent potential functions the spectral moments and line shapes of collision-induced absorption spectra are computed. Agreement with existing measurements is observed for the first time for the systems Ne-Ar and Ne-Kr.

704,697

PB84-217181 Not available NTIS
National Bureau of Standards, Washington, DC.
Coexistence and Spinodal Curves in Directionally Bonded Liquids Using the Four-Cluster Approximation.
Final rept.
E. Bodegom, and P. H. E. Meijer. Feb 84, 8p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Chemical Physics, v80 n4 p1617-1624 Feb 84.

Keywords: *Phase diagrams, *Binary systems(Materials), *Liquid phases, Chemical bonds, Clustering, Anisotropy, Reprints.

The authors derive the phase diagrams and spinodals of binary liquid systems with anisotropic interactions, such as hydrogen-bonded molecules. The work is based on the four-particle cluster variation method, using a different potential for different contact points. It is shown that the introduction of a cluster larger than previously used by Barker and Fock, leads to a considerable improvement in the shape of the phase diagram and avoids some of the difficulties encountered in their calculation. Phase diagrams are displayed for various choices of the parameters: the number of contact points, the interaction potential, and the order of the approximation.

704,698

PB84-217199 Not available NTIS
National Bureau of Standards, Washington, DC.
Long Term Behavior of Phase Separation. Computations with the Non-Homogeneous, Time Dependent Cluster Variation Method.
Final rept.
E. Bodegom, and P. H. E. Meijer. 1983, 24p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Physica 122A, p13-36 1983.

Keywords: Reprints, *Path probability method, *Cluster variation method, *Spinodal decomposition, *Phase separation, Numerical solution.

Time-dependent computations on the phase separation between two kinds of molecules are performed by means of the Path Probability Method (PPM). The PPM is solved in both the mean field and pair approximations. This is the first application of the PPM to an inhomogeneous, non-stationary system and it is found that the resulting differential equations are relatively easy to solve using a stiff integration technique. The PPM allows for a realistic kinetic process using an activation process for the migration of the particles through substitutional vacancies. The complete process of phase separation is closely analogous with calculations performed by de Fontaine and Langlois using completely different theories.

704,699

PB84-217223 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Penning Ionization Study of the CO/Ni(III) System.
Final rept.
F. Bozso, J. T. Yates, J. Arias, H. Metiu, and R. M. Martin. 15 Mar 83, 14p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. of Physical Chemistry, v78 n6 pt2 p4256-4269, 15 Mar 83.

Keywords: *Surface chemistry, *Ionization, *Nickel, *Cobalt, *Electronic spectra, Metastable state, Excitation, Reprints, *Surface Penning ionization spectroscopy.

Metastable He(2 singlet S) and Ne(triplet P sup 2,0) beams were used to probe the electronic properties of Ni(111) and CO/Ni(111) surfaces. The metastable atoms collide with the surface and transfer their electronic excitation energy, causing electron ejection. With the Ni(111) surface the metastable is first resonantly ionized, and the ion is subsequently Auger neutralized, giving an electron energy spectrum which is similar to the corresponding low kinetic energy ion neutralization spectrum (INS). Differences between the metastable quenching spectrum and the INS spectrum were observed, and are discussed in terms of the differences in the mechanisms and the ion kinetic energies. With a CO/Ni(111) surface the CO eliminates direct interaction of the metastable atom with the metal, and the surface Penning ionization electron spectrum (SPIES) is obtained.

704,700

PB84-217272 Not available NTIS
National Bureau of Standards, Washington, DC.
Velocity Correlations in Supercooled and Nucleated Liquid Rubidium.
Final rept.
A. C. Brown, and R. D. Mountain. 1 Feb 84, 9p
Pub. in Jnl. of Chemical Physics, v80 n3 p1263-1271, 1 Feb 84.

Keywords: *Rubidium, *Transport properties, *Liquids, *Supercooling, *Momentum transfer, Nucleation, Velocity, Reprints, *Molecular dynamics.

The momentum transport is studied for supercooled liquid rubidium, via molecular dynamics. The transport is investigated on a microscopic scale by measuring the contribution to the two point velocity correlation function for various separations of the two points. The correlation functions are measured in both the normal and supercooled liquid and the solid phase. It is found that momentum is transported by two different mechanisms; by correlated oscillations associated with the maximum of g(r), and by strongly diffusive modes associated with the minimum of g(r). The amplitude of the diffusive or liquid like mode increases upon nucleation, and remains large at low temperatures in the solid phase.

704,701

PB84-217306 Not available NTIS
National Bureau of Standards, Washington, DC.
Counting of Resonance Structures for Large Benzenoid Polynuclear Hydrocarbons.
Final rept.
R. L. Brown. 1983, 7p
Sponsored in part by Gas Research Inst., Chicago, IL. and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Computer Chemistry, v4 n4 p556-562 1983.

Keywords: *Aromatic polycyclic hydrocarbons, Computer programs, Reprints, *Resonance structures, *Benzenoids, Numerical solution.

A method is presented for counting the number of resonance structures for large benzenoid polynuclear hy-

drocarbons. Structure counts for even systems are made and compared with those of the odd systems resulting from the removal of one of the pi-centers from various points in the even structure. A computer program for performing the calculations is also given.

704,702
PB84-217314 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamics of Hydroxyapatite Surfaces.
Final rept.
W. E. Brown, L. C. Chow, and M. Mathew. 1983, 9p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Croatica Chemica Acta, v56 n4 p779-787 1983.

Keywords: *Thermodynamics, *Mathematical models, *Crystals, *Surface chemistry, *Dental materials, Chemical equilibrium, Electrochemistry, Phase diagrams, Reprints, *Hydroxylapatite.

A new model for equilibria at the interface of a sparingly soluble crystal is reviewed. It provides that several kinds of equilibria are present and each type is characterized by (1) a set of species that are transported across the phase boundary, (2) a set of chemical reactions which describe this transport process, and (3) a set of thermodynamic expressions which define equilibrium. Three types are envisaged: 1. Stoichiometric equilibrium provides the thermodynamic communication between the lattice and the bulk solution, occurs at a kink site, preserves the composition of the solid phase, defines a solubility product, leads to an isotherm in the phase diagram, and is unaffected by Galvani potentials. The equilibrium is defined by a single equation. 2. Gibbsian equilibrium in which the chemical potential of each component is stated to be equal across the phase boundary, but does not define an actual chemical process. There is one such equation for each component in the system. 3. Electrochemical equilibrium provides thermodynamic communication between ions in the bulk phase and those in the outer layer of the crystal, is non-stoichiometric, is profoundly affected by Galvani potentials, does not lead to a solubility product constant nor to an isotherm, and requires one more equilibrium condition than there are components in the system. Equilibrium between the lattice and the surface is limited to reactions via the aqueous phase, one of which is stoichiometric and the other nonstoichiometric. This model provides a clarity of description of interfacial events heretofore unattainable.

704,703
PB84-217801 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Chemical Engineering.
Interpolation Formulas for Viscosity of Six Gases: Air, Nitrogen, Carbon Dioxide, Helium, Argon, and Oxygen.
Final rept.
F. E. Jones. Feb 84, 30p NBS/TN-1186
Also available from Supt. of Docs as SN003-003-02568-8.

Keywords: *Viscosity, *Air, *Nitrogen, *Carbon dioxide, *Helium, *Argon, *Oxygen, Numerical solution.

Equations for the calculation of viscosity for dry air, nitrogen, carbon dioxide, helium, argon, and oxygen have been developed as interpolation formulas fitted to experimental data. The approximate ranges of strict application of the equations are the ranges of temperature (20C < or = t < or = 50C) and pressure (0.04 < or = p < or = 4 MPa; 0.4 < or = p < or = 40 atm) for the experimental data. The estimates of relative residual standard deviation for the fits (0.05% for air, 0.03% for nitrogen, 0.02% for carbon dioxide, 0.02% for helium, 0.03% for argon, and 0.03% for oxygen) are in close agreement with estimates of precision for the experimental data.

704,704
PB84-217850 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Chemical Engineering.
Thermodynamic Surface for the Critical Region of Ethylene.
Final rept.
J. M. H. L. Sengers, G. A. Olchowy, B. Kamgar-Parsi, and J. V. Sengers. May 84, 100p NBS/TN-1189
Also available from Supt. of Docs as SN003-003-02588-7. Prepared in cooperation with Maryland Univ., College Park. Inst. for Physical Science and Technology.

Keywords: *Thermodynamic properties, *Surface chemistry, *Ethylene, Tables(Data), Critical point, Enthalpy, Density(Mass/volume), Fluids, Temperature, Equations of state, Specific heat, Impurity, Pressure, Speed of sound, Supercritical extraction.

Tables are presented of thermodynamic properties of ethylene in the range 279-300K in temperature, 5.75 - 10.5 mol/cu dm in density, which range includes the critical point. The tables presented here are based on the critical-point scaling laws and incorporate the critical anomalies as presently known from renormalization-group theory. The tables complement the formulation of the equation of state of fluid ethylene by McCarty and Jacobsen (NBS Tech. Note 1045, 1981) which does not claim accuracy near the critical point. The predictions of the present formulation are compared with four sets of recent PVT data, and with speed-of-sound and enthalpy data. Tables are presented of pressure, energy, enthalpy, entropy, specific heats and speed of sound as function of temperature along finely-spaced isochores. The computer program required for table generation is included. Even if the surface were perfect, the reliability of densities calculated at experimental pressures and temperatures of limited accuracy declines rapidly as the critical point is approached. Contour plots in P-T space are presented of regions to be avoided in custody transfer for given uncertainties in pressure, temperature and sample composition.

704,705
PB84-217983 Not available NTIS
National Bureau of Standards, Washington, DC.
Intensites dans la Pentrade - (nu sub 11), nu2 + nu12, 2 sup nu10 + nu12, nu9 (et) nu3 + nu8 + nu10 (de) (12)C2H.
Final rept.
A. S. Pine, M. Dang-Nhu, A. Fayt, M. de Vleeschouwer, and C. Lambeau. 1983, 8p
Pub. in Canadian Jnl. of Physics 61, p514-521 1983.

Keywords: *Infrared spectroscopy, *Ethylene, *Intensity, Doppler effects, Reprints, *Laser spectroscopy.

Analysis of the intensities of an interacting polyad of bands is complicated by basis function mixing. Fortunately it is usually possible to find lines belonging principally to one band or to subsets of the polyad to begin an interative procedure to derive intensity parameters. Five bands of ethylene in the micrometers region have been investigated for line intensities by this method, using 148 selected measurements of about 6800 Doppler-limited transitions recorded with a difference-frequency laser spectrometer. Finally two band strengths and two Herman-Wallis parameters have been determined with statistical significance, permitting the observed intensities of the pentad to be calculated with 1%.

704,706
PB84-217991 Not available NTIS
National Bureau of Standards, Washington, DC.
Turbidity Very Near the Critical Point of Methanol-Cyclohexane Mixtures.
Final rept.
R. B. Kopelman, R. W. Gammon, and M. R. Moldover. Apr 84, 18p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Physical Review A 29, n4 p2048-2053 Apr 84.

Keywords: *Critical point, *Methyl alcohol, *Cyclohexane, *Turbidity, *Mixtures, Light scattering, Phase transformations, Reprints.

The authors have measured the turbidity of a critical mixture of methanol and cyclohexane extremely close to the consolute point. A carefully controlled temperature history was used to mix the sample and to minimize the effects of critical wetting layers.

704,707
PB84-218007 Not available NTIS
National Bureau of Standards, Washington, DC.
Adsorption of H2O on Clean and Oxygen-Dosed Silver Single Crystal Surfaces.
Final rept.
M. Klaua, and T. E. Madey. 1984, 9p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Surface Science 136, p142-150 1984.

Keywords: *Water, *Silver, *Surface chemistry, *Crystal structure, Adsorption, Chemical bonds, Electron diffraction analysis, Reprints, Electron stimulated desorption ion angular distribution method, Low energy electron diffraction, Thermal desorption.

The adsorption of H2O on the surface of a single-crystal sphere of silver with exposed (111), (100) and (112) facets has been examined using ESDIAD (electron stimulated desorption ion angular distribution), LEED (low energy electron diffraction) and TDS (thermal desorption spectroscopy). The purpose of the study was (a) to examine the influence of substrate geometry for adsorption of H2O on a metal surface for which the adsorbate-substrate interaction is weak, and (b) to study the influence of a surface impurity, oxygen, on the surface chemistry and local bonding structure of H2O on Ag.

704,708
PB84-218015 Not available NTIS
National Bureau of Standards, Washington, DC.
Optimal Regimes of Facilitated Transport.
Final rept.
L. L. Kemena, R. D. Noble, and N. J. Kemp. 1983, 16p
Pub. in Jnl. of Membrane Science 15, p259-274 1983.

Keywords: *Transport properties, *Membranes, Reprints.

An optimization of facilitated transport in liquid membranes is accomplished to determine the maximum facilitation factor and corresponding dimensionless equilibrium constant for a given inverse Damkohler number epsilon and a parameter alpha which is directly proportional to the initial carrier concentration. The existence of the maximum is demonstrated. The optimal facilitation factor increases with decreasing alpha and is strongly dependent on alpha. The results can be used to select optimal operating conditions, and/or carriers, or to compare actual to optimal results.

704,709
PB84-218395 Not available NTIS
National Bureau of Standards, Washington, DC.
Matrix-Isolation Study of the Decomposition of CF3NNCF3 by Photons and by Excited Rare-Gas Atom Bombardment at Energies Between 4.9 and 16.8 eV.
Final rept.
M. E. Jacox. 1984, 10p
Pub. in Chemical Physics 83, p171-180 1984.

Keywords: *Decomposition reactions, *Infrared spectroscopy, Excitation, Photolysis, Chemical reactions, Fluorine organic compounds, Reprints, *Matrix isolation techniques, *Ethylamine/hexafluoro-bis, Atom molecule interactions, Argon atoms, Neon atoms.

When dilute solid solutions of CF3NNCF3 in argon at 14 K are irradiated by the full light of a medium pressure mercury arc, no net photolysis occurs, suggesting that the primary photodecomposition products, CF3N2 + CF3, undergo cage recombination. On 122-nm photolysis, cage recombination leads instead to the appearance of prominent infrared absorptions of C2F6, suggesting an initial photodecomposition process to form 2CF3 + N2. Prominent infrared absorptions of CF4 and CF2 were shown to result from the photodecomposition of C2F6. Argon resonance radiation does not penetrate solid Ar:CF3NNCF3 deposits, but when photolysis is conducted concurrently with deposition a high yield of CF3 is isolated in the argon matrix. Circumvention of the cage effect in this system is attributed to the large amount of excess energy with which the photofragments are formed and to a very short lifetime for the excited electronic state of CF3NNCF3 before dissociation. Even higher yields of CF3 are formed when the Ar:CF3NNCF3 sample is codeposited with a beam of argon atoms excited in a microwave discharge. The effects of concentration and experimental configuration on the product yield are discussed. When the sample is codeposited with a beam of excited neon atoms (16.6-16.8 eV), the most prominent product absorption is that of CF3(+1), with relatively weak absorptions of CF3, suggesting that at this energy the primary photodecomposition process leads to the formation of CF3 + CF3(+1) + N2 + e.

704,710
PB84-218403 Not available NTIS
National Bureau of Standards, Washington, DC.
Reaction of F Atoms with Methyl Nitrite. Infrared Spectroscopic Evidence for the Stabilization of FNO in an Argon Matrix.
Final rept.
M. E. Jacox. 24 Nov 83, 6p
Sponsored in part by Office of Naval Research, Arlington, VA.

Pub. in Jnl. of Physical Chemistry, v87 n24 p4940-4945, 24 Nov 83.

Keywords: *Infrared spectroscopy, *Formaldehyde, Stability, Chemical reactions, Exothermic reactions, Chemical bonds, Reprints, *Nitrite/methyl, *Atom molecule interactions, *Fluorine atoms, *Matrix isolation techniques.

When the products of the reaction between F atoms formed in a microwave discharge and methyl or methyl-d3 nitrite are frozen in a large excess of argon at 14 K, prominent absorptions of FNO appear in the infrared spectrum of the solid deposit, demonstrating that NO abstraction occurs. Two absorptions previously attributed to FNO are also very prominent, supporting the identification of that isomer, but the assignment of the NO-stretching fundamental was not confirmed. The appearance of infrared absorptions of isolated and hydrogen-bonded HF indicates that the more exothermic reaction channel involving H-atom abstraction also occurs. The absorptions of H2CO and NO, products of the decomposition of CH2ONO, are prominent, with indirect evidence that a small concentration offf CH2ONO may have been stabilized. Factors influencing the relative contributions of the two observed F-atom reaction channels are considered.

704,711
PB84-218445 Not available NTIS
National Bureau of Standards, Washington, DC.
Radio Searches for Additional Interstellar Molecules.
Final rept.
J. M. Hollis, R. D. Suenram, F. J. Lovas, and L. E. Snyder. 1983, 7p
Pub. in Astronomy and Astrophysics 126, p393-399 1983.

Keywords: *Radio astronomy, *Interstellar matter, Molecular energy levels, Nitrogen oxide(N2O), Sodium hydroxide, Sulfur dioxide, Molecular rotation, Acetic acid, Reprints, Sagittarius B2, Orion A, Formic acid/(methyl-ester), Cyanic acid/(ethyl-ester), Formic acid/diamino.

The authors report 2-mm wavelength range observations which yield new interstellar molecular transitions of NH2CHO, SO2, H2CCO, U150820.5 and U150850.0 toward Sgr B2 and SO2, CH2CHCN, HCOOCH3, and U153513.0 toward Orion A. They conducted the first interstellar searches for HOCl, CH3CH2CCH, and CH3SiH3 but did not detect these species. During these observations limits were also obtained on 2-mm wave transitions of N2O and NaOH toward several galactic sources of molecular emission.

704,712
PB84-218452 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoelectron Branching Ratios and Asymmetry Parameters for the Two Outermost Molecular Orbitals of Hydrogen Cyanide.
Final rept.
D. M. Holland, A. C. Parr, and J. L. Dehmer. 1984, 10p
Sponsored in part by Office of Naval Research, Arlington, VA., Department of Energy, Washington, DC. and North Atlantic Treaty Organization, Brussels (Belgium).
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 17, p1343-1352 1984.

Keywords: *Hydrogen cyanide, *Molecular orbitals, *Photoelectrons, Nitrogen, Carbon monoxide, Ethylene, Ionization potentials, Reprints.

Triply differential photoelectron spectroscopy has been performed on hydrogen cyanide in the photon energy range 14.5 to 24 eV, using synchrotron radiation. Photoelectron branching ratios and asymmetry parameters are presented for the two outermost molecular orbitals. The vibrationally resolved branching ratio X sup 2 II (nu sup 3 = 1)/(nu sup 3 = 0) exhibits strong non-Franck-Condon behavior from threshold to approximately 19 eV. The results are discussed in relation to similar studies on the isoelectronic molecules, N2, CO and C2H2. The evidence suggests that the prominent non-Franck-Condon feature observed in the HCN(+1) X sup 2 II channel may arise, at least in part, from a shape resonantly enhanced autoionizing state converging to a higher ionization potential.

704,713
PB84-218718 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Anisotropy on the Optical-Absorption Spectrum of Polyacetylene.
Final rept.
A. J. Glick, and G. W. Bryant. 15 Oct 83, 6p
Pub. in Physical Review B: Solid State, v28 n8 p4295-4300, 15 Oct 83.

Keywords: *Mathematical models, *Anisotropy, *Absorption spectra, Dielectric properties, Reprints, *Polyacetylene, *Maxwell Garnett theory.

The authors explore two different models for (CH)x films. In one model they assume all the chains are parallel to one another, but not to the film surface. Light propagation in such a medium can be treated exactly. The second model is based on an extension of Maxwell-Garnett theory, describing anisotropic randomly-oriented ellipsoids (the fibrils). The latter model ignores the details of light propagation by replacing the random medium with an effective uniform isotropic medium. Using the conductivity derived previously for individual dimerized chains they find that both models give structure below the interband threshold which resembles the midgap absorption observed experimentally. Thus anisotropy can be at least partially responsible for the absorption structure usually attributed to solitons.

704,714
PB84-218759 Not available NTIS
National Bureau of Standards, Washington, DC.
Microwave and Millimeter-Wave Spectra of Hypochlorous Acid.
Final rept.
H. E. G. Singbeil, W. D. Anderson, R. W. Davis, M. C. L. Gerry, E. A. Cohen, H. M. Pickett, F. J. Lovas, and R. D. Suenram. 1984, 40p
Pub. in Jnl. of Molecular Spectroscopy 103, p446-485 1984.

Keywords: *Microwave spectra, Isotopes, Stark effect, Dipole moments, Molecular rotation, Hyperfine structure, Reprints, *Hypochlorous acid.

To permit atmospheric monitoring of the molecule, the microwave spectra of two isotopic species of hypochlorous acid, HOCl, have been measured in the frequency range 8-650 GHz. Three b-type branches and an a-type Q branch have all been measured for the first time; improved measurements have been made for the a-type R branches. The analysis has included combination differences of earlier high-resolution infrared spectra to give accurate values for all rotational constants, five quartic and five higher degree centrifugal distortion constants, as well as the chlorine nuclear quadrupole and spin-rotation coupling constants. From the Stark effect, accurate values have also been obtained for both components of the molecular dipole moment. A table of transition frequencies of potential use in atmospheric monitoring is presented.

704,715
PB84-218767 Not available NTIS
National Bureau of Standards, Washington, DC.
Vibrational Excitation in Molecule-Surface Collisions Due to Temporary Negative Molecular Ion Formation.
Final rept.
J. W. Gadzuk. 15 Dec 83, 8p
Pub. in Jnl. of Chemical Physics, v79 n12 p6341-6348, 15 Dec 83.

Keywords: *Molecular vibration, *Surface chemistry, *Diatomic molecules, Excitation, Nitrogen, Nitrogen oxides(NO), Inelastic scattering, Electron scattering, Reprints.

Inelastic electron scattering from gaseous and physisorbed diatomic molecules results in greatly enhanced vibrational overtone excitation if the incident electron has the appropriate energy to form a shape-resonance-induced temporary negative molecular ion. It is proposed here that due to the image potential lowering of the electron affinity level of a diatomic molecule in interaction with a metal surface, somewhere outside the surface an incident molecule would find its affinity level degenerate with or lower than the substrate Fermi level at which point a substrate electron could hop onto the molecule, in analogy with gas phase harpooning processes. A negative molecular ion is thus formed which remains until the molecular ion reflects from the surface and the affinity level rises above the Fermi level, thus permitting reverse electron hopping back into the metal. The lifetime of the molecular ion can be controlled by varying both the kinetic energy of the incident molecule and also the substrate work function. In analogy with the electron scattering events, greatly enhanced vibrational excitation of overtones is expected in the molecules of the scattered beam. Induced fluorescence probing of the vibrational state distribution should then yield fundamental information pertaining to the dynamics of charge transfer reactions and nonadiabatic effects in molecule-surface interactions. A theory of this phenomenon is here presented together with the numerical consequences for a model system designed to simulate N2 or NO scattering from standard surface science metal surfaces.

704,716
PB84-218775 Not available NTIS
National Bureau of Standards, Washington, DC.
Separation of Dipeptide Diastereoisomers by High-Resolution Gas Chromatography.
Final rept.
M. Dizdaroglu, and M. G. Simic. 1982, 6p
Pub. in Jnl. of Chromatography 244, p293-298 1982.

Keywords: *Molecular structure, *Gas chromatography, *Isomers, *Peptides, Separation, Mass spectroscopy, Reprints.

Separation of trimethylsilylated diastereoisomers of dipeptides was achieved by high-resolution gas chromatography on a fused silica capillary column coated with an achiral (conventional) stationary phase. L,L- and D,D-isomers were separated from L,D- and D,L-isomers with excellent resolution. The nominal structure of the separated isomers was confirmed by gas chromatography-mass spectrometry.

704,717
PB84-218783 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Degradation of Polyisobutylene Studied Using Factor-Jump Thermogravimetry.
Final rept.
B. Dickens. 1983, 12p
Pub. in Jnl. of Thermal Analysis 27, p379-390 1983.

Keywords: *Polyisobutylene, *Thermal degradation, *Activation energy, Reaction kinetics, Polymerization, Reprints, *Chemical reaction mechanisms.

The overall activation energy of the thermal degradation of polyisobutylene has been measured using factor-jump thermogravimetry to be 206 + or - 1 kJ/mole over the range 365 to 405 degree in N2 at 800 mm Hg pressure and flowing at 4 mm/s over the sample. This equation presupposes a degradation mechanism of random initiation, unzipping, and bimolecular termination. Substitution of reasonable values for the heat of polymerization, delta H, in the definition delta H = E(p)-E(d) suggests that the activation energy of the polymerization reaction at 375 degrees is approximately 30 kJ/mole.

704,718
PB84-218791 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Degradation Study of Isotactic Polypropylene Using Factor-Jump Thermogravimetry.
Final rept.
B. Dickens. 1982, 15p
Pub. in Jnl. of Polymer Science 20, p1169-1183 1982.

Keywords: *Thermal degradation, *Polypropylene, Reaction kinetics, Activation energy, Thermogravimetry, Molecular weight, Reprints, *Chemical reaction mechanisms.

The degradation of isotactic polypropylene in the range 390-465C was studied using factor-jump thermogravimetry. The degradations were carried out in vacuum and at pressures of 5 and 800 mm Hg of N2, flowing at 100-400 standard mL/s. At 800 mm Hg this corresponds to linear rates of 1-4 mm/s. In vacuum bubbling in the sample caused problems in measuring the rate of weight loss. Initiation was considered to be backbone scission beta to allyl groups formed in the termination reaction. For initiation by random scission of the polymer backbone, as in the early stages of thermal degradation, an overall activation energy of 72 kcal/mol is proposed. The difference between vacuum and in-N2 activation energies is ascribed to the latent heat contributions of molecules which do not evaporate as soon as they are formed. At these imposed rates of weight loss the average molecular weights of the volatiles in vacuum and in 8 and 800 mm Hg N2 are in the ratios 1-1/2-1/9.

704,719
PB84-218817 Not available NTIS
National Bureau of Standards, Washington, DC.
Isoconversional Method for Determination of Energy of Activation at Constant Heating Rates. Corrections for the Doyle Approximation.
Final rept.
J. H. Flynn. 1983, 15p
Pub. in Jnl. of Thermal Analysis27, p95-102 1983.

Keywords: *Activation energy, *Thermal analysis, *Isothermal treatment, Temperature, Reprints, *Doyle equation, Numerical solution.

The isothermal method for the determination of energies of activation from the reciprocal temperature at which a fraction of conversion was reached in experiments at differing constant heating rates is reviewed and amplified. The error introduced the calculation of activation energy by the use of a linear approximation of the logarithm of the temperature integral is discussed. Methods for the correction of this error are developed and a table of correction factors are given.

704,720
PB84-218858 Not available NTIS
National Bureau of Standards, Washington, DC.
Fourier Transform Infrared Spectroscopy of Polymers. Theory and Application.
Final rept.
B. M. Fanconi. Jan 84, 7p
Pub. in Jnl. of Testing and Evaluation, p33-39 Jan 84.

Keywords: *Infrared spectroscopy, *Polymers, Reviews, Composite materials, Reprints, *Fourier transform spectroscopy.

The Fourier transform infrared (FT-IR) technique is replacing conventional dispersive instruments in the acquisition of IR spectroscopic data. For standards organizations this implies that existing standard test methods involving IR spectral analysis need to be modified. In an FT-IR system all spectral information is contained in the interferogram produced by scanning the Michelson interferometer. The factors controlling spectral resolution and sensitivity are, therefore, different from those governing these properties of dispersive instruments. The FT-IR technique has the advantages of greater signal-to-noise ratio, and digitized data that open up new areas of application as well as provide greater sensitivity in the more traditional uses of IR spectroscopy. A review of the field of vibrational spectroscopy of polymers identifies time-dependent phenomena and characterization of structural imperfections as two areas likely to see major advances as a result of FT-IR. Examples of the use of FT-IR in polymer research are given to illustrate the potential of the technique. At the National Bureau of Standards FT-IR has been used to determine the role of chain scission in the mechanical degradation of polymers, to measure the extent of chemical reactions during processing polymer composites, and to characterize polymeric materials.

704,721
PB84-218874 Not available NTIS
National Bureau of Standards, Washington, DC.
Variation of the Threshold Energies for Core-Electron Excitation in Electron Energy-Loss Spectra as a Function of Incident Electron Energy.
Final rept.
N. E. Erickson, and C. J. Powell. Jun 83, 4p
Pub. in Jnl. of Vacuum Science and Technology A., v1 p1165-1168 Apr-Jun 83.

Keywords: *Titanium, *Nickel, Atomic energy levels, Ionization, Excitation, X ray analysis, Reprints, *Electron energy loss spectroscopy, Threshold effects(Electron energy), Electron energy.

Measurements have been made of the 3p, 3s, and 2p core-electron energy-loss spectra of Ti and Ni as a function of incident electron energy. Attention was focussed on the threshold energy for core-level ionization to investigate possible changes in core-electron binding energies as a function of excitation conditions. Measured threshold energies decreased by between 0.1 and 1.5 eV, depending on the specific core level, as the incident electron energy was lowered from about 1500 eV to about 20-50 eV above the core threshold. The measured changes in threshold energies are due in part to different core-electron binding energies for bulk and surface atoms, to varying populations of final states, and to dynamical screening effects. These factors can account for differences in binding energies measured by x-ray photoelectron spectroscopy and by appearance potential spectroscopy.

704,722
PB84-218890 Not available NTIS
National Bureau of Standards, Washington, DC.
Coadsorption of Water and Sodium on the Ru(001) Surface.
Final rept.
D. L. Doering, S. Semancik, and T. E. Madey. 1983, 22p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Surface Science 133, p49-70 1983.

Keywords: *Surface chemistry, *Water, *Sodium, Ruthenium, Adsorption, Catalysts, Electrolytes, Metals, Reprints, *Electron stimulated desorption ion angular distributions methods, *Thermal desorption, *Low energy electron diffraction, *Auger electron spectroscopy.

The coadsorption of water and sodium on a Ru(001) surface has been studied as a model system of the interaction of adsorbed water with electropositive ions. A variety of surface sensitive methods were employed: electron stimulated desorption ion angular distributions (ESDIAD), thermal desorption spectroscopy (TDS), Auger electron spectroscopy (AES) and low energy electron diffraction (LEED). The striking dependence of the water surface chemistry on the coverage of preadsorbed Na has been associated with the electropositive properties of the Na-Ru layer. The influence of Na on the adsorption of water on Ru(001) is important for understanding processes occurring at the metal-electrolyte interface in an electrochemical cell as well as the catalytic promotion of transition metal catalysts by adsorbed alkalis.

704,723
PB84-218908 Not available NTIS
National Bureau of Standards, Washington, DC.
Oxidation of Polystyrene in Solution.
Final rept.
B. Dickens, and J. Marchal. 1984, 31p
Pub. in Polymer Degradation Stability 6, p211-241 1984.

Keywords: *Polystyrene, *Oxidation, Solutions, Polymers, Gamma rays, Reprints.

Polystyrene (PS) has been oxidized in carbon tetrachloride, chloroform, methylene chloride and cyclohexane under O2 at atmospheric pressure using y-initiation. Benzaldehyde, acetophenone and reductions in molecular weight were observed in all solvents. Yields of benzaldehyde and acetophenone were used to show that attack in chlorinated solvents is essentially random along the polymer chains and is predominantly by Cl radicals. Intramolecular propagation is much faster for attack on tertiary carbons than on secondary carbons. There are more neighboring hydroperoxide groups in PS oxidized in carbon tetrachloride and methylene chloride than in PS oxidized in chloroform, because, in chloroform, the solvent hydrogen is abstracted by polymer-based peroxyl radicals. For one set of conditions, about six intramolecular propagation steps took place in carbon tetrachloride and one in chloroform. At lower rates of initiation, the kinetic oxidation chains are longer and more intramolecular propagation occurs. HCl added in excess of that formed in these experiments decomposes hydroperoxide groups to give an auto-accelerating effect.

704,724
PB84-218916 Not available NTIS
National Bureau of Standards, Washington, DC.
Vapor Composition Profiles Estimated for Thermally Degrading Polyethylene.
Final rept.
B. Dickens. 1982, 9p
Pub. in Thermochimica Acta 55, p217-229 1982.

Keywords: *Polyethylene, *Thermal degradation, *Thermogravimetry, Activation energy, Vaporizing, Heat of vaporization, Reprints.

Calculated vapor pressures have been used to estimate the equilibrium composition of the vapor over an equimolar mixture of linear alkanes and to make inferences about the effects of pressure on the thermal degradation of polyethylene as studied using thermogravimetry. The bubbling in molten PE degrading under vacuum conditions has been related to the boiling out of molecules in the range C30 to >C80. The effect of pressure in lowering the apparent overall activation energy has been ascribed to contributions from the latent heats of vaporization of molecules in the range C15 to about C30.

704,725
PB84-218924 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermally Degrading Polyethylene Studied by Means of Factor-Jump Thermogravimetry.
Final rept.
B. Dickens. 1982, 323p
Pub. in Jnl. of Polymer Science 20, p1065-1087 1982.

Keywords: *Polyethylene, *Thermal degradation, *Thermogravimetry, Activation energy, Reaction kinetics, Reprints, *Factor-jump thermogravimetry.

Degradation of polyethylene in both linear (NBS 1475) and branched (NBS 1476) form has been studied using factor-jump thermogravimetry. The degradations were carried out in vacuum and under N2 flowing at 100 standard ml/s at pressures of 8 mm and 800 mm Hg. Changing the flow rates over the range 1 to 4 mm/s did not affect the results. In vacuum the rate of weight loss was erratic because of bubbling in the sample. The apparent activation energy was determined to be 65.4(5) kcal/mol (273(2) kJ/mol). There was no distinguishable difference between linear and branched samples. Values cited in the literature for comparable apparent activation energies of degradation range between 45 kcal/mol and 77 kcal/mol.

704,726
PB84-218957 Not available NTIS
National Bureau of Standards, Washington, DC.
Two-Dimensional J-Resolved Proton Nuclear Magnetic Resonance Spectrometry of Hydroxyl-Coupled A- and B-D Glucose.
Final rept.
B. Coxon. 1983, 6p
Pub. in Analytical Chemistry, v55 n14 p2361-2366 1983.

Keywords: *Nuclear magnetic resonance, *Glucose, Catalysis, Reprints, *Molecular conformation, *Chemical shifts(Nuclear magnetic resonance), Glucopyranose, Hydroxyl radicals.

Two methods have been investigated for the simplification and analysis of the proton NMR spectra obtained from the 12-proton spin systems of alpha- and beta-D-glucopyranose in dimethyl-d(6) sulfoxide solutions. Analysis of the resulting hydroxyl proton coupled spectra was facilitated at 400 MHz either by two-dimensional, J-resolved proton NMR spectrometry or by the spectral simplification induced by rapid chemical exchange of the hydroxyl protons, catalyzed by trifluoroacetic acid. By means of these techniques, a complete set of chemical shifts and CH and OH proton-proton coupling constants has been obtained for the anomeric D-glucopyranoses. The implications of the proton coupling constants for conformational analyses of the anomers are discussed.

704,727
PB84-218981 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Mass Spectrometry of Solids. A Bibliography 1963-82.
Final rept.
R. J. Conzemius, D. S. Simons, Z. Shankai, and G. D. Byrd. 1983, 32p
Prepared in cooperation with Ames Lab., IA.
Pub. in Microbeam Analysis, p301-332 1983.

Keywords: *Mass spectroscopy, *Solids, *Bibliographies, Ionization, Sources, Reprints, *Laser spectroscopy.

The use of lasers as an ionization source for solid samples in mass spectrometry has proliferated in recent years. The main reasons for this increased attention are twofold- the availability of commercial instruments that use the laser as a microprobe, primarily for the analysis of inorganic species, and the increased emphasis in organic mass spectrometry on 'soft' ionization sources for the analysis of thermally labile materials. The laser is unique as an ionization source for solids because of the spatial and temporal characteristics of the laser beam and because the ionization mechanism can be altered by changing the power density. The following bibliography is a best-effort attempt to include all papers published in the open literature through the end of 1982 where a laser is used as an

ionization source in mass spectrometry for a solid phase sample. It is organized chronologically by year, and alphabetically by first author within each year. A comprehensive cross-reference index by subject is included as an aid in locating references on a specific aspect of laser mass spectrometry. (906 references.)

704,728
PB84-219013 Not available NTIS
National Bureau of Standards, Washington, DC.
Heat Capacity and Thermodynamic Properties of Rho-Terphenyl: Study of Order-Disorder Transition by Automated High-Resolution Adiabatic Calorimetry.
Final rept.
S. S. Chang. Dec 83, 8p
Pub. in Jnl. of Chemical Physics, v79 n12 p6229-6236 Dec 83.

Keywords: *Thermodynamic properties, *Specific heat, Heat measurement, Melting point, Enthalpy, Reprints, *Terphenyl, *High resolution adiabatic calorimetry.

The heat capacity of a sample of zone-refined, high-purity p-terphenyl has been determined from 4 to 370 K in a fully automated high-resolution vacuum adiabatic calorimeter and from 320 to 580 K in a differential scanning calorimeter. The melting point of p-terphenyl is 487.0 K and the enthalpy of fusion is 35.3kJ/mol. A lambda-type solid-solid transition occurs with a peak temperature of 193.55 K. The transition is highly reproducible without observable hysteresis, even after various thermal treatments. In the transition region which spans from 140 to 240 K, the sample reaches a state of thermal equilibrium within a period of one-half to one hour, as normally required in adiabatic calorimetry. These characteristics are desirable for the application of the equilibrium lambda transitions as a calibration standard for use in dynamic calorimetry. The behavior of the lambda transition at equilibrium is mapped in high temperature resolution, with small temperature increments of measurement down to 0.01 K by adiabatic calorimetry. In the temperature region between the transtion and the fusion, the heat capacity of the high-temperature form of the crystal is proportional to the temperature C(p)=0.94 T J/K/mol to within 1%. The heat capcity of p-terphenyl in the liquid state above its melting point of 487.0 K appears to be an extension of the heat capacity of the liquid, and the supercooled liquid, state of o-terphenyl above its glass transition temperature of about 243 K.

704,729
PB84-219021 Not available NTIS
National Bureau of Standards, Washington, DC.
Structures of Lithium Inserted Metal Oxides: Li2FeV3O8.
Final rept.
R. J. Cava, A. Santoro, D. W. Murphy, S. Zahurak, and R. S. Roth. 1983, 9p
Pub. in Jnl. of Solid State Chemistry 48, p309-317 1983.

Keywords: *Crystal structure, *Neutron diffraction, Lithium inorganic compounds, Reprints, *Lithium iron vanadates.

Neutron diffraction powder profile analysis has been used to determine the structure of Li2FeV3O8. The compound is prepared from FeV3O8, which has the VO2(B) structure type, by a lithium insertion reaction employing n-BuLi. Only minimal distortion of the host lattice occurs on Li insertion. The Li ions occupy five coordinate square pyramidal sites with an average Li-O bond distance of 2.04 A. These five coordinate sites occur commonly in the capped perovskite cavities of crystallographic shear structures based on ReO3.

704,730
PB84-219054 Not available NTIS
National Bureau of Standards, Washington, DC.
Roles of Octacalcium Phosphate in Surface Chemistry of Apatites.
Final rept.
W. E. Brown, M. Mathew, and L. C. Chow. 1984, 16p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Adsorption on and Surface Chemistry of Hydroxyapatite, p13-28 1984.

Keywords: *Surface chemistry, *Dental materials, *Calcium phosphates, Colloids, Solubility, Crystal growth, Mechanical properties, Reprints, *Hydroxyapatite.

This paper reviews the effects of octacalcium phosphate (OCP), CagH2(PO4)6;5H2O, on the interfacial and colloidal properties of apatitic precipitates. The structural deductions are based on a combination of well established crystallographic concepts 1,2,3 and plausible projections regarding the chemical behavior of OCP. Although the colloidal nature of the systems makes difficult the verification of these properties, the ideas provide a substantive basis for interpretation of many experimental results. Apatitic systems are of such vital importance in so many areas, and the relationships between OCP and hydroxyapatite (OHAp), Ca5(PO4)3OH, are so close and so ubiquitous that the possibilities described here cannot be ignored. OCP seems to play important roles, also, in establishing the composition, solubility, reactivity, interfacial energy, nucleation, growth, and crystal-growth poisoning of apatitic materials. These all affect the surface and colloidal properties of apatitic precipitates.

704,731
PB84-219450 Not available NTIS
National Bureau of Standards, Washington, DC.
1-Butyne Microwave Spectrum, Barrier to Internal Rotation, and Molecular Dipole Moment.
Final rept.
B. M. Landsberg, and R. D. Suenram. 1983, 11p
Pub. in Jnl. of Molecular Spectroscopy 98, p210-220 1983.

Keywords: *Molecular rotation, *Microwave spectra, Dipole moment, Stark effect, Reprints, *Butyne.

Measurements of rotational transitions of 1-butyne have been made in the range of about 20-130 GHz. Both a-type transitions up to J = 46 and b-type transitions up to J = 42 have been measured and fitted to the Hamiltonian of Watson (8). In addition to the five quartic centrifugal distortion constants, three sextic coefficients had to be included to reproduce the observed frequencies to experimental error. The results of the analysis are sufficient for the prediction of all strong transitions throughout the millimeterwave range. A barrier to internal rotation of the methyl group of 3.260 Kcal/mol has been derived from the first excited torsional state.

704,732
PB84-219476 Not available NTIS
National Bureau of Standards, Washington, DC.
Triple Point of Succiononitrile and Its Use in the Calibration of Thermistor Thermometers.
Final rept.
B. W. Mangum. Dec 83, 6p
Pub. in Review of Scientific Instruments 54, n12 p1687-1692 Dec 83.

Keywords: *Thermistors, *Temperature measuring instruments, Laboratory equipment, Calibrating, Performance evaluation, Reprints, *Triple point, Succinonitrile.

Results are reported of an investigation of the triple point of succinonitrile as a temperature-fixed point and of its use in the calibration of thermistor thermometers. The average value of the triple point of several samples of this material was determined to be 58.0805C, with an estimated uncertainty of + or - 0.0015C relative to the International Practical Temperature Scale of 1968. Three-point calibrations of thermistor thermometers, using temperature-fixed points provided by succinonitrile, gallium, and water were compared with 15-point comparison calibrations performed with a standard platinum resistance thermometer (SPRT). Equations, solved by simultaneous solution using data obtained at the three calibration points, yield values of temperatures in the range from 0 to 70C which agree to within about + or - 1 mK with those obtained by calibration with a SPRT in a bath.

704,733
PB84-219807 Not available NTIS
National Bureau of Standards, Washington, DC.
Capillary Rise, Wetting Layers, and Critical Phenomena in Confined Geometry.
Final rept.
M. R. Moldover, and R. W. Gammon. 1 Jan 84, 10p
Contracts NASA-C-62861-C, NASA-H-27954-B
Pub. in Jnl. of Chemical Physics 80, n1 p528-535, 1 Jan 84.

Keywords: *Capillary flow, *Sulfur hexafluoride, *Surface properties, Critical points, Van der Waals equation, Interfacial tension, Wettability, Reprints.

The authors have used an interferometric technique to measure the capillary rise of sulfur hexafluoride (SF6) between closely spaced, nearly parallel plates. These layers are a factor of 3 thicker than our theoretical estimates which are based on very simple models which assume that the thickness is governed by a competition between the gravitational force which tends to thin the layers and long-ranged van der Waals forces which tend to thicken the layers. Furthermore the capillary rise data are consistent with the hypotheses that the surface tension and the difference between the liquid density and the vapor density of this confined sample of SF6 are the same as those of bulk SF6 at the same temperature. These results concerning critical phenomena contrast with results obtained in certain earlier studies of binary liquid mixtures near their consolute temperatures. The earlier experiments were interpreted without consideration of wetting layers to indicate that large critical temperature shifts and a crossover to two-dimensional behavior did occur in a confined geometry and temperature range similar to the one we use. We briefly discuss the effects that wetting layers have on other experiments near the critical point of SF6.

704,734
PB84-219914 Not available NTIS
National Bureau of Standards, Washington, DC.
Multichannel Quantum Defect Analysis of Two-State Couplings in Diatomic Molecules.
Final rept.
F. H. Mies, and P. S. Julienne. 15 Mar 84, 11p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 80, n6 p2526-2536, 15 Mar 84.

Keywords: *Quantum interactions, *Diatomic molecules, Dissociation, Reprints, *Multichannel quantum defect analysis, Atomic scattering, Resonance scattering.

A multichannel quantum defect analysis (MCQDA) for non-coulomb potentials is applied to two-channel coupling in diatomic molecules. Given the exact 2x2 scattering matrix S(E) obtained at a single energy above the dissociation threshold epsilon > 0, the author can extract an analytic, energy-insensitive 2x2 matrix Y(epsilon) which can be extrapolated across thresholds and yield a complete description of predissociating molecules. The predicted widths, shifts, and lineshapes obtained from MCQDA are in quantitative agreement with the exact numerical results and confirm the remarkable simplicity that can be achieved in describing diatomic systems near dissociation limits. The analysis is equally applicable to either adiabatic avoided crossings or diabatic curve crossings. The validity of MCQDA is independent of coupling strength and can quantitatively describe strongly overlapped predissociating resonance states. The application of MCQDA to the bound state spectrum, when both channels are closed, is discussed.

704,735
PB84-219922 Not available NTIS
National Bureau of Standards, Washington, DC.
Multichannel Quantum Defect Analysis of Diatomic Predissociation and Inelastic Atomic Scattering.
Final rept.
F. Mies. 15 Mar 84, 12p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 80, n6 p2514-2525, 15 Mar 84.

Keywords: *Quantum interactions, *Diatomic molecules, Dissociation, Inelastic scattering, Reprints, *Multichannel quantum defect analysis, Atomic scattering.

Given an N(sup tau) X N(sup tau) interaction matrix W-(R) which describes the dissociation of a diatomic molecule into N(sup tau) asymptotic atomic channel states, the authors can generate exact numerical solutions to the close-coupled scattering equations. However, based on a multichannel quantum defect analysis (MCQDA) of the coupled equations he finds that the numerical S(E) matrix can be made to yield a real, symmetric matrix Y(E) which is analytic in E. This matrix can then be analytically continued across threshold to provide rigorous analytic descriptions of the multichannel diatomic wave functions in the predissociating and bound-state regions of the energy spectrum.

704,736
PB84-219971 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Tunable Diode Laser Spectra of Lithium Fluoride at High Tamperatures.
Final rept.
A. G. Maki. 1983, 7p
Pub. in Jnl. of Mol. Spectrosc. 102, p361-367 1983.

Keywords: *Infrared spectroscopy, *High temperature tests, *Lithium fluorides, Reprints, *Laser spectroscopy.

At temperatures up to 1300 K the high resolution spectrum has been measured for the 1-0 through 7-6 vibrational transitions of 7LiF and the 1-0 through 8-7 vibrational transitions of 6LiF. These infrared ro-vibrational measurements have been combined with microwave measurements taken from the literature to obtain a set of ten Dunham potential constants that reproduce all the measurements for both isotopic species to within their experimental uncertainty.

704,737
PB84-219989 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamical Properties of Alkali Intercalates in Graphite.
Final rept.
A. Magerl, H. Zabel, J. J. Rush, and A. J. Dianoux. 1983, 6p
Pub. in Synthetic Metals 7, p227-232 1983.

Keywords: *Dynamic properties, *Alkali metals, Line widths, Diffusion coefficient, Graphite, Rubidium compounds, Reprints, *Clathrate compounds, *Graphite rubidium clathrates, Quasielastic scattering.

The authors report on neutron quasi-elastic measurements of in-plane Rb dynamics in a C24Rb compound. The spectra show diffusion broadened linewidths, yielding a diffusion constant of .000026 sq cm/s at 343 K which increases by a factor of 3 at 618 K. From the Q dependence of the linewidth the difference in the dynamics between an usual three-dimensional liquid and a single Rb layer is elucidated.

704,738
PB84-220029 Not available NTIS
National Bureau of Standards, Washington, DC.
Reaction of Ethynyl Radicals with O2. Rate Constant for Formation of CO.
Final rept.
A. H. Laufer, and R. Lechleider. Jan 84, 3p
Sponsored in part by National Oceanic and Atmospheric Administration, Washington, DC.
Pub. in Jnl. of Physical Chemistry 88, n1 p66-68 Jan 84.

Keywords: *Reaction kinetics, *Carbon monoxide, Free radicals, Chemical reactions, Reprints, *Chemical reaction mechanisms, *Ethynyl radicals.

Absolute rate constants and branching ratios for reactions of the C2H-O2 system have been obtained from observation of the CO product build up. In the system, C2HO produced in (3a) subsequently reacts with O2 to produce CO. The relationship of the C2H + O2 rate constants to those for reaction of C2H with hydrocarbons is discussed.

704,739
PB84-220037 Not available NTIS
National Bureau of Standards, Washington, DC.
Computations and Estimates of Rate Coefficients for Hydrocarbon Reactions of Interest to the Atmospheres of the Outer Solar System.
Final rept.
A. H. Laufer, E. P. Gardner, T. L. Kwok, and Y. L. Yung. 1983, 5p
Sponsored in part by National Oceanic and Atmospheric Administration Washington, DC.
Pub. in ICARUS 56, p560-567 1983.

Keywords: *Reaction kinetics, *Hydrocarbons, *Planetary atmospheres, Chemical reactions, Chemical bonds, Mathematical models, Three body problem, Reprints, Arrhenius parameters, Numerical solution.

The rate coefficients, including Arrhenius parameters, have been computed for a number of chemical reactions involving hydrocarbon species for which experimental data are not available and which are important in planetary atmospheric models. The techniques used to calculate the kinetic parameters include the Troe and semi-empirical Bond Energy-Bond Order (BEBO) or Bond Strength-Bond Length (BSBL) methods.

704,740
PB84-220961 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoionization Cross Section of Helium for Photon Energies 59-67 eV: The (sp, 2(+n)) singlet P(sub 0) Rydberg Series of Autoionizing Resonances.
Final rept.
H. D. Morgan, and D. L. Ederer. Apr 84, 6p
Pub. in Physical Review A 26, n4 p1901-1906 Apr 84.

Keywords: *Helium, *Atomic energy levels, *Ultraviolet spectroscopy, Photons, Line width, Resonance scattering, Excitation, Reprints, *Autoionization, *Rydberg series.

The central position of the 2s2p singlet P(sub 0) two-electron resonance of He at 206.21 A has been remeasured using the background continuum of the National Bureau of Standards storage ring facility. In addition, the line-shape parameter q and width P of the resonance have also been obtained. We obtained a value of 60.151 + or - 0.010 eV for the resonance position, -2.6 + or - 0.3 for the line-shape parameter, and 0.038 + or - 0.002 eV for the width of the resonance. Our value for the resonance position is in good agreement with the theoretical calculation of 60.145 eV of Bhatia and Temkin and lies within the error budget of the previous experimental measurements of Madden and Codling. Parameter values for the other resonances have also been obtained and are in good agreement with the earlier measurements of Madden and Codling.

704,741
PB84-220987 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Dynamics Investigation of Homogeneous Nucleation for Inverse Power Potential Liquids and for a Modified Lennard-Jones Liquid.
Final rept.
R. D. Mountain, and A. C. Brown. Mar 84, 5p
Pub. in Jnl. of Chemical Physics 80, n6 p2730-2734 Mar 84.

Keywords: *Nucleation, *Phase transformation, *Liquid phases, *Crystallization, Solid phases, Supercooling, Dynamics, Computerized simulation, Reprints, *Lennard-Jones system, Lennard-Jones potential.

The influence of the harshness of the repulsive part of the pair potential on the onset of the process of homogeneous nucleation of the crystal from the supercooled liquid has been investigated using the computer simulation method of molecular dynamics. An inverse twelfth power and an inverse seventh power system were studied along with a modified Lennard-Jones system. The authors find that the times required for both the onset and the completion of the homogeneous nucleation process increase significantly with the harshness of the repulsion. Local orientational order in supercooled liquids was also examined. Values of the orientational order parameter Q6 intermediate between those of a normal liquid and of a crystal were found to be associated only with amorphous solid states.

704,742
PB84-221019 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure of Cesium-Exchanged Zeolite-RHO at 293K and 493K Determined from High Resolution Neutron Powder Data.
Final rept.
J. B. Parise, and E. Prince. 1983, 12p
Pub. in Materials Research Bulletin 18, p841-852 1983.

Keywords: *Crystal structure, *Ion exchange resins, *Aluminum silicates, Neutron diffraction, Reprints.

The crystal structure of Cs-exchanged zeolite rho (1 (bar 4) 3m) has been solved using neutron powder data collected at 293K and 493K. The model differs from that proposed by Robson, Shoemaker, Ogilvie, and Manor (1973) for the hydrogen form. Structure modeling studies (DLS) suggested a starting point for the refinement. Cs at (1/2, 0, 0) is in the elliptically distorted double 8-ring blocking absorption. An increase in temperature decreases the elliptical distortion of the double 8-ring which is restored at lower temperature.

704,743
PB84-221027 Not available NTIS
National Bureau of Standards, Washington, DC.
Predictions of Multiphoton Resonances in SF6 and SiF4.
Final rept.
C. W. Patterson, and A. S. Pine. 1 Jan 83, 5p
Pub. in Optics Communications 44, n3 p170-174, 1 Jan 83.

Keywords: *Sulfur hexafluoride, *Silicon tetrafluoride, *Infrared spectroscopy, *Electromagnetic absorption, Absorption, Photons, Reprints, *Anharmonicity(Electrical), Numerical solution.

The frequency dependence of the multiphoton resonances to the rotation-vibrational levels of the first two nu 3 overtones are calculated for SF6 and SiF4. From these calculations we can identify most of the features seen in the high intensity SF6 absorption data and predict those features that would be seen in similar SiF4 data.

704,744
PB84-221035 Not available NTIS
National Bureau of Standards, Washington, DC.
Tunable Laser Spectra of the Infrared-Active Fundamentals of Cubane.
Final rept.
A. S. Pine, A. G. Maki, A. G. Robiette, B. J. Krohn, and J. K. G. Watson. 1984, 7p
Pub. in Jnl. of American Chemical Society 106, n4 p891-897 1984.

Keywords: *Infrared spectroscopy, Perturbation theory, Molecular structure, Chemical bonds, Molecular vibrations, Reprints, *Cubane, *Laser spectroscopy, *Molecular confirmation.

Confirmation of the octahedral symmetry and improved bond length measurements are obtained from high-resolution tunable laser spectra of the three infrared-active fundamental vibrations of cubane in the vapor phase. The C-H stretching band (nu 10) was recorded with a difference-frequency laser and is found to be severely perturbed by a second-order Coriolis resonance with another nearby (nominally inactive) C-H stretch. The C-H bend (nu 11) and the C-C stretch (nu 12), which were studied with diode lasers, are relatively unperturbed, revealing the symmetry from the nuclear spin weight intensities of the ro-vibrational clusters and the bond lengths from an analysis of the rotational fine structure. The data also provide the f (sup 1u) block sigma constants, which have been used, together with vibrational fundamentals from an earlier solid state study of cubane and its isotopic derivatives, to determine a quadratic force field for the molecule resulting in some minor reassignments of the modes.

704,745
PB84-221050 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectra and Energy Levels of Ions in the Copper Isoelectronic Sequence from Ru(+15) to Sn(+21).
Final rept.
J. Reader, N. Acquista, and D. Cooper. 1983, 6p
Pub. in Jnl. of Optical Society of America 73, n12 p1765-1770 1983.

Keywords: *Atomic energy levels, *Ionization potentials, Palladium, Rhodium, Ruthenium, Silver, Tin, Indium, Ions, Cadmium, Hartree-Fock approximation, Comparison, Plasmas(Physics), Reprints, *Isoelectronic sequence, *Laser spectroscopy, Numerical solution.

Spectra of the copperlike ions Ru(+15), Rh(+16), Pd(+17), Ag(+18), Cd(+19), In(+20), and Sn(+21) were observed with a laser-produced plasma and a 10.7m grazing-incidence spectrograph. Wavelengths, energy levels, and ionization energies were determined for each of these ions. The wavelengths are compared with relativistic Hartree-Fock calculations.

704,746
PB84-221225 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory and Computations for Electron Collisions with Polar Molecules.
Final rept.
D. W. Norcross. 1983, 8p
Pub. in Proceedings of U.S.-Japan Seminar Electron-Molecule Collisions Photoionization Processes held at California Institute of Technology on October 26-29, 1983 p71-78 1983.

Keywords: *Photoionization, Photochemical reactions, Polarity, Perturbation theory, *Electron-molecule interactions, Numerical solution.

In this paper the author discusses recent advances in theory that have occurred on several fronts: in applications and extensions of perturbation theory, semiclassical methods, and the adiabatic-nuclei approximation; in the development of more realistic and complete representations of the interaction at short as well as long range; in computational techniques for carrying out ever more elaborate and precise calculations; and in the application of these advances to more complicated collision processes such as vibrational excitation.

704,747
PB84-221340 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface-Enhanced Raman Spectroscopy of Pyridine Derivatives: Effects of Adsorption on Electronic Structure.
Final rept.
K. A. Bunding, and M. I. Bell. 1982, 16p
Pub. in Surface Science 118, p329-344 1982.

Keywords: *Raman spectroscopy, *Surface chemistry, Carbinols, Comparison, Adsorption, Electrodes, Substrates, Electronic spectra, Pyridines, Reprints, *Pyridine carboxaldehydes, *Ketone/methyl, Pyridine carboxaldehyde/N-methyl.

The surface-enhanced Raman (SER) spectra of 2-, 3-, and 4-pyridinecarboxaldehydes, methylketones, and 3- and 4-carbinols are compared with the spectra of the neat compounds and aqueous solutions, and effects of the adsorbate-substrate interactions which occur when these molecules are adsorbed on silver electrodes are identified. The 4-substituted carboxaldehyde and methylketone exhibit weaker carbonyl stretching bands when adsorbed on silver than in solution, while no such effect is found for the corresponding 3-substituted compounds. This is consistent with an interaction of the nitrogen lone-pair electrons with the silver, leading to electron withdrawal from 4-substituents and increased hydration of carbonyl groups at that position. Examination of solution spectra of the N-methylpyridinium salts shows a similar trend, with N-methylation increasing hydration and reducing the carbonyl band intensity in N-methyl 4-pyridiniumcarboxaldehyde but not in N-methyl-3-pyridiniumcarboxaldehyde. The surface enhanced spectrum of 4-pyridinecarboxaldehyde is identical to that of 4-pyridylcarbinol indicating that the aldehyde is completely hydrated on the electrode. Thus SER spectroscopy allows identification of a surface species which is quite different from that found in bulk solution. The reduction potentials of the pyridinecarboxaldehydes and methylketones are determined to show that no electrochemical reductions take place at the potentials used.

704,748
PB84-221381 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of the Kinetics of Thermogravimetry: Overcoming Complications of Thermal History.
Final rept.
J. H. Flynn. 1981, 17p
Pub. in Proceedings of Eastern Analytical Symposium held at New York, New York on November 19, 1980, paper in Thermal Analysis in Polymer Characterization, p43-59 1981.

Keywords: *Reaction kinetics, *Thermogravimetry, *Polymers, Degradation, Chemical reaction mechanisms.

The kinetic analysis of thermogravimetry of polymers requires the comparison of data from experiments performed at differing temperature programs. These data reflect divergent physical properties and thermal histories. This paper discusses how these differences arise, their effects upon the kinetic parameters, how they can be detected and what techniques and methods of data analysis are best suited to interpret them. The degradation of polystyrene in a vacuum is used as an illustrative example.

704,749
PB84-221449 Not available NTIS
National Bureau of Standards, Washington, DC.
Simple Explanation of the Polymer Collapse Transition: The (6/5)ths and the (2/3)rds Laws.
Final rept.
E. A. DiMarzio. Apr 84, 3p
Pub. in Macromolecules 17, p969-971 Apr 84.

Keywords: *Polymers, *Phase transformation, *Collapse, Molecular weight, Reprints.

A simple mean field treatment of the collapse transition in an isolated polymer is given. The two limiting laws (R sup 2 proportional to n(1.2) for the expanded polymer and R sup 2 proportional n(2/3) for the collapsed polymer) are obtained where R sup 2 is the mean square end-to-end length and n the molecular weight. The transition for this model is second-order.

704,750
PB84-221639 Not available NTIS
National Bureau of Standards, Washington, DC.
Photofragment Dynamics.
Final rept.
S. R. Leone. 1982, 70p
Grants NSF-CHE76-22600, NSF-PHY79-04928
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Advances in Chemical Physics, Dynamics of the Excited State, p255-324 1982.

Keywords: *Dissociation, *Photochemical reactions, *Dynamics, *Molecules, Fluorescence, Angular distribution, Reprints.

Molecular photodissociation has been studied by a wide variety of techniques for many years. Photofragment dynamics represents a subfield of photodissociation with special emphasis on fragmentation details, such as final state distributions, dissociation lifetimes, product angular distributions, fluorescence polarization fragments, and translational energy distributions. The field of photofragment dynamics is still remarkably young. Experimental tools have become available only very recently to explore the photofragmentation process in such great detail. At least for simple molecules, it is possible that their photofragment dynamics can be accurately described theoretically. This review considers in turn the developments in experimental technique (not intended to be exhaustive), the theoretical advances in describing photofragment dynamics, and finally the results for a number of specific systems. The bibliography contains 305 entries.

704,751
PB84-221761 Not available NTIS
National Bureau of Standards, Washington, DC.
Rotational Spectrum of the CD2 Radical Studied by Far Infrared Laser Magnetic Resonance Spectroscopy.
Final rept.
P. R. Bunker, T. J. Sears, A. R. W. McKellar, K. M. Evenson, and P. J. Lovas. Aug 83, 9p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Physics , v79 n3 p1211-1219 Aug 83.

Keywords: *Deuterium compounds, *Infrared spectroscopy, *Far infrared radiation, Molecular rotation, Molecular energy levels, Reprints, *Methyl radicals, *Laser spectroscopy, Laser magnetic resonance spectroscopy.

The authors report the detection of seventeen pure rotation transitions in the ground vibronic state of the CD2 radical using far infrared laser magnetic resonance spectroscopy. Fitting the data using an effective rotational Hamiltonian yields values for the three rotational constants, seven centrifugal distortion constants, the three electronic spin-rotation and two electronic spin-spin parameters. They also fit this data, using CD2 nu 2 band data (published separately), using the semirigid bender Hamiltonian and obtain the effective bending potential for CD2. Combining this with previous CH2 results enables us to predict the rotation bending energy levels of CHD. The authors also report here the detection of two further rotational transitions in the nu 1 excited vibrational state of CH2.

704,752
PB84-221886 Not available NTIS
National Bureau of Standards, Washington, DC.
Nitrogen-15 Nuclear Magnetic Resonance Spectroscopy of Neomycin B and Related Aminoglycosides.
Final rept.
R. E. Botto, and B. Coxon. Feb 83, 8p
Pub. in Jnl. of the American Chemical Society 105, n4 p1021-1028, 23 Feb 83.

Keywords: *Nuclear magnetic resonance, *Nitrogen isotopes, *Isotopic labeling, *Neomycins, Molecular structure, Antibiotics, Reprints, *Chemical shifts(Nuclear magnetic resonance), *Nitrogen 15.

Natural-abundance (15)N NMR spectra of four neomycin B derivatives and their structurally related components are reported. Complete (15)N chemical shift titration data for the antibiotic are used to compute pK sup a values for the individual nitrogen functions to within + or - 0.04 pK sup a unit and also to determine the extent and sites of protonation in commercial neomycin sulfate preparations. In general, (15)N protonation shifts are found to be downfield (6.4-14.2 ppm) and have been correlated with nitrogen structural types.

704,753
PB84-221951 Not available NTIS
National Bureau of Standards, Washington, DC.
Electronic Structure and Spectra of the Lowest Five 1 sup sigma (+1) and 3 sup sigma (+1) States, and Lowest Three 1 sup pi, 3 sup pi, 1 sup delta, and 3 sup delta States of NaK.
Final rept.
W. J. Stevens, D. D. Konowalow, and L. B. Ratcliff. 1 Feb 84, 10p
Pub. in Jnl. of Chemical Physics 80, n3 p1215-1224, 1 Feb 84.

Keywords: *Molecular energy levels, *Electronic spectra, *Sodium inorganic compounds, *Potassium inorganic compounds, Potential energy, Reprints, *Molecular configurations, Pseudopotentials.

The authors calculated the potential energy curves for all molecular states of NaK which may be obtained from the interactions Na(3s) + K(4s), Na(3s) + K(4p), Na(3p) + k(4s), Na(3s) + K(5s), Na(3s) + K(3d), and for the delta states corresponding to the interactions Na(3d) + K(4s) and Na(4p) + K(4p) by full-valence configuration interaction computations which utilize effective core potentials to describe the core electrons, core-valence orthogonality constraints and the core-valence correlation (CVC) energy. The differences between our computed curves and those deduced from experimental spectra are generally small and can be accounted for by: (1) the modest size of the basis set, which is insufficiently diffuse to describe Na(+1) and K(-1) resonances and related molecular Rydberg character, and (2) the approximate way in which the CVC interaction is included.

704,754
PB84-221993 Not available NTIS
National Bureau of Standards, Washington, DC.
Effective Thermal Conductivity of Glass-Fiber Board and Blanket Standard Reference Materials.
Final rept.
D. R. Smith, and J. G. Hust. 1983, 14p
Sponsored in part by Department of Energy, Oak Ridge, TN. Oak Ridge Operations Office.
Pub. in Proceedings Thermal Conductivity 17, Gaithersburg, MD, June 15-18, 1981, p483-496 1983.

Keywords: *Thermal conductivity, *Glass fibers, Nitrogen, Argon, Helium, Temperature, Density(Mass/volume), Standards, Reprints, *Standard reference materials.

Measurements of effective thermal conductivity, lambda, have been performed on a series of specimens of glass-fiber board and glass-fiber blanket. Measurements of lambda were conducted as a function of temperature from 85 to 360 K, of temperature difference with delta T=10 to 100 K, of bulk density from 11 to 148 kg/cu m and for nitrogen, argon, and helium inter-fiber fill gases at pressures from atmospheric to high vacuum. Results are analyzed and compared with values from the published literature and NBS certification data for similar material. Polynomial expressions are given for the functional relation between conductivity, temperature, and density for board and for blanket.

704,755
PB84-222009 Not available NTIS
National Bureau of Standards, Washington, DC.
Chain Scission and Mechanical Degradation of Polyethylene.
Final rept.
B. M. Fanconi, G. B. McKenna, K. L. DeVries, and R. H. Smith. Jul 82, 1p
Pub. in Proceedings of the International Union Pure Applied Chemistry Macromolecular Symposium (28th), Amherst, Massachusetts, July 12-16, 1982, p34.

Keywords: *Polyethylene, *Infrared spectroscopy, *Degradation, Polymers, Molecular weight, *Molecular conformation, *Polymeric chains, Free radicals.

Knowledge of molecular processes associated with mechanical degradation of polymers is important to the development of service life prediction and accelerated test procedures as well as the design of improved polymeric materials. One process thought to be involved in mechanical degradation is the scission of carbon-carbon backbone bonds. In a model due to Zhurkov and co-workers, the free radicals formed during the initial chain scissions produce a high localized concentration of bond ruptures due to extensive free radical reactions. These lead to microvoid formation from which cracks develop that result in macroscopic failure. An important aspect of this model is that a large number of chain scissions result from the initial bond rupture through free radical propagation reactions. The evidence for multiple chain scissions per initial free radical comes from comparisons of the electron spin resonance measured number of free radicals generated during mechanical degradation with the number of chain scissions determined from infrared spectroscopic measurements of new end group concentrations. Other estimates of the number of chain scissions are derived from measurements of the reduction in the viscosity average molecular weight. However, it has been found that the number of chain scissions per free radical determined by viscosity measurements on mechanically damaged polyethylene is at least three orders of magnitude lower than the ratio evaluated from previous infrared data.

704,756

PB84-222116 Not available NTIS
National Bureau of Standards, Washington, DC.
Accurate Wave-number Measurements for the (4)He I 1s2p-1s3d Transitions and Comparisons of Several Term Separations with Theory.
Final rept.
C. J. Sansonetti, and W. C. Martin. 1984, 10p
Pub. in Physical Review A 29, n1 p159-168 1984.

Keywords: *Atomic energy levels, *Helium, Doppler effect, Atomic structure, Atomic spectroscopy, Atomic theory, Reprints, *Laser spectroscopy.

The authors have measured the (4)He 2 triplet P - 3 triplet D (5875 A) and 2 singlet P - 3 singlet D (6678 A) lines by Doppler-free intermodulated fluorescence spectroscopy, and also the spin-forbidden 2 triplet P sup(1.2) - 3 singlet D sup(2) (5874 A) and 2 singlet P sup(1) - 3 triplet D sup(2) (6679A) lines as observed in Doppler-limited fluorescence spectra. The positive column of a low-pressure discharge was the source of the excited He atoms. The wave number of the tunable dye laser inducing the fluorescence was measured relative to an iodine-stabilized He-Ne laser by photographic Fabry-Perot interferometry. They give new parametric values for the other (4)He1s3d interactions (three magnetic fine-structure interactions and the exchange energy) and for the singlet-triplet mixing coefficient.

704,757

PB84-222140 Not available NTIS
National Bureau of Standards, Washington, DC.
Limiting Thickness of an Adsorbed Polymer Chain. Random Flight Model.
Final rept.
R. J. Rubin, and G. H. Weiss. 15 Feb 83, 5p
Pub. in Jnl. of Chemical Physics 78, n45 p2039-2043, 15 Feb 83.

Keywords: *Polymers, *Adsorption, *Surface chemistry, *Random walk, *Mathematical models, Thickness, Reprints, *Polymeric chains, *Molecular configurations.

The probability density of the span of an adsorbed polymer chain in the direction normal to the solution surface is derived in de Gennes' model for weakly adsorbed chains. The average value of the span is 1/2 1/k lnN for N>>l. This quantity is identically equal to the distance from the adsorbing solution surface at which the exponential step density obtained in this model is equal to unity.

704,758

PB84-222173 Not available NTIS
National Bureau of Standards, Washington, DC.
Chronocoulometry of a System with Deposition of the Product on the Electrode.
Final rept.
W. T. Yap, R. T. Burke, E. A. Blubaugh, and R. A. Durst. 1983, 7p
Pub. in Jnl. of Electroanalytical Chemistry 159, p287-293 1983.

Keywords: *Electrodes, *Electrodeposition, *Mathematical models, Concentration(Composition), Solubility, Reprints, *Chronocoulometry.

The charge-time relation for double potential-step large-amplitude chronocoulometry was developed for a system with electrodeposition of the product. The model assumes that the concentration of the product near the electrode cannot be larger than the solubility of the product.

704,759

PB84-222181 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectroelectrochemistry of a System with Product Deposition.
Final rept.
W. T. Yap, E. A. Blubaugh, R. A. Durst, and R. T. Burke. 1984, 6p
Pub. in Jnl. of Electroanalytical Chemistry 160, p73-78 1984.

Keywords: *Electrochemistry, *Mathematical models, *Thermodynamics, *Laser materials, Nitrogen organic compounds, Equilibrium, Nernst effect, Dyes, Reprints, Pyridinium toluene sulfonate/methyl-(phenyl-oxazolyl).

An analysis of the spectroelectrochemistry of systems containing a species which deposits onto the electrode is presented. In this model, in addition to the Nernst equation, a thermodynamic condition for phase equilibrium between the deposited and solution species of the product is assumed. Relations between the variables of the Nernst plot were derived and procedures for obtaining the formal potential, number of electrons involved, and the maximum equilibrium concentration of the product are presented. These results are applied to the experimental data on the aqueous solution of the laser dye, 1-methyl-4-(5-phenyl-2-oxazolyl)pyridinium p-toluenesulfonate.

704,760

PB84-222595 Not available NTIS
National Bureau of Standards, Washington, DC.
Applications of Fluorescence Techniques to Polymer Systems: Polymer Compatibility and Segmental Mobility.
Final rept.
F. W. Wang. 1983, 4p
Pub. in Polymer Preprints, Japan, v32 n1 p79-82 1983.

Keywords: *Polymers, *Fluorescence, *Energy transfer, Polymethyl methacrylate, Reprints, *Excimers, Vinylidene fluoride polymers, Polyethyl methacrylate.

Non-radiative energy transfer technique was used to determine the phase behavior of a poly(methyl methacrylate) - poly(ethyl methacrylate) blend and to evaluate the effectiveness of poly(vinylidene fluoride) as a compatibility enhancer for this blend. Excimer fluorescence technique was used to determine the segmental mobilities of poly(methyl methacrylate) polymers and a poly(methyl acrylate) polymer.

704,761

PB84-222884 Not available NTIS
National Bureau of Standards, Washington, DC.
Decay Rate of Critical Fluctuations in Carbon Dioxide-Ethane Mixtures Near the Critical Line.
Final rept.
R. F. Chang, and T. Doiron. 1982, 5p
Pub. in Proceedings of Symposium on Thermophysical Properties of Fluids (8th), Gaithersburg, Maryland, June 1982, 1, p458-462.

Keywords: *Binary systems(Materials), *Carbon dioxide, *Ethane, *Decay, Mixtures, Thermophysical properties, Critical point, *Critical line.

Using the techniques of photon correlation spectroscopy the authors have measured the decay rate of fluctuations of two binary mixtures of ethane and carbon dioxide near the plait point of the mixtures, along with pure ethane near its critical point at 90-degree scattering angle. The compositions of the two mixtures are 5.4% and 35.8% mole fractions of carbon dioxide with the remaining amount being ethane. Our experimental data indicate that the relaxation rate can be described satisfactorily by the predictions of the mode-coupling theory with the exponent nu=0.625 provided background contributions are not neglected.

704,762

PB84-223130 Not available NTIS
National Bureau of Standards, Washington, DC.
Calorimetric Studies of Clathrate Hydrates.
Final rept.
J. E. Callanan, and E. D. Sloan. 1983, 9p
Pub. in Proceedings of Int. Gas Res. Conf., Hilton International, London, England, June 6-16, 1983, 9p.

Keywords: *Heat measurement, *Hydrates, *Natural gas, Thermophysical properties, Specific heat, Heat of dissociation, Ethylene oxide, Cyclopropane, *Clathrate compounds, Furan tetrahydro.

World resources of natural gas in hydrate form are abundant. Thermophysical property measurements are vital to the determination of the exploitability of this resource. The natural gas hydrates are clathrates; the hydrate lattice exists in one of two special structures (I and II), both of which form with cavities or cages in which molecules in specific size ranges can be trapped. Heat capacities as a function of temperature and, where appropriate, heats of dissociation have been measured for tetrahydrofuran (II), ethylene oxide (I), and cyclopropane (I and II) hydrates by differential scanning calorimetry. The heat capacities were found to vary both with structure and with guest. Scanning calorimetric techniques and sample handling techniques suitable for dealing with hydrates in the subambient region were developed.

704,763

PB84-223155 Not available NTIS
National Bureau of Standards, Washington, DC.
Principles of Laser-Enhanced Ionization Spectrometry in Flames.
Final rept.
J. C. Travis, G. C. Turk, J. R. DeVoe, P. K. Schenck, and C. A. van Dijk. 1984, 43p
Pub. in Progr. Anal. Atom. Spectrosc. 7, n2 p199-241 1984.

Keywords: *Flames, *Ionization, Forecasting, Reprints, *Laser enhanced ionization, *Flame spectroscopy.

Laser-enhanced ionization (LEI) is a highly sensitive and selective flame spectrometric analytical technique. An overview of LEI is given, with special emphasis on the basis physical principles of the method. Topics covered include the production (with and without laser enhancement), destruction, and transport of ions and electrons in flames; the perturbation of an electric field by free charges; and the induction of current in the measurement circuit by moving charges in the flame. These principles are related to practice through discussions of the present analytical performance of, and future prospects for, the technique.

704,764

PB84-223171 Not available NTIS
National Bureau of Standards, Washington, DC.
Study of Microstructural Effects in the Strength of Alumina Using Controlled Flaws.
Final rept.
B. R. Lawn, S. W. Freiman, T. L. Baker, D. D. Cobb, and A. C. Gonzalez. Apr 84, 3p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of American Ceramic Society 67, n4 pC-67-C-69 Apr 84.

Keywords: *Aluminum oxide, *Fracture strength, Trends, Nondestructive testing, Microstructure, Ceramics, Reprints.

A study is made of strength characteristics as a function of Vickers indentation load for two grain-size aluminas. At low loads the strengths tend to well-defined plateaus, the levels of which bear an inverse relationship with grain size. These trends are consistent with a transition from indentation-controlled to microstructure-controlled behavior as flaw size diminishes. The conventional indentation fracture formalism is modified to account for this transition.

704,765

PB84-223197 Not available NTIS
National Bureau of Standards, Washington, DC.

Simulation of the Dynamic and Equilibrium Properties of Many-Chain Polymer Systems.
Final rept.
D. E. Kranbuehl, and P. H. Verdier. 1984, 7p
Contract W-7405-eng-48, Grant NSF-CHE77-21305
Pub. in Macromolecules 17, n45 p749-755 1984.

Keywords: *Polymers, *Dynamics, *Chemical equilibrium, Reprints, *Polymer chains.

Computer simulation of the motions of systems of lattice-model polymer chains on a simple cubic lattice was employed in order to study the effects of excluded volume and chain entanglement on the relaxation behavior and equilibrium properties of polymer chains. Multiple chains of from 8 to 64 beads each were studied, with periodic boundary conditions and occupying up to 80% of the lattice sites. As chain concentration increased, equilibrium dimensions were found to approach random-walk values, in agreement with results obtained by previous workers. The long relaxation times inferred from the limiting long-time behavior of the autocorrelation functions for end-to-end vector show a dramatic increase with increasing concentration. The variation of the long relaxation time with chain length and concentration is represented reasonably well by a simple free volume effect and an additional chain-length dependent factor.

704,766
PB84-223205 Not available NTIS
National Bureau of Standards, Washington, DC.
Signal Detection of Pulsed Laser-Enhanced Ionization.
Final rept.
G. J. Havrilla, P. K. Schenck, J. C. Travis, and G. C. Turk. Feb 84, 8p
Pub. in Analytical Chemistry 56, n2 p186-193 Feb 84.

Keywords: *Mathematical models, *Ionization, *Flames, Trends, Reprints, *Laser enhanced ionization, *Signal detection, *Flame spectroscopy.

A point charge model has been developed to describe the proposed detection mechanisms of laser enhanced ionization (LEI) which are based upon charge induction theory. The model predictions are in good agreement with experimentally observed LEI electron and ion signal pulses. This investigation provides theoretical as well as experimental basis for establishing experimental methodology that is necessary to the development of LEI as a technique for trace metal analysis. The predicted effects and behavioral trends of alkali metal matrix concentration and laser beam position were confirmed by experimental results. The development of this model provides a basis upon which the analytical capability of LEI can be refined and improved.

704,767
PB84-223387 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Studies of Methyl Radical Reactions with Cl2 and Br2: Absolute Rate Constants, Product Vibrational Excitation, and Hot Radical Reactions.
Final rept.
L. J. Kovalenko, and S. R. Leone. 15 Apr 84, 13p
Grants NSF-CHE79-11340, NSF-CHE82-00805
Pub. in Jnl. of Chemical Physics 80, n8 p3656-3667, 15 Apr 84.

Keywords: *Reaction kinetics, Excitation, Molecular vibration, Dynamics, Chemiluminescence, Halogen organic compounds, Reprints, *Methyl radicals, *Laser spectroscopy, Methane/dichloro, Methane/dibromo.

Reactions of methyl radicals with Cl2 and Br2 are studied by pulsed laser dissociation of CH3I followed by time-resolved detection of infrared vibrational fluorescence from the C-H stretch modes of the methyl halide product. This method provides a determination of the absolute rate constants for the methyl radical reactions. From the fluorescence intensity of the methyl halide product, an estimate can be made of the fraction of energy available upon reaction that goes into product vibration. For both reactions this is determined to be about 0.5. In addition, the reaction rates are observed to be considerably enhanced for hot methyl radicals produced in the dissociation of CH3I. The enhancement is shown to be due predominantly to the translational excitation, as opposed to the vibrational excitation, imparted in the photofragmentation.

704,768
PB84-223825 Not available NTIS
National Bureau of Standards, Washington, DC.
Tunable Far-Infrared Spectroscopy.
Final rept.
K. M. Evenson, D. A. Jennings, and F. R. Petersen. 15 Mar 84, 3p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Applied Physics Letters, v44 n6 p576-578, 15 Mar 84.

Keywords: *Infrared spectroscopy, *Far infrared radiation, Carbon dioxide lasers, Continuous radiation, Reprints, *Laser spectroscopy, *Far infrared spectroscopy, *Tunable lasers, Waveguide lasers.

Tunable, cw, far-infrared radiation has been generated by nonlinear mixing of radiation from two CO2 lasers in a metal-insulator-metal (MIM) diode. The FIR difference-frequency power radiated from the MIM diode antenna to a calibrated indium antimonide bolometer. Two-tenths of a microwatt of FIR power was generated by 250 mW from each of the CO2 lasers. The combination of lines from a waveguide CO2 laser, with its larger tuning range, with lines from CO2, N2O, and CO2 isotope lasers promises complete coverage of the entire far-infrared band from 100 to 5000 GHz (3 to 200/cm) with stepwise-tunable cw radiation.

704,769
PB84-223866 Not available NTIS
National Bureau of Standards, Washington, DC.
Polymer Dynamics: When Do Scaling Laws Apply.
Final rept.
D. W. Schaefer, and C. C. Han. Mar 81, 2p
Pub. in ACS (American Chemical Society) Polymer Preprints, v2 n1 p66-67 Mar 81.

Keywords: *Polymers, *Light scattering, *Polystyrene, *Dynamics, Molecular structure, Reprints, *Polymer chains.

The random motion of a flexible polymer chain is exceedingly complex. In spite of this complexity, however, recent theoretical developments suggest that universal behavior should be observed in certain dynamic regions, regardless of the detailed structure of a particular polymer. In this paper, some experimental results derived from dynamic light scattering will be compared with theoretical predictions. The limits of validity of scaling laws will be discussed.

704,770
PB84-223890 Not available NTIS
National Bureau of Standards, Washington, DC.
Resonance Ionization Mass Spectrometry of Iron--Quantitative Aspects.
Final rept.
J. D. Fassett, L. J. Moore, and J. C. Travis. 1984, 6p
Pub. in Analytic Spectroscopy 19, p137-142 1984.

Keywords: *Iron, Mass spectroscopy, Ionization, Comparison, Reprints, *Resonance ionization spectroscopy, *Laser spectroscopy.

Resonance ionization mass spectrometry has been used to study the formation of atomic ions of iron. Iron was thermally vaporized from a filament at 1250 K. A one-wavelength, two-photon ionization scheme was employed which utilized the tunable UV light provided by a Nd:YAG pumped tunable dye laser with frequency doubling. The systematics of the resonance ionization process has been studied and a comparison with thermal ionization made.

704,771
PB84-223916 Not available NTIS
National Bureau of Standards, Washington, DC.
Rotational Spectrum and Hyperfine Structure of the Methylene Radical CH2 Studied by Far-Infrared Laser Magnetic Resonance Spectroscopy.
Final rept.
T. J. Sears, P. R. Bunker, A. R. W. McKellar, K. M. Evenson, and D. A. Jennings. Dec 82, 15p
Pub. in Jnl. of Chemical Physics, v77 n11 p5348-5362 Dec 82.

Keywords: *Molecular rotation, *Hyperfine structure, Excitation, Microwave spectroscopy, Interstellar matter, Deuterium compounds, Reprints, *Methylene radicals, *Laser magnetic resonance spectroscopy, *Far infrared spectroscopy, Laser spectroscopy.

Thirteen pure rotational transitions of CH2 in its X triplet B sub 1 ground vibronic state have been measured and assigned using the technique of far-infrared laser magnetic resonance (LMR) spectroscopy. The analysis of these observations yields precise rotational constants as well as spin-spin, spin-rotation, and hyperfine interaction parameters for gas phase CH2. Its rotational spectrum may enable interstellar CH2 to be detected by radio astronomy. Two rotational transitions within the nu(1)=1 excited vibrational state have also been identified in the LMR spectrum. Future observations of vibrationally excited CH2 may afford a means of determining the singlet-triplet splitting in methylene, and studies of CD2 and CHD will result in improved structural determinations.

704,772
PB84-223924 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Frequency Measurements of the 2-0 Band of CO at 2.3 Micrometers; Calibration Standard Frequencies from High Resolution Color Center Laser Spectroscopy.
Final rept.
C. R. Pollock, F. R. Petersen, D. A. Jennings, J. S. Wells, and A. G. Maki. 1983, 12p
Pub. in Jnl. of Molecular Spectroscopy 99, p357-368 1983.

Keywords: *Frequency measurement, *Carbon monoxide, Line spectra, Band spectra, Near infrared radiation, Line width, Standards, Reprints, Pressure dependence, Color center lasers, Laser spectroscopy.

The absolute frequencies of 20 lines of the 2-O band of CO have been measured near 4260/cm by heterodyne frequency measurement techniques. Eleven of the lines were measured by saturated absorption techniques which produced line widths of about 3 MHz. New ro-vibrational constants have been fitted to these measurements. A table of calculated transition frequencies is given. The pressure shifts of three have been measured and fall in the range from -0.9 to -3 kHz/Pa (-122 to -400/Torr). It is suggested that the generally accepted frequencies of the 1-0 band of CO should be shifted by -7 MHz.

704,773
PB84-223973 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical Behavior of Isotactic Polypropylene Subjected to Various Strain Histories in Uniaxial Extension.
Final rept.
L. J. Zapas, and J. M. Crissman. Mar 83, 8p
Pub. in Polymer 24, p351-358 Mar 83.

Keywords: *Mechanical properties, *Polypropylene, Stability, Polymers, Stress relaxation tests, Strain tests, Creep rate, Loading rate, Reprints, *BKZ theory.

Bernstein and Zapas have recently extended the work of Ericksen on the discontinuous deformations of solid elastic bars to the case of viscoelastic materials which behave according to the BKZ theory. The theory cannot predict a priori when the material will exhibit the phenomenon of necking, but it does give an explanation for the formation of the neck, which depends upon the stretch history. In the work which the authors shall present here it will be their purpose (1) to present experimental data, obtained for a variety of different strain histories in uniaxial extension, for a material which can be described rather well by the BKZ theory, and (2) to show that by suitably extrapolating the available data into regions which are not accessable experimentally there is consistency between the theory and the experimental results. For this purpose, the authors have selected as a material a rather slowly quenched isotoetic polypropylene. Experiments were performed which involved single step stress relaxation, constant rate of strain, constant rate of loading, and creep.

704,774
PB84-223981 Not available NTIS
National Bureau of Standards, Washington, DC.
Accordion Type LASER-Raman Scattering by Polymers.
Final rept.
A. Peterlin. 1982, 28p
Pub. in Jnl. of Polymer Science, Polymer Physics Edition 20, p2329-2356 1982.

Keywords: *Raman spectroscopy, *Polymers, *Acoustic waves, Crystals, Infrared spectroscopy, Reprints, *Laser spectroscopy.

All the improvements of the independent-rod model of longitudinal accordian-type acoustic mode (LAM) oscillations have assumed that the oscillation energy is

retained either on the isolated macromolecule oscillating in a vacuum or in a narrow cylinder containing the straight sections of the macromolecules in the crystal lattice and their straight continuations through the amorphous layers. According to such concepts, concentration of the oscillation energy in gauche defects or amorphous layers occurs, respectively, whenever the axial elastic modulus of the straight sections (crystal lattice) is very much larger than that of the kinked sections (amorphous layers). The effect is enhanced by low crystallinity. Actually such behavior has never been observed. To agree with experimental data the model has to be modified in such a manner that the oscillation amplitude in the amorphous layer steadily decreases with increasing distance from the boundary between the two phases. The necessary large damping of the LAM oscillation in the kinked sections results from true damping in the viscoelastic amorphous component and energy transfer to adjacent chains which turns out to be just as easy as energy conduction along the kinked chain. Such a transfer is equivalent to radiation of the oscillation energy in all directions in the kinked phase. As a consequence of damping, the coupling of chains in adjacent crystals becomes so small that it may be completely neglected. Such a model explains in a satisfactory manner the observed accordion Laser-Raman spectra of the semicrystalline polymers and the infrared absorption of paraffins in the liquid state.

704,775
PB84-223999 Not available NTIS
National Bureau of Standards, Washington, DC.
Chemiluminescence of Fuels and Lubricants - A Critical Review.
Final rept.
D. B. Clark, and S. M. Hsu. Nov 83, 6p
Pub. in Lubrication Engineering, v39 n11 p690-695 Nov 83.

Keywords: *Chemiluminescence, *Fuels, *Lubricants, *Oxidation, Reviews, Chemical reactions, Reprints, Chemical reaction mechanisms.

Chemiluminescence (CL), light produced as a result of a chemical reaction, is a valuable but under-utilized tool for the study of fuel and lubricant oxidation. CL methods provide a practical means of studying the oxidation process under conditions similar to those experienced in service. The techniques are sensitive, rapid, non-intrusive, require only a small sample, and provide a continuous monitoring of the reaction. In spite of these advantages and a fair amount of CL research on simple hydrocarbons, the extension of that work to complex mixtures such as lubricants has been slow and rather limited. This review will describe the origin and mechanism of CL in hydrocarbon oxidation, present an overview of instrumentation for its measurement, and finally, discuss and critically evaluate the few studies available in the literature.

704,776
PB84-224070 Not available NTIS
National Bureau of Standards, Washington, DC.
Radial Distribution Function at Low Densities: Exact Results for Small and Large Separations for Smooth Potentials.
Final rept.
D. G. Friend. 1 Nov 83, 1p
Pub. in Jnl. of Chemical Physics, v79 n9 p4553, 1 Nov 83.

Keywords: Distribution functions, Numerical integration, Reprints, *Radial distribution functions.

Explicit expressions are obtained for the r approaches 0 and r approaches infinity limits of the first density coefficient of the radial distribution function. This double integral has also been evaluated numerically by Clenshaw-Curtis quadrature for Lennard-Jones and inverse power potentials. Our numerical results agree closely with previous work where overlap exists and confirm our analytic results in the r approaches 0 and r approaches infinity regions.

704,777
PB84-224120 Not available NTIS
National Bureau of Standards, Washington, DC.
Novel Excimer Fluorescence Method for Monitoring Polymerization. 1. Polymerization of Methyl Methacrylate.
Final rept.
F. W. Wang, R. E. Lowry, and W. H. Grant. May 84, 3p
Pub. in Polymer 25, p690-692 May 84.

Keywords: *Polymerization, *Fluorescence, *Polymethyl methacrylate, Molecular energy levels, Synthesis(Chemistry), Nondestructive testing, Pyrenes, Isotopic labeling, Reprints, *Excimers.

An excimer is formed by the association of an excited molecule with another molecule in its ground state. Such an excimer is characterized by a broad structureless fluorescence which is shifted to longer wavelengths compared to the fluorescence spectrum of the isolated molecule. Intramolecular excimer fluorescence has been observed in solutions of pyrene-labeled alkanes such as 1,3-bis-(1-pyrene) propane and 1,10-bis-(1-pyrene) decane.

704,778
PB84-224724 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of the Electric-Field in the Vicinity of an Oil-Pressboard Interfaces Parallel to the Field.
Final rept.
R. E. Hebner, and E F. Kelley. Dec 83, 4p
Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Proceedings of Conference on Interfacial Phenomena Practical Insulation System, Gaithersburg, MD., September 19-20, 1983, IEEE Conf. Rec. No. 83CH1946-3, p19-22 Dec 83.

Keywords: *Electric fields, *Insulating oil, *Kerr electrooptical effect, Electrodes, Pressboards.

Electro-optical Kerr-effect measurements are performed to measure the spatial variations of the electric field in transformer oil in a parallel plate electrode system with and without a pressboard interface bridging the gap between the electrodes. No space-charge field enhancements are observed at room temperature (25C) even with the interface present. At 125C space charge field enhancements are observed in transformer oil, but the field enhancement does not change upon the addition of an interface -- the field near the interface was the same as the field away from the interface to within + or - 5% precision of the experiment.

704,779
PB84-224732 Not available NTIS
National Bureau of Standards, Washington, DC.
Phase Transitions and Ferroelectric Polarization in a Vinylidenefluoride-Trifluoro-Ethylene Copolymer.
Final rept.
G. T. Davis. 1982, 6p
Pub. in Polymer Preprints, Japan, v31 n5 p937-942 1982.

Keywords: *Copolymers, *Phase transformation, *Ferroelectric materials, *Polarization(Charge separation), Piezoelectricity, Fluorine organic compounds, Reprints, *Vinylidene fluoride polymers, *Ethylene/trifluoro.

The ferroelectric to paraelectric phase transition in a copolymer of vinylidene-fluoride and trifluoroethylene (52/48 mole ratio) has been shown to be caused by a change in conformation of the polymer chain within the crystalline phase of the polymer. Polarization data from this copolymer are compared with predictions from a six-site model for ferroelectricity and the observed Curie point of 351.3 K is used to evaluate an energy parameter in the model.

704,780
PB84-224757 Not available NTIS
National Bureau of Standards, Washington, DC.
Preparation and Properties of Polymeric Solid Electrolyte: Polyethylene Oxide Sodium Iodide Complexes.
Final rept.
C. K. Chiang, G. T. Davis, C. A. Harding, and J. Aarons. 1983, 4p
Pub. in Solid State Ionics 9 and 10, p1121-1124 1983.

Keywords: *Polyoxyethylene, *Solid electrolytes, *Thermal properties, *Electrical properties, Polymers, Sodium iodides, Conductivity, Reprints, *Differential scanning calorimeters.

The thermal and electrical properties of mixtures of polyethylene oxide and sodium iodide were measured for concentrations of salt up to 25 mole%. A maximum in dc conductivity is observed at low concentrations of NaI, a region in which no crystalline complex is formed as determined from DSC measurements.

704,781
PB84-224765 Not available NTIS
National Bureau of Standards, Washington, DC.
Nature of Polymer Interfaces and Interphases.
Final rept.
I. C. Sanchez. Feb 84, 8p
Pub. in Polymer Engineering and Science, v24 n2 p79-86 Feb 84.

Keywords: *Polymers, *Interfacial tension, Surfaces, Liquids, Adsorption, Reprints.

An abbreviated review of the current state of knowledge of polymer interfacial phenomena is given. Classical thermodynamics treats the interfacial zone (the interphase) as a 'black box' and yields rigorous relationships among interfacial quantities. A recent reformulation of interphase thermodynamics, which eliminates the use of a Gibbs dividing surface, is shown to be an invaluable tool for investigating interfacial properties. Microscopic theories, such as the gradient theory, yield more details about what is in the black box, but the information is only approximate. The gradient theory has been used to: (1) relate the surface tension of a polymer liquid to its isothermal compressibility, (2) develop a quantitative theory of polymer liquid surface tension, and (3) determine the interfacial tension between two immiscible polymer liquids. The gradient theory will be shown to be in harmony with the microscopic theory of Helfand and co-workers although the latter treats polymer interfaces from a completely different point of view.

704,782
PB84-224898 Not available NTIS
National Bureau of Standards, Washington, DC.
Influence of Increasing Nuclear Charge on the Rydberg Spectra of Xe, Cs (+) and Ba (++): Correlation, Term Dependence and Autoionization.
Final rept.
W. T. Hill, K. T. Cheng, W. R. Johnson, T. B. Lucatorto, T. J. McIlrath, and J. Sugar. 29 Nov 82, 5p
Contract W-31-109-ENG-38, Grant NSF-CPE79-18387
Pub. in Physical Review Letters, v49 n22 p1631-1635, 29 Nov 82.

Keywords: *Atomic energy levels, Xeon, Ions, Reprints, *Autoionization, *Rydberg series, Isoelectronic sequences, Barium ions, Cesium ions, Quantum defect.

The first experimental-theoretical study of Rydberg autoionizing resonances along an isoelectronic sequence is presented. This analysis demonstrates the intimate connection between electron-electron correlation, term dependence, and autoionization and underscores the power of multichannel quantum-defect theory in analyzing complex spectra.

704,783
PB84-224906 Not available NTIS
National Bureau of Standards, Washington, DC.
Far-Infrared Spectrum of the OH Radical.
Final rept.
J. M. Brown, J. E. Shubert, K. M. Evenson, and H. E. Radford. 15 Jul 82, 5p
Pub. in Astrophysical Jnl. 258, p899-903, 15 Jul 82.

Keywords: *Infrared spectroscopy, *Astronomy, Reprints, *Hydroxyl radical, *Laser spectroscopy, Laser magnetic resonance spectroscopy.

The frequencies, wavelengths, and linestrengths for transitions between the lowest spin-rotation levels of the OH molecule have been calculated from the recently reported laser magnetic resonance spectra.

704,784
PB84-224997 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamic Scattering from Biomodal Polymer Solutions. 1. Apparent Diffusion Coefficient.
Final rept.
A. Z. Akcasu, B. Hammouda, T. P. Lodge, and C. C. Han. Jun 84, 8p
Pub. in Macromolecules, v17 n4 p759-766 Jun 84,

Keywords: *Polymers, *Diffusion coefficients, *Dynamics, Light scattering, Solutions, Molecular weights, Concentration(Composition), Reprints.

Dynamic scattering matrix S(q,t) for scattering from multimodal systems is formulated and explicit results in the case of bimodal systems are presented in the small-q limit. The total dynamic scattering function is expressed, in this limit, as a weighted sum of two exponentials with decay rates gamma sup 1 and gamma sup 2. Both the decay rates and the weighting factors are calculated in terms of the concentrations and molecular weights of the two components. The concentration dependence of the apparent diffusion coefficient and the collective diffusion coefficient in a single component system is expressed in terms of the pair correlation function for polymer molecules.

704,785
PB84-225234 Not available NTIS
National Bureau of Standards, Washington, DC.
Kinetics of the Manganese (III)-Sulfur (IV) Reaction in Aqueous Perchloric Acid Solutions.
Final rept.
P. A. Siskos, N. C. Peterson, and R. E. Huie. 1984, 4p
Sponsored in part by Department of Energy, Morgantown, WV. Morgantown Energy Technology Center.
Pub. in Inorganic Chemistry, v23 n8 p1134-1137 1984.

Keywords: *Manganese, *Sulfur, *Reaction kinetics, Reprints, *Dithionate.

The reaction of Mn(III) with S(IV) has been studied in perchloric acid solutions. The stoichiometry of the reaction is one Mn(+3) consumed per SO2 consumed and the production of dithionate was confirmed. The reaction shows a strong inverse dependence on acid concentration.

704,786
PB84-225259 Not available NTIS
National Bureau of Standards, Washington, DC.
Resonance Fluorescence and Raman Line Shapes Produced by Monochromatic Laser Fields: Effects of Branching Ratio and Homogeneous Broadening.
Final rept.
F. H. Mies. 1983, 22p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer, v29 n3 p237-258 1983.

Keywords: *Fluorescence, Excitation, Line spectra, Spectral lines, Reprints, *Laser spectroscopy, *Raman scattering, *Resonance fluorescence technique, *Resonance Raman spectra.

The Heitler-Ma damping theory is developed for a two level system in which the excited state is homogeneously, and irreversibly coupled to various continuum states with a total decay rate 1/tau. We give particular consideration to the channel consisting of a third, discrete, atomic level and a continuum of emitted photons, which simply corresponds to a spontaneous resonant Raman process. The theory applies to either a narrow, pulsed, laser beam, or injection of target atoms or molecules into a c.w. field.

704,787
PB84-225283 Not available NTIS
National Bureau of Standards, Washington, DC.
Polynomial Representation of the Decker Equations of State for NaCl and CsCl.
Final rept.
S. D. Wood, and V. E. Bean. 1983, 2p
Pub. in High Temperature-High Pressure 15, p715-716 1983.

Keywords: *Sodium chloride, *Equations of state, High pressure tests, Calibrating, Pressure, Reprints, *Cesium chloride.

Polynomials expressing pressure as a function of temperature and lattice parameter have been developed thereby reducing the table of values representing the Decker equations of state for NaCl and CsCl to a form easily stored in a computer memory.

704,788
PB84-225325 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Induced Atomic Excitation and Neutron Moderation.
Final rept.
C. D. Bowman, and R. G. Johnson. 1983, 3p
Sponsored in part by European Physical Society, Geneva (Switzerland), Antwerp Univ., Wilrijk (Belgium), and International Union of Pure and Applied Physics, London (England).
Pub. in Proceedings of Conf. Nuclear Data Science Technology, Antwerp, Belgium, September 6-10, 1982, p971-973 1983.

Keywords: *Neutron scattering, *Atomic energy levels, Excitation, Neutron cross sections, Atoms.

The excitation of electrons in atoms due to neutron-nucleus scattering has been examined. The cross section for neutron scattering with an accompanying excitation of a particular electron has been derived. In addition, a procedure for estimating the probability of any electron excitation in neutron scattering has been formulated. Using these probability estimates the effect of electronic excitations in neutron moderation problems has been connected to a small fractional increase (of the order of .0001) in the average logarithmic energy decrement. In special cases this small increase may lead to effects of about 1%.

704,789
PB84-225358 Not available NTIS
National Bureau of Standards, Washington, DC.
High Ionic Conduction in Polymers.
Final rept.
G. T. Davis, and C. K. Chiang. 1983, 22p
Pub. in High Conducting Polymeric Materials, p1-22 1983.

Keywords: *Polymers, *Ion currents, Reviews, Transport properties, Electric batteries, Electrochemical cells, Membranes, Diffusion coefficient, Polypropylene, Reprints.

A review of ionic conductivity in polymers is presented with an emphasis on alkali metal salts in poly(ethylene oxide), PEO. Evidence for the formation of a specific crystalline complex between PEO and the salt is summarized as well as conductivity data as a function of temperature. It is concluded that ionic transport occurs primarily within the non-crystalline phase of the polymer-salt system rather than along specific pathways within the crystalline complex. The high-melting crystals that form provide rigidity to the system at temperatures where the non-crystalline phase and its dissolved ions become highly mobile. The concept of ionic transport in a non-crystalline phase has important implications regarding the development of improved polymeric conductors for solid state batteries, electrochemical sensors, separation membranes, and other applications.

704,790
PB84-225382 Not available NTIS
National Bureau of Standards, Washington, DC.
Parameter-Free Model of the Correlation-Polarization Potential for Electron-Molecule Collisions.
Final rept.
N. T. Padial, and D. W. Norcross. Apr 84, 7p
Sponsored in part by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Physical Review A 29, n4 p1742-1748 Apr 84.

Keywords: *Mathematical models, *Potential energy, *Polarizational(Charge separation), Hydrogen, Nitrogen, Carbon dioxide, Hydrogen fluoride, Hydrogen chloride, Carbon monoxide, Reprints, *Electron molecule interactions.

A model potential that includes both correlation and polarization effects is proposed for electron-molecule collisions. It is based, as suggested by O'Connell and Lane, on a hybridization of local electron-gas theory for short distances and the asymptotic form of the polarization potential. It is energy independent and very simple to apply, depending only on the molecular charge density and polarizabilities. The potential has been calculated for several molecules (H2, N2, CO2, HF, HCl, and CO); the crossing point between the correlation and polarization potentials is remarkably constant, averaging 0.96 eV. Application in scattering calculations for H2 and N2 yields very encouraging results.

704,791
PB84-225390 Not available NTIS
National Bureau of Standards, Washington, DC.
Resonant Multiphoton Ionization via Rydberg States - Angular Distributions of Photoelectrons.
Final rept.
G. Leuchs, E. Matthias, D. S. Elliott, S. J. Smith, and P. Zoller. Oct 83, 3p
Grants NSF-PHY82-00805, NSF-INT81-20128
Pub. in Int. Conference Laser Spectroscopy (6th), Interlaken, Switzerland, June 27-July 1, 1983, p224-226 Oct 83.

Keywords: *Photoelectrons, *Angular distribution, Ionization, Reprints, *Laser spectroscopy, *Rydberg series.

The authors reported on the measurement of angular distributions of photoelectrons from aligned barium atoms in states of the 6snd Rydberg series for a range $19 < \text{or} = n < \text{or} = 34$, encompassing a strongly perturbing state, 5d7d singlet D2. Ionization was produced in a low density barium beam by pulsed 1.06 micrometers YAG-laser radiation, following resonant cascade excitation using two pulsed dye lasers. It was found that the total photoionization cross section is strongly enhanced by admixtures of the 5d7d singlet D2 perturber state. Likewise, the angular distribution of the photoelectrons was shown to be a most sensitive method for determining the structure of the excited state from which ionization takes place. As an example A6-coefficients were analyzed quantitatively and found to be consistent with singlet-triplet mixing ratios obtained by other methods.

704,792
PB84-225499 Not available NTIS.
National Bureau of Standards, Washington, DC.
Benchmark Measurement of Iodobenzene Ion Fragmentation Rates.
R. Bombach, J. P. Stadelmann, J. Dannacher, H. M. Rosenstock, R. Buff, A. C. Parr, and R. Stockbauer. 1983, 13p
Sponsored in part by Department of Energy, Washington, DC. Office of Environment.
Pub. in Chemical Physics 75, p23-35 1983.

Keywords: *Reaction kinetics, *Photoionization, Iodine organic compounds, Halogen organic compounds, Photochemical reactions, Ions, Photoelectrons, Reprints, *Benzene/iodo.

The unimolecular fragmentation rate of iodobenzene ion has been studied by variable residence time photoelectron-photoion coincidence techniques. The techniques employed variable wavelength with threshold photoelectron detection and fixed (58.4 nm) wavelength with variable energy photoelectron detection, respectively. Residence times of 1.0 + or - 0.25 or 5.9 + or - 0.3 and 21 + or - 1 or 57 + or - 1 microseconds were employed. The four sets of measurements were independently analyzed using exact counting of harmonic oscillator states, taking into account the appropriate (and different) apparatus functions and the thermal energy distributions of the parent ions. The resulting rate-energy dependences and fragmentation threshold values were in excellent agreement with one another. Some remaining uncertainties regarding the transition-state model are discussed.

704,793
PB84-225614 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin Relaxation of Triplet Excitons in Molecular Crystals.
Final rept.
N. F. Berk, J. Rosenthal, and L. Yarmus. 1 Nov 83, 7p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review B 28, n9 p4963-4969, 1 Nov 83.

Keywords: *Crystals, *Molecular relaxation, *Excitons, *Spin lattice relaxation, Anthracene, Line spectra, Reprints.

The primary spin relaxation mechanism for triplet excitons in many molecular crystals arises from hopping transport between two orientationally inequivalent sites and is the source of both EPR linewidth and level equilibration. A generalized stochastic theory of resonance linewidth due to Blume that was previously applied to this mechanism and shown in its random phase approximation (RPA) to yield the linewidth spectrum is extended to give a complete formulation of both linewidth and equilibration rate. The method employs the averaged time development superoperator of Blume's theory in the RPA in order to construct an equation of motion for the appropriately averaged spin density matrix from which these two can be extracted. The authors show associations between this work and related studies by Kubo and Suna. Comparison is made between rates calculated for anthracene and values of T(1) deduced by Haarer and Wolf from a Bloch analysis of their EPR saturation measurements.

704,794
PB84-225689 Not available NTIS
National Bureau of Standards, Washington, DC.
Orthobaric Liquid Densities and Dielectric Constants of (Methane + 2-Methylpropane) and (Methane + n-Butane) at Low Temperatures.
Final rept.
W. M. Haynes. 1983, 9p
Pub. in Jnl. of Chemical Thermodynamics 15, p903-911 1983.

Keywords: *Density(Mass/volume), *Dielectric properties, *Methane, *Butane, *Binary system(Materials), Mixtures, Vapor pressure, Liquids, Liquefied natural gas, Mathematical models, Thermodynamics, Reprints, Propane/methyl, Numerical solution, Clausius-Mossotti function.

Measurements of the orthobaric liquid densities and dielectric constants of methane-rich binary mixtures of methane + isobutane and methane + normal butane have been obtained at temperatures between 110 and 140 K. Densities were determined with a magnetic suspension densimeter, while a concentric cylinder capacitor was used for simultaneous measurements of dielectric constant. These measurements were part of an experimental program that has provided a consistent and comprehensive set of density data for the major components of liquefied natural gas (LNG) and their mixtures, which was used to develop mathematical models for the calculation or prediction of LNG densities. Along with the methane-butane experimental densities are presented experimental vapor pressures, as well as excess volumes, Clausius-Mossotti functions, and excess Clausius-Mossotti functions derived from the density and dielectric constant data. Comparisons are shown between the excess volumes of the present work and those from independent measurements using an extended corresponding state model that had been optimized to the data from this work.

704,795
PB84-225697 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of Densities and Dielectric Constants of Liquid Isobutane from 120 to 300 K at Pressures to 35 MPa.
Final rept.
W. M. Haynes. 1983, 3p
Pub. in Jnl. of Chemical and Engineering Data, v28 n4 p367-369 1983.

Keywords: *Butanes, *Density(Mass/volume), *Dielectric properties, Pressures, Reprints, *Compressed liquid, Clausius-Mossotti function.

Measurements of the densities and dielectric constants of compressed liquid isobutane have been carried out at temperatures between 120 and 300 K to pressures of 35 MPa. These experimental data along with computed values for the Clausius-Mossotti function (CM) are reported in this paper.

704,796
PB84-226109 Not available NTIS
National Bureau of Standards, Washington, DC.
Regime III Crystallization in Polypropylene.
Final rept.
E. J. Clark, and J. D. Hoffman. Apr 84, 8p
Pub. in Macromolecules, v17 n4 p878-885 Apr 84.

Keywords: *Polypropylene, *Crystallization, *Spherulites, Growth, Temperature, Reprints, *Regime III, Polymer chains.

The recently developed theory for Regime III crystallization from the melt is applied to isotactic polypropylene (i-PP) spherulite growth rate data. As the temperature decreases, a marked upward change in the slope of the published growth rate versus temperature curves is observed which is interpreted as a Regime II yields III transition. (A Regime I yields II transition would have exhibited a downward change in slope with decreasing temperature.) Growth rate data on syndiotactic polypropylene are discussed briefly. The significance of Regime III crystallization is discussed in a general way.

704,797
PB84-226125 Not available NTIS
National Bureau of Standards, Washington, DC.
Corresponding States in Polymer Mixtures.
Final rept.
I. C. Sanchez. Apr 84, 2p
Pub. in Macromolecules 17, p967-968 Apr 84.

Keywords: *Polymers, *Binary systems(Materials), Mixtures, Molecular weight, Blends, Phase diagrams, Critical point, Reprints, Spinodal decomposition, Flory-Huggins theory.

It is shown that the Flory-Huggins theory of polymer solutions implies that all binary polymer mixtures satisfy a corresponding states principle near the critical point. By choosing the appropriate composition and temperature variables, coexistence and spinodal curves of binary mixtures that vary in molecular weight can be superimposed. This procedure should be very useful in correlating and predicting phase diagrams of oligomeric mixtures and polymer blends.

704,798
PB84-226141 Not available NTIS
National Bureau of Standards, Washington, DC.
New Values for Some 4Hei 1snl Energy Levels, Ionization Energies, and Lamb Shifts.
Final rept.
W. C. Martin. Apr 84, 6p
Pub. in Physical Review A 29, n4 p1883-1888 Apr 84.

Keywords: *Atomic energy levels, *Helium, *Ionization potentials, Atomic theory, Atomic spectra, Lamb shift, Field theory.

Recent experimental determinations of energy separations within the 1snl term system (n=2-6) have been used to reevaluate 35 levels. Most of the levels have estimated errors less than 0.001/cm relative to the 2 triplet P levels. Addition of accurate theoretical term values (ionization energies) available for several 1snl levels to the corresponding experimental level values gives generally consistent values for the principal ionization energy (E(I). The theoretical energies are further confirmed by the agreement of the weighted average of seven of these E(I) values with a value obtained by fitting Ritz formulas to three accurately determined 1snl series; the suggested new E(I) is 198310.7745(40)/cm on an energy scale fixed by the value 171135.0000/cm for 2 singlet P. Lamb shifts are derived for the 2,3,4 triplet S sup 1, 2 singlet S sup 0, 2 triplet P sup 1, and 2 singlet P sup 1 levels as differences between experimental term values obtained with the new E(I) and corresponding calculated term values not including Lamb shifts.

704,799
PB84-226158 Not available NTIS
National Bureau of Standards, Washington, DC.
Monte Carlo Calculations of the Hydrodynamic Radii of Polymers in Theta and Good Solvents.
Final rept.
F. L. McCrackin, C. M. Guttman, and A. Z. Akcasu. Apr 84, 7p
Pub. in Macromolecules, v17 n4 p604-610 Apr 84.

Keywords: *Polymers, *Monte Carlo method, *Solvents, *Hydrodynamics, Temperature, Diffusion coefficient, Reprints, *Polymer chains, Numerical solution.

The inverse radius of a polymer chain at infinite dilution on cubic and face centered lattices is computed. The chains are created by a Monte Carlo simulation in which both volume exclusion and the energetics of nearest neighbor interactions are taken into account. Values of $<1/R>$ are calculated for various values of the energy parameter, epsilon/kT. The $<1/R>$ so computed are compared to those obtained from the Blob Model and the fit is found to be semi-quantitative. The values of the hydrodynamic radius, R(H), computed from these values of $<1/R>$ are found to be in reasonable agreement with the temperature versus diffusion coefficient data obtained by Prichard and Caroline.

704,800
PB84-226166 Not available NTIS
National Bureau of Standards, Washington, DC.
Forbidden Far Infrared nu6 Band of SF6.
Final rept.
C. Chapados, and G. Birnbaum. 1984, 9p
Sponsored in part by Natural Sciences and Engineering Research Council of Canada, Ottawa (Ontario).
Pub. in Jnl. of Molecular Spectroscopy 105, p206-214 1984.

Keywords: *Sulfur hexafluoride, Infrared spectroscopy, Vapor phases, Liquid phases, Fermi surfaces, Coriolis effects, Reprints, *Far infrared spectroscopy.

The authors have studied by far infrared spectroscopy the 300/cm region of SF6 in the gas phase at different pressures and in the liquid state. They have observed in the gas phase a small band situated at 351/cm with a PQR structure on the high frequency side of two difference bands situated at 304.5/cm. Since the intregrated intensity of the 351/cm band varies linearly with the density, it cannot be collision induced and they assume that it is the forbidden nu6 band that becomes active by Coriolis interactions. This band is seen in the liquid at about the same frequency, although there are some complications because the difference bands split into two components by Fermi resonance.

704,801
PB84-226190 Not available NTIS
National Bureau of Standards, Washington, DC.
Alloy Chemical Comparison of the Refractory Metal-Noble Metal Phase Diagrams T5-T10 (T5 equals V, Nb, Ta; T10 equals Pd, Pt).
Final rept.
R. M. Waterstrat, and B. C. Giessen. 1983, 6p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Proceedings of Materials Research Society Symposium, Boston, MA., November 2-3, 1982, p423-428 1983.

Keywords: *Phase diagrams, *Refractory metal alloys, *Precious metals, Molecular structure, Comparison, Chemical properties, Intermetallics, Palladium alloys, Platinum alloys.

The six T5-T10 metal alloy phase diagrams containing Pd or Pt have now all been established. The alloy phases occurring in these systems are tabulated and reviewed here with respect to their structures.

704,802
PB84-226216 Not available NTIS
National Bureau of Standards, Washington, DC.
Improved Rovibrational Constants and Frequency Tables for the Normal Laser Bands of 12C 16O2.
Final rept.
F. R. Petersen, E. C. Beaty, and C. R. Pollock. 1983, 11p
Pub. in Jnl. of Molecular Spectroscopy 102, p112-122 1983.

Keywords: *Infrared spectroscopy, *Carbon dioxide, *Line spectra, Doppler effect, Molecular vibration, Molecular rotation, Tables(Data), Isotopic labeling, Reprints, *Laser spectroscopy, Carbon 13, Oxygen 18.

New frequency difference measurements between Doppler-free stabilized laser lines in the 9.4 and 10.4 micrometers bands of 12C16O2, including high-J and across-the-band center measurements, have made significant improvements in the rovibrational constants. The absolute frequencies were referred to the methane stabilized 3.39 micrometers He-Ne laser. Frequency tables generated from these constants having absolute uncertainties of less than two parts in 10 to the 10th power are about a factor of ten better than older tables. The laser lines PI(50) in 13C16O2 and RII(26) in 12C18O2, which were used as reference lines in recent visible laser frequency measurements, were also measured to about the same accuracy.

704,803
PB84-226265 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecule-Surface Interactions and Dynamics (Summary Abstract).
Final rept.
R. R. Cavanagh, and D. S. King. 1984, 2p
Pub. in Jnl. of Vacuum Science and Technology A2, n2 p1036-1037 Apr-Jun 1984.

Keywords: *Nitrogen oxide(NO), *Surface chemistry, *Desorption, Thermodynamics, Reaction kinetics, Dynamics, Reprints, *Laser induced fluorescence, Molecule molecule interactions.

The desorption of atomic and molecular species represent one of the simplest chemical processes at surfaces. While the thermodynamics and kinetics of various desorption mechanisms have been widely studied, there are few experiments in the literature which directly address the dynamics of such events. In this paper, detailed studies of the thermally induced desorption of NO from various surfaces are reported. Laser excited fluorescence is used as a state specific diagnostic of both the rotational population, the angular flux distribution, and the velocity distribution of the desorbed NO. Observed correlations between angular flux and molecular speeds are considered as a function of the rotational state of the desorbed molecule.

704,804
PB84-226349 Not available NTIS
National Bureau of Standards, Washington, DC.
Historical Development and Newer Means of Temperature Measurement in Biochemistry.
Final rept.
R. L. Berger, T. Clem, V. A. Harden, and B. W. Mangum. 1984, 63p
Pub. in Methods Biochem. Anal. 30, p269-331 1984.

Keywords: *Biochemistry, *Temperature, *Thermometry, Laboratory equipment, Reprints.

This chapter gives a brief review of the history of thermometry, of temperature scales, and of the various types of thermometers used in numerous applications. Specific techniques and applications of temperature measurements in biochemical studies are given. These include the new methods in thermometry in biochemistry.

704,805
PB84-226356 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystal Structures of the Synthetic Zeolites (Cs, K)-ZK5 and (Cs, D)-ZK5 Determined from Neutron Powder Diffraction Data.
Final rept.
J. B. Parise, E. Prince, and D. Cox. 1983, 16p
Pub. in Zeitschrift fuer Kristallographie 165, p175-190 1983.

Keywords: *Crystal structure, *Ion exchange resins, *Neutron diffraction, *Aluminum silicates, Reprints.

The structure of a dehydrated ZK5 zeolite with the calculated composition Cs9.7K13.0Si73.2Al22.8O192 was refined using data collected on a high resolution neutron powder diffractometer at 294 K (a=18.671(1)A) and at 493 K (a=18.660(1)A) using a combination of Rietveld and Fourier techniques. There are significant distortions of pore openings upon extraction of the cations. The flat 8-ring is distorted elliptically. Both the ion-exchange properties of ZK5 and the positions of Cs and K can be explained in terms of the refined structure. The Cs preference for the flat 8-ring site sets an upper limit of 12 atoms/unit cell to its exchange into ZK5. The proximity of the flat and puckered 8-ring sites (5.8A) causes the Cs atom either to move towards the alpha cage if K is present or to relax toward the gamma cage if K is extracted.

704,806
PB84-226406 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Thermodynamics of Liquid Polymers: Theory.
Final rept.
I. C. Sanchez, and C. I. Poser. 1983, 10p
Pub. in Proc. ACS Int. Symp. Physico-Chemical Aspects Polymer Services, New York, August 24, 1981, Paper in Physico-Chemical Aspects of Polymer Surfaces, p173-182 1983.

Keywords: *Surface chemistry, *Polymers, *Thermodynamic properties, *Density(Mass/volume), Temperature, Molecular weight, Equations of state, Interfacial tension.

A generalized density gradient theory of interfaces has been combined with a compressible lattice theory of polymers. This yields a unified theory of bulk and surface thermodynamic properties. A unique feature of this theory is that it is parameterless. The only parameters required to calculate a surface tension are obtained from pure component thermodynamic properties. Since the theory is a mean field theory, it is only applicable to non-polar and slightly polar liquids. For such systems, surface tensions can be accurately calculated. The temperature and molecular weight dependence of liquid density on chain length. Polymer liquid surface tensions satisfy a corresponding states principle and can be estimated for many polymers with an error of less than 10%. This method of estimating polymer surface tensions appears to be the most accurate that is available.

704,807
PB84-226414 Not available NTIS
National Bureau of Standards, Washington, DC.
Switch Function Applied to the Thermodynamic Properties of Steam Near and Not Near the Critical Point.
Final rept.
H. W. Woolley. 1983, 45p
Pub. in Int. J. Thermophys. 4, n1 p51-95 1983.

Keywords: *Critical point, *Thermodynamic properties, *Steam, *Boolean functions, Reprints, *Helmholtz free energy.

A study is presented of the still-unsolved problem of estimating thermodynamic property values in a region intermediate between the critical region in which the scaling laws apply, and regions further from critical where classical behavior prevails. A procedure has been developed in which a varying weighting function is used in obtaining a weighted 'average' of the scaled and the classical Helmholtz free energy. Other properties are then obtained by differentiation. It is first demonstrated that it is fundamentally impossible for the 'averaged' Helmholtz free energy and its first two derivatives to all be intermediate between the corresponding values from the scaled and the classical formulations. The procedure has been developed and tested for steam. The scaled function is the simple linear model of Murphy et al., the classical equation that of Pollak.

704,808
PB84-226455 Not available NTIS
National Bureau of Standards, Washington, DC.
Fluid Property Research at the National Bureau of Standards, Boulder.
Final rept.
H. J. M. Hanley. 1983, 8p
Pub. in Proc. Int. Gas Res. Conf., London, England, June 13-16, 1983 8p.

Keywords: *Research projects, *Fluids, *Fuels, *Thermophysical properties, Liquefied natural gas, Mixtures, Butanes, Transport properties, Standards, Hydrogen sulfide, Carbon monoxide, Numerical solution.

The goals and philosophy of the Fluid Properties Group, NBS-Boulder, are discussed and the experimental facilities are reviewed. The group attempts to merge experiment, basic theory of fluids, and data correlation so that all facets complement and support each other to give an integrated program. Specific systems selected for our studies are simple enough for unambiguous theoretical and experimental analysis but represent a class of systems of general interest. For example, the author report on PVT measurements of H2S and on CO, which are typical of polar and reactive components in synfuels; viscosity data for C1/C2 mixtures are given to represent the transport behavior of fluids of interest to the gas industry. We mention fundamental studies of mixtures via computer simulation which raise very basic theoretical questions yet, with corresponding states, contribute to a practical prediction procedure to calculate thermophysical mixture properties. Three important correlations for propane, n- and i-butane are also mentioned.

704,809
PB84-226463 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamic Light Scattering of Polymer Solutions in the Intermediate Momentum Transfer Region.
Final rept.
C. C. Han, and A. Z. Akcasu. Mar 81, 2p
Pub. in ACS Polym. Prepr. 22, n1 p68-69 Mar 81.

Keywords: *Polystyrene, *Light scattering, *Hydrodynamics, Solutions, Momentum transfer, Polymers, Mathematical models, Reprints.

Polystyrene solutions in the dilute region have been studied by dynamic light scattering experiments. The first cumulant, omega(q), has been extracted consistently by either the cumulant analysis or the shape function analysis. It is found that omega(q) approaches sq q dependence as $qRg << 1$ and cu q dependence as $qRg >> 1$ with a broad transition region. It is also found that the asymptotic values at cu q region changes from theta-solvent to good solvent condition. In both cases, experimental results agree better with theoretical calculations with preaveraged Oseen tensor. This may be that the preaveraged Oseen tensor is a better physical model for the hydrodynamic interaction.

704,810
PB84-226802 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamic Light Scattering Measurements of Polystyrene in Semidilute Theta Solutions.
Final rept.
E. J. Amis, C. C. Han, and Y. Matsushita. May 84, 9p
Pub. in Polymer 25, p650-658 May 84.

Keywords: *Polystyrene, *Light scattering, *Dynamics, *Diffusion coefficients, Solutions, Molecular weight, Concentration(Composition), Scale effect, Reprints, Numerical solution.

Measurements of the co-operative diffusion coefficient, Dc, and a center of mass translational diffusion coefficient, Ds, have been made by dynamic light scattering for the polystyrene-cyclohexane theta system as a function of molecular weight and concentration. A discussion of the assumptions and potential shortcomings of the blob model which is used in the derivation of the power law predictions and the dynamic scattering equations is included. In addition, monomeric friction coefficients have been obtained from the Ds results within the framework of Doi-Edwards model. A comparison is made of the concentration dependence of the monomeric friction coefficient from the present data to that from similar experiments on a good solvent (tetrahydrofuran) system and from shear relaxation modulus measurements on the polystyrene in Aroclor 1248.

704,811
PB84-226828 Not available NTIS
National Bureau of Standards, Washington, DC.
Pressure Dependent Linewidth and Line Shift Measurements in the Vibrational Q-Branch of N2 from 4 to 200 kPa.
Final rept.
G. J. Rosasco, W. Lempert, W. S. Hurst, and A. Fein. Jul 82, 15p
Pub. in Proceedings of the International Conference on Spectral Line Shapes, Boulder, Colorado, July 1982, Paper in Spectral Line Shapes 2, p635-649 1983.

Keywords: *Nitrogen, *Raman spectroscopy, Perturbation theory, Mathematical models, Temperature, Pressure, Line spectra, Line width.

The non-linear optical technique of CW-inverse Raman spectroscopy has been applied to measure the effects of pressure (in the range 4-200 kPa) on the Q-branch spectrum of pure N2 gas at room temperature. The measurement approach provides a response linear in the third order susceptibility and a resolution of at least 20 MHz and frequency accuracy of 30 MHz. A number of simple models are tested quantitatively against the data; in particular, a first order in pressure perturbation theory is found to give a very useful description of the spectra. Use of such models is found to be required to extract accurate temperature measurements from such spectra.

704,812
PB84-226844 Not available NTIS
National Bureau of Standards, Washington, DC.
Chain Scission and Mechanical Degradation of Polystyrene.
Final rept.
P. Fordyce, K. L. Devries, and B. M. Fanconi. Apr 84, 6p
Pub. in Polymer Engineering and Science 24, n6 p422-427 Apr 84.

Keywords: *Infrared spectroscopy, *Electron paramagnetic resonance, *Viscometry, *Polyethylene, Sampling, Free radicals, Concentration(Composition), Molecular weight, Mechanical properties, Cryogenics, Reprints, *Polymer chains.

The extent of molecular degradation of amorphous polystyrene when subjected to mechanical grinding at cryogenic temperature has been investigated using electron spin resonance, infrared spectroscopy, and viscometry. Essentially identical concentrations of chain ruptures in the degraded samples were found from infrared spectroscopic determinations of molecular end group concentrations and by the changes in the viscosity-average molecular weights. The chain-scission concentration was from two to four times the free-radical concentrations, indicating that free-radical-propagation reactions play a much less dominant role in the degree of molecular damage associated with mechanically induced chain scission in glassy polymers. In addition, experiments were carried out as a function of molecular weight and these indicated a virtual independent behavior with molecular weight.

704,813
PB84-227024 Not available NTIS
National Bureau of Standards, Washington, DC.

Thermogravimetry Applied to Polymer Degradation Kinetics.
Final rept.
B. Dickens, and J. H. Flynn. 1983, 23p
Pub. in ACS (American Chemical Society) Advances in Chemical Series 203, p210-232 1983.

Keywords: *Polymers, *Degradation, *Oxidation, *Reaction kinetics, *Thermogravimetry, Activation energy, Isotherms, Factor analysis, Reprints.

The kinetics of polymer degradations (and oxidations) may be represented in the simple general form d(alpha)/dt = f(alpha)Ae sup -E/RT, where alpha is the extent of reaction, and A and E are Arrhenius parameters. The various attempts to represent f(alpha) in a simple way are discussed, with the conclusion that none is satisfactory for polymer degradation studies. Therefore, four method of thermogravimetry have been devised and implemented which avoid any need to model f(alpha). These methods give values for the activation energy, E, and through it shed some light on the dominant contributors to the kinetic form. The methods are (1) factor-jump thermogravimetry, a series of isothermals requiring only a single sample, (2) isoconversional diagnostic plots, a variable heating rate method applied to a series of samples, (3) analysis of initial stage of reaction, a variable heating rate method requiring only one sample, and (4) variable heating rate analysis, applied to several samples to examine any change in component reactions in f(alpha).

704,814
PB84-227107 Not available NTIS
National Bureau of Standards, Washington, DC.
Constant Photoelectron Energy Spectroscopy of Acetylene.
Final rept.
D. M. Holland, J. B. West, A. C. Parr, D. L. Ederer, R. Stockbauer, R. D. Buff, and J. L. Dehmer. 1 Jan 83, 7p
Sponsored in part by Department of Energy, Washington, DC., Office of Naval Research, Arlington, VA., and National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Physics, v78 n1 p124-130, 1 Jan 83.

Keywords: *Acetylene, Photoelectrons, Ionization, Electron energy, Reprints, *Autoionization.

Constant photoelectron energy spectra of acetylene are reported for low electron energies. The details of the techniques, and its ability in probing autoionization structure are discussed. The experiment was performed using radiation emitted from SURF II, the National Bureau of Standards storage ring. Photoelectrons carrying a particular kinetic energy were detected while the energy of the monochromated light was scanned.

704,815
PB84-227198 Not available NTIS
National Bureau of Standards, Washington, DC.
Free Radicals and New End Groups Resulting from Chain Scission: 2. Mechanical Degradation of Polyethylene.
Final rept.
B. M. Fanconi, K. L. DeVries, and R. H. Smith. Jul 82, 8p
See also PB81-248593.
Pub. in Polymer 23, p1027-1034 Jul 82.

Keywords: *Degradation, *Polyethylene, *Infrared spectroscopy, Chemical bonds, Mechanical properties, Viscosity, Electron spin resonance, Reprints, *Free radicals, *Polymer chains, *Molecular conformation.

The number of chain scissions accompanying mechanical degradation of polyethylene has been estimated from IR analysis of new end groups concentrations. Polyethylene specimens fractured in tensile deformation and ground under liquid nitrogen were examined. The results are compared to the number of free radicals generated during mechanical degradation and measured by ESR. In comparisons with previous results in the literature we find our results to be lower by one-to-two orders of magnitude and in better agreement with estimates of the number of chain scissions from viscosity measurements. A ultra high molecular weight polyethylene was examined as a control specimen containing few end groups. The changes in the number of vinyl groups resulting from grinding of this specimen was estimated to be at least an order of magnitude lower than that found for lower molecular weight polyethylenes. This finding suggests that large errors may be introduced into the determination of concentrations of end groups through subtraction of relatively intense absorption bands.

704,816
PB84-227206 Not available NTIS
National Bureau of Standards, Washington, DC.
Sum Frequency Generation of Narrowband cw 194 Radiation in Potassium Pentaborate.
Final rept.
H. Hemmati, J. C. Bergquist, and W. M. Itano. 1983, 2p
Pub. in Proceedings of Int. Laser Spectroscopy Conf. (6th), Interlaken, Switzerland, June 27-July 1, 1983, Laser Spectroscopy 6, p414-415.

Keywords: *Absorption spectra, *Ultraviolet spectroscopy, Doppler effect, Potassium inorganic compounds, Line width, Reprints, *Laser spectroscopy, *Potassium pentaborate.

Several microwatts of tunable cw radiation near 194 nm in a linewidth of less than 2 MHz have been generated by sum frequency mixing the radiation from a frequency doubled argon-ion laser with the radiation from a ring dye laser in a crystal of potassium pentaborate. An external ring cavity resonant with the dye laser give an enhancement factor of about 14 in the sum frequency-generated radiation power. The Doppler limited absorption spectrum of the first resonance line of natural Hg II has been resolved, and the vacuum wave number for the mass-202 isotope has been measured to be 51485.904(20)/cm. About 0.5 milliwatts 243 nm radiation has been generated with minor variations to the 194 apparatus.

704,817
PB84-227214 Not available NTIS
National Bureau of Standards, Washington, DC.
Fluorescence of the Na*-N2 Collision Complex.
Final rept.
W. Kamke, B. Kamke, I. Hertel, and A. Gallagher. 15 Apr 84, 11p
Grant NSF-PHY79-04928
Pub. Jnl. of Chemical Physics 80, n10 p4879-4889 Apr 84.

Keywords: *Fluorescence, *Nitrogen, *Visible spectroscopy, *Energy transfer, Atoms, Reprints, *Atom molecule interactions, *Sodium atoms.

The fluorescence spectrum of Na(3p) atoms in N2 gas has been measured in the far wings of the Na resonance lines, from 550-790 nm. The authors observe a broad continuum from 630-790 nm that is independent of N2 pressure and gas temperature, and which agrees with that calculated from the theoretical NaN2 potentials of Habitz if one includes only free collision states of the Na*N2 molecule. They conclude that this continuum is due to an attractive Na(3p)-N2 interaction, but that bound states in this potential well predissociate to Na(3s) and vibrationally excited N2 in much less than the Na* radiative lifetimes of about 16 ns. The intensity on the blue wing of the Na resonance lines decreases rapidly with decreasing wavelength, and shows temperature dependence corresponding to a repulsive Na(3p)-N2 interaction. Good agreement is obtained with a blue-wing spectrum calculated from the X and B states of Habitz.

704,818
PB84-227230 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Ionization and Excitation Yields.
Final rept.
L. V. Spencer. 1984, 29p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Radiation Research 97, p219-236 1984.

Keywords: *Ionization, *Excitation, *Hydrogen, Electron energy, Reprints, Numerical solution, Fowler equation.

The Fowler equation for excitation and ionization yields due to fast electrons in H2 is written down; and an approximation is developed which is expected to be accurate except for source electron energies below perhaps 200 eV. A general form for the solution is developed which is numerically evaluated. Results for the ionization yields, and also for the yield of all electronic excitations, agree within about 2% with more precise calculations except below about 300 eV. Extensions to more complex media, and to other fast particles are discussed.

704,819
PB84-227271 Not available NTIS
National Bureau of Standards, Washington, DC.
Factor-Jump Thermogravimetry as Applied to the Study of Polymer Degradation.
Final rept.
B. Dickens. 1983, 46p
Pub. in Degradation and Stabilization of Polymers 1, Chapter 11, p554-599 1983.

Keywords: *Thermogravimetry, *Polymers, *Degradation, Polystyrene, Polypropylene, Evaporation, Activation energy, Reaction kinetics, Plastics, Temperature, Reprints.

Methods of thermogravimetry are reviewed briefly and the rationale for the factor-jump method given. The automated apparatus and experiment-driving computer program are described. Results are given for investigation on polystyrene and polypropylene. The effect of the evaporation of preformed molecules is treated, as are the conditions involved in temperature-extrapolation of rates of chemical degradation.

704,820
PB84-227289 Not available NTIS
National Bureau of Standards, Washington, DC.
Solubilities of Two n-Alkanes in Various Solvents.
Final rept.
S. S. Chang, J. R. Maurey, and W. J. Pummer. 1983, 3p
Pub. in Jnl. of Chemical and Engineering Data 28, p187-189 1983.

Keywords: *Solvents, *Alkanes, *Solubility, *Heat measurement, Temperature, Heats of fusion, Phase transformation, Equilibrium, Reprints, *Octadecane, *Dotriacontane, *Differential scanning calorimetry, Phase equilibrium, Tracer studies.

Solubilities and phase equilibria of n-octadecane and n-dotriacontane have been determined in the following solvents; n-heptane, ethanol, ethanol/water mixtures, tributyrin, trioctanoin, and mixed triglycerides. In addition, temperatures and heats of fusion and transition of the two n-alkanes were measured by differential scanning calorimetry, in order to estimate the ideal solubility as a function of temperature.

704,821
PB84-227339 Not available NTIS
National Bureau of Standards, Washington, DC.
Methanation Reaction.
Final rept.
R. D. Kelley, and D. W. Goodman. 1982, 27p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Chemical Physics of Solid Surfaces and Heterogeneous Catalysis 4, Chapter 10, p427-454 1982.

Keywords: *Catalysts, *Surface chemistry, *Reaction kinetics, *Methane, Chemical reactions, Nickel, Ruthenium, Comparison, Catalysis, Crystals, Fuels, Reprints, *Methanation, *Chemical reaction mechanisms.

This chapter presents a review of recent studies on the kinetics and mechanism of the methanation reaction catalyzed by single crystal nickel and ruthenium. These studies, utilizing surface science techniques, are compared with traditional studies of high surface area catalysts.

704,822
PB84-227354 Not available NTIS
National Bureau of Standards, Washington, DC.
Diamond (111) Surface: A Dilemma Resolved.
Final rept.
B. B. Pate, B. J. Waclawski, P. M. Stefan, C. Binns, T. Ohta, M. H. Hecht, P. J. Jupiter, M. L. Shek, D. T. Pierce, N. Swanson, R. J. Celotta, G. Rossi, I. Lindau, and W. E. Spicer. 1983, 3p
Sponsored in part by Army Research Office, Arlington, VA.
Pub. in Physica 117B-118B, p783-785 1983.

Keywords: *Diamond, *Surface chemistry, Semiconductors, Deuterium, Atoms, Photoelectric emission, Exposure, Reprints, *Low energy electron loss spectroscopy, Photon stimulated desorption, Hydrogen atoms.

A dilemma due to the experimental observation of a 'clean' unreconstructed elemental semiconductor surface without band gap states is resolved. Results from

photon stimulated ion desorption, high resolution low energy electron loss spectroscopy and photo-emission spectroscopy find that the conventionally polished (in olive oil) diamond (111) 1 x 1 surface is atomically terminated and electronically stabilized by hydrogen. Thermal desorption of hydrogen upon heating (about 1000C) results in a reconstructed 2 x 2/2 x 1 surface with filled electronic surface states in and near the fundamental gap. Exposure of the reconstructed surface to atomic hydrogen (or deuterium) is found to again terminate the surface and remove the near band gap surface states. Apparent inconsistencies (with respect to the experimental literature) in the understanding of the diamond:hydrogen interaction are resolved in terms of our work.

704,823
PB84-227362 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute-Frequency Measurements of the 520 THz Hyperfine Components of Iodine and the 260 THz Emission of Neon.
Final rept.
C. R. Pollock, D. A. Jennings, F. R. Petersen, J. S. Wells, and R. E. Drullinger. 1982, 2p
Pub. in Proceedings of CPEM Digest, Conf. Precision Electro-Magnetic Measurement, 1982, Boulder, CO., Jun 28-Jul 1, 1982, pI-9-I-10.

Keywords: *Hyperfine structure, *Iodine, *Neon, *Frequency measurement, Carbon dioxide lasers, Helium neon lasers, *Laser spectroscopy, Color center lasers, Neon lasers.

The accuracy of the absolute frequency measurements of the 260 Tnz (lambda=1.15 micrometers) lamb-dip stabilized 20 Ne laser, and the hyperfine components of the 127I2 17-1 P(62) transition at 520 THz (lambda=0.576 micrometer) has been extended by two orders of magnitude to 1 part in 10 to the 9th power. The frequencies were measured by comparing them with the known frequency of the 11.5 micrometer 13C16O2 laser line by use of a 2.3 micrometer color center laser and a 1.15 micrometer He-Ne laser as frequency transfer oscillators. The accuracy of the absolute measurement is limited by the accuracy of the CO2 laser frequency (1 part in 10 to the 9th power), however relative measurements between the CO2 and I2 frequencies were demonstrated to be precise to 1 part in 10 to the 10th power.

704,824
PB84-227370 Not available NTIS
National Bureau of Standards, Washington, DC.
Far-Infrared Laser Magnetic Resonance Spectrum of the OH Radical and Determination of Ground State Parameters.
Final rept.
J. M. Brown, C. M. L. Kerr, F. D. Wayne, K. M. Evenson, and H. E. Radford. 1981, 11p
Pub. in Jnl. of Molecular Spectroscopy 86, p544-554 1981.

Keywords: *Infrared spectroscopy, Molecular energy levels, Free radicals, Reprints, *Laser spectroscopy, *Far infrared spectroscopy, *Hydroxyl radical, *Laser magnetic resonance.

The far-infrared Laser Magnetic Resonance (LMR) Spectrum of the OH radical in the nu = 0 level of the X sup 2 Pi state has been studied in detail. All transitions that are accessible with currently available laser lines have been recorded. The measurements have been analyzed and subjected to a single least-squares fit using an effective Hamiltonian.

704,825
PB84-227396 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiative Association of CH3(+1) and H2 at 13 K.
Final rept.
S. E. Barlow, G. H. Dunn, and M. Schauer. 12 Mar 84, 4p
Grant NSF-PHY82-00805
Pub. in Physical Review Letters 52, n11 p902-905, 12 Mar 84.

Keywords: *Hydrogen, Interstellar matter, Low temperature tests, Reprints, *Methyl radicals, *Ion molecule interactions.

The authors report here the first observation and measurement of two-body ion-neutral association at low temperatures and densities. They have measured the rate at 13 K for CH3(+1) + H2 yields CH5+ + h nu to be 1.8 + or - 0.3 x 10 to the -13th power cu cm/s. The reaction conditions were such that the process could only have proceeded by radiative stabilization of the collision complex. Given implied complex lifetimes of about 6 x 10 to the -7th power to 6 x 10 to the -8th powers from other measurements, the deduced radiation rate is about 100 to 1000/s.

704,826
PB84-227453 Not available NTIS
National Bureau of Standards, Washington, DC.
Liquid Structure Under Shear: Comparison between Computer Simulations and Colloidal Suspensions.
Final rept.
H. J. M. Hanley, J. C. Rainwater, N. A. Clark, and B. J. Ackerson. Nov 83, 11p
Grants NSF-DMR82-06472, NSF-DMR81-16119
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 79, n9 p4448-4458 Nov 83.

Keywords: *Colloid chemistry, *Shear properties, *Luminous intensity, Comparison, Dynamics, Debye-Scherer method, Non-Newtonian fluids, Reprints, Computer applications.

Simulated scattered light intensity plots are calculated for a soft sphere inverse-twelve system subjected to a shear and are compared to experimental plots for a colloidal suspension under approximately equivalent conditions. The simulated plots were obtained by a Fourier transform of the radial distribution function. The two sets show points of striking similarity: the Debye-Scherer rings become elliptical when both systems are subjected to the shear, and the light intensity around the rings is a function of polar angle. An interesting feature is the degree to which the experimental plots display non-Newtonian characteristics of the suspension. Overall, the work is a direct comparison of the results of a computer simulation with real experimental data. Suggestions for future work are given.

704,827
PB84-235332 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Chemical Engineering Science Div.
Experimental Thermal Conductivity Values for Hydrogen, Methane, Ethane and Propane.
H. M. Roder. May 84, 63p NBSIR-84/3006
Sponsored in part by National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.

Keywords: *Hydrogen, *Methane, *Ethane, *Propane, *Thermal conductivity, Laboratory equipment, Hot wire anemometers, Tables(Data).

The experimental measurements of thermal conductivity as obtained in a transient hot wire apparatus for hydrogen, methane, ethane and propane are recorded.

704,828
PB84-238427 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 13, Number 1, 1984.
Quarterly rept.
c1984, 318p
See also PB84-238435 through PB84-238492. Sponsored in part by National Bureau of Standards, Washington, DC. Prepared in cooperation with American Inst. of Physics, New York.

Keywords: *Physical properties, *Chemical properties, Thermodynamic properties, Sodium chloride, Refractivity, Zinc sulfides, Zinc selenides, Zinc tellurides, Oxides, Rare gases, High temperature tests, Metals, Water, Viscosity, Oxygen, Chemical equilibrium, Metal oxides.

The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature.

704,829
PB84-238435 Not available NTIS
California Univ., Berkeley.
Thermodynamic Properties of Aqueous Sodium Chloride Solutions.
K. S. Pitzer, J. C. Peiper, and R. H. Busey. c1984, 102p
Prepared in cooperation with Oak Ridge National Lab., TN.
Included in Jnl. of Physical and Chemical Reference Data, v13 n1 p1-102 1984.

Keywords: *Thermodynamic properties, *Sodium chloride, *Solution, Laboratory equipment, Activity coefficients, Enthalpy, Equations of state, Specific heat, Tables(Data).

Experimental measurements of the osmotic and activity coefficients, the enthalpy, and the heat capacity were used to derive a semiempirical equation for the thermodynamic properties of NaCl(aq) at constant pressure. This equation may be combined with results contained in the previous paper on the volumetric properties to yield a complete equation of state valid in the region 273 K < or = T < or = 573 K, saturation pressure < or = P < or = 1 kbar, O < or = m < or = 6.0 mol/kg. It is shown that this equation may be extrapolated to higher solute molalities at lower pressures. An estimation of uncertainties in various quantities is given. Tables of values for various thermodynamic properties are presented in the appendix.

704,830
PB84-238443 Not available NTIS
Purdue Univ., Lafayette, IN.
Refractive Index of ZnS, ZnSe, and ZnTe and Its Wavelength and Temperature Derivatives.
H. H. Li. c1984, 48p
Included in Jnl. of Physical and Chemical Reference Data, v13 n1 p103-150 1984.

Keywords: *Refractivity, *Zinc sulfides, *Zinc selenides, *Zinc tellurides, Temperature, Optical measurement.

Refractive index data of ZnS, ZnSe, and ZnTe were searched, compiled, and analyzed. Recommended values of refractive index for the transparent spectral region were generated in the ranges 0.5-14 micrometers and 93-1000 K for ZnS, 0.55-18 micrometers and 93-618 K for ZnSe, and 0.55-30 micrometers at room temperature for ZnTe. Generation of these values was based on a dispersion equation that best fits selected data sets covering wide temperature and wavelength ranges where the available experimental data permit. Temperature and wavelength derivatives of refractive index were calculated from the first derivatives of the equation with respect to temperature and wavelength, respectively. The results are in concordance with the existing data.

704,831
PB84-238450 Not available NTIS
SRI International, Menlo Park, CA.
High Temperature Vaporization Behavior of Oxides. 1. Alkali Metal Binary Oxides.
R. H. Lamoreaux, and D. L. Hildenbrand. c1984, 23p
Included in Jnl. of Physical and Chemical Reference Data, v13 n1 p151-173 1984.

Keywords: *High temperature tests, *Vaporization, *Binary systems(Materials), *Alkali metals, Assessment, Enthalpy, Metals, Thermodynamic properties, Tables(Data), Gibbs free energy, *Metal oxides, Numerical solution.

In order to assess the high temperature vaporization behavior and equilibrium gas phase compositions of binary alkali metal oxides, the relevant thermodynamic and molecular constant data have been compiled and critically evaluated. Selected values of the Gibbs energy and enthalpy functions of condensed and vapor phases are given in the form of equations valid over wide temperature ranges, along with the standard entropies and enthalpies of formation. These data were used to generate plots of the equilibrium partial pressures of vapor species as functions of temperature for representative conditions ranging from reducing to oxidizing. Maximum vaporization rates have been calculated using the Hertz-Knudsen equation. Literature references are given.

704,832
PB84-238468 Not available NTIS
National Bureau of Standards (NML), Washington, DC. Polymers Div.

Thermophysical Properties of Fluid H2O.
J. Kestin, J. V. Sengers, B. Kamgar-Parsi, and J. M. H. L. Sengers. c1984, 9p
Prepared in cooperation with Brown Univ., Providence, RI. Div. of Engineering and Maryland Univ., College Park. Inst. for Physical Science and Technology.
Included in Jnl. of Physical and Chemical Reference Data, v13 n1 p175-183 1984.

Keywords: *Water, *Thermophysical properties, Fluids, Equations of state, Viscosity, Surface tension, Critical point, Steam, Thermal conductivity, Tables(Data), Numerical solution.

In view of the important role that water substance plays in science and industry, this paper lists the thermophysical properties of fluid H2O which are most needed for engineering applications. The properties are described in a very compact form with the aid of explicit expressions for programming on a computer and for inclusion in data banks. The paper includes a fundamental equation in the form of the Helmholtz free energy expressed as an analytic function of temperature and density. This fundamental equation is a dimensionless version of the Provisional IAPS Formulation 1982 for the Thermodynamic Properties of Ordinary Water Substance for Scientific and General Use, which enables one to calculate all equilibrium thermodynamic properties in a wide range of states, but with the exclusion of a small region near the critical point. In the latter region, the equilibrium properties are described by a scaled fundamental equation in the form of the pressure as a function of chemical potential and temperature. In addition, the paper gives equations for the viscosity, thermal conductivity, and surface tension. All equations in the paper are mutually thermodynamically consistent. The set of equations and their constants listed here represents the most reliable information according to the judgment of the authors.

704,833
PB84-238476 Not available NTIS
National Bureau of Standards (NML), Washington, DC. Polymers Div.
Representative Equations for the Viscosity of Water Substance.
J. V. Sengers, and B. Kamgar-Parsi. c1984, 21p
Prepared in cooperation with Maryland Univ., College Park. Inst. for Physical Science and Technology.
Included in Jnl. of Physical and Chemical Reference Data, v13 n1 p185-205 1984.

Keywords: *Viscosity, *Water, Assessments, Numerical solution.

The International Association for the Properties of Steam adopted in 1982 a new formulation for the thermodynamic properties of water substance for scientific and general use. In this paper, the authors present an assessment of currently available methods for calculating the viscosity of water substance when used in conjunction with the new formulation for the equilibrium properties.

704,834
PB84-238484 Not available NTIS
Harvard-Smithsonian Center for Astrophysics, Cambridge, MA.
Atlas of the Schumann-Runge Absorption Bands of O2 In the Wavelength Region 175-205 nm.
K. Yoshino, D. E. Freeman, and W. H. Parkinson. c1984, 21p
Included in Jnl. of Physical and Chemical Reference Data, v13 n1 p207-227 1984.

Keywords: *Oxygen, *Ultraviolet spectroscopy, *Wavelengths, Absorption spectra, Numerical solution, Schumann-Runge bands.

After a critical summary of previous wavelength measurements and rotational line assignments of the Schumann-Runge absorption bands of O2, the results of the present study performed at high resolution with a 6.65 m vacuum spectrograph are given.

704,835
PB84-238492 Not available NTIS
Brown Univ., Providence, RI. Div. of Engineering.
Equilibrium and Transport Properties of the Noble Gases and Their Mixtures at Low Density.
J. Kestin, K. Knierim, E. A. Mason, B. Najafi, and S. T. Ro. c1984, 26p
Included in Jnl. of Physical and Chemical Reference Data, v13 n1 p229-254 1984.

Keywords: *Rare gases, *Mixtures, *Binary systems(Materials), *Chemical equilibrium, *Transport properties, Helium, Neon, Argon, Xeon, Krypton, Tables(Data), Graphs(Charts).

The report contains a set of easy-to-program expressions for the calculation of the thermodynamic and transport properties of the five noble gases (He, Ne, Ar, Kr, Xe) and of the 26 binary and multicomponent mixtures that can be formed with them. The properties in question are second virial coefficient B, viscosity (eta), thermal conductivity (lambda), self-diffusion and binary diffusion coefficient D, and thermal diffusion factor (alpha sup T). The calculation of properties is restricted to low densities (rho < B/C) but covers the full range of compositions and a temperature interval extending from absolute zero to the onset of ionization. Owing to the careful theoretical basis on which the algorithm has been erected, all properties are thermodynamically consistent with each other. Reference to a selected set of critically evaluated measurements provides a basis for the estimation of uncertainties. The report contains 54 abbreviated tables of numerical data and 86 deviation plots. It is asserted that the results are comparable to the best measurements that could be performed at present.

704,836
PB84-239284 Not available NTIS
National Bureau of Standards, Washington, DC.
Flowing Afterglow Studies of Ion Reaction Dynamics Using Infrared Chemiluminescence and Laser-Induced Fluorescence.
Final rept.
V. M. Bierbaum, G. B. Ellison, and S. R. Leone. 1984, 38p
Grants NSF-PHY79-04928, AFOSR-78-3565
Pub. in Gas Phase Ion Chemistry (Chapter 17), p2-39 1984.

Keywords: *Ions, *Reaction kinetics, Excitation, Molecular energy levels, Fluorescence, Chemiluminescence, Thermochemistry, Dynamics, Infrared spectroscopy, Reprints, *Ion molecule interactions, *Flowing afterglow, *Laser induced fluorescence.

In this chapter the authors describe new experiments to determine the initial vibrational energy distribution of ion reaction products in their ground electronic states; in the most recent work, information on nascent rotational populations and on vibrational deactivation of ions is also obtained. These studies are made possible by monitoring optically the excited products of ion-molecule reactions carried out in a flowing afterglow apparatus. Two complementary optical techniques are used: direct observation of wavelength dispersed infrared chemiluminescence from AB(v,J) and laser-induced fluorescence detection, i.e., laser excitation of product AB(v,J) molecules to bound electronic states and detection of the resulting visible fluorescence. Methods to probe the final product states resulting from neutral-neutral reactions (A+BC) are well established. A similar experimental program concerned with ions is a much more difficult enterprise for several reasons. The number density of reacting ions is much lower (by several orders of magnitude) than in the comparable neutral case. Reactant ions are difficult to prepare under known, controllable conditions. Moreover, in many cases, thermochemical and spectroscopic information is not available for ions. To overcome some of these difficulties we employ the flowing afterglow technique, which provides high densities of thermal ions and serves as a well-characterized medium for the study of ion reaction kinetics and dynamics.

704,837
PB84-239300 Not available NTIS
National Bureau of Standards, Washington, DC.
Microwave and Far Infrared Spectra of the CH Radical.
Final rept.
J. M. Brown, and K. M. Evenson. 1 May 83, 6p
Pub. in Astrophysical Jnl. 268, pL51-L56, 1 May 83.

Keywords: *Microwave spectroscopy, Infrared spectroscopy, Astrophysics, Reprints, *Methyl radicals, *Far infrared spectroscopy, Laser magnetic resonance, Laser spectroscopy.

The frequencies, wavelengths and linestrengths for transitions of the CH molecule at microwave and far infrared wavelengths have been calculated from an analysis of the laser magnetic resonance spectrum. The low frequency transitions are between lambda-type doublets while the higher frequency transitions are between different spin-rotation levels.

704,838
PB84-239326 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Beta Values and Branching Ratios in the Region of the 3s3p sup 6 4p singlet p (sup 0) (sub 1) Resonance in Ar and the 5s5p sup 6 6p singlet p (sup 0) (sub 1) Resonance in Xe.
Final rept.
K. Codling, J. B. West, A. C. Parr, J. L. Dehmer, and R. Stockbauer. Oct 80, 5p
Grant NATO-1939
Sponsored in part by National Aeronautics and Space Administration, Washington, DC., Office of Naval Research, Arlington, VA., and Department of Energy, Washington, DC.
Pub. in Jnl. of Physics B: Atomic Molecular Physics 13, pL693-L697 Oct 80.

Keywords: *Argon, *Xeon, *Molecular energy levels, Excitation, Angular distribution, Reprints.

Variations in asymmetry parameter, beta, and the ratio of partial photoionization cross sections sigma(doublet P(3/2): sigma (doublet P (1/2) have been determined in the region of the 3s3p sup6 4p singlet p(sup 0) (sub 1) resonance in Ar and the 5s5p sup 6 6p singlet P (sup 0) (sub 1) resonance in Xe. In both cases there is a considerable variation in beta through the resonance. In Ar the beta values for the spin-orbit components are similar; in Xe they are significantly different. In Xe, the branching ratio shows a modest variation through the resonance, whereas in Ar no noticeable change occurs.

704,839
PB84-239359 Not available NTIS
National Bureau of Standards, Washington, DC.
Specular and Off-Specular High Resolution Electron Energy Loss Spectroscopy of Acetylene and Ethylene on Tungsten (100).
Final rept.
J. C. Hamilton, N. Swanson, B. J. Waclawski, and R. J. Celotta. Apr 81, 8p
Pub. in Jnl. of Chemical Physics 74, n7 p4156-4163 Apr 81.

Keywords: *Acetylene, *Ethylene, *Surface chemistry, *Molecular vibration, Tungsten, Chemical bonds, Adsorption, Reprints, *Electron energy loss spectroscopy.

High resolution electron energy loss spectroscopy (EELS) in both specular and off-specular directions has been used to identify the vibrational modes of acetylene and ethylene on tungsten (100). The off-specular data were essential to this study since, at low coverages, some of the vibrational modes were detectable only for off-specular scattering. In addition, analysis of the relative intensities of the specular and off-specular loss peaks allows us to infer orientations of molecular dipole derivative and bond directions for the adsorbed species. The authors found at 135K that ethylene on tungsten (100) dissociates to acetylene and hydrogen for exposures less than 1 L. At saturation coverage molecular ethylene is also adsorbed. Warming of this adsorbed ethylene causes dissociation to acetylene. Analysis of specular and off-specular loss intensities suggests a geometry with the C-H bonds lying parallel to the surface. Previous UPS data for this adsorption system can be reinterpreted giving a C-C bond length of 1.35 A and a C-C-H bond angle of 180: This reinterpretation is consistent with the geometry suggested by our EELS measurements. They also present data for acetylene adsorption at room temperature and for ethylene physisorption at 82K. Physisorbed ethyelen shows vibrational losses identical to those seen in gas phase IR.

704,840
PB84-239367 Not available NTIS
National Bureau of Standards, Washington, DC.
Chemical Stability of Carbonate- and Fluoride-Containing Apatites.
Final rept.
R. Z. LeGeros, and M. S. Tung. 1983, 11p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Caries Research 17, p419-429 1983.

Keywords: *Dental caries, *Calcium phosphates, Stability, Acid treatment, Enamels, Dissolution, Carbonates, Fluorine organic compounds, Synthesis(Chemistry), Reprints.

Apatites containing CO3 and/or F were synthesized and exposed to acid buffer. The extent of dissolution was determined (as m M Ca/ml buffer solution) and

the apatites characterized by X-ray diffraction, IR absorption, and chemical analyses before and after acid exposure. Results showed that: (i) the extent of dissolution was directly proportional to the CO3 contents but that the simultaneous presence of F in the apatite minimized the adverse CO3 effect; (ii) the extent of dissolution during the second exposure was much less than during the first exposure; (iii) the lattice parameters, crystallinity and CO3 and F contents of the apatites differed before and after exposure to the acid buffer, i.e., larger a-axis, initial decrease then increase in crystallinity, lower carbonate and higher fluoride contents of apatites after acid exposure. Results from this study suggest that the vulnerability of synthetic and biological apatites to acid dissolution is largely due to their carbonate constituent and that the caries process may involve a combination of dissolution of carbonate-rich/fluoride-poor apatites and reprecipitation of carbonate-poor/fluoride-rich enamel apatites and that the reprecipitated apatite is rendered more resistant to acid dissolution.

704,841
PB84-239862 Not available NTIS
National Bureau of Standards, Washington, DC.
Quenching of Triplet Vinylidene Radicals by Helium.
Final rept.
A. H. Laufer. Jan 83, 4p
Pub. in Chemical Physics Letters 94, n2 p240-242 Jan 83.

Keywords: *Molecular energy levels, *Acetylene, *Ultraviolet spectroscopy, Excitation, Reaction kinetics, Absorption, Photolysis, Reprints, *Vinylidene radicals.

Triplet vinylidene radicals, produced in the vacuum-ultraviolet photolysis of acetylene, are observed in absorption at 137.4 nm. The lifetime in the presence of helium, for both the protonated and deuterated species, has been determined. An upper limit for removal by acetylene has been deduced.

704,842
PB84-239888 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure of Atomic Spectra: Some Recent Laboratory Research of Interest for Stellar Spectroscopy.
Final rept.
W. C. Martin. 1983, 5p
Pub. in Highlights of Astronomy 6, p775-779 1983.

Keywords: *Atomic spectra, *Stellar spectra, *Bibliographies, Atomic energy levels, Wavelengths, Line spectra, Reprints.

A bibliography covering atomic spectral wavelengths, line classifications, and energy levels is given. The references are selected as being of astrophysical interest and are mainly limited to the period from Sept. 1981 through Aug. 1982. Some ongoing laboratory, research of interest for astronomy is also reviewed.

704,843
PB84-239995 Not available NTIS
National Bureau of Standards, Washington, DC.
Far Infrared Laser Magnetic Resonance of Vibrationally Excited CD2.
Final rept.
K. M. Evenson, T. Sears, and A. R. W. McKellar. Mar 84, 7p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of the Optical Society of America B 1, p15-21 Mar 84.

Keywords: *Deuterium compounds, Excitation, Molecular energy levels, Molecular rotation, Molecular structure, Reprints, *Far infrared spectroscopy, *Laser magnetic resonance spectroscopy, *Methylene radicals, Laser spectroscopy.

The authors report the detection of 13 rotational transitions in the first excited bending state (010) of CD2 using the technique of far-infrared laser magnetic resonance spectroscopy. Molecular parameters for this state are determined from these new data together with existing infrared observations of the nu 2 band. Additional information on the ground vibrational state (000) is also provided by the observation of a new rotational transition, and this is combined with existing data to provide a refined set of molecular parameters for the CD2 ground state. One spectrum has been observed that we assign as a rotational transition within the first excited symmetric stretching state (100) of CD2. These data will be of use in refining the structure and the potential function of the methylene radical.

704,844
PB84-240001 Not available NTIS
National Bureau of Standards, Washington, DC.
Far-Infrared Laser Magnetic Resonance.
Final rept.
K. M. Evenson. 1981, 9p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Discussions of the Faraday Chemical Society (England) 71, p6-14 1981.

Keywords: *Laboratory equipment, Zeeman effect, Free radicals, Paramagnetic materials, Atoms, Molecules, Reaction kinetics, Design criteria, Performance evaluation, Reprints, *Far infrared spectroscopy, *Laser magnetic resonance spectroscopy, Laser spectroscopy.

Far-infrared laser magnetic resonance (l.m.r.) is now a laboratory spectroscopic technique used in at least six laboratories throughout the world, and some 50 papers on l.m.r. spectroscopy have been published. L.m.r. is an extremely sensitive technique for finding rotational Zeeman spectra in paramagnetic atoms and molecules. Some 31 species have been detected, some of which had never been discovered before. L.m.r. is now also used in a number of laboratories to study the reaction rates of these paramagnetic free radicals. The field of mid-infrared l.m.r. using CO and CO2 lasers has also expanded rapidly and is summarized in McKellar's paper at this meeting. A review of far-infrared l.m.r. was presented a little over one year ago. The purpose of the present report is to bring that comprehensive paper up to date and to point out some recent results in the field of laser frequency measurements which are leading the way to a redefinition of the metre. In this publication, I will list all of the far-infrared l.m.r. spectrosopic papers chronologically; give a list of all the species observed with references, describe the design of a new l.m.r. spectrometer in the N.B.S. Boulder Laboratories; present some new ideas on the sensitivity of intracavity absorption; and finally show how recent laser frequency measurements are leading to a new definition of the metre in terms of the second, thus fixing the value of the speed of light.

704,845
PB84-240019 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Magnetic Resonance Spectroscopy of Atoms.
Final rept.
K. M. Evenson, and M. Inguscio. 1983, 2p
Pub. in Proceedings of International Conference on Laser Spectroscopy VI, Interlaken, Switzerland, June 27-July 1, 1983, p80-81.

Keywords: *Atoms, *Laboratory equipment, *Laser magnetic resonance spectroscopy, Laser spectroscopy.

This paper describes, briefly, the applicability of laser magnetic resonance (LMR) to atoms, and the apparatus used in the experiments.

704,846
PB84-242064 Not available NTIS
National Bureau of Standards, Washington, DC.
Melting Curve of o-Terphenyl.
Final rept.
V. J. Fratello, and V. E. Bean. 1983, 7p
Pub. in Int. Jnl. of Thermophys. 4, n3 p253-259 1983.

Keywords: *Terphenyls, *Melting, *Thermal analysis, Recrystallization, Purity, High pressure tests, Reprints.

Melting of high purity o-terphenyl was investigated in the range 0-500 MPa by differential thermal analysis. The sample was purified by repeated recrystallization from methanol, followed by vacuum sublimation. This material was approximately 99.995% pure, and the results suggest that sample purity was maintained to within the experimental uncertainty. The sample was loaded into a high pressure cell with a teflon/nylon composite pressure transmitting diaphragm. A differential thermocouple and a calibrated temperature measuring thermocouple were in direct contact with the sample.

704,847
PB84-242080 Not available NTIS
National Bureau of Standards, Washington, DC.
Vibrational State Distributions and Absolute Excitation Efficiencies for T-V Transfer Collisions of NO and CO with H Atoms Produced by Excimer Laser Photolysis.
Final rept.
C. A. Wight, and S. R. Leone. 15 Nov 83, 7p
Grants NSF-CHE79-11340, NSF-PHY82-00805
Pub. in Jnl. of Chemical Physics 79, n10 p4823-4829, 15 Nov 83.

Keywords: *Energy transfer, *Carbon monoxide, *Nitrogen oxide(NO), Fluorescence, Infrared spectroscopy, Photolysis, Excitation, Inelastic scattering, Molecular vibration, Reprints, *Atom molecule interactions, *Hydrogen atoms, *Laser applications.

Translation-to-vibration energy transfer from fast H atoms to NO and CO is studied by the excimer laser photolysis/infrared fluorescence method. The distribution is similar to that previously reported for H + CO collisions at the same energy. However, the absolute T-V transfer efficiency for H + CO is a strong function of initial energy, increasing from 7% at 0.95 eV to 28% at 3.1 eV, whereas the efficiency for H + NO is essentially constant at 14% over the same range of initial energies. This qualitatively different behavior is not expected from simple models of T-V energy transfer, but may be attributed to differences in the attractive regions of the potential energy surfaces of the HNO and HCO transient species.

704,848
PB84-242452 Not available NTIS
National Bureau of Standards, Washington, DC.
Poling Behavior of Polyvinylidene Fluoride at Room Temperature.
Final rept.
F. I. Mopsik, and A. S. DeReggi. Jan 84, 3p
Pub. in Jnl. of Applied Physics Letters 44, n1 p65-67 Jan 84.

Keywords: *Polarization(Charge separation), Electret, Reprints, *Vinylidene fluoride polymers, *Thermal pulse method.

The electrical polarization distribution for biaxially oriented polyvinylidene fluoride poled at room temperature was measured by means of the thermal pulse experiment. The evolution of the distribution as a function of poling field and poling time was studied. The resolution was one-tenth the sample thickness. In addition, the sample poled to the highest field was reverse poled to successively higher fields to study the effects of field reversal. The film was found to pole easiest in the middle regions implying a higher coercive field near the surfaces.

704,849
PB84-242478 Not available NTIS
National Bureau of Standards, Washington, DC.
Adsorption and Decomposition of Hydrocarbons on Platinum Black: Vibrational Modes from NIS (Neutron Inelastic Scattering).
Final rept.
R. R. Cavanagh, J. J. Rush, R. D. Kelley, and T. J. Udovic. 1 Apr 84, 7p
Sponsored in part by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Jnl. of Chemical Physics 80, n7 p3478-3484 Apr 84.

Keywords: *Hydrocarbons, *Surface chemistry, *Neutron inelastic scattering, *Adsorption, *Decomposition, Chemisorption, Acetylene, Ethylene, Reprints, *Electron energy loss spectroscopy, Platinum black.

The adsorption and decomposition of acetylene and ethylene on platinum black has been investigated by neutron inelastic scattering (NIS) studies of the vibrations of chemisorbed species in the energy range 30-200 meV. Results are compared in detail with EELS data and with spectra of model inorganic complexes. The NIS spectra for C2H2 and C2H4 chemisorbed at 120-150K exhibit a number of spectral features (from both the internal modes and modes associated with vibrations against the surface metal atoms) which are in general agreement with EELS results for Pt(111). Detailed comparison of the spectral peak intensities and positions with various models for the adsorbed molecules rule out linear or planar species and are consistent with bent molecular configurations on the surface. Bond angles and force constants are derived from the model fits to the neutron data in each case. The NIS spectra of a 'saturated' C2H2 monolayer warmed to 300K indicates a rearrangement to more

fully hydrogenated species. Subsequent introduction of H2 at low pressure shows little evidence of chemical change while spectra measured at high H2 pressure show co-existence of chemisorbed H and saturated hydrocarbons on the surface. Warming the saturated C2H4 monolayer to 300K produces a discrete NIS spectrum consistent with rearrangement to methylated species, possibly ethylidyne, as suggested from previous EELS studies.

704,850

PB84-242486 Not available NTIS
National Bureau of Standards, Washington, DC.
Comment on 'Quantum Motion of Chemisorbed Hydrogen on Ni Surfaces'.
Final rept.
R. R. Cavanagh, J. J. Rush, and R. D. Kelley. 4 Jun 84, 1p
Pub. in Physical Review Letters 52, n23 p2100, 4 Jun 84.

Keywords: *Hydrogen, *Surface chemistry, *Band structure of solids, Molecular energy levels, Molecular vibration, Adsorption, Neutron scattering, Nickel, Reprints.

Recent theoretical efforts have suggested the vibrational energy levels of adsorbed hydrogen reflect band structure, rather than simple localized oscillator states. The experimental data relevant to such theories is reviewed and found not to support the notion of band structure for surface bound hydrogen. Hydrogen in metals is suggested as a more promising system in which to investigate the issue of such band structures.

704,851

PB84-242932 Not available NTIS
National Bureau of Standards, Washington, DC.
Stark Quenching of Metastable 2S States in Hydrogen and Helium at High Fields.
Final rept.
H. K. Holt. Aug 83, 3p
Pub. in Physical Review A 28, n2 p1157-1159 Aug 83.

Keywords: *Hydrogen, *Helium, *Stark effect, Metastable state, Molecular energy levels, Electric fields, Reprints.

The time-dependent theory of the Stark quenching of 2S states in hydrogen and helium is developed for high electric fields, fields for which the Stark matrix element is large compared to the state separations. The metastable 2S state of an atom is mixed with two P states by the field, and the subsequent decay is described.

704,852

PB84-242940 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectra of the Ammonium Radical: The Schuster Band of ND4.
Final rept.
G. Herzberg, and J. T. Hougen. 1983, 11p
Pub. in Jnl. of Molecular Spectroscopy 97, p430-440 1983.

Keywords: *Visible spectrum, Ammonia, Free radicals, Deuterium compounds, Broadband, Reprints, *Ammonium radicals, *Schuster bands.

The Schuster band of ammonia occurs in many kinds of electric discharges through streaming ammonia if the pressure is not too low. While it is entirely diffuse for ordinary ammonia it shows a fairly clear structure (and an isotope shift) when produced with heavy ammonia (ND3). Studies with intermediate isotopes show conclusively that there are four H atoms and a single N atom present in the molecule responsible for this spectrum, i.e., that it is due to the ammonium (NH4) radical. An attempt is made to understand the structure of the ND4 Schuster band in terms of a tetrahedral configuration of the molecule in both upper and lower state. The agreement of the wavenumber of the band origin with several recent ab initio calculations is not as good as one might wish and not as good as in the analogous case of H3. This and other difficulties of the present interpretation of the spectrum are briefly discussed.

704,853

PB84-243872 Not available NTIS
National Bureau of Standards, Washington, DC.
Fluorescence Measurement of Antioxidant Migration from Low Density Polyethylene into 1-Propanol.
Final rept.
F. Wang, and B. Howell. 1982, 4p
Pub. in Proceedings of Organic Coatings and Applied Polymer Science, Kansas City, MO., September 12-17, 1982, p41-44.

Keywords: *Antioxidants, *Fluorescence, *Transport properties, *Diffusion coefficients, *Polyethylene, Additives, Solvent extraction, *Low density polyethylene, Phenylene diamine/N-N-diphenyl.

Although the fluorescence technique has been used to determine additive concentration in polymers as far as the authors know, there has been no report on the use of this technique to measure the diffusion of an additive from a polymer matrix into an extracting solvent. To successfully carry out diffusion measurement by the fluorescence technique, they must take precautions to exclude oxygen from the extracting solvent since oxygen quenches the fluorescence of the additive and, in some cases, contributes to its photodegradation. In this paper, they describe how oxygen exclusion was incorporated into a procedure to measure the diffusion of an additive from a polymer matrix into an extracting solvent. They also describe the application of this procedure to the diffusion of an amine antioxidant, N,N'-diphenyl-p-phenylenediamine (DPPD), from low-density polyethylene (LDPE) into 1-propanol and the authors give a preliminary value for the diffusion coefficient of DPPD in LDPE at the experimental conditions.

704,854

PB84-243880 Not available NTIS
National Bureau of Standards, Washington, DC.
Family of Angle-Moments Proportional to r to the power (-n), n = 1, 2,. . ., in Free Space.
Final rept.
D. G. Hummer. 1984, 2p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 31, n3 p283-284 1984.

Keywords: Thermal radiation, Spheres, Reprints, *Radiative transfer.

The moments (M sub n)(r) is identically = 1/2 the integral between 0 and 2 pi, of ((cos theta)(sin to the nth power theta)I(r, theta)d(theta)) or the intensity I(r, theta) in free space surrounding a spherical object emitting radiation with an arbitrary directional dependence are shown to be exactly proportional to (r sup -(n+1)), n = 0,1,... .

704,855

PB84-244136 Not available NTIS
National Bureau of Standards, Washington, DC.
Anomalous N2 3 Auger Spectra of In and Sn.
Final rept.
J. Fine, T. D. Andreadis, and J. A. D. Matthew. 1984, 4p
Pub. in Jnl. of Physics C: Solid State Physics 17, pL257-L260 1984.

Keywords: *Indium, *Tin, Reprints, *Auger spectroscopy.

The N2 3Auger spectra of both In and Sn are shown to consist of single broad peaks with no electron emission peak in the N2 3N4 5N4 5 region, in sharp contrast to the conventional M2 3Auger spectra of Ga and Ge.

704,856

PB84-244243 Not available NTIS
National Bureau of Standards, Washington, DC.
Precision Measurements of Laser Cooled (sup 9) Be(+1) Ions.
Final rept.
J. J. Bollinger, D. J. Wineland, W. M. Itano, and J. S. Wells. 1983, 5p
Pub. in Proceedings of Int. Laser Spectroscopy Conf. (6th), Interlaken, Switzerland, June 27-July 1, 1983, Paper in Laser Spectroscopy 6, p168-172 1983.

Keywords: Ions, Atomic energy levels, Zeeman effect, Fluorescence, Hyperfine structure, Doppler effect, *Beryllium ions, *Laser spectroscopy.

Laser assisted measurements of cyclotron frequencies, g-factors, hyperfine constants and ion cloud parameters for laser cooled (9)Be(+1) ions in a Penning trap were made. The cyclotron and hyperfine-Zeeman resonances of the (9)Be(+1) ions were detected by changes in laser fluorescence. A laser optical-pumping double-resonance technique was used to measure the ground state hyperfine constant A and the nuclear to electronic g-factor ration g sub I/g sub J of (9)Be(+).

704,857

PB84-244268 Not available NTIS
National Bureau of Standards, Washington, DC.
Far Infrared LMR (Laser Magnetic Resonance) Detection of Hydroxymethyl.
Final rept.
H. E. Radford, K. M. Evenson, and D. A. Jennings. 15 Mar 81, 3p
Pub. in Chemical Physics Letters 78, n3 p589-591, 15 Mar 81.

Keywords: *Infrared spectroscopy, Solids, Liquids, Reprints, *Laser magnetic resonance spectroscopy, *Far infrared spectroscopy, *Hydroxymethyl radicals.

Laser magnetic resonance spectra of the free hydroxymethyl radical, produced by the reaction of atomic chlorine with methanol vapor, have been observed at several laser wavelengths between 118 and 657 micrometer. The spectra are identified by chemical tests and by comparison with the ESR spectrum of hydroxymethyl in solids and liquids.

704,858

PB84-244276 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of the Positronium 1 triplet S(sub 1)-2 triplet S(sub 1) Interval by Doppler-Free Two-Photon Spectroscopy.
Final rept.
S. Chu, A. P. Mills, and J. L. Hall. May 84, 10p
Contract N00014-77-C-0656, Grant NSF-PHY82-00805
Pub. in Physical Review Letters 52, n19 p1689-1698 May 84.

Keywords: *Positronium, Molecular energy levels, Quantum electrodynamics, Spectral lines, Doppler effect, Reprints, *Laser spectroscopy.

The authors have measured the 1 triplet S(sub 1)-2 triplet S(sub 1) interval in positronium (Ps) to be 1,233,607,185 +n 15 MHz, in agreement to within 1% of the alpha (sup 3)R(infinity) QED prediction. The quoted 12-ppb uncertainty has equal contributions from the measurement of the Ps resonance relative to a Te2 absorption line and the calibration of the Te2 line relative to the deuterium 2S(1/2) - 4P(3/2) Balmer line.

704,859

PB84-244300 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of L3-Shell Excitation Energies of 3d Transition Metals Obtained by XPS, AEAPS, and EELS - Summary Abstract.
Final rept.
N. E. Erickson, and C. J. Powell. Jun 84, 2p
Pub. in Jnl. of Vacuum Science and Technology A 2, n2 p840-841 Apr/Jun 84.

Keywords: *Molecular energy levels, *Metals, Nickel, Titanium, Vanadium, Chromium, Cobalt, Iron, Chemical bonds, X ray analysis, Reprints, X ray photoelectron spectroscopy, Auger spectroscopy, Electron energy loss spectroscopy.

A summary is given of measurements of L3-shell binding energies of the elements Ti, V, Cr, Fe, Co, and Ni by the techniques of x-ray photoelectron spectroscopy, Auger-electron appearance-potential spectroscopy, and electron energy-loss spectroscopy.

704,860

PB84-244698 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Magnetic Resonance Rotational Spectroscopy of 2 Sigma Radicals: Ethynyl (CCH).
Final rept.
R. J. Saykally, L. Veseth, and K. M. Evenson. 15 Mar 84, 9p
Sponsored in part by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Jnl. of Chemical Physics 80, n6 p2247-2255, 15 Mar 84.

Keywords: *Free radicals, *Molecular rotation, *Astronomical spectroscopy, Interstellar matter, Molecular energy levels, Least squares method, Reprints, *Eth-

ynyl radicals, *Laser spectroscopy, *Laser magnetic resonance.

The first terrestrial measurement of the free ethynyl radical (CCH), made by far-infrared laser magnetic resonance, is described. Because of the very weak spin coupling in this state, the LMR spectrum is complex and badly overlapped. A theoretical formalism for the prediction and analysis of such weakly coupled 2 sup sigma states is presented, in which frequencies, linewidths, and intensities of all transitions are computed as a function of magnetic flux density, and the total absorption coefficient is computed at each field point in order to simulate the magnetic resonance spectrum. This formalism is used to analyze the LMR spectra of CCH. A combined least squares analysis of existing microwave, astronomical, and LMR data was carried out to determine an improved set of molecular parameters for this important interstellar molecule.

704,861
PB84-244706 Not available NTIS
National Bureau of Standards, Washington, DC.
Pure Rotational Spectrum and Hyperfine Structure of CF Studied by Laser Magnetic Resonance.
Final rept.
R. J. Saykally, K. G. Lubic, A. Scalabrin, and K. M. Evenson. 1982, 10p
Grant NSF-CHE80-07042
Pub. in Jnl. of Chemical Physics 77, n2 p58-67 1982.

Keywords: *Molecular rotation, *Hyperfine structure, Infrared spectroscopy, Reprints, *Laser spectroscopy, *Laser magnetic resonance, *Carbon fluoride.

Laser magnetic resonance spectra have been measured for four rotational transitions and one spin-changing transition in the 2 sup pi ground state of CF, generated in an intracavity methane-fluorine flame. Comparison of these integrals with those of the fluorine atom indicates that the unpaired electron has approximately 18% F character, implying a substantial degree of double bonding.

704,862
PB84-244730 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamic Properties of Isobutane in the Critical Region.
Final rept.
J. M. H. L. Sengers, B. Kamgar-Parsi, and J. V. Sengers. 1983, 9p
Pub. in Jnl. of Chemical and Engineering Data 28, n4 p354-362 1983.

Keywords: *Butanes, *Thermodynamic properties, *Critical point, Tables(Data), Binary systems(Materials), Reprints, *Propane/methyl, Geothermal systems.

For geothermal applications, a scaled fundamental equation has been formulated to represent and tabulate the thermodynamic properties of isobutane in the critical region. In the supercritical range, the surface joins smoothly with that of Waxman and Gallagher, to which it is a complement.

704,863
PB84-244755 Not available NTIS
National Bureau of Standards, Washington, DC.
Atomic Transition Probability Measurements for Spectral Lines of the 3S-4P Transition Array of Neutral Carbon.
Final rept.
D. W. Jones, and W. L. Wiese. May 84, 8p
Pub. in Physical Review A 29, n5 p2597-2604 May 84.

Keywords: *Atomic energy levels, *Carbon, *Emission spectroscopy, *Visible spectroscopy, Reprints.

Absolute transition probabilities for the 18 transitions of the 3s-4p transition array of neutral carbon have been studied in emission with a wall-stabilized arc. Values are given for ten individual lines and one pair of strongly blended lines (476.23 and 476.25 nm). An upper bound is set for the remaining six lines of the array which were too weak to be observed in this work. An important feature of this work is the use of digital least-squares-fitting techniques to separate overlapping lines and to provide accurate line-wing corrections. Problems associated with demixing effects have been avoided by normalizing relative transition probability measurements to an absolute scale set by atomic lifetimes.

704,864
PB84-244763 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Atomization Sources and Resonance Ionization Mass Spectrometry (RIMS).
Final rept.
J. D. Fassett, J. C. Travis, and L. J. Moore. 1984, 8p
Pub. in Society of Photo-Optical Instrumentation Engineers 482, p36-43 1984.

Keywords: *Ionization, *Thermal analysis, *Atomizing, Ions, Vanadium, Iron, Mass spectroscopy, Vaporization, Reprints, *Resonance ionization mass spectroscopy, *Laser spectroscopy.

Resonance ionization mass spectrometry has been used to study the formation of atomic ions. A one-wavelength, two-photon ionization scheme was used that is potentially applicable to nearly 50 elements. Thermal vaporization from rhenium filament substrates is described, and the controlling physical processes are enumerated. The laser characteristics which affect ionization are also discussed. Results are presented for vanadium and iron.

704,865
PB84-244771 Not available NTIS
National Bureau of Standards, Washington, DC.
Transport Properties and Second Virial Coefficient of Argon: A Test of the Hulburt-Hirschfelder Potential.
Final rept.
P. M. Holland, L. Biolsi, and J. C. Rainwater. Dec 83, 13p
Pub. in Proceedings of Conference on Spectroscopic Probes of Van Der Waals Molecules, Oneonta, NY, March 20-21, 1981, p115-127 1983.

Keywords: *Argon, *Transport properties, Spectrochemical analysis, *Virial coefficients, *Hulburt-Hirschfelder potentials.

The Hulburt-Hirschfelder potential was used to calculate viscosity, thermal conductivity, self diffusion and second virial coefficients for argon without adjustable parameters. Comparison of the results with experimental data for these properties over a wide temperature range shows excellent overall agreement for the transport properties and good agreement for the second virial coefficient at higher temperatures. Deviations at lower temperatures are attributed to the difficulty of accurately determining the longer range part of the potential from spectroscopic data of the argon dimer. However, the H-H potential appears to accurately represent the true atom-atom potential over a wide range of interatomic separations so that the transport properties can be accurately estimated over a wide temperature range without the need to empirically adjust any of the experimentally determined spectroscopic constants used in the potential.

704,866
PB84-244821 Not available NTIS
National Bureau of Standards, Washington, DC.
Cryoscopic Determination of the Purity of Benzene by Calorimetry.
Final rept.
G. T. Furukawa, J. H. Piccirelli, and M. L. Reilly. 1984, 17p
Pub. in American Society for Testing Materials, Special Technical Publication 838, p90-106 1984.

Keywords: *Heat measurement, *Cryoscopy, *Purity, Benzenes, Crystallization, Reprints, *Benzene.

To test the cryoscopic method for determination of purity, the impurity concentrations of duplicate samples taken from four prepared lots of benzene were determined on basis of the van't Hoff law of freezing-point lowering and on the assumption that the phases in equilibrium were pure solid benzene and liquid benzene containing all of the impurities in ideal solution. The adiabatic calorimeter method was used in conjunction with automatic temperature controls and platinum resistance thermometry. Three of the lots contained weighed amounts of pure n-heptane, known only to the preparer, which were added to portions of the first lot which had been purified to better than 99.999 percent by a fractional crystallization technique. These results demonstrate that the cryoscopic determination of purity by calorimetry yields accurate values.

704,867
PB84-244839 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Effects of Spin-Orbit Interaction on Rotational Levels and Rotational Line Intensities in Vibrationally Unexcited 2A, 2E, and 2F Electronic States of XY4 Molecules.
Final rept.
J. T. Hougen. 1984, 21p
Pub. in Jnl. of Molecular Spectroscopy 106, p134-154 1984.

Keywords: *Spin orbit interactions, *Rotational spectra, Molecular energy levels, Molecular rotation, Angular momentum, Reprints.

Rotational energy levels in vibronic ground states of 2A, 2E, and 2F electronic states of open shell XY4 molecules are discussed, including the effects of spin-orbit interaction and tetrahedral splittings. Jahn-Teller effects are assumed to be small, and are only taken into account implicitly, through their contributions to various parameters in the effective Hamiltonian. Qualitative information is obtained by considering several coupling schemes among the electron spin angular momentum S, the electron orbital angular momentum L, and the pure rotational angular momentum R. These limiting cases are similar in spirit to Hund's coupling cases in diatomic molecules.

704,868
PB84-244847 Not available NTIS
National Bureau of Standards, Washington, DC.
Small-Angle Neutron Scattering from a Polyurethane Block Copolymer.
Final rept.
J. A. Miller, S. L. Cooper, C. C. Han, and G. Pruckmayr. 1984, 1p
Pub. in Macromolecules 17, p1063 1984.

Keywords: *Neutron scattering, *Copolymers, *Polyurethane resins, Separation, Isotopic labeling, Reprints, *Small angle scattering, Polymer chains, Molecular conformations.

Small angle neutron scattering (SANS) experiments were performed on a series of polyether polyurethane block copolymers. The samples possessed the same chemical composition, but differed in the percentage of polyether soft segments that were completely deuterolabelled. The level of labelling covered a wide range, from no labelling up to 30% of the total polyether chains. At the highest level of deuteration, little interphase scattering occurs and the coherent portion of the scattering is dominated by the interchain scattering. The single chain scattering is dominated by the interchain scattering. The single chain scattering functions extracted from the scattering data yield a radius of gyration for the soft segment that is substantially larger than that reported for the polyether homopolymer in a theta solvent (35). Thus the soft segment chains in this lamellar block copolymer are in a somewhat extended conformation. Results of other work on a styrene.isoprene lamellar block copolymer indicate a similar chain conformation (23). Experimentally it was found that the technique of matching the interphase contrast yielded the single chain scattering function with greater accuracy than did the subtraction method. In addition, the smearing effects of wavelength polydispersity and collimation were analyzed. For this experiment, neither smearing phenomenon had any significant effect on the scattering data.

704,869
PB84-244896 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanisms for Photon Stimulated Desorption of O+ from Cr(110).
Final rept.
R. Stockbauer, D. Ramaker, E. Bertel, R. Kurtz, and T. E. Madey. Jun 84, 2p
Pub. in Jnl. of Vacuum Science and Technology A2, n2 p1053-1054 Apr-Jun 84.

Keywords: *Desorption, *Oxygen, *Chromium, Synchrotron radiation, Photons, Stimulation, Reprints, *Electron stimulated desorption, *Photon stimulated desorption.

The interaction of oxygen with Cr(110) has been studied using synchrotron radiation techniques. A major objective of this work has been to determine the mechanism of electron and photon stimulated desorption (ESD/PSD) of O(+) from the surface of a non-maximal-valency, covalent oxide. The mechanism identified in this study is a generalization of the Knotek-Feibelman Auger decay model of ion desorption, because the driving force is the Coulomb correlation of a local-

ized 2 hole state rather than the instability of the ion in the Madelung potential.

704,870
PB84-244912 Not available NTIS
National Bureau of Standards, Washington, DC.
Adsorption and Orientation of NH3 on Ru(001).
Final rept.
C. Benndorf, and T. E. Madey. 1983, 20p
Pub. in Surface Science 135, p164-183 1983.

Keywords: *Ammonia, *Surface chemistry, Adsorption, Chemical bonds, Ruthenium, Reprints, LEED(Low energy electron diffraction), Electron stimulated desorption ion angular distribution method, Thermal desorption.

The interaction of NH3 with clean Ru(001) surfaces has been studied using LEED (low energy electron diffraction), ESDIAD (electron stimulated desoprtion ion angular distribution), TDS (thermal desorption spectroscopy), and work function changes (delta phi).

704,871
PB84-244920 Not available NTIS
National Bureau of Standards, Washington, DC.
Shape Resonances, Overtones, and Electron Energy Loss Spectroscopy of Gas Phase and Physisorbed Diatomic Molecules.
Final rept.
J. W. Gadzuk. 15 Oct 83, 6p
Pub. in Jnl. of Chemical Physics 79, n8 p3982-3987, 15 Oct 83.

Keywords: *Diatomic molecules, *Oxygen, *Nitrogen, *Vapor phases, Substrates, Excitation, Reprints, *Electron energy loss spectroscopy, *Overtone spectroscopy, Physisorption.

Electron energy loss spectra of O2 and N2 physisorbed on metallic substrates showing a series of high overtone losses have recently been reported. In the case of N2, the intense overtone excitation is credited to the formation of a well known temporary negative ion state with a resonance lifetime about 10 to the -15th power sec for gas phase N2(-1). The principal distinction between the gaseous and physisorbed molecule EELS spectrum is a significant depletion of the overtone intensity which has been attributed to a surface-induced decrease in the resonance lifetime. In the present work, a time dependent quantum mechanical model applicable to vibrational excitation in resonance scattering is outlined which quantitatively accounts for the observed spectra and in particular, the surface modifications to the gas phase results. The essential feature of the model is one in which the intramolecular dynamics of the intermediate state is characterized by nuclear propagation over a harmonic potential curve spatially displaced from the ground state curve for a time duration equal to the resonance lifetime. The resulting calculated overtone spectra agree well with the experimentally observed ones. The results suggest that the physisorbed N2(-1) lifetime is about 40% of that of the free molecule.

704,872
PB84-245794 Not available NTIS
National Bureau of Standards, Washington, DC.
Frequency-Dependent Conductivity of Polyacetylene.
Final rept.
A. J. Glick, and G. W. Bryant. 1982, 8p
Pub. in Proceedings of International Conference on Low-Dimensional Conductors, Boulder, CO, August 9-14, 1981, Molecular Crystals and Liquid Crystals 83, n1-4 p1183-1190 1982.

Keywords: *Conductivity, Impurities, Chemical bonds, Density(Mass/volume), *Polymer chains, *Polyacetylene, Electron energy loss spectroscopy.

The finite temperature frequency dependent conductivity of a polymer chain such as trans-polyacetylene has been calculated using a two band tight-binding model. A collective mode in the dielectric response gives rise to energy adsorption below the interband threshold even when no account is taken of possible soliton modes. The effect of impurities on this mode has been included phenomenologically by introducing a collision time. The effect of impurities on the density of states has been studied with diagram techniques and the CPA approach. The contributions of these effects to the optical and electron energy loss spectra of trans-polyacetylene are discussed.

704,873
PB84-245836 Not available NTIS
National Bureau of Standards, Washington, DC.
Fermi Resonances and Vibrational Spectra of Crystalline and Amorphous Polymethylene Chains.
Final rept.
S. Abbate, G. Zerbi, and S. L. Wunder. 1982, 10p
Pub. in Jnl. of Physical Chemistry 86, n16 p3140-3149 1982.

Keywords: *Raman spectroscopy, *Vibrational spectra, Infrared spectroscopy, Fermi surfaces, Reprints, *Polymer chains, *Polymethylene.

An improvement in the interpretation of the infrared and Raman spectra of polymethylene chains is obtained when Fermi Resonances are taken into account. In this paper Fermi resonances are considered both in the CH2 bending and stretching regions. A method is proposed for dealing with k-dependent frequencies for chains either isolated or in the crystalline state. In this work use is made of previous intensity studies in infrared and Raman for a quantitative account of intensities and band shapes. The ratio, R, of the Raman intensities of the lines at 2850 and 2940/cm is shown to be a measure of conformational disorder. The validity of this theoretical prediction is demonstrated for the case of polyethylene samples of varying degrees of crystallinity. Under the assumption that the remaining amorphous material obeys Boltzmann statistics with pentane exclusion, R is found to be a linear function of gauche bond population.

704,874
PB84-245851 Not available NTIS
National Bureau of Standards, Washington, DC.
Dielectronic Recombination of Some Singly Charged Ions.
Final rept.
G. H. Dunn, D. S. Belic, T. J. Morgan, D. W. Mueller, and C. Timmer. 1984, 9p
Pub. in Proceedings of Internationtional Conference on Physics of Electronic and Atomic Collisions (13th), Berlin, July 27-August 3, 1983, p809-817 1984.

Keywords: *Ions, *Recombination reactions, Magnesium, Calcium, Carbon, *Dielectronic recombination, Chemical reaction mechanisms.

Dielectronic recombination (DR) has recently yielded to measurement in four different laboratories. This paper, after discussing the mechanism of DR describes the experiments on singly charged ions. For all three ions, Mg(+1), Ca(+1), and C(+1), the measured cross sections are substantially larger than theoretical predictions. For the case of Mg(+1), taking account of extrinsic fields may account for most of the discrepancy, and new experiments to measure this are suggested. For Ca(+1) and C(+1) the extrinsic fields appear to have been very small, and the role of these fields in explaining experiment/theory discrepancies is not clear.

704,875
PB84-245919 Not available NTIS
National Bureau of Standards, Washington, DC.
Forward Depolarized Scattering of Semi-Dilute Solution of Poly (Alpha-Methyl Styrene).
Final rept.
M. Delsanti, C. C. Han, and H. Yu. Mar 81, 2p
Pub. in ACS (American Chemical Society) Polymer Preprints 22, n1 p76-77 Mar 81.

Keywords: *Doppler effect, *Light scattering, *Depolarization, Solutions, Molecular weight, Polymers, Plastics, Reprints, *Poly(styrene/methyl), *Forward depolarized scattering techniques.

The Doppler broadened power spectrum of scattered light in the forward depolarized configuration has been used to deduce the internal normal modes of isolated linear macromolecules (1-4). A distinguishing virtue of the forward depolarized scattering (FDS) technique is to focus on the intramolecular motion while suppressing the contribution of the center of mass transport to the power spectrum. If one is interested in the cooperative processes in polymer solutions wherein the individual macromolecules are no longer isolated from one another but with a good deal of overlap in the chain configurations of different molecules, the FDS technique may also be useful in probing the cooperative rotatory dynamics. Inasmuch as the technique reveals the time dependent optical anisotropy changes induced by spontaneous thermal fluctuations, it is not a priori obvious as to exactly what kind of the dynamic processes that contributes predominantly to the FDS power spectrum.

704,876
PB84-245935 Not available NTIS
National Bureau of Standards, Washington, DC.
Dielectric Saturation and Dielectric Friction on an Ion in a Polar Solvent.
Final rept.
J. B. Hubbard, and R. F. Kayser. 15 Apr 82, 6p
Pub. in Chemical Physics 66, n3 p377-382, 15 Apr 82.

Keywords: *Ions, *Dielectric properties, *Mathematical models, Solvents, Polarity, Reprints.

The effect of dielectric saturation on the mobility of an ion in a polar solvent is analyzed within the framework of a continuum dielectric friction model. It is shown that for large ions, polarization saturation results in an increased drag relative to the case of dielectric friction without saturation.

704,877
PB84-245968 Not available NTIS
National Bureau of Standards, Washington, DC.
Instrumental Effects on the Glass Transition Temperature.
Final rept.
P. D. Garn, and O. Menis. 1977, 19p
Pub. in Jnl. of Macromolecular Science, Part B: Physics B13, n4 p611-629 1977.

Keywords: *Glass transition temperature, *Standards, *Polystyrene, *Thermal analysis, Sensors, Sites, Measuring instruments, Reprints, *Certified reference materials.

The testing and evaluation program leading to the certification of a selected batch of polystyrene as ICTA Reference Material GM 754 is described. Defined points from the glass transition curve were obtained first in a preliminary program, then in 24 laboratories using eight kinds of apparatus. Separation of the data by heating rate, sample holder configuration, temperature sensor location and combinations of these disclosed that (a) the reproducibility under a given set of conditions warranted certification; (b) the apparent heating rate dependence of the measured points is largely due to separation of the measuring point (sensor location) from the sample; and (c) the inherent time dependence of the glass transition leads to an intrinsic contribution to the apparent heating rate dependence.

704,878
PB84-245984 Not available NTIS
National Bureau of Standards, Washington, DC.
Core-Level Processes in the Electron Stimulated Desorption of CO from the W(110) Surface.
Final rept.
J. E. Houston, and T. E. Madey. 15 Jul 82, 13p
Pub. in Physical Review B 26, n2 p554-556, 15 Jul 82.

Keywords: *Carbon monoxide, *Surface chemistry, Chemisorption, Adsorption, Excitation, Desorption, Reprints, *Electron stimulated desorption.

Franchy and Menzel recently reported a significant increase in the desorption (ESD) yield of O(+1) ions from CO absorbed on the (100) surface of W at 80K when the incident electron energy exceeded that necessary to excite the oxygen Is core level. Disintegration of the adsorption complex which becomes multiply charged by Auger decay of the core hole was offered as an explanation. In the present work they have investigated this effect in detail for absorption of CO at 80K on the W(110) surface. In agreement with Franchy and Menzel, the authors observed an increased O(+1) ESD yield for electron energies above the Ols threshold for saturation coverages of CO adsorbed at 80K. In addition, we find that the O(+1) yield in this region is strongly dependent on coverage and post-absorption thermal annealing. We present data which indicates that, in fact, the magnitude of the O(+1) yield for energies much greater than the threshold appears to be rather insensitive to the CO binding site and follows closely the total CO coverage. In contrast, it is found that the O(+1) yield from excitation processes which have their thresholds at low energies, i.e., less than 100 eV, is strongly dependent upon the chemical state of the adsorbed CO and is greatly suppressed for coverages above about 0.5 monolayer.

704,879
PB84-245992 Not available NTIS
National Bureau of Standards, Washington, DC.

Temperature-Dependent Photoemission Line Shapes of Physisorbed Xenon.
Final rept.
J. W. Gadzuk, S. Holloway, C. Mariani, and K. Horn. 3 May 82, 4p
Pub. in Physical Review Letters 48, n18 p1288-1291, 3 May 82.

Keywords: *Xenon, *Photoelectric emission, *Line width, *Surface chemistry, *Mathematical models, Temperature, Comparison, Copper, Reprints.

A model is presented for the temperature dependence of adsorbate photoemission line widths. By approximating the initial and final states as displaced harmonic oscillators, an analytic form for the observed line width is obtained. Comparison with angle-resolved photoemission spectra of xenon on Cu(110) yields excellent agreement.

704,880
PB84-246008 Not available NTIS
National Bureau of Standards, Washington, DC.
Equilibrium Properties of Polydisperse Systems.
Final rept.
J. A. Gualtieri, J. M. Kincaid, and G. Morrison. 1982, 4p
Pub. in Proceedings of Symposium on Thermophysical Properties (8th), Gaithersburg, MD., June 15-18, 1981, Paper in Thermophysical Properties of Fluids 1, p331-334 1982.

Keywords: *Polymers, *Phase transformations, *Free energy, Mixture, Van der Waals equation, Critical point, Dispersion, *Phase equilibrium, Numerical solution.

The authors give a prescription for obtaining a polydisperse free energy from the free energy of a finite component mixture. The two-phase equilibrium conditions are solved for the polydisperse impurity case, and the shift in the location of the critical point is obtained. Their calculations are carried out within the context of a generalized van der Waals model.

704,881
PB84-246016 Not available NTIS
National Bureau of Standards, Washington, DC.
Anatomy of the Thermodynamic Surface of Water: The Formulation and Comparisons with Data.
Final rept.
L. Haar, and J. S. Gallagher. 1982, 5p
Pub. in Proceedings of Symposium on Thermophysical Properties (8th), Gaithersburg, MD., June 15-18, 1981, Paper in Thermophysical Properties of Solids and of Selected Fluids for Energy Technology 2, p298-302 1982.

Keywords: *Water, *Thermodynamic properties, *Surface chemistry, Fluids, Equations of state, Enthalpy, Entropy, Specific heat, Comparison, Numerical solution.

A thermodynamic surface for water has been derived with which all thermodynamic properties for the fluid states can be calculated from the freezing line to in excess of 2000 K in temperature and from the dilute gas to in excess of 1 GPa in pressure. The calculated values are everywhere in good accord with accurate data.

704,882
PB84-246065 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Stark Spectroscopy of DCN and DC15N.
Final rept.
S. M. Freund, and A. G. Maki. Jun 82, 5p
Pub. in Jnl. of Molecular Spectroscopy 93, n2 p433-437 Jun 82.

Keywords: *Stark effect, *Hydrogen cyanide, *Deuterium compounds, Infrared spectroscopy, Dipole moments, Reprints, *Laser magnetic resonance, *Laser spectroscopy.

Using a CO laser, laser Stark resonance spectra have been measured for the C-N stretching fundamentals (the 001 sup 0-00 sup 00 bands) of D sup 12C sup 14N and D sup 12C sup 15N near 1925/cm. Laser Stark resonances have also been measured for the hot band 01 sup 1 1-01 sup 1 0 of D sup 12C sup 14N. In addition to accurately determining the band centers, dipole moments are given for the different vibrational states involved.

704,883
PB85-100170 Not available NTIS
National Bureau of Standards, Washington, DC.
Protonation of C3H6 and C4H8 Isomers: Isotope Exchange and Isomerization.
Final rept.
E. P. Hunter, and S. G. Lias. 1982, 7p
Pub. in Jnl. of Physical Chemistry 86, n14 p2769-2775 1982.

Keywords: *Isotope exchange, *Isomerization, *Cyclopropane, Deuterium compounds, Reprints, *Butene, *Ion cyclotron resonance spectrometers, *Ion molecule interactions.

Isotope exchange processes of the type (MH(+1) + C3D6 yields MD(+1) + C3HD5) or (MD(+1) + C3H6 yields (where C3(H,D)6 is propylene or cyclopropane) have been studied in an ICR spectrometer. It is shown that for both reactant molecules, the efficiency of the exchange reaction can be correlated with the exothermicity of the formation of the complex (M-C3(H,D)7(+1)) from separated M(H,D)(+1) and C3(H,D)6 reactants. In the case of propylene, all of the M(H,D)(+1) reactants are chosen so that proton (deuteron) transfer is endothermic. For cyclopropane reactant molecules, some of the reactant pairs have available an exothermic channel leading to the formation of a sec-propyl ion product, but this process is shown to compete poorly with the isotope exchange process (which may or may not involve isomerization of the neutral cyclopropane to propylene in the collision complex). Isotope exchange reactions involving the partially deuterated propylenes CD3CH=CH2, CH3CH=CD2, and CH3CH=CHD provide evidence that when M is a nitrile, there is statistical scrambling of the H and D atoms in the C3(H,D)7(+1) in the (M-sec-C3(H,D)7(+1)) complex; when M is an aldehyde or a format, the reaction involves only the H and D atoms on the methyl groups of the sec-C3(H,D)7(+1) species in that complex.

704,884
PB85-100188 Not available NTIS
National Bureau of Standards, Washington, DC.
Reinvestigation of the I*Yield in the 193 nm Photodissociation of 1,2-C2F4IBr.
Final rept.
C. A. Wight, and S. R. Leone. Dec 83, 2p
Contract DAAG29-82-K-0031
Pub. in Jnl. of Chemical Physics 87, n25 p5299-5300 Dec 83.

Keywords: *Iodine, *Ultraviolet spectroscopy, *Dissociation, *Photochemical reactions, Fluorescence, Fluorine organic compounds, Reprints, *Ethane/bromofluoro-iodo.

In a recent meeting, Y. T. Lee and co-workers reported that a high yield of excited I* does result from the 193 nm photodissociation of C2F4IBr. Their measurements use the molecular beam time-of-flight method. This discrepancy prompted us to reinvestigate the I* yield by the infrared fluorescence method. The authors report that the previous work of Baughcum, Pence and Leone is in error and that the high yield of I* is also observed in infrared emission from the 193 nm dissociation. There is no obvious explanation for the previous result. The new results substantially change the conclusions drawn concerning bond selective dissociation pathways in this class of compounds.

704,885
PB85-100196 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Spectrum of the C2F5 Free Radical Trapped in Solid Argon in Discharge Sampling Experiments.
Final rept.
M. E. Jacox. 1984, 4p
Pub. in Jnl. of Physical Chemistry 88, n3 p445-448 1984.

Keywords: *Infrared spectroscopy, *Free radicals, Absorption, Chemical bonds, Fluorine organic compounds, Reprints, *Ethylene/fluoro.

When the products of the reaction between F atoms formed in a microwave discharge and C2F4 are frozen in a large excess of argon at 14 K, prominent absorptions of C2F5 and C2F6 appear in the infrared spectrum of the solid deposit. All of the absorptions above 400/cm previously attributed to C2F5 except that near 1040/cm have been confirmed. Very little fragmentation of C2F5 occurs under the conditions of these experiments. The most prominent absorptions of C2F5 are also present in the infrared spectrum of the quenched products of the excitation of an Ar:C2F6 sample in a low-power microwave discharge, but rupture of the C=C bond predominates the corresponding study of discharged Ar:C2F4 samples. The vibrational assignment of the C2F5 spectrum and the processes which account for the observed product distribution in the F + C2F4 experiments are discussed.

704,886
PB85-100220 Not available NTIS
National Bureau of Standards, Washington, DC.
Ro-Vibrational Excitation of HCl by Electron Impact.
Final rept.
N. T. Padial, and D. W. Norcross. 1984, 4p
Contract DOE-EA-77-A-01-6010
Pub. in Physics Review A 29, n3 p1590-1593 1984.

Keywords: *Hydrogen chloride, *Molecular vibration, *Molecular rotation, Excitation, Inelastic scattering, Elastic scattering, Reprints, *Electron molecule interactions, Numerical solution.

Ab initio calculations of cross sections for simultaneous rotational and vibrational excitation of HCl by low-energy electrons have been made in the multipole-extracted adiabatic-nuclei approximation. These calculations employed a free-electron-gas model of the exchange interaction, and represent the first application of a new parameter-free model of the correlation-polarization interaction to vibrational excitation. The cross sections increase by an order of magnitude with the inclusion of this interaction, which is much more important for vibrationally inelastic than elastic collisions.

704,887
PB85-100246 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Double-Resonance Spectroscopy of V-T,R Relaxation of HF(v=1): Direct Measurement of the High-J Populations.
Final rept.
H. K. Haugen, and S. R. Leone. Mar 84, 12p
Sponsored in part by Air Force Office of Scientific Research, Arlington, VA.
Pub. in Jnl. of Chemical Physics 80, n5 p1839-1850 Mar 84.

Keywords: *Hydrogen fluoride, *Infrared spectroscopy, *Molecular relaxation, Molecular rotation, Molecular vibration, Molecular energy levels, Reprints, *Laser spectroscopy.

The V-T,R relaxation of HF(nu=1) by HF is studied by infrared pulse-probe transient absorption measurements using a tunable F-center laser. It is found that a substantial fraction of the relaxation occurs through the high-lying rotational levels of nu=0. The results indicate that the states J = 10-14 comprise about 20%-40% of the population in the total relaxation, with the distribution increasing rapidly with decreasing J in this range.

704,888
PB85-100279 Not available NTIS
National Bureau of Standards, Washington, DC.
Numerical Methods for Asymptotic Solutions of Scattering Equations.
Final rept.
D. W. Norcross. 1983, 19p
Pub. in Chapter 9 in Atoms in Astrophysics, p55-73 Jan 83.

Keywords: *Particle collisions, Applications of mathematics, *Scattering theory, Electron-atom collisions, Electron-ion collisions, Electron-molecule collisions.

Techniques for obtaining solutions of the coupled equations of electron-atom (ion, molecule) scattering in the asymptotic region (larger) are reviewed, with particular emphasis on the work of Prof. M. J. Seaton.

704,889
PB85-100345 Not available NTIS
National Bureau of Standards, Washington, DC.
Curie Transitions in Copolymers of Vinylidene Fluoride.
Final rept.
A. J. Lovinger, T. Furukawa, G. T. Davis, and M. G. Broadhurst. 1983, 10p
Pub. in Ferroelectrics 50, p227-236 1983.

Keywords: *Copolymers, *Curie temperature, Plastics, X ray analysis, Dielectric properties, Reprints, *Ethylene/trifluoro, *Vinylidene fluoride polymers.

A series of random copolymers of vinylidene fluoride and trifluoroethylene containing 52, 65, 73, and 78 mol % VF2 has been shown by X-ray and dielectric techniques to undergo Curie transitions.

704,890
PB85-102192 Not available NTIS
National Bureau of Standards, Washington, DC.
Heat Capacity and Electrical Resistivity of Nickel in the Range 1300-1700 K Measured with a Pulse Heating Technique.
Final rept.
A. Cezairliyan, and A. P. Miiller. 1983, 8p
Sponsored in part by Air Force Office of Scientific Research, Arlington, VA.
Pub. in International Jnl. of Thermophysics 4, n4 p389-396 1983.

Keywords: *Nickel, *Specific heat, *Electrical resistivity, Reprints, High temperature.

Measurements of heat capacity and electrical resistivity of nickel in the temperature range 1300-1700 K by a subsecond duration pulse heating technique are described. The results are given.

704,891
PB85-102200 Not available NTIS
National Bureau of Standards, Washington, DC.
Hysteresis in Copolymers of Vinylidenefluoride and Trifluoroethylene.
Final rept.
G. T. Davis, M. G. Broadhurst, A. J. Lovinger, and T. Furukawa. 1984, 12p
See also AD-A137446.
Pub. in Ferroelectrics 57, p73-84 1984.

Keywords: *Copolymers, *Hysteresis, Phase transformation, Piezoelectricity, Pyroelectricity, Temperature, Fluorine organic compounds, Polymers, Reprints, *Ethylene/trifluoro, *Vinylidene fluoride polymers.

Copolymers of vinylidenefluoride (VDF) and trifluoroethylene (TrFE), with more than 50 mole percent VDF exhibit D-E hysteresis loops at room temperature which are much sharper than those exhibited by various crystal phases of the PVDF homopolymer. For the copolymer samples investigated here, appreciable conductivity develops at elevated temperatures which in the presence of electric fields leads to trapped charges in the polymer film. These charges then prevent the switching of dipoles at values of electric fields that were previously applied, the room temperature hysteresis is greatly reduced and polarization through the thickness of the film is highly non-uniform. Upon heating the copolymers above the ferroelectric to paraelectric transition temperature, the polarization is destroyed, the space charges are apparently released and room temperature hysteresis is restored. Experiments with aluminum, and gold electrodes and with mica blocking electrodes lead one to conclude that the charges are generated internally and are not injected from the electrodes.

704,892
PB85-102218 Not available NTIS
National Bureau of Standards, Washington, DC.
Two-Dimensional Dynamical Jahn-Teller Effects in a Mixed-Valence Benzotriazolato Copper Cluster, Cu5(BTA)6(RNC)4.
Final rept.
G. F. Kokoszka, J. Baranowski, C. Goldstein, J. Orsini, A. D. Mighell, V. L. Himes, and A. R. Siedle. 1983, 6p
Pub. in Jnl. of the American Chemical Society 105, n17 p5627-5633 1983.

Keywords: *Complex compounds, *Corrosion prevention, *Copper organic compounds, *Isonitriles, Hyperfine structure, Temperature, Reprints, *Space group symbols, *Jahn-Teller effect, *Thiophenoxide, *Benzotriazole.

Clusters of composition Cu5(BTA)6(RNC)4(BTA = benzotriazolato(-1)) were prepared from the reaction of copper(I) thiophenoxide, benzotriazole, and an organic isocyanide. Cu5(BTA)6(1-C4H9NC)4 crystallizes in space group P42 sub 1 c, a = 13.836 (4) A. c = 16.686 (4) A. Z = 2. D (calcd) = 1.413. D (obsd) = 1.41 (2) Mg/cu m. The structure solution, based on 903 reflections. The molecular structure has 4 symmetry; compressed octahedral copper(II) is surrounded by four tetrahedrally coordinated copper(I) ions. Data were recorded at 9.24 and 54 GHz. Furthermore, the EPR data are not consistent with a d ground state in spite of the compressed octahedral molecular geometry. The other three compounds also showed interesting temperature-dependent effects.

704,893
PB85-102234 Not available NTIS
National Bureau of Standards, Washington, DC.
Space Group Frequencies for Organic Compounds.
Final rept.
A. D. Mighell, V. L. Himes, and J. R. Rodgers. 1983, 4p
Pub. in Acta Crystallographica A39, p737-740 1983.

Keywords: *Organic compounds, *Crystal structure, *Crystal symmetry, Reprints, *Matrix(Crystals), *Space group symbols.

The space-group frequency for approximately 30,000 organic compounds in the NBS Crystal Data Identification File has been calculated for each of the 230 space groups. In contrast, there are 29 space groups with only one entry and 35 space groups with none at all. Although the space-group frequencies should be fairly representative of their distribution in nature, certain frequencies are over- or under-estimated. An analysis of the metric symmetry for about 30,000 lattices using a matrix technique has revealed that it is not uncommon for the metric symmetry to exceed the reported crystal symmetry. In many of these cases, the structures have been described in space groups of unnecessarily low symmetry. By explicitly checking for the highest possible metric symmetry during the space-group-determination procedure, errors of this type can be prevented.

704,894
PB85-102267 Not available NTIS
National Bureau of Standards, Washington, DC.
Real-Time Mass-Spectrometric Study of the Chemistry Initiated by Infrared-Laser Photolysis: CF2HCl.
Final rept.
R. I. Martinez, and J. T. Herron. 1981, 3p
Pub. in Chemical Physics Letters 84, n1 p180-182 1981.

Keywords: *Mass spectroscopy, *Infrared spectroscopy, *Photolysis, Free radicals, Dissociation, Chemical reactions, Chlorine organic compounds, Reprints, *Laser spectroscopy, *Methane/chloro-difluoro.

The infrared-laser photolysis/mass-spectrometric (ILP/MS) technique was used to monitor directly in real time the free-radical and stable reactants and products present in the reactive system initiated by the multiphoton-induced dissociation of CF2HCl. The experimental observations indicate that in addition to the major channel CF2HCl + micro h nu yields CF2 + HCl, three additional minor channels can be accessed: CFCl + HF, CHCl + F2, and CHF + ClF. A reaction scheme is proposed to explain the observations.

704,895
PB85-102747 Not available NTIS
National Bureau of Standards, Washington, DC.
ENDOR of Triplet State Systems in Solids.
Final rept.
M. D. Kemple. 1979, 7p
Pub. in Multiple Electron Resonance Spectroscopy, p409-436 1979.

Keywords: *Solids, *Organic compounds, *Molecular energy levels, Ions, Excitation, Nuclear resonance, Reprints, *Electron nuclear double resonance.

A critical review of the application of electron nuclear double resonance (ENDOR) techniques to the study of paramagnetic triplet state systems in solids is given. Particular emphasis is placed on ground and excited triplet states of organic molecules but ions and defects in solids are covered as well. The general scheme of the manner in which ENDOR data are treated and interpreted is outlined in some detail. Experimental approaches are mentioned, and a considerable discussion of examples of ENDOR investigations of triplet states of various molecules, ions, and defects at high and zero applied static magnetic field is presented. A significant survey of the triplet ENDOR literature is included.

704,896
PB85-102762 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure of Racemic CIS-4-Phenylcyclophosphamide+.
Final rept.
V. L. Himes, A. D. Mighell, J. K. Stalick, and G. Zon. Mar 82, 4p
Pub. in Acta Crystallographica, Section B: Structural Crystallography and Crystal Chemistry 38, p1009-1012 Mar 82.

Keywords: *Crystal structure, *X ray diffraction, Chemical bonds, Reprints, *Cyclophosphamide/phenyl, Molecular conformation.

The molecule was found to exist in a chair conformation with the phenyl substituent and the phosphoryl oxygen atom in equatorial positions. The crystal structure consists of centrosymmetric dimers linked by hydrogen bonds between N-H and O = P.

704,897
PB85-103125 Not available NTIS
National Bureau of Standards, Washington, DC.
Adsorption on Metal Surfaces: Some Key Issues.
Final rept.
J. W. Gadzuk. 1983, 30p
Sponsored in part by Army Research Office, Arlington, VA., Office of Naval Research, Arlington, VA., and North Atlantic Treaty Organization, Brussels (Belgium).
Pub. in Atomistics of Fracture, NATO (North Atlantic Treaty Organization) Conference Series 6, Materials Science, p391-420 1983.

Keywords: *Surface chemistry, *Adsorption, *Metals, Chemisorption, Reaction kinetics, Hydrides, Reprints.

The physical picture and basic philosophy of the principal techniques for performing theoretical calculations of the electronic structure of adsorbates on metal surfaces are presented. A discussion of spectroscopic probes and non-adiabatic effects is given. These ideas are illustrated via specific case studies.

704,898
PB85-104677 Not available NTIS
National Bureau of Standards, Washington, DC.
Extended Basis Set LCAO Chi-Alpha Treatment of NiH and Ni2.
Final rept.
B. I. Dunlap, and H. L. Yu. 1980, 5p
Pub. in Chemical Physics Letters 73, n3 p525-529 1980.

Keywords: *Nickel, *Molecular energy levels, Hartree-Fock approximation, Density(Mass/volume), Reprints, *Nickel hydrides, *Linear combination of atomic orbitals, Numerical solution.

Extended basis set LCAO X(alpha) calculations on NiH and Ni2 are presented. The electronic structure of this state is in sharp disagreement with the ground state electronic structures found in various ab initio calculations. The differences between density functional and Hartree-Fock based calculations are analyzed for this molecule.

704,899
PB85-104701 Not available NTIS
National Bureau of Standards, Washington, DC.
Synthesis and Crystal-Chemistry of BaNd2Ti3O10, BaNd2Ti5O14, and Nd4Ti9O24.
Final rept.
D. Kolar, S. Gaberscek, B. Volavsek, H. S. Parker, and R. S. Roth. 1981, 7p
Pub. in Jnl. of Solid State Chemistry 38, n2 p158-164 1981.

Keywords: *Synthesis(Chemistry), *Crystal structure, *X ray diffraction, *Barium oxides, *Neodymium oxides, *Titanium oxides, *Barium neodymium titanates, *Neodymium titanates.

Two new ternary compounds BaNd2Ti3O10 and BaNd2Ti5O14 have been identified in the BaO-Nd2O3-TiO2 system. Single crystals of the compounds were grown and unit cell dimensions and space group symmetry were determined.

704,900
PB85-104776 Not available NTIS
National Bureau of Standards, Washington, DC.

Catalytic Methanation over Single Crystal Nickel and Ruthenium: Reaction Kinetics on Different Crystal Planes and the Correlation of Surface Carbide Concentration with Reaction Rate.
Final rept.
R. D. Kelley, and D. W. Goodman. 1982, 1p
See also PB81-240251.
Pub. in Surface Science 123, No. 2-3, p743 1982.

Keywords: *Methanation, *Catalysis, *Reaction kinetics, Nickel, Ruthenium, Surface chemistry, Concentration(Composition), Hydrogen, Carbon monoxide, Reprints.

The kinetics of the reaction of H2 and CO over single crystals of nickel ((100) and (111)) and ruthenium ((110) and (001)) has been studied as a function of pressure and H2/CO ratio. A striking correlation has been observed between the measured surface carbide concentration and the rate of methane production while varying the H2/CO ratio and the total pressure. This correlation is shown to be a necessary consequence of the reaction mechanism previously proposed (1) for the catalytic methanation reaction over nickel.

704,901
PB85-104784 Not available NTIS
National Bureau of Standards, Washington, DC.
Structures of Lithium Inserted Metal Oxides: LiReO3 and Li2ReO3.
Final rept.
R. J. Cava, A. Santoro, D. W. Murphy, S. Zahurak, and R. S. Roth. 1982, 12p
Sponsored in part by Bell Labs., Murray Hill, NJ. See also PB84-219021.
Pub. in Jnl. of Solid State Chemistry 42, n3 p251-262 1982.

Keywords: *Crystal structure, *Neutron diffraction, Electrodes, Reprints, *Lithium rhenium oxides, *Clathrate compounds.

The authors have determined the crystal structures of LiReO3 and Li2ReO3, obtained by Li insertion into ReO3, by neutron diffraction powder profile analysis. For both phases, the ReO3 host lattice, made exclusively of corner shared octahedra, is altered significantly on Li insertion without breaking bonds. The original twelve coordinate perovskite like cavity is changed into two octahedral sites, which are occupied by the lithium ions.

704,902
PB85-104792 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin-Orbit and Dispersion Energy Effects in XeF.
Final rept.
M. Krauss, W. J. Stevens, and P. S. Julienne. 1982, 9p
Pub. in Jnl. of Computational Chemistry 3, n3 p372-380 1982.

Keywords: *Xenon halides, *Dispersion relations, *Spin orbit interactions, Excitation, Molecular energy levels, Perturbation theory, Separation, Lasers, Reprints, *Xenon fluorides, *Xenon chlorides, Energy curves, Effective core potential, Numerical solution, Excimer lasers.

Spin-orbit and dispersion energy contributions to the energy curves of XeF are examined. A rapid variation in the spin-orbit coupling with internuclear separation is found for both the ground and excited states. This result can explain the experimentally observed ordering of the ionic excited states when the spin-orbit perturbation couples sup 2 sigma and sup 2 pi energy curves obtained by both all-electron and effective core potential (ECP) calculations at the first-order configuration interaction (FOCI) level of accuracy.

704,903
PB85-104834 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Vibrational Spectroscopy with Neutron Inelastic Scattering.
Final rept.
R. D. Kelley, R. R. Cavanagh, and J. J. Rush. 1982, 2p
Pub. in Jnl. of Vacuum Science and Technology 20, n3 p589-590 1982.

Keywords: *Inelastic scattering, *Neutron scattering, *Hydrogen, *Vibrational spectra, Chemisorption, Surface chemistry, Chemical bonds, Nickel, Reprints, *Raney nickel catalysts.

Neutron inelastic scattering (NIS) has been used to measure the vibrational spectra of hydrogen chemisorbed on Raney nickel. The binding site and geometry of the dominant surface species has been deduced from these measurements.

704,904
PB85-107316 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Magnetic Resonance Spectroscopy of C1O and Kinetic Studies of the Reactions of C1O with NO and NO2.
Final rept.
Y. P. Lee, R. M. Stimpfle, R. A. Perry, J. A. Mucha, K. M. Evenson, D. A. Jennings, and C. J. Howard. 1982, 22p
Sponsored in part by Chemical Manufacturers Association, Washington, DC.
Pub. in International Jnl. of Chemical Kinetics 14, p711-732 1982.

Keywords: *Reaction kinetics, *Nitrogen dioxide, *Nitrogen oxide(NO), Comparison, Chemical reactions, Reprints, *Laser magnetic resonance, Far infrared spectroscopy.

Far-infrared rotational transitions in ClO(X sup 2 Pi sub 3/2, nu = 0) have been observed using laser magnetic resonance (LMR) with an optically pumped spectrometer. Five observed transitions at wavelengths between 444 and 713 micrometers have been compared with values predicted with spectroscopic constants from the literature. LMR detection of ClO has been used to study its reactions with NO and NO2 in a discharge flow system under pseudo-first-order conditions for ClO. These results are compared with those from other studies.

704,905
PB85-107357 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of Capillary Gas Chromatography-Mass Spectrometry for Identification of Radiation-Induced DNA Base Damage and DNA Base-Amino Acid Crosslinks.
Final rept.
M. Dizdaroglu. 1984, 19p
Sponsored in part by National Foundation for Cancer Research, Bethesda, MD.
Pub. in Jnl. of Chromatography 295, p103-121 1984.

Keywords: *Deoxyribonucleic acids, *Gas chromatography, *Mass spectroscopy, Amino acids, Crosslinking, Damage, Irradiation, Biochemistry, Reprints, Capillary gas chromatography.

Application of capillary gas chromatography-mass spectrometry (GC-MS) to isolation and identification of radiation-induced DNA base damage including DNA base-amino acid crosslinks was demonstrated. All gas chromatograms and mass spectra obtained are discussed in detail.

704,906
PB85-107373 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanistic Investigation of the HO + HO2 Reaction.
Final rept.
M. J. Kurylo, O. Klais, and A. H. Laufer. 1981, 20p
Pub. in Jnl. of Physical Chemistry 85, n24 p3674-3678 1981.

Keywords: *Reaction kinetics, *Free radicals, *Mass spectroscopy, Chemical reactions, Water, Oxygen, Photolysis, Reprints, *Chemical reaction mechanisms, *Hydroxyl radical.

A steady state photolysis experiment including mass spectrometric end product analysis was used to perform a mechanistic investigation of the HO(18) + HO2 reaction system. The results obtained do not support the existence of an adduct reaction intermediate as suggested by a proposed pressure dependence for the title reaction.

704,907
PB85-107381 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Dynamical Studies of the Dissociation of a Diatomic Molecular Crystal. 2. Equilibrium Kinetics.
Final rept.
S. F. Trevino, and D. H. Tsai. Jul 84, 9p
See also PB84-105717.
Pub. in Jnl. of Chemical Physics 81, n1 p248-256 Jul 84.

Keywords: *Diatomic molecules, *Mathematical models, *Dissociation, *Chemical equilibrium, *Crystal structure, Thermodynamics, Chemical reactions, Reprints.

The properties of a molecular dynamical model undergoing equilibrium chemical reactions are reported. It is shown that the kinetics of the reaction is consistent with established thermodynamic considerations.

704,908
PB85-107431 Not available NTIS
National Bureau of Standards, Washington, DC.
Les Intensites Dans Les Bandes Nu sub 5, Nu sub 7 et Nu sub 8 + Nu sub 11 De L'Ethane (12) C2H6.
Final rept.
M. Dang-Nhu, A. S. Pine, and W. J. Lafferty. 1984, 8p
Pub. in Jnl. of Canadian Physics 62, n5 p512-519 1984.

Keywords: *Infrared spectroscopy, *Ethane, Band spectra, Reprints, *Laser spectroscopy.

The intensity parameters of the Nu sub 5, Nu sub 7 and Nu sub 8 + Nu sub 11 (A2u) bands of (12)C2H6 have been determined from the experimental line strengths in the 3 micrometer region with an infrared difference-frequency laser spectrometer.

704,909
PB85-108454 Not available NTIS
National Bureau of Standards, Washington, DC.
Inpurity Effects in the Interaction of Oxygen with Rh(111).
Final rept.
S. Semancik, G. L. Haller, and J. T. Yates. 1982, 13p
Pub. in Applications of Surface Science 10, p546-558 1982.

Keywords: *Oxygen, *Surface chemistry, Impurities, Crystals, Reprints, *Auger electron spectroscopy, *Electron energy loss spectroscopy.

High resolution electron energy loss spectroscopy (EELS) and Auger electron spectroscopy (AES) have been used to study a stable oxide-like species that can form on Rh(111) under ultrahigh vacuum dosing conditions. The results presented here demonstrate that this species develops because of the interaction of oxygen with low level boron impurities at the surface of the rhodium crystal. Although this oxide is difficult to detect and identify using Auger spectroscopy, even very small amounts of the boron oxide can be easily detected using EELS.

704,910
PB85-108645 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Absorption Intensities for N2O3.
Final rept.
R. H. Kagann, and A. G. Maki. 1984, 2p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 31, n2 p175-176 1984.

Keywords: *Nitrogen oxides, *Infrared spectroscopy, Absorption, Reprints, *Fourier transform spectroscopy.

A Fourier transform spectrometer has been used to measure the absorption intensity of the nu1 and nu3 bands of N2O3 near 1830 and 1300/cm, respectively. Digital spectral subtraction techniques were used to eliminate interference from NO, NO2, and N2O4 present in equilibrium with the N2O3.

704,911
PB85-110112 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrohydrodynamic Contribution to the Hall Effect in Electrolyte Solutions.
Final rept.
J. B. Hubbard, and P. G. Wolynes. 1981, 4p
Pub. in Jnl. of Chemical Physics 75, n6 p3051-3054, 15 Sep 81.

Keywords: *Electrolytes, *Electrohydrodynamics, *Hall effect, Solutions, Lorentz transformations, Ions, Reprints.

The authors calculate the electrohydrodynamic forces on an ion moving in a polarizable liquid in a magnetic

field. The result is a ponderomotive force which is about 30% of the Lorentz force and which acts in the opposite direction. The calculated effect is independent of ion size, charge, or solvent viscosity.

704,912
PB85-110138 Not available NTIS
National Bureau of Standards, Washington, DC.
Expressions for the Computer-Evaluation of the Four Kernel Functions for Line Formation with Doppler and Lorentz Profiles.
Final rept.
D. G. Hummer. 1981, 9p
Grant NSF-AST80-19874
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 26, n3 p187-195 Sep 81.

Keywords: *Line spectra, Reprints, *Radiative transfer, Kernel functions, Pade approximation, Computer applications.

Rational approximations for the kernel functions (K sub 1) (tau), (K sub 2) (tau), (M sub 1) (tau) and (M sub 2) (tau) for Doppler and Lorentz profiles have been obtained from their series and asymptotic expressions by the techniques of Pade approximants with a maximum relative error or less than 0.0001.

704,913
PB85-110153 Not available NTIS
National Bureau of Standards, Washington, DC.
Nature of Solution Spectra: Inhomogeneous Broadening and Phonon Effects in Frozen Solutions.
Final rept.
W. C. McColgin, A. P. Marchetti, and J. H. Eberly. 1978, 5p
Pub. in Jnl. of the American Chemical Society 100, n18 p5622-5626, 30 Aug 78.

Keywords: *Organic compounds, *Optical spectra, *Phonons, Excitation, Fluorescence, Comparison, Stokes law(Fluid mechanics), Reprints, *Laser induced fluorescence.

The optical spectra of a number of organic compounds have been examined in low temperature, glassy solutions. According to the experimental conditions of excitation, a given sample can yield either the usual broad bands complete with Stokes shift or a set of very narrow fluorescence lines (about 1/cm). The comparisons of these two distinct types of spectra from the same sample make it possible to explain such features of the conventional spectra as their broad bandwidths, peak positions, and Stokes shifts.

704,914
PB85-110161 Not available NTIS
National Bureau of Standards, Washington, DC.
Synthesis and Structure of a Tetrahydrotetrathiafulvalene-Mercuric Chloride Complex, (H4TTF)(HgCl2)3.
Final rept.
M. D. Glick, W. H. Ilsley, and A. R. Siedle. 1981, 4p
Sponsored in part by Minnesota Mining and Mfg. Co., St. Paul. Central Research Labs.
Pub. in Inorganic Chemistry 20, n11 p3819-3822 1981.

Keywords: *Synthesis(Chemistry), *Molecular structure, *Raman spectroscopy, *Complex compounds, *Infrared spectroscopy, Crystal structure, X ray analysis, Reprints, *Fulvalene/tetrahydro-tetrathia, *Mercury chlorides.

The solid state structure and infrared and Raman spectra of a mercuric chloride complex of tetrahydrotetrathiafulvalene are reported. There are two crystallographically independent mercury atoms. One, Hg(1), sits at an inversion center and the other, Hg(2), occupies a general position within the unit cell.

704,915
PB85-110187 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of the Criegee Intermediate in the Matrix Thermoluminescence Study of the CH2 + O2 Reaction.
Final rept.
R. I. Martinez, R. E. Huie, and J. T. Herron. 1981, 7p
Pub. in Jnl. of Chemical Physics 75, n12 p5975-5977 1981.

Keywords: *Thermoluminescence, *Formic acid, Chemical reactions, Reprints, *Chemical reaction mechanisms, *Criegee intermediate.

The identification by Lee and Pimentel (J. Chem. Phys. 74, 4851 (1981)) of two new progressions of formic acid arising from the reaction of CH2 with O2 in an argon matrix is interpreted in terms of the formation and isomerization of a Criegee intermediate. This is the first unambiguous identification of formic acid as a product of this process.

704,916
PB85-110211 Not available NTIS
National Bureau of Standards, Washington, DC.
Kinetics of the Reaction between Polyester Acid and Carbodiimide in Dry Polyester Diols and in a Polyester Polyurethane.
Final rept.
D. W. Brown, R. E. Lowry, and L. E. Smith. 1981, 5p
Pub. in Macromolecules 14, n3 p659-663 1981.

Keywords: *Reaction kinetics, *Polyurethane resins, Chemical reactions, Elastomers, Viscosity, Activation energy, Polyesters, Reprints.

The kinetics of reaction between mono- or polycarbodiimide and organic acid attached to polyester have been studied in dry polyester diols, in a polyester based polyurethane elastomer, and in solution in tetrahydrofuran. Thus rate constants are much the same in a mobile liquid, polyesters of several viscosities, and in an elastomer.

704,917
PB85-111839 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermogravimetric Analysis Kinetics.
Final rept.
J. H. Flynn. 1981, 3p
Pub. in Polymer Preprints 22, n1 p310-312 1981.

Keywords: *Reaction kinetics, *Thermogravimetry, Oxidation, Polymethyl methacrylate, Polystyrene, Polyurethane resins, Thermal analysis, Degradation reactions, Reprints.

Techniques for analyzing thermogravimetric data from experiments covering a broad range of heating rates from .1 to .0001/Ks are described. These techniques are used both to test the constancy of kinetic parameters and to interpret changes in kinetic mechanism. The methods are illustrated with examples from the degradation and oxidation of polystyrene, poly(methyl methacrylate) and polyurethane.

704,918
PB85-111854 Not available NTIS
National Bureau of Standards, Washington, DC.
Collection of Kinetic Data for the Diffusion of Organic-Compounds in Polyolefins.
Final rept.
J. H. Flynn. 1982, 20p
Pub. in Polymer 23, n9 p1325-1344 1982.

Keywords: *Reaction kinetics, *Organic compounds, *Diffusion, *Olefin resins, Polyethylene, Tables(Data), Polyisobutylene, Polypropylene, Polybutadiene, Copolymers, Reprints, Low density polyethylene, High density polyethylene, Poly(pentene/methyl).

A comprehensive collection of kinetic data on the diffusion of organic compounds in polyolefins is contained in tables for low density polyethylene, high density polyethylene, polyisobutylene, polypropylene, hydrogenated polybutadiene, poly(4-methylpentene-1), ethylene-propylene copolymers, and self-diffusion of polyolefins. Diffusion constants for over 250 polymer-migrant entries at temperatures from -30 to 190C, activation energies and preexponential factors for the diffusion process and parameters for the concentration dependence of the diffusion constant are included. A special feature of this compilation is an extensive section of annotated references. This includes: (1) as complete a characterization of each polymer and migrant as is possible. (2) a description of the experimental methods used to determine the diffusion constants, and (3) the assumptions made, equations utilized and calculations performed to obtain the data in the tables. The tables exhibit remarkable consistencies considering the great variations in diffusion constants which can be brought about by thermal, mechanical, and solvent action. These consistencies lend hope that useful correlations may be developed from these data.

704,919
PB85-115525 Not available NTIS
National Bureau of Standards, Washington, DC.
Photodissociation of HgBr, X-Sigma-1/2.
Final rept.
M. Krauss, and W. J. Stevens. 1981, 3p
Pub. in Applied Physics Letters 39, n9 p686-688 1981.

Keywords: *Photochemical reactions, *Dissociation, Mercury halides, Ions, Molecular energy levels, Reprints, *Laser spectroscopy, *Mercury bromide.

Transition moments and energies have been calculated for the X-A, bound to continuum, transition in HgBr. Absorption at the laser wavelength of 502 nm has been examined for two cases: (1) A thermal distribution of vibrational levels at 500K and (2) The terminus vibrational level of the B-X laser transition. In the first case a cross section of 7x 10 to the -20th power sq cm is calculated. Electron dissociative attachment of the X state is also shown to be improbable as a means of fast removal. Energy curves of the ground states of both the neutral and negative ion of HgBr are shown not to cross in any accessible region.

704,920
PB85-115707 Not available NTIS
National Bureau of Standards, Washington, DC.
Chemisorption and Reactivity Studies of Hydrogen and Carbon Monoxide of Sulfided Nickel (100).
Final rept.
D. W. Goodman, and M. Kiskinova. 1981, 6p
Pub. in Surface Science 105, n2-3 p265-270 1981.

Keywords: *Nickel, *Surface chemistry, *Chemisorption, *Sulfur, *Reaction kinetics, Hydrogen, Carbon monoxide, Catalysis, Methanation, Reprints.

Ultrahigh vacuum techniques have been used to study both the chemisorption and reaction kinetics of H2 and CO over a sulfided Ni(100) catalyst. Sulfur at low coverages (O sub S 0.2) very effectively poisons the Ni(100) surface for catalytic methanation, CO absorption, as well as hydrogen chemisorption. This poisoning effect is nonlinear - one sulfur atom reactivates approximately ten nickel atom sites. The results of chemisorption studies suggest that the attenuation of H2 and CO(B2) chemisorption is responsible for the reduction of catalytic activity. These data are consistent with electronic effects playing a major role at low sulfur coverages in reducing the reaction rate.

704,921
PB85-115715 Not available NTIS
National Bureau of Standards, Washington, DC.
Catalyzed Graphite-Water Vapor Reaction - Isotopic Studies Using Barium Carbonate (Carbon-13).
Final rept.
D. W. McKee, and J. T. Yates. 1981, 8p
Pub. in Jnl. of Catalysis, v71 n2 p308-315 1981.

Keywords: *Catalysis, *Barium carbonate, *Graphite, *Water vapor, *Gasification, Graphite, Chemical reactions, Reaction kinetics, Isotopic labeling, Carbon 13, Dissociation, Reprints, *Chemical reaction mechanisms.

The mechanism of the catalytic effect of barium carbonate on the steam gasification of carbon was investigated by adding BaC(13)03 to pure graphite and measuring the kinetics and products of the reaction with water vapor as functions of temperature. The onset of the catalyzed reaction at around 800 C was accompanied by the appearance of C(13)0 and C(13)02 in the gas phase. When BaC(13)03 and graphite were heated together an inert atmosphere, small amounts of C(13)02 were evolved above 600C and copious amount of C(13)0 and C(13)02 above 900C. Graphite catalyzed the decomposition of the BaC03 at low temperatures as the dissociation of pure BaC03 was very slow below 1000C. The catalytic effect of the salt in the gasification reaction could be interpreted in terms of a sequential series of reaction steps involving decomposition of the carbonate to oxide, followed by regeneration of the carbonate phase by reaction with the gaseous environment.

704,922
PB85-115731 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoabsorption Cross Section of O2 from 55-350 A.
Final rept.
G. Mehlman, D. L. Ederer, and E. B. Saloman. 1978, 33p
Pub. in Jnl. of Chemical Physics 68, n4 p1862-1864, 15 Feb 78.

Keywords: *Oxygen, *Absorption, Photons, Ionization, Synchrotron radiation, Molecular structure.

The photoabsorption cross section of 02 was measured photoelectrically in the wavelength range 55-350A. The 250 MeV storage ring at the National Bureau of Standards provided the background continum. The absolute accuracy of the measurements is + or - 3% between 55-140 A and 170-300 A + or - 5% in the wavelength range 140-170 A and 300-350A. The cross section decreased monotonically with increasing photon energy. No thresholds or new structure was observed in the total cross section.

704,923
PB85-115756 Not available NTIS
National Bureau of Standards, Washington, DC.
Far Infrared Laser Magnetic Resonance Spectrum of CH2F.
Final rept.
J. A. Mucha, D. A. Jennings, K. M. Evenson, and J. T. Hougen. 1977, 3p
Pub. in Jnl. of Molecular Spectroscopy 68, n1 p122-124 Oct 77.

Keywords: *Infrared spectroscopy, Free radicals, Molecular rotation, Fluorine organic compounds, Molecular structure, Reprints, *Laser magnetic resonance spectroscopy, *Methane/fluoro, *Methane/diazo, *Far infrared spectroscopy.

Laser magnetic resonance rotational spectra of the free radical CH2F have been obtained using far-infrared laser lines at 301.3, 393.6, 513.0 and 567.9 pm. The radical was prepared under fast-flow conditions by fluorine atom abstraction of a hydrogen from methyl fluoride and by fluorine atom addition to diazomethane.

704,924
PB85-115814 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Center for Chemical Engineering.
Update of Thermal Conductivity and Electrical Resistivity of Electrolytic Iron, Tungsten, and Stainless Steel.
Final rept.
J. G. Hust, and A. B. Lankford. Sep 84, 75p NBS/SP-260/90
Also available from Supt. of Docs as SN003-003-02609-3. Library of Congress catalog card no. 84-601107.

Keywords: *Iron, *Tungsten, *Stainless steel, *Thermal conductivity, *Electrical resistivity, Tables(Data), Graphs(Charts), Temperature, Standards, *Standard reference materials, Numerical solution.

An update is given of the thermal conductivity and electrical resistivity of the metals: electrolytic iron, tungsten, and stainless steel. This document describes the measurement effort that has occurred since the establishment of these SRM's. New data are presented and, based on these, changes in the recommended values are described. The new recommended values are presented in the form of equations, graphs, and tables. The temperature ranges included are: 2 to 1000 K for electrolytic iron, 2 to 3000 K for tungsten, and 2 to 1200 K for stainless steel.

704,925
PB85-116200 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 13, Number 2, 1984.
Quarterly rept.
c1984, 306p
See also PB85-116218 through PB85-116259 and PB84-238427. Sponsored by National Bureau of Standards, Gaithersburg, MD. Prepared in cooperation with American Inst. of Physics, New York.

Keywords: *Physical properties, *Chemical properties, *Standards, Tables(Data), Reaction kinetics, Photochemistry, Smog, Heavy water, Thermodynamic properties, Nitrogen, Aromatic polycyclic hydrocarbons, Solubility, Halogen organic compound, Nitrogen oxides, Sulfur oxides, Inelastic scattering, Diatomic molecules, Air pollution, Chemical reaction mechanisms, Atmospheric chemistry.

Contents: Evaluation of kinetic and mechanistic data for modeling of photochemical smog; Rate data for inelastic collision processes in the diatomic halogen molecules; Water solubilities of polynuclear aromatic and heteroaromatic compounds; The solubility of nitrogen and air in liquids; Thermophysical properties of fluid D2O.

704,926
PB85-116226 Not available NTIS
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Rate Data for Inelastic Collision Processes in the Diatomic Halogen Molecules.
J. I. Steinfeld. c1984, 109p
Included in Jnl. of Physical and Chemical Reference Data, v13 n2 p445-553 1984.

Keywords: *Reaction kinetics, *Diatomic molecules, *Halogen inorganic compounds, *Inelastic scattering, Tables(Data), Molecular relaxation.

A detailed compilation of rate data for inelastic collision processes involving the homonuclear and heteronuclear diatomic halogen molecules is presented. The literature has been surveyed through April 1983. Processes that are considered include exchange of energy between electronic, vibrational, rotational and translational degrees of freedom, electronic quenching, dephasing, depolarization, pressure broadening, and spontaneous radiation. Collision partners include rare-gas atoms, halogen and other diatomic molecules, and polyatomic species; a few measurements in liquids and cryogenic matrices are also included. Each data entry includes collision partner, temperature, method of measurement, and an error estimate where available. While a large mass of data is available for these systems, there still exist sizable gaps in our knowledge concerning these processes, particularly for the interhalogen species.

704,927
PB85-116242 Not available NTIS
Wright State Univ., Dayton, OH. Dept. of Chemistry.
Solubility of Nitrogen and Air in Liquids.
R. Battino, T. R. Rettich, and T. Tominaga. c1984, 38p
Included in Jnl. of Physical and Chemical Reference Data, v13 n2 p563-600 1984.

Keywords: *Nitrogen, *Air, *Solubility, Temperature, Pressure, Water, Heavy water, Air water interfaces, Sea water, Solvents, Hydrocarbons, Tables(Data), Virial coefficients, Biological processes.

This review covers the solubility of nitrogen and air in liquids as a function of temperature and pressure. Solubility data for individual systems were critically evaluated. Recommended or tentative values are presented as smoothing equations and/or in tabular form. Trends in homologous series or related solvents are discussed. Data for the n-alkanes were water; heavy water; seawater; aqueous salt solutions; mixed solvents; hydrocarbons; organic compounds containing oxygen, halogen, sulfur, nitrogen, or silicon; olive oil; various biological fluids; H2S; SO2; NH3; CO2; nitrogen oxides; and several halogen and boron containing inorganic solvents.

704,928
PB85-116259 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Thermophysical Properties of Fluid H2O.
J. Kestin, J. V. Sengers, B. Kamgar-Parsi, and J. M. H. Levelt Sengers. c1984, 9p
Prepared in cooperation with Maryland Univ., College Park. Inst. for Physical Science and Technology.
Included in Jnl. of Physical and Chemical Reference Data, v13 n2 p601-609 1984.

Keywords: *Thermophysical properties, *Heavy water, Water, Equations of state, Thermal conductivity, Viscosity, Critical point, Computer applications.

The present publication contains data on the thermophysical properties of deuterium oxide (heavy water). It is a companion to the paper on the thermophysical properties of fluid H2O published earlier in this journal by the same authors. The properties are represented by equations which can be readily programed on a computer and incorporated in data banks. All data have been carefully and critically analyzed. The compendium represents the best available data for fluid D2O.

704,929
PB85-118008 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Deceleration of an Atomic Beam.
Final rept.
W. D. Phillips, and H. J. Metcalf. 1982, 34p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Physical Review Letters 48, n9 p596-599, 1 Mar 82.

Keywords: *Laser beams, *Atomic beams, *Deceleration, Zeeman effect, Doppler effect, Absorptions, Atoms, Reprints, *Sodium atoms, *Laser applications.

The authors have observed deceleration of Na atoms in an atomic beam from absorption of resonant laser light. The deceleration amounts to 40% of the initial thermal velocity corresponding to about 15000 absorptions. Atoms were kept in resonance with the laser by using a spatially varying magnetic field to provide a changing Zeeman shift to compensate for the changing Doppler shift as the atoms decelerated.

704,930
PB85-118248 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoemission Studies of H2S, H2, and S Adsorbed on Ru(110): Evidence for an Adsorbed SH Species.
Final rept.
G. B. Fisher. 1979, 13p
See also AD-A070054.
Pub. in Surface Science 87, n1 p215-227 Aug 79.

Keywords: *Hydrogen sulfide, *Hydrogen, *Sulfur, *Photoelectric emission, Chemisorption, Adsorption, Surface chemistry, Reprints.

H2S, H2 and S adsorbed on Ru(110) have been studied by angle-integrated ultraviolet photoemission (UPS) as part of a study of the effect of adsorbed sulfur, a common catalytic poison, on this Ru surface. For low exposures of H2S at 80 K, the work function rises to a value 0.15 eV above that of clean Ru(110) while the associated UPS spectra (h(nu) = 21.2 eV) exhibit features similar to those of H(ads) and S(ads) and different from those of molecular H2S. We conclude that H2S dissociates completely at low coverages on Ru(110) at 80 K. At intermediate exposures the work function drops and the UPS spectra show new features which are attributed to the presence of an adsorbed SH species. This appears to be the first direct observation of this surface complex. At higher exposures the work function saturates at a value 0.35 eV below the clean value; the UPS spectra change markedly and indicate the adsorption of molecular H2S. Thermal desorption from an H2S layer shows that the H2 desorption peak appears at about 180 K, below the desorption peaks for an H2 monolayer on the same surface. Heating adsorbed H2S leaves a stable layer of S(ads) on Ru(110). The surface with adsorbed sulfur strongly modifies the adsorption at 80 K of a number of molecules relative to the clean Ru(110) surface.

704,931
PB85-118263 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectrum of Benzene in the 3-Mu-M Region: The Nu-12 Fundamental Band.
Final rept.
J. Pliva, and A. S. Pine. 1982, 28p
Pub. in Jnl. of Molecular Spectroscopy 93, n1 p209-236 1982.

Keywords: *Absorption spectra, Doppler effect, Blends, Benzenes, Reprints, *Benzene.

The absorption spectrum of benzene vapor between 3020 and 3125/cm has been recorded at 297 and 204 K with Doppler-limited resolution using a difference-frequency laser spectrometer. Since in this highly complex spectrum much of the observed structure results from blends of two or more transitions, deconvolution was used to reduce the line width by a factor of about 3 down to 0.0010 - 0.0015/cm. This made it possible to resolve and analyze the spectrum in detail.

704,932
PB85-118271 Not available NTIS
National Bureau of Standards, Washington, DC.
Intercomparison of Selected Semi-Empirical and Fundamental Parameter Interelement Correction Methods in X-Ray Spectrometry.
Final rept.
P. A. Pella, and J. R. Sieber. 1982, 3p
Pub. in X-Ray Spectrometry 11, n4 p167-169 1982.

Keywords: *X ray spectroscopy, *Alloys, Comparison, Performance evaluation, Research project, Reprints.

Fundamental parameter interelement correction methods such as NRLXRF are finding increased use in quantitative x-ray spectrometry. The purpose of this work was to compare the results obtained with each of the three options in NRLXRF, namely Empirical, Full, and Theoretical, with a semiempirical model such as Rasberry-Heinrich and an NBS fundamental parameter method to check for consistency. Well characterized alloys were chosen for making the intercomparison.

704,933
PB85-118289 Not available NTIS
National Bureau of Standards, Washington, DC.
Overview of EXFNBS: A Data Reduction Procedure for Energy-Dispersive XRF with Secondary Target Excitation.
Final rept.
R. L. Myklebust, P. A. Pella, and B. B. Thorne. 1982, 3p
Pub. in X-Ray Spectrometry 11, n4 p170-172 1982.

Keywords: *X ray absorption, *X ray spectroscopy, *Data processing, Excitation, Reprints, *Energy dispersive x ray spectroscopy, Computer applications.

An overview of a fundamental parameter data reduction procedure for processing energy-dispersive x-ray spectrometric data obtained with monochromatic excitation is described. The program called EXFNBS and NBSROI are written in FORTRAN and correct for interfering x-ray peaks, scope peaks, background, and x-ray absorption/enhancement due to interelement effects in a specimen. This procedure is designed to operate in an interactive mode with a minicomputer in real time.

704,934
PB85-118305 Not available NTIS
National Bureau of Standards, Washington, DC.
New FIR Laser Lines and Frequency Measurements in CD3OD.
Final rept.
E. C. C. Vasconcellos, A. Scalabrin, F. R. Petersen, and K. M. Evenson. 1981, 7p
Pub. in International Jnl. of Infrared Millimeter Waves 2, n3 p533-539 1981.

Keywords: *Methyl alcohol, *Deuterium compounds, Optical pumping, Line spectra, Polarization(Waves), Reprints, *Laser spectroscopy, *Far infrared spectroscopy.

Nineteen new submillimeter laser lines in fully deuterated methyl alcohol (CD3OD) in the wavelength range from 42 to 419 micrometers have been obtained in a Fabry-Perot FIR resonator by optically pumping the methanol with a cw CO2 laser. The authors have made accurate wavelength measurements and have determined the relative polarization of most of the known CD3OD laser lines. The frequencies of 13 of the strongest lines were also measured.

704,935
PB85-118313 Not available NTIS
National Bureau of Standards, Washington, DC.
Ionization of Normal Alkanes: Enthalpy, Entropy, Structural and Isotope Effects.
Final rept.
M. Meot-Ner, L. W. Sieck, and P. Ausloos. 1981, 7p
Pub. in Jnl. of the American Chemical Society 103, n18 p5342-5348 1981.

Keywords: *Alkanes, *Ionization, Photochemical reactions, High pressure tests, Mass spectroscopy, Reprints.

Charge transfer equilibria involving n-alkanes, cyclohexane and some 2-Methyl-alkanes were measured between 300 and 420 K by high-pressure photoionization mass spectrometry.

704,936
PB85-118347 Not available NTIS
National Bureau of Standards, Washington, DC.
Reliability of Partial Structure Factors Determined By Anomalous Dispersion of X-Rays.
Final rept.
R. G. Munro. 1982, 9p
Pub. in Physical Review B 25, n8 p5037-5045 Apr 82.

Keywords: *X rays, *Dispersions, Reprints, *Partial structure factors.

The reliability of the partial structure factors determined by either of two X-ray scattering techniques using the effects of anomalous dispersion is considered. A comparison of the two experimental techniques is given for both binary and ternary systems. The recently proposed X-ray frequency modulation technique is found to be about an order of magnitude better than the direct X-ray anomalous scattering method, and it is also found to be suitable for ternary systems. Experimental error is simulated by a pseudorandom number generator which produces normally distributed numbers with a specified mean and standard deviation. Conditions corresponding to about 1 percent experimental error from data acquisition and processing are assumed.

704,937
PB85-118354 Not available NTIS
National Bureau of Standards, Washington, DC.
Microwave Optical Double Resonance of NO2 with a Tunable CW Laser.
Final rept.
T. Tanaka, A. D. English, R. W. Field, D. A. Jennings, and D. O. Harris. 1973, 2p
Pub. in Jnl. of Chemical Physics 59, n9 p5217-5218, 1 Nov 73.

Keywords: *Nitrogen dioxide, *Optical spectra, Reprints, *Laser spectroscopy, *Microwave double resonance.

A tunable CW dye laser has been used, using MODR techniques to give a complete rotational assignment of four NO2 absorption lines at 593.6 nm. The usefulness of this method of investigating complex optical spectra is shown and the details of the rotational assignment are discussed.

704,938
PB85-118362 Not available NTIS
National Bureau of Standards, Washington, DC.
Investigation of Laser Temporal Pulse Duration on Rayleigh Scattering.
Final rept.
T. A. Nee, and J. R. Roberts. 1982, 4p
Pub. in Physical Review A 25, n2 p1000-1003 Feb 82.

Keywords: *Rayleigh scattering, *Cross sections, Pulse duration modulation, Reprints, *Laser applications.

Relative Rayleigh scattering cross sections from nitrogen have been measured for various pulse durations and various wavelengths of incident laser radiation. No pulse duration dependance has been observed for laser pulses as short as 5 ns, and classical theory is believed to be still valid for pulses shorter than 50 ns.

704,939
PB85-118396 Not available NTIS
National Bureau of Standards, Washington, DC.
Phase Diagram of Water Based on a Lattice Model.
Final rept.
P. H. E. Meijer, R. Kikuchi, and P. Papon. 1981, 17p
Pub. in Physica A 109, n3 p365-381 Dec 81.

Keywords: *Phase diagrams, *Water, *Lattice parameters, Chemical bonds, Entropy, Ice, Equations of state, Reprints.

In order to calculate the phase diagram of water the authors introduce a lattice model that has the following features for its potential. A nearest neighbor attraction, which due to hydrogen bonding, is strongly dependent on the relative orientation of water molecules, and a next-nearest neighbor or a three-body repulsion. The hydrogen bonding is introduced in the model by means of a set of weight factors that are in accordance with Pauling's ice rules. The entropy is calculated using the cluster variation method for tetrahedrons. The isotherms show a maximum in the density and we obtain phase separations between the vapor, the open ice state and a state which is densely packed.

704,940
PB85-120582 Not available NTIS
National Bureau of Standards, Washington, DC.
Study of Corresponding States for the Liquid Alkali Metals.
Final rept.
R. D. Mountain. 1976, 10p
Sponsored in part by Energy Research and Development Administration, Washington, DC.
Pub. in Proc. Int. Conf. on Liquid Metals (3rd), Bristol, England, July 12-15 1976, p62-71.

Keywords: *Alkali metals, *Equations of state, X ray diffraction, Thermodynamic properties, Pseudopotentials, Liquid potassium, Liquid sodium, Liquid rubidium.

The pseudopotential pair potentials developed by Price, et al. and by Dagens, Rasolt and Taylor are used to investigate the microscopic basis for a law of corresponding states for the liquid alkali metals. Both sets of potential functions show small departures from corresponding states. Monte Carlo simulation is used to show that the temperature dependent part of the pressure scales for Na and K with an error on the order of 10%. The pair distribution functions for Na are in good agreement with the results of X-ray diffraction measurements. These studies suggest that corresponding states is a reasonable, but not completely accurate, way of describing the thermodynamic properties of the liquid alkali metals.

704,941
PB85-120624 Not available NTIS
National Bureau of Standards, Washington, DC.
Ion Fragmentation of Benzene and Linear Benzene Isomers.
Final rept.
H. M. Rosenstock, K. E. McCulloh, and F. P. Lossing. 1978, 6p
Pub. in Advances in Mass Spectrometry 7B, p1260-1265 1978.

Keywords: *Ionization, *Photochemical reactions, *Fragmentation, Benzenes, Ionization potentials, Reprints, *Benzene, *Hexadiyne, Chemical reaction mechanisms, Autoionization, Rydberg series.

Photoionization and electron monochromator studies have been carried out on the ionization and fragmentation of benzene, 1,5-hexadiyne and some other pertinent molecules to further our understanding of the mechanism of benzene ion fragmentation. Evidence is presented for the formation of a new C4H4(+1) species with a heat of formation of about 286 kcal/mol, significantly lower than the species formed from vinylacetylene or butatriene. Heats of formation of a number of isomeric ions have been estimated. A number of these are nearly equivalent in energy to the first excited state of benzene ion and could serve as intermediates in the skeletal fragmentation reactions which occur with a significant kinetics shift. Autoionizing Rydberg states converging to the 16.84 eV ionization potential are observed in the photoionization yield curves of the benzene parent ion and all four major primary fragments. Evidence is presented which suggests that 1,5-Hexadiyne may also decompose via independent sets of fragmentation reactions.

704,942
PB85-120632 Not available NTIS
National Bureau of Standards, Washington, DC.
Scaled Fundamental Equation for the Critical Region of Steam.
Final rept.
J. M. H. Levelt Sengers. 1977, 12p
Pub. in Proc. Symp. Thermophysical Properties (7th), Gaithersburg, Maryland, May 10-12 1977, p774-785.

Keywords: *Thermophysical properties, *Critical point, *Steam, *Mathematical models, Equations of state, Comparison, Enthalpy, Entropy, Specific heat.

The Linear Model scaled equation-of-state previously formulated for steam by Murphy et al. has been generalized to a fundamental equation. Intercomparisons are made with experimental data for pressure, energy and specific heats Cp and Cv. A tabulation is given of the thermodynamic functions volume, energy, entropy, enthalpy and specific heats, with pressure and temperature as entries. The range covered is 356-420C in temperature, 2.5-4.0 cu cm/g in volume.

704,943
PB85-120764 Not available NTIS
National Bureau of Standards, Washington, DC.
Trends in Structure and Vibrational Frequencies of MX2 and MX3 High Temperature Halide Vapors.
Final rept.
M. C. Drake. 1979, 10p
Pub. in Jnl. of Electrochem. Soc. 126, n8 p1387-1396 Aug 79.

Keywords: *High temperature tests, *Molecular structure, *Molecular vibration, *Transition metals, *Halogen inorganic compounds, Thermodynamics, Trends, Reprints.

Trends in the structures and vibrational frequencies of gaseous MX2 and MX3 halides are summarized. Both molecular orbital and ion polarizability models are consistent with planar symmetry for all Group III A tribalides in accord with recent experiments. Both models yield the same qualitative predictions for the structures of other MX3 species. Correlations of stretching frequencies and internuclear distances in MX, MX2, and MX3 molecules can be used to estimate shapes and unobserved vibrations. The implications of the results for the thermodynamic functions of gaseous halides are discussed.

704,944

PB85-120780 Not available NTIS
National Bureau of Standards, Washington, DC.
Universality of Thermophysical Properties Near Critical Points.
Final rept.
J. M. H. Levelt Sengers. 1977, 8p
Pub. in Proc. Symp. Thermophysical Properties (7th), Gaithersburg, Maryland, May 10-12 1977, p766-773.

Keywords: *Thermophysical properties, *Critical point, Mathematical models, Scaling, Reprints, Ising model.

It is expected that critical behavior in a large variety of physical systems is the same. Reasons for the similarity are given. The principle of universality of critical behavior is first defined for magnetic systems and then extended to fluids. The factors that determine to which universality class a system belongs are given. Tests of the validity of the principle of universality in model systems and magnets are discussed. In fluids, three recent experiments have confirmed that these systems belong in the same universality class as the Ising model. Correction terms to asymptotic scaling will be important in fluids in regions of interest to engineers.

704,945

PB85-120830 Not available NTIS
National Bureau of Standards, Washington, DC.
Triplet Correlations.
Final rept.
H. J. Raveche, and R. D. Mountain. 1978, 33p
Pub. in Progress in Liquid Physics, p469-501 1978.

Keywords: *Liquids, *Thermodynamic properties, Laboratory design, Neutron scattering, Reprints, *Triplet correlation, Computer applications.

The phenomenon of the correlation between three arbitrary molecules in a liquid is analyzed. The contribution of this correlation to the microscopic and thermodynamic properties of liquids and dense fluids is considered. Results from both laboratory measurements and computer simulations are included. The theory of triplet correlation is discussed and all the most widely used integral equations are analyzed.

704,946

PB85-121564 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Materials Science.
Phase Equilibria of Stored Chemical Energy Reactants.
Annual rept.
L. P. Cook, E. R. Plante, R. S. Roth, and J. W. Hastie. Sep 84, 113p NBSIR-84/2940
Grant N00014-83-F-0117

Keywords: *Phase diagrams, *Chemical equilibrium, *Crystallography, *Lithium aluminum hydride, Chemical reactions, X ray analysis, Thermodynamics, Mass spectroscopy, Mathematical models, Lithium oxides, Aluminum oxides, Mixtures.

The reaction of lithium aluminum alloy with water at high temperature is discussed in terms of phase equilibria in the system Li-Al-O-H. A thermodynamic analysis of the system reveals the potential importance of lithium hydride as a reaction product. Major needs for experimental phase equilibria data are outlined, and a determination of the Li2O-Al2O3 phase diagram is given top priority. Appendices are given for the modeling of viscosities in multiphase mixtures, and describing results of a computerized literature search on the system Li-Al-O-H.

704,947

PB85-123321 Not available NTIS
National Bureau of Standards, Washington, DC.
Small Angle Neutron Scattering (SANS) Measurements of Block Chains at National Bureau of Standards.
Final rept.
E. J. Amis, C. J. Glinka, C. C. Han, H. Hasegawa, T. Hashimoto, T. P. Lodges, and Y. Matsushita. 1983, 3p
Pub. in Polymer Preprints 24, n2 p215-217 1983.

Keywords: *Neutron scattering, *Polymers, Polystyrene, Copolymers, Reprints, *Small angle scattering, *Molecular conformation, *Polymer chains.

Deuterium labelling technique is used in the Small Angle Neutron Scattering experiments to determine the conformation of portion of polymer chain. Two such studies are presented in this paper. In the first experiment, the chain length and contour position dependence of the excluded volume effect is studied. In the second experiment, the dimensions of a polystyrene block chain in a microphase separated lamellar domain are studied. Also, the characteristics and capabilities of the NBS-SANS facility are described and illustrated.

704,948

PB85-123339 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure of C4H4(+) Produced in the Unimolecular Fragmentation of C6H6(+) and C5H5N(+).
Final rept.
P. Ausloos. 1981, 2p
Pub in. Jnl. of the American Chemical Society 103, n13 p3931-3932 1981.

Keywords: *Fragmentation, *Molecular structure, *Reaction kinetics, Pyridine, Ions, Reprints, *Ion molecule interactions, Benzene, Hexadiyne.

Ion cyclotron resonance experiments indicate that fragmentation of benzene, 1,5-hexadiyne, 2,4-hexadiyne, and pyridine ions lead to the formation of two isomeric C4H4(+1) fragment ions, one linear (the but-1-yne-3-ene structure) and one cyclic (the methylenecyclopropene structure). At the threshold energy for formation of C4H4(+1) in benzene, only the cyclic ion is produced, while the linear C4H4(+1) predominates at energies about 2 eV above the onset of this fragmentation process. It is suggested that the striking change in branching ratios for formation of C3H3(+1) and C4H4(+1) at a total energy of about 15.6 eV can be explained in terms of the existence of two channels leading to the formation of C4H4(+1) species.

704,949

PB85-123347 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure and Isomerization of C7H7(+) Ions Formed in the Charge Transfer-Induced Fragmentation of Ethylbenzene, Toluene, and Norbornadiene.
Final rept.
P. Ausloos. 1982, 7p
Pub. in Jnl. of the American Chemical Society 104, n20 p5259-5265 1982.

Keywords: *Molecular structure, *Isomerization, *Benzenes, *Toluene, Ions, Deuterium compounds, Reaction kinetics, Reprints, *Benzene ions, *Benzene/ethyl, *Norbornadiene, Charge transfer.

C7H7(+1) ions with internal energies varying from about 0.5 eV to 6.5 eV above their ground state energy have been prepared in an ion cyclotron resonance spectrometer (ICR) by charge transfer-induced fragmentation of ethyl benzene, toluene, and norbornadiene. It is shown that in the case of ethyl alpha, alpha-d2 benzene and toluene -alpha, alpha, alpha-d3 the abundance of unscrambled C6H5CD2(+1) ions produced by direct bond cleavage increases with energy to reach respectively 60 and 10 percent of the total C7(H,D)(+1)7 population at 3 eV above the appearance energy. C7H5D2(+1) ions are also produced after the occurrence of ring expansion and contraction in the parent ion. However, because these ions produced from ethyl -alpha, alpha-d2 benzene are not statistically scrambled, especially at high internal energies, it is suggested that only a few passages over the energy barrier separating the six-membered ring from the seven-membered ring structure occur during the dissociative lifetime of the ethylbenzene ion. In contrast, the hydrogens in benzyl-d2 and benzyl-d3 ions produced from toluene -alpha, alpha, alpha-d3 after ring expansion are statistically scrambled.

704,950

PB85-123362 Not available NTIS
National Bureau of Standards, Washington, DC.
Total and Partial Cross Sections for Electron Capture in Collisions of Hydrogen Atoms with Completely Stripped Ions.
Final rept.
D. S. Belic, B. H. Bransden, and R. K. Janev. 1983, 10p
Pub. in Physical Review A 28, n3 p1293-1302 Sep 83.

Keywords: *Exchange reactions, *Absorption cross sections, *Electron capture, Atoms, Ions, Electron scattering, Reprints, *Atom ion interactions, *Hydrogen atoms, Numerical solution.

Total and partial cross sections for the charge exchange reaction H(ls) + A(+Z) yields H(+1) + A(+(Z-1)) (n) A(+Z) being a fully stripped ion) are calculated in the energy range .01-100 keV/amu by using the multichannel Landau-Zener theory with rotational coupling included. The calculations are performed for Z between 5 and 74 and include species with highest priority for fusion research.

704,951

PB85-123388 Not available NTIS
National Bureau of Standards, Washington, DC.
Silane Pyrolysis.
Final rept.
R. Robertson, D. Hils, and A. Gallagher. Jan 84, 8p
Sponsored in part by Solar Energy Research Inst., Golden, CO.
Pub. in Chemical Physics Letters 103, n5 p397-404 Jan 84.

Keywords: *Silane, *Pyrolysis, *Surface chemistry, Chemical reactions, Decomposition reactions, Mathematical models, Reprints, Homogeneous reactions.

The authors show that silane pyrolysis is initiated by decomposition on the amorphous silicon surface, with an activation energy E sub a of 56 kcal/mole. The observed surface decomposition rate is only weakly dependent on silane pressure. Much faster delayed decomposition rates, approximately independent of surface area and proportional to pressure, are shown to be initiated by surface reactions. A model for surface decomposition is given. Also a model for gas reactions is suggested based on H atom or SiH3 release by surface decomposition, causing chain reactions that process the gas to high silanes that decompose rapidly. This model can explain the previous observations that the initial disilane formation rate and the delayed decomposition rate were independent of the surface area to volume ratio A/V, which had misled previous investigators to suggest homogeneous initiation processes.

704,952

PB85-123412 Not available NTIS
National Bureau of Standards, Washington, DC.
2-Amino-6,7-Dihydroxytetralin Hydrobromide, C10H13NO2.HBr.
Final rept.
J. K. Stalick, C. R. Hubbard, A. D. Mighell, J. R. Rodgers, and A. S. Horn. 1984, 4p
Contract FDA-224-80-3009
Pub. in Acta Crystallographica. Section C 40, p317-320 1984.

Keywords: *Crystal structure, *X ray analysis, Molecular structure, Stereochemistry, Nitrogen organic compounds, Reprints, *Tetralin hydrobromide/amino-dihydroxy.

There are two independent molecules in the unit cell. Molecule A is essentially planar, except for two C atoms of the aliphatic ring which are displaced equally 0.33 A above and below the plane of the molecule; the N atom also lies in the molecular plane defined by the aromatic ring. Molecule B exhibits partial disorder of the (+)- and (-)- enantiomers.

704,953

PB85-123438 Not available NTIS
National Bureau of Standards, Washington, DC.
High Resolution Spectrum of the HC1 Dimer.
Final rept.
N. Ohashi, and A. S. Pine. 1 Jul 84, 12p
Pub. in Jnl. of Chemical Physics 81, n1 p73-84, 1 Jul 84.

Keywords: *Hydrogen chloride, *Infrared spectroscopy, *Molecular rotation, *Molecular vibration, Chemical bonds, Dimerization, Isotopic labeling, Electron tunneling, Reprints, *Laser spectroscopy, *High resolution infrared spectroscopy, Chlorine 35, Chlorine 37.

Rotational structure in the spectrum of the HCl stretching bands of the HCl dimer has been fully resolved using a tunable difference-frequency laser. The spectrum of a natural isotopic sample was recorded under thermal equilibrium conditions near the condensation point (T about 130 K) of HCl at low pressures (3-4 Torr) and long pathlengths (64-80 m). The spectra suggest an extremely rapid tunneling motion between equilivalent forms of nearly orthogonally oriented monomer units.

704,954
PB85-123636 Not available NTIS
National Bureau of Standards, Washington, DC.
Assessment of the Effective Gaunt Factor Approximation.
Final rept.
S. M. Younger, and W. L. Wiese. 1979, 10p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 22, n2 p161-170 1979.

Keywords: *Ions, *Electron scattering, Assessments, Comparison, Excitation, Performance evaluation, Reprints, *Gaunt factor.

Based on comparisons with recent theoretical data, it is shown that the effective Gaunt factor for delta n = 0 transitions in alkali-like ions is within 25% of unity in most cases and is a slowly varying function of energy.

704,955
PB85-123669 Not available NTIS
National Bureau of Standards, Washington, DC.
Reduction Parameters in a Phenomenological 3-Parameter Corresponding States Theory for N-Alkanes.
Final rept.
F. Dowell. 1979, 3p
Pub. in Jnl. of Physical Chemistry 83, n7 p802-804 1979.

Keywords: *Alkanes, *Critical point, *Scaling, Entropy, Molecular structure, Reprints, *Correspondence principle.

Reduction (scaling) parameters in a phenomenological three-parameter corresponding states theory for n-alkanes are determined at the gas-liquid critical point and compared with values previously determined away from the critical region. The relative reduction parameters for volume and temperature remain virtually constant, but the relative reduction parameters for energy and entropy change; the trend in the relative entropy reduction parameter as a function of the number of carbon atoms changes. From these results, certain implications are observed regarding the parameters for corresponding states models for chain molecules.

704,956
PB85-123685 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Collisions with Highly Polar-Molecules: Integrated and Momentum-Transfer Cross-Sections and Conductivity Integrals for KOH and CSOH.
Final rept.
L. A. Collins, D. W. Norcross, and G. B. Schmid. 1979, 13p
Sponsored in part by Department of Energy, Washington, DC. and Department of the Air Force, Washington, DC.
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 12, n6 p1019-1030 1979.

Keywords: *Electron scattering, *Potassium hydroxides, Dipole moments, Cross sections, Reprints, *Electron molecule interactions, *Cesium hydroxides.

The authors report close-coupling calculations of the total integrated and momentum transfer cross sections for the scattering of electrons from KOH and CsOH in the energy range 0.01 eV to 10 eV. A cut-off dipole potential is used to account for the long-range interaction. We nominally chose the cut-off radius, R sub c, such that the potential has a minimum in the vicinity of the nucleus nearest to the center-of-mass (COM) of the molecule. No explicit account is taken of the short-range interactions. The results exhibit oscillations about a mean value, with an amplitude of approximately 1% and 10%, respectively, of the mean value for the two cross sections.

704,957
PB85-124048 Not available NTIS
National Bureau of Standards, Washington, DC.
Simulated Precipitation Reference Materials: Measurement of pH and Acidity.
Final rept.
W. F. Koch, and G. Marinenko. 1983, 8p
See also PB80-227044.
Pub. in American Society for Testing and Materials, Special Technical Publication 823, p10-17 1983.

Keywords: *pH, *Acidity, Air pollution, Reprints, *Reference materials, Acid rain, Atmospheric chemistry.

The Center for Analytical Chemistry of the National Bureau of Standards has prepared and analyzed several series of simulated precipitation reference materials to be used as a means of intercalibrating atmospheric monitoring stations. In addition, research has shown serious errors in the measurement of pH and acidity determined in solutions of low-acidity and low-ionic strength. Contingent on further research pH measurements of acid rain should not be reported with greater confidence than 0.1 pH number. Titrations for total acidity should be performed to an inflection point or Gran plot endpoint and not to a fixed pH endpoint. Improved measurement protocols and reference standards are necessary to assure measurement comparability and consistency throughout the nation.

704,958
PB85-124055 Not available NTIS
National Bureau of Standards, Washington, DC.
Correcting Emission and Excitation Spectra: A Review of Past Procedures and New Possibilities Using Silicon Photodiodes.
Final rept.
E. F. Zalewski, J. Geist, and R. A. Velapoldi. Dec 83, 9p
Pub. in Proceedings of Symposium New Directions in Molecular Luminescence, Atlantic City, NJ., March 10, 1982, American Society for Testing and Materials, Special Technical Publication 882, p103-111, Dec 83.

Keywords: *Emission spectra, *Photodiodes, Silicon, Excitation, Fluorescence, Reviews, Standards, Spectroradiometers, Fluorometric analysis.

A brief review of procedures used to produce corrected excitation and emission spectra is given. Recent advances in silicon photodiodes as detector standards and the possibility of their use to produce both corrected excitation and emission spectra are discussed in more detail. The advantages in the use of the photodiodes based on accuracy, stability, simplicity of use, and extensive linear dynamic range will be reviewed.

704,959
PB85-124063 Not available NTIS
National Bureau of Standards, Washington, DC.
Improved Flexibility in MODR (Microwave-Optical Double Resonance) Using a Supersonic Jet Source: Applications to CO+ and CN.
Final rept.
M. A. Johnson, M. L. Alexander, I. Hertel, and W. C. Lineberger. Mar 84, 6p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Chemical Physics Letters 105, n4 p374-379 Mar 84.

Keywords: *Carbon monoxide, *Cyanides, Hyperfine structure, Microwave spectroscopy, Ions, Free radicals, Reprints, *Carbon 12, *Nitrogen 14, Microwave double resonance.

Microwave-optical double resonance (MODR) is carried out on the N=0 to 1 transitions of CN and CO(+1), which are rotationally cooled in a supersonic jet. Large modulations in the probe LIF (100%) are observed without optical saturation, demonstrating that short pulse dye lasers may be used in MODR.

704,960
PB85-124238 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Ultracentrifugation Interference Patterns with Image Digitizer: Application to Molecular Weight Determination of SRM 1478 Polystyrene.
Final rept.
F. W. Wang, and F. L. McCrackin. Dec 83, 6p
Pub. in Polymer 24, p1541-1546 Dec 83.

Keywords: *Molecular weight, *Polystyrene, *Analog to digital converters, Standards, Reprints, *Standard reference materials, *Ultracentrifugation.

A new method for the analysis of ultracentrifugation interference patterns with the use of a commercial image digitizer is given. The application of the method to the sedimentation equilibrium data for SRM 1478 Polystyrene leads to a weight-average molecular weight of 37,400 g/mol having a sample standard deviation of 0.7% and an expected systematic error limit of 2%.

704,961
PB85-124261 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron-Detachment Progress in keV H-, Li-, Na-, K- - Rare Gas Collisions.
Final rept.
N. Andersen, T. Andersen, L. Jepsen, and J. Macek. Jun 84, 14p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 17, n2 p2281-2294 Jun 84.

Keywords: *Rare gases, Ions, Helium, Neon, Argon, Excitation, Reprints, *Ion molecule interactions.

Electron detachment processes have been measured for the (quasi-) two-electron negative ions with n (square sec) structures (n=1,2,3,4), namely H(-1), Li(-1), Na(-1), K(-1) in collisions with He, Ne, and Ar at energies of 0.5-100 keV/amu. Total detachment cross sections have been determined for n = 1-4. Detachment with simultaneous ns-np excitation has been measured for n = 2 and 3. Finally, cross sections for target excitation and/or ionization have been estimated for 50 keV. For energies above 1 keV/amu, the total detachment cross sections are found to scale with the cross section for H(-1) at the same velocity as the inverse square of the detachment energies. Simultaneous ns-np excitation is found to be important (about 30%) and exhibits a considerable alignment. Target excitation at these energies is relatively small in all cases except for Na(-1) -Ne due to strong quasi-molecular effects in this system.

704,962
PB85-124279 Not available NTIS
National Bureau of Standards, Washington, DC.
Pressure Dependance of Viscosity of Pressure Transmitting Fluids.
Final rept.
V. E. Bean, S. D. Wood, and R. J. Lazos. 1984, 4p
Pub. in Proceedings of AIRAPT Interactive High Pressure Conference (9th), July 24-29, 1983, pt. 2, p289-292 1984.

Keywords: *Viscosity, *High pressure tests, *Transmission fluids, *Viscometers.

A rolling-ball viscometer has been constructed and the viscosities of 19 candidate pressure transmitting fluids have been measured as a function of pressure up to 700 MPa at room temperature.

704,963
PB85-124287 Not available NTIS
National Bureau of Standards, Washington, DC.
Compression of CCl4 at High Pressures.
Final rept.
S. D. Wood, and V. E. Bean. 1984, 4p
Pub. in Proceedings of AIRAPT Interactive High Pressure Conference (9th), Albany, NY., July 24-29, 1983, pt. 2, p29-32 1984.

Keywords: *Carbon tetrachloride, *Compressibility, Equations of state, High pressure tests, Isotherms, Critical point.

The compression of carbon tetrachloride has been measured along twelve isotherms covering a pressure range of 0.1 to 200 MPa and a temperature range of 254 to 298 K. Volume changes were measured with an automated capacitance bridge--one side of the bellows containing the sample serving as one plate of the capacitor. Data were obtained in the liquid, face-centered cubic (fcc), and rhombohedral phases; during melting, during freezing into the fcc phase and during the fcc to rhombohedral phase change. Premelting behavior was observed for both solids. The disappearance of the fcc phase at approximately 273 K and the existence of dual melting curves for the fcc and rhombohedral phases were reaffirmed.

704,964
PB85-124337 Not available NTIS
National Bureau of Standards, Washington, DC.

Cure Kinetics Measurements on Polymer Composite Matrix Materials.
Final rept.
G. A. Senich, J. H. Flynn, J. C. Phillips, and H. Weisshaus. Aug 84, 2p
Pub. in Polymer Preprints 25, n2 p211-212 Aug 84.

Keywords: *Reaction kinetics, *Polymers, *Composite materials, Nondestructive tests, Curing, Exothermic reactions, Heat measurement, Thermosetting resins, Mechanical properties, Infrared spectroscopy, Comparison, Acrylates, Reprints, Fourier transform spectroscopy.

Nondestructive techniques are being used during cure of identical samples for analysis of the rate and reaction kinetics of polymer composite matrix formation. Curing of acrylates and other unsaturated oligomers is initiated by ultra-violet light or by thermal means. Fourier transform infrared spectroscopy is used to determine the extent and rate of reaction of participating chemical functional groups. Differential scanning calorimetry is used to monitor thermally the kinetics of these exothermic cure process. Ultrasonic shear wave propagation in a quartz substrate coated with the curing sample gives information on the changes in mechanical properties occurring with time. By comparing the results for the same material it is possible to obtain a more thorough understanding of the cure chemistry kinetics occurring during processing of thermoset polymer matrix materials.

704,965
PB85-124352 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of Laser-Induced Rayleigh Light Scattering to the Study of Turbulent Mixing.
Final rept.
W. M. Pitts, and T. Kashiwagi. 1984, 39p
Pub. in Jnl. of Fluid Mechanics 141, p391-429 1984.

Keywords: *Light scattering, *Rayleigh scattering, Raman spectroscopy, Turbulence, Turbulent flow, Methane, *Laser applications.

This work describes the development and characterization of an experimental system employing laser-induced Rayleigh light scattering with digital data acquisition as a time-resolved, quantitative concentration probe in the turbulent flow field of a binary gas mixture. Equations for the expected signal and noise levels are given. Estimates of these parameters for the experimental system used here are in satisfactory agreement with experiment. It is demonstrated that the laser Rayleigh light scattering technique provides measurements having high spatial and temporal resolution for various locations within the concentration flow field. Measurements at various positions in the flow field of an axisymmetric methane jet issuing into a slow flow of air are reported and, where possible, compared with appropriate literature results. The statistical properties of the turbulent concentration fluctuations are found to be in good agreement with other independent measurements. Conditionally sampled measurements are also reported and shown to behave in the same manner as the limited number of similar measurements in the literature. The capability of calculating power spectra and correlation functions for the time behavior of the methane concentration is also demonstrated. Raman and Rayleigh scattering techniques are compared as measurement techniques of scalar values in turbulent flow fields.

704,966
PB85-124378 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoacoustic Measurements of Multiple Photon Infrared Absorption by Alkyl Chlorides and Hexadienes.
Final rept.
T. A. Seder, and E. Weitz. Feb 84, 7p
Pub. in Chemical Physics Letters 104, n6 p545-551 Feb 84.

Keywords: *Chlorides, Infrared spectroscopy, Absorption, Reprints, *Photoacoustic spectroscopy, *Hexadienes.

The multiple-photon absorption behavior of a series of alkyl chlorides and a number of hexadiene isomers has been examined in order to elucidate the dependence of absorption cross section on fluence. Measurements of absorbed energy via a photoacoustic technique show that, while a high density of states is necessary for an absorption cross section linear influence, other factors are also important. A photoacoustic technique for measuring absorbed energy by weakly absorbing molecules at low pressure is described.

704,967
PB85-124386 Not available NTIS
National Bureau of Standards, Washington, DC.
Porosity Study of Sintered and Green Compact YCrO3 Using Small Angle Neutron Scattering Techniques.
Final rept.
K. Hardman-Rhyne, N. F. Berk, and E. D. Case. 1984, 6p
Pub. in Proceedings of Symposium Nondestructive Evaluation Application and Materials Processing, Philadelphia, PA., October 3-4, 1983, p103-108 1984.

Keywords: *Neutron scattering, Nondestructive testing, *Small ahgle scattering, *Yttrium chromates.

A sintered and 'green' compact of YCrO3 are studied to determine the void sizes and density using mall angle neutron scattering techniques which have been extended to the beam broadening regime to detect sizes larger than 0.15 micrometers. This approach can be used with other on-line processing NDE techniques such as ultrasonics to standardize their results. Although the density ratio of the voids in the 'green' compact and sintered material of YCrO3 are very different (0.42 and 0.03 respectively), the average void radius is very similar (0.17 and 0.18 micrometers respectively).

704,968
PB85-124394 Not available NTIS
National Bureau of Standards, Washington, DC.
Collision Dynamics of Three Interacting Atoms: The Faddeev Equations in a Diabatic Electronic Basis.
Final rept.
Z. C. Kuruoglu, and D. A. Micha. Dec 83, 15p
Pub. in Jnl. of Chemical Physics 79, n12 p6115-6129 Dec 83.

Keywords: *Diatomic molecules, Hydrogen, Hydrogen fluoride, Reprints, *Atom atom interactions, Faddeev equations.

Starting with all the electrons and nuclei making up a system of three atoms, the authors introduce a basis of antisymmetrized products of atomic states to define a matrix hamiltonian partition applicable to atom-diatom collisions. They derive a three-atom generalization of the Faddeev equations, in terms of diatomic transition operators. Equations are obtained for three-atom rearrangement transition operators, that are then reduced to sets of effective two-body (atom-diatom) equations by introducing separable expansions of the diatomic transition operators. They also discuss the permutational symmetry of identical nuclei, and briefly describe how the formalism applies to the H3 and FH2 systems.

704,969
PB85-124402 Not available NTIS
National Bureau of Standards, Washington, DC.
Certified Reference Materials for Thermophysical Properties.
Final rept.
R. K. Kirby. 1984, 5p
Pub. in Compendium on Thermophysical Properties Measurement Methods (Chapter 20), p771-775 1984.

Keywords: *Thermophysical properties, *Laboratory equipment, *Standards, Calibrating, Thermal conductivity, Electrical resistivity, Specific heat, Melting points, Freezing, Thermal expansion, Reprints, *Certified reference materials.

Reference materials for use in calibrating either the temperature scale of equipment or a physical property measured by the equipment as a function of temperature are available from certifying agencies in at least 5 countries. These reference materials are certified for properties that include thermal conductivity, electrical resistivity, heat capacity, thermal expansion, and freezing and melting points.

704,970
PB85-124410 Not available NTIS
National Bureau of Standards, Washington, DC.
Isomerization of Carbonium Ions in Collision Complexes.
Final rept.
P. Ausloos, and S. G. Lias. 1984, 32p
Pub. in International Jnl. of Mass Spectrometry and Ion Processing 58, p165-180 1984.

Keywords: *Reaction kinetics, Ions, Isotope exchange, Isomerization, Reprints, *Butene, *Cyclopropane/methyl, *Ion molecule interactions.

Rate constants for proton transfer to the C4H8 isomers, cis- and trans-2-butene, 1-butene, and methylcyclopropane from various proton donors (such as CH3CNH(+1), CH3CHOH(+1), AsH4(+1), H3S(+1), and H3O(+1) are reported, and the structures of the product C4H9(+1) ions have been determined. In some mixtures, on the other hand, both sec-butyl and tert-butyl ions are formed as products. The probability of rearrangement in the complex is greater, the greater the dipole moment of the M species, since a larger dipole moment is associated with a deeper well-depth for the ion-molecule complex, and hence, a lower energy for the 'transition state-complex'. When proton transfer to form an unrearranged sec-butyl product ion is highly exothermic (>10 kcal/mol), that channel will predominate over the rearrangement channel, even if the transition state for the isomerization is energetically favorable. Results on the protonation of 2-pentene indicate that rearrangement of sec-C5H11(+1) to tert-C5H11(+1) occurs in the ion-molecule complex.

704,971
PB85-124428 Not available NTIS
National Bureau of Standards, Washington, DC.
Collisional Narrowing Effects in the Raman Q-Branch Spectral Profiles of N2, CO, and NO.
Final rept.
W. S. Hurst, G. J. Rosasco, and W. Lempert. Jun 84, 8p
Pub. in Society of Photo-Optical Instrumentation Engineers 482, p23-30 1984.

Keywords: *Raman spectroscopy, *Nitrogen, *Carbon monoxide, *Nitrogen oxide(NO), Inelastic scattering, Molecular rotation, Line spectra, Reprints.

High resolution (10 MHz) stimulated Raman Q-branch spectra of molecules important in combustion are reported. In addition to the normal linear pressure broadening, line interference which leads to collisional narrowing is demonstrated. If proper account is not taken of this latter effect, large errors in the temperature and/or pressure as extracted from the spectral profile can result. The formalism which describes the spectrum and accounts for both line broadening and line interference effects is reviewed. The resulting ('relaxation') matrix equation (NxN for an N-line spectrum) can be reduced by means of a perturbation solution to a spectral distribution involving a line broadening coefficient and a line interference coefficient for each line. This approach is applied successfully for the spectra of N2 and CO. Further, it is shown that for the simple diatomics the J-dependent line broadening/interference coefficients can be expressed in terms of simple scale/fitting laws for the rates of rotationally inelastic collisions. This approach, in terms of the rate laws, leads to a simple parameterization of all the elements of the relaxation matrix and therefore allows a determination of the spectrum. The latter approach is used in the analysis of the Q-branch spectrum of NO, for which the perturbation solution cannot be applied because of the nearly degenerate Q-branch lines arising from its two ground state electronic configurations. It is shown that collisional narrowing in the NO Q-branch spectrum is reproduced reasonably well by a rate low model fit to literature data on specific state-to-state rates for rotational energy transfer.

704,972
PB85-128874 Not available NTIS
National Bureau of Standards, Washington, DC.
Basic Research Needs and Opportunities for Characterizing the Microstructure and Microchemistry of Interfaces.
Final rept.
P. H. Holloway, K. R. Lawless, D. Lichtman, R. G. Meisenheimer, L. E. Murr, C. J. Powell, and J. Silcox. 1982, 14p
Pub. in Materials Science and Engineering 53, n1 p149-162 Apr 82.

Keywords: *Research projects, *Molecular structure, *Interfaces, Electron microscopy, Performance evaluation, Solids, Gases, Liquids, Comparison, Reprints, *Solar equipment.

This article is a chapter in the report of a Workshop on Basic Research Needs and Opportunities on Interfaces in Solar Materials sponsored by the Department of Energy Division of Materials Sciences in July 1980. Interfaces of many types (solid/solid, solid/gas, solid/

liquid) occur in the materials configurations of most solar devices, often with several in close proximity. To secure satisfactory performance of devices, interfaces have to be adequately characterized, particularly the local microstructure and microchemistry. Needs were identified for microcharacterization on spatial scales ranging from the macroscopic to the microscopic giving structural, chemical or electronic configurations. Comparison of available techniques with these needs revealed major inadequacies. Much greater effort needs to be invested in 'in-situ' techniques. Efforts to extend the capabilities of surface analytical techniques to meet the identified needs are necessary. Recent developments in analytical electron microscopy show promise of complementing the surface technologies and should be developed. Wide use of these techniques in concert is encouraged and wider use of electron microscopy in general is necessary. Much deeper understanding of existing techniques is necessary and totally novel characterization approaches should be encouraged, particularly for 'in-situ' characterization of S/L, S/G interfaces.

704,973

PB85-128882 Not available NTIS
National Bureau of Standards, Washington, DC.
Line Frequency Expressions for Triply Degenerate Fundamentals of Spherical Top Molecules Appropriate for Large Angular Momentum.
Final rept.
H. W. Galbraith, C. W. Patterson, B. J. Krohn, and W. G. Harter. 1978, 19p
Pub. in Jnl. of Molecular Spectroscopy 73, n3 p475-493 1978.

Keywords: *Molecular rotation, *Angular momentum, *Molecules, *Fundamental constants, Molecular vibration, Absorption spectra, Reprints, Numerical solution.

The authors obtain spectroscopically accurate expressions for the transition frequencies in the triply degenerate fundamental of a 'heavy' spherical top, without tedious calculation of octahedral vector coupling coefficients or diagonalization of matrices. Their calculations are based upon the physical assumption that as the molecule rotates with large angular momentum it behaves as a symmetric top with the coupled pure rotational angular momentum quantized along either the four- or three-fold body fixed axes. They found that a second order calculation which involves only 3-J symbols significantly exceeds the corresponding calculation in terms of non-diagonal octahedral vector coupling coefficients, so that for all but the most accurate saturated absorption spectra theoretical analysis may be carried out without reference to the octahedral subgroup of the rotation group.

704,974

PB85-128890 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Tin in Bacterial Methylation of Mercury.
Final rept.
C. Huey, F. E. Brinckman, S. Grim, and W. P. Iverson. 1974, 6p
Pub. in Proceedings of International Conference on Transport of Persistent Chemistry in Aquatic Ecosystems, College Park, MD, April 30-May 4, 1974, p73-78.

Keywords: *Bacteria, *Methylation, *Water pollution, Sediments, Gas chromatography, Mass spectroscopy, Atomic spectroscopy, Pseudomonas, *Mercury/methyl, *Chemical reaction mechanisms, Tin/methyl, Fluorometric analysis, Atomic absorption spectrophotometry.

Evidence has been obtained for the methylation of Sn(IV) by a Sn and Hg tolerant strain of Pseudomonas isolated from the Chesapeake Bay. Growth of this organism in the presence of both Hg(II) and Sn(IV) results in the formation of methylmercury. A postulated mechanism to account for this formation is: Sn(IV) yields Methyltin species (Biological pathway), Methyltin species + Hg(+2) yields MeHg+ (Abiotic reaction).

704,975

PB85-128924 Not available NTIS
National Bureau of Standards, Washington, DC.
Second Joint Test of an U.S. Electrode System in the U.S.S.R. U-02 Facility.
Final rept.
G. Rudins, S. J. Schneider, T. Negas, B. R. Rossing, J. L. Bates, G. P. Telegin, T. Borodina, O. Zamislov, and V. Zalkind. 1977, 13p
Pub. in Proceedings of a Symposium on Engineering Aspects of Magnetohydrodynamics (16th), Pittsburgh, PA, May 16-18, 1977, pIV.1--IV.1.12.

Keywords: *Electrodes, *Materials tests, Tests, Magnetohydrodynamics, Cesium oxides, Zirconium oxides, Thermal analysis, Chemical reactions, Phase changes, Lanthanum chromates.

The second (Phase II) joint U.S.-U.S.S.R. test of U.S. electrode materials was carried out in Moscow between September 21 and September 27, 1976 in the Soviet U-02 MHD Facility. The test procedure followed closely a predetermined work plan designed to test five different electrode materials, different lead-out and attachments, and the cathode and anode electrode walls under MHD operation conditions. Extensive pre- and post-test materials characterizations were made to determine the effect of the MHD environment on the electrodes and insulators. Measurements included: thermal diffusivity, thermal expansion, chemical composition, microstructure, electrical conductivity, phase composition, closed and open porosity, pore size distribution and radiography. Results indicated that there was extensive attack by the seed on the cathode wall resulting in chemical reactions and phase changes of the electrode materials.

704,976

PB85-128973 Not available NTIS
National Bureau of Standards, Washington, DC.
Transport Properties of a Moderately Dense Gas.
Final rept.
D. G. Friend, and J. C. Rainwater. 15 Jun 84, 5p
Pub. in Chemical Physics Letters 107, n6 p590-594, 15 Jun 84.

Keywords: *Transport properties, *Density(Mass/volume), *Gases, Kinetic theory, Viscosity, Thermal conductivity, Comparison, Reprints, *Dimer monomer interactions.

The initial density dependences of both viscosity and thermal conductivity are calculated according to a microscopically based theory which includes effects due to collisional transfer (from only free two-body phase space), three monomer collisions, and monomer-dimer collisions. A Lennard-Jones potential is used to model the interactions. Comparison of the calculated results with experiment (in reduced form) shows very good agreement for both viscosity and thermal conductivity over a wide temperature range.

704,977

PB85-128999 Not available NTIS
National Bureau of Standards, Washington, DC.
Photodecomposition of Nitromethane Trapped in Solid Argon.
Final rept.
M. E. Jacox. 19 Jul 84, 7p
Pub. in Jnl. of Physical Chemistry 88, n15 p3373-3379 1984.

Keywords: *Nitromethane, *Photolysis, *Infrared spectroscopy, Chemical bonds, Absorptions, Vapor phases, Reprints, *Matrix isolation techniques, Chemical reaction mechanisms, Methanol/nitroso.

When nitromethane isolated in solid argon at 14 K is exposed to the full light of a medium pressure mercury arc, infrared absorptions of cis- and trans-CH3ONO initially grow in intensity. On prolonged photolysis, these absorptions diminish in intensity, and there is continued growth in the infrared absorptions of the H2CO...HNO hydrogen-bonded complex and in those of the cis- and trans- rotamers of the recently discovered species nitrosomethanol. Detailed isotopic substitution studies are consistent with these identifications. In the later stages of the photolysis, absorptions of CO, NO, and HNCO and of the H2CO...HNCO hydrogen-bonded complex become increasingly prominent. The mechanism by which these products are formed is discussed. When the enhanced role of cage recombination is taken into account, this mechanism is compatible with that determined from gas-phase studies of the photolysis of nitromethane.

704,978

PB85-129005 Not available NTIS
National Bureau of Standards, Washington, DC.
Electronic States of Al2.
Final rept.
H. Basch, W. J. Stevens, and M. Krauss. 10 Aug 84, 5p
Pub. in Chemical Physics Letters 109, n2 p212-216, 10 Aug 84.

Keywords: *Aluminum, *Atomic energy levels, Electrons, Reprints, Multiconfiguration self consistent field.

Ab initio multi-configuration self-consistent field and first-order configuration interaction (FOCI) calculations in an extended basis set have been carried out for the lower energy electronic states of Al2 in an attempt to assign its ground state. The ten core electrons of each Al atom were replaced by a compact effective core potential of a type which has been shown to give molecular results that agree with the corresponding all electron results to a high degree of accuracy.

704,979

PB85-129021 Not available NTIS
National Bureau of Standards, Washington, DC.
Phase Space Subdivision of the Second Virial Coefficient and Its Consequences for Kinetic Theory.
Final rept.
J. C. Rainwater. Jul 84, 6p
Pub. in Jnl. of Chemical Physics 81, n1 p495-510 Jul 84.

Keywords: *Kinetic theory, *Metastable states, Reprints, *Virial coefficients, *Phase space, Curtiss theory, Numerical solution.

Two new methods of partitioning the second virial coefficient B into free, bound, and metastable parts, which differ from the well known partitioning of Stogryn and Hirschfelder, are presented. It is shown that the proper partitioning to use depends on the specific physical problem of interest. In particular, in the kinetic theory of moderately dense gases due to Curtiss, Snider and co-workers, certain collision integrals reduce unambiguously to linear sums of B and its temperature derivatives for repulsive potentials, but it has not been clear to what such integals reduce for realistic potentials. It is shown that such integrals reduce to the previously derived expressions with B replaced by one of our two new definitions of its free part. This contrasts with previous applications to real gases in which Curtiss and co-workers have used the full B and Kuznetsov has used the free part of B as defined by Stogryn and Hirschfelder. Also, original numerical calculations for the collision integals are presented and the numerical consistency of the theory is verified.

704,980

PB85-129195 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystal Structure of Polytetrafluoroethylene Homo and Copolymers in the High Pressure Phase.
Final rept.
E. S. Clark, R. K. Eby, G. J. Piermarini, and S. Block. Aug 83, 2p
Pub. in Polym. Prepr. 24, n2 p423-424 Aug 83.

Keywords: *Crystal structure, *X ray diffraction, Copolymers, High pressure tests, Fluorine organic compounds, Reprints, *Poly(ethylene/tetrafluoro).

Polytetrafluoroethylene is a linear polymer which has a helical conformation at atmospheric pressure. Three distinct phases have been identified at one atmosphere (101 MPa)--Form (above 30C), Form IV (19-30C) and Form II (below 19C). Various investigators have identified a fourth phase (Form III) at pressures above about 700 MPa at room temperature. Studies of the crystal structure using x-ray diffraction by Nakafuku and Takemura (1) indicated a crystal structure similar to orthorhombic polyethylene whereas x-ray studies by Flack (2) indicated a monoclinic packing of planar zigzag chains. We have undertaken a study of the crystal structure of the high pressure (Form III) of polytetrafluoroethylene homopolymer as well as several copolymers containing randomly distributed hexafluoropropylene units.

704,981

PB85-129203 Not available NTIS
National Bureau of Standards, Washington, DC.

Viscosities and Glass Transitions in Liquids at High Pressures.
Final rept.
R. G. Munro, G. J. Piermarini, and S. Block. 1980, 18p
Pub. in Review of Physical Chemistry of Japan 50, p79-96 1980.

Keywords: *Viscosity, *Liquids, *Glass transition temperatures, *High pressure tests, Fluorescence, Reprints.

The study of the pressure dependence of the viscous properties of liquids, including glass transitions, is reviewed. An overview of the present status of both the theory of viscosity and the experimental techniques and results for high pressure viscometry is presented. Representative examples of several viscometers for high pressure applications are described briefly. A more detailed description of the diamond anvil pressure cell falling sphere viscometer is given. Viscosity data obtained by this method for several liquids are correlated with their glass transition pressures which are derived from ruby fluorescence line-broadening measurements.

704,982
PB85-129237 Not available NTIS
National Bureau of Standards, Washington, DC.
Impedance Spectroscopy Model for Electron-Transfer Reactions at an Electrode Solid Electrolyte Interface.
Final rept.
H. J. deBruin, and A. D. Franklin. 1981, 14p
Pub. in Jnl. of Electroanalytical Chemistry and Interfacial Electrochemistry 118, p405-418 1981.

Keywords: *Mathematical models, *Electron transfer, *Electrodes, *Solid electrolytes, Electrochemistry, Reaction kinetics, Chemical reactions, Reprints, *Impedance spectroscopy, Numerical solution.

Numerical calculations have been performed for a model for the frequency-dependence of the impedance of a diffusion-limited electrode on a solid electrolyte. Three circuit elements are connected in series in the model. Bulk charge transport is represented by a simple parallel R-C circuit and the diffusion process itself by a Warburg impedance. The possibility of a multistep redox reaction at the electrode-electrolyte interface is modeled by a string, in series, of parallel R-C networks, and the possibility of competing redox reactions by combining several of these series strings in parallel. The distributions of the elements in the series strings were represented by both Cole-Cole and normal distribution. Calculations were carried out for several such arrangements, varying the nature and width of the distributions and the number of parallel strings. It is found that these variations are reflected in subtle changes in the impedance data, and it is concluded that important kinetic information is contained in the sub-structure of the impedance spectra.

704,983
PB85-129245 Not available NTIS
National Bureau of Standards, Washington, DC.
Rotational-State and Spin-State Distributions - NO Thermally Desorbed from Ru(001).
Final rept.
R. R. Cavanagh, and D. S. King. 1981, 4p
Pub. in Physical Review Letters 47, n25 p1829-1832 1981.

Keywords: *Surface chemistry, *Molecular rotation, *Nitrogen oxide(NO), Fluorescence, Desorption, Ruthenium, Boltzmann equation, Thermal environments, Reprints, *Laser excited fluorescence.

Rotational state distributions in both spin manifolds of the ground electronic state of NO desorbed from single crystal Ru(001) via thermal heating in ultra-high vacuum have been measured using laser excited fluorescence techniques. NO molecular desorption proceeds from singly coordinated (i.e., atop) sites of the Ru basal plane between 435 and 475 K. The nascent population distribution for those states with less than 400 /cm of rotational energy (including spin) can be represented by a single Boltzmann factor, T sub (rot)=235 + or - 35 K, significantly lower than the surface temperature.

704,984
PB85-129260 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical and Transport Properties of the Drawn Cross-Linked Low Density Polyethylene (CLPE).
Final rept.
F. DeCandia, R. Russo, V. Vittoria, and A. Peterlin. 1982, 9p
Pub. in Jnl. of Polymer Science, Polymer Physics Edition 20, n2 p269-277 1982.

Keywords: *Polyethylene, *Mechanical properties, *Transport properties, Crosslinking, Density(Mass/volume), Elastic modulus, Drawing, Diffusion coefficients, Elastomers, Reprints, *Low density polyethylene.

The draw ratio dependence of the density p and the elastic modulus E, and the maximum draw ratio lambda of the CLPE are rather similar to the values obtained with the not crosslinked branched material with a similarly low density. Very much the same applies to the equilibrium concentration of the sorbed methylene chloride in the amorphous component, and the zero concentration diffusion coefficient D sub 0. The exponential concentration coefficient gamma sub D, however, even at the maximum draw ratio does not show any indication of the rapid increase which is so characteristic for the completion of the transformation from the lamellar to the fibrous structure. On the basis of this finding, one could understand the small deviations in the dependence of the mechanical properties between the cross-linked and the not cross-linked branched material. The segments between the crosslinks, much shorter than the free molecules, favor the formation of the intermicrofibrillar tie molecules which limit the drawability of the sample. But since they cannot be extended to the same length as the free molecules, they contribute less to the total fraction of tie molecules per amorphous layer and hence yield a smaller axial elastic modulus.

704,985
PB85-129302 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of 13C Chemical Shifts in Solids.
Final rept.
W. L. Earl, and D. L. Vanderhart. 1982, 20p
Pub. in Jnl. of Magnetic Resonance 48, n1 p35-54 1982.

Keywords: *Solids, *Isotopic labeling, Plastics, Reprints, *Chemical shifts(Nuclear magnetic resonance), *Carbon 13, Reference materials, Poly(Silane/dimethyl).

A pulse sequence and sample geometry which allows the measurement of (13)C chemical shifts of solid materials relative to liquid TMS are described. Using this technique, the chemical shifts of a series of common engineering plastics were measured and reported. A small number of candidate secondary shift reference materials have been considered and their chemical shifts measured. Most of these materials proved to be unsuitable for general (13)C shift references for differing reasons. The most promising standard investigated was polydimethylsilane. The measurement of chemical shifts in solid materials is slightly complicated by anisotropic magnetic properties and sensitivity to magic angle missetting when the material exhibits macroscopic orientation. These complications are discussed in detail and examples of misleading spectra are shown.

704,986
PB85-129351 Not available NTIS
National Bureau of Standards, Washington, DC.
Factor-Jump Thermogravimetry Applied to Polymer Degradations.
Final rept.
B. Dickens. 1981, 2p
Pub. in Polym. Prepr. 22, n1 p316-317 1981.

Keywords: *Polymers, *Degradation, *Thermogravimetry, Activation energy, Polystyrene, Polypropylene, Polyethylene, Plastics, Reprints.

The factor-jump method of thermogravimetry has been developed to study thermal degradations of polymers by continually measuring the activation energy of the degradation process. The method requires only one sample for these determinations and thus complicating effects arising from the use of two samples with differing thermal histories are avoided. Also, the effect of thermal history on the weight loss process can be studied. Preheating for longer than a few minutes at temperatures below the ultimate temperature of degradation produces small molecules which later volatize to give apparent activation energies of greater than 110 kcal/mole. Use of a chemically significant quantity such as the activation energy allows the estimation of the importance of physical effects such as diffusion in the weight-loss processes. Average activation energies are estimated from individual values using trimmed means and probability plot-type calculations. The method has been applied to the study of the degradations of PS, PE, and PP in vacuum and in slowly flowing N2.

704,987
PB85-129369 Not available NTIS
National Bureau of Standards, Washington, DC.
Specific Heat of Phenolic Resins.
Final rept.
S. S. Chang. 1983, 2p
Pub. in Polym. Prepr. 24, n2 p187-188 1983.

Keywords: *Phenols, *Specific heat, Polymers, Chemical reactions, Reviews, Reprints.

A review of specific heat investigations on phenolic resins and other crosslinked polymers are presented. The temperature range of investigations covered from cryogenic temperatures of 0.1 K through the normal useful range of about 500 K up to charred materials at 3000 K. Because of the variations in composition, as well as in the degree of crosslinking and curing, emphasis will be placed on the general characteristics of these materials. The thermal behavior of these crosslinked polymers at low temperatures is rather similar to that normally observed for glassy polymers. At high temperatures, thermal effects from chemical reactions may often interfere with the determination of the physical constants.

704,988
PB85-129393 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Packing In 15/7 Hexagonal Polytetraflouroethylene.
Final rept.
B. L. Farmer, and R. K. Eby. Aug 83, 2p
Pub. in Polym. Prepr. 24, n2 p421-422 Aug 83.

Keywords: *Crystal structure, X ray diffraction, X ray analysis, Fluorine organic compounds, Reprints, *Poly(ethylene/tetrafluoro), *Molecular conformation, Numerical solution.

Semiempirical energy calculations were used extensively in the elucidation of the crystalline structure of the low temperature phase (II) of polytetrafluoroethylene (PTFE) (1,2). The structure which emerged from x-ray diffraction analysis and energy minimization was a triclinic unit cell containing one left and one right-handed 54/25 helical PTFE molecule. The molecular packing could best be described as rows of like-handed molecules having setting angles (defined as the orientation of a specific CF2 group in a reference plane) increasing progressively with a 40 deg increment. The setting angle progressions in adjacent, opposite-handed molecular rows run in opposite directions.

704,989
PB85-130292
(Order as PB85-130078, PC **A99**/MF **A01**)
Stanford Univ., CA. Dept. of Physics.
Spectroscopy, Quantum Electrodynamics, and Elementary Particles: Precision Laser Spectroscopy.
T. W. Haensch. 1984, 5p
Included in Precision Measurement and Fundamental Constants II, p111-115 1984.

Keywords: *Quantum electrodynamics, *Fundamental constants, Doppler effect, *Laser spectroscopy, *Hydrogen atoms, *Deuterium atoms.

Precision laser spectroscopy of atomic hydrogen and deuterium will be reviewed. The Balmer-alpha line has been studied by Doppler-free saturated absorption spectroscopy, polarization spectroscopy, optical-radiofrequency double quantum spectroscopy, and by laser-quenching of a beam of metastable atoms. These experiments have led to an eightyfold improvement in the accuracy of the Rydberg constant. Two-photon spectroscopy of the 1S-2S transition has made possible an accurate measurement of the ground state Lamb shift, and further advances in resolution promise new stringent tests of quantum electrodynamic theory.

704,990
PB85-130300

(Order as PB85-130078, PC **A99**/MF **A01**)
Yale Univ., New Haven, CT. Dept. of Physics.
Atomic Beam, Linear, Single-Photon Measurement of the Rydberg Constant.
S. R. Amin, C. D. Caldwell, and W. Lichten. 1984, 6p
Included in Precision Measurement and Fundamental Constants II, p117-122 1984.

Keywords: *Fundamental constants, Atomic energy levels, Atomic beams, *Rydberg series, *Laser spectroscopy, *Hydrogen atoms, *Deuterium atoms.

The Rydberg constant has been measured to a standard error of one part in 10 to the 9th power for the first time by atomic beam, laser spectroscopy. The results are consistent with recent, less precise measurements.

704,991
PB85-130318
(Order as PB85-130078, PC **A99**/MF **A01**)
Michigan Univ., Ann Arbor. Dept. of Physics.
Current Work on Two Photon Excitation in a Hydrogen Beam for the Measurement of the Rydberg Constant and M(sub e)/M(sub p).
D. Shiner, and C. Wieman. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p123-125 1984.

Keywords: *Fundamental constants, Atomic energy levels, Excitation, Metastable state, *Rydberg series, *Hydrogen atoms, *Deuterium atoms, *Laser spectroscopy.

The authors have observed the two quantum 2S to 3S transition in a beam of hydrogen in the metastable 2S state. The transition was excited by 6563 A laser light plus a 315 MHz radio frequency field and is much narrower than the 2S to 2P single photon transition. The transition is detected by observing the increase in the number of metastable atoms which survive passage through the region containing the two fields. Work is underway to preceisely measure the transition energy and the shift between hydrogen and deuterium. These results will provide more precise values for the Rydberg constant and the electron to proton mass ratio.

704,992
PB85-130326
(Order as PB85-130078, PC **A99**/MF **A01**)
Harvard Univ., Cambridge, MA. Lyman Lab. of Physics.
Measurement of the 2 doublet P (3/2) - 2 doublet S (1/2) Fine-Structure Interval in Atomic Hydrogen.
K. A. Safinya, K. K. Chan, S. R. Lundeen, and F. M. Pipkin. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p127-130 1984.

Keywords: *Atomic beams, Atomic energy levels, *Hydrogen atoms, *Separated oscillatory fields, *Fine structure constant, Lamb shift.

A separated-microwave-oscillatory-field technique has been used in conjunction with a fast atomic-hydrogen beam to measure the 2 doublet P (3/2) - 2 doublet S (1/2) fine-structure interval in atomic hydrogen. The value obtained for the 2 doublet P (3/2) - 2 doublet S (1/2) fine-structure interval is 9911.117(41) MHz. This value is compared with other measurements of this fine structure interval and the potential precision obtainable in a more definitive measurement is discussed.

704,993
PB85-130334
(Order as PB85-130078, PC **A99**/MF **A01**)
Harvard Univ., Cambridge, MA. Lyman Lab. of Physics.
Measurement of the Lamb Shift in Hydrogen, eta = 2.
S. R. Lundeen, and F. M. Pipkin. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p131-133 1984.

Keywords: *Hydrogen, *Atomic beams, Quantum electrodynamics, Line width, *Lamb shift, *Hydrogen ions, *Fine structure, Separated oscillatory fields.

A measurement based on the fast atomic beam separated oscillatory field method of sub-natural linewidth spectroscopy gives for the Lamb shift in hydrogen: S (eta = 2) = 1057.845(9) MHz. The result is not in good agreement with theory.

704,994
PB85-130342
(Order as PB85-130078, PC **A99**/MF **A01**)
Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow. Inst. Atomnoi Energii.
Atomic Interferometer Method Measurement of the Lamb Shift in Hydrogen (eta = 2).
Y. L. Sokolov. 1984, 5p
Included in Precision Measurement and Fundamental Constants II, p135-139 1984.

Keywords: *Interferometers, *Lamb shift, *Hydrogen atoms, *Atomic interferometers.

The frequency of the (2S (1/2), F = 0) - (2P (1/2), F = 1) transition in the hydrogen atom has been measured by means of an atomic interferometer. The Lamb shift has been found to be S = 1057.8583 + or - 0.0022 MHz, where the uncertainty is the statistical standard deviation of a single observation.

704,995
PB85-130359
(Order as PB85-130078, PC **A99**/MF **A01**)
Harvard Univ., Cambridge, MA. Lyman Lab. of Physics.
Measurement of the 4 doublet S(1/2) - 4 doublet P(1/2) Lamb Shift in He(+1).
J. J. Bollinger, S. R. Lundeen, and F. M. Pipkin. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p141-144 1984.

Keywords: *Quantum electrodynamics, Ions, Atomic energy levels, Experimental design, *Lamb shift, *Helium ions, Separated oscillatory fields.

The separated oscillatory field technique is being used with a fast 120 keV He(+1) beam and a miniature microwave spectroscopy region to make a zero magnetic field measurement of the n = 4 Lamb shift interval in He(+1). The 4 doublet S(1/2) state population is monitored by observing its decay to the 2P state with a large solid angle VUV photoionization detector. With 10 minutes of counting time, the signal to noise ratio is sufficient to make a 100 ppm measurement of the line center. It is believed that with this signal to noise ratio the systematics can be well enough understood to determine the line center better than previous He(+1) Lamb shift measurements and test the Erickson and Mohr calculations of the Lamb shift.

704,996
PB85-130367
(Order as PB85-130078, PC **A99**/MF **A01**)
Bell Labs., Murray Hill, NJ.
Lamb Shift in the Hydrogenic Ion Cl(+16).
E. T. Nelson, O. R. Wood, C. K. N. Patel, M. Leventhal, and H. W. Kugel. 1984, 3p
Prepared in cooperation with Rutgers - The State Univ., Piscataway, NJ.
Included in Precision Measurement and Fundamental Constants II, p145-147 1984.

Keywords: Atomic energy levels, *Lamb shift, *Chlorine ions, *Laser spectroscopy.

The Cl(+16) n = 2 Lamb shift has been measured by resonant laser quenching of a fast (nu/c about 0.1) metastable beam. The result for the 2S(1/2) - 2P(1/2) splitting is 31.19(22)THz in agreement with the calculation of Mohr and with the series expansion in powers of (Z(alpha)).

704,997
PB85-130375
(Order as PB85-130078, PC **A99**/MF **A01**)
Yale Univ., New Haven, CT.
Helium Fine Structure and the Fine Structure Constant.
W. Frieze, E. A. Hinds, A. Kponou, V. W. Hughes, and F. M. J. Pichanick. 1984, 3p
Prepared in cooperation with Massachusetts Univ., Amherst.
Included in Precision Measurement and Fundamental Constants II, p149-151 1984.

Keywords: *Helium, *Fundamental constants, Quantum electrodynamics, Optical spectra, Microwave spectroscopy, Atomic energy levels, *Fine structure, *Fine structure constant.

A series of precision measurements have been made of the fine structure interval nu sub (JJ') in the 2 triplet P state of helium. These results are self-consistent and in good agreement with theory. Experiment and theory can be combined to produce an independent value for the fine structure constant 1/alpha = 137.036 13(11) (0.8 ppm), in good agreement with the more accurate value currently accepted 1/alpha = 137.035 963(15) (0.11 ppm).

704,998
PB85-130383
(Order as PB85-130078, PC **A99**/MF **A01**)
State Univ. of New York at Stony Brook. Dept. of Physics.
Preliminary Measurement of the J = 0 to J = 2 Fine Structure Interval in the 3 triplet P State of Helium.
M. Feldman, T. Breeden, L. DiMauro, T. Dong, and H. Metcalf. 1984, 5p
Included in Precision Measurement and Fundamental Constants II, p153-157 1984.

Keywords: *Helium, Atomic energy levels, Zeeman effect, Excitation, Fundamental constants, Nuclear magnetic resonance, *Fine structure.

The authors have made time resolved measurements of the level crossing signal from the J = M = 2, and the J = M = 0 sublevels of the 3 triplet P state of He near 2277 gauss. A thermal beam of He 2 triplet S metastables is excited by a pulse of 3889 A dye laser light and a temporal slice of the fluorescence at 90 degrees to the field is recorded by fast electronics as a function of field. This experiment has been carefully designed to minimize the effects of very many possible systematic errors. They have a S/N of about 15 in each of about 100 data sets (about 1 hour run time). The result has a statistical standard error of 1.4 ppm and a systematic uncertainty of about 1.4 ppm, resulting in a net uncertainty of 2 ppm. The distribution of the results is approximately a Gaussian of width 14 ppm and the average, corrected for field inhomogeneity, is 9695.013 kHz (NMR, H2O).

704,999
PB85-130391
(Order as PB85-130078, PC **A99**/MF **A01**)
Heidelberg Univ. (Germany, F.R.). Physikalisches Inst. (II).
Laser Microwave Precision Measurements of 2 triplet S(1) and 2 triplet P Term Splittings in Helium-Like Li(+1).
U. Koetz, J. Kowalski, R. Neumann, S. Noehte, and H. Suhr. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p159-162 1984.

Keywords: *Hyperfine structure, Atomic energy levels, Ions, *Lithium ions, *Laser spectroscopy.

The hyperfine structure (hfs) splittings of the metastable 1s2s triplet S(1) state of helium-like (6,7)Li(+1) have been measured with combined laser optical pumping and microwave resonance. A low energy Li(+1) ion beam, optically exicted by an intersecting laser beam, passed through a waveguide where radio frequency transitions were induced. The resulting population transfer between the hfs levels of the triplet S(1) was detected via the change of fluorescence light intensity from a second crossing region of laser light and ion beam located behind the waveguide. The magnetic hfs constants A (6Li(+1), 2 triplet S(1) and A (7Li(+1, 2 triplet S(1)) were extracted from the measurements and compared with theory. The hfs anomaly is in good agreement with the value obtained from the magnetic hfs constants of the atomic 2 doublet S1/2 ground states. In addition rf measurements of the 2 triplet P hfs have been performed.

705,000
PB85-130409
(Order as PB85-130078, PC **A99**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Center for Absolute Physical Quantities.
Optically Pumped Metastable Hydrogen Beam.
K. C. Harvey. 1984, 5p
Included in Precision Measurement and Fundamental Constants II, p163-167 1984.

Keywords: *Optical pumping, *Fundamental constants, *Atomic beams, Atomic energy levels, Metastable state, *Hydrogen atoms.

A beam source of atomic hydrogen is described which produces metastable atoms in the 2S1/2 state by optical pumping. An effusive beam of atomic hydrogen is generated in the ground state. The atoms pass in front of a VUV lamp producing Lyman-beta (1026 A) radiation. The atoms are excited to the 3p level and then cascade to the 2S1/2 state. The metastable atoms are measured by quenching them with an electric field and

detecting the emitted Lyman-alpha radiation. Beams with a flux of 10 to the 6th power atoms/sec were obtained. A metastable-beam effective temperature of 100 K was measured. In addition preliminary measurements of the transition from n = 9 to n = 20 in hydrogen using a Woods discharge are presented and directions for improvement are indicated.

705,001
PB85-130417
(Order as PB85-130078, PC **A99**/MF **A01**)
Ecole Normale Superieure, Paris (France). Lab. de Physique.
Precise Determination of the S and P Quantum Defects in Sodium and Cesium by Millimeter and Submillimeter Spectroscopy between Rydberg States.
P. Goy, J. M. Raimond, G. Vitrant, C. Fabre, and S. Haroche. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p169-172 1984.

Keywords: *Atomic beams, Quantum theory, Excitations, Millimeter waves, Submillimeter waves, *Fine structure, *Rydberg series, *Quantum defects, *Sodium atoms, *Cesium atoms.

Well-stabilized millimeter and submillimeter sources in the frequency range 50-500 GHz permit one to induce narrow transitions between Rydberg states of alkalis with the principal quantum numbers n in the range 23 < or = n < or = 41. The levels are prepared by laser excitation. Detection of the atomic levels is performed through the selective field ionization technique. Precise experimental values for quantum defects and fine structure intervals are reported for the S and P states in sodium and cesium. The hyperfine structure of Rydberg states n S1/2 and n P1/2 has been observed for the first time in cesium. The extension of these experiments with increased accuracy to the spectroscopy of hydrogen would provide a new way to determine the Rydberg constant in frequency units.

705,002
PB85-130425
(Order as PB85-130078, PC **A99**/MF **A01**)
Princeton Univ., NJ. Dept. of Mechanical and Aerospace Engineering.
New Method for Measuring the Fine Structure Constant Using Stark Spectroscopy.
M. G. Littman, and W. D. Phillips. 1984, 4p
Prepared in cooperation with National Bureau of Standards (NML), Gaithersburg, MD. Electrical Measurements and Standards Div.
Included in Precision Measurement and Fundamental Constants II, p173-176 1984.

Keywords: *Fundamental constants, *Stark effect, Excitation, Atomic energy levels, *Fine structure constant, *Hydrogen atoms, Rydberg series.

An experiment to determine a value for alpha, the fine structure constant, is proposed. The determination is to be based on a measurement of the Stark effect of hydrogen Rydberg states. Hydrogen atoms in a uniform field of known strength will be excited to Rydberg levels using intense tunable lasers. The presence of excited atoms will be detected using the sensitive technique of field ionization. A precise measurement of the linear energy shift of an extreme Stark state is to be made, and from this measurement, in conjunction with reported values of R(x), the Rydberg constant, and 2e/h, the Josephson frequency-voltage ratio, a value of alpha will be determined. The estimated accuracy of the determination is expected to be competitive with or better than the 0.11 ppm accuracy best non-QED determination of alpha.

705,003
PB85-130433
(Order as PB85-130078, PC **A99**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Electrical Measurements and Standards Div.
Time Resolved Sub-Natural Width Spectroscopy.
W. D. Phillips, and H. J. Metcalf. 1984, 4p
Prepared in cooperation with State Univ. of New York at Stony Brook. Dept. of Physics.
Included in Precision Measurement and Fundamental Constants II, p177-180 1984.

Keywords: *Line width, *Line spectra, *Mathematical models, Separated oscillatory fields.

A number of techniques exist in both practice and theory for achieving spectral signals narrower than the width imposed by the natural lifetime. The author examines a simple mathematical model for subnatural width spectroscopy, and identify two distinct characteristics of time resolved line narrowing. He discusses the conditions where line narrowing techniques may be valuable, and comments on some misconceptions concerning these techniques.

705,004
PB85-130441
(Order as PB85-130078, PC **A99**/MF **A01**)
Cornell Univ., Ithaca, NY. Center for Radiophysics and Space Research.
Spectroscopy of Atoms and Molecules in Gases: Corrections to the Doppler-Recoil Shift.
M. P. Haugan, and F. V. Kowalski. 1984, 4p
Prepared in cooperation with Colorado School of Mines, Golden. Dept. of Physics.
Included in Precision Measurement and Fundamental Constants II, p181-184 1984.

Keywords: *Doppler effect, *Atoms, *Molecules, *Gases, Electrodynamics, *Doppler and recoil effects, *High resolution molecular spectroscopy, Doppler broadening.

The authors analyze the excitation by a monochromatic plane electromagnetic wave of a two-level atom or molecule moving through a rarefied gas. This yields a prediction for the Doppler-recoil shift which differs significantly from the familiar formula derived by studying isolated atoms or molecules in vacuum. The difference arises from an interplay between the collective and individual particle responses of a gas to an electromagnetic wave and is of fundamental importance for high-resolution laser spectroscopy. They propose an experiment using saturation spectroscopy to observe sodium molecular transitions near the atomic D lines that could easily verify our prediction for the first order Doppler shift of spectral features due to atomic or molecular absorption in rarefied gases.

705,005
PB85-130532
(Order as PB85-130078, PC **A99**/MF **A01**)
Duke Univ., Durham, NC.
Measured g(sub J)-Factor Ratio of 4 sup He(+1) (1 doublet S(1/2)) and 4 sup He(+1) (2 triplet S(1)).
H. G. Robinson, and C. E. Johnson. 1984, 3p
Sponsored by National Science Foundation, Washington, DC. Prepared in cooperation with North Carolina State Univ. at Raleigh.
Included in Precision Measurement and Fundamental Constants II, p229-231 1984.

Keywords: *Helium, Optical pumping, Zeeman effect, Ions, Metastable state, *G factor, *Helium ions.

The g(sub J)-factor of the ground state hydrogen-like helium ion (4 sup He(+1)) relative to that of the 2 triplet S(1) state of helium (4 sup HC*) has been measured using a (87)Rb optical pumping technique. The linewidth budget for the 4 sup He(+1) Zeeman resonance shows the conspicuous absence of broadening due to charge exchange between the ion and ground state He even though the exchange rate is > 10 to the 7th power/s.

705,006
PB85-130557
(Order as PB85-130078, PC **A99**/MF **A01**)
Yale Univ., New Haven, CT. Josiah Willard Gibbs Research Labs.
Precision Exotic Atom Spectroscopy.
V. W. Hughes. 1984, 12p
Included in Precision Measurement and Fundamental Constants II, p237-248 1984.

Keywords: *Atomic spectroscopy, Muonium, Quantum electrodynamics, Positronium.

Precision measurements by microwave or laser spectroscopy techniques of the energy levels of exotic atoms containing particles such as positrons, muons, or pions not present in ordinary atoms allow the determination of the fundamental constants associated with these so-called exotic but basic particles. Moreover, the simplicity of some of these atoms, such as positronium (e(+)e(-)) and muonium (mu(+)e(-)), which consist only of structureless leptons, allows precise tests of quantum electrodynamics which is basic to our understanding of many of the fundamental constants, especially the fine-structure constant, alpha. This paper reviews recent work and work in progress on positronium, muonium, and simple muonic atoms relevant to the precision measurement-fundamental constants field.

705,007
PB85-130581
(Order as PB85-130078, PC **A99**/MF **A01**)
National Physical Lab., Teddington (England).
Gas Constant, X-ray Interferometry, Nuclidic Masses, Other Constants, and Uncertainty Assignment: Methods for the Determination of the Gas Constant.
A. R. Colclough. 1984, 13p
Included in Precision Measurement and Fundamental Constants II, p263-275 1984.

Keywords: *Fundamental constants, *Ideal gas law, Reviews, Boltzmann equation.

Following a brief discussion of the role of the gas constant in physics, a review is made of the possible methods for its experimental determination and of values obtained in the past by direct measurements or by inference from other work. Four practicable methods by which the gas constant might be accurately determined are cosidered. These are (a) the conventional method of the limiting density of a gas based on the virial equation of state, (b) the method of sound velocity measurement in a gas depending upon the normal law for the speed of sound in a compressible fluid together with the virial equation, (c) determination via the Boltzmann constant and Avogadro's constant by the measurement of the electrical noise in a resistance invoking Nyquist's formula, and (d) determination via the Stefan-Boltzmann and other constants by the measurement of the power radiated by a blackbody cavity relying on the Stefan-Boltzmann law. The four methods have very different sources of systematic error. The analysis of the four methods suggests that there is scope for a useful reduction in the uncertainty of the gas and the other thermal constants.

705,008
PB85-130599
(Order as PB85-130078, PC **A99**/MF **A01**)
Virginia Military Inst., Lexington. Dept. of Physics.
Ultrasonic Determination of the Gas Constant.
W. C. Sauder. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p277-279 1984.

Keywords: *Fundamental constants, *Ideal gas law, *Ultrasonic tests, *Interferometry.

Progress on a gas constant determination by means of ultrasonic interferometry is reported. The acoustic interferometer is a two arm instrument designed to operate in the range 0.1-1.0 MHz. An approximately half-scale model has been constructed in order to establish the data taking algorithm as well as to investigate aberrations. Electrostatic transducers have been designed for the experiment that will allow characterization of the acoustic field, a necessary step in extracting wave length measurements from the fringe data.

705,009
PB85-130607
(Order as PB85-130078, PC **A99**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Spherical Acoustic Resonators: Promising Tools for Thermometry and Measurement of the Gas Constant.
M. R. Moldover, and J. B. Mehl. 1984, 6p
Included in Precision Measurement and Fundamental Constants II, p281-286 1984.

Keywords: *Ideal gas law, *Fundamental constants, *Temperature measurement, Feasibility, *Acoustic resonators.

The authors report progress in our study of the feasibility of using spherical acoustic resonators for primary thermometry and for measurement of the gas constant. Prototype resonators of differing sizes and materials have been tested.

705,010
PB85-130615
(Order as PB85-130078, PC **A99**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Measurements and Standards Div.
Proposed Method for the Determination of the Molar Gas Constant, R.
L. A. Guildner, and M. L. Reilly. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p287-290 1984.

Keywords: *Fundamental constants, *Ideal gas law, Equations of state, *Molar gas constant.

A new, accurate measurement of the molar gas constant, R, is proposed. The volume occupied by 2 g of neon gas at 273.15 K is to be determined at pressure of 135, 81 and 40 kPa. An error analysis shows that the derived value of R should have a total uncertainty of 2.9 ppm at the 99% confidence level.

705,011
PB85-130706
(Order as PB85-130078, PC **A99**/MF **A01**)
Minnesota Univ., Minneapolis. School of Physics and Astronomy.
Measurement of Atomic Masses by Mass Spectroscopic Methods and a Role for Atomic Masses in the Determination of the Fundamental Constants.
W. H. Johnson. 1984, 10p
Included in Precision Measurement and Fundamental Constants II, p335-344 1984.

Keywords: *Atomic mass, *Fundamental constants, Mass spectrometers, Precision, Measurement.

A description of atomic mass determinations is given with the emphasis on mass spectroscopic methods. A review of current techniques is made which includes conventional mass spectrometers and radio frequency instruments. Precision attained in these measurements is discussed together with the possibilities of improvements in precision. Finally, the use of atomic mass measurements as input data for the determination of fundamental constants is considered.

705,012
PB85-134005 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamic Anomalies Near the Liquid-Vapor Critical Point: A Review of Experiments.
Final rept.
M. R. Moldover. 1982, 32p
Pub. in NATO Adv. Study Inst. Ser. B 72, Phase Transitions, ;p63-94 1982.

Keywords: *Critical point, *Thermodynamic properties, *Fluids, Review, Liquid phases, Vapor phases, Specific heat, Equations of state, Phase transformation, Reprints.

Recent measurements of the thermodynamic properties of various fluids near the liquid-vapor critical point are described. Among the properties considered are: the liquid and vapor densities at coexistence, the vapor pressure, the equation-of-state, the specific heat, and the density-vs-height profile that develops extremely close to the critical temperature because of the fluids compression under its own weight. The experimental results are interpreted in the context of recent theoretical developments. A particularly important prediction based on the renormalization group is: sufficiently close to the critical point, the functional form of the singular part of the thermodynamic potential for all fluids is identical with the functional form of the thermodynamic potential for the Landau-Ginsberg-Wilson (LGW) hamiltonian with a scalar order parameter in three spatial dimensions. The experimental results are consistent with this prediction, provided the pressure (or the pressure divided by the temperature) is chosen as the potential and analytic functions of temperature and chemical potential are used as its variables. Existing experiments can not clearly resolve the small differences between the numerical values for critical exponents calculated for the LGW hamiltonian using field theory techniques and the exponents calculated for the three dimensional spin 1/2 Ising model using high temperature series expansions. Straightforward extensions of particular experimental techniques will be able to resolve these small differences.

705,013
PB85-135432 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Multi-Photon Infrared Laser-Induced Decomposition of Acetone-D6.
Final rept.
W. Braun, and J. R. McNesby. 1980, 7p
Pub. in Jnl. of Physical Chemistry 84, n20 p2521-2527 1980.

Keywords: *Acetone, *Decomposition reactions, Infrared spectroscopy, Binary systems(Materials), Reaction kinetics, Chemical reactions, Pyrolysis, Reprints, *Laser spectroscopy, *Chemical reaction mechanism, *Laser induced reactions.

The focused IR laser induced decomposition of acetone-d6 has been studied to determine if the classical mechanism for the thermal decomposition can explain the distribution of reaction products. Binary mixtures of acetone-d6 with acetone, ethane, (CH3)2N2 and cyclopropane have been studied for product composition and isotopic distribution in the products. It is argued on the basis of these observations that ketene is not produced and a classical acetone chain mechanism cannot explain the facts. The material balance and the production of hydrogen and ethylene as major products are best explained on the basis of total decomposition of acetone-d6 near the focus. This is followed by a rapid temperature rise resulting from recombination of CD3. The chemistry that follows is simply the thermal decomposition of ethane at temperatures approaching 1900 K.

705,014
PB85-135465 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
X-ray Spectra of Molecular Gases.
Final rept.
R. E. LaVilla. 1982, 14p
Pub. in Advances in X-Ray Spectroscopy: A Reference Text in Honour of Professor Y. Cauchois, Chapter 14 p240-253 1982.

Keywords: *X ray spectra, *Gases, Absorption spectra, Excitation, Reprints, *Free molecules.

The X-ray spectra of free molecules is a very rich source of spectral data and complements the UPS and XPS data in the elucidation of molecular electronic structure and the dynamics of core excitation process. The evolving features to date of molecular X-ray spectra are summarized and briefly discussed. Also indicated are some directions where further work should be directed.

705,015
PB85-135507 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamic Properties for Fluid Water.
Final rept.
L. Haar, J. Gallagher, and G. S. Kell. 1980, 14p
Pub. in Proceedings of International Conference on Properties of Steam (9th), Munich, West Germany, 1979, p69-82 1980.

Keywords: *Thermodynamic properties, *Water, Fluids, Equations of state, Density(Mass/volume).

A fundamental equation is presented for the thermodynamic behavior of steam in the range 0-900C, 0-1000 MPa. The equation contains newly calculated ideal-gas properties; a reference function which becomes accurate for all values of density at high temperatures and for the high density region elsewhere; and deviation functions which provide for an accurate fit to PVT and coloric data everywhere. Detailed comparisons are drawn with the best experimental data are presented and conclusions are drawn on the consistency of the various data sets.

705,016
PB85-135549 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron Cloud Points and Concentration Fluctuations of Polymer Blends.
Final rept.
H. Yang, M. Shibayama, R. S. Stein, and C. C. Han. 1984, 7p
Pub. in Polymer Bulletin 12, p7-13 1984.

Keywords: *Polymers, Polystyrene, Concentration(Composition), Reprints, *Small angle scattering, *Neutron cloud points, Poly(ether/methylviny!).

Cloud points were observed in the blends of deuterated polystyrene (PSD) and hydrogeneous poly (vinyl methyl ether) (PVME) by means of temperature scanning Small Angle Neutron Scattering (SANS) technique. The scattering function in the miscible region can be described by the random phase approximation results calculated by de Gennes. This scattering function can also be expressed in the Ornstein-Zernike form in the small q region. A correlation length and spinodal point can then be determined from this critical fluctuation approach.

705,017
PB85-135929 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 89, Number 3, May-June 1984.
1984, 71p
See also PB85-135937 through PB85-135960 and PB85-115426. Also available from Supt. of Docs as SN003-003-72087-9. Library of Congress catalog card no. 63-37059.

Keywords: *Research, Deuterium, Thermodynamic properties, Electric current meters, Faraday effect, Activity coefficients, Osmosis, Solubility, Hydrocarbons, Liquid hydrogen, Solid hydrogen, Partition coefficients.

The Journal of Research of the National Bureau of Standards features advances in measurement methodology and analyses consistent with the NBS responsibility as the nation's measurement science laboratory. It includes reports on instrumentation for making accurate and precise measurements in fields of physical science and engineering, as well as the mathematical models of phenomena which enable the predictive determination of information in regions where measurements may be absent. Papers on critical data, calibration techniques, quality assurance programs, and well characterized reference materials reflect NBS programs in these areas. They include: pressure-volume-temperature relationships for normal deuterium between 18.7 and 21.0 K; an equilibrium model for the calculation of activity and osmotic coefficients in aqueous solution; an absolute electric current probe based on the faraday effect, and a head-space method for measuring activity coefficients, partition coefficients, and solubilities of hydrocarbons in saline solutions.

705,018
PB85-135945
(Order as PB85-135929, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Equilibrium Model for the Calculation of Activity and Osmotic Coefficients in Aqueous Solutions.
R. N. Goldberg. 13 Mar 84, 13p
Included in Jnl. of Research of the National Bureau of Standards, v89 n3 p251-263 May-Jun 84.

Keywords: *Chemical equilibrium, *Activity coefficients, *Osmosis, *Mathematical models, Ions, Solutions, Gibbs free energy, Numerical solution, Procedures.

A procedure is described for the calculation of activity and osmotic coefficients which is based upon a knowledge of the equilibria in solution and assumed single-ion activity coefficients. The procedure permits one to introduce chemical equilibria of various types (ion-pairing, complexation, hydration, and hydrolysis) into a model which can be used to calculate values of the excess Gibbs energy and the activity and osmotic coefficients. Both the Debye-Huckel theory and Pitzer's expression are used to calculate the electrostatic contribution to the single-ion activity coefficients. Calculations have been performed on aqueous sulfuric acid, acetic acid, hydrofluoric acid, cadmium chloride, copper sulfate, and sodium carbonate. Properties which have been calculated are the excess Gibbs energy, the osmotic coefficient, the mean ionic activity coefficient, and Frank's single-ion activity coefficient function. Agreement between calculated and measured properties has been obtained up to molalities of about 1.0 mol/kg.

705,019
PB85-135960
(Order as PB85-135929, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Head-Space Method for Measuring Activity Coefficients, Partition Coefficients, and Solubilities of Hydrocarbons in Saline Solutions.
S. P. Wasik, F. P. Schwarz, Y. B. Tewari, M. M. Miller, and J. H. Purnell. 2 Feb 84, 5p
Prepared in cooperation with University Coll. of Swansea (Wales).
Included in Jnl. of Research of the National Bureau of Standards, v89 n3 p273-277 May-Jun 84.

Keywords: *Activity coefficients, *Solubility, *Hydrocarbons, *Laboratory equipment, *Chemical equilibrium, Solutions, Salinity, Vapor phases, Liquid phases, Gas chromatography, *Partition coefficients.

An apparatus is described which measures the equilibrium distribution of a hydrocarbon between a gas and aqueous phase. Soluble hydrocarbons are extracted from an aqueous salt solution by very small bubbles of hydrogen generated electrolytically from a gold elec-

trode located at the bottom of a cylindrical cell. The partition coefficient is determined from the volume of the aqueous solution and the solute concentration in the head-space after a measured volume of hydrogen has bubbled through the cell. The concentration of the solute in the head-space is measured by gas chromatography. The observed distribution is supplemented by vapor pressure and molar volume data and can be used to calculate the solubility and the activity coefficient of the aqueous 0.5 M NaCl at 25 C were measured by this method.

705,020
PB85-136802 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rh I Isoelectronic Sequence: Analysis of the 4d(sup 9)-4d(sup 8) 5p Transition Array in La XIII.
Final rept.
J. L. Tech, V. Kaufman, and J. Sugar. Mar 84, 4p
Pub. in Jnl. of the Optical Society of America B 1, n1 p41-44 Mar 84.

Keywords: *Lanthanum, *Ultraviolet spectroscopy, Hartree-Fock approximation, Eigenvectors, Least squares method, Reprints, *Isoelectronic sequences.

The spectrum of twelve-times ionized lanthanum (La XIII) was produced by a triggered, high-voltage, vacuum spark discharge and photographed by using the 10.7-m grazing-incidence spectrograph at the National Bureau of Standards. These intensities are in good qualitative agreement with the relative intensities visually estimated from the spectrograms. Least-squares-fitted values for the energy parameters and their ratios to the calculated Hartree-Fock values are given.

705,021
PB85-137438 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Discussion of Electron Cross Sections for Transport Calculations.
Final rept.
M. J. Berger. May 84, 8p
Sponsored in part by Department of Energy, Washington, DC. and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of Workshop on Electronic and Ionic Collision Cross Sections Needed in the Modeling of Radiation Interactions with Matter, Argonne, IL., December 6-8, 1983, ANL-84-28, p1-8 1984.

Keywords: *Transport properties, *Mathematical models, Ionization, Excitation, *Biological samples, *Electron cross sections.

This paper deals with selected aspects of the cross sections needed as input for transport calculations and for the modeling of radiation effects in biological materials. Attention is centered mainly on the cross sections for inelastic interactions between electrons and water molecules and the use of these cross sections for the calculation of energy degradation spectra and of ionization and excitation yields.

705,022
PB85-137487 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
4 doublet s 4p (sup 2)p Intervals in the Ga Isoelectronic Sequence from Rb(+6) to In(+18).
Final rept.
L. J. Curtis, J. Reader, S. Goldsmith, B. Denne, and E. Hinnov. Apr 84, 3p
Pub. in Physical Review A 29, n4 p2248-2250 Apr 84.

Keywords: *Atomic energy levels, Molybdenum, Niobium, Palladium, Rhodium, Rubidium, Ruthenum, Silver, Strontium, Yttrium, Zirconium, Reprints, *Fine structure, *Isoelectronic sequences.

Measurements of the fine-structure splitting of the 4 doublet s 4p (sup 2)P ground-state term of the gallium isoelectronic sequence using low-inductance sparks, laser-produced plasmas, and tokamak plasma sources are presented. The observations are in excellent agreement with semiempirical predictions using screening parametrizations, and permit a refinement of these predictions.

705,023
PB85-137495 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Molecular Dynamics Study of Collision Induced Absorption in Rare Gas Liquid Mixtures.
Final rept.
G. Birnbaum, and R. D. Mountain. 1 Sep 84, 5p
Pub. in Jnl. of Chemical Physics 81, n5 p2347-2351, 1 Sep 84.

Keywords: *Infrared spectroscopy, *Absorption spectra, *Rare gases, Absorption, Dipole moments, Mixtures, Argon, Neon, Reprints, *Molecular dynamics.

Molecular dynamics simulation of a rare gas liquid mixture has been used to investigate the connections of the collision induced absorption spectrum and the forces acting between liquid particles. The authors find that the force law and induced dipole moments determined for low density gases are incapable of producing collision induced absorption spectra which are in qualitative agreement with the experimentally observed low frequency part of the spectra for Ar-Ne mixtures. Qualitative agreement is obtained if the gas phase dipole is modified so that the zero of the dipole moment roughly matches the zero of the force between unlike species. This represents a substantial change in the gas phase dipole. The implications of these results are briefly discussed.

705,024
PB85-137503 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Random Systems of Particles: An Approach to Polydisperse Systems.
Final rept.
J. J. Salacuse. 1 Sep 84, 14p
Pub. in Jnl. of Chemical Physics 81, n5 p2468-2481, 1 Sep 84.

Keywords: *Particles, *Random functions, *Statically determine structures, Thermodynamics, Equilibrium methods, Probability theory, Reprints, *Phase equilibrium.

The concept of a random system of particles is introduced and a probabilistic description of these types of systems is given. In addition the relationship of random systems to polydisperse systems is explored. The random systems approach to polydisperse systems is a particle as opposed to a continuum type theory and yields a number of results concerning the particle structure of polydisperse systems as well as a statistical mechanical description of polydisperse systems. As an illustration of this the thermodynamic properties of a polydisperse system of hard rods are obtained. Phase equilibrium in polydisperse systems is considered in the context of the random systems approach. A set of equilibrium conditions are obtained and shown to be equivalent to conditions previously given.

705,025
PB85-137693 PC **A06**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD.
Compiled Thermodynamic Data Sources for Aqueous and Biochemical Systems: An Annotated Bibliography (1930-1983).
Final rept.
R. N. Goldberg. Dec 84, 110p NBS/SP-685
Sponsored in part by American Inst. of Chemical Engineers, New York. Also available from Supt. of Docs as SN003-003-02606-9. Library of Congress catalog card no. 84-601131.

Keywords: *Thermodynamic properties, *Biochemistry, *Bibliographies, Gibbs free energy, Chemical equilibrium, Enthalpy, Specific heat, Entropy, Sources, Transport properties, Mechanical properties, Review, Thermochemistry, Water, *Aqueous systems.

This is a selected and annotated bibliography of sources of compiled and evaluated chemical thermodynamic data relevant to biochemical and aqueous systems. The principal thermodynamic properties considered herein are Gibbs energy and equilibrium data, enthalpies of formation and reaction, heat capacities and entropies, and the corresponding partial molar and excess properties. Derived quantities used in calculating the above are also included. Transport and mechanical data have also been identified to a lesser degree. Included in the annotations to the data sources are brief descriptions of the types of properties tabulated, the classes of materials dealt with, and the degree of completeness of the compilations.

705,026
PB85-137776 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurements of the Viscosity of Compressed Gaseous and Liquid Methane + Ethane Mixtures.
Final rept.
D. E. Diller. Apr 84, 7p
Pub. in Jnl. of Chemical and Engineering Data 29, n2 p215-221 Apr 84.

Keywords: *Viscosity, *Methane, *Ethane, Mixtures, Density(Mass/volume), Temperatures, Reprints, PVT properties.

The shear viscosity coefficients of three compressed gaseous and liquid methane + ethane mixtures have been measured at temperatures between 100 and 300 K and at pressures to about 30 MPa (4350 psia) with a piezoelectric quartz crystal viscometer. The precision of the measurements ranges from 0.5 to about 2 percent, depending on the (density x viscosity) range. The experimental error is estimated to be less than 2 percent in most cases. The measurements have been compared with other data, and with a multiparameter extended corresponding states model, previously proposed for calculating the viscosities of fluid mixtures throughout a wide range of PVT states.

705,027
PB85-137784 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of the Shift of Rydberg Energy Levels Induced by Blackbody Radiation.
Final rept.
L. Hollberg, and J. L. Hall. Jul 84, 4p
Grants N00014-77-C-0656, NSF-PHY82-00805
Pub. in Physical Review Letters 53, n3 p230-233 Jul 84.

Keywords: *Atomic energy levels, *Blackbody radiation, Reprints, *Rydberg series, *Laser spectroscopy.

Using high precision laser spectroscopic techniques we have measured the predicted shift of Rydberg energy levels induced by blackbody radiation. Fractional shifts of about 2 x 10 to the -12th power are consistent with theoretical predictions.

705,028
PB85-137842 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 13, Number 3, 1984.
Quarterly rept.
c1984, 328p
See also PB85-137859 through PB85-137909 and PB85-116200. Sponsored by National Bureau of Standards, Gaithersburg, MD. Prepared in cooperation with American Inst. of Physics, New York.

Keywords: *Chemical properties, *Physical properties, Stark effect, Spectral lines, Ions, Atoms, Deuterium, Temperature, Heats of formation, Molecules, Isotope separation, Chemical analysis, Thermal conductivity, Water, *Reference materials.

Contents:
- Experimental stark widths and shifts for spectral lines of neutral atoms (a critical review of selected data for the period 1976 to 1982);
- Experimental stark widths and shifts for spectral lines of positive ions (a critical review and tabulation of selected data for the period 1976 to 1982);
- A review of deuterium triple-point temperatures;
- Evaluated gas phase basicities and proton affinities of molecules;
- heats of formation of protonated molecules;
- Isotopic abundances and atomic weights of the elements;
- Representative equations for the thermal conductivity of water substance.

705,029
PB85-137859 Not available NTIS
Institute of Physics, Belgrade (Yugoslavia).
Experimental Stark Widths and Shifts for Spectral Lines of Neutral Atoms (A Critical Review of Selected Data for the Period 1976 to 1982).
N. Konjevic, M. S. Dimitrijevic, and W. L. Wiese.
c1984, 29p
Prepared in cooperation with National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Included in Jnl. of Physical and Chemical Reference Data, v13 n3 p619-647 1984.

Keywords: *Stark effects, *Atoms, *Spectral lines, Experimental design, Reviews, Tables(Data), Line width, *Reference materials.

A critical review of all experimental data on Stark widths and shifts of spectral lines of neutral elements published during the period 1976-1982 has been carried out. This work represents an extension and

update of an earlier review which covered the period before 1976. Data tables containing the selected experimental Stark broadening parameters are presented together with estimated accuracies. Comparisons with comprehensive calculations based on the semiclassical theory are made whenever possible.

705,030
PB85-137867 Not available NTIS
Institute of Physics, Belgrade (Yugoslavia).
Experimental Stark Widths and Shifts for Spectral Lines of Positive Ions (A Critical Review and Tabulation of Selected Data for the Period 1976 to 1982).
N. Konjevic, M. S. Dimitrijevic, and W. L. Wiese. c1984, 38p
Prepared in cooperation with National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Included in Jnl. of Physical and Chemical Reference Data, v13 n3 p649-686 1984.

Keywords: *Stark effect, *Ions, *Spectral lines, Experimental design, Line width, Reviews, Tables(Data), *Reference materials.

A new critical review of the available experimental data on the Stark widths and shifts for lines of non-hdrogenic ionized spectra has been carried out which covers the period from 1976 to the present and represents a continuation of an earlier critical review. The relevant literature, compiled by the NBS Data Center on Atomic Lines Shapes and Shifts as well as by the present authors, was critically evaluated, and data tables containing the selected experimental Stark broadening parameters have been assembled. The data are arranged according to spectra and elements and these are presented in alphabetical order. The accuracy of the experimental data is estimated on the basis of guidelines developed during the previous review. Comparisons with theoretical results are made whenever possible since the comparison with theory has often been a principal motivation for the experiments.

705,031
PB85-137875 Not available NTIS
Los Alamos National Lab., NM.
Review of Deuterium Triple-Point Temperatures.
L. A. Schwalbe, and E. R. Grilly. c1984, 7p
Included in Jnl. of Physical and Chemical Reference Data, v13 n3 p687-693 1984.

Keywords: *Deuterium, Temperatures, Reviews, *Reference materials.

A review is presented of the existing measurements of the triple-point temperatures T sub tp of deuterium. All data are adjusted to a common temperature scale, and error limits are proposed where none was provided in the source publications. The effect of sample contamination are also considered. Impurity corrections, based on estimates from vapor-pressure measurements, are applied to the results.

705,032
PB85-137883 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Chemical Physics.
Evaluated Gas Phase Basicities and Proton Affinities of Molecules; Heats of Formation of Protonated Molecules.
S. G. Lias, J. F. Liebman, and R. D. Levin. c1984, 114p
Prepared in cooperation with Maryland Univ. Baltimore County, Catonsville. Dept. of Chemistry.
Included in Jnl. of Physical and Chemical Reference Data, v13 n3 p695-808 1984.

Keywords: *Heats of formation, *Molecules, Protons, Vapor phases, Tables(Data), *Ion molecule interactions, *Proton affinities, *Reference materials.

The available data on gas phase basicities and proton affinities of molecules are compiled and evaluated. Tables giving the molecules ordered (1) according to proton affinity and (2) according to empirical formula, sorted alphabetically are provided. The heats of formation of the molecules and the corresponding protonated species are also listed.

705,033
PB85-137891 Not available NTIS
Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements.
Isotopic Abundances and Atomic Weights of the Elements.
P. De Bievre, M. Gallet, N. E. Holden, and I. L. Barnes. c1984, 84p
Prepared in cooperation with National Nuclear Data Center, Upton, NY., and National Bureau of Standards (NML), Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v13 n3 p809-891 1984.

Keywords: *Atomic weights, *Chemical elements, *Isotope separation, Mass spectroscopy, Tables(Data), *Reference materials.

A large number of measurements describing the isotopic composition of the elements using a variety of analytical methods have been reported since the discovery of the first isotope in 1912. During the past several decades, however, mass spectrometric methods have been used, almost exclusively, to determine the isotopic composition, and thus the atomic weights, of the elements. This evaluated compilation reports the literature references for all complete mass spectrometric measurements published during the period 1920 through 1983. Also given are the isotopic compositions, the isotope ratios, the atomic weights calculated from the data, the appropriate nuclidic masses and an evaluation of the errors of the measurements. For each polynuclidic element, a best measurement has been selected.

705,034
PB85-137909 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Representative Equations for the Thermal Conductivity of Water Substance.
J. V. Sengers, J. T. R. Watson, R. S. Basu, B. Kamgar-Parsi, and R. C. Hendricks. c1984, 41p
Prepared in cooperation with National Engineering Lab., East Kilbride (Scotland), Maryland Univ., College Park. Inst. for Physical Science and Technology and National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.
Included in Jnl. of Physical and Chemical Reference Data, v13 n3 p893-933 1984.

Keywords: *Thermal conductivity, *Water, *Transport properties, Water vapor, Tables(Data), *Reference materials, Numerical solution.

The paper documents the development of the available information for the thermal conductivity of fluid H2O since the promulgation of the first international formulation for the transport properties of water substance in 1964. As a result of this development, the International Association for the Properties of Steam has adopted new recommended interpolating equations for the thermal conductivity of fluid H2O at pressures up to 100 MPa and at temperatures up to 800 C. These new international equations are discussed.

705,035
PB85-139988 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Physical Basis for Piezoelectricity in PVDF.
Final rept.
M. G. Broadhurst, and G. T. Davis. 1984, 11p
Pub. in Ferroelectrics 60, p3-13 1984.

Keywords: *Crystals, *Molecular structures, *Elastic properties, *Piezoelectricity, Electrodes, Dipole moments, Reviews, Transducers, Polymers, Physical properties, Reprints, *Semicrystalline polymers.

The molecular and bulk structures of PVDF and related semicrystaline polymers are reviewed, and the effects of processing to make transducer films is discussed. A novel way of analyzing the elastic and piezoelectric constant data is introduced. The results of the analysis are shown to support the conclusion that thickness changes contribute about 2/3 of the piezoelectric activity. An increase in thickness decreases the charge on the electrodes. The probable mechanism is simply the motion of the electrodes in the fields of the constant dipole moments of the crystals. The remaining 1/3 of the activity is attributed to changes in the film's dipole moment at constant thickness. Strains in the orientation direction of the film increase the charge on the surface while strains in the plane of the film normal to the orientation direction decrease it. Eight separate possible contributions to the change in moment are discussed, and qualitative evaluations of their importance are given.

705,036
PB85-140267 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Selfconsistent Eikonal Treatment of Diabatic Rearrangement: Model H(+) + H2 Calculations.
Final rept.
J. A. Olson, and D. A. Micha. Mar 84, 13p
Pub. in Jnl. of Chemical Physics 80, n6 p2602-2614 Mar 84.

Keywords: *Diatomic molecules, *Electronic transfer, *Hydrogen, Equations of motion, Comparison, Mathematical models, Reprints, *Ion molecule interactions, *Eikonal approximation, *Hydrogen ions, Numerical solution.

An eikonal treatment of nonadiabatic reactions, in which nuclear positions and moments are selfconsistently coupled to electronic transition amplitudes in a Hamiltonian formalism, is applied to H(+1) + H2 collisions where both electron transfer and nuclear rearrangement may occur. The approach is based on the diabatic electronic representation and uses potential energy surfaces and momentum couplings obtained within the method of diatomics-in-molecules. Equations of motion are obtained for hyperspherical coordinates in a model collinear treatment. Calculations carried out at collision energies 1 eV above the n = 4 threshold of H2 illustrate reactive and nonreactive processes, electron transfer and translational-vibrational energy transfer. Results for total electron transfer probabilities are compared with other calculations within the same model.

705,037
PB85-140309 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interfacial-Tension Theory of Low and High Molecular-Weight Liquid-Mixtures.
Final rept.
C. I. Poser, and I. C. Sanchez. 1981, 10p
Pub. in Macromolecules 14, n2 p361-370 1981.

Keywords: *Binary systems(Materials), *Fluids, *Van der Waals equation, *Polymers, *Vapor phases, Equations of state, Interfaces, Surface properties, Interfacial tensions, Reprints, Compressible lattice theory, Cahn-Hilliard theory.

A generalized van der Waals or density gradient theory of interfaces has been combined with a compressible lattice theory of homogeneous fluid mixtures. Binary liquid-vapor and liquid-liquid systems are treated. For non-polar low molecular weight mixtures, liquid-vapor tensions are calculated as a function of composition with an error of less than 5%. These calculations involve no adjustable parameters; all required parameters are determined from pure component properties. For polymer solutions, it is usually necessary to introduce an adjustable interaction parameter to accurately correlate liquid-vapor tensions. Approximate equations are a function of a single interaction parameter; when this parameter is chosen to match experimental tensions, interfacial thicknesses of 1 to 5 nm are obtained. To assess the importance of compressibility effects, the interaction parameter can be chosen so that the heat of mixing is zero for an incompressible system. This 'pure compressibility approximation' works well for polymer pairs with relatively low interfacial tensions. The most serious deficiency of the theory is that intramolecular correlational effects present in long polymer chains are only crudely approximated.

705,038
PB85-140317 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Water Upon the Critical Points of Carbon Dioxide and Ethane.
Final rept.
G. Morrison. 1981, 4p
Pub. in Jnl. of Physical Chemistry 85, n7 p759-761, 2 Apr 81.

Keywords: *Critical point, *Carbon dioxide, *Ethane, *Phase diagrams, Water, Reprints.

The effect of water upon the critical points of carbon dioxide and ethane has been measured. The critical temperature for CO2 is raised 0.372K; the critical locus ends at x(H2O) = .0011. The critical temperature is lowered 0.022K; the critical locus ends at x(H2O) = .00055.

705,039
PB85-140341 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Fourier Transform Infrared Study of the Gas-Phase Reactions of Ozone with Chloroethylenes. Detection of Peroxyformic Acid.
Final rept.
H. Niki, P. D. Maker, C. M. Savage, L. P. Breitenbach, R. I. Martinez, and J. T. Herron. 1982, 4p
Pub. in Jnl. of Physical Chemistry 86, n10 p1858-1861 1982

Keywords: *Infrared spectroscopy, Vapor phases, Chemical reactions, Ozone, Vinyl chloride, Reprints, *Fourier transform spectroscopy, *Formic acid/(peroxy-ester).

Using the FTIR spectroscopic method, peroxyformic acid was identified among the products formed in the gas-phase reactions of O3 with chloroethylenes of the form CHCl=CH(x)Cl(y) (y=2-x(0 < or = 2)). It was concluded that the transient species observed by Hisatsune and Heicklen (Canad. J. Spectrosc. 1973, 18 135) in the O3-CHCl=CHCl system was HC(O)OOH and not the anti conformer of HC(O)OH which they had postulated. The results obtained also suggest that the Criegee intermediate H(Cl)COO. is the precursor of the HC(O)OOH.

705,040
PB85-140358 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Low-Energy Electron Collisions with Highly Polar-Molecules - LIF.
Final rept.
L. A. Collins, and D. W. Norcross. 1977, 4p
Grant NSF-AER74-20552
Pub. in Physical Review Letters 38, n21 p1208-1211 1977.

Keywords: *Lithium fluorides, Inelastic cross sections, Elastic cross sections, Polarity, Hartree-Fock approximation, Reprints, *Electron molecule interactions.

Close coupling calculations of rotational elastic and inelastic cross sections have been performed using the full static Hartree potential surface plus a local approximation to the exchange interaction. The results for this typical highly polar molecule (D=6.58 Debye) suggest that while simpler approximations to the interaction potential are adequate for the total integrated cross section, accurate treatment of short-range interactions may be essential for the momentum transfer cross section. In particular, the authors find a resonance with pi symmetry in the momentum transfer cross section at about 2 eV only in the static model-exchange calculations.

705,041
PB85-140366 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Observations by High-Resolution 13C Nuclear Magnetic-Resonance of Cellulose I Related to Morphology and Crystal-Structure.
Final rept.
W. L. Earl, and D. L. Vanderhart. 1981, 5p
Pub. in Macromolecules 14, n3 p570-574 1981.

Keywords: *Nuclear magnetic resonance, *Crystal structure, *Cellulose, *Morphology, Solids, Reprints, *High resolution molecular spectroscopy.

High resolution solid phase (13)C NMR spectra were obtained on celluloses from cotton linters, ramie, hydrocellulose prepared from cotton linters, Acetobacter Xylinum and Valonia Ventricosa. The spectra from cotton, ramie and hydrocellulose are virtually identical. Peak positions for all peaks are the same for the cotton, Acetobacter and Valonia celluloses although there are differences in resolution and in the intensity of two broad resonances attributed to C-4 and C-6. These differences are ascribed to differences in the morphology of the samples. The higher resolution obtained in the NMR spectra of Acetobacter and Valonia celluloses plus the improved resolution obtained at an applied field of 4.7 T relative to 1.4 T shows definite multiplicity in the resonances assigned to C-1 and C-4. It is argued that this multiplicity is higher than two and reflects the fact that there must be more than two anhydrocellobiose residues per unit cell in the crystal structure of cellulose I.

705,042
PB85-140374 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystal-Chemistry, Modulated Structure, and Electrical-Conductivity in the Oxygen Excess Scheelite-Based Compounds La(1-x)Th(x)NbO(4+x/2) and LaNb(1-x)W(x)O(4+x/2).
Final rept.
R. J. Cava, R. S. Roth, T. Negas, H. S. Parker, and D. B. Minor. 1981, 12p
Pub. in Jnl. of Solid State Chemistry 40, n3 p318-329 1981.

Keywords: *Crystal structure, *Electrical resistivity, *Tungsten oxides, Chemical properties, Phase transformation, Reprints, *Lanthanum niobates, *Thorium niobates, Phase equilibrium.

For La(1-x)Th(x)NbO(4+x/2, three phases with broad homogeneity regions occur, for 0.075 < or = x < or = 0.37, 0.41 < x < 0.61, and 0.65 < or = x < or = 0.74. All are related to the scheelite structure type, with at least the first exhibiting an incommensurate structural modulation. An analogous structurally modulated phase was found for LaNb(1-x)W(x)O(4+x/2) for 0.11 < or = x < or = 0.22. Additional phases occur at La(0.2)Th(0.8)NbO(4.4) and LaNb(0.4)W(0.6)O(4.3). The electrical conductivity and the direction and wavelength of the structural modulation have been characterized for the La(1-x)Th(x)NbO(4+x/2) phase with 0.075 < or = x < or = 0.37.

705,043
PB85-140382 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Excitation of Thallium 7 Doublet S (1/2) and 6 Doublet D (3/2), (5/2) Levels.
Final rept.
S. T. Chen, and A. Gallagher. 1977, 8p
Grant NSF-MPS72-05169
Pub. in Physical Review A 15, n3 p888-895 Mar 77.

Keywords: *Thallium, *Atomic energy levels, Excitation, Reprints.

The authors have measured the relative optical excitation function of the 3776-A and 3519-A lines, and the polarization function of the 2768-A line, using crossed beams of electrons and thallium atoms, for electron energies from thresholds to 1500 eV. The electron energy resolution was 0.3 eV for energies below 13 eV, and the atom beam was optically thin. The 2768-A polarization function shows strong resonance at a few electron volts above the threshold.

705,044
PB85-140390 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermochemical Information from Ion-Molecule Rate Constants.
Final rept.
S. G. Lias. 1982, 23p
Pub. in Lecture Notes in Chemistry 31, n2 p409-431 1982.

Keywords: *Reaction kinetics, *Thermochemistry, Propylene, Reprints, *Ion molecule interactions, Benzyl radicals, Arrhenius equation.

Examples are given, derived from recent ICR work at NBS, of thermochemical information derived from ion-molecule rate constants. Finally, a series of results are given in which the delta H of charge transfer reactions are determined by an Arrhenius treatment of the temperature dependence of the rate constant of the endothermic reaction. (An example is also given of a reaction for which this approach does not work because of the negative temperature dependence of the rate constants of both exothermic and endothermic channels.) New absolute values for the proton affinity scale based on propylene and the benzyl radical are given and compared with values based on isobutene, the usual primary standard for the scale.

705,045
PB85-140408 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Time-of-Flight Determination of Radiative Decay Rates for High Rydberg States in Atomic Nitrogen.
Final rept.
C. A. Kocher, and C. E. Fairchild. 1978, 6p
Pub. in Jnl. of Chemical Physics 68, n4 p1884-1889, 15 Feb 78.

Keywords: *Atomic beams, Electric fields, Ionization, Excitation, Reprints, *Rydberg series, *Time of flight mass spectroscopy, *Nitrogen atoms.

State selection by electric field ionization is employed in an atomic beam time-of-flight determination of radiative decay rates for nitrogen atoms in high Rydberg levels. Highly excited nitrogen atoms are produced in the electron impact dissociative excitation of N2. As the atomic beam passes through an electric field region, the highest-lying Rydberg states are field-ionized. Populations of the remaining excited states are modified by in-flight radiative decay.

705,046
PB85-140465 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison of Spreading Resistance Correction Factors as Calculated from Continuum and Finite-Layer Models.
Final rept.
J. Albers. 1979, 1p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Jnl. of the Electrochemical Society 126, n8 p374 1979.

Keywords: Mathematical models, Partial differential equations, Nonlinear differential equations, Electrical resistivity, Correction, Reprints, *Spreading resistance, Laplace equation.

A continuum formulation of spreading resistance correction factors is derived in the limit as the layer thickness approaches zero. The correction factors calculated from the continuum equations for an exponentially varying resistivity are compared with the correction factors obtained from the finite layer equations.

705,047
PB85-140507 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Role of Penning Ionization of the Minor Species in a Neon Hollow-Cathode Discharge.
Final rept.
K. C. Smyth, B. L. Bentz, C. G. Bruhn, and W. W. Harrison. 1979, 2p
Pub. in Jnl. of the American Chemical Society 101, n4 p797-799 1979.

Keywords: *Mass spectroscopy, Electric discharge, Atomic energy levels, Neon, Reprints, *Penning ionization, *Hollow cathode discharge, Chemical reaction mechanisms.

Using a tunable dye laser, a neon hollow cathode discharge was irradiated at wavelengths corresponding to 1s(sub n) yields 2p(sub n) neon transitions, and thereby the neon metastable atom population was perturbed. At these wavelengths, changes were detected in both the voltage across the discharge and in the ion signals for the various neon species, as well as for minor (including sputtered) species in the discharge. Attention is focussed on the several possible ionization mechanisms for the minor species. Our results indicate that Penning ionization by metastable neon atoms plays the most important role at low discharge currents, but only a minor role at high currents.

705,048
PB85-140648 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Critical Dilemma of Dilute Mixtures.
Final rept.
R. F. Chang, G. Morrison, and J. M. H. Levelt Sengers. Aug 84, 3p
Pub. in Jnl. of Physical Chemistry 88, n16 p3389-3391, 2 Aug 84.

Keywords: *Critical point, *Solutes, *Phase transformation, Mixtures, Specific heat, Enthalpy, Solvents, Solubility, Reprints, Supercritical extraction.

Remarkable anomalies in excess properties and partial molar quantities recently reported in dilute mixtures near the solvent's critical point are explained as due to a solute-induced phase transition. A more intriguing effect, the path dependence of partial molar properties near the solvent's critical point, is analyzed for a classical (analytic) and a nonclassical (scaled) model. Asymptotic expressions are presented for partial molar volumes, enthalpies, and specific heats along a variety of paths to the solvent's critical point. The authors results contribute to the formulation of supercritical solubility and of impurity effects in near-critical fluids.

705,049
PB85-140721 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Retention of Ring Structure in Cyclopentane and Alkylcyclopentane Molecular Cations.
Final rept.
L. W. Sieck, M. Mautner, and P. Ausloos. 1980, 2p
Pub. in Jnl. of American Chemical Society 102, n22 p6866-6867 1980.

Keywords: *Molecular structure, *Cations, *Cyclopentane, *Cyclopentane compounds, Photoionization, Mass spectroscopy, Reprints, *Ion molecule interactions.

Recent mass spectrometric studies using electron impact ionization have concluded that cyclopentane and alkylcyclopentane molecular ions undergo ring opening to form the corresponding olefin. The extent of cyclic retention was also studied in methylcyclopentane, and iso- and normal propylcyclopentane and it is shown that the extent of ring retention is again wavelength-dependent. The present results are consistent with earlier radiolysis studies, and it appears that the probability for ismerization to the acyclic structure depends upon both the internal energy of the molecular cation and the collision frequency.

705,050
PB85-140739 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Trans-Gauche Concentration in Crystalline Polyethylene Measured by the Intensity of Rocking Mode Vibrations of Deuterated Methylene Groups.
Final rept.
D. H. Reneker, J. Mazur, J. P. Colson, and R. G. Snyder. 1980, 15p
Pub. in Jnl. of Applied Physics 51, n10 p5080-5094 Oct 80.

Keywords: *Polyethylene, *Deuterium compounds, *Infrared spectroscopy, Concentration(Composition), Molecular vibration, Crystal structure, Reprints.

Polyethylene with a low concentration of doubly deuterated displays an infrared band in the region of 646 to 651 wavenumbers. This band is attributed to a rocking normal mode of a CD2 group with one of the adjacent dihedral angles approximately trans and the other approximately gauche (tg). This mode vibrates at 620 wavenumbers when the dihedral angles adjacent to the CD2 group are both trans (tt). In polyethylene crystals tg sequences can occur only in defects where constraints cause some of the dihedral angles to be only approximately trans or gauche. Calculations of the rocking mode vibrational frequencies of CD2 groups in model chains which incorporate some of the typical defects showed that the bands were broadened but not completely disrupted by the distorted dihedral angles. Measurements of the relative intensities of the CD2 rocking bands show an increase in the concentration of tg sequences consistent with the thermal generation of defects which may be involved in transport of the polymer chain through the crystal. Confidence in the particular values of the concentration ratio is limited by uncertainties in the determination of the baseline for the infrared bands of interest. Quantitative measurements of the concentration ratio, tg/(tg + tt), determined from the integrated band intensities, fall between limits set by reasonable independent estimates of the concentration of folds and point dislocations.

705,051
PB85-140952 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Expansion Factor of a Part of Polymer Chain in Good Solvent Measured by Small Angle Neutron Scattering.
Final rept.
Y. Matsushita, I. Noda, M. Nagasawa, C. C. Han, T. P. Lodge, and E. J. Amis. 1984, 5p
Sponsored by Ministry of Education, Science and Culture, Tokyo (Japan).
Pub. in Macromolecules 17, n9 p1785-1789 1984.

Keywords: *Polystyrene, *Neutron scattering, *Expansion, *Solvents, Molecular weight, Perturbation theory, Radius of gyration, Reprints, *Small angle scattering, *Polymer chains.

The radii of gyration of deuterium labelled parts in polystyrenes with narrow molecular weight distributions in good solvent (carbon disulfide) were determined by small angle neutron scattering (SANS). The expansion factors of the labelled parts were calculated from the observed radii of gyration and their unperturbed ones which were estimated from the unperturbed radius of gyration-molecular weight relationship of polystyrene in the literature. The expansion factors of the labelled parts were smaller than those of the whole chains, but were larger than that of a whole chain with the same molecular weight as that part. This result is reasonable compared with a Monte Carlo calculation in the literature and also with the perturbation theory.

705,052
PB85-140960 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stochastic Dynamics Simulation of Particle Aggregation.
Final rept.
R. D. Mountain, and G. W. Mulholland. 1984, 4p
Pub. in Proceedings of International Topical Conference on Kinetics of Aggregation and Gelation, Athens, GA., April 2-4, 1984, p83-86.

Keywords: *Particle interactions, *Agglomeration, *Clustering, Particle trajectories, Size determination, Simulation, Soot, Langevin equation, Three dimensional, Fractals.

The kinetics of cluster aggregation and the structure of the resulting clusters have been studied using a 'Brownian dynamics' simulation technique with the coagulation condition that particles stick upon contact. Three dimensional simulations with 500 particles were run to determine the effects of the friction coefficient and the particle concentration on the resulting particle structure and the growth dynamics.

705,053
PB85-141000 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Improved Deuterium Bromide 1-0 Band Molecular Constants from Heterodyne Frequency Measurements.
Final rept.
J. S. Wells, D. A. Jennings, and A. G. Maki. 1984, 14p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 107, p48-61 1984.

Keywords: *Deuterium compounds, *Hydrogen bromide, *Fundamental constants, Infrared spectroscopy, Reprints, *Laser spectroscopy, *Heterodyne spectroscopy, Far infrared spectroscopy.

Heterodyne frequency measurements have been made on selected deuterium bromide 1-0 band transitions ranging from P(20) to R(17). Difference frequency beat notes between a tunable diode laser whose frequency was locked to the DBr absorption lines and a CO laser whose frequency was either locked or adjusted to a reference synthesized from CO2 laser frequency standards were measured. The beat note frequency was then combined with the measured CO laser frequency to give the DBR frequency. For two of the measurements, frequency doubled CO2 laser radiation was substituted for the CO laser radiation. The measurements included electric quadrupole split triplets comprising the R(0) and P(1) transitions in the D(sup 79)Br isotope. New DBr constants have been determined and a table of frequencies is presented for the calibration of spectrometers and tunable lasers in the wavenumber range 1600 to 1990/cm. A table of far-infrared frequencies is also given for DBr covering the range from 50/cm to 206/cm.

705,054
PB85-141323 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Search for Chemisorbed HCO: The Interaction of Formaldehyde, Glyoxal and Atomic Hydrogen + CO with Rh.
Final rept.
J. T. Yates, and R. R. Cavanagh. 1982, 13p
See also AD-A099 970.
Pub. in Jnl. of Catalysis 74, n1 p97-109 1982.

Keywords: *Chemisorption, *Infrared spectroscopy, *Formaldehyde, *Hydrogenation, *Surface chemistry, Reprints, *Formyl, *Glyoxal.

Transmission infrared spectroscopy has been used to search for the chemisorption-stabilization of formyl (HCO) on Al2O3 -supported Rh surfaces. Formaldehyde (H2CO) and glyoxal (HCO)2 have been used as potential sources of HCO. In addition, chemisorbed CO on Rh has been treated with atomic deuterium in an attempt to produce DCO. None of these routes have led to spectroscopically detectable levels of formyl adsorption at temperatures near or above 100K. These results suggest that the formyl intermediate may not be a stable surface species on Rh in CO-hydrogenation chemistry.

705,055
PB85-141398 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mechanical and Transport Properties of Drawn Isotactic Polypropylene.
Final rept.
F. de Candia, A. Perullo, V. Victoria, and A. Peterlin. 1984, 15p
Pub. in Interrelations between Processing Structure and Properties of Polymeric Materials, p713-727 1984.

Keywords: *Mechanical properties, *Transport properties, *Polymeric films, *Polypropylene, Sorption, Diffusion, Samples, Density(Mass/volume), Drawing, Reprints.

Quenched films of isotactic polypropylene were drawn at different temperatures in the range between 25 and 80C. The plastic deformation was quantitatively defined by the true draw ratio lambda (sub loc) of the volume element. Mainly transparent samples were used for the density and transport properties measurement. The observed effects were similar to those obtained formerly with branched and linear polyethylene. The creep deformation before necking is substantially smaller than in polyethylene. In the neck the draw ratio increases by about 6. The axial elastic modulus increases faster than the draw ratio. The drop of the sorption and the zero concentration diffusion coefficient indicate that at the maximum achieved draw ratio the original lamellar structure of the transparent samples is almost completely transformed in the microfibrillar structure.

705,056
PB85-141414 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Resolution Spectrum of the nu 5 Band of Nitric Acid HNO3 Near 880/cm.
Final rept.
A. G. Maki, and J. S. Wells. 1984, 14p
Pub. in Jnl. of Molecular Spectroscopy 108, p17-30 1984.

Keywords: *Nitric acid, *Infrared spectra, Performance evaluation, Reprints, *Laser spectroscopy.

Tunable diode lasers have been used to measure the spectrum of HNO3 from 853/cm to 892/cm. A Fermi interaction with the nearby 2 nu (sub g) state perturbs some of the transitions and causes some problems in the analysis, but several hundred lines have been assigned and fit to a set of band constants with a standard deviation of 0.0007/cm. The measurements include most of the P-branch, the strongest lines of the Q-branch, and some R-branch transitions. Only A-type transitions have been identified and any B-type transitions must be much weaker.

705,057
PB85-141554 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Carbon Monoxide Compressibility Data from 100 to 300 K; Derived Virial Coefficients, Orthobaric Densities, and Heats of Vaporization.
Final rept.
R. D. Goodwin. Aug 83, 12p
Pub. in Cryogenics 23, n8 p403-414 Aug 83.

Keywords: *Carbon monoxide, Density(Mass/volume), Heat of vaporization, Tables(Data), Critical point, Vapor pressure, Cryogenics, Reprints, *Virial coefficients.

Experimental densities of carbon monoxide are tabulated along experimental pseudoisochores from 90 through 300 K at pressures to 350 bar. Virial coefficient data on isotherms are derived from 120 through 300 K and are formulated vs. temperature by inclusion of data from other sources. Vapor pressures from other sources are formulated and used to derive some orthobaric vapor densities via the virial equation; and orthobaric vapor and liquid densities via isochoric P(rho)T data. All available orthobaric vapor and liquid density data then are formulated and are used to derive and to formulate the heats of vaporization.

705,058
PB85-141851 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Transport Properties as an Extremely Sensitive Indicator of the Status of the Amorphous Component in the Elastically and Plastically Deformed Semicrystalline Polymer.
Final rept.
A. Peterlin. 1984, 20p
Pub. in Interrelations between Processing Structure and Properties of Polymeric Materials, p585-604 1984.

Keywords: *Transport properties, *Polymers, Diffusion, Density(Mass/volume), Neutron scattering, Drawing, Reprints, *Semicrystalline polymers, *Amorphous materials.

As far as the density is concerned the amorphous component in the semicrystalline polymer does not behave like an incompressible rubber although it is above the glass-transition temperature. As a consequence of the uniaxial elastic extensional deformation the specific volume of the amorphous material increases while that of a strained rubber remains constant. The difference between the amorphous phase in a semicrystalline polymer and in an ideal rubber is a consequence of the intimate connection between the amorphous and crystalline phase. As a consequence of the increased specific volume of the amorphous component in the uniaxially strained semicrystalline polymer the enhancement of the transport properties is large and easy to measure, much easier than any other property of the amorphous component. The plastic deformation retains the specific volume and hence, in first approximation, does not modify the transport properties.

705,059
PB85-141919 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Spectroscopy of Stored Ions Using Fluorescence Techniques.
Final rept.
D. J. Wineland, W. M. Itano, J. J. Bollinger, J. C. Bergquist, and H. Hemmati. 1983, 6p
Pub. in SPIE 426, p65-70 1983.

Keywords: *Fluorescence, *Ions, *Spectroscopic analysis, Mass spectroscopy, Reprints, *Laser spectroscopy, *Ion trappings.

Fluorescence light is used in spectroscopic experiments on stored ions. The authors discuss applications in (1) high resolution microwave and rf/optical double resonance spectroscopy, (2) single ion detection, (3) mass spectroscopy and (4) studies of stored ion clouds which exhibit properties of strongly coupled plasmas.

705,060
PB85-141927 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Collisional Redistribution of Light: Far-Wing Line Shapes and Polarizations for the Ba-Ar, Xe Systems.
Final rept.
W. J. Alford, N. Andersen, K. Burnett, and J. Cooper. Nov 84, 15p
Grant NSF-PHY82-00805
Pub. in Physical Review A: General Physics 30, n5 p2366-2380 Nov 84.

Keywords: *Line spectra, *Barium, *Binary systems(Materials), *Light scattering, Rayleigh scattering, Fluorescence, Argon, Xenon, Atomic energy level, Reprints, *Collision broadening.

The authors have measured the far-wing collisional redistribution line shape, the redistributed fluorescence polarization, and the collisional alignment decay rates for barium perturbed by argon and xenon. The experiment was performed with a heated gas cell (T about 900 K) with perturber gas densities in the 1-30 Torr range and laser light detuned 3-1000/cm from the 5535 A Bal 6 singlet P - 6 singlet P resonance line. Metal vapor densities were determined by a Rayleigh scattering technique which is outlined in detail. By correlating structure in the line shape with that of the polarization, they are able to make definitive statements about the interatomic potentials. The Ba data show strong similarities with previous experimental results for similar two-electron atoms, namely Ca, Sr, and Hg, so our conclusions are of relevance to these systems as well.

705,061
PB85-141968 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser-Induced Fluorescence Measurement of Nascent Vibrational and Rotational Product State Distributions in the Charge Transfer of Ar(+1) + N2 yields Ar + N2(+1) (v=0.1) at 0.2 eV.
Final rept.
L. Huwell, D. R. Guyer, G. H. Lin, and S. R. Leone. 15 Oct 84, 16p
Grants NSF-PHY82-00805, NSF-CHE79-11340
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 81, n8 p3520-3535, 15 Oct 84.

Keywords: *Molecular vibration, *Molecular rotation, *Argon, Fluorescence, Nitrogen, Experimental design, Reprints, *Laser induced fluorescence, *Ion molecule interactions, *Argon ions.

A novel experimental technique couples a flowing afterglow ion source with a supersonic nozzle expansion in order to deliver high densities of relatively low kinetic energy ions into a low pressure chamber. Nascent rotational and vibrational state distributions are obtained by the method of saturated laser-induced fluorescence probing. It is found that a substantial fraction of the available energy is partitioned into internal excitation of the N2(+1) product molecule. It is suggested the experimental findings are best explained in terms of the detailed locations of potential surface crossing seams, rather than by the widely used energy-resonance or diatomic molecule, Franck-Condon ionization models.

705,062
PB85-141992 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
State-Resolved Molecular Reaction Dynamics.
Final rept.
S. R. Leone. 1984, 27p
Contract DE-AC02-79ER10396, Grant AFOSR-78-3565
Sponsored by Grants NSF-PHY82-00805, NSF-CHE79-11340, and DAA29-82-K-0031.
Pub. in Annual Review of Physical Chemistry 35, p109-135 1984.

Keywords: *Vapor phases, Chemical reactions, Surface chemistry, Trends, Reprints, *Molecular dynamics, Chemical reaction mechanisms, Ion molecule interactions.

The subject of gas phase molecular reaction dynamics is a mature field; but it is one which continues to offer exciting new perspectives on the fundamental nature of chemical transformations. Chemists have in their vocabulary such familiar concepts as 'early' and 'late' reaction barriers, the harpoon mechanism, and 'direct' and 'complex' reaction dynamics. The authors also have a modicum of understanding about which forms of energy, i.e. vibrational, translational, electronic, or rotational, will successfully carry a reaction to completion. Much of this understanding comes from ingenious state-resolved experimental measurements on elementary chemical reactions, coupled with the excellent insight provided by detailed theoretical calculations. Because so much has already been discovered and said about reaction dynamics, it is important to identify significant new developments and results. This review focuses on recent experimental investigations in state-resolved molecular reaction dynamics, involving primarily work carried out from 1980-1983. The trend is toward investigations that involve a higher degree of sophistication to learn about geometrical and orientation effects, bimodal state distributions that result from multiple reaction pathways, resonance effects, and the competition between reactive and inelastic channels. In addition, well-known techniques are being applied to new systems, including investigation of reaction dynamics on catalytic metal surfaces, study of atom-radical reactions and ion-molecule reactions, and determination of product branching in reactions that have a manifold of pathways.

705,063
PB85-142008 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Status of Thermophysical Properties Data for Pure Fluids and Mixtures at Low Temperatures.
Final rept.
A. J. Kidnay, N. A. Olien, and M. J. Hiza. 1983, 9p
Pub. in AIChE (American Institute of Chemical Engineers) Symposium Series 79, n224 p105-113 1983.

Keywords: *Thermophysical properties, *Low temperature tests, Physical properties, Thermodynamics, Mixtures, Fluids, Experimental design, Reprints.

This paper discusses the need for and the availability of both thermodynamic and physical properties data for the fluids generally encountered in low-temperature processing. The important gaps in the existing data are noted and recommendations are made for future experimental programs.

705,064
PB85-142032 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Gruneisen Parameter in Fluids.
Final rept.
V. Arp, J. M. Persichetti, and C. Guo-bang. Jun 84, 9p
Pub. in Jnl. of Fluids Engineering 106, p193-201 Jun 84.

Keywords: *Fluids, *Binary systems(Materials), Mixtures, Diatomic molecules, Thermodynamic properties, Hydrocarbons, Mercury(Metal), Sodium, Water, Equations of state, Reprints, *Gruneisen parameters.

The Gruneisen parameter has been identified with the thermodynamic properties of lattice structures for some fifty years. In this paper, the authors show that the same thermodynamic variable also occurs prominently in the hydrodynamics of compressible fluids. In the ideal gas region, the Gruneisen parameter is equal to gamma (the specific heat ratio) minus one, and thus is easily overlooked as a separate parameter in its own right. In this paper, they give examples of its appearance and use in hydrodynamics and diatomic gases, heavy hydrocarbons, water, mercury, liquid sodium, and two-phase (liquid-vapor) mixtures.

705,065
PB85-142073 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Direct Measurement of the 3 triplet P(sub 0)-3 triplet P(sub 1) Fine-Structure Interval and the g(sub j)-Factor of Atomic Silicon by Laser Magnetic Resonance.
Final rept.
M. Inguscio, K. M. Evenson, V. Beltran-Lopez, and E. Ley-Koo. 15 Mar 84, 4p
Pub. in Astrophysical Jnl. 278, pL127-L130, 15 Mar 84.

Keywords: *Silicon, Interstellar matter, Zeeman effect, Atomic energy levels, Hartree-Fock approximation, Experimental design, Reprints, *Fine structure, *G factor, *Laser magnetic resonance spectroscopy, Laser spectroscopy.

Laser magnetic resonance measurements have been performed on the ground 3(doublet p)triplet P multiplet of atomic silicon. The J = 0 yields 1 fine-structure interval and the g-factor of the triplet P(sub 1) state have been determined with high precision.

705,066
PB85-142081 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of a High Temperature (600 K), High Pressure (100 MPa) Viscometer.
Final rept.
D. E. Diller. 1984, 5p
Pub. in Proceedings of Symposium on Energy Engineering Sciences, Research on Instrumentation, Testing and Evaluation (2nd), Argonne, IL., April 10-11, 1984, Conf-8404123, p49-53.

Keywords: *Viscometers, *High temperature tests, *High pressure tests, *Piezoelectric crystals, Fuels, Chemical industry, Design criteria, Performance evaluation, Density(Mass/volume), Gases, Liquids, Calibrating.

A high temperature (600 K), high pressure (100 MPa) torsional, piezoelectric crystal viscometer is being developed for accurate, wide-range shear viscosity measurements on compressed gaseous and liquid mixtures of interest to the fuel and chemical industries. The method is absolute in the sense that the apparatus does not require calibration with a fluid of known viscosity. The upper temperature limit is chosen to exceed the critical temperatures of a considerable number of industrially important fluids. The upper pressure limit is chosen to permit separating the dependence of the viscosity coefficient on density (at fixed temperature) from the dependence on temperature (at fixed density). Four, nearly identical, cylindrical quartz crystals, about 4.3 cm long by 0.5 cm diameter, have been fabricated from specially prepared ('swept', electrolyzed), high quality cultured quartz.

705,067
PB85-142099 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electrochemical Investigation of N-Methyl-4-(5-Phenyl-2-Oxazolyl)Pyridinium p-Toluenesulfonate: A Laser Dye with Product Deposition.
Final rept.
R. T. Burke, E. A. Blubaugh, W. T. Yap, and R. A. Durst. 1984, 12p
Pub. in Jnl. of Electroanalytical Chemistry 177, p77-88 1984.

Keywords: *Electrochemistry, *Electrodeposition, *Laser materials, *Dyes, Electrodes, Nernst effect, Transport properties, Thermodynamics, Reprints, *Pyridinium toluene sulfonate/N-methyl-(phenyl-oxazolyl).

The electrochemical and spectroelectrochemical behavior of N-methyl-4-(5-phenyl-2-oxazolyl)pyridinium p-toluenesulfonate was studied to provide an evaluation of the electrochromic properties of this laser dye. Preliminary cyclic voltammetric experiments provided evidence for the deposition onto the electrode of the product of the electrochemical reduction process. Double potential-step chronocoulometry and spectroelectrochemistry at an optically transparent thin-layer gold-minigrid electrode were used to elucidate the reaction mechanism further. Equations were derived to interpret the spectropotentiostatic Nernst plots which exhibit discontinuities as a result of product precipitation onto the electrode. For redox systems in which there is product deposition, the mathematical treatment described permits the calculation of various thermodynamic and transport properties based on spectropotentiostatic and chronocoulometric data.

705,068
PB85-142107 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Prediction of the Viscosity of Pure and Mixed Cryogenic Fluids.
Final rept.
J. F. Ely, and J. K. Baker. 1983, 5p
Pub. in AIChE (American Institute of Chemical Engineers) Symposium Series 79, n224 p100-104 1983.

Keywords: *Viscosity, *Thermal conductivity, *Fluids, Mixtures, Cryogenics, Comparison, Mathematical models, Reprints.

Viscosity and thermal conductivity play an important role in engineering design. Recently, a predictive corresponding states model for these properties in nonpolar mixtures has been developed. The method, which is applicable to the entire range of fluid states, does not require any transport data in the predictions. This manuscript summarizes recent studies dealing with the applicability of a corresponding states principle for fluid viscosity. Comparisons of predictions and experiment for eight pure cryogenic fluids and three mixtures are presented.

705,069
PB85-142115 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Apparatus for Moderate Temperature VLE Measurements of CO2-Isobutane Systems.
Final rept.
L. A. Weber. 1984, 7p
Sponsored by Department of Energy, Washington, DC. and Argonne National Lab., IL. Components Technology Div.
Pub. in Proceedings of Symposium on Energy Engineering Sciences, Research on Instrumentation, Testing and Evaluation (2nd), Argonne, IL., April 10-11, 1984, Conf-8404123, p10-16.

Keywords: *Laboratory equipment, *Butanes, *Carbon dioxide, *Binary systems(Materials), Separations, Temperature, Design criteria, Cryogenics, *Phase equilibrium, *Vapor liquid equilibrium.

This paper describes a new apparatus designed for making VLE measurements on light hydrocarbon containing systems in the range 300-400 K and pressures of 2-150 bar. Features of the new apparatus, systems to be studied, and treatment of the data are discussed. Some data from a similar previous (cryogenic) apparatus are shown to illustrate expected results.

705,070
PB85-142123 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Non-Newtonian Phenomena in Simple Fluids.
Final rept.
D. J. Evans, H. J. M. Hanley, and S. Hess. Jan 84, 8p
Pub. in Physics Today 37, n1 p26-33 Jan 84.

Keywords: *Fluids, Thermodynamics, Liquids, Reprints, *Molecular dynamics.

Computer simulation indicates simple liquids can display a surprising range of exotic nonequilibrium phenomena, many of which are associated conventionally with macromolecular systems. Their presence has significant implications for nonequilibrium statistical mechanics and thermodynamics.

705,071
PB85-142149 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Infrared and Far-Infrared Transition Frequencies for the CH2 Radical.
Final rept.
T. J. Sears, A. R. W. McKellar, P. R. Bunker, K. M. Evenson, and J. M. Brown. 1 Jan 84, 4p
Pub. in Astrophysical Jnl. 276, p399-402, 1 Jan 84.

Keywords: *Infrared spectroscopy, *Interstellar matter, Free radicals, Methane, Reprints, *Methyl radicals, *Laser magnetic resonance spectroscopy, *Far infrared spectroscopy, Laser spectroscopy.

Frequencies, wavelengths, and line strengths for transitions of the CH2 molecule at far-infrared and midinfrared (9-12 micrometers) wavelengths have been calculated from recently reported laser magnetic resonance spectra.

705,072
PB85-142347 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Formulations for the Thermodynamic Properties of Dry Air (from 173.15 K to 473.15 K) and of Saturated Moist Air (from 173.15 K to 372.15 K), at Pressures to 5 MPa.
Final rept.
A. Wexler, and R. W. Hyland. 1983, 1p
Sponsored by American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., New York.
Pub. in ASHRAE Jnl. 25, n5 p64 1983.

Keywords: *Thermodynamic properties, *Air, Pressures, Enthalpy, Entropy, Water vapor, Ideal gas, Humidity, Reprints, Virial coefficients.

Calculations are made of the thermodynamic properties of moist air, in SI units, at pressures of 0.1, 0.5, 1 and 5 MPa, with the thermodynamic temperature as the independent variable. The real-gas behavior of moist air is represented by a volume-series virial equation of state for mixtures. The ideal-gas thermodynamic properties of the consituents of moist air, that is, dry air and water vapor, are formulated as empirical equations based on statistical mechanical computations from spectroscopic data. The volume, enthalpy and entropy of the air-water vapor mixture, per unit mass of dry air, are tabulated at standard atmospheric pressure for two conditions: dry and saturated. Estimates are made of the overall (maximum) uncertainty of these properties. Expressions are given for obtaining values of these properties at any desired relative humidity. Equations are derived for the second and third virial coefficients of dry air, the second and third cross-virial coefficients of water vapor-air mixtures, and their corresponding derivatives (enthalpy coefficients). Computations are made of the enhancement factor and the humidity (mixing) ratios.

705,073
PB85-142354 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Low-Energy Electron-Atom Scattering in a Magnetic Field.
Final rept.
C. W. Clark. Jul 83, 8p
Pub. in Physical Review A: General Physics 28, n1 p83-90 Jul 83.

Keywords: *Electron scattering, *Cations, *Photoionization, Ionization, Magnetic fields, Reprints.

The threshold laws for electron-atom scattering processes in a magnetic field are shown not to contain singularities in general. Observed modulations of photodetachment cross sections are due to the presence of true resonances rather than divergence of phase space. These resonances may be associated with thresholds, or they may be analogous to the quasi-Landau resonances observed in photoionization.

705,074
PB85-142370 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Method for Construction of Nonclassical Equations of State.
Final rept.
J. R. Fox. 1983, 9p
Pub. in Fluid Phase Equilibria 14, p45-53 1983.

Keywords: *Equations of state, *Critical point, Thermodynamics, Van der Waals equation, Vapor phases, Liquid phases, Reprints, Phase equilibrium, Numerical solution.

A method of modifying empirical equations of state in order to improve their performance in the critical region is introduced. The implementation of this method involves the construction of a state function which measures the effective distance between the state in question and the critical state. A mathematical transformation, parameterized by this function, is then used to define a new equation of state which is designed to be identical in behavior to the original formulation outside the critical region, but to develop the nonclassical scaling behavior characteristic of real fluids near the critical point. Application of this method to an equation of state of van der Waals type is presented as an illustration.

705,075
PB85-142388 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comment on 'A Theoretical Study of Coherence Effects in Charge Transfer Collisions: Application to Na + Li(+1)'.
Final rept.
I. V. Hertel, and H. Schmidt. Oct 84, 2p
Pub. in Jnl. of Chemical Physics 81, p3361-3362 Oct 84.

Keywords: *Coherent effects, Ions, Atoms, Reprints, *Atom ion interactions.

In a recent article Orel and Kulander have reported theoretical calculations of charge exchange processes involving excited alkali atoms. In view of the experimental possibilities to prepare oriented and aligned atoms by laser optical pumping and the substantial progress made recently in deriving detailed information on excitation and charge exchange amplitudes and their relative phases in ion atom scattering, this is a timely and very interesting study. There are, however, some conceptional misunderstandings which deserve clarification in order to fully exploit the theoretical results when comparing with experiments.

705,076
PB85-142396 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Far Infrared Laser Magnetic Resonance of Singlet Methylene: Singlet-Triplet Perturbations, Singlet-Triplet Transitions, and the Singlet-Triplet Splitting.
Final rept.
A. R. W. McKellar, P. R. Bunker, T. J. Sears, K. M. Evenson, R. J. Saykally, and S. R. Langhoff. 1 Dec 83, 14p
Contract NASA-W-15047
Pub. in Jnl. of Chemical Physics 79, n11 p5251-5264, 1 Dec 83.

Keywords: *Methylene, *Atomic energy levels, Free radicals, Molecular rotation, Molecular vibration, Reprints, *Laser magnetic resonance spectroscopy.

The authors have observed and assigned a number of far infrared laser magnetic resonance spectra arising from rotational transitions within the vibrational ground state of a(sup about 1) A(sub 1) electronic excited state of the methylene radical and from transitions between such singlet levels and vibrationally excited levels of the X(sup about 3) B(sub 1) electronic ground state. The singlet-singlet transitions are magnetically active, and the singlet-triplet transitions have electric dipole intensity, because of the spin-orbit mixing of singlet levels with vibrationally excited levels of the triplet state. By identifying four pairs of singlet and triplet levels that perturb each other we can accurately position the singlet and triplet state relative to each other and determine the singlet-triplet splitting.

705,077
PB85-142404 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heterodyne Frequency Measurements and Analysis of CO2 Laser Hot Band Transitions.
Final rept.
F. R. Petersen, J. S. Wells, K. J. Siemsen, A. M. Robinson, and A. G. Maki. 1984, 7p
Pub. in Jnl. of Molecular Spectroscopy 105, p324-330 1984.

Keywords: Least squares method, Molecular vibrations, Molecular rotation, *Laser spectroscopy, *Band transitions, *Heterodyne spectroscopy.

New frequency measurements of molecular lines in the P-branch of the 01(sup 1) 1-(11(sup 1) 0, 03(sup 1) 0)(sup I) band of (12)C(16)O2, observed in laser emission, and lines in the R-branch, observed in absorption with a tunable diode laser, have been made by heterodyne difference frequency techniques with stabilized CO2 lasers as the reference frequencies. The data obtained, plus additional results of measurements made by two other groups of researchers, were combined in a least squares fit to obtain improved rovibrational constants for this band. The new constants predict more reliably the frequencies of both the P- and R-branch transitions. A table of transition frequencies and their estimated uncertainties is given for this band.

705,078
PB85-142479 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystal Structures of the Chevrel Phases Li3.3Mo6S8 and Li3.2Mo6Se8.
Final rept.
R. J. Cava, A. Santoro, and J. M. Tarascon. 1984, 11p
Pub. in Jnl. of Solid State Chemistry 54, p193-203 1984.

Keywords: *Crystal structures, *Lithium, *Neutron diffraction, Reprints, *Lithium molybdenum sulfide, *Lithium molybdenum selenide.

The crystal structures of Li(3.3)Mo6S8 and Li(3.2)Mo6Se8, Chevrel phases formed by the insertion of lithium into Mo6S8 and Mo6Se8, were determined by neutron diffraction powder profile analysis. The Mo6S8 and Mo6Se8 clusters are quite similar to those in other compounds of this type. The lithium atoms in both cases are disordered over the two concentric rings of available tetrahedrally coordinated small atom sites. For both compounds, occupancy of the outer ring is strongly preferred, and in Li(3.3)Mo6S8 the inner lithium ring has a unique puckered geometry.

705,079
PB85-142545 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chronoamperometric Determination of Diffusion-Layer Thickness at Hydrodynamic Electrodes.
Final rept.
K. W. Pratt. Sep 84, 4p
Pub. in Analytical Chemistry 56, n11 p1967-1970 Sep 84.

Keywords: *Electrodes, *Electrical measurement, Diffusion, Chemical reactions, Mass transfer, Comparison, Reprints, *Hydrodynamic voltammetry.

A new technique is described by which diffusion-layer thicknesses at hydrodynamic electrodes are measured without knowing the electrode area, solution concentration, or number of electrons in the electrode reaction. Comparison of the chronoamperometric current, obtained in quiescent solution, with the limiting current obtained at the same electrode in hydrodynamic voltammetry yields a characteristic 'equivalent time'. This parameter is directly related to the diffusion-layer thickness at the electrode. Experimental diffusion-layer thicknesses are measured at rotating disk and vibrating wire electrodes using this technique. The values agree with those obtained from limiting-current measurements to within 5% at the rotating disk and 16% at the vibrating wire electrode. Factors contributing to these errors are evaluated.

705,080
PB85-142552 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Eigenphase Sum in Electron Scattering by Polar Molecules.
Final rept.
C. W. Clark. Aug 84, 8p
Pub. in Physical Review A: General Physics 30, n2 p750-757 Aug 84.

Keywords: *Eigenvectors, *Electron scattering, *Diatomic molecules, Polarity, Sulfur dioxide, Water, Reprints, *Electron molecule interactions.

The eigenphase sum for electron-polar-molecule scattering admits separation into a part which is wholly dependent on the long-range field and a part which reflects other interactions. Closed-form expressions are given for the zero-energy eigenphase sum for diatomic molecules and simple polyatomic molecules in the fixed-nuclei approximation. A general framework for performing body-frame scattering calculations is presented.

705,081
PB85-142560 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Isotope Shifts of C I Spectral Lines and Their Application to Radioactive Dating by Laser-Assisted Mass Spectrometry.
Final rept.
C. W. Clark. Nov 83, 3p
Pub. in Optics Letters 8, n11 p572-574 Nov 83.

Keywords: *Carbon, *Atomic structure, *Mass spectroscopy, *Isotope effect, Radioactive age determination, Trace elements, Spectral lines, Carbon isotopes, Reprints, *Laser spectroscopy.

The author has calculated isotope shifts for several one- and two-photon transitions in neutral carbon. The results provide a unified interpretation of existing experimental data, and they demonstrate the applicability of a new method of ultrasensitive isotope trace analysis to carbon.

705,082
PB85-142792 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Handling and Evaluation of Large Networks of Thermochemical Data.
Final rept.
D. Wagman, D. Garvin, V. Parker, W. Evans, J. Pedley, and P. Burkinshaw. 1981, 8p
Pub. in Proceedings of International CODATA Conference, Data Science and Technology, p361-368 1981.

Keywords: *Thermochemical properties, *Information systems, *Organic compounds, Thermodynamics, Least squares method, Tables(Data).

This paper summarizes some recent developments in the automation of the thermochemical evaluation process made in closely related collaborative programs at the U.S. National Bureau of Standards and the University of Sussex in England. The types and contents of both the NBS inorganic compound data banks and the University of Sussex organic compound data banks are described. Emphasis is given to how the machines can assist the data analysts both in making decisions and in disseminating the results of their work. The data banks described have been designed for direct processing. The design provides facilities for search and retrieval, analysis of relationships among measurements, capabilities for evaluations, updating and printing of tables. Validation procedures are described for the data banks of selected thermochemical properties of compounds and for the data banks of the reaction catalogs of thermochemical measurements. The catalogs are the centerpiece for the establishment of 'best values' for the thermochemical properties, delta H, delta G and delta S of chemical processes and of individual substances. At present the catalogs contain only measurements corrected to 298.15K. Automated aids to the analyst in analyzing the catalogs are also described. Some of these are display of measurement networks, loop analysis, least sum and least square solutions and residuals analysis. Tables of thermodynamic properties of compounds can be published directly from the data banks of selected values.

705,083
PB85-142891 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of Polymer-Solvent Diffusivity by Inverse Gas-Chromatography.
Final rept.
G. A. Senich. 1981, 1p
Pub. in Bulletin of the American Phys. Society 26, n3 p429 1981.

Keywords: *Gas chromatography, Diffusivity, Polymers, Polyethylene, Diffusion, Plastics, Reprints, *Inversion gas chromatography.

The diffusivity of a volatile compound or probe in a polymer can be derived from nonequilibrium inverse gas chromatography (IGC) experiments conducted at rapid carrier gas flow rates. The van Deemter equation is commonly used to relate experimentally measured peak broadening to the probe-polymer diffusion coefficient. This relation, as commonly applied, neglects diffusive processes in the gas phase and variations in the local carrier gas flow velocity, two factors which can have a significant effect on the magnitude of the diffusivity found by IGC studies. Another important parameter is the diffusion path length in the polymer phase. Two extremes in polymer geometry possible within the column are considered, a thin, uniformly distributed covering over the entire surface of the spherical column packing or annulus-like regions collected at the contact points between spheres, each with a different diffusion path length. The influence of these factors on probe-polymer diffusivity determinations is illustrated with results from an experimental IGC study of normal octadecane diffusion in linear polyethylene at 150C.

705,084
PB85-142925 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Preparation, Vapor Pressure and Infrared Spectrum of Methyl Nitrite.
Final rept.
F. L. Rook. 1982, 2p
Pub. in Jnl. of Chemical and Engineering Data 27, n1 p72-73 1982.

Keywords: *Deuterium compounds, *Synthesis(Chemistry), *Vapor pressure, *Infrared spectroscopy, Reprints, *Nitrite/methyl.

A convenient preparation of ordinary and deuterated methyl nitrite has been described, their high resolution infrared spectra recorded, and the vapor pressure curve of CH3ONO measured in the region 154 < or = T(K) < or = 225: log (sup 10) P(torr) = -1365/T + 8.102.

705,085
PB85-142982 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Asymmetry Patterns of Plasma-Broadened Isolated Lines (Carbon I).
Final rept.
D. W. Jones, and W. L. Wiese. Nov 84, 7p
Pub. in Physical Review A 30, n5 p2602-2608 Nov 84.

Keywords: *Stark effect, *Line spectra, *Carbon, Line width, Comparison, Asymmetry, Reprints.

The authors have measured detailed profiles of plasma-broadened neutral-carbon lines, utilizing a wall-stabilized arc source and a specially designed data acquisition and processing system. They analyzed the lines in terms of symmetric Lorentzian profiles in order to isolate the deviations due to asymmetries and found regular patterns of an antisymmetric nature around the line centers. The asymmetry patterns have a common shape with a minimum, maximum, and zero crossing at the same points on a reduced wavelength scale, but they vary widely in their amplitudes. These findings are in excellent qualitative agreement with the quasistatic theory of ion broadening due to the quadratic Stark effect. A comparison and match of experimental and theoretical amplitudes has thus been used to determine the ion broadening parameters of these lines, which are in satisfactory agreement with directly calculated values.

705,086
PB85-143329 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Influence of Molecular Packing on Solid-State 13C Chemical Shifts: The n-Alkanes.
Final rept.
D. L. VanderHart. 1981, 9p
Pub. in Jnl. of Magnetic Resonance 44, n1 p117-125 1981.

Keywords: *Alkanes, Solids, Reprints, *Chemical shifts(Nuclear magnetic resonance), *Molecular packing, *Carbon 13, Molecular conformation.

The question of the influence of molecular packing on isotropic chemical shifts (ICS) in solids is probed experimentally. The n-alkanes are found in four crystallographic forms. Since the isolated chain geometry is considered to be the same in all of these forms and since these solids lack specific interactions (e.g. hydrogen bonds), observed shifts should be related to packing effects. It is found that the ICS of the interior methylene groups is very constant in all forms plus orthorhombic polyethylene. The exception is triclinic C-20, for which this resonance is shifted 1.3 + or - 0.4 ppm downfield. The exact reasons for this shift is not obvious, beyond the uniqueness of the triclinic subcell. Magnetic susceptibility effects were considered and dismissed as inadequate. It is suggested that until solid state chemical shifts are better understood, care should be taken in attributing observed shifts for a given carbon to changes in conformation or specific interactions.

705,087
PB85-143386 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Unified Treatment of Radiative and Dielectronic Recombination.
Final rept.
G. Alber, J. Cooper, and A. R. P. Rau. Nov 84, 4p
Grants NSF-PHY82-00805, NSF-PHY81-20234
Pub. in Physical Review A: General Physics 30, n5 p2845-2848 Nov 84.

Keywords: Comparison, Experimental design, Reprints, *Autoionization, *Electron ion interactions, *Dielectronic recombination.

A coupled channel analysis of electron-positive ion recombination is carried out, with full treatment of the coupling between radiation and autoionization continua. The cross section for this process reduces in the appropriate limits to the expressions for radiative and dielectronic recombination. The coupling to the radiation continuum leads to a modified Fano profile for the autoionizing resonances. The more complete, combined expressions derived here may be of interest for recent experimental studies of recombination and their comparison with theory.

705,088
PB85-143402 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Registration/Identification of Crystalline Materials Based on Lattice and Empirical Formula.
Final rept.
J. R. Rodgers, and A. D. Mighell. 1981, 6p
Pub. in Jnl. of Chemical Information and Computer Sciences 21, n1 p42-47 Feb 81.

Keywords: *X ray diffraction, *Crystal lattices, Chemical analysis, Information systems, Organic compounds, Reprints, *Empirical formulas, Registration, Computer applications.

Data files containing information on solid state materials are rapidly expanding. Each year, for example, several thousand new materials are characterized by x-ray diffraction. Consequently, it has become necessary to develop computer techniques to register materials entering large data bases of solid state materials. We have found that registration based on lattice parameters and empirical formula is especially effective. In our present registration procedure, the lattice is uniquely represented by the reduced cell and the elements in the formula are uniquely specified by prime numbers. Such a method has been applied for several years to register new materials entering the Cambridge Crystallography Data File and is currently being adapted to register materials entering the NBS Crystal Data File. The Cambridge File contains data on over 25,000 carbon containing compounds. For these materials, we have found that the lattice/formula registration is extremely effective. In fact, the authors experience shows that it would be highly desirable if organic materials were routinely characterized by cell parameters in addition to the traditional chemical analysis. A solid-state registry number which would allow one to identify the same compound in different data bases could also be based on lattice/formula. Such a number would allow one to distinguish polymorphs and different phases of the same composition.

705,089
PB85-143436 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of the Aqueous Solubilities of Organic Liquids at 10.0 C, 20.0 C, and 30.0 C by Elution Chromatography.
Final rept.
F. P. Schwarz, and J. Miller. 1980, 3p
Pub. in Analytical Chemistry 52, n13 p2162-2164 1980.

Keywords: *Solubility, *Organic compounds, Toluene, Chlorobenzenes, Reprints, *Elution chromatography, Ethane/trichloro, Ethane/tetrachloro, Phthalic acid/(dibutyl-ester), Benzene/ethyl, Benzene/dichloro.

The elution chromatography method was used to determine the aqueous solubilities of toluene, chlorobenzene, m-dichlorobenzene, diethylphthalate, dibutylphthalate, 1,1,1 trichloroethane, and 1,1,2,2 tetrachloroethane at 10.0, 20.0 and 30.0C and the aqueous solubilities of ethylbenzene and o-dichlorobenzene at 20.0 and 30.0C. The aqueous solubility determinations of the family of benzene derivatives were compared to their solubilities determined by UV absorption measurements on the solution phase. Fifteen of the nineteen benezene solubilities determined by elution chromatography agreed to within an experimental error of 4% with the solubilities determined by the UV absorption method. The experimental error of the aqueous solubilities of the chloroethane derivatives was 2%. The solubilities ranged from 0.00111 wt% for dibutylphthalate at 20.0C to 0.385 wt% for 1,1,2,2 tetrachloroethane at 20.0C.

705,090
PB85-143501 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fluorescence and Photofragmentation of Liquid Saturated-Hydrocarbons at Energies above the Photo-Ionization Threshold.
Final rept.
F. P. Schwarz, D. Smith, S. G. Lias, and P. A. Ausloos. 1981, 9p
Pub. in Jnl. of Chemical Physics 75, n8 p3800-3808 1981.

Keywords: *Fluorescence, *Alkanes, *Photoionization, Excitation, Photolysis, Reprints.

Fluorescence quantum yields, phi (sub F), are reported for liquid alkanes and cycloalkanes excited below and above the photoionization threshold. The quantum yields of fluorescence obtained in the subionization region are in excellent agreement with those reported by Lipsky and colleagues. In the photoionization region, the emission quantum yield is seen to decrease continuously from 8 to 11.6 eV. Measurements carried out in the presence of an electron scavenger, SF6, show that in the photoionization region, emission occurs both from charge recombination processes and deactivation of the superexcited molecule to the vibrationally relaxed singlet state. The presence of these two populations of fluorescing species above the ionization threshold is manifested in differences in the slopes of plots of phi (sub F) as a function of energy above and below the ionization onset. Photofragmentation being the only non-radiative channel in the case of saturated hydrocarbons, the modes of fragmentation have been examined for selected hydrocarbons, as a function of energy. It is noted that the two main dissociative processes H and H2 elimination, show a continuous variation with photon energy, following the trends in the fluorescence quantum yields at these energies. At the highest energy covered in this study (11.6 eV) H atom detachment from the superexcited molecule predominates over all other processes.

705,091
PB85-143568 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Direct Measurement of Fine Structure in the Ground State of Atomic Carbon by Laser Magnetic Resonance.
Final rept.
R. J. Saykally, and K. M. Evenson. 1980, 5p
Pub. in Astrophysical Jnl., Letters to the Editor 238, n2 p107-111, 1 Jun 80.

Keywords: *Atomic energy levels, *Carbon, Interstellar matter, Performance evaluation, Atoms, Sources, Reprints, *Fine structure, *Carbon atoms, *Laser magnetic resonance.

The fine-structure intervals in the ground 2 triplet P multiplet of (12)C(I) have been measured with high accuracy by laser magnetic resonance. These precise measurements have made possible the astronomical detection of far-infrared line emissions from (12)C atoms in several interstellar sources, as reported in another paper in this Journal.

705,092
PB85-143576 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Structure of Diammonium Tricalcium Bis(pyrophosphate) Hexahydrate.
Final rept.
S. Takagi, M. Mathew, and W. E. Brown. 1980, 4p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Acta Crystallographica, Section B: Structural Crystallography and Crystal Chemistry 36, p2526-2529 1980.

Keywords: *Crystal structure, *Calcium phosphates, Ions, Calcium inorganic compounds, Reprints, *Diammonium tricalcium bis(pyrophosphate).

Ca3(NH4)2(P2O7):6H2O crystallizes in the monoclinic space group P2 (sub 1)/n with a = 7.674(1), b = 11.455(2), c = 11.014(2)A, beta = 92.44(5) and Z = 2 at room temperature. The structure was refined to R(F) = 0.059, R (sub W) = 0.057 for 2179 reflections with F (sub 0) > 3 sigma F (sub 0).

705,093
PB85-143626 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Role of Angular Momentum for Atomic Scattering in Intense Laser Fields.
Final rept.
P. S. Julienne, and F. H. Mies. 1982, 4p
Pub. in Physical Review A 25, n6 p3399-3402 Jun 82.

Keywords: *Inelastic scattering, *Angular momentum, Quantum mechanics, Reprints, *Atom interactions, *Laser applications.

The authors have used nonperturbative quantum mechanical close coupled scattering calculations to investigate inelastic atomic collisions induced by strong laser fields. If a partial wave expansion in total angular momentum states is used for the scattering wavefunction, the selection rule delta J = + or -1 for the radiative interaction matrix elements results in an infinite set of close coupled equations. Model calculations for the total laser-induced inelastic cross section for beam and homogeneous gas experiments are carried out for two (1 sup) sigma states coupled by linearly polarized light.

705,094
PB85-143642 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Diode Laser Heterodyne Spectroscopy on the Nu1 Band of Sulfur Dioxide.
Final rept.
J. P. Sattler, T. L. Worchesky, and W. J. Lafferty. 1981, 8p
Pub. in Jnl. of Molecular Spectroscopy 88, n2 p364-371 Aug 81.

Keywords: *Sulfur dioxide, *Infrared spectroscopy, Reprints, *Laser spectroscopy.

Diode laser heterodyne techniques have been used to obtain the frequencies of 55 IR absorption lines of (32)S (16)O2. From these data and from previous microwave and millimeter wave measurements, new spectroscopic constants for the nu 1 band have been determined. The new constants have been used to predict new optically pumped submillimeter wave emissions.

705,095
PB85-143683 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Refinement of the Crystal Orientation Matrix for the Flat-Cone Diffractometer.
Final rept.
A. Wlodawer, L. Sjoelin, and A. Santoro. 1982, 4p
Pub. in Jnl. of Applied Crystallography 15, n1 p79-81 1982.

Keywords: *Diffractometers, Proteins, Molecules, Orientation, Reprints, *Flat cone diffractometers.

A procedure for refining a crystal orientation matrix for the flat-cone diffractometer is discussed. The positions of the centers of gravity of reflections obtained during routine data collection are transformed in such a way that they can be used as input to the least-squares procedures of Busing and Levy (Acta Cryst. 22, 457-

464, 1967) or Schoemaker and Bassi (Acta Cryst. A26, 97-101, 1970). The orientation matrix can be refined on the basis of the positions of all observed reflections, and not only of a selected sample, thus increasing its reliability. The procedure is particularly suited for protein crystallographic studies, as it makes it possible to compensate for crystal movements and electronic drifts encountered during data collection.

705,096
PB85-143857 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Melting Temperature of Nickel by a Pulse Heating Technique.
Final rept.
A. Cezairliyan, and A. P. Miiller. 1984, 6p
Pub. in Int. J. Thermophys. 5, n3 p315-320 1984.

Keywords: *Nickel, *Melting, Measurement, Reprints, High temperature.

The melting temperature of 99.98+% pure nickel was measured by means of a subsecond duration pulse heating technique. The results, based on IPTS-68, yield a value of 1729 K for the melting temperature with an estimated maximum uncertainty of + or - 4 K.

705,097
PB85-143865 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Predicted Wavelengths and Transition Rates for Magnetic Dipole Transitions within 3 doublet s 3p(sup n) Ground Configurations of Ionized Cu to Mo.
Final rept.
J. Sugar, and V. Kaufman. Apr 84, 6p
Pub. in Jnl. of the Optical Society of America B1, n2 p218-223 Apr 84.

Keywords: *Magnetic dipoles, *Ionization, *Wavelengths, Atomic energy levels, Hartree-Fock approximation, Excitation, Reprints, *Copper ions, *Molybdenum ions.

Scaled Hartree-Fock radial integrals for the electrostatic parameter (F(sup2)) and the spin-orbit parameter (Zeta(sub p)) and empirical values for the effective far configuration interaction parameter alpha were used in calculating the energy levels of the 3 doublet S 3p(sup n) configurations of ions of copper through molybdenum in the Al, Si, P, S, and Cl isoelectronic sequences. The scale factors were obtained from the trend of fitted values derived from known energy levels of potassium through nickel and known magnetic-dipole lines from copper to molybdenum. The estimated uncertainty for the transition energies varies from + or - 200/cm for Cu to + or - 1000/cm for Mo. Wave functions generated with the scaled integrals were used to calculate magnetic-dipole transition rates between the calculated energy levels.

705,098
PB85-143873 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reference Lines for Dye Laser Wavenumber Calibration in the Optogalvanic Spectra of Uranium and Thorium.
Final rept.
C. Sansonetti, and K. H. Weber. Jun 84, 5p
Pub. in Jnl. of the Optical Society of America B1, n3 p361-365 Jun 84.

Keywords: *Uranium, *Thorium, *Line spectra, Calibrating, Reprints, *Optogalvanic spectroscopy, *Laser spectroscopy, Fourier transform spectroscopy.

The optogalvanic spectra of uranium and thorium observed in commercial hollow-cathode lamps provide convenient lines for dye-laser wave-number calibration. The authors describe a simple procedure by which a single-frequency cw dye laser can be set on such lines with an accuracy of a few parts in 10 to the 8th power. They report wave numbers for 16 U and 16 Th lines distributed over the wavelength range 5750-6920 A. The estimated uncertainty of the measurements is 0.0003/cm for U and 0.0004/cm for Th. The results are compared with previous U and Th measurements and are found to be in good agreement with recently reported emission wave numbers determined by Fourier spectroscopy.

705,099
PB85-143881 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Vibrational Predissociation, Tunneling and Rotational Saturation in the HF and DF Dimers.
Final rept.
A. S. Pine, W. J. Lafferty, and B. J. Howard. 1 Oct 84, 12p
Pub. in Jnl. of Chemical Physics 81, n7 p2939-2950, 1 Oct 84.

Keywords: *Hydrogen fluoride, *Deuterium compounds, *Molecular vibration, *Molecular rotation, Chemical bonds, Reprints.

The high-resolution spectra of the intramolecular stretching bands of the HF and DF dimers have been recorded with a tunable difference-frequency laser. These measurements yield considerable information about the dynamics of hydrogen bonding in these complexes. Vibrational predissociation is observed as a non-pressure-dependent excess linewidth for the 'bound-H' stretching band of the HF dimer, but no excess linewidth is observed for the 'free-H' stretching band of the HF dimer or for either band of the DF dimer. An unusually large vibrational dependence to the interconversion tunneling frequency is observed for both species, with about a factor of three reduction from the ground state splitting upon excitation of any of the intramolecular stretches. The K subband origins obtained from the A/B hybird 'free-H' stretching band of the HF dimer exhibit an irregular pattern indicating anomalous centrigugal distortion effects suggestive of rotational saturation of the angular orientation of the hydrogen bond.

705,100
PB85-143899 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Wetting, Multilayer Adsorption, and Interface Phase Transitions.
Final rept.
M. R. Moldover, and J. W. Schmidt. 1984, 9p
Pub. in Physica 12D, p351-359 1984.

Keywords: *Phase transformations, *Adsorption, *Critical point, *Liquid phases, *Wetting, Interfaces, Fluids, Reprints.

When two fluid phases coexist near their mutual critical point one fluid phase forms a layer which intrudes between the other fluid phase and any third phase that happens to be present. As the two fluid phases are taken away from their critical point a phase transition often occurs such that the intruding layer vanishes. The authors present recent evidence that the transition from the complete wetting (intruding layer) configuration to the incomplete wetting (three-phase contact) configuration is a first-order phase transition. The thickness of the intruding layers has been measured for diverse systems. These data are not fully understood. The intruding layers are extreme examples of multilayer adsorption. Certain theories predict that a 'prewetting' transition from high adsorption to low adsorption is associated with the transition from complete wetting to incomplete wetting. Their search for this transition is inconclusive.

705,101
PB85-143931 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Kinetics Investigation of the Gas-Phase Reactions of Cl(doublet P) and OH(X(sup 2)/pi) with CH3CN: Atmospheric Significance and Evidence for Decreased Reactivity between Strong Electrophiles.
Final rept.
M. J. Kurylo, and G. L. Knable. 19 Jul 84, 4p
Pub. in Jnl. of Physical Chemistry 88, n15 p3305-3308, 19 Jul 84.

Keywords: *Reaction kinetics, *Electrophilic reactions, *Vapor phases, Coulomb interactions, Fluorescence, Photolysis, Reprints, *Chlorine atoms, *Hydroxyl radicals.

The kinetics of the reactions of Cl(doublet P) and OH(X(sup 2)pi) with acetonitrile (CH3CN) in the gas phase were investigated by the flash photolysis resonance fluorescence technique. The low preexponential factor for the OH reaction as well as the low reactivity of Cl are discussed in terms of coulombic interactions between the attacking free radical and the electrophilic substituent on methane. Changes in reactivity for OH and Cl in the reactant sequence CH3OH, CH3Cl, and CH3CN indicate inadequencies in our current predictive abilities for reaction rate parameters. The atmospheric significance of the present results for acetonitrile is also discussed.

705,102
PB85-143949 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rydberg Series 5p(sup 6) 6snd in the Autoionizing Continua of Neutral Cesium.
Final rept.
V. Kaufman, J. Sugar, C. W. Clark, and W. T. Hill. Nov 83, 5p
Pub. in Physical Review A: General Physics 28, n5 p2876-2880 Nov 83.

Keywords: *Cesium, *Absorption spectra, Comparison, Reprints, *Autoionization, *Rydberg series.

An absorption spectrum of neutral cesium between the 5p(sup 5)(doublet P3/2)6s and 5p(sup 5)(doublet P1/2)6s thresholds was observed in the range of 650-700 A with the National Bureau of Standards 10.7-m grazing-incidence spectrograph. Rydberg series 5p(sup 5)6sns and 5p(sup 5)6snd approaching both upper threshold states (doublet P(sup 1/2)6s, J = 0,1 were identified on the basis of quantum-defect comparisons and Hartree-Fock term energies. Distinctive nd line shapes are compared with those of neutral xenon.

705,103
PB85-143956 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ag I-like Array 4d sup 10 5s-4d sup 9 5s5p of I VII through Eu XVII.
Final rept.
V. Kaufman, and J. Sugar. Mar 84, 3p
Pub. in Jnl. of the Optical Society of America B1, p38-40 Mar 84.

Keywords: *Iodine, *Xenon, *Atomic energy levels, Hartree-Fock approximation, Reprints, *Isoelectronic sequence.

The spectra were produced with a high-voltage spark discharge and photographed with the National Bureau of Standards' 10.7-m grazing-incidence spectrograph. The Ag I-like transition array 4d sup 10 5s-4d sup 9 5s5p was first identified by comparison with the analogous array in the Cu I isoelectronic sequence, then by comparison with a calculated spectrum. The latter was obtained with scaled Hartree-Fock radial energy integrals. The array has been observed most completely in I VII and Xe VIII and, with decreasing strength, to higher sequence members. In Sm XVI and Eu XVII only the strongest line was found. The energy levels and the fitted parameter values for I VII and Xe VIII are given.

705,104
PB85-143972 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evidence for Molecular Reorientations on a Surface: Coadsorption of CO and Na on Ru(001).
Final rept.
F. P. Netzer, D. L. Doering, and T. E. Madey. 1984, 8p
Pub. in Surface Science 143, pL363-L370 1984.

Keywords: *Surface chemistry, *Carbon monoxide, *Sodium, Chemisorption, Reprints, *Electron stimulated desorption, *Molecular configuration.

Evidence is presented for a local interaction between CO and Na adsorbed on Ru(001). For low coverages of Na (theta (sub Na) < or about 0.15 ML) and saturation coverages of CO at 80 K, a fraction of the CO molecules undergo a substantial change in bonding configuration: molecular CO bound perpendicular to the Ru(001) surface changes to an 'inclined' configuration in the presence of low coverages of Na.

705,105
PB85-143980 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Influence of the Image Interaction on Ion Desorption Processes.
Final rept.
Z. Miskovic, J. Vukanic, and T. E. Madey. 1984, 16p
Pub. in Surface Science 141, p285-300 1984.

Keywords: *Desorption, *Surfaces, Particle trajectories, Electrons, Ions, Reprints, Ion scattering, Ion trajectories.

A classical treatment of the interaction between an ion and a conducting surface during an ion desorption process is presented. Analytical expressions have been obtained for the trajectories of desorbing ions as

well as for the trajectories of ions trapped by the image potential. The distortion by the image potential of a general form of the energy and angular distribution of desorbing ions is estimated. The authors' objective has been to provide a guide for experimentalists to the surprisingly large changes in such distributions caused by the image forces.

705,106
PB85-144004 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Threshold Photoelectron-Photoion Coincidence Spectrometric Study of Dimethylether (CH3OCH3).
Final rept.
J. J. Butler, D. M. Holland, A. C. Parr, and R. Stockbauer. 1984, 15p
Pub. in International Jnl. of Mass Spectrometry and Ion Physics 58, p1-14 1984.

Keywords: *Cations, *Photoionization, *Photoelectrons, Heat of formation, Ions, Spectroscopic analysis, Reprints, *Ether/dimethyl, *Autoionization.

The technique of threshold photoelectron-photoion coincidence spectroscopy has been used to study the dissociation of state-selected dimethylether (CH3OCH3) cations. The crossover region (10.5-11.5 eV) of the breakdown curve for the lowest energy dissociation (CH3OCH3(+1) yields CH3OCH2(+1) + H has been recorded using threshold photoelectron-photoion coincidence with variable ion residence time.

705,107
PB85-144384 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Low Temperature Plasma-Enhanced Epitaxy of GaAs.
Final rept.
K. P. Pande, and A. C. Seabaugh. Jun 84, 3p
Pub. in Jnl. of the Electrochemical Society 131, n6 p1357-1359 Jun 84.

Keywords: *Low temperature tests, *Gallium arsenides, *Epitaxy, Plasmas(Physics), Deposition, Reprints, *Chemical vapor deposition.

Low-temperature (<450C) deposition of single crystal GaAs using a new plasma-enhanced MO-CVD technique is reported. In this technique, plasma is created by a dc potential and the substrate is not directly exposed to the plasma. Deposition of GaAs was achieved at extremely low plasma power (<5 W) using trimethylgallium (TMGa) and arsine (or trimethylarsenic) reactants. The resulting epitaxial films show excellent surface morphology and thickness uniformity over a large area substrate. Measurements on Schottky barrier devices fabricated on n/n+ layers show uniform impurity doping profiles. Temperature dependence of the diode capacitance indicates a density of deep trapping centers as low as 6.2 x 10 to the 13th power/cc.

705,108
PB85-144459 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Adsorption of Polystyrene on Thermally Oxidized Silicon.
Final rept.
J. A. Hinkley. Apr 84, 2p
Pub. in Polymer Preprints, American Chemical Society, Division of Polymer Chemistry 25, n1 p178-179 Apr 84.

Keywords: *Polystyrene, *Adsorption, *Surface chemistry, Silicon, Oxidation, Ellipsometry, Reprints, Molecular conformation.

Ellipsometry was used to observe the adsorption, from theta solvents, of polystyrene on thermally oxidized silicon. Since no adsorption was seen with a polar solvent, it is concluded that specific acid-base interactions are decisive in adsorption. At high surface coverages, the present results agree with those on various metal surfaces, and the root mean square extension of polymer coils from the surface is almost twice the radius of gyration of a chain in solution.

705,109
PB85-144863 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Flexibility of the Framework of Zeolite Rho. Structure Variation from 11 to 573 K. A Study Using Neutron Powder Diffraction Data.
Final rept.
J. B. Parise, L. Abrams, T. E. Gier, D. R. Corbin, J. D. Jorgensen, and E. Prince. 1984, 5p
Pub. in Jnl. of Physical Chemistry 88, p2303-2307 1984.

Keywords: *Neutron diffraction, *Crystal structure, *Ion exchange resins, X ray diffraction, Reprints, *Rietveld refinement technique, *Zeolite Rho.

The structure of the dehydrated and deuterium-exchanged form of deammoniated zeolite Rho (Cs1.15(SiAl)48O96D) has been studied at 11, 295, 423, and 573 K. All data sets were refined by using the Rietveld refinement technique in the noncentrosymmetric space group I43m and are characterized by the presence of elliptically distorted double 8-rings. In agreement with a previous study of the effects of hydration upon the framework, increase in temperature causes a monotonic increase in the cubic-unit-cell parameter (a sup 0) and a corresponding decrease in delta, the parameter describing the 'degree of ellipticity' as measured by the difference between the major and minor axes of the 8-ring ellipses. The variations of both delta and a sup 0 with temperature in the range $11 < T < 573$ K appear to fall close to smooth curves. Extrapolation of these curves suggests that the structure may be centrosymmetric above 800 K. This prediction is supported by a study of the changes in the X-ray diffraction pattern of deammoniated Rho up to 773 K.

705,110
PB85-144871 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Refinement of the Structure of Trilanthanum Trichlorohexaoxotungstate, La3WO6Cl39, from Neutron Powder Diffraction Data.
Final rept.
J. B. Parise, L. H. Brixner, and E. Prince. 1983, 3p
Pub. in Acta Crystallographica C39, p1326-1328 1983.

Keywords: *Neutron diffraction, *X ray analysis, *Molecular structure, Chemical bonds, Reprints, *Lanthanum trichlorotungstate.

M(sup r) = 802.9, P6(sup 3)/m, a = 9.4092(2), c = 5.4276(2) A, V = 416.15(2) Cu A, Z = 2, high-resolution neutron powder diffraction data (lambda = 1.5416(3) A, T = 295K), collected from 10 to 122 degrees in 2 theta with 0.05 step size; final weighted profile R = 9.6% was compared to an expected R(sup E) = 7.41% (conventional R based on integrated intensities = 6.00%). The refinement confirms the unusual trigonal prismatic coordination found for the WO6 group in the X-ray study (Brixner, Chen & Foris (1982). J. Solid State Chem. 44, 99-107). The W-O and La-Cl bond lengths determined in this study are slightly shorter, by 0.006 (2)-0.014(4) A, than those found in the X-ray determination.

705,111
PB85-145191 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Aqueous Solubility and Octanol/Water Partition Coefficient of Organic Compounds at 25.0 C.
Final rept.
Y. B. Tewari, M. M. Miller, S. P. Wasik, and D. E. Martire. 1982, 4p
Pub. in Jnl. of Chemical and Engineering Data 27, n4 p451-454 1982.

Keywords: *Organic compounds, *Solubility, *Thermodynamics, Temperature, Gas chromatography, Reprints, *Activity coefficients, *Octanol, High pressure liquid chromatography.

Aqueous solubilities (C(sub s)(sup w)) and octanol/water partition coefficients (K(sub o/w)) of 62 organic solutes, falling into 7 general chemical classes, have been systematically determined using the modified generator column method. From thermodynamics an equation is derived relating K(sub o/w) to the volume-fraction-based solute activity coefficient in water (gamma(sub s)(sup w)), the latter being determinable from C(sub s). For each class of compounds, excellent linear correlations are found between log C(sub o/w) and log gamma (sub s)(sup w), with slopes close to the theoretical value of unity.

705,112
PB85-145290 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Distribution of Straight-Chain Lengths in Unannealed and Annealed Solution-Crystallized Polyethylene by Raman Spectroscopy.
Final rept.
R. G. Snyder, J. R. Scherer, D. H. Reneker, and J. P. Colson. 1982, 9p
Pub. in Polymer 23, n9 p1286-1294 Aug 82.

Keywords: *Raman spectroscopy, *Polyethylene, Crystallization, Sampling, Solutions, Reprints, *Polymer chains.

The effect of annealing on the morphology of solution-crystallized polyethylene had been studied by analyzing the shape of the low-frequency Raman LAM-1 band. The distributions of lengths of straight-chain segments have been determined for samples annealed at different temperatures. Unannealed samples, which have distribution peaks L(max) near 100 A, have halfwidths delta L(sub 1/2) less than 20 A. However, this narrow distribution is drastically broadened when the sample is annealed. The broadening is less if the breadth of the distribution of the unannealed sample is initially less. For equilibrium crystallized samples, the observed halfwidth and peak position of LAM-1 are related. This relation can be understood quantitatively if it is assumed that delta L(sub 1/2) and 1/L(sub max) are linearly related as is indeed found to be the case for solution-crystallized samples. As L(max) becomes very large, delta L(sub 1/2) approaches a limiting value near 300 A.

705,113
PB85-145373 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Aqueous Solubilities and Octanol-Water Partition-Coefficients of Binary-Liquid Mixtures of Organic-Compounds at 25 C.
Final rept.
Y. B. Tewari, D. E. Martire, S. P. Wasik, and M. M. Miller. 1982, 11p
Pub. in Jnl. of Solution Chemistry 11, n6 p435-445 1982.

Keywords: *Binary systems(Materials), *Liquid phases, *Solubility, Mixtures, Organic compounds, Solutions, Experimental design, Hexane, Chloroform, Nitrobenzenes, Thermodynamics, Reprints, *Activity coefficients, Benzene/propyl, Benzene/ethyl, Ether/isopropyl, Benzene/nitro.

From thermodynamics it is shown that, under the usual experimental conditions, the octanol-water partition coefficient (K(sup o/w)) of a given organic liquid should be the same whether the substance is partitioned by itself or as part of a mixture.

705,114
PB85-145399 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Corrosion Phenomena for Iron Covered with a Cellulose Nitrate Coating.
Final rept.
J. J. Ritter, and M. J. Rodriguez. 1982, 4p
Pub. in Corrosion 38, n4 p223-226 Apr 82.

Keywords: *Corrosion, *Protective coatings, *Organic coatings, *Cellulose nitrate, Electrochemistry, Ellipsometry, pH, Reprints.

The corrosion of metals protected by organic coatings is an incompletely understood phenomenon. Recent investigations by an in situ ellipsometric-electrochemical technique combined with microanalytical studies have provided new insights into the destructive processes. Events such as the roughening of the metal surface, chloride ion accumulation and the thickening of the surface oxide have been detected under the coating and are interpreted in terms of the chemistry which develops between the microenvironment and the substrate.

705,115
PB85-145431 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stochastic Defect Diffusion Model for Relaxation Effects in Crystalline Polyethylene.
Final rept.
D. H. Reneker, and J. Mazur. 1982, 12p
Pub. in Polymer 23, n3 p401-412 Mar 82.

Keywords: *Polyethylene, *Mathematical models, *Diffusion, *Crystal defects, *Molecular relaxation, Reprints.

It is suggested that some relaxation processes observed in crystalline polyethylene are consequences of the diffusive motion of a particular defect called a point dislocation or twist dispiration loop along the polyethylene stems in lamellar crystals. The motion of the defect, characterized by a diffusion coefficient and a mobility, is described by solutions of the Smoluchowski diffusion equation with boundary conditions that con-

strain the defect to move along routes that produce experimentally observable results. The fact that passage of the defect causes both a 180 rotation of the chain and moves an extra CH2 group in the direction of the chain axis is important to the interpretation of the data according to this model. The diffusion coefficient for a defect is estimated to be around 5 x 10 to the -9th power sq cm/s. This value is shown to be reasonable both from the viewpoint of detailed computer modeling of defect motion and contemporary ideas about scaling.

705,116
PB85-145464 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Total and Partial Electron Collisional Ionization Cross Sections for CH4, C2H6, SiH4 and Si2H6.
Final rept.
H. Chatham, D. Hils, R. Robertson, and A. Gallagher. Aug 84, 8p
Sponsored by Solar Energy Research Inst., Golden, CO.
Pub. in Jnl. of Chemical Physics 81, n4 p1770-1777 Aug 84.

Keywords: *Ionization, *Methane, *Ethane, *Silane, *Disilane, Comparison, Reprints, *Electron molecule interactions.

The total and partial electron collisional ionization cross sections for CH4, C2H6, SiH4 and Si2H6 have been measured for electron energies from threshold to 300 eV. Comparisons are made to earlier measurements.

705,117
PB85-145480 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Shear Viscosity Coefficients of Nitrogen + Methane and Methane + Ethane Mixtures.
Final rept.
D. E. Diller. Nov 83, 5p
Pub. in American Society of Mechanical Engineers Paper No. 83-WA/HT-49, 5p Nov 83.

Keywords: *Binary systems(Materials), *Viscosity, *Shear tests, *Nitrogen, *Methane, *Ethane, Mixtures, Temperatures, Pressures, Density(Mass/volume), Reprints.

The shear viscosity coefficients of compressed gaseous and liquid nitrogen + methane and methane + ethane mixtures have been measured with a torsional crystal viscometer at three fixed compositions (each) and throughout a large range of temperatures (100-300 K), pressures (0.5-30 MPa) and densities (0.1-3 pc). This PVT range includes states near liquid-vapor equilibrium, states near liquid-solid equilibrium and states near the critical region. The measured dependences of the viscosities on density, temperature and composition are compared with an extended corresponding states model.

705,118
PB85-145498 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Apparatus for the Measurement of Gas Fluxes through Immobilized Liquid Membranes.
Final rept.
B. R. Bateman, J. D. Way, and K. M. Larson. 1984, 12p
Pub. in Separations Science and Technology 19, n1 p21-32 1984.

Keywords: *Membranes, *Laboratory equipment, *Gases, Transport properties, Design criteria, Performance evaluation, Reprints.

An automated apparatus to measure gas fluxes through immobilized liquid membranes is described. Specific design features permit safe operation for experimentation with CO, NO, and H2S. Nitric oxide fluxes through immobilized Fe(II) solutions have been measured and are presented as a typical equipment application. Facilitation factors (ratio of total flux to flux without carrier) greater than 5 were observed.

705,119
PB85-145506 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calculations for Separations with Three Phases. 2. Continuous Contact Systems.
Final rept.
P. C. Wankat, and R. D. Noble. 1984, 7p
Pub. in Industrial and Engineering Chemistry Fundamentals 23, n2 p137-143 1984.

Keywords: *Phase measurement, Separations, Membranes, Extraction, Steam distillation, Graphs(Charts), Reprints, *Phase equilibrium.

General graphical solution methods for continuous contact separations with two cocurrent streams flowing countercurrent to the third stream are developed. Applications include liquid membrane separations, slurry adsorption, three-phase extraction, and steam distillation. For two phases in equilibrium, and methods are simplified. For nonlinear equilibria two graphical techniques are developed. One method uses variable operating lines while the other method develops a pseudo-equilibrium curve. The analysis shows that the evaluation of NTU is independent of a series or parallel separation when two phases are in equilibrium. HTU does depend on the separation path.

705,120
PB85-145548 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Vibration-Rotation Interaction on the Quadrupole Hyperfine Structure of Molecular Rotational Levels.
Final rept.
M. R. Aliev, and J. T. Hougen. 1984, 14p
Pub. in Jnl. of Molecular Spectroscopy 106, p110-123 1984.

Keywords: *Molecular rotation, *Hyperfine structure, *Quadrupole moments, Molecular vibration, Reprints.

By using a contact transformation method similar to that commonly emploYed when determining higher-order corrections to the harmonic oscillator and rigid rotor energy levels of molecules, analogous centrifugal distortion and anharmonic corrections to the nuclear quadrupole coupling energies have been obtained for molecules containing one quadrupolar nucleus. The J, K dependence and v, I dependence of these higher-order corrections to the quadrupole hyperfine energies can be cast in a form which is remarkably similar to the form taken for ordinary vibrational and rotational energy corrections, a result which was not evident from earlier partial treatments of this general problem. Results are obtained here for asymmetric top, symmetric top, spherical top, and linear molecules.

705,121
PB85-145589 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Absolute Frequency Measurements of the 00(sup 0)2-00(sup 0)0, 20(sup 0)1-00(sup 0)0, and 12(sup 0)1-00(sup 0)0 Bands of N2O by Heterodyne Spectroscopy.
Final rept.
C. R. Pollock, F. R. Petersen, D. A. Jennings, J. S. Wells, and A. G. Maki. 1984, 10p
Pub. in Jnl. of Molecular Spectroscopy 107, p62-71 1984.

Keywords: *Nitrogen oxide(N2O), *Infrared spectroscopy, Absorption, Standards, Molecular vibration, Calibrating, Reprints, *Heterodyne spectroscopy.

The absolute frequency of 39 lines in the 00(sup 0)2-00(sup 0)0, 20(sup 0)1-00(sup 0)0, and 12(sup 0)1-00(sup 0)0 band of N2O in the 4300 - 4800/cm range have been measured through heterodyne frequency measurements. The lines were each measured in Doppler-limited absorption using a color center laser as a tunable probe of the N2O, and two stabilized CO2 lasers as reference frequencies. New ro-vibrational constants have been fitted to these measurements. Tables of calculated transition frequencies are given with estimated absolute uncertainties as small as .0001/cm. The pressure shift of four lines has been measured and the values fall within the range of 0 to -2 kHz/Pa (0 to -200 kHz/Torr).

705,122
PB85-145605 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electrochemical Studies on Doping of Polyacetylene.
Final rept.
C. K. Chiang, E. A. Blubaugh, and W. T. Yap. Aug 84, 5p
Pub. in Polymer 25, p1112-1116 Aug 84.

Keywords: *Electrochemistry, *Additives, Reprints, *Polyacetylene, *Voltammetry.

The mechanism for electrochemical doping of polyacetylene was studied using cyclic voltammetry. The I-V curve of a thin (CH)x film (<1 micrometer) electrode exhibited a redox peak with a formal redox potential of +0.63 V vs sodium SCE. Approximately 30% of the total charge that oxidized (CH)x was not reversible when held at the open circuit voltage of the cell. A more negative potential was needed to recover the remaining charge. This large charge-trapping phenomenon was the consequence of the (CH)x film being doped. Using a thick film electrode or freestanding film (about 0.1 mm) as an electrode, the I-V curve gave only a broad reduction peak at +0.4 V. The disappearance of the well-defined redox peak implies that the redox process revealed by the thin film data may not be the primary mechanism for the doping process.

705,123
PB85-145613 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effective Potentials in Molecular Quantum Chemistry.
Final rept.
M. Krauss, and W. J. Stevens. 1984, 29p
Pub. in Annual Review of Physical Chemistry 35, p357-385 1984.

Keywords: *Quantum chemistry, *Molecular structure, *Potential energy, *Mathematical models, Reprints.

Model potentials and effective core potentials are impacting quantum chemistry by allowing accurate structure calculations to be performed for very large systems such as solid state systems, complex organic and biomolecules, and polymers. Relativistic effective potentials have allowed, for the first time, systematic theoretical exploration of heavy atom chemistry. The most appealing aspect of these effective potential methods is that they are ab initio, and, therefore, like the all-electron methods they simulate, extensible to all atomic and molecular systems. The theoretical framework that underlies the determination of effective potentials is intuitively sound, but sometimes less than rigorous. This is especially true for the relativistic extensions which need to be examined much more carefully since direct comparisons with more rigorous all-electron results are difficult.

705,124
PB85-145621 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Collision Dynamics of Three Interacting Atoms: Model Calculations of H + H2 Resonances.
Final rept.
A. C. Kuruoglu, and D. A. Micha. May 84, 15p
Pub. in Jnl. of Chemical Physics 80, n9 p4262-4276 May 84.

Keywords: *Hydrogen, *Mathematical models, *Resonance scattering, Diatomic molecules, Reprints, *Atom atom interactions.

Collisions of H and H2 at thermal energies are studied within a three-body theory of atom-diatom rearrangement collisions. A previously developed general formalism based on a diabatic electronic representation is shown to be equivalent, for this system, to a treatment in terms of atomic spins. It further provides a novel approach to nuclear exchange symmetry. The interaction potential is parametrized by introducing a minimal valence-bond basis, and the collision dynamics is described with the Faddeev equations. These equations are reduced to two-body form, and are analyzed in terms of angular momentum components. A detailed description is given of the numerical procedure applied to the coupled integral equations that result from expanding in diatomic square integrable basis functions. Those equations are solved in momentum variables using quadrature techniques, and provide K-matrix elements.

705,125
PB85-145639 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Magnetic Resonance of the O2 Molecule at 699 micrometers.
Final rept.
M. Mizushima, K. M. Evenson, J. A. Mucha, D. A. Jennings, and J. M. Brown. 1983, 12p
Contract NASA-W-15047
Pub. in Jnl. of Molecular Spectroscopy 100, p303-315 1983.

Keywords: *Oxygen, *Microwave spectroscopy, *Hyperfine structure, Molecular energy levels, Design criteria, Performance evaluation, Reprints, *Laser magnetic resonance spectroscopy, Laser spectroscopy.

A new highly sensitive far infrared optically pumped laser magnetic resonance (LMR) spectrometer has facilitated the observation of 21 transitions in O2 at 699 micrometers (428.6285 GHz). From the intensity of the observed lines the sensitivity limit of this LMR spectrometer is found to be about 10 to the -9th power/cm at this frequency with a 1-sec time constant.

705,126
PB85-147908 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Picosecond Vibrational Energy Relaxation of Surface Hydroxyl Groups on Colloidal Silica.
Final rept.
E. J. Heilweil, M. P. Casassa, R. R. Cavanagh, and J. C. Stephenson. 15 Sep 84, 3p
Pub. in Jnl. of Chemical Physics 81, n6 p2856-2858, 15 Sep 84.

Keywords: *Surface chemistry, *Molecular vibration, *Infrared spectroscopy, *Molecular relaxation, Chemisorption, Silicon dioxide, Atomic energy levels, Reprints, *Hydroxyl radicals.

The authors report the first time-resolved measurement of vibrational energy relaxation (T1) for a chemisorbed species. A picosecond infrared saturation and ground state recovery technique measured population decay of vibrationally excited hydroxyl groups bound to room temperature colloidal SiO2 dispersed in CCl4. The ground electronic state vibrational decay times correspond to twenty thousand vibrational periods.

705,127
PB85-148062 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Vibrational Energy Disposal in Reactive and Inelastic Collisions of H(D) + HCl(DCl) at 1 to 3 eV.
Final rept.
C. A. Wight, F. Magnotta, and S. R. Leone. 1 Nov 84, 7p
Contract DAAG29-82-K-0031, Grant NSF-PHY82-00805
Sponsored by Grant NSF-CHE79-11340.
Pub. in Jnl. of Chemical Physics 81, n9 p3951-3957, 1 Nov 84.

Keywords: *Hydrogen chloride, *Deuterium compounds, *Molecular vibration, *Inelastic scattering, Excitation, Infrared spectroscopy, Fluorescence, Reprints, *Atom molecule interactions, *Hydrogen atoms.

Vibrational energy disposal due to reactive exchange and unreactive translational-to-vibrational excitation in hyperthermal collisions of H + HCl and deuterated analogues is investigated by the excimer laser photolysis/ infrared fluorescence technique. This is consistent with an interpretation that the inelastic T-V excitation pathway is predominant. No information is obtained on the H atom abstraction channel.

705,128
PB85-148088 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dependence of the Phase Diagram on the Coupling Parameters in Water-Lattice Models.
Final rept.
E. Van Royen, and P. H. E. Meijer. 1984, 26p
Pub. in Physica 127A, p87-112 1984.

Keywords: *Phase diagrams, *Mathematical models, *Water, *Crystal lattices, Chemical bonds, Ice, Reprints.

This paper reports specific results obtained with the two previously proposed lattice models of water as based on the cluster variation method. The hydrogen-bonded lattice gas with next nearest neighbor repulsion has a Hamiltonian with three coupling parameters. The authors map out the region in the coupling parameter space which gives a phase diagram that has the same topology as the phase diagram of water. They first discuss, using the simple model, how one diagram evolves into a seemingly different topology and explain how the first order terminal points disappear in the metastable region. They then use the extended model, which contains two extra degrees of freedom to describe four phase diagrams that show some of the desired features the authors want in a water potential. The final choice is made, using a potential labelled 9, which shows all desired features in a qualitative way. A discussion is given about the limitations of the model.

705,129
PB85-148104 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Transient Heat Transfer Processes.
Final rept.
V. D. Arp, D. E. Daney, P. J. Giarratano, and W. G. Steward. 1983, 7p
Pub. in AIChE (American Institute of Chemical Engineers) Symposium Series 79, n224 p126-132 1983.

Keywords: *Heat transfer, *Mathematical models, *Experimental design, *Fluids, Equations of state, Boundary layer, Reprints.

An integrated experimental and modeling study of transient heat transfer to a compressible fluid involving rapid convective motion normal to the heated surface, perturbations due to superimposed motion parallel to the surface, and modeling of these effects will be summarized. Analyses done for both one and two-dimensional thermally-induced convective motions and deviations from incompressible fluid theory documented in one dimension will be discussed. Mathematical stability problems associated with the form of the fluid equation of state also will be discussed.

705,130
PB85-148112 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nonlinear Flow Behavior of Gases.
Final rept.
S. Hess, H. J. M. Hanley, and N. Herdegen. 15 Oct 84, 3p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Physic Letters 105A, n4-5 p238-240, 15 Oct 84.

Keywords: *Gases, *Boltzmann equation, Computerized simulation, Comparison, Kinetic theory, Pressure, Viscosity, Reprints, Lennard Jones system.

Computer simulation results for a dilute Lennard-Jones gas subjected to a shear are compared with theoretical predictions from an approximate solution of the Boltzmann equation. Nonlinear, non-newtonian characteristics are observed in the gas, including the existence of normal pressure differences. Agreement between the simulations and kinetic theory is satisfactory.

705,131
PB85-148146 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Surface Chemistry of Bone and Tooth Mineral.
Final rept.
D. N. Misra. 1984, 31p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Methods of Calcified Tissue Preparation, Chapter 13, p435-465 1984.

Keywords: *Surface chemistry, *Bones, *Dental materials, Adsorption, Crystal structure, Electrochemistry, Ion exchanging, Solubility, Reprints, Fluorapatite, Hydroxyapatite.

This article will constitute a chapter of a book 'Calcified Tissue Preparation', edited by Dr. Glenn R. Dickson of The Queens University of Belfast and will be published by Elsevier/North Holland. The chapter reviews the surface chemistry of hydroxyapatite, the structural prototype of bone mineral, from the viewpoints of adsorption, chemical and crystal structure, electrochemistry, isoionic exchange, and solubility.

705,132
PB85-151587 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characterization of Surfaces Through Electron and Photon Stimulated Desorption.
Final rept.
T. E. Madey, D. E. Ramaker, and R. Stockbauer. 1984, 26p
Pub. in Annual Review of Physical Chemistry 35, p215-240 1984.

Keywords: *Surface chemistry, *Chemisorption, Molecule structure, Reprints, *Electron stimulated desorption ion angular distribution method, *Photon stimulated desorption.

The authors review various mechanisms of electron and photon stimulated desorption of ions and neutrals from surfaces. Examples include desorption from ionic surfaces, from covalent adsorbates on metal surfaces, and from layers of physically adsorbed atoms. The use of the electron stimulated desorption ion angular distribution (ESDIAD) method for determining local structures of surface molecules is described.

705,133
PB85-151603 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Vibrational Excitation, Harpooning, and Sticking in Molecule-Surface Collisions.
Final rept.
J. W. Gadzuk, and J. K. Noerskov. 15 Sep 84, 11p
Pub. in Jnl. of Chemical Physics 81, n6 p2828-2838, 15 Sep 84.

Keywords: *Diatomic molecules, *Metals, *Surface chemistry, *Molecular vibration, Excitation, Reprints.

The problem of vibrational excitation of a diatomic molecule scattering from a metal surface is considered for encounters in which the molecular electron affinity level crosses the surface Fermi level, thus allowing for electron transfer back and forth between metal and molecule during the scattering process. The problem is formulated within a diabatic representation in terms of a Landau-Zener-Tully-Preston curve hopping at the location where charge transfer or harpooning occurs, following related theory for other surface charge transfer processes. Account is taken of both the time dependence of the affinity level position and width due to the translational motion of the molecule. Vibrational excitation probability distributions for scattered molecules are calculated. Under certain circumstances, these are obtained in analytic form using a semi-classical wave packet dynamics model. A novel mechanism in which the energy redistribution from translational to internal vibrational modes gives rise to sticking of the undissociated molecule on the surface is presented.

705,134
PB85-151660 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heat Transfer Effects in Facilitated Transport Liquid Membranes.
Final rept.
N. J. Kemp, and R. D. Noble. 1984, 19p
Pub. in Separation Science and Technology 18, n15 p1147-1165 1984.

Keywords: *Heat transfer, *Transport properties, *Membranes, *Mathematical models, Temperature, Isothermal treatment, Diffusion, Reprints, *Liquid membranes.

Various mathematical models have been developed to describe facilitated transport. There are two limiting regimes where steady-state analytical solutions are available; diffusion-limited (reaction equilibrium) and reaction-limited (frozen condition). For intermediate cases, numerical solutions are available. All of these models are valid for isothermal conditions. It is possible in practice that the system may not be isothermal. The gas streams on each side of the membrane may be at different temperatures and/or there can be heat of reaction effects. These effects can cause the total facilitated flux to deviate from the isothermal case.

705,135
PB85-151702 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electrostriction and Dielectric Friction on Ions Moving through Compressible Polar Solvents.
Final rept.
P. J. Stiles, and J. B. Hubbard. 6 Apr 84, 4p
Pub. in Chemical Physics Letters 105, n6 p655-658, 6 Apr 84.

Keywords: *Ions, *Electrostriction, *Dielectric properties, *Mathematical models, Solvents, Drag, Reprints.

The Hubbard-Onsager electrohydrodynamic model is extended to examine the influence of electrostriction on the mobilities of large ions in compressible polar solvents. The authors find that electrostriction leads to significant augmentation of the drag coefficients of large ions in aprotic solvents such as acetonitrile and acetone.

705,136
PB85-151744 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Application of the Extended Corresponding States Model to Hydrocarbon Mixtures (Computer Program EXCST).
Final rept.
J. F. Ely. 1984, 14p
Sponsored by National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.

Pub. in Proceedings of Gas Processors Association Annual Convention (63rd), New Orleans, LA., March 19-21, 1984, p9-22.

Keywords: *Hydrocarbons, *Fluids, *Thermophysical models, Mixtures, Van der Waals forces, Computer programs, Density(Mass/volume), Viscosity, Thermal conductivity, Enthalpy, Phase equilibrium.

The past few years have seen a resurgence of interest in accurate modelling of thermophysical properties of fluids. This interest can be attributed to both emerging new technological demands and to economic factors such as rising energy costs and needs for more accurate custody transfer models. In this report results obtained from a study designed to develop an accurate predictive model for the thermodynamic properties of hydrocarbon mixtures are presented. The model is called the extended corresponding states model and incorporates a mixture one-fluid concept originally due to van der Waals. In order to test the accuracy of the model, extensive comparisons between predicted and experimental densities, viscosities and thermal conductivities are presented. In addition, work is currently in progress to document phase equilibria and enthalpy prediction accuracy.

705,137

PB85-151777 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamic Properties of Ethylene at Saturation.
Final rept.
M. Jahangiri, R. T. Jacobsen, R. B. Stewart, and R. D. McCarty. 1984, 8p
Pub. in Advances in Cryogenic Engineering 29, p965-972 1984.

Keywords: *Thermodynamic properties, *Ethylene, Mathematical models, Vapor pressure, Density(Mass/volume), Temperature, Reprints, *PVT properties.

A new analysis of the liquid-vapor coexistence PVT of ethylene is presented. Mathematical models of the vapor pressure, saturated liquid and vapor densities are presented. Deviations between calculated and experimental data are given.

705,138

PB85-151785 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Semi-Automated Facilities for Measuring Density, PVT and VLE of Energy-Related Fluids.
Final rept.
J. M. H. Levelt Sengers, and D. Linsky. 1984, 11p
Pub. in Proceedings of Symposium on Energy Engineering Sciences, Research on Instrumentation, Testing and Evaluation (2nd), Argonne, IL., April 10-11, 1984, p1-11.

Keywords: *Fluids, *Density(Mass/volume), Critical point, Ethylene, Butanes, *PVT properties, *Vapor liquid equilibrium, Propane/methyl.

To characterize the behavior of the thermodynamic properties of systems near a critical point systems are grouped into universality classes. Systems within a universality class have the same universal critical exponents and scaling functions. Specifically, fluids are expected to belong to the universality class of 3-dimensional Ising-like systems for which the universal quantities have been calculated with considerable accuracy. A scaled fundamental equation is presented which incorporates these theoretical predictions. Results obtained for various technologically important fluids, namely ordinary steam, heavy steam, ethylene and isobutane, are discussed.

705,139

PB85-151793 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Universal Representation of the Thermodynamic Properties of Fluids in the Critical Region.
Final rept.
J. V. Sengers, and J. M. H. Levelt Sengers. Feb 84, 14p
Pub. in Int. J. Thermophys. 5, n2 p195-208 Feb 84.

Keywords: *Fluids, *Density(Mass/volume), Critical point, Ethylene, Butanes, Reprints, *PVT properties, *Vapor liquid equilibrium, Propane/methyl.

To characterize the behavior of the thermodynamic properties of systems near a critical point systems are grouped into universality classes. Systems within a universality class have the same universal critical exponents and scaling functions. Specifically, fluids are expected to belong to the universality class of 3-dimensional Ising-like systems for which the universal quantities have been calculated with considerable accuracy. A scaled fundamental equation is presented which incorporates these theoretical predictions. Results obtained for various technologically important fluids, namely ordinary steam, heavy steam, ethylene and isobutane, are discussed.

705,140

PB85-154581 PC **A09**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Thermodynamic Properties of Isobutane-Isopentane Mixtures from 240 to 600K and up to 20 MPa (with Supplemental Tables from -40 to +600F and up to 1000 psia).
Interim rept.
J. S. Gallagher, J. M. H. Levelt Sengers, G. Morrison, and J. V. Sengers. Nov 84, 183p NBSIR-84/2971
See also DE84-015137. Sponsored by Department of Energy, Oakland, CA. San Francisco Operations Office.

Keywords: *Butanes, *Propanes, Mixtures, Thermodynamic properties, Critical points, Tables(Data), Enthalpy, Binary systems(Materials), Vapor pressure, *Helmholtz function, *Propane/methyl, *Butane/methyl.

The Helmholtz function for pure isobutane from a recent correlation has been converted to a dimensionless form and a pressure-enthalpy chart based on this function has been generated by computer. A Helmholtz function for mixtures of isobutane and isopentane has been formed based upon the dimensionless isobutane Helmholtz function as the reference fluid by means of an extended corresponding-states principle. Scarce literature data for saturation properties of isopentane, and new data for its vapor pressure and for the critical line of the mixture were used. The accuracy of the surface was checked by comparing with literature enthalpy data and with new VLE data for the mixture. Tables of thermodynamic properties have been generated from this Helmholtz function for the 0.1 mole fraction isopentane-in-isobutane mixture in the single-phase region and on the dew- and bubble-point curves, together with properties of the coexisting phase. A pressure-enthalpy chart for this mixture has also been generated.

705,141

PB85-161297
(Order as PB85-161271, PC **A05**/MF **A01**)
National Bureau of Standards, Boulder, CO.
Automated High-Temperature PVT Apparatus with Data for Propane.
G. C. Straty, and A. M. F. Palavra. 20 Jun 84, 9p
Prepared in cooperation with Instituto Superior Tecnico, Lisbon (Portugal).
Included in Jnl. of Research of the National Bureau of Standards, v89 n5 p375-383 Sep-Oct 84.

Keywords: *Propane, *Laboratory equipment, *Compressibility, Fluids, Design criteria, Performance evaluation, Supercritical flow, *PVT properties, Burnett method.

An apparatus is described which can be used for PVT and compressibility measurements on supercritical fluids from near room temperature to 600 degrees C and pressures to 35 MPa. Two separate experimental techniques are employed to obtain PVT data over a broad range of the state surface. Burnett expansions are performed to generate compressibility factor (or equivalently density) data along a well-behaved supercritical isotherm. A series of isochoric measurements is then made to extend the temperature range. Densities assigned to the isochores are determined from their intersection with the previously measured Burnett isotherm or gravimetrically. A computer is used for experimental control and for data logging. Isochoric measurements lasting several days can be performed routinely and without operator attention. The apparatus has been tested on propane to a temperature of 325 degrees C. The density data, estimated to + or - 0.1 percent, are in excellent agreement with other existing data.

705,142

PB85-161313
(Order as PB85-161271, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Report on the National Bureau of Standards pH Standards.
Y. C. Wu, W. F. Koch, and G. Marinenko. 19 Sep 84, 6p
Included in Jnl. of Research of the National Bureau of Standards, v89 n5 p395-400 Sep-Oct 84.

Keywords: *pH, *Standards, Thermodynamics, Activity coefficients, *Standard reference materials.

In 1980, the research program in pH was re-established at the National Bureau of Standards (NBS). This report describes the state of this research, as well as the state of the NBS pH standards. The thermodynamic defintion and the determination of pH are elaborated. The problems of liquid junction potentials encountered in the practical determination of pH are discussed. The goal of the research program in pH is to develop and maintain a unified pH scale based on clearly stated thermodynamic criteria, with a wide range of applicability to practical pH measurements.

705,143

PB85-170652 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Solubility of Strontianite (SrCO3) in CO2-H2O Solutions between 2 and 91C, the Association Constants of SrHCO3(+1)(aq) and SrCO3 (sup)(aq) between 5 and 80C and an Evaluation of the Thermodynamic Properties of Sr(2+)(aq) and SrCO3(cr) at 25C and 1 atm Total Pressure.
Final rept.
E. Busenberg, L. N. Plummer, and V. B. Parker. Oct 84, 15p
Pub. in Geochimica et Cosmochimica Acta 48, p2021-2035 Oct 84.

Keywords: *Solubility, *Strontianite, *Chemical equilibrium, Reprints.

Seventy new measurements (Sr(sub tau)-P(sub CO2)) of the solubility of strontianite were used to evaluate the equilibrium constant for the reaction SrCO3(cr) = Sr(+2)(aq) + CO3(-2)(aq) between 2 and 91C.

705,144

PB85-172203 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron-Induced Reactions and Secondary Ion Mass Spectrometry: Complementary Tools for Depth Profiling.
Final rept.
G. Downing, R. Fleming, D. Simons, and D. Newbury. 1982, 4p
Pub. in Proceedings of Annual Conference of the Microbeam Analysis Society (17th), Washington, DC., August 9-13, 1982, p219-221.

Keywords: Bismuth, *Secondary ion mass spectroscopy, *Neutron induced reactions, *Depth profiles.

The technique of neutron depth profiling is based upon inducing nuclear reactions by bombardment with low energy neutrons. The nuclear reactions result in the emission of high energy alpha particles or protons. The energy spectrum of the emitted particles is used to derive a depth distribution by transforming the energy loss into an equivalent depth by stopping power calculations. Depth profiles of bismuth distributions in silicon and tin have been measured by both neutron depth profiling and secondary ion mass spectrometry. Information from both techniques can be used synergistically to aid in a full characterization of the depth distribution.

705,145

PB85-172500 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Intermolecular Potential Calculations for Polycyclic Aromatic Hydrocarbons.
Final rept.
J. H. Miller, W. G. Mallard, and K. C. Smyth. 11 Oct 84, 8p
Pub. in Jnl. of Physical Chemistry 88, n21 p4963-4970, 11 Oct 84.

Keywords: *Aromatic polycyclic hydrocarbons, *Intermolecular forces, *Potential energy, Soot, Air pollution, Reprints, Benzene, Molecular configuration, Numerical solution, Dimers, Coronene, Circumcoronene.

Methods of calculating the dispersive part of the intermolecular potential for polycyclic aromatic hydrocarbons of D(sub 6h) symmetry are examined. A new, semi-empirical method is utilized to generate the ap-

proximate angle dependent dispersive potentials. These dispersive potentials are added to the electrostatic potentials which arise from the permanent quadrupole moments, and the resulting total potential is used to predict the angle between the planes of the molecules in the most stable dimer configuration for the homologous series benzene, coronene, and circumcoronene. These angles are 90, 42, and 36 degrees, respectively, and the well depths at these angles are 2.41, 7.87, and 23.0 kcal/mol.

705,146
PB85-172534 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chemical Behavior of SO3- and SO5- Radicals in Aqueous Solutions.
Final rept.
R. E. Huie, and P. Neta. 8 Nov 84, 5p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Physical Chemistry 88, n23 p5665-5669, 8 Nov 84.

Keywords: *Free radicals, *Sulfites, *Chemical properties, Solutions, Spectrophotometry, Reaction kinetics, Oxidation, Reprints.

The chemistry of the radicals SO3(-1) and SO5(-1) has been investigated using pulse radiolysis with kinetic spectrophotometry. Rate constants for the oxidation by SO3(-1) of a variety of organic compounds were measured and equilibrium constants determined for the reactions of SO3(-1) with chlorpromazine and phenol. The oxidation of several compounds by SO5(-1) was found to occur more rapidly than their oxidation by SO3(-1). E(SO5(-1)/HSO5(-1) was estimated to be approximately 1.1V at pH 7.

705,147
PB85-179075
(Order as PB85-179042, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD. Center for Materials Science.
Interactions of Composition and Stress in Crystalline Solids.
F. C. Larche, and J. W. Cahn. 30 Aug 84, 34p
Prepared in cooperation with Montpellier-2 Univ. (France).
Included in Jnl. of Research of the National Bureau of Standards, v89 n6 p467-500 Nov-Dec 84.

Keywords: *Crystals, *Stress analysis, *Solids, Phase transformation, Thermodynamics.

The thermodynamics of stressed crystals that can change phase and composition is examined with particular attention to hypotheses used and approximations made. Bulk and surface conditions are obtained and for each of them practical expressions are given in terms of experimentally measurable quantities. The concept of open-system elastic constants leads to the reformulation of internal elastochemical equilibrium problems into purely elastic problems, whose solutions are then used to compute the composition distribution. The atmosphere around a dislocation in a cubic crystal is one of several examples that are completely worked out. The effects of vacancies and their equilibrium within a solid and near surfaces are critically examined, and previous formulas are found to be first order approximations. Consequences of the boundary equations that govern phase changes are studied with several examples. Finally, problems connected with diffusional kinetics and diffusional creep are discussed.

705,148
PB85-179091
(Order as PB85-179083, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Development of a One-Micrometer-Diameter Particle Size Standard Reference Material.
G. W. Mulholland, A. W. Hartman, G. G. Hembree, E. Marx, and T. R. Lettieri. 11 Oct 84, 24p
Included in Jnl. of Research of the National Bureau of Standards, v90 n1 p3-26 Jan-Feb 85.

Keywords: *Particle size, *Standards, *Polystyrene, Light scattering, Optical measurement, Spheres, Surfaces, Error analysis, *Standard reference materials, Transmission electron microscopy.

The average diameter of the first micrometer particle size standard (Standard Reference Material 1690), an aqueous suspension of monosized polystyrene spheres with a nominal 1 micrometer diameter, was accurately determined by three independent techniques. In one technique the intensity of light scattered by a diluted suspension of polystyrene spheres was measured as a function of scattering angle, using a He-Ne laser polarized in the vertical direction. The second technique consisted of measuring as a function of angle the intensity of light scattered from individual polystyrene spheres suspended in air, using a He-Cd laser with light polarized parallel and perpendicular to the scattering plane. The measurement of row length by optical microscopy for polystyrene spheres arranged in close-packed, two-dimensional hexagonal arrays was the basis of the third technique. The measurement errors for each technique were quantitively assessed. For the light scattering experiments, this required simulation with numerical experiments. The average diameter determined by each technique agreed within 0.5% with the most accurate value being 0.895 + or - 0.007 micrometers based on light scattering by an aqueous suspension. Transmission electron microscopy, flow through electrical sensing zone counter measurements, and optical microscopy were also used to obtain more detailed information on the size distribution including the standard deviation (0.0095 micrometers), fraction of agglomerated doublets (1.5%).

705,149
PB85-179109
(Order as PB85-179083, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Stable Law Densities and Linear Relaxation Phenomena.
M. Dishon, G. H. Weiss, and J. T. Bendler. 27 Nov 84, 13p
Prepared in cooperation with National Institutes of Health, Bethesda, MD., and General Electric Corporate Research and Development, Schenectady, NY.
Included in Jnl. of Research of the National Bureau of Standards, v90 n1 p27-39 Jan-Feb 85.

Keywords: *Density(Mass/volume), *Molecular relaxation, *Mathematical models, *Linearity, Polymers, Semiconductors, Tables(Data), Stability, Numerical solution.

Stable law distributions occur in the description of the linear dielectric behavior of polymers, the motion of carriers in semi-conductors, the statistical behavior of neurons, and many other phenomena. No accurate tables of these distributions or algorithms for estimating the parameters in these relaxation models exist. In this paper the authors present tables of the functions together with related functional properties of zQ(sub alpha) (z). These are useful in the estimation of the parameters in relaxation models for polymers and related materials. Values of the integral Q(sub alpha) (z) are given for alpha=0.01, 0.02(0.02)0.1(0.1) 1.0(0.2)2.0 and those of V(sub alpha) (z) are given for alpha=0.0(0.1)0.1(0.1)2.0. A variety of methods was used to obtain six place accuracy. The tables can be used to sequentially estimate the three parameters appearing in the Williams-Watts model of relaxation. An illustration of this method applied to data in the literature is given.

705,150
PB85-179117
(Order as PB85-179083, PC **A05**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Center for Chemical Physics.
Automated Coupled-Column Liquid Chromatography System for Measuring Aqueous Solubilities of Hydrophobic Solutes.
J. W. Owens, H. DeVoe, T. J. Buckley, and S. P. Wasik. 11 Oct 84, 8p
Prepared in cooperation with Maryland Univ., College Park. Dept. of Chemistry.
Included in Jnl. of Research of the National Bureau of Standards, v90 n1 p41-48 Jan-Feb 85.

Keywords: *Solubility, *Automation, *Laboratory equipment, Solutes, Temperatures, *Coupled column liquid chromatography, Benzene/ethyl, Computer applications, High performance liquid chromatography.

An automated apparatus is described for measuring the aqueous solubility of a sparingly soluble organic compound at many different temperatures. Water is pumped through a generator column packed with a chromatographic support coated with the organic compound, producing a saturated solution. The solute in a measured volume of this solution is extracted with an extractor column and analyzed by high performance liquid chromatography (HPLC). The temperature of the thermostat bath and the operation of the valves and the HPLC are under the control of a microcomputer. Solubility measurements of ethylbenzene obtained with this apparatus have a standard deviation at any one temperature of about 3% of the mean.

705,151
PB85-182715 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Far Infrared Absorption in Normal H2 from 77 K to 298 K.
Final rept.
P. Dore, L. Nencini, and G. Birnbaum. 1983, 9p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 30, n3 p245-253 Sep 83.

Keywords: *Hydrogen, Absorption, Molecular rotation, Temperature, Reprints, *Far infrared spectroscopy.

The translational-rotational absorption spectrum of normal H2 has been measured from 80 to 900/cm at seven temperatures from 77.4 to 298 K. These results have been accurately fitted by a three parameter line shape function thereby providing a reliable way of predicting the absorption of H2 anywhere in this frequency and temperature region.

705,152
PB85-182731 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Diamagnetism in Excited States of Hydrogen.
Final rept.
C. W. Clark, and K. T. Taylor. 1982, 9p
Sponsored by North Atlantic Treaty Organization.
Pub. in Jnl. Phys. Colloq. 43, n2 p127-135 Nov 1982.

Keywords: *Magnetic fields, *Diamagnetism, Experimental design, Excitation, Zeemen effect, Ionization, Forecasting, Reprints, *Hydrogen atoms, *Rydberg series, Numerical solution.

The spectrum of high Rydberg states of atomic hydrogen in a magnetic field has received much attention in the last few years. Although no experimental work has been done, theoretical activity has elucidated major features of the spectrum ranging in energy up to a few cyclotron frequency units below the ionization threshold. In the weak field limit an unexpected richness of structure has been uncovered by perturbative treatments based on the 0(4) symmetry of hydrogen. Though this symmetry is absent in the more complex atoms for which experimental data are available, the authors believe that a comprehensive theory of Rydberg diamagnetism will ultimately be phrased in hydrogenic language. The authors review here the basic physics which motivates this hypothesis, the experimental and numerical results which substantiate it, and the opportunities it suggests for future investigations.

705,153
PB85-182756 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sputter Coated Carbon Specimens for SEM Performance Testing.
Final rept.
D. R. Black, and D. B. Ballard. 1982, 2p
Sponsored by Electron Microscopy Society of America, Oak Ridge, TN.
Pub. in Proceedings of Annual Meeting of the Electron Microscopy Society of America (40th), Washington, DC. August 9-13, 1982, p750-751.

Keywords: *Carbon fibers, *Metal coatings, Performance evaluation, Sputtering, Substrates, Graphitizing, *Scanning electron microscopy.

A performance test is recommended as a supplement to the image separation resolution determination for the SEM. The performance test involves measurement of the straight line (slope) segment of a step waveform in a specified manner divided by the known magnification. Two different carbon substrates sputter etched, then sputter coated with Au-Pd were developed that provide the necessary electron beam-specimen edge profile for wave-form analysis. One substrate is a spectrographic grade carbon disc and the other is graphitized polymer fibers.

705,154
PB85-182764 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermoneutral Isotope Exchange-Reactions of Cations in the Gas-Phase.
Final rept.
P. Ausloos, and S. G. Lias. 1981, 7p
Pub. in Jnl. of the American Chemical Society 103, n13 p3641-3647 1981.

Keywords: *Cations, *Vapor phases, *Isotope exchange, *Reaction kinetics, Chemical reactions, Reprints, *Ion molecule interactions.

Rate constants have been measured for reactions of the type: RD(+1) + MH yields RH(+1) + MD where RD(+1) is CD3CND, CD3CDOD(+1), CD3CODCD(+1)3, or (C2D5)2OD+ and the MH molecules are alcohols, acids, mercaptans, H2S, AsH3, PH3, or aromatic molecules. Rate constants are also presented for the reactions: Ar(sub H)D(+1) + D(sup 2)O yields Ar(sub D)D(+1) is a deuteronated aromatic molecule and Ar(sub D)D(+1) is the same species with a D atom incorporated on the ring. In all but two cases, the competing deuteron transfer is sufficiently endothermic that it can not be observed under the conditions of the ICR experiments at 320-520 K.

705,155
PB85-182806 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Elastic and inelastic-Scattering of Electrons by Atomic-Hydrogen at Intermediate Energies in a Coupled-Channel Second Order Potential Model.
Final rept.
B. H. Bransden, T. Scott, R. Shingal, and R. K. Roychoudhury. 1982, 12p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 15, n24 p4605-4616 1982.

Keywords: *Elastic scattering, *Inelastic scattering, *Electron scattering, *Mathematical models, Excitation, Reprints, *Hydrogen atoms.

A second-order model employing a pseudostate expansion in intermediate states is applied in a 1s-2s-2p coupled channel formalism to electron scattering by atomic hydrogen in the energy range 54 to 200 eV. Although the model predicts cross sections for elastic scattering, and excitation of the n = 2 levels, which are in reasonable accord with the experimental data, the predicted results for the angular correlation parameters show little improvement over the 1s-2s-wp close coupling model.

705,156
PB85-182814 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Auger Electron Emission from the Decay of Collisionally-Excited Atoms Sputtered from Al and Si.
Final rept.
T. D. Andreadis, J. Fine, and J. A. D. Matthew. 1983, 8p
Sponsored by Centre National d'Etudes des Telecommunications, Lannion (France)., and CEA Centre d'Etudes Nucleaires de Grenoble (France), Lab. d'Electronique et de Technologie de l'Informatique.
Pub. in Proceedings of International Conference on Ion Beam Modification of Materials (3rd), Grenoble, France, September 6-10, 1982, Nuclear Instruments and Methods in Physics Research, 209-210, pt1 p495-502, 1 May 83.

Keywords: *Aluminum, *Silicon, *Auger electrons, *Ion beams, *Ion irradiation, Sputtering, Monte Carlo method, Solids, Reprints, *Atom atom interactions, *Auger spectroscopy.

Atom collisions of several keV may result in inner-shell excitations. The energy spectra of Auger electrons from excitations induced by ion bombardment of solid materials are different from those stimulated by x-rays or electrons. Auger electron spectra produced by ion bombardment of solids contain features similar to spectra obtained from atoms undergoing Auger transitions in the gas phase, i.e., atomic-like spectra. An interpretation of the atomic-like spectra from ion-bombarded solids is that a significant portion of the atoms undergoing Auger de-excitation have previously been sputtered from the solid. Auger decay in the gas phase can occur if the inner-shell lifetime is sufficiently long for the excited atom to escape. Results from our Monte Carlo calculations of the origin, movement, and decay of ion-bombardment induced 2p inner-shell excitations of Al and Si will be presented. These calculations indicate that a significant portion of the Auger emission originates from sputtered atoms; the kinetic energy of atoms sputtered while experiencing inner-shell excitation far exceeds the average kinetic energy of sputtered atoms, and so, Auger electron emission may constitute a probe of the high energy collision cascade near the surface. Calculated dependence of the Auger electron intensity on the incident angle of the ion beam will be compared with measurements, and the effect of inner-shell lifetime on the calculated Auger electron intensity will be discussed.

705,157
PB85-182855 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Critical Evaluation of Thermodynamic Data: A Research Activity.
Final rept.
S. Abramowitz, D. D. Wagman, V. B. Parker, and D. Garvin. 1984, 12p
Pub. in NATO Adv. Study Inst. Ser., Ser. C 119, p803-814 1984.

Keywords: *Thermodynamics, *Research projects, Tables(Data), Reprints, Computer applications.

The principles underlying the evaluation of thermodynamic data are described. The role of modern computer technology in data evaluation is discussed.

705,158
PB85-182863 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Barriers to Internal Rotation in Inorganic Species.
Final rept.
S. Abramowitz. 1984, 14p
Pub. in NATO Adv. Study Inst. Ser., Ser. C 119, p789-802 1984.

Keywords: *Inorganic compounds, *Molecular rotation, *Infrared spectroscopy, *Raman spectroscopy, *Barriers, Thermodynamics, Molecular vibration, Reprints.

Barriers to internal rotation have been determined using infrared and Raman spectroscopy for some inorganic species. The determination of these barriers will be described for a high barrier (BCl2SH) a medium barrier (PF5, AsF5 and VF5) and a low or zero energy barrier (B(CH3)3).

705,159
PB85-182905 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Oxidation of the Ti(0001) Surface.
Final rept.
E. Bertel, R. Stockbauer, and T. E. Madey. 1983, 2p
Pub. in Jnl. of Vacuum Science and Technology, A1 n2 p1075-1076 1983.

Keywords: *Surface chemistry, *Oxidation, *Titanium, *Electronic spectra, Titanium oxides, Reprints.

Upon exposure of a Ti(0001) surface to oxygen a thin oxide overlayer is formed as revealed by ELS. AES, UPS, and ESD indicate a TiO2 stoichiometry in this surface oxide.

705,160
PB85-183192 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Multiple Reflection Corrections in Fourier Transform Spectroscopy.
Final rept.
A. Baghdadi. 1983, 10p
Sponsored by Electrochemical Society, Inc., Pennington, NJ. Electronics Div.
Pub. in Proceedings of a Symposium on Defects in Silicon, San Francisco, CA., May 8-13, 1983, Proc. Electrochem. Soc. 83, n9 p293-302 1983.

Keywords: *Infrared spectroscopy, *Surfaces, *Fourier transform spectroscopy.

In order to account properly for multiple passes of the infrared beam in back-surface damaged wafers in infrared spectrometers, the effective reflectivity of the back surface must be measured. Two methods for accomplishing this are evaluated in a comparative study. The first method is based upon an analysis of the spectrum and the second method is based upon an analysis of the interferogram.

705,161
PB85-183218 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Summary of Group Theoretical Results for Microwave and Infrared Studies of H2O2.
Final rept.
J. T. Hougen. Jun 84, 11p
Pub. in Canadian Jnl. of Physics 62, n12 p1392-1402 Jun 84.

Keywords: *Hydrogen peroxide, *Molecular rotation, *Microwave spectroscopy, *Infrared spectroscopy, Reprints.

Group theoretical treatments found in the literature for other molecules, based on double-groups of appropriate permutation--inversion groups, are modified slightly and applied to H2O2. This permits a more unified view of many theoretical results derived in various earlier studies of the molecule. Briefly, if no effects due to internal rotation tunneling were observed in the H2O2 spectrum, the molecule could be treated using the C2 point group of its equilibrium geometry. If effects due to internal rotation tunneling through only the trans barrier are observed (as is presently the case), the molecule should be treated using the C2h point group of its trans planar conformation at the top of the tunneling barrier. An empirically discovered successful fitting procedure for the ground state rotational levels, reported in a treatment of microwave and millimetre wave measurements on H2O2, can be rationalized on the basis of the present theoretical results.

705,162
PB85-183226 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Vinylidene (3B2): An Active Intermediate in the Photolysis of Ethylene.
Final rept.
A. H. Laufer. 1984, 5p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Photochemistry 27, p267-271 1984.

Keywords: *Vinylidene resins, *Photolysis, *Ethylene, *Ultraviolet spectroscopy, Excitation, Photochemistry, Reprints.

Triplet vinylidene has been observed, by time-resolved absorption spectroscopy, as an intermediate in the vacuum UV flash photolysis of ethylene. The several primary photochemical processes are discussed. Rate constants for the interaction of both protonated and deuterated vinylidene species with C2H4 and C2D4 have been obtained. The nature of the interaction between triplet vinylidene and ethylene is discussed.

705,163
PB85-183242 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Thermal Expansion Coefficient of FCC Metals.
Final rept.
R. A. MacDonald. 1984, 9p
Pub. in Thermal Expansion 8, p11-19 1984.

Keywords: *Thermodynamic properties, *Thermal expansion, Forecasting, Reprints.

The work to be reported here improves upon and extends that presented at the 7th European Thermophysical Properties Conference in 1980. There it was shown that the calculated thermal expansion values, epsilon, were very sensitive to the curvature of the potential, phi (r), assumed for the nearest neighbor interaction. The authors give a brief summary of the theory pertinent to their calculation of the thermodynamic properties of the fcc metals. Next they present the results that were obtained for the thermal expansion of copper and then they examine the problem of obtaining alpha by derivation from thermal expansion data. They find that there can be quite a large variation in the values of alpha derived from thermal expansion data and they urge that the 'direct' method of measurement of alpha be used in the future.

705,164
PB85-183267 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Planar Ca-PO4 Sheet-Type Structures: Calcium Bromide Dihydrogenphosphate Tetrahydrate, CaBr(H2PO4)-4H2O, and Calcium Iodide Dihydrogenphosphate Tetrahydrate, CaI(H2PO4)-4H2O.
Final rept.
M. Mathew, S. Takagi, and W. E. Brown. 1984, 4p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Acta Crystallographica C40, p1662-1665 1984.

Keywords: *Calcium phosphates, *Crystal structure, Sheets, Reprints.

Both compounds have planar sheet-type structures consisting of Ca-H2PO4 chains. The halide ions, X, and the water molecules are linked via O-H...X hydrogen bonds to form X(H2O)6 octahedra. These octahe-

dral units are linked together to form a polymeric layer (X(H2O)4)n between the Ca-H2PO4 sheets.

705,165
PB85-183317 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Inelastic Mean Free Paths and Attenuation Lengths of Low-Energy Electrons in Solids.
Final rept.
C. J. Powell. 1984, 16p
Pub. in Scanning Electron Microscopy IV, p1649-1664 1984.

Keywords: *Surface chemistry, *Solids, *Electron energy, Dielectric properties, Free electron theory, Reprints.

Calculations of inelastic mean free paths and measurements of attenuation lengths of low-energy electrons in solids have been studied. The emphasis of the study was on the systematics of the dependences of these quantities on material and electron energy. Calculations of inelastic mean free paths from experimental dielectric data indicate that different dependences on electron energy occur in different materials and that deviations from simple theoretical or empirical expressions are to be expected.

705,166
PB85-183390 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
GAMPHI - A Database of Activity and Osmotic Coefficients for Aqueous Electrolyte Solutions.
Technical note.
R. N. Goldberg, J. L. Manley, and R. L. Nuttall. Mar 85, 28p NBS/TN-1206
Also available from Supt. of Docs as SN003-003-02640-9. Sponsored by Department of Energy, Pittsburgh, PA.

Keywords: *Information systems, *Activity coefficients, *Osmosis, *Electrolytes, Fortran, Thermodynamics, Solutions, Computer programming, Gibbs free energy.

A database of activity and osmotic coefficients for 350 binary aqueous electrolyte solutions at 298.15 K has been assembled together with a collection of subroutines for utilizing the database. The computer codes, which are written in FORTRAN 77, can be used either interactively or from user-written programs to calculate values of the activity and osmotic coefficients at selected molalities.

705,167
PB85-183549 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Detection of the 2pi* Orbital of CO and NO Chemisorbed on Ni(111) by Surface Penning Ionization Electron Spectroscopy (SPIES).
Final rept.
F. Bozso, J. Arias, J. T. Yates, R. M. Martin, and H. Metiu. 1983, 4p
Pub. in Chemical Physics Letters 94, n3 p243-246 1983.

Keywords: *Carbon monoxide, *Nitrogen oxides(NO), *Chemisorption, Nickel, Surface chemistry, Ionization, Reprints, *Surface Penning Ionization Electron Spectroscopy.

The authors use surface Penning ionization spectroscopy (SPIES) to study the electronic properties of CO and NO adsorbed on Ni(111). In this experiment an atomic beam containing ground state and 2 singlet S He atoms collides with the adsorbate covered Ni(111) surface. This causes the transfer of approximately 20.6 eV energy into the electronic degrees of freedom of the adsorbate molecules, forcing them to emit electrons. The SPIE spectrum is obtained by analyzing the energy of these electrons. The high surface sensitivity of this method allows us to measure the binding energy of the partly filled 2 pi* orbitals of CO and NO.

705,168
PB85-184521 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analyses of the Aqueous Phase During Early C3S Hydration.
Final rept.
P. W. Brown, E. Franz, G. Frohnsdorff, and H. F. W. Taylor. 1984, 6p
Pub. in Cement and Concrete Research 14, n2 p257-262 1984.

Keywords: *Liquid phases, *Hydration, Surfaces, Reprints, *Carbon sulfide, Phase equilibrium.

The concentrations of calcium and silica in solution during the first 4 hours of C3S hydration were measured. The results of these analyses indicate that a solid hydrate forms within 30 seconds of hydration and that an equilibrium between the solution and the solid hydration product is rapidly established. A strong dependence of the degree of early hydration on the water to C3S ratio was observed, while the dependence on the surface area of the C3S was minimal.

705,169
PB85-184547 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effects of Coherency Constraints on Phase Equilibria.
Final rept.
J. W. Cahn, and F. C. Larche. 1983, 2p
Sponsored by Materials Research Society, University Park, PA., and American Society for Metals, Metals Park, OH.
Pub. in Proceedings of Symposium on Alloy Phase Diagrams, Boston, MA., November 1982, Materials Research Society Symposia Proceedings, v19 p311-312 1983.

Keywords: *Thermodynamics, Alloys, Phase diagrams, Congruencies, Consolidation, Strain energy methods, *Phase equilibrium, Solid state chemistry.

The thermodynamics of coherent phase equilibria is reviewed. It is recommended that boundaries between fields in which different combinations of phases coexist coherently be depicted on phase diagrams. However, the compositions of coexisting phases cannot be read from such a diagram because tie-lines will not usually end on these boundaries. Apparent discrepancies between different experimental phase diagram determination for solid state equilibria may have a sound physical basis.

705,170
PB85-184562 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Polymer Crystallization: Proper Accounting of a Wider Class of Paths to Crystallization Variations on a Theme of Point.
Final rept.
E. A. DiMarzio, and C. M. Guttman. 1982, 10p
Pub. in Jnl. of Applied Physics 53, n10 p6581-6590 Oct 82.

Keywords: *Crystallization, *Polymers, Crystal growth, Nucleation, Reprints, Monomers.

Point has suggested that during the polymer crystallization process individual stems form by zippering of monomer segments onto the substrate and that at any time during the zippering process the stem can fold over, thus initiating a new stem. The authors augment the treatment of Point analytically by allowing each of the subsequent stems to fold any stage in the zippering process rather than only during the forming of the first stem. The problem is isomorphic to the mathematical problem of the growth of a Cayley Tree with infinite branching. Although there is net growth, the rules of growth (crystallization) are such that branches of the tree can be resorbed. By use of a simple renormalization technique, formulae are obtained both for the steady state growth rate and for the lamellar thickness which for special cases reduce to the Point results. Classical nucleation theory remains valid at low to moderate supercoolings.

705,171
PB85-184604 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cross Polarization-Magic Angle Sample Spinning NMR Study of Several Crystal Forms of Lactose.
Final rept.
W. L. Earl, and F. W. Parrish. 1983, 10p
Pub. in Carbohydrate Research 115, n1 p23-32 1983.

Keywords: *Isotopic labeling, *Lactose, *Nuclear magnetic resonance, *Molecular structure, Carbon 13, Reprints, *Chemical shifts(Nuclear magnetic resonance).

Five different crystalline forms of lactose were investigated using cross polarization-magic angle sample spinning (13)C (CP-MAS) NMR. Both the anhydrous beta-lactose and the alpha-lactose monohydrate structures are known from x-ray diffraction studies and the CP-MAS NMR data agree with those structures. The structure of the stable anhydrous alpha-lactose has not been reported. The CP-MAS NMR results indicate that the crystal must have two or more lactose molecules per unit cell. The chemical shifts measured for two mixed crystals with alpha:beta ratios of 5:3 and 4:1 are a direct result of the fact that both materials are real mixed crystals rather than physical mixtures of crystals of pure alpha- and beta-lactose. The chemical shifts also indicate that the lactose molecules in both mixed crystals are in environments similar to the crystalline environment of the stable anhydrous alpha-lactose.

705,172
PB85-184612 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermochemistry of Interface and Surface Segregation and Chemisorption for Core Level Binding Energy Shifts.
Final rept.
W. F. Egelhoff. 1983, 2p
Pub. in Jnl. of Vacuum Science and Technology 1, n2 p1102-1103 Apr/Jun 83.

Keywords: *Thermochemistry, *Surface chemistry, *Interfaces, *Copper, *Carbon monoxide, Chemisorption, Nickel, Binding, Reprints.

The equivalent core approximation has been applied to measured shifts in core level binding energies to determine thermochemical values. The examples reported here are, first the heat of interface segregation for Cu in bulk Ni to a Cu-Ni interface, second the heat of surface segregation of Cu to a Ni surface and third the difference in the heat of CO chemisorption on Cu and Ni.

705,173
PB85-184653 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of Ionization Rates of Ti IX, Ne VI, Ne VII and O VI.
Final rept.
R. U. Datla, and J. R. Roberts. 1983, 8p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Physical Review A: General Physics 28, n4 p2201-2208 Oct 83.

Keywords: *Ionization, *Reaction kinetics, *Titanium, *Neon, *Oxygen, Reprints, *Plasma spectroscopy, *Electron ion interactions.

The effective ionization rates of Ti IX, Ne VI, Ne VIII and O VI have been measured using the plasma spectroscopy method in a theta-pinch discharge at an electron temperature (50-60 ev) much below their ionization threshold and at an electron density of (about 2-3) 10 to the 16th power/cu cm. A theoretical analysis of the effective ionization rates showed that excitation-ionization is a major contributing process. Theoretical values are in reasonable agreement with experiment.

705,174
PB85-184687 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Enskog Theory for Multicomponent Mixtures: 1. Linear Transport Theory.
Final rept.
M. L. de Haro, E. G. D. Cohen, and J. M. Kincaid. 1983, 14p
Pub. in Jnl. of Chemical Physics 78, n5 p2746-2759, 1 Mar 83.

Keywords: *Transport theory, *Fluids, Mixtures, Viscosity, Thermal conductivity, Diffusion coefficients, Reprints, *Enskog-Thome theory.

The Enskog theory for dense multicomponent fluid mixtures is developed. Two versions are considered: the standard theory and the revised theory. Explicit expressions for all the transport coefficients (shear and bulk viscosity, thermal conductivity, mutual and thermal diffusion coefficients) in terms of the sizes, masses, and concentrations of the constituents of the mixture are given in third Enskog approximation. Applications will be discussed in subsequent papers.

705,175
PB85-184695 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Multi-Vacancy Effects in Argon K-Spectra.
Final rept.
R. D. Deslattes, P. L. Cowan, R. E. LaVilla, and K. Dyall. 1982, 5p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Proceedings of International Conference on X-Ray and Atomic Inner-Shell Physics, 'X-82', Eugene, OR., August 23-27 1982, AIP Conference Proceedings n94, p100-104.

Keywords: *Argon, *Atomic energy levels, *X-ray analysis, Emission spectroscopy, Excitation.

The authors have carried out coordinated measurements of K series emission and absorption spectra in atomic argon. Specifically, emission spectra (especially in the region of K(beta(sub 1,3) were recorded with photon excitation energies ranging from below the single-vacancy threshold to energies above most important double-vacancy thresholds. Satellite emission spectra were modelled using both Dirac-Fock and Configuration Interaction (CI) calculations. Comparisons with experiment show reasonable agreement of the CI calculations for the first high energy satellite complex, beta(sup V), but not for the second, beta.

705,176
PB85-184729 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Preface to Industrial Applications of Surface Analysis.
Final rept.
L. A. Casper, and C. J. Powell. 1982, 2p
Sponsored by American Chemical Society, Washington, DC.
Pub. in Proceedings of Symposium of the American Chemical Society (181st), New York, August 23-28, 1981, ACS Symposium Series 199, pvii-viii, 1982.

Keywords: *Surface analysis, *Industrial plants, Interfaces.

This paper is the Preface for a book which contains the Proceedings of a Symposium on Industrial Application of Surface Analysis held at the 181st American Chemical Society National Meeting, New York, NY, August 23-28, 1981. The Preface describes briefly the significance of surface analysis in industry and the scope and purpose of the Symposium.

705,177
PB85-184760 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Application of Huckel-Mobius Concept to Torsional Vibration and Internal Rotation of Molecules.
Final rept.
Y. N. Chiu. 1984, 18p
Pub. in Theochem 17, n3-4 p211-228 Apr 84.

Keywords: *Molecular rotation, *Molecular vibration, Angular momentum, Ethane, Reprints, *Huckel molecular orbitals, *Huckel approximation, *Linear combination of vibrational wavefunctions.

Linear combination of vibrational wavefunctions (LCVW) centered at the periodic potential minima is used to represent the approximate torsional wavefunction of the hindered internal rotation of a coaxial-(XY(sub n))2-type molecule. These linear combinations are shown to have the correct pseudo-angular momentum upon rotation of one or both parts of the rotor. And they are uniquely correlated with the wavefunctions of free internal rotation having the same angular momentum.

705,178
PB85-184778 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron Diffraction Study of Sodium Sesquicarbonate Dihydrate.
Final rept.
C. S. Choi, and A. D. Mighell. 1982, 3p
Pub. in Acta Crystallographica, Section B: Structural Crystallography and Crystal Chemistry 38, n11 p2874-2876, 15 Nov 82.

Keywords: *Crystal structure, *Neutron diffraction, *Hydrogen bonds, Least squares method, Sodium carbonates, Reprints, *Sodium sesquicarbonate dihydrate.

Na2CO3:NaHCO3:2H2O, M(sup r) = 220.0, monoclinic, C2/c, a = 20.36(2), b = 3.48(1), c = 10.29(1)A, beta = 106.48(1) degrees, Z = 4, Dx = 2.147 Mg/cu m. The final R value after full matrix least-squares refinement was 0.040 for 932 observed reflections. Analysis of thermal ellipsoids and least-squares refinement of a split hydrogen model reveal that this hydrogen atom may be viewed as slightly disordered.

705,179
PB85-184786 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
SEM and TEM Investigation of Sintering in Anorthite.
Final rept.
L. P. Cook. 1982, 18p
Sponsored by Metallurgical Society of AIME, Warrendale, PA., and American Ceramic Society, Columbus, OH. Basic Science Div.
Pub. in Proceedings of Symposium on Metal and Ceramic Powders, Louisville, KY., October 12-14, 1981, Processing of Metal and Ceramic Powders, p165-182, 1982.

Keywords: *Densification, *Sintering, *Kinetics, Diffusion, Powders, *Anorthite, *Scanning electron microscopes, *Transferred electron microscopes, Calcium aluminate silicate.

By comparison with other tectosilicates, powdered crystalline anorthite (CaAl2Si2O8) shows a strong tendency for densification during sintering. Experiments have been conducted to determine the conditions under which this behavior is reproducible and to determine the mechanism or mechanisms responsible. Results indicate that while minor changes in grain size distribution have a large effect upon the kinetics of sintering and densification, relatively coarse powders ultimately yield as dense a product as powders with a much higher percentage of fines. A two-stage hypothesis for densification at 1400C is proposed: (1) an early rapid densification associated with grain boundary diffusion driven by minimization of highly anisotropic surface energy; (2) volume diffusion, primarily along closely spaced parallel twin planes.

705,180
PB85-187268 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Number and Novelty in Approaches to the Calculation of Strainless Group Increments.
Final rept.
D. Van Vechten, and J. F. Liebman. 1981, 6p
Pub. in Israel Jnl. of Chemistry 21, n2-3 p105-110 1981.

Keywords: *Strain energy methods, *Molecular structure, *Thermochemistry, Differences, Reprints, *Alicyclic hydrocarbons.

In this paper, the authors show that the large number of approaches using apparently unrelated strainless increments for unsubstituted alicyclic hydrocarbons in the literature are neither mathematically nor conceptually unique. They additionally demonstrate that if the strain energy assigned to a compound by any three sets of increments are known, the strain energy any other approach would assign can automatically be determined without considering any further details of the structure of the compound. Equivalently, there are but three mathematically distinct, i.e. linearly independent, strainless incremental approaches for these compounds. Thus the choice of which method to employ in one's own reasoning relative to a chemical problem must be based on personal, rather than strictly chemical or mathematical criteria. They proceed by presenting our criteria and their molecular realization, the concepts of diagonal reference states. Diagonal reference states are defined from hydrocarbons composed solely of the group of interest. The virtues and debits of this method are presented in support of their conclusion that this approach is preferable because it is diagonal.

705,181
PB85-187276 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Inferences About Molecular Motion from Proton Decoupled 13C NMR Spectra of Solid Polymers.
Final rept.
D. L. Vanderhart, G. G. A. Bohm, and V. D. Mochel. 1981, 1p
Pub. in Abstracts of Papers American Chemical Society 182, 112p Aug 81.

Keywords: *Nuclear magnetic resonance, *Solids, *Polyethylene, *Polyethylene terephthalate, *Molecular rotation, Carbon 13, Mechanical properties, Magnetic fields, Sites, Comparison, Reprints, *Chemical shifts(Nuclear magnetic resonance).

Proton decoupled (13)C spectra are used to describe molecular motion in polyethylene (PE) and polyethyleneterephthalate (PET). Use of static oriented samples suitably aligned in the magnetic field allow one to obtain information about the frequency and geometry of motion from the (13)C lineshape. In systems with appropriate symmetries, molecular motion can effect an exchange between magnetically inequivalent sites. In particular, 180 degrees flip-flop motions in the crystalline regions of PE and aromatic ring flip-flops in PET represent two-site exchange processes with equal populations at each site. The dipolar interaction between isolated pairs of (13)C nuclei was used to study flip-flop motions in PE whereas the anisotropic chemical shift of the protonated aromatic carbons in PET was used to study aromatic ring motion. For the flip-flop motion in crystalline PE comparison will be made with some dynamic mechanical measurements. It is felt that information about crystalline motions is generalizable to unoriented, melt crystallized samples since some of the oriented samples were annealed so as to minimize any crystalline defects introduced by mechanical deformation.

705,182
PB85-187292 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photoionization of Liquid Benzene: Fluorescence and Electron Scavenger Quenching between 1900 and 1150-A.
Final rept.
F. P. Schwarz, and M. Mautner. 1982, 6p
Pub. in Chemical Physics Letters 85, n2 p239-244 1982.

Keywords: *Photochemical reactions, *Ionization, *Ultraviolet spectroscopy, Excitation, Fluorescence, Quenching, Excitation, Liquids, Reprints, *Benzene, *Cation electron interactions, *Electron scavenger.

In the photoionization of liquid benzene, the fluorescence yield and the fluorescence quenching by CHCl3 increase slowly from 1900 A to 1750 A, rapidly from 1750 to 1400 A, and level off from 1400 to 1150 A. Below 1750 A, the relative quenching constants of CHCl3, CC3Cl, and C2H5Cl are the same as their relative reactivities with quasi-free electrons. The quenching constants extrapolate to zero at 7.1 eV, the estimated ionization potential of liquid benzene. The quenching results are consistent with the assumption that the benzene fluorescence in the photoionization region is generated by recombination of the electron with the benzene cation.

705,183
PB85-187318 Not available NTIS
National Bureau of Standards, Boulder, CO.
Shape and Dynamics of States Excited in Electron-Atom Collisions: A Comment on Orientation and Alignment Parameters by Consideration of Attractive and Repulsive Forces.
Final rept.
N. Andersen, I. V. Hertel, and H. Kleinpoppen. 1984, 8p
Pub. in Jnl. of Physics B: At. Mol. Phys. 17, pL901-L908 1984.

Keywords: *Helium, *Magnetic moments, Electron scattering, Atomic energy levels, Excitation, Experimental design, Comparison, Dynamics, Reprints, *Atom electron interactions.

Several ways of parametrizing results of coherence and correlation analysis of atomic excitation in planar scattering experiments have been suggested over the years. Recently, Beyer and Kleinpoppen introduced new scattering amplitudes related to contributions from predominantly the attractive and the repulsive parts of the electron-atom potential. The authors clarify their relation to the so-called neutral amplitudes of Hermann and Hertel and pursue the ideas further for the example of 80 eV electron excitation of the He (2 singlet P)-state. They demonstrate that this way of parametrizing the data is directly related to the experimental observables, enables easy visualization of the shape and dynamics of the charge cloud of the excited electron, and clarifies comparison between theory and experiment.

705,184
PB85-187342 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Wetting Layers and Dispersion Forces for a Fluid in Contact with a Vertical Wall.
Final rept.
R. F. Kayser, J. W. Schmidt, and M. R. Moldover. 18 Feb 85, 4p
NASA Order-H-27954B
Pub. in Physical Review Letters 54, n7 p707-710, 18 Feb 85.

Keywords: *Fluids, *Wetting, *Dispersion relations, *Ellipsometry, Stability, Van der Waals equation, Sulfur hexafluoride, Reprints.

When a liquid wets a vertical wall, wetting layers form on the wall high above the liquid-vapor meniscus. These layers are stabilized against gravity by dispersion forces. For SF6 in contact with fused silica, the authors find layers between 20 and 40 nm thick in a range of temperatures below critical. Their results support the predictions of Dzyaloshinskii, Lifshitz, and Pitaevskii, in contrast to recent experiments which are much harder to reconcile with theory.

705,185
PB85-187359 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Interfacial Tension of Fluids Near Critical Points and Two-Scale-Factor Universality.
Final rept.
M. R. Moldover. Feb 85, 12p
NASA Order-H-27954-B
Pub. in Physical Review A 31, n2 p1022-1033 Feb 85.

Keywords: *Interfacial tension, *Fluids, *Critical point, *Liquid phases, Thermodynamic properties, Binary mixtures(Materials), Temperature, Tables(Data), Reprints.

Data for the surface tension of pure fluids near critical points and for the interfacial tension between coexisting liquid phases of binary mixtures near consolute points are reviewed using recent theoretical values for the critical exponents and the concept of two-scale-factor universality. The observation implies that the scale factors for the critical anomaly in the free energy of these liquid-vapor systems can be estimated from measurements of the densities of the coexisting phases at all temperatures and a measurement of the capillary rise near the triple point.

705,186
PB85-187391 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Thermal Conductivity of Parahydrogen.
Final rept.
H. M. Roder. Oct 84, 5p
Pub. in Jnl. of Chemical and Engineering Data 29, n4 p382-386 Oct 84.

Keywords: *Thermal conductivity, *Hydrogen, Experimental design, Isotherms, Temperature, Density(Mass/volume), Comparison, Reprints.

The paper presents new experimental measurements of the thermal conductivity of parahydrogen for eight isotherms at temperatures from 100 to 275 K with intervals of 25 K, pressures to 12 MPa, and densities from 0 to 12 mol/L. Three additional isotherms at 150, 250, and 275 K cover para-rich compositions with para percentages varying from 86% to 73%. For these three isotherms the pressures reach 70 MPa and the density a maximum of 30 mol/L. The data for all compositions are represented by a single thermal conductivity surface in which the differences in thermal conductivity for different ortho-para compositions are accounted for in the dilute-gas term. The new measurements are compared with previous data on parahydrogen through the new correlation. It is estimated that the overall uncertainty of both experimental and correlated thermal conductivity is 1.5 percent at the 3 sigma level.

705,187
PB85-187474 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Non-Linear Behavior of Polyisobutylene Solutions as a Function of Concentration.
Final rept.
L. J. Zapas, and J. C. Phillips. 1981, 16p
Pub. in Jnl. of Rheology 25, n4 p405-420 1981.

Keywords: *Polyisobutylene, *Nonlinear systems, Solutions, Concentration(Composition), Stress relaxation, Strain analysis, Rheological properties, Reprints, *BKZ theory.

The nonlinear behavior in simple shear of polyisobutylene (Vistanex L-100) solutions in cetane was studied for three concentrations in various shear histories. The concentrations of the solutions were 10, 15.1, and 19.3 percent by weight. It is shown that a simple superposition principle can be applied at concentrations region where the intermolecular forces are predominant for the systems and for which the potential function in the Bernstein, Kearsley and Zapas elastic fluid theory can be expressed as a product of a function of time and a function of strain. An excellent agreement was obtained with the experimental data, even for transient experiments where the shearing and normal stresses depend on time.

705,188
PB85-187490 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermal, Unsensitized Infrared-Laser, and Laser SiF4 Sensitized Decomposition of 1,2-Dichloropropane.
Final rept.
W. Tsang, J. A. Walker, and W. Braun. 1982, 5p
Pub. in Jnl. of Physical Chemistry 86, n5 p719-723 1982.

Keywords: *Decomposition reactions, *Thermal analysis, *Reaction kinetics, *Infrared spectroscopy, Chlorine organic compounds, Reprints, *Laser spectroscopy, *Propane/dichloro.

1,2 Dichloropropane decomposes via 4 reaction channels forming chloropropene-3, cis-chloropropene-1, trans-chloropropene-1 and chloropropene-2. All pathways have been observed in thermal and laser induced processes. Rate parameters for the thermal processes have been derived from comparative rate single pulse shock tube studies. The focused laser experiments, direct as well as the sensitized with SiF4 yield product ratios which are very similar and suggest that the latter also involve a photolytic process. The cis-chloropropene-1 to trans-chloropropene-1 ratios from the laser experiments suggest that they represent a final product distribution.

705,189
PB85-187615 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Convective and Interfacial Instabilities during Solidification of Succinonitrile Containing Ethanol.
Final rept.
R. J. Schaefer, and S. R. Coriell. 1982, 11p
Sponsored by Materials Research Society, University Park, PA. and Universities Space Research Association, Columbia, MD.
Pub. in Proceedings of Symposium on Materials Processing in the Reduced Gravity Environment of Space, Boston, Mass., November 16-18, 1981, v9 p479-489 1982.

Keywords: *Solidification, *Crystallization, *Convection, *Interfaces, Additives, Ethyl alcohol, Stability, *Succinonitrile.

Although slow convective flow is difficult to detect in solidifying metals, it can readily be observed in transparent materials by observing the motion of small neutrally buoyant particles. An excellent material for such studies is succinonitrile, which solidifies with an unfaceted solid/liquid interface and which has well characterized physical properties. For studies of solute-induced convection, ethanol is a useful addition to succinonitrile because it has a lower density and a somewhat similar molecular structure. Samples of high purity and ethanol-doped succinonitrile are solidified unidirectionally in a vertical temperature gradient. Latex microspheres, 2 micrometers in diameter, are suspended in the liquid to delineate convective flow. Convective and morphological stability are observed as a function of solute concentration and growth velocity. These measurements are compared to theoretical calculations which predict the transition from stability to instability as a function of solidification conditions. The predicted transitions occur at low concentrations and solidification velocities, so that extreme care is required to eliminate the effects of impurities or thermally-induced convection.

705,190
PB85-187771 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Raman and X-Ray Investigations of Ice VII to 36.0 GPa.
Final rept.
G. E. Walrafen, M. Abebe, F. A. Mauer, S. Block, G. J. Piermarini, and R. Munro. 1982, 9p
See also AD-A116 900.
Pub. in Jnl. of Chemical Physics 77, n4 p2166-2174 1982.

Keywords: *X ray analysis, *Raman spectroscopy, *X ray diffraction, *Ice, Hydrogen bonds, Chemical bonds, Pressure, Water, Reprints, Hydroxyl radicals.

Raman spectra for ice VII to 30 GPA and x-ray lattice parameters to 36 GPa, both at room temperature, are presented and discussed. Both the Raman OH-stretching peak frequency (delta nu) and the edge distance of the body-centered cubic unit cell (a) decrease at a decreasing rate with pressure rise. This minimum suggests that a symmetric hydrogen bond, O-H-O, and thus a new structure, may result at pressures of 75 GPa, or above. An analysis of both the present and previously published data verified this relation with A=2943/cm (sq A).

705,191
PB85-187789 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamic Surface for Isobutane.
Final rept.
M. Waxman, and J. Gallagher. 1982, 9p
Sponsored by American Society of Mechanical Engineers, New York.
Pub. in Thermophysical Properties of Fluids, p88-96 1982.

Keywords: *Butanes, *Thermodynamics, *Surface chemistry, Temperature, Cryogenics, Vapor phases, Liquid phases, Ideal gases, Density(Mass/volume), Pressure, *Isobutane.

A thermodynamic surface is presented for the thermodynamic properties of isobutane for the ranges of temperature from 250 to 600 K and of pressures from 0 to 400 bar, exclusive of the critical region. The surface, expressed analytically, is in the form of the Helmholtz free energy as a function of temperature and density. The Helmholtz free energy is based upon the sum of three contributions: that of the ideal gas, of a physically based function incorporating the effects of molecular repulsion and attraction, and of a sum of residual terms that compensate for inadequacies of the physically based function. The latter two contributions are evaluated from only pressure density-temperature data. The significant deviations are in regions where exclusive of vapor pressure data, the liquid and vapor phases are not defined adequately by experimental data. The authors discuss the development of the correlation and also its possible extension to cryogenic temperatures.

705,192
PB85-187813 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Resolution in C-13 NMR of Organic-Solids Using High-Power Proton Decoupling and Magic-Angle Sample Spinning.
Final rept.
D. L. Vanderhart, W. L. Earl, and A. N. Garroway. 1981, 41p
Pub. in Jnl. of Magnetic Resonance 44, n2 p361-401 1981.

Keywords: *Nuclear magnetic resonance, *Solids, *Line width, *Organic compounds, Experimental design, Carbon 13, Reprints, *Chemical shifts(Nuclear magnetic resonance).

It is found experimentally that (13)C linewidths in solids are 10-100 times broader than those in liquids even though the combined techniques of high-power proton decoupling and magic angle sample spinning are employed. The combination of the latter techniques should produce spectra determined by isotropic chemical shifts just as in a liquid. Various linebroadening mechanisms are described and evaluated for semirigid, disordered (glassy) solids and ordered crystalline solids. The greater strength of secular local magnetic fields and the more restricted molecular mobility in solids versus liquids are the principal reasons for greater linewidths in solids. In particular, the importance of anisotropic bulk susceptibility is pointed out for the first time. An important perspective is that resolution will improve only marginally if at all for higher values of the static field.

705,193
PB85-187847 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Thermodynamic Properties for H2O in the Ideal Gas State.
Final rept.
H. W. Woolley. 1980, 10p
Sponsored by Verein Deutscher Ingenieure, Duesseldorf (Germany, F.R.).
Pub. in Proceedings of Int. Conference on the Properties of Steam (9th), Munich, Germany, September 10-14, 1979, p166-175 1980.

Keywords: *Thermodynamic properties, *Water, *Ideal gas, Molecular energy levels, Steam.

Ideal gas thermodynamic properties for water have been calculated recently at the National Bureau of Standards. Through the technological range of up to 1500 K, the values obtained are purely or primarily based on values for energy levels of Flaud, Camy-Peyret, and their co-workers. Energies and rotational constants for higher vibrational levels were based on data for low lying vibrational levels of H2O essentially as fitted by Prof. W.S. Benedict of the University of Maryland, including effects of resonance.

705,194
PB85-189207 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron-Impact Excitation of Li II: A Model Study of Wave-Function and Collisional Approximations and of Resonance Effects.
Final rept.
R. B. Christensen, and D. W. Norcross. Jan 85, 10p
Contract DOE-EA-77-A-01-6010
Pub. in Physical Review A 31, n1 p142-151 Jan 85.

Keywords: *Lithium, *Molecular energy levels, *Mathematical models, Excitation, Ionization, Resonance, Wave functions, Reprints, *Electron electron interactions.

Results are presented of five-state close-coupling and distorted-wave calculations for electron impact excitation of Li II from the ground state to the four n = 2 states for energies below the ionization threshold. Sensitivity of the results to scattering approximation, target wave functions, and resonance effects is examined. The spin-allowed transitions are found to be much more sensitive to scattering approximation and to the choice of target wave functions than are the spin-forbidden transitions, but rather more strongly to the latter.

705,195
PB85-189264 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Laser Studies of Near-Resonant State-Changing Collisions of Calcium 4s6s singlet S(sub 0) with the Rare Gases.
Final rept.
M. O. Hale, and S. R. Leone. Jan 85, 10p
Grants NSF-PHY82-00805, NSF-CHE79-11340
Pub. in Physical Review A 31, n1 p103-112 Jan 85.

Keywords: *Calcium, *Rare gases, Excitation, Molecular energy levels, Reaction kinetics, Mathematical models, Resonance, Reprints, *Laser spectroscopy, *Molecule molecule interactions, Numerical solution.

State-changing collisions of Ca(4s6s singlet S(sub 0) with the rare gases are studied by pulsed laser excitation and time and wavelength-resolved detection. The total depletion rates of the 4s6s singlet S(sub 0) state with different rare gases vary by over a factor of ten, with the lighter rare gases being markedly more efficient than the heavier ones.

705,196
PB85-189272 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Effects of Orbital Alignment on Inelastic Collisions of Ca(4s5p singlet P(sub 1)) with Helium.
Final rept.
M. O. Hale, I. V. Hertel, and S. R. Leone. 10 Dec 84, 4p
Grants NSF-PHY82-00805, NSF-CHE79-11340
Pub. in Physical Review Letters 53, n24 p2296-2299, 10 Dec 84.

Keywords: *Calcium, *Helium, *Inelastic scattering, Reprints, *Molecule molecule interactions.

The relative cross section for the process Ca(4s5p singlet P(sub 1)) + He yields Ca(4s5p triplet P (sub j) + He + delta E = 177/cm is determined as a function of initial alignment of the Ca(4s5p singlet P(sub 1)) state. The experiment is carried out with pulsed laser excitation in a crossed beam. These results are discussed in terms of physical models of the curve-crossing interaction.

705,197
PB85-189314 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Resonant Two-Photon Ionization and Dissociation of the Hydrogen Atom and Molecule.
Final rept.
K. H. Welge, and H. Rottke. 1984, 10p
Pub. in Proceedings of Int. Conf. on Multiphoton Processes (3rd), Iraklio, Crete, Greece, September 5-12, 1984, p48-57.

Keywords: *Hydrogen, *Ionization, *Dissociation, Excitation, Stark effect, Resonance, *Hydrogen atoms.

The authors report on two experimental studies: (A) the ionization of the H atom in strong external electric fields around the ionization limit by state-selective two-photon, one-photon resonant excitation through single sublevels of the n=2 Stark manifold as intermediate step, and (B) the two-photon, one-photon resonant ionization and dissociation of the H2 molecule through selected rotational-vibrational levels of the B(sup 1) sigma(+1)(sub u) electronic state as intermediate step.

705,198
PB85-189439 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
CO Isotopic Mixing Measurements on Nickel: Evidence for Irreversibility of CO Dissociation.
Final rept.
D. W. Goodman, and J. T. Yates. 1983, 6p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Catalysis 82, p255-260 1983.

Keywords: *Carbon monoxide, *Isotopic labeling, *Catalysis, Nickel, Dissociation reactions, Methanation, Methane, Water, Chemisorption, Reaction kinetics, Reprints.

The isotopic mixing reaction, (12 sup)C (18 sup)O + (13 sup)C (16 sup)O yields (12 sup)C (16 sup)O + (13 sup)C (18 sup)O, and the methanation reaction (3H2 + CO yields CH4 + H2O) have been studied at 2 Torr CO pressure over a Ni(100) single crystal between 300 and 700 K. At 600 K the rate of the exchange reaction is a factor of 50 slower than CO hydrogenation indicating irreversibility of the CO dissociation reaction step. The steady state reaction becomes significant at approximately 850 K at which temperature a graphite layer begins to decompose, opening up free Ni sites. Various models to explain these observations are discussed.

705,199
PB85-189488 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Element by Element Review of the Atomic Weights.
Final rept.
H. S. Peiser, N. E. Holden, P. De Bievre, I. L. Barnes, R. Hagemann, J. R. DeLaeter, T. J. Murphy, E. Roth, M. Shima, and H. G. Thode. 1984, 74p
Sponsored by International Union of Pure and Applied Chemistry, Oxford (England).
Pub. in Pure and Applied Chemistry 56, n6 p695-768 1984.

Keywords: *Atomic weights, *Elements, Experimental design, Reprints, Natural emissions.

The IUPAC 'standard' atomic weights of the terrestrial occurring chemical elements are individually reviewed tracing changes during the past 25 years. Emphasized is the relevant published scientific evidence which in each case constitutes the basis for the expert judgment by the responsible IUPAC Commission. It biennially reports on, recommends, and tabulates the best values of these atomic weights with an implied judgement of their individual reliability. In the introductory part of this Review the history of atomic-weight determinations is sketched. The IUPAC leadership in this data-evaluation project is described as it benefits science, technology, and trade. The remaining experimental uncertainties and natural variabilities are discussed. The treatment of abnormal materials is explained. The principal techniques for determining atomic weights are outlined. The effects of naturally occurring radioactive nuclides are characterized in their essentials.

705,200
PB85-189512 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Simulation of the Initiation of Detonation in an Energetic Molecular Crystal.
Final rept.
D. H. Tsai, and S. F. Trevino. 15 Dec 84, 2p
Pub. in Jnl. of Chemical Physics 81, n12, pt. 1, p5636-5637, 15 Dec 84.

Keywords: *Detonation, *Mathematical models, *Exothermic reactions, Dissociation reactions, Chemical reactions, Shock waves, Reprints, *Molecular crystals.

A molecular dynamical study of the detonation process in a dense system is presented. The model is a filament of a molecular crystal capable of undergoing exothermic dissociation. When the model is heated at one end, dissociation reactions start at the heated end and propagate along the filament. The accompanying expansion of the heated region drives a shock wave into the filament, causing further reactions due to shock heating. The results thus obtained provide a molecular description of the initiation of detonation.

705,201
PB85-189520 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Compact Effective Potentials and Efficient Shared-Exponent Basis Sets for the First- and Second-Row Atoms.
Final rept.
W. J. Stevens, H. Basch, and M. Krauss. 15 Dec 84, 8p
Pub. in Jnl. of Chemical Physics 81, n12, pt. 2, p6026-6033, 15 Dec 84.

Keywords: *Atoms, *Potential theory, Atomic energy levels, Normal density functions, Reprints, *Effective-range theory, *Pseudopotential theory, Pseudospectral methods, Numerical solution, Gaussian measures.

Compact effective potentials, which replace the atomic core electrons in molecular calculations, are presented for atoms in the first and second rows of the periodic table. The angular-dependent components of these potentials are represented by compact one- and two-term gaussian expansions obtained directly from the appropriate eigenvalue equation. Energy-optimized gaussian basis set expansions of the atomic pseudo-orbitals are also presented. The basis sets consist of four gaussian functions which have a common set of exponents (shared-exponents) for the s and p orbitals. The potentials and basis sets have been used to calculate the equilibrium structures and spectroscopic properties of several molecules. The results compare extremely favorably with corresponding all-electron calculations.

705,202
PB85-191427 PC **A03**/MF **A01**
National Physical Lab., Teddington (England). Div. of Material Applications.
Coordinated Development of Standards for Surface Chemical Analysis.
M. P. Seah, and C. J. Powell. Mar 85, 41p NBSIR-85/3120

Keywords: *Surface chemistry, *Standards, *Chemical analysis, Coatings, Films, *Standard reference materials, Versailles project.

This report is based on a proposal to the Steering Committee of the Versailles Project on Advanced Materials and Standards (VAMAS) for the coordinated development amongst the VAMAS member states of standards for surface chemical analysis. VAMAS was established following a meeting of the Heads of State or government at Versailles, France in 1982 that agreed on a number of projects relating to technology, growth, and employment. Specifically, VAMAS was organized to promote international coordination in the development of standards in a wide range of advanced material sectors. Surface chemical analysis was approved as a VAMAS Technical Working Area in June, 1984. The report describes the growth and diversity of surface analysis in the development of advanced materials in modern technologies and additionally, the use of surface analysis for improved films and coat-

ings. The principal techniques of surface analysis in common use are identified and the technical limitations to accurate surface analyses identified. Specific needs are identified for the common methods of surface analysis, Auger-electron spectroscopy, x-ray photoelectron spectroscopy, and secondary-ion mass spectroscopy together with the needs for ion sputtering which is used to obtain composition versus depth information in films and coatings. Existing standards activities in the member countries of VAMAS are reviewed and suggestions are made for additional standards for surface chemical analysis.

705,203
PB85-195907 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Infrared Laser-Induced Decomposition of Diethyl Ketone and n-Butane.
Final rept.
M. J. Pilling, J. R. McNesby, and W. Braun. 1981, 15p
Sponsored by Maryland Univ., College Park.
Pub. in Jnl. of Photochemistry 17, n3-4 p281-295 1981.

Keywords: *Decomposition reactions, *Mathematical models, Infrared lasers, Reprints, *Laser induced reactions, *Ketone/diethyl, *Butane, Laser applications.

The focused, IR Laser-induced decomposition of diethyl ketone has been studied and compared with the SiF4-sensitized decomposition of diethyl ketone and n-butane. A model has been constructed for the direct decomposition of diethyl ketone involving total decomposition of diethyl ketone into ethyl radicals and CO near the focus. Reaction between ethyl radicals form a short-lived n-butane which decomposes statistically into two ethyls or two methyls and ethylene. The system is allowed to react with due account being taken of unimolecular fall-off behavior for all species. The temperature which best explains the experimental product distribution is 1400 K. SiF4-sensitized decomposition of diethyl ketone and n-butane appear to be characterized by purely thermal processes.

705,204
PB85-195998 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Equation of State Theories of Polymer Blends.
Final rept.
I. C. Sanchez, and K. Solc. 1982, 18p
Pub. in Polymer Compatibility and Incompatibility, Principles and Practices, Midland Macromolecular Meeting (10th), p59-76 1982.

Keywords: *Polymers, *Equations of state, *Phase diagrams, Blends, Mixtures, Stability, Critical temperature, Thermodynamics, Entropy.

Phase diagrams of liquid polymer/polymer mixtures (blends) are very unusual when compared to similar low molecular weight mixtures. Neither the familiar adage 'likes dissolve likes' nor the familiar observation that solubility increases with temperature are in general applicable to polymer blends. In this paper, the authors examine the thermodynamic and molecular reasons responsible for this unusual phase behavior. A general thermodynamic analysis of phase stability is presented which suggests that thermally induced phase separation near a low critical solution temperature is an entropy driven process. The entropic driving force is related to the compressible nature of a fluid mixture and the propensity of fluids to contract upon mixing (negative volume changes) at sufficiently high temperatures, or equivalently, sufficiently low fluid densities. By using molecular equation of state theories, they are able to show that volume contraction is always expected at low fluid densities if attractive interactions exist between dissimilar molecular species. All of the unusual aspects of polymer blend phase behavior can be given a rational basis.

705,205
PB85-196046 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development and Use of Numeric Physical/Chemical Properties Databases.
Final rept.
S. P. Fivozinsky. 1982, 12p
Pub. in Drexel Library Quarterly 18, n3/4 p27-38 1982.

Keywords: *Physical properties, *Chemical properties, *Information systems, Utilization, Forecasting, Reprints.

This article presents a glimpse of activities which are producing and disseminating numeric physical and chemical databases. The discussion defines evaluated databases, looks at the history and present organization of major U.S. activities, examines the structure of similar programs in other countries, and projects into the future.

705,206
PB85-196061 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Lifetime Prediction from Polymer Degradation Kinetics.
Final rept.
J. H. Flynn. 1982, 1p
Pub. in Proceedings of the I.U.P.A.C. International Symposium on, Macromolecules(28th), 1982, p322.

Keywords: *Reaction kinetics, *Degradation, *Life(Durability), *Life tests, *Thermogravimetry, Materials tests, Polyurethane resins, Polyester resins, Polyether resins, Diisocyanates, Polymers, Isocyanic acid/methylene-(diphenylene-ester)-di, Isocyanic acid/(methylphenylene-ester).

New techniques for measuring kinetics parameters at low conversion and over a wide range of heating rates were applied to thermogravimetric data on MDI and TDI, polyether and polyester soft segment, polyurethanes. Use of higher molecular weight diisocyanaters and surface blockage are suggested as means to obtain improved durability.

705,207
PB85-196152 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Studies of Liquid Metal Surfaces Using Auger Spectroscopy.
Final rept.
S. C. Hardy, and J. Fine. 1982, 9p
Sponsored by Universities Space Research Association, Columbia, MD., and Materials Research Society, University Park, PA.
Pub. in Proceedings of Materials Research Society Annual Meeting: Materials Processing in the Reduced Gravity Environment of Space, Boston, MA., November 16-18, 1981, v9 p503-511 1982.

Keywords: *Surface chemistry, *Liquid metals, Concentration(Composition), Adsorption, Surface tension, Chemical composition, Temperature, *Gallium tin alloys, *Auger spectroscopy.

The surface composition of liquid gallium-tin alloys has been studied in an Auger electron spectrometer (AES) as a function of bulk composition and temperature. The sessile drop samples were cleaned by argon ion bombardment sputtering of the liquid. This technique produced surfaces that were entirely free of impurities within the sensitivity of AES and remained so for many days. Tin was found to be strongly adsorbed at the liquid-vacuum interface. The surface concentrations measured by AES are in reasonably good agreement with values calculated from surface tension measurements assuming a monolayer distribution for the adsorbed tin.

705,208
PB85-196202 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Infrared Photoluminescence in Polyacetylene.
Final rept.
E. A. Imhoff, D. V. Fitchen, and R. E. Stahlbush. 1982, 4p
Pub. in Solid State Communications 44, n3 p329-332 Oct 82.

Keywords: *Photoluminescence, *Infrared spectroscopy, Sampling, Semiconductors, Reprints, *Polyacetylene.

More extensive photoluminescence measurements of polyacetylene reveal a broad new emission band between 1.2 and 1.6 eV in samples with various isomeric contents. The peak energy and the intensity of this low energy luminescence decrease as the cis fraction decreases, but the band is still present in fully converted trans samples. These characteristics suggest that the infrared emission either is due to perturbed fragments of cis polyacetylene or is unquenched (sup 1)Ag luminescence from segments of trans (CH)x.

705,209
PB85-196210 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Early Hydration of Large Single Crystals of Tricalcium Silicate.
Final rept.
J. B. Ings, P. W. Brown, and G. Frohnsdorff. 1983, 6p
Pub. in Cement and Concrete Research 13, n6 p843-848 Nov 83.

Keywords: *Calcium silicates, *Hydration, *Crystals, *Surface chemistry, Calcium hydroxide, Cements, Concrete products, Construction materials, Reprints.

A reaction product believed to be an initial hydrate layer was observed to have formed on large pure C3S single crystals after 5 minutes of hydration. This layer was then increased in thickness and became covered with micrometer-sized spheres of poorly crystallized Ca(OH)2, within 30 minutes. Subsequently, the formation of a new hydration of acicular morphology was observed to occur on the surface of the first-formed hydrate. This transformation was accompanied by the disappearance of the first hydrate layer and the calcium hydroxide spheres.

705,210
PB85-196244 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Emission and Predissociation of Li2(+1) (sup 2)Pi(sub u).
Final rept.
P. S. Julienne. 1982, 4p
Pub. in Chemical Physics Letters 87, n3 p240-243, 26 Mar 82.

Keywords: *Emission spectroscopy, *Reaction kinetics, Radioactive age determination, Reprints, *Lithium ions, *Predissociation, Ab initio properties.

The spontaneous (sup 2)Pi(sub u) - (sup 2)sigma(+1)(sub b) radiative emission rates and predissociation rates of (sup 2)Pi(sub u) by (sup 2)sigma(+1)(sub u) are calculated for the (sub u) state of Li2(+1) using ab initio transition matrix elements. The phi branches are not predissociated, whereas the P and R branches are predissociated in a manner that varies strongly with vibrational and rotational quantum numbers. The v = 0 (sub u) radiative lifetime is 12 ns.

705,211
PB85-197424 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reaction Products from a Microwave Discharge in N2 and H2S. 1. The Microwave Spectrum of NS.
Final rept.
F. J. Lovas, and R. D. Suenram. 1982, 7p
Pub. in Jnl. of Molecular Spectroscopy 93, n2 p416-422 Jun 82.

Keywords: *Microwave spectra, Molecular energy levels, Interstellar matter, Radio astronomy, Molecular rotation, Reprints, *Nitrogen sulfide.

The microwave spectrum of NS has been reinvestigated in order to provide more accurate molecular constants, and measured and predicted transition frequencies for radio astronomers. The analysis follows earlier studies but provides an improvement in the accuracy of the molecular constants which is essential for predicting higher frequency transitions for radio astronomy. The calculated transitions range up to the N=6-5 levels with an accuracy on the order of 1 MHz.

705,212
PB85-197432 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reactions of Sulfur(IV) with Transition-Metal Ions in Aqueous Solutions.
Final rept.
R. E. Huie, and N. C. Peterson. 1983, 30p
Pub. in Advances in Environmental Science and Technology 12, p117-146 1983.

Keywords: *Sulfur, *Transition metals, *Oxidation reduction reactions, Ions, Air polution control equipment, Scrubbers, Flue gases, Oxidation, Corrosion, Solutions, Reprints, *Acid rain, *Chemical reaction mechanisms.

The redox and complexation reactions of S(IV) with transition metal ions was reviewed, with emphasis on the mechanism of the oxidation of S(IV). Primary emphasis was on the reactions of Fe(III), Cu(II), Mn(III), and Co(III), but others, such as Hg(II), Cu(III), and Ir(IV) were also discussed. The results were analyzed and the proposed mechanisms discussed. Suggestions

were given for the experimental work needed to establish the mechanism of the oxidation of S(IV) by transition metal ions.

705,213
PB85-197473 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dielectric Friction and Ionic Mobility in Polar Liquids and Liquid Crystals.
Final rept.
J. B. Hubbard, R. F. Kayser, and P. J. Stiles. 1983, 2p
Pub. in Chemical Physics Letters 95, n4-5 p399-401 1983.

Keywords: *Dielectric properties, *Liquid crystals, *Ionic mobility, *Mathematical models, Friction, Molecular relaxation, Comparison, Diffusion, Transport properties, Reprints, *Polar liquids.

The authors introduce a continuum model of dielectric friction on an ion in a polar liquid. This model couples hydrodynamic motions of the polarized solvent to dielectric relaxation by both rotational diffusion and translational diffusion of solvent molecules. They show that in solvents with sufficiently long dielectric relaxation times, translational diffusion is the dominant relaxation mechanism. They compare their predictions with experimental data on ion mobilities in nematic liquid crystals.

705,214
PB85-197564 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mechanism of O3-Aldehyde Reactions.
Final rept.
R. I. Martinez. 1982, 13p
Pub. in International Jnl. of Chemical Kinetics 14, n3 p237-249 1982.

Keywords: *Ozone, *Aldehydes, *Chemical reactions, Reprints, *Chemical reaction mechanisms.

Examination of the recent work of several investigators indicates that the currently-accepted O3-aldehyde reaction mechanism is incomplete, and an alternative mechanism is proposed to explain the observations.

705,215
PB85-197598 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Infrared Spectrum of Stannous Oxide (SnO).
Final rept.
A. G. Maki, and F. J. Lovas. 1983, 8p
Pub. in Jnl. of Molecular Spectroscopy 98, n1 p146-153 Mar 83.

Keywords: *Infrared spectra, *Tin oxides, High temperature tests, Least square method, Molecular energy, Vapor phases, Isotopes, Reprints, *Laser spectroscopy.

A tunable diode laser has been used to measure the infrared spectrum of stannous oxide (SnO) in the gas phase between 830/cm and 868/cm. Measurements of the v = 1-0, 2-1, 3-2, and 4-3 transitions have been made at temperatures ranging from 930C to 1150C. Over 175 infrared transitions of the nine most abundant SnO isotopic species have been combined with microwave measurements reported by others in a single least-squares analysis of the data to yield a set of eight Dunham coefficients for the X(sup 1) Sigma(sup +) state of SnO.

705,216
PB85-197614 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamic Surface for the Critical Region of Ethylene.
Final rept.
J. M. H. L. Sengers, J. S. Gallagher, F. W. Balfour, and J. V. Sengers. 1982, 9p
Sponsored by American Society of Mechanical Engineers, New York and National Science Foundation, Washington, DC. See also PB84-217850.
Pub. in Proceedings of Symposium on Thermophysical Properties (8th), Gaithersburg, MD., June 15-18, 1981, Volume 1: Thermophysical Properties of Fluids, p368-376 1982.

Keywords: *Thermodynamic properties, *Surface chemistry, *Ethylene, *Critical point, Equations of state, Scaling, Fluids, Speed of sound, Vapor pressure, Comparison, Experimental design, PVT properties.

The anomalous thermodynamic behavior of fluids near the critical point is described by a thermodynamic potential the authors introduced before. It has the following features: dependent and independent variables are intensive; the thermodynamic properties are analytic throughout the one-phase region except at the critical point; the asymptotic critical behavior is described by Ising-model critical exponents; liquid-vapor asymmetry is incorporated by means of 'mixing of variables'; one correction term to asymptotic scaling is used. A complete formulation of thermodynamic properties is presented here. For ethylene, the thirteen adjustable parameters in the potential were determined by a fit to PVT, vapor pressure and speed-of-sound data. Comparison with experimental data and with other recent formulations are presented.

705,217
PB85-197648 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Representation for Thermodynamic Properties of a Fluid.
Final rept.
F. Kohler, and L. Haar. 1981, 7p
Pub. in Jnl. of Chemical Physics 75, n1 p388-394, 1 Jul 81.

Keywords: *Fluids, *Thermodynamic properties, Equations of state, Thermodynamic properties, Density(Mass/volume), Helmholtz free energy, Reprints, Virial coefficients.

It is proposed to consider the contribution of the non-isolated molecular pairs to the configurational Helmholtz' energy, i.e., the quantity f*/RT B(rho), where the product of second virial coefficient beta times molar density rho covers the contribution of the isolated pairs. The difference function can be correlated empirically in a simple way and can be used for estimating thermodynamic properties at intermediate and low densities from high density results.

705,218
PB85-197689 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electrodynamics of an Ion Near the Surface of a Conducting Dielectric.
Final rept.
R. F. Kayser, and J. B. Hubbard. 1982, 10p
Pub. in Jnl. of Chemical Physics 77, n9 p4704-4713, 1 Nov 82.

Keywords: *Electrodynamics, *Surfaces, *Ions, *Solids, *Dielectric properties, Conductivity, Reprints.

The authors investigate the electrodynamic phenomena associated with an ion moving near the flat surface of a conducting dielectric solid, where the medium containing the ion has an arbitrary dielectric constant, and the solid has a surface conductivity which is independent of its bulk conductivity. For a fixed ratio of surface to bulk conductance, they show that the frictional drag on the ion is dominated by surface dissipation if the ion is sufficiently close to the surface, while bulk (i.e., ohmic) dissipation is the dominant drag mechanism at large distances. The energy dissipation turns out to be independent of the dielectric constants of the two media, given that dielectric dispersion effects are neglected.

705,219
PB85-197697 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mechanism of Fischer-Tropsch Synthesis on a Single Crystal Nickel Catalyst.
Final rept.
R. D. Kelley, and S. Semancik. 1983, 4p
Pub. in Jnl. of Catalysis 84, n1 p248-251 1983.

Keywords: *Hydrogen, *Carbon monoxide, *Catalysts, *Surface chemistry, Molecular weight, Pressure, Reprints, *Chemical reaction mechanisms, *Auger spectroscopy, Fischer-Tropsch synthesis.

Reactions of H2 and CO over a Ni(100) model catalyst have been studied. Measurements of the surface carbon concentrations and the product yields show that, for a fixed carbon level, the amounts of higher molecular weight hydrocarbons are strongly dependent on the reactant carbon monoxide pressure, and suggest a formation mechanism that involves a CO insertion step.

705,220
PB85-197713 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Extension of the Square-Gradient Theory to Fourth Order.
Final rept.
R. F. Kayser, and H. J. Raveche. 1983, 9p
Pub. in Physica A 120A, n1-2 p68-76 1983.

Keywords: *Helmholtz free energy, *Fluids, Reprints, *Square gradient theory, Pair correlation function.

In the square-gradient theory, the Helmholtz free energy density of a nonuniform fluid is approximated by that of a uniform fluid plus a term proportional to the square of the density gradient. Presented here is the extension of this theory (and the corresponding theory of the chemical potential) to fourth order in the gradients. The new results can be applied to study the pair correlation function and interfacial density profile in a fluid near its critical point.

705,221
PB85-197762 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Group Theoretical Treatment of the Planar Internal Rotation Problem in (HF)2.
Final rept.
J. T. Hougen, and N. Ohashi. 1985, 32p
Pub. in Jnl. of Molecular Spectroscopy 109, p134-165 1985.

Keywords: *Molecular rotation, *Hydrogen fluoride, Molecular structure, Reprints, *Dimers, *Molecular configurations.

The HF dimer is believed to exhibit an internal rotation tunneling process between two planar but nonlinear equilibrium configurations, during which tunneling the roles of the hydrogen-bonded and the free hydrogen atom are interchanged. Various-details of energy level diagrams, symmetry species for operators, selection rules for spectroscopic transitions, and statistical weights are presented for the (HF)2 tunneling problem, as well as some speculation on the general question of when point groups, permutation-inversion groups, or double groups are preferable for treating large-amplitude vibrational motion problems.

705,222
PB85-197788 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Quantum Metrology Group.
Molecular X-Ray Spectra: S-K(beta) Emission and K Absorption Spectra of SCO and CS2.
Final rept.
R. C. C. Perera, and R. E. LaVilla. 15 Oct 84, 8p
Pub. in Jnl. of Chemical Physics 81, n8 p3375-3382, 15 Oct 84.

Keywords: *X ray spectra, *Emission spectroscopy, *Absorption spectra, Comparison, Fluorescence, Reprints, *Carbonyl sulfide, *Carbon sulfide(CS2).

The sulfur K(beta) emission in fluorescence and K absorption of SCO and CS2 in gas/vapor phase were measured with a double crystal spectrometer. The sulfur K(beta) emission spectra were compared with the complimentary x-ray spectral data and with the MNDO and ab initio (STO-3G) MO calculations and with previous larger basis set ab initio calculations. A comparison with the x-ray spectra from CO2 was included for completeness. In addition the S-1s binding energy was estimated for SCO and CS2 as 2478.7 eV and 2478.1 eV, respectively. Using the MO calculations as a guide, a tentative assignment of the prominent features in the absorption spectra was made and compared with the S-L(sub 2,3) absorption and energy loss spectra.

705,223
PB85-200129 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 90, Number 2, March-April 1985.
1985, 124p
See also PB85-200137 through PB85-200160 and PB85-179042. Also available from Supt. of Docs as SN703-027-00003-2. Library of Congress catalog card no. 63-37059.

Keywords: *Research projects, Fundamental constants, Standards, Laboratory equipment, Hydrogen, Fugacity, Solutions, Superconductors, Critical field, Spectral emittance, Measurements, Holmium oxides.

Contents:
- New results from previously reported NBS fundamental constant determinations;
- Standards for measurement of the critical fields of superconductors;
- Spectral transmittance characteristics of holmium oxide in perchloric acid solution;
- An apparatus for direct fugacity measurements on mixtures containing hydrogen;
- Programs considered in radiation instruments and laboratory system.

705,224
PB85-200137
(Order as PB85-200129, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
New Results from Previously Reported NBS (National Bureau of Standards) Fundamental Constant Determinations.
B. N. Taylor. 13 Dec 84, 4p
Included in Jnl. of Research of the National Bureau of Standards, v90 n2 p91-94 Mar-Apr 85.

Keywords: *Fundamental constants, *Standards, Faraday effect, Josephson junctions, Hall effect, Measurement, Avogadro constant.

A new treatment of previously reported results of three electric-unit-dependent fundamental constant experiments carried out at NBS over the last decade or so yields accurate, indirect values in SI units for a number of important quantities. These include the fine-structure constant alpha, the Avogadro constant (N sup A), the Josephson frequency-voltage ratio 2e/h, and the quantized Hall resistance R(sup H)=h/sq e.

705,225
PB85-200152
(Order as PB85-200129, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Spectral Transmittance Characteristics of Holmium Oxide in Perchloric Acid Solution.
V. R. Weidner, R. Mavrodineanu, K. D. Mielenz, R. A. Velapoldi, and K. L. Eckerle. 28 Nov 84, 11p
Included in Jnl. of Research of the National Bureau of Standards, v90 n2 p115-125 Mar-Apr 85.

Keywords: *Spectral emittance, *Solutions, *Spectrophotometers, Measurement, Visible spectrum, Design criteria, Performance evaluation, Wavelengths, *Holmium oxides.

The work describes the methods and procedures used to determine the wavelengths of minimum transmittance of holmium oxide in perchloric acid solution. Measurements of spectral transmittance of the solutions were made by means of a high precision spectrophotometer over the wavelength range 200 nm to 680 nm. The wavelength scale accuracy of this instrument was verified by extensive measurements of mercury and deuterium emission lines. The measurements of spectral transmittance of the holmium oxide solutions were made as a function of temperature, purity, concentration, and spectral bandwidth. Analysis of the uncertainties associated with these parameters and the uncertainties associated with the calibration of the instrument wavelength scale and the data analysis have resulted in an estimated uncertainty of + or - 0.1 nm for the determination of the wavelengths of minimum transmittance of the holmium oxide solution.

705,226
PB85-200160
(Order as PB85-200129, PC **A06**/MF **A01**)
National Bureau of Standards, Boulder, CO.
Apparatus for Direct Fugacity Measurements on Mixtures Containing Hydrogen.
T. J. Bruno. 7 Jan 85, 12p
Included in Jnl. of Research of the National Bureau of Standards, v90 n2 p127-139 Mar-Apr 85.

Keywords: *Fugacity, *Measuring instruments, *Hydrogen, Mixtures, Membranes, Methane, Propane, Partial pressure, Temperature, Gas chromatography, Measurement.

An apparatus has been designed and constructed to allow measurements of fugacities in gaseous mixtures containing hydrogen. The apparatus makes use of a semipermeable membrane to allow a direct measurement of the partial pressure of a permeating component (in this case, hydrogen) in a mixture with a nonpermeating component. In this study, measurements were made on mixtures of hydrogen/methane and hydrogen/propane. Using measured values of the mixture pressure, hydrogen partial pressure and mixture mole fraction at a given temperature, fugacity coefficients were determined using the virial equation. The measured values are compared with some previous data and general trends are discussed.

705,227
PB85-201515 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comments on 'Scaling Theory and Enthalpy of Mixing for Binary Mixtures' (and Reply).
Final rept.
G. Morrison, G. T. Brinke, and F. E. Karasz. 1983, 3p
Pub. in Jnl. of Chemical Physics 78, n7 p4790-4792, 1 Apr 83.

Keywords: *Binary systems(Materials), *Enthalpy, Critical point, Thermodynamics, Mixing, Reprints, *Scaling theory.

A brief geometric argument showing the connection between the excess properties of mixing for binary mixtures near a critical point and the second law of thermodynamics.

705,228
PB85-201788 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Hydrolysis of Dicalcium Phosphate Dihydrate in the Presence or Absence of Calcium Fluoride.
Final rept.
M. S. Tung, L. C. Chow, and W. E. Brown. Jan 85, 4p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 64, n1 p2-5 Jan 85.

Keywords: *Hydrolysis, *Calcium phosphates, pH, Temperature, Dential materials, Reaction kinetics, Thermodynamics, Chemical reactions, Reprints, *Apatite.

Effects of temperature (25 and 37C), pH (4.9-10.5) and CaF2 on CaHPO4:2H2O (DCPD) hydrolysis were studied in a pH-stat. Octa-calcium phosphate (OCP) was the product at pH 6.2-6.8 and 25-37C; thermodynamically stable apatitic compounds were formed at higher pH and/or higher temperature. In the presence of CaF2, apatite was the product, its crystallinity improved, and the fluoride content increased as pH of the reaction decreased. The results demonstrate the remarkable ability of fluoride to promote the hydrolysis of an acidic calcium phosphate, DCPD, to apatite.

705,229
PB85-201846 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
High Resolution Raman Spectroscopy of Gases with a Fourier Transform Spectrometer.
Final rept.
A. Weber, D. E. Jennings, and J. W. Brault. 1984, 4p
Pub. in Proceedings of Int. Conf. on Raman Spectroscopy (9th), Tokyo, Japan, August 27-September 1, 1984, p58-61.

Keywords: *Raman spectroscopy, Raman spectra spectra, Spectrometers, Fourier transformation, Performance evaluation, Spectrochemical analysis, *Fourier transform spectroscopy.

An experimental study was undertaken showing for the first time that, contrary to earlier predictions, good quality high resolution Raman spectra of gases can be obtained with a Fourier transform spectrometer. Several improvements in the technique are suggested to further enhance the advantages of Fourier transform Raman spectroscopy over that done with grating spectrographs.

705,230
PB85-201853 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
In situ Monitoring of Polymerization Reactions by Excimer Fluorescence Technique.
Final rept.
F. W. Wang, R. E. Lowry, and W. H. Grant. 1983, 15p
Pub. in Proceedings of ACS (American Chemical Society) Division of Polymeric Materials Science and Engineering, Washington, DC., August 28-September 2, 1983, p138-142.

Keywords: *Polymerization, Excitation, Molecular energy levels, Solutions, Fluorescence, Nondestructive testing, *Excimer fluorescence method, *Bis(pyrene)propane, *Bis(pyrene)decane, *Chemical reaction mechanisms.

An excimer is formed by the association of an excited molecule with another molecule in its ground state. Such an excimer is characterized by a broad structureless fluorescence which is shifted to longer wavelengths compared to the fluorescence spectrum of the isolated molecule. Intramolecular excimer fluorescence has been observed in solutions of pyrene-labeled alkanes such as 1,3-bis-(1-pyrene)propane and 1,10-bis-(1-pyrene)decane.

705,231
PB85-201861 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
State Selected Velocity Measurements: NO/Ru(001) Thermal Desorption.
Final rept.
D. S. King, and R. R. Cavanagh. 1982, 3p
See also AD-A112 210.
Pub. in Jnl. of Chemical Physics 76, n11 p5634-5636 1982.

Keywords: *Velocity measurement, *Quantum interactions, *Surface chemistry, *Molecular rotation, Molecular beams, Metals, Molecules, Fluorescence, Ultrahigh vacuum, Nitrogen oxide(NO), Doppler effect, Reprints, *Laser induced fluorescence, *Thermal desorption, *Molecule molecule interactions.

Quantum state specific studies of the interactions of molecules with clean, well characterized metal surfaces are quite sparse. The authors report here the first measurement of a rotational-state specific velocity distribution for thermally desorbed molecules from a single crystal metal under ultrahigh vacuum (UHV) conditions. The experiment is based on the measurement of a molecular Doppler profile using laser Excited Fluorescence techniques.

705,232
PB85-201879 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Acid Precipitation: The Role of O3-Alkene-SO2 Systems in the Atmospheric Conversion of SO2 to H2SO4 Aerosol.
Final rept.
R. I. Martinez, and J. T. Herron. 1983, 7p
Pub. in Jnl. of Environmental Science and Health 18, n6 p739-745 1983.

Keywords: *Air pollution, *Sulfuric acid, *Aerosols, Alkenes, Ozone, Sulfur dioxide, Chemical reactions, Reprints, *Acid rain, *Atmospheric chemistry, Chemical reaction mechanism.

The atmospheric conversion of SO2 to H2SO4 aerosol is discussed in the context of O3-alkene-SO2 reactions and a mechanism is proposed.

705,233
PB85-201887 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Adsorption of H2O on Ni(III); Influence of Preadsorbed Oxygen on Azimuthal Ordering.
Final rept.
T. E. Madey, and F. P. Netzer. 1982, 12p
Pub. in Surface Science 117, n1-3 p549-560 1982.

Keywords: *Water, *Adsorption, *Surface chemistry, Azimuth, Chemical bonds, Reprints, *Electron stimulated desorption ion angular distribution, *Temperature programmed thermal desorption.

ESDIAD (electron stimulated desorption ion angular distribution), LEED and TPD (temperature programmed thermal desorption) have been used to study the adsorption of H2O on Ni(III), both clean and with preadsorbed oxygen. On the clean surface, a fractional H2O monolayer adsorbed at 80 K exhibits no preferred azimuthal orientation for the H-ligands; the local bonding configurations of H2O have a nearly random distribution.

705,234
PB85-201960 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

3D-4P Transitions in the Zinclike and Copperlike Ions YX, XI; Zr XI, XII; Nb XII, XIII; and Mo XIII, XIV.
Final rept.
J. F. Wyart, J. Reader, and A. Ryabtsev. 1981, 7p
Pub. in Jnl. of the Optical Society of America 71, n6 p692-698 Jun 81.

Keywords: *Atomic energy levels, Ions, Reprints, Molybdenum ions, Niobium ions, Yttrium ions, Zirconium ions.

Lines occuring as satellites on the long wavelength side of the 3d(sup 10)-3d(sup 9) 4p resonance lines of Ni-like ions have been investigated with a low inductance vacuum spark and a 10.7-m spectrograph for the elements Y, Zr, Nb, and Mo. The spectra of the Cu-like ions were interpreted by generalized least-squares fits for the sequence of four ions. Line identifications and energy levels were obtained for the 3d(sup 10) 7p configuration of the Cu-like ions Y XI - Mo XIV.

705,235
PB85-202026 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dispirations, Disclinations, Dislocations, and Chain Twist in Polyethylene Crystals.
Final rept.
D. H. Reneker, and J. Mazur. 1983, 14p
Pub. in Polymer 24, n11 p1387-1400 1983.

Keywords: *Polyethylene, Molecular structure, Reprints, *Polymeric chains, *Molecular conformation.

It is proposed that the twist in polyethylene chains that can result from crystallization and subsequent deformation aggregates at boundaries and becomes a template for further reorganization that results in the long period observed in polyethylene fibers. The observed lower density at the boundaries requires the transport of free volume to the twist boundaries. Dispirations, disclinations, and dislocations are crystallographic defects that provide the necessary transport mechanism. Twist and bend, derived from the Eulerian angles-which are computed from the sets of chain internal coordinates, relate the orientation of different segments of a chain. Twist and bend are useful for the characterization of both crystallographic defects and arbitrary conformations of polymer chains. Defects, along with folds, chain ends, and ordinary edge and screw dislocations provide a basis for interpretation of structure-property relationships in solid polyethylene.

705,236
PB85-202042 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cell Model Theory of Polymer-Solutions.
Final rept.
I. C. Sanchez, and D. J. Lohse. 1981, 7p
Pub. in Macromolecules 14, n1 p131-137 1981.

Keywords: *Polymers, *Solutions, Thermodynamics, Scaling, Reprints, *Cell model, Virial coefficients, Chemical potentials, Numerical solution, Flory Huggins theory.

An incompressible, statistical thermodynamic theory of a polymer solution is formulated, which takes into account concentration in homogeneities. A generalized cell model is used as the basis for the new polymer solution theory. Closed-form, parametric equations are obtained for solvent and polymer chemical potentials which only reduce to classical (Flory-Huggins) potentials when concentration homogeneity is assumed. In a good solvent, the calculated second virial coefficient decreases with molecular weight M(sup -1/5) dependence) in good agreement with available experimental data. In dilute solutions, chain dimensions can be analytically determined; the well-known Flory excluded volume equation is obtained. The most important parameter in the cell model is the average number of chains/cell, lambda. For semi-dilute solutions (lambda << 1), it is shown that several important scaling results are recovered from a simple scaling hypothesis for lambda.

705,237
PB85-202620 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Adsorption of Water on Aluminum(111).
Final rept.
F. P. Netzer, and T. E. Madey. 1983, 8p
Pub. in Surface Science 127, n1 pL102-L109 1983.

Keywords: *Water, *Adsorption, Aluminum, Surface chemistry, Reprints, Electron stimulated desorption ion angular distributions, Low energy electron diffraction, Auger electro spectroscopy.

The adsorption of H2O on Al(111) has been studied by ESDIAD (electron stimulated desorption ion angular distributions), LEED (low energy electron diffraction), AES (Auger electron spectroscopy) and thermal desorption in the temperature range 80-700 K. The general behavior of H2O adsorption on clean and oxygen-precovered Al(111) (theta (sub 0) < or about monolayer) is rather similar at low temperature, but a much higher reactivity for dissociative adsorption of H2O is noted on the oxygen-dosed surface around room temperature.

705,238
PB85-202646 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Monte Carlo Electron Trajectory Calculations of Electron Interactions in Samples with Special Geometries.
Final rept.
D. E. Newbury, and R. L. Myklebust. 1984, 11p
Pub. in Proceedings of Pfefferkorn Conference on Electron Beam Interactions with Solids for Microscopy, Microanalysis and Microlithography (1st), Monterey, CA., April 18-23, 1982, p153-163 1984.

Keywords: *Electron scattering, *Electron probes, Monte Carlo method, Elastic scattering, Backscattering, X ray analysis, Spatial distributions, *Electron electron interactions, *Microprobe analysis, *Monte Carlo simulation, Numerical solution, Scanning electron microscopy.

Implementing a Monte Carlo simulation for application to electron sample interactions requires use of accurate treatments of elastic and testing must be carried out to ensure that the calculation yields sensible and useful results. A suitable testing procedure includes calculation of (1) electron backscatter coefficients as a function of atomic number, including any necessary adjustment of scattering parameters (2) backscatter coefficients as a function of speciment tilt; (3) backscatter and transmission coefficients for thin foils; (4) backscattered electron energy distributions; (5) electron spatial distributions; and (6) x-rays, including x-ray depth distributions and relative and absolute yields. Adapting a Monte Carlo simulation to a particular problem involving special sample geometry requires careful consideration of the interaction of the electron with the target. When the electron trajectory crosses a boundary, the segments of the trajectory in each phase must be calculated in a logical, stepwise fashion, allowing for modification of the step lengths due to variable scattering power in phases of different composition. The particular example of a planar boundary between phases of different composition is considered.

705,239
PB85-202679 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystal Growth Kinetics and the Lateral Habits of Polyethylene Crystals.
Final rept.
E. Passaglia, and F. Khoury. 1984, 14p
Pub. in Polymer 25, n5 p631-644 1984.

Keywords: *Polyethylene, *Crystal growth, *Reaction kinetics, Polymers, Lateral stability, Surface energy, Reprints.

For polyethylene crystals the aspect ratio r of the crystal dimensions in the a and b crystallographic directions depends on temperature, undercooling, solvent, concentration, and molecular weight. At steady state growth, r can be expressed in terms of the ratio of growth rates normal to the (110) and (100) faces. Writing the growth rates in terms of the kinetic theory of crystal growth yields an expression which is used to analyze experimental results for crystallization from xylene.

705,240
PB85-202687 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hydrocarbon Type Separation of Lubricating Base Oil in Multigram Quantity by Preparative HPLC.
Final rept.
P. Pei, J. Britton, and S. M. Hsu. 1983, 19p
Pub. in Jnl. of Liquid Chromatography 6, n4 p627-645 1983.

Keywords: *Lubricating oils, *Chemical analysis, *Hydrocarbons, Aromatic compounds, Reprints, High performance liquid chromatography.

A preparative HPLC method has been developed to separate lubricating base oil into its three major hydrocarbon fractions: saturates, aromatics and polars. The results are directly comparable to ASTM Method D2007, 'Hydrocarbon Type Analysis by Gradient Elution Liquid Chromatography.' The new method employs a prep HPLC unit with equal dual, radically compressed columns consisting of clay and alumina/silica gel columns. Depending on the solvent elution schemes, minor components (1 to 2% by wt.) of a base oil can be isolated in multigram quantities for further study.

705,241
PB85-202703 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Solid-State Structures of Keto-Disaccharides as Probed by Carbon-13 Cross-Polarization, 'Magic-Angle' Spinning NMR Spectroscopy.
Final rept.
P. E. Pfeffer, K. B. Hicks, and W. L. Earl. 1983, 13p
Pub. in Carbohydrate Research 111, n2 p181-193 1983.

Keywords: *Isotopic labeling, *Nuclear magnetic resonance, *Saccharides, Solid state physics, Carbon 13, Crystal structure, Reprints, *Cross polarization magic angle spinning, Lactulose, Maltulose.

The 15 MHz(13)C cross-polarization magic angle spinning (CP-MAS) spectra of maltulose H2O and anhydrous lactulose were examined at different B(sub 0) and B(sub 1) field strengths. While the lactulose spectrum was insensitive to changes in these parameters, the maltulose spectrum showed significant responses. From selective relaxation experiments, a mixture of three 'forms' (based on the ratio of the C-2' carbon resonances) of both lactulose and maltulose were shown to exist in the solid state. the (1/sup H)360 MHz DMSO-OH solution spectra of the unmutarotated disaccharides were used to establish the isomeric and anomeric composition of these crystalline solids. The chemical composition of lactulose, as determined by the (1 sup)H DMSO-OH spectrum, correlated well with the CP-MAS data, however, the spectrum of unmutarotated maltulose showed the presence of only a single beta-pyranose form anomer. Based on the ratio of the lactulose tautomers determined from the (1 sup)H DMSO-OH spectrum (referenced to fructose), the C-2' carbon resonances representing each anomeric form of lactulose were assigned in the CP-MAS spectrum. A 'crossover' in chemical shift positions of the anomeric resonances was observed in going from solution to solid state. Furthermore, a pronounced increase in the proportion of the furanoid anomers was noted for lactulose in the crystalline state relative to solution.

705,242
PB85-202711 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stress Relaxation of Polyvinylidene Fluoride in Ethyl Acetate Vapor.
Final rept.
J. C. Phillips, A. Peterlin, and P. F. Waters. 1983, 7p
Pub. in Polym. Mater. Sci. Eng. 49, p555-561 1983.

Keywords: *Stress relaxation, Diffusion, Sorption, Vapor pressure, Reprints, *Vinylidene fluoride polymers, Acetic acid/(ethyl-ester).

In general, the presence of a vapor or gas in a polymer matrix enhances the stress relaxation of the polymer. The diffusion process at a given strain level may also be affected by the relaxation process. By studying diffusion and relaxation simultaneously, one obtains useful information of the concurrent processes. Polyvinylidene Fluoride in Ethyl Acetate vapor was studied at 30C for different vapor pressures at a given strain level. The results indicate that the time-dependent changes due to the sorption are reflected in the stress relaxation. These effects are also enhanced by polymer anisotropy and with the equilibrium concentration of the sorbate which is roughly proportional to the vapor pressure.

705,243
PB85-202737 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Measurements and Standards Div.

Rotational Collisional Narrowing in the NO Fundamental Q Branch, Studied with cw Stimulated Raman Spectroscopy.
Final rept.
W. Lempert, G. J. Rosasco, and W. S. Hurst. 15 Nov 84, 5p
Pub. in Jnl. of Chemistcal Physics 81, n10 p4241-4245, 15 Nov 84.

Keywords: *Raman spectroscopy, *Nitrogen oxide(NO), *Molecular rotation, Spectral lines, Line width, Inelastic scattering, Reprints.

Self-broadened NO Q-branch spectra were obtained in the pressure region about 20-100 kPa. The authors determined J-and omega-dependent pressure broadening coefficients. The observed collisional narrowing was fitted by means of a relaxation matrix theory, incorporating recent experimental and theoretical values of NO state-to-state rates. A 'fitting law' representation of the state-to-state rates yielded good agreement with both the measured broadening coefficients and the observed spectrum.

705,244
PB85-202752 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Kinetic Isotope Effect in the Thermal Dehydration of Cellobiose.
Final rept.
M. D. Scheer. 1985, 6p
Pub. in Fundamentals of Thermochemical Biomass Conversion, p89-94 1985.

Keywords: *Dehydration, *Reaction kinetics, *Isotope effect, *Cellobiose, Water, Deuterium compounds, Hydrogen, Reprints.

The rates of dehydration of cellobiose, with 50% deuteration of its hydroxyl hydrogens, were measured in the 190-250 C temperature range. These rates were found to be smaller and the liquefaction temperature about two degrees higher than was the case for ordinary cellobiose. This is shown to be quantitatively consistent with the previously proposed view that the process of 'melting with decomposition' is an aqueous dissolution of the sugar and its decomposition products in the eliminated water. It is also shown that the rates of elimination of D2O relative to H2O and HDO cannot be accounted for by consideration of the difference in zero point energies. It is concluded that there is a significant quantum mechanical tunnelling contribution to the rates of saccharide dehydration at the relatively low temperatures of these experiments.

705,245
PB85-202836 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Fluorescence Measurements of Diffusion in Polymer Systems.
Final rept.
F. W. Wang, R. E. Lowry, and E. S. Wu. 1984, 18p
Pub. in Proceedings of Transport Phenomena: Migration of Gases, Liquids, and Solids in Elastomers, Denver, CO., October 24, 1984, 18p.

Keywords: *Fluorescence, *Diffusion coefficient, *Polymers, Extraction, Antioxidants, Nitrogen organic compounds, *Phenylene diamine/N-N-diphenyl, *Thiophene/di(butyl-benzoxazolyl).

The diffusion coefficients for two antioxidants N, N'-diphenyl-p-phenylene-diamine (DPPD) and 2,5-di(5-tert-butyl-2-benzoxazolyl)thiophene (Uvitex OB) have been measured by extraction from a low density polyethylene film into 1-propanol at 22C. Extraction was done in a special cuvet-equipped vessel which excludes oxygen during extraction and permits direct fluorescence monitoring of the extraction solvent. Oxygen exclusion eliminates errors due to fluorescence quenching and antioxidant oxidation and allows precise measurement of the diffusion coefficient. The self-diffusion coefficient of a polystyrene polymer in diethyl phthalate was measured as a function of polymer concentration. The concentration dependence of the self-diffusion coefficient was found to agree with the predictions of the scaling concepts.

705,246
PB85-202844 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Structurally Complex Organic Ions: Thermochemistry and Noncovalent Interactions.
Final rept.
M. Mautner. 1984, 8p
Pub. in Accounts of Chemical Research 17, n5 p186-193 1984.

Keywords: *Molecular structure, *Complex ions, Hydrogen bonds, Van der Waals equation, Thermochemistry, Steric hindrance, Reprints.

The thermochemical properties of protonated organic ions B:H(+1) and of clusters or monosolvated species B1H(+1):B2 and BH(+1):H2O are significantly affected by the following structural factors: (1) Intramolecular hydrogen bonding; (2) Multiple hydrogen bonding; (3) Steric hindrance; (4) Charge resonance and charge delocalization; (5) Attractive van-der-Waals dispersion forces.

705,247
PB85-202869 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Uniformly Valid Asymptotic Solutions of Chemical Rate Equations for Irradiation-Produced Point Defects.
Final rept.
R. E. Mickens. 1983, 9p
Pub. in Acta Physica Polonica A 64, n1 p59-67 Jul 83.

Keywords: *Reaction kinetics, *Mathematical models, *Asymptotic series, *Point defects, Irradiation, Reprints, Numerical solution.

The authors present a perturbation technique for obtaining solutions to a pair of nonlinear coupled differential equations which model the behavior of the kinetics of irradiation-produced interstitials and vacancies. The procedure eliminates secular terms at each stage of the calculation; consequently, the solutions are uniformly valid for 0 < or = t < infinity.

705,248
PB85-202877 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparative Rate Single Pulse Shock Tube Studies on the Thermal Stability of Polyatomic Molecules.
Final rept.
W. Tsang. 1981, 71p
Pub. in Shock Tubes and Chemistry, p59-129 1981.

Keywords: *Thermal stability, *Polyatomic molecules, *Shock tubes, *Chemical bonds, *Bonding strength, Heats of formation, Decomposition, Polymers.

The comparative rate single pulse shock tube technique is shown to offer unique advantages for the determination of unimolecular rate parameters for the transformations of polyatomic organic molecules. The results derived from this method on bond fissions, complex fissions and isomerizations are summarized. Particularly noteworthy are the regularities and interrelationships in the rate parameters. Results on the bond fission reactions have led to rates that are much lower than originally expected. This is brought about by smaller A-factor (for the alkanes) and higher carbon-carbon bond energies. The former is suggestive of a transition state that grows 'tighter' with temperature, while the latter calls into question heats of formation of organic radicals determined by metathesis reactions. It is demonstrated that the new bond energies provide a much sounder basis for the biradical mechanism for cis-trans isomerization and small ring decyclization. Directions for future work are indicated.

705,249
PB85-202893 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Measurements and Standards Div.
Dynamic Behaviour of the Pople and Karasz Model.
Final rept.
P. H. E. Meijer, and M. Keskin. 1984, 8p
Contract N00014-78-C-0518, Grant NATO-1928
Pub. in Jnl. of Physics and Chemistry of Solids 45, n8-9 p955-962 1984.

Keywords: *Crystallization, *Plastics, *Dynamics, *Mathematical models, Reprints, *Pople Karasz model, *Most probable path method.

Using the Pople and Karasz model for the solidification of plastic crystals, the authors construct two different sets of dynamic equations for the translational and rotational order parameters. The first is straight generalization of the Pople and Karasz model, whereby one coupling parameter is a function of the other, and vice versa. The second generalization is based on the most probable path method of Kikuchi. In order to accomplish this they start with an appropriate transformation of the parameters. It is then shown that it is necessary to incorporate the special-angular correlation in order to apply this method. Computations for both systems of equations are given to demonstrate the behavior of the long range order parameter if it is initially far from equilibrium.

705,250
PB85-203412 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Transduction Phenomena in Ferroelectric Polymers and Their Role in Pressure Transducers.
Final rept.
A. S. DeReggi. 1983, 6p
Sponsored by Army Research Office, Arlington, VA. and Office of Naval Research, Arlington, VA.
Pub. in Ferroelectrics 50, p21-26 1983.

Keywords: *Transducers, *Piezoelectricity, *Pyroelectricity, *Ferroelectric materials, *Polymers, Adiabatic conditions, Heat transfer, Reprints, *Vinylidene fluoride polymers.

The facts (1) that the piezo and pyroelectricity of polyvinylidene fluoride (PVF2) is largely secondary and (2) that polymers in general have large thermal expansion coefficients, are responsible for tranduction properties where piezo and pyroelectric effects may have to be considered together. In particular, in a PVF2 transducer subjected to compression, the adiabatic compressional heating of the polymer is calculated to give a pyroelectric response amounting to approximately -10 percent of the isothermal piezoelectric response to the same compression. The thermal time constant governing the heat exchange between the polymer and its surrounding thus is an important design parameter. This time constant sets a crossover frequency between adiabatic and non-adiabatic response.

705,251
PB85-203420 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electronic Emission Spectrum of Triatomic Hydrogen. 4. Visible Bands Near 5800 AA and Infrared Bands Near 3950/cm.
Final rept.
G. Herzberg, J. T. Hougen, and J. K. G. Watson. 1982, 24p
Pub. in Canadian Jnl. of Physics 60, n9 p1261-1284 Sep 82.

Keywords: *Emission spectra, *Tritium, *Visible spectroscopy, *Infrared spectroscopy, *Electronic spectra, Hydrogen isotopes, Reprints.

No abstract available.

705,252
PB85-203461 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Model of the Kinetics of High Temperature Free Radical Reactions.
Final rept.
N. C. Peterson, T. Ishii, and W. Braun. 1981, 9p
Sponsored by Polytechnic Inst. of New York, Brooklyn.
Pub. in NATO Adv. Study Inst. Ser., Ser. C 71, p531-539 1981.

Keywords: *Reaction kinetics, *Mathematical models, *High temperature tests, Acetone, Dissociation, Infrared spectroscopy, Chemical reactions, Thermal conductivity, Reprints, *Methyl radicals.

Methyl radicals are generated by multiple photon dissociation of acetone in a small volume. The temperature rises rapidly to 2000 K and high temperature reactions take place. Rapid expansion quenches the high temperature reactions in time of the order of .00001 s. Quenching of the chemical reactions occurs rapidly by expansion and more slowly by thermal conductivity. A picture of the hydrodynamic flow, equilibration of vibrational and translational temperatures and thermal conductivity for a computer model consistent with experimental data is described.

705,253
PB85-203529 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Determination of the 1s Lamb Shift in One-Electron Argon Recoil Ions.
Final rept.
H. F. Beyer, R. D. Deslattes, F. Folkmann, and R. E. LaVilla. 1985, 9p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 18, p207-215 1985.

Keywords: *Radioactive decay, *Electron spectroscopy, Atomic energy levels, Ions, Field theory, Reprints, *Argon ions, *Lamb shift, *Recoil spectroscopy.

The authors report accurate measurements of doublet P(sub 3/2, 1/2) yields 1s (Lyman-alpha(sub 1,2)) transitions in Ar(+17) produced by encounters with a U(+66) beam at 5.9 MeV/nucleon. The 'recoil' production mechanism eliminates the need for Doppler corrections while a wavelength accuracy of 5 ppm relative to visible standards is attained through use of a transfer standard x-ray profile. This permits a 1.5% test of the 1s(sub 1/2) Lamb shift as limited by model uncertainties arising from spectator electron satellites.

705,254
PB85-205185 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of the 1s Lamb Shift in Hydrogenlike Chlorine.
Final rept.
P. Richard, M. Stockli, R. D. Deslattes, P. Cowan, R. E. LaVilla, B. Johnson, K. Jones, M. Meron, R. Mann, and K. Schartner. May 84, 4p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 29, n5 p2939-2942 May 84.

Keywords: *Atomic energy levels, *X ray analysis, Excitation, Fine structure, Reprints, *Lamb shift, *Beam foil excitation, *Chlorine ions.

The 1s Lamb shift in hydrogenlike chlorine has been determined froma precision measurement of x-ray transitions using beam-foil excitation. The x-rays are emitted from high-velocity chlorine-ion beams at several ion velocities produced by a Van de Graaf accelerator. The 1s Lamb shifts obtained from the Ly(alpha 1) + Ly(alpha 2) measurements are 0.84(12) and 0.90(10) eV, respectively, compared with a calculated value of 0.9384(6) eV. The fine-structure splitting of the 2p level was also determined in the experiment and found to be 3.889(30) eV compared with a theoretical value of 3.82718(2) eV. A precision measurement of the Ar K alpha x rays was made in order to establish the energy scale for Cl Ly(alpha) x-rays.

705,255
PB85-205193 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Estimated Thermodynamic Functions for Some Chlorinated Benzenes, Phenols, and Dioxins.
Final rept.
W. M. Shaub. 1982, 34p
Pub. in Thermochimica Acta 58, n1 p11-44 1982.

Keywords: *Thermodynamics, *Benzenes, *Phenols, *Dioxins, *Chlorine organic compounds, Molecular structures, Molecular vibration, Reprints, Dibenzodioxins, Polychlorinated biphenyls, Chlorinated dibenzodioxins.

Procedures for estimating the values of gas phase thermodynamic functions for a large number of chlorinated benzenes, phenols and dioxins (dibenzo-p-dioxins) have been developed from estimated values of molecular parameters. Structurally similar model compounds were used to make frequency assignments, and when available, interatomic distances were taken from the literature. Symmetry numbers were assigned based upon known structures.

705,256
PB85-205243 Not available NTIS
National Bureau of Standards (NEL), Washington, DC. Statistical Engineering Div.
Some Basic Statistical Methods for Chromatographic Data.
Final rept.
K. Kafadar, and K. R. Eberhardt. 1984, 34p
Pub. in Advances in Chromatography 24, p1-34 1984.

Keywords: *Chromatographic analysis, *Statistical analysis, Reviews, Gas chromatography, Mathematical models, Liquid chromatography, Reference materials, High performance liquid chromatography.

The article reviews some basic notions of statistics that are applicable particularly for measurements obtained by gas and liquid chromatography. Included in this review are probability models for measurement error, classical and robust methods for obtaining confidence intervals, and the use of analysis of variance and median polish to analyze linear additive models. GC and HPLC data are used to illustrate these techniques, as well as to introduce methods for estimating a drift rate, testing homogeneity of a reference material, and obtaining a valid uncertainty statement from a set of correlated measurements.

705,257
PB85-205268 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Observation of Prebreakdown and Breakdown Phenomena in Liquid Hydrocarbons Under Nonuniform Field Conditions.
Final rept.
R. E. Hebner, E. F. Kelley, E. O. Forster, and G. J. FitzPatrick. Jul 84, 5p
See also PB83-135160.
Pub. in Proceedings of Int. Conf. on Conduction and Breakdown in Dielectric Liquids (8th), Pavia, Italy, July 24-27, 1984, IEEE (Institute of Electrical and Electronics Engineers) Conf. Record No. 84CH2055-2, p185-189.

Keywords: *Electrical faults, *Electrical discharges, Electrical insulators, Field tests, Dielectric properties, Hexane, Toluene, Impurities, Cathode, Anode, Ionization potentials, Insulating oil, Marcol 70.

The prebreakdown processes have been recorded in n-hexane, toluene, and Marcol 70, both in a pure state and with selected impurities. The study was carried out using a point-plane geometry. A low ionization potential additive had only a small effect on the breakdown voltage or the streamer propagation speed but did significantly alter the shape of the prebreakdown streamer when the needle was the anode. For a cathode needle, chemical impurities affected the breakdown voltage.

705,258
PB85-205292 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Transduction Phenomena in Ferroelectric Polymers and Their Role in Biomedical Applications.
Final rept.
A. S. DeReggi. 1984, 23p
Sponsored by Army Research Office, Arlington, VA. and Office of Naval Research, Arlington, VA.
Pub. in Ferroelectrics 60, p83-105 1984.

Keywords: *Ferroelectric materials, *Polymers, *Transducers, *Piezoelectricity, *Pyroelectricity, Heat transfer, Adiabatic conditions, Polyvinyl fluoride, Reprints, *Vinylidene fluoride polymers, Biomedicine.

Ferroelectric polymers such as polyvinylidene fluoride, polyvinyl fluoride, and several copolymers and blends when poled have pressure and temperature transduction properties which are related mainly to volume changes. Because of compressional heating effects, the pressure response includes both piezoelectric and pyroelectric terms, the latter representing nominally a -10 percent effect under adiabatic conditions. At low frequencies, where there is enough time in a cycle period for significant heat to be exchanged between the polymer and the surroundings becomes relevant as well as the compressional heating of the surroundings. For sensors in good thermal contact with thermally conducting surroundings, the time constant for internal thermal equilibration of the polymer becomes relevant also along with the polarization distribution function, unless the latter is uniform. The piezoelectric response of thin tubes, balloons and caps is discussed within the dipole density model for which the response is determined by thickness changes.

705,259
PB85-205300 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Two-Photon Induced Fluorescence of the Tumor Localizing Photosensitizer Hematoporphyrin Derivative via 1064 nm Photons from a 20 ns Q-Switched Nd-YAG Laser.
Final rept.
R. Bodaness, and D. King. 16 Jan 85, 6p
Pub. in Biochemical and Biophysical Research Communications 126, n1 p346-351, 16 Jan 85.

Keywords: *Fluorescence, *Hematology, *Porphyrins, *Photochemical reactions, *Chemotherapy, Biochemistry, Excitation, Photons, Reprints, *Cancer, Laser applications.

The authors demonstrate the direct 1064 micrometers two-photon excitation of hematoporphyrin derivative(HPD), a complex mixture of photosensitizing porphyrins which is selectively retained in tumor tissue and used in cancer photochemotherapy. Although 1064 micrometers is outside of the one-photon HPD absorption spectrum, two-photon induced fluorescence from HPD was observed following excitation by the 20 ns output of an amplified, Q-switched Nd-YAG laser at peak power levels of 0.1 to 3 GW/sq cm. Evidence for the successful two-photon excitation to vibrational levels of the S1 state consists of the observation of the known HPD fluorescence spectrum exhibiting peaks at approximately 615 and 675 micrometers, with the observed two-photon induced fluorescence intensity exhibiting a quadratic dependence on the excitation laser intensity as required for a direct two-photon process. More generally, these results suggest the possibility for the achievement of photosensitized oxidations utilizing photons of lower energy than that required for single photon excitation, offering the potential for both greater selectivity and a reduction in competing photochemical processes.

705,260
PB85-205342 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
SANS (Small-Angle Neutron Scattering) and SAXS (Small-Angle X-ray Scattering) Studies on Molecular Conformation of a Block Polymer in Microdomain Space.
Final rept.
H. Hasegawa, T. Hashimoto, H. Kawai, T. P. Lodge, E. J. Amis, C. J. Glinka, and C. C. Han. 1985, 12p
Pub. in Macromolecules 18, n1 p67-78 1985.

Keywords: *Neutron scattering, *X ray analysis, *Polymers, Polystyrene, Polyisopyrene, Reprints, *Molecular conformation, *Small angle scattering.

The molecular conformation of a block polymer chain in a microphase-separated domain space (a confined space) was studied by small-angle neutron scattering (SANS) with a deuterium labeling technique. The samples studied were polystyrene-polyisoprene diblock polymers, and they have a morphology of highly oriented alternating lamellar microdomains composed of polystyrene (PS) and polyisoprene (PI) in bulk when cast from dilute solutions in toluene. Conclusion (iii) does not mean at all that the chains in domain space are unperturbed but rather that they are strongly perturbed. The lateral contraction was proposed to be the consequence of the repulsive potential between the centers of block chains which are located in narrow interfacial regions (i.e., essentially in the two-dimensional space). A residual 'memory' of the repulsion in the bulk block polymer could be a consequence of the two-dimensionality of the space available to chemical junctions of the block polymers and/or an effect of repulsive potential (which existed in the polymer solution with a good solvent) being 'locked-in' at high polymer concentrations.

705,261
PB85-205631 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ionization Energies and Entropies of Cycloalkanes: Kinetics of Free Energy Controlled Charge-Transfer Reactions.
Final rept.
L. W. Sieck, and M. Mautner. 1982, 5p
Pub. in Jnl. of Physical Chemistry 86, n18 p3646-3650 1982.

Keywords: *Cyclohexanes, *Reaction kinetics, *Free energy, *Ionization, Chemical equilibrium, Mass spectroscopy, Enthalpy, Entropy, Thermodynamic properties, Reprints.

Enthalpies and entropies of ionization (delta H ion and delta S ion) of alkylcyclohexanes, as well as cycloheptane, cyclooctane, and trans-decalin, have been determined by charge transfer equilibrium measurements. A major effect of alkyl substitution is observed following substitution at a site alpha to a tertiary hydrogen atom (as from mehtyl-cyclohexane to 1,2-dimenthylcyclohexane), or following replacement of a tertiary hydrogen atom (as from methylcyclohexane to 1,1-dimethylcyclohexane). The charge transfer reactions involving the cycloalkanes are shown to be fast processes; i.e., the sum of the reaction efficiencies (r=k/k(collision))

of the forward and reverses processes is near unity. The efficiencies of these processes appear to be determined uniquely by the overall free energy change (or equilibrium constant K).

705,262
PB85-205656 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Catalysis by Carbides, Nitrides and Group VIII Intermetallic Compound.
Final rept.
S. T. Oyama, and G. L. Haller. 1982, 33p
Pub. in Catalysis 5, p333-365 1982.

Keywords: *Catalysis, *Carbides, *Nitrides, *Group 8 compounds, *Intermetallics, Physical properties, Chemical properties, Decomposition, Reaction, Oxidation, Hydrogenation, Isomerization, Hydrolysis, Ammonia, Reprints, Fischer Tropsch synthesis.

A review is presented of catalysis by carbides, nitrides, and Group VIII intermetallic compounds. The catalytic and other properties of transition-metal carbides and nitrides are discussed for oxidation, hydrogenation, dehydrogenation, isomerization, hydrolysis, Fischer-Tropsch synthesis, and ammonia synthesis. A similar discussion is presented for catalysis by binary compounds of Group VIII metals and lanthanides or actinides. It is not clear at this time whether the unique properties of the latter catalysts are due to the method of preparation (e.g., the extent of decomposition) or to a particular metal-oxide interaction.

705,263
PB85-205664 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Bond Homolysis in High Temperature Fluids.
Final rept.
S. E. Stein, D. A. Robaugh, A. D. Alfieri, and R. E. Miller. 1982, 4p
Pub. in Jnl. of the American Chemical Society 104, n24 p6567-6570 1982.

Keywords: *Reaction kinetics, *High temperature tests, *Fluids, Vapor phases, Liquid phases, Solutions, Chemical bonds, Chemical reactions, Reprints, *Ethane/diphenyl, *Free radicals, *Homolysis, *Cage effect(Chemistry).

Rate constants for the homolysis of 1,2-diphenylethane have been determined in tetralin, in dodecahydrotriphenylene and in the gas phase at temperatures above 350C. The arrhenius expression for this reaction in the gas phase has been found consistent with available thermo-kinetic data. In liquid tetralin up to its critical temperature and in liquid dodecahydrotriphenylene Arrhenius parameters for this reaction were found to be distinctly higher than gas phase values and rate constants to be somewhat lower. Differences between gas and liquid phase kinetics are attributed to recombination of nascent free radicals in solution (the 'cage effect'), the probability of which decreases with decreasing viscosity.

705,264
PB85-205706 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dielectric Saturation and Dielectric Friction in Electrolyte Solutions.
Final rept.
P. J. Stiles, J. B. Hubbard, and R. F. Kayser. 1982, 8p
Pub. in Jnl. of Chemical Physics 77, n12 p6189-6196 1982.

Keywords: *Dielectric properties, *Ion currents, *Electrolytes, Solutions, Electrohydrodynamics, Comparison, Experimental design, Reprints, Numerical solution.

Electrohydrodynamic equations developed by Hubbard and Kayser to account for the combined effects of dielectric saturation and dielectric friction on ionic motion in polar solvents are solved numerically to yield ionic conductances. Dielectric saturation is incorporated into this continuum treatment through a phenomenological relationship between the electric permittivity and field strength. The results of the analysis are critically tested by comparison with experimental conductance data.

705,265
PB85-205722 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Intensity Dependence of Multiphoton Excitation vs. Collisional Relaxation in Chlorodifluoromethane and Chlorotrifluoroethylene.
Final rept.
J. C. Stephenson, J. A. Blazy, C. Li, and D. S. King. 1982, 6p
Pub. in Jnl. of Chemical Physics 76, n12 p5989-5994 1982.

Keywords: *Molecular relaxation, Excitation, Reprints, *Methane/chloro-difluoro, *Ethylene/chloro-trifluoro, *Laser induced fluorescence, *Multiphoton processes, *Molecular photon interactions.

CO2 laser pulses for which the intensity vs. time profile is rectangular (10 or 50 ns duration) were used in the multiphoton excitation of CF2HCl and CF2 CFCl dilute in high pressure (400 Torr) argon. Energy deposition was measured by optoacoustic detection, and CF2 product yield by laser-excited fluorescence. Even at low yield (e.g. .001) more than 100 photons were absorbed per CF2CFCl molecule, while for an identical yield, CF2HCl absorbed 200 times less energy. For the same laser fluorescence, the higher intensity 10 microseconds pulses gave more yield from CF2CFCl (factors up to 500 were observed) than the less intense 50 microseconds pulses: for CF2HCl the two intensities give the same yield. For both molecules, the two intensities gave the same optoacoustic signal for a given fluorescence. These results are related to the dependence on reactant energy of the competing ratio of collisional deactivation to laser excitation.

705,266
PB85-205730 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photon Stimulated Desorption of Ions from Water and Methanol Adsorbed on a Titanium(0001) Surface.
Final rept.
R. Stockbauer, D. M. Hanson, S. A. Flodstrom, E. Bertel, and T. E. Madey. 1983, 3p
Pub. in Physica Scripta 4, p126-128 1983.

Keywords: *Desorption, *Ions, Simulation, Water, Carbinols, Titanium, Surface chemistry, Reprints.

Synchrotron radiation has been used to study ion desorption from water and methanol adsorbed on a Ti(0001) surface, in an effort to understand ion desorption from covalently bonded systems. Both water and methanol dissociate upon adsorption on Ti at 300K. Using variable wavelength UPS, the species OH, O and H are observed for water and CH3O, C, O and H for methanol. No molecular species adsorb at 300K. At 90K, dissociation occurs initially to yield the same products, while at higher exposures, condensed overlayers are formed. PSD of ions from the two adsorbates show very different behavior. In the water experiment ion desorption is dominated by the dissociated species at both 300 and 90K. H(+) emission from dissociated water is correlated with the presence of OH on the surface while ion desorption from the ice multilayer is almost an order of magnitude less. In contrast, ion emission from the dissociated methanol is immeasurably low in our instrument while a large H(+) signal is observed from the condensed layer.

705,267
PB85-205771 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Surface Raman Scattering from Effervescent Magnetic Peroxyborates.
Final rept.
G. E. Walrafen, P. N. Krishnan, D. L. Griscom, R. G. Munro, and M. Hokmabadi. 1982, 7p
See also AD-A116899.
Pub. in Jnl. of Chemical Physics 77, n8 p3840-3846 1982.

Keywords: *Raman spectra, *Reaction kinetics, *Catalysis, *Oxygen, Surface chemistry, Concentration(Composition), Reprints, *Trapped particles, *Boric acid/peroxy-(sodium-salt).

Raman spectra were obtained from NaBo3(4H2O) and NaBO3(H2O), from electron bombarded peroxyborateds from peroxyborated heated for various times and at temperatures from 110-180C and from solid Na2O2 and BaO2. The Raman spectra indicate that the breakdown of peroxy groups is accompanied by the formation of trapped molecular O2. Quantitative Raman intensity data were also obtained as functions of heating time at 110C for the 1556/cm lines whose intensities scale with the peroxy concentration. These intensity data were treated by logistics theory, and they were found to be consistent with a second-order auto-catalyzed forward reaction dependent on the product of the peroxy and trapped O2 concentrations, plus a first-order reverse reaction dependent upon the trapped O2 concentration.

705,268
PB85-205789 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interpretation of Quasi-Elastic Light Scattering Data for Flexible Chains: Model Dependence.
Final rept.
P. H. Verdier, and D. E. Kranbuehl. 1983, 4p
Pub. in Polymer 24, n4 p383-386 1983.

Keywords: *Light scattering, *Mathematical models, *Elastic scattering, *Polymers, Dynamics, Molecular structure, Polarizability(Charge separation), Reprints, Polymer chains.

The autocorrelation functions and corresponding relaxation times obtained from the forward depolarized quasi-elastic light scattering experiment are exhibited for two quite similar models of flexible polymer chains in solution. A very small change in the chain dynamics is found to be sufficient to change the relaxation time from a relatively short time independent of chain length, with an autocorrelation function suggestive of an unweighted sum of contributions from all the relaxation times in the spectrum of chain motion, to a long time with an autocorrelation function identical with those for the end-to-end vector, strongly dependent upon chain length and dominated by the longest relaxation time in the spectrum. These results raise the question whether widely-used models in which information about short-range chain structure and motion is deliberately omitted can be expected to be appropriate for the interpretation of depolarized scattering experiments.

705,269
PB85-205821 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
d-Band Bonding Theory of the Relative Heats of Solution of Transition Metal Alloys and Its Relation to Solubility Limits.
Final rept.
R. E. Watson, L. H. Bennett, and D. A. Goodman. 1983, 7p
Pub. in Acta Metallurgica 31, n8 p1285-1291 1983.

Keywords: *Transition metals, *Solubility, *Alloys, Heat of formation, Chemical bonds, Reprints.

The relative solubilities of one transition metal in another, and vice-versa, are derived within a Friedel d-band bonding model. The results are found to be in accord with experiment.

705,270
PB85-205839 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Regime III Crystallization in Melt-Crystallized Polymers: The Variable Cluster Model of Chain Folding.
Final rept.
J. D. Hoffman. 1983, 24p
Pub. in Polymer 24, n1 p3-26 1983.

Keywords: *Crystal growth, *Nucleation, *Reaction kinetics, Crystallization, Polyethylene, Acetal resins, Reprints, *Polymer chains, *Variable cluster model, Poly(methylene/oxy), Polycrystalline compounds.

The kinetic nucleation theory of chain folding, including the effects of reptation, is extended to predict the increase in crystal growth rate G that is implied by measurements on PE and POM at moderately large undercoolings. Growth rate data on PE and POM crystallized from the melt suggest conformity with the theoretical predictions. The implications of Regime III crystallization to chain morphology are discussed.

705,271
PB85-205847 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Recent Developments in the Theory of Electron Scattering by Highly Polar Molecules.
Final rept.
D. W. Norcross, and L. A. Collins. 1982, 57p
Pub. in Advances in Atomic and Molecular Physics 18, p341-397 1982.

Keywords: *Electron scattering, Polarity, Reprints, *Electron molecule interactions.

Theoretical and computational techniques for electron-collisions with polar molecules are reviewed. Particular problems addressed are the availability of simple perturbative approaches and the use of the fixed-nuclei approximation.

705,272
PB85-205870 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Ab Initio Calculation of Spectroscopic Properties of SiO and HOSi+.
Final rept.
P. Botschwina, and P. Rosmus. 1 Feb 85, 7p
Sponsored by Deutsche Forschungsgemeinschaft, Bonn-Bad Godesberg (Germany, F.R.).
Pub. in Jnl. of Chemical Physics 82, n3 p1420-1426 Feb 85.

Keywords: *Spectroscopic analysis, *Silicon monoxide, *Silicon oxides, Dipole moments, Vibrational spectra, Rotational spectra, Reprints, *Proton affinity.

Spectroscopic properties of SiO and HOSi(+1) have been calculated from highly correlated wave functions. While the dipole moment of HOSi(+1) is very small (which will make detection of pure rotational transitions of this ion a difficult task), large intensities are predicted for stretching vibrational transitions both in absorption and emission. The proton affinity of silicon monoxide is calculated to be 8.44 eV.

705,273
PB85-205888 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ab Initio Effective Spin-Orbit Operators for Use in Atomic and Molecular Structure Calculations. Results for Methylidyne, Hydroxyl Radicals, Silylidyne, Carbon Monoxide(+1) Ion, Carbon Monoxide and Silicon Monoxide.
Final rept.
W. J. Stevens, and M. Krauss. 1982, 3p
Pub. in Jnl. of Chemical Physics 76, n7 p3834-3836 1982.

Keywords: *Atomic structure, *Molecular structure, *Spin orbit interactions, Carbon monoxide, Ions, Comparison, Reprints, *Ab initio analysis, Silicon monoxide, Silylidyne, Methylidyne, Hydroxyl radicals.

Ab initio effective spin-orbit operators, based on relativistic effective core potentials are used to determine the spin-orbit coupling constants for CH(X(sup 2) pi(sub r)), OH(X(sup 2) pi(sub i)), SiH(X(sup 2) pi(sub r)), CO(+1)6(A(sup 2)) pi(sub i)), CO(A(sup 3) pi(sub r)), and SiO(A(sup 3) pi(sub r)). Comparison with experimental values and ab initio all electron values are very favorable.

705,274
PB85-205896 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamic Properties of Isobutane for Temperatures from 250 to 600 K and Pressures from 0.1 to 40 MPa.
Final rept.
M. Waxman, and J. S. Gallagher. 1983, 18p
Pub. in Jnl. of Chemical and Engineering Data 28, n2 p224-241 1983.

Keywords: *Thermodynamic properties, Tables(Data), Pressure, Density(Mass/volume), Surfaces, Temperature, Reprints, *Virial coefficients, *Propane/methyl.

Tables of isobutane thermodynamic properties are presented for temperatures from 245 to 600 K and pressures from 0.1 to 40 MPa. The tables include saturation and isobaric properties; namely, pressure, specific volume, temperature, internal energy, enthalpy and entropy. The properties are defined by a specific thermodynamic surface, which is expressed analytically in the form of the Helmholtz energy as a function of temperature and density. The surface is developed from only pressure-density-temperature data. The appendix to the paper includes a summary of the correlation development and of new isobutane measurements, saturated vapor pressures and isothermal pressure-density-temperature data for temperatures of 377.59, 394.26, 423.15 and 448.15 K. The isothermal data are reported in the form of a virial series representation of the compressibility factor for pressures up to about 3.5 MPa and as correlated Burnett points for the higher pressures at 423.15 K. The data were used to assess the reliability of literature sources used in the correlation. Surface derived properties are compared with experimental data.

705,275
PB85-205938 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Spectroscopy and Chemiluminescence from the Monomethoxides of Calcium, Strontium, and Barium.
Final rept.
R. F. Wormsbecher, and R. D. Suenram. 1982, 14p
Pub. in Jnl. of Molecular Spectroscopy 95, n2 p391-404 1982.

Keywords: *Chemiluminescence, *Vibrational spectra, Chemical bonds, Molecular structure, Reprints, *Laser spectroscopy, *Calcium methoxides, *Strontium methoxides, *Barium methoxides.

Production of the monomethoxides of Ca, Sr, and Ba (MOCH3) is described. The production scheme uses a metal vapor flow reactor in which the appropriate metal vapor is mixed with methylnitrite (CH3ONO) to produce the metal methoxides. Chemiluminescence spectra from these reactions is recorded, and features due the metal oxides, and mono-methoxide are observed. Dynamical aspects of these reactions are discussed. Laser excitation spectra are obtained for CaOCH3, CaOCD3, SrOCH3, SrOCD3, using a pulsed dye laser. Vibrational features are observed and assigned for all of the molecules. A summary of frequencies is given. The nature of the bonding and structural considerations of the monomethoxides are described in terms of a localized ionic bonding model which was used previously on the isoelectronic monohydroxides and monohalides of the alkaline-earths.

705,276
PB85-205979 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Center for Materials Science.
JCPDS (Joint Committee on Powder Diffraction Standards) Data Base--Present and Future.
Final rept.
W. Wong-ng, M. Holomany, W. F. McClune, and C. R. Hubbard. 1982, 2p
Sponsored by Denver Research Inst., CO.
Pub. in Advances in X-Ray Analysis 26, p87-88 1982.

Keywords: *X ray diffraction, *Powders, Reprints, Data bases, X ray powder diffraction, NBS-AIDS80 computer program.

The Powder Diffraction File is a large numerical data base consisting of nearly 40,000 x-ray powder diffraction patterns. This data base is being converted from the storage on Gothic cards to a magnetic form in order to simplify operations and to enhance product generation. The computer program NBS-AIDS80, which is being used to prepare the data base, also provides extensive, systematic methods of evaluating powder patterns.

705,277
PB85-205995 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
SANS (Small Angle Neutron Scattering) Investigation into the Role of Melting and Recrystallization during Solid State Deformation of Polyethylene.
Final rept.
G. D. Wignall, and W. Wu. 1983, 6p
Pub. in Polym. Communic. 24, n12 p354-359 1983.

Keywords: *Polyethylene, *Plastic deformation, *Neutron scattering, *Melting, *Crystallization, Molecular weights, Blends, Deuterium compounds, Reprints, *Small angle scattering, *Molecular conformation, *Solid state chemistry.

Small angle neutron scattering (SANS) has been used to investigate the role of melting and recrystallization in the solid state deformation of polyethylene. Blends containing 4.3 vol % deuteropolyethylene (PED) in normal polyethylene (FEH) have been prepared with non-random distribution of PED molecules in PEH. These blends show anomalously high apparent SANS molecular weights (M(sub w)) and radii of gyration, resulting from the correlations in the centers of gravity (clusters) of the PED molecules. A dramatic reduction in the SANS (M(sub w)) was observed in the specimens subject to plastic deformation in a temperature range (50-119C) where annealing alone is known not to affect (M(sub w)). A similar reduction in the apparent SANS-(M(sub w)) may be achieved by melting and rapidly quenching the blend. This implies that large scale reorganization takes place at the molecular level during deformation, with a consequent relative motion and randomization of the centers of gravity of the PED molecules. The implications of these findings are discussed in terms of the mechanisms involved in the plastic deformation process.

705,278
PB85-206001 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Model for the Saturated Water Bilayer on Ru(001) Based on a Comparison of Experimental and Calculated LEED Patterns.
Final rept.
E. D. Williams, and D. L. Doering. 1983, 5p
Pub. in Jnl. of Vacuum Science and Technology A 2, n2 p1188-1192 1983.

Keywords: *Mathematical models, *Water, *Adsorption, *Surface chemistry, *Molecular structure, Electrolytes, Electrochemistry, Comparison, Experimental design, Ruthenium, Electron diffraction analysis, Chemical bonds, Reprints, *LEED(Low energy electron diffraction), Electron stimulated desorption ion angular distributions, Numerical solution, Thermal desorption.

A complex coverage- and temperature-dependent LEED pattern was observed for water adsorbed on clean Ru(001). This pattern has been modeled in terms of an antiphase structure of two-dimensional, hydrogen-bonded, bilayer domains. A computer simulation of the LEED patterns arising from this model structure gives good agreement with the experimental results. Other considerations in the model determination were based on simple water bilayer island models which were developed to explain experimental thermal desorption and electron stimulated desorption ion angular distribution data. This new insight into the molecular structure of adsorbed water on Ru may lead to a better understanding of the metal-electrolyte interface in electrochemistry.

705,279
PB85-206456
(Order as PB85-206324, PC **A13**/MF **A01**)
Northwestern Univ., Evanston, IL.
Review of the Optical Data Analysis for Phthalocyanine Conducting Polymer and Molecular-Metal Systems.
W. J. McCarthy, C. R. Kannewurf, T. Inabe, T. J. Marks, and R. L. Burton. Apr 85, 4p
Prepared in cooperation with IIT Research Inst., Chicago, IL.
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p54-57 Apr 85.

Keywords: *Phthalocyanines, *Metal containing organic compounds, *Optical tests, Reviews, Additives, Optical properties, Polycrystals, Dielectric properties, *Polyphthalocyanines, Doped materials.

During the past decade a number of interesting low-dimensional materials have been prepared which have been found to exhibit a combination of unusual properties that are not generally observed in the conventional inorganic semiconductor and metallic systems. Optical diagnostics have provided a key method for obtaining important information about both molecular-metal and conducting polymer systems. For many of these systems the optical measurements and the methods of analysis have been carried out by D.B. Tanner, C.S. Jacobsen and their respective co-workers. At this laboratory the principal effort in this area has been devoted to the development of phthalocyanine based systems with various doping agents. It has been found that the phthalocyanine polymers possess a rather unique blend of properties that show considerable promise for applications. Optical reflectance studies have also provided valuable information about the phthalocyanine systems, but for many compounds single crystal samples have not been successfully prepared as yet. Thus the majority of the optical measurements have been performed on polycrystalline pressed powder compactions. Such specimens also have been used to provide information in other systems that could not be obtained from single crystal data alone.

705,280
PB85-206464
(Order as PB85-206324, PC **A13**/MF **A01**)
Oak Ridge National Lab., TN.

Optical Properties of PBS (Poly(butene-1-sulfone)).
M. W. Williams, D. W. Young, J. C. Ashley, and E. T. Arakawa. Apr 85, 2p
Contract DE-AC05-84OR21400
Sponsored by Rome Air Development Center, Griffiss AFB, NY.
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p58-59 Apr 85.

Keywords: *Optical properties, Photons, Electron energy, Lithography, Microstructure, *Polybutene sulfone.

PBS, or poly(butene-1-sulfone) with a formula of (C4H8SO2)n, is a fast electron-resist used in microlithography. To understand, and to be able to predict, the resolution attainable with this system, it is necessary to know the optical properties of the resist material over the range of photon energies associated with the oscillator strength of the valence electrons. Electron mean free paths in the material can be calculated from these data as a function of incident electron energy. Energy deposition and details of track structure can then be calculated for incident electron beams. Predictions of the sharpness and resolution in the resulting microstructures can be compared with those obtained experimentally.

705,281
PB85-206498 (Order as PB85-206324, PC **A13**/MF **A01**)
Illinois Univ. at Urbana-Champaign.
Quantitative Sampling in Planar Waveguides.
P. W. Bohn. Apr 85, 3p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p71-73 Apr 85.

Keywords: *Spectroscopic analysis, *Thin films, *Mathematical models, *Polymeric films, Raman spectra, Elastic scattering.

A simple model for quantitative spectroscopic sampling in thin films has been advanced and compared with experiment for the simple case of spatially homogeneous scatterers. Agreement with theoretical scattering intensities demands a treatment which takes into account both surface and volume elastic scattering and mode dependent coupling efficiency effects.

705,282
PB85-206696 (Order as PB85-206324, PC **A13**/MF **A01**)
Hughes Aircraft Co., Long Beach, CA.
Importance of Electron-Electron Correlation in the Calculation of Second-Order Nonlinear Optical Properties of Organic Molecules. The Case of Urea.
B. M. Pierce. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p150-153 Apr 85.

Keywords: *Molecular structure, *Optical properties, *Organic compounds, Excitation, Molecular energy levels, *Electron electron interactions, *Nonlinear optics, *Self constant field molecular orbitals, *SCF MO methods, *Single excitation configuration interactions.

In studies of nonlinear optical organic molecules, the theoretical understanding of the relation between the electronic structure of the molecule and the molecular electronic component of the second-order nonlinear optical susceptibility (the hyperpolarizability tensor, beta(i)(j)(k)) has been an important objective (1). The theoretical description of molecular electronic structure improves with the theoretical treatment of electron-electron correlation (EEC) in the molecule. Three general quantum mechanical molecular orbital (MO) formalisms (2) used to study molecular electronic structure, and ordered according to an improving treatment of EEC, are (1) the self-consistent-field (SCF)-MO method, (2) the SCF-MO method with single excitation configuration interaction (SCF-MO-SCI), and (3) the SCF-MO method with single and double excitation configuration interaction (SCF-MO-SDCI). The organic molecule selected for the authors initial theoretical study was urea, (NH2)2C = 0, because its nonlinear optical response has been the subject of extensive theoretical and experimental investigations.

705,283
PB85-207124 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Precision X-ray Wavelength Measurements in Helium-Like Argon Recoil Ions.
Final rept.
R. D. Deslattes, H. F. Beyer, and F. Folkmann. 1984, 6p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 17, pL689-L694 1984.

Keywords: *X ray analysis, *Ions, *Radioactive decay, Argon, Calibrating, Performance evaluation, Quantum electrodynamics, Wavelengths, Reprints, *Argon ions, *Ion ion collision.

The authors report precise wavelength measurements of the 1 double s S(sub 0)-1s2p(sup 3) P-(sub 12), transitions in Ar(+16) produced by collisions of 5.9 MeV/amu U(+66) ions with an argon gas target. By use of this 'recoil source', the precision is not limited by Doppler shifts while the influence of spectator electrons is minimized by observation of their relative importance as a function of gas pressure. The accuracy obtained is at the 12 ppm level dominated by the x-ray calibration standard. The measurement is thus sensitive to quantum-electro-dynamic (QED) and electron correlation effects.

705,284
PB85-207199 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fluorescence Quenching of Liquid Alkylbenzenes Excited By Nonionizing and Ionizing Ultraviolet Radiation and By Beta-Radiation.
Final rept.
F. P. Schwarz, and M. Mautner. 1983, 8p
Pub. in Jnl. of Physical Chemistry 87, n25 p5206-5213 1983.

Keywords: *Benzenes, *Ultraviolet radiation, *Beta particles, *Photoionization, Fluorescence, Excitation, Xylenes, Molecular energy levels, Cations, Reprints, *Fluorescent quench principle, Benzene, Benzene/propyl, Mesitylene, Indan, Decylbenzene, Ion electron collisions, Ion ion collisions.

At wavelengths above the photoionization wavelength, the CCl3H quenching of the benzene, toluene, o-xylene, p-xylene, mesitylene, propylbenzene, isopropylbenzene, indane, and decylbenzene fluorescences results from quenching of the S1 state with quenching constants ranging from 0.6 plus or minus 0.1 M(-1) for benzene to 19 plus or minus 1 M(-1) for p-xylene. At wavelengths below the photoionization wavelength, the S1 fluorescence is generated from recombination of the aromatic cation-electron ion-pairs and the fluorescence yield increases to an average of 0.8 plus or minus 0.1 near 1450 A for the alkylbenzene derivatives. The CCl3H quenching of the recombination fluorescence results from quenching of the ion-pairs and the quenching constants increase from 0 near the estimated photoionization wavelength to a near constant value ranging from 3.0 plus or minus 0.2/M (mesitylene) to 1.7 plus or minus 0.2/M (indane) below 1450 A.

705,285
PB85-207207 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dioxin Formation in Incinerators.
Final rept.
W. M. Shaub, and W. Tsang. 1983, 10p
Pub. in Environmental Science and Technology 17, n12 p721-730 1983.

Keywords: *Mathematical models, *Air pollution, *Incinerators, Combustion products, Forecasting, Sources, Reprints, *Dioxin(Herbicides), *Polychlorinated dibenzodioxins, *Chemical reaction mechanisms, Numerical solution, Polychlorinated biphenyls, Homogeneous reactions.

Processes which may contribute to the formation of polychlorinated dibenzo-p-dioxins (PCDDs) are examined. A model mechanism has been constructed to investigate the possibility for homogeneous gas phase formation of PCDDs from polychlorinated phenols in an incinerator environment. Numerical calculations have been performed. The results lead to the conclusion that the probability for gas phase formation of PCDDs is likely to be very low at high temperatures if mixing between fuel and air is efficient. Effects of use of auxiliary hydrocarbon fuel and excess air are examined. Probable sources of non-idealities are examined. The potential role of non-gas phase effects is considered. Conclusions are drawn regarding some future research needs.

705,286
PB85-207272 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Measurement of Relative Extreme-Wing Absorption Coefficients By Excited-State Degenerate Four-Wave Mixing.
Final rept.
P. Ewart, and S. V. O'Leary. Nov 84, 8p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 17, n22 p4609-4616 1984.

Keywords: Helium, Neon, Argon, Excitation, Reprints, *Absorption coefficients, *Sodium atoms, *Degenerate four wave mixing.

The population of the 3P state in atomic sodium produced by absorption in the extreme blue wing of the D lines is measured by excited state degenerate four-wave mixing (ESDFWM). The strength of the ESDFWM signal is shown to give a measure of the pressure-broadened extreme-wing absorption coefficient alpha(omega). Relative values of alpha(omega) for the rare gases He, Ne and Ar are measured and compared with values calculated from theoretical interatomic potentials and from extreme-wing emission data. Very good agreement is found demonstrating the ability of the nonlinear technique to make accurate measurements of small excited-state densities with excellent spatial and temporal resolution. Advantages of the method for other applications are briefly discussed.

705,287
PB85-207280 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Absorption and Saturation Effects on Degenerate Four-Wave Mixing in Excited States Formed during Collisions.
Final rept.
P. Ewart, and S. V. O'Leary. Nov 84, 14p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 17, n22 p4595-4608 1984.

Keywords: Helium, Neon, Argon, Excitation, Reprints, *Degenerate four wave mixing, Sodium atoms, Laser radiation.

Degenerate four-wave mixing (DFWM) in excited atoms is investigated as a probe of the excited state density produced by collision assisted transitions. Sodium atoms are excited to the 3P state by absorption of light in the extreme blue wing of the D lines in the presence of He, Ne and Ar perturbers. The rare gas-pressure dependence of the DFWM signals, resonantly enhanced by the 3P-4D transition, is studied to determine the regime where the signals give an unambiguous measure of the excited state (3P) density. The observed behavior is compared with a simple model of DFWM in absorbing media. Good qualitative agreement is obtained and the results illustrate the role of absorption, saturation and finite laser bandwidth. The technique allows small excited state densities (about 10 to the 9th power/cc) to be detected with good temporal and spatial resolution.

705,288
PB85-207298 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron-Ion Ionization.
Final rept.
G. H. Dunn. 1985, 43p
Pub. in Electron Impact Ionization, Chapter 8, p277-319 1985.

Keywords: *Ionization, *Reaction kinetics, *Cross sections, Ions, Reviews, Excitation, Experimental design, Reprints, *Chemical reaction mechanisms, *Electron-ion collisions, *Electron impact spectra, Autoionization.

Methods are presented for measurement of rates and cross sections for electron-impact ionization of ions. Status of the data is reviewed. Specific data are discussed and compared with various theoretical estimates. The ionization mechanisms of direct ionization, excitation-autoionization, and resonant excitation-double autoionization are demonstrated with specific examples from the measured data.

705,289
PB85-207322 Not available NTIS

National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Study of Polycation-Anionic-Surfactant Systems.
Final rept.
P. S. Leung, and E. D. Goddard. 1985, 16p
Pub. in Colloids and Surfaces 13, p47-62 1985.

Keywords: *Polyelectrolytes, *Cations, *Anions, *Surfactants, *Neutron scattering, Copolymers, Molecular structure, Viscosity, Vinyl copolymers, Stability, Reprints, *Sulfuric acid/dodecyl-(sodium-salt), *Small angle scattering, *Molecule molecule interactions, *Ion molecule interactions, Polymer chains, Cellulose ether.

An investigation of the interaction of sodium dodecyl sulfate (SDS) with two cationic polyelectrolytes, Polymer JR, a cationic cellulose ether, and Reten, a synthetic vinyl copolymer, is reported. The study emphasizes small angle neutron scattering but also includes viscosity and dye-solubilization measurements. The results indicate that small additions of SDS to Polymer JR of 1% concentration lead to intermolecular interactions between the polymer chains via the bound surfactant, whereas in the more flexible and globular vinyl polyelectrolyte, intramolecular interaction is favored. Just into the resolubilization zone, where excess anionic surfactant is present (approximately 1.5% SDS), Polymer JR favors a polymer micellar association, whereas the more flexible Reten polymer seems to stabilize a structure involving association of surfactant into smaller units, perhaps surfactant pairs. In both cases the characteristic interaction peak of SDS micelles is absent in the SANS profile. When the surfactant is in large excess (5%) this peak returns, i.e., micellar structures predominate in both systems, probably with the macromolecule woven into the micellar domains, resembling an entangled string of beads.

705,290
PB85-208056 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Viscoelastic Relaxation of Cross-Linked Polymer Networks.
Final rept.
R. J. Gaylord, and E. A. DiMarzio. 1984, 4p
Pub. in Polymer Bulletin 12, p29-32 1984.

Keywords: *Elastomers, *Crosslinking, *Viscoelasticity, *Molecular relaxation, Entropy, Stress relaxation tests, Reprints, *Polymer chains.

Theoretical interpretations of the viscoelastic relaxation behavior of cross-linked elastomers are discussed. The dangling chain retracing mechanisms of de Gennes and Pearson-Helfand, which assume that the stress contribution of a dangling chain decreases as it assumes successively lower entropy configurations, are replaced by an alternative relaxation mechanism, based on the hopping model of hindered diffusion.

705,291
PB85-208072 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Monte Carlo Studies of Two Measures of Polymer Chain Size as a Function of Temperature.
Final rept.
C. M. Guttman. Sep 84, 17p
Pub. in Jnl. of Statistical Physics 36, n5/6 p717-733 Sep 84.

Keywords: *Monte Carlo method, *Temperature, Radius of gyration, Reprints, *Polymer chains.

Monte Carlo simulations of single polymer chains with both excluded volume and nearest-neighbor interaction energies are discussed. Two measures of chain size are obtained in the simulation, the radius of gyration of the polymer chain and the inverse radius of the polymer chain. Both of these are reported as a function of temperature, or interaction energy, and chain length, N. The possibility of estimating the fractal dimensions of these measures from the Monte Carlo data is discussed in the context of two different interpolation functions for the temperature dependence of the fractal dimensions. The approach to the fractal dimension as a function of chain length, N, is studied. It is suggested that the approach to fractal dimension of the measures of chain size of polymers is slow, perhaps a fractional power itself.

705,292
PB85-219830 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 13, Number 4, 1984.
Quarterly rept.
c1984, 460p
See also PB85-219848 through PB85-219913 and PB85-137842. Sponsored by National Bureau of Standards, Washington, DC. Prepared in cooperation with American Inst. of Physics, New York.
Available from American Chemical Society, 1155 Sixteenth St., N.W., Washington, DC 20036.

Keywords: *Research projects, Assessments, Alkanes, Thermodynamic properties, Physical properties, Chemical properties, Molecular energy levels, Molecular vibration, Polymers, Electrical resistivity, Hafnium, Molybdenum, Tantalum, Tungsten, Elements, Reviews, Vanadium, Zirconium, Aluminum, Manganese, Zinc, Standards, Reaction kinetics, Copper, Specific heat, Photochemical reactions, *Reference materials, Matrix isolation technique, Atmospheric chemistry, Electron ion interactions.

Contents:
- Ground-state vibrational energy levels of polyatomic transient molecules;
- Electrical resistivity of selected elements;
- Electrical resistivity of vanadium and zirconium;
- Electrical resistivity of aluminum and manganese;
- Standard chemical thermodynamic properties of alkane isomer groups;
- Evaluated theoretical cross-section data for charge exchange of multiply charged ions with atoms. III. Nonhydrogenic target atoms;
- Heat capacity of reference materials: Cu and W;
- Evaluated kinetic and photochemical data for atmospheric chemistry:
- Supplement II. CODATA task group on gas phase chemical kinetics.

705,293
PB85-219848 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Ground-State Vibrational Energy Levels of Polyatomic Transient Molecules.
M. E. Jacox. c1984, 125p
Included in Jnl. of Physical and Chemical Reference Data, v13 n4 p945-1068 1984. Available from American Chemical Society, 1155 Sixteenth St., N.W., Washington, DC 20036.

Keywords: *Molecular energy levels, *Molecular vibration, *Polyatomic molecules, *Spectroscopic analysis, Tables(Data), Thermodynamic properties, Hydrides, Experimental design, Reaction kinetics, Van der Waals equations, Nitrogen, Argon, Neon, Chemical bonds, Photochemistry, Hydrocarbons, Temperature, Ultraviolet spectroscopy, Infrared spectroscopy, *Laser spectroscopy, Matrix isolation techniques.

The experimentally determined ground-state vibrational energy levels of approximately 480 covalently bonded transient molecules possessing from 3 to 16 atoms are tabulated, together with references to the pertinent literature. The types of measurement surveyed include laser-based high resolution gas phase infrared absorption and visible-ultraviolet emission techniques, ultraviolet photoelectron spectroscopy, and matrix isolation spectroscopy. An assessment of the magnitude of the uncertainty of observations in neon, argon, and nitrogen matrices is given.

705,294
PB85-219889 Not available NTIS
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
Standard Chemical Thermodynamic Properties of Alkane Isomer Groups.
R. A. Alberty, and C. A. Gehrig. c1984, 25p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v13 n4 p1173-1197 1984. Available from American Chemical Society, 1155 Sixteenth St., N.W., Washington, DC 20036.

Keywords: *Alkanes, *Thermodynamic properties, *Standards, *Molecular isomerism, *Hydrocarbons, Stereochemistry, Chemical equilibrium, Fuels, Tables(Data), Temperature, Enthalpy, Entropy, Specific heat, Gibbs free energy, *Stereoisomers, *Benson method, Numerical solution.

The chemical thermodynamic properties of alkane isomer groups from C4H10 to C10H22 have been calculated from 200 to 1500 K from Scott's tables of 1974. The numbers of stereoisomers in each isomer group have been checked and all of them have been included in the calculations. The following properties for alkane isomer groups have been calculated with energy in joules for a standard state pressure of 1 bar; standard heat capacity at constant pressure, standard entropy, standard enthalpy of formation, standard Gibbs energy of formation, standard enthalpy relative to isomer group at 298.15 K, and standard enthalpy relative to the elements at 298.15 K. Equilibrium mole fractions within isomer groups have been calculated for the ideal gas state from 200 to 1500 K. The four basic properties are given for all the individual isomers in joules for a standard state pressure of 1 bar. The properties of individual alkanes from C4H10 to C10H22 have also been calculated using the Benson group method and the resulting isomer group properties and equilibrium mole fractions have been calculated.

705,295
PB85-219897 Not available NTIS
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Evaluated Theoretical Cross-Section Data for Charge Exchange of Multiply Charged Ions with Atoms. 3. Nonhydrogenic Target Atoms.
R. K. Janev, and J. W. Gallagher. c1984, 49p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v13 n4 p1199-1249 1984. Available from American Chemical Society, 1155 Sixteenth St., N.W., Washington, DC 20036.

Keywords: *Electron capture, *Electron transfer, Ion exchanging, Atomic energy levels, Assessments, Mathematical models, Collisional energy transfer, Experimental design, Graphs(Charts), Atoms, Ions, Tables(Data), *Atom ion interactions, *Ion ion interactions, *Charge exchange reactions, *Charge transfer cross sections, Numerical solution, Ion-atom collisions.

The theoretical cross-section data for single-electron capture in collisions of multiply charged ions with nonhydrogenic atoms are compiled and their accuracy is assessed. The energy per unit mass range considered is from about 1 eV/u to several MeV/u, u being the unified atomic mass unit. Accuracy is assessed using both pure theoretical arguments and comparison with experimental data, where available. A similar assessment is performed for the two-electron capture cross-section data in ion-atom collisions, as well as for single-and double-charge exchange in ion-ion collisions.

705,296
PB85-219905 Not available NTIS
Commonwealth Scientific and Industrial Research Organization, Lindfield (Australia). Div. of Applied Physics.
Heat Capacity of Reference Materials: Cu and W.
G. K. White, and S. J. Collocott. c1984, 5p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v13 n4 p1251-1257 1984. Available from American Chemical Society, 1155 Sixteenth St., N.W., Washington, DC 20036.

Keywords: *Copper, *Specific heat, *Tungsten, Tables(Data), Purity, Pressure, Temperature, Thermodynamic properties, Measuring instruments, Metals, Interpolation, *Reference materials.

The CODATA Task Group on Thermophysical Properties is preparing a set of recommended values for the heat capacity, thermal expansion, and transport properties of key solids which are used in calibrating or checking measuring equipment. The present paper surveys selected data on heat capacity at constant pressure C(sub p) of copper from 1 to 1300 K and tungsten from 1 to 3400 K. Selected values are tabulated for C(sub p) and also for heat capacity at constant volume C(sub v). Interpolating functions are given for C(sub p).

705,297
PB85-221869 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Role of Melting-Recrystallization Mechanism in Deformation of Crystalline Polymers.
Final rept.
W. L. Wu, H. G. Zachmann, and C. Rickel. 1984, 3p
Pub. in Polym. Commun. 25, n3 p76-78 1984.

Keywords: *Synchrotron radiation, *Deformation methods, *Fibers, X ray stress analysis, Mechanical analysis, Melting, Recrystallization, Comparison, Reprints, *Small angle scattering, *Crystalline polymers.

Synchrotron radiation source at DESY, Hamburg, of West Germany, was used to carry out a small angle x-ray scattering (SAXS) study on the deformation mechanisms of oriented PET yarns. The stress-induced changes in the fiber morphology detected by SAXS can best be interpreted by a mechanical scheme instead of a melting-recrystallization mechanism.

705,298
PB85-221877 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Studies of Microstructure in Native Celluloses Using Solid-State 13C NMR.
Final rept.
D. L. Vanderhart, and R. H. Atalla. 1983, 9p
Sponsored by Technical Association of the Pulp and Paper Industry, Atlanta, GA.
Pub. in Proceedings of International Conference on Dissolving and Specialty Pulps, Boston, MA., April 5-8, 1983, p207-215.

Keywords: *Cellulose, *Microstructure, *Crystal structure, *Nuclear magnetic resonance, *Isotopic labeling, Polymorphy, Biochemistry.

High-resolution solid-state (13)C NMR spectra have been taken on several native cellulosic materials as well as on a regenerated, low DP cellulose I material. Resonance multiplicities are observed for several carbon positions in the anhydroglucose units. The narrow-line multiplets, which are assigned to chains in the interior of crystallites, show significant variations in relative multiplet intensities, implying that native celluloses exhibit heterogeneous crystal structures. On the basis of these spectra it is proposed that all native celluloses are a mixture of two crystalline modifications, cellulose I(sub alpha) and I(sub beta). All native celluloses examined represent mixtures of these two structures in various proportions. There is no indication in the samples that each elementary fibril must contain the mixture of the two forms typical of the bulk sample. Therefore, the possibility that native celluloses are biosynthetically-tailored composites certainly exists.

705,299
PB85-221893 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
PSD and ESD (Photon and Electron Stimulated Desorption) of Condensed Films: Relevance to the Mechanism of Ion Formation and Desorption.
Final rept.
R. Stockbauer, E. Bertel, and T. E. Madey. 1983, 2p
Pub. in Proceedings of International Workshop on Desorption Induced by Electronic Transitions (DIET I) (1st), Williamsburg, VA., May 12-14, 1982, p267-268 1983.

Keywords: *Thin films, *Water, *Methyl alcohol, *Cyclohexane, *Ionization, Desorption, Electron transitions, Chemical bonds, *Electron stimulated desorption, *Photon stimulated desorption, *Time of flight mass spectroscopy, Ion induced desorption.

Photon and electron stimulated desorption (PSD and ESD) have been used to study the electronic processes leading to ion formation in condensed films of water, methanol, and cyclohexane (C6H12). The dominant ions from condensed layers of water and methanol are H(+1). Higher mass ions were less than 1% at all thicknesses. In contrast, heavy fragments C2H(sub n) - C5H(sub n) were observed for films of C6H12 at doses above 10L. It is likely that heavy ions are effectively reneutralized in thin films of C6H12 or by a de-excitation mechanism provided by hydrogen-bonding in the thick water and methanol films.

705,300
PB85-221935 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Methanation Activity of W(110).
Final rept.
T. J. Udovic, R. D. Kelley, and T. E. Madey. 1985, 6p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Surface Science 150, pL71-L76 1985.

Keywords: *Surface chemistry, *Catalysis, *Activation energy, Partial pressures, Temperature, Hydrogenation, Tungsten carbides, Reprints, *Methanation, Auger electron spectroscopy.

The methanation activity of W(110) was measured over a range of reactant partial pressures and temperatures (P sub H2) = 1-1000 Torr, (P sub CO = 0.1-10 Torr, T = 475-820 K). Plotting the results in an Arrhenius fashion yielded a lower apparent activation energy (E sub a = 56 kj/mol) than previously determined for Ni(100) (E sub a) = 103 kj/mol) with an activity surpassing that of Ni at lower temperatures. The H2 pressure dependence of the methanation activity was found to be much stronger for W(110) than for Ni(100), the surface becoming increasingly inactive at the lowest H2 pressures investigated. Auger electron spectroscopy revealed the active catalytic surface to be carbidic in nature.

705,301
PB85-221943 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron-Electron Interaction in Doubly-Excited States of Atoms.
Final rept.
A. R. P. Rau. 1984, 7p
Pub. in Pramana 23, n3 p297-303 Sep 84.

Keywords: *Atomic energy levels, Excitation, Comparison, Quantum numbers, Ions, Angular momentum, Reprints, *Electron-electron collisions, *Isoelectronic sequence, *Hydrogen ions, Numerical analysis.

Doubly excited states of the isoelectronic sequence of H(-1), in which both electrons are in high principal quantum numbers, are examined on the basis of alternative pictures of the correlations between the two electrons. Restricting ourselves to the lowest singlet S states with both electrons in principal quantum number n, the author parameterized the electron-electron interaction on the basis of these pictures and compare the resulting simple expressions with more elaborate numerical calculations. This provides further understanding of the nature of correlations in such states.

705,302
PB85-221976 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Unusual C-O Bond Weakening on a Clean Metal Surface: CO on Cr(110).
Final rept.
N. D. Shinn, and T. E. Madey. 24 Dec 84, 4p
Sponsored by Department of Energy, Washington, DC., and National Research Council of Canada, Ottawa (Ontario).
Pub. in Physical Review Letters 53, n26 p2481-2484, 24 Dec 84.

Keywords: *Carbon monoxide, *Chemisorption, *Surface chemistry, *Chemical bonds, *Weak interactions, Chromium, Metals, Electron diffraction analysis, Spectroscopic analysis, Molecular structure, Reprints, *Molecular configuration, Electron energy loss spectroscopy, Auger electron spectroscopy, Electron stimulated desorption angular distributions, Low energy electron diffraction.

A unique CO chemisorption mode (alpha(sub 1)CO), with the lowest reported CO stretching frequencies (1150-1330/cm) on any clean or promoted metal surface, has been identified on Cr(110) using EELS, ESDIAD, LEED, AES, and oxygen coadsorption experiments. A 'lying down' binding configuration in two-fold symmetric hollow sites is proposed for (alpha(sub 1)CO) molecules.

705,303
PB85-221992 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Determination of Molecular Weight Distribution of Aromatic Components in Petroleum Products by Chemical Ionization Mass Spectrometry with Chlorobenzene as Reagent Gas.
Final rept.
L. W. Sieck. 1983, 4p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Analytical Chemistry 55, n1 p38-41 1983.

Keywords: *Molecular weight, *Aromatic compounds, *Petroleum products, Fuels, Mass spectroscopy, Benzenes, Naphthalenes, Reprints, *Chemical ionization mass spectroscopy, *Chemical reaction mechanisms, *Charge exchange reactions, Benzene/chloro.

A chemical ionization mass spectrometric technique for direct determination of the molecular weight distributions of the major aromatic components in liquid fuels and other petro-products is discussed. The basic mechanism involves selective charge exchange reactions between chlorobenzene cations and the substituted benzenes and naphthalenes present in the sample. Chlorobenzene also serves as the solvent for the fuel, and screening of successive samples can be carried out with a 3-min turn-around time. Depending upon conditions, the paraffinic components present in the fuel are absent in the resulting mass spectrum.

705,304
PB85-222032 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Laser Probing of Chemical Reaction Dynamics.
Final rept.
S. R. Leone. 22 Feb 85, 7p
Contracts NSF-PHY82-00805, DAAG29-82-K-0031
Sponsored by Air Force Office of Scientific Research, Arlington, VA.
Pub. in Science 227, p889-895, 22 Feb 85.

Keywords: *Molecular energy levels, *Chemical reactivity, *Dynamics, Molecular vibration, Molecular rotation, Excitation, Electron transitions, Reprints, *Laser enhanced reactions, *Laser induced excitation, *Laser microprobe analysis.

Lasers are used in increasingly sophisticated ways to carry out reactions between molecules in selected vibrational, rotational, and electronic states and to probe the product states of chemical reactions. Such investigations are providing unprecendented insights into chemical reaction dynamics, which is the study of the detailed motions that molecules undergo in simple chemical reactions. In many cases it is possible to describe the influence that specific types of molecular excitation have on reactive events. Experiments are also being carried out to learn about chemical reactivity as a function of the alignment of reagents. There is increasing excitement concerning the potential of laser methods to interrogate the transition states of molecular reactions.

705,305
PB85-222057 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Determination of Molecular Structure at Surfaces Using Angle Resolved Electron and Photon-Stimulated Desorption.
Final rept.
T. E. Madey, F. P. Netzer, J. E. Houston, D. M. Hanson, and R. Stockbauer. 1983, 19p
Contract DE-AC04-76DP00789
Sponsored by Office of Naval Research, Washington, DC.
Pub. in Proceedings of Int. Workshop Desorption Induced by Electronic Transitions (DIET 1) (1st), Williamsburg, VA., May 12-14, 1982, p120-138 1983.

Keywords: *Molecular structure, *Surface chemistry, Chemisorption, Desorption, Comparison, Photons, Electron transitions, *Electron stimulated desorption ion angular distributions, *Photon stimulated desorption ion angular distributions.

The authors review recent data and theoretical models related to the use of angle-resolved electron and photon stimulated desorption in determining the structures of molecules at surfaces. Examples include a variety of structural assignments based on ESDIAD (electron stimulated desorption ion angular distributions), the observation of short-range local ordering effects induced in adsorbed molecules by surface impurities, the influence of electron-beam damage on surface structure, and a direct comparison of ESD and PSD ion yields for the same system.

705,306
PB85-222065 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.

Concentration Dependence of the Diffusion and Permeability in a Homogeneous Membrane. 1. The Fickian and Chemical Potential Formulation of the Diffusion Current.
Final rept.
A. Peterlin. 1985, 7p
Pub. in Colloid and Polymer Science 263, n1 p35-41 1985.

Keywords: *Membranes, *Sorption, *Permeability, *Polymeric films, *Diffusion coefficient, Concentration(Composition), Transport properties, Experimental design, Reprints, *Chemical potential, *Fick's law.

For the sorption and diffusion coefficient dependence on the concentration of the penetrant the transport properties of a homogeneous medium are calculated. The diffusion current is assumed to be proportional to the negative gradient of the chemical potential. This is in contrast with the first Fick's law that assumes the current to be proportional to the negative gradient of the concentration of the penetrant. The difference between the two cases depends on the concentration dependence of the sorption coefficient. In a homogeneous membrane the chemical potential formulation leads to an equation which is very similar to the Fickian expression. The apparent diffusion coefficient, however, depends not only on the transport resistance but also on the deviation of the sorption coefficient from constancy.

705,307

PB85-222081 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Concentration Dependence of the Diffusion and Permeability in a Homogeneous Membrane. 2. The Differences between the Fickian and Chemical Potential Formulation in the Case of a Linear Increase of the Sorption Coefficient with the Equivalent Penetrant Pressure.
Final rept.
A. Peterlin. 1985, 9p
Pub. in Colloid and Polymer Science 263, n1 p42-50 1985.

Keywords: *Membranes, *Sorption, *Permeability, *Polymeric films, *Diffusion coefficient, Concentration(Composition), Experimental design, Free energy, Pressure distribution, Reprints, *Chemical potential, *Fick's law.

In a linear dependence of the sorption coefficient S on the equivalent pressure of the penetrant the differences between the Fickian and chemical potential formulation of the diffusion current are very soon larger than 20%, the assumed and tolerated error limit of the experiment. It turns out that the zero concentration diffusion coefficient D(sub 0) determined from the sorption or permeation transient on the basis of the chemical potential basis is larger than that determined on the basis of Fick's law.

705,308

PB85-222099 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Adsorption of Oxygen on Ag(110): A New View of Structure and Bonding.
Final rept.
K. Bange, T. E. Madey, and J. K. Sass. 4 Jan 85, 7p
Sponsored by Deutsche Forschungsgemeinschaft, Bonn-Bad Godesberg (Germany, F.R.).
Pub. in Chemical Physics Letters 113, n1 p56-62, 4 Jan 85.

Keywords: *Molecular structure, *Chemical bonds, *Oxygen, *Surface chemistry, Silver, Adsorption, Reprints, *Molecular configurations, *Electron stimulated desorption ion angular distributions.

The authors have used ESDIAD (electron stimulated desorption ion angular distributions) to characterize the structure and bonding of O2 on Ag(110). Possible structures are discussed which are at variance with existing models of the oxygen-Ag(110) system.

705,309

PB85-222370 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Trajectory Approach to the Hydrogen Evolution Reaction.
Final rept.
S. Holloway, and J. W. Gadzuk. 1983, 6p
Pub. in Nordic Conf. on Surface Science, Tampere, Finland, August 18-20, 1982, Physica Scripta T4, p86-91 1983.

Keywords: *Hydrogen, *Electrochemistry, *Dynamics, Surface chemistry, Equations of motion, Potential energy, Reaction kinetics, Chemical reactions, Solvents.

A classical trajectory analysis for the discharge reaction step in the hydrogen evolution reaction is presented. The construction of an adiabatic potential energy surface is discussed with emphasis on the solvent motion and the charge transfer process. Corrections to absolute rate theory reaction probabilities arising from dynamical effects are presented as a function of applied potential.

705,310

PB85-222396 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Infrared Multiphoton Dissociation of Methyl Nitrite in a Molecular Beam: Internal States of the Nitric Oxide Fragment.
Final rept.
D. S. King, and J. C. Stephenson. 1 Mar 85, 4p
Sponsored by Army Research Office, Arlington, VA., and Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Chemical Physics 82, n5 p2236-2239, 1 Mar 85.

Keywords: *Nitrogen oxide(NO), *Dissociation, *Spectroscopic analysis, *Pulse transmission, *Molecular beams, Molecular rotation, Molecular energy levels, Excitation, Spin orbit interactions, Reprints, *Laser excited fluorescence, *Laser spectroscopy, *Methyl nitrite, *Rotational energy levels.

The rotational-, spin-, and lambda doublet-state distributions for nitric oxide (NO) formed in the CO2 laser multiphoton dissociation of methyl nitrite, CH3ONO, in a pulsed molecular beam are reported. There is no apparent preference for formation of either lambda doublet component and there is no observable fragment alignment, the nascent NO species exhibiting an isotropic distribution of angular momentum vectors.

705,311

PB85-222404 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Kinetic Energy Disposal in the Unimolecular IRMPD of Methyl Nitrite in a Pulsed Molecular Beam.
Final rept.
D. S. King, and J. C. Stephenson. 15 Mar 85, 6p
Sponsored by Army Research Office, Arlington, VA., and Office of Naval Research, Arlington, VA.
Pub. in Chemical Physics Letters 114, n5-6, p461-466, 15 Mar 85.

Keywords: *Kinetic energy, *Dissociation, *Spectroscopic analysis, *Molecular beams, *Pulse transmission, Molecular rotation, Molecular energy levels, Excitation, Spin orbit interactions, Doppler effects, Temperature, Nitrogen oxide(NO), Reprints, *Laser excited fluorescence, *Methyl nitrite, *Laser spectroscopy, *Rotational energy levels.

Methyl nitrite, CH3ONO, was dissociated by infrared laser pulses of well defined intensity under collisionless conditions in a pulsed molecular beam. Doppler-resolved laser-excited fluorescence spectroscopy determined the kinetic energy of the nitric oxide fragments formed in particular quantum states. The observed Doppler profiles were Gaussian over two e-foldings and, when converted to translational temperatures, corresponded to temperatures in the range of 260 to 350 K for states with 40 to 1308/cm of rotational energy; no significant correlation was observed between rotational, spin-orbit, or lambda doublet/state and kinetic energy.

705,312

PB85-225225 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Model Describing the Steady-State Pyrolysis of Bubble-Forming Polymers in Response to an Incident Heat Flux.
I. S. Wichman. May 85, 48p NBSIR-85/3130

Keywords: *Mathematical models, *Bubbles, *Thermoplastic resins, *Heat flux, *Gasification, Steady state, Heat transmission, Transport properties, Nucleation, Equations of state, Surface chemistry, Mass transfer, *Chemical reaction mechanisms, Monomers.

A theoretical model is developed to describe the in-depth effect of bubbles on the steady-state transport of volatile gases (monomer) from the surface of a polymer subjected to an incident heat flux. In this model the effect of the bubbles on the surrounding (liquid) polymer is felt through the bubble number distribution function, n, which appears in the equations for conservation of mass, momentum, species and energy in the melt. The equation for the evolution of n includes the effects of bubble growth, convection and nucleation; its derivation requires preliminary study of the growth and motion of an individual bubble in a liquid with a temperature gradient. With these equations, formulas for the mass flux of volatiles from the polymer surface and the bubble void fraction are developed, for the special case of constant polymer mass fraction.

705,313

PB85-225696 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Saturation of Continuum-Continuum Transitions in Multiphoton Absorption.
Final rept.
K. Rzazewski, and R. Grobe. 15 Apr 85, 1p
Pub. in Physical Review Letters 54, n15 1729p, 15 Apr 85.

Keywords: *Continuum mechanics, *Mathematical models, Dipole moments, Atomic theory, Reprints, *Hydrogen atoms.

The author comment on a recent letter by Deng and Eberly (Phys. Rev. Lett. 53, 1810 (1984)) and suggest a specific experiment which could test the model developed by those authors.

705,314

PB85-225704 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Resonant Transitions of Kr X.
Final rept.
J. Reader, A. N. Ryabtsev, and A. A. Ramonas. Mar 85, 5p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of the Optical Society of America B 2, n3 p417-421 Mar 85.

Keywords: *Krypton, *Spectroscopic analysis, *Line spectra, Hartee-Fock approximation, Least squares method, Reprints, *Krypton ions.

The spectrum of nine-times ionized krypton, KrX, was observed with a low-inductance vacuum spark and a 10.7-m grazing-incidence spectrograph. Forty-four spectral lines in the region 91-105 A were classified. The identifications were made with the aid of Hartree-Fock and least-squares parametric calculations.

705,315

PB85-225720 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Collisions in the Presence of a Laser Field and the Laser as a Tool for State Selective Preparation of Molecular States in Collisions.
Final rept.
I. V. Hertel. Jan 85, 5p
Pub. in Jnl. de Physique 46, n1 pCL37-CL41 Jan 85.

Keywords: *Molecular energy levels, Excitation, Ions, Laser beams, Atoms, Reprints, *Laser spectroscopy, *Laser induced excitation, *Molecule-molecule collisions, Ion-atom collisions.

In the study of individual collision events laser light can be used to influence or probe the process prior to, during, or after the binary particle interaction. The author discusses some problems and particularly challenging possibilities for modifying the collision process in a high, but not too high, laser field. He discusses the possibilities of state selective preparation of quasimo-

lecular sigma and pi states in ion-atom collisions, with asymptotically laser optical pumped atomic p-states.

705,316
PB85-225738 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Anisotropic Scattering of Electrons by N2 and Its Effect on Electron Transport.
Final rept.
A. V. Phelps, and L. C. Pitchford. May 85, 18p
Grant ARO-8-82
Pub. in Physical Review A 31, n5 p2932-2949 May 85.

Keywords: *Electron transfer, *Electron scattering, *Nitrogen, *Anisotropy, Transport properties, Spatial distribution, Ionization, Excitation, Mathematical models, Elastic scattering, Experimental design, Boltzmann equation, Inelastic scattering, Reprints, *Electron-molecule collisions.

As part of a systematic study of approximations commonly made in solutions of the Boltzmann equation for electrons in molecular gases, the authors have investigated the effects of anisotropic scattering on electron transport coefficients in N2 and have extended our study of the multiterm expansion technique to higher E/n. The importance of proper interpretation of ionization and excitation experiments at high E/n is illustrated by calculations which model either an exponential growth of density in time or an exponential growth with position. The calculated excitatioo coefficients are generally higher than experiment at low and high E/n but in agreement with experiment at E/n near 150 Td.

705,317
PB85-225746 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Absolute Cross-Section Measurements for Electron-Impact Ionization of Doubly Charged Ions Ti(+2), Fe(+2), Ar(+2), Cl(+2) and F(+2).
Final rept.
D. W. Mueller, T. J. Morgan, G. H. Dunn, D. C. Gregory, and D. H. Crandall. May 85, 9p
Contract DOE-EA-77-A-0101
Pub. in Physical Review A 31, n5 p2905-2913 May 85.

Keywords: *Ionization coefficients, *Reaction kinetics, *Collision cross sections, Temperature, Excitation, Comparison, Reprints, *Electron-ion collisions, *Autoionization, Numerical solution, Iron ions, Chloride ions, Fluoride ions, Argon ions, Titanium ions.

Measurements have been made of the cross section for electron-impact single ionization of the ions Ti(+2), Fe(+2), Ar(+2), Cl(+2), and F(+2), spanning the range of energies from below threshold to 1500 eV. Indirect processes such as excitation-autoionization contribute substantially to the cross section for Ti(+2), while such contributions are less pronounced for the other species. Comparisons with available theoretical predictions and with the Lotz semiempirical formula are presented. Expansion coefficients and formulas for generating ionization rate coefficients in the temperature range 10,000 < T < 10,000,000 K are included for each ion.

705,318
PB85-226033 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Structures of C6H7(+1) Ions Formed in Unimolecular and Bimolecular Reactions.
Final rept.
S. G. Lias, and P. Ausloos. 15 Apr 85, 12p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 82, n8 p3613-3624, 15 Apr 85.

Keywords: *Molecular structure, *Reaction kinetics, *Isomerization, *Spectroscopic analysis, Stereochemistry, Heats of formation, Benzenes, Molecular energy levels, Mass spectroscopy, Cyclohexadiene compounds, Reprints, *Benzenium ions, *Chemical reaction mechanisms, *Fragmentation patterns(Mass spectroscopy), *Proton affinity, *Photoisomerization, Ion cyclotron resonance mass spectroscopy, Hexatriene, Cyclohexadiene.

The structures, isomerization mechanisms, and reaction kinetics of C6H+7 ions formed in a variety of systems have been studied. The ions formed in the reactions (H2C=C=CH2(+1)+H2C=C=CH2) and (HC=CCH3(+1)+HC=CCH3) as well as the fragment C6H7(+1) ions in 1,3-cyclohexadiene, 1,4-cyclohexadiene, trans-1,3,5-hexatriene, 1-methylcyclopentene, 3-methylcyclopentene, and 4-methylcyclopentene exhibit at least two structures under the conditions of an ICR experiment. In each case, one isomer transfer a proton to bases with proton affinity higher than that of benzene demonstrating that the species has the benzenium (protonated benzene) structure. The energetics of the fragmentation process leading to C6H7(+1) formation have been examined in a photoelectron-photoion coincidence spectrometer for trans-1,3,5--hexatriene and 1,3- and, 1,4-cyclohexadiene. It is found that the transition state for the fragmentation process (C6H8(+1) yields C6H7(+1)+H) is effectively the same in all three systems but lies at an energy level higher than (benzenium ion +H) products. Rate constants for reactions of benzenium ions with a variety of organic and inorganic compounds have been determined.

705,319
PB85-226041 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Resonance Transitions 4d(sup 10)5s - 4d(sup 9)5s5p in the Ag I Sequence of In III, Sn IV, Sb V, and Te VI.
Final rept.
V. Kaufman, J. Sugar, T. A. M. van Kleef, and Y. Joshi. Mar 85, 4p
Pub. in Jnl. of the Optical Society of America B 2, n3 p426-429 Mar 85.

Keywords: *Molecular energy levels, *Ions, *Eigenvectors, Antimony, Cadmium, Indium, Tellurium, Tin, Wavelengths, Reprints, *Isoelectronic sequence, *Molecular configuration, Resonant transfer.

Nearly complete resonance transition arrays 4d (sup 10)5s-4d (sup 9)5s5p in the Ag I isoelectronic sequence were observed in sliding and triggered sparks for the ions In III through TeVI. Wavelengths and estimated relative intensities are given as well as energy levels and eigenvectors for the upper levels. Evidence of configuration interaction is indicated by the irregular behavior of the fitted radial energy integrals for 4d (sup 9)5s5p, but no attempt was made to add configuration interaction.

705,320
PB85-226066 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Experimental Thermal Conductivity Values for Mixtures of Methane and Ethane.
Final rept.
H. M. Roder, and D. G. Friend. Mar 85, 43p NBSIR-85/3024

Keywords: *Methane, *Ethane, *Thermal conductivity, Mixtures, Experimental design, Pressures, Temperatures, Density(Mass/volume), Tables(Data).

The experimental measurements of thermal conductivity as obtained in a transient hot wire apparatus for mixtures of methane and ethane are recorded. The measurements were made at temperatures between 140 and 330 K with pressures between 0.1 and 70 MPa. The density range is 0 to 24 mol/L, the mole fractions of methane are 0.69, 0.50, and 0.35, and the total number of points recorded is 2476.

705,321
PB85-227072 PC **A06**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Bibliography on Atomic Energy Levels and Spectra, July 1979 through December 1983.
Interim rept.
A. Musgrove, and R. Zalubas. Jun 85, 124p NBS/SP-363-SUPPL-3
See also PB81-125833. Also available from Supt. of Docs as SN003-003-02661-1. Library of Congress catalog card no. 85-600543.

Keywords: *Atomic energy levels, *Atomic spectra, *Bibliographies, Atoms, Ions, Spectral lines, Wavelengths, Zeeman effect, Hyperfine structure, Ionization potentials, Isotope effect, Tables(Data).

The is the third supplement to NBS Special Publication 363. Bibliography on Atomic Energy Levels and Spectra, July 1968 through June 1971. Supplement 1 covered the period from July 1971 through June 1975, Supplement 2 covered the period from July 1975 through June 1979, and this bibliography covers the literature from July 1979 through December 1983. It contains approximately 1200 references classified by subject for individual atoms and atomic ions. A number index identifies the references. An author index is included. References included contain data on energy levels, classified lines, wavelengths, Zeeman effect, Stark effect, hyperfine structure, isotope shift, ionization potentials, or theory which gives results for specific atoms or atomic ions.

705,322
PB85-227577 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Detection of Nitrogen Rotational Distributions by Resonant 2 + 2 Multiphoton Ionization Through the a(sup 1)pi(sub g) State.
Final rept.
K. L. Carleton, K. H. Welge, and S. R. Leone. Apr 85, 4p
Contract DE-AC02-79ER10396, Grant NSF-CHE79-11340
Sponsored in part by Grant NSF-PHY82-00805.
Pub. in Chemical Physics Letters 115, n6 p492-495, 19 Apr 85.

Keywords: *Molecular rotation, *Nitrogen, *Ionization, Photons, Reprints, *Laser induced ionization, *Rotational energy levels.

Characterization of laser 2+2 multiphoton ionization of nitrogen to obtain rotational state distributions has been investigated via the resonant two-photon transition. For room-temperature nitrogen, the spectral intensities and state distribution are directly related and give rotational temperatures of 290+or-20K. For power densities of 3 GW/sq cm, the ionization probability is .00001 per N2 molecule per average rotational state.

705,323
PB85-227585 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Collisional Redistribution of Circularly Polarized Light in Barium Perturbed by Argon.
Final rept.
W. J. Alford, N. Andersen, M. Belsley, J. Cooper, D. M. Warrington, and K. Burnett. May 85, 5p
Grant NSF-PHY82-00805
Pub. in Physical Review A 31, n5 p3012-3016 May 85.

Keywords: *Barium, *Molecular energy levels, *Molecular orbitals, Circular polarization, Excitation, Molecular orbitals, Pressure, Reprints, *Molecule-molecule collisions, Polarized light.

The authors have measured the orientation of the Ba 6p1P level produced by collision-induced excitation from the ground state by circularly polarized light. The detuning dependence of the far-wing excited-state orientation can be interpreted in terms of reorientation of molecular orbitals which occur during the collision. Effects due to rotational coupling are seen to occur at large blue-wing detunings. They have also determined the collisional rate for destruction of orientation by measuring the pressure dependence of the excited-state orientation.

705,324
PB85-227601 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Angle-Resolved Photoelectron Study of the Valence Levels of BF3 in the Range 17 = h(nu) = 28eV.
Final rept.
J. L. Dehmer, A. C. Parr, S. H. Southworth, and D. M. P. Holland. Oct 84, 8p
Grant NATO-1939
Sponsored by Department of Energy, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Physical Review A 30, n4 p1783-1790 Oct 84.

Keywords: *Photochemical reactions, *Ionization, *Boron fluorides, *Molecular energy levels, *Photoelectric emission, Mathematical models, Experimental design, Comparison, Angular distribution, Reprints.

Photoelectron branching ratios and angular distributions have been measured for the six outermost levels of BF3 in the range 17<or=hv<or=28 eV with the use of synchrotron radiation. Comparisons are made with a recent multiple-scattering model calculation which indicates that a shape resonance in the e' elec-

tronic continuum should appear in five of the six channels studied. Good agreement between experiment and theory is found in a majority of the comparisons; however, experimental evidence for the expected e' shape resonance is clear in some cases but absent in others. The results are discussed in the context of other cases in which shape resonances, well known from inner-shell spectra, are obscured in valence-shell properties. Experiments which would help clarify the role of the e' shape resonance in the photoionization dynamics of BF3 are suggested.

705,325
PB85-227619 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Multiple-Pulse Proton NMR of Pressure-Crystallized Linear Polyethylene.
Final rept.
J. R. Havens, and D. L. VanderHart. 1985, 3p
Pub. in Jnl. of Magnetic Resonance 61, p389-391 1985.

Keywords: *Nuclear magnetic resonance, *Polyethylene, Molecular relaxation, Crystallization, Anisotropy, Pressure, Reprints, *Chemical shift(Nuclear magnetic resonance).

The multiple-pulse proton NMR spectrum of pressure-crystallized linear polyethylene is reported. A clearly defined axially symmetric chemical shift tensor is observed, whose anisotropy has a width of approximately 6.9 ppm. Use of a spherical sample is seen to reduce broadening from bulk magnetic susceptibility effects. A comparison of the effectiveness of two multiple-pulse sequences is made based on the linewidths. Relaxation behavior under multiple pulse is also reported and leads to an estimate of the percentage crystallinity of this sample in excess of 90%.

705,326
PB85-227627 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Molecular Dynamics Study of the Liquid and Plastic Phases of Neopentane.
Final rept.
R. D. Mountain, and A. C. Brown. May 85, 7p
Pub. in Jnl. of Chemical Physics 82, n9 p4236-4242 May 85.

Keywords: *Phase transformation, *Liquid phases, Molecular rotation, Plasticity, Reprints, *Molecular dynamics, *Propane/dimethyl, Molecular models.

Molecular dynamics has been used to investigate a model for neopentane. The velocity-velocity and angular momentum-angular momentum time correlation functions were constructed for the liquid and the single particle time correlation functions for the orientation of twofold and threefold axes of symmetry of the molecules were constructed for both the liquid and plastic phases. The model produces liquid properties that are in agreement with those of liquid neopentane. The dynamics of the molecular reorientations in the plastic phase has been examined. These reorientations are found to consist of jumps between equivalent orientations by a rotation of 120 degrees around a threefold molecular symmetry axis.

705,327
PB85-227684 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
NMR (Nuclear Magnetic Resonance) Self-Diffusion Study of Polyethylene and Paraffin Melts.
Final rept.
I. Zupancic, G. Lahajnar, R. Blinc, D. H. Reneker, and D. L. Vanderhart. 1985, 18p
Pub. in Jnl. of Polymer Science, Polymer Physics Edition 23, p387-404 1985.

Keywords: *Nuclear magnetic resonance, *Polyethylene, *Diffusion coefficient, *Alkanes, *Melts, Molecular weight, Transport properties, Reprints.

The self-diffusion coefficient D of paraffin and polyethylene melts--covering the range between N = 19 and 1,000 where N is the number of monomeric units--was measured by the pulsed-magnetic-field-gradient NMR method for diffusion times between 3 ms and 1 s. For the paraffins, D is proportional to 1/sq N though the molecular weights are smaller than the critical molecular weight for entanglement. In polyethylene, melts a strong dependence of the diffusion coefficient on the diffusion time is observed, whereas no such dependence is found in paraffin melts. A mathematical formalism for describing spin-echo attenuation in terms of a velocity autocorrelation function is shown to yield qualitative agreement with the experimental results.

705,328
PB85-228401 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Chemical Physics.
Bibliography of Sources of Thermodynamic Data for the Systems: CO2+NH3+H2O, CO2+H2S+H2O, H2S+NH3+H2O, and CO2+NH3+H2S+H2O.
Final rept.
R. N. Goldberg, and D. K. Steckler. May 85, 41p
NBS/SP-699
Also available from Supt. of Docs as SN003-003-02664-6. Library of Congress catalog card no. 85-600545. Sponsored by American Inst. of Chemical Engineers, New York.

Keywords: *Thermodynamic properties, *Bibliographies, *Chemical equilibrium, Thermodynamic equilibrium, Physical properties, Sources, Experimental design, Density(Mass/volume), Enthalpy, Sources, Tables(Data), Ammonium carbonate, Specific heat, Hydrogen sulfide, Carbon dioxide, Ammonia, Urea, Water.

Contained herein is a bibliography of sources of experimental and correlated thermodynamic data for the systems CO2 + NH3 + H2O, CO2 + H2S + H2O, H2S + NH3 + H2O, and CO2 + NH3 + H2S + H2O. The types of data in this bibliography include all types of equilibrium data, including both equilibria in solution and vapor-liquid equilibrium data, enthalpies, heat capacities, and densities. There are 215 references cited.

705,329
PB85-229276 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Separation and Purification of Diastereomers of Angiotensin I by Weak Anion-Exchange High-Performance Liquid Chromatography.
Final rept.
S. A. Margolis, and M. Dizdaroglu. 1985, 12p
Pub. in Jnl. of Chromatography 322, p117-128 1985.

Keywords: *Anion exchanging, *Purification, *Separation, *Chromatographic analysis, *Stereochemistry, Peptides, Separation, Comparison, Assessments, Reprints, *High performance liquid chromatography, *Angiotensin.

Several diastereomers of angiotensin I were resolved by weak anion-exchange high-performance liquid chromatography (HPLC). All of the diastereomers which were examined contained significant amounts of peptides whose amino acid composition differed from the designated diastereomer of angiotensin I. The results are compared with the results of separations of the same peptides by reversed-phase HPLC. The comparison strongly suggests that the two HPLC methods, utilizing different separation principles, are complementary; hence their combined use leads to a more confident assessment of the purity of a given peptide preparation.

705,330
PB85-229292 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Excited Electron Correlations in Resonant Multiphoton Ionization via Barium Rydberg States.
Final rept.
G. Leuchs, and S. J. Smith. 1985, 8p
Grant NSF-PHY82-00805
Pub. in Physical Review A 31, n4 p2283-2290 Apr 85.

Keywords: *Barium, *Angular distributions, *Photoionization, *Molecular energy levels, Excitation, Reprints, *Rydberg series, *Molecular configuration.

Photoelectron angular distributions have been studied in resonant multiphoton ionization of barium via J=0 states, in the region where the 6sns singlet S(sub 0) Rydberg series interacts strongly with the 5d 7(triplet d)P0 doubly excited state. The interaction is dominantly quadrupole and is localized around n=18. The data analysis reveals spin-orbit coupling and strong channel mixing in the continuum.

705,331
PB85-229326 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Laser-Induced Fluorescence Measurement of Nascent Vibrational and Rotational Product State Distributions in the Charge Transfer of Ar(+1) + N2 yields Ar + N2(+1) (nu=0,1) at 0.2 eV.
Final rept.
L. Huwel, D. R. Guyer, G. H. Lin, and S. R. Leone. 1984, 16p
Grants NSF-PHY82-00805, NSF-CHE79-11340
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Petroleum Research Fund, Washington, DC.
Pub. in Jnl. of Chemical Physics 81, n8 p3520-3535 1984.

Keywords: *Reaction kinetics, *Fluorescence, *Supersonic nozzles, *Ionization chambers, Rotational vibration, Ions, Diatomic molecule, Reprints, *Laser induced fluorescence, *Ion molecule collisions, Laser applications.

A novel experimental technique couples a flowing afterglow ion source with a supersonic nozzle expansion in order to deliver high densities of relatively low kinetic energy ions into a low pressure chamber. The technique is used to study the charge transfer reaction under single collision conditions at 0.24eV c.m. Nascent rotational and vibrational state distributions are obtained by the method of saturated laser-induced fluorescence probing. It is found that a substantial fraction of the available energy is partitioned into internal excitation of the N2(+1) product molecule. The results are compared with a number of recent state-selected experiments on charge exchange in ArN2(+1) ArH2(+1) and NCO (+1) systems. It is suggested the experimental findings are best explained in terms of the detailed locations of potential surface crossing seams, rather than by the widely used energy resonance or diatomic molecule, Franck-Condon ionization models.

705,332
PB85-229334 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Fluorescence Measurement of the Diffusion Coefficient for Butylated Hydroxyanisole in Low-Density Polyethylene.
Final rept.
B. F. Howell, F. L. McCrackin, and F. W. Wang. 1985, 4p
Pub. in Polymer 26, p433-436 Mar 85.

Keywords: *Diffusion coefficients, *Antioxidants, *Fluorescence, Extraction, Reprints, *Low density polyethylene, *Phenol/butyl-hydroxy, *Cresol/dibutyl.

Measurement of the diffusion coefficient (D) of butylated hydroxyanisole (BHA) in low density polyethylene at 31C was made by two techniques (1) Measurement of diffusion rate in the absence of solvent was made by use of a film stack with BHA-loaded discs on top and bottom. After a given diffusion time, the films were separated and the BHA extracted from the films into 1-propanol. (2) Fluorescence monitoring, under oxygen free conditions, was used to measure rate of BHA extraction from a film into 1-propanol at 31 C.

705,333
PB85-229342 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Intensity-Dependent Electron Angular Distributions in Resonant Multiphoton Ionization.
Final rept.
S. Geltman, and G. Leuchs. Mar 85, 7p
Grant NSF-PHY82-00805
Pub. in Physical Review A 31, n3 p1463-1469 Mar 85.

Keywords: *Angular distributions, *Photoionization, Hyperfine structure, Comparison, Experimental design, Ionization, Stark effect, Atomic energy levels, Anisotropy, Resonant frequency, Sodium, Reprints, *Sodium atoms.

A theoretical investigation has been carried out on the dependence of the photoelectron angular distributions on laser intensity for the case of two-photon-resonant three-photon ionization of sodium. Good overall agreement is obtained with the experimental anisotropy parameters for ionization via the 4D(3/2) and 4D(5/2) intermediate states. The comparison of the theoretical results with the experimental data also clearly shows that the hyperfine splitting of the ground state has to

be taken into account at high laser intensities although the low intensity angular distributions do not depend on the initial ground hyperfine state.

705,334
PB85-229367 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Resonance Scattering of a Short Laser Pulse on a Two-Level System: Time-Dependent Approach.
Final rept.
M. Florjanczyk, K. Rzazewski, and J. Zakrzewski.
Mar 85, 5p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Physical Review A 31, n3 p1558-1562 Mar 85.

Keywords: *Resonance scattering, *Spectroscopic analysis, Fluorescence, Time dependence, Reprints, *Laser spectroscopy, *Laser induced fluorescence.

The authors discuss the time-dependent power spectrum of fluorescence light produced by a two-level system driven by a smooth, short, resonant laser pulse. They show how the multipeak structure of the spectrum develops in time. The possibility of a smooth transition to the conventional Mollow spectrum is discussed.

705,335
PB85-229383 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Infra-red Bandshapes of Methylene-d2 Bending Vibrations in n-Hexatriacontane-n-Hexatriacontane-d74.
Final rept.
B. Fanconi, F. McCrackin, and D. Sarazin. 1985, 10p
Pub. in Polymer 26, p219-228 Feb 85.

Keywords: *Infrared spectroscopy, *Deuterium compounds, *Band spectra, *Methylene, Isotopic labeling, Lattice parameters, Alkanes, Experimental design, Concentration(Composition), Reprints, *Hexatriacontane, Numerical solution.

Infra-red spectra in the CD2 bending vibration region (1080-1100/cm1) have been analyzed for mixtures of deuterated and hydrogenated hexatriacontane. The i.r. data analyses are based on lattice dynamical calculations of guest deuterated molecules in the host n-C36H74 and infrared intensities calculated using the electro-optical parameter method. The calculated band profiles as a function of the deuterated molecule concentration compare favorably to experimental spectra taken at 80K. The high resolution, low temperature spectra reveal features heretofore only observed at much higher concentrations of deuterated species. Self deconvolution procedures were used to further resolve the spectra. Excellent agreement was found between calculated and experimental ratios of the i.r. intensity of certain dimer arrangements to that of singlet molecules. The intensity ratio was found to be a better measure of deuterated species concentration than the halfwidth of the CD2 bending vibration band that had been previously used.

705,336
PB85-229409 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Dielectronic Recombination.
Final rept.
G. H. Dunn, D. S. Belic, N. Djuric, and D. W. Mueller. 1984, 18p
Pub. in Proceedings of the International Conference on Atomic Physics (9th), Seattle, Washington, July 1984, p505-522.

Keywords: Experimental design, Reviews, Cross sections, *Dielectronic recombination.

Within the past one and a half years, the process known as dielectronic recombination has for the first time been observed and measured in isolation from other processes. The measurements and comparison with theory have highlighted interesting physical phenomena as well as raised questions about the completeness of accepted theoretical treatments of the process.

705,337
PB85-229433 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Poly(ethylene imine)-Sodium Iodide Complexes.
Final rept.
C. K. Chiang, G. T. Davis, C. A. Harding, and T. Takahashi. 1985, 3p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Macromolecules 18, n4 p825-827 1985.

Keywords: *Complex compounds, *Differential thermal analysis, Inorganic salts, Concentration(Composition), Electrical resistance, Reprints, *Poly(ethylene imine), Monomers.

Sodium iodide can be incorporated into linear poly(ethylene imine) up to 0.3 moles of NaI per mole of monomer repeat. At low concentrations, the incorporation of salt inhibits the normal crystallization of the polymer while at high concentrations the salt and polymer form a complex crystal phase which melts near 150 C. The addition of NaI to the polymer initially increases d-c conductivity but the incorporation of 0.3 moles of NaI per mole of monomer reduces conductivity relative to that of polymer to which no salt has been purposely added.

705,338
PB85-229441 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Automated Apparatus for X-ray Pole Figure Studies of Polymers.
Final rept.
J. D. Barnes, and E. S. Clark. 1985, 7p
Pub. in Proceedings of the ACS (American Chemical Society) Division of Polymeric Materials: Science and Engineering, Miami Beach, Florida, v52 p382-388 Apr 85.

Keywords: *Automatic control equipment, *X ray diffraction, *Polymers, *Crystal structure, Laboratory equipment, Fortran, Computer programs, Performance evaluation, Design criteria, Crystallite, Computer applications.

The authors have adapted a commercially available x-ray diffractometer normally used for structure determinations on single crystals to operate as a very flexible device for performing x-ray pole figure determinations and related studies on polymeric materials. Descriptions of crystallite orientations, as provided by pole figures, are useful in studying many aspects of the behavior of products made from semicrystalline polymers. The paper describes the software that they have written for their pole figure facility. Except for some vendor-provided routines to drive the hardware interface all of their software is written in FORTRAN. Menu driven operation is provided to maximize user convenience.

705,339
PB85-229912 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Network Structure of Epoxies: 1. A Neutron Scattering Study.
Final rept.
W. Wu, and B. J. Bauer. 1985, 4p
Pub. in Polymer Communication 26, p39-42 Feb 85.

Keywords: *Epoxy resins, *Molecular structure, *Neutron scattering, *Elastic scattering, Molecular weight, Deuterium compounds, Crosslinking, Thermosetting resins, Reprints, *Polymer chains, *Propanol/bis((epoxy propoxy)phenoxy).

The elastic neutron scattering technique was applied to elucidate the network structure of epoxies. A partially deuterated epoxy, the diglycidyl ether of Bisphenol A (DGEBA) was synthesized. It was then cured with di- and triamines based on polypropylene oxide chains for the neutron study. Prominent scattering peaks were observed in all the specimens over the q region within 1.2/A. Furthermore, multiple scattering peaks were observed in the specimens cured with a diamine with rather high molecular weight.

705,340
PB85-229953 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Phonon Softening in a Mixed Layered System K(1-x)Rb(x)C8.
Final rept.
D. A. Neumann, H. Zabel, J. J. Rush, and N. Berk. 1984, 4p
Grant NSF-DMR83-04890
Sponsored by Conoco, Inc., Stamford, CT.
Pub. in Physical Review Letters 53, n1 p56-59, 2 July 84.

Keywords: *Inelastic scattering, *Neutron scattering, *Phonons, *Softening, *Graphite, Layers, Reprints, *Clathrate compounds.

By means of inelastic neutron scattering, the dispersion of the longitudinal (00q) phonon modes has been measured for the first time in the mixed layered compound K(1-x)Rb(x)C8 over the whole composition range 0 <or= x <or= 1. From the optic and acoustic phonon branches interlayer force constants are derived which are strongly composition dependent. At x=0.65 the elastic constant C33 shows an anomalous softening of more than 20%, which may be due to a composition-dependent charge transfer between the intercalant and graphite layers.

705,341
PB85-230019 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Phase Decomposition Phenomena of Polystyrene/Polyvinylmethylether.
Final rept.
C. C. Han, M. Okada, Y. Muroga, B. J. Bauer, and Q. Tran-Cong. 1985, 5p
Pub. in Proceedings of the SPE Annual Technical Conference and Exhibition (43rd), ANTEC 85, Plastics 85, p306-310 1985.

Keywords: *Deuterium compounds, *Polystyrene, *Light scattering, *Decomposition reactions, Phase diagrams, Reaction kinetics, Nucleation, Experimental design, Plastics, Polyether resins, *Small angle scattering, *Poly(ether/methyl-vinyl), *Spinodal decomposition, Chemical reaction mechanisms.

Static and kinetic parameters of deuterated polystyrene/polyvinylmethylether blends before and during phase decomposition have been studied by the small angle neutron scattering and temperature jump light scattering techniques. Phase diagram, correlation length, critical exponent, binary interaction parameter together with spinodal temperatures and spinodal decomposition rate can all be studied in this approach. Two different decomposition mechanisms--spinodal and nucleation and growth--can be inferred to from experimental results.

705,342
PB85-230407 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Ionic Hydrogen Bond and Ion Solvation. 2. Solvation of Onium Ions by One to Seven H2O Molecules. Relations between Monomolecular, Specific, and Bulk Hydration.
Final rept.
M. Mautner. 1984, 8p
See also Part 1, PB85-230415.
Pub. in Jnl. of the American Chemical Society 106, n5 p1265-1272 1984.

Keywords: *Enthalpy, *Water, *Hydration, Hydrogen bonds, Ions, Specific energy, pH, Chemical bonds, Reprints, *Onium ions, Proton affinity.

The relation between enthalpies of solvation of onium ions BH(+1) by one water molecule, -deltaH(sub 0.1), and by four water molecules, -deltaH(sub 0.4), is constant for most onium ions: deltaH(sub 0.4)/deltaH(sub 0.1) is 2.8 + or - 0.1 for all oxonium ions and monoprotonic ammonium and pyridinium ions, and 3.1 + or - 0.1 for polyprotonic ammonium ions. These relations, in conjunction with the correlation between deltaH(sub 0.1) and the proton affinity difference delta PA=PA(B)-PA(H2O), allow the prediction of the total four-molecule specific hydration energy -deltaH(sub 0.4) for all onium ions within the experimental accuracy of + or - 3 kcal/mol. The observed (or predicted) fourfold specific relative hydration energies simulate closely the relative bulk hydration enthalpies for most ions. In other words, for most onium ions differential hydration effects are determined by the specific hydrogen-bonding interactions. Deviations are useful to identify bulk solvation effects. For example, such deviations indicate attenuated bulk solvation of ions with phenyl substituents.

705,343
PB85-230415 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Ionic Hydrogen Bond and Ion Solvation. 1. NH(+1)-O, NH(+1)-N, and OH(+1)-O Bonds. Correlations with Proton Affinity. Deviations due to Structural Effects.
Final rept.
M. Mautner. 1984, 8p
See also Part 2, PB85-230407.
Pub. in Jnl. of the American Chemical Society 106, n5 p1257-1264 1984.

Keywords: *Hydrogen bonds, *Molecular structure, *Solvation, Ions, Chemical bonds, Trends, Reprints, *Onium ions, *Proton affinity, Hydroxyl ions, Ammonium ions, Pyridium ions, Dimers.

In dimers BH(+1)...A, a linear correlation is found between the bond dissociation energy deltaH (sub D) and the difference delta PA between the proton affinities of the proton donor B and the proton acceptor A. The correlation applies for 48 -NH(+1)...O-dimers including a series with varying A and constant B, i.e., hydrates of ammonium and pyridium ions (-NH(+1)...OH2); a series with varying B and constant A, i.e., complexes CH3NH3(+1)...O-; and other dimers with delta PA values varying from 9 to 70 kcal mol and bond energies from 27 to 12 kcal/mol. The correlations are in accord with trends predicted by ab initio calculations of Desmeules and Allen. The correlations are reliable predictors of BH(+1)...A energies within experimental error limits. Deviations from the correlations help to identify special structural effects. Such effects include multiple hydrogen bonding, intramolecular hydrogen bonding, resonance, and steric crowding.

705,344
PB85-230423 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Ionic Hydrogen Bond. 1. Sterically Hindered Bonds. Solvation and Clustering of Protonated Amines and Pyridines.
Final rept.
M. Mautner, and L. Sieck. 1983, 6p
See also Part 2, PB85-230431.
Pub. in Jnl. of the American Chemical Society 105, n10 p2956-2961 1983.

Keywords: *Hydrogen bonds, *Protonation, *Amines, *Pyridines, *Solvation, *Water, Stereochemistry, Hydration, Proton reactions, Entropy, Chemical bonds, Ions, Reprints, *Onium ions, *Proton affinity, Pyridium ions, Ammonium ions, Dimers.

The hydrogen-bonded dimer ions BH(+1)-B and monohydrates BH(+1)-H2O of 2-alkylpyridines, 2,6-dialkylpyridines, and tertiary amines were investigated in the gas phase in the absence of solvent effects. The dissociation energies deltaH(sub D) of the dimers and hydrates are not affected by steric crowding. The authors observations may be summarized as follows: as long as there exists a single confirmation in which the hydrogen bond in BH(+1)-B or BH(+1)-H2O can obtain optimal geometry, the bond strength is not weakened by steric crowding. However, steric crowding may result in major entropy effects due to the hindrance of internal rotors in the dimers and monohydrates.

705,345
PB85-230431 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Ionic Hydrogen Bond. 2. Intramolecular and Partial Bonds. Protonation of Polyethers, Crown Ethers, and Diketones.
Final rept.
M. Mautner. 1983, 6p
See also Part 1, PB85-230423.
Pub. in Jnl. of the American Chemical Society 105, n15 p4906-4911 1983.

Keywords: *Hydrogen bonds, *Proton reactions, *Ethers, *Ketones, *Polyethers, *Intermolecular forces, Enthalpy, Stability, Thermochemistry, Entropy, Stereochemistry, Molecular rotation, Reprints, *Proton affinity.

Intramolecular hydrogen bonding in protonated di-, tri-, and tetraethers, as well as cyclic crown ethers, increases the proton affinities of these compounds vs. comparable monoethers. Thus, due to the stretched OH(+1)--O bond and small bond angle, here the 'hydrogen bond' may amount only to the electrostatic stabilization of the cis conformation, and rotation about the C-C bond is still allowed, although the barrier is increased by -delta H(HB). The stability of the internal hydrogen bond decreases in the order diamines > diethers > diketones.

705,346
PB85-230654 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Product State and Kinetic Energy Distributions in the Ultraviolet Photodissociation of the NO-Ar van der Waals Molecule.
Final rept.
D. S. King. Apr 85, 5p
Pub. in Jnl. of Chemical Physics 82, n8 p3629-3633, 15 Apr 85.

Keywords: *Ultraviolet spectroscopy, *Photodissociation, *Nitrogen oxide(NO), *Argon, *Reaction kinetics, Excitation, Doppler effect, Van der Waals equations, Fluorescence, Dissociation, Molecular rotation, Molecular vibration, Reprints, *Laser induced fluorescence.

The internal state and kinetic energy distributions of the X NO fragments formed from the ultraviolet photodissociation of the NO-Ar van der Waals species were obtained by laser-excited fluorescence techniques. The initially excited A NO-Ar rapidly dissociates to form X NO with little rotational excitation, with vibrational excitation determined by a Franck-Condon process, with a cos2 0 angular flux distribution (0 defined relative to the direction of polarization of the pump laser), and with a speed v-4.4x10 sub 5 cm/s.

705,347
PB85-230662 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Energy Distribution in the Nitric Oxide Fragments from the nu7 Vibrational Predissociation of NO-C2H4.
Final rept.
D. S. King, and J. C. Stephenson. Jun 85, 3p
Pub. in Jnl. of Chemical Physics 82, n11 p5286-5288, 1 Jun 85.

Keywords: *Molecular vibration, *Nitrogen oxides(NO), *Molecular rotation, Energy transfer, Van der Waals equation, Fluorescence, Doppler effect, Reprints, *Laser excited fluorescence, *Laser spectroscopy.

The rotational level distribution of the NO fragments from the nu7 vibrational dissociation of the NO-C2H4 van der Waals molecules was measured by laser excited fluorescence techniques to be Boltzmann in character, described by the rotational temperature 75 + or - 15K.

705,348
PB85-230670 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Analysis of the Fourth Spectrum of Tungsten (W IV).
Final rept.
L. Iglesias, V. Kaufman, O. Garcia-Riquelme, and F. R. Rico. 1985, 11p
Pub. in Physica Scripta 31, p173-183 1985.

Keywords: *Tungsten, *Ionization, *Spectrographic analysis, *Ultraviolet spectroscopy, Molecular energy levels, Comparison, Least square methods, Reprints, Molecular configurations.

The spectrum of triply ionized tungsten (W IV) was produced in a sliding-spark discharge and recorded photographically on the NBS 10.7 m normal-incidence vacuum spectrograph in the 600-2600A spectral region. A total of 774 lines have been classified as transitions between these levels. Comparison of observed level values with those calculated in a least-squares fit shows an rms deviation of + or - 50 cm for the even configurations and + or - 250 cm for the odd ones.

705,349
PB85-230688 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Vibrational Deactivation of Surface OH Chemisorbed on SiO2: Solvent Effects.
Final rept.
E. J. Heilweil, M. P. Casassa, R. R. Cavanagh, and J. C. Stephenson. Jun 85, 16p
Pub. in Jnl. of Chemical Physics 82, n11 p5216-5231, 1 Jun 85.

Keywords: *Deactivation, *Molecular relaxation, *Surface chemistry, *Chemisorption, *Silicon dioxide, *Solvents, *Molecular vibration, Catalysis, Energy transfer, Lattice vibrations, Liquids, Infrared spectroscopy, Spectrographic analysis, Line width, Reprints, *Hydroxyl radicals, Picosecond pulses.

Picosecond infrared transmission spectroscopy was used to directly measure the vibrational energy relaxation time T1 of hydroxyl groups chemisorbed on the surface of colloidal silica (SiO2). These observations are discussed in terms of the possible mechanisms of vibrational energy flow in these systems. The observed T1 values demonstrate that the spectral linewidths (e.g., IR and Raman) observed for these surface vibrations are too large (by factors of 200-2000) to be caused solely by T1 uncertainty broadening. The slow transfer of vibrational energy between surface and lattice vibrations may have important implications for surface chemistry.

705,350
PB85-230696 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Vibrational Energy Relaxation of Adsorbates on Surfaces.
Final rept.
E. J. Heilweil, M. P. Casassa, R. R. Cavanagh, and J. C. Stephenson. 1985, 5p
Pub. in Proceedings of the Society of Photo-Optical Instrumentation Engineers 533, Ultrashort Pulse Spectroscopy and Applications, p15-19 1985.

Keywords: *Molecular vibration, *Surface chemistry, *Molecular relaxation, *Silicon dioxide, *Chemisorption, *Adsorbates, Spectroscopic analysis, Substrates, Infrared spectroscopy, Molecular energy levels, Reprints, *Lifetimes(Energy levels), Picosecond pulses, Hydroxyl radicals.

Picosecond infrared transient bleaching experiments have been performed to measure the population lifetime (T1) of vibrationally excited (v=1) functional groups chemisorbed on high surface area colloidal silicas (SiO2). The experimental method and results for vibrational modes of -OH, -OD, -NH2 and -OCH3 coordinated to surface silicon atoms and for the -BOH surface species are presented. Lifetimes for these groups at both vacuum and liquid interfaces indicate that the adsorbate degrees of freedom, chemical coordination and nearby substrate modes play an important role in damping vibrational energy. It is also surmised that the vibrational lifetime, especially that for the hydroxyl group (T1=150 ps), is related to the chemical reactivity of adsorbates on surfaces.

705,351
PB85-230738 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Pulsed Laser-Induced Thermal Desorption from Surfaces: instrumentation and Procedures.
Final rept.
D. R. Burgess, I. Hussla, P. C. Stair, R. Viswanathan, and E. Weitz. Nov 84, 6p
Contract N00014-79-C-0794
Pub. in Review of Scientific Instruments 55, n11 p1771-1776 Nov 84.

Keywords: *Laboratory equipment, *Surface chemistry, *Carbon monoxide, *Copper, Experimental design, Desorption, Reprints, *Time of flight mass spectroscopy, *Thermal desorption, *Laser induced desorption, Thermal pulse method, Procedures.

Instrumentation and procedures for performing pulsed laser-induced thermal desorption experiments are described. The influence of various instrumental parameters on the measured desorption signals is discussed. Proper conditioning of the desorption flux is shown to be a critical factor for obtaining desorption signals undistorted by the finite pumping speed of the apparatus. Instrumental effects are illustrated using data for pulsed laser desorption of CO from clean copper surfaces.

705,352
PB85-230753 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Vibrational Energy Transfer Pathways in CH3F Under Weak and Strong Excitation Conditions: A Comparison.
Final rept.
V. A. Apkarian, J. M. Lindquist, and E. Weitz. Dec 84, 7p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Chemical Physics Letters 112, n4 p328-334, 14 Dec 84.

Keywords: *Molecular vibrations, *Energy transfer, *Mathematical models, *Molecular energy levels, Excitation, Comparison, Fluorine organic compounds, Reprints, *Laser induced fluorescence, *Methane/fluoro.

Energy transfer processes in CH3F have been reinvestigated under high excitation conditions with and without added rare gas via a mathematical model developed as a consequence of studies under low excitation. The model can be used to describe energy transfer under high excitation conditions with the inclusion of an additional state and energy transfer pathways coupling that state to others in the model. It is also concluded that multiple photon absorption takes place under high excitation conditions.

705,353
PB85-235232 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Selected Tables of Atomic Spectra: A. Atomic Energy Levels - Second Edition. B. Multiplet Table - O III. Data Derived from the Analyses of Optical Spectra.
C. E. Moore. Jul 85, 35p NBS/NSRDS-3/Suppl 11
See also PB83-208942. Library of Congress catalog card no. 64-6074. Sponsored by Naval Research Lab., Washington, DC. E. O Hulburt Center for Space Research.

Keywords: *Atomic spectra, *Atomic energy levels, *Oxygen, Tables(Data), *Multiplet energies.

The present publication is the eleventh section of a series being prepared in response to the read for a current revision of two sets of the author's tables containing data on atomic spectra is derived from analyses of optical spectra. As in the previous Sections, Part A, contains the atomic energy levels and Part B the multiplet tables. Section II includes these data for O III. The form of the presentation is described in detail in the text to Section I.

705,354
PB85-237329 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 90, Number 3, May-June 1985.
Jun 85, 64p
See also PB85-237337 through PB85-237360 and PB85-200129. Also available from Supt. of Docs as SN703-027-00004-1. Library of Congress catalog card no. 63-37059.

Keywords: *Research projects, Chemical analysis, Bioassay, Phase transformation, Laboratory equipment, Density(Mass/volume), Solids, Standards, Comparison, Volume, Design criteria, Performance evaluation, Fluids, Decomposition reactions, Sulfur hexafluoride, High temperature tests, High pressure tests, Reaction kinetics, Concentration(Composition), Electric corona, Electrophoresis, Chemical reaction mechanisms, Sulfur fluoride oxides, Sulfuryl fluoride, Thionyl fluoride, Thionyl tetrafluoride, PVT properties.

Contents:
- Comparison of solid density standards between IMGC and NBS;
- Production rates for oxyfluorides SOF2, SO2F2, and SOF4 in SF6 corona discharges;
- A high temperature, high pressure reaction-screening apparatus;
- Ways to standardization in electrophoresis are brought to light.

705,355
PB85-237337
(Order as PB85-237329, PC **A04**/MF **A01**)
Istituto di Metrologia Gustavo Colonnetti, Turin (Italy).
Comparison of Solid Density Standards between IMGC (Istituto di Metrologia 'Gustavo Colonnetti') and NBS (National Bureau of Standards).
A. Peuto, and R. S. Davis. 1 Mar 85, 11p
Prepared in cooperation with National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v90 n3 p217-227 May-Jun 85.

Keywords: *Density(Mass/volume), *Solids, *Standards, Silicon, Comparison, Volume.

Solid-object density standards developed independently by the Isituto di Metrologia 'G. Colonnetti' (IMGC) and NBS, and traceable to SI units of length and mass, have been compared using a silicon transfer standard. Results agree to approximately .000001, which is consistent with the uncertainties assigned by the two laboratories.

705,356
PB85-237345
(Order as PB85-237329, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Production Rates for Oxyfluorides SOF2, SO2F2, and SOF4 in SF6 Corona Discharges.
R. J. Van Brunt. 23 Jan 85, 25p
Included in Jnl. of Research of the National Bureau of Standards, v90 n3 p229-253 May-Jun 85.

Keywords: *Electric corona, *Reaction kinetics, *Sulfur hexafluoride, *Chemical analysis, Decomposition reactions, Chemical reactions, Trace elements, Gas chromatography, Mass spectroscopy, *Sulfur fluoride oxides, Chemical reaction mechanisms, Sulfuryl fluoride, Thionyl fluoride, Thionyl tetrafluoride.

The most abundant, long-lived stable gaseous species generated by corona discharges in SF6 gas containing trace levels of O2 and H2O are the oxyfluorides SOF2, SO2F2, and SOF4. Absolute energy and charge rates-of-production of these and the minor products SO2, OCS, and CO2 have been measured at different total gas pressures from 100 kPa to 300 kPa and for discharges of different current, power, and polarity. The discharge current and time dependence of the production rates are discussed in terms of gas-phase mechanisms that have been proposed to explain previous observations of electrical, thermal, and laser-induced decomposition of SF6 and SF6/O2 mixtures. Details of the chemical analysis procedures are given, and application of the results to the design of chemical diagnositcs for SF6-insulated, high-voltage apparatus is discussed.

705,357
PB86-101946 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Vibrational Excitation of D2 by Low Energy Electrons.
Final rept.
S. J. Buckman, and A. V. Phelps. Jun 85, 13p
Pub. in Jnl. of Chemical Physics 82, n11 p4999-5011, 1 Jun 85.

Keywords: *Molecular vibration, *Molecular energy levels, *Deuterium, Excitation, Cross sections, Hydrogen, Carbon dioxide, Carbon monoxide, Nitrogen, Reprints, *Electron molecule collision.

Excitation coefficients for the production of vibrationally excited D2 by low energy electrons have been determined from measurements of the intensity of infrared emission from mixtures of D2 and small concentrations of CO2 or CO. The CO2 and CO concentrations were chosen to allow efficient excitation transfer from the D2 to the carbon containing molecule, but to minimize direct excitation of the CO2 or CO. The measured infrared intensities were normalized to predicted values for N2-CO2 and N2-CO mixtures at E/n where the efficiency of vibrational excitation is known to be very close to 100%. For our H2-CO mixtures the excitation of CO via excitation transfer from H2 is small compared to direct electron excitation of CO molecules. Published experiments and theories on electron-H2 and electron-D2 collisions are reviewed to obtain the cross sections used in the predictions.

705,358
PB86-102407 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Observation of Autoionizing States of Beryllium by Resonance-Ionization Mass Spectrometry.
Final rept.
C. W. Clark, J. D. Fassett, T. B. Lucatorto, L. J. Moore, and W. W. Smith. Jun 85, 6p
Contract DE-AI05-83ER60185
See also DE 85-009047.
Pub. in Jnl. of the Optical Society of America B 2, n6 p891-896 Jun 85.

Keywords: *Beryllium, Excitation, Atomic energy levels, Reprints, *Resonance ionization mass spectroscopy, *Autoionization, Rydberg series.

The authors have made the first reported observations of the Be 2p(sup 2) singlet S state, and of high-lying members of the Rydberg series 2pnd (sup 1)P(sup 0) ($n < \text{or} = 16$), by multiphoton resonance-ionization mass spectrometry (RIMS). The energy of the 1S state is compared with a number of theoretical predictions, which differ from one another over a range of about 0.75 eV. Good agreement is found when corrections are made for intershell electron correlations. These results show that precision spectroscopy can be performed by RIMS with samples of a few hundred atoms and that direct multiphoton excitation of autoionizing states may be a useful new addition to the existing catalog of resonance-ionization schemes.

705,359
PB86-102415 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Ion Chemistry in Silane dc Discharges.
Final rept.
H. Chatham, and A. Gallagher. 1 Jul 85, 11p
Sponsored by Solar Energy Research Inst., Golden, CO.
Pub. in Jnl. of Applied Physics 58, n1 p159-169, 1 Jul 85.

Keywords: *Silane, *Ionization, *Chemical reactions, *Electric discharges, Comparison, Mass spectroscopy, Reprints, *Ion molecule interactions.

The ion production and reactions in dc silane discharges are calculated. It is noted that almost all ion production and reaction occur in the cathode sheath region for typical low-pressure silicon-deposition discharges, so that the calculation considers ion production, drift, and reactions in the sheath region. Sheath models, for inert gas discharges, that utilize local and nonlocal electron energy distributions are compared, and one is adapted to silane conditions. The distribution of ion species (Si(sub l)H(sub m)(+1)) arriving at the cathode is calculated for a range of discharge pressures and currents, for comparison to mass spectrometer measurements. However, the authors do not make quantitative comparisons to reported observations due to sampling-bias issues that have not been taken into account.

705,360
PB86-102423 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Nonadiabatic Molecular Collisions. 2. A Further Trajectory-Surface-Hopping Study of the ArH2(+1) System.
Final rept.
S. Chapman. May 85, 11p
Pub. in Jnl. of Chemical Physics 82, n9 p4033-4043, 1 May 85.

Keywords: *Surface chemistry, Mathematical models, Diatomic molecule, Experimental design, Comparison, Reprints, Ion molecule interactions, *Molecule molecule collisions, *Ion molecule collisions.

Both charge transfer and chemical reaction are studied for the reactants Ar(+1) + H2, Ar + H2(+1), and Ar + D2(+1), using the trajectory-surface-hopping model with diatomics-in-molecules 2A surfaces for ArH2(+1). Results are compared with a number of recent experiments. Agreement with experiment is generally satisfactory. The reactions are direct. The Ar(+1) + H2 yields ArH(+1) + H reaction is well characterized as a stripping process. Charge transfer occurs predominantly by long-range electron jump. Points of disagreement with experiment are discussed in the light of the approximations in the surface and the TSH model.

705,361
PB86-102456 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Remarks on the Translational Diffusion Coefficient of Relatively Short Chains.
Final rept.
A. Z. Akcasu, and C. M. Guttman. 1985, 6p
Pub. in Macromolecules 18, n5 p938-943 1985.

Keywords: *Molecular structure, *Mathematical models, Diffusion coefficients, Hydrodynamic configurations, Reprints, *Polymer chains.

The expansion of the hydrodynamic radius R(sub H) in inverse powers of N(sup 1/2) is presented for three chain models which allow only for local structure along the chain. The effect of chain stiffness is included in one of the models. Formulas are presented to interpret R(sub H) data for relatively short chains. The approach to the Gaussian chain limit as N approaches infinity is discussed.

705,362
PB86-102944 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Rapid Collisional Quenching of the N=1, nu=2 level of the H2(cu c)pi(sub u) Metastable State by H2.
Final rept.
H. Tischer, and A. V. Phelps. Jul 85, 5p
Pub. in Chemical Physics Letters 117, n6 p550-554 Jul 85.

Keywords: *Hydrogen, *Reaction kinetics, *Metastable state, Electric discharges, Quenching distance, Reprints, *Molecule molecule collisions, *Laser spectroscopy.

The rate coefficient for collisional quenching of the N = 1, nu =2 level of the H2(cu c Pi(sub u)) metastable state by H2 is measured to be (2.0 + or - 0.2) x 10 to the -15th power cu m/s at 300 K. The metastables are produced by an electric discharge, radiatively quenched by a pulsed laser and the recovery of metastable population monitored by cw dye laser absorption.

705,363
PB86-102969 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Laser-Assisted Charge-Transfer Reactions (Li(+3) + H): Coupled Dressed-Quasimolecular-State Approach.
Final rept.
T. S. Ho, C. Laughlin, and S. I. Chu. Jul 85, 11p
Pub. in Physical Review A 32, n1 p122-132 Jul 85.

Keywords: *Hydrogen, Perturbation theory, Hamiltonian functions, Reprints, *Lithium ions, *Dressed quasimolecular states, *Laser enhanced ionization, Generalized Van Vleck theory, Floquet theory.

A semiclassical coupled dressed-quasimolecular-states (DQMS) approach is presented for nonperturbative treatment of multichannel charge-transfer reactions at low collision velocities and high laser intensities, incorporating the implementation of the generalized Van Vleck (GVV) nearly degenerate perturbation theory. The GVV technique allows block partitioning of the infinite-dimensional Floquet Hamiltonian into a finite-dimensional model DQMS space, and thereby reduces greatly the number of effective coupled channels. Further, the GVV-Floquet basis allows minimization of the (usually large in amplitude) field-induced nonadiabatic radial couplings without the need to explicitly construct the transformation between the adiabatic and diabatic DQMS basis. This yields a new set of coupled GVV-DQMS equations (neither adiabatic nor diabatic) which are particularly convenient for multichannel calculations.

705,364
PB86-102977 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Ab Initio Calculations of Low-Energy Electron Scattering by HCN Molecules.
Final rept.
A. Jain, and D. W. Norcross. Jul 85, 10p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A32, n1 p134-143 Jul 85.

Keywords: *Cyanides, *Molecular rotation, *Electron scattering, Mathematical models, Comparison, Experimental design, Excitation, Hartree Fock approximation, Reprints, *Electron molecule collisions.

The authors report results for vibrationally elastic scattering over the energy range 0.0006-11.6eV. The interaction potential is composed of a near-Hartree-Fock static term plus a parameter-free model of the correlation-polarization potential. The exchange interaction is included exactly through a separable expansion. Results with a model-exchange potential (free-electron-gas plus orthogonalization) are also reported. A resonance appears in pi symmetry near 2.7eV (width 1.9eV) that may be the same feature observed in several experiments. In the model-exchange calculation the pi resonance is shifted toward higher energy (3.8eV, width 2.4eV). The sigma symmetry was also found to be very sensitive to the treatment of exchange and to the effect of polarization. Differential and rotational excitation cross sections are evaluated in the multipole-extracted adiabatic-nuclei approximation. Results are compared with the available experimental and theoretical data.

705,365
PB86-103025 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Hyperfine Structure of the 2p doublet P(sub 1/2) State in (sup 9)Be(+).
Final rept.
J. J. Bollinger, J. S. Wells, D. J. Wineland, and W. M. Itano. 1985, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Physical Review A 31, n4 p2711-2714 Apr 85.

Keywords: *Hyperfine structure, *Atomic energy levels, Excitations, Magnetic dipoles, Reprints, *Beryllium ions.

An optical-optical double resonance technique has been used on beryllium ions stored in a Penning trap to measure the magnetic dipole hyperfine interaction constant A(sub 1/2) of the 2p double P(sub 1/2) level in (sup 9)Be(+). The measured value of A(sub 1/2) = -118.6(3.6) MHz is in good agreement with theoretical calculations.

705,366
PB86-103470 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
NBS (National Bureau of Standards): Materials Measurements. Annual Report for 1 April 1984-31 March 1985.
J. R. Manning. Jul 85, 98p NBSIR-85/3217
Contract NASA-H-27954-B
See also PB80-223159.

Keywords: *Interfacial tension, *Convection, *Thermodynamic properties, Gallium, Silicon, Impurities, Reduced gravity, *Directional solidification, Temperature dependence, Levitation.

The report describes NBS work for NASA in support of NASA's Microgravity Science and Applications Program under NASA Government Order H-27954B (Properties of Electronic Materials) covering the period April 1, 1984 to March 31, 1985. The work has been carried out in three independent tasks: Task 1--Surface Tensions and Their Variations with Temperature and Impurities; Task 2--Convention during Unidirectional Solidification; Task 3--Measurement of High Temperature Thermodynamic Properties. The results for each task are given separately in the body of the report.

705,367
PB86-103496 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Molecular and Microstructural Factors Affecting Mechanical Properties of Polymeric Cover Plate Materials.
E. J. Clark. Jul 85, 67p NBSIR-85/3197
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.

Keywords: *Mechanical properties, *Polymers, *Microstructure, *Degradation, *Coverings, Reviews, Deformation, Structural analysis, Plastics, Molecular structure, Molecular weight, Crosslinking, Materials tests.

The paper reviews the dependence of mechanical properties of polymers on various microstructural factors. The microstructural and molecular factors considered are: molecular weight, crystallinity, crosslinking, branching, copolymerization, plasticization, orientation, and residual stresses. The types of mechanical properties considered are: direct loading, fatigue, creep, wear and abrasion, and environmental stress cracking. The effects of polymer deformation and fraction at the molecular level are discussed. Cracking, crazing, and shear yielding are described. Polymeric cover plate materials are discussed and their degradation reviewed. Methods to measure microlevel changes in polymers are identified.

705,368
PB86-103603 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Electron Spectrometry Study of Associative and Penning Ionization in Laser Excited Sodium Vapor.
Final rept.
B. Carre, G. Spiess, J. M. Bizau, P. Dhez, P. Gerard, F. Wuilleumier, J. C. Keller, J. L. Picque, D. L. Ederer, and P. M. Koch. 1 Nov 84, 6p
Pub. in Optics Communications 52, n1 p29-34, 1 Nov 84.

Keywords: *Ionization, *Electronic spectra, *Atomic energy levels, Excitation, Synchrotron radiation, Reprints, *Sodium atoms, *Penning effect, *Laser enhanced ionization.

The first observation, by electron spectrometry, is reported in laser-excited sodium vapor of the primary low energy electrons produced by associative ionization and by Penning ionization of sodium atoms in highly excited nl states. The sequential heating of these primary electrons has been observed in 1, 2, or 3 superelastic collisions with Na (3p) atoms. The variation of associative ionization was measured as a function of the excited state density by using inner-shell photoionization produced by synchrotron radiation.

705,369
PB86-103629 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron Impact Excitation of Ions in the Magnesium Sequence: Fe XV.
Final rept.
R. B. Christensen, D. W. Norcross, and A. K. Pradhan. Jul 85, 12p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A32, n1 p93-104 Jul 85.

Keywords: *Quantum theory, Excitation, Hamiltonian functions, Reprints, *Electron ion interactions, *Electron ion collisions, *Magnesium ions.

Intermediate-coupling collision strengths are calculated for all transitions between the states. Calculations are carried out in a ten-state distorted-wave approximation. Resonance effects are considered by using multichannel quantum-defect theory, and relativistic effects in the target Hamiltonian are taken into account in the Breit-Pauli formulation. Term coupling among the target states also affects several transitions considerably. Present results are compared with previous calculations; some significant differences are noted. The new results suggest a serious discrepancy between calculated and observed relative intensities of the 284.2-A (resonance) and 417.3-A (intercombination) lines for Fe XV in the Sun, but will reduce the discrepancy for this ratio for other Mg-like ions observed in tokamak plasmas.

705,370
PB86-109949 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO.
Glass Fiberblanket SRM (Standard Reference Material) for Thermal Resistance.
Final rept.
J. G. Hust. Sep 85, 30p NBS/SP-260/103
Also available from Supt. of Docs as SN003-003-02687-5. Library of Congress catalog card no. 85-600582.

Keywords: *Glass fibers, *Thermal resistance, *Thermal insulation, *Standards, Thermal conductivity, *Blankets(Bedding), *Standard reference materials.

The apparent thermal conductivity data that provide the basis for the certification of glass fiberblanket as an SRM of thermal resistance are reported and analyzed. Detailed analysis and intercomparisons of NBS and other published data are given. These data are represented by an equation describing the dependencies of the data on temperature and density. Certified values of thermal resistance are given for temperatures from 100 to 330 K and densities from 10 to 16 kg/cu m.

705,371
PB86-110178 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Stability and Corrosion Div.
Thermodynamic Models of Alkali-Metal Vapor Transport in Silicate Systems.
Final rept.
J. W. Hastie, W. S. Horton, E. R. Plante, and D. W. Bonnell. 1982, 11p
Pub. in High Temperature - High Pressures 14, n6 p669-679 1982.

Keywords: *Thermodynamics, *Mathematical models, *Transport properties, *Alkaline earth metals, *Silicates, *Liquid theory, Experimental design, Vaporizing, High temperature tests, Solutions, Reprints.

A thermodynamic data base has been developed for liquid/solid mixtures containing K2O, Al2O3 and SiO2. Together with the hypothesis of Ideal Mixing of Complex Phases (IMCP) this data base reproduces experimental activity data, expressed here for convenience in terms of P(sub K), over a wide range of composition and temperature. The authors are confident that the model (IMCP + data base) can be applied to the prediction of solution thermodynamics, vaporization rates, and prehaps even phase stability diagrams for systems not readily amenable to experimental study. As a future extension of this work, they will progressively extend the data base and provide model validation tests for systems containing Na2O, CaO, MgO and Fe2O3, in addition to the components considered here.

705,372
PB86-111366 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Beam Broadening in the Analytical Electron Microscope.
Final rept.
D. E. Newbury. 1982, 5p
Sponsored by Microbeam Analysis Society, Bethesda, MD.
Pub. in Proceedings of Annual Conference of the Microbeam Analysis Society (17th), Washington, DC., August 9-13, 1982, p79-83.

Keywords: *Electron microscopes, *X ray analysis, Scattering cross sections, Elastic scattering, Mathematical models, Gold, *Beam foil spectroscopy.

Beam spreading in thin foils occurs in the analytical electron microscope as a result of elastic scattering. Various models which attempt to quantify the dimensions of the spreading are cataloged: analytic single, plural, and multiple scattering models, thermal diffusion analog model, and Monte Carlo electron trajectory simulations. Despite apparent differences in the assumptions of the models, calculated results show only a 30% range for a gold foil. This similarity is ascribed to a basic dependence on the single scattering cross section for all of the models.

705,373
PB86-111382 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Monte Carlo Electron Trajectory Calculations of X-ray Generation in Tilted, Solid Specimens.
Final rept.
D. E. Newbury, and R. L. Myklebust. 1981, 3p
Pub. in Proceedings of Annual Conference of the Microbeam Analysis Society (16th), Vail, CO., July 13-17, 1981, p175-177.

Keywords: *Solids, *X-ray analysis, *Monte Carlo method, Electron probes, Backscattering, Sampling, Numerical solution.

Monte Carlo electron trajectory calculations provide a useful technique to obtain information on electron beam interactions in solids in situations in which direct experimental measurements are difficult or impossible. In the present work, electron interactions have been simulated in solid specimens tilted at various angles to the incident beam. Parameters which describe certain aspects of x-ray generation, including the characteristic-bremsstrahlung ratio (peak-to-background), loss of generation due to electron backscattering, and the x-ray absorption effect, have been determined in support of the development of methods for quantitative x-ray micro-analysis of tilted samples.

705,374
PB86-111713 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Measurements of the Viscosities of Saturated and Compressed Liquid Normal Butane and Isobutane.
Final rept.
D. E. Diller, and L. J. Van Poolen. Jan 85, 20p
Sponsored by Gas Research Inst., Chicago, IL., and Department of Energy, Washington, DC.
Pub. in Int. J. Thermophysics 6, n1 p43-62 Jan 85.

Keywords: *Viscosity, Compressed liquid, Density(Mass/volume), Saturation, Piezoelectric crystals, Butanes, Reprints, *Butane, *Propane/methyl, Numerical solution.

The shear viscosity coefficients of saturated and compressed liquid normal butane and isobutane have been measured with the torsional piezoelectric crystal method at temperatures between 115 and 300 K and at pressures to 30 MPa. The measurements have been correlated with a modified Hildebrand equation. The experimental error is estimated to be smaller than 3%. The measurements of normal butane and isobutane have been compared with a global extended corresponding states model and with each other. Differences between measured and calculated viscosities are discussed.

705,375
PB86-111747 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Excited States Created in Charge Transfer Collisions between Atoms and Highly Charged Ions.
Final rept.
R. K. Janev. 1983, 14p
Pub. in Physica Scripta T3, p208-221 1983.

Keywords: *Atomic energy levels, Excitation, Electron transfer, Electron capture, Reprints, *Atom ion collisions, *Charge exchange reactions.

A survey of theoretical achievements and problems in the study of formation of excited states in atom-highly charged ion charge-exchange collisions is presented. Both one- and many-electron colliding systems are considered. Apart from the basic single electron transfer reactions, other multi-electron transition processes leading to creation of excited product states are also discussed. The theoretical data on the final state distributions of capture electrons are critically analyzed and the problems which require further investigations are emphasized.

705,376
PB86-111754 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron Capture into Excited States in H + Ar(+18), Kr(+36) and Xe(+54) Charge Transfer Collisions.
Final rept.
R. K. Janev, and D. S. Belic. 1983, 3p
Pub. in Physica Scripta T3, p246-248 1983.

Keywords: *Electron capture, *Atomic energy levels, Excitations, Electron transfer, Mathematical models, Reprints, *Charge exchange reactions, *Atom ion collisions.

Partial cross sections for electron capture into specific final state principal shells in H + Ar(+18), Kr(+36) and Xe(+54) collisions are calculated. A multi-channel Landau-Zener model, which includes also the rotational transitions in the ionic channels, is employed. The calculations are performed in the energy range from .01 to 100 keV/amu.

705,377
PB86-111796 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Pump-Probe Techniques Applied to Spectroscopic and Kinetic Studies of Radicals.
Final rept.
D. S. King, and R. F. Wormsbecher. 1981, 6p
Sponsored by SPIE-The International Society for Optical Engineering, Bellingham, WA.
Pub. in Proceedings of the SPIE Laser Spectroscopy for Sensitive Detection Conference, Washington, DC., April 23-24, 1981, v286 p111-116.

Keywords: *Free radicals, *Reaction kinetics, *Electron probes, Dissociation, Molecular relaxation, Mass transfer, Electronic pumping, Combustion products, Gas analysis, *Laser spectroscopy, Air pollution detection, Nitride/methyl, Atmospheric chemistry.

In response to recent interests in laser applications to monitoring the role of radical species in combustion and atmospheric chemistry several new techniques have been developed. In this paper the authors discuss a laser-probe technique utilized in our lab to obtain spectroscopic data for such in situ or long range studies and kinetic data on mass transport, vibrational and rotational relaxation, and chemical delay. The work utilizes a pulsed photolysis (excimer, YAG, CO2) laser to generate the radical in a well defined spatial region and a second probe (tunable dye) laser delayed in time. Applications of this technique to relaxation processes in CF2 and to new spectroscopic data on OCH3 will be discussed.

705,378
PB86-111820 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Applications of Equilibrium Diagrams to Corrosion and Electrodeposition.
Final rept.
J. Kruger. 1982, 19p
Pub. in Proceedings of Diagrams of Chemical and Electrochemical Equilibria: Their Setting-Up and Applications, Brussels, Belgium, September 2-5, 1981, p215-233 1982.

Keywords: *Chemical equilibrium, *Corrosion prevention, *Electrodeposition, *Phase diagrams, Passivity, pH, Electrolysis, Oxidation, Reviews, Metal coatings, Solutions.

The application of the equilibrium pH-potential diagrams to corrosion has been a crowning accomplishment of CEBELCOR, especially its founder, M. Pourbaix. This review will describe the application of these diagrams to both corrosion and electrodeposition problems in aqueous systems at room temperature. For corrosion the diagrams have been used in the classic applications of establishing theoretical domains of conditions for corrosion, immunity and passivation, resistance of metals to pure water, the use of oxidizing corrosion inhibitors, and the classification of the degree of nobility of metals. Other applications have been to localized corrosion, passivity, problems in complex practical environments, e.g., atmospheric corrosion, useful corrosion processes and corrosion protection measures. For electrodeposition, the diagrams have been used to determine conditions to promote desired cathodic and anodic processes and to select suitable electrolytic solutions. The application of the diagrams to the development of new electrodeposition technologies, e.g., pulsed electrodeposition of alloy coatings, looks promising.

705,379
PB86-111838 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Passivity and Breakdown of Passivity.
Final rept.
J. Kruger. 1982, 14p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of Electrochemistry in Industry: New Directions, Cleveland, OH., October 20-22, 1980 p317-330 1982.

Keywords: *Passivity, *Corrosion, *Iron, *Surface chemistry, Electrochemistry, Ferrochromium, Molecular structure, Films.

The structure, composition and mechanism of formation of the passive film on iron is described. Breakdown of passivity mechanisms are discussed along with the role that structure and alloy composition play in breakdown processes.

705,380
PB86-111861 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Structure of Passive Films on Iron Using a New Surface-EXAFS (Extended X-ray Absorption Fine Structure) Technique.
Final rept.
G. G. Long, J. Kruger, D. R. Black, and M. Kuriyama. 1983, 8p
Pub. in Jnl. of Electroanalytical Chemistry and Interfacial Electrochemistry 150, n1-2 p603-610 1983.

Keywords: *Molecular structure, *Surface chemistry, *Iron, *Iron oxides, *Corrosion, Chemical bonds, Crystal structure, Fine structure, Reprints, *Extended X ray absorption fine structure.

There exists considerable controversy about the structure, the bonding, and the composition of the passive films that form on iron surfaces in aqueous electrolytes. A major problem is that most of the surface analytical techniques used to characterize the passive film require exposure to vacua, which can alter the structure of the passive film. This study seeks to overcome this problem through the application of a new surface-EXAFS (extended x-ray absorption fine structure) technique that is both extremely sensitive to structural and bonding changes in the 2 to 3 nm passive film and does not require the use of a vacuum environment. Near edge and extended x-ray absorption fine structure spectra from passive films on iron were measured and compared with those from pure iron and a polycrystalline iron oxide of known structure. The EXAFS data provide a measure of the relative disorder in the passive films, and they were used to derive bond lengths for the iron-to-oxygen and the iron-to-iron coordination shells.

705,381
PB86-111911 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Adsorption and Decomposition of N2O on Ru(001).
Final rept.
T. E. Madey, N. R. Avery, A. B. Anton, B. H. Toby, and W. H. Weinberg. 1983, 2p
Pub. in Jnl. of Vacuum Science and Technology, A1 n2 p1220-1221 Apr/Jun 83.

Keywords: *Nitrogen oxide(N2O), *Adsorption, *Decomposition, *Surface chemistry, Chemisorption, Chemical bonds, Ruthenium, Reprints, Molecular configuration.

The authors found evidence that N2O binds to Ru(001) at 75K via the N atom in both vertical and inclined configurations, and that chemisorbed N2O both desorbs molecularly and decomposes to N2(g) and 0(ads) when the surface is heated.

705,382
PB86-111929 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Nascent Vibrational and Rotational Distributions from the Charge Transfer Reaction Ar(+1) + CO yields CO(+1) + Ar at Near Thermal Energy.
Final rept.
G. H. Lin, J. Maier, and S. R. Leone. Jun 85, 9p
Grants NSF-CHE79-11340, NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 82, n12 p5527-5535, 15 Jun 85.

Keywords: *Molecular vibration, *Molecular rotation, Carbon monoxide, Argon, Fluorescence, Reprints, *Laser induced fluorescence, *Flowing afterglow, *Ion molecule collisions, Franck-Condon principle, Argon ions.

Saturated laser-induced fluorescence detection is used to study the vibrational and rotational distributions produced in the charge transfer reaction Ar(+1)(double+ P(sub 3/2) + CO(X) singlet sigma(+1) nu=0) yields Ar(singlet S(sub 0) + CO(+1) (X doublet sigma (+1), nu=0-7) at 0.2 eV energy. The apparatus combines a flowing afterglow ion source with a sampling orifice to obtain a supersonic expansion of near thermal energy ions for reaction under nearly single collision conditions in the reaction chamber. The experimental results are better explained by a potential surface crossing at close approach, than either by considerations of strict Franck-Condon overlaps or energy resonance.

705,383
PB86-111937 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Steric Effects in Neophyltin(IV) Chemistry.
Final rept.
T. P. Lockhart. 1985, 8p
Pub. in Jnl. of Organometallic Chemistry 287, n2 p179-186 1985.

Keywords: *Nuclear magnetic resonance, Metal containing organic compounds, Stability, Solutions, Chemical equilibrium, Reprints, *Steric effects, *Distannoxane/neophyl.

The stability and self-association in solution of (neophyl3Sn)2o, neophyl3SnOH, and (neophyl3Sn)2CO3 (neophyl=C6H5(CH3)2CCH2) have been examined by 119Sn NMR. The presence of Sn,Sn spin coupling through oxygen (doublet J(119Sn,117Sn)) has been used to distinguish between the distannoxane and stannol. These observations are in sharp contrast with a previous report that the sterically bulky neophyl ligands render neophyl3SnOH stable toward dehydration. Singlet J((119)Sn,(13)C) observed for neophyl3SnOH and (neophyl3Sn)2CO3 indicates that these compounds, unlike their n-alkyl-substituted homologues, are unassociated in solution, a result attributed to the steric bulk of the neophyl ligand.

705,384
PB86-111978 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
High Excitation of Two Electrons.
Final rept.
A. R. P. Rau. 1984, 14p
Grant NSF-PHY81-20243
Sponsored by National Science Foundation, Washington, DC.
Pub. in Proceedings of International Conference on Atomic Physics (9th), Seattle, WA., July 1984, Atomic Physics 9, p491-504.

Keywords: *Atomic energy levels, Excitation, Quantum numbers, Oxygen, *Electron electron interactions.

Doubly-excited states of high excitation in atoms and ions - their description through appropriate quantum numbers, mechanisms for their excitation and very recent experimental evidence for them - are reviewed. The states are divided into two classes depending on whether the two electrons have comparable excitation or are widely disparate in their radial extent. Different sets of quantum numbers are appropriate to the description of the two kinds of states. In particular, the states of high and comparable excitation are best viewed as a single entity, the pair, attached to the grandparent ion, with a reference throughout only to quantum numbers characteristic of the pair. Elements from the literature on planetary atoms, ridge states, O4 group symmetry for two electrons, the adiabatic hyperspherical method, and the Wannier theory for two-electron escape are brought together in the description of pathways to, and properties of, high excitation.

705,385
PB86-112000 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Liquid-Vapor Interface of a Binary Liquid Mixture Near the Consolute Point.
Final rept.
J. W. Schmidt, and M. R. Moldover. 15 Aug 85, 6p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Physics 83, n4 p1829-1834, 15 Aug 85.

Keywords: *Surface chemistry, *Binary systems(Materials), *Critical point, Polarimetry, Molecular structure, Mixtures, Ternary systems, Refractivity, Adsorption, Liquid phases, Vapor phases, Temperature, Reprints, *Isopropyl alcohol, *Cyclohexane/fluoro-methyl.

The liquid-vapor interface above mixtures of isopropanol (i-C3H7OH) and perfluoromethylcyclohexane (C7F14) has been studied in the vicinity of the consolute point T(sub c) = 363 K). As three-phase coexistence is approached, the excess fluorocarbon adsorbed at this interface increases; the adsorption is expected to diverge at T(sub c) for a mixture of the critical composition. A simple model of the interface which incorporates the adsorption anomaly is compared with out ellipticity measurements. Both the model and our data yield ellipticities which have a finite maximum at 0.1 K above T(sub c). Ellipticity data for noncritical compositions are presented; however, their analysis will be presented elsewhere.

705,386
PB86-112018 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Oxygen-Induced CO Reorientation on Cr(110).
Final rept.
N. D. Shinn, and T. E. Madey. Jun 85, 5p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Vacuum Science and Technology A3, n3 p1673-1677 May/Jun 85.

Keywords: *Carbon monoxide, *Chemisorption, *Oxygen, Chromium, Surface chemistry, Chemical bonds, Reprints, Electron energy loss spectroscopy, Electron stimulated desorption ion angular distributions, Low energy electron diffraction, Auger electron spectroscopy.

Studies of CO and CO/O chemisorption on Cr(110) at 120 K using high resolution electron energy loss spectroscopy (EELS), electron stimulated desorption ion angular distributions (ESDIAD), low energy electron diffraction (LEED), and Auger electron spectroscopy (AES) are reported. On the clean surface, two molecular binding modes are sequentially populated.

705,387
PB86-112042 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Two-Laser Pulse-and-Probe Study of T-R,V Energy Transfer Collisions of H + NO at 0.95 and 2.2 eV.
Final rept.
C. A. Wight, D. J. Donaldson, and S. R. Leone. 15 Jul 85, 8p
Sponsored by Army Research Office, Research Triangle Park, NC.
Pub. in Jnl. of Chemical Physics 83, n2 p660-667, 15 Jul 85.

Keywords: *Molecular rotation, *Molecular vibration, *Spin orbit interactions, Nitrogen oxide(NO), Excitation, Temperature, Reprints, *Atom molecule collision, *Laser induced fluorescence, Hydrogen atoms.

Vibrational, rotational, and spin-orbit state distributions are obtained for inelastic collisions of H+NO at 2.2 and 0.95 eV. The H atoms are generated by excimer laser photolysis of H2S at 193 and 248 nm, respectively, and the excited states of the NO molecules are probed by laser-induced fluorescence using a tunable dye laser. The rotational state distribution accompanying the T-V excitation of nu = 1-3 at 2.2 eV is approximately characterized by a Boltzmann distribution at 1275 K, and is essentially independent of the vibrational level excited. At 0.95 eV, the rotational populations are approximately characterized by a 1050 K distribution. In each case, the temperatures of the spin-orbit state populations and the rotational states are the same. No selective population of lambda doublet states is observed. The results are discussed in terms of chemical interactions between these two open-shell species on the HNO potential energy surfaces.

705,388
PB86-112075 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Electrical Test Structure for Proximity Effects Measurement and Correction.
Final rept.
D. Yen, L. W. Linholm, and W. B. Glendinning. Jul 85, 4p
Pub. in Jnl. of the Electrochemical Society 132, n7 p1726-1729 Jul 85.

Keywords: *Test specimens, *Electronic test equipment, *Lithography, Design criteria, Distance, Experimental designs, Reprints, Electron beam lithography.

The paper describes the design of a proximity effect test structure and electrical test method for estimating the magnitude of proximity effects in electron-beam lithography. The test structure consists of a van der Pauw cross resistor for measuring sheet resistance, a bridge resistor for measuring electrical linewidth, and a second bridge resistor simulating a close line-space environment for measuring electrical linewidth where proximity exposure effects from nearby patterns may be encountered. In this experiment, test structures were delineated in aluminum on silicon wafers using electron-beam exposure and wet chemical etching. Electrical measurements from these test structures are compared to optical measurements to verify the measurement method. In addition, results from the test structures are used to estimate the parameters for the gaussian model commonly used for proximity correction.

705,389
PB86-112091 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Multiple Ionization of a Hartree Atom by Intense Laser Pulses.
Final rept.
S. Geltman. 29 Apr 85, 4p
Pub. in Physical Review Letters 54, n17 p1909-1912, 29 Apr 85.

Keywords: *Ionization, *Hartree-Fock approximation, *Atoms, Atomic orbitals, Reprints, *Laser applications.

It is shown that a good representation of recent experimental results on the relative production of multiply charged ionic states by intense laser pulses of various wavelengths may be obtained on the basis of Hartree's independent-electron shell model of the atom.

705,390
PB86-112109 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Dielectronic Recombination as a Direct Free-Bond Radiative Process.
Final rept.
S. Geltman. 1985, 18p
Grant NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 18, n7 p1425-1442 1985.

Keywords: *Atomic energy levels, Ionization, Chemical equilibrium, Elastic scattering, Comparison, Excitation, Reprints, *Autoionization, *Dielectronic recombination, *Dipole radiation, Electron ion collision, Rydberg series.

The process of dielectronic recombination is studied in terms of the standard treatment of a free-bound dipole radiative transition between stationary states. The initial free state of electron-ion resonant elastic scattering is analysed using the Fano formulation for discrete-state-continuum configuration mixing. In most cases there is reasonable overall qualitative agreement, but uncertainties in the final-state distributions involved in the measurements prevent a fully quantitative comparison. The effects of external fields on the dielectronic recombination process are also discussed in the context of the present method.

705,391
PB86-112158 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Product Vibrational State Distributions of Thermal Energy Charge Transfer Reactions Determined by Laser-Induced Fluorescence: N(+1) + CO yields CO(+1)(nu=0-2) + N.
Final rept.
C. E. Hamilton, V. M. Bierbaum, and S. R. Leone. Jul 85, 10p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 83, n2 p601-610, 15 Jul 85.

Keywords: *Molecular vibration, Carbon monoxide, Nitrogen, Dynamics, Reprints, *Laser induced fluorescence, *Ion molecule interactions, *Flowing afterglow, Nitrogen ion.

The nascent vibrational state distribution of the N(+1) + CO yields CO(+1)(v=0-2)+ N charge transfer reaction is measured at thermal energy. The reaction is carried out in a flowing afterglow and the vibrational state populations are determined by laser-induced fluorescence on the CO(+1)(A(sup 2) pi-X(sup 2) sigma (+1) system. The observed vibrational distribution suggests that neither a long-range Franck-Condon mechanism nor an energy resonant process adequately describes the charge transfer reaction. A dual channel mechanism of the reaction is considered, in which a fraction of the reactive collisions proceed by a long-range Franck-Condon mechanism while the remainder proceed via a long-lived NCO(+1) intermediate. The intermediate may lead tothe observed extent of CO(+1) vibrational excitation either through statistical partitioning of the energy or by dynamical changes in the CO bond length through specific molecular orbital occupancies.

705,392
PB86-112166 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Nascent Product Vibrational State Distributions of Thermal Ion-Molecule Reactions Determined by Infrared Chemiluminescence.
Final rept.
C. E. Hamilton, and S. R. Leone. 1985, 18p
Grant NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Gas Phase Chemiluminescence and Chemiionization, p139-156 1985.

Keywords: *Molecular vibration, *Infrared analysis, *Chemiluminescence, Excitation, Chemical reactions, *Ion molecule interactions, *Flowing afterglow.

A flowing afterglow apparatus is used to study the dynamics of ion-molecule reactions by detection of vibrational states in the products with infrared chemiluminescence. Other reactions of polyatomic molecules have been studied to test whether the products are formed in a 'direct' fashion or through a long-lived collision intermediate. The results are compared to successful theoretical models of Gauyacq, in which the electron is released by dynamically-induced transitions on the outer region of the potential upon the initial reagent approach.

705,393
PB86-112174 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Temperature Dependence of the Vibrational Population Lifetime of OH(nu=1) in Fused Silica.
Final rept.
E. J. Heilweil, M. P. Casassa, R. R. Cavanagh, and J. C. Stephenson. 7 Jun 85, 6p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Chemical Physics Letters 117, n2 p185-190, 7 Jun 85.

Keywords: *Silicon dioxide, *Molecular vibration, *Infrared spectroscopy, *Relaxation(Mechanics), Reprints, *Hydroxyl radicals, *Picosecond pulses.

An infrared picosecond transient bleaching technique was used to measure vibrational lifetimes T(sub 1) of hydroxyl groups in fused silica over the temperature range 100-1450 K. T(sub 1) decreases from 109 to 15 ps in this range. The T(sub 1) temperature dependence is compared to non-radiative relaxation theory for the decay of the OH(nu=1) quantum by a multiphonon mechanism.

705,394
PB86-112828 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Chemisorbed Oxygen on Ni(110) Studied by Spin Polarized Inverse Photoemission.
Final rept.
C. S. Feigerle, A. Seiler, J. L. Pena, R. J. Celotta, and D. T. Pierce. 1985, 4p
Sponsored by Office of Naval Research, Arlington, VA., and National Science Foundation, Washington, DC.
Pub. in Jnl. of Vacuum Science and Technology, A3 n3 p1487-1490 May/Jun 85.

Keywords: *Chemisorption, *Oxygen, *Surface chemistry, *Oxidation, Nickel, Polarization(Spin alignment), Electron diffraction analysis, Reprints, *Spin polarized inverse photoemission spectroscopy, Low energy electron diffraction, Auger electron spectroscopy.

Dissociative chemisorption of O2 on the surface on Ni(110) has been investigated by the techniques of AES, LEED, and spin polarized inverse photoemission spectroscopy (SPIPES). SPIPES provides a unique method for studying the empty electronic states of the majority and minority spin bands separately and at the same time serves as a surface magnetometer. This is taken as evidence for interactions of the adsorbate with the d levels of the substrate.

705,395
PB86-112844 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interfacially Controlled Phenomena in the System Potassium Carbonate-Potassium Aluminate.
Final rept.
L. P. Cook. 1981, 12p
Sponsored by Department of Energy, Washington, DC.
Pub. in Materials Science Research 14, p143-154 1981.

Keywords: *Potassium carbonates, *Potassium aluminates, *Interfacial tension, Melting points, Crystallography, Liquid phases, Experimental design, Clathrate compounds.

Anomalous melting behavior is described in the system K2CO3-KA102. Compositions with less than 90 mole % K2CO3 show no evidence of melting at 1150C despite the known melting of pure K2CO3 at 901C. X-ray analysis of the products shows primarily well-defined patterns of K2CO3 and KA102. The influence of platinum reaction and surface tension effects is discussed. The possibility of a regular intergrowth of potassium carbonate with potassium aluminate along a crystallographically-controlled interface at temperatures above the melting point of K2CO3 is suggested as a way of explaining the experimental data. This intergrowth could occur either in the form of an intercalation-type solid or as a partially ordered liquid (mesomorphic) phase.

705,396
PB86-112893 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Improved Analysis Procedures for Deep-Level Measurements by Transient Capacitance.
Final rept.
W. E. Phillips, W. R. Thurber, and J. R. Lowney. 1983, 6p
Pub. in Proceedings of the Electrochemical Society 83-9, p485-490 1983.

Keywords: *Semiconductor diodes, *Semiconductors(Materials), Semiconductor doping, Density(Mass/volume), Platinum, Silicon, Reprints, *Deep level transient spectroscopy.

The procedures reported here provide a way to analyze data from nonexponential transient capacitance measurements made under conditions such that (a) the traps are charged in only a part of the depletion layer or (b) the trap density is not small compared with the net shallow dopant density. This analysis requires 1/(C squared) vs. V data to be linear over the voltage range used, which may be a small range at low temperatures because of the compensation effect of traps. Computer simulations of 1/(C squared) vs. V plots are given for various ratios of trap and dopant densities at several temperatures and show ranges which are sufficiently linear, but which have a trap-density-dependent slope. These effects are illustrated by experimental 1/(C squared) vs. V, isothermal transient capacitance (ITCAP), and DLTS measurements for a wide range of densities of platinum in p(sup +)n and n(sup +)p silicon diodes.

705,397
PB86-113636 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Defects and Charge Transport in Stabilized alpha-Ta2O5.
Final rept.
A. McHale, and H. L. Tuller. Aug 83, 15p
Pub. in Radiation Effects 75, n1-4 p267-281 Aug 83.

Keywords: *Tantalum oxide, *High temperature tests, Stability, Electronic conductivity, Transport properties, Ions, Thermodynamics, Reprints.

The high temperature form of tantalum oxide, alpha-Ta2O5, stabilized by the addition of several mol% Sc2O3 has been shown to be an excellent oxygen conductor, comparable to stabilized zirconias in the range 500-950C. Electrical conductivity is characterized by the dominant ionic component in air, with an activation ene of about/ev. N-type electronic conduction, proportional to P(sub O2)(sup -1/4), becomes significant at highly reduced oxygen partial pressures and high temperatures. Transport properties have been characterized using complex impedance methods. Galvanic cell measurement of ionic transference number was used to confirm oxygen ions as dominant charge carriers. Both polycrystalline and single crystal specimens were examined. Stabilization of high Ta2O5 via incorporation of aliovalent impurities is discussed in relation to its probable effects on crystalline anisotropy and charge transport.

705,398
PB86-113693 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Materials.

Development of a One-Micrometer-Diameter Particle Size Standard, SRM (Standard Reference Material) 1690.
Final rept.
G. W. Mulholland, A. W. Hartman, G. G. Hembree, E. Marx, and T. R. Lettieri. May 85, 36p NBS/SP-260/95
Also available from Supt. of Docs as SN003-003-02665-4. Library of Congress catalog card no. 85-600539.

Keywords: *Particle size, *Standards, *Particle size distribution, Refractivity, Aerosols, Light scattering, Polystyrene, Spheres, Error analysis, *Standard reference materials, Transmission electron microscopy.

The average diameter of the first micrometer particle size standard (Standard Reference Material 1690), an aqueous suspension of monosized polystyrene spheres with a nominal 1micrometers diameter, was accurately determined by three independent techniques. In one technique the intensity of light scattered by a diluted suspension of polystyrene spheres was measured as a function of scattering angle, using a He-Ne laser polarized in the vertical direction. The second technique consisted of measuring the intensity of light scattered from individual polystyrene spheres suspended in air as a function of angle, using a He-Cd laser with light polarized parallel and perpendicular to the scattering plane. The measurement of row length by optical microscopy for polystyrene spheres arranged in close-packed, two-dimensional hexagonal arrays was the basis of the third technique. The measurement errors for each technique were quantitatively assessed.

705,399
PB86-119229 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Studies of Passive Film Breakdown by Detection and Analysis of Electrochemical Noise.
Final rept.
U. Bertocci, and J. Kruger. 1980, 11p
Pub. in Surface Science 101, n1-3 p608-618 1980.

Keywords: *Electric current, *Electrodes, *Electrochemistry, *Acoustic measurement, Passivity, Corrosion, Aluminum, Amorphous alloys, Surface chemistry, Reprints, *Passivation(Semiconductor), *Noise exposures.

Random fluctuations in the passive current of electrodes under potentiostatic conditions have been measured on aluminum in boric acid: borate solution and on a Fe-Cr-Ni alloy, both in the amorphous and in the crystalline state, in sulfuric acid. The onset of pitting can be detected by the large increase in current noise. The noise level is different in the amorphous and crystalline Fe-Cr-Nialloy, indicating that the breakdown of the passive film differs in the two conditions. The experimental aspects involved in carrying out meaningful noise measurements in electrochemical systems are also discussed.

705,400
PB86-119237 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Martensitic Transformations in Iron-Nickel-Carbon Alloys.
Final rept.
T. N. Durlu, and J. W. Christian. 1979, 6p
Pub. in Proceedings of International Conference on Martensitic Transformations (ICOMAT), Cambridge, MA., June 24-29, 1979, p343-348.

Keywords: *Phase transformation, *Crystallography, *Martensite, Reaction kinetics, Stress strain analysis, *Iron nickel carbides.

Small austenitic single crystals of two alloys with subzero M(sub s) (burst) temperatures were spark-machined from recrystallized samples and used in both the undeformed and deformed conditions to investigate the subsequent transformation. The M(sub s) temperature as a function of reduction in area by rolling increased to a broad maximum at 40-50% deformation and then decreased again. Crystallographic investigations were made of the preferred habit plane variants formed in the first burst in single crystals of many different orientations predeformed in compression. Most of the crystals were orientated for single slip and the initial transformation occurred by the co-operative formation of a single group of plates with four habit plane variants. It is believed that the results indicate that an active slip system stimulates particular habit plane variants rather than inhibits others. Studies were also made of deformation-induced martensite in polycrystalline samples of Fe-Ni-C alloys. Different morphologies were found for stress-induced and strain-induced martensites.

705,401
PB86-119294 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Far-Infrared Laser Magnetic Resonance Spectrum of the SiH Radical and Determination of Ground State Parameters.
Final rept.
J. M. Brown, R. F. Curl, and K. M. Evenson. 1984, 7p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Physics 81, n7 p2884-2890, 1 Oct 84.

Keywords: *Molecular energy levels, *Silane, Free radicals, Reprints, *Laser spectroscopy, *Far infrared laser magnetic resonance spectroscopy.

The far-infrared laser magnetic resonance (LMR) spectrum of the SiH radical in the nu=0 level of its X (sup 2)pi state has been recorded. The signals are rather weak. The molecules were generated in the reaction between fluorine atoms and SiH4. Rotational transitions have been detected in both (sup 2)pi(sub 1/2) and (sub 2)pi(sub 3/2) spin components but no fine structure transitions between the spin components were observed. Proton hyperfine splittings were resolved on some lines. The measurements have been analyzed, subjected to a least-squares fit using an effective Hamiltonian and the appropriate molecular parameters determined. The weakness of the spectrum and the failure of attempts to power saturate favorable lines are both consistent with a small value for the electric dipole moment for SiH.

705,402
PB86-119302 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Modeling of Axially Symmetric Flow Reactors.
Final rept.
R. L. Brown. 1984, 7p
Pub. in Computers and Chemistry 8, n2 p139-145 1984.

Keywords: *Mathematical models, *Axisymmetric flow, *Chemical reactors, Reaction kinetics, Velocity measurement, Concentration(Composition), Reprints.

A method of calculating the velocity profiles and species concentrations in axially symmetric flow reactors is presented. The method is illustrated with a reactor consisting of three concentric tubes arranged so that reactants flow through the inner tube and inner annulus to a mixing region and the products flow out through the outer annulus. A single bimolecular reaction is used in the example. The method involves two steps; calculation of the velocity field from a solution of the Navier-Stokes equations, followed by solution of the species conservation equations. The technique provides a way of analyzing reactors with variable cross sections and sampling ports near mixing regions.

705,403
PB86-119336 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Studies of Internal Interfaces in Solid Electrolytes by Impedance Spectroscopy.
Final rept.
C. K. Chiang, A. L. Dragoo, and A. D. Franklin. 1981, 1p
Pub. in Jnl. of the Electrochemical Society 128, n3 p124C 1981.

Keywords: *Electrodes, *Solid electrolytes, *Electrical impedance, *Spectrographic analysis, Ceramics, Crystals, Interfaces, Surface chemistry, Additives, Electrochemistry, Grain boundaries, Reprints, Cesium oxides, Lanthanum chromites, Yttrium chromates.

The frequency dependence of the impedance of the system electrode/solid electrolyte/electrode contains information about charge transport processes not only at the solid electrolyte/electrode interfaces and within the single-crystal grains of the solid electrolyte itself, but also at internal interfaces within the soli3 and Cadped yCrO3 illustrate howgrain-boundaries may be studied.

705,404
PB86-119377 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Orientational Ordering in a Strongly Chemisorbed System: Na on Ru(001).
Final rept.
D. L. Doering, and S. Semancik. 1984, 4p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review Letters 53, n1 p66-69, 2 Jul 84.

Keywords: *Sodium, *Surface chemistry, *Chemisorption, *Crystal structure, Rhuthenium, Substrates, Mathematical models, Rare gases, Orientation, Reprints, *Low energy electron diffraction.

The study of Na on Ru(001) at 80 K provides the first detailed examination of orientational ordering in a strongly chemisorbed monolayer. The relative orientation of a Na layer on Ru(001) varies with the Na-Ru lattice misfit in a way consistent with predictions from theoretical models that have been used to explain orientational ordering of rare gases physisorbed on graphite. The similarity between physisorbed systems and the chemisorbed Na on Ru system suggests a universal behavior of rigid overlayers on hexagonal substrates.

705,405
PB86-119385 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Structure of the 1:1 Molecular Complex of Pyrene and Dicyanomethylenecroconate.
Final rept.
R. M. Doherty, J. M. Stewart, A. D. Mighell, C. R. Hubbard, and A. J. Fatiadi. 1982, 5p
Pub. in Acta Crystallographica, Section B: Structural Crystallography and Crystal Chemistry, B38 n3 p859-863 1982.

Keywords: *Complex compounds, *Crystal structure, *X ray diffraction, Reprints, *Pyrene, *Cyclopentene dione/dicyanomethylene-diethoxy.

A 1:1 molecular complex of pyrene and 2-dicyanomethylene-4,5-diethoxy-4-cyclopentene-1,3-dione (DDC) is formed upon evaporation of a solution containing equimolar amounts of the two substances. The product is a charge-transfer complex containing a novel oxocarbon acceptor. The crystal structure of the adduct has been determined by single crystal x-ray diffraction.

705,406
PB86-119443 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Isochoric (p, V(sub m), x, T) Measurements on (Methane + Ethane) from 100 to 320 K at Pressures to 35 MPa.
Final rept.
W. M. Haynes, R. D. McCarty, B. E. Eaton, and J. C. Holste. 1985, 24p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Jnl. of Chemical Thermodynamics 17, p209-232 1985.

Keywords: *Methane, *Ethane, *Thermodynamics, Mixture, Density(Mass/volume), Equations of state, Comparison, Pressure, Volume, Temperature, Reprints, *Isochore, Corresponding states models, Benedict-Webb-Rubin equation.

Comprehensive isochoric (p, V(sub m) x,T) values have been obtained for (xCH4+(1-x)C2H6) with x=0.35. 0.50, and 0.69 at amount-of-substance densities from 1 to 25 mol/cu dm. The measurements for each composition cover a temperature range from approximately 100 to 320 K at pressures up to 35 MPa. For each mixture the results have been fit to a 32-term modified Benedict-Webb-Rubin equation of state. Further development of the extended corresponding-states model has been accomplished using the results presented here. Comparisons with values from independent sources have been made where possible.

705,407
PB86-119450 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Orthobaric Liquid Densities and Dielectric Constants of Ethylene.
Final rept.
W. M. Haynes. 1985, 3p
Pub. in Cryogenics 25, p68-70 1985.

Keywords: *Ethylene, *Dielectric properties, *Density(Mass/volume), Temperatures, Comparison, Reprints, *Orthobaric liquids, Clausius Mossotti function.

Measurements of the orthobaric liquid densities and dielectric constants of ethylene have been obtained at temperatures from 200 to 270 K. Simultaneous measurements of these properties were carried out using a magnetic suspension densimeter and a concentric cylinder capacitor. Comprehensive comparisons of the present results with the data of other investigators are presented. Also reported are computed values of the Clausius-Mossotti function.

705,408
PB86-119468 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Critical-Point Conditions for Classical Polydisperse Fluids.
Final rept.
K. A. Johnson, D. A. Jonah, J. M. Kincaid, and G. Morrison. 1985, 6p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Jnl. of Chemical Physics 82, n11 p5178-5183, 1 Jun 85.

Keywords: *Critical point, *Fluids, Density(Mass/volume), Temperature, Chemical composition, Gibbs free energy, Dispersion, Reprints.

The critical-point conditions for a polydisperse mixture are shown to be equivalent to those for the existence of nontrivial solutions to two homogeneous integral equations of the Fredholm type. This mathematically rigorous treatment is not dependent on the form of any particular model free energy and hence shows that there is no formal distinction between the critical-point conditions of a polydisperse fluid and those conditions derived by Gibbs for the critical point of a mixture with a finite number of components. Using the method of Fredholm, the authors express the critical-point conditions in terms of the zeros of two absolutely convergent expansions, and demonstrate how the expansions may be used to determine the shifts in critical density and temperature caused by changes in the composition of the fluid.

705,409
PB86-122835 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Structural Investigations by Solid-State (sup 13)C NMR. Dependence of (singlet J((sup 119)Sn, (sup 13)C)) on the Me-Sn-Me Angle in Methyltin(IV)s.
Final rept.
T. P. Lockhart, W. F. Manders, and J. J. Zuckerman. 1985, 2p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of the American Chemical Society 107, p4546-4547 1985.

Keywords: *Molecular structure, *Isotopic labeling, *Nuclear magnetic resonance, Molecular energy levels, Reprints, Solid state chemistry, Stannane/methyl.

The magnitude of (sup 119)Sn,(sup 13)C), 1J1, has been determined for 13 methyltin solids by 13C cross polarization magic angle spinning solid state NMR. The relationship of 1J1 to the tin coordination number is discussed. The use of the empirical plot for determining the Me-Sn-Me bond angle in uncharacterized solids and for methyltins in solution is noted.

705,410
PB86-122967 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Summary Abstract: Methyl Isocyanide Adsorption on Rh(111).
Final rept.
S. Semancik, G. L. Haller, and J. T. Yates. 1983, 2p
Pub. in Jnl. of Vacuum Science and Technology A: Vacuum, Surfaces and Films 1, n2 pt2 p1226-1227 Apr/Jun 83.

Keywords: *Adsorption, *Surface chemistry, *Dissociation, Reprints, *Methyl isocyanides, *Electron energy loss spectroscopy, *Auger spectroscopy.

High resolution electron energy loss spectroscopy, temperature programmed desorption and Auger electron spectroscopy have been used to characterize the interaction of methyl isocyanide with Rh(111). Thermally-induced changes in the overlayer as well as the effects of preadsorbates have also been considered.

705,411
PB86-123023 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Electron- and Photo-Stimulated Desorption of Condensed Molecular Films: Relevance to the Mechanisms of Ion Formation and Desorption.
Final rept.
R. Stockbauer, E. Bertel, and T. E. Madey. 1983, 2p
Pub. in Jnl. of Vacuum Science and Technology A1, n2 pt2 p1162-1163 Apr/Jun 83.

Keywords: *Ionization, *Desorption, *Monomolecular films, Comparison, Methyl alcohol, Cyclohexane, Hydrogen, Water, Chemical bonds, Surface chemistry, Reprints, *Electron stimulated desorption, *Photon stimulated desorption, *Chemical reaction mechanisms.

Electron and photon stimulated desorption (ESD,PSD) have been applied mainly to adsorbed monolayers and ionic solids. In an attempt to clarify mechanisms of ion deexcitation and desorption in covalent systems we compare ESD of condensed films of hydrogen-bonded methanol (CH3OH) and water, and non-hydrogen-bonded cyclohexane (C6H12). There are striking differences in the results. These results are qualitatively consistent with a model by which more massive ions are preferentially neutralized close to the metal surface. The reneutralization rate decreases with increasing film thickness causing an increased yield of higher mass fragments. It appears that the hydrogen-bonding in the methanol layer provides an effective de-excitation mechanism for higher mass fragments at all thicknesses.

705,412
PB86-123064 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
C(sup 13) NMR in Oriented Polymers.
Final rept.
D. L. VanderHart, G. G. A. Bohm, and V. D. Mochel. 1982, 1p
Pub. in Proceedings of International Union of Pure and Applied Chemistry Macromolecular Symposium (28th), Amherst, MA., July 12-16, 1982, p4.

Keywords: *Nuclear magnetic resonance, *Isotopic labeling, *Polymers, *Orientation, *Polyethylene, *Polyethylene terephthalate, Solids, Molecular flow.

The 13C solid-state NMR spectra of oriented polymers are useful for investigating orientation and anisotropic molecular mobility. In favorable cases, e.g., polyethylene, the orientation of the non-crystalline regions can be determined. The mobility of crystalline chains in both linear polyethylene and polyethyleneterephthalate will also be discussed.

705,413
PB86-123106 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Materials.
Reference Data for Thermophysical Properties.
Final rept.
H. J. White, and J. R. Rumble. 1982, 4p
Pub. in Proceedings of Symposium on Thermophysical Properties, Gaithersburg, MD., June 15-18, 1981, Thermophysical Properties of Solids and of Selected Fluids for Energy Technology 2, p415-418 1982.

Keywords: *Thermophysical properties, *Materials test, Transport properties, Thermodynamics, Physical properties, Crystal structure, Phase diagrams, Sources, *Reference materials.

The activities of the Office of Standard Reference Data of the National Bureau of Standards and the National Standard Reference Data System (NSRDS) for which it provides program management will be discussed briefly. Emphasis will be placed on those activities thought to produce products of interest to workers in the area of thermophysical properties. Included will be data centers and projects covering such technical areas as thermodynamics, transport properties, physical properties, and materials properties such as phase diagrams and crystal structure. An attempt will also be made to list other major sources of evaluated reference data of interest.

705,414
PB86-123130 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reliable Data for Flue Gas Desulfurization Processes.
Final rept.
B. R. Staples. 1982, 16p
Sponsored by American Chemical Society, Washington, DC.
Pub. in Proceedings of Meeting of the American Chemical Society Flue Gas Desulfurization, Atlanta, GA., March 29-30, 1981, p41-56 1982.

Keywords: *Air pollution control equipment, *Scrubbing, *Electrolytes, *Thermodynamic properties, Physical properties, Guidelines, Chemical equilibrium, Enthalpy, Entropy, Performance evaluation, Chemical properties, Flue gases, Specific heat, Gibbs free energy, Activity coefficient, Tables(Data), Flue gas desulfurization.

A wide variety of physical chemical data and vapor liquid equilibria is required to predict and extrapolate performance reliability of flue gas desulfurization processes. A chemical and physical model capable of predicting actual scrubber performance is a continuing goal, but any model is only as reliable as the input data. Carefully evaluated thermodynamic and kinetic data are needed to ensure consistency, accuracy, and to provide a basis for comparing processes or models. The methodology for the critical evaluation of thermodynamic properties of electrolytes is discussed in general, with emphasis on processes important in flue gas washing systems. How we intend to use the present evaluation systems to provide updated data for flue gas washing processes is also discussed. A number of these specific processes was chosen to illustrate the evaluation procedure. Guidelines are provided for calculating an equilibrium constant, activity coefficient, Gibbs energy and enthalpy of reaction, enthalpy of dilution, and standard enthalpy, Gibbs energy, entropy, and heat capacity. Sources of data and how to use them are discussed.

705,415
PB86-123999 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Angular Momentum Transfer and Charge Cloud Alignment in Atomic Collisions: Intuitive Concepts, Experimental Observations and Semiclassical Models.
Final rept.
I. V. Hertel, H. Schmidt, A. Bahring, and E. Meyer. 1985, 40p
Pub. in Reports on Progress in Physics 48, n3 p375-414 Mar 85.

Keywords: *Angular momentum, Mathematical models, Experimental design, Excitation, Reprints, *Atom atom interactions, *Laser spectroscopy, Sodium atoms, Xeon atoms, Barium atoms.

The authors discuss intuitive concepts to describe alignment and orientation effects in collision processes with, or leading to, an atomic np charge cloud state. For direct excitation one understands the atomic angular momentum transferred to terms of a rolling ball; and for excitation (deexcitation) in a molecular picture one can visualize the alignment angle of the atomic p charge cloud in terms of a transition from a body fixed molecular picture (small internuclear distances R) to a space fixed picture (large R). These concepts are illustrated by experimental results for e+ Na* and Na+ + Na* collisions. Further examples are the molecular processes N2 + Na* and the atomic process Xe + Ba* at thermal energies.

705,416
PB86-124005 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
NO Thermally Desorbed from a Saturation Coverage on Pt(111): Internal State Distributions.
Final rept.
D. S. King, D. A. Mantell, and R. R. Cavanagh. 1985, 3p
Contract DE-A105-84ER13150
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 82, n2 p1046-1048, 15 Jan 85.

Keywords: *Nitrogen oxides(NO), *Desorption, *Surface chemistry, Platinum, Thermochemistry, Reprints.

No abstract available.

705,417
PB86-124021 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Fracture Strength and the Weibull Distribution of Beta-Sialon.
Final rept.
K. Kobayashi, S. Umebayashi, K. Kishi, N. J. Tighe, and R. J. Fields. 1981, 6p
Pub. in Yogyo Kyokaishi 89, n10 p550-555 1981.

Keywords: *Chemical bonds, *Fracture strength, Weibull density functions, High temperature tests, X ray analysis, Reprints, *Sialon, Aluminum silicon oxynitride.

4 point bend strength and the Weibull distribution were measured for hot-pressed beta-sialon (Si5Al1O1N7) at room temperature, 1200C and 1400C in air. The hot-pressed beta-sialon was fabricated from SiO2, Al and Si powders in N2. The hot-pressed sample consisted of single beta-sialon as an crystalline phase by X-ray analysis, but glassy grain boundary phase was detected by SEM observation.

705,418
PB86-124047 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Doppler-Limited Study of the Infrared Spectrum of Allene from 2965 to 3114 /cm.
Final rept.
A. G. Maki, A. S. Pine, and M. Dang-Nhu. 1985, 23p
Pub. in Jnl. of Molecular Spectroscopy 112, p459-481 1985.

Keywords: *Infrared spectroscopy, *Doppler effect, *Allene, Molecular structure, Molecular energy levels, Reprints, *Laser spectroscopy.

A difference-frequency laser spectrometer has been used to measure the infrared absorption spectrum of the nu(sub 5) and nu(sub 8) bands of allene (C3H4).

705,419
PB86-124112 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Torsional-Wagging Tunneling Problem and the Torsional-Wagging-Rotational Problem in Hydrazine.
Final rept.
N. Ohashi, and J. Hougen. 1985, 17p
Pub. in Jnl. of Molecular Spectroscopy 112, p384-400 1985.

Keywords: *Hydrazine, *Molecular rotation, *Molecular vibration, Molecular energy levels, Reprints.

Results derived previously for the rotational levels of the eight-framework and three-large-amplitude vibrational problem in N2H4, using a tunneling formalism based on a treatment of the vibration-rotation problem as a whole, are rederived here in a much simpler fashion, using a tunneling formalism based on a separate treatment of the vibrational and rotational problems. The present formalism is thus much more akin to the usual vibration-rotation formalism, and the origins of the various contributions to the vibration-rotation energy levels can be understood relatively easily. It is convenient here, as earlier, to make extensive use of permutation-inversion and extended-group (double-group) ideas, but it is necessary in the present treatment to consider tunneling between 16 minima in molecular coordinate space, i.e., between a number of minima which is twice the number of nonsuperimposable molecular frameworks that can actually be constructed for N2H4. (Copyright (c) Academic Press, Inc. 1985.)

705,420
PB86-124120 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Characterization of Bioactive Organotin Polymers: Fractionation and Determination of MW by SEC (Size Exclusion Chromatography)-GFAA.
Final rept.
E. J. Parks, and F. E. Brinckman. 1981, 20p
See also AD-A089164.
Pub. in Proceedings of International Symposium on Controlled Release Pestic. Pharm. (7th), p219-238 1981.

Keywords: *Copolymers, *Polymerization, *Molecular weight, *Distillation, *Tin organic compounds, Chromatographic analysis, Polymethyl methacrylate, Concentration(Composition), Ultraviolet spectroscopy, Sampling, *Free radicals, *Size exclusion chromatography, *Graphite furnace spectroscopy, Methyl methacrylates, Biological processes, Methacrylic acid/(methacryloyloxy).

Organotin polymers (OMP's) prepared by the free radical copolymerization of methyl methacrylate (MMA) with tributyltin methacrylate (TBTM) and/or tripropyltin methacrylate (TPTM) were subjected to size exclusion chromatography (SEC) in tetrahydrofuran as solvent and mobile phase, with continuous eluant monitoring by ultraviolet (UV) and tin-specific graphite furnace (GFAA) spectrophotometry.

705,421
PB86-124757 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Photodissociation of the Molecular Ion of n-Butylbenzene: Effect of Photon Energy.
Final rept.
M. J. Welch, D. J. Pereles, and E. White. 1985, 2p
Pub. in Organic Mass Spectrometry 20, n6 p425-426 1985.

Keywords: *Photochemical reactions, *Dissociation, Ions, Mass spectroscopy, Photons, Reprints, *Benzene/butyl, *Laser spectroscopy.

The authors investigated the photon-induced dissociation of the n-butylbenzene molecular ion. An argon ion laser was used to irradiate the first field-free region of a Mattauch-Herzog geometry mass spectrometer. Only source temperatures had a significant effect, but temperature differences were not enough to account for the differences between our results and those previously reported, which were obtained in the second field-free region of a reverse geometry instrument. The reasons for the discrepancies are not understood.

705,422
PB86-124922 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Thermal Conductivity of Hydrogen for Temperatures between 78 and 310 K with Pressures to 70 MPa.
Final rept.
H. M. Roder. 1984, 28p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in International Jnl. of Thermophysics 5, n4 p323-350 Dec 84.

Keywords: *Hydrogen, *Thermal conductivity, *Laboratory equipment, Temperatures, Pressures, Experimental design, Isotherms, Density(Mass/volume), Reprints.

The paper presents new experimental measurements of the thermal conductivity of hydrogen. The ortho-para compositions covered are normal, near normal, para, and para-rich. The measurements were made with a transient hot wire apparatus. The temperatures covered the range from 78 to 310 K with pressures to 70 MPa and densities from 0 to a maximum of 40 mol/L. For compositions normal and near normal, the isotherms cover the entire range of pressure, and the temperatures are 78, 100, 125, 150, 175, 200, 225, 250, 275, 294, 300, and 310 K. The para measurements include eight isotherms at temperatures from 100 to 275 K with intervals of 25 K, pressures to 12 MPa, and densities from 0 to 12 mol/L. Three additional isotherms at 150, 250, and 275 K cover para-rich compositions with para percentages varying from 85 to 72%. For these three isotherms the pressures reach 70 MPa and the density a maximum of 30 mol/L. The data for all compositions are represented by a single thermal conductivity surface. The data are compared with the experimental measurements of others through the new correlation. The precision (2 sigma) of the hydrogen measurements is between 0.5 and 0.8% for wire temperature transients of 4 to 5 K, while the accuracy is estimated to be 1.5%.

705,423
PB86-125150 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Scaled Fundamental Equation for the Thermodynamic Properties of Steam Near the Critical Point.
Final rept.
J. V. Sengers, J. M. H. Levelt Sengers, and B. Kamgar-Parsi. 1985, 15p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Strojnicky Casopis 36, n3 p277-291 1985.

Keywords: *Critical point, *Thermodynamic properties, *Steam, Surface chemistry, Scaling, Comparison, Reprints, Numerical solution.

The modern theory of critical phenomena asserts that the thermodynamic surface of fluids near the critical point is characterized by scaling laws with universal critical exponents and universal scaling functions. The paper reviews results obtained with a scaled fundamental equation for steam in the critical region. A comparison with a new formulation adopted by IAPS for the thermodynamic properties of water substance is also included.

705,424
PB86-128113 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Density Expansion (DEX) Mixing Rules: Thermodynamic Modeling of Supercritical Extraction.
Final rept.
G. A. Mansoori, and J. F. Ely. 1985, 8p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 82, n1 p406-413, 1 Jan 85.

Keywords: *Mathematical models, *Thermodynamics, *Density(Mass/volume), Solubility, Mixtures, Reprints, *Supercritical gas extraction.

Conformal solution theory and the density expansion expression of the radial distribution function of fluids are used to derive a set of mixing rules. The new mixing rules are composition, density, and temperature dependent. To test the new mixing rules they are used for thermodynamic modeling of supercritical extraction. Comparison of the result of calculation by the mixing rules with the van der Waals mixing rules indicates a profound improvement over the latter in prediction of properties of mixtures consisting of species with large molecular size and shape differences.

705,425
PB86-128139 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Optically Transparent Thin-Layer Electrode for Organic Solvents.
Final rept.
E. P. Muth, J. E. Fuller, L. M. Doane, and E. A. Blubaugh. 1982, 2p
Pub. in Analytical Chemistry 54, p604-605 1982.

Keywords: *Organic solvents, *Electrodes, Thin layer chromatography, Optical materials, Reprints.

An optically transparent thin layer electrode for use in nonaqueous solvents is described.

705,426
PB86-128162 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Applications of Fourier Transform Infrared Spectroscopy in Surface and Interface Studies.
Final rept.
T. Nguyen. 1985, 34p
Pub. in Progress in Organic Coatings 13, p1-34 1985.

Keywords: *Infrared spectroscopy, *Chemical analysis, *Surface chemistry, *Organic coatings, Reviews, Reprints, *Fourier transform spectroscopy.

The development of Fourier transform infrared (FTIR) spectrometers, which have superior sensitivity, more rapid sample measurement and more versatile spectral processings, has revised interest of infrared spectroscopy as an analytical method for surface and interface studies. The article will briefly review the background of FTIR and extensively review the current literature on the applications of FTIR spectroscopy for surface and interface studies. The literature surveyed in this review indicates the strength and suitability of FTIR, coupled with appropriate IR spectroscopic technique for surface and interface studies. The selection

of a specific technique for a particular surface application depends upon factors such as sample nature and morphology and sensitivity required. Despite remarkable advancement of FTIR instrumentation, the applications of this technique in surface and interface studies are still in the infancy stage. With much interest in obtaining molecular level information in a wide range of materials applications, FTIR spectroscopy is expected to be increasingly utilized for providing qualitative and quantitative molecular information on the surface and interface of materials.

705,427
PB86-128840 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Dielectric Properties of Polymers at Microwave Frequencies: A Review.
Final rept.
A. J. Bur. 1985, 15p
Sponsored by Construction Engineering Research Lab. (Army), Champaign, IL.
Pub. in Polymer 26, p963-977 Jul 85.

Keywords: *Polymers, *Dielectric properties, *Microwave frequencies, Reviews, Reprints.

A review of the dielectric loss spectra of polymers at microwave frequencies has been carried out. While the main focus of attention is the frequency range from 100 MHz to 100 GHz, loss spectra outside this region are also reviewed because variations in temperature can cause a shift of dielectric loss into or out of the microwave range. A large volume of data for low loss polymers (polyethylene, polypropylene and poly(tetrafluoroethylene)), which are used in the communications industry, was available for review. Also, the microwave dielectric properties of engineering thermoplastics such as poly(phenylene oxide), polycarbonate and polysulphane have been reviewed. The origins of microwave dielectric loss in polymers are categorized as: (a) dipolar absorption dispersions in both crystalline and amorphous polymers; (b) dipolar losses due to impurities, additives or fillers in a polymer material; (c) microwave absorption in conducting polymers (polyacetylene and poly(sulphur nitride)) for which the current carriers are electrons; and (d) photon-phonon absorption spectra corresponding to the density of states in amorphous regions of a polymer material.

705,428
PB86-128964 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Raman Microprobe Spectroscopic Analysis.
Final rept.
J. J. Blaha. 1981, 41p
Pub. in Vibrational Spectra and Structure: A Series of Advances, v10 p227-267 1981.

Keywords: *Raman spectroscopy, *Microanalysis, *Molecular vibration, Particles, Sampling, Laboratory equipment, Forecasting, Molecular structure, Chemical analysis, Reprints.

Raman microprobe and microscopes have extended vibrational spectroscopy to the analysis of microparticles whose dimensions are on the order of micrometers. These techniques have been applied to the analysis of a wide variety of materials in a broad range of fields. Many of these investigations have been demonstrations of potential while others have yielded information that can not be obtained by any other technique. Raman spectra obtained from microparticles are directly related to that from both samples. In contrast to the measurement of macroscopic crystals, all of the Raman active modes of a sample are usually observed in a single spectrum when microparticles are examined. In this review, a general summary of the Raman microprobe technique, instrumentation and applications will be made to demonstrate the versatility of the technique to a wide range of problems. In addition some information is presented on possible future developments in applications and improvements in instrumentation.

705,429
PB86-129640 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Neutron Scattering from Polymers.
Final rept.
R. S. Stein, and C. C. Han. 1985, 8p
Pub. in Physics Today, p1-8 Jan 85.

Keywords: *Neutron scattering, *Polymers, Solutions, Melts, Gels, Crystals, Deuterium compounds, Reprints.

The great difference in scattering power between a deuterated polymer and its hydrogenous counterpart allows one to determine the shapes and movements of polymers in solutions, melts, gels, and crystals.

705,430
PB86-129657 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Linear-Versus-Nonlinear Regime in Macroscopic Quantum Fluctuations of Stokes Pulses.
Final rept.
M. Trippenbach, and K. Rzazewski. 1985, 4p
Pub. in Physical Review A: General Physics 31, n3 p1932-1935 Mar 85.

Keywords: *Quantum, *Mathematical models, *Stokes law(Fluid mechanics), *Raman scattering, Dynamics, Reprints.

An explicitly soluble model of macroscopic quantum fluctuations of Stokes pulses is presented. The model deals with a small sample placed in a cavity and covers both linear and nonlinear regimes. The energy distribution of pulses narrows in the nonlinear regime, which is in agreement with the recent experiments.

705,431
PB86-130135 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Heterodyne Frequency Measurements on N2O at 5.3 and 9.0 Micrometers.
Final rept.
J. S. Wells, D. A. Jennings, A. Hinz, J. S. Murray, and A. G. Maki. 1985, 5p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of the Optical Society of America B2, n5 p857-861 May 85.

Keywords: *Nitrogen oxide(N2O), *Infrared spectroscopy, Calibrating, Molecular vibration, Absorption, Standards, Performance evaluation, Reprints, *Laser spectroscopy, Heterodynereactions.

Heterodyne frequency measurements on the 01(sup 1)1-00(sup 0)0 band of N2O have been made with the use of a tunable-diode laser, a CO laser transfer oscillator, and a CO2 laser frequency synthesizer. A beat frequency was measured between a CO laser and a tunable-diode laser whose frequency was locked to the peak of N2O absorption features. The frequency of the CO laser was simultaneously determined by measuring the beat frequency with respect to a reference synthesized from two CO2 lasers. New rovibrational constants are given for the 01(sup 1)1 state of N2O, which are in excellent agreement with previous results, although the band center is 4 MHz higher than in the previous measurements. A table of the line frequencies and their absolute uncertainties is given for the N2O absorption lines in the wave-number region from 1830 to 1920/cm. Some additional frequency measurements near the lower-frequency end of the 02(sup 0)0-00(sup 0)0 band have also been made with respect to a (12 sup)C(18 sup)O2 laser.

705,432
PB86-130937 PC **A13**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Chemical Thermodynamics in Steam Power Cycles Data Requirements.
O. Jonas, and H. J. White. Jul 85, 291p NBSIR-85/3205
Proceedings of a workshop held at National Bureau of Standards, Gaithersburg, Maryland, February 8-9, 1983. Sponsored by American Society of Mechanical Engineers, New York, and Electric Power Research Inst., Palo Alto, CA.

Keywords: *Thermodynamics, *Meetings, *Steam electric power generation, *Corrosion, *Impurities, *Industrial waste treatment, Tables(Data), Materials tests, Water pollution control, Experimental design, Nuclear power plants, Boilers, Marine engines, *Reference materials, *Chemical treatment.

The report represents the proceedings of a workshop on data needs for chemical thermodynamics in power cycles held at the National Bureau of Standards, February 8-9 1983. It contains a summary of the recommendations of working groups that met during the workshop as well as the texts or abstracts of most of the papers presented at the workshop.

705,433
PB86-132222 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Alternative Approach to the Calculation of Four-Probe Resistances on Nonuniform Structures.
Final rept.
J. Albers, and H. L. Berkowitz. 1985, 4p
Pub. in Jnl. of the Electrochemical Society: Solid-State Science and Technology 132, n10 p2453-2456 Oct 85.

Keywords: *Electrical resistivity, *Structural analysis, *Probes, Calibrating, Substitutes, Electrochemistry, Reprints, *Spreading resistance, Numerical solution.

An alternative approach to the calculation of the four-probe resistance of nonuniform resistivity structures is presented. This approach is based upon two simplifications in the form of the four-probe resistance integral. The first arises from the integral's being independent of the probe current density as well as the probe radius. The second simplification involves the rewriting of the integral as one involving only the kernel (without any Bessel functions) and with finite limits which depend only upon the probe spacing. The form of these limits is determined by analytic calculation of the four-probe resistance for the case of a semi-infinite slab. For the case of a uniform layer over an insulating or conducting boundary, the simplified integral leads to analytic expressions for the four-probe resistance which are compared with the more extensive technique and are also investigated as a function of the probe spacing. For nonuniform resistivity structures, the simplified integral can be easily evaluated by means of the Newton-Cotes numerical procedure. For general multilayer cases, the results obtained from the Newton-Cotes method are compared with those obtained from more extensive numerical techniques and are shown to be in excellent agreement. This allows for a vastly simplified implementation of the previously proposed spreading resistance calibration technique.

705,434
PB86-132230 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Investigation of the Relation between the Correction Factor and the Local Slope in Spreading Resistance.
Final rept.
J. Albers. 1983, 1p
Pub. in Jnl. of the Electrochemical Society 130, n8 pC327 1983.

Keywords: *Correction, *Mathematical models, *Electrical resistivity, Electrochemistry, Reprints, *Spreading resistance, *Local slope, Laplace equation.

The local slope method for the calculation of the spreading resistance correction factor has been proposed by Dickey. The method is based on two asymptotic models for the conduction process involved in the spreading resistance measurement for the cases of (1) a conducting layer over an insulating substrate, and (2) a high resistivity layer over a low resistivity or conducting substrate. The two extreme cases are bridged by means of an assumed single-valued relation between the correction factor and the local slope of the spreading resistance data. The paper examines the two asymptotic models and the assumed single-valued relation in terms of the multilayer Laplace equation description of spreading resistance. It is shown that the asymptotic models adequately describe the behavior of the correction factor for a thin uniform layer over insulating or conducting boundaries. In addition, the single-valued relation between the correction factor and the local slope which is assumed by the local slope method is shown not to be an adequate representation of the multiple-valued relation between these two quantities found from the Laplace equation description. A comparison of the two correction factor vs. local slope relations provides the basis for the understanding of the results of these schemes when model spreading resistance data are used. Nonetheless, the local slope results qualitatively follow the multilayer results thus making the technique a usable one for the calculation of approximate correction factors.

705,435
PB86-132248 Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Coherence Study of 2p(sigma)-2p(pi) Rotational Coupling: Li(2 doublet P) and He(2 singlet P) Orientation and Alignment in 1-25 keV Li(+1)-He Collisions.
Final rept.
N. Andersen, T. Andersen, H. Neitzke, and E. H. Pedersen. 1985, 23p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 18, n11 p2247-2269 1985.

Keywords: *Molecular energy levels, *Lithium, *Helium, Molecular rotation, Reprints, *Ion molecule collisions, Lithium ions.

The authors have studied the alignment and orientation of the electron cloud of the Li(2 doublet P) and He(2 singlet P) states excited by 2p(sigma)2p(pi) rotational coupling for impact parameters between 0.2 and 1.1 au in 1-25 keV Li(+1)-He collisions by coherence and correlation analysis techniques. It is found that for collision energies below 5 keV the shape of the excited electron cloud is very nearly that of a p orbital, aligned perpendicular to the asymptotic internuclear axis, independent of impact parameter and of whether the electron stays on the He core or is transferred to the Li centre during the collision. These findings agree with the predictions based on an analysis of the simple diabatic MO diagram for the Li-He system. At energies above 5 keV, the shape changes significantly. Also, the alignment angle deviates from the perpendicular direction, being larger than 90 deg for Li and smaller for He. The angular momentum perpendicular to the collision plane shows a pronounced variation with collision energy but is only weakly dependent on impact parameter. Possible origins for this behavior are discussed.

705,436
PB86-132255 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Multiply Excited Three-Electron Systems Studied by Optical Emission Spectroscopy.
Final rept.
T. Andersen, and S. Mannervik. 1985, 14p
Pub. in Comments on Atomic and Molecular Physics 16, n4 p185-198 1985.

Keywords: *Emission spectroscopy, *Molecular energy levels, *Lithium, *Boron, *Beryllium, Excitation, Reprints.

Recent developments in the study of radiative multiply excited states in three-electron systems are reviewed. The progress concerns experimental and theoretical studies of the term schemes for quartet states in Li I, Be II, and B III, the first term schemes for doublet states in Li I and Be II, absolute term values for Li I, the existence of two bound states in Li(-1), and the first accurate autoionization widths for autoionizing resonances in Li I and Be II. This comment concentrates on the low Z numbers for which strong effects of eLectron correlation and configuration interactions are important.

705,437
PB86-132263 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Native Cellulose - A Composite of 2 Distinct Crystalline Forms.
Final rept.
R. H. Atalla, and D. L. VanderHart. 1984, 3p
Pub. in Science 223, n4633 p283-285 1984.

Keywords: *Cellulose, *Carbon 13, *Crystal structure, *Nuclear magnetic resonance, *Isotopic labeling, Plants(Botany), Bacteria, Algae, Reprints.

Multiplicities in the resonances of chemically equivalent carbons, which appear in the solid state (sup 13)C NMR spectra of native celluloses have been examined at high resolution. The patterns of variation are consistent with existence of two distinct crystalline forms in native celluloses. One of the two forms is dominant in bacterial and algal celluloses, while the other form is dominant in celluloses from high plants.

705,438
PB86-132271 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Chemical Physics.
Radiation-Induced Ionization and Excitation in Liquid p-Dioxane.
Final rept.
P. Ausloos, C. Lutz, F. Schwarz, and S. G. Lias. 1984, 8p
Pub. in Radiation Physics and Chemistry 23, n1-2 p97-104 1984.

Keywords: *Ionization, *Dioxanes, *Ultraviolet spectroscopy, Liquid phases, mixtures, Excitation, Molecular energy levels, Water, Reprints, *Dioxane, *Fluorescence induced ionization.

The fluorescence of neat liquid p-dioxane-and p-dioxane-water mixtures has been studied as a function of wavelength in the range 200-110 micrometers, and in the system under beta irradiation. It is seen that the quantum yield of fluorescence declines from the absorption threshold to the ionization onset (about 160-170 micrometers), because of the increasing importance of the competing decomposition processes. Above the ionization onset, there is a slight increase in the quantum yield of fluorescence as a result of the occurrence of 'recombination fluorescence'. However, it is estimated that in the region, neutralization does not always lead to a vibrationally equilibrated excited state. This explains in part why the G-value of thermally equilibrated s(sub 1) states is considerably lower than G(ion)(about 5), under conditions that fluorescence originates mainly from charge recombination. Auxiliary experiments carried out in the gas phase, in an ion cyclotron resonance spectrometer, elucidated the reaction of p-C4H8O2 ions with p-dioxane molecules.

705,439
PB86-132487 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Surface Chemistry of Water on Clean and Oxygen-Covered Copper (110).
Final rept.
K. Bange, D. E. Grider, J. K. Sass, and T. E. Madey. 1984, 27p
Pub. in Surface Science 137, n1 p38-64 1984.

Keywords: *Surface chemistry, *Water, Copper, Adsorption, Desorption, Chemical reactions, Reprints.

Adsorption of water at 110 K on clean and oxygen-covered Cu(110) has been studied using UPS, TDS, delta phi and LEED measurements. A model of the arrangement of oxygen atoms and water molecules is presented, based upon the LEED observations for these layers and an estimate of the relative oxygen and water coverages. The intensity variation of a thermal desorption peak at 290 K, attributed to adsorbed OH-species, with oxygen coverage is in accordance with this model. For low oxygen coverages, the TDS and delta phi results indicate that small oxygen-water clusters with an enhanced ratio of water molecules per adsorbed oxygen atom are present.

705,440
PB86-132511 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Interaction of Ammonia with Adsorbed Oxygen and Sodium on Ruthenium(001): Evidence for Both Local and Long-Range Interactions.
Final rept.
C. Benndorf, and T. E. Madey. 1983, 6p
Pub. in Chemical Physics Letters 101, n1 p59-64 1983.

Keywords: *Ammonia, *Chemisorption, Ruthenium, Adsorption, Chemical bonds, Molecular structure, Atoms, Reprints, *Sodium atoms, *Atom molecule interactions, *Oxygen atoms.

The bonding geometry of adsorbed molecular NH3 on Ru(001) is changed in different ways by interaction with adsorbed oxygen or sodium atoms. Evidence for both local interactions and long range electronic effects is found.

705,441
PB86-132529 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Elastic Coherent Scattering from Multicomponent Systems. Applications to Homopolymer Mixtures and Copolymers.
Final rept.
H. Benoit, W. Wu, M. Benmouna, B. Mozer, B. Bauer, and A. Lapp. 1985, 8p
Pub. in Macromolecules 18, p986-993 1985.

Keywords: *Copolymers, *Elastic scattering, *Polymers, *Thermodynamics, Solutions, Polystyrene, Polymethyl methacrylate, Reprints, *Small angle scattering, Numerical solution.

A general equation giving the scattering intensity of a solution of polymers and copolymers at any concentration and angle is derived. Its relation with thermodynamics and its application to polydisperse systems are discussed. Small-angle neutron scattering experiments on a diblock copolymer of deuterated polystyrene-poly(methyl methacrylate)(PS-PMMA) were performed in bulk and in solution near the theta point. The results are consistent with the theoretical predictions.

705,442
PB86-132545 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Decay Channels of the 3p Resonance in the 3d Transition Metals and Their Relevance to the Mechanism of Electron- and Photon-Stimulated Ion Desorption.
Final rept.
E. Bertel, R. Stockbauer, R. L. Kurtz, T. E. Madey, and D. E. Ramaker. 1985, 8p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Surface Science 152/153, p776-783 1985.

Keywords: *Transition metals, *Molecular energy levels, *Chromium, Excitation, Oxygen, Ions, Reprints, *Photon stimulated ion desorption method, *Electron stimulated desorption, Oxygen ions.

The 3p excitation cross section in the 3d transition metals shows a resonant maximum in photoabsorption and electron energy loss spectroscopy. The resonant 3p excitation is shown to decay into various decay channels with Auger decay and direct recombination being most prominent. Electron and photon stimulated ion desorption from the 3d transition metal oxide surfaces is initiated by Auger induced 2 hole and 2 hole, 1 electron final states. In Cr(110)/O2 the O(+1) yield differs significantly from the total secondary electron yield. This rules out electron stimulated ion desorption induced by secondary electrons. It is the first instance of a pronounced core hole state sensitivity observed in PSD.

705,443
PB86-132552 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Resonant Photoemission and the Mechanism of Photon-Stimulated Ion Desorption in a Transition-Metal Oxide.
Final rept.
E. Bertel, R. Stockbauer, R. L. Kurtz, D. E. Ramaker, and T. E. Madey. 1985, 4p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Physical Review B: Condensed Matter 31, n8 p5580-5583, 15 Apr 85.

Keywords: *Transition metals, *Metal oxides, *Molecular energy levels, *Synchrotron radiation, *Chromium, Excitation, Photoemission, Ions, Reprints, *Photon stimulated ion desorption method, Oxygen ions.

The Cr 3p excitation spectrum has been studied in the Cr(110) surface oxide using synchrotron radiation in the photon-energy range 40-75 eV. The photon-stimulated-desorption O(+1) yield from the surface is seen to be sensitive to the electronic configuration of the Cr 3p core-hole state. The results are discussed in the context of the competitive decay processes which also depend on the electronic configuration of the 3p core-hole state.

705,444
PB86-132560 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Photon-Stimulated Desorption of H(+1) Ions from OH on Ti and Cr: Comparison with Bulk Solid H2O.
Final rept.
E. Bertel, D. E. Ramaker, R. L. Kurtz, R. Stockbauer, and T. E. Madey. 1985, 3p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Physical Review B: Condensed Matter 31, n10 p6840-6842, 15 May 85.

Keywords: Comparison, Excitation, Ions, Reprints, *Photon stimulated ion desorption method, *Hydrogen ions, Hydroxyl radicals.

An interpretation and comparison of photon-stimulated desorption yields of H(+1) ions from OH on Ti and Cr and from bulk solid H2O indicate that desorption occurs through two entirely different mechanisms. The first involves an intramolecular excitation of the OH adsorbate producing a H(+1) yield similar to that in bulk H2O. The second involves metal core-level excitation followed by Auger decay and is an example of molecular adsorbate dissociation arising from a metal-substrate Auger decay. This is a further generalization of the Knotek-Feibelman model applicable for desorption in ionic systems.

705,445
PB86-132578 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Electrochemical Noise Measurements for the Study of Localized Corrosion and Passivity Breakdown.
Final rept.
U. Bertocci, J. L. Mullen, and Y. Ye. 1983, 6p
Pub. in Proceedings of Passivity of Metals and Semiconductors, Bombannes, France, May 30-June 3, 1983, p229-234.

Keywords: *Electrochemistry, *Corrosion, *Acoustic measurement, *Electrodes, *Passivity, Comparison, Aluminum, Chromium steels, Pitting.

Measurement of the random fluctuations of the current for Al, Fe-Cr and amorphous Fe-Ni-Cr electrodes are reported, both in the form of time records and frequency spectra. Comparison between the noise measured when no pitting could occur and when pitting was possible, showed that detectable fluctuations were present only in the second case. For the amorphous alloy, which is not susceptible to pitting, little noise could be measured even when the electrode was undergoing transpassive dissolution. Examples of random noise used for measuring electrode impedance are also given.

705,446
PB86-132586 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Examination of Current Fluctuations during Pit Initiation in Fe-Cr Alloys.
Final rept.
U. Bertocci, and Y. Ye. 1984, 7p
Pub. in Jnl. of the Electrochemical Society 131, n5 p1011-1017 1984.

Keywords: *Chromium steels, *Passivity, *Pitting, *Electrochemistry, *Corrosion, *Acoustic measurement, Comparison, Reprints.

Random fluctuations of the passive current for Fe-Cr alloys of various Cr content have been examined, both in borate buffer and in the same solution with 0. mol/L NaCl added. Frequency spectra of these fluctuations have been recorded before and during pit initiation. No detectable fluctuations were observed in the absence of chlorides, when pitting does not occur. Comparison with the current noise measured before pit initiation indicates that the most important role of the aggressive ions is that of increasing the chance of local breakdown of the passive film. Frequency spectra give information concerning the time constants of the various processes, including repassivation. No correlation was found between the rate of attack during pitting and noise amplitude.

705,447
PB86-132636 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Interactions of Sulfur with Nickel Surfaces: Adsorption, Diffusion, and Desorption.
Final rept.
M. Blasczyszyn, R. Blasczyszyn, R. Meclewski, A. J. Melmed, and T. E. Madey. 1983, 15p
Pub. in Surface Science 131, n2-3 p433-447 1983.

Keywords: *Surface chemistry, *Sulfur, *Adsorption, *Diffusion, *Desorption, Nickel, Emission spectrascopy, Reprints.

The kinetics of adsorption, surface diffusion and thermal desorption of sulfur on Ni surfaces, have been studied using field electron emission microscopy methods. The sticking probability for elementary sulfur sublimed onto a Ni specimen is approximately unity for Ni substrate temperatures from 77 to 530 K. For multilayer adsorption of sulfur, diffusion occurs without motion of a sharp boundary, and there is evidence of extensive surface reaction between S and Ni (emission from small 'crystallites' is evident in the field emission patterns). Sulfur desorbs from Ni at temperatures above 1500 K.

705,448
PB86-133394 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Center for Materials Science.
Comment on 'New Critical Point in the Vicinity of the Freezing Temperature of Potassium-Cesium (K2Cs)'.
Final rept.
J. W. Cahn, and J. L. Murray. 1983, 1p
Pub. in Physical Review Letters 51, n16 p1493 1983.

Keywords: *Critical point, *Freezing, *Cesium alloys, *Potassium alloys, Phase diagrams, Calorimetry, Heat capacity, Reprints.

A recent report of a critical point in the K-Cs system seemed unlikely to the authors. With the existing phase diagram and calorimetric data the authors could fit quite accurately almost all the data including those that led to the hypothesized critical point. The only discrepancy was resolved when they contacted the author and found that a power outage had occurred which they had not deemed significant enough to report. They conclude that no change in the phase diagram is needed to account for these data.

705,449
PB86-133402 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Nonequilibrium Surface and Interface Thermodynamics.
Final rept.
J. W. Cahn. 1983, 5p
Pub. in Proceedings of NATO Advanced Research Institute on Atomistics of Fracture, Calcatoggio, Corsica, France, May 22-31, 1981, Atomistics of Fracture, p427-431 1983.

Keywords: *Surface chemistry, *Thermodynamics, *Adsorption, *Fractures(Materials).

Thermodynamics of surfaces has played an important role in the development of fracture criteria. It seems clear that many of these classical papers were based on simplifying assumptions whose validity needs to be reexamined. The recent concerns with the subtleties of the effects of adsorption underscore this point. The difficulty of finding and proving the validity of simple inequalities for surface creation in nonequilibrium systems and Gibbs' counterexample should serve as warning that these concerns are real and deserve our attention.

705,450
PB86-133451 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Time-Resolved Measurements of Vibrational Relaxation of Molecules on Surfaces: Hydroxyl Groups on Silica Surfaces.
Final rept.
M. P. Casassa, E. J. Heilweil, J. C. Stephenson, and R. R. Cavanagh. 1985, 2p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Vacuum Science and Technology A3, n3 p1655-1656 May/Jun 85.

Keywords: *Molecular relaxation, *Molecular vibration, *Silicon dioxide, *Surface chemistry, Infrared spectroscopy, Reprints, *Hydroxyl radicals.

The vibrational population relaxation rate of the O-H stretching fundamental of hydroxyl groups on SiO2 surfaces was measured directly using picosecond infrared pulses. The vibrational lifetime determined for hydroxyls at the silica-vacuum interface is 204 + or - 20 ps. For silica-bound hydroxyls in a saturated atmosphere of CCl4, the lifetime decreases to 159 + or - 16 ps. Both lifetimes are many times longer than would be inferred from infrared absorption linewidths.

705,451
PB86-133477 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Laser Studies of Surface Chemical Reactions.
Final rept.
R. R. Cavanagh, and D. S. King. 1984, 18p
Pub. in Springer Series of Chemical Physics 35, n5 p141-158 1984.

Keywords: *Surface chemistry, *Nitrogen oxide(NO), *Desorption, *Fluorescence, Dynamics, Doppler effects, Molecular energy levels, Ruthenium, Oxidation, Angular distribution, Reprints, *Laser excited fluorescence.

A review of laser studies of surface chemical dynamics with emphasis on thermal desorption processes is presented. The correlation of gas phase and liquid molecular dynamics with analogous surface processes is demonstrated, with primary emphasis on experimental techniques for monitoring relevant quantum state populations. Recent results for the desorption of NO from Ru(001) and NO from oxidized Ru crystals are compared in terms of rotational populations, and velocity and angular flux distributions.

705,452
PB86-133519 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Leung-Griffiths Model for the Thermodynamic Properties of the Mixture of Carbon Dioxide and Ethane Near the Gas-Liquid Critical Line.
Final rept.
R. F. Chang, and T. Doiron. 1983, 16p
Pub. in International Jnl. of Thermophysics 4, n4 p337-352 1983.

Keywords: *Mathematical models, *Carbon dioxide, *Ethane, *Phase transformation, Thermodynamic properties, Equations of state, Mixtures, Critical points, Comparison, Reprints, Numerical solution.

Leung and Griffiths have proposed a thermodynamic fundamental equation for a binary mixture near the critical line. The equation is of the scaling form which incorporates nonclassical exponents. They developed the equation based on the idea that the thermodynamic properties of mixtures can be obtained from the interpolation between the critical properties of pure components when a set of suitable variables are used. They demonstrated the applicability of the idea successfully in the mixture of He3 and He4 in which the critical line is a nearly linear function of composition. We have used a Leung-Griffiths type equation of state to describe the thermodynamiic properties of the mixture of carbon dioxide and ethane. The critical line of this mixture is, unlike that of He3 and He4, a non-linear function of composition and the azeotropic line extends to the critical line. Comparison of the predictions of the equation to experimental data shows a good agreement for the mixtures of CO2 and C2H6.

705,453
PB86-133568 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electric Field Effects on the Absorption Spectra of Molecular Hydrogen Near the Ionization Limit.
Final rept.
J. W. Cooper, E. B. Saloman, B. E. Cole, and 1983, 3p
Pub. in Physical Review A: General Physics 28, n3 p1832-1834 1983.

Keywords: *Hydrogen, *Photoionization, *Ultraviolet spectroscopy, *Absorption spectra, Stark effect, Electric fields, Reprints.

The abosorption cross section of H2 has been measured in the region between 77.5 and 83.7 micrometers and the effects of electric fields up to 22 kV/cm on the cross sections has been investigated. The apparent cross section is found to be increased in the neighborhood of optically allowed transitions to nu rho signa and nu rho pi states with nu=4-7. This increase in absorption is attributed to field mixing with nearby optically forbidden states.

705,454
PB86-133824 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reaction of Oxygen Atoms with Olefins.
Final rept.
R. J. Cvetanovic, and D. L. Singleton. 1984, 44p
Pub. in Rev. Chem. Intermed. 5, n2 p183-226 1984.

Keywords: *Reaction kinetics, *Alkene hydrocarbons, Chemical reactions, Atomic energy levels, Reprints, *Chemical reaction mechanisms, *Oxygen atoms.

The mechanisms and kinetics of the chemical reactions of the ground state oxygen atoms, O(triplet P), with olefins are reviewed in detail. More recent experimental and theoretical literature is analyzed with respect to its bearing on the early pioneering and extensive subsequent developments in this field carried out in authors' laboratory.

705,455

PB86-133832 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Ni/Cr Interface Width Dependence on Sputtered Depth.
Final rept.
F. Davarya, M. L. Roush, J. Fine, T. D. Andreadis, and O. F. Goktepe. 1983, 4p
Pub. in Jnl. of Vacuum Science and Technology A-Vacuum Surfaces and Films 1, n2 p467-470 1983.

Keywords: *Interfaces, *Thin films, *Topography, *Nickel, *Chromium, Monte Carlo methods, Auger electrons, Sputtering, Reprints.

The composition depth distribution of an interface as determined by Auger sputter depth profiling is dependent, to a large extent, on both the ion bombardment induced cascade mixing and on the surface topography generated as a result of ion erosion. The authors assess the relative influence of these two processes on the depth resolution by comparing interface widths obtained by Auger sputter depth profiling (resulting from both the cascade mixing and the topography) to interface widths obtained by computer simulation (due to cascade mixing alone). Depth profiles were measured at eight successive interfaces of a multilayered Ni/Cr/Ni/Cr...thin-film structure using both 1 and 3-keV argon ion beams for sputter profiling. These interface widths increase with sputter depth, the increase being more rapid for the 3-keV bombardment. The calculations with the computer code EVOLVE contain modeling of all contributions to interface broadening except that of surface topography, thus resulting in constant values of interface widths. The difference in width obtained from the measured and calculated data is used to estimate the extent of the topography produced as a function of sputtered depth.

705,456

PB86-136744 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Photoionization Dynamics of Small Molecules.
Final rept.
J. L. Dehmer, D. Dill, and A. C. Parr. 1985, 68p
Pub. in NATO ASI Ser., Ser. C, Photophys. Photochem. Vac. Ultraviolet 142, p341-408 1985.

Keywords: *Photochemical reactions, *Ionization, *Dynamics, Excitation, Reprints, *Autoionization.

Photoionization dynamics of small molecules are discussed with emphasis on shape and autoionizing resonances. These resonant processes are important probes of the photoionization process for various reasons, the most obvious one being that they are usually displayed prominently against nonresonant behavior in such observables as the total photoionization cross section, photoionization branching ratios, and photoelectron angular distributions. More importantly, the study of these resonant features has repeatedly led to a deeper physical insight into the mechanisms of excitation, resonant trapping of the photoelectron, and decay of the excited complex that occur during the photoionization process. Of particular interest in this context are the uniquely molecular aspects resulting from the anisotropic molecular field and the interplay among rovibronic modes. The authors review the fundamental aspects of both types of resonant process and discuss recent progress and prospects for future work from both experimental and theoretical points of view. Finally, a brief overview of various approaches not covered in the main discussion is presented to stress the variety of complementarity of alternative probes of molecular photoionization dynamics.

705,457

PB86-136751 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Chemical Physics.
Aqueous Solubilities and Enthalpies of Solution of Adenine and Guanine.
Final rept.
H. DeVoe, and S. P. Wasik. 1984, 10p
Pub. in Jnl. of Solution Chemistry 13, n1 p51-60 1984.

Keywords: *Solubility, *Enthalpy, *Adenine, *Guanine, Solutions, Temperature, Reprints, Liquid chromatography.

A generator column - liquid chromatographic technique was used to determine the aqueous solubility of adenine in the temperature range 20 - 30 C, and of guanine in the range 15 - 40 C. The adenine enthalpy value includes a small correction for association in the saturated solutions. The previously undetermined molar enthalpy of the second ionization step of guanine (to form the doubly-charged guanine anion) is estimated from our data combined with other measurements to equal (33.8 + or - 2.9) kJ/mol.

705,458

PB86-136777 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Radiation-Induced Formation of Thymine-Thymine Crosslinks.
Final rept.
M. Dizdaroglu, and M. G. Simic. 1984, 6p
Pub. in International Jnl. of Radiation Biology and Related Studies in Physics, Chemistry and Medicine 46, n3 p241-246 1984.

Keywords: *Dimers, *Radiation effects, Crosslinking, Gas chromatography, Reprints, *Thymine, *Hydroxyl radicals, Chemical reaction mechanisms.

The formation of thymine dimers as a major consequence of radiation-generated OH radical reactions with thymine in aqueous solutions is reported. About one half of the intermediates which resulted from OH reactions with thymine, i.e., thymine radicals, dimerize, indicating dimerization as one of the major reaction pathways. The other half of thymine radicals disproportionate and give previously observed monomeric products. One should point out that the 'thymine dimers' observed in this work are not the same as the UV light-induced dimers of thymine.

705,459

PB86-136793 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Orientational Ordering of an Incommensurate Sodium Layer on Ru(001).
Final rept.
D. L. Doering, and S. Semancik. 1984, 1p
Pub. in Jnl. of Vacuum Science and Technology A-Vacuum Surfaces and Films 2, n2 p893 1984.

Keywords: *Surface chemistry, *Sodium, *Chemisorption, Ruthenium, Orientation, Reprints, *Low energy electron diffraction.

Orientational ordering refers to the azimuthal alignment of an overlayer into a specific orientation relative to a substrate lattice. Experimental demonstrations of this effect for solid, incommensurate monolayers have been reported previously for inert gases physisorbed on graphite. The work summarized here describes the first detailed examination of orientational ordering in a strongly chemisorbed incommensurate layer.

705,460

PB86-136850 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Frequency Optical Heterodyne Spectroscopy.
Final rept.
M. Ducloy, and J. J. Snyder. 1983, 4p
Pub. in Proceedings of the Society of Photo-Optical Instrumentation Engineers Laser-Based Ultrasensitive Spectroscopy and Detection, San Diego, CA., August 23-24, 1983, v426, p87-90.

Keywords: *Doppler effect, *Noise reduction, Performance evaluation, *Laser spectroscopy, *Optical heterodyne spectroscopy.

The progress over the last few years in the field of sub-Doppler saturated absorption spectroscopy has been greatly assisted by the development of new techniques for increasing sensitivity. For many laboratory situations it is now routinely possible to achieve signal-to-noise ratios and sensitivities very near the quantum limit imposed by the fundamental statistical fluctuations (shot noise) of the probe laser beam. It has been known for some time that the sensitivity of shot-noise limited saturation spectroscopy is exceedingly high. Until recently however, the sensitivity achieved in practice was more often several orders of magnitude worse than the predicted shot-noise limit. The reason for the reduced sensitivity is due to a number of non-fundamental or 'technical' sources, including common problems such as electronic interference and ground loops as well as amplifier noise, unstable laser feedback interference, and excessive laser amplitude noise. In this discussion the authors shall assume that the electronic problems have been solved, and that high-quality, low-noise amplifiers are in use. Their objective will be to show how the effects of laser feedback and laser amplitude noise may be reduced to the level of shot noise or below.

705,461

PB86-136876 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Core-Level Binding-Energy Shift Analysis of Adsorption and Dissociation.
Final rept.
W. F. Egelhoff. 1984, 3p
Pub. in Physical Review B: Condensed Matter 29, n6 p3681-3683 1984.

Keywords: *Adsorption, *Dissociation, *Thermochemistry, Atomic energy levels, Molecular energy levels, Photoemission, Nitrogen, Nitrogen oxides(NO), Reprints.

An analysis of core-level binding-energy shifts of adsorbed atoms and molecules is used to determine important thermochemical quantities which are often otherwise unmeasurable. Also presented are a new approach to interpreting adsorbate core-level spectra and a novel technique for probing adsorbed molecules in energetically unfavored orientations.

705,462

PB86-136892 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Core-Level Binding-Energy Shift Analysis of N2 on Ni(100). Summary Abstract.
Final rept.
W. F. Egelhoff. 1984, 1p
Pub. in Jnl. of Vacuum Science and Technology A-Vacuum Surfaces and Films 2, n2 p1013 1984.

Keywords: *Molecular energy levels, *X ray analysis, *Surface chemistry, *Nickel, *Thermochemistry, X ray spectroscopy, Photoemission, Atomic energy levels, Nitrogen, Nitrogen oxide(NO), Reprints.

The equivalent core approximation has been used together with a Born-Haber cycle analysis to treat the x-ray photoelectron spectra of the nitrogen 1s core levels of molecular N2 adsorbed on the Ni(100) surface. The analysis yields the heats of adsorption of nitric oxide, oxygen atom down and nitrogen atom down.

705,463

PB86-136900 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Core-Level Binding-Energy Shift Analysis of CO, H, and O Adsorption on Cu-Ni Surfaces.
Final rept.
W. F. Egelhoff. 1985, 4p
Pub. in Jnl. of Vacuum Science and Technology A3, n3 p1305-1308 May/Jun 85.

Keywords: *Carbon monoxide, *Hydrogen, *Oxygen, *Adsorption, *Molecular energy levels, *Surface chemistry, Copper, Nickel, Desorption, Chemisorption, Thermochemistry, Reprints.

The equivalent core approximation (Z + 1) is used with a Born-Haber cycle analysis to analyze the Ni2p(sub 3/2) surface core-level binding-energy shifts which occur upon adsorption of CO, H, and O on Ni(100). The analysis gives values for the heats of desorption of these gases from Cu-Ni alloy surfaces. Perhaps more importantly, it also provides a quantitative determination of how chemisorption of CO, H, and O modify the heats of surface segregation for Cu-Ni surfaces.

705,464
PB86-136942 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
N2 on Ni(100): Angular Dependence of the N(sub 1S) XPS (X-ray Photoelectron Spectroscopy) Peaks.
Final rept.
W. F. Egelhoff. 1984, 5p
Pub. in Surface Science 141, pL324-L328 1984.

Keywords: *X ray spectroscopy, *Nickel, *Surface chemistry, *Adsorption, Nitrogen, Molecular structure, Reprints, Nitrogen atoms.

The X-ray photoelectron spectrum of molecular N2 adsorbed in a c(2x2) structure on Ni(100) shows two N(sub 1s) peaks in the fully-screened N(sub 1s) region around 400 eV binding energy and a shake-up structure around 405eV. The assignment of the two fully-screened peaks to the two inequivalent N atoms is established on the basis of the angular variation in the peak intensities. This assignment provides important support for a Born-Haber cycle analysis of these peaks.

705,465
PB86-137627 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 90, Number 4, July-August 1985.
Aug 85, 69p
See also PB86-137635 through PB86-137676, and PB85-237329. Also available from Supt. of Docs as SN703-027-000005-9.

Keywords: *Research projects, Calibrating, Density(Mass/volume), Comparison, Silicon, Standards, Enthalpy, Combustion, Triazines, Calorimeters, Corrosion, Bioassay, Deoxyribonucleic acids, Rydberg series, Computer applications.

Contents:
- Recalibration of the U.S. National Prototype Kilogram;
- Density comparison of silicon artifacts between NML (Australia) and NBS (U.S.);
- Mass comparator for in-situ calibration of large mass standards;
- Determination of the enthalpies of combustion and formation of substituted triazines in an adiabatic rotating bomb calorimeter;
- Metrics and techniques to measure microcomputer productivity;
- Field effects on Rydberg atoms;
- International assembly discusses mechanisms of DNA damage repair;
- Microbes play a considerable role in corrosion.

705,466
PB86-137965 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Determination of Longitudinal Crystal Moduli in Polymers by Spectroscopic Methods.
Final rept.
B. Fanconi, and J. F. Rabolt. 1985, 15p
Pub. in Jnl. of Polymer Science: Polymer Physics Edition 23, p1201-1215 1985.

Keywords: *X ray diffraction, *Polymers, *Raman spectroscopy, *Modulus of elasticity, Inelastic scattering, Neutron scattering, Reprints, Numerical solution.

Experimental methods for determining longitudinal crystal moduli of polymers were evaluated in light of recent processing methods that produced macroscopic Young's moduli which exceeded ultimate values as found by the x-ray diffraction method. The spectroscopic techniques of Raman and coherent inelastic neutron scattering yielded higher longitudinal crystal moduli than x-ray diffraction, and from calculations described herein it is concluded that these spectroscopic values are better estimates of the maximum Young's moduli in fully aligned and crystalline polymeric materials.

705,467
PB86-137973 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Ammonia Adsorption on the Ag(311) Surface.
Final rept.
S. T. Ceyer, and J. T. Yates. 1985, 12p
Pub. in Surface Science 155, p584-595 1985.

Keywords: *Silver, *Surface chemistry, *Adsorption, Molecular structure, Chemical bonds, Ammonia, Performance evaluation, Reprints, Electron stimulated desorption ion angular distribution method, Thermal desorption spectroscopy, Electron energy loss spectroscopy.

The adsorption of ammonia on the Ag(311) surface has been studied by ESDIAD (electron stimulated desorption-ion angular distributions), high resolution electron energy loss spectroscopy and thermal desorption spectroscopy. Two desorption peaks are observed in the thermal desorption spectra and are correlated with two bonding geometries. The more strongly bound state corresponds to ammonia bound on top of the ridge atom through the nitrogen end with its C(sub 3v) axis perpendicular to the macroscopic surface. It is suggested that the less strongly bound state corresponds to ammonia molecules lying down in the troughs.

705,468
PB86-138054 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Kinetics of Sputter-Enhanced Surface Segregation at a Ni/Ag Interface.
Final rept.
J. Fine, T. D. Andreadis, and F. Davarya. 1983, 2p
Pub. in Jnl. of Vacuum Science and Technology A-Vacuum Surface and Films 1, n2 p507-508 1983.

Keywords: *Sputtering, *Nickel, *Silver, *Ion beams, *Ion irradiation, Reaction kinetics, Diffusion, Surfaces, Reprints, *Auger spectroscopy.

Sputter profiling of a Ni/Ag interface produces a mixed Ni-Ag surface region and the authors have found that in such a region that Ag will segregate to the surface. This segregation can be observed to occur in real time after the ion bombardment has been stopped. Auger spectroscopy was used to obtain a unique set of measurements of the kinetics of surface segregation due to bombardment enhanced diffusion and to determine the thickness of the segregated Ag layer at equilibrium.

705,469
PB86-138088 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Desorption Mass Spectrometry of Surface-Absorbed Molecules.
Final rept.
R. A. Fletcher, I. Chabay, D. A. Weitz, and J. C. Chung. 1984, 5p
Pub. in Chemical Physics Letters 104, n6 p615-619 1984.

Keywords: *Mass spectroscopy, *Surface chemistry, *Adsorption, Desorption, Visible spectroscopy, Ultraviolet spectroscopy, Reprints, *Laser spectroscopy, *Time of flight mass spectroscopy.

The role of surface microstructure in the visible and UV pulsed laser desorption of surface adsorbates is examined. It is shown that the surface roughness aids in a relatively gentle thermal desorption of adsorbed molecular monolayers, substantially increasing the sensitivity and selectivity of time of flight mass spectroscopy in the analysis of adsorbates on metal surfaces.

705,470
PB86-138138 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysical Properties Div.
Thermal-Conductivity Enhancement Near the Liquid-Vapor Critical Line of Binary Methane-Ethane Mixtures.
Final rept.
D. G. Friend, and H. M. Roder. 1985, 4p
Pub. in Physical Review A: General Physics 32, n3 p1941-1944 Sep 85.

Keywords: *Thermal conductivity, *Critical point, *Binary systems(Materials), *Methane, *Ethane, Mixtures, Alkanes, Liquid phases, Vapor phases, Temperature, Reprints.

Measurements of the thermal conductivity of mixtures of methane and ethane reveal an enhancement in the mixture critical region apparently contradicting theoretical predictions. The anomaly is similar in size and temperature dependence to that found for pure fluids.

705,471
PB86-138146 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Hydroxyl Radical-Induced Crosslinks of Methionine Peptides.
Final rept.
E. Gajewski, M. Dizdaroglu, H. C. Krutzsch, and M. G. Simic. 1984, 9p
Sponsored by National Cancer Inst., Bethesda, MD.
Pub. in International Jnl. of Radiation Biology and Related Studies in Physics, Chemistry and Medicine 46, n1 p47-55 1984.

Keywords: *Peptides, Crosslinking, Gas chromatography, Mass spectroscopy, Hydrolysis, Samples, Reprints, *Hydroxyl radicals, *Methionine, *Methionines, Dimers, Homocystine, Butanic acid/amino-(methyldithio), Butanoic acid/thiobis(amino).

Reactions of radiation-generated OH radicals with methionine (Met) and its homopeptides, L-Met-L-Met and tri-L-Met, were investigated through reaction products. Samples of irradiated Met and HCl-hydrolyzates of its irradiated homopeptides were trimethylsilylated and analyzed by capillary gas chromatography-mass spectrometry. Mass spectra taken revealed the formation of three dimerization products, e.g., 2-amino-4-(methyldithio)butanic acid, 4,4'-thiobis(2-aminobutanoic acid) and homocystine. G-values of these products were determined to be 0.1, 0.16 and 0.3, respectively.

705,472
PB86-138153 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Thermodynamics of the Conversion of Fumarate to L-(-)-Malate.
Final rept.
E. Gajewski, R. N. Goldberg, and D. K. Steckler. 1985, 9p
Pub. in Biophysical Chemistry 22, p187-195 1985.

Keywords: *Thermodynamics, *Malates, Gas chromatography, Calorimetry, Enthalpy, Heat capacity, Enzymes, Catalysis, Chemical equilibrium, Fumarates, pH, Gibbs free energy, Reprints.

The thermodynamics of the conversion of aqueous fumarate to L-(-)-malate has been investigated using both heat conduction microcalorimetry and a gas chromatographic method for determining equilibrium constants. The reaction was carried out in aqueous Tris-HCl buffer over the pH range 6.3-8.0, the temperature range 25-47C, and at ionic strengths varying from 0.0005 to 0.62 mol/kg. Equations are given which allow one to calculate the combined effects of pH and temperature on equilibrium constants and enthalpies of this reaction.

705,473
PB86-138187 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Separated-Atom Theory of Laser-Induced Collisional Ionization of Cs by Sr.
Final rept.
S. Geltman. 1982, 19p
Pub. in Photon-Assisted Collisions and Related Topics, p35-53 1982.

Keywords: *Cesium, *Ionization, Perturbation theory, Stark effect, *Atom molecule collision, *Laser induced ionization, *Strontium atoms.

A semiquantitative theoretical description is given for the observed laser-induced collisional ionization (LICI) of Cs by Sr atoms. This is done in the separated-atom picture in which the resonant interaction of the atoms with the radiation is fully taken into account and the collision is treated perturbatively. The basic intensity dependence of the cross section and its spectral width are well explained, but the distinctive observed line asymmetry is accounted for only qualitatively.

705,474
PB86-138229 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Monte Carlo Modeling of Kinetics of Polymer Crystal Growth: Regime III and Its Implications on Chain Morphology.
Final rept.
C. M. Guttman, and E. A. DiMarzio. 1983, 13p
Pub. in Jnl. of Applied Physics 54, n10 p5541-5553 Oct 83.

Keywords: *Mathematical models, *Crystal growth, *Monte Carlo method, Crystallization, Reprints, *Polymer chains.

A Monte Carlo simulation of polymer crystal growth from the melt is presented. This two dimensional model approximates growth by laying down crystal stems one at a time. The Monte Carlo simulation of various geometric models of the crystal surface yields Regime I and Regime II growth similar to that predicted by Lauritzen and Frank. The analytical expression of Frank is shown to be accurate. A recent prediction by Hoffman of a low temperature region (Regime III) with properties similar to Regime I has been verified. Regime III is lattice dependent. Specifically the solid on solid model (SOS) commonly used to model monatomic systems yields Regime III but is not space filling. The hexagonal lattice yields correctly formed crystals but does not show Regime III as long as we require that the crystals grow on one plane. On the hexagonal lattice, if we allow growth on more than one growth plane, we obtain both space filling crystals and Regime III growth. There are no regimes of growth other than the three discussed here.

705,475
PB86-138237 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Product Vibrational State Distributions of Thermal Energy Charge Transfer Reactions Determined by Laser-Induced Fluorescence in a Flowing Afterglow: Ar(+1) + CO yields CO(+1) (v=0-6) + Ar.
Final rept.
C. E. Hamilton, V. M. Bierbaum, and S. R. Leone. 1985, 9p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 83, n5 p2284-2292, 1 Sep 85.

Keywords: *Carbon monoxide, *Dynamics, *Molecular vibration, Afterglows, Reprints, *Ion molecule interactions, *Laser induced fluorescence.

The Ar(+1) + CO yield CO(+1)(nu=0-6) + Ar charge transfer reaction is studied at thermal energy in a flowing afterglow and the vibrational state distribution is determined by laser-induced fluorescence on the CO(+1)(A (sup 2)pi-X(sup 2)sigma(+1) bands. The Ar(+1) + CO reaction is described as proceeding via a bent ArCO(+1) intermediate that forms in a side-on attack. Vibrational excitation may then result from delocalization of the bonding electron density of CO and the corresponding dynamical changes in the CO bond length in the intermediate.

705,476
PB86-138369 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Repair of Tryptophan Radicals by Antioxidants.
Final rept.
S. V. Jovanovic, and M. G. Simic. 1985, 5p
Pub. in Jnl. of Free Radicals in Biology and Medicine 1, n2 p125-129 1985.

Keywords: *Free radicals, *Antioxidants, Proteins, Oxidation, Phenols, Ascorbic acid, Reprints, *Tryptophan radicals, Phenylene diamine N-N-N-N-tetramethyl-(dihydrochloride).

Oxidizing free radicals with redox potential greater than 1 V generate indole radicals as in trytophan. These resonance-stabilized free radicals can be repaired efficiently with electron donors such as ascorbate, N,N,N1,N1-tetramethyl- p-phenylenediamine dihydrochloride (TMPD), and phenolic antioxidants.

705,477
PB86-138393 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Reaction Diffusion in a Medium Containing a Random Distribution of Nonoverlapping Traps.
Final rept.
R. F. Kayser, and J. B. Hubbard. 1984, 4p
Pub. in Jnl. of Chemical Physics 80, n3 p1127-1130 1984.

Keywords: *Reaction kinetics, *Diffusion, *Traps, Density(Mass/volume), Random functions, Reprints.

The transient reaction-diffusion kinetics in a system containing a random distribution of stationary spherical traps is analyzed. It is shown that recently obtained results concerning the long-time behavior of the trap-averaged density at the origin, may be readily extended to the cases of partially absorbing and nonoverlapping traps, independently of the number density of traps. The authors also estimate the size of the relative fluctuations and show that these fluctuations diverge at long times.

705,478
PB86-138401 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Diffusion in a Medium with a Random Distribution of Static Traps.
Final rept.
R. F. Kayser, and J. B. Hubbard. 1983, 4p
Pub. in Physical Review Letters 51, n2 p79-82, 11 Jul 83.

Keywords: *Reaction kinetics, *Diffusion, *Traps, Density(Mass/volume), Random functions, Reprints.

The authors consider particles diffusing in d-dimensional space among a random distribution of stationary spherical traps. Given a particle at the origin at time t=0, they show that the density of particles at the origin as t goes to infinity must decay at least as fast as (-t(sub d/(d+2))). The density here is obtained by averaging the diffusive field for a given configuration of traps over all configurations. The upper bound coincides with the lower bound recently derived by Grassberger and Procaccia.

705,479
PB86-138419 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Concentration Dependence of the Diffusion Coefficient and the Longest Relaxation Time of Polymer Chains in Solution.
Final rept.
D. E. Kranbuehl, and P. H. Verdier. 1985, 3p
Sponsored by American Chemical Society, Washington, DC.
Pub. in Macromolecules 18, n8 p1638-1640 1985.

Keywords: *Diffusion, *Molecular relaxation, *Dynamics, *Mathematical models, *Polymers, Solutions, Monte Carlo method, Concentration(Composition), Reprints, *Polymer chains.

The concentration dependence of the translational diffusion constant of polymer chains in non-dilute solutions has been examined by direct computer simulation for simple lattice-model chains. In agreement with several recent experimental studies, the results show no sign of regions of constant power-law dependence of diffusion constant upon concentration predicted by some theoretical models. They also appear to suggest that the major part of the concentration dependence may be accounted for by simple free-volume considerations.

705,480
PB86-138435 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Time Dependence of Mechanical and Transport Properties of Drawn and Annealed Linear Polyethylene.
Final rept.
F. Decandia, V. Vittoria, and A. Peterlin. 1985, 18p
Sponsored by Consiglio Nazionale delle Ricerche, Milan (Italy).
Pub. in Jnl. of Polymer Science, Polymer Physics Edition 23, p1217-1234 1985.

Keywords: *Polyethylene, *Mechanical properties, *Transport properties, Polymers, Reprints, *Crystalline polymers.

Linear polyethylene both as drawn, or drawn and subsequently annealed with free ends, changes its length, density, crystallinity, elastic modulus, sorption, and diffusivity as the sample stands completely unrestrained at room temperature. Most of these changes occur during the first few hours. But they are important on a molecular scale since they suggest strongly that drawn, and drawn and annealed samples are far from equilibrium. As a consequence of the tendency of each mobile tie molecule in the amorphous conformation to retract and to crystallize, the specimen approaches but does not reach complete equilibrium. The transient seems to be caused by slow crystallization of tie molecules which creates crystalline bridges across the amorphous layers.

705,481
PB86-138443 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Effect of Spin-Orbit Excitation on Chemical Reactivity: Laser Transient Absorption Spectroscopy of Br(doublet P(1/2), doublet P(3/2)) + IBr Reactive Dynamics.
Final rept.
H. K. Haugen, E. Weitz, and S. R. Leone. 1985, 8p
Grants NSF-CHE79-11340, NSF-PHY82-00805
Sponsored by National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Chemical Physics Letters 119, n1 p75-80, 23 Aug 85.

Keywords: *Bromine, *Dynamics, *Iodine halides, *Spin orbit interactions, Absorption, Reaction kinetics, Reprints, *Laser spectroscopy, *Iodine bromides.

A laser pulse-and-probe technique incorporating a tunable infrared color center laser is used to study the reactions and quenching of Br(doublet P(sub 1/2), doublet P(sub 3/2) with IBr. A highly selective spin-orbit effect on chemical reactivity is observed. The ground-state reaction, Br(doublet P(sub 3/2) +IBr yields Br2 +I, k=(4.6 + or - 0.6)x 10 to the -11th power/cc molecule s proceeds at a rate > or = 40 times faster than the rate of total Br (double P(sub 3/2) quenching and reaction with IBr.

705,482
PB86-138450 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Morphology of Poly(ethylene terephthalate) Fibers as Studied by Multiple-Pulse (1)H NMR (Nuclear Magnetic Resonance).
Final rept.
J. R. Havens, and D. L. VanderHart. 1985, 14p
Pub. in Macromolecules 18, n9 p1663-1676 1985.

Keywords: *Polyethylene terephthalate, *Nuclear magnetic resonance, Fibers, Molecular relaxation, Surfaces, Reprints, *Crystalline polymers.

Drawn poly(ethylene terephthalate) (PET) fibers annealed under various conditions are investigated by proton spin diffusion as detected through nuclear magnetic resonance. The primary objective is to study morphology on the 1-50-nm scale, the smaller dimensions of which have proved difficult to characterize for PET by conventional techniques. The spin diffusion experiment is comprised of three periods: generation of a magnetization gradient among different domains, relaxation of the gradient by diffusion for a variable time, and separate detection of the magnetization corresponding to each domain. The use of a multiple-pulse sequence permits spin diffusion to be confined to the second period, resulting in enhanced resolution among the domains. The procedure allows the magnetization decay observed during the detection period to be decomposed into three components, which are assigned to mobile noncrystalline, constrained noncrystalline, and crystalline domains. Rates of polarization redistribution among these three components are studied as a function of the diffusion time. Computer modeling is carried out in order to relate these measurements to the spatial arrangement and size of the three components. The results quantify the increase in crystallinity and in crystallite size upon annealing. Information pertaining to the structure of the noncrystalline region, the importance of noncrystalline chain orientation, and the relative surface areas of the crystallites is also presented.

705,483
PB86-138468 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of the Director.
Simple Accurate Absorption Model.
Final rept.
K. F. J. Heinrich. 1985, 4p
Pub. in Proceedings of Annual Meeting of Electron Probe Microanalysis Society, Louisville, Kentucky, August 5-9, 1985, p79-82.

Keywords: *Absorption, *Mathematical models, *X ray analysis, Experimental design, Excitation.

A new model for the absorption of electron excited x-rays in the target, is proposed. This empirical model is simple and provides a good fit to existing experimental

information. it will be particularly useful when elements of low (<15) atomic numbers are determined.

705,484
PB86-138484 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Charge Transfer, Vibrational Excitation, and Dissociative Adsorption in Molecule - Surface Collisions: Classical Trajectory Theory.
Final rept.
S. Holloway, and J. W. Gadzuk. 1985, 13p
Pub. in Jnl. of Chemical Physics 82, n11 p5203-5215, 1 Jun 85.

Keywords: *Diatomic molecules, *Surface chemistry, Excitation, Potential energy, Adsorption, Molecular vibration, Dynamics, Reprints, *Atom diatom collisions.

The consequences of charge transfer processes occurring when a molecular beam of diatomic molecules is directed upon a solid surface are here considered. In analogy with resonance electron scattering from molecules or harpooning processes in atom-diatom collisions, the incident beam could either be scattered into a highly vibrationally excited molecular state, dissociatively scattered, or dissociatively adsorbed due to formation of temporary negative molecular ions which enable redistribution of the incident translation energy of the beam into intramolecular degrees of freedom. In the work, the exact classical trajectories for the diatomic molecule, including internal vibrational motion, are calculated for motion over model diabatic potential surfaces in which surface hopping due to charge transfer/harpooning is accounted for. Connections between classes of trajectories and topological features of the potential energy surfaces (PES) are illustrated. The model is used to study the average translational to vibrational energy transfer as a function of incident kinetic energy and of PES parameters. Branching ratios between scattered and dissociatively adsorbed molecules are obtained as a function of both incident translational and total energy and the role of the intermediate negative ion resonance in influencing the dynamics of molecular processes at surfaces is illustrated. Comparison with quantum mechanical theories is given in a subsequent paper.

705,485
PB86-138534 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Kinetics of Peroxy Radical Reactions with Antioxidants.
Final rept.
E. P. Hunter, and M. G. Simic. 1983, 6p
Pub. in Proceedings of Int. Conf. Superoxide and Superoxide Dismutase--Oxy Radicals Their Scavenger Syst. (3rd), v1 p32-37 1983.

Keywords: *Reaction kinetics, *Antioxidants, *Radiolysis, Activation energy, Viscosity, Phenols, *Peroxy radicals.

A variety of peroxy radicals were generated by pulse radiolysis in aqueous solutions and organic solvents and their rates with some phenolic antioxidants were measured. The rate constants depend on the nature of peroxy radicals, viscosity of the medium and temperature.

705,486
PB86-138542 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysical Properties Div.
Status of Thermal Conductivity Standard Reference Materials at the National Bureau of Standards.
Final rept.
J. G. Hust. 1985, 12p
Pub. in Therm. Conduct. 18, p327-338 1985.

Keywords: *Thermal conductivity, *Standards, Metals, Tungsten, Iron, Stainless steel, Graphite, Calibrating, Reprints, *Standard reference materials.

The paper describes the present status of NBS thermal conductivity Standard Reference Materials (SRM's) and Calibrated Transfer Specimens (CTS's). Included are the metal SRM's, tungsten, electrolytic iron, and austenitic stainless steel. Also discussed is graphite, a soon-to-be-established SRM and candidate SRM's, such as black quartz. Finally, a description is given of the insulation SRM's and CTS's.

705,487
PB86-138609 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Reaction of F Atoms with the Methylhalides. Vibrational Spectra of CH3XF and of H2CX...HF Trapped in Solid Argon.
Final rept.
M. E. Jacox. 1985, 13p
Pub. in Jnl. of Chemical Physics 83, p3255-3267, 1 Oct 85.

Keywords: *Halides, *Vibration spectra, Chemical bonds, Photochemistry, Complex compounds, Infrared spectroscopy, Reprints, *Matrix isolation technique, *Fluorine atoms, *Chemical reaction mechanisms, Methane/chloro, Methane/bromo, Methane/iodo.

When the products of the reaction between F atoms formed in a microwave discharge and CH3Cl, CH3Br, or CH3I were frozen in a large excess of argon at 14 K, the infrared spectra of the primary reaction products wre obtained. Isotopic substitution experiments have provided evidence for two major reaction channels in each of these three reaction systems. Attack of the F atom at the halogen position results in the formation of the CH3XF addition product, which has a moderately strong X-F bond and is photochemically stable at wavelengths as short as 250 nm. F-atom reaction with a hydrogen atom of the methyl halide results in the stabilization of a weakly bound F-HCH2X complex, intermediate to the formation of H2CX + HF. For all of the species studied except CH3Cl, the barrier to the decomposition of this complex is sufficiently great to require exposure of the solid deposit to visible light for the production of H2CX and HF. The infrared spectra of the H2CX-HF hydrogen-bonded complexes isolated in solid argon are discussed.

705,488
PB86-139839 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Viscosities and Glass Transition Pressures in the Methanol-Ethanol-Water System.
Final rept.
I. Fujishiro, G. J. Piermarini, S. Block, and R. G. Munro. 1982, 3p
Pub. in Proceedings of 8th AIRAPT - 19th EHPRG Conference on High Pressure in Research and Industry, Uppsala, Sweden, August 17-27, 1981, v2 p608-611 1982.

Keywords: *Viscosity, *Transition points, *Methyl alcohol, *Ethyl alcohol, *Water, Mixtures, Pressure.

The pressure dependence of the viscosity and glass transition pressures for the binary methanol-water and ternary methanal-ethanol-water system have been measured at room temperature for several methanol-water compositions. A diamond-anvil falling-sphere viscometer, which uses the ruby fluorescence method of pressure measurement, was employed. Glass transition pressures were determined for the various mixtures by the ruby fluorescence line-broadening method. A new hydrostatic pressure transmitting medium was found having the composition 16 methanol: 3 ethanol: 1 water solution which extends the hydrostatic limit to 14.4 GPa at room temperature. A correlation between the pressure dependence of viscosity and the glass transition pressure is discussed for these solutions.

705,489
PB86-139896 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Spin Coupling through Oxygen. Influence of Structure and Solvent on doublet J((119)Sn,(117)Sn) in the (119)Sn NMR of Hexaorganodistannoxanes.
Final rept.
T. P. Lockhart, W. F. Manders, and F. E. Brinckman. 1985, 6p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Organometallic Chemistry 286, p153-158 1985.

Keywords: *Oxygen, *Tin isotopes, *Molecular structure, Solvents, Molecular energy levels, Reprints, *Chemical shifts(Nuclear magnetic resonance), *Distannoxanes.

Sn,Sn spin coupling though oxygen, doublet J(119)Sn,(117)Sn), has been measured for seven hexaorganodistannoxanes (R3Sn)2O). The magnitude of the coupling constant depends strongly on the organic ligand, varying over the range 421 to 651 Hz in benzene solution. The substituent effect on doublet J is interpreted as arising from changes in the Sn-O-Sn bond angle, which should strongly influence the magnitude of the Fermi contact term contribution to the coupling constant. A pronounced solvent effect on doublet J(119Sn, 117Sn) was also observed; solvent studies with (n-Bu3Sn)2O indicate that the electron acceptor strength of the solvent determines the magnitude of the interaction. The utility of the coupling constant as a means of distinguishing between distannoxanes and related compounds is noted.

705,490
PB86-139904 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Photodetachment Spectroscopy of -CH2CN.
Final rept.
K. R. Lykke, D. M. Neumark, V. J. Trapa, W. C. Lineberger, and T. Andersen. 1985, 4p
Grants NSF-PHY82-00805, NSF-CHE83-16628
Sponsored by National Science Foundation, Washington, DC.
Pub. in Proceedings of International Conference on Laser Spectroscopy (7th), Maui, Hawaii, Jun 24-28, 1985, p130-133.

Keywords: *Molecular structure, *Molecular energy levels, *Dynamics, Excitation, Line width, *Laser spectroscopy, *Methane/cyano, *Photodetachment.

High resolution photodetachment spectroscopy of -CH2CN has been used to study the ionic ground state as well as an electronically excited dipole-bound state located in the vicinity of the threshold. The dynamical properties of the dipole-bound state have been investigated by means of line-width measurements. A surprising J dependence has been observed for the autodetachment lifetimes.

705,491
PB86-140019 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Reaction Products from a Discharge of N2 and H2S: The Microwave Spectrum of Two Conformers of Sulfur Diimide (HNSNH).
Final rept.
R. D. Suenram, F. J. Lovas, and W. J. Stevens. 1985, 12p
Pub. in Jnl. of Molecular of Spectroscopy 112, p482-493 1985.

Keywords: *Molecular rotation, *Molecular structure, *Microwave spectroscopy, Dipole moments, Deuterium compounds, Reprints, *Molecular conformations, *Sulfur diimide.

The rotational spectra of two conformations of sulfur diimide (HNSNH) are reported. The HNSNH species are produced in a low-pressure microwave discharge of N2 and H2S. The microwave spectrum of the normal isotopic form, HNSNH, and dideutro form, DNSND, of the cis,trans and cis,cis forms have been observed. The electric dipole moment components of both forms have been determined. The molecular structures were determined from the experimental rotational constants and from geometry optimized ab initio calculations with 4-31G Gaussian basis sets and CEP-31G basis sets including polarization. The experimentally and theoretically derived molecular properties are found to be in good agreement.

705,492
PB86-140282 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Virial Coefficients of Ethylene.
Final rept.
J. M. H. Levelt Sengers, and J. R. Hastings. 1981, 5p
Pub. in Proceedings of the Thermophysical Properties Symposium (8th), Thermophysical Properties of Fluids, Gaithersburg, Maryland, June 15-18, 1981, v1 p66-70.

Keywords: *Ethylene, *Virial coefficients, *Burnett method.

The authors report virial coefficients for ethylene, obtained in the vapor phase in the range 223-273 K by means of the Burnett method, at pressures from near saturation down to 0.23 MPa. The uncertainty of the pressure measurements is 5 parts in 10 to the 5th power; temperature was controlled and measured to better than 1 mK. Noxious volumes were absent. The data were tested for adsorption by coupling the isotherms isochorically; a small effect was found. Additional values of the second and third virial coefficient were

derived from two sets of recent PVT data. Recent virial data from five sources, including the authors own, were correlated in the range 223 - 448 K by means of a simple empirical relationship. The data for the second virial from three of the sources generally agree to better than 0.5 cu cm/mol. Virials derived from speed-of-sound data are in excellent agreement with these data. There seems to be no need for further PVT data on low-density ethylene in the temperature range. Comparisons are also made of the predictions of two recent correlations of thermodynamic properties of ethylene. There is room for improvement, and suggestions are made as to how to achieve this.

705,493
PB86-140340 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Thermal and Oxidative Degradation of Poly(Methyl Methacrylate): Weight Loss.
Final rept.
T. Hirata, T. Kashiwagi, and J. E. Brown. 1985, 9p
Pub. in Macromolecules 18, n7 p1410-1418 1985.

Keywords: *Polymethyl methacrylate, *Thermal degradation, *Oxidation, Diffusion, Weight measurement, Comparison, Impurity, Samples, Reprints.

The effects of gas-phase oxygen on the weight loss of poly(methyl methacrylate) (PMMA) were studied by comparing weight loss behavior of PMMA degraded in nitrogen with that of PMMA degraded in air. Thermogravimetry (TG) and isothermal heating experiments were conducted to obtain kinetic constants for the degradation of PMMA. The results show that there are two distinct effects of oxygen on the weight loss of PMMA; one is an increase in PMMA stability at low temperatures and the other is destabilization of PMMA at high temperatures by enhanced random scission. There are two reaction stages for the weight loss from PMMA degraded in nitrogen and four reaction stages for PMMA degraded in air. These four reaction stages are, however, caused mainly by impurities in the sample. The effects of purification of the commercial PMMA on the weight loss are small for samples degraded in nitrogen, but they are significant for samples degraded in air.

705,494
PB86-140357 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Spectroscopy and Photochemistry of Free Radicals Formed by the Reaction of F Atoms with Small Molecules.
Final rept.
M. E. Jacox. 1985, 44p
Pub. in Review of Chemical Intermediates 6, p77-120 1985.

Keywords: *Spectrochemical analysis, *Photochemistry, *Free radicals, Chemical bonds, Infrared spectroscopy, Comparison, Reprints, *Matrix isolation techniques, *Fluoride atoms, *Chemical shifts(Nuclear magnetic resonance).

The techniques used for both gas phase and matrix isolation spectroscopic studies of the primary products of the reaction of F atoms with small molecules are surveyed. A review of the spectra of free radicals formed by F-atom reaction is presented, with emphasis on contributions of spectral studies to our understanding of the detailed reaction mechanism. When an F atom abstracts a II atom from a molecule trapped in solid argon, the resulting HF is hydrogen-bonded to the free radical product. Trapping of the R..HF species in solid argon somewhat strengthens the hydrogen bond compared to that typical of the gas-phase complex. An attempt is made to assess the extent of perturbation of the vibrations of the HF moiety by the argon matrix. Shifts in the vibrations of the free radical, R, as a result of the formation of R--HF are also considered.

705,495
PB86-142437 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Nonlinear Mechanical Behavior of Polymer Solutions at Various Concentrations.
Final rept.
L. J. Zapas. 1982, 1p
Pub. in Proceedings of IUPAC Macromol. Symposium (28th), 1p 1982.

Keywords: *Mechanical properties, *Polymers, *Solutions, Concentration(Composition).

The reduction scheme proposed by Zapas and Phillips for concentrated polymer solutions, was derived for materials which obey certain conditions. In the paper it is shown that these conditions were very strict, and more relaxed conditions give the same reduced properties even for a class of materials whose behavior can not be described with a single integral.

705,496
PB86-142445 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Vapour-Liquid Equilibria Measurements for Carbon Dioxide with Normal and Isobutane from 250 to 280 K.
Final rept.
L. A. Weber. 1985, 5p
Sponsored by Department of Energy, Washington, DC. Div. of Chemical Sciences.
Pub. in Cryogenics 25, p338-342 Jun 85.

Keywords: *Chemical equilibrium, *Carbon dioxide, Vapor phases, Liquid phases, Binary systems(Materials), Gibbs free energy, Reprints, *Isobutane.

Vapour-liquid equilibria measurements were made on binary mixtures of carbon dioxide with normal and isobutane at 250, 260, 270 and 280 K. Both liquid and vapour compositions were measured. The data correlated using the Peng-Robinson equation of state, and values are given for the activity coefficients and the excess Gibbs free energy, G(sup E). The heat of mixing is estimated from the temperature dependence of G(sup E).

705,497
PB86-142452 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Thermodynamics of the Conversion of Aqueous Xylose to Xylulose.
Final rept.
Y. B. Tewari, D. K. Steckler, and R. N. Goldberg. 1985, 5p
Pub. in Biophysical Chemistry 22, p181-185 1985.

Keywords: *Thermodynamics, *Chemical equilibrium, Heat measurement, Liquid phases, Enzymes, Gibbs free energy, Enthalpy, Isomers, Reprints, *Xylulose, High pressure liquid chromatography.

The thermodynamics of the conversion of aqueous xylose to xylulose has been investigated using high-pressure liquid chromatogrphy (HPLC) and microcalorimetry. The reaction was carried out in aqueous phosphate buffer over the pH range 6.8-7.4 using solubilized glucose isomerase with MgSO4 as a cofactor. The temperature range over which this reaction was investigated was 298.15-342.15 K. A combined analysis of both the HPLC and microcalorimetric data leads to the following results at 298.15 K for the conversion process. Comparisons are made with literature data.

705,498
PB86-142460 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Investigation of the Equilibria between Aqueous Ribose, Ribulose, and Arabinose.
Final rept.
Y. B. Tewari, and R. N. Goldberg. 1985, 8p
Pub. in Biophysical Chemistry 22, p197-204 1985.

Keywords: *Chemical equilibrium, *Thermodynamics, Heat measurement, Liquid phases, Enzymes, Enthalpy, Gibbs free energy, Isomers, Reprints, *Ribose, *Ribulose, *Arabinose, High pressure liquid chromatography.

The thermodynamics of the equilibria between aqueous ribose, ribulose, and arabinose were investigated using high-pressure liquid chromatography and microcalorimetry. The reactions were carried out in aqueous phosphate buffer over the pH range 6.8-7.4 and over the temperature range 313.15-343.75 K using solubilized glucose isomerase with either Mg(NO3)2 or MgSO4 as cofactors. Information on rates of the reactions were also obtained.

705,499
PB86-142486 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Excimer Fluorescence Technique for Study of Polymer-Segment Mobility: Applications to Pyrene-Labelled Poly(methyl methacrylate) and Poly(methyl acrylate) in Solution.
Final rept.
F. W. Wang, and R. E. Lowry. 1985, 7p
Pub. in Polymer 26, p1046-1052 Jul 85.

Keywords: *Polymethyl methacrylate, *Fluorescence, *Transport properties, Solutions, Pyrene, Viscosity, Reprints, *Poly(acrylic acid/(methyl-ester)), Excimers, Tracer techniques.

An excimer fluorescence technique for the study of polymer-segment mobility has been developed and applied to pyrene-labelled poly(methyl methacrylate) and poly(methyl acrylate) polymers in solution. The results of the study have been interpreted in terms of Kramers' theory for the crossing of a potential barrier by a particle embedded in a viscous medium. The results show that the internal viscosity has a solvent-independent part and lead to an estimate of the dimensionless internal viscosity parameter introduced by Cerf.

705,500
PB86-142635 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Critical Properties, Potential Force Constants, and Structure of Organic Molecules.
Final rept.
I. C. Sanchez. 1985, 3p
Pub. in American Institute of Chemical Engineers Jnl. 31, n9 p1563-1565 Sep 85.

Keywords: *Critical points, *Molecular structure, *Alkanes, *Force, Temperature, Volume, Pressure, Van der Waals equation, Reprints, Carbon atoms, Oxygen atoms, Nitrogen atoms.

Recently, it was discovered that a certain combination of Lennard-Jones force constants varies linearly with the number of C, O, and N atoms in an organic molecule. The discovery implies that the product of the critical temperature T(sub c) and the 2/3 power of the critical volume V(sub c) and the product of the critical pressure P(sub c) and the 5/3 power of V(sub c) might also vary linearly with the number of C, O, and N atoms. The implication has been confirmed for a wide variety of organics.

705,501
PB86-142643 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Universal Coexistence Curve for Polymer Solutions.
Final rept.
I. C. Sanchez. 1985, 4p
Pub. in Applied Physics 58, n8 p2871-2874, 15 Oct 85.

Keywords: *Polymers, *Solutions, *Solvents, *Mathematical models, Binary systems(Materials), Concentration(Composition), Reprints.

Coexistence curves for binary polymer/solvent solutions are asymmetric when volume fraction is used as the concentration variable. Coexistence curves for polystyrene/methylcyclohexane solutions can be symmetrized by a simple transformation of variables.

705,502
PB86-142718 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Effect of Water on Maleic Acid and Salicyclic Acid Extractions.
Final rept.
L. Struble. 1985, 6p
Grant NSF-CEE82-10791
Sponsored by National Science Foundation, Washington, DC.
Pub. in Cement and Concrete Research 15, p631-636 1985.

Keywords: *Maleic acid, *Salicylic acid, *Extractions, *Cement, *Water, Reprints.

Contamination of methanol by water was evidenced by the occurrence of ettringite in residues of cement extracted using a solution of maleic acid in methanol. Therefore, an analytical method was developed to determine water contents, based on the reaction of 2,2-dimethoxypropane with water, which forms acetone

and methanol. Methanol analyzed by the method was found to contain as much as 2 percent H2O. Thus it is necessary to use freshly dried methanol for extracting the silicates from cement or clinker. However, it was found that removal of all water causes the solution of maleic acid in methanol to gel when the cement or clinker is added, and the salicylic acid procedure is thus preferred because it does not form such a gel. It was shown that methanol containing levels of water as low as 0.5 percent will cause loss of water-soluble phases from cement or clinker.

705,503
PB86-142726 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Quasielastic Light Scattering from Dilute and Semidilute Polymer Solutions.
Final rept.
D. W. Schaefer, and C. C. Han. 1985, 63p
Contract DE-AC04-76DP00789
See also DE82-016806. Sponsored by Department of Energy, Washington, DC.
Pub. in Dynamic Light Scattering, Chapter 5, p181-243 1985.

Keywords: *Light scattering, *Elastic scattering, *Polymers, *Dynamics, Spectroscopic analysis, *Photon correlations.

No abstract available.

705,504
PB86-142759 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
State-Selective Photoionization and Photodissociation Spectroscopy of the H2 Molecule from Excited States.
Final rept.
H. Rottke, and K. Welge. 1985, 8p
Pub. in Jnl. de Physique 46, n1 pCL127-CL134 Jan 85.

Keywords: *Hydrogen, *Ionization, *Dissociation, *Photochemical reactions, Excitations, Molecular rotation, Molecular vibration, Reprints.

First experiments have been carried out on the two-step photoionization and photodissociation of the H2 molecule from individual rotational-vibrational levels in the B(sup 1) sigma (+1) (sub u) state, employing tunable, pulsed, linearly polarized vuv and uv laser radiation: High Rydberg states have been detected by field ionization, applied after the laser excitation pulse. Examples of ionization-dissociation spectra taken from v'=0; J'=0 and 1 levels in the B state are given. Also, some results obtained in dissociation region are reported.

705,505
PB86-142775 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Non-Newtonian Flow of a Model Liquid between Concentric Cylinders.
Final rept.
J. C. Rainwater, H. J. M. Hanley, T. Paszkiewicz, and Z. Petru. 1985, 9p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Jnl. of Chemical Physics 83, n1 p339-347, 1 Jul 85.

Keywords: *Non-newtonian fluids, *Mathematical models, *Liquids, Cylindrical bodies, Compressibility, Equations of motion, Pressure, Reprints, *Concentric cylinders, Computer applications, Numerical solution, Weissenberg effect.

Computer simulations of fluids out of equilibrium indicate that even the simplest fluid is in principle non-Newtonian. In particular, the simulations can provide explicitly the pressure tensor as a function of shear rate at a given temperature and density. In this paper the steady state flow of a model soft sphere liquid between rotating vertical concentric cylinders is discussed from a microscopic standpoint, given the coefficients that characterize the pressure tensor. The equations of motion are solved numerically. It is found that the normal pressure differences lead to an enhanced depression of the free surface at the inner cylinder, in contrast to a climbing (Weissenberg effect) which is usually regarded as the consequence of such differences. Reasons for the behavior observed for the soft sphere system are discussed. A consequence of the analysis is that a unique and self-consistent solution of the equations of motion is obtained only if the effects of finite compressibility are included.

705,506
PB86-142924 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Competitive Facilitated Transport through Liquid Membranes.
Final rept.
K. Y. Niiya, and R. D. Noble. 1985, 16p
Pub. in Jnl. of Membrane Science 23, p183-198 1985.

Keywords: *Membranes, *Mathematical models, *Transport properties, *Gases, Chemical reactions, Diffusion, Mass transfer, Reprints.

A mathematical model is presented which solves the dimensionless, transient, non-linear partial differential equations governing the competive facilitated transport of two gases through a liquid membrane. The model incorporates the mass transfer coefficients in the boundary conditions for the free gas concentrations. Several studies were carried out. A comparison of this model with a steady-state 'equilibrium core' model was excellent. The idea of pumping one of the gases against its concentration gradient was shown to be theoretically possible.

705,507
PB86-143765 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Physical Modification of Properties of Semi-Crystalline Polymers.
Final rept.
A. Peterlin. 1984, 53p
Pub. in Industrial Materials Science and Engineering, ch5 p145-197 1984.

Keywords: *Polymers, Physical properties, Revisions, Reprints, *Crystalline polymers.

No abstract available.

705,508
PB86-155587 PC **A07**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Standard Reference Data Publications, 1964-1984.
J. C. Sauerwein, and G. R. Dalton. Dec 85, 147p NBS/SP-708
Supersedes PB82-134362. Also available from Supt. of Docs as SN003-003-02705-7. Library of Congress catalog card no. 85-600607.

Keywords: *Standards, Chemical properties, Physical properties, Bibliographies, Information systems, Indexes(Documentation), Computer programs, *Standard reference materials, Listings.

The National Bureau of Standards' Office of Standard Reference Data manages a network of data centers that prepare evaluated data bases of physical and chemical properties of substances. Data bases are available in printed form, on magnetic tapes and through on-line computer networks. This document provides a comprehensive list of the products available from the National Standard Reference Data System (NSRDS) for the years 1964-1984, including indexes qualified by author, material, and property terms. Ordering information and current prices can be found at the end of this document.

705,509
PB86-157336 PC **A16**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Chemical Physics.
Technical Activities 1985, Center for Chemical Physics.
P. Ausloos. Dec 85, 357p NBSIR-85/3257

Keywords: *Research projects, Surface chemistry, Reaction kinetics, Thermodynamics, Molecular spectroscopy, *Chemical physics.

The report summarizes research projects, measurement method development, testing and data evaluation activities carried out during Fiscal Year 1985 in the NBS Center for Chemical Physics. These activities fall in the areas of surface science, chemical kinetics, chemical thermodynamics and molecular spectroscopy.

705,510
PB86-160546 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Resonant Structure in Multiphoton Ionization of Calcium.
Final rept.
C. L. Cromer, and C. W. Clark. 1985, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 18, pL497-L500 1985.

Keywords: Reprints, *Autoionization, *Calcium atoms, *Multi-photon processes.

The authors propose a candidate mechanism for the lambda = 564.6 nm resonance in multiphoton ionization of calcium observed by Agostini and Petite.

705,511
PB86-160603 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Oscillator Strength Measurements of Even-Parity Autoionizing Resonances by Combined Synchrotron Radiation-Laser-Excitation.
Final rept.
J. M. Bizau, F. Wuilleumier, D. L. Ederer, J. C. Keller, J. L. LeGouet, J. L. Picque, B. Carre, and P. M. Koch. 1985, 4p
Pub. in Physical Review Letters 55, n12 p1281-1284, 16 Sep 85.

Keywords: *Molecular energy levels, Sodium, Excitation, Oscillators, Photons, Reprints, *Autoionization, *Synchrotron radiation, *Laser spectroscopy.

The authors have obtained oscillator strengths for transitions between a laser-excited initial state and autoionizing final states. In the case of sodium, a laser was used to populate the 3p initial state, and synchrotron radiation was used to excite the autoionizing resonances. The sum of the oscillator strengths for all the observed transitions between the 2p(sup 6)3p initial-state and the 2p(sup 5)3s3p final-state configurations was found to be equal to 0.22(4).

705,512
PB86-160611 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Effect of Sequence Distribution on the Miscibility of Polymer/Copolymer Blends.
Final rept.
A. C. Balazs, I. C. Sanchez, I. R. Epstein, F. E. Karasz, and W. J. MacKnight. 1985, 4p
Contract F49620-84-C-0051
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Macromolecules 18, n11 p2188-2191 1985.

Keywords: *Copolymers, *Solubility, *Sequencing, Blends, Binary systems(Materials), Chemical bonds, Molecular structure, Reprints, *Polymer chains, Monomers.

Previous theories describing the phase behavior of copolymer blends have ignored the sequence distribution of monomer units in the copolymer. The authors introduce a parameter, theta, that describes the binary sequence distribution of the monomers in a copolymer chain. By varying theta, the authors can describe a block, random, or alternating copolymer. It is assumed that the interaction energy between a monomer of homopolymer C and the monomer A (or B) in the copolymer AB is mediated by the nearest neighbors chemically bonded to the A (or B) structural unit. It is found that the sequence distribution may significantly affect the degree of compatibility between the polymers AB and C. For a fixed composition, there is an optimal range of theta values (or sequence distributions) for which the C/AB system is miscible.

705,513
PB86-160637 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Broadening of a Valence Autoionization Resonance in Electric Fields.
Final rept.
D. E. Kelleher, J. F. Delpech, and J. Weiner. Oct 85, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Physical Review A 32, n4 p2230-2233 Oct 85.

Keywords: *Electric fields, Reprints, *Autoionization, Line broadening.

The authors have observed a doubly excited autoionization resonance to broaden with increasing electric field. The broadening is consistent with the quadratic field dependence predicted by a simple perturbative model, but the magnitude of the observed broadening is about four times larger than predicted. Possible reasons for the discrepancy are discussed.

705,514
PB86-160645 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Selective Transport of Gaseous CO through Liquid Membranes Using an Iron (II) Macrocyclic Complex.
Final rept.
C. A. Koval, R. D. Noble, J. D. Way, B. Louie, Z. E. Reyes, B. R. Bateman, G. M. Horn, and D. L. Reed. 1985, 6p
Pub. in Inorganic Chemistry 24, n8 p1147-1152 1985.

Keywords: *Transport properties, *Carbon monoxide, *Chemical equilibrium, *Reaction kinetics, *Complex compounds, Iron organic compounds, Membranes, Reprints, *Liquid membranes, Chemical reaction mechanisms.

The equilibrium constant and rate constants for the reversible 1:1 complexation reaction, Fe(II)(TIM)(C6H5CN)2(+2) + CO K yields Fe(II)(TIM)(C6H5CN)(C0)(+2) + C6H5CN, have been measured in benzonitrile. In CO-saturated solutions, the Fe(II) complex can be oxidized electrochemically by a CrErErCi mechanism, which allows the diffusion coefficients of the complex and CO-adduct to be determined. The reversible complexation reaction of the Fe(II) complex with carbon monoxide affords facilitated transport of CO across benzonitrile liquid membranes. For a membrane with a thickness of about 0.072 cm, the transport rate for CO is increased by 14% over the purely diffusional rate. Since the Fe(II) complex does not bind N2, O2, CO2, or H2, the facilitated transport will be selective for CO in a variety of gaseous matricies. Selectivity is demonstrated for CO/O2 gas mixtures.

705,515
PB86-160652 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Rotational Relaxation of the 00(sup 0)1 Level of CO2 Including Radiative Transfer in the 4.3 Micrometer Band of Planetary Atmospheres.
Final rept.
A. A. Kutepov, D. G. Hummer, and C. B. Moore. 1985, 14p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 34, n2 p101-114 1985.

Keywords: *Carbon dioxide, *Rotational relaxation, *Molecular energy levels, *Planetary atmospheres, Thermodynamics, Reprints.

Accurate numerical solutions have been obtained for a model problem of rotational relaxation within the 00(sup 0)1 or vibrational level of C(12)O2(16) accounting for the transfer of radiation in the lines of the fundamental transition 00(sup 0)1-00(sup 0)0 of the 4.3 micrometer band. Intramolecular exchange of vibrational energy with the reservoir of V sub 2 quanta and absorption of solar radiation in the 00(sup 0)1-00(sup 0)0-band are accounted for. A plane-parallel isothermal atmosphere of pure CO2 with the barometric pressure distribution and solar illumination is assumed. The line opacity is represented by nonoverlapping Voigt profiles depending on temperature and pressure. The transfer problem which is equivalent to that of a multiplet with a large number of lines with a common lower level, was solved by a generalization of the Rybicki method. Absorption of solar radiation can affect significantly the source functions of lines at the centers of the P and R branches. Deviations from rotational LTE are shown to influence the intensity and shape of the 4.3-micrometer band of CO2 in the spectra of Mars and Venus, and should be taken into account in the interpretation of the observations in which the rotational structure is resolved, especially in limb measurements, where these effects are particularly apparent.

705,516
PB86-160660 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Hindered and Modulated Rotations of Absorbed Diatomic Molecules: States and Spectra.
Final rept.
U. Landman, G. G. Kleiman, C. L. Cleveland, E. Kuster, R. N. Barnett, and J. W. Gadzuk. Apr 84, 14p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review B 29, n8 p4313-4326, 15 Apr 84.

Keywords: *Adsorption, *Vibrational spectra, Surface chemistry, Substrates, Diatomic molecules, Reprints, Rotational states.

The authors present results for the rotational states and spectra of adsorbed diatomic molecules whose rotations are frustrated by the interaction with the substrate, for several solvable models of the interaction potentials. For a vertical adsorption configuration, hindrance is modeled by constraining the molecular motion via an infinite conical potential well. For a horizontal adsorption configuration the infinite conical-well model as well as hindrance caused by a softer hindrance potential are studied. For both hindrance models, the authors study the effects caused by a modulation of the molecular motion due to periodic azimuthal potentials dependent upon the adsorption site symmetry and other characteristics of the adsorption system. A detailed analysis of the spectra as a function of the parameters of the models is presented, allowing us to formulate a state classification scheme and draw general conclusions with regard to the systematics of the spectra of frustrated rotations of adsorbed diatomic molecules applicable to a wide class of potentials, which could guide the analysis and interpretation of data.

705,517
PB86-160678 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Flowing Afterglow Infrared Chemiluminescence Studies of Vibrational Energy Disposal in the Ion-Molecule Reactions F(-1)+HBr,DBr yields HF,DF+Br(-1).
Final rept.
A. O. Langford, V. M. Bierbaum, and S. R. Leone. 1985, 6p
Contract F49620-83-X-0013
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 83, n8 p3913-3918, 15 Oct 85.

Keywords: *Molecular vibration, *Chemiluminescence, *Hydrogen fluoride, *Deuterium compounds, Reprints, *Ion molecule interactions, *Flowing afterglow infrared chemiluminescence method.

Product vibrational state distributions for the ion-molecule reactions F(-1) + HBr,DBr yields HF(nu < or =4),DF(nu < or =6) + Br(+1) are determined using the flowing afterglow infrared chemiluminescence technique. A surprisal analysis suggests that less than 5% of the product molecules are formed in nu=0. The HF distribution is somewhat hotter than that reported previously, while the DF distribution is measured for the first time. Both distributions are remarkably similar to those reported for the analogous neutral processes, which suggests that direct collisions dominate the reactive encounters despite the presence of a deep attractive well in the potential surface for the ion-molecule reactions.

705,518
PB86-160694 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Competition between Photoionization and Two-Photon Raman Coupling.
Final rept.
G. Leuchs, G. Alber, and S. J. Smith. 1985, 2p
Pub. in Proceedings of the International Conference on Laser Spectroscopy (7th), Maui, HI., June 24-28, 1985, p216-217.

Keywords: *Photoionization, *Angular distributions, *Raman spectra, Absorption, *Laser spectroscopy.

The experiment the authors describe focusses on the intensity dependence of the photoionization process leading to the first, lowest energy electron peak, which can be reached by one-photon absorption. This bound-free transition should not show any intensity dependence apart from depletion of the bound state. In contrast to this expectation they demonstrate that a third-order process involving Raman coupling to a nearby nearly degenerate state may effectively compete with the one-photon absorption process.

705,519
PB86-160702 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysical Properties Div.
Statistical Mechanical Theory of Local Compositions.
Final rept.
G. A. Mansoori, and J. F. Ely. 1985, 23p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Fluid Phase Equilibria 22, p253-275 1985.

Keywords: *Fluids, *Phase transformation, Thermodynamic properties, Mixing, Reprints, *Phase equilibrium.

The concept of local composition has received much attention during the past few years, much of which has been devoted to justifying the empirical model proposed by Wilson in 1964. In the report the concept of local composition is defined on statistical mechanical grounds and expressions relating these compositions to thermodynamic properties of equilibrium fluid mixtures are derived. In particular, different local composition approximations are presented and new approximations based on molecular theories of mixtures are derived. Sets of mixing rules consistent with these different local composition approximations result, some of which are density and temperature dependent. Also, relations for partial molar properties in terms of local compositions are derived from the Kirkwood-Buff solution theory. Finally the radius of the sphere of influence of local compositions is formulated on statistical mechanical grounds.

705,520
PB86-160736 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Spin Dependence in Superelastic Electron Scattering from Na(3P).
Final rept.
J. J. McClelland, M. H. Kelley, and R. J. Celotta. 12 Aug 85, 4p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Physical Review Letters 55, n7 p688-691, 12 Aug 85.

Keywords: *Electron scattering, *Sodium, Reprints, *Electron-atom collisions, eV range 10-100, Laser radiation, Polarized light, Electron spin polarization.

Measurements are presented of spin asymmetries for superelastic scattering of 10-eV spin-polarized electrons from the excited Na triplet P(3/2) state created by linearly polarized laser optical pumping. Asymmetries as large as 16% are observed in scattering from a state which is not spin polarized. Results are shown both as a function of scattering angle with fixed laser polarization direction, and as a function of the laser polarization direction at a fixed scattering angle.

705,521
PB86-160959 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Excitation of Laser State-Prepared Na*(3p) to Na*(3d) in Low-Energy Collisions with Na(+1): Experiment and Calculations of the Potential Curves of Na2(+1).
Final rept.
A. Bahring, I. V. Hertel, E. Meyer, W. Meyer, N. Spies, and H. Schmidt. 1984, 15p
Sponsored by Deutsche Forschungsgemeinschaft, Bonn-Bad Godesberg (Germany, F.R.).
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 17, p2859-2873 1984.

Keywords: *Sodium, Excitation, Reprints, *Ion-atom collisions, Sodium ions, EV range 10-100.

The authors report experimental results on Na*(3p) excitation by Na(+1) impact for collision energies E(cm)=20-47.5eV together with calculated potential energy curves for the Na(+2) molecular ion for internuclear distances R=3-40 au. The state-to-state angular differential cross section for p-> collisional excitation has been measured. The authors find a pronounced maximum for the differential cross section at a reduced scattering angle tau=260eV deg. rotational coupling is responsible for the non-adjabatic collision. The largest excitation cross section is observed when the E vector of the exciting linearly polarized laser light

is almost parallel to the velocity of the incoming Na (+1) ion thus preparing 3p(sigma) orbital asymptotically.

705,522
PB86-161007 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Pulse Radiolysis Study of the Leucocyanide of Malachite Green Dye in Organic Solvents.
Final rept.
K. Bobrowski, G. Dzierzkowska, J. Grodkowski, Z. Stuglik, Z. P. Zagorski, and W. L. McLaughlin. 1985, 9p
Sponsored by Institut Curie, Paris (France).
Pub. in Jnl. of Physical Chemistry 89, n20 p4358-4366 1985.

Keywords: *Radiolysis, *Organic solvents, Dyes, Absorption spectra, Solutions, Reprints, *Leucocyanide, *Malachite green, Chemical reaction mechanisms.

Microsecond pulse radiolysis studies have been carried out on the leucocyanide of malachite green dye (MGCN) dissolved in either 1,2-dichloroethane, chloroform, carbon tetrachloride, acetone, cyclohexane, benzene, toluene, dimethyl sulfoxide, N,N-dimethylformamide, methanol, 2-propanol, tetrahydrofuran, dioxane, benzonitrile, or acetonitrile. The transient absorption spectra obtained in argon-saturated solutions, and with various added electron scavengers (N2O, O2, or CCl4), indicate that there are several intermediate species and radiolytic products. There is evidence for the formation of an intermediate primary radical cation (MGCN (+1)) and a triplet excited state of malachite green cyanide. The first is very fast (much shorter than the 5.5 microseconds pulse) and the second much slower (lasting tens of microseconds after the pulse). Possible mechanisms for the fast and slow components of radiolytic dye formation are postulated.

705,523
PB86-161031 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Two-Photon Absorption from a Phase-Diffusing Field.
Final rept.
D. S. Elliott, M. W. Hamilton, K. Arnett, and S. J. Smith. 1985, 2p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of the International Conference on Laser Spectroscopy (7th), Maui, HI., June 24-28, 1985, p212-213.

Keywords: Laser radiation, *Two photon absorption, *Sodium atoms.

Field-correlation effects are studied experimentally for the weak-field two-photon 3S-5S transition in atomic sodium in a Doppler-free configuration. A laser field with the properties of constant amplitude and diffusing phase is synthesized by applying random fluctuations to a laser beam, using phase and frequency modulators. The width measured at half maximum, of the absorption profile is found to depend on band-shape as well as band width. In particular, for a Lorentzian laser power spectrum the absorption width has four times the spectral width of the exciting field.

705,524
PB86-161072 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Resonant Four-Photon Ionization of Atomic Hydrogen.
Final rept.
D. E. Kelleher, M. Ligare, and L. R. Brewer. 1985, 3p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and National Science Foundation, Washington, DC.
Pub. in Physical Review A 31, n4 p2747-2749 Apr 85.

Keywords: *Gas ionization, *Ionization, Stark effect, Reprints, *Hydrogen atoms, *Multi-photon processes, *Photoionization.

The authors have measured the three-photon resonant, four-photon ionization profile of atomic hydrogen. The width of the profile is large compared with the laser bandwidth, fine-structure splitting, Doppler width, and radiative and collisional rates. The shape, shift, width, and laser intensity dependence of the measured profiles are in excellent agreement with theoretical predictions.

705,525
PB86-162088 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Structural Analysis of Methyltin(IV) Polymers by Solid-State 13C NMR Spectroscopy.
Final rept.
T. P. Lockhart, and W. F. Manders. 1985, 4p
Pub. in Jnl. of the American Chemical Society 107, n21 p5863-5866 1985.

Keywords: *Molecular structure, *Nuclear magnetic resonance, Metal containing organic compounds, Reprints, *Poly(Tin/methyl), Tin oxide/dimethyl.

High-resolution solid-state (13)C NMR analysis of 11 crystalline and amorphous polymeric methyltin(IV)s is described. Multiple Sn-methyl resonances observed for linear polymeric trimethyltin acetate and trimethylstannol indicate hindered rotation of the trigonal-planar Me3Sn group in the crystal lattice. The magnitude of J of the amorphous polymers methylstannonic acid and bis(trimethyltin) carbonate provides new insight into their bonding and structure.

705,526
PB86-163441 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Thermal Conductivity of Methane for Temperatures between 110 and 310 K with Pressures to 70 MPa.
Final rept.
H. M. Roder. Mar 85, 24p
Pub. in International Jnl. of Thermophysics 6, n2 p119-142 Mar 85.

Keywords: *Methane, *Thermal conductivity, Measurement, Reprints, Temperature dependence, Pressure dependence.

The paper presents new experimental measurements of the thermal conductivity of methane for 14 temperatures between 110 and 310 K with pressures to 70 MPa and densities from 0 to 30 mol/L. The measurements were made with a transient hot-wire apparatus and they cover a wide range of physical states including the dilute gas, the moderately dense gas, the near-critical region, the compressed liquid states, and the vapor at temperatures below the critical temperature.

705,527
PB86-163466 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Electric-Field-Induced Interferences in Autoionizing Resonances.
Final rept.
E. B. Saloman, J. W. Cooper, and D. E. Kelleher. Jul 85, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Physical Review Letters 55, n2 p193-196, 8 Jul 85.

Keywords: *Barium, Electric fields, Resonance, Reprints, *Autoionization.

The authors have observed the effect of electric fields on the 5d9p triplet P(1) barium resonance above the first ionization threshold. The relatively broad autoionizing level is nearly degenerate with a much narrower level of opposite parity. At moderate fields, the sharp level produces an interference dip in the broad level. At higher fields, the interference eventually gives rise to two split components. The results are in good agreement with a nonperturbative theory, summarized in the Letter.

705,528
PB86-163482 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Ab Initio Calculations of Radiative Transition Probabilities in SH, SH(+) and SH(-).
Final rept.
J. Senekowitsch, H. J. Werner, P. Rosmus, E. A. Reinsch, and S. V. O'Neil. 1985, 7p
Sponsored by National Science Foundation, Washington, DC., and Deutsche Forschungsgemeinschaft, Bonn-Bad Godesberg (Germany, F.R.).
Pub. in Jnl. of Chemical Physics 83, n9 p4661-4667, 1 Nov 85.

Keywords: *Hydrogen sulfide, Calculations, Reprints, *Radiative transition probabilities, Ab initio.

Potential energy and dipole moment functions for the ground states of SH, SH(+), and SH(-) have been calculated from highly correlated electronic wave functions. The electric dipole moments in the vibrational ground states of 32SH, 32SH(+), and 32SH(-) are calculated to be 0.74, 1.29, and 0.27 D. The predicted transition probabilities between the low lying vibrational states of the electronic ground state of SH and SD are among the smallest so far known for dipole allowed rotation-vibration transitions. The calculated A-X transition probabilities in SH confirm recent indirect determinations of the radiative lifetimes and absorption oscillator strengths in the predissociating v=0 level of the A state.

705,529
PB86-163540 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Pressure Broadening, Lineshapes, and Intensity Measurements in the 0 yields 2 Band of NO.
Final rept.
A. S. Pine, A. G. Maki, and N. Y. Chou. 1985, 15p
Grant NSF-CHE82-19255
Sponsored by National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 114, p132-147 1985.

Keywords: *Nitrogen oxide(NO), Band spectra, Molecular spectroscopy, Infrared radiation, Absorption spectra, Line width, Pressure, Intensity, Reprints.

Lineshape and intensity measurements were made on the overtone band (upsilon = 2 <- 0) of nitric oxide (NO) using a tunable difference-frequency laser system. Self- and N2-pressure broadening coefficients were obtained at 296 K, and a small amount of collisional, or Dicke, narrowing (which reduces the Doppler width by about 9% at 50 Torr) was also evident. The pressure broadening observed for the doublet Pi(3/2) transitions was larger than that of the doublet Pi(1/2) for corresponding J by about 7%, so an empirical scaling law model was fit to the broadening coefficients to determine the role of interstate(spin-flipping) collisions.

705,530
PB86-163557 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Self-Broadening in the Fundamental Bands of HF and HCl.
Final rept.
A. S. Pine, and A. Fried. 1985, 15p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 114, p148-162 1985.

Keywords: *Hydrogen chloride, *Hydrogen fluoride, *Band spectra, Molecular spectroscopy, Infrared radiation, Reprints, Self broadening, Laser spectroscopy.

Self-broadened lineshapes in the fundamental bands of HF and HCl have been measured with a high-resolution difference-frequency laser spectrometer. Self-induced broadenings, shifts, and collisional narrowings have been extracted by least squares fitting several collisional profiles to the spectra. At low pressures, the collisional narrowing effect causes deviations of the lineshapes from the Voigt profile having a Doppler-fixed Gaussian component, and yields a measure of the diffusion constants of the molecules.

705,531
PB86-163581 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Absorption and Emission of Radiation in the Region of an Avoided Level Crossing.
Final rept.
M. O'Callaghan, A. Gallagher, and T. Holstein. 1985, 15p
Grant NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review A: General Physics 32, n5 p2754-2768 Nov 85.

Keywords: Line width, Absorption spectra, Emission spectra, Band spectra, Cesium, Reprints, *Atom collisions, Atom-atom collisions, Excimers.

The spectrum for absorption and emission of radiation by colliding atoms or a diatomic molecule is calculated for spectral regions dominated by an avoided level crossing. Example processes are absorption during an atom-atom collision with separation to either crossing atomic state, total absorption to both crossing states, and spontaneous emission during a collision with either state initially populated. Absorption and emission by bound diatomic molecules (including photodissociation) is described by the theory, and as an example it is applied to the Cs2 A-X band. The authors conclude that measurements of spectra in the region of level crossing is a very powerful diagnostic of the potentials and transfer probability in the level-crossing region, which is responsible for most inelastic atom-atom energy-transfer processes.

705,532
PB86-163599 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Infrared Spectrum and Autodetachment Dynamics of NH(-).
Final rept.
D. M. Neumark, K. R. Lykke, T. Andersen, and W. C. Lineberger. 1985, 10p
Grants NSF-PHY82-00805, NSF-CHE83-16628
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 83, n9 p4364-4373, 1 Nov 85.

Keywords: *Infrared spectroscopy, Reprints, *Autodetachment dynamics, *Negative ions.

The infrared vibration-rotation spectrum of NH- has been obtained by autodetachment spectroscopy in a coaxial laser-ion beam spectometer. Transitions from the v=0 to v=1 vibrational levels were excited with an F-center laser, and subsequent autodetachment from the v=1 levels was observed. The apparatus resolution was better than 20 MHz, allowing the resolution of the fine structure and Lambda-doubling transitions. The linewidths of the autodetachment resonances revealed some of the dynamics of the autodetachment process. The autodetachment rates were, in general, much greater for the upper Lambda-doublet levels of NH-(v=1) than for the lower levels. In addition, the increase of the autodetachment rate with rotational energy for the upper levels was much faster than would be predicted if vibrational autodetachment were the primary detachment mechanism. It therefore appears that rotational-electronic coupling plays an important role in this system, and the differences in the Lambda-doublet autodetachment rates are explained in terms of this mechanism.

705,533
PB86-164381 PC **A06**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Technical Activities 1985, Molecular Spectroscopy Division.
A. Weber. Jan 86, 110p NBSIR-86/3313

Keywords: *Molecular spectroscopy, Resolution, Research projects, Frequency standards, Photochemical reactions, Quantum chemistry, Laser applications.

The report summarizes the technical activities of the NBS Molecular Spectroscopy Division during the Fiscal Year 1985. The activities span experimental and theoretical research in high resolution molecular spectroscopy, quantum chemistry and laser photochemistry, and include the development of frequency standards, critically evaluated spectral data, applications of spectroscopy to important scientific and technological problems, and the advancement of spectroscopic measurement methods and techniques.

705,534
PB86-164498 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
CO Chemisorption on Cr(110): Evidence for a Precursor to Dissociation.
Final rept.
N. D. Shinn, and T. E. Madey. 1 Dec 85, 17p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Jnl. of Chemical Physics 83, n11 p5928-5944, 1 Dec 85.

Keywords: *Carbon monoxide, *Chemisorption, *Chromium, Catalysis, Desorption, Reprints, Electron spectroscopy.

High resolution electron energy loss spectroscopy (EELS), electron stimulated desorption ion angular distributions (ESDIAD), low energy electron diffraction (LEED), and Auger electron spectroscopy (AES) have been combined to study CO chemisorption on the Cr(110) surface. The implications of these results to catalytic reactions of CO are considered, and comparisons to CO adsorption on clean and 'promoted' transition metals are made.

705,535
PB86-164522 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Instrumentation for Photon Stimulated Desorption.
Final rept.
R. Stockbauer. 1984, 7p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Nuclear Instruments and Methods in Physics Research 222, p284-290 1984.

Keywords: *Surfaces, *Desorption, Reprints, *Photon stimulated desorption, Instrumentation.

Photon stimulated desorption (PSD) refers to the ejection of ions, atoms, or molecular fragments from a surface initiated by the adsorption of single photons; to date, most studies have concentrated on the detection of ions. The properties of PSD which make it attractive as a surface characterization tool are its extreme surface sensitivity, the ions being ejected only from the topmost layer and the rapidity with which the ions are ejected. Since the desorption is fast (about 10 to the -14th power s), with respect to molecular vibrations (about 10 to the -12th power s), the ion trajectory reflects the initial bonding geometry of the particle to the surface. To study the ion desorption process, one would like to measure the mass, kinetic energy distribution, angular distribution and the yield (desorption rate vs photon energy) of the desorbing ions. Time-of-flight analyzers measure only ion mass and yield, while most electrostatic deflection analyzers measure kinetic energy and yield. The ellipsoidal mirror analyzer is unique, in that it measures all four quantities simultaneously.

705,536
PB86-164548 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Coriolis-Induced Intramolecular Vibrational Energy Flow between Anharmonic Normal Modes.
Final rept.
T. Uzer, G. A. Natanson, and J. T. Hynes. Nov 85, 7p
Sponsored by National Science Foundation, Washington, DC., and Petroleum Research Fund, Washington, DC.
Pub. in Chemical Physics Letters 122, n1-2 p12-18, 29 Nov 85.

Keywords: Energy flow, Reprints, *Intramolecular energy flow, *Coriolis coupling.

The classical flow of energy between anharmonic normal vibrational modes induced by Coriolis coupling is studied for a simple model of a linear triatomic molecule rotating in a plane. The dynamics are analytically solved via a mapping onto a hindered rotor representation. The theory is confirmed by trajectory calculations.

705,537
PB86-165446 PC **A99**/MF **E04**
American Chemical Society, Washington, DC.
Atomic Energy Levels of the Iron-Period Elements: Potassium through Nickel.
J. Sugar, and C. Corliss. c1985, 680p ISBN-0-88318-480-X
Also pub. as Jnl. of Physical and Chemical Reference Data, v14 suppl2 1985. Library of Congress catalog card no. 85-72287. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards (NML), Gaithersburg, MD.

Keywords: *Atomic energy levels, *Potassium, *Calcium, *Scandium, *Titanium, *Vanadium, *Chromium, *Manganese, *Iron, *Cobalt, *Nickel, Ionization, Experimental design, Eigenvectors, *Isoelectronic sequence, Rydberg series.

Experimentally derived energy levels of the elements from potassium to nickel in all stages of ionization are critically compiled. The data for each level include its position in /cm (relative to the ground state), configuration, term designation, J-value, and, where available, the g-value and two leading percentages of the eigenvector composition in the most appropriate coupling scheme. For the He I and H I isoelectronic sequences, calculated level positions are given because they are considered more accurate than the measurements presently available. Ionization energies for each ion are derived either from Rydberg series, extrapolation, or calculation. Complete references are given for the compiled data.

705,538
PB86-165453 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 14, Number 1, 1985.
Quarterly rept.
c1985, 400p
See also PB86-165461 through PB86-165511, and PB85-219830. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Research projects, Molecular energy levels, Air, Thermal conductivity, Viscosity, Thermodynamic properties, Oxygen organic compounds, Specific heat, Enthalpy, Standards, Isomerization, Tables(Data), Electronic spectra, Density(Mass/volume), Binary systems(Materials), Oxygen, Nitrogen, Assessments, Critical point, Water, Heavy water, Deuterium compounds, Equations of state.

Contents:
- Thermodynamic Properties of Key Organic Oxygen Compounds in the Carbon Range C1 to C4. Part 1. Properties of Condensed Phases;
- Standard Chemical Thermodynamic Properties of Alkylbenzene Isomer Groups;
- Assessment of Critical Parameter Values for H2O and D2O;
- The Viscosity of Nitrogen, Oxygen, and Their Binary Mixtures in the Limit of Zero Density;
- The Thermal Conductivity of Fluid Air;
- The Electronic Spectrum and Energy Levels of the Deuterium Molecule;
- Cumulative Listing of Reprints and Supplements.

705,539
PB86-165461 Not available NTIS
Texas A and M Univ., College Station. Thermodynamics Research Center.
Thermodynamic Properties of Key Organic Oxygen Compounds in the Carbon Range C1 to C4. Part 1. Properties of Condensed Phases.
R. C. Wilhoit, J. Chao, and K. R. Hall. c1985, 175p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v14 n1 p1-175 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Oxygen organic compounds, *Thermodynamic properties, *Condensing, Specific heat, Enthalpy, Tables(Data), Least squares method, Phase transformations, Heat measurement.

A survey of the published values of heat capacity and enthalpy obtained from calorimetric measurements on the crystal, glass, and liquid phases of the first few members of homologous series of organic oxygen compounds is presented. Equations for the heat capacities expressed as polynomial functions of temperature were fit to selected data by a least squares procedure. Tables of smoothed values of thermodynamic properties, derived from these functions, are presented for 38 compounds.

705,540
PB86-165479 Not available NTIS
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
Standard Chemical Thermodynamic Properties of Alkylbenzene Isomer Groups.
R. A. Alberty. c1985, 16p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v14 n1 p177-192 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Benzenes, *Thermodynamic properties, *Standards, Isomerization, Specific heat, Enthalpy, Entropy, Gibbs free energy, Tables(Data), Benson method.

The chemical thermodynamic properties of alkylbenzene isomer groups from C8H10 to C9H12 in the ideal gas phase have been calculated from 298.15 to 1000K from tables of Stull, Westrum, and Sinke. In the absence of literature data on all isomers of higher isomer groups, the properties of isomers of C10H14 to C12H18 have been calculated using Benson group values. For isomer group properties, increments per carbon atom have been calculated to show the extent to which thermodynamic properties of higher isomer groups may be obtained by linear extrapolation. Equilibrium mole fractions within isomer groups have been calculated for the ideal gas state from 298.15 to 1000K. Values of specific heat, Enthalpy, entropy, and Gibbs energy are given for all species from C6H6 to C12H18 in joules for a standard state of pressure of 1 bar.

705,541
PB86-165487 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Assessment of Critical Parameter Values for H2O and D2O.
J. M. H. Levelt Sengers, J. Straub, K. Watanabe, and P. G. Hill. c1985, 15p
Prepared in cooperation with Technische Univ., Munich (Germany, F.R.). Lehrstuhl A fuer Thermodynamik, Keio Univ., Yokohama (Japan). Dept. of Mechanical Engineering, and British Columbia Univ., Vancouver. Dept. of Mechanical Engineering.
Included in Jnl. of Physical and Chemical Reference Data, v14 n1 p193-207 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Critical point, *Water, *Heavy water, *Steam, Assessments, Pressure, Temperature, Volume, Thermodynamic properties, Density(Mass/volume).

Recommendations for the most likely values of the critical parameters of light and heavy water as accepted by the International Association for the Properties of Steam are presented, together with an assessment of their reliability. Supporting material for these choices of values and the assessment of their reliability is provided. Temperature values are on the International Practical Temperature Scale of 1968 (IPTS 1968) unless otherwise indicated.

705,542
PB86-165495 Not available NTIS
Imperial Coll. of Science and Technology, London (England). Dept. of Chemical Engineering and Chemical Technology.
Viscosity of Nitrogen, Oxygen, and Their Binary Mixtures in the Limit of Zero Density.
W. A. Cole, and W. A. Wakeham. c1985, 18p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v14 n1 p209-226 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Viscosity, *Nitrogen, *Oxygen, *Binary systems(Materials), Density(Mass/volume), Temperature, Mixtures.

The paper presents a concise and accurate representation of the viscosity of nitrogen, oxygen, and their binary mixtures at the limit of zero density and in the temperature range 110-2100K, which can be programed easily on a computer. The correlation is founded upon the semiclassical kinetic theory of polyatomic gases and a body of critically evaluated experimental data. Use is also made of the principle of corresponding states to extend the correlation outside of the temperature range for which direct experimental results exist. The optimum correlation has an associated uncertainty of + or - 0.3% around room temperature, but it rises to a maximum of + or - 2% at either extreme of the temperature range. A secondary representation of the viscosity of the same gases, providing some saving in computational effort and a further extension of the temperature range at the expense of a small loss of accuracy, is also presentd. The relationship of this second representation to similar correlations for other gases makes it attractive for some purposes.

705,543
PB86-165503 Not available NTIS
Stuttgart Univ. (Germany, F.R.). Inst. fuer Technische Thermodynamik und Thermische Verfahrenstechnik.
Thermal Conductivity of Fluid Air.
K. Stephan, and A. Laesecke. c1985, 8p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v14 n1 p227-234 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Thermal conductivity, *Air, Thermophysical properties, Thermodynamics, Equations of state, Density(Mass/volume), Fluids, Pressure, Temperature, Graphs(Charts).

Based on available experimental data, the thermal conductivity of fluid air has been critically evaluated. A new set of recommended values is presented covering a pressure range from 1 to 1000 bar and a temperature range from 70 to 1000K. Using the concept of residual thermal conductivity the recommended values are described by a 13-parameter equation of state in terms of temperature and density which may be applied up to a density of 900 kg/cu m. From comparisons of all data sources, the uncertainty of the recommended values was estimated to be below + or -4%. Additional experiments are needed, especially in the subcritical region of liquid air.

705,544
PB86-165511 Not available NTIS
Bell Labs., Murray Hill, NJ.
Electronic Spectrum and Energy Levels of the Deuterium Molecule.
R. S. Freund, and J. A. Schiavone. c1985, 149p
Prepared in cooperation with Argonne National Lab., IL. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v14 n1 p235-383 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Molecular energy levels, *Electronic spectra, *Deuterium, Hydrogen isotopes, Tables(Data).

Beginning in the 1930s, G. H. Dieke and his students carried out an extensive program of measuring the optical spectrum of molecular hydrogen and its isotopes. Parts of the work were published but the project was interrupted by Dieke's death in 1965, with much of the latest and most accurate work unpublished. This paper gives the 27,488 lines of molecular deuterium, measured by Dieke, arranged the 8243 assigned lines into band systems, and derives rotational-vibrational energy levels for over 50 electronic states. It also derives energy levels from published vacuum ultraviolet spectra of D2.

705,545
PB86-165529 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 14, Number 2, 1985.
Quarterly rept.
c1985, 241p
See also PB86-165537 through PB86-165552, and PB86-165453. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Research projects, Sulfur dioxide, Microwave spectroscopy, Astrophysics, Thermodynamics, Sodium chloride, Chemical equilibrium, Heat measurements, Viscosity, Polyethylene, Hamiltonian functions, Isotopes, Molecular vibration, Listings, Mark-Houwink-Sakurada equation.

Contents:
- Microwave Spectra of Molecules of Astrophysical Interest. XXII. Sulfur Dioxide(SO2);
- Evaluation of the Thermodynamic Functions for Aqueous Sodium Choride from Equilibrium and Calorimetric Measurements below 154C;
- The Mark-Houwink-Sakurada Equation for the Viscosity of Linear Polyethylene;
- Cumulative Listing of Reprints and Supplements.

705,546
PB86-165537 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Microwave Spectra of Molecules of Astrophysical Interest. XXII. Sulfur Dioxide (SO2).
F. J. Lovas. c1985, 94p
Included in Jnl. of Physical and Chemical Reference Data, v14 n2 p395-488 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Microwave spectroscopy, *Sulfur dioxide, Astrophysics, Molecular vibration, Molecular energy levels, Molecular rotation, Sulfur 33, Sulfur 34, Sulfur 32.

The microwave spectrum of sulfur dioxide (SO2) is critically reviewed and supplemented with spectral frequency calculations derived from rotational and centrifugal distortion terms in the molecular Hamiltonian. The primary objective of this review is to provide the microwave transition frequencies applicable to molecular radio astronomy for the ground vibrational state of the most abundant isotopic forms, i.e., the singly substituted atoms (33)S and (34)S.

705,547
PB86-165545 Not available NTIS
Dow Chemical of Canada Ltd., Sarnia (Ontario).
Evaluation of the Thermodynamic Functions for Aqueous Sodium Chloride from Equilibrium and Calorimetric Measurements below 154C.
E. C. W. Clarke, and D. N. Glew. c1985, 122p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v14 n2 p489-610 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Sodium chloride, *Chemical equilibrium, *Heat measurement, Solutions, Thermodynamic properties, Least square methods, Specific heat, Activity coefficients, Boiling point, Solubility, Tables(Data).

A new weighted least-squares method is described which is generally applicable for the nonsubjective evaluation of the best set of thermodynamic functions from a given data set of equilibrium (delta G) and calorimetric (delta H, C(sup p)) measurements. The method, applied to model a wide range of 2428 measurements for the water-sodium chloride system between -21 and 154C, accurately represents all measurements within experimental error. The resulting model is used to predict the thermodynamic functions and their standard errors for aqueous sodium chloride up to 110C. Tables are given for freezing point, solubility, boiling point, osmotic and activity coefficients, vapor pressure, apparent molal relative enthalpy, partial molal relative enthalpies, integral heat of solution, specific heat, apparent molal heat capacity, partial molal heat capacities, apparent molal relative heat capacity, partial molal relative heat capacities, standard thermodynamic functions, and their changes for dissolution.

705,548
PB86-165552 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mark-Houwink-Sakurada Equation for the Viscosity of Linear Polyethylene.
H. L. Wagner. c1985, 7p
Included in Jnl. of Physical and Chemical Reference Data, v14 n2 p611-617 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Polyethylene, *Viscosity, *Molecular weight, Decalin, Tetralin, Xylene, Chlorobenzenes, Solvents, Mark-Houwink-Sakurada equation, Benzene/trichloro, Naphthalene/chloro, Benzene/dichloro.

In this review, the parameters K and alpha found in the literature for the Mark-Houwink-Sakurada equation relating viscosity to molecular weight have been critically evaluated for linear polyethylene, and values have been recommended for six commonly used solvents. These are decalin, 1,2,4-tricholorbenzene, 1-chloronaphthalene, tetralin, o-dichlorobenzene, and p-xylene. In addition, the literature values of K for several different theta solvents are presented.

705,549
PB86-165560 Not available NTIS
American Chemical Society, Washington, DC.

Journal of Physical and Chemical Reference Data, Volume 14, Number 3, 1985.
Quarterly rept.
c1985, 225p
See also PB86-165578 through PB86-165636, and PB86-165644. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Research projects, Isotopes, Naphthalenes, Solubility, Mercury(Metals), Water, Electrolytes, Reviews, Phase transformations, Nitrogen, Alkenes, Thermodynamic properties, Phosphorus, Methane, Heat of mixing, Liquids, Nucleation, Cations, Chemical bonds, Molecular energy levels, Phase equilibrium, PVT measurements, Listings.

Contents:
- The Solubility of Mercury and Some Sparingly Soluble Mercury Salts in Water and Aqueous Electrolyte Solutions;
- A Review and Evaluation of the Phase Equilibria, Liquid-Phase Heats of Mixing and Excess Volumes, and Gas-Phase PVT Measurements for Nitrogen + Methane;
- The Homogeneous Nucleation Limits of Liquids;
- Binding Energies in Atomic Negative Ions: II;
- Energy Levels of Phosphorus, P I through P XV;
- Standard Chemical Thermodynamic Properties of Alkene Isomer Groups;
- Standard Chemical Thermodynamic Properties of Alkylnaphthalene Isomer Groups;
- Cumulative Listing of Reprints and Supplements.

705,550
PB86-165578 Not available NTIS
Emory Univ., Atlanta, GA. Dept. of Chemistry.
Solubility of Mercury and Some Sparingly Soluble Mercury Salts in Water and Aqueous Electrolyte Solutions.
H. L. Clever, S. A. Johnson, and M. E. Derrick.
c1985, 50p
Included in Jnl. of Physical and Chemical Reference Data, v14 n3 p631-680 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Mercury(Metal), *Water, *Electrolytes, *Mercury inorganic compounds, Thermodynamics, Solutions, Inorganic salts, Solubility, Tables(Data).

The literature on the solubility of mercury and of the sparingly soluble salts of mercury-(I) and mercury (II) in water and in aqueous electrolyte solutions has been reviewed. The solubility data have been compiled and evaluated. Recommended and tentative values of the solubilities are presented when warranted. Auxiliary thermodynamic data and crystallographic data useful in the interpreation of solubility data are given. An annotated bibliography on the solubility of some of the less common inorganic mercury compounds, with emphasis on the solubility literature published since 1950, is given.

705,551
PB86-165586 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Center for Chemical Engineering.
Review and Evaluation of the Phase Equilibria, Liquid-Phase Heats of Mixing and Excess Volumes, and Gas-Phase PVT Measurements for Nitrogen + Methane.
A. J. Kidnay, R. C. Miller, E. D. Sloan, and M. J. Hiza.
c1985, 14p
Included in Jnl. of Physical and Chemical Reference Data, v14 n3 p681-694 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Nitrogen, *Methane, *Heat of mixing, *Binary systems(Materials), Reviews, Phase transformations, Gibbs free energy, *Phase equilibrium, *PVT measurements.

The available experimental data for vapor-liquid equilibria, heat of mixing, change in volume on mixing for liquid mixtures, and gas-phase PVT measurements for nitrogen + methane have been reviewed and where possible evaluated for consistency. The derived properties chosen for analysis and correlation were liquid mixture excess Gibbs free energies, and Henry's constants.

705,552
PB86-165594 Not available NTIS
Sibley School of Mechanical and Aerospace Engineering, Ithaca, NY.
Homogeneous Nucleation Limits of Liquids.
C. T. Avedisian. c1985, 35p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v14 n3 p695-729 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Liquids, *Nucleation, Graphs(Charts), Metastable states, Tables(Data).

The work provides a critical compilation of the homogeneous nucleation limits of liquids. Data for 90 pure substances and 28 mixtures have been compiled over a range of pressures, nucleation rates, and compositions. Detailed descriptions of the experimental methods used to obtain the included data are given to assess the accuracy of measured values. Criteria used to select the measurements included in the final listing are discussed.

705,553
PB86-165602 Not available NTIS
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Binding Energies in Atomic Negative Ions: 2.
H. Hotop, and W. C. Lineberger. c1985, 20p
Included in Jnl. of Physical and Chemical Reference Data, v14 n3 p731-750 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Cations, Reviews, Fine structures, Atomic energy levels, Excitation, *Electron affinity.

The article updates a ten-year-old review of this subject (J. Chem. Phys. Ref. Data 4, 539(1975)). A survey of the electron affinity determinations for the elements up to Z=85 is presented, and based upon these data, a set of recommended electron affinities is established. Recent calculations of atomic electron affinities and the major semiempirical methods are discussed and compared with experiment. The experimental methods which yield electron binding energy data are described and intercompared. Fine structure splittings of these ions and excited state term energies are given.

705,554
PB86-165610 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Energy Levels of Phosphorus, P (I) through P (XV).
W. C. Martin, R. Zalubas, and A. Musgrove. c1985, 52p
Included in Jnl. of Physical and Chemical Reference Data, v14 n3 p751-802 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Atomic energy levels, *Phosphorus, Ionization potentials, Optical spectra, Ions, Tables(Data), Isoelectronic sequence.

Energy level data are given for the atom and all positive ions of phosphorus (Z=15). These data have been critically compiled, mainly from published and unpublished material on measurements and analyses of the optical spectra. The authors have derived or recalculated the levels for a number of the ions. In addition to the level values in cm and the parity, the J value and the configuration and term assignments are listed if known. Leading percentages from the calculated eigenvectors are tabulated or quoted wherever available. Ionization energies are given for all spectra.

705,555
PB86-165628 Not available NTIS
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
Standard Chemical Thermodynamic Properties of Alkene Isomer Groups.
R. A. Alberty, and C. A. Gehrig. c1985, 18p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v14 n3 p803-820 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Alkenes, *Standards, *Thermodynamic properties, Enthalpy, Gibbs free energy, Entropy, Specific heat, Tables(Data).

The chemical thermodynamic properties of alkene isomer groups from C4H8 to C6H12 in the ideal gas phase have been calculated from 298.15 to 1000K from tables of Stull, Westrum, and Sinke. In the absence of literature data on all isomers of higher isomer groups, the properties of isomers of C7H14 to C8H16 have been estimated using Benson group values. Equilibrium mole fractions within isomer groups have been calculated for the ideal gas state from 298.15 to 1000K. For isomer group properties increments per carbon atom have been calculated to show the extent to which thermodynamic properties of higher isomer groups may be obtained by linear extrapolation. Values of heat capacity, enthopy, enthalpy of formation, and Gibbs energy of formation are given for all speciies from C2H4 to C8H16 in joules for a standard state of 1 bar.

705,556
PB86-165636 Not available NTIS
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
Standard Chemical Thermodynamic Properties of Alkylnaphthalene Isomer Groups.
R. A. Alberty, and T. M. Bloomstein. c1985, 17p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v14 n3 p821-837 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Naphthalene, *Thermodynamic properties, *Standards, Isomers, Specific heat, Entropy, Enthalpy, Gibbs free energy.

The chemical thermodynamic properties of alkylnaphthalene isomer groups for C10H8 and C11H10 in the ideal gas phase have been calculated from 298.15 to 1000 K from tables of Stull, Westrum, and Sinke. In the absence of literature data on all isomers of higher groups, the properties of isomers of C12H12 to C14H16 have been calculated using Benson groups values. A new Benson group value for the 1,8-dimethyl steric hindrance has been calculated from recent experimental data. The increments in isomer group properties per carbon atom have been calculated to show the extent to which thermodynamic properties of higher isomer groups may be obtained by linar extrapolation. Equilibrium mole fractions within isomer groups have been calculated for the ideal gas state from 198.15 to 1000K. Values of heat capacity, entropy, enthalpy of formation, and Gibbs energy of formation are given for all species from C10H8 to C14H16 with energy units of joules for a standard state pressure of 1 bar.

705,557
PB86-165644 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 14, Number 4, 1985.
Quarterly rept.
c1985, 317p
See also PB86-165651 through PB86-165719, and PB86-165560. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Research projects, Cyclohexanes, Density(Mass/volume), Temperature, Thermophysical properties, Carbon monoxide, Water, Refractivity, Wavelength, Viscosity, Thermal conductivity, Metals, Reaction kinetics, Free radicals, Tables(Data), Polystyrene, Thermodynamic properties, Cyclopentanes, Listings, Isomers, Hydrogen ions, Hydrogen atoms, Atom ion collisions, Superoxides, Mark Houwink Sakurada equation.

Contents:
- Carbon Monoxide Thermophysical Properties from 68 to 100K at Pressures to 100 MPa;
- Refractive Index of Water and Its Dependence on Wavelength, Temperature, and Density;
- Viscosity and Thermal Conductivity of Dry Air in the Gaseous Phase;
- Charge Transfer of Hydrogen Ions and Atoms in Metal Vapors;

Reactivity of HO2/O2(-1) Radicals in Aqueous Solution;
The Mark-Houwink-Sakurada Equation for the Viscosity of Atactic Polystyrene;
Standard Chemical Thermodynamic Properties of Alkylcyclopentane Isomer Groups, Alkylcyclohexane Isomer Groups, and Combined Isomer Groups;
Cumulative Listing of Reprints and Supplements.

705,558
PB86-165651 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Carbon Monoxide Thermophysical Properties from 68 to 1000 K at Pressures to 100 MPa.
R. D. Goodwin. c1985, 84p
Included in Jnl. of Physical and Chemical Reference Data, v14 n4 p849-932 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Carbon monoxide, *Thermophysical properties, Pressures, Equations ofstate, Temperature, Tables(Data).

An improved form of the nonanalytic equation of state is used to compute thermodynamic properties of carbon monoxide along isobars up to 100 MPa, at integral temperatures from coexistence to 1000K.

705,559
PB86-165669 Not available NTIS
Technische Univ., Munich (Germany, F.R.). Lehrstuhl A fuer Thermodynamik.
Refractive Index of Water and Its Dependence on Wavelength, Temperature, and Density.
I. Thormaehlen, J. Straub, and U. Grigull. c1985, 13p
Included in Jnl. of Physical and Chemical Reference Data, v 14 n4 p933-945 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Refractivity, *Water, *Steam, Equations of state, Graphs(Charts), Tables(Data), Least square methods.

A survey of the available experimental data and the existing equations for the refractive index of water is given. The dependence of the molar refraction on wavelength, temperature, and density is shown over an extended range. Based upon the electromagnetic theory of light an equation for the refractive index of water with wavelength, temperature, and density as independent variable is constructed. Its coefficients are directly deduced from all available experimental data by least-squares fit. Good agreement exists between the new relation, the availble experimental data, and several existing equations.

705,560
PB86-165677 Not available NTIS
Keio Univ., Yokohama (Japan). Dept. of Mechanical Engineering.
Viscosity and Thermal Conductivity of Dry Air in the Gaseous Phase.
K. Kadoya, N. Matsunaga, and A. Nagashima. c1985, 24p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v14 n4 p947-970 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Viscosity, *Thermal conductivity, *Air, Transport properties, Temperature, Pressure, Graphs(Charts), Tables(Data), Dry methods.

In view of the importance of air in science and technology and the abundance of experimental data, the authors present in this report a consistent set of critically evaluated data and an up-to-date correlation of the thermal conductivity of air in the gaseous phase over a wide range of temperature and pressure. This is especially important for the viscosity, since the recent data show systematic differences compared with the old standard value used for many years. The present paper was written in order to document the critical evaluation of the latest data sets and to present a new set of correlations of the viscosity and thermal conductivity of air. The range covered is from 85 to 2000K for temperature and up to 100 MPa for pressure.

705,561
PB86-165685 Not available NTIS
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Charge Transfer of Hydrogen Ions and Atoms in Metal Vapors.
T. J. Morgan, R. E. Olson, A. S. Schlachter, and J. W. Gallagher. c1985, 68p
Prepared in cooperation with Wesleyan Univ., Middletown, CT., Missouri Univ.-Rolla, and California Univ., Berkeley. Lawrence Berkeley Lab.
Included in Jnl. of Physical and Chemical Reference Data, v14 n4 p971-1040 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Metals, Chemical equilibrium, Graphs(Charts), Tables(Data), Excitation, *Hydrogen ions, *Hydrogen atoms, *Atom ion collisions, *Charge transfer cross sections, *Atom atom collisions, Collisional energy transfer.

Cross sections and equilibrium fractions for energetic H(+1), H(-1), and H(sup 0) in collisions with metal-vapor targets have been compiled and evaluated. Both experimental and theoretical results are reported. Sources of errors are discussed, and recommended values for the data are presented.

705,562
PB86-165693 Not available NTIS
Brookhaven National Lab., Upton, NY.
Reactivity of HO2/O2(-1) Radicals in Aqueous Solution.
B. H. J. Bielski, D. E. Cabelli, R. L. Arudi, and A. B. Ross. c1985, 59p
Prepared in cooperation with Notre Dame Univ., IN. Radiation Chemistry Data Center. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v14 n4 p1041-1100 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Free radicals, *Reaction kinetics, Solutions, Reviews, Tables(Data),Concentration(Composition), Absorption spectra, *Superoxides, *Perhydroxyl radical, *Oxygen ions, Chemical reaction mechanisms.

Kinetic data for the superoxide radical (HO2 yields O2(-1) + H(+1), pK=4.8) in aqueous solution have been critically assessed. Rate constants for reactions of O2(-1) and HO2 with more than 300 organic and inorganic ions, molecules and other transient species have been tabulated.

705,563
PB86-165701 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mark-Houwink-Sakurada Equation for the Viscosity of Atactic Polystyrene.
H. L. Wagner. c1985, 6p
Included in Jnl. of Physical and Chemical Reference Data, v14 n4 p1101-1106 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Polystyrene, *Viscosity, Solvents, Molecular weight, *Mark-Houwink-Sakurada equation.

In this review, the second in a series, the viscosity-molecular weight (Mark-Houwink-Sakurada) relationships have been critically evaluated for atactic polystyrene for a variety of solvents often used for viscosity measurements. These are benzene, toluene, 1,2,4-trichlorobenzene, tetrahydrofuran, o-dichlorobenzene, 2-butanone, and two theta solvents, cyclohexane and decalin. In addition, the Mark-Houwink-Sakurada parameters for several other solvents, not used as frequently, are provided.

705,564
PB86-165719 Not available NTIS
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
Standard Chemical Thermodynamic Properties of Alkylcyclopentane Isomer Groups, Alkylcyclohexane Isomer Groups, and Combined Isomer Groups.
R. A. Alberty, and Y. S. Ha. c1985, 26p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v14 n4 p1107-1132 1985. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Thermodynamic properties, *Cyclopentanes, *Cyclohexanes, *Standards, Specific heat, Gibbs free energy, Enthalpy, Entropy, Pressure, Tables(Data), *Isomers, Benson method.

The standard chemical thermodynamic properties of the alkylcyclopentane isomer groups have been calculated through C9H18 in the ideal gas phase from 298.15 to 1000K, and the properties of the alkylcyclohexane isomer groups have been calculated through C10H20. The properties of individual species for which literature data are not available have been estimated using the Benson method. The increments per carbon atom in the isomer group properties have been calculated to determine the extent to which extrapolations may be made to higher carbon numbers. Since alkylcyclopentanes and alkylcyclohexanes of the same carbon number are isomers, the chemical thermodynamic properties of these combined isomer groups have also been calculated.

705,565
PB86-165776 PC **A08**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 90, Number 6, November-December 1985. Special Issue: Chemometrics Conference Proceedings.
Dec 85, 154p
See also PB86-165784 through PB86-165982, and PB86-137627. Also available from Supt. of Docs as SN703-027-00007-5.

Keywords: *Research projects, *Meetings, Chemical analysis, Calibrating, Reaction kinetics, Mathematical models, Spectroscopic analysis, Crystallography, Random walk, Chromatographic analysis, Polymers, Comparison, Experimental design, Electrochemistry, Pattern recognition, Kalman filtering, Procedures, Chemometrics.

Contents:
Topical issue:
Chemometrics;
Jack Youden;
The organizers' goals;
Agenda for chemometricians;
Adaptive Kalman filtering;
The limitations of models and measurements as revealed through chemometric intercomparison;
Statistical properties of a procedure for analyzing pulse voltammetric data;
Fitting first order kinetic models quickly and easily;
The use of Kalman filtering and correlation techniques in analytical calibration procedures;
Intelligent instrumentation;
The regression analysis of collinear data;
Optimization;
Strategies for the reduction and interpretation of multicomponent spectral data;
Some new ideas in the analysis of screening designs;
Polymers and random walks-renormalization group description and comparison with experiment;
Fourier representations of Pdf's arising in crystallography;
Aggregated Markov processes and channel gating kinetics;
Automated pattern recognition:
Self-generating expert systems for the future;
Regression analysis of compartmental models;
Measurement and control of information content in electrochemical experiments;
Pattern recognition studies of complex chromatographic data sets.

705,566
PB86-165818
(Order as PB86-165776, PC **A08**/MF **A01**)
Wisconsin Univ.-Madison.
Agenda for Chemometricians.
W. G. Hunter. Dec 85, 6p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p397-402 Nov-Dec 85.

Keywords: *Research projects, Chemical analysis, Statistical analysis, Management planning, Experimental design, *Chemometrics, Statisticians, Chemists.

No abstract available.

705,567
PB86-165842
(Order as PB86-165776, PC **A08**/MF **A01**)
Massachusetts Inst. of Tech., Cambridge.
Statistical Properties of a Procedure for Analyzing Pulse Voltammetric Data.
T. P. Lane, J. J. O'Dea, and J. Osteryoung. 24 Jun 85, 9p
Prepared in cooperation with State Univ. of New York at Buffalo. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p423-431 Nov-Dec 85.

Keywords: *Electrical measurements, *Mathematical models, Autocorrelation, Error analysis, Kinetics, Confidence limits, *Voltammetry, Maximum likelihoodd estimation, Procedures.

O'Dea et al. (1983,J. Phys. Chem. 97, 3911-3918) proposed an empirical procedure for obtaining estimates and confidence intervals for kinetic parameters in a model for pulse voltammetric data. Their goal was to find a procedure that would run in real time, not necessarily one that would have well-defined statistical properties. In this paper the authors investigate some of the statistical properties of their procedure. The authors show that their estimation method is equivalent to maximum likelihood estimation, and their confidence intervals, while related to likelihood ratio confidence regions, have a coverage probability that is not fixed and that is potentially quite large. The authors suggest modifications of their procedure that lead to more traditional confidence intervals. The authors examine the effect on their procedure of the presence of nuisance parameters. Finally, the authors discuss the possibility of serially correlated errors.

705,568
PB86-165859
(Order as PB86-165776, PC **A08**/MF **A01**)
Wisconsin Univ.-Madison.
Fitting First Order Kinetic Models Quickly and Easily.
D. M. Bates, and D. G. Watts. 24 Jun 85, 7p
Prepared in cooperation with Queen's Univ., Kingston (Ontario). Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p433-439 Nov-Dec 85.

Keywords: *Reaction kinetics, *Mathematical models, Linear differential equations, Compartment analysis.

Kinetic models described by systems of linear differential equations can be fitted to data quickly and easily by taking advantage of the special properties of such systems. The estimation situation can be greatly improved when multiresponse data are available, since one can then automatically determine starting values and better discriminate between rival models.

705,569
PB86-165909
(Order as PB86-165776, PC **A08**/MF **A01**)
Emory Univ., Atlanta, GA.
Strategies for the Reduction and Interpretation of Multicomponent Spectral Data.
I. M. Warner, S. L. Neal, and T. M. Rossi. 1 Jul 85, 7p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p487-493 Nov-Dec 85.

Keywords: *Fluorescence, *Spectrochemical analysis, Eigenvectors, Pattern recognition, Excitation, Molecular energy levels, Procedures.

Fluorescence data can be rapidly acquired in the form of an emission-excitation matrix (EEM) using a novel fluorometer called a video fluorometer (VF). An EEm array of 4096 data points composed of fluorescence intensity measured at 64 different emission wavelengths can be acquired in less than one second. The time-limiting factor in using this information for analytical measurement is the interpretation step. Consequently, sophisticated computer algorithms must be developed to aid in interpretation of such large data sets. Recently, a new instrument has been described which rapidly acquires fluorescence detected circular dichroism (FDCD) data for chiral fluorophores as a function of multiple excitation and emission wavelengths. The FDCD matrix is similar in form to EEM data. However, since the FDCD matrix may have legitimate negative entries while the EEM is theoretically non-negative, different assumptions are required. This paper will describe the mathematical algorithms developed in this laboratory for the interpretation of the EEM in various forms. Particular emphasis will be placed on linear algebraic and two-dimensional Fourier Transform procedures.

705,570
PB86-165925
(Order as PB86-165776, PC **A08**/MF **A01**)
Chicago Univ., IL.
Polymers and Random Walks - Renormalization Group Description and Comparison with Experiment.
K. F. Freed. 1 Jul 85, 4p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p503-506 Nov-Dec 85.

Keywords: *Polymers, *Random walk, Experimental design, Physical properties, Solutions, Molecular structure, Chemical bonds, Comparison, *Molecular configuration, Monomers.

Although real polymers involve the sequential addition of monomers having fixed bond lengths, fixed bond angles and some freedom of rotation about single bond, the properties of polymers over large length scales can be modeled by treating the polymer configuration as that of a random walk formed by the monomer units. Serious complications arise in the theoretical description of these polymers because of excluded volume constraints which prohibit different monomers from occupying the same position in space. This polymer excluded volume problem has been modeled in terms of a simple continuous random walk with short range repulsive interactions. The expansion of polymer properties in this repulsive interaction can readily be shown by dimensional analysis to involve an expansion in a large parameter, in the limit of long polyumers. The renormalization group method is utilized as a systematic means for resuming this divergent perturbation expansion. The theory proceeds by analytically continued theory. The renormalization group approach is described from a heuristic physical standpoint and extensive comparisons are provided to show how it quantitatively reproduces vast amounts of dilute solution polymer properties with no adjustable parameters.

705,571
PB86-165941
(Order as PB86-165776, PC **A08**/MF **A01**)
California Univ., San Diego, La Jolla.
Aggregated Markov Processes and Channel Gating Kinetics.
D. R. Fredkin, and J. A. Rice. 1 Jul 85, 4p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p517-520 Nov-Dec 85.

Keywords: *Markov processes, *Kinetics, Aggregates, Membranes, Ions, Mathematical models, Biochemistry, Proteins.

A finite state Markov process is aggregated into several groups. Rather than observing the underlying Markov process, one is only able to observe the aggregated process. What can be learned about the underlying process from the aggregated one. Such questions arise in the study of gating mechanisms in ion channels in muscle and nerve cell membranes. The authors discuss some recent results and their implications.

705,572
PB86-166733 PC **A06**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Technical Activities 1985, Surface Science Division.
C. J. Powell. Jan 86, 123p NBSIR-86/3304
See also PB81-158719.

Keywords: *Surface chemistry, Standards, Catalysis, Electron spectra, Atomic structure, Adsorption.

The report summarizes technical activities of the NBS Surface Science Division during Fiscal Year 1985. These activities include surface-standards work, experimental and theoretical research in surface science, the development of improved measurement methods, and applications to important scientific and national problems. A listing is given of publications, talks, professional committee participation, and professional interactions by the Division staff.

705,573
PB86-166782 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 90, Number 5, September-October 1985.
Oct 85, 64p
See also PB86-166790 through PB86-166832. and PB86-137627. Also available from Supt. of Docs SN703-027-00006-7. Library of Congress catalog card no. 63-37059.

Keywords: *Research projects, Thermodynamics, Solutions, Sulfur dioxide, Standards, Speech recognition, Performance evaluation, Automatic control equipment, Weight measurement, Weight indicators, Temperature, Succinonitrile, Assessments, Reaction kinetics, Standard reference materials.

Contents:
- Note on Weighings Carried Out on the NBS-2 Balance;
- Thermodynamics of Solution of SO2(g) in Water of Aqueous Sulfur Dioxide Solutions;
- SRM 1970:
- Succinonitrile Triple-Point Standard-A Temperature Reference Standard Near 58.08C;
- Performance Assessment of Automatic Speech Recognizers;
- Chemical Kinetics-Theory and Experiment.

705,574
PB86-166808
(Order as PB86-166782, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Thermodynamics of Solution of SO2(g) in Water and of Aqueous Sulfur Dioxide Solutions.
R. N. Goldberg, and V. B. Parker. 19 Jun 85, 18p
Included in Jnl. of Research of the National Bureau of Standards, v90 n5 p341-358 Sep-Oct 85.

Keywords: *Thermodynamics, *Sulfur dioxide, *Solutions, Water, Gibbs free energy, Specific heat, Enthalpy, Entrapy, Chemical equilibrium, Heat measurement, Tables(Data), Oxidation.

A consistent set of thermochemical property values at 298.15K is given for the known constitutents of aqueous sulfur dioxide. Also tabulated are values of the mean ionic activity coefficients, osmotic coefficients, partial pressure of SO2(g), and the relative apparent molar enthalpy as a function of concentration of SO2(aq) at 298.15K. The data analysis considered a wide variety of measurement techniques: calormetric enthalpies of solution and reaction, heat capacities, equilibrium constants, solubilities, and vapor pressure measurement, both partial and total, over aqueous solutions of SO2 for the temperature range 278 to 393K. All auxiliary data have been taken from the most recent set of CODATA values which were converted to a standard state pressure of one bar (0.1 MPa). Parameters are given which extend the predictions to temperatures up to 373K.

705,575
PB86-166832
(Order as PB86-166782, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Chemical Kinetics - Theory and Experiment.
Oct 85, 2p
Included in Jnl. of Research of the National Bureau of Standards, v90 n5 p389-390 Sep-Oct 85.

Keywords: *Reaction kinetics, *Meetings, Laboratories, Experimental design, Reviews, Chemical physics, Numerical solution.

The purp0se of the conference was to bring together investigators from a broad range of institutions and backgrounds to review progress and problems in theoretical and experimental kinetics.

705,576
PB86-182300 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.

Introduction to Fourier Transform Spectroscopy.
J. Cohen. Mar 86, 102p NBSIR-86/3339

Keywords: *Infrared spectroscopy, *Chemical analysis, Spectrophotometry, Sampling, *Fourier transform spectroscopy.

The document is a simplified, concise introduction to Fourier Transform spectroscopy. The emphasis is on concepts and comprehension, and abundant diagrams are provided as an aid. The work is organized into three parts: first, a selective, but adequate review of Fourier transform mathematics, next, a treatment of the physics of a simple Michelson interferometer, and last, salient topics in Fourier transform spectroscopy.

705,577
PB86-185287 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Generalized Internal Axis Method for High Barrier Tunneling Problems, as Applied to the Water Dimer.
Final rept.
J. T. Hougen. 1985, 32p
Pub. in Jnl. of Molecular Spectroscopy 114, p395-426 1985.

Keywords: *Water, Molecular vibration, High resolution, Reprints, Molecular rotation, Rotational states, Coordinates, Molecular tunneling.

When more than one large-amplitude vibrational motion is present in a molecule, it is often not possible to define a global internal-axis-method (IAM) coordinate system and set of basis functions. In the present work, a method is presented for extending the IAM treatment to tunneling problems in such cases, using as an illustration a model for the water dimer with three large-amplitude vibrational coordinates. The method involves the construction of two different sets of local IAM-like coordinate systems. The first of these contains n coordinate systems, one for the small neighborhood surrounding each of the n equilibrium frameworks. The second contains on the order of (n square)/2 coordinate systems, one for each feasible tunneling path between each pair of frameworks. Basis functions written in the second set of local IAM-like coordinates are used to determine the complex phase factors associated in this method with tunneling matrix elements of the phenomenological rotational Hamiltonian in the high barrier limit. These phase factors govern the way in which the various real tunneling frequencies in the molecule constructively and/or destructively interfere in the Hamiltonian matrix elements and final energy expressions.

705,578
PB86-185840 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Effect of Water Loss on the Heat Capacity of Coal.
Final rept.
R. A. MacDonald, J. E. Callanan, and S. A. Sullivan. 1985, 8p
Pub. in High Temperatures - High Pressures 17, n3 p387-394 1985.

Keywords: *Specific heat, *Bituminous coal, *Coal, Water loss, Mathematical models, Moisture content, Reprints, Char, Volatile matter.

The moisture content of coal has a serious effect on its measured heat capacity. Measurements on high-volatile bituminous coal samples from Colorado (PSOC-854), using a differential scanning calorimeter over the temperature range 300-500 K, show that moisture evolves from apparently dried coals over a considerable range of temperature above 373 K. Recently, Merrick has developed a model to predict the loss of volatile matter from coal, the resulting heat capacity of the char, and the heat loss due to the evolution of volatile components, for temperature above 573 K. At the lower temperatures used in the experiments reported here, water is the only component that evolves, and Merrick's model has been adapted to this situation. The results of the calculation of the heat capacity are presented and compared with experimental values.

705,579
PB86-186699 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Photoeffect in the 4d Subshell of Atomic Silver Between 14 and 140 eV.
Final rept.
M. O. Krause, W. A. Svensson, T. A. Carlson, G. Leroi, D. E. Ederer, D. M. P. Holland, and A. C. Paris. 1985, 7p
Contract DE-AC05-84OR21400
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 18, p4069-4075 1985.

Keywords: Cross sections, Palladium, Reprints, *Silver atoms, *Photoelectron spectroscopy, *Photoionization, EV range 10-100, EV range 100-1000.

Relative partial photoionisation cross sections and the photoelectron angular distribution parameter beta have been measured for the 4d electrons of atomic silver in the energy range 14 = or < h(nu) = or <140 eV. Data are found to be in good agreement with the results calculated in the relativistic random-phase approximation (RRPA) for the neighbouring atom palladium. Comparison with solid-state data reveals a dominant atomic character of the 4d electrons in metals. This is especially evident for the beta parameter. However, differences occurring around the Cooper minimum at 130 eV show the influence of the metallic state on the properties of the 4d electrons.

705,580
PB86-186723 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Copolymer/Copolymer Blends: Effect of Sequence Distribution on Miscibility.
Final rept.
A. C. Balazs, F. E. Karasz, W. J. MacKnight, H. Ueda, and I. C. Sanchez. 1985, 3p
Contract F49620-84-C-0051
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Macromolecules 18, n12 p2784-2786 1985.

Keywords: *Copolymers, *Solubility, Interactions, Blends, Distribution(Property), Chemical composition, Reprints.

An earlier theory on the effect of sequence distribution in copolymer/homopolymer blends is applied to blends of two copolymers that differ only in composition. A general expression for (chi blend) is derived which contains contributions from a composition dependent term (Chi comp), as well as a term (Chi dist) which depends only on the difference between the sequence distributions in the two copolymers. A special case of the above equation is a blend where both copolymers have the same composition but differ only in sequence distribution: for example, a blend of a 50:50 alternating copolymers with a 50:50 random copolymer. The general formula is adapted to the case, and the authors can theoretically confirm the experimental observation that PVC and chlorinated polyethylene (CPE) of the same composition are immiscible. From experimental data on CPE/CPE mixtures, they can evaluate the chi parameters required by their theory and consequently calculate (chi sub CH2; CHC1.)

705,581
PB86-186731 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
H2O Adsorption on Oxygen-Dosed Ni(110) - Formation and Orientation of OH(ad).
Final rept.
C. Benndorf, C. Nobl, and T. E. Madey. 1984, 13p
Pub. in Surface Science 138, n2-3 p292-304 1984.

Keywords: *Surface chemistry, *Water, *Nickel, Orientation, Adsorption, Reprints, *Hydroxyl radicals, Electron stimulated desorption.

The presence of oxygen on a Ni(110) surface promotes the adsorption and decomposition of H2O at 300 K. Angle resolved UPS (ultraviolet photoemission spectroscopy), ESDIAD (electron stimulated desorption ion angular distribution) and isotope experiments all indicate that OH(ad) is formed on the surface, presumably via a hydrogen abstraction reaction, H2O + O(ad) -> 2OH(ad). The molucular axes of the OH(ad) species are inclined with respect to the surface normal, and are oriented along (001) and (001) azimuthal directions.

705,582
PB86-186749 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

Mass Spectrometry of 2-Substituted-4-Arylthiazoles. 3. Identification of Microsomal Nitroreduction Products by Mass Spectrometry.
Final rept.
M. B. Mattammal, T. V. Zenser, B. B. Davis, and E. White. 1984, 6p
Sponsored by Veterans Administration Medical Center, Washington, DC., and Saint Louis Univ., MO.
Pub. in Biomedical Mass Spectrometry 11, n4 p149-154 1984.

Keywords: *Thiazoles, Chemical reactions, Mass spectroscopy, Heterocyclic compounds, Carcinogens, Nitro compounds, Reduction, Reprints, Thiirene/phenyl.

The electron impact mass spectra of the chemical carcinogens 4-(4-nitrophenyl)-2-methylaminothiazole, 4-(4-aminophenyl)-2-methylaminothiazole and 4-(4-aminophenyl)-2-aminothiazoles were studied. The 4-(4-aminophenyl)-2-substituted thiazoles were isolated from the anaerobic microsomal reduction of their respective 4-nitrophenyl analogues. The identity of the reduction products were established by chemical synthesis and mass spectrometry. The mass spectrometric fragmentation of the nitro derivative shows prominent ions arising from the loss of the nitro group, ring enlargement of the thiazoles, and the phenylthiirene ion resulting from 1,2-cleavage of the thiazole ring. In the 4-(4-aminophenyl)-2-substituted amino derivative prominent ions result from the preferential 1,2-cleavage of the thiazole ring to give the common 2-(4-aminophenyl)thiirene ion and subsequent fragmentation of the ion.

705,583
PB86-186764 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Methylthiirane: Kinetic Gas-Phase Titration of Sulfur Atoms in (SxOy) Systems.
Final rept.
R. I. Martinez, and J. T. Herron. 1983, 6p
Pub. in International Jnl. of Chemical Kinetics 15, n11 p1127-1132 1983.

Keywords: *Reaction kinetics, *Sulfur oxides, Gases, Titration, Reprints, *Methylthirane, *Sulfur atoms.

The reaction SO + SO ->S + SO2 was studied in the gas phase at 298 K by using methyl thiirane as a titrant for sulfur atoms. By monitoring the C3H6 produced in the reaction S + CH3-CH-CH2-S-> S2 + C3H6, the authors determined an expression for (K sub 2). (K sub 2) approx = (10 to the power (-12.0 + or -0.3))(e exp (-1700 + or - 200))/T cc/s, (T= 298-1000K).

705,584
PB86-187036 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Formulations for the Thermodynamic Properties of the Saturated Phases of H2O from 173.15 K to 473.15 K.
Final rept.
R. W. Hyland, and A. Wexler. 1983, 20p
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions 89, Pt. 2A/2B p500-519 1983.

Keywords: *Thermodynamic properties, *Water, *Ice, *Water vapor, Enthalpy, Entropy, Vapor pressure, Reprints.

No abstract available.

705,585
PB86-187044 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Dependence of the Stimulated Emission Cross Section of Yb(3+) on Host Glass Composition.
Final rept.
M. J. Weber, J. E. Lynch, D. H. Blackburn, and D. J. Cronin. Oct 83, 9p
Sponsored by Lawrence Livermore National Lab., CA.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Jnl. of Quantum Electron QE-19, n10 p1600-1608 Oct 83.

Keywords: Laser materials, Cross sections, Fluorescence, Glass, Reprints, *Ytterbium ions, *Stimulated emission.

The stimulated emission cross section for the doublet F (5/2) -> doublet F (7/2) transition of Yb(3+) has been determined from absorption and emission measurements of 41 different oxide, fluoride, and oxyfluoride glasses at 293 K. The effective peak cross sections for transitions to Stark levels above the ground state range from approximately 0.3 to 0.8 pm sup 2. The largest values occur in borate and phosphate glasses; the smallest values occur in silicate and low-refractive-index fluoride glasses. Radiative lifetimes calculated from integrated absorption spectra are also reported and range from 0.6 to 2.7 ms. Systematic variations in cross sections with changes in modifier ions can be used to tailor stimulated emission cross sections and fluorescence lifetimes.

705,586

PB86-187101 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Characterization of Organometallic Polymers by Size Exclusion Chromatography on Preconditioned Columns.
Final rept.
E. J. Parks, W. F. Manders, R. B. Johannesen, and F. E. Brinckman. 1986, 13p
Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Jnl. of Chromatography 351, p475-487 1986.

Keywords: *Chromatographic analysis, *Polymers, Tin organic compounds, Chemical analysis, Reprints, *Chemical reaction mechanisms.

Tin-bearing organometallic polymers (OMPs) having tributyltin substituents on pendant carboxylic acid groups are in current, extensive use as marine biocides. Fractionation of the substituted polymer by size exclusion chromatography (SEC) on polystyrene cross-linked with divinylbenzene (PS-DVB) is complicated by surface adsorption of cations even on this relatively inert packing material. The paper describes chromatography performed successfully on PS-DVB columns following pretreatment with an organometallic cation to establish a positively charged surface. Tin-specific SEC illustrates the methodology. The column packing is preconditioned with an organic solution of tributyltin-bearing cation derived from monomer esters, to prevent cleavage of the tin-bearing moieties from the OMP. Mass-sensitive differential refractive index and element-specific graphite furnace atomic absorption spectroscopy detectors in tandem give self-consistent values for key molecular parameters (molecular weight, molecular weight dispersion, and the distribution of tin in high- and low-molecular-weight fractions).

705,587

PB86-187119 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Static and Kinetic Studies of Polystyrene/Poly(vinylmethylether) Blends.
Final rept.
C. C. Han, M. Okada, Y. Muroga, F. L. McCrackin, B. J. Bauer, and Q. Tran-Cong. 1986, 6p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Polymer Engineering and Science 26, n1 p3-8 Jan 86.

Keywords: *Reaction kinetics, Static characteristics, Interactions, Thermodynamic properties, Vinyl ether resins, Polystyrene, Phase diagrams, Reprints, Spinodal decomposition.

A systematic study of static and kinetic phase behavior of deuterated polystyrene/poly(vinylmethylether) blends is presented in the paper. The static properties are studied by the small angle neutron scattering techniques and the kinetics of phase decomposition are studied by the temperature jump light scattering technique. The procedure provides detailed information about phase behavior with regard to both thermodynamics and kinetics.

705,588

PB86-187127 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Precision Measurement of the 1s Lamb Shift in Hydrogenlike Argon.
Final rept.
E. S. Marmar, J. E. Rice, E. Kaellne, J. Kaellne, and R. E. LaVilla. 1986, 4p
Grant DE-AC02-78ET1013
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A: General Physics 33, n1 p774-777 Jan 86.

Keywords: Argon, Wavelengths, Emission spectra, Accuracy, Calibrating, Measurement, Reprints, *Argon plasma, *Lamb shift, Alcator device.

Precision measurements of the absolute wavelengths of the Lyman-alpha doublet (2p doublet P(3/2,1/2)->5s doublet 5(1/2)) in hydrogenlike argon Ar(+17), as well as those of some strong dielectronic satellites, are reported. The Alcator C tokamak plasma was seeded with trace amounts of argon and the emission spectra were taken with a high-resolution, crystal x-ray spectrometer. In situ wavelength calibration was achieved by utilizing the potassium K alpha lines from a KCl fluorescence source. For the Ly alpha sub 2 line, a precision of 11 ppm was achieved. Comparisons of these data with QED predicted wavelengths show good agreement, yielding a test of the 1s Lamb shift at the 3% level. The precision of these measurements was limited by uncertainties in the wavelength calibration, with the uncertainties due to the influence of unresolved satellites being of secondary importance.

705,589

PB86-187135 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Charge Transfer and Vibrational Excitation in Molecule-Surface Collisions: Trajectorized Quantum Theory.
Final rept.
J. W. Gadzuk, and S. Holloway. 1985, 10p
Pub. in Physica Scripta 32, p413-422 1985.

Keywords: *Surfaces, Diatomic molecules, Excitation, Molecular vibration, Iodine, Nitrogen, Quantum theory, Reprints, *Charge transfer, Molecule-molecule collisions, Molecular trajectories, Molecular ions.

Vibrational excitation of diatomic molecules scattered from solid surfaces is considered. Emphasis is placed on a mechanism in which charge transfer between the molecule and surface creates a temporary molecular ion. A classical mechanics analysis of the effect has been presented previously. Here a mixed picture is offered in which the center-of-mass translational motion is treated classically with a trajectory approximation (TA) and the intramolecular vibrational motion quantum mechanically. A procedure for insuring energy conservation and microscopic reversibility in the TA is given. Both state-to-state T->V probabilities and mean energy transfer to the vibrational system are calculated for parameters which model N sub 2 and I sub 2 molecules and the results are considered in the light of the 'exact' classical mechanics results.

705,590

PB86-187259 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Comparison of Vibrational Broadening in Auger and Photoelectron Spectroscopy.
Final rept.
J. A. D. Matthew. 1984, 4p
Pub. in Physical Review B 29, n6 p3031-3034, 15 Mar 84.

Keywords: *Surfaces, Rare gases, Metals, Adsorption, Reprints, *Photoelectron spectroscopy, *Auger electron spectroscopy.

Within linear coupling the vibrational broadening of quasi-atomic Auger peaks and core photoelectron peaks is approximately equal in ionic crystals, but the Auger Broadening is about three times that of the core photoelectron broadening for rare gas atoms physisorbed on metal surfaces.

705,591

PB86-187275 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Molecular Symmetry and Translation-Rotation Coupling in Orientationally Disordered Crystals.
Final rept.
K. H. Michel, and J. M. Rowe. 1 Nov 85, 8p
Sponsored by Institut Interuniversitaire des Sciences Nucleaires, Brussels (Belgium).
Pub. in Physical Review B 32, n9 p5818-5826, 1 Nov 85.

Keywords: *Phase transformations, Degrees of freedom, Crystal symmetry, Reprints, Ferroelasticity.

The theory of coupling between rotational and translational degrees of freedom in orientationally disordered crystals is studied in detail, with careful attention to the requirements of symmetry. An essential feature of this coupling is the presence or absence of a center of symmetry in the molecule or molecular ion, which determines the nature of the coupling to optic- and acoustic-phonon modes. The present analysis is relevant for the understanding of ferroelastic phase transitions, of incommensurate transitions in insulators, and of structural transitions and related properties in synthetic organic conductors.

705,592

PB86-187283 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Aqueous Solubilities, Octanol Water Partition Coefficients, and Entropies of Melting of Chlorinated Benzenes and Biphenyls.
Final rept.
M. M. Miller, S. Ghodbane, S. P. Wasik, Y. B. Tewari, and D. E. Martire. 1984, 7p
Pub. in Jnl. of Chemical Engineering 29, n2 p184-190 1984.

Keywords: *Chemical analysis, *Chlorobenzenes, *Biphenyl/perchloro, Solubility, Entropy, Chlorine organic compounds, Reprints, Partition coefficients.

The aqueous solubilities and octanol/water partition coefficients at 25 C are determined for 12 chlorobenzenes, 16 polychlorinated biphenyls and for biphenyl using the modified generator column method. These values are correlated with chlorine number and with either boiling point for the chlorobenzenes or the relative retention time of a polychlorinated biphenyl eluting from a gas chromatographic column. Using differential scanning calorimetry, the melting points and enthalpies of melting for those compounds which are solid at room temperature are determined. A correlation between the octanol/water partition coefficient and corrected aqueous solubility is also presented, and the universality of the derived eqation is demonstrated.

705,593

PB86-187291 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
FT-IR (Fourier Transform Infrared) Microspectroscopic Method for Kinetic Measurements at High Temperatures and High Pressures.
Final rept.
P. J. Miller, G. J. Piermarini, and S. Block. 1984, 7p
Sponsored by Naval Surface Weapons Center, Silver Spring, MD.
Pub. in Applied Spectroscopy 38, n5 p680-686 1984.

Keywords: *Reaction kinetics, Pyrolysis, Infrared spectroscopy, Reprints, Fourier transform spectroscopy, RDX, Pressure dependence, Temperature dependence.

A Fourier transform infrared microspectroscopic method has been developed for obtaining kinetic data as a function of pressure and temperature. The method employs a diamond anvil high pressure cell with heating capability in conjunction with a FT-IR spectrometer modified with an on-axis cassegrain-type beam condenser. Time-dependent absorption spectra have been obtained for the thermal decomposition of 1,3,5-Trinitrohexahydro-1,3,5-Triazine (RDX) as a function of pressure and temperature. The pressure dependence of the temperature of thermal decomposition has also been determined. The method has wide applicability to kinetic measurements in general.

705,594

PB86-187671 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Interactions of CO + K on Ru(001): Structure and Bonding.
Final rept.
T. E. Madey, and C. Benndorf. 1985, 23p
Sponsored by North Atlantic Treaty Organization, Brussels (Belgium), and Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Surface Science 164, p602-624 1985.

Keywords: *Surface chemistry, *Chemisorption, *Carbon monoxide, *Potassium, Interactions, Chemical bonds, Ruthenium, Desorption, Reprints, Electron stimulated desorption.

Recent studies of CO+K on Ru(001) revealed an anomalously low CO stretching frequency of 1460/cm for low CO and K coverages. Hoffmann and de Paola proposed a side-on bound molecule with the CO molecular axis parallel to the metal surface: Weimer and Umbach suggested that CO is bound perpendicular to the surface, as on clean Ru(001), but that the CO is s(p sup 2) hybridized in the presence of K(ads). The main objectives of the present work were to search for configurational changes of adsorbed CO on K + Ru(001) and to compare these results with CO + O(ad). The authors used the ESDIAD (electron stimulated desorption ion angular distribution) method in combination with LEED (low energy electron diffraction) and TDS (thermal desorption spectroscopy).

705,595

PB86-187713 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Stochastic Model for Predicting the Service Life of Photolytically Degraded Polymethyl Methacrylate Films.
Final rept.
J. W. Martin. 1984, 18p
Pub. in Jnl. of Applied Polymer Science 29, n3 p777-794 1984.

Keywords: *Polymethyl methacrylate, Acrylic resins, Photodegradation, Quantum effiency, Markor processes, Molecular weight, Stochastic processes, Reprints, Poisson processes.

A general stochastic model is proposed for predicting the service life of a polymeric film subjected to photodegradation. The model has two parts. One part models the arrival of successful chain scission causing photons as a function of both temperature and irradiance. The other models material degradation as a function of the number of successful chain scissions. Two indicators of degradation are used in the paper-(1) changes is the weight average molecular weight and (2) changes in the glass transition temperature. The model is partially validated against twenty-five published data sets.

705,596

PB86-187762 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Dipole Threshold Laws for Single and Double Detachment from Negative Ions.
Final rept.
C. H. Greene, and A. R. P. Rau. Sep 85, 5p
Grants NSF-PHY82-11387, NSF-PHY81-20243
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review A 32, n3 p1352-1356 Sep 85.

Keywords: *Anions, Cross sections, Dipoles, Reprints, *Photodetachment, Hydrogen ions 1 minus, Threshold effects.

The threshold behavior of the cross section when electron detachment leaves behind a neutral atom (or molecule) with an electric dipole moment is derived through the formalism of quantum-defect theory. The cross section is a constant with a superimposed modulation with energy which has negligible amplitude for realistic situations such as the photodetachment of H(1-) accompanied by excitation. The threshold behavior for double detachment is also derived on the basis of a Coulomb-dipole description of the two electrons. It is shown that no oscillations will be observed in the cross section for this process.

705,597

PB86-189073 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Planar Diffusive Motion of Alkali-Metal Intercalant Atoms in Graphite.
Final rept.
H. Zabel, A. Magerl, A. J. Dianoux, and J. J. Rush. 1983, 4p
Pub. in Physical Review Letters 50, n26 p2094-2097 1983.

Keywords: *Graphite, *Diffusion, Alkali metals, Neutron scattering, Reprints, *Intercalation, Quasi-elastic scattering, Structure factors.

No abstract available.

705,598

PB86-189115 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Chemical Theory of Graphite-like Molecules.
Final rept.
S. E. Stein, and R. L. Brown. 1985, 5p
Pub. in Carbon 23, n1 p105-109 1985.

Keywords: *Graphite, *Molecular theory, Chemical reactivity, Molecular orbitals, Molecules, Reprints, Resonance radiation.

Graphite is composed of very large, highly condensed benzenoid polyaromatic molecules whose electronic properties can, in principle, be examined by conventional chemical theory. In the work, the authors present initial results of calculations on well-defined benzenoid molecules containing as many as 3300 carbon atoms. Computation times are held to practical levels using theories that require as input only counts of Kekule structures along with an efficient algorithm for counting these structures in polyaromatic molecules. These 'structure-counting' theories are particularly suited for these calculations since they have been shown to both accurately correlate a wide range of properties of polyaromatic species and yield resonance energies and reactivity indicies in good agreement with those of more sophisticated, but more time consuming, molecular orbital calculations.

705,599

PB86-189149 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Millimeter Wave Spectrum of Chlorine Nitrate.
Final rept.
R. D. Suenram, and F. J. Lovas. 1984, 9p
Pub. in Jnl. of Molecular Spectroscopy 105, n2 p351-359 1984.

Keywords: *Microwave spectra, Millimeter waves, Rotational spectra, Molecular vibration, Excitation, Atmospheric composition, Stratosphere, Reprints, *Chlorine nitrate(ClNO3), Chlorine 35, Chlorine 37.

New measurements of the millimeter wave spectra of the (35)Cl and (37)Cl, isotopic forms of chlorine nitrate in the ground and lowest vibrational state have been made in the 80-228 GHz region. These measurements allow accurate frequency predictions of all strong transitions up to 300 GHz. A comparison of rotational line intensities with those of ClO, which has already been observed in the stratosphere, is provided. The measured and calculated frequencies of ClNO3 are available on magnetic tape.

705,600

PB86-189685 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Infrared Spectra and Band Strengths of the Fundamental and First Overtone of HCl and DCl in Liquid Xenon Solutions.
Final rept.
J. T. Knudtson, and E. Weitz. 1985, 7p
Grant DAAG29-82-K-0125
Sponsored by Army Research Office, Arlington, VA.
Pub. in Jnl. of Chemical Physics 83, n3 p927-933, 1 Aug 85.

Keywords: *Hydrogen chloride, Deuterium compounds, Infrared spectroscopy, Liquefied gases, Cryogenics, Reprints, Liquid xenon.

The band strengths of the fundamental and first overtone of HCl and DCl have been measured in liquid xenon solution. The fundamental increases in intensity while the overtone decreases in intensity relative to the respective gas phase values. A variety of simple models are applied to the system in an effort to explain the observed effects. The possible effect of HCl-Xe complexes on the spectra is considered.

705,601

PB86-189693 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Branching Ratios for Electronically Excited Oxygen Atoms Formed in the Reaction of N(+) with O(sub 2) at 300 K.
Final rept.
A. O. Langford, V. M. Bierbaum, and S. R. Leone. 1986, 9p
Grant F49620-83-X-0013
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. Chemical Physics 84, n4 p2158-2166, 15 Feb 86.

Keywords: *Excitation, *Oxygen, Chemiluminescence, Electron emission, Reprints, *Ion-molecule collisions, *Oxygen atoms, *Nitrogen ions, Flowing afterglow.

Absolute branching ratios for production of O(triplet P), O(singlet D), and O(singlet S) in the reaction of N(sup +) with O2 are measured using the flowing afterglow/visible chemiluminescence technique. The O(1S) product is monitored by the O(1S)-O(1D) emission at 557.7 nm. The O(1D) product is monitored via sensitized fluorescence at 760 nm from O sub 2(sub 1) sigma (sub g)(sup +)) formed by energy transfer from O(1D) to O(sub 2)((x sup 3)(sigma(subg)(sup-)). Absolute O(1D) and O(1S) yields of 70 plus or minus 30% and less than or equal to 0.1%, respectively, of the total atomic oxygen product are inferred by comparison to the known O(1S) and O sub 2((sub 1) sigma(sub g)(sup +)) emission intensities from the reaction of Ar(triplet P) with O2. The low O(1S) yield is also obtained directly from the relative O(1S) and O sub 2((sub 1)signma(sub g)(sup +)) emission intensities from the title reaction. A qualitative reaction mechanism consistent with these observations is presented.

705,602

PB86-189719 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Nascent Rotational and Vibrational Product State Distribution in the Charge Transfer Reaction of N(+) + CO yields CO(+) + N at Near Thermal Energy.
Final rept.
G. H. Lin, J. Maier, and S. R. Leone. 1986, 7p
Grants NSF-PHY82-00805, NSF-CHE79-11340
Sponsored by National Science Foundation, Washington, DC., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 84, n4 p2180-2186, 15 Feb 86.

Keywords: *Carbon monoxide, Chemical analysis, Vibration, Rotation, Transport properties, Reprints, *Ion-molecule collisions, Charge exchange reactions, Nitrogen ions, Flowing afterglow.

An improved ion beam apparatus is used to measure the nascent product state distribution in the charge transfer reaction N+ + CO->CO+ + N under single-collision conditions at 0.16 eV energy. At the energy, the major vibrational channel in the CO+ products is v = 1, in contrast to the predominant formation of v = 0 at thermal energy. The relative vibrational distribution for the N+ + CO reaction is (0.40 plus or minus 0.07)sub nu = 0: (0.57 plus or minus 0.04)sub nu = 1: (0.03 plus or minus 0.01)sub nu = 2. In the v = 0 channel, the rotational distribution under single-collision conditions can be characterized by a Boltzmann distribution with a temperature of T = 410 plus or minus 40 K. In the nu = 1 channel the rotational distribution is highly excited and non-Boltzmann. The lower rotational states approximate a very high temperature of 2000K. For high rotational quantum numbers (K>23), the rotational temperature is about T = 810 plus or minus 20K. The dramatic differences in the rotational distributions are clear evidence that these two vibrational channels are formed by different reaction mechanisms, most likely a direct reaction for nu = 0, and an intimate collision for nu = 1.

705,603

PB86-189727 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Ion Association and Dipolar Dumbbells: Solutions of the HNC (Hypernetted Chain) and HNC/MS (Mean Spherical) Approximations at L = sigma/2 and sigma/3 for the Sticky Electrolyte Model.
Final rept.
J. C. Rasaiah, and S. H. Lee. 1985, 12p
Grant NSF-CHE83-05747
Sponsored by National Science Foundation, Washington, DC.

Pub. in Jnl. of Chemical Physics 83, n11 p5870-5881, 1 Dec 85.

Keywords: *Electrolytes, Mathematical models, Reprints, Percus - Yevick equation, *Hypernetted chain approximation.

The authors extend an earlier analytic study of a sticky electrolyte model(SEM) to the case L = sigma/3, where L is the distance at which positive and negative ions bind to each other, using the hypernetted chain (HNC) approximation within the spherical core and the mean spherical approximation (MSA) outside. They also present numerical solutions to the HNC approximation alone for sigma/3 < or = L < or = sigma/2. The average number of bonded pairs is found to be essentially the same for the two approximations but the ion-ion correlation functions are very different except at high concentrations when the shielding is large. Small amounts of tetramers are also observed in the HNC correlation functions for sigma/3 less than L < or = sigma/2, and trimers are found when L = sigma/2. An expression for the excess free energy of the SEM electrolyte is derived by turning on the stickiness between oppositely charged ions. The excess energy of the system of dipolar dumbbells with charges at a distance L = sigma/3 is obtained in the MSA and the atom-atom correlation functions are compared with the HNC approximation and with recent Monte Carlo simulations. The asymptotic form of the direct correlation functions defined through the Ornstein-Zernike equation is given for dipolar dumbbells.

705,604
PB86-189735 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Equilibrium Properties of Charged Hard Spheres with Adhesive Interactions between Oppositely Charged Ions.
Final rept.
J. C. Rasaiah, and S. H. Lee. 1985, 9p
Grant NSF-CHE83-05747
Pub. in Jnl. of Chemical Physics 83, n12 p6396-6404, 15 Dec 85.

Keywords: *Electrolytes, Chemical equilibrium, Thermodynamic properties, Adhesion, Interactions, Phase transformations, Ions, Reprints, Wiener-Hopf factorization, Percus-Yevick equation.

The equilibrium properties of charged hard spheres with adhesive interactions between oppositely charged ions are studied in the hypernetted chain/mean spherical (HNC/MS) approximation which are solved analytically. Numerical solutions to the hypernetted chain (HNC) approximation for the model are also compared with the HNC/MS approximation for a model 2-2 electrolyte in the preparative concentration range. The effect of adhesion on the low density phase transition of the primitive model electrolyte is found to be slight in contrast to the effect of charge on the phase separations at high densities of a two component mixture of hard spheres in which there is adhesion only between molecules of different species.

705,605
PB86-189750 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Time-Dependent Approach to the Magnetic-Field-Induced Redistribution of Oscillator Strength in Atomic Photoabsorption.
Final rept.
W. P. Reinhardt. 1983, 7p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 16, n21 pL635-L641, 14 Nov 83.

Keywords: Magnetic fields, Reprints, *Photoabsorption, *Oscillator strengths.

A time dependent wave packet approach is presented as a description of the dynamics responsible for the oscillatory observed structure near the zero field ionization threshold for atomic photoabsorption in a magnetic field. The description has a simple classical interpretation which both complements and extends earlier one dimensional WKB work. Absolute positions of the oscillations, widths, and amplitude modulations are correctly accounted for. Oscillatory structure in photodetachment of negative ions in either magnetic or electric fields is predicted for appropriate polarization.

705,606
PB86-189768 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Floquet-Liouville Super-Matrix Approach for Multiphoton Non-Linear Optical Processes in Intense Laser Fields.
Final rept.
T. S. Ho, and S. I. Chu. 1985, 6p
Sponsored by Department of Energy, Washington, DC., and American Chemical Society, Washington, DC.
Pub. in Chemical Physics Letters 122, n4 p327-332, 13 Dec 85.

Keywords: Eigenvalues, Reprints, *Multi-photon processes, Resonance fluorescence, Floquet function, Liouville equations, Nonlinear optics, Laser radiation.

A practical non-perturbative approach is presented for the treatment of multiphoton non-linear optical processes in intense monochromatic or polychromatic field. By extending the many-mode Floquet theory recently developed by the authors, the time-dependent Liouville equation for the density matrix of atoms or molecules undergoing radiative and/or collisional relaxations can be transformed into an equivalent time-independent Floquet-Liouville super-matrix eigenvalue problem. The method is illustrated by a study of the multiphoton resonance fluorescence spectra of two-level systems.

705,607
PB86-190642 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Multivacancy Effects in the X-ray Spectra of CH3Cl.
Final rept.
R. C. C. Perera, J. Barth, R. E. LaVilla, R. D. Deslattes, and A. Henins. 1985, 6p
Grant DE-AC03-76SF00098
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A: General Physics 32, n3 p1489-1494 Sep 85.

Keywords: *X ray spectra, *Chloromethanes, Absorption, X ray spectroscopy, Emission spectra, Excitation, Reprints, Methyl chloride.

A high-efficiency x-ray spectrometer has been constructed with use of a curved crystal and a position-sensitive detector mounted along a Rowland circle. Results obtained for the ClK absorption and fluorescent K beta emission of molecular CH3Cl show previously unobtainable details. The gas target is excited by primary radiation from a demountable conventional x-ray tube. The use of different anode materials and the insertion of filters between x-ray source and target allow some variation of the primary excitation energy. By monitoring emission spectra for different primary excitation energies, we are able to attribute the newly observed absorption features to multivacancy excitations. Such modulations in the suprathreshold absorption cross section would complicate the extraction of structural information in an extended x-ray-absorption fine-structure (EXAFS) analysis.

705,608
PB86-190675 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Hydrogen Bond Energies of the HF and HCl Dimers from Absolute Infrared Intensities.
Final rept.
A. S. Pine, and B. J. Howard. 1986, 7p
Pub. in Jnl. of Chemical Physics 84, n2 p590-596, 15 Jan 86.

Keywords: *Dissociation energy, *Hydrogen bonds, *Hydrogen chloride, *Hydrogen fluoride, Infrared radiation, Reprints, *Dimers, Tunable lasers.

The dissociation energies of the hydrogen-bonded complexes, (HF)2 and (HCl)2, have been obtained from high-resolution measurements of absolute infrared line strengths at a single temperature and pressure under the assumption of minimally perturbed local-mode behavior of the outer hydrogen stretch. The zero-point dissociation energies for the HF and HCl dimers are D sub zero = 1038(+43, -34) and 431(plus or minus 22)/cm-1, respectively. Estimates of the zero-point energies of the low frequency intermolecular vibrations enable us to obtain the well depths and equilibrium dissociation energies for comparison to ab initio calculations and empirical models.

705,609
PB86-191418 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Non-Adiabatic Effects in Elementary Surface Reactions: State-to-State Molecular Beam Experiments as a Probe.
Final rept.
J. W. Gadzuk. 1984, 16p
Grant NSF-PHY77-27084
Sponsored by National Science Foundation, Washington, DC.
Pub. in Many-Body Phenomena at Surface, p517-532 1984.

Keywords: *Surface chemistry, *Surfaces, Chemical reactions, Diatomic molecules, Excitation, Surface reactions, Surface scattering, Vibrational energy levels.

A theory of elementary chemical reactions at solid surfaces is described in terms of surface induced diabatic transitions between 'reactant' and 'product' potential curves. It is then shown how the internal vibrational state distribution of a diatomic molecule scattered from a surface could provide unique dynamical information required as input to the diabatic transition theory.

705,610
PB86-191434 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Interaction of Physisorbed Species with Chemisorbed Species as Studied by Infrared Spectroscopy.
Final rept.
J. T. Yates, and G. L. Haller. 1984, 5p
Pub. in Jnl. of Physical Chemistry 88, n20 p4660-4664 1984.

Keywords: *Chemisorption, *Carbon monoxide, Surface chemistry, Adsorption, Rhodium, Aluminum oxide, Reprints.

Infrared spectroscopy has been used to study the physical adsorption of CO onto a Rh/Al2O3 surface. In addition to absorption bands related to monolayer and multilayer physisorbed CO species, an interaction between the physisorbed species and chemisorbed CO has been observed causing a decrease of the chemisorbed CO wavenumber. Similar effects between physisorbed Xe and chemisorbed N2 on Rh surfaces have also been observed, suggesting that the effect is a general one. Correlation of these measurements with measurements of CO trapped in CO matrices suggests that inductive and dispersive effects are the main factors responsible for the negative shift in chemisorbed species wavenumber. It has been found that physisorbed CO preferentially adsorbs in the vicinity of ionic sites.

705,611
PB86-191442 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Single-Pulse Shock-Tube Studies on the Decomposition of 1,2-Dibromoperfluoroethane and Allyl Bormide.
Final rept.
W. Tsang. 1984, 6p
Pub. in Jnl. of Physical Chemistry 88, n13 p2812-2817 1984.

Keywords: *Decomposition, Chemical reactions, Cyclopentane, Chemical radicals, Reprints, *Bromide/allyl, *Ethane/dibromo-perfluoro, *Chemical reaction kinetics, Collision rates, Shock tubes.

1,2-Dibromoperfluoroethane and allyl bromide have been decomposed in comparative rate single pulse shock tube experiments. Cyclopentane is used as a radical trap and as a source of the ethylene which serves as a direct measure of the number of radicals generated in the system. Under the reaction conditions both decomposition processes (1) BrCF2CF2Br -> Br + C2F4Br (radical), and (2) Allyl Br -> allyl + Br (radical) are in the beginning of the fall-off region, k/k(sub infinity) greater than or approx. equal to 0.7 RRKM calculations yield the following high pressure rate expressions.

705,612
PB86-192150 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Kinetics and Mechanisms of Hydroxyl Radical-Induced Crosslinks between Phenylalanine Peptides.
Final rept.
M. G. Simic, E. Gajewski, and M. Dizdaroglu. 1984, 8p
Pub. in Radiation Physics and Chemistry 24, n5-6 p465-473 1984.

Keywords: *Peptides, *Phenylalanine, Chemical reactions, Gas chromatography, Mass spectroscopy, Reprints, *Chemical reaction kinetics, *Hydroxyl radicals, Dimerization, Pulse radiolysis.

Reactions of OH radicals with phenylalanine (Phe) and its homopeptides, i.e. L-Phe-L-Phe and L-Phe-L-Phe-L-Phe, in N2O-saturated aqueous solutions were investigated by pulse radiolysis, high-performance liquid chromatography and mass spectrometry. For identification of radiation-induced products, samples of irradiated Phe and HCl-hydrolyzates of its irradiated homopeptides were trimethylsilylated and analyzed by capillary gas chromatography-mass spectrometry. Mass spectra of the trimethylsilylated products revealed the formation of o-, m- and p-tyrosines and biphenyl type dimers. G-Values of these products were also determined by gas chromatography. Mechanisms of product formation were discussed in detail.

705,613
PB86-192457 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Center for Materials Science.
Vibrations of Crystallographic Defects Associated with a Single Chain in Polyethylene.
Final rept.
D. H. Reneker, and J. Mazur. 1984, 13p
Pub. in Polymer 25, n11 p1549-1561 1984.

Keywords: *Polyethylene, *Crystal defects, *Molecular vibration, Crystallography, Dispersion, Dislocations(Materials), Reprints.

The vibrational behavior of crystallographic defects associated with a single chain were investigated for a dispiration, disclination, and dislocation in polyethylene. An approximate longitudinal modulus for the defects was determined by using conformational calculations to estimate the energy changes associated with changes in length of a defect. The modulus, combined with the mass per unit length of the defect, was used to estimate the lowest longitudinal frequency of the defect, which was found to be around 100/cm for all the defects considered. Normal mode vibrational calculations for oligomers containing defects showed that the predicted lowest longitudinal modes could be identified by examination of the displacements associated with modes occurring in the estimated frequency range. It was shown that the defects could be considered as localized oscillators embedded in the crystal and coupled to the vibrational modes of the crystal. The presence of defects provides special mechanisms for coupling light waves and lattice vibrations in the crystal which may affect the Raman spectrum.

705,614
PB86-192481 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
State-to-State Differential and Integral Cross Sections for Vibrational-Rotational Excitation and Elastic Scattering of Electrons by Nitrogen at 5-50 eV: Calculations using Extended-Basis-Set Hartree-Fock Wave Functions.
Final rept.
J. R. Rumble, D. G. Truhlar, and M. A. Morrison. 1983, 13p
Sponsored by National Center for Atmospheric Research, Boulder, CO., and National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 79, n4 p1846-1858 1983.

Keywords: *Nitrogen, *Electron scattering, Differential cross sections, Elastic scattering, Excitation, Reprints, *Electron-atom collisions.

The authors have calculated differential, integral, and momentum-transfer cross sections for vibrational-rotational excitation as well as pure rotational excitation, pure vibrational excitation, and elastic scattering for electron collisions with N2 at 5-50 eV impact energy. The interaction potential has three terms: static and local exchange potentials calculated from extended-basis-set Hartree-Fock wavefunctions as functions of internuclear distance and a semiempirical polarization potential. The results are compared to previous calculations and to experiment.

705,615
PB86-192523 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Resonance Vibrational Excitation in Electron-Energy-Loss Spectroscopy of Adsorbed Molecules.
Final rept.
J. W. Gadzuk. 1985, 3p
Pub. in Physical Review B: Solid State 31, n10 p6789-6791, 15 May 85.

Keywords: *Adsorption, Excitation, Surfaces, Interactions, Molecular vibration, Reprints, *Energy-loss spectroscopy, Electron-molecule collisions.

A mechanism is suggested which could lead to enhanced excitation of the low-frequency vibrational modes associated with the bond between a solid surface and a molecule adsorbed upon it or of hindered rotational modes with displacement components normal to the surface, as observed in electron-energy-loss spectroscopy. If the incident electron becomes trapped in a negative-molecular-ion shape resonance, manifesting itself in significant intramolecular overtone excitation, the molecule-surface potential-energy curve is augmented by the image potential of the negative ion. This allows displacement of the molecule from its equilibrium neutral position which in turn appears as vibrational excitation of adsorbate-substrate relative motions, upon return to the neutral curve. A simple theory for the effect is presented and numerical estimates of its magnitude are given.

705,616
PB86-192986 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Role of Standards in Secondary Ion Mass Spectrometry.
Final rept.
D. E. Newbury, and D. Simons. 1984, 6p
Pub. in Springer Ser. Chem. Phys. 36, p101-106 1984.

Keywords: *Mass spectroscopy, Standards, Ions, Reprints, *Secondary ion mass spectroscopy, Ion microprobe analysis, Ion microscopes, Sensitivity analysis.

The existence of strong matrix and instrumental effects in secondary ion mass spectrometry procludes the use of theoretical models for accurate quantitative elemental analysis. Standards must be employed to reduce problems associated with instrumental effects and matrix effects. By means of relative elemental sensitivity factors based on glass standards, analysis with errors of 20% relative or less is feasible, even for trace elements.

705,617
PB86-193018 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Diode Laser Spectra of Cis-Nitrous Acid Near 850/cm and Trans-Nitrous Acid Near 1700/cm.
Final rept.
A. G. Maki, and R. L. Sams. 1983, 7p
Pub. in Jnl. of Molecular Structure 100, p215-221 1983.

Keywords: *Nitrous acid, *Molecular isomerism, Infrared spectroscopy, Absorption spectra, Frequencies, Reprints, High resolution.

Tunable diode laser spectra have been measured for the nu sub 4 band of cis-HONO near 850/cm and the nu sub 2 band of trans-HONO near 1700/cm. The nu sub 4 band is completely unperturbed and 355 well resolved transitions have been fit with a standard deviation of 0.0007/cm. The nu sub 2 band appears to have some small perturbations, but about 190 transitions have been fit with a standard deviation of 0.0027/cm. Rotational and centrifugal distortion constants are given for both bands.

705,618
PB86-193026 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
ns Rydberg Series of 1,3-Trans-Butadiene Observed Using Multiphoton Ionization.
Final rept.
W. G. Mallard, J. H. Miller, and K. C. Smyth. 1983, 6p
Pub. in Jnl. of Chemical Physics 79, n12 p5900-5905 1983.

Keywords: *Butadienes, Reprints, *Multiphoton ionization, *Rydberg series, Diffusion flames, Core sampling.

The ns Rydberg series of 1,3-trans-butadiene has been observed in a diffusion flame environment using two-photon resonant multiphoton ionization in the 330-269 nm wavelength region. An analysis of the energies for the N=4 to N=10 states yields a series limit of 73172 + or - 22/cm and a quantum defect of 0.91 + or - 0.04. The ns series limit has been averaged with the limits of three other Rydberg series to give an ionization potential of 73154 + or - 30/cm. The 3s and 4s states show substantial effects of mixing with the core orbitals.

705,619
PB86-193034 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Real-Time Mass-Spectrometric Study of the Chemistry Initiated by Infrared-Laser Photolysis: CF2Cl2.
Final rept.
R. I. Martinez, and J. T. Herron. 1983, 6p
Pub. in Chemical Physics Letters 98, n2 p184-189 1983.

Keywords: *Reaction kinetics, Chemical analysis, Free radicals, Photolysis, Mass spectroscopy, Infrared spectroscopy, Reprints, *Methane/dichloro-difluoro, *Ethylene/tetrafluoro, Real time measurements.

The infrared-laser photolysis/mass-spectrometric (ILP/MS) technique was used to monitor directly in real time the free-radical and stable reactants and products present in the reactive system initiated by the multiphoton-induced dissociation of CF2Cl2. It was found that, contrary to conclusions based on final-products analyses, the C2F4 observed as a final product in the system is not formed solely through the recombination of:CF2 radicals, but rather C2F4 is produced in a complex series of secondary reactions.

705,620
PB86-193117 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Heterodyne Frequency Measurements on N2O between 1257 and 1340/cm (sup minus 1).
Final rept.
J. S. Wells, A. Hinz, and A. G. Maki. 1985, 13p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 114, p84-96 1985.

Keywords: *Nitrous oxide, Absorption spectra, Frequency measurement, Frequency standards, Demodulation, Reprints, Laser applications, Tunable lasers, Infrared radiation.

Frequency measurements are given for the (00 sup 0)1 - (00 sup 0)0 and (01 sup 1)1 - (01 sup 1)0 bands of N2O from 1257 to 1340/cm. The measurements utilize heterodyne techniques by measuring small frequency differences between a tunable diode laser locked to the center of an N2O absorption line and harmonic combinations of frequencies of radiation from two CO2 Lamb-dip-stabilized lasers. The measurements are facilitated by the use of the CO laser as a transfer laser whose frequency is also measured. These measurements have been combined with other data to provide new band constants and frequency calibration tables for several band systems of N2O in the following regions; 1215 to 1340, 1816 to 1930, and 2135 to 2268/cm. A correction factor is also provided for existing calibration tables near 590/cm.

705,621
PB86-193141 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Electronic Structure and Spectra of UO(1+).
Final rept.
M. Krauss, and W. J. Stevens. 1983, 5p
Pub. in Chemical Physics Letters 99, n5-6 p417-421, 19 Aug 83.

Keywords: *Uranium oxides, Visible spectrum, Infrared spectra, Reprints, *Electronic structure, Relativistic effects.

Relativistic effective potentials are used to calculate the electronic structure and spectroscopic properties of UO(1+). The lowest energy states are very ionic and the molecular orbitals substantially localized so that the molecule is described by the ionic fragments, U(+3)(f sup 3, 4l) and O(-2)(singlet 1). All of the quartet states from Sigma (sup-) to I, that arise from the coupling of these ionic fragments, are perturbatively mixed using an effective operator for the spin-orbit. The Re and Omega sub e of the ground Omega = 9/2 state have been determined to be 3.48 bohr and 925/cm. The vibrational and electronic states are interleaved with the lowest excited state, Omega = 7/2, at 1315/cm. The excitation energies of the excited states of UO(1+) were calculated using a restricted valence configuration interaction. Strong radiative transitions are predicted in the red part of the visible. These transitions are predominately atomic-like f to d.

705,622
PB86-193190 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Multiple Ionization and the Charged State Evolution of Ions Exposed to Electron Impact.
Final rept.
A. Mueller. 1986, 5p
Pub. in Physics Letters 113A, n8 p415-419, 13 Jan 86.

Keywords: *Gas ionization, Electric charge, Reprints, *Electron-atom collisions, EV range 100-1000.

Charge state abundances of atoms exposed to an electron flux for a time t are calculated from experimental cross sections by considering either electron impact single ionization only or by including multiple ionization. When multiple ionization is neglected (Xe sup qt) ion abundances (q=0,1,...,6) for an electron energy of 700 eV are off by a factor of up to 2 both in peak size and in time necessary to reach the peak value.

705,623
PB86-193299 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Neutron Spectroscopic Studies of the Adsorption and Decomposition of C2H2 and C2H4 on Raney Nickel.
Final rept.
R. D. Kelley, R. R. Cavanagh, J. J. Rush, and T. E. Madey. 1985, 19p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Surface Science 155, p480-498 1985.

Keywords: *Chemisorption, *Catalysts, *Nickel, Surface chemistry, Adsorption, Ethylene, Acetylene, Decomposition, Neutron scattering, Reprints.

Incoherent neutron inelastic scattering has been applied to the study of the chemisorption of C2H2 and C2H4 on Raney nickel (a high surface area nickel powder) as a function of temperature. Surface vibrational spectra of the adsorbed layer obtained through neutron scattering demonstrate that at 150 K C2H2 adsorbs molecularly on the nickel surface. Ethylene, however, is more reactive. Even at 120 K there is some C2H4 decomposition. In addition, perdeuteroethylene coadsorbed with atomic hydrogen undergoes isotopic exchange at 120 K. As the temperature is raised to 275 K both hydrocarbons decompose. The vibrational spectra of the molecularly adsorbed species are similar to those observed on flat Ni(111) single crystal surfaces with EELS. However, the decomposition process at higher temperature is not simply related to results reported on either flat or stepped Ni(111) surfaces. The authors conclude that the dominant influence of steps (or other defect structures) on high surface area nickel powders is to lower the activation energy for dissociation.

705,624
PB86-193323 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Structure of the Surface Hydration Shell of Bromide on Ag(110).
Final rept.
K. Bange, T. E. Madey, and J. K. Sass. 1985, 7p
Sponsored by Department of Energy, Washington, DC., and Deutsche Forschungsgemeinschaft, Bad Godesberg (Germany, F.R.).
Pub. in Surface Science 162, p252-258 1985.

Keywords: *Surface chemistry, *Sorption, *Bromine, *Silver, Desorption, Adsorption, Water, Electrochemistry, Reprints, *Electron stimulated desorption ion angular distribution.

The interaction of water and bromine on Ag(110) has been studied in the temperature range 80-300 K, using ESDIAD (electron stimulated desorption ion angular distribution), LEED (low energy electron diffraction) and TDS (thermal desorption spectroscopy). Compared to the clean surface, water adjacent to surface bromide was characterized by a higher binding energy and pronounced orientational order. The mixed adlayers resulting from the surface hydration of bromide exhibited long-range order. The surface hydration number (n sub H2O/n sub Br) was two for Theta sub Br < or approx = 0.25 and decreased to a few tenths at the bromine saturation coverage Theta sub Br approx. equal 0.75. Comparison is made to the results of a recent similar study on Cu(110) and electrochemical aspects are briefly considered.

705,625
PB86-193331 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Application of Decelerated Bare Nuclei to Precision Spectroscopy of One-Electron Ions.
Final rept.
R. D. Deslattes, R. Schuch, and E. Justiniano. Sep 85, 3p
Pub. in Physical Review A: General Physics 32, n3 p1911-1913 Sep 85.

Keywords: *Ions, X ray spectra, Reprints, *Chlorine ions, Lamb shift.

Bare Cl nuclei were decelerated and then allowed to capture a single electron in a He-gas target. By the method pure hydrogenlike Cl ions were prepared in an excited state from which the 2p-1s transition wavelength could be accurately (about 0.00001) measured without distortion by spectator electrons. After Doppler correction utilizing measurements at four different ion velocities (vc about = 0.038-0.067), fine-structure splitting and 1s Lamb-shift values were determined within 15% error bars, which, while far from the potential possible limits of our method, are in agreement with theoretical results.

705,626
PB86-193349 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Fundamental and Incidental Limits on the Spectroscopy of Single Electron Ions.
Final rept.
R. D. Deslattes. 1985, 5p
Pub. in Nuclear Instruments and Methods in Physics Research B9, p668-672 1985.

Keywords: *Spectroscopy, *Ions, Reprints, Quantum electrodynamics, Lamb shift.

Precision measurements of spectra from one-electron ions are principally focused on tests of QED corrections to the energy levels implied by the Dirac equation. Even though spectroscopic tests in atomic hydrogen itself and determination of the anomalous moment of the electron have reached impressive levels of refinement and demonstrate equally impressive consistency between experiment and theory, exploration of the Z-dependence of such comparisons remains of interest. Fundamentally, such 'Lamb-shift' experiments are characterized by and are limited by some 'Q-value' determined by the magnitude of the QED shift, S, in relation to a line-width parameter, gamma. Such Q-values are rather small for the traditional delta n=0 experiments, regardless of Z. Substantial improvement in the regard is available if one studies deltan=1 transitions, but in these cases there is a substantial, though largely incidental, penalty in loss of 'leverage' in the measurement. Additionally, and also incidentally, the earliest example of such deltan =1 experiments have suffered from various combinations of Doppler troubles and spectator electron perturbations. Only in one very recent effort has it been possible to bring both of these problems under simultaneous control thereby inviting consideration of a still more refined level at which fundamental limitations again appear dominant.

705,627
PB86-193588 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Time-Resolved Measurements of OH(v=1) Vibrational Relaxation on SiO2 Surfaces: Isotope and Temperature Dependence.
Final rept.
M. P. Casassa, E. J. Heilweil, J. C. Stephenson, and R. R. Cavanagh. 1986, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 84, n4 p2361-2364, 15 Feb 86.

Keywords: *Surface chemistry, *Surfaces, *Silicon dioxide, Chemisorption, Molecular relaxation, Energy transfer, Reprints, Temperature dependence, Time dependence, Multiphonon processes, Picosecond pulses.

Picosecond infrared spectroscopy was used to measure the vibrational energy relaxation time T1 of OH(Nu=1) and OD(Nu=1) groups chemisorbed on silica surfaces over the temperature range 100 less than or equal to T less than or equal to 800K. The observed T1 times and their temperature dependencies are discussed in terms of a multiphonon relaxation mechanism. Limiting low temperature lifetimes are T1=220 plus or minus 20 ps (1 sigma) for OH(Nu=1) and T1=149 plus or minus 10 ps for OD(Nu=1).

705,628
PB86-193620 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Symmetry beyond Point Groups in Molecular Spectroscopy.
Final rept.
J. T. Hougen. 1986, 7p
Pub. in Jnl. of Physical Chemistry 90, n4 p562-568 1986.

Keywords: *Molecular spectroscopy, Group theory, Reprints, Point groups.

An attempt is made to distill from the published literature a summary of some new uses of group theory in high resolution gas-phase spectroscopic studies of molecules with large amplitude and/or tunneling motions, paying particular attention to questions like the following: (i) When is a point group sufficient, and when is it not. (ii) What kind of information is easy, and what kind is difficult to extract from a permutation-inversion group treatment. (iii) What seem to be the advantages and disadvantages of various extended groups of the permutation-inversion group. While most spectroscopists would agree that a general group theoretical approach, suitable for application without modification to the majority of floppy molecules, has not yet been synthesized from the particular cases studied in the literature, some feeling for one direction of progress in the field can be obtained from the several examples presented.

705,629
PB86-193729 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Optical and Electrical Analysis of Blue Polymethyl Methacrylate for High-Dose Dosimetry.
Final rept.
N. S. I. Rageh, N. B. El-Assy, M. Ashry, and W. L. McLaughlin. 1986, 5p
Pub. in Radiation Physics and Chemistry 27, n2 p127-131 1986.

Keywords: *Dosimetry, *Plastics, Conductivity, Reprints, Polymethyl methacrylate.

The response to gamma radiation of polymethyl methacrylate ('blue PMMA') containing a blue dye was investigated, with the aim of providing a high-dose dosimeter based on either spectrophotometry or electrical-conductivity measurements. It is found that the 3-mm thick pieces of blue PMMA can be used for dosimetry in a range of absorbed doses from about 5-50 kGy, for which the changes in optical transmission density (absorbance) at different wavelengths in the visible region (402, 596, 612, and 643 nm) are linear functions of dose. Results also show that irradiation of thin 0.1 mm films of blue PMMA produces two components of radiation-induced conductivity: a transient component which can be used to determine the absorbed dose rate and a steady-state component which registers the total absorbed dose in the range 20-80 kGy as based on a suitable calibration. The effects of

post-irradiation storage time, day light, and storage temperature on the radiation-induced visible spectrum were investigated. The storage-temperature effect on post-irradiation conductivity measurement was also evaluated.

705,630
PB86-193745 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Network Structure of Epoxies: 2. A Neutron Scattering Study.
Final rept.
W. Wu, and B. J. Bauer. 1986, 12p
See also PB85-229912.
Pub. in Polymer 27, p169-180 1986.

Keywords: *Epoxy resins, *Molecular structure, *Neutron scattering, *Elastic scattering, Molecular weight, X rays, Thermosets, Reprints.

Neutron scattering measurements were performed on epoxies to elucidate the molecular network structure of these commonly used thermosets. A partially deuterated diglycidyl ether of bisphenol A (DGEBA) was cured with di- and triamines based on poly(propylene oxide) chains. Pronounced neutron scattering peaks were observed on all three epoxies studied, while X-ray scattering yielded scattering typical of most amorphous materials. The neutron scattering results can be explained successfully using equations that have been derived using a result from a random phase approximation based on an ideal network. Neutron measurements were also conducted on epoxies that had been swollen in acetone. The swollen sample results, along with those from the bulk specimens, provide a unique approach to the network homogeneity problem in epoxies.

705,631
PB86-193760 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Neutron Scattering Study of Zeolite Rho.
Final rept.
M. J. Wax, R. R. Cavanagh, J. J. Rush, G. D. Stucky, L. Abrams, and D. R. Corbin. 1986, 3p
Pub. in Jnl. of Physical Chemistry 90, n4 p532-534 1986.

Keywords: *Ion exchange resins, Neutron scattering, Chemical bonds, Reprints, *Zeolite rho, Molecular sieves, Faujasite.

Incoherent inelastic neutron scattering has been used to examine the bonding of framework hydrogen to the faujasite zeolite Rho. Vibrational spectra obtained from 160 to 1600/cm are consistent with the existence of planar, symmetric AlO(H)Si units in the acid form of Rho at room temperature. As the zeolite undergoes a slight change in structure on heating, an accompanying transfer of hydrogen atoms occurs to some new bonding site of unknown nature, which is characterized by an unusually large-amplitude, low-energy vibration. Quasi-elastic neutron scattering data have allowed an upper limit to be set for the diffusion coefficient of hydrogen on the framework of partially dehydroxylated Rho, consistent with diffusion measurements by macroscopic methods.

705,632
PB86-193778 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Multiphoton Dynamics and Resonance Lineshapes in Three-Level Systems: Many-Mode Floquet Treatment.
Final rept.
K. Wang, T. S. Ho, and S. I. Chu. 1985, 18p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 18, p4539-4556 1985.

Keywords: Absorption, Perturbation, Excitation, Reprints, *Multi-photon processes, *Resonance absorption, Floquet theory.

The authors present an exact treatment of two- and multiquantum transitions in three-level systems driven by two intense linearly polarized monochromatic fields based on the semiclassical many-mode Floquet theory developed recently. Further they extend the almost degenerate perturbation theory of Salwen to the two-mode Floquet Hamiltonian and obtain approximate analytical formulae for multiphoton transition probabilities, resonance bichromatic shifts and widths, and absorption lineshapes, beyond the conventional rotating-wave approximation (RWA). Detailed comparison of the analytical, the RWA, and the exact results is given. Several novel features of multiphoton lineshape characteristics are pointed out.

705,633
PB86-193794 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
NBS/NRC (National Bureau of Standards/National Research Council) Steam Tables.
Final rept.
L. Haar, J. S. Gallagher, and G. S. Kell. 1984, 400p
Pub. in 400 pages from Hemisphere Publication Corporation, Washington, DC., 1983.

Keywords: *Water, *Steam, Thermodynamic properties, Transport properties, Surface tension, Tables(Data), Reprints, *Calibration standards.

Thermodynamic properties values for water and steam based on a new formulation derived by the authors are included at closely spaced intervals, for the range 0 < or - t < or - 2000 C and 0 < or - P < or - 30,000 bar. The formulation has been provisionally accepted (September of 1982) as the international standard for scientific and general use by the International Association for the Properties of Steam (IAPS). Also provided are IAPS approved values for the transport and other thermophysical properties, all of which have been made consistant with the thermodynamic formulation. In addition to tables and figures the book includes a discussion of the derivation and the accuracy for thermodynamic formulation, and lists the equations approved by IAPS for the transport and the thermophysical properties.

705,634
PB86-193869 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Field Effects on the Rydberg Product-State Distribution from Dielectronic Recombination.
Final rept.
A. Mueller, D. S. Belic, B. D. DePaola, N. Djuric, G. H. Dunn, D. W. Mueller, and C. Timmer. 1986, 4p
Contract DOE-EA-77-A-01-6010
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Physical Review Letters 56, n2 p127-130, 13 Jan 86.

Keywords: Reprints, *Magnesium ions, *Electron-ion collisions, Dielectronic recombination.

The effects of state mixing by extrinsic fields in the collision region have been investigated for the dielectronic recombination process Mg + (3s) + e -> Mg(3p,nl) -> Mg(3s,nl) + h nu. By field ionization of the Rydberg atoms produced, cross sections sigma(N sub f) have been measured. The observed large changes of sigma(N sub f) with alteration of the extrinsic field provide the first incontrovertible experimental evidence that dielectronic recombination can be changed by external fields.

705,635
PB86-193877 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Raman Spectroscopy of Gases with a Fourier Transform Spectrometer: The Spectrum of D2.
Final rept.
D. E. Jennings, A. Weber, and J. W. Brault. 1986, 7p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Applied Optics 25, n2 p284-290, 15 Jan 86.

Keywords: *Raman spectroscopy, *Deuterium, Hydrogen, Reprints, Fourier transform spectroscopy.

A high-resolution Fourier transform spectrometer (FTS) has been used to record spontaneous incoherent laser Raman spectra of gases. The resolution, sensitivity, calibration accuracy, and spectral coverage achieved in these spectra demonstrate the viability of the FTS for Raman spectroscopy. Measurements from a spectrum of D2 containing both v=0-0 and v=1-0 transitions were fitted to the Dunham expansion of the vibration-rotation energy levels. The coefficients are given.

705,636
PB86-194974 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Studies of Thin-Films in Binary Fluid Mixtures Using Ellipsometry.
Final rept.
J. W. Schmidt, and M. R. Moldover. 1983, 1p
Pub. in Annals of the New York Academy of Sciences 404, p350 May 83.

Keywords: *Thin films, *Mixtures, Binary systems(Materials), Surfaces, Reprints, *Cyclohexane/methyl, *Cyclohexane/methyl-perfluoro, *Ellipsometry.

In certain binary solutions, the lower of the two liquid phases forms a layer that intrudes between the upper liquid phase and the vapor. The authors used ellipsometry to measure the intruding layer's thickness--it was between 0.7 micrometer and 4 micrometers in a system consisting of C7F14 (perfluoromethycyclohexane) and C7H14 (methycyclohexane). The thickness varies approximately as L sup -1/3, where L is the height spanned by the upper liquid phase. The behavior was predicted by de Gennes, who used the idea that the long-ranged part of the intermolecular potential governs the layer's thickness. Deviations from L sup -1/3 behavior occur near consolute points.

705,637
PB86-194982 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Reaction of Oxygen and Aluminum on Rh(111).
Final rept.
S. Semancik. 1984, 2p
Pub. in Jnl. of Vacuum Science and Technology A-Vacuum Surfaces and Films 2, n2 p886-887 1984.

Keywords: *Aluminum, *Oxygen, Surface chemistry, Adsorption, *Aluminum oxide, Rhodium, Chemical reactions, Reprints, Low energy electron diffraction, Auger electron spectroscopy.

The initial stages of aluminum oxide formation on rhodium have been studied by absorbing oxygen and aluminum on a Rh(111) surface. Low energy electron diffraction and Auger spectroscopy were used to characterize, as a function of temperature and coverage, both individual overlayers of aluminum and oxygen on Rh, and the interaction between these species during coadsorption experiments.

705,638
PB86-194990 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Study of Miscibility and Critical Phenomena of Deuterated Polystyrene and Hydrogenated Poly(vinyl methyl ether) by Small-Angle Neutron Scattering.
Final rept.
M. Shibayama, H. Yang, R. Stein, and C. C. Han. 1985, 9p
Pub. in Macromolecules 18, n11 p2179-2187 1985.

Keywords: *Solubility, *Polystyrene, *Polyvinyl methyl ether, Polymers, Vinyl ether resins, Length, Neutron scattering, Reprints, Small angle scattering.

Miscibility and critical phenomena were studied on the polymer system of deuterated polystyrene and hydrogenated poly(vinyl methyl ether) by the small-angle neutron scattering technique. The phase diagram was constructed with 'light' and 'neutron' cloud points as well as spinodal points. It shows a well-known behavior of a lower critical solution temperature. The agreement between the 'light' and 'neutron' cloud points is fairly good for all compositions. The correlation length, the statistical segment length, and the Flory-Huggins Chi-parameter were obtained as functions of temperature and composition by employing de Gennes' scattering equation for polymer blends. The Chi-parameter showed not only a temperature dependence but also a composition dependence. Comparison of the Chi-parameter with the lattice fluid theory shows that the composition dependence of Chi results from the lattice fluid nature of the system, i.e., the compressibility and the thermal expansion of the system.

705,639
PB86-195187 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Desorption of Ions from Surfaces: Mechanisms of Photon Stimulated Desorption.
Final rept.
R. Stockbauer, and T. E. Madey. 1984, 8p
Pub. in Ann. Isr. Phys. Soc. 6, p483-490 1984.

Keywords: *Desorption, *Surfaces, Chemisorption, Synchrotron radiation, Reprints, *Photon stimulated desorption.

A review is given of the mechanisms of Photon Stimulated Desorption (PSD) from ionic, covalent and van der Waals bonded surfaces. An interatomic Auger decay process describes desorption from ionically bonded, maximal valency compounds. The mechanism for ion desorption from covalently bonded systems is not as well understood but is thought to involve relatively long-lived two hole states similar to doubly charged ionic states in the gas phase. Ion desorption from thick molecular films presents a challenge to theory since heavy fragments (CxHy) desorb from some (cyclohexane) and not from others (water, methanol). It is possible that hydrogen bonding or proton transfer could play a significant role in suppressing heavy fragments from the water or methanol surface.

705,640
PB86-195195 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron Excitation of Na(3S) and Na(3P) Atoms to the Na(3D) State.
Final rept.
B. Stumpf, and A. Gallagher. Dec 85, 10p
Contract ARO-8-82, Grant NSF-PHY82-00805
Sponsored by Army Research Office, Research Triangle Park, NC., and National Science Foundation, Washington, DC.
Pub. in Physical Review A 32, n6 p3344-3353 Dec 85.

Keywords: *Sodium, Atomic energy levels, Excitation, Reprints, *Electron-atom collisions.

The cross sections for electron-impact excitation of Na(3S) and Na(3P) atoms to the 3D state have been measured from threshold to 1000 eV, with about 0.3 eV resolution. The 3P-state atoms are produced in the m(l)=1, m(s)=1/2 level by optical excitation, and 3D->3P fluorescence is detected at 90 degrees to the quantization axis. The resulting polarization anisotropies are considered, and included along with cascade effects in the high-energy normalizations to the Born approximation. The 3S->3D and 3P->3D excitation cross sections both rise very abruptly at threshold, and are indistinguishable from a step function with our energy resolution.

705,641
PB86-195492 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Comment on 'Anomalies in Chemical Equilibrium near Critical Points'.
Final rept.
G. Morrison, I. Procaccia, and M. Gitterman. Jul 84, 4p
Pub. in Physical Review A 30, n1 p644-647 Jul 84.

Keywords: *Critical point, Scattering, Turbidity, Reprints, *Equilibrium constant.

An analysis of measurements purporting to show the effect of a critical point on the extent of a chemical reaction indicates that the measured phenomenon can be accounted for by turbidity at the critical point.

705,642
PB86-195518 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Photodetachment Threshold of CN (1-) by Laser Optogalvanic Spectroscopy.
Final rept.
R. Klein, R. P. McGinnis, and S. R. Leone. 1983, 4p
Grants NSF-CHE79-11340, NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Chemical Physics Letters 100, n6 p475-478, 30 Sep 83.

Keywords: *Cyanides, Anions, Reprints, Laser spectroscopy, Optogalvannic effect, *Photodetachment.

Laser optogalvanic spectroscopy is used for the first time to obtain the photodetachment threshold for a molecular negative ion, CN(1-). The electron affinity for CN is determined to be 3.821 + or - 0.004 eV.

705,643
PB86-195526 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Enskog Theory for Multicomponent Mixtures: 2. Mutual Diffusion.
Final rept.
J. M. Kincaid, M. L. de Haro, and E. G. D. Cohen. 1983, 13p
Pub. in Jnl. of Chemical Physics 79, n9 p4509-4521, 1 Nov 83.

Keywords: *Diffusion, Fluids, Hard sphere, Kinetic theory, Mixtures, Multicomponent, Reprints, Enskog theory.

The authors present a detailed description of the mutual diffusion coefficients of binary and ternary dense fluid mixtures of hard spheres, as given by the Revised Enskog Theory (RET) of van Beijeren and ERnst and the Standard Enskon Theory (SET) of Tham and Gubbins. The formulae for the diffusion coefficients, (see Part I of the series, J. Chem. Phys. 78, 2746 (1983)) involve the contact values of the equilibrium pair distribution functions and the chemical potentials, for which the Carnahan-Starling approximation is used. The formulae, which were obtained by making an expansion in Sonine polynomials, are evaluated up to the third order and the convergence of the Sonine polynomial expansion is discussed. Except at low densities, the SET cannot be used to describe diffusion in hard-sphere mixtures, since it is in conflict with irreversible thermodynamics when either the Carnahan-Starling (CS) or exact equilibrium pair distribution functions are used.

705,644
PB86-195559 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Length and Mass Div.
Saturated Fluorescence in a Standing-Wave Laser Field.
Final rept.
H. K. Holt. 1984, 4p
Pub. in Physical Review A 30, n5 p2495-2498 Nov 84.

Keywords: *Fluorescence, Resonance, Standing waves, Reprints, Laser radiation.

An atom in a near-resonant standing wave laser field emits light spontaneiously from its upper level which shows a dip at resonance. The calculation gives the intensity emitted as a function of laser tuning and of the saturation parameter. The case of oppositely directed waves of unequal amplitudes is also treated.

705,645
PB86-195617 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Spectroscopy and Collisional Quenching for A C2H2(V' sub 3 = 0,1,2).
Final rept.
J. C. Stephenson, J. A. Blazy, and D. S. King. 1984, 8p
Pub. in Chemical Physics 85, n1 p31-38 1984.

Keywords: *Acetylene, *Spectroscopy, Spectra, Excitation, Fluorescence, Reprints.

Laser excited fluorescence excitation and dispersed fluorescence spectra have been recorded for the origin and v3 = 1 and 2 levels of A C2H2. Fluorescence decay rates were obtained as a function of pressure at room temperature. The slopes of the Stern-Volmer plots gave quenching rate constants for the A C2H2 v3 = 0, 1, and 2 levels in collisions with C2H2, N2, O2, He, and Ar; the intercepts gave zero pressure fluorescence lifetimes. The results are compared to available information on acetylene spectroscopy and kinetics.

705,646
PB86-195765 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Field-Dependent C-13 Chemical Shifts in Solids: A Second-Order Dipolar Perturbation.
Final rept.
D. L. VanderHart. 1 Feb 86, 10p
Pub. in Jnl. of Chemical Physics 84, n3 p1196-1205, 1 Feb 86.

Keywords: *Chemical shifts, *Carbon 13, Dipolar, Solids, Reprints, Nuclear magnetic resonance.

The observation of field-dependent C-13 chemical shifts in the presence of high-power proton decoupling and magic angle sample spinning (MAS) is documented. While the principal data were taken at fields of 1.4 and 4.7 T, the difference in chemical shift, in ppm, between the crystalline resonance of polyethylene and a reference resonance of solid adamantane varied as (a+bB0-2) in measurements taken at six different fields in as many laboratories. At a given field there is no dependence of the shift difference on proton resonance offset, proton rf field strength, or sample spinning speed. In rigid solids, the 'b' term in the foregoing relationship is twice as large for a methylene as for a methine carbon. Results of chemical shift measurements at two fields are reported for polyethylene, polypropylene, and three molecular solids including the normal alkane, nonadecane, which exhibits fast well-defined molecular rotation in the solid rotator phase. The observed shift differences for several kinds of carbons at 1.4 and 4.7 T agree very well with the explanation that the b term in the above expression results from a second-order energy perturbation involving the nonsecular 'C' and 'D' terms of the dipolar Hamiltonian.

705,647
PB86-196003 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Length and Mass Div.
Analytical Study of Quasi-Discrete Stark Levels in Rydberg Atoms.
Final rept.
D. A. Harmin. 1984, 16p
Pub. in Physical Review A: General Physics 30, n5 p2413-2428 1984.

Keywords: *Energy transfer, Atomic energy levels, Reprints, *Rydberg atoms, *Stark effect, *Excitation transfer.

A theory of nonhydrogenic Stark spectra based on the hydrogen atom is specialized to quasi-discrete levels. Core effects appear through zero-field quantum defects microliters and dipole matrix elements. Isolated and interacting Stark manifold with m=0 and 1 are examined for systems with two non-negligible microliters. A full Stark map of calculated intensities fr is presented for Li (m=0) and agrees with experiment. Pseudo-crossings occur at near triple degeneracies of hydrogen-Stark states. Extensions to include ls coupling are indicated. Experimental ionization rates in He are analyzed in a companion paper by van de Water, Mariani, and Koch.

705,648
PB86-196276 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Near-Threshold Measurements of the Spin Dependence of Electron-Impact Ionization.
Final rept.
M. H. Kelley, W. T. Rogers, R. J. Celotta, and S. R. Mielczarek. 1983, 3p
Pub. in Physical Review Letters 51, n24 p2191-2193 1983.

Keywords: *Sodium, *Polarization(Spin alignment), *Ionization, Electron irradiation, Reprints, Electron spin polarization.

The authors have measured the spin dependence of the ionization of Na up to 2eV above threshold with high precision and electron energy resolution to search for the existence of characteristic oscillations which would support the Coulomb-dipole theory of threshold ionization. The authors see no such oscillations and the results are fully consistent with the Wannier theory.

705,649
PB86-196284 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Transpiration Mass-Spectrometric Analysis of Liquid KCl and KOH Vaporization.
Final rept.
J. W. Hastie, K. F. Zmbov, and D. W. Bonnell. 1984, 32p
Pub. in High Temperature Science 17, p333-364 1984.

Keywords: *Potassium chloride, *Potassium hydroxides, Vaporizing, Transpiration, Mass spectroscopy, Electron irradiation, Reprints, Ionization cross sections.

Existing thermodynamic functions for the equilibrium vapor species over liquid KCl and KOH are based largely on an extrapolation of data for the lower temperature solid systems together with estimated spectroscopic constants. Using a transpiration mass spectroscopic method, the authors have determined the equilibrium vapor composition in the presence of liquid over a wide range of temperature and pressure. The results for KCl are in very good agreement with the JANAF evaluation of previous work. In addition, thermodynamic data are given for the (KCl)3 trimer species for the first time. For the KoH system, the dimer species (KOH)2 is much more important than suggested by the JANAF evaluation of previous work. Thermochemical data are also reported for the KO2 species. Bond dissociation energies and entropies for the various potassium halide and hydroxide species are found to correlate well with other alkali halide systems. Evidence of temperature dependent electron impact ionization is also indicated in these results.

705,650
PB86-196474 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Selection Rules for Rotational Excitation of Polyatomic Molecules by Slow Electron Impact.
Final rept.
G. A. Natanson. 1985, 9p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 18, p4481-4489 1985.

Keywords: *Atomic excitations, *Molecular rotation, *Particle collisions, Reprints.

Fundamental selection rules for rotational excitation of polyatomic molecules by slow electron impact have been derived as a result of conservation of molecular symmetry with respect to feasible permutations of nuclei. Special attention is given to an analysis of selection rules for molecules having the same dynamical permutation-inversion group of their free rotating rigid models with the only difference being that elements of the group represent feasible permutations in different ways. Asymmetric tops H2O, H2CO and C2H4 give a typical example.

705,651
PB86-196490 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Reactions of Iron (3): Porphyrins with Peroxyl Radicals Derived from Halothane and Halomethanes.
Final rept.
D. Brault, and P. Neta. 1984, 6p
Pub. in Jnl. of Physical Chemistry 88, n13 p2857-2862 1984.

Keywords: *Electron transfer, *Electrochemistry, Porphyrins, Halothane, Reprints, *Cytochrome.

The reactions of haloalkane derived peroxyl radicals with ferric deuterophyrins in aerated acidic or alkaline aqueous 2-propanol solutions are investigated by means of pulse radiolysis. CC13O2, CHCl2O2, CH2ClO2 and CF3CHIO2 radicals (the latter one being derived from the anesthetic agent halothane, CF3CHC1Br) are found to oxidize the ferric porphyrins with reaction rate constants ranging between 6 times 10 to the seventh power and 2.6 times 10 to the eight power M-1s-1. In keeping with an electron transfer mechanism, the spectrum of the oxidized ferric porphyrin does not depend on the nature of the peroxyl radicals. Also, the rate constant for the reaction of CCl3O2 radicals with ferric porphyrins is lowered by a factor greater than or equal to 20 when experiments are performed in the less polar solvents neat 2-propanol and neat carbon tetrachloride. The spectrum of the oxidized ferric porphyrin depends on pH with large changes around pH = 2.3 which are attributed to the protonation of an alkoxide ligand of the iron ion.

705,652
PB86-196508 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Chemical Physics.
Comparative Rate Method for the Study of Unimolecular Fall-Off Behavior.
Final rept.
W. Braun, J. R. McNesby, and M. D. Scheer. 1984, 5p
Pub. in Jnl. of Physical Chemistry 88, n9 p1846-1850 1984.

Keywords: High temperatures, Comparison, Reprints, *Unimolecular decomposition, Fall off behavior.

A comparative method was applied to a high temperature fast flow reactor to determine relative kinetic parameters for the two channel decomposition of cyclobutanone in the fall-off regime. The applicability of the method to such non-thermally-equilibrated systems was assessed and found to be generally useful over wide range of conditions. The measurements could, therefore, be used as a quantitative diagnostic tool for sensing unimolecular fall-off behavior in a number of heat bath gases. A simple stepladder collisional activation--deactivation model was used to determine the energy transferred per collision. The values obtained for the heat bath gases; He, Ar, SiF4 and SF6 were 3.0, 2.0, 3.5, and 4.0 kcal/mol respectively. These are small multiples of RT and very small fractions of the activation energy indicating that weak collisions must be a dominant feature of reaction types represented by the decomposition of cyclobutanone.

705,653
PB86-196839 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Laser Photodetachment Measurement of the Electron Affinity of Atomic Oxygen.
Final rept.
D. M. Neumark, K. R. Lykke, T. Andersen, and W. C. Lineberger. Sep 85, 3p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review A 32, n3 p1890-1892 Sep 85.

Keywords: Reprints, *Atomic oxygen, *Electron affinity, *Photodetachment.

The electron affinity of atomic oxygen, an important calibration standard in negative-ion photoelectron spectroscopy, has been determined by tunable-laser photodetachment in a coaxial laser-ion-beam spectrometer to be 11 784.645 + or - 0.006 per cm. In addition, the spin-orbit splitting between the 2P 3/2 and 2P 1/2 states of 0- was found to be 177.13 + or - 0.05 per cm.

705,654
PB86-200219 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Search for the Prewetting Line.
Final rept.
J. W. Schmidt, and M. R. Moldover. 15 Apr 86, 6p
Contract NASA-H-27954-B
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Physics 84, n8 p4563-4568, 15 Apr 86.

Keywords: *Wetting, Polarimetry, Reprints, Liquid-vapor interfaces, Ellipsometry, Cyclohexane/methylperfluoro, Isopropyl alcohol.

The paper describes efforts to locate the prewetting line in a binary liquid system (isopropanol-perfluoromethylcyclohexane) at the vapor-liquid interface. We placed tight upper bounds on the temperature separation (0.2K) between the prewetting line and the line of bulk liquid phase separation. We did not detect the prewetting line in systems at equilibrium. Experimental signatures indicative of the prewetting line occurred only in nonequilibrium situations. Several theories predict that the adsorption of one of the components (the fluorocarbon, in this case) at the liquid-vapor interface should increase abruptly, at a temperature sightly above the temperature at which the mixture separates into two liquid phases. A regular solution calculation indicates that the prewetting line should have been easily detectable with the instruments used in the experiment. Significant features of the experiment are: (1) low-gradient thermostating, (2) in situ stirring, (3) precision ellipsometry from the vapor-liquid interface, (4) high resolution differential index of refraction measurements using a novel cell design, and (5) computer control.

705,655
PB86-200227 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Time-Resolved Measurements of Vibrational Relaxation at Surfaces.
Final rept.
M. P. Casassa, E. J. Heilweil, J. C. Stephenson, and R. R. Cavanagh. 1986, 9p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Electron Spectroscopy and Related Phenomena 38, p257-265 1986.

Keywords: *Surfaces, *Molecular relaxation, Semiconductor(Materials), Silicon dioxide, Zinc oxides, Ion exchange resins, Time measurement, Reprints, Time dependence, Pico second pulses, Hydroxyl compounds.

Time-resolved measurements of optically induced transients on surfaces are reported. Room temperature vibrational energy relaxation rates for OH groups on the insulators SiO2 and zeolite ZSM-5 are found to be comparable (approx. equal to 10 to the 10th power/s). The relaxation rate for optically induced transients on the semiconductor surface ZnO appears to reflect the influence of conduction bands in the 8 micrometer spectral region.

705,656
PB86-200391 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Model Simulation of Chemical Reaction in a Diatomic Crystal. 1. Energy Exchange in Rapid Exothermic Dissociation.
Final rept.
D. H. Tsai, and S. F. Trevino. 1984, 4p
See also PB86-200409. Sponsored by American Physical Society, New York.
Pub. in Proceedings of the Americal Physical Society Topical Conference on Shock Waves in Condensed Matter, Santa Fe, NM., July 18-21, 1983, p629-632 1984.

Keywords: *Dissociation energy, Exothermic reactions, Diatomic molecules, Computerized simulation, Energy transfer, Explosions, *Diatomic crystals.

In the work the author describes the results of a molecular dynamics simulation of a rapid exothermic reaction in the solid state. The model consists of 256 particles arranged in pairs as diatomic molecules in a three-dimensional cube with periodic boundary conditions. The particles interact through a pairwise potential such that the diatomic molecules are metastable with respect to the dissociated state. The dynamics of energy transport (potential and kinetic) during the dissociation process is studied as are the conditions prerequisite to initiation.

705,657
PB86-200409 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Model Simulation of Chemical Reaction in a Diatomic Crystal. 2. Kinetics of Equilibrium Chemistry.
Final rept.
S. F. Trevino, and D. H. Tsai. 1984, 4p
See also PB86-200391. Sponsored by American Physical Society, New York.
Pub. in Proceedings of the American Physical Society Topical Conference on Shock Waves in Condensed Matter, Santa Fe, NM., July 18-21, 1983, p633-636 1984.

Keywords: Chemical equilibrium, Computerized simulation, Heat of reaction, *Chemical reaction kinetics, *Diatomic crystals.

The properties of a model which exhibits equilibrium chemical reactions are reported. It is shown that the kinetics produced is consistent with established thermodynamic considerations. Further, at constant pressure, the relation between the Arrhenius energy of reaction, the potential energy change upon reaction, and the work done due to the volume change upon reaction, is satisfied.

705,658
PB86-200433 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Quenching of Resonant Laser-Driven Ionisation at High Buffer Gas Pressures.
Final rept.
W. T. Hill. 1986, 10p
Sponsored by Maryland Univ. at Baltimore, and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Physics B: At. Mol. Phys. 19, p359-368 1986.

Keywords: *Barium, *Gas ionization, Atomic energy levels, Helium, Argon, Reprints, Laser-produced plasma, Quenching.

The modification of ion production efficiency via resonant laser-driven ionization in the presence of high buffer gas atmospheres has been experimentally investigated in a barium vapor. The populations of several energy levels of neutral and singly ionized Ba were measured as a function of both helium and argon pressures by the time-resolved hook technique. The behaviors of He and Ar are quite distinct. The percentage of ionization decreased monotonically from nearly 100% to less than 10% as the helium pressure was increased from 0.01 to 1 atm, while no quenching was observed in 1 atm of Ar. These observations are consistent with a quenching mechanism based in part on cooling of the 'hot' electrons through momentum-changing elastic collisions with the He atoms.

705,659
PB86-200680 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Angular Momentum Distribution of Electrons in Above-Threshold Ionization.
Final rept.
K. Rzazewski, and R. Grobe. Mar 86, 4p
Sponsored by Joint Inst. for Lab. Astrophysics, Boulder, CO.
Pub. in Physical Review A 33, n3 p1855-1858 Mar 86.

Keywords: Photoelectrons, Gas ionization, Reprints, *Multiphoton ionization, *Multi-photon processes, *Hydrogen atoms, Laser radiation.

The authors examine a quantum optical model describing absorption of photons above an ionization threshold in multiphoton ionization. They calculate 12-photon ionization of the hydrogen atom by a strong, linearly polarized laser pulse. The angular momentum distribution of photoelectrons in the consecutive peaks depends on the intensity of the laser but reveals the prescence of only a few of the lowest angular momenta. No 'peak switching' is observed, but a finite-number-of continua model becomes unstable at an intensity of about 0.001 a.u.

705,660
PB86-200706 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Relationship of the Unweighted Rosenbluth Walk to a Polymer Chain at the Theta Point.
Final rept.
C. M. Guttman. Mar 86, 5p
Pub. in Macromolecules 19, n3 p833-837 Mar 86.

Keywords: Reprints, *Polymer chains, *Rosenbluth walk, *Theta point.

It is shown that the unweighted Rosenbluth and Rosenbluth (R-R) chains (sometimes called the 'true' self-avoiding walk) can be viewed as polymer chains at the theta point where only second-order cluster-like terms have been included in the partition function. A modified weighting function for the R-R model is proposed that includes only such second-order cluster terms. Such a polymer chain is shown to show normal polymer chain behavior, i.e., chain expansion, a theta point, and chain collapse. It is suggested that by comparing the results of studies on these chains with those obtained by a normal R-R weighting procedure one should be able to accurately assess the contributions of third-order and higher order cluster terms to polymer chain properties.

705,661
PB86-200722 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Study of Thermal Depolarization of Polyvinylidene Fluoride Using X-ray Pole-Figure Observations.
Final rept.
A. J. Bur, J. D. Barnes, and K. J. Wahlstrand. Apr 86, 10p
Pub. in Jnl. of Applied Physics 59, n7 p2345-2354 Apr 86.

Keywords: *Depolarization, Aging tests(Materials), Piezoelectricity, Pyroelectricity, Dipole, Reprints, *Vinylidene fluoride polymers.

Measurements of piezoelectric and pyroelectric activity, density, and x-ray pole figures were used to study the effect of thermal aging on the state of polarization in polyvinylidene fluoride. A rolled and poled beta-phase specimen of polyvinylidene fluoride was subjected to thermal aging which consisted of temperature cycling between room temperature and successively higher maximum temperatures T (max), where T (max) ranged from room temperature to 164 deg C. We found that the room temperature piezo and pyroelectric activity decreased linearly as a function of T (max) from 75 deg C to 164 deg C at which temperature the specimen had 30% of its original activity; a linear extrapolation of these data to zero activity yielded a temperature T sub c = 207 deg C. Based on these data, we propose a model which describes the state of polarization in polyvinylidene fluoride and from which we calculate the fraction of dipoles in the crystalline state contributing to the polarization.

705,662
PB86-200755 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Low Vapor Density Measurements by Saturated Absorption.
Final rept.
M. Raab, and J. J. Snyder. 1983, 7p
Pub. in Proceedings of SPIE - Laser-Based Ultrasensitive Spectroscopy and Detection V, San Diego, CA., August 23-24, 1983, p99-105.

Keywords: Sodium, Spectral lines, Absorption, Sensitivity, *Low density gases, *Sodium vapor, Laser spectroscopy.

Saturation spectroscopy and polarization spectroscopy were applied to low density measurements in sodium vapor. Using the D sub 1 and D sub 2 lines a sensitivity was achieved to defect a minimum number of a few thousand atoms.

705,663
PB86-200979 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Spectrum and Energy Levels of Singly Ionized Cesium: 1. Revision and Extension of the Cs II Energy Levels.
Final rept.
C. J. Sansonetti, and K. L. Andrew. Mar 86, 12p
Pub. in Jnl. of the Optical Society of America B 3, n3 p386-397 Mar 86.

Keywords: *Atomic energy levels, Hyperfine structure, Ionization, Reprints, *Cesium ions.

The experimentally determined energy levels of Cs II have been revised and extended based entirely on recent observations of the spectrum. Most observed lines have been classified as transitions between 118 even and 167 odd energy levels. Of these 285 levels, 233 have not been previously reported. All the levels have been assigned designations in the jK coupling notation based on theoretical interpretation of the structure and empirical factors. Hyperfine splitting constants are given for 167 levels. By fitting polarization and extended Ritz formulas to selected Rydberg series, the Cs II ionization energy has been determined to be 186 777.4(5)/cm.

705,664
PB86-200987 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Laser-Driven Ionization of Cs and Absorption Spectrum of Resultant Cs (1+) Vapor.
Final rept.
T. J. McIlrath, J. Sugar, V. Kaufman, D. Cooper, and W. T. Hill. Mar 86, 5p
Contract AFOSR-ISSA-850033, Grant NSF-CPE84-17933
Sponsored by National Science Foundation, Washington, DC., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of the Optical Society of America B 3, n3 p398-402 Mar 86.

Keywords: *Gas ionization, Absorption spectra, Optical pumping, Reprints, *Cesium ions, Laser-produced plasma, Laser radiation, Dye lasers.

By pumping the 6s-7p line of neutral cesium at 4593 with a flash-pumped dye laser, the authors obtained about 80% ionization in a heat-pipe-generated Cs vapor. An absorption spectrum of Cs (1+) was then obtained, showing the 5p(6) - 5p(5)nd and ns Rydberg series both below and above the 5p(5) doublet P(3/2) threshold. Effects of channel mixing are seen in the broadening of the nd series members above threshold and in the anomolous intensity behavior below. This strong interaction is reflected in the Lu-Fano plot shown for these data.

705,665
PB86-201001 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Absolute Physical Quantities.
Longitudinal Ramsey-Fringe Spectroscopy in a Calcium Beam.
Final rept.
J. J. Snyder, J. Helmcke, and D. Zevgolis. 1983, 7p
Pub. in Applied Physics B-Photophysics and Laser Chemistry 32, n1 p25-31 1983.

Keywords: *Calcium, *Frequency standards, Atomic beams, Reprints, *Laser spectroscopy, *Ramsey fringes.

For ultra-high resolution applications such as optical frequency standards, the value of thermal sources such as atomic beams is currently limited by second-order Doppler broadening. The use of a longitudinal interaction geometry in which an atomic beam crosses the counter-propagating laser fields at a shallow angle is able to reduce second-order Doppler broadening to an insignificant level as well as to provide long interaction times without the necessity of large diameter optical beams. We have analyzed the geometry for the case of the long-lived calcium intercombination line, and conclude that when combined with pulsed (Ramsey) excitation, the longitudinal interaction geometry could be used with a thermal calcium beam to create an optical frequency standard with a reproducibility of the order of 10 to the minus 14th power for a few seconds' averaging time. Our initial experimental results have demonstrated the first use of the longitudinal geometry.

705,666
PB86-201043 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Auger Spectroscopy of Solid Surfaces: Electron Versus Ion Excitation.
Final rept.
J. A. D. Matthew. 1982, 10p
Pub. in Proceedings of International Workshop Inelastic Ion-Surface Collisions, Middelfart, Denmark, September 21-24, 1982, Phys. Scr. T6, p79-88 1983.

Keywords: *Surfaces, *Auger electron spectroscopy, Band theory.

Auger transitions involving outer electrons in free atoms and in solids are compared with particular reference to L(23) deexcitation in elements Na to Si. Under electron or X-ray excitation the elemental solid state spectra are band-like in character with breadth twice that of the conduction valence band, and a shape determined in detail by matrix element, surface and electronic relaxation effects. This is in strong contrast to the L(23)VV spectrum of Cu which is quasi-atomic in character and the M(45)VV spectrum of various Ag alloys which show mixed atomic-band like behavior. Under ion excitation a superposition of a solid state spectrum and an excited atom spectrum is observed. Various theories of the origin of the quasi-atomic spectrum are considered, and attempts are made to account for the energies in the atomic spectrum and the relative intensities of atomic and solid state features. Calculations of the detailed motions of atoms in the surface region following inner shell ionization are reviewed, and the sensitivity of atomic yield to inner core lifetime and the angle of incidence of the ion beam is discussed.

705,667
PB86-201449 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Interaction of Vibrating H Atoms on the Surface of Platinum Particles by Isotope Dilution Neutron Spectroscopy.
Final rept.
J. J. Rush, R. R. Cavanagh, R. D. Kelley, and J. M. Rowe. 15 Nov 85, 3p
Pub. in Jnl. of Chemical Physics 83, n10 p5339-5341, 15 Nov 85.

Keywords: *Platinum, *Surfaces, Particles, Neutron spectroscopy, Catalysts, Reprints, *Hydrogen atoms.

No abstract available.

705,668
PB86-201456 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Aluminum. 1. Measurement of the Relative Enthalpy from 273 to 929 K and Derivation of Thermodynamic Functions for Al(s) from 0 K to Its Melting Point.
Final rept.
D. A. Ditmars, C. A. Plint, and R. C. Shukla. Sep 85, 17p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Natural Sciences and Engineering Research Council of Canada, Ottawa (Ontario).
Pub. in International Jnl. of Thermophysics 6, n5 p499-415 Sep 85.

Keywords: *Aluminum, *Enthalpy, Polycrystalline, Specific heat, Thermodynamics, Quartz, Reprints, Calorimetry.

The relative enthalpy of pure, polycrystalline aluminum (NBS Standard Reference Material 44f, for the freezing point of aluminum on IPTS-68) has been measured over the temperature range 273 to 929 K. The enthalpy measurements were made in a precision isothermal phase-change calorimeter and are believed to have an inaccuracy not exceeding 0.2 percent. Pt-10Rh alloy and quartz glass were used as the encapsulating materials. The enthalpy data for Al(s) and SiO2(l) have been fitted by the method of least squares with cubic polynomial functions of temperature. Heat capacity data for Al(s), derived from these polynomials, have been smoothly merged using a spline technique to the most reliable low-temperature heat capacity data for Al(s) below 273 K. The merged data are compared with corresponding data from the literature as well as with published critical compilations of heat capacity data for Al(s). A new table of thermodynamic functions for Al(s) has been derived. A theoretical interpretation of the results appears in a companion paper.

705,669
PB86-202397 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Spectroscopy and Reaction Kinetics of Photolytically Generated Fe(CO)x (x=2,3,4).
Final rept.
A. J. Ouderkirk, T. A. Seder, and E. Weitz. 1984, 6p
Sponsored by SPIE-The International Society for Optical Engineering, Bellingham, WA.
Pub. in Proceedings of the SPIE International Conference on Applications of Lasers to Industrial Chemistry, Los Angeles, CA., January 24-25, 1984, v458 p148-153.

Keywords: *Metal carbonyls, *Reaction kinetics, Adsorption, Infrared spectra, *Iron carbonyls.

An apparatus for the gas phase infrared spectroscopic detection of coordinatively unsaturated metal carbonyls is described. Coordinatively unsaturated species are produced by UV photolysis. Infrared spectra of coordinatively unsaturated iron carbonyls are reported for the carbonyl stretch region. Rate constants for the reaction of Fe(CO)3 and Fe(CO)4 with Co are also reported. The photophysics of Fe(CO)x formation is discussed.

705,670
PB86-202819 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
4d-Photoabsorption of Barium: A View of Shell Collapse vs Contraction.
Final rept.
T. B. Lucatorto, T. J. McIlrath, W. T. Hill, and C. W. Clark. Dec 82, 18p
Pub. in Proceedings of the AIP (American Institute of Physics) Conference on X-ray and Atomic Inner-Shell Physics, Eugene, OR., August 22-27, 1982, 94, p584-601.

Keywords: *Barium, Ionization, Photochemical reactions, Contraction, Atomic orbitals, *Photoabsorption, Barium ions, Configurations.

Ba with Z=56 is at the edge of 4f collapse; neutral ground state atoms with Z<56 have 4f orbitals which are hydrogenic with (r sub (av) approx = 17a sub 0) while elements with Z>56 have a 'collapsed' 4f orbital with (r sub (av) approx = 1a (sub 0). Since the 4d orbital is collapsed (r sub (av) approx = 1a (sub 0) the nature of the 4d-absorption is expected to depend critically on whether the 4f orbital can be considered 'collapsed' or not. Using a laser technique to prepare dense homogenous columns of Ba(1+) and Ba(2+) the authors have obtained the 4d photoabsorption spectra of Ba, Ba(1+) and Ba(2+). The technique thus allows the authors to observe the effects on the 4f orbitals of the increased nuclear attraction experienced in the absence of screening by the 6s electrons. It is found that exchange effects are critically important in configurations of the type 4d(9)4f, and that progressive 'contraction' rather than 'collapse' is a more appropriate description under such conditions.

705,671
PB86-204567 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 15, Number 1, 1986.
Quarterly rept.
c1986, 451p
See also PB86-204575 through PB86-204609, and PB86-165560. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Research, Microwave spectra, Water, Heavy water, Thermodynamic properties, Triplet state, Interstellar gas, Molecular clouds, Forbidden transitions.

Contents:
- Triplet-Triplet absorption spectra of organic molecules in condensed phases;
- Recommended rest frequencies for observed interstellar molecular microwave transitions-1985 revision;
- New international formulations for the thermodynamic properties of light and heavy water;
- Forbidden lines in n(s, sup 2)n(p sup k) ground configurations and nsnp excited configurations of beryllium through Molybdenum atoms and ions;
- Cumulative listing of reprints and supplements.

705,672
PB86-204575 Not available NTIS
Notre Dame Univ., IN. Radiation Chemistry Data Center.
Triplet-Triplet Absorption Spectra of Organic Molecules in Condensed Phases.
I. Carmichael, and G. L. Hug. c1986, 250p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n1 p1-250 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Triplet state, Absorption spectra, Condensing, Photolysis, Organic compounds, Triplet-triplet interactions, Triplet production, Pulse radiolysis, Extinction coefficients.

A compilation of spectal parameters associated with triplet-triplet absorption of organic molecules in condensed media is presented.

705,673
PB86-204591 Not available NTIS
Maryland Univ., College Park. Inst. for Physical Science and Technology.
New International Formulations for the Thermodynamic Properties of Light and Heavy Water.
J. Kestin, and J. V. Sengers. c1986, 16p
Prepared in cooperation with National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Included in Jnl. of Physical Chemical Reference Data, v15 n1 p305-320 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Heavy water, *Water, *Thermodynamic properties, Equations of state.

The general assembly of the international association for the properties of steam (IAPS), meeting at the 10th international conference on the properties of steam in Moscow in September 1984, adopted new formulations for the thermodynamic properties of fluid H2O and D2O. The new formulations have been designated as the IAPS Formulation 1984 for the thermodynamic properties of ordinary water substance for scientific and general use and the IAPS formulation 1984 for the thermodynamic properties of heavy water substance. In the paper the authors present and discuss these new formulations.

705,674
PB86-204609 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Forbidden Lines in n(s sup 2)n(p sup k) Ground Configurations and nsnp Excited Configurations of Beryllium through Molybdenum Atoms and Ions.
V. Kaufman, and J. Sugar. c1986, 105p
Included in Jnl. of Physical and Chemical Reference Data, v15 n1 p321-435 1986. Available from American Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: Line spectra, Magnetic dipoles, Ground state, Transition probabilities, Wavelengths. Tables(Data), *Forbidden transitions, Energy-level transitions, Excited states.

Observed and predicted wavelengths of magnetic dipole lines arising within ground configurations of the type n(s sup 2)n(p sup k)(n=2 and 3, k=1 to 5) are compiled. For n=2 the compilation includes the elements B through Kr, and for k=5 it extends to Mo. For n=3 Al through Mo are included. In addition the 2s2p excited configuration of the Be i isoelectronic sequence for Be through Kr and 3s3p of the Mg sequence for Mg through Mo are included. For each line the authors give a calculated value for the transition probability obtained mainly from the Dirac-Fock method or from the use of scaled radial integrals. The calculated wavelengths are obtained from known energy levels or from levels derived from scaled radial integrals. A small group of electric quadrupole lines seen in astronomical sources are included. The list contains 1660 predicted wavelengths in the range 100 A to 25.9 mm and 406 observed wavelengths in the range 325 A to 609 micrometers.

705,675
PB86-207164 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Metastability in the H2O and D2O Systems at High Pressure.
Final rept.
G. J. Piermarini, R. G. Munro, and S. Block. 1984, 4p
Pub. in Proceedings of AIRAPT International High Pressure Conference (9th), Albany, NY., July 24-29, 1983, p25-28 1984.

Keywords: *Heavy water, *Water, Deuterium compounds, Metastable state, High pressure.

The pressure and temperature parameters which delineate the equilibrium thermodynamic stability fields of the liquid, VI and VII phases, including the triple point, were measured for the H2O and D2O systems over the pressure range, 0.8 to 2.4 GPa, and the temperature interval, 20 to 135 C. The phenomenon of metastability associated with the liquid-VII phase boundary was observed during the work; and, subsequently, a metastable extension of the coexistence curve was determined, from the liquid-VI-VII triple point down to 20 C, for both H2O and D2O. The measurements were made by optical polarizing microscopy in conjunction with a diamond anvil cell equipped with a miniature resistance coil heating element. Pressures were measured by the ruby fluorescence method.

705,676
PB86-208410 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Internal States Distributions of NO Thermally Desorbed from Pt(111): Dependence on Coverage and Co-Adsorbed CO.
Final rept.
D. A. Mantell, R. R. Cavanagh, and D. S. King. 1986, 12p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 84, n9 p5131-5142, 1 May 86.

Keywords: *Desorption, *Nitric oxide, Lasers, Platinum, Polarization, Rotational state, Reprints.

The distribution of population in the internal energy levels of nitric oxide thermally desorbed from Pt(111) has been probed using laser excited fluorescence. The observed rotational distributions have been found to follow the Boltzmann distribution function, independent of NO coverage or the presence of pre- or post-adsorbed CO. Under all conditions of NO desorption, the observed NO was characterized by a temperature (0.95 + or - 0.05) times the surface temperature. No

evidence of a preferred alignment of the rotational angular momentum vectors was observed, nor was there any difference between the two spin-orbit multiplets beyond that associated with the rotational temperature.

705,677
PB86-208444 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Transpiration Mass Spectrometry - A New Thermochemical Tool.
Final rept.
J. W. Hastie, and D. W. Bonnell. 1984, 51p
Sponsored by NATO Advanced Study Inst., Oslo (Norway).
Pub. in NATO Advanced Study Institute Series 119, p183-233 1984.

Keywords: Sampling, Mass spectrometry, Pressure measurements, Sodium chloride, Sodium sulfate, Transpiration, Reprints, *Alkali vapor transport, *Electron impact ionization.

Classical vaporization methods such as transpiration and Knudsen or Langmuir effusion have been limited because they do not establish the molecular identity of transport species or because low pressures are necessary to make effusion measuremenets. The authors have developed a new technique--Transpiration Mass Spectrometry (TMS)--that overcomes both of these limitations by combining the basic features of transpiration and molecular beam mass spectrometry. With this technique, it is possible to sample reactive gases directly from high-temperature (to 1500 deg C), high-pressure (to 10 atm) atmospheres for quantitative characterization with a mass spectrometer. The accuracy of thermochemical data obtained by the TMS method is competitive with that of established lower dynamic range techniques. Examples of application to vaporization of complex silicate slags, glasses, and minerals are considered. Implications and precautions resulting from cooling effects during the sampling process are also discussed.

705,678
PB86-208451 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Analysis of Submicrometer Particles by Sequential AEM and LAMMA.
Final rept.
E. B. Steel, D. S. Simons, J. A. Small, and D. E. Newbury. 1984, 3p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Army Materials and Mechanics Research Center, Watertown, MA.
Pub. in Proceedings of Annual Conference on Microbeam Analysis Society (19th), Bethlehem, PA., July 16-20, 1984, Microbeam Analysis-1984, p27-29.

Keywords: *Particles, AEM, LAMMA, Submicrometer.

No abstract available.

705,679
PB86-212818 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Absolute Rate Coefficients for Methyl Radical Reactions by Laser Photolysis, Time-resolved Infrared Chemiluminescence: CD3 + HX yields CD3H + X (X = Br,I).
Final rept.
D. J. Donaldson, and S. R. Leone. 1986, 6p
Grants NSF-CHE79-11340, NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Physical Chemistry 90, n5 p936-941 1986.

Keywords: *Chemiluminescence, Hydrogen bromide, Hydrogen iodide, Photolysis, Deuterium compounds, Reprints, *Chemical reaction kinetics, *Methyl radicals, Excimer lasers.

Absolute rate coefficients are reported for the room temperature reactions of deuterated methyl radicals with HI and HBr, CD3 + HI(HBr) -> CD3H + I(Br). Excimer laser photolysis of CD3I is used to generate methyl radicals, and time-resolved infrared chemiluminescence from the CH stretch of the CD3H products is detected to follow the time evolution of the reaction. The rate constants obtained in this manner are: (7.7 + or - 0.7) x 10 to the 12th power cc/molecule s for CD3 + HI and (4.7 + or - 0.4) x 10 to the 12th power cc/molecule s for CD3 + HBr. These rate constants are considerably greater than earlier, indirectly-measured values and indicate that the activation energy for these light-atom transfer reactions is lower than previously believed.

705,680
PB86-212834 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Resonant Photoionisation of Hydrogen Atom in Intense Magnetic Fields.
Final rept.
S. K. Bhattacharya, and S. I. Chu. 1985, 6p
Sponsored by Department of Energy, Washington, DC., Alfred P. Sloan Foundation, New York, and Army Research Office, Research Triangle Park, NC.
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 18, n10 pL275-L280, 28 May 85.

Keywords: Reprints, *Autoionization, *Photoionization, *Hydrogen atoms, High magnetic field research.

A complex quasi-energy approach is presented for accurate treatment of photo-ionization of the H atom in strong magnetic fields. The autoionizing resonances near the first two excited Landau thresholds are determined by the complex-coordinate coupled-Landau-channel method. Detailed resonant photoionization cross sections and asymmetric line shapes are reported for the case of B=4.7 x 10 to the 9th power G.

705,681
PB86-212859 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Flowing Afterglow Negative Ion Photoelectron Spectroscopy of Dirhenium: Evidence for Multiple Bonding in Re2 and Re2 (1-).
Final rept.
D. G. Leopold, T. M. Miller, and W. C. Lineberger. 1986, 2p
Grants NSF-CHE83-16628, NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of the American Chemical Society 108, p178-179 1986.

Keywords: *Chemical bonding, Dimers, Metals, Anions, Reprints, *Dirhenium, *Flowing afterglow, Photoelectron spectra, Photoelectron spectroscopy.

The authors report the first gas phase spectroscopic study of a third row open d-shell transition metal dimer. The low-lying electronic states of Re2 were probed by negative ion photoelectron spectroscopy of Re2(1-), prepared from Re2(CO)10 in a flowing afterglow ion source. Results indicate a Re2 electron affinity of 1.571 + or - 0.008 eV, and fundamental vibrational frequencies of 340 + or - 20/cm for Re2 and 320 + or - 15/cm for Re2. These frequencies imply high vibrational force constants which are strongly indicative Of multiple metal-metal bonding in both the neutral and anionic dimers.

705,682
PB86-212867 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Ab Initio Calculations of Low-Energy Electron Scattering by HCN Molecules: Dependence on Internuclear Distance in Linear Geometry.
Final rept.
A. Jain, and D. W. Norcross. 15 Jan 86, 6p
Contract DOE-EA-77-A-01-6010
See also PB86-102977. Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 84, n2 p739-744, 15 Jan 86.

Keywords: *Hydrogen cyanide, Bonding, Anions, Resonance, Band spectra, Electron scattering, Reprints, *Electron-molecule collisions, Molecular ions.

Low-energy electron scattering with HCN molecules is studied in the SEP (static-exchange plus parameter-free polarization potential) model as a function of both bond (CH and CN) stretches. A doublet Pi resonance at the equilibrium geometry behaves very similarly to the CO doublet Pi resonance as the CN bond is stretched; the corresponding HCN(-1) (doublet Pi) potential surface seems to cross the neutral curve (HCN singlet Sigma (+1) around 2.9 a.u. of CN distance. In (supZ)Sigma symmetry, where no shape resonance is present at equilibrium geometry, a broad resonance appears when the CH or CN bonds are stretched well beyond the equilibrium position; the former appears to cross the (doublet Sigma (+1) curve at about 2.8 a.u., i.e., just below the H + CN(-1) asymptote, the latter to approach the neutral curve much more slowly and tangentially. Structure interpreted as a Pi resonance in vibrational excitation, and as necessarily of Sigma character in dissociative attachment to the lowest anion-neutral asymptote, can be explained as due to the mixing of the lowest linear doublet Pi and (sup 2)Sigma resonances through bending (the Renner-Teller effect) and the peculiarity (cusp behavior) associated with anion-neutral curve crossings in polar molecules.

705,683
PB86-212875 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Angularly Resolved Vibrational Excitation in Na2-He Collisions.
Final rept.
E. Gottwald, A. Mattheus, K. Bergmann, and R. Schinke. Jan 86, 8p
Pub. in Jnl. of Chemical Physics 84, n2 p756-763 Jan 86.

Keywords: *Helium, *Sodium, Excitation, Energy transfer, Molecular vibration, Reprints, *Molecule-molecule collisions.

The paper reports angle-resolved measurements of V(subi)=0->V(Sub f)=1 vibrational transitions in Na2-He collisions at an energy of 90 MeV. The agreement with calculated cross sections using an ab initio surface is good, both in the angular variation of the cross section as well as with respect to its magnitude relative to the vibrationally elastic process. The calculated v(sub i)=0,j(sub i)=0 ->v(sub f)=1, j(sub f) differential cross sections are discussed in some more detail. They show structure, in addition to the rainbow oscillations, related to the fact that the vibrational transition probability vanishes for a specific approach angle.

705,684
PB86-212891 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Saturation of an Atomic Transition by a Phase-Diffusing Laser Field.
Final rept.
M. W. Hamilton, D. S. Elliott, K. Arnett, and S. J. Smith. Jan 86, 4p
Contract DOE-EA-77-A-01-6010
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 33, nl p778-781 Jan 86.

Keywords: *Electron transitions, Resonance, Atomic energy levels, Reprints, Sodium atoms, Laser radiation.

The authors have studied the effect of well-characterized laser frequency fluctuations on the saturation of an atomic resonance in a double optical resonance experiment. The peak-height asymmetry of the observed Autler-Townes signal was reversed at small detunings when the shape of the saturating laser power spectrum was changed from nearly Gaussian to nearly Lorentzian. The behavior agrees qualitatively with theoretical calculations and also with previous observations using lasers without such well-characterized fluctuations.

705,685
PB86-212917 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Comment on Rotational Energy Surfaces and High-J Eigenvalue Structure of Polyatomic Molecules.
Final rept.
G. A. Natanson. 1986, 3p
Pub. in Jnl. of Chemical Physics 84, n9 p5216-5218, 1 May 86.

Keywords: *Molecular structure, Assymmetry, Eigenvalues, Reprints, *Polyatomic molecules.

The main aim of these comments is to reveal some defects of the labeling scheme proposed by Harter and Patterson. It is shown that quasi-degenerate doublets found by these authors in the calculated spectra of an asymmetric-top molecule are nothing but K-doublets well known to molecular spectroscopists. The use of the nonstandard notation merely disguised this fact.

705,686

PB86-212925 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Experimental Proof of an (Absolute Value of Delta m) << j Propensity Rule in Rotationally Inelastic Differential Scattering.
Final rept.
A. Mattheus, A. Fischer, G. Ziegler, E. Gottwald, and K. Bergmann. 1986, 4p
Pub. in Physical Review Letters 56, n7 p712-715, 17 Feb 86.

Keywords: Differential cross sections, Sodium, Neon, Optical pumping, Reprints, *Atom molecule interactions, MeV range 100-1000.

The first measurement of a fully state-selected differential cross section in atom-molecule collisions is reported. A realistic estimate for the relative contribution of collision processes with (absolute value of delta m) > 0 gives an upper limit of 10%.

705,687

PB86-212933 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Nascent Rotational Distribution of the Minor v=0 Channel in the N2(1+) Product of the AR(1+)N2 Charge Transfer Reaction at Near Thermal Energy.
Final rept.
G. H. Lin, J. Maier, and S. R. Leone. 1986, 4p
Contract NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Chemical Physics Letters 125, n5/6 p557-560, 18 Apr 86.

Keywords: Chemical reactions, Reprints, *Ion-molecule collisions, *Nitrogen ions, *Argon ions, Flowing afterglow, Charge transfer.

An improved ion beam apparatus is used to study the nascent state distribution of products in the Ar(1+)+N2 charge transfer reaction at 0.28 eV collision energy. The rotational distribution of the minor nu=0 vibrational channel under single-collision conditions can be characterized by a Boltzmann distribution with a temperature T=710 + or - 70 K, compared to the higher temperature of 980 + or - 10 K for the major nu=1 vibrational pathway. It is suggested that these two vibrational channels are formed by different reaction mechanisms, most likely a relatively direct reaction for nu=0, and a more intimate collision for nu=1.

705,688

PB86-212941 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Observation of Interference between Quadrupole and Dipole Transitions in Low-Energy (2 eV) Photoionization from a Sodium Rydberg State.
Final rept.
G. Leuchs, S. J. Smith, S. N. Dixit, and P. Lambropoulos. 1986, 4p
Contract NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review Letters 56, n7 p708-711, 17 Feb 86.

Keywords: Dipoles, Atomic energy levels, Reprints, *Photoionization, *Sodium atoms, Angular distribution, Laser applications, Quadrupoles.

A measurement of the azimuthal dependence of the angular distribution of photoelectrons from 13 doublet D(3/2)-state sodium atoms aligned transversely to the direction of propagation of, and parallel to the direction of linear polarization of, 532-nm ionizing laser radiation is described. The measured distribution is 1 phi = 1 + 0.026(6)cos phi, where phi=0 is the direction of the laser beam. The departure from the symmetry 1 phi = const predicted for a pure electric dipole transition is represented theoretically as due to a dipole-quadrupole interference term.

705,689

PB86-213253 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Angular Distributions of Ions Desorbing from Ti02.
Final rept.
R. L. Kurtz, R. Stockbauer, and T. E. Madey. 1986, 7p
Pub. in Nuclear Instruments and Methods in Physics Research B13, p518-524 1986.

Keywords: *Titanium dioxide, *Desorption, *Surface chemistry, Chemisorption, Surfaces, Ions, Reprints, Angular distribution, *Electron stimulated desorption.

The dependence of the electron- and photon-stimulated desorption (ESD, PSD) O(1+)-ion yield on surface preparation from TiO2 (110) and (001) surfaces has been studied. Angle-integrated electron-stimulated desorption yields have been measured versus annealing temperature from room temperature sputtered surfaces to 900 deg C annealed surfaces. Both the surface cation valence state and the surface geometry change as a function of annealing temperature, giving rise to a rich variety of ESD ion angular distribution (ESDIAD) patterns. These patterns are discussed in terms of possible models of local surface structure.

705,690

PB86-213261 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Dynamics of Molecular Processes at Surfaces: Vibrational Lineshapes and Spectra.
J. W. Gadzuk. 1986, 22p
Sponsored by North Atlantic Treaty Organization, Brussels (Belgium).
Pub. in Jnl. of Electron Spectroscopy and Related Phenomena 38, p233-254 1986.

Keywords: *Surfaces, Surface chemistry, Adsorption, Vibrational spectra, Molecular spectra, Reprints.

Extremely useful connections exist between the dynamics of adsorbed molecule vibrations, as revealed in spectroscopic lineshapes, and the dynamics of molecular processes at surfaces because in both cases, the constituent atoms of a molecule, solid, or combination of the two execute multi-dimensional, motion over the same potential energy surfaces. In this paper, recent insights and advances in surface dynamics will be applied to the problem of vibrational lineshapes. Classical particle and semi-classical wavepacket dynamics will be used to address the issues of energy decay (T sub 1) vs. pure dephasing (T sub 2), overtones, and non-linear dynamics as they apply to lineshape analysis.

705,691

PB86-213279 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Collision Induced Dissociation of Diatomic Molecules on Surfaces: A Charge Transfer Mechanism.
Final rept.
J. W. Gadzuk, and S. Holloway. 1986, 7p
Sponsored by North Atlantic Treaty Organization, Brussels (Belgium).
Pub. in Jnl. of Chemical Physics 84, n6 p3502-3508, 15 Mar 86.

Keywords: *Dissociation, Surfaces, Diatomic molecules, Excitation, Magnesium oxides, Iodine, Reprints, *Electron-molecule collisions, Molecular ions, Charge transfer.

A theory is presented which accounts for one of the possible mechanisms responsible for dissociative scattering of diatomic molecules from surfaces. If on the incident trajectory of the molecule, a surface-to-molecule electron transfer occurs and on the outgoing trajectory, the reverse, then the temporary negative molecular ion formed for the time duration between electron hops will displace in its intramolecular vibrational coordinate. The molecule will emerge as a vibrationally excited neutral, with some of the excited states lying within the dissociative continuum. A model is described for this process in which the center-of-mass translational motion is handled classically and the intramolecular motion via wave packet dynamics. The theory is energy and probability conserving and microscopically reversible. Dissociation probabilities calculated as a function of incident energy and system parameters are discussed in the light of experimental measurements for the system of I2 dissociatively scattered from MgO surfaces.

705,692

PB86-213287 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Fundamental Excitations in Solids Pertinent to Desorption Induced by Electronic Transitions.
Final rept.
J. W. Gadzuk. 1983, 22p
Pub. in Springer Ser. Chem. Phys. 24, p4-25 1983.

Keywords: *Excitation, *Desorption, Surfaces, Chemisorption, Solids, Interactions, Reprints, Time dependence.

Various aspects of the dynamics of time-dependent localized potentials and interactions in solids and at surfaces, as they might relate to the fundamental processes involved in desorption induced by electronic transitions (DIET) are explored.

705,693

PB86-213295 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Modeling the Effect of Atomic Mass Difference in Ion-Bombardment Induced Recoil Mixing of Binary Alloys.
F. Davarya, M. L. Roush, T. D. Andreadis, and O. F. Goktepe. 1982, 5p
Pub. in Proceedings of Summer Computer Simulation Conference (1982), Denver, CO., July 19-21, 1982, p243-247.

Keywords: Computerized simulation, Mathematical models, Monte Carlo method, Surfaces, Binding energy, Atomic mass, *Ion bombardment, EVOLVE computer program, Ion implantation.

EVOLVE, a Monte Carlo computer code, is used to simulate the concentration changes which result from incident beam atoms and the cascade of recoil atoms. The changes in composition depend upon differences in the atomic masses of the target atoms, displacement energy, surface binding energy, and other factors. This study investigates the commonly held belief that lighter target elements tend to be preferentially implanted inwardly relative to heavier elements. Cases are presented here where, contrary to this perception, preferential inward movement of the heavier element was observed.

705,694

PB86-214202 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
High-Resolution Infrared Spectrum of Hydrogen Peroxide the nu sub 6 Fundamental Band.
Final rept.
J. Hillman, D. Jennings, W. Olson, and A. Goldman. 1986, 14p
Pub. in Jnl. of Molecular Spectroscopy 117, p46-59 1986.

Keywords: *Molecular spectra, *Hydrogen peroxide, Infrared spectra, Spectroscopic analysis, Bandwidth, Reprints, High resolution, Tunable lasers, Fourier transform spectroscopy.

The infrared spectrum of the nu(sub 6) asymmetric deformation band of hydrogen peroxide (H2O2) was studied in the region 1100-1350/cm using the two techniques of Fourier transform spectroscopy at 0.02/cm resolution and tunable diode laser spectroscopy at Doppler-limited resolution. Details of the wavelength calibration procedures adopted are discussed. For the first time, accurate values of the molecular parameters of the torsionally doubled, vibrational band were obtained. A total of 708 assigned transitions have been analyzed to yield a set of 14 rovibrational constants for the lower torsion-vibration level (SD=0.00487/cm) and 13 rovibrational constants for the upper torsion-vibration level (SD = 0.00382/cm). These hybrid bands are primarily A type with band centers at 1264.5812 + or - 0.0009 and 1273.6830 + or - 0.0009/cm. Because of the absence of observed perturbations, the derived molecular constants can be used to calculate transition frequencies with a high degree of accuracy up to K(sub a) = 6.

705,695

PB86-214210 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Localized Hydrogen Modes in LaNi5H(x).
Final rept.
R. Hempelmann, D. Richter, G. Eckold, J. J. Rush, J. M. Rowe, and M. Montoya. 1984, 12p
Pub. in Jnl. of the Less-Common Metals 104, p1-12 1984.

Keywords: Hydrogen, Distortion, Adsorption, Vibration, Crystal lattices, Neutron scattering, Reprints, *Lanthanum nickel.

The localized vibrations of hydrogen in various LaNi5H(x) samples were studied using inelastic neutron scattering (neutron spectroscopy). The pronounced vibrational peaks obtained for 'virgin' strain-free alpha-LaNi5H0.15 indicate the existence of two different hydrogen sites. During the activation for hydrogen absorption, substantial distortion is introduced into the LaNi5 lattice which is locally probed by the vibrating hydrogen atoms.

705,696
PB86-214665 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Ultraviolet Two-Photon Ionization of Molecules in Flames.
Final rept.
W. G. Mallard, J. Miller, and K. C. Smyth. 1985, 8p
Pub. in Lasers as Reactants and Probes in Chemistry, p127-134 1985.

Keywords: *Nitric oxides, *Phosphorous oxide, Flames, Reprints, *Multi-photon processes, Two photon absorption, Multiphoton ionization, *Photoionization.

A study was conducted on resonantly enhanced 2 photon photoionization of NO and PO in the ultraviolet region in atmospheric pressure flames. The results show that collisional refilling of the laser depopulated ground state rotational level is fast, with an effective collisional cross section > or equal to 70A. This rapid relaxation leads to photoion spectra that are essentially identical to those expected from a simple 1 photon absorption to the resonant intermediate state.

705,697
PB86-214715 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Molecular X-ray Spectra: S-K(beta) Emission and K Absorption Spectra of Thiophene.
Final rept.
R. C. C. Perera, and R. E. LaVilla. 1986, 7p
Contract DE-AC03-76SF00098
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 84, n8 p4228-4234, 15 Apr 86.

Keywords: *Thiophenes, X ray spectra, Molecular spectra, Absorption spectra, Sulfur heterocylic compounds, Reprints.

The high resolution sulfur K(Beta) emission in fluorescence and sulfur K absorption of thiophene (C4H4S) were measured with a double crystal spectrometer. The sulfur K(Beta) emission spectrum was analyzed by comparison with complementary spectral data and with MNDO and ab initio (STO-3G) MO calculations. A tentative assignment of the prominent features in the absorption spectrum was made using MO calculations as a guide. In addition the sulfur L(sub 2,3) emission spectrum was reinterpreted. The sulfur 1s binding energy of thiophene was estimated as 2477.6 eV.

705,698
PB86-228673 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Photodetachment Spectroscopy of FeO(-1).
Final rept.
T. Andersen, K. R. Lykke, D. M. Neumark, and W. C. Lineberger. 1986, 8p
Grants NSF-CHE83-16628, NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Electronic and Atomic Collisions, p791-798 1986.

Keywords: *Iron oxides, Iron inorganic compounds, Molecular energy levels, Excitation, Molecular structure, *Photodetachment.

High-resolution autodetachment spectroscopy of FeO(1-) has been used to study the ionic ground state as well as electronically excited states located in the vicinity of the FeO(sup 5 delta sub i) thresholds. The observed autodetachment resonances suggest two qualitatively different types of electronic states in this region, a sup 4 delta valence state and two negative ion complexes consisting of an FeO(sup 5 delta sub 3) core and an s or p electron primarily bound by the dipolar electric field of the neutral core. The dependence of autodetachment lifetimes upon the rotational quantum numbers of the excited states shows markedly different properties for the two types of states. A significant difference in autodetachment lifetimes is observed for the two Lambda-doublet components assigned to the FeO-p electron complex. The authors propose that a difference in the location of the electron density of the detaching electron with respect to the plane of rotation is responsible for the Lambda-doublet effect.

705,699
PB86-228970 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Alignment and Orientation of Atomic Outer Shells Induced by Electron and Ion Impact: Some Recent Developments and Remaining Problems.
Final rept.
N. Andersen, J. W. Gallagher, and I. V. Hertel. 1986, 20p
Pub. in Electronic and Atomic Collisions, p57-76 1986.

Keywords: Electron irradiation, Ion irradiation, *Electron-atom collisions, *Ion-atom collisions, *Atom-atom collisions.

Alignment and orientation of atoms in collision experiments with planar symmetry have now been studied for about 15 years and close to 500 papers have been produced, mainly devoted to S -> P excitation. Despite the large variety of electron-atom, ion-atom and atom-atom collision systems considered, a unified framework for description of these phenomena is now emerging. The framework is a generalization of the original ideas of Macek and Jaecks and is based on consideration of symmetries, conservation laws, etc. The key parameters are directly related to the shape and dynamics of the charge cloud of the excited electron as well as to experimental observables. A brief review is given of the framework, and some current problems and prospects for the future are discussed.

705,700
PB86-229036 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Laser-Induced Fluctuations in Single-Photon Ionization.
Final rept.
K. Rzazewski. May 86, 2p
Pub. in Physical Review A 33, n5 p3527-3528 May 86.

Keywords: *Ionization, Electromagnetic noise, Band width, Variations, Reprints, Laser-produced plasma, Laser radiation.

By the example of single-photon ionization, it is shown that laser noise can induce major fluctuations of physical observables in strong-field laser-atom interactions.

705,701
PB86-229044 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Mono- and Disilicon Radicals in Silane and Silane-Argon DC Discharges.
Final rept.
R. Robertson, and A. Gallagher. 1986, 10p
Sponsored by Solar Energy Research Inst., Golden, CO., and Department of Energy, Washington, DC.
Pub. in Jnl. of Applied Physics 59, n10 p3402-3411, 15 May 86.

Keywords: *Chemical radicals, *Silanes, Free radicals, Silicon, Surfaces, Cathodes, Electric discharges, Reprints.

Measurements of monosilicon (SiH(n)) and disilicon (Si2H(n)) radicals at the cathode surface of dc discharges in silane and silane-argon mixtures are reported. Silyl radical density per decomposed silane was constant for fixed flow conditions over a range of powers and silane-argon ratios. The relative densities for other monosilicon radicals SiH(n)/SiH3 decreased with increased fraction of silane in silane-argon mixtures. The density of disilicon radicals was observed to be comparable to some of the monosilicon radicals, with Si2H2 and Si2H4 the dominant Si2H(n) species. Formation and destruction reactions are discussed for these radicals, disilane, and the deposited film. The authors deduce that disilane is formed primarily on surfaces and that sputtering is a significant source for radicals near the cathode.

705,702
PB86-229051 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Energy Transfer Processes of Aligned Excited States of Ca Atoms.
Final rept.
D. Neuschafer, M. O. Hale, I. V. Hertel, and S. R. Leone. 1986, 7p
Grants NSF-CHE79-11340, NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Electronic and Atomic Collisions, p585-591 1986.

Keywords: *Calcium, Orientation, Atomic orbitals, Polarization, Excitation, Energy transfer, Reprints.

Effects of orbital alignment on the near resonant energy transfer process from Ca(4s5p singlet P sub 1) to Ca(4s5p triplet P sub J) induced by collisions with rare gases are studied in a crossed molecular beam. A linearly polarized, pulsed ultraviolet laser is used to introduce the initial orbital alignment, and the relative energy transfer cross sections as a function of alignment are monitored by time-gated fluorescence detection. Different results are observed with several rare gases; a rather large, approx=50% enhancement in the rate is observed for the perpendicular vs. parallel approach with He and Ne. A smaller, but opposite effect is observed for Xe, and no effect of alignment occurs with Kr.

705,703
PB86-229069 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron Affinities.
Final rept.
T. M. Miller. 1986, 4p
Pub. in CRC Handbook of Chemistry and Physics (66th Edition), pE62-E65 Aug 85-86.

Keywords: *Atoms, *Molecules, *Affinity, Negative ions.

A tabulation is provided of experimentally-determined electron affinities for 72 atoms and 197 molecules.

705,704
PB86-229077 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Atomic and Molecular Polarizabilities.
Final rept.
T. M. Miller. 1986, 10p
Pub. in CRC Handbook of Chemistry and Physics (66th Edition), pE65-E74 Aug 85-86.

Keywords: *Polarization(Charge separation), Dielectric properties, Molecules, Atoms, *Electric dipoles.

A tabulation is provided of static electric dipole polarizabilities for 102 atoms and 366 molecules. A brief discussion is included in which the electric dipole polarizability is defined, along with the various units one encounters. A listing of formulas describing polarizability-related phenomena is given.

705,705
PB86-229267 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron Affinities of Ge and Sn.
Final rept.
T. M. Miller, A. E. S. Miller, and W. C. Lineberger. 1986, 2p
Grants NSF-CHE83-16628, NSF-PHY83-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review A: General Physics 33, n5 p3558-3559 May 86.

Keywords: *Tin, *Germanium, Metals, Reprints, *Photoelectron spectroscopy, Electron affinity.

The laser photoelectron spectra of Ge(1-) and Sn(1-) are reported. Transitions in the electron detachment from the (Sup 4 S sub 3/2) ground state of the ions to the Triplet P (sub 0,1,2) states of the neutral atom are used to determine the electron affinities, 1.233 + or - 0.003 eV for Ge and 1.112 + or - 0.004 eV for Sn. The relative transition strengths to the fine-structure sublevels of the neutral do not follow the 1:3:5 statistical ratio, indicating the systematic breakdown of L-S coupling for these species.

705,706
PB86-229309 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Radiatively Stabilized Collisions: Dielectronic Recombination and Radiative Association.
Final rept.
G. H. Dunn. 1986, 13p
Grant DOE-EA-01-A-6010
Sponsored by Department of Energy, Washington, DC.
Pub. in Electronic and Atomic Collisions, 23-36, 1986.

Keywords: Radioactive association, *Dielectronic recombination, Ion traps, Rydberg states.

Radiatively stabilized collisions are a class to which relatively little attention has been given -- especially experimentally. In the paper two processes representative of radiatively stabilized collisions -- dielectronic recombination and radiative association -- are discussed, and recent experimental measurements on both collision types are described. Radiative association rate measurements have been carried out in a Penning ion trap at 11 K. Dielectronic recombination measurements have been made which show definitively the dependence of cross sections on extrinsic fields in the collision region and also demonstrate the dependence of cross sections on principal quantum numbers of the product Rydberg atoms.

705,707
PB86-229408 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Photoabsorption Cross Section of Barium from 237.9 to 120 nm.
Final rept.
E. B. Saloman, J. W. Cooper, and G. Mehlman. Sep 85, 2p
Pub. in Physical Review A 32, n3 p1878-1879 Sep 85.

Keywords: *Barium, Synchrotron radiation, Far ultraviolet radiation, Near ultraviolet radiation, Reprints, *Photoabsorption.

The relative photoabsorption cross section of barium in the spectral range from the ionization limit at 237.9 to 120 nm has been measured and the results of previous measurements extending to 170 nm confirmed. The cross section is found to rise slowly at wavelengths shorter than 170 nm and to decrease in the region between 140 and 130 nm.

705,708
PB86-229416 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Channel Coupling and Shape Resonance Effects in the Photoelectron Angular Distributions of the 3(sigma sub g) (-1) and 2(sigma sub u) (-1) channels of N2.
Final rept.
S. H. Southworth, A. C. Parr, J. E. Hardis, and J. L. Dehmer. Feb 86, 4p
Sponsored by Office of Naval Research, Arlington, VA., and Department of Energy, Washington, DC.
Pub. in Physical Review A33, n2 p1020-1023 Feb 86.

Keywords: *Nitrogen, Photoelectrons, Reprints, *Autoionization, Photoionization, Angular distribution, Channel coupling.

The authors report measurements of photoelectron angular distributions for the 3 sigma (sub g)(-1) and 2 sigma (sub u)(-1) photoionization channels of N2 from their thresholds up to 35 and 37.5 eV, respectively.

705,709
PB86-229952 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Copper Spectra in a Laser-Generated Plasma: Measurements and Classifications of Cu XII to Cu XXI.
Final rept.
J. Sugar, and V. Kaufman. May 86, 7p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of the Optical Society of America B 3, n5 p704-710 May 86.

Keywords: Atomic energy levels, Line spectra, Reprints, *Laser-produced plasma, *Copper ions, Neodymium lasers.

A vapor containing 10- to 20-times-ionized copper was generated by focusing a 1-GW, 15-nsec, Nd-glass-laser pulse down to 0.3 mm on a metallic copper sample. Spectral radiation in the range of 125 to 450 A was recorded photographically with the National Bureau of Standards 10.7-m grazing-incidence spectrograph. Ninety-two spectral lines arising from Cu XII to Cu XXI (Ar I through F I isoelectronic sequences) were identified. Twenty-six of these, mainly in Cu XIX and Cu XXI, had been interpreted previously. Slater integrals were fitted to the energy levels derived from these data and from previously measured magnetic-dipole lines.

705,710
PB86-230257 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Structural Studies of Passive Films Using Surface EXAFS.
Final rept.
J. Kruger, G. G. Long, M. Kuriyama, and A. I. Goldman. 1983, 6p
Pub. in Proceedings of International Symposium on Passivity of Metals and Semiconductors (5th), Bombannes, France, May 30-June 30, 1983, p163-168.

Keywords: *Crystal structure, *Passivity, *Films, *Surfaces, Iron, Oxides, Substrates.

Iron K-absorption edge spectra were obtained from the passive films on iron for the dried films in air (ex situ) and for the films in the passivating solutions (in situ). The ex situ results demonstrate that, while the structures of the films are more disordered than the spinel-like iron oxides (e.g. gamma -Fe2O3), they are nevertheless closely related to these crystalline oxides. The in situ data shows evidence of a quite different structure, which may be due to the accommodation of hydrogen containing species into the structure.

705,711
PB86-230265 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Synchrotron Photoemission Evidence for 'Lying-Down' CO on Cr(110).
Final rept.
N. D. Shinn. 1986, 3p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Vacuum Science and Technology, A4 n3 p1351-1353 May/Jun 86.

Keywords: *Carbon monoxide, *Chemisorption, *Chromium, Orientation, Molecular structure, Surfaces, Bonding, Synchrotron radiation, Ultraviolet spectroscopy, Reprints, Photoemission spectroscopy.

Synchrotron ultraviolet photoemission spectroscopy (UPS) has been used to identify two sequentially populated molecular CO binding modes on Cr(110) at 90 K. These are distinguished by both intensity and electron-binding-energy differences in the CO-derived valence-band UPS features. These results support the previously proposed models in which the first binding mode (alpha sub 1 CO) is 'lying down' on the surface, with both the carbon and oxygen coordinated to chromium atoms, and the second binding mode (alpha sub 2 CO) is terminally bonded and oriented roughly along the (110) surface normal.

705,712
PB86-230273 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Calculations of Reneutralization Effects in ESDIAD (Electron Stimulated Desorption Ion Angular Distributions).
Final rept.
Z. Miskovic, J. Vukanic, and T. E. Madey. 1986, 9p
Pub. in Surface Science 169, p405-413 1986.

Keywords: Surfaces, Reprints, *Electron stimulated desorption, Angular distribution, Reneutralization.

Calculations are presented which describe the influence of ion reneutralization processes on measured electron stimulated desorption ion angular distributions (ESDIAD). The results indicate that reneutralization effects generally act in an opposite sense to the image field in affecting ion angular distributions, and that these counterbalancing effects tend to cancel one another partially over a wide range of polar angles.

705,713
PB86-230299 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Measurements of Electron Attenuation Lengths in Condensed Molecular Solids.
Final rept.
R. L. Kurtz, N. Usuki, R. Stockbauer, and T. E. Madey. 1986, 24p
Pub. in Jnl. of Electron Spectroscopy and Related Phenomena 40, p35-58 1986.

Keywords: *Methyl alcohol, *Cyclohexane, Water, Kinetic energy, Adsorption, Reprints, *Electron attenuation length, Energy range, eV range 10-100, Microcapillary array.

The attenuation lengths are approximately 13, 10 and 9A, respectively, for water, methanol and cyclohexane and show only a slight energy dependence over the electron kinetic energy range covered (18-68eV). The experiment consisted of monitoring the attenuation of Cu(100) substrate photoelectrons as solid H2O, CH3OH and C6H12 were condensed at 90 K by dosing from a microcapillary array. Accurate measurement of adsorbate layer thickness was accomplished by calibration of the doser; the procedure is described in detail.

705,714
PB86-230489 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Field Effects on Rydberg Product State Distribution from Dielectronic Recombination.
Final rept.
G. H. Dunn, D. S. Belic, B. DePaola, N. Djuric, D. Mueller, A. Muller, and C. Timmer. 1985, 16p
Contract DOE-EA-77-A-01-6010
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Workshop on Atomic Spectra and Collisions in External Fields, Gaithersburg, MD, October 22-23, 1984, Atomic Excitation and Recombination in External Fields, p405-420 1985.

Keywords: Atomic orbitals, Magnesium, *Dielectronic recombination, Rydberg states.

The effects of state mixing by extrinsic fields in the collision region have been investigated for dielectronic recombination. Using a field ionization technique, cross sections sigma sup n, sub DR have been measured as a function of the final Rydberg state, n sub f, for the dielectronic recombination process.

705,715
PB86-230497 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
High-Energy Forward Elastic Scattering of Electrons: Partial-Wave Approximations.
Final rept.
R. K. Nesbet, and S. Geltman. Jun 86, 10p
Grant NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review A 33, n6 p3815-3824 Jun 86.

Keywords: *Electron scattering, Elastic scattering, Argon, Hydrogen, Reprints, *Electron-atom collisions, Born approximation, KeV range 10-100.

Partial-wave analysis is applied to a parametrized pseudostate excitation model of high-energy electron-atom scattering. Consistency checks are carried out between asymptotic distorted-wave calculations (for coupled differential equations), second-Born-approximation scattering amplitude calculations, and partial-wave second-Born-approximation calculations. Closure formulas for partial-wave amplitude sums are derived for a static model potential and for the second-Born-approximation amplitude due to the asymptotic dipole excitation potential. Calculations using these closure formulas in e(-) + H and e(-) + Ar models at 15 keV show cusplike forward elastic scattering peaks, confirming recent exact second-Born-approximation results for an e(-) + H pseudostate model.

705,716
PB86-230737 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Working Group 2: Atomic Transition Probabilities.
Final rept.
W. L. Wiese. 1985, 17p
Pub. in Reports on Astronomy (Transactions of the International Astronomical Union), v19A p122-138 1985.

Keywords: *Transition probabilities, *Electron transitions, *Atomic spectra, Bibliographies, Oscillator strengths.

Some new activities on the determination of atomic transition probabilities are briefly described, and an exhaustive list of new literature references is given which covers all transition probability data for the period August 1981 to the present (fall 1984).

705,717

PB86-230745 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Experimental Methods for Determining Atomic Transition Probabilities.
Final rept.
W. L. Wiese. 1985, 25p
Pub. in Physics of Ionized Gases, p621-645 1985.

Keywords: *Transition probabilities, *Electron transitions, Oscillator strengths.

The main experimental methods for the determination of atomic transition probabilities are based on emission, absorption, and anomalous dispersion measurements. In addition, transition probabilities may also be derived from lifetime determinations of excited atomic states. All these approaches have undergone significant modifications and refinements in recent years, and some new experimental tools and combinations of techniques have been added. As a result, impressive accuracies have been reached and the ranges of applicability of some approaches have been greatly enlarged. These advances and developments, as well as remaining problem areas, will be described and illustrated with a number of typical examples.

705,718

PB86-230760 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Comprehensive, Consistent Thermodynamic Tables.
Final rept.
D. Garvin, and H. J. White. 1986, 112p
Pub. in Committee on Data for Science and Technology Bulletin No. 58, Chapter 1, p1-112 1986.

Keywords: *Thermodynamics, Tables(Data).

No abstract available.

705,719

PB86-230778 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Discrimination of C3H3+ Structures on the Basis of Chemical Reactivity.
Final rept.
P. Ausloos, and S. G. Lias. 1981, 3p
Pub. in Jnl. of American Chemical Society 103, n21 p6505-6507 1981.

Keywords: *Chemical reactivity, Reaction kinetics, Flames, Acetylene, Molecular structure, Benzene, Reprints, *Cyclopropenium ions, *Ion-molecule collisions, Ion cyclotron resonance spectroscopy, Molecular ions.

Kinetic evidence is presented for the existence of C3H3(1+) ions in two distinct isomeric structures, cyclo-C3H3(1+) and C3H2(1+), when these ions are produced through the decomposition of a variety of molecular ions. The relative abundance of the two isomeric C3H3(1+) ions depends on the identity of the precursor molecule as well as the internal energy of the dissociating parent ion. While the cyclo-C3H3(1+) ions do not react with acetylene, C3H3(1+) ions react to give C5H5(1+) and C5H3(1+) products; these ions, and the products of their further reactions are seen in acetylene flames, and have been suggested to be the precursors in the mechanism leading to soot formation. Reactions of the two C3H3(1+) ions with benzene, olefins, and other compounds are discussed.

705,720

PB86-230935 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Universal Amplitude Ratios and the Interfacial Tension Near Consolute Points of Binary Liquid Mixtures.
Final rept.
H. Chaar, M. R. Moldover, and J. W. Schmidt. 1986, 10p
Pub. in Jnl. of Chemical Physics 85, n1 p418-427, 1 Jul 86.

Keywords: *Cyclohexane, *Methyl alcohol, Density, Heavy water, Tertiary amines, Liquids, Reprints, Binary systems(Materials), *Interfacial tension, Binary mixtures, Thermophysical properties, Amplitude ratios.

The densities of the coexisting phases and the capillary length have been measured to obtain the interfacial tension (sigma) near the consolute temperatures T sub c of the three binary liquid mixtures: triethylamine + water, triethylamine + heavy water, and methanol + cyclohexane.

705,721

PB86-231131 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Spin-Dependent Superelastic Scattering from Pure Angular Momentum States of Na(3P).
Final rept.
J. J. McClelland, M. H. Kelley, and R. J. Celotta. 1986, 4p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review Letters 56, n13 p1362-1365, 31 Mar 86.

Keywords: Atomic energy levels, Electron scattering, Excitation, Elastic scattering, Reprints, *Electron-atom collisions, *Sodium atoms, Electron spin polarization.

Spin asymmetries are presented for superelastic scattering of spin-polarized electrons from spin-polarized M sub L = + 1 and M sub L = - 1 states of the Na 3P(3/2) atom. The incident-energy dependence at a scattering angle of 30 deg is shown for energies of 1.26 to 11.76 eV. In addition, angular dependences over the range 5 deg to 40 deg are given at 2.0 and 9.26 eV. Large differences are seen between the spin asymmetries for the two M sub L sublevels of the excited state, with the M sub L = - 1 asymmetry reaching a value of 100% at 2 eV and 35 deg scattering angle, corresponding to pure singlet scattering.

705,722

PB86-231149 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Far Infrared Spectrum of Magnesium Hydride.
Final rept.
K. R. Leopold, L. R. Zink, K. M. Evenson, D. A. Jennings, and M. Mizushima. 1986, 3p
Pub. in Jnl. of Chemical Physics 84, n3 p1935-1937, 1 Feb 86.

Keywords: *Interstellar matter, *Magnesium hydrides, *Infrared spectra, Atomic energy levels, Ground state, Rotational spectra, Far infrared radiation, Reprints.

The rotational spectrum of MgH in its ground doublet Sigma has been observed for the first time using a new tunable far infrared spectrometer. The molecular constants derived are of sufficient accuracy to permit astrophysical identification of the species.

705,723

PB86-231552 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Sub-Doppler Infrared Absorption Spectroscopy of Ar-HF ((10 sup 0) <- (00 sup 0)) in a Linear Supersonic Jet.
Final rept.
C. M. Lovejoy, M. D. Schuder, and D. J. Nesbitt. 20 Jun 86, 3p
Grant NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Chemical Physics Letters 127, n4 p374-376, 20 Jun 86.

Keywords: *Argon, *Hydrogen fluoride, Absorption, Infrared spectroscopy, Reprints, Tunable lasers.

Ultra-sensitive tunable difference frequency IR absorption spectroscopy in a slit supersonic jet has been used to observe sub-Doppler spectra of Ar-HF in the (10 sup 0 0) HF stretch and (11 sup 1 0) HF stretch plus van der Waals bend modes. Linewidths yield a lower limit of 3 x 10 to the -9th power s for the predissociation lifetime in the vibrationally metastable upper state. The sensitivity of these direct absorption methods (< or approx. equal to 2 x 10 to the 9th power molecules/cc per quantum state), in conjunction with the wide tunability of the difference frequency laser (2.2-4.2 micrometers permit high-resolution studies of a large class of van der Waals complexes.

705,724

PB86-232345 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Rotational Spectrum and Structure of CF3H-NH3.
Final rept.
G. T. Fraser, F. J. Lovas, R. D. Suenram, D. D. Nelson, and W. Klemperer. 1986, 6p
Pub. in Jnl. of Chemical Physics 84, n11 p5983-5988, 1 Jun 86.

Keywords: *Molecular structure, *Ammonia, Rotational spectra, Excitation, Reprints, *Methane/trifluoro.

The rotational spectrum of CF3H-NH3 has been obtained using a pulsed nozzle Fourier transform microwave spectrometer. A symmetric top spectrum is observed that is consistent with free internal rotation of the NH3 subunit against the CF3H subunit. Rotational transitions have been measured for both the ground and first excited internal rotor state of the complex. The spectroscopic constants which have been obtained include: B sub 0=1996.903(2) MHz, D sub J=3.46(12) kHz, and eQ(q sub N) = -3.186(8) MHz. From the quadrupole coupling constant of the nitrogen nucleus, eQ(q sub N), the bending amplitude of the NH3 unit is determined to be 22.57(10) deg. The hydrogen bond length is 2.314(5) A and the weak bond stretching force constant is 0.066(2) mdyn/A. The bond length and stretching force constant for CF3H-NH3 are similar in value to those determined for HCCH-NH3 (2.33 A and 0.070 mdyn/A, respectively).

705,725

PB86-232733 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Line Interference Effects in the Vibrational Q-Branch Spectra of N2 and CO.
Final rept.
G. J. Rosasco, W. Lempert, W. S. Hurst, and A. Fein. 1983, 6p
Pub. in Chemical Physics Letters 97, n4/5 p435-440, 27 May 83.

Keywords: *Nitrogen, *Raman spectra, *Carbon monoxide, Ramon spectroscopy, Reprints.

Self-broadened (about 20-200 kPa) Q-branch spectra are measured by high resolution CW stimulated Raman spectroscopy. Line overlap in these spectra is described in a relaxation matrix formalism and a first order (in density) solution to the resulting equation is used to fit the data. The parameters of the model are analyzed in terms of rates of rotational energy transfer.

705,726

PB86-232741 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Phase Space Subdivision of the Second Virial Coefficient.
Final rept.
D. G. Friend. 1985, 5p
Sponsored by National Research Council, Washington, DC.
Pub. in Jnl. of Chemical Physics 82, n2 p967-971, 15 Jan 85.

Keywords: Reprints, *Virial coefficients, Phase space, Metastable states.

The division of two-body relative space into free, bound, and metastable subspaces is presented in terms of fundamental variables. This enables us to examine the differences among the various partitions of the second virial coefficient presented by Rainwater, as boundary effects. Explicit evaluations of these boundary contributions are presented in certain cases and agreement is obtained between this and the earlier approach to the problem. For the bound subspace, in particular, an identity is established which relates the partition function and potential formulations of the second virial coefficient.

705,727
PB86-232964 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Laser Desorption Mass Spectrometry of Squaric Acid and Its Salts.
Final rept.
G. D. Byrd, A. J. Fatiadi, D. S. Simons, and E. White. 1986, 6p
Pub. in Organic Mass Spectrometry 21, p63-68 1986.

Keywords: *Desorption, Mass spectroscopy, Reprints, *Cyclobutene-dione/dihydroxy.

The laser desorption mass spectrometry of the oxocarbon squaric acid (3,4-dihydroxy-3-cyclobutene-1,2-dione) and its salts of the form A2C4O4 (A=cation) is described. Both positive and negative ion spectra were obtained. The positive ion spectrum of the acid is characterized by an ion corresponding to loss of CO from (M+H)(1+). The negative ion spectrum shows an intense (M-H) (1-) peak in addition to a dimer species. The alkali salt spectra contain (M+A) (1+) in the positive mode and (M-A)(1-) and an intense (C4HO4) (1-) in the negative mode. The smaller alkali salts also have an (M+H) (1+) adduct ion. Unlike the alkali squarates, the ammonium salt shows ions corresponding to losses of neutrals from the molecular adduct in the positive ion spectrum and a dimer species in the negative ion spectrum. Molecular weight information was obtained in all cases. A (bis)dicyanomethylene derivative of potassium squarate was also studied. Some field desorption mass spectrometry results are presented for comparison.

705,728
PB86-235827 PC **A99**/MF **E04**
National Bureau of Standards, Boulder, CO.
Proceedings of the International Symposium on Free Radicals (17th).
K. M. Evenson. Apr 86, 787p NBS/SP-716
Held at Granby, Colorado on August 18-23, 1985. Also available from Supt. of Docs. as SN003-003-02742-1. Sponsored by Spectra Physics, Inc., Bedford, MA. Laser Analytics Div., National Aeronautics and Space Administration, Washington, DC., Smithsonian Astrophysical Observatory, Cambridge, MA., and Oriel Corp., Stratford, CT.

Keywords: *Free radicals, *Meetings, Chemical radicals, Low temperature research, Chemical reactions, Reaction kinetics, Complex compounds, Spectroscopy, Photodissociation.

The publication contains a total of 67 papers which appears in written form. Partial listing includes: Difference frequency laser spectroscopy of polyatomic ions; Kinetics of hydroxyl radical reactions with alkyl radicals; Vibration rotation spectroscopy of open-shell molecular ions; Faraday-LMR of DC(1+) in a DC-Discharge; The low-temperature measurements of the 'dimol' emission from singlet molecular oxygen; Laser spectroscopy of organometallic free radicals; Fourier transform detection of laser induced fluorescence from CCN and SrOH; Atmospheric free radicals: detection, calibration, and field measurement; Some studies of the atmospheric reactions of NO3 and FTIR matrix isolation spectrum of NO3; The far-infrared LMR spectrum of the CN radical; Inner and outer nitrogen hyperfine structure in the HN2(1+) molecular ion; Far-infrared measurements of stratospheric trace gases; Multiphoton ionization studies of UV-multiphoton fragmentation processes.

705,729
PB86-238300 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Rovibrational Analysis of an Intermolecular Hydrogen-Bonded Vibration: The nu(sub 6, sup 1) Band of HCN---HF.
Final rept.
B. A. Wofford, M. W. Jackson, J. W. Bevan, W. B. Olson, and W. J. Lafferty. 1986, 4p
Grant NSF-CHE83-00592
Sponsored by National Science Foundation, Washington, DC., and Robert A. Welch Foundation, Houston, TX.
Pub. in Jnl. of Chemical Physics 84, n11 p6115-6118, 1 Jun 86.

Keywords: *Infrared spectra, *Hydrogen cyanide, *Hydrogen fluoride, Hydrogen bonds, Molecular vibration, Reprints.

The infrared spectrum of the intermolecular bending vibration, the nu(sub 6, sup 1) band, of the heterodimer HCN-HF has been obtained with 0.010/cm resolution, and the rotational structure of the band has been assigned. The spectroscopic constants of the nu(sub 6, sup 1) state in cm are: Nu sub 0 = 550.0285(2); B sub 6 = 0.117652 9(10); D(sub J, sup 6) = 0.2791(5) x 10 to the -6 power; q sub 6= 0.579(8)x10-4; alpha sub 6= -0.002137(1), where the uncertainties cited are one standard deviation.

705,730
PB86-238672 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Energy and Radiative Lifetime of the 5d(9) 6s(2) doublet D(5/2) State in Hg II by Doppler-Free Two-Photon Laser Spectroscopy.
Final rept.
J. C. Bergquist, D. J. Wineland, W. M. Itano, H. Hemmati, H. U. Daniel, and G. Leuchs. 7 Oct 85, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Physical Review Letters 35, n15 p1567-1570, October 7, 1985.

Keywords: Atomic orbitals, Reprints, *Electronic structure, *Mercury ions.

The Doppler-free, two-photon 5d10 6s doublet S sub 1/2 - 5d9 6s22 D sub 5/2 transition in singly ionized Hg, attractive as an optical-frequency standard, has been observed for the first time on a small number of (198)Hg(1+) ions confined in a radio-frequency trap. The radiative lifetime of the doublet D sub 5/2 state and the absolute wave number of the two-photon transition were measured to be 0.090(15) s and 17757.152(3)/cm, respectively. Optical amplitude-modulation sidebands, induced by the secular (thermal) motion of the harmonically bound ions, were observed also for the first time.

705,731
PB86-238912 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Rotational Analysis and Vibrational Predissociation in the (nu sub 2) Band of HCN Dimer.
Final rept.
B. A . Wofford, J. W. Bevan, W. B. Olson, and W. J. Lafferty. 1 Jul 86, 4p
Grant NSF-CHE83-00592
Sponsored by National Science Foundation, Washington, DC., and Robert A. Welch Foundation, Houston, TX.
Pub. in Jnl. of Chemical Physics 85, n1 p105-108, 1 Jul 86.

Keywords: *Hydrogen cyanide, *Molecular structure, Vibrational spectra, Rotational spectra, Infrared spectra, Excitation, Hydrogen bonds, Reprints.

The rovibrational infrared spectrum of the bound C-H stretching vibration, nu(sub 2), in the HCN dimer has been analyzed. Observed transition frequencies have been combined with previously recorded microwave data to obtain the following molecular parameters (in cm): nu(sub 2)= 3241.5696(8), alpha(sub 2)=-0.000 110(1), B(double prime) = 0.058 233 92(1), B(sup prime)=0.058 344(1), (D(sub J), double prime)= 0.7013(52) x 10 to the -7th power, D'J=0.6636(18) x 10 to the -7th power. The observed full widths at half-maximum intensity of the observed transitions are consistent with excited state lifetimes of 1.7(4) x 10 to the -9th powers.

705,732
PB86-239084 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Local Exchange Approximations.
Final rept.
A. W. Weiss. Jul 86, 2p
Pub. in Physical Review A 34, n1 p624-625 Jul 86.

Keywords: Wave functions, Approximation, Reprints, *Exchange interactions, Hartree-Fock method.

It is shown for the particular example of a berylliumlike atom that the Hartree-Fock 2s inflection point does not occur at the node of the wave function, as it must for a central potential. Local exchange approximations, therefore, cannot be expected to be capable of exactly modeling the effect of the exchange interaction.

705,733
PB86-239092 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Accurate Energies for the Low-Lying Levels of Singly Ionized (198)Hg.
Final rept.
J. Reader, and C. J. Sansonetti. Feb 86, 4p
Pub. in Physical Review A 33, n2 p1440-1443 Feb 86.

Keywords: Atomic energy levels, Atomic orbitals, Wavelengths, Ionization, Reprints, *Mercury ions, *Electronic structure, *Mercury 198.

A 3.34-m plane-grating spectrograph has been used to measure the wavelengths of 11 lines of singly ionized (198)Hg emitted by an electrodeless discharge lamp in the region 1942-7944. The uncertainty varies from + or -0.0003 to + or -0.0015. From these wavelengths, accurate values were determined for all levels of the 5d10 6s, 6p, 6d, 7s, 7p, and 5d9 6s2 configurations and for four levels of the 5d9 6s 6p configuration. By using existing isotope-shift data, values of wavelengths and energy levels for natural Hg II were deduced. Accurate values for 12 lines of Hg II in the region 893-2026 were calculated from the energy levels.

705,734
PB86-239100 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
4s(2) singlet S(sub 0) - 4s4p singlet P(1) Transitions in Zinclike Ions.
Final rept.
N. Acquista, and J. Reader. 1984, 3p
Sponsored by Department of Energy, Washington, DC. Office of Magnetic Fusion Energy.
Pub. in Jnl. of the Optical Society of America B-Optical Physics 1, n4 p649-651 1984.

Keywords: Atomic orbitals, Iron, Ultraviolet spectra, Reprints, *Isoelectronic sequence, *Electronic structure, Laser-produced plasma.

The 4s2 singlet S sub 0 - 4s 4p singlet P sub 1 transitions of twenty zinclike ions from Ru(14+) to Dy(36+) were observed with a laser-produced plasma and a 10.7-m grazing-incidence spectrograph. Also, new observations were made for the 3d-4f transitions of Fe(15+). Based on the new wavelengths obtained for these Fe transitions and improved wavelengths recently published for other Fe ions, revised values were determined for the 4s2 singlet S sub 0 - 4s 4p singlet P sub 1 transitions in ten zinclike ions from Ba(26+) to W(44+) observed by Reader and Luther, where a laser-produced spectrum of Fe was used for wavelength calibration.

705,735
PB86-239282 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Simplified Method for Calculating Four-Probe Resistances on Nonuniform Structures.
Final rept.
H. L. Berkowitz, and J. Albers. 1984, 1p
Pub. in Electrochemical Society Extended Abstracts 84-2, p751 1984.

Keywords: *Electrochemistry, Four probe resistance, Numerical solution.

A simple method for calculating the four-probe resistance as an integral involving only the kernel of the correction factor integral (and independent of the probe radius and the probe-current density) is presented. Analytic expressions are derived for uniform layers and are investigated as a function of the probe spacing. For nonuniform resistivity structures, a simple numerical procedure is presented for the evaluation of the four-probe resistance and is compared with more extensive techniques.

705,736
PB86-239720 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Rovibrational Analysis of (nu sub 3) HCN---HF Using Fourier Transform Infrared Spectroscopy.
Final rept.
B. A. Wofford, J. W. Bevan, W. B. Olson, and W. J. Lafferty. 15 Dec 85, 5p
Grant NSF-CHE83-00592
Sponsored by National Science Foundation, Washington, DC., and Robert A. Welch Foundation, Houston, TX.

Pub. in Jnl. of Chemical Physics 83, n12 p6188-6192, 15 Dec 85.

Keywords: *Molecular structure, *Hydrogen cyanide, *Hydrogen fluoride, Vibrational spectra, Rotational spectra, Infrared spectroscopy, Excitation, Reprints, Fourier transform spectroscopy.

The gas phase rovibrational spectrum of the (nu sub 3) band arising from the cyanide stretching vibration in the hydrogen bonded heterodimer HCN---HF has been observed at 0.004/cm instrumental resolution using a Fourier transform infrared spectrophotometer. Analysis of the spectrum gave the following molecular parameter (in/cm): (nu sub 3)=2120.935(12), (alpha sub 3)= + 5.06(19) x 10 to the -4 power, B'= 0.119 283(19), (D sub j)= 2.30(7) x 10 to the -7 power. Excited state amplitude lifetimes of observed transitions are demonstrated to be 5.6(4) x 10 to the -10 power s.

705,737
PB86-239738 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Determination of A (sub 0) for CH3D from Perturbation-Allowed Transitions.
Final rept.
C. Chackerian, E. S. Bus, W. B. Olson, and G. Guelachvili. 1986, 6p
Pub. in Jnl. of Molecular Spectroscopy 117, p355-360 1986.

Keywords: *Molecular structure, *Methane, Ground state, Infrared spectroscopy, Deuterium compounds, Reprints.

Ground state combination differences obtained from normally allowed and perturbation-allowed transitions in the 2 nu (sub 6) band of (12) CH3D have been fitted to obtain the following values for rotational constants: A (sub 0)=5.2508231 + or - 0.0000043/cm, and D (sub 0, sup K)=(-7.869 + or -0.23) x 10 to the -5th power/cm.

705,738
PB86-240462 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Final-State Distribution for Na(3P sub J) + Na(3P sub J prime) > Na(nL sub J double prime) + Na(3S sub 1/2) Collisional Excitation Transfer.
Final rept.
S. A. Davidson, J. F. Kelly, and A. Gallagher. 1986, 11p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review A: General Physics 33, n6 p3756-3766 Jun 86.

Keywords: *Sodium, *Excitation, Energy transfer, Reprints, *Molecule-molecule collisions, *Electronic state.

The authors report the ratio of rate coefficients for the excitation-transfer reaction Na(3P(sub J)) + Na(3P(sub J)) -> Na(nL(sub J double)) + Na(3S (sub 1/2)), which has sometimes been labeled energy pooling, measured in a cell at T=640 K. Rate-coefficient ratios are given for nL(sub J double prime = 4D (sub 3/2), 4D (sub 5/2), 4F(sub 5/2), 4F(sub 7/2), and 5S(sub 1/2), each for J= J'= 1/2 and 3/2. The authors also report the (nL(sub J double prime)) ratios when the 3P states are populated in nearly statistical ratios; these are related to the rate coefficients when J=1/2 and J'3/2.

705,739
PB86-240488 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Characterization of OH(ad) Formation by Reaction between H2O and O(ad) on Ag(110).
Final rept.
K. Bange, T. E. Madey, and J. K. Sass. 1985, 9p
Pub. in Surface Science 152, p550-558 Apr 85.

Keywords: *Oxygen, *Water, *Silver, *Surface chemistry, Chemical reactions, Reprints, *Hydroxyl radicals.

TDS (thermal desorption spectroscopy), LEED (low energy electron diffraction) and ESDIAD (electron stimulated desorption ion angular distribution) have been used to characterize hydroxyl groups formed by the reaction of oxygen and water on Ag(110). It is concluded that hydroxyl formation on Ag(110) is accompanied by large translation of O(ad) and OH9ad) along troughs and across ridges.

705,740
PB86-240769 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Measurements of the g(sub J) Factors of the 6s doublet S(1/2) and 6p doublet P(1/2) states in (198)Hg(1+).
Final rept.
W. M. Itano, J. C. Bergquist, and D. J. Wineland. Sep 85, 3p
Pub. in Jnl. of the Optical Society of America B 2, n9 p1392-1394 Sep 85.

Keywords: Magnetic moments, Resonance absorption, Atomic spectroscopy, Reprints, *Mercury ions, *Electronic structure, *Mercury 198, Ion storage.

Measurements of (198)Hg(1+) g sub J factors by two methods are reported. The first method was based on optical wavelength measurements of the Zeeman components of the 6s doublet S sub 1/2 (ground state) to 6p doublet P sub 1/2 transition at 194 nm. The lines were observed by the absorption of tunable 194-nm radiation by Hg(1+) ions created in a rf discharge. The results were g sub J (6s doublet S 1/2) = 2.0036(20) and g sub J (6p doublet S 1/2) = 0.6652(20). The second method was based on microwave-optical double resonance of ions confined in a Penning trap. They were optically pumped by the 194-nm source, which was tuned to a particular Zeeman component. An increase in the resonance-fluorescence intensity was observed when the microwave frequency was tuned to the ground-state Zeeman resonance. The result is g sub J (6s doublet S 1/2) = 2.003 174 5*74).

705,741
PB87-100228
(Order as PB87-100186, PC **A08**/MF **A01**)
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Thermophysical Property Measurement on Chemically Reacting Systems: A Case Study.
T. J. Bruno, and G. C. Straty. Jun 86, 4p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Included in Jnl. of Research of the National Bureau of Standards, v91 n3 p135-138 May-Jun 86.

Keywords: *Chemical reactions, *Carbinals, Thermophysical properties, Decomposition, Methyl alcohol, High temperature.

Thin short paper describes several experimental approaches for dealing with chemical reactions or decomposition which can occur when making thermophysical property measurements at high temperature and high pressure. The associated equipment was designed and built to allow thermophysical property data to be cast in a more realistic perspective by taking explicit account of chemical changes which may occur during an experiment. As an example of these methods, the measurements on the methanol system are discussed in detail.

705,742
PB87-103255 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Thermodynamic Properties of Nitrogen Tetroxide.
Final rept.
R. D. McCarty, H. U. Steurer, and C. M. Daily. Jul 86, 106p NBSIR-86/3054
Contract NASA-CC-26848B
Sponsored by National Aeronautics and Space Administration, Cocoa Beach, FL. John F. Kennedy Space Center.

Keywords: *Chemical equilibrium, Thermodynamic properties, Mathematical models, Equations of state, Temperature, Density, Tables(Data), Chemical composition, *Nitrogen tetroxide.

A mathematical model of the equation of state of nitrogen tetroxide is presented. Isobaric tables of P-rho-T and composition for temperatures from the triple point (261.95 K) to 600 K with pressures to 40 MPa are also given. The mathematical model of the equation of state is a 32 term modified Benedict-Webb-Rubin equation. A method of calculating chemical equilibrium for the system is also presented.

705,743
PB87-104022 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Quasi-Penning Resonances of a Rydberg Electron in Crossed Electric and Magnetic Fields.
Final rept.
C. W. Clark, E. Korevaar, and M. Littman. 1985, 3p
Pub. in Physical Review Letters 54, n4 p320-322, 28 Jan 85.

Keywords: Electrons, Electric fields, Magnetic fields, Resonance, Reprints, *Rydberg states, Penning traps.

It is shown that the combination of crossed electric and magnetic fields and the Coulomb field of the atomic nucleus can lead to the localization of the Rydberg electron in the vicinity of the Stark saddle point. The localization principle is shown to be similar to the one which serves as the basis for a Penning trap. The localized electron is expected to give rise to quasi-bound states near and above the saddle-point ionization limit. These states are expected to cause modulations in the threshold photoionization cross sections.

705,744
PB87-104030 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Isotope Shifts of Some Ultraviolet Transitions of First Row Elements.
Final rept.
C. W. Clark. 1984, 3p
Contract DE-AI05-83ER60185
Sponsored by Department of Energy, Washington, DC.
Pub. in Astrophysical Jnl. 285, n1 p322-324, 1 Oct 84.

Keywords: *Isotope effect, *Alkali metal compounds, *Interstellar matter, Ultraviolet radiation, Reprints, Atomic interactions.

Attention is drawn to the existence of unusually large isotope shifts in the spectra of first row elements, and a simple explanation for the phenomenon is given. Calculated values of these shifts are presented, which are believed accurate to within 10-20%; they agree well with the available experimental data, which is very sparse, and with other theoretical values. Some of these shifts could be employed for isotopic abundance studies of interstellar matter, when sufficient resolution in the ultraviolet range becomes available.

705,745
PB87-104048 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Enhancement of the Isotopic Abundance Sensitivity of Mass Spectrometry by Doppler-Free Resonance Ionization.
Final rept.
C. W. Clark, J. D. Fassett, T. B. Lucatorto, and L. J. Moore. 1984, 11p
Contract DE-AI05-83ER60185
Sponsored by Department of Energy, Washington, DC.
Pub. in Resonance Ionization Spectroscopy 1984, p107-117.

Keywords: Excitation, Mass spectroscopy, Sensitivity, Ionization, Geochronology, Reprints, *Resonance ionization mass spectrometry, *Carbon atoms, Isotope dating.

The use of two-photon Doppler-free excitation in atomic resonance ionization offers the possibility of considerable enhancement of the isotopic abundance sensitivity of conventional mass spectrometry. In some applications of interest, e.g. carbon dating, this technique may provide sensitivity comparable to that presently attained by accelerator-based high energy mass spectrometry. The authors discuss the basic physics underlying the method, and describe preliminary experimental work on three-photon ionization of atomic carbon.

705,746
PB87-104063 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Adiabatic Hyperspherical Treatment of Lithium doublet P States.
Final rept.
C. H. Greene, and C. W. Clark. 1984, 9p
Pub. in Physical Review A: General Physics 30, n5 p2161-2169 Nov 84.

Keywords: *Atomic structure, Excitation, Atomic energy levels, Reprints, *Lithium atoms, Autoionization, Hyperspherical coordinate method.

The lithium atom is studied by treating all three electrons on an equal footing using hyperspherical coordinates. The use of asymptotic base states improves the convergence of the potential curve calculation dramatically at large R. A potential curve plot suggests that a few localized pathways dominate the formation and decay of the lowest triply-excited state, 2s2 2p. A quantitative study of the lowest state of the symmetry, 1s2 2p, shows that the adiabatic approximation in hyperspherical coordinates gives an improvement over independent-electron methods, owing primarily to its inclusion of radial correlation effects at small distances R.

705,747

PB87-104089 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Doppler-Free Two-Photon Laser Spectroscopy of HgII.
Final rept.
J. C. Bergquist, D. J. Wineland, M. Wayne, W. M. Itano, H. Hemmati, H. U. Daniel, and G. Leuchs. 1986, 3p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of Annual Symposium on Frequency Control (39th), Philadelphia, PA., May 29-31, 1985, p85-87.

Keywords: *Atomic orbitals, Doppler effect, Atomic energy levels, Frequency standards, Reprints, *Mercury ions, *Mercury 198, Ion traps, Laser cooling, Two photon adsorption.

The Doppler-free, two-photon 5d10 6s2 doublet S(sub 1/2) - 5d9 6s2 doublet D (sub 5/2) transition in singly ionized Hg, attractive as an optical frequency standard, has been observed for the first time. A few 198 Hg(1+) ions were confined in a radio-frequency (rf) trap and the two-photon transition was detected by monitoring the change in the fluorescence light scattered by the ions from a laser beam tuned to the first resonance transition at 194 nm. The radiative lifetime of the doublet D sub 5/2 state and the absolute wavenumber of the two-photon transition were measured to be 0.090(15) s and 17 757.152(3) /cm respectively.

705,748

PB87-104097 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Laser-Magnetic-Resonance Detection of Magnesium Atoms in the Metastable triplet P (sub 0,1,2) States.
Final rept.
M. Inguscio, K. R. Leopold, J. S. Murray, and K. M. Evenson. 1985, 4p
Grant NASW-15 047
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of the Optical Society of America B2, n9 p1566-1569 Sep 85.

Keywords: *Metastable state, Far infrared radiation, Atomic structure, Reprints, *Magnesium atoms, Laser magnetic resonance, Fine structure, G factor.

Transitions between fine-structure levels of the metastable (3s3p triplet P) state of magnesium have been observed by means of the highly sensitive technique of far-infrared laser-magnetic-resonance spectroscopy. The g factors for the triplet P sub 1 and triplet P sub 2 levels are 1.50111(16) and 1.50102(16), respectively, and the triplet P(sub 1) - triplet P(sub2) energy separation is 1 220 575.1(33) MHz. The observed g factors show good agreement with the predicted values. This stands in marked contrast to similar results for atomic silicon (triplet P) and aluminum (doublet P), for which the theoretical and experimental g factors differ substantially. The value of the triplet P(sub 1) - triplet P(sub 2) energy separation is improved by nearly 2 orders of magnitude over the optical value and is of sufficient accuracy to permit possible extraterrestrial identification.

705,749

PB87-104105 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Far Infrared Laser Magnetic Resonance of Metastable (triplet P) Mg.
Final rept.
M. Inguscio, K. R. Leopold, J. M. Murray, and K. M. Evenson. 1984, 2p
Pub. in Proceedings of International Conference on Infrared and Millimeter Waves (9th), Takarazuka (Japan), 22-26 October 1984, p96-97.

Keywords: *Magnesium, Far infrared radiation, Zeeman effect, Metastable state, Reprints, Gyromagnetic ratio, Laser magnetic resonance, Fine structure.

Laser Magnetic Resonance spectroscopy inside the cavity of an optically pumped Fir laser has been successfully extended to the detection of a refractory atom in metastable states. Several coincidences with frequency measured laser lines are detected both for the 0 - 1 and 1 - 2 transitions of the metastable triplet P(sub 0,1,2) state of Mg. The fine structure separation is determined as well as the gyromagnetic factors.

705,750

PB87-104253 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Shear Viscosity Coefficients of Compressed Gaseous and Liquid Carbon Dioxide at Temperatures between 220 and 320 K and at Pressures to 30 MPa.
Final rept.
D. E. Diller, and M. J. Ball. 1985, 11p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in International Jnl. of Thermophysics 6, n6 p619-629 Nov 85.

Keywords: *Carbon dioxide, *Viscosity, Thermophysical properties, Density(Mass/volume), Temperature, Reprints, High pressure.

The shear viscosity coefficients of compressed gaseous and liquid carbon dioxide have been measured with the torsional piezoelectric crystal method at temperatures between 220 and 320 K and at pressures to 30 MPa. The dependencies of the viscosity on pressure, density, and temperature and the dependencies of the fluidity (inverse viscosity) on molar volume and temperature have been examined. The measurements on the compressed liquid were correlated with a modified Hildebrand equation.

705,751

PB87-104451 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Anomalous Pressure-Dependence of the Torsional Levels in Solid Nitromethane.
Final rept.
D. Cavagnat, A. Magerl, C. Vettier, I. Anderson, and S. F. Trevino. 1985, 4p
Pub. in Physical Review Letters 54, n3 p193-196 1985.

Keywords: Neutron scattering, Molecular structure, Inelastic scattering, Reprints, *Methane/nitro, Pressure dependence.

Inelastic neutron scattering measurements of the torsional levels of CH3NO2 and CD3NO2 are presented as functions of pressure and temperature. In contrast to all previously observed pressure dependence of hindered rotors, the ground state tunnel splitting increases and the energy of the bound torsional levels decrease with pressure. A potential which reproduces these anomalous effects is found and the source of the anomanly explained.

705,752

PB87-105045 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Center for Materials Science.
Simple Model for Coherent Equilibrium.
Final rept.
J. W. Cahn, and F. Larche. 1984, 9p
Pub. in Acta Metallurgica 32, n11 p1915-1923 1984.

Keywords: *Phase diagrams, Thermodynamics, Elastic properties, Reprints, Coherence.

The authors prove by a simple counterexample that many general theorems of fluid phase equilibrium are not valid for coherent phase equilibrium. Many discrepancies among solid state phase diagram determinations could be the result of applying thermodynamic theorems, whose proofs are invalidated by the presence of an elastic energy term in the free energy.

705,753

PB87-105169 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Improved Mixing Rules for One-Fluid Conformal Solution Calculations.
Final rept.
J. F. Ely. 1986, 20p
Pub. in Equations of State: Theories and Applications, ch. 16 p331-350 1986.

Keywords: *Fluids, Equations of state, Thermodynamics, Leonard-Jones potential, Mean density approximation.

During the past few years there has been great interest in improving equation of state mixing rules for fluid modeling. In the report new one-fluid mixing rules are proposed which explicitly take size difference effects into account. The resulting rules give the hard sphere mixture compressibility factor exactly. Comparisons of predicted excess properties for Lennard-Jones mixtures of varying size and energy ratios are presented. The results of the new mixing rules are superior to the van der Waals one-fluid model, especially for the excess volume.

705,754

PB87-105805 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Microwave and Far-Infrared Spectra of the (sup 18)OH Radical.
Final rept.
E. R. Comben, J. M. Brown, T. C. Steimle, K. R. Leopold, and K. M. Evenson. 1986, 5p
Grant NASW-15047
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 305, p513-517, 1 Jun 86.

Keywords: Infrared spectra, Chemical radicals, Microwave spectra, Rotational spectra, Far infrared radiation, Reprints, *Hydroxyl radials, Laser magnetic resonance.

The frequencies, wavelengths, and line strengths for transitions of the (18)OH molecule at microwave and far-infrared frequencies have been calculated from an analysis of its far-infrared laser magnetic resonance spectrum.

705,755

PB87-106068 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Sensitive Comparison of Inner-Vacancy and Stripped Ion Spectra with Theory.
Final rept.
R. D. Deslattes, and E. G. Kessler. 1984, 11p
Pub. in Proceedings of International Conference on X-Ray and Inner-Shell Processes in Atoms, Molecules and Solids, Leipzig, East Germany, August 20-25, 1984, p165-175.

Keywords: *Electron transitions, X rays, Electronic spectra, One electron ions.

There are converging lines of theoretical and experimental progress in regard to rigorous comparisons between theory and experiment both for one-electron ions up to the region near Z=30 and for single vacancy x-ray transitions throughout the periodic table. Among the more important contributions to this progress are improved connections to the optical region (i.e., the Rydberg constant), enhanced ability to produce one-electron spectra over a significant range of Z, and the availability of all Z relativistic self consistent field calculations which are both accurate and convenient to use. The available comparisons suggest that (1) experiment and theory are consistent for low Z one-electron atoms, (2) experiment and theory are inconsistent for mid-to-high Z x-ray transitions, and (3) this inconsistency is probably not dominated by quantum electrodynamic contributions.

705,756

PB87-106134 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Measurement of Liquid-Liquid Interfacial Kinetics.
Final rept.
G. J. Hanna, and R. D. Noble. 1985, 16p
Pub. in Chemical Reviews 85, n6 p583-598 1985.

Keywords: *Interfacial tension, Mass transfer, Reprints, *Liquid phases, *Chemical reaction kinetics.

Literature covering measurement of liquid-liquid interfacial kinetics, interfacial concentration measurement, and modeling of interfacial kinetics is reviewed. 85 References.

705,757

PB87-107074 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Computer Matching Two Different Images of the Same Particle Field.
Final rept.
D. S. Bright. 1984, 2p
Pub. in Proceedings of the Annual Conference of the Microbeam Analysis Society (19th)--Microbeam Analysis 1984, Bethlehem, PA, July 16-20, 1984, p173-174.

Keywords: Particles, *Microbeam analysis, Computer applications.

No abstract available.

705,758

PB87-107132 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Consecutive Ion Molecule Condensation-Reactions and Photodissociation Mechanisms of Condensation Ions in Polyacetylenic Compounds.
Final rept.
T. J. Buckley, L. W. Sieck, R. Metz, S. G. Lias, and J. F. Liebman. 1985, 16p
Pub. in International Jnl. of Mass Spectrometry and Ion Processes 65, n1-2 p181-196 1985.

Keywords: Mass spectroscopy, Chemical reactions, Chemical radicals, Reprints, *Photodissociation, *Chemical reaction mechanisms, Ion-molecule collisions, Photoionization, Acetylene/cyano, Cyanogen, Acetylene/di, Ion cyclotron resonance spectroscopy.

Consecutive ion-molecule condensation and condensation/dissociation reactions in diacetylene, cyanoacetylene, and cyanogen have been examined in an ion cyclotron resonance spectrometer at pressures of about 0.000001 torr, and in a high pressure photoioization mass spectrometer at pressures of about 0.01 torr.

705,759

PB87-107389 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Laser Diagnostics of Gas/Surface Interactions.
Final rept.
R. R. Cavanagh, D. S. King, and D. A. Mantell. 1984, 7p
Pub. in Proceedings of 1984 Annual Meeting of American Institute of Chemical Engineers, San Francisco, CA., November 25-30, 1984, 7p.

Keywords: *Surfaces, *Desorption, Gases, Interactions, Energy transfer, Platinum, Ruthenium, Nitrogen oxide(NO).

Laser probes of energy transfer at surfaces are providing a new picture of fundamental energy transfer processes. The application of such techniques to monitor the vibrational, rotational, translational, alignment, and spatial orientation which results from gas/surface interactions is discussed. Emphasis is placed on systems which reflect departure from equilibrium behavior.

705,760

PB87-107777 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Simulation of Aerosol Agglomeration in the Free Molecular and Continuum Flow Regimes.
G. W. Mulholland, R. D. Mountain, and H. Baum. Mar 86, 50p NBSIR-86/3342
Sponsored by Defense Nuclear Agency, Washington, DC.

Keywords: *Aerosols, *Agglomerates, Molecular structure, Reaction kinetics, Clustering, Brownian movement, Fractals, Fractal dimensions.

The formation of high temperature aerosol agglomerates is simulated by following the Langevin trajectory of each particle with the boundary condition that the particles stick upon collision. Both the free molecular and continuum flow are treated. A new derivation of the friction force of an agglomerate in the continuum limit is developed based on the evaluation of the surface momentum flux at the Oseen flow limit. The agglomerates can be described as fractal, at least in regard to power law relationship between mass and size, with a dimensionality of 1.7-1.9 independent of the flow regime. The particle growth is shown to be much more rapid in the free molecular regime than in the continuum. The global kinetics are shown to be consistent with a similarity analysis of the coagulation equation with a modified coagulation coefficient. Comparison between the simulation and coagulation theory at small time suggests a slight fluctuation enhancement in the free molecule case and a small-time enhancement of the coagulation rate at high concentration for the continuum case.

705,761

PB87-108122 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Least Endothermic Fragmentation Pathways of the Diazine Cations.
Final rept.
R. Buff, and J. Dannacher. 1984, 15p
Pub. in International Jnl. of Mass Spectrometry and Ion Processes 62, n1 p1-15 1984.

Keywords: *Cations, *Diazine, Fragmentation, Endothermic reactions, Spectroscopy, Ions, Cleavage, Reprints, Energy conversion.

The least endothermic fragmentation pathways of the diazine cations have been investigated by variable residence time photoelectron-photoion coincidence spectroscopy. A detailed RRKM analysis of the corresponding results provides the rate energy functions for the loss of N sub 2 from the 1,2-diazine-and for the loss of HCN from the 1,3- and 1,4-diazine cations. The outcome of the analysis further implies that the processes in question involve a rate determining cleavage of the aromatic rings with a critical energy of approx. 2.7 eV and a correspondingly loose transition state. Quantitative accord between computed and measured rates can only be achieved when it is assumed that the reactions occur on the ground state manifold of the respective parent ions, suggesting rapid internal conversion of any initial excess electronic energy.

705,762

PB87-108403 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Predicting Transport Properties without Adjustable Parameters: A Test Application of the Hulburt-Hirschfelder Potential to Argon.
Final rept.
P. M. Holland, L. Biolsi, and J. C. Rainwater. 1985, 6p
Pub. in Chemical Physics 99, p383-388 1985.

Keywords: *Transport properties, *Argon, Diffusion, Thermal conductivity, Viscosity, Gases, Reprints, Hulburt-Hirschfelder potential.

Accurate estimates of the transport properties of gaseous systems under conditions where experimental transport data are sparse or unavailable are important in a number of applications. The Hulburt-Hirschfelder (HH) potential for monatomic gas interactions, which is determined entirely by spectroscopic constants of diatomic molecules, provides a basis for calculating transport properties without adjustable parameters. In the paper the authors report test calculations of the viscosity, thermal conductivity and self-diffusion coefficients for argon. Comparison with the comprehensive correlation of thermophysical properties for argon by Kestin and co-workers shows very reasonable agreement for the transport properties at moderate and high temperatures. Deviations at lower temperatures may be attributed to inaccuracies in the long-range part of the HH potential, whereas the core and well of the potential appear to be adequately represented. These results strongly support the use of the HH potential for estimating the transport properties of monatomic gases at high temperatures.

705,763

PB87-108411 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Thermal Conductivity of Ethane at Temperatures between 110 and 325 K and Pressures to 70 MPa.
Final rept.
H. M. Roder, and C. A. N. de Castro. 1985, 8p
Pub. in High Temperatures-High Pressures 17, p453-460 1985.

Keywords: *Ethane, *Thermal conductivity, Temperature, Density, Reprints.

New experimental measurements of the thermal conductivity of ethane for seventeen temperatures between 110 and 325 K at pressures to 70 MPa and densities to 22 mol dm sup-3 are presented. The measurements were made with a transient hot wire apparatus and cover a wide range of physical states including the dilute gas, the moderately dense gas, the near critical region, the compressed liquid states, and the vapor at temperatures below the critical temperature. A curve fit of the thermal conductivity surface allows comparison of the present results with others and with other correlations. The precision (two standard deviations) of the measurements is between 0.5% and 0.8% for wire temperature transients of 4-5 K, while the accuracy is estimated to be + or - 1.6%.

705,764

PB87-108437 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Effect of External Mass-Transfer Resistance on Facilitated Transport.
Final rept.
R. D. Noble, J. D. Way, and L. A. Powers. 1986, 3p
Contract DE-AC21-84MC21271
Sponsored by Department of Energy, Washington, DC.
Pub. in Industrial and Engineering Chemistry Fundamentals 25, n3 p450-452 1986.

Keywords: *Mass transfer, Mathematical models, Membranes, Resistance, Reprints, *Liquid membranes, *Facilitated transport, Carrier mediated transport.

An analytical expression is derived for the facilitation factor in facilated transport across a liquid film. The expression accounts for external mass-transfer resistances as well as diffusion and reaction within the liquid film. Evaluation of Sherwood numbers encountered in hollow-fiber membrane systems indicates the importance of external mass-transfer resistance. A graphical method based on the equation is presented and compared to experimental results.

705,765

PB87-108445 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Kinetic Efficiency Factors for Facilitated Transport Membranes.
Final rept.
R. D. Noble. 1985, 9p
Pub. in Separation Science and Technology 20, n7-8 p577-585 1985.

Keywords: *Membranes, *Kinetics, Mathematical models, Reprints, *Facilitated transport, Efficiency factors, Carrier mediated transport.

A kinetic efficiency factor (eta) is defined for facilitated transport membranes. Eta is defined as the actual facilitated flux divided by the facilitated flux under reaction equilibrium conditions. Eta is correlated with an inverse Damkohler number epsilon. A dimensionless equilibrium constant K and mobility ratio alpha also affect the value of eta. Eta is shown to be useful in determining the operating regime of the system, comparing actual performance to maximum attainable, and providing a qualitative measure of the time to reach steady-state conditions.

705,766

PB87-108452 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Mathematical Modeling of Facilitated Liquid Membrane Transport Systems Containing Ionically Charged Species.
Final rept.
J. P. Leiber, R. D. Noble, J. D. Way, and B. R. Bateman. 1985, 26p
Pub. in Separation Science and Technology 20, n4 p231-256 1985.

Keywords: *Mathematical models, Diffusion, Chemical reactions, Numerical analysis, Membranes, Reprints, *Liquid membranes, Facilitated transport, Carrier mediated transport.

A numerical model is presented which solves the transient nonlinear system of partial differential equations governing the facilitated transport of ionically charged species through a liquid membrane. The mathematical model is derived in dimensionless form and solved numerically. Facilitation factors and electrical potentials across the membrane are computed and compared to experimental results. This model is useful in predicting transient concentration, flux, and electrical potential gradients provided that the values of the required physical constants are known. It was noticed that transient facilitation factors are not affected by the transient electrical potential buildup, which indicated that both the pure diffusion and the facilitated transport of permeate are affected equally by the electrical effects of the ionically charged species.

705,767
PB87-108601 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Far Infrared Laser Magnetic Resonance Detection of NH and ND (a (sup 1 Delta)).
Final rept.
K. R. Leopold, K. M. Evenson, and J. M. Brown. 1 Jul 86, 7p
Pub. in Jnl. of Chemical Physics 85, n1 p324-330, 1 Jul 86.

Keywords: *Spectroscopic analysis, Rotational spectra, Excitation, Hyperfine structure, Reprints, *Electronic structure, Laser magnetic resonance.

Rotational spectra of the excited a (sup 1 Delta) state of NH and ND have been observed by far infrared laser magnetic resonance spectroscopy. For ND A (sup1 Delta) the spectroscopic constants are B sub 0 = 264.750.263(30)MHz,Do = 13.383 83(91) MHz, (a sub N) = 109.63(22) MHz, (a sub D) = 11.03(23) MHz, eqQ(N) = -4.0(15) MHz,gr = -0.000 86(10), and gl =1.000 506(17). For NH a (sup1 Delta), the constants are (B sub 0) = 493 043.182(95) MHz,D sub 0 = 50.453 MHz (constrained in fit), (a sub N) = 109.65(85) MHz,(a sub H) = 70.9(14) MHz,eqQ(N) = -4.0 MHz(constrained in fit), (g sub r) = -0.001 58(6), and (g sub L) = 1.001 03 (constrained in fit). Aspects of the electronic structure of the radical as revealed by the magnetic hyperfine constants are discussed in relation to those of chemically similar systems. The Zeeman parameters are interpreted in terms of mixing of the a (sup1 Delta) state with the c sup II state.

705,768
PB87-108643 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Calculation of Phase Equilibria in Nitrogen-Ethane Mixtures by Extended Corresponding States.
Final rept.
K. D. Romig, and H. J. M. Hanley. Jan 86, 6p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Cryogenics 26, p33-38 Jan 86.

Keywords: *Phase transformations, *Ethane, *Nitrogen, Thermodynamics, Cryogenics, Phase diagrams, Reprints, Binary mixtures.

The phase diagram for the nitrogen-ethane mixture is determined via the extended corresponding states one-fluid theory. The authors support the contention that the mixture is a Type III mixture with a three-phase (liquid-liquid-vapour) line. The line can be calculated extremely well if binary interaction factors are fitted to the three-phase data. Without further adjustment, the liquid-liquid equilibrium (LLE) and vapour-liquid equilibrium (VLE) for the system are predicted satisfactorily. The parameters used, however, are not sufficient to predict satisfactory VLE data near a mixture critical line. The conclusion is in agreement with our previous work.

705,769
PB87-109500 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
First and Second Dissociation Constants of Deuterio-o-Phthalic Acid in D20 from 5 to 50 C.
Final rept.
Y. C. Wu, and W. F. Koch. 1986, 13p
Pub. in Jnl. of Solution Chemistry 15, n6 p481-493 1986.

Keywords: Thermodynamic properties, Heavy water, Concentration(Composition), Isotope effect, Reaction kinetics, Reprints, *Dissociation constants, *Phthalic acid/deuterio, Activity coefficient, Thermodynamic activity.

The first and second dissociation constants of deuterio-o-phthalic acid in deuterium oxide have been determined by the emf method over the temperature range of 5 to 50 deg C. The pD values for potassium deuterium phthalate have been calculated from these two constants and experimentally verified. The thermodynamic properties for the dissociation of deuterio-o-phthalic acid have been evaluated.

705,770
PB87-109518 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Thermodynamic Properties of DCl in D20 Solution from 5 to 50 C.
Final rept.
Y. C. Wu, W. F. Koch, and G. Marinenko. 1986, 20p
Pub. in Jnl. of Solution Chemistry 15, n8 p675-692 1986.

Keywords: *Hydrogen chloride, *Heavy water, Thermodynamic properties, Enthalpy, Entropy, Free energy, Electrochemical cells, Specific heat, Isotope effect, Reprints, *Deuterium chloride, Heat capacity.

The themodynamic properties of solutions of deuterium chloride (DCl) in deuterium oxide (D2O) have been determined from emf measurements of the electrochemical cell without transference from 5 to 50 deg C, and from 0.002 to 1.0/mol-kg. The standard potential of the silver/silver chloride electrode relative to the platinum/deuterium electrode has been determined. An equation for the Gibbs energy as a function of temperature has been derived from which the enthalpy, entropy, and heat capacity have been computed. Equations for the activity coefficient and the osmotic coefficient of DCl in D2O have been developed. The excess Gibbs energy of the solution and the excess partial molar free energy as a function of temperature have been calculated, from which the other excess thermodynamic properties have been computed. The solvent isotope effect on the excess thermodynamic functions is discussed.

705,771
PB87-109641 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Spectrum and Energy Levels of the Sodiumlike Ion Sr(27+).
Final rept.
J. Reader. Jun 86, 4p
Pub. in Jnl. of the Optical Society of America B 3, n6 p870-873 Jun 86.

Keywords: *Molecular spectra, *Atomic energy levels, Plasma radiation, X rays, Reprints, *Strontium ions, *Ionization energy, Sodiumlike ions, Laser-produced plasma.

The spectrum of Sr(27+) was observed with a laser-produced plasma and a 2.2-m grazing-incidence spectrograph in the region 12-160 A. From the identification of 37 lines a system of 27 energy levels of the type 2p6nl was determined. The level system includes the configurations ns(n=3-5), np(n=3-6), nd(n=3-7), nf(n=4-6), and 5g. The ionization energy is determined as 11 188 200 + or - 1000/cm (1387.16 + or - 0.12 eV).

705,772
PB87-109658 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Stark Broadening Along Homologous Sequences of Singly Ionized Noble Gases.
Final rept.
T. L. Pittman, and N. Konjevic. 1986, 7p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 35, n4 p247-253 1986.

Keywords: *Rare gases, *Stark effect, Neon, Argon, Krypton, Xenon, Plasma radiation, Reprints, Line broadening, Plasma spectroscopy.

The authors report measured Stark widths for eight Ne II, eight Ar II, five Kr II, and seven Xe II spectral lines, all belonging to np-nd doublets. A low-pressure, pulsed arc was used as a plasma source. Electron densities determined with an He-Ne laser quadrature interferometer cover the range 0.9 - 1.4 x 10 to the 23rd power/cu m. Electron temperatures, in the range 23,000 - 28,500 K, were measured by using the relative intensities of O II impurity lines. Experimental data for Ne II and Ar II agree well with the results of semiclassical calculations, where the average ratio of measured to calculated data is 0.96. The authors show that the analyzed results of the experimental data for np-nd doublets, within multiplets and supermultiplets along homologous sequences, are in close agreement with those presented in an earlier study.

705,773
PB87-109674 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Thermal Conductivity of Methane-Ethane Mixtures at Temperatures between 140 and 330 K and at Pressures up to 70 MPa.
Final rept.
H. M. Roder, and D. G. Friend. Nov 85, 11p
Pub. in International Jnl. of Thermophysics 6, n6 p607-617 Nov 85.

Keywords: *Methane, *Ethane, *Thermal conductivity, Thermophysical properties, Reprints, Binary mixtures, Augmentation, Hot wires.

The paper presents new measurements on the thermal conductivity of three methane-ethane mixtures with methane mole fractions of 0.69, 0.50, and 0.35. The thermal conductivity surface for each mixture is defined by up to 13 isotherms at temperatures between 140 and 330 K with pressures up to 70 MPa and densities up to 25 mol/L. The measurements were made with a transient hot-wire apparatus. They cover a wide range of physical states including the dilute gas, the single-phase fluid at temperatures above the maxcondentherm, the compressed liquid states, and the vapor at temperatures below the maxcondentherm. The results show an enhancement in the thermal conductivity in the single-phase fluid down to the maxcondentherm temperature, as well as in the vapor and in the compressed liquid. A curve fit of the thermal conductivity surface is developed separately for each mixture.

705,774
PB87-109690 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Vapor-Liquid Equilibrium of Near-Critical Binary Alkane Mixtures.
Final rept.
J. C. Rainwater, and F. R. Williamson. Jan 86, 10p
Pub. in International Jnl. of Thermophysics 7, n1 p65-74 Jan 86.

Keywords: Critical point, Thermophysical properties, Hexane, Pentane, Propane, Butane, Reprints, *Vapor liquid equilibrium, *Binary mixtures.

The modified Leung-Griffiths model of Rainwater and Moldover is used to correlate vapor-liquid equilibrium (VLE) surfaces in pressure, temperature, and density for binary mixtures in the near-critical region. The systems studied are butane-pentane, propane-isopentane, butane-hexane, and ethane-butane. The model, which has also successfully fit several other mixtures, is based on scaling-law equations of state expressed in terms of field variables. It incorporates a variation of the principle of corresponding states as well as the coupling of density and composition change across the phase boundary. As the width of the dew-bubble curves increases, additional parameters are required to obtain successful VLE correlations.

705,775
PB87-109732 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Autoionization in a Fluctuating Electric Field.
Final rept.
K. Rzazewski, and J. Cooper. Jun 86, 4p
Grant NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of the Optical Society of America B 3, n6 p891-894 Jun 86.

Keywords: *Electric fields, Variations, Ionization, Reprints, *Autoionization, *Plasma, Fluctuating microfield.

A simple model of autoionization in a fluctuating electric field is proposed and solved for the ionization rate. The fluctuating electric field can be a microfield in a plasma. Both dilute and dense plasmas are considered. Explicit expressions for broadening the Fano profile are derived and discussed in both cases, and particularly simple results are obtained in the impact limit.

705,776
PB87-109906 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 15, Number 2, 1986.
Quarterly rept.
c1986, 437p
See also PB87-109914 through PB87-109955, and PB86-204567. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036-9976.

Keywords: *Research, Thermodynamic properties, Entropy, Enthalpy, Molecular vibration, Chemical reactions, Aromatic hydrocarbons, Aromatic monocyclic hydrocarbons, Equations of state, Density, Ethylene, Vapor pressure, Nitrogen, Solubility, *Foreign technology, Chemical reaction kinetics, Heat capacity, Polychlorinated biphenyls.

Table of contents include: Thermodynamic properties of twenty-one monocyclic hydrocarbons; Evaluated kinetic data for high-temperature reactions. Volume 5. Part 1. Homogeneous gas phase reactions of the hydroxyl radical with alkanes; Thermodynamic properties of ethylene from the freezing line to 2000 K at Pressures to 1000 MPa; A critical review of aqueous solubilities, vapor pressures, Henry's law constants, and octanol-water partition coefficients of the polychlorinated biphenyls.

705,777
PB87-109914 Not available NTIS
American Chemical Society, Washington, DC.
Thermodynamic Properties of Twenty-One Monocyclic Hydrocarbons.
O. V. Dorofeeva, L. V. Gurvich, and V. S. Jorish.
c1986, 28p
Prepared in cooperation with Akademiya Nauk SSSR, Moscow. Inst. Vysokikh Temperatur. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n2 p437-464 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036-9976.

Keywords: *Aromatic monocyclic hydrocarbons, *Thermodynamic properties, Molecular structure, Molecular vibration, Entropy, Enthalpy, Free energy.

The available structural parameters, fundamental frequencies, and relative energies of different stable conformers, if any, for cyclopropane, cyclopropene, cyclobutane, cyclobutene, 1,3-cyclobutadiene, cyclopentane, cyclopentene, 1,3-cyclopentadiene, cyclohexane, cyclohexene, 1,3-cyclohexadiene, 1,4-cyclohexadiene, cycloheptane, cycloheptene, 1,3-cycloheptadiene, and 1,3,5,7-cyclooctatetraene were critically evaluated and the recommended values selected. Molecular constants for some molecules were estimated as the experimental values for these compounds are not available. This information was utilized to calculate the ideal gas thermodynamic properties C sub p,S,-(G-H sub 0)/T, H - H sub 0, and log K sub f from 100 to 1500K

705,778
PB87-109922 Not available NTIS
Leeds Univ. (England). Dept. of Physical Chemistry.
Evaluated Kinetic Data for High-Temperature Reactions. Volume 5. Part 1. Homogeneous Gas Phase Reactions of the Hydroxyl Radical with Alkanes.
D. L. Baulch, M. Bowers, D. G. Malcolm, and R. T. Tuckerman. c1986, 128p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n2 p465-592 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036-9976.

Keywords: Thermodynamics, Chemical radicals, Chemical reactions, Aliphatic hydrocarbons, Aromatic hydrocarbons, Methane, Ethane, Butane, Hexane, Heptane, *Chemical reaction kinetics, *Hydroxyl radicals, Butane/dimethyl, Pentane/methyl.

The available kinetic data for the homogeneous gas phase reactions of the hydroxyl radical with alkanes have been compiled and critically evaluated. For each reaction, relevant thermodynamic data, a table of measured rate constants, a discussion of the data, and a comprehensive bibliography are presented. Wherever possible the preferred rate parameters are given with their associated error limits and temperature ranges.

705,779
PB87-109930 Not available NTIS
Idaho Univ., Moscow. Center for Applied Thermodynamic Studies.
Thermodynamic Properties of Ethylene from the Freezing Line to 450 K at Pressures to 260 MPa.
M. Jahangiri, R. T. Jacobsen, and R. B. Stewart.
c1986, 141p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n2 p593-734 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036-9976.

Keywords: *Ethylene, *Thermodynamic properties, Enthalpy, Vapor pressure, Specific heat, Entropy, Density, Equations of state.

A new fundametnal equation explicit in Helmholtz energy for thermodynamic properties of ethylene from the freezing line to 450 K at pressures to 260 MPa is presented. Independnt equations for the vapor pressure for the saturated liquid and vapor densities as functions of temperature, and for the ideal gas heat capacity are also included. The fundamental equation was selected from a comprehensive function of 100 terms on the basis of a statistical analysis of the quality of the fit. The fundamental equation and the derivative functions for calculating internal energy, enthalpy, entropy, isochoric heat capacity (Cv), isobaric heat capacity (Cp), and velocity of sound are included. The fundamental equation reported here may generally be used to calculate pressures and densities with an uncertainty of + or - 0.1%, heat capacities within + or - 3%, and velocity of sound values within + or - 1%. Comparisons of calculated properties to experimental data are included to verify the accuracy of the formulation.

705,780
PB87-109948 Not available NTIS
Idaho Univ., Moscow. Center for Applied Thermodynamic Studies.
Thermodynamic Properties of Nitrogen from the Freezing Line to 2000 K at Pressures to 1000 MPa.
R. T. Jacobsen, R. B. Stewart, and M. Jahangiri.
c1986, 175p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n2 p735-909 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036-9976.

Keywords: *Thermodynamic properties, *Nitrogen, Density, Enthalpy, Entropy, Equations of state, Specific heat, Tables(Data), Heat capacity, Temperature dependence, Pressure dependence.

A new fundamental equation explicit in Helmholtz energy for thermodynamic properties of nitrogen from the freezing line to 2000 K at pressures to 1000 MPa is presented. New independent equations for the vapor pressure and for the saturated liquid and vapor densities as functions of temperature are also included. Tables of thermodynamic properties of nitrogen are given for liquid and vapor states within the range of validity of the fundamental equation.

705,781
PB87-109963 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 15, Number 3, 1986.
Quarterly rept.
c1986, 349p
See also PB87-109971 through PB87-110029, and PB86-204567. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Research, Thermochemical properties, Titanium chlorides, Thermodynamic properties, Iron, Silicon, Enthalpy, Entropy, Standards, Thermal conductivity, Toluene, Heptane, Methane, Combustion, Ion-molecule collisions, Computer applications, Electron photon interactions, Photoionization, Photodissociation, Ion clusters, Standard reference materials, Chemical reaction kinetics.

Table of contents includes the following: Computer methods applied to the assessment of thermochemical data. Part 1. The establishment of a computerized thermochemical data base illustrated by data for TiCl4(g), TiCl4(l), TiCl3(cr), and TiCl2(cr); Thermodynamic properties of Iron and Silicon; Cross Sections for collisions of electrons and photons with nitrogen molecules; Thermochemical data on gas-phase ion-molecule association and clustering reactions; Standard reference data for the thermal conductivity of liquids; Chemical kinetic data base for combustion chemistry. Part 1. Methane and related compounds; Cumulative listing or reprints and supplements.

705,782
PB87-109971 Not available NTIS
Sussex Univ., Brighton (England). School of Chemistry and Molecular Sciences.
Computer Methods Applied to the Assessment of Thermochemical Data. Part 1. The Establishment of a Computerized Thermochemical Data Base Illustrated by Data for TiCl4(g), TiCl4(l), TiCl3(cr), and TiCl2(cr).
S. P. Kirby, E. M. Marshall, and J. B. Pedley. c1986, 23p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n3 p943-965 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Titanium chlorides, *Thermochemical properties, Enthalpy, Heat of formation, Entropy, Computer applications.

Computer methods are described for the storage, retrieval, and processing of large amounts of thermochemical data and related textual material. The procedures are illustrated by a critical evaluation of data for TiCl4(g), TiCl4(1), TiCl3(cr), and TiCl2(cr); values for standard enthalpies of formation and entropies at 298.15 K are selected for these species.

705,783
PB87-109989 Not available NTIS
Center for Information and Numerical Data Analysis and Synthesis, Lafayette, IN.
Thermodynamic Properties of Iron and Silicon.
P. D. Desai. c1986, 17p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n3 p967-983 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Thermodynamic properties, *Iron, *Silicon, Enthalpy, Specific heat, Vapor pressure, Gibbs free energy, Heat capacity.

The work reviews and discusses the data on the various thermodynamic properties of iron and silicon available through March 1984. These include heat capacity, enthalpy, enthalpies of transition and melting, vapor pressure, and enthalpy of vaporization. The recommended values for heat capacity, enthalpy, entropy, and Gibbs energy function cover the temperature range from 1 to 3200 K for iron and 1 to 3600 K for silicon. The recommended values for vapor pressure cover the temperature range from 298.15 to 3200 K for iron and from 298.15 to 3600 K for silicon. These values are referred to temperatures based on the International Practical Temperature Scale o

705,784
PB87-109997 Not available NTIS
Institute of Space and Astronautical Science, Tokyo (Japan).

Cross Sections for Collisions of Electrons and Photons with Nitrogen Molecules.
Y. Itikawa, M. Hayashi, A. Ichimura, K. Onda, and K. Sakimoto. c1986, 27p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n3 p985-1010 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Nitrogen, Cross sections, Excitation, Elastic scattering, Molecular vibration, *Electron-molecule collisions, *Photon-molecule collisions, Photoionization, Photodissociation, Electron collisions.

Data have been compiled on the cross sections for collisions of electrons and photons with nitrogen molecules(N2). For electron collisions, the processes considered are: total scattering, elastic scattering, momentum transfer, excitations of rotational, vibrational and electronic states, dissociation, and ionization. Ionization and dissociation processes are discussed for photon impact. Cross section data selected are presented graphically. Spectroscopic and other properties of the nitrogen molecule are summarized. The literature was surveyed through the end of 1984, but some more recent data are included when useful.

705,785
PB87-110003 Not available NTIS
Pennsylvania State Univ., University Park. Dept. of Chemistry.
Thermochemical Data on Gas-Phase Ion-Molecule Association and Clustering Reactions.
R. G. Keesee, and A. W. Castleman. c1986, 61p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n3 p1011-1071 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Thermodynamic properties, Enthalpy, Entropy, Free energy, Chemical reactions, Dissociation energy, *Ion-molecule collisions, *Ion clusters.

A comprehensive tabulation of the standard enthalpy change, delta H, entropy change, delta S, and free energy change delta G, for the formation of ion clusters from ion-molecule association reactions is given. The experimental methods which are used to derive the data are briefly discussed. For some experiments, dissociation energies of ion clusters are reported and listed under the category of delta H. The relationship between delta H and dissociation energy is discussed in the text

705,786
PB87-110011 Not available NTIS
Lisbon Univ. (Portugal). Dept. de Quimica.
Standard Reference Data for the Thermal Conductivity of Liquids.
C. A. Nieto de Castro, S. F. Y. Li, N. Nagashima, R. D. Trengove, and W. A. Wakeham. c1986, 14p
Prepared in cooperation with Imperial Coll. of Science and Technology, London (England). Dept. of Chemical Engineering and Chemical Technology, and Keio Univ., Yokohama (Japan). Dept. of Mechanical Engineering. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n3 p1073-1086 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Thermal conductivity, *Water, *Toluene, *Heptane, Thermodynamic properties Liquids, Convection, Concentric cylinders.

The available experimental liquid-phase thermal conductivity data for water, toluene, and n-heptane have been examined with the intention of establishing standard reference values along the saturation line. The quality of available data is such that for toluene and water new standard reference values can be proposed with confidence limits better than + or - 1.0% for most of the normal liquid range. For n-heptane there are insufficient reliable experimental data for the system to be treated as a primary reference standard, so a lower quality correlation has been developed which yields a set of secondary reference data with confidence limits of + or - 1.5% for most of the normal liquid range.

705,787
PB87-110110 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Photoelectron-Photoion Coincidence Study of the Bromobenzene Ion.
Final rept.
H. M. Rosenstock, R. Stockbauer, and A. C. Parr. 15 Jul 80, 5p
Pub. in Jnl. of Chemical Physics 73, n2 p773-777, 15 Jul 80.

Keywords: Photoelectrons, Mass spectroscopy, Fragmentation, Reprints, *Electron-ion collisions, *Benzene/bromo, *Photoionization, Phenyl radicals.

The technique of variable time photoelectron-photoion coincidence mass spectrometry has been applied to the fragmentation of bromobenzene ion producing a phenyl ion. A detailed analysis of the variation of the breakdown curve with parent ion residence time was performed. The results lead to phenylion = 270 kcal/mole in close agreement with recalculated results from an earlier study on chlorobenzene. This, combined with other photoionization results leads to phenyl radical = 83 plus or minus 3 kcal/mole, slightly higher than the value 80.9 plus or minus 2 kcal/mole obtained from neutral kinetics. The analysis leads to a rate-energy dependence for the fragmentation process and an equivalent 1000 K Arrhenius pre-exponential factor of 9.4 x 10 to the 14th power/sec, which may be compared to the value 2 x 10 to the 14th power/sec for the analogous neutral process. The possible contribution of spin orbit splitting is discussed.

705,788
PB87-110185 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Resonant Electron and Ion Emission and Desorption Mechanism in Rare Earth Oxides.
Final rept.
J. Schmidt-May, F. Senf, J. Voss, C. Kunz, A. Flodstrom, R. Nyholm, and R. Stockbauer. 1985, 12p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Surface Science 163, p303-314 1985.

Keywords: *Desorption, Chemisorption, Rare earth compounds, Reaction kinetics, Surface chemistry, Reprints, *Samarium oxides, *Europium oxides, *Ytterbium oxides, Ion emission, Photoelectron spectroscopy.

The resonant enhancement in photoelectron spectra at the 4d edges of rare earth atoms and metals is also found in yield spectra of desorbed ions from the surfaces of the oxides of Sm, Eu and Yb following the photon excitation. The analysis of the 4 -> 4f resonance leads to a picture of an indirect mechanism of ion desorption which is mainly caused by the flux of energetic 4f photoelectrons from the bulk. In this case the dominant desorption through secondary processes limits the use of the photon-stimulated desorption (PSD) to determine to which type of atom the desorbing species was attached.

705,789
PB87-110193 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Recent Developments in Quantitative Surface Analysis by Electron Spectroscopy.
Final rept.
C. J. Powell. 1986, 8p
Pub. in Jnl. of Vacuum Science and Technology A4, n3 p1532-1539 May/Jun 86.

Keywords: *Electron spectroscopy, *Chemical analysis, Surface chemistry, Calibration, Reprints.

An overview is given of recent developments in quantitative surface analysis by x-ray photoelectron spectroscopy and Auger electron spectroscopy. The two major tasks of an analysis are the identification of the surface phases that are present and the determination of the concentrations of particular elements or compounds. Methods for accomplishing both tasks are described together with the pitfalls and problems that remain. Particular attention is given to the following topics: identification of surface phases and reference data for the calibration of instrumental energy scales; reference data on inelastic mean free paths and attenuation lengths; effects of specimen crystallinity; intensity measurements; measurement of the imaging properties of electron energy analyzers; and the intensity-energy response functions of different instruments.

705,790
PB87-111050 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Photofragmentation Dynamics of Acetone at 193 nm: State Distributions of the CH3 and CO Fragments by Time- and Wavelength-Resolved Infrared Emission.
Final rept.
D. J. Donaldson, and S. R. Leone. 1986, 8p
Contract DOE-EA-77-A-01-6010, Grant NSF-PHY82-00805
Sponsored by Department of Energy, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 85, n2 p817-824, 15 Jul 86.

Keywords: *Acetone, *Photolysis, Chemical radicals, Excitation, Carbon monoxide, Infrared radiation, Vibration, Rotation, Reprints, *Methyl radicals.

The photolysis of acetone at 193 nm is known to produce two methyl radicals and CO following excitation of a (sup1 (n,3s)) Rydberg transition. Vibrational excitation is detected in both products immediately following the dissociating laser pulse by observing the resulting infrared emission. Vibrational distributions are obtained for CH (nu sub 3) and for CO. These are, for CH (nu sub 3) nu=1/2/3=0.73 + or - 0.05/0.13 + or - 0.05/0.13 + or 0.05 and for CO nu =1/2/3=0.75 + or - 0.05/0.16 + or -0.05/0.09 + or -0.05. An approximate rotational temperature of 1500 K can be used to fit the CH3(nu sub 3) emission spectrum. The CO is formed with very high, non-Boltzmann rotational excitation. The result strongly suggests that the three-body dissociation occurs via a two-step mechanism, rather than a rigorously concerted process. The high rotational excitation is most likely imparted by the kinematics in the breakup of a bent acetyl fragment.

705,791
PB87-111076 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron-Impact Ionization of Mg-Like Ions: S(4+), C1(5+), and Ar(6+).
Final rept.
A. M. Howald, D. C. Gregory, F. W. Meyer, R. A. Phaneuf, N. Djuric, A. Muller, and G. H. Dunn. 1986, 8p
Contract DE-AC05-84OR21400
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Physical Review A 33, n6 p3779-3786 Jun 86.

Keywords: Excitation, Cross sections, Reprints, *Magnesiumlike ions, *Electron-ion collisions, Autoionization, Sulfur ions, Chlorine ions, Argon ions, Crossed beams, *Ionization cross sections.

Absolute electron-impact ionization cross sections were measured as a function of collision energy for ions in the Mg-isoelectronic sequence S(4+), C(5+), and Ar(6+). The measurements cover the energy range from threshold to 1500 eV and show onsets due to the indirect ionization process of innershell excitation followed by autoionization. The relative magnitude of the indirect ionization process increases dramatically in comparison with the direct process along the sequence, a feature which is also emphasized by earlier data for Al(1+).

705,792
PB87-113619 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Viscosity of Light and Heavy Water and Their Mixtures.
Final rept.
J. Kestin, N. Imaishi, S. H. Nott, J. C. Nieuwoudt, and J. V. Sengers. 1985, 21p
Contract DE-AC02-81ER10811
Sponsored by Department of Energy, Washington, DC.
Pub. in Physica 134A, p38-58 1985.

Keywords: *Heavy water, *Water, *Viscosity, Measurement, Mixtures, Reprints.

The paper presents measurements of the viscosity of light and heavy water and their mixtures at temperatures between 25C and 220C and at pressures from the saturation pressure up to 30MPa. A comparison with the international formulations for the viscosity of fluid H2O and D2O adopted by the International Association for the Properties of Steam reveals some systematic differences from the previously accepted

values for the viscosity of liquid D2O. A unified representative equation is proposed which yields the viscosity of mixtures of liquid H2O and D2O at all concentrations, at temperatures from the freezing point up to 350C, and at pressures up to approximately 100 MPa.

705,793

PB87-113627 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Boundary Layer Effects in Facilitated Transport Liquid Membranes.
Final rept.
R. D. Noble, J. D. Way, and L. A. Powers. 1986, 4p
Pub. in American Institute of Chemical Engineers Symposium Series 82, n248 p94-97 1986.

Keywords: Mass transfer, Mathematical models, Separation, Reprints, *Liquid membranes, *Facilitated transport.

An analytical expression is derived for the facilitation factor in facilitated transport across a liquid film. The expression accounts for external mass-transfer resistances as well as diffusion and reaction within the liquid film. Comparison with experimental results is very good.

705,794

PB87-114930 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Ion Broadening of Ar I Lines in a Plasma.
Final rept.
D. W. Jones, W. L. Wiese, and L. A. Woltz. 1986, 7p
Pub. in Physical Review A 34, n1 p450-456 Jul 86.

Keywords: *Argon, Line spectra, Line width, Stark effect, Reprints, *Line broadening.

The authors have measured the profiles of plasma-broadened, slightly red-shifted spectral lines of neutral argon with a wall-stabilized arc and performed a detailed line-shape analysis with a computerized data acquisition and processing system. In full agreement with the quasistatic theory of ion broadening, the authors' experiment shows asymmetry patterns with characteristic minima and maxima near the central part of the lines. While the positions of these extrema--as well as the zero crossing point--stay essentially constant for all lines when compared on a reduced wavelength scale, the amplitudes of the extrema vary from line to line. Measurements of the amplitudes thus allow, by comparison with theoretical asymmetry patterns, the determination of ion broadening parameters.

705,795

PB87-115218 PC **A07**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Bibliographies of Industrial Interest: Thermodynamic Measurements on the Systems CO2-H2O, CuCl2-H2O, H2SO4-H2O, NH3-H2O, H2S-H2O, ZnCl2-H2O, and H3PO4-H2O.
Final rept.
B. R. Staples, D. Garvin, D. Smith-Magowan, T. L. Jobe, and J. Crenca. Sep 86, 149p NBS/SP-718
Also available from Supt. of Docs as SN003-003-027-68-5. Library of Congress catalog card no. 86-600544.
Sponsored by American Inst. of Chemical Engineers, New York.

Keywords: *Thermodynamic properties, *Bibliographies, Specific heat, Enthalpy, Ammonia, Carbon dioxide, Copper chlorides, Hydrogen sulfide, Phosphoric acid, Sulfuric acid, Zinc chlorides, Equilibrium, *Binary mixtures.

Contained herein are bibliographies of sources of experimental and correlated thermodynamic data for seven binary aqueous mixtures of industrial importance, namely mixtures of CO2, H2S, NH3, H2SO4, H3PO4, CuCl2 and ZnCl2 with water. The categories of equilibrium data included in the bibliographies are activity and osmotic coefficients, equilibria in solution, enthalpies and heat capacity data, vapor-liquid equilibria, and phase equilibrium data.

705,796

PB87-116232 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Automation of the NBS (National Bureau of Standards) Threshold Photoelectron-Photoion Coincidence Mass Spectrometer.
Final rept.
J. J. Butler, D. M. P. Holland, A. C. Parr, R. Stockbauer, and R. Buff. 1985, 4p
Pub. in Jnl. of Physics E: Scientific Instruments 18, p286-289 1985.

Keywords: *Mass spectrometers, Chemical analysis, Automation, Reprints, Threshold photoelectrons, Time-of-flight spectrometers, Photoions.

The pulse counting and delay circuitry for a threshold photoelectron-photoion coincidence mass spectrometer is presented along with the automation system using a DEC LSI 11/23 computer and CAMAC instrumentation. A switching output register and logic circuits are used to measure alternately a time of flight coincidence mass spectrum and a background accidental spectrum, at selected photon energies. The high voltage, fast rise time pulse used for time of flight analysis creates special signal isolation problems which are handled with unique pulse blanking techniques.

705,797

PB87-116240 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Photoelectron Branching Ratios and Asymmetry Parameters of the Two Outermost Molecular Orbitals of Methyl Cyanide.
Final rept.
D. M. P. Holland, A. C. Parr, and J. L. Dehmer. 1984, 10p
Grant NATO-1939
Sponsored by Office of Naval Research, Arlington, VA., Department of Energy, Washington, DC., and North Atlantic Treaty Organization, Brussels (Belgium).
Pub. in Jnl. of Electron Spectroscopy and Related Phenomena 34, p87-96 1984.

Keywords: *Atomic orbitals, Atomic energy levels, Photoelectrons, Reprints, *Cyanide/methyl, Photoionization.

Vibrationally resolved photoelectron branching ratios and asymmetry parameters have been determined for the two outermost molecular orbitals of methyl cyanide. The results are discussed briefly within the context of similar studies on cyanogen and hydrogen cyanide, and in relation to structures exhibited in the photoionization efficiency curve.

705,798

PB87-117693 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Multiphoton Ionization Spectroscopy of ClO and BrO.
Final rept.
M. T. Duignan, and J. W. Hudgens. 1985, 8p
Pub. in Jnl. of Chemical Physics 82, n10 p4426-4433 1985.

Keywords: Excitation, Mass spectra, Reprints, *Multiphoton ionization, *Bromine monoxide, *Chlorine monoxide, Electronic structure, Ryberg states.

The authors report the resonance enhanced multiphoton ionization spectra of ClO and BrO between 415 and 475 nm. The observed electronic states were prepared by simultaneous absorption of three identical photons from a dye laser. Absorption of at least one additional photon induced ionization. ClO showed spectra originating from the D, E, and F states. BrO showed three new vibrational progressions originating from transitions between the X (sup2)Pi(sub3/2) state to Rydberg states with assignments of E (sup2)sigma (nu(sub 00) = 65003/cm), F (sup2)sigma (nu(sub 00) = 67470/cm), and an apparently inverted multiplet state designated G (nu(sub 00 = 70504/cm). The G-state bands were separated by 139 (+ or - 3) cm which should approximate the magnitude of the spin-orbit coupling constant of the excited state if it is of (sup2)Pi(subi) symmetry.

705,799

PB87-118105 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Thermodynamics of Ammonium Scheelites II. Heat Capacity of Deuterated Ammonium Perrhenate ND4Re04 from 7.5 to 320 K.
Final rept.
R. J. C. Brown, J. E. Callanan, R. D. Weir, and E. F. Westrum. 1986, 6p
Sponsored by Michigan Univ., Ann Arbor. Dept. of Chemistry, and Royal Military Coll. of Canada, Kingston (Ontario).
Pub. in Jnl. of Chemical Thermodynamics 18, p787-792 1986.

Keywords: *Specific heat, Scheelite, Thermodynamic properties, Metaliferous minerals, Reprints, *Heat capacity, *Deuterated ammonium perrhenate.

The heat capacity of the scheelite salt deuterated ammonium perrhenate ND4ReO4 was measured from 7.5 to 320 K without detection of any phase transition. An anomalous peak found between 270 and 280 K resulted from fusion of a saturated solution of D2O trapped in the lattice. Values of the standard molar thermodynamic quantities for pure ND4ReO4 are presented up to 320 K.

705,800

PB87-118139 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Dependence of Pressure in a Bubbler Tube on Liquid Properties.
Final rept.
A. K. Gaigalas. 1982, 8p
Pub. in American Institute of Chemical Engineers Jnl. 28, p922-929 1982.

Keywords: *Liquids, Density, Cross sections, Calibration, Reprints, *Pressure dependence, Bubbler tubes.

An experiment was performed to study the dependence of pressure (P) in a bubbler tube on liquid properties. For a given mass of liquid in a tank of uniform cross-sectional area A, the pressure in the bubbler tube depends on liquid temperature, density, surface tension, bubble size, and heel volume, which is the space between the bottom of the tank and the tip of the bubbler tube. The relationship for the pressure was found to be consistent with all measurements. In a second part of the investigation a cylindrical tank was calibrated with water at room temperature. The calibration was extrapolated to measure the volume of water at 40 deg C and uranyl nitrate ar 20 deg C and 40 deg C. All measurements indicated that the extrapolation procedure discussed in the study is valid. The sensitivity of the extrapolation to density changes and tank geometry changes is presented.

705,801

PB87-118303 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Hydrogen Component Fugacities in Binary Mixtures with Carbon Dioxide.
Final rept.
T. J. Bruno, and G. L. Hume. 1986, 11p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in International Jnl. of Thermophysics 7, n5 p1053-1063 1986.

Keywords: *Hydrogen, *Carbon dioxide, Thermophysical properties, Reprints, Fugacity coefficients, Binary mixtures, Gas mixtures.

The fugacity coefficients of hydrogen in binary mixtures with carbon dioxide were measured using a physical equilibrium technique. The technique involves the use of an experimental chamber which is divided into two regions by a semipermeable membrane. Hydrogen can penetrate and pass through the membrane, while the other component (in this case carbon dioxide) cannot. At equilibrium, pure hydrogen will permeate into one 'compartment' of the chamber, while the binary mixture occupies the other compartment. Thus, the pressure of pure hydrogen on one side of the membrane approaches the partial pressure of hydrogen in the mixture on the other side of the membrane. This allows the direct measurement of the hydrogen component fugacity at a given mixture mole fraction. In this study, results are reported for measurements made on the hydrogen+carbon dioxide binary at 80 deg C (355 K), 130 deg C (403 K), 160 deg C (433 K), and 190 deg C (463 K).

705,802

PB87-118311 Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Hydrogen Component Fugacities in Binary Mixtures with Methane and Propane.
Final rept.
T. J. Bruno, G. L. Hume, and J. F. Ely. 1986, 19p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in International Jnl. of Thermophysics 7, n5 p1033-1051 1986.

Keywords: *Hydrogen, *Methane, *Propane, Thermophysical properties, Reprints, Fugacity coefficients, Binary mixtures, Gas mixtures.

The fugacity coefficients of hydrogen in binary mixtures with methane and propane were measured using a physical equilibrium technique. The technique involves the use of an experimental chamber which is divided into two regions by a semipermeable membrane. Hydrogen can penetrate and pass through the membrane, while the other component (in this case, methane or propane) cannot. At equilibrium, pure hydrogen will permeate into one 'compartment' of the chamber, while the binary mixture occupies the other compartment. Thus, the pressure of pure hydrogen on one side approaches the partial pressure of hydrogen in the mixture on the other side of the membrane. In the study, results are reported for measurements made on the hydrogen+propane binary at 80 deg C (353 K) and 130 deg C (403 K) and the hydrogen+methane binary at 80 deg C (353 K). All measurements were performed with a total mixture pressure of 3.45 MPa.

705,803
PB87-118337 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Multiphone Excitation of Autoionizing States of Mg: Line-Shape Studies of the 3p2 singlet S State.
Final rept.
R. E. Bonanno, C. W. Clark, and T. B. Lucatorto. 1986, 4p
Contract DE-AI01-85ER60302
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 34, n3 p2082-2085 Sep 86.

Keywords: Excitation, Reprints, *Magnesium atoms, *Autoionization, Multi-photon processes, Resonance ionization mass spectrometry.

The authors have observed ionization of Mg by both direct and stepwise two-photon excitation of the 3p(2) Singlet S state. The line shape of the single-color direct process is strongly modified by the resonance denominator associated with the intermediate virtual state. The measured energy and width of this resonance as determined by the stepwise two-color technique agree well with previous determinations.

705,804
PB87-118626 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Migration of Population to Higher-Angular-Momentum Rydberg States through the Degenerate Raman Coupling.
Final rept.
R. Grobe, G. Leuchs, and K. Rzazewski. 1986, 7p
Pub. in Physical Review A: General Physics 34, n2 p1188-1194 Aug 86.

Keywords: Atomic energy levels, Reprints, *Rydberg states, Hydrogen atoms.

A model is formulated which describes migration of population from low-l to higher-l states of the same principal quantum number in the highly excited state of the atom. The physical mechanism is the degenerate, nearly resonant Raman coupling. Specific calculations are performed for the hydrogen atom. The laser light is modeled as a monochromatic coherent or chaotic colored noise.

705,805
PB87-118683 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Thermodynamic Properties of Isobutane-Isopentane Mixtures.
Final rept.
J. S. Gallagher, and J. M. H. Levelt Sengers. 1984, 6p
Sponsored by Department of Energy, San Francisco, CA. San Francisco Operations Office.
Pub. in Transactions - Geothermal Resources Council 8, p59-64 1984.

Keywords: *Thermodynamic properties, Equations of state, Enthalpy, Reprints, *Pentane/iso, *Butane/iso, Binary mixtures.

A Helmholtz function for mixtures of isobutane and isopentane has been formed based upon a recent correlation of pure isobutane as the reference fluid and using extended corresponding states principles. The function can be used to generate other thermodynamic properties of interest by differentiations with respect to its independent variables V,T, and X. Sample tables of properties generated in the way and a pressure-enthalpy chart of interest to the designer of geothermal power cycles are presented.

705,806
PB87-118717 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
PVT Properties of Methanol at Temperatures to 300 deg C.
Final rept.
G. C. Straty, A. M. F. Palavra, and T. J. Bruno. 1986, 13p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in International Jnl. of Thermophysics 7, n5 p1077-1089 1986.

Keywords: *Methyl alcohol, Carbinols, Compressibility, Density, Pressure, Volume, Temperature, Reprints, *Compressed gas.

Measurements of the PVT behavior of compressed gas and liquid methanol are reported. Pressure versus temperature observations were made along paths of very nearly constant density (pseudoisochores) in the temperature range from about 100 to 300 deg C and at pressures to about 35 MPa. Eighteen pseudoisochores were determined, ranging in density from about 2 to 22 mol/cu dm.

705,807
PB87-118725 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Test of the Mean Density Approximation for Lennard-Jones Mixtures with Large Size Ratios.
Final rept.
J. F. Ely. 1986, 13p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in International Jnl. of Thermophysics 7, n2 p381-393 Mar 86.

Keywords: Computerized simulation, Reprints, *Lennard-Jones mixtures, Molecular dynamics.

The mean density approximation for mixture radial distribution functions plays a central role in modern corresponding-states theories. This approximation is reasonably accurate for systems that do not differ widely in size and energy ratios and which are nearly equimolar. As the size ratio increases, however, or if one approaches an infinite dilution of one of the components, the approximation becomes progressively worse, especially for the small molecule pair. In an attempt to better understand and improve this approximation, isothermal molecular dynamics simulations have been performed on a series of Lennard Jones mixtures. Thermodynamic properties, including the mixture radial distribution functions, have been obtained at seven compositions ranging from 5 to 95 mol %. The results of the simulations are compared with the mean density approximation and a modification to integrals evaluated with the mean density approximation is proposed.

705,808
PB87-119582 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Heterodyne Frequency Measurements on the Nitric Oxide Fundamental Band.
Final rept.
A. Hinz, J. S. Wells, and A. G. Maki. 1986, 6p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 119, p120-125 1986.

Keywords: *Nitric oxide(NO), *Molecular spectra, Band spectra, Frequency measurement, Reprints.

Heterodyne frequency measurements have been made on the fundamental band of nitric oxide from 1750 to 1931/cm. Based on the analysis of these new measurements, minor changes are made in the band constants and an improved list of calculated energy levels for the nu = 0 and nu = 1 states is given.

705,809
PB87-119764 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Thermodynamic Property Formulation for Ethylene from the Freezing Line to 450 K at Pressures to 260 MPa.
Final rept.
M. Jahangiri, R. T. Jacobsen, R. B. Stewart, and R. D. McCarty. 1986, 11p
Pub. in International Jnl. of Thermophysics 7, n3 p491-501 1986.

Keywords: *Thermodynamic properties, *Ethylene, Equations of state, Reprints.

A new thermodynamic property formulation based upon a fundamental equation explicit in Helmholtz energy of the form A=A(rho, T) for ethylene from the freezing line to 450 K at pressures to 260 MPa is presented. A vapor pressure equation, equations for the saturated liquid and vapor densities as functions of temperature, and an equation for the ideal-gas heat capacity are also included. The fundamental equation and the derivative function for calculating internal energy, enthalpy, entropy, isochoric heat capacity (C sub v), isobaric heat capacity (C sub P), and velocity of sound are included. The fundamental equation reported here may be used to calculate pressures and densities with an uncertainty of plus or minus 0.1%, heat capacities within plus or minus 3%, and velocity of sound values within plus or minus 1%, except in the region near the critical point.

705,810
PB87-119772 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Orthobaric Liquid Densities and Dielectric Constants of Carbon Dioxide.
Final rept.
W. M. Haynes. 1986, 6p
Pub. in Advances in Cryogenic Engineering 31, p1199-1204 1986.

Keywords: *Carbon dioxide, *Density(Mass/volume), Dielectric properties, Reprints, *Dielectric constant.

Measurements of the orthobaric liquid densities and dielectric constants of carbon dioxide have been obtained at temperatures between 220 and 300 K. Densities were determined with a magnetic suspension densimeter, while a concentric cylinder capacitor was used for measurements of dielectric constant. The experimental densities and dielectric constants have been used to compute values for the Clausius-Mossotti function. Comparisons with the experimental results of other investigators are presented.

705,811
PB87-119780 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Dissociation of Diatomic Molecules at Metal Surfaces.
Final rept.
J. W. Gadzuk, and S. Holloway. 1985, 4p
Pub. in Chemical Physics Letters 114, n3 p314-317 1985.

Keywords: *Dissociation, Surface chemistry, Reprints, *Metal surfaces, *Diatomic molecules.

No abstract available.

705,812
PB87-119798 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Vibrational Lineshapes of Adsorbed Molecules.
Final rept.
J. W. Gadzuk, and A. C. Luntz. 1984, 22p
Pub. in Surface Science 144, n2-3 p429-450 1984.

Keywords: *Surface chemistry, Vibrational spectra, Adsorption, Molecules, Reprints.

The possible information content in lineshapes observed in vibrational spectroscopy of molecules adsorbed on surfaces is considered by drawing analogies with similar situations in other spectroscopic areas

where the systematics are more completely understood. Particular emphasis is placed on the relative roles of T(sub 1) (dissipative decay) vs. T'(sub 2) (pure dephasing) processes in determining linewidths, on the roles of substrate electron-hole pairs, phonons, and photons in T(sub 1) processes, and possible ways to establish which broadening mechanism is operative in a given situation. A particular kind of dephasing that is important for vibrational lineshapes in molecular crystals, so called exchange-coupling, is suggested as playing a significant role for molecular adsorbates as well. Some recent experimental studies are analyzed in the light of concepts introduced in the paper.

705,813
PB87-119806 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Energy Redistribution and Dissociation in Molecule-Surface Collisions Involving Charge Transfer/Surface Hopping.
Final rept.
S. Holloway, and J. W. Gadzuk. 1985, 13p
Pub. in Surface Science 152-153,n2 p838-850 1985.

Keywords: *Surface chemistry, Surfaces, Excitation, Dissociation, Vibration, Adsorption, Reprints, *Molecule collisions, Charge transfer.

In analogy with resonance electron scattering from molecules in which substantial high vibrational overtone losses are observed, beams of diatomic molecules scattered from solid surfaces could emerge highly vibrationally excited due to the formation of temporary negative molecular ions resulting from charge transfer between the solid and molecule on the inward and outward legs of the scattering trajectory. In the present work, the exact classical trajectories for the diatomic molecule, including internal vibrational motion, are calculated for motion over model diabatic potential surfaces in which surface hopping due to charge transfer/harpooning is accounted for. From these calculations, the probability for translational to vibrational energy transfer are obtained as a function of incident kinetic energy and system parameters.

705,814
PB87-120010 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Van der Waals Potentials from the Infrared Spectra of Rare Gas-HF Complexes.
Final rept.
G. T. Fraser, and A. S. Pine. 1986, 14p
Pub. in Jnl. of Chemical Physics 85, n5 p2502-2515, 1 Sep 86.

Keywords: *Hydrogen fluoride, *Rare gases, Infrared spectra, Reprints, *Binding energy, Van der Waals forces, Tunable lasers.

High-resolution infrared spectra of the Ar-HF, Kr-HF, and Xe-HF van der Waals molecules have been recorded in the vicinity of the H-F stretching fundamentals nu sub 1 under thermal equilibrium conditions at T approx. 211 K with a tunable difference-frequency laser. Rotational structure has been observed up to or approaching rotational predissociation, permitting us to model the effective radial van der Waals potentials for these complexes. These potentials provide good estimates for the binding energies, D(sub 0) and the van der Waals stretching frequencies nu sub 3, in the ground (nu sub 1 = 0) and excited (nu sub 1 = 1) states of the molecules.

705,815
PB87-120028 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Vibrational Population Lifetimes of OH(v=1) in Natural Crystalline Micas.
Final rept.
E. J. Heilweil. 1986, 7p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Chemical Physics Letters 129, n1 p48-54, 15 Aug 86.

Keywords: *Mica, Infrared spectra, Muscovite, Nonmetalliferous minerals, Hydrogen bonds, Crystal structure, Biotite, Reprints, *Vibrational lifetime, Picosecond pulses.

Picosecond infrared saturation-recovery measurements have been performed on the OH-stretching vibrations (3500-3710/cm) of hydroxyl groups located within the octahedral layers of ten naturally occurring crystalline micas. At room temperature, the average OH(nu = 1) vibrational population lifetime (T1 plus or minus sigma for OH(1-) in muscovite is 92 plus or minus 13 ps. For biotite samples, absorptions arising from two distinct lattice sites yield T1=221 plus or minus 23 and 87 plus or minus 33 ps, respectively. Crystal structures, hydroxyl orientation and hydrogen bonding, ionic environment and infrared spectroscopy of these mineral families are used to rationalize the observed relaxation times.

705,816
PB87-120226 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Photodissociation of Vinyl Chloride: Formation and Kinetics of Vinylidene H2CC((3)B2).
Final rept.
A. Fahr, and A. H. Laufer. 1985, 4p
Pub. in Jnl. of Physical Chemistry 89, n13 p2906-2909 1985.

Keywords: *Vinyl chloride, Chlorine organic compounds, Excitation, Concentration(Composition), Photolysis, Reprints, *Photodissociation, *Chemical reaction kinetics, *Vinylidene, Rate constants.

The primary photodissociation processes in the photolysis of vinyl chloride have been investigated using the flash photolysis-kinetic spectroscopic technique. Concentrations and temporal profiles of product H2CC((3)B2), HC1 and C2H2 are monitored by their absorption in the vacuum ultraviolet at 137, 139 and 151 nm, respectively. HC1 and H2CC((3)B2) are formed with the same time history via a 1,1 elimination from excited C2H3C1. Rate constants for the interaction of H2CC((3)B2) with He, 1.07 plus or minus 0.17 x 10 to the -14th power cc/molec s, and C2H3C1, 3.5 x 10 to the 11th power cc/molec s, have been obtained.

705,817
PB87-121331
(Order as PB87-121315, PC **A04**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Triple Point of Oxygen in Sealed Transportable Cells.
G. T. Furukawa. 19 Mar 86, 21p
Included in Jnl. of Research of the National Bureau of Standards, v91 n5 p255-275 Sep-Oct 86.

Keywords: *Oxygen, Calorimeters, Calibration, Phase transformations, Thermodynamic properties, *Triple points.

The triple points of oxygen samples sealed in miniature pressure cells were investigated by means of adiabatic calorimetry. The triple point of a 99.999 percent pure commercial oxygen sample was found to be 0.94 mK higher than that of an 'ultra-pure' sample prepared by thermal decomposition of potassium by thermal decomposition of potassium permanganate (KMnO4). The capsule-type platinum resistance thermometers that have been used are shown to have outstanding stability and the multiple calibrations made on them at the National Bureau of Standards extending over six years are shown to be consistent to within 0.15 mK at 54.361K. The results of measurements on an internationally circulated sealed cell of commercial oxygen show its temperature to by 0.58(sub 1) mK higher than those of the ultra-pure oxygen.

705,818
PB87-122248 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Differential Techniques of Kinetic Analysis of DSC (Differential Scanning Calorimetry) Data for Thermal and Photopolymerization Reactions.
Final rept.
J. H. Flynn. 1984, 5p
Pub. in Proceedings of North American Thermal Analysis Society Conference (13th), Philadelphia, PA., September 23-26, 1984, p229-233.

Keywords: *Reaction kinetics, Curing, Chemical reactions, Thermal analysis, Polymerization, *Photopolymerization, Differential scanning calorimetry.

The kinetics of bulk thermal or photochemical cure of resins are typically complex. Interpretation of the initial phase is beclouded by induction periods and irregular activation of radical initiators. Differential scanning calorimetry is ideal for monitoring these reactions as the amplitude is a robust measure of the rate of change in the enthalpy of propagation step--often the opening of a double bond to form a polymer linkage. Because of the above mentioned complexities it is prudent to perform isothermal measurement of these processes. Therefore, the paper develops isothermal differential techniques in which the rate is described as a function of time. Also, a quick method for estimating 'reaction order' from ratios of times to reach various fractions of an arbitrary initial rate is described. The above methods are illustrated by examples from photo and thermal cure DSC experiments.

705,819
PB87-122339 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electron Devices Div.
Advanced Integrated Test Structure for High Speed Measurement of Generation Lifetime.
Final rept.
D. McCarthy, M. G. Buehler, J. Acevedo, B. Stamps, and M. Lonky. 1978, 3p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Extended Abstracts, Electrochemical Society Fall Meeting, 1978, Monterey, CA., November 14-16, 1978, p488-490.

Keywords: *Electrochemistry, Semiconductor diodes, Lifetime(Durability), Silicon.

An integrated test circuit, consisting of a reverse biased gated diode connected to a source-follower MOSFET amplifier, was developed to rapidly measure the generation lifetime in a p-n junction. As many as 540 junctions were measured on a 55 mm diameter silicon wafer where the measurement time was less than 0.5 s per structure. Circuit models were developed which indicate how to design the circuit so as to simplify the analysis.

705,820
PB87-122354 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Calculation of Thermal Degradation Initiated by Random Scission. 1. Steady-State Radical Concentration.
Final rept.
A. Inaba, and T. Kashiwagi. 1986, 8p
Pub. in Macromolecules 19, n9 p2412-2419 Sep 86.

Keywords: *Thermal degradation, Concentration(Concentration), Molecular weight, Mathematical models, Chemical radicals, Reprints.

Changes in molecular weight distribution and in sample volume were calculated for thermal degradation of a polymer. The thermal degradation scheme consists of random scission initiation, depropagation, and disproportionation termination reactions. A steady-state radical concentration was used in the study. The initial molecular weight distribution of the sample was expressed by a logarithmic normal distribution. Results were obtained in two ways: one was by approximate analytical solutions describing changes in molecular weight and in the sample volume, including effects of initial polydispersity of the sample; the other was by numerical calculation. Comparison among the analytical solutions obtained in the study, previously published solutions, and the numerically calculated results indicates that the solutions obtained in the study can apply to more general initial molecular weight distributions and agree better with the numerical results than previously published results. Effects of initial molecular weight, average zip length, initial polydispersity, and order of the termination reaction on changes in molecular weight, polydispersity, and the volume of the sample are discussed.

705,821
PB87-122370 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Polarization Switching Versus Optical Bistability: Experimental Observations for a J(sub lower) = 1 to J(sub upper) = 0 Transition in a Fabry-Perot Cavity.
Final rept.
C. Parigger, P. Hannaford, and W. J. Sandle. 1986, 16p
Pub. in Physical Review A 34, n3 p2058-2072 Sep 86.

Keywords: Optical pumping, Reprints, *Samarium atoms, Optical bistability, Polarization.

Experiments on the steady-state, nonlinear behavior of the (sup 7)F(1)-(sup 7)F(0) 570.68-nm transition of atomic samarium in a laser-driven, near-concentric Fabry-Perot cavity are reported. For zero applied magnetic field, only simple optical bistability, symmetric in both sigma(+) and sigma(-) transmitted polarization, is observed for a linearly polarized excitation beam. However, for a magnetic field applied parallel to the propagation direction, polarization-sensitive switching appears, with lowest power threshold near the edge of the Doppler-broadened region. Subsidiary measurements of atomic parameters are also given to enable the transition to be experimentally well characterized.

705,822
PB87-122388 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron Affinities of the Alkali Halides and the Structure of Their Negative Ions.
Final rept.
T. M. Miller, D. G. Leopold, K. K. Murray, and W. C. Lineberger. 1986, 8p
Grant NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 85, n5. p2368-2375, 1 Sep 86.

Keywords: *Haloalkanes, Molecular structure, Ground states, Reprints, *Electron affinity, Photoelectron spectroscopy, Negative ions.

Photoelectron spectra are reported for the MX(X tilde (sup 1 Sigma)(1+))+e(1-)<-MX-(1-) X tilde (sup 2 Sigma(1+)) transitions of ten alkali halide anions at 488 nm. Adiabatic electron affinities (plus or minus 0.010 eV) are determined to be 0.593 (LiC1), 0.520 (NaF), 0.727 (NaC1), 0.788 (NaBr), 0.865 (NaI), 0.582 (KCl), 0.642 (KBr), 0.728 (KI), 0.543 (RbCl) and 0.455 eV (CsCl). Fundamental vibrational frequencies, equilibrium bond lengths, and dissociation energies are also reported for the anion sup 2 Sigma(1+) ground states. An observed linear correlation of electron affinities with alpha/r(sup 2) (alpha = metal atom polarizability) is used to predict the electron affinities of the remaining alkali bromides and iodides, as well as related alkali salts. A simple electrostatic model for the alkali halide anions is also presented which enables the accurate (plus or minus 0.1 eV) calculation of electron affinities.

705,823
PB87-122396 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Reaction Mechanism and Kinetics of Silane Pyrolysis on a Hydrogenated Amorphous Silicon Surface.
Final rept.
R. Robertson, and A. Gallagher. 1986, 8p
Sponsored by Solar Energy Research Inst., Golden, CO.
Pub. in Jnl. of Chemical Physics 85, n6 p3623-3630, 15 Sep 86.

Keywords: *Silicon, Silane, Pyrolysis, Surface chemistry, Substrates, Reprints, *Chemical reaction kinetics, Amorphous silicon.

Three regimes of pressure and temperature are identified in which silane pyrolysis has distinctly different initial kinetics: in two regimes the initial reactions are heterogeneous and in the third regime it is homogeneous. The authors report here a preliminary model for the heterogeneous reaction regime where the decomposition rate is nearly independent of pressure. In the model the silicon surface is saturated with hydrogen and hence is nonreactive. The rate limiting step for silane decomposition is the creation of reactive surface sites by release of hydrogen. These reactive sites are refilled by decomposition of SiH4 or reincorporation of H2. A new adsorbed state of SiH4 is proposed which is bound to the surface by a three-center bond. After making some simplifications to the full model the kinetics are solved for static-and flowing-gas hot wall reactor experiments. The implications of the proposed reactions for the other two pyrolysis regimes and for silane discharges are briefly discussed.

705,824
PB87-122412 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Impure Steam Near the Critical Point.
Final rept.
J. M. H. L. Sengers, C. M. Everhart, G. Morrison, and R. F. Chang. 1984, 11p
Pub in Proceedings of International Conference on the Properties of Steam (10th), Moscow, USSR, September 3-7, 1984 p277-287.

Keywords: *Steam, Thermodynamic properties, Sodium chloride, Specific heat, Critical point, Solutions, Impurities.

The thermodynamic properties of dilute near-critical mixtures are given according to a classical and a nonclassical model. Measurements obtained in dilute solutions of NaCl in near-critical steam are discussed in the light of these models. Questions are raised regarding the validity near the critical point of extended Debye-Huckel formulations recently proposed by Pitzer et al.

705,825
PB87-122420 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Photoinduced Evaporation of Charged Clusters.
Final rept.
P. C. Engelking. 1986, 8p
Pub. in Jnl. of Chemical Physics 85, n5 p3103-3110, 1 Sep 86.

Keywords: *Evaporation, *Carbon dioxide, Reprints, Clusters, Photodissociation.

The average cluster size remaining after photoinduced evaporation of a cluster of specific initial size can be predicted by an RRK/QET statistical model, provided that the correct average kinetic energy release is used. Theoretical justification for this correction, based upon detailed balance, is provided here. Agreement with experiments on (CO2(1+)sup n clusters at several wavelengths shows that for these aggregates the average bond strength above n=2 is approximately 3.6 plus or minus 0.6 kcal/mol.

705,826
PB87-122446 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Approximate Rotational Band Shifts.
Final rept.
P. C. Engelking. 1986, 2p
Pub. in Jnl. of Physical Chemistry 90, n19 p4544-4545 1986.

Keywords: *Spectroscopic analysis, Band spectra, Rotational vibration, Reprints.

Interpretation of spectroscopic experiments in which the rotational lines are not resolved often requires an expression for the shift of the center of the rotational band. Previous expressions are corrected and extended to cases of linear, symmetric, spherical, and asymmetric rotors, with typical accuracy of a fraction of the rotational B constant.

705,827
PB87-122479 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Band Broadening of CH2 Vibrations in the Raman Spectra of Polymethylene Chains.
Final rept.
S. L. Wunder, M. I. Bell, and G. Zerbi. 1986, 13p
Pub. in Jnl. of Chemical Physics 85, n7 p3827-3839, 1 Oct 86.

Keywords: Alkanes, Vibrational spectra, Raman spectra, Polymers, Reprints, *Line broadening, *Polymethylene.

The isotropic and anisotropic linewidths of methylene vibrations in a homologous series of alkanes of increasing chain length have been measured in the liquid state as a function of temperature. The bandwidths of the CH2 symmetric stretching modes, which are in Fermi resonance with overtones of the CH2 bending vibrations, are temperature insensitive over a 200 K interval; this is best explained in terms of a vibrational dephasing mechanism (inhomogeneous broadening) for these modes. In contrast, for the bending and antisymmetric stretching vibrations, significant band broadening occurs over this same temperature interval. In addition, for these modes, both the absolute value of the bandwidth and the relative rate of increase of the bandwidth with increasing temperature, decrease with increasing chain length. These observations are consistent with a reorientational broadening mechanism as the principal bandwidth contribution for these vibrations.

705,828
PB87-122578 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Characterization of the Imaging Properties of a Double-Pass Cylindrical-Mirror Analyzer.
Final rept.
N. E. Erickson, and C. J. Powell. 1986, 7p
Pub. in Surface and Interface Analysis 9, p111-117 1986.

Keywords: Surfaces, Electron beams, Electron energy, Reprints, *Photoelectron spectroscopy, Auger electron spectroscopy, Imaging techniques.

The imaging properties of a double-pass cylindrical-mirror analyzer have been investigated using extensions of the technique recently described by Seah and Mathieu. Elastic-peak intensity data obtained as an electron beam was rastered across a test specimen, was recorded in digital form and later used to generate 'three-dimensional' images. Images have been obtained for a range of operating conditions and for displacements of the specimen from its optimum position. Measured image widths were in semi-quantitative agreement with those expected from a simple analysis although deviations attributed to instrument imperfections were found. Elastic-peak images provide a convenient and quantitative means of assessing instrument performance and defining the specimen area being analyzed for the selected conditions.

705,829
PB87-122586 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Dynamics of the Laser-Induced Thermal Desorption of Nitric Oxide from a Platinum Foil.
Final rept.
D. R. F. Burgess, D. A. Mantell, R. R. Cavanagh, and D. S. King. 1986, 2p
Contract DE-AI05-84ER13150
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 85, n5 p3123-3124, 1 Sep 86.

Keywords: *Nitric oxide(NO), *Desorption, Platinum, Surface chemistry, Kinetic energy, Reprints, Time-of-flight method.

The internal and kinetic energy distributions of nitric oxide, which was desorbed from a cold polycrystalline platinum foil by laser-induced thermal desorption, were measured using a laser-excited fluorescence, time-of-flight technique. Under irradiation conditions which are estimated to produce a maximum surface temperature of 320 K, the desorbed NO was represented by two distributions of molecules: a translationally energetic component with a mean kinetic energy E(sub T) = 450 meV, a rotational temperature T(sub R) = 410 K, and a vibrational temperature T(sub V) = 800 K; and a slower component with E(sub T) = 57 meV and T(sub R) = 170 K.

705,830
PB87-122594 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Surface Chemical Analysis - Report on the VAMAS (Versailles Project on Advanced Materials and Standards) Project.
Final rept.
C. J. Powell, and M. P. Seah. 1986, 5p
Contract DE-AI05-84ER13150
Pub. in Jnl. of Chemical Physics 85, n5 p3123-3124, 1 Sep 86.

Keywords: *Surfaces, *Chemical analysis, Standards, Reprints, Reference materials, VAMAS project.

The VAMAS project on surface chemical analysis is a multi-national cooperation for the provision of standards data and materials for surface chemical analysis measurement and for the provision of the basic understanding necessary for these activities. The project is one of a rapidly growing suite of projects initiated as a result of decisions following the 1982 Versailles Summit Meeting of the Heads of State or Government of Canada, France, Germany, Italy, Japan, UK, USA and the representatives of the Commission of the European Communities. During the past year national

representatives to the VAMAS project have been appointed and national committees established. The article summarizes the philosophy, scope, and organization of the project and describes specific activities that have been initiated. Information is given on how individuals, both within and outside the group of member states, may participate.

705,831
PB87-122727 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Length and Mass Div.
Electric Field Effects in Rydberg Atoms.
Final rept.
D. A. Harmin. 1985, 16p
Pub. in Comments on Atomic and Molecular Physics 15, n6 p281-296 1985.

Keywords: *Stark effect, Symmetry, Density, Atomic spectra, Reprints, Autoionization.

A comprehensive, nonperturbative theory of the dc Stark effect in non-hydrogenic atoms is outlined for any multichannel spectrum amenable to a quantum-defect analysis. The density of atomic states is obtained, through a geometrical transformation, in terms of atomic parameters and separate hydrogenic barrier effects.

705,832
PB87-122735 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Length and Mass Div.
Asymmetry of Field-Induced Shape Resonances in Hydrogen.
Final rept.
D. A. Harmin. 1985, 7p
Pub. in Physical Review A 31, n5 p2984-2990 May 85.

Keywords: *Hydrogen, Resonance, Stark effect, Reprints.

Asymmetric resonance profiles observed in H atoms in a strong electric field are derived analytically. The most significant deviations from a Lorentzian lineshape, H sup F = gamma/e(sup Z) + gamma (sup Z), occur for resonances near the top of a potential barrier. Parametrization as a Fano profile is inappropriate. The lineshape formula, a Lorentzian with energy dependent reduced width gamma(sub Q) (e) = ln(1+Q(1-Q) (sup (-1-e))/ln(1-Q) (sub -1), depends on a single asymmetry parameter Q (0 plus or minus Q plus or minus 1).

705,833
PB87-122768 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Theoretical Studies of Potential Gas-Phase Charge-Transfer Complexes: NH3 + HX (X = Cl, Br, I).
Final rept.
P. Jasien, and W. Stevens. 1986, 5p
Pub. in Chemical Physics Letters 130, n1-2 p127-131, 26 Sep 86.

Keywords: *Ammonia, Hydrogen bonds, Gases, Haloalkanes, Hydrogen bromide, Hydrogen chloride, Hydrogen iodide, Reprints, Charge transfer.

Theoretical calculations of the potential curves for the NH3 + HX systems (X = Cl, Br, I) predict only a single minimum for the HCl and HBr complexes, corresponding to the hydrogen-bonded structure. In the case of the HI complex, a double-well proton-transfer potential curve with a small barrier is found. The presence of the second minimum corresponding to the NH4(1+) I (1-) structure may result in an anomalous intensity and transition energy for excitation of the HI stretch in the NH3-HI complex.

705,834
PB87-127999 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Use of Synchrotron Radiation to Measure Electron Attenuation Lengths in Condensed Molecular Solids.
Final rept.
R. Stockbauer, R. L. Kurtz, N. Usuki, and T. E. Madey. 1986, 5p
Pub. in Nuclear Instruments and Methods in Physics Research A246, p820-824 1986.

Keywords: *Surface chemistry, Photoelectrons, Thickness, Solids, Substrates, Reprints, Synchrotron radiation.

The authors describe a method for using synchrotron radiation to measure accurately electron attenuation lengths in condensed molecular solids as a function of electron energy. It consists of measuring the attenuation of photoelectrons from a well characterized, relatively inert, cooled surface as a condensable overlayer is deposited. As photoelectrons from the substrate escape they pass through and are scattered in the overlayer. This scattering appears as a decrease in the intensity of the substrate photoelectron peak. The measurement of this decrease as a function of layer thickness gives the electron attenuation lengths directly. By using monochromatized synchrotron radiation for the photoemission excitation source, one can tune the photon energy and, hence, obtain the attenuation lengths as a function of electron kinetic energy. The techniques developed for obtaining a uniform overlayer film and for determining its thickness are given in detail. These techniques are applicable to most condensable samples that can be introduced into the vacuum system as a gas.

705,835
PB87-128039 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
2s(2) 2p(5) - 2s 2p(6) Transitions in Fluorinelike Ions from Zr(31+) to SN(41+).
Final rept.
J. Reader, C. M. Brown, J. O. Ekberg, U. Feldman, J. F. Seely, and W. E. Behring. Nov 86, 3p
Contract DE-AI08-84-DP40092/26
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of the Optical Society of America B3, n11 p1609-1611 Nov 86.

Keywords: *Atomic energy levels, Excitation, Wavelengths, Zirconium, Tin, Plasma(Physics), Reprints, *Fluorinelike ions.

Transitions of the type 2s(2) 2p(5) - 2s2p(6) have been observed in eight fluorinelike ions from Z(31+) to Sn(41+). The spectra were produced by focusing light from the Nd:glass Omega laser at the University of Rochester onto solid targets and photographing the resultant plasmas with a 3-m grazing-incidence spectrograph. The identified transitions are in the region 24-60 A. The measured wavelengths are in good agreement with wavelengths calculated with the semiempirical formulas of Edlen (Phys.xScr. 28, 51 (1983). Wavelengths for the 2s(2) 2p(5) doublet P(sub 3/2) - doublet P(sub 1/2) magnetic-dipole transitions are given for each ion.

705,836
PB87-128047 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Specific Heats (Cv) of Saturated and Compressed Liquid and Vapor Carbon Dioxide.
Final rept.
J. W. Magee, and J. F. Ely. 1986, 20p
Sponsored by National Research Council, Washington, DC.
Pub. in International Jnl. of Thermophysics 7, n6 p1163-1182 Nov 86.

Keywords: *Carbon dioxide, *Specific heat, Thermophysical properties, Reprints, *Heat capacity.

Specific heats of saturated liquid carbon dioxide (C sub sat) have been measured in the temperature range 220 to 303 K. Specific heats at constant volume (C sub v) have been measured at 12 densities ranging from 0.2 to 2.5 times the critical density in the temperature range 233 to 330 K, with pressures varying from 3.4 to 32 MPa. The measurements have been conducted in an adiabatic constant-volume calorimeter of conventional design. Uncertainty of the specific heats is estimated to not exceed 2.0%. Comparisons are made with an extended Benedict-Webb-Rubin equation of state and with the results of other workers.

705,837
PB87-128096 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Gas-Phase Hydrolysis of SOF2 and SOF4.
Final rept.
R. J. Van Brunt, and I. Sauers. 1986, 4p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Jnl. of Chemical Physics 85, n8 p4377-4380, 15 Oct 86.

Keywords: Hydrolysis, Reprints, *Chemical reaction kinetics, *Fluoride/thionyl, *Tetrafluoride/thionyl, Vapor phases.

The rates for gas-phase hydrolysis of SOF2 (thionylfluoride) and SOF4 (thionyl tetrafluoride) have been measured at a temperature of 298 K. The second order rate constant for SOF2 hydrolysis in SF6 buffer gas was found to have the value (1.2 + or - 0.3) x 10 to the -23 power cc/s which agrees with previous estimates of Sauers, et al., but is three orders of magnitude lower than the value obtained by Ruegsegger, et al. at 340 K. The rate constant for SOF4 hydrolysis has not previously been measured and its value in both SF6 and N2 buffer gases was found here to be (1.0 + or - 0.3) x 10 to the -21st power cc/s.

705,838
PB87-128229 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Comparison of Some Thermodynamic Properties of H2O from 273.15 to 473.15 K as Formulated in the 1983 ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers) Tables and the 1983 NBS/NRC Steam Tables.
Final rept.
R. W. Hyland. 1985, 7p
Pub. in Proceedings of the International Symposium on Moisture Humidity, p29-35 1985.

Keywords: *Water, *Thermodynamic properties, Enthalpy, Entropy.

In 1983 two independent studies of the thermodynamic properties of saturated H2O were completed, one by Wexler and Hyland (WH) and a second by Haar, Gallagher, and Kell (HGK). WH includes only saturated phases for 173.15 < or = +0 T < or = +0 473.15 K, and is derived from fitting equations to data for particular parameters. HGK includes the entire thermodynamic surface over the temperature range 273.15 < or = +0 T < or = +0 2500 K and the pressure range O < or = +0 P < or = +0 3 x 10 to the 9th power Pa, and is derived from the Helmholz function. Because of the differences in approach and scope, it is of interest to compare the formulations in their region of overlap. The paper includes comparisons for the specific volumes, enthalpies, and entropies of the liquid and vapor states. Also given are comparisons for the vapor pressure and second virial coefficients. Generally, the agreement is within the stated uncertainties of the two formulations.

705,839
PB87-128294 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Vibrational Predissociation of the Nitric Oxide Dimer: Total Energy Distribution in the Fragments.
Final rept.
M. P. Casassa, J. C. Stephenson, and D. S. King. 1986, 2p
Pub. in Jnl. of Chemical Physics 85, n4 p2333-2334, 15 Aug 86.

Keywords: *Nitrogen oxide(NO), *Dissociation, Vibration, Reprints, *Energy distribution, Van der waals forces.

Rotational-, spin-orbit-, lambda doublet-, and kinetic energy distributions were measured by laser-excited fluorescence techniques for the nitric oxide fragments formed from the vibrational predissociation of nitric oxide dimers in a free jet expansion. The NO fragments, produced following excitation in the dimer -nu sub 1 fundamental, were described by a rotational temperature of TR=102 K, with full equilibration of lambda doublet states, and a spin-orbit 'temperature' TSO=175 K. The velocity distributions were isotropic with an average fragment kinetic energy of 245/cm.

705,840
PB87-128419 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Differential Techniques for the Kinetic Analysis of DSC Data.
Final rept.
J. H. Flynn. 1985, 4p
Pub. in Thermochimica Acta 92, p153-156 1985.

Keywords: Thermal analysis, Chemical reactions, Thermochemistry, Reprints, *Chemical reaction kinetics, Differential scanning calorimetry.

A simple technique for the kinetic analysis of rate vs. time data from an isothermal DSC experiment is presented. Selected ascending or descending sections of the rate curve are fitted to dq/dt = k(q sub 0 + or - q) (sub n). Values for n are determined and their consistency tested by the ratios of times to reach reduced rates of reaction.

705,841
PB87-128427 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Temperature Gradients in Horizontal Tube Furnaces.
Final rept.
J. H. Flynn, and L. A. Dunlap. 1986, 4p
Pub. in Thermochimica Acta 105, p215-218 1986.

Keywords: *Temperature gradients, Thermal analysis, Temperature measurement, Calibrating, Temperature control, Laminar flow, Furnaces, Reprints.

Radial temperature differences in a 1 in. diameter horizontal tube furnace similar to those used in thermogravimetry were measured as a function of purge gas flow rate and pressure at temperatures from 25 to 525 deg C. The temperature difference between a thermocouple at the tube axis and one 0.8 cm off center was 45 deg C at 400 deg C, 1 atm pressure of nitrogen and 25 ml/min flow rate. The large temperature difference was attributed to laminar flow conditions. Effects of these large radial variations on temperature measurement and calibration are discussed. Several methods for minimizing these temperature differences by insertion of in-line preheaters and mixers are suggested.

705,842
PB87-128443 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Thermoneutral Isotope Exchange Reactions in Proton-Bound Complexes of Water with Organic Molecules: Correlations with Energetics of Formation of the Corresponding Association Ions.
Final rept.
S. G. Lias. 1984, 7p
Pub. in Jnl. of Physical Chemistry 88, n19 p4401-4407 1984.

Keywords: Isotope exchange, Chemical reactions, Reprints, *Ion-molecule collisions, *Chemical reaction kinetics.

The efficiencies of the reaction: MH(1+) + D2O -> MD(1+) + HDO or the analogous reaction in which deuteration is reversed have been measured for the cases, M = formaldehyde, acetaldehyde, methanol, methyl formate, propionaldehyde, dimethylether, 1,4-dioxane, acetone, diethylether, di-n-propylether, and pyridine. A quantitative evaluation of the model used in estimating well depths leads to the conclusion that the energies of association in such complexes are primarily electrostatic in nature, since the model, which considers only electrostatic interactions, predicts well depths in close agreement with those obtained by experiment or ab initio calculations.

705,843
PB87-128468 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Collisional Quenching of Excited Vinylidene ((3)B2) Radicals.
Final rept.
A. Fahr, and A. H. Laufer. 1986, 4p
Pub. in Jnl. of Physical Chemistry 90, n21 p5064-5067, 9 Oct 86.

Keywords: Excitation, Chemical radicals, Reprints, *Chemical reaction kinetics, *Vinylidene radicals, Rate constants, Quenching.

Rate constants for the removal of excited-state vinylidene D2CC ((3) B 2) in the presence of He, Ar, N2, H2, CO, and CH4 are reported at room temperature.

705,844
PB87-128815 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Shear-Induced Phase Changes in Mixtures.
Final rept.
K. D. Romig, and H. J. M. Hanley. 1986, 9p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in International Jnl. of Thermophysics 7, n4 p877-885 Jul 86.

Keywords: *Phase transformations, *Shear tests, Mixtures, Thermophysical properties, Reprints.

A thermodynamic theory to account for the behavior of liquid mixtures exposed to a shear is developed. One consequence of the theory is that shear-induced phase changes are predicted. The theory is based on a thermodynamics that includes specifically the shear rate in the formalism and is applied to mixtures by a straightforward modification of the corresponding states, conformal-solution approach. The approach is general but is used here for a mixture of Lennard-Jones particles with a Lennard-Jones equation of state as a reference fluid. The results are discussed in the context of the Scott and Van Konynenberg phase classification. It is shown that the influence of a shear does affect substantially the type of the phase behavior. Results from the model mixture are equated loosely with those from real polymeric liquids.

705,845
PB87-128823 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Extended Corresponding States as a Tool for the Prediction of the Thermodynamic Properties of Mixtures.
Final rept.
R. D. McCarty. 1986, 10p
Pub. in International Jnl. of Thermophysics 7, n4 p901-910 Jul 86.

Keywords: Themodynamic properties, Nitrogen, Methane, Ethane, Equations of state, Reprints, *Binary mixtures.

The principle of corresponding states, with one of its many extensions, is used to predict the thermodynamic properties of the binary mixtures N2-CH4 and CH4-C2H6. Comparisons of the predicted properties with experimental data are given to illustrate some of the powers and problems associated with the method. Problems encountered in modeling mixtures, which are not necessarily associated with the mathematical model of the equation of state, are also discussed. Wide-range equations of state for the two binary systems mentioned above are presented.

705,846
PB87-128831 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Thermodynamic Behavior of Fluids Near the Critical Point.
Final rept.
J. V. Sengers, and J. M. H. Levelt Sengers. 1986, 34p
Pub. in Annual Review of Physical Chemistry 37, p189-222 1986.

Keywords: *Fluids, Thermophysical properties, Gravity, Reprints, *Critical points.

The chapter reviews the current state of knowledge of the thermodynamic behavior of fluids and fluid mixtures near the gas-liquid critical point. The concepts of simple, revised and extended scaling are explained, as they have evolved from the principle of critical point universality and the renormalization group approach. Critical point parameters and critical amplitudes are given for a dozen one component fluids, and revised and extended scaled formulations for five. The ranges of validity of these formulation and the problem of crossover to classical behavior are discussed. Several formulations of critical behavior, including their limitations, are described for fluid mixtures, and applications to vapor liquid phase equilibria, dilute mixtures and supercritical solubility are presented. The extrinsic and intrinsic effects of gravity on near critical fluids are described.

705,847
PB87-131439 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Collision-Induced Radiative Transitions at Optical Frequencies.
Final rept.
P. S. Julienne. 1985, 22p
Pub. in Phenomena Induced by Intermolecular Interactions, p749-771 1985.

Keywords: Molecular spectroscopy, *Radiative collisions, *Atomic collisions, Optical frequency.

A brief overview is given in the field of collision-induced atomic radiative transitions at optical frequencies, including both collision-induced forbidden transitions and light induced collisional energy transfer (LICET). The main focus is on the theory of such processes. The theory of scattering in a radiation field can be used to calculate absorption or emission profiles, and the distribution of final product states. Several simplifying approximations greatly facilitate a qualitative understanding of the profile, but may fail in quantitative studies.

705,848
PB87-131447 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Nonadiabatic Theory of Atomic Line Broadening: Final-State Distributions and the Polarization of Redistributed Radiation.
Final rept.
P. S. Julienne, and F. H. Mies. 1984, 13p
Pub. in Physical Review A: General Physics 30, n2 p831-843 Aug 84.

Keywords: Absorption, Reprints, *Line broadening, Electronic structure, Atom collisions.

The close coupled theory of atomic collisions in the presence of a radiation field may be used to calculate the distribution of final atomic states which results from absorption of polarized light during a collision. The theory applies equally well to optical collisions (line broadening) and to radiative collisions (laser induced collisional energy transfer). For an optical collision the detuning omega - omega (sub infinity) is restricted to be larger than either the Rabi frequency or the widths due to natural, Doppler, or pressure broadening. The radiation field is assumed to be weak enough that the transition probabilities are linear in field intensity. The molecular picture is emphasized in which the wavefunction is expanded in a basis of field-free molecular states and the Hamiltonian is blocked in accordance with molecular quantum numbers.

705,849
PB87-131454 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Ab Initio Calculations of the Rotational Barriers in Formamide and Acetamide: The Effects of Polarization Functions and Correlation.
Final rept.
P. Jasien, W. Stevens, and M. Krauss. 1986, 10p
Pub. in Jnl. of Molecular Structure (Theochem) 139, p197-206 1986.

Keywords: *Acetamides, Molecular structure, Amides, Reprints, *Formamide, Rotational barriers.

Ab initio calculations have been used to determine the gas-phase rotational barrier about the CN bond in formamide and acetamide. The results indicate that the inclusion of polarization functions in the basis set leads to a substantial decrease (ca. 5 kcal/mol) in the calculated barrier height at the SCF level. Electron correlation effects decrease the barrier by less than 1 kcal/mol, while the addition of zero point energy corrections changes the barrier height only slightly. Based upon the current calculations, the 0 K rotational barriers for isolated formamide and acetamide are predicted to be 14.2 and 12.5 kcal/mol, respectively.

705,850
PB87-131462 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Population Lifetimes of OH(v=1) and OD(v=1) Stretching Vibrations of Alcohols and Silanols in Dilute Solution.
Final rept.
E. J. Heilweil, M. P. Casassa, R. R. Cavanagh, and J. C. Stephenson. 1986, 15p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Chemical Physics 85, n9 p5004-5018, 1 Nov 86.

Keywords: *Molecular relaxation, Alcohols, Vibrations, Reprints, *Lifetime, Silanols, Picosecond pulses.

Picosecond infrared pump-probe experiments determined the vibrational population lifetimes (T1) of the hydroxyl fundamental stretching mode OH(nu = 1) in 12 alcohols (R3COH) and 8 silanols (R3SiOH) in dilute room temperature CCl solutions. T sub 1 for the silan-

ols is in the range 185 < T sub 1 < 292 ps, while T sub 1 for the alcohols is much less (T sub 1 < 80 ps). The deuterium-exchanged analogs (COD and SiOD) exhibit population relaxation times similar to protonated hydroxyls. An analysis of the vibrational energy levels corresponding to modes involving the four bonds nearest the hydroxyl groups of these molecules is used to qualitatively explain the trends of the observed T sub 1 lifetimes for these systems. Solution T sub 1 lifetimes are also compared to those previously measured for OH (nu = 1) on the surface of silica and in other condensed phase, room temperature systems.

705,851
PB87-131512 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of the Director.
Comparison of Algorithms for X-ray Mass Absorption Coefficients.
Final rept.
K. F. J. Heinrich. 1986, 2p
Pub. in Microbeam Analysis-1986, p279-280.

Keywords: Algorithms, Absorption, Data reduction, Microanalysis, X-ray absorption, *Mass absorption coefficients, Electron probes.

A new model for the calculation of mass absorption coefficients is presented which takes into account the inaccuracy of the model mu = (C)(lambda sub n) used in the current algorithms for estimating mu, which are incorporated in data reduction programs for electron probe microanalysis.

705,852
PB87-131827 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Simulation of Aerosol Agglomeration in the Free Molecular and Continuum Flow Regimes.
Final rept.
R. D. Mountain, G. W. Mulholland, and H. Baum. Nov 86, 15p
See also PB87-107777. Sponsored by Defense Nuclear Agency, Washington, DC.
Pub. in Jnl. of Colloid and Interface Science 114, n1 p67-81 Nov 86.

Keywords: *Aerosols, *Agglomeration, Colloids, Brownian movement, Soot, Reprints, Fractals.

The formation of high temperature aerosol agglomerates is simulated by following the Langevin trajectory of each particle with the boundary condition that the particles stick upon collision. Both the free molecular and continuum flow are treated. A new derivation of the friction force of an agglomerate in the continuum limit is developed based on the evaluation of the surface momentum flux at the Oseen flow limit. The agglomerates can be described as a fractal, at least in regard to the power law relationship between mass and size, with a dimensionality of 1.7-1.9 independent of the flow regime. The particle growth is shown to be much more rapid in the free molecular regime than in the continuum. The global kinetics are shown to be consistent with a similarity analysis of the coagulation equation with a modified coagulation coefficient. Comparison between the simulation and coagulation theory at small time suggests a slight fluctuation enhancement in the free molecule case and a small-time enhancement of the coagulation rate at high concentration for the continuum case.

705,853
PB87-132064 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Enthalpy of Combustion of Purine.
Final rept.
D. R. Kirklin, and E. S. Domalski. 1984, 9p
Pub. in Jnl. of Chemical Thermodynamics 16, n7 p633-641 1984.

Keywords: *Combustion, *Enthalpy, *Purines, Thermodynamic properties, Chemical reactions, Nitrogen heterocyclic compounds, Heat of formation, Reprints.

The enthalpy of combustion for a commercial purine sample of better than 99 percent purity was measured in an aneroid adiabatic bomb calorimeter. The enthalpy of combustion at 298.15 K for the reaction, C5H4N4(c) + 6 O2(g) -> 5 CO2(g) + 2 H2O(l) + 2 N2(g) is delta(sub c) H = -(2708.63 + or - 2.23) kJ/mol. The corresponding enthalpy of formation for purine, C5H4N4, is delta(sub f) H = (169.42 + or - 2.26) kJ/mo1.

705,854
PB87-132254 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Site Specificity in Stimulated Desorption from TiO2.
Final rept.
R. L. Kurtz, R. Stockbauer, and T. E. Madey. 1985, 5p
Pub. in Springer Ser. Surf. Sci. 4, p89-93 1985.

Keywords: *Surfaces, *Desorption, *Titanium dioxide, Chemisorption, Surface chemistry, Oxides, Reprints, Synchrotron radiation.

Synchrotron radiation has been combined with surface characterization techniques to study electron and photon-stimulated ion desorption from single-crystal TiO2. TiO2 is the model system for the Knotek-Feibelman mechanism describing the production and desorption of O(1+)-ions because it is a maximal-valent oxide: the Ti 3d-electron population on the stoichiometric, annealed surface is minimal. O-vacancy defects associated with appreciable Ti 3d-electron population can be created resulting in a non maximal-valent surface and straightforward interpretation of the Knotek-Feibelman mechanism would predict a reduced O(1+)-ion yield. Unexpected total ion-yield results have been obtained, however, and are shown to add new insights to the field of stimulated desorption.

705,855
PB87-134177 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
High Resolution IR Laser Spectroscopy of van der Waals Complexes in Slit Supersonic Jets: Observation and Analysis of nu(sub 1), nu(sub 1) + nu(sub 2), and nu(sub 1) + 2nu(sub 3) in ArHF.
Final rept.
C. M. Lovejoy, M. D. Schuder, and D. J. Nesbitt. 1986, 13p
Grant NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 85, n9 p4890-4902, 1 Nov 86.

Keywords: Infrared spectroscopy, Supersonic aircraft, Jet aircraft, Reprints, *Van der Waals forces, Argon hydrogen fluorides, Tunable lasers.

IR spectra of jet cooled ArHF are obtained via direct absorption of a high resolution tunable difference frequency laser in a 2.54 cm path length, slit supersonic pulsed expansion at <10 K. Detection limits of 2x 10 to the 9th power molecules/cc/quantum state permit observation of the high frequency nu(sub 1) fundamental stretch (10(sup 0) 0) <- 00(sup 0) 0, the nu(sub 1) + nu(sub 2) van der Waals bend plus stretch combination band (11 (sup 1) 0) (00(sup 0) 0), as well as transitions to the 10(sup 0) 2 triply vibrationally excited state that are weakly allowed via Coriolis interactions with the Pi(sub 1+) component of the (11 (sup 1) 0) manifold. The ground state (00(sup 0) 0) molecular constants are in excellent agreement with previous microwave data.

705,856
PB87-134201 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Ionisation of a One-Dimensional Hydrogen Atom by a Resonant Electric Field.
Final rept.
J. N. Bardsley, and M. J. Comella. 1986, 4p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 19, pL565-L568 1986.

Keywords: Excitation, Reprints, *Hydrogen atoms, *Multiphoton ionization, Rydberg states.

The complex coordinate method is used in quantum calculations of the rate of ionization of highly excited states of H atoms by microwave radiation. The results are compared with classical calculations by Leopold and Richards.

705,857
PB87-134235 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Threshold Shift and Above-Threshold Multiphoton Ionization of Atomic Hydrogen in Intense Laser Fields.
Final rept.
S. I. Chu, and J. Cooper. 1985, 7p
Grant NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Physical Review A: General Physics 32, n5 p2769-2775 Nov 85.

Keywords: Ionization potentials, Reprints, *Hydrogen atoms, *Multiphoton ionization.

Accurate ab initio nonperturbative L(sup2) non-Hermitian Floquet calculations for intensity-dependent threshold shifts and ground-state total ionization widths (rates) for one-, two-, and three-photon-dominant intense-field ionization of atomic hydrogen are presented. The results show the importance of both the ac Stark shift and the pondermotive potential in the determination of the net threshold shift. In addition, branching ratios to individual continua have been estimated, yielding physical insights regarding the general features and mechanisms of the frequency- and intensity-dependent continuum-continuum transitions and 'peak switching' phenomena in the above-threshold ionization processes.

705,858
PB87-134250 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Silane Discharge Gas and Surface Reactions.
Final rept.
A. Gallagher. 1985, 12p
Pub. in Proceedings of Symposium on Plasma Synthesis and Etching of Electronic Materials, Boston, MA., November 27-30, 1984, v38 p99-110 1985.

Keywords: *Silanes, Discharge, Chemical radicals, *Surface reactions.

Ion chemistry and neutral radical chemistry in silane discharges are described. A method by which the dominant SiH3 radical produces surface growth is suggested, and surface reactions are suggested as the principal source of Si2Hn species.

705,859
PB87-134268 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Preparation and Detection of Alignment with High /m/ Selectivity by Saturated Laser Optical Pumping in Molecular Beams.
Final rept.
U. Hefter, G. Ziegler, A. Mattheus, A. Fischer, and K. Bergmann. 1986, 17p
Pub. in Jnl. of Chemical Physics 85, n1 p286-302, 1 Jul 86.

Keywords: Atomic energy levels, Orientation, Neon, Sodium, Reprints, *Molecule-molecule collisions, Optical pumping, Molecular beams.

The authors describe a technique for preparation of molecules in single /m/ levels involving saturated laser optical pumping on molecular P, R, and Q transitions. The technique is not limited to small rotational quantum numbers j. It allows the determination of the populations of /m/ levels for arbitrary distribution functions f(j,m) or alternatively, the determination of all moments of f(j,m). In principle, the method is able to completely determine the angular distribution of j vectors. Experimental verification of the high /m/-state purity achieved in Na2 supersonic beams, as well as of inherent limitations due to hyperfine interaction is provided. For illustration, experimental data on laser-induced alignment, the dependence of the flow induced molecular alignment, and on delta m-propensity rules in differential rotationally inelastic scattering are presented.

705,860
PB87-134284 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Rational Approximations for the Holtsmark Distribution, Its Cumulative and Derivative.
Final rept.
D. G. Hummer. 1986, 5p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 36, n1 p1-5 1986.

Keywords: *Quantum chemistry, Approximation, Reprints, Holtsmark distribution.

The convergent series expansions of the Holtsmark distribution P(beta), its cumulative Q(beta), its derivative R(beta) and the semiconvergent asymptotic series for these functions are used to calculate rational approximations for P,Q, and R, which are valid for all positive beta and have maximum errors of approximately 10 to the 8th power, 10 to the 9th power, 10 to the 7th power, respectively.

705,861
PB87-134870 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Observation of the 3s (sup 2)A(sub 1) Rydberg States of Allyl and 2-Methylallyl Radicals with Multiphoton Ionization Spectroscopy.
Final rept.
J. W. Hudgens, and C. S. Dulcey. 1985, 5p
Pub. in Jnl. of Physical Chemistry 89, n8 p1505-1509 1985.

Keywords: *Chemical radicals, Excitation, Absorption, Reprints, *Chemical reaction kinetics, *Rydberg states, Multiphoton ionization, Allyl radicals, Methylallyl radicals.

Previously unreported bands of allyl, allyl-d, and 2-methylallyl radicals have been detected by mass resolved resonance enhanced multiphoton ionization spectrometry. Focused laser light between 480-535 nm induced two photon absorptions preparing the 3s (sup 2) A (sub 1) Rydberg states of the radicals. Absorption of two additional photons ionized the excited radicals. These electronic states of allyl and 2-methylallyl radicals lie at 40085/cm and 38369/cm respectively. No subsequent fragmentation of the molecular ions was observed.

705,862
PB87-134912 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
New Efficient Far Infrared Lasing Molecule: (13)CD3OH.
Final rept.
M. Inguscio, K. M. Evenson, F. R. Petersen, F. Strumia, and E. Vasconcellos. 1984, 8p
Pub. in International Jnl. of Infrared and Millimeter Waves 5, n9 p1289-1296 1984.

Keywords: Deuterated compounds, Frequency measurement, Far infrared radiation, Infrared lasers, Reprints, *Methyl alcohol isotopic species.

Thirty-six new cw laser lines ranging from 52 to 469 micrometers are obtained by pumping, for the first time, the isotope of methyl alcohol (13)CD3OH. The new laser line at 127.0 micrometers is one with the highest efficiency ever reported. Direct frequency measurements are reported for eleven new lines.

705,863
PB87-134946 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Laboratory Measurement of the Rotational Spectrum of the OH Radical with Tunable Far-Infrared Radiation.
Final rept.
J. M. Brown, L. R. Zink, D. A. Jennings, K. M. Evenson, A. Hinz, and I. G. Nolt. 1986, 4p
Sponsored by National Aeronautics and Space Administration, Washington, DC., and Chemical Manufacturers Association, Washington, DC.
Pub. in Astrophysical Jnl. 307, p410-413, 1 Aug 86.

Keywords: *Rotational spectra, Far infrared radiation, Frequency measurement, Reprints, *Hydroxyl radicals, Tunable lasers.

Rotational and fine-structure transitions between the low rotational levels of the OH radical in its X (sup 2) Pi state have been observed in absorption in the laboratory. It has thus been possible to measure the frequencies of these transitions directly. The observations were made with tunable far-infrared radiation generated by mixing two chosen CO2 laser frequencies in a metal-insulator-metal diode; the far-infrared difference frequency was radiated from the diode's whisker antenna. The measurements have an accuracy of a few hundred kHz. They both confirm and improve on the best previous estimates, which were obtained by extrapolation of laser magnetic resonance data.

705,864
PB87-134961 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Thermodynamic Anomalies in Near-Critical Aqueous NaCl Solutions.
Final rept.
J. M. H. Levelt Sengers, C. M. Everhart, G. Morrison, and K. S. Pitzer. 1986, 14p
Pub. in Chemical Engineering Communications 47, p315-328 1986.

Keywords: *Sodium chloride, Thermophysical properties, Solutions, Abnormalities, Reprints.

Apparent molar properties of near-critical aqueous NaCl solutions have been reported to show very large anomalies. The authors show that these anomalies are to be expected in any dilute solution of a nonvolatile in a near-critical solvent. Debye-Huckel effects need to be handled with some care; if inserted in the Helmholtz free energy, they cause no more than a higher-order effect.

705,865
PB87-134979 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Dilute Mixtures and Solutions Near Critical Points.
Final rept.
J. M. H. Levelt Sengers. 1986, 9p
Pub. in Fluid Phase Equilibria 30, p31-39 1986.

Keywords: Thermophysical properties, Equilibrium, Fluid dynamics, Impurities, Reprints, *Critical fluids.

At given pressure and temperature, impurities have very large effects on the density and enthalpy of near-critical fluids because the derivative (partial derivative of V with respect to x)(sub PT) diverges. Thermodynamic relations permit to calculate impurity effects from the initial slope of the critical line or from the dew-bubble curve. Examples are given for both nonaqueous and aqueous mixtures.

705,866
PB87-134987 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Molecular Dynamics Study of Compositional Order in a Binary Fluid Mixture.
Final rept.
R. D. Mountain. 1986, 11p
Pub. in Molecular Physics 59, n4 p857-867 1986.

Keywords: Liquids, Reprints, *Molecular dynamics, *Binary mixtures.

Molecular dynamics is used to investigate the connection between strong compositional order in a binary liquid mixture and the interactions between the unlike species of the mixture. Two classes of models are examined. The first has strong attraction between the unlike species and the second has purely repulsive interactions with a nonadditive diameter for the unlike pairs which is less than the average of the diameters of the like pairs. Both models lead to compositional ordering. The structure is characterized in terms of both pair and three-particle correlation functions which are constructed during the molecular dynamics computations. The connection of these models with observations of compositional ordering in alloys is discussed. Also, the possible utility of purely repulsive models for characterizing a wide range of binary liquid mixture properties is mentioned.

705,867
PB87-135026 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Molecular Beam Study of Electronic to Electronic, Vibrational, and Rotational Energy Transfer in the Collision of Two Step Laser Excited Sodium with N2.
Final rept.
G. Jamieson, W. Reiland, C. P. Schulz, H. U. Tittes, and I. V. Hertel. 1984, 6p
Pub. in Jnl. of Chemical Physics 81, n12 p5805-5810 1984.

Keywords: *Nitrogen, Excitation, Quenching, Atomic energy levels, Reprints, *Sodium atoms, *Atom-molecule collisions.

The quenching of excited Na(sup *)(4d/5s,4p,4s) by N2 has been studied in a crossed atomic and molecular beam apparatus at thermal collision energies. The sodium atoms are excited by two laser beams of different wavelengths to either the 4 doublet S(sub 1/2) or 5 doublet S(sub 1/2) state, via the intermediate 3 doublet P(sub 3/2) state. For both excitation schemes optical relaxation processes lead to a population in the 4 doublet P(sub 3/2) and 4 doublet S(sub 1/2) states of several percent. The relative densities of the excited states have been calculated from rate equations using stationary conditions. The structure can be partially disentangled using the results of the previously studied Na(sup *) (3 doublet P(sub 3/2)) + N2 quenching process. The main conclusion is that collisional deexcitation to the Na(3s) ground state is negligible whereas among the higher levels the collisional energy transfer cross sections are between 0.5 and 7.5 times the magnitude of the 3p-3s quenching cross section and they are strongly forward peaked in the same way.

705,868
PB87-135232 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Comparison of the Ground State Vibrational Fundamentals of Diatomic Molecules in the Gas Phase and in Inert Solid Matrixes.
Final rept.
M. E. Jacox. 1985, 16p
Pub. in Jnl. of Molecular Spectroscopy 113, n2 p286-301 1985.

Keywords: *Molecular structure, Ground state, Vibrational spectra, Reprints, *Diatomic molecules, Van der Waals forces, Charge transfer.

Despite the voluminous literature on the spectra of diatomic molecules, there are many gaps in the knowledge of the ground-state vibrational frequencies. For many important diatomic molecules, only values obtained in matrix isolation experiments are available. In order to assess the likely extent of deviation of the ground-state deltaG(1/2) values of diatomic molecules observed in rare-gas and nitrogen matrices from the gas-phase values, a systematic comparison has been made between gas-phase and matrix frequencies. The dependence of matrix shifts on the matrix material and type of chemical bond is considered for the approximately 230 pairs of observations, spanning the entire Periodic Table, which have been reported. Except for van der Waals molecules and for the Group Ia and IIIa halides, the argon-matrix shift for most diatomic molecules is less than 2%.

705,869
PB87-136594 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Vibrational Relaxation of HCl in Dilute CCl4 and CCl3F Solutions.
Final rept.
J. T. Knudtson, and J. C. Stephenson. 1984, 4p
Pub. in Chemical Physics Letters 107, n4-5 p385-388 1984.

Keywords: *Carbon tetrachloride, *Molecular relaxation, Molecular spectroscopy, Reprints, *Methane/fluoro-trichloro, Chlorofluorocarbons, Picosecond pulses.

Picosecond infrared pump, spontaneous anti-Stokes Raman probe experiments determined the vibrational relaxation rates of HCl(v=1) dilute in liquid CCl4 and CCl3F at T=295 K to be 2.12(+ or - .14) x 10 to the 8th power /s and 1.57(+ or - .22) x 10 to the 8th power/s, respectively. If the liquid phase data are interpreted in terms of the isolated binary collision model, the resultant deactivation probabilities are consistent with an extrapolation of gas phase results.

705,870
PB87-136602 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Relativistic Effective Potential SCF Calculations of AgH and AuH.
Final rept.
M. Krauss, W. J. Stevens, and H. Basch. 1985, 9p
Pub. in Jnl. of Computational Chemistry 6, n4 p287-295 1985.

Keywords: Hydrides, Dipole moments, Reprints, *Hydride/silver, *Hydride/gold, Relativistic effective potentials.

Relativistic effective potential (REP) are now widely used in molecular electronic structure calculations. Tests of these REP are needed to assess their accuracy. This can now be done for AgH and AuH since Lee and McLean have published Dirac-Fock calculations for these molecules. Comparative SCF calculations have been performed for two types of effective potential. Satisfactory agreement between the effective potential results for spectroscopic constants and dipole moments with the Dirac-Fock values is found which supports the use of these potentials for heavy atom containing molecules.

705,871
PB87-136669 PC **A16**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Chemical Physics.
Technical Activities 1986, Center for Chemical Physics.
P. Ausloos. Oct 86, 366p NBSIR-86-3470
See also PB86-157336.

Keywords: *Research projects, Molecular spectroscopy, Surface chemistry, Reaction kinetics, Thermodynamics, *Chemical physics.

The report summarizes research projects, measurement method development, testing and data evaluation activities carried out during Fiscal Year 1986 in the NBS Center for Chemical Physics. These activities fall in the areas of surface science, chemical kinetics, chemical thermodynamics and molecular spectroscopy.

705,872
PB87-137188
(Order as PB87-137154, PC **A04**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Thermal Expansion of Platinum and Platinum-Rhodium Alloys.
R. E. Edsinger, M. L. Reilly, and J. F. Schooley. 23 Jul 86, 23p
Included in Jnl. of Research of the National Bureau of Standards, v91 n6 p333-362 Nov-Dec 86.

Keywords: *Thermal expansion, *Platinum, Thermodynamic properties, *Platinum rhodium alloys.

The paper contains descriptions of the construction and use over the temperature range -27C to 570C of a Merritt-Saunders (optical interferometric) linear thermal expansion apparatus. Measurements of thermal expansion are reported for platinum and for two platinum-rhodium alloys (nominally 12 wt% Rh and 20 wt% Rh). Detailed analyses are given of the measurement uncertainties involved in the experiment and of the representation of the data by polynomials in the sample temperatures. The data show precision at the 1-ppm level and good agreement with results already published.

705,873
PB87-140570 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Center for Chemical Engineering.
Computer Code for Gas-Liquid Two-Phase Vortex Motions: GLVM.
T. T. Yeh. Jul 86, 45p NBSIR-86/3414
Sponsored by National Aeronautics and Space Administration, Cocoa Beach, FL. John F. Kennedy Space Center.

Keywords: *Liquid phases, Mathematical models, Vortices, *Vortex separation process, *Vapor phases, Computer applications.

A computer program aimed at the phase separation between gas and liquid at zero gravity, induced by vortex motion, is developed. It utilizes an explicit solution method for a set of equations describing rotating gas-liquid flows. The vortex motion is established by a tangential fluid injection. A Lax-Wendroff two-step (McCormack's) numerical scheme is used. The program can be used to study the fluid dynamical behavior of the rotational two-phase fluids in a cylindrical tank. It provides a quick/easy sensitivity test on various parameters and thus provides the guidance for the design and use of actual physical systems for handling two-phase fluids.

705,874
PB87-145066 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Interactive FORTRAN Programs for Micro Computers to Calculate the Thermophysical Properties of Twelve Fluids (MIPROPS).
Technical note.
R. D. McCarty. May 86, 92p NBS/TN-1097
Also available from Supt. of Docs as SN003-003-02745-6. Sponsored by National Aeronautics and Space Administration, Houston, TX. Lyndon B. Johnson Space Center.

Keywords: *Thermophysical properties, *Transport properties, *Helium, *Hydrogen, *Nitrogen, *Oxygen, *Methane, *Ethylene, *Propane, *Butanes, *Argon, *Liquid helium, *Liquefied gases, Viscosity, Density, Fluids, Computer programs, Entropy, Enthalpy, Thermal conductivity, Vapor phases, Nitrogen fluorides, *Nitrogen fluoride(NF3), Fortran 77 programming language, Dielectric constant, Heat capacity.

The thermophysical and transport properties of selected fluids have been programmed in FORTRAN 77 which is available for micro computers. The input variables are any two of P, p, T (pressure, density, and temperature) in the single phase regions, and either P or T for the saturated liquid or vapor states. The output is pressure, density, temperature, internal energy, enthalpy, entropy, specific heat capacities (C(sub p) and C(sub v)), speed of sound and, in most cases, viscosity, thermal conductivity, and dielectric constant. The fluids included are: helium, hydrogen, nitrogen, oxygen, argon, nitrogen trifluoride, methane, ethylene, ethane, propane, iso- and normal butane. The programs give properties in both the liquid and vapor states over a wide range of temperature and pressure. Copies of the program may be obtained from the Office of Standard Reference Data, Room A320, Physics Building, National Bureau of Standards, Gaithersburg, MD 20899.

705,875
PB87-145371 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 14, Supplement No. 1, 1985. JANAF Thermochemical Tables, 3rd Edition, Parts 1 and 2.
M. W. Chase, C. A. Davies, J. R. Downey, D. J. Frurip, and A. N. Syverud. c1986, 1880p
Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Thermochemical properties, Tables(Data), Thermodynamic properties, Specific heat, Entropy, Enthalpy, Gibbs free energy, Temperature.

Recommended temperature-dependent values are provided for chemical thermodynamic properties of inorganic substances and for organic substances containing only one or two carbon atoms. These tables cover the thermodynamic properties over a wide temperature range with single-phase and multiphase tables for the crystal, liquid, and ideal gas state. The properties tabulated are heat capacity, entropy, Gibbs energy function, enthalpy, enthalpy of formation, Gibbs energy of formation, and the logarithm of the equilibrium constant for formation of each compound from the elements in their standard reference states. All values are given in SI units and are for a standard-state pressure of 100,000 Pa (1 bar). Each tabulation is accompanied by a critical evaluation of the literature upon which the thermochemical table is based. Literature references are given. The volume is a new collective edition of five previous publications. In it all tabulations have been rewritten in a consistent style. Many, but not all, tabulations have been revised as a result of a reevaluation of the data. (Copyright (c) 1986 by the U.S. Secretary of Commerce on behalf of the United States. This copyright will be assigned to the American Insitute of Physics and the American Chemical Society, to whom all requests regarding reproduction should be addressed).

705,876
PB87-148300 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 15, Number 4, 1986.
Quarterly rept.
c1986, 196p
See also PB87-148318 through PB87-148375, and PB87-109963. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Research, Water, Viscosity, Thermal conductivity, Transport properties, Hydrogen, Argon, Thermodynamic properties, Alkyne compounds, Deuterium, Actinide series compounds, Oxygen organic compounds, Triple point, Rate constants.

Topics include: Improved international formulations for the viscosity and thermal conductivity of water substance; The viscosity and thermal conductivity of normal hydrogen in the limit of zero density; The viscosity and thermal conductivity coefficients of gaseous and liquid argon; Standard chemical thermodynamic properties of alkyne isomer groups; Recent progress in deuterium triple-poimt measurements; Rate constants for reactions of radiation-produced transients in aqueous solutions of actinides; Thermodynamic properties of key organic oxygen compounds in the carbon range C1 to C4. Part 2. Ideal gas properties.

705,877
PB87-148318 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Improved International Formulations for the Viscosity and Thermal Conductivity of Water Substance.
J. V. Sengers, and J. T. R. Watson. c1986, 24p
Prepared in cooperation with National Engineering Lab., East Kilbride (Scotland).
Included in Jnl. of Physical and Chemical Reference Data. v15 n4 p1291-1314 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Water, *Viscosity, *Thermal conductivity, Transport properties, Tables(Data).

The paper describes improved international formulations for the viscoisity and thermal conductivity of water substance recently adopted by the International Association for the Properties of Steam.

705,878
PB87-148326 Not available NTIS
Thessaloniki Univ., Salonika (Greece). Dept. of Chemical Engineering.
Viscosity and Thermal Conductivity of Normal Hydrogen in the Limit of Zero Density.
M. J. Assael, S. Mixafendi, and W. A. Wakeham. c1986, 8p
Prepared in cooperation with Imperial Coll. of Science and Technology, London (England). Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n4 p1315-1322 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Hydrogen, *Thermal conductivity, *Viscosity, Gases, Temperature dependence.

The paper contains a new representation of the viscosity and thermal conductivity coefficients of normal hydrogen in the limit of zero density as a function of temperature. The correlation is based upon the semiclassical kinetic theory of polyatomic gases and a body of critically evaluated experimental data. In the temperature range 200-400 K the accuracy of the representation of the viscosity is estimated to be plus or minus 0.5%. However, at the lowest temperature of 20 K and the highest temperature of 2200 K, the uncertainty rises to plus or minus 2.0%. The available thermal conductivity data of high accuracy cover the much more restricted temperature range from 100 to 400 K and the correlation of this property is limited to that range. An attempt has also been made to represent the viscosity data by means of a correlation universal among several other polyatomic gases but it has proven unsatisfactory.

705,879
PB87-148334 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Viscosity and Thermal Conductivity Coefficients of Gaseous and Liquid Argon.
B. A. Younglove, and H. J. M. Hanley. c1986, 16p
Included in Jnl. of Physical and Chemical Reference Data, v15 n4 p1323-1337 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Argon, *Viscosity, *Thermal conductivity, Thermophysical properties, Gases, Liquids.

Data for the viscosity and thermal conductivity of gaseous and liquid argon have been evaluated and represented by empirical functions. Tables for the viscosity from 86 to 500 K for pressures to 400 MPa, and for the thermal conductivity from 90 to 500 K for pressures to 200 MPa are presented. For the viscosity, uncertainties of 2% or better for pressures below 100 MPa, and 3% for higher pressures are assigned. For the thermal conductiviy the uncertainties are 4% for temperatures below 150 K and 3% or better for temperatures above. The enhancement in the conductivity close to the critical point has been accounted for. The status of the argon transport data and the philosophy of fitting them are reviewed.

705,880
PB87-148342 Not available NTIS
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
Standard Chemical Thermodynamic Properties of Alkyne Isomer Groups.
R. A. Alberty, and E. Burmenko. c1986, 12p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n4 p1339-1347 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Thermodynamic properties, *Alkyne compounds, Enthalpy, Entropy, Gibbs free energy, Specific heat.

The chemical thermodynamic properties of alkyne isomer groups from C2H2 to C5H8 in the ideal gas phase have been calculated from 298.15 to 1000 K from tables of Stull, Westrum, and Sinke. In the absence of literature data on all isomers of higher isomer groups, the properties of isomers of C6H10 to C8H14 have been estimated using Benson group values. Equilibrium mole fractions within isomer groups have been calculated for the ideal gas state from 298.15 to 1000 K. for isomer group properties, increments per carbon atom have been calculated to show the extent to which thermodynamic properties of higher isomer groups may be obtained by linear extrapolation. Values of C(sub p),S, delta(sub f) H, and delta(sub f) G are given for all species from C2H2 to C8H14 in SI units for a standard state pressure of 1 bar.

705,881
PB87-148359 Not available NTIS
Los Alamos National Lab., NM.
Recent Progress in Deuterium Triple-Point Measurements.
L. A. Schwalbe. c1986, 6p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n4 p1351-1356 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Deuterium, Hydrogen isotopes, *Triple point.

The triple point of deuterium is a proposed reference for defining the temperature scale between 13.81 and 24.562 K. The author reviewed recent measurements of this fixed point; the discussion concentrates on experiments with samples confined in transportable sealed cells. The authors also present theoretical estimates of the dependence of the triple-point temperature on the spin composition of the sample. Satisfactory agreement is obtained with experimental data on deuterium at low concentrations of the para (J=1) species. Present results support the adoption of the triple point of e-D(sub 2) as a standard temperature reference.

705,882
PB87-148375 Not available NTIS
Texas A and M Univ., College Station. Thermodynamics Research Center.
Thermodynamic Properties of Key Organic Oxygen Compounds in the Carbon Range C1 to C4. Part 2. Ideal Gas Properties.
J. Chao, K. R. Hall, K. N. Marsh, and R. C. Wilhoit. c1986, 68p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v15 n4 p1369-1436 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Thermodynamic properties, *Oxygen organic compounds, Specific heat, Enthalpy, Ideal gas.

The ideal gas thermodynamic properties of forty-four key organic oxygen compounds in the carbon range C1 to C4 have been calculated by a statistical mechanical technique. The properties determined are the heat capacity, entropy, enthalpy, and Gibbs energy function. The calculations have been performed, in most cases, over the temperature range 0 to 1500 K and at 1 bar. The contributions to the thermodyamic properties of compounds having internal-or-pseudo-rotations have been computed by employing a partition function formed by the summation of the internal rotational or pseudorotational energy level for each rotor in the given molecule. These energy levels have been calculated by solving the wave equation using appropriate barrier heights, rotational constants, and potential functions for the given rotations. The thermodynamic properties have been calculated using a rigid-rotor and harmonic-oscillator molecular model for each species.

705,883
PB87-149381 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Picosecond Measurements of the Dissociation Rates of the Nitric Oxide Dimer nu(sub 1)=1 and nu(sub 4)=1 Levels.
Final rept.,
M. P. Casassa, A. M. Woodward, J. C. Stephenson, and D. S. King. 1986, 3p
Pub. in Jnl. of Chemical Physics 85, n10 p6235-6237, 15 Nov 86,

Keywords: *Nitrogen oxide(NO), *Dissociation, Vibrational spectra, Reprints, *Rate constants, Dimers, Picosecond pulses.

Direct picosecond measurements of the vibrational predissociation rates of the nitric oxide dimer excited to v=1 levels of the nearly equal energy symmetric nu(sub 1) = 1870/cm) and asymmetric nu(sub 4) = 1789/cm) N-0 stretching fundamentals are reported. Lifetimes obtained are 880 + or - 260 ps for nu(sub 1) and 39 + or -8 ps for nu(sub 4) excitations.

705,884
PB87-149415 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Adiabatic Analysis of Distant Perturbations: Application to Herzberg-Teller Vibronic Coupling Theory.
Final rept.,
F. H. Mies. 1985, 14p
Pub. in Molecular Physics 54, n6 p1423-1436 1985.

Keywords: *Adiabatic conditions, Molecular spectra, Formaldehyde, Intensity, Reprints, *Vibronic coupling, Propynal.

The simplest form of Herzberg-Teller theory involves the vibronic coupling of a single mode between two energetically separated molecular states. An adiabatic analysis of the system is presented which incorporates the effect of the distant state without recourse to direct summation over distant energy levels. The theory is compared to exact numerical results for vibronic-coupling in Propynal and Formaldehyde. The adiabatic eigenvalues are exceptionally accurate, especially if proper radial Born-Oppenheimer terms are added to the adiabatic potential for the ground state. The quality of the resultant amplitudes associated with the distant state are adequate to represent any intensity borrowing effects in the molecular spectra to well within 5%. The adiabatic theory is quite general and can be used with equal force to represent distant perturbations due to repulsive as well as attractive states, and without any commitment to linear vibronic coupling models.

705,885
PB87-149423 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Microwave Spectrum of the K=0 States of Ar-NH3.
Final rept.,
D. D. Nelson, G. T. Fraser, K. I. Peterson, K. Zhao, W. Klemperer, F. J. Lovas, and R. D. Suenram. 1986, 7p
Pub. in Jnl. of Chemical Physics 85, n10 p5512-5518, 15 Nov 86.

Keywords: *Ammonia, *Argon, *Microwave spectra, Reprints, Dimers.

The microwave spectrum of Ar-NH3 has been obtained using molecular beam electric resonance spectroscopy and pulsed nozzle Fourier transform microwave spectroscopy. The spectrum is complicated by nonrigidity and most of the transitions are not yet assigned. The NH3 orientation in the complex is discussed primarily on the basis of the measured dipole moment projection and the quadrupole coupling constant. It is concluded that the Ar-NH3 intermolecular potential is nearly isotropic and that the NH3 subunit undergoes practically free internal rotation in each of its angular degrees of freedom. Spectroscopic evidence is presented which indicates that the NH3 subunit also inverts within the complex. These conclusions concerning the internal dynamics in the Ar-NH3 complex support the model initially proposed in the authors previous study of the microwave and infrared spectra of this species.

705,886
PB87-149449 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Free Radical Chemistry of Sulfite.
Final rept.,
P. Neta, and R. E. Huie. 1985, 9p
Pub. in Environmental Health Perspectives 64, p209-217 Dec 85.

Keywords: *Free radicals, *Sulfites, Chemical radicals, Oxidation, Reprints, *Chemical reaction kinetics, Sulfite radicals, Peroxysulfate radicals.

The free radical chemistry of sulfite oxidation is reviewed. Chemical transformations of organic and biological molecules induced by sulfite oxidation are summarized. The kinetics of the free radical oxidations of sulfite are discussed as are the kinetics of the reactions of the sulfite derived radicals SO3(1-) and its peroxy derivative (SO5(1-) with organic compounds.

705,887
PB87-149472 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Zinc Porphyrin pi-Radical Cations in Aqueous Solution. Formation, Spectra and Decay Kinetics.
Final rept.,
P. Neta, and A. Harriman. 1985, 16p
Pub. in Jnl. of the Chemical Society-Faraday Transactions II, v81 p123-138 Jan 85.

Keywords: *Zinc, *Porphyrins, Chemical radicals, Reaction kinetics, Reprints, Pulse radiolysis.

Zinc porphyrins are oxidized readily to the pi-radical cation by certain inorganic and organic radicals in aqueous solution under pulse radiolytic conditions. Dimolecular rate constants for the oxidation process depend upon thermodynamic driving forces and Coulombic interactions between the reactants and lie within the range 10 to the 7th power - 10 to the 10th power/M s. The resultant pi-radical cations exist in aqueous solution in equilibrium with any anions or complexing agents (e.g. pyridine) present in solution. This complexation affects both the absorption spectrum of the pi-radical cation and its rate of decay. With zinc tetrakis (4-sulphonatophenyl) porphyrin, the pi-radical cation is quite persistant (t (sub 1/2) approx 6s) but its rate of decay increases when SCN-ions are present. Positively-charged zinc porphyrins form shorter-lived pi-radical cations that decay on the ms timescale. Under some conditions, this decay leads to formation of a relatively long-lived intermediate which is either a pi-radical dimer of an isoporphyrin derivative.

705,888
PB87-149506 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Viscosity and Structure of Iron- and Aluminum-Bearing Calcium Silicate Melts at 1 atm.
Final rept.,
B. O. Mysen, D. Virgo, C. M. Scarfe, and D. J. Cronin. 1985, 12p
Pub. in American Mineralogist 70, n5-6 p487-498 1985.

Keywords: *Viscosity, *Calcium silicates, Molecular structure, Silicate minerals, Raman spectra, Reprints, *Silicate melts.

The temperature-viscosity relationships of four melt compositions in the system CaO-SiO2-Fe-O have been determined. The Fe(3+)/sigma Fe and structural positions of Fe(3+) and Fe(2+) in the melts were obtained with (57)Fe Mossbauer spectroscopy. Raman spectra were obtained on quenched melts (from 1550 deg C) of these samples as well as aluminous analogues of the iron-bearing melts. Aluminum and ferric iron are tetrahedrally coordinated, and ferrous iron is in octahedral coordination in all melts. The viscosities (n) range between 8 and 50 kcal/mole as a function of Ca/Si, iron content and temperature (in the temperature range 1400 deg - 1600 deg C). The viscosity shows a distinct increase as 5 wt % Fe2O3 is added to iron-free melts. Additional Fe2O3 results in decreasing viscosity. Published data show that analogous addition of Al2O3 results in a continuous viscosity increase.

705,889
PB87-149589 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Rare-Earth Crystal Growth from the Vapor: Eu/Re and Eu/W.
Final rept.,
A. J. Melmed, V. Maurice, O. Frank, and J. H. Block. 1984, 6p
Pub. in Jnl. de Physique 45, nC9 p47-52 1984.

Keywords: *Crystal growth, *Rare earth minerals, Europium, Rhenium, Tungsten, Epitaxy, Reprints.

Epitaxial crystal growth of Eu/Re and Eu/W has been done using Field Emission Microscopy. Nucleation, crystal growth and epitaxial relationships are comparatively described and discussed, and a value of the electron work function for poly-faced Eu has been determined.

705,890
PB87-149597 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Influence of Surface Additives, Sodium and Oxygen, on the Structure and Bonding of H2O and NH3 on Ru(001).
Final rept.,
T. E. Madey, C. Benndorf, D. L. Doering, and S. Semancik. 1985, 12p
Pub. in Proceedings of Int. Congr. Catal. (8th), pIV51-IV62 1985.

Keywords: *Surface chemistry, *Sodium, *Oxygen, Surfaces, Chemisorption, Bonding, Water, Ammonia, Ruthenium, Molecular structure, Electron stimulated desorption.

The bonding geometry and thermal desorption kinetics of adsorbed molecular NH3 and H2O on Ru(001) are altered by interaction with adsorbed oxygen or sodium atoms. In all instances, local molecular reorientations are induced in NH3 and H2O by the additive atoms. The molecular axes of adsorbed H2O and NH3 are strongly 'tilted' by interaction with Na, whereas adsorbed oxygen causes a striking azimuthal-ordering in NH3.

705,891
PB87-149605 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Influence of Surface Additives (Na and O) on the Absorption and Structure of NH3 on Ni (110).
Final rept.,
T. E. Madey, and C. Benndorf. 1985, 9p
Pub. in Surface Science 152, p587-595 Apr 85.

Keywords: *Chemisorption, *Surface chemistry, *Sodium, *Oxygen, *Ammonia, *Nickel, Adsorption, Molecular structure, Reprints, Electron stimulated desorption.

The structure and kinetics of NH3 interacting with clean and sodium or oxygen-dosed Ni(110) have been studied using ESDIAD (electron stimulated desorption ion angular distribution), LEED and thermal desorption spectroscopy. NH3 adsorbs in molecular form at 80 K. No azimuthal ordering is found for molecular NH3 on either clean or 0-dosed Ni(110), but NH3 reacts with O above 200 K to form a surface species 'inclined' along (001) azimuths, identified as OH(ad). Coadsorption of NH3 with Na causes a reorientation of the molecular axes of the NH3 bonded near Na.

705,892
PB87-149613 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Welch Memorial Lecture: Electron Stimulated Desorption and Its Relation to Molecular Structure at Surfaces.
Final rept.,
T. E. Madey. 1986, 5p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences, and Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Vacuum Science and Technology A. 4, n3 p257-261 May/Jun 86.

Keywords: *Molecular structure, *Surfaces, *Desorption, Chemisorption, Ammonia, Water, Silver, Iron, Surface chemistry, Reprints, Electron stimulated desorption.

Recent examples of the use of electron stimulated desorption ion angular distribution (ESDIAD) in determining the structures of molecules on surfaces are discussed. These include the adsorption and decomposition of NH3 on Fe(100), and the stabilization of H2O on Ag(110) by impurity O and Br atoms, ESDIAD evidence for 'lying down' CO on several surfaces is presented, and the influence of beam damage in producing new surface structures for H2O on Ni(110) is discussed. Calculations of the influence of the surface image potential and reneutralization effects on ion trajectories are described briefly.

705,893
PB87-149621 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Uses and Limitations of ESDIAD for Determining the Structure of Surface Molecules.
Final rept.,
T. E. Madey. 1985, 5p
Pub. in Springer Ser. Surf. Sci., Struct. Surf. 2, p264-268 1985.

Keywords: *Molecular structure, *Surface chemistry, Chemisorption, Reprints, Electron stimulated desorption.

The principles and mechanisms of electron stimulated desorption (ESD) and photon stimulated desorption (PSD), as well as the utility of the electron stimulated desorption ion angular distributions (ESDIAD) method as a tool for determining the structure of surface molecules, have been described in a recent book and several review articles. The present short paper is intended to provide a guide to the relevant literature, and to describe briefly some recent work relating to the uses and limitations of ESDIAD for determining the structure of surface molecules.

705,894
PB87-149779 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
X-ray Absorption Study of Tantalum Oxide Films on Silicon.
Final rept.,
G. G. Long, A. G. Revesz, and M. Kuriyama. 1985, 8p
Pub. in Jnl. of Non-Crystalline Solids 70, n2 p271-279 1985.

Keywords: *Silicon, *Tantalum oxides, Films, X ray absorption, Reprints.

The results of x-ray absorption measurements are used to demonstrate that noncrystalline Ta 0.29 0.71 films, prepared by thermal oxidation of deposited Ta on Si single crystals, are glassy in the sense that the short range order and bond (chemical) ordering closely resemble those in B-Ta2O5.

705,895
PB87-150660 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Re-examination of the Characteristic Fluorescence Correction.
Final rept.,
R. L. Myklebust, and R. B. Marinenko. 1984, 3p
Pub. in Proceedings of the Annual Conference - Microbeam Analysis Society (19th), Bethlehem, PA., July 16-20, 1984, p205-207.

Keywords: Fluorescence, *Electron microprobes.

Methods of computing the characteristic fluorescence correction factors in quantitative electron microprobe analysis procedures is discussed. Various formulas for calculating fluorescence yields are compared.

705,896
PB87-150686 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Use of a Monte Carlo Electron Trajectory Simulation for Quantitative Analysis of Thick Films in the Electron Probe Microanalyzer.
Final rept.,
D. Newbury, R. Myklebust, and E. Steel. 1984, 3p
Pub. in Proceedings of the Annual Conference - Microbeam Analysis Society (19th), Bethlehem, PA., July 16-20, 1984, p198-200.

Keywords: *Microanalysis, Monte Carlo method, *Electron probes.

The analysis of thick films, that is, those whose thickness dimension is greater than 0.1 of the range of a 20 keV electron, is complicated by electron scattering and x-ray absorption and fluorescence effects which differ from bulk targets. Conventional ZAF analysis with normalization produces relative errors of + or - 20% or more. Monte Carlo electron trajectory simulation can be used to calculate x-ray emission from thick film targets in order to provide correction factors to apply to ZAF analysis.

705,897
PB87-150694 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Experimental Study of Thermal Fluctuation in Spinodal Decomposition of a Binary Polymer Mixture.
Final rept.,
M. Okada, and C. C. Han. 1 Nov 86, 11p
Pub. in Jnl. of Chemical Physics 85, n9 p5317-5327, 1 Nov 86.

Keywords: *Polymers, Neutron scattering, Polystyrene, Reprints, *Binary mixtures, *Spinodal decomposition, Poly(ether/methyl-vinyl).

The kinetics of spinodal decomposition of a binary polymer system of polystyrene/poly (vinylmethylether) near its critical composition has been studied by the temperature jump light scattering technique. The results indicate that the linearized theory of the Cahn-Hilliard Cook type which includes the thermal fluctuation term can describe the polymer system very well in the early-time and shallow-quench region. The virtual structure factor Sx(q), which is a consequence of including the thermal fluctuation, has been obtained for the first time. For experiments of deeper quench, the virtual structure factor becomes small in our experimental q range, and the time dependent static structure factor, S(q,t), reduces back to the original Cahn-Hilliard type.

705,898
PB87-150702 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Refractive Index and Evaporation Rate of Individual Smoke Droplets.
Final rept.,
G. W. Mulholland, R. L. McKenzie, E. Marx, and R. A. Fletcher. 1985, 6p
Pub. in Langmuir 1, n3 p367-372 1985.

Keywords: *Drops(Liquids), *Smoke, *Refractivity, Particle size, Evaporation, Reprints.

The size and refractive index of individual smoke droplets have been measured using a single particle light scattering instrument. Droplets of a given size were selected by use of a mobility classifier and then electrostatically charged. The measured scattered intensities were fitted to curves determined from Mie theory to find the best values of the refractive indices. The refractive index of smoke from a moderately large, steady state smolder reactor is found to be much less variable than that of cigarette smoke. Relative humidity is found to have a significant effect on the evaporation rate of the smoke droplets.

705,899
PB87-150736 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

H2O Adsorption on Ni(110): Evidence for Oriented Water Dimers.
Final rept.,
C. Nobl, C. Benndorf, and T. E. Madey. 1985, 14p
Pub. in Surface Science 157, n1 p29-42 1985.

Keywords: *Chemisorption, *Nickel, Adsorption, Surface chemistry, Reprints, Electron stimulated desorption.

H2O adsorption on clean Ni(110) surfaces at less than or = 150 K leads at coverages below theta approx. = 0.5 to the formation of chemisorbed water dimers, bound to the Ni substrate via both oxygen atoms. The linear hydrogen bond axis is oriented parallel to the (001) surface directions. With increasing H2O coverage (theta greater than or equal to 0.5), the accumulation of further hydrogen bonded water molecules induces some modifications into the dimer configuration resulting at theta approx. = 1 in a two dimensional hydrogen bonded network with a slightly distorted ice lattice structure and long range order.

705,900
PB87-150751 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
One-Electron and Inner-Shell Energy Levels in High Z Atoms.
Final rept.,
E. G. Kessler, and R. D. Deslattes. 1986, 5p
Pub. in Physica Scripta 34, p408-412 1986.

Keywords: *Atomic energy levels, X ray spectroscopy, Electrons, Reprints.

Precision X-ray spectroscopy of one electron and one vacancy ions in the mid-to-high-Z region is discussed and results are compared to recent theoretical calculations. The comparisons are made as a function of Z and reveal deficiencies in the theoretical calculations and experimental measurements. Pertinent experimental topics are briefly covered including wavelength normalization, production of clean X-ray spectra (free of satellites), and high resolution instrumentation. Discussion of the theoretical calculations includes the variation of various terms as a function of Z and the importance of correlation effects in one vacancy ions. Future experimental measurements are briefly mentioned.

705,901
PB87-150876 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Two-Photon Optical Spectroscopy of Trapped HgII.
Final rept.,
J. C. Bergquist, D. J. Wineland, W. M. Itano, H. Hemmati, H. U. Daniel, and G. Leuchs. 1985, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Laser Spectroscopy VII 49, p6-9 1985.

Keywords: *Frequency standards, Reprints, *Mercury ions, Multi-photon processes, Laser spectroscopy, Mercury 198.

The Doppler-free, two-photon 5d(10) 6s doublet S(1/2)-5d(9) 6s(2) doublet D(5/2) transition in singly ionized Hg, attractive as an optical frequency standard, has been observed for the first time. A few 198Hg ions were confined in a radio-frequency (rf) trap and the two-photon transition was detected by monitoring the change in the fluorescence light scattered by the ions from a laser beam tuned to the first resonance transition at 194 nm. Optical amplitude modulation (AM) sidebands, induced by the secular (thermal) motion of the harmonically bound ions, were observed also for the first time.

705,902
PB87-150884 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Rotational Structure of (16)O2, (16)O(17)O, and (16)O(18)O (X (sup 3)Sigma g bar) from Laser Magnetic Resonance Spectra.
Final rept.,
M. Mizushima, L. R. Zink, and K. M. Evenson. 1984, 10p
Pub. in Jnl. of Molecular Spectroscopy 107, n2 p395-404 1984.

Keywords: *Rotational spectra, *Oxygen, Molecular spectroscopy, Isotopes, Reprints, Laser magnetic resonance.

Improved values of the rotational constants, B and D of (16)O (17)O(v=0) and D of (16)O2(v=1) were obtained from an analysis of the laser magnetic resonance spectra at 765 and 4252 GHz.

705,903
PB87-151270 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Microelectronics Dimensional Metrology in the Scanning Electron Microscope, Part 2.
Final rept.,
M. T. Postek, and D. C. Joy. Dec 86, 9p
Pub. in Solid State Technology 29, n12 p77-85 Dec 86.

Keywords: Metrology, Reprints, *Scanning electron microscopy.

The initial installment of the paper appeared in our November 1986 issue. In this concluding installment, the effects of the electron beam/sample interaction and its modelling with the Monte Carlo technique are discussed. The various sources of error in SEM metrology are also examined. Finally, the prospect of automated wafer inspection and progress in establishing SEM measurement standards are outlined.

705,904
PB87-151288 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Redistribution of Radiation in the Absence of Collisions.
Final rept.,
G. G. Lombardi, D. E. Kelleher, and J. Cooper. 1985, 4p
Pub. in Astrophysical Jnl. 288, n2 p820-823 1985.

Keywords: *Helium, *Hydrogen, *Spectral lines, Excitation, Radiation, Reprints.

Redistribution and depolarization of near-resonant radiation was studied for the He 2 singlet P - 3 singlet D line (668 nm) (and some data are also presented for H(alpha) (656 nm)). These transitions have lower levels with natural line widths large compared with their upper level natural widths and, under experimental conditions, their collisional widths were also small. The authors measurement of the ratio of Rayleigh to fluorescent intensities confirm the prediction that redistribution of radiation occurs in the absence of collisions for transitions having significant lower level radiative widths. Depolarization rates by collisions with helium were also inferred from the measurements.

705,905
PB87-151478 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Magnetic Excitations in Transition Metals.
Final rept.,
J. W. Lynn. 1984, 9p
See also report dated Dec 84, DE85-007396.
Pub. in Proceedings of 1984 Workshop on High-Energy Excitations in Condensed Matter, Los Alamos, New Mexico, February 13, 1984, v1 p255-263.

Keywords: *Transition metals, *Excitation, Atomic energy levels, Iron, Cobalt, Nickel, Chromium, Neutron scattering.

A brief review is given of the spin dynamics of the 3d elements Fe, Co, Ni and Cr. These materials have proved difficult to investigate thoroughly because the excitations extend to very high energies, but should be well suited to study with spallation neutron sources as demonstrated by recent measurements on pure iron at IPNS.

705,906
PB87-151502 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
What Controls the Thicknesses of Wetting Layers.
Final rept.,
R. F. Kayser, M. R. Moldover, and J. W. Schmidt. 1986, 19p
Pub. in Jnl. of Chem. Soc., Faraday Trans. 82, p1701-1719 1986.

Keywords: *Wetting, *Substrates, Thickness, Adsorption, Fluid dynamics, Diffusion, Reprints.

Wetting layers can form on solid and fluid substrates when the long-ranged part of the effective intermolecular potential (which tends to thicken the layers) competes with gravity (which tends to thin the layers). Authors have reported layers whose thicknesses range from 7 to 600 nm on a variety of substrates. The authors use the theory of dispersion forces to make simple estimates of a layer's thickness in equilibrium. The estimates imply that, in certain cases, the measured, thickness differs by a factor 10 from the thickness expected in equilibrium. To resolve these differences, they have estimated the rates of several hydrodynamic processes are estimated.

705,907
PB87-151510 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Theoretical Calculation of the Transport Properties of Monatomic Lithium Vapor.
Final rept.,
P. M. Holland, L. Biolsi, and J. C. Rainwater. 1986, 8p
Pub. in Jnl. of Chemical Physics 85, n7 p4011-4018, 1 Oct 86.

Keywords: *Transport properties, *Lithium, *Vapors, Thermophysical properties, Diffusion, Reprints, Monoatomic gases, Atom-atom collisions.

Transport properties of dilute monatomic gases depend on two body atom-atom interaction potentials. When two ground state (doublet S) lithium atoms interact, they can follow either of two potential energy curves corresponding to the Li2 molecule in the X singlet Sigma(1+)(sub g) or triplet Sigma (1+)(sub u) state. Transport collision integrals for these states have been calculated by accurately representing quantum mechanical potential energy curves with the Hulburt-Hirschfelder potential. The excellent agreement of calculated viscosities with experimental results provides further evidence that the potential can be used to estimate accurately transport properties under conditions where experimental data are sparse or unavailable.

705,908
PB87-151635 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Modifying Structure and Properties of Optical Films by Coevaporation.
Final rept.,
A. Feldman, E. N. Farabaugh, W. K. Haller, D. M. Sanders, and R. A. Stempniak. 1986, 6p
Contracts AFOSR-ISSA-84-00060, AFOSR-ISSA-84-0006
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Vacuum Science and Technology A4, n6 p2969-2974 Nov/Dec 86.

Keywords: *Optical materials, *Thin films, Molecular structure, Refractivity, Optical properties, Reprints, *Coevaporation.

Coevaporated e-beam films show modification of structure and properties that depend on composition. In pure zirconia films, x-ray diffraction indicates two crystal phases present and scanning electron microscopy (SEM) shows a columnar structure. The pore fractions in these films can exceed 25%. The admixture of small amounts of silica (<20% by volume) results in films having a single crystalline phase. At volume fractions of silica >20%, the films show an amorphous structure lacking columnar growth. Measurements of refractive index and thickness as a function of composition indicate an initial decrease in porosity with increasing silica content. A simple model gives the porosity of the films as a function of composition. In addition, the mixed films show greater index stability, decreased surface roughness, and decreased optical scatter.

705,909
PB87-151999 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.

Effect of Electron Correlation in the Target Wavefunction on Electron-molecule Scattering.
Final rept.,
J. R. Rumble, W. J. Stevens, and D. G. Truhlar.
1984, 7p
Pub. in Jnl. of Physics B-Atomic and Molecular Physics 17, n15 p3151-3157 1984.

Keywords: *Nitrogen, Elastic scattering, Reprints, *Electron-molecule collisions.

Elastic scattering cross sections for electron scattering by N2 have been calculated in the static-plus-local-exchange model using two different target wavefunctions: Hartree Fock (HF) and Multi-configuration Self-Consistent-Field First-Order-Configuration-Interaction (MCSCF-FOCI). The range of impact energy considered is 1.5 to 30 eV. Inclusion of electron correlation in the target wavefunction changes the position of the Pi(sub g) low-energy resonance by about 0.5 eV. Nonresonant partial cross sections typically change by 2% at the equilibrium internuclear separation but sometimes more (up to 26% at the equilibrium internuclear distance and even more at stretched geometries).

705,910
PB87-152013 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Measurement of Resonant and Non-Resonant Third Order Nonlinear Susceptibilities by Coherent Raman Spectroscopy.
Final rept.,
G. J. Rosasco, and W. S. Hurst. 1985, 19p
Pub. in Physical Review A-General Physics 32, n1 p281-299 1985.

Keywords: *Nitrogen, Gases, Reprints, *Raman spectroscopy.

A phase modulation technique for coherent Raman spectroscopy is used to measure both the real and imaginary parts of the third-order nonlinear susceptibility of gases. The Raman Q-branch resonance of D2 is calibrated by comparison to the Q-branch resonance of N2. By using D2 as an internal standard, the nonresonant electronic susceptibility of Ar and the sum of the electronic and molecular reorientation contributions to the non-resonant susceptibility of N2 are determined. The results of these measurements are compared to published data on the Q-branch Raman cross-section of H2, to predictions from the theory of the optical (AC) Kerr effect, and to measurements of electronic hyperpolarizabilities. Formula inter-relating a number of different definitions of third-order susceptibilities found in the literature are presented.

705,911
PB87-152864 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Molecular Half Collision Analysis of Atomic Lineshapes.
Final rept.,
F. H. Mies, and P. S. Julienne. 1985, 28p
Pub. in Spectral Line Shapes 3, p393-420 1985.

Keywords: *Dissociation, *Photochemical reactions, Reprints, *Atomic line shapes.

Given current access to powerful quantum chemistry codes which provide interaction potentials, electronic wavefunctions and coupling matrix elements for diatomic molecules, and given the very stable numerical close-coupling codes that are available, the authors can generate multichannel continuum wavefunctions Psi(1+, sub i) for the diatom AB of almost arbitrary accuracy. If these numerical capabilities are coupled with the rigorous analytic description of the diatomic wavefunctions provided by multichannel quantum defect analysis (MCQDA), especially in the vicinity of dissociation thresholds, the authors are in a position to describe a wide variety of diatom phenomena with a great deal of confidence, and with renewed insights.

705,912
PB87-153672 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Stimulated Desorption Studies of Defect Structures on TiO2.
Final rept.,
R. L. Kurtz. 1986, 27p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Surface Science 177, p526-552 1986.

Keywords: *Titanium dioxide, *Rutile, *Desorption, Surfaces, Reprints, Electron stimulated desorption, Photon stimulated desorption.

The influence of the surface geometric structure on the electron and photon-stimulated desorption (ESD, PSD) ion yield from TiO2(001) and TiO2(110) has been studied. For both surfaces, angle-integrated ESD yields have been measured as a function of annealing temperature ranging from room temperature sputtered surfaces to 1200 K annealed surfaces. These measurements imply that the local geometry of the desorption site must be considered in order to adequately explain the observed ion yield variations.

705,913
PB87-153698 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Alkali-Metal Negative Ions. 4. Multichannel Calculations of K(1-) Photodetachment.
Final rept.,
K. T. Taylor, and D. W. Norcross. 1986, 14p
Grant NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review A 34, n5 p3878-3891 Nov 86.

Keywords: Reprints, *Photodetachment, *Negative ions, *Alkali metals.

The results of ab initio calculations of photodetachment of K(-1) are presented and compared with experimental measurements. The energy region studied is from threshold to the vicinity of the first excited state of neutral potassium. The calculations are essentially nonrelativistic in nature, but the fine structure in the first excited state (a doublet) is resolved in the calculations by a three-step process: a transformation of dynamical variables to a form that is relatively independent of energy over an energy range comparable to the splitting, an algebraic transformation from LS to jj coupling, and finally by kinematic corrections for the splitting. The initial transformation, a simple phase rotation, was determined empirically, but is shown to be consistent with a formal correction for the effects of long-range polarization forces in electron scattering by potassium near the np(2)p(0) threshold.

705,914
PB87-153706 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Observation of Quantum Jumps.
Final rept.,
T. Sauter, W. Neuhauser, R. Blatt, and P. E. Toschek. 1986, 3p
Pub. in Physical Review Letters 57, n14 p1696-1698, 6 Oct 86.

Keywords: Reprints, *Barium ions, *Laser spectroscopy, *Resonance fluorescence, Ion trapping.

The authors have recorded the laser-excited resonance fluorescence of one to three Ba(+) ions and observed Bohr's 'quantum jumps' when an ion decayed to the metastable doublet D(5/2) state, suddenly quenching its fluorescence. Most of the jumps mark Raman-Stokes scattering from the doublet S(1/2) and doublet D(3/2) levels.

705,915
PB87-153805 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Stark Broadening of H(sub alpha) and H(sub beta) Lines of C(5+).
Final rept.,
D. H. Oza, R. L. Greene, and D. E. Kelleher. 1986, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Review A 34, n5 p4519-4522 Nov 86.

Keywords: *Carbon, Spectral lines, Electrons, Density, Reprints, *Stark broadening.

The authors have computed the Stark-broadened profiles of the first two Balmer lines (n=3,4->2) of C(5+). Plasma conditions span the electron density range n(sub e)=10(sup 17)-10(sup 20)/cc, and T=20-300 eV. The calculations include ion-dynamic effects, which are very important at the lower densities for H(sub alpha) (n = 3 -> 2). At the higher densities, the dynamic profiles approach the static ones.

705,916
PB87-153847 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Characterization of Single Levitated Droplets by Raman Spectroscopy.
Final rept.,
R. E. Preston, T. R. Lettieri, and H. G. Semerjian. 1985, 3p
Pub. in Langmuir 1, n3 p365-367 1985.

Keywords: *Drops(Liquids), Aerosols, Molecular spectra, Reprints, *Raman spectroscopy.

The results of a preliminary investigation into the use of Raman spectroscopy for the chemical characterization of single aerosol droplets are reported. The dioctyl phthlate droplets, 10 to 35 micrometers in diameter, were suspended by the radiation pressure of an argon ion laser beam. Initial experiments used a photomultiplier-based system which collected a 400 cm wide spectrum in about one half hour. This system was adequate for monitoring quasi-static droplet processes, but for faster processes an optical multichannel analyzer-based system was used to collect spectra in about one second. Droplet spectra from both instruments showed sharp, unexplained features not present in bulk liquid spectra.

705,917
PB87-157111 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Electronic Transition Dipole Moment Functions for NaK.
Final rept.,
L. B. Ratcliff, D. D. Konowalow, and W. J. Stevens. 1985, 14p
Pub. in Jnl. of Molecular Spectroscopy 110, n2 p242-255 Apr 85.

Keywords: *Dipole moments, Molecular spectroscopy, Reprints, Diatomic molecules.

Phase consistent electronic transition dipole moment functions are calculated (as a function of internuclear separation) for the 80 dipole selection rule allowed transitions in the manifold of states of NaK treated by the authors earlier. Agreement is found with experimental determinations of the Z (sup 1)Pi - 1 (sup 1) sigma(1+) transition. Agreement of the asymptotic values with experimental and previous theoretical determinations of corresponding atomic transition moments suggests that the present computations may be relatively reliable. The positions of a number of satellite bands are predicted from their potential energy difference curves.

705,918
PB87-157152 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Neutron and X-ray Diffraction Study on Polymorphism in Lithium Orthotantalate, Li3TaO4: Correction and Discussion.
Final rept.,
R. S. Roth. 1984, 2p
See also report dated 1983, PB84-137876.
Pub. in Jnl. of Solid State Chemistry 51, n3 p403-404 1984.

Keywords: *Neutron diffraction, *X ray diffraction, *Polymorphism, Synthesis(Chemistry), Stability, Low temperature tests, Reprints, *Lithium tantalates.

Synthesis and stability of various polymorphs of Li3TaO4 are discussed and a wrong impression, given in the previous paper of the same title, is corrected.

705,919
PB87-161568 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Theory of Ostwald Ripening.
Final rept.,
P. W. Voorhees. Jan 85, 21p
See also report dated January 1, 1984, AD-A139661.
Pub. in Jnl. of Statistical Physics 38, n1-2 p232-252 Jan 85.

Keywords: *Phase transformation, *Ostwald ripening.

Developments in the theory of Ostwald ripening since the classic work of I. M. Lifshitz and V. V. Sloyzov (LS)

is reviewed and directions for future work are suggested. Recent theoretical work on the role of a finite volume fraction of coarsening phase on the ripening behavior of two-phase systems is reformulated in terms of a consistent set of notation through which each of the theories can be compared and constrasted. New work on transient Ostwald ripening is presented which illustrates the broad range of behavior which is possible in the regime. The conditions responsible for the presence of the asymptotic state first discovered by LS, as well as the manner in which this state is approached is also discussed. The role of elastic fields during Ostwald ripening in solid-solid mixtures is reviewed, and it is shown that these fields can play a dominant role in determining a solid-solid systems coarsening behavior.

705,920
PB87-161576 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Trends in the Electric Quadrupole Fields at Dilute Impurity Sites in Transition Metal-Transition Metal Alloys.
Final rept.,
R. E. Watson, R. M. Sternheimer, and L. H. Bennett. 1 Nov 84, 11p
Pub. in Physical Review B 30, n9 p5209-5219, 1 Nov 84.

Keywords: *Transition metals, Alloys, Reprints, Electric quadrupole fields.

The available electric field gradient data at transition metal impurity and at host sites in transition metal hosts has been inspected for indications of trends in alloying behavior. The raw data indicates that the gradients fall in two groups, depending on whether the host metal has over or under half-filled d bands, and the gradients for any given probe atom are largely independent of which host, in a given group, is involved. Inspection of the normalized results suggests that the observed gradients, by their very magnitude, must be largely intra-atomic in origin. It is found that, while there is scatter in the data, the gradients at host and impurity sites, in the under half-filled d shell hosts, show little chemical variation with either differing impurity or differing host. The normalized data for the over half-filled d shell hosts, on the other hand, appear to show a chemical trend which is also to be seen in the enthalpies of formation of the more concentrated alloys.

705,921
PB87-161634 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Convection-Induced Distortion of a Solid-Liquid Interface.
Final rept.,
R. J. Schaefer, and S. R. Coriell. 1984, 7p
Pub. in Metallurgical Transactions A 15A, n12 p2109-2115 1984.

Keywords: *Convection, Crystal growth, Stability, Solidification, Reprints.

Measurements of convective flow fields and solid-liquid interface shapes during the solidification of a pure and a slightly alloyed transparent material reveal that the convective transport of solute can cause a macroscopic depression to develop in the solid-liquid interface. This effect occurs under conditions close to those which are predicted to produce morphological instability of a planar interface. A cellular or dendritic microstructure later develops within the interface depression. The convection is attributed to the effect of radial temperature gradients in the crystal growth apparatus.

705,922
PB87-161741 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Observation of Quantum Jumps in a Single Atom.
Final rept.,
J. C. Bergquist, R. G. Hulet, W. M. Itano, and D. J. Wineland. 6 Oct 86, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Physical Review Letters 57, n14 p1699-1702, 6 Oct 86.

Keywords: *Atoms, *Atomic energy levels, Fluorescence, Reprints, *Mercury ions, Ion trapping, Laser cooling.

The authors detect the radiatively driven electric quadrupole transition to the metastable doublet D(5/2) state in a single, laser-cooled Hg II ion by monitoring the abrupt cessation of the fluorescence signal from the laser-excited doublet S(1/2) -> doublet P(1/2) first resonance line. When the ion 'jumps' back from the metastable D state to the ground S state, the S -> P resonance fluorescence signal immediately returns. The statistical properties of the quantum jumps are investigated; for example, photon antibunching in the emission from the D state is observed with 100% efficiency.

705,923
PB87-161758 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Far-Infrared Laser Magnetic Resonance Spectrum of the CF Radical and Determination of Ground State Parameters.
Final rept.,
J. M. Brown, J. E. Schubert, R. J. Saykally, and K. M. Evenson. 1986, 14p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 120, p421-434 1986.

Keywords: *Chemical radicals, Ground state, Far infrared radiation, Molecular spectroscopy, Reprints, *Electronic structure.

Observations in the far-infrared laser magnetic resonance spectrum of the CF radical in its ground (sup 2)Pi state have been extended to include fine structure transitions between the two spin components. The data are fitted together with all previous measurements relating to the nu=0 level to obtain a complete set of molecular parameters, including the spin-orbit splitting which has been determined at 77.196916(14)/cm. The implications for the electronic structure of various parameters are also discussed.

705,924
PB87-161790 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Interaction of Water with Li-Predosed Ru (001).
Final rept.,
S. Semancik, D. L. Doering, and T. E. Madey. 1985, 2p
Pub. in Jnl. of Vacuum Science and Technology A - Vacuum Surfaces and Films 3, n3 p1571-1572 1985.

Keywords: *Sorption, *Ruthenium, *Water, Surface chemistry, Lithium, Reprints, Electron stimulated desorption.

Surface sensitive techniques have been used to investigate the reaction of H2O with Li on a Ru(001) crystal. Water dissociation was found to occur for Li coverages significantly lower than those at which Na induced H2O decomposition on the same substrate.

705,925
PB87-161840 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Ellipsometry of Thin Films on Vapor-Liquid Interfaces.
Final rept.,
J. W. Schmidt, and M. R. Moldover. Dec 83, 3p
Pub. in Jnl. Phys. Colloq. 44, nC-10 p243-245 Dec 83.

Keywords: *Thin films, *Polarimetry, Reprints, Binary mixture, Cyclohexane/methyl-perfluoro, Isopropanol.

In certain binary solutions the lower of the two liquid phases can form a layer which intrudes between the upper liquid phase and the vapor. As the temperature is increased, the intruding layer abruptly appears at a characteristic wetting temperature T(sub w)=311K. This temperature is well below the consolute temperature (T(sub c)=363K). Below T(sub w, the layer's thickness (measured by ellipsometry) may be zero and is no greater than 2 nm. Above T(sub w) the intruding layer's thickness is several hundred Angstroms and its variation with temperature is extremely weak. As the temperature of a particular sample was raised still further towards T(sub c) the lower phase dissolved into the upper liquid phase. At 328K the lower phase disappeared. Within + or - 0.05 K of this temperature the film thickness abruptly returned to zero. These data provide strong experimental evidence that both transitions are first order.

705,926
PB87-161857 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Transport Properties of Isobutane.
Final rept.,
J. C. Nieuwoudt, B. Le Neindre, R. Tufeu, and J. V. Sengers. 1987, 8p
Pub. in Jnl. of Chemical and Engineering Data 32, n1 p1-8 1987.

Keywords: *Transport properties, Butanes, Viscosity, Thermal conductivity, Reprints, *Isobutane.

Representative equations are presented for the viscosity and thermal conductivity of isobutane as a function of temperature and density. The equations are based on existing experimental data for the viscosity and new experimental data for the thermal conductivity of isobutane.

705,927
PB87-162053 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Molecular Dynamics on Vector Computers.
Final rept.,
F. Sullivan, R. D. Mountain, and J. O'Connell. 1985, 16p
Pub. in Jnl. of Computational Physics 61, n1 p138-153 1985.

Keywords: Algorithms, Reprints, *Molecular dynamics, Computer applications, Cyber-205 computers.

An algorithm has been developed for computer simulation of molecular dynamics. The algorithm, called the 'Method of Lights', is based on sorting and on reformulating the way in which neighbor lists are constructed. It uses data structures compatible with either traditional scalar computer architecture or specialized vector statements which perform computations in parallel. The algorithm has been implemented on the CYBER 205 computer. Tests indicate that the method reduces running time over standard methods in scalar form, and that 'vectorization' produces an order-of-magnitude decrease in execution time.

705,928
PB87-162087 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Length and Mass Div.
Remeasurement of the Rydberg Constant.
Final rept.,
P. Zhao, W. Lichten, H. P. Layer, and J. C. Bergquist. 1986, 4p
Grant NSF-PHY84-19105
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review A 34, n6 p5138-5141 Dec 86.

Keywords: Metrology, Reprints, *Rydberg constant.

The authors report a remeasurement of the Rydberg constant via a single-photon determination of the Balmer-a wavelength. The new value reflects the redefinition of the meter, a reexamination of corrections, and improvements of the experimental apparatus. The result is R= 109737.31569 cm, where c = 299792458 m/s by definition. The result does not significantly disagree with the preceding measurement by Amin et al., significantly disagrees with the measurement by Hildum et al., and agrees very well with a recent measurement by Biraben and Julien.

705,929
PB87-162244 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Doppler-Free Resonantly-Enhanced Two-Photon Spectroscopy of np and nf Rydberg States in Atomic Cesium.
Final rept.,
C. J. Sansonetti, and C. J. Lorenzen. Oct 84, 7p
Pub. in Physical Review A 30, n4 p1805-1811 Oct 84.

Keywords: *Cesium, Excitation, Reprints, *Rydberg states, Laser spectroscopy.

The fine-structure intervals of selected np (n=18-83) and nf (n=14-28) Rydberg states in neutral Cs have been measured by Doppler-free resonantly-enhanced two-photon laser spectroscopy with a thermionic diode detector. One cw dye laser was tuned near resonance

with a 6s - 5d electric quadrupole transition while a second was scanned through the relevant 5d - np, nf transitions. This is the first Doppler-free study of these series by strictly optical methods. The experimental fine-structure intervals are in good agreement with splitting formulas derived by other authors from fine-structure measurements of lower-lying np and nf levels. Our results and the best previous data have been fitted with several expressions that have been used or suggested for the representation of fine structure data. A recently proposed expansion formula including inverse even powers of the effective quantum number is found to be inconsistent with the best available n(2)P intervals.

705,930
PB87-162285 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Application of a New High Temperature Reactor to Unimolecular Decompositions.
Final rept.,
M. D. Scheer, W. Braun, and J. R. McNesby. 25 Jan 85, 6p
Pub. in Chemical Physics Letters 113, n4 p407-412, 25 Jan 85.

Keywords: *Decomposition, Chemical reactions, Activation energy, Reprints, *Cyclobutanone, *Chemical reactors, Laser applications.

The heating of fused silica by the absorption of laser infra-red radiation is the basis for the design of a short residence time-high temperature reactor. When the laser is focused on the exit orifice of a silica flow tube a dilute mixture of a reactant gas in helium is exposed to the high orifice temperature for only about 2 x 10 to the -5th s. During such short time intervals, secondary decompositions tend to be reduced. The heating method was applied to the multichannel decomposition of cyclobutanone. The formation of propylene by the secondary isomerization of cyclopropane was suppressed sufficiently and shown to be formed directly from the cyclobutanone in a high activation energy channel.

705,931
PB87-162293 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Thermal Decomposition of Ions. 1. Pyrolysis of Protonated Ethers. Activation Energies and A Factors.
Final rept.,
L. W. Sieck, and M. Mautner. 1984, 4p
See also PB87-162301.
Pub. in Jnl. of Physical Chemistry 88, n22 p5324-5327 1984.

Keywords: *Pyrolysis, *Ethers, Mass spectroscopy, Chemical reactions, Gases, Decomposition, Activation energy, Reprints, Rate constants.

Unimolecular rate constants k(sub d) have been measured at the high pressure limit for the thermal decomposition of protonated dimethoxyethane (glyme) and (2-methoxyethyl) ether (diglyme). In both cases the decomposition involves loss of CH3OH and formation of an oxy-carbonium ion. The variation of k(sub d) with temperature gives log A = 11.1 and E(sub a) = 21.1 kcal/mol for the pyrolysis of (glyme)H(+1) and log A=13.7 and E(sub a)=30.7 for (diglyme)H. To the best of the authors knowledge these are the first Arrhenius parameters ever determined for the decomposition of cations in the vapor phase underequilibrium conditions at the high pressure limit. The data and thermochemistry are consistent with a transition state in which electron shifts result in the disruption of an internal hydrogen bond.

705,932
PB87-162301 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Thermal Decomposition of Ions. 2. Pyrolysis of Protonated t-Butylmethylether at the Low Pressure Limit. Activation Efficiencies for Various Bath Cases.
Final rept.,
L. W. Sieck, and M. Mautner. 1984, 4p
See also PB87-162293.
Pub. in Jnl. of Physical Chemistry 88, n22 p5328-5331 1984.

Keywords: *Pyrolysis, Chemical reactions, Gases, Reprints, *Ether/butyl-methyl, Rate constants.

The efficiencies of various bath gases in promoting the thermal unimolecular decomposition of (t-C4H9O(H3)H(+1) which dissociates to yield CH3OH and t-C4H9(+1), has been investigated by pulsed high pressure mass spectrometry. These measurements were taken at the low pressure limit at 518 K. Taking the activation efficiency of CO2 as 1.00, relative values range from 0.42 for N2 to 3.8 for cyclohexane. The temperature dependence of the efficiencies of N2 and cyclohexane have also been measured from 500 to 560 K. Comparison of the activation data with efficiencies reported for collisional stabilization (deactivation) of excited ionic substrates shows some striking similarities.

705,933
PB87-163697 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD.
Catalog of Saddle Shaped Surfaces in Crystals.
Final rept.,
J. E. Taylor, and J. W. Cahn. Jan 86, 12p
Pub. in Acta Metallurgica 34, n1 p1-12 Jan 86.

Keywords: *Crystal structures, *Surfaces, Anisotropy, Metallography, Reprints.

The authors present a catalog of features of surfaces of minimum energy in or on solids. This catalog corrects an earlier expectation about local structures by one of us (Cahn) that was too restrictive. The authors list all possible local structures of interfaces under quite general conditions, and provide in the appendix a proof of completeness.

705,934
PB87-163705 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD.
Metallic Phase with Long-Range Orientational Order and No Translational Symmetry.
Final rept.,
D. Shechtman, I. Blech, D. Gratias, and J. W. Cahn. 12 Nov 84, 3p
Pub. in Physical Review Letters 53, n20 p1951-1953, 12 Nov 84.

Keywords: *Aluminum alloys, Symmetry, Reprints, Amorphous materials.

The authors give evidence of a new kind of metallic solid made by rapid solidification that has long-ranged orientational order, but is not a crystal. Its point group symmetry, icosahedral, is inconsistent with lattice translations. The solid is unlike a liquid crystal because it is solid and its orientational order is long-ranged. For the same reasons, it is also unlike several theoretical speculations about locally orientationally ordered phases, such as the hexatic two-dimensional phase. The morphology indicates that the solid forms from the liquid by a first order transition.

705,935
PB87-163770 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Measurement of Ion/Molecule Reactions between 10 and 20 K.
Final rept.,
S. E. Barlow, J. A. Luine, and G. H. Dunn. 1986, 32p
Grant NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in International Jnl. of Mass Spectrometry and Ion Processes 74, p97-128 1986.

Keywords: *Mass spectroscopy, Chemical reactions, Spectroscopic analysis, Reprints, *Penning ion trap, *Ion-molecule collision.

In the paper, the authors describe an instrument and measurement technique which makes possible the determination of gas-phase ion/molecule reactions down to 10 K or lower and up to 20-100 K, depending on the species. The technique is particularly useful for the measurement of reaction rates between 10 to the minus 11th power and 10 to the minus 15th power cc/s to the minus 1 power. The instrument makes use of a cooled hyperbolic Penning trap and a bolometric detector. The authors also describe the behavior of the stored ions and their interactions with the cryogenic neutral gases.

705,936
PB87-163812 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron-Impact Excitation of Ions in the Magnesium Sequence. II. S V, Ar VII, Ca IX, Cr XIII, and Ni XVII.
Final rept.
R. B. Christensen, D. W. Norcross, and A. K. Pradhan. Dec 86, 12p
Contract DOE-EA-77-66-6010
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 34, n6 p4704-4715 Dec 86.

Keywords: *Excitation, Electron scattering, Sulfur, Vanadium, Argon, Calcium, Chromium, Nickel, Reprints, *Electron-ion collisions, *Mg like ions.

Collision strengths are presented for all transitions between the states (including fine structure) 3s(2) singlet S(sub 0), 3s 3p(triplet P(sub 0,1,2), singlet P(sub 1)), 3p(2) (triplet P(sub 0,1,2), singlet D(sub 2), singlet S(sub 0), 3s 3d (triplet D(sub 1,2,3), singlet D(sub 2), and 3s 4s (triplet S(sub 1), singlet S(sub 0)) in Mg-like ions Sv, Ar VII, Ca IX, Cr XIII, and Ni XVII. The calculations are carried out in LS coupling using the distorted-wave approximation with a ten-state eigenfunction expansion. Relativistic effects in the target states are taken into account using the Breit-Pauli Hamiltonian, and the term-coupling coefficients thereby obtained are employed to accomplish the transformation of the scattering matrices to intermediate coupling. Atomic effects involving autoionizing resonances in some transitions are considered, as well as the contribution of high partial waves to the transition 3s(2) singlet S(sub 0) - 3s 3d singlet D(sub 2). The problem of bound-channel correlation-type functions in the eigenfunction expansion is discussed in some detail.

705,937
PB87-163820 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Time-Resolved FTIR Photofragment Emission Spectroscopy: HCl Vibrational Distributions from the 193 nm Photolysis Chloroethylenes.
Final rept.,
D. J. Donaldson, and S. R. Leone. 12 Dec 86, 7p
Contract DE-AC02-79-ER10396, Grant NSF-CHE84-08403
Sponsored by Department of Energy, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Chemical Physics Letters 132, n3 p240-246, 12 Dec 86.

Keywords: *Infrared spectroscopy, Vinyl chloride, Hydrogen chloride, Reprints, *Fourier transform spectroscopy, Ethylene/dichloro.

With minor modifications to commercial instrumentation, time-resolved FTIR emission spectroscopy is demonstrated for the determination of photofragment internal state distributions. Vinyl chloride and dichloroethylene photolysis at 193 nm serve as test cases and exhibit high signal-to-noise. The vibrational distributions in the first four levels of the HCl photoproduct of vinyl chloride and 1.2-trans-dichloroethylene are in good agreement with previous determinations.

705,938
PB87-163861 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Thermodynamics of Ammonium Scheelites. 3. An Analysis of the Heat Capacity and Related Data of Deuterated Ammonium Perrhenate ND4ReO4.
Final rept.,
R. J. C. Brown, J. E. Callanan, R. D. Weir, and E. F. Westrum. 15 Nov 86, 8p
See also PB87-118105. Sponsored by Natural Sciences and Engineering Research Council of Canada, Ottawa (Ontario), and Department of National Defence, Ottawa (Ontario).
Pub. in Jnl. of Chemical Physics 85, n10 p5963-5970, 15 Nov 86.

Keywords: *Thermodynamics, Specific heat, Deuterium compounds, *Ammonium scheelites, Heat capacity.

An analysis of the heat capacity of deuterated and undeuterated NH4ReO4 has been carried out in which the effects of the anisotropy of the thermal expansion have been considered, an approach hitherto not used for ammonium compounds. In the ammonium scheelites, the axial thermal expansion coefficients are very

large, but of opposite sign, and as a result the volume of the scheelite lattice is nearly independent of temperature. It is shown that the correction from constant stress to constant strain results in a major contribution to the heat capacity of this highly anisotropic lattice. The difference between the experimental and calculated values of heat capacity, referred to as delta C(sub p), is expressed as the sum of the contributions from the anisotropy and the rotational heat capacity. The results of the analysis show that the rotational contribution is much smaller than previously thought. However, the exact contribution of the anisotropy cannot be calculated at this time because the elastic constants are not known.

705,939
PB87-164000 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Stabilized Vapor Liquid Interface in Deuterated Cyclohexane-Methanol Mixtures.
Final rept.,
J. W. Schmidt. 15 Sep 86, 5p
Contract NASA-H-27954-B
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Physics 85, n6 p3631-3635, 15 Sep 86.

Keywords: *Cyclohexane, Ellipsometry, Carbinols, Interfaces, Deuterium compounds, Reprints, *Binary mixtures, *Methanol.

The ellipticity of the vapor-liquid interface above mixtures of methanol (CH3OH) and deuterated cyclohexane (C6D12) has been measured in the vicinity of the consolute point. The data above and below T(sub c) are consistent with models for the structure of the interface adapted from the theory of Widom and Ramos-Gomez and Widom. As three-phase coexistence is approached, the quantity of methanol adsorbed at the interface increases whether ordinary or deuterated cyclohexane is used in the mixture. If ordinary cyclohexane were used for studies within the three-phase region below T(sub c), thick, unstable, lenticular films of the methanol-rich liquid phase would form at the interface and lead to nonreproducible data. In the present measurements lenticular films do not form when deuterated cyclohexane is used in the mixture. (The entire methanol-rich phase then forms on top.) The gravitationally stable interface above the deuterated mixture can be studied reliably in the three-phase region below T(sub c) even though the liquid phases are nearly density matched.

705,940
PB87-164018 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Surface Properties of the Mixture Water + Phenol.
Final rept.,
F. Guzman, and J. W. Schmidt. 15 Jan 87, 2p
Pub. in Jnl. of Physical Chemistry 91, n2 p263-264, 15 Jan 87.

Keywords: *Phenol, *Water, *Surface properties, Wetting, Polarimetry, Reprints, Binary mixtures.

A surprising observation concerning the vapor-liquid interface in the mixture phenol + water has been confirmed. An ellipsometric study of this mixture shows no indication of a thick wetting layer at the vapor-liquid interface when the mixture undergoes a transition from one into two liquid phases. The behavior in this system is markedly different from that of alcohol + fluorocarbon systems studied with the same technique in which layers form that can be hundreds of angstroms thick. By contrast in this system hundreds of tiny droplets form at the vapor-liquid interface and persist for many hours both in thermally equilibrated and in steadily cooled samples. Ellipticity values from equilibrated samples when interpreted via a slab model yield film thicknesses of only two or three monolayers.

705,941
PB87-165684 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron-Impact Excitation of the Resonance Transition in Be (+1): An 'ab initio' Treatment of Core-Correlation and - Polarization Effects.
Final rept.,
F. A. Parpia, D. W. Norcross, and F. J. da Paixao. Dec 86, 8p
Contract DOE-77-A-01-6010
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 34, n6 p4777-4784 Dec 86.

Keywords: *Excitation, *Beryllium, Electron scattering, Reprints.

The authors present theoretical electron-impact-excitation cross sections for several transitions in Be(+1), and fluorescence radiation polarizations for the Be(+1) resonance doublet. The projectile-electron energy varies from 0.3-2.0 Ry. A five-state close-coupling approximation is used. The target model is the most sophisticated employed in any scattering calculation to date, and yields oscillator strengths for several transitions in Be(+1) that are the most accurate available. The results do not, however, improve upon previous work as regards the notable discrepancies between calculations and experimental measurements for excitation of the resonance transition. This indicates that high rigor in the treatment of short-range core-correlation effects is not required for an accurate description of these processes, and therefore either that other, heretofore ignored, effects must be taken into account in the theory or that other measurements are necessary. An accurate measurement of the hyperfine structure of the j=3/2 fine-structure level of the doublet would be of particular and decisive importance.

705,942
PB87-165692 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Bound Electronic States of HCl(-1).
Final rept.,
S. V. O'Neil, P. Rosmus, D. W. Norcross, and H. J. Werner. 15 Dec 86, 9p
Contract DOE-EA-77-A-01-6010, Grant NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 85, n12 p7232-7240, 15 Dec 86.

Keywords: *Hydrogen chloride, Reprints, *Electronic structure.

The paper reports ab initio Born-Oppenheimer calculations on the X singlet Sigma state of HCl and on the 1 double Sigma, 2 doublet Sigma and (sup 2)Pi states of HCl(-1) for internuclear distances at which these states are electronically bound. The calculations employed square-integrable configuration interaction wave functions which included all single and double replacements from multiconfiguration reference functions. The MC-SCF reference configurations and the Gaussian atomic basis encompass the dominant effects which govern the electronic states studied. In the process of these calculations, the authors have calculated the static polar izability of Cl(-1) and reproduced the known polarizabilities of H, Cl, and H(-1). The calculations on the X singlet Sigma state of HCl yield a D(sub e) within 0.10 eV of the measured value, and omega (sub e) within 3/cm of the measured value. For the molecular ion, they find the potential of the doublet Sigma state of HCl(-1) to be attractive and to undergo substantial charge transfer, and the potential of the (sup 2)Pi and 2 doublet Sigma states to be repulsive even at large internuclear separations.

705,943
PB87-165726 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Optimized Predictions for Heats of Formation of Transition-Metal Alloys 2.
Final rept.,
R. E. Watson, and L. H. Bennett. 1984, 15p
Pub. in CALPHAD: Computer Coupling Phase Diagrams Thermochem 8, n4 p307-321 1984.

Keywords: *Heat of formation, *Transition metals, Thermodynamic properties, Enthalpy, Reprints.

A simple Friedel type d-band model of alloy enthalpies of formation has been used in an interpolation scheme, fitted to experimental data, to obtain heats for the 50/50 transition-metal alloys. This present fit employs a data base which is substantially improved over the one used previously in the journal. The fit has also been extended to include La and Th alloys. The rms error in the fit, for the set of alloys for which there is experimental enthalpy, is the same as the rms uncertainty in that data. Granted this, these enthalpy values should be of use in the thermodynamic predictions of phase diagrams for which there is no experimental data.

705,944
PB87-165742 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Quasi-Static Ion Broadening of Isolated Spectral Lines.
Final rept.,
L. A. Woltz. 1986, 9p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 36, n6 p547-555 1986.

Keywords: *Spectral lines, Reprints, *Static ion broadening.

A tabulation of theoretical profiles of isolated spectral lines broadened by quasi-static ions is presented. This calculation is based on the quasi-static ion theory of Griem. A greater frequency range and a larger number of ion-broadening parameters than published by Griem are employed to facilitate comparisons with experiments. Observations on the validity of asymptotic wing formulas are included.

705,945
PB87-165890 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Autoionisation States (3l3l') of the Helium-Like Nitrogen Ion.
Final rept.,
D. H. Oza. 1987, 5p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl of Physics B: Atomic and Molecular Physics 20, pL13-L17 1987.

Keywords: Electron scattering, Resonance, Reprints, *Nitrogen ions, *Autoionization.

The scattering of electrons by the N(6+) ion has been studied in the vicinity of the intrashell autoionization levels (3l3l') of the N(5+) ion using a 14-state pseudostate close-coupling approximation. The resonance parameters (energy and width) are determined for the autoionization states. The present results are in good agreement with those obtained by the complex coordinate rotation method. The energy values of these states are supported by recent experimental measurements of the ejected-electron energies following the autoionization.

705,946
PB87-166443
(Order as PB87-166401, PC **A05**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Chemical Engineering.
Ideal Gas Thermodynamic Functions for Water,
H. W. Woolley. 27 Oct 86, 17p
Included in Jnl. of Research of the National Bureau of Standards, v92 n1 p35-53 Jan-Feb 87.

Keywords: *Water vapor, *Steam, *Thermodynamic properties, Ideal gas law, Computer programs, Basic programming language.

The calculation of ideal gas thermodynamic properties for steam to 10,000 K is examined. Centrifugal effects are included using spectroscopic data for the lowest vibrational levels, with extension to higher bending levels based on estimates from a bending model. Modifications are examined for rotational and vibrational cut-off effects. Uncertainties in obtaining a suitably regularized representation of energy versus bond stretching vibration in approaching the dissociation energy region appear relevant to the reliability of the extrapolation.

705,947
PB87-171690 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Equilibrium Study of the Conversion of L-Phenylalanine to Trans-Cinnamic Acid and Ammonia.
Final rept.,
Y. B. Tewari, E. Gajewski, and R. N. Goldberg. 12 Feb 87, 6p
Pub. in Jnl. of Physical Chemistry 91, n4 p904-909, 12 Feb 87.

Keywords: *Thermodynamics, *Phenylalanine, *Cinnamic acids, Chemical equilibrium, Amino acids, Carboxylic acids, Chromatographic analysis, Enthalpy, Gibbs free energy, Specific heat, Reprints.

The thermodynamics of the enzymatic conversion (L-phenylalanine ammonia-lyase) of aqueous L-phenylalanine to trans-cinnamic acid and ammonia has been investigated by using high-performance liquid chromatography (HPLC). The reaction was carried out in 0.1 M Tris/HC1 buffer containing ammonium chloride over the pH range 7.0-7.7, at ionic strengths from 1.0 to 2.1 mol/kg, and over the temperature range 285-316 K. Analysis of the HPLC data using an estimated heat capacity change of 50 J/mol K and an 'ion-size' parameter of 1.6/mol(sup 1/2) kg(sup 1/2) leads to an equilibrium constant of 1.16 + or - 0.3 mol/kg and an enthalpy change of 24.8 + or - 2.0 kJ/mol at 298.15 K for the process L-phenylalanine (aq) = trans-cannamic acid (aq) + NH4+(aq). The use of these thermodynamic parameters in an equilibrium model for this system allows for the prediction of values of the apparent equilibrium constant as a function of pH, temperature, and composition and also of the effects of these parameters on the optimal product yield of L-phenylalanine during its manufacture from trans-cinnamic acid and ammonia. The available thermochemical data for this generic type of reaction can be rationalized in terms of a scheme which views the entropy changes for related processes to be comparable and then attributes differences in Gibbs energy changes to differences in enthalpy changes which can be influenced by effects such as resonance stabilization of the double bonds which are formed.

705,948
PB87-171757 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Wavelengths and Energy Levels of Zn XII to Zn XX.
Final rept.,
J. Sugar, and V. Kaufman. 1986, 8p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physica Scripta 34, p797-804 1986.

Keywords: *Zinc, *Atomic energy levels, Wavelengths, Atomic spectra, Reprints.

Spectra of zinc in the ionization stages XII to XX were obtained with a laser-generated plasma and recorded photographically with a 10.7m grazing incidence vacuum spectrograph in the range of 40 to 460 A. Transition arrays of the type 3s(2) 3p(sup n) - 3s 3p((n+1) sup 1) and 3s(2) 3p(sup n) - 3s 3p((n-1) sup 1) 3d in the Al to Cl isoelectronic sequences were analyzed. In addition four excited configurations of Mg-like Zn were established. The authors present measurements of 145 spectral lines, of which 120 are newly classified. Energy levels, fitted radial integrals, and percentage compositions in LS-coupling are given. Previously classified magnetic dipole (M1) lines are compared with these levels for confirmation of their identification, and are sometimes used to improve the level values. For P-like zinc, predicted values for the M1 transitions within the ground configuration are obtained from the new levels.

705,949
PB87-172680 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Interfacial Resistance for Carboxylic Acid Transfer from Decane to Water.
Final rept.,
G. J. Hanna, R. D. Noble, and F. C. Michel. 15 Jan 87, 4p
Pub. in Jnl. of Physical Chemistry 91, n2 p362-365, 15 Jan 87.

Keywords: *Carboxylic acids, *Decane, Acetic acid, Butyric acid, Propionic acid, Water, Reprints, *Interfacial resistance.

The transfer of three carboxylic acids (acetic, propionic, and butyric) from decane to water was studied by using the rotating diffusion cell with organic and aqueous membranes. The interfacial resistance was very sensitive to the value of the diffusion coefficient used. A trend of increasing interfacial resistance with increasing carbon chain length was observed.

705,950
PB87-172755 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Role of Site Conversion in Vibrational Spectroscopy of Adsorbed Molecules.
Final rept.,
J. W. Gadzuk. Feb 87, 10p
Pub. in Jnl. of the Optical Society of America B 4, n2 p201-210 Feb 87.

Keywords: *Carbon monoxide, *Platinum, *Adsorption, Surface chemistry, Vibrational spectra, Reprints.

Extremely useful connections exist between the dynamics of adsorbed molecules and their vibrational spectra, as revealed in optical absorption spectroscopy. These connections have been nicely established by Noid et al. (J. Chem. Phys. 67,404 (1977)). The present study has been motivated by recent experiments suggesting that CO adsorbed on Pt(111) shows evidence for conversion between twofold and threefold symmetric adsorption sites. The role of multiple wells along a reaction coordinate (hindered translations) in determining the vibrational spectrum of an internal mode (intramolecular stretch) anharmonically coupled to the hindered translation is investigated.

705,951
PB87-173696 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron Impact Ionization of B(2+) and O(5+): Excitation-Autoionization in Li-Like Ions.
Final rept.,
D. H. Crandall, R. A. Phaneuf, D. C. Gregory, A. M. Howald, D. W. Mueller, T. J. Morgan, G. H. Dunn, D. C. Griffin, and R. J. W. Henry. Sep 86, 11p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 34, n3 p1757-1767 Sep 86.

Keywords: *Excitation, *Oxygen ions, Reprints, *Oxygen ions, *Boron ions, *Autoionization.

New measurements for the total, single ionization of B(2+) and O(5+) by electron impact are reported with particular attention directed to the indirect contribution of excitation-autoionization. For B(2+) these are the first measurements to our knowledge while for O(5+) the present data improve on previous measurements. In both cases the direct total ionization cross sections are in good agreement with recent distorted-wave predictions of Younger, and the excitation-autoionization contribution is consistent with measurements for other Li-like ions.

705,952
PB87-173795 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Neutron Powder Diffraction Study and Physical Characterization of Zeolite D-ZK-5 Deep-Bed Calcined at 500 deg C and 650 deg C.
Final rept.,
R. X. Fischer, W. H. Baur, R. D. Shannon, R. H. Staley, A. J. Vega, L. Abrams, and E. Prince. Sep 86, 10p
Pub. in Zeolites 6, p378-387 Sep 86.

Keywords: *Neutron diffraction, *Ion exchange resins, Reprints, *Powder diffraction, *Zeolites.

Zeolite ZK-5 samples, deep-bed calcined at 500 deg C and at 650 deg C, respectively, were studied by neutron powder diffraction, i.r. and n.m.r. In addition their methanol sorption was measured. The neutron diffraction study shows Cs atoms located in eight rings and shows a peak in the difference Fourier map at 0, approx 0.45, and approx 0.07 in the y cage which has been attributed to non-framework Al/O atoms. The discrepancy between the number of Al/O in the y cage and that found by Al and Si n.m.r. is attributed to the presence of non-framework Al/O in other sites or randomly distributed condensed Al-O-OH clusters.

705,953
PB87-173803 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Structure of the Lithium Insertion Compound Li2Fe2(MoO4)3 from Neutron Powder Diffraction Data.
Final rept.,
C. C. Torardi, and E. Prince. 1986, 8p
Pub. in Materials Research Bulletin 21, n6 p719-726 1986.

Keywords: *Neutron diffraction, Molecular structure, Reprints, *Powder diffraction, *Ferric molybdate.

The structure of Li2Fe2(MoO4)3 has been determined by a profile refinement of neutron powder diffraction data. Li2Fe2(MoO4)3 was prepared at ambient temperature by the reaction of solid ferric molybdate, Fe2(MoO4)3, with a LiI/acetonitrile solution. The title compound is orthorhombic with a = 12.8947(5), b = 9.4957(4), and c = 9.3477(3) Angstrom, in the space group Pbcn. Its structure is related to that of garnet and langbeinite with corner-sharing Fe(2+)O6 octahedra and Mo(6+)O4 tetrahedra. The lithium ions reside in general positions and these sites are ordered and fully occupied. Lithium is tetrahedrally coordinated to oxygen by bridging the edges of two FeO6 octahedra. Bond valence calculations are entirely consistent with the structure.

705,954
PB87-173878 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Synthesis, Structure and Low Temperature Magnetism of the New Lithium and Sodium Insertion Compounds: LiFe(II) ClMoO4 and NaFe(II)ClMoO4.
Final rept.,
C. C. Torardi, W. M. Reiff, K. Lazar, and E. Prince. 1986, 10p
Pub. in Jnl. of Physical Chemistry Solids 47, n8 741-750 1986.

Keywords: *Magnetism, Molecular structure, Synthesis(Chemistry), Reprints, *Lithium iron chlorine molybdate.

The recently described tetragonal layered compound Fe(III)ClMoO4 is found to undergo reversible lithium and sodium ion insertion by stirring the solid in an acetonitrile solution of lithium or sodium iodide under argon. The structure of LiFe(II)ClMoO4, determined by a Rietveld refinement of neutron powder diffraction data, is essentially the same as that of the precursor and contains Li ions in distorted octahedral sites between the layers. Also, the Fe atoms are shifted to a position where they are 6-coordinated compared to the 5-coordination observed in the ferric precursor. Zero field Mossbauer spectra for the lithium compound undergo hyperfine splitting that corresponds to a three-dimensional magnetic ordering process with T(sub Neel) approx 68.5 K.

705,955
PB87-179354 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Classical Trajectory Surface Hopping Approach to Non-Adiabatic Molecule-Surface Processes.
Final rept.,
M. Karikorpi, S. Holloway, and J. W. Gadzuk. 1986, 12p
Pub. in Jnl. of Electron Spectroscopy and Related Phenomena 39, p223-234 1986.

Keywords: *Surface chemistry, Reprints, *Molecule collisions.

Scattering processes of diatomic molecules from solid surfaces in which the molecular affinity level crosses the surface Fermi level thus enabling charge transfer back and forth between the metal and molecule are considered here. The nuclei are assumed to move classically on a single model potential energy surface until a diabatic potential energy surface crossing is reached. At such points the trajectory is split into branches, each of which follows a different potential surface. The probability for hopping onto a new potential energy surface or remaining on the initial one is determined within the Landau-Zener-Tully-Preston picture. The phase averaged outgoing vibrational energy as well as the average residence time of the molecular ion resonances have been calculated as a function of the incident kinetic energy treating the off-diagonal matrix element within the Landau-Zener branching probabilities parametrically.

705,956
PB87-179362 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Vibrational Excitation in Gas-Surface Collisions.
Final rept.,
J. W. Gadzuk, and S. Holloway. Mar 86, 3p
Pub. in Physical Review B33, n6 p4298-4300, 15 Mar 86.

Keywords: *Surface chemistry, *Nitrogen oxide(NO), *Silver, Excitation, Molecular vibration, Reprints, *Molecule collisions.

Recent experimental observations and accompanying interpretation of Rettner, Fabre, Kimman, and Auerbach for vibrational excitation in NO molecules scattered from Ag(III) surfaces are discussed in terms of existing models for such events.

705,957
PB87-179370 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Anisotropic Charge Transfer Rates in the Scattering of Oriented Atoms or Molecules from Surfaces.
Final rept.,
J. W. Gadzuk. 1987, 12p
Pub. in Surface Science 180, p225-236 1987.

Keywords: *Surface chemistry, Scattering, Excitation, Reprints.

Atoms or molecules scattered from surfaces can undergo charge transfer to or from the surface during the scattering event. It is proposed that when the incident particle is 'prepared' in an excited or ionic state which is oriented with respect to the surface, observable anisotropies in charge transfer rates involving the oriented state should occur. The effect is illustrated with two examples.

705,958
PB87-179404 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Torsional-Wagging Tunneling Problem and the Torsional-Wagging-Rotational Problem in Methylamine.
Final rept.,
N. Ohashi, and J. T. Hougen. 1987, 28p
See also report dated 1985, PB86-124112.
Pub. in Jnl. of Molecular Spectroscopy 121, p474-501 1987.

Keywords: *Methylamine, *Molecular rotation, Molecular vibration, Molecular energy levels, Reprints.

A theoretical formalism is presented for fitting rotational energy levels in isolated (unperturbed) vibrational states of methylamine. The formalism is obtained by recasting and extending theoretical studies in the earlier literature, which were undertaken to help analyze the methylamine microwave spectrum. The present formalism is applicable when both the NH2 umbrella (wagging) motion and the CH3 internal rotation (torsion) motion take place near the high-barrier limit and leads to the usual Fourier sine and cosine series expansions for molecular energy levels. The derivation is separated into two parts, one treating the large-amplitude vibrational problem (the torsional-wagging problem) by itself, the other treating the torsional-wagging-rotational problem. In both treatments, permutation-inversion group and extended group ideas are used to determine the allowed terms in an effective rotational-tunneling Hamiltonian operator and to block diagonalize the matrix representation of this operator for a near-prolate symmetric top. The resulting energy levels and selection rules are discussed, but application of the method in detail to the methylamine spectrum is planned for a later paper.

705,959
PB87-179412 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Infrared Spectrum of the Overtone Band 2nu(sub5,sup0) of the Hydrogen Bonded Complex HCN--HF.
Final rept.,
M. W. Jackson, B. A. Wofford, J. W. Bevan, W. B. Olson, and W. J. Lafferty. 1 Sep 86, 5p
Grant NSF-CHE83-00592
Pub. in Jnl. of Chemical Physics 85, n5 p2401-2405, 1 Sep 86. Sponsored by National Science Foundation, Washington, DC.

Keywords: *Infrared spectrum, *Hydrogen fluoride, *Hydrogen cyanide, Molecular spectroscopy, Reprints.

The infrared spectrum of the overtone of the 'intramolecular' bending vibration 2nu(sub5,sup0) of the hydrogen bonded complex HCN--HF centered at 1437.539 91 (24)/cm has been obtained with a resolution of 0.006/cm. Line assignments for the band as well as two hot bands 2nu(sub5,sup0) + nu(sub7,sup1) - nu(sub7,sup1) and 2nu(sub5,sup0) + 2nu(sub7,sup2) - 2nu(sub7,sup2) have been made, and rotational constants for all the levels involved have been determined. Despite the fact that the higher J energy levels of the observed lines of 2nu(sub5,sup0) are above the dissociation energy of the complex, no predissociative line broadening is apparent.

705,960
PB87-180840 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Programmed Symmetry Lowering in 2D Colloids.
Final rept.,
Y. Tang, R. M. Malzbender, R. C. Mockler, W. J. O'Sullivan, and J. A. Beall. 1987, 4p
Contract DE-FG02-86ER45236
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Physics A: Mathematical and General 20, pL189-L192 1987.

Keywords: *Colloids, *Dispersions, Electron beams, Electrostatics, Lithography, Reprints, Two dimensional.

A new experimental technique is presented for producing model two-dimensional systems subject to external fields of arbitrary symmetry and variable coupling strength. An aqueous suspension of colloidal microspheres is confined to a single layer between two quartz flats, on one of which a pattern of eroded features is etched using electron-beam lithography combined with plasma etching. By varying the depth of the etched features, the strength of the electrostatic wall-particle forces can be adjusted smoothly. The feasibility of the method is presented, and possible applications are discussed.

705,961
PB87-181285
(Order as PB87-181251, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Description of the Thermotropic Behavior of Membrane Bilayers in Terms of Raman Spectral Parameters: A Two-State Model,
W. H. Kirchhoff, and I. W. Levin. 3 Dec 86, 16p
Prepared in cooperation with National Institutes of Health, Bethesda, MD.
Included in Jnl. of Research of the National Bureau of Standards, v92 n2 p113-128 Mar-Apr 87.

Keywords: *Phase transformations, *Membranes, Mathematical models, Spectroscopic analysis, Raman spectroscopy.

An analytical expression is developed for describing the thermotropic behavior of membrane bilayers as studied by Raman spectroscopy. The expression is derived from a two-state model of the main gel to liquid crystalline phase transition in lipid bilayers. Experimental data for a variety of diacylphosphatidylcholines and their derivatives have been fit by least squares to the two-state expression to within currently achievable measurement error. Numerical techniques have been developed for placing bounds on the parameters of the two-state model in situations of sparse data in the phase transition region. By fitting the model to the measured spectroscopic data, estimates of the extent of cooperativity in the phase transition can be obtained in a systematic manner.

705,962
PB87-181830 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Molecular Dynamics Study of a Supercooled Soft-Sphere Fluid.
Final rept.,
J. G. Amar, and R. D. Mountain. Feb 87, 7p
Pub. in Jnl. of Chemical Physics 86, n4 p2236-2242, 15 Feb 87.

Keywords: Viscosity, Reprints, *Molecular dynamics, Soft sphere, Supercooled liquids.

Results obtained from equilibrium molecular dynamics simulations (performed on a 1000-particle system) for a soft-sphere fluid in the supercooled region are presented. The hydrodynamic length l(sub 1) corresponding to the range of dynamical correlations in the transverse current is found to increase rapidly as the amount of supercooling increases. The shear viscosity and bulk viscosity are also found to increase rapidly in the supercooled region, due to the increasing contribution of the tails of the corresponding correlation functions. While the bond-orientational order parameters Q(sub 6) and Q(sub 8) do not increase significantly the lifetimes of the corresponding time correlation functions also increase rapidly in the supercooled region.

705,963
PB87-190252 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
One-Dimensional Coagulation: Scaling and Phase-Separation Dynamics,
J. A. Marqusee. 15 Feb 87, 7p
Pub. in Physical Review A 35, n4 p1856-1862, 15 Feb 87.

Keywords: *Coagulation, Scaling, Simulation, Reprints, *Droplets, *Phase studies, Density, Mass.

A simulation of a one-dimensional coagulating system of droplets with mass-dependent diffusion coefficient is presented. Simple kinetic arguments are derived. The scaling behavior and the similarity to phase-separation dynamics is investigated. The scattering function is calculated. It develops a well-defined peak which grows in intensity and shifts to lower wave vectors as a function of time. The scattering function and the droplet-size distribution are both shown to assume scaled forms in the late stages.

705,964
PB87-191011 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Effects of Cinnabar on Pyrite Oxidation by 'Thiobacillus ferrooxidans' and Cinnabar Mobilization by a Mercury-Resistant Strain.
Final rept.,
F. Baldi, and G. J. Olson. 1987, 5p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Applied and Environmental Microbiology 53, n4 p772-776 Apr 87.

Keywords: *Cinnabar, *Pyrite, *Oxidation, Mercury, Ores, Reprints, *Thiobacillus ferroxidans, *Bioleaching, Biotechnology.

The effect of cinnabar on pyrite oxidation by mercury-sensitive and mercury-resistant strains of Thiobacillus ferroxidans was investigated by using percolation columns. Mercury-resistant strains oxidized pyrite in pyrite-cinnabar mixtures, whereas a mercury-sensitive strain did not. Elemental mercury was produced by the mercury-resistant strains growing in the pyrite-cinnabar mixtures in percolation columns and in flasks containing cinnabar only. Manometric experiments showed that cinnabar had little effect on oxygen uptake of mercury-sensitive or mercury-resistant cells growing on ferrous sulfate, pyrite, or pyrite-ferrous sulfate mixture. In addition, shake flask leaching experiments showed that cinnabar had little effect on pyrite oxidations at 1% but inhibited growth of mercury-sensitive and mercury-resistant strains at 10%. Mercury-resistant strains were unable to grow on cinnabar as an energy source.

705,965
PB87-191086 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Photoionization Cross-Section Studies of the Platinum-Donor Center in Silicon.
Final rept.,
S. Mayo, and J. R. Lowney. Apr 87, 7p
Pub. in Jnl. of Applied Physics 61, n7 p2626-2632, 1 Apr 87.

Keywords: *Silicon, *Platinum, Reprints, *Photoionization.

The relative photoionization cross section of the platinum donor center in silicon was measured over the wavelength range of 2.4 to 3.9 micrometers by electrical deep-level optical spectroscopy on an n(sup +) p junction at 80 K. The data were analyzed in terms of the lattice-coupling model proposed by Ridley and Amato which was modified for valence-band nonparabolicity. Good agreement was obtained between the experimental results and the model calculations of the cross section with the energy level of the donor at 0.320 + or - 0.005 eV above the valence-band edge and a Huang-Rhys factor S of approximately 1.4. The S value corresponds to a Franck-Condon energy shift of 70 meV with a phonon energy of 50 meV. Previously reported photoionization data of the gold donor were also fit by the same model, yielding S approx. 0.4, a surprisingly small value.

705,966
PB87-191094 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Effects of Ion-Implantation Damage on Two-Dimensional Boron Diffusion in Silicon.
Final rept.,
J. F. Marchiando, and J. Albers. Feb 87, 12p
Pub. in Jnl. of Applied Physics 61, n4 p1380-1391, 15 Feb 87.

Keywords: *Boron, *Silicon, *Diffusion, Implantation, Reprints.

Model two-dimensional distributions of implanted boron and implantation-induced displacemeent damage near a mask edge are used to calculate the two-dimensional redistribution of boron resulting from a typical short-time anneal. The damage is removed during annealing by releasing vacancies which enhance the diffusion of boron. The effect is that boron preferentially redistributes further into the bulk. Such considerations become increasingly important as metal-oxide-semiconductor field-effect transistors become smaller.

705,967
PB87-191102 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Novel Superconducting Thermometer for Bolometric Applications.
Final rept.,
D. G. McDonald. Mar 87, 3p
Pub. in Physical Review Letters 50, n12 p775-777, 23 Mar 87.

Keywords: *Bolometers, Temperature measurement, Reprints.

The temperature dependence of the magnetic penetration depth in a superconductor, in the kinetic inductance limit, is proposed as a basis for a sensitive thermometer. Considered as a bolometer, the noise equivalent power from the sum of the Johnson noise and the preamplifier noise can be reduced to about 10 to the -20th W/sq rt (Hz), which is approximately four orders of magnitude below currentlzed values.

705,968
PB87-191144 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
N2 and Air Broadening in the Fundamental Bands of HF and HC1.
Final rept.,
A. S. Pine, and J. P. Looney. 1987, 15p
Pub. in Jnl. of Molecular Spectroscopy 122, p41-55 1987.

Keywords: *Molecular spectroscopy, *Hydrogen fluoride, *Hydrogen chloride, Band spectra, Lasers, Reprints, Collision line narrowing.

N2- and air-broadened lineshapes of HF and HCl transitions in the upsilon = 1 <- 0 bands have been measured at T = 295 and 202 K with a high-resolution difference-frequency laser spectrometer. Pressure broadening, shift and collisional narrowing parameters have been extracted by least-squares fitting of several collisional profiles to the spectra. At low pressures, the collisional, or Dicke, narrowing effect caused deviations from the Voigt profile having a Doppler-fixed Gaussian component and yields a measure of the diffusion constants for the hydrogen halides in the buffer gases. At high J, where the pressure shifts are comparable to or larger than the broadenings, a slight asymmetry is observed in the lineshapes which is attributed to statistical correlation between velocity and state-changing collisions. The ratio of air-to-N2 broadening is roughly given by the relative quadrupolar contributions of O2 and N2, though it varies systematically with rotational level. The temperature variations in the broadening coefficients are also J dependent, deviating significantly from T 1/2 and exhibiting opposite behavior for HF and HC1. (Copyright (c) 1987 Academic Press, Inc.)

705,969
PB87-191219 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Diffusion Coefficients of Multicomponent Hard-Sphere Fluid Mixtures.
Final rept.,
M. L. de Haro, J. M. Kincaid, and E. G. D. Cohen. 1983, 5p
Pub. in Proceedings of Winter Annual Meeting of the American Society of Mechanical Engineers, Boston, MA., November 13-18, 1983, 5p.

Keywords: *Fluids, *Mixtures, *Diffusion coefficient, Kinetic theory, Binary systems(Materials), Ternary systems, Reprints.

As part of a general kinetic theory for multicomponent dense fluid mixtures, results for the mutal diffusion coefficients of binary and ternary hard-sphere mixtures are presented. The theoretical values are obtained on the basis of the Standard and Revised Enskog theories. A study is made of the dependence of the diffusion coefficients on a wide variety of settings of the parameters of the mixture. The Standard Enskog theory, used up until now for correlation purposes, appears to be only reliable at low densities. Some trends, noted in the Revised Enskog theory and possibly useful for real mixtures, are discussed.

705,970
PB87-191227 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
New Correlation Effects Observed for Inner-Shell Excitations in Titanium and Vanadium.
Final rept.,
N. E. Erickson, C. J. Powell, and D. E. Ramaker. Feb 87, 4p
Pub. in Physical Review Letters 58, n5 p507-510, 2 Feb 87.

Keywords: *Titanium, *Vanadium, Spectroscopy, Metals, Reprints, *Appearance potential spectra, Auger electron spectroscopy, X-ray spectroscopy.

An interpretation of energy-calibrated appearance-potential spectra for Ti and V reveals new correlation effects. A proposed initial-state, final-state rule is utilized to understand these and other many-body effects which arise in the x-ray, Auger-electron, and appearance-potential spectra for these metals.

705,971
PB87-197729 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Enthalpies of Combustion of D-ribose and 2-deoxy-D-ribose.
Final rept.
J. C. Colbert, E. S. Domalski, and B. Coxon. 1987, 9p
Pub. in Jnl. of Chemical Thermodynamics 19, p433-441 1987.

Keywords: *Calorimetry, Combustion, Enthalpy, Formation, Monosaccharide, Reprints, *Anomer, Ribose/deoxy, Pentose.

The enthalpies of combustion of the crystalline monosaccharides D-ribose (C5H10O4, cr) and 2-deoxy-D-ribose (2-deoxy-D-erythro-pentose) (C5H10O4, cr) have been determined by combustion bomb calorimetry.

705,972
PB87-197760 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
(A Tilde) (sup 2)Pi - (X Tilde)(sup 2)Sigma(+) Transition of HC2 Isolated in Solid Argon.
Final rept.,
M. E. Jacox, and W. B. Olson. 1987, 9p
Sponsored by Army Research Office, Research Triangle Park, NC.
Pub. in Jnl. of Chemical Physics 86, n6 p3134-3142, 15 Mar 87.

Keywords: *Acetylene, *Absorption spectra, *Argon, Atoms, Excitation, Infrared spectra, Fourier transformation, Perturbation, Electron transitions, Ground state, Atomic energy levels, Reprints, *Fourier transform absorption spectra, *Acetylene radicals.

Fourier transform absorption spectra have been obtained between 700 and 7900 /cm at a resolution of 0.2 /cm for Ar:C2H2 samples codeposited at 12 K with a beam of argon atoms that had been excited in a microwave discharge. Detailed isotopic substitution studies have confirmed that the predominant product species is HC2, which contributes not only the absorptions previously assigned to its two stretching fundamentals but also several weaker absorptions in the 2000-3600 /cm spectral region and a prominent, complicated pattern of absorptions between 3600 and 7800 /cm. The previous assignment of the 3611 /cm HC2 absorption as the CH-stretching fundamental is reviewed, and the assignment of an absorption at 2104 /cm as v2 + v2 of ground-state HC2 is discussed. The near infrared absorption band system has been assigned to the (A Tilde) (sup 2)Pi - (X Tilde) (sup 2)Sigma(+) transition of HC2, extensively perturbed by interaction with high vibrational levels of the ground state. The position of the transition origin could not be definitively established. The previous assignment of gas-phase absorptions of HC2 at 3786, 4012, and 4108 /cm to ground-state combination bands has been confirmed, and carbon-isotopic data have been obtained for these bands.

705,973
PB87-197893 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Thermal Conductivity Surface for Mixtures of Methane and Ethane.
Final rept.,
D. G. Friend, and H. M. Roder. 1987, 14p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in International Jnl. of Thermophysics 8, n1 p13-26 Jan 87.

Keywords: *Ethane, *Methane, *Thermal conductivity, Mixtures, Gases, Liquids, Reprints.

A correlation is presented for the extensive series of thermal conductivity measurements of binary methane-ethane mixtures. The composition dependences of the thermal conductivity in the dilute-gas region, dense-gas and liquid region, and critical region are discussed. The average absolute percentage deviation of the thermal conductivity surface as a function of temperature, density, and composition, from the experimental data, is 1.60%.

705,974
PB87-197927 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Nearly Free Internal Rotation in Ar-CH3Cl.
Final rept.,
G. T. Fraser, R. D. Suenram, and F. J. Lovas. 1987, 8p
Pub. in Jnl. of Chemical Physics 86, n6 p3107-3114, 15 Mar 87.

Keywords: *Argon, Internation, Methyl chloride, Reprints, *Intermolecular forces, Van der Waals molecule.

Rotational spectra of Ar-CH3Cl, for both Cl isotopes, have been observed, at 4 kHz resolution, using a pulsed nozzle Fourier transform microwave spectrometer. The observed spectra are consistent with a T-shaped complex in which the methyl group is undergoing nearly free internal rotation. A combined analysis of the ground and excited (E) internal rotor states places an upper bound of 20 cm-1 on the threefold barrier to internal rotation. The Coriolis interactions in the E state also allow the determination of eQq(ab) for Ar-CH3 35Clas 13.0(3) MHz. The symmetry axis of the CH3Cl subunit is nearly perpendicular (approx. 82 deg) to the line joining the centers of mass of the two binding partners. The isotopic data indicate that the Cl end of the methyl chloride is tilted toward the argon. The distance between the centers of mass of the two subunits is 3.7826 A for Ar-CH3 35Cl and 3.7839 A for Ar-CH3 37Cl implying an Ar-Cl distance of 3.750 A. Centrifugal distortion analysis yields a weak bond stretching force constant of 0.0157 mdyn/A and stretching frequency of 34.6 cm-1 for Ar-CH3 35 Cl. The results from this investigation are related to previous lower resolution microwave studies on Ar-CH3Cl.

705,975
PB87-197968 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Synthesis of Ionic Conducting Interpenetrating Polymer Networks.
Final rept.,
C. K. Chiang, B. J. Bauer, R. M. Briber, and G. T. Davis. Feb 87, 2p
See also AD-A 171547. Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Polymer Communications 28, n2 p34-35 Feb 87.

Keywords: *Solid electrolytes, *Polymers, Epoxy compounds, Polyethylene plastics, Salts, Electrical conductivity, Ionic current, Synthesis, Networks, Lithium, Chlorates, Reprints, Ionic conductivity.

Epoxy and ionic conducting poly(ethylene oxide)-salt complexes form interpenetrating polymer networks. The co-continuity of the two phases has been tested independently by using mechanical and electrical measurements. Examination of the network by using transmission electron microscopy suggests that the size scale of the phases ranges from 0.1 to 0.5 micro.

705,976
PB87-198008 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Near-Resonant Collisional Energy Transfer in Sr(5s6p singlet P(1))-Rare-Gas Systems.
Final rept.,
R. W. Schwenz, and S. R. Leone. 1987, 7p
Grant AFOSR-84-0272
Sponsored by Air Force Weapons Lab., Kirtland AFB, NM., and National Science Foundation, Washington, DC.
Pub. in Chemical Physics Letters 133, n5 p433-439, 30 Jan 87.

Keywords: Lasers, Metal vapors, Strontium, Reprints, *Branching ratios, *Electronic energy transfer.

The total quenching cross sections for strontium (5s6p 1P1) collisions with the rare gases are determined by pulsed laser, time-resolved fluorescence measurements to be 80, 40, 73, 101, 140 A2 for He, Ne, Ar, Kr and Xe, respectively. For collisions with Kr, all of the near-resonant states, 4d5p3F, 5s6p3P and 4d5p1D2, are observed to be excited. The cross sections are interpreted in terms of a curve crossing mechanism. The product branching can be explained in terms of strong coupling of the initial state with the near-resonant states, weighted by energy gap considerations.

705,977
PB87-198016 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Reply to the 'Comment on Silane Pyrolysis and the Insertion of Silylene into Molecular Hydrogen'.
Final rept.,
R. M. Robertson, and A. Gallagher. 1987, 2p
Pub. in Jnl. of Chemical Physics 86, n5 p3059-3060, 1 Mar 87.

Keywords: *Silane, *Pyrolysis, Surfaces, Reprints, Amorphous silicon.

The authors respond to a comment on the recent paper on silane pyrolysis (R. M. Robertson and A. Gallagher, J. Chem. Phys. 85, 3623 (1986)).

705,978
PB87-198057 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Autodetachment Study of the Electronic Spectroscopy of FeO(-1).
Final rept.,
T. Andersen, K. R. Lykke, D. M. Neumark, and W. C. Lineberger. 1987, 10p
Grants NSF-CHE83-16628, NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 86, n4 p1858-1867, 15 Feb 87.

Keywords: *Iron oxides, Ground state, Ions, Reprints, Autodetachment spectroscopy, Photodetachment spectroscopy, Excited states.

The anion FeO(1-) was studied by autodetachment spectroscopy in a coaxial laser-ion beam photodetachment spectrometer. Transitions were observed between the ground electronic state of the ion and several excited electronic states near the electron detachment threshold. Rotational assignments were carried out for several bands, and the measured linewidths yielded autodetachment lifetimes as a function of rotational energy for these bands. The results indicate a (sup 4)Delta ground state of FeO(1-). The autodetachment lifetimes show that some of the excited electronic states are dipole bound, and that one weakly bound state may be a valence excited state.

705,979
PB87-198115 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Hydrogen Pairing and Anisotropic Potential for Hydrogen Isotopes in Yttrium.
Final rept.,
I. S. Anderson, J. J. Rush, T. J. Udovic, and J. M. Rowe. 1986, 4p
Pub. in Physical Review Letters 57, n22 p2822-2825, 1 Dec 86.

Keywords: *Yttrium, *Hydrogen, *Hydrogen isotopes, Neutron spectroscopy, Reprints.

The potential for H isotopes in alpha-phase (hexagonal) YH(D)0.18 has been probed by neutron spectroscopy. The results reveal a highly unusual potential, which is considerably softer and anharmonic along the c axis than in the basal plane, even though the near-neighbor arrangement of metal atoms is only slightly distorted from regular tetrahedral symmetry. Low-temperature results show a splitting of the c-axis vibrational modes, consistent with the pairing of hydrogen on either side of yttrium atoms.

705,980
PB87-198149 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Neutron Powder Diffraction Study and Physical Characterization of Zeolite D-RHO Deep-Bed Calcined at 773 and 923 K.
Final rept.
R. X. Fischer, W. H. Baur, R. D. Shannon, R. H. Staley, A. J. Vega, L. Abrams, and E. Prince. 1986, 10p
See also PB87-173795.
Pub. in Jnl. of Physical Chemistry 90, n18 p4414-4423 1986.

Keywords: *Ion exchange resins, *Neutron diffraction, Reprints, *Zeolites, *Powder diffraction, Rietveld method.

Zeolite RHO samples, deep-bed calcined at 773 and at 923 K, respectively, were studied by neutron powder diffraction, IR, and NMR. In addition their methanol sorption was measured.

705,981
PB87-199279 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Round-Table: Perspectives in Nonequilibrium Molecular Dynamics.
Final rept.,
H. J. M. Hanley. 1986, 10p
Pub. in Proceedings of Conference on Molecular-Dynamics Simulation of Statistical-Mechanical Systems, Varenna, Italy, July 23-August 2, 1986, p317-326.

Keywords: *Simulation, Computer simulation, *Molecular dynamics.

Panel remarks on nonequilibrium molecular dynamics held at the Enrico Fermi Summer School on Statistical Mechanics are recorded. The status of the technique is discussed, speculations on the future are given and some problems are mentioned.

705,982
PB87-199329 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Resonance Ionization Mass Spectrometry.
Final rept.,
J. C. Travis, J. D. Fassett, and T. B. Lucatorto. 1987, 4p
Pub. in Proceedings 1986 Resonance Ionization Mass Spectrometry Conference, Swansea, Wales, September 7-12, 1986, p91-96.

Keywords: *Atomic spectroscopy, Mass spectroscopy, Instrumentation, Atoms, Ionization potentials, Trends, Excitation, Dispersion, Reprints, *Resonance ionization mass spectrometry, Laser spectroscopy, Ionization spectrometers.

A review is given of the literature on resonance ionization mass spectrometry (RIMS) during the period 1984 through early 1986. Instrumentation trends are discussed in the areas of free-atom generation methods, excitation/ionization lasers, and mass-dispersion. The analytical performance of the method is surveyed, as well as the apparent directions.

705,983
PB87-203022 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Length and Mass Div.
New Value for the Rydberg Constant from the Hydrogen Balmer-beta Transition.
Final rept.,
P. Zhao, W. Lichten, H. P. Layer, and J. C. Bergquist. 1987, 3p
Pub. in Physical Review Letters 58, n13 p1293-1295, 30 Mar 87.

Keywords: *Fundamental constants, Hydrogen, Metrology, Standards, Reprints, *Rydberg constant, Laser spectroscopy.

The Rydberg constant R was determined to 3 parts in 10 to the 10th power by direct comparison of the four H,D Balmer-beta transitions with a National Bureau of Standards standard laser. This is the most precise value: R-109737.31573(3)/cm; it approaches the limits of accuracy for optical measurements. The fine structure splittings and isotope shift are in excellent agreement with theory. The result agrees with less precise experiments by Zhao et al. and Biraben and Julien, but disagrees with the result of Hildum et al.

705,984
PB87-203691 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Dielectronic-Recombination Rate Coefficients for Ions of the Fluorine Isoelectronic Sequence.
Final rept.,
L. J. Roszman. 1987, 8p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy, and Lawrence Livermore National Lab., CA.
Pub. in Physical Review A 35, n5 p2138-2145, 1 Mar 87.

Keywords: Reprints, *Atomic rates, *Dielectronic recombination, *Ion impurities.

The rate coefficients for the dielectronic recombination of Ar(9+), Fe(17+), Kr(27+), and Mo(33+), all members of the fluorine isoelectronic sequence, are computed in the single-configuration, LS-coupled, frozen-core, corona model approximation. Comparison is made with other calculations, Analytic formulas which can be used for interpolating the rate coefficients for other members of the fluorine isoelectronic sequence are given.

705,985
PB87-203709 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
F- and G-Wave Phase Shifts and Resonances for Electron Scattering by He(1+).
Final rept.,
D. H. Oza. 1987, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Physical Review A 35, n10 p4430-4433, 15 May 87.

Keywords: *Electron scattering, Phase shift, Resonance, Reprints, *Electron-ion collisions, *Helium ions.

The study of the scattering of electrons by He(1+) ions has been extended to the L=3 and the L=4 partial waves below the N=2 threshold of the ion. The ab initio calculations are performed in a pseudostate close-coupling approximation. An 11-state pseudostate basis set is used in the non-resonant energy range and a relatively long-range 14-state pseudostate basis set is used to examine the resonances. Resonance parameters for 19 F-wave and 10 G-wave resonances are obtained with the outer electron extending up to n approx = 7. Comparisons with other available results are made.

705,986
PB87-203717 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Ryberg States with Anisotropic Ion Cores: Stark Effect.
Final rept.,
D. E. Kelleher, and E. B. Saloman. 1987, 12p
Pub. in Physical Review A 35, n8 p3327-3338, 15 Apr 87.

Keywords: *Stark effect, *Anisotropy, Quadrupole moment, Ionization, Spectrum analysis, Barium, Reprints, *Rydberg states, Autoionization, Spectral shift.

The authors have measured the Stark spectra of 5d3/28l autoionizing states in barium. Because of the anisotropic 5d ion core, the Stark manifolds at higher fields are considerably more complex than those for the analogous 6snl bound states. The electrostatic coupling of the Rydberg electron with the anisotropic core gives rise to relatively large fine-structure splittings. For nonpenetrating orbitals (lry greater than lcore), jK coupling is a useful representation and the number of fine-structure components due to this interaction with the core increases the number of eigenstates (2jcore+1)-fold. The authors present a theoretical model for the calculation of Stark spectra in jK coupling. Results for barium are in quantitative agreement with the experimental observations for both sigma and pi polarizations up to fields where there is extensive overlap between adjacent n manifolds. These fine-structure effects occur for any states with nonisotropic cores (jcore greater than 1/2), i.e., the states of most atoms except for bound singly excited states of alkali-metal and alkaline-earth-metal atoms.

705,987
PB87-203725 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Thermal Conductivity of Liquid Argon.
Final rept.,
J. C. G. Calado, U. V. Mardolcar, C. A. Nieto de Castro, H. M. Roder, and W. A. Wakeham. 1987, 12p
Sponsored by North Atlantic Treaty Organization, Brussels (Belgium).
Pub. in Physica 143A, p314-325 1987.

Keywords: *Argon, *Thermal conductivity, Liquefied gases, Reprints, *Liquid argon, *Hard-sphere model.

The thermal conductivity of liquid argon has been measured along isotherms at 107, 113, 118, 124 and 130 K and pressures up to 10 MPa using the transient hot-wire technique. The instrument is capable of measuring the thermal conductivity of fluids with an accuracy of +0.5 percent in thermodynamic states far from the critical region. The experimental data have been employed in conjunction with ideas based upon the hardsphere theory of dense fluids to develop a reliable procedure for interpolation and extrapolation of the thermal conductivity of liquid argon.

705,988
PB87-203790 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Hydrogen Component Fugacities in Binary Mixtures with Carbon Dioxide: Pressure Dependence.
Final rept.,
T. J. Bruno. 1987, 12p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in International Jnl. of Thermophysics 8, n2 p205-216 1987.

Keywords: *Hydrogen, *Carbon dioxide, *Fugacity, Measurement, Reprints, *Binary mixtures, High pressure, Equilibrium, Membrane transport.

The fugacity coefficients of hydrogen in binary mixtures with carbon dioxide were measured isothermally using a physical equilibrium technique. This technique involves the use of an experimental chamber which is divided into two regions by a semipermeable membrane. Hydrogen can penetrate and pass through the membrane, while carbon dioxide cannot. During the approach to equilibrium, the pressure of pure hydrogen on one side of the membrane approaches the partial pressure of hydrogen in the mixture on the other side of the membrane. This allows a direct measurement of the hydrogen component fugacity at a given mixture mole fraction. In the study, results are reported for measurements made on the hydrogen plus carbon dioxide binary at 130 C (403 K), with total mixture pressure of 3.45, 5.17, 8.62, 10.34, and 13.79 MPa. General trends in the experimental results are discussed and comparisons are made with predictions from the Redlich Kwong, Peng-Robinson, and extended corresponding-states models.

705,989
PB87-203816 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Conformality in the Kirkwood-Buff Solution Theory of Statistical Mechanics.
Final rept.,
E. Z. Hamad, G. A. Mansoori, and J. F. Ely. 1987, 7p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Jnl. of Chemical Physics 86, n3 p1478-1484, 1 Feb 87.

Keywords: Reprints, *Chemical potentials, *Corresponding states, *Kirkwood-Buff theory, *Mixing rules.

The Kirkwood-Buff solution theory of statistical mechanics is examined in the light of the conformal solution approximation of the mixture radial distribution functions. By joining the mixture compressibility equation of the Kirkwood-Buff solution theory with the mixture energy and virial equations of statistical mechanics, a set of density and temperature dependent mixing rules has been developed which are used here to calculate properties of molecular fluids with varying size and interaction energy differences. It is demonstrated that the conformality approximation in the compressibility equation produces mixture results with a deviation, from the exact mixture data, on the opposite side of the predictions of the van der Waals theory of mixtures. The Kirkwood-Buff relation for the composition derivative of the chemical potential is also integrated by combining it with the conformal solution approximation and compared with the simulation data.

705,990
PB87-203840 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Dielectronic-Recombination Rate Coefficients for Ions of the Oxygen Isoelectronic Sequence.
Final rept.,
L. J. Roszman. 1987, 13p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 35, n8 p3368-3380, 15 Apr 87.

Keywords: Plasma, Recombination, Reprints, *Autoionization, *Dielectronic recombination, *Oxygen isoelectronic.

The rate coefficients for the dielectronic recombination of Ar(10+), Fe(18+), Kr(28+), and Mo(34+) of the oxygen isoelectronic sequence are computed in the single-configuration, LS-coupled, frozen-core, corona-model approximation. Analytic interpolation formulas for the dielectronic-recombination rate coefficients of the oxygen isoelectronic sequence are given, and comparisons are made with other calculations.

705,991
PB87-203857 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Dielectronic-Recombination Rates for Some Ions of the Lithium Isoelectronic Sequence.
Final rept.,
L. J. Roszman. 1987, 16p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Physical Review A 35, n5 p2122-2137, 1 Mar 87.

Keywords: Reprints, *Atomic rates, *Dielectronic recombination, *Ion impurities.

The total dielectronic-recombination rates for Ne(7+), Ar(15+), Fe(23+), and Kr(33+), all members of the lithium isoelectronic sequence, are computed in the nonrelativistic, single-configuration, LS-coupling, frozen-core, corona model approximation. Comparison is made with other calculations, and differences are noted and analyzed. Analytic formulas for interpolating the total dielectronic recombination rates for other members of the lithium isoelectronic sequence are given.

705,992
PB87-210241 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Standard Reference Data Publications, 1985-1986.
Special pub.
J. C. Sauerwein. Jun 87, 43p NBS/SP-708-SUPPL-1
See also PB86-155587. Also available from Supt. of Docs as SN003-003-02802-9.

Keywords: *Bibliographies, Chemical properties, Physical properties, Information systems, Indexes(Documentation), Computer programs, *Standard reference materials, Listings.

The National Bureau of Standards' Office of Standard Reference Data manages a network of data centers that prepare evaluated databases of physical and chemical properties of substances. Databases are available in printed form, on magnetic tapes, diskettes, and through on-line computer networks. The document provides a comprehensive list of the products available from the National Standard Reference Data System (NSRDS) for the years 1985-1986, including indexes qualified by author, material, and property terms. Ordering information and current prices can be found at the end of the document.

705,993
PB87-218913 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
How Do You Know That's the Atomic Weight.
Final rept.,
L. J. Powell, and T. J. Murphy. 1984, 5p
Pub. in Chemtech 14, n12 p726-730 1984.

Keywords: Mass spectroscopy, Silver, Accuracy, Reprints, *Atomic weights, Faraday, Calibration.

Calibrated mass spectrometry has been used at the National Bureau of Standards for the high accuracy redetermination of the atomic weights of 14 elements. The method, which focuses on the determination of absolute isotopic composition using thermal ionization mass spectrometry, is described. Particular emphasis is given to the recent determination of the absolute isotopic composition and atomic weight of silver and to the impact of this work on the Faraday.

705,994
PB87-219051 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Dielectronic Recombination of Highly Ionized Iron.
Final rept.,
D. C. Griffin, and M. S. Pindzola. 1987, 11p
Contract DE-AC05-84OR21400
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Physical Review A 35, n7 p2821-2831, 1 Apr 87.

Keywords: *Iron, Reprints, *Cross section calculations, *Dielectronic recombination, Electric fields.

Dielectronic recombination of the iron ions Fe(15+), Fe(23+), and Fe(25+) has been studied in the isolated-resonance, distorted-wave approximation. The cross-section calculations include the dielectronic transitions associated with the 3s -> 3l and 3s -> 4l excitations in Fe(15+), the 2s -> 2p and 2s -> 3l excitations in Fe(23+) and the ls -> 2l excitations in Fe(25+). The effects of external electric fields have been included by employing intermediate-coupled, field-mixed eigenvectors for the doubly excited Rydberg states, determined by diagonalizing a Hamiltonian matrix which includes the internal electrostatic and spin-orbit terms, as well as the Stark matrix elements. The field effects are found to be quite large in Fe(25+), relatively small in Fe(23+), and negligible in Fe(25+). The calculations indicate that there are large resonances near threshold in Fe(23+) that are unaffected by external fields and may be measurable in new experiments currently being designed. In addition, the contributions of radiative recombination and the possible interference between radiative and dielectronic recombination in low-lying resonances are considered. Even though the radiative recombination cross sections may be appreciable near threshold in Fe(15+) and Fe(23+), the interference between these processes appears to be completely negligible.

705,995
PB87-219093 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
High Sensitivity, High-Resolution IR Laser Spectroscopy in Slit Supersonic Jets: Application to N2HF (nu sub 1) and (nu sub 5)+(nu sub 1)-(nu sub 5).
Final rept.,
C. M. Lovejoy, and D. J. Nesbitt. 1987, 15p
Grant NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 86, n6 p3151-3165, 15 Mar 87.

Keywords: Reprints, *Direct absorption, *Infrared spectroscopy, *Supersonic expansion, van der Waals molecules, Vibrational predissociation.

A difference frequency IR spectrometer is combined with a slit supersonic expansion for high resolution (less than or equal to 50 MHz FWHM) direct absorption investigations of jet-cooled species. The 1.25 cm long nozzle provides a long path length and high densities suitable for synthesis and observation of van der Waals clusters, with a gradual spatial temperature gradient that permits experimental control of low frequency vibrational populations. Due to collisional quenching of velocity distributions, absorption linewidths are reduced and peak absorbance increased five-to sevenfold compared to pinhole expansions. Minimum detectable concentrations of HF combining complexes are 2 times 10 to the ninth power molecules/cu. cm./ quantum state in a 2.5 cm path length. The combination of high sensitivity, sub-Doppler resolution, long path lengths, and temperature control make direct absorption in slit nozzle expansions a powerful and general technique for high-resolution study of jet-cooled species. The spectometer is used to obtain the near-infrared spectrum of N2HF. The v1 (HF stretch) fundamental is observed at 3918.2434(2)/cm, red shifted by 43.1795(2)/cm from the HF origin.

705,996

PB87-220505 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Time-Dependent Radiative Transfer.
Final rept.,
A. Streater, J. Cooper, and W. Sandle. 1987, 6p
Contract NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 37, n2 p151-156 1987.

Keywords: Emission spectroscopy, Integral equations, Quantum interactions, Time dependence, Reprints, *Radiative transfer, Payne equation.

An integral equation is developed for application to time-dependent laboratory experiments in which partial redistribution effects are important. The equation of transport with the Heasley-Kneer emission coefficient and the equation of statistical equilibrium lead to a time-dependent redistribution function containing an absorption - re-emission term which decays exponentially in time and a scattering term which is instantaneous. The integral equation does not agree with an equation written by Payne et al. (Phys. Rev. A 9, 1050 (1974)) that has been used to compare theory with experiments. The difference between the Payne equation and the equation developed here needs to be examined in detail, since it might under some circumstances be on the same order as the difference between partial and complete redistribution.

705,997

PB87-220539 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Absolute I*Quantum Yields for the ICN (A tilde) State by Diode Laser Gain-versus-Absorption Spectroscopy.
Final rept.,
W. P. Hess, and S. R. Leone. 1 Apr 87, 8p
Grant NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 86, n7 p3773-3780, 1 Apr 87.

Keywords: *Lasers, Reprints, *Iodine atom, *ICN, Quantum yield.

Absolute I* quantum yields have been measured as a function of wavelength for room temperature photodissociation of the ICN *(A tilde) state continuum. The yields are obtained by the technique of time-resolved diode laser gain-vs-absorption spectroscopy. Quantum yields are evaluated at seven wavelengths from 248 to 284 nm. The yield at 266 nm is 66.0 plus or minus 2% and it falls off to 53.4 plus or minus 2% and 44.0 plus or minus 4% at 284 and 248 nm, respectively. The latter values are significantly higher than those obtained by previous workers using infrared fluorescence. Estimates of I* quantum yields obtained from analysis of CN photofragment rotational distributions, as discussed by other workers, are in good agreement with the I* yields reported here. The results are considered in conjunction with recent theoretical and experimental work on the CN rotational distributions and with previous I* quantum yield results.

705,998

PB87-220547 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Transient Gain-versus-Absorption Laser Probing of Spin-Orbit States, Kinetics and Dynamics.
Final rept.,
J. E. Smedley, W. P. Hess, H. K. Haugen, and S. R. Leone. 1987, 7p
Grants NSF-PHY82-00805, NSF-CHE84-04804
Sponsored by National Science Foundation, Washington, DC., National Aeronautics and Space Administration, Washington, DC., and Air Force Weapons Lab., Kirtland AFB, NM.
Pub. in Jnl. de Chimie Physique 84, n3 p385-391 1987.

Keywords: *Spin orbit interactions, Near infrared radiation, Gain, Reprints, *Bromine atoms, *Iodine atoms, Tunable lasers, Laser applications, Excited states, Stimulated emission.

A tunable F-center laser and a diode laser are used to probe the spin-orbit populations of excited (doublet P(1/2)) and ground (doublet P(3/2)) state Br and I atoms at 2714 nm and 1315 nm, respectively. The technique uses pulsed laser photoysis and time-resolved cw laser probing of the gain or absorption signals from the coupled pair of states in the halogen atoms. Transient laser gain-versus-absorption measurements provide highly accurate quantum yields of the spin-orbit states in the photodissociation of molecules such as Br2, IBr, Ch3I, ICN and C3F7I. In Br2, the continuum yields that result from absorption of vibrationally excited states are investigated as a function of temperature to determine the contributions to the absorption of individual upper excited states.

705,999

PB87-220570 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
High Rydberg States of an Atom in Parallel Electric and Magnetic Fields.
Final rept.,
R. L. Waterland, J. B. Delos, and M. L. Du. 15 Jun 87, 17p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review A 35, n12 p5064-5080, 15 Jun 87.

Keywords: Electric fields, Magnetic fields, Zeeman effect, Stark effect, Diamagnetism, Reprints, *Rydberg states.

The authors have calculated the energy spectrum of a highly excited atom in parallel electric and magnetic fields. The eigenvalues were obtained by semiclassical quantization of action variables calculated from first-order classical perturbation theory. A classification scheme for the eigenstates is proposed. Comparison with first-order degenerate quantum perturbation theory verifies the accuracy of the semiclassical treatment.

706,000

PB87-220588 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Ultraviolet Absorption Spectrum of the (A tilde) ((sup 1)(A double prime, sub 2))(X tilde)((sup 1) (A' sub1)) Transition of Jet-Cooled Ammoinia.
Final rept.,
V. Vaida, M. McCarthy, P. C. Engelking, P. Rosmus, H. J. Werner, and P. Botschwina. 15 Jun 87, 8p
Sponsored by National Science Foundation, Washington, DC., and North Atlantic Treaty Organization, Brussels (Belgium).
Pub. in Jnl. of Chemical Physics 86, n12 p6669-6676, 15 Jun 87.

Keywords: *Ammonia, *Ultraviolet spectra, *Absorption spectra, Reprints.

The (A tilde)<-(X tilde) absorption spectra of NH3 and ND3, recorded in a cold molecular jet, are presented. Vibrational band progressions resolvable up to (v1 sub 2) = 14 appear. No other vibrations are present, either alone or in combinations. Relative band intensities for (v1 sub 2) progressions are recorded, and the homogeneous lifetime broadening of vibrational levels of the A state are reported. The FWHM linewidths span 34-293/cm over all bands of NH3 and 30-135/cm over the (v sub 2) = 2 through 14 bands of ND3. In general, the rate of dissociation increases nonlinearly with vibrational energy. The band intensity alternation, previously observed only in matrix spectra below 15 K, has been observed in these very cold gas phase samples.

706,001

PB87-223723 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Reinvestigation of the Laser-Initiated Cl2/HBr Chain Reaction: Absolute Rate Constants and the v = 2/v = 1 Ratio from Cl + HBr Yields HCl(v) + Br.
Final rept.,
D. A. Dolson, and S. R. Leone. 1987, 8p
Grants NSF-CHE84-08043, NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Jnl. of Physical Chemistry 91, n13 p3543-3550 1987.

Keywords: *Chlorine, *Hydrogen bromide, Kinetics, Lasers, Vibration, Reprints, *Chain reaction.

The Cl2/HBr chain reaction is reinvestigated by using real time state-selected observations of delta upsilon = -1 chemiluminescence from the HCl(upsilon) products following pulsed laser photolysis of Cl2. These state-selected observations are analyzed with a more complete kinetic treatment to obtain room temperature rate constants for the chain propagation steps and the vibrational deactivation of HCl(upsilon=1,2) by HBr. The chain propagation rate constants are kR1 = (1.02 plus or minus 0.15) times 10 to the minus 11th power and KR2 = (1.1 plus or minus 0.4) times 10 to the minus 15th power cu.cm. per molecule per s, respectively, for Cl + HBr -> HCl(v) + Br and Br + Cl2 -> BrCl + Cl. Rate constants for vibrational deactivation of HCl(v=1) and HCl(v=2) by HBr are Kv1 = (1.06 plus or minus 0.16) times 10th to the minus 12 power and K(V2) = (2.09 plus or minus 0.50) times 10 to the minus 12th power cu. cm per molecule s. Relative intensity measurements of the HCl v = 2 -> 1 and 1 -> 0 vibrational fluorescence are used to obtain an HCl(v) product branching ratio. The kinetic analysis indicates that broad-band observations of infrared chemiluminescence may lead to erroneous rate constant determinations because of vibrational cascade, whereas the detection of individual vibrational states leads to correct results.

706,002

PB87-223731 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Laser Photolysis, Infrared Fluorescence Determination of CH3(nu 3) Vibrational Deactivation by He, Ar, N2, CO, SF6, and (CH3)2CO.
Final rept.,
D. J. Donaldson, and S. R. Leone. 1987, 4p
Grants NSF-PHY86-04050, NSF-CHE83-08403
Sponsored by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Jnl. of Physical Chemistry 91, n12 p3128-3131 1987.

Keywords: *Lasers, *Photolysis, *Deactivation, Methyl, Radical, Vibration, Reprints, Intramolecular.

Room temperature vibrational deactivation rate constants are reported for methyl radicals with antisymmetric stretch excitation, CH3(v3) + M -> CH3 + M, where M = He, Ar, N2, CO, SF6, (CH3)2CO. Excimer laser photolysis of acetone at 193 nm is used to populate CH3(v3), and time-resolved infrared emission from the CH stretch is used to follow the deactivation kinetics. The rate constants obtained are (plus or minus 2 sigma) (2.6 plus or minus 0.5) times 10 the minus 13th power (He), (6.8 plus or minus 0.7) times 10 the minus 13th power (Ar), (6.1 plus or minus 0.6) X times 10 the minus 13th power (N2), (3.6 plus or minus 0.7) times 10 the minus 13th power (CO), (6.9 plus or minus 0.7) times 10 the minus 13th power (SF6), and (8.1 plus or minus 0.9) times 10 the minus 12th power (CH3COCH3) in units of cu.cm-per molecule per s. The deactivation probability is not controlled by long-range forces due to the lone electron on the radical, but rather by the probabilities for intramode vibrational energy flow in CH3.

706,003

PB87-223772 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Direct IR Laser Absorption Spectroscopy of Jet-Cooled CO2HF Complexes: Analysis of the (nu sub 1) HF Stretch and a Surprisingly Low Frequency (nu sub 6) Intermolecular CO2 Bend.
Final rept.,
C. M. Lovejoy, M. D. Schuder, and D. J. Nesbitt. 15 May 87, 13p
Grant NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 86, n10 p5337-5349, 15 May 87.

Keywords: *Molecular spectroscopy, Hydrogen fluoride, Molecular structure, Weak interactions, Hydrogen bonds, Chemical bonds, Reprints, Infrared laser spectroscopy, Carbon dioxide hydrogen fluoro.

High sensitivity, tunable laser direct absorption methods are exploited to obtain high resolution IR spectra (Delta nu approx = or < 0.001/cm) of weakly bound CO2HF complexes in a pulsed supersonic slit jet expansion. Transitions from the ground vibrational state corresponding to a single quantum excitation of the (nu sub 1)HF stretch are observed and analyzed with a semirigid linear molecule Hamiltonian.

706,004
PB87-224069 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Rotational and Vibrational Excitation of Molecules by Low-Energy Electrons.
Final rept.,
D. W. Norcross. 1986, 21p
Contract DOE-EA-77-C-0610
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of the Int. Swarm Seminar and the Inelastic Electron-Molecule Collisions Symposium (4th), Tahoe City, CA, July 19-23, 1985 p217-237.

Keywords: *Excitation, *Electron-molecule collisions, Excited states, Vibrational excitation, Rotational excitation.

The purpose of the paper is to review and summarize recent advances (since about 1982) in theoretical and computational techniques, and to illustrate the application of some of these developments in practical calculations. Important features of recent work are increased interest in polar molecules and complex polyatomics, the development of more realistic and complete representations of the interaction at short as well as long range, and important progress in theory and calculations for the treatment of nuclear dynamics in general, and vibrational excitation in particular.

706,005
PB87-224150 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Vibrational Excitation in Molecule-Surface Collisions. Analytical Modeling versus Classical Trajectories.
Final rept.,
J. W. Gadzuk. 1987, 15p
Pub. in Jnl. of Chemical Physics 86, n9 p5196-5210, 1 May 87.

Keywords: *Surfaces, *Excitation, Scattering, Iodine, Reprints, *Molecule collisions, Charge transfer, Vibrational excitation.

The problem of translational to vibrational energy redistribution occurring in collisions between diatomic molecules and solid surfaces is considered. Attention is focused solely on a mechanism which is a consequence of a molecule-surface interaction giving rise to an intramolecular potential whose equilibrium separation is a function of distance from the surface. The 'three-body' chemical effect is totally unrelated to mechanical excitation due to spring compression. While past work has emphasized the specific process of charge transfer/harpooning as a means for obtaining such an interaction, the mechanism is more general in the sense that it depends only upon the topology of the potential energy surface (PES) and not on what electronic properties gave rise to the topology. I2 is the molecule of choice in the work.

706,006
PB87-224168 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Heterodyne Frequency Measurements on N2O Near 1060/cm.
Final rept.,
L. R. Zink, J. S. Wells, and A. G. Maki. 1987, 8p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 123, p426-433 1987.

Keywords: *Nitrous oxide, Molecular constants, Reprints, *Calibration tables, *Heterodyne frequency measurements.

The results of heterodyne frequency measurements are given for the 10 degrees 0.02 degrees 0 band of N2O centered at 1056 per cm. Nine lines are measured and fit with an rms deviation of 1.3 MHz. The data are combined with other infrared and microwave data in a least-squares fit that gives accurate ro-vibrational constants for the two states involved in these transitions. The analysis of the data is based on a treatment that includes the effect of l-type resonance between the 02 degrees 0 and 02(2)0 states. Derived tables of wave numbers are given for the 02 degrees 0.00 degrees 0 band near 2460 per cm.

706,007
PB87-224184 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Detection of the Methyl Radical in a Methane/Air Diffusion Flame by Multiphoton Ionization Spectroscopy.
Final rept.,
K. C. Smyth, and P. H. Taylor. 1985, 5p
Pub. in Chemical Physics Letters 122, n5 p518-522, 20 Dec 85.

Keywords: *Diffusion, *Flame, *Spectroscopy, Ionization, Methyl, Multiphoton, Profile, Reprints.

Methyl radicals have been detected in an atmospheric pressure, methane/air diffusion flame by three-photon ionization. The origin band of the transition between the X(2)A2' ground electronic state and the 3p(2)A2' Rydberg state is observed at 333.5 nm via two-photon excitation. A second peak at 340.8nm is likely due to both a methyl radical hot band in the same electronic transition and three-photon ionization of carbon atoms produced by photolysis. Spatial profiles are presented as a function of height above the burner and are discussed in terms of resonant and non-resonant ionization processes.

706,008
PB87-224192 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Multiphoton Ionization Spectra of Trans-1,3-Butadiene: Reassignment of a Rydberg Series.
Final rept.,
P. H. Taylor, W. G. Mallard, and K. C. Smyth. 15 Jan 86, 3p
Pub. in Jnl. of Chemical Physics 84, n2 p1053-1055, 15 Jan 86.

Keywords: *Butadiene, *Ionization, Reprints, Multiphoton, Polarization, Rydberg, Spectra.

A Rydberg series of 1,3-trans-butadiene has been recently observed using two-photon resonant, three-photon ionization in the 330-269 nm wavelength region. An ns assignment was originally made due to the spectral similarity of the proposed 4s and 5s origins and associated vibronic structure with that of the 3s origin region. Subsequent experiments on the polarization behavior of the Rydberg series are not consistent with an s series assignment. An nd spectroscopic assignment is proposed based on the polarization measurements in conjunction with an analysis of the allowed two-photon optical transitions from the ground state.

706,009
PB87-224200 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Selectivity of Elementary Molecular Processes in Molecule-Surface Collisions.
Final rept.,
J. W. Gadzuk. 1987, 5p
Pub. in Chemical Physics Letters 136, n5 p402-406, 15 May 87.

Keywords: *Surfaces, Molecular beams, Scattering, Reprints, *Molecule collisions.

Excitation of internal vibrational modes of molecules scattered from surfaces in which charge transfer between collision partners occurs, is considered. A mechanism is proposed which should lead to controllable selectivity in the fragmentation distributions of scattered polyatomic molecules.

706,010
PB87-224531 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Effect of Post-oxidation Anneal on the Electrical Characteristics of Thin Oxides.
Final rept.,
D. J. Mountain, K. F. Galloway, and T. J. Russell. 1987, 3p
Pub. in Jnl. of the Electrochemical Society 134, n3 p747-749 Mar 87.

Keywords: *Integrated circuit, *Annealing, Oxides, Silicon dioxide, Thermal oxidation, Reprints, *Thin oxides, Post oxidation annealing, Processing technology, Semiconductor processing.

The study, the effects of pre- and post-oxidation treatments on thin (approx. 20-nm) gate oxide properties have been made. Pre-oxidation cleans and post-oxidation anneal (POA) times and ambients were compared. Flatband voltage, oxide field breakdown, and average density of interface trap (Dit) measurements were used to evaluate the different sequences. The data indicate that an optimum oxidation sequence for thin gate oxides can be designed. A sacrificial oxidation cleaning procedure and a long (120-min) POA in nitrogen gave the oxide with the best electrical characteristics.

706,011
PB87-224564 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Opacity Effects on Near-Resonance-Rayleigh Scattering in a Barium Plasma.
Final rept.,
T. J. A. Nee, and G. Chen. 1987, 7p
Pub. in Jnl. Quant. Spectrosc. Radiat. Transfer 37, n5 p425-431 1987.

Keywords: Reprints, *Barium plasma, *Rayleigh scattering, Opacity.

Near-resonance-Rayleigh scattering (NRRS) was used to measure the effects of opacity on the resonance transition of Ba(1+). The influence of the oven temperature, pumping laser-beam size, and probe-laser detuning on the opacity of the transition was investigated. The experimental results indicate a minimum detuning from the Ba(1+) resonance line center to avoid opacity problems in NRRS.

706,012
PB87-224580 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Progress and Challenges in the Determination of Atomic Transition Probabilities.
Final rept.,
W. L. Wiese. 1987, 5p
Pub. in Physica Scripta 35, p846-850 1987.

Keywords: *Transition probabilities, Aluminum, Argon, Lithium, Reviews, Accuracy, Reprints, Oscillator strengths, Lifetime.

A brief review of advances in the determination of atomic transition probabilities during the last 20 years is given. Several frequently studied transitions are used as examples to indicate the remarkable advances in accuracy and consistency between independent results. Major developing trends and some challenges for the future are also briefly discussed.

706,013
PB87-225348 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Collisions of F(1+) with Ne.
Final rept.,
M. Hottoka, B. Roos, J. B. Delos, R. Srivastava, R. B. Sharma, and W. S. Koski. 1 Jun 87, 11p
Pub. in Physical Review A 35, n11 p4515-4525, 1 Jun 87.

Keywords: Differential cross sections, Inelastic scattering, Spin orbit interactions, Reprints, *Ion-atom collisions, *Iron ions, *Sodium atoms, Charge transfer.

Measurements of inelastic collisions of F(1+) with Ne have been made. Transitions between triplet P and singlet D terms of F+ are seen, with the inelastically scattered ions sharply focused in the forward direction. Potential energy curves of (FNe)(1+) have been calculated. Several curve crossings are identified, where transitions occur through spin-orbit coupling. Scattering angles and differential cross sections have been calculated, and they show the presence of a 'glory' (or halo) effect, which accounts for the forward scattering of ions.

706,014

PB87-225371 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Transition Probabilities (Atomic Physics).
Final rept.,
W. L. Wiese. 1987, 11p
Pub. in Encyclopedia of Physical Science and Technology, v14 p59-69 1987.

Keywords: *Transition probabilities, Hartree-Fock approximation, Spectral lines, Forbidden transitions, Oscillator strengths, Ion spectroscopy, Lifetime.

In atomic spectral line radiation, the transition probability is the quantity that determines the intensity of a spectral line, aside from light-source-dependent factors. A characteristic feature of the atomic quantity is that it is generally difficult to determine, so that many of the known data are rather uncertain.

706,015

PB87-230868 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Fluorescence Polarization Studies of Autoionization in CS2.
Final rept.,
E. D. Poliakoff, J. L. Dehmer, A. C. Parr, and G. E. Leroi. 1987, 6p
Grants NSF-CHE83-10661, AFOSR-84-0261
Sponsored in part by Contract W-31-109-eng-38. Sponsored by National Science Foundation, Washington, DC., Air Force Office of Scientific Research, Bolling AFB, DC., Department of Energy, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Chemical Physics 86, nr p2557-2562, 1 Mar 87.

Keywords: *Carbon disulfide, Reprints, *Autoionization, Molecular spectroscopy, Photoionization, *Polarized fluorescence, Synchrotron radiation.

The polarization of the CS2+ (A2II -> X2II) transition was measured following photoionization of CS2 with synchrotron radiation excitation in the range 875 A < lambda < 967 A. Autoionization features are prominent in the fluorescence polarization spectrum and were investigated in detail. The spectral assignments of the absorption spectrum by Ogawa and Chang (Can. J. Phys. 48,2455 (1970)) are supported by the current measurements. Although fluorescence excitation and fluorescence polarization profiles normally align precisely, exceptions have been found for many resonances (sigma -> nd pi, n>3), and comparisons between the line shapes are given for several features.

706,016

PB87-230942 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
C1-Kappa(beta) Emission of Chloromethanes and Comparison with Semiempirical and 'ab initio' MO Calculations.
Final rept.,
R. C. C. Perera, R. E. LaVilla, and G. V. Gibbs. 1987, 7p
Contract DE-AC03-76SF00098
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Physics 86, n9 p4824-4830, 1 May 87.

Keywords: *Chloromethanes, Reprints, *MO calculations, X ray emissions, Free molecules.

The chlorine K beta emission in fluorescence from gas/vapor phase CCl4, CHCl3, CH2Cl2, and CH3Cl were measured with 'good statistics' and previously undetected weak x-ray emission features were observed. Results from ground state minimal and extended basis set ab initio (STO-3G) and MNDO MO calculations for these molecules are presented. The chlorine K beta emission spectra were analyzed by comparison with complementary spectral data and the MO calculations. In addition, weak features in Cl-K beta emission spectra resulting from self-absorption in the sample were identified.

706,017

PB87-231361 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Batch Extraction of Amines Using Emulsion Liquid Membranes: Importance of Reaction Reversibility.
Final rept.,
R. S. Baird, A. L. Bunge, and R. D. Noble. 1987, 11p
Pub. in American Institute of Chemical Engineers Jnl. 33, n1 p43-53 Jan 87.

Keywords: *Emulsion, *Extraction, Experiments, Mathematical models, Reprints, Interfacial adsorption, Liquid membranes, Multiple solutes, *Reversible reaction.

Experimental results for the batch extraction of amines using emulsion liquid membranes with an internal aqueous HCl solution are presented. Four amines and mixtures of one binary pair were studied. Reversibility of the acid-amine reaction within the internal droplets affected extraction rates. The reversible reaction model presented earlier satisfactorily predicts these experimental results.

706,018

PB87-231379 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Thermal Conductivity of Liquid Hydrogen Filled Foam.
Final rept.,
D. E. Daney, and E. Mapoles. 1987, 2p
Contract SANL-423-005
Sponsored by Lawrence Livermore National Lab., CA.
Pub. in Cryogenics 27, p427-428 Aug 87.

Keywords: *Hydrogen, *Thermal conductivity, Reprints, *Aerogel foam, Deuterium.

The effective thermal conductivities of silica aerogel foam (0.1(10)-3kg m-3 nominal density) filled with liquid n-H2, liquid n-D2 and an equimolar mixture of liquid H2-D2 were measured near 19.6 K. The measured value of 97 mW m-1 K-1 for hydrogen filled foam is essentially the same as for the liquid alone. The result agrees with predictions for the thermal conductivity of porous systems which give a 2% enhancement in the effective thermal conductivity for the system relative to the liquid alone.

706,019

PB87-231544 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Tunneling Spectroscopy of a La-Sr-Cu-O Break Junction: Evidence for Strong-Coupling Superconductivity.
Final rept.,
J. Moreland, A. F. Clark, L. F. Goodrich, H. C. Ku, and R. N. Shelton. 1987, 3p
Contract N00014-86-F-0109
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Physical Review B 35, n16 p8711-8713, 1 Jun 87.

Keywords: Superconductors, Reprints, *Break junction, *Electron tunneling, Tunneling spectroscopy, Vacuum tunneling.

Detailed structure in the quasiparticle tunneling has been observed in La-Sr-Cu-O superconductive tunneling junctions using the break-junction technique. Variability in the energy gap and associated structure in the current-voltage curves are observed indicating significant inhomogeneity in the superconducting properties. Large energy gaps (7.0 meV) and deep structure in the conductance derivative are evidence for a strong-coupling mechanism.

706,020

PB87-232013 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Effects of Pressure and Temperature on the Thermal Decomposition Rate and Reaction Mechanism of Beta-Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine.
Final rept.,
G. J. Piermarini, S. Block, and P. J. Miller. 1987, 7p
Sponsored by Army Research Office, Research Triangle Park, NC.
Pub. in Jnl. of Physical Chemistry 91, n14 p3872-3878, 2 Jul 87.

Keywords: *Explosives, High pressure, Kinetics, Temperature, Reprints, HMX, Reaction mechanism, Reaction rates, Thermal decomposition.

The effects of pressure and temperature on the thermal decomposition rate of Beta-HMX (HMX = octahydro-1,3,5,7-tetra-nitro-1,3,5,7-tetrazocine) in a diamond anvil high-pressure cell were measured by a FTIR method up to 6.5 GPa and 583 K. The observed alpha (mole fraction) vs. time curves were sigmoid and followed rate equations based on the theory of nuclei chain formation with branching interference suggesting an autocatalytic-type reaction. Pressure decreases the rate of thermal decomposition, while temperature increases the rate in typical Arrhenius behavior. The energy of activation decreases with increasing pressure linearly from 501 kJ/mol at 3.6 GPa to 150 kJ/mol at 6.5 GPa. The entropy of activation is positive but with a negative linear pressure dependence. At 3.6 GPa the entropy change at 563 K is 0.60 (kJ/mol)/K decreasing to 0.047 (kJ/mol)/K at 6.5 GPa. The volume of activation is positive (4.1 cu, cm./mol) and nearly constant over the P-T domain studied. The reactant increases in volume by about 3% in order to achieve the activated state. Between 3.6 and 5.5 GPa, the reaction mechanism is unimolecular and probably involves a ring expansion prior to bond scission. Above 5.5 GPa the mechanism is bimolecular. The change in molecularity can be explained by the introduction of strain into the kinetic model. The observed pressure dependences of the entropy, activation energies, and volume appear to explain why beta-HMX can detonate at high pressures.

706,021

PB87-233342 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Methods for Accurate Determination of Emission Rate and Trap Concentration with Application to Platinum-Doped Silicon.
Final rept.,
W. R. Thurber, and J. R. Lowney. 1987, 7p
Pub. in Jnl. of Applied Physics 62, n2 p534-540, 15 Jul 87.

Keywords: Reprints, *Deep levels, *Emission rates, *Nonexponential transients, Platinum in silicon, Trap concentration.

A procedure for the analysis of junction capacitance was developed which allows one to extract accurate values of emission rate and trap concentration from isothermal transient capacitance measurements. Experiments to demonstrate the procedure were performed on silicon diodes doped with platinum. The capacitance-ratio method of determining the emission rate was used to remove the nonexponentiality due to large trap concentration from the capacitance transients. Arrhenius plots of scaled emission rate gave activation energies of Ec - Ea = 0.2271 + or - 0.0002 eV for the platinum acceptor level in n-type silicon and Ea - Eu = 0.3215 + or - 0.0012 eV for the platinum donor level in p-type silicon. A new method for determining the trap concentration is derived and verified by use of simulations and data. The method involves the subtraction of capacitance values obtained from two transients with the same fill voltage, but different reverse voltages. It is much simpler than methods which require iterative solutions of Poisson's equation and a priori knowledge of the trap energy.

706,022

PB87-233409 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

State-Specific Orbital Alignment Effects in Electronic Energy Transfer: Sr(5s6p singlet P(1)) + M Sr(5s6p triplet P(J), 4d5p triplet F(4), triplet F(3)) + M.
Final rept.,
W. Bussert, and S. R. Leone. 1987, 7p
Grant NSF-CHE83-08403
Sponsored by National Science Foundation, Washington, DC., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Chemical Physics Letters 138, n2-3 p276-282, 17 Jul 87.

Keywords: *Strontium, Atomic orbitals, Energy transfer, Alignment, Hydrogen, Helium, Reprints.

Orbital alignment effects are investigated for an energy transfer process involving several competing pathways in the system Sr(5s6p singlet P(1) + rare gases and H2. Most of the cross sections to populate either (1) the combined 5s6p triplet P(J) and 4d5p triplet F(4) states or (2) the individual 4d5p triplet F(3) level show a marked preference for the perpendicular approach of the p orbital. However the cross section with He to populate the triplet F(3) state strongly favors the parallel orbital direction.

706,023

PB87-233417 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Orbital Alignment Effects in the Ca(4s5p singlet P(1)) to Ca(4s5p triplet P(J)) Electronic Energy Transfer with Molecular Collision Partners.
Final rept.,
W. Bussert, and S. R. Leone. 1987, 7p
Grant NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Chemical Physics Letters 138, n2-3 p269-275, 17 Jul 87.

Keywords: *Calcium, Atomic orbitals, Alignment, Energy transfer, Hydrogen, Deuterium, Nitrogen, Oxygen, Carbon monoxide, Carbon dioxide, Methane, Sulfur hexafluoride, Ethane, Reprints, Atom-molecule collisions, Polarization.

The effects of orbital alignment on the Ca(4s5p singlet P(1)) to Ca(4s5p triplet P(J)) electronic energy transfer process are determined for molecular collision partners, H2, D2, N2, O2, CO, CO2, CH4, C2H6, and SF6. Most of the molecules exhibit neglible effects, except for H2(D2) and CO2, which show significant preferences for perpendicular and parallel initial orbital alignments, respectively. In the reverse transfer direction, hydrogen exhibits an even larger effect favoring the perpendicular laser polarization.

706,024

PB87-233474 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Core-Exciton-Induced Desorption from MgO.
Final rept.,
R. L. Kurtz, R. Stockbauer, R. Nyholm, S. A. Flodstrom, and F. Senf. 15 May 87, 4p
Sponsored by Swedish Natural Science Research Council, Stockholm, and Office of Naval Research, Arlington, VA.
Pub. in Physical Review B 35, n14 p7794-7797, 15 May 87.

Keywords: *Desorption, Magnesium oxide, Reprints, *Excitons, Photon stimulated desorption.

Core-exciton-induced desorption of O+ and H+ from MgO(100) and MgO(111) has been observed using photon excitation energies spanning the O K edge. Electron-yield data from partially oxidized Mg implies that these states are localized in the near-surface region. O+ and H+ desorption results from the decay of different O core-exciton states as well as the states produced by interband transition. The O excitonic levels are interpreted in terms of their related atomic origin.

706,025

PB87-233508 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Heats of Adsorption of Atomic C, N, and O on Ni(100) and Cu(100) from a (Z+1) Core-Level Shift Analysis (Summary Abstract).
Final rept.,
W. F. Egelhoff. Aug 87, 1p
Pub. in Jnl. of Vacuum Science and Technology A 5, n4 p700 Jul/Aug 87.

Keywords: *Carbon, *Copper, *Heat of adsorption, Nickel, Nitrogen, Oxygen, Reprints, XPS.

It has been demonstrated in several recent papers that the equivalent core approximation can be used in an energy cycle analysis to extract heats of adsorption from core-level shift data on adsorbed atoms and molecules on metal surfaces. The purpose of the present work is to apply such an analysis to the important cases of atomic C, N, and O on Ni(100) and Cu(100). These cases are important because the heats of adsorption of these atoms represent a fundamental (and at present largely unknown) parameter in the dissociative chemisorption, associative desorption, and chemical reactions of a number of simple molecules on these surfaces.

706,026

PB87-233516 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Vibrational Relaxation of Adsorbed Molecules: Comparison with Relaxation Rates of Model Compounds.
Final rept.,
R. R. Cavanagh, M. P. Casassa, E. J. Heilweil, and J. C. Stephenson. Aug 87, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Vacuum Science and Technology A 5, n4 p469-472 Jul/Aug 87.

Keywords: *Hydroxyl, *Vibration, Picosecond, Silanol, Solution, Reprints, *Relaxation.

Time-resolved measurements of vibrational relaxation rates are reviewed. Depopulation of the vibrationally excited OH oscillator (on high surface area SiO2, ZSM-5, and ZnO) was found to occur on a time scale of 200 ps or less, depending on the substrate. The temperature dependence of both the OH and OD vibrational relaxation rates on SiO2 was found to follow simple multiphonon relaxation models. However, the relative rates for the two isotopes did not scale as predicted by the same theoretical models. Measurements of isotopically substituted silanols and alcohols (i.e., R3SiO(D) and R3COH(D) dilute in CCl4) also find OD decay times comparable to those of OH. Based on results from these model compounds, the observed relaxation rates for OH/SiO2 appear to be dominated by processes which proceed through a SiOH bending mode.

706,027

PB87-233532 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Facilitated Transport of CO2 in Ion Exchange Membranes.
Final rept.,
J. D. Way, R. D. Noble, D. L. Reed, G. M. Ginley, and L. A. Jarr. 1987, 8p
Contract DE-AC21-84MC21271
Sponsored by Department of Energy, Morgantown, WV. Morgantown Energy Technology Center.
Pub. in AIChE Jnl. 33, n3 p480-487 Mar 87.

Keywords: *Carbon dioxide, *Membranes, Separation, Mathematical models, Transport, Reprints, *Acid gas separation, Ion exchange membranes.

The facilitated transport of CO2 through ion exchange membranes containing organic amine counterions was studied. Steady state CO2 fluxes were measured from pure gas streams and mixtures with CH4. Facilitation factors for CO2 up to 26.7 were calculated from transport data. Transport measurements were binary mixtures of CO2 and CH4 yielded ratios of CO2 flux to CH4 flux ranging from 29.0 to 264. Conversion of flux ratios to permeabilities yielded separation factors up to 551 for CO2 over CH4, which are compared to literature data for polymeric membranes. The transport data support a mobile, reactive-carrier facilitated transport mechanism with a carbamate zwitterion complex. Effective diffusivities for CO2 and the carrier-gas complex were determined from transport data. A reaction equilibrium model predicted facilitation factors that were in very good agreement with experimental values. Potential applications are also discussed.

706,028

PB87-233565 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Scanning Electron Microscope with Polarization Analysis Studies of Magnetic Materials (Summary Abstract).
Final rept.,
J. Unguris, G. G. Hembree, R. J. Celotta, and D. T. Pierce. 1987, 2p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Vacuum Science and Technology A5, n4 p1976-1977 Jul/Aug 87.

Keywords: *Electron microscopy, Reprints, *Magnetic microstructure, *Polarized electron.

The technique of Scanning Electron Microscopy with Spin Polarization Analysis (SEMPA) is summarized. By measuring the spin polarization of secondary electrons generated in an SEM, SEMPA can directly image magnetic domain structures with a spatial resolution of about 100 Angstroms. The apparatus and its applications to the study of magnetic domains in Ge-Si are described.

706,029

PB87-233599 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
C1-K(beta) (K-V) Emission of CFC13 Excited by Synchrotron Radiation Below and Above C1-1s Binding Energy: Perturbation Effects in a Highly Excited Neutral Molecule.
Final rept.,
R. C. C. Perera, R. E. LaVilla, P. L. Cowan, T. Jach, and B. Karlin. 1987, 3p
Contract DE-AC03-76SF00098
Sponsored by Department of Energy, Washington, DC.
Pub. in Physica Scripta 36, p132-134 1987.

Keywords: *Chlorine, Synchrotron radiation, Perturbation, Absorption spectra, Emission spectra, Fluorescence, Reprints, *Methane/fluoro-trichloro.

The Cl K(beta) (K-V) fluorescent emission and K absorption spectra from CFCl3 vapor were measured using monochromatic synchrotron radiation. Weak supra-threshold features were observed in the Cl K absorption spectrum. The Cl is binding energy of CFCl3 was estimated to be 2829.4eV.

706,030

PB87-233714 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Dropwise Evaporative Cooling of High Thermal Conductivity Materials.
Final rept.,
M. di Marzo, and D. D. Evans. 1987, 11p
Pub. in Heat and Technology 5, n1-2 p126-136 1987.

Keywords: *Conduction, *Droplets, Evaporation, Extinguishment, Fire models, Reprints, *Thermal conductivity, Spray quenching.

Transient cooling of solid surfaces by water droplet evaporation has been investigated through controlled experiments using a large heated aluminum cylinder. Quantitative prediction of droplet evaporation time and in-depth transient temperature distribution in the solid have been made. In the case studied, a single droplet is deposited on a horizontal nonporous surface with initial temperatures in the range of 75 C to 100 C. The liquid-vapor interfacial temperature and the water vapor molar fraction in the air at the exposed surface of the water droplet are deduced from the coupled heat and mass transfer energy balance at the interface. Spatial and temporal integration of the overall droplet energy equation is used to predict the instantaneous evaporation rate and the droplet evaporation time. The boundary conditions for the wetted region proposed by Seki are used to obtain the transient temperature distribution for a semi-infinite solid.

706,031

PB87-233722 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Accurate Energies for the 4p (5)5s5p Quartet S(3/2) and 4p (5)5s4d Quartet P(5/2) Levels of Neutral Rubidium (Rb I).
Final rept.,
J. Reader. 1987, 2p
Pub. in Physical Review A 36, n1 p415-416, 1 Jul 87.

Keywords: Reprints, *Core excited states, *Energy levels, Rubidium, Spectrum, Ultraviolet vacuum, Wavelengths.

Accurate wavelengths for the 4p(sup 6)5p(sup 2)P1/2-4p(sup 5)5s5p(sup 4)S3/2, 4p(sup 6)5p(sup 2)P3/2-4p(sup 5)5s5p(sup 4)S3/2, and 4p(sup 6)4d(sup 2)D3/2,5/2-4p(sup 5)5s4d(sup 4)P5/2 transitions of Rb1 have been measured by photographing a sliding-spark light source with a 10.7-m normal-incidence vacuum spectrograph. The energies of the 4p(sup 5)5s5p(sup 4)S3/2 and 4p(sup 5)5s4d(sup 4)P5/2 levels were determined as 134250.1 plus or minus 0.4 cm-1 and 136806.4 plus or minus 0.4 cm-1, respectively.

706,032
PB87-233912 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Relationship between Least-Squares-Surface and Celles-Darling's Hyperspherical Coordinates.
Final rept.,
G. A. Natanson. 27 Feb 87, 6p
Pub. in Chemical Physics Letters 134, n3 p301-306, 27 Feb 87.

Keywords: *Atoms, Reprints, *Bending motion, *Linear path, Molecular vibration, Reaction theory, Saddle points.

The Carrington-Miller reaction-surface approach to a nearly collinear reaction in a triatomic system is used to substantiate the bending-corrected rotating linear model of Walker and Hayes. To avoid couplings between mutually perpendicular bending vibrations the change of variables suggested by Carrington and Miller is slightly modified by describing overall rotation of the triatomic by means of the body-fixed frame with the polar angle of the double degenerate bending mode used as the third Euler angle. It is proved that axes of the frame defined in such a way are directed along the principal axes of the triatomic and that the appropriate parameterization of the collinear reaction surface leads to Celles-Darling's hyperspherical coordinates zeta, eta, chi.

706,033
PB87-233953 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
T-V Energy Transfer and the Exchange Reaction of H(D)+HF at 2.2(2.1)eV: Vibrational State Distributions by Time and Wavelength Resolved Infrared Fluorescence.
Final rept.,
L. M. Cousins, and S. R. Leone. 1987, 7p
Grants NSF-PHY86-04504, NSF-CHE84-08403
Sponsored by National Science Foundation, Washington, DC., and Army Research Office, Research Triangle Park, NC.
Pub. in Jnl. of Chemical Physics 86, n12 p6731-6737, 15 Jun 87.

Keywords: *Hydrogen fluoride, *Hydrogen, *Deuterium, Energy transfer, Excitation, Reprints, *Atom-molecule collisions, Hot atom chemistry, Laser applications.

The product state distributions for hot atom collisions of H(D) + HF were measured by the laser photolysis-infrared emission technique. It was found that H atoms are 3.0 times more efficient than D atoms at exciting HF vibrations for the same kinetic energy. Although the vibrational distributions are similar, the D + HF T-V channel deposits approximately two times as much energy in the HF molecules as the vibrational exchange channel leaves in the DF molecules. The agreement between experiment and theory is excellent. The theoretical results show that significantly different mechanisms are responsible for T-V energy transfer on the reactive and unreactive portions of the potential energy surface.

706,034
PB88-109301 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Polarization Diffusion and Dielectric Friction in Polar Liquids.
Final rept.,
P. J. Stiles, and J. B. Hubbard. 1984, 9p
Pub. in Chemical Physics 84, p431-439 1984.

Keywords: Reprints, *Dielectric friction, Dielectric relaxation, *Polarization dynamics, Polar molecule, Rotational diffusion, Translational diffusion.

The authors introduce a new mechanism for collective polarization dynamics in a polar liquid. The continuum model couples hydrodynamic motions of the liquid to dielectric relaxation by both rotational and translational diffusion of polar molecules. As an application of the theory the authors calculate the dielectric friction on an ion in a solvent that relaxes only by the translational diffusion mechanism. The result is quite different from dielectric friction dominated by rotational (Debye) relaxation.

706,035
PB88-109319 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Conceptual Design of Low Gravity Experiments on Phase Transition and Critical Phenomena in Fluids.
Final rept.,
M. R. Moldover, and R. W. Gammon. 1983, 103p
Pub. in NASA Contractor's Report CR174637, 103p 1983.

Keywords: *Capillary rise, *Critical phenomena, *Dielectric constant, Gravity effects, Light scattering.

Four experimental areas are discussed in the context of possible low-g studies of phase transition and critical phenomena in fluids. They are: (1) photographic and light scattering studies of phase separation dynamics near the liquid-vapor critical point; (2) light scattering from critical fluctuations in equilibrium; (3) wetting films on container walls near the critical point; and (4) dielectric constant anomalies near the critical point. New results, heretofore unpublished, have been obtained in areas (1), (2), and (3). In the optical studies of phase separation near the critical point, hydrodynamic processes are observed. Proximity to the critical point determines the values of the thermodynamic and transport properties that enter into the hydrodynamic equations. The authors imaging and scattering measurements are at too late a time and at too large a size scale to be influenced by microscopic fluctuations. Furthermore, when the volume fractions of the new phases forming are roughly equal, the extreme turbidity of the fluid prevents us from making meaningful observations of phase separation in the absence of severe wall effects which have not been modeled. The authors conclude that optical studies of a phase separating pure fluid, in a low-g environment, could not be justified as a means of extending our understanding of fluctuations in the critical region.

706,036
PB88-109327 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Viscosity and Density of Two Alkali Metal Mixtures.
Final rept.,
R. F. Berg, M. R. Moldover, S. Rabinovich, and A. Voronel. 1987, 6p
Contract NASA-C-86129-D
Sponsored by National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.
Pub. in Jnl. of Physics F: Metal Physics 17, p1861-1866 1987.

Keywords: *Viscosity, Sodium, Reprints, *Alkali metal mixtures, *Cesium, *Density, Glass formation, Hard sphere models, Packing fraction, Potassium.

The authors have measured the density and viscosity of a K-Cs binary mixture and a Na-K-Cs ternary mixture from their crystallization points (234 K and 199 K respectively) to 300 K. Extrapolations of the fluidity data indicate that the effective glass temperatures are only 39 K and 12 K below the minimum melting and eutectic temperatures for the binary and ternary mixtures, respectively. The extrapolated liquid densities at these temperatures agree well with predictions based on hard-sphere models.

706,037
PB88-109335 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Scaled Fundamental Equation for the Thermodynamic Properties of Carbon Dioxide in the Critical Region.
Final rept.,
P. C. Albright, T. J. Edwards, Z. Y. Chen, and J. V. Sengers. 1987, 9p
Pub. in Jnl. of Chemical Physics 87, n3 p1717-1725, 1 Aug 87.

Keywords: *Carbon dioxide, Reprints, *Critical phenomena, *Parametric model, Equation of state, Specific heat.

A scaled fundamental equation is presented for the thermodynamic properties of carbon dioxide in the critical region. The equation is constructed by combining earlier experimental pressure data of Michels and coworkers with new specific heat data obtained by one of the authors and represents the thermodynamic properties of carbon dioxide in the critical region at temperatures from 301.15 to 323 K and at densities from 290 to 595 kg/cu. m.

706,038
PB88-109343 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Crossover from Singular to Regular Thermodynamic Behavior of Fluids in the Critical Region.
Final rept.,
P. C. Albright, Z. Y. Chen, and J. V. Sengers. 1987, 4p
Grant NSF-DMR82-05356
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review B 36, n1 p877-880, 1 Jul 87.

Keywords: *Carbon dioxide, Reprints, *Critical phenomena, *Equation of state, Specific heat, Supercritical fluids, Thermodynamic properties.

A procedure is presented for constructing equations for the thermodynamic properties of fluids in the critical region which incorporates the crossover from Ising-like scaled behavior near the critical point to regular (i.e., classical) behavior away from the critical point in a theoretically consistent manner. When the procedure is applied to a truncated classical Landau expansion, the authors obtain an accurate representation of the thermodynamic properties of carbon dioxide in both the asymptotic critical region and in the crossover regime.

706,039
PB88-110051 PC **A03**/MF **A01**
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
NO2 Heterodyne Frequency Measurements with a Tunable Diode Laser, a CO Laser Transfer Oscillator, and CO2 Laser Standards,
L. R. Zink, M. Vanek, and J. S. Wells. Apr 87, 28p
NBS/TN-1308
Also available from Supt. of Docs. Sponsored by National Aeronautics and Space Administration, Washington, DC.

Keywords: *Nitrogen dioxide, *Frequency measurement, Molecular spectra, Intermediate infrared radiation, Heterodyning, Carbon dioxide lasers, Calibration, Tunable lasers, Carbon monoxide lasers.

Heterodyne frequency measurements have been made on selected groups of nitrogen dioxide rovibronic transitions between 1580.8 and 1650.7/cm. The groups are separated by 7 to 10/cm, and the intent is to provide a limited (and interim) calibration table for the region. In addition to a table of measured frequencies in the region, the authors have included figures of spectra in the vicinity of the measured lines to provide a map for identifying the transitions measured.

706,040
PB88-110713 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Ionic Hydrogen Bond. 3. Multiple NH(1+)...O and CH(delta +)...O Bonds. Complexes of Ammonium Ions with Polyethers and Crown Ethers.
Final rept.,
M. Mautner. 1983, 4p
See also PB85-230431.
Pub. in Jnl. of the American Chemical Society 105, n15 p4912-4915 1983.

Keywords: *Hydrogen bonds, *Proton reactions, *Ethers, *Ketones, *Polyethers, Reprints, *Proton affinity.

Complexes of ammonium ions RNH3+ (R=CH3, c-C6H11), (CH3)3NH+, and pyridineH+ with polyethers and crown ethers are observed in the gas phase in the absence of solvent effects. The dissociation energies, delta H D, of the RNH3+ polyether complexes range from 29.4 kcal mol-1 (for RNH3+.CH3OCH2CH2OCH3) to 46 kcal mol-1 (RNH3+.18-crown-6). The large delta H D values for complexes of polydentate ligands indicate multiple -NH+...O- hydrogen bonding. Such multiple bonding can contribute up to 18 kcal mol-1 to the bonding in RNH3+.CH3(OCH2CH2)3OCH3 and 21 kcal mol-1 in RNH3+.18-crown-6. Multiple interactions are also evident in the (CH3)3NH+.polyether complexes where -CH delta+...O- hydrogen bonding seems to occur; and consecutive -CH delta+...O- bonds contribute approximately 6,4, and 2 kcal/mol-1 respectively for up to three such bonds. Total delta H D values in the (CH3)3NH+.polyether complexes thus range from 26.7 kcal mol-1 in (CH3)3NH+.CH3O-(CH2)2OCH3 to 41 kcal mol-1 in (CH3)3NH+.18-crown-6. Multiple interaction effects, possibly including van der Waals dispersion forces, are observed also in pyridineH+.polyether complexes. Large negative entropies in RNH3+.acyclic polyether complexes vs. RNH3+.cyclic crown ethers make the acyclic polyethers less efficient ligands.

706,041
PB88-110721 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Ionic Hydrogen Bond. 4. Intramolecular and Multiple Bonds. Protonation and Complexes of Amides and Amino Acid Derivatives.
Final rept.,
M. Mautner. 1984, 6p
See also PB88-110713.
Pub. in Jnl. of the American Chemical Society 106, n2 p278-283 1984.

Keywords: *Amides, *Amino acids, Clusters, Complexes, Hydrogen bonding, Solvation, Reprints.

The thermochemistry of protonation and ion-neutral interactions of CH3CON(CH3)2(DMA) and of the peptide-like alanine derivative CH3CONHCH(CH3)COOCH3(1) are models for ionic interactions in proteins. High proton affinity and negative entropy of protonation of 1 vs. DMA indicate intramolecular hydrogen bonding in 1H+. The internal hydrogen bond decreases the availability of the proton for external hydrogen bonding. Thus, the attachment energy of H2O to 1H+, 13.0 kcal mol-1, is lower than that to DMAH+, 16.5 kcal mol-1. The thermochemistry of the 1H+.H2O complex suggests a T-shaped structure, or one where H2O bridges between the two carbonyl groups. In other complexes 1 can serve as a neutral ligand. In such a complex, CH3NH3+.1, the unusually large experimental enthalpy of complexation, -40.1 kcal mol-1, suggests multiple hydrogen bonding. These results, combined with the thermochemistry of protonated amide dimers, suggest that intramolecular and multiple ionic hydrogen bonds can contribute significantly to the stabilities of ionic intermediates in protein and enzyme environments. Such contributions can range, per single hydrogen bond, from 5 kcal mol-1 for strained and distorted bonds to 30 kcal mol-1 for geometrically optimized bonds.

706,042
PB88-110754 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Measurement and Rate Law Analysis of D2 Q-Branch Line Broadening Coefficients for Collisions with D2, He, Ar, H2, and CH4.
Final rept.,
K. C. Smyth, G. J. Rosasco, and W. S. Hurst. 1987, 11p
Sponsored by Army Research Office, Research Triangle Park, NC.
Pub. in Jnl. of Chemical Physics 87, n2 p1001-1011, 15 Jul 87.

Keywords: *Gas analysis, Raman spectroscopy, Resolution, Inelastic scattering, Vibrational spectra, Gases, Rare gases, Reprints.

Continuous-wave stimulated Raman spectroscopy has been used to obtain high resolution vibrational Q-branch spectra at room temperature for pure D2 and D2:He, D2:H2, D2:Ar, and D2:CH4 mixtures. Measurements have been made for J= 0-5 in the density region of 0.5-20.0 amagat, from which line broadening coefficients have been determined. These coefficients have been analyzed using a modified exponential energy gap rate law to identify the contributions of rotationally inelastic collisions and vibrational dephasing collisions to the linewidth. The analysis has assumed that vibrational dephasing is independent of rotational state, in accord with available theoretical studies. Results are compared with experimental and theoretical work on H2, HD, and D2, thereby characterizing the contributions of rotationally inelastic and vibrational dephasing collisions to the line broadening coefficients as a function of both rotational level and collision partner.

706,043
PB88-110846 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Use of Angle Resolved Electron and Photon Stimulated Desorption for the Determination of Molecular Structure at Surfaces.
Final rept.,
T. E. Madey, and R. Stockbauer. 1983, 13p
Sponsored by Office of Naval Research, Arlington, VA., and Department of Energy, Washington, DC.
Pub. in Rev. Brasil. Apl. Vac. 3, n1-2 p47-59 1983.

Keywords: *Desorption, Chemisorption, Adsorption, Surfaces, Molecular structure, Synchrotron radiation, Reprints, Electron stimulated desorption.

The paper is a brief review of recent data related to the use of angle-resolved electron stimulated desorption and photon stimulated desorption in determining the structures of molecules at surfaces. Examples include a variety of structural assignments based on ESDIAD (electron stimulated desorption ion angular distributions), the observation of short-range local ordering effects induced in adsorbed molecules by surface impurities, and the application of photon stimulated desorption to both ionic and covalent adsorbate systems.

706,044
PB88-112511 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 16, Number 1, 1987.
Quarterly rept.
c1987, 168p
See also PB88-112529 through PB88-112578 and PB87-109963. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Research projects, *Chemical industry, Thermodynamic properties, Thermochemistry, Chemical shieldings, *Foreign technology.

Contents: Thermochemical data on gas phase compounds of sulfur, fluorine, oxygen, and hydrogen related to pyrolysis and oxidation of sulfur hexafluoride; The thermochemical measurements on rubidium compounds: A comparison of measured values with those predicted from NBS tables of chemical and thermodynamic properties; Standard thermodynamic functions of gaseous polyatomic ions at 100-1000 K; Thermodynamic properties of manganese and molybdenum; Thermodynamic properties of selected binary aluminum alloy systems; 13C chemical shieldings in solids.

706,045
PB88-112685 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 16, Number 3, 1987.
Quarterly rept.
c1987, 188p
See also PB88-112693 through PB88-112743 and PB88-112586. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC 20036.

Keywords: *Research projects, *Chemical industry, Thermodynamic properties, Combustion, Transport properties, Vaporization, Thermochemistry, *Foreign technology.

Contents: Standard chemical thermodynamic properties of alkanol isomer groups; High-temperature vaporization behavior of oxides II. Oxides of Be, Mg, Ca, Sr, Ba, B, Al, Ga, In, Tl, Si, Ge, Sn, Pb, Zn, Cd, and Hg; Equilibrium and transport properties of eleven polyatomic gases at low density; The thermochemistry of inorganic solids IV. Enthalpies of formation of compounds of the formula MXaYb; Chemical kinetic data base for combustion chemistry, Part 2. Methanol; Phase diagrams and thermodynamic properties of the 70 binary alkali halide systems having common ions; Cumulative listing of reprints and supplements.

706,046
PB88-112693 Not available NTIS
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
Standard Chemical Thermodynamic Properties of Alkanol Isomer Groups,
R. A. Alberty, M. B. Chung, and T. M. Flood. c1987, 27p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n3 p391-417 1987. Available from American Chemical Society, 1155 Sixteenth St., NW, Washington, DC. 20036.

Keywords: *Thermodynamic properties, *Alkanol isomer groups, Benson method, Enthalpy of formation.

The chemical thermodynamic properties of alkanol (ROH) isomer groups from CH4O to C4H10O in the ideal gas phase have been calculated from 298.15 to 1000 K from tables of Stull, Westrum, and Sinke. In the absence of literature data on all isomers of higher isomer groups, the properties of isomers of C5H12O to C8H18O have been estimated using Benson group values. Equilibrium mole fractions within isomer groups have been calculated for the ideal gas state from 298.15 to 1000 K. For isomer group properties increments per carbon atom have been calculated to show the extent to which thermodynamic properties of higher isomer groups may be obtained by linear extrapolation. Values of Cp, S, delta(f)H, and delta(f)G are given for all species of alkanols from CH4O to C8H18O in SI units for a standard state pressure of 1 bar.

706,047
PB88-117338 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Structure of the Mixed Crystal (KCN)0.7(KBr)0.3 Determined by Neutron Powder Diffraction.
Final rept.,
J. Bouillot, J. M. Rowe, and J. J. Rush. 1987, 6p
Pub. in Physical Review B 36, n3 p1766-1771, 15 Jul 87.

Keywords: Reprints, *Alkali cyanide/halide mixtures, *Ionic crystals, Mixed crystals, Neutron diffraction, Powder diffraction.

Neutron powder diffraction patterns of (KCN)0.7(KBr)0.3 measured at various temperatures in the range 17-200 K reveal a transition at Tc approx. 113 K between a cubic phase above Tc and a mixed rhombohedral-monoclinic phase (below Tc), in general agreement with recent x-ray studies (K. Knorr, A. Loidl, and J.K. Kjems, Phys, Rev. Lett. 55, 2445 (1985). In the low-temperature rhombohedral structure, the (CN)-ions lie in the plane perpendicular to the threefold axis. Structural data are given and discussed.

706,048
PB88-117379 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Powder Neutron Diffraction Study of ZrTiO4, Zr5Ti7O24, and FeNb2O6.
Final rept.,
P. Bordet, A. McHale, A. Santoro, and R. S. Roth. 1986, 17p
Pub. in Jnl. of Solid State Chemistry 64, p30-46 1986.

Keywords: *Diffraction, Reprints, *Powder neutron diffraction, Zirconium titanates, Iron niobate.

The zirconium titanates ZrTiO4 and Zr5Ti7O24 and the iron niobate FeNb2O6 have been investigated with the neutron diffraction powder technique and the Rietveld method. All three compounds crystallize with the symmetry of space group Pbcn and have lattice parameters a = 4,8042(2), b = 5.4825(3), c = 5.0313(2) A for ZrTiO4; a = 14.3574(6), b = 5.3247(3), c = 5.0200(2) A for Zr5Ti7O24; and a = 14.2661(2), b =

5.7334(l), c = 5.0495(l) A for FeNb2O6. Pure zirconium titanate, ZrTiO4, has the a-PbO2-type structure with a random distribution of the two cations. The compounds Zr5Ti7O24 and FeNb2O6 are ordered superstructures of alpha-PbO2 and in these two cases the observed distortions depend on the differences between ionic radii, leading to a fersmite-type structure in the case of Zr5Ti7O24 and to a columbite-type structure in the case of FeNb2O6.

706,049
PB88-117403 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Effects of Configuration Mixing on Computed Dielectronic-Recombination Rates.
Final rept.,
R. D. Cowan, and D. C. Griffin. 1987, 7p
Contract DE-AC05-84OR21400
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 36, n1 p26-32, 1 Jul 87.

Keywords: Reprints, *Configuration mixing, *Dielectronic recombination rates.

The authors investigate qualitatively and semiquantitatively the effects on computed dielectronic-recombination rate coefficients of including mixing between basis states of two or more configurations, as opposed to the single-configuration approximation. The authors have made model-parameter studies for two-electron systems, and have also considered physically realistic three- and four-electron systems. The authors have attempted to categorize the various circumstances under which configuration-interaction effects are significant, but overall effects appear to be generally small-usually no more than 10-20%.

706,050
PB88-117486 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Frozen Fragment Reduced Variational Space Analysis of Hydrogen Bonding Interactions. Application to the Water Dimer.
Final rept.,
W. J. Stevens, and W. H. Fink. 1987, 8p
Pub. in Chemical Physics Letters 139, n1 p15-22, 14 Aug 87.

Keywords: *Hydrogen, *Coulomb interactions, Chemical bonds, Polarization(Waves), Dimerization, Reprints.

A reduced variational space method is presented for analyzing hydrogen bonding interactions in terms of Coulomb and exchange, polarizability, and charge-transfer components. The method relies on the use of SCF optimized monomer orbitals in dimer calculations in which the wavefunction of one monomer is held frozen while the other is optimized with a basis set including selected subsets of the unoccupied monomer orbitals. Freezing the monomer wavefunctions allows the polarizability and charge-transfer interactions to be ascribed to specific monomers. Applications are presented for the interaction energy and dipole moment of the water dimer.

706,051
PB88-117494 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Pulsed Beam Fourier Transform Microwave Measurements on OCS and Rare Gas Complexes of OCS with Ne, Ar, and Kr.
Final rept.,
F. J. Lovas, and R. D. Suenram. 1987, 11p
Pub. in Jnl. of Chemical Physics 87, n4 p2010-2020, 15 Aug 87.

Keywords: *Rare gases, *Microwave spectroscopy, Measurements, Van der Waals equation, Neon, Argon, Krypton, Reprints, *Carbonyl sulfide.

A pulsed molecular beam Fourier transform microwave spectrometer, which has been recently constructed at NBS, was employed for measurements on several monomer and van der Waals species of OCS. The absorption-emission cell consists of a Fabry-Perot resonant cavity inside a high vacuum chamber. A pulsed nozzle is used to generate a supersonic molecular beam of a seeded inert gas.

706,052
PB88-117502 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Analysis of the Vibrational Spectrum of the Nitromethyl Free Radical.
Final rept.,
M. E. Jacox. 1987, 4p
Contract N00014-84-F-0159
Sponsored by Army Research Office, Research Triangle Park, NC., and Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Physical Chemistry 91, n19 p5038-5041, 10 Sep 87.

Keywords: Vibrational spectra, Chemical bonds, Molecular structure, Reprints, *Nitromethyl radical.

The vibrational spectra previously reported for the nitromethyl free radical, CH2NO2, and its isotopically substituted counterparts have been assigned. The agreement obtained in a least-squares force constant adjustment calculation is sufficiently good to provide strong support both for the assignment and for the assumed C2 nu symmetry of nitromethyl. The magnitude of the CN-stretching force constant is appropriate for a C-N single bond.

706,053
PB88-117718 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Adsorption of H2O on Planar and Stepped Si(100): Structural Aspects.
Final rept.,
C. U. S. Larsson, A. L. Johnson, A. Flodstrom, and T. E. Madey. 1987, 5p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Vacuum Science and Technology A 5, n4 p842-846 Jul/Aug 87.

Keywords: *Silicon, *Water, *Adsorption, Reprints, Low energy electron diffraction, Temperature dependence.

The adsorption of water on two silicon surfaces reconstructed planar (100)2X1 and single domain stepped (100)2x1 cut 5 degrees towards (011)) was studied using low-energy electron diffraction and digital imaging electron stimulated desorption ion angular distributions (ESDIAD) as a function of temperature (145-700 K) and coverage. An interpretation is presented based on the dimer model of the Si(100) reconstruction in which the OH bond axis azimuths are oriented nearly perpendicular to the dimer azimuths.

706,054
PB88-120936 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Polarized Fluorescence Spectroscopy of O2(1+).
Final rept.,
J. W. Keller, W. T. Hill, D. L. Ederer, T. J. Gil, and P. W. Langhoff. 1987, 5p
Grants NSF-PHY84-51284, NSF-RII84-06192
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 87, n6 p3299-3303, 15 Sep 87.

Keywords: *Alignment, *Autoionization, Molecular oxygen, Polarized fluorescence, Synchrotron radiation, Vacuum ultraviolet, Reprints.

Polarized fluorescence from the A2Ilu and b 4 sigmag- states of O2+ following photoionization of O2(X3sigmag-) in the 17-21 eV region has been employed to determine population alignment in the O2+ photoion. The measured A-channel polarization exhibits pronounced structure which correlates well with the known positions of (autoionizing) Rydberg states, whereas polarization signal in the b channel has broad and less prominent features. The measured b-channel polarization values (ranging from -0.02 to -0.05) are consistent with single-channel calculations, while the A-channel polarization measurements (which range from 0 to 0.09) are of opposite sign to the previously reported single-channel calculations. The results of more involved calculations show that this sign reversal in the A channel can be attributed to the presence of intravalent 3 sigma U- states which autoionize into the A channel in the near-threshold region.

706,055
PB88-121033 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
High-Resolution Spectroscopy of HF from 40 to 1100/cm: Highly Accurate Rotational Constants.
Final rept.,
D. A. Jennings, K. M. Evenson, L. R. Zink, C. Demuynck, J. L. Destombes, B. Lemoine, and J. W. Johns. 1987, 4p
Contract NASA-W-45047
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 122, p477-480 1987.

Keywords: *Hydrogen fluoride, *Infrared spectroscopy, Far infrared radiation, Reprints, High resolution, Rotational states.

Highly accurate spectra of ground state rotational transitions in HF have been combined with earlier spectra to yield accurate rotational constants and frequencies of HF from 1 to 33 THz (40 to 1100/cm). These lines can be used for accurate secondary frequency references for IR and FIR spectroscopy. Direct frequency measurements provided the references for the most accurate of these data.

706,056
PB88-121082 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Dielectronic Recombination of the Be-Like Ions: C(2+), N(3+), O(4+), and F(5+).
Final rept.,
P. F. Dittner, S. Datz, H. F. Krause, P. D. Miller, P. L. Pepmiller, C. Bottcher, C. M. Fou, D. C. Griffin, and M. S. Pindzola. 1987, 7p
Contract DE-AC05-84OR21400
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 36, n1 p33-39, 1 Jul 87.

Keywords: Reprints, *Beryllium ions, *Dielectronic recombination, Metastable states, Rate coefficients.

The first measurements of dielectronic recombination rate coefficients associated with the 2s yields 2p excitation in the Be-like ions C2+, N3+, O4+, and F5+ are reported. The authors observed the amount of electron capture attending the passage of MeV/nucleon ion beams through a collinear, magnetically confined, space-charged-limited electron beam as a function of relative energy. The initial beams contained large numbers of ions for which the metastable states of the term 2s2p(3)P were populated, and the fraction of ions in the metastable states to those in the ground-state configuration 2s2 were measured. The experimental rate coefficients are consistent in magnitude and shape with rates determined from distorted-wave calculations of the dielectronic recombination cross sections. The large fraction of metastable states in the initial ion beams had a pronounced effect on the shape and magnitude of the rate coefficients.

706,057
PB88-121124 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Near-Infrared Spectrum of ONNHF--Direct Evidence for Geometric Isomerism in a Hydrogen Bonded Complex.
Final rept.,
C. M. Lovejoy, and D. J. Nesbitt. 1987, 2p
Grants NSF-CHE86-05970, NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 87, n2 p1450-1451, 15 Jul 87.

Keywords: Reprints, *Absorption spectroscopy, *Laser absorption, Geometrical isomers, Hydrogen bonded dimers.

The near-IR spectrum and equilibrium structure of a novel hydrogen bonded complex between nitrous oxide and hydrogen fluoride is described. In contrast to a previously reported structure, in which the HF bonds to the oxygen end of NNO, the present structure has the HF bonded to the nitrogen end of NNO. The structure is unambiguously confirmed by isotopic substitution. The identification of the two stable, spectroscopically distinct structures represents the first demonstration of geometric isomerism in a hydrogen-bonded complex.

706,058
PB88-121132 Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Excitation of the 1s(5) and 1s(4) Levels of Neon by Low-Energy Electrons.
Final rept.,
K. Tachibana, and A. V. Phelps. 1987, 9p
Contract N00014-76-C-123
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Physical Review A 36, n3 p999-1007, 1 Aug 87.

Keywords: *Electrons, Excitation, Reprints, *Boltzmann equation, Cross sections, Metastables, Neon.

Excitation coefficients for production of 1s5 and 1s4 levels (Paschen notation) of neon in collisions with low-energy electrons have been measured using a drift-tube technique combined with laser absorption and laser-induced fluorescence techniques. The absorption and fluorescence signals have been analyzed using coupled rate equations which include the effects of population mixing among these levels in collisions with neon atoms. The excitation coefficients for the metastable and resonance levels alpha m/N and alpha R/N have been obtained as functions of the electric field to gas density ratio E/N. The measured values of alpha M/N vary from 1.3 times 10 to the minus 24th power sq. m. at E/N=1.6 times 10 to the minus 21 power V sq m. to 6.5 times 10 to the minus 22 power sq m. at 3.0 times 10 to the minus 19 th power V sq m. The values of alpha R/N are comparable in the experimental E/N range. The experimental excitation coefficients are in agreement with values calculated from a Boltzmann analysis using a recommended set of electron excitation cross sections derived from published experimental electron beam data.

706,059
PB88-121140 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Theoretical (A sup 1)(A sub 2)''-(X sup 1)(A sub 1) Absorption and Emission Spectrum of Ammonia.
Final rept.,
P. Rosmus, P. Botschwina, H. J. Werner, V. Vaida, P. C. Engelking, and M. I. McCarthy. 1987, 16p
Contract NSF-CHE83-18605
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 86, n12 p6677-6692, 15 Jun 87.

Keywords: *Absorption, *Emission, Reprints, *Ab initio calculation, *Ammonia A.

Potential energy, electric dipole moment, and electronic transition moment surfaces have been calculated for the A and X states of NH3 from CASSCF and CEPA electronic wave functions. Anharmonic vibrational term values, Franck-Condon factors, and A-X radiative transition probabilities for the symmetric stretching and bending modes of NH3 and ND3 have been evaluated. The theoretical absorption spectra at room and low temperatures agree well with experimental data. The symmetric stretching mode in the A state has only small intensities in the A-X absorption spectrum. Emission rates from various initial vibronic levels of the A state are given. The ab initio electric dipole moment surfaces for the ground state of NH3 have been used to compute transition moments, which are in good agreement with experimental data.

706,060
PB88-122007 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Effects of Substituents on the Length of Central C(sp sup 3)-C(sp sup 3) Bond in Anthracene Photodimers and Related Molecules.
Final rept.,
D. A. Dougherty, C. S. Choi, G. Kaupp, A. B. Buda, J. M. Rudzinski, and K. Osawa. 1986, 8p
Pub. in Jnl. of the Chemical Society, Perkin Transactions 2, p1063-1070 1986.

Keywords: *Anthracene, *Photodimers, *Substituents, Reprints.

Effects of substituents on the lengths of the central C-C single bond in the butterfly-shaped anthracene photodimers (1)-(7) and lepidopterenes (8) are studied. X-Ray analysis of the photodimer (10) of 9,10-difluoroanthracene gave a C(9)-C(10') bond length of 1.631(3) A. An attempt to re-determine molecular structure of the photoisomer (5) of (2.2)(9,10) anthracenophane (12) by neutron diffraction analysis is also reported (C(9)-C(10'); obs. 1.64(1), calc. 1.63(1) A). The D2 structure that had been proposed for the minimum-energy conformation of (5) is questioned and the D2h symmetric conformation is suggested on the basis of the diffraction results and MNDO calculations. The experimentally determined distances of the long central C-C bonds in these butterfly compounds including dianthronyl (9) are well reproduced by MNDO calculations with a standard deviation of 0.013 A. Small but significant further elongation of the central C-C bond by up to 0.07 A resulting from annulation of cyclobutane or cyclopentane ring in anthracene photodimers and from remote chlorine substitution in lepidopterene are interpreted in terms of the increased pi yields sigma orbital interation.

706,061
PB88-122080 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Hydrogen Sulfide Facilitated Transport in Perfluorosulfonic Acid Membranes.
Final rept.,
J. D. Way, and R. D. Noble. 1987, 15p
Contract DE-AI21-84MC21271
Sponsored by Department of Energy, Morgantown, WV. Morgantown Energy Technology Center.
Pub. in ACS (American Chemical Society) Symposium Series 347, Liquid Membranes: Theory and Applications, Chapter 9, p123-137 1987.

Keywords: *Membranes, *Hydrogen sulfide, *Cation exchanging, Mathematical models, Liquid phases, Sulfonic acid/perfluoro, Liquid membranes.

Hydrogen sulfide and methane fluxes were measured at ambient conditions for 200 micrometers perfluorosulfonic acid cation exchange membranes containing monopositive EDA counterions as carriers. Facilitation factors up to 26.4 and separation factors for H2S/CH4 up to 1200 were observed. The H2S transport is diffusion limited. The data are well represented by a simplified reaction equilibrium model. Model predictions indicate that H2S facilitated transport would be diffusion limited even at a membrane thickness of 1 micrometers.

706,062
PB88-122098 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Liquid Membrane Technology: An Overview.
Final rept.,
R. D. Noble, and J. D. Way. 1987, 26p
Pub. in ACS (American Chemical Society) Symposium Series 347, Liquid Membranes: Theory and Applications, Chapter 1, p1-26 1987.

Keywords: *Membranes, Liquid phases, Surveys, *Liquid membranes, Technology assessment.

Liquid membrane technology is introduced and is identified as a subset of membrane science. A tutorial section discusses configurations, transport mechanisms, experimental techniques, and a survey of basic theoretical approaches. The concepts of reactive liquid membranes which combine traditional unit operations such as extraction or absorption with stripping are discussed. The chapters to follow in the volume are summarized and the subject of each is placed in perspective to the field of liquid membrane technology.

706,063
PB88-124433
(Order as PB88-124409, PC **A04**/MF **A01**)
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Moessbauer Imaging,
S. J. Norton. 1987, 10p
Included in Jnl. of Research of the National Bureau of Standards, v92 n5 p325-334 Sep-Oct 87.

Keywords: *Mossbauer effect, *Image reconstruction, *Tomography.

In a Mossbauer experiment, if a spatially-extended absorbing sample is rotated relative to a moving gamma-ray Doppler shift are generated through the absorber parallel to the motion of the source. As a result, resonant absorption takes place along a series of parallel lines cutting through the absorber, where a particular line is determined by the velocity of the source. The result is a series of measurements of line integrals of the absorption coefficient through the absorber. An image or spatial map of the absorption coefficient distribution may then be reconstructed using tomographic image-reconstruction algorithms. Moreover, when measurements are recorded both as a function of the source velocity and the absorber rotational velocity, spectra information may also be recovered as a function of position. Spatial resolution is proportional to the rate of rotation of the absorber, but is ultimately signal-to-noise limited.

706,064
PB88-129663 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
New Comparative Method for the Determination of Activation Energies.
Final rept.,
W. Braun, and M. D. Scheer. 1985, 6p
Pub. in Chemical Physics Letters 118, n3 p229-234, 20 Jul 85.

Keywords: Reaction kinetics, Thermal radiation, Measurement, Exitation, Computation, Comparative analysis, Chemical reactors, Simulation, Reprints, *Activation analysis, Laser application, Computer applications.

The thermal emission of radiation from the surface of a rapid flow reactor is used as a reference standard in a new comparative method for determining chemical activation energies. The reactor consists of a fused silica, conical nozzle whose inner surface was heated to incandescence by CO2 laser radiation. The surface temperature and hence the thermal radiation are modulated by a periodic on-off switching of the laser. After coming in thermal contact with the periodically heated reactor surface, a reactive gas forms products at a rate that is also modulated at the laser switching frequency. The chemical activation energy could then be calculated from the energy of the thermal photons selected for observation and the measured temperature dependence of both the product formation rate and spectral radiance of the reactor surface. The method was illustrated by some experimental measurements. A computer simulation was used to assess the error in the measured activation energy resulting from time-varying temperature gradients generated on the reactor surface.

706,065
PB88-129721 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Mass Spectrometric Investigation of the Thermal Oxidative Reactivity of Ethylene Glycol.
Final rept.,
P. W. Brown, W. J. Rossiter, and K. G. Galuk. 1986, 6p
Sponsored by Department of Energy, Washington, DC.
Pub. in Solar Energy Materials 13, n3 p197-202 Apr 86.

Keywords: *Ethylene glycol, *Thermal degradation, Mass spectroscopy, Chemical reactivity, Solar energy, Materials, Copper, Oxidation, Carbon dioxide, Oxygen consumption, Reprints.

The thermal oxidative degradation of ethylene glycol at temperatures above 100 degrees C results in the evolution of CO2 as one of the degradation products. The rate of 02 consumption during the process appears to follow zero order kinetics. This implies that the rate limiting step is independent of 02 concentration and that a mechanism involving free radical nitration may be rate limiting. Both the rate of O2 consumption and the rate of CO2 evolution are accelerated in the presence of copper.

706,066
PB88-129739 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Infrared and Far-Infrared Laser Magnetic Resonance Spectroscopy of the GeH Radical: Determination of Ground State Parameters.
Final rept.,
J. M. Brown, K. M. Evenson, and T. J. Sears. 1985, 10p
Pub. in Jnl. of Chemical Physics 83, n7 p3275-3284, 1 Oct 85.

Keywords: *Germanium hydrides, *Free radicals, Ground state, Intermediate infrared radiation, Far infrared radiation, Reprints, Laser magnetic resonance.

The GeH radical has been detected in its ground doublet state in the gas phase reaction of fluorine atoms with GeH4 by laser magnetic resonance techniques. Rotational transitions within both doublet Pi(1/2) and

doublet Pi(3/2) manifolds have been observed at far infrared wavelengths and rotational transitions between the two fine structure components have been detected at infrared wavelengths (10 micrometers). Signals have been observed for all five naturally occuring isotopes of germanium. Nuclear hyperfine structure for (1)H and (73)Ge has also been observed. The data for the dominant isotope ((74)GeH) have been fitted to within experimental error by an effective Hamiltonian to give a set of molecular parameters for the X doublet Pi state which is very nearly complete. In addition, the dipole moment of GeH in its ground state has been estimated from the relative intensities of electric and magnetic dipole transitions in the 10 micrometer spectrum to be 1.24 (+ or - 0.10) Debyes.

706,067
PB88-129754 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
3p-Core Hole State Sensitivity in Ion Desorption from Oxidised Cr.
Final rept.,
E. Bertel, R. Stockbauer, R. L. Kurtz, T. E. Madey, and D. E. Ramaker. 1985, 5p
Pub. in Springer Series in Surface Sciences 4, p84-88 1985.

Keywords: *Surface chemistry, *Chromium oxides, *Chromium, Ions, Reprints.

The desorption of ions induced by electronic transitions involving core levels has been studied intensively during the last decade. It is well recognized, that Auger decay is an important mechanism to produce active states for ion desorption in ionic as well as covalent compounds. However, it is also clear that the ion desorption yield induced by core excitation is not proportional to the total core hole production rate. Therefore a detailed analysis of initial excited states, their decay channels and the corresponding final states is needed for further progress towards a comprehensive knowledge of the basic mechanisms and possible applications of photon and electron stimulated ion desorption (PSD and ESD). The present study is intended to provide an example of such an analysis.

706,068
PB88-134549 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
XPS (X-ray Photoelectron Spectroscopy) Searchlight Effect: A New Analytical Tool for Layered Structures, Epitaxy, and Interfaces.
Final rept.,
W. F. Egelhoff. 1985, 5p
Sponsored by Materials Research Society, Pittsburgh, PA.
Pub. in Proceedings of Layered Structures, Epitaxy, and Interfaces Symposium, Boston, MA., November 26-30, 1984, p443-447 1985.

Keywords: *Surfaces, Epitaxy, Copper, Nickel, Interfaces, *X ray photoelectron spectroscopy, *Photoelectron spectroscopy, Layered structures.

Enhanced core-level peak intensities at angles corresponding to the internuclear axes among the near surface atoms is a characteristic feature of angle resolved XPS. The phenomenon, which is due to constructive interference in forward scattering of photoelectrons, acts, in effect, as a searchlight allowing relatively easy mapping out of the structural arrangement atoms in the near-surface region. Examples which illustrate the usefulness of the XPS searchlight effect are presented.

706,069
PB88-134564 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Imaging Properties and Energy Aberrations of a Double-Pass Cylindrical-Mirror Electron Energy Analyzer.
Final rept.,
N. E. Erickson, and C. J. Powell. 1986, 6p
Pub. in Jnl. of Vacuum Science and Technology A 4, n3 pt2 p1551-1556 1986.

Keywords: Electron energy, Analyzers, Surfaces, Reprints, *Auger electron spectroscopy, *X ray photoelectron spectroscopy, *Photoelectron spectroscopy.

The imaging properties and energy aberrations of a commercial double-pass cylindrical-mirror analyzer have been characterized, using an extension of the method recently reported by Seah and Mathieu. The electron beam from the coaxial electron gun was rastered across a test surface and the intensity of either elastically-scattered electrons or of electrons at other selected energies was stored in a computer as a function of beam position on the specimen and other experimental parameters. The intensity data was later plotted to provide an 'image' of the detected intensity. Images are presented for electron energies of 100, 500, and 1000 eV and for the application of small offset voltages (typically between -1 and 5 V) applied to the gun cathode with the instrument operated in conditions appropriate for XPS or AES. The images obtained with elastically and inelastically scattered electrons provide a convenient and quantitative means of assessing instrument performance and of defining the specimen area being analyzed for the particular combination of instrument operating conditions and the energy width of AES or XPS features from the specimen.

706,070
PB88-134598 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Effect of Orbital Alignment on the Forward and Reverse Electronic Energy Transfer Ca(4s5p singlet P(1)) + M (Reversible Process) Ca(4s5p triplet P(J)) + M with Rare Gases.
Final rept.,
W. Bussert, D. Neuschafer, and S. R. Leone. 1987, 10p
Grant NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 87, n7 p3833-3842, 1 Oct 87.

Keywords: Atomic orbitals, Electron transitions, Helium, Neon, Argon, Xenon, Energy transfer, Reprints, *Calcium atoms, Atom-atom collisions, Laser radiation.

Effects of orbital alignment on the relative cross sections for electronic energy transfer are determined for the near resonant transfer between Ca (4s5p singlet P(1)) and Ca (4s5p triplet P(J)) states with rare gas collision partners. The experiments are carried out by pulsed laser excitation in a crossed beam. The results for the forward direction, singlet P to triplet P, formulated in terms of the ratio of the maximum to minimum transfer probability, are given. The energy transfer is also carried out in the reverse direction, triplet P(1) to singlet P, for He and Xe. The alignment results provide a first experimental determination of the dominant electronic states involved in a collisional energy transfer process.

706,071
PB88-138920 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Extinction Coefficient of H2CC((sup 3)B(sub2)) at 137 nm.
Final rept.,
A. Fahr, and A. H. Laufer. 1985, 3p
Pub. in Jnl. of Chemical Physics 83, n2 p908-910 Jul 85.

Keywords: Reprints, *Extinction coefficient, *Metastable, Spectra, Vacuum ultraviolet, Vinylidene.

The extinction coefficient of H2CC(3B2) was obtained at 137 nm. The vinylidene radicals were produced from the flash photolysis of C2H3Cl and their concentration from the equal quantity of HCl produced in the photolysis. The measured extinction coefficient is 694 + or - 218/atm/cm.

706,072
PB88-139118 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Elemental Characterization of the National Bureau of Standards Milk Powder Standard Reference Material by Instrumental and Radiochemical Neutron Activation Analysis.
Final rept.,
R. R. Greenberg. 1986, 6p
Pub. in Analytical Chemistry 58, n12 p2511-2516 1986.

Keywords: *Milk, Reprints, *Neutron activation analysis, Radiochemical, *Standard reference materials, Trace element analysis, Ultratrace levels.

The Milk Powder Standard Reference Material, SRM 1549, recently prepared by the National Bureau of Standards has been analyzed by instrumental and radiochemical neutron activation analysis (INAA and RNAA). The extremely low levels of many of the elements of interest, combined with the high levels of the matrix elements, necessitated improvements in many of the existing analytical procedures. Special attention has been given to reducing and evaluating the analytical uncertainties. Bovine Liver, SRM 1577, was analyzed as a control and the results obtained were compared with the literature and the NBS certified values.

706,073
PB88-140850 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Ultraviolet Absorption Spectroscopy of Dissociating Molecules: Effects of Cluster Formation on the Photodissociation of CH3I.
Final rept.,
D. J. Donaldson, V. Vaida, and R. Naaman. 1987, 9p
Pub. in Jnl. of Chemical Physics 87, n5 p2522-2530, 1 Sep 87.

Keywords: *Clusters, *Dimers, Methyl iodide, Ultraviolet absorption, Reprints.

The ultraviolet absorption spectra of jet-cooled CH3I, (CH3I)2, and (CH3I)n, N>2 are measured in the valence A state and the Rydberg B state. A significant blue shift of the valence state is observed upon cluster formation. The magnitude of the shift yields a dimer bond strength of at least 500 cm-1 which implies extensive dimer formation at room temperature and moderate pressures. The methyl iodide B-state spectrum consists of a single progression in the v2 mode. Dimerization retards the predissociation and therefore increases the excited state lifetime; consequently many new modes are observed which in the monomer are coupled to the dissociation. The implications of the result to the photodissociation dynamics are discussed. The Rydberg spectra of (CH3I)n, n>2 show asymmetric line shapes which may be due to interferences between the B state and an underlying continuum. The nature of these interferences and the possible indentity of the continuum are discussed.

706,074
PB88-140900 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Laser Determinations of 'Hot Band' Quantum Yields: Br* doublet P(1/2) Formation in the Continuum Absorption of Br2 at 510-550 nm.
Final rept.,
J. E. Smedley, H. K. Haugen, and S. R. Leone. 1987, 9p
Grant NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 87, n5 p2700-2708, 1 Sep 87.

Keywords: *Bromine, Absorption spectra, Quantum efficiency, Reprints, Photodissociation, Vibrational states, Laser applications.

Absolute quantum yields of Br* in the photodissociation of thermally excited vibrational levels of Br2 are measured by transient gain vs absorption probing of the Br* (doublet P(1/2))-Br(doublet P(3/2)) transition at 2.7 micrometers with an F-center laser. An etalon-narrowed pulsed dye laser with a linewidth of 0.04/cm is used to excite continuum regions between the bound Br2(B-X) transitions of isotopic Br2 (about 81% (81)Br2) at selected wavelengths between 510 and 550 nm.

706,075
PB88-140983 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Office of Nondestructive Evaluation.
Studies of Collision-Induced Emission in the Fundamental Vibration-Rotation Band of H2*.
Final rept.,
G. E. Caledonia, R. H. Krech, T. Wilkerson, R. L. Taylor, and G. Birnbaum. 1986, 7p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Proceedings of the International Symposium of Shock Waves and Shock Tubes (15th), Berkeley, CA., July 28-August 2, 1985, p835-841 1986.

Keywords: *Hydrogen, Near infrared radiation, Emission spectra, Shock tubes, Argon, Vibrational states, Rotational states.

Measurements are presented of the collision induced emission (CIE) from the fundamental vibration-rotation band of H2 taken over the temperature range of 900-3000 K. The spectral shape and strength of this infrared band centered about 2.4 micrometers has been measured behind reflected shocks in mixtures of H2/Ar. The observed radiation at elevated temperatures is found to be dominantly in the Q branch. The results have been compared with theory. These comparisons show that radiation at elevated temperatures is primarily the results of an induced dipole moment in H2 induced by the overlap between the H2 and Ar electron clouds during collision. The strength of this interaction has been evaluated by an analysis of the measured temperature dependence of the absolute band-strength.

706,076
PB88-141015 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Microwave Spectrum of the Ar...Vinyl Cyanide Van Der Waals Complex.
Final rept.,
R. D. Suenram, and F. J. Lovas. 1987, 9p
Pub. in Jnl. of Chemical Physics 87, n8 p4447-4455, 15 Oct 87.

Keywords: Reprints, *Acrylonitrite, *Vinylcyanide, Fourier transform microwave spectroscopy, *Microwave spectra, van der Waals.

The microwave spectrum of the Ar...vinyl cyanide van der Waals complex has been observed using a pulsed Fourier transform microwave spectrometer. Two vibrational states have been identified. Centrifugal distortion and (14)N quadrupole hyperfine analyses of the observed transitions have been performed for both states. The lower (ground) state fits an asymmetrical top Hamiltonian significantly better than the upper state. The two states are believed to arise because of a tunneling motion within the complex. The preferred structure of the complex has the Ar atom located approximately equidistant from the methylene carbon and nitrogen atoms and about 34 degrees out of the plane of the vinyl cyanide subunit.

706,077
PB88-141197 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Decay Rate of Critical Fluctuations in Ethane+Carbon Dioxide Mixtures Near the Critical Line Including the Critical Azeotrope.
Final rept.,
R. F. Chang, T. Doiron, and I. L. Pegg. 1986, 10p
See also PB84-222884.
Pub. in International Jnl. of Thermophysics 7, n2 p295-304 1986.

Keywords: *Carbon dioxide, *Ethane, *Azeotropes, Liquids, Fluids, Mixtures, Critical point, Thermophysical properties, Reprints.

Near a critical point, the order parameters of fluctuations are, respectively, density and concentration for simple fluids and binary liquid mixtures. The order parameter for binary fluid mixtures near a plait point is not clear because of the presence of two coupled diffusive modes of fluctuations, namely heat and mutual diffusion. A mixture near a critical azeotrope is interesting because the concentration fluctuations are suppressed. Consequently, an azeotropic mixture is expected to behave like a simple fluid near a critical point. Using the technique of photon correlation spectroscopy the authors have measured the decay rate of critical fluctuations in mixtures of ethane and carbon dioxide of various compositions including a near-azeotropic mixture.

706,078
PB88-141205 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Corona-Induced Decomposition of Dielectric Gases.
Final rept.,
R. J. Van Brunt, J. T. Herron, and C. Fenimore. 1987, 10p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Proceedings of International Symposium on Gaseous Dielectrics (5th), Gaseous Dielectrics V, Knoxville, TN., May 3-7, 1987, p163-172.

Keywords: *Sulfur hexafluoride, *Gas discharges, *Electric corona, Dielectric properties, Chemical reactions, Water vapor, *Corona discharges.

A three-zone model for chemical decomposition of electronegative gases in negative point-plane corona discharges is proposed which considers the discharge glow, ion-drift, and main gas volumes respectively as separate regions of diminishing chemical activity and increasing relative size. The proposed model is shown to be useful in predicting discharge by-product yields and the dependences of these yields on discharge current and gas mixture composition. As an example, the model is applied here to the decomposition of pressurized SF6 containing trace levels of water vapor and is shown to yield results for oxyfluoride production that are in satisfactory agreement with observations.

706,079
PB88-147210 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Incoherent Inelastic Neutron Scattering: Vibrational Spectroscopy of Adsorbed Molecules on Surfaces.
Final rept.,
R. R. Cavanagh, J. J. Rush, and R. D. Kelley. 1987, 40p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Vibrational Spectroscopy of Molecules on Surfaces, Chapter 5, p183-222 1987.

Keywords: *Adsorbates, *Neutron scattering, Adsorption, Inelastic scattering, Surfaces, Probes, Vibrational states.

An introduction to neutron scattering as a probe of adsorbates at surfaces is presented. Emphasis is placed on experimental aspects of triple axis and time-of-flight techniques along with a single phonon model for the spectral features. Wilson FG methods for constructing molecular force fields relevant to the molecular modes of the adsorbate are presented. The applicability of neutron scattering for exploring rotational diffusion and adsorbate torsions is also examined.

706,080
PB88-147228 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Kinetics and Dynamics of the Nitric Oxide/Ammonia Interaction on Pt(111).
Final rept.,
D. Burgess, D. S. King, and R. R. Cavanagh. 1987, 2p
Contract DE-AI05-84ER13150
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Vacuum Science and Technology A 5, n5 p2959-2960 Sep/Oct 87.

Keywords: *Surface chemistry, *Platinum, *Nitrogen oxide(NO), *Ammonia, Reaction kinetics, Desorption, Fluorescence, Thermodynamic properties, Reprints.

The kinetics and dynamics of the nitric oxide/ammonia interaction on Pt(111) were studied using a combination of temperature-programmed desorption (TPD) and laser-excited fluorescence techniques. Although NO desorption kinetics are significantly altered by interaction with preadsorbed NH3, no effect was seen in the dynamical accommodation of rotational energy with the surface.

706,081
PB88-147244 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Orientation of CH3NC Adsorbed on Ag(311).
Final rept.,
S. T. Ceyer, and J. T. Yates. 1985, 4p
Pub. in Jnl. of Physical Chemistry 89, n18 p3842-3845 1985.

Keywords: *Surface chemistry, Desorption, Spectroscopy, Reprints, *Methyl isocyanides, Silver 311.

The adsorption of methyl isocyanide on the Ag(311) surface at 95K has been studied by high resolution electron energy loss spectroscopy, electron stimulated desorption ion angular distribution (ESDIAD) and thermal desorption spectroscopy. Examination of the intensities of the loss features in the HREEL spectrum within the selection rule for a dipolar scattering mechanism, and the behavior of the ESDIAD patterns as a function of coverage lead to the conclusion that CH3NC adsorbes on Ag(311) in two distinct bonding geometries. The more strongly bound CH3NC interacts with the surface through the pi-type orbitals leading to the CH3NC molecule bound with its axis close to parallel with the surface. The more weakly bound state interacts through the sigma-type orbital on the carbon end of the molecule leading to the CH3NC molecule bound with its C3v axis perpendicular to the macroscopic surface. The thermal desorption data exhibit two peaks which correlate with these bonding geometries.

706,082
PB88-147251 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Influence of Atomic Corrugations on Alkali Chemisorption (Summary Abstract).
Final rept.,
N. D. Shinn, and P. D. Szuromi. 1987, 2p
See also DE87002491. Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Jnl. of Vacuum Science and Technology A 5, n4 p796-797 Jul/Aug 87.

Keywords: *Alkali metals, *Copper, *Chemisorption, Auger electron spectroscopy, Desorption, Electron diffraction, Electronic structure, Reprints.

Low energy electron diffraction, Auger electron and thermal desorption spectroscopies, and electron stimulated desorption ion angular distribution were used to study the alkali-induced reconstructions and ordered overlayers on Cu(311). Both (1x3) and (1x2) reconstructions are observed at low coverages of K, Na and Li, implying that charge donation alone induces the surface reordering. High coverage ordered overlayers are observed for both Na and K, reflecting the atomic corrugations of Cu(311) and steric packing constraints.

706,083
PB88-147269 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Surface Harpooning.
Final rept.,
J. W. Gadzuk. 1985, 22p
Pub. in Comments on Atomic and Molecular Physics 16, n5 p219-240 1985.

Keywords: Excitation, Reprints, *Surface scattering, *Charge exchange, Vibrational states, Atomic collisions, Molecular collisions, Charge state.

The principles involved in charge transfer/harpooning collisions between atoms or molecules and surfaces are presented in terms of concepts drawn from gas phase atomic and molecular collision theory. As specific examples, the charge state of atoms and the vibrational excitation or dissociation of molecules which have experienced harpooning while scattering from a surface are considered.

706,084
PB88-147285 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Scattering Properties of a Model Bicontinuous Structure with a Well Defined Length Scale.
Final rept.,
N. F. Berk. 1987, 4p
Pub. in Physical Review Letters 58, n25 p2718-2721, 22 Jun 87.

Keywords: Neutron scattering, Emulsions, Porosity, Reprints, *Microemulsions, Small angle scattering.

Cahn's scheme for simulating the morphology of isotropic spinodal decomposition is adapted to a mathematical model of bicontinuous partitioning of space by interfacial pairs that may be useful for problems of microdispersed and microporous systems distinguished by a morphology with a well defined length scale, including surfactant films in microemulsions and coatings in porous media. Real-space and scattering properties are analyzed, and qualitatively the model accounts for the principal features of recent contrast-variation small-angle neutron-scattering experiments on Winsor III type microemulsions.

706,085

PB88-147343 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Crossover Description for the Thermodynamic Properties of Fluids in the Critical Region.
Final rept.,
P. C. Albright, J. V. Sengers, J. F. Nicoll, and M. Ley-Koo. 1986, 11p
Pub. in International Jnl. of Thermophysics 7, n1 p75-85 Jan 86.

Keywords: Specific heat, Reprints, *Critical phenomena, *Crossover theory, Renormalization, Equation of state, van der Waals equation.

The authors have developed a 'crossover' formalism that reconciles the singular asymptotic critical behavior of the thermodynamic properties of fluids with the classical behavior of these properties well away from the critical point. The proposed formalism is based on theoretical predictions for the crossover behavior suggested by the renormalization group theory of critical phenomena. The authors demonstrate the formalism for a fluid whose classical behavior away from the critical point is represented by the equation of state of van der Waals.

706,086

PB88-147368 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Molecular-Dynamics Study of Glassy and Supercooled States of a Binary Mixture of Soft Spheres.
Final rept.,
R. D. Mountain, and D. Thirumalai. 1987, 12p
Grant NSF-CHE86-09722
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review A 36, n7 p3300-3311, 1 Oct 87.

Keywords: *Glass, *Supercooling, Fluids, Spheres, Reprints, Binary mixtures.

A series of molecular-dynamics simulations of binary-fluid mixtures composed of softly repelling spheres have been made as part of an investigation of the glass-forming properties of mixtures. These mixtures are simple prototypes of glass-forming systems, as both randomness and frustration are intrinsic to them. The randomness is inherent in the fluid and frustration is due to the large, local rearrangement of atoms required for the formation of a crystal from a fluid or glassy configuration. The equation of state, pair and triplet correlation functions, single-particle velocity time autocorrelation functions, and some measures of local glassy order have been determined for a range of compositions, and effective reduced densities. In addition, attention has been focused on the relaxation of some anisotropic correlation functions characterizing the local environment. Attempts have been made to analyze some of these quantities using plausible phenomenological models. The changes in these quantities which occur as the fluid is supercooled and finally forms a glass are examined, and the possible implication of these findings for certain dynamical theories of the glass transition are discussed.

706,087

PB88-147665 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Detection of SiF Radicals with Multiphoton Ionization Spectroscopy.
Final rept.,
C. S. Dulcey, and J. W. Hudgens. 1985, 4p
Pub. in Chemical Physics Letters 118, n4 p444-447, 2 Aug 85.

Keywords: Spectra, Spectroscopy, *Silicon monofluoride, *Multi-photon processes.

The authors report the resonance enhanced multiphoton ionization spectrum of SiF between 430 and 492 nm. SiF radicals absorbed at least three photons to generate the observed m/z 47 SiF ion.

706,088

PB88-147673 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Proton Affinities of Diacetylene, Cyanoacetylene, and Cyanogen: Experimental and Ab initio Studies.
Final rept.,
C. A. Deakyne, M. Mautner, T. A. Buckley, and R. Metz. 1987, 9p
Pub. in Jnl. of Chemical Physics 86, n4 p2334-2342, 15 Feb 87.

Keywords: *Acetylene, *Mass spectroscopy, *Molecular spectroscopy, Chemical bonds, Reprints, *Cyano compounds, Diacetylene, Propiolonitriles, Acetylene/cyano, Cyanogen radical, Molecular orbitals.

The proton affinities of cyanoacetylene, diacetylene and cyanogen were determined by pulsed high pressure mass spectrometry and by ion cyclotron resonance spectometry as 180, 180 and 161 kcal/mol, respectively. Ab initio calculations at the 6-31G** level show that the high proton affinity of diacetylene results partially in destabilizing antibonding interactions between the triple bonds in the molecule, which changes into an attractive interaction upon protonation at the terminal carbon.

706,089

PB88-147681 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Structural and Electronic Properties of Clean and Water-Dosed SnO2(110).
Final rept.,
D. F. Cox, S. Semancik, and P. D. Szuromi. 1986, 2p
Pub. in Jnl. of Vacuum Science and Technology A 4, n3 p627-628 May/Jun 86.

Keywords: *Tin oxides, Sputtering, Water, Adsorption, Desorption, Reprints, Low energy electron diffraction, Band theory, Photoemission.

The ion sputtered SnO2(110) surface is found to exhibit (4x1) and (1x1) LEED patterns following annealing at 900K and 1000K, respectively. Downward surface band bending observed with ultraviolet photoemission reveals the formation of an accumulation layer in the presence of the (4x1) LEED pattern. Molecular adsorption at 90K on the (1x1) surface bends the bands down indicating the formation of a H2O-surface donor complex. A comparison with thermal desorption measurements shows that the band bending reaches a maximum on completion of the first water overlayer. No water induced band bending is observed for the (4x1) structure where the clean surface exhibits an accumulation layer prior to adsorption. The lack of any apparent donor/acceptor characteristics for H2O on the (4x1) surface is accompanied by the formation of a more weakly bound overlayer as observed in thermal desorption spectroscopy.

706,090

PB88-147699 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Argon K Suprathreshold Structure.
Final rept.,
K. G. Dyall, and R. E. LaVilla. 1986, 3p
Pub. in Physical Review A 34, n6 p5123-5125 Dec 86.

Keywords: *Argon, Emission spectra, Absorption spectra, Reprints.

The argon K absorption suprastructure features are assigned, using ab initio calculations and tabulated experimental final state energies. The assignments are supported by estimates of relative intensities. It is suggested, on the basis of the analysis, that the origin of the argon K beta double prime satellite is due to initial states with triple vacancy 1s 3p(2) core configurations.

706,091

PB88-147707 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Resonant Structure in 3P Subshell Absorption of Excited and Ionized Manganese.
Final rept.,
J. W. Cooper, C. W. Clark, C. R. Cromer, and T. B. Lucatorto. 1987, 4p
Pub. in Physical Review A 35, n9 p3970-3973, 1 May 87.

Keywords: *Manganese, Absorption cross sections, Far ultraviolet radiation, Atomic energy levels, Reprints, *Manganese ions, *Resonance absorption, Excited states.

Spectra representing the relative cross sections for resonant absorption from the 3p subshell of laser-excited and ionized manganese have been obtained in the 47-52-eV range. The results show a marked change in the resonant structure and the appearance of new resonances which are attributed to 3p-4s transitions.

706,092

PB88-147731 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Analysis of the 5p(6)->5p(5)nl (J=1) Rydberg Series in Ba(2+).
Final rept.,
W. T. Hill, J. Sugar, T. B. Lucatorto, and K. T. Cheng. 1987, 7p
Grant NSF-PHY84-51284
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and National Science Foundation, Washington, DC.
Pub. in Physical Review A 36, n3 p1200-1206, 1 Aug 87.

Keywords: Atomic energy levels, Reprints, *Barium ions, Photoabsorption, Rydberg series, Bound state.

A detailed analysis is made for the bound 5p(6)->p(5)ns,nd levels observed in the photoabsorption of Ba(2+). A multichannel quantum-defect theory approach, with ab initio calculations for some of the parameters, is used to describe periodic enhancements in intensity associated with interchannel mixing. Qualitative agreement between experiment and theory requires the inclusion of plasma-broadening effects to account for the apparent increase in strength of the higher n levels.

706,093

PB88-151956 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Collision Kernel and Interatomic Potential.
Final rept.,
T. S. Ho, and S. I. Chu. 1986, 7p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 33, n5 p3067-3073 May 86.

Keywords: Differential cross sections, Sodium, Argon, Reprints, *Atomic collisions, Interatomic potentials, Laser spectroscopy, Lennard-Jones potential.

The authors present a detailed study of the influence of the form and strength of the interatomic potential on the one-dimensional elastic collision kernel, a quantity of interest in the study of the effects of velocity-changing collisions on laser spectroscopic line shapes. While the analysis is confined to the Na-Ar and Ar-Ar systems, the conclusions derived from the study are general, and are expected to be also applicable to other systems where both the long- and short-range interactions play essential roles in velocity-changing collisions.

706,094

PB88-151964 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron Capture in Ar(1+) + H2 Collisions in the keV Energy Regime.
Final rept.,
M. Kimura, S. Chapman, and N. F. Lane. 1986, 7p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 33, n3 p1619-1625 Mar 86.

Keywords: *Electron capture, *Hydrogen, Reprints, *Ion-molecule collisions, *Argon ions, *Charge exchange, KeV range.

Electron capture in Ar(1+)(doublet P)+H2(X singlet Sigma(g)) collisions in the keV energy regime has been studied theoretically. The molecular-orbital expansion method was used within a semiclassical formalism and an electron translation factor correction was incorporated to the first order in the magnitude of the relative velocity V. The molecular wave function and eigenenergy were obtained using the diatoms-in-molecules (DIM) method.

706,095

PB88-151998 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Laser Probing of Gallium Atom Interactions with Silicon (100) Surfaces.
Final rept.,
K. L. Carleton, and S. R. Leone. 1987, 6p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Vacuum Science and Technology B 5, n4 p1141-1146 Jul/Aug 87.

Keywords: *Silicon, *Surfaces, *Desorption, Reprints, *Gallium atoms, Laser induced fluorescence.

The interactions of gallium atoms with silicon (100) surfaces are studied with laser probing. Laser-induced fluorescence is used to interrogate either the Ga doublet P(1/2) or doublet P(3/2) state following desorption from a 2x1 reconstructed Si(100) surface. From isothermal desorption measurements, the desorption energy of Ga on silicon is determined to be 277 plus or minus 7.5 kJ/mol (66 plus or minus 2 kcal/mol or 2.9 eV) with a frequency factor of 6 x 10 to the (14 + or - 1) power/s. Temperature programmed desorption heating rate studies give slightly larger values for the desorption energy and preexponential factor, but these results appear to be less reliable because of thermal lags in the temperature measurement. The strong gallium-silicon bond is consistent with the unity sticking coefficient observed here, and the fact that the scattering is dominated by a trapping desorption mechanism. The value of the preexponential factor is suggestive of a one-dimensional mobility of the Ga atoms on the 2x1 silicon (100) surface.

706,096
PB88-152004 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Observation of Three-Body Collisional Transfer between Atomic Levels.
Final rept.,
M. Harris, J. F. Kelly, and A. Gallagher. 1987, 3p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Physical Review A 36, n3 p1512-1514, 1 Aug 87.

Keywords: Atomic energy levels, Krypton, Xenon, Energy transfer, Reprints, *Strontium atoms, Atom-atom collisions.

Collisional J-mixing rates between the J=0,1,2 states of the Sr(5 triplet P(J)) multiplet have been measured in the presence of rare-gas perturbers. For Kr and Xe pressures above 100 Torr, the rates are dominated by a component which is quadratic in pressure. The authors believe the very unusual behavior is brought about by the simultaneous interaction of a Sr atom with two perturbers and not by excimer formation.

706,097
PB88-152079 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Estimation of the Amount of Nonadjacent Reentry in Polymer Crystallization. 2. Application to Once Folded N-Paraffins.
Final rept.,
E. Passaglia, and E. A. DiMarzio. 1987, 9p
Pub. in Jnl. of Chemical Physics 87, n8 p4908-4916, 15 Oct 87.

Keywords: *Polymers, *Crystallization, *Crystal defects, *Alkanes, Reprints, *Paraffins.

The methods described in the preceding paper have been used to calculate the composition of a strip of once folded molecules of n-c(sup 294)H(sup 590). The fraction of cilia and of stems participating in adjacent and nonadjacent reentry were calculated as a function of undercooling in regime I. Two cases corresponding to crystallization from the melt and one corresponding to dilute solution were considered. The results are strongly dependent on the relative rates of deposition of a stem from the liquid phase and the folding and reentry of the dangling half of an already attached molecule. The rate constants for adjacent and nonadjacent reentry were taken to be the same except that nonadjacent reentry leaves a hole in the strip. The undercooling below the melting point of the extended chain crystal at which the growing strip is in equilibrium with its environment is shown to be determined by all the imperfections in the strip, and particularly by the free energy of mixing. In all cases, the fractions of adjacent and nonadjacent reentry at this equilibrium undercooling are approximately equal and the fraction of cilia is a maximum. At higher undercoolings, the fraction of adjacent reentry rises, while the fractions of cilia and nonadjacent reentry fall, the exact behavior depending on the solution concentration and hence the relative rates of stem deposition from the liquid phase and of folding. The behavior is correlated with the free energy of mixing.

706,098
PB88-152111 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Ab initio Study of the Hydrogen Bonding Interactions of Formamide with Water and Methanol.
Final rept.,
P. G. Jasien, and W. J. Stevens. 1986, 7p
Pub. in Jnl. of Chemical Physics 84, n6 p3271-3277, 15 Mar 86.

Keywords: *Hydrogen bonds, Methanol, Water, Chemical reactions, Reprints, *Formamide.

Ab initio calculations of hydrogen bond energies for a number of water-formamide and methanol-formamide complexes are reported at both the SCF and correlated levels. Full gradient optimizations of these structures have been performed for basis sets of double zeta and double zeta plus polarization quality. For both water and methanol, the most stable 1:1 complex is found to be a cyclic double hydrogen bonded structure. Basis set effects on the calculated hydrogen bond energies were investigated as was the magnitude of the basis set superposition error.

706,099
PB88-152145 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Kinetics of One-Electron Transfer Reactions Involving ClO2 and NO2.
Final rept.,
R. E. Huie, and P. Neta. 1986, 6p
Pub. in Jnl. of Physical Chemistry 90, n6 p1193-1198, 13 Mar 86.

Keywords: *Electron transfer, Reaction kinetics, Nitrogen dioxide, Oxygen chlorides, Oxygen bromide, Electrode potentials, Reprints.

Rate constants for the one-electron oxidation of ClO2 and NO2 by several organic and inorganic free radicals have been measured along with rate constants for several reactions of ClO2, NO2, and BrO2. The kinetics of the reactions of ClO2 and NO2 are consistent with simple electron-transfer theory, except for the reaction of NO2 with SO3, which appears to be oxygen atom transfer. Equilibrium constants have been determined for the reactions of ClO2 with aniline at pH 6.9 and N,N-dimethylaniline at pH 9.6. This leads to one-electron redox potentials of 1.03 V and 0.86 V for these aromatic amines, respectively, at the corresponding pH.

706,100
PB88-152152 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Measurements of the Pressure Dependence of the HO2 Radical Self Disproportionation Reaction at 298K.
Final rept.,
M. J. Kurylo, P. A. Ouellette, and A. H. Laufer. 1986, 4p
Pub. in Jnl. of Physical Chemistry 90, n3 p437-440 1986.

Keywords: *Hydroperoxides, Water, Pressure, Photochemical reactions, Reaction kinetics, Constants, Measurement, Stratosphere, Reprints, *Atmospheric chemistry, Radicals, Absorption spectroscopy, Data bases, Rates.

Flash Photolysis kinetic absorption spectroscopy was used to investigate the gas disproportionation reaction of hydroperoxy radicals at 298K. Measurements of k/o (where k is the rate constant and o is the HO2 absorption cross section) were made as a function of N2 and O2 pressures between 25 and 600 Torr. The authors observations of the linear dependence of k on total pressure as well as the existence of a finite bimolecular (zero-pressure) reaction component are in good agreement with other recent investigations. Together with these earlier studies, the present work provides a detailed data base upon which to make rate constant recommendations for atmospheric modeling.

706,101
PB88-152160 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Multiphoton Ionization Detection of Gas Phase Benzyl Radicals.
Final rept.,
M. A. Hoffbauer, and J. W. Hudgens. 1985, 3p
Pub. in Jnl. of Physical Chemistry 89, n24 p5152-5154 1985.

Keywords: Photochemical reactions, Reaction kinetics, Ionized gases, Spectroscopy, Toluene, Reprints, *Benzyl radical.

Benzyl and benzyl-d (sub 7) radicals generated in a flow reactor were detected using mass-resolved, resonance enhanced multiphoton ionization spectroscopy. The strongest features of the spectra were observed between 500-510 nanometer. In both isotopic species, an electronic band origin was assigned at 502.5 nanometer.

706,102
PB88-152178 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
One-Electron Redox Reactions in Aqueous Solutions of Sulfite with Hydroquinone and Other Hydroxyphenols.
Final rept.,
R. E. Huie, and P. Neta. 1985, 4p
Pub. in Jnl. of Physical Chemistry 89, n18 p3918-3921 1985.

Keywords: *Sulfites, Oxidation, Reprints, *Electrode potentials, Aqueous solutions, Hydroxyphenols, Hydroxyquinone, Peroxysulfite, Radicals.

The one-electron oxidation of hydroquinone and other hydroxyphenols by the sulfite radical SO3(1-), and the peroxysulfite radical, SO5(1-), have been investigated along with the oxidation of sulfite by several phenoxyl radicals. Rate constants for the oxidation of hydroxyphenols by SO3(1-) are small in neutral solution but increase dramatically in basic solution, in correspondence to the deprotonation of the hydroxyphenol. SO5(1-) reacts with most hydroxyphenols at moderate rates (K=1 million to 5 million/M/s) in neutral solution. The phenoxyl radicals with higher redox potentials, from phenol, resorcinol, and phloroglucinol, were found to oxidize sulfite in neutral solutions.

706,103
PB88-152194 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Proton Affinity and Gas Phase Ion Chemistry of Methyl Isocyanate, Methyl Isothiocyanate and Methyl Thiocyanate.
Final rept.,
Z. Karpas, W. J. Stevens, T. J. Buckley, and R. Metz. 1985, 5p
Pub. in Jnl. of Physical Chemistry 89, n24 p5274-5278, 21 Nov 1985.

Keywords: *Cyanates, Ionized gases, Isocyanates, Protons, Reprints, *Methyl thiocyanates, *Methyl isothiocyanates, Affinity.

The gas-phase ion chemistry of CH3NCO, CH3NCS and CH3SCN was investigated by pulsed ICR techniques and their proton affinities were determined.

706,104
PB88-152202 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Pressure Dependence of the Rate Constant for the Reaction HO2 + NO2 + M + HO2NO2 + M (M=N2,O2) at 298K.
Final rept.,
M. J. Kurylo, and P. A. Ouellette. 1986, 4p
Pub. in Jnl. of Physical Chemistry 90, n3 p441-444 1986.

Keywords: *Nitrogen dioxide, *Water, *Photochemical reactions, *Reaction kinetics, *Pressure, Constants, Measurement, Reprints, *Atmospheric chemistry, Absorption spectroscopy, Rates.

The pressure dependence at 298K of the rate constant for the combination reaction between HO2 and NO2 was investigated by flash photolysis kinetic ab-

sorption spectroscopy. Measurements were made at N2 and O2 pressures ranging from 25-600 Torr and the data were fit to an expression suitable for describing the pressure dependence of reactions in the fall-off region. Potential sources of error in these measurements are discussed. The present results are compared to earlier measurements of the reaction system and their importance with respect to atmospheric chemistry is detailed.

706,105
PB88-152236 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
IrO2 RF Sputtered Thin Film Properties.
Final rept.,
K. G. Kreider. 1986, 2p
Pub. in Jnl. of Vacuum Science and Technology A-4, n3 p606-607 May/Jun 86.

Keywords: pH, Thin films, Sputtering, Radio frequencies, Crystal structure, Microstructure, Aluminum oxide, Substrates, Reprints, *Iridium oxides, Electrical conductivity, Sensors.

Iridium oxide is being considered as a pH sensing material that would enable the fabrication of pH sensors which would be considerably smaller than the glass electrode type and would have higher temperature capabilities. The electrochemical behavior of sputtered IrO2 appears to contrast with that of IrO2 produced by anodization. The study has been used to investigate the effect of varying the fabrication conditions on the films structure and electrical properties. Radio frequency planar magnetron sputter deposited thin films of IrO2 were fabricated and evaluated. The Al2O3 substrate temperature, sputtering composition and pressure, power levels, and deposition rates were systematically varied to affect the physical, chemical, mechanical, and electrical properties of the films. X-ray diffraction was used to determine the Ir/IrO2 ratio, the crystallinity and grain size of the films. Electrical conductivity measurements are correlated to processing variables and physical properties. The one micrometer films are also characterized using scanning electron microscopy and for their adherence to the Al2O3 substrates.

706,106
PB88-152467 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Neutron Scattering Study of NH4(1+) Dynamics during the Deammoniation of NH4 - rho Zeolite.
Final rept.,
T. Udovic, R. Cavanagh, J. J. Rush, M. Wax, G. Stucky, G. A. Jones, and D. R. Corbin. 1987, 6p
Pub. in Jnl. of Physical Chemistry 91, n23 p5968-5973 1987.

Keywords: *Ion exchange resins, *Neutron scattering, Reprints, *Zeolites, *Elastic scattering, Deammoniation, Ammonia cation.

Inelastic and quasi-elastic neutron scattering measurements of ammonium-rho zeolite have been used to characterize the NH4(1+) cation dynamics during deep-bed deammoniation over the temperature range 473-723 K. As the deammoniation temperature is increased, the assigned vibrational features of the bound NH4(1+) at 180 meV (bending modes), 38-45 meV (ammonium-coupled pore-opening modes of the zeolite framework), and 10-14 meV (hindered rotational modes) are found to diminish, concomitant with the emergence of scattering features due to H-rho. Reorientational dynamics of NH4(1+) in rho are evident in the quasi-elastic scattering data. The dependence of the elastic incoherent structure factor on momentum transfer suggests 120 degrees reorientations as the dominant NH4(1+) rotational mechanism. The temperature dependence of the quasi-elastic broadening indicates a very low (35 + or - 5 meV) reorientation barrier.

706,107
PB88-152483 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Effect of Capillary Waves on Surface Tension.
Final rept.,
R. F. Kayser. 1986, 9p
Pub. in Physical Review A 33, n3 p1948-1956 Mar 86.

Keywords: *Interfacial tension, Hamiltonian functions, Critical point, Reprints, *Surface tension, *Capillary waves.

The capillary-wave interface Hamiltonian is generalized to include a wavevector-dependent surface tension, sigma(k). The model preserves the long-wavelength consequences of the theory, but leads in addition to several provocative new predictions. In particular, a self-consistent calculation of sigma(k) implies large positive departures of sigma (k) from the experimentally-measured surface tension, sigma(o), even for wavevectors with corresponding wavelengths that are large compared to the intrinsic interface width, w. It also follows that sigma(o) and the bare surface tension cannot scale in quite the same way near a critical point, where the bare surface tension is that of a hypothetical interface constrained to be flat on horizontal length scales somewhat larger than w. The implications of these and other predictions are discussed in light of recent experimental and theoretical developments.

706,108
PB88-152566 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Electronic Structure of FeO and RuO.
Final rept.,
M. Krauss, and W. J. Stevens. 1985, 13p
Pub. in Jnl. of Chemical Physics 82, n12 p5584-5596, 15 Jun 85.

Keywords: *Iron oxides, Spin orbit interactions, Reprints, *Ruthenium oxides, *Electronic structure, Excited states.

The electronic structure of FeO and RuO is examined using multiconfiguration self-consistent-field (MC-SCF) wave functions that go asymptotically to minimally correlated fragment atoms. The natural orbitals are determined and evaluated in detail. The characteristics of these orbitals are used to hypothesize an aufbau for the ground states of most of the first and second row transition metal oxides.

706,109
PB88-152590 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Rotational Spectrum and Structure of H2CO-HCl.
Final rept.,
G. T. Fraser, C. W. Gillies, J. Zozom, F. J. Lovas, and R. D. Suenram. 1987, 10p
Pub. in Jnl. of Molecular Spectroscopy 126, p200-209 1987.

Keywords: *Rotational spectra, *Microwave spectroscopy, Hydrogen chloride, Formaldehyde, Van der Waals equation, Reprints, *Hydrogen bonds.

Rotational spectra of H2CO-H(35)Cl, H2CO-H(37)Cl, D2CO-H(35)Cl, and D2CO-H(37)Cl have been observed using a pulsed-nozzle Fourier transform microwave spectrometer. For H2CO-H(35)Cl the spectroscopic constants have been determined.

706,110
PB88-152608 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Rotational Predissociation and Libration in the Infrared Spectrum of Ar-HCl.
Final rept.,
B. J. Howard, and A. S. Pine. 1985, 8p
Pub. in Chemical Physics Letters 122, n1-2 p1-8, 29 Nov 85.

Keywords: *Argon, *Hydrogen chloride, *Molecular spectroscopy, Van der Waals equation, Lasers, Reprints.

Fully-resolved rotational structure in the high-frequency vibrational region of the Ar-HC1 van der Waals complex has been recorded under thermal equilibrium conditions at T=127 K with a tunable difference-frequency laser. Both the fundamental H-C1 stretch and its combination with the low-frequency large-amplitude band (libration) have been observed with comparable intensities. An abrupt cutoff of the spectrum at high J due to rotational predissociation yields a measure of the binding energy of the complex. The band center shifts and rotational and distortion constants provide much information about the interaction potential surface and its vibrational dependence and about perturbations from other low-frequency modes not directly observed.

706,111
PB88-152616 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Role of Tunneling Models in Analyzing High-Resolution Spectra of Weakly Bound Molecular Complexes.
Final rept.,
J. T. Hougen. 1987, 9p
Pub. in Structure and Dynamics of Weakly Bound Molecular Complexes, p191-199 1987.

Keywords: *Molecular spectra, *Molecular structure, Chemical bonds, Reaction kinetics, Chemical analysis, Reprints, Amplitudes, Vibrational states, High resolution.

As the number of large amplitude motions in a weakly bound molecular complex increases, the size of the vibration-rotation basis set necessary for carrying out accurate calculations with model potentials (and consequently the difficulty of the calculation) increases also. In the paper the authors shall discuss one alternative to such full-scale calculations, which can be used for assigning spectra in the broad class of problems where the large amplitude motions can be described as 'tunneling' motions. The strong and weak points of the method, which uses group theory to derive phenomenological vibration-rotation-tunneling Hamiltonians, will be described together with some successful applications and some possibilities for future work.

706,112
PB88-152624 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Time-Resolved Vibrational Energy Relaxation of Surface Adsorbates.
Final rept.,
E. J. Heilweil, M. P. Casassa, R. R. Cavanagh, and J. C. Stephenson. 1985, 3p
See also PB85-230696.
Pub. in Jnl. of Vacuum Science and Technology B 3, n5 p1471-1473 1985.

Keywords: *Surface chemistry, *Adscrbates, *Silica gel, Colloids, Molecular relaxation, Reprints.

Time resolved measurements of picosecond vibrational population decay of chemisorbed species (OH, OD, BOH, NH2, and OCH3) on high surface area colloidal silica at room temperature have been performed. The influence of solvents on OH relaxation and the variation in observed relaxation rates are discussed in terms of the vibrational level structure and surface coordination of each adsorbate.

706,113
PB88-152632 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Vibrational Energy Decay of Surface Adsorbates.
Final rept.,
E. J. Heilweil, M. P. Casassa, R. R. Cavanagh, and J. C. Stephenson. 1985, 5p
Pub. in Springer Proceedings Phys.-Time-Resolved Vib. Spectrosc. 4, p71-75 1985.

Keywords: *Silicon dioxide, *Surface chemistry, *Adsorption, Excitation, *Adsorbents, Silicon atoms, Vibrational states, Chemisorption, Picosecond pulses, Temperature dependence.

Picosecond infrared transient bleaching experiments have been performed to measure the population lifetime (T1) of vibrationally excited (V=1) functional groups chemisorbed on high surface area colloidal silica (SiO2). The experimental method and results for vibrational modes of -OH, -OD, -NH2 and -OCH3 coordinated to surface silicon atoms and for the -BOH surface species are presented. Lifetimes for these groups at both the vacuum and liquid interfaces indicate that the adsorbate degrees of freedom, chemical coordination and nearby substrate modes play an important role in damping the vibrational energy. Additional measurements of the T1 temperature dependence for OH(v=1) in bulk silica and of relaxation times for model OH-containing molecules in dilute solution are also reviewed.

706,114
PB88-152822 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Chemical Physics.

Proton Affinity of H2Se, SeCO and H2CSe and Reactions of Positive Ions with H2Se.
Final rept.,
Z. Karpas. 1985, 5p
Pub. in Chemical Physics Letters 120, n1 p53-57, 27 Sep 85.

Keywords: *Selenium inorganic compounds, Condensation reactions, Ions, Protons, Reprints.

The proton affinities of H2Se, SeCO and H2CSe were determined by bracketing ICR techniques, and found to be 171.3, 152 plus or minus 1.5 and 186 plus or minus 1 kcal/mol, respectively. These values are slightly higher than those of the analogous sulfur compounds.

706,115
PB88-152962 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
One-Electron Redox Potentials of Purines and Pyrimidines.
Final rept.,
S. V. Jovanovic, and M. G. Simic. 1986, 5p
Pub. in Jnl. of Physical Chemistry 90, n5 p974-978 1986.

Keywords: *Purines, *Pyrimidines, Electrode potentials, Deoxyribonucleic acids, pH, Reprints, Electron transfer, DNA.

One-electron redox potentials of some purine and pyrimidine derivatives were determined by pulse-radiolysis from electron transfer equilibria involving their and other free radicals. The redox potentials were determined at pH 13 using p-methoxyphenol, trolox C and tryptophan, as references. The lowest oxidation potential measured for DNA bases was for guanosine, and the highest for 1-methylpyrimidines. Uric acid and isobarbituric acid were found to have the lowest potentials.

706,116
PB88-152996 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Mutual Diffusion Constant of Binary, Isotopic Hard-Sphere Mixtures: Molecular Dynamics Calculations Using the Green-Kubo and Steady-State Methods.
Final rept.,
J. M. Kincaid, and J. J. Erpenbeck. 1986, 14p
Pub. in Jnl. of Chemical Physics 84, n6 p3418-3431, 15 Mar 86.

Keywords: *Fluid mechanics, *Equilibrium flow, *Mixtures, Velocity, Molecular flow, Steady state, Computation, Reprints, Binary mixtures, Diffusion coefficient.

The mutual diffusion constant of a binary mixture of equal diameter hard spheres is estimated using the method of molecular dynamics. The mixture considered is equimolar, with a species mass ratio of ten to one in a volume that is three times the close-packed volume. Two molecular dynamics methods are used: the standard Green-Kubo technique based on the evaluation of equilibrium velocity correlation functions, and a nonequilibrium method that generates a steady diffusive flow along a composition gradient by imposing special boundary conditions on two opposing faces of the cubic volume. The authors find that both methods yield, within an estimated error of about three percent, the same value of the diffusion coefficient.

706,117
PB88-153002 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Phase Equilibrium in Nearly Monodisperse Fluids.
Final rept.,
J. M. Kincaid, G. Morrison, and E. Lindeberg. 1983, 4p
Pub. in Physics Letters A 96A, n9 p471-474, 1 Aug 83.

Keywords: *Fluids, Critical point, Mixtures, Reprints, Phase equilibrium.

The two-phase equilibrium and critical point conditions of a polydisperse fluid (a mixture with a continuous distribution of components) are solved by making power-series expansions about the properties of a single representative species.

706,118
PB88-153929 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Chemically Modified Electrode Sensors.
Final rept.,
R. A. Durst. 1985, 14p
See also PB86-230513.
Pub. in Analytical Chemistry Symposium Ser. Ion-Sel. Electrodes 22, p115-128 1985.

Keywords: *Electrodes, Fabrication, Chemical analysis, Bioinstrumentation, Electrochemical cells, Reprints.

Electroanalytical sensors based on amperometric measurements at chemically modified electrodes are in the early stages of development. The modes of modification can take many forms, but the most common approach at the present time is the immobilization of electrocatalyts in polymer films which are applied to bare metal and carbon electrodes. The review gives a brief summary of the types of chemically modified electrodes, their fabrication, and some examples of their uses. The incorporation of biochemical systems should greatly extend the usefulness of these devices for analytical purposes.

706,119
PB88-153945 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Tunable Far Infrared Laser Spectroscopy.
Final rept.,
K. M. Evenson, D. A. Jennings, K. R. Leopold, and L. R. Zink. 1985, 5p
See also PB84-223825.
Pub. in Proceedings of the Laser Spectroscopy Conference (7th), Hawaii, June 24-28, 1985, p366-370.

Keywords: *Infrared spectroscopy, *Far infrared radiation, *Laser spectroscopy, *MIM diodes, Tunable lasers.

The authors describe the generation of far infrared (FIR) radiation with the metal-insulator-metal (MIM) diode and the operation of a spectrometer employing this diode. The technique is an extension of the use of the MIM diode from its use in the measurement of frequencies to the generation of far infrared radiation between 0.3 and 6.0 THz. The MIM diode has previously been used in frequency measurements yielding a definitive value for the speed of light and in the measurement of the frequency of visible radiation.

706,120
PB88-154018 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Electron Transfer Reactions of Tryptophan and Tyrosine Derivatives.
Final rept.,
S. V. Jovanovic, A. Harriman, and M. G. Simic. 1986, 5p
Pub. in Jnl. of Physical Chemistry 90, n9 p1935-1939 1986.

Keywords: *Tryptophan, *Tyrosine, Oxidation, Electrode potentials, Electron transfer, Reprints.

Oxidation of tryptophan and tyrosine, and their derivatives by oxidizing radicals was studied by pulse radiolysis in aqueous solutions at 20 degrees C. Results are presented.

706,121
PB88-156435 Not available NTIS
American Chemical Society, Washington, DC.
Journal of Physical and Chemical Reference Data, Volume 16, Number 4, 1987.
Quarterly rept.
c1987, 491p
See also PB88-156443 through PB88-156500 and PB88-112685. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Physical properties, *Chemical properties, Measurement techniques, Reviews, Data, Evaluation, Accuracy, Reprints.

Contents: Thermophysical properties of fluids. II. Mehane, ethane, propane, isobutane, and normal butane; Methanol thermodynamic properties from 176 to 673 K at pressures to 700 bar; Internal equations for the saturation properties of ordinary water substance; Rate data for inelastic collision processes in the diatomic halogen molecules. 1986 supplement; Critical survey of data on the spectroscopy and kinetics of ozone in the mesosphere and thermosphere; Critical compilation of surface structures determined by low-energy electron diffraction crystallography; Viscosity and thermal conductivity of nitrogen for a wide range of fluid states.

706,122
PB88-156443 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Thermophysical Properties of Fluids. 2. Methane, Ethane, Propane, Isobutane, and Normal Butane,
B. A. Younglove, and J. F. Ely. c1987, 222p
Included in Jnl. of Physical and Chemical Reference Data, v16 n4 p577-798 1987. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Density, *Thermophysical properties, Ethane, Isobutane, Methane, Normal butane, Propane, Transport properties, *Equation of state.

Tables of methane, ethane, propane, isobutane, and normal butane thermodynamic and transport properties are presented. The mathematical relations from which these thermophysical properties are obtained are discussed. The tables list pressure, density, temperature, internal energy, enthalpy, entropy, specific heat at constant pressure and at constant volume, sound speed, viscosity, thermal conductivity, and dielectric constant.

706,123
PB88-156450 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Methanol Thermodynamic Properties from 176 to 673 K at Pressures to 700 Bar,
R. D. Goodwin. c1987, 94p
Included in Jnl. of Physical and Chemical Reference Data, v16 n4 p799-892 1987. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Densities, *Thermodynamic properties, Enthalpies, Entropies, *Compressibility factors, Equation of state, Fugacities, Heats of vaporization.

Available data for vapor pressures and for the orthobaric densities of methanol are examined and formulated. Then PpT data are correlated by an equation of state (EOS) which is constrained to the given coexistence boundary. Via ideal gas state specific heats, the thermodynamic properties of methanol then are obtained by numerical integrations of the EOS, and are tabulated along isobars. A comparison is made with some recent calorimetric enthalpy differences data over a wide range of the EOS surface.

706,124
PB88-156468 Not available NTIS
Ruhr Univ., Bochum (Germany, F.R.). Inst. fuer Thermo- und Fluiddynamik.
International Equations for the Saturation Properties of Ordinary Water Substance,
A. Saul, and W. Wagner. c1987, 7p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n4 p893-901 1987. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Enthalpy, *Entropy, Water, IAPS, Orthobaric densities, Saturation line, Vapor pressure.

Consistent with the latest experimental data and the recent internationally recommended values for the critical parameters, the authors have developed compact and accurate representative equations for the following properties on the saturation line of ordinary (light) water substance: vapor pressure, density, enthalpy and entropy of both the saturated liquid and the saturated vapor. These equations form the basis of a 'Supplementary Release on Saturation Properties of Ordinary Water Substance' issued by the International Association for the Properties of Steam (IAPS).

706,125
PB88-156476 Not available NTIS
Joint Inst. for Lab. Astrophysics, Boulder, CO.

Rate Data for Inelastic Collision Processes in the Diatomic Halogen Molecules. 1986 Supplement,
J. I. Steinfeld. c1987, 8p
Included in Jnl. of Physical and Chemical Reference Data, v16 n4 p903-910 1987. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Halogens, *Energy transfer, Inelastic collisions, Quenching, Radiative lifetimes, Rotational relaxation.

The previously published compilation of rate data for inelastic collision processes involving the homonuclear and heteronuclear diatomic halogen molecules (J. Phys. Chem. Ref. Data 13, 445 (1984)) has been updated through June, 1986. Additional data on collision processes involving the interhalogens, and on processes at very low kinetic temperatures, are presented; in addition, several previously accepted rate data have been corrected.

706,126
PB88-156484 Not available NTIS
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Critical Survey of Data on the Spectroscopy and Kinetics of Ozone in the Mesosphere and Thermosphere,
J. I. Steinfeld, S. M. Adler-Golden, and J. W. Gallagher. c1987, 38p
Prepared in cooperation with Spectral Sciences, Inc, Burlington, MA., and Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
Included in Jnl. of Physical and Chemical Reference Data, v16 n4 p911-951 1987. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: Data, Kinetics, Ozone, Reaction rate coefficients, Spectroscopy, *Cross sections, *Electron collisions, Upper atmosphere.

Spectroscopic data and reaction rate coefficients pertinent to ozone in the mesosphere and thermosphere (altitude $>$ 50 km) are critically surveyed. These data should be of use in modeling atmospheric infrared luminescence, measuring atmospheric ozone concentrations by remote sensing, and designing and interpreting laboratory measurements. There is a clear need for additional data on metastable ozone electronic states, additional atmospheric ozone formation channels, collision processes involving electrons and ions, and vibrational state dependence of reaction rate coefficients.

706,127
PB88-156492 Not available NTIS
Oregon State Univ., Corvallis. Dept. of Chemistry.
Critical Compilation of Surface Structures Determined by Low-Energy Electron Diffraction Crystallography,
P. R. Watson. c1987, 38p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n4 p953-992 1987. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: Critically reviewed data, LEED, *Low energy electron diffraction, Reliability factor, *Surface crystallography, Surface structure.

The review critically compiles all surface structures derived from low-energy electron diffraction (LEED) crystallography reported in the refereed literature prior to January 1986. Over 250 investigations have been analyzed covering all types of surfaces including clean and adsorbate-covered metal, semiconductor and other nonmetallic substrates. Particular attention is paid to developing and applying objective criteria that allow an estimation of the reliability of a particular structural determination. The important experimental and theoretical aspects of such investigations have been extracted into easily understood tabular form supplemented by many figures and ancillary tables and complete references. It is hoped that this compilation will provide a valuable resource both for the surface science specialist and for those nonspecialists in other areas who need surface crystallographic data.

706,128
PB88-156500 Not available NTIS
Stuttgart Univ. (Germany, F.R.). Inst. fuer Technische Thermodynamik und Thermische Verfahrenstechnik.
Viscosity and Thermal Conductivity of Nitrogen for a Wide Range of Fluid States,
K. Stephan, R. Krauss, and A. Laesecke. c1987, 19p
Prepared in cooperation with Gesamthochschule Siegen (Germany, F.R.). Inst. fuer Fluid- und Thermodynamik. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v16 n4 p993-1023 1987. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: Evaluation, Nitrogen, *Thermal conductivity, *Correlation, *Dilute gas function, Excess function, Fluid state, Recommended values.

The viscosity and the thermal conductivity of fluid nitrogen were critically evaluated and correlated on the basis of a comprehensive literature survey. Recommended values were generated in a temperature range from 70 to 1100 K and pressures up to 100 MPa using the residual concept. To retain consistence with the IUPAC Thermodynamic Tables, the same thermodynamic key data were used. Additionally, a so-called transport equation of state was established that makes it possible to achieve a unified representation of the viscosity and thermal conductivity in terms of pressure and temperature.

706,129
PB88-162508 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
International Conference on Chemical Kinetics.
Final rept.,
J. T. Herron, W. Tsang, S. E. Stein, and D. M. Golden. 1986, 2p
See also AD-A182 285. Sponsored by SRI International, Menlo Park, CA. Chemical Kinetics Dept.
Pub. in Jnl. of Physical Chemistry 90, n3 p343-344 1986.

Keywords: *Reaction kinetics, *Chemical reactions, Meetings, Abstracts, Reprints.

This is a report on the International Conference on Chemical Kinetics, held at the National Bureau of Standards, June 17-19, 1985. The purpose and organization of the conference are described, and a list of invited speakers and their topics provided. Some general observations are made on the status of chemical kinetics.

Polymer Chemistry

706,130
PATENT-4 006 023 Not available NTIS
Department of Health, Education, and Welfare, Washington, DC.
Photographic Polymeric Composition Containing a Leuco Dye Cyanide.
Patent.
W. L. McLaughlin, H. Levine, and M. Rosenstein.
Filed 7 Oct 74, patented 1 Feb 77, 9p PB-267 253/3, PAT-APPL-512 621
Supersedes PB-238 435.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, D.C. 20231 $0.50.

Keywords: *Patents, *Vinyl resins, *Acrylic resins, *Cyanides, Polymers, Dyes, Radiation tolerance, Ultraviolet radiation, Ionizing radiation, Sensitivity, Thin films, Dosimeters, Detectors, Polymeric films, PAT-CL-96-90, Monomers.

A hard, clear, glassy, smooth polymer with a dry surface having a dye precursor therein which forms a permanent color at those areas of the solid polymer that have been irradiated with ultra-violet or ionizing radiation is formed by combining vinyl and/or acrylic monomers, a triphenylmethane cyanide dye precursor and a chemical initiator that is compatible with the dye cyanide and polymerizing in the presence of a slight excess of hydrogen ions in an inert atmosphere.

706,131
PATENT-4 536 523 Not available NTIS
Department of Health and Human Services, Washington, DC.
Dental Composite Formulation from Acrylate Monomer and Polythiol Accelerator.
Patent.
J. M. Antonucci. Filed 23 Dec 83, patented 20 Aug 85, 6p PB86-218989, PAT-APPL-6-565 212
Supersedes PB84-159946.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Patents, *Dental materials, *Acrylate copolymers, *Synthesis(Chemistry), *Polymerization, Storage, Stability, Discoloration, Monomers.

A two paste dental composite formulation is disclosed, wherein one paste comprises a polymerizable monomer and a stable organic hydroperoxide initiator, and the other paste comprises a polymerizable monomer and a polythiol accelerator, the hydroperoxide having a ten-hour half-life temperature in excess of about 100 degrees C., and the polythiol being capable of accelerating the decomposition of the hydroperoxide into polymerization initiating free radicals at ambient temperatures.

706,132
PB-263 263/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Spans of Polymer Chains.
Final rept.,
R. J. Rubin, J. Mazur, and G. H. Weiss. 1976, 6p
Pub. in Pure Appl. Chem., v46 p143-148 1976.

Keywords: *Polymers, *Molecular structure, Surfaces, Mathematical models, Random walk, Statistical tests, Reprints.

The span of an N-segment chain in a given direction, e, is defined as the maximum distance between parallel planes normal to e which contain segments of the chain. The authors present a simple derivation of Daniel's result for the span of a random chain. They have generalized this simple derivation and have calculated: (1) (X(ring)), the average span of an N-segment random polymer ring; (2) (X(surf)) the average span in the direction normal to the solution surface of an N-segment chain which is attached at one end to the surface; (3) In addition, they have obtained the exact solution of a problem treated by Hollingsworth, the calculation of (R(Holl)), the average distance between the first segment and the most distant segment in an N-segment polymer chain. The spans of each chain configuration in the directions defined by the principal components of the square radius of gyration of the chain have been determined. The relative values of the average squares of the spans in the directions of the largest, intermediate, and smallest components of the square radius of gyration are found to be 6.7:2.2:1 in the case of the unrestricted polymer chain model. For the same model, Solc and Stockmayer obtained the following set of relative values of the ordered principal components of the square radius of gyration. 11.7:2.7:1. They have determined that the apparent difference between these two sets of relative average dimensions arises from a different segment density distribution in the different principal directions.

706,133
PB-263 529/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mark-Houwink Equation and Chain Dimensions of Linear Polyethylene in Theta Solvents.
Final rept.,
H. L. Wagner, and C. A. J. Hoeve. 1976, 13p
Pub. in Jnl. of Polymer Science, Pt C Polymer Symposia n54 p327-339 1976.

Keywords: *Polyethylene, Chemical analysis, Polymers, Molecular structure, Standards, Organic solvents, Chromatography, Reprints, *Standard reference materials, Gel chromatography, Mark-Houwink equation.

In order to ascertain whether the fractions used to determine the molecular weight distribution of the NBS standard polyethylene sample SRM 1475 by gel-permeation chromatography are linear, the exponent alpha in the Mark-Houwink equation was determined in three theta solvents: biphenyl, dodecanol, and 3,3,5-trimethylhexylacetate. The data indicates that alpha might exceed the theoretical value of 0.5. This is attributed to the fractions below molecular weight 20,000, which approach free-draining coils in their behavior. When an exponent of 0.5 is assumed and fractions

below 20,000 are omitted, the characteristic size ratio (r squared (0)/nl l squared) is found to be 7.21 at 140C. The average value at 140C derived from available data is 6.79, in excellent agreement with the theoretical value of 6.89. The authors concluded that standard sample SRM 1475 is linear polyethylene.

706,134
PB-265 228/7 PC **A06**/MF **A01**
Purdue Univ., Lafayette, Ind. Center for Information and Numerical Data Analysis and Synthesis.
Thermophysical Properties of Polystyrene and Poly (Vinyl Chloride).
Final rept.,
C. Y. Ho, P. D. Desai, K. Y. Wu, T. N. Havill, and T. Y. Lee. Mar 77, 111p CINDAS-38, NBS-GCR-77-83 Contract C-510374

Keywords: *Thermophysical properties, *Polyvinyl chloride, *Polystyrene, Thermoplastic resins, Specific heat, Density(Mass/volume), Thermal conductivity, Thermal diffusivity, Chemical analysis, Synthesis(Chemistry), Experimental design, Data analysis, Tables(Data).

This technical report presents the most comprehensively compiled experimental data and the critically evaluated and recommended reference values for the thermal conductivity, specific heat, density, and thermal diffusivity of polystyrene and poly(vinyl chloride). The compiled data include all the experimental data available from the literature. The recommended values generated from critical evaluation, analysis, and synthesis of the available data and information are for solid (unexpanded) polystyrene with a density of 1.050 g/cc, for foamed polystyrene expanded with air with densities of 0.060 and 0.010 g/cc, for solid poly(vinyl chloride) with a density of 1.400 g/cc, and for foamed poly(vinyl chloride) expanded with air with densities of 0.060 and 0.020 g/cc. The temperature range covered by the compiled data on some of the properties is from cryogenic temperatures to above the melting point of the material. The recommended values for polystyrene cover the temperature range from 100 to 600 K and those for poly(vinyl chloride) cover the range from 100 to 400 K.

706,135
PB-266 864/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rate of Crystallization of Linear Polymers with Chain Folding.
J. D. Hoffman, G. T. Davis, and J. I. Lauritzen. 1976, 128p
Pub. in Treatise on Solid State Chemistry, ch7 n3 p497-614 1976.

Keywords: *Crystallization, *Polymers, Growth rate, Reprints.

The article is an in-depth review of crystallization of polymers with chain-folding, written specifically as a chapter in a book.

706,136
PB-270 339/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effects of Pressure on the Equilibrium Properties of Glass-Forming Polymers.
Final rept.,
E. A. DiMarzio, J. H. Gibbs, P. D. Fleming, and I. C. Sanchez. 1976, 9p
Pub. in Macromolecules, v9 p763-771 Sep-Oct 76.

Keywords: *Polymers, *Chemical equilibrium, *Glass transition temperature, Entropy, Pressure, Glasses, Reprints.

The entropy theory (Gibbs-DiMarzio theory) of the glass transition is extended to incorporate the effects of pressure. The second order transition temperature T(2) increases with increasing pressure but approaches a finite asymptote at very high pressure (>10 kbars). This conclusion is unlike that of an isofree volume theory, according to which the transition temperature should increase without bound. The point is that the apparent order parameters are not independent. A useful classification of order parameters is presented. The theory also predicts that the volume decreases along the transition line as pressure increases, in contradistinction to an isofree volume theory. This volume decrease is in accord with known experimental data and can also be used to explain the densification of glasses. Finally, it is suggested how the relevant kinetic parameters associated with this theory can be determined experimentally.

706,137
PB-270 345/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Morphology of Crystalline Synthetic Polymers.
Final rept.,
F. Khoury, and E. Passaglia. 1976, 6p
Pub. in Chapter 6 in Treatise on Solid State Chemistry, n3 p335-340 1976.

Keywords: *Crystals, *Polymers, Molecular structure, Crystallization, Solutions, High pressure.

An overview of the morphology of crystalline polymers is given. The topics covered are: the requisites on polymer chains for crystallization; the morphology of polymers crystallized from solution; and the morphology of polymers crystallized from the melt at ordinary and at high pressures.

706,138
PB-277 324/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Adhesive Bonding of Various Materials to Hard Tooth Tissues: XIII. Synthesis of a Polyfunctional Surface-Active Amine Accelerator.
Final rept.,
J. M. Antonucci, and R. L. Bowen. 1977, 6p
Grants PHS-DE-40015, PHS-DE-02494-09
Sponsored in part by American Dental Association, Chicago, Ill.
Pub. in Jnl. of Dental Research 56, n8 p937-942 Aug 77.

Keywords: *Synthesis(Chemistry), *Amines, *Surfactants, *Dental materials, Polymerization, Adhesives, Catalysts, Epoxy resins, Reprints, Toluidine/N-methyl-(sodium-salt), Glycine/N-phenyl-(sodium-salt).

Surface-active amine polymerization accelerators can be prepared by the reaction of polyepoxy resins with the sodium salt of N-phenylglycine and N-methyl-p-toluidine. These materials are expected to promote adhesion through complexation with surface calcium (or other metal ions), using several chelating groups per molecule, and by functioning as polymerization accelerators for dental resins; they can also function as catalysts for the anionic polymerization of cyanoacrylate monomers.

706,139
PB-280 444/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pyroelectricity in a Vinylidenefluoride-Tetrafluoroethylene Copolymer (Extended Abstract).
Final rept.,
G. T. Davis, and M. G. Broadhurst. 1978, 3p
Sponsored in part by Office of Naval Research, Arlington, Va.
Pub. in Proceedings of Meeting of the Electrochemical Society (148th), Dallas, TX, Oct 5-10, 1975, 75-2, p297-299 1978.

Keywords: *Pyroelectricity, *Piezoelectricity, *Polymeric films, Copolymers, Crystal structure, *Vinylidene fluoride resins, *Ethylene/tetrafluoro, Reprints.

The pyroelectric (p) and piezoelectric (d(P)) coefficients of poled films of a vinylidenefluoride-tetrafluoroethylene copolymer have been investigated. Using a model of aligned dipoles within the crystalline regions of the polymer, it is shown that pyroelectricity can arise from a change in polarization due to thermal volume change as well as a change in amplitude of thermal oscillations of the dipole about a fixed mean orientation. The maximum experimental values of the coefficients obtained so far ($p = 2.7$ nC/sq cm K and $d(P) = 12.1$ pC/N) can be accounted for by this model.

706,140
PB-280 450/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Initial Weight-Loss Kinetics for the Thermal Degradation of Polyurethanes.
Final rept.,
J. H. Flynn, W. J. Pummer, and L. E. Smith. Mar 77, 4p
Pub. in Proceedings of American Chemical Society New Orleans Meeting, La. 20-25 Mar 77. Paper in Polym. Prep4. 18, n1 p757-760 Mar 77.

Keywords: *Reaction kinetics, *Aging tests(Materials), *Polyurethane resins, Decomposition reactions, Degradation, Polymers, Weight(Mass), Activation energy, Reprints.

Rates of degradation obtained from the initial stages of decomposition of a polymer are the most useful in relating the observed kinetics to a mechanistic scheme as well as in predicting a useful service lifetime for the material. Unfortunately, the determination of such initial rates is complicated by a number of experimental factors. Using techniques to minimize these factors, initial rates of weight-loss for an MDI and TDI polyether urethane have been determined by a differential method at a constant heating rate of two degrees per minute in nitrogen and vacuum. The activation energy determined under these conditions was - 38 kcal/mole in the 0.5% to 4.0% weight-loss range for both cases. There was no evidence for an early acceleration of the rate.

706,141
PB-280 465/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Piezoelectricity and Pyroelectricity in Polar Polymers.
Final rept.,
G. T. Davis, and M. G. Broadhurst. 1977, 21p
Sponsored inpart by Office of Naval Research, Arlington, Va.
Pub. in Proceedings of Intl. Symp. on Electrets and Dielectrics, Sao Carlos, Brazil, Sep. 1-6, 1975, p299-319 1977.

Keywords: *Piezoelectricity, *Pyroelectricity, *Polymers, *Polyvinyl chloride, *Electrets, Crystal structure, Polarization(Spin alignment), Copolymers, Reprints, *Vinylidene fluoride resins, *Ethylene/tetrafluoro.

The piezoelectric and pyroelectric response in polymer electrets is explained using a model of frozen-in molecular dipoles aligned during the poling procedure. The piezoelectric coefficient d sub p for a change in hydrostatic pressure has been given. The pyroelectric coefficient p has also been given. These expressions are compared with experimental results for a glassy polymer, polyvinylchloride, in which P is a linear function of the polarizing electric field and found to account well for the data. The above expressions are also compared with data obtained for poled samples of a copolymer of vinylidene fluoride containing 27 percent tetrafluoroethylene in which P is not a linear function of the field. When it is assumed that the oriented dipoles lie within the crystalline regions of the polymer, the results obtained so far can be accounted for by invoking less than the predicted maximum polarization.

706,142
PB-280 540/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Monte Carlo Studies of the Motion of Random-Coil Polymer Chains: Studies of Model Dependence.
Final rept.,
P. H. Verdier, and D. E. Kranbuehl. 1976, 3p
Pub. in Polym. Prepr. 17, p148-140 1976.

Keywords: *Monte Carlo method, *Polymers, *Mathematical models, Relaxation time, Reprints, *Molecular configuration.

Dynamical Monte Carlo studies of the motion of lattice-model polymer chains have been carried out for move rules which include a crankshaft-like local motion of two adjacent beads. Simulations have been carried out for chains of 15 and 63 beads, with and without excluded volume interactions. The results obtained with the crankshaft rules are essentially identical with previously reported work employing single-bead chain movement rules. In particular, the additional chain-length dependence of the relaxation time of end-to-end length which appears in the earlier work when excluded volume is introduced also appears with the crankshaft model. The similarity of the results obtained with both sets of bead movement rules, although not demonstrating the correctiveness of either model, supports the view that the excluded volume result is not an artifact of the bead movement rules and the lattice geometry.

706,143
PB-280 812/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Piezo- and Pyroelectricity of Poly(vinylidene Fluoride) from Plasma Poling.
Final rept.,
J. McKinney, and G. T. Davis. 1978, 7p
Pub. in Proceedings of Meeting of the American Chemical Society (175th), Anaheim, Calif. 12-17 Mar 78. Paper in Organic Coatings and Plastics Chemistry, v38 p271-277 1978.

Keywords: *Polymeric films, *Piezoelectricity, *Pyroelectricity, Crystal structure, Plasmas(Physics), X ray analysis, Reprints, *Vinylidene fluoride resins.

A plasma poling device is described which allows essentially instantaneous poling of polymeric films at room temperature at very high fields. Using poly(vinylidene fluoride) both undrawn (comprising essentially pure alpha conformation) and bi-axially drawn (both alpha and beta conformation) were polarized in this manner. The polarization of the sample was determined from current integration measurements. The piezoelectric and pyroelectric coefficients were then measured and compared with those estimated from the polarization theory of Mopsik and Broadhurst, which expresses these coefficients as linear functions of polarization. The theory gives an accurate representation of the piezoelectric coefficients, but underestimates the pyroelectric coefficients considerably. In addition, x-ray measurements from various techniques were made on both drawn and undrawn PVDF samples. For the unpoled samples the results are in good agreement with those in the literature. Some changes in spacings and intensities were observed with poling for both the drawn and undrawn samples. As yet we do not have a clear interpretation of these results in terms of crystal structure changes resulting from polarization.

706,144
PB-285 355/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of Block-Copolymer Molecular Weight from Measurements of Frictional Properties,
F. W. Wang. 1977, 7p
Pub. in Jnl. Polymer Sci.: Polymer Symp. 60 p201-207, 1977.

Keywords: *Polyisoprene, *Styrene copolymers, *Molecular weight, Copolymers, Solutions, Sedimentation, Measurement, Viscosity, Reprints, Block copolymers, Mandelkern-Fiory-Scheraga equation, Bread spring model.

The experimental values of the Mandelkern-Flory-Scheraga parameter for several styrene-isoprene block copolymers are compared with those predicted by the bead-spring model theory which has been previously described. In agreement with the theory, the experiments show that the Mandelkern-Flory-Scheraga parameter is insensitive to composition and molecular weight. A procedure for the determination of block-copolymer molecular weight from measurements of sedimentation coefficient (or translational diffusion coefficient) and limiting viscosity number is discussed.

706,145
PB-287 309/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Amine Accelerators for Composite Restorative Resins.
Final rept.,
G. M. Brauer, D. M. Dulik, J. M. Antonucci, and H. Argentar. Sep 78, 6p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD.
Pub. in Polym. Prepr. American Chemical Society, Div. Polym. Chem., v19 n2 p585-590 Sep 78.

Keywords: *Polymerization, Nitrogen organic compounds, Composites, Synthesis(Chemistry), Amines, Acetic acid/amino-dimethyl-phenyl, Xylidine/N-N-dimethyl-amino, Toluidine/N-N-dimethyl-amino, Glutethimide/N-N-dimethyl-amino, Acetic acid/dimethyl-amino-phenyl-(methyl-ester), Toluidine/N-N-dihydroxyethyl, *Chemical accelerators, Reprints.

A number of newly synthesized tertiary aromatic amines were compared with commonly used accelerators in the benzoyl peroxide initiated room temperature polymerization of composite restorative resins. The order of reactivity of the more desirable amines based on the cure times of the composite is p-dimethyl-aminophenylacetic acid (DMAPAA) > N,N-dimethylamino-sym-xylidine (DMSX) N,N-dimethylamino-p-toluidine (DMPT), N,N-dimethylaminoglutethimide (DMAG) > methyl ester of p-dimethylaminophenylacetic acid (MDMPAA) >> N,N-dihydroxyethyl-p-toluidine (DHEPT). The overall characteristics of the composites (hardening time, strength and color stability) containing DMAPAA, MDMAPAA and DMAG compared favorably to resins cured with commonly used tertiary amines or the other accelerators evaluated. Maximum compressive and tensile strength for the composites are obtained only over a narrow concentration range of accelerator used.

706,146
PB-288 527/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Additional Studies of Metal-Filled Resin Composites.
Final rept.,
R. L. Bowen, H. H. Chandler, H. O. Wyckoff, and D. N. Misra. Feb 78, 8p
Grant PHS-DE-02494-06
Pub. in Jnl. of Dental Research 57, n2 p213-220, Feb 78.

Keywords: *Polymerization, *Resins, *Composites, Metals, Physical properties, Reprints.

Various particulate materials were combined with a BIS-GMA resin, and the resulting composites were evaluated. The fillers prevented, altered, had no apparent effect, or accelerated polymerization. Coupling agents also influenced polymerization. Physical properties varied widely with different fillers.

706,147
PB-289 012/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pyroelectricity and Charge Transport in a Copolymer of Vinylidene Fluoride and Tetrafluoroethylene.
Final rept.
M. G. Broadhurst, G. T. Davis, S. C. Roth, and R. E. Collins. 1978, 10p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Proceedings Conf. Electrical Insulation and Dielectric Phenomena, Held at Buck Hill Falls, PA on Oct 18-21, 1976 p38-47 (Natl. Academy of Sciences, Washington, DC. 1978).

Keywords: *Pyroelectricity, *Piezoelectricity, Copolymers, Fluorine aliphatic compounds, Electric fields, Fluorine organic compounds, Polymers, *Vinylidene fluoride polymers, *Ethylene/tetrafluoro, Fluorinated polymers.

A copolymer of 73 weight percent vinylidene fluoride and 27 weight percent tetrafluoroethylene can be made piezoelectric and pyroelectric by the temporary application of high electric fields. The application of a thermal pulse technique to the active films reveals that they are polarized preferentially near the positive electrode and that the polarization extrudes further into the film as the poling temperature is increased. These observations can be made consistent with earlier data which show the piezoelectric and pyroelectric coefficient to be independent of poling temperature by proposing charge transfer through the unpoled region of the polymer. Transient charge flow following a step-increase in temperature and pyroelectric response from layered structures support this explanation.

706,148
PB-289 013/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Piezoelectricity and Pyroelectricity in Polyvinylidene Fluoride - A Model.
Final rept.,
M. G. Broadhurst, G. T. Davis, J. E. McKinney, and R. E. Collins. Oct 78, 6p
Pub. in Jnl. Appl. Phys., v49 n10 p4992-4997, Oct 78.

Keywords: *Piezoelectricity, *Pyroelectricity, *Mathematical models, Fluorine aliphatic compounds, Polymers, Molecular structure, Dipole moments, *Vinylidene fluoride polymers, Fluorinated polymers, Numerical solution, Reprints.

A description is given of the molecular and morphological structure of polyvinylidene fluoride and from this description a classical model is proposed for calculating the piezo- and pyroelectric properties. The model consists of an array of crystal lamellae with a net moment from aligned dipoles in the crystals and compensating space charge on the crystal surfaces. The results for no compensation and complete compensation essentially bracket experimentally observed results and indicate that the largest contribution to the activity of this polymer arises from bulk dimensional changes, rather than from changes in molecular dipole moments.

706,149
PB-289 024/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electric-Field-Induced Phase Changes in Poly(Vinylidene Fluoride).
Final rept.,
G. T. Davis, J. E. McKinney, M. G. Broadhurst, and S. C. Roth. Oct 78, 5p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. Appl. Phys., v49 n10 p4998-5002, Oct 78.

Keywords: *Phase transformations, Piezoelectricity, Pyroelectricity, Electric fields, Infrared spectroscopy, X ray diffraction, Crystals, Polymers, Fluorine aliphatic compounds, *Vinylidene fluoride polymers, Fluorinated polymers, Reprints.

The antipolar crystal form of poly(vinylidene fluoride) can be made piezoelectric and pyroelectric by the temporary application of electric fields in excess of 1 MV/cm at room temperature. Infrared and x-ray diffraction data reveal that the poling occurs in two stages. At intermediate fields, a phase transition to a polar form II occurs with presumably no change in chain conformation. Higher fields cause a phase transformation to form I which involves a change in conformation. These results indicate that the source of residual polarization is within the crystal phase of the polymer.

706,150
PB-289 028/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calculation of Piezoelectricity and Pyroelectricity in Polyvinylidene Fluoride.
Final rept.
M. G. Broadhurst, G. T. Davis, J. E. McKinney, and R. E. Collins. 1978, 10p
Pub. in Proceedings Annual Report Conf. on Electrical Insulation and Dielectric Phenomena, 1978, Held at Gaithersburg, MD. on Nov 3-6, 1978 p85-94 (National Academy of Sciences, Washington, DC. 1978).

Keywords: *Piezoelectricity, *Pyroelectricity, *Mathematical models, Molecular structure, Polymers, Dipole moments, Fluorine aliphatic compounds, Numerical solution, *Vinylidene fluoride polymers, Fluorinated polymers.

A description is given of the molecular and morphological structure of polyvinylidene fluoride and from this description a classical model is proposed for calculating the piezo- and pyroelectric properties. The model consists of an array of crystal lamellae with a net moment from aligned dipoles in the crystals and compensating space charge on the crystal surfaces. The results for no compensation and complete compensation essentially bracket experimentally observed results and indicate that the largest contribution to the activity of this polymer arises from bulk dimensional changes, rather than from changes in molecular dipole moments.

706,151
PB-289 899/7 PC **A03**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Center for Materials Science.
Standard Reference Materials: The Characterization of Linear Polyethylene SRM's 1482, 1483, and 1484.
Special pub.
P. H. Verdier, and H. L. Wagner. Dec 78, 44p NBS-SP-260-61
Library of Congress Catalog Card no. 78-600148. Pub. in National Bureau of Standards Jnl. of Research, v83 n2 p169-201 Mar/Apr 78.

Keywords: *Polyethylene, Molecular weights, Viscosity, Standards, Light scattering, Viscometry, *Standard reference materials.

The National Bureau of Standards has issued a new series of three linear polyethylene Standard Reference Materials, SRM 1482, 1483, and 1484. These polyethylenes have molecular weights of the order of 10,000, 30,000, and 100,000 g/mol, respectively, and ratios (M sub w)/(M sub n) of weight-to-number-average molecular weight of the order 1.2. Their number-average molecular weights (by membrane osmometry), weight-average molecular weights (by light scattering), and limiting viscosity numbers in two solvents (by capillary viscometry) are certified; the procedures employed are described in these collected papers previously published in the Journal of Research of the National Bureau of Standards.

706,152
PB-296 943/4 Not available NTIS

National Bureau of Standards, Gaithersburg, MD.
Molecular Weight Standards from Sulfonation of Polystyrene.
Final rept.,
D. W. Brown, and R. E. Lowry. 1979, 8p
Pub. in Jnl. Polym. Sci., Polym. Chem. Ed. v17 p1039-1046, 1979.

Keywords: *Molecular weight, *Polystyrene, *Sulfonation, Standards, Styrene resins, Synthesis(Chemistry), *Poly(Ethylene/sulfophenyl), Reprints.

Polystyrene was sulfonated with sulfur trioxide-triethyl phosphate complexes in dichloroethane, the object being to prepare polystyrene sulfonates substantially free of sulfone links between polymer chains. Variations in the sulfone content with reaction conditions were conveniently followed by exclusion chromatography, the sulfone peak appearing at about twice the molecular weight of the main peak. Completely soluble polystyrene sulfonate was also obtained from polystyrene of molecular weight 2.05 x 10 to the 6th power. Requirements for the successful use of the 1.5:1 complex include careful purification of the dichloroethane and, if 2 g or more polystyrene is to be sulfonated, formation of the complex at -20C. A method is given for measuring the sulfonating capability of the reagent before adding the polymer.

706,153
PB77-600012 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heat Capacity and Thermodynamic Properties of Poly(Vinyl Chloride).

S. S. Chang. 1977, 9p
Included in Jnl. of Research of the National Bureau of Standards, v82 n1 p9-18 1977.

Keywords: Calorimetry, Enthalpy relaxation, Glass transition, Heat capacity, Polymer, *Poly(vinyl chloride), Pressure effects, Thermodynamic properties.

Heat capacities, C sub p of three different samples of poly(vinyl chloride), PVC, have been determined from 56 to 375 K by adiabatic calorimetry. These three samples were derived from either bulk- or suspension-polymerization processes and were measured either as received or after pelleting under pressure. The heat capacities of the sample s are almost identical if the thermal and pressure histories are the same. Below the glass transition temperature, T sub g of about 355 K, C sub p of PVC was found to e exceptionally linear over a wide temperature range. C sub p of annealed PVC may be represented by (10 + 0.166 T) J K to the minus 1 power mol to the minus 1 power to within 1 percent of the measured values from 80 to 340 K. Approximately 200 J mol to the minus 1 power of energy were stored in the samples by the pelleting processes. The stored energies begin to release at about 30 to 40 K below the glass transition temperature. T sub g for powdery or relaxed samples occurs around 352 to 356 K for the suspension-polymerized PVC sample and 348 to 351 for bulk-polymerized sample.

706,154
PB78-600001
(Order as PB-287 689/4, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Configurational Statistics of a Polymer Confined to a Wedge of Interior Angle Alpha.
J. I. Lauritzen, and E. A. DiMarzio. 1978, 5p
Included in Jnl. of Research of the National Bureau of Standards, v83 n4 p381-385 Jul-Aug 1978.

Keywords: *Polymer in a wedge, Polymer interface, Polymer statistics, Polymer surface problem, Probability distribution of polymer near surface.

The probability distribution for the end-to-end length of a polymer of N segments confined in a wedge of interior angle alpha is obtained (2 pi is equal to or greater than alpha is greater than 0). The result is used to evaluate the partition function, Q, for the cases: (1) one end free - one end tied to the vertex, Q is proportional to gamma 5 to the Nth power N to the minus 3rd power/2-pi/alpha.

706,155
PB78-600030 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Critical Review of Vibrational Data and Force Field Constants for Polyethylene.
J. Barnes, and B. Fanconi. c1978, 14p
Included in Jnl. of Physical and Chemical Reference Data, v7 n4 p1309-1322 1978.

Keywords: *Force field refinement, Lattice dynamics, n-alkanes, Nonbonded potential functions, Polyethylene, Vibrational data.

The results of a critical review of vibrational data, their assignments, and force field constants of polyethylene and the related homologous series of n-alkanes are presented. The vibrational frequencies derived from Raman spectroscopy, infrared spectroscopy, and neutron inelastic scattering were collected from the literature. We have reviewed the vibrational band assignments starting from the comprehensive treatment of the n-alkanes by Schachtschneider and Snyder and including subsequent reassignments. Theoretical calculations of the vibrational frequencies were reviewed with emphasis on the various models used for molecular structure and force fields. Lattice dynamical calculations of polyethylene were performed using a valence force field for intramolecular interactions and a force field derived from a nonbonded atom-atom potential function for intermolecular interactions. The molecular and lattice structural parameters were taken from x-ray and neutron diffraction studies of polyethylene and selected n-alkanes. A refinement procedure was carried out by the method of least squares on intramolecular force field constants and on parameters of a phenomenological nonbonded atom-atom potential energy function. The resulting force field constants and associated standard deviations are presented.

706,156
PB79-600003
(Order as PB80-103674, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Theory of Flow-Induced Fibril Formation in Polymer Solutions.
J. D. Hoffman. 1979, 26p
Included in Jnl. of Research of the National Bureau of Standards, v84 n5 p359-384 1979.

Keywords: *Core fibril, Cumulative stress, Flow-induced crystallization, Nucleation theory, Polyethylene, Polymer fiber, Shish, Volume strain.

A treatment of the formation of a basic core fibril (shish) of the type that is generated by flow-induced crystallization of a polymer from solution is given that features the concept of cumulative strain. Multiple nucleation acts by flow-elongated molecules produce an empbryonic fibril that is a connected set of bundlelike nuclei. Surface stress resulting from repulsion of the quasi-random coil chains in the amorphous zone between the nuclei or crystallites builds up at the bundle ends as the nuclei mature, leading ultimately to a high end surface free energy, and to volume strain in the crystallites comprising the diameter a sub s and mean characteristic length l sub s with a fixed axial ratio, and predicts why the diameter does not grow further even in a medium that is supersaturated with polymer. The predicted dependence of a sub s(3), l sub s(3), and the axial ratio, on undercooling is in approximate agreement with experiment. The lattice expansion in the crystal resulting from volume strain is also in fair accord with experiment. The effect of annealing, including the commonly encountered case where the volume strain relaxes to give normal lattice dimensions, but with a high end surface energy still remaining, is noted. The effect of volume strain and the distribution of core fibril lengths about l sub s on the melting behavior is calculated. The theory can reproduce crystallinity versus temperature data on polyethylene fibrils. This procedure yields an independent value of l sub s. The overall treatment implies that the core fibril is a set of concatenated and substantially extended-chain crystallites with bundlelike ends and a somewhat expanded lattice when unannealed and under tension, the molecular connections between the crystallites consisting of short amorphous ciliary bridges. It is suggested that prolonged annealing at high temperatures can remove a substantial number of the amorphous zones.

706,157
PB80-151970 Not available NTIS
National Bureau of Standards, Washington, DC.
Isocyanato Urethane Methacrylates Derived from Hydroxyethyl Methacrylate.
Final rept.,
J. M. Antonucci, G. M. Brauer, and D. J. Termini. Jan 80, 9p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD.
Pub. in Journal of Dental Research 59, n1, p35-43, Jan 80.

Keywords: *Synthesis(Chemistry), *Dental materials, Adhesion, Polymerization, Oxygen organic compounds, Dentin, Reprints, *Methacrylic acid/isocyanato-hydroxyethyl.

Isocyanato urethane methacrylates were synthesized from five diisocyanates and hydroxyethyl methacrylate. They may be homopolymerized or copolymerized with other methacrylates by the usual free radical methods of initiation and have potential as adhesion-promoting agents for dentin.

706,158
PB80-225394 Not available NTIS
National Bureau of Standards, Washington, DC.
Phosgene in the Thermal Decomposition Products of Poly(Vinyl Chloride): Generation, Detection and Measurement.
Final rept.,
J. E. Brown, and M. M. Birky. Aug 80, 9p
Pub. in Jnl. of Analytical Toxicology 4, p166-174 Jul-Aug 80.

Keywords: *Phosgene, *Polyvinyl chloride, *Combustion, Chlorine organic compounds, Decomposition reactions, Measurement, Concentration(Composition), Reprints, Chemical reaction mechanisms.

An analytical study was made to determine whether carbonyl chloride (phosgene) is formed during the thermal decomposition of poly(vinyl chloride), PVC. Four methods of decomposition were studied: (1) thermal degradation of PVC in a resistively heated furnace, (2) electrical overloading of a PVC clad wire, (3) electrical arcing between electrodes partially covered with PVC, and (4) electric arc initiated flaming combustion in a cup furnace. Results are reported which show that significant quantities of phosgene can be generated from PVC by the electric arc method. Lesser amounts were found in the other scenarios. The measurements, identification and quantification of phosgene in the decomposition product, were obtained through the use of gas chromatography, infrared spectroscopy and mass spectroscopy. Reaction mechanisms are suggested.

706,159
PB80-600033 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Amine Accelerators for Composite Restorative Resins.
G. M. Brauer, D. M. Dulik, J. M. Antonucci, D. J. Termini, and H. Argentar. 1979,6p
Pub. in Jnl. Dent. Res. 58, n10 p1994-2000 1979.

Keywords: *Amine accelerators, Composite restorative resins, Dimethylaminoglutethimide, Dimethylaminophenylacetic acid and esters, Properties of composites, Tertiary aromatic amines.

A number of newly synthesized tertiary aromatic amines were compared with commonly used accelerators in the benzoyl peroxide initiated room temperature polymerization of composite restorative resins. The order of reactivity of the more desirable amines based on the cure times of the composite is p-dimethylaminophenylacetic acid (DMAPAA) > N,N-dimethyl-sym-xylidine (DMSX) > N,N-dimethyl-p-toluidine (DMPT), N,N-dimethylaminoglutethimide (DMAG) > methyl ester of p-dimethylaminophenylacetic acid (MDMPAA) > N,N-dihydroxyethyl-p-toluidine (DHEPT). The overall characteristics of the composites (hardening time, strength, and color stability) containing DMAPAA, MDMAPAA and DMAG compared favorably to resins cured with commonly used tertiary amines or the other accelerators evaluated. Maximum compressive and tensile strength for the composites are obtained only over a narrow concentration range of accelerator used.

706,160
PB81-600009 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heat Capacity and Other Thermodynamic Properties of Linear Macromolecules. II. Polyethylene.
U. Gaur, and B. Wunderlich. c1981, 34p
Included in Jnl. of Physical and Chemical Reference Data, v10 n1 p119-152 1981.

Keywords: *Crystal, Crystallinity, Density, Enthalpy, Entropy, Fusion, Gibbs energy, Glass transition, Heat capacity, Linear macromolecule, Melt, Polythylene.

The heat capacity of polyethylene from 0 K to 600 K is reviewed using measurements on 46 samples reported in the literature. The crystallinity dependence is evaluated critically and a set of recommended data for completely crystalline and amorphous polyethylene is

derived. Entropy, enthalpy, and Gibbs energy functions are calculated. Polyethylene can serve as a standard material for the thermodynamic functions of a simple linear macromolecule. The paper is the second in a series which will ultimately cover all heat capacity measurements on linear macromolecules.

706,161
PB82-140914 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystalline Polymers.
Final rept.
R. K. Eby, A. Peterlin, F. A. Khoury, M. G. Broadhurst, and B. M. Fanconi. Nov 81, 9p
Pub. in Polymer Science and Engineering: Challenges, Needs and Opportunities (Chapter 2), p49-57 Nov 81.

Keywords: *Polymers, *Crystals, Forecasting, Laboratory equipment, Reprints.

The state of crystalline polymer science is reviewed briefly. Important unresolved problems are discussed, as are future research needs and trends. The future role of newly developed instrumentation is discussed. A list of important problems is presented in summary.

706,162
PB83-600004 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heat Capacity and Other Thermodynamic Properties of Linear Macromolecules. VII. Other Carbon Backbone Polymers.
U. Gaur, B. B. Wunderlich, and B. Wunderlich. c1983, 35p
Included in Jnl. of Physical and Chemical Reference Data, v12, n1 p29-63 1983.

Keywords: *Enthalpy, Entropy, Fusion, Glass transition, Halogenated polymers, Heat capacity, Linear macromolecule, Polyalkenes, Polybenzoates, Polystyrenes, Vinylidene polymers, Vinyl polymers.

The heat capacity of poly-1-butene, poly-1-pentene, poly-1-hexene, polysiobutylene, poly(4-methyl-1-pentene), polybutadiene, cis-1, 4-poly(2-methylbutadiene), polycyclopentene, poly(vinyl fluoride), poly(vinylidene fluoride), polytrifluoroethylene, polytetrafluoroethylene, poly(vinyl chloride), poly(vinylidene chloride), polychlorotrtrifluoroethylene, poly(vinyl alcohol), poly(vinyl acetate), poly(a-methylstyrene), poly(0-methylstyrene), poly(o-chlorostyrene) and a series of poly(vinyl benzoate)s is reviewed on the basis of 62 measurements reported in the literature. A set of recommended data has been derived for each polymer. Entropy and enthalpy functions have been calculated for poly-1-hexene, polysiobutylene, cis-1, 4-poly(2-methylbutadiene), poly(vinyl chloride), and poly(a-methylstyrene). This paper is seventh in a series which will ultimately cover all heat capacity measurements on linear macromolecules.

706,163
PB83-600005 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heat Capacity and Other Thermodynamic Properties of Linear Macromolecules, VIII. Polyesters, and Polyamides.
U. Gaur, S. Lau, B. B. Wunderlich, and B. Wunderlich. c1983, 25p
Included in Jnl. of Physical and Chemical Reference Data, v12, n1 p65-89 1983.

Keywords: *Amorphous, Crystal, Enthalpy, Entropy, Fusion, Glass transition, Heat capacity, Nylon, Polyamide, Polyester, Polypeptide, Thermodynamic properties.

Heat capacity of polyglycolide, poly(epsilom-caprolactone), poly(ethyleneterephthalate), (poly)ethylene sebacate), polyglycine, poly(L-alanine), poly(L-valine), nylon 6, nylon 6.6, and nylon 6.12 is reviewed on the basis of measurements on 35 samples reported in the literature. All heat capacity data are compiled and a set of recommended data have been derived for each polymer. Crystallinity dependence is critically evaluated for poly(ethylene terephthalate). Enthalpy and entropy functions are calculated for amorphous poly(ethylene terephthalate). This is the eight paper in a series of publications which will ultimately cover all heat capacity measurements of linear macromolecules.

706,164
PB83-600006 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heat Capacity and Other Thermodynamic Properties of Linear Macromolecules, IX. Final Group of Aromatic and Inorganic Polymers.
U. Gaur, S. Lau, and B. Wunderlich. c1983, 18p
Included in Jnl. of Physical and Chemical Reference Data, v12, n1 p91-108 1983.

Keywords: *Enthalpy, Entropy, Germanium polymers, Glass transition, Heat capacity, Linear macromolecules, Polycarbonate, Poly(dimethyl siloxane), Polyheteroarylene, Polyphenylenediamide, Polysulfone, Silicon polymer.

In this final review, a series of polymers which include aromatic rings and/or inorganic chain atoms are treated. Heat capacities of poly(4-4prime-isopropylidenediphenylene carbonate), polyphenylenediamides, ployheteroarylenes, poly(dimethyl siloxane), poly(diethyl siloxane), poly(trimethylsilyl ethylene), poly(dimethylbenzylsilyl ethylen), poly(dimethylbenzylsilyl ethylene), poly(vinylene diphenylsilylene), poly(vinylene diphenylgermylene), poly(diethnyl diphenysilylene), poly(diethnyl diphenylgermylene), poly(2,3,4,5-tetraphenyl-1, 1-diethylgermocyclopentadiene), poly(phenylsilsesquioxane), poly(ethylene-N-(Beta-trimethylsilylethly) im ine) and polysulfones have been reviewed on the basis of measurements on 36 samples reported in the literature. All heat capacity data are compiled and a set of recommended data are derived. Enthalpy and entropy functions are calculated for poly(4,4prime-isopropylidenediphenylene carbonate) and poly(dimethyl siloxane).

706,165
PB84-155704 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Polymer Science and Standards Division Annual Report 1983.
L. E. Smith, M. G. Broadhurst, G. T. Davis, F. W. Wang, B. M. Fanconi, J. Tesk, and I. Sanchez. Jan 84, 114p NBSIR-84-2813
See also PB83-200105.

Keywords: *Polymers, *Standards, Dental materials, Medical supplies, Durability, Plastics, Dielectric properties, Additives, Transport properties, Elastomers, Stability, Performance evaluation, Molecular structure, Standards, Mechanical properties, Composite materials, Molecular conformation.

Although synthetic polymers have been used as materials for technology during only three quarters of a century, they have left little of our economy, technology, industry, science, and culture untouched. We have moved rapidly into an age in which an evergrowing number of humanity's needs are served by polymers. The volume currently produced exceeds that of steel and forms the basis of industries which add over $106 billion of value by manufacturer (a measure of the relative economic importance of manufacturing among industries) and provides 3.3 million jobs. Recent summaries show that polymers and polymer composites research already accounts for about 47 percent of the total industrial R&D expenditure for metals, polymers, and inorganic materials. Among these materials, polymers also constitute about 40 percent of the value added by manufacturer, 45 percent of the jobs, 49 percent of the number of scientific publications, and 42 percent of the American Society for Testing and Materials (ASTM) standards.

706,166
PB84-222124 Not available NTIS
National Bureau of Standards, Washington, DC.
Synthesis and Characterization of Polymeric C18 Stationary Phases for Liquid Chromatography.
Final rept.
L. C. Sander, and S. A. Wise. 1984, 7p
Pub. in Analytical Chemistry 56, n3 p504-510 1984.

Keywords: *Aromatic polycyclic hydrocarbons, *Synthesis(Chemistry), Chromatographic analysis, Reprints.

The synthesis of monomeric, polymeric, and 'oligomeric' C18 alkyl phases is described for a series of wide pore (300 A) silica substrates. Chromatographic properties of the phases are compared by use of polycyclic aromatic hydrocarbon (PAH) probes. A three-component test mixture was used to evaluate the relative polymeric nature of a given phase. On the basis of the elution order of the components of this mixture, the phase type could be classified rapidly and the selectivity toward more complex PAH mixtures could be predicted. Selectivity was observed to be related to surface coverage values while absolute retention was found to be more closely related to the total carbon contained within the column. Although in past work intentional polymerization has usually been avoided in the preparations of alkyl-bonded phases, the unique selectivity of polymeric phases makes them an excellent complement to monomeric phases.

706,167
PB84-242098 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Polymer-Polymer Compatibility by Non-Radiative Energy Transfer Technique.
Final rept.
F. W. Wang, and R. E. Lowry. 1982, 2p
Pub. in Polym. Prepr. 23, n2 p205-206 1982.

Keywords: *Polymers, *Energy transfer, *Fluorescence, Blends, Polymethyl methacrylate, Fluorine organic compounds, Compatibility, Heat measurement, Reprints, Vinylidene fluoride polymers, Poly(Methacrylic acid/(ethyl-ester)).

Non-radiative energy transfer can take place between an energy donor and a suitable energy acceptor over distances of the order of 30 A. Since the efficiency of energy transfer depends on the inverse sixth power of the distance between the donor and the acceptor, in a blend containing two polymers labeled with donor and acceptor chromophores, respective ly, the efficiency of transfer will be small if the two polymers are incompatible and segregated but will be large if they are compatible and form a single phase. There have been recently some efforts to study polymer-polymer compatibility by non-radiative energy transfer technique. Since this technique is relatively new, it is important to further compare the results from this technique with those obtained from more conventional techniques. The author have used this technique to evaluate the effectiveness of poly(vinylidene fluoride) (PV2) as a compatibility enhancer for poly(methyl methacrylate) (PMMA) and poly(ethyl methacrylate) (PEMA), which are known to be incompatible. In this paper they describe our experimental procedure, which permits thermal treatment of polymer blends, and they give a comparison of our results with calorimetry results of Kwei and coworkers.

706,168
PB84-244656 Not available NTIS
National Bureau of Standards, Washington, DC.
National Bureau of Standards, Polymer Science and Standards Division.
Final rept.
R. K. Eby, M. B. Broadhurst, B. M. Fanconi, I. C. Sanchez, G. T. Davis, F. W. Wand, and J. A. Tesk. May 84, 7p
Pub. in Polymer News 9, n6 p178-184 May 84.

Keywords: *Polymers, *Standards, *Research projects, Utilization, Reprints.

The National Bureau of Standards has a long and successful background of advancing polymer science, polymer standards and the effective use of polymers in solving national problems. The present program of the Polymer Science and Standards Division continues this service with emphasis on the applications of polymers to the growth of industrial productivity, improved national security, increased conservation of critical materials, more efficient government, better materials utilization and improved health. Surveys and other planning activities suggest that in the future the polymer field and the Division will place increased emphasis on polymer blends, reinforced polymers, highly developed molecular orientation, conducting polymers, high strength polymers, and high temperature polymers.

706,169
PB85-135416 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Relaxation of Stresses in Grazes at Crack Tips and Rate of Craze Extension.
Final rept.
E. Passaglia. 1982, 7p
Pub. in Polymer 23, n5 p754-760 1982.

Keywords: *Crazing, *Crack propagation, *Stress analysis, *Polymers, Stress relaxation, Mathematical models, Reprints, *Barenblatt theory.

The Barenblatt theory of cohesive stresses at crack tips is used to investigate the effect of the relaxation of craze stresses at crack tips on the rate of craze exten-

sion. A general equation relating the rate of change of craze length to the rate of change of stress intensity factor (K1) and the rate of change of the craze stress is derived. It is argued from this equation that uniform crack growth with a constant craze length cannot occur for a generalized Dugdale model with relaxation. Using plausibility arguments for the behavior of the craze stress with time and position in the craze, and assuming a generalized Dugdale model, differential equations for the rate of craze extension with no crack growth are derived for the constant load and constant K1 cases. These equations relate the rate of change of craze length to the craze stress at the tip of the crack. Assuming a specific form for the time dependence of this stress, the equation for the constant K1 case to yield an expression for the craze length as a function of time is given.

706,170
PB85-189504 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Synthesis and Characterization of C18 Stationary Phases for the Liquid Chromatographic Separation of Polycyclic Aromatic Hydrocarbons.
Final rept.
L. C. Sander, and S. A. Wise. 1983, 12p
Pub. in Proceedings Polynuclear Aromatic Hydrocarbons: Int. Symposium on Mechanisms, Methods, and Metabolism (8th), p1133-1144 1983.

Keywords: *Aromatic polycyclic hydrocarbons, *Synthesis(Chemistry), Separation, Substrates, Comparison, Polymers, Mixtures, *Reverse phase liquid chromatography, Monomers.

A number of monomeric and polymeric C18 bonded phases were synthesized on a variety of silica substrates to evaluate selectivity differences for the liquid chromatographic (LC) separation of polycyclic aromatic hydrocarbons (PAH). The results of this study indicate which parameters (i.e., phase type, surface coverage, and silica pore diameter) are responsible for providing optimum selectivity for the separation of PAH. Comparisons of phase types indicated that polymeric C18 phases on wide pore silica substrates (300 A) were most effective in separation of a sixteen-component PAH mixture. A simple empirical LC test was devised to gauge the extent of the monomeric or polymeric nature of a phase.

706,171
PB85-197796 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Influence of Substrate Parameters on Column Selectivity with Alkyl Bonded-Phase Sorbents.
Final rept.
L. C. Sander, and S. A. Wise. 1984, 19p
Pub. in Jnl. of Chromatography 316, p163-181 1984.

Keywords: *Silicon dioxide, *Synthesis(Chemistry), *Polymers, *Sorbents, Substrates, Physical properties, Surface chemistry, Phase rule, Reprints, Chemical reaction mechanisms.

Differences in bonded-phase properties were studied for monomeric and polymeric C18 phases prepared on a variety of silica substrate materials. A total of 22 silicas with pore diameters ranging from 50-1000 A were used in synthesis. Phase loadings for the resulting bonded phases ranged from 1.3-5.4 micromol/sq m. Physical properties of the substrates including surface area, pore volume, packing density, and background carbon were measured prior to bonding. Large differences were observed in the properties of the silica substrates and in the chromatographic behavior of the resulting phases. Differences in selectivity as well as absolute retention were observed as a function of pore size, with the greatest changes in selectivity occurring for the polymeric phases. The effect of silica pretreatment on phase synthesis and column selectivity was also examined for wide- and narrow-pore substrates. Phases prepared from silica pretreated with acid had greater polymeric character than those prepared from base-pretreated silica. Variation in phase loading and column selectivity is thought to be a function of both the reactivity of the silica surface and pore size. A model for polymeric phase synthesis is proposed where the extent of reaction is limited by a size-exclusion mechanism.

706,172
PB86-129731 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Intaglio Ink Considerations.
B. Dickens. Sep 85, 31p NBSIR/85-3216
Sponsored by Bureau of Engraving and Printing, Washington, DC.

Keywords: *Printing inks, *Alkyd resins, *Setting time, *Polymerization, Molecular weight, Solubility, Oxygen, Curing, Thixotropy, Silicon dioxide, Fillers, Performance evaluation.

Alkyds are recommended as the most practical resin system to polymerize in air. The alkyd should have a well-chosen molecular weight distribution and be dispersible in a water-containing solvent system. The solubility of oxygen in the ink formulations and solvent mixtures should be determined and the compositions adjusted to provide a level of oxygen which gives optimum cure. UV irradiation of the newly printed currency paper can probably be used to skin the ink rapidly and prevent blocking. This may allow printing of both sides of the currency paper in one pass. Replacement of the various pigments and fillers currently in use by dyes attached to the backbone of an organic polymer, either in water-soluble form or in the form of a glass should be investigated. The silica filler may be acting as a dessicant as well as a thickening agent. If this dessicant action is not important, thixotropy of the ink should be adjusted by using sodium carboxy methyl cellulose instead. Other recommendations are given and the formulation of intaglio printing inks is reviewed with special reference to BEP requirements.

706,173
PB86-165024 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Polymers: Technical Activities 1985.
Annual rept. 1 Oct 84-30 Sep 85.
L. E. Smith, and B. M. Fanconi. Nov 85, 104p
NBSIR-85/3190

Keywords: *Polymers, Reviews, Standards, Plastics, Performance evaluation, Blends, Mechanical properties, Composite materials, Molecular structure, Dential materials.

Technical Activities of the Polymers Division for FY 85 are reviewed. Included are descriptions of the 6 Tasks of the Division, project reports, publications, and other technical activities.

706,174
PB86-185485 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Small-Angle Neutron Scattering of Partially Segregated Amorphous Polyethylene Terephthalate.
Final rept.
W. Wu, D. Wiswe, H. G. Zachmann, and K. Hahn. 1985, 6p
Sponsored by Hamburg Univ. (Germany, F.R.).
Pub. in Polymer 26, n5 p655-660 1985.

Keywords: *Polyethylene terephthalate, Deuterium compounds, Neutron scattering, Reprints, Small angle scattering, Amorphous materials.

Deuterated polyethylene terephthalate (DPET) was synthesized from deuterated ethylene glycol and deuterated dimethyl terephalate which was derived from 1,4-dibromobenzene. Amorphous specimens for the small angle neutron scattering (SANS) were prepared by solution blending the DPET with the hydrogenerated PET and subsequently melt pressing. The SANS results suggested the occurrence of both segregation and transesterification between the deuterated and hydrogenerated species. An expression for the scattered intensities from partially segregated blends has been derived. Using this expression the average molecular weight, radius of gyration as well as the size of the segregation domains can be determined quantitatively from the SANS data.

706,175
PB86-192788 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Molecular Weight Effects on the Phase Diagram of Polystyrene-Poly(vinyl methyl ether) Blends.
Final rept.
J. M. Ubrich, F. B. C. Larbi, J. L. Halary, L. Monnerie, B. J. Bauer, and C. C. Han. 1986, 7p
Pub. in Macromolecules 19, n3 p810-815 1986.

Keywords: *Molecular weight, *Polystyrene, *Polyrinyl methyl ether, Phase diagrams, Vinyl ether resins, Reprints.

Fluorescence emission of labeled polystyrene is employed to reexamine the lower critical solution temperature phase diagram of the system polystyrene (PS)-poly(vinyl methyl ether) (PVME) over a large range of molecular weights. The influence of polymer chain length is investigated by using a variety of PS's and PVME's having molecular weights ranging from 20 400 to 1660 000 and from 45 000 to 1330 000, respectively. Fluorescence measurements are shown to be suitable for the determination of the coexistence curve, even in the case of the largest molecular weights, for which the phase separation process develops very slowly. Particular attention is paid to a series of blends in which the molecular weight of one component is kept constant, whereas that, M(sub w)(i), of the other one varies.

706,176
PB86-192952 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Anomalies in the Physical Ageing Behavior of PMMA.
Final rept.
G. B. McKenna, and A. J. Kovacs. 1983, 2p
Sponsored by Centre National de la Recherche Scientifique, Strasbourg (France). Centre de Recherches sur les Macromolecules.
Pub. in Polym. Prepr. 24, n2 p100-101 1983.

Keywords: *Polymethyl methacrylate, Aging tests(Materials), Stress relaxation, Torque, Deformation, Cylinders, Reprints.

Cylindrical specimens of PMMA were quenched from above the glass transition and subsequently tested in torsion. Torque and normal force relaxation responses were recorded. The experiments were performed at 40 deg, 60 deg and 80 deg C and at increasing ageing times. Two anomalies from the classical picture of ageing were revealed by these investigations: (1) The small deformation relaxation curves could not be superposed by any combination of vertical and horizontal shifts. (2) The ageing responses of the torque relaxation and normal force relaxation at mode-rate deformations (gamma approx. 0.04), while superposeable, are different. The shift required to superpose the normal force response is two times that required to superpose the torque response.

706,177
PB86-193539 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Polymeric Electrolyte Based on Poly(ethylene imine) and Lithium Salts.
Final rept.
C. K. Chiang, G. T. Davis, C. A. Harding, and T. Takahashi. 1986, 6p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Solid State Ionics 18 and 19, p300-305 1986.

Keywords: *Batteries, *Conductivity, Ionic conduction, Lithium salts, Electrolytes, Polymers, Reprints, Poly(ethylene imine).

The dissolution of lithium salts in linear poly(ethylene imine) has been investigated because of its possible role as a solid electrolyte in lithium batteries. Lithium salts included in the study are LiF, LiCl, LiBr, LiI, LiSCN, LiC104 and LiBF4. When cast from solution in a common solvent, a uniform mixture is obtained (except for the case of LiF). Interaction of the salt and polymer can be characterized by observing a loss in crystallinity of the polymer and an increase in the glass transition temperature. At concentrations of salt below 10 mole percent, the polymer can slowly recrystallize at room temperature but at higher concentrations, the mixture remains amorphous for an indefinite period of time. DC conductivity at room temperature is about 1 times 10 to the 8th power S/cm but increases to 0.0001 S/cm at 150 C.

706,178
PB86-193612 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Laser Ionization Mass Spectrometry of Poly(4-vinylpyridine).
Final rept.
R. A. Fletcher, and A. J. Fatiadi. 1985, 3p
Pub. in Polymer Communications 26, p270-272 Sep 85.

Keywords: Mass spectroscopy, Reprints, *Laser enhanced ionization, *Poly(ethylene/pyridyl).

Commercial poly(4-vinylpyridine) (PVP) solid beads have been investigated by laser ionization mass spectrometry using a Laser Microprobe Mass Analyzer (LAMMA 500). The objective was to structurally characterize the fragment ion patterns of both the positive and negative ion mass spectra. Main emphasis is placed on PVP 2% crosslinked with divinylbenzene, but comparison with non-crosslinked PVP and 25% crosslinked samples as well as HCl treated 2% crosslinked PVP are reported.

706,179
PB86-193703 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Chemical Modification of Poly(ethylene imine) for Polymeric Electrolyte.
Final rept.
T. Takahashi, G. T. Davis, C. K. Chiang, and C. A. Harding. 1986, 5p
See also AD-A160 482. Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Solid State Ionics 18 and 19, p321-325 1986.

Keywords: Ionic conduction, Electrolytes, Reprints, *Conductivity, *Cross linking.

Linear PEI has been chemically modified in an attempt to prevent formation of a crystalline complex without altering its ability to dissolve salts and conduct ions. Three main systems were investigated: (a) poly(N-acetylethylene imine), (b) partially quaternized PEI with ethyl or butyl groups, and (c) PEI cross-linked with diepoxyoctane. Dissolution of salt was followed by x-ray diffraction on the mixtures and changes in Tg as determined by DSC. In all cases, the crystallinity was destroyed but conductivity of salt-containing polymer was not improved. However, lightly cross-linked PEI exhibits much improved mechanical properties and the incorporation of .05 mole NaI/mole of monomer yields a conductivity of 5 times 10 to the 5th power S/cm at 100 C.

706,180
PB86-193737 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Equilibrium Phase Compositions of Heterogeneous Copolymers.
Final rept.
B. J. Bauer. 1985, 7p
Pub. in Polymer Engineering and Science 25, n17 p1081-1087 Dec 85.

Keywords: *Copolymers, *Polymerization, Thermodynamic properties, Phase diagram, Heterogeneity, Reprints.

The products of random copolymerizations are heterogeneous in chemical composition, having a distribution of the fraction of each monomer in the copolymer. Polymer molecules with the same composition and molecular weight can be treated as separate components in a polymer blend. The spinodal limit is a simple function of chemical heterogeneity. The equilibrium number of phases, phase volumes, and average composition can be calculated from the condition that the chemical potential of a polymer species is equal in every phase. Phase diagrams are calculated for various hypothetical chemical distributions as well as a distribution characteristic of a random acrylonitrilebutadiene copolymerization to high conversion.

706,181
PB86-195773 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Picosecond Excimer Fluorescence Spectroscopy: Applications to Local Motions of Polymers and Polymerization Monitoring.
Final rept.
F. W. Wang, R. E. Lowry, and R. R. Cavanagh. 1985, 5p
Contract ARO-111-84
Sponsored by Army Research Office, Research Triangle Park, NC.
Pub. in Polymer 26, p1657-1661 1985.

Keywords: *Energy migration, Methyl methacrylate, Monitoring, Spectroscopy, Polymerization, Reprints, *Excimer fluorescence.

The local motions of bis-(1-pyrene)alkanes and pyrene-labelled poly(methyl methacrylate) polymers in solution were characterized by picosecond excimer fluorescence spectroscopy. The experimental results showed that 1,3-bis-(1-pyrene)propane and 1,10-bis-(1-pyrene)decane have similar local motions that bring two pyrene groups together to form excimers. Further, poly(1-pyrenylmethyl methacrylate) and a copolymer of methyl methacrylate and 1-pyrenylmethyl methacrylate in solution were found to have similar local motions that lead to excimer formation. In addition, the viscosity change during the polymerization of methyl methacrylate was monitored by measuring with picosecond fluorimetry the fluorescence lifetime of a trace amount of 1,3-bis-(1-pyrene)propane dissolved in methyl methacrylate.

706,182
PB86-195781 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Self-Diffusion in Concentrated Polystyrene Solutions Measured by Fluorescence Recovery After Photobleaching.
Final rept.
F. W. Wang, R. E. Lowry, and E. S. Wu. 1985, 3p
Pub. in Polymer 26, p1654-1656 1985.

Keywords: *Esterification, Polystyrenes, Reduction, Reprints, *Carboxylation, Photobleaching.

A polystyrene polymer of narrow molecular weight distribution was carboxylated, then reduced, and finally esterified with NBD-aminohexanoic acid (6-(7-nitrobenz-2-oxa-1,3-diazol-4-yl)-aminohexanoic acid). The self-diffusion of the NBD-labelled polystyrene polymer in concentrated solutions of the unlabelled polystyrene polymer was measured by the method of fluorescence recovery after photobleaching over a concentration range from 0.017 g/ml to 0.41 g/ml at room temperature. In the semi-dilute region, the concentration dependence of diffusion coefficient was found to be in agreement with the predictions of scaling concepts.

706,183
PB86-208469 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Structure of Metal-Coordinated Polymers: Laser Desorption of Poly(4-Vinylpyridine) and Poly(4-Vinylpyridine)-Metal Complexes.
Final rept.
R. A. Fletcher, and A. J. Fatiadi. 1984, 1p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Army Materials and Mechanics Research Center, Watertown, MA.
Pub. in Proceedings of Annual Conference on Microbeam Analysis Society (19th), Bethlehem, PA., July 16-20, 1984, Microbeam Analysis-1984, p14.

Keywords: *Polymers, *Metals, Lasers, Desorption, *Poly(4-vinylpyridine).

No abstract available.

706,184
PB86-231495 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Assignment of IR (Infra-Red) Band Near 680/cm in Polyethylene to Molecular Twist Boundaries.
D. H. Reneker, J. Mazur, and B. M. Fanconi. Nov 85, 3p
Pub. in Polymer Communications 26, p332-334 Nov 85.

Keywords: *Polyethylene, *Molecular structure, Polymers, Infrared spectra, Crystal defects, Reprints.

An infra-red absorption band in polyethylene near 680/cm is assigned to a rocking mode vibration of a twisted segment of a polyethylene zig-zag on the basis of calculations of the vibrational modes of defects in crystalline polyethylene in their minimum energy conformations. The twisted segments are probably associated with twist boundaries.

706,185
PB87-105151 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Polymer Science Standards Division.
Final rept.
R. K. Eby. 1982, 5p
Pub. in Kobunshi/High Polymers Japan 31, p1026-1030 1982.

Keywords: *Polymers, Projects, History, Research, Reprints, National Bureau of Standards.

The article (in Japanese) was prepared at the invitation of the Society of Polymer Science (Japan) for publication in its Official Bulletin, KOBUNSHI/High Polymer Science Japan. There has been research on polymeric materials since the early days of the United States National Bureau of Standards. The background and function of the Polymer Science and Standards Division is reviewed. The present program is discussed in the context of the large, rapidly growing, and economically important U.S. synthetic polymer industry which contributes strongly to national productivity. The program develops concepts, measurements, standards, and data that can be used to insure the reliable performance and effective use of polymers in solving national problems including the growth of industrial productivity, improved national security, more efficient government, a more scientific basis for regulation, improved health, and better materials utilization.

706,186
PB87-132262 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Chain Configurations in Lamellar Semicrystalline Polymer Interphases.
Final rept.
J. A. Marqusee, and K. A. Dill. 1986, 7p
Pub. in Macromolecules 19, n9 p2420-2426 1986.

Keywords: *Polymers, Lamellar structure, Reprints, Interphases.

A mean-field lattice theory is developed to describe the configurations of long-chain molecules at the crystal/amorphous interface in semicrystalline polymers. Chains are assumed to satisfy continuity and space-filling requirements. The theory permits systematic levels of approximation for correlations among neighboring bonds along the chains subject to the interfacial constraints. The authors consider the two lowest levels of approximation here: (i) single bonds (two segments) or (ii) bond pairs (three segments). Both models predict that approximately 73% of the chains which emerge from the crystal reenter at sites which are immediately adjacent and that the interfacial region should therefore be small, provided the chains are freely flexible. The models predict that the ratio of chain loops to ties in the amorphous region is smaller, and the mean lengths are greater, than predicted by random walk models.

706,187
PB87-134805 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Thermal Crosslinking Procedure for Preparing Solvent-Stable Polymer-Film Electrodes.
Final rept.
E. A. Blubaugh, W. C. Bushong, S. I. Shupack, and R. A. Durst. 1986, 9p
Pub. in Analytical Letters 19, n17-18 p1777-1785 1986.

Keywords: *Crosslinking, *Polymeric films, Electrodes, Porphyrins, Reprints.

Published procedures for polymer-film electrodes often give unsatisfactory results because of instability of the film-electrode interface or film dissolution. The authors report a procedure which involves the thermal crosslinking of polymer-film electrodes. These polymer films, prepared from a poly(vinylpyridine/styrene) copolymer, are stable toward a variety of solvents both polar and nonpolar. Electrochemical evaluation of these crosslinked polymer films after chemical derivatization with transition metal-porphyrin complexes is described. The electrochemical studies show that these catalyst-derivatized, polymer-film electrodes are stable for long periods of extended potential cycling through the observed redox couples. Also, the magnitude of the observed currents and peak separation indicates very facile electron transport and small uncompensated film resistance.

706,188
PB87-136693 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Institute for Materials Science and Engineering, Polymers: Technical Activities 1986.
Annual rept. 1 Oct 85-30 Sep 86.
L. E. Smith, and B. M. Fanconi. Nov 86, 103p
NBSIR-86/3437
See also PB86-196771.

Keywords: *Polymers, Chemical properties, Mechanical properties, Standards, Processing, Composite materials, Durability, Technical activities.

Technical Activities of the Polymers Division for FY 86 are reviewed. Included are descriptions of the 6 Tasks of the Division, project reports, publications, and other technical activities.

706,189
PB87-140208 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Towards a Theory for the Orientation Dependent Packing Entropy of Inhomogeneous Polymer Systems.
P. van der Schoot. Nov 86, 75p NBSIR-86/3466

Keywords: *Entropy, *Polymers, Orientation, Thermodynamic properties, Liquid crystals.

The report can be thought of as consisting of three parts. In the first part a review is given of Di Marzio's site fraction concept to calculate the configurational entropy of polymers in a homogeneous system. The second part is concerned with Monte Carlo calculations, performed to check the validity of this concept. Results are presented of the packing of rigid, rodlike polymer chains on a square lattice, in the spirit of earlier work by McCrackin. The third and last part of the report deals with the application of the site fraction treatment to the calculation of the configurational entropy of a polymeric system having a density gradient in one direction.

706,190
PB87-150827 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Physical Aging of PMMA in the Non-Linear Range: Torque and Normal Force Measurements.
Final rept.,
G. B. McKenna, and A. J. Kovacs. 1984, 4p
Sponsored by Centre National de la Recherche Scientifique, Strasbourg (France). Centre de Recherches sur les Macromolecules.
Pub. in Polymer Engineering and Science 24, n14 p1138-1141 1984.

Keywords: *Aging tests(Materials), *Polymethyl methacrylate, Polymers, Polyacrylates, Deformation, Reprints.

Cylindrical specimens of PMMA were quenched from above the glass transition and subsequently tested in torsion. Torque and normal force relaxation responses were recorded. The experiments were performed at 40 deg, 60 deg and 80 deg C, at increasing ageing times and at deformations of from 0.0027 to 0.074. It was found, at 40 deg and 60 C deg that, contrary to the classical picture of ageing, the small deformation torque relaxation curves could not be superposed by any combination of vertical and horizontal shifts. In the non-linear range of deformations the aging responses of the torque and normal forces are different. The double logarithmic shift rates for the normal force are significantly higher than are those for the torque at the same deformation over most of the range of deformations studied.

706,191
PB87-150835 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Time Dependent Strain Energy Function for a Polymeric Glass.
Final rept.,
G. B. McKenna, and L. J. Zapas. 1985, 8p
Pub. in Polymer 26, n4 p543-550 1985.

Keywords: *Polymers, *Glass, Polymethyl methacrylate, Torsion tests, Strain tests, Reprints, Polymeric glass.

Torsion and normal force measurements were made during single step stress relaxation experiments on a plymeric glass (PMMA). Isochronal data were analyzed using an approach adapted from that developed by Penn and Kearsley (for incompressible elastic materials) to determine the derivatives delta W/delta I(sub 1) of the time dependent strain energy function. delta W/delta I(sub 1) delta W/delta I(sub 2) are determined from the existing solution to the torsion of an incompressible cylinder. A spacial solution to the torsion of a compressible cylinder is presented and it is shown that the values of delta W/delta I(sub 2) and delta W/delta I(sub 1) obtained from the solution do not differ greatly from those obtained using the incompressible solution. It is found from both solutions that delta W/delta I(sub 1) is negative and increasing towards zero with increasing time and deformation while delta W/delta I(sub 2) is positive, greater in magnitude than delta W/delta I(sub 1) and decreases towards zero with increasing time and deformation.

706,192
PB87-152906 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Models of Chain Folding in Semicrystalline, Lamellar Polymers.
Final rept.,
M. L. Mansfield, C. M. Guttman, and E. A. DiMarzio. 1986, 8p
Pub. in Jnl. of Polymer Science, Polymer Letters Edition 24, p565-572 1986.

Keywords: *Polymers, Mathematical models, Reprints, Chain folding.

One possible theoretical treatment of the amorphous domains between crystalline lamellae in semicrystalline polymers is provided by the statistics of random walks between two absorbing parallel plane barriers. This so-called gambler's ruin model on the simple cubic lattice leads to a prediction of the amounts of random and adjacent reentry possible in semicrystalline polymer systems. Vonk has recently argued that when such walks are performed off-lattice, e.g., the freely jointed chain, they have average length 2L, rather than 3L, as predicted by the gambler's ruin model on a cubic lattice. This would seem to imply that the conclusions dictated by the lattice treatment are incorrect, and that only about one half of the stems are required to fold back abruptly. In this letter the authors explain the discrepancy between these two seemingly contradictory results. The authors show that both models lead to the same picture of the amorphous-crystalline interface, with over 2/3 of the stems turning back abruptly in both cases.

706,193
PB87-153276 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Radom-Walk Model of Chain Polymer Adsorption Behavior at Critical Energy and Relation to a Reflecting Boundary Condition.
Final rept.,
R. J. Rubin. 1984, 11p
Pub. in AIP Conference Proceedings, n109 p73-83 1984.

Keywords: *Polymers, *Random walk model.

It is found that there is a subtle difference between the set of energy-weighted random walks generated in the discrete random-walk model of polymer chain adsorption at the critical energy and the corresponding set of random walks generated in the presence of a reflecting boundary. This difference is lost in the continuous random flight model of adsorption of de Gennes.

706,194
PB87-153284 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Application of a Photodimerizable Probe to the Forced Rayleigh Scattering Technique for Measurement of Self-Diffusion of Polymer Chains.
Final rept.,
Q. Tran-Cong, T. Chang, C. C. Han, and Y. Nishijima. Nov 86, 4p
Pub. in Polymer 27, n1705-1708 Nov 86.

Keywords: *Polymers, Optical materials, Reprints, *Ether/bis(anthrylmethyl), Rayleigh scattering, Photodimerizable probe.

A new type of photochromic compound, a bis-(9-anthrylmethyl) ether (BAME), is introduced as a potential probe for the forced Rayleigh scattering (FRS) technique. Upon irradiation with ultra-violet (u.v.) light (approx. 360nm), BAME undergoes intramolecular dimerization which involves a large refractive index change in the visible region. The dimerization is known to be essentially irreversible in the absence of short u.v. light (approx. 250nm) at room and moderately high temperatures. A derivative of BAME is synthesized and chemically attached to polystyrene chains. Some photochemical properties of the BAME-labelled polystyrene are reported together with the results of a preliminary diffusion measurement of polystyrene by the FRS technique.

706,195
PB87-161667 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Novel Fluorescence Technique for Measurements of Additive Migration from Polymers.
Final rept.,
F. W. Wang, and B. F. Howell. 1984, 3p
Pub. in Polymer 25, n11 p1626-1628 1984.

Keywords: *Polymers, Antioxidants, Reprints, Diffusion coefficients, Phenylene diamine/N-N'(diphenyl), Thiophene/(benzoxazolyl-butyl)-di.

Diffusion coefficients for two antioxidants N,N'-diphenyl-p-phenylenediamine (DPPD) and 2,5-di(-5-tert-butyl-2-benzoxazolyl)thiophene (Uvitex OB) have been measured by extraction from a low density polyethylene film into 1-propanol at 22 degrees C. Extraction was done in a special cuvet-equipped vessel which excludes oxygen during extraction and permits direct fluorescence monitoring of the extraction solvent. Oxygen exclusion eliminates errors due to fluorescence quenching and anti-oxidant oxidation and allows precise measurement of the diffusion coefficient.

706,196
PB87-161675 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Synthesis and Self-Diffusion of Nitrobenzoxadiazole-Labeled Polystyrene.
Final rept.,
F. W. Wang, R. E. Lowry, and E. S. Wu. 1985, 5p
Pub. in Polymer Material Science and Engineering 52, p355-359 1985.

Keywords: *Synthesis(Chemistry), Polystyrene, Polymers, Diffusion, Reprints, *Benzofurazan/nitro.

A polystyrene polymer of narrow molecular weight distribution was carboxylated, then reduced, and finally esterified with NBD-aminohexanoic acid (6-(7-nitrobenz-2-oxa-1,3-diazol-4-yl)-aminohexanoic acid). The self-diffusion of the NBD-labeled polystyrene polymer in concentrated solutions of the unlabeled polystyrene polymer was measured by the method of fluorescence recovery after photobleaching over a concentration range from 0.017 g/ml to 0.41 g/ml at room temperature. In the semidilute region, the concentration dependence of diffusion coefficient was found to be in agreement with the predictions of scaling concepts.

706,197
PB87-167680 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Superposition of Small Shear Deformations on Large Uniaxial Extensions for Viscoelastic Materials.
Final rept.,
L. J. Zapas, and A. Wineman. 1985, 5p
Pub. in Polymer 26, n7 p1105-1109 1985.

Keywords: *Polymers, *Viscoelasticity, Deformation.

The equation for small amplitude torsional response superposed on a finite axial stretch history is derived for a material modeled by the BKZ constitutive equation. For the case of a uniaxial step stretch history, this equation contains a term generalizing the well known Rivlin result for nonlinear elasticity plus two additional terms. The equation is used to analyze a recent experiment which studies the relation between the period of free torsional oscillations, axial stretch and axial force in a material undergoing stress relaxation. It is shown that a 10% discrepancy which arises when the data is related by Rivlin's formula can be accounted for by the two additional terms associated with the BKZ formulation. Finally, an expression for the complex modulus for forced torsional oscillations is derived.

706,198
PB87-190146 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Natural-Abundance (13)C-(13)C Spin Exchange in Rigid Crystalline Organic Solids.
Final rept.,
D. L. VanderHart. 1987, 35p
Pub. in Jnl. of Magnetic Resonance 72, p13-47 1987.

Keywords: *Magnetic resonance, *Spin lattice relaxation, *Polymers, Polyethylene, Cellulose, Crystal structure, Mathematical models, Solids, Diffusion, Lattice vibrations, Reprints, Spin exchange.

Natural-abundance 13C-13C spin exchange, in the presence of proton dipolar couplings, has been investigated for the crystalline regions of two semicrystalline polymers, linear polyethylene (LPE), and cellulose. Because of very long longitudinal relaxation times, spin exchange could be followed to times exceeding 100 s. The paper focuses on the behavior of spin exchange at the longer times. The incentive for investigating LPE was that other published work on this system suggested that spin exchange proceeded more rapidly than theory would predict. The results on an oriented sample were similar to those reported. In addition, however, the spin-exchange behavior had an unexpected temperature dependence which, in turn, was attributed to temperature-dependent chain transport through the crystalline lattice. In the low-temperature limit, spin exchange was consistent with theory. In cellulose whose monomer contains six different carbons and whose crystal structure imposes magnetic inequivalence on certain carbons there also exist questions about crystalline polymorphy. Spin exchange was studied following a selective population perturbation of only one multiplet component within the CI resonance pattern. Results reenforced the hypothesis of polymorphy. Mathematical modeling of spin exchange in LPE and cellulose was carried out using an isolated-pair approximation.

706,199
PB87-190245 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Longitudinal Acoustic Mode Frequencies of Polyethylene Chains Containing Defects.
Final rept.,
J. Mazur, D. H. Reneker, and B. M. Fanconi. Mar 87, 4p
Pub. in Polymer Communications 28, p78-81 Mar 87.

Keywords: *Raman spectra, *Polyethylene, Crystal lattices, Defects, Crystal dislocations, Molecular vibration, Reprints, Longitudinal acoustic mode, LAM vibration.

The relation between the longitudinal acoustic mode (LAM) frequencies of crystalline polyethylene and detailed morphological models was investigated. The morphological arrangement of conformational defects which fit into the lattice and which contain gauche dihedral angles was shown to determine the LAM frequencies. The internal structural details of the defect and the conformation of adjacent chains are relatively unimportant. The LAM frequencies are inversely proportional to the sum of the length of the all-trans segment and to a quantity 2Lambda which represents the masslike effect of the defect region on the LAM vibration. Delta was found to have a value of 3.75 + or - 0.25 A, which is independent of the exact conformation of the defect.

706,200
PB87-190260 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Solubilities of BHT in Various Solvents.
Final rept.,
S. S. Chang, and J. R. Maurey. 1985, 4p
Pub. in Jnl. of Chemical Engineering Data 30, n4 p384-387 1985.

Keywords: *Solubility, *Toluene, Antioxidants, Polymers, Solvents, Ethanols, Water, Corn oil, Alcohols, Heat measurement, Heptanes, Phase diagrams, Polyethylene, Glycerides, Reprints, BHT.

BHT (3,5-di-tert-butyl-4-hydroxytoluene) is a widely used antioxidant in polymers as well as in many other applications. The solubilities of BHT in various solvents, such as n-heptane, ethanol, water, ethanol/water mixtures, n-octanol and corn oil, have been determined. The solubility of BHT in n-heptane is found to be slightly less than the ideal solubility predicable from calorimetric constants of BHT. Application of the solubility data from this research and from the literature are used to derive partition coefficients for BHT between solvents and polymers.

706,201
PB87-190997 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Phase Diagram and Morphology of Blends of Poly(vinylidene fluoride) and Poly(ethyl acrylate).
Final rept.,
R. Briber, and F. A. Khoury. 1987, 9p
Pub. in Polymer 28, p38-46 Jan 87.

Keywords: *Phase diagrams, *Crystallization, *Polymers, Blends, Morphology, Spherulites, Crystal structure, Reprints, Polyethylacrylate, Polyvinyledene fluoride, Polymer blends.

The phase diagram and crystallization behavior of the polymer blend system consisting of poly(vinylidene fluoride) (PVF2) and poly(ethyl acrylate) (PEA) have been examined. The melt exhibits phase separation upon heating to 10 C-50 C above the melting point of the PVF2, depending on the composition. The cloud point and equilibrium melting point curve intersect at about 180 C and a composition of 50% (by weight) PVF2. Spherulite growth rate data have been measured as a function of composition and temperature. In blends crystallized from the one phase melt the texture of spherulites becomes more open and the spherulite extinction ring spacing (due to lamaller twist) becomes larger with increasing crystallization temperature. In addition the ring spacing increases with PEA content at constant crystallization temperature.

706,202
PB87-196903 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Novel Fluorescence Method for Cure Monitoring of Epoxy Resins.
Final rept.,
F. W. Wang, R. E. Lowry, and B. M. Fanconi. 1986, 4p
Sponsored by Army Research Office, Research Triangle Park, NC.
Pub. in Polymer 27, p1529-1532 Oct 86.

Keywords: *Cure monitoring, Polymerization, Excimer, Fluorescence, Local viscosity, Process control, Spectroscopy, Reprints, *Epoxy resins.

The fluorescence spectra of organic dyes dissolved in epoxy resins are sensitive to local viscosity. The excimer forming dyes are particularly useful as probes since the monomer emission can be used as an internal standard in the measurement. In this case, the probability of excimer formation is related to molecular mobility and hence to the microviscosity. The approach has been demonstrated on epoxy resins. In another approach, trace amounts of 1-(4-dimethylaminophenyl)-6-phenyl-1,3,5-hexatriene (DMA-DPH) and 9,10-diphenylanthracene (DPA) are added to an epoxy resin. The fluorescence intensity of DMA-DPH increases with the increase in local viscosity while the fluorescence intensity of DPA is insensitive to local viscosity and can be used as an internal standard. The ratio of the fluorescence intensities of DMA-DPH and of DPA has been measured to monitor the cure of epoxy resins.

706,203
PB87-196911 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Cure Monitoring of Epoxy Resins by Fluorescence Recovery After Photobleaching.
Final rept.,
F. W. Wang, and E. S. Wu. 1987, 3p
Sponsored by Army Research Office, Research Triangle Park, NC.
Pub. in Polymer Communications 28, p73-75 Mar 87.

Keywords: *Fluorescence recovery, *Epoxy resins, Reprints, *Cure monitoring, Photobleaching.

The diffusion coefficients of organic dyes dissolved in epoxy resins are sensitive to the local viscosity. The diffusion coefficient of a fluorescent probe dissolved in epoxy resins has been measured by fluorescence recovery after photobleaching to monitor the cure of epoxy resins.

706,204
PB87-197687 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Polymer Diffusion in an Interacting System.
Final rept.,
C. C. Han, T. Sato, M. Okada, and C. Wu. 1987, 3p
Pub. in Polymer Preprints, ACS 28, n1 p358-360 1987.

Keywords: *Interaction parameters, *Polymer diffusion, Neutron scattering, Light scattering, Reprints, PS/PVME, Sinodal decomposition.

The apparent diffusion coefficient, Dapp, has been measured for a binary polymer system of deuterated polystyrene/poly(vinyl methyl ether). This has been measured by time resolved light scattering technique of observing the demixing (temperature jump) or remixing (reverse quench) of the system. Together with the temperature and composition dependence of the effective interaction parameter, y, obtained from small angle neutron scattering experiment, the mobility, M, can also be extracted. It is shown that Dapp decreases as the temperature of the system increases and changes sign at the critical point. Also, the mobility, M, has an Arrhenius type of temperature dependence in the temperature range of the authors study, (approx. 130 degs C to 160 degs C) with an activation energy of 37 Kcal/mole.

706,205
PB87-197695 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Thermodynamic and Hydrodynamic Properties of Dilute Solutions of Cyclic and Linear Polystyrenes.
Final rept.,
G. Hadziioannou, P. Cotts, G. ten Brinke, C. Han, P. Lutz, C. Strazielle, P. Rempp, and A. Kovacs. 1987, 5p
Pub. in Macromolecules 20, n3 p493-497 1987.

Keywords: *Polymers, *Light scattering, Radius of gyration, Neutron scattering, Reprints.

The thermodynamic and hydrodynamic properties of cyclic and linear polystyrenes, ranging from 10,000 to 180,000 molecular weight, in dilute solutions of cyclohexane have been measured by small-angle neutron scattering (SANS) and dynamic light scattering. The diffusion coefficient D(c) = D(0)(1 + kDc), was found to be negative and was, within experimental error, independent of molecular architecture. The molecular weight dependence of the radius of gyration, the hydrodynamic radius, and kD is discussed.

706,206
PB87-198156 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Flammability.
Final rept.,
R. G. Gann, R. A. Dipert, and M. J. Drews. 1986, 57p
Pub. in Encyclopedia of Polymer Science and Engineering, v6 p154-210 1986.

Keywords: Fire tests, Flame retardants, Flammability, Plastics, Polymers, Pyrolysis, *Fire retardants.

The combustible materials in most fatal fires is polymeric in nature. Whether natural or synthetic, these solid fuels account for 94% of lives lost, 80% of reported injuries, and 94% of property lost in residential fires in the United States (1). As a result, numerous tests have been devised for flammability and many codes and regulations cite them. Not coincidentally, significant effort has been devoted to improve the fire resistance of polymers. Such progress relies on understanding the nature of fire, fuel properties and how to measure them, and the mechanisms of polymer degradation.

706,207
PB87-203865 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Analysis of Damage Profiles in Poly(methyl methacrylate) in Terms of Oxygen Diffusion and Consumption.
Final rept.,
B. Dickens, J. W. Martin, and D. Waksman. 1986, 15p
Pub. in Polymer Degradation and Stability 15, p265-279 1986.

Keywords: *Methacrylates, Oxygen, Diffusion, Oxidation, Solubility, Polymers, Degradation, Stability, Reprints, *Chain scission, *Activation energy, *Photolysis, Polymethyl methacrylate.

Profiles of photolytically induced chain scissions in poly(methyl methacrylate) (PMMA) and oxygen diffusion and solubility parameters have been used to estimate the activation energy of the chain scission proc-

ess. The resulting activation energy of 19 kcal/mol, which does not include contributions from the activation energies of oxygen diffusion and solubility, suggests that the temperature-sensitive changes in photolytic scission in PMMA arise from changes in the efficiency of the cage effect.

706,208
PB87-224499 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Simulation of Polymer Chain Dynamics by Lattice Models with Excluded Volume: Lattice Dependence.
Final rept.,
P. H. Verdier, and D. E. Kranbuehl. 1987, 7p
Pub. in Macromolecules 20, n6 p1362-1368 1987.

Keywords: Diffusion, Dilute solutions, Monte Carlo, Simulation, Solution properties, Reprints, *Polymer chain dynamics, Bread stick models, *Lattice model polymer chains, Relaxation times.

The effects of varying the lattice and the elementary move rules upon the dynamical behavior of bead-stick models of polymer chains with excluded volume have been studied by computer simulation. Long relaxation times and translational diffusion constants are reported for chains on body-centered cubic, face-centered cubic, and simple cubic lattices, for chains not constrained to lie on a lattice, for one-bead and two-bead elementary moves, and for random mixtures of one- and two-bead moves. The chain-length dependence of the effects of excluded volume upon long relaxation times is similar for all three lattices: When only one kind of elementary move (one-bead or two-bead) is employed, the chain-length dependence of the long relaxation times is increased by somewhat more than the first power of chain length for all three lattices. When a mixture of two kinds of elementary moves is employed, the increase in chain-length dependence drops to somewhat more than the 0.5 power. However, when the requirement of lying on a lattice is removed altogether from chains using both kinds of elementary move, the chain-length dependence increases to roughly the common value found for lattice chain simulations using only one kind of elementary move. The behavior of the translational diffusion constants parallels that of the long relaxation times.

706,209
PB87-231338 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Polyesters: A Review of the Literature on Products of Combustion and Toxicity.
Final rept.,
E. Braun, and B. C. Levin. 1986, 17p
Sponsored by Consumer Product Safety Commission, Bethesda, MD.
Pub. in Fire and Materials 10, p107-123 1986.

Keywords: *Polyesters, *Toxicity, Reviews, Thermal decomposition, Reprints, *Combustion products, Flame retardants, Pyrolysis.

The available literature was reviewed to determine the nature and extent of information available on the thermal decomposition products and the toxicity of the combustion products of polyester materials used in consumer applications such as textiles and building construction. The literature review is limited to those publications printed in English through June 1984. The thermal decomposition products of polyesters are a function of temperature and oxygen content of the atmosphere. In general, as the temperature increases, the quantity of heavier hydrocarbons decreases and the production of CO and CO2 increases. The presence of flame retardant additives, such as bromine and chlorine-containing compounds, produce halogenated combustion products. The use of phosphorus and bromine together in the same flame retardant finish increases the concentration of low molecular weight compounds. Thirteen different test protocols have been used to evaluate the toxicity of various types of polyester. Non-flame retarded polyesters give measured LC50 values ranging from 30.5m to 95.7 mg/l, while flame retarded polyesters, have LC50 values ranging from 24.0 mg/l to 38.0 mg/l. Several exceptions, however, are noted. Toxicologists consider these differences to be not significant. In general, the results from large-scale tests are ambigous because of the presence of other materials in addition to the polyesters.

706,210
PB87-231353 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Acrylonitrile-Butadiene-Styrene Copolymers (ABS): Pyrolysis and Combustion Products and Their Toxicity--A Review of the Literature.
Final rept.,
J. V. Rutkowski, and B. C. Levin. 1986, 13p
See also PB86-153772. Sponsored by Consumer Product Safety Commission, Bethesda, MD.
Pub. in Fire and Materials 10, p93-105 1986.

Keywords: *Carbon monoxide, *Combustion products, *Toxicity, Reviews, Hydrogen cyanide, Thermal decomposition, Reprints, ABS plastics.

A review of the literature was undertaken to ascertain the current knowledge of the nature of the thermal decomposition products generated from ABS and the toxicity of these evolved products in toto. The literature review encompasses English language publications available through June 1984. The literature surveyed showed that the principal ABS thermoxidative degradation products of toxicologic importance are carbon monoxide and hydrogen cyanide. The experimental generation of these and other volatile products is principally depenent upon the combustion conditions and the formulation of the plastic. The toxicity of ABS thermal degradation products has been evaluated by five methods. The LC50 (30 min exposure + 14 day post-exposure period) values for flaming combustion ranged from 15.0 mg to 28.5 mg. In the non-flaming mode of combustion, the LC50 values ranged from 19.3 mg to 64.0. Therefore, no apparent toxicological difference exists between the flaming mode and the non-flaming mode. The toxicity of ABS degradation products was found to be comparable with the toxicity of the thermal decomposition products of other common polymeric materials.

706,211
PB87-231486 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Intramolecular Photodimerizable Probe (BAME) for Mass Diffusion Measurements by the Forced Rayleigh Scattering.
Final rept.,
C. C. Han, Q. Tran-Cong, and T. Chang. 1987, 2p
Pub. in Polymer Preprints 28, n1 p371-372 1987.

Keywords: Polymers, Reprints, *Forced Rayleigh scattering, *Intramolecular photodimerizable probe, Mass diffusion, Probe molecule, Polystyrene, BAME.

A new photochromic probe, 9-bis anthryl methyl ether (BAME) derivative, was synthesized and introduced as an effective probe for the Forced Rayleigh Scattering (FRS) technique. It is shown that BAME and polystyrene labeled with BAME exhibit a large change in refractive index under irradiation with UV light (363.8 nm). The self-diffusion of BAME and polystyrene labeled with BAME (PSA) were measured in various solvents. Self-diffusion coefficients of PSA in good, marginal and poor solvents are consistent with those obtained from quasi-elastic light scattering (QELS). Some exceptions of using BAME as a probe are shown in fluorescence quenching solvents. Results indicate that BAME can be used as an effective probe, which overcome some problems other photochromic probes are having in certain systems for mass diffusion measurements by FRS.

706,212
PB87-233425 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Small Angle Neutron Scattering of Partially Segregated Polymer Blends.
Final rept.,
W. Wu. Jan 83, 4p
Pub. in Polymer 24, p43-46 Jan 83.

Keywords: *Polymers, Macromolecules, Reprints, *Long chain conformations, *Neutron scattering, Gyration radius, Segregations, Small angle scattering.

Small angle neutron scattering (SANS) has been used extensively to investigate the conformation of macromolecules. However, the scattered intensity has been found to be extremely sensitive to the segregation of the isotopic labelled species. The segregation has resulted in enormous increases in both the radius of gyration and the molecular weight. A theoretical treatment based on the Zernicke-Prins equation with a modified pair correlation function has been developed in this work; the size and the degree of segregation can be calculated from the scattering data using the equations obtained herein.

706,213
PB87-233805 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Degradation and Pyrolysis Mechanisms.
Final rept.,
J. H. Flynn, and R. E. Florin. 1985, 60p
Pub. in Pyrolysis and Gas Chromatography in Polymer Analysis, Chapter 4, p149-208 1985.

Keywords: *Polymers, Gas chromatography, Kinetics, Mass spectrometry, Pyrolysis, Reprints, *Carbonization, Ceiling temperature, Depolymerization, Flash pyrolysis, Thermal degradation.

Thermal degradation mechanisms for organic homopolymers, copolymers and blends are discussed with emphasis on their relationship to mass spectrometry and gas chromatography. The pyrolysis mechanisms have been fitted into four types: random scission, depolymerization, carbonization and side group reactions. Applications of programmed temperature to the analysis of these systems and the effects of higher temperatures on the mechanism and product distribution are discussed. It contains 112 references and a bibliography for further reading.

706,214
PB88-100722 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Comparisons among Process Monitoring Techniques.
Final rept.,
B. M. Fanconi, F. W. Wang, and D. L. Hunston. 1987, 3p
Pub. in Proceedings of SPE Annual Technical Conference and Exhibit (45th), p1100-1102 1987.

Keywords: *Polymer composites, *Process monitoring, Viscosity, Ultrasonics, Flurescence probes, Dielectric measurements, Differential scanning calorimetry.

Comparisons are made among six different techniques used to monitor the processing of polymer matrix composites. Three techniques, two using fluoescence probes and the third based on ultrasonics, that have potential for on-line processing are discussed in detail. Results from these techniques are compared to laboratory measurements of viscosity, conductance, and heat evaluation.

706,215
PB88-100730 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Electron Microscopy of Polymer Blends.
Final rept.,
R. M. Briber. 1987, 4p
Pub. in Proceedings of Annual Meeting of the Electron Microscopy Society of America (45th), Baltimore, MD., August 3-7, 1987, p506-509.

Keywords: *Electron microscopy, Morphology, Phase separation, Polybenzimidazole, *Polymer blends, Polyvinylidene.

Polymer blends have come to play an increasingly important role in materials science as the need for polymeric materials with wider ranging properties has developed. Data will be presented in the paper on two polymer blend systems that have benefited from the use of electron microscopy in understanding the complex morphologies than can occur in polymer systems.

706,216
PB88-100748 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Microanalysis and Electron Energy Loss Spectroscopy of Polymers.
Final rept.,
R. Briber. 1987, 4p
Pub. in Proceedings of Annual Meeting of the Electron Microscopy Society of America (45th), Baltimore, MD., August 3-7, 1987, p430-433.

Keywords: *Compositional analysis, *Electron microscopy, Electron energy loss spectroscopy, Microanalysis, Microscopy.

Analytical electron microscopy has progressed in recent years such that quantitative chemical information can be obtained from very small volumes of sample. In principle, the composition of regions on the order of a few nanometers in both diameter and thickness can be determined using energy dispersive x-ray analysis (EDS) and electron energy loss spectroscopy (EELS) (1,2). In the case of organic polymers the limitations to quantitative microanalysis are generally due to the sample and not to the instrument. Radiation damage induced mass loss often proves to be the constraining factor in obtaining quantitative information from small volumes of sample (3). The principles and processes of radiation damage in organic materials and polymers can be found in various review articles (4,5).

706,217

PB88-140934 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
SANS (Small Angle Neutron Scattering) and SAXS (Small Angle X-ray Scattering) Studies on Molecular Conformation of a Block Polymer in Microdomain Space. 2. Contrast Matching Technique.
Final rept.,
H. Hasegawa, H. Tanaka, T. Hashimoto, and C. C. Han. 1987, 8p
Pub. in Macromolecules 20, n9 p2120-2127 1987.

Keywords: Reprints, *Block copolymer, *Contrast matching, *Microdomain space, Molecular conformation, Small angle neutron scattering.

The authors critically tested the contrast matching technique in the small-angle neutron scattering from block polymers to study the molecular conformation of a block polymer chain in microdomain space. It was found that the blending of deuteriated and undeuteriated block polymers with a composition to produce zero contrast ('contrast matching') does not always result in true contrast matching even in the case of the two block polymers mixed at a molecular level in the microdomain space. The true matching is expected to occur only in the case when the deuteriated block polymers overlap each other in the domain space to produce uniform segmental density of their own at the given composition, giving rise to the zero contrast between each microdomain. However, even in the event of incomplete contrast matching, the suppression of the domain scattering by 2 orders of magnitude was attained, which enabled us to measure the component of the radius of gyration of the block polymer chain parallel to the interface with much better accuracy than the previous work without the contrast matching. The component was again found to be 70% of the component for the unperturbed chain.

706,218

PB88-140942 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Relationship of Intrinsic Viscosity of Polymer Solutions to Molecular Weight.
Final rept.,
F. L. McCrackin. 1987, 4p
Pub. in Polymer 28, p1847-1850 Oct 87.

Keywords: Reprints, *Intrinsic viscosity, Mark-Houwink equation, *Polymer solutions, Polystyrene, Theta solvent.

An equation derived by Han relating intrinsic viscosity to molecular weight of a polymer has been fitted to experimental data over a large range of molecular weight. Excellent fits were obtained although the Mark-Houwink equation did not fit the data over the complete molecular weight range. Han's equation may be fit to intrinsic viscosity data over a moderate range of molecular weight, and is shown to then accurately predict the intrinsic viscosities for molecular weights outside the range. A method is given to compute the two parameters of Han's equation from the Mark-Houwink parameters of a polymer in a solvent.

706,219

PB88-140967 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Motion of Polymers Near Surfaces.
Final rept.,
E. A. DiMarzio. 1985, 14p
Pub. in AIP (American Institute of Physics) Conference Proceedings, n137 p271-284 1985.

Keywords: *Polymers, Surface(Chemistry), Fluid flow, Reptation.

Three separate polymer problems that involve motion near surfaces are considered. The first is Separation by Flow (SBF) according to which large polymer molecules flow through a capillary faster than small polymers. The large molecules favor the central region of the tube where the fluid velocity is highest. The second problem is to determine the effect of a linear shear field on isolated polymers that are covalently attached to a surface immersed in flowing fluid. It is found that the power dissipation is 4 times higher than for a polymer freely flowing in the fluid. The third problem is to calculate reptation times in the presence of applied force fields. This last problem has applications to: (1) diffusion at an interface; (2) reptation in a shear field; (3) electrophoresis; (4) diffusion in a random force field. If the force field is large enough the reptation times get so large that the reptation concept itself fails.

706,220

PB88-152640 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Vibrational Predissociation Dynamics of Weakly Bonded Dimers: A Summary.
Final rept.,
D. S. King. 1987, 5p
Pub. in Structure and Dynamics of Weakly Bound Molecular Complexes, p593-597 1987.

Keywords: *Dimerization, Ethylene, Nitrogen oxide(NO), Tetrazines, Chemical bonds, Reaction kinetics, Reprints, *Dimers, Predissociation.

Summary of molecular dynamics section of NATO ARW on Clusters held in Maratea, Italy, September 1986.

General

706,221

PATENT-4 217 264 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microporous Glassy Fillers for Dental Resin Composites.
Patent.
C. P. Mabie, and D. L. Menis. Filed 11 Sep 78, patented 12 Aug 80, 23p PB80-600029, PAT-APPL-941 308

Keywords: *Dental composite resin restorations, Finishability, Gelled inorganic 'polymers', Microporous filler, System nontoxicity, X-ray opacification.

A microporous filler for dental composite resin restorations has been developed which gives greatly improved finishability, system nontoxicity and x-ray opacification. These fillers are prepared from frits obtained by the low temperature calcination of gelled inorganic 'polymers' followed by a pulsed high-heat treatment.

706,222

PATENT-4 681 855 Not available NTIS
Department of Commerce, Washington, DC.
Humidity Sensing and Measurement Employing Halogenated Organic Polymer Membranes.
Patent,
P. H. Huang. Filed 5 Aug 85, patented 21 Jul 87, 7p PB87-218400, PAT-APPL-6-762 740
Supersedes PB85-246866.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Patents, *Humidity, *Moisture content, *Polymers, Membranes, Sensors, Laboratory equipment, High temperature tests, Acids, Halogen organic compounds.

The invention is thin films of hygroscopic, halogenated organic polymer having pendant groups of a relatively strong acidic type (e.g., sulfonic groups) and pendant groups of a relatively weak acidic type (e.g., carboxylic groups) employed for humidity sensing by electronic, acoustic, and optical techniques.

706,223

PB-265 432/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Design of a Three-Stage Alkali Beam Source.
Final rept.,
M. Lambropoulos, and S. E. Moody. 1977, 4p
Pub. in Rev. Sci. Instrum., v48 n2 p131-134 Feb 77.

Keywords: *Sodium, *Atomic beams, Alkalinity, Reprints, Dimers.

A three-stage effusive alkali beam source is described in detail. Among the advantages of this device over ordinary effusive ovens are greatly increased intervals between refillings, and the production of beams with significantly reduced alkali dimer densities.

706,224

PB-270 044/1 PC **A11**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards. Section A. Physics and Chemistry. Volume 81A, Number 1, January-February, 1977.
Bi-monthly rept.
1977, 247p JNBAAR-81A(1)
Library of Congress catalog card no. 62-37059. Consists of PB-270 045 thru PB-270 051. See also PB-254 239-03.

Keywords: *Chemical properties, Atomic weight, Gallium, Vapor pressure, Ice, pH, Potassium, Phthalates, Iodine, Visible spectrum, Humidity, Solutions, Binary systems(Materials), Mathematical models, Polymers, Potassium phthalates, Scientific research.

Contents:
- On the atomic weight of gallium;
- Vapor pressure formulation for ice;
- Standard pH values for the potassium hydrogen phthalate reference buffer solution from 0 to 60C;
- Atlas of the I2 spectrum from 19,000 to 18,000 cm;
- The NBS two-pressure humidity generator;
- Humidity fixed points of binary saturated aqueous solutions;
- and Frequency dependence of intrinsic shear and birefringence tensor of Bead/Spring model of polymer solutions.

706,225

PB-270 047/4
(Order as PB-270 044/1, PC **A11**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Standard pH Values for the Potassium Hydrogen Phthalate Reference Buffer Solution from 0 to 60 Degrees C.
H. B. Hetzer, R. A. Durst, R. A. Robinson, and R. G. Bates. 1977, 4p JNBAAR-81A(1)-3
Included in Jnl. of Research of the National Bureau of Standards, Section A, Physics and Chemistry, v81A n1 p21-24 Jan-Feb 77. Prepared in cooperation with Florida Univ., Gainesville. Dept. of Chemistry.

Keywords: *pH, Buffers(Chemistry), Standards, Potassium, Phthalates, *Potassium phthalates, Reprints.

The standard pH values of the solution of potassium hydrogen phthalate (molality 0.05 mol/kg) have been redetermined over the temperature range 0 to 60C, using SRM 185d. Extensive measurements were made of the emf of cells of the type Pd;H2(g, 1 atm)/KH phthalate (m = 0.05), KCl (m)/AgCl;Ag where m(KCl) was 0.015, or 0.005 mol/kg, from which values of the acidity function p(alpah H, gamma cl) were derived. The pH convention defines gamma cl in the range of ionic strengths 0 to 0.1 mol/kg and permits conventional values of p(alpah H) to be obtained. According to NBS procedures p(alpha H) for selected reference solutions is identified with the standard pH(S) in the operational definition of pH.

706,226

PB-270 049/0
(Order as PB-270 044/1, PC **A11**/MF **A01**)
National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.

NBS Two-Pressure Humidity Generator, Mark 2.
S. Hasegawa, and J. W. Little. 1977, 7p JNBAAR-81A(1)-5
Included in Jnl. of Research of the National Bureau of Standards, Section A, Physics and Chemistry, v81A n1 p81-88 Jan-Feb 77.

Keywords: *Gas generating systems, *Humidity, *Calibrating, *Hygrometers, Performance evaluation, Reprints.

A new humidity calibration facility which uses the two-pressure principle for generating gas of known humidity has been developed at NBS for calibrating and testing hygrometers. The relative humidity range of the two-pressure humidity generator is 3 to 98 percent for ambient temperatures -60 to 80C and test chamber pressures 5 to 200 kPa (absolute). This is equivalent to a nominal dew/frost point range of -80 to 80C. Intercomparison tests were made with the NBS standard gravimetric hygrometer over a portion of the generator's operating range. The estimated maximum uncertainty (three standard deviations) is 0.2 percent RH for temperatures 0 to 80C which in units of dew point corresponds to an estimated maximum uncertainty of 0.04C for dew points -35 to 80C.

706,227
PB-270 050/8
(Order as PB-270 044/1, PC **A11**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Humidity Fixed Points of Binary Saturated Aqueous Solutions.
L. Greenspan. 1977, 8p JNBAAR-81A(1)-6
Included in Jnl. of Research of the National Bureau of Standards, Section A, Physics and Chemistry, v81A n1 p89-96 Jan-Feb 77.

Keywords: *Humidity, *Solutions, Binary systems, Standards, Hygrometers, Vapor pressure, Calibrating, Tables(Data), Reprints, Relative humidity, Fixed points.

An evaluated compilation of equilibrium relative humidities in air versus temperature from pure phase to approximately 100,000 pascal (1 atm) in pressure is presented for 28 binary saturated aqueous solutions. The relative humidities of the solutions range from about 3 to 98 percent. Using a data base from 21 separate investigations comprising 1106 individual measurements, fits were made by the method of least squares to regular polynomial equations with two through four coefficients. Equations and tables are presented along with the estimated uncertainties in the correlated results.

706,228
PB-282 191/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Statistics and Standard Reference Materials.
Final rept.,
J. Mandel. Oct 77, 6p
Pub. in ASTM Standard News, v5 n10 p10-15 Oct 77.

Keywords: *Standard reference materials, Measurement, Tests, Reprints.

The purpose of this paper is to place the use of standard reference materials in proper perspective within the larger framework of the evaluation of measuring and testing methods. According to the dictionary, the term measurement has a dual meaning: 'the act or process of measuring,' and a 'figure, extent, or amount obtained by measuring.' The distinction is not pedantic for while we are often interested in the quality of an individual measurement result, we cannot, in general evaiuate this quality except through a study of the method by which the result was obtained.

706,229
PB-283 854/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Possible Areas of Effort by the International Committee on Radionuclide Metrology in the Field of Low-Level Radioactivity Measurements.
Final rept.,
J. M. R. Hutchinson. 1978, 4p
Pub. in Proceedings of Seminar on Metrology Needs in the Measurement of Environmental Radioactivity, Paris, France 4-6 Oct 76, Paper in Environ. Int. v1 n1/2 p11-14 1978.

Keywords: *Radioactivation analysis, *Surveys, Metrology.

The results of a survey of the metrology needs in the field of low-level radioactivity measurements are reported.

706,230
PB-293 918/9 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Automation of the Ion Energetics Data Center.
Final rept.
R. Thompson, W. Webb, and H. M. Rosenstock. Dec 77, 83p NBSIR-78-1432
Sponsored in part by National Inst. of General Medical Sciences, Bethesda, MD.Portions of this document are not fully legible.

Keywords: *Ions, *Information centers, *Documentation, Automatic abstracting, Heat of formation, Ionization potentials, Electric potential, Data processing, Electrons, Gases, Computer programming, Automation, Information retrieval, Manuals, Information systems, *Data bases, Data compilation, Electron attachment, IONPACK system, WREFS computer program, IASORT computer program, IASTRP computer program, Computer applications, Information processing, Molecular ions.

The Ion Energetics Data Center is engaged in the compilation, evaluation and dissemination of experimental information on gaseous ion energetics. Outputs include bibliographic and tabular information on ionization potentials, appearance potentials, electron affinities and heats of formation of gaseous positive and negative ions. The operation of the data center is discussed. This operation has recently been automated by the development of a set of computer programs, called IONPACK, which minimize the manual effort required for the numerous file manipulations and editing steps necessary to produce the data center output. The functions of the programs are outlined and the associated operating procedures are described in detail. Full documentation of the programs are presented in a separate reports.

706,231
PB-294 666/3 PC **A06**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.
NBS Standard Reference Materials Catalog, 1979-80 Edition.
R. W. Seward. Apr 79, 111p NBS-SP-260
Supersedes COM-75-10943. Library of Congress catalog card no. 79-600021.

Keywords: *Catalogs(Publications), Standards, Chemical composition, Physical properties, Engineering standards, *Standard reference materials.

This Catalog lists those Standard Reference Materials (SRM's), Research Materials (RM's), and Special Reference Materials (GM's) that are available from the National Bureau of Standards (NBS), and those that are soon to be available. The Catalog describes these materials as to their certified characterization, unit size, and type, as well as providing ordering information. Prices for these materials are listed separately in annual supplements to this Catalog.

706,232
PB-296 439/3 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards. Volume 84, Number 2, March-April 1979.
Bi-monthly rept.
1979, 80p
See also Volume 83, Number 2, PB-283 996.

Keywords: *Physical chemistry, Psychrometers, Laboratory equipment, Group theory, Moisture content, Silver, Matrices(Mathematics), Chemical analysis, Monomolecular films, Nonfree groups, Faraday.

Contents:
- A novel method for analyzing silver sediment with high precision;
- Psychrometric wet element as a bias for precise physico-chemical measurements;
- Non-free groups generated by two parabolic matrices.

706,233
PB-296 931/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nuclear Medicine and Clinical Chemistry (NBS) - Standard Reference Materials.
Final rept.
J. P. Cali. 1977, 4p
Pub. in Proceedings Symp. on Standardization, Performance and Quality Control in Nuclear Medicine, Held at Gaithersburg, MD. on 12-14 Jun 75. Paper in Quality Control in Nuclear Medicine, Radiopharmaceuticals, Instrumentation, and in Vitro Assays, ch16 p150-153, 1977.

Keywords: *Clinical medicine, Standards, Error analysis, Electrolytes, Calibrating, Blood analysis, Lead(Metal), Glucose, *Standard reference materials.

Since 1967, NBS has been deeply involved in a program dedicated to the improvement of the reliability of measurements in clinical chemistry. NBS views its role in this highly complex and interactive measurement network as that of providing the 'well-characterized' reference materials, called Standard Reference Materials (SRM's), and reference methods whereby measurements can be placed on an accuracy basis. When measurements are accurate, that is, are free of systematic error and also precise--with the end-use requirements--then the measurements so made are compatible, i.e., they agree. NBS has now produced, certified, and issued 20 SRM's for use in clinical chemistry. These range from SRM's used in the measurement of cholesterol, bilirubin, and electrolytes, among others, to glass filter and quartz cuvettes for the calibration of spectrophotometers. Another half dozen are within a year or so of issuance. To date there exists only one reference method--that for the determination of calcium in serum. However, NBS, in collaboration with other Government agencies, professional societies, and standards bodies, will issue another 6-7 reference methods within the next year or two. These include methods for lead in blood, five additional electrolytes in serum, and a method for glucose.

706,234
PB-297 098/6 PC **A03**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Polymer Science and Standards Div.
Standard Reference Materials: SRM 1470: Polyester Film for Oxygen Gas Transmission Measurements.
J. D. Barnes, and G. M. Martin. Jun 79, 47p NBS-SP-260-58
See report dated Apr 79, PB-294 666. Library of Congress catalog card no. 79-600077.

Keywords: *Polymeric films, Permeability, Oxygen, Standards, Transport properties, Statistical analysis, Glass transition temperature, Time lag, Mean, Accuracy, Temperature, Carboxylic acid esters, Pressure, Oxygen organic compounds, Standard reference materials, *Poly(terephthalic acid/(ethylene-ester)), State of the art.

This report presents information which should be of interest to users of NBS Standard Reference Material 1470. This SRM takes the form of 23 micrometer thick sheets of poly(ethylene terephthalate) film. The gas transmission rates of these films with respect to oxygen gas have been carefully analyzed. The authors describe where the film comes from, how it is packaged, and how it shcuid be conditioned prior to measuring. The steps which were taken to characterize a random sample of sheets from the production lot of the SRM are discussed in detail. The gas transmission rates and the time-lags of 22 films were measured using a state-of-the-art electronic manometric permeation facility. The temperature dependence of the permeability was determined over the temperature range 288 K to 310 K. A small pressure effect was found which is thought to be an artifact. The statistical measures which were derived from the data are discussed in detail. It is concluded that the largest source of variability is from one sample to another with a coefficient of variation amounting to 4 percent. A brief discussion of units for expressing permeabilities is given. Effects due to thermal conditioning ('aging') and outgassing are discussed.

706,235
PB-298 555/4 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Thermophysical Properties Div.

Producing Slush Oxygen with an Auger and Measuring the Storage Characteristics of Slush Hydrogen.
R. O. Voth, and P. R. Ludtke. Mar 79, 42p NBSIR-79-1607
Contract NASA-CC-6253QA

Keywords: *Gas storage, *Solidified gas, Augers, Oxygen, Hydrogen, Design criteria, Heat exchangers, Performance evaluation, Pressures, Manufacturing, Slush, Cryogenics, *Slush oxygen, *Slush hydrogen.

An auger rotating inside a brass tube refrigerated with liquid helium was used to produce liquid-solid (slush) mixtures of oxygen. The auger produced small particles of solid oxygen so that the resulting mixture could be transferred and stored. The auger could produce slush continuously in an appropriate system, and it could produce slush at pressures higher than the triple point pressure of the oxygen. Three long term storage tests were conducted on an Apollo hydrogen vessel. The vessel was filled to 88 percent with normal boiling point liquid hydrogen then the pressure rise rate to 17.6 bar and the venting rate at 17.6 bar were measured. The two other tests were similar except the vessel was filled with slush hydrogen. In one of these tests, the slush was mixed to eliminate thermal stratification. Filling with slush instead of liquid hydrogen increased the storage time before venting by 1.08 to 1.17 times and increased the mass loaded by 1.11 to 1.13 times.

706,236
PB-298 655/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of New Kinetic Techniques to the Lifetime Prediction of Polymers from Weight-Loss Data.
Final rept.
J. H. Flynn, and B. Dickens. 1979, 19p
Pub. in Proceedings of the Symposium of the National Meeting of the American Chemical Society (176th) Held at Miami, FL. on September 11-14, 1978, Paper 7, p97-115, 1979.

Keywords: *Polymers, *Aging(Materials), *Weight measurement, Economics, Degradation, Thermogravimetry, Chemical properties, Physical properties.

The authors have chosen to examine the applicability to lifetime prediction of four methods of thermogravimetry. Although one can argue that many useful properties of polymers may disappear before weight loss occurs, it is worthwhile to examine the role of thermogravimetry in lifetime prediction because the technique can be applied to any condensed phase sample, soluble or not, in almost any geometric form. Further, thermogravimetry is simple, convenient, and, in some modes of application, fairly fast. The hardware is rugged, reliable and stable. Finally, the process which results in the volatilization of small fragments is often closely related to the process which results in the loss of desired properties.

706,237
PB77-600082 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 6, Number 1, 1977.
c1977, 307p
See also PB77-600030 through PB77-600033.

Keywords: *Physical properties, *Chemical properties.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature.

706,238
PB77-600083 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 6, Number 2, 1977.
c1977, 610p
See also PB77-600034 through PB77-600037.

Keywords: *Chemical properties, *Physical properties.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature.

706,239
PB77-600084 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 6, Number 3, 1977.
c1977, 1102p
See also PB77-600038 through PB77-600043.

Keywords: *Chemical properties, Physical properties.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature.

706,240
PB77-600085 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 6, Number 4, 1977.
c1977, 1330p
See also PB77-600044 through PB77-600049.

Keywords: *Chemical properties, *Physical properties.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the national Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature.

706,241
PB78-600022 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Viscosity of Liquid Water in the Range -8C to 150C.
J. Kestin, M. Sokolov, and W. A. Wakeham.
c1978,7p
Included in Jnl. of Physical and Chemical Reference Data, v7 n3 p941-948 1978.

Keywords: *Critically evaluated data, Critical review, Data compilation, Liquid water, Viscosity.

The paper re-analyzes the results of earlier, very precise measurements of the viscosity of water at essentially atmospheric pressure. This is done in terms of a new, theoretically-based equation for the operation of a capillary viscometer rather than in terms of semi-empirical equations used by the original authors. The new analysis eliminates possible systematic errors and permits the establishment of realistic error bounds for water in its role as a standard reference substance for viscosity. The latter are smaller than those embodied in the most recent International Formulation. Standard values of the ratio of viscosity at a temperature T to its value at 20C have been derived from the re-analyzed data because the uncertainty of this ratio is an order of magnitude smaller than that of the absolute values. The ratios are used to generate absolute values with the aid of the standard NBS datum mu = 1002.0 muPa s at 20C. The viscosity ratios have been correlated with the aid of two empirical equations. The more accurate equation covers the range 0C equal to or less than t equal to or less than 40C with an uncertainty of plus or minus 0.05 percent. The less accurate equation covers the wider range -8C equal to or less than t equal to or less than 150C with the more limited accuracy of plus or minus 0.2 percent. The two empirical equations are compatible with each other to 0.09 percent.

706,242
PB79-600004
(Order as PB80-103674, PC **A05**/MF**A01**)
National Bureau of Standards, Gaithersburg, MD.
Observations of Surface Changes in Platinum Crucibles.
C. P. Saylor, E. Wichers, and J. H. Hoffman. 1979, 10p
Included in Jnl. of Research of the National Bureau of Standards, v84 n5 p385-394 1979.

Keywords: *Contrast augmentation of reflecting surfaces, double-diaphragm, faces (crystal) on platinum cruciles, Hematite forming on platinum, Iron as alloy in platinum, Platinum ware, Surface of platinum influenced by method heating.

Ion which has been solid solution in a platinum crucible will cause iron determinations in analyses to become high. Likewise the iron, oxidizing to ferric oxide during ignition, segregates along the boundaries between platinum crystals. It causes embrittlement and eventual crumbling of the crucible. During these studies it was observed that after heating in an electric muffle furnace the surface of a crucible was covered by tiny crystallographic faces. When, however, heating to the same temperature was carried out in a gas flame the facets almost smoothed out of existence.

706,243
PB79-600006 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 8, Number 1, 1979.
c1979, 303p
See also PB79-600007 through PB79-600011.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretically nature.

706,244
PB79-600011 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Molten Salts: Volume 4, Part 4. Mixed Halide Melts.
G. J. Janz, R. P. T. Tomkins, and C. B. Allen. c1979, 178p
Included in Jnl. of Physical and Chemical Reference Data, v8 n1 p125-302 1979.

Keywords: *Bromides, Chlorides, Data compilation, Density, Electrical conductance, Fluorides, Halides, Iodides, Molten salt mixtures, Standard reference data, Surface tension, Viscosity.

Data on the electrical conductance, density, viscosity, and surface tension of mixed halide melts have been systematically collected and evaluated. Results are given for eighty-five binary mixtures over a range of compositions and temperatures.

706,245
PB79-600012 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 8, Number 2, 1979.
1979, 268p
See also PB79-600013 through PB79-600021.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objectaive of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature.

706,246
PB79-600022 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 8, Number 3, 1979.
c1979, 339p
See also PB79-600023 through PB79-600029.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objectaive of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature.

706,247
PB79-600030 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 8, Number 4, 1979.
c1979, 376p
See also PB79-600031 through PB79-600035.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature.

706,248
PB80-103674 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 84, Number 5, September-October 1979.
Bi-monthly rept.
1979, 95p
See also Volume 84, Number 2, PB-296 439.

Keywords: *Physical chemistry, Cells, Design, Laboratory equipment, Natural rubber, Crosslinking, Polymers, Mathematical models, Surfaces, Crucibles, Ion exchanging, Solutions, Hydroxylapatite.

Contents:
- A high precision load cell mass comparator;
- Molecular interpretations of modulus and swelling relations in natural rubber cross-linked by dicumyl peroxide;
- Theory of flow-induced fibril formation in polymer solutions;
- Observations of surface changes in platinum crucibles;
- Isoionic isotope exchange with hydroxylapatite and the dilution effect.

706,249
PB80-104276 Not available NTIS
National Bureau of Standards, Washington, DC.
Economics of Hydrogen.
Final rept.,
J. Hord, and W. R. Parrish. 1979, 46p
Pub. in Hydrogen: Its Technology and Implications, n5, Chapter 1, p3-48 1979.

Keywords: *Hydrogen, *Economic analysis, Manufacturing, Storage, Transmission, Reprints.

The costs of producing, transmitting, and storing hydrogen are presented in this chapter. Production methods considered are steam-reformation and partial oxidation of methane, coal gasification, partial oxidation of fuel oil, water electrolysis, and hybrid thermochemical-electrolysis. The costs of compressing, liquefying, slushing, and solidifying hydrogen gas are also outlined. Modes of hydrogen transmission considered are overland and underwater gas pipelines, overland liquid pipelines, compressed gas or liquid by highway, railway, or sea, and metal hydrides by highway or railway. Hydrogen storage options considered are underground caverns for compressed gas, low pressure gas holders, metal hydride, high pressure compressed gas in steel cylinders, and dewars for liquid. Potential by-product cost credits are reviewed and examples of hydrogen-system cost analyses are given.

706,250
PB80-123284 Not available NTIS
National Bureau of Standards, Washington, DC.
How to Balance Chemical Equations.
Final rept.,
W. V. Loebenstein. 1979, 5p
Pub. in Jnl. of the Washington Academy of Sciences 69, n1, p7-11 1979.

Keywords: *Chemical reactions, Balance, Oxidation reduction reactions, Organic compounds, Ions, Reprints.

It has been shown that an algebraic method may always be used to balance chemical equations. The method is equally applicable to REDOX reactions, complex organic reactions, ionic reactions, etc. It is not necessary to determine the oxidation numbers of the elements which comprise the various molecules, nor is there any advantage to be gained by doing so. In rare instances more than one 'correct' solution can be found for the balanced equation. When this occurs, the method reveals the fact that it is the result of independent chemical processes taking place simultaneously.

706,251
PB80-132046 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Fluorescence Standard Reference Material: Quinine Sulfate Dihydrate.
Final rept.,
R. A. Velapoldi, and K. D. Mielenz. Jan 80, 143p
NBS-SP-260-64
Library of Congress catalog card no. 79-600119. See also PB-294 666.

Keywords: Fluorescence, Standards, Emission spectroscopy, Spectroradiometers, Laboratory equipment, *Standard reference materials, *Quinine/sulfate.

The need, material selection, characterization, certification, and uses of the fluorescence Standard Reference Material, quinine sulfate dihydrate, have been discussed. The emission spectrum for quinine sulfate dihydrate in 0.1 mol/L HClO4 has been measured on the NBS reference spectroradiometer. The technical emission spectrum has been corrected for the instrumental parameters of the spectral responsitivity of the detection system, photomultiplier tube nonlinearity, bandpass, monochromator wavelength error, and further corrections for the sample parameters of solvent refractive index and cell window transmittance were applied to obtain the molecular emission spectra. The purity and the stability of the SRM quinine sulfate dihydrate and the effect of solute concentration, solvent acid, acid concentration, excitation wavelength, oxygen quenching, temperature and polarized exciting radiation on the emission spectrum, and in part, on the absorbance spectrum, photon yield, and fluorescence lifetime also have been discussed.

706,252
PB80-203441 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
National Bureau of Standards Mass Calibration Computer Software.
Final rept.,
R. N. Varner, and R. C. Raybold. Jul 80, 170p NBS-TN-1127

Keywords: *Mass, *Calibrating, Standards, Fortran, Least squares method, Error analysis, Computer programs.

This report describes the Fortran computer program used to generate a comprehensive report covering the sequence of operations used to assign mass values to weights submitted to the National Bureau of Standards for calibration. The assignment of these values is accomplished by the method of least squares analysts of the observation of differences between test items and reference items having the same or nearly same density and normal size. The calculations are defined and the various weighing method options are given. To assist in the implementation of the computer program, a flow chart, a description of each subprogram, a cross-reference of labeled COMMON, a list of DOUBLE PRECISION variables, a list of EQUIVALENCED variables and other pertinent information is given.

706,253
PB80-207707 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 85, Number 3, May-June 1980.
Bi-monthly rept.
1980, 84p
See also Volume 85, Number 2, PB80-185036. Library of Congress catalog card no. 62-37059.

Keywords: *Physical chemistry, *Research, Electrochemistry, Silver, Calorimeters, Noise, Density(Mass/volume), Aerosols, Smoke, Amplitude, Foraday effecf, Heat measurement, Potentiostats, Pacemakers, Urea/N-N-dixanthenyl, Smoke detectors, Nuclear materials management.

Contents:
- The electrochemical equivalent of pure silver--a value of the Faraday;
- A microcalorimeter for measuring self-discharge of pacemakers and pacemaker power cells;
- Dixanthylurea (N,N-di-Xanthen-9-ylurea);
- A low-noise potentiostat for the study of small amplitude signals in electrochemistry;
- In-tank measurement of solution density;
- Response of smoke detectors to monodisperse aerosols.

706,254
PB80-212145 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Polydispersity of Narrow Fractions and Column Spreading Parameters by Recycle Liquid Size Exclusion Chromatography,
F. L. McCrackin, and H. L. Wagner. Jun 80, 6p
Pub. in Macromolecules 13, n3 p685-690 Jun 80.

Keywords: *Polymers, *Spreading, Chromatography, Molecular weight, Dispersing, Polystyrene, Laboratory equipment, Reprints.

A method has been developed, employing recycle size exclusion chromatography (GPC), to separate instrumental spreading from spreading due to the molecular weight distribution of the polymer. This is particularly important for polymers with small M(w)/M(n) values, such as the anionic polystyrenes, where instrumental spreading accounts for a large fraction of the total spreading. Because of interferences with the base line from impurities, a novel technique for treating the data was employed to minimize the effect of base line irregularities.

706,255
PB80-600001 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 9, Number 1, 1980.
1980,290p
See also PB80-600002 through PB80-600004.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically envaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evalua-

tion. Critical reviews of measurement techniques, whose aim is to assess the accuray of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature.

706,256
PB80-600005 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 9, Number 2, 1980.
1980, 224p
See also PB80-600006 through PB80-600008.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurements techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature.

706,257
PB80-600009 Not Available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 9, Number 3, 1980.
1980,262p
See also PB80-600010 through PB80-600015.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature.

706,258
PB80-600016 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 9, Number 4, 1980.
1980,539p
See also PB80-600017 through PB80-600023.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature.

706,259
PB81-106536 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 85, Number 4, July-August 1980.
Bi-monthly rept.
1980, 87p
See also Volume 85, Number 3, PB80-207707. Library of Congress catalog card no. 62-37059.

Keywords: *Research, Electric current, Polymers, Surface energy, Vulcanized elastomers, Gums, Units of measurement, Calibrating, Experimental design.

Contents:
A proposed coil system for the improved realization of the absolute ampere;
The polymer in a cone + A model for the surface free energy of polymer crystal with emergent cilia;
Representation of long-time creep in a pure-gum rubber vulcanizate;
Design aspects of Scheffe's calibration theory using linear splines.

706,260
PB81-115263 Not available NTIS
National Bureau of Standards, Washington, DC.
Linewidth Measurement: From Fine Art to Science.
Final rept.
D. Nyyssonen, and J. M. Jerke. 1978, 4p
Pub. in Proceedings of the International Electron Devices Meeting Held at Washington, DC. on Dec 4-6, 1978, p437-440 1978.

Keywords: *Line width, *Microscopy, Laboratory equipment.

Traditional methods of linewidth measurement on integrated circuit photomasks and wafers have employed an optical microscope with some type of measuring eyepiece. In recent years, the push to finer line geometries has revealed systematic measurement differences between instruments as large as 1.0 micrometers. Modeling of linewidth measurement systems has shown that these differences may be attributed to differences in edge detection criteria. New techniques have been developed at the NBS for accurate optical edge detection and calibration of other optical linewidth measurement systems.

706,261
PB81-118556 Not available NTIS
National Bureau of Standards, Washington, DC.
Fifty Years of International Cooperation on the Properties of Steam.
Final rept.
H. J. White. 1980, 7p
Pub. in Proc. Int. Conf. Properties of Steam (9th) held at Munich (Germany, F.R.) Sep 10-14, 1979. Paper in Water and Steam, Their Properties and Current Industrial Applications, p18-24 1980.

Keywords: *Steam, *Chemical properties, *Physical properties.

Since the 1st International Conference on the Properties of Steam was held in London in 1929, the current 9th International Conference on the Properties of Steam marks the golden jubilee of cooperative international steam research. It is, therefore, a fitting time for a look at research and the preparation of critically evaluated reference data on steam from an historical point of view. A brief summary will be given of the International Conference, the activities generated by them, and the development of the International Association for the Properties of Steam, which now serves to organize the International Conference, provide continuity between conferences, and encourage and coordinate research on the properties of steam and on the chemistry of steam power cycles.

706,262
PB81-132664 Not available NTIS
National Bureau of Standards, Washington, DC.
Scientific Uncertainty and Societal Decisions: The Challenge to the Analytical Chemist.
L. A. Currie. 1980, 31p
Pub. in Analytical Letters Guest Editorial 12, nA1 p1-31 1980.

Keywords: *Chemical analysis, *Research, *Chemists, Reprints.

A large portion of the problems facing society today have an intrinsic scientific component. Because of imperfect scientific information, decisions concerning such problems, for example in the areas of energy, the environment or health, must be made in the presence of (scientific) uncertainty. Absence of firm predictions or accurate observations make many such decisions dependent on theoretical models, and the phenomena involved often have far-reaching consequences (long time constants, global extent). The analytical chemist has a crucial part to play in providing the information needed for optimal societal decisions through: basic research, development of new and more sensitive measurement processes, development and validation of theoretical models, and rigorous and meaningful specification of uncertainty bounds.

706,263
PB81-134652 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Model of Fracture of Fibrous Polymeric Material.
A. Peterlin. 1977, 15p
Pub. in Proceedings of the International Conference on Fracture (4th), Waterloo, Canada, June 19-24, 1977, Fracture 1, No. ICF4, p471-485 1977.

Keywords: *Mathematical models, *Fractures(Materials), *Polymers, Fibers.

The fibrillar model of fibrous structure assumes a dense packing of long and narrow microfibrils into spindle shaped slightly skewed fibrils. The ends of microfibrils located mainly on the outer boundary of the fibrils represent an interruption of the massive axial connection by taut tie molecules. They are prime candidates for microcrack formation upon tensile loading which deforms the sample by shear displacement of adjacent fibrils and microfibrils. The axial and radial growth of microcracks ruptures the tie molecules in its path. The sample fails as soon as one of cracks reaches critical dimensions. The rest of the sample in a new loading run exhibits a lower load-elongation curve but practically the same or even higher strength because the reopening of old microcracks is easier than their initial formation while the growth of microcracks beyond the limits of the first run requires an increased load.

706,264
PB81-189367 PC **A99**/MF **E04**
National Standard Reference Data System.
EPA/NIH Mass Spectral Data Base, Supplement 1, 1980 and 1980 Cumulative Indexes to EPA/NIH Mass Spectral Database.
S. R. Heller, and G. W. A. Milne. Dec 80, 2153p
NSRDS-NBS-63-SUPPL-1
Library of Congress catalog card no. 78-606175. Prepared in cooperation with Environmental Protection Agency, Washington, DC. Office of Planning and Management, and National Heart, Lung, and Blood Inst., Bethesda, MD.

Keywords: *Mass spectroscopy, *Organic compounds, Graphs(Charts), Tables(Data).

This Supplement to the EPA/NIH Mass Spectral Data Base (NSRDS-NBS 63) presents an additional collection of 8807 verified mass spectra of individual substances compiled from the EPA/NIH mass spectral file. The spectra are given in bar graph format over the full mass range. Each spectrum is accompanied by a Chemical Abstracts Index substance name, molecular formula, molecular weight, structural formula, and Chemical Abstracts Service Registry Number. A cumulative index has also been issued which provides access to the entire file of 34, 363 mass spectra.

706,265
PB81-199192 Not available NTIS
National Bureau of Standards, Washington, DC.
New National Bureau of Standards Contemporary Carbon-14 Standards.
Final rept.
L. M. Cavallo, and W. B. Mann. 1980, 2p
Pub. in Proceedings of the Radiocarbon Dating Conference Held at Heidelberg, Germany, F.R., on August 19-26, 1979, Paper in Radiocarbon 22, n3 p962-963 1980.

Keywords: *Carbon 14, *Standards, *Oxalic acid, *Standard reference materials, NTISCOMNBS.

In 1957 the National Bureau of Standards (NBS) agreed, at the request of Dr. James R. Arnold, to store and distribute an oxalic acid contemporary carbon-14 standard. In 1978 stocks of this standard were practically gone so the authors approached Chas. Pfizer and Company, Inc., which had provided the original 1000 lb of oxalic acid to Dr. Arnold to see if they could provide another one-batch lot of 1000 lb of oxalic acid to replace the old standard. This they did and generously provided it at no cost to NBS. Samples of the old standard and the new material were sent to leading national and international laboratories for intercomparative mass-spectrometric and activity concentration measurements.

706,266
PB81-203408 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.

Biodeterioration of Standard Reference Materials.
G. J. Olson, W. P. Iverson, and F. E. Brinckman. Apr 81, 18p NBSIR-81-2246

Keywords: *Biodeterioration, *Storage, Bacteria, Fungi, Humidity, Microorganisms, Chemical composition, *Standard reference materials, NTISCOMNBS.

Several National Bureau of Standards Standard Reference Materials have been examined for susceptibility to biodeterioration. Several of these materials were attacked by bacteria and fungi when stored at elevated humidity after exposure to outdoor air. Some SRMs underwent deterioration after following certificate instructions for handling. Suggestions for some certificate revisions are made.

706,267
PB81-207748 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 86, Number 2, March-April 1981.
Bi-monthly rept.
1981, 116p
See also Volume 86, Number 1, PB81-196198. Library of Congress catalog card no. 63-37059.

Keywords: *Research, Propane, Acoustic velocity, Plumbing, Piping systems, Pipe flow, Game theory, Inspection, Transition temperature, Hydrates, NTISCOMNBS.

Contents:
- Velocity of sound in liquid propane;
- Models of quasi-steady and unsteady discharge from plumbing fixtures;
- Transition temperatures of the hydrates of Na2SO4, Na2HPO4, and KF as fixed points in biomedical thermometry;
- A game-theoretic model of inspection-resource allocation.

706,268
PB81-220311 Not available NTIS
National Bureau of Standards, Washington, DC.
Progress of the ASTM E-42 Committee on Surface Analysis.
Final rept.
C. J. Powell. 1981, 5p
Pub. in Surf. Interface Anal. 3, n2 p94-98 1981.

Keywords: *Surfaces, *Standards, Reviews, Reprints, American Society for Testing and Materials, Standard reference materials.

The American Society for Testing and Materials (ASTM) formed Committee E-42 on Surface Analysis in 1976. Subcommittees have been established for the four surface-analysis techniques in common use (AES, XPS, ISS, and SIMS) and for terminology, ion-beam sputtering, standard reference materials, and editorial processing. The principle objective of the Committee and its component groups is to advance the field of surface analysis and the quality of surface analyses through the development of appropriate standards, standard procedures, standard materials, roundrobins, symposia, workshops, and publications. A review is given of recent activities of the Committee and of work in progress. The success of the Committee will depend a great deal on adequate communication and coordination with other interested individuals and groups to ensure the adequacy and quality of proposed standards and to prevent unnecessary confusion or duplication of effort. Suggestions are made for this purpose.

706,269
PB81-220402 Not available NTIS
National Bureau of Standards, Washington, DC.
Quick and Accurate Density Determination of Laboratory Weights.
Final rept.
R. M. Schoonover, and R. S. Davis. 1980, 5p
Proceedings of the Conference on the IMEKO Technical Committee TC3 on Measurement of Force and Mass (8th) held at Krakow, Poland on September 9-11, 1980.
PUB. in Weighing Technology, pII23-II27 1980.

Keywords: *Density(Mass/volume), *Weight measurement, Laboratory equipment, Performance evaluation, Mass, Reprints.

The assignment of mass values to laboratory weights or other objects of interest where the highest accuracy is desirable is normally accomplished by a difference measurement performed on a balance or mass comparator. The balance responds to gravitational force acting downward on the mass and the buoyant force of air acting in the opposite direction. This technique has proved to be very successful in that in just a few minutes' time a density determination can be accomplished; accurate to better than 3 parts in 100,000. Furthermore, sample degassing is not required and there is no delicate hydrostatic suspension demanding special treatment and protection. The authors experience with this technique indicates that it is also capable of production-line density determinations, and hence useful in industrial metrology.

706,270
PB81-220899 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 86, Number 3, May-June 1981.
Bi-monthly rept.
1981, 83p
See also Volume 85, Number 2, PB80-185036. Library of Congress catalog card no. 63-37059.

Keywords: *Research.

Contents: An intercomparison of pressure standards between LNE and NBS; Foundations of metrology; Absolute determination of the thermal conductivity of argon at room temperature and pressures up to 68 M Pa; The effect of calcium carbonate on the stability of acid treated papers; Properties of labeling methods for determining shortest path trees.

706,271
PB81-233694 Not available NTIS
National Bureau of Standards, Washington, DC.
Standard Reference Materials for Physical Measurement Traceability.
Final rept.
S. D. Rasberry, and G. A. Uriano. Dec 80, 5p
Pub. in Proceedings of Workshop and Symposium National Conference of Standards Laboratories (1980), Gaithersburg, MD., September 22-25, 1980, Paper in NCSL Newsletter 20, n4 p23-27 Dec 80.

Keywords: *Physical tests, Steel, Glasses, Plastics, Cement, Elastomers, *Standard reference materials, *Tracer studies.

Standard Reference Materials are widely used to achieve measurement traceability to NBS in fields such as industrial analysis of steel, glass, plastics, cement and rubber; clinical chemistry; environmental measurements and many others. The metrology community is beginning to realize the benefits of SRMs in achieving physical measurement traceability for areas such as temperature and length (including linewidth). This paper describes the NBS Standard Reference Materials Program and explains how SRMs are certified. Examples are provided of how SRMs are currently being used by calibration laboratories to achieve traceability. Still other possible uses of SRMs in the future to support a wider spectrum of physical measurements will be discussed.

706,272
PB81-236283 Not available NTIS
National Bureau of Standards, Washington, DC.
Empirical Relation for Diffusion of Gases in Hydrocarbon Polymers: Interpretation in Terms of Fractional Free Volume.
Final rept.
A. Peterlin, and F. L. McCrackin. 1981, 4p
Pub. in Jnl. of Polymer Science, Polymer Physics Edition 19, p1003-1006 1981.

Keywords: *Diffusion coefficients, *Polyethylene, *Natural rubber, Reprints, *Fractional free volume, Numerical relation.

An empirical relationship between the diffusion coefficients of gases in three polyethylenes and their diffusion coefficient in natural rubber is given. The diffusion coefficients are given within a relative error of 4.7%. This relationship is interpreted according to the fractional free volume theory. The ratios of the fractional free volumes in the polyethylenes to the fractional free volume in natural rubber are derived.

706,273
PB81-600050 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Desorption of Cesium from Molybdenum(111); Positive Ion and Neutral Lifetime Measurements.
R. Klein, and J. Fine. 1980, 4p
Pub. in Le Vide, les Couches Minces 2, n201 p361-364 1980.

Keywords: *Cesium from molybdenum(111), Ion and neutral lifetime, Positive ion and neutral lifetime.

Abstract not available.

706,274
PB82-112483 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Conductivity of Polyester-Amide-Imide Film.
Final rept.
J. G. Hust, and R. Boscardin. May 81, 2p
Pub. in Cryogenics 21, n5 p297-298 May 81.

Keywords: *Polymeric films, *Thermal conductivity, Polyester resins, Amides, Imides, Reprints.

Thermal conductivity measurements were performed on polyester-amide-imide film from 4 to 323 K. The specimen was in the form of a stack of aluminium discs coated on both sides with film. The results exhibit a temperature dependence similar to varnish, but are about half as large in conductivity. The results, based on nineteen data points, are estimated to be accurate to about 10%.

706,275
PB82-118068 Not available NTIS
National Bureau of Standards, Washington, DC.
Views on the Current Status of the pH Scale.
Final rept.
R. A. Durst. 1981, 11p
Pub. in Proceedings of the Meeting IFCC Expert Panel on pH and Blood Gases (5th), Copenhagen, Denmark, June 16-18, 1980, Paper in Blood pH, Carbon Dioxide, Oxygen, and Calcium-ion, p89-100 1981.

Keywords: *pH, *Standards, *Standard reference materials.

Several international organizations, e.g., IUPAC, ISO, OIML, IEC, are currently reviewing and/or revising their definitions of the pH scale. This paper reviews the present status of the pH scale and proposals for changes in the definition. A compromise proposal for an international practical pH scale is presented which retains the features of the NBS multiple primary standard pH scale while permitting the introduction of a single primary standard defining point and an indefinite number of secondary standards.

706,276
PB82-118076 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of a General Equation for Controlled Pore Glass Permeation Chromatography to an Aggregating, Spherical Virus.
Final rept.
W. Haller, H. G. Gschwender, and K. R. Peters.
1981, 7p
Pub. in Jnl. of Chromatography 211, p53-59 1981.

Keywords: *Viruses, *Particles, *Size determination, Electron microscopy, Reprints, *Glass permeation chromatography, *Numerical solution.

A semi-empirical permeation chromatography equation relating pore size, species size and elution coefficient, which had previously been derived from chromatographic data to narrow-molecular-weight dextrans on controlled pore glass, was applied to the chromatography of an aggregating virus particle. A large number of chromatographic runs on columns of different pore sizes were combined and statistically evaluated. The resulting diameter distribution versus infectivity curve for the virus particle population shows distinct maxima at multiples of 50 nm. This unit size agrees with electron microscopical observations and confirms the applicability of the chromatography equation.

706,277
PB82-149154 Not available NTIS
National Bureau of Standards, Washington, DC.
Computer Simulation of Titration Curves with Application to Aqueous Carbonate Solutions.
A. K. Covington, R. N. Goldberg, and M. Sarbar.
1981, 7p
Pub. in Analytica Chimica Acta 130, p103-109 1981.

Keywords: *Volumetric analysis, *Carbonates, Solutions, Concentration(Composition), pH, Time lag, Reprints, Numerical solution, Computer applications.

A computer simulation calculation is used to generate theoretical acid-base titration curves for aqueous carbonate solutions. The calculation allows for the time delay in the conversion of aqueous CO2 to H2CO3 and permits the calculation of concentrations of the species in solution and their time derivatives during the course of a titration. Detailed calculations, which include the effect of the time delay, show that the existence of a peak in the differential titration curve corresponds to the protonation of a species in solution, and that no extra peaks are produced as a result of the time delay. The calculations also show the pH values obtained from such titrations are not affected by the time delay, and that a systematic error may be incurred when such titrations are used for analytical purposes when the rate of addition of titrant is too rapid.

706,278
PB82-152497 Not available NTIS
National Bureau of Standards, Washington, DC.
Gage Installation Can Trim Level-Measurement.
Final rept.
J. D. Siegwarth. Dec 81, 5p
Pub. in Oil Gas Jnl. 79, n49 p142-144, 149, 152, Dec 81.

Keywords: *Liquefied natural gas, *Measuring instruments, Liquids, Reprints, *Gages.

The systematic errors introduced into level measurements by the gage-mounting method and the tank environment are analyzed for the cable-type gage with emphasis on LNG level gaging. The cable-type gage consists of a movable surface sensor suspended by a cable, tape, or wire. Two gage-installation methods that eliminate most of the systematic errors are described. Though this study deals primarily with LNG gaging, it applies as well to the gaging of any liquid.

706,279
PB82-152778 Not available NTIS
National Bureau of Standards, Washington, DC.
Automatic Karl Fischer Titration of Moisture in Grain.
F. E. Jones, and C. S. Brickenkamp. 1981, 7p
Pub. in Jnl. of the Association of Official Analytical Chemists 64, n6 p1277-1283 1981.

Keywords: *Volumetric analysis, *Moisture content, *Grain crops, *Karl Fischer reagent, Corn, Soybeans, Performance evaluation, Reprints.

Automatic Karl Fischer titrators of the motor-driven buret type and the coulometric generation type were applied to the determination of moisture in grain. Techniques were developed to optimize the performance of the Karl Fischer titration method and to overcome disadvantages attributed to it. It is suggested that the method be designated as the primary reference method for grain in general and for corn and soybeans in particular.

706,280
PB82-152786 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Water in Solids by Automatic Karl Fischer Titration.
F. E. Jones. Oct 81, 3p
Pub. in Analytical Chemistry 53, n12 p1955-1957 Oct 81.

Keywords: *Volumetric analysis, *Karl Fischer reagent, *Moisture content, *Solids, Performance evaluation, Solvent extraction, Reprints.

Techniques have been developed to optimize the performance of automatic Karl Fischer reagent titrators in the determination of water in solids. Water is extracted from the material by methanol in a mixer/mill; the methanol-extracted H2O mixture is introduced volumetrically from a calibrated syringe into the titration vessel. The titrators (of the coulometric generation type and the motor-driven buret type) are standardized with distilled H2O. An analysis has been made of the sources and estimated magnitudes of the uncertainties in the determination of H2O. For solid material with a moisture content (% H2O) of 15%, the imprecision (standard deviation of the mean) is estimated to be 0.4% relative and the systematic uncertainty is estimated to be plus or minus 0.4% relative.

706,281
PB82-162876 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Procedure for Establishing Traceability of Gas Mixtures to Certain National Bureau of Standards Standard Reference Materials.
Final rept.
E. Hughes, and J. Mandel. Jan 81, 43p NBSIR-81-2227, EPA-600/7-81-010
Contract EPA-IAG-D8-E684
Errata sheet inserted.

Keywords: *Gases, *Gas cylinders, Standards, Comparison, Nitrogen oxide(NO), Sulfur dioxide, Carbon dioxide, Oxygen, Auditing, Concentration(Composition), Air pollution, *Standard reference materials, *Certified reference materials, Procedures.

This procedure includes the specifications and requirements that must be followed by gas manufacturers during the preparation of compressed cylinder gas Certified Reference Materials (CRM). A CRM is a certified gas standard prepared at a concentration that does not exceed + or - 1 percent of currently available National Bureau of Standards Standard Reference Material (SRM) cylinder gases. The procedure includes specifications and requirements for: (1) preparation of compressed gas samples in cylinders prepared in lots of ten or more of identical concentration with the average concentration for the lot within + or - 1.0 percent relative to the concentration of a specific SRM; (2) tests to verify compressed gas samples stability and within lot homogeneity; (3) simultaneous submission by the gas manufacturer of analysis results to NBS and cylinder gas numbers to USEPA (without analysis results); (4) random selection by USEPA of two cylinders per lot for an USEPA performance audit analysis; (5) submission by USEPA of audit results to NBS, and (6) decision by NBS whether to allow the gas manufacturer to sell the lot of cylinders as CRM. A procedure for CRM for CO in N2 or air is described as Appendix C. Future appendices will be added for other CRM including NO in N2, SO2 in N2, CO2 in N2, and O2 in N2.

706,282
PB82-165820 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Technical Activities 1981. Office of Standard Reference Data.
S. P. Fivozinsky. Dec 81, 82p NBSIR-81-2442

Keywords: *Physical properties, *Chemical properties, *Management planning, Environmental surveys, Energy, *Office of standard reference data, *National standard reference data system.

The Office of Standard Reference Data is one of six program offices in the National Measurement Laboratory, National Bureau of Standards. The Standard Reference Data Program develops and disseminates data bases of critically evaluated physical/chemical properties of substances. These data bases are available through NBS and private publications, on magnetic tape, and from on-line retrieval systems. The Office of Standard Reference Data is responsible for management and coordination of the program. Work is carried out through a decentralized network of data centers and projects referred to as the National Standard Reference Data System (NSRDS). This volume summarizes the activities of the program for the year 1981.

706,283
PB82-199266 Not available NTIS
National Bureau of Standards, Washington, DC.
Fading of Quinoline Dye by Light: Application to the Measurement of the Integrated Lamp Output and Solar Energy.
Final rept.
H. Okabe. 1 Dec 81. 5p
Pub. in Applied Optics 20, n23 p4054-4058, 1 Dec 81.

Keywords: *Solar energy, *Lamps, *Dyes, Fading, Plates, Plastics, Quinolines, Reprints.

The fading rates of the plastic plates dyed with a quinoline derivative (quinophthalone) have been measured by the decrease of absorbance at 420 nm as a function of absorbed energy of light of wavelengths, 336, 404.7, 435.8 nm and from a high pressure Xe arc. The decrease of absorbance is nonlinear with exposure and the decrease becomes dependent on temperature for long exposure. The initial quantum yield of fading is independent of incident wavelengths and is .00002. The fading plates provide simple and unexpensive means to measure the integrated lamp output and solar energy.

706,284
PB82-205782 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Molecular Biophysics of Olfaction: Report of Progress.
R. B. Murphy. Apr 82, 35p NBS-GCR-82-378
Sponsored in part by Defense Nuclear Agency, Washington, DC. Prepared in cooperation with New York Univ., NY. Dept. of Chemistry.

Keywords: *Smell, Rats, Chemical analysis, Proteins, Electrochemistry, Separation, Laboratory equipment, Epithelium, Membranes(Biology).

This report summarizes progress in the Olfactory Research Program at the Department of Chemistry, New York University, under Prof. Randall B. Murphy. The report is divided into three technical sections: Biochemistry, Biophysics, and Practical Olfactory Device. In the first area, methods are described for the preparation of homogenates from the olfactory epithelium which contain principally ciliary protein fractions. The preliminary biochemical characterization of these homogenates, including binding studies with 35S labeled alkyl sulphides, is detailed. Experiments designed to relate biochemical composition to ultrastructure of the rat olfactory epithelium are described. In the biophysical studies, the procedure for monitoring functional reconstitution is detailed, utilizing both the technique of surface pressure quantitation of lipid-protein monolayers, as well as more conventional approaches such as construction of lipid bilayer membranes containing reconstituted olfactory fractions. The construction of novel experimental apparatus for the monitoring of the electrochemical properties of such bilayer membranes, designed around a computer-based voltage measurement system is described. The final section of the report deals with the use of this apparatus to test the feasibility of a practical olfactory device.

706,285
PB82-210956 Not available NTIS
National Bureau of Standards, Washington, DC.
Liquid Radiochromic Dosimetry.
Final rept.
N. Rativanich, B. B. Radak, A. Miller, R. M. Uribe, and W. L. McLaughlin. 1981, 10p
Pub. in Proceedings of International Meeting on Radiation Processing (3rd),Tokyo, Japan, October 26-30, 1980, paper in Radiation Physics and Chemistry 18, n5-6 p1001-1010 1981.

Keywords: *Dosimetry, Dyes, Absorption, Solvents, *Leucodyes, Leucocyanides, Methane/triphenyl, Pyrrolidone/N-vinyl, Ethanol/methoxy, Formamide/N-N-dimethyl, Sulfoxide/dimethyl, Phosphoric acid/(triethyl-ester).

By strategic combination of weak acid, mild oxidizing agent, and polary organic solvents containing millimolar concentrations of leucocyanides of certain triphenylmethane dyes, fairly broad ranges of absorbed doses of ionizing radiation can be determined.

706,286
PB82-211210 Not available NTIS
National Bureau of Standards, Washington, DC.
Adiabatic Solution Calorimetry and Standards.
Final rept.
E. J. Prosen. 1981, 9p
Pub. in Proceedings of the Workshop on Techniques for Measurement of Thermodynamic Properties, Albany, OR., Aug 21-23, 1979, Bur. Mines Info. Circ. 8853, p152-160 1981.

Keywords: *Heat measurement, Enthalpy, Standards, *Standard reference materials.

The high accuracy platinum-lined adiabatic solution calorimeter of the National Bureau of Standards is described briefly. Its capabilities for working with highly corrosive substances, at temperatures from 278 (5C) to 368 (95C), and for reaction times as long as 20 hours are illustrated. Values for the enthalpies of reaction of four different standards or Standard Reference Materials are given.

706,287
PB82-212242 Not available NTIS
National Bureau of Standards, Washington, DC.

Characterization by Tin-Specific Size Exclusion Chromatography of the Free Radical Copolymerization of Tributyltin Methacrylate and Methyl Methacrylate.
Final rept.
E. J. Parks, F. E. Brinckman, C. E. Mullin, D. M. Andersen, and V. J. Castelli. 1981, 8p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Applied Polymer Science 26, p2967-2974 1981.

Keywords: Copolymerization, Tin organic compounds, Separated, Coatings, Reprints, *Stannane/tributyl(Methacryloxy), *Methyl methacrylates, *Size exclusion chromatography, Free radicals, Slow release formulations.

Copolymers of tributyltin methacrylate (TBTM) and methyl methacrylate (MMA) comprise an important class of biocidal slow-release organotin polymers (OMP's). Little is known of the kinetics and mechanism of copolymerization. TBTM and MMA were copolymerized in the presence of a free radical initiator (benzoyl peroxide) at 80.1 C. Aliquots, taken at preselected intervals from 0 to 1440 min, were fractionated by size exclusion chromatography (SEC) coupled with ultraviolet (UV) and tin-specific graphite furnace atomic absorption (GFAA) detectors. A UV absorbance observed at 254 nm was associated with low molecular weight (MW) species, decreasing in concentration continuously with time of reaction. Tin-specific GFAA indicated a decrease in low MW species (c. 350 daltons) with concurrent increases in high MW species (c. 40,000 daltons). The fraction of high MW increased as a linear function of the logarithm of the time of reaction. SEC-UV-GFAA thus provides a tool of major importance for characterizing the time dependence and continuity of the process by which monomers of TBTM are converted to a useful bioactive slow-release coating material.

706,288
PB82-215559 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Standard Reference Materials: A Standard Reference Material Containing Nominally Fifteen Percent Austenite (SRM 486).
Final rept.
C. G. Interrante, and G. E. Hicho. Jan 82, 38p NBS-SP-260-73
Library of Congress catalog card no. 81-600173.

Keywords: *Austenite, *Standards, X ray diffraction, Calibrating, *Standard reference materials.

This Standard Reference Material, SRM-486, is intended for the calibration of x-ray diffraction equipment used in determining the amount of retained austenite in ferrous materials. It was produced using powder metallurgical techniques and known amounts of type 310 stainless steel powder (austenitic) and type 430 stainless steel powder (ferritic) to make a blend of 15 percent by weight (14.7 percent by volume) austenite in ferrite. From a larger blend of these powders, powder for 174 compacts was taken. Using 12 of these compacts, a calibration curve was established for the certification of the remaining compacts. The curve relates the nickel x-ray count rate of x-ray fluorescence measurements to the volume percentage of austenite as determined by quantitative microscopy measurements of area percentage. The austenite content of this SRM can be related directly to the nickel count rate, because the nickel content of the austenitic powder (20.9 weight percent) is many times that of the ferritic powder (0.10 weight percent). The mean percentage austenite for 162 certified standards is 14.7 volume percent; this value exactly equals the volume percentage of austenite powder in the original blend. X-ray diffraction determinations of the austenite content are in good agreement with the certified content of austenite. The SRM may be used as an x-ray diffraction standard for austenite or, in special cases, as an x-ray fluorescence standard for nickel content.

706,289
PB82-226226 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 87, Number 1, January-February 1982.
1982, 156p
See also PB82-226234 through PB82-226325 and PB81-247017. Library of Congress catalog card no. 62-37059.

Keywords: *Research, Sampling, Strontium, Isotopes, Atomic mass, Silver, Weight indicators, Lithium, Ionization, Least squares methods, Laboratory equipment, Nuclear radiation spectroscopy, Regression analysis, Median(Statistics), Inequalities, Graph theory.

Contents:
- Absolute isotopic abundance ratios and atomic weight of a reference sample of strontium;
- The absolute isotopic abundance and atomic weight of a reference sample of silver;
- Recalculation of the faraday constant due to a new value for the atomic weight of silver;
- An analysis of read-out perturbations seen on an analytical balance with a swinging pan;
- A 30 kg capacity high precision load cell mass comparator;
- Electron impact ionization of lithium;
- An approach to peak area estimation;
- A note on the behavior of least squares regression estimates when both variables are subject to error;
- A univariate inequality for medians;
- Minimum-loop realization of degree sequences.

706,290
PB82-234881 Not available NTIS
National Bureau of Standards, Washington, DC.
Preparation of High-Density Ceria-Yttria Ceramics.
Final rept.
A. L. Dragoo, and L. P. Dominques. May 82, 7p
Pub. in Jnl. of American Ceramics Society 65, n5 p253-259 May 82.

Keywords: *Cerium, *Yttrium, *Ceramics, Precipitation(Chemistry), Hydrolysis, Reprints.

Coprecipitation of Ce and Y from homogeneous solution by hydrolysis of trichlorocetic acid was used to produce a fine precipitate that was calcined to a sinterable oxide powder at 620C. The precipitate apparently consisted of more than one phase and has an overall composition which implied that it was a possible mixture of hydrated carbonate, hydroxy-carbonate and hydroxide. The calcined oxide powder was used to prepare a YDC ceramic by hot-pressing. The ceramic had the fluorite structure phase with a lattice constant of 0.541088 nm and a composition of Ce(0.914)Y(0.086)O(1.957). The bulk density of the material was 6.96 Kg/cu m, or 99.4 percent of TD. The ceramic had equiaxed grains, with an average dimension of 2-4 mm and with residual porosity mainly at the junctures of the grain boundaries.

706,291
PB82-239088 Not available NTIS
National Bureau of Standards, Washington, DC.
Selected X-ray Data for Comparison with Theory.
Final rept.
R. D. Deslattes, E. G. Kessler, L. Jacobs, and W. Schwitz. May 79, 4p
Pub. in Physics Letters 71A, n5/6 p411-414, 28 May 79.

Keywords: *X rays, Comparison, Reprints, Numerical solution.

By combining a few recently available optically referenced X-ray measurements with a highly selected group of previously reported X-ray to X-ray and X-ray to gamma-ray ratios, we obtain a set of accurate X-ray transition energies. Using these in comparison with theoretical calculations in the relaxed orbital limit of the relativistic self-consistent field approximation leads to a clearer delineation of the trend of discrepancies that has hitherto been available. The result, namely a linear variation with Z, appears to call for explication.

706,292
PB82-600007 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 11, Number 1, 1982.
c1982, 237p
See also PB82-600008 through PB82-600013.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is The National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature. Supplements to the Journal are published at irregular intervals and are not included in subscriptions to the Journal. They contain compilations which are too lengthy for a journal format.

706,293
PB82-600014 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 11, Number 2, 1982.
c1982, 245p
See also PB82-600015 through PB82-600017.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is The National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature. Supplements to the Journal are published at irregular intervals and are not included in subscriptions to the Journal. They contain compilations which are too lengthy for a journal format.

706,294
PB82-600018 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 11, Number 3, 1982.
c1982, 490p
See also PB82-600019 through PB82-600022.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is The National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature. Supplements to the Journal are published at irregular intervals and are not included in subscriptions to the Journal. They contain compilations which are too lengthy for a journal format.

706,295
PB82-600023 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 11, Number 4, 1982.
c1982, 165p
See also PB82-600024 through PB82-600029.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal sources for the Journal is The National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature. Supplements to the Journal are published at irregular intervals and are not included in subscriptions to the Journal. They contain compilations which are too lengthy for a journal format.

706,296
PB83-135186 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultrafast Techniques Applied to DNA Studies.
Final rept.
S. L. Shapiro. 1982, 13p
Pub. in Biological Events Probed by Ultrafast Laser Spectroscopy (Chapter 16) p361-383 Academic Press Inc., 1982.

Keywords: *Deoxyribonucleic acids, *Laboratory equipment, Reprints.

Recent experimental studies of rapid processes in DNA are reviewed. New nonlinear selectivity measurements are described in detail.

706,297
PB83-162222 Not available NTIS
National Bureau of Standards, Washington, DC.
Silica (Introduction).
Final rept.
T. D. Coyle. 1982, 19p
Pub. in Kirk-Othmer: Encycl. Chem. Technol. Third Edition, 20, p748-766 1982.

Keywords: *Silicon dioxide, Molecular structure, Chemical bonds, Chemical reactions, Chemical properties, Reprints.

This is an introduction to the section on Silica in the 3rd edition of the Encyclopedia of Chemical Technology. This introductory material provides an elementary discussion of structure and bonding in silica and related systems. Structural aspects of the principal forms of crystalline and non-crystalline silica are presented. Chemical reactions of SiO2 are reviewed briefly. A brief summary of generic users is included.

706,298
PB83-182550 Not available NTIS
National Bureau of Standards, Washington, DC.
Time Dependence of Pressure in a Bubbler Tube.
Final rept.
A. K. Gaigalas, and B. Robertson. Nov 82, 8p
Pub. in AIChE (American Insitute of Chemical Engineering) Jnl. 28, n6 p922-929 Nov 82.

Keywords: *Pressure, *Time dependence, Measuring instruments, Reprints, *Bubbler tubes.

An experimental and theoretical study is presented of the time dependence of air pressure in a bubbler tube used to measure the liquid level in a tank. The observed time dependence of the air pressure is a superposition of two components. The first component is a repeated slow rise and sudden fall in the air pressure that is associated with bubble growth and breakoff. It is the sudden breakoff that generates the second component consisting of damped oscillations associated with sound waves in the air interacting with an oscillating flow of the liquid.

706,299
PB83-191106 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Mechanical Relaxation of Liner Materials in Acetic Acid.
J. C. Phillips. Jan 83, 27p NBSIR-82-2615

Keywords: *Stress relaxation, *Linings, *Acetic acid, Comparison, Performance evaluation, Stress corrosion tests, Polyethylene, High density polyethylene, Polyvinyl chloride, Chlorinated polyethylene.

This report describes stress relaxation of three liner materials in air and acetic acid (HAc) environments. Additional experiments of environmental stress cracking (ESC) and recovery were also performed. The stress relaxation modulus from the stress relaxation data was chosen as the prime parameter for comparing the three liner materials. The results suggest rather strongly that over the temperature range used HDPE is a better and more desirable liner material in terms of its stress-strain behavior with time in air and acetic acid.

706,300
PB83-193078 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Technical Activities 1982 - Office of Standard Reference Data.
S. P. Fivozinsky. Feb 83, 82p NBSIR-83-2661
See also PB82-165820.

Keywords: *Physical properties, *Chemical properties, *Standards, Environmental surveys, Energy, *Office of standard reference data, *National standard reference data system.

The Office of Standard Reference Data is one of four program offices in the National Measurement Laboratory, National Bureau of Standards. The Standard Reference Data Program develops and disseminates data bases of critically evaluated physical/chemical properties of substances. These data bases are available through NBS and private publications, on magnetic tape, and from on-line retrieval systems. The Office of Standard Reference Data is responsible for management and coordination of the program. Work is carried out through a decentralized network of data centers and projects referred to as the National Standard Reference Data System (NSRDS). This volume summarizes the activities of the program for the year 1982.

706,301
PB83-204248 PC **A03**/MF **A01**
National Research Council, Washington, DC. Numerical Data Advisory Board.
Research Concerning Metrology and Fundamental Constants.
Final rept.
1983, 50p
Contract NB82-SBCA-1715

Keywords: *Fundamental constants, *Metrology, Forecasting, Research.

The purpose of this report is to call attention to the important role of fundamental constants and precision measurements in science and to demonstrate a requirement for increased and continuing support of this field. Precise knowledge of fundamental constants and techniques for making more accurate and reliable measurements are required to test basic theories, to extend our knowledge of the universe, and for practical applications of fundamental theories. This report demonstrates by example that research in this field has led to profound advances that have had an impact on much of our technology-based society.

706,302
PB83-234377 Not available NTIS
National Bureau of Standards, Washington, DC.
Liquid Membrane Transport: A Survey.
Final rept.
J. D. Way, R. D. Noble, T. M. Flynn, and E. D. Sloan. 1982, 21p
Contract GRI-5080-361-0345
Pub. in Jnl. of Membrane Science 12, p239-259 1982.

Keywords: *Membranes, *Transport properties, Surveys, Surfactants, Mathematical models, Forecasting, Reprints, *Liquid membranes, Coupled transport.

The literature pertaining to facilitated transport and liquid membrane separations was reviewed and summarized. Liquid membranes of all geometries were discussed, including immobilized liquid membranes and liquid surfactant or emulsion liquid membranes. Special emphasis was placed on work since 1977. Mathematical modeling and numerical solutions for facilitated transport models were summarized. The most important experimental techniques for liquid membrane research were discussed and directions for future research were recommended.

706,303
PB83-234450 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibration of Densimeters for Liquefied Light Hydrocarbons.
Final rept.
J. D. Siegwarth, and J. F. LaBrecque. Dec 82, 6p
Sponsored in part by Gas Research Inst., Chicago, IL.
Pub. in Oil Gas Jnl. 80, p64-69, 20 Dec 82.

Keywords: *Densitometers, Density(Mass/volume), Calibrating, Performance evaluation, Liquefied natural gas, Reprints.

A densimeter calibration apparatus is described in which an instrument to be calibrated is compared to a self-calibrating standard densimeter in homogeneous isothermal samples of liquids similar to those in which the instrument will be used. The calibration apparatus is estimated to give the true density to + or - 0.055%. The results of tests of a number of densimeters for liquefied natural gas service are described.

706,304
PB83-234559 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Neutron Irradiation on Electric Conductivity in Cellulose Acetate.
Final rept.
M. G. Broadhurst, A. J. Bur, and R. B. Schwartz. 1982, 2p
Pub. in Radiation Protection Dosimetry 3, n1/2 p107-108 1982.

Keywords: *Cellulose acetate, *Neutron irradiation, *Electrical resistivity, Dosimetry, Reprints, Neutron dosimetry.

Resistivities of cellulose acetate (CA) were measured before and after neutron irradiation in order to investigate the possibility of using this material for neutron dosimetry.

706,305
PB83-600016 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 12, Number 3, 1983.
1983, 405p
See also PB83-600017 through PB83-600022.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature. Supplements to the Journal are published at irregular intervals and are not included in subscriptions to the Journal. They contain compilations which are too lengthy for a journal format.

706,306
PB84-106038 Not available NTIS
National Bureau of Standards, Washington, DC.
International Reference Materials for Radiocarbon Dating.
Final rept.
W. B. Mann. 1983, 9p
Pub. in Radiocarbon 25, n2 p519-527 1983.

Keywords: *Radiocarbon dating, *Oxalic acid, Standards, Reprints, *Standard reference materials, Carbon 14.

In August, 1980, the National Bureau of Standards issued, in the form of oxalic acid, a new International Reference Material of contemporary carbon-14 for use in radiocarbon-dating laboratories. The preparation of the new oxalic-acid standard was described in a preliminary report, as were, also, the results then available for the activity-concentration ratio of the new to the old standard obtained by a number of leading international laboratories. With the recent completion of the analysis of all the submitted results by the participating laboratories the National Bureau of Standards plans to issue these recently calibrated samples of oxalic acid as an NBS Standard Reference Material. There is, however, no significant difference in the reported value of its activity concentration, relative to that of the 1957 standard, from that given provisionally in 1980.

706,307
PB84-106624 Not available NTIS
National Bureau of Standards, Washington, DC.
Proficiency Testing - An Essential Element of Accreditation.
Final rept.
D. Kirkpatrick, and J. Horlick. Dec 80, 5p
Pub. in American Society for Testing and Materials Standardization News, p14-17, 48 Dec 80.

Keywords: *Laboratories, *Tests, Performance evaluation, Insulation, Carpets, Concretes, Reprints.

The National Voluntary Laboratory Accreditation Program (NVLAP) is administered by the Department of Commerce to accredit testing laboratories upon request. Accreditation is currently available for laboratories that test carpet, thermal insulation materials, and freshly mixed field concrete. Decisions to accredit lab-

oratories are based on an evaluation conducted by the National Bureau of Standards which includes questionnaires, on-site examination, and proficiency testing. It was recognized early that while questionnaires and site visits could provide valuable insight into a laboratory's ability, a true measure of it's capability could only be determined through proficiency testing. This paper discusses the design and operation of the proficiency portion of the approach used in evaluating laboratories that test thermal insulation materials and carpets.

706,308
PB84-109552 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Standard Reference Materials: Sampling, Materials Handling, Processing, and Packaging of NBS (National Bureau of Standards) Sulfur in Coal Standard Reference Materials.
T. E. Gills, R. W. Seward, R. J. Collins, and W. C. Webster. Aug 83, 66p NBS-SP-260-84
Library of Congress catalog card no. 83-600553. Prepared in cooperation with Valley Forge Labs., Inc., Devon, PA., and Webster and Associates, Ltd., Norristown, PA.

Keywords: *Bituminous coal, *Sulfur, Sampling, Standards, Materials handling, Packaging, *Standard reference materials.

This publication describes in detail the performance of a grant given to Valley Forge Laboratories, Inc., by the National Bureau of Standards, to obtain and prepare four standard reference coals, with nominal sulfur contents of 0.5, 2.0, 3.0, and 4.5 percent to be issued as SRM's 2682, 2683, 2684, and 2685, respectively. All activities pertaining to the sampling, preparation, packaging, and homogeneity testing of the coal SRM's are documented in this report, including a separate description of each of the four coal sampling activities. Protocols used in the development of these Standard Reference Materials are similar to those used in other NBS SRM preparation procedures to ensure that materials used for SRM's have the highest possible homogeneity and stability.

706,309
PB84-112648 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
Standard Reference Materials: A Look at Techniques for the Dimensional Calibration of Standard Microscopic Particles.
Final rept.
D. A. Swyt. Sep 83, 153p NBS/SP-260-85
Library of Congress catalog card no. 83-600571.

Keywords: *Calibrating, *Electron microscopes, Particle size, Light scattering, Standards, Polymers, Plastics, *Standard reference materials.

This report surveys generic techniques for the dimensional calibration of microscopic particle size standards. It notes some user needs and available instrumentation, documentary standards, and commercial, sized particles. It discusses the elements of the measurement process, including the particle and medium, size-dependent phenomena, shape factors, single-number indices of average size, and means of length calibration. The report examines systematic differences among published results of electron microscopy, light scattering, particle counter, and other measurements on widely-used commercial polymer spheres. It concludes that the definitive calibration of narrow-distribution polymer spheres, a prerequisite first step toward calibration of irregularly-shaped matter, would best involve a three-element approach involving the techniques named.

706,310
PB84-115823 Not availabe NTIS
National Bureau of Standards, Washington, DC.
Application of Back-to-Back Accelerometers to Precision Vibration Measurements.
B. F. Payne. 16 Aug 82, 4p
Included in Jnl. of Research of the National Bureau of Standards, v88 n3 p171-174, May-Jun 83.

Keywords: *Accelerometers, Vibration meters, Calibrating, Standards.

Precision vibration measurements depend on accurate and repeatable calibration methods. Standardization of calibration test equipment and measurement techniques ensures more accurate and repeatable measurements. The use of the back-to-back accelerometer as a laboratory standard has become widespread. However, this use has been somewhat limited because of inadequate calibration methods. Recent developments in improved calibration methods have given the back-to-back accelerometer a greater potential as an accurate, repeatable, and stable vibration standard. As a vibration standard, the back-to-back accelerometer should prove to be a valuable asset for laborities involved in vibration measurements and vibration transducer calibrations. By adapting existing techniques of laser interferometric calibration to the special geometry of the back-to-back accelerometer, improved accuracy (over existing methods) can be obtained over the range of 2-15,000 Hz and extension to 20,000 Hz is a good possibility. Recent work at NBS in this area is presented along wiih a description of a sample back-to-back transducer calibration.

706,311
PB84-135987 Not available NTIS
National Bureau of Standards, Washington, DC.
Standard Reference Materials for Gas Transmission Measurements.
Final rept.
J. D. Barnes. 1983, 14p
Pub. in Proceedings of Symposium on Industrial Gas Separations Held at Washington, DC. on June 14, 1982, p75-88 1983.

Keywords: *Polyester resins, *Polymeric films, *Gases, Permeability, Helium, Carbon dioxide, Oxygen, Nitrogen, *Standard reference materials, SRM 1470.

Standard Reference Material 1470 is a 23 micrometer thick polyester film whose gas transmission characteristics with respect to Helium, Carbon Dioxide, Oxygen, and Nitrogen have been carefully measured. A completely computerized manometric permeation measuring facility developed at NBS was used for the measurements. The steps taken to characterize the gas transmission rate of this material over the range of pressures from 67.5 kPa to 135 kPa and over the range of temperatures from 18C to 31C are described. The results obtained in these measurements are compared with those in the literature. The role of Standard Reference Material 1470 in improving the repeatability and reproducibility of gas transmission measurements employing other instrumentation is described.

706,312
PB84-154608 Not available NTIS
National Bureau of Standards, Washington, DC.
Recent Activities of the National Bureau of Standards and the American Society for Testing and Materials in Developing Particulate Standard Reference Materials.
Final rept.
R. K. Kirby. 1983, 6p
Pub. in Proceedings of Fine Particle Society Fall Meeting, 1980, University of Maryland, College Park, MD., September 16-18, 1980. Article in Particulate Systems Technology and Fundamentals, p329-334 1983.

Keywords: *Particles, Fines, Standards, Surfaces, *Standard reference materials, *Certified reference materials.

During the past three years a new American Society for Testing and Materials Coordinating Committee (S-21) has been formed with the purpose of obtaining the cooperation of industry to assist National Bureau of Standards in the certification of Standard Reference Materials (SRM's) for particle size metrology. These SRM's will probably include monosize particles, distributed size particles, and surface area powders. These SRM's will be used in the calibration of particle sizing equipment. They will provide for traceability in the market-place. They can also be used to develop accurate secondary reference materials. The progress that has occurred to date in this activity and the associated NBS SRM program are discussed.

706,313
PB84-154954 Not available NTIS
National Bureau of Standards, Washington, DC.
Transient Response of Facilitated Transport Membranes.
Final rept.
C. A. Folkner, and R. D. Noble. 1983, 3p
Pub. in Jnl. of Membrane Science 12, p289-301 1983.

Keywords: *Membranes, *Transport properties, Flux density, Reprints.

The transient flux of permeate is determined for one-dimensional facilitated transport in flat plate, cylindrical, and spherical geometries. The results are presented graphically. The flux is a function of four parameters. The graphical results allow one to determine the permeate flux as a function of time for given set of operating conditions, determine the steady-state value of the permeate flux, and the time to reach steady-state.

706,314
PB84-156496 PC **A99**/MF **E15**
National Standard Reference Data System.
EPA/NIH (Environmental Protection Agency/National Institutes of Health) Mass Spectral Data Base, Supplement 2, 1983; Includes 1983 Cumulative Indexes.
S. R. Heller, G. W. A. Milne, and L. H. Gevantman. c1983, 2110p NSRDS-NBS-63-SUPPL-2
Supersedes PB81-189367. Library of Congress catalog card no. 78-606175. Prepared in cooperation with Environmental Protection Agency, Washington, DC., and National Cancer Inst., Bethesda, MD.

Keywords: *Mass spectroscopy, *Organic compounds, Graphs(Charts), Tables(Data).

This second Supplement to the EPA/NIH Mass Spectral Data Base (NSRDS-NBS 63) presents an additional collection of 6557 verified mass spectra of individual substances compiled from the EPA/NIH mass spectral file. The spectra are given in bar graph format over the full mass range. Each spectrum is accompanied by a Chemical Abstracts Index substance name, molecular formula, molecular weight, structural formula, and Chemical Abstracts Service Registry Number. A cumulative index has also been issued which provides access to the entire file of mass spectra.

706,315
PB84-160605 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 88, Number 6, November-December 1983.
Bi-monthly rept.
Dec 83, 61p
See also PB84-160613 through PB84-160647 and Volume 88, Number 5, PB84-125293. Library of Congress catalog card no. 63-37059.

Keywords: *Research projects, Polystyrene, Calorimeters, Water, Graph theory, Pipe flow.

Contents:
- A polystyrene-water calorimeter;
- Applicability of the Colebrook-White formula to represent frictional losses in partially filled unsteady pipeflow;
- Circulants and the characterization of vertex-transitive graphs;
- On the decomposition of vertex-transitive graphs into multicycles.

706,316
PB84-160613
(Order as PB84-160605, PC **A04**/MF **A01**)
National Bureau of Standards, Washington, DC.
Polystyrene-Water Calorimeter.
S. R. Domen. 15 Jul 83, 15p
Included in Jnl. of Research of the National Bureau of Standards, v88 n6 p373-387, Nov-Dec 83.

Keywords: *Polystyrene, *Calorimeters, *Water, Design criteria, Performance evaluation, Absorption, Temperature.

The paper describes a new type of calorimeter that can be quickly put into operation for determining absorbed dose at a point in polystyrene. It also describes a unique method of decreasing drifts in electrical signals caused by temperature gradients. Two calibrated thermistors were placed close together between sandwiched polystyrene discs that were immersed in water. The method can be applied to other calorimeters.

706,317
PB84-223361 Not available NTIS
National Bureau of Standards, Washington, DC.
Intercomparison of Different 'Absolute' Instruments for Measurement of Aerosol Number Concentration.
Final rept.
B. Y. H. Liu, D. Y. H. Pui, R. L. McKenzie, J. K. Agarwal, R. Jaenicke, F. G. Pohl, O. Preining, G. Reischl, W. Szymanski, and P. E. Wagner. 1982, 22p
Pub. in Jnl. of Aerosol Science 13, n5 p429-450 1982.

Keywords: *Measuring instruments, *Aerosols, Concentration(Composition), Comparison, Fines, Reprints.

During the 1979 workshop of the working group on ultrafine aerosols (WUFA) an intercomparison of different instruments for measurement of aerosol number concentration was performed. Each of these instruments (TSI-aerosol electrometer, TSI-condensation nuclei counter. Jaenicke-condensation nuclei counter, size analyzing nuclei counter SANC) can be regarded as 'absolute' because they do not depend on empirical calibration relative to external reference standards. Number concentrations were measured for monodispersed NaCl-aerosols with a mean particle diameter of 56nm generated by means of a collision atomizer and an electrostatic aerosol classifier. The readings of TSI-aerosol electrometer and SANC are quite linearly related over the whole concentration range, the SANC being low by a factor of about 0.59. Thus different measuring techniques based on completely different principles yield comparable aerosol number concentrations and accordingly condensation nuclei counters are truly aerosol counters.

706,318
PB84-233659 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
Experimentation and Measurement.
W. Y. Youden. Mar 84, 132p NBS/SP-672
Also available from Supt. of Docs as SN003-003-02575-5. Library of Congress catalog card no. 84-601011.

Keywords: *Measurement, *Measuring instruments, *Units of measurement, Laboratory equipment, Weight measurement.

This book is an elementary introduction to the laws of measurements. But the approach is not an abstract discussion of measurements, instead it depends upon getting you to make measurements and, by observing collections of measurements, to discover for yourself some of the properties of measurements. The idea is to learn something about measurement that will be useful-no matter what is being measured. Some hint is given of the devices that scientists and measurements specialists use to get more out of the available equipment. Understanding something about the laws of measurements, a person may be able to get the answers to your own research problems with half the usual amount of work. No young scientist can afford to pass up a topic that may double his scientific achievements.

706,319
PB84-244011 Not available NTIS
National Bureau of Standards, Washington, DC.
Certificate Values - What Do They Mean and How They Should Be Used.
Final rept.
H. H. Ku. Sep 83, 2p
Pub. in Jnl. of Test. Eval. 11, n5 p350-351 Sep 83.

Keywords: Probability theory, Standards, Reprints, *Standard reference materials, Certified values, Uncertainty.

The meanings of commonly used uncertainty statements associated with certified values of Standard Reference Materials are explained. In particular, the implications of these statements are interpreted in nonstatistical terms for the users.

706,320
PB84-245232 PC **A05**/MF **A01**
National Bureau of Standards (NML), Washington, DC.
Technical Activities 1983: Office of Standard Reference Data.
S. P. Fivozinsky. Apr 84, 82p NBSIR-84/2864
See also PB83-193078.

Keywords: *Physical properties, *Chemical properties, *Standards, Information systems, Environmental surveys, Energy, Materials, *Office of standard reference data, *National standard reference data system.

The Office of Standard Reference Data is one of two program offices in the National Measurement Laboratory, National Bureau of Standards. The Standard Reference Data Program develops and disseminates data bases of critically evaluated physical/chemical properties of substances. These data bases are available through NBS and private publications, on magnetic tape, and from on-line retrieval systems. The Office of Standard Reference Data is responsible for management and coordination of the program. Work is carried out through a decentralized network of data centers and projects referred to as the National Standard Reference Data System (NSRDS). This volume summarizes the activities of the program for the year 1983.

706,321
PB85-104859 Not available NTIS
National Bureau of Standards, Washington, DC.
Systematic Nomenclature for the 'Peroxyacyl Nitrates', the Functional and Structural Misnomers for Anhydride Derivatives of Nitrogen Oxo Acids.
Final rept.
R. I. Martinez. 1980, 5p
Pub. in International Jnl. of Chemical Kinetics 12, n10 p771-775 1980.

Keywords: *Chemical compounds, *Organic nitrates, *Anhydrides, Reprints, *Chemical nomenclature.

'Peroxyacyl Nitrates' are functional and structural misnomers for anhydride derivatives of nitrogen oxo acids. Their systematic nomenclatureis discussed.

706,322
PB85-108561 Not available NTIS
National Bureau of Standards, Washington, DC.
Separation Between Deterministic Response and Random Fluctuations by Means of the Cross-Power Spectrum in the Study of Electrochemical Noise.
Final rept.
U. Bertocci. 1981, 4p
Pub. in Jnl. of Electrochemical Society 128, n3 p520-523 Mar 81.

Keywords: *Electrochemistry, *Random noise, *Spectrochemical analysis, Laboratories, Reprints, Numerical solution.

It is shown that by calculating the cross-power spectrum between the input (the electrode potential) and the output (the cell current) of an electrochemical system under potentiostatic conditions, it is possible to identify which part of the cell current is the response to the input voltage and which part is caused by random fluctuations of the parameters characterizing the electrode. The noise introduced by the amplifiers can be measured separately and then subtracted from the signal. As an example, the current noise of an aluminum electrode below and at the pitting potential is examined. Both electrode impedance and spectral power density of the random fluctuations are obtained. It is shown that below the pitting potential, random fluctuations are below the minimum detectable value of 10 to the -23th power sq A/cm sup 4 Hz.

706,323
PB85-121192 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
National Bureau of Standards.
Jul 84, 53p NBS/SP-679
Also available from Supt. of Docs as SN003-003-02618-2. Library of Congress catalog card no. 84-601089.

Keywords: *Research projects, *Laboratories, *Test facilities, Chemistry, Tests, Laboratory equipment, Standards, National government, Industries, Physics, *National Bureau of Standards.

When the Bureau was established more than 80 years ago, it was given the specific mission of aiding manufacturing, commerce, government, and academia. Today, NBS remains the only federal laboratory with the explicit goal of serving U.S. industry and science. This mission takes on special significance now as the country responds to serious challenges to its industry and manufacturing--challenges which call for industry, universities, and government to pool their resources in research and development. The U.S. Department of Commerce has made industrial competitiveness a cornerstone of its programs. As a Commerce Department agency, NBS provides the measurement foundation that our changing industrial economy needs, and thus is well-positioned to help the nation meet these challenges. This brochure describes some of the cooperative programs the Bureau has underway as well as other work it is doing to improve the nation's measurement capabilities.

706,324
PB85-121200 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Facilities of the National Bureau of Standards.
Sep 84, 33p NBS/SP-682
Also available from Supt. of Docs as SN003-003-02617-4. Library of Congress catalog card no. 84-601093.

Keywords: *Research projects, *Laboratories, *Test facilities, Chemistry, Tests, Laboratory equipment, Standards, National government, Industries, Physics, *National Bureau of Standards.

Every laboratory in this country is a valuable national resource. Along with the people who work in these facilities, U.S. laboratories constitute the basic foundation of this country's scientific and industrial strength. As the nation's foremost science and engineering measurement laboratory, the National Bureau of Standards has some of the premier research and testing facilities in the United States, and several of our laboratories are unequaled anywhere in the world. This brochure highlights only a small number of the special facilities available at NBS and provides information about their availability for collaborative or independent research and testing. Individuals or organizations wishing to use a facility should contact the facility manager listed in each write-up. NBS has designed its system for reviewing such requests to be as efficient and responsive as possible, to encourage maximum use and minimal paperwork on the part of both NBS and the prospective user.

706,325
PB85-140325 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
25-Gram-Capacity Oxygen Bomb Calorimeter.
Final rept.
D. R. Kirklin, and E. S. Domalski. 1983, 11p
Pub. in Resource Conservation 10, n3 p177-187 1983.

Keywords: *Calorimeters, *Oxygen, Samples, Design criteria, Performance evaluation, Reprints, Refuse derived fuels, Solid wastes.

A 25 gram-capacity oxygen bomb calorimeter has been designed, constructed and tested at the National Bureau of Standards. The calorimeter should produce more representative calorific values for heterogeneous materials because the samples are an order of magnitude larger in mass than those used in conventional-size bomb calorimeters. The calorific values for processed and unprocessed samples were equivalent. The 25 gram-capacity bomb calorimeter yields more representative calorific values and requires less sample processing.

706,326
PB85-142917 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Enhanced Ionization Flame Velocimeter.
Final rept.
P. K. Schenck, J. C. Travis, G. C. Turk, and T. C. O'Haver. 1982, 4p
Pub. in Applied Spectroscopy 36, n2 p168-171 Mar/Apr 82.

Keywords: *Speed indicators, Performance evaluation, Atoms, Reprints, *Laser enhanced ionization.

The temporal and spatial evolution of the depleted neutral atom density following laser enhanced ionization in laminar flow flames has been used to characterize the flow velocity of the flame gases. This technique utilizes a low power CW dye laser and a low sodium seed density (10 to the 11th power-10 to the 12th power atoms/cc). The flow velocity can be measured to better than 2 percent in standard analytical burners.

706,327
PB85-147940 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characteristics of Ion Gages.
Final rept.
C. R. Tilford. 1984, 10p
Pub. in Proceedings of International Symposium on Vacuum Technology and Nuclear Applications, Bombay, India, December 6-9, 1983, p139-148 1984.

Keywords: *Ionization gages, Performance evaluation, Sampling, Stability, Design criteria.

The operation of ionization vacuum gages is affected by a number of factors that make it very difficult to theoretically predict or characterize their performance. This has lead to efforts in recent years to experimentally characterize the properties of commercially avail-

able gages. Factors affecting the performance of ion gages are discussed and results are presented from a National Bureau of Standards program that has determined nitrogen sensitivities, relative sensitivities for several common gages, dependences on operating parameter, and limited long-term stability tests for samples of several gage types. The results favor tungsten filament gages, particularly of the conventional triode type. However, one design of a dual tungsten filament Bayard-Alpert gage came close to the conventional triode in many criteria and performed significantly better on a limited long-term stability test.

706,328
PB85-148500 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Densimetry in Compressed Fluids by Combining Hydrostatic Weighing and Magnetic Levitation.
Final rept.
R. Masui, W. M. Haynes, R. F. Chang, H. A. Davis, and J. M. H. L. Sengers. Jul 84, 11p
Contract DOE-EA-77-A-01-6010
Sponsored by Science and Technology Agency, Tokyo (Japan).
Pub. in Review of Scientific Instruments 55, n7 p1132-1142 Jul 84.

Keywords: *Density(Mass/volume), *Densitometers, *Liquids, Design criteria, Performance evaluation, Compressibility, Magnetic fields, Reprints.

A magnetic densimeter is described that has been built for measuring the density of compressed liquids at pressures up to 15 MPa in the temperature range 20-200C with a desired accuracy of 0.1%. The densimeter combines the principle of magnetic levitation of a buoy with that of liquid density determination by hydrostatic weighing. To this effect, the support coil is suspended from an electronic balance, and the balance readings are recorded (1) with the buoy at rest, and (2) with the buoy in magnetic suspension. Details are given of the construction of the cell, coil, buoy and thermostat. The procedure is described by which cell and buoy are aligned so that the suspended buoy does not touch the cell wall. Test data on the densities of seven different liquids were obtained at room temperature. They agree with reliable literature values to within 0.1%. In a separate experiment, the thermal expansion coefficient of the buoy material was determined. This experiment and its results are also given here.

706,329
PB85-151637 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Investigations in Array Sizing. Part 1. Accuracy of the Sizing Process.
Final rept.
A. W. Hartman. 1984, 10p
Pub. in Powder Technology 39, p49-59 1984.

Keywords: *Optical microscopes, *Size determination, *Arrays, *Particle size, Calibrating, Performance evaluation, Light scattering, Reprints.

The technique of two-dimensional array sizing by optical microscopy is investigated for use in the determination of the average diameter of 0.9 micrometers polystyrene latex spheres. Error sources for the diameter measurement are discussed, including the effects of microcracks, anisotropy, and dissolved impurities. The technique has been used in a particle calibration program at NBS. The average diameter found was 0.897 + or - 0.016 micrometers, while techniques based on light scattering from a single particle and from a suspension yielded 0.900 + or - 0.011 and 0.895 + or - 0.008 micrometers, respectively.

706,330
PB85-160695 PC **A08**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Calorimeter for Measuring High-Energy Optical Pulses.
P. A. Simpson, E. G. Johnson, and S. M. Etzel. Oct 84, 169p NBSIR-84/3008
Sponsored by Aerospace Guidance and Metrology Center, Newark AFS, OH.

Keywords: *Calorimeters, *Optical equipment, Calibrating, Design criteria, Performance evaluation, Laser applications, Computer applications.

Two similar calorimeters for measuring laser pulses in the range 1 kJ to 15 kJ are described. The calorimeters, which are electrically calibrated, can be operated anywhere from the ultraviolet to infrared by selecting the proper materials for the volume absorber and deflecting mirror. Operation of each calorimeter is controlled by a dedicated desk-top computer. The theoretical basis for the calorimeters is given as are the constructional and operational details. The computer programs that are used are included in the appendices.

706,331
PB85-182889 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis of Small Current and Potential Fluctuations in Electrochemical Systems: Significance and Applications.
Final rept.
U. Bertocci. 1982, 16p
Sponsored by American Inst. of Chemical Engineers, New York.
Pub. in Proceedings of 1982 Annual Meeting of the American Institute of Chemical Engineers, Los Angeles, CA, November 14-19, 1982.

Keywords: *Electrochemistry, *Noise, Reviews, Sources, Spectral analysis.

The paper is a review of the work on electrochemical noise measurements. They are divided into cases where random noise is the input signal, cases where spontaneous fluctuations of the current or potential occur at or near equilibrium, and cases where macroscopic fluctuations of irreversible nature are the source of the noise. The theoretical background experimental results and their interpretation and applications are presented and discussed.

706,332
PB85-183531 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Automation of the NBS (National Bureau of Standards) Laser-Raman Microprobe.
Final rept.
J. J. Blaha, R. L. Myklebust, and E. S. Etz. 1981, 4p
Sponsored by Microbeam Analysis Society, Bethesda, MD.
Pub. in Proceedings of Annual Conference of the Microbeam Analysis Society (16th), Vail, CO., July 13-17, 1981 p61-64.

Keywords: *Raman spectroscopy, *Microprobes, *Laboratory equipment, Fortran, Automatic control equipment, *Laser spectroscopy, Computer applications.

Most functions of the NBS laser Raman microprobe have been placed under computer control. The system controls not only the spectrometer and sample stage but also the data acquisition, the data storage and the data display functions. The automation consists of a DECLAB-11/MNC computer interfaced to a JY HG2 optical spectrometer, a PAR SSR photon counter, a Burleigh dual PZT translator stage (inchworm type), and a Houston 2000 stripchart recorder. A series of FORTRAN routines has been developed to control all of the above for the initialization of all parameters and the subsequent data collection sequence. FORTRAN routines are also available for interactive graphic display of spectra on a DEC VT105 terminal or for plotting the spectra on the stripchart recorder.

706,333
PB85-184513 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Portable Ambient Aerosol Sampler.
Final rept.
D. S. Bright, and R. A. Fletcher. 1983, 9p
Pub. in American Industrial Hygiene Association Jnl. 44, n7 p528-536 1983.

Keywords: *Portable equipment, *Samplers, *Aerosols, Design criteria, Performance evaluation, Particle size, Reprints.

The NBS portable ambient aerosol sampler is designed to collect the respirable and inhalable particle size fractions at 6 1/min for 24 hour sampling periods. Particle size fractionation is accomplished with series filters. The collection efficiency of the inlet is measured by wind tunnel comparisons with isokinetic probes.

706,334
PB85-207215 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Temperature and Thermometry.
Final rept.
B. W. Mangum. 1985, 9p
Pub. in Encyclopedia of Physics, p1215-1223 1985.

Keywords: *Temperature measurement, *Temperature measuring instruments, Performance evaluation, *Thermometry.

The report gives a very brief history and discussion of thermometry and temperature scales. The fundamental bases of temperature scales and some of the most commonly used thermometers are briefly discussed.

706,335
PB85-237352
(Order as PB85-237329, PC **A04**/MF **A01**)
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
High Temperature, High Pressure Reaction-Screening Apparatus.
T. J. Bruno, and G. L. Hume. 7 Jan 85, 3p
Included in Jnl. of Research of the National Bureau of Standards, v90 n3 p255-257 May-Jun 85.

Keywords: *High temperature tests, *High pressure tests, *Decomposition reactions, *Laboratory equipment, *Fluids, Design criteria, Performance evaluation, Mixtures, Phase transformation, Gas chromatography, Sampling, Chemical properties, Chemical equilibrium, PVT properties.

This short note describes an apparatus that has been designed and constructed to allow assessment of the extent of chemical decomposition of fluids and fluid mixtures under high temperature, high pressure conditions. The apparatus is used to screen fluid systems prior to PVT (pressure-volume-temperature) or VLE (vapor-liquid equilibrium) experiments under severe conditions. For a predetermined residence time, the fluids are maintained at the temperature and pressure at which the PVT or VLE experiment will be conducted. The residence time in the reactor is comparable to the expected residence time in the PVT or VLE apparatus. Samples of fluid are withdrawn directly at regular intervals for analysis by gas chromatography, or collected in a sampling vessel for more extensive analysis.

706,336
PB86-106747 PC **A04**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Materials.
Feasibility Study for the Development of Standards Using Differential Scanning Calorimetry.
Final rept.
J. E. Callanan, S. A. Sullivan, and D. F. Vecchia. Aug 85, 59p NBS/SP-260/99
Also available from Supt. of Docs as SN003-003-02675-1. Library of Congress catalog card no. 85-600567.

Keywords: Feasibility, Standards, Calibrating, Materials tests, Temperature, Heat flow, Enthalpy, *Standard reference materials, *Differential scanning calorimetry.

The tremendous increase in the use of differential scanning calorimetry, coupled with the decrease in the capability for conventional precision calorimetry, has created a need for more and better thermal standards for use with scanning calorimeters and other thermal instruments currently available, such as thermomechanical analyzers. The development of these standards by methods such as adiabatic or drop calorimetry is impractical because of the number and variety of standards required, the associated expense, and the lack of facilities and personnel to do the certification. A two-part study was designed to evaluate the capability of a differential scanning calorimeter for developing temperature and enthalpy of fusion standards. Part I evaluated the variability of the differential scanning calorimeter (DSC) and factors which affected it; Part II applied American Society of Testing Materials (ASTM) procedures for the temperature and heat flow calibration. The study shows that fusion standards can be developed with a differential scanning calorimeter.

706,337
PB86-133360 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Simple Gas Sampling and Injection Apparatus.
Final rept.
T. J. Bruno. 1985, 3p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Jnl. of Chromatographic Science 23, p325-327 Jul 85.

Keywords: *Gas chromatography, *Samplers, Injection, Laboratory equipment, Design criteria, Performance evaluation, Reprints.

The short paper describes a simple apparatus used for gas sampling and injection in gas chromatographic analysis. It can be constructed easily from commercially available equipment, and provides results which rival those obtainable from less conventional sampling systems. The main features of the sampler/injector are a variable volume sample reservoir and a standard ten-port sampling valve equipped with an evacuable sample loop of fixed volume. The variable volume of the sample reservoir allows control of the sample pressure inside the loop. Evacuation of the sample loop prior to filling has been found to give a considerable increase in precision of replicate area count measurements. The sampler/injector is especially useful for situations in which a very limited amount of gaseous sample is available for analysis.

706,338
PB86-137635
(Order as PB86-137627, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Recalibration of the U.S. National Prototype Kilogram.
R. S. Davis. 14 Jun 85, 19p
Included in Jnl. of Research of the National Bureau of Standards, v90 n4 p263-283 Jul-Aug 85.

Keywords: *Mass, *Standards, *Units of measurement, *International prototype kilogram, *Kilogram.

The U.S. national prototype kilogram, K20, and its check standard, K4, were recalibrated at the Bureau International des Poids et Mesures (BIPM). Both these kilograms are made of platinum-iridium alloy. Two additional kilograms, made of different alloys of stainless steel, were also included in the calibrations. The mass of K20 in 1889 was certified as being 1 kg-0.039 mg. Prior to the work reported below, K20 was most recently recalibrated at the BIPM in 1948 and certified as having a mass of 1 kg-0.019 mg. K4 had never been recalibrated. Its initial certification in 1889 stated its mass as 1 kg-0.075 mg. The work reported below establishes the new mass value of K20 as 1 kg-0.022 mg and that of K4 as 1 kg-0.106 mg. The new results are discussed in detail and an attempt is made to assess the long-term stability of the standards involved with a view toward assigning a realistic uncertainty to the measurement.

706,339
PB86-137643
(Order as PB86-137627, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Density Comparison of Silicon Artifacts between NML (National Measurement Laboratory) (Australia) and NBS (National Bureau of Standards) (U.S).
J. B. Patterson, and R. S. Davis. 6 Jun 85, 3p
Prepared in cooperation with National Measurement Lab., Chippendale (Australia).
Included in Jnl. of Research of the National Bureau of Standards, v90 n4 p285-287 Jul-Aug 85.

Keywords: *Silicon, *Density(Mass/volume), *Units of measurements, *Volume, Comparison, Standards, *Standard reference materials, *Artifacts.

The densities of four silicon artifacts were measured in SI units to .000001 by NML (Australia) and NBS (U.S.). Agreement is within the experimental uncertainty of each labortory. Two of the artifacts had been used in the determination of the Avogadro constant at NBS. The remaining two objects had been used at NBS to establish silicon density artifacts available as a Standard Reference Material (SRM).

706,340
PB86-137650
(Order as PB86-137627, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Mass Comparator for In-Situ Calibration of Large Mass Standards.
R. M. Schoonover. 17 Jul 85, 6p
Included in Jnl. of Research of the National Bureau of Standards, v90 n4 p289-294 Jul-Aug 85.

Keywords: *Mass, *Standards, *Calibrating, *Units of measurement, *Mass comparators.

The paper describes a high precision electronic mass comparator with a range from 250 kg to 5,000 kg. It is suggested that it would be useful to transport the comparator to the test weights rather that to transport the weights to the comparator, the usual method, thus economizing time and monies.

706,341
PB86-137668
(Order as PB86-137627, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Determination of the Enthalpies of Combustion and Formation of Substituted Triazines in an Adiabatic Rotating Bomb Calorimeter.
W. H. Johnson, and E. J. Prosen. 28 Mar 85, 9p
Included in Jnl. of Research of the National Bureau of Standards, v90 n4 p295-303 Jul-Aug 85.

Keywords: *Enthalpy, *Combustion, *Triazines, *Calorimeters, Thermodynamic properties, Sampling, Thermochemistry, Laboratory equipment.

To obtain reliable thermodynamic data on substituted triazines, it is necessary to use a calorimeter that is capable of high precision with small quantities of sample and in which a homogenous solution of the corrosive combustion products can be maintained. The enthalpies of combustion of six substituted triazines have been determined in a platinum-lined adiabatic rotating bomb calorimeter. These are the first determinations of enthalpies of combustion or formation to have been reported for these compounds.

706,342
PB86-155561 PC **A04**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD.
Summary of the Biological and Botanical Standards Issued by the National Bureau of Standards.
R. Mavrodineanu, and R. Alvarez. Oct 85, 75p NBS/SP-260/104, LCCCN-85-600605
See also PB84-165349. Also available from Supt. of Docs as SN003-003-02704-9. Library of Congress catalog card no. 85-600605.

Keywords: *Bioassay, *Materials, *Chemical analysis, *Botany, Environmental surveys, Clinical medicine, Physical properties, Chemical properties, Engineering standards, Research projects, *Standard reference materials, *Biological processes.

The publication is a summary of the biological and botanical Standard Reference Materials and Research Materials issued by the National Bureau of Standards. The material, composition, certification, use, and remarks concerning each of the ten materials described are presented in tabular form. Copies of the Certificates of Analysis for these materials are contained in the appendix for more detailed information.

706,343
PB86-166790
(Order as PB86-166782, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Note on Weighings Carried Out on the NBS-2 Balance.
R. S. Davis, and P. Carre. 28 Aug 85, 9p
Prepared in cooperation with Bureau International des Poids et Mesures, Sevres (France).
Included in Jnl. of Research of the National Bureau of Standards, v90 n5 p331-339 Sep-Oct 85.

Keywords: *Weight indicators, *Weight measurement, Design criteria, Performance evaluation.

The NBS-2 balance was designed and built at NBS and transferred to the BIPM in 1972. It is presently used for the comparison of national prototype kilograms with international standards. Excellent environmental conditions at the BIPM have resulted in a long-term standard deviation of 1 microgram (1 x 10 to the -9th power) for a comparison of two 1-kilogram standards. With this remarkable precision, one has begun to observe and quantify systematic biases of less than 5 micrograms. The nature of these biases is presented as well as the remedy adopted to eliminate their influence on both the final measurement results and the variance assigned to those results.

706,344
PB86-166816
(Order as PB86-166782, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
SRM 1970: Succinonitrile Triple-Point Standard - A Temperature Reference Standard Near 58.08C.
B. W. Mangum, and S. El-Sabban. 8 Aug 85, 12p
Prepared in cooperation with National Inst. for Standards, Cairo (Egypt).
Included in Jnl. of Research of the National Bureau of Standards, v90 n5 p359-370 Sep-Oct 85.

Keywords: *Succinonitrile, *Thermometers, Temperature measurement, Standards, Calibrating, *Standard reference materials.

Triple-point-of-succinonitrile cells have been tested and established as Standard Reference Material (SRM) 1970. Of the 115 cells tested, 109 were accepted as SRM 1970. Five of the 115 cells had triple-point temperatures lower than 58.0785C (the low-temperature limit established for SRM 1970) and, consequently, were rejected. One of the 115 cells broke during tests on it. The mean value of the triple-point temperatures (obtained by freezing) of the 109 cells is 58.0796 + or -0.0015C, where the uncertainty is the total estimated uncertainty relative to the International Practical Temperature Scale of 1968, Amended Edition of 1975. The standard deviation of the triple-point temperatures is 0.48 mK. The purity of the succinonitrile of the SRM 1970 cells is estimated to range from 99.999.97% to 99.999.84%. The preparation of the cells, the various tests performed on them, and the procedure recommended for their use are described.

706,345
PB86-197100 PC **A02**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
SRM 1970: Succinonitrile Triple-Point Standard--A Temperature Reference Standard Near 58.08C.
Final rept.
B. W. Mangum, and S. El-Sabban. Mar 86, 25p NBS/SP-260/101
See also PB86-166782. Also available from Supt. of Docs as SN003-003-02722-7. Library of Congress catalog card no. 86-600505. Prepared in cooperation with National Inst. for Standards, Cairo (Egypt).

Keywords: *Succinonitrile, *Temperature measurement, *Standards, Calibrating, *Standard reference materials.

Triple-point-of-succinonitrile cells have been tested and established as Standard Reference Material (SRM) 1970. Of the 115 cells tested, 109 were accepted as SRM 1970. Five of the 115 cells had triple-point temperatures lower than 58.0785 deg.C (the low-temperature limit established for SRM 1970) and, consequently, were rejected. One of the 115 cells broke during tests on it. The mean value of the triple-point temperatures (obtained by freezing) of the 109 cells is 58.0796 plus or minus 0.0015 deg.C, where the uncertainty is the total estimated uncertainty relative to the International Practical Temperature Scale of 1968, Amended Edition of 1975. The standard deviation of the triple-point temperatures is 0.48 mK. The purity of the succinonitrile of the SRM 1970 cells is estimated to range from 99.999,97% to 99.999,84%. The preparation of the cells, the various tests performed on them, and the procedure recommended for their use are described.

706,346
PB86-227592 PC **A08**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
NBS (National Bureau of Standards) Standard Reference Materials Catalog 1986-87.
Special pub.
R. W. Seward. Jun 86, 165p NBS/SP-260
Supersedes PB84-165349. Also available from Supt. of Docs as SN003-003-02740-5.

Keywords: *Catalogs(Publications), Standards, *Standard reference materials.

The catalog describes the Standard Reference Materials (SRM's) currently available from the National Bureau of Standards (NBS), lists those in preparation, and provides ordering information. The descriptions provide nominal values for these SRM's. Certified values are provided in the certificates that accompany each SRM. Price Lists for SRM's are issued as separate supplements to the catalog and include new SRM's as they are issued.

706,347
PB87-100186 PC **A08**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 91, Number 3, May-June 1986.
Jun 86, 166p
See also PB87-100194 through PB87-100244 and PB86-206364. Also available from Supt. of Docs as SN703-027-00010-5.

Keywords: *Research, Chemical analysis, Heat measurement, Chemical reactions, Thermal analysis, Enthalpy, Electric switches, Temperature control, Carbinols, Metalloids, Pipe flow, Unsteady flow, Calorimetry, Differential scanning calorimetry, Biotechnology.

Table of contents includes: High precision microcalorimetry: Apparatus, procedures, and biochemical applications; Standards development for differential scanning calorimetry; Miniature mercury contact switches for instrument temperature control; Thermophysical property measurement on chemically reacting systems--a case study; Inorganic materials biotechnology: A new industrial measurement challenge; Improvements in the application of the numerical method of characteristics to predict attenuation in unsteady partially filled pipe flow.

706,348
PB87-100210
(Order as PB87-100186, PC **A08**/MF **A01**)
National Bureau of Standards (NEL), Boulder, CO.
Miniature Mercury Contact Switches for Instrument Temperature Control.
T. J. Bruno, and J. G. Shepherd. Jun 86, 3p
Sponsored by Gas Research Inst., Chicago, IL., and Department of Energy, Washington, DC.
Included in Jnl. of Research of the National Bureau of Standards, v91 n3 p131-133 May-Jun 86.

Keywords: *Electric switches, *Mercury, Temperature control, Temperature measuring instrument.

In this short note the authors described the design and construction of several modifications of miniature mercury contact switches for use in laboratory temperature control applications. Commerical contact switches, or contact thermometers as they are commonly called, are limited in their application because of their large size. The units which we present here are much more compact and are thus suitable for a wider range of applications. The limitations of the miniature contact switches in their present configurations are also discussed.

706,349
PB87-128179 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Comment on 'Convection Currents in a Water Calorimeter'.
Final rept.
S. R. Domen. 1986, 3p
Pub. in Physics in Medicine and Biology 31, n10 p1166-1168 1986.

Keywords: *Calorimeters, *Convection, Ionizing radiation, Water, Thermistor, Reprints.

Schulz and Weinhous (Phys. Med. Biol., 1985 30, 1093-1099) detected convection currents in a water calorimeter irradiated with broad horizontal beams of 25-MV x rays and 19-MeV electrons. The region of particular interest is near the beam entrance wall. Considering their recorded results, the broad beams and large electrical powers dissipated in the sensing thermistors, and calculations which approximately describe the convective velocity stream, it is hypothesized that most of the observed convective effects could have been caused by convective cooling of the sensors.

706,350
PB87-137154 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 91, Number 6, November-December 1986.
Dec 86, 56p
See also PB87-137162 through PB87-137188, and PB87-121315. Also available from Supt. of Docs as SN703-027-00013-0.

Keywords: *Research, Chemical analysis, Gases, Gallium, Atomic mass, Thermal expansion, Platinum, Temperature dependence, Isotope ratio, Reference materials, Platinum rhodium alloys.

The report includes the folliwng papers: The temperature dependence of spectral broadening in the Hg (6 singlet S(sub 0) - 6 triplet P(sub 1)) Multiplet at high optical densities; Absolute isotopic abundance ratio and atomic weight of a reference sample of gallium; Thermal expansion of platinum and platinum-rhodium alloys.

706,351
PB87-209953 PC **A11**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD
Summary of Gas Cylinder and Permeation Tube Standard Reference Materials Issued by the National Bureau of Standards.
Final rept.,
R. Mavrodineanu, and T. E. Gills. May 87, 235p
NBS/SP-260/108
See also PB86-227592. Also available from Supt. of Docs as SN003-003-02799-5. Library of Congress catalog card no. 87-619817.

Keywords: *Catalogs(Publications), Standards, Air, Benzene, Carbon dioxide, Carbon monoxide, Gas, Methane, Nitrogen oxide, Oxygen, Propane, Sulfur dioxide, *Standard reference materials.

The publication is a summary of the gas cylinders and permeation tubes issued by NBS as Standard Reference Materials (SRM's). The material, composition, certification, use, and remarks concerning each of the SRM's described are presented in tabular form. Copies of the certificates of these SRM's are contained in the appendices for more detailed information.

706,352
PB87-218327 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Overview of Membrane Separations.
Final rept.,
R. D. Noble. 1987, 13p
Pub. in Separation Science and Technology 22, n2-3 p731-743 1987.

Keywords: *Membranes, *Separation, Applications, Reviews, Reprints.

The field of membrane separations is discussed. The major membrane types and applications are outlined. The outlook with respect to research activities and commercial applications is surveyed. The advantages and disadvantages of this separation process are discussed. Certain applications where membranes may save energy and improve productivity are also discussed.

706,353
PB87-230801 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Comparison of Isotope Dilution Mass Spectrometric Methods for the Assay of Copper in Copper Ore Reference Materials.
Final rept.,
E. S. Beary, K. A. Brletic, P. O. J. Paulsen, and J. R. Moody. 1987, 4p
Pub. in Analyst 112, p441-444 Apr 87.

Keywords: *Mass spectrometry, *Copper, Assays, Reprints, Isotope dilution, Reference materials.

The trend toward lower assays in the repeated determination of copper in copper ore, Standard Reference Material 332, have resulted in the withdrawal of this reference material due to material instability. Recent analyses by both isotope dilution thermal ionization mass spectrometry (TIMS) and isotope dilution inductively coupled plasma mass spectrometry (ICP-MS) have confirmed this change in copper assay. In this study ICP-MS was shown to be an excellent method for the determination of the concentration of copper in copper ore and therefore may be capable of relatively high precision for a number of elements in inorganic matrices. Two experiments were designed to study the relationship between the high loss of volatile components on drying and the corresponding low copper assay. The slow oxidation of CuS to CuSO4 was confirmed. The accelerated moisture study indicated that exposure to changes in temperature and relative humidity did not cause this oxidation. Microwave drying provided additional information about moisture associated with the samples that had been oxidized.

706,354
PB88-156708 PC **A23**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Compilation of Elemental Concentration Data for NBS (National Bureau of Standards) Clinical, Biological, Geological, and Environmental Standard Reference Materials.
Special pub. 1982-86,
E. S. Gladney, B. T. O'Malley, I. Roelandts, and T. E. Gills. Nov 87, 536p NBS/SP-260/111
Also available from Supt. of Docs. as SN003-003-02836-3. See also PB86-227592. Library of Congress catalog card no. 87-619888. Prepared in cooperation with Los Alamos National Lab., NM., and Liege Univ. (Belgium).

Keywords: *Catalogs(Publications), Standards, *Standard reference materials.

Concentration data on as many as 92 constituents in 166 NBS Standard Reference Materials have been collected from over 1500 journal articles and technical reports. These data are summarized in consensus (mean) values with uncertainties expressed as plus or minus one standard deviation and compared with all available certification data from NBS. Data are presented on the analytical procedures employed and all raw data are given in the tables. The compilation is a successor to NBS Special Publication 260-88.

CIVIL ENGINEERING

Civil Engineering

706,355
AD-A109 502/5 PC **A02**/MF **A01**
Coastal Engineering Research Center, Fort Belvoir, VA.
Measurements of Oscillatory Drag on Sand Ripples.
K. E. B. Lofquist. 1980, 22p Rept no. CERC-R-81-11
Pub. in the Proceedings of the 17th International Coastal Engineering Conference ASCE, ch186 p3087-3106, 23-28 Mar 80.

Keywords: *Drag, Water tunnels, Water flow, Oscillation, Water waves, Bottom, Sand, Ripples, Stresses, Reprints, Oscillatory flow.

No abstract available.

706,356
PB-266 077/7 PC **A22**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Wind and Seismic Effects - Proceedings of the Joint Panel Conference of the U.S.-Japan Cooperative Program in Natural Resources (7th) Held at Tokyo, Japan on May 20-23, 1975,
H. S. Lew. Apr 77, 513p NBS-SP-470
Library of Congress Catalog Card no. 77-608015. See also PB-252 683.

Keywords: *Structures, *Earthquakes, *Wind pressure, *Meetings, Dynamic structural analysis, Design criteria, Dynamic response, Gust loads, Wind(Meteorology), Volcanism, Earthquake resistant structures, Developing countries, Soil dynamics, Design standards, *Natural hazards, *Natural disasters, *Liquefaction(Soils), *Earthquake engineering, *Ground motion.

The Seventh Joint Meeting of the U.S.-Japan Panel on Wind and Seismic Effects was held in Tokyo, Japan on May 20-23, 1975. The proceedings of the Joint Meeting include the program, the formal resolutions, and the technical papers. The subject matter covered in the papers includes characteristics of strong wind; response of full-scale structures to wind action; geological distribution of seismic activity; maintenance of strong motion accelerographs and data processing; strong earthquake motions and ground failures; response of hydraulic and building structures to seismic forces; aseismic considerations for vessels; recent revisions of design standards on wind and seismic effects; joint research program utilizing large scale testing facilities; and technological assistance to developing countries.

706,357
PB-280 448/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Mathematical Aspects of Engineering Research at Selected Universities in Hong Kong and Japan.
Final rept.,
J. T. Fong. Dec 77, 4p
Pub. in Science Bulletin, v2 n4 p15-18 Oct/Dec 77.

Keywords: *Structural engineering, *Mechanics, Structural design, Computerized simulation, Safety

factor, Fatigue(Materials), Fractures(Materials), Structural analysis, Japan, Hong Kong, Reprints.

Recent progress on the mathematical aspects of two research problems in engineering at several academic centers in Hong Kong and Japan is reported. The two engineering research problems are: (a) How to quantify the engineering judgment in the use of safety factors, and (b) how to quantify the mathematical judgment in the use of lower-dimensional solutions as approximations to higher-dimensional problems in engineering design. Significance of selected works at University of Hong Kong, two research institutes of University of Tokyo, and Tohoko University at Sendai, Japan, is discussed in conjunction with recent works on similar subjects at U.S. National Bureau of Standards.

706,358
PB-289 871/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Uncertainties in Fatigue Life Prediction and a Rational Definition of Safety Factors.
Final rept.,
J. T. Fong. 1978, 10p
Pub. in Nuclear Engineering and Design 51, p45-54 1978.

Keywords: *Structural engineering, *Safety factor, *Fatigue life, Structural design, Weibull density functions, Benefit cost analysis, Predictions, Mathematical models, Aluminum alloys, Aluminum alloy 6061, Reprints.

To cope with uncertainties in mechanical and structural design, engineers exercise their judgment through the use of safety factors based on service experience and laboratory data on relevant design parameters. Using the problem of fatigue life prediction as a vehicle, the relationship between the size of a safety factor and the associated risk and cost-benefit estimates of the engineering judgment based on new technical information, is demonstrated. The subtle influence of the choice of a distribution function for a given set of data is exhibited by comparing the Gaussian with the three-parameter Weibull fits of a set of fatigue life data on 6061-T6 aluminum. A system of ranking the importance of different sources of uncertainties based on an analysis of service data is proposed along with an example to refine the system using up-to-date laboratory and field measurements. The concept of a rational definition of safety factors as a tool for engineers who design under uncertainty is discussed.

706,359
PB80-101470 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Water Supply and Drainage in Buildings.
Final rept.,
L. S. Galowin, and J. R. Debelius. Aug 79, 232p NBS-SP-553
Proceedings of an International Symposium Held at Washington, DC., on September 28-30, 1976. Library of Congress catalog card no. 79-600105. Sponsored in part by National Research Council, Washington, DC. Building Research Advisory Board.

Keywords: *Buildings, *Water supply, *Drainage, *Meetings, Plumbing, Sanitary engineering, Piping systems, Water services, Water conservation, Hydraulics, Standardization, *Foreign technology, Plumbing systems.

Contents: Water requirements and procedures for estimating the demand for water in buildings; Protecting water quality in buildings; Water and water-related conservation in buildings; Hydraulics of gravity drainage systems; Performance concepts for water supply and drainage systems in buildings; Alternative concepts for transporting and treating wastes within buildings; CIB W-62 purpose, methodology, and fields of work; Standardization structure in Europe; Certification and agreement system in Europe; Research laboratories with CIB interest; Cost benefit of plumbing-Large fringe benefits for sanitary installations by thorough analysis of systems; Economic water supply design based on performance requirements; Production, transport, and use of hot water; Performance requirements for taps--A consensus from Scandinavia; Code structure and standardization in the United States; Potential savings from using reduced-size venting in the United States.

706,360
PB80-130511 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Proceedings, Federal Workshop on Excavation Safety, September 19 and 20, 1978,
L. A. Salomone, and F. Y. Yokel. Dec 79, 118p NBSIR-79-1935

Keywords: *Excavation, *Trenching, *Safety engineering, *Meetings, Accident prevention, Soil classification, Engineers, Guidelines, Shoring.

A two-day workshop was held to obtan opinions from knowledgeable people on tentative conclusions and recommendations of a NBS Study on excavation safety. The workshop agenda included a series of presentations on Tuesday, September 19, 1978 and a series of group discussions on Wednesday, September 20, 1978. The topic areas covered in the group discussions were: soil classification; acceptable measures to protect workers against death by caving of banks in trenches and excavations; and, role of the professional engineer and engineering guidelines. This report summarizes and synthesizes opinions expressed in these group discussions and presents comments provided by correspondence after the two-day workshop.

706,361
PB80-140817 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Analysis of the Responses from an Associated General Contractors of America (AGC) Survey of Trenching and Shoring Practices,
L. A. Salomone, and F. Y. Yokel. Jul 79, 62p NBSIR-79-1936
Prepared in cooperation with Occupational Safety and Health Administration, Washington, DC.

Keywords: *Excavation, *Construction management, Safety engineering, Shoring, Bracing, Timbering(Supporting), Trenching, Materials handling, Questionnaires.

Results of an Associated General Contractors of America (AGC) survey of present practice in excavation, trenching, and shoring, and of the impact of the OSHA Regulations for Excavation, Trenching, and Shoring as perceived by a selected number of the membership are presented. The survey consisted of forty-seven (47) questions. A response of about fify percent resulted in twenty-three (23) questionnaires being completed and returned to AGC. Although the twenty-three responses did not merit a rigorous statistical analysis, the data are useful in making some general statements about trenching and excavation operations.

706,362
PB80-182314 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Soil Classification for Construction Practice in Shallow Trenching.
Building science series (Final),
F. Y. Yokel, R. L. Tucker, and L. C. Reese. Mar 80, 92p NBS-BSS-121
Sponsored in part by Occupational Safety and Health Administration, Washington, DC., and National Inst. for Occupational Safety and Health, Rockville, MD. Library of Congress catalog card no. 80-600014.

Keywords: *Trenching, *Soil classification, Slope, Soil stabilization, Construction, Construction equipment, Excavation, Field tests.

Construction practices in trenching and data on potential causes of trenching accidents are reviewed. A study is made of the soil properties and site conditions that must be identified in order to determine the stability of shored and sloped excavations against cave-ins. Two possible alternate soil classification methods are recommended. The methods are simple enough to be used by construction foreman and at the same time use parameters which can be measured or identified without ambiguity. The classification methods are supplemented by appropriate field tests and correlated with allowable side slopes and lateral soil pressures on shoring.

706,363
PB80-185648 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Fracture Control Practices for Metal Structures,
H. I. McHenry, and S. T. Rolfe. Jan 80, 115p NBSIR-79-1623
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD. Prepared in cooperation with Kansas Univ., Lawrence. Dept. of Civil Engineering.

Keywords: *Structural engineering, Fracturing, Control, Stress analysis, Steel structures, Structural design, Quality assurance, Fractures(Materials), *Fracture mechanics.

Fracture control practices are the engineering procedures and requirements that contribute to the prevention of fracture in metal structures. These practices are identified as the elements of fracture control and each element is defined and described. The systematic application of these practices to the prevention of fracture in a particular structure is accomplished by either the code approach or the performance specification approach to fracture control. In these two approaches, the consideration given to each of the elements of fracture control is discussed and illustrated with examples for specific types of structures. Selected practices that may be of use in Naval systems are discussed. An Appendix contains detailed summaries of the fracture control practices used in each of thirteen classes of metal structures, including ships, offshore structures, bridges, cryogenic tanks, pressure vessels, piping, power generation equipment, and aerospace structures.

706,364
PB80-192800 PC **A05**/MF **A01**
Texas Univ. at Austin. Dept. of Civil Engineering.
Trench Pressure Measurements with Hydraulic Shores.
Final rept.,
R. L. Tucker, L. C. Reese, and M. H. Nicholas. May 80, 86p NBS-GCR-80-202
Sponsored in part by National Inst. for Occupational Safety and Health, Morgantown, WV. Div. of Safety Research, and Occupational Safety and Health Administration, Washington, DC.

Keywords: *Trenching, *Shoring, Pressure measurement, Soil properties, Soil pressure, Hydraulic equipment, Construction, Slope stability.

A system was developed by which strut-loads in shallow trench bracing can be measured. The system makes use of commercially available hydraulic shores. The results of a pilot study in which the system was developed and used to measure strut loads are reported. Data on strut loads in a fissured clay, taken during and after the development of failure slip surfaces, are reported.

706,365
PB80-202252 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations.
Building science series (Final),
F. Y. Yokel. Jun 80, 90p NBS-BSS-127
Sponsored in part by National Inst. for Occupational Safety and Health, Rockville, MD., and Occupational Safety and Health Administration, Washington, DC. Library of Congress catalog card no. 80-600068.

Keywords: *Excavation, *Trenching, Construction, Shoring, Timbering(Supporting), Soil classification, Standards, Guidelines, *Slope stability.

On the basis of studies conducted by the National Bureau of Standards, technical provisions for the sloping and shoring of the banks of trenches and excavations are recommended. Included are a recommended standard practice for trenching which can be used by construction supervisors and compliance officers of the Occupational Safety and Health Administration, and proposed engineering guidelines for the design of shoring systems and other means to prevent mass movement of soil or rock in excavations.

706,366
PB80-203631 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.

Study of Lumber Used for Bracing Trenches in the United States.
Building science series (Final),
L. I. Knab, F. Y. Yokel, W. L. Galligan, B. A. Bendtsen, and J. F. Senft. Mar 80, 223p NBS-BSS-122
Sponsored in part by Occupational Safety and Health Administration, Washington, DC. Prepared in cooperation with Forest Products Lab., Madison, WI., and Purdue Univ., Lafayette, IN. Dept. of Forestry and Natural Resources. Library of Congress catalog card no. 80-600015.

Keywords: *Trenching, *Timbering(Supporting), Bracing, Shoring, Hardwoods, Softwoods, Douglas fir wood, Pine wood, Construction, Computer programs, Fortran, Fortran 5 programming language, Univac - 1110 computers.

This report presents a study of the properties and characteristics of trenching lumber which are critical to its structural performance. Using these properties and characteristics, allowable stresses and use recommendations are proposed. The National Bureau of Standards (NBS) conducted a field study of trenching lumber and found that either ungraded eastern species, primarily hardwood, or graded Douglas-fir is used. For graded Douglas-fir, allowable design stresses and other properties are established by existing standards. The eastern species, however, are ungraded and no accepted guidelines are used to assign allowable design stresses and other properties.

706,367
PB80-222631 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Analysis of Construction Conditions Affecting the Structural Response of the Cooling Tower at Willow Island, West Virginia,
H. S. Lew, and S. G. Fattal. Jul 80, 49p NBSIR-80-2010
Sponsored in part by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Cooling towers, *Structural analysis, Concrete structures, Concrete construction, Structural engineering, Collapse, Strength, Failure, Loads(Forces), Willow Island(West Virginia).

The initial investigation of the Willow Island cooling tower collapse (NBSIR 78-1578) established that the most probable cause of the collapse was the imposition of construction loads on the tower before the concrete had gained adequate strength. The analysis presented herein responds to questions outside the scope of that investigation which considered only actual conditions existing at the time of the collapse. The present investigation shows that failure would initiate in lift 28 if the concrete strength in that lift is 100 psi (6.9 MPa) or less, and to maintain a safety factor of 2.0, the concrete strength in that lift should be 4000 psi (27.6 MPa). This study also reveals that even if an additional bolt had been introduced between each exterior jumpform beam and the tower, the stresses would not have been relieved enough to prevent failure of lift 28. Finally, it is shown, that if the ground anchor point of the static line had been kept at the location occupied just prior to its last move to a location near the center of the tower, the stresses in the shell due to construction loads would have been relieved to the extent that failure of lift 28 would probably not have occurred.

706,368
PB81-203176 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Experimental Investigation of Transport of Finite Solids in a 76 mm-Diameter Partially-Filled Pipe.
Rept. for Jan 79-Mar 80.
B. M. Mahajan. Apr 81, 66p NBSIR-81-2266
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Sewage disposal, *Piping systems, Transport properties, Water flow, Volumetric analysis, Water pipes, Solids flow, Plumbing, *Solids transport, NTISCOMNBS, NTISHUDPDR.

An exploratory experimental investigation of the hydrotransport mechanisms of finite solids with non-uniform, unsteady and transient water flow introduced into a pitched-horizontal drain (p-h drain) pipe by discharging a plumbing fixture was carried out. The purpose of the investigation was to examine the effects of relevant variables on the velocity attained and the distance traversed by the solid in the p-h drain. The variables selected for the study include: the water volume used (i.e., the volume of water discharged from the plumbing fixture into the drain), diameter and length of cylindrical solid, and diameter and slope of the p-h drain. This report contains a description of the experimental equipment and procedures, and a summary of the data acquired during the solid transport experiment in 7.6 cm diameter drain pipe at a pipe slope of 0.02, 0.04, and 0.06.

706,369
PB81-203416 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Unsteady Water Depth Measurement in a Partially Filled 7.6 cm Diameter Horizontal Pipe.
B. M. Mahajan. Apr 81, 54p NBSIR-81-2249
Contract HUD-H-48-78

Keywords: *Sewage disposal, *Piping systems, Transport properties, Water flow, Volumetric analysis, Water pipes, Solids flow, Plumbing, *Solids transport, NTISCOMNBS, NTISHUDPDR.

A research program to investigate the wastewater solid transport in horizontal drains is under way. The objective of the program is to develop data base and establish correlations for selecting drain pipe diameter, length, and slope for an effective solid waste transport with reduced water usage. The purposes of this portion of the research program, which is presented here, were: to measure the stream depth histories of unsteady, non-uniform transient, partially-filled pipe flow that ensures when water from a plumbing fixture is discharged into the drain, and to examine the effects of the presence of a cylindrical solid and other relevant variables on the stream depth. The variables selected for the study include: the water volume discharged from the fixture into the drain, drain slope, and the diameter and length of cylindrical solids. The report contains a description of the experimental apparatus, instrumentation and procedures, and a summary of the stream depth data acquired from experiments in a 7.6 cm diameter drain.

706,370
PB81-226839 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Criteria and Evaluation for Two-Step Flush Devices for Water Closets.
F. Winter, and L. S. Galowin. Jun 81, 94p NBSIR-81-2296

Keywords: *Toilet facilities, *Water conservation, Flushing, Water flow, Siphons, Plumbing, Water closets.

Laboratory tests of two-step flush control devices for water closets were conducted to provide data and develop test methods for evaluating water saving devices for water closets. Criteria for performance and testing procedures for laboratory testing are recommended for evaluating two-step flush devices for installation in conventional water closets.

706,371
PB82-132978 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Energy Measurement in the Standard Penetration Test.
Building science series (Final).
W. D. Kovacs, L. A. Salomone, and F. Y. Yokel. Aug 81, 104p NBS-BSS-135
Library of Congress catalog card no. 81-600101. Errata sheet inserted.

Keywords: *Subsurface investigations, *Penetration tests, Soil mechanics, Boreholes, Drilling rigs, Field tests, Measuring instruments, Guidelines.

Geotechnical engineers in the United States commonly use the Standard Penetration Test, SPT, in subsurface investigation for routine foundation designs. It has been said that perhaps up to 80 to 90 percent of the routine foundation designs are accomplished by the use of the SPT 'N' value. Despite efforts to standardize more details of the SPT procedure, variability between tests is inherent under present guidelines. A field measurement system and procedure which measures the energy delivered by a drill rig system were developed and successfully used to study the factors which affect delivered energy. Results are presented which indicate the energy delivered by certain drill rig systems used in engineering practice. Also, the transmission characteristics of certain hammer/anvil systems are examined. Guidance on the need to measure the actual fall height of the hammer during the Standard Penetration Test is provided based on the findings of the study.

706,372
PB82-134008 Not available NTIS
National Bureau of Standards, Washington, DC.
Goal: Better Standards for Pipeline Welds.
Final rept.
R. P. Reed. Sep 81, 4p
Pub. in Weld. Des. Fabr. 54, n8 p68-71 Sep 81.

Keywords: *Pipelines, *Welded pipes, Quality control, Nondestructive tests, Standards, Welded joints, Pipe joints, Fracture mechanics.

The NBS program to assist the Department of Transportation in establishing fitness-for-service alternative allowable flaw size standards is reviewed. The application of fracture mechanics technology to fitness-for-service standards is discussed. Past research is reviewed. NBS programs on fracture mechanics and non-destructive testing with respect to the Alaska Natural Gas Transportation System are presented.

706,373
PB82-142134 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Prediction of the Hydraulic Jump Location Following a Change of Slope in a Partially Filled Drainage Pipe.
J. A. Swaffield. May 81, 193p NBSIR-81-2367
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research. Prepared in cooperation with Brunel Univ., Uxbridge (England).

Keywords: *Drains, *Pipe flow, *Hydraulic jump, Open channel flow, Flow rate, Slope, Mathematical models, Computer programs, Fortran, HYDJUMP computer program, HYDSUM computer program, Perkin Elmer 732 computers.

The criteria governing the formation of a hydraulic jump in a partially filled fluid conduit downstream of a slope change are presented together with the necessary techniques to enable water surface profiles and jump location to be predicted. Computer programs designed to model the conditions leading to jump formation under flow and channel scale conditions compatible with current drainage system design are presented. The results of a wide range of test conditions in terms of jump formation and position downstream of a change in channel slope are presented together with a set of criteria to be used in evaluating whether a jump will occur for a given set of design conditions.

706,374
PB82-163791 PC **E99**
Association of State and Territorial Solid Waste Management Officials, Washington, DC.
States Measurements Needs Study.
30 Sep 81, 1235p-in 8v
Set includes PB82-163809 through PB82-163874.

No abstract available.

706,375
PB82-178724 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Experimental Investigation of Transport of Discrete Solids with Surge Flows in a 10.0 cm-Diameter Partially Filled Pipe.
B. M. Mahajan. Jan 82, 66p NBSIR-81-2450
Contract HUD-H-48-78

Keywords: *Sewer pipes, Flow rate, Flow measurement, Water flow, Surges, Toilet facilities, *Solid waste transport.

This report presents the results of a series of experiments on the transport of discrete solids with surge flows in a partially filled slightly pitched horizontal pipe. The experimental apparatus, instrumentation, and procedures are described. The experiments were conducted using a cylindrical solid in a 10.0-cm (4-in) diameter pipe. The water surge flows were obtained by

discharging different volumes of water into the pipe from a falling head open container which simulated a water closet. For each experiment, flow induced solid velocities and stream depth histories at various locations along the length of the pipe were measured. The effects of water volume used, pipe slope, and size of the solid on the solid velocities were examined. Solid velocities were compared with the maximum water velocities estimated from the stream depth histories. Also, the distance traversed by the solids in the pipe were measured for those cases in which the solids did not clear the pipe.

706,376
PB83-162727 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Examination of the State of the Art in Inland Waterways System Lock Research.
Final rept.
M. H. Pearl. Feb 82, 112p NBSIR-81-2411
Sponsored in part by Institute for Water Resources (Army), Fort Belvoir, VA.

Keywords: *Inland waterways, *Locks(Waterways), *Reviews, Dams, Traffic, Waterways(Transportation), Mathematical models, Computerized simulation, Queueing theory, Barges, Idle time.

Locks which pass waterborne traffic through dams act as bottlenecks and interfere with the free flow of traffic. Two complementary mathematical tools have been used to determine the maximum capacity of a lock and the operating procedures which achieve this capacity. These are (i) computer simulations of traffic flows, and, (ii) the mathematical theory of queues. Several researchers have attempted to model the operation at a lock using mathematical queueing theory. In addition, queueing theory has been applied to analyze traffic flow through a bottleneck on other modes of transportation.

706,377
PB83-233353 PC **A14**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of Draft Construction Safety Standards for Excavations. Volume 2.
F. Y. Yokel, and R. L. Stanevich. Apr 83, 314p
DHHS/PUB/NIOSH-83-2693, NBSIR-83-2693
See also PB80-202252.

Keywords: *Construction industry, *Excavation, Trenching, Shoring, Safety engineering, Regulations, Construction equipment, Meetings, Industrial accidents, *Occupational safety and health.

A record of an interim stage in the development of revisions to existing Occupational Safety and Health Administration (OSHA) regulations governing excavations, trenching and shoring practices in the construction industry, Subpart P 29 CFR 1926, is presented. The National Bureau of Standards (NBS) prepared a working draft of recommended changes to the regulations based on previous NBS technical studies. Five regional industry workshops were held to discuss the proposed revisions. Included in the report is a copy of the recommended revisions, which were submitted to the workshops, and a record of industry's response in the form of suggestions, commentary and summaries of workshop activities.

706,378
PB83-259598 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Prediction of Floating Solid Velocities in Unsteady Partially Filled Pipe Flow.
J. A. Swaffield. Jul 83, 37p NBSIR-82-2614
Sponsored in part by Department of Housing and Urban Development, Washington, DC.

Keywords: *Solids flow, *Pipe flow, Drains, Transport properties, Sliding friction, Velocity, Mathematical models, *Solid waste transport.

The method of characteristics is applied to solve the unsteady partially filled pipe flow equations and to predict the velocity of floating solids assumed to travel at a fixed percentage of the local flow velocity. Experimental verification for the technique is provided for cylindrical solids in 100 mm diameter drainage pipe at a range of gradients from 1/40 to 1/150. The system upstream boundary conditions are shown to be capable of representation in terms of the inflow energy at the pipe entry section. Steady flow floating solid to flow velocity ratios are presented at 1/150 pipe gradient and further areas of experimental work to determine the variation of these ratios with pipe gradient and flow depth are identified.

706,379
PB84-100569 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of Draft Construction Safety Standards for Excavations. Volume 1.
F. Y. Yokel, and R. L. Stanevich. Apr 83, 124p
NBSIR-83-2693-VOL-1, DHHS/NIOSH/PUB-83-103-VOL-1
See also PB83-233353.

Keywords: *Construction industry, *Excavation, Trenching, Shoring, Safety engineering, Regulations, Construction equipment, Meetings, Industrial accidents.

A record of an interim stage in the development of revisions to existing Occupational Safety and Health Administration (OSHA) regulations governing excavations, trenching and shoring practices in the construction industry, Subpart P 29 CFR 1926, is presented. The National Bureau of Standards (NBS) prepared a working draft of recommended changes to the regulations based on previous NBS technical studies. Five regional industry workshops were held to discuss the proposed revisions. Included in the report is a copy of the recommended revisions, which were submitted to the workshops, and a record of industry's response in the form of suggestions, commentary and summaries of workshop activities. The key section of the report presents an analysis of industry response and resulting recommendations. The document is a record intended to aid OSHA during subsequent stages of the rule-making process.

706,380
PB84-102045 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Status of Safety Net Standards for Construction and Research Needs.
J. H. Pielert. Sep 83, 43p NBSIR-83-2709
Sponsored in part by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Construction, *Safety devices, *Nets, Standards, Equipment specifications, Materials specifications, Reviews, *Safety nets.

This report represents the status of standards for safety nets used in construction and identifies areas of technical inconsistency. Typical applications of safety nets are reviewed including the results of literature and field surveys. Major technical sections of six standards are compared in a tabular format to highlight areas of agreement, as well as, requirements which vary and indicate lack of consensus. This information is analyzed and used to develop a prioritized research plan for safety nets.

706,381
PB84-103621 Not available NTIS
National Bureau of Standards, Washington, DC.
Time Series Analysis of Cooling Tower Wind Loading.
Final rept.
D. A. Reed, and R. H. Scanlan. Feb 83, 17p
Sponsored in part by Princeton Univ., NJ. Dept. of Civil Engineering.
Pub. in Jnl. of Structural Engineering 109, n2 p538-554, Feb 83.

Keywords: *Cooling towers, *Wind pressure, Gust loads, Concrete structures, Turbulence, Time series analysis, Transfer functions, Reprints.

This paper considers full-scale wind velocity and wind pressure time series data collected on two cooling towers. ARIMA time series models are shown to describe these data adequately. The advantage of using these models is that they provide a convenient method for loading simulation. Transfer function models in the time domain relating input wind velocity to output wind pressure-difference at three circumferential tower locations are presented and discussed.

706,382
PB84-110105 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Guide for Safety Inspection of Jumpform and Slipform Systems Used in Concrete Cooling Tower and Chimney Construction.
S. G. Fattal. Sep 83, 84p NBSIR-83-2627
Sponsored in part by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Cooling towers, *Chimneys, *Concrete construction, Slip forms, Structural members, Construction joints, Scaffolds, Safety, Inspection, Guidelines, *Jump forms.

This report provides a basic guide for the safety inspection of jump form and slip form systems used in the construction of cooling towers and chimneys. The systems are described in terms of their components and operating procedures involved in the casting cycle of a typical lift. Special emphasis is given to the structural aspects of components which are most critical in the maintenance of overall structural integrity of the system during construction.

706,383
PB84-218353 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
Offshore Concrete Structures in the Arctic: Research Needs.
Final rept.
N. J. Carino. Apr 84, 56p NBS/TN-1192
Also available from Supt. of Docs as SN003-003-02582-8. Sponsored in part by Minerals Management Service, Reston, VA.

Keywords: *Concrete structures, *Offshore structures, *Arctic regions, Reviews, Meetings, Design, Materials, Construction, Inspection, Maintenance, Research.

A study of research needs to enhance the capability to design, maintain, and approve concrete offshore structures for the Arctic was carried out by the National Bureau of Standards on behalf of the Minerals Management Service, Department of the Interior. The study was composed of three activities: a letter survey of key individuals in the field; an international workshop on the subject; and a review of available literature. Data gathered from these activities were used to develop a comprehensive list of research needs in the following areas: design, materials, construction, inspection and repair.

706,384
PB85-106839 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Structures Div.
Construction Research in Japan.
H. S. Lew. Sep 84, 28p NBSIR-84/2834

Keywords: *Construction industry, *Research, Construction equipment, Laboratories, Development, Japan, Trends, Public works.

The construction industry is one of the key industries in Japan. The annual volume of business of the industry accounts for over 20 percent of the GNP of Japan. Partially due to large investments in the public works projects by the Japanese Government, the industry maintained a steady growth during the past two decades. During this period of steady growth, many large construction firms established research laboratories to place themselves in a favorable position in the domestic, as well as international, construction market. The construction machinery industry of Japan also grew steadily during the same period, and their share of the world market increased significantly. In order to meet foreign competition, the industry has also made significant investments in their research and development efforts. This report examines the research and development efforts of Japan's construction and construction machinery industries and their trends.

706,385
PB86-192473 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Thermal Resistivity of Soils.
Final rept.
L. A. Salomone, and W. D. Kovacs. 1984, 15p
Pub. in Jnl. of the Geotechnical Engineering Division, American Society of Civil Engineers 110, n3 p375-389 1984.

Keywords: *Thermal conductivity, *Soils, *Civil engineering, Plasticity, Cost analysis, Atterberg limits, Moisture contents, Heat transfer, Soil tests, Reprints.

Information on the thermal properties of soils from different disciplines of science and engineering is consolidated for the purpose of identifying low cost, simple procedures for assessing the variation of the thermal resistivity of soils with changes in moisture content. Three procedures for determination of the critical moisture content are presented. The critical moisture content is the moisture content at the knee of the thermal resistivity versus moisture content curve.

706,386
PB86-193893 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Thermal Performance of Fine-Grained Soils.
Final rept.
L. A. Salomone, W. D. Kovacs, and T. Kusuda. 1984, 16p
Pub. in Jnl. of the Geotechnical Engineering Division, American Society of Civil Engineers 110, n3 p359-374 1984.

Keywords: *Soil compacting, *Civil engineering, Thermal conductivity, Atterberg limits, Bearing capacity, Moisture content, Optimization, Plasticity, Reprints, AASHTO standards.

Laboratory thermal probe tests performed on an AASHTO standard reference material (a silty clay) showed that thermal resistivity (C cm/watt) varies with soil moisture content and dry density. The tests were performed to correlate soil thermal behavior with the limit states of fine-grained soils. Over 80 thermal resistivity measurements were made on specimens compacted to various densities and moisture contents. Results are presented which indicate that the optimum moisture content and the plastic limit can be correlated with the thermal behavior of fine-grained soils.

706,387
PB86-230976 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Reflections on the Presentations: Technology and the Future of the U.S. Construction Industry.
Final rept.
J. G. Gross. 1986, 4p
Pub. in Proceedings of the Panel on Technical Change and the U.S. Building Construction Industry, Washington, DC., August 29-30, 1984, p150-153 1986.

Keywords: *Buildings, *Construction industry, Productivity, Technology assessment.

Provides comments and observations for the OTA Panel on Technology Changes and Impacts on the Building Construction Industries. It addresses needs for improving the application of computers to construction and particularly the need for interface standards. Arguments are made for advances in education of construction professionals and the opportunity for research to improve productivity. Other research needs discussed are indoor air quality and diagnostics.

706,388
PB87-171427 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Fenestration Design for Office and Residential Buildings,
S. J. Treado, and D. B. Holland. Jan 87, 80p NBSIR-86/3489
Sponsored by Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Civil engineering, *Windows, Office buildings, Residential buildings, Design, Comparison, *Foreign technology.

The influence of fenestration design on energy performance and illumination conditions in office and residential buildings is examined, and recommendations are given for effective design of fenestration systems to meet occupant requirements. Particular emphasis is given to various shading strategies, such as blinds, shades, light shelves and fins, and their impacts on interior daylight levels and distribution, illumination quality, and energy requirements. A comparison is made between the total daylight gain into the building and the useful daylight gain, where useful daylight is defined as daylight which can be used to offset electric lighting requirements. Significant improvements in daylighting, lighting and thermal performance are shown to be possible with various fenestration designs.

Construction Equipment, Materials, & Supplies

706,389
PB-265 058/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Limitations to Fly Ash Use in Blended Cements.
Final rept.,
P. W. Brown, R. L. Berger, J. R. Clifton, and G. Frohnsdorff. 1976, 12p
Pub. in Proceedings of International Ash Utilization Symposium (4th), Held at St. Louis, Missouri on March 24-25, 1976 p518-529.

Keywords: *Cements, *Fly ash, Blending.

The production and utilization of blended cements containing fly ash is less than one million tons a year in the U.S. This accounts for only about one percent of the cement produced. It has been demonstrated that utilization of fly ash with portland cement to make blended cement results in energy and raw materials savings almost directly proportional to the amount of ash used. Additional property data need to be developed to address uncertainties and misconceptions regarding the performance of blended cements. Facilitation of blended cement use requires the development of data to be used by voluntary consensus standards organizations as a basis for standard test procedures and specifications.

706,390
PB-269 779/5 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Urea-Formaldehyde Based Foam Insulations: An Assessment of Their Properties and Performance.
Final rept.,
W. J. Rossiter, R. G. Mathey, D. M. Burch, and E. T. Pierce. Jul 77, 96p NBS-TN-946
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Assistant Secretary for Policy Development and Research.

Keywords: *Thermal insulation, *Acoustic insulation, *Assessments, *Cellular plastics, *Urea formaldehyde resins, Chemical properties, Physical properties, Performance evaluation, Mechanical properties, Buildings, Ureas, Formaldehyde, Flammability, Construction materials, Combustion, Safety, Public health, Odors, Concentration(Composition), Acoustic properties, Tests, Foams, Thermal properties.

The properties and performance of urea-formaldehyde based foams pertinent to their use as insulation in buildings were assessed based essentially on existing information. Pertinent materials properties were identified and guidelines prepared for the suggested values of these properties along with corresponding methods of test. Four certain materials properties information was not found to enable suggested values of these properties. The factors affecting performance of urea-formaldehyde based foam insulations were also identified and discussed. Some performance factors could not be adequately evaluated because of insufficient or contradictory data in the literature. Methods of foam application were studied and suggested general application guidelines were prepared. The advantages and disadvantages of using urea-formaldehyde based foam insulations were discussed and problem areas identified. Recommendations were made pertaining to the use and assessment of urea-formaldehyde based foam insulations for residential construction.

706,391
PB-270 314/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Conservation Through the Use of Waste Materials in Cement and Concrete.
Final rept.,
P. W. Brown, and J. R. Clifton. 1977, 33p
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Div. of Buildings and Industry.
Pub. in Proceedings of Seminar on Energy and Resource Conservation in the Cement and Concrete Industry, Ottawa, Ontario (Canada), November 8-9, 1976, Paper 3.2, p3.2.1-3.2.33 1977.

Keywords: *Concretes, *Solid waste disposal, *Reclamation, *Aggregates, Fly ash, Slags, Industrial wastes, Energy conservation.

The utilization of suitable mineral waste products can result in reducing the energy requirement in cement manufacture. Waste products, when used as the raw materials in cement production, can reduce the energy requirements associated with raw materials processing and pyroprocessing. Intergrinding waste materials with cement clinker or blending them with finished cement also reduces the energy consumption in the manufacture of cement, in this instance by replacing a portion of the cement. The relative energy savings achieved through waste utilization by these methods are discussed. Factors affecting the selection of waste materials, such as compositional suitability, availability, and cost, are considered along with the effects of market related factors and consensus standards.

706,392
PB-270 854/3 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Materials and Composites Section.
Survey of Uses of Waste Materials in Construction in the United States,
J. R. Clifton, P. W. Brown, and G. Frohnsdorff. Jul 77, 64p NBSIR-77-1244
Contribution to the RILEM Symposium by Correspondence on the Use of Waste Materials in the Construction Industry.

Keywords: *Construction materials, *Industrial wastes, *Reclamation, *Solid waste disposal, Fly ash, Slags, Refuse disposal, Rocks, Spoil, Phosphate deposits, Aluminum industry, Cements, Calcium sulfates, Sludge disposal, Combustion products, By-products, Slimes, Demolition, *Waste recycling, Mine wastes, Dredge spoil, Cement industry, Phosphate industry, Limestone scrubbing, Red mud.

This survey covers the sources, amounts and disposal of major mining, industrial and municipal wastes available in the 48 conterminous states of the United States along with their present and potential uses as construction materials. In this report wastes from mining, industrial and municipal sources are treated separately and in that order. This is the order of decreasing amount of usable wastes available from each major classification. Wastes from mineral, metallic ore and coal mining operations are covered in Section 2. Industrial wastes are treated in Sections 3 to 5, with Section 3 describing a variety of important wastes which have found few markets; by-products from coal combustion, which are examples of wastes for which there are growing markets, are discussed in Section 4; and Section 5 covers slags, by-products which are already extensively used as aggregates in construction but for which there may be higher value uses. Municipal wastes, including municipal refuse, incinerator residue, glass, demolition waste and sewage sludge, are the subject of Section 6. Then Section 7 is directed towards some potential wastes which may be generated in substantial amounts by emerging technologies related to energy production and environmental protection. Obstacles to and incentives for the increased use of waste materials in construction are discussed in Section 8.

706,393
PB-272 494/6 PC **A04**/MF **A01**
Institut Technique du Batiment et des Travaux Publics, Paris (France).
Materials and Building Research. Number 39, June 1977. French Selection of Condensed Papers on Civil Engineering and Construction.
Jun 77, 54p
Trans. of Institut Technique du Batiment et des Travaux Publics, Paris. Annales (France) n351, Suppl, Serie: Hors Serie n39 Jun 77. Sponsored in part by National Bureau of Standards, Washington, D.C. Inst. for Applied Technology. See also PB-253 723.

Keywords: *Construction materials, Mechanical properties, Concretes, Compressive properties, Deformation, Fatigue(Materials), Heating, Smoke, Noise reduction, Reinforcing materials, France.

Contents: Behaviour of various concretes subjected to an oil/air or oil/sea-water gradient; Influence of intermediate stress on the mechanical behaviour of concrete under biaxial compression; Influence of fillers on the deformability of hardened concrete; A differential law for non-linear cumulative fatigue damage; Electronuclear heating; Smoke clearance in high-rise buildings; Measurement of the sound reduction index of facades and facade units; Numerical methods for calculating foundations on vertical or sloping piles; and Tie bar shear reinforcement of bond splices.

706,394
PB-282 062/9 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Methods for Characterizing Adobe Building Materials.
Final rept.,
J. R. Clifton, P. W. Brown, and C. R. Robbins. Jun 78, 63p NBS-TN-977
Sponsored in part by National Park Service, Washington, D.C.

Keywords: *Construction materials, *Residential buildings, *Cohesive soils, Physical properties, Mineralogy, Particle size, pH, Durability, Standards, Plastic properties, Chemical composition, Microscopy, X ray diffraction, Color, Inorganic salts, Electron microscopy, *Adobe soils.

Methods are described for the characterization of those physical properties and mineralogical features of adobe which appear to have the most significant affect on the durabilities of adobes. These methods include determinations of color, pH, soluble salts, particle size distribution, liquid and plastic limits, and the X-ray 'fingerprint' of adobe. In addition, methods are given for the identification of the mineralogy of adobe soils and for the examination of the microfabric of adobe.

706,395
PB-282 868/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Prediction of Bitumen Slip and Sag in Roofing Systems.
Final rept.,
J. M. Pommersheim, and R. G. Mathey. 1977, 13p
Pub. in Proceedings of International Conference of Math. Modeling (1st), St. Louis, Mo. 29 Aug-1 Sep 77, Eng. Sci. III, p1347-1359 1977.

Keywords: *Bitumens, *Roofs, Sag, Coal tar, Asphalts, Mathematical models, Slippage.

Mathematical models for slippage of built-up roofing membranes and sag of roofing bitumens were formulated, solved and tested against previously developed experimental data. Bitumens used were coal-tar pitch and ASTM Types I, II and III asphalts. Model predictions confirmed the increased slip and sag observed with increased membrane loading, roof slope, interply bitumen film thickness and bitumen temperature. Viscosities were calculated from the models for slip and sag and compared to ones measured independently using a plastometer. Design predictions were made for the amount of slip in a built-up roofing membrane subjected to typical summer temperatures and solar radiation intensities. The methods presented in this paper help to quantify the separate and combined effects of the factors influencing roofing performance when slippage and sag occur.

706,396
PB-282 873/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of Performance Criteria for the Selection of Stone Preservatives.
Final rept.,
G. Sleater. 1978, 7p
Sponsored in part by National Park Services, Washington, D.C.
Pub. in Proceedings of American Geological Society Symposium, Miami Beach, Fla. Nov 74, Eng. Geology Case Histories n11 p65-71 1978.

Keywords: *Construction materials, *Rocks, *Preservatives, Accelerated tests, Performance evaluation, Laboratory tests, Aging(Materials).

This paper describes how test methods and performance criteria for the selection of stone preservatives are being developed. Accelerated aging of stone and of preservative treated stone followed by tests of the aged specimens is used to evaluate both test methods and stone preservatives. The laboratory aging procedure incorporates important causes of stone decay--Chemical Attack, Salt Action, Water Action, Thermal Effects--in a special test chamber (CAD) and test cycle. The effects of the accelerated aging on the weight, appearance, absorption of liquid water, permeability to water vapor, abrasion resistance, and surface hardness of the treated test specimens are used as measures of preservative performance. It is explained how this test data and the test methods employed can be used to set performance criteria for the selection of stone preservatives.

706,397
PB-283 847/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of Performance Criteria for the Selection of Stone Preservatives.
Final rept.,
G. Sleater. 1978, 7p
Pub. in Proc. Geological Society of America Symp., Held at Miami Beach, Florida November 1974. Paper in Engineering Geology Case Histories, n11 p65-71 1978.

Keywords: *Construction materials, *Rocks, *Preservatives, Accelerated tests, Laboratory tests.

This paper describes how test methods and performance criteria for the selection of stone preservatives are being developed. Accelerated aging of stone and of preservative treated stone followed by tests of the aged specimens is used to evaluate both test methods and stone preservatives. The laboratory aging procedure incorporates important causes of stone decay -- chemical attack, salt action, water action, thermal effects -- in a special test chamber (CAD) and test cycle. The effects of the accelerated aging on the weight, appearance, absorption of liquid water, permeability to water vapor, abrasion resistance, and surface hardness of the treated test specimens are used as measures of preservative performance. It is explained how this test data and the test methods employed can be used to set limits of acceptable performance criteria for the selection of stone preservatives.

706,398
PB-285 142/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Preliminary Performance Criteria for Stone Preservatives.
Final rept.,
G. A. Sleater. 1977, 11p
Sponsored in part by National Park Service, Washington, D.C.
Pub. in Proc. RILEM/ASTM/CIB Symp. on Evaluation of the Performance of External Vertical Surfaces on Buildings, Otaniemi, Espoo, Finland, Aug 28-Sep 2 1977, v2 p309 p311-321 (Technical Research Centre of Finland, Helsinki, Finland, 1977).

Keywords: *Construction materials, *Rocks, *Preservatives, Performance evaluation, Criteria, Accelerated tests.

As part of a program to develop performance criteria for the selection of stone preservatives, laboratory methods of accelerated stone decay have been used to obtain data on stone preservatives and to suggest criteria for their selection. Causes of stone decay were simulated in two types of testing: (1) a number of causes were combined in one testing operation, using a special test chamber; (2) the effects of single causes of stone decay were studied individually. Methods for measuring the effects of the test exposures are given, as are the preliminary performance criteria for selecting stone preservatives. No one stone preservative studied in the program met all criteria.

706,399
PB-286 096/3 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Factors Affecting the Durability of Adobe Structures.
P. W. Brown, C. R. Robbins, and J. R. Clifton. Jul 78, 42p NBSIR-78-1495

Keywords: *Construction materials, *Residential buildings, *Cohesive soils, *Weathering, Physical properties, Mineralogy, Particle size distribution, Size determination, X ray diffraction, Porosity, Durability, Moisture content, Inorganic salts, Chemical composition, Arizona, *Adobe brick, Historic buildings, Historic preservation, Tumacacori National Monument, Fort Bowie National Historic Site, Escalante Ruin.

Adobe samples from three sites of historic interest in the State of Arizona were analyzed to determine their mineral assemblages, particle size distributions, soluble salt contents, and porosities. These analyses were accompanied by microscopic observations of polished sections and thin sections. These data were correlated with the weathering observed and it was found that soluble salt action was responsible for the deterioration of the adobe from one of the sites. The nature of the particle size distribution has resulted in the rapid deterioration of the adobe from a second site. The adobe from a third site was found to be well consolidated due to the presence of large amounts of calcite.

706,400
PB-289 008/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quality in Concrete Testing.
Final rept.,
J. R. Dise. 1978, 5p
Pub. in Am. Soc. Test. Mater., Spec. Tech. Publ. 169-B p44-48 1978.

Keywords: *Concretes, *Quality assurance, Mechanical tests, Performance tests, Quality control, Laboratories, Test facilities, Nondestructive tests, Destructive tests, Reprints.

Quality in testing of concrete is of interest to everyone concerned with its use in construction. Some of the causes of failures to obtain satisfactory test results are enumerated, and ways of avoiding difficulties or of obtaining assistance when problems occur are discussed. Some of the more significant efforts that are being made to advance the quality of concrete testing are described.

706,401
PB-295 584/7 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Possible Contributions of Cement and Concrete Technology to Energy Conservation.
G. Frohnsdorff, P. W. Brown, and J. R. Clifton. May 79, 78p NBS-SP-542
Sponsored in part by Department of Energy, Washington, DC. Library of Congress catalog card no. 79-600056. Summary of the NBS/DOE Workshop held October 3-4., 1977 at the National Bureau of Standards, Gaithersburgh, MD.

Keywords: *Concrete construction, *Portland cements, *Manufacturing, *Meetings, Production control, Raw materials, Fly ash, Blends, Product development, *Energy conservation.

A workshop on possible contributions of cement and concrete technology to energy conservation by the year 2000 was held at the National Bureau of Standards on October 3 and 4, 1977. The purpose of the workshop was to identify and record ideas on possible contributions of cement and concrete technology to energy conservation in the near term and by the year 2000. This included consideration of current technology as well as areas in which technological advances might be realized. The workshop was divided into working groups on cement composition, cement production, blending materials, concrete production, efficient use of concrete, and institutional factors. The essential results from the six working groups were statements of Energy-Saving Opportunities, Research Needs, and Unresolved Issues. The statements, which are the major part of this report, are presented without critical analysis. They suggest, however, that there are a large number of possible opportunities which should be evaluated for their ability to contribute to energy conservation in the cement and concrete industries.

706,402
PB-296 120/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Timber Pilings: Maintenance and Inspection Summary of a Panel Discussion.
Final rept.
J. Kaiserlik, H. Berger, and C. McGogney. 1979, 5p
Pub. in Proceedings of the Nondestructive Testing of Wood Symposium (4th) Held at Vancouver, WA. on August 28-30, 1978, p155-159 1979.

Keywords: *Wood piles, Maintenance, Inspection, Nondestructive testing, Bridges, Failure.

The panel discussion concerned with maintenance and inspection of timber pilings attracted about 100 attendees (including ten who registered only for this event) to a lively evening session. Timber pilings are used in large numbers in bridge structures and for harbor and navigational facilities. The inspection and maintenance of these pilings, to prevent failures such as the collapse of the Coos Bay bridge in Oregon in 1977 (because of damage caused by marine borers), was the topic for discussion.

706,403
PB-298 752/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Composite Materials for Cryogenic Structures.
Final rept.
M. B. Kasen. 1978, 11p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings Int. Cryogenic Materials Conf. (2nd), Held at Boulder, CO. on Aug 3-5, 1977. Paper A-5 in Advances in Cryogenic Engineering, v24 p63-73, 1978.

Keywords: *Construction materials, *Composite materials, Cryogenics, Laminates, Concretes, Fiber composites.

Composite laminates and aggregates are already playing a significant role as structural materials in cryogenic technology. A much wider usage is anticipated as additional data and experience are obtained. Concretes, and to a certain extent industrial high-pressure laminates, will see increased usage in massive installations due to favorable cost factors. Some industrial laminates and low-pressure glass-reinforced laminates will serve for intermediate sized structures where their non-magnetic character and insulation qualities offer advantages over metallic structures. The high-modulus, low-pressure composites will see increasing usage as their cost decreases and as their cryogenic performance becomes better understood. The ability of such composites to match or exceed the strength and modulus of stainless steel suggests that their usage will substantially increase as alloying elements become scarce and more expensive. For the present, high-modulus composites will be selectively used for critical components where a nonmetallic, strong, stiff, low-thermal conductivity material is required to adequately perform specific critical tasks.

706,404
PB80-107402 Not available NTIS
National Bureau of Standards, Washington, DC.
History and Status of Standards Relating to Alkalies in Hydraulic Cements.
Final rept.,
G. Frohnsdorff, J. R. Clifton, and P. W. Brown. 1978, 19p
Pub. in Proceedings American Soc. for Testing and Materials Symp. on Cement Standards - Evolution and Trends, Held at St. Louis, MO on Dec 7, 1977. Amer. Soc. Test. Mater. Spec. Tech. Publ. n663 p16-34, 1978.

Keywords: *Hydraulic cements, *Alkalies, *Standards, *Chemical analysis, Portland cements, Sodium, Potassium.

The evolution of ASTM standards relating to alkalies, specifically sodium and potassium, in portland and blended hydraulic cements is described. The standards include analytical methods for the determination of alkalies in cements, optional specification limits for alkalies in portland cements for use with aggregates that may be deleteriously reactive, and tests for potential alkali reactivity of aggregates. Some shortcomings of the standards are mentioned, and, where they do not treat portland and blended cements in comparable ways, this fact is pointed out. Finally, changes which might be made in the standards to make them responsive to national needs for conservation of energy and materials are suggested.

706,405
PB80-128317 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Interlaboratory Evaluation of the ASTM (American Society for Testing and Materials) E 84-77a Tunnel Test Modified By the Consumer Product Safety Commission for Cellulosic Loose Fill Insulation.
Final rept.,
J. R. Lawson. Nov 79, 37p NBSIR-79-1922

Keywords: *Thermal insulation, *Flammability testing, Cellulose, Evaluation, Flame spread.

An interlaboratory evaluation was conducted to determine precision estimates for repeatability and reproducibility of the American Society for Testing and Materials (ASTM) E 84-77a tunnel test as modified by the Consumer Product Safety Commission for cellulosic loose fill insulation. Six laboratories participated in this study by running tunnel tests on eight cellulosic loose fill materials. Each laboratory was surveyed during the project to examine its conformance with the critical details of the test apparatus and procedure. The results of the survey showed that none of the tunnels completely conformed with the specifications of the modified ASTM E 84-77a standard.

706,406
PB80-130545 Not available NTIS
National Bureau of Standards, Washington, DC.
Creep of Coated Reinforcing Bars in Concrete.
Final rept.,
J. R. Clifton, R. G. Mathey, and E. D. Anderson. Oct 79, 13p
Pub. in ASCE Jnl. Struct. Div. 105, nST10, p1935-1947, Oct 79.

Keywords: *Reinforcing steels, *Creep properties, Bars, Reinforced concrete, Plastic coatings, Polyvinyl chloride, Epoxy coatings, Structural engineering, Dynamic structural analysis, Reprints.

The creep properties of organic coated and uncoated No. 6 deformed steel reinforcing bars, embedded in concrete prisms, were determined for corresponding tensile stresses in the bars at the loaded ends of 15,000 psi (103 MN/sq m) and 30,000 psi (206 MN/sq m). Slip of the bars in the concrete under static loading was measured at both the free and loaded ends of the specimens at periodic intervals for two years. Twenty-four reinforcing bars were included in the tests, they consisted of 18 bars coated (in duplicates) with 9 different epoxy materials; 2 bars coated with a poly(vinyl chloride) material; and 4 uncoated reinforcing bars. The relative performance of some coated reinforcing bars in the creep study were different than those obtained in earlier pullout tests. Therefore, from the data obtained in this study, it appears that the long-term structural performance of organic coated reinforcing bars in concrete cannot be estimated solely on the basis of their bond strength determined from pullout tests.

706,407
PB80-170848 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Measuring the Rate of Corrosion of Reinforcing Steel in Concrete.
Annual rept.,
E. Escalante, S. Ito, and M. Cohen. Mar 80, 45p NBSIR-80-2012
Sponsored in part by Federal Highway Administration, Washington, DC.

Keywords: *Reinforcing steels, *Corrosion, Measurement, Bridge decks, Reinforced concrete, Nondestructive tests, Rates(Per time).

The progress on a research program directed at developing a nondestructive method for measuring the corrosion of steel in concrete as related to bridge deck deterioration is reported. Several polarization techniques for measuring the corrosion rate of steel in concrete are correlated to actual weight loss measured gravimetrically. The design of a prototype automated minicomputer system for measuring the corrosion of steel in concrete is also described. Included are the results of a laboratory basic study on the effect of pH, Cl-, O sub 2, and moisture on initiating and maintaining corrosion in mortar.

706,408
PB80-192883 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Investigation of Construction Failure of Reinforced Concrete Cooling Tower at Willow Island, West Virginia.
Final rept.,
H. S. Lew, S. G. Fattal, J. R. Shaver, T. A. Reinhold, and B. J. Hunt. Nov 79, 195p NBSIR-78-1578
Sponsored in part by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Cooling towers, *Reinforced concrete, *Collapse, Construction, Construction equipment, Loads(Forces), Shells(Structural forms), Scaffolds, Failure, West Virginia, Willow Island(West Virginia).

The collapse of the natural-draft hyperbolic concrete cooling tower unit no. 2 at the Pleasants Power Station at Willow Island, West Virginia has been investigated. This investigation included onsite inspections, laboratory tests of construction assembly components and concrete specimens, and analytical studies. Based on the results of these field, laboratory and analytical investigations, it was concluded that the most probable cause of the collapse was due to the imposition of construction loads on the shell before the concrete of lift 28 had gained adequate strength to support these loads. The analysis of the shell indicates that the collapse initiated at the part of the shell in lift 28 where cathead no. 4 was located. It further showed that calculated stress resultants at several points in that part equaled or exceeded the strength of the shell in compression, bending and shear. The failure of these points in that part of the shell would have propagated to cause the collapse of the entire lift 28.

706,409
PB81-159618 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Nondestructive Evaluation Methods for Quality Acceptance of Hardened Concrete in Structures.
J. R. Clifton, and E. D. Anderson. Jan 81, 55p
NBSIR-80-2163
Sponsored in part by Construction Engineering Research Lab. (Army), Champaign IL.

Keywords: *Concrete construction, *Quality assurance, *Nondestructive tests, Reinforced concrete, Ultrasonic tests, Radiography, Neutron sources, Probes, Measuring instruments, Electric potential.

Nondestructive test methods which can be used in quality acceptance programs for hardened concrete have been critically reviewed and are described in this report. Methods have been identified which provide information on the strength, quality and uniformity, thickness, air content, stiffness, finish, density of concrete as well as the location and condition of steel reinforcement. Both commonly used methods and possible test methods are covered. In addition, the feasibility of combining two or more test methods for improving the prediction of the strength or quality of concrete is explored.

706,410
PB81-180259 PC **A13**/MF **A01**
Kansas Univ., Lawrence.
Development of a Research Program for Scaffolding Standards.
Final rept.
B. Hunt. Aug 80, 279p NBS-GCR-80-255
Grant NB79-NAHA-0015

Keywords: *Scaffolds, *Construction, Safety engineering, Standards, Structural design, Industrial accidents, Guidelines, Design criteria, Finite element analysis.

Under the auspices of the National Institute for Occupational Safety and Health (NIOSH), the Construction Safety Group of the National Bureau of Standards (NBS) has embarked on a scaffolding research program to provide the necessary technical assistance for developing performance standards and design guidelines for scaffolds. This paper describes the various problem areas that exist with construction scaffolding and appendix A presents the major types of scaffolds under study. The first study is the analysis of scaffolding accidents and related employee casualties and is presented in appendix B. The second study is the review of current scaffolding codes and standards and is presented in appendix C. Two concurrent studies have been performed and are presented in the major portions of this paper. These are a review and evaluation of the technical literature on scaffolding and a study and analysis of in-field scaffold loading practices. Using the results of these first four studies, this paper presents a newly developed analytically based scaffolding research plan.

706,411
PB81-183410 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Temperature Effects on the Strength-Maturity Relation of Mortar.
N. J. Carino. Mar 81, 100p NBSIR-81-2244

Keywords: *Concretes, *Curing, Compressive strength, Temperature, Penetration tests, Regression analysis, *Aging(Materials).

A study was performed to gain a fundamental understanding of the traditional maturity method used to predict the in-place strength of concrete. Research was undertaken to answer two questions: (1) What are the quantitative effects of curing temperature on the compressive strength-maturity relation of concrete. (2) Is there an age beyond which temperature no longer affects the strength-maturity relation of concrete. To simplify testing, mortar cubes were used as specimens for compressive strength determinations. Penetration resistance measurements were performed to determine initial and final setting times. Phase I of the re-

search addressed the first question and involved preparing and curing specimens at 5, 12, 23, 32, and 43 C. Phase II addressed the second question and involved curing specimens at 5 and 32 C for short periods, followed by additional curing at 23 C. It was found that initial set occurred at approximately the same maturity regardless of the curing temperature. A three-parameter hyperbolic equation was used to represent the strength-maturity relation. The parameters, determined by regression analysis, were found to vary systematically with curing temperature. Theoretical justification for the hyperbolic equation is presented and a key assumption in the maturity method is identified. The strength versus age data were also analyzed and a new concept, effective age, is suggested as a possible alternative for representing the combined effects of time and temperature on the compressive strength development of concrete.

706,412
PB81-183428 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Fly Ashes in Cements and Concretes: Technical Needs and Opportunities.
G. Frohnsdorff, and J. R. Clifton. Mar 81, 36p NBSIR-81-2239

Keywords: *Concretes, *Cement additives, *Fly ash, Technology assessment, Admixtures, Pozzolans.

Following a brief review of the nature of fly ashes and their levels of production and use in various countries, an estimate is made of the potentially achievable level of use of fly ash in cement and concrete in the United States. The estimate assumes that 20 percent of the mass of all the portland cement used in the United States could be replaced by the same mass of fly ash; it ignores possible competition from granulated blast-furnace slag as a finely-divided mineral admixture for concrete. It appears that about 16 million tons (18 million tons) per year of fly ash could be consumed in cement and concrete, provided there were sufficient ash of suitable quality and a general understanding of the technical requirements for satisfactory fly ash use. Present standards which affect the use of fly ashes are discussed. Steps which could be taken to improve knowledge of factors affecting fly ash performance in cement and concrete, and hence to improve standard test methods and specifications, are outlined.

706,413
PB81-203754 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Review of Technical Information on Scaffolds.
B. J. Hunt, and S. G. Fattal. May 81, 104p NBSIR-81-2265
Sponsored in part by National Inst. of Occupational Safety and Health, Washington, DC.

Keywords: *Scaffolds, *Technology assessment, Structural design, Standards, Footings, Frames, Supports, Safety devices, Stability, Structural analysis, NTISCOMNBS, NTISHEWOSH.

This report presents a review of the available literature on scaffolds and is the third of several inter-related studies of a scaffolding research program at the National Bureau of Standards (NBS). This study was sponsored by the National Institute for Occupational Safety and Health (NIOSH) to improve scaffolding system performance and reduce the work related injuries and losses. A computerized search of the published literature was performed and technical information that could serve to upgrade existing codes and standards for scaffolds or offer direction to future analytical research has been presented. This information concerned the design, erection, operation or maintenance of scaffolding systems. Appendix A presents the 22 types of scaffolds under study. In addition, U.S. scaffold patent claims and the manufacturers' literature was reviewed and discussed. Appendix B presents selective model analyses of scaffolds.

706,414
PB81-229189 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Initial Study of the Application of the Numerical Method of Characteristics to Unsteady Flow Analysis in Partially Filled Gravity Drainage Sized Pipes,
J. A. Swaffield. Jul 81, 65p NBSIR-81-2308
Sponsored in part by the Department of Housing and Urban Development, Washington, DC. Prepared in cooperation with Brunel Univ., Uxbridge (England).

Keywords: *Pipe flow, *Unsteady flow, Drains, Gravity drainage, Open channel flow, Fortran, Computer programs, Solids flow, Method of characteristics, Drain pipes.

The application of the numerical method of characteristics to the solution of the differential equations defining unsteady flow in partially filled drainage system sized pipes is outlined. The derivation of the flow equations is presented, together with the necessary boundary equation formulation to represent variable inflow, system discharge and leakage flow past a stationary deposited solid. A computer program, written in Fortran, is included, together with typical output, that establishes the applicability of this computational method to unsteady flow analysis in gravity flow drainage systems. Proposals for the extension of the described techniques to the prediction of solid transport and flow attenuation in long pipes are also presented.

706,415
PB81-233751 Not available NTIS
National Bureau of Standards, Washington, DC.
What Constitutes a Turn.
Final rept.
W. D. Kovacs. Sep 81, 4p
Pub. in Geotech. Test. J. Tech. Note 3, n3 p127-130 Sep 81.

Keywords: *Drilling rigs, *Soil tests, Penetration tests, Field tests, Rotation, *Catheads.

There are wide variations in physical configuration and cathead equipment among the available drill rigs used to perform the Standard Penetration Test (SPT). Such differences may be partly responsible for variations in blow count among different drill rigs. The paper draws attention to the fact that about one-half of the available drill rigs use clockwise rotation of the cathead while the remainder use counterclockwise rotation. Depending upon which direction is used, differences in the actual number of turns could be off by as much as 1/2 a turn. This difference could result in a substantial variation in the energy delivered to the sampler and in the blow count for the same soil conditions.

706,416
PB81-600031 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Soil Impact Attenuation Performance: A Field Study.
W. B. Beine, and J. R. Sorrells. 1980, 38p NBSIR-80-2106

Keywords: *Asphalt, Impact attenuation, Peak acceleration, Playground safety, Playground surfaces, Soil, Surfacing materials, Test methods.

Impact attenuation performance tests were conducted on the playing surface of selected public playgrounds in Montgomery County, Maryland, using a test method developed in an earlier laboratory investigation of surfacing materials. Controlled impacts were obtained by dropping an instrument headform in guided freefall onto the test surfaces from various heights. The peak acceleration imparted to the headform during impact was recorded as the performance parameter. At four playgrounds, the tests were performed on the undisturbed soil underlying existing play equipment. At a fifth location, the asphalt surface of an outdoor basketball court was tested. Soil samples from each playground were collected, analyzed and classified in accordance with standard methods prescribed by the ASTM. Separate tests were conducted following periods of dry and wet weather and on-site measurements of soil density and moisture content were recorded at the time of tests.

706,417
PB82-104746 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Factors Affecting the Soundness of Blended Cements.
P. W. Brown, and J. R. Clifton. Jun 81, 27p NBSIR-81-2273
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Portland cements, *Admixtures, *Slags, *Fly ash, Portland slag cements, Magnesium silicates.

Blended cements containing fly ash and blastfurnace slag were examined to assess their soundness in the presence of admixed MgO. Measurements of linear expansion were combined with compressive strength determinations to evaluate the volume stabilities of samples cured under various conditions. The effects of magnesium silicate formation on volume stability were also examined.

706,418
PB82-134370 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Thermal Conductivity of a Concrete Mortar from 95 K to 320 K.
L. L. Sparks. Oct 81, 17p NBSIR-81-1651
Sponsored in part by Maritime Administration, Washington, DC.

Keywords: *Concretes, *Mortars(Materials), *Thermal conductivity, Moisture content, Temperature gradients, Thermal measurements, *Moisture migration.

The thermal conductivity of a single concrete mortar specimen with varying moisture content is reported in the temperature range from 95 to 320 K. The measurements were made in a guarded-hot-plate apparatus (ASTN C-177). Moisture migration caused by temperature gradients was minimized by studying the saturated specimen in the low-temperature region. Specimen moisture content and concomitant thermal conductivity were altered by imposing low-pressure, high-temperature conditions on the specimen. The effect of changing the moisture content is discussed.

706,419
PB82-141771 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Analysis and Modeling of Corrosion of Steel in Prestressed Concrete.
S. T. Wu, and J. R. Clifton. Nov 81, 25p NBSIR-81-2390
Sponsored in part by Department of State, Washington, DC.

Keywords: *Prestressed concrete, *Prestressing steels, *Corrosion, Stress corrosion, Corrosion mechanisms, Electrochemical corrosion, Mathematical models.

Development of conceptual and mathematical models describing the corrosion of steel in prestressed concrete is outlined. The application of the principles of stress corrosion and general corrosion to understanding the mechanisms involved in corrosion of steel in prestressed concrete is discussed. The first step in estimating the failure time of a prestressed concrete structural system because of corrosion of the reinforced steel is to estimate corrosion rates under various but realistic conditions. A simplified approach based on mathematical modeling of concrete properties for estimating corrosion rates is proposed. Before the proposed mathematical model can be applied to practical problems information is needed on the specific mechanisms of corrosion cell processes of steel in prestressed concrete. In addition, well designed corrosion tests need to be performed in which all the important factors affecting the corrosion rates are considered.

706,420
PB82-177932 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Penetration Resistance of Concrete: A Review.
J. R. Clifton. Jan 82, 27p NBS-SP-480-45
Library of Congress catalog card no. 81-600191.

Keywords: *Nuclear materials management, *Concrete structures, *Penetration resistance, Dynamic loads, Reinforced concrete, Impact tests, Dynamic response, *Nuclear safeguards, Nuclear security management.

The mechanisms accounting for the failure of concrete under impact and impulsive loads, and the factors controlling the resistance of concrete to such loads, have been reviewed. It was found that little is known concerning the damage mechanism within concrete in response to dynamic loads. Apparently, the dynamic tensile strength of concrete has an important effect on its impact and impulsive resistances. A model based on the propagation of stress waves, which appears to give some insight to important material variables is described. Types of concrete which may merit evaluation for constructing structures subjected to dynamic loads are identified and discussed.

706,421
PB82-185125 PC **A02**/MF **A01**
National Bureau of Standards, Boulder, CO.
Mechanical Properties of Concrete Mortar at Low Temperatures.
J. M. Arvidson, L. L. Sparks, and E. Steketee. Feb 82, 10p NBSIR-82-1658
Sponsored in part by Maritime Administration, Washington, DC.

Keywords: *Mortars(Materials), Concretes, Mechanical properties, Cryogenics, Low temperature tests, Compressive strength.

This report includes test results conducted at ambient (295 K), dry-ice and alcohol (195 K), liquid nitrogen (76 K), and liquid helium (4 K) temperatures. The compressive properties reported are Young's modulus, yield (at 0.2% offset) and maximum strengths, and elongation (elastic and plastic). Test specimens (5.1 cm diameter x 10.2 cm) were instrumented with a specially designed, diametrically opposed, cryogenic strain-gaged extensometer that minimizes possible errors due to specimen bending during the test.

706,422
PB82-229147 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
Internal Strain, Deformation, and Failure of Large Scale Pullout Tests in Concrete.
W. C. Stone. May 82, 177p NBSIR-82-2484

Keywords: *Reinforced concrete, *Crack propagation, Strain measurement, Stress analysis, Strain measuring instruments, Finite element analysis, Mathematical models, *Pullout tests.

A study was performed to obtain detailed experimental data on crack propagation and internal strain distribution for the pullout test. A 12:1 scaled-up pullout test was designed, using a commercial pullout insert for the prototype dimensions, and was instrumented with small waterproof embedment strain gages so as to obtain internal strain profiles at critical locations. Two large scale specimens were tested with apex angles falling at the upper and lower bounds currently recommended in ASTM C-900. Two dimensional axisymmetric finite element analyses were performed for the two experimental specimens and the results were compared with measured strains for load stages below the onset of internal cracking.

706,423
PB83-121665 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC.
Construction Materials for Coal Conversion: Performance and Properties Data.
H. M. Ondik, B. W. Christ, and A. Perloff. Sep 82, 826p NBS-SP-642
Library of Congress catalog card no. 82-600610. Sponsored in part by Department of Energy, Washington, DC. Office of Fossil Energy.

Keywords: *Construction materials, *Coal gasification, Mechanical properties, Physical properties, Performance evaluation, Corrosion, Erosion, Equipment.

This book provides a central source of materials information needed for the fossil fuel industry. Data have been collected and evaluated from Department of Energy-sponsored projects. The focus is on construction materials for coal gasification use. The book is organized so that the information is given both with respect to the various component areas of a coal gasification plant and with respect to the properties or possible failure mechanisms, e.g., corrosion, erosion, mechanical properties, and physical properties.

706,424
PB83-164608 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Review of the Bituminous Reference Sample Program of the AASHTO (American Association of State Highway and Transportation Officials) Materials Reference Laboratory.
P. A. Spellerberg, and J. Y. Welborn. 16 Dec 82, 28p NBSIR-82-2632

Keywords: *Roads, *Bitumens, *Materials specifications, Bituminous cements, Sampling, Tests.

Background information on the development of standard specifications and methods of test, the AASHTO and the AMRL, is presented to give a historical perspective and to identify the need for the program. Details concerning its operation are reviewed. The coefficients of variation derived from the analysis of laboratory test data from a number of selected tests are plotted and evaluated. The value of the laboratory rating system and the laboratory performance charts which have been developed is discussed. Conclusions are made regarding the effectiveness of the program and the accuracy of established test precision limits.

706,425
PB83-179283 Not available NTIS
National Bureau of Standards, Washington, DC.
Maturity Functions for Concrete.
Final rept.
N. J. Carino. 1982, 6p
Pub. in Proceedings of the International Conference Concrete at Early Ages, Paris, France, April 6-8, 1982, p123-128.

Keywords: *Concretes, Curing, Temperature, Time, Strength, Mechanical properties, Hydration.

This paper deals with the characteristics of a function to account for the combined effects of temperature and time on the strength development of concrete. Starting with a differential equation to describe the rate of strength gain under isothermal curing conditions, it is shown that the product of age and the rate constant is the sought after function. Assuming a linear variation of the rate constant with temperature results in a temperature-time function identical to the traditional Saul-maturity-function. By using the Arrhenius equation to represent the variation of rate constant with temperature, a temperature-time function, called 'effective age,' is proposed which better describes the effects of temperature and time on strength development for isothermal curing.

706,426
PB83-179333 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of Maturity Concept to Form Removal and Reshoring Schedule.
Final rept.
N. J. Carino. 1982, 19p
Sponsored in part by Occupational Safety and Health Administration, Washington, DC.
Pub. in Proceedings of the International Conference Forming Economical Concrete Buildings, Lincolnshire, Chicago, IL, Nov 8-10, 1982, p8.1-8.19.

Keywords: *Concretes, Curing, Hydration, Temperature, Compressive strength.

A brief account of the historical development of the maturity concept is presented. This is followed by a derivation to illustrate the basis of the maturity concept. It is shown that the commonly used Saul-maturity function is, at best, an approximation of the combined effects of temperature and time on strength development of concrete. However, the accuracy can be improved by using the correct value of the datum temperature. Finally, examples are presented to illustrate the application of the maturity concept in construction practice.

706,427
PB83-182634 Not available NTIS
National Bureau of Standards, Washington, DC.
Mathematical Modeling of Tricalcium Silicate Hydration II. Hydration Sub-Models and the Effect of Model Parameters.
Final rept.
J. M. Pommersheim, J. R. Clifton, and G. J. Frohnsdorff. 1982, 8p
See also PB80-132749.
Pub. in Cement and Concrete Research 12, p765-772 1982.

Keywords: *Mathematical models, *Hydration, Particle size, Diffusivity, Cement, Reprints, *Tricalcium silicate.

Further details are reported for a previously developed mathematical model for the hydration of tricalcium silicate. The model is based on conceptual models for the different stages of hydration. Sub-models are given which consider the effects of the particle size, thickness of the barrier layer, and ratios of diffusivities through the hydrate layers. The model suggests that the barrier layer responsible for the induction period is most likely to form a finite time after the cement is mixed with water, rather than immediately. Model predictions were consistent with experimental data.

706,428
PB83-234435 Not available NTIS
National Bureau of Standards, Washington, DC.
Early Age Temperature Effects on Concrete Strength Prediction by the Maturity Method.
Final rept.
N. J. Carino, H. S. Lew, and C. K. Volz. Apr 83, 9p
Pub. in Jnl. of the American Concrete Institute 80, n2 p93-101 Mar/Apr 83.

Keywords: *Concrete durability, Aging tests(Materials), Compressive properties, Curing, Temperature gradients.

A comparison was made between the strength-maturity relations of concrete cylinders cured outdoors and of cylinders cured in a laboratory. It was found that when the early age (assumed as 48 hr) temperatures of the outdoor-cured and laboratory-cured cylinders were similar, the strength-maturity relations were similar despite the temperature fluctuations experienced by the outdoor-cured specimens. The relations were dissimilar when their early age temperatures differed. Another series of tests further investigated and confirmed the importance of early age temperature on the strength-maturity relation. From the additional tests it appeared that the early age period may be as short as the first 6 hours after initial mixing.

706,429
PB83-234526 Not available NTIS
National Bureau of Standards, Washington, DC.
Reference Sample Program for Fly Ashes as a Stimulus to Technological Progress.
Final rept.
G. Frohnsdorff, J. R. Dise, and J. R. Clifton. Sep 82, 8p
Pub. in Proceedings of a Workshop on Research Development Needs for Use of Fly Ash in Cement Concrete, Subsec. 5.4, p5-14--5-21 Sep 82.

Keywords: *Concretes, *Cement additives, *Fly ash, Performance evaluation.

The ultimate level of acceptance of fly ashes for use in concrete will depend upon their performance in concrete and upon the predictability of their performance. The desired level of knowledge about fly ash performance and uniformity is not yet available because of the scarcity of suitable data for the testing of hypotheses about factors affecting performance and also uncertainty about the appropriateness and reliability of current standard tests of performance. A practical way of simultaneously contributing to the data base for research and promoting assurance of fly ash quality would be establishment of a fly ash reference sample program.

706,430
PB83-234849 Not available NTIS
National Bureau of Standards, Washington, DC.
Laboratory Evaluation of Ultrasonics for Crack Detection in Concrete.
L. I. Knab, G. V. Blessing, and J. R. Clifton. Feb 83, 11p
Pub. in American Concrete Institute Jnl. Technical Paper No. 80-3, p17-27 Jan/Feb 83.

Keywords: *Concretes, *Cracks, *Ultrasonic tests, Nondestructive tests, Ultrasonic radiation, Amplitude, Velocity, Reprints.

A laboratory study was performed to quantify the capabilities of ultrasonic through-transmission methods to detect cracks in concrete. Pulse velocity and amplitude measurements were taken perpendicular to the crack plane (in cracked concrete) and compared with measurements parallel to the crack plane (in uncracked concrete). The direct path length was 152 mm. Parallel crack surfaces, approximately 0.05 mm apart and having depths of 19, 38, and 57 mm and widths of 152 mm, were fabricated in the specimens. Transducer frequencies of 150 and 54 kHz were used. Concrete specimens with a 28 day compressive strength of about 36 MPa were tested at several ages.

706,431
PB83-235044 Not available NTIS
National Bureau of Standards, Washington, DC.
Cumulative Damage of Reinforced Concrete Subjected to Repeated Impact.
Final rept.
L. I. Knab, and J. R. Clifton. 1982, 12p
Sponsored in part by Defense Nuclear Agency, Washington, DC.
Pub. in Cem. Concr. Res. 12, p359-370 1982.

Keywords: *Reinforced concrete, Impact tests, Damage assessment, Cratering, Penetration, Reprints.

This study was performed to develop methods of measuring the cumulative damage of steel reinforced concrete slabs subjected to repeated impact. Cumulative damage was monitored by measuring the crater depth and the reduction in ultrasonic pulse velocity across the impact region. Crater depth generally increased with increasing number of impacts and therefore was determined to be a reasonable indicator of cumulative damage. The percent reduction in velocity generally increased with increasing number of impacts up to about 40 percent or more of the total number of impacts to failure.

706,432
PB84-105147 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Effects on Strength-Maturity Relations of Mortar.
Final rept.
N. J. Carino, and H. S. Lew. Jun 83, 6p
Pub. in American Concrete Institute Jnl., Title no. 80-17, n3 p177-182 May/Jun 83.

Keywords: *Concretes, *Curing, Aging tests(Materials), Temperature control, Compressive strength, Regression analysis, Reprints, *Curing temperatures.

This study addresses two questions: (1) What are the quantitative effects of curing temperature on the strength-maturity relations of concrete. (2) At what age will curing temperature no longer affect the strength-maturity relation. To answer the first question, mortar cubes were cast and cured at five different temperatures from 5C to 43C. Compression tests were performed at seven maturity levels. A three-parameter equation was used to represent the strength-maturity relations; and regression analysis was used to evaluate the coefficients. To answer the second question, mortar cubes were cast and stored at 5C and 32C; they were then transferred to a 23C environment for subsequent curing. Compression tests were performed at five maturity levels. The resulting data were analyzed to determine the age beyond which curing temperature no longer affected the strength-maturity relation.

706,433
PB84-165331 PC **A99**/MF **E04**
National Bureau of Standards, Washington, DC.
Construction Materials for Coal Conversion: Performance and Properties Data. Supplement 1.
H. M. Ondik, B. W. Christ, T. R. Shives, A. Perloff, and B. A. Beck. Dec 83, 776p NBS-SP-642-SUPPL-1
Also available from Supt. of Docs. as SN003-003-02550-0. See also PB83-121665. Sponsored in part by Department of Energy, Laramie, WY. Laramie Energy Technology Center. Library of Congress catalog card no. 82-600610.

Keywords: *Construction materials, *Coal gasification, *Industrial plants, Alloys, Mechanical properties, Physical properties, Performance evaluation, Failure, Corrosion, Erosion, Tables(Data), Equipment, *Coal liquefaction.

This book expands the information provided in the original NBS SP 642 publication, Construction Materials for Coal Conversion--Performance and Properties Data, which was intended to provide a central source of materials information needed for the fossil fuel industry. Data have been collected and evaluated from Department of Energy-sponsored projects. The book is organized so that the information is given both with respect to the various component areas of coal gasification or liquefaction plants and with respect to the properties or possible failure mechanisms, e.g. corrosion, erosion, mechanical properties, and physical properties.

706,434
PB84-229491 Not available NTIS
National Bureau of Standards, Washington, DC.
Impact Resistance of Concrete.
Final rept.
J. R. Clifton, and L. I. Knab. 1 Jun 81, 5p
Sponsored in part by Defense Nuclear Agency, Washington, DC. See also PB84-228165.
Pub. in Proceedings of Annual Symposium Role of Behavioral Science in Physical Security (5th), Gaithersburg, MD., June 11-12, 1980, p49-53, 1 Jun 81.

Keywords: *Concrete, *Impact strength, Performance evaluations, Dynamic properties, Dynamic loads, Security.

The effects of dynamic loading on concrete is experimentally investigated, appropriate performance tests are developed, and the materials under consideration for use in the construction of security barriers are delineated.

706,435
PB84-232552 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
Investigation of Construction Failure of Reinforced Concrete Cooling Tower at Willow Island, WV.
Final rept.
H. S. Lew, S. G. Fattal, J. R. Shaver, T. A. Reinhold, and B. J. Hunt. Sep 82, 159p NBS/BSS-148
Sponsored in part by Occupational Safety and Health Administration, Washington, DC. Library of Congress catalog card no. 82-600602. Also available from Supt. of Docs as SN003-003-02436-8.

Keywords: *Reinforced concrete, *Cooling towers, *Loads(Forces), *Concrete durability, Failure, Electric power plants, Safety, Willow Island(West Virginia).

The collapse of the natural-draft hyperbolic concrete cooling tower unit no. 2 at the Pleasants Power Station at Willow Island, West Virginia, was investigated by the National Bureau of Standards. The investigation included on-site inspections, laboratory tests of construction assembly components and concrete specimens, and analytical studies. Based on the results of these field, laboratory, and analytical investigations, it was concluded that the most probable cause of the collapse was due to the imposition of construction loads on the shell before the concrete of lift 28 had gained adequate strength to support these loads.

706,436
PB84-234509 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
Pulse-Echo Method for Flaw Detection in Concrete.
Final rept.
N. J. Carino, and M. Sansalone. Jul 84, 42p NBS/TN-1199
Also available from Supt. of Docs as SN003-003-02601-8.

Keywords: *Concrete, *Ultrasonic tests, Nondestructive tests.

The basic principles of the pulse-echo method for the detection of internal flaws in concrete are presented. As the heterogeneous nature of concrete poses problems not encountered in pulse-echo evaluation of metals, progress in this area of concrete nondestructive testing has been slow. A review of past research shows that pulse-echo techniques have been used successfully to detect flaws within concrete; however, no standardized method currently exists for pulse-echo evaluation of concrete structures. Based on the current state of knowledge, areas of needed research are outlined.

706,437
PB85-123628 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of the Sulfate Resistance of Cements in a Controlled Environment.
Final rept.
P. Brown. 1981, 9p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Cement and Concrete Research 11, n5-6 p719-727 Sep/Nov 81.

Keywords: *Cements, *Corrosion prevention, *Sulfates, pH, Sulfuric acid, Reprints.

It was initially established that the maintenance of the pH of a sulfate solution in which mortar specimens were immersed at a constant and predetermined value through controlled sulfuric acid additions ensured that the sulfate ion concentration in solution remained invarient with time. The rates of sulfate attack of mortar specimens exposed under typical immersion and environmentally controlled conditions were then compared. It was observed that environmental control significantly increased the rate of sulfate attack as measured either by strength, loss or linear expansion. However, the strength changes and the expansions observed occurred in a manner consistent with the severity of the test conditions imposed.

706,438
PB85-141505 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laboratory Study of Flaw Detection in Concrete by the Pulse-Echo Method.
Final rept.
N. J. Carino. Oct 84, 23p
Pub. in Proceedings of the International Conference on Nondestructive Testing of Concrete, Ottawa, Canada, Oct 3-5, 1984 p557-579.

Keywords: *Concretes, *Nondestructive tests, *Sonic tests.

A study was performed to evaluate the applicability of using the echoes from mechanically produced impact to locate hidden defects within concrete. The expected interactions of spherical waves with concrete-air interfaces are reviewed, and the results of experiments using artificial flaws in a large concrete slab are summarized. The following aspects were studied: type of impact source; distance from impact point to receiver; type of receiving transducer; depth of reflecting interfaces; and diffraction effects by sharp edges. The contact time of the impact is shown to be an important parameter for the success of the technique. The influence of the concrete thickness from impact point to the reflecting interface is an area of needed research.

706,439
PB85-142339 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Uses of Waste Materials and By-Products in Construction.
Final rept.
J. R. Clifton, P. W. Brown, and G. Frohnsdorff. 1980, 22p
Pub. in Resource Recovery and Conservation 5, n2 p139-160 Jul 80.

Keywords: *Construction materials, Byproducts, Utilization, Wastes, Reprints, *Wastes utilization.

A survey has been made of the sources, amounts and methods of disposal of major mining, industrial and municipal wastes available in the 48 counterminous states of the United States. This includes the present and potential uses of these wastes as construction materials. While over 3 x 10 to the 9th power tons of waste materials are generated annually in the United States, only small amounts are being used by the construction industry. The low level of use does not yet reflect the advances being made in converting wastes into viable construction materials. In several cases, construction materials produced from wastes have been at least the technological equivalent of materials produced from virgin resources. Factors which are impeding the increased utilization of wastes are discussed and emerging incentives which could facilitate their increased use are covered.

706,440
PB85-189199 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Maturity Method: Theory and Application.
Final rept.
N. J. Carino. 1984, 13p
Pub. in Cement, Concrete and Aggregates 6, n2 p61-73 1984.

Keywords: *Concretes, *Strength, Hardening(Materials), Theories, Mortars(Materials), Predictions, Thermodynamic properties, Temperature, Time, Reprints, *Maturity method, Arrhenius equation, Aging(Materials).

The maturity method may be used to predict the in-place strength of hardening concrete based on its thermal history. This paper presents a theoretical basis for the maturity method. The general form of the time-temperature function is found to be the time integral of the rate constant. For the case of linear dependence between temperature and the rate constant, the time-temperature function becomes the traditional maturity function. The Arrhenius equation is shown to be an accurate representation of the temperature dependence of the rate constant, and the concept of equivalent age is explained for practical application of the Arrhenius equation. It is explained how the accuracy of strength prediction by the traditional maturity method can be im-

proved by using the proper datum temperature. Results illustrate that the appropriate value of apparent activation energy or datum temperature for concrete may be obtained from strength-gain data of isothermally-cured, mortar specimens.

706,441
PB85-197655 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effects of Maximum Void Size and Aggregate Characteristics on the Strength of Mortar.
Final rept.
L. I. Knab, J. R. Clifton, and J. B. Ings. 1983, 8p
Pub. in Cement and Concrete Research 13, n3 p383-390 May 83.

Keywords: *Mortars(Materials), Voids, Aggregates, Flexural strength, Reprints.

The effects of the maximum void size and aggregate surface roughness and shape on the flexural strength of mortar were investigated. Substantial reductions in the maximum void size and air content of high strength quartz aggregate mortars resulted in flexural strength increases. However, these increases were lower than predicted by the Griffith theory, thus indicating that the maximum void size did not act as the critical flaw controlling the flexural strength. Rather, factors relating to the cement-aggregate bond, including aggregate roughness and surface area, appeared to affect the flexural strength more than the maximum void size.

706,442
PB85-200095 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Alkali-Silica Reaction in Concrete.
Final rept. Nov 83-Jan 85.
L. J. Struble. Mar 85, 38p NBSIR-85/3116
Grant NSF-CEE82-10791

Keywords: *Concretes, *Alkalies, *Silicon dioxide, Portland cements, Aggregates, Cracks, Mortars(Material), Tests, Chemical reactions.

Reaction in concrete between alkalies from the cement and reactive silica in the aggregate may cause expansion and cracking, and occasionally may cause significant weakening of the structure. The objective of this program is to determine whether there is any influence of the alkali mineralogy in the cement on the expansion of mortar due to alkali-silica reaction. The experimental approach consisted of determining the distribution of alkalies within a group of commercial portland cements with a variety of alkali mineralogies, and measuring expansion of mortar bars prepared using these cements and various reactive aggregates. In some cases, differences were observed in both level and rate of expansion for cements differing in alkali mineralogy. The differences were substantial with cements high in alkali and with opal as the reactive constituent. The results support the authors hypothesis that the specific alkali mineralogy of the cement affects the expansion due to alkali-silica reaction.

706,443
PB85-229862 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Fracture Toughness of Polymer Concrete Materials Using Various Chevron-Notched Configurations.
Final rept.
R. F. Krause, and E. R. Fuller. 1984, 15p
Sponsored by Department of Energy, Washington, DC.
Pub. in American Society for Testing and Materials, Special Technical Publication 855, p309-323 1984.

Keywords: *Fracture strength, Acrylonitriles, Notch tests, Crack propagation, Reprints, *Polymer concretes, Stress intensity factors.

The fracture toughness of two similar polymer concrete materials was determined using several fracture mechanics configurations to show any influence of crack geometry on resistance to fracture in these materials. The testing configurations included a conventional straight-through notch in a flexure bar and various chevron-notched geometries in both flexure-bar and short-rod specimens. The materials were polymerized mixtures of monomers, anhydrous Type III portland cement, and silica sand. In one composition the monomers were styrene and trimethylolpropane-trimethacrylate; whereas, in the other composition, acrylonitrile was added as well. The fracture toughness was calculated from published stress-intensity coefficients for the straight-through notch which were adapted for use with a chevron notch by assuming that the derivative of the compliance with respect to crack length was the same for both notch types. Effects of varying chevron-notched angle, chevron-vertex position, and width of specimen in the crack plane were examined.

706,444
PB85-236024 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Development of Durcon, an Expert System for Durable Concrete: Part 1.
J. R. Clifton, B. C. Oltikar, and S. K. Johnson. Jul 85, 24p NBSIR-85/3186

Keywords: *Concrete durability, *Concretes, Admixtures, Construction materials, Cements, Deterioration, Corrosion, Aggregates, Reinforcing steels, Sulfates, Mixtures, Design, Computer applications, Expert systems.

This is a progress report on the development of DURCON an expert system to give recommendations on the selection of constituents for durable concrete. Four major concrete deterioration problems will be covered when the DURCON system is completed; freeze-thaw, sulfate attack, corrosion of reinforcing steel, and cement-aggregate reactions. The factual knowledge base for DURCON is based on the American Concrete Institute Guide to Durable Concrete. Heuristic knowledge is being obtained from experts on the durability of concrete. The approach being taken in developing DURCON is discussed. Then a model expert system for concrete exposed to freeze-thaw conditions is described.

706,445
PB86-111960 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Prediction of Concrete Service-Life.
Final rept.
J. Pommersheim, and J. R. Clifton. 1985, 10p
Pub. in Materiaux et Constructions 18, n103 p21-30 1985.

Keywords: *Concrete, *Life(Durability), *Mathematical models, *Accelerated tests, *Degradation, *Service life, Scale(Corrosion), Corrosion, Reprints.

The paper discusses development of accelerated tests and mathematical models for predicting the durability of concrete. Durability, service life, and degradation factors are defined and accelerated test methods are contrasted to conventional comparative methods. Factors and mechanisms of concrete degradation are reviewed, as are efforts to quantify these phenomena. Deterministic and stochastic models are discussed. Procedures for developing accelerated tests are presented and applied to a hypothetical example involving freeze-thaw damage. Advantages and disadvantages of accelerated testing and mathematical modeling are discussed in terms of the degradation mechanisms affecting concrete. Examples given of the modeling approach and service life prediction include the prediction of the strength and maturity of concrete, acid attack on cement, sulphate attack, and the effect of scaling and corrosion on load-bearing capacity of concrete.

706,446
PB86-160090 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Cement in the 1990s: Challenges and Opportunities.
Final rept.
G. Frohnsdorff, and J. Skalny. 1983, 14p
Pub. in Philosophical Transactions of the Royal Society of London, Series A 310: Mathematical and Physical Sciences, p17-30 1983.

Keywords: *Cements, Utilization, Performance standards, Forecasting, Standards, Reprints.

Despite large gaps in knowledge of cement science, cement and concrete are the preferred materials for much civil engineering construction. As the gaps are filled, cement and concrete should become even more valuable construction materials. The gaps stem in large part from the inability to characterize cements and their hydration products in unambiguous terms. For many reasons, there have been significant barriers to cement research. The barriers have resulted in fragmentation of research efforts among groups with less than adequate mixtures of skills. Nevertheless, the authors believe there will be a revolution in cement technology based on an integration of research efforts through cooperation on national and international levels.

706,447
PB86-169109 PC **A99**/MF **E04**
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Construction Materials for Coal Conversion: Performance and Properties Data. Supplement 2.
Final rept.
H. M. Ondik. Dec 85, 695p NBS/SP-642-SUPPL-2
See also PB84-165331. Also available from Supt. of Docs as SN003-003-02703-1. Library of Congress catalog card no. 85-600639.

Keywords: *Construction, *Coal gasification, *Ceramics, Industrial plants, Alloys, Mechanical properties, Physical properties, Performance evaluation, Failure, Corrosion, Erosion, Tables(Data), Equipment, Refractories, Coal liquefaction.

The book expands the information provided in the original NBS/SP 642 and in NBS/SP 642 Supplement 1 publications, Construction Materials for Coal Conversion--Performance and Properties Data. These volumes are intended to provide a central source of materials information needed for the fossil fuel industry. Data have been collected and evaluated from Department of Energy-sponsored projects. The book is organized so that the information is given both with respect to the various component areas of coal gasification, liquefaction, and direct combustion plants and also with respect to the properties or possible failure mechanisms, e.g., corrosion, erosion, mechanical properties, and physical properties.

706,448
PB86-192135 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Shear Resistance of Unreinforced Hollow Concrete Block Masonry Walls.
Final rept.
K. Woodward, and F. Rankin. 1985, 15p
Pub. in Proceedings of North American Masonry Conference (3rd), Arlington, TX., June 3-5, 1985, p38-1 - 38-15.

Keywords: *Concrete blocks, Masonry, Shear strength.

An experimental investigation is described which has as its primary focus the determination of shear resistance exhibited by unreinforced, ungrouted, hollow concrete block masonry walls. Thirty-two wall panel tests are reported. The parameters in the investigation include the amount of applied vertical compressive stress, wall aspect-ratio, block strength and mortar type.

706,449
PB86-193125 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Fluorescent Thin Sections to Observe the Fracture Zone in Mortar.
Final rept.
L. I. Knab, H. N. Walker, J. R. Clifton, and E. R. Fuller. 1984, 6p
Pub. in Cement and Concrete Research 14, n3 p339-344 May 84.

Keywords: *Mortars(Materials), *Fracturing, Fluorescence, Fracture properties, Cracking(Fracturing), Concretes, Microstructure, Reprints.

The report deals with the use of fluorescent thin sections to observe the microstructural details of the fracture zone. A mortar is used to illustrate the technique. It is concluded that the fluorescent thin section technique has the potential of providing a valuable new source of information on the microstructural details of the fracture zone in mortars and concretes, both near the surface and in the interior of specimens.

706,450
PB86-196425 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Calcium Hydroxide Distribution and Calcium Silicate Hydrate Composition in Tricalcium Silicate and Beta-Dicalcium Silicate Pastes.
Final rept.
H. F. W. Taylor, and D. E. Newbury. 1984, 6p
Pub. in Cement and Concrete Research 14, n1 p93-98 Jan 84.

Keywords: *Silicate cements, Calcium hydroxides, Calcium silicates, Microanalysis, Reprints.

Pastes of C3S and B-C2S 23 years old were studied by electron probe microanalysis. In both cases, regions consisting entirely or largely of calcium hydroxide and of C-S-H were distinguished on a scale of 2-50 um. The regions high in C-S-H accounted for 75-80 percent of the whole in the C3S paste and about 96 percent in the C2S paste; these values are much higher than those initially occupied by anhydrous starting materials. Within the high C-S-H areas, no variation was detected that could have corresponded to the so-called inner and outer hydrates. The ratio of mean Ca to mean Si in the high C-S-H areas was 1.72 for the C3S and 1.78 for the C2S paste, but because of possible admixture with calcium hydroxide on or below a micrometer scale, the Ca/Si ratio of the C-S-H may be as low as 1.5.

706,451
PB86-196433 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Electron Microprobe Study of a Mature Cement Paste.
Final rept.
H. F. W. Taylor, and D. E. Newbury. 1984, 9p
Pub. in Cement and Concrete Research 14, n4 p565-573 Jul 84.

Keywords: *Portland cement, Electron microscopy, Electron probes, X ray analysis, Silicate cements, Reprints.

A portland cement paste 23 years old, and essentially fully hydrated, was studied by electron probe microanalysis. X-ray images indicated that the distributions in space of the original, largely polymineralic cement grains, and of the individual phases within them, are substantially preserved in the hydrated material. This was shown especially clearly by the Mg and Fe images, probably because these elements do not readily migrate in the alkaline medium.

706,452
PB86-213378 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Investigation of the Corrosion of Aluminum Standing-Seam Roofing at an Army Facility.
R. G. Mathey. Jun 86, 21p NBSIR-86/3387
Sponsored by Construction Engineering Research Lab. (Army), Champaign, IL., and Defense Logistics Agency, Alexandria, VA.

Keywords: *Roofing, *Aluminum, Corrosion, Weathering.

An investigation was conducted to determine the extent of corrosion of an aluminum standing-seam roofing system exposed to weathering over a period of nearly three years. The aluminum roofing was installed on three large warehouses at an Army facility in Columbus, Ohio. A high performance elastomeric sealant was used in forming the standing seams of the roofing system. The roof slope, about 5 percent, was less than that usually recommended for unsoldered standing-seam roofing. The roofs were located in a region having a high level of acid rain.

706,453
PB86-238268 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Calcium Aluminate Cements.
Final rept.
G. J. Frohnsdorff, and J. E. Kopanda. 1986, 3p
Pub. in Encyclopedia of Materials Science and Engineering, v1 p472-474 1986.

Keywords: *Aluminate cements, Cements, Calcium, Reprints.

No abstract available.

706,454
PB86-238276 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Portland Cements, Blended Cements and Mortars.
Final rept.
G. J. Frohnsdorff. 1986, 8p
Pub. in Encyclopedia of Materials Science and Engineering, v5 p3847-3854 1986.

Keywords: *Cements, Portland cements, Mortars(Material), Reprints.

No abstract available.

706,455
PB86-238284 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Cements, Specialty.
Final rept.
G. Frohnsdorff. 1986, 5p
Pub. in Encyclopedia of Materials Science and Engineering, v1 p575-579 1986.

Keywords: *Cements, Reprints.

No abstract available.

706,456
PB86-238292 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Building Materials: Nondestructive Evaluation.
Final rept.
J. R. Clifton. 1986, 4p
Pub. in Encyclopedia of Materials Science and Engineering, v1 p446-449 1986.

Keywords: *Construction materials, Nondestructive tests, Reprints.

No abstract available.

706,457
PB87-106753 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Point Source-Point Receiver, Pulse-Echo Technique for Flaw Detection in Concrete.
Final rept.
N. J. Carino, M. Sansalone, and N. N. Hsu. 1986, 10p
Pub. in Jnl. of the American Concrete Institute 83, n2 p199-208 1986.

Keywords: *Concretes, *Nondestructive tests, Greens function, Wave propagation, Impact, Reprints.

Numerical and experimental results are presented on the use of a point source point receiver, pulse-echo technique to locate flaws within hardened concrete. A large concrete slab was cast with known internal flaws which were created by embedded polyurethane foam disks, ranging from 5 to 50 cm in diameter. Using steel balls dropped onto the slab surface as a point source and a conical, broadband, displacement transducer with a small contact area as a point receiver, the ability of the technique to locate the embedded disks was evaluated. Numerical solutions for the response of an infinite plate to surface impact were used to help interpret experimental signal traces. Boundaries of both planar and inclined disks were determined to within a few centimeters. Thus, it was concluded that the proposed technique can be a reliable nondestructive test method for detecting flaws and discontinuities within hardened concrete. The inherent limitations of the method are alse discussed.

706,458
PB87-153086 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Application of CCRL Data in the Formulation of Precision Estimates for Selected Cement Standards.
Final rept.,
J. H. Pielert, J. W. Haverfield, and P. A. Spellerberg. 1985, 6p
Sponsored by American Society for Testing and Materials, Philadelphia, PA., and American Association of State Highway and Transportation Officials, Washington, DC.
Pub. in Cement and Concrete Aggregates 7, n1 p37-42 1985.

Keywords: *Cements, *Concretes, *Construction materials, *Bitumens, *Standards, Precision, Reprints, National Bureau of Standards.

Increased emphasis is being placed on the quality control of materials used by the construction industry. The needs for uniformity and accuracy of testing conducted in materials laboratories is receiving considerable attention. Precision statements included in many standard test methods provide a basis for evaluating the quality of testing. The paper provides an overview of the Materials Testing Laboratories located at the National Bureau of Standards and demonstrates how data from the reference sample programs may be used to formulate precision estimates which can be used in developing statements of precision.

706,459
PB87-161071 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Effect of Geometry and Aggregate on the Reliability of the Pullout Test.
Final rept.,
W. C. Stone, and B. J. Giza. Feb 85, 10p
Pub. in Concrete International: Design and Construction 7, n2 p27-36 Feb 85.

Keywords: *Concrete, *Aggregates, *Nondestructive tests, Reliability, Strength, Mechanical properties, Reprints.

A series of tests was performed to investigate the effect of aggregate size, and type, and the geometry of the pullout test apparatus on the reliability of the pullout test. Reliability was assessed by the standard deviation of the experimental ultimate load in replicated tests. Key geometric variables included the apex angle and the depth of embedment of the 1-inch (25mm) insert. Apex angles were varied from 30 degrees to 86 degrees, and embedment depths were varied from 0.4 in to 1.67 in (10mm to 42mm). Also investigated were the effects of nominal maximum aggregate size and the type of aggregate on reliability. Mortar specimens were used for comparison. Four aggregate types were investigated: an expanded shale lightweight aggregate, crushed soft limestone, crushed hard limestone, and river gravel.

706,460
PB87-219010 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Finite-Element Analysis of the Pullout Test Using a Nonlinear Discrete Cracking Approach.
Final rept.,
A. K. Hellier, M. Sansalone, N. J. Carino, W. Stone, and A. R. Ingraffea. 1987, 10p
Pub. in Cement, Concrete, and Aggregates 9, n1 p20-29 1987.

Keywords: *Concretes, *Strength, Crack propagation, Mathematical models, Finite element analysis, Stresses, Failure, Shear stress, Model tests, Reprints, *Pullout tests, Fracture mechanics, Aggregate interlock.

An axisymmetric finite-element model, in which fracture was simulated by means of a nonlinear discrete cracking approach, was used to study the pullout test. The pullout test involves measuring the force required to extract a conical frustum of concrete by pulling on an embedded steel disk in opposition to a concentric steel reaction ring at the concrete surface. The precise mechanism of failure and therefore the strength property of concrete, which is actually being measured by the pullout test, has been the subject of several recent studies. The present analysis indicaters that failure initiates with the formation of a stable, primary crack system extending from the outer edge of the insert to a point beneath the reaction ring where it is arrested. A stress redistribution resulting from this cracking leads to the development of a secondary crack system which initiates below the concrete surface at the inner edge of the reaction ring and propagates towards the outer edge of the insert. This secondary crack system becomes the eventual failure surface definging the conical frustum. The failure surface appears to be completed by shear fracture of the remaining uncracked ligament. The ultimate load-carrying mechanisms is aggregate interlock across the completed failure surface.

706,461
PB88-110804 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.

Evaluation and Accreditation of Construction Materials Laboratories.
Final rept.,
J. W. Locke, and J. H. Pielert. 1983, 19p
Pub. in Proceedings of Conference on Quality Assurance of Highways and Bridges, Gaithersburg, MD., August 30-31, 1983, 19p.

Keywords: *Construction materials, *Laboratories, *Test facilities, Highways, Quality assurance, Manpower, Requirements, *Road materials, Accreditation, State of the art, National organizations.

The Surface Transportation Assistance Act of 1982 directs the Secretary of Transportation to coordinate a study with NBS, ASTM and others to determine the manpower needs and costs of developing a national system for the evaluation and accreditation of testing and inspection agencies. The paper provides a description of the current state-of-the-art in the areas of laboratory evaluation and accreditation, provides available data on the level and quality of construction materials laboratory testing, and specifies additional information required to predict manpower needs and costs of a national system.

706,462

PB88-111851 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Measurement of the Setting Time and Strength of Concrete by the Impact-Echo Method,
S. P. Pessiki, and N. J. Carino. Jul 87, 122p NBSIR-87/3575

Keywords: *Concretes, *Setting time, *Mechanical properties, Measurement, Impact tests, Echoes, Nondestructive tests.

Tests were performed to evaluate the feasibility of using the impact-echo method to determine setting time and monitor strength development of concrete. In the impact-echo method, the test object is subjected to point impact and the surface displacement adjacent to the impact point is monitored. From the measured displacement waveform and the thickness of the object, the P-wave velocity is determined. Changes in the P-wave velocity with time reveal information about the development of mechanical properties. Setting time tests were made on concrete mixtures of two water-cement ratios and with and without set-controlling admixtures. A strong correlation was found between the time of initial setting of mortars sieved from the concrete, as determined by penetration resistance (ASTM C 403), and the time when the P-wave velocity began to increase. It is concluded that the impact-echo method is a promising technique for nondestructively monitoring the development of mechanical properties in concrete from initial setting to ages of several days.

706,463

PB88-129705 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Effect of Inorganic Salts on Tricalcium Silicate Hydration.
Final rept.,
P. W. Brown, C. L. Harner, and E. J. Prosen. 1986, 6p
Pub. in Cement and Concrete Research 16, n1 p17-22 Jan 86.

Keywords: *Calcium silicates, *Hydration, Inorganic salts, Admixtures, Concretes, Cements, Reprints.

Hydration of C3S in salt solutions having ions in common with its products was investigated by calorimetry and aqueous phase analyses. Soluble calcium salts, which depress hydroxyl ion concentrations in solution by promoting Ca(OH)2 precipitation, were observed to accelerate hydration. Acceleration did not occur prior to Ca(OH)2 precipitation. A saturated CaSO4 solution, which delayed Ca(OH)2 precipitation, was initially retarding but subsequently accelerated hydration as the hydroxyl ion concentration in solution decreased. Of the solutions investigated, a 0.2M CaCl2 solution was the most effective in depressing the hydroxyl ion concentration and caused the greatest acceleration.

Highway Engineering

706,464

PB-262 366/8 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Engineering Mechanics Section.
Skid Resistance Measurement Test Procedures for Intercomparing FHWA National and Regional Reference Systems.
Final rept.,
R. W. Kearns, and J. F. Ward. Dec 76, 34p NBSIR-76-1174
Sponsored in part by Federal Highway Administration, Washington, D.C. Office of Development.

Keywords: *Skid resistance, *Highways, Measurement, Standardization, Pavements, Friction, Traffic safety, Wet pavements.

The measurement of the skid resistance of highways, under wet weather conditions, is part of the Federal Highway Administration (FHWA) skid-accident reduction program. A national reference system and regional reference systems are operated to improve the method of measurement, to reduce differences in results between systems and to include measurement assurance in the program. State highway measuring systems are intercompared with reference systems at FHWA regional field test centers. The document describes the objectives, the scope and the general procedures of the tests used to intercompare the regional reference systems with the national reference system operated by the National Bureau of Standards. Listings of the general equipment required are included.

706,465

PB-265 102/4 PC **A07**/MF **A01**
National Bureau of Standards, Washington, D.C. Engineering Mechanics Section.
Skid Resistance Measurement Tests of New FHWA Reference Systems at the Eastern Field Test Center.
Final rept. Feb-Apr 76,
R. W. Kearns, and J. F. Ward. Mar 77, 131p NBSIR-77-1213
Sponsored in part by Federal Highway Administration, Washington, D.C. Office of Development.

Keywords: *Pavements, *Skid resistance, Standards, Measurement, Surface properties, Calibration, Tests, Wet pavements.

The Federal Highway Administration (FHWA) is developing a program to improve the method of measuring wet weather pavement skid resistance (SN) and to reduce the variation in results. At the national level, an interim reference system (IRS) is maintained and operated by the National Bureau of Standards. At the regional level, an area reference system (ARS) is maintained and operated at each FHWA Field Test Center. Intercomparisons between these reference systems and the highway measuring systems at the state level provide measurement assurance. In this report, the first correlations between three identical, newly manufactured systems (ARS 1, 2, 3) and the IRS are given. Computed standard deviations of mid-range predicted SN values are typically less than 0.1 SN. SN is given as a function of test speed for each system, on two test surfaces. Speed gradients of SN are found to be characteristic of the surface.

706,466

PB-287 936/9 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Acoustical Engineering Div.
Techniques for the Measurement of Acoustic Impedance of Asphalt.
Final rept. Aug 76-Mar 77.
P. A. Mansbach, and C. I. Holmer. Oct 78, 94p NBSIR-78-1541
Prepared for Environmental Protection Agency, Washington, DC. Office of Noise Abatement and Control.

Keywords: *Flexible pavements, *Acoustic impedance, Acoustic measuring instruments, Sound analyzers, Wind, Temperature gradients, Transportation noise, Noise pollution, *Truck noise.

Five techniques were used in an attempt to measure the very high acoustic impedance of an asphalt surface. These techniques are: Impedance Tube, Pure-Tone Traverse, Pulse-Echo, Broad-Band Cross-Correlation, and Direct Accelerometer Measurement. These techniques are described and evaluated in some detail, and the results of the measurements are presented. Of the five techniques, the broad-band cross-correlation proved to be the most effective, and also is capable of even further improvement. The value of the specific acoustic admittance of the sealed asphalt surface obtained with this technique is .007. The effects of wind and temperature gradients on ray propagation are derived theoretically, as well as spherical wavefront corrections to plane-wave reflection. These refinements are necessary to realize the full potential of the broad-band measurement technique. Effects of the finite test surface impedance on source emission measurements are discussed. Measurement uncertainties of the order of 1-2 dB due to surface impedance are considered likely.

706,467

PB82-122888 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Analysis of Thermal Stresses in Internally Sealed Concrete Bridge Decks.
Final rept. Jul 77-Dec 79.
S. G. Fattal, T. A. Reinhold, and B. Ellingwood. Apr 81, 119p FHWA/RD-80/085

Keywords: *Bridge decks, Thermal stresses, Temperature distribution, Finite element analysis, Heat treatment, *Internally sealed concrete, Wax beads, Computer applications.

A structural model was developed for use with a finite element program to predict thermal stresses which result from the application of heat to the concrete decks of highway bridges. The decks are heated to obtain an internally sealed concrete so as to better protect the reinforcement from deicer-induced corrosion. Simple decks were first studied to determine the sensitivity of the solutions to various modeling assumptions. Two full-scale bridge decks were also analyzed for which the temperature distributions are predefined on the basis of field data. The model will provide a helpful tool which will enable future field measurements to be planned more selectively. It will also provide insight on means for improving the heat treatment process so as to minimize cracking damage.

706,468

PB83-124800 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Investigation of Construction Failure of the Riley Road Interchange Ramp, East Chicago, Indiana.
N. J. Carino, H. S. Lew, W. C. Stone, R. M. Chung, and J. R. Hoblitzell. Oct 82, 224p NBSIR-82-2593
Sponsored in part by Occupational Safety and Health Administration, Washington, DC. and Federal Highway Administration, Washington, DC.

Keywords: *Interchanges, *Highway bridges, Concrete construction, Collapse, Ramps, Structural analysis, Accident investigations, Indiana, *Progressive collapse, Riley Road interchange, East Chicago(Indiana).

The National Bureau of Standards (NBS), at the request of the Occupational Safety and Health Administration, conducted an investigation to determine the most likely cause of the collapse of a portion of a highway ramp in East Chicago, Indiana. The accident occurred on April 15, 1982, and resulted in the death of 13 workers. A team of engineers from NBS and the Federal Highway Administration carried out an extensive field investigation, in cooperation with personnel from the Indiana Occupational Safety and Health Administration, to ascertain the conditions prior to and after the accident. In addition, the NBS performed physical tests on key components of the temporary support system used to build the ramp. A structural analysis was also performed to compute the magnitude of the forces acting in various components of the support system.

706,469

PB83-192252 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Highway Noise Criteria Study: Relations Among Frequency Rating Procedures.
Final rept.
D. R. Flynn, and S. L. Yaniv. Feb 83, 60p NBS-TN-1113-3
Sponsored in part by Federal Highway Administration, Washington, DC.

Keywords: *Highways, *Noise pollution, *Acoustic measurement, Transportation noise, Site surveys, Regression analysis, *Noise levels.

A series of calculations was performed to ascertain how well one frequency-weighted rating, such as weighted sound level, loudness level, or perceived noise level, may be predicted from another such rating. A total of 103 average sound level spectra, measured at several distances from different types of highways, were used in these calculations. It was found that knowing a single noise rating, such as the A-weighted sound level, enables one to predict other outdoor ratings in this set of 103 spectra with a standard deviation of the order of 1 to 2 dB. If, in addition, traffic speed and mix and the distance to the highway are taken into account, these standard deviations can be reduced to 0.5 to 1 dB, depending upon the particular noise rating of interest. Equations are given for predicting one rating from another; the associated standard deviations are presented as a measure of how well any given rating can be predicted from a single measured, or otherwise known, noise rating.

706,470
PB84-218072 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Structures Div.
Responses to Questions by the General Accounting Office Related to Construction of the Sunshine Skyway Bridge.
N. J. Carino. Jun 84, 30p NBSIR-84/2892

Keywords: *Construction, *Highway bridges, Investigations, Cracks, Bridge piers, Safety, Loads(Forces), Reinforced concrete, Mixtures, Florida, *Sunshine Highway Bridge.

The General Accounting Office (GAO) requested the assistance of the National Bureau of Standards in the investigation of the construction of the new Sunshine Skyway Bridge in Florida. Specifically, GAO desired answers to questions related to the following: (1) the formation of cracks in the main piers of the bridge span; (2) the materials used in the concrete mixtures; and (3) the procedures used in the placement of concrete in the drilled shaft foundations. The objective of the GAO inquiry is to determine the reasonableness and validity of the positions taken by the Florida Department of Transportation on each of the concerns expressed by a number of individuals in connection with the bridge construction. This report provides answers to the questions and provides explanations for each answer.

706,471
PB84-227404 Not available NTIS
National Bureau of Standards, Washington, DC.
Investigation of East Chicago Ramp Collapse.
Final rept.
N. J. Carino, H. S. Lew, and W. C. Stone. Mar 84, 18p
Pub. in ACSE Jnl. of Construct. Eng. Manage. 110, n1 p1-18 Mar 84.

Keywords: *Highways, *Ramps, *Collapse, Investigations, Failure, Structural analysis, Accidents, Structural members, Cracking(Fracturing), Concrete structures, Indiana, East Chicago(Indiana).

A summary is presented of the investigation performed by the National Bureau of Standards (NBS), at the request of the Occupational Safety and Health Administration, to determine the most likely cause of the collapse of a portion of a highway ramp in East Chicago, Indiana. The investigative effort included an extensive field study to ascertain the conditions prior to and after the accident. In addition, the NBS performed physical tests on key components of the temporary support system used to build the ramp. A structural analysis was performed to compute the magnitude of the forces acting in various components of the support system prior to the failure. The calculated forces were compared with the expected strengths of the structural components. It was concluded that the most likely triggering mechanism of the collapse was the cracking of concrete pads supporting a shoring tower. It was further concluded that there were four deficiencies that contributed directly to the collapse. Had any of these deficiencies not existed, it is unlikely that the collapse would have occurred.

706,472
PB87-145413 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Measuring the Corrosion Rate of Reinforcing Steel Concrete - Final Report.
E. Escalante, E. Whitenton, and F. Qiu. Oct 86, 50p NBSIR-86/3456
See also report dated Apr 84, PB84-144532. Sponsored by Federal Highway Administration, Washington, DC.

Keywords: *Reinforcing steels, *Corrosion tests, *Bridge decks, Highway bridges, Reinforced concrete, Bars, Nondestructive tests, Computer programs, Frederick County(Maryland).

The report describes a two phase study directed at developing a portable system for measuring the corrosion of steel in concrete bridge decks. A small, portable computer system is used to control the measurement of polarization resistance of steel in concrete, and using current interruption, iR compensation is accomplished. During the development stage, measurements were made on small specimens in a laboratory controlled environment, and the results of the calculated weight loss measurements based on the electrochemical measurement are compared to gravimentrically determined weight loss. In the second phase, the portable system was used to measure the corrosion of three bridge decks in Frederick County, Maryland, over a four month period. The results of these field measurements and the problems encountered are discussed.

706,473
PB87-152245 PC **A13**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Behavior of 1/6-Scale Model Bridge Columns Subjected to Cyclic Inelastic Loading,
G. S. Cheok, and W. C. Stone. Nov 86, 292p NBSIR-86/3494
Sponsored by National Science Foundation, Washington, DC., Federal Highway Administration, Washington, DC., and California State Dept. of Transportation, Sacramento.

Keywords: *Columns(Support), *Bridges(Structures), Cyclic loads, Elastic properties, Model tests, Reinforced concrete, Ready mixed concrete, Gravel, Aspect ratio, Axial stress, Computer programs, Energy absorption, Displacement, Strains, Graphs(Charts), Microconcrete, Computer graphics.

Circular, spirally reinforced concrete bridge columns were subjected to cyclic inelastic loading in the laboratory. The bridge columns were one-sixth scale models of prototype columns designed in accordance with current California Department of Transportation specifications. A total of six models were tested; three were constructed with microconcrete, and three with ready-mix concrete using pea gravel. Variables included the aspect ratio, magnitude of axial load, and the use of microconcrete versus ready-mix. The models were subjected to slow reversed cyclic loading with the axial load held constant. Results from the tests are presented in the form of energy absorption, load-displacement curves, longitudinal steel strains, and displacement profiles. Comparisons of the ultimate moment capacities, measured displacement ductilities, plastic hinge lengths, and the failure mode for the six models are discussed. Comparisons with previous studies are presented. A series of graphics-based computer programs are discussed. Source code is provided.

Soil & Rock Mechanics

706,474
PB-264 137/1 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Applied Technology.
Preservation of Historic Adobe Structures - A Status Report.
Final rept.,
J. R. Clifton. Feb 77, 37p NBS-TN-934
Sponsored in part by National Park Service, Washington, D.C.

Keywords: *Buildings, *Construction materials, *Cohesive soils, Mechanical properties, Soil properties, Moisture content, Clay soils, Physiochemical properties, Preserving, *Adobe soils, Historic buildings, *Historic preservation.

The physicochemical and mechanical properties of adobe soils and building materials, and the technology of preserving historic adobe structures have been critically reviewed. In most cases, the deterioration of adobe structures can be directly or indirectly correlated with the presence of excess moisture. Therefore, the successful preservation of most historic adobe structures depends largely on effectively protecting these structures from water. This review indicates that the technology of preserving adobe structures needs further development to ensure the longevity of the structures. Areas in which research is needed have been identified and include: (1) the development of standard methods to characterize the composition and physical properties of adobe soils, and the mechanical properties of adobe brick; (2) nondestructive methods to measure the water contents of and watermovement in adobe structures; and (3) the evaluation of the effectiveness of different types of preservation materials and methods.

706,475
PB82-195140 Not available NTIS
National Bureau of Standards, Washington, DC.
Cyclic Simple Shear of Large Scale Sand Samples: Effects of Diameter to Height Ratio.
Final rept.
W. D. Kovacs, and E. Leo. 1981, 8p
Prepared in cooperation with Purdue Univ., Lafayette, IN. School of Civil Engineering.
Pub. in Proceedings of Conference (Int.) on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics. Held April 26-May 3, 1981, p897-904 1981.

Keywords: *Sands, Shear tests, Cyclic loads, Shear strain, Mechanical hysteresis, Damping.

Cyclic drained simple shear tests on a dry sand using a 12 in. diamter sample with sample heights of 1, 2, and 4 in show the affect of Diameter/Height ratio on the shear modulus and percent of critical hysteretic damping at various shear strain levels. The shear modulus is found to increase with cycle number and with increasing specimen size. The D/H ratio is found to affect the shear modulus at low shear strains (less than 1 percent) and found to have little effect at higher shear strains and at failure. The hysteretic damping decreases for all values of shear strain tested (0.01 to 1 percent) as the cycle number and D/H ratio increases. Possible implications on design and pore pressure development are mentioned.

706,476
PB82-210535 Not available NTIS
National Bureau of Standards, Washington, DC.
Results and Interpretation of SPT Practice Study.
Final rept.
W. D. Kovacs. Sep 81, 4p
Pub. in ASTM Tech. Note GTJODJ 4, n3 p126-129 Sep 81.

Keywords: *Foundations, *Subsurface investigations, *Penetration tests, Site surveys, Soil properties, Field tests, Engineering standards, Reprints.

Geotechnical engineers in the United States commonly use the results of the Standard Penetration Test in subsurface investigations for routine foundation design. Wide variations in SPT results occur because present test standards do not address some of the variables that control the energy delivered to the sampler. This research deals with current methods of performing the SPT in engineering practice. The results of this study will aid in bringing current practice to a more uniform state and provide information for the next revision of the ASTM D 1586 Standard.

706,477
PB83-111617 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Prediction of Pore Water Pressure Buildup and Liquefaction of Sands during Earthquakes by the Cyclic Strain Method.
Building science series (Final).
R. Dobry, R. S. Ladd, F. Y. Yokel, R. M. Chung, and D. Powell. Jul 82, 171p NBS-BSS-138
Library of Congress catalog card no. 82-600561. Prepared in cooperation with Woodward-Clyde Consultants, Clifton, NJ., and Rensselaer Polytechnic Inst., Troy, NY. Dept. of Civil Engineering.

Keywords: *Sands, *Earthquakes, Liquefaction, Pore pressure, Cyclic loads, Shear strain, Shear modulus,

Stress strain diagrams, *Liquefaction(Soils), Earthquake engineering, Seismic loads.

A cyclic strain approach for evaluating the buildup of excess pore water pressures and the potential for liquefaction of level sandy sites during earthquakes is proposed in this report. This strain approach is based on the premise that, for undrained loading of sand, there is a predictable correlation between cyclic shear strain and excess pore water pressure; also, that there is a threshold shear strain below which there is no sliding at the contacts between sand particles and no pore water pressure buildup can occur. As the result, a sand deposit will not develop excess pore pressures if the induced seismic shear strain is less than the threshold strain. Both theoretical evidence and experimental verification suppoting the cyclic strain approach and the existence of the threshold, are presented in the report. Based on all there findings, a specific design method is proposed for predicting if excess pore pressures will develop at a specific site during a design earthquake.

706,478
PB83-154161 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Contribution to the ASTM Resonant Column Round Robin Testing Program.
R. M. Chung, and F. Y. Yokel. Dec 82, 54p NBSIR-82-2568
Portions of this document are not fully legible.

Keywords: *Sands, *Soil tests, Soil dynamics, Shear modulus, Torsion, Vibration, Particle size distribution.

Results from National Bureau of Standards (NBS) resonant column tests to determine shear moduli and damping ratios for Monterey No. 0 sand are presented to supplement the ASTM resonant column round robin program. In addition to testing solid specimen as specified for the initial ASTM round robin program, hollow cylindrical specimens were tested to provide an independent check on the validity of the results.

706,479
PB83-164400 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Thermal Behavior of Fine-Grained Soils.
Building science series (Final).
L. A. Salomone, W. D. Kovacs, and H. Wechsler. Nov 82, 107p NBS-BSS-149
Library of Congress catalog card no. 82-600636.

Keywords: *Atterberg limits, *Thermodynamics, *Soil tests, Silts, Clay soils, Moisture content, Heat transfer, Soil compacting, Thermal conductivity, Correlation, Tables(Data), Standards, Fine grained soils.

Laboratory thermal probe tests performed on an AASHTO standard reference material (a silty clay) showed that thermal resistivity (C. cm/watt) varies with soil moisture content and dry density. The tests were performed to correlate soil thermal behavior with the limit states of fine-grained soils. Over 80 thermal resistivity measurements were made on specimens compacted to various densities and moisture contents. Results are presented which indicate that the optimum moisture content of soils and the Atterberg Limits can be correlated with the thermal behavior of fine-grained soils.

706,480
PB85-128130 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
Influence of Soil Type and Gradation on the Thermal Resistivity of Soils.
L. A. Salomone, F. Y. Yokel, and H. Wechsler. Oct 84, 39p NBSIR-84/2935

Keywords: *Thermal conductivity, *Soil tests, Thermal measuring instruments, Soil compacting, Soil water, Sands, Clay soils, Silts, Moisture content, Heat transfer, Tables(Data), Graphs(Charts).

Laboratory thermal probe tests performed on four (4) different soils were used to study the influence of soil type and gradation on the thermal resistivity of soils. The four soils covered a wide range of gradations and included: two sands (SP and SP-SM), a silty clay (CL), and a silt (ML). Results are presented which indicate that as the sand content increases in a silty clay (CL), the minimum thermal resistivity and the critical moisture content decrease for the range of compactive efforts studied. Increasing the medium and coarse sand fraction in a granular soil significantly increases the heat conductive properties of the soils. Also, in the stable region of each of the major soil groups (i.e. granular and fine-grained soils), the influence of soil type and density on the thermal resistivity of soils is negligible and a constant value of thermal resistivity is observed. The constant value of thermal resistivity is approximately 30 to 40C cm/watt and 50 to 70C cm/watt for granular soils and fine-grained soils, respectively.

706,481
PB85-184570 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Liquefaction Potential of Saturated Sand: The Stiffness Method.
Final rept.
R. Dobry, D. J. Powell, F. Y. Yokel, and R. S. Ladd. 1980, 8p
Sponsored by Turkish National Committee on Earthquake Engineering, Ankara., and Technical Univ. of Istanbul (Turkey).
Pub. in Proceedings of World Conference on Earthquake Engineering (7th), Istanbul, Turkey, September 8-13, 1980, v3 p25-32.

Keywords: *Liquefaction, *Stiffness methods, *Sands, Sites, Evaluation, Saturated soils, Earthquakes, Design, Shear modulus, Stability, Earthquake engineering.

The paper proposes a new stiffness method for evaluating the liquefaction potential of horizontal saturated sand layers (level sites) during earthquakes. The method is based on field measurements of the shear modulus of the sand at small strains using geophysical techniques.

706,482
PB85-187854 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Liquefaction of Sands during Earthquakes - The Cyclic Strain Approach.
Final rept.
F. Y. Yokel, R. Dobry, D. J. Powell, and R. S. Ladd. 1980, 10p
Pub. in Proceedings of Int. Symposium on Soils Under Cyclic and Transient Loading 2, Swansea, England, January 7-11, 1980, p571-580.

Keywords: *Liquefaction, *Sands, *Earthquakes, Velocity, Secondary waves, Shear strain, Soil properties, Shear modulus, Tangent modulus, Evaluation, Predictions, Correlation, Earthquake engineering, Pore water pressure.

A method for evaluating the liquefaction potential of level sandy sites subjected to earthquake loads on the basis of anticipated cyclic shear strains is proposed. The data includes tests as well as test results. A method is proposed by which the maximum tangent shear modulus, which can be measured by shear wave propagation velocities, can be used to predict liquefaction potential.

706,483
PB85-208494 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Development of an NBS (National Bureau of Standards) Polymer Gage for Dynamic Soil Stress Measurement.
R. M. Chung, A. J. Bur, and E. Reasner. Apr 85, 89p NBSIR-85/3135
Sponsored by Air Force Armament Center, Elgin AFB, FL., and Air Force Engineering and Services Center, Tyndall AFB, FL. Engineering and Services Lab.

Keywords: *Measuring instruments, *Soils, *Stresses, Blast loads, Performance tests, Polymers, Protective coverings, Calibrating, Dynamic loads.

Polymer gages developed by the National Bureau of Standards (NBS) have been tested extensively in the NBS Geotechnical Engineering Laboratory to evaluate their capability and reliability for use in determining dynamic soil stresses generated by blast loadings. Penetration of soil grains into the gage surface was found to be the major concern and a major effort was undertaken to develop the most appropriate protective covering. Gages were dynamically loaded to develop their corresponding calibration curves.

706,484
PB86-114014 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Liquefaction Potential of Overconsolidated Sands in Areas with Moderate Seismicity.
Final rept.
R. Dobry, F. Y. Yokel, and R. S. Ladd. 1981, 22p
Pub. in Earthquakes and Earthquake Engineering 2, p643-664 1981.

Keywords: *Sands, *Earthquake resistant structures, *Liquefaction, Pore pressure, Shear strain, Shear strength, Saturated soils.

The liquefaction potential of a saturated sand depends on both the characteristics of the seismic shaking and of the soil. The paper reviews available evidence showing that overconsolidated sands have a larger resistance to liquefaction than normally consolidated sands, and it also presents new data from strain-controlled tests. Finally, the liquefaction potential of an overconsolidated sand site in Massachusetts, is discussed.

706,485
PB87-103297 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Study of Reverse Torque Ratio in the Helical Probe Test.
F. Y. Yokel, and K. Y. Chung. Sep 86, 27p NBSIR-86/3423
Prepared in cooperation with Korea Inst. of Science and Technology, Seoul.

Keywords: *Soil properties, *Augers, *Grain size, Helical gears, Torque, Field tests, Data, Soil tests.

The report covers a study to determine whether the ratio of the torque required to extract the Helical Test Probe to the torque required to advance the probe (the reverse torque ratio) can be used to determine the average grain size of the soil. On the basis of 274 test points in sandy, silty, and clayey soils, it was concluded that the reverse torque ratio decreases with increasing average grain size. The relation between grain size and reverse torque ratio is apparently not sensitive to the magnitude of the torque required to advance the probe.

706,486
PB87-161055 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Energy Transfer in the Standard Penetration Test,
F. Y. Yokel. Sep 82, 6p
Pub. in American Society of Civil Engineers Jnl. of Geotechnical Engineering Division 108, nGT-9 p1197-1202 1982.

Keywords: *Penetration tests, Energy transfer, Accuracy, Soil tests, Standards, Rods, Hammers, Reprints.

It has been shown that the results of the Standard Penetration Test are influenced by many test variables. There is little doubt that the accuracy of the test can be greatly improved if the effect of these variables is eliminated or reduced by either accounting for the variables when the test results are interpreted or reducing their effect by modifications in the test itself. One of the test variables is the effect of the drill rod length on the energy transfer from the hammer to the sampler. The problem of energy transfer has been studied theoretically and experimentally. Schmertmann and Palacios concluded that the hammer ceases to transfer energy to the drill rod at time $t(s) = 2l/c$, in which $t(s)$ = the time at which the hammer separates from the drill rod; l = the length of the drill rod from the point of impact to the bottom of the sampler; and c = the velocity of the stress wave propagation in steel (5,100 m/s). This conclusion is predicated on the assumption that a tensile-stress wave, reflected back from the lower end of the rod, will cause the hammer to separate from the anvil, and is considered valid if the resistance force at the lower end of the rod is significantly smaller than the force imparted by the hammer at impact.

General

706,487
PB-266 331-SET PC **E08**
National Bureau of Standards, Washington, D.C. Center for Building Technology.

Building to Resist the Effect of Wind.
May 77, 212p-in 5v
Set includes PB-266 332 thru PB-266 336.

No abstract available.

706,488
PB85-144020 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Multidirectional Analysis of Extreme Wind Speed Data.
Final rept.
E. Simiu, E. M. Hendrickson, W. A. Nolan, I. Olkin, and C. H. Spiegelman. Aug 84, 4p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Proceedings of Engineering Mechanics Division Specialty Conference (5th), Laramie, WY., August 1-3, 1984, Eng. Mech. Civ. Eng. 2, p1196-1199 Aug 84.

Keywords: *Structural engineering, *Wind velocity, Directional measurement, Analysis(Mathematics), Wind pressure, Gust loads, Extreme-value problems.

An extended abstract is presented in which: (1) Existing methods for taking wind directionality into account in structural engineering calculations are reviewed; (2) A new such method is proposed; (3) It is shown that published data issued by the National Oceanic and Atmospheric Administration are sufficient to characterize the directional extreme wind climate.

706,489
PB85-170587 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Civil Engineering Standards for the Computer Age.
Final rept.
R. Wright. May 84, 1p
Pub. in Civil Engineering Magazine, 7p May 84.

Keywords: *Civil engineering, *Standards, Interfaces, Reprints, Computer applications, Expert systems.

As computer aids permeate civil engineering practice we may expect two major changes in civil engineering standards: expert computer systems will succeed printed paper as the medium for expression and use of standards, and new areas of standardization will promote the effectiveness, reliability and economy of computer aids. Civil engineers are alerted to opportunities and needs to participate in the evolution of civil engineering standards.

COMBUSTION, ENGINES, & PROPELLANTS

Combustion & Ignition

706,490
AD-A048 475/8 PC **E02**/MF **A01**
National Aviation Facilities Experimental Center, Atlantic City, NJ.
Studies of the Flash Fire Potential of Aircraft Cabin Interior Materials.
Rept. no. 3 (Final) Aug 75-Sep 76,
M. J. Manka, H. Pierce, and C. Huggett. Dec 77, 34 P FAA-NA-77-180, FAA-RD-77-47
Contract DOT-FA67NF-AP-21
Prepared in cooperation with National Bureau of Standards, Washington, DC.

Keywords: *Aircraft cabins, *Aircraft fires, *Fire resistant materials, Fire safety, Aviation accidents, Flame propagation, Fuel air ratio, Polyurethane resins, Foam, Pyrolysis, Organic materials, Flammability, Flash point, Epoxy compounds, Fiberglass, *Flash fires, Pyrolyzates, Heat resistant plastics.

This is the third in a series describing work carried out under the joint sponsorship of the National Bureau of Standards (NBS) and the Federal Aviation Administration (FAA) to develop a method of assessing the flash fire potential of materials found in aircraft cabin interiors. The flash fire cell described in the previous report was modified further and used to evaluate the flash fire potential of a series of 24 typical aircraft cabin interior materials. Flash fires were observed in the apparatus at fuel loadings as low as 0.23 g/L. A minimum energy principle was proposed to characterize the flash fire behavior of the complex mixture of fuels derived from the pyrolysis of organic materials. This principle states that a flash fire is possible when the potential combustion energy content of the pyrolyzate-air mixture exceeds approximately 425 cal/L. A variety of experiments was performed to provide support for the minimum energy principle. The results were in general agreement with predictions, but the accuracy of the measurements was not good enough to permit detailed conclusions. Oxidative pyrolysis plays a significant role in the formation of the fuel-air mixture in the flash fire cell. Particulates contribute to the creation of flash fire conditions, but they present a difficult measurement problem.

706,491
AD-A088 496/5 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Ignition of a Liquid Fuel Under High Intensity Radiation.
T. Kashiwagi. 16 Aug 79, 11p AFOSR-TR-80-0617
Grant AFOSR-ISSA-78-0002
Pub. in Combustion Science and Technology, v21 p131-139 1980.

Keywords: *Carbon dioxide lasers, *Ignition, *Fuels, Laser beams, Intensity, Absorption, Reprints, Experimental studies, Liquid fuels.

No abstract available.

706,492
AD-P004 524/5 PC **A02**/MF **A01**
Colorado Univ. at Boulder.
Ignition Phenomena of Bulk Aluminum Alloy as a Function of Oxygen Pressure.
K. Nguyen. Oct 84, 9p
This article is from JANNAF (Joint Army-Navy-NASA-Air Force) Combustion Meeting (21st) Held at Laurel, Maryland on 1-4 October 1984. Volume 1, AD-A150 981, p53-61.
Availability: Chemical Propulsion Information Agency, Laurel, MD 20707 (No copies furnished by DTIC).

Keywords: *Ignition, *Aluminum alloys, Oxygen, Pressure, Carbon dioxide lasers, Laser beams, Irradiation, Surface temperature, Aluminum oxides, Cooling, Aluminum alloy 6061, Component Reports.

An experimental study was undertaken to investigate the ignition phenomena of 6061 aluminum alloy as a function of oxygen pressure. Cylindrical aluminum alloy specimens were ignited in a pure oxygen environment by a focused cw CO2 laser beam. To study the effect of oxygen pressure on the surface temperature at ignition of 6061 aluminum alloy, the experiments were conducted at oxygen pressures ranging from 0.084 to 2,413 MPa. The temperature of history of the entire upper surface of the specimen and of a 0.5 mm diameter spot located initially at the center of the specimen top surface was recorded by using a commercial two-color ratio pyrometer and a fast-response, narrowband, two-color pyrometer. Mass, brightness, and interior temperatures, for certain experiments were also recorded throughout the experiment. The results show that the surface temperatures at ignition of the alloy obtained from the temperature curves are below the melting temperature of the aluminum oxide and are slightly dependent on oxygen pressure. The data indicate that the ignition mechanism is complex and probably composed of several phenomena acting both separately and in conjunction with each other.

706,493
PB-263 100/0 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Numerical Solution of the Time Dependent Partial Differential Equations Which Describe a One-Dimensional, Laminar, Premixed Flame.
Final rept.,
R. L. Brown. Jan 76, 178p NBSIR-76-994

Keywords: *Flames, *Laminar flow, *Parabolic differential equations, *Numerical integration, *Computer programs, Partial differential equations, Combustion, One dimensional flow, Steady state.

The set of time dependent, parabolic differential equations, which describe the physical and chemical processes in a one-dimensional, laminar, premixed flame is solved by adapting a solution procedure originally developed to solve the two-dimensional steady state boundary layer equations. The flame equations are integrated by an implicit method until the steady state is reached. This corresponds to a flame propagating steadily through a mixture of combustible gases. By a suitable choice of boundary conditions, it is also possible to model a flame which is stabilized on a burner. Solution of the flame equations yields the concentration profiles of the different chemical species as well as the temperature profile. From these one can also calculate the production rates of each species, the rate of each chemical reaction, and the heat release rate at each point in the flame. The velocity of the freely propagating flame can be calculated from the integrals over the whole flame zone of any of the species production rates. The model incorporates realistic thermodynamic data and transport property data that are functions of both temperature and concentration. A complete documentation of the computer program which accomplishes the integration is presented.

706,494
PB-263 633/0 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Effect of Sample Orientation in the Smoke Density Chamber.
Final rept.,
L. Breden, and M. Meisters. May 76, 35p NBSIR-76-1030

Keywords: *Smoke, *Concentration(Composition), Additives, Carpets, Measurement instruments, Fire tests, Test chambers, Sampling, Polymers, Thermoplastics, Burning rates, Retarding, Fire resistant materials, Combustion products.

Smoke measurements were compared for various materials in the vertical and horizontal positions. There appeared a significant difference for thermoplastic materials because of the melting away from the incident heat flux in the vertical position. The horizontal mode in addition allows one to relate the chemistry of polymeric materials to the amount of smoke production. Finally, smoke measurements are made of products containing various amounts of smoke suppressants.

706,495
PB-270 722/2 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Investigation of the Fire Environment in the ASTM E 84 Tunnel Test.
Final rept.,
W. J. Parker. Aug 77, 79p NBS-TN-945

Keywords: *Fire tests, *Materials tests, Oxygen, Concentration(Composition), Temperature, Velocity, Pressure, Heat flux, Burning rate, *ASTM E 84 tunnel.

Measurements were made of heat flux, oxygen concentration, temperature, velocity and pressure in a series of instrumented ASTM E 84 tunnel tests using (1) standard length specimens, (2) 0.91-m (3-ft) long specimens, and (3) a reference specimen consisting of asbestos-cement board and an auxiliary controlled supply of methane. Five different flow rates of methane to the auxiliary burner provided constant and known heat inputs simulating the gaseous decomposition products from regular test specimens. While oxygen depletion in the tunnel did not appear to be a dominating factor in controlling the flame spread, the oxygen depletion measured in the exhaust duct beyond the tunnel correlated with the total rate of heat production of the specimens. It appears that the differences in the observed burning behavior of materials in the tunnel test and in a room may be mainly due to differences in the incident heat flux distribution in the two cases. These distributions reflect the different geometries, orientations, and ignition sources. The potential for rapid flame spread of some low flame spread classification (FSC) low density materials is evident from observations of the flame propagation along these materials during the tunnel test, but is not adequately reflected in the flame spread classification.

706,496
PB-273 977/9 PC **A12**/MF **A01**
Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.

Prediction of Fire Hazard from Fabrics and Building Materials.
Research rept. no. 5, Sep 75-Feb 77,
P. Durbetaki, W. C. Tincher, L. R. Lloyd, R. P. Lowry, W. J. Tingle, and V. L. Wolfe. 28 Feb 77, 267p NBS-GCR-77-99
Grant NSF-AEN72-03359-A04
See also report dated 31 Mar 74, PB-242 740.

Keywords: *Construction materials, *Fabrics, *Fire hazards, *Assessments, Ignition, Thermophysical properties, Convection(Heat transfer), Flammability, Cellulosic resins, Thermoplastics, Pyrolysis, Laboratory equipment, Samples, Mathematical models.

The assessment of the fire hazard of a system (fabrics, furniture, building materials, etc.) requires, first, a quantitative measure which characterizes the fire hazard, and, second, a rational relation between the hazard and the relevant descriptions of the system and its environment. Probabilistic failure analysis was proposed as a rational measure of a system's fire hazard and this is quantitatively expressed in terms of the probability with which use of a system leads to a prescribed loss. The fire loss probability is composed of all sub-probabilities which are associated with the events and processes leading to the occurrence of the fire loss. Measurements have been carried out to provide required data on thermophysical properties, constitutive description of processes, and ignition times. Thermal radiative properties have been measured both on original and charred samples of cellulosic and thermoplastic materials. Modeling analyses have been carried out for single and pairs of thermally thin materials under radiative heating and single thermally thick materials under convective heating.

706,497
PB-275 173/3 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Numerical Technique to Correct Heat Release Rate Calorimetry Data for Apparatus Time Delay
Final rept.,
D. D. Evans, and L. H. Breden. Nov 77, 26p NBSIR-77-1302

Keywords: *Calorimetry, *Laboratory equipment, *Fire tests, Heat transfer, Numerical analysis, Fire resistant materials, Time lag, Particle boards, Balsa wood.

A numerical scheme is presented to correct heat release rate measurements made with the Ohio State University rate of heat release apparatus for the effects of inherent time delays in the measurement system. The magnitude of the correction is shown to increase with increasing rate of change in heat release rate. Illustrative heat release rate curves for particle board and balsa wood show that corrections to the peak heat release rate of 40% and 130% respectively are necessary. Measurements of the apparatus time response to step changes in heat release rate are reported. A simple method of determining corrections to the measured peak heat release rate is discussed.

706,498
PB-275 999/1 PC **A03**/MF **A01**
Princeton Univ., NJ. Dept. of Aerospace and Mechanical Sciences.
Experimental Investigation of Flame Spread over Condensed Combustibles: Gas Phase Interactions.
Annual progress rept. 1 Dec 76-30 Nov 77,
A. C. Fernandez-Pello. Dec 77, 29p NBS-GCR-78-117
Grant NBS-7-9004

Keywords: *Vapor phases, *Combustion, Gases, Heat transfer, Convection, Speed indicators, Doppler effect, Forecasting, *Flame spread, Laser doppler velocimeters.

The present study of flame spreading over combustible materials is intended to elucidate the role of gas phase heat transfer on flame spread over solid materials. Particularly, the major objective is to ascertain the importance of gas phase convective effects in the energy transfer mechanism. The importance of convective gas phase effects on flame spread has been a controversial point for some time. Due to instrumentation problems, measurements of gas phase velocities which could resolve the question have not been determined unambiguously. Qualitative measurements of velocities of the order of magnitude of those encountered in the flame spread environment are simply difficult to make using conventional techniques such as pitot tubes or hot wire anemometers. With the additional complication that the flow may also be reversing in direction, little real progress has been possible. With the advent of LDV techniques however the possibility of determining the role of gas phase convective effects has become realizable. A sophisticated Laser Doppler Velocimeter facility has been constructed to undertake this project. The authors feel that the present fire research facility at Princeton University represents a unique capability in the fire research field for the study of gas phase phenomena.

706,499
PB-276 549/3 PC **A06**/MF **A01**
Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
Investigation of the Properties of the Combustion Products Generated by Building Fires.
Final rept. 1 Oct 76-30 Sep 77,
B. T. Zinn, R. A. Cassanova, C. P. Bankston, R. F. Browner, E. A. Powell, J. U. Rhec, and K. Kailasanath. 1977, 103p NBS-GCR-77-116
Grant NBS-G7-9001

Keywords: *Combustion products, *Buildings, *Polyvinyl chloride, *Polypropylene, Flammability, Particle size distributions, Smoke, Optical density, Chemical properties, Gas analysis, Chemical analysis.

Eleven polyvinyl chloride and seven polypropylene samples of different compositions were burned under non-flaming conditions and measurements were made of smoke particle size distributions, total smoke particulate mass generated, smoke mean particle diameter, smoke optical density, and sample weight loss. Measurements have also been taken for the polypropylene samples burned in a heated ventilation gas. Results show that the characteristics of the smoke particulates and sample weight loss behavior are affected by the presence or absence of different chemical additives for both PVC and polypropylene. Also, the burning and smoke characteristics of the polypropylene samples are influenced by the ventilation gas temperature.

706,500
PB-280 424/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Transient Heat Flow to a Liquid Fuel Droplet in Combustion Gases.
Final rept.,
H. S. Bennett, and R. Kayser. Feb 78, 3p
Pub. in Industrial and Engineering Chemistry, Fundamentals, v17 n1 p8-10 Feb 78.

Keywords: *Combustion, *Fuels, *Heat transmission, Drops(Liquids), Temperature gradients, Heating.

Two models for the preheat stage of conventional liquid fuel droplets and of emulsified fuel droplets in combustion gases are analyzed theoretically. These models contain the effects of transient heat conduction to the droplets. In the first model, the droplet and gas temperatures vary temporally but only the gas temperature varies spatially; i.e., the droplet temperature is spatially uniform. Numerical examples, computed from this model, for both the droplet and gas temperatures are given. In the second model, both the droplet and gas temperatures vary spatially and temporally. Numerical examples computed from this second model for the surface and average temperature of the droplet are given. These analyses show that the temperature gradients inside droplets of oil and water are small compared to those in the combustion gases near the droplet and that temperature profiles given by both models are very similar. In particular, the predicted times at which micro-explosions are expected to occur agree within 10% of each other.

706,501
PB-280 814/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Smoldering Combustion of Cotton and Rayon.
Final rept.,
R. J. McCarter. Dec 77, 13p
Pub. in Jnl. Consum. Prod. Flammability, v4 p346-358 Dec 77.

Keywords: *Cotton, *Rayon, *Combustion, Inhibitors, Free radicals, Char, Oxidation, Reaction kinetics, Reprints, Smoldering.

Smolder of cottons and rayons was found to be induced by absorbed inorganic impurities, which may be largely removed by a water rinse. Compounds identified as promoting smolder included salts and hydroxides of monovalent metals, and salts of iron and lead. These compounds were found to effect an increase in the yield and reactivity of char formed during the pyrolysis of cellulosics. The actions of smolder inhibitors were investigated. Conventional inhibitors appeared to intervene chemically in oxidation reactions on char surfaces. Various compounds in powder form were found to suppress smolder, and may indicate innovative possibilities. Data were obtained indicating that free radicals may influence smolder kinetics and have a key role in the smolder process.

706,502
PB-281 431/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Importance of Externally Imposed Heat Flux on the Burning Behavior of Materials.
Final rept.,
J. W. Rowen, and J. W. Lyons. Feb 78, 8p
Pub. in Jnl. Cell. Plast., p25-32 Jan/Feb 78.

Keywords: *Heat flux, *Flammability tests, *Fire resistant materials, Plastics, Burning rate, Plywood, Hardwoods, Polystyrene, Polyurethane resins, Heat transfer, Reprints.

This study develops further understanding of behavior of materials at increasing heat fluxes and seeks to explain differences in rank ordering within a set of materials. The study involves four sets of materials--Plywood, Hardboard, Polyurethane, and Polystyrene--modified with four levels of fire retardants. Two types of measurements, rate of burning (m) and rate of heat release (q) were carried out over the heat flux range of 2 - 6 watts/sq cm to obtain the needed understanding. This work shows the importance of knowing the heat flux applied to a material in a fire test and how this heat flux compares to that anticipated in the most probable scenarios. Finally, this study shows why rank ordering will produce different results at different heat fluxes.

706,503
PB-281 999/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mechanistic Studies of Halogenated Flame Retardants: The Antimony-Halogen System.
Final rept.,
J. W. Hastie, and C. L. McBee. 1975, 29p
Pub. in Proceedings of Symposium, Southwest Research Institute, San Antonio, Tex. 23-24 Apr 75, ACS Symp. Ser16, Halogenated Fire Suppressants, Paper 4, p118-146 1975. (American Chemical Society).

Keywords: *Antimony oxides, *Fire resistant materials, Chlorine inorganic compounds, *Antimony chlorides.

A fundamental study of the chemical interactions leading to flame inhibition is described for systems containing antimony oxide and a chlorine containing component.

706,504
PB-283 838/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Detection and Smoke Properties.
Final rept.,
R. Levine. 1976, 31p
Pub. in Proc. Joint Panel Meeting (2nd) The U.J.N.R. Panel on Fire Research and Safety, Held at Tokyo, Japan on October 19-22, 1976. Part 1. General Report, p350-380.

Keywords: *Fire detection systems, Combustion, Smoke, *Smoke detectors.

The purpose of this paper is to describe on-going smoke research in the United States that is applicable to the problem of detection of unwanted fires while minimizing false alarms. The characteristics and short comings of several types of fire warning devices are discussed briefly. This is followed by a review of current U.S. basic research on the properties of smokes as affected by aging, the materials burned, smoldering vs flaming combustion, and other factors. The paper is prepared for presentation to a Japanese - U.S. Panel to facilitate continued Japanese - U.S. scientific cooperation in this field.

706,505
PB-284 500/6 PC **A06**/MF **A01**
Princeton Univ., NJ. Dept. of Aerospace and Mechanical Sciences.

Experimental and Modeling Studies of Smoldering in Flexible Polyurethanes.
Summary rept. Jul 74-Jun 76,
T. J. Ohlemiller, F. E. Rogers, A. Kurtz, J. Bellan, and M. Summerfield. 15 Jul 77, 121p 1337, NBS/GCR-77/101
Grant NBS-4-9026

Keywords: *Polyurethane resins, *Textiles, *Flammability tests, Cellular materials, Fire resistant materials, Mathematical models, Thermal analysis, Fire safety, Degradation, Furniture, Chairs, Smoldering.

The fire safety hazard posed by smoldering combustion of polyurethane-based cushioning materials is the subject of a continuing study, now underway for two years. The focus is on the smolder process in open cell, flexible polyurethanes. The goal is a sufficient understanding of the thermophysics and chemistry of this process to permit construction of a predictive mathematical description of it; this model should help indicate what steps are needed to eliminate the smolder hazard. This report summarizes results of the two-year study in four sections. (1) The phenomenogy of the smolder process have been derived from two sources: detailed studies of a particular self-smoldering foam and smolder tendency studies of a large variety of systematically varied foam formulations. (2) The smoldering of a cellulosic fabric is important because in a hazard situation it frequently is a large part of the driving force in foam smolder. (3) The complex degradation chemistry occurring in a polyurethane during smolder can, with the help of thermal analysis (TGA and DSC), be reduced to a simple scheme of overall reactions. (4) Model development has proceeded in stages beginning with the transient heating of 1-D inert foam. The second state of modeling, 1-D reactive foam with one step char oxidation, was based on a program seeking an artificial steady state and the extinction limits for it. Experimental data on the results of computer simulations are presented and discussed.

706,506
PB-292 066/8 PC **A04**/MF **A01**
Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
Review of Smoke Particulate Properties Data for Burning Natural and Synthetic Materials.
C. P. Bankston, R. A. Cassanova, E. A. Powell, and B. T. Zinn. May 78, 62p NBS-GCR-78-147
Grant NBS-G8-9003

Keywords: *Combustion, *Smoke, *Wood, *Polyvinyl chloride, *Polyurethane resins, *Polypropylene, Foams, Particle size, Ventilation, Physical properties, Samples.

This report comprises a catalogue of smoke particulate properties data which were taken in the Combustion Products Test Chamber at the Georgia Institute of Technology through October 1, 1977. Results of smoke tests conducted under a variety of environmental conditions are presented for the following natural and synthetic materials: Douglas fir (wood), polyvinyl chloride (PVC), rigid and flexible polyurethane foams, and polypropylenes. Comparisons are provided which illustrate the effects of material variables, radiant heating rate (nonflaming), type of combustion (flaming vs. nonflaming), ventilation gas composition, and ventilation gas temperature upon smoke properties. The smoke particulate properties which have been tabulated are: fraction of sample weight loss which becomes particulate matter, particle mass median diameter and standard deviation, maximum optical densities at 633 nm and 458 nm, volume-surface mean particle diameter at maximum optical density, and plots of the cumulative particle mass-size distribution.

706,507
PB-293 159/0 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Interlaboratory Evaluation of the Attic Floor Radiant Panel Test and Smoldering Combustion Test for Cellulose Thermal Insulation.
Final rept.
J. R. Lawson. Feb 79, 42p NBSIR-79-1588
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD. Textile and Mechanical Engineering Group.

Keywords: *Flammability, *Cellulose, *Thermal insulation, Combustion, Residential buildings, Heat loss, Tests, Samples, Laboratory equipment, Attic floor radiant panel test, Smoldering.

An interlaboratory test program was conducted to provide estimates of repeatability and reproducibility of fire tests for cellulose loose fill insulation. The test methods evaluated were for critical radiant flux, using the Attic Floor Radiant Panel, and for smoldering combustion; they were based on Federal Specification HH-I-515D. Seven commercially manufactured cellulose thermal insulations marketed for residential use were evaluated by each procedure. An additional set of four replicate hardboard specimens were tested by each participant using the Attic Floor Radiant Panel. Nine laboratories conducted the Attic Floor Radiant Panel test, and ten conducted tests for smoldering combustion. The testing was conducted during the month of June 1978. The participating laboratories were surveyed prior to testing in order to ensure conformance to the critical details of the test apparatus and procedures. The between-laboratory coefficient of variation for critical radiant flux ranged from 13 to 30 percent with an average for seven insulation materials of 21 percent. Estimated precision levels of repeatability and reproducibility for the Attic Floor Radiant Panel test when compared to other standard flame spread tests and materials are favorable. Data from the Smoldering Combustion test was evaluated on a pass/fail basis with agreement by nine of ten laboratories for six of the seven materials tested. Seven of ten laboratories also agreed on the seventh material. Based on work of this study, there is reasonable assurance that results from different laboratories evaluating the same material for compliance with Federal Specification HH-I-515D will be consistent.

706,508
PB80-102429 Not available NTIS
National Bureau of Standards, Washington, DC.
From the History of Combustion Calorimetry.
Final rept.,
E. S. Domalski. 1979, 28p
Pub. in Combustion Calorimetry, n1, Chapter 18, p401-428 1979.

Keywords: *Heat measurement, *Combustion, *Reviews, Benzoic acid, Calibrating, Performance evaluation, Reprints, *Calorimetry.

The history of combustion calorimetry is surveyed from the early part of the nineteenth century to its current state of development. Advances in calorimetric apparatus and techniques are presented; these are concurrent with improvements found in the precision and accuracy of the combustion data obtained from calorimetric investigations. A chronology of the use of benzoic acid as a calibration standard is given particular emphasis. Contributions by prominent calorimetrists are identified. This presentation of the history of combustion calorimetry is not a highly-detailed study of this branch of physical chemistry, but is an attempt to highlight significant phases of development over the past one hundred years. A bibliography containing 172 references is provided.

706,509
PB80-112113 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Purely Buoyant Diffusion Flames: Some Experimental Results.
Final rept.,
B. J. McCaffrey. Oct 79, 52p NBSIR-79/1910

Keywords: *Burners, *Diffusion flames, Combustion, Plumes, Flame propagation, *Fire spread.

Measurements of temperature and velocity using thermocouples and an impact probe were made in the near field of a purely buoyant diffusion flame produced by a porous refractory burner. Based on time-averaged center line value of V and delta T together with photographic records the flame can be conveniently divided into three distinct regimes: (1) a continous flame region, starting from the surface of the burner with V equal to zero at the surface and rising with the height above the burner, z to the 1/2 power. delta T is constant over this regime. Higher up is (2), an intermittent regime, with pulsating flame exhibiting approximately constant V and delta T falling with z to the first power. Still higher is (3) the plume region which is, most of the time, free of flames as predicted by conventional plume theory. Throughout the three regimes and indistinguishable among these is the consistency of the buoyancy relation.

706,510
PB80-189434 Not available NTIS
National Bureau of Standards, Washington, DC.
Rate of Heat Release Measurements Using Oxygen Consumption.
R. F. Krause, and R. Gann. Apr 80, 14p
Pub. in Jnl. Fire Flammability 12, p117-130 Apr 1980.

Keywords: *Oxygen, *Heat measurement, *Combustion products, Thermal analysis, Polymers, Laboratory equipment, Reprints.

The novel method of oxygen consumption calorimetry was tested against a conventional temperature rise method as an alternative for rate of heat release measurements. An existing apparatus was modified to include an oxygen analysis of the exhaust gas, and a variety of gaseous and polymeric fuels were burned. The new method gives fairly accurate values and is not confounded by heat transfer considerations that are inherent in thermal techniques.

706,511
PB81-120545 Not available NTIS
National Bureau of Standards, Washington, DC.
Estimation of Rate of Heat Release by Means of Oxygen Consumption Measurements.
C. Huggett. 1980, 5p
Pub. in Fire and Materials 4, n2 p61-65 1980.

Keywords: *Heat measurements, *Fire tests, *Oxygen consumption, Heat of combustion, Error analysis, Reprints.

Oxygen consumption calorimetry provides a simple, versatile, and powerful tool for the measurement of the rate of heat release in fire experiments and fire tests. The method is based on the generalizaion that the heats of combustion per unit of oxygen consumed are approximately the same for most fuels commonly encountered in fires. A measurement of the rate of oxygen consumption can then be converted to a measure of rate of heat release. The applicability of the generalization to combustion under fire conditions is examined, other possible sources of error in the measurements are discussed, the application of the method are reviewed. It is concluded that the accuracy of oxygen consumption based on the rate of heat release measurements should compare favorably with those derived from conventional calorimetric measurements. The method offers significant advantages in operational simplicity and versatility.

706,512
PB81-170375 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
Molecular Chemistry of Inhibited Combustion Systems.
Final rept. May 77-May 79.
J. W. Hastie, and D. W. Bonnell. Dec 80, 181p NBSIR-80-2169
Sponsored in part by Army Research Office, Research Triangle Park, NC.

Keywords: *Flames, *Combustion, *Phosphorus inorganic compounds, Chemical reactions, Reaction kinetics, Chemiluminescence, Additives, Free radicals, Chemical reaction mechanisms.

Virtually nothing is known about the high temperature chemistry of phosphorus in a flame environment. Phosphorus compounds are known flame retardants though the mechanistic evidence is empirically based. In the present study, high pressure sampling mass spectrometry and optical spectroscopic methods have been applied to the molecular characterization of P-containing flames. The key process controlling flame inhibition and enhancement is identified as: HPO2 + H = H2O + PO New thermodynamic data are presented for NaPO2 and LiPO2 which are present in Li/Na-containing flames.

706,513
PB81-205429 PC **A14**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Tables of Experimental Rate Constants for Chemical Reactions Occurring in Combustion (1971-1977).
Interim rept.
F. Westley. Apr 81, 303p NBSIR-81-2254
Sponsored in part by Department of Energy, Washington, DC.Portions of this document are not fully legible.

Keywords: *Combustion, *Reaction kinetics, Chemical reactions, Tables(Data), Oxidation, Decomposition, Arrhension equation, NTISCOMNBS, NTISDE.

A table of experimental rate constants for gas phase chemical reactions occurring in combustion is presented. Specifically, it gives in tabular form the values of the parameters for the modified Arrhenius equation k = ATsupB exp(-E/RT). The table covers reactions occurring in the combustion, oxidation and decomposition of aliphatic saturated or unsaturated C1 to C10 hydrocarbons, alcohols, aldehydes, ketones, thiols, ethers, peroxides, amines, amides and their free radicals, as well as the reactions of O, O2, H, H2, OH, H2O, H2O2, N, N2, NO, N2O, NO2, N2O4, N2O5, S, S2, SH, SO, SO2, SOH, NS, with each other. The table includes 220 monomolecular, 1092 bimolecular, and 108 termolecular reactions totalling 1420 distinct chemical reactions. There are 2608 distinct entries, distributed as follows: 308 for first order reactions, 1984 for second order reactions and 316 for third order reactions. The kinetic data were compiled from 843 experimental papers published between 1971 and 1977.

706,514

PB81-240194 Not available NTIS
National Bureau of Standards, Washington, DC.
Optical Tomography for Diagnostics in Combusting Flows.
Final rept.
H. G. Semerjian, R. J. Santoro, R. Goulard, and P. J. Emmerman. 1981, 10p
Pub. in Mechanical Properties of Bone, The American Society of Mechanical Engineers (AMD-45), New York, p119-128 1981.

Keywords: *Flames, Methane, Combustion, Concentration(Composition), Absorption, Reprints, *Tomography.

The optical tomography technique has been used for diagnostics of the concentration field in a turbulent methane-air jet and laminar methane diffusion flame. Optical tomography is a multiangular absorption technique which involves making M line of sight absorption measurements (projections) at N angles. These measurements are then used to reconstruct the original two dimensional flow field. Absorption measurements were made on methane using the 3.39 micrometer line of a He-Ne laser. Mean concentration profiles were obtained in the turbulent jet at three axial positions. Comparisons with the results of previous workers for the axial and radial mean concentration profiles show excellent agreement. Absorption measurements of methane were also carried out in a laminar diffusion flame, at three axial positions within the reaction zone. Some of the concentration measurements have been compared with results of previous workers obtained using sampling techniques. Results indicate the need for simultaneous temperature measurements, and a more detailed study of methane absorption at elevated temperature.

706,515

PB81-600058 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Titanium Combustion in Turbine Engines.
T. R. Strobridge, J. C. Moulder, and A. F. Clark. 1979, 133p
Pub. in Dept. of Energy Rept. No. FAA-RD-79-51 1979.

Keywords: *Aircraft turbine engine, Analytic models, Combustion, Compressor, Correlation of experiments, Dynamic combustion, Ignition, Jet engine, Metal combustion, Metal oxidation, Oxidation, Static combustion, Thermodynamics, Titanium alloys, Titanium combustion.

Pure and alloyed titanium components are routinely used in aircraft turbine engines because of their uniquely high strength-to-weight ratios among structural metals, combined with excellent fatigue and corrosion resistance. Like most other metals, titanium is combustible under certain conditions of temperature, pressure and oxygen concentration and in fact there have been several instances of titanium combustion in service engines. Contemporary titanium use in aircraft turbine engines and the limits of that use are explored. Combustion incidents and their causes are discussed as well as the typical extent of damage. Current preventative measures are outlined. For better understanding, the fundamentals of metal combustion and the experimental research related to titanium combustion are thoroughly treated and analytical combustion models are presented. Finally, the relevant experimental combustion data are correlated as a function of static temperature and Reynolds number and compared to the model predictions.

706,516

PB82-118316 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanism of Cellulose Smoldering Retardance by Sulfur.
Final rept.
R. G. Gann, W. L. Earl, M. J. Manka, and L. B. Miles. 1981, 8p
Pub. in Proceedings of Symposium on Combustion (18th), Pittsburgh, Pennsylvania, August 17-22, 1980, p571-578 1981.

Keywords: *Cotton fabrics, *Fire resistant materials, *Sulfur, Cellulose, X ray fluorescence, Mass spectroscopy, *Smoldering, Free radicals.

The addition of elemental sulfur is effective in preventing cotton smoldering, a process which leads to a major fraction of fire loss. The objective of this work is to determine the mechanism of the observed retardance. Electron paramagnetic resonance data showed that a reduction in the number of free radicals in the char by a factor of two resulted from the addition of five percent sulfur. X-ray fluorescence measurements showed that the concentration of bound sulfur in the char was comparable to that of eliminated free radicals. Mass spectrometric studies indicated that little sulfur was oxidized, and then only to SO2. Thus the critical properties of sulfur are vaporization at the correct temperature, reactivity with the char, and stability of the resulting adduct.

706,517

PB82-154386 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Finite Difference Calculations of Buoyant Convection in an Enclosure, Part I: The Basic Algorithm.
Final rept.
H. Baum, R. G. Rehm, P. D. Barnett, and D. M. Corley. Dec 81, 69p NBSIR-81-2385

Keywords: *Fires, *Convection, Smoke, Mathematical models, Finite difference theory, Boundary value problems, Algorithms, Buoyant convection.

A novel mathematical model of buoyant convection in an enclosure, developed earlier, is solved by finite difference techniques in the two-dimensional case. This model has been developed as a principal analytical tool for the prediction of the movement of smoke and hot gases in fires. Effects of large density variations caused by substantial heating are retained while acoustic (high-frequency) waves, which are unimportant to buoyant convection, are analytically filtered out. No viscous or thermal conduction effects are included in the model. These two characteristics (filtering and no dissipative effects) distinguish the model from all others describing buoyant convection. The mathematical model consists of a mixed hyperbolic and elliptic set of non-linear partial differential equations: the problem is a mixed initial, boundary value one. An explicit time-marching algorithm, second-order accurate in both space and time, is used to solve the equations. The computational procedure uses a software package for solving a nonseparable elliptic equation developed especially for this problem. The finite difference solutions have been carefully compared with analytical solutions obtained in special cases to determine the stability and accuracy of the numerical solutions. The computer model has been used to compute the buoyant convection produced in an enclosure by a spatially distributed heat source simulating a fire. The computed results show qualitative agreement with experimentally observed buoyant convection in enclosure fires.

706,518

PB82-165176 PC **A05**/MF **A01**
Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
Investigation of Axisymmetric Buoyant Turbulent Diffusion Flames,
S. M. Jeng, L. D. Chen, and G. M. Faeth. Jan 82, 91p NBS/GCR-82/367
Grant NBS-7-9020

Keywords: *Fires, *Flame propagation, Heat flux, Temperature distribution, Thermal radiation, Mathematical models, *Buoyant flames, Fire models.

This investigation considered measurements of the structure of axisymmetric, buoyant, turbulent diffusion flames in still air. Profiles of mean temperature, mean velocity, velocity fluctuations and total radiant heat flux were completed for methane flames, including careful characterization of burner exit conditions, in order to provide data for the evaluation of models of the process. Preliminary tests also provided mean temperature profiles for propane flames. Test conditions were chosen so that the flow was turbulent near the burner exit while effects of buoyancy were significant over most of the luminous portion of the flames. Both the present measurements and those of other investigators were compared with predictions of a k-epsilon-g differential model, which included effects of buoyancy in the transport equations for turbulence quantities. The results indicated anisotropic effects in regions where buoyancy dominates flow properties suggesting the eventual desirability of multi-stress models for buoyant flames, although extensive recalibration of model constants from a limited data based would be required if this step were taken. Additional measurements and analysis of methane flames are in progress, in order to investigate the flame radiation properties and provide additional data on turbulence properties needed for model development.

706,519

PB82-196296 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Entrainment and Heat Flux of Buoyant Diffusion Flames.
Final rept.
B. J. McCaffrey, and G. Cox. Feb 82, 36p NBSIR-82-2473

Keywords: *Diffusion flames, Entrainment, Heat flux, Thermal radiation, Fire tests, Buoyant flames.

Measurements of the vertical component of velocity in buoyant diffusion flames from extended sources by both cross-correlation and pressure probe techniques incorporating time-average signal processing appear to overestimate the transverse size of these systems based on a heat balance using measured mean flux. By utilizing measurements of the radiative fraction of the flames, and forcing a mean flux heat balance, estimates of the transverse variation of velocity are obtained and expressions for flame entrainment and convective heat flux are determined. The use of mean values is seen to lead to both overestimates as well as underestimates of total flux due to turbulent transport.

706,520

PB82-198672 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Sample Orientation on Radiative Ignition.
Final rept.
T. Kashiwagi. 1982, 3p
Pub. in Combustion and Flame 44, p223-245 1982.

Keywords: *Polymethyl methacrylate, *Wood, *Combustion, *Radiation, Samples, Ignition, Reprints, *Autoignition, *Red oak.

The effects of sample orientation on autoignition delay times and the minimum external radiant flux for autoignition were studied using a CO2 laser and a gas fired radiant panel as external radiant sources with PMMA and red oak as samples. Ignition delay times were shorter with the horizontal sample than with the vertical one at the same external radiant flux. The minimum external radiant flux for ignition was also less with the horizontal sample. The absorption of external radiation by the boundary layer of decomposition products for the vertical orientation is significant, although its amount is less than the absorption through the plume for the horizontal orientation. Surface temperature at ignition is higher with vertical sample orientation than with horizontal at the same external radiant flux. A theoretical calculation of the surface temperature history with endothermic gasification significantly underestimates the experimental results; this raises a question of the applicability of regression rate expression derived from steady state experiments to the dynamic heating condition.

706,521

PB82-199274 Not available NTIS
National Bureau of Standards, Washington, DC.
Combustion Inhibition of Cellulose by Powders: Preliminary Data and Hypotheses.
Final rept.
R. J. McCarter. Jun 81, 7p
Pub. in Fire and Materials, v5 n2 p66-72 Jun 81.

Keywords: *Combustion inhibitors, *Cellulose, Inorganic salts, Powder metals, Halides, Reprints, *Smoldering.

Small-scale qualitative tests were used to screen 185 inorganic powders for flame and smolder inhibiting effect upon cellulose. Nearly half of the compounds indicated inhibition of smoldering. These were limited essentially to inorganic salts whose anions include boron, phosphorus, sulfur, or halogen. Over half of the compounds indicated a flame retarding effect, and about one third inhibited both flaming and smoldering. Differences are noted between the actions of the powders and those of the retardants in other form and conditions. Thermal analysis is reported of the effects of alkali metal halides on cellulose. Implications of the results to the functioning of inhibitors are discussed.

706,522
PB82-199373 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Room Openings on Fire Plume Entrainment.
Final rept.
J. G. Quintiere, W. J. Rinkinen, and W. W. Jones. 1981, 9p
Pub. in Combustion Science and Technology 26, p193-201 1981.

Keywords: *Fires, *Entrainment, Plumes, Air flow, Reprints, *Room fires.

The mass rate of entrainment is examined for a fire plume in a room. Entrainment rates are inferred from measurements of air flow through a door or window and from room temperature data. The effect of the air flow is to tilt the flame plume, and to increase the entrainment rate over that of a vertical free standing plume. Dimensional analysis and theoretical results for a non-reacting wind blown plume model are used to correlate the flame angle and entrainment rate results.

706,523
PB82-206475 PC **A10**/MF **A01**
Princeton Univ., NJ. Dept. of Mechanical and Aerospace Engineering.
Flame Spread over Solid Fuels.
Final rept.
S. R. Ray. Oct 81, 225p NBS-GCR-82-388
Grant NBS-7-9004
Doctoral thesis.

Keywords: *Fuels, *Flame propagation, Heat flux, Heat transfer, Combustion, Mathematical models, Theses, *Solid fuels, Flame spread.

An experimental investigation of the flame spread process over solid fuels using a Laser Doppler Velocimeter (LDV) to provide two dimensional velocity measurements near the flame and the fuel surface; and thermocouple probes and radiometers were used to develop a more complete picture of the interactions of the fluid flow, heat transfer and species transport near a spreading flame. Flames spread against low opposed flows and/or high oxygen concentrations are controlled by heat transfer effects. At higher opposed flows and/or lower oxygen concentrations, gas phase chemistry effects begin to dominate. It is believed that the fuel is vaporized behind the flame front, followed by diffusion upstream within the quench layer next to the fuel surface. The process results in a decrease in flame spread rate with opposed flow velocity and leads eventually to extinction.

706,524
PB82-239112 Not available NTIS
National Bureau of Standards, Washington, DC.
Applications of Predictive Smoke Measurements.
Final rept.
V. Babrauskas. Jan 81, 14p
Pub. in Jnl. Fire Flammability 12, p51-64 Jan 81.

Keywords: *Flammability testing, *Smoke, *Bedding equipment, Optical density, Reprints.

Simple theoretical considerations can be used to establish the proper smoke quantities that are preserved between small-scale and full-scale tests. By proper analysis, measurements taken in a sealed box test can be applied predictively to full-scale fire flows. Specific extinction area is identified as the variable to be measured. Data from the combustion of institutional mattresses show the improved predictiveness of specific extinction area over the more commonly specified specific optical density. Analysis suggests 0.5 to 20 percent of the specimen mass loss is converted into obscuring particulates.

706,525
PB82-246737
(Order as PB82-246703, PC **A02**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Buoyant Convection Computed in a Vorticity, Stream-Function Formulation.
R. G. Rehm, H. R. Baum, and P. D. Barnett. 2 Sep 81, 21p
Included in Jnl. of Research of the National Bureau of Standards, v87 n2 p165-185 Mar-Apr 82.

Keywords: *Fires, *Mathematical models, Computation, *Buoyant convection, Numerical solution.

Model equations describing large scale buoyant convection in an enclosure are formulated with the vorticity and stream function as dependent variables. The mathematical model, based on earlier work of the authors, is unique in two respects. First, it neglects viscous and thermal conductivity effects. Second the fluid is taken to be thermally expandable: large density variations are allowed while acoustic waves are filtered out. A volumetric heat source of specified spatial and temporal variation drives the flow in a two-dimensional rectangular enclosure. An algorithm for solution of the equations in this vorticity, stream-function formulation is presented. Results of computations using this algorithm are presented. Comparison of these results with those obtained earlier by the authors using a finite difference code to integrate the primitive equations show excellent agreement. A method for periodically smoothing the computational results during a calculation, using Lanczos smoothing, is also presented. Computations with smoothing at different time intervals are presented and discussed.

706,526
PB82-258724 PC **A04**/MF **A01**
Case Western Reserve Univ., Cleveland, OH. Dept. of Mechanical and Aerospace Engineering.
Flame Spread and Spread Limits.
Final rept. 19 Jun 80-18 Jun 82.
R. A. Borgeson. Jul 82, 59p NBS-GCR-82-396
Contract NB80-NADA-1017

Keywords: *Flame propagation, *Mathematical models, Pyrolysis, Flames, Additives, Reaction kinetics, Computer applications.

The computer model of Frey and T'ien (1979) has been extended to study the effects of the initial bulk fuel temperature and an inert additive. The theory assumes a thermally thin solid in an opposed flow with negligible forward heat conduction in the fuel. Raising the initial fuel temperature was found to increase the flame spread rate by augmenting the fuel mass flux in the forward part of the pyrolysis zone. As the initial fuel temperature increases, the limiting value of the Damkohler number for extinction decreases. An inert additive reduces the spread rate by lowering the flame temperature and wasting energy in the inert pyrolysis.

706,527
PB82-264128 Not available NTIS
National Bureau of Standards, Washington, DC.
Resonantly Enhanced Two Photon Photoionization of NO in Atmospheric Flame.
Final rept.
W. G. Mallard, J. H. Miller, and K. C. Smyth. 1 Apr 82, 10p
Pub. in Jnl. of Chemical Physics 76, n7 p3483-3492, 1 Apr 82.

Keywords: *Flames, *Nitrogen oxide(NO), *Ionization, *Ultraviolet spectroscopy, Mathematical models, Reprints.

The first example of multiphoton ionization in a flame is reported. The resonantly enhanced two photon photoionization spectrum of NO from 270 to 317 nm in an atmospheric pressure H2/air/N2O flame is essentially identical with respect to both line position and intensity to that which would be expected from the one photon absorption to the intermediate A state. A model is developed here which accounts for this result by including large rates for collisional repopulation of the laser depleted state.

706,528
PB83-107847 PC **A10**/MF **A01**
California Inst. of Tech., Pasadena.
Entrainment and Flame Geometry of Fire Plumes.
B. M. Cetegen, E. E. Zukoski, and T. Kubota. Aug 82, 206p NBS-GCR-82-402
Grant NBS-G8-9014

Keywords: *Natural gas, *Diffusion flames, Plumes, Flame propagation, Entrainment, Theses, Room fires.

This study concerns the flame structure and fire plume entrainment of natural gas diffusion flames on 0.10, 0.19 and 0.50 m. diameter burners. The heat release rates ranged from 10 kW to 200 kW. Entrainment measurements spanned heights starting very close to the burner surface to distances about six times the average flame heights. Finally, a theoretical study of a steady, buoyant, diffusion flame indicated the importance of the puffing in the entrainment process.

706,529
PB83-127688 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement and Meaning of Flame Retardance.
Final rept.
C. Huggett. Nov 79, 8p
Pub. in Proceedings Workshop on the Flammability of Solid Polymer Cable Dielectrcs, Colonie, New York, October 20, 1977, p8-1-8-8 Nov 79.

Keywords: *Fire resistant materials, *Flameproofing, Flammability testing, Laboratory equipment, Field tests, Mathematical models.

Various definitions of flame retardancy and fire retardancy are considered. It is concluded that, for the present purpose, fire retardancy is 'the property of a combustible material which reduces destruction by fire.' This definition leads directly to a method of measuring fire retardance - full scale fire testing of prototypes. The limitations of such a method are discussed and the possibility of using laboratory scale property measurements to predict fire performance are explored. Such methods are of limited use because they frequently fail to simulate the environment of real fires and because they do not adequately represent the dynamics of fire growth. Mathematical modeling is suggested as a means of bridging the gap between laboratory measured properties of materials and fire performance. It is concluded that appropriately chosen small scale tests can guide product development, but at the present time the safety of a design must be confirmed by full scale prototype tests.

706,530
PB83-132936 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiative Ignition Mechanism of Solid Fuels.
Final rept.
T. Kashiwagi. 1979, 16p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Fire Safety Jnl. 3, p185-200 1979.

Keywords: *Ignition, *Polymethyl methacrylate, Surface temperature, Decomposition, Absorption, Reprints, *Red oak.

Transmittance of external radiation through a boundary layer of decomposition products over a vertical sample surface is measured during the ignition period. The results indicate that there is significant absorption of the external radiation for PMMA and a lesser but still not negligible amount, for red oak. An increase in gas phase temperature over surface temperature is observed over much of the ignition interval. Using the experimentally measured incident flux at the sample surface, surface temperature history was calculated from a model that included reradiation and convection losses from the surface, endothermic decomposition and conduction into the material. The results confirm the significant effect of gas phase absorption on surface temperature. Steady state-derived surface regression rate expression was used for PMMA in this model. The results raise questions about the validity of such data for the dynamic heating conditions during the ignition period. Further studies needed to understand the radiative ignition mechanism are identified.

706,531
PB83-134049 Not available NTIS
National Bureau of Standards, Washington, DC.

Ion-Molecule Chemistry of C3H3(+) and the Implications for Soot Formation.
Final rept.
K. C. Smyth, S. G. Lias, and P. Ausloos. 1982, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Combustion Science Technology 28, p147-154 1982.

Keywords: *Soot, *Molecular structure, Reaction kinetics, Flames, Reprints, *Ion molecule interactions, *Propyne.

The ion-molecule chemistry of C3H3(+1) is systematically investigated with a series of alkenes, alkynes, and aromatic molecules under low-pressure, room temperature conditions. Based upon their reactivity differences, two C3H3(+1) structures are distinguished and are assigned as the cyclic (the most stable) and linear isomers. Cyclic C3H3(+1) readily reacts with unsaturated compounds having four or more carbon atoms. Linear C3H3(+1) is found to be even more reactive and, in particular, forms condensation products with acetylene and benzene. The relevance of these results for the higher temperature and atmospheric pressure conditions of a flame environment is discussed. Since C3H3(+1) has been found to be the dominant positive ion for rich and sooting hydrocarbon flames, its high reactivity provides a rapid first step in the ion models of soot formation.

706,532
PB83-134189 Not available NTIS
National Bureau of Standards, Washington, DC.
Experimental Observation of Radiative Ignition Mechanisms.
Final rept.
T. Kashiwagi. 1979, 13p
Pub. in Combustion and Flame 34, p231-244 1979.

Keywords: *Ignition, *Polymethyl methacrylate, Radiation tests, Oak trees, Surface temperature, Decomposition, Reprints, *Red oak.

Radiative ignition experiments were conducted on PMMA and red oak using a CO2 laser with incident flux up to about 20 W/sq cm in air with both auto ignition and piloted ignition. The laser irradiates vertically perpendicular to the horizontal sample surface. It was observed that there was strong attenuation of the incident laser radiation by the plume consisting of gas phase decomposition products. This was also observed using an electric coil heater as a radiant source. It is postulated that, under auto ignition, PMMA ignites by the absorption of the incident radiation by the decomposition products in the gas phase. Red oak ignites by a similar absorption at high incident flux and at medium flux by high surface temperature acting as an induced pilot.

706,533
PB83-134247 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Attenuation of Radiation on Surface Temperature for Radiative Ignition.
Final rept.
T. Kashiwagi. 1979, 10p
Pub. in Combustion Science and Technology 20, p225-234 1979.

Keywords: *Ignition, *Surface temperature, *Polymethyl methacrylate, Oak trees, Reprints, *Red oak.

The effects of the attenuation of the radiation by the decomposition products in the gas phase on surface temperatures of PMMA and red oak were studied by using a CO2 laser in the radiant flux range from 7 to 18 W/sq cm irradiating normally downward to the horizontally mounted sample. It was observed that the attenuation of the radiation caused by the decomposition products in the gas phase was significant enough to affect surface temperature.

706,534
PB83-135012 Not available NTIS
National Bureau of Standards, Washington, DC.
Observation of Laser-Induced Visible Fluorescence in Sooting Diffusion Flames.
Final rept.
J. H. Miller, W. G. Mallard, and K. C. Smyth. 1982, 10p
Pub. in Combustion and Flame 47, p205-214 1982.

Keywords: *Flames, *Soot, Fluorescence, Excitation, Reprints, *Laser spectroscopy, *Laser induced fluorescence.

Visible fluorescence is produced using an argon-ion laser for excitation in sooting methane/air and methane/oxygen diffusion flames. Following previous studies, this emission is attributed to small polycyclic aromatic hydrocarbons. Spectra obtained with a slot burner and a cylindrically symmetric burner are presented, and are usually found to be broad and unstructured. However, under certain experimental conditions the laser-induced fluorescence spectra show considerable structure; four distinct peaks are identified at different excitation wavelengths. Evidence is presented that the structured spectra are caused by recirculation of downstream combustion gases (and particles) into the optically sampled area. Possible temperature effects and the relevance of these results to soot formation processes are also discussed.

706,535
PB83-150656 PC **A07**/MF **A01**
Princeton Univ., NJ. Dept. of Mechanical and Aerospace Engineering.
Studies of Dry-Powder Extinguishment of Diffusion Flames for Condensed Fuels.
Final technical rept.
J. W. Peters. Nov 82, 126p NBS-GCR-82-412
Contract NB81-NADA-2041

Keywords: *Extinguishing, *Diffusion flames, *Fuels, *Powders, Fire protection, Laboratory equipment.

A powder delivery system for the extinction of diffusion flames of condensed fuels is studied. The main component of the delivery system is a glass elutriation vessel containing a bed of powder. The extinction experiments were conducted in counterflow flame geometry. A flat, laminar diffusion flame was produced in a stagnation-point boundary layer by directing an oxidizing gas stream downward onto the surface of a liquid fuel burning at atmospheric pressure. The extinction data can be used to extract overall activation energies and prefactors for the inhibition processes in one-step reaction rate approximations, perhaps ultimately leading to conclusions regarding chemical mechanisms for powder suppression.

706,536
PB83-151266 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Development of the Cone Calorimeter - A Bench-Scale Heat Release Rate Apparatus Based on Oxygen Consumption.
V. Babrauskas. Nov 82, 86p NBSIR-82-2611

Keywords: *Calorimeters, *Oxygen consumption, Flammability testing, Laboratory equipment, Heat of combustion, Ignition, Design criteria, Performance evaluation, Plastics, Numerical solution.

A new bench-scale rate of heat release calorimeter utilizing the oxygen consumption principle has been developed for use in fire testing and research. Specimens may be of uniform or composite construction and may be tested in a horizontal, face-up orientation, or, for ones which do not melt, also vertically oriented. An external irradiance of zero to over 100 kW/sq m may be imposed by means of a temperature-controlled radiant heater. The rate of heat release is determined by measuring combustion product gas glow and oxygen depletion, while the mass loss is simultaneously recorded directly. The instrument has been designed to be capable of higher accuracy than existing instruments and yet to be simple to operate and moderate in construction cost. The instrument is termed a 'cone calorimeter' because of the geometric arrangement of the electric heater.

706,537
PB83-162156 Not available NTIS
National Bureau of Standards, Washington, DC.
Oxygen Flow Calorimeter for Kilogram-Size Samples of Municipal Solid Waste. Part II: Trial Combustions of Kilogram-Size Samples.
Final rept.
A. E. Ledford, R. V. Ryan, M. L. Reilly, E. S. Domalski, and K. L. Churney. 1982, 7p
Sponsored in part by Department Energy, Washington, DC.
Pub. in Resources Conserv. 8, p159-165 1982.

Keywords: *Calorimeters, *Enthalpy, *Sewage, Sampling, Fuels, Design criteria, Performance evaluation, Reprints, *Solid wastes, *Refuse derived fuels.

A new calorimeter is being developed at the National Bureau of Standards to determine the enthalpies of combustion of kilogram-size samples of municipal solid waste (MSW) in flowing oxygen near atmospheric pressure. Experiments were carried out to develop a prototype combustor in which pellets of relatively unprocessed MSW can be rapidly and completely burned with minimal scattering of ash. Pellets of up to 2.2 kg mass with ash contents between 20 and 35 percent have been successfully burned at a rate of 15 minutes per kilogram initial mass with CO/CO2 ratios not greater than 0.1 percent.

706,538
PB83-164251 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Assessment of Correlations between Laboratory and Full Scale Experiments for the FAA (Federal Aviation Administration) Aircraft Fire Safety Program. Part 3: ASTM (American Society for Testing and Materials) E 84.
W. J. Parker. Jan 83, 61p NBSIR-82-2564, FAA/CT-82/133
See also PB83-113522.

Keywords: *Fire tests, *Material tests, Fire safety, Flames, Performance evaluation, Assessments, Laboratory equipment, Field tests.

A comparison is presented between the room fire performance in four different full scale fire test series and the flame spread classification obtained by the ASTM E 84 tunnel test for a wide range of materials. A good correlation is obtained only for conventional interior finish materials. A flame spread hypothesis is presented to account for the stopping of the flame in the tunnel and the difference in the fire performance of materials in the tunnel test and in the room fire test.

706,539
PB83-165050 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Upholstered Furniture Heat Release Rates Measured with a Furniture Calorimeter.
V. Babrauskas, J. R. Lawson, W. D. Walton, and W. H. Twilley. Dec 82, 74p NBSIR-82-2604

Keywords: *Burning rate, *Furniture, *Heat measurement, Fire tests, Textiles, Plastics, Flammability tests.

Accurate burning rate information on upholstered furniture is important for two purposes - to predict the room fire development history for a fire involving the furniture, and to relatively, but adequately, rank commercial products for a given application. Small-scale test results data not referenced to full-scale fires lack validity, while full-scale room fires are costly and lack generality. To enable simplified but realistic full-scale testing to be done, a new apparatus, termed a furniture calorimeter was developed. Rates of heat release are measured by using the oxygen consumption principle. Tests were conducted in the furniture calorimeter on thirteen different specimens of upholstered furniture, representing typical, but carefully controlled construction. The results showed significant heat release differences between thermoplastic and cellulosic fabrics, between frame types and between padding materials. For polyurethane foam padding, however, performance was unrelated to results of Bunsen burner type tests on the foam. The data developed (1) can be used directly in the calculation of room fire growth; (2) will form some of the reference data for development of appropriate bench-scale test procedures; and (3) can be used in some cases to estimate burning rates of similar but not identical furniture.

706,540
PB83-175612 PC **A04**/MF **A01**
Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
Investigation of Axisymmetric Buoyant Turbulent Diffusion Flames: Turbulence Properties and Concentrations of Major Species.
S. M. Jeng, L. D. Chen, and G. M. Faeth. Feb 83, 74p NBS-GCR-83-422
Contract NB81-NADA-2044
See also PB82-165176.

Keywords: *Fires, *Flame propagation, Heat flux, Temperature distribution, Thermal radiation, Mathematical models, Methane, Propane, Turbulence, *Buoyant flames, Fire models.

Earlier measurements of mean velocities and temperatures in buoyant, turbulent, axisymmetric methane diffusion flames burning in still air were extended to

include measurements of fluctuating velocities and mean species concentrations (CH4, N2, O2, CO2, H2O, CO and H2). These measurements, as well as existing measurements in turbulent propane diffusion flames, were employed to evaluate differential models of the process including: (1) a base k-epsilon-g model where effects of buoyancy are only considered in the governing equations for mean quantities; and (2) an extended k-epsilon-g model where buoyancy is also considered in the governing equations for turbulence quantities. Two methods for determining state relationships (the variation of scalar properties as a function of mixture fraction) used in these models were also evaluated.

706,541
PB83-179523 Not available NTIS
National Bureau of Standards, Washington, DC.
Development of an Improved Radiant Heat Source for Fire Testing.
Final rept.
A. F. Robertson. 1982, 4p
Sponsored in part by Coast Guard, Washington, DC.
Pub. in Fire and Materials 6, n2 p68-71 1982.

Keywords: *Fire tests, *Burners, Performance evaluation, Propane, Natural gas, Reprints, *Heat sources.

The development, construction, and testing of a gas-fired radiant heat source for use as part of a fire test method is described. The unit has been shown capable of operation over extended periods at surface temperatures yielding radiance corresponding to that of a black body at 935C. This performance is achieved while maintaining effective spatial separation between specimen and heat source. This assists in avoiding imposition of vitiated air near the surface of a burning specimen. Some performance data are provided on its behavior when supplied with natural gas. The unit can burn propane but only with a significant reduction of thermal output.

706,542
PB83-193060 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Laser Enhanced Ionization in Flames.
Final rept.
J. R. Devoe, J. C. Travis, G. C. Turk, and S. J. Weeks. Mar 83, 38p NBSIR-83-2668
Sponsored in part by Environmental Protection Agency, Washington, DC.

Keywords: *Flames, Excitations, Performance evaluation, *Laser enhanced ionization, Laser spectroscopy.

This report describes the discovery of laser enhanced ionization in flames along with a description of research on the mechanisms of signal production and collection. Early experiments on the method's use for complex sample analysis are described. Results of this research predict that two photon-two wavelength laser enhanced ionization will produce detection limits at the 10 parts per trillion level in solution for most elements. Laser excitation provides high selectivity so that the method can be predicted to have high accuracy.

706,543
PB83-222711 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of a Calorimeter for Simultaneously Measuring Heat Release and Mass Loss Rates.
J. Tordella, and W. H. Twilley. Jun 83, 36p NBSIR-83-2708

Keywords: *Calorimeters, *Heat transmission, *Mass transfer, Design criteria, Performance evaluation, Flammability testing.

A heat release rate calorimeter (designated as NBS II) was designed, built, and put into operation. Heat release rate, mass loss rate, smoke, and heat of combustion of the unburned gaseous decomposition products are measured. A program involving through characterization of the instrument, obtaining reference heat release data for numerous materials, and conducting research in heat release rate and other flammability characteristics is recommended.

706,544
PB83-248682 PC **A05**/MF **A01**
National Forest Products Association, Washington, DC.
Heat Release Rate Properties of Wood-Based Materials.
D. L. Chamberlain. Jul 83, 92p NBSIR-82-2597

Keywords: *Heat measurement, *Wood products, *Flammability testing, Construction materials, Fire resistant materials, Heat transmission.

A background to the present heat release rate calorimetry is presented. Heat release rates and cumulative heat release were measured for 16 different lumber and wood products, using three different heat release rate instruments. The effects of moisture content, exposure heat flux, density of product, and fire retardant on rate of heat release were measured. The three small-scale heat release rate calorimeters were compared, and equations relating the data from each were developed.

706,545
PB83-261198 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire Hazard Evaluation of Shipboard Hull Insulation and Documentation of a Quarter-Scale Room Fire Test Protocol.
B. T. Lee. Aug 83, 49p NBSIR-83-2642

Keywords: *Flammability testing, *Shipboard fire control, *Foam, *Ship hulls, *Insulation, Heat measurement, Smoke, Flashover, Tests, Laboratory equipment, Field tests.

A variety of shipboard hull insulations including damping and acoustical materials, painted and unpainted, were evaluated for their flashover potential using a quarter-scale room fire test developed by the Center for Fire Research at the National Bureau of Standards. Three painted insulations were also evaluated in full-scale room fire tests. Comparison of full-scale and quarter-scale fire behavior again demonstrated that the quarter-scale test can predict full-scale room fire buildup. It was found that decorative paints, including the Navy's chlorinated alkyd formulation, could seriously compromise the fire safety of otherwise low fire risk insulations. A recommended test protocol was developed for determining the flashover potential of hull insulation using the quarter-scale room fire test.

706,546
PB84-100155 PC **A05**/MF **A01**
California Univ., Berkeley. Dept. of Mechanical Engineering.
Fire Propagation in Concurrent Flows.
Final rept. 1 Jun 82-31 May 83.
A. C. Fernandez-Pello. Jul 83, 77p NBS/GCR-83/437

Keywords: *Flame propagation, *Convection, *Mathematical models, *Fires, Heat transfer, Burning rate, Pyrolysis, Surfaces, Polymethyl methacrylate, Acetal resins, Plastics.

A study has been performed of the process of fire spread in gaseous flows moving in the direction of flame propagation, i.e.: concurrent or flow assisted flame spread. The study includes two research efforts: (1) Natural convection, flow assisted, flame spread over enclosure's walls; (2) Flame spread over a flat surface in a concurrent forced flow. During this reporting period, a numerical analysis has been performed of the natural convection, steady burning of combustible surfaces of varied length and composition forming the walls of an enclosure. The results for the location and length of the flame agree well with experimental data.

706,547
PB84-101336 PC **A06**/MF **A01**
California Univ., Berkeley. Lawrence Berkeley Lab.
Structure, Inhibition and Extinction of Polymer Diffusion Flames.
W. J. Pitz. Jul 83, 122p NBS/GCR-83/436
Sponsored in part by Departmemt of Energy, Washington, DC.

Keywords: *Polyethylene, *Flammability testing, *Combustion stability, *Diffusion flames, Temperature, Oxidation, Halogen organic compounds, Physical properties, Chemical properties, Test chambers, Gas chromatography, Burning rate, Inhibitors.

Composition and temperature profiles for combustion of high-purity polyethylene polymer in the opposed flow of a gaseous oxygen-nitrogen stream were obtained to examine the flame structure near extinction. As the oxygen concentration in the oxidizer was reduced, the flame moved toward the surface, the position of unity equivalence ratio moved away from the surface, and the maximum flame temperature decreased. Surface oxidation reactions were of minor importance. Halogenated inhibition effectiveness was assessed by evaluating its influence on extinction limits. The order of increasing effectiveness was found to be chlorine in the oxidizer flow, chlorine in the polymer, and bromine in the oxidizer flow. Predictions from a stagnation boundary-layer model with either a one-step, Arrhenius-rate expression or a flame-sheet representation were compared to the measured structure. Penetration of oxygen through the flame was accurately predicted by a finite-rate model. The temperature dependences of the global reaction rates at extinction were largely unaffected by addition of the halogen inhibitors.

706,548
PB84-106137 Not available NTIS
National Bureau of Standards, Washington, DC.
Hazard Assessment - Challenge to Fire Science.
Final rept.
J. E. Snell. Jan 83, 5p
Pub. in Jnl. Fire Sci. 1, p4-8 Jan/Feb 83.

Keywords: *Fire safety, *Toxicity, *Combustion products, *Industrial hygiene, Assessments, Hazardous materials, Reprints, *Toxic substances, Occupational safety and health.

This article discusses technical issues relevant to development of practical guidance for fire protection engineers and code officials on assessing the toxic hazard of combustion products from fires. Also, an approach for developing a toxic hazard assessment methodology over the next three years is outlined, and major additional research needs are noted to stimulate discussion and assistance for planned NBS work in this area.

706,549
PB84-106822 Not available NTIS
National Bureau of Standards, Washington, DC.
Interpretation of Optical Measurements of Soot in Flames.
Final rept.
R. J. Santoro, R. A. Dobbins, and H. G. Semerjian. 1983, 12p
Pub. in Proceedings of AIAA Thermophysics Conference (18th), Montreal, Canada, June 1-3, 1983, Paper AIAA-83-1516, 12p 1983.

Keywords: *Optical measurement, *Soot, *Flames, Mie scattering, Refractive index, Light scattering, Particles, Agglomerates.

Optical observations of agglomerated soot in flames in our laboratory and elsewhere are reviewed. The incompatibility of these observations with the Mie theory for polydispersions of absorbing spheres noted by D'Alessio et al. is confirmed. It is concluded that this conflict arises because the loosely packed, low density agglomerates have an effective refractive index that is singificantly reduced below that of the particulate material. When the particles display the characteristics of Mie scattering, it is possible to determine the soot volume fraction, the width of the distribution function and various mean diameters, the agglomerate number concentration, and the effective refractive index of the soot agglomerates from certain optical observations. The solution for the soot properties is recovered from the observed data.

706,550
PB84-106905 Not available NTIS
National Bureau of Standards, Washington, DC.
Cigarette Ignition of Upholstered Chairs.
Final rept.
E. Braun, J. F. Krasny, R. D. Peacock, M. Paabo, G. F, Smith, and and A. Stolte. 1983, 17p
Pub. in Jnl. of Consumer Product Flammability 9, n4, p167-183 1982.

Keywords: *Flammability testing, *Upholstery, Toxicity, Carbon monoxide, Carbon dioxide, Hydrocarbons, Smoke, Ignition, Foam, Fabrics, Air pollution, Reprints, *Smoldering, *Cigarettes, *Indoor air pollution.

The cigarette initiated smoldering behavior of six upholstered chairs in a small, closed test room was analyzed in detail. The C0, C02, and total hydrocarbon concentrations, oxygen depletion, temperature rise, smoke obscuration, and weight loss were recorded. All chairs were covered with medium to heavy weight, cel-

lulosic (cotton or rayon) fabric. Two chairs were commercial, UFAC labeled chairs varying in fabric construction, filling materials, and configuration. Four experimental chairs were constructed which had identical cover fabric and configurations, but varied widely in filling materials. Potentially hazardous conditions occurred in all cases.

706,551
PB84-136456 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Material Flame Spread Properties.
Final rept.
J. Quintiere, M. Harkleroad, and D. Walton. 1983, 23p
See also PB83-101931.
Pub. in Combustion Science and Technology 32, n1-4 p67-89 1983.

Keywords: *Flame propagation, *Materials tests, Ignition, Flammability testing, Fire tests, Particle board, Reprints.

A concept was examined for measuring flame spread parameters suitable for predicting the performance of a material in fires. The study examines a radiant panel test apparatus used to measure downward and lateral flame spread, and ignition. An analysis of data from tests of Douglas fir particle board is presented. A procedure has been identified for measuring specific parameters useful in the general prediction of ignition and flame spread for complex materials.

706,552
PB84-152289 Not available NTIS
National Bureau of Standards, Washington, DC.
Momentum Implications for Buoyant Diffusion Flames.
Final rept.
B. J. McCaffrey. Sep 83, 9p
Pub. in Combustion and Flame 52, n2 p149-167 Sep 83.

Keywords: *Diffusion flames, Fires, Turbulence, Buoyancy, Fire tests, Reprints.

Using assumed Gaussian forms for the transverse variation of mean quantities and well established centerline variations, the integrated form of the momentum equation is solved for the vertical variation of the radial extent of buoyant diffusion flames. Closure is obtained by assuming that the convective heat flux at the flame tip is equal to the total heat release rate minus the radiative fraction.

706,553
PB84-152461 Not available NTIS
National Bureau of Standards, Washington, DC.
Optical Studies of Polycyclic Aromatic Hydrocarbons in Pyrolysis and Diffusion Flame Environments.
Final rept.
J. H. Miller, W. G. Mallard, and K. C. Smyth. 1982, 15p
Pub. in Proceedings of Polynuclear Aromatic Hydrocarbons: International Symposium on Formation, Metabolism, Measurement (7th), held at Columbus, OH. on October 26-28, 1982, p905-919.

Keywords: *Aromatic polycyclic hydrocarbons, *Pyrolysis, *Diffusion flames, *Optical measurement, Ultraviolet spectroscopy, Absorption spectra, Air pollution, Fluorescence, Soot, Laser induced fluorescence.

In the present work results are presented for two types of optical measurements of PAH in fuel rich systems: ultraviolet absorption spectroscopy (in a flowing pyrolysis tube and in a slot burner supporting a diffusion flame) and visible laser-induced fluorescence. Preliminary results show that the absorption spectrum obtained in a flowing, 50 torr mixture of 1,3-butadiene and nitrogen at 600-700 K is similar in spectral shape to an absorption spectrum taken under identical optical conditions in a diffusion flame. From this spectral shape it is determined that PAH from 1 to 4 rings in size are present in the sampled area (2 mm diameter), which is on the fuel side of the flame front. A spatial profile of the broad, unstructured fluorescence observed when probing with a visible laser beam peaks in approximately the same position in the flame.

706,554
PB84-153980 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Estimating Effectiveness of State-of-the-Art Detectors and Automatic Sprinklers on Life Safety in Residential Occupancies.
Final rept.
E. K. Budnick. 30 Jan 84, 82p NBSIR-84-2819

Keywords: *Residential buildings, *Fire detection systems, Sprinkler systems, Fire alarm systems, Safety, Assessments, State of the art.

The report provides a qualitative assessment of the life safety impact of early warning fire detection and automatic sprinkler technology in residential occupancies. This assessment is based on the results of full scale studies and statistics on residential fire fatalities from the NFIRS data base. Estimates of the impact of three alternatives, smoke detectors, standard automatic sprinklers, and residential sprinklers, are provided for major fire hazard scenarios in residential occupancies. A quantitative approach is outlined that can lead to a more accurate assessment of the impact of detectors and sprinklers. An initial framework is presented which identifies the key parameters for residential life safety. A mathematical expression is proposed as a success criterion. Work is underway to extend the framework to sufficient detail to permit formulation of appropriate analytical expressions necessary for quantitative evaluation of specific parameters and their interrelationships.

706,555
PB84-154327 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Intensity and Duration of Chimney Fires in Several Chimneys.
R. D. Peacock. Dec 83, 136p NBSIR-83-2771
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD., and Department of Energy, Washington, DC.

Keywords: *Chimneys, *Fire safety, *Intensity, *Time, Surveys, Stoves, Accident prevention, Fire tests, Wood burning appliances.

A series of tests was conducted in five instrumented chimneys to study the intensity and duration of chimney fires due to the ignition and burning of combustible deposits accumulated on the chimney lining over a prolonged period of time. These tests were conducted (1) to establish typical conditions including temperatures in the chimneys and on combustible surfaces nearby, (2) to determine the duration of the burnout as evidenced by elevated temperatures within the chimneys, and (3) to compare these measured values with those obtained during overfire conditions - prolonged firing of the appliances at high rates. The results of these tests point out some areas where the codes and standards covering residential wood heating appliances should be modernized to better protect against failure due to chimney fires.

706,556
PB84-155340 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Summaries of Center for Fire Research (of the National Bureau of Standards) Grants and In-House Programs - 1983.
Final rept.
S. M. Cherry. Dec 83, 164p NBSIR-83-2800

Keywords: *Fire tests, Research projects, Toxicity, Combustion, Ignition, Mathematical models, Risks, Plastics, Fire safety, Soot, Smoke, Human behavior, Smoldering.

This report was prepared for distribution at the 7th Annual Conference on Fire Research, August 23-25, 1983. It contains extended abstracts of grants and contracts for fire research sponsored by the Center for Fire Research, National Bureau of Standards, as well as descriptions of the internal programs of the Center for Fire Research.

706,557
PB84-155787 PC **A06**/MF **A01**
Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
Computer Fire Code VI. Volume 1.
J. B. Gahm. Dec 83, 117p HOME FIRE PROJECT TR-58, NBS-GCR-83-451-VOL-1
Contract NB82-NADA-3030
See also Volume 2, PB84-155795.

Keywords: *Fires, *Mathematical models, Computer programming, Fortran.

There is no definitive version of CFR VI yet, but this document will be valid for any version. The numerical 'package' used is described in general terms only. The physics inherent in the program is also omitted; however, most of those subroutines have been taken directly from Mark 5, although they have been broken up so that any subroutine has just one output. For the reader interested in the documentation of the physics, it is given in detail in Harvard Fire Project Technical Reports 34 and 45. There are four appendices, wherein it is explained how to insert a new subroutine or a new physical variable. Following the report, a listing of the program appears; this is a version of CFC VI which compiles on both a VAX and a Perkin-Elmer computer. The program was written in ANSI 77 FORTRAN, and is fairly machine-independent. It consists of two independent parts: BINP is a program which produces an input file for the second (main) program, DBLE, to use. Two differences between CFC VI and Mark 5 not described in the Foreword are: first, the gas burner algorithm in Mark 5 has not been incorporated. Second, the gas concentrations are incorrectly computed.

706,558
PB84-155795 PC **A07**/MF **A01**
Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
Computer Fire Code VI. Volume 2.
J. B. Gahm. Dec 83, 150p NBS-GCR-83-451-VOL-2
Contract NB82-NADA-3030
See also Volume 1, PB84-155787.

Keywords: *Fires, *Mathematical models, Computer programs, Fortran.

There is no definitive version of CFR VI yet, but this document will be valid for any version. The numerical 'package' used is described in general terms only. The physics inherent in the program is also omitted; however, most of those subroutines have been taken directly from Mark 5, although they have been broken up so that any subroutine has just one output. For the reader interested in the documentation of the physics, it is given in detail in Harvard Fire Project Technical Reports 34 and 45. There are four appendices, wherein it is explained how to insert a new subroutine or a new physical variable. One of the appendices is a dictionary of symbols, terms, and variables used in the program and in the text. Appendix D is in a separate volume. Following the report, a listing of the program appears; this is a version of CFC VI which compiles on both a VAX and a Perkin-Elmer computer. The program was written in ANSI 77 FORTRAN, and is fairly machine-independent. It consists of two independent parts: BINP is a program which produces an input file for the second (main) program, DBLE, to use. Two differences between CFC VI and Mark 5 not described in the Foreward are: first, the gas burner algorithm in Mark 5 has not been incorporated. Second, the gas concentrations are incorrectly computed.

706,559
PB84-155829 PC **A05**/MF **A01**
Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
Investigation of Axisymmetric Buoyant Turbulent Diffusion Flames: Flow Structure and Radiation Properties.
S. M. Jeng, M. C. Lai, and G. M. Faeth. Jan 84, 98p NBS-GCR-84-458
Contract NB81-NADA-2044
See also PB82-165176.

Keywords: *Fires, *Flame propagation, Heat flux, Temperature distribution, Thermal radiation, Mathematical models, *Buoyant flames, Fire models.

A theoretical and experimental study of flow structure and nonluminous radiation properties of turbulent, buoyant, axisymmetric, methane diffusion flames burning in still air is reported. Past measurements of velocities, temperatures and species concentrations in the same buoyant flames were used to evaluate a Favre-averaged k-epsilon-g turbulence model of the process - with all empirical constants fixed by earlier measurements in noncombusting flows. The model yielded reasonably good predictions of mean properties. Turbulence predictions were less satisfactory, generally underestimating fluctuation levels and Reynold stress in highly buoyant regions of the flow.

706,560
PB84-176759 PC **A04**/MF **A01**

National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire Induced Flows Through Room Openings - Flow Coefficients.
K. D. Steckler, H. R. Baum, and J. G. Quintiere. Mar 84, 60p NBSIR-83-2801
Sponsored in part by Armstrong World Industries, Lancaster, PA.

Keywords: *Air flow, *Fire tests, *Flow distribution, *Orifice coefficients, *Room fires.

A full-scale experimental and theoretical study was made of steady-state fire-induced flows through doorway and window openings. Measurements included two-dimensional temperature and pressure-difference profiles within the opening and vertical temperature profiles within the rooms connected by the openings. A floor-level gas burner served as the energy source. Mass flow rates through the openings were calculated from the opening data. A static-pressure flow model was used to establish ideal orifice flows from different combinations of the experimental temperature profiles. The opening and ideal flow results were combined to form room-opening flow coefficients as a function of fire energy release rate, opening geometry, and fire location. Two calculation procedures were used to compute the ideal flow. An irrotational jet model for the flow coefficients was developed and found to be in reasonable agreement with these and other measurements. Measured flow coefficient results show no significant dependence on fire strength, opening geometry, or fire location, as long as the ideal mass flow rate was based on measured gas temperatures. However, the theory indicates a significant variation in flow coefficient with opening widths larger than those used in the experiments.

706,561
PB84-218411 Not available NTIS
National Bureau of Standards, Washington, DC.
Flash Fire Hazards in Fire Experiments.
Final rept.
C. Huggett. Oct 83, 3p
Pub. in Jnl. of Fire Sciences 1, p396-398 Oct 83.

Keywords: *Fire hazards, *Flammability test, *Flash point, Fire safety, Safety, Experiments, Reprints, Numerical solution.

The potential for encountering hazardous flash fire conditions in fire experiments can be estimated by a simple calculation. The limiting conditions for safe operation is: C (h sup c) $<$ -1.8 kJ/1 where C is the fuel load in grams per liter and h sup c is the gross heat of combustion of the fuel. The critical fuel load is small compared to that likely to be encountered in a real fire situation so the possibility of a flash fire under ventilation limited conditions must always be considered.

706,562
PB84-219500 PC **A19**/MF **A01**
Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
Pyrolysis, Ignition and Fire Spread on Horizontal Surfaces of Wood.
Doctoral thesis.
A. Atreya. c1983, 439p NBS/GCR-83/449
Contract NB81-NADA-2026

Keywords: *Pyrolysis, *Ignition, *Wood, *Fire tests, Surfaces, Thesis, Heat transfer, Mass transfer, Thermochemistry, Temperature, Physical properties, Chemical properties, *Fire spread, Mass fractions.

In this work, experimental techniques and methods were developed to study the growth of fire from a point ignition to a burning area of two feet in diameter. Numerous experiments on ten different kinds of wood were conducted to determine the dominant mechanisms of fire spread and to obtain reliable chemical and physical data. Simultaneous measurements of fire diameter, weight loss, surface temperature, forward flame radiation, total convective and radiative energy, depletion of O2, production of CO2, CO, total unburned hydrocarbons, and water were made. The study also developed a theory to predict transient fire growth on the basis of the following observations: (1) that fire spread may be treated as a continuous ignition process, (2) forward gas-phase heat transfer is a local phenomenon independent of fire size, (3) forward radiative heat transfer is the primary accelerating mechanism, (4) energetics due to desorption of adsorbed moisture is far more important than heat of thermal decomposition of wood, (5) reradiation from wood and char is the primary heat loss mechanism, (6) conduction of the heat parallel to the spread surface does not contribute significantly to the fire spread process.

706,563
PB84-220979 Not available NTIS
National Bureau of Standards, Washington, DC.
Compatibility of Materials with Cryogens.
Final rept.
J. C. Moulder, and J. G. Hust. 1983, 28p
Pub. in Materials at Low Temperatures, Chapter 10, p343-370 1983.

Keywords: *Cryogenics, *Combustion, *Materials tests, *Ignition, Metals, Alloys, Hydrogen embrittlement, Liquid oxygen, Liquid fluorine, Liquid hydrogen, Reprints.

The compatibility of materials with liquid oxygen, liquid fluorine, and liquid hydrogen is reviewed. Special emphasis is given to the ignition and combustion of structural metals and alloys, but the behavior of many nonmetals used with these cryogens is also discussed. Ignition sources common to cryogenic systems are enumerated and the experimental methods used to objectively determine compatibility of materials with liquid oxygen and liquid fluorine are classified and described. The relative compatibility of materials with fluorine and oxygen as revealed by various compatibility tests is discussed. Several guidelines are suggested for choosing materials compatible with liquid oxygen or liquid fluorine. A brief discussion of hydrogen embrittlement of metals and alloys as it pertains to liquid hydrogen service concludes the review.

706,564
PB84-221399 Not available NTIS
National Bureau of Standards, Washington, DC.
Prediction of Heat and Smoke Movement in Enclosure Fires.
Final rept.
H. R. Baum, R. G. Rehm, and G. W. Mulholland. 1983, 9p
Pub. in Fire Safety Jnl. 6, p193-201 1983.

Keywords: *Fire detection systems, *Fire safety, *Heat transfer, *Smoking, *Particle size distribution, *Aerosols, Sources, Mathematical models, Reprints, Numerical solution.

In order to understand the response of a detector to a given fire in an enclosure, it is necessary to relate the local thermal and aerosol characteristics actually sensed by the detector to the physical and geometrical properties of the fire and the enclosure. This paper presents computations designed to predict the evolution of the size distribution of smoke aerosol as it ages, as well as the large-scale air movement and temperature fields generated by an enclosure fire. The computations contain three main ingredients: first, a finite difference solution for the air movement and temperature generated by a prescribed source of heat used to represent a fire in a closed room; second, the computer evaluation of an exact solution to the ageing equation corresponding to the evolution of an experimentally observed size distribution; and third, a particle tracking scheme which permits the smoke aerosol to be followed in space and time as it gradually fills the room. No nonphysical empirical parameters (e.g. turbulence models) are employed in these calculations. The mathematical and physical models are summarized briefly, but most emphasis is placed on displaying results. Sample calculations are presented, comparisons are made with relevant experiments, and predictions of the local environment experienced by a detector due to the occurrence of an enclosure fire are shown.

706,565
PB84-224187 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Examples of Application of Harvard V Fire Computer Code to Fire Investigation.
Final rept.
T. Handa, M. Morita, J. A. Rockett, O. Sugawa, and K. Hayashi. 1983, 9p
Pub. in Fire Science Technology, v3 n1 p63-72 1983.

Keywords: *Fire tests, *Mathematical models, *Furniture, Residential buildings, Hotels, Reprints, Computer applications.

Full scale fire tests of a simulated Japanese style hotel guest room are described. Experimental results are compared with calculations using the Harvard Computer Fire Simulation, level 5.2. The computed results were in reasonable agreement with the experimental observations.

706,566
PB84-225556 Not available NTIS
National Bureau of Standards, Washington, DC.
Experimental Comparison of Forward and Reverse Smolder Propagation in Permeable Fuel Beds.
Final rept.
T. Ohlemiller, and D. Lucca. 1983, 17p
Pub. in Combustion and Flame 54, p131-147 1983.

Keywords: *Combustion, *Foam, *Insulation, *Flammability testing, *Flame propagation, Wood, Cellulose, Polymers, Plastics, Oxidation, Pyrolysis, Sampling, Oxygen, Carbon monoxide, Carbon dioxide, Reprints, *Smoldering.

Forward and reverse smoldering combustion propagation, supported by forced air flow, have been studied in two types of permeable fuels, a cellulosic loose-fill insulation (wood fibers) and a particulated polymer foam (polyisocyanurate). Thermocouples and gas sampling (O2, CO, CO2) were used to probe the structure of the two types of smolder wave. There are marked qualitative and quantitative differences in the two smolder propagation modes. Reverse smolder quickly reaches a steady propagation rate determined largely by heat transfer processes; forward smolder propagation is unsteady and moves at a lower rate that appears limited by the stoichiometry of char oxidation. Both modes of propagation are ultimately limited by the rate of oxygen supply.

706,567
PB84-229517 Not available NTIS
National Bureau of Standards, Washington, DC.
Calculating Escape Time from Fires.
Final rept.
L. Y. Cooper. 1980, 19p
Pub. in Proceedings of Engineering Applications Fire Technology Workshop, Gaithersburg, MD., April 16-18, 1980, p195-213.

Keywords: *Escape systems, *Fire safety, *Time measurement, *Mathematical models, Fire tests, Fire detection, Smoke, Safety, Reprints.

A general technique for calculating the time available for safe egress from a fire is presented. A definite model of hazard development is introduced, and the details of the technique are formulated for the room of fire origin problem. The inputs to the model are the area and ceiling height of the room, data from free burn tests of characteristic fuel assemblies likely to be found therein, the anticipated mode of fire detection and a criterion for hazard. The output is a definite estimate of the length of time between detection of a fire and the onset of hazardous conditions. Examples of applying the calculation technique are presented and discussed. In the course of developing these examples some universal working graphs are generated.

706,568
PB84-229525 Not available NTIS
National Bureau of Standards, Washington, DC.
Smoke Control by Stairwell Pressurization.
Final rept.
J. Klote. 1980, 21p
Pub. in Proceedings of Engineering Applications Fire Technology, p137-157 1980.

Keywords: *Stairways, *Smoke, *Pressurizing, *Escape systems, *Air flow, Design criteria, Performance evaluation, Safety, *Smoke control, Numerical solution, Computer applications.

Pressurized stairwells have been used increasingly in the past few years to provide smoke free escape routes. However, generally accepted and proven design procedures for these systems are not available. This paper provides a discussion of several of the designs currently in use. In particular, single and multiple injection systems are discussed. The factors affecting the performance of pressurized stairwells are discussed. A method of analyzing pressurized stairwells is developed for a simple building model, and example calculations using this method are provided.

706,569
PB84-229814 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Fire Research.

Flame Spread on Combustible Solar Collector Glazing Materials.
Final rept.
E. Braun, and P. J. Allen. Jul 84, 64p NBSIR-84/2887
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Fire tests, *Glazes, *Flame propagation, Performance evaluation, Buildings, Ignition, Reinforced plastics, Plastics, Fiberglass reinforced plastics, Polymethyl methacrylate, Polycarborate resins, *ASTM D635 test, *Solar collectors, *Flame spread.

The use of ASTM D635 and associated criteria as an evaluation method for solar collector glazings was investigated. Four materials commonly used in solar collector applications were evaluated by ASTM D635. Four other test methods were used to characterize the glazing materials as to ignition, flame spread, and heat release rate. These results were compared to large scale fire tests of these materials. Based on the large scale tests, it was found that ASTM D635 produced test results that were not consistent with those obtained from the large scale tests. Good agreement was found between the rank ordering of the large scale tests and heat release rate and ignition properties as measured in the cone calorimeter and modified ISO test.

706,570
PB84-244615 Not available NTIS
National Bureau of Standards, Washington, DC.
Observation of Vapor Generation Preceding the Ignition of Liquid N-Decane and I-Decane by CO2 Laser Radiation.
Final rept.
T. Kashiwagi, and T. J. Ohlemiller. 1982, 21p
Pub. in Combust. Sci. Technol. 29, n1-2 p15-35 1982.

Keywords: *Ignition, *Fuels, *Decanes, Liquid phases, Vapor phases, Vaporization, Aviation fuels, Absorption, Drops(Liquids), Reprints, *Laser applications, Chemical reaction mechanisms.

As an aid to understanding the ignition mechanism of liquid fuels under high intensity radiation, the time sequence of behavior of a liquid fuel and of the fuel vapor near the liquid surface was observed by high speed schlieren and direct photography. A CW CO2 laser with fluxes up to 1000 W/sq cm was used with beam incident angles of 30 and 90 degrees with respect to the liquid surface. Both n-decane and 1-decene were used as the liquid fuel. The pictures reveal, in time sequence, the formation of a radial wave, a central surface depression, bubble nucleation/growth/bursting followed by complex surface motion and further bubbling. Effects of laser flux level, incident laser angle and absorption coefficient of the liquid (16/cm and 50/cm) on the formation of bubbles, the size of the bubbles, the frequency of bubble formation and the vaporization process were studied. A simple order of magnitude analysis is applied to ascertain the dominant process that underlies these phenomena.

706,571
PB84-245877 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of the Protective Value of Fabrics in a Fire Environment.
Final rept.
E. Braun, D. Cobb, V. B. Cobble, J. F. Krasny, and R. Peacock. Mar 80, 11p
Pub. in Jnl. of Consumer Product Flammability 7, n1 p15-25 Mar 80.

Keywords: *Fabrics, *Fire protection, *Fire tests, Insulation, Heat flux, Ignition, Industrial hygiene, Exposure, Reprints, *Consumer products, Occupational safety and health.

A method for measuring the protection provided by fabrics in a fire environment is described. Fabrics are subjected to a heat load, and the heat flux behind them is measured. The apparatus can be adjusted to simulate a variety of fire situations; the total incident heat flux can be varied, as well as the ratio of the radiative and convective components; the heat sensor can be in contact with the fabric, or at a distance simulating looseness of fit of various garments; resistance to ignition can be determined by exposing the heated specimen to a pilot flame; and the heat received by the fabric at which charring or melting occurs can be determined. Typical results on a variety of reasonably ignition resistant fabrics are shown and related to fabric construction parameters. The results are expressed in terms of time of exposure until an incipient second degree burn is likely to occur. This time to injury is estimated based on work of previous investigators. Optimum use of the method would involve study of the types of heat exposure to which workers in various industries, fire fighters, etc. are likely to be subjected and reproducing these conditions in the laboratory.

706,572
PB85-108470 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Environmental Cycling of Cellulosic Thermal Insulation and Its Influence on Fire Performance.
J. R. Lawson. Aug 84, 47p NBSIR-84/2917
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Environmental surveys, *Fire tests, *Insulation, *Cellulose, Performance evaluation, Humidity, Temperature, Exposure, Air pollution, *Indoor air pollution.

A study was conducted on climatological data for eleven cities located throughout the United States. Findings from this environmental study were used to develop conditioning cycles for a research project on the influence of environments on the fire performance of loose-fill cellulosic thermal insulation. Six cellulosic insulation materials containing 25 percent by weight of fire retardant chemical add-on of different compositions were specially manufactured for this study. These materials were tested to establish a baseline. After the materials were exposed to the various environmental cycles, they were tested for fire performance. Results from these tests show that environmental exposure can have a significant effect on the fire performance of cellulosic insulation materials and indicates that long term fire protection provided by fire retardant compounds may be limited.

706,573
PB85-115608 Not available NTIS
National Bureau of Standards, Washington, DC.
Flame Boundary Layer Effects Line-Of-Sight Optical Measurements.
Final rept.
L. H. Grabner, and J. W. Hastie. 1982, 11p
Pub. in Combustion and Flame 44, n1-3 p15-25 Jan 82.

Keywords: *Flames, *Mathematical models, *Combustion, *Boundary layer, Concentration(Composition), Optical measurement, Absorption spectra, Reprints, *Hydroxyl radical.

A flame is approximated by a core surrounded by a boundary layer, both of uniform but different temperatures and species concentrations. For this model the temperature measured by the line-reversal and ratio method is calculated as well as the OH concentration from the integrated absorption of an OH line.

706,574
PB85-115665 Not available NTIS
National Bureau of Standards, Washington, DC.
Mobility Measurements of Atomic Ions in Flames Using Laser-Enhanced Ionization.
Final rept.
W. G. Mallard, and K. C. Smyth. 1982, 10p
Pub. in Combustion and Flame, v44 n1-3 p61-70 1982.

Keywords: *Combustion, *Flames, Ions, Excitation, Ionic mobility, Comparison, Reprints, *Laser enhanced ionization.

Atomic ion mobilities have been directly determined in C2H2/air and CO/O2 flames using optical excitation to instantaneously create a pencil of ions and then measuring ion velocities in an applied electric field. The ions were chosen to provide a wide range of atomic weights (Li, Na, K, Ca, Sr, Ba, Fe, In, Tl, U), thus providing a good comparison with the Langevin theory of ion mobility under several flame conditions. In all cases the Langevin theory provides an upper limit and predicts the measured mobility to within 50%, with best agreement obtained in general for the smaller and less polarizable ions.

706,575
PB85-120707 Not available NTIS
National Bureau of Standards, Washington, DC.
Experimental and Theoretical Analysis of Quasi-Steady Small-Scale Enclosure Fires.
Final rept.
J. G. Quintiere, B. J. McCaffrey, and K. DenBraven. 1979, 13p
Pub. in Proc. Symp. Int. Combustion 17, University of Leeds, England, August 20-25 1978, p1125-1137 1979.

Keywords: *Fires, *Enclosures, Experimental data, Analysis(Mathematics), Burning rate, Doors, Heat, Pressure measurement, Temperature measurement.

Forty-six small-scale experiments were conducted to measure the characteristics of horizontal plastic (PMMA) pool fires in an enclosure as a function of doorway width and fuel area. A 0.30 m high enclosure was instrumented to measure sample mass loss, the upper gas layer and ceiling temperatures, heat flux to the floor, and the pressure drop across the doorway. Results are reported for the maximum steady burning period; however, a few cases do not seem to have reached a steady state. For small sample sizes a distinct plume could be perceived in the enclosure, while for larger sample sizes flames tended to fill the enclosure (sometimes to within 2 to 3 cm of the floor), and extended out the door opening.

706,576
PB85-120731 Not available NTIS
National Bureau of Standards, Washington, DC.
Investigation of the Flammability Hazard of Apparel Fabrics.
Final rept.
L. B. Miles. 1978, 37p
Sponsored in part by Cotton Foundation, Memphis, TN.
Pub. in Proc. Symp. on Textile Flammability (6th), 20 April 1978, p38-74.

Keywords: *Fabrics, *Flammability testing, Hazards, Comparison.

The flammability hazard of various apparel fabrics was examined on both the Apparel Fire Modeling Apparatus (AFMA) and the Mushroom Apparel Flammability Tester (MAFT). Potential hazard as measured on the AFMA generally decreased for the cellulosic fabrics under the following conditions: (1) contact with a copper surface, (2) surface (vs hole) ignition, and (3) addition of flame retardant (FR) chemicals. The untreated synthetics had lower potential hazard than most of the cellulosics and appeared relatively unaffected by varying experimental conditions on the AFMA. On the Mushroom Apparel Flammability Tester most fabrics studied did not qualify for the safest class of fabrics according to the proposed apparel flammability standard. Ignition studies on the MAFT for further classification of the fabrics showed that classification for the cellulosics could be improved by: (1) increasing fabric weight, (2) increasing level of FR treatment, and (3) blending with an inherently FR fiber, (modacrylic). Comparison of AFMA potential hazard measurements with MAFT values showed that four of the eighteen fabrics tested were less hazardous than MAFT classification indicated, i.e., they had AFMA hazard potentials comparable to fabrics with low MAFT heat values.

706,577
PB85-120772 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Profiles of Inhibited Flames Using Raman-Spectroscopy.
Final rept.
M. C. Drake, and J. W. Hastie. 1981, 11p
Pub. in Jnl. of Combustion and Flame 40, n2 p201-211 1981.

Keywords: *Flames, *Raman spectroscopy, Temperature, Nitrogen, Hydrogen, Oxygen, Reprints.

Laser Raman scattering from vibrational and rotational states of N2 and H2 has been used to determine temperature profiles for several H2/O2/N2 flames with and without HBr present. The inhibiting effect of HBr is clearly demonstrated and the derived properties of burning velocity and inhibition index are in good agreement with literature data.

706,578
PB85-124253 Not available NTIS
National Bureau of Standards, Washington, DC.

Multiphoton Ionization of Molecules in Flames.
Final rept.
K. C. Smyth, W. G. Mallard, and J. H. Miller. 1984, 8p
Pub. in Society of Photo-Optical Instrumentation Engineers 482, p66-73 1984.

Keywords: *Ionization, *Molecules, *Flames, Trace elements, Pyrolysis, Fluorescence, Nitrogen oxide(NO), Butadiene, Potassium oxides, Diffusion, Reprints, Laser induced fluorescence.

Multiphoton ionization of molecules can be observed easily in both premixed and diffusion flame environments. Recent experiments on NO, PO, and butadiene show that this method is very sensitive for trace species detection and is well suited for making profile measurements. Multiphoton ionization complements laser-induced fluorescence techniques and now appears to be the best prospect for extending optical diagnostic studies to additional polyatomic molecules.

706,579
PB85-124295 Not available NTIS
National Bureau of Standards, Washington, DC.
Upholstered Furniture Room Fires - Measurements, Comparisions with Furniture Calorimeter Data, and Flashover Predictions.
Final rept.
V. Babrauskas. Feb 84, 15p
Pub. in Jnl. of Fire Sciences 2, p5-19 Jan-Feb 84.

Keywords: *Fire tests, *Furniture, Heat measurement, Burning rates, Comparison, Flashover, Reprints.

This paper describes a series of room fire tests using upholstered furniture items for comparison with their open burning rates, previously determined in a furniture calorimeter. For the four tests conducted good agreement was seen in all periods of the room fires, including post-flashover, noting that only fuel-controlled room fires were considered. Difficulties in making accurate mass and heat flow measurements in the room's window opening were found, and it is suggested that with present day instrumentation only exhaust stack measurements are reliable. Finally, a number of simplified rules or theories for predicting room flashover based on room physical properties and open-burning heat release values were examined and compared. Broad agreement was generally found, with recommended ones selected on the basis of well controlled asymptotic behavior.

706,580
PB85-128114 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Laser-Initiated Combustion Studies on Metallic Alloys in Pressurized Oxygen.
J. W. Bransford. Aug 84, 74p NBSIR-84/3013

Keywords: *Combustion, Ignition, Aluminum alloys, Steels, Stainless steels, Nickel alloys, Cobalt alloys, Oxygen, Compatibility.

The interim results of ignition and combustion studies on aluminum, cobalt, iron, and nickel based alloys are presented. It was found that aluminum alloys could be ignited below the melting point of the product alloy oxides. It was also found that the cobalt, iron, and nickel based alloys generally ignited slightly below to slightly above the melting range of the respective alloy. Unsupported combustion could not be achieved until the alloys and oxides were in the liquid state.

706,581
PB85-133973 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
New Concepts for Measuring Flame Spread Properties.
J. G. Quintiere, and M. Harkleroad. Nov 84, 158p NBSIR-84/2943
Sponsored in part by Federal Aviation Administration Technical Center, Atlantic City, NJ.

Keywords: *Flame propagation, *Ignition, *Materials tests, *Fire tests, Experimental design, Composite materials, Plastics, Wood, Carpets.

An experimental procedure is described which can be used to derive data relevant to the prediction of ignition and flame spread on materials. The apparatus utilizes a radiant heat source capable of supplying up to 6.5 W/sq cm to a vertically oriented specimen. The test results pertain to piloted ignition of a vertical sample under constant and irradiation, and to lateral flame spread on a vertical surface due to an external applied radiant heat flux. The results can be used to display the maximum velocity and ignition time as a function of irradiance. Critical or minimum irradiances for spread and ignition are determined. An empirical correlation, based on heat conduction principles, is found to correlate the ignition data and also provides a more general interpretation for the flame spread results. Further analyses of the data yield effective values for the thermal inertia of the material (kpc), its ignition temperature, and a parameter related to flame temperature. These parameters appear to be phenomenological constants for each material, rather than factors dependent on the apparatus. Results are presented for a wide range of materials. Suggestions for extending the results to other flame spread conditions are presented.

706,582
PB85-136786 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of the Cone Calorimeter - A Bench-Scale Heat Release Rate Apparatus Based on Oxygen Consumption.
Final rept.
V. Babrauskas. 1984, 15p
See also PB83-151266.
Pub. in Fire and Materials 8, n2 p81-95 1984.

Keywords: *Calorimeters, *Plastics, *Combustion, *Fire tests, *Oxygen consumption, Design criteria, Performance evaluation, Ignition, Reprints.

A new bench-scale rate of heat release calorimeter utilizing the oxygen consumption principle has been developed for use in fire testing and research. Specimens may be of uniform or composite construction and may be tested in a horizontal, face-up orientation, or, for those which do not melt, in a vertical orientation. An external irradiance of zero to over 100 kW/sq m may be imposed by means of a temperature-controlled radiant heater. The rate of heat release is determined by measuring combustion product gas flow and oxygen depletion, while the mass loss is also recorded simultaneously. The instrument has been designed to be capable of higher accuracy than existing instruments and yet to be simple to operate and moderate in construction cost. The instrument is termed a 'cone calorimeter' because of the geometric arrangement of the electric heater.

706,583
PB85-136794 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calculating Fire Plume Characteristics in a Two-Layer Environment.
Final rept.
D. D. Evans. Aug 84, 25p
See also PB84-114578.
Pub. in Fire Technology 20, n3 p39-63 Aug 84.

Keywords: *Fires, *Plumes, Layers, Gas flow, Enclosures, Activation, Predictions, Sprinkler systems, Environments, Temperature.

Methods are developed to determine axial gas flow conditions within a weakly buoyant plume that passes from an ambient quiescent environment, in which the plume originates, to an upper layer at elevated temperatures. The methods are appropriate for inclusion in two-layer analysis of enclosure fire. In particular, they are first steps in developing a prediction of actuation time for thermally activated automatic sprinklers exposed to an enclosure fire. Results obtained with various methods are compared with measurements in a 1.22 m diameter cylindrical enclosure.

706,584
PB85-140291 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Remarks to NFPA (National Fire Protection Association) Board of Directors on Center for Fire Research Programs and Implications to NFPA.
Final rept.
J. E. Snell. Jul 84, 7p
Pub. in Fire Jnl. 78, n4 p64-66, p68-70, p72 Jul 84.

Keywords: *Fire safety, *Fires, Research, Utilization, Project management, Research management, Reprints.

An overview is presented of the purpose and content of the fire research programs at the National Bureau of Standards. Written for a meeting of the Board of Directors of the National Fire Protection Association (NFPA), the paper emphasizes the necessary role of the NFPA in facilitating the application of the resulting practical tools to reduce the loss and cost of unwanted fires.

706,585
PB85-140432 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Will the Second Item Ignite.
Final rept.
V. Babrauskas. 1982, 12p
See also PB81-214025.
Pub. in Fire Safety Jnl. 4, n4 p281-292 1982.

Keywords: *Combustion, *Burning rate, *Furniture, Flammability, Thermal radiation, Fires, Fire tests, Analyzing, Heat flux, Flash point, Reprints, *Room fires, *Fire spread.

The burning of more than a single fuel item in a room fire has not been well characterized. The first step in describing multiple item burning is to determine if, in fact, it will occur. This question has been experimentally explored from two aspects. (1) The radiant heat fluxes from burning first-to-ignite objects have been measured, along with their mass loss rates. (2) The ignitability of exposed objects has been determined using a bench-scale uniform flux ignitability test. It is then suggested that whether the second item will ignite can best be determined analytically from considering these two sets of results.

706,586
PB85-140457 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Alternative Derivation of Some Flame Spread Integral Equations.
Final rept.
H. R. Baum. 1980, 4p
Pub. in Combustion Science and Technology 23, n1-2 p79-82 1980.

Keywords: *Flame propagation, Integral equations, Flames, Combustion, Analysis(Mathematics), Greens function, Heat, Phase, Reprints.

An alternate derivation of flame spread integral equations is presented. The method audits the use of transform techniques. The equations governing the evolution of the gas phase dependent variables are transformed into the heat conduction equation. The introduction of the Greens function corresponding to a one dimensional heat source then leads to the desired result.

706,587
PB85-140499 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cellulosic Insulation Material. 3. Effects of Heat Flow Geometry on Smolder Initiation.
Final rept.
T. J. Ohlemiller. 1981, 17p
Sponsored by Department of Energy, Washington, DC.
Pub. in Combustion Science and Technology 26, n3-4 p89-105 Aug 81.

Keywords: *Insulation, *Combustion, *Flammability testing, Cellulose, Thermal analysis, Tests, Heat transmission, Mathematical models, Fire protection, Reprints.

The variation with heat flow geometry of minimum heat source temperature which causes smolder initiation has been examined for eight configurations. These range from a wire-like source, to a flat planar source, to a corner formed by planar sources. They span the geometry range seen by insulation in practice. The ignition temperature for the same insulation varies from 235C (corner source) to 385 degrees (wire source). Other variables such as bulk density or the presence of smolder retardants have much less effect on ignitability. This behavior is predicted in an approximate manner by simple heat generation/heat flow arguments. It is predicted semi-quantitatively by a numerical model using reaction kinetics derived from thermal analysis. The results are used to suggest a smolder ignitability test design and procedure that should correspond closely to the real hazard situation.

706,588
PB85-141406 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Burning Behavior of Upholstered Furniture Mock-ups.
Final rept.
J. F. Krasny, and V. Babrauskas. Jun 84, 31p
Pub. in Jnl. of Fire Sciences 2, p205-235 May-Jun 84.

Keywords: *Furniture, *Flammability testing, *Heat measurement, Ignition, Polyurethane resins, Foam, Chloroprene resins, Reprints.

Furniture mockups consisting of various arrangements of full-size cushions were tested in the NBS furniture calorimeter. Measurements included heat release, combustion product concentrations, and flame spread characteristics. Major variations in burning were observed: neoprene mockups only smoldered; flame retardant treated polyurethane mockups burned more slowly than untreated mockups but eventually reached similar maximum heat release rates. Fabrics ranked, in terms of maximum heat release rate and several other measured characteristics, from low to high; heavy cotton fabric; light cotton and heavy olefin; and light olefin. Flame spread rate measured on the mockups correlated with time to 100 kW heat release rate. Heat release rate and combustion product concentration generally increased with increasing number of cushions per mockup. Thinner cushions burned more rapidly than thicker ones.

706,589
PB85-141877 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interpretation of Optical Measurements of Flame Generated Particles.
Final rept.
R. A. Dobbins, and G. W. Mulholland. 1984, 17p
Pub. in Combustion Science and Technology 40, p175-191 1984.

Keywords: *Flames, *Particles, *Optical measurement, Aerosols, Soot, Coagulation, Agglomeration, Concentration(Composition), Reprints, *Particle volume distribution function.

The dynamic equation for an aerosol undergoing simultaneous particle formation and coagulation is solved by the moment method. Solutions are obtained that quantify the evolution of the particle volume distribution function (PVDF) for both a size independent and a free molecular collision function. The solutions show that an equilibrium is rapidly established between the source and the coagulation terms and that the particle number concentration N is then proportional to the square root of the source strength. During the interval of equilibrium there is a widening of the PVDF. These quantities may exceed the asymptotic values that apply in the absence of particle formation.

706,590
PB85-143493 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Collection of Ions Produced by Continuous Wave Laser-Enhanced Ionization in a Hydrogen-Air Flame.
Final rept.
P. K. Schenck, J. C. Travis, G. C. Turk, and T. C. O'Haver. 1981, 11p
Pub in Jnl. of Physical Chemistry 85, n17 p2547-2557 1981.

Keywords: *Flames, *Ionization, *Atomic spectroscopy, Excitation, Combustion, Sodium, Reaction kinetics, Reprints, *Laser enhanced ionization.

Laser enhanced ionization (LEI) -- or the optogalvanic effect in flames -- is known to result when a tunable laser is used to significantly populate an excited state of an atomic species in an atmospheric pressure flame. The perturbed ionization rate may be sensed with external electrodes, providing the opportunity for applications to trace metal analysis and combustion research. The present study correlates experimental studies of the spatial and temporal characteristics of the LEI signal with theoretical expectations. The experiments are performed with a cw dye laser exciting the D2 transition of sodium introduced in to H2/air flame. Saturation currents with and without laser excitation are found to be consistent with expected ionization rate constants for the Na ground and excited states. Vertical spatial profiles -- using a unique imaging method -- show the physical size of the excess ion region generated by the laser, and the influence of external voltage, flame velocity, diffusion, and coulombic expansion on the excess ion region. Rise and fall times -- measured at different voltages with the laser switched by an acousto-optic modulator -- show the dependence on ion mobility, electric field, and excited state ionization rate constant. The relationships derived and illustrated would be of value for the improvement of precision and accuracy in analytical and diagnostic LEI.

706,591
PB85-143964 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Assessment of Fire Induced Flows in Compartments.
Final rept.
J. G. Quintiere, K. Steckler, and D. Corley. 1984, 14p
Pub. in Fire Prevention Science and Technology 4, n1 p1-14 1984.

Keywords: *Fire tests, *Flow rate, Enclosures, Temperature, Predictions, Vents, Windows, Doors, Reprints, *Compartments.

An experimental study was conducted to measure flow rates of air and fire products through wall vents, namely windows and doors. A burner (diffusion flame) was used to simulate a line fire of various heating rates and line widths along a wall of the enclosure. Analysis of the data showed the temperatures followed a two-layer profile with both upper and lower average gas temperatures correlated by dimensionless groups. Estimates of vent mixing rates into the lower layer and estimates of wall vertical boundary layer flows were made. The former were up to 30 per cent of the vent flow rate and the latter were up to 100 per cent of the vent flow rate. This estimate for the wall flows appears high due to inconsistencies in the analysis. The primary result shows that a prediction, based on a two-layer (hot and ambient) model with only plume entrainment manifesting flow between the layers, gives results to within 50 per cent of the experimental vent flows.

706,592
PB85-159945 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Heat Release and Mass Loss Rate Measurements for Selected Materials.
W. D. Walton, and W. H. Twilley. Dec 84, 63p NBSIR-84/2960
Sponsored by Federal Aviation Addministration Technical Center, Atlantic City, NJ.

Keywords: *Flammability testing, *Heat of combustion, *Mass, *Construction materials, *Aircraft cabins, Experimental design, Plastics, Foam, Polymethyl methacrylate, Buildings.

The purpose of this study was to measure fire parameters for a selected group of materials. These parameters are to be used in a continuing study of flame spread. The parameters measured are rate of heat release, rate of mass loss, heat of gasification, effective heat of combustion, stoichiometric ratio and time to ignite. Heat release rates and mass loss rates are given as a function of time for several external heat flux levels. The rate of heat release is also given as a function of the total heat released. The experimental results and analysis are shown for six diverse materials representative of aircraft (interior panels, carpeting, and seat cushions) and buildings (particle board, polymethyl methacrylate (PMMA) and rigid foam).

706,593
PB85-177988 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Effect of Wall and Room Surfaces on the Rates of Heat, Smoke, and Carbon Monoxide Production in a Park Lodging Bedroom Fire.
B. T. Lee. Feb 85, 57p NBSIR-85/2998
Sponsored by National Park Service, Washington, DC.

Keywords: *Buildings, *Furnishings, *Fire tests, *Heat flux, Flashover, Burning rate.

A furnishing arrangement representative of those in U.S. Park Service lodging facilities was evaluated for its open burn (free burn) characteristics. The arrangement consisted of a double bed with a wood headboard and one wood night table. The proximity of a wall and the effect of a room on the combustion of the same arrangement were examined. Wall finish materials were gypsum board and plywood. The presence or combustibility of an adjacent wall did not have a significant effect on the burning behavior of the furnishing arrangement. Nor did the effect of a room enclosure for the first few minutes subsequent to ignition. However, after this initial time interval, the effect of a room, lined with gypsum board finish, on the burning furnishings was pronounced, with flashover occurring as early as 233 s with heat release rates of over 2 MW. This compared with a peak rate of 1.2 MW for the open burn. Wood paneling in the room increased the peak rate to 7 MW. Mass flow of hot gases, smoke, and carbon monoxide from the room fires were measured. The use of a sprinkler or automatic door closing device activated by a smoke detector was shown to prevent room flashover.

706,594
PB85-178002 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Significant Parameters for Predicting Flame Spread.
J. G. Quintiere. Feb 85, 13p NBSIR-85/3109

Keywords: *Flame propagation, Equations, Combustion, Predictions, Flammability, Walls, Vents, Enclosures, Temperature, Room fires.

Flame spread is considered on a vertical wall surface in a vented enclosure. A theoretical formulation is developed to describe the burning and fire spread behavior and its response to the changing environmental conditions of the room. These formulations have been kept simple in form, but consistent with current levels of accuracy and completeness. The primary aim was to establish the relevant and significant set of dimensionless parameters which govern the fire spread process. These are given in terms of room geometric factors and wall flammability properties. No solution of the equations has been developed.

706,595
PB85-178101 PC **A06**/MF **A01**
Brown Univ., Providence, RI. Div. of Engineering.
Experimental Study of the Burning of Pure and Fire Retarded Cellulose.
Doctoral thesis.
S. S. Tewari. Jan 85, 104p NBS/GCR-85/485
Grant NB83-NADA-4017

Keywords: *Cellulose, *Burning rate, *Fire resistant coatings, *Flammability testing, *Cellular materials, Combustion, Sodium hydroxide, Sodium carbonates, Samples, Pyrolysis, Wood, Surface temperature, Theses, Experimental design, Char, Oxygen, Concentration(Composition).

The burning of charring materials is studied using samples prepared from pure cellulose and the cellulose which has been fire retarded by the addition of Sodium Hydroxide and Sodium Carbonate. The samples which are hemispherically nosed cylinders, are burned in a vertical orientation in a variable oxygen/nitrogen mixture at atmospheric pressure. Ambient oxygen concentration has a stronger effect on the change in burning rate and surface temperature than a proportional change in the retardant concentration. This dominant effect of oxygen concentration is also evident in a significant increase in the amount of retardant needed to cause extinction (both stagnation point and flaming) as the ambient oxygen concentration is increased. At sufficiently high oxygen concentration no extinction is found for the maximum retardant concentration used in this study. A practical consequence of these findings is the need to exercise proper caution in using these retardants in cellulosic products in oxygen rich environments.

706,596
PB85-182723 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quasichemical Melt Polymerization Model of SEED/SLAG Interaction.
Final rept.
L. P. Cook. 1980, 8p
Sponsored by United Nations Educational, Scientific and Cultural Organization, Paris (France)., and Department of Energy, Washington, DC.
Pub. in Proceedings of International Conference on MHD Electrical Power Generation (7th), Cambridge, MA., June 16-20, 1980, v1 p212-219.

Keywords: *Mathematical models, *Slags, *Magnetohydrodynamics, *Combustion, *Melts, Experimental design, Potassium carbonates, Oxidation, *Quasichemistry, *Seed-slag interactions, Phase equilibrium, Aluminum potassium silicates.

Experimental data illustrating KAlSiO4/melt interaction as a function of temperature are presented for synthetic channel slags modeling MHD combustion of 'Eastern' and 'Western' coals. The phase equilibrium behavior of the two slags is markedly different. In particular, a wide area of high temperature liquid immiscibility is found in the iron rich 'Eastern' slag. However the quasichemical model, by choice of appropriate parameters, can be used to fit the two-liquid data for the 'Eastern' slag. The quasichemical model suggests a sensitive relation between oxidation state and melt phase equilibrium behavior. The need for quantitative data on the effect of Fe(+3) on melt polymerization is discussed.

706,597
PB85-187599 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Predictions of Pressure and Composition Limits for Confined Hydrogen-Oxygen Detonations.
Final rept.
H. G. Semerjian, and J. E. Dove. 1981, 6p
Sponsored by Combustion Inst., Bordeaux (France). France Section.
Pub. in Proceedings of Int. Specialists Meeting of the Combustion Institute (1st), Bordeaux, France, July 20-25, 1981, p455-460.

Keywords: *Detonation waves, *Boundary layers, *Combustion, *Reaction kinetics, Pressure, Mathematical models.

Pressure and composition limits, and velocity deficits have been calculated for confined hydrogen-oxygen detonations, and the effect of initial pressure, mixture composition and tube diameter on detonability limits has been investigated. A quasi-one-dimensional Zeldovich-von-Neumann-Doring model is used to represent the reaction zone, and the effect of the viscous boundary layer along the wall is accounted for using a negative displacement thickness. The model predicts all the experimentally observed features of detonation waves; (a) all confined detonation waves travel at a velocity somewhat lower than the C-J velocity, and the velocity deficit is dependent on pressure, gas composition and tube diameter; (b) detonability limits exist and again depend on pressure, composition and tube diameter. Effect of the chemical reaction scheme and multidimensional effects are also discussed.

706,598
PB85-189298 Not available NTIS
National Bureau of Standards (NEL), Washington, DC. Center for Fire Research.
Heating Rates in Fire Experiments.
Final rept.
C. Huggett. Aug 84, 3p
Pub. in Jnl. of Fire Sciences 2, p257-259 Jul/Aug 84.

Keywords: *Fire tests, Heating, Combustion, Experimentation, Simulation, Reprints, Solid fuels.

The rate at which a solid fuel sample should be heated in a small scale experiment to best simulate conditions in a real fire is a subject of continuing discussion.

706,599
PB85-196137 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Speed Three-Dimensional Diagnostics in Combustion.
Final rept.
R. Goulard, P. J. Emmerman, R. J. Santoro, and H. G. Semerjian. 1982, 10p
Sponsored by National Academy of Engineering, Washington, DC., and Chinese Scientific and Technical Association, Beijing.
Pub. in Proceedings of the U.S.-China Conference on Energy (1st), Beijing, China, November 7-12, 1982, p162-171.

Keywords: *Combustion, Temperature, Concentration(Composition), *Optical tomography.

Recent research in turbulent combustion has shown the important role played by coherent structures in the onset of complete reactants mixing. An understanding of their three dimensional, time-histories would be an essential step into better combustor design and the study of turbulence fundamentals. A new diagnostics technique - optical tomography - is described, with its capability for high speed, three-dimensional resolution of temperature and concentrations.

706,600
PB85-196616
(Order as PB85-196541, PC **A07**/MF **A01**)
Underwriters' Labs., Inc., Northbrook, IL.
Survey of the State of the Art of Mathematical Fire Modeling.
J. S. Parikh, and J. R. Beyreis. Apr 85, 19p
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology, and National Conference of States on Building Codes and Standards, Inc., Herndon,VA.
Included in Research and Innovation in the Building Regulatory Process: Proceedings of the NBS/NCSBCS Joint Conference (6th), Technical Seminar on Streamlined Administrative Procedures, Computers in Construction, and Fire Safety Technology held at Denver, Colorado on September 11, 1984, p93-111 Apr 85.

Keywords: Fires, Mathematical models, Surveys, Flame propagation, Design, *Fire models.

In the past decade, considerable effort and resources have been directed at the development and use of mathematical modeling for predicting the fire response of products in a particular fire situation. Recently, Underwriters Laboratories Inc. (UL) undertook a survey of the state of the art of mathematical fire modeling for predicting the growth of a fire within a room under the sponsorship of the Society of the Plastics Industry. The objective was to assist in bridging the application of mathematical fire modeling from fire researcher to fire practitioner.

706,601
PB85-197671 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Enthalpy of Combustion of Adenine.
Final rept.
D. R. Kirklin, and E. S. Domalski. 1983, 7p
Pub. in Jnl. of Chemical Thermodynamics 15, n10 p941-947 1983.

Keywords: *Adenine, *Enthalpy, *Combustion tests, Thermodynamic properties, Nucleotides, Heat of formation, Heat measurement, Reprints.

The enthalpy of combustion for a commercial adenine sample of 99.9 percent purity was measured in an aneroid adiabatic bomb calorimeter. The enthalpy of combustion at 298.15 K for the reaction.

706,602
PB85-198935 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
ASET-B, a Room Fire Program for Personal Computers.
W. D. Walton. Apr 85, 41p NBSIR-85/3144
Sponsored by National Park Service, Washington, DC. and Department of Health and Human Services, Washington, DC.

Keywords: *Fires, Flame propagation, Manuals, Evacuating(Transportation), BASIC(Programming language), Computer programs, Smoke, ASET-B computer program, Room fires, Compartment fires.

ASET-B, a personal computer program for predicting the fire environment in a single room, is presented. ASET-B solves the same differential equations as the previously developed computer program, ASET (Available Safe Egress Time), using a simpler numerical technique. ASET-B requires as input the height and area of the room, the elevation of the fire above the floor, a heat loss factor, and a fire specified in terms of heat release rate. The program predicts the thickness and the temperature of the hot smoke layer as a function of time. ASET-B is written in BASIC and is not subject to copyright. This paper describes the program and its use. Included are a listing of the program, program variable name listing and a sample run. A discussion of user modifications also is given.

706,603
PB85-200202 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Summaries of Center for Fire Research (of the National Bureau of Standards) Grants and In-House Programs - 1984.
Final rept.
S. M. Cherry. Apr 85, 162p NBSIR-85/3136
See also PB84-155340.

Keywords: *Fires, Fire protection, Combustion, Evacuating(Transportation), Flame propagation, Fire safety, Smoke, Soot, Toxicity, Polymers, *Fire research, Computer applications.

This report was prepared for distribution at the 1984 Annual Conference on Fire Research, October 17-19, 1984. It contains extended abstracts of grants and contracts for fire research sponsored by the Center for Fire Research, National Bureau of Standards, as well as descriptions of the internal programs of the Center for Fire Research.

706,604
PB85-202091 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Upholstered Furniture Heat Release Rates: Measurements and Estimating.
Final rept.
V. Babrauskas. 1983, 24p
Pub. in Jnl. of Fire Sci. 1, n1 p9-32 Jan-Feb 83.

Keywords: *Flammability testing, *Calorimeters, *Burning rate, *Upholstery, Textiles, Design criteria, Comparison, Oxygen consumption, Cotton fabrics, Polyurethane, Foam, Reprints.

A new instrument, termed a furniture calorimeter, has been constructed and placed into operation for measuring furniture heat release rates based on oxygen consumption. Using the furniture calorimeter, burning rate information has been obtained on a series of 13 chairs, loveseats, and sofas, most of them specially built to permit direct comparisons of construction features. A quantitative assessment is made of the effect of fabric types, filling types (cotton batting, ordinary polyurethane foam, and California-requirements foam), and frame types. The advantages of furniture calorimeter testing over normal room fire testing are discussed. Based on these measurements, an estimating rule is presented for determining the heat release rate. Finally, implications for achieving both good flaming ignition behavior and good cigarette ignition resistance are discussed.

706,605
PB85-202745 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Calculations of Three Dimensional Buoyant Plumes in Enclosures.
Final rept.
H. R. Baum, and R. G. Rehm. 1984, 23p
Pub. in Jnl. of Combustion Science and Technology 40, n1-4 p55-77 1984.

Keywords: *Plumes, *Combustion, Enclosures, Convection, Fires, Mathematical models, Aerosols, Fluid flow, Eddies, Reprints.

A computational model of the three dimensional buoyant convection and aerosol dynamics induced by a weak volumetric source of heat and mass is presented. The hydrodynamics is directly based on the time dependent inviscid Boussinesq equations. No turbulence model or other empirical parameters are introduced. The use of Lagrangian particle tracking together with an exact solution of the Smoluchowski equation allows prediction of smoke aerosol transport and coagulation. The combined calculations represent predictions involving five independent variables. Flow features from three different configurations are illustrated with both Eulerian and Lagrangian displays of information. Sample aerosol coagulation results are compared with data from a wood fire. The computer resources required are discussed and an assessment of the current feasibility of large-eddy simulations in fire research is made.

706,606
PB85-202778 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Office of Fire Research Resources.
Workshop on Flame Radiation and Soot. Proceedings: Ad Hoc Mathematical Fire Modeiing Working Group.
Final rept.
R. S. Levine. Feb 85, 18p
Pub. in Jnl. of Fire Technology 21, n1 p41-58 Feb 85.

Keywords: *Flame propagation, *Fire extinguishing agents, Soot, Heat transfer, Combustion, Fires, Reprints, Fire models.

From the several research projects on extinguishment, we conclude that there are two important extinguishment mechanisms, and both of them can be incorporated into the models: Method 1 requires enough extinguishing agent so that its heat of vaporization is of the order of the heat stored in the ceiling layer plus the

thermal output of the fire. It is possible that the stirring caused by a sprinkler in a small room will rapidly carry vaporized extinguishing agent into the lower layer. Method 2 requires only a few percent of the amount of extinguishing agent in method 1, provided it can be efficiently delivered to the fuel surface.

706,607
PB85-203487 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Smoke Measurements: An Assessment of Correlations between Laboratory and Full-Scale Experiments.
Final rept.
J. G. Quintiere. 1982, 16p
Pub. in Fire and Materials 6, n3-4, p145-160 Sep-Dec 82.

Keywords: *Smoke, *Fires, Measurement, Correlations, Tests, Light transmission, Visual perception, Visibility, Equations, Reprints.

An extensive review is presented demonstrating the nature of comparison between full-scale fire smoke data and test method results for materials. These correlations are presented in terms of consistent parameters established through a development of the governing equations for smoke concentration and light attenuation. Visibility data pertaining to light transmission through smoke is presented. Recommendations are made for further research to establish a sounder basis for correlations, and a practical strategy is suggested for proceeding in the present.

706,608
PB85-205177 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Wall Flames and Implications for Upward Flame Spread.
Final rept.
J. Quintiere, M. Harkleroad, and Y. Hasemi. 1985, 16p
Pub. in Proceedings of AIAA (American Institute of Aeronautics and Astronautics) Aerospace Sciences Meeting (23rd), Reno, Nevada, January 14-17, 1985, AIAA-85-0456, 16p 1985.

Keywords: *Flame propagation, Polyurethane resins, Fires, Aircraft, Foam, Combustion, Heat transfer, Polymethyl methacrylate, Particle boards, Wool, Nylon, Flammability, *Flame spread tests.

The study marks the second phase of a project aimed at developing a predictive and quantitative measurement strategy for flame spread on materials. It deals with the heat transfer processes important to the inception of upward flame spread. In the study, six materials have been consistently used throughout. They included: polymethymethacrylate (PMMA); Douglas fir particle board; low density rigid polyurethane foam (GM-31); flexible polyurethane foam; wool/nylon carpet and an aircraft interior panel. Vertical sections of the materials, nominaly 28 x 28 cm were irradiated by infrared heaters and burned. Flame height and the heat transfer to a cool (60 degrees C) vertical copper plate were dynamically recorded. The results are analyzed in terms of the flame height and the energy release rate of the wall fire.

706,609
PB85-205276 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Perspective on Compartment Fire Growth.
Final rept.
J. Quintiere. 1984, 44p
Pub. in Combustion Science and Technology 39, n1-6 p11-54 1984.

Keywords: *Fires, Flame propagation, Combustion, Heat transfer, Fluid mechanics, Reprints, *Compartment fires, *Fire growth.

A review was made of research related to fire growth in compartments. Mention is made of the zone and field model approaches that have been used to describe many aspects of compartment developing fires. Primarily the review is organized by phenomena associated with compartment fires. These include fluid mechanic, heat transfer and combustion processes. Each phenomenon is discussed and work is presented to illustrate predictive techniques. Limitations and deficiencies in the authors understanding are discussed. A previously unavailable analysis of radiative transfer in an enclosure for a two layer participating gas is also presented.

706,610
PB85-205672 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Structure and Equilibria of Polyaromatic Flame Ions.
Final rept.
S. E. Stein. 1983, 8p
Pub. in Combustion and Flame 51, n3 p357-364 1983.

Keywords: *Molecular structure, *Aromatic polycyclic hydrocarbons, *Ions, *Reaction kinetics, *Flammability testing, *Thermodynamics, High temperature tests, Experimental design, Sampling, Stability, Reprints.

The aim of this work is to determine structures of a series of major hydrocarbon ions found in the burnt gas region of fuel-rich acetylene flames. Both kinetic and thermodynamic arguments are presented to first show that protonated and ionized benzenoid polynuclear aromatics are more stable than any of their nonbenzenoid structural isomers, and then that the ionized forms are expected to predominate in low pressure flames above about 1600 K. The fact that only the protonated forms are detected in flame-sampling experiments is attributed to rapid H-atom addition reactions in a region cooled by the sampling probe. This work demonstrates the utility of thermokinetic estimation methods for determining the most stable ion structures, correcting for sampling effects and finding ion reaction pathways.

706,611
PB85-205680 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Spectroscopy - Multiphoton Techniques Expand Combustion Diagnostic Capabilities.
Final rept.
K. C. Smyth. 1983, 2p
Pub. in Nature 301, n5900 p467-468 Feb 83.

Keywords: *Combustion, *Photons, *Ionization, *Fluorescence, *Flammability testing, Reprints, *Laser spectroscopy.

The application and future prospects of multiphoton ionization and multiphoton fluorescence experiments to flame diagnostics are described.

706,612
PB85-205698 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Soot Particle Measurements in Diffusion Flames.
Final rept.
R. J. Santoro, H. G. Semerjian, and R. A. Dobbins. 1983, 16p
Pub. in Combustion and Flame 51, n2 p203-218 1983.

Keywords: *Soot, *Particle size, *Combustion, *Flames, Chemical reactions, Fluorescence, Oxidation, Light scattering, Ethane, Diffusion, Reprints.

The formation and growth of soot particles in a co-annular diffusion flame has been studied using a laser extinction/scattering technique for particle size measurement. Measurements have been obtained with ethene as the fuel for various fuel flow rates. The results reveal that the flame can be broadly divided into two regions. One characterized as a region of growth where soot formation processes dominate and a second in which oxidation processes are dominant. Measurement show that soot is first observed to form low in the flame in an annular region inside the main reaction zone. At higher locations this annular region widens until the entire flame is observed to contain particles. Measurements of depolarized scattered light and fluorescence have also been obtained and indicate a correlation between the species responsible for these processes and soot growth. Results indicate that the particle formation region obeys closely the Burke Schumman analysis for flow rate dependence, where as substantial differences occur in the oxidation region. Measurements have also been obtained using ethane as the fuel as an intial comparison of fuel structure effects.

706,613
PB85-207405 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Simon H. Ingberg -- Pioneer in Fire Research.
Final rept.
A. F. Robertson. Feb 85, 4p
Pub. in ASTM (American Society for Testing and Materials) Standardization News 13, n2 p50-53 Feb 85.

Keywords: *Research projects, *Fire tests, Safety, Construction materials, Buildings, Reprints, *Simon H. Ingberg.

Ingberg's work is recognized, respected, and studied not only in the United States but in every nation that tries to make progress in control of unwanted fires.

706,614
PB85-208023 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Calculations of the Heat Release Rate by Oxygen Consumption for Various Applications, September-October 1984.
Final rept.
W. J. Parker. Oct 84, 6p
See also PB82-192956.
Pub. in Jnl. of Fire Sciences 2, n5 p380-395 Sep/Oct 84.

Keywords: *Fire tests, *Heat measurement, Computation, Calorimeters, Oxygen consumption, Formulas(Mathematics), Reprints, *Heat release rate, Room fires.

The calculation of heat release rate by oxygen consumption is based on the assumption that all materials release approximately the same amount of heat per unit mass of oxygen consumed. The technique is now being employed to determine the heat release rate of materials in various heat release rate calorimeters. Other uses include the heat release rate of assemblies in the fire endurance furnaces and the total heat release rate in room fire tests. Various assumptions about CO levels in the exhaust duct and vitiation and humidity in the incoming air are made. General formulas for the heat release rate by oxygen consumption are developed in the paper from which the formulas for specific applications can easily be derived.

706,615
PB85-208049 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Approach to Hazard Assessment of Combustion Products in Building Fires.
Final rept.
A. J. Fowell. 1984, 12p
Pub. in Proceedings of Flame Retardancy Advances in Fire Safety: Regulations, Testing, Product, Markets, Pine Mountain, GA., March 28-30, 1984, p24-35.

Keywords: *Fire tests, *Toxicity, *Combustion products, *Materials tests, *Building codes, Assessments, Air pollution, Hazards, Smoke, Burning rate, Predictions, *Air pollution effects(Humans), *Indoor air pollution.

A framework for addressing hazards associated with the spread of smoke and hot gases from fires in buildings is proposed, and the current predictive capabilities for each component of that framework are described. A method for assessing the significance of the toxicity of the combustion products of a material in relation to its other fire properties is proposed.

706,616
PB85-208130 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Bench-Scale Methods for Prediction of Full-Scale Fire Behavior of Furnishings and Wall Linings.
Final rept.
V. Babrauskas. 1984, 26p
Pub. in SFPE (Society of Fire Protection Engineers) Technology Report 84-10, p1-25 1984.

Keywords: *Furniture, *Walls, *Linings, Flammability, Measurement, Flashover, Fires, Heat transfer, Flame propagation, Test equipment, Ignition, Fire resistant materials, Reprints, *Fire tests.

Fire development in a room involves three basic phenomena: ignition, flame spread, and heat release rate. Of these, the heat release rate tends to be more important than the other two in most common fire scenarios. Heat release rates are difficult to determine accurately by direct, sensible-enthalpy measurements. It has recently been used in two test apparatuses developed at the National Bureau of Standards: a furniture calorimeter for conducting full-scale tests, and a cone calorimeter for conducting bench-scale tests. Bench-scale data have now been gathered on upholstered furniture and on wall-lining materials, with correspond-

ing full-scale data available from furniture calorimeter or room fire measurements. In both cases, bench-scale measurements allowed the successful prediction of full-scale data for variables of interest, which were the peak rate of heat release and the time to flashover.

706,617
PB85-208502 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Research Publications, 1984.
Final rept.
N. H. Jason. May 85, 20p NBSIR-85/3153
See also PB84-217066.

Keywords: *Fires, Bibliographies, Combustion, Smoke, Toxicity, Fire safety, Fire protection, Meetings, *Fire research, Means of degrees.

Fire Research Publications, 1984 is a supplement to previous editions; the last five editions are referenced below. Information about earlier editions is available upon request. 1979--NBSIR 80-2114, PB80-103335; 1980--NBSIR 81-2272, PB81-203317; 1981--NBSIR 82-2499, PB82-220104; 1982--NBSIR 83-2706, PB83-238915; 1983--NBSIR 84-2871, PB84-217066. In a departure from the authors usual practice of citing only publications prepared by the Center for Fire Research (CFR) staff, by other National Bureau of Standards (NBS) personnel for CFR, or by external laboratories under contract or grant from the CFR, they are pleased to include the papers presented at the Howard Emmons' Conference, Fire Science for Safety. The CFR devoted its 1983 Annual Conference to invited papers on subject areas that have been significantly influenced by Professor Emmons and his students. The Conference was held at NBS in Gaithersburg, MD, August 23-24, 1983. Selected papers have been published in a special issue of Combustion Science and Technology, Vol. 39-40, 1984 and are cited herein.

706,618
PB85-224400 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Slide-Rule Estimates of Fire Growth.
J. R. Lawson, and J. G. Quintiere. Jun 85, 57p NBSIR-85/3196
Sponsored by David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.

Keywords: *Flame propagation, Temperature, Carbon monoxide, Calculators, Estimates, Predictions, Computation, Fires, Smoke, *Fire growth, Fire models, Compartment fires.

A series of prediction methods have been assembled to provide an analytical basis for estimating fire growth in compartments. Solutions for each prediction method can be made using programmable scientific calculators. Prediction methods are presented for: fire size and growth rates, mass loss rates, radiant heat flux, flame height, radial flame impingement, heat flux to a ceiling, smoke filling of a room, carbon monoxide hazard with smoldering fires, temperature rise in a compartment, ventilation flow rate, flashover occurrence, corridor smoke transfer and filling, smoke concentration, visibility, flame spread rates, and fire burn time. These predictive methods are useful for estimating many of the critical elements related to fire behavior and help provide a better understanding of this complex phenomenon. This report appears in Appendix B in Fire Growth in Combat Ships by J.G. Quintiere, H.R. Baum and J.R. Lawson, NBSIR 85-3159.

706,619
PB85-224483 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Evaluation and Refinement of Test Methods Used for Measuring Fire Hazards of Shipboard Hull Insulations and Mattress Insert Foams.
B. T. Lee. May 85, 57p NBSIR-85/3148
Sponsored by Naval Sea Systems Command, Washington, DC.

Keywords: *Fire tests, *Construction materials, *Insulation, *Ship hulls, *Bedding equipment, Smoke, Carbon monoxide, Foam, Heat transmission, Burning rate, Experimental design, Fire hazards, Laboratory equipment, Polyphosphazene.

A quarter-scale room fire test developed at NBS was used to help develop a preliminary approach for fire hazard assessment of wall-ceiling combinations of hull insulation materials. The quarter-scale test has been refined to include measurement of heat release rate, smoke, and carbon monoxide. In addition, polyphosphazene foam insulations were evaluated with this test. The quarter-scale test was also modified for testing mattress insert materials, including polyphosphazene foam. Existing tests, used for measuring total heat, rate of heat release, and smoke production, were also used to evaluate these materials. Heat release rate measurements with the Ohio State University apparatus and smoke measurements with the ASTM E 662 test, modified for horizontal placement of specimens, gave adequate evaluation of the fire hazards of mattress insert materials.

706,620
PB85-234946 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO.
Literature Survey on Drop Size Data, Measuring Equipment, and a Discussion of the Significance of Drop Size in Fire Extinguishment.
W. D. Hayes. Jul 85, 31p NBSIR-85/3100/1
Sponsored by Federal Emergency Management Agency, Washington, DC.

Keywords: *Fire extinguishing agents, *Drops(Liquids), Fire extinguishers, Fire fighting, Spraying, Water, Measurement, Fire hoses, Spray nozzles.

The literature was searched for information on the size of water droplets from fire fighting equipment, on instrumentation and techniques for measuring droplet size in dense sprays, and on the significane of droplet size in water sprays used for fire extinguishment. From the information on drop size analyzers gathered, it is likely that analyzers using a shadowgraphic method to measure drop size are best suited for drop size measurements in water sprays from fire hose nozzles. The effects of droplet size in water sprays used for extinguishment is confined and unconfined spaces and with and without counterflowing air currents are discussed. The report supersedes the January 1985 edition (NBSIR 85-3100).

706,621
PB85-246080 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Polyesters: A Review of the Literature on Products of Combustion and Toxicity.
E. Braun, and B. C. Levin. Jan 85, 72p NBSIR-85/3139
Sponsored by Consumer Product Safety Commission, Washington, DC.

Keywords: *Polyester resins, *Combustion products, *Toxicity, *Pyrolysis, *Fire tests, *Thermoplastics, Reviews, Textiles, Construction materials, Fire resistant materials, Air pollution, Plastics, Additives, *Indoor air pollution, Consumer products.

The available literature was reviewed to determine the nature and extent of information available on the thermal decomposition products and the toxicity of the combustion products of polyester materials used in consumer applications such as textiles and construction. The literature review is limited to the publications printed in English through June, 1984. The thermal decomposition products of polyesters are a function of temperature and oxygen content of the atmosphere. In general, as the temperature increases, the quantity of heavier hydrocarbons decreases and the production of CO and CO2 increases. The presence of flame retarded additives, such as bromine and chlorine containing compounds, product halogenated combustion products. The use of phosphorus and bromine together in the same flame retardant finish increases the concentration of low molecular weight compounds. Thirteen different test protocols have been used to evaluate the toxicity of various types of polyester. In general, the results from large-scale tests are ambiguous because of the presence of other materials in addition to the polyesters.

706,622
PB85-248755 PC **A08**/MF **A01**
California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
Experimental Study of Environment and Heat Transfer in a Room Fire. Mixing in Doorway Flows and Entrainment in Fire Plumes.
Rept. for 1982-84.
E. E. Zukoski, T. Kubota, and C. S. Lim. May 85, 175p NBS/GCR-85/493
Grant NB82-NADA-3033

Keywords: *Fire tests, *Heat transfer, *Building fires, *Combustion products, Plumes, Experimental design, Doors, Ceilings(Architecture), Gravity, Experimental design, Concentration(Composition), Mixing, Mathematical models, Gas flow.

The report contains a description of an ongoing study of gravity currents for conditions which match those the authors expect to find in unwanted fires in buildings. A review is made of the pertinent literature and a description is given of the flow regimes which can exist for ideal gravity currents when viscous effects, heat transfer, and mixing are ignored. The influence of boundary conditions fixed by the method used to withdraw the fluid displaced by the current is given. Algebraic equations for the thickness of the current and the velocity of the head are derived for these ideal flows. The influences of viscosity and mixing are briefly discussed and the status of salt water and gas modeling experiments is given.

706,623
PB86-101029 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Applied Mathematics.
Applied Model Validation.
A. D. Davies. Jul 85, 32p NBSIR-85/3154/1

Keywords: *Fires, *Smoke, Temperature, Computation, *Fire models, *Toxic gases, Fire spread, Fire tests, Computer applications.

The progress report is about an applied model validation case study. The subject model is 'Transport of Fire, Smoke and Toxic Gases (FAST)' by W. W. Jones of the National Bureau of Standards, Center for Fire Research. Products from a fire in a 'burn room' exit through a connected corridor to outdoors. Cooler counterflow air in a lower layer feeds the fire. The model predicts corridor layer temperatures and thicknesses vs. time, given enclosure, fire and ambient specifications. Data have been collected from 38 tests using several fire sizes, but have not been reduced. Corresponding model results, and model and test documentation are yet to come. Considerable modeling and calculation is needed to convert instrument readings to test results comparable with model outputs so that residual differences may be determined. Test results as well as model results must be validated, and test result uncertainties estimated so that they are not unfairly attributed to the model.

706,624
PB86-102233 PC **A04**/MF **A01**
Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
Investigation of Turbulent Fires on Vertical Walls: Wall Plume Structure.
M. C. Lai, S. M. Jeng, and G. M. Faeth. Feb 85, 74p NBS/GCR-85/486
Grant NB81-NADA-2044

Keywords: *Fires, Air flow, Turbulence, Walls, Flow visualization, Measurement, Combustion, Flames, *Wall flow, Buoyant plume, Fire plume.

A theoretical and experimental study designed to improve understanding of buoyant fires is described. The main objective is to study turbulent fires along surfaces, however, several noncombusting and combusting flow configurations, which offer opportunities to highlight aspects of this problem under simpler circumstances, were considered during the work, e.g., buoyant noncombusting wall plumes, for studies of flow properties; and turbulent round flames, for studies of flame radiation properties. Various phases of the study are reported separately; this report considers results for noncombusting wall plumes.

706,625
PB86-102266 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Pyrolysis of Cellulose, an Introduction to the Literature.
T. Hirata. Aug 85, 36p NBSIR-85/3218

Keywords: *Cellulose, *Pyrolysis, *Bibliographies, *Fire resistant materials, *Biomass, Reaction kinetics, Molecular structure, Mathematical models, Polymerization, Fine structure, Chemical properties, Wood, Anaerobic processes.

Topics related to cellulose pyrolysis are briefly surveyed under several headings. The principal aim is to give the reader some grasp of the issues involved and provide a guide to the relevant literature; 171 references are cited. The headings include: Changes in cellulose fine structure with heating; chemical changes during pyrolytic weight loss and kinetic modeling of pyrolysis. Principal emphasis is on the last area; it is concluded that no current model adequately predicts both the observed changes in degree of polymerization and the weight loss during heating.

706,626
PB86-108347 PC **A03**/MF **A01**
Notre Dame Univ., IN. Dept. of Aerospace and Mechanical Engineering.
Scaling Parameters of Flashover.
Final rept.
A. M. Kanury. Jul 85, 50p NBS/GCR-85/497
Contract NB83-NADA-4018
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Flashover, *Fires, Combustion, Walls, Flames, Flame propagation, Scaling, Room fires, Fire growth, Compartment fires.

The topic of concern in this project is room fire growth to flashover. The objective is to develop scaling rules for flashover time and to apply these rules to certain existing room fire flashover test data. In this report, the scaling rules are deduced from first principles of energy and mass conservation describing the physics of fire growth. The nondimensional scaling parameters are all obtained in the desirable terms of fundamental combustion properties. Collection, estimation, and deduction of these fundamental properties for the materials involved in the concerned fire tests has to be done in the immediate future to evaluate the scaling parameters for correlating the test data.

706,627
PB86-110004 PC **A04**/MF **A01**
Factory Mutual Research Corp., Norwood, MA.
Scale Effects on Fire Properties of Materials.
A. Tewarson. Feb 85, 52p NBS/GCR-85/488
Grant NB83-NADA-4021
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Materials tests, *Flammability testing, Experimental design, Plastics, Wood, Pyrolysis, Paper, Cellulose, Carbon monoxide, Furniture, *Indoor air pollution, *Toxic substances.

The objective of this study was to examine the scale effects on fire properties of materials over a range of fire sizes from 10 kW to 5000 kW-scale fires. Experiments were performed for cellulosic materials, alone and in combination with synthetic materials in box-like and crib-like configurations. Experimental results for a pool-like material configuration from our previous study and for enclosure fires of wood cribs reported in the literature were also used. For turbulent fires of various sizes with various geometrical material configurations, a chemical similarity was found for each material for each specified value of the ventilation parameter. The decomposition mode in the combustion of the cellulosic material was found to be very important for CO and particulates, but less important for CO2 and heat.

706,628
PB86-111986 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Two Approaches to the Analysis of Actual Fires.
Final rept.
J. A. Rockett. 1985, 12p
Pub. in Fire Safety Jnl. 9, p17-28 1985.

Keywords: *Fire tests, Reprints, Numerical solution.

Two calculations are described. One used only simple algebra to show the rate of development of a critical aspect of a fire. The other used one of our most elaborate computer based schemes to extend the results of full-scale fire tests to additional, important situations. Both provided useful results. The significance of this is that it is not the complexity of a calculation that is important but its relevance to the problem at hand.

706,629
PB86-112364 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Computer Modeling for Smoke Control Design.
Final rept.
J. H. Klote. 1985, 8p
Pub. in Fire Safety Jnl. 9, p181-188 1985.

Keywords: *Building codes, *Fire safety, *Mathematical models, *Smoke abatement, Ventilation, Design criteria, Pressure, Reprints, *Indoor air pollution, Computer applications, Numerical solution.

The concept of using pressurization to control smoke movement in building fire situations has developed considerably over the past decade and a half. This paper discusses a steady state, network, airflow computer model which can be used for smoke control system design. Assumptions, equations and numerical solution technique are presented. An example problem also is included.

706,630
PB86-114022 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Study of the Radiative Ignition Mechanism of a Liquid Fuel Using High Speed Holographic Interferometry.
Final rept.
T. Kashiwagi, and T. Kashiwagi. 1982, 11p
Sponsored by Combustion Inst., Pittsburgh, PA.
Pub. in Proceedings of Symposium on Combustion (19th), Haifa, Israel, August 8-13, 1982, p1511-1521.

Keywords: *Ignition, *Fuels, Combustion, Experimental design, Plumes, *Interferometric holography, *Chemical reaction mechanisms, Laser applications.

The ignition mechanism of 1-decene is investigated experimentally using a high speed two-wavelength holographic interferometry technique with a framing speed of 500 f/sec for measurements of temperature and fuel vapor concentration distributions in the gas phase near the liquid surface from the CO2 laser irradiation up to ignition. The effects of oxygen concentration using three different environments of nitrogen, air and 40% 02/60% N2 and of peak laser flux at 260, 520 and 780 W/sq cm on the growth of the fuel vapor plume, the location of ignition and distributions of temperature and fuel vapor concentration are studied.

706,631
PB86-122975 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermal Processes Div.
Laser Tomography for Diagnostics in Reacting Flows.
Final rept.
H. G. Semerjian, S. R. Ray, and R. J. Santoro. 1982, 9p
Pub. in Proceedings of AIAA/ASME Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference (3rd), St. Louis, MO., June 7-11, 1982, p1-9.

Keywords: *Absorption spectra, *Flames, *Fuel air ratio, Methane, Concentration(Composition), Temperature, *Laser spectroscopy, *Tomography, Hydroxyl radical.

The laser tomography technique has been developed for simultaneous measurement of temperature and species concentration in reacting flows. Laser tomography is a multiangular absorption technique which involves making absorption measurements along M parallel rays at N equally spaced angles. These MxN measurements are then used to reconstruct the spatially resolved two-dimensional property field. Results of a simulation study are presented for a methane/air diffusion flame. Two techniques, a two-line ratio and a spectral line profile technique, have been used to obtain the temperature and OH concentration and temperature fields can be reconstructed with a resolution of better than 1%. Sensitivity of the technique to the choice of particular spectral lines, and the effect of large temperature gradients are also discussed.

706,632
PB86-122983 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermal Processes Div.
Laser Tomography for Temperature Measurements in Flames.
Final rept.
H. G. Semerjian, R. J. Santoro, P. J. Emmerman, and R. Goulard. 1982, 11p
Sponsored by American Inst. of Physics, New York, and Instrument Society of America, Pittsburgh, PA.
Pub. in Proceedings of International Symposium on Temperature: Its Measurement and Control in Science and Industry (6th), Washington, DC., March 15, 1982, v5 pt1 p649-659.

Keywords: *Absorption spectra, *Flames, *Fuel air ratio, Methane, Temperature, Concentration(Composition), *Laser spectroscopy, *Tomography.

The laser tomography technique has been used for composition measurements in a laminar methane/air diffusion flame. A simulation study has also been carried out to extend the technique for simultaneous temperature and composition measurements using two-line absorption and tomographic reconstruction techniques. Laser tomography is a multiangular absorption technique which involves making M line-of-sight absorption measurements (projections) at N angles. These MxN measurements are then used to reconstruct the original two dimensional property field. These studies have demonstrated the feasibility of extending the laser tomography technique for simultaneous temperature and concentration measurements in nonuniform and nonsymmetric flow fields.

706,633
PB86-153772 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Acrylonitrile-Butadiene-Styrene Copolymers (ABS): Pyrolysis and Combustion Products and Their Toxicity - A Review of the Literature.
J. V. Rutkowski, and B. C. Levin. Dec 85, 60p NBSIR-85/3248
Sponsored by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *ABS resins, *Pyrolysis, *Combustion products, *Toxicity, *Carbon monoxide, *Hydrogen cyanide, Reviews, Plastics, Copolymers, Exposure, Polymers, Flammability testing, Oxidation, Households, Aircraft, Automobiles, Public health, Air pollution, Chemical properties, Chemical analysis, Laboratory equipment, *Indoor air pollution, *Toxic substances, Consumer products.

A review of the literature was undertaken to ascertain the current knowledge of the nature of the thermal decomposition products generated from ABS and the toxicity of these evolved products into. The literature review encompasses English language publications available through June 1984. This literature surveyed showed that the principal ABS thermooxidative degradation products of toxicologic importance are carbon monoxide and hydrogen cyanide. The experimental generation of these and other volatile products is principally dependent upon the combustion conditions and the formulation of the plastic. The toxicity of ABS thermal degradation products has been evaluated by five methods. The toxicity of ABS degradation products was found to be comparable to the toxicity of the thermal decomposition products of other common polymeric materials.

706,634
PB86-166196 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Naval Fire Fighting Trainers: Effect of Ventilation on Fire Environment (Model Calculations for 19F3 FFT).
B. J. McCaffrey, J. A. Rockett, and R. S. Levine. Dec 85, 32p NBSIR-85/3238
Sponsored by Naval Training Equipment Center, Orlando, FL.

Keywords: *Entrainment, Fires, Models, Safety, Plumes, Simulation, Ventilation, *Fire models.

The Harvard 5.2 Mathematical Fire Growth Model was used to calculate required ventilation rates for two simulated fire scenarios in the Navy 19F3 trainer. These calculations were performed for design purposes to insure that the hot gas layer temperature in the trainer would be acceptable and that the oxygen content of

the gas would be above 18%. Wall temperatures were also calculated.

706,635
PB86-166592 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Program for the Development of a Benchmark Compartment Fire Model Computer Code.
L. Y. Cooper, J. A. Rockett, H. E. Mitler, and D. W. Stroup. Oct 85, 30p NBSIR-85/3252

Keywords: *Fires, *Fire safety, Fire tests, *Compartment fires, Fire models, Fire studies, Computer codes.

With a variety of objectives in mind, many different compartment fire model computer codes have been developed within the fire safety/research community. Yet, no one of these can be described as being a 'benchmark' model in the sense that it is reliable enough to be accepted as a standard of reference for the performance of design-oriented fire models. It is the major objective of the Compartment Fire Modeling Research (CFMR) Group in the Fire Safety Technology Division of the Center for Fire Research (CFR) to develop such a Benchmark Compartment Fire Model (BCFM) computer code. This paper describes the characteristics of this BCFM, and outlines the program which will lead to its development.

706,636
PB86-166659 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Forced Smolder Propagation and the Transition to Flaming in Cellulosic Insulation.
Final rept.
T. J. Ohlemiller. Oct 85, 50p NBSIR-85/3212
Sponsored by Department of Energy, Washington, DC.

Keywords: *Insulation, *Combustion, Cellulose, Fire resistant coatings, Flame propagation, Flammability testing, Smoldering.

It is well known that a smoldering fuel responds to an increased oxygen supply by becoming faster and hotter until, eventually, flames erupt. This sequence is examined quantitatively for thick horizontal layers of a permeable fuel, i.e., cellulosic insulation. Two configurations are possible, forward and reverse smolder; both are investigated experimentally. The influence of combustion retardants is also investigated; these include boric acid, a smolder retardant; and borax, a flaming retardant. Both prevent the transition to flaming in the absence of adjacent flammable material but are less effective in its presence. The overall response of these various fuel mixtures and configurations suggests that both kinetics and oxygen supply rate (not the latter alone) play substantial roles in dictating smolder response to an air flow.

706,637
PB86-166667 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Survey of Alternate Stored Chemical Energy Reactions.
Annual rept. 25 May 84-25 May 85.
L. P. Cook, and E. R. Plante. Dec 85, 107p NBSIR-85/3282
Contracts N00014-83-F-0117, N00014-84-F-0204
Sponsored by Office of Naval Research, Arlington, VA.

Keywords: *Liquid metals, *Combustion, Reaction kinetics, Enthalpy, Oxidation, Lithium, Aluminum, Boron, Beryllium, Magnesium, Nitrogen fluorides.

A survey of eight alternative liquid metal stored chemical energy reactions has been made for purposes of comparison with the lithium-aluminum/water, lithium/sulfur hexafluoride, and other reaction schemes. The objective of the study was to survey the potential of these eight reactions as alternate stored chemical energy systems and to develop priorities for future study. Experimental data on the products of reaction and kinetics of reaction are presented for: (Li/H2O; H2/O2), (Li/H2O; NaO2/H2O; H2/O2), (MgAl/H2O; H2/O2), and (LiAl/ClO3F). These data have been collected using thermogravimetry and Knudsen effusion mass spectrometry, with x-ray diffraction analysis of experimental products. Among other results, the data show that the aluminum component of the fuels is relatively inert to oxidation up to 650 degrees C. Above this temperature, materials limitations have hampered the collection of experimental data. Thermodynamic analysis has been used to extend the data on each of the eight reaction schemes, and to predict the chemical reaction which best represents the complete oxidation of each fuel by the indicated oxidant at 1100 K. Enthalpies have been calculated for each fuel/oxidant combination. Safety considerations are also discussed for each.

706,638
PB86-170719 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Preliminary Analysis of Oil-Slick Combustion.
Final rept.
I. S. Wichman. Nov 85, 20p NBSIR-85/3266
Sponsored by Minerals Management Service, Reston, VA.

Keywords: *Combustion, Ignition, Oil spills, Burning rate, *Oil slicks.

The preliminary study of oil-slick combustion contains a literature review, a formulation of a physical model of oil-slick burning, and some suggested experiments. The theoretical model is divided into three stages: (1) an ignition and acceleratory-growth stage; (2) a slow-down regime, in which finite slick thickness effects become important; and (3) an extinction cycle. The proposed experiments emphasize the use of the Fire Research Laboratory, located on the NBS grounds.

706,639
PB86-171089 PC **A04**/MF **A01**
Case Western Reserve Univ., Cleveland, OH. Dept. of Mechanical and Aerospace Engineering.
Rate Constants for Polymethyletacrylate Diffusion Flame Using a Semi-Global Reaction Model.
Final rept.
N. A. Messaoudene, and J. S. Tien. Feb 86, 59p NBS/GCR-86/508
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Combustion, *Diffusion flames, Polymethyl methacrylate, Reaction kinetics, Extinction.

A numerical study of the combustion and extinction in the stagnaion point boundary layer of a condunsed fuel (PMMA) has been performed using a three-step semi-global reactions model. In the first step considered, fuel is oxidized to form carbon monoxide and water vapor. In the second, carbon monoxide is oxidized to form carbon dioxide, and in the third reaction, carbon dioxide decomposes into carbon monoixde and oxygen, which is the reverse of the second reaction. The governing equations were transformed into a set of ordinary differential equations through a similarity variable. Fictitions unsteady terms were added to the ordinary differential equations and the resulting equations were solved numerically using an explicit scheme for the fictitions unsteady terms. Use has been made of Howard, et. al., kinetics constants for the forward reaction of CO (second reaction), and constants calculated from equilibrium considerations for the backward reaction (third reaction). Comparing the extinction results with experimental data, good agreement was found for B sub F = 4.43 x 10 to the 13th power cu ml/gmole.sec. and E sub F = 32000 cal/mole, which are respectively the preexponential factor and the activation energy for the rate of the first reaction.

706,640
PB86-171170 PC **A08**/MF **A01**
Case Western Reserve Univ., Cleveland, OH. Dept. of Mechanical and Aerospace Engineering.
Diffusion Flame Stabilization at the Leading Edge of a Fuel Plate.
Final rept.
C. H. Chen, and J. S. Tien. Feb 86, 173p NBS/GCR-86/509
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Combustion, *Diffusion flames, Computer programs, Stability, Computerized simulation.

A theoretical model of a laminar diffusion flame at the leading edge of a fuel plate in a forced convective flow is presented and solved numerically to study the flame stabilization and blowoff phenomena. The system of governing equations consists of the two-dimensional Navier-Stokes' momentum, energy and species equations with a one-step overall chemical reaction and second-order, finite rate Arrhenius kinetics. The computation is performed over a wide range of Damkohler numbers. For large Damkohler numbers, envelope flames are found to exist where the computed fuel evaporation rate, the flame stand-off distance and the velocity profiles show certain similitude. As Damkohler number is lowered, a transition to open-tip flame takes place where the flame becomes stabilized on the sides of the fuel plate. Further decreasing of the Damkohler number pushes the diffusion flame downstream out of the leading edge region. In the paper, the flame structures of the envelope and the open-tip flames are presented together with a description of the transition sequence. The implication of the work to downstream boundary layer combustion is also discussed.

706,641
PB86-182813 PC **A03**/MF **A01**
Case Western Reserve Univ., Cleveland, OH. Dept. of Mechanical and Aerospace Engineering.
Effect of Convective Velocity on Upward and Downward Burning Limits of PMMA (Polymethylmethacrylate) Rods.
Final rept.
Y. Halli, and J. S. T'ien. Feb 86, 42p NBS/GCR-86/507
Grant NANB-D0013
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Burning rate, *Combustion physics, *Polymethyl methacrylate, Oxygen, Velocity, Flames.

Limiting oxygen mole fractions for 1.27 centimeter PMMA rods in upward and downward self-sustained burnings are measured as a function of the oxygen/nitrogen mixture flow velocity. For downward burning, the limiting oxygen mole fractions are found to be essentially independent on the flow velocity in the range between 5 to 40 cm/sec and increases when velocity is greater than 40 cm/sec. In the upward burning configuration, a stronger and non-monotonic velocity dependence is discovered. The limiting oxygen percentage reaches a minimum at a velocity of 12 cm/sec and increases in both directions as the mixture velocity increases or decreases. The minimum limiting oxygen mole fractions are, for the downward case, 0.184 and for the upward case, 0.15. Upward flame propagation limits in the presence of a small pilot flame have also been determined for PMMA rod. It is demonstrated that flames can propagate in an environment with an oxygen mole fraction lower than its critical extinction value for self-sustained flames.

706,642
PB86-183548 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Smoldering Combustion.
T. J. Ohlemiller. Feb 86, 33p NBSIR-85/3294

Keywords: *Combustion, Cellulose, Toxicity, Fire safety, Fire hazards, *Smoldering.

Smoldering combustion is a common fire safety hazard that contributes substantially to the fire losses in the United States; fire protection engineers thus have a need to be familiar with its characteristics. The post-initiation behavior of smoldering (self-sustaining propagation and transition to flaming) is described here. The most studied cases of propagation are one-dimensional; the underlying mechanisms are described qualitatively and spread rates for several materials are presented along with limited information on toxic gas evolution.

706,643
PB86-189677 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Validation of Network Models for Smoke Control Analysis.
Final rept.
J. H. Klote, and X. Bodart. 1985, 7p
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions 91, n2 pt2 p1134-1145 1985.

Keywords: *Smoke, Buildings, Air flow, Simulation, Reprints, *Smoke control.

Currently there are many buildings with systems intended to control smoke movement in building fire situations. Network computer models have been developed to analyze these systems for research and design purposes. The paper presents a general description of such models, a discussion of validation techniques used to check the computer algorithms,

and the results of full scale tests conducted in a pressurized stairwell at Champs Sur Marne, France to validate the basic assumptions of these computer models.

706,644
PB86-189883 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Nylons: A Review of the Literature on Products of Combustion and Toxicity.
E. Braun, and B. C. Levin. Feb 86, 89p NBSIR-85/3280
Sponsored by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Polyamide resins, *Nylon 6, *Combustion products, *Toxicity, Pyrolysis, Reviews, Laboratory animals.

The English literature through 1984 on polyamides was reviewed to determine the nature of the combustion products and their toxicity. The review was limited to aliphatic polyamides normally called nylon and excludes aromatic polyamides such as Nomex and bicomponent polymers. Typical pyrolysis products from a broad range of nylons do not appear to differ greatly. Many of the decomposition products detected in vacuum pyrolysis experiments appear as products of thermal degradation in inert and air atmospheres. In air, a general reduction in the quantities of heavier hydrocarbons is noted along with an increase in the production of CO, CO2, H2O, NH3, HCN, and NOx. The toxicity of the thermal degradation products from various types of nylon has been evaluated by nine different protocols. Reported LC50 values range from 10.8 mg/l to 61.9 mg/l. Dyes apparently do not affect the materials' combustion products toxicity, but an increase in the amount of backcoating on a nylon fabric increase toxicity. Time to death measurements show that volatile products from nylons are less toxic than those from rayons or cotton, while the blending of wool with nylon greatly increase the toxicity of the thermal decomposition products. In general, however, the overall toxicity of the thermal degradation products from nylon do not appear to be greatly different than those from many other polymeric materials.

706,645
PB86-195815 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Modeling of Smoldering Combustion Propagation.
Final rept.
T. J. Ohlemiller. 1985, 34p
See also PB84-236389.
Pub. in Progress in Energy and Combustion Science 11, p277-310 1985.

Keywords: *Combustion, *Cellulosic resins, Fire hazards, Reprints, *Smoldering, Polyurethanes.

Smoldering combustion of various natural and synthetic solid materials constitutes a substantial fire hazard; the process itself produces copious toxic gases and it can lead to flaming combustion. The review focuses on the coupled chemical and physical processes involved in self-sustained propagation of smoldering. The potential heat sources (gas-phase oxidation, oxidative polymer degradation char oxidation) are examined along with the heat sinks (polymer pyrolysis, water vaporization). It is concluded that even for the most-studied case of cellulose, the chemical mechanisms involved in these processes are both too complex and too poorly understood to be included in a smolder propagation model.

706,646
PB86-202074 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Overview of Dioxin Formation in Gas and Solid Phases Under Municipal Incinerator Conditions.
Final rept.
W. M. Shaub, and W. Tsang. 1983, 2p
Sponsored by American Chemical Society, Washington, DC.
Pub. in Proceedings of the National Meeting, American Chemical Society, Division of Environmental Chemistry (186th), Washington, DC, August 28-September 2, 1983, v23 n2 p267-268.

Keywords: *Incinerators, Combustion, Fly ash, Gases, Oxygen heterocyclic compounds, Chlorine organic compounds, *Dioxin(Herbicides), Solid wastes, Dibenzodioxin/tetrachloro.

Mechanisms for the formation of dioxins during incineration via gas and gas-fly ash interactions are presented and discussed. On the basis of simplifying assumptions analytical expressions which relate dioxin formation with elementary reactions are derived. A previous conclusion regarding the inability of the former to account for reported emissions from municipal incinerators is reinforced. For the latter, experimental observations are used to derive relevant rate parameters. While these do not appear to be unreasonable, direct experimental verification is required.

706,647
PB86-204617 PC **A06**/MF **A01**
Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
Structure of Adiabatic Wall Plumes.
M. C. Lai, and G. M. Faeth. Nov 85, 106p NBS/GCR-86/503
Grant NANB-4D0032
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Plumes, Turbulence, Buoyancy, Velocity measurement, Walls, Cross correlation.

A theoretical and experimental study of turbulent buoyancy plumes along plane surfaces is described. These flows are of interest since their hydrodynamic properties are similar to wall fires and they can be studied without complications due to combustion and radiation. Wall plumes were generated by carbon dioxide/air mixtures flowing from a slot at the top of the wall (since the flows were negatively buoyant). The following measurements were made; mean and fluctuating velocities and Reynolds stresses, using laser Doppler anemometry (LDA); mean and fluctuating concentrations, using laser-induced fluorescence (LIF); and velocity/concentration correlations, using combined LDA/LIF. The flows were also analyzed using a mixing-length model and a k-epsilon-g turbulence model (both ignoring buoyancy/turbulence interactions). Buoyancy/turbulence interactions were significant in the present flows; therefore while predictions of mean properties were reasonably good, turbulence quantities were underestimated.

706,648
PB86-215159 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Buoyancy Driven Flow as the Forcing Function of Smoke Transport Models.
Final rept.
W. W. Jones, and X. Bodart. May 86, 27p NBSIR-86/3329

Keywords: *Smoke, Flow distribution, Buoyancy, Numerical analysis, *Fire models.

Flow at vents is the major driving force in smoke transport models. The precision with which we can calculate these flows determines to a great extent how accurately we can model buoyant flow and the inherent speed of the models. This report describes some of the problems encountered in calculating these flows, and gives a general algorithm for their calculation.

706,649
PB86-230943 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Buoyant Source in the Lower of Two, Homogeneous, Stably Stratified Layers.
Final rept.
L. Y. Cooper. 1984, 7p
Sponsored by Department of Health and Human Services, Washington, DC., Federal Aviation Administration, Washington, DC., and Department of the Interior, Washington, DC.
Pub. in Proceedings of International Symposium on Combustion (20th), Ann Arbor, MI., p1567-1573 1984.

Keywords: *Buoyancy, *Plumes, *Fires, Layers, Heat transfer, Turbulent flow.

A point source of buoyancy is located at a specified elevation within the lower of two, homogeneous, stably stratified layers. A turbulent buoyant plume is formed above the source, and it impinges on the layers' interface. Derives and solves a set of model equations for these plume-interface interactions, and the results are applied to a generic heat transfer problem related to fires in enclosures.

706,650
PB86-232410 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Development of an Automated Probe Positioner for Measurements in Fire-Generated Plumes and Ceiling Jets.
D. W. Stroup. May 86, 46p NBSIR-86/3379

Keywords: *Probes, *Plumes, Temperature measurement, Gas burners, Measurement, Velocity, *Ceiling jets.

The report describes the development of an automated probe positioner. The system has been used for extensive measurements of temperatures at a large number of positions within a laboratory-scale fire-flow experimental apparatus. In its present configuration, the device is designed to operate within a 1.22 m diameter cylindrical enclosure. The apparatus has horizontal, vertical, and rotational motion capabilities. A single microcomputer is used to control probe positioning, perform data-taking, and evaluate statistical results. These statistical results are used by the system to determine the number of data points to record at a given position.

706,651
PB87-110029 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Chemical Kinetic Data Base for Combustion Chemistry. Part 1. Methane and Related Compounds.
W. Tsang, and R. F. Hampson. c1986, 190p
Included in Jnl. of Physical and Chemical Reference Data, v15 n3 p1087-1289 1986. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Methane, *Combustion, Chemical reactions, Thermodynamic properties, Oxidation, Pyrolysis, Transport properties, Aromatic hydrocarbons, Aliphatic hydrocarbons, Chemical reaction kinetics.

The document contains evaluated data on the kinetics and thermodynamic properties of species that are of importance in methane pyrolysis and combustion. Specifically, the substances considered include H, H2, O, O2, OH, HO2, H2O2, H2O, CH4, C2H6, HCHO, CO2, CO, HCO, CH3, C2H5, C2H4, C2H3, C2H, CH3CO, CH3O2, CH3O, singlet CH2, and triplet CH2. All possible reactions are considered. In arriving at recommended values, first preference is given to experimental measurements. Where data do not exist, a best possible estimate is given. In making extrapolations, extensive use is made of RRKM calculations for the pressure dependence of unimolecular processes and the BEBO method for hydrogen transfer reactions. In the total absence of data, recourse is made to the principle of detailed balancing, thermokinetic estimates, or comparisons with analogous reactions. The temperature range covered is 300-2500 K and the density range 1 x 10 raised to the 16th power - 1 x 10 raised to the 21st power molecules/cc. This data base forms a subset of the chemical kinetic data base for all combustion chemistry processes.

706,652
PB87-121349
(Order as PB87-121315, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Multi-kilogram Capacity Calorimeter for Heterogeneous Materials.
K. L. Churney, A. E. Ledford, M. L. Reilly, and E. S. Domalski. 24 Apr 86, 22p
Included in Jnl. of Research of the National Bureau of Standards, v91 n5 p277-298 Sep-Oct 86.

Keywords: *Enthalpy, *Combustion, *Calorimeters, Thermodynamic properties, *Solid wastes.

A large capacity calorimeter was designed and constructed in order to determine the enthalpies of combustion of kilogram-size samples of municipal solid waste (MSW) in flowing oxygen near atmospheric pressure. The combustion of the organic fraction of the samples was complete to greater than 99.9+%. The percent coefficient of variation (100 X standard deviation/average), % CV, of calibration measurements using microcrystalline cellulose was 0.2%. The % CV of the measurements of the enthalpy of combustion of a processed MSW sample was 0.4%. The combined systematic errors due to departure from usual design

standards and conventional operating procedures is estimated to be less than 0.4% of the calorific value.

706,653
PB87-122800 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Ignition and Combustion Temperatures Determined by Laser Heating.
Final rept.
J. W. Bransford. 1985, 20p
Contract NASA-H-43201(B)
Sponsored by National Aeronautics and Space Administration, Huntsville, AL. George C. Marshall Space Flight Center.
Pub. in Flammability and Sensitivity of Materials in Oxygen-Enriched Atmospheres: Second Volume, ASTM STP 910, p78-97 1985.

Keywords: *Ignition, *Combustion, Aluminum alloys, Nickel alloys, Stainless steels, Reprints, Laser-radiation heating, Steel S30200, Nickel alloy N07718, Nickel alloy N04400, Aluminum alloy A96061.

A laser heating technique and facility have been developed to study metal ignition and combustion in high-pressure oxygen. The ignition and combustion temperatures, estimates of oxidation rates, and ignition and combustion morphology can be determined. This facility and the laser heating techniques are described. Examples of the type of data obtained are presented and discussed. The ignition temperature curves for an aluminum alloy-Unified Numbering System (UNS) A96061, a stainless steel-UNS S30200, and two nickel alloys-UNS N07718 and N04400 are given.

706,654
PB87-123196 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Ignitability Measurements with the Cone Calorimeter.
V. Babrauskas, and W. J. Parker. Sep 86, 50p NBSIR-86/3445

Keywords: *Calorimeters, *Ignition, Heat measurement, Combustion, Flammability, Plastics, Particle boards.

The Cone Calorimeter is a new-generation instrument developed primarily for making rate of heat release measurements. The instrument, containing a uniform and well-characterized irradiance source, was also seen to be useful for making measurements of radiant ignition on materials. Data have now been collected for a wide range of materials. The effects of various apparatus dependencies are discussed. Also, some comparative data are available illustrating the performance of similar materials in other apparatuses. Finally, for a selected material, Douglas fir particle board, a detailed comparison with an ignition model has been made.

706,655
PB87-128005 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Upward Turbulent Flame Spread.
Final rept.
K. Saito, J. Quintiere, and F. A. Williams. 1986, 12p
Pub. in Proceedings of International Symposium on Fire Safety Science (1st), Gaithersburg, MD., October 7-11, 1985, p75-86 1986.

Keywords: *Flames, *Combustion, Polymethyl methacrylate, Wood particle boards, Fire tests, Time dependence.

Mechanisms and rates of upward spread of turbulent flames along thermally thick vertical sheets are considered for both noncharring and charring fuels. By addressing the time dependence of the rate of mass loss of the burning face of a charring fuel, a linear integral equation of the Volterra type is derived for the spread rate. Measurements of spread rates, of flame heights and of surface temperature histories are reported for polymethylmethacrylate and for Douglas-fir particle board for flames initiated and supported by a line-source gas burner, with various rates of heat release, located at the base of the fuel face. Sustained spread occurs for the synthetic polymer and not for the wood. Comparisons of measurements with theory aid in estimating characteristic parameters for the fuels.

706,656
PB87-131496 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Optical Tomography in Combustion.
Final rept.
R. Goulard, and S. R. Ray. 1985, 21p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Advances in Remote Sensing Retrieval Methods, p71-91 1985.

Keywords: *Combustion, Absorption, Chemical analysis, Tomagraphy, Diagnostic techniques.

The principles of tomography, or multiangular measurements, have only recently been implemented using visible light. Tomographic absorption measurements, in particular, have a number of advantages over optical point measurement techniques. In addition to the evident potential for rapid two or three dimensional imaging with high temporal and spatial resolution, the technique is also attractive in terms of the signal to noise ratio, due to multiple measurements of any single space element. A brief treatment shows the influence of redundancy, background and Poisson statistics on the overall signal to noise ratio as compared to point scattering techniques. Experimental work on the development of a high speed optical tomography system is presented, demonstrating the capability to measure the two dimensional distribution of temperature and OH concentration in a premixed methane flame within five milliseconds.

706,657
PB87-140190 PC **A04**/MF **A01**
California Univ., Berkeley. Dept. of Mechanical Engineering.
Fire Propagation in Concurrent Flows.
Final rept. 1 Aug 85-31 Jul 86.
A. C. Fernandez-Pello. Nov 86, 66p NBS/GCR-86/518
Contract NB83-NADA-4020
See also PB86-181849. Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Flame propagation, *Fire tests, Combustion, Numerical analysis, Gas flow, Ignition, Diffusion flames, *Flame spread.

A research program is being carried out to study the mechanisms controlling the spread of fire in a concurrent gas flow. Research performed includes a numerical analysis of the flow assisted spread of flames over the surface of a thermally thick fuel, an experimental study of the extinction and stabilization of a diffusion flame over a flat combustible surface, and a theoretical study of the forced ignition of a vaporizing combustible surface. The flow assisted flame spread analysis incorporates finite rate kinetics in the formulation of the problem. This provides a more accurate description of the regions with slow chemistry such as the upstream leading edge of the flame and the flame tip. The flame extinction experiments compliment a previously developed numerical analysis of the problem. The study addresses the process controlling the structure and stabilization of the upstream leading edge of the flame. The ignition study has as final objective the description of the ignition by a hot particle (firebrand), or by gas absorption of radiation, of a vaporizing surface in a convective flow. During this period, a one-dimensional model of ignition has been developed.

706,658
PB87-140240 PC **A04**/MF **A01**
Factory Mutual Research Corp., Norwood, MA.
Prediction of Fire Properties of Materials. Part 1. Aliphatic and Aromatic Hydrocarbons and Related Polymers.
Technical rept.
A. Tewarson. Dec 86, 61p NBS/GCR-86/521
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Combustion, Aliphatic hydrocarbons, Aromatic hydrocarbons, Combustion products, Polymers, Flammability testing.

Combustion behavior of 82 aliphatic and aromatic hydrocarbons and related polymers has been examined for application to fire models. Quantitative predictions have been made for the following fire properties; combustion efficiency and its convective and radiative components; fraction of unconsumed hydrocarbon and polymer vapors present as hydrocarbons; and generation efficiencies of CO2, CO, particulates and mixture of unidentified carbon compounds.

706,659
PB87-140257 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Time-Dependent Simulation of Small-Scale Turbulent Mixing and Reaction.
Annual rept. Nov 84-Nov 85.
H. R. Baum, R. G. Rehm, D. M. Corley, and D. W. Lozier. Feb 86, 43p NBSIR-86/3334
Contract AFOSR-ISSA-85-0026
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.

Keywords: *Combustion, Mathematical models, Chemical reactions, Diffusion, Convection.

A mathematical model of the local transient diffusion-controlled reaction between initially unmixed species is presented. It is intended ultimately as a computational 'molecule' to be imbedded in direct simulations of larger scale reacting flows. The model consists of an interacting three-dimensional strain vortex field which exactly satisfies the Navier-Stokes equation, an analytically determined Lagrangian representation of the mixing process and convection-diffusion equations for the reacting species in Lagrangian coordinates. The length scale established by the stretching of the vorticity field is shown to be directly relatable to the Kolmogoroff scale if the local strain rate has a scale consistent with laminar boundary layer mixing. An analytical solution to the convection-diffusion equation governing the diffusion-controlled reaction is derived. The solution is valid for large Schmidt number and describes the evolution of any initially two-dimensional configuration of reactants. A special two-dimensional case of this model, in which vortex strain is excluded and fuel and oxidizer initially occupy adjacent half-spaces, is also analyzed.

706,660
PB87-150710 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
New Concepts for Measuring Flame Spread Properties,
J. G. Quintiere, and M. Harkleroad. 1985, 29p
See also report dated Nov 84, PB85-133973. Sponsored by Federal Aviation Administration Technical Center, Atlantic City, NJ.
Pub. in American Society for Testing and Materials, Special Technical Publication 882, p239-267 1985.

Keywords: *Flame propagation, *Ignition, *Materials tests, *Fire tests, Experimental design, Composite materials, Plastics, Wood, Carpets, Reprints.

An experimental procedure is described which can be used to derive data relevant to the prediction of ignition and flame spread on materials. The apparatus utilizes a radiant heat source capable of supplying up to 6.5 W/sq cm to a vertically oriented specimen. The test results pertain to piloted ignition of a vertical sample under constant and uniform irradiation, and to lateral flame spread on a vertical surface due to an external applied radiant heat flux. The results can be used to display the maximum velocity and ignition time as a function of irradiance. Critical or minimum irradiances for spread and ignition are determined. Further analyses of the data yield effective values for the thermal inertia of the material (k rho c), its ignition temperature, and a parameter related to flame temperature. These parameters appear to be phenomenological constants for each material, rather than factors dependent on the apparatus. Results are presented for a wide range of materials. Suggestions for extending the results to other flame spread conditions are presented.

706,661
PB87-156519 PC **A03**/MF **A01**
Brown Univ., Providence, RI. Div. of Engineering.
Study of the Effects of Oxygen Transport and Temperature History of the Chemistry of PMMA Pyrolysis.
Annual rept. 1985-86,
E. M. Suuberg, V. Dalal, and T. Kelly. Dec 86, 47p NBS/GCR-87/523
Grant NANB-400036
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Pyrolysis, *Polymethyl methacrylate, *Thermal degradation, Thermoplastic resins, Oxygen, Combustion.

Thermal degradation and thermal oxidative degradation of commercially available poly(methyl methacrylate) were studied at heating rates of 5, 100, and 1000 K/min. Sample residue weights and molecular weights were measured during the degradation. Results indicate that previously obtained kinetic parameters from low heating rates (0.5-5 K/min.) in inert gas agree with the results obtained from the high heating rate experiments. The effects of oxygen on degradation diminishes with higher heating rate.

706,662
PB87-161808 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Direct Measurement of Char-Particle Temperatures in Fluidized-Bed Combustors.
Final rept.,
A. Macek, and C. Bulik. 1984, 8p
Pub. in Proceedings of International Symposium on Combustion (20th), Ann Arbor, MI, August 12-17, 1984, p1223-1230.

Keywords: *Combustion, *Fluidized bed processors, Combustion chambers, Coal.

A new technique is described, allowing direct in situ measurement of temperatures of burning coal-char particles in the interior of fluidized-bed combustors. A prerequisite of the technique was the development of uncooled optic guides capable of withstanding the harsh environment of fluidized combustors, and the demonstration of their capability to transmit continuous, time-resolved quantitatively measurable optical information to the outside for analysis by a two-channel recording systems. Radiometric records, obtained from the interior of a fluidized-bed reactor containing a low concentration of coal particles, consist of d.c. signals, corresponding to temperatures of inert bed particles, with transient excursions due to burning particles. The records not tractable by simple ratio pyrometry, were analyzed by a method based on the assumption of two temperature levels.

706,663
PB87-162269 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Soot Formation in Diffusion Flames: Flow Rate, Fuel Species and Temperature Effects.
Final rept.,
R. J. Santoro, and H. G. Semerjian. 1984, 10p
Pub. in Proceedings of the International Symposium on Combustion (20th), Ann Arbor, MI., August 12-17, 1984, p997-1006.

Keywords: *Combustion, *Soot, Combustion products, Aerosols, Methane, Ethane, Ethylene, Flow rate, Diffusion flames.

A detailed study of soot particle formation in diffusion flames has been made for a series of laminar diffusion flames using a laser scattering/extinction technique. The effects of flow rate, fuel species and temperature on the evolution of the soot particle field have been investigated for methane, ethane and ethene diffusion flames. Temperature effects have been examined through nitrogen dilution of the fuel. In the studies of flow rate, fuel species and temperature variations, it has been observed that effects in the annular region of the flame, where particles first appear, control the general features of the particle field in these flames. For flow rate variations, the maximum particle size observed in the flame remains nearly constant while the soot volume fraction increases slightly with increased flow rate. Thus, particle number concentration appears to be the quantity sensitive to the flow rate variation.

706,664
PB87-165577 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Some Observations on the Shape of Impinging Diffusion Flames,
M. A. Kokkala, and W. J. Rinkinen. Jan 87, 25p NBSIR-87/3505
Prepared in cooperation with Valtion Teknillinen Tutkimuskeskus, Espoo (Finland).

Keywords: *Diffusion flames, shape, Propane, Natural gas, Flammable gases.

The structure of impinging diffusion flames of propane and natural gas is described. In these experiments, a burner with a diameter of 64 mm was used. The spacing between the burner surface and the horizontal ceiling was varied in the range of 15 mm - 100 mm and the nominal heat release rate in the range of 2.9 kW - 11 kW. New kinds of regular flame shapes were observed: complete rings, broken rings, laminar disc, daisy flower, cellular daisy flower. Color photographs of the various flame shapes are presented. Combustion processes causing the instabilities are discussed qualitatively, and the differences between propane and natural gas flames are identified.

706,665
PB87-179222 PC **A07**/MF **A01**
California Univ., Berkeley. Dept. of Mechanical Engineering.
Perturbed Boundary Layer Diffusion Flames,
J. A. Ang. Mar 87, 138p NBS/GCR-87/526
Grant NANB5-D0552
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Diffusion flames, *Combustion, Boundary layers.

Thermal cracking is shown to have a significant effect on the temperature profiles in a boundary layer diffusion flame. In the study, measurements of temperature profiles in a sooting free flow flame are compared with classic flame sheet model results. This comparison reveals a large over prediction of temperatures in the region between the fuel surface and the flame. The principle cause of this overprediction is the neglect of thermal cracking in the flame sheet model. A second possible cause for the temperature overprediction is the sink effect of radiative heat transfer from soot in the boundary layer. This effect and the effects of wall emission and normal buoyancy on a horizontal boundary layer diffusion flame are studied by perturbing the cracking sheet solution. The principle effect of soot radiation is an increased blowing rate at the wall. This blowing is offset by the radiation wall emission. The postulated sink effect of soot emission is negligible. The major buoyancy effect is primarily the inducement of a velocity overshoot.

706,666
PB87-191060 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Structural Analysis of Soot Agglomerates.
Final rept.,
R. J. Samson, G. W. Mulholland, and J. W. Gentry. 1987, 10p
Pub. in Langmuir 3, n2 p272-281 1987.

Keywords: *Structural analysis, *Soot, *Agglomerates, Combustion, Acetylene, Reprints.

The structure of soot agglomerates formed by the combustion of acetylene in a coannular diffusion burner is studied. Structural data from electron micrographs were obtained by two methods, particle counting with the aid of stereopairs for small clusters and electronic digitization with high-resolution image processing, used for the larger agglomerates. Langevin dynamics computer simulations based on free molecular motion were performed as an aid to interpreting the experimental results. Small agglomerates (with overall size < 1.0 micrometer were found to have a fractal dimension of 1.5-1.6 compared to about 1.9 obtained by computer simulations. The power law exponent for the pair correlation function obtained over a limited range in r was found to be consistent with the value obtained by computer simulations for agglomerates in the 5-12 micrometers range but somewhat greater for the agglomerates larger than 12 micrometers. From the simulations it appears that the range of power law behavior for the pair correlation function based on the projected images is less than the range for the pair correlation function based on three-dimensional (3-D) structure.

706,667
PB87-197943 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
ASET-B: A Room Fire Program for Personal Computers.
Final rept.,
W. D. Walton. 1985, 17p
See also PB85-198935, and PB85-153913.
Pub. in Fire Technology 21, n4 p293-309 Nov 85.

Keywords: *Fires, Flame propagation, Manuals, Evacuating(Transportation), BASIC(Programming language), Computer programs, Smoke, Reprints, ASET-B computer program, Room fires, Compartment fires.

ASET-B, a personal computer program for predicting the fire environment in a single room, is presented. ASET-B solves the same differential equations as the previously developed computer program, ASET (Available Safe Egress Time), using a simpler numerical technique. ASET-B requires as input the height and area of the room, the elevation of the fire above the floor, a heat loss factor, and a fire specified in terms of heat release rate. The program predicts the thickness and the temperature of the hot smoke layer as a function of time. ASET-B is written in BASIC and is not subject to copyright. The paper describes the program and its use. Included are a listing of the program, program variable name listing and a sample run. A discussion of user modifications also is given.

706,668
PB87-201802 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Cooling Effect of a Single Evaporating Droplet on a Hot Semi-Infinite Metal Body,
M. di Marzo, D. D. Evans, and A. K. Trehan. Apr 87, 30p NBSIR-87/3517
Sponsored by Maryland Univ., College Park. Computer Science Center.

Keywords: Evaporation, Fire fighting, Fuels, Mathematical models, Temperature distribution, Cooling, Thermal measurements, Surfaces, Solids, Aluminum, Thermal conductivity, *Spray cooling, *Droplets, *Solid fuels.

Transient cooling of solid surfaces by water droplet evaporation has been investigated through controlled experiments using a large heated aluminum cylinder. Quantitative prediction of droplet evaporation time and in-depth transient temperature distribution in the solid have been made. All data, regardless of the droplet volume or of the initial body surface temperature, lie within a narrow band about a straight line. This finding is the first important step to obtain a simple model for spray cooling based on local accurate description of the droplet-solid interactions. Modelling of spray cooling phenomena is the foundation for the construction of a thermal model for solid fuel fire extinguishment.

706,669
PB87-210266 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD.
Diffusion-Controlled Reaction in a Vortex Field.
Rept. for Sep 86-Sep 87,
R. G. Rehm, H. R. Baum, and D. W. Lozier. Jun 87, 40p NBSIR-87/3572
Contract AFOSR-155A-87-0018
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.

Keywords: *Turbulent flow, Chemical reactions, Fuels, Oxidizers, Graphs(Charts), Navier-Stokes equations, Models, *Fuel combustion, Turbulent mixing.

A two-dimensional model of a constant-density diffusion controlled reaction between unmixed species initially occupying adjacent half-spaces is formulated and analyzed. An axisymmetric viscous vortex field satisfying the Navier-Stokes equations winds up the interface between the species as they diffuse together and react. A flame-sheet approximation of the rapid reaction is made using Shvab-Zeldovich dependent variables. The model was originally proposed by F. Marble, who performed a local analysis and determined the total consumption rate along the flame sheet. The present paper describes a global similarity solution to the problem which is Fourier analyzed in a Lagrangian coordinate system. An asymptotic analysis of the Fourier amplitudes, valid for large Schmidt numbers is presented. The solution is evaluated numerically in Lagrangian and Eulerian coordinate systems. This problem has been studied as part of a more general model which has application to the description of turbulent combustion.

706,670
PB87-231320 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Simplified Characterization of Upholstered Furniture Heat Release Rates.
Final rept.,
V. Babrauskas, and W. D. Walton. 1986, 12p
Pub. in Fire Safety Jnl. 11, p181-192 1986.

Keywords: Chairs, Models, Reprints, *Fire engineering design, *Furniture calorimeters, Heat release, Sofas, Upholstered furniture.

The technology for measuring upholstered furniture heat release rates was established with the development of the furniture calorimeter. Analysis of a large number of tests in the furniture calorimeter has now demonstrated that for most specimens a good approximation to the rate of heat release as a function of time may take the form of a triangle. Methods of generating such curves, suitable for fire protection engineering hazard assessment purposes, have been developed.

706,671
PB87-233672 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Effects of External Radiant Flux and Ambient Oxygen Concentration on Nonflaming Gasification Rates and Evolved Products of White Pine.
Final rept.,
T. Kashiwagi, T. J. Ohlemiller, and K. Werner. 1987, 15p
Contract DE-AI01-76PR06010
Sponsored by Department of Energy, Washington, DC.
Pub. in Combustion and Flame 69, p331-345 1987.

Keywords: *Pine wood, *Thermal degradation, Carbon dioxide, Carbon monoxide, Gasification, Reprints, *Foreign technology.

Time-dependent gasification mass flux, sample temperatures, and evolved products (CO, CO2, H2O, and total hydrocarbons) of thermally thick white pine (approximately 3.8 cm cubes) were measured under the nonflaming condition at thermal radiant fluxes of 2.5-6.9 W/cm squared in three different atmospheres of N2, 10.5% O2/89.5% N2 and air. Results indicate that ambient oxygen significantly increases the gasification mass flux (for example, at 2.5 W/cm squared, the mass flux in air increases about three times over the mass flux in nitrogen), sample temperatures (surface temperature in air increases as much as 200 deg. C over that in nitrogen), and char depth, and changes the evolved products distribution (carbon dioxide yields in air are about 6-8 times larger than that in nitrogen and CO yields in air are about twice as large as that in nitrogen). Therefore, extreme care is needed to apply results obtained in an inert atmosphere to cases, such as ignition, flame spread, and smoldering, in which a wood sample is exposed to oxygen containing atmospheres.

706,672
PB87-233706 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Example Illustrating Slide Rule Estimates of Fire Growth.
Final rept.,
J. R. Lawson, and J. G. Quintiere. 1986, 9p
Pub. in Fire Technology 22, n1 p45-53 Feb 86.

Keywords: *Fire growth, Visibility, Smoke, Reprints, *Mass loss rate, *Heat release, *Radiant flux ventilation.

The exercise is designed to provide an example of the use of the predictive methods presented in the November 1985 issue of Fire Technology. It is intended as a hypothetical illustration and should not be construed as representative of the hazard associated with the particular items, materials and occupancy configuration selected. The first step in analyzing a fire scenario is to define the problem in terms of information required by the relevant predictive formula.

706,673
PB88-109889 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Research Publications, 1986,
N. H. Jason. Apr 87, 48p NBSIR-87/3555
See also report for 1985, PB86-203817.

Keywords: *Fires, *Bibliographies, Combustion, Smoke, Toxicity, Fire safety, Fire protection, Meetings, Soot, *Fire research.

'Fire Research Publications, 1986' is a supplement to previous editions; the last five editions are referenced below. Earlier edition information is available upon request: 1981 NBSIR 82-2499 PB82-220104; 1982 NBSIR 83-2706 PB83-238915; 1983 NBSIR 84-2871 PB84-217066; 1984 NBSIR 85-3153 PB85-208502; 1985 NBSIR 86-3372 PB86-208317. Only publications prepared by members of the Center for Fire Research (CFRO, by other National Bureau of Standards (NBS) personnel for CFR, or by external laboratories under contract or grant from the CFR are cited.

706,674
PB88-110044 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Mixing in Variable Density, Isothermal Turbulent Flows and Implications for Chemically Reacting Turbulent Flows,
W. M. Pitts, and T. Kashiwagi. May 87, 74p NBSIR-87/3550
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.

Keywords: *Turbulent flow, *Flames, *Jet mixing flow, Reynolds number, Flow visualization, Velocity measurement, Chemical reactivity.

The goal of the research was to improve the fundamental understanding of chemically reacting turbulent flow. The approach which was taken was to investigate mixing in variable density flows in order to better understand the role of local density fluctuations (which result from chemical heat release) on the turbulent mixing behavior. The development of new experimental diagnostics having excellent spatial and temporal resolution is described. These techniques have been utilized to investigate a wide range of mixing properties in variable density flows.

706,675
PB88-110317 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
FIREDOC Users Manual,
N. H. Jason. Sep 87, 40p NBSIR-87/3562

Keywords: *Fires, *Research management, *Data bases, Manuals, FIREDOC, FRIS (Fire Research Information Services), Bibliographic data base, On line systems.

FIREDOC is the on-line bibliographic database which reflects the holdings (published reports, articles, books, and audiovisual items) of the Fire Research Information Services (FRIS), at the Center for Fire Research, National Bureau of Standards. This manual provides a step-by-step technique for entering and exiting the database via telecommunication lines, as well as a number of techniques for searching the database and processing the results of the searches.

706,676
PB88-111810 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Users' Guide to FIRST (Fire Simulation Technique), a Comprehensive Single-Room Fire Model,
H. E. Mitler, and J. A. Rockett. Sep 87, 141p NBSIR-87/3595

Keywords: *Enclosures, *Fires, Computerized simulation, Mathematical models, Bench marks, User manuals(Computer programs), Computer programs, Compartment fire models.

The document is an instructional manual which will facilitate use of the computer program FIRST. (The name 'FIRST' is an acronym; it stands for FIRe Simulation Technique). This is a prototype of a 'benchmark' computer model of how a fire develops in a single compartment. Given a fire (or fires) ignited on one or more fuel sources, FIRST describes the principal phenomena which occur, such as the movement of gases in and out of the compartment, the growth of the fire(s), the development of a hot layer, etc. This guide is not meant to be documentation for the model, and so detailed descriptions of the physics or of the program structure have been kept to a minimum.

706,677
PB88-113709 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Some Performance Comparisons for a Fluid Dynamics Code,
D. W. Lozier, and R. G. Rehm. Sep 87, 20p NBSIR-87/3638

Keywords: *Computational fluid dynamics, *Fires, *Combustion, Data processing, Computer programs, Fortran, Minicomputers, *Supercomputers, Scientific data, Computer performance evaluation.

The 3D transient motion of a buoyancy-driven perfect gas in an enclosure is computed by a Fortran program (BF3D). A combustion model for eventual inclusion in the program is under development. BF3D changes slowly, has a long lifetime, and is run fairly infrequently. Typical runs have large storage and moderate CPU requirements. BF3D runs on large supercomputers but the newer mini-supercomputers appear to be suitable also and may be advantageous for ease of access and usage. Scientific workstations are convenient for development. Comparisons of BF3D on selected supercomputers, mini-supercomputers, scientific workstations and conventional mainframes are presented for the purpose of making partial benchmark data available to the computing public.

706,678
PB88-115761 PC **A99**/MF **E04**
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Compilation of Chemical Kinetic Data for Combustion Chemistry. Part 1. Non-Aromatic C, H, O, N, and S Containing Compounds (1971-1982),
F. Westley, J. T. Herron, and R. J. Cvetanovic. Aug 87, 685p NBS/NSRDS-73/1
Also available from Supt. of Docs. as SN003-003-02804-5. See also PB81-205429.

Keywords: *Combustion, *Reaction kinetics, Chemical reactions, Tables(Data), Oxidation, Decomposition, Arrhenius parameters.

Chemical kinetics data for reactions of importance in combustion chemistry are compiled. Experimental, theoretical, evaluated, or estimated rate constants are given for reactions of O, O2, O3, H, H2, OH, HO2, H2O, H2O2, N, N2, N3, NO, NO2, NO3, N2O, N2O5, NH, NH2, NH3, NH=NH, NH2=NH, NH2=NH2, HN3, HNO, HONO, HONO2, HO2NO2, NH2O, NH2O2, S, S2, SO, SO2, SH, H2S, and the aliphatic, alicyclic, and heterocyclic saturated and unsaturated C1 to C15 hydrocarbons, alcohols, aldehydes, ketones, thiols, ethers, perioxides, amines, amides, and their free radicals. The data were taken from the literature published between 1971 and 1982. Data previously issued in 1981 as NBSIR-81-2254, which covered the literature published from 1971 through 1977, are included. The data are reported as rate constants or in terms of the parameters A, n, and B of the extended Arrhenius expression k = A(T/298)n x exp(-B/T), where B = E/R. Data are given for t931 reactions.

706,679
PB88-141254 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Fire Chemistry of Polymeric Materials.
Final rept.,
R. G. Gann. 1985, 7p
Pub. in Chemical and Physical Processes in Combustion 1985, pC.1-C.7.

Keywords: *Flammability, *Polymers, Fire tests, Combustion, Reprints.

Solid (polymeric) materials are the fuels for nearly all fires. The paper reviews the elements of fire science pertinent to polymer combustion, their generic degradation mechanisms, and the activity of fire retardant additives.

706,680
PB88-141262 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Effects of Exposure to Single or Multiple Combinations of the Predominant Toxic Gases and Low Oxygen Atmospheres Produced in Fires.
Final rept.,
B. C. Levin, M. Paabo, J. L. Gurman, and S. E. Harris. 1987, 15p
Pub. in Fundamental and Applied Toxicology 9, p236-250 1987.

Keywords: *Exposure, *Fires, *Combustion products, Carbon monoxide, Hydrogen cyanide, Gases, Toxicity, Hypoxia, Carbon dioxide, Reprints.

The toxicity of single and multiple fire gases is studied to determine whether the toxic effects of the combustion products from materials can be explained by the toxicological interactions (as indicated by lethality) of

the primary fire gases or if minor, more obscure gases need to be considered. LC50 values for Fischer-344 rats have been calculated for the individual gases, carbon monoxide (CO), hydrogen cyanide (HCN), or decreased oxygen (O2), for 30-min exposures plus relevant postexposure periods using the NBS Toxicity Test Method.

706,681
PB88-147772 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Smoke Measurements on Upholstered Furniture Using the Cone Calorimeter.
Final rept.,
V. Babrauskas. 1985, 5p
Pub. in Proceedings of International Conference on Fire Safety 10, p39-43 1985.

Keywords: *Smoke, *Upholstery, Furniture, Smoke measurement, Calorimeters, Reprints.

No abstract available.

706,682
PB88-155833 PC **A03**/MF **A01**
Maryland Univ., College Park. Dept. of Mechanical Engineering.
Measurement of Velocity and Temperature Profiles in Low-Speed, Turbulent Non-Isothermal Flows,
V. Motevalli, C. H. Marks, and B. J. McCaffrey. Nov 87, 27p NBS/GCR-87/535
Prepared in cooperation with Maryland Univ. Baltimore County, Catonsville. Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Fire tests, *Turbulent flow, *Thermocouple pyrometers, Velocity measurement, Temperature measurement, Ceilings(Architecture), Plumes, Room fires.

A probe has been developed utilizing thermocouples as the sensors which, together with associated data-reduction and processing equipment, makes it possible to measure velocity and temperature profiles in low-speed, turbulent, non-isothermal flows. The technique presented here might be well suited for transient processes where simultaneous measurements are required in multiple locations. This probe was devised in order to measure the velocity and temperature profiles in the jet formed under a ceiling when a buoyant plume from a fire impinges on the ceiling.

706,683
PB88-156690 PC **A07**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Compilation of Chemical Kinetic Data for Combustion Chemistry. Part 2. Non-Aromatic C, H, O, N, and S Containing Compounds (1983),
F. Westley, J. T. Herron, and R. J. Cvetanovic. Dec 87, 143p NBS/NSRDS-73/2
Also available from Supt. of Docs. as SN003-003-02830-4. See also PB88-115761. Library of Congress catalog card no. 87-20244.

Keywords: *Combustion, *Fossil fuels, Hydrocarbons, Reaction kinetics, Carbon, Nitrogen, Chemical reactions, Sulfur, Oxidation, Hydrogen, Fossil fuels, Arrhenious parameters.

Chemical kinetic data for reactions of importance in combustion chemistry are compiled. Experimental, theoretical, evaluated, or estimated rate constants are given for reactions of O, O3, H, H2, OH, HO2, H2O, N, N3, NO, NO2, N2O, NH, NH2, SH, H2S, SO, SO2, and the aliphatic, alicyclic, and heterocyclic saturated and unsaturated C1 to C15 hydrocarbons, alcohols, aldehydes, ketones, thiols, ethers, peroxides, amines, amides, and their free radicals. The data were taken from the literature published in 1983. Data omitted from Part 1 of the series, covering the period 1971 to 1982, are also included.

Reciprocation & Rotating Combustion Engines

706,684
PB81-600001
(Order as PB81-220899, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Intercomparison of Pressure Standards between LNE and NBS.
R. G. Driver, J. C. Houck, and B. E. Welch. 1981, 3p
Included in Jnl. of Research of the National Bureau of Standards, v86 n3 p277-279 1981.

Keywords: *Effective area, Intercomparison, Piston gage, Pressure, Primary standard, Transfer standard.

An intercomparison between a transfer piston gage used by the Laboratoire National d'Essais (LNE) and a primary standard piston gage of the National Bureau of Standards was performed over the range of pressure of 0.4 to 3.9 MPa. The agreement between the computation of the effective area of the LNE gage by the two laboratories was within 6.4 ppm and the agreement between the average of the pressures generated by these two gages was within 3.3 ppm, well below the estimated uncertainty of either gage (NBS 30 ppm and LNE 24 ppm).

706,685
PB84-223882 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Viscosity, Temperature, and Rate of Rotation on Pressure Generated by a Controlled-Clearance Piston Gauge.
Final rept.
J. K. N. Sharma, K. K. Jain, V. E. Bean, B. E. Welch, and R. J. Lazos. Apr 84, 7p
Pub. in Review of Scientific Instruments, v55 n4 p563-569 Apr 84.

Keywords: *Pistons, *Pressure measurement, *Pressure gages, *Viscosity, Standards, Fluid mechanics, Temperature, Reprints.

The calculation of the pressure generated by a controlled-clearance piston gauge depends upon the jacket pressure corresponding to zero clearance between the piston and cylinder, P(Z). The dependence of P(Z) on the viscosity of the pressure transmitting fluid, the temperature, and the rate of piston rotation have been measured. The results suggest that the best choice of fluid is the one having the lowest viscosity at pressure. Such a fluid can be selected on the basis of having the most nearly linear plot of P(Z) as a function of pressure of the candidate fluids. These results are also a clear indication that for the most accurate pressure measurements, a controlled-clearance piston gauge must be characterized using the same operational and environmental conditions with the same fluid as are used in normal operation.

Rocket Engines & Motors

706,686
PB87-134342 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Vortex Shedding Flow Meter Performance at High Flow Velocities.
J. D. Siegwarth. Oct 86, 97p NBS/TN-1302
Also available from Supt. of Docs as SN003-003-02777-4. Sponsored by National Aeronautics and Space Administration, Huntsville, AL. George C. Marshall Space Flight Center.

Keywords: *Flow meters, Gas flow, Water flow, Liquid oxygen, Air flow, Cryogenics, *Vortex shedding, Space shuttle.

In some of the ducts of the space shuttle main engines (SSME), the maximum liquid oxygen flow velocities approach 10 times those at which liquid flow measurements are normally made. The hydrogen gas flow velocities in other ducts exceed the maximum for gas flow measurement by more than a factor of 3. The results presented here show from water flow tests that vortex shedding flow meters of the appropriate design can measure water flow to velocities in excess of 55 m/s, which is a Reynolds number of about 2 million. Air flow tests have shown that the same meter can measure flow to a Reynolds number of at least 22 million. Vortex shedding meters were installed in two of the SSME ducts and tested with water flow. Narrow spectrum lines were obtained and the meter output frequencies were proportional to flow to + or - 0.5% or better over the test range with no flow conditioning, even though the ducts had multiple bends preceding the meter location. Meters with the shedding elements only partially spanning the pipe and some meters with ring shaped shedding elements were also tested.

Rocket Propellants

706,687
AD-A183 010/8 PC **A04**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
High Temperature Chemistry of Stored Chemical Energy Reactions for Propulsion.
Annual rept. 25 May 85-31 Dec 86,
L. P. Cook, E. R. Plante, D. W. Bonnell, and J. W. Hastie. Jul 87, 57p NBSIR-87-3601
Contract N00014-85-F-0144

Keywords: *Liquid propellants, *Liquid metals, *Reaction kinetics, Energy storage, Aluminum oxides, Coalescence, Islands, Kinetics, High temperature, Magnesium oxides, Edges, Growth(General), Fuels, Lithium fluorides, Aluminum, Drops, Melts, Lithium compounds, Oxides, Phase studies, Equilibrium(General), Thermochemistry, Perchloryl compounds, Fluorides, Ceramic materials, Containment(General), Oxidation, Thermogravimetric analysis, Transport, Vapor phases, Nucleation, Thermodynamics.

This report summarizes the results of a continuing study of the high temperature chemistry of stored chemical energy reaction systems. Thermogravimetric studies have been completed on the behavior of Aluminum oxide and Magnesium oxide in the presence of C103F. Based on these data a new ceramic containment systme comprised of alumina and magnesia parts has allowed extension of kinetic experiments from the 650 C limit previously encountered to a temperature in excess of 800 C. Using the new apparatus, we have observed the relative inertness of the Al component of the fuel to oxidation by ClO3F even at 800 C. We have also noted the extensive vapor phase transport of Lithium fluoride and Magnesium flouride not expected on the basis of known thermodynamic data. Thermogravimetric experiments have been completed on the oxidation of molten aluminum droplets by ClO3F. Rate data for this reaction indicate multiple mechanisms, possibly including the following steps: (1) nucleation and growth of AlF3 precipitation sites; (2) edge growth of AlF3 islands followed by coalescence of islands; (3) diffusion limited thickening of the AlF3 layer. Observations on the early stages of the Al/ClO3F reaction have also been made using high pressure sampling transpiration mass spectrometry.

706,688
PB88-157698 PC **A03**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
In situ Fluorescence Monitoring of the Viscosities of Particle-Filled Polymers in Flow.
Annual rept. 1 Oct 86-30 Sep 87,
A. J. Bur, F. W. Wang, and R. E. Dehl. Jan 88, 30p NBSIR-88/3694
Sponsored by Office of Naval Research, Arlington, VA.

Keywords: *Propellants, *Binders, *Polymers, *Fluorometers, *Fluorescence, Spectroscopy, Mixing, Rheology, Viscosity, Polybutadiene, Aluminum oxide, Measuring instruments.

During FY87, the authors activity has focused on the development of measurement equipment. laboratory experiments using fluorescence monitoring, and the synthesis of a polymeric fluorescent chromophore. Laboratory equipment development has consisted of the design and construction of a capillary flow apparatus and a laboratory mixer. The capillary apparatus has been incorporated into a commercial fluorometer and is being used for the simultaneous measurement of fluorescence anisotropy and rheological parameters of concentrated polymer solutions and low molecular weight polymers. The authors have demonstrated the feasibility of the capillary measurement system by observing the anisotropy of a toluene solution of a polymer binder as a function of capillary head pressure from 0 to 40 psi. A mixer, which incorporates co-rotating and counter-rotating shearing elements and glass walls for viewing fluorescence, has been constructed and used to monitor the mixing of a low molecular weight polybutadiene based polymer and aluminum oxide.

General

706,689
PB88-110671 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Zone Modeling of Forced Ventilation Fires.
Final rept.,
H. E. Mitler. 1984, 24p
Pub. in Combustion Science and Technology 39, p83-106 1984.

Keywords: *Fire safety, Algorithms, Ventilation, Computerized simulation, Layers, Zones, Carbon dioxide, Oxygen, Reprints, *Foreign technology, *Fire scale models.

In 1982, the Nuclear Regulatory Commission posed a forced-ventilation problem which is described. The algorithm developed for its solution is discussed. This was embedded in the Harvard Mark 5.3 computer code, and predictions then made for the outcome of a series of experiments carried out at Lawrence Livermore Laboratory (see previous paper). Comparisons are made between the predicted and the actual results. Predictions are generally in good agreement with experiment, especially for the volumetric input rate and the CO2 and oxygen concentrations. One inadequate feature, however, is the model's consistent underprediction of the peak temperatures reached in the upper layer.

COMMUNICATION

Common Carrier & Satellite

706,690
FIPS-PUB-18-1 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C.
Character Structure and Character Parity Sense for Parallel-By-Bit Data Communication in the Code for Information Interchange. Category: Hardware Standard. Subcategory: Transmission.
Federal information processing standards.
1 Sep 77, 9p
Supersedes report dated 1 Oct 71, FIPS-PUB-18.

Keywords: *Data transmission, Telecommunication, Parity, Federal information processing standards, Character parity, Character structure.

This standard specifies the channel assignment for transmitting the Standard Code for Information Interchange (FIPS 1) in parallel-by-bit serial-by-character data transmission. This revision supersedes FIPS PUB 18 and reflects changes necessary to accommodate revisions prescribed by FIPS 1 when operated in either 7 or 8 bit coded environments. This standard is identified also as Federal Standard Number 1012.

706,691
FIPS-PUB-22-1 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C.
Synchronous Signaling Rates Between Data Terminal and Data Communication Equipment. Category: Hardware Stands. Subcategory: Transmission.
Federal information processing standards.
1 Sep 77, 9p
Supersedes report dated 1 Nov 72, FIPS-PUB-22.

Keywords: *Data transmission, *Data processing terminals, Voice communications, Signal processing, Federal information processing standards, *Data rate.

This standard specifies the rates of transferring binary encoded information in synchronous serial or parallel form between data processing terminal and data communications equipments that employ voice band communication facilities. This revision supersedes FIPS PUB 22 and reflects changes made to the corresponding American National Standard X3.1-1976. This standard is identified also as Federal Standard Number 1013.

706,692
FIPS PUB 71 PC **E07**
National Bureau of Standards, Washington, DC.
Advanced Data Communication Control Procedures (ADCCP). Category: Hardware. Subcategory: Data Transmission.
Federal information processing standards (Final),
E. Scace. c1980, 114p
Three ring FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Data transmission, *Standards, Control, Data links, *Federal information processing standards, *Teleprocessing.

Data communication control procedures define the means for exchanging data between business machines (e.g., computers, concentrators, and terminals) over communication circuits. The advanced data communication control procedures (ADCCP) described in this standard are synchronous, bit oriented (i.e., use bit patterns instead of ASCII characters for control), code independent (i.e., are capable of handling any data code or pattern), and interactive (i.e., have relatively high efficiency in an interactive application). Batch operation is handled with efficiency comparable to that in American National Standard procedures for the Use of the Communications Control Characters of American National Standard Code for Information Interchange in Specified Data Communication Links, ANSI X3.28-1976. Improvements have also been made with respect to ANSI X3.28-1976 in the areas of reliability and modularity. (Copyright (c) 1979 by American National Standards Institute, Inc.)

706,693
FIPS PUB 83 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Guideline on User Authentication Techniques for Computer Network Access Control. Category: ADP Operations. Subcategory: Computer Security.
Federal information processing standards (Final).
P. Meissner. 29 Sep 80, 42p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Identification systems, Guidelines, Standards, National government, Identifying, Verifying, *Computer networks, *Access methods, *Federal information processing standards, Computer security.

The Guideline provides information and guidance to Federal agencies on techniques and practices which can be used to control access to computer resources via remote terminals and networks. A variety of methods are described for verifying the identity of persons using remote terminals, as a safeguard against unauthorized usage. This Guideline discusses the three basic ways which may serve as a basis for verifying a person's identity: something the person KNOWS, such as a password; something the person HAS, such as a key or access card; or something ABOUT the person, such as fingerprints, signature, voice, or other personal attribute. In view of the present dependence on authentication techniques other than personal attributes, this Guideline provides advice on the effective use of passwords. This Guideline also discusses a variety of cards and badges with various forms of machine-readable coding that may be used for access control. In order to protect information used for identity verification, encryption is recommended.

706,694
PATENT-4 709 987 Not available NTIS
Department of Commerce, Washington, DC.
Pressure and Temperature Insensitive Glass and Optical Coatings and Fibers Therefrom.
Patent,
D. Blackburn, A. Feldman, and N. Lagakos. Filed 10 Dec 85, patented 1 Dec 87, 9p PB88-147939, PAT-APPL-6-807 150
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.50.

Keywords: *Optical coatings, *Fiber optics, *Patents, Tantalum oxides, Glass fibers, Heat resistant coatings, PAT-CL-350-96.34.

Pressure and temperature insensitive optical fibers are produced using a Ta2O5 based glass composition which has a high bulk modulus and a low thermal expansion coefficient. The glass composition can function as the cladding in the optical fiber or as a protective coating which surrounds the cladding thereby protecting the fiber from fluctuations in temperature and pressure.

706,695
PB-264 668/5 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
Guide to Voice Scramblers for Law Enforcement Agencies.
R. E. Nelson. Dec 76, 42p NBS-SP-480-8
Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, D.C. Report on Law Enforcement Equipment Technology. Library of Congress Catalog Card no. 76-600070.

Keywords: *Speech scrambling, Secure communication, Voice communication, Communication equipment, Radio equipment, Law enforcement.

The guideline presents information and suggestions which will assist law enforcement agencies in the selection, procurement, and implementation of voice scramblers in their communications systems. Important points are discussed that need to be considered in choosing the proper scrambler, negotiating the procurement contract, installing the scramblers, and evaluating their performance.

706,696
PB-265 119/8 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Computer Systems Engineering Div.
Computer Science and Technology: Computer Network Interconnection: Problems and Prospects.
Special pub. (Final),
I. W. Cotton. Apr 77, 87p NBS-SP-500-6
Grant NSF-DCR72-01206-A05
Library of Congress catalog card no. 77-608026.

Keywords: *Computer networks, Telecommunication, Standards, Interfaces, Switching theory, Common carriers, Forecasting, *Communications networks, *Packet switched networks, *Interconnection.

This report examines the current situation regarding the interconnection of computer networks, especially packet switched networks (PSNs). The emphasis is on identifying the barriers to interconnection and on surveying approaches to a solution, rather than recommending any single course of action. Sufficient organizational and technical background is presented to permit an understanding and appreciation of the problem. Four major types of interconnections are then surveyed: (1) Circuit switched network to PSN; (2) Star network to PSN; (3) Simple terminal to PSN; (4) PSN to PSN. The major barriers to interconnection are then outlined. The report concludes with some comments on the prospects for overcoming these barriers. An extensive bibliography, glossary with list of abbreviations, and listing of existing data communications standards relevant to interconnection are also included.

706,697
PB-268 424/9 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C. Applied Mathematics Div.
Cost/Benefit Analysis of Automated Transit Information Systems.
Final rept.,
D. R. Shier, and J. F. Gilsinn. Jun 77, 112p NBSIR-77-1253
Sponsored in part by Urban Mass Transportation Administration, Washington, D.C.

Keywords: *Mass transportation, *Telephone systems, *Information systems, *Routing, Automation, Benefit cost analysis, Economic models, Computer programming, Personnel, Equipment, Queueing theory, Consumers, Services, Urban transportation, Comparison, Alternatives.

This report discusses the costs and benefits associated with automating the route-finding portion of a telephone transit information system. The various costs of implementing such a system are categorized and compared with those of a manual system over an appropriate time span using a present value approach. A queueing model, described in the report, is used for computing manpower requirements of the two systems, manual and automated. Outputs of the queueing model for a wide range of input parameters are tabulated in an appendix. Benefits from automating transit information route-finding are discussed, and measures of performance improvement available as output from the queueing model are provided.

706,698
PB-268 633/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interfaces: New Standards Catch Up with Technology,
H. C. Folts, and I. W. Cotton. Jun 77, 10p
Pub. in Data Commun. 6, n6 p31-40 Jun 77.

Keywords: *Data transmission, Standards, Interfaces, Telecommunication, Reprints.

Recent developments in data communications standards have been patterned on a hierarchical approach to communications system architecture. A number of independent levels have been identified, and standards development has proceeded at its own pace within each level. These levels are identified and recent progress at standardization is discussed for each.

706,699
PB-270 280/1 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
Digital Data Transmission Tests on Voice Channels.
Jul 77, 64p NBS-SP-480-19
Library of Congress Catalog card no. 77-600023. Prepared in cooperation with National Inst. of Law Enforcement and Criminal Justice, Washington, D.C., and Urban Sciences, Inc., Wellesley, Mass.

Keywords: *Data transmission, *Pulse communication, Tests, Digital techniques, Mobile equipment, Modulation, Rates(Per time), Allegheny County(Pennsylvania).

In order to better understand the ramifications of transmitting and receiving digital data over typical data over typical voice channels, a series of tests were performed in Allegheny County, Pennsylvania, using existing local government transmitting sites and a specially equipped mobile unit and the time of day were varied for test purposes. Tests were conducted in both urban and suburban environments. This paper discusses test procedures, sites routes, test equipment and the results obtained.

706,700
PB-272 049/8 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
Police Communications Equipment Survey of 1976.
Special pub.,
W. A. Shand, and M. J. Treado. Aug 77, 57p NBS-SP-480-13
Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, D.C.

Keywords: *Communication equipment, Law enforcement, Police, Surveys, Standards.

The report discloses the results of a survey conducted by NBS for the Law Enforcement Assistance Administration. The survey was designed to determine the degree of utilization of law enforcement communications equipment documentation developed by the Law Enforcement Standards Laboratory of NBS and the need, if any, for additional documentation. 176 of 254 questionnaires were returned by respondents for a 69% rate of return.

706,701
PB-273 117/2 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
Image Quality of Monochrome Television Cameras,
J. C. Richmond. Oct 77, 18p NBS-SP-480-25, LEAA-LESP-RPT-0311.00

Keywords: *Television cameras, Contrast, Transfer functions, Images, Resolution, Photoconductivity, Signal to noise ratio.

The camera operating characteristics most frequently quoted by manufacturers of monochrome television cameras are the (1) limiting resolution, (2) signal-to-noise ratio, and (3) sensitivity. These characteristics are coupled to each other and to the scene parameters (1) spatial frequency, (2) contrast and (3) brightness. The camera characteristics are evaluated under limiting conditions of the scene parameters, and hence define in a general way the range of scene parameters over which the camera will produce useful pictures, but they do not give much information about the quality of the image produced. The contrast transfer function and the responsivity curve of the camera give more information about image quality. A fourth camera operating characteristic, relative spectral response, which is independent of the other camera characteristics and scene parameters, may also affect image quality.

706,702
PB-274 351/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Satellite Earth Terminal G/T Measurements.
Final rept.,
D. F. Wait. Apr 77, 3p
Pub. in Microwave Jnl. 20, n4 p49, 51, 58, Apr 77.

Keywords: *Radio relay stations, Radio relay systems, Communication satellites, Measurement, Communication terminals, Ground stations, Figure of merit, Satellite earth terminals, Reprints.

A new measurement service of the National Bureau of Standards is the measurement of Figure of Merit (G/T) of satellite communications earth Terminals. The G/T of the 10-meter earth terminal at Fucino, Italy was recently measured at 2.2655 GHz, at low elevation angles to + or - 8% (+ or - 0.3 dB). This measurement was one of the most carefully evaluated measurements of G/T of any commercial earth terminal.

706,703
PB-276 253/2 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Error Equations Used in the NBS Earth Terminal Measurement System,
W. C. Daywitt. Dec 77, 32p NBSIR-78-869

Keywords: *Communication satellites, *Radiofrequency power, Error analysis, Measurement, Equations, Radio sources(Astronomy), Microwave relay systems.

An outline for the derivation of equations employed in a measurement and error analysis of satellite EIRP (effective isotropic radiated power), using a calibrated radio star, is presented. A table showing analysis results at 7.55 GHz using Cassiopeia A for a satellite at 12 degrees elevation angle is given. The quadrature sum of the systematic errors appearing in the table is 10.1%. Also presented is a curve of the systematic errors as a function of elevation angle showing a 7.3% minimum at high elevation angles. Included are working equations for the calculation of correction and errors.

706,704
PB-282 505/7 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
Atmospheric Propagation Equations Used in the NBS Earth Terminal Measurement System,
W. C. Daywitt. Apr 78, 46p NBSIR-78-883

Keywords: *Radio transmission, Atmospheric refraction, Coefficients, Microwave communication, Communication satellites, Radio relay systems, Radiofrequency power, Signal to noise ratio, Gain, Errors, Ground stations.

A derivation of equations for approximating the atmospheric refraction angle and transmission coefficient is outlined. The approximations apply in the 1 GHz to 10 GHz frequency range and are accompanied by systematic error estimates. They are used in the NBS Earth Terminal Measurement System for quasi-real-time calculations concerned with the measurement of earth-terminal gain-to-noise-temperature ratio (G/T), satellite effective isotropic radiated power (EIRP), and downlink carrier-to-noise-density ratio (C/kT).

706,705
PB-285 331/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Precision Earth-Terminal System for Accurate C/kT, G/T, and EIRP Measurements with a Calibrated Radio Star,
W. C. Daywitt. 1977, 4p
Sponsored in part by Army Communications Command, Fort Huachuca, Ariz.
Pub. in Proc. URSI Int. Symp. on Measurements in Telecommunications, Lannion, France, Oct 3-7 p1-4, 1977.

Keywords: *Radio relay systems, *Communication satellites, Performance tests, Microwave relay systems, Measurement, Errors, Test equipment, Radio sources(Astronomy), Communication satellite terminals, Computer applications.

The National Bureau of Standards (USA) has constructed a system designed to accurately measure the downlink C/kT, earth-terminal G/T, and satellite EIRP. It operates off the i-f patch panel of the downlink earth terminal and automatically controls the steps of the several measurement sequences. The procedure employed in the system is a modified version of the radio star method of measuring the above parameters. The modification allows earth terminal receiver gain fluctuations to be removed from the measurement, significantly reducing the measurement error. In addition to a digital voltmeter, programmable i-f attenuators, and well characterized bandpass filters, the system features an extremely accurate power bridge and an improved rf solid state noise source of high stability. Combined, the components can routinely measure power ratios to a few hundredths of a decibel. A thorough measurement and error analysis appropriate to the 1 GHz to 10 GHz frequency range has been incorporated into the system's computer software. The analysis reveals additional errors, a higher atmospheric correction factor than previously calculated, and adds some interesting insight into the usual star shape correction factor.

706,706
PB-292 301/9 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Communication Systems Guide.
Special pub.
W. W. Scott. Jan 79, 39p NBS-SP-480-12
Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, DC. Library of Congress catalog card no. 78-600150.

Keywords: *Telecommunication, *Law enforcement, Guidelines, Systems analysis, Communication equipment.

Contents:
Communication systems;
Principal components;
Cost considerations;
Purchase of communications equipment;
References.

706,707
PB-292 967/7 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Acoustical Engineering Div.
Microphone Windscreen Performance.
Final rept.
R. N. Hosier, and P. R. Donavan. Jan 79, 85p NBSIR-79-1599
Sponsored in part by Environmental Protection Agency, Washington, DC. Office of Noise Abatement and Control.

Keywords: *Microphones, *Shielding, *Noise reduction, Performance, Wind(Meteorology), Noise(Sound), Insertion loss, Polyester resins, Spheres, Foam, Protectors, Tables, *Windscreens.

Measurements were made of the wind-induced noise and acoustic insertion loss of ten microphone windscreens. Eight of these were reticulated polyester spheres of varying porosity. The other two were the metal cage type typically used in long term outdoor noise monitoring. The measurements were made under laboratory conditions for normal and grazing flow incidence at wind speeds up to 14 m/sec. The data show that the windscreens are very different in the amount of wind-induced noise reduction they provide, with some achieving more than 25 dB. In general the foam windscreens provided more wind-induced noise reduction than the cage windscreens; however, the cylindrical cage windscreen performed better than any of the foam windscreens for normal flow incidence. The insertion loss measurements proved difficult to make because of the small insertion losses encountered. However, data for grazing flow and normal acoustic incidence show no strong velocity dependence for any of the windscreens tested. Examination of the wind-induced noise spectra provided significant insight into the noise generating mechanisms associated with flow around a porous sphere. Effects of inflow turbulence, self-generated turbulence, mean flow, flow through the sphere, and flow incidence angle were identified. Test results are provided in the form of curves and tables for easy use in evaluating potential wind noise levels in outdoor measurements.

706,708
PB-298 660/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Orbiting Standards Platform.
Final rept.
H. T. Dougherty, A. J. Estin, W. L. Morgan, and J. J. Woodruff. Sep 78, 9p
Pub. in Proceedings of the Antenna Applications Symposium (1978) Held at Urbana-Champaign, IL. on September 20-22, 1978, p1-9, Sep 78.

Keywords: *Communication satellites, Standards, Radio relay systems, Antennas, Antenna radiation patterns, Gain, Polarization, Measurement, Signal generators, Field strength, Ground stations.

Startling growth in satellite communication has placed new burdens on measurement of performance of these systems. The Orbiting Standards Platform (OSP) is a combination satellite signal source and field strength meter which will enable one to make highly accurate truly far field measurements of large aperture antenna gain, pattern, sidelobes, and polarization as well as system G/T and EIRP. These measurements may be used to initially characterize earth station equipment and for the subsequent monitoring of its performance. This is a report on a study just completed on the feasibility of the OSP.

706,709
PB-300 369/6 PC **A03**/MF **A01**
Assessment Group, Santa Monica, CA.
NBS Interagency Transducer Project 1951-1979 - An Overview.
Final rept.
P. S. Lederer. Aug 79, 50p NBS-TN-1110

Keywords: *Transducers, *Pressure sensors, Detectors, Telemetry, Reviews, Calibrating, Interagency Transducer project.

Between 1951 and 1979, the National Bureau of Standards was engaged in a continuing project to study the performance of sensory transducers, primarily those used in telemetry. This project has been supported by agencies of the Defense Department and NASA. This report provides a brief description of the background and history of the project, of its objectives, of some of the techniques and specialized facilities developed and used, and of some of the publications that have been issued from the project.

706,710
PB80-112097 PC **A05**/MF **A01**
National Telecommunications and Information Administration, Boulder, CO. Inst. for Telecommunication Sciences.
Optical Waveguide Communications Glossary.
Special publications rept.
A. G. Hanson, L. R. Bloom, G. W. Day, R. L. Gallawa, and E. M. Gray. Sep 79, 77p NTIA/SP-79/4

Keywords: *Optical communication, *Fiber optics, *Dictionaries, Telecommunications, Optics, Optical properties, *Optical waveguides.

This document is a technical dictionary containing approximately 300 terms, concisely defined for the communications engineer, covering the field of optical fiber waveguide communication.

706,711
PB80-152903 PC **A15**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Update: Local Area Networks.
Final rept.,
R. Rosenthal, and N. B. Meisner. 1979, 347p
Sponsored in part by MITRE Corp., Bedford, MA.
Pub. in Proceedings of the Local Area Communications Network Symposium Held at Boston, Massachusetts on May 7-9, 1979.

Keywords: *Telecommunication, *Meetings, Pulse communication, Data transmission, Computer networks, Broadband, *Local area networks, Communication networks, Protocols, Multimode.

Contents:
Overview of local area networks;
Non-defense networks;
Local area network technology;
Defense-related networks;
Future environments;
Panel discussion;
Workshop summaries.

706,712
PB80-202393 PC **A05**/MF **A01**
Hawaii Univ., Honolulu.
Standards for Computer-Based Message Service.
Final rept.,
R. R. Panko. 1979, 91p NBS-GCR-80-210
Contract NB79-NAAB-1587

Keywords: *Telecommunication, Standards, Trends, Requirements, Computer applications, Electronic message systems, *Computer based message systems.

This report surveys the complex environment in which standards for Computer Based Message Systems and Services must be created -- CBMS design trends, organizational communication needs, technological trends, and the probable industry structure. The report also discusses three major standards areas: message structure, delivery and the user interface.

706,713
PB80-226947 PC **A04**/MF **A01**
Bolt Beranek and Newman, Inc., Cambridge, MA.
Service Specification of Transport and Session Protocols.
Draft rept.,
G. Pearson, and J. Burruss. Mar 80, 73p BBN-4362, NBS-GCR-80-246, ICST/HLNP-80-2
Contract NB79-SBCA-0092

Keywords: *Telecommunication, *Computer networks, Specifications, *Protocols, Federal information processing standards.

The National Bureau of Standards, Institute for Computer Sciences and Technology (ICST), has initiated a program to develop computer network protocol standards as Federal Information Processing Standards (FIPS). SERVICE SPECIFICATION OF TRANSPORT AND SESSION PROTOCOLS is one of a series of draft reports being prepared under the network protocol standards program for distribution to government agencies, voluntary standards organization, computer and communications equipment manufacturers, and other interested parties. This draft report specifies the actual operation of the proposed transport and session protocols.

706,714
PB80-600034 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Technologies for Local Area Computer Networks.
I. W. Cotton. 1979,20p
Pub. in Update: Local Area Networks, p25-44 1979.

Keywords: *Communications, Computer communications, Computer networks, Data communications, Data networks, Local area networks, Networks.

Local area computer networks are distinguished from long distance networks by the need to serve users in a limited geographic area. The service requirements for local area computer networks are reviewed and several candidate technologies are examined. These technologies are briefly compared in the concluding section.

706,715
PB80-600035 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Serving Users with a Local Area Network.
R. J. Carpenter, and J. Sokol. 1979, 11p
Pub. in Update: Local Area Networks, p75-85 1979.

Keywords: *Area, Computer, Data, Digital, Ethernet, Local, Network, Terminal.

The NBS local data network NBSNET, emphasizes serial, asynchronous service at speeds up to 9600 bauds to terminal users and small computers. Network-wide conventions have been adopted so servers need not be aware of the detailed characteristics of user terminals or computers. These conventions have been implemented in software which resides in the individual network nodes. This software does all of the necessary translation to generate the correct control and escape sequences required by the attached equipment. Nodes attached to terminals handle the following characteristics: speed, echoing, parity, flow control, within-line editing, cursor positioning, delay after formal characters, and line-at-a-time or character-at-a-time transmission mode. Each network node has the correct variants of these characteristics for a single specified terminal type, but most of them may be varied under local and/or remote control. Another variant of the node software supports connections to computers acting as either servers or users of the network. Cooperating software in the attached computer can implement both TELNET (simulated terminal) connections, and a file transfer protocol. Full end-to-end-flow control is provided in three stages; user-to-node, and node-to-user. This prevents needless lost data packets when output has been suspended by a user, and is required for speed conversion to be done correctly. By segmenting the flow control, a device need not know all the various ways that other devices do flow control. An interrupt feature allows data buffers to be flushed and supporting processes to be notified. A software rotary has been incorporated in all nodes to provide automatic sequencing of connection attempts to a computer acting as a server which has multiple-nodes attached to it.

706,716
PB80-600054 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microphone Cable Assemblies for Mobile FM Transceivers.
R. E. Nelson, R. M. Jickling, R. N. Jones, and M. J. Treado. 1980, 10p
Pub. in NIJ-Std-0217.00.

Keywords: *Communications equipment standard, Compatibility, Interchangeability, Law enforcement, Microphone cable, Microphone connector, Mobile FM transceiver.

The document is a voluntary performance standard, developed by the Law Enforcement Standards laboratory, to identify characteristics, establish minimum performance requirements, and describe test methods for measuring the electrical characteristics of microphone cable and connector assemblies used in law enforcement mobile transceivers. The standard addresses the microphone plug, the mating panel receptacle, and the multiconductor cable used to connect the microphone to the control head of a mobile FM transceiver. The use of this standard is intended to achieve interchangeability and compatibility among microphone eonnector and cable assemblies used with law enforcement mobile transceivers and microphones, regardless of the manufacturer or model.

706,717
PB81-144370 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
GRIDNET.
Interim rept.
R. T. Moore. Oct 80, 75p NBSIR-80-2149
Sponsored in part by Defense Nuclear Agency, Washington, DC.

Keywords: *Data transmission, Digital techniques, Pulse communication, Routing, Survival, Reliability, *Communication networks, Protocols, Message processing.

This report describes a highly reliable and survivable digital data communication system. It is based on the multiple interconnection of dual fiber optic loops, with up to about twenty data communications stations being served by each dual loop. The dual loop configuration is called CROSSFIRE. The interconnection of many of these to form a large network is called GRIDNET. The network is highly connected and many alternate routes are available for transmitting a message between two stations located at different points on the network. The intelligence required for the control of communications and the routing of traffic is distributed among a number of data communication nodes called gateway stations. Network survival is not dependent on the survival of any node or link, but requires instead that the network not be fragmented.

706,718
PB81-158255 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
NBS Computer Networking Program,
R. Blanc, J. Heafner, R. Rosenthal, and S. Watkins. Oct 80, 23p NBSIR-80-2154

Keywords: *Networks, Standards, National government, Systems analysis, Descriptions, *Computer networks, *National Bureau of Standards.

The report provides a description of the NBS program in computer networking. The description includes ac-

tivities in computer network protocols for large global networks, protocol interfaces, and measurement techniques for local area computer networks and work in computer based office systems. These efforts include the development of standards and the performance of the necessary research to support that standards development. Descriptions of the specific products being worked on are also included.

706,719
PB81-170656 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Local Area Network Feasibility Study for the Naval Sea Systems Command.
A. Mink, and C. B. Silio. Jan 81, 56p NBSIR-80-2187

Keywords: Data processing, Navy, Technology assessment, Systems analysis, Bus conductors, Requirements, *Computer networks, *Naval Sea Systems Command, Communications networks, Access methods.

The Naval Sea Systems Command (NAVSEA) requested a feasibility study of a Local Area Networking (LAN) capability to enhance its computing facilities. In the report, NAVSEA's environment is established. This includes the physical and the computing environment. After establishing the environment, a representative set of application programs is used to determine NAVSEA's LAN requirements. Then a discussion of LAN topologies is presented, and those applicable to NAVSEA are indicated. Implementations of these applicable topologies are discussed along with the technologies involved and their advantages and disadvantages.

706,720
PB81-203622 PC **A13**/MF **A01**
Network Analysis Corp., Vienna, VA.
Cost/Benefit Analysis of High-Level Computer Network Protocol Class Standards.
Draft rept.
Nov 80, 300p NBS/GCR-81-323, ICST/HLNP-81-9
Contract NB79-SCA-0151

Keywords: *Benefit cost analysis, Standards, National government, Economic analysis, Standardization, Operating costs, Acquisition, Procurement, *Computer networks, *Protocols, *Federal information processing standards.

Costs are defined to be just the costs of developing and adopting a standard, while benefits are the changes in acquisition and operating budgets due to the standard. The difference between cost and benefit yields the net economic benefit of a standard to the Government.

706,721
PB81-215873 Not available NTIS
National Bureau of Standards, Washington, DC.
Perspective on Trends in Electronic Communication.
Final rept.
I. W. Cotton. 1980, 12p
Proceedings of AAAS Selected Symp. 52, held in Houston, Texas on January 3-8, 1979.
Pub. in Electronic Communication: Technology and Impacts, p7-18 1980.

Keywords: *Data transmission, Telecommunication, Trends, *Electronic message systems, Computer applications.

This review and perspective will concentrate on the area of electronic data communications, where major technological advances have been made in the past ten or fifteen years. Not only technological changes but relevant regulatory concerns are of interest to us, and will be covered here. Their impact on users will also be summarized.

706,722
PB81-247363 Not available NTIS
National Bureau of Standards, Washington, DC.
Integrating the Data Encryption Standard Into Computer Networks.
Final rept.
M. E. Smid. Jun 81, 11p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Communications COM-29, n6 p762-772 Jun 81.

Keywords: *Security, Standards, Communications management, Cryptology, *Computer networks, *Data encryption, Data processing security, Cryptography.

The NBS Data Encryption Standard may be integrated into computer networks to protect personal (nonshared) files, to communicate securely both on- and off-line with local and remote users, to protect against key substitution, to authenticate data, and to provide digital signatures using a nonpublic key encryption algorithm. Key notarization facilities give users the capability of exercising a set of commands for key management as well as for data encryption functions. The facilities perform notarization which, upon encryption, seals a key or password with the identities of the transmitter and intended receiver. Thus, in order to decrypt a message, the receiver must authenticate himself and supply the correct identity of the transmitter. This feature eliminates the threat of key substitution which must be protected against to attain a high level of security.

706,723
PB82-105297 PC **A12**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Shielded Balanced and Coaxial Transmission Lines - Parametric Measurements and Instrumentation Relevant to Signal Waveform Transmission in Digital Service.
Final rept.
W. L. Gans, and N. S. Nahman. Jun 81, 260p NBS-TN-1042
Sponsored in part by Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, AZ.

Keywords: *Coaxial cables, *Pulse communication, Computerized simulation, Computer programs, Responses, Measurement, Data, Error analysis.

A method is presented for determining the impulse and step responses of a shielded cable using time domain terminal measurements and a physically based mathematical model for the transmission line properties of the cable. The method requires a computer controlled time domain measurement system and was implemented using the NBS Automatic Pulse Measurement System (APMS). Data are also developed for the frequency domain complex propagation function (attenuation and its related minimum-phase shift). The method is applied to 12 shielded paired-conductor (balanced) cables and 5 coaxial cables. Time domain responses are presented for three nominal cable lengths, 60 m (200 ft), 150 m (500 ft), and 300 m (1000 ft). The time domain responses are applied to the estimation of bit error rate increases due to the insertion of the cables into a digital signaling system employing a balanced polar NRZ waveform. Also discussed is the application of the time domain responses to time domain reflectometry techniques for cable acceptance tests and field-site testing of installed cables.

706,724
PB82-116013 PC **A04**/MF **A01**
General Electric Co., Huntsville, AL. Space Systems Div.
GRIDNET Simulation. Volume 1. System Description and Results.
Final rept.
N. Geer, H. A. Graf, and P. Stromecky. Aug 81, 64p 81HV008, NBS/GCR-81-336
Contract NB80-SBCA-0477
See also report dated Oct 80, PB81-144370.

Keywords: *Data transmission, Digital techniques, Pulse communication, Routing, Survival, Reliability, Computerized simulation, Telecommunication, *Communications networks, Protocols, Message processing.

This report is a summary of the results of a computer simulation of a novel, highly connected data communication network that was introduced by R.T. Moore is NBSIR 80-2149, GRIDNET, October 1980. The objectives of the program were to test algorithms which would permit messages to be routed from any source to any destination, in a network having thousands of nodes, and to accomplish this routing in an efficient manner using only limited local knowledge of network operability status. In addition, estimates were developed of the network's delay and throughput characteristics as a function of traffic loading. Based on the simulation results, GRIDNET could be developed into a highly reliable and highly survivable data communications network that could support traffic between a large number of nodes in an effective and efficient manner.

706,725
PB82-142894 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Discussion of GRIDNET Simulation Results.
Rept. for 30 Nov 80-4 Sep 81.
R. T. Moore. Nov 81, 17p NBSIR-81-2414
Sponsored in part by Defense Nuclear Agency, Washington, DC.

Keywords: *Telecommunication, *Computerized simulation, Routing, Computer programming, Computer networks, *Communications networks, *GRIDNET.

The objectives of the program were to test and modify algorithms which would permit messages to be routed from any source to any destination, in a network having thousands of nodes, and to accomplish this routing in an efficient manner using only limited local knowledge of network operability status. In addition, estimates were developed of the network's daley and throughput characteristics as a function of traffic loading. Based on the simulation results, GRIDNET could be developed into a highly reliable and highly survivable data communications network that could support traffic between a large number of nodes in an effective and efficient manner.

706,726
PB82-165259 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Methods of Suppressing Automotive Interference.
Special pub.
H. E. Taggart. Nov 81, 20p NBS-SP-480-44
Sponsored in part by National Inst. of Justice, Washington, DC. Library of Congress catalog card no. 81-600165.

Keywords: *Electromagnetic interference, Automobiles, Ignition systems, Suppressors, Attenuators, Attenuation, Radio receivers.

The purpose of this report is to (1) review the sources of electromagnetic interference (EMI) within a vehicle so that the reader will have a basic understanding of the EMI problem; (2) discuss the techniques that have been used successfully by the auto industry to suppress EMI, and (3) suggest some newer techniques for suppressing EMI within an automobile. The automotive manufacturers utilize several techniques to reduce EMI emanating from the vehicle. The techniques include resistor spark plugs, resistor spark plug cables, use of silicone lubricant in the distributor, use of capacitors as filters, placement of grounding straps at key locations, conductive fan belt discharge, and tire static-charge reduction. If even further reduction of MI is needed to obtain the maximum capability of a specific mobile communication system, there are additional suppression techniques discussed herein that can be employed to achieve this goal. These techniques are effective at frequencies from approximately 30 to 1000 MHz. Measurement results show that the EMI from a new production-line automobile, measured in accordance with SAE Standard J551g, can be reduced as much as 10 to 15 dB by employing these new suppression techniques. The amount of degradation to a mobile narrow-band FM receiver, such as the type used by law enforcement agencies, can be measured using the measurement technique described. This same technique can then be used as a tool to further reduce EMI from the vehicle components.

706,727
PB82-165283 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Communication Systems for Disabled Users of Buildings.
B. L. Collins, W. F. Danner, and R. L. Tibbott. Dec 81, 74p NBSIR-81-2428
Sponsored in part by Architectural and Transportation Barriers Compliance Board, Washington, DC.

Keywords: *Telecommunication, *Human factors engineering, Building codes, Handicapped persons, Buildings, Warning systems, Safety engineering, Availability, Requirements.

Communication systems in buildings are designed to provide both emergency and directional information to all building users. Yet such systems, which are typically comprised of visual signs and audible alarms, may fail to reach some of the estimated twenty-seven million hearing or vision impaired people in the United States. As a result, a number of alternative communication systems have been proposed for inclusion in

accessibility guidelines. In the following pages the research base underlying communication provisions for each of three sensory modalities, vision, hearing and touch, are reviewed. In addition, various proposed code recommendations are presented and discussed. The adequacy of the research base for each provision is discussed along with the need for various code provisions. It is noted that code provisions for tactile warnings and exit markings are particularly inadequate. Recommendations for further research into tactile warnings, tactile signage, and visual alarms are suggested.

706,728

PB82-166257 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Optical Waveguide Communications Glossary.
A. G. Hanson, L. R. Bloom, A. H. Cherin, G. W. Day, R. L. Gallawa, E. M. Gray, C. Kao, F. P. Kapron, B. S. Kawasaki, P. Reitz, and M. Young. Jan 82, 36p NBS/HB-140
Prepared in cooperation with Bell Telephone Labs., Norcross, GA., ITT, Roanoke, VA., Communications Research Centre, Ottawa, CA., and Corning Glass Works, Corning, NY. Library of Congress catalog card no. 81-600151.

Keywords: *Optical communication, *Dictionaries, Fiber optics, *Fiber optics transmission lines, *Glossaries, Optical waveguides.

The rapid emergence of optical communications from the laboratory into commercial systems applications has been accompanied by the growth of a specialized vocabulary. Some terms have been borrowed freely from the disciplines of optical physics and communications engineering; others have been coined independently. In this process, inevitably, some ambiguity and impreciseness have resulted. More significantly perhaps, some terms have been used to specify a product--and are beginning to be accepted by manufacturers and users--but are not precise descriptors beyond rather narrow limits. The absence of a precise, common language among researchers, manufacturers, systems designers, and users is a hindrance to effective technology development and utilization. The goal of this glossary is to nurture such a language.

706,729

PB82-195264 Not available NTIS
National Bureau of Standards, Washington, DC.
Operational Experience with the NBS Local Area Network.
Final rept.
R. J. Carpenter, J. E. Malcolm, and M. L. Strawbridge. 1981, 18p
Pub. in Proceedings of IFIP Working Group 6.4 Inst. Workshop on Local Networks Held at Zurich, Switzerland on Aug. 27-29, 1980. Paper in Local Networks for Computer Communications, Amsterdam, The Netherlands, 1981.

Keywords: *Data transmission, Telecommunication, Pulse communication, Local area networks.

The local area network designed and built at the National Bureau of Standards (NBSNET) has been in routine use since October 1979, and now serves about 70 user devices in eight different buildings. It employs a carrier sense multiple access, collision detection (CSMA-CD), protocol with a one megabit per second data rate and Manchester encoding on the coaxial distribution cable. The system contains a number of repeater amplifiers because of the site topology and a desire to keep signal levels within a small dynamic range. The current user devices are primarily graphic and alphanumeric terminals, with a smaller number of mini- and microcomputers. Both terminal access and file transfer protocols have been implemented. Most nodes keep traffic and error statistics during each connection and report the information to a central logging node when the connection terminates.

706,730

PB82-195496 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Digital Communications Techniques and Equipment for Law Enforcement Use.
Final rept.
Jan 82, 78p NBS-GCR-81-356
Sponsored in part by National Inst. of Justice, Washington, DC. Prepared in cooperation with Urban Sciences, Inc., Pennsauken, NJ.

Keywords: *Pulse communication, Law enforcement, Mobile equipment, Radio equipment.

This report is the result of a study of digital communications equipment for law enforcement use. The primary objective was to determine the suitability of the various types of this equipment for use by law enforcement agencies. The report reviews present voice message traffic on typical police radio networks and discusses operational requirements for digital communications equipment. It further reviews the possible applications of digital communications equipment for law enforcement use, and lists the characteristics of mobile digital terminals being offered at present. A brief technical discussion of mobile digital communications is also provided.

706,731

PB82-236225 Not available NTIS
National Bureau of Standards, Washington, DC.
GRIDNET Simulation.
Final rept.
R. T. Moore. May 82, 17p
Sponsored in part by Defense Nuclear Agency, Washington, DC.
Pub. in Proceedings Carnahan Conference on Security Technology, University of Kentucky, Lexington KY, May12-14 1982, p31-36.

Keywords: *Data transmission, Telecommunication, Routing, Reliability, Optical communication, Fiber optic transmission lines.

A highly reliable and survivable data communication system is described. The network is called GRIDNET and is formed by the multiple interconnection of large numbers of dual, fiber optic loops. This provides many alternate routes for the transmission of messages between stations that occupy different positions on the network. The intelligence required for the control of communications and the routing of traffic is distributed among the gateway stations that serve to interconnect the loops. These gateway stations select the most direct route from source to destination for a message when the network is intact, and select alternate routes around failures. Only limited local knowledge of operability status is required by the gateways for routing, and the resulting limited demands for bandwidth permit the network to serve many thousands of stations. Network survival is not dependent upon the survival of any node or link, and a message will reach its destination so long as any operable path to that destination exists. Computer simulations of the GRIDNET have been conducted with the results output to a graphics display terminal. Examples of route finding around outages will be shown together with simulation results showing system throughput and display characteristics.

706,732

PB83-136432 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
HYBRID GRIDNET: Packet and Circuit Switching in a Single Network.
R. T. Moore. Oct 82, 64p NBSIR-82-2588

Keywords: *Data transmission, Switching circuits, Survival, Pulse communication, *Communication networks, Packet switching, Hybrid systems.

GRIDNET is a packet switching network, composed of multiply connected dual loops, being developed for the Defense Nuclear Agency in order to provide highly survivable data communications among a large number of sites. This report describes a concept for overlaying such a network with additional channels and switching facilities that may be used to establish point-to-point circuits on a demand basis. Switched connections are established following the exchange of appropriate frames between the stations that are involved. These exchanges use the regular GRIDNET packet switching facilities to provide essential supervisory and control functions including collision avoidance by means of circuit reservation in advance of connection. Switched circuits are automatically disconnected whenever no traffic is observed on them for a designated interval of time.

706,733

PB83-159947 PC **A13**/MF **A01**
National Telecommunications and Information Administration, Boulder, CO. Inst. for Telecommunication Sciences.
User-Oriented Performance Measurements on the ARPANET: The Testing of a Proposed Federal Standard.
D. R. Wortendyke, N. B. Seitz, K. P. Spies, E. L. Crow, and D. S. Grubb. Nov 82, 297p NTIA/REPORT-82-112

Keywords: *Computer networks, Standards, Performance evaluation, ARPANET computer network.

The report presents the results of a trial implementation of a newly developed data communication performance measurement methodology which has been proposed as Federal Standard 1043. In this experiment, a prototype data communication performance measurement system was developed in accordance with specifications defined in the standard. The system was used to assess the data communication service provided to a typical pair of ARPANET end users (host computer application programs). These user-oriented measurements differed from earlier ARPANET measurements in that the host computer operating systems and network control programs were regarded as providers of an end-to-end data communication service, rather than as users of the subnetwork.

706,734

PB83-181768 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Discussion of GRIDNET Algorithms and Simulation Results.
Interim rept. 17 May-12 Nov 82.
J. A. Epstein. Nov 82, 41p NBSIR-83-2660
Sponsored in part by Defense Nuclear Agency, Washington, DC.

Keywords: *Telecommunication, *Computerized simulation, Routing, Algorithms, Vulnerability, *Communications networks, Communications traffic, Packet switching, Packet switched networks.

The report is an evaluation of the results of computer simulation of GRIDNET conducted during the period from 17 May 1982 to 12 November 1982. The report describes the testing and modification of algorithms which permit messages in a GRIDNET to be routed from any source to any destination, in a network having thousands of nodes, and to accomplish this routing in an efficient manner using only limited local knowledge of network operability status. Estimates were developed for algorithm performance and runtime efficiency. Additional studies were made concerning network connectivity, reducing packet overhead, network topology, and resolving packet overflow.

706,735

PB83-205369 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Preliminary Examination of 20 GHz G/T Measurements of Earth Terminals.
D. F. Wait, and W. C. Daywitt. Mar 83, 42p NBSIR-83-1686
Sponsored in part by Army Communications-Electronics Command, Fort Monmouth, NJ.

Keywords: *Electromagnetic noise, Figure of merit, Measurement, Microwave communication, *Communication satellite terminals, Ground stations, Satellite communications.

Three basic measurement techniques and the associated measuring systems are examined to determine which are most likely to meet the needs of measuring the figure of merit (G/T) for future 20 GHz satellite systems: use of the Sun as a known source, use of the Sun as an intercomparison source with a calibrated reference terminal, and the use of a satellite signal as an intercomparison source. It is shown that the method of using the Sun as a known source is not very accurate (about 1.5 dB uncertainty), but that using the Sun as a transfer source is useful (0.3 dB to 0.5 dB, depending on measuring system) for Earth terminals with antenna diameter less than 1.8 m (6 ft). For Earth terminals with antenna diameters greater than 1.8 m (6 ft), the Sun cannot be used as a transfer source for technical reasons, but a satellite signal can be used as a transfer source.

706,736

PB84-103522 Not available NTIS
National Bureau of Standards, Washington, DC.

GOES Satellite Time Code Dissemination.
Final rept.
R. E. Beehler. 1983, 26p
Pub. in Proceedings of the Annual Precise Time Time Interval (PTTI) Applications Planning Meeting (14th) Greenbelt, Maryland, 30 Nov-2 Dec 82, NASA Conference Publication 2265, p57-82, 1983.

Keywords: *Time signals, Frequency measurement, Frequency distribution, Standards, Time measurement, *GOES satellites.

The National Bureau of Standards, in cooperation with the National Oceanic and Atmospheric Administration (NOAA), has been disseminating a time code referenced to UTC(NBS) via two of NOAA's geostationary GOES satellites since 1975. A review of the GOES time code system, the performance achieved to date, and some potential improvements in the future will be discussed. The disseminated time code is originated from a triply redundant set of atomic standards, time code generators and related equipment maintained by NBS at NOAA's Wallops Island, VA satellite control facility. It is relayed by two GOES satellites located at 75 degrees W and 135 degrees W longitude on a continuous basis to users within North and South America (with overlapping coverage) and well out into the Atlantic and Pacific ocean areas. Downlink frequencies are near 468 MHZ. The signals from both satellites are monitored and controlled from the NBS labs at Boulder, CO with additional monitoring input from geographically separated receivers in Washington, DC and Hawaii.

706,737
PB84-106277 Not available NTIS
National Bureau of Standards, Washington, DC.
Guide to Electronic Facsimile Systems.
Final rept.
D. Brenner, and M. J. Treads. Jan 83, 40p
Sponsored in part by National Inst. of Justice, Washington, DC.
Pub. in National Institute of Justice Standard-201-83, 40p Jan 83.

Keywords: *Facsimile communication, Communication equipment, Data transmission, Interfaces, Law enforcement, Transmitters, Transmitter receivers, Images.

The guide presents the basic concepts of facsimile transmission and reception. It discusses the types of equipment available and how each is used. Image quality, operating procedures, data transmission, the facsimile/communications equipment interface, and law enforcement uses are among the topics discussed. Also included is a section on equipment selection criteria and a discussion of image quality on a noisy radio channel. References, an annotated bibliography and a list of facsimile equipment manufacturers are also provided.

706,738
PB84-153071 Not available NTIS
National Bureau of Standards, Washington, DC.
Overview of the Proposed American National Standard for Local Distributed Data Interfaces.
Final rept.
W. E. Burr. Aug 83, 8p
Pub. in Communications ACM 26, n8 p554-561 Aug 1983.

Keywords: *Standards, *Data transmission, Interfaces, Reprints, *Local area networks, Protocols.

The Local Distributed Data Interface (LDDI) Project of X3 Technical Committee X3T9 has resulted in three draft proposed American National Standards for a high performance local area network. The proposed standards are organized in accordance with the ISO Reference Model for Open Systems Interconnection and encompass the lowest two protocol layers (data link and physical) of the model, plus a serial broadband coaxial bus interface. The intended application of the LDDI is as a backend network for the interconnection of high performance CPUs and block transfer peripherals such as magnetic disk and tapes. A carrier-sense multiple access with collision prevention (CSMA-CP) distributed bus arbitration protocol is employed. The cable interface supports the attachment of up to 28 ports over a cable distance of 0.5 km (8 ports may be attached to a 1 km cable) at a transfer rate of 50 Mbit/s.

706,739
PB84-153865 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Performance Evaluation of Telephone Cable Pedestals in Underground and Atmospheric Environments.
J. L. Fink, and E. Escalante. Jan 84, 61p NBSIR-84-2810
Sponsored in part by Rural Electrification Administration, Washington, DC.

Keywords: *Columns(Supports), Telephone cables, Performance evaluation, Corrosion, Degradation, Subsurface structures, Pedestals.

Data are given on the corrosion of the metal surfaces and on the degradation of the fiberglass surfaces of the housing, mounting stake and internal and external hardware of telephone cable pedestals. The materials investigated on were exposed for periods up to six years in six different soil and atmospheric environments. Specimens were eposed as either a painted galvanized steel housing with a painted galvanized steel mounting stake, a painted galvanized steel housing with an unpainted galvanized steel mounting stake, a fiberglass housing with a fiberglass mounting stake, a fiberglass housing with an unpainted galvanized mounting stake, or a fiberglass housing with a polyvinychloride mounting stake. Metals studied included, aluminum, galvanized steel, plated brass, plated steel, steel, and stainless steel alloys.

706,740
PB84-221704 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Two 'Guaranteed' Local Network Access Methods.
Final rept.
R. Carpenter. Feb 84, 6p
Pub. in Data Communication, 6p Feb 84.

Keywords: Standardization, *Local area networks, *Interfaces, *Communication networks.

Two industry standardization groups, IEEE project 802 and ANSI working group X3T9.5 have recently produced finished proposals for the Physical and Data Link layers of serial broadcast local area networks. There is Substantial similarity in the goals of the IEEE 'Token Bus' (TB) variant, and that of the ANSI Local Distributed Data Interface (LDDI). These goals include the absolute prevention of collisions and the ability to bound access latency. The following comparisons show that LDDI offers lower average and worst-case medium access latency than TB, and gives higher throughput in many situations. LDDI is at its best when offered load is concentrated in a few stations.

706,741
PB84-224823 Not available NTIS
National Bureau of Standards, Washington, DC.
Wideband Local Nets Enter the Computer Arena.
Final rept.
W. E. Burr, and R. J. Carpenter. 3 May 84, 6p
Pub. in Electronics, v57 n9 p145-150, 3 May 84.

Keywords: *Computer networks, Standards, *Local area networks, Computer communications, Data communications.

Three commercial wideband LAN's are being offered for mainframes and supercomputers, and a standard for a fourth has been drafted.

706,742
PB85-109148 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Selected NBSNET Software.
Interim rept.
M. Strawbridge, S. Schooley, R. Crosson, and J. Sokol. Sep 84, 111p NBSIR-84/2902

Keywords: Interfaces, Personality, *Computer software, *Communications networks, National Bureau of Standards, Protocols.

NBSNET is a local area communications network at the National Bureau of Standards. Ethernet-like in its design, it has operated successfully since 1979, supporting terminal-computer and computer-computer communications. Devices physically connect to NBSNET through RS-232-C interfaces; each being customized to the device being served. Customization primarily involves modifying the control program, called a 'personality', for each interface. Each personality is divided into modules which implement, among other things, the network's internal protocol and the external device communications protocol. Three external device protocols are used. A listing of some typical personality modules is supplied.

706,743
PB85-114718
(Order as PB85-114700, PC **E07**/MF **E01**)
British Telecommunications Research Labs., Martlesham Heath (England).
Single Mode Fibre Specification and System Performance.
D. B. Payne, M. H. Reeve, C. A. Millar, and C. J. Todd. Oct 84, 5p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p1-5 1984.

Keywords: *Optical communication, *Fiber optics, Predictions, Trends, Specifications, Performance, *Optical fibers.

It can now be safety stated that single mode fiber is established as a viable transmission medium for communications networks. This paper considers fiber specifications in isolation from the system specification, trends in optical technology, and speculations about possible system requirements in the future.

706,744
PB85-114759
(Order as PB85-114700, PC **E07**/MF **E01**)
Yokosuka Electrical Communication Lab. (Japan).
Issues in the Characterization of Coherent Optical Communications Systems.
T. Ito. Oct 84, 6p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p19-24 1984.

Keywords: *Optical communication, Near infrared radiation, Infrared lasers, Fiber optics, Optical fibers.

These few years, research on coherent optical transmission systems has been prosecuted enthusiastically by a couple of laboratories. It raises up world-widely the 'revival' of an interest in coherent systems. The present major interest is to seek ever more sensitive receivers, ever longer repeater spans, ever greater transmission capacities and so on. Laying stress on the sensitivity of a receiver, this paper compares a coherent system with a direct detection system, referring to published or reported experimental data, and describes the future research items.

706,745
PB85-114858
(Order as PB85-114700, PC **E07**/MF **E01**)
Bell Labs., Norcross, GA.
Multimode Fiber Measurements - Present and Future.
A. H. Cherin. Oct 84, 6p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p67-72 1984.

Keywords: *Optical communication, *Fiber optics, Bandwidth, Attenuation, Diameters, Optical measurement, *Optical fibers, Multimode, Numerical aperture, Intrinsic quality factors.

Multimode graded-index fibers are commonly used as the transmission medium in the intracity trunking and loop feeder distribution portions of modern telecommunication systems. It also appears likely that multimode fibers will be used, for the foreseeable future, in local area networks that offer a wide variety of integrated services. Because multimode fibers are used for both short and long distance applications, a number of different measurement methods have been developed to describe their transmission characteristics. This paper reviews some of the standardized multimode measurement methods and highlights current areas of concern related to the measurement of bandwidth, numerical aperture, core diameter, and attenuation. In addition, a performance related specification parameter known as the intrinsic quality factor will be briefly discussed.

706,746
PB85-114874
(Order as PB85-114700, PC **E07**/MF **E01**)
BICC Telecommunication Cables Ltd., Prescot (England).

Bandwidth Optimisation of a Multimode Fibre Installation.
S. C. Hampson. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p77-80 1984.

Keywords: *Optical communication, *Telephone lines, *Bandwidth, Telephone exchanges, Frequency response, Optimization, Autocorrelation, Fiber optics, *Optical fibers, Multimode.

The Autocorrelation Function (ACF) Effective Bandwidth was used to predict the concatenated frequency transmission response of a multimode fiber installation. The -3dB (Optical) bandwidth for each route fiber was then measured, and the figure compared with that which had been previously predicted. A program of cross-jointing was then devised in order to achieve the optimum transmission response for the installation. A specific objective of gaining a -3dB (Optical) bandwidth figure greater than 140 MHz for all route fibers was also set and achieved. The installation in question runs from a local telephone exchange to a repeater station, a distance of 22.8 km.

706,747
PB85-114890
(Order as PB85-114700, PC **E07**/MF **E01**)
British Telecommunications Research Labs., Martlesham Heath (England).
Distribution of H2 Gas Along an Inland Optical Fibre Cable.
S. Hornung, S. A. Cassidy, and M. H. Reeve. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p85-88 1984.

Keywords: *Communication cables, *Optical communication, *Fiber optics, *Hydrogen, Distribution, Measurement, *Optical fibers.

Recently a good deal of interest has concentrated on the effects of H2 on the optical attenuation of optical fibers. The work has mainly focused on the response of optical fibers to relatively high levels of H2, often at elevated temperatures. Little has been reported of actual levels of H2 in cables in operational environments. In this paper, the authors report the field measurement of levels of H2 an inside optical fiber cable and its distribution along the cable length. The cable chosen was a BICC 'Jubilee' type, linking Guildford to Aldershot. It was selected because it contains high phosphorus doped multimode fiber, which is particularly sensitive to H2 (2). The authors also report two follow-up experiments, which together with a simple model go some way in explaining the nature of the experimental results.

706,748
PB85-115004
(Order as PB85-114700, PC **E07**/MF **E01**)
Valtec, West Boylston, MA.
Field Dispersion Measurements - A Swept Frequency Technique.
R. Rao. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p135-138 1984.

Keywords: *Fiber optics, *Optical dispersion, *Field tests, Near infrared radiation, Optical measurement, Optical communication, *Fiber optics transmission lines, *Optical fibers.

As transmission rates increase and WDM systems become operational, it is likely that the dispersion characteristics of long spans of single mode cable will have to be checked after installation. This will require dispersion measurement equipment capable of making field measurements. Dispersion in single mode fibers is caused by the material and waveguide properties of the fiber. For long lengths of fiber, it can be determined from measuring the relative group delay through the fiber as a function of wavelength. Present laboratory techniques for doing this measurement are unsuitable for field use due to their complexity and equipment size. In this paper a swept frequency measurement system is described where group delay is determined from frequency domain data. This system has been developed specifically for field use and uses typical multimode frequency domain bandwidth test equipment.

706,749
PB85-142263 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Book Review: Optical Fibre Communication.
Final rept.
R. L. Gallawa. Nov 81, 2p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Spectrum 18, n11 p81-82 1981.

Keywords: *Optical communication, Reviews, Reprints, Optical fibers, Fiber optics transmission lines.

This manuscript reviews the book 'Optical Fibre Communication,' prepared by the technical staff of CSELT, Torimo, Italy.

706,750
PB85-143550 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Security in Computer Communication Systems.
Final rept.
H. M. Wood, and I. W. Cotton. 1983, 41p
Pub. in Computer Communications, Volume 1: Principles, p369-409 1983.

Keywords: *Computer communications, Security, Computer networks, Cryptology, Control, Reprints, Access.

The growing recognition of the need for computer and communications security has resulted in the design, development, and installation of 'patches', packages, and even new operating systems intended to provide higher degrees of data and systems protection. With the increased utilization of computer networks and current developments in the area of network operating systems the requirements for security in networking environments are also coming under investigation. While research and development are still ongoing in the area, it is vital to ensure that requirements for the security and integrity of data are well specified and that mechanisms for achieving the needed levels of systems protection are included in the design of networking systems. This chapter reviews methods and mechanisms that may be used to achieve required degrees of computer network security. Such methods include those aimed primarily at communications security (e.g., data encryption techniques), as well as access control techniques (e.g., authentication an authorization checking), physical security, and procedural controls. Emphasis is placed on those aspects of security that particularly relate to the communications environment in computer networks. Many references to the open literature are included in order to guide the interested reader into the rapidly growing area of computer communications security.

706,751
PB85-144830 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Field Strength Levels in Vehicles Resulting from Communications Transmitters.
Final rept.
J. F. Shafer. Jun 84, 14p
Sponsored by National Inst. of Justice, Washington, DC.
Pub. in NIJ (National Inst. of Justice) Report-0200-83, 14p Jun 84.

Keywords: *Field strength, Measurement, Automobiles, Electric fields, Transmitter receivers, Radar equipment, Law enforcement, Standards.

The report provides the results of an exploratory study to measure the electric field strength levels inside an automobile from communications equipment (transmitters and associated antennas) typical of that likely to be operated in and around the automobile as a law enforcement vehicle, with and without the driver's door open, and with and without front-seat occupants, at frequencies representing the frequency bands of 25 to 50, 150 to 174, 400 to 512, and 806 to 866 MHz. Levels of output power are given for the data presented. Field strength levels are also given for the situation when a metallic prisoner shield or a personal transceiver is used in a vehicle, together with a mobile transceiver, in some cases. Also included are field strength measurements of speed measuring radar devices used in vehicles.

706,752
PB85-145225 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Authentication Using the Federal Data Encryption Standard.
Final rept.
M. E. Smid. 1981, 6p
Pub. in Proceedings of Natl. Electronics Conference, Chicago, IL., October 26-28, 1981, v35 p296-301.

Keywords: *Authentication, Algorithms, Standards, Cryptology, *Data encryption, Federal Data Encryption Standards, Data integrity, Electronic funds transfer.

The Federal Data Encryption Standard (DES) cryptographic algorithm can be used to authenticate the integrity of data by detecting unauthorized modifications. DES authentication algorithms are similar to those for data encryption, but authentication algorithms permit data to be transmitted or stored in an unencrypted form. Authentication algorithms differ from error detecting codes in that authentication algorithms detect intentional modifications as well as accidental alterations. These algorithms have several communications and data storage applications.

706,753
PB85-170645 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fault-Tolerant Hierarchical Broadcast Network.
Final rept.
W. E. Burr. Dec 84, 7p
Pub. in Proceedings of Conference Computer Networking Symposium, Gaithersburg, MD., December 11, 1984, p11-17.

Keywords: *Networks, *Radio broadcasting, *Local area networks, *Computer networks, Optical fibers, Fault tolerance.

Hierarchical star or rooted tree local networks have been implemented and have many desirable characteristics, including excellent performance, conceptual simplicity, and suitability for optical fiber implementations. They do, however, have a single point of vulnerability to catastrophic failure (the master or root hub) as well as vulnerabilities to single failure of links or hubs high in the hierarchy, which could disable large portions of the network. A generalization of the hub and network structure is presented, which adds redundant network components to eliminate this vulnerability and make an extremely robust and fault-tolerant network.

706,754
PB85-189363 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Law Enforcement Standards Lab.
Telephone Dialers with Taped Voice Messages.
Final rept.
Oct 84, 18p
Sponsored by National Inst. of Justice, Washington, DC.
Pub. in NIJ (National Inst. of Justice) Standard-0322.00, 18p Oct 84.

Keywords: *Warning systems, *Telephone equipment, Standards, Performance, Voice communication, *Telephone dialers.

The standard establishes performance requirements and test methods for evaluating dialers that dial one or more specified telephone numbers and transmit one or more taped voice messages in response to an actuation. These devices transmit an alarm signal (the voice message(s)) through the ordinary switched telephone network to a telephone answering service or private phone. Emphasis in this standard is on characteristics affecting the ability of the devices to perform their tasks reliably and on factors that affect false alarm susceptibility.

706,755
PB85-189371 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Law Enforcement Standards Lab.
Telephone Dialers with Digitally Coded Messages.
Final rept.
Oct 84, 18p
Sponsored by National Inst. of Justice, Washington, DC.
Pub. in NIJ (National Inst. of Justice) Standard-0323.00, 18p Oct 84.

Keywords: *Warning systems, *Telephone equipment, Standards, Performance, Digital systems, *Telephone dialers.

The standard establishes performance requirements and test methods for digital dialers. These dialers are intended to dial one or more preprogrammed telephone numbers and to transmit digitally coded messages in response to an actuation. These alarm messages are transmitted to special digital signal receivers via the ordinary switched telephone network. Empha-

sis in this standard is on characteristics that influence the ability of the dialer to perform its intended function reliably and some factors that affect false alarm susceptibility.

706,756
PB85-196269 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
GRIDNET - An Alternative Large Distributed Network.
Final rept.
R. T. Moore, N. F. Geer, and H. A. Graf. 1984, 10p
Pub. in Computer 17, n4 p57-66 Apr 84.

Keywords: Data links, Routing, Reprints, *Distributed computer systems, *Communications networks, Packet switching, Distributed processing.

GRIDNET is a highly connected, highly reliable and survivable data communications network based on the use of distributed processing and redundant data links. Alternate routing of traffic around outages is performed without the use of global operability status information using only information about the status of near neighbors. Computer simulation was used to develop estimates of the performance characteristics of the network.

706,757
PB85-196640
(Order as PB85-196541, PC **A07**/MF **A01**)
Totel Systems, Inc., Stratford, CT.
Telephone Connected Early Warning and Communication System.
W. M. Smith. Apr 85, 5p
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology, and National Conference of States on Building Codes and Standards, Inc., Herndon, VA.
Included in Research and Innovation in the Building Regulatory Process: Proceedings of the NBS/NCSBCS Joint Conference (6th), Technical Seminar on Streamlined Adminisirative Procedures, Computers in Construction, and Fire Safety Technology held at Denver, Colorado on September 11, 1984, p131-135 Apr 85.

Keywords: *Warning systems, *Telephone equipment, *Communication equipment, Buildings, Fire fighting, Fire safety, Smoke detectors.

This paper describes a new development in telephone engineering that provides two vital fire fighting functions - annunciation of smoke detectors by individual location, and one way voice communication to remote sections of buildings by zone or all-call using existing standard telephone equipment. This development creates an opportunity for advanced fire systems features to be put in place quickly and at low cost since most structures already have complete telephone system wiring and standard station line telephones throughout the building.

706,758
PB85-197770 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Use of Power Transfer Matrices in Predicting System Loss: Theory and Experiment.
Final rept.
J. M. Maisonneuve, and R. L. Gallawa. 1984, 6p
Sponsored by Centre de Documentation de l'Armement, Paris (France). Direction des Recherches, Etudes et Techniques.
Pub. in Proceedings of SPIE, Fiber Optics: Short-Haul and Long-Haul Measurements and Applications II, San Diego, CA., August 21-22, 1984, v500, p88-93.

Keywords: Attenuation, *Local area networks, *Fiber optics transmission lines, Ray theory, Power transfer.

The phase space diagram for parabolic and step index fibers leads to a graphic representation of the bound, leaky, and refracted rays of ray theory. This concept is used to predict the attenuation of typical components of local area networks. The technique uses power transfer matrices to track the evolution of power distribution in ray packets. In particular, we predict and then measure the power transfer of two ray packets for a step index fiber. The comparison is encouraging.

706,759
PB85-202083 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measuring a Local Network's Performance.
Final rept.
P. D. Amer, R. Rosenthal, and R. E. Toense. 1983, 10p
Pub. in Data Commun. 12, n4 p173-182 Apr 83.

Keywords: *Computer networks, *Communication networks, *Radio broadcasting, Traffic, Evaluation, Measurement, Performance, Computer systems hardware, Reprints, *Local area networks, Multichannel communications, Multiple access, NBSNET network, Computer software.

A local area computer network (LAN) measurement center has been implemented at the National Bureau of Standards, Institute for Computer Sciences and Technology (ICST) for the performance investigation of NBSNET, one of the largest operational local broadcast networks. The measurement center is a facility for characterizing NBSNET traffic and for performing research experiments with artificially generated traffic. The center consists of four components: a monitoring system for collecting measurements about both artificial and normal network traffic, an artificial traffic generator for emulating various loads on the network, analysis software for summarizing the measurement information into performance reports, and a development system for generating hardware and software support of the entire measurement center. A taxonomy of audiences interested in local network traffic characterization is presented.

706,760
PB85-221919 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Performance Analysis of NBSNET.
Final rept.
R. E. Toense. 1983, 10p
Pub. in Jnl. Telecommun. Networks 2, n2 p177-186 1983.

Keywords: *Computer networks, *Telecommunication, Carriers, Performance evaluation, Utilization, Channel stabilization, Reprints, *Communications networks, *Local area network, NBSNET, NBS network, Broadcasting.

The performance of NBSNET, a broadcast, packet switched, carrier sense multiple access with collision detection (CSMA/CD) local area network, is analyzed in terms of utilization, stability, delay and fairness. Traffic generators transmit packets of known arrival rate and packet length distributions on an isolated network segment. The packets are recorded and time-stamped for analysis. Analysis of the empirical laboratory data shows that (1) utilization of the network under heavy and overloaded conditions approaches the theoretical limit and is predictable, (2) the network remains stable under the conditions observed, (3) the mean delay introduced by the network is predictable as a hyperbolic function of the observed channel utilization, (4) the network is fair with uniformly distributed individual node utilizations.

706,761
PB85-222271 Not available NTIS
Bolt Beranek and Newman, Inc., Cambridge, MA.
Design of a Message Format Standard.
Final rept.
D. Deutsch. 1981, 22p
Contract NB79-SBCA-0092
Pub. in Proceedings of IFIP TC-6 Int. Symp. Computer Message Systems, Ottawa, Canada, April 6-8, 1981, p199-220.

Keywords: Standards, Design, Computer systems hardware, Data links, *Message processing, *Message formats, *Computer communications, Office management, Electronic mail.

Computer Based Message Systems (CBMS), once exclusive tools of programmers and researchers, are rapidly finding their way into commercial and governmental offices. The first CBMSs were designed as closed systems, allowing messages to be exchanged only between the users of the same CBMS. The proliferation of CBMSs has been accompanied by a growing desire by users for communication between different systems. Standards and protocols provide common ground for the interconnection of dissimilar systems. The paper discusses the design and rationale of a draft CBMS message format standard being developed by Bolt Beranek and Newman under contract to the U.S. National Bureau of Standards. The draft standard provides a machine-readable format for the representation of CBMS messages as they are sent or received by computer based mail systems. It also provides a set of standard message fields which may be used to convey specific information often found in CBMS messages.

706,762
PB86-105277 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Center for Electronics and Electrical Engineering.
Transparent Metrology of Signal to Noise Ratios of Noisy Band-Limited Digital Signals.
D. Halford. Jun 85, 32p NBS/TN-1077
Also available from Supt. of Docs SN003-003-02658-1.

Keywords: *Signal to noise ratio, *Pulse communication, Metrology, Noise(Sound), Measurement, Monitors, Real time operations, Signals, Synchronism.

The author propose the use of a template method for quantitative, correct, and transparent measurement of signal power to additive noise power ratios (SNR) of digital signals and systems under full operating conditions. The author discusses the significance of transparent metrology, the measurement of various SNR's by the template method, and the general applicability of the template method for measurements on any noisy digital signal. The template method can provide transparent metrology procedures for other basic measurands, e.g., intersymbol interference, multiplicative noises, and synchronization.

706,763
PB86-133410 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Internetwork Protocol.
Final rept.
R. Callon. 1983, 6p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) 71, n12 p1388-1393 1983.

Keywords: *Computer networks, Telecommunication, Reprints, Protocols.

Application of the OSI protocols to the 'real world' requires cost-effective interconnection of a wide variety of existing and future networks. Differences in underlying technologies, in administrative control, in available qualities of service, and in other important factors complicate the task of achieving interconnection. The paper discusses a variety of the major technical issues related to achieving interconnection within the OSI network layer.

706,764
PB86-140290 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Current NBS (National Bureau of Standards) Metrology Capabilities and Limitations at Millimeter Wave Frequencies.
Final rept.
G. R. Reeve, and C. K. S. Miller. 1985, 19p
Pub. in Proceedings of the Measurement Science Conference (1985), Santa Clara, California, January 17-18, 1985, p296-314.

Keywords: *Metrology, Measuring instruments, Low frequencies, Millimeter waves, Measurement.

It is the intent of the paper to describe the technical demands of responding to the challenges of millimeter-wave technology. A description of the current capabilities that exist at NBS will be given for those parameters and frequencies where measurement services exist. Where novel standards have been developed. Limitations in services and in concepts of standards for providing those services will be described to indicate the degree of research that must be undertaken to satisfy future industrial needs in this evolving technology.

706,765
PB86-146537 CP **T03**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
NBS/OSI (National Bureau of Standards/Open Systems Interconnection) Transport Class 4.
Software.
D. E. Rorrer, and M. A. Wallace. Oct 85, mag tape NBS/SW/MT-86/002
Supersedes PB84-222918.
Source tape is in the ASCII character set. This resricts preparation to 9 track, one-half inch tape only. Identify

recording mode by specifying density only. Call NTIS Computer Products if you have questions. Documentation is included on the tape.

Keywords: *Software, *Telecommunication, *Data transmission, Operating systems(Computers), Standards, Magnetic tapes, *Transport class 4, C programming language, DEC VAX 11-780 Computers, EUNICE/VMS V3.7 operating systems.

The tape consists of programs which provide the NBS implementation of OSI Transport Class 4 and a test system which measures the conformance of an implementation to the ISO standard. It was written 'c' language and developed under 'EUNICE', a UNIX simulator running on the VMS V3.7 operating system. Also, the Transport implementation uses an interprocess communication facility composed of port, await, and capac system manipulation routines, an internal timer facility and specialized string handling functions. Documentation on the implementation and test system is included on tape...Software Description: The program is written in the C programming language for implementation on a DEC VAX 11-780 computer using the EUNICE/VMS V3.7 operating system.

706,766
PB86-196391 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Law Enforcement Standards Lab.
Performance of Amplitude Companded Sideband. Interim Report: A Review and Measurement Plan.
W. L. Kissick, L. T. Jones, and W. J. Hartman. Apr 86, 74p NBS/GCR-86/511
Prepared in cooperation with National Telecommunications and Information Administration, Boulder, CO. Inst. for Telecommunication Sciences. Sponsored by National Inst. of Justice, Washington, DC.

Keywords: *Compandor transmission, Amplitude modulation, Intelligibility, Single sideband transmission, Land mobile radio.

Amplitude companded sideband (ACSB) has been proposed as a useful technique for the land mobile communications needed by law enforcement agencies. These users have certain requirements that their communications systems must meet in order for them to be effective; one of these requirements is for adequate speech intelligibility under a variety of conditions. The report describes the basic principles of operation and those technical aspects of ACSB that may affect speech quality, and then, proposes a measurement program to determine what performance measures are appropriate to characterize the aspect of ACSB performance. It is assumed that the intelligibility of an FM system operating at the condition of 12 dB SINAD represents a reference level of intelligibility. The measurement program will attempt to determine, using the articulation score (AS), the values of the chosen performance measures for ACSB that correspond to the reference level of intelligibility.

706,767
PB86-197209 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Electronic Bulletin Boards.
T. Landberg. Apr 86, 38p NBSIR-86/3356

Keywords: Information systems, Computer applications, *Electronic message systems.

Many organizations have established electronic bulletin boards to distribute information products electronically. For organizations that need to rapidly distribute press releases, product information, provide customer support or transfer data to a geographically dispersed constituency, electronic bulletin boards are proving to be an inexpensive solution. Bulletin board software is a highly specialized application designed to accomplish a rather limited function of peer to peer communication. Each feature of a bulletin board has been developed to accomplish a different aspect of peer to peer communication. These features include sending and receiving messages, transferring files, and chatting with the system operator. However, bulletin board systems cannot search a textual data base by keyword, initiate other computer jobs or create and edit new data files.

706,768
PB86-203015 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Standards Code and Information.
GRIDNET: A Highly Survivable Digital Communications Network. Final Report, Phase 1.
A. Mink, G. G. Nacht, A. L. Koenig, and A. W. Holt. Apr 86, 33p NBSIR-86/3361
Sponsored by Defense Nuclear Agency, Washington, DC.

Keywords: *Pulse communication, Survival, Optical communication, Fiber optics, Computer systems programs, *Packet switched networks, Packet switching, Protocols, Wide area networks.

GRIDNET is a highly reliable and survivable packet switched, wide area communication network that may consist of thousands of nodes and may span thousands of miles. The reliability of GRIDNET is based on redundant transmission of data via two distinct paths and bitwise comparison of the duplicate received data in addition to error detection codes. The survivability of GRIDNET is attributed to its intrinsic topology, which provides for a number of alternative paths between pairs of nodes. A feasibility prototype of a GRIDNET was proposed as a multi-phase research project. The report describes the design of the phase I GRIDNET prototype which was constructed. This prototype satisfied all of the Phase I operational performance objectives.

706,769
PB87-105185 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Optical Fiber Power Meters: A Round Robin Test of Uncertainty.
Final rept.
R. L. Gallawa, and S. Yang. 1986, 3p
Pub. in Applied Optics 25, n7 p1066-1068, 1 Apr 86.

Keywords: *Power meters, *Fiber optics, Optical communication, Detectors, Errors, Reprints, *Optical fibers, Uncertainty, Intercomparison.

The proliferation of optical fiber systems has spawned a variety of optical power meters. These meters are important to the analysis and maintenance of fiber communication systems. One obvious attendant concern is with the uncertainty of the meter readings. In the paper, the authors give the results of an interlaboratory test conducted to circumscribe and define the extent of the problem. The test yielded 46 data points from 11 participants collected over a period of about 9 months. The results indicate that the variation in power meter readings taken in different laboratories is unreasonably large. The variance improved when measurements taken with very small detectors were excluded from the data base. This suggests that errors are being made in the collection of power in typical laboratory environments.

706,770
PB87-108668 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Use of Mode Transfer Matrices in L.A.N. (Local Area Network) Loss Evaluation.
Final rept.
J. M. Maisonneuve, P. Churoux, and R. L. Gallawa. 1985, 4p
Pub. in SPIE Fiber Optics: Short-Haul and Long-Haul Measurements and Applications II 559, p182-185 1985.

Keywords: *Fiber optics, Reprints, *Local area networks, Mode transfer matrices.

A method, using Mode Transfer Matrices (MTM) to characterize step index fiber components and predict Local Area Network (LAN) power budget, is presented. The results show this method is well adapted to describing modal power distribution variations.

706,771
PB87-131322 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Calibration Requirements for EHF Satellite Communication Systems.
R. C. Baird, W. C. Daywitt, A. C. Newell, S. Perera, A. G. Repjar, D. F. Wait, and A. J. Estin. Oct 86, 39p NBSIR-86/3058
Prepared in cooperation with CyberLink Corp., Boulder, CO. Sponsored by Air Force Satellite Control Facility, Sunnyvale, CA.

Keywords: *Spacecraft communication, Millimeter waves, Atmospheric attenuation, Extremely high frequencies, *Calibration, MILSTAR system.

The calibration and measurement support requirements of millimeter wave satellite systems such as MILSTAR have been investigated. The needs for measurements on satellite systems are reviewed. An overview of the various means available for calibrating antenna gain, one of the key measurements that needs to be accurately accomplished, is presented. Essentially three new measurement problems arise because of operating in the upper SHF and EHF frequency ranges. First, without adequate methods to measure the atmospheric loss, the accuracy of effective isotropic radiated power (EIRP) measurements in the 20-45 GHz range can be no better than 0.5-3 dB (depending on frequency and antenna elevation angle), which is inadequate for MILSTAR requirements. Second, standards and measurement support services are not presently available from the National Bureau of Standards and are needed to support millimeter wave antenna gain and thermal noise measurements. Third, if the Sun and/or Moon are to be used for measuring Earth terminal G/T, Earth terminal antenna gain, or satellite EIRP in the millimeter region, they need to be appropriately characterized at those frequencies.

706,772
PB87-132247 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Network Architecture Div.
Testing to Assure Interworking of Implementations of ISO/OSI (International Organization for Standardization/Open Systems Interconnection) Protocols.
Final rept.
R. J. Linn. 1986, 10p
Pub. in Computer Networks 11, n4 p277-286 Apr 86.

Keywords: Standards, Tests, Computer networks, Reprints, *Open systems interconnections, *Communication networks, *ISO/OSI Protocols, Protocols, National Bureau of Standards, International Organization for Standardization, ISO.

At the Institute for Computer Sciences and Technology of the National Bureau of Standards, an architecture has been specified for testing protocols in layers four through seven of the International Organization for Standardization's (ISO) Basic Reference Model for Open Systems Interconnection (OSI). The paper describes the application of that architecture to testing Class 4 Transport with thirteen vendors' implementations of the protocol prior to a demonstration of ISO protocols at the National Computer Conference in 1984. The test results are summarized and an evaluation of the architecture and individual tools is presented. The paper concludes with a summary of a more ambitious demonstration of networking using implementation of ISO protocols.

706,773
PB87-134821 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems Components Div.
Performance Measurements on the NBS (National Bureau of Standards) Local Data Test Network.
Final rept.
D. S. Grubb. 1984, 7p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Global Telecommunications Conference, GLOBECOM '84: Communications in the Information Age, Atlanta, GA., November 26-29 1984. p859-865.

Keywords: *Computer networks, Interfaces, Standards, Input output routines, *Communication networks, *Local Data Test network, *LDTN network, *Data communication protocol, Mainframe computers, Minicomputers, Computer performance evaluation, National Bureau of Standards.

The report describes data communication performance measurements made on the Local Data Test Network (LDTN) at the National Bureau of Standards. The network is an implementation of a network proposed as an American National Standard by Task Group 5 on Future Interfaces of the X3T9 Committee on I/O Interfaces. The proposed network is intended for the connection of mainframe computers and large mini-computers to each other and to their input/output subsystems.

706,774
PB87-148490 PC **A05**/MF **A01**

National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Parametric Cost-Revenue Model ('PAREC') for Electronic Message Service Systems,
Technical note,
C. Witzgall, P. B. Saunders, and R. E. Schofer. Nov 86, 93p NBS/TN-1225
Also available from Supt. of Docs as SN003-003-02785-5.

Keywords: *Cost engineering, *Cost benefit analysis, Mail, Mathematical models, Profits, Optimization, Return on investment, Network flows, Systems engineering, Investments, Services, Methodology, Combinatorial analysis, *Electronic message systems, *PAREC model, Costs, Revenue.

The report describes a methodology for analyzing costs and benefits of a national electronic message service system and of similar systems involving alternative configurations of unspecified size. At the core of this methodology is a mathematical model, called PAREC, which provides information on sizes and configurations which optimize profit or return on investment. It is based on a technique for optimal selection of subconfigurations due to J.M.W. Rhys. A parametric minimum cost network flow algorithm was developed for the purpose of solving the resulting optimization problems.

706,775
PB87-151015 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Assessment of Error Bounds for Some Typical MIL-STD-461/462 Types of Measurements.
Technical note,
J. E. Cruz, and E. B. Larsen. Oct 86, 111p NBS/TN-1300
Also available from Supt. of Docs as SN003-003-02782-1. Sponsored by Army Aviation Systems Command, St. Louis, MO.

Keywords: *Electromagnetic compatibility, *Standards, Field strength, Military communication, Calibrating, Transmission lines, Electromagnetic fields, Error analysis, Measurement, Antenna factors, Test methods.

The report deals with the instrumentation and equations for several systems used by the U.S. Army for electromagnetic compatibility (EMC) testing and calibrations. Most testing for MIL-STD-461/462 is performed in a shielded enclosure (screenroom) rather than at an open field site, which leads to uncertainty in the measurement of emissions from electronic equipment, or the susceptibility of equipment to radiation. Assessment of error bounds by the National Bureau of Standards (NBS) is covered in the report, and suggestions are given for improving the measurements. Four areas of concern were studied as follows: (a) electromagnetic (EM) fields generated in a parallel-plate transmission line (stripline), (b) EM fields beneath a single-wire transmission line in a screenroom (longwire line), (c) determination of antenna factors for electromagnetic interference (EMI) antennas located in a screenroom, and (d) calibration of EMI receivers to measure broadband impulsive signals.

706,776
PB87-172045 PC **A99**/MF **E04**
National Bureau of Standards, Boulder, CO.
Achievement in Radio: Seventy Years of Radio Science, Technology, Standards, and Measurement at the National Bureau of Standards,
W. F. Snyder, and C. L. Bragaw. Oct 86, 887p NBS/SP-555
Also available from Supt. of Docs as SN003-003-02762-6. Library of Congress catalog card no. 85-600619.

Keywords: *Radio communication, *Telecommunication, Radio equipment, Frequency standards, Time standards, Ionospheric propagation, Radio waves, Electrical measurement, Antennas, Standards, History, Reviews, *National Bureau of Standards, *US NBS.

Topics discussed include the following (partial listing): The early years of radio at NBS; Fighting a war with Hertzian waves; Radio standards and measurements; Antennas, instruments, and systems in development; Probing the ionosphere; Time and frequency standards; Radio waves in the lower atmosphere; Engineering for radio propagation; Beyond the ionosphere; Quantum and plasma physics; On the international scene; The precursor roles.

706,777
PB87-191391 CP **T03**
National Bureau of Standards, Gaithersburg, MD.
Transport Class 4 and Internet Protocol.
Software,
J. Mulvenna. 2 Apr 87, mag tape NBS/SW/MT-87/007
See also PB86-146537.
Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions.

Keywords: *Software, *Telecommunication, *Data transmission, Operating systems(Computers), Standards, Magnetic tapes, *Transport class 4, C programming language, DEC VAX 11-780 computers.

The tape contains the NBS implementation of the Operating Systems Interconnections (OSI) Transport Class 4 and Internet Protocol. The protocols operate in the user space of Berkeley UNIX 4.3. The Internet Protocol is capable of accessing IEEE 802.3, IEEE 802.4 and X.25 subnetworks. The transport protocol is automatically derived in part from a formal description based on an extended finite date automata model. The formal specifications and the finite state automata tools are included on the tape. Also included is a sample protocol user...Software Description: The program is written in the C programming language for implementation on a DEC VAX 11/780 computer using the UNIX operating system.

706,778
PB87-202941 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Calibration of Optical Fiber Power Meters: The Effect of Connectors.
Final rept.,
R. L. Gallawa, and X. Li. 1987, 5p
Pub. in Applied Optics 26, n7 p1170-1174, 1 Apr 87.

Keywords: *Optical communication, *Power meters, *Calibrating, Fiber optics, Optical measurement, Reprints, *Optical connectors, *Optical fibers.

The paper addresses the question of accurate measurement of optical power at the wavelengths and power levels of interest to the telecommunication community. In particular, the authors examine the calibration of power meters that are destined for use in a field environment. Connectors and adapters are shown to skew the measurements, leading to errors attributable to reflections from the connector or to angular dependence of detector response. Calibration data are taken using two popular connector types: a biconic and an SMA type. The data are sufficient to illustrate the problem but definitive conclusions cannot be drawn regarding variability of performance with connector or connector type, because of the limited data.

706,779
PB87-223756 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Use of Power Transfer Matrices in Predicting System Loss: Theory and Experiment.
Final rept.,
J. M. Maisonneuve, and R. L. Gallawa. 1985, 16p
See also PB85-197770. Sponsored by Direction des Recherches, Etudes et Techniques, Paris (France).
Pub. in Fiber and Integrated Optics 6, n1 p11-26 1985.

Keywords: Attenuation, Reprints, *Local area networks, *Fiber optics transmission lines, Ray theory, Multimode, Matrices.

The phase space diagram for parabolic and step index fibers leads to a graphic representation of the bound, leaky, and refracted rays of ray theory. This concept is used to predict the attenuation of typical components of local area networks. The technique uses power transfer matrices to track the evolution of power distribution in ray packets. In particular, the authors predict and then measure the power transfer of two ray packets for a step index fiber. The comparison is encouraging.

706,780
PB88-153994 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Network Architecture Div.
Performance Improvements for ISO Transport.
Final rept.,
R. Colella, R. Aronoff, and K. Mills. 1985, 8p
See also PB88-154000. Sponsored by Institute of Electrical and Electronics Engineers, Inc., New York, and Association of Computing Machinery, New York.
Pub. in Proceedings of the Data Communications Symposium (9th), Whistler Mountain, British Columbia, Canada, September 10-13, 1985, p9-16.

Keywords: *Computer networks, *Data transmission, Protocols, Standards, Efficiency, Performance, *Channels(Data transmission), *Open systems interconnections, *Transport protocol, *Throughput, ISO, Computer performance evaluation.

The NBS Protocol Performance Laboratory is developing enhanced protocol mechanisms for OSI class 4 transport that will improve the throughput efficiency achieved on a satellite channel. A selective acknowledgement mechanism has been shown to improve throughput efficiency by as much as 34%. Several alternative expedited data mechanisms have demonstrated throughput efficiency improvements as great as 38%. Most of the protocol mechanism enhancements considered require only minor changes to the international standard OSI transport protocol.

706,781
PB88-154000 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Network Architecture Div.
Performance Improvements for ISO Transport.
Final rept.,
R. Colella, R. Aronoff, and K. Mills. 1985, 7p
Sponsored by Institute of Electrical and Electronics Engineers, Inc., New York, and Association of Computing Machinery, New York.
Pub. in Proceedings of the International Conference on the Management and Performance Evaluation of Computer Systems (CMG '85), Dallas, TX., December 9-13, 1985, p379-385.

Keywords: *Computer networks, *Data transmission, Protocols, Standards, Efficiency, Performance, *Channels(Data transmission), *Open systems interconnections, *Transport protocol, *Throughput, ISO, Computer performance evaluation.

The NBS Protocol Performance Laboratory is developing enhanced protocol mechanisms for OSI class 4 transport that will improve the throughput efficiency achieved on a satellite channel. A selective acknowledgement mechanism has been shown to improve throughput efficiency by as much as 34%. Several alternative expedited data mechanisms have demonstrated throughput efficiency improvements as great as 38%. Most of the protocol mechanism enhancements considered require only minor changes to the international standard OSI transport protocol.

Communication & Information Theory

706,782
PB-287 308/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation of Signal Plus Noise Detection Error in an Envelope Detector with Logarithmic Compression.
Final rept.
A. J. Estin, and W. C. Daywitt. 1978, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, 26-29 Jun 78 (IEEE Cat. no. 78CH 1320-1 IM, CPEM Digest p103-104 1978)

Keywords: *Demodulation, Errors, Correction, Random noise, Demodulators, Logarithmic functions.

A correction factor is derived for the detected output of a modulated sinusoidal signal with added Gaussian noise, as processed by an envelope detector with logarithmic compression. Supporting experimental data are presented, which were obtained on a typical commercial system using such a detector.

706,783
PB80-122849 Not available NTIS
National Bureau of Standards, Washington, DC.

Plane-Radial Scanning Techniques with Probe Correction; Natural Orthogonalities with Respect to Summation on Planar Measurement Lattices.
Final rept.,
P. F. Wacker. 1979, 4p
Pub. in Proc. 1979 Int. IEEE/AP-S Sump., Seattle, WA, June 18-22, 1979, Paper in 1979 International Symposium Digest: Antennas and Propagation, 79 CH1456-3 AP, 2, p561-564 1979.

Keywords: *Signal processing, Transducers, Fourier transformation, Orthogonal functions, Orthogonality, Data processing, Fast Fourier transformations.

For transducers many wavelengths across, highly efficient data processing is needed, requiring Hermitian orthogonalities with respect to summation on the measurement lattice. Moreover, in expressing the fields as linear combinations of basis functions, exact global solutions of the pertinent differential equation(s) make much more effective use of the data than ad hoc basic functions. Furthermore, for both accurate measurement and for non-ideal (e.g., directional) probes, correction for the pattern of the probe is required. For both the ideal probe and probe correction cases, the lattice must provide the required orthogonalities. Assuming that the properties of the medium are invariant under certain translations, rotations, and/or reflections, the author determines all the lattices providing natural orthogonalities for any type of planar scanning involving exact solutions of a linear system.

Graphics

706,784
AD-A147 500/3 PC **A07**/MF **A01**
Army Armament Research and Development Center, Aberdeen Proving Ground, MD. Ballistic Research Lab.
Electronic Typesetting Program Programmer's Manual.
Final rept.
J. H. Whiteside, and C. G. Messina. Aug 84, 130p
ARBRL-MR-03379, SBI-AD-F300 488
This report supersedes IMr-755, dated October 1982.

Keywords: *Typography, *Electronic equipment, *Photocomposition, Firing tables, Printing equipment, Programming manuals, Artillery, Electronic typesetting.

A new method of processing the data to make print masters (images from which printing plates are made) for artillery firing tables has been developed. The new system uses electronic typesetting, derived from the National Bureau of Standards Typographic System, to prepare data for a photocomposition machine. This is a programmer's manual with information on how the program works, how to alter it to produce artillery firing tables, and the structure of the Typographic System from which it is derived.

706,785
PB81-157059 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Workplace Safety Symbols: Current Status and Research Needs.
N. D. Lerner, and B. L. Collins. Mar 80, 63p NBSIR-80-2003
Sponsored in part by National Inst. for Occupational Safety and Health, Rockville, MD.

Keywords: *Symbols, *Safety, Visibility, Color codes, Communicating, Hazards, Standardization, Visual communication, Requirements.

Although written signs are a common means of conveying safety information in the workplace, pictographic symbols can be a more effective way of providing the same information. Symbols are independent of a particular written language, and can be more accurately and rapidly perceived than the comparable work message. Despite the many advantages of safety symbols, they can be ineffective or even dangerous if the intended meaning is not accurately communicated. As a result, there is a great need for careful evaluation, consistent application, and eventual standardization for safety symbols. This report documents an initial assessment of current symbol use and future requirements. It includes a review of the technical literature on symbol research; observation of safety sign and symbol use in the workplace; compilation of commercially available symbol referents; and review of national and international standards. Based upon these sources, an initial list of 40 symbol referents is presented along with research priorities for evaluating the effectiveness of symbols for these referents.

706,786
PB81-187965 PC **A04**/MF **A01**
Minnesota Dept. of Administration, St. Paul. Resource Conservation and Recovery Office.
Study of Resource and Energy Conservation Practices in the Procurement and Management of Commodities.
Final rept.
Mar 81, 66p NBS-GCR-81-311
Contract NB80-NAAE-6015

Keywords: *Commodity management, *Government procurement, *State government, *Materials recovery, Commodities, Acquisition, Purchasing, Government policies, Legislation, Regulations, *Recycled materials, Resource conservation, Energy conservation, Recycling.

The report examines the current State activities, regulations, statutes, and policies, as well as technical institutional and economic barriers relating to the public procurement of products containing recovered or recycled materials. The report also lists the top ten commodities procured by the State in dollars plus a listing of products that, in the opinion of the State, have a high potential for the use of recycled or recovered material. The report includes a list of recommendations or suggested actions that could be taken to potentially improve the manufacture, distribution, and procurement of products containing recovered or recycled materials.

706,787
PB81-203671 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Evaluation of Exit Directional Symbols.
Final rept.
N. D. Lerner. May 81, 56p NBSIR-81-2268

Keywords: *Symbols, *Visibility, Fire safety, Visual aids, Graphic methods, Arrows, Direction signs, NTISCOMNBS.

The paper discusses visibility considerations for exit symbols and the relationship between understandability and visibility concerns. Two experiments evaluated directional indicators (arrows) in the context of building exit signage. The first experiment compared the visibility of 32 arrows under degraded visual conditions that were comparable to a smoke environment. This experiment had two objectives: (1) the development of a methodology for assessing exit pictogram visibility; and (2) a comparison of the visibilities of the specific arrows tested. A second experiment obtained subjective rankings of the arrow types on the basis of several criteria of concern for exit signage. These criteria included connotative meaning, uniqueness from other directional indicators, and appropriateness.

706,788
PB82-242355 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development and Evaluation of Effective Symbol Signs.
Building science series (Final).
B. L. Collins. May 82, 99p NBS-BSS-141
Library of Congress catalog card no. 81-600192.

Keywords: *Graphic methods, *Communicating, Symbols, Safety, Visual communication, Warning systems.

Graphic symbols have recently been widely adopted for sign systems in the United States. Beginning with traffic sign systems, symbols have become widely used for applications ranging from products buildings. In this report a brief history of the development of symbols is given, followed by a review of research on experimental evaluation of symbols. Some of the general advantages and limitations of symbols are discussed, along with graphic considerations essential in the development of effective symbols. Research on symbols for five areas of application--highway, automotive/machinery, public information, product hazard, and safety--is then discussed. Finally, issues in the research and development of more effective symbols are reviewed. These include the need for good graphic design, characteristics of the intended user group, use of shape and color encode information, and general visibility considerations.

706,789
PB84-162809 PC **A04**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Utility Programs for Producing Camera Ready Illustrations on a Microcomputer and a Laboratory Plotter.
Technical note (Final).
C. E. Dick. Jan 84, 64p NBS-TN-1184
Also available from Supt. of Docs. as SN003-003-02552-6. Portions of this document are not fully legible.

Keywords: *Graphic arts, *Computer programs, Routines, Microcomputers, Apple II computers, DRAFTSMAN computer program.

A collection of software routines is described that allows the user to prepare camera ready illustrations in the laboratory or office environment. These routines are written in APPLESOFT BASIC and 6502 assembly code for the Apple II microcomputer which is interfaced with an inexpensive digital plotter. Provisions are made to draw figures composed of straight and curved line segments, letter the figures with a variety of graphic arts fonts, and save the figures on disk for later plotting or revision.

706,790
PB85-212082 CP **T99**
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Contribution to Computer Typesetting Techniques (for Microcomputers).
Data file.
R. C. Thompson. Apr 76, 6 diskettes NBS/DF/DK-85/003
For system on magnetic tape, see PB-263 925, and PB-263 926.
The data file is contained on 5 1/4-inch, double-sided, double-density diskettes, compatible with the IBM-PC microcomputer. The file is in ASCII. New formats will likely be available in the future. Contact NTIS Computer Products for current formats. Price includes documentation, PB-251 845.

Keywords: *Data file, *Plotting, Digital techniques, Fonts, Magnetic tapes, *Alphanumeric symbols, *Graphics, Typesetting, Vector processing, Hershey character set.

The diskettes contain two files. The first file contains tables of coordinates which make it possible to generate 1377 different alphabetic and graphic characters on either COM devices or on digital plotters. The characters can be generated on vector plotters by connecting the points given in these tables. This method of digitizing graphic arts characters allows them to be generated on any device which can plot vectors of arbitrary length and direction. The second file contains the Katakana, Hiragana, and approximately 600 Kanji characters also digitized by Dr. Allen V. Hershey of the Naval Surface Weapons Laboratory in Dahlgren, VA. This particular version of the data file is contained on 5 1/4 in. floppy disks formatted for the IBM PC microcomputer and PC-compatible microcomputers.

706,791
PB87-140281 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Tiletool: A Graphical Interface for the Exploration of Generalized Penrose Tilings.
S. Ressler. Nov 86, 18p NBSIR-86/3488
Sponsored by Bureau of Engraving and Printing, Washington, DC.

Keywords: *Printing, *Printing papers, *Security, Engraving, Interfaces, Bond papers, *Computer graphics.

A graphical system to experiment with non-periodic tilings of a plane has been developed. Non-periodic tilings have several properties which may be useful in the domain of security printing. A large variety of visually interesting patterns which conform to the constraint of non-periodicity may be rapidly produced with the system. The interaction has been made usable by organizing a set of flexible, consistent, and redundant mechanisms for the selection and modification of the various parameters.

Policies, Regulations, & Studies

706,792
AD-P004 572/4 PC **A02**/MF **A01**
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
New Time and Frequency Services at the National Bureau of Standards.
S. R. Stein, G. Kamas, and D. W. Allan. 2 Apr 84, 11p
Pub. in Proceedings of the Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (15th) Held at Washington, DC on 6-8 December 1983, AD-A149 163, p17-27.

Keywords: *Time standards, Measurement, Calibration, Accuracy, Precision, Global positioning system, Component Reports, National Bureau of Standards.

The two new measurement services offered in 1983 extend the range and capability of the other frequency and time services offered by NBS: telephone time of day; high frequency broadcasts (WWV and WWVH); low frequency broadcast (WWVB), the GOES satellite time code; and laboratory calibrations. These services previously provided routine time synchronization capability in the one second to 25 microsecond range. The new services offer enhanced automation and a greater confidence in the results of the measurements. In addition, NBS provides consultation to assist the user in selecting the best solution to his problems, initial training and follow-up consultation whenever measurement problems are detected. The new time and frequency services provide traceability to NBS and a direct link to one of the world's best time scales. They greatly reduce the need for the user to become an expert on the intracacies of navigation systems such as Loran-C and GPS. The systems reliability will be high because all the components are off-the-shelf commercial equipment and because NBS maintains the systems to minimize hardware failures.

706,793
PB-269 220/0 PC **A10**/MF **A01**
National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
Time and Frequency Users' Manual.
Final rept.,
G. Kamas. May 77, 221p NBS-TN-695

Keywords: *Time measurement, *Frequency measurement, Time standards, Frequency standards, Time signals, Frequencies, Time, Calibrating, Radio broadcasting, Television broadcasting, High frequencies, Low frequencies, Very low frequencies, Carrier waves, Manuals.

The manual has been written for the person who needs information on making time and frequency measurements. It has been written at a level that will satisfy those with a casual interest as well as laboratory engineers and technicians who use time and frequency every day. It gives a brief history of time and frequency, discusses the roles of the National Bureau of Standards and the U.S. Naval Observatory, and explains how time and frequency are internationally coordinated. It also explains what time and frequency services are available and how to use them. It discusses the accuracy that can be achieved using the different services as well as the pros and cons of using various calibration methods.

706,794
PB-269 740/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
VLF Precision Timekeeping Potential.
Final rept.,
B. Blair, J. Jesperson, and G. Kamas. 1971, 6p
Pub. in Proceedings of General Assembly of the International Union of Radio Science (URSI) (16th) Ottawa, Canada, Aug 1969; Paper in Progress in Radio Science 1966-1969, v2 p143-148 1971.

Keywords: *Time signals, Very low frequencies, Clocks, Synchronism, Precision.

Timing needs exist today for synchronization of remote clocks to tens of microseconds or better. This paper discusses the potential of dual frequency VLF transmissions to fulfill those needs. The approach considers phase control of the transmission frequencies, phase relations of near field measurements to the far field reception, propagation of the transmitted signals, and the resulting time synchronization at a remote receiver. Specifically, studies were made of recent WWVL broadcasts as received at several distant points and compared with local cesium frequency standards. The transmission format of 19.9 and 20.0 kHz signals (100 Hz frequency separation), broadcast at 10 second alternate intervals, resulted in less than desirable cycle identification and time synchronization within several hundred microseconds. The format of 20.0 and 20.5 kHz time shared signals (500 Hz frequency separation) gave positive cycle identification at several receiving sites. Day to day cycle identification is improved at both sites through a running average technique. Theoretical group delay predictions, which include dispersion corrections, are given for propagation to both magnetic east and west. Such predictions may provide coarse time bases for multiple frequency VLF timing. The considerations of this paper are directly applicable to the proposed Omega timing system.

706,795
PB-271 584/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
National Measurement System Time and Frequency - A Micro Study.
Final rept.,
S. L. Howe, and A. S. Risley. 1975, 5p
Pub. in NCSL Newsletter 15, n1 p16-20 Apr 75.

Keywords: *Time standards, *Frequency standards, Time signals, Utilization, Surveys, National measurement system, Reprints.

Members of the National Conference of Standards Laboratories were surveyed to determine their needs for Time and Frequency technology and their use of NBS radio broadcasts. There was a 67.5% (106 labs) response to the NCSL questionnaire. Results showed that 92% of the standards labs use NBS broadcast services. It also revealed that these standards labs represent a total capital investment in T&F equipment of $3.5 million.

706,796
PB-271 587/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Recent Changes and Future Trends in NBS Time and Frequency Dissemination Services.
Final rept.,
R. E. Beehler, D. W. Hanson, and D. D. Davis. 1975, 35p
Pub. in Proc. Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (7th), Goddard Space Flight Center, Greenbelt, Maryland, December 2-4, 1975, X-814-76-45, p61-95 1975.

Keywords: *Time signals, Frequency standards, Time standards, Radio broadcasting, Calibrating, Utilization, Telecommunication, Distributing, Trends, Surveys, Television transmission, Carrier waves.

During the past two years a number of improvements have been made in the NBS Time and Frequency (T/F) Dissemination Services. These range from making the WWVB 60 kHz broadcasts available on a continuous basis to implementing a new nationwide frequency calibration service using television techniques. NBS now provides regularly published calibrations of both the East Coast and the West Coast commercial TV network subcarrier frequencies for use as a transfer standard at the 10 to the minus 11 power accuracy level. Several versions of NBS-developed user equipment are described, covering a broad range of required user involvement, cost, and complexity. During the first half of 1975 the NBS conducted an extensive survey of WWV/WWVH users to obtain their views relating to possible reductions in the present broadcast services. A summary of the results of this survey, based on about 12,000 responses, is included along with a discussion of possible actions to be taken by NBS to reduce operating costs of these services. Future trends in NBS T/F dissemination services are discussed with special emphasis on the objectives and major milestones of the NBS program to disseminate T/F information via satellite.

706,797
PB-273 124/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dissemination of Time and Frequency by Satellite.
Final rept.,
R. Easton, L. C. Fisher, D. Hanson, H. Hellwig, and L. Rueger. 1976, 12p
Pub. in Proceedings IEEE 64, n10 p1482-1493 Oct 76.

Keywords: *Time signals, Spacecraft communication, Time standards, Frequency standards, Communication satellites.

A survey is given of the field of satellite time dissemination covering past experience, present activities, and future planned services with their respective precisions and accuracies. Transponder satellites, clock-carrying satellites, satellite systems, and two-way satellite links are discussed.

706,798
PB-275 612/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Time Code from NOAA's Geostationary Operational Environmental Satellites.
Final rept.,
D. W. Hanson, J. V. Cateora, and D. D. Davis. 1976, 20p
Pub. in Proceedings of Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (8th), Greenbelt, Md. 30 Nov-2 Dec 77 p105-124 1976.

Keywords: *Time signals, Coding, Scientific satellites, Data aquisition, GOES satellites.

In support of the environmental data collection on NOAA's GOES satellites, a time code has been incorporated by NBS into an interrogation message from these satellites. This message is directed to data-collection platforms engaged in seismic, tsunami, hydromet and other related monitoring activities. The NBS has developed this time-code system to serve environmental data users who require only a few tenths of a second accuracy as well as those who need a more accurate time reference. The time code is available continuously from two geostationary satellites and provides a coverage of the Atlantic and Pacific Ocean Basins as well as the North and South American Continents. The time code includes the necessary information to compensate for free-space propagation delays between the master clock located at Wallops Island, VA, and the user.

706,799
PB-279 335/4 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
Automatic Path Delay Corrections to GOES (Geostationary Operational Environmental Satellites) Satellite Time Broadcasts,
J. V. Cateora, D. W. Hanson, and D. D. Davis. Feb 78, 52p NBS-TN-1003

Keywords: *Time signals, Radio broadcasting, Correction, Microprocessors, Scientific satellites, GOES satellites.

In support of the environmental data collection by the National Oceanic and Atmospheric Administration's (NOAA's) Geostationary Operational Environmental Satellites (GOES), a time code has been incorporated into an interrogation message from these satellites by the National Bureau of Standards (NBS). This message is directed to data-collection platforms engaged in seismic, tsunami, hydromet and other related monitoring activities. The NBS has developed this time-code system to serve environmental data users who require only a few tenths of a second accuracy as well as those who need a more accurate time reference. The time code is available continuously from two geostationary satellites and provides a coverage of the Atlantic and Pacific Ocean Basins as well as the North and South American Continents. The time code includes the necessary information to compensate for free-space propagation delays between the master clock located at Wallops Island, Virginia, and the user. Preliminary results indicate a timing resolution of 10 microseconds.

706,800
PB-279 684/5 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
Disseminating Standards of Time and Frequency: Issues in the Evaluation of Alternative Systems.
Final rept. Jan 76-Apr 77,
R. H. F. Jackson. Mar 78, 33p NBSIR-78-874

Keywords: *Time standards, *Frequency standards, *Time signals, Benefit cost analysis, Cost effectiveness, Radio broadcasting, Communication satellites, Radio relay systems, Distributing, Substitutes, Evaluation.

Since 1923 the National Bureau of Standards (NBS) has broadcast standards of time and frequency over dedicated radio stations. Recently, the Bureau's Time and Frequency Division (TFD) has implemented pro-

grams of cost reduction at these radio stations. In addition, TFD undertook a study to identify and evaluate alternative modes of disseminating these standards in a search for methods to reduce costs further and to improve the quality of services offered. The primary purpose of this report is to document the economic issues involved in this study by discussing the problem in terms of both cost-benefit analysis and cost-effectiveness analysis. Preliminary cost studies for some of the dissemination alternatives are also included.

706,801
PB-283 815/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Creation of a Delphi Study for Forecasting Time and Frequency Technology.
Final rept.,
A. S. Risley. 1974, 5p
Pub. in Proceedings of 1974 National Telecommunications Conference, San Diego, Calif., Dec 2-4, 1974, p1087-1091.

Keywords: *Time, *Frequency, Technology, Forecasting, Technology assessment, National Measurement System.

The Delphi Study described here is a part of a more general study of the time and frequency needs of U.S. society. The paper describes the needs for the Delphi study and the four parameters which comprise it. The three sets of questions that form the questionnaire are discussed. The formation of these questions was based, in part, on the more general study, which is also described in some detail.

706,802
PB-285 015/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Time from NBS by Satellite.
Final rept.,
D. W. Hanson, D. D. Davis, and J. V. Cateora. Mar 78, 12p
Pub. in Annual Precise Time and Time Interval Applications and Planning Meeting (9th), Held at NASA Goddard Space Flight Center, Maryland on November 29-December 1, 1977, p139-150 (Goddard Space Flight Center, Greenbelt, Maryland, Mar 78).

Keywords: *Time signals, Radio relay systems, Synchronous satellites, GOES satellites, Time codes.

As a complement to the present time and frequency services of WWV, WWVH, and WWVB, the National Bureau of Standards (NBS) is now sponsoring a satellite-disseminated time code using the GOES satellites of the National Oceanic and Atmospheric Administration. The time code is referenced to the UTC (NBS) time scale, giving Coordinated Universal Time. It is considered by NOAA to be a permanent feature of the GOES satellites intended to serve the GOES users. It may, however, be used by others requiring a general purpose time reference. The time code is available to the entire Western Hemisphere from two satellites on a near full-time basis. The paper is basically an update of last year's PTTI paper on the GOES time code. The time-code generation system is being improved to include a continuous update of its ephemeris message in place of the present 30-minute updated message; triple redundancy is being designed into the generation equipment at the Wallops Island, Virginia, ground station; and monthly status reports will be included in the NBS Time and Frequency Services Bulletin; e.g., scheduled outages, solar eclipses, and past performances. This paper includes comments on NBS experience with the reception of the signals, possible sources of interference, and how to obtain best results.

706,803
PB-286 489/0 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Fields Div.
Feasibility Study of Orbiting Standards Platform.
A. J. Estin, and R. C. Baird. Jun 78, 47p NBSIR-78-886

Keywords: *Communication satellites, *Standards, Spacecraft communication, Radio relay systems, Feasibility, Measurement, Antennas, Radio signals, Electromagnetic interference, Performance, Orbiting standards platforms.

The report consists of four components of a feasibility study for a satellite-based measurement system for determining important operational parameters of satellite communications systems and its major sub-systems. The authors addressed the questions of required accuracy, methods of attaining and maintaining measurement accuracy and traceability, system tradeoffs, and economic impacts and benefits.

706,804
PB80-107352 Not available NTIS
National Bureau of Standards, Washington, DC.
Two-way Time Transfers Between NRC/NBS and NRC/USNO via the Hermes (CTS) Satellite.
Final rept.,
C. C. Costain, H. Daams, J. S. Boulanger, D. W. Hanson, and W. J. Kelpczynski. 1978, 16p
Pub. in Proceedings of the Annual PTTI Conference (10th), Washington, DC., November 28-30, 1978, p585-600 1978.

Keywords: *Time signals, Time, Comparison, Communication satellites, Transferring.

Two-way time transfers via the Hermes (CTS) satellite between NRC, Ottawa and NBS, Boulder and between NRC and USNO, Washington, DC, began once a week in July 1978. At each station the differences were measured between the local UTC seconds pulse and the remote UTC pulse received by satellite. The difference between the readings, if station delays are assumed to be symmetrical, is two times the difference between the clocks at the two ground station sites. Over a 20-minute period, the precision over the satellite is better than 1 ns. The time transfer from NRC to the CRC satellite terminal near Ottawa and from NBS to the Denver HEW terminal are still subject to larger uncertainties which are being examined. The absolute measure of UTC differences also depends on the measurement of station delays, which in present circumstances will be difficult to carry out.

706,805
PB80-110059 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. Experimental Technology Incentives Program.
FCC Public Message Services Policy Change: An ETIP Evaluability Assessment Report. Volume 1.
Interim rept.,
J. Bell, S. Kirby, R. G. Weiss, and S. Watson. Sep 79, 236p NBS-TN-1104-VOL-1
Prepared in cooperation with Urban Inst., Washington, DC. See also Volume 2, PB80-110067.

Keywords: *Telecommunication, *Regulations, Government policies, Assessment, Incentives, Technology innovation, Evaluation, Telegraph systems, Commerce, National government, Competition, Common carriers, Organization theory, Financial management, Tariffs, Legislation, Industrial structure, Public message services, Federal Communications Commission.

This document is a report of work in progress toward evaluating effects of the recent decision of the Federal Communications Commission to open public message services to competition. It is one product of the Regulatory Processes and Effects Project of the Center for Field Methods (ETIP). The broader project, described elsewhere, is attempting to analyze the effects of changes in regulatory processes on industrial innovation. The joint ETIP/FCC project will involve measuring whether the FCC policy change leads to increases in competition, technological innovation, and public benefit. The first two chapters provide an introduction and synopsis. Chapter II examines the setting in which the decision occurs in terms of historical developments, industry trends, and views held by various observers. Chapter IV describes the: Commission's mandate for regulation, process for implementing this mandate in terms of regulations and operations, and current industry status. The fifth chapter describes the evaluation logic. The last chapter is an assessment which shows that there are many choices to be made to target the evaluation. A glossary of terms and bibliography are included. Seven appendices are bound separately.

706,806
PB80-110067 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Experimental Technology Incentives Program.
FCC Public Message Services Policy Change: An ETIP Evaluability Assessment Report. Volume 2.
Interim rept.,
J. Bell, S. Kirby, R. G. Weiss, and S. Watson. Sep 79, 115p NBS-TN-1104-VOL-2
See also Volume 1, PB80-110059. Prepared in cooperation with Urban Inst., Washington, DC.

Keywords: *Telecommunication, *Regulations, Government policies, Assessment, Incentives, Technology renovation, Evaluation, Telegraph systems, Commerce, National government, Common carriers, Organization theory, Tariffs, Legislation, Data sources, Public message services, Federal Communications Commission.

Contents:
- Public message services chronology (1844 through January 1979);
- Execunet chronology with brief introduction (July 1975 through June 1978);
- Space industrialization concept and implications for telecommunications;
- Findings about information sources available at the Federal Communications Commission and elsewhere;
- Potential uses of information and potential measurable issues;
- Potential users of information;
- FCC news release announcing end of Western Union monoply and conditional approval of Graphnet's application for domestic service (CC Docket Nos. 78-95-96).

706,807
PB80-117799 Not available NTIS
National Bureau of Standards, Washington, DC.
National Bureau of Standards Time to the Western Hemisphere by Satellite.
Final rept.,
D. W. Hanson, D. D. Davis, and J. V. Cateora. Aug 79, 10p
Pub. in Radio Sci., v14 n4 p731-740 Jul/Aug 79.

Keywords: *Time signals, Radio relay systems, Synchronous satellites, Time standards, Radio broadcasting, Reprints, *Western hemisphere, Satellite communications.

As a complement to the present time and frequency services of WWV, WWVH, and WWVB, the National Bureau of Standards (NBS) is now providing a satellite-disseminated time code using the Geostationary Operational Environmental Satellites (Goes) of the National Oceanic and Atmospheric Administration (NOAA). The time code is referenced to the NBS time scale, giving coordinated universal time (UTC). In addition to the usual information of day of year, hours, minutes, seconds, and the UTI correction the time code contains the satellite's current position for use in path delay calculations. The time signals are relayed to the entire Western Hemisphere from two geostationary satellites on a full-time basis except during brief periods of solar eclipses occurring during the vernal and autumnal equinoxes. The time code, originally intended for use by environmental monitoring platforms, is easily accessible by anyone using relatively simple, commercially available equipment. Physically small antennas (30 cm x 30 cm x 1 cm) are typical. The generation, satellite relay, and recovery of these signals is discussed. Results obtained with commercial receiving equipment are included.

706,808
PB80-143993 PC **A12**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Time and Frequency Users' Manual,
G. Kamas, and S. L. Howe. Nov 79, 258p NBS-SP-559
Supersedes PB-269 220. Library of Congress catalog card no. 79-600169.

Keywords: *Time measurement, *Frequency measurement, Time standards, Frequency standards, Time signals, Utilization, Calibrating, Radio broadcasting, Time, Frequencies, High frequencies, Television broadcasting, Loran, Manuals, Carrier waves, Loran C navigation systems.

This manual has been written for the person who needs information on making time and frequency measurements. It has been written at a level that will satisfy those with a casual interest as well as laboratory engineers and technicians who use time and frequency every day. It gives a brief history of time and frequency, discusses the roles of the National Bureau of Standards, the U. S. Naval Observatory, and the International Time Bureau, and explains how time and frequency are internationally coordinated. It also explains what time and frequency are internationally coordinated. It also explains what time and frequency services are available and how to use them. It discusses the accuracies that can be achieved using the

different services as well as the pros and cons of using various calibration method.

706,809

PB80-147747 PC **A02**/MF **A01**
National Bureau of Standards, Boulder, CO.
NBS Time and Frequency Dissemination Services, 1979 Edition.
Final special pub.,
S. L. Howe. Sep 79, 25p NBS-SP-432/79 Ed
Supersedes PB-253 114.

Keywords: *Time signals, Time standards, Frequency standards, Radio broadcasting, Standards, Calibrating, Medium frequencies, High frequencies, National Bureau of Standards.

Detailed descriptions are given of the time and frequency dissemination services of the National Bureau of Standards. These services include the broadcasts from radio stations WWV, WWVH, WWVB, and WWVL, and new time and frequency calibration services using television. This publication shows the services available on April 1, 1979. It will be updated only when the services are revised or when new services are added. A list of other publications available about the Time and Frequency Division is also included.

706,810

PB81-104440 Not available NTIS
National Bureau of Standards, Washington, DC.
Voice Announcements of Time: A New Approach.
Final rept.
J. Jespersen, G. Kamas, and M. Weiss. 1979, 22p
Pub. in Proc. Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (11th), Goddard Space Flight Center, Greenbelt, MD., Nov 27-29, 1979 p363-384 1979.

Keywords: *Time signals, Voice communication, Radio broadcasting, Improvement.

A recent survey by NBS reveals that the voice time announcements provided by radio stations WWV and WWVH are used more often than any other features of the time signals. It is the purpose of this paper to describe some recent NBS work aimed at exploring a different technique for generating voice time announcements.

706,811

PB81-104465 Not available NTIS
National Bureau of Standards, Washington, DC.
Time Recovery Measurements Using Operational GOES and Transit Satellites.
Final rept.
R. E. Beehler, D. D. Davis, J. V. Cateora, A. J. Clements, J. A. Barnes, and E. Mendez-Quinones. 1979, 30p
Pub. in Proc. Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (11th), Goddard Space Flight Center, Greenbelt, MD., Nov 27-29, 1979 p282-312 1979.

Keywords: *Time signals, Accuracy, Monitoring, Synchronous satellites, GOES satellites, Transit satellites.

Results of regular monitoring of both the GOES and TRANSIT timing signals over a number of months at NBS, Boulder, CO are presented. The TRANSIT results include an analysis of how received timing accuracy and stability are affected by: (1) averaging over varying numbers of satellite passes; (2) averaging over different combinations of the 5 available satellites; (3) using several independent receivers of the same type; and (4) application of (TRANSIT-UTC(USNO)) published corrections to the received data. Based on monitoring experience to date at NBS, some pros and cons of using each of the available operational systems are discussed. Updated information on recent improvements incorporated into the GOES time code generation and monitoring system at Wallops Island, VA is also included.

706,812

PB81-104481 Not available NTIS
National Bureau of Standards, Washington, DC.
Two-Way Time Transfer via Geostationary Satellites. NRC/NBS, NRC/USNO and NBS/USNO via Hermes and NRC/LPTF (France) via Symphonie.
Final rept.
C. C. Costain, J. S. Boulanger, D. W. Hanson, R. E. Beehler, A.J. Clements, D. D. Davis, H. Daams, W. J. Klepczynski, L. Veenstra, J. Kaiser, B. Guinot, J. Azoubib, P. Parcelier, G. Freon, and M. Brunet. 1979, 21p
Pub. in Proc. of Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (11th), Goddard Space Flight Center, Greenbelt, MD., Nov 27-29, 1979, p499-519 1979.

Keywords: *Time signals, Synchronous satellites.

The two-way time transfer using the Hermes (CTS) satellite and the Symphonie satellite began in July, 1978. The Hermes experiment finished at the end of June 1979, and the Symphonie experiment will continue until the end of 1980. The N.R.C. uses terminals at the Communication Research Center about 25 miles from the N.R.C. laboratory, and the time transfer from N.R.C. to C.R.C. is made using line of sight IV reception with frequency checks by portable cesium or rubidium clocks. Initially the USNO used Goddard terminals, and the NBS a HEW terminal in Denver, and both relied primarily on portable clock synchronization. For the last eight months, Comsat terminals were used at the USNO and at NBS, so that no secondary time transfer was required. In France, the PBS Symphonie terminal is in Brittany, 300 miles from the Laboratoire de Temps et Frequence (LPTF) at the Observatoire de Paris, and the time transfer to the terminal is made via the TV networks. The uncertainty in this latter link is about 20 ns, but for the other stations the uncertainty is 1 to 5 ns.

706,813

PB81-174153 Not available NTIS
National Bureau of Standards, Washington, DC.
Accurate Time and Frequency Transfer during Common-View of a GPS Satellite.
Final rept.
D. W. Allen, and M. A. Weiss. May 80, 13p
Pub. in Proceedings of the Annual Symposium on Frequency Control (34th) Held at Fort Monmouth, NJ., on May 28-30, 1980, p334-346 May 80.

Keywords: *Time signals, Comparison, Navigation satellites, Time, Time measurement, Atomic clocks, Global positioning system.

Even though the GPS is primarily a navigation system, if two clocks at known coordinates A and B are in common-view of a single GPS satellite, receivers at these two clock sites may coincidentally receive transmitted GPS clock times. By subtracting the received times of arrivals as measured by clocks A and B at the two sites while compensating for the propagation delays, one has an accurate measure of the time difference between clock A and clock B.

706,814

PB81-197493 Not available NTIS
National Bureau of Standards, Washington, DC.
Electronic Communication: Technology and Impacts.
Final rept.
M. M. Henderson, and M. J. MacNaughton. 1980, 191p
Pub. in Proceedings of the AAAS Selected Symposium 52, 191p Held at Houston, TX., on January 3-8, 1979.

Keywords: *Telecommunication, Technology, Computer networks, Social effect, Policies, Technology assessments, NTISCOMNBS.

Electronic communications technology and services permeate every aspect of national life. This book examines the current and expected states of the technology and considers the societal impact and policy issues arising from new technological developments. Particular attention is paid to evaluation of computerized conferencing for enhanced communication among researchers in specialized and interdisciplinary fields and to technology assessments of criminal justice and tax administration systems.

706,815

PB82-133414 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Telecommunication Technologies, Networking and Libraries.
Final rept.
N. H. Knight. Dec 81, 93p NBS-SP-610
Library of Congress catalog card no. 81-600069. Proceedings of a Conference Held at Gaithersburg, Maryland on June 3, 1977.

Keywords: *Telecommunication, *Meetings, *Libraries, Pulse communication, Computer networks, Information systems, Television transmission, Protocols, Electronic message systems, Image transmission, Videodiscs, Teleconferencing.

The conference provided an overview of current and developing technologies for digital transmission of image data that are likely to have an impact on the operations of libraries and information centers or provide support for information networking. Technologies reviewed include slow-scan television, teleconferencing, and videodisc. Other papers discuss technology and standards development for computer network interconnection through hardware and software, particularly packet-switched networks; computer network protocols for library and information service applications; the structure of a national bibliographic telecommunications network; and the major policy issues involved in the regulation or deregulation of the common communications carriers industry.

706,816

PB82-137464 Not available NTIS
National Bureau of Standards, Washington, DC.
Broadband Orthogonal Array Antenna System Microprocessor Control and Computation.
Final rept.
W. D. Bensema. 1981, 3p
Pub. in Proceedings of IEEE International Symposium on Electromagnetic Compatibility (1981), Boulder, Colorado, August 18-30, 1981, p43-45.

Keywords: *Antenna arrays, Broadband antennas, Omnidirectional antennas, Electromagnetic interference, Field strength, Measurement, Computation, Control equipment, Microprocessors, Computer applications.

A broadband orthogonal array antenna system and associated control circuitry have been designed to reduce the man hours required when making spectrum occupancy studies. Effective omnidirectional coverage is obtained by rapidly switching among arrays of conventional antennas; resultant field strengths are calculated and recorded using a microprocessor. The system is man pack portable, covers from 10 kHz to 18 GHz and is capable of recording fields up to 100 V/meter. The system has demonstrated a factor of 50 to 1 reduction in man hours required to carefully measure and record spectrum occupancy over conventional non-automated searching. This paper concentrates on the microprocessor computation, control, display, print out and convenience features. A companion paper discusses antenna systems and rf switching.

706,817

PB83-103754 Not available NTIS
National Bureau of Standards, Washington, DC.
Construction and Performance Characteristics of a Prototype NBS/GPS Receiver.
Final rept.
D. D. Davis, M. Weiss, A. Clements, and D. W. Allan. 1981, 7p
Pub. in Proceedings of the Annual Frequency Control Symposium (35th), Philadelphia, Pennsylvania, May 27-29, 1981, p 625-636.

Keywords: *Time signals, Time, Transferring, Frequency standards, Time comparsion.

NBS has proposed a particular application of the C/A Global Positioning System (GPS) signal using the fact that the location of two earth stations may be known. Hence, if one has common-view of a single satellite from these two earth stations, excellent time transfer capability exists. NBS has developed a prototype receiver featuring extremely high time transfer accuracy and low cost. Even though one may not know the absolute delays through the receivers, one can do absolute time transfer by knowing the differential delay between two receivers. The received satellite signals gave an RMS time fluctuation of the receiver output as good as 3.5 nanoseconds for an omni antenna using 15 second averages. The noise was characterized as white noise phase modulation, which can be averaged below the systematics, which are about 1 nanosecond

over a thermal range of several degrees about ambient. The day to day time fluctuations, when measuring the time difference between NBS-Boulder and USNO-Washington, D.C. were about 5 ns.

706,818
PB83-140558 PC **A04**/MF **A01**
Performance Development Inst., Washington, DC.
Agenda for FCC Telecommunications Monitoring and Analysis.
Final rept.
M. A. Mulkey, and K. P. Timpane. Dec 82, 55p NBS-GCR-ETIP-82-101
Contract NBS-78-3603

Keywords: *Communications management, *Public administration, Regulations, Monitoring, Telecommunication, Government policies, Federal Communications Commission, Deregulation, Telecommunication industry.

This is the final report on an experiment in communications deregulation. In this report of the last phase of that project an agenda for future monitoring of the effects of deregulation is suggested. Like most ETIP work it is based on the views of many, varied interests both inside and outside the Federal Communications Commission (FCC)--ETIP's partner in this project. The report contains, first, the views of those interviewed of the major issues facing the Commission, such as the effects on competition of deregulation. Secondly, the report suggests measures for monitoring and analyzing those issues. Finally, it recommends ongoing processes for the Commission to pursue in order to maintain a credible monitoring capability for the near future.

706,819
PB83-143693 Not available NTIS
National Bureau of Standards, Washington, DC.
Time/Frequency Services of the U.S. National Bureau of Standards and Some Alternatives for Future Improvement.
Final rept.
R. E. Beehler. 1981, 4p
Pub. in Jnl. of the Institute of Electronics and Telecommunications Engineers 27, n10 p389-402 1981.

Keywords: *Time standards, *Frequency standards, Artificial satellites, Reviews, Reprints, National Bureau of Standards.

The National Bureau of Standards (NBS) currently disseminates time and frequency information to a broad range of users by LF and HF radio broadcasts; a telephone time-of-day service; calibration of selected Loran-C, TV, and Omega Navigation System broadcasts; a time code from two geostationary meteorological satellites; and appropriate publications. These various services will be described briefly with special emphasis on the newer satellite dissemination method. For the future, satellite-based dissemination and coordination methods appear to offer promise for substantial improvement relative to present terrestrial services and techniques. Some of the potential advantages include better coverage throughout the world, greater reliability of reception, higher accuracy and precision, economical operation, and reduced interference. Some of the leading satellite alternatives for future time/frequency dissemination and/or coordination will be discussed and evaluated. In recognition of the potential improvements realizable from satellite-based techniques, Study Group 7 of the International CCIR organization has initiated a study of possibilities for developing operational use of such techniques for improved dissemination and coordination on a worldwide basis. A status report on this study will be given.

706,820
PB83-600035 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cryptographic Key Notarization Methods and Apparatus.
M. E. Smid, and D. K. Branstad. Filed 29 Sep 80, patented 31 May 83, 1p PAT-APPL-6-192 129, PATENT-4 386 233

Keywords: *Cryptographic function, Cryptographic keys, Identifier, Password disignation.

Cryptographic keys for a cryptographic function are notarized by encrypting the keys with the cryptographic function using a notarizing cryptographic key derived from identifier designations associated with the encryptor and intended decryptor, respectively, and an interchange key which is accessible only to authorized users of the cryptographic function. Preferably, the identity of a user of the cryptographic function is authenticated as a condition to access to an interchange key. Advantageously, authentication is accomplished by comparing a password designation supplied by the user with a prestored version therof which has been notarized by having been accepted with the cryptographic function using a notarizing cryptographic key derived from the identifier designation of the corresponding authorized user and an interchange key. Signature properties similar to those provided by public key systems are provided for nonpublic keys by allowing a user to use a key for only encryption or decryption and not both. Preferably, this is attained through the use of user identifiers which are combined in predetermined combinations for data key notarization and notarized data key decryption in dependence on whether a key is to be used for encryption or decryption.

706,821
PB84-155571 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
American National Standard X3.102 User Reference Manual.
N. B. Seitz, and D. S. Grubb. Oct 83, 107p NTIA-REPORT-83-125

Keywords: *Telecommunication, *Standards, Data transmission, Manuals.

American National Standard X3.102 defines a set of 21 standard parameters that provide a uniform means of specifying the performance of data communication systems and services as seen by users. This report is basically an explanation and elaboration of that standard. The report first outlines the benefits of using the standard from the viewpoint of the end user, the communication provider, and the communication manager. The report then summarizes the standard's overall approach and content in informal, non-technical terms. Finally, the report examines the meaning and importance of each standard parameter in a series of tutorial parameter descriptions. Typical parameter values are presented and their design implications are discussed.

706,822
PB84-217884 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Coaxial Noise Standard for the 1 GHz to 12.4 GHz Frequency Range.
Final rept.
W. C. Daywitt. Mar 84, 48p NBS/TN-1074
Also available from Supt. of Docs as SN003-003-02564-0.

Keywords: *Standards, *Thermal noise, Microwaves, Error analysis, Computer programs, Cryogenics, Design, *Noise standards, Coaxial configurations.

This note describes the design and construction of a coaxial thermal noise standard. The standard is designed to operate at the boiling point of liquid nitrogen with a noise temperature accurate to + or - 1 K in the frequency range from 1 GHz to 12.4 GHz.

706,823
PB85-203552 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Coordinate Time on and Near the Earth.
Final rept.
N. Ashby, and D. W. Allan. 5 Nov 84, 1p
Pub. in Physical Review Letters 53, n19 1858p, 5 Nov 84.

Keywords: *Atomic clocks, *Time measurement, General relativity, Synchronism, Reprints, Frequency synchronization, Sagnac effect.

Gravitational frequency shifts, second-order Doppler shifts, and the Sagnac effect are well determined path-dependent relativistic effects which must be considered when synchronizing atomic clocks. Using the coordinate time of General Relativity in a local inertial frame as a basis, and applying appropriate corrections to the readings of atomic clocks and to time delays of electromagnetic signals, a network of consistently synchronized clocks can be established near the Earth.

706,824
PB86-128857 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Accuracy of International Time and Frequency Comparisons via Global Positioning System Satellites in Common-View.
Final rept.
D. W. Allan, D. D. Davis, M. Weiss, A. Clements, B. Guinot, M. Granyeaud, K. Dorenwendt, B. Fischer, P. Hetzel, S. Aoki, M. K. Fujimoto, L. Charron, and N. Ashby. 1985, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-34, n2 p118-125 Jun 85.

Keywords: *Frequency standards, *Time standards, *Accuracy, Measurement, Reprints, Global positioning system.

Frequency differences between major national timing centers are being resolved with uncertainty of less than 1 part in 10 to the 14th power, using satellites of the Global Positioning System (GPS) in common-view. Portable clock and GPS time differences are in excellent agreement. Around the world GPS measurement between three laboratories had a time residual of 5.1 ns.

706,825
PB86-238664 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Recent Trends in NBS (National Bureau of Standards) Time and Frequency-Distribution Services.
Final rept.
R. E. Beehler, and D. W. Allan. 1986, 3p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) 74, n1 p155-157 1986.

Keywords: *Time signals, *Frequency distribution, Radio broadcasting.

Since 1967 the National Bureau of Standards has improved its traditional radio broadcast services from WWV, WWVH, and WWVB and introduced several new services to meet changing needs. The new services are described briefly, including the GOES satellite time code, the Frequency Measurement Service using Loran-C and WWVB, and the Global Time Service based on the GPS satellite common-view technique.

706,826
PB87-122529 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Time Scale Stabilities Based on Time and Frequency Kalman Filters.
Final rept.
J. A. Barnes, and D. W. Allan. 1985, 6p
Pub. in Proceedings of Annual Symposium on Frequency Control (39th), Philadelphia, PA., May 29-31, 1985, p107-112.

Keywords: *Frequency control, Frequency stability, *Kalman filters.

The paper details the various scale performances between measurements and provides an insight into the different performances based on computer simulation studies. For example, the 'Time' Kalman filter displays discrete steps in the time corrections where the 'Frequency' Kalman filters are continuous (being the integral of a bounded process). Depending on whether one is most interested in minimizing the RMS time error or minimizing the Allan Variance, one chooses the one time scale over the other.

706,827
PB87-122537 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
New System for Measuring Frequency.
Final rept.
G. Kamas, and M. Lombardi. 1985, 7p
Pub. in Proceedings of National Conference of Standards Laboratories 1985 Workshop and Symposium, Boulder, CO., July 15-18, 1985, p224-231.

Keywords: *Frequency measurement.

The paper provides an overview of the NBS Frequency Measurement Service. It begins by discussing the basis for the new service, and the equipment supplied with the service. It shows the advantages of the output data obtained with the service. It explains how the system works and discusses accuracy, reliability, and ease of use. The paper also discusses how the NBS supports the service with training, on-line diagnostics,

published measurement data, and monthly performance reports.

706,828
PB87-134938 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
High-Accuracy Global Time and Frequency Transfer with a Space-Borne Hydrogen Maser Clock.
Final rept.
R. Decher, D. W. Allan, C. O. Alley, C. Baugher, B. J. Duncan, R. F. C. Vessot, and G. M. R. Winkler. 1983, 17p
Pub. in Proceedings of Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (14th), Greenbelt, MD., November 30-December 1-2, 1982, p205-221 1983.

Keywords: Frequency standards, *Time transfer, *Frequency transfer, Hydrogen masers, Space shuttles, Global.

The paper describes a proposed system for high-accuracy global time and frequency transfer using a hydrogen maser clock in a space vehicle. Direct frequency transfer with an accuracy of 10 to the -14th power and time transfer with an estimated accuracy of 1 nsec are provided by a 3-link microwave system. A short pulse laser system is included for subnanosecond time transfer and system calibration. The basic concept of such a system was discussed at the 1980 PTTI Meeting. The paper presents the results of further studies including operational aspects, error sources, data flow, system configuration, and implementation requirements for an initial demonstration experiment using the Space Shuttle.

706,829
PB87-173720 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
NBS-Industry (National Bureau of Standards-Industry) Cooperation to Advance Microwave Standards.
Final rept.,
B. C. Belanger. 1987, 12p
Pub. in Proceedings of 1987 Measurement Science Conference, Irvine, CA., January 29-30, 1987, p1-12.

Keywords: *Millimeter waves, *Microwaves, Standards, US NBS.

A comprehensive status report on NBS' microwave measurement services was presented at the last Measurement Science Conference. The paper provides an update on developments over the past year. The most significant advance is a recent decision by the MILSTAR Program to support NBS to develop national measurement standards for the frequencies and measurements of interest to the MILSTAR contractors. In the present climate of concern over budget deficits, it is very unlikely that major new programs can be initiated to expand NBS' level of effort on microwave measurements through direct Congressional appropriations to NBS. Accordingly, the paper explores possible ways that NBS and industry can work together to ensure that critical microwave standards needs are met, in particular, those identified by the IEEE Committee to Promote National Microwave Standards and the NCSL National Measurement Requirements Committee.

706,830
PB88-109186 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Millimeter-Wave Standards: An Emerging Need.
Final rept.,
R. T. Adair, G. R. Reeve, and L. E. Gatterer. 1986, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-35, n4 p376-382 Dec 86.

Keywords: *Millimeter waves, *Standards, Surveys, Reprints, Calibration, US NBS.

Several technology surveys concerning millimeter-wave (MMW) measurement needs and capabilities have been conducted by the National Bureau of Standards (NBS), Boulder Laboratories, and others. The results of some of these studies are summarized. Current MMW standards and calibration capabilities at NBS are reviewed. The lack of national standards in certain frequency bands may lead to problems with the specification, acceptance testing, and calibration of some components and systems.

706,831
PB88-134606 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Relaxation of an Unattached Chain in a Cross-Linked Network: A Span Analysis of Reptation.
Final rept.,
R. Gaylord, E. DiMarzio, A. Lee, and G. H. Weiss. Nov 85, 2p
Pub. in Polymer Communications 26, n11 p337-338 Nov 85.

Keywords: Reprints, *Reptation, *Span, *Random walk, Viscoelasticity, Tube model.

The reptation model is analyzed in terms of the properties of the span of an ordinary random walk. Expressions are obtained for the fraction of occupied tube, the tube escape time and the complex dynamic viscosity. The continuous-time random walk modification of the reptational model is also discussed.

706,832
PB88-138813 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Stability Measurements of Ku-Band Spread Spectrum Equipment Used for Two-Way Time Transfer.
Final rept.,
D. A. Howe. 1987, 15p
Contract F30602-85-0055
Sponsored by Rome Air Development Center, Griffiss AFB, NY.
Pub. in Proceedings of Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (18th), Washington, DC., December 2-4, 1986, p437-451.

Keywords: Frequency stability, Syhchronous satellites, *Time transfer, Ku band, Spread spectrum transmission.

The NBS Boulder Laboratory is in the process of assembling a very high accuracy time transfer system. The system includes a 6.1 meter Ku-band satellite earth station, two transportable earth stations each with a 1.8 meter dish, and commercial modems designed for two-way timing. Elements of the facilities are described in the paper. High-accuracy timing with this equipment using the two-way time transfer technique via a geostationary satellite is discussed. Phase stability measurements of ground facilities in various loop-around schemes using a satellite simulator have been performed in order to determine ultimate stability limits. Allan-variance stability plots are generated for sample times of 1 s to several days at various carrier-to-noise density (C/No) ratios. These plots are compared to theoretical limits obtained from the model of phase jitter given for the spread spectrum modem.

706,833
PB88-147384 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
NBS (National Bureau of Standards) Calibration Procedure for Providing Time and Frequency at a Remote Site by Weighting and Smoothing of GPS (Global Positioning System) Common View Data.
Final rept.,
M. A. Weiss, and D. W. Allan. 1987, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p572-578 Jun 87.

Keywords: *Frequency stability, Frequency standards, Data smoothing, Reprints, Time transfer, Global positioning system, Calibration.

The National Bureau of Standards (NBS) Time and Frequency Division now performs precision time and frequency transfer using common view measurements of Global Positioning System (GPS) satellites as a calibration service. Using the service, the authors have been able to transfer time with time stabilities of a few nanoseconds, time accuracies of the order of 10 ns, and frequency stabilities of one part in 10 to the 14th power, or better, for measurement times of about four days and longer. The full accuracy of the NBS primary frequency standard is now available at a remote site. The paper describes the technique used for weighting and smoothing the data to produce these levels of stability and accuracy. All of the primary frequency standards used in the generation of International Atomic Time (TAI) now use the technique.

706,834
PB88-152756 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
GPS (Global Positioning System) Time Steering.
Final rept.,
W. J. Klepczynski, H. F. Fliegel, and D. W. Allan. 1986, 13p
Pub. in Proceedings of Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (18th), Washington, DC., December 2-4, 1986, p237-249.

Keywords: *Time transfer, Global positioning system.

The importance of the Global Positioning System (GPS) for global time transfer makes it desirable to steer GPS time as closely as possible to the UTC rate. Currently, GPS time is maintained to satisfy two system requirements. First, GPS time is steered to within one microsecond of UTC(USNO) when the leap seconds imposed on UTC since 1980 have been removed. Second, the GPS Navigation Message gives the offset UTC(USNO) - GPS time to users with an error not to exceed 100 nanoseconds. User performance would be improved, however, if changes in the GPS time rate were smaller and more gradually imposed than at present. Three current developments are expected to improve GPS time steering performance: the installation of a stable clock ensemble at the GPS Mater Control Station: improvement of supporting hardware; and application of control theory to steering procedures.

Radio & Television Equipment

706,835
PB-257 190/9 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
Development of Reports and Guidelines for Law Enforcement Communications Equipment.
Final rept.
M. J. Treado. Aug 74, 13p
Pub. in Proceedings of Annual Crime Countermeasures Conference (8th), Held in Lexington, Kentucky, on April 16-19, 1974. Paper in Proceedings 1974 Carnahan and Int. Crime Countermeasures Conference, UKY BU 105 p102-112 Aug 74.

Keywords: *Communication equipment, *Pulse communication, *Law enforcement, Radio equipment, Mobile equipment, Digital systems, Performance standards.

The Law Enforcement Standards Laboratory (LESL), was established by NBS for the National Institute of Law Enforcement and Criminal Justice (NILECJ) primarily to develop performance standards to assist law enforcement agencies in their equipment selection and procurement process. In addition to performance standards, LESL also is developing equipment reports, guidelines and glossaries for use by the law enforcement community. The paper uses a typical study effort, in this case one on mobile digital communications, to illustrate the development of a law enforcement equipment report.

706,836
PB-274 356/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Proposed Standard for Monochrome Television Cameras for Courtroom Use.
Final rept.,
J. C. Richmond. 1977, 9p
Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, D.C.
Pub. in Proceedings of SPIE Tech. Symposium East-Seminar on Optics in Security and Law Enforcement, Reston, Virginia, April 21-22, 1977, p126-134 Oct 77.

Keywords: *Television cameras, *Standards, Monchromatic radiation, Contrast, Transfer functions, Distortion, Resolution, Signal to noise ratio, Photoconductivity, Law(Jurisprudence), Courts of law.

This paper briefly describes a proposed Standard for Monochrome Television Cameras for Courtroom Use. In this brief description, the physical parameters (size, weight, marking, user information etc.) are ignored,

and the operational parameters (format, sync signal, power requirements, connections, etc.) are mentioned only briefly. The performance parameters, (1) relative spectral response, (2) total response, (3) signal-to-noise ratio, (4) limiting resolution, (5) contrast transfer function, (6) shading and (7) geometric distortion, are described in some detail. Minimum acceptance levels and methods of evaluation are given for each of the performance parameters.

706,837
PB-277 323/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
FM Repeater Systems.
Final rept.,
R. M. Jickling, and J. F. Shafer. 1977, 16p
Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, D.C.
Pub. in NILECJ-STD-0213.00, 16p 1977.

Keywords: *Radio repeaters, *Performance standards, Frequency modulation, Law enforcement, Mobile equipment, Radio relay systems, Tests.

The document is a voluntary performance standard that establishes minimum performance requirements and methods of test for FM repeaters used by law enforcement agencies. This standard specifies the test conditions, the test equipment needed, the test methods, and the minimum performance requirements necessary for satisfactory performance.

706,838
PB-284 589/9 Not available NTIS
National Engineering Lab. (NBS), Boulder, Colo. Electromagnetic Fields Div.
Earth Terminal Measurement System Operations Manual,
D. F. Wait. Apr 78, 266p NBSIR-78-879
Paper copy available from David R. Wait, Electromagnetic Fields Div., Radio Building, Room 4085, National Bureau of Standards, Boulder, Colo. 80303.

Keywords: *Radio relay systems, *Manuals, Measurement, Communication satellites, Radiofrequency power, Computer programs, Performance evaluation, Earth Terminal Measurement System, *Communication satellite terminals, Ground stations, Noise temperature.

The Earth Terminal Measurement System (ETMS) was developed by the National Bureau of Standards to make accurate measurements of earth terminal and satellite parameters such as figure of merit (G/T), antenna gain relative to a reproducible reference level, satellite effective isotropic radiated power (EIRP), and ratio of carrier power to the operating noise temperature (C/kT). Because of difficulties of using the standard earth terminal parameters to precisely characterize the earth terminal, the parameters noise equivalent flux (NEF) and noise ulterior flux (NUF) are introduced. NEF characterizes the earth terminal hardware, and it is defined so that it is largely independent of frequency and antenna elevation angle. Thus, it is easier to evaluate the 'reasonableness' of a particular set of results in light of the other results taken at various frequencies and elevation angles. This manual includes the theory of the measurements, measurement procedures, measurement troubleshooting, interpretation of the results, and a discussion of the ETMS software.

706,839
PB-288 567/1 PC **A10**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Fields Div.
Earth Terminal Measurement System Maintenance Manual.
J. P. Wakefield. Sep 78, 217p NBSIR-78-895
Prepared for Army Communications Command, Fort Huachuca, AZ.

Keywords: *Test equipment, *Radio relay systems, Communication satellites, Radiofrequency power, Measurement, Maintenance, Thermal noise, Manuals, Power meters, Gain, Radio equipment, *Communication satellite terminals, Noise temperature, Figure of merit, Earth terminal measurement system.

The manual describes the equipment and maintenance procedures to support the earth terminal measurement system (ETMS) developed by the National Bureau of Standards for making measurements of earth terminal and satellite parameters such as figure of merit (G/T), antenna gain relative to a reproducible reference level, ratio of carrier power to the operating noise temperature (C/kT), and satellite effective isotropic radiated power (EIRP). System equipment specifications, site set-up instructions, equipment theory of operation, troubleshooting and maintenance are included. This manual does not include measurement theory nor measurement operating procedures that are described in the Earth Terminal Measurement System-Operation Manual.

706,840
PB-298 166/0 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Consumer Product Technology.
Effects of Home Video Games on Television Receivers.
Final rept.
K. W. Yee, and O. B. Laug. Oct 77, 25p NBSIR-77-1393(FTC)
Sponsored in part by Federal Trade Commission, Washington, DC. Bureau of Consumer Protection.

Keywords: *Television receivers, Degradation, Investigations, Cathode ray tubes, Fluorescent screens, *Video games.

This report describes the results of a short investigation on the effects of home video games on television receivers for the Federal Trade Commission. The length of the study and the funding level did not allow an indepth investigation. As a result, the number of games and number of television receivers tested is limited. As noted under 'Significance of Laboratory Evaluations' only one game and one receiver were used for any particular test. Effects of interactions of the various games, receivers, and factors examined were not determined. Visual rather than optical measurements have been used. The purpose of the study was to determine if a potential problem exists in terms of video games producing objectionable permanent patterns on television receiver screens and was not intended to fully define any problem that exists or determine all possible actions that would reduce such a problem.

706,841
PB77-600065 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Simple Test for Evaluating the Spectral Responsivity of Monochrome Television Cameras.
J. C. Richmond. 1977, 24p
Pub. in LESP-RPT-0310.00.

Keywords: Diffuser, Interference filters, *Spectral responsivity, Spectral transmittance, Television camera tubes, *Television cameras, Test methods.

This report describes a light source designed for measureing the spectral responsivity of monochrome television cameras, and a simple procedure for making such measurements. The light from a quartz-halogen lamp is diffused and passes through an array of twelve interference filters, of 50 nm bandpass each, with peak wavelengths at about 50 nm intervals from 400 to 950 nm. The spectral transmittance of the diffuser, and of each interference filter-diffuser combination was measured, and factors are supplied to compute the radiance of the light transmitted by each filter from the measured luminance of the diffuser. A step wedge, with 21 steps, in which the ratio of the transmittance of adjacent steps is about square root of 2, is located below the array of interference filters. The gamma of the television camera is evaluated by use of the step wedge. The voltage of the video signal produced when the image of each filter impinges on the face of the camera tube is measured, and divided by the radiance of the filter raised to the gamma power, to obtain the relative spectral responsivity of the camera at the peak wavelength of the filter. The results are normalized by dividing each value by the maximum value obtained, and the quotients plotted as a function of wavelength to produce the spectral responsivity curve of the camera.

706,842
PB80-103450 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Characterization of Electrical Ignition Sources within Television Receivers.
Final rept.,
G. J. Rogers, and D. D. Evans. Oct 79, 64p NBS-TN-1109
Sponsored in part by Consumer Product Safety Commission, Washington, DC.

Keywords: *Television receivers, *Electric ignition, Short circuits, Fire safety, Failure.

The ignition of television receivers initiated by electrical failures in the circuitry was examined by studying four receivers. They were: two black and white portables, a color portable, and a color console receiver. Selected locations within the circuitry were stressed by introducing full or partial short circuits to simulate the failure of electronic components. The temperatures and increased power dissipation generated by short-circuited components were recorded. Although component temperatures greater than 500C were achieved, no flaming ignition sources were generated.

706,843
PB82-151994 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Earth Terminal Measurement System Maintenance Manual (Addendum).
J. P. Wakefield. Oct 81, 50p NBSIR-81-1641
Sponsored in part by Army Communications Command, Fort Huachuca, AZ. See also PB-288 567.

Keywords: *Maintenance, Manuals, Radio relay systems, Communication satellites, Thermal noise, Revisions, Measurement, Test equipment, *Communication satellite terminals, Satellite communications.

This addendum to the Earth Terminal Measurement System Maintenance Manual, NBSIR 78-895, describes the equipment and maintenance procedures required to support the retrofit package for the Earth Terminal Measurement System (ETMS) developed by the National Bureau of Standards. This retrofit adds a multi-input-port relay module which provides the capability of connecting three receiver channels to the ETMS, thereby enabling measurement of pertinent earth terminal parameters at as many as three frequencies in a single measurement pass. This manual does not include measurement theory nor measurement operating procedures that are described in the Earth Terminal Measurement System Operation Manual, NBSIR 78-879.

706,844
PB82-210840 Not available NTIS
National Bureau of Standards, Washington, DC.
Control Heads and Cable Assemblies for Mobile FM Transceivers.
Final rept.
H. E. Taggart, F. F. Jeffers, R. F. Jickling, R. E. Nelson, L. F. Saulsbury, and G. R. Sugar. Dec 81, 13p
Sponsored in part by National Inst. of Justice, Washington, DC.
Pub. in NIJ Standard-0216.00, 13p 1981.

Keywords: *Radio equipment, *Standards, Control equipment, Communication cables, Mobile equipment, Transmitter receivers, Law enforcement.

This document is a voluntary performance standard that identifies characteristics, establishes minimum performance requirements, and describes test methods for measuring the electrical characteristics of control heads and control cable assemblies used with law enforcement mobile transceivers. The standard addresses the control head, its control functions, the control cables used to connect the transceiver to the control head, the connectors on each end of the control cable, and the power cable connecting the transceiver to the vehicular battery. The use of this standard is intended to achieve interchangeability and compatibility among control heads, control cables, and connectors used with law enforcement mobile transceivers, regardless of the manufacturer or model.

706,845
PB83-189928 PC **A16**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Earth Terminal Measurement System Operations Manual (Revised).
D. F. Wait. Jan 83, 354p NBSIR-83-1679
Supersedes PB-284 589.

Keywords: Manuals, Radio relay systems, Radiofrequency power, Gain, Measurement, Computer programs, Antennas, *Earth terminal measurement system, Satellite communications, Ground stations, Noise temperature.

The Earth Terminal Measurement System (ETMS) was developed by the National Bureau of Standards to make accurate measurements of earth terminal parameters such as the figure of merit (G/T), antenna

gain relative to a reproducible reference level, the noise equivalent flux (NEF), and noise ulterior flux (NUF). This manual includes the theory of the measurements, measurement procedures, measurement troubleshooting, interpretation of the results, and a discussion of the ETMS software.

706,846
PB84-106152 Not available NTIS
National Bureau of Standards, Washington, DC.
Mobile Digital Equipment.
Final rept.
M. J. Treado. May 83, 20p
Sponsored in part by National Inst. of Justice, Washington, DC.
Pub. in National Institute of Justice Standard-0215.00, 20p May 83.

Keywords: *Pulse communication, *Mobile equipment, Standards, Data transmission, Data processing terminals, Law enforcement, Radio equipment, Reprints.

The document establishes minimum performance requirements and test methods for evaluating mobile digital equipment. It addresses characteristics such as message duration, information throughput, error sensitivity, and display readability. An FM transceiver interface is prescribed and an alphanumeric keyboard layout is suggested. Tests are prescribed at temperature, humidity, and vibration environmental extremes in addition to those conducted at ambient conditions. The principal terms and definitions needed to use the standard are included, as is a listing of the primary items of test equipment needed to perform the required measurements. The standard is intended for use by law enforcement agencies and other interested parties in the selection and procurement of digital devices used in vehicles.

706,847
PB84-223403 Not available NTIS
National Bureau of Standards, Washington, DC.
Mobile Radio Guide.
Final rept.
W. W. Scott. Nov 83, 38p
Sponsored in part by National Inst. of Justice, Washington, DC.
Pub. in NIJ Guide-202-83, 38p Nov 83.

Keywords: *Radio equipment, *Law enforcement, Mobile, Antennas, Selection, Procurement, Frequency allocations, Transmitter receivers, Radiofrequency interference, Maintenance, Safety.

Mobile radios are considered vital equipment in every law enforcement communications system. This user guide was prepared to assist law enforcement officials and others in the selection and procurement of mobile radio equipment. General topics include frequency and design considerations, equipment attributes, service and safety aspects and purchasing considerations. Topics treated in detail include frequency allocation, types of mobile transceivers, antenna coverage, interference, maintenance, and safety and purchasing hints. References and an annotated bibliography are included.

706,848
PB85-142990 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Personal Radio Guide.
Final rept.
J. F. Shafer. 1984, 19p
Sponsored by National Inst. of Justice, Washington, DC.
Pub. in NIJ (National Institute of Justice) Guide 203-83, 19p 1984

Keywords: *Transmitter receivers, Portable equipment, Information.

This guide describes the characteristics of personal (handheld) transceivers that are currently available and discusses some of their uses and their application in law enforcement communications systems. The purpose of this guide is to provide general background information that will help law enforcement planners analyze their personal radio needs and enable them to select the best type of equipment to satisfy those needs. In addition to personal radios, the guide discusses accessory equipment such as batteries and antennas. It includes sections on design and construction, operational considerations, cost, maintenance, safety and recent improvements. Topics treated in detail include propagation and coverage, frequency availability, building penetration, battery capacity, chargers and charging techniques, and antenna performance and construction.

706,849
PB86-232337 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Guide to Base Station Communications Equipment.
Final rept.
R. M. Jickling. 1985, 33p
Sponsored by National Inst. of Justice, Washington, DC.
Pub. in NIJ Guide 204-83, 33p 1985.

Keywords: *Radio equipment, Transmitter receivers, Antennas, Law enforcement, Reprints.

The guide presents information to assist the law enforcement community and others in the selection and procurement of base station communications equipment. The effects of propagation, interference and noise on communications are described briefly. Emphasis is placed on the description of commercially available base station equipment, such as transmitters, receivers, antennas, control units and transmission lines. Auxilliary equipment such as power generators, tone-coding systems, voice scramblers and digital systems are described in less detail.

706,850
PB87-121109 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Electromagnetics LAP Handbook: Operational and Technical Requirements of the Laboratory Accreditation Program for Electromagnetics Compatibility and Telecommunications.
J. Horlick, and H. Berger. Sep 86, 33p NBSIR-86/3447

Keywords: *Telecommunication, *Laboratories, *Electromagnetic compatibility, Equipment, Manuals, Tests, Requirements, *Accreditation, Programs.

The document explains the operational and technical requirements of the Laboratory Accreditation Program (LAP) for Electromagnetics Compatibility and Telecommunications (Electromagnetics LAP). All of the steps leading to accreditation are discussed. Technical requirements are explained indicating how the NVLAP criteria are applied. It is intended for use by the staff of accredited laboratories, those seeking accreditation, other laboratory accreditation systems, and others needing information on the requirements for NVLAP accreditation under this LAP.

706,851
PB87-197786 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Personal/Mobile FM (Frequency-Modulated) Transceivers.
Final rept.,
R. L. Jesch, and M. J. Treado. 1986, 17p
Sponsored by National Inst. of Justice, Washington, DC.
Pub. in NIJ (National Institute of Justice) Standard-0224.00, p1-17 May 86.

Keywords: *Transmitter receivers, Law enforcement, Frequency modulation, Mobile equipment, Performance standards, Reprints.

The document establishes minimum performance requirements and methods of test for frequency-modulated personal/mobile transceivers. It is intended for use by law enforcement agencies and other interested parties in the selection and procurement of mobile transceivers. The standard covers mobile equipment operating in the 150-174 MHz and 400-512 MHz frequency bands, and addresses performance characteristics such as receiver sensitivity, audio power, distortion and response, carrier power, insertion loss, and electromagnetic compatibility. Tests are conducted both at ambient conditions and at environmental extremes. The document includes the principal terms and definitions required to use the standard and lists the primary items of test equipment needed to make the measurements. References and a bibliography are included.

706,852
PB87-233888 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Mobile FM Transceivers.
Final rept.,
W. D. Bensema, and M. J. Treado. May 86, 32p
Sponsored by National Inst. of Justice, Washington, DC.
Pub. in National Institute of Justice Standard-0210.00, 32p May 86.

Keywords: *Transmitter-receivers, *Law enforcement, Mobile equipment, Frequency modulation, Very high frequencies, Ultrahigh frequencies, High frequencies.

The document establishes minimum performance requirements and methods of test for frequency-modulated mobile transceivers. It is intended for use by law enforcement agencies and other interested parties in the selection and procurement of mobile transceivers. The standard covers mobile equipment operating in the 25-50 MHz, 150-174 MHz, 400-512 MHz and 806-866 MHz frequency bands, and addresses performance characteristics such as receiver sensitivity and selectivity, audio distortion and response, carrier power, frequency stability, and electromagnetic compatibility. Tests are conducted both at ambient conditions and at environmental extremes. The document includes the principal terms and definitions required to use the standard and lists the primary items of test equipment needed to make the measurements. References and a bibliography are included.

Sociopolitical

706,853
PB-271 973/0 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Analysis of Employee Publics and Employee Communication Programs in the National Bureau of Standards.
Final rept.,
J. E. Grunig. Jun 77, 43p NBSIR-77-1257
Prepared in cooperation with Maryland Univ., College Park. Seminar in Corporate Communication.

Keywords: *Communicating, *Organizations, Interpersonal relations, Government employees, Professional personnel, Requirements, Information processing(Psychology), Information services, Periodicals, Surveys, Social communication, National Bureau of Standards, Information seeking.

An evaluative study of the employee communication program at the National Bureau of Standards was conducted in cooperation with the Seminar in Corporate Communication, University of Maryland College of Journalism to: (1) identify the information needs of different types of NBS employees, (2) relate these information needs to use of internal employee media, and (3) evaluate and make recommendations on these media. Information needs were identified using a communication model developed by Grunig, which predicts the probability that a public will actively seek out information or passively process it. The variables of this model were related to content preference and media use through factor analysis and canonical correlation. Recommendations are made for how employee media should be designed for each employee type and on how to deal with the generally low level of employee involvement.

706,854
PB80-104243 Not available NTIS
National Bureau of Standards, Washington, DC.
Interpreting the Scientific Paper for the Trade Press.
Final rept.,
F. P. McGehan. May 79, 3p
Pub. in Proceedings of the International Technical Communication Conference (26th) Held at Los Angeles, CA. on May 16-19, 1979, pM-115-M-117, May 79.

Keywords: *Periodicals, *Scientists, Interpretation, Mass media, Authors, Marketing, Technical writing.

The technical communicator serves as a valuable liaison between the scientific institution and the world of trade and technical publications. When sifted through the communicator's skillful hand, the scientist's technical work can reach larger audiences and have greater impact than publication only in an archival journal. The communicator must be familiar with the needs of trade and technical publications editors in order to advise

the scientist-author. An up-to-date mailing list of trade and technical publications is a valuable aid to the communicator. This specialized knowledge can mean the difference between success and failure in obtaining exposure for an agency's technical output. Once the publications have been targeted, then it is the job of the communicator to reach those publications through announcements, technical news releases and specialized articles. These releases should be based on technical reports and/or discussions with the bench scientists.

Verbal

706,855
PB83-262154 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Workshop on Standardization for Speech I/O (Input/Output) Technology.
D. S. Pallett. 19 Mar 82, 238p NBS-GCR-83-444
Proceedings of a workshop held at Gaithersburg, MD. on March 18-19, 1982. Sponsored in part by Naval Air Development Center, Warminster, PA.

Keywords: *Meetings, *Speech recognition, *Standards, Performance evaluation, Data bases, Speech analysis, Input, Output, Vocoders, Human factors engineering.

The Proceedings documents papers presented at the Workshop on Standardization for Speech I/O Technology held at the National Bureau of Standards in Gaithersburg, Maryland, on March 18-19, 1982. The key issue discussed at the Workshop was how to assess the performance of speech recognition and synthesis technology. A secondary issue dealt with the need for speech data bases used in performance assessment testing. The Proceedings volume contains the text of thirty-one papers presented on this topic.

706,856
PB85-229888 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems Components Div.
Reference Speech Recognition Algorithm for Benchmarking and Speech Data Base Analysis.
Final rept.
J. L. Hieronymus, and W. J. Majurski. 1985, 4p
Pub. in Proceedings of the Institute of Electrical and Electronic Engineers International Conference on Acoustics, Speech, and Signal Processing, ICASSP 85, Tampa, Florida, March 26-29, 1985, p1573-1576.

Keywords: *Speech recognition, Statistics, Performance, Words(Language), Reprints, Data bases, Data analysis, Benchmarking.

A complete connected word reference algorithm has been developed at NBS. It provides score statistics and confusibility measures as well as word decisions on speech data base on which it is run. The basic algorithm is like the Bridle, Brown, and Chamberlain (1) algorithm with Euclidean distances on mel scale cepstral coefficients. There are options as to the particular spectral features, the type of spectral comparison measures and the training scheme. Score statistics are collected and a measure of confusibility is computed for each word in the vocabulary. The algorithm has been tested on the Texas Instruments Isolated Word Data Base (2). The most confusible words in the data base are no and go. In addition the performance of the reference system has been compared with several generic types of recognizers.

706,857
PB86-166824
(Order as PB86-166782, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Performance Assessment of Automatic Speech Recognizers.
D. S. Pallett. 3 Sep 85, 17p
Included in Jnl. of Research of the National Bureau of Standards, v90 n5 p371-387 Sep-Oct 85.

Keywords: *Speech recognition, Automation, Signal processing.

The paper discusses the factors known to influence the performance of automatic speech recognizers and describes test procedures for characterizing their performance. It is directed toward all the stakeholders in the speech community (researchers, vendors and users) consequently, the discussion of test procedures is not directed toward the needs of specific users to demonstrate the performance characteristics of any one specific algorithmic approach or particular product. It relies significantly on contributions from an emerging consensus standards activity, especially material developed within the IEEE Working Group on Speech I/O Performance Assessment.

General

706,858
PB79-600053 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NILECJ Standard for Body-Worn FM Transmitters.
M. J. Treado, J. J. Diamond, H. E. Taggart, R. N. Jones, L. F. Saulsbury, and J. L. Workman. 1979, 20p
Pub. in NILECJ-Std-0214.00.

Keywords: *Body-worn transmitters, Communications equipment, FM transmitters, Law enforcement equipment, Standards, Surveillance, Undercover equipment.

This is a voluntary national standard that establishes minimum performance requirements and methods of test for body-worn FM transmitters used by law enforcement personnel in undercover operations. The standard specifies the test equipment needed, the test methods, and the minimum performance requirements for satisfactory performance.

706,859
PB80-123136 Not available NTIS
National Bureau of Standards, Washington, DC.
Precise Time and Frequency.
Final rept.,
H. Hellwig. 1978, 2p
Pub. in Physics in Technology 9, p266-267 1978.

Keywords: *Time, *Frequencies, Meetings, Frequency standards, Reprints, *Foreign technology, Time dissemination.

The article entitled Precise Time and Frequency, is a brief summary of the Symposium on Time and Frequency, 19th General Assembly of URSI, 1-4 August 1978, Helsinki, Finland.

706,860
PB80-123227 Not available NTIS
National Bureau of Standards, Washington, DC.
Practical Implications of Relativity for a Global Coordinate Time Scale,
N. Ashby, and D. W. Allan. 1979, 21p
Pub. in Radio Science 14, n4, p649-669, Jul/Aug 79.

Keywords: *Time, Synchronism, Clocks, Networks, Relativity, Reprints, *Time scales.

Frontiers of technology now need synchronization between remote clocks to an accuracy of about a nanosecond. Rate changes arising from the velocity and gravitational potential of a transported clock used for synchronization of a network must be accounted for. In addition one cannot assume the earth is an inertial frame--i.e., not spinning. If classical Einstein synchronization were used where from the midpoint between two clocks of A and B one simultaneously sends light pulses to A and B to synchronize them, then two problems arise: first, the synchronization process will not be transitive: i.e., if A is synchronized with B, and B with C then A will not necessarily be synchronized with C. Second, starting at a point on the equator and transporting a portable clock eastward (westward), while establishing a synchronized coordinate time grid on the way will result in a discontinuity upon returning to the original points of -200 ns (200ns); minus (-) means the portable clock will be late. This paper will discuss the use of a coordinate clock network constructed on the earth's surface which does not have these problems, i.e., synchronization is transitive, and there is no discontinuity. This may be done by adjusting clocks to read coordinate time on an underlying non-rotating inertial frame. The theoretical and practical implications of setting up such a coordinate clock network using either electromagnetic signals (e.g., lasers, Loran C) or portable clocks will be discussed. It will be shown how this network may be applied in making UTC or any other global scale more useful for state-of-the-art navigation and communication systems.

706,861
PB83-106138 Not available NTIS
National Bureau of Standards, Washington, DC.
Timekeeping Potentials Using Passive Hydrogen Masers.
Final rept.
F. L. Walls, and D. A. Howe. Dec 81, 8p
Sponsored in part by Naval Research Lab., Washington, DC., and Jet Propulsion Lab., Pasadena, CA.
Pub. in Jnl. Phys. Colloq. C8, 42, n12 pC8-151--C8-158 Dec 81.

Keywords: *Frequency stability, Time standards, Frequency standards, Gas masers, Comparison, Reprints, *Hydrogen masers.

Recent experimental data of the frequency stability of the National Bureau of Standards small-passive hydrogen masers indicate that they are superior to any commercially available cesium standard for frequency comparisons or timekeeping out to periods of at least a month. Frequency drift between the small passive hydrogen maser and an ensemble of nine commercial cesium standards has been measured and is substantially less than the drift in active hydrogen masers. Timekeeping to a few nanoseconds per week has been demonstrated using the small passive hydrogen masers. These small masers are expected to be available in a 30 cm high rack mount in the near future. Using full-sized passive hydrogen masers, it appears possible to achieve frequency stabilities of order 10-15 over days and timekeeping to about one nanosecond per week. In order to take full advantage of the improved capabilities of the passive hydrogen masers, it will be necessary to use improved time comparison techniques.

706,862
PB83-106146 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Cooled, Stored Ion Experiments at NBS and Possible Applications to Microwave and Optical Frequency Standards.
Final rept.
D. J. Wineland, J. C. Bergquist, R. E. Drullinger, H. Hemmati, W. M. Itano, and F. L. Walls. Dec 81, 7p
Pub. in Jnl. Phys. Colloq. C8, 42, n12 pC8-307--C8-313 Dec 81.

Keywords: *Frequency standards, Atomic clocks, Atomic spectroscopy, Microwave frequencies, Light(Visible radiation), Infrared radiation, Ultraviolet radiation, Reviews, Reprints.

Research on stored ion frequency standards at the United States National Bureau of Standards is discussed briefly. The authors summarize past work, and indicate directions of future research.

706,863
PB83-106179 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Methods of Maintaining and/or Generating Time and Frequency at Arbitrary Points on Surface of the Earth.
Final rept.
D. W. Allan. 1981, 6p
Pub. in Jnl. of the Institution of Electronics and Telecommunication Engineers 27, n10 p383-388 1981.

Keywords: *Time standards, *Frequency standards, Metrology, Accuracy, Reprints, GOES satellites, TRANSIT satellites.

Moving from terrestrial to satellite techniques for time and frequency comparisons has moved the metrology accuracy from milliseconds and microseconds to microseconds and nanoseconds. GOES and TRANSIT are the only two operational satellite systems from which time and frequency can be obtained, and accuracies of 50 microseconds and 10 microseconds, respectively, are specified. Other experimental satellite techniques will be reviewed--some with accuracies of the order of 1 ns. Methods of generation of time and of maintaining time at remote locations on the surface of the earth are outlined. RMS time deviations of the order of 1 ns in a day and a few microseconds in a year are achievable for state-of-the-art time scale systems.

706,864

PB86-186863 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Bulletin Board System for Feedback to the Durcon Expert System: A Description and Reference.
L. J. Kaetzel, and J. R. Clifton. Mar 86, 27p NBSIR-86/3332

Keywords: *Telecommunication, Feedback, *Electronic bulletin boards, Computer networks, Electronic message systems.

The electronic communication of information among building research experts through the use of a computer speeds up the feedback process for projects requiring the exchange of ideas. The DURCON expert system requires such feedback in the form of evaluation, suggested changes and the communication of expert knowledge related to the project. The report describes a bulletin board system that has been established to aid the researchers in communicating effectively.

706,865

PB86-193133 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Network Architecture Div.
Description of Text Structures Defined for Office Document Interchange.
Final rept.
J. E. Knoerdel, and R. Pierce. 1983, 14p
Pub. in Jnl. of Telecommunication Networks 2, n4 p371-384

Keywords: *Documents, *Office management, Organizations, Telecommunication, Reprints, *Foreign technology.

The paper discusses many issues related to interchanging documents among office systems and some solutions to the problems created in document interchange. Further, it provides a tutorial on the approach to document interchange being taken within the ANSI, ISO, and CCITT standards organizations. That approach entails definition of document architecture as two separate structures, logical structure and layout structure, which are related by use of layout directives. Those architectural components are then represented in an office document interchange format with varying amounts of logical information and layout information. An interchange format which contains only the layout structure is called a text image format (TIF), while one with only the logical structure or a mixture of logical and layout structure is called a text processable format (TPF).

706,866

PB87-135034 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Methodology for Evaluating Microwave Anechoic Chamber Measurements.
Final rept.
M. Kanda. 1985, 6p
Pub. in Proceedings of Symposium and Technical Exhibition Electromagnetic Compatibility (6th), Zurich (Switzerland), March 5-7, 1985, p69-74.

Keywords: *Anechoic chambers, Microwave frequencies, Plane waves, Measurement, Evaluation.

The anechoic chamber measurement is evaluated in terms of the net power delivered to a transmitting antenna, the near-zone gains of open-ended rectangular waveguides and rectangular pyramidal horns, and reflections from chamber walls. The on-axis field intensity of the standard transmitting horn in an anechoic chamber is calculated in terms of the net power delivered to the transmitting antenna. The resulting data can be used for estimating the overall uncertainty in the anechoic chamber measurements. The statistical control of the measurement process by use of transfer standard antennas will monitor the measurement uncertainties. The paper discusses the methodology for evaluating anechoic chamber measurements.

COMPUTERS, CONTROL & INFORMATION THEORY

Computer Hardware

706,867

FIPS PUB 114 PC **E06**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
200 MM (8 in) Flexible Disk Cartridge Track Format Using Two-Frequency Recording at 6631 BPRAD on One Side - 1.9 TPMM (48 TPI) for Information Interchange. Category: Hardware Standard. Subcategory: Interchange Codes and Media.
Federal information processing standards (Final).
M. D. Hogan. c1985, 21p
Prepared in cooperation with International Organization for Standardization, Geneva (Switzerland).
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Electric drives, Data processing equipment, *Flexible disks, Federal information processing standards, Cartridges.

The standard prescribes a set of physical track format specifications for single-sided, single-density, 200 mm (8 in) flexible disk cartridges which have a data density of 6631 bits per radian (bprad) and 77 tracks at a track density of 1.9 tracks per millimeter (tpmm) (48 tracks per inch (tpi)). Citing these specifications will help to ensure that interchange parties can reliably interchange data files between information processing systems. This standard incorporates by reference (with qualifications as noted) the technical specifications of ISO 5654/2.

706,868

FIPS PUB 115 PC **E07**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
200 MM (8 in) Flexible Disk Cartridge Track Format Using Modified Frequency Modulation Recording at 13262 BPRAD on Two Sides - 1.9 TPMM (48 TPI) for Information Interchange. Category: Hardware Standard. Subcategory: Interchange Codes and Media.
Federal information processing standards (Final).
M. D. Hogan. c1985, 25p
Prepared in cooperation with International Organization for Standardization, Geneva (Switzerland).
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Electric drives, Data processing equipment, *Flexible disks, Federal information processing standards, Cartridges.

The standard prescribes a set of physical track format specifications for two-sided, double-density, 200 mm (8 in) flexible disk cartridges which have a data density of 13262 bits per radian (bprad) and 77 tracks at a track density of 1.9 tracks per millimeter (tpmm) (48 tracks per inch (tpi)). Citing these specifications will help to ensure that interchange parties can reliably interchange data files between information processing systems. This standard incorporates by reference (with qualifications as noted) the technical specifications of ISO 7065/2.

706,869

FIPS PUB 116 PC **E07**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
130 MM (5.25 in) Flexible Disk Cartridge Track Format Using Two-Frequency Recording at 3979 BPRAD on One Side - 1.9 TPMM (48 TPI) for Information Interchange. Category: Hardware Standard. Subcategory: Interchange Codes and Media.
Federal information processing standards (Final).
M. D. Hogan. c1985, 23p
Prepared in cooperation with International Organization for Standardization, Geneva (Switzerland).
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Electric drives, Data processing equipment, *Flexible disks, Federal information processing standards, Cartridges.

The standard prescribes a set of physical track format specifications for single-sided, single-density, 130 mm (5.25 in) flexible disk cartridges which have a data density of 3979 bits per radian (bprad) and 35 tracks at a track density of 1.9 tracks per millimeter (tpmm) (48 tracks per inch (tpi)). Citing these specifications will help to ensure that interchange parties can reliably interchange data files between information processing systems. This standard incorporates by reference (with qualifications as noted) the technical specifications of ISO 6596/2.

706,870

FIPS PUB 117 PC **E07**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
130 MM (5.25 in) Flexible Disk Cartridge Track Format Using Modified Frequency Modulation Recording at 7958 BPRAD on Two Sides - 1.9 TPMM (48 TPI) for Information Interchange. Category: Hardware Standard. Subcategory: Interchange Codes and Media.
Federal information processing standards (Final).
M. D. Hogan. c1985, 22p
Prepared in cooperation with International Organization for Standardization, Geneva (Switzerland).
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Electric drives, Data processing equipment, *Flexible disks, Federal information processing standards, Cartridges.

The standard prescribes a set of physical track format specifications for two-sided, double-density, 130 mm (5.25 in) flexible disk cartridges which have a data density of 7958 bits per radian (bprad) and 40 tracks at a track density of 1.9 tracks per millimeter (tpmm) (48 tracks per inch (tpi)). Citing these specifications will help to ensure that interchange parties can reliably interchange data files between information processing systems. The standard incorporates by reference (with qualifications as noted) the technical specifications of ISO 7487/3.

706,871

FIPS PUB 118 PC **E12**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Flexible Disk Cartridge Labelling and File Structure for Information Interchange. Category: Software Standard. Subcategory: Operating Procedure.
Federal information processing standards (Final).
M. D. Hogan. c1985, 37p
Prepared in cooperation with International Organization for Standardization, Geneva (Switzerland).
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Electric drives, Data processing equipment, *Flexible disks, Federal information processing standards, Cartridges.

The standard prescribes a set of logical track format specifications for flexible disk cartridges described in the following physical track format standards; FIPS PUB 114, FIPS PUB 115, FIPS PUB 116, and FIPS PUB 117. The standard incorporates by reference (with qualifications as noted) the technical specifications of ISO 7665.

706,872

FIPS-PUB-48 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Guidelines on Evaluation of Techniques for Automated Personal Identification.
Federal information processing standards.
P. Meissner. 1 Apr 77, 25p

Keywords: *Data processing security, *Data processing terminals, *Identification systems, Specifications, Interfaces, Signatures, Fingerprints, *Access methods, Communications networks, Computer networks, *Personal identification, Federal information processing standards, Hand geometry, Voiceprints, Personal privacy.

This publication provides a guideline to be used by Federal organizations in the selection and evaluation of techniques for automatically verifying the identity of individuals seeking access to computer systems and networks via terminals, where controlled accessibility is required for security purposes. The guideline describes various techniques for verifying identity and provides a set of criteria for the evaluation of automated identification systems embodying these techniques.

706,873
FIPS PUB 60-2 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
I/O Channel Interface. Category: Hardware Standard. Subcategory: Interface.
Federal information processing standards (Final).
W. E. Burr, and S. Recicar. 29 Jul 83, 116p
Supersedes FIPS PUB 60-1.
Three ring FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Computer systems hardware, *Interfaces, *Standards, Auxiliary equipment(Computers), Data processing equipment, Specifications, Input output devices(Computers), Control equipment, National government, *Federal information processing standards.

This standard defines the functional, electrical, and mechanical interface specifications for connecting computer peripheral equipment as a part of automatic data processing (ADP) systems. This standard, together with a companion standard for power control, defines the hardware characteristics for the I/O channel level interface. In order to achieve full plug-to-plug interchangeability of peripheral components, device class specific operational specifications standards are also required for each class of peripheral device. These operational specifications standards will be proposed as Federal Information Processing Standards to accompany this standard as they are developed.

706,874
FIPS PUB 67 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Guideline for Selection of Data Entry Equipment.
Final rept.,
S. A. Recicar. 30 Sep 79, 28p
Also available 3 ring vinyl FIPS binder, $6.25 North American Continent price; all others write for quote.

Keywords: *Auxiliary equipment(Computers), *Data transmission, Punched card equipment, Optical character recognition devices, Speech recognition, Magnetic disks, Data entry systems, Data transmission systems, Federal information processing standards, Bar codes, Magnetic ink character recognition, Magnetic tape, Alphanumeric displays.

This publication provides a guideline to be used by Federal agencies in the selection of data entry equipment. The objective is to make available information that will assist in the selection of more efficient and economical data entry systems. The guideline provides information about economic and general operational considerations, steps to be followed in acquisition and training, and other factors pertinent to data entry equipment selection.

706,875
PATENT-4 069 479 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Speed, Wide Dynamic Range Analog-to-Digital Conversion.
Patent.
R. J. Carpenter, and K. W. Yee. Filed 3 Mar 76, patented 17 Jan 78, 9p PB78-600036, PAT-APPL-663 401

Keywords: *Analog-to-digital converter, Expanded range analog-to-digital conversion, Overlapping analog-to-digital converters, Priority encoder, Sample and hold, Scaling amplifiers.

A wide dynamic range, wide bandwidth, analog-to-digital conversion system and method. A plurality of overlapped analog-to-digital converters are utilized in conjunction with scaling amplifiers to provide a plurality of output ranges. Means for selecting the set of output bits which provides a magnitude representation of the input signal are provided along with means for outputting a digital representation of the appropriate range.

706,876
PB-263 123/2 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Foreign and Domestic Accomplishments in Magnetic Bubble Device Technology.
Final rept. 1967-1975,
R. B. J. Warnar, and P. J. Calomeris. Jan 77, 54p NBS-SP-500-1
Library of Congress catalog card no. 76-608386.

Keywords: *Magnetic domains, *Magnetic materials, Technology assessment, Tests, Design, Performance evaluation, Industrial plants, Surveys, Economic analysis, Research management, Vitreous state, Garnets, Photolithography, Ferrates, Rare earth compounds, Cobalt alloys, Iron alloys, *Magnetic bubble domains, Magnetic film memories, Amorphous materials.

This document assesses the status of magnetic bubble technology as displayed by non-U.S. research and manufacturing facilities. Non-U.S. research and U.S. accomplishments are described while both technical and economic factors are addressed. Magnetic bubble devices are discussed whenever their application could impact future computer system design. Generally the magnetic bubble device can be applied to a computer system as a peripheral mass memory. Magnetic bubble devices are produced from either synthetic garnet or amorphous materials rather than from familiar silicon material. The document contains a significant bibliography to support certain main points which are supplemented by information supplied by the library of the Information Technology Division (ICST-NBS) and from private interviews with various U.S. technical experts.

706,877
PB-263 771/8 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
World of EDP Standards,
M. F. Hill, and J. L. Walkowicz. Dec 76, 156p NBSIR-77-1195
Prepared in cooperation with Control Data Corp., Washington, D.C.

Keywords: *Data processing, *Standards, Computer systems hardware, Computer programming, Information systems, *Information processing.

This publication describes the activities and relationships of the many organizations and individuals involved at the national, regional, and international levels in the development of standards for computers and information processing. A generalized description of the standardization process is presented first and then used as a basis for describing the activities of the principal organizations that comprise the WORLD OF EDP STANDARDS. The Second Edition of the WORLD brings up-to-date the information contained in the first edition and retains the format used therein. The description of each organization is structured in a uniform manner and includes the history of each organization, its objectives, membership, organization, finance, relationship to other organizations, and its technical work.

706,878
PB-265 117/2 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Impact of Charge-Transfer Device Technology on Computer Systems,
R. B. J. Warnar. Apr 77, 52p NBS-SP-500-5
Library of Congress Catalog Card no. 77-608053.

Keywords: *Semiconductor computer storage, Technology assessment, Computer storage devices, Semiconductor devices, Computer systems hardware, Great Britain, Japan, Canada, Netherlands, West Germany, United States, *Charge transfer devices, Charge coupled devices, Bucket brigade devices.

The document assesses the status of charge-transfer device technology as displayed by foreign research and manufacturing facilities for a period up to September 1975. Capabilities and accomplishments of charge-transfer device research facilities in Japan, Canada, Great Britain, The Netherlands, The Federal Republic of Germany, and the United States are described. Technical and economic factors are addressed and compared. Conclusions are presented which suggest future impacts of charge-transfer devices on current electronic systems, especially computers. Information contained in this report was derived from the open technical literature and from interviews with various U.S. technical experts. The technology assessment resulting in this report was conducted by the Information Technology Division of the Institute for Computer Sciences and Technology, National Bureau of Standards, as part of an 'Advanced Computer Technology Survey' project.

706,879
PB-265 139/6 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Survey of Remote Terminal Emulators,
S. W. Watkins, and M. D. Abrams. Apr 77, 84p NBS-SP-500-4
Library of Congress Catalog Card no. 77-608013.

Keywords: *Data processing terminals, *Computer networks, Telecommunication, Time sharing, Real time operations, Compilers, Data processing security, IBM 360 computers, *Remote terminal emulators, Computer performance evaluation, Communications networks, IBM 370 computers, Burroughs 6700 computers, CDC 6600 computers, Univac 1108 computers, HP 2000 computers, PDP 11 computers.

This report describes twelve Remote Terminal Emulators (RTE's). The key terminology associated with remote terminal emulation is defined and possible application areas are discussed. Technical implementation details and operational considerations are addressed for each RTE. Summary tables are provided to indicate current RTE capabilities and capacities, as claimed by the RTE developers.

706,880
PB-265 789/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
CAMAC Parallel Branch Driver for the Harris 6024/5 Computer,
D. C. Green. Apr 77, 2p
Pub. in IEEE Transactions on Nuclear Science, vNS24 n2 p931-932 Apr 77.

Keywords: *Computer systems hardware, Interfaces, *Camac, *Harris 6024/5 computers.

A CAMAC parallel Branch Driver has been developed for the Harris 6024/5 series computers. The Branch Driver allows either programmed transfers or programmed interrupt transfers of data between the computer and a CAMAC Branch Highway.

706,881
PB-265 950/6 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Systems Architecture Section.
Automatic Data Processing Risk Assessment.
Interim rept.,
S. K. Reed. Mar 77, 36p NBSIR-77-1228

Keywords: *Data processing security, *Risk, Cost effectiveness, Management methods, Vulnerability, *Risk analysis, Computer privacy, Computer information security.

This document presents a technique for conducting a risk analysis of an ADP facility and related assets. Risk analysis produces annual loss expectancy values based on costs and potential losses estimated by a management-appointed team from within the organization using and maintaining the ADP facility. The annual loss expectancy values are fundamental to the cost-effective selection of safeguards for the security of the facility. For the purpose of clarity, the ADP facility of a hypothetical Federal agency is used for an example. The characteristics and attributes which must be known in order to perform a risk analysis are described and the process of analyzing some of the assets is demonstrated, showing how the problem of risk analysis can be reduced to manageable proportions.

706,882
PB-266 323/5 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: The Use of Passwords for Controlled Access to Computer Resources.
Interim rept.,
H. M. Wood. May 77, 63p NBS-SP-500-9
Library of Congress Catalog Card no. 77-5558.

Keywords: *Data processing security, Risk, Vulnerability, Costs, Time sharing, *Passwords, Computer networks, Communications networks, Computer privacy, Computer information security, Access methods.

This paper considers the generation of passwords and their effective application to the problem of controlling access to computer resources. After describing the need for and uses of passwords, password schemes are categorized according to selection technique, lifetime, physical characteristics, and information content. Password protection, both in storage and transmission, is dealt with in the next section, followed by brief sections on current implementations and cost considerations. A glossary and an annotated bibliography of all referenced material are included.

706,883
PB-267 038/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Demanding More from Computers,
R. M. Davis. 1976, 2p
Pub. in Comput. Dec., p47-48 Jan 76.

Keywords: *Computers, Control systems, Utilization, Real time operations, Reprints, Computer program reliability, Computer performance evaluation.

Computers are becoming the control elements of systems that initiate actions with little or no human intervention. Since the actions taken by these systems can have serious and far reaching effects, deficiencies in computer hardware and software design which contribute to unreliable results must be overcome. Means must be found to make sure that systems are doing what they are supposed to, and not performing any unintended functions. Success in overcoming the problems will determine the extent to which computers will be the pacing element in government and industry operations.

706,884
PB-267 039/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evolution of Computers and Computing,
R. M. Davis. 1977, 7p
Pub. in Science, v195 n4283 p1096-1102, 18 Mar 77.

Keywords: *Computers, Evolution(Development), Trends, Utilization, Computer programming, Reprints, Computer networks, Computer applications.

The evolution of digital operation, stored program, automatic, electronic computers over the past 25 years has been accompanied by notable trends and changes. Engineering developments have produced computers ranging from very large systems capable of performing many complex calculations to very small microprocessors that can be used to control household appliances. The decreasing size and cost of computers and the development of computer networks have made access to computing power available to individuals and to small organizations. Techniques of programming computers have not changed as dramatically as the engineering features. Program correctness remains a problem, but programming developments have been oriented toward user convenience. The future looks bright for a wide variety of computer applications in scientific calculations, data processing and automatic control systems as man devises ways to use computers to extend his intellectual capabilities.

706,885
PB-267 607/0 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Information Technology Div.
Computer Science and Technology: Computers in the Federal Government: A Compilation of Statistics,
M. M. Gray. Jun 77, 45p NBS-SP-500-7
Library of Congress catalog card no. 77-608102.

Keywords: *Computer applications, *Minicomputers, *Central processing units, *National government, Statistical analysis, Fixed investment, Value, Costs.

The material in this report is a compilation of some of the data on the status of computer technology in the Federal Government. This compilation is a combination of existing statistics from Federal Government and computer industry sources, and original statistics based on these sources. Information is included on numbers of computers installed in the Federal Government, dollar value of computers installed, numbers of computers installed by agency, Federal ADP costs by agency and minicomputers in the Federal Government.

706,886
PB-268 948/7 Not available NTIS
National Bureau of Standards, Washington, D.C.
Computer Network Interconnection.
Final rept.,
I. W. Cotton. 1977, 16p
Grant NSF-DCR72-01206-A05
Pub. in Proceedings Berkeley Workshop on Computer Networks and Distributed Data Management (2nd), Held at Berkeley, California on May 25-27, 1977, p3-18.

Keywords: *Computer networks, Data processing terminals, Switching circuits, *Interconnection(Electronics), *Packet switched networks, Communications networks.

This report examines the current situation regarding the interconnection of computer networks, especially packet switched networks (PSNs). Four major types of interconnections are surveyed: (1) Circuit switched network to PSN; (2) Star network to PSN; (3) Simple terminal to PSN; (4) PSN to PSN. The emphasis is on identifying the barriers to interconnection and on surveying approaches to a solution, rather than recommending any single course of action.

706,887
PB-269 739/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparing Equivalent Network Services Through Dynamic Processing Time Prediction.
Final rept.,
S. A. Mamrak, and S. R. Kimbleton. 1977, 6p
Pub. in Proceedings of 1977 National Computer Conference, Dallas, Tex. 12-16 Jun 77, v46 p455-460 1977.

Keywords: *Computer networks, Resources, Utilization, *Resource sharing, Response time.

Computer networks provide the potential for resource sharing. Realization of this potential requires knowledge of the available resources within the network. Moreover, if a given resource is available at more than one host, selection of the most appropriate host is required. This paper develops a dynamic means for host selection assuming that the evaluation metric is processing time. An experiment is described which provides an initial evaluation of the key component of the methodology on two separate systems. The paper concludes with a discussion of some overall insights into the applicability of the methodology and its implementation requirements.

706,888
PB-269 741/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Remote Terminal Emulation in the Procurement of Teleprocessing Systems.
Final rept.,
S. W. Watkins, and M. D. Abrams. 1977, 5p
Pub. in Proceedings of National Computer Conference, Dallas, Tex. 13-16 Jun 77 v46 p723-727 1977.

Keywords: *Data processing, *Computation, *Remote terminal emulation, *Teleprocessing, Computer performance evaluation, On line interactive computerss.

This paper addresses some of the problems which exist when benchmarking interactive computing. The teleprocessing workload may be emulated by a program running internal to the System Under Test (SUT), known as an internal driver or internal stimulator. The limitations of internal drivers are discussed, especially with respect to procurement testing. The use of live operators and tape loops are also discussed, but these are also limited techniques. The most attractive alternative is to employ another, external, computer system to emulate the teleprocessing workload; this approach is called remote terminal emulation. The emulation constraints are delineated; terms applicable to the process are defined, including: Remote Terminal Emulator (RTE), scenario, script, and scene. Ten RTE's representative of current capabilities, are briefly described.

706,889
PB-270 581/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Simulation of Computers - A Tutorial Introduction.
Final rept.,
P. F. Roth. 1975, 3p
Pub. in Proceedings of Symp. on Simulation of Computer Systems, Boulder, Colorado, August 12-14, 1975, p3-5 1975.

Keywords: *Central processing units, *Computer systems hardware, Simulation, Mathematical models, *Computer performance evaluation.

This paper discusses the highlights of a tutorial on the simulation of computer systems. It deals with three major topics: the history and techniques of computer system models and simulations; the utility of applications of the technique; and some problems experienced during the maturation of the subject areas. Simulation, the process of using models to acquire data on computer systems is discussed in the context of benchmarking, a technique of using an actual system, as opposed to a model. The phases of a computer system life cycle are discussed, with relation to the applicability of simulation in each phase. Finally, there is a discussion of problems arising from users misconstruing the accuracies of simulation-derived data.

706,890
PB-272 072/0 PC **A11**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Proceedings of Computer Performance Evaluation Users Group (CPEUG) (13th) Held at New Orleans, Louisiana on October 11-14, 1977,
D. M. Conti, and J. L. Walkowicz. Sep 77, 245p NBS-SP-500-18
Library of Congress catalog card no. 77-600040. See also report dated Sep 75, PB-252 174.

Keywords: *Central processing units, *Computer programming, *Performance evaluation, *Meetings, Queueing theory, Network analysis theory, Computerized simulation, Mathematical models, Statistical analysis, Scheduling, Monitors, Minicomputers, Data processing terminals, Bench marks, Clustering, *Computer performance evaluation, On line systems, Response time, Hardware monitors, Software monitors, Bubble memories.

Contents: Functional Workload Characteristics and Computer Response Time in the Design of On-line Systems; Functional Workload Characterization; Some results on the Clustering Approach To Workload Modelling; Workload Characterization and Performance Measurement for a CDC Cyber 74 Computer System; Selection of ADPS for The Air Force Academy--A Case Study; Validation--All Important in Benchmarking; Determination of Non-steady State Conditions in Performance Measurement Runs; Capturing Terminal Traffic Using a Hardware Monitor; A New Tool for Measuring Response Time; Comparative Study of Task Dispatching Algorithms in An IBM MVT/ASP Environment; Computer Performance Comparisons; A Study on The Effectiveness of Data Blocking in an MVS Environment; A New Methodology for Computer System Data Gathering; The Use of a Validated Event Model in a Comprehensive Performance Evaluation of an On-line Minicomputer System; Approximate Evaluation of the Effect of a Bubble Memory in a Virtual Memory System; The Use of Measured Utilizations in Queueing Network Analysis; Applications of Queuing Models to ADP System Performance Prediction--A Workshop Summary; A Simulation Study of Initiator/Terminator Policy in OS/MVT.

706,891
PB-272 971/3 PC **A12**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Audit and Evaluation of Computer Security.
Final rept.,
Z. G. Ruthberg, and R. G. McKenzie. Oct 77, 258p NBS-SP-500-19
Proceedings of the NBS Invitational Workshop Held at Miami Beach, Florida on March 22-24, 1977. Sponsored in part by General Accounting Office, Washington, D.C. Library of Congress Catalog Card no. 77-600045. See also report dated Sep 77, PB-272 072.

Keywords: *Data processing security, *Auditing, *Meetings, Tests, Specifications, Standards, Interfaces, Performance evaluation, *Computer auditing, *Computer information security, *Computer privacy, Data integrity, Privacy Act(1974).

The National Bureau of Standards, with the support of the U.S. General Accounting Office, sponsored an invitational workshop on 'Audit and Evaluation of Computer Security', held in Miami Beach, Florida on March 22-24, 1977. Its purpose was to explore the state-of-the-art in this area and define appropriate subjects for future research. Leading experts in the audit and computer communities were invited to discuss the subject in one of ten sessions, each of which considered a different aspect. A consensus report was produced by each of the ten sessions and these reports form the body of these Proceedings. The ten topics reported on are: Internal Audit Standards, Qualifications and Training, Security Administration, Audit Considerations in Various System Environments, Administrative and Physical Controls, Program Integrity, Data Integrity, Communications, Post-Processing Audit Tools and Techniques, and Interactive Audit Tools and Techniques.

706,892
PB-273 648/6 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Systems and Software Div.
Computer Science and Technology: Validating the Correctness of Hardware Implementations of the NBS Data Encryption Standard,
J. Gait. Nov 77, 50p NBS-SP-500-20
Library of Congress catalog card no. LCCCN 77-16067. See also PB-272 971.

Keywords: *Computer systems hardware, *Cryptology, Tests, Validation, Monte Carlo method, Algorithms, Chips, Federal information processing standards, *Data encryption standards, *Microcircuits.

This publication describes the design and operation of the NBS testbed that is used for the validation of hardware implementations of the Federal Information Processing Data Encryption Standard (DES). A particular implementation is verified if it correctly performs a set of 291 test cases that have been defined to exercise every basic element of the algorithm. As a further check on the correctness of the implementation, an extensive Monte-Carlo test is performed. This publication includes the full specification of the DES algorithm, a complete listing of the DES test set, and a detailed description of the interface to the testbed.

706,893
PB-274 453/0 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Four Versatile MIDAS Compatible Modules.
Technical note,
M. A. Lind, and J. B. Fowler. Nov 77, 38p NBS-TN-958

Keywords: *Data processing equipment, *Data acquisition, Laboratory equipment, Modules, Digital to analog converters, Counters, Data recorders, Interfaces, Computer systems hardware, Automatic control, MIDAS system.

Four versatile MIDAS compatible modules are documented. These modules include a precision digital to analog converter, a programmable up/down counter, a high speed stepping motor indexer, and an amplifier controller-filter-V/F converter.

706,894
PB-274 508/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Techniques for Evaluating the Effectiveness of Interactive Computer Service.
Interim rept.,
M. D. Abrams. 1977, 7p
Pub. in 1977 ACM Annual Conference, Seattle, Wash. 16-19 Oct 77 p452-458 1977. (Association for Computing Machinery, New York, N.Y.)

Keywords: *Computer systems hardware, Performance evaluation, *Computer performance evaluation, Response time, Throughput, Hardware monitors, Remote terminal emulators.

Three key system-independent functional measures of the effectiveness of interactive computer service are response time, turnaround time, and throughput. Measurement can be made under uncontrolled conditions using a hardware monitor such as the NBS Network Measurement Machine and under controlled conditions using Remote Terminal Emulators. Additional measurement and test tools include accounting logs and programs, stopwatches, live operators, tape loops, and internal stimulators. A feasibility test is described; illustrative collected data is presented.

706,895
PB-275 028/9 Not available NTIS
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
CAMAC Instrumentation and Interface System for Computer Automated Measurement and Control.
Final rept.,
L. Costrell. 1977, 16p
Pub. in Proceedings of International Conference on X-ray Optics and Microanalysis (8th), Boston, Mass. 19 Aug 77, p1-16 1977.

Keywords: *Computer applications, *Measurement, *CAMAC.

The CAMAC instrumentation system for computer automated measurement and control is gaining wide international acceptance for industrial and laboratory applications. The system features a fully specified dataway together with modular functional units that are completely compatible with each other and that are available from diverse sources. The system is non-proprietary and can be freely used without license or restrictions of any kind.

706,896
PB-276 400/9 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Performance Assurance and Data Integrity Practices.
Final rept.,
R. L. Patrick, and R. P. Blanc. Jan 78, 57p NBS-SP-500-24
Library of Congress Catalog Card no. 77-608309. Prepared in cooperation with Patrick (Robert L.), Northridge, Calif.

Keywords: *Computer systems hardware, *Computer programming, Systems analysis, Errors, Performance evaluation, *Data integrity, *Computer performance evaluation.

This report identifies the approaches and techniques now practiced for detecting, and when possible, correcting malperformance as it occurs in computer information systems. This report is addressed to two audiences: to the systems designer using stock commercial hardware and software who is creating a system which will tax the available hardware, software, or staff skills; and to the manager who wishes to chronicle the deficiences in an existing system prior to improvement. It enumerates 67 items of current practice which prevent computer malperformance.

706,897
PB-279 373/5 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Computer Systems Engineering Div.
Report of the Workshop on Estimation of Significant Advances in Computer Technology.
Final rept.,
P. Meissner. Dec 76, 33p NBSIR-76-1189
Held at the National Bureau of Standards on August 30-31, 1976.

Keywords: *Data processing security, *Meetings, Logic circuits, Semiconductor devices, Standards, Cryptology, *Computer architecture, *Computer information security, *Computer privacy, Large scale integrated circuits, State of the art, *Data encryption.

A workshop on the estimation of significant advances in computer technology was held to obtain current scientific and technical information on advances in computer technology which could significantly impact the Federal Government's knowledge and use of computer technology developments in relation to computer security and export administration. Presentations were made on anticipated advances in computer architecture and semiconductor technology. It was indicated that the present trends in component density for LSI will continue to increase at the current rate for at least five years. The speed of logic circuitry has been increasing at a rate of about 1.5 megahertz per year, and a speed of 30 megahertz is presently attainable. Speed-power ratios have been improving by a factor of 10 about every 4 years, and a similar improvement appears likely in the next 4 years. The current emphasis in development work is on achieving high density at low cost. In order to provide a vehicle around which to organize its discussions, the workshop considered the design of a hypothetical machine for extracting the key used for encrypting data under the proposed NBS Data Encryption Standard. Several designs were postulated and engineering estimates were developed for operating speed, size, development time, cost, and other factors.

706,898
PB-279 921/1 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Local Area Networking,
I. W. Cotton. Apr 78, 94p NBS-SP-500-31
Report of a Workshop Held at the National Bureau of Standards, Gaithersburg, Maryland on August 22-23, 1977. Library of Congress Catalog Card no. 78-606029.

Keywords: *Computer networks, *Meetings, Operating systems(Computers), Computer architecture, Computer communications, Computer performance evaluation, Protocols, Packet switching.

This is the report of a workshop convened at the National Bureau of Standards on August 22-23, 1977, to discuss the different technologies applicable to computer networks serving a limited geographic area, such as a single campus, factory or office complex. A number of short presentations were made by active researchers and implementers in this area, afterwards the group broke up into a number of working sessions for intensive discussion of specific topics. A recorder at each session prepared a session report with the session chairman. The sessions were as follows: (1) Subnet architecture; (2) Protocols for local area networks; (3) Local network applications; (4) Network architecture; (5) Network operating systems; (6) Analysis and performance evaluation. A list of attendees and bibliography on local area computer networks is included in the report.

706,899
PB-280 361/7 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Institute for Computer Sciences and Technology Publications, 1966-1976,
A. G. Chattic. Apr 78, 140p NBSIR-78-1425

Keywords: *Computers, *Bibliographies, *Indexes(Documentation), National government, Institute for Computer Sciences and Technology, National Bureau of Standards.

This bibliography consists of the publications authored by personnel in the Institute for Computer Sciences and Technology (ICST), National Bureau of Standards (NBS), during the period from 1966 through 1976. The references, which total more than two hundred, are to publications in NBS media only. There are three cross-reference indexes to the bibliography: personal author index, key word index, and key word out-of-context (KWOC) index. Also included is a list of publications in the National Bureau of Standards Special Publication 500- series.

706,900
PB-280 532/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Graphic Pen, An Economical Semiautomatic Fingerprint Reader.
Final rept.,
R. T. Moore, and J. R. Park. Apr 77, 4p
Sponsored in part by Federal Bureau of Investigation, Washington, D.C.
Pub. in Proceedings of 1977 Carnahan Conference on Crime Countermeasures, Carnahan House, Lexington, Ky., Apr 608, 1977, p59-62 1977.

Keywords: *Pattern recognition devices, Criminal investigations, *Fingerprints, *Graphic pens, Computer applications.

Progress in the development of minutiae-based systems for automatic fingerprint identification has highlighted the need for an economical semiautomatic device for reading data from low quality impressions such as latents or scene of crime prints. With a semiautomatic reader, the superior pattern recognition capabilities of the human can be supported by the accuracy and fidelity of machine recording to yield minutiae data of a quality that is unattainable by a fully automatic fingerprint reader. Several semiautomatic fingerprint readers have been implemented using a variety of technical approaches. Of these, the Graphic Pen is novel chiefly in terms of its simplicity and economy. It can function as a local or remote terminal on any gen-

eral-purpose computer system and it requires little or no changes to existing teleprocessing software. Minutiae position and orientation data are read with eight bits resolution and with accuracy and repeatability of + or - 1/2 1sb. A description of the Graphic Pen is provided, together with examples of its performance capabilities.

706,901
PB-282 291/4 PC **A05**/MF **A01**
Auerbach Associates, Inc., Philadelphia, PA.
Comparison of Tape Drive Interface Characteristics.
Final rept.
15 Jun 78, 77p AAI-3024-FR, NBS/GCR-78/127
Contract NBS-7-35843

Keywords: *Magnetic tape transports, Interfaces, Computer components, Controllers, Coding, Characteristics.

The report describes and compares the various characteristics of the interface between computer tape drives and their controllers for 9-track tape drives operating at 75 inches per second or more, using the 800 bpi NRZI, 1600 bpi Phase Encoding and 6250 bpi Group Coded Recording methods. It presents the results of an investigation conducted for the National Bureau of Standards in support of the possible development of a Federal Information Processing Standard for the device level interface. Through textual descriptions and an extensive series of tables, the various functional and interface electrical characteristics of the tape drives are compared. It was concluded that the drives reviewed could be placed in one of two general types, those with explicitly defined signal lines and those with multiplexed signalling between drive and controller. Within each of these types there is a substantial degree of commonality among drives but also important differences. At the electrical signal and physical interface level there are also significant differences of a detailed engineering nature among the drives.

706,902
PB-282 406/8 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Cost Benefit Analysis of Proposed Federal Input/Output Channel Level Computer Interface Standards.
T. Pyke. Jun 78, 38p NBSIR-78-1487

Keywords: *Data processing equipment, *Government procurement, *Benefit cost analysis, *Standards, National Government, Magnetic discs, Magnetic tapes, *Computer interface standards, Interface standards, Computer peripherals.

This report summarizes the results of an analysis of the cost savings that are expected to accrue to the Federal Government through use of four proposed Federal input/output channel level computer interface standards. The analysis is based on the best available data, and the results are intended to be a best conservative estimate of the potential Federal Government cost savings that will occur through use of the proposed interface standards to increase competition in the procurement of computer peripheral equipment. The analysis concludes that the Federal Government will accrue cost savings through use of this standard of over $55 million during the five year period beginning in FY 1979.

706,903
PB-287 069/9 PC **A16**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Computer Performance Evaluation Users Group (CPEUG).
Final rept.
J. E. Weatherbee. Oct 78, 357p NBS-SP-500-41
Library of Congress Catalog Card no. 78-600118. See also report dated Sep 77, PB-272 072.

Keywords: *Central processing units, *Computer programming, *Meetings, Performance evaluation, Simulation, Queueing theory, Network analysis theory, Computerized simulation, Mathematical models, Statistical analysis, Scheduling, Monitors, Minicomputers, Data processing terminals, Bench marks, Clustering, *Computer performance evaluation, On line systems, Response time(Computers).

The Proceedings record the papers that were presented at the Fourteenth Meeting of the Computer Performance Evaluation Users Group (CPEUG) held October 24-27, 1978 in Boston. The technical presentations were organized around the three phases of the ADP Life Cycle: the Requirements Phase (workload definition), the Acquisition Phase (computer system and service selection), and the Operational Phase (performance) measurement and prediction methods. The program of CPEUG 78 is also included and serves as an Appendix to the Proceedings.

706,904
PB-290 017/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Agonies of Automating Almost Anything.
Final rept.,
D. R. Boyle. 1978, 3p
Pub. in Agri. Eng., p50-52 Oct 78.

Keywords: *Automation, *Laboratory equipment, Laboratories, Control equipment, Minicomputers, Systems engineering, Systems management, Reprints.

This paper is written to the scientist or engineer who would like to use automation in his laboratory but who is not a computer specialist. The discussion attempts to illuminate some of the major problem areas which are commonly encountered in the development of a minicomputer based automation system, and to give suggestions for reducing their adverse impact. Problem areas discussed include: system design, procurement, hardware and software aspects of system integration, and maintenance.

706,905
PB-291 768/0 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: A Survey of Remote Monitoring.
Final rept.
G. J. Nutt. Jan 79, 40p NBS-SP-500-42
Contract NBS-7-35839
Library of Congress Catalog Card no. 78-26313.

Keywords: *Monitors, *Computers, Performance evaluation, Data processing security, Diagnostic routines, *Remote monitors, Monitoring, Diagnostic equipment, *Computer performance evaluation, Software monitors, Hardware monitors, Fault detection.

This report describes remote monitoring in the application areas of performance evaluation, diagnostic testing, performance assurance, and system security testing. The evolution of remote monitoring is briefly reviewed, sample and remote monitors are categorized into seven classes. Several e systems are discussed for each classification, along with their capabilities in each application area. The views presented in this report represent only those of the author, an independent consultant, and should not be construed as a policy statement of NBS or any other organization.

706,906
PB-294 041/9 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Computers in the Federal Government: A Compilation of Statistics - 1978.
M. M. Gray. Apr 79, 102p NBS-SP-500-46
See also report dated Jun 77, PB-267 607. Library of Congress catalog card no. 79-600023.

Keywords: *Data processing equipment, *National government, Central processing units, Minicomputers, Special purpose computers, General purpose computers, Cost analysis.

This report presents data on the status of computer technology in the Federal Government. It is an extension and update of 'Computers in the Federal Government: A Compilation of Statistics' (NBS SP-500-7), June 1977. The report contains a combination of existing statistics from Federal Government and computer industry sources and original statistics based on these sources. Data is included on numbers of computers installed in the Federal Government, dollar value of computers installed, numbers of computers installed by agency, Federal ADP costs by agency, Federal computers by acquisition date, and Federal ADP workyears. A detailed analysis is presented for Federal computers classifying the computers into three major categories, general purpose computers, special computers and minicomputers. Federal computers are compared with U.S. computers in the same categories.

706,907
PB-294 148/2 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Computer Peripheral Memory System Forecast.
Final rept.
R. B. J. Warnar, P. J. Calomeris, and S. A. Recicar.
Apr 79, 153p NBS-SP-500-45
Library of Congress catalog card no. 79-600036.

Keywords: *Data storage devices, Forecasting, Magnetic drums, Magnetic disks, Magnetic tapes, Magnetic storage, Solid state devices, Random access computer storage, Core storage, Computer storage devices, Computer peripherals, Optical storage, Bubble memories, Charge coupled devices, Metal oxide semiconductors.

This document describes and forecasts computer peripheral memory technologies as displayed by U.S. research and manufacturing facilities. Specifically, both technical and economic criteria are discussed. The presented peripheral memories include contemporary and emerging systems, all of which are compared in graphs, tables, and decision trees. The document contains an extensive bibliography (in ANSI format) to support certain main points that are supplemented by information supplied by the Institute for Computer Sciences and Technology (ICST) resources. Additional information and verification was received from private interviews with various U.S. technical experts and equipment manufacturers.

706,908
PB-298 943/2 PC **A07**/MF **A01**
Calculon Corp., Philadelphia, PA.
Comparison of High Speed Printer Interface Characteristics.
Final rept.
31 Jul 79, 144p CALCULON-3050-R, NBS/GCR-79/182
Contract NBS-8-3631

Keywords: *Printers(Data processing), Interfaces, Comparison, Controllers, Input output devices(Computers), Bus conductors, High speed printers, Impact printers.

This report describes and compares the characteristics of the interface between various high speed printers and their control units, for line printers operating at 600 lines per minute and above. It presents the results of an investigation conducted for the National Bureau of Standards in support of the possible development of a Federal Information Processing Standard for the high speed printer device to controller interface. Through textual descriptions and an extensive series of tables, the functional and electrical interface characteristics of the various printer mechanisms are compared. It is concluded that the high speed printers considered could be placed into three general types according to their arrangement of hammer drive signals, i.e., those with individual hammer drive signals, those with coded hammer address signals, and those which include a line buffer and control electronics within the printer and therefore accept coded data signals representing successive characters in the line to be printed. Among each of these three types of printers, only the third type exhibits significant commonality of interface among the various printers and suppliers.

706,909
PB80-100845 Not available NTIS
National Bureau of Standards, Washington, DC.
Microprocessor-Based Local Network Node.
Final rept.,
R. J. Carpenter, J. Sokol, and R. Rosenthal. 1978, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Catalog No. 78CH 1388-8C, p104-110 1978.

Keywords: *Computer networks, *Microcomputers, Computers, Data transmission, Data processing security, Coding, Minicomputers, Distributed computer systems, Distributed processing, Time division multiple access.

Along with the growth and development of national and international computer networks, there has been a more recent parallel growth in the field of local area networks. Background is given on a time division multiple access cable local network with adaptive resource allocation through a fully distributed contention-type

control system. There is no central control equipment. Details are given on the microprocessor-based node which allows a wide variety of terminals, microprocessors, minicomputers, and larger mainframes on one campus or in a building complex to be fully interconnected by a common coaxial cable. The node or terminal interface equipment is partitioned to allow efficient modular expansion for single or multiple-user network connection. Provision is made for data encryption where required.

706,910
PB80-126931 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Recovery from Soft Errors in Triplicated Computer Systems Operating in Lock-Step,
A. L. Koenig, and A. W. Holt. Nov 79, 30p NBSIR-79-1927
Sponsored in part by Defense Nuclear Agency, Washington, DC.

Keywords: *Computer systems hardware, *Redundant components, Failure, Microcomputers, Synchronous computers, Error detection codes, Assembly languages, Computer programs, *Fault tolerant computing, Computer architecture.

A Triply Modular Redundant (TMR) computer system operating in clocked lock-step is being investigated for an application requiring a Mean Time Between Failure of five years. No mechanical memories are used; this allows comparison of the outputs of the three computers to be made each clock period. The most novel contribution is the method of recovery from soft errors, such as those produced by lightning strokes or alpha particles. Data are provided on the uptime history of an experimental system, which uses three commercial microcomputers.

706,911
PB80-177645 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Application of Measurement Criteria in the Selection of Interactive Computer Services.
Final rept.,
P. D. Amer. Apr 80, 95p NBS-SP-500-58
Library of Congress catalog card no. 80-600035.

Keywords: Time sharing, Selection, Criteria, Decisions, Tables(Data), *Interactive systems, *Computer performance evaluation.

This publication addresses the data analysis component of the computer service selection process. A computer service selection model is presented and three binary type selection procedures applicable in the measurement phases of that model are given. A binary type procedure determines which of a set of competing computer services perform above and which perform below a specified performance level. As a result of employing these procedures, those services that perform below the performance level can be eliminated or penalized depending on whether the performance specification is mandatory or desirable in nature. The procedures explicitly specify prior to measurement an appropriate selection rule and/or the number of test measurements required in a comparison effort to attain a given level of statistical confidence in the results. Data from a previous case study are reanalyzed to illustrate application of the selection procedures.

706,912
PB80-184377 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Sizing Distributed Systems: Overview and Recommendations.
Final rept.,
S. A. Mamrak. May 80, 25p NBS-SP-500-60
Library of Congress catalog card no. 80-600061.

Keywords: Procurement, Computer system hardware, Capacity, Optimization, Evaluation, *Distributed computer systems, Computer software.

Computer system sizing is a complicated process for which a variety of tools have been developed. The choice of tools for a particular sizing exercise is guided by many considerations such as cost, available data and the expertise of the analyst. This report presents an overview of sizing techniques, a brief discussion of the factors that affect choosing one or a combination of techniques, and a set of recommendations for choosing tools for sizing distributed systems. The report is aimed at managerial-level personnel who have developed technical competence with regard to single-processor computer systems and are faced with procurement decisions regarding distributed computer systems or services.

706,913
PB80-224926 PC **A06**/MF **A01**
Measurement Concept Corp., Rome, NY..
Assessment of Computer Mass Storage Technology.
Final rept.
Jan 80, 125p NBS-GCR-80-278
Contract E0-A01-7800-3630

Keywords: *Technology assessment, Reviews, *Mass storage, Computer architecture, Data base management systems, Distributed processing.

The objective of this study is to assess the state-of-the-art of computer mass storage devices and technology, giving particular emphasis to computer system architecture implications. Provided in this report is an overview of the technologies that presently are and, in the near future and intermediate future, can be applied in the construction of mass storage systems. Discussed are implementation considerations of mass storage systems ranging from the most primitive interface techniques to sophisticated back-end data base processor approaches. The concept of data base machines is introduced particularly in the way they impact on architectural requirements of mass storage systems. Finally the consequences of the eventual use of mass storage systems in distributed and network processing systems are discussed.

706,914
PB81-106486 PC **A14**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Computer Performance Evaluation Users Group (CPEUG).
Final rept.
H. J. Highland. Oct 80, 322p NBS-SP-500-65
Library of Congress catalog card no. 80-600155. See also report dated Nov 76, PB-290 701.
Proceedings of the Meeting (16th) Held at Orlando, Florida on October 20-23, 1980.

Keywords: *Meetings, Computerized simulation, Systems analysis, Performance evaluation, Computer programming, Telecommunication, Computers, Computer systems hardware, Acquisition, *Computer performance evaluation, Computer software.

The Proceedings record the papers that were presented at the Sixteenth Meeting of the Computer Performance Evaluation Users Group (CPEUG 80) held October 20-23, 1980, in Orlando, Florida. CPEUG 80 focused on new applications that are expected to grow in the 80's and changes that may occur in traditional areas during the 80's. The program was divided into two parallel sessions and included technical papers on previously unpublished work, case studies, tutorials, and panels. Technical papers are presented in the Proceedings in their entirety.

706,915
PB81-171365 PC **A05**/MF **A01**
Sutron Corp., Fairfax, VA.
Technology Assessment of Flexible Disks as Used in Stand-Alone Text-Processing Systems.
Final rept.
W. G. Dickamore, and I. K. Dampier. Nov 80, 86p
SCR-354-80-036A, NBS-GCR-80-307
Contract NB79-SBCA-0141

Keywords: *Technology assessment, Telecommunication, Magnetic disks, Data storage devices, Labels, Benefit cost analysis, Data processing equipment, Data tapes, Marketing, Magnetic cards, *Text processing, *Word processing, *Flexible disks, Diskettes, Video disks, Optical character readers, Bubble memories, Disk recording systems.

The report includes the following information: identifying alternatives to the flexible disk cartridge for providing information interchange between stand-alone word processors; defining the technical problems associated with flexible disk cartridge information interchange; surveying the Federal Government to ascertain the volume and different types of stand-alone text processors currently being used and the 5-year projection of word-processing equipment needed; identifying any negative impacts from the establishment of a label format and file structure standard for flexible disk cartridges; and identifying all costs and benefits that would accrue to the Federal Government as a result of a label and file structure standard for flexible disk cartridges used in stand-alone word processors.

706,916
PB81-205387 PC **A04**/MF **A01**
System Development Corp., McLean, VA.
Virtual Terminal Protocol Feature Analysis.
Draft rept.
C. B. Shelton, and J. R. Moulton. Mar 81, 60p NBS/GCR-81-324
Contract NB79-SBCA-0274

Keywords: *Data processing terminals, Standards, National government, Standardization, *Computer networks, *Protocols, *Federal information processing standards, Data structures, NTISCOMNBS.

This is one of a series of draft reports being prepared under the network protocol standards program for distribution to government agencies, voluntary standards organizations, computer and communications equipment manufacturers, and other interested parties. The report analyzes protocol features as a method of determining the kernel set of essential features of a protocol, along with the clusters of value-added features which will support various application categories.

706,917
PB82-136730 PC **E16**
Computer Corp. of America, Cambridge, MA.
CODASYL Query Language: Evaluation Criteria, Capabilities, and a Survey.
1980, 499p-in 3v
Set includes PB82-136748 through PB82-136763.

No abstract available

706,918
PB82-138181 PC **A06**/MF **A01**
Little (Arthur D.), Inc., Cambridge, MA.
Effects of Future Information Processing Technology on the Federal Government ADP Situation.
Sep 81, 106p NBS-GCR-81-342
Prepared in cooperation with General Systems Group, Inc., Salem, NH., and Aurora Associates, Inc.

Keywords: *Technology innovation, *Data processing, *National government, Computer programming, Government policies, Regulations, Computer systems hardware, Data processing equipment, Systems engineering, Cost analysis, Forecasting, Operating systems(Computers), Industrial structure, Software engineering.

This report qualitatively forecasts the effects on the Federal ADP inventory of new and expected automated data processing technology, shifts in industry structure, and proposed changes in Federal ADP regulations. The report includes both forecasts jointly prepared by Arthur D. Little, Inc. and General Systems Group, Inc. and comments by ICST staff. Major sections of the document cover underlying technologies, changes in the information industry and market, future products and systems, the present Federal ADP situation, and proposed policy changes.

706,919
PB83-134502 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Annotated Bibliography of Introductory Articles to Aid in the Selection of Small Computer Systems,
L. Rosenthal, and J. Barkley. Aug 82, 20p NBSIR-82-2573

Keywords: *Bibliographies, *Microcomputers, Selection, Computer systems hardware, Telecommunication, Auxiliary equipment(Computers), *Personal computers, Data processing systems, Computer software.

A bibliography of references on personal computers is presented. The purpose in compiling this limited bibliography was to separate the articles on personal computing from those concerning the more general issues of computers and microprocessors.

706,920
PB83-164384 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.

Computer Science and Technology: Federal ADP (Automated Data Processing) Equipment: A Compilation of Statistics - 1981.
Final rept.
M. M. Gray. Nov 82, 106p NBS/SP-500-97, NBS/SP-500-97
Library of Congress catalog card no. 82-600638.

Keywords: *Data processing equipment, *Computer systems hardware, *National government, General purpose computers, Statistical data, Data processing terminals, Printers(Data processing), Plotters, Auxiliary equipment(Computers), Magnetic storage devices, Magnetic disks, Acquisition, Prices, Computers, Input output devices.

This report presents data on the status of computer technology in the Federal Government. The report contains a combination of existing statistics from Federal Government and computer industry sources and original analyses and statistics based on these sources. Data is included on CPUs, disk units, magnetic tape units, I/O controllers, terminals, printers, plotters and other related ADP equipment. Analyses are included on the acquisition dates of CPUs, equipment installed by agencies, the purchase-price ranges of equipment, and the type and size class of general purpose computers in the Federal Government compared with the United States. The report is based on Federal Government data from 1971 through December 31, 1981 and industry data from 1972 through 1980.

706,921
PB83-235630 Not available NTIS
National Bureau of Standards, Washington, DC.
Personal Scientific Computers.
Final rept.
S. Haber. Sep 82, 11p
Pub. in Jnl. of the Washington Academy of Sciences 72, n3 p87-97 Sep 82.

Keywords: *Microcomputers, Technology assessment, Reprints, *Personal computers, *Scientific personnel, Computer software.

This paper discusses the sorts of small, low-priced computers that are now available for scientific work, and that are expected to become available during this decade. The background technological developments are described briefly and projections are made of the capabilities that may be expected in desktop computers. Software questions that are especially relevant to the use of such computers are taken up. It is suggested that some software developments may lead scientists to extend the ways in which they use computers.

706,922
PB83-237271 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
Computer Science and Technology: Care and Handling of Computer Magnetic Storage Media.
Final rept.
S. B. Geller. Jun 83, 129p NBS-SP-500-101
Libray of Congress catalog card no. 83-600536.

Keywords: *Magnetic storage devices, *Magnetic tapes, *Materials handling, Memory devices, Preserving, Controlled atmospheres, Environments.

This Special Publication deals with the physical/chemical preservation of computer magnetic storage media--principally computer magnetic tapes--and their stored data, through the application of proper care and handling methods under various conditions. It emphasizes the media handling methods and environmental conditions which should be instituted during the course of controllable day-to-day and long-term archival storage activities. It also considers measures which can be initiated during media transit and in the aftermath of catastrophic or uncontrollable events. However, the publication does not address the problem of computer storage system security from the viewpoint of data theft or intentional data modification.

706,923
PB83-238972 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Microcomputers: A Review of Federal Agency Experiences.
Final rept.
D. Gilbert, E. Parker, and L. Rosenthal. Jun 83, 149p NBS-SP-500-102
Library of Congress catalog card no. 83-600545.

Keywords: *Microcomputers, Utilization, Computer system hardware, *Federal agencies, Computer software.

This document presents the results of a recent study which reviewed Federal agency experience with microcomputers during the period of August 1982 - January 1983. Its intended audience are all those who are interested in microcomputer-based technology and want to benefit from the current Federal experience. Interviews conducted with the Federal agencies are presented in detail, summarized, and tabulated. Related management and technical issues are identified and discussed.

706,924
PB84-105956 Not available NTIS
National Bureau of Standards, Washington, DC.
FASTBUS Modular High Speed Data Acquisition System.
Final rept.
L. Costrell, and W. K. Dawson. 1982, 5p
Prepared in cooperation with Alberta Univ., Edmonton.
Pub. in Proceedings of Institute of Electrical and Electronics Engineers Int. Conference Communications, ICC'82, Philadelphia, PA., June 13-17, 1982, p5C.4.1-5C.4.5 1982.

Keywords: *Channels(Data transmission), Data acquisition, Data processing, Physics, *Foreign technology, *Data busses, FASTBUS system.

FASTBUS is a flexible modular data bus system for data acquisition, data processing, and equipment control. It consists of multiple bus segments which operate independently but which can automatically and transparently link together for inter-segment communication. A bus segment may be implemented as a cable connecting devices or as a crate backplane which can accommodate up to 25 devices. The multiplexed data and address fields are 32 bits wide. FASTBUS can operate asynchronously using a handshake protocol to reliably accommodate different speed devices without prior knowledge of their speed capabilities. It can also operate synchronously without handshake for transfer of blocks of data at maximum speed. System speed is limited soley by propagation and logic delays. For intracrate operations data transfer rates of better than 10 MHz have been obtained for ECL implementation. FASTBUS originated in the high energy physics community but, because of its many attractive features, will find application in numerous other areas.

706,925
PB84-150184 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: A Bibliography of the Literature on Optical Storage Technology.
Final rept.
J. R. Park. Dec 83, 182p NBS-SP-500-107
Library of Congress catalog card no. 83-600617.

Keywords: *Computer storage devices, *Data storage devices, *Bibliographies, Holography, Magnetooptics, *Optical memory(Data storage), *Optical memories, Optical storage, Video disks, Optical data storage materials, Holographic information storage, Disks.

This bibliography contains nearly 700 references related to optical storage and retrieval of digital computer data. The citations are divided into two major groupings: General Literature and Patent Literature Documents. Annotations are provided under the General Literature for many of the references in the critical area concerned with the media used for the optical recording and playback of optical digital data disks. The documents have been classified into several broad categories for the user's convenience. Access to the individual citations for each category is obtained through cross indexes which facilitate the rapid selection of pertinent articles. In addition to the categorical classifications, several other indexes are included in this bibliography.

706,926
PB84-167725 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Selection of Microcomputer Systems.
Final rept.
J. Barkley, D. Gilbert, and A. Hankinson. Mar 84, 34p NBS-SP-500-112
Also available from Supt. of Docs. as SN003-003-02553-4. Library of Congress catalog card no. 84-601010.

Keywords: *Microcomputers, *Computers, Equipment specifications, Evaluation.

This document is chiefly aimed at providing assistance to non-technical users in evaluating the applicability of microcomputer-based systems in addressing their needs and choosing appropriate systems. However, technical users providing related support to their organizations should also find the material useful. Similarly, while focussed for Federal users of administrative/management applications, there is general applicability to other environments.

706,927
PB84-178821 PC **A07**/MF **A01**
SoHaR, Inc., Los Angeles, CA.
Microcomputers: Introduction to Features and Uses.
Final rept.
M. Hecht, H. Hecht, and L. Press. Mar 84, 148p NBS-SP-500-110
Grant NB82SB-C-A1654
Also available from Supt. of Docs. as SN003-003-02560-7. Library of Congress catalog card no. 84-601005.

Keywords: *Microcomputers, Computer programming, Dictionaries, Bibliographies.

This document is an introduction to microcomputers and their uses in the Federal government. Basic concepts in microcomputers are discussed, and their uses by clerical, administrative, professional, and technical Federal personnel are described. The motivations, costs, and risks of microcomputer use are identified, and recommendations for successful implementations are provided. Appendices contain a glossary and annotated bibliography.

706,928
PB84-217785 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. Systems Components Div.
Proceedings of the National Bureau of Standards/National Security Agency Workshop on Standardization Issues for Optical Digital Data Disk (OD3) Technology Held at Gaithersburg, Maryland on June 1-3, 1983.
Final rept.
J. B. Freedman. Apr 84, 242p NBS/SP-500/111
Also available from Supt. of Docs as SN003-003-02573-9. Library of Congress catalog card no. 84-601025. Sponsored in part by National Security Agency/Central Security Service, Fort George G. Meade, MD.

Keywords: *Standards, Standardization, *Optical storage, *Disk recording systems, Data transfer.

This report constitutes the proceedings of the National Bureau of Standards/National Security Agency jointly-sponsored Workshop on Standardization Issues for Optical Digital Data Disk (OD) Technology, held in Gaithersburg, Maryland, June 1-3, 1983. The objective of this workshop is to promote discussion and interchange among current and potential OD users and suppliers, regarding the prospects for OD data interchange standardization. The workshop presentations include definitions of the physical, dimensional, optoelectrical, quality and data transfer characteristics of OD media, as related to the drive performance. A range of OD applications and their standards' requirements are also described. The various methods currently used for estimating media life expectancies and the potential for standardized terminologies and procedures for such assessments are discussed.

706,929
PB84-223296 Not available NTIS
National Bureau of Standards, Washington, DC.
100 GHz Binary Counter Using SQUID Flip Flops.
Final rept.
C. A. Hamilton. May 83, 2p
Pub. in IEEE Transactions on Magnetics MAG-19, n3 p1291-1292 May 83.

Keywords: *Counters, *Analog to digital converters, Flip flops, Binary digits, Superconductors, Reprints, SQUID devices, Flip flop circuits.

A binary counter using bistable dc SQUID's as flip flop circuits is reviewed. Its potential for frequency division in the THz range and for ultra high accuracy A/D conversion are discussed.

706,930

PB84-223312 Not available NTIS
National Bureau of Standards, Washington, DC.
Operation of a Superconducting Analog-to-Digital Converter at Short Conversion Times.
Final rept.
R. L. Kautz, and F. L. Lloyd. May 83, 4p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in IEEE Transactions on Magnetics MAG-19, n3 p1186-1189 May 83.

Keywords: *Analog to digital converters, Josephson junctions, Superconductors, Accuracy, Performance, Tests, Reprints, SQUID devices.

The accuracy of a six-bit superconducting analog-to-digital converter has been tested at short conversion times. The accuracy was found to be good for conversion times down to 0.5 ns but significant errors were observed at a conversion time of 0.1 ns. These errors can be understood in terms of unwanted switching events that occur when the mode boundary separating two flux states is crossed rapidly.

706,931

PB84-223411 Not available NTIS
National Bureau of Standards, Washington, DC.
Design Limitations for Superconducting A/D Converters.
Final rept.
C. A. Hamilton, and F. L. Lloyd. Nov 81, 6p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in IEEE Transactions on Magnetics MAG-17, n6 p3414-3419 Nov 81.

Keywords: *Analog to digital converters, Josephson junctions, Superconductors, Performance, Design, Reprints, SQUID devices.

This paper reviews the principal of A/D conversion using superconducting quantum interference and describes the results obtained with this technique. At an accuracy of four or six bits, the design of such converters is straightforward. Higher accuracy requires careful consideration of numerous design constraints including critical current uncertainty, power supply regulation, turn-on-delay, signal line crosstalk, and the threshold curve critical points. The implications of these constraints are analyzed with respect to an example design for an 8-bit converter.

706,932

PB84-224062 Not available NTIS
National Bureau of Standards, Washington, DC.
Trouble on the Line - Finding Faults in Local Area Networks.
Final rept.
R. J. Crosson. 24 Mar 83, 5p
Pub. in Proceedings of Workshop Performance Evaluation Local Area Networks, Program Working Papers, Worcester Polytechnic Institute, Worcester, MA., May 24-25, 1983, 5p Jun 83.

Keywords: *Telecommunication, *Computer networks, *Computer communications, *Communication networks, Failure analysis.

In February, 1976, the National Bureau of Standards began designing a local area network to interconnect computers and terminals. Subsequent operation of the NBSNET illuminated two types of failures which can occur in such a system; total and limited service disruption. Methods have been developed for dealing with total disruption failure modes. Dealing with limited failure modes is the goal of a current automation project and a plan to design increased intelligence into NBSNET equipment.

706,933

PB85-100154 Not available NTIS
National Bureau of Standards, Washington, DC.
Linear Programming Model for Optimal Computer Network Protocol Design.
Final rept.
J. F. Heafner, and F. H. Nielsen. 1980, 7p
Pub. in Proceedings of the Conference AFIPS, 1980 Computer Conference, Anaheim, CA, May 19-22, 1980, p855-861.

Keywords: *Computer networks, *Linear programming, Mathematical models, Optimization, Design, Standards, Protocols.

The ability to widely intercommunicate using networks of heterogeneous computers requires defining and adopting standards for computer network protocols. The International Organization for Standardization has developed a reference model which specifies the range of functions of a hierarchial set of network protocols. The need is generally recognized for a multiplicity of protocols at a given layer within the model's hierarchy. An outstanding problem is to determine a small set of protocols that together satisfy the requirements of a broad spectrum of applications. One step-wise approach to specifying these protocols is to determine just what protocol service features are, how to derive them, then how to match them with applications in order to define the needed protocol families. These steps give rise to a number of technical subproblems. A research approach to one subproblem is described here. This paper presents an analytical model to be jointly used by the applications builder and protocol designer to define optimal protocols for a given application category and protocol family.

706,934

PB85-115566 Not available NTIS
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Industrial Engineering and Operations Research.
Network Protocol Design: Model Relationships, Heuristic Feature Specification and Analytical Extensions.
Final rept.
R. P. Davis. 1983, 8p
Sponsored in part by National Bureau of Standards, Washington, DC.
Pub. in Computers and Industrial Engineering 7, n3 p209-216 1983.

Keywords: *Computer networks, Design, Mathematical models, Heuristic methods, Specifications, Reprints, Protocols, Relationships.

This paper presents a brief description of the network protocol design problem, and a mathematical model which has been developed to assist in the specification of protocol features. Heuristic solutions to the feature specification problem are described in the context of a design process and computational results from such heuristics are presented. Finally, analytical issues appropriate to the feature specification model, and their utility, are identified.

706,935

PB85-128932 Not available NTIS
National Bureau of Standards, Washington, DC.
Modified CAMAC System for High Speed Burst Data Acquisition.
Final rept.
J. Glaab, W. Schaeffer, E. Johnson, and J. Degnan. Feb 81, 12p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Nuclear Science NS-28, n1 p341-352 Feb 81.

Keywords: Data acquisition, Laser beams, Reprints, *CAMAC system, HSCC(High Speed Crate Controllers), HSC(High Speed Cache), High altitude.

A highly modified CAMAC Data Acquisition System has been developed and flown to acquire and preprocess multichannel 1 MHz data sample bursts with no deadtime for a high altitude (130,000 ft.) balloon experiment. A multiwavelength laser is fired at 10 pps, and 300 microsec of continuous 1 microsec samples are obtained in 6 independent data channels for each shot.

706,936

PB85-141356 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Design and Engineering of a Performance Measurement Center for a Local Area Network.
Final rept.
D. P. Stokesberry, and R. Rosenthal. 1980, 6p
Sponsored by Institute of Electrical and Electronics Engineers, Inc., New York.
Pub. in Proceedings of Computer Networking Symposium, Gaithersburg, MD., December 10, 1980, p110-115 1980.

Keywords: *Computer networks, Performance, Measurement, Design, Distributed computer systems.

The design and implementation of a performance measurement center for a local area network, using a carrier sense multiple access protocol with collision detection, is described. Performance measurements on this type of network require specialized equipment and techniques to gather and analyze the data. This is particularly true for fully distributed networks where there is no central control facility. Network performance is measured in terms of message delay, channel thruput, message overhead, network stability and fairness under a variety of traffic load conditions. NBSnet, a fully distributed local network in operation at the National Bureau of Standards, has been used as a model for the design process.

706,937

PB85-145258 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS (National Bureau of Standards) Calibration Service for A/D and D/A Converters.
Final rept.
T. M. Souders, and D. R. Flach. 1981, 14p
Pub. in Proceedings of 1981 International Test Conference, Philadelphia, PA., October 27-29, 1981, IEEE (Institute of Electrical and Electronics Engineers) Cat. No. 81-CH1957-0, p290-303.

Keywords: *Analog to digital converters, *Digital to analog converters, Calibrating, Data converters, Measurement, Linearity, Amplification, Tests, Errors, Quality control, Reprints.

An NBS calibration service for high performance 12- to 18-bit analog-to-digital converters (ADC's) and digital-to-analog converters (DAC's) is described. The service offers comprehensive measurements of linearity, differential linerity, gain, offset, and rms input noise (for ADC's), with systematic uncertainties as low as 3 ppm. Measurements are made at a minimum of 1024 different codewords. The measurement approach, design features, test programs, and data reduction techniques are discussed as are the methods of error estimation and quality control.

706,938

PB85-170637 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fiber Distributed Data Interface: A Proposal for a Standard 100 Mbit/s Fiber Optic Token Ring Network.
Final rept.
W. E. Burr, and F. E. Ross. Sep 84, 4p
Prepared in corporation with Sperry Corp., Blue Bell, PA.
Pub. in Proceedings of FOC/LAN 1984, Las Vegas, Nevada, September 17-21, 1984, p254-257.

Keywords: *Computer networks, *Fiber optics, *Standards, *Local area networks.

The Fiber Distributed Data Interface, a proposed American National Standard for a 100 Mbit/s token ring network using optical fiber, is described. The purpose of this proposed standard is the interconnection of a number of high performance mainframe computers or supercomputers, together with mass storage elements, to form a loosely-coupled system in a local network (that is building or campus-wide) environment.

706,939

PB85-177996 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Guidance on Planning and Implementing Computer System Reliability.
Final rept.
L. S. Rosenthal. Jan 85, 53p NBS/SP-500/121
Also available from Supt. of Docs as SN003-003-02628-0. Library of Congress catalog card no. 84-601159.

Keywords: *Systems management, Computers, Reliability, Specifications, Measurement, Quality, Projects, *Computer system reliability, *Computer system design, Systems engineering.

Computer systems have become an integral part of most organizations. The need to provide continuous,

correct service is becoming more critical. However, decentralization of computing, inexperienced users, and larger more complex systems make for operational environments that make it difficult to provide continuous, correct service. This document is intended for the computer system manager (or user) responsible for the specification, measurement, evaluation, selection or management of a computer system. This report addresses the concepts and concerns associated with computer system reliability. Its main purpose is to assist system managers in acquiring a basic understanding of computer system reliability and to suggest actions and procedures which can help them establish and maintain a reliability program. The report presents discussions on quantifying reliability and assessing the quality of the computer system. Design and implementation techniques that may be used to improve the reliability of the system are also discussed. Emphasis is placed on understanding the need for reliability and the elements and activities that are involved in implementing a reliability program.

706,940
PB86-112760 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Superconducting A/D Converter Using Latching Comparators.
Final rept.
C. A. Hamilton, F. L. Lloyd, and R. L. Kautz. 1985, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics MAG-21, n2 p197-199 Mar 85.

Keywords: *Analog to digital converters, Josephson junctions, Superconductors, Reprints.

The paper describes the design and performance of a six-bit A/D converter using fast edge latching comparators. Simulations predicting conversion times of 100 ps and 100 MHz signal bandwidth are verified experimentally. The addition of a superconducting track/hold circuit in front of the A/D converter is expected to substantially improve the signal bandwidth.

706,941
PB86-138112 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems Components Div.
Institute for Computer Sciences and Technology at the National Bureau of Standards (NBS/ICST) Optical Digital Data Disk (OD sup 3) Standardization Activities.
Final rept.
J. B. Freedman. 1984, 3p
Pub. in Proceedings of the Society of Photo-Optical Instrumentation Engineers: Applications of Optical Digital Data Disk Storage Systems, Brussels, Belgium, June 25-28, 1984, v490 p77-79.

Keywords: *Computer storage devices, *Standardization, *Optical disks, Disk recording systems, National Bureau of Standards.

The paper describes the optical digital disk (OD/sup 3/) standardization activities including the NBS-sponsored Federal Council on Computer Storage Standards and Technology (FCCSSAT); the National Bureau of Standards/National Security Agency Workshop on standardization issues for OD/sup 3/ technology; and the NBS/ICST participation in the voluntary OD/sup 3/ standards process. All of the NBS/ICST activities provide a forum for discussion among current and potential OD/sup 3/ users and suppliers, regarding the prospects for OD/sup 3/ data interchange standardization.

706,942
PB86-164514 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Modeling and Test Point Selection for Data Converter Testing.
Final rept.
T. M. Souders, and G. N. Stenbakken. Nov 85, 5p
Sponsored by Institute of Electrical and Electronics Engineers, Inc., New York.
Pub. in Proceedings of International Test Conference, 1985, Philadelphia, PA., November 19-21, 1985, p813-817.

Keywords: *Data converters, Digital to analog converters, Mathematical models, Tests.

Methods for generating efficient testing strategies for data converters are presented. Linear modeling techniques based on circuit analysis and empirical test data are included, as well as algorithms for selecting optimal test points. Using these tools, converter errors can be accurately estimated for all code states from a relatively small number of measurements.

706,943
PB86-203411 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Planning and Implementing System Reliability.
Final rept.
L. S. Rosenthal. 1983, 7p
Pub. in Proceedings of Total Systems Reliability Symposium, Gaithersburg, MD., December 12-14, 1983, p112-118.

Keywords: Systems management, Reliability, Guidelines, *Computer systems design, *Computer program reliability.

The paper is an abbreviated version of a NBS publication of the same name and is part of the Computer System Selection and Evaluation Program within the Bureau's Institute for Computer Sciences and Technology. It is intended to assist the system manager in acquiring a basic understanding of computer system reliability concepts, techniques, and controls.

706,944
PB86-244175 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Standards Code and Information.
National Bureau of Standards Workshop on Performance Evaluation of Parallel Computers.
S. B. Salazar, and C. H. Smith. Jul 86, 51p NBSIR-86/3395

Keywords: *Benchmarks, Measurement, Workshops, Laboratories, Universities, Industries, National government, *Parallel computers, *Computer performance evaluation, National Bureau of Standards.

The Systems Components Division of the Institute for Computer Sciences and Technology at the National Bureau of Standards is actively engaged in the development of techniques to measure and evaluate the performance of parallel computers. As a preliminary step, a workshop on performance evaluation was held in Gaithersburg, Maryland on June 5th and 6th, 1985. The goal of the workshop was to define the issues and problems involved in the development of benchmarks for large parallel computers. Thirty-six talks were given by representatives of government, industries, universities and research laboratories. The topics presented ranged from specific measurements of large parallel machines to the philosophical issues concerned with the development of universally applicable benchmarks. The document is a report on the workshop.

706,945
PB87-122776 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems Components Div.
National Bureau of Standards Research Program for the Archival Lifetime Analysis of Optical Digital Data Disks (O(D sup 3)).
Final rept.
S. B. Geller. 1984, 4p
Pub. in Proceedings of the Society of Photo-Optical Instrumentation Engineers 490, p80-83 1984.

Keywords: *Life(Durability), *Archives, Data processing, Information retrieval, Drives, Servomechanisms, Lasers, Chemical tests, Physical properties, Dynamic tests, Information systems, *Optical disks, Computer storage management, Failure(Electronics), National Bureau of Standards.

The Institute for Computer Sciences and Technology at the National Bureau of Standards (NBS/ICST) is embarking on a research program into the life expectancy properties of optical digital data disks (OD3). The paper discusses lifetime concepts in a general sense and some philosophies and objectives which will underlie the NBS/ICST archival program when it is initiated. Whereas the associated OD3 systems including optical disk drives, servos, lasers, and optics are usually replaceable (providing that they do not fall into the one-of-a-kind category), data contents which are lost due to the OD3 media failure may be irretrievable. Therefore, the principal archival lifetime factors to be investigated by NBS are related primarily to the life expectancies of the OD3 media and media structures. The initial program efforts will be towards determining the system independent degradation and failure mechanisms of the media materials through static optical, chemical, and physical testing. Subsequently, where possible these static test results will be correlated with the results derived from dynamic tests of the system dependent degradation and failure mechanisms of the media.

706,946
PB87-180832 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Hybrid Computer-Optical Processing with Inexpensive Liquid Crystal Television.
Final rept.,
M. Young, and M. Weppner. 1986, 8p
Pub. in the Proceedings of the International Optical Computing Conference, Jerusalem, Israel, July 6-11, 1986, p146-153.

Keywords: *Pattern recognition, Holography, Fourier transformation, Real time operations, Matched filters, Television equipment, *Optical processing, Liquid crystal display systems, Image processing.

A computer-optical processing system is described that uses an inexpensive liquid crystal (LCD) television monitor and a selective holographic filter for coherent pattern recognition. A digital computer is used to generate an edge enhanced image of an object, to expose a Fourier transform hologram of the image, and to use the hologram as a sort of matched filter for recognizing the original object in real time.

706,947
PB87-180857 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems Components Div.
Programming the Parallel Processor.
Final rept.,
G. Lyon. 1987, 13p
Pub. in The Role of Language in Problem Solving 2, p321-333 1987.

Keywords: *Parallel processors, *Serial processors, Computer programming, Reprints, *Parallel programming.

Language pragmatics for efficient parallel programming encompass many things, of which some are familiar from serial machines and others are not. Proceeding discursively, numerous examples illustrate language-level facets selected from parallel performance areas of load balance, granularity, and memory domains. A concluding sketch of a construct for 'self-service' shows how an understanding of execution implications might eventually yield a portable language construct.

706,948
PB87-195327 PC **A03**/MF **A01**
National Bureau of Standards (ICST), Gaithersburg, MD.
Methodology for Broadband Token Passing Bus Interoperability Testing,
R. Rosenthal, and D. P. Stokesberry. Apr 87, 48p NBSIR-87/3536

Keywords: *Data transmission, *Modems, Broadband, Protocols, Tests, *Byte functional modules, *Token bus networks, *Modules(Electronics), *Local area networks.

A method for testing broadband token passing bus interoperability is described. The method was tested in a controlled laboratory environment at the National Bureau of Standards with four modem manufacturers' and three headend remodulator manufacturers' equipment. The tested equipment implemented specific token passing bus options found in commercially available products. The methodology specifies seven environmental and electrical parameters; for the first set of tests, nominal parameter settings were selected. The methodology uses specific test frames developed for their unique bit patterns. These frames were transmitted, received, and counted to exercise the broadband modems and headend remodulators. The methodology organizes the frame transmissions into five test definitions. Each test definition is repeated for each headend remodulator.

706,949
PB87-208328 PC **A03**/MF **A01**
National Bureau of Standards (ICST), Gaithersburg, MD.

Measurement of Fault-Tolerant Parallel Processors,
J. W. Roberts, A. Mink, and R. J. Carpenter. May 87, 50p NBSIR-87/3568
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Computer systems hardware, Performance, Control equipment, Reliability, Measurement, *Fault detection, *Parallel processors.

Computer systems that continue to operate correctly in the presence of faults are vital for many important applications. A number of measurement techniques can be used to determine how well computers detect and recover from faults. Both time to recover and degree of recovery can be measured.

706,950
PB87-225363 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems Components Div.
Fast, Message-Based Tagless Marking.
Final rept.,
G. Lyon. 1987, 5p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings of Conference on Hypercube Multiprocessors (1987), Knoxville, TN., September 29-October 1, 1986, p78-82 1987.

Keywords: Addressing, Algorithms, *Memory devices, *Marking, *Parallel processing, Domains.

The parallel implementation of a marking algorithm provides an object lesson on the importance of memory domains for some classes of parallel application, especially searchings. A new tagless marking algorithm for list-structures has an underlying linear mode that initiates an independent O(n) cycle test (and sometimes, cycle cut) only when a reentrancy arises. The maximum cost of cycle testing is established by the size of the address space. The method is ideal for parallel implementation across private memory domains linked via message-passing, since segmenting the address space abbreviates cycle tests. In particular, while both domains and processors equally shorten worst case execution times, the disposition of domains is a static determination independent of dependencies within a list-structure. Domain balance is thus easier to satisfy than processor load balance.

706,951
PB87-226908 PC **A02**/MF **A01**
National Bureau of Standards (ICST), Gaithersburg, MD. Advanced Systems Div.
Hardware-Assisted Multiprocessor Performance Measurements,
J. W. Roberts, A. Mink, J. M. Draper, and R. J. Carpenter. Jun 87, 16p NBSIR-87/3585
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: Computer systems hardware, Performance, Measurement, Tests, *Multiprocessors, *Parallel processors, Computer performance evaluation, Events.

The report describes the implementation and use of a hardware-assisted trace measurement system (TRAMS) used to obtain performance measurements of parallel cooperating processes executing on a multiprocessor computer. The benefit of TRAMS is that the overhead required to obtain timing information is approximately two orders of magnitude better than the standard system call, thus providing more accurate results with minimum perturbation to the measured processes. The level of accuracy allows measurement of fine-grain portions of these parallel processes which cannot be reasonably measured using standard techniques, and are therefore usually presented as negligible. Some measurements that have been obtained using TRAMS on a tightly-coupled, shared-memory parallel processor are reported here and include basic programming constructs, process creation, process synchronization, and shared memory allocation.

706,952
PB88-100714 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
On-Chip Propagation Delay Measurement.
Final rept.,
D. J. Radack, and L. W. Linholm. 1987, 3p
Pub. in Proceedings of Institute of Electrical and Electronics Engineers Custom Integrated Circuits Conference (1987), Portland, OR., May 4-7, 1987, p579-581.

Keywords: *Integrated circuits, *Delayed Johnson counter, *Inverter chain, Propagation delay, Ring oscillator, Test pattern, Test structure.

The accurate measurement of gate propagation delay is needed for inceasing the accuracy of simulators and for comparing device designs and evaluating fabrication technologies. A digital circuit is presented which can be used to determine propagation delay of any unclocked circuit elements. The circuit contains on-chip logic which allows propagation delay measurement using a low-frequency parametric test system.

706,953
PB88-112313 PC **A03**/MF **A01**
National Bureau of Standards (ICST), Gaithersburg, MD. Advanced Systems Div.
Performance Measurement Instrumentation for Multiprocessor Computers,
R. J. Carpenter. Aug 87, 32p NBSIR-87/3627
ARPA Order-5520
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Computer systems hardware, *Performance tests, Measurement, Instruments, *Parallel computers, *Multiprocessors, Computer performance evaluation.

The complexity of achieving near-optimum performance from multiprocessor parallel computers demonstrates a need for performance measurement. However, when multiple processors are acting in concert on a single problem, perturbations caused by measurement can be unacceptable. Additional hardware can reduce the perturbation caused by measurement, and can be offered in several stages of refinement and cost. The hardware can often be offered as an option; it is necessary to provide access to the required signals in the system's original design.

Computer Software

706,954
AD-A053 987/4 PC **A02**/MF **A01**
Maryland Univ., College Park. Dept. of Computer Science.
Implementation of a Capability-Based Data Abstraction.
M. V. Zelkowitz, and H. J. Larsen. 14 Dec 76, 12p
AFOSR-TR-78-0733
Grant AFOSR-77-3181
Availability: Pub. in IEEE Transactions on Software Engineering, vSE-4 n1 p56-64 Jan 78.

Keywords: *Computer programming, Data reduction, *Programming languages, Compilers, Reprints, *Structured programming, PL/1 programming language, Pascal programming language, Design.

One important feature in programming language design is an appropriate data definitional facility. Criteria now recognized as important are the concepts of information hiding and data abstraction. The problem, however, is to embed these ideas into languages. Although including these ideas has often led to the design of a new language, that is not always necessary. Such facilities may be added to languages like PL/1 or Pascal. This report discusses the inclusion of such facilities within one such PL/1 compiler. While the resulting system does not have the optimal set of protection features, it does have several advantages: the base language is known to a large class of programmers, there are many such compilers already written, and the system achieves almost as much protection as is needed. (Author)

706,955
AD-A083 263/4 PC **A06**/MF **A01**
RAND Corp., Santa Monica, CA.
Formal Methods for Communication Protocol Specification and Verification.
Final rept.
C. A. Sunshine. Nov 79, 104p Rept no. RAND/N-1429-ARPA/NBS
Contract MDA903-78-C-0029, ARPA Order-3460

Keywords: *Computer communications, *Communications networks, Message processing, Computer programming, Computer programs, Mathematical models, Computer program verification, Specifications, Computer architecture, *Communication protocols, Petri nets.

Increasingly numerous and complex communication protocols are being employed in distributed systems and computer networks of all types. This Note describes some of the more formal techniques that are being developed to facilitate design of correct protocols. Our major conclusion is that it is vital to specify the services provided by a protocol layer in addition to specifying the cooperating protocol entities which make up the layer. We develop service specifications of several representative protocols by using formal techniques from software engineering such as abstract machines and buffer histories. A survey of protocol verification methods and a bibliography indexed by key phrases are also provided. (Author)

706,956
AD-A092 929/9 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Guidelines for Exchangeable APT Data Packages. APT Part Programmer's Manual.
Final rept.
B. M. Smith. Jun 80, 27p Rept no. NBSIR-80-2073.2
See also AD-A092 933.

Keywords: *Machine coding, *Automation, *Computer programming, Data management, Manufacturing, Programming languages, Specifications, Drilling machines, Milling machines, Computer program documentation, Fortran, Man machine systems, Fault tolerant computing, Magnetic tape, Punched tape, Computer program verification, Data bases, Machine tools, Efficiency, Instruction manuals, *Numerical control.

A method of APT programming and postprocessor design has been developed which permits more efficient data preparation for numerical control (NC) machine tools and then allows this data to be quickly and easily exchanged among different NC machines. This is accomplished through rigorous specification of the APT post-processor language based upon new ANSI standards for APT plus a comprehensive definition of the machining functions which should result from the use of each APT language statement. Individual postprocessors are modified to process each statement in the same manner. The concept was successfully demonstrated in production by processing a single APT data package on three different milling-drilling type machine tools. A 23% increase in NC manufacturing efficiency is projected. This document describes the APT post-processor language used, including the syntax and semantics of each statement. It also defines the default conditions under which the post-processor and machine tool operator accomplish the desired function in the absence of the automatic feature. (Author)

706,957
AD-A092 933/1 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Guidelines for Exchangeable APT Data Packages. APT Postprocessor Specifications.
Final rept.
B. M. Smith. Jun 80, 15p Rept no. NBSIR-80-2073.3
See also AD-A092 929.

Keywords: *Machine coding, *Automation, Data management, Manufacturing, Programming languages, Specifications, Drilling machines, Milling machines, Computer program documentation, Fortran, Man machine systems, Punched tape, Fault tolerant computing, Magnetic tape, Computer program verification, Data bases, Machine tools, Efficiency, *Numerical control.

A method of APT programming and postprocessor design has been developed which permits more efficient data preparation for numerical control (NC) machine tools and then allows this data to be quickly and easily exchanged among different NC machines. This is accomplished through rigorous specification of the APT post-processor language based upon new ANSI standards for APT plus a comprehensive definition of the machining functions which should result from the use of each APT language statement. Individual postprocessors are modified to process each statement in the same manner. This document sets forth minimum specifications for the procurement of APT Postprocessors consistent with the standardized postprocessing language concept. It is expected that these specifications will be used in future machine tool procurements. The concept was successfully demonstrated in production by processing a single APT data package on

three different milling-drilling type machine tools. A 23% increase in NC manufacturing efficiency is projected. (Author)

706,958
AD-A098 127/4 PC **A02**/MF **A01**
Maryland Univ., College Park. Dept. of Computer Science.
Implementation of Program Specifications.
M. V. Zelkowitz, and J. Lyle. 1980, 8p AFOSR-TR-81-0375
Contract F49620-80-C-0001
Pub. in COMP 80, The IEEE Computer Society's International Conference (4th), p194-200 Oct 80.

Keywords: *Computer programming, *Specifications, *Computer program documentation, Data reduction, Computer program verification, Reprints, Places computer program, PL/1 programming language.

No abstract available.

706,959
AD-A147 834/6 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Systems and Software Technology Div.
Dialogue Mechanisms in a Tabletop Programming Environment.
G. Lyon, M. V. Zelkowitz, J. Elgot, D. Itkin, and B. Kowalchack. 20 Sep 84, 10p AFOSR-TR-84-0936
Contract F49620-83-K-0018
Pub. in Proceedings IEEE COMPCON Fall 84, p33-39, 16-20 Sep 84.

Keywords: *Man computer interface, *Integrated systems, *Computer programming, High level languages, Syntax, Microcomputers, Programmers, Editing, User needs, Reprints, Syntax directed editors, Pascal programming language.

No abstract available.

706,960
FIPS PUB 105 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Guideline for Software Documentation Management. Category: Software. Subcategory: Documentation.
Federal information processing standards publication (Final).
P. Wray, S. Pakin, and A. J. Neumann. 6 Jun 84, 33p
Prepared in cooperation with Pakin (S.) and Associates, Inc., Chicago, IL.
Three ring FIPS binder also available, North American Continent price $6.25: all others write for quote.

Keywords: *Documentation, *Management, Guidelines, Computer programs, Policies, Standards, Planning, Distributing, *Computer software management, *Computer software.

This Guideline can assist managers in establishing policies and procedures for effective preparation, distribution, control, and maintenance of documentation which will aid in the re-use, transfer, conversion, correction, and enhancement of computer programs. It outlines policies, procedures, and applicable standards and provides checklists in support of documentation policies, and procedures. It also includes references to relevant standards, guidelines, and the literature and a glossary of terms. Adequate software documentation, together with the computer programs themselves, provide software product packages that can be transferred and used by people other than the originators of the programs.

706,961
FIPS-PUB-46 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Data Encryption Standard. Category: ADP Operations. Subcategory: Computer Security.
Federal information processing standards.
D. K. Branstad. 15 Jan 77, 20p

Keywords: *Data processing security, *Cryptology, *Algorithms, *Standards, Coding, Federal information processing standards, Ciphers, Computer privacy, Computer information security.

The selective application of technological and related procedural safeguards is an important responsibility of every Federal organization in providing adequate security to its ADP systems. This publication provides a standard to be used by Federal organizations when these organizations specify that cryptographic protection is to be used for sensitive or valuable computer data. Protection of computer data during transmission between electronic components or while in storage may be necessary to maintain the confidentiality and integrity of the information represented by that data. The standard specifies an encryption algorithm which is to be implemented in an electronic device for use in Federal ADP systems and networks. The algorithm uniquely defines the mathematical steps required to transform computer data into a cryptographic cipher. It also specifies the steps required to transform the cipher back to its original form. A device performing this algorithm may be used in many applications areas where cryptographic data protection is needed. Within the context of a total security program comprising physical security procedures, good information management practices and computer system/network access controls, the Data Encryption Standard is being made available for use by Federal agencies.

706,962
FIPS-PUB-47 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Federal Standard COBOL Pocket Guide.
Federal information processing standards (Final),
M. V. Vickers. 1 Feb 77, 37p

Keywords: *Cobol, *Standards, Programming manuals, Syntax, Federal information processing standards.

This document contains a composite language skeleton of Federal Standard Cobol. It is intended to display complete and syntactically correct formats for the high level of the standard. In addition, the document contains other selected prompts for the Cobol programmer to assist in expediting the programming task.

706,963
FIPS PUB 98 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Message Format for Computer-Based Message Systems. Category: Software Standard. Subcategory: Interchange Codes, Media, and Data Files.
Federal information processing standards (Final).
S. Watkins, and G. Mulvenna. 1 Mar 83, 68p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: Telecommunication, Computer networks, *Message processing, *Electronic mail, Computer communications.

A computer-based message system (CBMS) allows communication between 'entities' (usually people) using computers. Computers serve both to mediate the actual communications between systems and to provide users with facilities for creating and reading the message. The message format specification addresses the problem of exchanging messages between different CBMSs. The specification addresses only the issues of form and meaning of messages at the points in time when they are sent from one CBMS and received by another. Messages are composed of fields, containing different classes of information. These fields contain information about the message originator, message recipient, subject matter, precedence and security, and references to previous messages, as well as the text of the message. Standard formats (syntax) for messages provide a basis for the contents of messages generated by one CBMS to be processed by another CBMS. Standard meanings (semantics) for the components of a message facilitate standard interpretation of a message, so that everyone receiving a message gets the meaning intended by its sender.

706,964
PB-263 177/8 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C.
Technical Profile of Seven Data Element Dictionary/Directory Systems,
B. Leong-Hong, and B. Marron. Feb 77, 49p NBS-SP-500-3
Library of Congress catalog card no. 76-58915.

Keywords: *Information systems, *Computer programming, Dictionaries, Terminology, Data base administrators, *Data element dictionary-directory systems, Data elements, Data base management systems, File structure.

A Data Element Dictionary/Directory (DED/D) is a software tool that is used to control and manage data elements in a uniform manner. It can serve data base administrators, systems analysts, software designers, and programmers by providing a central repository for information about data resources across organization and application lines. This report describes and classifies DED/D systems and discusses the potential benefits from their use. A technical profile of seven commercially-available DED/D systems is presented with side-by-side exposition of technical features.

706,965
PB-268 203/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Operating System Structures to Support Security and Reliable Software,
T. A. Linden. 1976, 37p
Pub. in Comput. Surv., v8 n4 p409-445 Dec 76.

Keywords: *Data processing security, *Operating systems(Computers), Protection, Computer program reliability, Computer privacy, Computer information security, Reprints.

Security has become an important and challenging goal in the design of computer systems. This survey focuses on two system structuring concepts that support security; namely, small protection domains and extended-type objects. These two concepts are especially promising because they also support reliable software by encouraging and enforcing highly modular software structures--in both systems software and in applications programs. Small protection domains allow each subunit or module of a program to be executed in a restricted environment that can prevent unanticipated or undesirable actions by that module. Extended-type objects provide a vehicle for data abstraction by allowing objects of new types to be manipulated in terms of operations that are natural for these objects. This provides a way to extend system protection features so that protection can be enforced in terms of applications-oriented operations on objects. This survey also explains one approach toward implementing these concepts thoroughly and efficiently--an approach based on the concept of capabilities incorporated into the addressing structure of the computer. Capability-based addressing is seen as a practical way to support future requirements for security and reliable software without sacrificing requirements for performance, flexibility, and sharing.

706,966
PB-268 205/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Protection: A Nuisance or an Opportunity,
T. A. Linden. 1976, 7p
Pub. in Proceedings COMPCON 76, Washington, D.C., Sept 7-10, 1976, p30-36 (IEEE Computer Society, Long Beach, CA 1976).

Keywords: *Data processing security, *Operating systems(Computers), *Programming languages, Translator routines, Protection, Computer privacy, Computer information security, Computer program reliability.

The protection needed to support security is generally regarded as a nuisance; however, new protection systems promise not only to provide more flexible support for security but also to lead to software that is more reliable and less costly. Flexible protection can be used to control the interactions between software modules and thus simplify the problems encountered when modules are integrated into large software systems. Furthermore, it is closely linked with recent approaches to data abstraction where users are allowed to create and manipulate objects of user-defined types. Access controls can then be specified and enforced in terms of the problem-oriented concepts implemented by the user-defined types. These ideas are emerging from research on both operating systems and programming languages; and the access controls can be enforced by an operating system, by a language translator, or by both.

706,967
PB-268 500/6 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Systems and Software Div.
Computer Science and Technology: A Data Base Management Approach to Privacy Act Compliance.
Special pub.,
E. Fong. Jun 77, 37p NBS-SP-500-10
Library of Congress catalog card no. 77-608106.

Keywords: *Data processing security, Specifications, *Privacy Act(1974), *Data base management sys-

tems, Computer privacy, Computer information security, Personal privacy.

The Privacy Act (PL 93-579) provisions on personal record handling present new issues concerning effective use of commercial data base management systems (DBMS) by Federal agencies. The widespread use of such systems in recordkeeping activities will definitely have an impact on methods of administering compliance with the Privacy Act. This report proposes a technical approach to compliance with certain Privacy Act requirements through the use of generalized data base management system. Requirements are translated into a set of computer data file and procedures. These procedures, incorporated at pivotal points of data base software, can implement those Privacy Act compliance procedures amenable to automation. The use of DBMS appears to be a viable and technologically feasible solution to the effective and efficient implementation of many Privacy Act provisions.

706,968
PB-268 517/0 PC **A11**/MF **A01**
Howden (William E.), Solana Beach, Calif.
Symbolic Testing - Design Techniques, Costs and Effectiveness.
Final rept.,
W. E. Howden. May 77, 228p NBS-GCR-77-89

Keywords: *Symbolic programming, Tests, Cost estimates, Fortran, *Computer program reliability.

The report is divided into two parts. The first part contains a study of the design of a symbolic evaluation system. It also contains an estimate of the costs of using such a system to carry out symbolic program testing. The second part contains a study of the effectiveness of symbolic testing. It contains an analysis of the circumstances under which symbolic testing is reliable for discovering program bugs. The effectiveness of symbolic testing is compared with other reliability analysis techniques. The analysis of the effectiveness of symbolic testing which is contained in Part 2 is based on the study of six programs. Descriptions of the programs and the details of the analyses are continued in the six appendices.

706,969
PB-269 344/8 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
Crossi - A Univac Processor Which Assembles Code for Interdata Minicomputers,
C. V. Young. Apr 77, 34p NBSIR-77-1230

Keywords: *Minicomputers, *Assembler routines, Computer programming, Programming manuals, *Crossi computer program, Preprocessors, Univac 1108 computers, *Interdata 70 minicomputers.

Instructions are given for the use of Crossi, a computer program which assembles Interdata assembler code on the Univac 1108, producing an assembler listing and relocatable code for the minicomputer. The assembler statements, relocatable output formats and the structure of the processor are described. A preprocessor is given for converting Crossi's zoned relocatable format to Interdata's zoned relocatable format. A method of reconfiguring the Crossi processor to assemble code for newer upward compatible minicomputer models is explained.

706,970
PB-270 205/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Data Element Dictionary/Directory Systems - A Tool for Data Management.
Final rept.,
B. Leong-Hong, and B. Marron. 1977, 4p
Pub. in Proceedings Annual Tech. Symp. Systems and Software Operational Reliability and Performance Assurance (16th), Gaithersburg, Maryland, June 2, 1977, p17-20 1977.

Keywords: *Computer programming, *Data element dictionaries, Computer software.

A Data Element Dictionary/Directory (DED/D) is a software tool that provides a central respository of information about data resources. It can aid in achieving system operational reliability and performance assurance by reducing data redundancy, controlling access, and maintaining data integrity. This paper describes key features of DED/D's, and notes their advantages and disadvantages. Current usage patterns and the availability of systems are presented.

706,971
PB-270 597/8 PC **A04**/MF **A01**
Federal Information Processing Standards Task Group 14, Washington, D.C.
Computer Science and Technology: Documentation of Computer Programs and Automated Data Systems. Proceedings of a Symposium Held at the National Bureau of Standards in Gaithersburg, Maryland on October 12, 1976.
Final rept.,
M. A. Krasny. Jul 77, 70p NBS-SP-500-15
Sponsored in part by Civil Service Commission, Washington, D.C. ADP Management Center. Library of Congress Catalog Card No. 77-608169. Prepared in cooperation with National Technical Information Service, Springfield, Va., Department of Health, Education and Welfare, Washington, D.C. and Geological Survey, Reston, Va.

Keywords: *Meetings, *Computer programming, *Data processing equipment, Standards, *Computer program documentation, Federal information processing standards.

Contents: Why document (Theodore D. Puckorius); The philosophy of FIPS PUB 38 - an introduction (James Gillespie); Life cycle concepts and document types (Roy A. Young); Flexibility provisions and document type selection (Robert R. Hegland); Content guidelines (Thomas M. KUrihara); USDA application management (Robert V. Head); Documentation standards - a management view (Eugene B. Smith); Key elements in the ADP system development process at HUD (Dr. Marvin Goer); Synopsis of questions and answers from parallel session A (Greg Loss and Tom Kurihara); Introduction--ADP systems, operations, and programmer personnel (Thomas Giammo); Problems in using the documentation guideline (Robert R. Hegland); Synopsis of questions and answers from parallel session B (Robert A. Mattes and Kenneth Rodey); Introduction--'standards, training, policy and audit personnel' (Harris G. Reiche); FIPS PUB 38 - implementation philosophy in HEW (Joseph J. Strnad); The role of the auditors in the development and evaluation of automated systems (Phillip L. Morrison); Synopsis of questions and answers from parallel session C (Fred J. Cole and Edie Lasner); FIPS task group 14 membership and symposium planning committee bibliographic data sheet.

706,972
PB-270 724/8 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Survey of Eleven Government-Developed Data Element Dictionary/Directory Systems.
Final rept.,
H. McEwen. Aug 77, 114p NBS-SP-500-16
Library of Congress Catalog Card no. 77-608155. See also report dated 1977, PB-270 205.

Keywords: *Computer programming, Dictionaries, Directories, *Data element dictionary/directory systems, Computer software, Data management, DED/D systems.

This report presents the current state-of-the-art of government-developed Data Element Dictionary/Directory (DED/D) systems. DED/D's are software tools used for managing and controlling information and data. Eleven DED/D systems are described, first using a side-by-side features presentation approach, and followed by narrative systems descriptions which highlight special capabilities and experiences with each system. Information presented in this report is intended to serve both the technical and administrative ADP community.

706,973
PB-270 855/0 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
OMNITAB II User's Reference Manual 1977 Supplement.
Final rept.,
D. Hogben, and S. T. Peavy. Jul 77, 177p NBSIR-77-1276
Sponsored in part by National Highway Traffic Safety Administration, Washington, D.C. See also COM-71-50609.

Keywords: *Computer programming, *Statistical analysis, *Numerical analysis, Plotting, Curve fitting, Regression analysis, Computation, Programming manuals, *Omnitab 2 system, *Omnitab 1977, Calcomp plotters.

The supplement describes all the additions and improvements made to the Omnitab 2 computing system at NBS since 1970. Omnitab 1977, as Omnitab 2 is now known, is fully interactive. Major new capabilities now exist in the following areas: Use of labels, table making, plotting, numerical analysis, editing of data, stem-and-leaf displays, selection of variables in linear regression and probability plotting. The supplement is an interim document for use until Omnitab 1977 is released and new documentation prepared.

706,974
PB-270 971/5 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Computer Science and Technology: Software Tools. A Building Block Approach.
Final rept.,
I. T. Hardy, B. Leong-Hong, and D. W. Fife. Aug 77, 69p NBS-SP-500-14

Keywords: *Computer programming, Editing, Syntax, *Computer software, *Computer software tools, Text editing systems, *Computer programming aids, Debugging(Computers).

The present status of software tools is described; the need for special-purpose tools and for new techniques with which to construct such tools is emphasized. One such technique involving the creation of general-purpose building blocks of code is suggested; an initial application of the technique to the construction of a text editor and syntax analyzer tool is described. An annotated bibliography of current literature relevant to software tools is provided.

706,975
PB-271 550/6 PC **A04**/MF **A03**
National Bureau of Standards, Washington, D.C. Systems and Software Div.
Computer Science and Technology: Computer Software Management: A Primer for Project Management and Quality Control.
Special pub.,
D. W. Fife. Jul 77, 60p NBS-SP-500-11
See also PB-268 500. Library of Congress catalog card no. 77-608127.

Keywords: *Computer programming, *Quality control, Management methods, Standards, Computer software, *Computer program reliability.

Today, providing computer software involves greater cost and risk than providing computer equipment, because hardware is mass produced by industry using proven technology, while software is still produced mostly by the craft of individual computer programmers. This brief guide is intended for managers who are responsible for computer projects, to explain the use of quality controls and software management methods. The typical problems of software development are explained. Over twenty distinct quality controls are defined, and recommendations are given for software management actions. Empirical information is included that would help top executives to appreciate the potential problems and importance of software management.

706,976
PB-272 789/9 PC **A12**/MF **A01**
National Bureau of Standards, Washington, D.C. Information Technology Div.
Computer Science and Technology: Copyright in Computer-Readable Works: Policy Impacts of Technological Change.
Final rept.,
R. G. Saltman. Oct 77, 271p NBS-SP-500-17
Grant NSF-SIS74-14168
Library of Congress catalog card no. 77-14143. Continuation of Grant Number NSF-CA148.

Keywords: *Copyrights, Policies, Decision making, Costs, Prices, Economic analysis, Legislation, *Computer software, *Data bases.

The findings, recommendations, and conclusions of a policy-oriented, multi-disciplinary study of copyright in computer-readable works are reported. The foundations of copyright are examined for basic principles, and the theory of public goods is applied to develop the rationale for copyright protection. The judicial history of copyright in the twentieth century is reviewed with respect to advances in information technology. The impact of technological change on judicial decision-making in copyright is analyzed. The problem of transaction costs in the marketplace for copyrighted

works is examined and methods for the reduction of such costs are described. Models of policymaking are developed which clarify the roles of interest groups and the branches of Government, demonstrating their interactions and providing insights into possible futures. Recommendations on the conditions of copyrightability for computer-readable data bases and computer programs are presented and are based on findings of basic principles developed during the study and described in the report.

706,977
PB-273 175/0 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C.
Review of Computer Software Applicable to the MIUS Program.
Final rept.,
W. L. Carroll, and J. R. Schaefgen. Oct 77, 103p NBSIR-77-1307
Prepared in cooperation with Department of Housing and Urban Development, Washington, D.C. Policy Development and Research.

Keywords: *MIUS, *Computer programming, Buildings, Heating load, Cooling load, Energy requirements, Scheduling, Cost analysis, Optimization, Reviewing, Modular integrated utility systems, Computer applications.

Thirteen computer programs are examined for potential application to the Modular Integrated Utility System (MIUS) program. The software programs considered calculate all or partial combinations of: heating and cooling loads, simulation of physical systems to determine the energy requirements necessary to satisfy those loads, prediction of optimal operation schedules and associated costs, and accomplishment of full lifecycle economic analyses. A set of criteria for evaluation of this software is presented. Information regarding the programs, obtained from user manuals and a series of seminar presentations, is collected and systematically summarized in a standardized format using information available as of June, 1974. An evaluation summary of each program as of that date is given.

706,978
PB-274 895/2 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Fortran Program to Determine Length of Gage Blocks Using Single Wavelength Interferometry.
Technical note,
R. N. Varner. Sep 77, 55p NBS-TN-956

Keywords: *Computer programs, Fortran, Interferometers, Standards, *Gage blocks, Computer program transferability, *Interferometry.

A description of a computer program which computes the length of a gage block from a process using single wavelength interferometry is given. The computer program has been written in American National Standards Institute Fortran, with emphasis on making it as machine-independent as possible. A sample of input and output is given.

706,979
PB-274 966/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Technological Tool and Information Management.
Final rept.,
B. Leong-Hong, and B. Marron. 1977, 1p
Abstract only, paper is in microfiche.
Pub. in Proceedings of ASIS Annual Meeting: Information Management in the 1980's, Chicago, Ill. 26 Sep-1 Oct 77 p3 1977.

Keywords: *Information systems, *Data element dictionaries/directories, Data base management systems, Data bases.

A Data Element Dictionary/Directory (DED/D) is a technological tool that supports information management. It functions as a central repository of information about data resources; and it helps in the implementation of information resources management by providing a mechanism for administering, controlling and retrieving stored information. Key features of DED/D's are presented, and advantages and disadvantages resulting from their use are noted. The options for building or buying systems and current availability of commercial systems are discussed.

706,980
PB-275 513/0 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Systems and Software Div.
Computer Science and Technology: COBOL Instrumentation and Debugging: A Case Study.
Final rept.,
G. Lyon. Jan 78, 34p NBS-SP-500-26
Library of Congress Catalog Card no. 77-608347.

Keywords: *Cobol, Compilers, Histograms, Tests, *Debugging(Computers), Symbolic programming.

Traditionally Cobol has been run in batch execution and debugged through abnormal terminations; indeed, whole books have been devoted to deciphering Cobol core dumps. With modern equipment there is little excuse for writing Cobol source code this way. A carefully chosen example (a Cobol program to tally reserved words and cross-reference other tokens) is used as a vehicle for an examination of a contemporary Cobol coding experience. Cobol can be written quite fast interactively, and Cobol programs can be easily tuned if good timing facilities are available. Strengths and limitations of a current debugging package are highlighted in the case study.

706,981
PB-275 514/8 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: An Analysis of Computer Security Safeguards for Detecting and Preventing Intentional Computer Misuse.
Final rept.,
B. Ruder, J. D. Madden, and R. P. Blanc. Jan 78, 80p NBS-SP-500-25
Prepared in cooperation with Stanford Research Inst., Menlo Park, Calif. Library of Congress Catalog Card no. 77-25368.

Keywords: *Data processing security, *Vulnerability, *Crimes, Protection, Detection, *Computer crimes, *Computer theft, *White collar crimes, *Computer misuse.

Stanford Research Institute (SRI) has an extensive file of actual computer misuse cases. The National Bureau of Standards asked SRI to use these cases as a foundation to develop ranked lists of computer safeguards that would have prevented or detected the recorded intentional misuses. This report provides a working definition of intentional computer misuse, a construction of a vulnerability taxonomy of intentional computer misuse, a list of 88 computer safeguards, and a model for classifying the safeguards. In addition, there are lists ranking prevention and detection safeguards, with an explanation of the method of approach used to arrive at the lists. This report should provide the computer security specialist with sufficient information to start or enhance a computer safeguard program.

706,982
PB-275 515/5 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: An Architecture for a Robot Hierarchical Control System,
A. J. Barbera. Dec 77, 230p NBS-SP-500-23
Library of Congress Catalog Card no. 77-17960.

Keywords: *Robots, *Computer programming, *Automation, *Automatic control, Assembly lines, Industries, Numerical control, Computer programs, Fortran, Computer architecture.

Complex automation systems, such as industrial robots, require a computer based control system for the effective utilization of this advanced technology. This report describes such a control system developed at the National Bureau of Standards. The approach has been to partition the control system into a hierarchy of different functional levels. This has proven to be a powerful technique in obtaining sensor-controlled robot behavior at a minimum cost of programming time and computer size. Further, this partitioning has greatly simplified the implementation of additional functions and sensors. This report discusses the control system, its implementation and use, and provides a documented listing of all of the control programs.

706,983
PB-277 305/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Nonlinear Pseudorandom Number Generator.
Final rept.,
J. Gait. 1977, 5p
Pub. in IEEE Trans. Software Eng. SE-3, n5 p359-363 Sep 77.

Keywords: *Data processing security, Pseudorandom sequences, Cryptology, Nonlinear systems, Pseudorandom number generators, Random number generators, *Data encryption, Reprints.

During the next few years, a new pseudorandom number generator will become available on many computer systems. A concern for the security of computer data has lead to the adoption of a Data Encryption Standard by the National Bureau of Standards. This standard specifies a non-linear cryptographic algorithm which can be used as a source of pseudorandom numbers in software applications where the usual linear generators seem to be inadequate.

706,984
PB-277 307/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
DATAPAC: A Data Analysis Package.
Final rept.,
J. J. Filliben. 1976, 6p
Pub. in Proceedings of Interface Symposium on Computer Science and Statistics (9th), Boston, Mass., April 1-2, 1976, p212-217 1976.

Keywords: *Subroutines, *Statistical analysis, Distribution functions, Probability density functions, Time series analysis, Regression analysis, Random numbers, Fortran, DATAPAC subroutines, Random number generators, Computer program portability.

DATAPAC is a homogeneous and systematic set of Fortran subroutines for statistical data analysis. DATAPAC subroutines are portable (ANSI Fortran) and stand-alone (self-contained) with simple, systematic, and consistent subroutine names, simple argument structure, and modularized internal coding. The 168 DATAPAC subroutines are grouped into 14 categories: cumulative distribution functions, probability density functions, percent point functions, sparsity functions, random number generators, probability plots, individual statistics, general analyses, time series analyses, polynomial regression, printer plots, terminal plots, I/O, and data manipulation. The DATAPAC package is unique in the completeness of its cdf/pdf/ppf/sf categories, its probability plot category (18 distributions), and its tail length analyses (3 distributions).

706,985
PB-278 396/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effects of Structured Programming on PL/I Programmers.
Final rept.,
M. V. Zelkowitz. 1977, 3p
Grant AFOSR-77-3181
Software-Pract. Exper. Short Commun.7, n6 p793-795 1977.

Keywords: *Structured programming, PL/I programming language, Reprints.

A PL/I system has been implemented which automatically collects and saves information on every program compiled and executed. This note describes some of the analysis that has been performed on approximately 9,000 of these collected programs.

706,986
PB-278 613/5 PC **A17**/MF **A01**
National Bureau of Standards, Washington, D.C. Applied Mathematics Div.
Computers and Mathematical Programming.
Final rept.,
W. W. White. Feb 78, 387p NBS-SP-502
Proceedings of the Bicentennial Conference on Mathematical Programming Held at Gaithersburg, Maryland on November 29-December 1, 1976. Sponsored in part by Association of Computing Machinery, New York. Special Interest Group on Mathematical Programming. Prepared in cooperation with IBM Corp., Poughkeepsie, N.Y.

Keywords: *Mathematical programming, *Computer programming, *Meetings, Linear programming, Nonlinear programming, Scheduling, Optimization, Minimax technique, Problem solving, Algorithms, Computer software, Integer programming, Unconstrained optimization, Data bases.

The Bicentennial Conference on Mathematical Programming, examined the relationship between mathematical programming and the computer. General topics discussed include the following: Recent algorithmic advances; Applications-public sector; Issues in

the evaluation of mathematical programming algorithms; Applications-private sector; Database management support; Panel on the implications of the hardware environment; Numerical methods; Solution strategies and tactics; Mathematical programming education; Panel on executor/supervisor subsystems and the software environment; Problem solving systems-capabilities and structure; Software development; Operational management. (Portions of this document are not fully legible)

706,987
PB-278 664/8 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Systems and Software Div.
Computer Science and Technology: Database Administration: Concepts, Tools, Experiences, and Problems,
B. Leong-Hong, and B. Marron. Mar 78, 52p NBS-SP-500-28
Library of Congress Catalog Card no. 78-606197.

Keywords: *Data base administration, Data processing security, National government, Data base management systems, *Data base administrators, *Data element directories/dictionaries, Computer software.

In this report the concepts of database administration, the role of the database administrator (DBA), and computer software tools useful in database administration are described in order to assist database technologists and managers. A study of DBA's in the Federal Government is detailed in terms of the functions they perform, the software tools they use, the problems they have encountered, and advice they offer. Finally, some guidelines are presented on what database administration should do for management, and what management must do for their DBA's.

706,988
PB-279 939/3 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: FORTRAN IV Enhanced Character Graphics,
N. M. Wolcott. Apr 78, 60p NBS-SP-500-32
Library of Congress Catalog Card no. 78-606027.

Keywords: *Computer graphics, *Computer programs, Plotting, Composing, Forts, Alphabets, Symbols, Automation, *Typesetting, *Alphanumeric symbols, *Computer aided typesetting, *Typography, Computer output microfilm, Fortran 4 programming language, Fortran 5 programming language, Univac 1108 computers, Univac 1110 computers, IBM-360 computers, IBM-370 computers, PDP-10 computers, PDP-11 computers.

A FORTRAN IV subroutine is described which allows the drawing of six styles of alphabetic characters, three styles of numbers, and 48 special mathematical symbols from the enhanced graphic character set of Dr. A.V. Hershey. Twenty-two symbols for graph plotting are also provided. Output is by linkage to an external subroutine PLOT. The program requires a computer which can accommodate a 30 bit word-length.

706,989
PB-280 370/8 PC **A20**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Computer Science and Statistics: Tenth Annual Symposium on the Interface.
Final rept.,
D. Hogben, and D. W. Fife. Mar 78, 468p NBS-SP-503
Grant NSF-MCS77-04441
Proceedings of the Annual Symposium (10th) Held at the National Bureau of Standards, Gaithersburg, Maryland, April 14-15, 1977.

Keywords: *Computer programming, *Statistical analysis, *Meetings, Computer graphics, Minicomputers, Computerized simulation, Analysis of variance, Regression analysis, Time series analysis, Numerical analysis, Linear programming, Approximation, Interactive graphics, Computer software, Data files, Robust procedures, Integer programming.

The Proceedings of Computer Science and Statistics: Tenth Annual Symposium on the Interface contains 36 invited and 36 contributed poster session papers. The invited papers were presented in six workshops on Evaluation of Statistical Software, Nonlinear Models, Graphics, Large Data Files, Numerical Analysis in Statistics, and Maintenance and Distribution of Statistical Software. The Evaluation of Statistical Software Workshop was divided into two sessions on Statistical Program Packages for Small Computers and Computing Approaches to the Analysis of Variance for Unbalanced Data.

706,990
PB-280 404/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Payoff in COBOL Compiler Validation - What Has Been Gained.
Interim rept.,
G. N. Baird, P. Oliver, and R. Rountree. Oct 77, 4p
Pub. in Courr. Norm., v257 p413-416 Sep/Oct 77.

Keywords: *Compilers, *Cobol, *Standards, National government, Federal information processing standards, Reprints.

The paper gives the background and history of validating COBOL compilers to assure compliance with the U.S. Federal Government Standard COBOL, and current status of the testing program.

706,991
PB-280 435/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Software Management Standards.
Final rept.,
D. W. Fife. 1977, 14p
Pub. in Working Papers of the Software Life Cycle Management Workshop, Airlie House, Warrenton, VA, Aug 21-33, 1977, p63-80.

Keywords: *Computer software management, Reprints.

Software management consists of all the technical and management activities, decisions, and controls that are directly required to purchase, produce, or maintain software throughout the useful life of a computer system or service. This paper discusses the scope of software management from the viewpoint of life cycle phases. Needs are described for standards of practice in the areas of quality assurance, software design, and software production tools.

706,992
PB-280 460/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Computer-Assisted Data Evaluation in a Small Data Center.
Final rept.,
H. M. Gerstenberg. 1977, 4p
Pub. in Proceedings of Biennial Intl. Conf. on CODATA (5th), Boulder, CO, Jun 28-July 1, 1976, p515-518 1977.

Keywords: *Data processing, Photonuclear reactions, Nuclear cross sections, Photonuclear Data Center, National Bureau of Standards.

The Photonuclear Data Center of the National Bureau of Standards (NBS) is a relatively small group presently engaged in the evaluation of cross section (graphical) data. These data exist in digital form in a library maintained by the Center. Extensive use is made of the NBS central computer and its facilities to process data for entry into the digital library, to manipulate the data in various ways during evaluation, and finally, to prepare camera-ready copy in tabular as well as graphical form for publication. Maximum use is made of the computer's executive control language to handle data flow in the evaluation process. For instance, the 'chaining' together of programs (the concept where the output of one program is used as input in another program) is used to maximize the efficiency of data flow from the initial stage to the final result desired. A brief description is given of the computer programs used to obtain an evaluated data set. An example of the data flow from the published literature to the final evaluated data is also shown.

706,993
PB-280 526/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Test Problems and Test Procedures for Least Squares Algorithms.
Final rept.,
R. H. Wampler. 1978, 7p
Prepared in cooperation with American Statistical Association, Washington, D.C., Association for Computing Machinery, New York, and North Carolina State Univ. at Raleigh. Inst. of Statistics.
Pub. in Proceedings of Computer Science and Statistics Annual Symposium on the Interface (11th), North Carolina State Univ., Raleigh, N.C., Mar 6-7, 1978, p84-90.

Keywords: *Least squares method, *Computer programming, Test methods, Algorithms.

Numerous test problems have been introduced in the past twenty years for the purpose of studying and comparing least squares algorithms and computer programs. This paper discusses and classifies some of the useful test problems which have appeared in the literature. A recent large-scale test procedure is briefly summarized. Several neat, mathematical examples are displayed. A new example is presented, and results from several computer programs in solving this problem are given.

706,994
PB-280 530/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Remote Terminal Emulation in the Procurement of Teleprocessing Systems.
Final rept.,
S. W. Watkins, and M. D. Abrams. 1977, 5p
Pub. in Proceedings 1977 in National Computer Conference, Dallas, Tex., June 13-16, 1977, 46 p723-727.

Keywords: *Benchmarks, Remote terminals, *Emulators, *Teleprocessing, *Remote terminal emulators.

This paper addresses some of the problems which exist when benchmarking interactive computing. The teleprocessing workload may be emulated by a program running internal to the System Under Test (SUT), known as an internal driver or internal stimulator. The limitations of internal drivers are discussed, especially with respect to procurement testing. The use of live operators and tape loops are also discussed, but these are also limited techniques. The most attractive alternative is to employ another, external, computer system to emulate the teleprocessing workload; this approach is called remote terminal emulation. The emulation constraints are delineated; terms applicable to the process are defined, including: Remote Terminal Emulator (RTE), scenario, script, and scene. Ten RTE's, representative of current capabilities, are briefly described.

706,995
PB-280 599/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Personal Identification Devices Help to Keep Networks Safe.
Final rept.,
P. Meissner. Apr 77, 5p
Pub. in Data Commun. 6, n4 p67-71, Apr 77.

Keywords: *Data processing security, *Computer networks, *Personal identification, Computer information security, Computer privacy.

Computers are becoming increasingly accessible through the use of data communications, remote terminals, and computer networks. In order to prevent the misuse of these facilities by unauthorized persons, provisions must be included for automatically verifying the identity of authorized users. Several techniques for this purpose are presently being perfected. A person's identity may be verified by the possession of unique information (such as a password), a unique artifact (such as a key), or a unique attribute (such as his signature). This article discusses the factors involved in determining the effectiveness of various identity verification techniques and provides a set of evaluation criteria for use in assessing their suitability for intended applications.

706,996
PB-281 047/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Specifying Abstract Data Types by Restriction.
Final rept.
T. A. Linden. Apr 78, 7p
Pub. in ACM SIGSOFT, Software Eng. Notes 3, n2 p7-13, Apr 78.

Keywords: *Computer programming, Syntax, Semantics, Reprints.

Restrictions are one instance of mathematically-based relationships between types that can be used to simplify program specifications. Restriction of an abstract data type provides a theoretical justification for the concept of a hidden function that appears in some current specification methodologies. The use of type re-

strictions to simplify formal specifications is illustrated by the example of traversible stacks.

706,997
PB-282 012/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Software Engineering is Engineering.
Final rept.,
S. Jeffery, and T. A. Linden. 1977, 4p
Pub. in Proceedings of Hawaii International Conference on System Sciences (10th), Hawaii Univ., Honolulu 6-7 Jan 77 p204-207 1977.

Keywords: *Computer software, Computer program reliability.

Software engineering implies an orderliness to the design and implementation of computer software. It also implies that the results will meet certain quality, performance, and cost objectives analogous to those traditionally set in the more classical engineering disciplines. A considerable body of knowledge and methods common to the traditional areas of engineering is also applicable to software engineering. General engineering methods will be more readily applied in the development of software when software engineering is recognized as a legitimate engineering discipline with its own educational curriculum.

706,998
PB-282 510/7 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: The Design and Implementation of the National Bureau of Standards' Network Access Machine (NAM).
Interim rept. Jun 77-Jun 78,
R. Rosenthal, and B. D. Lucas. Jun 78, 54p NBS-SP-500-35
Library of Congress Catalog Card no. 78-600055.

Keywords: *Computer networks, Minicomputers, Interpreters, *Network access machines, PDP-11/45 computers, Protocols, Command languages(Computers), On line systems, Access methods.

The Network Access Machine (NAM), a programmed minicomputer designed to assist interactive on-line terminal users of computer network services and resources, is discussed in detail. The minicomputer allows the user to specify (or to have specified) network command sequences for execution on a specified network and host connected to that network. Computer responses are analyzed to assure agreement with those anticipated for specific commands. Experience with the NAM and specific examples of NAM use including a common command language for bibliographic retrieval are presented.

706,999
PB-282 511/5 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C.
Computer Science and Technology: Considerations in the Selection of Security Measures for Automatic Data Processing Systems.
Final rept.,
M. J. Orceyre, R. H. Courtney, and G. R. Bolotsky. Jun 78, 37p NBS-SP-500-33
Prepared in cooperation with IBM Federal Systems Div., Bethesda, Md.

Keywords: *Data processing security, Vulnerability, Protection, Cryptology, Identification, Auditing, *Computer information security, Computer privacy, Distributed processing.

The authors introduce the readers to presently known methods and techniques for protecting data in an ADP facility and during transmission. The material is presented as an aid in evaluating and selecting security measures following the identification of existing risks and potential losses via a risk analysis.

707,000
PB-283 153/5 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: UNIVAC 1108 EXEC Level 32R2 Performance Handbook.
Final rept.,
J. C. Kelly, and G. P. Route. Jun 78, 147p NBS-SP-500-34
Library of Congress Catalog Card no. 78-600054. Prepared by Federal Computer Performance Evaluation and Simulation Center (Air Force), Washington, D.C. Sponsored in part by Army Military Personnel Center, Alexandria, Va.

Keywords: *Computer performance evaluation, Operating systems(Computers), Performance evaluation, *UNIVAC-1108 computers, UNIVAC-1100 computers, Computer storage management.

This report describes a set of hypotheses for evaluating the performance of UNIVAC 1100 Computer Systems. The hypotheses specifically apply to EXEC Level 32R2 operating on UNIVAC 1108 Computer Systems. Attempts to apply the guidelines to different UNIVAC 1100 models or to different levels of the EXEC may lead to erroneous results. The report contains sections on each major complex within the EXEC. Each section (1) states the performance hypotheses associated with that complex, (2) explains how the available measurement tools may be used to determine if the hypotheses are true, and (3) identifies which performance parameters need to be changed to correct the problem situation. All of the performance hypotheses discussed in the body of the report are collected together in Appendix A. Appendix B summarizes the performance parameters and Appendix C contains an introduction to the Software Instrumentation Package (SIP).

707,001
PB-284 459/5 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Computer Systems Engineering Div.
Computer Science and Technology: Common Command Language for File Manipulation and Network Job Execution: An Example.
Special pub.,
M. L. Fitzgerald. Aug 78, 37p NBS-SP-500-37
See also PB-282 510.

Keywords: *Computer networks, *Programming languages, Minicomputers, *Network access machines, *Command languages(Computers), PDP-11/45 computers, Honeywell-6180 computers, PDP-10 computers, MULTICS system, TENEX system, UNIX system, TOPS-10 system, Access methods.

Computer networks provide the capability for sharing resources across many diverse computer systems. Utilizing this capability is inhibited by the requirement that the user become familiar with all the varied command languages and protocols of each accessed system. This report presents a general approach to solving this problem using an intermediary system to support a set of Common Commands for File Manipulation and Network Job Execution. To show the feasibility of this approach, common commands were implemented for four systems using the NBS Network Access Machine.

707,002
PB-284 724/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Program Complexity Using Hierarchical Abstract Computers.
Final rept.,
W. G. Bail, and M. V. Zelkowitz. Jun 78, 4p
Pub. in Proceedings of National Computer Conference, Anaheim, Calif., June 5-8, 1978, p605-608.

Keywords: *Computer programming, Mathematical models, Structured programming.

To measure program complexity of programs, certain restrictions are made on the variance of programs to be compared. Hierarchical abstract computers are defined as a model for computation, and a particular decomposition of the program is defined - the prime program parse. A complexity measure is defined on this decomposition, and it is shown to be useful in comparing two similar programs for structure and complexity.

707,003
PB-285 028/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Protection for Reliable Software.
Final rept.,
T. A. Linden. 1978, 15p
Pub. in Paper in System Reliability and Integrity, v2 p245-259 1978, Infotech State-of-the-Art Report.

Keywords: *Data processing security, Programming languages, Availability, Operating systems(Computers), Reviews, *Computer software reliability, Computer information security, Computer privacy, State of the art.

Research on operating systems and programming languages is leading to protection concepts which are flexible enough to detect unanticipated interactions between modules within the same program. In addition to a role in support of computer security, flexible protection can improve the reliability of software by simplifying the problems encountered when modules are integrated into large software systems. This research is opening the way for many new interactions with software engineering methods. Protection is closely linked with recent approaches to data abstraction where users are allowed to create and manipulate objects of user-defined types. Access controls can then be specified and enforced in terms of the problem-oriented operations implemented by an abstract data type.

707,004
PB-285 216/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characteristics of Generalized Data Base Management Systems.
Final rept.,
D. R. Deutsch, and E. Fong. 1978, 23p
Contract DOE-EA-77-A-01-6010
Pub. in Proceedings OECD Specialist Study on the Use of Generalized Data Management Systems for Handling Scientific Information, Paris, France, Jan 11-13, 1977 and Lawrence Berkeley Lab., Berkeley, Calif. Oct 5-7, 1977. Paper in Generalized Data Mgt. Systems and Scientific Inform., CONF 771062 p27-49 (Director of Info., OECD Nuclear Energy Agency, Paris, France, 1978).

Keywords: *Computer programming, *Data base management systems, Computer software.

Generalized database management systems are complex and diverse software products that are used increasingly by organizations of all types. While many applications of database technology are highly successful, others do not meet expectations. An important determinant of success appears to be a close match between application requirements and database management system capabilities. This paper describes characteristics that differentiate database management software packages and presents in an appendix a list of software products and the computer systems on which they are available.

707,005
PB-285 218/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cost Considerations for Database Management Systems.
Final rept.,
D. Deutsch, E. Fong, and J. Collica. 1978, 21p
Contract DOE-EA-77-A-01-6010
Pub. in Proceedings OECD Specialist Study on the Use of Generalized Data Management Systems for Handling Scientific Information, Paris, France, Jan 11-13, 1977 and Lawrence Berkeley Lab., Berkeley, Calif., Oct 5-7, 1977. Paper in Generalized Data Management Systems and Scientific Inform., CONF 771062, p50-70 (Director of Info., OECD Nuclear Energy Agency, Paris, France, 1978).

Keywords: *Cost analysis, Expenses, Estimates, *Data base management systems, Computer software, Life cycle costs.

One important factor that must be considered when evaluating whether generalized database management software should be used is cost. A methodology and a framework based on the application life cycle for estimating costs associated with potential applications of these new software tools is proposed. Important classes of costs are identified and discussed. The problem of comparing costs for database oriented versus traditional software systems is also considered. Finally, budget guidelines for estimating total life cycle costs for generalized database management applications appear in an appendix.

707,006
PB-285 285/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
PLACES - Programming Language and Construct Evaluation System.
Final rept.,
M. V. Zelkowitz. 1978, 7p
Sponsored in part by the Department of the Air Force, Washington, D.C.
Pub. in Proceedings of Annual Technical Symposium (17th) - Tools for Improved Computing in the 80s, Gaithersburg, Md. 15 Jun 78, Assoc. for Computing Machinery, Washington, D.C. p79-85 1978.

Keywords: *Programming languages, PL/1 programming language, Compilers, PLACES project, PLUM compiler.

The PLACES project has been organized to study new language features by using an easily modifiable PL/1 compiler called PLUM. This paper describes PLACES and explains two current investigations. One of these is the inclusion of data abstraction facilities to improve reliability and to make data in programs more modular. The second study is in verification systems. In this case, testing at execution those assertions that cannot be proven may lead to a useful validation and testing tool.

707,007

PB-289 023/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Approaches to Program Correctness.
Final rept.,
J. O. Harrison. Nov 78, 10p
Pub. in Jnl. Tech. Councils Am. Soc. Civ. Eng., v104 nTC1 p39-48, Nov 78.

Keywords: Diagnostic routines, Computer programming, *Computer program verification, Structured programming, Theorem proving, *Computer program reliability, Reprints.

At the beginning of the computer age programs were verified primarily by spot checking them against precomputed values. Except for programmed diagnostics, which detect only specific classes of errors, this is still the only verification technique in general use today. A great deal of research is being devoted to new approaches. Generally speaking, these fall into three broad categories: systematic program testing, mathematical proofs of program correctness, and writing programs so that they are known to be correct in the first place. The last of these, writing programs that are known to be correct, appears to be already developed and ready for use. The first, systematic program testing, has reached the computer assisted stage. The extent of its usefulness in this form and the prospects for extending it to a fully automatic technique remain to be seen. The second, mathematical proofs of program correctness, will be restricted in its application to relatively trivial problems until at least one serious fundamental difficulty is overcome -- the development of more powerful theorem provers.

707,008

PB-289 129/9 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Guideline on Major Job Accounting Systems: The System Management Facilities (SMF) for IBM Systems under OS/MVT.
G. Durbin, T. Kinney, P. Lamasney, E. Newman, and E. Syrett. Oct 78, 181p NBS-SP-500-40
Library of Congress Catalog Card no. 78-600113. Prepared by Tesseract Corp., San Francisco, CA.

Keywords: *Data processing, Performance evaluation, Computer performance, Accuracy, Systems management, Idle time, Multiprogramming, *Job accounting systems, IBM-360 computers, IBM-370 computers, Computer performance evaluation, Systems effectiveness.

This document reports the results of a study which was commissioned in response to the need for a better understanding of how job accounting systems work, what they measure, and how accurately they measure. The accounting system described is IBM's System Management Facilities (SMF) for 360/370 environments operating under OS/MVT. Considerable detail is provided on SMF's activity in collecting the data necessary to account for resources used by the individual jobs in a multiprogramming system and to provide some indicators of the performance of the system itself. Included within the scope of this study was an investigation of the accuracy, both absolute and relative, of SMF as a measurement tool and the costs entailed in the use of SMF. The experimental methodology used to explore these questions is summarized in the report, as are the conclusions reached.

707,009

PB-289 930/0 PC **A10**/MF **A01**
Victoria Univ. (British Columbia).
Effectiveness of Program Validation Methods for Scientific Programs.
Final rept.
W. E. Howden. 1978, 206p NBS/GCR-78/148
Contract NBS-7-35846

Keywords: Computer programming, Mathematical programming, Performance evaluation, Errors, *Computer program verification, *Computer program reliability, Computer software.

This report describes the results of an investigation of the effectiveness of different software validation techniques. The investigation involved two types of activities. The first included a survey of software validation methods and of previous studies of effectiveness. The second involved a project in which each of the errors in a collection of scientific programs was carefully analyzed to determine which validation method would have been most useful in preventing the error from occurring. The report contains five sections, in addition to an appendix. Each section consists of a paper which was written to cover a specific topic. The first two papers are surveys of previous studies of dynamic and static analysis. The third paper is a survey of previous studies of the effectiveness of software validation methods. The fourth and fifth papers describe the results of the analysis of the errors in the scientific programs studies in the project. The errors that were analyzed occur in 50 programs in edition five of the IMSL Scientific Subroutine Library. All errors were corrected in edition six. The errors are described in IMSL maintenance and recipient's letters. The dynamic analysis method which was most effective in discovering the IMSL errors was a form of functional testing which was developed during the research project. The details of the method are contained in the paper in section four. The paper compares the method with the more widely studied kind of testing - structured testing.

707,010

PB-289 931/8 PC **A05**/MF **A01**
Maryland Univ., College Park. Dept. of Computer Science.
Computer Science and Technology: A Guide to Major Job Accounting Systems: The Logger System of the UNIVAC 1100 Series Operating System.
Technical rept.
J. M. Mohr, A. K. Agrawala, and J. F. Flannagan.
Dec 78, 85p TR-434, NBS-SP-500-43
Grants NBS-5-9017, NSF-GK-41062
Library of Congress Catalog Card no. 78-600135.

Keywords: *Operating systems(Computers), Data processing, Performance evaluation, Efficiency, *Job accounting systems, *LOGGER system, *Resource utilization, Computer performance evaluation, EXEC-8 operating system, Univac 1100 computers, Computer installations, User chargeback.

This report has been prepared to serve as guides to the use of Logger, the job accounting system supplied by UNIVAC for its 1100 Series Operating System, Level 32. Logger provides a capability for the automatic collection of information that may be used both for billing a computer installation's customers on the basis of resources utilized by their programs, and for gaining useful insights into the performance characteristics of the system itself. This report describes the structure of the accounting log system, provides a description of the information contained in the log tapes, and describes how the information is gathered by the Operating System.

707,011

PB-291 767/2 PC **A05**/MF **A01**
Gass (Saul I.), Potomac, MD.
Computer Science and Technology: Computer Model Documentation: A Review and an Approach.
Final rept.
S. I. Gass. Feb 79, 95p NBS-SP-500-39
Library of Congress catalog card no. 78-606146.

Keywords: *Computerized simulation, Decision making, Mathematical models, Validation, Documentation, *Computer program documentation.

Recent studies and surveys have concluded that, in general, the documents produced to support the understanding and use of computer models are inadequate. This paper describes the issues and concerns of computer model documentation and proposes an approach for the development of adequate documentation. First, a number of documentation studies and reports are reviewed, including software documentation guidelines and model documentation procedures. Then, based on the relationship between the phases of the model life cycle and documentation information needs, a set of documents is proposed and described. The author takes a highly critical view of the past and present inadequate state of documentation procedures for computer models. The attention of computer model sponsors and developers must be directed to this area. Otherwise, the author feels, there will be an unfortunate decline in the use of decision models as aids in the analysis of important policy issues. The course of action recommended in this report is an extreme position as to the total information and number of documents required to produce adequate documentation. The author calls for the capturing of all information generated during a model's life cycle. Further research is needed to adapt this extreme position to the realities of cost, resources, model complexity, and model use.

707,012

PB-291 779/7 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Findings of the Standard Benchmark Library Study Group.
Final rept.
D. M. Conti. Jan 79, 62p NBS-SP-500-38
Library of Congress catalog card no. 78-606168.

Keywords: *Benchmarks, Performance evaluation, Government procurement, Selection, Computers, Computer programming, Cost benefit analysis, *Computer performance evaluation.

This report presents the findings of a Government-industry study group investigating the technical feasibility of standard benchmark programs. As part of its investigation, the study group reviewed earlier efforts to develop and use standard benchmark programs. Several issues dealing with the implementation, maintenance, cost/benefit, and acceptability of standard benchmarks emerged as a result of this review. The problems encountered by the study group, notably the lack of an accepted definition of 'representativeness,' prevented it from arriving at a definitive statement on feasibility. However, several areas were identified as topics requiring further investigation and are presented in this report.

707,013

PB-291 961/1 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Mathematical Analysis Div.
Universal Set of Test Data for Computer Implementations of Elementary Mathematical Functions.
Final rept.
D. W. Lozier. May 78, 30p NBSIR-78-1478

Keywords: *Functions(Mathematics), *Computer programming, Errors, Exponential functions, Periodic functions, Hyperbolic functions, Logarithm functions, Square roots, Real variables, Complex variables, Tests, Trigonometric functions, Norms, Floating point operation.

A short table of values of 20 mathematical functions commonly found in computer libraries is given. The data was chosen to sample the functions throughout the range of a typical floating-point arithmetic. Computer implementations can be tested by comparing computed function values against the tabular values. A discussion on how to interpret the test results is included, for both decimal and non-decimal implementations.

707,014

PB-293 452/9
(Order as PB-293 447/9, PC **A05**/MF **A01**)
National Engineering Lab. (NBS), Washington, DC. Center for Applied Mathematics.
Critical Review of Comparisons of Mathematical Programming Algorithms and Software (1953-1977),
R. H. F. Jackson, and J. M. Mulvey. 27 Jun 78, 22p
Prepared in cooperation with Harvard Univ., Boston, MA. Graduate School of Business Administration.
Included in Jnl. of Research of the National Bureau of Standards, v83 n6 p563-584, Nov-Dec 78.

Keywords: *Mathematical programming, Computer programming, Algorithms, Reviews.

Since the introduction of general-purpose computers during the early 1950's, competing techniques of mathematical programming have been developed, analyzed empirically, and compared. In this paper the authors survey fifty articles (spanning the period 1953-1977) which report the computational testing of mathematical programming algorithms. The intention is to document the performance measures which were used, the standards which were maintained, and the forms in which the results are reported for these experiments. Trends in methodology are noted, and suggestions for improving the current state of affairs are offered.

707,015
PB-295 139/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Data Sharing Protocols: Structure, Requirements and Interrelationships.
Final rept.,
S. R. Kimbleton. Nov 78, 7p
Pub. in Proceedings of the COMPSAC 78, IEEE Computer Society's International Computer Software and Application Conference (2nd) Held at Chicago, IL. on November 13-16, 1978, p270-276.

Keywords: *Data transmission, Computer networks, Operating systems(Computers), *Protocols, Data bases, Structure transport protocols.

Computer networks provide the basic mechanism for accessing programs and data. Effective use of networks requires appropriate protocols to preserve the meaning of data being transmitted between heterogeneous systems. Currently existing protocols were developed to support the requirements of scientists and engineers. Information processing support, for example remote database access, requires substantially more sophisticated protocols. This paper describes a spectrum of data sharing protocols, identifies the need for a Structure Transport Protocol (STP), describes the nature of an STP, and discusses its utilization in the context of remote database access.

707,016
PB-295 425/3 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Application Systems Div.
Computer Science and Technology: Data Base Reorganization - Principles and Practice.
Final rept.
G. H. Sockut, and R. P. Goldberg. Apr 79, 57p NBS-SP-500-47
Prepared in cooperation with BGS Systems, Inc., Lincoln, MA.

Keywords: Data storage, Data retrieval, Information systems, *Data bases, Reorganization, Data files, File maintenance, Data management, Data base management systems.

Data base reorganization can be defined as changing some aspect of the way in which a data base is arranged logically and/or physically. This paper contains tutorials and surveys. It introduces the basic concepts of reorganization, including why it is performed. Many examples of types of reorganization are described and are classified into logical / physical levels. The paper then covers pragmatic issues such as reorganization strategy, a survey of several commercial reorganization facilities, case studies, and data base administration considerations. Finally, several research efforts are surveyed.

707,017
PB-295 739/7
(Order as PB-295 736/3, PC **A05**/MF **A01**)
Department of Energy, Washington, DC. Office of Analytic Methods.
Enhancing Fortran to Aid Manipulation of Large Structured Matrices,
H. J. Greenberg, and J. E. Kalan. 21 Sep 78, 30p
Prepared in cooperation with Florida Univ., Gainesville. Dept. of Management.
Included in Jnl. of Research of the National Bureau of Standards, v84 n1 p21-50, Jan-Feb 79.

Keywords: *Matrices(Mathematics), *Fortran, Data processing, Programming languages, Mathematical arrays, Computer programs, Sparse matrices, FORTREV programming languages, Data elements.

This paper presents, for wider discussion by the technical community, suggested means for enhancing (ANS) Fortran in order to accommodate the needs of operations research analysts in programming tasks involving large, structured or sparse matrices. Such needs frequently arise in connection with large-scale optimization problems. Most of the text deals with fundamental concepts and descriptions of syntax, but related data structures are also treated. Proposed new capabilities include exploitation of repeated values among matrix entries, space-saving 'quasi-dynamic storage allocation', and easy set-up for construction of large matrices from smaller ones (with the actual construction deferable until and if the need arises).

707,018
PB-296 100/1 Not available NTIS
National Bureau of Standards, Washington, DC.
DATAPLOT--An Interactive System for Graphics, Fortran Function Evaluation, and Linear/Non-Linear Fitting.
Final rept.
J. J. Filliben. 1978, 10p
Pub. in Proceedings of the Statistical Computing Section of the American Statistical Association 1978 Held at San Diego, CA. in August 1978, p344-353 1978.

Keywords: *Programming languages, Computer graphics, Data processing, Curve fitting, Fortran, *Interactive systems, DATAPLOT programming language, Computer program verification, Nonlinear problems, Linear problems.

DATAPLOT is a high-level language that was developed in response to data analysis problems encountered at the National Bureau of Standards. The language is very powerful, very flexible, and very fast to use--especially in an interactive environment. The system combines the best features of the 3 kernel operations of data analysis--graphics (continuous or discrete), data transformations, and linear/non-linear fitting--into one language. Many of the features in dataplot are singularly unique and unmatched by any other interactive system in existence. Features of the system include: Interactive Fortran expression evaluation for transformations plotting/fitting, continuous/discrete plots, single/multi-trace plots, single/multi-function plots, labelled/unlabelled plots, linear/log-scale plots, linear/non-linear fittings, interactive analyses, subset analysis, distributional summary plots, data analysis plots, control charts, probability plots (24 distributions), times series plots, complex demodulation plots, exact rational function fitting, least squares smoothing, random number generation (24 distributions), data manipulation capabilities, probability function calculations, elementary statistics (18 statistics), format-free I/O, diversible graphics output, and a desk calculator mode.

707,019
PB-297 201/6 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Measurement of Interactive Computing: Methodology and Application.
I. W. Cotton. Jun 79, 114p NBS-SP-500-48

Keywords: *Man machine systems, Computer programming, Performance evaluation, Measurement, Programmers, Digital computers, Delay time, Theses, *Interactive systems, *Computer performance evaluation.

This dissertation addresses the measurement of interactive computing, including both the computer system providing service and the users demanding and receiving it. The focus is on the performance of the user and the system in individual interaction sessions (rather than on the performance of the system under varying conditions of load). A new measurement tool developed at the National Bureau of Standards is employed to record a large number of individual interactive sessions over a period of three years. The basic data of interest are the number and rate of characters sent by user and system, and latencies or delays prior to and during transmission by either party. These data are fit to a model of user-computer interaction which distinguishes between stimuli from the user, acknowledgements from the system (which only indicate that a service request has been received) and responses from the system (which contain meaningful information).

707,020
PB-297 846/8 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. Center for Programming Science and Technology.
Computer Science and Technology: Modeling and Measurement Techniques for Evaluation of Design Alternatives in the Implementation of Database Management Software.
Final rept.
D. R. Deutsch. Jul 79, 249p NBS-SP-500-49
Library of Congress catalog card no. 79-600088.

Keywords: Performance evaluation, Project planning, Project management, Computer programming, Theses, *Data base management systems, Data bases, Computer software.

The substantial costs associated with building complex hardware/software systems make the traditional development approach of implementation followed by several iterations for modification and enhancement unacceptable for building modern database management systems. Mechanisms for determining gross feasibility prior to the commitment of resources for major software development efforts are required. An integrated approach combining the development of a limited but well-structured DBMS prototype with the use of high-level measurement and predictive modeling techniques for evaluating design alternatives in the implementation of database management software is proposed as an alternative to the traditional development - enhancement spiral. Using a prototype for a set-theoretic implementation of a database management system with a relational user interface as an object, this research demonstrates that proposed DBMS designs can be evaluated through the use of performance prediction models based on prototype implementations and associated measurement systems.

707,021
PB-297 848/4 PC **A06**/MF **A01**
Federal Information Processing Standards Task Group on Database Management System Standards, Washington, DC.
Computer Science and Technology: Recommendations for Database Management System Standards.
Special pub. (Final).
J. Berg. Aug 79, 103p NBS-SP-500-51
Library of Congress catalog card no. 79-600087.

Keywords: Standards, Recommendations, National government, Government policies, *Data base management systems, Data bases.

In March, 1977, FIPS Task Group 24 (TG-24) initiated a study of the need for database standards within the Federal government. The voluntary participants from several Federal agencies considered the actions of other standards bodies; reviewed the alternatives to Federal standards; examined the issues of standards adoption, timing, and impact on technology; developed a method for justifying standards, and attempted to anticipate likely database technology advancements. TG-24 recommended standards in certain specific technical areas, concluded that standards were premature in others, and emphasized the need for certain guidelines. This final report of TG-24 contains the recommendations for standards and guidelines as well as the assumptions, benefits, and costs considerations used to justify the recommendations.

707,022
PB-299 998/5 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
SPEED2, a Computer Program for the Reduction of Data from Automatic Data Acquisition Systems.
Final rept.
R. D. Peacock, and J. M. Smith. Sep 79, 158p NBS-TN-1108

Keywords: *Data processing, Matrices(Mathematics), Computer graphics, Fortran, Computer programs, *SPEED 2 system, Data acquisition systems, SPEED2 computer program, Univac computers, User manuals(Computer programs).

The voluminous amount of data that can be collected by automatic data acquisition systems requires the use of a digital computer for the reduction of data. A general purpose computer system for the reduction of data collected by automatic data acquisition systems is presented. The system is written with the ability to accept data from a number of different data acquisition systems, with the ability to check the correctness of data included. Through the use of Fortran computer programming, the data can be converted to meaningful scientific and engineering units. The data can then be presented in tabular, printer plot or ink pen plot form.

The system is documented, and detailed instructions for its use, with examples, are presented. The use of the SPEED2 system requires some knowledge of Fortran programming language and the executive control language for the computer system in use.

707,023
PB77-600050 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Computer Science and Technology: Guide to Computer Program Directories.
A. G. Chattic. 1977, 168p NBS-SP-500-22

Keywords: *Computer program index, Federal Software Exchange program, Proprietary software, Public domain software, Software exchange, Software guide, Software index, Software sharing.

The Guide is a product of the computer Information Section's efforts to establish and maintain a reference index to computer programs. CIS has over the past several years collected catalogs that contain proprietary and public domain software and answered queries on the availability of computer programs already developed, tested on in use. Included here are abstracts of catalogs from the collection; no computer program abstracts are included individually. Information concerning specific programs may be obtained from the catalogs abstracted here. Key word indexes for applications and systems programs are included to help users identify catalogs which list programs in their area of interest.

707,024
PB78-600064 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Packed Scatter Tables.
G. Lyon. 1978, 9p
Pub. in Commun. ACM 21, n10 p857-865 Oct 1978.

Keywords: *Assignment problem, Backtrack programming, Hashing, Open addressing, Recursion, Scatter table rearrangements.

Scatter tables for open addressing benefit from recursive entry displacements, cutoffs for unsuccessful searches, and auxiliary cost functions. Compared with conventional methods, the new techniques provide substantially improved tables that resemble exact-solution optimal packings. The displacements are depth-limited approximations to an enumerative (exhaustive) optimization, although packing costs remain linear--O(n)--with table size n. The techniques are primarily suited for important fixed (but possibly quite large) tables for which reference frequencies may be known: op-code tables, spelling dictionaries, access arrays. Introduction of frequency weights further improves retrievals, but the enhancement may degrade cutoffs.

707,025
PB80-117245 Not available NTIS
National Bureau of Standards, Washington, DC.
Software Certification - Fact or Fancy.
Final rept.,
S. W. Katzke. Dec 77, 11p
Pub. in Proceedings of the Annual Conference of the Society for Computer Medicine on Effective Performance in the Dynamic Health Care Environment (7th) Held at Las Vegas, NV., on November 9-11, 1977, p1-11, 1977.

Keywords: Computer programming, Proving, Quality assurance, *Computer program verification, Computer program reliability, Computer software.

Software certification is an approval or an endorsement of some designated authority that there is an acceptable level of confidence that the software, when used in its intended environment, will satisfy its critical specifications. This paper discusses the future possibility of certifying software by defining software certification, validation, and reliability, by explaining the factors that make software certification difficult, and by considering new technological developments that enhance the possibility of limited certification. It concludes that relatively small pieces of software that implement critical functions can be certified, provided that emerging technological developments prove practical and that the developments are used throughout the entire software development life cycle.

707,026
PB80-117377 Not available NTIS
National Bureau of Standards, Washington, DC.
Data Sharing Protocols: Structure, Requirements and Interrelationships.
Final rept.,
S. R. Kimbleton. 1978, 7p
Pub. in IEEE (Institute of Electric and Electronics Engineers) Catalog No. 78CH1338-3C, p270-276 1978.

Keywords: Computer networks, Data transmission, *Protocols, Data bases, Remote systems, Access.

Computer networks provide the basic mechanism for accessing programs and data. Effective use of networks requires appropriate protocols to preserve the meaning of data being transmitted between heterogeneous systems. Currently existing protocols were developed to support the requirements of scientists and engineers. Information processing support, for example remote database access, requires substantially more sophisticated protocols. This paper describes a spectrum of data sharing protocols, identifies the need for a Structure Transport Protocol (STP), describes the nature of an STP, and discusses its utilization in the context of remote database access.

707,027
PB80-117773 Not available NTIS
National Bureau of Standards, Washington, DC.
Key Notarization System for Computer Networks.
Final rept.,
M. E. Smid. 1979, 5p
Pub. in Proceedings of National Telecommunications Conference, Washington, DC., November 27-29, 1979, Paper in NTC 1979 Conference Record 3, p43.3.1-43.3.5 (IEEE Catalog No. 79CH1514-9) 1979.

Keywords: *Data processing security, *Computer networks, Coding, Secure communications, KNS system.

A cryptographic key notarization system (KNS) is proposed for computer networks to protect personal (non-shared) files, to communicate securely both on and off-line with local and remote users, to protect against key substitution, to authenticate system users, to authenticate data, and to provide a digital signature capability using a nonpublic key encryption algorithm. The system is implemented by the addition of key notarization facilities (KNF's) which give users the capability of exercising a set of commands for key management as well as for data encryption functions. Key notarization facilities perform notarization which, upon encryption, seals a key or password with the identities of the transmitter and intended receiver.

707,028
PB80-120918 Not available NTIS
National Bureau of Standards, Washington, DC.
Access Control Mechanisms for a Network Operating System.
Final rept.,
H. M. Wood, and S. R. Kimbleton. Jun 79, 9p
Sponsored in part by Rome Air Development Center, Griffiss AFB, NY.
Pub. in Proceedings of National Computer Conference (1979), New York, NY., June 6, 1979, p821-829 Jun 79.

Keywords: *Data processing security, *Operating systems(Computers), Computer networks.

While research and development are still ongoing in the Network Operating Systems (NOS) area, it is vital to ensure that requirements for the security and integrity of data are well specified and that mechanisms for achieving and needed levels of systems protection are included in the design of the NOS. This will ensure that subsequent production versions of NOSs incorporate such mechanisms--thus charting a course away from otherwise inevitable 'retrofit security' situation. This paper addresses the problem of incorporating access control mechanisms into a general-purpose NOS. The varying requirements and motivations for security in an NOS environment are briefly explored. Mechanisms for controlling NOS access (logon) and data access in the National Bureau of Standards Experimental Network Operating System (XNOS) are then described.

707,029
PB80-122864 Not available NTIS
National Bureau of Standards, Washington, DC.
OMNITAB 78 Plotting Capability.
Final rept.,
D. Hogben, and S. T. Peavy. 1979, 5p
Pub. in Proc. Computer Science and Statistics: 12th Ann. Symp. on the Interface, University of Waterloo, Ontario, May 10-11, 1979 p413-417 1979.

Keywords: *Computer graphics, *Statistical analysis, Data processing, *OMNITAB 78 programming language, OMNITAB 78 system.

OMNITAB 78 is an integrated programming language and statistical software system, particularly suitable for physical and engineering scientists. This paper gives a brief description of OMNITAB 78 and then describes its extensive plotting capability, which includes plots with easy to read scales, plots of varing sizes, multiple plots per page, and CALCOMP plots. Nine examples are described showing many of the plots which can be easily obtained using OMNITAB 78.

707,030
PB80-131790
(Order as PB80-131766, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Generators for Discrete Polynomial L1 Approximation Problems,
P. Domich, J. Lawrence, and D. Shier. 27 Jun 79, 34p
Included in Jnl. of Research of the National Bureau of Standards, v84 n6 p455-488, Nov-Dec 79.

Keywords: *Curve fitting, Approximation, Polynomials, Computer programs, Fortran, POLY1 computer program, POLY2 computer program.

Polynomial approximation problems represent a class of specially structured problems which are frequently encountered in empirical curve-fitting. Two generators for creating such problems have been developed, implemented and used in the testing of discrete L1 approximation codes. Both generators permit automatic generation of problems with specified characteristics and (for one generator) having known, unique and controllable solutions.

707,031
PB80-148281 MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Collection of Test Problems for Discrete Linear L1 Data Fitting,
D. R. Shier, S. J. Neupauer, and P. B. Saunders. Nov 79, 144p NBSIR-79-1920
Available Microfiche Only Because of Poor Quality.

Keywords: *Data smoothing, Tests, Data reduction, Optimization, Data processing, Computer programming, Verifying, Linear systems, Tables(Data), Computer program verification.

This document assembles 27 test problems representing a variety of examples in which least absolute deviation (or L(1)) data fitting has been used. The problems were collected from the literature, from the authors of several L(1) solutions to these problems (objective function value and solution vector) have been obtained using a double-precision computer code designed for checking the Kuhn-Tucker conditions and for performing an accurate reinversion of the optimal basis. Special problem characteristics such as alternative optima, degeneracy, and rank loss are also noted. This set of test problems has proven useful in evaluating and improving the performance of L(1) codes as well as in suggesting types of problem structures that might be mimicked by problem generators.

707,032
PB80-166960 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Validation, Verification, and Testing for the Individual Programmer.
Final rept.,
M. A. Branstad, J. C. Cherniavsky, and W. R. Adrion. Feb 80, 31p NBS-SP-500-56
Library of Congress catalog card no. 80-600005.

Keywords: Computer programming, Proving, Standards, Guidelines, *Computer program verification, Federal information processing standards.

Guidelines are given for program testing and verification to insure quality software for the programmer working alone in a computing environment with limited resources. The emphasis is on verification as an integral part of the software development. Guidance includes developing and planning testing as well as the application of other verification techniques at each lifecycle stage. Relying upon neither automated tools nor

formal quality assurance support, the guidelines should be appropriate for applications programmers doing small development projects.

707,033
PB80-168545 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Using ANS FORTRAN.
Final rept.,
G. E. Lyon, F. E. Holberton, J. Larmouth, and M. D. McIlroy. Mar 80, 109p NBS/HB-131
Grant NSF-DCR75-045443
Prepared in cooperation with Salford Univ. (England), and Bell Telephone Labs., Inc., Murray Hill, NJ. Library of Congress catalog card no. 80-600009.

Keywords: *Fortran, Programming manuals, Computer programming, Compilers, Standards, Fortran 77 programming language, Fortran 66 programming language.

This Fortran volume presents, in order: a set of quick and clear reference charts for ANS Fortran 66 syntax; observations on using only standard Fortran 66 featurs; instructions on circumventing and extending Fortran 66 with the least harm; an appraisal of the new Fortran 77 in terms of Fortran 66 constructs. Although the chapters comprise much material that has appeared in other technical memoranda or published articles, heavily recast sections have been re-referenced. The four chapters address programmers concerned with Fortran transportability, managers engaged in programming standards, and other practitioners interested in system influences upon languages. Since the text touches upon several general programming aspects (input/out, storage allocation, storage lifetime and protection, control structures), the volume's appeal will extend beyond the immediate Fortran community.

707,034
PB80-176902 PC **A03**/MF **A01**
Software Management Consultants, Torrance, CA.
Software Tool Taxonomy Annotated Bibliography.
Special rept.,
D. J. Reifer, and H. A. Montgomery. 1 Dec 79, 38p
SMC-SOH-79-0001, NBS-GCR-80-199
Contract NB79-SBCA-0273
Prepared in cooperation with SoHaR, Inc., Los Angeles, CA.

Keywords: *Bibliographies, Computer programming, Classifications, Data sources, Instructional materials, Reviews, *Software engineering.

The report covers the results of a literature search conducted to identify source material useful in the development of a software tool taxonomy. The findings are organized into three parts. Part 1 summarizes twelve articles which deal with taxonomies. Each article is abstracted and evaluated in terms of its strengths and weaknesses. Part 2 provides an annotated bibliography of thirty articles which survey, compare and/or report experience with tools. Part 3 lists 197 references which were reviewed during the investigation.

707,035
PB80-183833 PC **A05**/MF **A01**
Maryland Univ., College Park. Dept. of Computer Science.
Computer Science and Technology: Data Abstraction, Databases, and Conceptual Modelling: An Annotated Bibliography.
Final rept.,
M. L. Brodie. May 80, 91p NBS/SP-500-59
Library of Congress catalog card no. 80-600052.

Keywords: *Data processing, *Bibliographies, Programming languages, Artificial intelligence, Abstracts, Data base management, Software engineering, Data bases.

This bibliography contains entries for over 350 books, articles, and papers on issues within the area of conceptual modelling of dynamic systems of complex data. The entries have been drawn from recent work in the areas of database management, programming languages, artificial intelligence, and software engineering. The bibliography has two purposes: to present a comprehensive list of annotated references to research into issues of data abstraction, databases, and conceptual modelling: and second, to encourage the crossfertilization of the three research areas of database management, programming languages, and artificial intelligence.

707,036
PB80-211261 PC **A07**/MF **A01**
System Development Corp., McLean, VA.
Common Command Language Feature Analysis.
Draft rept.,
J. Moulton. Jun 80, 141p SDC-TM-WD-8036/101/01, ICST/HLNP-80-4, NBS-GCR-80-256
Contract NB79-SBCA-0274

Keywords: *Programming languages, Computer networks, Telecommunication, Standards, *Protocols, *Federal information processing standards, File management.

The report will focus on the access and management of files in a complex, heterogeneous computer network. It presents a feature analysis of a standard language and its associated protocol. In order to allow system independent manipulation of files and file management systems a Common Command Language (CCL) and a Common Command Language Protocol (CCLP) must be developed. The feature analysis results in the definition of plausible commands and functions that are candidates for inclusion in the service specification. These features are analyzed according to their applicability, usefulness, and cost.

707,037
PB80-212186 Not available NTIS
National Bureau of Standards, Washington, DC.
Ambiguity in Processing Boolean Queries on TDMS Tree Structures: A Study of Four Different Philosophies,
W. T. Hardgrave. Jul 80, 16p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) on Software Engineering SE-6, n4 p357-372 Jul 80.

Keywords: *Computer programming, *Boolean functions, *Trees(Mathematics), Query languages, Semantics, Data processing, Set theory, Boolean algebra.

The paper defines and demonstrates four philosophies for processing queries on tree structures; shows that the data semantics of queries should be described by designating sets of nodes from which values for attributes may be returned to the data consumer; shows that the data semantics of database processing can be specified totally independent of any machine, file structure, or implementation; shows that set theory is a natural and effective vehicle for analyzing the semantics of queries on tree structures; and finally, shows that Bolts is an adequate formalism for conveying the semantics of tree structure processing.

707,038
PB80-215296 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: A Testbed for Providing Uniformity to User-Computer Interaction Languages.
Final rept.,
S. Treu. Aug 80, 78p NBS-SP-500-63
Library of Congress catalog card no. 80-600107. Prepared in cooperation with Pittsburgh Univ., PA. Dept. of Computer Science.

Keywords: *Programming languages, *Data retrieval, Computer systems programs, Standards, Computer networks, Data processing, Systems engineering, Information systems, DIALOG systems.

The differing user-computer interaction languages, implemented for conducting the same applications-specific functions on different systems, represent significant stumbling blocks to users. Toward alleviating this problem area, the use of an intermediary processor to uniformize interaction languages is presented. A framework for such processing is characterized in terms of the required intermediary actions and the logical capabilities needed to perform those actions. The testbed software facilities, centered on the NBS Network Access Machine, are then portrayed. Throughout, an example application, using a common command language subset to access five bibliographic retrieval systems, is described.

707,039
PB80-215338 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Conversion of Federal ADP Systems: A Tutorial.
Final rept.,
J. C. Collica, M. W. Skall, and G. R. Bolotsky. Aug 80, 77p NBS-SP-500-62
Library of Congress catalog card no. 80-600106.

Keywords: *National government, *Conversion, Computer programming, Maintenance, Computer systems programs, Programming languages, Standards, *Software engineering, *Data processing systems.

The tutorial report was undertaken to provide a better understanding of conversion of Federal Government ADP Systems. Three sources were used for gathering the required information to prepare this tutorial: (1) interviews with commercial conversion experts; (2) interviews with Federal Government agency personnel who have recently experienced conversions; (3) current literature. The first three chapters comprise the tutorial. The next three chapters discuss the information gathered from the above three sources. The last chapter summarizes the authors' conclusions, while highlighting the major problem areas requiring guidance.

707,040
PB80-215700 PC **A05**/MF **A01**
Bolt Beranek and Newman, Inc., Cambridge, MA.
Formal Description Techniques for Network Protocols, Draft Report.
Jun 80, 89p ICST/HLNP-80-3, NBS-GCR-80-247
Contract NB79-SBCA-0092
Prepared in cooperation with System Development Corp., McLean, VA.

Keywords: *Computer networks, *Programming languages, Standards, National government, Telecommunication, Descriptions, Computer programming, Systems analysis, *Federal information processing standards, *Protocols.

The National Bureau of Standards, Institute of Computer Sciences and Technology (ICST), has initiated a program to develop computer network protocol standards as Federal Information Processing Standards (FIPS). This is one of a series of draft reports prepared under the network protocol standards program for distribution to government agencies, voluntary standards organizations, computer and communications equipment manufacturers, and other interested parties. The draft report contains two formal description techniques, a general survey, and a set of criteria for evaluation of these techniques.

707,041
PB80-219777 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Problems Used in Testing the Efficiency and Accuracy of the Modified Gram-Schmidt Least Squares Algorithm.
Final rept.,
R. H. Wampler. Aug 80, 86p NBS-TN-1126

Keywords: *Least squares method, *Curve fitting, *Computer programs, Fortran, Algorithms, Efficiency, Accuracy, Gram-Schmidt algorithm, Univac-1108 computers.

In preparing 'Algorithm 544: L2A and L2B, Weighted Least Squares Solutions by Modified Gram-Schmidt with Iterative Refinement' for publication in ACM Transactions on Mathematical Software (Vol. 5, 1979), the Fortran computer program was extensively tested. This not describes the various types of problems which were used to explore the efficiency and accuracy of this algorithm. The Fortran subprograms which performed the various tests are listed in an appendix. Also listed are the data used in executing the testing routines as well as typical output form several different types of problems. Among the testing routines is one which is suitable for handling general linear least squares problems. Here, the user has the option of scaling his raw data in order to mitigate the effects of ill-conditioning.

707,042
PB80-221112 PC **A04**/MF **A01**
Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.

Performance Requirements for Standards Processing Software.
Final rept.,
S. J. Fenves. Apr 79, 58p R-79-111, NBS-GCR-80-257
Contract NBS-816661
See also report dated Jun 79, PB80-221120.

Keywords: *Performance standards, *Computer programming, *Standards, Data processing, Requirements, Systems analysis, Systems engineering, Decision theory, User needs, *Software engineering, Data base management.

A methodology for the analysis and synthesis of standards exists which can provide significant assistance to standard writers and developers. Several of the methods have been implemented as computer programs. With the experience gained in the use of the first generation of programs, this report presents a set of performance requirements for a new generation of standards processing software. It is intended that these requirements serve as a basis for defining functional specifications for the subsequent development of the new software. The performance requirements are organized into six categories (general, database, interaction, user interaction, analysis, and processing environment), and they provide an ability to work with all the major elements of the methodology: decision tables for the meaning of individual provisions, information networks for the precedence between provisions, and classification systems for the production of indexes and outlines. The report also presents a concise overview of the methodology for analysis and synthesis of standards with an annotated, chronological bibliography and brief descriptions of previously developed computer programs.

707,043
PB80-221120 PC **A08**/MF **A01**
Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.
Functional Specifications for Standards Processing Software.
Final rept.,
S. J. Fenves. Jun 79, 171p R-120-679-SJF, NBS-GCR-80-258
Contract NBS-816657
See also report dated Apr 79, PB80-221112.

Keywords: *Specifications, *Standards, *Computer programming, Functional analysis, Data processing, Requirements, Systems analysis, Systems engineering, Decision theory, User needs, *Software engineering, Data base management.

This is the second in a series of reports leading to the development of a standards processing software capability. The reader of this report will need to have read and be familiar with the concepts and terms used in the first report. This report provides the complete functional specifications which establish the technical basis for the development of the software. The salient features are: (1) the integration of all user functions into a single system, (2) maintenance of all information in a data base, (3) facilities for convenient user interaction, (4) facilities for processing and combining large standards subdivided into several units, such as chapters, and (5) facilities for interfacing with additional capabilities to be developed in the future, both external and internal to the system.

707,044
PB80-225204 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Prospectus for Data Dictionary System Standard.
Sep 80, 20p NBSIR-80-2115

Keywords: Standards, Information systems, National government, Data processing, Descriptions, Systems engineering, *Data dictionairies, Data management systems.

A Data Dictionary System is an automated information system to assist in organization-wide data management, without restriction to computer data. This report describes NBS effort to develop a Federal Data Dictionary System standard. It discusses the scope and purpose of the standard, the intended audience, general issues being investigated, and the basic project approach.

707,045
PB81-115537 PC **A04**/MF **A01**
SRI International, Menlo Park, CA. Computer Science Lab.
Computer Science And Technology: The SRI Hierarchical Development Methodology (HDM) and its Application to the Development of Secure Software.
Final rept.
K. N. Levitt, P. Neumann, and L. Robinson. Oct 80, 59p NBS-SP-500-67
Contract NBS-5-35932
Library of Congress catalog card no. 80-600157.

Keywords: *Computer programming, Systems engineering, Design criteria, Specifications, *Data processing security, *Software engineering, Computer security, Data base management.

The document provides an introduction to the SRI Hierarchical Development Methodology (HDM). The methodology employs a staged decomposition of the development process, which separates design, data representation, and implementation. For any given system development, HDM employs a hierarchical decomposition of the design and formal specifications of modules and their interconnections. Extensive tools are used throughout the development to check the appropriateness of the design and its implementation. The role of HDM in developing secure systems is considered, and various current efforts using HDM to develop such systems are summarized. The use of the methodology is illustrated by a simple but complete example. A somewhat larger example of part of a secure data management system is also discussed.

707,046
PB81-124935 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
NBS Software Tools Database.
R. C. Houghton, and K. A. Oakley. Oct 80, 108p NBSIR-80-2159

Keywords: *Computer systems programs, Computer programming, Quality control, Tests, Standards, National government, *Software engineering, *National Bureau of Standards, *Data bases, Computer software, Relational data bases, Pascal programming language.

The Center for Programming Science and Technology has been compiling data on the availability of software development and testing tools. The data has been placed into a relational database using Pascal/R, a language that extends Pascal by a data relation. The database allows for information retrieval on tool features, languages, developers, documentation, hardware and software requirements, availability, publications, and contacts. The purpose of this report is to put forward the information currently contained in the database for review, assimilation, and update.

707,047
PB81-125783 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
Computer Science and Technology: An Analytic Study of a Shared Device Among Independent Computing Systems.
Final rept.
A. Mink. Nov 80, 180p NBS/SP-500-69
Library of Congress catalog card no. 80-600170.

Keywords: *Queueing theory, *Data processing, Time sharing, Resource allocating, Algorithms, Computer programming, Network analysis, Mathematical models, *Computer networks.

Global queueing network performance models are developed for the increasingly important class of computer networks comprising a number of independent computing systems sharing a single resource. An extensive bibliography and survey of prior work relating to this topic are included. Analytic expressions of performance measures for this class of systems are derived from the general theory of multiclass queueing networks, and new computational algorithms for evaluating them are presented that are memory-space efficient (linear vs. exponential) compared with known algorithms for the general theory. This exact analytic model, called the Shared Central Server Model, incurs approximately the same exponential time complexity in its evaluation as do all models based on the general theory; because of this, a simple heuristic approximate model of this class of systems is also presented that is computationally efficient in both time and space. Modular expansion of this class of systems is investigated using the approximate model, and a useful relationship is derived between the number of additional independent computing systems and the incremental increase in capability of the shared resource required to maintain the existing level of system performance.

707,048
PB81-137721 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Remote Record Access: Requirements, Implementation and Analysis.
Final rept.
H. M. Wood, and S. R. Kimbleton. Dec 80, 46p NBS-SP-500-71

Keywords: Operating systems(Computers), Data transmission, Network analysis, Systems analysis, *Computer networks, *Remote record access, Access methods, Data conversions.

A key support component for network-wide data sharing is the ability of a process to access remotely stored data at runtime. In order for the accessed data to be useful, a means of overcoming differences in data representation and format is necessary. Such a capability is termed remote record access. This paper identifies some of the problems inherent in the sharing of data among dissimilar computer and data systems. Implementation issues and alternatives are presented, followed by a description of XRRA, the Experimental Remote Record Access component which has been implemented as part of the Experimental Network Operating System (XNOS) at the National Bureau of Standards.

707,049
PB81-152118 PC **A04**/MF **A01**
Federal Computer Performance Evaluation and Simulation Center, Washington, DC.
Computer Science and Technology: Computer Model Documentation Guide.
Final rept.
Jan 81, 61p NBS/SP-500-73
Library of Congress catalog card no. 80-600190.

Keywords: *Models, *Computerized simulation, Manuals, Technical writing, Documentation, Computer programming, Guidelines, Users manuals(Computer programs), Programming manuals.

This document provides guidelines for preparing documentation for computer models. Recommended structures for four types of manuals providing model information for four different classes of audiences (managers, users, analysts, and programmers) is presented. This document specifies the content of sections and subsections for each type of manual. Manuals prepared using these guidelines will enable persons interested in a model to understand the capabilities and limitations of that model.

707,050
PB81-167074 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Computer Science and Technology: Validation, Verification, and Testing of Computer Software.
Final rept.
W. R. Adrion, M. A. Branstad, and J. C. Cherniavsky. Feb 81, 62p NBS-SP-500-75
Library of Congress catalog card no. 80-600199.

Keywords: *Computer programming, Verifying, Proving, Quality assurance, Validity, Computer systems programs, Statistical analysis, Error analysis, *Software engineering, Software tools, Information validation.

Programming is an exercise in problem solving. As with any problem solving activity, determination of the validity of the solution is part of the process. This survey discusses testing and analysis techniques that can be used to validate software and to instill confidence in the programming product. Verification throughout the development process is stressed. Specific tools and techniques are described.

707,051
PB81-169948 Not available NTIS
National Bureau of Standards, Washington, DC.
Case Study in Rapid Prototyping.
Final rept.
M. V. Zelkowitz. 1980, 6p
Pub. in Software-Practice Experiment 10, p1037-1042 1980.

Keywords: *Programming languages, *Prototypes, Computer programming, Interpreter routines, Translator routines, *Language programming, PASCAL programming language, SNOBOL programming language.

A case study in rapid prototyping of a new language processor is described. A quick version of the system was developed in SNOBOL4, revised in SNOBOL4, and then rewritten in PASCAL. This led to an operational system very early in the development cycle where operational characteristics of the system could be tested easily. The goals of this experiment as well as some of the results are described.

707,052
PB81-176562 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Computer Science and Technology: Features of Software Development Tools.
Final rept.
R. C. Houghton. Feb 81, 29p NBS-SP-500-74
Library of Congress catalog card no. 80-600193.

Keywords: *Computer programming, Computer systems programs, Descriptions, Definitions, Classifications, *Software tools, Software engineering, Computer software.

Software tools are powerful productivity and quality aids that in many cases are not being used effectively. This report discusses an effort to lessen this problem by providing a formal way in which tools can be classified according to the features that they provide.

707,053
PB81-216699 Not available NTIS
National Bureau of Standards, Washington, DC.
ANS FORTRAN: Past and Near Future.
Final rept.
G. Lyon. 1980, 3p
Pub. in Proceedings of the International Computer Technology Conference ASME Century 2--Emerging Technology Conferences held at San Francisco, CA., on August 12-15, 1980.
Paper in Advances in Computer Technology-1980, n2 p402-404 1980.

Keywords: *Fortran, *Programming languages, Computer programming, PL/1 programming language, PASCAL programming language.

Although the essential design of FORTRAN was made over twenty-five years ago, the language will persist. A large community supports its use and it is widely available. FORTRAN will remain viable because of this availability because of an uncomplicated and malleable nature, and because of evolutionary improvements.

707,054
PB81-223430 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Computer Science and Technology: NBS Programming Environment Workshop Report.
Final rept.
M. A. Branstad, and W. R. Adrion. Jun 81, 109p NBS-SP-500-78
Library of Congress catalog card no. 81-600068.

Keywords: *Meetings, *Computer programming, Programming languages, Research projects, Systems analysis, *Software engineering, Software tools.

In May of 1980, NBS hosted a workshop to assess the state-of-the-art in programming environment technology and to determine the key questions and issues that must be addressed to use these techniques to improve software quality and productivity within the Federal Government. This document reports the results of the workshop.

707,055
PB81-243941 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Multiprecision Computing at NBS; Yesterday, Today, and Tomorrow.
D. W. Lozier. Oct 80, 55p NBSIR-80-2138

Keywords: *Computation, *Data processing, Precision, Computer programming, Fortran, Arithmetic functions, *Software engineering.

Multiprecision computing is a technique by which arithmetic operations may be performed on a computer to precision levels that are higher than the directly supported single and double precisions. The last ten years have seen the development of portable Fortran software of very high quality that essentially duplicates all the capabilities of standard Fortran, so that an existing standard Fortran program can be re-executed to arbitrarily high precision. In this paper some of the design techniques for such software, which have evolved at NBS and elsewhere, will be discussed. Methods for using the software presently available at NBS will be described, and a complete example will be given. Directions for further extensions and improvements will be indicated.

707,056
PB82-101312 Not available NTIS
National Bureau of Standards, Washington, DC.
Alternation-Tree Insertions for Open-Addressed Hash Buckets.
Final rept.
G. E. Lyon. 1981, 4p
Pub. in Proceedings of Information Sciences and Systems Annual Conference (15th), Baltimore, MD., 25-27 March, 1981, p398-401 1981.

Keywords: *Computer programming, *Addressing, Algorithms, Data retrieval, Data storage, *Hashing.

Open-addressing is a hashing method that uses no explicit table structures such as bit fields, pointers, or index linkages. It is a compact method of storing information that can later be retrieved, on the average, very quickly. However, sometimes the objective is not so much to achieve a fast average retrieval as it is to ensure that worst cases are short. It is known that for hashing into buckets, worst case searches can usually be limited to two probes, although known computational methods to do this can be slow. In attacking this problem of computation, principal focus is upon a new, practical algorithm that constructs tables cheaply.

707,057
PB82-103961 PC **A06**/MF **A01**
Software Management Consultants, Torrance, CA.
Software Tool Taxonomy.
Final rept.
D. J. Reifer, and H. A. Montgomery. 1 Jun 80, 115p SMC-TR-004, NBS-GCR-81-335
Contract NB79-SBCA-0273
See also PB80-176902, and PB81-176562. Prepared in cooperation with SoHaR, Inc. Los Angeles, CA.

Keywords: *Computer programming, Computer systems programs, Descriptions, Definitions, Classifications, *Software tools, Software engineering, Computer software.

An initial set of software tool classifications are defined that can be used to: (1) categorize currently available tools, (2) standardize terminology associated with tools, and (3) ease the task of comparing and evaluating the utility of tools within a class. Example, classifications of 30 tools are provided.

707,058
PB82-112392 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC.
Computer Science and Technology: Proceedings of the NBS/IEEE/ACM Software Tool Fair.
Final rept.
R. C. Houghton. Oct 81, 241p NBS-SP-500-80
Sponsored in part by IEEE Computer Society, Silver Spring, MD., and SIGSOFT ACM, New York, Library of Congress catalog card no. 81-600109. Held in conjunction with the International Conference on Software Engineering (5th) in San Diego, California on March 10-12, 1981.

Keywords: *Meetings, *Computer programming, Quality control, Systems analysis, *Software engineering, Software tools, San Diego(California), Computer software.

This document summarizes the presentations made by each demonstrator at the San Diego Tool Fair. The San Diego Tool Fair was a first-of-its-kind demonstration of software engineering tools at a major conference. Each summary includes a short description of the tool, a scenario of the demonstration, a list of references, background on the demonstrators, sample output, and a page of miscellaneous data obtained from the NBS Software Tools Database. The appendix provides a cross reference to the features of the tools.

707,059
PB82-112533 Not available NTIS
National Bureau of Standards, Washington, DC.
Test Problem Generator for Discrete Linear L1 Approximation Problems.
Final rept.
K. L. Hoffman, and D. R. Shier. Dec 80, 7p
Pub. in ACM Transactions on Mathematical Software 6, n4 p587-593 Dec 80.

Keywords: *Approximation, Computer programming, Matrices(Mathematics), Reprints.

Described here are the theoretical development and computer implementation of a procedure that generates test problems for L1 estimation of the linear model y=X (beta) + u. The generation procedure allows the user flexibility in specifying the problem dimensions, the L1 solution vector beta*, the distribution of the observed residuals epsilon, as well as the column rank, row repetitions, and degree or degeneracy of the matrix X. The user can also specify the distributional form, mean, and variance for each independent variable. An important feature of the generator is that any problem it creates is guaranteed to have a unique solution beta whenever X has full rank.

707,060
PB82-133521 PC **A05**/MF **A01**
SoHaR, Inc., Los Angeles, CA.
Synopsis of Interviews from a Survey of Software Tool Usage.
H. Hecht. Nov 81, 81p NBSIR-81-2388
Contract NB79-SBCA-0273

Keywords: *Computer programming, Utilization, Maintenance management, Interviews, *Software tools, Software engineering.

This report contains synopses of all interviews conducted as part of a survey of the development and use of software tools in industry and Government and a classification of the tools encountered. The purpose of the report is to document the detailed data in a form which may be helpful for further research.

707,061
PB82-134743 PC **A04**/MF **A01**
SoHaR, Inc., Los Angeles, CA.
Computer Science and Technology: A Survey of Software Tools Usage.
Final rept.
H. Hecht. Nov 81, 61p NBS/SP-500-82
Library of Congress catalog card no. 81-600112.

Keywords: *Computer programming, Utilization, Maintenance management, *Software tools, Software engineering.

The state of the art regarding the development and use of software tools is presented. The information was gathered from an in-depth survey of 23 sites with Government and industry. A comparison is made among the levels of tool usage based on the size and type of programming group. The survey examines aspects that both promote or inhibit tool usage and provide requirements for the future.

707,062
PB82-136474 PC **A14**/MF **A01**
National Bureau of Standards, Washington, DC.
Test Problems and Results for OMNITAB 80.
Final rept.
S. T. Peavy, and S. G. Bremer. Nov 81, 320p NBS-TN-1147
See also report for Dec 70, COM-71-50076. Supersedes COM-71-50609.

Keywords: *Computer programming, Systems analysis, Statistical tests, Proving, *OMNITAB 80 systems, *Software engineering, Computer software.

The lack of test problems and results for many computer software packages is a great hindrance to both the systems programmer and the general user. In this publication a set of 69 test problems and results for the OMNITAB 80 system is provided to assist individuals in checking the installation of the OMNITAB 80 system on their particul ar computer. The general user will also find these descriptive examples instructive in the use of the OMNITAB 80 system.

707,063
PB82-136748 PC **A07**/MF **A01**
Computer Corp. of America, Cambridge, MA.

Evaluation Criteria for a CODASYL Query Language.
Interim rept.
F. Manola, J. Smith, and D. Smith. 10 Mar 80, 150p CCA-80-17, NBS-GCR-81-337
Contract NB79-SBCA-0088
See also PB82-136755.
Also available in set of 3 reports PC E16, PB82-136730.

Keywords: *Programming languages, Computer programming, Evaluation, Criteria, Information retrieval, *Query languages, *CODASYL programming languages, Data base management systems.

This report describes evaluation criteria which will be used in the development by CCA of a query Language for CODASYL-type data structures. The evaluation criteria will be the basis for a specific set of capabilities to be provided by the query language. The capabilities to be provided are determined by choosing, for each evaluation criterion, a position describing a specific level of capability. The evaluation criteria are also useful in the evaluation of existing query languages. In addition to a discussion of the evaluation criteria and positions, the report includes a description of those database users for which a query language based on the proposed evaluation criteria is intended. The report also discusses related language facilities which might appear in the context of such a query language.

707,064
PB82-136755 PC **A07**/MF **A01**
Computer Corp. of America, Cambridge, MA.
Capabilities for a CODASYL Query Language.
Interim rept.
F. Manola. 10 Jun 80, 126p CCA-80-18, NBS-GCR-81-338
Contract NB79-SBCA-0088
See also PB82-136748, and PB82-136763.
Also available in set of 3 reports PC E16, PB82-136730.

Keywords: *Programming languages, Computer programming, Information retrieval, *Query languages, *CODASYL programming languages, Data base management systems, Relational data bases.

This report describes proposed capabilities which are to be provided in a query language being designed by CCA which will operate on CODASYL-type database structures. In order to define the nature of these capabilities in a way sufficiently detailed to be the basis of language design, the capabilities are illustrated by examples using two prototype languages. These languages, while not complete, are currently under investigation. The languages are SNEQUEL, based on IBM's relational query language SQL, and CODAPLEX, based on Shipman's functional language DAPLEX. Proposed capabilities include those necessary for querying relational, as well as CODASYL, databases.

707,065
PB82-136763 PC **A10**/MF **A01**
Computer Corp. of America, Cambridge, MA.
Survey of CODASYL Query Languages.
Interim rept.
F. Manola, and J. Barnett. 22 Sep 80, 223p CCA-80-19, NBS-GCR-81-339
Contract NB79-SBCA-0088
See also PB82-136755.
Also available in set of 3 reports PC E16, PB82-136730.

Keywords: *Programming languages, Computer programming, Utilization, Evaluation, Criteria, Information retrieval, *Query languages, *CODASYL programming languages, Data base management systems.

This report describes capabilities provided by query languages designed for use with CODASYL-type database management systems. The languages surveyed include both commercially-available products and query languages which have been described in the research literature. The report first discusses criteria used to evaluate the various query languages studied, as well as capabilities which were considered of special interest in the study. The report then presents a separate section on each query language surveyed. The capabilities of each language are described with respect to the specified evaluation criteria, and a list of references for each language is provided.

707,066
PB82-140864 Not available NTIS
National Bureau of Standards, Washington, DC.
Assessing the Performance of High-Level Computer Network Protocols.
Final rept.
W. H. McCoy, R. P. Colella, and M. A. Wallace. Sep 81, 29p
Pub. in Proceedings of Protocol Testing - Towards Proof, INWG/NPL Workshop, Teddington, Middlesex, United Kingdom, May 27-29, 1981, 2, p25-53, Sep 81.

Keywords: Performance evaluation, Systems analysis, *Protocols, *Computer networks, *Federal information processing standards, Computer program verification.

There are two aspects to assessing the performance of high-level network protocols: (1) establishing correct performance and (2) determining and evaluating measurable parameters of performance. The first of these is strongly related to software verification, while the latter is more related to system performance evaluation. In this paper, both aspects are discussed with regard to techniques that are being employed by the Institute for Computer Sciences and Technology (ICST) of the National Bureau of Standards (NBS). The ICST is developing a laboratory for experimentally assessing performance of network protocols. The principal objective of this laboratory is to test protocols that have been proposed as draft standards for their viability as Federal Information Processing Standards (FIPS). Another goal is to determine certification methods and procedures for verifying compliance of a vendor's protocol to established FIPS. The protocols which are currently under development as prototype standards conform to the Open Systems Interconnection architecture of the International Standards Organization (ISO).

707,067
PB82-154378 PC **A04**/MF **A01**
Intermetrics, Inc., Bethesda, MD.
Compiler-Based Programming Support Capabilities.
Final rept.
G. Bray, R. Lipsett, W. Bail, and V. Berman. Jan 82, 72p NBSIR-81-2423
Contract NB79-SBCA-0131

Keywords: *Compilers, *Computer programming, Computer systems programs, *Software tools, Software engineering.

An effort to determine a set of features offered by program analysis and testing tools that could be feasibly implemented in a compiler is reported. Currently, program analysis and testing tools offer features that require syntactical analysis of a program in a manner similar to compilers. Much of the information that is generated during compilation could be used to aid program development in other ways. It was the goal of this effort to identify a set of software tool features and develop a methodology for combining these into a compiler.

707,068
PB82-181447 CP **T14**
National Bureau of Standards, Washington, DC. National Engineering Lab.
DATAPLOT: An Interactive High-Level Language for Graphics, Non-Linear Fitting, Data Analysis, and Mathematics (FORTRAN 1966) (Version 82.3).
Software.
J. J. Filliben. 15 Feb 82, mag tape NBS/DF-82/001
Source tape is in ASCII character set. Character set restricts preparation to 9 track one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products, if you have questions. Price includes documentation, PB82-181462, PB82-181470, PB82-181488, PB82-181496, PB82-182504, PB82-191685, PB81-191677, PB82-191669 and PB82-191651.

Keywords: *Software, *Computer graphics, *Programming languages, *Plotting, Computer programming, Magnetic tapes, Fortran, Mathematical models, *DATAPLOT programming language, Univac-1108 computers.

DATAPLOT is a high-level (free-format English-like syntax) language for: (1) graphics (continuous or discrete); (2) fitting (linear or non-linear); (3) general data analysis; and (4) mathematics. It was developed originally in 1977 in response to data analysis problems encountered at the National Bureau of Standards. It is a valuable tool not only for raw graphics, but also for manuscript preparation, modeling, data analysis, data summarization, and mathematical analysis. DATAPLOT may be run either in batch or interactively, although it was primarily designed for (and is most effectively used in) an interactive environment. DATAPLOT graphics may appear on many different types of output services...Software Description: This software was developed on a UNIVAC 1108 under EXEC 8. However, due to its modular design and underlying ANSI FORTRAN (PFORT or Portable FORTRAN) code, DATAPLOT is portable to a wide variety of computers. Approximately 300K bytes (overlay) or 2.5MB (non-overlay) of memory is required. Test problems are included with the package.

707,069
PB82-181454 CP **T14**
National Bureau of Standards, Washington, DC.
DATAPLOT: An Interactive High-Level Language for Graphics, Non-Linear Fitting, Data Analysis, and Mathematics (FORTRAN 1977) (Version 82.3).
Software.
J. J. Filliben. 15 Feb 82, mag tape NBS/DF-82/002
Source tape is in ASCII character set. Character set restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation, PB82-181462, PB82-181470, PB82-181488, PB82-181496, PB82-181504, PB82-191685, PB82-191677, PB82-191669, and PB82-191651.

Keywords: *Software, *Programming languages, *Computer graphics, Computer programming, Magnetic tapes, *DATAPLOT, L=FORTRAN 66 or FORTRAN 77, H=Univac-1108.

DATAPLOT is a high-level (free-format English-like syntax) language for graphics (continuous or discrete), fitting (linear or non-linear), general data analysis, and mathematics. It was developed originally in 1977 in response to data analysis problems encountered at the National Bureau of Standards. It is a valuable tool not only for raw graphics, but also for manuscript preparation, modeling, data analysis, data summarization, and mathematical analysis. DATAPLOT may be run either in batch or interactive mode. DATAPLOT graphics may appear on many different types of output services. Software Description: This software was developed on a UNIVAC 1108 under EXEC 8. However, due to its modular design and underlying ANSI FORTRAN (PFORT or Portable FORTRAN) code, DATAPLOT is portable to a wide variety of computers. Approximately 300K bytes (overlay) or 2.5MB (non-overlay) of memory are required. Test problems are included with the package.

707,070
PB82-181462 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
DATAPLOT - Examples Manual for the FIT Command.
J. J. Filliben. Mar 82, 86p NBS/DF-82/001A
For system on magnetic tape, see PB82-181447 and PB82-181454.

Keywords: *Computer graphics, *Programming languages, Computer programming, Fortran, Mathematical models, Plotting, *DATAPLOT programming language, Programming manuals.

The purpose of this manual is to demonstrate by example the use of the DATAPLOT FIT Command. The FIT command frees the analyst from typical programming details, and allows the analyst to concentrate on the physical modeling problem at hand. Of particular note with respect to the FIT command is that (1) The DATAPLOT fitting operation is done interactively which is conductive to model-building and model-exploration; (2) The FIT command has automatic in-line function parsing so that the analyst need just enter the desired model directly as a Fortran-like expression; (3) DATAPLOT automatically checks for replication and (if existent) automatically carries out a lack-of-fit F test; (4) DATAPLOT automatically stores predicted values (in a variable called PRED) and residuals (in a variable called RES) which may be used by the analyst after the fit in any fashion desired; and (5) After the fit is carried out, the analyst may access any of DATAPLOT's graphical and statistical capabilities as needed to carry out an appropriate residual analysis. The net result is that whereas before it would not be unusual for the several iterations typical for exploratory non-linear model-building to take days and weeks, it may now take only minutes. This significant saving of time in turn promotes the continuity which is so important in scientific investigations.

707,071
PB82-181470 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
DATAPLOT - Examples Manual for the Graphics Commands.
J. J. Filliben. Mar 82, 44p NBS/DF-82/001B
For system on magnetic tape, see PB82-181447 and PB82-181454.

Keywords: *Computer graphics, *Programming languages, *Plotting, Computer programming, *DATAPLOT programming language, Programming manuals.

The purpose of this manual is to demonstrate by example the use of those DATAPLOT commands in the 'Graphics' category. This category includes: (1) General graphics capabilities: continuous display terminal plots (e.g., Tektronix), discrete (narrow-width or wide-carriage) terminal plots (e.g., TI 700), high-speed printer plots, high-quality secondary output plots (e.g., Calcomp); on-line interactive definition and plotting of functions; data plots; multi-trace plots; linear or log scale plots; plots with or without labels, titles, frames, tic marks, grid lines, legends, legend boxes, arrows, etc.; automatic hardcopying of 3-d plots of functions and/or data; multi-colored graphics; all of above for full data sets or subsets of data. (2) Graphical data analysis capabilities: box plots; complex demodulation plots; control charts; correlation plots; distributional frequency plots; histograms; lag plots; percent point plots; auto and cross periodograms; probability plots (24 distributions); probability plot corr. coef. dist. analysis plots (3 families); auto- and cross-spectral plots; scatter plots; pie charts; Youden plots; graphical ANOVA/ANOCOV; runs plots; 3-d dist. frequency plots; 3-d histograms; 4-plot per page univariate analysis; all of above for full data sets or for subsets of data.

707,072
PB82-181488 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
DATAPLOT - Examples Manual for the Analysis Commands.
J. J. Filliben. Mar 82, 69p NBS/DF-82/001C
For systems on magnetic tape, see PB82-181447 and PB82-181454.

Keywords: *Computer graphics, *Programming languages, Computer programming, Mathematical models, Plotting, *DATAPLOT programming language, Programming manuals.

The purpose of this manual is to demonstrate by example the use of those DATAPLOT commands in the 'Analysis' category. This category includes: (1) Fitting capabilities: interactive on-line model specification; fitting of linear, polynomial, multi-linear, and non-linear models; fitting may be linear/non-linear, weighted/unweighted, constrained/unconstrained; non-linear fitting without need of derivatives; pre-fit analyses for determination of non-linear fit starting values; exact rational function fitting; spline fitting; least squares smoothing; robust smoothing; automatic storage of predicted values/residuals from all fitting and smoothing operations; superimposed raw and predicted value plots; residual plots; fitting and smoothing over full data sets or subset of data. (2) Non-graphical data analysis capabilities: elementary statistics; analysis of variance; median polish; tabulation of summary statistics; on-line definition and execution of functional transformations; cum. dist. functions; prob. density functions; percent point functions; random number generation; all operations may be over full data sets or subsets of data. (3) Mathematical capabilities: interactive on-line definition & concatenation/composition of functions; functional analyses; exact analytic symbolic differentiation; root extraction; definite integration; convolution.

707,073
PB82-181496 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
DATAPLOT - Command Dictionary.
J. J. Filliben. Mar 82, 52p NBS/DF-82/001D
For systems on magnetic tape, see PB82-181447 and PB82-181454.

Keywords: *Computer graphics, *Programming languages, Dictionaries, Computer programming, Plotting, *DATAPLOT programming language, Programming manuals.

The purpose of this manual is to serve as an abbreviated reference dictionary for the commands in the DATAPLOT language. The main body of this dictionary is an alphabetical listing of DATAPLOT commands which includes--(1) Command name; (2) Command category (graphics, diagrammatic graphics, analysis, plot control, support, output device, or keywords); (3) Default; (4) Function (purpose); and (5) Example of usage. The appendix includes a listing and description of sub-commands under the LET command.

707,074
PB82-181504 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
DATAPLOT - Examples Manual for the Diagrammatic Graphics Commands.
J. J. Filliben. Mar 82, 24p NBS/DF-82/001E
For magnetic tape, see PB82-181 447 and PB82-181454.

Keywords: *Computer graphics, *Programming languages, Computer programming, Fortran, Diagrams, Plotting, *DATAPLOT programming language, Programming manuals.

The purpose of this manual is to demonstrate by example the use of those DATAPLOT commands in the Diagrammatic Graphics category. This category includes all interactive capabilities relating to manuscript and slide preparation, word charts, chemical diagramming, electrical diagramming, IC and LSI device diagramming, printed circuit diagramming, flow charting, logo construction, and general text/equation writing (with choice of Hershey character fonts, character sizes, upper and lower case, mixture of English/Greek/math symbols, superscripting and subscripting, etc.).

707,075
PB82-182965 PC **A06**/MF **A01**
Alpha Omega Group, Inc., Silver Spring, MD.
Functional Specification of the Relational DBMS.
Final rept.
E. H. Sibley. Feb 82, 103p NBS-GCR-82-372
Contract NB80-SBCA-0531

Keywords: Specifications, Systems analysis, *Data base management systems, *Relational data bases, File maintenance.

A functional specification is a description of the way that a system shall operate, with every attempt made to remove from the specification any syntactical details of the interface. Here a set of mandatory and optional functions is specified for a 'relational calculus' interface to a relational database management system (RDBMS). The document is intended to be a self-contained -- a data processing manager or technician should be able to read and understand the material without prior knowledge of database management. Thus a basic description of database management and the relational method precedes the mandatory specification. The second part discusses the need for extensions to this basic specification and provides a set of generally distinct additions that the user may choose to require. The final selection examines two well-known systems (INGRES of UC Berkeley and SQL/DS of IBM) for their degree of compliance with the mandatory functions. This comparison shows that either the mandatory requirements are too rigid, or that current systems have some practical deficiencies.

707,076
PB82-183989 PC **A03**/MF **A01**
Intermetrics, Inc., Bethesda, MD.
PASCAL Compiler Functional Specification.
G. Bray, R. Lipsett, W. Bail, and V. Berman. 18 Dec 80, 40p IR-576, NBS-GCR-82-376
Contract NB79-SBCA-0131

Keywords: *Compilers, Specifications, *Software tools, *PASCAL programming language, Software engineering.

A functional specification for a Pascal compiler system is reported that incorporates an integrated set of software development capabilities. The capabilities include automated support for program design, documentation, implementation, debugging, and maintenance.

707,077
PB82-191651 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
DATAPLOT - Implementation Manual (Vers 82/3). Volume 3.
J. J. Filliben. Mar 82, 870p NBS/DF-82/001H
For system on magnetic tape, see PB82-181447 and PB82-181454.

Keywords: *Computer graphics, *Programming languages, Computer programming, Verifying, Fortran, Plotting, *DATAPLOT programming language, Programming manuals.

The purpose of the Manual is to provide a step-by-step check-out procedure for implementing DATAPLOT in an orderly and systematic fashion. DATAPLOT is an interactive high-level language for graphics, non-linear fitting, data analysis and mathematics. Volume 3 contains miscellaneous testing procedures. This includes instructions, code (Fortran or DATAPLOT) and data for test problems, and output from test problems.

707,078
PB82-191669 PC **A23**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
DATAPLOT - Implementation Manual (Vers 82/3). Volume 2.
J. J. Filliben. Mar 82, 529p NBS/DF-82/001G
For system on magnetic tape, PB82-181447 and PB82-181454.

Keywords: *Computer graphics, *Programming languages, Computer programming, Verifying, Fortran, Plotting, *DATAPLOT programming language, Programming manuals.

The purpose of the Manual is to provide a step-by-step check-out procedure for implementing DATAPLOT in an orderly and systematic fashion. DATAPLOT is an interactive high-level language for graphics, non-linear fitting, data analysis and mathematics. There are 4 steps contained in Volume 2: Test Underlying Graphics Software; Test Continuous Graphics; Test Diagrammatic Graphics Commands; and Test Support Commands (Part 3-file/subfile usage). A given step includes instruction Code (Fortran or DATAPLOT) and data for test problems, and output from test problems.

707,079
PB82-191677 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
DATAPLOT - Implementation Manual (Vers 82/3). Volume 1.
J. J. Filliben. Mar 82, 721p NBS/DF-82/001F
For system on magnetic tape, see PB82-181447 and PB82-181454.

Keywords: *Computer graphics, *Programming languages, Computer programming, Verifying, Fortran, Plotting, *DATAPLOT programming language, Programming manuals.

The purpose of the Manual is to provide a step-by-step check-out procedure for implementing DATAPLOT in an orderly and systematic fashion. DATAPLOT is an interactive high-level language for graphics, non-linear fitting, data analysis and mathematics. There are 8 steps contained in Volume 1: (1) Preliminary Testing; (2) Test Plot Control Commands; (3) Test Output Device Commands; (4) Test Support Commands (Part 1 - no I/O and no file/subfile usage); (5) Test Analysis Commands; (6) Test Support Commands (Part 2; I/O but no file/subfile usage); (7) Test Discrete Graphics; and (8) Test Batch Graphics. A given step includes instructions, code (Fortran or DATAPLOT) and data for test problems, and output from test problems.

707,080
PB82-191685 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
DATAPLOT - Implementation Tapes Guide.
J. J. Filliben. Mar 82, 18p NBS/DF-82/001I
For system on magnetic tape, see PB82-181447 and PB82-181454.

Keywords: *Computer graphics, *Programming languages, Computer programming, Specifications, Plotting, Source programs, *DATAPLOT programming language.

DATAPLOT is a high-level (free-format English-like syntax) language for graphics (continuous or discrete), fitting (linear or non-linear), general data analysis, and mathematics. The DATAPLOT Implementation Module

consists of two tapes: the DATAPLOT source code tape and the DATAPLOT test problems tape. This guide provides a description and sample dumps of both tapes.

707,081
PB82-199308 Not available NTIS
National Bureau of Standards, Washington, DC.
Queueing Network Model of a Shared Device Among Independent Computing Systems.
Final rept.
A. Mink, and C. B. Silio. 1981, 6p
Pub. in Proceedings of the Annual Conference on Information Sciences and Systems (15th), Baltimore, MD. Mar 81, p418-423, The Johns Hopkins University, Baltimore, MD.

Keywords: *Computer networks, Mathematical models, Algorithms, Performance evaluation, *Queueing, Computer architecture.

A queueing network model of a special class of computer architecture is presented. The configuration of this class is that of several independent computing systems sharing a single processing resource. A space efficient algorithm is presented to evaluate the analytic expressions for this specific model. Because this algorithm requires only linear growth in memory space, this model can be applied to a larger subset of problems than can existing more general models with associated evaluation algorithms requiring exponential growth in memory space and time.

707,082
PB82-199472 Not available NTIS
National Bureau of Standards, Washington, DC.
Calculating Eigenvalues and Eigenfunctions Using an Interior Constraint.
Final rept.
J. L. Blue, and C. L. Wilson. Nov 81, 13p
Pub. in Jnl. of Computational Physics 44, n1 p70-83 Nov 81.

Keywords: *Eigenvalues, *Eigenvectors, *Computation, Elliptic differential equations, Computer programming, Iteration, Convergence, Fortran, Reprints.

A new method for calculating eigenvalues and eigenfunctions of elliptic operators is presented. An interior constraint is used to allow reliable convergence to any desired eigenfunction. The method has been implemented in a portable Fortran computer program which features adaptively-generated triangulations in two dimensions, and which uses multi-level iteration. The program has been used to calculate efficiently eigenvalues and eigenfunctions on single- and multiply-connected regions, with internal and boundary singularities.

707,083
PB82-203316 PC **A12**/MF **A01**
California Univ., Los Angeles. Graduate School of Management.
Logical Database Design Framework.
Final rept.
P. P. Chen, I. Chung, and D. Perry. Apr 82, 260p NBS-GCR-82-390
Contract NB80-SBCA-0528

Keywords: *Logic design, Verifying, *Data base management, Schema, Data structures, Relational data bases, Data base management systems.

This report presents a methodology to be used for logical database design. The report covers the entire spectrum of the logical database design process. The logical database design process is broken down into five major tasks: requirements analysis, global information modeling, conceptual schema design, local information modeling, and the translation of the conceptual schema into schemas for commercial DBMSs (e.g., relational, hierarchical, and network schemas).

707,084
PB82-203621 PC **A06**/MF **A01**
Computer Corp. of America, Cambridge, MA.
Component Architecture for Database Management Systems.
Interim rept.
D. Smith, J. Rothnie, D. Hsiao, F. Manola, and U. Dayal. 18 Jun 80, 113p CCA-80-16, NBS-GCR-81-340
Contract NB79-SBCA-0086

Keywords: Computer programming, Standardization, Subroutines, *Data base management systems, *Architecture(Computers), Computer architecture, Schema.

This report presents an architecture for database management systems (DBMS's) that has been designed to provide a framework for developing database management standards. The architecture is based on the concept of a component. A comontnet is a module of a DBMS which could be marketed as a product separately from the rest of the DBMS, such as a query language processor. Each DBMS component can have one or more interfaces to users and to other components. The objective of this component architecture is to identify all important interfaces, particularly those which would otherwise be internal to the DBMS architecture. Such interfaces have not previously been considered as candidates for standardization. By making appropriate interfaces standard, a market can be created for plug conpatible pieces of a DBMS. In this manner, standardization activities will provide increased scope for DBMS product development.

707,085
PB82-203688 PC **A03**/MF **A01**
Plagman Group, Inc., New York.
Technical Issue Paper on Entity Types and Relationships for a Data Dictionary System.
Final rept.
B. Plagman. Aug 81, 28p NBS-GCR-82-386
Contract NB81-SBCA-0733

Keywords: Computer programming, Standards, *Data dictionaries, *Data structures, *Federal information processing standards.

The specification for the Federal Information Processing Standard Data Dictionary System (FIPS DDS) under the development by the Institute for Computer Sciences and Technology is envisioned to consist of a basic or 'core' module, with a set of optional modules containing advanced features. This report presents a proposed set of entities, relationships and attributes for inclusion in the core module of the FIPS DDS. Full extensibility is recommended for inclusion in the core module.

707,086
PB82-203696 PC **A02**/MF **A01**
Plagman Group, Inc., New York.
Technical Issue Paper on Interactive Language Characteristics for a Data Dictionary System.
Final rept.
B. Plagman. Aug 81, 18p NBS-GCR-82-387
Contract NB81-SBCA-0733

Keywords: *Programming languages, Standards, *Data dictionaries, *Federal information processing standards.

The Functional Specification for the Federal Information Processing Standard Data Dictionary System (FIPS DDS) is under development by the Institute for Computer Sciences and Technology. This paper presents some considerations concerning the interactive language of the system. The features and functions of the language are presented from the perspectives of four different types of DDS user. Requirements for specific functions are developed using each user's needs. A discussion of possible forms of the interactive language is included.

707,087
PB82-209172 PC **A07**/MF **A01**
Boeing Computer Services Co., Seattle, WA.
Survey of Software Validation, Verification, and Testing Standards and Practices at Selected Sites.
Final rept.
M. K. Smith, and D. R. Hudson. Apr 82, 135p NBSIR-82-2482
Grant NB79-SBCA-0102

Keywords: Computer programming, Proving, Validity, Verifying, Maintenance, *Software engineering, *Computer program verification, Software tools.

A survey of software validation, verification and testing (V,V&T) practices at five governmental and five commercial sites was performed. The survey collected information describing each site environment, software development and maintenance practices, the V,V&T techniques and tools employed, and standards and/or procedures guiding the activities at each site. This report summarizes the information obtained and presents observations about current operations with respect to software development, maintenance, and V,V&T. It also includes reports discussing each of the sites surveyed, and the survey instruments used.

707,088
PB82-209735 PC **A05**/MF **A01**
California Univ., Los Angeles. Graduate School of Management.
Survey of State-of-the-Art Logical Database Design Tools.
Final rept.
P. P. Chen, I. Chung, and D. Perry. Apr 82, 93p NBS-GCR-82-389
Contract NB80-SBCA-0528

Keywords: Design criteria, Logic design, *Data base management, Schema, Data structures.

This document presents the results of a survey of the state-of-the-art logical database design tools. Data base design tools which are related to requirements analysis and physical database design are not included in this report. The survey results are presented in a format that includes the names of the developers, their addresses, the characteristics of the tools, references, etc. Only those tools deemed most representative of their type have been included in this document.

707,089
PB82-211285 Not available NTIS
National Bureau of Standards, Washington, DC.
Approximate Queueing Network Model of a Shared Device among Independent Computing Systems.
Final rept.
A. Mink, and C. B. Silio. 1981, 11p
Prepared in cooperation with Maryland Univ., College Park.
Pub. in Proceedings of Fall Compcon 81: Productivity - An Urgent Priority, Washington, DC., September 15-17, 1981, p156-166.

Keywords: *Computer networks, *Meetings, Mathematical models, Algorithms, Performance evaluation, *Queueing, Computer architecture.

An approximate queueing network model of a special class of computer architecture is presented. The configuration of this class is that of several independent computing systems sharing a single processing resource. This approximate model represents each device in the network as a single server queue. A relationship to approximate the job arrival rate at each device is established as a function of the network parameters and the corresponding number of jobs in a related closed queueing network model. This model is both memory space and computation time efficient; whereas, exact models require exponential growth in computation time as the number of independent systems increases. The results of this approximate model are compared to those of the exact model.

707,090
PB82-218066 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Software Development Tools.
Final rept.
R. C. Houghton. Mar 82, 196p NBS-SP-500-88
Library of Congress catalog card no. 82-600517.

Keywords: *Computer programming, Characteristics, Abstracts, *Software tools, *Software engineering, Computer software.

As a part of the program to provide information to Federal agencies on the availability, capabilities, limitations, and applications of software development tools, a database of information about existing tools was collected over a 3-year period. The purpose of this report is to present an analysis of the information contained in the database. Various categorizations of the tools are presented in classes listed by their characteristic features. The lists incorporate percentage summaries that are based on the total number of tools for which information is stored in the database. Trends found in the lists are analyzed and discussed. Abstracts of each tool are presented in an appendix.

707,091
PB82-226374
(Order as PB82-226333, PC **A09**/MF **A01**)
Hawaii Univ., Honolulu.
Computer Networks-The ALOHA System.
F. F. Kuo. 11 Aug 81, 5p
Contract N00014-C-78-0498
Included in Jnl. of Research of the National Bureau of Standards, v86 n6 p591-595 Nov-Dec 81.

The ALOHA System, an experimental UHF radio computer communication network, was developed at the University of Hawaii, 1970-76. In this survey paper, we give a general overview of packet communication techniques applied to coomputer networks. Then we discusse the concept of packet broadcasting and give a short description of the ALOHANET. Next, a discussion of the application of ALOHA techniques to satellite communications is presented. Finally, a short survey of present-day research and development efforts in packet broadcasting is presented.

707,092
PB82-227083 PC **A03**/MF **A01**
Wharton School, Philadelphia, PA.
Access Control Language Syntax and Semantics.
Final rept.
E. K. Clemons, S. Hanks, and J. A. Pastor. 1 Apr 82, 45p NBS-GCR-82-370
Contract NB80-SBCA-0527

Keywords: *Programming languages, Computer programming, Computer networks, Syntax, Semantics, *Access methods, *Data base management systems, Schema.

The paper presents a language to provide enhanced access control capabilities for network data base management systems. The architecture of a proposed access control facility is reviewed, and its language and interface requirements discussed. The functional requirements for the language are enumerated, and its syntax and semantics are described. Language facilities are provided for access control definition and update, and for inquiries concerning access privileges granted. The language is designed such that it may be used for initial definition, update, or query of access privileges, in either batch or interactive mode. The access control system proposed is at the schema level, rather than at the subschema level, and is standalone, rather than embedded in the schema definition processor. Finally, the facility is based on granting or denying rights to roles that may be occupied by one or more users, in contrast to the lock and key approach originally proposed by the CODASYL Data Base Task Group and perpetuated through subsequent data description language specifications.

707,093
PB82-238932 PC **A04**/MF **A01**
Nevada Univ., Las Vegas.
Relationship between Database Sysems and Operating System Capabilities. Stage One: The Survey.
Final rept.
S. Sherman, and J. Werth. 25 Mar 82, 52p NBS-GCR-82-393
Contract NB80-SBCA-0532
Portions of this document are not fully legible.

Keywords: *Operating systems(Computers), Ranking, Requirements, *Data base management systems, IDMS system, BDMS system, RIM system, ADABAS system, FRAMIS system, PASCAL/R system, INGRES system.

The report examines the following seven data base management systems to determine relationships among their functional capabilities or features and their operating systems requirements: IDMS, BDMS, RIM, ADABAS, FRAMIS, PASCAL/R and INGRES. The capabilities of these systems are ranked using 38 functional components.

707,094
PB82-250853 CP **T05**
National Bureau of Standards, Washington, DC.
Legendre Function Programs.
Software.
J. M. Smith, and R. M. McCabe. Jul 82, mag tape NBS/DF-82/004
Source tape is in ASCII character set. Character set restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions.

Keywords: *Software, *Legendre functions, Magnetic tapes, Fortran, Fortran 77 programming language, UNIVAC - 1100/80 computers.

A source code is given for a test program and 15 subroutines, written in FORTRAN 77, which provide for the calculation of Legendre functions of the first kind of positive order of negative order, Legendre fuctions of the second kind of positive order, or normalized Legendre functions. These programs were written and tested on a UNIVAC 1100/80 computer using EXEC-8 operating system. Input and output is fully discussed in program comments and in the paper 'Associated Legendre Functions on the Cut,' submitted to the Journal of Computational Physics...Software Description: The system is written in the FORTRAN programming language for implementation on a UNIVAC 1100/80 computer using the EXEC-8, Level 37R2B operating system. 100K bytes of core storage are required to operate the system.

707,095
PB82-264243 Not available NTIS
National Bureau of Standards, Washington, DC.
Database Semantic Integrity for a Network Data Manager.
Final rept.
E. Fong, and S. R. Kimbleton. 1980, 28p
Contract F30602-77-0068
Pub. in Proceedings of National Computer Conference, Anaheim, CA, May 19-22, 1980 p261-288 1980.

Keywords: *Semantics, *Computer networks, *Data base management, *Data integrity, Remote record access, Data base management systems.

Data in a database represents an abstraction or model of a 'real world' application. Effective use of the database requires that the contained data accurately describe the application. The field of semantic integrity is concerned with assuring that data is logically correct. Semantic integrity promises to be of even greater importance in the context of networked databases since local database management is likely to want strong assurances that remote, and therefore, presumably less knowledgeable users, will not impact database integrity. This paper: (i) categorizes semantic integrity features; (ii) identifies an approach to maintaining integrity in accessing multiple, remote, heterogeneous DBMSs; and (iii) describes an Experimental Semantic Integrity System (XSIS) now being designed and implemented at the National Bureau of Standards.

707,096
PB83-107003 PC **A03**/MF **A01**
SoHaR, Inc., Los Angeles, CA.
Computer Science and Technology: The Introduction of Software Tools.
Final rept.
H. Hecht. Sep 82, 44p NBS-SP-500-91
Library of Congress catalog card no. 82-600577.

Keywords: *Computer programming, Management methods, Management information systems, *Software tools, Software engineering.

From a survey of current tool usage it is concluded that the greatest obstacles to effective use of software tools are encountered in organizations employing fewer than 40 programmers, and the needs of these environments are therefore emphasized. Specific needs for software tools in programming for management information systems and for scientific applications are discussed. Measures are described to overcome organizational obstacles to use of tools, to deal with problems arising from the tools, and to reduce the difficulties posed by existing computer installations. Steps required for the successful introduction of tools are organized in two ways: by the function responsible for their accomplishment, and by the time schedule in which they must be completed. The detail work to be performed in each step is described.

707,097
PB83-115584 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Systems Programmer's Guide for Installing OMNITAB 80.
Technical note (Final).
S. G. Bremer, and S. T. Peavy. Aug 82, 76p NBS-TN-1163
Supersedes COM-71-00068.

Keywords: Systems engineering, Utilization, Computer programming, Fortran, *OMNITAB 80 system, *Computer program portability, Computer program transferability.

OMNITAB 80 is a general-purpose package which permits direct use of a computer without prior knowledge of computer languages. Every effort has been made to produce a system as computer independent as possible to make installation on any large computer configuration relatively easy. This Technical Note provides assistance to the systems programmer, with the task of installing OMNITAB 80, by pointing out where difficulties may occur and how to resolve them. The Note is intended more as reference material, since all modifications for a particular configuration are made prior to the distribution of the OMNITAB 80 system. OMNITAB 80 is a large system requiring a large computer. Overlay or segmentation is virtually essential. A method, that is employed at the National Bureau of Standards, for overlaying OMNITAB 80 is outlined. The method should be useful for other computer configurations.

707,098
PB83-131565 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Hashing Requirements in Perspective.
Extended abstract.
G. Lyon. 1980, 1p
Pub. in Proceedings of Conference on Information Sciences and Systems, Princeton, New Jersey, March 26-28 1980, p443.

Keywords: Computer programming, Information retrieval, Algorithms, Data retrieval, *Hashing.

Refinements and variations on hashing techniques may achieve their performance by shifting the field of application. Two points based upon Brent's method advance the argument that such refinements are not always unqualified improvements.

707,099
PB83-134320 Not available NTIS
National Bureau of Standards, Washington, DC.
Network Protocol Standards: The U.S. Government Approach.
Final rept.
H. M. Wood. 1982, 2p
Pub. in Jnl. of Telecommunications Networks 1, n2 p189-190 1982.

Keywords: *Computer networks, *Standards, National government, Telecommunication, Data transmission, Reprints, *Protocols, Communication networks.

This paper briefly describes the computer network protocol program carried out by the Institute for Computer Sciences and Technology at the National Bureau of Standards.

707,100
PB83-134379 Not available NTIS
National Bureau of Standards, Washington, DC.
Data Model Processing.
Final rept.
M. B. Koll, W. T. Hardgraves, and S. B. Salazar. 1982, 28p
Pub. in Proceedings of the National Computer Conference, Houston, Texas, Jun 7-10 p 571-578 1982.

Keywords: *Models, *Data base management systems, *Data structures, Data definition languages.

The Data Model Processor (DMP) is an interactive tool for defining and evaluating data models. It is based on Positional Set Notation: a formalism for uniform representation of data modeling objects. The DMP allows the user to enter a set-theoretic description of a data model's primitive operations based on positional set operations. Based on the data model definition, the DMP then emulates a database management system (DBMS) implementing that data model. It allows the user to play various roles associated with a DBMS, such as database definer and end user. This paper gives an overview of the DMP and discusses its foundations - namely, Positional Set Notation and a Positional Set Processor. It traces an example showing how the DMP has been used to model the relational data model. (Heirarchical and network models have also been implemented on the DMP.) Future applications of the DMP are considered.

707,101
PB83-137455 PC **A07**/MF **A01**
Boeing Computer Services Co., Seattle, WA.
Computer Science and Technology: Software Validation, Verification, and Testing Technique and Tool Reference Guide.
Final rept.
P. B. Powell. Sep 82, 141p NBS-SP-500-93
Contract NB79-SBCA-0102
Library of Congress catalog card no. 82-600589.

Keywords: Computer programming, Proving, Verifying, Error analysis, *Computer program verification, *Software tools, Software engineering.

Thirty techniques and tools for validation, vertification, and testing (V,V&T) are described. Each description includes the basic features of the technique or tool, the input, the output, an example, an assessment of the effectiveness and usability, applicability, an estimate of the learning time and training, an estimate of needed resources, and references.

707,102
PB83-142976 Not available NTIS
National Bureau of Standards, Washington, DC.
Double Integration Using One-Dimensional Adaptive Quadrature Routines: A Software Interface Problem.
Final rept.
F. N. Fritsch, D. K. Kahaner, and J. N. Lyness. Mar 81, 54p
Sponsored in part by Lawrence Livermore National Lab., CA. and Argonne National Lab., IL.
Pub. in ACM Transactions on Mathematical Software 7, n1 p46-75 Mar 81.

Keywords: *Computer programming, Adaptive communication, Reprints, *Interfaces, *Computer software, Fault tolerant computing.

A software interface problem occurs when two or more items of software are used in conjunction with one other. If proper advantage of using good software is to be gained, the user has to connect them properly. In this paper, the authors consider the problem of double integration employing two similar one-dimensional adaptive quadrature routines. The paper discusses in detail two simply accuracy assignment strategies.

707,103
PB83-144493 PC **A05**/MF **A01**
Boeing Computer Services Co., Seattle, WA.
Computer Science and Technology: Planning for Software Validation, Verification, and Testing.
Final rept.
P. B. Powell. Nov 82, 91p NBS-SP-500-98
Contract NB79-SBCA-0102
Library of Congress catalog card no. 82-600644.

Keywords: Computer programming, Validity, Proving, *Computer program verification, *Software engineering, *Software tools.

Today, providing computer software involves greater cost and risk than providing computer equipment. One major reason is hardware is mass-produced by proven technology, while software is still produced primarily by the craft of individual computer programmers. The document is for those who direct and those who implement computer projects; it explains the selection and use of validation, verification, and testing (V,V&T) tools and techniques for software development. A primary benefit of practicing V,V&T is increasing confidence in the quality of the software. The document explains how to develop a plan to meet specific software V,V&T goals.

707,104
PB83-150458 PC **A07**/MF **A01**
Sytek, Inc., Sunnyvale, CA.
Computer Science and Technology: The Selection of Local Area Computer Networks.
Final rept.
R. Rosenthal. Nov 82, 136p NBS/SP-500-96
Library of Congress catalog card no. 82-600635.

Keywords: *Computer networks, Telecommunication, Selection, *Local networks, Protocols, Communications networks, Data transmission systems.

These guidelines present features available in contemporary local area computer networks including distinctions between network applications, topology, protocol architecture and transmission media. Guidance is given to identify the installation's needs. These needs are described in terms of network reliability, traffic characterizations, expected growth, and maintenance requirements.

707,105
PB83-164376 PC **A07**/MF **A01**
Computer Corp. of America, Cambridge, MA.
CODASYL Query Language Flat (CQLF) Specifications.
F. Manola, and A. Pirotte. Dec 82, 144p CCA-81-10, NBS-GCR-82-415
Contract NB79-SBCA-0088

Keywords: Specifications, *Query languages, *CQLF programming language, *Data definition languages, *Data manipulation languages, Data base management systems, Schema.

CQLF is a high-level language for defining, accessing, and manipulating data in databases described using the 1981 ANSI dpANS version of the CODASYL Data Description Language. CQLF has similarities to both the SQL and QUEL query languages, both of which have been widely discussed in the research literature on the relational data model. The CODASYL data model has traditionally been associated with batch-oriented, record-at-a-time data processing, but many of the same principles that have been developed for the relational model also apply to the CODASYL model. Database administrators can use CQLF to define ANSI-compliant schemas, and users can manipulate data with a sequence of CQLF statements. Implementation of this specification would dramatically enhance ad hoc access to CODASYL databases.

707,106
PB83-164418 PC **A04**/MF **A01**
Intermetrics, Inc., Bethesda, MD.
Compiler Features: A Survey.
Final rept.
B. M. Shahdad, and E. Libster. Jan 83, 69p IR-MD-006, NBS-GCR-82-418
Contract NB82-SBCA-1533

Keywords: *Compilers, Comparison, Fortran, Cobol, Evaluation, Software engineering.

In essence, a compiler is a software tool that translates a high level programming language into a low level one. As compilers have evolved, additional support features have been incorporated into them. In this report, the results of a two-phased survey of FORTRAN and COBOL compilers are presented. The first phase of the survey was a literature search to determine features offered by current compilers. During the second phase, the results of the literature survey were verified by actually using a representative set of compilers.

707,107
PB83-175760 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
BASIC Utility Graphics Software for A Desktop Computer.
C. Y. Trahan, and S. W. Jensen. Oct 82, 157p NBSIR-82-2566

Keywords: *Computer graphics, *Microcomputers, Utility routines, Computer programs, Plotting, *HP-9845B computer, Hewlett-Packard computers, BASIC programming language.

This report describes an interactive BASIC language graphics utility program designed to facilitate easy plotting of X,Y data. The program operates on a Hewlett-Packard 9845B desktop computer, in its standard configuration, and uses a Hewlett-Packard 9872 A four pen digital plotter. The program allows the user to view X,Y data graphically, and provides a broad range of plotting options so that publication quality graphs and transparencies may be created using up to four colors on the digital plotter. Data may be digitized from a user's graph on the digital plotter, generated as a user defined function, or input directly from the computer keyboard or magnetic tape cassette. Data may be plotted on the computer CRT, on the computer's internal thermal printer, or on the digital plotter.

707,108
PB83-179002 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Taxonomy of Tool Features for the Ada (Trade Name) Programming Support Environment (APSE).
Final rept.
R. C. Houghton. Feb 83, 42p NBSIR-82-2625
Sponsored in part by Department of Defense, Washington, DC.

Keywords: Programming languages, *Ada programming language, *Software tools, Software engineering, Integrated software.

A categorization of the software development tool features of the Ada Programming Support Environment (APSE) is presented. The features of two Ada environments, the Ada Language System (ALS) and the Ada Integrated Environment (AIE), are compared. The underlying features of the APSE are presented.

707,109
PB83-182600 Not available NTIS
National Bureau of Standards, Washington, DC.
Current Status of Software Tool Usage.
Final rept.
H. Hecht, and R. C. Houghton. Nov 82, 23p
Prepared in cooperation with SoHar, Inc., Los Angeles, CA.
Pub. in Proceedings of COMPSAC 82, Chicago, Illinois, November 8-10, 1982, p1-8.

Keywords: *Utilization, *Meetings, Computer programming, Quality assurance, Reprints, *Software tools, Software engineering, Computer software, Computer program reliability.

As part of its efforts to improve productivity and quality of software procured by the Government, the National Bureau of Standards initiated a survey of software development organizations on their use of tools. Partial findings reported here indicate that (1) tool usage is positively correlated with the size of the software organization, (2) software tool developers are intense users of tools, not only of their own, regardless of size, (3) there is no pronounced difference in tools usage for a given size of organization between the private sector, Government support organizations, and Government agencies. Tool features utilized, and user reaction to selected tools are also described.

707,110
PB83-195743 PC **A07**/MF **A01**
International Software Systems, Inc., College Park, MD.
Database Logical Schema Design.
Final rept.
N. Roussopoulos, and R. T. Yeh. Dec 82, 145p NBS/GCR-82-411
Contract NB79-SACA-0229

Keywords: Systems analysis, Data sources, *Data base management, *Schema, *File organization, Relational data bases, File structures.

This report presents a methodology for logical database design. Included in this methodology are systems analysis and specification, conceptual modeling, application view modeling, conceptual schema design and mapping to the relational, network and hierarchical models. The report concludes with a section on design maintenance, including maintenance of the logical database.

707,111
PB83-198283 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Positional Set Processor: A Tool for Data Modeling.
Final rept.
W. T. Hardgrave, and S. B. Salazar. 30 Nov 81, 23p NBSIR-81-2302

Keywords: Mathematical programming, *Software tools, *Data base management systems, Data structures.

The Positional Set Processor (PSP) is a software tool for manipulating mathematical objects such as sets, sequences, ordered pairs, etc. The PSP serves as the underpinning for a Data Model Processor (DMP), an experimental system for emulating commercial and prototype database management systems. The PSP also provides a mathematical basis for semantic specification and interpretation of database operations. This paper reviews the mathematical formalism, Positional Set Notation, and describes the design of the Positional Set Processor.

707,112
PB83-200832 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Overview of Computer-Based Natural Language Processing.
W. B. Gevarter. Apr 83, 83p NBSIR-83-2687
Sponsored in part by National Aeronautics and Space Administration Headquarters, Washington, DC.

Keywords: Computational linguistics, Technology assessment, Artificial intelligence, *Natural language processing, Natural language(Computers), Text processing.

Computer-based Natural Language processing and understanding is the key to enabling humans and their creations to interact with machines in natural language

(in contrast to computer language). The doors that such an achievement can open has made this a major research area in Artificial Intelligence and Computational Linguistics. Commercial natural languages interfaces to computers have recently entered the market and the future looks bright for other applications as well. This report reviews the basic approaches to such systems, the techniques utilized, applications, the state-of-the-art of the technology, issues and research requirements, the major participants, and finally, future trends and expectations.

707,113
PB83-202549 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Proceedings of the NBS LAN-Transport Workshop (1st).
2 Feb 83, 21p NBSIR-83-2673

Keywords: *Computer networks, *Meetings, Standards, Specifications, *Protocols, *Local networks.

The National Bureau of Standards Institute for Computer Sciences and Technology (ICST) has prepared specifications for the International Organization for Standardization's (ISO) Class 4 Transport Protocol. At the request of a number of companies, ICST organized a workshop for local area network implementors of these specifications. The workshop focused on implementation techniques and strategies so that a multivendor demonstration of these protocols can occur at a major computer conference in the 1984 time frame. This report documents the workshop and records implementation choices and agreements made by the participants.

707,114
PB83-215574 CP **T14**
National Bureau of Standards, Washington, DC. National Engineering Lab.
DATAPLOT: An Interactive High-Level Language for Graphics, Non-Linear Fitting, Data Analysis, and Mathematics (FORTRAN 1977, Version 82.3, for VAX Machines).
Software.
J. J. Filliben. 15 Feb 82, mag tape NBS/SW/MT-83/001
Source tape is in ASCII character set. Character set restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation, PB82-191651, PB82-181462, PB82-181488, PB82-181504, PB82-191677, PB82-181470, PB82-181496, PB82-191685, and PB82-191669.

Keywords: *Software, *Programming languages, *Computer graphics, Computer programming, Plotting, *DATAPLOT programming languages, Interactive graphics, DEC VAX-11/780 computers.

DATAPLOT is high-level (free-format English-like sytnax) language for: (1) graphics continuous or discrete); (2) fitting (linear or non-linear); (3) general data analysis; and (4) mathematics. It was developed originally in 1977 in response to data analysis problems encountered at the National Bureau of Standards. It is a valuable tool not only for raw graphics, but also for manuscript preparation, modeling, data analysis, data summarization, and mathematical analysis. DATAPLOT may be run either in batch or interactively, although it was primarily designed for (and is most effectively used in) an interactive environment. DATAPLOT graphics may appear on many different types of output services...Software Description: This tape contains DATAPLOT code which has incorporated changes that allow it to run as is on VAX 11/780 or 11/750 machines. Approximately 300K bytes (overlay) or 2.5 MB (non-overlay) of memory are required. Test problems are included.

707,115
PB83-220467 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Utility Programs for Generating the Hershey Character Fonts on Microcomputers and Laboratory Plotters.
Final rept.
C. E. Dick, and J. Hilsenrath. Jun 83, 48p NBS-TN-1176

Keywords: *Computer graphics, *Utility routines, Microcomputers, Computer programs, *Apple 2 computers, *Fonts.

Two programs are described that allow for the storage and manipulation of digitized fonts of graphic arts symbols and characters on the Apple II computer system. These fonts are based on the work of A.V. Hershey and provide the user with a repertory of digitized characters suitable for use in the preparation of camera-ready illustration in the laboratory environment. The programs described contain routines for reading files of the Hershey coordinates, storing them as text files, displaying them as individual characters or combined text on the high resolution display, and two methods for editing them or creating special symbols and graphics.

707,116
PB83-222687 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Proceedings of the LAN (Local Area Network)-Transport Workshop (2nd).
K. L. Mills. May 83, 22p NBSIR-83-2717

Keywords: *Computer networks, *Meetings, Specifications, *Protocols, *Local networks.

The National Bureau of Standards, Institute for Computer Sciences and Technology (ICST) has prepared specifications for the International Organization for Standardization's (ISO) Class 4 Transport Protocol. At the request of a number of companies, ICST organized a second workshop for local area network implementors of these specifications. The second workshop focused on (1) token bus local area networks and (2) file transfer applications to be run at a multi-vendor demonstration in the 1984 timeframe. This report documents the second workshop and records implementation choices and agreements made by the participants.

707,117
PB83-234500 Not available NTIS
National Bureau of Standards, Washington, DC.
Software Tools for Quality Software Development.
Final rept.
R. C. Houghton. May 80, 5p
Pub. in Proceedings of Annual COCACM Symposium (24th) held at Columbus, Ohio on May 9, 1980, 5p.

Keywords: *Computer program, Quality assurance, *Software tools, *Software engineering.

This paper summarizes the types and functions of software tools in the major areas of concern to quality software development. Some NBS efforts to increase the effective use of software tools are reported.

707,118
PB83-249714 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Specification and Interpretation of Data Model Semantics: An Integration of Two Approaches.
W. Lamersdorf. Jul 83, 58p NBSIR-83-2740

Keywords: *Semantics, Models, Programming languages, *Data base management, *Data structures, Software engineering, Data definition languages.

Two different approaches to database model description and evaluation are presented, compared, and integrated: a formal semantic specification method as originally developed for programming languages, and a computer-based data model processor to be used as a rapid prototyping system. Both ways to specify database model semantics are applied to a common example. Two alternatives to combine the advantages of both methods are analyzed in detail.

707,119
PB83-251348 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Proceedings of the LAN-Transport Workshop (3rd) Held on July 18-20, 1983.
Jul 83, 21p NBSIR-83-2757
See also PB83-202549.

Keywords: *Computer networks, *Meetings, Standards, Specifications, *Protocols, *Local networks.

The National Bureau of Standards' Institute for Computer Sciences and Technology (ICST) has prepared specifications for the International Organization for Standardization's (ISO) Class 4 Transport Protocol. A second workshop focused on token bus LANs and file transfer application to be run at the targeted 1984 demonstration. This report covers the third in the series of LAN/Transport Workshops, and reports agreements on the specifics of the transfer protocol.

707,120
PB83-252924 PC **A03**/MF **A01**
Datametrics Systems Corp., Fairfax, VA.
Capacity Planning: A State of the Art Survey.
J. C. Kelly. Jul 83, 48p NBS-GCR-83-440
Contract NB82-NAAM-6607-1

Keywords: *Data processing, *Production capacity, *Computers, Planning, Productivity, Capacity, Performance evaluation, Throughput.

This report presents a survey of computer capacity planning. Sections 2 and 3 of the report discuss the general concepts of computer capacity and capacity planning. They provide the background needed to properly discuss capacity measures. Section 4 surveys the capacity measures discussed in the literature and used in practice. Section 5 describes the methodologies and tools used to do capacity measurement. Section 6 summarizes the major problem areas in capacity measurement and planning, and Section 7 presents some recommendations for future work.

707,121
PB83-264432 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Artificial Traffic Generation of ISO (International Organization for Standardization's) Transport Class IV Protocol Data Units on an IEEE (Institute of Electrical and Electronics Engineers) 802.3 10 Megabit CSMA/CD Local Area Network.
T. J. Gardner. Aug 83, 24p NBSIR-83-2763

Keywords: *Computer networks, Standards, *Local networks, *Protocols.

The National Bureau of Standards' Institute for Computer Sciences and Technology (ICST) is testing the International Organization for Standardization's (ISO) Transport Class IV protocol on an Institute of Electrical and Electronics Engineers (IEEE) 802.3 Local Area Network. Part of the test facility includes an artificial traffic generator that produces ISO Transport Class IV protocol data units encapsulated in IEEE 802.2 Type 1 Class 1 Logical Link frames. The traffic generator submits the frames to the network for transmission. This document describes the architecture and usage of the traffic generator for multi-host and multi-connection traffic.

707,122
PB84-102144 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Initial Graphics Exchange Specification Test Library, Version 1.3.
Rept. for 30 Sep 81-28 Feb 83.
B. Smith, and M. Liewald. Sep 83, 225p NBSIR-83-2704
Sponsored in part by Air Force ICAM Program, Wright-Patterson AFB, OH.

Keywords: *Computer graphics, *Computer program verification, *Benchmarking, *Data interchange, *Computer aided manufacturing, Interactive graphics, Interfaces, Computer aided design.

This document contains a library of benchmark tests to be used to verify the interface capability possible with the Initial Graphics Exchange Specification (IGES) (Reference A). IGES provides a common data format to facilitate the exchange of data between different Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) systems. The test cases outlined in this document provide data for software modules which translate IGES format to and from the format of a particular CAD/CAM system. The geometric and drafting entities contained in these parts comprise only a limited portion of all IGES entities and are intended to demonstrate some capabilities of an IGES translator on an individual entity basis. This set of tests does not constitute a test of compliance with any existing or proposed standardization of IGES. Subsequent tests with more complex parts should be made to insure the suitability of the processors for a user's production environmemt.

707,123
PB84-114529 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC.

Computer Science and Technology: Proceedings of the Meeting of the Computer Performance Evaluation Users Group (CPEUG) (19th).
Final rept.
D. Mobray. Oct 83, 237p NBS/SP-500-104
See also PB83-125757. Library of Congress catalog card no. 82-600594.

Keywords: *Meetings, Technology assessment, Performance evaluation, Telecommunications, Quality assurance, *Computer performance evaluation, Users groups, Software engineering.

These proceedings record the papers that were presented at the Nineteenth Meeting of the Computer Performance Evaluation Users Group (CPEUG 83) held October 25-28, 1983 in San Francisco, CA. CPEUG 83 recognized the rapid introduction of sophisticated end-user technology into the information processing environment and addressed the challenges posed to the CPE community. CPEUG 83 offered topics ranging from microcomputers to supercomputers. The increasingly complex area of data communications was presented as well as topics in office automation, software improvement and engineering, capacity planning, and quality assurance. The program was divided into three parallel sessions and included technical papers, case studies, tutorials, and panels. Technical papers are presented in the proceedings in their entirety.

707,124
PB84-118314 PC **A10**/MF **A01**
CRC Systems, Inc., Fairfax, VA.
Computer Science and Technology: Guide to Software Conversion Management.
Final rept.
M. Skall. Oct 83, 215p NBS//SP-500-105
Library of Congress catalog card no. 83-600589.

Keywords: *Management, Conversion, Project management, Planning, Scheduling, *Computer software conversion, *Software conversion, Software engineering.

This guideline was developed to provide federal ADP managers a better understanding of the entire process of software conversion. Software conversions have life cycles with distinct phases and activities that occur in each phase. Understanding the order or sequence of a conversion and of the associated costs should help managers to plan and execute software conversions efficiently, effectively, and with minimum operations disruption to federal agencies. Although extensive references were consulted in preparing this guideline, the most important sources were interviews conducted at 14 federal agencies that had completed or were involved in software conversion projects. These interviews influenced the structure and organization of this guideline in an attempt to present, in logical order, activities that must be performed to achieve a successful conversion.

707,125
PB84-136282 Not available NTIS
National Bureau of Standards, Washington, DC.
Error Bounds for Arithmetic Operations on Computers Without Guard Digits.
Final rept.
F. W. J. Olver. 1983, 8p
Pub. in IMA Jnl. Numer. Anal. 3, p153-160 1983.

Keywords: *Arithmetic, *Error analysis, Linear algebraic equations, Numerical analysis, Reprints, *Floating point arithmetric, Computer applications.

For computers having no form of guard digit in the accumulator register it is not possible to bound the relative error of floating-point subtraction processes in a satisfactory manner. This paper describes some modifications of recent error analyses to cover this situation, including the evaluation of sums and inner products and the solution of systems of linear algebraic equations.

707,126
PB84-138403 Not available NTIS
National Bureau of Standards, Washington, DC.
Machines, Programs, and Languages: A Simplistic Introduction to Computer Science.
Final rept.
G. Lyon. Jul 83, 3p
Pub. in Jnl. of ACM SIGSOFT Software Engineering Notes 8, n3 p61-63 Jul 83.

Keywords: *Data processing, *Programming languages, *Computer programming, Computer systems hardware, Reprints, Computer software.

The general aim of computer science is to discover and exploit principles of computation that are suitable on digital computers. In pursuit of this goal, there emerge three broad conceptual categories: computers-- digital computering hardware that stores discrete information and works in discrete steps, programs which describe operation sequences and open and formats within computers, programming languages that express programs.

707,127
PB84-138825 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Proceedings of the LAN-Transport Workshop (4th) Held on October 27-28, 1983.
F. Nielsen. Nov 83, 47p NBSIR-83-2796
See also PB83-251348.

Keywords: *Computer networks, *Meetings, Standards, Specifications, *Protocols, *Local area networks, File transfer protocol.

The National Bureau of Standards Institute for Computer Sciences and Technology (ICST) has prepared specifications for the International Organization for Standardization's (ISO) Class 4 Transport Protocol. At the request of a number of companies, ICST organized a workshop series for implementors of these specifications using local area networking technology. The first workshop focused on implementation techniques and strategies so that a multivendor demonstration of these protocols can occur at a major computer conference in 1984 targeted for the NCC 1984. Primarily the details of CSMA/CD and Transport Class 4 were discussed and parameters were selected. A second workshop focused on token bus LANs and file transfer applications to be run at the targeted 1984 demonstration. Agreements on the specifics of the file transfer protocol were reached at the third workshop. This report documents the fourth workshop in the series of LAN-Transport workshops. The fourth workshop covered further refinements to the file transfer protocol, testing procedures, and demonstration details.

707,128
PB84-162189 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Computer Science and Technology: Guide on Data Models in the Selection and Use of Database Management Systems.
Final rept.
L. J. Gallagher, and J. M. Draper. Jan 84, 74p NBS-SP-500-108
Also available from Supt. of Docs. as SN003-003-02543-7. Library of Congress catalog card no. 83-600630.

Keywords: *Computer programming, *Information systems, User needs, Data processing, Programming languages, *Data base management systems, Relational data bases.

Selecting a database management system involves matching users' requirements and the capabilities of available products. One way to simplify this task is to define data models identifying both data structures and the operations on those structures. In the past every commercial product has implemented its own data model. Now technical committee X3H2 of the American National Standards Institute is working on specifications for two models that are similar but not identical to many existing products. In addition to the issue of data models, prospective buyers of database software need to consider features that affect daily operations. Existing hardware and operating systems sometimes limit the choice to a few commercial products. Systems also vary widely in their facilities for backup and recovery, bulk loading, scheme manipulation, concurrency control, and report writers.

707,129
PB84-166214 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Nonlinear Least Squares Regression Using STARPAC: The Standards Time Series and Regression Package.
J. R. Donaldson, and P. V. Tryon. Oct 83, 64p NBS-TN-1068-2

Keywords: *Statistical analysis, *Regression analysis, *Subroutine libraries, Computer programs, Least squares method, Nonlinear systems, Fortran, Time series analysis, STARPAC subroutines.

STARPAC, the Standards Time Series and Regression Package, is a library of Fortran subroutines for statistical data analysis. Earlier versions of this library were distributed by the SED under the name STATLIB, (Tryon and Donaldson, 1978). STARPAC incorporates many changes to STATLIB, including additional statistical techniques, improved algorithms, and enhanced portability. STARPAC emphasizes the statistical interpretation of results, and, for this reason, comprehensive printed reports of auxiliary statistical information, often in graphical form, are automatically provided to augment the basic statistical computations performed by each user-callable STARPAC subroutine. STARPAC thus provides the best features of many standalone statistical software programs within the flexible environment of a subroutine library. This Note documents 16 subroutines for nonlinear least squares regression. Twelve of these compute the least squares estimates, performing either weighted or unweighted analysis with either numerically approximated or user-supplied (analytic) derivatives. The other four are user-callable subroutines for two procedures used within the estimation code: the first selects optimum step sizes for approximating the partial derviatives of the model; and the second checks the validity of a user-supplied derivative subroutine.

707,130
PB84-171305 PC **A19**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Guide to Available Mathematical Software.
R. F. Boisvert, S. E. Howe, and D. K. Kahaner. Jan 84, 441p NBSIR-84-2824

Keywords: *Computer systems programs, *Catalogs(Publications), Applications of mathematics, Statistical analysis, Computer programs, Libraries.

The second edition of the Guide to Available Mathematical Software (GAMS) provides summary documentation of software available to NBS staff on a variety of computers. The fifteen libraries documented in GAMS are: BMDP, CMLIB, (containing three dozen public-domain packages), DATAPAC, IMSL, INVAR, MATHWARE, MATLAB, MINITAB, NAG, PDELIB, PLOD, PORT, SLDGL, SPECTRLAN, STATLIB. GAMS is based on an extensive problem-oriented scheme for classifying software for mathematical computations including special functions, linear algebra, optimization, differentiation and integration, differential and integral equations, and statistics and probability. The document contains the classification scheme, a catalog of software organized by class, a dictionary of the software, library references, and an index.

707,131
PB84-176494 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Assessment of Techniques for Evaluating Computer Systems for Federal Agency Procurements.
Final rept.
H. Letmanyi. Mar 84, 39p NBS-SP-500-113
Also available from Supt. of Docs. as SN003-003-02561-5. Prepared in cooperation with MITRE Corp., McLean, VA. Library of Congress catalog card no. 84-601012.

Keywords: *Computer programs, *Assessments, *Ratings, *Computer systems programs, *Computer systems hardware, Aquisition, Bench marks, Microcomputers, National government, Main frame computers.

The primary purpose of this document is the identification and qualitative assessment of computer system evaluation techniques for use during acquisition of computer systems. Also addressed is the identification of several criteria by which these alternative evaluation techniques may be compared and selected. The concepts presented in this study are applicable to all sizes of general purpose computers, from microcomputers to mainframes. Embedded or single-purpose computers, such as those used in weapon systems, have been excluded.

707,132
PB84-178029 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.

Comparing Software Development Methodologies for Ada (Trade Name): A Study Plan.
Final rept.
P. Freeman, A. I. Wasserman, and R. C. Houghton.
Mar 84, 38p NBSIR-84-2827
Contract AJPO-83-27
Prepared in cooperation with California Univ., Irvine, and California Univ., San Francisco.

Keywords: *Computer systems programs, Maintenance, *Computer software, Ada codes, Computer software maintenance.

A study plan is presented that concentrates on the impact of alternative development methodologies on the maintainability of Ada code. The basic elements of the study include: (1) experts in each of several methods create Ada implementation for a specific problem, (2) each implementation is modified by each of several maintenance teams, and (3) the impact of the methodology on the maintainability of the resulting Ada-coded systems is evaluated and reported.

707,133
PB84-178367 PC **A02**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Introduction to STARPAC. The Standards Time Series and Regression Package.
Technical note no. 1 in a series.
J. R. Donaldson, and P. V. Tryon. Oct 83, 22p NBS-TN-1068-1

Keywords: *FORTRAN, *Time series analysis, *Regression analysis, Subroutine libraries, Computers, Programming languages, Statistical analysis, Subroutine libraries(Computers).

STARPAC, the Standards Time Series and Regression Package, is a library of Fortran subroutines for statistical data analysis developed by the Statistical Engineering Division (SED) of the National Bureau of Standards (NBS), Boulder, Colorado. Earlier versions of this library were distributed by the SED under the name STATLIB (Tryon and Donaldson, 1978). STARPAC incorporates many changes to STATLIB, including additional statistical techniques, improved algorithms and enhanced portability. STARPAC emphasizes the statistical interpretation of results, and, for this reason, comprehensive printed reports of auxiliary statistical information, often in graphical form, are automatically provided to augment the basic statistical computations performed by each user-callable STARPAC subroutine. STARPAC thus provides the best features of many stand-alone statistical software programs within the flexible environment of a subroutine library. STARPAC documentation is being published as a series of Technical Notes. This Note is the first in the series. It gives an overview of the STARPAC library, defines conventions used in the documentation, provides an example using STARPAC subroutines, and presents general background material. This Note includes information which is essential for using the STARPAC library, and users should be familiar with its contents before attempting to use any STARPAC subroutine.

707,134
PB84-211796 CP **T19**
National Bureau of Standards (NEL), Washington, DC. Statistical Engineering Div.
DATAPLOT: An Interactive High-Level Language for Graphics, Non-Linear Fitting, Data Analysis, and Mathematics, Version 84/7.
Software.
J. J. Filliben. Jul 84, mag tape NBS/DF-84/003
Supersedes PB83-215574.
Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentaion, PB82-181462, PB82-181470, PB82-181504, PB82-181488, PB82-181496, PB84-214063 and PB84-214055.

Keywords: *Software, *Computer graphics, *Mathematics, *Statistics, *Plotting, *Data analysis, *Curve fitting, *Modeling, Magnetic tapes, Fortran-77, *Dataplot programming language.

DATAPLOT is a high-level (free-format English-like syntax) language for: (1) graphics (continuous or discrete); (2) fitting (linear or non-linear); (3) general data analysis; (4) mathematics. It was developed originally in 1977 in response to data analysis problems encountered at the National Bureau of Standards. It is a valuable tool not only for 'raw' graphics, but also for manuscript preparation, modeling, data analysis, data summarization, and mathematical analysis. DATAPLOT may be run either in batch or interactively, although it was primarily designed for (and is most effectively used in) an interactive environment. DATAPLOT is virtually machine and device independent...Software Description: This software was developed on a DEC VAX 11/780 under the VMS operating system. However, due to its modular design and underlying ANSI FORTRAN code, DATAPLOT is portable to a wide variety of computers. Approximately 300K bytes (overlay) or 2.5MB (non-overlay) of memory are required. Test problems are included with the package.

707,135
PB84-214055 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Statistical Engineering Div.
DATAPLOT - Introduction and Overview.
J. J. Filliben. Jun 84, 117p NBS-SP-667, NBS/DF-84/003B
For system on magnetic tape, see PB84-211796.

Keywords: *Computer graphics, *Programming languages, Computer programming, Specifications, Plotting, Manuals, Source programs, Reprints, *DATAPLOT programming language.

DATAPLOT is a high-level (free-format English-like syntax) language for graphics (continuous or discrete), fitting (linear or non-linear), general data analysis and mathematics. The purpose of this manual is to give the analyst a broad overview of the structure, capabilities, and features of the DATAPLOT language. The features and capabilities described are for version 84/7 of DATAPLOT. Most (but not all) descriptions also hold for prior versions.

707,136
PB84-214063 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Statistical Engineering Div.
DATAPLOT - Implementation Tapes Guide.
J. J. Filliben. Jul 84, 79p NBS/DF-84/003A
For system on magnetic tape, see PB84-211796. Supersedes PB82-191685.

Keywords: *Computer graphics, *Programming languages, Computer programming, Specifications, Plotting, Source programs, *DATAPLOT programming language.

DATAPLOT is a high-level (free-format English-like syntax) language for graphics (continuous or discrete), fitting (linear or non-linear), general data analysis and mathematics. The DATAPLOT Implementation Tapes Guide provides instruction and guidance for implementing DATAPLOT.

707,137
PB84-217504 PC **A03**/MF **A01**
Software Systems Technology, Inc., College Park, MD.
Performance Evaluation of Database Systems: A Benchmark Methodology.
Final rept.
S. B. Yao, and A. R. Hevner. May 84, 46p NBS/GCR-84/467
Contract NB82-SBCA-1645
See also PB84-217512.

Keywords: Minicomputers, Microcomputers, Performance evaluation, *Relational data bases, *Data bases, *Benchmarks.

This report presents a generalized performance analysis methodology for the benchmarking of database systems. This methodology discusses criteria to be used in the design, execution, and analysis of a database system benchmark. This is a generalized methodology that can apply to any possible database system. By presenting a wide variety of possible considerations in the design and implementation of the benchmark, it is intended to make this methodology applicable to the evaluation, or to the comparison of several systems.

707,138
PB84-217512 PC **A09**/MF **A01**
Software Systems Technology, Inc., College Park, MD.
Analysis of Three Database System Architectures Using Benchmarks.
Final rept.
S. B. Yao, and A. R. Hevner. 9 May 84, 182p NBS/GCR-84/468
Contract NB82-SBCA-1645
See also PB84-217504.

Keywords: Minicomputers, Microcomputers, Performance evaluation, *Relational data bases, *Data bases, Computer architecture, *Benchmarks.

This report tests a newly designed benchmarking methodology (see related document), which evaluates the performance of database management systems, by applying it to three different database systems representative of current microcomputer, minicomputer, and database machine architectures. These experiments serve to demonstrate the viability of the methodology, and provide performance measures which characterize today's relational database systems under these environments. Finally, this report reaches conclusions, based upon the results of the benchmark experiments, which span the three architectural classes. Observations are made about the performance of each type of system architecture, rather than comparing three commercial database systems.

707,139
PB84-217843 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Systems and Software Technology Div.
Introduction to Software Packages.
Final rept.
S. Frankel. Apr 84, 61p NBS/SP-500/114
Also available from Supt. of Docs as SN003-003-02569-1. Library of Congress catalog card no. 84-601045.

Keywords: Computer programs, Purchasing, Selection, *Computer software, *Computer applications, Software engineering.

This document provides an introduction to applications software packages. It encourages the use of software packages as an alternative to in-house development and directs potential users of software packages to sources of useful information. Application areas which are currently supported by software packages are reviewed and the benefits of software package use versus in-house development are discussed. This document includes an annotated list of publications which may be useful to potential users of software packages in searching for a package to perform a specific application, and in critically evaluating the merits of different packages.

707,140
PB84-217892 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
Modular Data Acquisition and Display Software System for a Laboratory Environment.
Final rept.
L. Kaetzel, J. Grimes, and P. Brown. May 84, 63p NBS/TN-1188
Also available from Supt. of Docs as SN003-003-02589-5. Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Laboratory equipment, Experimental data, Data acquisition, Data processing, Minicomputers, *Computer software, Multiprogramming, MADS system, Building materials, Phase change materials.

This report describes the processes involved in acquiring and analyzing experimental laboratory data using a medium sized computer in a multi-programming environment with a modular software system. Research involving Phase Change Materials and Calorimetric Performance measurements in building research are used as case studies to describe the functional capabilities and operational procedures of the system. The software system consists of computer programs which allow the researcher to collect, store, and analyze data graphically.

707,141
PB84-217900 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.

Computer Science and Technology: Report on Approaches to Database Translation.
Final rept.
L. Gallagher, and S. Salazar. May 84, 89p NBS/SP-500/115
Also available from Supt. of Docs as SN003-003-02583-6. Library of Congress catalog card no. 84-601055.

Keywords: Models, *Data base management, Data structures, File maintenance, Data tagging.

Transporting a database from a source to a target environment has often been an expensive and complex project. In large part this is due to the lack of standards for data models and database interchange forms. This report describes approaches to database translation, discusses candidate interchange forms, and recommends a method for representing the data structures of newly proposed network and relational data models in a form suitable for database interchange. Methods for representing other commonly used database structures in terms of the proposed standard structures show that automated database translation is feasible for most currently installed data models.

707,142
PB84-221738 Not available NTIS
National Bureau of Standards, Washington, DC.
Cataloging Statistical Software: Current Efforts by NBS (National Bureau of Standards) and the Committee on Statistical Algorithms.
Final rept.
S. E. Howe. 1983, 15p
Pub. in Proceedings of American Statistical Association, Statistical Computing Section, Toronto, Canada, August 15-18, 1983, p45-50.

Keywords: Algorithms, Linear algebra, Special functions, *Computer software, *Data base management systems, Relational data bases.

In the second phase of a project to organize and publicize the mathematical and statistical software available to scientists at the National Bureau of Standards, the new edition of the Guide to Available Mathematical Software (GAMS) is being produced. In addition to the approximately 2500 subroutines documented in the first edition of GAMS (including IMSL, NAG, PORT, and approximately three dozen high-quality public-domain packages), the second edition describes more subroutines, stand-alone program libraries (e.g., BMDP) and interactive systems (e.g., Minitab). GAMS is based on an extensive problem-oriented scheme for classifying software for statistical computations, as well as other mathematical computations of interest to statisticians, including special functions, linear algebra (e.g., LINPACK), integrals, differential equations, and optimization. The GAMS data are maintained on-line using a relational data base management system, and are accessed via an on-line query system based on the classification scheme. A hard-copy version of GAMS is forthcoming. The GAMS effort is being coordinated with the efforts of the Committee on Statistical Algorithms, Statistical Computing Section, ASA, to document both software and algorithms.

707,143
PB84-222850 PC **A22**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Specification of a Transport Protocol for Computer Communications. Volume 1. Overview and Services. Volume 2. Class 2 Protocol. Volume 3. Class 4 Protocol.
Final rept.
Jun 84, 509p NBSIR-84-2880-VOLS-1/3, NBS/DF-84/005A
For system on magnetic tape, see PB84-222918. See also PB84-222868.

Keywords: *Standards, *Telecommunication, Operating systems(Computers), *Data communications, *Transport protocols, UNIX operating systems, C programming language, Software.

The tape contains the source code for the NBS implementation of ISO Scenario Interpreter and Exception Generator; suite of approximately 250 test scenarios; and documentation thereof. The source code is in the C language and the resulting software has been executed in a UNIX environment on a PDP-11/70.

707,144
PB84-222868 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Specification of a Transport Protocol for Computer Communications. Volume 4. Service Specifications. Volume 5. Guidance for the Implementor. Volume 6. Guidance for Implementation Selection.
Final rept.
Jun 84, 135p NBSIR-84-2880-VOLS-4/5, NBS/DF-84/005B
For system on magnetic tape, see PB84-222918. See also PB84-222850, and PB84-222876.

Keywords: *Standards, *Telecommunication, Operating systems(Computers), *Data communications, *Transport protocols, UNIX operating systems, PDP-11/70 computers, C programming language, Software.

The tape contains the source code for the NBS implementation of ISO Scenario Interpreter and Exception Generator; suite of approximately 250 test scenarios; and documentation thereof. The source code is in the C language and the resulting software has been executed in a UNIX environment on a PDP-11/70.

707,145
PB84-222876 PC **A14**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Specification of a Transport Protocol for Computer Communications. Volume 7. Testing OSI Protocols - A Compendium of Papers. Volume 8. User's Guide to the Testing System for Implementations of the ICST Transport Protocol. Volume 9. A Test Suite for Implementations of the ICST Transport Protocol. Volume 10. Specification of a Remote Scenario Interpreter for Implementations of the ICST Transport Protocol.
Final rept.
Jun 84, 301p NBSIR-84-2880-VOLS-7/10, NBS/DF-84/005C
For system on magnetic tape, see PB84-222918. See also PB84-222868.

Keywords: *Standards, *Telecommunications, Operating systems(Computers), *Data communications, *Transport protocols, UNIX operating systems, C programming language, Software.

The tape contains the source code for the NBS implementation of ISO Scenario Interpreter and Exception Generator; suite of approximately 250 test scenarios; and documentation thereof. The source code is in the C language and the resulting software has been executed in a UNIX environment on a PDP-11/70.

707,146
PB84-222918 CP **T14**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
NBS/ISO (National Bureau of Standards/International Organization for Standardization) Transport Protocol and Testing Tools.
Software.
R. J. Linn. 1 Mar 84, mag tape NBS/DF-84/005
Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer products if you have questions. Price includes PB84-222850, PB84-222868, and PB84-222876.

Keywords: *Software, *Telecommunication, Operating systems(Computers), Standards, Magnetic tape, *Data communications, *Transport protocols, UNIX operating systems, C programming language, PDP-11/70 computers.

The tape contains the source code for the NBS implementation of ISO Scenario Interpreter and Exception Generator; suite of approximately 250 test scenarios; and documentation thereof. The source code is in the C language and the resulting software has been executed in a UNIX environment on a PDP-11/70...Software Description: The system is written in the C programming language for implementation on a DEC PDP 11/70 computer using the UNIX V. 6 modified operating system. The computer memory requirement is 64K words/process.

707,147
PB84-223551 PC **A04**/MF **A01**
McCabe and Associates, Inc., Columbia, MD.
Computer Science and Technology. Structured Testing: A Software Testing Methodology Using the Cyclomatic Complexity Metric.
Final rept.
T. J. McCabe. Dec 82, 75p NBS/SP-500/99
Also available from Supt. of Docs as SN003-003-02456-2. Library of Congress catalog card no. 82-600651.

Keywords: *Computer programming, Fortran, *Structured programming, *Software engineering, Software metrics.

Various applications of the Structured Testing methodology are presented. The philosophy of the technique is to avoid programs that are inherently untestable by first measuring and limiting program complexity. Part 1 defines and develops a program complexity measure. Part 2 discusses the complexity measure in the second phase of the methodology which is used to quantify and proceduralize the testing process. Part 3 illustrates how to apply the techniques during maintenance to identify the code that must be retested after making a modification.

707,148
PB84-224831 Not available NTIS
National Bureau of Standards, Washington, DC.
Realizing a Flexible, Iterative Style of Statistical Analysis with a Microcomputer.
Final rept.
W. Liggett. 1983, 5p
Pub. in Proceedings of Annual Technical Symposium of the Washington, DC Chapter of the Association for Computing Machinery (22nd), Gaithersburg, Maryland, June 23, 1983, pL2.1-L2.6.

Keywords: *Statistical analysis, *Microcomputers, BASIC programming language, Iterative methods, Computer software.

To analyze a data set as completely as possible, a statistician needs computing methods that are flexible, facilitate iterative development, and provide full documentation. A statistician can meet these requirements with a microcomputer by developing for each analysis a BASIC program that does all the computing including the graphics. This approach is flexible because the necessary data management, numerical, and graphical operations can be easily programmed. It facilitates iterative development because the BASIC program records the current state of the analysis and can be updated. It provides full documentation in the form of the final version of the program. This approach is appropriate only for analysts who are knowledgeable enough in statistics and numerical analysis to choose and code good algorithms. For such an analyst, this approach may be competitive with the analyst's other options. It is competitive with the use of a statistical package when the package is inflexible. It is competitive with the use of FORTRAN for interfacing software when the interfacing requires additional programming skill.

707,149
PB84-225333 Not available NTIS
National Bureau of Standards, Washington, DC.
Operating NBSNET.
Final rept.
R. J. Crosson. Apr 84, 6p
Pub. in Proceedings of Annual Federal DP Expo and Conference (10th), Washington, DC., April 17-19, 1984, p1-6.

Keywords: *Computer networks, *Local area networks, Data communications, Computer communications.

NBSNET is a local area network at the National Bureau of Standards with branches in Gaithersburg, Maryland, and Boulder, Colorado. Each branch consists of segments which have a total of over 500 individual connections. Each user connection is customized to the specific type of equipment being connected, permitting many types of devices to be used. The lack of adherence to established interconnection standards, or the lack of standards altogether, has increased the level of support necessary to connect equipment. Experience has shown the need for well designed, comprehensive, industry-wide standards. As use of the system has increased, the need for diagnostic techniques and tools has become more evident.

707,150
PB84-226943 PC **A04**/MF **A01**

TITAN Systems, Inc., McLean, VA.
Toward an Improved FIPS Cost-Benefit Methodology. Phase 2. Descriptive Models - General Purpose Application Software Development and Maintenance.
Final rept.
M. L. Chipman, M. Fiorello, M. Snead, P. Kay, and P. Powell. Jun 84, 60p NBS/SP-500/116
Contract NB80-SBCA-0405
Prepared in cooperation with Aurora Associates, Inc., Washington, DC. Also available from Supt. of Docs as SN003-003-02591-7. Library of Congress catalog card no. 84-601071.

Keywords: *Benefit cost analysis, Maintenance, Computer programming, *Software engineering, *Federal information processing standards, *Cost benefit analysis.

This report presents a functional-flow descriptive model that can be used to categorize the application software (ASOF) development and maintenance activities of Federal data processing facilities. ASOF-related activities may be conceptually represented in descriptive model form by combining one or more of the basic model tasks. The comprehensive framework for ASOF development and maintenance provided by the descriptive model can be used in the identification of impacts from standards and guidelines and in the preparation of cost-benefit impact assessments. The framework provides both macro and micro levels of detail in order to link the descriptive models to additional data processing issues.

707,151
PB84-232867 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Systems and Network Architecture Div.
Proceedings of the LAN-Transport Workshop (5th) Held on March 8-9, 1984.
M. A. Wallace. Mar 84, 34p NBSIR-84/2855
See also PB84-138825.

Keywords: *Computer networks, *Meetings, Standards, Specifications, *Protocols, *Local area networks, File transfer protocol.

The National Bureau of Standards Institute for Computer Sciences and Technology (ICST) has prepared specifications for the International Organization for Standardization's (ISO) Class 4 Transport Protocol. At the request of a number of companies, ICST organized a workshop series for implementors of these specifications using local area networking technology. The first workshop focused on implementation techniques and strategies so that a multivendor demonstration of these protocols can occur at a major computer conference in 1984 targeted for the NCC 1984. Primarily the details of CSMA/CD and Transport Class 4 were discussed and parameters were selected. A second workshop focused on token bus LANs and file transfer applications to be run at the targeted 1984 demonstration. Agreements on the specifics of the file transfer protocol were reached at the third workshop. The fourth workshop covered further refinements to the file transfer protocol, testing procedures, and demonstration details. This report documents the fifth workshop in the series of LAN/Transport workshops. The fifth workshop defined the File Transfer Protocol (FTP) testing schedule and minimum vendors tests, made minor adjustments to the FTP and reached agreements on participation in the HIS and BCS demonstrations.

707,152
PB84-242536 Not available NTIS
National Bureau of Standards, Washington, DC.
XERROR: The SLATEC Error-Handling Package.
Final rept.
R. E. Jones, and D. K. Kahaner. 1983, 7p
See also DE82-015494.
Pub. in Software Practice Experience 13, p251-257 1983.

Keywords: *Errors, Subroutine libraries, Fortran, Reprints, XERROR computer programs, Portability.

The XERROR package is a collection of portable Fortran routines for processing of errors that occur in other routines. It was developed as the error-handling package for the SLATEC Common Mathematical Library, which is currently in use at a number of U.S. Department of Energy and other facilities. This paper describes how to use the package, from the viewpoint of the writer of library routines that need to call the XERROR package to handle errors, and from the viewpoint of the user of those library routines.

707,153
PB84-245802 Not available NTIS
National Bureau of Standards, Washington, DC.
Software Development Tools.
Final rept.
R. C. Houghton. May 83, 8p
Pub. in Computer 16, n5 p63-70 May 83.

Keywords: Computer systems programs, Computer programming, Performance evaluation, Reprints, *Software tools, Software engineering.

An analysis of the various types and capabilities of software development tools is presented along with percentage profiles and actual tool memberships. These charts and tables can be used for overview information and also as a means to determine tools of interest for a given category. A listing of tool information from the NBS Software Tools Database, also contained in the report, can then be used for additional information about specific tools.

707,154
PB85-104693 Not available NTIS
National Bureau of Standards, Washington, DC.
Process Standards for Software Engineering.
Final rept.
M. A. Branstad, and P. B. Powell. 1981, 4p
Pub. in Proceedings of Software Engineering Standards Applied workshop, San Francisco, CA, August 18-20, 1981, p15-18.

Keywords: Data processing, Standards, Computers, Effectiveness, Quality, Productivity, *Software engineering, National government, National Bureau of Standards.

ICST, within NBS, is responsible for automated data processing standards for the Federal Government. The major objective of these standards is to foster the economic and effective use of computers within the Government. Software engineering standards and guidelines focus upon facilitating an increased level of software quality and productivity. The approach concentrates on the development process.

707,155
PB85-111763 Not available NTIS
National Bureau of Standards, Washington, DC.
Inverted View of Software Development Tools.
Final rept.
R. C. Houghton. 1981, 13p
Pub. in Proceedings of Annual Technical Symposium (20th), Washington DC Chapter of ACM, College Park, MD., June 18, 1981, p45-52.

Keywords: *Software, *Meetings, *Classifications, *Computer programs.

Traditional classification schemes for software tools are reviewed and critiqued according to their ability to uniquely classify modern software tools. An approach based on the inversion of these schemes is presented and is shown to be more effective in classifying tools.

707,156
PB85-115657 Not available NTIS
National Bureau of Standards, Washington, DC.
Syntax of Interactive Command Languages: A Framework for Design.
Final rept.
I. T. Hardy. 1982, 11p
Pub. in Software Pract. Exper. 12, n1 p67-75 Jan 82.

Keywords: *Computer programs, Syntax, Text editor, Reprints, *Command language, *Interactive systems.

Various qualities of simple command languages, such as ease of use and flexibility, are defined. Certain design attributes--namely style, structure and level of abstraction--are described for command languages, and these attributes are shown to strongly influence the defined qualities. Three existing text editors' command languages are used as examples of how a rather simple analysis of attributes can reveal a language's potential qualities and its appropriateness for any given group of users.

707,157
PB85-122000 PC **A09**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Selection and Use of General-Purpose Programming Languages - Program Examples. Volume 2.
Final rept.
J. V. Cugini. Oct 84, 185p NBS/SP-500/117/2
See also PB85-122018. Also available from Supt. of Docs as SN003-003-02613-1. Library of Congress catalog card no. 84-601120.

Keywords: *Programming languages, Selection, Use, Examples, Programming, Alternatives, ADA programming language, Basic programming language, Cobol programming language, Fortran programming language, PASCAL programming language, PL/I programming language.

Given that conventional programming is the appropriate technique for a particular application, the choice among the various languages becomes an important issue. There a great number of selection criteria, not all of which depend directly on the language itself. Broadly speaking, the criteria are based on (1) the language and its implementation, (2) the application to be programmed, and (3) the user's existing facilities and software. This study presents a survey of selection factors for the major general-purpose languages: Ada, BASIC, C, COBOL, FORTRAN, Pascal, and PL/I. The factors covered include not only the logical operations within each language, but also the advantages and disadvantages stemming from the current computing environment, e.g., software packages, microcomputers, and standards. The criteria associated with the application and the user's facilities are explained. Finally, there is a set of program examples to illustrate the features of the various languages. This volume includes the program examples. Volume 1 contains the discussion of language selection criteria.

707,158
PB85-122018 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Selection and Use of General-Purpose Programming Languages - Overview. Volume 1.
Final rept.
J. V. Cugini. Oct 84, 82p NBS/SP-500/117/1
See also PB85-122000. Also available from Supt. of Docs as SN003-003-026123. Library of Congress catalog card no. 84-601119.

Keywords: *Programming languages, Selection, Use, Criteria, Surveys, Programming, Alternatives, ADA programming language, BASIC programming language, Cobol programming language, Fortran programming language, PASCAL programming language, PL/I programming language.

Given that conventional programming is the appropriate technique for a particular application, the choice among the various languages becomes an important issue. There are a great number of selection criteria, not all of which depend directly on the language itself. Broadly speaking, the criteria are based on (1) the language and its implementation, (2) the application to be programmed, and (3) the user's existing facilities and software. This study presents a survey of selection factors for the major general-purpose languages: Ada, BASIC, C, COBOL, FORTRAN, Pascal, and PL/I. The factors covered include not only the logical operations within each language, but also the advantages and disadvantages stemming from the current computing environment, e.g., software packages, microcomputers, and standards. The criteria associated with the application and the user's facilities are explained. Finally, there is a set of program examples to illustrate the features of the various languages. This volume contains the discussion of language selection criteria. Volume 2 comprises the program examples.

707,159
PB85-128502 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Diamonds and Diamond Sorting.
E. Bromberg, and F. Sullivan. Sep 84, 24p NBSIR-84/2936

Keywords: *Sorting routines, Subroutines, Algorithms, Fortran, Parallel programming, Vector processors.

The present paper describes and analyzes the Diamond sort algorithm. The algorithm is designed for parallel operations, which makes it well suited to vector-computer architecture. The instruction sequences are fixed, without any branches. The algorithm therefore has a fixed complexity determined solely by the

number of elements to be sorted, rather than by any pattern of distribution of element values. The Diamond sort is of special interest not only because of the unusual arrangement of its steps, but also because it introduces the concept of a Diamond as a set with a specific kind of partial ordering that is closely linked to the halving principle, which is used in the sort procedure.

707,160
PB85-128916 Not available NTIS
National Bureau of Standards, Washington, DC.
Processing Data Model Abstractions.
Final rept.
W. T. Hardgrave, and D. R. Deutsch. Jan 81, 2p
Pub. in Proceedings of Data Abstraction, Databases and Conceptual Modelling, Pingree Park, CO, June 23, 1980, SIGART Newsletter n74 p126-127 Jan 81.

Keywords: Artificial intelligence, Programming languages, *Data abstraction, Data base management, Data structures.

Data abstraction is an important topic in the three fields of artificial intelligence, database management and programming languages. This paper briefly discusses some problems shared by the three fields and describes the ongoing NBS Abstract Data Models research project. This competency building initiative is concerned with the application of set-theoretic mathematical formalisms to the specification of both syntax and semantics of data models for database management systems.

707,161
PB85-134039 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Diamond: A Sorting Method for Vector Machines.
Final rept.
H. K. Brock, B. J. Brooks, and F. Sullivan. 1981, 11p
Pub. in Bit 21, n2 p142-152 1981.

Keywords: *Sorting routines, Algorithms, Reprints, Vector processors, Computational complexity.

In this paper the authors present a non-contingent method of the Batcher type which they call Diamond Sort. The algorithm makes use of the 'perfect shuffle' and also processes of 'unshuffling' and 'block-shuffling' are used. The asymptotic complexity of the algorithm is O(N(log N) sup 2). The implementation of the algorithm on the CYBER 200 system is described. Timing tests comparing Diamond Sort with Stone's version of the Batcher method are provided, along with operation counts for both.

707,162
PB85-135473 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
ISO Presentation Layer 6 Protocol Issues.
Final rept.
J. F. Heafner, and H. M. Wood. 1980, 5p
Pub. in Proceedings International Communications Conference, Seattle, WA, June 8-12, 1980, Part 1, Section 5.2 p1-5.

Keywords: *Computer networks, *Protocol(Computers), Data structures.

Production use of heterogeneous computer networks occasions the need to shield the user from operational differences in data access, reconfiguration, and transmission. This paper discusses the technical problems and the progress related to the development of network protocols of the presentation layer--the layer responsible for resolving differences in data format. Levels of difficulty are distinguished with respect to both the data structure and the data mapping functions. Inherent data incompatibilities are identified and methods to circumvent them are noted. This is followed by a discussion of some vanguard protocols and their closeness of fit to the description of the presentation layer. Lastly, the paper describes the technical problems attendant to realizing presentation layer protocol standards, and then presents the status of ongoing programs to develop them.

707,163
PB85-135481 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Toward the Extraction of Service Features from Definitive Documents on High-Level, Network Protocols.
Final rept.
J. F. Heafner, F. H. Nielsen, and M. W. Shiveley. 1980, 8p
Pub. in Proceedings of National Computer Conference, Anaheim, CA, May 19-22, 1980, p863-870 1980.

Keywords: *Computer networks, *Standards, Design, *Protocol (Computers).

The need is widely recognized for computer network protocol standards as prerequisite to effective use of networking potential. Current network protocols, designed by computer scientists, focus on the support of specific applications of local concern. These applications are not necessarily known to represent mainstream governmental and industrial applications in distributed information processing. Accordingly, procedures are needed to ensure that emerging protocol standards are functionally compatible with application requirements. This implies the need to determine, with respect to significant applications, just what constitutes a sufficient service for a given protocol. The first step in this determination, and the subject of this paper, is that of identifying protocol service features. Then, features can be associated with application needs. The objective in identifying features can be stated thusly: Given a protocol specification document written in English, devise a set of rules to extract service features. This method must be repeatable.

707,164
PB85-140275 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Beyond Floating-Point.
Final rept.
C. W. Clenshaw, and F. W. J. Olver. Apr 84, 18p
Pub. in Jnl. of the Association for Computing Machinery 31, n2 p319-328 Apr 84.

Keywords: *Arithmetic, Error analysis, Exponential functions, Iteration, Reprints, Floating point arithmetic, Fixed point arithmetic, Computer applications.

A new number system is proposed for computer arithmetic, based on iterated exponential functions. The main advantage is to eradicate overflow and underflow, but there are several other advantages, and these are described and discussed.

707,165
PB85-141497 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Guide to Better Software.
Final rept.
D. R. Wallace. Oct 84, 4p
Pub. in Government Data Systems 13, n5 p40-43 Sep/Oct 84.

Keywords: Quality control, Proving, Tests, Reprints, *Computer software, Computer software maintenance, Computer program verification, Validation.

The 'Guideline for Lifecycle Validation, Verification, and Testing of Computer Software' presents a methodology to be used throughout the software lifecycle to ensure the production and maintenance of quality software. The guideline suggests a combination of verification and testing techniques to arrive at recommended level of validation, verification, and testing tailored to the needs of a specific project. The guideline is a basic reference addressed to managers, developers, verifiers, maintainers, and end users.

707,166
PB85-143634 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fortran 77 Portability.
Final rept.
J. Larmouth. 1981, 47p
Pub. in Software-Pract. and Exper. 11, n10 p1071-1117 Oct 81.

Keywords: Reprints, *Computer program portability, Fortran 77 programming language.

The study focuses upon those aspects of Fortran 77 that are likely to be of interest when the final product is to be shared among users on different equipment. The material is intended to compliment the X3.9-1978 standard, and should be read in conjunction with that document.

707,167
PB85-144426 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Personal Number Cruncher.
Final rept.
S. Haber. 1983, 4p
Pub. in Proceedings of Technical Symposium (22nd) of the Washington, DC. Chapter of the ACM, Gaithersburg, MD., June 23, 1983, pA.1.1-A.1.4.

Keywords: *Numerical analysis, Computation, Personal computers, Benchmarks.

An account is given of the author's use of an inexpensive personal computer in consulting and research in numerical analysis. The effects on his work are described. The construction of a speed-measuring benchmark program, designed to be specifically applicable to the author's typical computations, is described. Results of applying this benchmark to a number of computers are given.

707,168
PB85-147957 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Observations on Data Element Naming Conventions.
Final rept.
J. J. Newton. 1984, 5p
Pub. in Proceedings of Trends and Applications 1984, Making Databases Work, Gaithersburg, MD., May 23-24, 1984, p153-157.

Keywords: Data processing, Standards, *Data elements, Naming systems, Data base management.

Data element naming conventions are an increasing concern of data administrators. Names in the past have been based on two differing philosophies of data organization. Three systems which have been used provide a basis of discussion; the issue of software independence must also be considered. Some rules for good names can be defined as a contribution to the establishment of naming conventions.

707,169
PB85-151769 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Report on the Status of the Development of the IEEE (Institute of Electrical and Electronics Engineers) Standard for Software Verification Plans (P1012).
Final rept.
R. U. Fujii, D. R. Wallace, and M. Edwards. Oct 84, 8p
Pub. in Proceedings of Software Engineering Standards Application Workshop (3rd), San Francisco, CA., October 2-4, 1984, p100-107.

Keywords: *Standards, Verifying, Development, *Computer software, *Computer program verification, Software lifecycle, Software engineering, IEEE standards.

The proposed IEEE Standard for Software Verification Plans (SVP) will be a member of IEEE's software engineering family of standards. This paper represents an interim stage of the proposed SVP standard. The final form is scheduled for ballot by IEEE in 1985. It will provide the user with a format and content for software verification plans. It will establish a minimum set of verification tasks to be performed for critical software during each phase of the lifecycle. The SVP standard will also provide for optional verification tasks based upon individual program needs. The SVP standard will provide adequate guidance to ensure that the SVP provides for proper management checkpoints and audits, including written results of executing the SVP.

707,170
PB85-155794 PC **A04**/MF **A01**
Software Systems Technology, Inc., College Park, MD.
Computer Science and Technology: A Guide to Performance Evaluation of Database Systems.
Final rept.
D. R. Benigni, S. B. Yao, and A. R. Hevner. Dec 84, 58p NBS/SP-500/118
See also PB84-217504. Also available from Supt. of Docs as SN003-003-02624-7. Library of Congress catalog card no. 84-601144.

Keywords: Performance evaluation, Microcomputers, Minicomputers, *Data bases, *Relational data bases, *Benchmarks.

This guide presents a generalized performance analysis methodology for the benchmarking of database systems. The methodology identifies criteria to be utilized in the design, execution, and analysis of a database system benchmark. This generalized methodology can apply to most database system designs. In addition, presenting a wide variety of possible considerations in the design and implementation of the benchmark, this methodology can be applied to the evalua-

tion of either a single system with several configurations, or to the comparison of several systems.

707,171

PB85-170595 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mathematical Software for Elliptic Boundary Value Problems.
Final rept.
R. F. Boisvert, and R. A. Sweet. 1984, 64p
Pub. in Chapter 9 in Sources and Development of Mathematical Software, p200-263 1984.

Keywords: *Partial differential equations, *Elliptic differential equations, *Boundary value problems, *Numerical integration, Reprints, *Computer software, Software engineering.

The authors survey recent advances in general-purpose mathematical software for elliptic partial differential equations. First, the types of equations handled by extant software are characterized and the most popular numerical methods are outlined. They then discuss software engineering issues related to the design and production of high-quality software which implement these methods. Detailed case studies are presented for two software packages: ELLPACK and FISHPAK. The authors conclude with a catalog of currently available software, describing the problems solved, the numerical methods, portability, and distribution in each case.

707,172

PB85-177632 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Guide on Workload Forecasting.
Final rept.
H. Letmanyi. Mar 85, 71p NBS/SP-500/123
Also available from Supt. of Docs as SN003-003-02634-4. Library of Congress catalog card no. 85-600504.

Keywords: *Data processing, *Forecasting, *Work measurement, Time series analysis, *Data base administrators, *Data base management systems, *Workload.

The purpose of this guide is to provide ADP managers and technical personnel with useful quantitative techniques for forecasting future workload requirements. It additionally provides a step-by-step approach to the forecasting process. Readers can then, in a timely manner, provide the computing resources needed to perform the user's workload at required service levels throughout the life-cycle of an ADP system. These techniques are described so that readers with little or no training in statistics should find them useful. However, this guide does not intend to give an exhaustive treatment of the techniques discussed. Readers requiring more information are referred to Appendix A ('Suggested Readings and References').

707,173

PB85-177657 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Systems and Network Architecture Div.
Performance Measurement of OSI (Open System Interconnection) Class 4 Transport Implementations.
K. L. Mills, J. W. Gura, and C. M. Chernick. Jan 85, 53p NBSIR-85/3104

Keywords: *Computer networks, Performance evaluation, Measurement, Implementation, *Protocols, Open system interconnections.

A measurement system to evaluate the performance of open system interconnection (OSI) transport protocol implementations is described. Several metrics are proposed to establish a quantitative characterization of layered protocol performance. Metrics specific to the OSI transport protocol are also proposed. The measurement system and metrics are applied to a multi-vendor National Computer Conference demonstration network and the results are reported.

707,174

PB85-177970 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Guide on Logical Database Design.
Final rept.
E. N. Fong, M. W. Henderson, D. K. Jefferson, and J. M. Sullivan. Feb 85, 119p NBS/SP-500/122
Also available from Supt. of Docs as SN003-003-02631-0. Library of Congress catalog card no. 85-600500.

Keywords: *Information systems, Systems design, Systems analysis, Methodology, *Data base design, *Data bases, *Data management, *Data base management systems, Data dictionaries, User needs, Relational data base.

This report discusses an iterative methodology for Logical Database Design. The methodology includes four phases: Local Information-flow Modeling, Global Information-flow Modeling, Conceptual Schema Design, and External Schema Modeling. These phases are intended to make maximum use of available information and user expertise, including the use of a previous Needs Analysis, and to prepare a firm foundation for physical database design and system implementation. The methodology recommends analysis from different points of view--organization, function, and event--in order to ensure that the logical database design accurately reflects the requirements of the entire population of future users. The methodology also recommends computer support from a data dictionary system, in order to conveniently and accurately handle the volume and complexity of design documentation and analysis. The report places the methodology in the context of the complete system life cycle. An appendix of illustrations shows examples of how the four phases of the methodology can be implemented.

707,175

PB85-189496 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Solving Elliptic Problems Using ELLPACK.
Final rept.
J. R. Rice, and R. F. Boisvert. 1985, 497p
Prepared in cooperation with Purdue Univ., Lafayette, IN.
Pub. in Solving Elliptic Problems Using ELLPACK 2, 497p 1985.

Keywords: *Partial differential equations, *Elliptic differential equations, *Boundary value problems, Finite difference theory, Finite element analysis, Numerical integration, Linear differential equations, *ELLPACK system, Two dimensional calculations, Three dimensional calculations, Computer software.

This book describes the use of the ELLPACK system and language for solving elliptic boundary value problems. ELLPACK provides many facilities for solving two-dimensional, linear elliptic partial differential equations on rectangular domains, and several facilities for non-rectangular domains and for three-dimensional rectangular domains. The book includes a users guide, a module reference, a contributors guide, and a system programmers guide.

707,176

PB85-191385 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Annotated Bibliography of Recent Papers on Software Engineering Environments.
Final rept.
R. C. Houghton, and D. R. Wallace. Apr 85, 25p NBSIR-85/3113

Keywords: *Computer programming, *Bibliographies, Environments, Requirements, *Software engineering, Software tools, Interactive systems.

This document reports on the contents of fifty-five recent papers on software engineering environments. Several of these papers present an overview of software engineering environments. Other papers discuss issues to be considered in building software engineering environments. The remaining papers describe general software engineering environments, system development environments, and programming environments.

707,177

PB85-191955 PC **A04**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
PIPE/1000: An Implementation of Piping on an HP-1000 Minicomputer.
Final rept.
N. L. Seidenman. Mar 85, 54p NBS/TN-1208
Also available from GPO as SN003-003-02639-5.

Keywords: *Operating systems(Computers), *Routing, Computer programs, Linkages, Implementation, Minicomputers, *PIPE system, *UNIX system, C programming language.

Piping is a system by which programs can communicate so as to coordinate their respective functions in a synchronized effort aimed at the completion of a given task. Piping is one of the strong points of the increasingly popular operating system UNIX, developed at Bell Laboratories and licensed by AT&T. This paper describes an implementation of piping in a non-UNIX environment; in particular, on an HP-1000 minicomputer.

707,178

PB85-197747 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mathematical Software in Basic.
Final rept.
D. K. Kahaner, and W. L. Wyman. 1983, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Micro 3, n5 p42-46 Oct 83.

Keywords: BASIC programming language, Numerical quatrature, Approximation, Algorithms, Reprints, *Integrals, *Computer software, One dimensional.

A new algorithm is presented for approximation of one dimensional definite integrals. It is implemented in Basic.

707,179

PB85-202018 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reflections on Ten Years of Computer Security.
Final rept.
S. K. Reed, and D. K. Branstad. 1982, 2p
Pub. in Computing Security 1, n3 p231-232 Nov 82.

Keywords: Risk, Verifying, Reprints, *Computer security, *Data encryption, Access.

The progress in computer security in the last ten years is considered from the standpoint of what has and has not changed.

707,180

PB85-202158 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Survey of Mathematical Software for Elliptic Boundary Value Problems.
Final rept.
R. F. Boisvert, and R. A. Sweet. 1982, 3p
Sponsored by International Association for Mathematics and Computers in Simulation and Concordia Univ., Loyola Campus, Montreal (Quebec).
Pub. in Proceedings of World Congress on System Simulation and Scientific Computation (10th), Montreal, Canada, August 8-13, 1982, Numerical Methods for Scientific Computation, v1, p449-451 1982.

Keywords: *Boundary value problems, *Elliptic differential equations, *Partial differential equations, Reviews, *Computer software.

In this paper, the authors summarize the state of mathematical software for elliptic boundary value problems. These problems are fundamental to the study of static physical phenomena such as electromagnetic fields and steady-state diffusion. In addition, they often arise as intermediate steps in the modelling of dynamic processes such as fluid flow. The authors limit this discussion to portable general-purpose mathematically-oriented software, and hence much useful applications-oriented is necessrily omitted.

707,181

PB85-202919 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Software Technology Div.
Structural Dimensions of Small Programming Environments.
Final rept.
G. Lyon. Jan 85, 13p
Pub. in Software--Practice and Experience 15, n1 p105-117 Jan 85.

Keywords: *Computer programming, Reprints, *Computer software.

Although substantial variety exists among small programming environments, common points-of-choice in their design suggest the following structural characterization: real or virtual hardware; message-passing or procedure-calling; static or dynamic binding; horizontal or vertical organizations; abstract or concrete structures; fixed or extensible language. Often these dimensions must support a very focused programming idiom, which combined with other requirements such as portability or performance, establishes structural dependencies, precludes features and forces exceptions. The characterization provides a rough framework that is useful in evaluating programming environments.

707,182
PB85-202935 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
View of Software Development Support Systems.
Final rept.
M. A. Branstad, W. R. Adrion, and J. C. Cherniavsky. 1981, 6p
Sponsored by National Engineering Consortium, Inc., Oak Brook, IL.
Pub. in Proceedings of Natl. Electronics Conf., Chicago, IL, October 26-28, 1981, v35, p257-262.

Keywords: *Systems engineering, Computer programming, Automation, *Computer software, *Software engineering.

The ability to adequately monitor and control the software development process is important as a mechanism for achieving higher quality and productivity. Automation, specifically a collection of software development tools, can be used to facilitate and constrain the process. Integrated tool collections are termed software development support systems on programming environments.

707,183
PB85-221950 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Database Management in Science and Technology.
Final rept.
J. Rumble. 1984, 13p
Pub. in Database Management in Science and Technology, p1-13 1984.

Keywords: Computation, *Data base management, Science and technology, Numerical data, Computer systems design.

The paper features an introduction to the use of computers in the handling of numeric scientific data. It is the introductory chapter in a new CODATA Sourcebook. In addition, it outlines the use of database management systems and their design.

707,184
PB85-221968 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis and Display of Data in Science and Technology.
Final rept.
J. R. Rumble, and N. L. Seidenman. 1984, 17p
Pub. in Database Management in Science and Technology, p75-91 1984.

Keywords: Computation, Statistical analysis, Data displays, Photocomposition, Bibliographies, *Data base management, Numerical data, Computer graphics, Data analysis, Science and technology.

The paper discusses the use of numeric databases including preparation of subsets, statistical analysis, photocomposition, and graphics. Examples of each are given as well as a comprehensive bibliography.

707,185
PB85-224491 PC **A07**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Technical Overview of the Information Resource Dictionary System.
A. Goldfine, and P. Konig. Apr 85, 135p NBSIR-85/3164

Keywords: Standardization, Specifications, Proposals, *Data base management, *Information Resource Dictionary System, *IRDS system, *Federal information processing standards, Information processing, Computer software, Data dictionary, International standard.

The publication provides a technical overview of the computer software specifications for an Information Resource Dictionary System (IRDS). It summarizes the data architecture and the software functions and processes of the IRDS. The IRDS Specifications are a draft proposed American National Standard, a draft proposed U.S. Federal Information Processing Standard, and a Working Document of the International Organization for Standardization (ISO), Subcommittee 21, Working Group 3. The Overview also provides background information on the development of the draft proposed U.S. standards.

707,186
PB85-225217 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Reference Model for DBMS (Database Management System) Standardization.
D. K. Jefferson, and E. N. Fong. May 85, 79p NBSIR-85/3173

Keywords: Standardization, Models, Concepts, Proposals, *Data management, *Data base management systems, *DBMS systems, *Data dictionary, Reference models, Data representation, DL programming language, i-DL programming language.

The report proposes a Reference Model (RM) for database management system (DBMS) standardization. A Reference Model is a conceptual framework whose purpose is to divide standardization work into manageable pieces and to show at a general level how these pieces are related with each other. The proposed RM comprises a Data Mapping Control System (DMCS) that retrieves and stores application data, application schemas, and data dictionary schemas. This DMCS is bounded by two interfaces: the Data Language (DL) interface which defines the services offered by the DMCS to various Data Management Tools (DMT), and the internal Data Language (i-DL) interface which defines the services required by the DMCS from the host operating system. The report suggests two candidates for standardization: the DL and the i-DL.

707,187
PB85-227783 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Using the Information Resource Dictionary System Command Language.
Final rept.
A. Goldfine. Apr 85, 86p NBSIR-85/3165

Keywords: *Information systems, *Data base management systems, *Command languages, *Data dictionary, Information Resource Dictionary System, IRDS system.

The document introduces and provides examples of the Command Language of the draft proposed Information Resource Dictionary System (IRDS). A dictionary maintained by the U.S. Air Force is defined in the IRDS and used as a continuing example throughout the document. The dictionary is populated, manipulated; and reported on using the precise syntax of the Command Language. An appendix to the document provides a complete listing of the creation of the example. Other appendices provide indices of all command appearances and all clause appearances.

707,188
PB86-105814 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement Center for the NBS (National Bureau of Standards) Local Area Computer Network.
Final rept.
P. D. Amer. 1982, 7p
Pub. in Institute of Electrical and Electronics Engineers Trans. Comput. C-31, n8 p723-729 Aug 82.

Keywords: *Computer networks, *Network flows, Performance evaluation, Radio broadcasting, *Local area networks, *NBSNET computer network, Multiple access, Distributed computer systems.

The paper describes a measurement center for a local area computer network (LAN). A LAN measurement center is a tool that allows careful testing and evaluation of a network under diverse and highly controlled conditions. Three measurement center components are discussed: a monitoring system, analysis software, and an artificial traffic generator. The monitoring system captures measurement information about the traffic being transmitted over the network. The analysis software provides ten measurement reports which are generated following each monitoring period. Finally, the traffic generator can place varied loads on the network, allowing for controlled experimentation and functional testing. The measurement center described here is being implemented for the NBSNET, a distributed, broadcast LAN at the National Bureau of Standards. Implementation issues and problems are discussed.

707,189
PB86-105855 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Services and Mechanisms of a Data Presentation Protocol.
Final rept.
S. E. Clopper, and J. E. Swanson. 1982, 4p
Pub. in Proceedings of INFOCOM 82, Las Vegas, Nevada, March 30-April 1, 1982, p148-151.

Keywords: *File transfer protocols, *Open system interconnection, *Computer networks, *Computer files, Data requirements, Protocols.

The paper describes the services and protocol mechanisms of a protocol residing in layer six of the International Standards Organization's (ISO's) Reference Model for Open Systems Interconnection. The Data Presentation Protocol (DPP) was designed to provide presentation layer services to a File Transfer Protocol entity residing at layer seven of the ISO model. The services are consistent with the current concept of the presentation layer within ISO and the American National Standards Institute (ANSI). Specific features were selected based on the needs of the agencies of the Federal Government within the United States; however, these needs are consistent with those of any large organization engaged in the procurement or development of networks of heterogeneous computer systems.

707,190
PB86-111002 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Software Technology Div.
Is There a Language-Knowledgeable Program Constructor-Executor in Your Future.
Final rept.
P. B. Henderson. 1982, 1p
Pub. in Proceedings of Institute of Electrical and Electronics Engineers Computer Society's International Computer Software and Applications Conference (6th), Chicago, IL., November 8-12, 1982 p613.

Keywords: *Computer programming, Editing, Programming languages, Reprints, *Software engineering, *Personal computers, *User needs, Software tools.

The author believes that within the next 10-15 years most software development will be done on personal workstations using an environment which includes a language-knowledgeable program constructor-executor system which is tuned to the users needs.

707,191
PB86-111895 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Software Technology Div.
Language-Based Editors/Interpreters.
Final rept.
G. Lyon. Nov 82, 2p
Pub. in Proceedings of COMPSAC 82 IEEE Computer Society's International Computer Software and Applications Conference (6th), Chicago, IL., November 8-12, 1982, p611-612.

Keywords: *Editing, *Interpreters, Bibliographies, *Computer software, Programming languages.

One can argue that in many respects language-based editor-interpreters are a natural extension (into the area of programming staff) of the popular interactive 'spreadsheet' packages. A language-based system can take many forms - the list included here is a sampling of recent works.

707,192
PB86-112026 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Automation Sensors Group.
Framework for Logical-Level Changes Within Database Systems.
Final rept.
G. H. Sockut. May 85, 19p
Pub. in Computer 18, n5 p9-17 May 85.

Keywords: Logic design, Reprints, *Data base management systems, *Data structures, *Data conversion, Front end processors.

The paper considers several types of changes that can take place within logical constructs of database systems, such as ordinary update, restructuring, data interchange, conversion, and support of an interface for one data model as a front end for a database management system of a different data model. A Data Model Processor (DMP), reviewed briefly herein, provides a unifying conceptual framework for defining and comparing types of changes such as those listed above, some of which may seem mutually unrelated at first glance. The paper describes practical uses of the changes.

707,193
PB86-113966 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Systems and Network Architecture Div.
NBS (National Bureau of Standards) Host to Front End Protocol.
C. M. Chernick. Aug 85, 93p NBSIR-85/3236

Keywords: *Computer networks, Interfaces, Protocols, Network flows, Multiplexing, *Front end processors, *Host computers, Communication networks, Offload, National Bureau of Standards.

'Front end' processors can be used to 'offload' communications processing from host computers. This paper describes a generic protocol (denoted HFEP) for host to (and from) front end communications processors. The HFEP, used in conjunction with additional, more user oriented protocols, such as ISO Transport or Virtual Terminal Protocol, can be used to offload these protocols. The NBS HFEP provides for a reliable, multiplexed, connection oriented services with a mechanism for process rendezvous. Primitives are defined for opening and closing connections, transfering data and determining the status of a connection. The HFEP uses underlying X.25 network technology (although other reliable, multiplexed and individually flow controlled network connection oriented technologies could be used.)

707,194
PB86-118700 CP **T08**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
ISO Connectionless Network Protocol - Implementation and Test System.
Software.
D. E. Rorrer, and M. A. Wallace. Oct 85, mag tape NBS/SW/MT-86/001
Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions.

Keywords: *Software, Computer programs, Standards, Tests, Magnetic tapes, Computer networks, L=C, H=DEC VAX-11/780, ISO standard.

The tape consists of programs which provide an implementation of the ISO Connectionless-Mode Network Service and a Test System which measures the conformance of an Implementation to the ISO standard...Software Description: The program is written in the 'C' programming language for implementation on DEC VAX 11/780 computer using the EUIN-ICE/VMS V5.7 operating system.

707,195
PB86-119187 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Role of Testing Tools and Techniques in the Procurement of Quality Software and Systems.
Final rept.
J. C. Cherniavsky, W. R. Adrion, and M. A. Branstad. 1979, 5p
Pub. in Conference Record of the Asilomar Conference on Circuits, Systems and Computers (13th), Pacific Grove, CA., November 5-7, 1979, p309-313.

Keywords: *Computer systems programs, *Procurement, Quality control, Tests, Programming, *Computer software, *Software tools.

The paper is oriented towards thosequality control problems peculiar to the procurement of software. The authors discuss the deficiencies, and possible corrections, of several current methodologies. The authors propose a set of software management and development tools for software quality assurance which enables better contractor-developer communication during the development. The paper also includes a discussion of how sophisticated programmig environments can play a central role in procured software development and a discussion of the associated research issues.

707,196
PB86-119260 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Processing Text Versus Editing and Formatting.
Final rept.
C. P. Howerton. 1979, 2p
Pub. in CIPS Review 3, n6 p24-25 Dec 79.

Keywords: *Editing, Programming languages, Reprints, *Text processing, *Formats.

The paper discusses various forms of text processing which are not classical and compares them to editing and formatting. Calls for creation of a super formatter which becomes a formal programming language in its optimal manifestation.

707,197
PB86-122850 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems Components Div.
Modular Expansion in a Class of Homogeneous Networks.
Final rept.
A. Mink, and C. B. Silio. 1982, 5p
Sponsored by Association for Computing Machinery, New York.
Pub. in Proceedings of Computer Network Performance Symposium, College Park, MD., April 13-14, 1982, v11 n1 p95-100.

Keywords: *Computer networks, Modular structures, Expansion, Capacity, Performance, Queuing theory, *Computer architecture, Computer systems design.

The authors consider a special class of homogeneous computer network comprising several essentially identical but independent computing systems (ICSs) sharing a single resource. Of interest here are the effects of modularly expanding the network by adding ICSs. The authors use a previously presented approximate queuing network model to analyze modular expansion in this class of network. The performance measure used in this analysis is the mean cycle time, which is the mean time between successive requests for service by the same job at the CPU of an ICS. In this analysis the authors derive an intuitively satisfying mathematical relation between the addition of ICSs and the incremental increase in the service rate of the shared resource required to maintain the existing level of system performance.

707,198
PB86-122900 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Session Layer Protocols.
Final rept.
F. H. Nielsen. 1982, 8p
Pub. in State of the Art Report Network Architectures, Series 10, n1 p191-198 1982.

Keywords: Standards, Proposals, Reprints, *Foreign technology, *Session protocols, *Computer networks, National Bureau of Standards.

The role and services of the Session layer in the ISO architecture is explained. A Session layer protocol proposed by the National Bureau of Standards is discussed. Also described is a proposal for a network interprocess communication protocol, which would reside in the Session layer.

707,199
PB86-123122 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Data Management and Programming Languages Div.
Developing a Programming Environment.
Final rept.
M. V. Zelkowitz. 1981, 6p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Proceedings of Annual Technical Symposium of the Washington, DC. Chapter of ACM (20th), Crisis in Computing: Innovation in a Constrained Environment, College Park, MD., June 18, 1981, p23-28.

Keywords: *Computer programming, Prototypes, Specifications, System analysis, *Translators, *Software engineering, *Software tools, *SNOBOL programming language, *High level languages.

There is a need to develop a prototype rapidly in order to be able totest systems specifications before a costly implementation is undertaken. The paper describes two research projects that aid in this effort. In one project, SNOBOL4 is used as a very high level executable design language in order to develop a rapid prototype of a language translater. In a second project, an intelligent data base is being designed to aid in developing PL/I programs. This PL/I system will have some of the characteristics of the earlier SNOBOL4 system. An eventual goal of this research is to later include a high level design language like SNOBOL4 to totally merge the two concepts into one system.

707,200
PB86-124088 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Network Architecture Div.
Protocol Standardization.
Final rept.
L. J. Miller. 1980, 7p
Pub. in Proceedings of EASCON '80 Record IEEE (Institute of Electrical and Electronics Engineers) Electronics and Aerospace Systems Conventions, Arlington, VA., September 29-October 1, 1980, p507-513.

Keywords: *Standards, *Computer networks, *Open system interconnections, Distributed computer systems, Network analysis, Protocols.

The paper describes the seven layers of the Reference Model of Open Systems Interconnection which has been developed by the International Organization for Standardization, and indicates other areas of network protocol standardization activity within ANSI, ISO, and CCITT. The National Bureau of Standards' program in Computer Network Protocol Standards is then described. This program involves the design, implementation, impact study, evaluation, and standardization of a family of protocols considered necessary for the development of distributed networks within the Federal Government.

707,201
PB86-124799 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Network Architecture Div.
Data Transfer Protocol for Remote Database Access.
Final rept.
P. S. C. Wang, and S. R. Kimbleton. 1980, 82p
Pub. in Proceedings of Trends and Applications: 1980 Computer Network Protocols, Gaithersburg, MD., May 29, 1980, p701-782.

Keywords: *Computer networks, *Data transfer protocols, Data bases, Access, Remote systems.

A Data Transfer Protocol (DTP) is a protocol for transfering data, in a meaning-preserving way, among different hosts of a computer network. The design of DTPs is separated into the following components: (1) specification of the services provided; (2) description of the internal structure of the protocol (in the form of descriptions of the individual entities of the DTP and the messages exchanged among these entities); and (3) identification of the required lower level support functions. The paper considers, in detail, the above three aspects of the design of a specific DTP.

707,202
PB86-124807 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of Standards Code and Information.
Network Access Technology: A Perspective.
Final rept.
S. W. Watkins, and S. R. Kimbleton. 1978, 9p
Pub. in AFIPS (American Federation of Information Processing Societies), Conference Proceedings, Anaheim, CA., June 5-8, 1978, v47 p495-503.

Keywords: *Telecommunication, *Computer networks, Computer components, Evaluation, *Access methods, Support services.

Effective user access to network resources is inhibited by differences in command languages, operating systems functions, file naming conventions, and system idiosyncracies. This has resulted in the gradual development of network access support aids which offload many access related problems from the user to a support system. The paper: (i) overviews the area of net-

work access; (ii) identifies related research efforts; (iii) identifies some of the factors which make network access support difficult; and (iv) structures major access support components. Insights resulting from the current implementation of one of these components, expert assistance, are also presented.

707,203
PB86-124815 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of Control and Data Flow Complexity in Software Designs.
Final rept.
M. H. Whitworth, and P. A. Szulewski. 1980, 9p
Pub. in Proceedings of COMPSAC 80 IEEE (Institute of Electrical and Electronics Engineers) Computer Society's International Computer Software and Applications (4th) Conference, Chicago, IL., October 27-31, 1980, p735-743.

Keywords: *Software designs, *Software engineering, *Data flow analysis, *Software quality control, *Computer systems design.

Progress in the areas of software development methodology and software quality measurement has lagged far behind the advances made in other computer-related fields. Most previous work in software quality assessment has addressed the quality of computer code. In the paper, the focus is shifted and the quality of software designs is emphasized. Two metrics of design complexity are proposed (complexity is often cited as having a negative impact upon software quality). By allowing software quality assessment techniques to be applied in the design phase of the development cycle, continuous evaluation of alternative designs is facilitated.

707,204
PB86-124849 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Lexical Synthesis Approach to User-Oriented Input Specification.
Final rept.
C. Witzgall, and K. Hoffman. 1978, 8p
Pub. in Proceedings of Annual Technical Symposium on Tools for Improved Computing in the 80's (17th), Gaithersburg, MD., June 15, 1978, p178-185.

Keywords: Word organized storage, Decoding, Specifications, Words(Language), *Applications programs(Computers), Natural language, User needs.

Modern large-scale application programs often call for flexible natural-language type input capabilities. The paper presents a general and highly flexible 'lexical synthesis' approach to the lexical decoding problem based on systematic string recognition rather than delimiting rules. It has successfully been implemented in an operating general-purpose lexical synthesis package ULEX.

707,205
PB86-124948 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Status and Trends of Numeric Data Banks.
Final rept.
J. Rumble. 1983, 5p
Sponsored by Polish Academy of Sciences, Warsaw. Inst. of Physical Chemistry.
Pub. in Proceedings of International CODATA Conference (8th) Data for Science and Technology, Jachranka, Poland, October 4-7, 1982, p188-192 1983.

Keywords: Numbers, Interfaces, Trends, *Data banks, *Scientific data, Machine translations, User needs, On-line systems.

The paper discusses the present-day status and trends of scientific numeric data banks. The main emphasis is on the user interfaces to data banks which provide the extra capability to computer-readable data which distinguishes them from the paper data banks.

707,206
PB86-126687 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Benchmark Analysis of Database Architectures: A Case Study.
Final rept.
S. B. Yao, A. R. Hevner, and D. R. Benigni. Oct 85, 100p NBS/SP-500/132
See also PB85-155794. Also available from Supt. of Docs as SN003-003-02684-1. Library of Congress catalog card no. 85-600599. Prepared in cooperation with Software Systems Technology, Inc., College Park, MD.

Keywords: Performance evaluation, Guidelines, Microcomputers, Minicomputers, *Data base management systems, *Data bases, *Benchmarks, Analysis, Computer architecture.

The purpose of this guideline is to present an application of the generalized performance analysis methodology for the benchmarking of database systems that was reported in NBS Special Publication 500-118. The principal objectives of this guide are to benchmark the performance of three distinct database system architectures: (1) a microcomputer database system; (2) a minicomputer database system; and (3) a database machine. This guide not only proves the viability of the benchmarking methodology in evaluating real systems, but it also provides comparable observations as to the capabilities of database systems based upon different architectures. Together with NBS Special Publication 500-118, this report serves as a reference for the benchmarking of database systems by providing a complete description of the benchmarking framework and a detailed application showing how to implement it.

707,207
PB86-126745 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Software Maintenance Management.
Final rept.
J. A. McCall, M. A. Herdon, and W. M. Osborne. Oct 85, 71p NBS/SP-500/129
Also available from Supt. of Docs as SN003-003-02681-6. Library of Congress catalog card no. 85-600596. Prepared in cooperation with Science Applications, Inc., La Jolla, CA.

Keywords: *Computer software, *Data processing, Management, *Computer software maintenance, *Computer software management, Software quality, Software tools, Life cycle costs, Federal agencies.

The report presents an overview of the various aspects of software maintenance, and provides an in-depth analysis of the associated problems, giving particular attention to the most pressing ones. It identifies tools, techniques, and procedures which aid in reducing these problems. This report also provides detailed guidance for managing software maintenance as a separate organizational entity. It also provides assistance needed to develop and employ improved maintenance practices and procedures, that result in reduced software costs and which help to insure that quality software is developed for and by the Federal ADP community.

707,208
PB86-128212 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Data Management and Programming Languages Div.
Data Models: Keys to Understanding Data Base Management Systems.
Final rept.
D. R. Deutsch, and J. M. Draper. 1984, 21p
Pub. in Advances in Data Base Management 2, Chapter 1, p1-21 1984.

Keywords: Selection, Standardization, Computer software, *Data base management systems, *Data structures, Relational data bases, Hierarchical data bases, Network data bases.

A data model describes the essential characteristics, including the logical data structures and operations, of an approach to data base management. This chapter demonstrates the pedagogical use of the data model concept by applying it to the relational, network, and hierarchical data models. After these descriptions the role of data models in the selection and standardization of data base management systems is examined.

707,209
PB86-128816 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Network Architecture Div.
Analysis of Link Level Protocols for Error Prone Links.
Final rept.
L. J. Miller. 1981, 6p
Pub. in Comput. Commun. Rev. 11, n4 p130-135 Oct 81.

Keywords: *Data links, *Duplexers, Errors, Reprints, *Computer communications, Protocols, Throughput, Computer performance evaluation, Packet switching.

The paper analyzes the maximum throughput across a full duplex link, under three link level protocols. The three protocols all assume cumulative acknowledgements, but the sender's retransmission policy and the destination's policy on retaining correctly received packets which arrive before an expected retransmission do differ. The results quantify the throughput advantages in retaining all correctly received packets, for the two different retransmission policies. A retention policy on the part of the destination is most advantageous when the link is quite error-prone.

707,210
PB86-129012 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Software Technology Div.
Summary of the NBS (National Bureau of Standards) Programming Environment Workshop.
Final rept.
M. A. Branstad. 1981, 5p
Pub. in Proceedings of Annual Technical Symposium (20th) on Crisis in Computing: Innovation in a Constrained Environment, College Park, MD., June 18, 1981, p39-43.

Keywords: *Computer programming, Productivity, Meetings, *Software engineering, *Software tools, *Software quality control, Workshops, National Bureau of Standards.

In May of 1980 NBS hosted a workshop to assess the state of the art in programming environment technology and to determine the key questions and issues that must be addressed to use these techniques to improve software quality and productivity within the Federal Government. This paper summarizes the results of the workshop.

707,211
PB86-129749 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Characteristics and Functions of Software Engineering Environments.
Research rept. 1 Oct 84-19 Sep 85.
R. C. Houghton, and D. R. Wallace. Sep 85, 45p NBSIR-85/3250
Prepared in cooperation with Duke Univ., Durham, NC.

Keywords: Life cycles, *Software quality control, *Software engineering, *Software tools, Computer software maintenance.

As part of the program to provide information to Federal agencies on software tools for improving quality and productivity in software development and maintenance, data was collected on software engineering environments. Software engineering environments surround their users with software tools necessary for systematic development and maintenance of software. The purpose of this report is to characterize software engineering environments by type and by their relationship to the software life cycle and by their capabilities, limitations, primary users, and levels of support. This report provides examples of existing software engineering environments that are available commercially or in research laboratories with the features and characteristics they provide.

707,212
PB86-132107 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Guide for Selecting Microcomputer Data Management Software.
Final rept.
C. L. Sheppard. Oct 85, 69p NBS/SP-500/131
Also available from Supt. of Docs as SN003-003-02682-4. Library of Congress catalog card no. 85-600598.

Keywords: *Microcomputers, Bench marks, Data processing, Selection, *Computer software, *Applications programs(Computers), File management systems, Data bases, User manuals(Computer programs).

No abstract available.

707,213
PB86-132693 Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Summary Assessment of the Symposium on the Role of Language in Problem Solving.
Final rept.
J. C. Boudreaux. 1985, 8p
Pub. in Role of Language in Problem Solving I, p341-348 1985.

Keywords: *Meetings, *Problem solving, *Programming languages, Reprints.

The paper summarizes the significant results of the Symposium on the Role of Language in Problem Solving, and states a series of open questions in the design of programming languages and programming environments.

707,214
PB86-132701 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Problem Solving and the Evolution of Programming Languages.
Final rept.
J. C. Boudreaux. 1985, 24p
Pub. in Role of Language in Problem Solving I, p103-126 1985.

Keywords: *Programming languages, Evolution(Development), Problem solving, Automation, Transformational grammars, Cognition, Computation, Design, Reprints, *Foreign technology, *High level languages, User needs.

Backus has observed that von Neumann programming languages are fat and weak. Though there are current efforts to provide alternate models of computation, an examination of the genealogy of programming languages suggests that it is unlikely that the issues now facing programming language designers will be resolved by the simple expedient of replacing one model with another. What such an examination does suggest is that each succeeding generation transfers new and more difficult cognitive functions from the programmer to the computer. If this is correct, then the author can predict that the next generation will come about not by some revolutionary advance in computer technology, but by the successful automation of higher-order cognitive functions which now require human attention. One ideal solution would be a cluster of programming languages that are expressive enough to reflect as nearly as possible the user's own cognitive framework, i.e., the structured world of abstract objects which define the user's application domain, together with the set of transformation rules on that domain which permit the user to create and/or modify those objects. The paper examines existing programming languages and then shows how ideal programming languages could be realized in practice.

707,215
PB86-133618 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Operating a Local Area Network.
Final rept.
R. J. Crosson. 1983, 5p
Pub. in Proceedings of Computer Networking Symposium, Silver Spring, MD., December 3, 1983, p73-77.

Keywords: *Computer networks, Standards, Operations, *Ethernet computer network, *NBSNET computer network, *Local area network, Computer systems design, Protocols, Operating systems(Computers), User needs.

NBSNET is a baseband Ethernet-like network at the National Bureau of Standards serving over 400 nodes. Connected devices communicate with the network using three types of protocols - one for terminals, and two for computers. The protocols contain flexibility to accomodate the unique facilities of the user's equipment. The lessons learned from the NBSNET experience are that capabilities for coping with user's equipment and for diagnosing problems encountered in the network's operation must be integral parts of the network's design. Also, the lack of standards increases the amount and level of support required.

707,216
PB86-138161 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Data Management and Programming Languages Div.
Procedure Language Access to Proposed American National Standard Database Management Systems.
Final rept.
L. J. Gallagher. 1984, 12p
Pub. in Comput. Networks 8, n1 p31-42 Feb 84.

Keywords: *Procedure oriented languages, Standards, Specifications, Reprints, *Data base management systems, *Application programs(Computers), *Relational data bases, *Open system interconnections, *Access methods, Distributed processing.

Network and relational database standards are under development by technical committee X3H2 of the American National Standards Institute. This paper is an overview of the procedure language interface to these proposed standards. It introduces the basic structures and operations of each data model, focuses on the procedure language interface as a facility for database access from external languages, and discusses various alternatives for use of the database language standard with existing standard programming languages. The paper contains example application programs of each access alternative and concludes with a discussion of basic requirements for application of the standard specifications to distributed database processing in an open systems environment.

707,217
PB86-138195 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Data Management and Programming Languages Div.
Distributed Database Management Systems: An Architectural Perspective.
Final rept.
V. D. Gligor, and E. N. Fong. 1983, 22p
Pub. in Jnl. of Telecommunications Networks 2, n3 p249-270 1983.

Keywords: Global communication, Data links, Heterogeneity, Telecommunication, Reprints, *Data base management systems, *Distributed processing, Computer systems design, Remote systems, Architecture(Computers), Communication networks.

Several distributed Database Management Systems which have been developed in the U.S., Europe, and Japan are reviewed in the paper. Most of the systems discussed are the result of various experimental projects. The basis for the review is provided by an architectural model which includes a set of necessary features for the interconnection of remote, heterogeneous systems. These features refer to the user-visible layers of a general, distributed DBMS architecture, and include those of the Global Data Management layer and of the Distributed Transaction Management layer.

707,218
PB86-138377 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Sources of Information on Quadrature Software.
Final rept.
D. Kahaner. 1984, 31p
Pub. in Sources and Development of Mathematical Software, ch7 p134-164 1984.

Keywords: *Numerical quadrature, *Integral equations, Computer software.

The paper surveys the area of numerical quadrature - evaluation of integrals. Particular emphasis is placed on the problems which lend themselves to efficient solution by readily available computer programs from four well supported libraries. The authors describe several of the basic ideas now in use and point out software built upon them. The paper assumes very little background in quadrature. It is not a complete tutorial on quadrature but does hope to give a few salient details.

707,219
PB86-138997 PC **A11**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Device Independent Graphics Kernel.
W. W. Jones, and A. B. Fadell. Oct 85, 245p NBSIR-85/3235

Keywords: *Computer graphics, *Display devices, Interfaces, *Computer program transferability, *Machine-independent programs, Input output devices, User needs.

The paper describes an interface for programs which allows one to write graphics primitives to several devices without regard for the type of device. The most salient features are that it has low overhead, is transportable and can be expanded as the nature of the input/output devices changes. A conscious effort has been made to include all normal graphics primitives together with the most useful high level routines without compromising the use of special features of custom display units.

707,220
PB86-162047 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Network Architecture Div.
Some Experience with Testing Tools for OSI (Open Systems Interconnection) Protocol Implementations.
Final rept.
R. J. Linn, and J. S. Nightingale. 1983, 11p
Pub. in Proceedings of the International Workshop on Protocol Specification, Testing, and Verification (3rd), Ruschlikon, Switzerland, May 31-June 2, 1983, p521-531.

Keywords: Verifying, Specifications, Tests, Programming languages, *Foreign technology, *Open systems interconnections, *Federal information processing standards, *Software tools, Computer architecture, Transport protocols.

At the Institute for Computer Sciences and Technology (ICST), test architecture has been specified for testing protocols of layers four through seven within the ISO Basic Reference Model for Open Systems Interconnection. The paper describes specific tools within the test architecture which have been developed and refined using a prototype implementation of the NBS Class 4 Transport Protocol. The language which drives the tool provides the mechanisms to edit protocol data units.

707,221
PB86-162054 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Network Architecture Div.
Producing Tests for Implementations of OSI (Open Systems Interconnection) Protocols.
Final rept.
R. J. Linn, and W. H. McCoy. 1983, 16p
Pub. in Proceedings of the International Workshop on Protocol Specification, Testing, and Verification (3rd), Ruschlikon, Switzerland, May 31-June 2, 1983, p505-520.

Keywords: Tests, Design, Computational linguistics, Grammars, *Foreign technology, *Open systems interconnections, Transport protocols, Protocols.

Problems associated with protocol test design, semantics and completeness are explored. A linguistics approach utilizing a generative grammar augmented with probability distributions associated with the production rules and random selection is used to produce test sequences for the NBS/ICST implementation of ISO Class 4 Transport protocol. Advantages and limitations of the methodology are presented.

707,222
PB86-167830 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Integrated Software for Microcomputer Systems.
Final rept.
L. S. Rosenthal. Jan 86, 41p NBS/SP-500/135
Also available from Supt. of Docs as SN003-003-02711-1. Library of Congress catalog card no. 86-600500.

Keywords: Microcomputers, *Computer software, *Integrated systems, Application programs(Computers), Operating systems(Computers).

Integrated software products combine several applications within a single program and enable information to be shared between the applications. The report defines five approaches to integration: the all-in-one, product suite, software integrator, operating environment, and background utility. Each of these approaches is designed to achieve different objectives by emphasizing the power and importance of the features of each approach. Consequently, there is no best approach to software integration. The selection of an approach depends on the application requirements, current system configurations, and personal preferences. Selecting an integrated product begins by considering the various approaches to integration and determining

which one is most appropriate. Subsequently, the products within the chosen approach are evaluated against a preestablished set of criteria relating to the product design, technical capabilities, and product quality. Careful selection of an integrated product will insure that the benefits to be gained from its use can be achieved.

707,223
PB86-169349 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Computer Science and Technology: An Overview of Computer Software Acceptance Testing.
Final rept.
D. R. Wallace. Feb 86, 28p NBS/SP-500/136
Also available from Supt. of Docs as SN003-003-02712-0. Library of Congress catalog card no. 86-600502.

Keywords: Acceptability, Tests, Proving, Planning, Guidelines, *Computer software, *Computer program verification, Validation, User needs.

The document provides guidance in planning and managing acceptance testing of computer software. It emphasizes the need for quantitative acceptance criteria and itemized test cases and procedures. It provides a checklist of activities to be performed for planning and managing acceptance testing.

707,224
PB86-185295 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Network Architecture Div.
Testing OSI (Open System Interconnection) Protocols: NBS (National Bureau of Standards) Advances the State of the Art.
Final rept.
K. L. Mills. Mar 84, 9p
Pub. in Data Communications 13, n3 p277-285 Mar 84.

Keywords: *Computer networks, Automation, Tests, Reprints, *Open system interconnections, Protocols.

The Institute for Computer Sciences and Technology (ICST) has established a methodology and architecture for testing implementations of standard open systems interconnection protocols. The ICST has also developed a set of automated tools to support the testing of protocols. The document describes the methodology, architecture, and test tools; provides a summary of experience to date; and outlines future plans for testing implementation of standard open system interconnection protocols.

707,225
PB86-186855 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Standards Code and Information.
Performance Measurement Techniques for Multiprocessor Computers.
Interim rept.
J. W. Roberts. Feb 86, 59p NBSIR-85/3296
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: Performance, Measurement, *Multiprocessors, *Computer performance evaluation.

A wide range of possible measures for multiprocessor computers is discussed, along with the realizability of each class of measurement technique and the applicability of the results.

707,226
PB86-189099 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Network Architecture Div.
Generating Artificial Traffic Over a Local Area Network Using Random Number Generators.
Final rept.
L. A. Ramshaw, and P. D. Amer. 1983, 19p
Pub. in Computer Networks 7, n4 p233-251 Aug 83.

Keywords: Algorithms, Random numbers, Generators, Traffic, Sequencing, Reprints, *Local area networks, *Computer performance evaluation.

Effective testing and performance evaluation of a local area computer network requires the ability to generate artifical traffic. This in turn requires algorithms for generating random number sequences. The article evaluates several random number generation algorithms considered for emulating traffic over NBSNET, a local area computer network at the National Bureau of Standards. The table-based method, using an additive uniform random number generator for selection from the table, was determined to be a satisfactory method considering NBSNET's constraints, and is being used to generate artificial traffic for continuing local network research experimentation.

707,227
PB86-196482 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Software Technology Div.
Software Engineering Project Standards.
Final rept.
M. A. Branstad, and P. B. Powell. 1984, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Software Engineering SE-10, n1 p73-78 Jan 84.

Keywords: *Standards, Reprints, *Software engineering, *Computer software.

Software Engineering Project Standards (SEPS) and their importance are presented in the article by looking at standards in general, then progressively narrowing the view to software standards, to software engineering standards, and finally to SEPS. After defining SEPS, issues associated with the selection, support, and use of SEPS are examined. A brief overview of existing software engineering standards is presented and trends are discussed.

707,228
PB86-202066 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Software Requirements Analysis: A Disciplined Approach.
Final rept.
P. B. Powell. 1983, 2p
Sponsored by Institute of Electrical and Electronics Engineers, Inc., Piscataway, NJ. Service Center.
Pub. in Proceedings of the International Computer Software and Applications - COMPSAC 83 Conference (7th), Chicago, Illinois, November 7-11, 1983, p642-643.

Keywords: Quality, Requirements, *Software engineering, *Computer program reliability, Software tools, Analysis.

The paper addresses software requirements analysis from a management point of view with the goal of producing software requirements which are complete, consistent, and unambiguous. Three type of analysis are mentioned, static, dynamic and formal, to promote a disciplined approach to requirements analysis. Among the benefits which can be derived from this approach are confidence raising that the requirements are complete and consistent, improving the quality of the software, and promoting reliability.

707,229
PB86-203437 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Software Technology Div.
Performance and Cost Characterization of A-Tree (Real-Time) Hashing (Extended Abstract).
Final rept.
G. Lyon. 1983, 1p
Sponsored by Johns Hopkins Univ., Baltimore, MD.
Pub. in Proceedings of Annual Conference on Information Sciences and Systems (17th), Baltimore, MD., March 23-25, 1983, p477.

Keywords: *Search structuring, *Data retrieval, *Addressing, Tables(Data), Searching, Algorithms, Performance, *Memory devices, Computer software, Access time, Real time, Cost.

Hashing is a software realization of content-addressable memory. Average hash retrievals are swift but worst cases, especially failed-lookups, are often unacceptably slow. Yet open-addressing hasing with mild restrictions can limit all searches to two probes: Attractive as this may be, available construction methods have been computation-bound and impractical. A new, fast algorithm--a-tree hashing--builds the open-addressing tables in times linear with their size. In descending importance, design objectives for the a-tree hash table builder are: incremental open-addressing insertion; searching in one or two probes; economical table construction; good average retrieval; easy coding; light memory demands.

707,230
PB86-203445 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Software Technology Div.
Need for Management of Software Maintenance.
Final rept.
R. J. Martin. 1983, 2p
Sponsored by Computer Society (IEEE), Los Alamitos, CA.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Computer Software and Applications Conference (7th), COMPSAC 83, Chicago, IL., November 7-11, 1983, p83-84.

Keywords: Management, Guidelines, *Software maintenance, Software engineering.

The paper develops the thesis that a software maintenance manager must not only be a good maintainer, but also a good manager. It presents an overview of some of the key findings of a National Bureau of Standards' Institute for Computer Sciences and Technology project to investigate and develop guidance on software maintenance.

707,231
PB86-203452 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Software Technology Div.
Controlling Software Change.
Final rept.
W. M. Osborne. 1983, 3p
Sponsored by Computer Society (IEEE), Los Alamitos, CA.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Computer Society's International Computer Software and Applications Conference (7th), COMPSAC 83, Chicago, IL., November 7-11, 1983, p89-90.

Keywords: Computer software, *Software maintenance, Software engineering, User needs.

The paper addresses three issues necessary for controlling software change: centralized approval, formal requests, and involvement of the user, management, and maintenance staff in the maintenance change process.

707,232
PB86-214236 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Reconstituting Shared Variables.
Final rept.
G. Lyon. 1982, 1p
Pub. in Proceedings of Conference on Information Sciences and Systems, Princeton, NJ., March 17-19, 1982, p246.

Keywords: *Computer programming, *Binary digits, *Machine coding, Abandonment, Bits, Variables.

In expanding the efficiency and flexibility of variables shared among tasks, it is not uncommon to allow 'read-lock' as a variable state. Once this accommodation is made, there are three states: unlocked, read-locked, and write-locked. Since two bits allow four possible states, a fourth value-abandoned-can be introduced. 'Abandoned' is then assigned whenever a task owning a write-locked variable terminates abnormally. A problem arises because recovery of abandoned shared variables can engender problems in writing secure, error-free programs. Addressing this not unimportant facet, the idea will be to diminish chances of abandoned objects (variables) slipping into unlocked status through programming error or oversight.

707,233
PB86-214244 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Considerations for Effective Program Development Systems.
Final rept.
P. Henderson, and G. Lyon. 1982, 6p
Pub. in Proceedings of Conference on Information Sciences and Systems, Princeton, NJ., March 17-19, 1982, p247-252.

Keywords: *Editing routines, *Interpreters, Microcomputers, Computer systems programs, Productivity, Programmers, *Software engineering, *Software tools.

The explosive push of microcomputers will render many computational services almost free. Accordingly, there exists an excellent opportunity for improving the

productivity of programmers, while at the same time enhancing the quality of the programs produced. One component of a microprocessor based software development system is an interactive program constructor-executor similar to, but more powerful than, a BASIC editor-interpreter. Our purpose here is to (i) give a brief survey of characteristics of existing constructor-executor systems; (ii) to discuss a spectrum of useful enhancements to the characteristics of such systems.

707,234
PB86-229622 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Functional Model for Fourth Generation Languages.
Final rept.
G. E. Fisher. Jun 86, 40p NBS/SP-500/138
Also available from Supt. of Docs as SN003-003-02731-6. Library of Congress catalog card no. 86-600545.

Keywords: *Programming languages, Data processing, Services, *Fourth generation programming languages, *Computer software, Data management, High level languages, On line systems, User needs, Applications programs(Computers).

The Fourth Generation Language (4GL) functional model places 4GL in the context of programming language evolution, and describes the functions provided within the context. A 4GL is a software system that provides integrated functions for developing interactive on-line data processing applications. These functions are defined as: (1) user functions that define those services and capabilities necessary to provide a high level dialogue between the 4GL and users of the 4GL; (2) data management functions that provide capabilities to describe, store and retrieve, and perform ancillary tasks in the management and safekeeping of application data; and (3) system functions that provide the support services necessary to allow the user of 4GL to define and access applications in relation to the constraints of the 4GL's environment. A typical implementation of 4GL distributes pieces of these functions over various components, such as a DBMS, query language, data dictionary, screen formatter, report generator, and high level procedural language.

707,235
PB86-231420 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Mathematical Software in Basic: RV, Generation of Uniform and Normal Random Variables.
Final rept.
D. Kahaner, J. Horlick, and D. Foer. Jun 86, 9p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Micro 6, n3 p52-60 Jun 86.

Keywords: *Random numbers, Basic programming language, Reprints, Computer applications.

Two programs, written in Basic, are described for generating uniform and normal random numbers.

707,236
PB86-232329 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Automation Sensors Group.
Reference Models for Standardization.
Final rept.
E. N. Fong, and D. K. Jefferson. 1986, 5p
Pub. in Proceedings of Computer Standards Conference, 1986-Striking a Balance between Technology, Economics, Politics, and Reality - For Substance, Not Form, San Francisco, CA., May 13-15, 1986, p86-90.

Keywords: *Standards, *Standardization, Development, Methodology, Protocols, Programming languages, *Data base management systems, Computer graphics, Computer communications, Reference model, Software engineering.

As the use of computer technology becomes more complex and pervasive, computer standards are being developed to facilitate the interconnection of components and transfer of programs, data, and skills from one environment to another. There are standards activities in the areas of programming languages, database management systems, computer communication protocols, graphics, and software engineering. Since these standards may overlap or interact with one another, there is a need for 'standard' methods to help manage the development of standards. One such method is to use a 'reference model' (RM) for an area in which standards are to be developed. A RM is a conceptual framework which divides standardization work into manageable pieces, and shows, at a general level, how these pieces are related to each other.

707,237
PB86-232352 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Software Technology Div.
Computer Security Evaluation and Certification.
Final rept.
Z. G. Ruthberg. 1982, 9p
Sponsored by Department of Defense, Washington, DC.
Pub. in Proceedings of Seminar on DOD Computer Security Initiative (5th), Gaithersburg, MD., May 24-26, 1982, p207-215.

Keywords: Security, Classified matter, Evaluation, Guidelines, *Computer security, Certification.

The paper is based on a talk given at the Fifth Conference of the Department of Defense Computer Security Initiative, May 24-26, 1982. It initially, presents a brief history of the certification and evaluation efforts at ICST/NBS and definitions of the centrally important terms 'computer security', 'computer security evaluation', 'security certification', 'computer system', 'computer application', and 'sensitive application'. It then goes on to briefly describe the certification and evaluation projects at ICST/NBS.

707,238
PB86-232360 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Software Technology Div.
Computer Security and Risk Management Program.
Final rept.
S. W. Katzke. 1982, 10p
Sponsored by Department of Defense, Washington, DC.
Pub. in Proceedings of Seminar on DOD Computer Security Initiative (5th), Gaithersburg, MD., May 24-26, 1982, p157-166.

Keywords: *Data processing security, Technical assistance, *Computer security, *Computer information security, Data encryption, Federal agencies, Risk analysis.

ICST/NBS has a computer security and risk management (CSRM) program that provides technical assistance to Federal agencies in reducing ADP related risks. The article discusses the scope of the Computer Security problem, Federal agencies' responsibilities for providing CSRM, and ICST's CSRM program objectives and activities designed to assist Federal agencies in meeting their responsibilities.

707,239
PB86-245263 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Study of a Prototype Software Engineering Environment.
D. R. Wallace, and D. R. Kuhn. Jun 86, 24p NBSIR-86/3408

Keywords: Prototypes, Environments, *Software engineering, *Software tools, Federal agencies, User needs.

A prototype software engineering environment was studied as part of the program to provide information to Federal agencies on software tools for improving quality and productivity in software development and maintenance. The purpose of a software engineering environment is to surround its users with software tools necessary for systematic development and maintenance of software. The report presents the results of the study of the prototype software engineering environment with respect to its features. The report also presents several factors to consider when evaluating a software engineering environment.

707,240
PB86-247590 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Experiment in Software Acceptance Testing.
D. R. Wallace. Jul 86, 20p NBSIR-86/3407

Keywords: Acceptability, Prototypes, Productivity, *Software engineering, *Software tools, *Software quality control, Federal agencies.

Software acceptance testing was performed on a prototype software engineering environment as part of the program to provide information to Federal agencies for improving quality and productivity in software development and maintenance. The purpose of software acceptance testing is to demonstrate to its purchasers that the software satisfies its requirements. The report describes the method and standards applied in this study in software acceptance testing. The report also discusses the difficulties encountered during the study and proposes research directions for software acceptance testing.

707,241
PB87-108551 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Guide to the Selection and Use of Fourth Generation Languages.
Special pub. (Final).
M. M. Gray. Sep 86, 70p NBS/SP-500/143
Also available from Supt. of Docs as SN003-003-02758-8. Library of Congress catalog card no. 86-600582.

Keywords: *Programming languages, *Fourth Generation programming languages, *High level languages, End use.

The report provides guidance on the selection process for Fourth Generation Languages (4GLs). It also gives a description of the features, functions and capabilities of 4GLs; and a brief discussion on the use of 4GLs. A ten step selection process is suggested: (1) describing the application; (2) analyzing the application environment; (3) deciding on selection approach; (4) defining requirements; (5) developing list of desired 4GL features; (6) rating desired features; (7) selecting candidate packages; (8) rating 4GLs; (9) analyzing top few in detail; and (10) selecting 4GL. Check lists are provided for screening 4GLs and analyzing the application environment.

707,242
PB87-109849 PC **A07**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Annotated Bibliography on Software Maintenance.
W. M. Osborne, and R. Raigrodski. Sep 86, 142p NBS/SP-500/141
See also PB87-109856. Also available from Supt. of Docs as SN003-003-02756-1. Library of Congress catalog card no. 86-600579.

Keywords: *Bibliographies, Maintenance, Productivity, Errors, Measurement, Technical reports, Periodicals, *Software maintenance, Computer software, Software tools, Software configuration management, Software quality control, Life-cycle cost, Cost, User needs.

The annotated bibliography contains summaries of two hundred and eighty-five software maintenance articles or papers from computer science journals, books, proceedings, Federal publications, computer newspapers, and other technical reports. It covers a fifteen year period between 1972 and 1986, and presents an overview of the various aspects of software maintenance including problems and issues faced in most software maintenance environments. It identifies techniques, procedures, methodologies, and tools that have been effectively employed throughout the software system lifecycle to improve the quality of that system.

707,243
PB87-109856 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Management Overview of Software Reuse.
W. Wong. Sep 86, 27p NBS/SP-500/142
See also PB87-109849. Also available from Supt. of Docs as SN003-003-02757-0. Library of Congress catalog card no. 86-600581.

Keywords: Organizations, Management, Productivity, Economic analysis, *Reusable software, *Software engineering, Software quality control, Costs.

With skyrocketing software costs, both Federal and private sector organizations are increasingly interested in finding ways to improve software quality and productivity, and reduce software risks. Software reuse is one promising method of accomplishing the objective. The report presents a management overview of the problems and issues related to software reuse. It provides

a description of software reusability and its scope. The necessity of technical and management involvement to achieve greater levels of software reuse is emphasized.

707,244
PB87-122669 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
SETKY-GETKY, Keyed Access System for the HP1000.
Final rept.
D. Bickham, and D. Neumann. 1986, 16p
Pub. in Proceedings of Conference on INTEREX International Association of Hewlett-Packard Computer Users, Detroit, MI., September 28-October 3, 1986, p1-16.

Keywords: Data processing, Data files, Data displays, Data bases, Information retrieval, Data storage, Chemistry, *Access methods, *HP1000 computers, *SETKY-GETKY system, Computer output devices, On line systems, User manuals(computer programs), Formats, User needs, Minicomputers.

SETKY-GETKY is a keyed access system written for the HP1000 mini-computer. Its main function is to provide rapid access to free formatted textual or tabular material stored in large data files. It provides a choice among output devices and some user control over the format of the data display. Three examples are presented to demonstrate the use of SETKY-GETKY. The first is a simple example of a database of computer users. The second example shows the development of an online help system and user's manual. The last example involves the storage and retrieval of tables of chemical thermodynamic functions.

707,245
PB87-140810 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Guidance on Software Package Selection.
Final rept.
S. Frankel. Nov 86, 124p NBS/SP-500/144
Also available from Supt. of Docs as SN003-003-02773-1. Library of Congress catalog card no. 86-600593.

Keywords: Evaluation, Guidelines, *Computer software, *Applications programs (Computers).

The report describes a systematic procedure for identifying and evaluating off-the-shelf software packages, and for incorporating the selected package into the organizational environment. Its purpose is to enable the layperson to choose and implement software packages with a minimum of dependence on technical personnel. The report provides guidance on each phase of the package selection and implementation process.

707,246
PB87-150595 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Framework for Improving Software Maintenance Throughout the Software Life Cycle.
Final rept.,
W. M. Osborne. 1984, 2p
Pub. in Proceedings of Software Engineering Standards Application Workshop (3rd), San Francisco, California, October 2-4, 1984, p137-138.

Keywords: Quality assurance, Maintenance, *Computer software maintenance, *Computer software, *Life cycle costs, *Software tools, Computer software management, Software engineering.

The paper discusses the need to adopt a software maintenance framework which addresses each phase of the software life cycle and influences the decisions made during that phase. The framework should identify software maintenance policies, procedures, and activities. When developing a software maintenance framework, consideration should be given to such life-cycle requirements: the ease of understanding and using the software; the ease of making and controlling changes; the adoption and use of improved techniques and tools and a quality assurance plan.

707,247
PB87-152005 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Why Can't We Access More Numeric Data Via Computers.
Final rept.,
J. R. Rumble. 1984, 6p
Pub. in Proceedings of National Online Meeting, New York, NY., April 10-12, 1984, p325-330.

Keywords: *Data processing, Materials, Telecommunication, Handbooks, Economic factors, *Access methods, *Data bases, *Scientific data, *Technical data, *Data compilation, On line systems, Costs, Benefits.

It appears obvious that at some future time, say 25 to 50 years from now, scientists and engineers will be able to access by computer any numeric data they need. Even now, the computer and communications technology to provide this access is available and has been implemented in several small systems. If, however, one compares the number of individual machine-readable databases available (less than 150) to the large number of printed handbooks and data compilations (over 2500 in the NSRDS collection alone), it is evident that only a minute fraction of the everyday working data can in fact be reached by computer today. Why is this so. In the paper, several reasons will be identified and discussed. These include the high cost of data entry, the difficulty of database building, the lack of obvious economic benefits, the small number of well-articulated demands, and the lack of encouragement from major on-line vendors. In addition, some recent attempts to make engineering properties of materials available by computer will be presented.

707,248
PB87-153052 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Forth Profile Management System.
Final rept.,
J. L. Michaloski. 1984, 1p
Sponsored by Journal of Forth Application and Research, Rochester, NY.
Pub. in Proceedings of Rochester Forth Conference on Real Time Systems, Rochester, NY., June 6-9, 1984, p193.

Keywords: *Loader routines, *Source programs, Program management, *Computer files, *File management systems, Off line systems, On line systems, Computer codes, FORTH programming language.

A new approach to program management is presented called Profile Management (PM). Differing from conventional file systems, PM not only handles those problems of offline source code management, but extends this concept to deal with the on-line status of the machine. The basis of this new approach is the 'profile', i.e. a partition of source code on the disk. Each profile names a section of code that can be used throughout the loading process, plus allowing various forms of status information to be accessed via commands within the Profile Management system. Further, each profile can be subdivided into smaller partitions that themselves act as an individual profile or as a part of the parent profile. These subdivisions offer a flexible mechanism for loading entire programs or just individual components.

707,249
PB87-157137 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
K* (Kay-Star): A FORTRAN-Based Code for Programming and Evaluating Interactive Software.
Final rept.,
D. F. Redmiles. 1984, 9p
Pub. in Proceedings of Conference on Engineering Databases: Software for On-Line Applications, San Antonio, TX., June 17-21, 1984, p61-69.

Keywords: *Software engineering, *Data structure, Computer programs, Evaluation, Interfaces, Programmers, *Computer codes, *Fortran-based codes, Interactive systems, Fortran 77 subroutines, Command languages, Operating systems(Computers).

K* (read kay-star) is an experimental library of FORTRAN 77 subroutines that simplifies the design and implementation of command-driven interactive programs. K* gives program designers a way to evaluate and modify easily the user interface. Also, it relieves programmers of coding many tasks associated with user interaction. The K* library and the programming methodology it uses are designed with 'mid' to 'large' sized applications in mind. The paper first describes K* and under which circumstances K* is most useful second, it presents an example implementation of ar interactive program.

707,250
PB87-157228 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD Center for Programming Science and Technology.
Programming Languages for Knowledge-Based Systems.
Special pub.,
J. V. Cugini. Feb 87, 82p NBS/SP-500/145
Also available from Supt. of Docs as SN003-003-02783-9. Library of Congress catalog card no. 86-600602.

Keywords: *Programming languages, *Symbolic programming, Procedure oriented languages, Terminology, Evaluation, *Knowledge based systems, *Expert systems, *LISP programming language, Prolog programming language, OPS 5 programming language, Computer software.

Knowledge-Based Systems (KBS) represent a new software methodology which can broaden the scope of computer applications. When developing such software at the programming level, symbolic languages offer features to the programmer not provided by traditional procedural languages. The three most widespread symbolic languages are Lisp, Prolog, and OPS5. An abstract model for a basic KBS and associated terminology is described. This provides a framework for evaluation of the languages. There are several criteria by which one may assess the relative merits of these languages for a given knowledge-based application. Some are related to the languages' expressiveness for typical KBS techniques, others to the user's requirements. An extensive set of these criteria is discussed, and the languages are evaluated in light of them.

707,251
PB87-160990 CP **T19**
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
DATAPLOT: An Interactive High-Level Language for Graphics, Non-Linear Fitting, Data Analysis, and Mathematics. Version 87.1.
Software,
J. J. Filliben. Jan 87, mag tape NBS/SW/MT-87/005
Supersedes PB82-181454, PB83-215574, and PB84-211796.
Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation, PB87-161006, PB87-161014, PB82-181462, PB82-181470, PB82-181488, PB82-181496, and PB82-181504.

Keywords: *Software, *Computer graphics, *Plotting, Programming languages, Mathematics, *DATAPLOT programming language, *High level languages, *Interactive graphics, Menus, Computer program portability, Data analysis, H=Univac; IBM; Cyber; DEC VAX, L=Fortran.

DATAPLOT is a portable, high-level interactive language/system for graphics, fitting, data analysis, and mathematics. It has wide applicability--especially in a research/scientific/engineering environment. Recent enhancements allow DATAPLOT to be run as a menu system. Such menus are completely user-definable thereby allowing them to be fully tailored to one's local needs and environment...Software Description: The program is written in FORTRAN for implementation on a number of host computers, such as, UNIVAC, IBM, CYBER, DEC VAX, and others. Approximately 600K bytes of main memory are required.

707,252
PB87-161006 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
DATAPLOT: New Features. Version 87.1,
J. J. Filliben. Jan 87, 62p NBS/SW/MT-87/005A
For system on magnetic tape, see PB87-160990. Supersedes PB84-214055. See also PB87-161014.

Keywords: *Computer graphics, Programming languages, Documentation, *DATAPLOT programming language, *High level languages.

The document is an overview of new features which have been implemented into DATAPLOT from July

1985 to December 1986. These features enhance not only the analysis power of DATAPLOT, but also the ease-of-use of DATAPLOT. All enhancements featured in the document have been incorporated into the DATAPLOT 87.1 release.

707,253
PB87-161014 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
DATAPLOT: Implementation Manual. Version 87.1,
J. J. Filliben. Jan 87, 83p NBS/SW/MT-87/005B
For system on magnetic tape, see PB87-160990. Supersedes PB84-214063. See also PB87-161006.

Keywords: *Computer graphics, *Programming languages, Minicomputers, Manuals, *DATAPLOT programming language, User manuals(Computer programs), Computer program portability, Mainframe computers.

DATAPLOT is a portable, high-level interactive language/system for graphics, fitting, data analysis, and mathematics. It has wide applicability--especially in a research/scientific/engineering environment. The Manual outlines the step-by-step procedure for implementing DATAPLOT 87.1. Inasmuch as the underlying DATAPLOT code is portable (FORTRAN 77), and inasmuch as transportability considerations are an integral part of the design, then this described implementation procedure is valid and appropriate for a wide variety of mainframes and minis.

707,254
PB87-171880 CP **T11**
National Bureau of Standards (ICST), Gaithersburg, MD.
NBS (National Bureau of Standards) Prototype Compiler for Estelle.
Software,
M. Hobbs, and R. J. Linn. Nov 86, mag tape NBS/SW/MT-87/002
Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation, PB87-171898.

Keywords: *Software, Hierarchies, Protocols, Prototypes, Specifications, *Estelle system, *Open systems interconnections, *Compilers, *Computer communications, Software libraries, National Bureau of Standards, Software tools, Byte functional modules, L=C; YACC; LEX, H=VAX-11/780.

Estelle is a formal description technique for computer communication protocols being developed in the International Standards Organization (ISO) for specifying Open Systems Interconnection (OSI) protocols. It models protocols as extended finite state machines, called modules, arranged in a dynamic hierarchy. Modules communicate by exchanging interactions at named interaction points. The prototype compiler translates an Estelle formal description into declarations in the C language of data structures and procedures. The code must be augmented with a library of run-time functions (supplied with the compiler) and certain implementation-dependent functions (written by the user based on supplied examples). From these elements, an executable program can be produced to realize the behavior of the formal description. Because the compiler is an early prototype, it may not be appropriate for some situations. However, it should be a useful tool for suitable users with detailed knowledge of Estelle and a willingness to deal with compiler internals when necessary. The compiler was implemented using the Unix 4.2bsd operating system, including the YACC and LEX tools for compiler construction. The full compiler source is provided. The compiler code and the code that it generates are both in the C language, mostly avoiding non-portable constructs...Software Description: The program is written in the YACC, LEX, and C programming languages for implementation on a VAX 11/780 computer using the Unix 4.2bsd operating system. 200K bytes of core storage are required.

707,255
PB87-171898 PC **A05**/MF **A01**
National Bureau of Standards (ICST), Gaithersburg, MD.
User Guide for the NBS (National Bureau of Standards) Prototype Compiler for Estelle.
Draft rept.,
R. J. Linn. Nov 86, 76p ICST/APM-87-1, NBS/SW/MT-87/002A
For system on magnetic tape, see PB87-171880.

Keywords: Simulation, Protocols, Prototypes, Documentation, *Estelle system, *Compilers, *Subroutine libraries(Computers), Software libraries, National Bureau of Standards, User manuals(Computer programs).

The document accompanies a software product, the NBS Prototype Compiler for Estelle. It describes an implementation model for Estelle, the output of the compiler, the run-time library of support routines, and the syntax of Estelle used by the compiler. Instructions are provided for installing the compiler, executing it, and providing the necessary implementation environment. Complete source is provided for a practical example of a simple protocol simulation, and the report describes this example in some detail.

707,256
PB87-172235 PC **A16**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
OMNITAB 80: An Interpretive System for Statistical and Numerical Data Analysis.
Final rept.,
S. T. Peavy, S. G. Bremer, R. N. Varner, and D. Hogben. Nov 86, 357p NBS/SP-701
Supersedes PB82-136474. Also available from Supt. of Docs as SN003-003-02775-8. Library of Congress catalog card no. 86-600589.

Keywords: *Computer programming, *Statistical analysis, *Numerical analysis, *Probability theory, Programming languages, Bessel functions, Matrices(Mathematics), Least squares method, Plotting, *OMNITAB 80 system, Computer software, Portability.

OMNITAB 80 is a highly integrated general purpose programming language and statistical software computing system. The system enables the user to use a digital computer to perform statistical and numerical data analysis without having any prior knowledge of computers or programming languages. The system responds to simple instructions to obtain accurate results since reliable, varied and sophisticated algorithms for data analysis and manipulation are referenced. It may be used either interactively or in batch mode. OMNITAB 80 has been installed nationally and internationally. OMNITAB has been completely written to make it as machine independent as possible. The document describes Version 6.0. Details are presented so that the user can easily find the specific information needed in any particular instance. Part A is a simple compact introduction to OMNITAB. Part B describes the general and special features of the OMNITAB system. Part C gives explanations, with short examples, for the use of specific instructions. Part D is a complete alphabetical list of the instructions which are in the system.

707,257
PB87-173910 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
OED: Object-Oriented Editor,
J. C. Boudreaux. Mar 87, 19p NBSIR-87/3530

Keywords: *Editing, *Object programs, *Editing routines, *FranzLISP programming language, *LISP programming language.

In the paper an object-oriented editor, called OED, is defined in the FranzLISP programming language. Though editors are usually associated with sets of functions to manipulate textfiles, in the work the term is being used to characterize a family of LISP functions which create and modify formal representations of objects in AMPLE/Core.

707,258
PB87-193603 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Achieving Hash Table Searchers in One or Two Bucket Probes.
Final rept.,
G. Lyon. 1985, 6p
Pub. in Computer Jnl. 28, n3 p313-318 1985.

Keywords: Addressing, Tables(Data), Searching, Reprints, *Sorting, *Computer files, *File maintenance, *File management systems.

No abstract available.

707,259
PB87-195277 PC **A13**/MF **A01**
National Bureau of Standards (ICST), Gaithersburg, MD.
Workshop on Factory Communications, March 17-18, 1987,
R. Rosenthal. Mar 87, 282p NBSIR-87/3516
Sponsored by Institute of Electrical and Electronics Engineers, Inc., Washington, DC.

Keywords: *Computer systems programs, *Industrial engineering, *Information systems, *Networks, Automation, Computerized simulation, Design, Manufacturing, Factories, Computer networks, Communication networks, Computer aided manufacturing, Computerized control systems.

The workshop proceedings report recent efforts of government, industrial, and academic researchers in factory communication networks. Four major research areas are addressed: the application of manufacturing automation protocols (MAP) in factory networks, the application of non-MAP protocols, design and simulation tools and analytic and simulation modeling.

707,260
PB87-210332 PC **A04**/MF **A01**
National Bureau of Standards (ICST), Gaithersburg, MD. Center for Programming Science and Technology.
Application Software Prototyping and Fourth Generation Languages.
Special pub. (Final),
G. E. Fisher. May 87, 69p NBS/SP-500/148
Also available from Supt. of Docs as SN003-003-02797-9. Library of Congress catalog card no. 87-619824.

Keywords: Productivity, Specifications, Prototypes, *Applications programs(Computers), *Software engineering, *Computer software, *Fourth generation programming language, *4GL programming language, Life cycle costs.

The report describes a methodology for developing software requirements and specifications using Fourth Generation Languages (4GLs) and application prototyping. Various prototyping methodologies are reviewed, and general prototyping strategies and factors are discussed. The report describes the advantages and disadvantages of application prototyping, and develops techniques for implementing a software development model that incorporates prototypes based on the capabilities of 4GLs. The phases, processes, and deliverables are described for each event in the development cycle. An appendix contains a tutorial example to illustrate the methodology proposed.

707,261
PB87-218269 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Editor for Program Design.
Final rept.,
M. V. Zelkowitz. 1987, 5p
Contracts F49620-85-K-0008, N000014-85-K-0633
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Compcon Spring 87, San Francisco, CA., February 23-27, 1987, p242-246.

Keywords: *Editing, Design, Environments, *Artificial intelligence, Program generation, Syntax.

An integrated environment for creating program designs is being built at the University of Maryland. The editor is based on a six-level hierarchy that describes the process of program editing. Three levels describe the current set of available text editors that are used to build program text, while levels four through six raise the language level available to the programmer to that of a design language. Many programming tools such as macro processing, templates and some fourth generation language features are contained within this hierarchy. The role of artificial intelligence applications for program design is also being investigated. The result is a system that allows for the easy merging of design and code into one document.

707,262
PB87-225439 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.

Multiple Programs in One UNIX Process.
Final rept.,
D. E. Libes. Aug 87, 7p
Pub. in Login 12, n4 p7-13 Jul-Aug 87.

Keywords: *Operating systems(Computers), *Multiprocessing, Reprints, *XINU operating system, *UNIX operating system, *Interprocessor communication, Global.

A small operating system (XINU) was ported to UNIX 4.2BSD. The entire operating system runs as a single UNIX process. The code is approximately 1000 lines of C (including comments) and 6 lines of assembler. All of the code is user-level, and thus presents a system easy to examine, understand, and experiment with further. The code has been used as a base for an application of several cooperating processes communicating through global variables. Alternatively, the system provides semaphores and messages for interprocess communication.

707,263

PB87-233581 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Note on Real Time Parametric Cubic Segment Curve Generation.
Final rept.,
M. Roche, and W. X. Li. 1987, 7p
Pub. in Intelligent Instruments and Computers 5, n7 p168-174 Jul 87.

Keywords: *Computer graphics, Arrays, Curves(Geometry), Interpolation, Reprints, Real time.

As coordinate values are determined, the authors wish to add them to an array and apply an interpolation procedure to the new coordinate values of the array. That is, as the sequence is being increased, it will be interpolated by a cubic fit. The authors will exhibit two procedures which limit the cubic construction to be one segment behind the last segment of the sequence. That is the input coordinate values are not the end points for the cubic segment being constructed. Another procedure will include this last input coordinate value as end coordinate values for this last cubic segment being generated. The method of parabolic blending for the curve and surface interpolation originally conceived by A. W. Overhauser (1) is applied as well as two procedures employing three points and one vector. As will-be seen, these methods lend themselves to real time curve generation.

707,264

PB88-108667 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Tutorial on Programming in LEMM and MACFOR,
D. F. Redmiles. Jul 87, 47p NBSIR-87/3622

Keywords: *Computer programming, *Programming, *Fortran 77 programming language, *Software libraries, *Data structures, Relational data bases, LISP programming language, LEMM system, MACFOR system, User manuals(Computer programs).

Two FORTRAN 77 libraries called LEMM and MACFOR are described. These libraries were implemented to enable FORTRAN programmers to use list and structure oriented data types like those available in LISP and Pascal. The LEMM library combines ideas from the LISP programming language and the relational database model to provide a structured data type for representing and storing data. The MACFOR library implements many of the functions of the LISP programming language within FORTRAN and supports the implementation of the LEMM subroutines. The two libraries are intended to be used together and their expositions here are interposed with emphasis placed on using LEMM. However, the MACFOR library can be used independently, especially by programmers familiar with LISP. The LEMM and MACFOR libraries codify popular and proven concepts in data representation. Many programming examples are provided to make the use of these libraries understandable and applicable in the field.

707,265

PB88-109848 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Annotated Bibliography on Reliable System Design,
W. McCoy, K. Roessing, and M. Ruhl. May 87, 116p NBSIR-87/3559

Keywords: *Reliability(Electronics), Systems design, *Distributed computer systems, *Fault tolerant computing, *Bibliography, Software tools.

The difficulty in assuring some level of fault-tolerance, reliability, safety availability or survivability in large, complex distributed system has long been recognized. Techniques are now emerging that try to address the issue in system design, including formal description, design tools, automatic implementation and system simulation. The bibliography contains brief summaries of 350 papers from various computer science and engineering journals, books, dissertations and technical report in the years 1972-1987, on these and related topics.

707,266

PB88-109855 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Interactive Nonlinear Least Squares Program.
Technical note (Final),
C. M. Wolfe, B. W. Rust, J. H. Dunn, and I. E. Brown. Jul 87, 163p NBS/TN-1238
Also available from Supt. of Docs. as SN003-003-02815-1.

Keywords: *Computer programming, *Diagnostic routines, Mathematical models, Nonlinear programming, Least squares method, Linear programming, Fortran, *Software engineering, *INVAR computer program, *Interactive systems, On line systems, Real time systems, NBS Cyber 855 computer, Computer codes.

INVAR is an interactive computer code which uses the Stanford variable-separable nonlinear regression program. VARPRO to solve nonlinear (and linear) least squares problems. The variable-separable feature of VARPRO makes it attractive to users with real-world fitting problems because it iterates only on the parameters which appear nonlinearly in the model. Not only does this simplify the iteratation, but it also means that the user is not required to supply initial estimates for the parameters which appear linearly. INVAR implements VARPRO within an environment providing the user with on-line feedback and the opportunity to make changes, transformations, and corrections in real-time. It provides extensive statistical diagnostics and plots of the results. The report is both a tutorial guide for beginners and a reference manual for experienced users who wish to make changes in the code. It contains three completely solved example problems. Three appendices contain information necessary for making changes in the programs.

707,267

PB88-110036 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Survey of OSI (Open Systems Interconnection) Network Management Standards Activities.
Final rept.,
C. M. Chernick, K. Mills, R. Aronoff, and J. W. Strauch. 17 Jul 87, 58p NBSIR-87/3593
Sponsored by Air Force Unified Local Area Network Architecture Program Office, Hanscom AFB, MA.

Keywords: *Computer networks, *Standards, Management, Protocols, Surveys, Layers, Security, *OSI computer network, *OSI systems, *Open systems interconnections, Interconnections, Configuration management, Fault tolerant computing, Commercial sector.

The paper surveys the status of OSI network management activities. The executive summary projects future availability of standards and commercial products for the management of OSI systems. Several major problems remaining to be solved by the standards community, are discussed. The paper reviews the characteristics and capabilities of the specific management areas described in the ISO management framework model. These management areas include: Configuration and Name Management; Security Management; Performance Management; Fault Management; and Accounting Management. The Common Management Information Service (CMIS) and Common Management Information Protocol (CMIP) and their capabilities are reviewed A bibliography of relevant standards papers relating to OSI Network Management, as of March, 1987, is provided.

707,268

PB88-123799 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Automation Sensors Group.
Guide on Data Entity Naming Conventions.
Special pub. (Final),
J. J. Newton. Oct 87, 61p NBS/SP-500/149
Also available from Supt. of Docs. as SN003-003-02818-5. Library of Congress catalog card no. 87-619867.

Keywords: *Naming, *Data dictionaries, *Data base management, Data bases, Data structures, Data base administrator.

A coherent set of naming conventions for data entities is crucial to the central management of data. Name content and format must be designed to maximize the information content and relationship to the logical structure of the data. The report discusses the development and administration of naming conventions for data entities. The Information Resource Dictionary System (IRDS) meta-name schema provides a framework for name development. The report describes a methodology for deriving a relationship between an entity's dictionary names and details a method for structuring the format and content of entity names which maximizes opportunities for analysis and sharing of data.

707,269

PB88-124177 CP **T11**
National Bureau of Standards (ICST), Gaithersburg, MD.
NBS (National Bureau of Standards) Prototype Compiler for Estelle.
Software,
B. Strausser, and J. Linn. Oct 87, mag tape NBS/SW/MT-88/001
Supersedes PB87-171880.
Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation PB88-124185, and PB88-124193.

Keywords: *Software, Hierarchies, Protocols, Prototypes, Specifications, *Estelle system, *Open systems interconnections, *Compilers, *Computer communications, National Bureau of Standards, L=C; YACC; LEX, H=VAX-11/780.

Estelle is a formal description technique for computer communication protocols being developed in the International Standards Organization (ISO) for specifying Open Systems Interconnection (OSI) protocols. It models protocols as extended finite state machines called modules, arranged in a dynamic hierarchy. Modules communicate by exchanging interactions at named interaction points. The prototype compiler translates an Estelle formal description into declarations in the C language of data structures and procedures. The code must be augmented with a library of run-time functions (supplied with the compiler) and certain implementation-dependent functions (written by the user based on supplied examples). From these elements, an executable program can be produced to realize the behavior of the formal description. Because the compiler is an early prototype, it may not be appropriate for some situations. However, it should be a useful tool for suitable users with detailed knowledge of Estelle and a willingness to deal with compiler internals when necessary.

707,270

PB88-124193 PC **A04**/MF **A01**
National Bureau of Standards (ICST), Gaithersburg, MD.
Internals Guide for the NBS (National Bureau of Standards) Prototype Compiler for Estelle.
Final rept.,
R. J. Linn. Sep 87, 55p ICST/SNA-87/4, NBS/SW/MT-88/001B
For system on magnetic tape, see PB88-124177.

Keywords: Simulation, Protocols, Prototypes, Documentation, *Estelle system, *Compilers, *Subroutine libraries(Computers), National Bureau of Standards.

The document describes the theory of operation and some of the internal details of the compiler. It may be of interest to someone considering modifications to the compiler.

Computer Software

707,271
PB88-138961 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Recovering Files from a Damaged Files-11 Disk.
Final rept.,
J. Levine. 1985, 12p
Pub. in RSX Multi-Tasker, p19-30 Jul 85.

Keywords: *Magnetic disks, Recovery, Reprints, *File maintenance, *Disk recording systems, *Computer files.

A Method for recovering files from a disk which has been damaged by a hardware malfunction is described. The method will work on any disk that is in Files-11 format, such as is written by the RSX11M operating system.

707,272
PB88-152426 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Building and Sustaining Software Maintainability.
Final rept.,
W. M. Osborne. 1987, 11p
Pub. in Proceedings of the Conference on Software Maintenance, Austin, TX., September 21-24, 1987, p13-23.

Keywords: Maintenance, Quality control, *Computer software maintenance, *Software quality control, Computer software, Life cycles.

The paper provides an overview of the current techniques used for achieving and sustaining maintainable software. Strategies for improving software quality and maintainability throughout the software lifecycle are presented.

707,273
PB88-152434 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Source Code Analyzer for Maintenance.
Final rept.,
D. R. Kuhn. 1987, 5p
Pub. in Proceedings of the Conference on Software Maintenance, Austin, TX., September 21-24, 1987, p176-180.

Keywords: Maintenance, Analyzers, Source programs, *Computer program maintenance, *Data dictionaries, *Software tools, *Software engineering, C programming language, Public domain, Computer software.

The paper describes a tool that reads all C source files in a directory and produces information useful for program maintenance. The tool generates a call tree, a call matrix, and the transitive closure of the matrix, which shows indirect relationships between routines. It computes some measures that may help estimate the complexity of the program being maintained, and also identifies subsystems (possibly nested) within the program. The paper describes the information provided and shows how it saves time in understanding the program to be modified, estimating the complexity of the change, and performing regression testing on the modified program. The tool is in the public domain and will be available through the National Technical Information Service (NTIS).

707,274
PB88-152442 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Simple Tools to Automate Documentation.
Final rept.,
D. R. Kuhn, and C. G. Hollis. 1985, 8p
Pub. in Proceedings of the Conference on Software Maintenance, Washington, DC., November 11-13, 1985, p203-210.

Keywords: Automation, *Computer program documentation, *Software tools, On line systems, Computer software maintenance, Cost.

Automated documentation normally requires complex and expensive software. The paper describes how detailed documentation can be extracted from source code using simple programs and standard utilities. The ability to extract such information is a by-product of a methodology designed to reduce the complexity of data-driven systems. Almost all documentation can be regenerated as needed, instead of storing extensive and often obsolete material. The authors experience with the method indicates that it is valuable for use in on-line system maintenance and documentation, and as an inexpensive alternative to the large-scale software development environment. The paper gives examples and describes the method in sufficient detail to allow those interested to adapt these techniques to their own environment.

707,275
PB88-152459 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Validation, Verification, and Testing of Software: An Enhancement to Software Maintainability.
Final rept.,
D. R. Wallace. 1985, 10p
See also PB81-167074.
Pub. in Proceedings of the Conference on Software Maintenance, Washington, DC., November 11-13, 1985, p69-78.

Keywords: *Computer programming, Verifying, Proving, Quality assurance, Validity, *Software engineering, Information validation.

The proliferation of software and the increasing complexity of software systems increase the need for software maintenance and the importance of software maintainability. An integrated validation, verification, and testing (VV and T) program for software is essential to achieving improved software maintenance and maintainability. The paper addresses early planning for VV and T, issues in selecting standards and analytic techniques for use throughout the software lifecycle, and finally the benefits derived from VV and T to both software maintenance and software maintainability.

707,276
PB88-152657 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Information Systems Engineering Div.
Data Element Standards: Communication Standards for End Users.
Final rept.,
R. G. Saltman. 1986, 4p
Pub. in Proceedings of the Computer Standards Conference Striking a Balance between Technology, Economics, Politics, and Reality--For Substance, Not Form, San Francisco, CA., May 13-15, 1986, p34-37.

Keywords: Computer networks, Standards, *Information management, *Data elements, *Data transfer(Computers), End use, Costs.

Data element standards are a type of communication standard, as their function is to maximize the ease of data interchange among data systems. A new way of defining the concept of data element and related terms contributes to the view of a data element as a communications channel. Data element standards reduce data collection costs, and improve the consistency of data derived from different sources. The latter is essential for effective organizational decision making. Data element standards are an essential component of information management. Important tasks in data element standardization are the specification of data types and naming conventions, the selection of organizational data elements, and the assignment of maintenance responsibilities. Decision making in data element standardization must include organizational as well as technical considerations.

707,277
PB88-153663 PC **A12**/MF **A01**
National Bureau of Standards (ICST), Gaithersburg, MD.
Draft Stable Implementation Agreements for Open Systems Interconnection Protocols. NBS (National Bureau of Standards) Workshop for Implementors of Open Systems Interconnection. Version 1, Edition 0,
R. Rosenthal. Oct 87, 253p NBSIR-87/3674

Keywords: *Computer networks, Standards, Tests, Protocols, Agreements, Meetings, *Open systems interconnections, OSI, Local area networks, Draft.

The document records current Draft Stable Agreements for Open System Interconnection Protocols among the organizations participating in the NBS/OSI Workshop Series for Implementors of OSI Protocols. This document is updated after each workshop (every 4 months).

707,278
PB88-153713 PC **A08**/MF **A01**
National Bureau of Standards (ICST), Gaithersburg, MD.
Ongoing Implementation Agreements for Open Systems Interconnection Protocols. NBS (National Bureau of Standards) Workshop for Implementors of Open Systems Interconnection,
R. Rosenthal. Oct 87, 162p NBSIR-86/3385/7

Keywords: *Computer networks, Tests, Protocols, Implementation, Standards, Meetings, Agreements, *Foreign technology, *Open systems interconnections, *Local area networks, OSI.

The document records current agreements on implementation details of Open System Interconnection Protocols among the organizations participating in the NBS/OSI Workshop Series for Implementors of OSI Protocols. These decisions are documented to facilitate organizations in their understanding of the status of agreements. This is a standing document that is updated after each workshop (every four months).

Control Systems & Control Theory

707,279
PB83-137059 PC **A03**/MF **A01**
Bolt Beranek and Newman, Inc., Cambridge, MA.
Heirarchical Control System Emulation: Programmmer's Manual.
Final rept. Nov 81-Oct 82.
S. D. Milligan, and T. L. Johnson. Oct 82, 40p NBS-GCR-82-414

Keywords: *Control equipment, *Programming manuals, Computer systems hardware, Production control, Computer programming, Industrial plants, *Computer aided design, Computer aided manufacturing, PRAXIS programming language, VAXX-11/780 computers.

The Hierarchical Control System Emulation is a collection of computer programs written in the high-level Praxis language which allow the user to write, debug, and concurrently emulate modules of a hierarchical control system and to simulate the physical plant which is being controlled. The emulation executes in real time, and interactive display and data logging facilities are included. It is intended as a computer-aided design tool for the NBS Automated Manufacturing Research Facility shop floor control system.

707,280
PB83-141952 PC **A07**/MF **A01**
Bolt Beranek and Newman, Inc., Cambridge, MA.
Hierarchical Control System Emulation: User's Manual.
Final rept. Nov 81-Oct 82.
T. L. Johnson, S. D. Milligan, and T. E. Fortmann.
Oct 82, 131p NBS-GCR-82-413
Contract NB81-SBCA-0826

Keywords: *Control equipment, *Programming manuals, Computer systems hardware, Production control, Computer programming, Industrial plants, *Computer aided design, *User manuals(Computer programs), Computer aided manufacturing, VAX-11/780 computers, PRAXIS programming language.

The Hierarchical Control System Emulation is a collection of computer programs written in the high-level Praxis language for use on a Digital Equipment Company VAX 11/780 processor under the VMS operating system. These programs allow the user to write, debug, and concurrently emulate modules of a hierarchical control system and to simulate the physical plant which is controlled. The emulation executes in real time and interactive display and data logging capabilities are included. The emulation is intended as a computer-aided control system design tool for the NBS Automated Manufacturing Research Facility. The User's Manual describes the use of the emulation and provides necessary theoretical background; it is not application-specific.

707,281
PB85-100147 Not available NTIS
National Bureau of Standards, Washington, DC.

Theory and Practice of Hierarchical Control.
Final rept.
J. S. Albus, A. J. Barbera, and R. N. Nagel. 1981, 22p
Sponsored in part by American Federation of Information Processing Societies, Arlington, VA.
Pub. in Proceedings of IEEE Computer Soc. Int. Conf. (23rd), Productivity - An Urgent Priority Held at Washington, DC. on September 15-17, 1981, p18-39.

Keywords: *Control theory, *Robots, *Automatic control, Microcomputers, *Hierarchical control.

A theory of hierarchical control is presented incorporating three parallel interconnected hierarchies. The first is a behavior-generating hierarchy which decomposes tasks into subtasks in the context of sensory information. The second is a sensory-processing hierarchy which extracts the information needed for goal seeking behavior. The third is a world-model hierarchy which generates expectations and predictions for the sensory-processing modules at each level. A robot control and vision systems is described that implements the triple hierarchy model in a microcomputer network. A possible application of the theory to an automatic factory control system is outlined.

707,282
PB85-151801 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Language Independent Superstructure for Implementing Real-Time Control Systems.
Final rept.
A. J. Barbera, M. L. Fitzgerald, J. S. Albus, and L. S. Haynes. 1984, 12p
Sponsored by Maryland Univ., College Park.
Pub. in Proceedings of Workshop on High-Level Computer Architecture, Los Angeles, CA., May 21-25, 1984, p7.28--7.39.

Keywords: Robots, *Control systems, Computer software, Software tools, Real time, Computerized control systems.

It is the purpose of the system superstructure described in this paper to create an environment that eases the user's development of software. Techniques and software tools are described that help organize a system into a very structured and modular framework that is conducive to interfacing, upgrading, partitioning onto multiple computer systems, and debugging. A system dictionary is described that, together with the modular superstructure, allows the creation of a highly interactive environment where single programs or any level of aggregation of programs can be executed and where any variable or aggregation of variables can be examined, traced, displayed, or modified.

707,283
PB85-233823 CP **T03**
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Hierarchical Control System Emulator Version 3.1.
Model-Simulation.
C. Furlani. Jul 85, mag tape NBS/SW/MT-85/003
Supersedes PB85-152759.
Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. NTIS Computer Products if you have questions. Price includes documentation, PB85-233849, PB85-233831, and PB83-175075.

Keywords: *Models-simulation, *Control simulation, *Automatic control, Computerized simulation, Magnetic tapes, Real time operations, Industrial plants, Production control, Automation, Fortran, *Hierarchical control, Emulators(Computers), *Control systems, *Computerized control systems, *Computer aided design, Computer aided manufacturing, Praxis programming language, VAX-11/780 computers.

The Hierarchial Control System Emulator is a collection of computer programs written in the high-level Praxis language for use on a Digital Equipment Company VAX 11/780(TM) processor under the VMS(TM) operating system. The programs allow the user to write, debug, and concurrently emulate modules of a hierarchical control system and to simulate the physical plant which is controlled. The emulation executes in real time and interactive display and data logging capabilities are included. The emulator is currently implemented at the NBS Automated Manufacturing Research Facility as a computer-aided control system design tool. The magnetic tape contains a copy of version 3.1 of the entire HCSE software package. In addition, the tape is accompanied by an instruction sheet which describes the procedure for transferring the HCSE from magnetic tape to a VAX/VMS system. Software Description: The Model is written in the FORTRAN programming language for implementation on a Digital Vax-11/780 computer using the Vax/VMS V.3.7 operating system.

707,284
PB85-233831 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Hierarchical Control System Emulation Programmer's Manual.
C. M. Furlani. Jan 85, 48p NBSIR-85/3157, NBS/SW/MT-85/003B
Supersedes PB83-137059. For system on magnetic tape, see PB85-233823.

Keywords: *Control simulation, *Automatic control, Programming manuals, Computerized simulation, Real time operations, Industrial plants, Production control, Automation, Fortran, *Hierarchical control, *Control systems, *Computerized control systems, *Computer aided design, Computer aided manufacturing, Emulators(Computers), VAX-11/780 computers, Praxis programming language.

The Hierarchical Control System Emulation is a collection of computer programs written in the high-level Praxis language for use on a Digital Equipment Company VAX 11/780(TM) processor under the VMS(TM) operating system. The programs allow the user to write, debug, and concurrently emulate modules of a hierarchical control system and to simulate the physical plant which is controlled. The emulation executes in real time and interactive display and data logging capabilities are included. The emulation is intended as a computer-aided control system design tool for the NBS Automated Manufacturing Research Facility. The Programmer's Manual provides documentation of the design of the emulation code and the emulation programs themselves; it is intended for the system programmer rather than the user.

707,285
PB85-233849 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Hierarchical Control System Emulation User's Manual.
C. M. Furlani. Jan 85, 136p NBSIR-85/3156, NBS/SW/MT-85/003A
Supersedes PB83-141952. For system on magnetic tape, see PB85-233823.

Keywords: *Control simulation, *Automatic control, Computerized simulation, Real time operations, Industrial plants, Production control, Automation, Fortran, *Hierarchical control, *Control systems, *Computerized control systems, *Computer aided design, Computer aided manufacturing, Emulators(Computers), Praxis programming language, User manuals.

The Hierarchical Control System Emulation is a collection of computer programs written in the high-level Praxis language for use on a Digital Equipment Company VAX 11/780(TM) processor under the VMS(TM) operating system. The programs allow the user to write, debug, and concurrently emulate modules of a hierarchical control system and to simulate the physical plant which is controlled. The emulation executes in real time and interactive display and data logging capabilities are included. The emulation is intended as a computer-aided control system design tool for the NBS Automated Manufacturing Research Facility. The User's Manual describes the use of the emulation and provides necessary theoretical background; it is not application-specific.

707,286
PB86-196268 CP **T03**
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Hierarchical Control System Emulator Version 3.2.
Model.
C. Furlani. Apr 86, mag tape NBS/SW/MT-86/006
Supersedes PB85-233823.
Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation, PB85-233849, PB85-233831 and PB83-175075.

Keywords: *Models-simulation, *Control simulation, *Automatic control, Computerized simulation, Magnetic tapes, Real time operations, Industrial plants, Production control, Automation, Fortran, *Hierarchical control, *Control systems, *Computerized control systems, *Computer aided design, Computer aided manufacturing, Emulators(Computers), Praxis programming language, VAX-11/780 computers.

The Hierarchical Control System Emulator is a collection of computer programs written in the high-level Praxis language for use on a Digital Equipment Company VAX/780 processor under the VMS operating system. These programs allow the user to write, debug, and concurrently emulate modules of a hierarchical control system and to simulate the physical plant which is controlled. The emulation executes in real time and interactive display and data logging capabilities are included. The emulator is currently implemented at the NBS Automated Manufacturing Research Facility as a computer-aided control system design tool. The magnetic tape contains a copy of version 3.2 of the entire HCSE software package. In addition, the tape is accompanied by an instruction sheet which describes the procedure for transferring the HCSE from magnetic tape to a VAX/VMS system...Software Description: The model is written in the FORTRAN programming language for implementation a Digital VAX-11/780 computer using the VAX/VMS operating system.

Information Processing Standards

707,287
FIPS PUB 1-1 PC **A03**
National Bureau of Standards, Washington, DC.
Code for Information Interchange. Category: Hardware and Software Standard. Subcategory: Interchange Codes, Media, and Data Files.
Federal information processing standards.
J. L Little. c1977, 27p
Supersedes FIPS-PUB-1.
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Coding, National government, Standards, Information systems, Data processing, *Federal information processing standards, *Computer codes, Information transfer, Communication networks, NTIS-COMNBS.

The publication provides a standard code and character set for use in Federal information processing systems, communications systems, and associated equipment. It also provides a standard collating sequence. This Federal Information Processing Standard adopts in whole the American National Standard Code for Information Interchange (ASCII) X3.4-1977, a fundamental standard upon which many other standards are based. Twenty-six related standards are listed. (Copyright (c) 1977 by American National Standards Institute, Inc.)

707,288
FIPS PUB 1-2 PC**$20.40**
National Bureau of Standards, Gaithersburg, MD.
Code for Information Interchange, Its Representations, Subsets, and Extensions.
Final rept.
J. L. Little. c1984, 93p
Supersedes FIPS PUB 1-1.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Coding, Standards, Information systems, Data processing, Computer systems hardware, National government, *Federal information processing standards, *Information interchange, Software, Communication networks, Data systems, Computer codes, Data file.

The publication provides a standard coded character set and a recommended collating sequence, subsets, extensions, and certain graphic representations for the set, all for use in Federal information processing systems, communications systems, and related equipment, that are procured by the Federal Government. This Federal Information Processing Standard adopts in whole three voluntary industry standards: a. American National Standard X3.4-1977, Code for Informa-

tion Interchange (ASCII). b. American National Standard X3.32-1973, Graphic Representation of the Control Characters of American National Standard Code for Information Interchange. c. American National Standard X3.41-1974, Code Extension Techniques for Use with the 7-Bit Coded Character Set of American National Standard Code for Information Interchange. Twenty-seven other related international, national, and Federal standards are also listed.

707,289
FIPS-PUB-10-2 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Federal Information Processing Standards Publication: Countries, Dependencies, and Areas of Special Sovereignty.
Federal information processing standards.
15 Jun 74, 33p
Supersedes FIPS-PUB-10-1. Also available in 3 ring vinyl FIPS binder, $6.25 North American Continent price; all others write for quote.

Keywords: *Data processing, *Standards, Identifying, Coding, Geography, Data elements, *Countries, *Federal information processing standards.

This publication provides a list of geographical-political entities of the world and associated standard codes. These entities include independent states, dependent areas, areas of quasi-independence, noncontiguous territories, possessions without population, areas with special sovereignty associations, areas without sovereignty, political regimes not recognized by the United States, and outlying areas of the United States.

707,290
FIPS PUB 100 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Interface between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Operation with Packet-Switched Data Communications Networks. Category: Hardware Standard. Subcategory: Data Transmission.
Federal information processing standards (Final).
M. Wong. 6 Jul 83, 18p FEDSTD-1041
Sponsored in part by General Services Administration, Washington, DC.

Keywords: *Computer networks, *Data processing terminals, Telecommunication, *Interfaces, *Federal information processing standards, *Communication networks, Communication terminals, X-25 protocol, Packet switching.

This joint Federal Information Processing Standard (FIPS) and Federal (Telecommunication) Standard (FED-STD) specifies the means of interfacing automated data processing (ADP) equipment and services, as well as telecommunication system terminal equipment, with packet-switched data communication networks. It is based on Recommendation X.25 which was developed and approved by the International Telegraph and Telephone Consultative Committee (CCITT) of the International Telecommunications Union (ITU). Recommendation X.25 contains a large number of options and implementation alternatives, which if exercised in different ways would impede the interoperability of equipment and services. This joint standard limits these options and alternatives in order to satisfy the vast majority of Federal user requirements for interconnections with packet-switched data communications networks.

707,291
FIPS PUB 101 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Guideline for Lifecycle Validation, Verification, and Testing of Computer Software. Category: Software. Subcategory: Validation, Verification, and Testing.
Federal information processing standards (Final).
D. R. Wallace. 6 Jun 83, 42p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Computer programming, *Standards, *Guidelines, National government, *Federal Information Processing Standards, *Computer software tools, *Computer software validation, Computer software verification, Automatic programming, Life cycle.

The Guideline is intended for those who direct or implement software development projects. It recommends that validation, verification, and testing (VV&T) be performed throughout the software development lifecycle, and presents information on selection and use of such techniques to meet project requirements. The Guideline also explains how to develop a VV&T plan to fulfill a specific project's VV&T requirements.

707,292
FIPS PUB 104-1 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
American National Standard Codes for the Representation of Names of Countries, Dependencies, and Areas of Special Sovereignty for Information Interchange. Category: Data Standards and Guidelines. Subcategory: Representations and Codes.
Federal information processing standards (Final).
R. G. Saltman. 12 May 86, 25p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote

Keywords: *Geography, *Standards, Information, Exchanging, Data, Dependence, *Federal information processing standards, Nations, Sovereignty, Alphanumeric data, Codes, Information processing.

The Federal Program Standard implements American National Standard ANSI Z39.27-1984, Structure for the Representation of Names of Countries, Dependencies, and Areas of Special Sovereignty for Information Interchange. ANSI Z39.27 adopts, with qualifications, the entities, names, and codes prescribed by ISO 3166-1981, Codes for the Representation of Names of Countries, a standard of the International Organization for Standardization (ISO). The qualifications provide for coverage of the total land area of the earth without overlap or duplication, and provide for entity names that, to the maximum extent possible, are approved or accepted by the U.S. Board on Geographic Names. Both two-character and three-character alphabetic codes are provided for each entity adopted from ISO 3166-1981. The two-character codes are adopted as the Federal Program Standard and they are recommended by ISO for international interchange. The three-character codes are available for special applications when their use would provide a particular advantage.

707,293
FIPS PUB 106 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Guideline on Software Maintenance. Category: Software. Subcategory: Software Maintenance.
Federal information processing standards.
R. Martin, and W. Osborne. 15 Jun 84, 25p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: Computer systems programs, Standards, Policies, *Federal Information Processing Standards, *Computer software maintenance, Software engineering, Software tools, Software lifecycle, Guidelines.

The need for a strong, disciplined, clearly-defined approach to software maintenance is presented. Emphasis is placed on the maintainability of the software and the need for consideration of software maintenance throughout the lifecycle of a software system. The need to plan, develop, use, and maintain a software system with future software maintenance in mind is stressed. The conclusion is drawn that improvements in an organization's software maintenance efforts will come primarily as a result of the institution and enforcement of software maintenance policies, standards, procedures, and techniques.

707,294
FIPS PUB 108 PC **A02**
National Bureau of Standards, Gaithersburg, MD.
Alphanumeric Computer Output Microform Quality Test Slide. Category: Hardware Standard. Subcategory: Media.
Federal information processing standards (Final).
T. C. Bagg. c1983, 13p
See also FIPS PUB 82. Prepared in cooperation with Association for Information and Image Management, Silver Spring, MD.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Microfilm, National government, Standards, Reprography, Data storage devices, Micrography, Inspection, Quality control, *Federal information processing standards, *Computer output microfilm, Alphanumeric data.

This FIPS PUB announces the adoption of the Association for Information and Image Management Standard for Alphanumeric COM Quality Test Slide, AIIM MS28-1983, as a Federal standard. This standard is a companion to FIPS PUB 82, Guideline for Inspection and Quality Control for Alphanumeric Computer-Output Microforms. This standard provides detailed information for the preparation of a test form slide to ensure the generation of quality microforms by computers.

707,295
FIPS PUB 109 PC **E08**
National Bureau of Standards, Gaithersburg, MD.
Pascal Computer Programming Language. Category: Software Standard. Subcategory: Programming Language.
Federal information processing standards (Final).
M. V. Vickers. c1985, 133p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Programming languages, Standards, *PASCAL programming language, *Federal information processing standards, Computer software, Computer program portability.

The publication announces the adoption of American National Standard Pascal Computer Programming Language, ANSI/IEEE770X3.97-1983, as a Federal Information Processing Standard (FIPS). The American National Standard Pascal, ANSI/IEEE770X3.97-1983, specifies the form and establishes the interpretation of programs expressed in the Pascal programming language. The purpose of the standard is to promote portability of Pascal programs for use on a variety of data processing systems. The standard is used by implementors as the reference authority in developing compilers, interpreters, or other forms of high level language processors; and by other computer professionals who need to know the precise syntactic and semantic rules of the standard. (Copyright (c) 1983, American National Standards Institute, Inc., and Institute of Electrical and Electronics Engineers, Inc.)

707,296
FIPS PUB 110 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Guideline for Choosing a Data Management Approach. Category: Software. Subcategory: Data Management Applications.
Federal information processing standards (Final).
J. C. Collica. 11 Dec 84, 31p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Data processing, Decision making, Guidelines, *Federal information processing standards, *Data management, Data management systems, Data base management systems, File management systems.

This Guideline assists the Federal data processing manager in the identification and selection of a data management approach appropriate to organizational requirements. In this Guideline is a framework for comparing and selecting alternative data management approaches. The emphasis is on pragmatic guidance that captures the principal, relevant decision factors.

707,297
FIPS PUB 111 PC **A03**
National Bureau of Standards, Gaithersburg, MD.
Storage Module Interfaces (with Extensions for Enhanced Storage Module Interfaces). Category: Hardware Standard. Subcategory: Interface.
Federal information processing standards (Final).
W. E. Burr. c1982, 48p
Prepared in cooperation with American National Standards Inst., New York.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Magnetic disks, *Computer storage devices, Specification, Government procurement, *Federal information processing standards, *Disk recording systems, Control units(Computers), Modules(Electronics), Storage module.

The Federal Information Processing Standard (FIPS) specifies the functional, electrical and mechanical properties of a 'device level' interface between a magnetic disk drive and its controller. The Storage Module or 'SMD' interface is very widely used in commerce, and this FIPS may be used to assist procuring agencies in the specification of interchangeable commodity magnetic disk drives and controllers. This FIPS adopts

American National Standard, X3.91M-1982, 'Storage Module Interfaces.'

707,298
FIPS PUB 112 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Password Usage. Category: ADP Operations. Subcategory: Computer Security.
Federal information processing standards (Final).
D. K. Branstad. 30 May 85, 60p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: Data processing, Identification systems, Authentication, Guidelines, *Federal information processing standards, *Computer security, *Data processing security, *Password, Access, Managers.

The document specifies basic security criteria for two different uses of passwords in an ADP system, (1) personal identity authentication and (2) data access authorization. It establishes the basic criteria for the design, implementation and use of a password system in those systems where passwords are used. It identifies fundamental ADP management functions pertaining to passwords and specifies some user actions required to satisfy these functions. In addition, it specifies several technical features which may be implemented in an ADP system in order to support a password system. An implementation schedule is established for compliance with the Standard. Numerous guidelines are provided in the Appendices for managers and users seeking to comply with the Standard.

707,299
FIPS PUB 113 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Computer Data Authentication. Category: ADP Operations. Subcategory: Computer Security.
Federal information processing standards (Final).
M. E. Smid, and D. K. Branstad. 30 May 85, 11p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: Authentication, Standards, *Data integrity, *Data encryption, *Federal Information Processing Standards, Computer codes, Cryptography.

The publication specifies a standard to be used by Federal organizations which require that the integrity of computer data be cryptographically authenticated. In addition, it may be used by any organization whenever cryptographic authentication is desired. Cryptographic authentication of data during transmission between electronic components or while in storage is necessary to maintain the integrity of the information represented by the data. The standard specifies a cryptographic authentication algorithm for use in ADP systems and networks. The authentication algorithm makes use of the Data Encryption Standard (DES) cryptographic algorithm as defined in Federal Information Processing Standard 46 (FIPS PUB 46).

707,300
FIPS PUB 119 PC **E08**
National Bureau of Standards (ICST), Gaithersburg, MD.
Ada. Category: Software Standard. Subcategory: Programming Language.
Federal information processing standards.
M. V. Vickers. 8 Nov 85, 345p
Errata sheet inserted. Prepared in cooperation with American National Standards Inst., New York.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Standards, *Programming languages, Programming manuals, Compilers, Interpreters, *ADA programming languages, *Federal information processing standards, *Computer program portability, High level programming languages.

The publication announces the adoption of American National Standard Reference Manual for the Ada* Programming Language, ANSI/MIL-1815A-1983, as a Federal Information Processing Standard (FIPS). The American National Standard Ada, ANSI/MIL-STD-1815A-1983, specifies the form and meaning of program units written in Ada. The purpose of the standard is to promote portability of Ada programs for use on a variety of data processing systems. The standard is for use by implementors as the reference authority in developing compilers, interpreters, or other forms of high level language processors; and by other computer professionals who need to know the precise syntactic and semantic rules of the standard.

707,301
FIPS PUB 120 PC **E13**
National Bureau of Standards, Gaithersburg, MD.
Graphical Kernel System (GKS). Category: Software Standard. Subcategory: Graphics.
Federal information processing standards (Final).
D. R. Benigni. c1985, 400p
Prepared in cooperation with American National Standards Inst., New York.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Computer graphics, *Federal information processing standards, *Graphical kernel system, *Software tools, *Computer program portability.

The publication announces the adoption of the American National Standard Graphical Kernel System (ANS GKS), ANSI X3.124-1985, as a Federal Information Processing Standard (FIPS). ANS GKS specifies a library (or toolbox package) of subroutines for an application programmer to incorporate within a program in order to produce and manipulate two-dimensional pictures. The purpose of the standard is to promote portability of graphics application programs between different installations. The standard is for use by implementors as the reference authority in developing graphics software systems; and by other computer professionals who need to know the precise syntactic and semantic rules of the standard.

707,302
FIPS PUB 121 PC **E06**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Videotex/Teletext Presentation Level Protocol Syntax (North American PLPS). Category: Hardware and Software Standard. Subcategory: Interchange Codes.
Federal information processing standards (Final).
J. L. Little. c1983, 181p
Prepared in cooperation with American National Standards Inst., New York.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Television systems, Standards, *Federal information processing standards, *Open systems interconnections, *Video networks, Presentation layer protocols.

The standard describes the formats, rules, and procedures for the encoding of alphanumeric text and pictorial information for videotex and teletext applications. It is based upon the architecture defined in the multi-layered reference model of open systems interconnection (OSI), under development by the ISO, and defines a specific data syntax for use by OSI presentation layer protocols and some specific semantics for use at the application layer. Based upon ASCII and its extensions (as specified in FIPS 1-2), it adopts the whole American National Standard X3.110-1983/Canadian Standard T500-1983, Videotex/Teletext Presentation Level Protocol Syntax (North American PLPS). It is intended to be used in Federal information processing systems, communications systems, and associated videotex/teletext equipment.

707,303
FIPS PUB 122 PC **E05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Conformance Tests for FIPS PUB 100/FED-STD 1041 Version of CCITT 1980 Recommendation X.25, Interface between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Operation with Packet-Switched Data Communications Networks. Category: Conformance Tests.
Final rept.
M. K. Wong. 28 May 86, 211p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Interfaces, *Data processing terminals, Computer networks, Telecommunication, *Federal information processing standards, *Communication networks, X-25 protocol, Packet switching, Communication terminals.

The document describes a set of verification tests designed by the Institute for Computer Sciences and Technology (ICST) at the National Bureau of Standards (NBS) to evaluate the conformance to the joint Federal Information Processing Standard Publication 100 (FIPS PUB 100)/Federal Standard 1041 (FED-STD 1041) for the interface to an X.25 packet switched network. A fundamental objective of these verification tests is concerned with establishing uniform verification testing and unambiguous evaluation procedures to aid government users in acquiring ADP and telecommunications facilities or services based on the X.25 specifications. These tests are designed for use by vendors and suppliers so as to provide government users with assurance the products they acquire are in conformance with the FIPS PUB 100/FED-STD 1041 specifications and can interwork.

707,304
FIPS PUB 123 PC **E04**
National Bureau of Standards, Gaithersburg, MD.
Specification for a Data Descriptive File for Information Interchange (DDF). Category: Software Standard. Subcategory: Information Interchange.
Federal information processing standards (Final).
J. V. Upperman. 19 Sep 86, 43p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Standards, *Data transmission, *Information systems, Specifications, Computer networks, *Files(Records), *Federal Information Processing Standards, *Data conversion, *Information transfer, Data structures, Formats, Communications networks, Computer software.

The publication announces the adoption of the ANSI/ISO 8211-1985, Specification for a Data Descriptive File for Inforamtion Interchange (DDF), as a Federal Information Processing Standard (FIPS). ANSI/ISO 8211-1985 specifies media-independent and system-independent file and record formats for the interchange of information between computer systems. The standard is intended for use with physical media as well as with communications media in applications where a high volume of data is to be interchanged, rather than for an isolated interchange of a single or small number of resources. The purpose of the standard is to provide a mechanism to allow data structures to be easily transported from one computer system to another computer system, independent of make, with the capability of restructuring the data without loss of who have a need to represent data structures and data definitions in a standard format for information interchange purposes so that the data can be transported from one system to another while maintaining the integrity of the data.

707,305
FIPS PUB 124 PC **A03**/MF **A01**
National Bureau of Standards (ICST), Gaithersburg, MD.
Guideline on Functional Specifications for Database Management Systems. Category: Software. Subcategory: Data Management Applications.
Federal information processing standards (Final),
C. L. Sheppard. 30 Sep 86, 35p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: Specifications, Computer systems hardware, Guidelines, *Data base management systems, *Federal information processing standards, Global, Computer software, Data structures.

The Guideline assists the data processing manager in the specifications of database management functions. In the Guideline is a framework for gathering and incorporating an appropriate set of data management functions into a request for proposals document. The emphasis is on the logical separation of the database management functional specifications, the relationship among the logical categories, and the recommended set of sources.

707,306
FIPS PUB 125 PC **E11**
National Bureau of Standards (ICST), Gaithersburg, MD.
MUMPS. Category: Software Standard. Subcategory: Programming Language.
Federal information processing standards (Final),
M. V. Vickers. c1984, 161p
Prepared in cooperation with American National Standards Inst., New York.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Standards, *Information systems, *Programming languages, *MUMPS programming lan-

guage, *Federal information processing standards, Computer software.

The publication announces the adoption of American National Standard for Information Processing Systems Programming Language MUMPS, ANSI/MDC X11.1-1984, as a Federal Information Processing Standard (FIPS). The American National Standard specifies the form and meaning of program units written in MUMPS. The purpose of the standard is to promote portability of MUMPS programs for use on a variety of data processing systems. The standard is used by implementors as the reference authority in developing language processors; and by other computer professionals who need to know the precise syntactic and semantic rules of the language. (Copyright (c) 1984 by American National Standards Institute, Inc.)

707,307
FIPS PUB 126 PC **E11**
National Bureau of Standards (ICST), Gaithersburg, MD.
Database Language NDL (Network Database Language). Category: Software Standard. Subcategory: Database.
Federal information processing standards (Final), J. Sullivan. c1986, 148p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Programming languages, *Standards, Data processing, Information systems, Programming manuals, *Federal information processing standards, Computer software, NDL.

The publication announces adoption of American National Standard Database Language NDL, ANSI X3.133-1986, as a Federal Information Processing Standard (FIPS). ANSI X3.133-1986, specifies three languages that make up a network model database management system. They are: (a) A schema definition language, for declaring the structures and integrity constraints of a network structured database; (b) A subschema definition language, for declaring a user view of that database; (c) A module language, including NDL statements, for declaring the database procedures and executable statements of a specific database application. The purpose of the standard is to promote portability of database definitions and database application programs between different installations. The standard is used by implementors as the reference authority in developing a network model database management system and standard language interfaces to that database management system; and by other computer professionals who need to know the precise syntactic and semantic rules of the standard.

707,308
FIPS PUB 127 PC **E10**
National Bureau of Standards (ICST), Gaithersburg, MD.
Database Language SQL (Structured Query Language). Category: Software Standard. Subcategory: Database.
Federal information processing standards (Final), J. Sullivan. c1986, 121p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Programming languages, *Standards, Data processing, Information systems, Programming manuals, *Federal information processing standards, Computer software, SQL.

The publication announces adoption of American National Standard Database Language SQL, ANSI X3.135-1986, as a Federal Information Processing Standard (FIPS). ANSI X3.135-1986 specifies two languages that make up a relational model database management system. They are: (a) A schema definition language, for declaring the structures and integrity constraints of a database; (b) A module language, including SQL statements, for declaring the database procedures and executable statements of a specific database application. The purpose of the standard is to promote portability of database definitions and database application programs between different installations. The standard is used by implementors as the reference authority in developing a relational model database management system and standard language interfaces to that database management system; and by other computer professionals who need to know the precise syntactic and semantic rules of the standard.

707,309
FIPS PUB 128 PC **E13**
National Bureau of Standards (ICST), Gaithersburg, MD.
Computer Graphics Metafile (CGM). Category: Software Standard. Subcategory: Graphics.
Federal information processing standards (Final), D. Benigni. 1986, 343p
Prepared in cooperation with American National Standards Inst., New York.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Computer graphics, *Federal information processing standards, Metafile, *Software tools, *Computer program portability.

The publication announces the adoption of the American National Standard for Computer Graphics Metafile, ANSI X3.122-1986, as a Federal Information Processing Standard (FIPS). ANSI X3.122-1986 is a graphics data interface standard which specifies a file format suitable for the description, storage, and communication of graphical (pictorial) information in a device independent manner. The purpose of the standard is to facilitate the transfer of graphical information between different graphical software systems, different graphical devices, and different computer graphics installations.

707,310
FIPS PUB 129 PC **E04**
National Bureau of Standards (ICST), Gaithersburg, MD.
Optical Character Recognition (OCR) - Dot Matrix Character Sets for OCR-MA. Category: Hardware Standard. Subcategory: Character Recognition.
Federal information processing standards (Final), T. C. Bagg. c1987, 41p
Prepared in cooperation with American National Standards Committee, New York.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: Standards, Data processing, Cost engineering, *Optical character recognition, *Federal information processing standards.

The FIPS announces the adoption of the American National Standard X3.111-1986, Optical Character Recognition (OCR) -- Matrix Character Sets for OCR-MA, as a Federal Information Processing Standard. The standard provides the description, scope, and application rules for character sets that are generated by low resolution dot matrix printers and designed to match, as close as practical, the design of the OCR-A character set. A major purpose of this OCR standard is to reduce the cost of data input into ADP systems which use Optical Character Recognition (OCR) equipment.

707,311
FIPS PUB 14-1 PC **A02**
National Bureau of Standards, Washington, DC.
Hollerith Punched Card Code. Category: Hardware Standard. Subcategory: Interchange Codes and Media.
Federal information processing standards.
J. L. Little. c1976, 19p
Supersedes FIPS-PUB-14.
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Hollerith code, *Punched cards, *Coding, National government, Standards, Data storage devices, Data processing, *Federal information processing standards, Information transfer, NTISCOMNBS.

The publication provides a standard set of 256 hole patterns which represent the 128 characters of the Federal Standard Code for Information Interchange (ASCII) FIPS 1-1, in 12-row, 80-column, rectangular hole, 'Hollerith' punched cards, or the subsets of ASCII as specified in FIPS 15, Subsets of the Standard Code for Information Interchange, or supersets of ASCII as specified in FIPS 35, Code Extension Techniques in 7 or 8 Bits. It adopts all 256 hole patterns given in the American National Standard X3.26-1980, Hollerith Punched Card Code. The 128 hole patterns for ASCII are the same as in the original FIPS 14. Nine related standards are listed. (Copyright (c) 1976 by American National Standards Institute, Inc.)

707,312
FIPS-PUB-16-1 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Bit Sequencing of the Code for Information Interchange in Serial-by-Bit Data Transmission. Category: Hardware Standard. Subcategory: Transmission.
Federal information processing standards.
1 Sep 77, 9p
Supersedes report dated 1 Oct 71, FIPS-PUB-16.

Keywords: *Data transmission, *Binary digits, Data processing, Standards, *Federal information processing standards, *Serial by bit transmission, Serial by character transmission.

This standard specifies the method of transmitting the Standard Code for Information Interchange (FIPS 1) in the serial-by-bit, serial-by-character data transmission. This revision supersedes FIPS PUB 16 and reflects changes necessary to accommodate FIPS 1 when operating in either 7 or 8 bit coded environments. This standard is identified also as Federal Standard Number 1010.

707,313
FIPS-PUB-17-1 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Character Structure and Character Parity Sense for Serial-by-Bit Data Communication in the Code for Information Interchange. Category: Hardware Standard. Subcategory: Transmission.
Federal information processing standards.
1 Sep 77, 9p
Supersedes report dated 1 Oct 71, FIPS-PUB-17.

Keywords: *Data transmission, *Parity, Data processing, Standards, *Serial by bit transmission, Federal information processing standards, Character structure, Character parity.

This standard specifies the method of transmitting the Standard Code for Information Interchange (FIPS 1) in the serial-by-bit, serial-by-character data transmission. This revision supersedes FIPS PUB 17 and reflects changes necessary to accommodate revisions prescribed by FIPS 1 when operating in either 7 or 8 bit coded environments. This standard is identified also as Federal Standard Number 1011.

707,314
FIPS PUB 19-1 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Catalog of Widely Used Code Sets. Category: Data Standards and Guidelines Subcategory: Representations and Codes.
Federal information processing standards (Final).
R. G. Saltman. 7 Jan 85, 65p
Supersedes FIPS-PUB-19.
Three ring vinyl also available, North American Continent price $6.25; all others write for quote.

Keywords: *Data processing, *Standards, *Coding, *Catalogs(Publications), Directories, *Federal Information Processing Standards, Data elements.

The catalog lists and briefly describes code sets that are in wide use in the United States and that might be useful to Federal data systems. The purpose of the catalog is to assist Federal agencies and other organizations in the selection of appropriate code sets and in the avoidance of duplication of effort. The standard format that describes each code set listed specifies code characteristics, maintenance agency, source document, and other pertinent data. This revision supersedes FIPS PUB 19 in its entirety.

707,315
FIPS PUB 2-1 PC**$7.00**
National Bureau of Standards, Gaithersburg, MD.
Perforated Tape Code for Information Interchange.
Final rept.
J. L. Little. c1984, 18p
Supersedes FIPS PUB 2.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Punched tapes, Code, Standards, Computer systems hardware, *Federal information processing standards, *Information interchange, Communication networks.

The publication provides the representation of the Code for Information Interchange, Its Representations, Subsets, and Extensions (FIPS 1-2) on perforated tape used in Federal information processing systems, com-

munications systems, and associated equipment. The Federal Information Processing Standard adopts in whole American National Standard X3.6-1965 (reaffirmed in 1983), Perforated Tape Code for Information Interchange. Three other related standards are also listed. (Copyright (c) 1965, American Standards Association, Incorporated.)

707,316
FIPS PUB-21-2 PC **E15**
National Bureau of Standards, Gaithersburg, MD.
COBOL. Category: Software Standard. Subcategory: Programming Language.
Final rept.,
M. V. Vickers. 18 Mar 86, 822p
Supersedes FIPS-PUB-21-1.
Three ring vinyl FIPS binder also available, $6.25 N.A.C. Others write for quote.

Keywords: *Cobol, *Programming languages, *Standards, Data processing, Information systems, Programming manuals, *Federal information processing standards, *High level languages, Computer software.

The publication announces the adoption of American National Standard Programming Language, COBOL, ANSI X3.23-1985, as amplified herein, as a Federal Information Processing Standard (FIPS). The revision supersedes FIPS PUB 21-1 and reflects major changes and improvements in the COBOL specifications. It also contains changes to the Objectives, Applicability, and Implementation portions of FIPS PUB 21-1 to recognize advances in programming language technology and to provide consistent policy for all FIPS languages. The American National Standard defines the elements of the COBOL programming language and the rules for their use. The purpose of the standard is to promote portability of COBOL programs for use on a variety of data processing systems. The standard is used by implementors as the reference authority in developing processors and by users who need to know the precise syntactic and semantic rules of the standard language.

707,317
FIPS PUB 29-1 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Interpretation Procedures for Federal Information Processing Standard Programming Languages.
Federal information processing standards (Final).
M. V. Vickers. 31 Dec 81, 8p NBS-FIPS-PUB-29-1
Supersedes report for 30 Jun 74, FIPS PUB 29.
Three ring FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Programming languages, Data processing, Standards, *Federal information processing standards, Agencies.

This FIPS PUB defines the procedures that will be followed in requesting interpretations of FIPS Programming Languages and in providing responses to those requests. The provisions of this document apply to all Federal departments and agencies and to vendors of processors in their dealings with the Federal Government.

707,318
FIPS PUB 29-2 PC **A02**/MF **A01**
National Bureau of Standards (ICST), Gaithersburg, MD.
Interpretation Procedures for Federal Information Processing Standards for Software. Category: Software Standard. Subcategory: Graphics.
Federal information processing standards (Final),
M. Vickers. 14 Sep 87, 8p
Supersedes FIPS PUB-29-1.

Keywords: *Computer graphics, *Programming languages, *Standards, *Federal information processing standards, *Computer software.

The purpose of the Federal Information Processing Standards Publication (FIPS PUB) is to establish the procedures for requesting a technical interpretation of any of the Federal Information Processing Standards (FIPS) for software and for providing a solution to the request. The FIPS PUB supersedes FIPS PUB 29-1 in its entirety. The FIPS for software include, but are not limited to, FIPS programming languages, FIPS database languages, FIPS graphics languages, and FIPS operating systems languages. The standards are used as the basis for the implementation of software, validation of software, or writing of application programs.

707,319
FIPS PUB 32-1 PC **A07**
National Bureau of Standards, Washington, DC.
Character Sets for Optical Character Recognition (OCR). Category: Hardware Standard. Subcategory: Character Recognition.
Federal information processing standards. (Final)
T. Bagg. c1982, 150p
Supersedes FIPS PUB 32 dated 1 December 1974.
Three ring vinyl FIPS binder also available, North American Continent price $6.25: all others write for quote.

Keywords: *Standards, *Data processing, *Symbols, Character recognition, Graphic methods, *Federal information processing standards, *Optical character recognition.

This Federal Information Processing Standard supersedes FIPS PUB 32 and provides the description, scope, and identification of sets of graphic shapes to be used in applying Optical Character Recognition (OCR) in Federal Government agencies. American National Standards X3.2-1970 (R1976), X3.17-1981, and X3.49-1975 (R1982) are incorporated by reference. They supply all of the required dimensions, application rules, and reference sources. A set of graphic shapes for special applications related to Magnetic Ink Character Reading (MICR) is provided and is designated MICR Characters Read Optically. This is a unique requirement for certain Federal Government agencies that has not yet been addressed by an American National Standard. Its principal function is to provide the different tolerances involved in optical character reading practice from certain requirements usually needed in magnetic ink reading practice. (Copyright (c) 1971 by American National Standards Institute Inc.)

707,320
FIPS PUB 33-1 PC **A03**
National Bureau of Standards, Gaithersburg, MD.
Character Set for Handprinting. Category: Hardware Standard. Subcategory: Character Recognition.
Federal information processing standards (Final).
T. C. Bagg. c1982, 37p
Supersedes FIPS PUB 33.
Three ring vinyl FIPS binder also available, North American Contintent price $6.25; all others write for quote.

Keywords: *Data processing, *Standards, *Handwriting, *Symbols, *Federal information processing standards, *Optical character recognition.

This FIPS PUB announces the adoption of the American National Standard X3.45-1982, Character Set for Handprinting, as a Federal Standard. This standard provides the description, scope, and application rules for a character set for handprinting. A major purpose of this standard is to reduce the cost of data input into ADP systems which use Optical Character Recognition (OCR) equipment. This character set remains the same as the previous standard set with the exception of the Yen symbol.

707,321
FIPS-PUB-42-1 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of Information Processing Standards.
Guidelines for Benchmarking ADP Systems in the Competitive Procurement Environment.
Federal information processing standards (Final),
J. F. Wood. 15 May 77, 32p FIPS-PUB-42-1
See also report dated 15 Dec 75, PB-249 586.

Keywords: *Computer systems hardware, *Computer programming, Bench marks, Standards, *Federal information processing standards, *Computer performance evaluation, *Computer software.

This publication provides general guidelines to best practice for use by Federal agencies in benchmark mix demonstrations for validating hardware and software performance in context with processing an expected actual workload. The publication provides an overview and general discussion of the benchmarking process; guidelines for reducing the problems in benchmarking at the management level and at the technical staff level including a discussion of how these problems can be resolved or minimized; and procedural benchmarking guidelines, a discussion of the four phases of benchmarking, workload analysis, construction and validation of the benchmark, procedural documentation and preparation of the benchmark for the vendors, conducting benchmark tests. The document is written so that the various hierarchical levels in an organization's structure can be directed toward applicable sections of these guidelines.

707,322
FIPS-PUB-49 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C.
Guideline on Computer Performance Management: An Introduction.
Federal information processing standards (Final),
D. M. Conti. 1 May 77, 17p

Keywords: *Data processing, *Standards, *Performance evaluation, Management, Resource allocation, Reliability, *Computer performance evaluation, Federal information processing standards, *Computer performance management.

A Computer Performance Management (CPM) program is any structured effort to measure and evaluate the performance of installed computer systems in support of established management goals and objectives. The purpose of this publication is to introduce the Federal ADP manager to the subject of CPM, to provide general assistance to Federal ADP managers in planning and organizing a CPM program, and to recommend the establishment of CPM programs at all Federal ADP facilities. Guidance is presented on the use of performance measures in four major areas of management responsibility. The role of the ADP manager and the expected resources required in instituting a CPM program are discussed.

707,323
FIPS PUB 5-2 PC **A03**/MF **A01**
National Bureau of Standards (ICST), Gaithersburg, MD.
Codes for the Identification of the States, the District of Columbia and the Outlying Areas of the United States, and Associated Areas. Category: Data Standards and Guidelines. Subcategory: Representations and Codes.
Federal information processing standards (Final),
R. G. Saltman. 28 May 87, 11p
Supersedes FIPS PUB 5-1.
Three ring vinyl binder also available, North American Continent price $9.95; all others write for quote.

Keywords: *Coding, *Information systems, Standards, States(United States), Countries, *Federal information processing standards, *Geocoding.

The standard provides a set of two-digit numeric codes and a set of two-letter alphabetic codes for representing the 50 states, the District of Columbia and the outlying areas of the United States, and associated areas. The standard covers all land areas under the sovereignty of the United States, the freely associated states of Federated States of Micronesia and Marshall Islands, and the trust territory of Palau. The revision supersedes FIPS PUB 5-1 in its entirety.

707,324
FIPS-PUB-50 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Recorded Magnetic Tape for Information Interchange, 6250 cpi (246 cpmm), Group Coded Recording.
Federal information processing standards (Final),
M. D. Hogan. 1 Feb 78, 32p
Also available 3 ring vinyl FIPS binder, $6.25 North American Continent price; all others write for quote.

Keywords: *Data processing, Standards, Magnetic tapes, *Federal information processing standards, *Information processing.

This FIPS PUB announces the adoption, with one exception, of the American National Standard X3.54-1976, Recorded Magnetic Tape for Information Interchange (6250 CPI, Group-Coded Recording). This standard specifies the recorded characteristics of 9-track, one-half inch (12.7 mm) wide magnetic computer tape, including the format for implementing the Standard Code for Information Interchange (ASCII) at the recording density of 6250 characters per inch (246 characters per millimeter). It is one of a series of Federal Standards implementing ASCII on magnetic tape media.

707,325
FIPS-PUB-51 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.

Magnetic Tape Cassettes for Information Interchange (3.810 mm(0.150 in) Tape at 32 bpmm (800 bpi), PE).
Federal information processing standards (Final),
M. D. Hogan. 1 Feb 78, 35p
Also available 3 ring vinyl FIPS binder, $6.25 North American Continent price; all others write for quote.

Keywords: *Data processing, Standards, Magnetic tapes, *Federal information processing standards, *Information processing.

This FIPS PUB announces the adoption of the American National Standard X3.48-1977, Magnetic Tape Cassettes for Information Interchange (3.810-mm (0.150-in) Tape at 32 bpmm (800 bpi), PE). This standard specifies the physical, magnetic, and recorded characteristics of a 3.810 mm (0.150 in) magnetic tape cassette in order to provide for data interchange between information processing systems at a recording density of 32 bits per millimeter (800 bits per inch) using phase encoding techniques. The magnetic tape cassette consists of a twin hub co-planar type cassette containing 3.810 mm (0.150 in) wide magnetic tape. It is one of a series of Federal Standards implementing the Standard Code for Information Interchange (ASCII) on magnetic tape media.

707,326
FIPS PUB 52 PC **A02**
National Bureau of Standards, Gaithersburg, MD.
Recorded Magnetic Tape Cartridge for Information Interchange, 4-Track, 6.30 mm (1/4 in), 63 bpmm (1600 bpi), PHASE ENCODED. Category: Hardware Standard. Subcategory: Interchange Codes and Media.
Federal information processing standards,
M. D. Hogan. 15 Jul 78, 22p
Also available 3 ring vinyl FIPS binder, $6.25 North American Continent price; all others write for quote.

Keywords: *Data processing, *Standards, Magnetic tape transports, Magnetic tapes, National government, *Federal information processing standards, *Magnetic tape cartridges.

This FIPS PUB announces the adoption, with one exception, of the American National Standard X3.56-1977, Recorded Magnetic Tape Cartridge for Information Interchange, 4-Track, 1/4 in (6.30 mm), 1600 bpi (63 bpmm), Phase Encoded. This standard specifies the recorded characteristics for a 6.30 mm (1/4 in) wide magnetic tape cartridge with either one, two or four serial data tracks in order to provide for data interchange between information processing systems, communication systems, and associated equipment at a recording density of 63 bits per millimeter (1600 bits per inch) using phase encoding techniques. This standard is one of a series of Federal Standards implementing the Federal Standard Code for Information Interchange (FIPS 1) on magnetic tape media.

707,327
FIPS PUB 53 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Transmittal Form for Describing Computer Magnetic Tape File Properties.
Federal information processing standards (Final),
H. E. McEwen. 1 Apr 78, 9p
Also available 3 ring vinyl FIPS binder, $6.25 North American Continent price; all others write for quote.

Keywords: *Magnetic tapes, Properties, Standards, *Federal information processing standards, Magnetic tape files.

This publication provides a standard magnetic tape transmittal form (SF-277), together with instructions for providing the necessary information on the form. The standard magnetic tape transmittal form, Computer Magnetic Tape File Properties (SF-277), will be used by Federal agencies to document the physical properties and characteristics of a recorded magnetic tape file needed by the receiving agency to process the tape.

707,328
FIPS PUB 54 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Computer Output Microform (COM) Formats and Reduction Ratios, 16 mm and 105 mm.
Federal information processing standards (Final),
T. C. Bagg. 15 Jul 78, 20p
Also available 3 ring vinyl FIPS binder, $6.25 North American Continent price; all others write for quote.

Keywords: *Data processing, *Standards, *Microfilm, National government, Data storage devices, Reduction, *Federal information processing standards, *Microform, *Microfiche.

This FIPS PUB specifies the image arrangement, size, and reduction ratios for 16 mm and 105 mm microforms generated by Computer Output Microfilmers. It is limited to systems using business-oriented fonts similar to line printer output. This standard covers microform formats and reduction ratios for Computer Output Microforms using business-oriented fonts

707,329
FIPS PUB 55 PC **E15**/MF **E15**
National Bureau of Standards, Washington, DC.
Codes for Named Population Places, Primary County Divisions, and Other Locational Entities of the United States (Second Printed Version): Guidelines.
Federal information processing standards (Final).
R. Saltman, H. Tom, and G. Martin. Feb 82, 2034p
Supersedes FIPS PUB 55 dated 1 Jun 78.
Three ring FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Coding, Data processing, Standards, Geography, States(United States), Counties, Urban areas, Military facilities, *Federal information processing standards, *Geocoding, ZIP codes, Indian reservations.

The document provides numeric codes for the complete file of incorporated places, census designated places, townships, census county divisions, and Indian reservations in the U.S., Puerto Rico, Virgin Islands, American Samoa, Guam, the prospective Commonwealth of the Northern Mariana Islands, and the Trust Territory of the Pacific Islands. The file also includes certain facilities such as military bases, airports, and transport points. This guideline implements ANS X3.47-1977. The standard code is seven characters in length, the first two of which identify the State. The last five numeric characters identify the place within the State and provide an alphabetic ordering of the place names. In addition to the place name and its code, each record provides the name and code for the county (or counties) in which the place is located, the ZIP code of the servicing post office (or offices), cross-references to former or alternate names, an inclusion code, a class designator code, and a cross-reference to the Worldwide Geographic Location Codes issued by the General Services Administration. Each record also provides fields for a cross-reference to the Bureau of the Census' Master Area Reference File and for specifying location in a Standard Metropolitan Statistical Area and in one or more Congressional Districts.

707,330
FIPS PUB 56 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Guideline for Managing Multivendor Plug-Compatible ADP Systems.
Federal information processing standards (Final),
J. M. Bakshi. 15 Sep 78, 23p
Also available 3 ring vinyl FIPS binder, $6.25 North American Continent price; all others write for quote.

Keywords: *Data processing equipment, *Government procurement, National government, Management planning, Standards, Operations, Maintenance, *Federal information processing standards, *Plug compatible systems.

To an increasing extent, Federal automatic data processing (ADP) systems are being configured with components obtained from multiple sources and ADP managers are being provided with services from multiple suppliers. This multivendor environment has led to both increased competition in the marketplace and substantial procurement savings by the Federal Government. This document is intended for the Federal ADP manager who is responsible for the planning, acquisition, and operation of multivendor ADP systems--particularly multivendor plug--compatible ADP systems. Its main purpose is to facilitate the planning and operation of multivendor systems by providing guidance based upon actual Federal agency experiences with problems in such installations and recommend ways through which they may be resolved.

707,331
FIPS PUB 57 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.

Guidelines for the Measurement of Interactive Computer Service Response Time and Turnaround Time. Category: ADP Operations. Subcategory: Computer Performance Management.
Federal information processing standards (Final).
M. D. Abrams. 1 Aug 78, 31p
Also available 3 ring vinyl FIPS binder, $6.25 North American Continent price; all others write for quote.

Keywords: *Data processing, *Computer networks, National government, Evaluation, *Federal information processing standards, Response time, Turnaround time, Guidelines, Emulators.

These guidelines are primarily directed to the person who will be writing specifications for or conducting evaluation and selection of interactive computer network services. Response time and turnaround time are defined. Measurement methodologies are described, and recommendations are made concerning their applicability. The methodologies include accounting logs, stopwatches, communications monitors, live users at terminals, ASR terminals, intelligent terminals, internal measurement drivers, and remote terminal emulators.

707,332
FIPS PUB 58 PC **A02**
National Bureau of Standards, Gaithersburg, MD.
Representations of Local Time of the Day for Information Interchange. Federal General Data Standard Representations and Codes.
Federal information processing standards (Final).
H. E. McEwen. c1 Feb 79, 17p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Standards, National government, Day, Time, *Federal Information Processing Standards, *Time of day, Time standards.

This FIPS PUB announces the adoption of American National Standard X3.43-1977, Representations of Local Time of the Day for Information Interchange. This standard provides the means for representing local time of the day to facilitate the interchange of information among data systems. (Copyright (c) 1977 by American National Standards Institute, Inc.)

707,333
FIPS PUB 59 PC **A02**
National Bureau of Standards, Gaithersburg, MD.
Representations of Universal Time, Local Time Differentials, and United States Time Zone References for Information Interchange. Federal General Data Standard Representations and Codes.
Federal information processing standards (Final).
H. E. McEwen. c1 Feb 79, 7p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: Time, Standards, National government, Day, *Universal time, *Local time, *Federal Information Processing Standards, Time of day, Time standards.

This FIPS PUB announces the adoption of American National Standard X3.51-1975, Representations of Universal Time, Local Time Differentials, and United States Time Zone References for Information Interchange. This standard provides the means for representing universal time, local time differentials, and U.S. time zone references to facilitate interchange of information among data systems.

707,334
FIPS PUB 6-3 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Counties and County Equivalents of the States of the United States and the District of Columbia.
Federal information processing standards.
J. L. Walkowicz. 15 Dec 79, 40p
Supersedes FIPS PUB 6-2.
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Counties, *United States, Data processing, Coding, Standards, *Federal information processing standards.

This publication provides names and codes for representing the counties and county equivalents of the 50 States and the District of Columbia for use in the inter-

change of formatted machine-sensible data. County equivalents include the parishes of Louisiana; the census areas and boroughs of Alaska; the consolidated government of Columbus, Georgia; the independent cities of the States of Maryland, Missouri, Nevada, and Virginia; and that part of Yellowstone National Park in Montana. For the convenience of data systems that need county equivalent codes for certain outlying areas of the United States, Appendix C lists Bureau of the Census codes for Puerto Rico and the Virgin Islands.

707,335
FIPS PUB 60 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
I/O Channel Interface. Category: Hardware Standard. Subcategory: Interface.
Federal information processing standards (Final).
16 Feb 79, 78p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Computer systems hardware, *Interfaces, *Standards, Auxiliary equipment(Computers), Data processing equipment, Specifications, Input output devices(Computers), Control equipment, National government, *Federal information processing standards.

The standard defines the functional, electrical, and mechanical interface specifications for connecting computer peripheral equipment as a part of automatic data processing (ADP) systems. This standard, together with a companion standard for power control, defines the hardware characteristics for the I/O channel level interface. In order to achieve full plug-to-plug interchangeability of peripheral components, device class specific operational specifications standards are also required for each class of peripheral device. These operational specifications standards will be proposed as Federal Information Processing Standards to accompany this standard as they are developed. The Government's intent in employing this I/O Channel Interface standard is to reduce the cost of satisfying the Government's data processing requirements through increasing its available alternative sources of supply for computer system components at the time of initial system acquisition, as well as in system replacement and augmentation and in system component replacement. This standard is also expected to lead to improved reutilization of system components. When acquiring ADP systems and system components, Federal agencies shall cite this standard in specifying the interface for connecting computer peripheral equipment as a part of ADP systems.

707,336
FIPS PUB 60-1 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
I/O Channel Interface. Category: Hardware Standard. Subcategory: Interface.
Federal information processing standards (Final).
c1971, 85p
Supersedes FIPS PUB 60.
Three ring FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Computer systems hardware, *Interfaces, *Standards, Auxiliary equipment(Computers), Data processing equipment, Specifications, Input output devices(Computers), Control equipment, National government, *Federal information processing standards.

This standard defines the functional, electrical, and mechanical interface specifications for connecting computer peripheral equipment as a part of automatic data processing (ADP) systems. This standard, together with a companion standard for power control, defines the hardware characteristics for the I/O channel level interface. In order to achieve full plug-to-plug interchangeability of peripheral components, device class specific operational specifications standards are also required for each class of peripheral device. These operational specifications standards will be proposed as Federal Information Processing Standards to accompany this standard as they are developed. The Government's intent in employing this I/O Channel Interface standard is to reduce the cost of satisfying the Government's data processing requirements through increasing its available alternative sources of supply for computer system componentsat the time of initial system acquisition, as well as in system replacement and augmentation and in system component replacement. This standard is also expected to lead to improved reutilization of system components. When acquiring ADP systems and system components, Federal agencies shall cite this standard in specifying the interface for connecting computer peripheral equipment as a part of ADP systems. (Copyright (c) 1971 by International Business Machines Corporation.)

707,337
FIPS PUB 61 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Channel Level Power Control Interface. Category: Hardware Standard. Subcategory: Interface.
Federal information processing standards (Final).
16 Feb 79, 19p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Computer systems hardware, *Interfaces, *Standards, Auxiliary equipment(Computers), Data processing equipment, Specifications, Input output devices(Computers), Control equipment, Power, National government, *Federal information processing standards.

The standard defines the functional, electrical, and mechanical interface specifications for a power control interface for use in connecting computer peripheral equipment as a part of automatic data processing (ADP) systems. This standard, together with a companion standard for I/O Channel Interface, defines the hardware characteristics for the I/O channel level interface. The Government's intent in employing this Channel Level Power Control Interface standard is to reduce the cost of satisfying the Government's data processing requirements through increasing its available alternative sources of supply for computer system components at the time of initial system acquisition, as well as in system replacement and augmentation and in system component replacement. This standard is also expected to lead to improved reutilization of system components. When acquiring ADP systems and system components, Federal agencies shall cite this standard in specifying the power control interface for connecting computer peripheral equipment as a part of ADP systems.

707,338
FIPS PUB 61-1 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Channel Level Power Control Interface. Category: Hardware Standard. Subcategory: Interface.
Federal information processing standards (Final).
M. Wong. 13 Jul 82, 22p
Supersedes FIPS PUB-61.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Computer systems hardware, *Interfaces, *Standards, Auxiliary equipment(Computers), Data processing equipment, Specifications, Input output devices(Computers), Control equipment, Power, National government, *Federal information processing standards.

This standard defines the functional, electrical, and mechanical interface specifications for a power control interface for use in connecting computer peripheral equipment as a part of automatic data processing (ADP) systems. This standard, together with a companion standard for I/O Channel Interface, defines the hardware characteristics for the I/O channel level interface. This revision supersedes FIPS PUB 61 in its entirety.

707,339
FIPS PUB 62 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Operational Specifications for Magnetic Tape Subsystems. Category: Interface Standard.
Federal information processing standards (Final).
16 Feb 79, 67p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Computer systems hardware, *Interfaces, *Standards, Auxiliary equipment(Computers), Data processing equipment, Specifications, Control equipment, Magnetic tapes, Input output devices(Computers), National government, *Federal information processing standards.

The standard defines the peripheral device dependent operational interface specifications for connecting magnetic tape equipment as a part of automatic data processing (ADP) systems. It is to be used together with FIPS PUB 60, I/O Channel Interface, and FIPS PUB 61, Channel Level Power Control Interface. This standard, together with these two referenced standards, provides for full plug-to-plug interchangeability of magnetic tape equipment as part of ADP systems. The Government's intent in employing this standard for Operational Specifications for Magnetic Tape Subsystems is to reduce the cost of satisfying the Government's data processing requirements through increasing its available alternative sources of supply for computer system components at the time of initial system acquisition, as well as in system replacement augmentation and in system component replacement. This standard is also expected to lead to improved reutilization of system components. When acquiring ADP systems and system components, Federal agencies shall cite this standard in specifying the interface for connecting magnetic tape peripheral equipment as a part of ADP systems.

707,340
FIPS PUB 63 PC **A07**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Operational Specifications for Rotating Mass Storage Subsystems. Category: Hardware Standard. Subcategory: Interface.
Federal information processing standards (Final).
W. E. Burr, G. E. Clark, J. L. Little, and T. N. Pyke.
27 Aug 79, 133p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Magnetic disks, *Magnetic drums, Data storage devices, Computer storage devices, Rotation, Standards, National government, *Federal information processing standards, Mass storage.

This Federal Information Processing Standard specifies the command, status and sense codes associated with three classes of rotating mass storage subsystems designed to be employed with the I/O Channel Interface prescribed by FIPS PUB 60. The three classes of rotating mass storage subsystems provided for are: Class A with 100 to 200 megabytes per logical device address; Class B with 317.5 megabytes per logical device address; Class C with 35 or 70 megabytes per logical device address. The provisions of this standard are effective on June 23, 1980.

707,341
FIPS PUB 63-1 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Operational Specifications for Variable Block Rotating Mass Storage Subsystems. Category: Hardware Standard. Subcategory: Interface.
Federal information processing standards (Final).
W. E. Burr, and S. A. Recicar. 14 Apr 83, 52p
Supersedes FIPS PUB-63. See also FIPS-PUB-63-1-SUP.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: * Magnetic disks, *Magnetic drums, Data storage devices, Computer storage devices, Rotation, Standards, *Federal information processing standards, Disk recording systems, Mass storage.

This standard provides operational specifications for command codes, data formats, sense and status information, etc., for variable block rotating mass storage subsystems which attach to the I/O Channel Interface, FIP 60.* This standard will facilitate the connection of variable block rotating mass storage subsystems to general purpose computer systems; however, additional optional specifications of track format and sense information are provided for the most common device types.

707,342
FIPS PUB 63-1 SUP PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Additional Operational Specifications for Variable Block Rotating Mass Storage Devices (Supplement).
Federal information processing standards (Final).
W. E. Burr, and S. A. Recicar. 14 Apr 83, 62p
See also FIPS PUB-63-1.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Magnetic disks, *Magnetic drums, Data storage devices, Computer storage devices, Rotation, Standards, *Federal information processing standards, Disk recording systems, Mass storage.

This report is a supplement to Federal Information Processing Standards Publication (FIPS PUB) 63.* FIPS 63 specifies the command set and track formats of Variable Block Rotating Mass Storage (VBRMS) Devices. The VBRMS devices specified in FIPS 63 are frequently called Count, Key, and Data devices because each data recorder includes a separate count field, an optional key field, and a variable length data field. A number of distinct classes of VBRMS devices exist in common use, some of which are obsolete and therefore of little present interest. This report covers recent VBRMS devices which are widely available. It specifies details of capacities and sense information pertinent to each class. Only sense information which is useful to error recovery software is specified. Sense information which is used to diagnose internal subsystem faults is not specified.

707,343
FIPS-PUB-64 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Guidelines for Documentation of Computer Programs and Automated Data Systems for the Initiation Phase. Category: Software. Subcategory: Documentation.
Federal information processing standards.
B. Leong-Hong. 1 Aug 79, 50p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: Computer programming, Documentation, Standards, Benefit cost analysis, Feasibility, Technical writing, *Computer program documentation, Federal information processing standards.

These guidelines provide a basis for determining the content and extent of documentation for the initiation phase of the software life cycle. Content guidelines are given for the following document types: Project Request Document, Feasibility Study Document, and Cost/Benefit Analysis Document. The guidelines are intended to be a basic reference and a check-list for general use throughout the Federal Government to plan and evaluate documentation practices.

707,344
FIPS PUB 68 PC **A04**
National Bureau of Standards, Washington, DC.
Minimal BASIC. Category: Software Standard. Subcategory: Programming Language.
Federal information processing standards (Final).
J. Cugini. c1978, 51p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Computer programming, National government, Standards, Programming languages, Semantics, *BASIC programming language, *Federal information processing standards, Language programming, Software engineering.

The FIPS PUB announces the adoption of the American National Standard for Minimal BASIC as a Federal Standard. This standard defines the syntax of the Minimal BASIC programming language and the semantics for its interpretation. It is to be used by implementors as the reference authority in developing high level language processors and by other computer professionals. Minimal BASIC is recommended for fast creation of computer programs to solve small nonrecurring problems, particularly in time-sharing environments, and for the casual programmer when ease of learning and use are most important. (Copyright (c) 1978 by American National Standards Institute, Inc.)

707,345
FIPS PUB 69 PC **E13**
National Bureau of Standards, Washington, DC.
FORTRAN. Category: Software Standard. Subcategory: Programming Language.
Federal information processing standards (Final).
J. C. Boudreaux. c1978, 446p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Fortran, *Computer programming, National government, Standards, Programming languages, Semantics, *Federal information processing standards, Language programming, Software engineering.

The FIPS PUB announces the adoption of the American National Standard FORTRAN as a Federal Standard. This standard defines the syntax of the FORTRAN programming language and the semantics for its interpretation. It is to be used by implementors and other computer professionals as the authoritative reference for developing FORTRAN language processors. FORTRAN is recommended for the solution of numeric, scientific, or engineering problems. (Copyright (c) 1978 by American National Standards Institute, Inc.)

707,346
FIPS PUB 69-1 PC **E13**
National Bureau of Standards, Gaithersburg, MD.
FORTRAN. Category: Software Standard. Subcategory: Programming Language.
Federal information processing standards.
c1985, 464p
Supersedes FIPS PUB 69.
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Fortran, *Standards, Documents, Data processing, National government, Programming languages, *Federal information processing standards, *Software engineering, *Computer program portability.

The publication announces the revision of Federal Information Processing Standard FORTRAN. The revision supersedes FIPS PUB 69 and reflects changes to the Objectives, Applicability, and Implementation portions of FIPS FORTRAN. FIPS FORTRAN is the adoption of American National Standard Programming Language FORTRAN, X3.9-1978. The American National Standard specifies the form and establishes the interpretation of programs expressed in the FORTRAN programming language. The standard consists of a full language and a subset language. The purpose of the standard is to promote portability of FORTRAN programs for use on a variety of data processing systems. The standard is used by implementors as the reference authority in developing compilers, interpreters, or other forms of high level language processors, and by other computer professionals who need to know the precise syntactic and semantic rules of the standard.

707,347
FIPS PUB 70 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Representation of Geographic Point Locations for Information Interchange. Federal General Data Standard Representations and Codes.
Federal information processing standards (Final).
J. Walkowicz. 24 Oct 80, 22p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Geography, *Location(Position), Standards, National government, Coordinates, Latitude, Longitude, Mapping, *Federal information processing standards, *Information transfer.

This standard specifies a uniform format for representing geographic point location data in digital form for purposes of information interchange among data systems. This standard applies only to the three coordinate systems most widely used in the United States to define the position of a point that may be on, above, or below the earth's surface. These systems include: Latitude and Longitude, Universal Transverse Mercator (UTM), and State Plane Coordinate Systems; all three are mathematically interconvertible and are officially recognized by many mapping and surveying agencies of the Federal and State governments.

707,348
FIPS PUB 70-1 PC **E05**
National Bureau of Standards, Gaithersburg, MD.
Representation of Geographic Point Locations for Information Interchange. Category: Data Standards and Guidelines. Subcategory: Representations and Codes; Earth Science Series.
Federal information processing standards (Final).
R. G. Saltman. 14 Nov 86, 31p
Supersedes FIPS PUB 70.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Geography, *Location(Position), Standards, National government, Coordinates, Latitude, Longitude, Mapping, *Federal information processing standards, *Information transfer.

The standard specifies a uniform format for representing geographic point location data in digital form for purposes of information interchange among data systems. The standard applies only to the three coordinate systems most widely used in the United States to define the position of a point that may be on, above, or below the Earth's surface. These systems include: Latitude and Longitude, Universal Transverse Mercator (UTM), and State Plane Coordinate Systems; all three are mathematically interconvertible and are officially recognized by many mapping and surveying agencies of the Federal and State governments.

707,349
FIPS PUB 72 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Guidelines for the Measurement of Remote Batch Computer Service. Category: ADP Operations. Subcategory: Computer Performance Management.
Federal information processing standards (Final).
T. E. Bell, and M. D. Abrams. 1 May 80, 32p
Three ring FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Data processing, Services, National government, Guidelines, Performance standards, Work measurement, *Federal Information Processing standards, *Remote systems, *Batch processing, Information processing.

These Guidelines are primarily directed to people who operate or consume remote batch computer service. The evaluation of Remote Batch (Computer) Service (RBS) is dependent on several factors, including the nature of the service provided, the RBS equipment and its staffing, the criteria and metrics which are deemed applicable, and the measurement methodology. These Guidelines present these factors in a unifying context which should introduce increased orderliness into management and selection of RBS.

707,350
FIPS PUB 73 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Guidelines for Security of Computer Applications. Category: ADP Operations. Subcategory: Computer Security.
Federal information processing standards (Final).
S. Katzke. 30 Jun 80, 60p
Three ring FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Data processing, *Security, Standards, Information systems, National government, Management planning, Personnel management, Identifying, Systems engineering, Computer programming, Guidelines, *Federal information processing standards, *Computer security, Computer applications, Access methods, Information validation, Software engineering.

Security decisions should be an integral part of the entire planning, development and operation of a computer application. This guideline describes the technical and managerial decisions that should be made in order to assure that adequate controls are included in new and existing computer applications to protect them from natural and man-made hazards and to assure that critical functions are performed correctly and with no harmful side effects. The multifaceted nature of computer security is described and differences in security objectives, sensitivity levels, and vulnerabilities that must be considered are identified. Fundamental security controls such as data validation, user identity verification, authorization, journalling, variance detection and encryption are discussed as well as security-related decisions that should be made at each stage in the life cycle of a computer application.

707,351
FIPS PUB 74 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Guidelines for Implementing and Using the NBS Data Encryption Standard.
Federal information processing standards (Final).
M. E. Smid, and D. K. Branstad. 1 Apr 81, 44p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Cryptology, Security, Secure communications, Coding, *Data encryption, *Federal Information Processing Standards, Data processing security, Computer information security.

The Data Encryption Standard (DES) was published as Federal Information Processing Standards Publication (FIPS PUB) 46 on January 15, 1977. The DES specifies a cryptographic algorithm for protecting computer data. FIPS PUB 81 defines four modes of the operation for the DES which may be employed in a wide variety of applications. These guidelines are to be applied in conjunction with FIPS PUB 46 and FIPS PUB 81 when implementing and using the Data Encryption Standard. They provide information on what encryption is, general guidance on how encryption protects against certain vulnerabilities of computer networks, and specific guidance on the DES modes of operation in data communications applications. When used with the proper administrative procedures and when implemented in accordance with these guidelines, electronic devices performing the encryption and decryption operations of the standard can provide a high level of cryptographic protection to data in computer systems and networks.

707,352
FIPS PUB 75 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Guideline on Constructing Benchmarks for ADP System Acquisitions. Category: ADP Operations. Subcategory: Benchmarking for Computer Selection.
Federal information processing standards (Final).
H. Letmanyi, and D. Conti. 18 Sep 80, 47p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Procurement, *Acquisition, Government procurement, National government, Standards, Data processing equipment, Computer systems hardware, Guidelines, Resource allocation, Scheduling, Management planning, *Federal information processing standards, *Data processing systems, Computer software.

This Guideline describes a step-by-step procedure for constructing benchmarks for use in the acquisition of ADP systems. Ten steps in the benchmark construction process are identified involving such areas as workload analysis and forecasting, construction of the benchmark mix, and documentation and testing of the benchmark package. Although the Guideline is directed to the technical staff who will actually be constructing the benchmark, portions of it should also be useful to management. In addition, the Guideline should be useful to those in private industry who are also involved in constructing benchmarks for use in the evaluation of alternative vendor systems.

707,353
FIPS PUB 77 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Guideline for Planning and Management of Database Applications. Category: Software. Subcategory: Data Management Applications.
Federal information processing standards.
1 Sep 80, 52p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Management planning, Systems engineering, National government, Standards, *Data base management, *Federal information processing standards, Software engineering, NTISCOMNBS.

The Federal Government uses computers principally to process and maintain large collections of data, often called databases. Databases may be separate files on personnel, property, finances, etc., or they may be integrated collections of all such information for a bureau, agency, project, or Federal program. Database users and system administrators face difficult tasks and choices in effectively applying available software technology to their particular agency needs. They often choose a general purpose database management system (DBMS) as the primary software that will enhance application services and improve overall economy. But DBMS usage has special risks because of the technical complexity of these software packages and the scarcity of skilled support personnel, among other factors. This Guideline is a technical primer for Federal managers and applications analysts, to advise them of alternative software capabilities and recommended development practics for database applications. Specific guidelines address applications planning and management, and software selection.

707,354
FIPS PUB 78 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Guideline for Implementing Advanced Data Communication Control Procedures (ADCCP). Category: Hardware. Subcategory: Data Transmission.
Federal information processing standards (Final).
E. Scace. 26 Sep 80, 27p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: Standards, National government, *Data links, *Federal information processing standards, Communication networks, NTISCOMNBS.

Advanced Data Communications Control Procedures (ADCCP) has been adopted for use as the data link control procedure within the Federal Government under the circumstances detailed in FIPS 71. This document is intended to guide the system designer in the selection of ADCCP options and other parameters. Certain options for ADCCP operations are recommended so that equipment and services purchased by the Government can be used and reused in the largest possible variety of applications.

707,355
FIPS PUB 79 PC **E05**
National Bureau of Standards, Washington, DC.
Magnetic Tape Labels and File Structure for Information Interchange. Category: Software Standard. Subcategory: Operating Procedures.
Federal information processing standards (Final).
J. Collica. c1978, 77p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Magnetic tapes, *Labels, National government, Standards, Data processing, *Federal information processing standards, *File structures, File organization, Information transfer.

The publication announces the adoption of X3.27-1978, American National Standard Magnetic Tape Labels and File Structure for Information Interchange, as a Federal Standard. The standard establishes four levels of labeling, label formats, blocking structure, and tape-mark relationships on magnetically recorded tapes (volumes) so that these volumes can be used for information interchange. The standard contains specifications for processing volumes that correspond to a level of this standard to ensure proper treatment and understanding of these volumes and their contents in information interchange. The implementation of these processing specifications is called the system. A system exists for each level. (Copyright (c) 1978 by American National Standards Institute, Inc.)

707,356
FIPS PUB 8-5 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Metropolitan Statistical Areas (Including CMSAs (Consolidated Metropolitan Statistical Areas), PMSAs (Primary Metropolitan Statistical Areas), and NECMAs (New England County Metropolitan Areas)). Category: Data Standards and Guidelines. Subcategory: Representations and Codes.
Federal information processing standards (Final).
H. Tom. 31 Oct 84, 103p
Supersedes FIPS PUB 8-4.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Data processing, *Standards, Identifying, Coding, Urban areas, *Standard metropolitan statistical areas, *Federal Information Processing Standards, Counties, Metropolitan areas.

This standard specifies names, principal components, and identification codes for the Metropolitan Statistical Areas (MSAs) of the United States and Puerto Rico, including units called Consolidated Metropolitan Statistical Areas (CMSAs) and Primary Metropolitan Statistical Areas (PMSAs), and related units called New England County Metropolitan Areas (NECMAs). The general concept underlying the definitions of MSAs and related units is that of a geographic area consisting of a large population nucleus together with adjacent communities having a high degree of economic and social integration with that nucleus. This revision supersedes FIPS PUB 8-4 in its entirety.

707,357
FIPS PUB 80 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Guide for the Implementation of Federal Information Processing Standards (FIPS) in the Acquisition and Design of Computer Products and Services.
Federal information processing standards (Final).
H. S. White. 19 Dec 80, 87p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Procurement, *Data processing equipment, Services, Standards, National government, Telecommunication, Acquisition, Computer systems hardware, Computer programming, *Federal information processing standards, *Computer systems design, Software engineering, Data base management systems, NTISCOMNBS.

The Guide provides information about the 67 FIPS publications currently in effect and identifies the computer products and services to which they may apply. This Guide is intended to serve as a supplemental reference in the use of approved standards and guidelines. It should prove useful in the preparation of specifications for computer systems, components, services and supplies that must conform to Federal Government Procurement requirements.

707,358
FIPS PUB 81 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
DES Modes of Operation.
Federal information processing standards (Final).
D. Branstad. 2 Dec 80, 31p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Cryptography, Security, Coding, Computer programming, *Data encryption, *Federal information processing standards, Data processing security.

The Federal Data Encryption Standard (DES) (FIPS 46) specifies a cryptographic algorithm to be used for the cryptographic protection of sensitive, but unclassified, computer data. This FIPS defines four modes of operation for the DES which may be used in a wide variety of applications. The modes specify how data will be encrypted (cryptographically protected) and decrypted (returned to original form). The modes included in this standard are the Electronic Codebook (ECB) mode, the Cipher Block Chaining (CBC) mode, the Cipher Feedback (CFB) mode, and the Output Feedback (OFB) mode.

707,359
FIPS PUB 82 PC **E06**
National Bureau of Standards, Washington, DC.
Guideline for Inspection and Quality Control for Alphanumeric Computer-Output Microforms. Category: Hardware. Subcategory: Media.
Federal information processing standards (Final).
T. C. Bagg. c1980, 28p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Microfilm, National government, Standards, Reprography, Data storage devices, Microphotography, Photomicrography, Inspections, Quality control, *Federal information processing standards, *Computer output microfilm, Alphanumeric data.

The standard describes operational and quality-control guidelines for alphanumeric computer-output microfilm (COM) recorders and microforms. It is limited to images of line printer equivalent output only, such as those used for business and government records. The document covers microforms containing data generated by dynamic energy sources, such as cathoderay tubes, light-emitting diodes or lasers, and fixed data, such as that contained on a form slide, with effective reductions up to and including 48X. The subjects covered include a method for comparing legibility of the dynamic information to that contained in an image of the Alphanumeric COM Quality Test Form Slide when exposed in the same frame and duplicated onto silver, diazo and vesicular films. The films, film processing, film storage, film density practices and guidelines for preparing form-slide artwork and form slides are also discussed. (Copyright (c) 1980 by the National Micrographics Association.)

707,360
FIPS PUB 85 PC **A03**
National Bureau of Standards, Washington, DC.
Optical Character Recognition (OCR) Inks. Category: Hardware Standard. Subcategory: Character Recognition.
Federal information processing standards.
T. C. Bagg. c1980, 31p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Inks, *Optical character recognition device, Optical scanners, National government, Standards, Character recognition, Printing inks, *Federal information processing standards, NTISCOMNBS.

The objective of this standard is to define the spectral band for read inks and to provide spectrophotometric curves for red and blue nonread inks that are used by optical readers in order to facilitate the interchange of information among compatible OCR equipment. (Copyright (c) 1980 by the American Standards Institute, Inc.)

707,361
FIPS PUB 86 PC **E06**
National Bureau of Standards, Washington, DC.
Additional Controls for Use with American National Standard Code for Information Interchange: Category: Hardware Standard. Subcategory: Interchange Codes and Media.
Federal information processing standards (Final).
J. L. Little. c1981, 90p
See also FIPS PUB 85.

Keywords: *Data processing, *Standards, National government, Coding, Telecommunication, Input output devices(Computers), Printers(Data processing), *Federal information processing standards, *Information transfer, Word processing.

The standard specifies a set of encoded control functions to facilitate data interchange between data processing equipment, data communication equipment, and two dimensional character-imaging input-output devices, such as interactive ADP terminals of the display or printer type, line printers, microfilm printers, typesetting composers, word processors, and related devices. (Copyright (c) 1979 by American National Standards Institute, Inc.)

707,362
FIPS PUB 87 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Guidelines for ADP (Automatic Data Processing) Contingency Planning. Category: ADP Operations. Subcategory: Computer Security.
Federal information processing standards (Final).
J. K. Shaw. 27 Mar 81, 35p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Data processing, *Contingency, *Management planning, Standards, Expectation, Security, Recovery, *Federal information processing standards, Computer security.

The document provides guidelines to be used in the preparation of ADP contingency plans. The objective is to ensure that ADP personnel, and others who may be involved in the planning process, are aware of the types of information which should be included in such plans; to provide a recommended structure and a suggested format; and generally to make those responsible aware of the criticality of the contingency planning process.

707,363
FIPS PUB 88 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Guideline on Integrity Assurance and Control in Database Administration.
Federal information processing standards.
W. E. Perry, and A. H. Goldfine. 14 Aug 81, 76p
Three ring vinyl FIPS binder also available: $6.25 Domestic, others write for quote.

Keywords: *Quality assurance, Quality control, Auditing, Accuracy, *Data base management, *Computer security, *Federal information processing standards, Data dictionaries, Data processing security.

The Guideline provides explicit direction to Federal database administration and database security personnel on how to improve database control. The document identifies integrity and security problems in the administration of database technology, and discusses those procedures and methods which have proven effective in addressing these problems. The document also provides an explicit, step-by-step procedure for examining and verifying the accuracy and completeness of a database.

707,364
FIPS PUB 89 PC **A02**
National Bureau of Standards, Washington, DC.
Optical Character Recognition (OCR) Character Positioning.
Federal information processing standards (Final).
T. Bagg. c1981, 22p NBS-FIPS-PUB-89
Three ring FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Positioning, *Character recognition, National government, Standards, *Federal information processing standards, *Optical character recognition.

This FIPS PUB announces the adoption of American National Standard for Optical Character Recognition (OCR) Character Positioning, ANSI X3.93M-1981, as a Federal standard. This standard specifies the nominal position with allowable tolerances of OCR characters in relation to their location to other machine readable characters or sensed marks and to the document edges. This standard is related to FIPS PUBS 32, 40, and 85. (Copyright (c) 1981 by American National Standards Institute, Inc.)

707,365
FIPS PUB 90 PC **A03**
National Bureau of Standards, Washington, DC.
Guidelines for Optical Character Recognition (OCR) Print Quality. Category: Hardware Standard. Subcategory: Character Recognition.
Federal information processing standards (Final).
T. C. Bagg. 29 Sep 83, 29p
See also FIPS PUB 3201.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Data processing, *Symbols, *Standards, Optical character recognition device, *Federal information processing standards, *Optical character recognition.

This Guideline provides basic information on methods for evaluating the readability of printed characters and symbols that are to be optically recognized by electronic means. In addition, it gives tolerance ranges which permit the system designers to make the most beneficial cost tradeoffs between the various parts of a complete optical character recognition system. The specifications are contained in 'Guidelines for Optical Character Recognition (OCR) Print Quality' ANS X3.99-1983 published by the American National Standards Institute. This Guideline is related to FIPS PUBS 32-1, 40, 85, and 89.

707,366
FIPS PUB 91 PC **A02**
National Bureau of Standards, Washington, DC.
Magnetic Tape Cassettes for Information Interchange, Dual Track Complementary Return-to-Bias (CRB) Four-States Recording on 3.81-mm (0.150-in) Tape.
Federal information processing standards (Final).
M. Hogan. c1982, 21p NBS-FIPS-PUB-91
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: Computer storage devices, Magnetic tape transports, Standards, Data recording, *Federal information processing standards, *Data interchange, *Magnetic tape cassettes

This FIPS PUB announces the adoption of the American National Standard X3.59-1981, Magnetic Tape Cassettes for Information Interchange, Dual Track Complementary Return-to-Bias (CRB) Four-States Recording on 3.81-mm (0.150-in) Tape. This standard specifies the recorded characteristics for a magnetic tape cassette with data recorded on two tracks using complementary recordings and a return-to-bias method of encoding in order to provide for digital data interchange between information processing systems. This standard is one of a series of Federal Information Processing Standards implementing the Code for Information Interchange (FIPS 1-1) on flexible magnetic media. (Copyright (c) 1981 by American National Standards Institute, Inc.)

707,367
FIPS PUB 92 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO.
Guideline for Standard Occupational Classification (SOC) Codes.
Final rept.
R. G. Saltman, and J. L. Walkowicz. 24 Feb 83, 36p

Keywords: *Classifications, Coding, Employment, Job analysis, *Federal information processing standards, *Occupations.

This Guideline adopts the set of codes used to identify the occupational classifications published in the Standard Occupational Classification Manual 1980. The Standard Occupational Classification provides a mechanism for cross-referencing and aggregating occupation-related data collected by social and economic statistical reporting programs. The system is designed to maximize the analytical utility of statistics on the labor force, income, and other occupational data collected for a variety of purposes by various agencies of the U.S. Government, State agencies, professional associations, labor unions, and private research organizations.

707,368
FIPS PUB 93 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Parallel Recorded Magnetic Tape Cartridge for Information Interchange, 4-Track, 6.30 mm (1/4 in), 63 bpmm (1600 bpi), Phase Encoded. Category: Hardware Standard. Subcategory: Interchange Codes and Media.
Federal information processing standards (Final).
M. Hogan. 29 Jun 82, 19p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Magnetic tapes, *Data recording, Data storage, Standards, National governments, *Federal information processing standards, Tape cartridges, Data interchange.

This FIPS PUB announces the adoption of the American National Standard X3.72-1981, Parallel Recorded Magnetic Tape Cartridge for Information Interchange, 4 Track, 0.250 inch (6.30 mm), 1600 bpi, (63 bpmm), Phase Encoded. This standard specifies the recorded characteristics for a magnetic tape cartridge with data recorded across four parallel tracks at a recording density of 63 bits per millimeter (1600 bits per inch) using a phase encoding method of recording in order to provide for digital data interchange between information processing systems. This standard is one of a series of Federal Information Processing Standards implementing the Code for Information Interchange (FIPS 1-1) on flexible magnetic media.

707,369
FIPS PUB 94 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Guideline on Electrical Power for ADP Installations. Category: Hardware. Subcategory: Power, Grounding, and Life-Safety.
Federal information processing standards (Final).
S. Recicar. 21 Sep 83, 103p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Data processing, *Standards, Guidelines, Safety, Electrical grounding, Lightning protection, Power supply circuits, *Federal information processing standards.

This recommended Guideline for Federal agencies identifies and describes the electrical environment for safe, reliable operation of automatic data processing (ADP) systems. The electrical environment in and immediately outside the computer room is considered. The Guideline describes the fundamentals which underlie the power, grounding, and life-safety requirements, and provides a guide and checklist for specifying and preparing ADP sites, and evaluating their suitability. An annotated bibliography is provided.

707,370
FIPS PUB 96 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.

Guideline for Developing and Implementing a Charging System for Data Processing Services. Category: ADP Operations. Subcategory: Computer Performance Management.
Federal information processing standards pub. (Final).
K. L. Moore. 6 Dec 82, 88p
Prepared in cooperation with Federal Computer Performance Evaluation and Simulation Center, Washington, DC.

Keywords: *Fees, *Data processing, *Services, Standards, Billing, Accounting, Rates(Costs), Cost analysis, Reporting, *Federal information processing standards.

These guidelines describe a step-by-step methodology for developing and implementing a charging system for use in Data Processing (DP) facilities. Charging for DP services refers to distributing the costs of providing DP services to the users who receive the services. The distribution of costs requires definition of the basic DP services, the resources used to provide the services, and the costs incurred to obtain and make use of the resources. A charging system is comprised of two subsystems: the rate-setting subsystem and the billing subsystem. The rate-setting subsystem incorporates procedures for forecasting the use of each service, forecasting the costs of the resources used to provide each service, and establishing the rate to be charged for each unit of service. The billing subsystem includes procedures for monitoring the use of services, applying the billing rates to compute the total charge for the services each user receives, and reporting the charges to the user and to appropriate accounting groups.

707,371
FIPS PUB 97 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Operational Specifications for Fixed Block Rotating Mass Storage Subsystems. Category: Hardware Standard. Subcategory: Interface.
Federal information processing standards (Final).
W. E. Burr, and S. Recicar. 4 Feb 83, 92p
See also FIPS PUB 93. Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Magnetic disks, *Data storage devices, Standards, Specifications, *Federal information processing standards, Error recovery.

This specification is intended for use in the acquisition of Fixed Block Rotating Mass Storage (FBRMS) Subsystems (e.g., magnetic disk devices with fixed sized blocks and their controllers), and is a companion to the I/O Channel Interface Standard, FIPS 60. This standard defines the command repertory for FBRMS subsystems, sense information supplied by FBRMS subsystems for error recovery purposes and error recovery procedures for both FBRMS subsystems and attached computers. This standard does not specify recording technology or the internal implementation of subsystems; consequently, storage geometries, recording formats, physical addressing, and hardware diagnostic sense information are not specified.

707,372
FIPS PUB 99 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Guideline: A Framework for the Evaluation and Comparison of Software Development Tools. Category: Software. Subcategory: Software Engineering.
Federal information processing standards (Final).
R. C. Houghton. 31 Mar 83, 31p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: Standards, Computer systems programs, Computer programming, *Federal information processing standards, *Software tools, Software engineering, Computer software.

A framework for the evaluation and comparison of software development tools is introduced and presented. The framework is a hierarchical structure of tool features that provides the level of detail necessary to analyze and classify the capabilities of tools. Through a careful analysis of tool features, one can obtain a better understanding of the characteristics of a tool and can compare these characteristics with those of other tools.

707,373
PB-269 296/0 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
Data Compression: A Comparison of Methods.
Final rept.,
J. Aronson. Jun 77, 43p NBS-/SP-500-12
Library of Congress Catalog Card no. 77-608132.

Keywords: *Coding, *Computer storage devices, Statistical analysis, Telemetering data, Federal information processing standards, *Data compression, Huffman codes, Computer storage management.

One important factor in system design and in the design of software is the cost of storing data. Methods that reduce storage space can, besides reducing storage cost, be a critical factor in whether or not a specific application can be implemented. This paper surveys data compression methods and relates them to a standard statistical coding problem -- the noiseless coding problem. The well defined solution to that problem can serve as a standard on which to base the effectiveness of data compression methods. A simple measure, based on the characterization of the solution to the noiseless coding problem, is stated through which the effectiveness of a data compression method can be calculated. Finally, guidelines are stated concerning the relevance of data compression to data processing applications.

707,374
PB80-144322 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Selection of Data Entry Equipment,
S. A. Recicar. Nov 79, 80p NBS-SP-500-55
Library of Congress catalog card no. 79-600173.

Keywords: Auxiliary equipment(Computers), Input output devices(Computers), Key punches, Magnetic disks, Optical character recognition devices, Recommendations, Magnetic tapes, *Data entry systems, Federal information processing standards, Alphanumeric displays, Magnetic ink character recognition, Bar codes.

This publication provides information to be used by Federal organizations in the selection of data entry equipment. It serves as a supplement to the Federal Information Processing Standards Publication (FIPS PUB) 67, 'Guideline for Selection of Data Entry Equipment.' The objective is to make available information that could lead to the selection of more efficient and economical data entry systems. This report provides information about economic and general operational considerations, steps to be followed in acquisition and training, and other factors pertinent to data entry equipment selection. Equipment profiles for the different data entry methods are also provided.

707,375
PB80-183189 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Technical Specifications of a Proposed Federal Information Processing Standard on the Modes of Operation for the Data Encryption Standard,
M. J. O'Brien. Apr 80, 40p NBSIR-80-2019

Keywords: *Data processing, *Cryptology, *Standards, United States government, Specifications, Algorithms, *Federal information processing standards, Data encryption standards, *Computer information security.

The paper contains a draft of the technical information describing some of the modes of operation for the Federal Data Encryption Standard (DES). A DES mode of operation is a technique, external to the cryptographic algorithm, for incorporating the DES into a cryptographic system. Four modes of operation are described: the electronic codebook (ECB) mode, the cipher block chaining (CBC) mode, the cipher feedback (CFB) mode, and the authentication-only mode.

707,376
PB80-205214 PC **A05**/MF **A01**
Bolt Beranek and Newman, Inc., Cambridge, MA.
Features of the Transport and Session Protocols. Draft Report,
J. Burruss. Mar 80, 78p BBN-4361, ICST/HLNP-80-1, NBS-GCR-80-245
Contract NB79-SBCA-0092

Keywords: *Computer networks, Standards, Data processing, Telecommunication, *Protocols, *Federal information processing standards, Computer architecture.

The National Bureau of Standards, Institute for Computer Sciences and Technology (ICST), has initiated a program to develop computer network protocol standards as Federal Information Processing Standards (FIPS). This is one of a series of draft reports prepared under the network protocol standards program for distribution to government agencies, voluntary standards organizations, computer and communications equipment manufaturers, and other interested parties. The draft report analyses protocol features as a method of determining the kernel set of essential features of a protocol along with the clusters of value-added features which will support various application categories.

707,377
PB80-216211 PC **A13**/MF **A01**
Network Analysis Corp., Vienna, VA.
Distributed Data Processing Standards Forecast.
Final rept.,
T. R. Stack, and K. A. Dillencourt. 9 Jul 80, 287p
Contract NB79-SBCA-0320

Keywords: *Standards, *Data processing, Telecommunication, Cost effectiveness, Government procurement, National government, Government policies, *Distributed processing, Protocols, Distributed computer systems, Data base management systems, Software engineering.

Distributed Data Processing (DDP) technology was reviewed in each of five different areas: Methodologies, Protocols, Distributed Data Base Management Systems (DDBMS), Distributed Operating Systems, and DDP Software Development Tools. This investigation led to the identification of many DDP technical issues and culminated in a prioritized list of standards activities recommendations and the cost avoidance for the years 1983-1986 that these standards activities could potentially achieve. A total of 52 standards activities are presented. Five types of standards activities have been defined and characterized according to the product type that results: (1) standards, (2) guidelines, (3) analysis reports, (4) reports, and (5) standard validation procedures.

707,378
PB80-221211 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Maintenance Testing for the Data Encryption Standard.
Final rept.,
J. Gait. Aug 80, 32p NBS-SP-500-61
Library of Congress catalog card no. 80-600105.

Keywords: *Crytology, *Standards, Maintenance, Data processing, Security, Communications intelligence, *Federal information processing standards, *Data encryption, Software engineering, Computer security, Data validation.

The publication describes the design of maintenance tests for the Federal Information Processing Data Encryption Standard (DES). The test consists of an iterative procedure that completely tests the operation of DES devices by using a small program and minimum data. The tests are designed to be independent of implementation and to be fast enough to test devices during actual operation. The tests are defined as four stopping points in a general testing process, and satisfy four testing requirements depending on the thoroughness of testing desired.

707,379
PB81-105322 PC **A13**/MF **A01**
Bolt Beranek and Newman, Inc., Cambridge, MA.
Formal Specification of the Transport and Session Protocols.
Draft rept.
R. Tenney, J. Burruss, and G. Pearson. Jun 80, 281p
BBN-4445, NBS-GCR-80-289, ICST/HLNP-80-5
Contract NB79-SBCA-0092

Keywords: *Computer networks, Specifications, Standards, Data processing, *Protocols, *Federal information processing standards, Computer architecture.

This report is the third report on the development of transport and session control protocols under the Federal Computer Network Protocol Standards Program (NBS80). This report will specify the actual operation of the transport and session control protocols.

707,380
PB81-105868 PC **A10**/MF **A01**
Network Analysis Corp., Vienna, VA.
Microcomputer Interfacing Standards Survey and Analysis.
Final rept.
8 Aug 80, 205p NBS--GCR-80-288
Contract NB79-SBCA-0209

Keywords: *Microcomputers, Microprocessing, Microprocessors, Systems analysis, Computer storage devices, Standards, Bus conductors, *Federal information processing standards, Architecture(Computers).

An initial phase in the process of developing a Federal Information Processing Standard for a particulate field is the identification of categories within that field appropriate for standards development, and the identification and evaluation of existing and proposed candidate standards within these categories. The purpose of this study, the results that have been obtained, and the conclusions that have been drawn are discussed in this summary.

707,381
PB81-108623 CP **T02**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Counties and County Equivalents of the States of the United States.
Data file.
A. Wenberg. 15 Dec 79, mag tape NBS/DF-81/001
Supersedes Rept. no. NBS/DF-73-005, COM-74-11289.
Source tape is in ASCII or EBCDIC character set. Tapes can be prepared in most standard 7 or 9 track recording modes for one-half inch tape. Identify recording mode desired by specifying character set, track, density, and parity. Call NTIS Computer Products if you have questions. Price includes documentation, FIPS PUB-6-3.

Keywords: *Data file, *States(United States), *Counties, Urban areas, Coding, Data processing, Standards, Magnetic tapes, Federal information processing standards.

The data file provides names and codes for representing the Counties of the 50 states or county equivalents thereof for use in the interchange of formatted machine sensible data. Also included in the set of codes are the independent cities of Maryland, Missouri, Nevada, and Virginia and the Census Divisions and boroughs of Alaska. The following data elements are provided: State abbreviation, State code, county name, and county code. File use and descriptions are found in FIPS PUB 6.3.

707,382
PB81-113524 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Validating the Correctness of Hardware Implementations of the NBS Data Encryption Standard.
Final rept.
J. Gait. Sep 80, 50p NBS-SP-500-20
See also report dated Nov 77, PB-273 648. Library of Congress catalog card no. 77-16067.

Keywords: *Computer systems hardware, Cryptology, Verifying, Proving, Algorithms, Computer programming, *Data encryption, *Federal information processing standards.

The publication describes the design and operation of the NBS testbed that is used for the validation of hardware implementations of the Federal Information Processing Data Encryption Standard (DES). A particular implementation is verified if it correctly performs a set of 291 test cases that have been defined to exercise every basic element of the algorithm. As a further check on the correctness of the implementation an extensive Monte-Carlo test is performed. This publication includes the full specification of the DES algorithm, a complete listing of the DES test set and a detailed description of the interface to the testbed.

707,383
PB81-128399 CP **T05**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
NBS Minimal Basic Test Programs, Version 2.
Software.
J. V. Cugini. Nov 80, mag tape NBS-SP-500-70, NBS/DF-81/003
Source tape is in ASCII character set. Character set restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation, PB81-128407, and PB81-128415.

Keywords: *Software, *Computer programming, Standards, National government, Computer programs, Programming languages, Verifying, Magnetic tapes, *BASIC programming language, *Federal information processing standards, Software engineering.

The set of programs was developed by NBS for the purpose of testing conformance of implementations of the computer language BASIC to the American National Standard for Minimal Basic, ANSI X3.60-1978. The Department of Commerce has adopted this ANSI standard as Federal Information Processing Standard 68. By submitting the programs to a candidate implementation, the user can test the various features which an implementation must support in order to conform to the standard. While some programs can determine whether or not a given feature is correctly implemented, others produce output which the user must then interpret to some degree...Software Description: The system is written in the BASIC programming language for implementation on a DEC-10 computer using the TOPS-10 operating system. 10K bytes of core storage is required to operate the system.

707,384
PB81-128407 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: NBS Minimal BASIC Test Programs, Version 2, User's Manual. Volume I. Documentation.
Final rept.
J. V. Cugini, J. S. Bowden, and M. W. Skall. Nov 80, 82p NBS-SP-500-70/1, NBS/DF-81/003A
For system on magnetic tape, see PB81-128399. See also Volume 2, PB81-128415.

Keywords: *Computer programming, Standards, National government, Programming languages, Verifying, Documentation, *BASIC programming language, *Federal information processing standards, *User manuals(Computer programs), Software engineering.

The publication describes the set of programs developed by NBS for the purpose of testing conformance of implementations of the computer language BASIC to the American National Standard for Minimal Basic, ANSI X3.60-1978. The Department of Commerce has adopted this ANSI standard as Federal Information Processing Standard 68. By submitting the programs to a candidate implementation, the user can test the various features which an implementation must support in order to conform to the standard. While some programs can determine whether or not a given feature is correctly implemented, others produce output which the user must then interpret to some degree. This manual describes how the programs should be used so as to interpret correctly the results of the tests. Such interpretation depends strongly on a solid understanding of the conformance rules laid down in the standard, and there is a brief discussion of these rules and how they relate to the test programs and to the various ways in which the language may be implemented.

707,385
PB81-128415 PC **A21**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: NBS Minimal BASIC Test Programs, Version 2, User's Manual. Volume 2. Source Listings and Sample Output.
Final rept.
J. V. Cugini, J. S. Bowden, and M. W. Skall. Nov 80, 491p NBS-SP-500-70/2, NBS/DF-81/003B
For system on magnetic tape, see PB81-128399. See also Volume 1, PB81-128407.

Keywords: *Computer programming, Standards, National government, Programming languages, Computer programs, Verifying, Documentation, *BASIC programming language, *Federal information processing standards, *User manuals(Computer programs), Software engineering.

The document is a user's manual for the NBS Minimal Test Programs which tests implementation conformance of the computer language BASIC to the American National Standard for Minimal Basic, ANSI X3.60-1978. The document contains source listings and sample outputs.

707,386
PB81-153520 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Executive's Guide to Data Resource Management.
Dec 80, 40p

Keywords: Management analysis, Data sources, National government, Standards, Data processing, Guidelines, Information systems, Directories, Systems analysis, *Federal information processing standards, *Data management, Organizational structure, Data elements.

Data Resource Management concerns knowledge and management of data and of its composition, sources, dissemination, flow, locations, and uses. It is a management program, supported by a Data Resource Directory system, which applies to the management of data the basic principles of resource management. This document publishes one of the three final reports of Federal Information Processing Standards Task Group 17. This report is an executive guide to Data Resource Management.

707,387
PB81-153538 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Guidelines for Implementing Data Resource Management.
Dec 80, 109p

Keywords: Management analysis, Data sources, National government, Standards, Data processing, Guidelines, Information systems, Directories, Systems analysis, *Federal information processing standards, *Data management, Organizational structure, Data elements.

Data Resource Management concerns knowledge and management of data and of its composition, sources, dissemination, flow, locations, and uses. It is a management program, supported by a Data Resource Directory system, which applies to the management of data the basic principles of resource management. This document publishes one of the three final reports of Federal Information Processing Standards Task Group 17. This report provides guidelines on the characteristics, tools, and implementation of a Data Resource Management program.

707,388
PB81-171266 CP **T02**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Standard Codes for Named Populated Places and Related Entities of the States of the United States and District of Columbia, FIPS PUB 55.
Data file.
H. Tom. Feb 81, mag tape NBS/DF-81/004
Supersedes Rept. no. NBS/DF-80/002, PB80-219884.
Source tape is in EBCDIC or ASCI character set. Tapes can be prepared in most standard 7 or 9 track recording modes for one-half inch tape. Identify recording mode desired by specifying character set, track, density, and parity. Call NTIS Computer Products if you have questions.

Keywords: *Data file, *Coding, Urban areas, Rural areas, Communities, States(United States), Magnetic tapes, Counties, Manuals, *Federal information processing standards, *Geographic areas, Geocoding.

The users guide provides users with information needed to process the data file in this third update of the magnetic tape version of document NBS-FIPS-55, Codes for Named Populated Places and Related Entities of the States of the United States. This update includes the changes and additions published in Change Notices 1 thru 13. The documentation describes changes made in the record format resulting in a single format of 132 characters per record. The tape consists of 51 files, one file per State. There are 64 records per block. The location of a particular state file on the tape and record count are noted in the documentation.

707,389
PB81-219305 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Computer Science and Technology: Specifications and Test Methods for Numeric Accuracy in Programming Language Standards.
Final rept.
J. V. Cugini. Jun 81, 42p NBS-SP-500-77, NBS/SP-500-77
Library of Congress catalog card no. 81-600056.

Keywords: *Programming languages, *Standards, Error analysis, Computer programming, National government, *Floating point operation, Number codes, Floating point arithmetic.

The publication formulates language-independent and machine-independent criteria for assessing the quality of floating-point arithmetic operations and functions. The criteria require that results be within the limits generated by perturbing the arguments or operands by a specified amount, and thus allow for the mathematical instability of some functions at certain arguments and also for the granularity of numeric representation inherent in digital machines. Automatic test methods derive naturally from the accuracy requirements. Model algorithms for testing are included.

707,390
PB82-117607 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Federal Requirements for a Federal Information Processing Standard Data Dictionary System.
P. A. Konig, J. J. Newton, and R. G. Saltman. Sep 81, 81p NBSIR-81-2354

Keywords: *Requirements, *Data processing, *Standards, Dictionaries, Guidelines, Computer programming, National government, Federal Information Processing Standard program, FIPS program, National Bureau of Standards, *Data management, Data base management systems.

The report presents information and preliminary conclusions about Federal agencies' requirements for a Federal Information Processing Standard Data Dictionary System. Some initial requirements were identified through analysis of comments made on the 'Prospectus for Data Dictionary System Standard' which describes NBS' efforts to develop a standard. Most of the data used to develop preliminary conclusions on Federal requirements was collected during interviews with Federal Government users and developers of Data Dictionary Systems. Comments received on the Prospectus and data collected during the interviews are summarized. Preliminary conclusions and issues being investigated also are presented.

707,391
PB82-135146 CP **T02**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Codes for Named Populated Places, Primary County Divisions, and Other Locational Entities of the United States (Fourth Update); FIPS PUB-55.
Data file.
H. Tom. 1 Dec 81, mag tape NBS/DF-81/006
Supersedes PB81-171266.
Source tape is in ASCII or EBCDIC character set. Character set restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions.

Keywords: *Data file, *Coding, Urban areas, Communities, Counties, States(United States), Magnetic tapes, Rural areas, *Federal information processing standards, *Geographic areas, Geocoding.

The files of the fourth update provide a unique code for each listed populated place, primary county division, and other locational entity. The tape now includes outlying areas. Additional data added to this update concern incorporated places, census designated places, Indian reservations, and Alaskan native villages. For incorporated and census designated places, the Master Reference File (MRF) numbers assigned by the U. S. Bureau of the Census have been added. Identification numbers assigned by the same agency have been added for Indian reservations and Alaskan native villages. Identification numbers of all Congressional Districts (CD's) in which these places, reservations, and villages are located have been added also. If any of these entities are located in a Standard Metropolitan Statistical Area (SMSA), that information is recorded. Four indexing fields are used on the tape, but are not printed in the hard copy version.

707,392
PB82-140245 PC **A05**/MF **A01**
Aurora Associates, Inc., Washington, DC.
Cost-Benefit Analysis of a Federal Information Processing Standard: COBOL (FIPS 21) Impacts on Air Force Data System Design Center Functions.
Sep 81, 88p NBS-GCR-81-262
Contract NBS-CA0405
Prepared in cooperation with Fiorello, Shaw and Associates, McLean, VA.

Keywords: *Benefit cost analysis, *Cobol, *Conversion, Programming languages, Systems engineering, Air Force, *Federal information processing standards, *Data processing systems, Assembly languages.

The primary objective of this study is to define and evaluate the economic costs and benefits of a selected Federal Information Processing Standard (FIPS) which has been implemented by Federal agencies. A secondary objective is to demonstrate a cost-benefit analysis framework for the post-implementation evaluation of a FIPS. This framework should provide guidance for future post-implementation analyses of FIPS.

707,393
PB82-155227 Not available NTIS
National Bureau of Standards, Washington, DC.
U.S. Efforts to Develop Standard Benchmark Programs.
Final rept.
D. M. Conti. 1978, 2p
Pub. in Proceedings of Int. Conference Performance of Computer Installations, Held at Lake Garda, Italy, on June 22-23, 1978, Paper in Performance of Computer Installations, p55-66 1978.

Keywords: *Computer programming, Standards, National government, Tests, *Federal information processing standards, *Benchmarking, Computer program verification.

This paper surveys attempts within the United States to develop and use standard benchmark programs. In addition, the paper describes several issues raised by a recent Government-industry study group which was organized to determine the technical feasibility of using standard benchmark programs on a Government-wide basis. Problems encountered by the study group as well as suggestions for future work are also presented.

707,394
PB82-170051 PC **A08**/MF **A01**
American National Standards Inst., New York.
ANSI/X3/SPARC DBS-SG Relational Database Task Group (Final Report).
M. K. Brodie, and J. W. Schmidt. Sep 81, 175p NBS/GCR-82/379

Keywords: Standards, *Relational data bases, *Data base management systems, Architectural(Computers).

In May 1979, the RTG was chartered to investigate Relational Database Management Systems and to propose a standards project if appropriate. The RTG produced this report and some supplemental material plus a proposal for a relational DBMS standards project. The report describes the relational model, catalogs the features of current relational systems, discusses architectural issues related to relational systems, and makes recommendations for developing a relational standard.

707,395
PB82-176322 PC **A04**/MF **A01**
Computer Corp. of America, Cambridge, MA.
Computer Science and Technology: An Architecture for Database Management Standards.
Final rept.
Jan 82, 57p NBS/SP-500-86
Contract NB79-SBC-0086
Library of Congress catalog card no. 81-600174.

Keywords: Standards, Computer systems hardware, Programming languages, *Data base management systems, *Architecture(Computers), *Federal information processing standards.

This report describes the current status of an Institute for Computer Sciences and Technology project on architectures for Database Management Systems. An architectural framework for developing DBMS standards is presented. It addresses requirements of both the Federal data processing community and the DBMS vendor community. The architecture groups DBMS functions into both internal and external components and proposes for these components a family structure that supports the integration of DBMS standards for multiple data models.

707,396
PB82-200403 PC **A02**/MF **A01**
Alpha Omega Group, Inc., Harvard, MA.
Issue Paper on Entity Types and Relationships (For a Data Dictionary System).
Final rept.
H. C. Lefkovits. Aug 81, 12p NBS-GCR-82-384
Contract NB81-SBCA-0735
See also PB82-212739.

Keywords: Computer programming, Subroutines, Specifications, *Data dictionaries, *Federal information processing standards, *Data structures.

The specification for the Federal Information Processing Standard Data Dictionary System (FIPS DDS), under development by the Institute for Computer Sciences and Technology is envisioned to consist of a basic or 'core' module, with a set of optional modules containing advanced features. This report presents a proposed set of entities, relationships and attributes for inclusion in the core module of the FIPS DDS. A subset of the extensibility facility, called derivation, is recommended for the core standard, together with attribute-type extensibility. Optional module facilities are also mentioned.

707,397
PB82-212739 PC **A02**/MF **A01**
Alpha Omega Group, Inc., Harvard, MA.
Issue Paper on Interactive Language Characteristics (For a Data Dictionary System).
Final rept.
H. C. Lefkovits. Aug 81, 9p NBS-GCR-82-385
Contract NB81-SBCA-0735
See also PB82-200403.

Keywords: *Programming languages, Specifications, *Data dictionaries, *Federal information processing standards.

The functional specification for the Federal Information Processing Standard Data Dictionary System (FIPS DDS) is under development by the Institute for Computer Sciences and Technology. This paper presents some considerations concerning the interactive language of the FIPS DDS. The major recommendation is that the DDS should include a single, unified interactive command language; such features as menu selection, fill-in-blank mode and command mode, will be integrated into the language. Further recommendations are that the language should be hierarchical in structure, that commands should be structurally simple and include incremented reversibility.

707,398
PB82-236738 Not available NTIS
Bolt Beranek and Newman, Inc., Cambridge, MA.
Automated Formal Specification Technique for Protocols.
Final rept.
May 81, 50p
Contract NB79-SBCA-0092
Pub. in Proceedings of Protocol Testing - Towards Proof. Specification and Validation, National Physical Laboratory, Middlesex, United Kingdom, May 27-29, 1981, 1, p277-326 May 81.

Keywords: *Computer networks, Specifications, Descriptions, *Protocols, Federal information processing standards.

The National Bureau of Standards, Institute for Computer Sciences and Technology (ICST) has initiated a program to develop computer network protocols standards as Federal Information Processing Standards (FIPS). This paper describes a formal method for specifying these computer communication protocols. The method, based on a finite automation, is able to model quite diverse protocols and can be used as the basis for semi-automatic generation of protocol implementations.

707,399
PB83-135103 Not available NTIS

National Bureau of Standards, Washington, DC.
NBS Program in Computer Network Protocol Standards.
Final rept.
R. P. Blanc, and J. F. Heafner. 1980, 6p
Pub. in Proceedings of the International Conference on Computer Communications (5th), Atlanta, Georgia, October 27-30, 1980, p423-428.

Keywords: *Meetings, *Standards, *Computer networks, National government, *Protocols, National Bureau of Standards, Distributed processing.

The NBS has developed a program which will result in a family of high level protocol standards. These federal standards will form a basis for distributed computing in the Federal Government and provide minimum cost, higher performance networking to meet Federal needs. The NBS program includes a systematic approach which is well underway for developing these standards. This approach comprises design tasks, implementation tasks, impact tasks, and evaluation tasks. One objective of this program is to develop Federal standards which are consistent with national and international voluntary standards. To this end NBS will be providing substantive inputs to the American National Standards Institute (ANSI) protocol standards program and assist ANSI in developing a strong U.S. position to present at international protocol standards forums.

707,400
PB83-139162 Not available NTIS.
National Bureau of Standards, Washington, DC.
Off-the-Shelf Solutions Motivate NBS's Standards Drive.
Final rept.
R. P. Blanc, and J. F. Heafner. Mar 82, 4p
Pub. in Data Commun. 4p 1982.

Keywords: *Computer networks, *Standards, National government, Reprints, *Protocols, *Federal information processing standards, Local networks.

Many organizations in the United States as well as in other countries are faced with problems of achieving organizational network systems compatibility. This compatibility can be achieved through an agreed upon set of network protocol standards. Such a set of standards would have the greatest possible impact if the agreements were as widespread as possible, preferably internationally. Such an international agreement on network protocol standards would have the greatest potential for leading to off-the-shelf implementations of these protocols. This paper summarizes the national and international efforts to standardize a set of network protocols to permit systems integration on a network-wide basis. The paper describes the program of the National Bureau of Standards (NBS) in computer network protocols standardization in the context of these national and international efforts. The specifications which NBS will be proposing as Federal Information Processing Standards (FIPS) are based on the work of the International Organization for Standardization (ISO) and the requirements of the Federal Government.

707,401
PB83-140632 PC **A13**/MF **A01**
National Bureau of Standards, Washington, DC.
Computer Science and Technology: NBS FIPS Software Documentation.
Final rept.
A. J. Neumann. Oct 82, 295p NBS-SP-500-94
Proceedings of a Workshop Held March 3, 1982 at NBS, Gaithersburg, MD. Library of Congress catalog card no. 82-600600.

Keywords: *Meetings, *Documentation, *Computer programming, Quality assurance, Standards, *Federal information processing standards, *Computer software, Software engineering.

These proceedings provide a record of papers and discussions presented at a workshop held on March 3, 1982, at the National Bureau of Standards. The meeting was sponsored by the NBS Institute for Computer Science and Technology. In addition to papers presented, the record also provides remarks by discussants and other participants. The workshop covered a variety of topics pertaining to software documentation. Topical sessions included: case studies of and reports on application of existing standards, documentation for operation and maintenance, tools for improved documentation, proposal for new documentation standards, enhancing software sharing, improving human interfaces, and quality assurance of documentation. Sixty-three papers were presented in parallel sessions, and a summary session concluded the meeting; over 300 persons participated in the workshop.

707,402
PB83-163394 PC **A17**/MF **A01**
Computer Corp. of America, Cambridge, MA.
Family of Data Model Specifications for DBMS (Database Management Systems) Standards.
Final rept.
F. Manola, A. Pirotte, B. Blaustein, and D. R. Ries.
Dec 82, 390p NBS-GCR-82-419
Contract NB79-SBCA-0086
See also PB80-183833.

Keywords: *Standards, Specifications, Architecture, *Data base management systems, Data models, Schema, Query languages, Data definition languages, Relational data bases.

This report describes the current status of a National Bureau of Standards project on architectures for Database Management Systems (DBMSs). Semiformal specifications for three major data models (relational, network, and hierarchical) are presented. A model that is a subset of operations and data objects common to all three models is identified. These models will be the basis of the development of a family of language specifications that are defined so that a user of a DBMS based on these specifications can use the common subset of operations and data objects without regard to the particular model that the DBMS implements.

707,403
PB83-169441 PC **A18**/MF **A01**
Alpha Omega Group, Inc., Harvard, MA.
Functional Specifications for a Federal Information Processing Standard Data Dictionary System.
P. A. Konig, A. Goldfine, and J. J. Newton. Jan 83, 421p NBSIR-82-2619
Contract NB81-SBCA-0735

Keywords: Specifications, Computer programming, Standards, *Federal information processing standards, *Data dictionaries, Data base management, Schema.

This interim report contains Functional Specifications for the basic functions that data dictionary software must perform to satisfy Federal agency requirements. The functionality specified will be incorporated into a planned Federal Information Processing Standard (FIPS) Data Dictionary System (DDS). The complete FIPS DDS also will contain additional specifications for such things as the user interface. Comments are being solicited from Federal agencies and suppliers of data dictionary software to determine any modifications that should be made to the Functional Specifications. Information about the effort to develop the planned FIPS DDS and a Management Overview of the Functional Specifications appear in Part I of this document. The Functional Specifications are in Part II.

707,404
PB83-170647 CP **T02**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Codes for Named Populated Places, Primary County Divisions, and Other Locations Entities of the United States (Fifth Update); FIPS PUB 55.
Data file.
H. Tom. 4 Mar 83, mag tape NBS/DF-83/001
Supersedes PB82-135146.
Source tape is available in ASCII or EBCDIC character set. Character set restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions.

Keywords: *Data file, *Coding, Urban areas, Rural areas, Counties, Magnetic tapes, *Federal information processing standards, *Geographic areas, Geocoding.

Federal Information Processing Standard (FIPS) 55 assigns standard codes used in information processing and interchange to about 160,000 populated places, government units, statistical areas, military bases, airports, and other facilities in the US and its outlying areas. This new 5th update tape lists the appropriate Congressional District(s) of the newly-convened 98th Congress with each entry of a county, primary county division, incorporated place, Census-designated place, Indian reservation, Alaska native village and military base. The Tape also provides, for the first time, an individual entry and place code for each county and county equivalent in the United States. Another feature of the tape is an updated cross-reference to the GSA Worldwide Geographic Location Code.

707,405
PB83-177063 Not available NTIS
National Bureau of Standards, Washington, DC.
Commentary on Computers and Standards.
Final rept.
J. H. Burrows, and S. M. Radack. Jan 82, 4p
Pub. in Comput. Stand. 1, n1 p5-8 Jan 82.

Keywords: *Data processing, *Standards, *Computers, Utilization, Computer networks, Federal information processing standards.

It is becoming increasingly important that users' needs be considered in the development of computer standards. Future standards development activities should focus on areas such as terminal, computer system and network interconnections; data and media exchange; and work environments to help the user make more effective use of computers and improve productivity. Current efforts to develop network protocol standards by NBS, national, and international voluntary groups are important steps toward establishing user-oriented standards.

707,406
PB83-191098 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Cost-Benefit Impact Study on the Adoption of the Draft Proposed Revised X3.23 American National Standard Programming Language COBOL.
M. Fiorello, and J. Cugini. Mar 83, 79p NBSIR-83-2639
Prepared in cooperation with Fiorello, Shaw and Associates, and Aurora Associates, Inc.

Keywords: *Benefit cost analysis, *Cobol, *Standards, Programming languages, Productivity, *Federal information processing standards, Software engineering.

The purpose of the study is to assess the estimated costs and benefits for the Federal Government which would result from adoption of the proposed revision of American National Standard COBOL as a Federal Information Processing Standard (FIPS). Potential benefits of $90.2 million have been identified, stemming primarily from improved productivity in both the development and maintenance of COBOL programs.

707,407
PB84-121367 CP **T02**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
MSA: Metropolitan Statistical Areas Data Tape.
Data file.
H. Tom. 30 Jun 83, mag tape NBS/DF-84/001
Source tape is in both the EBCDIC and the ASCII character sets. Character sets restrict preparation to 9 track, one-half inch tape only. Identify recording mode by specifying character set and density. Call NTIS Computer Products if you have questions.

Keywords: *Data file, *Metropolitan areas, *Coding, Urban areas, Magnetic tapes, *Standard metropolitan statistical areas, *Federal information processing standards, Geographical areas.

The Office of Management and Budget (OMB) announced revised definitions of the nation's metropolitan statistical areas (MSAs) effective June 30, 1983. Based on demographic data derived from the 1980 decennial census, a comprehensive review was undertaken by the Federal Committee on MSAs, which advises OMB on MSA matters. The previous term Standard Metropolitan Statistical Area (SMSA) has been shortened to Metropolitan Statistical Area (MSA). Under the new standards, an area qualifies for recognition as an MSA in one of two ways: if there is a city of at least 50,000 population, or an urbanized area of at least 50,000 with a total metropolitan population of at least 100,000. If an area has more than 1 million population and meets certain other specified requirements, it now will be termed a 'Consolidated Metropolitan Statistical Area' (CMSA), consisting of major components recognized as 'Primary Metropolitan Statistical Areas' (PMSAs). A total of 257 MSAs are recognized. In addition, there are 23 CMSAs, consisting of 78 PMSAs. This tape contains computer files documenting titles, components and Federal Information Processing Standards (FIPS) codes for Metropolitan Statistical Areas and related statistical areas. It includes two

computer files to convert titles, components, and FIPS codes for Standard Metropolitan Statistical Areas to June 30, 1983 MSA definitions.

707,408
PB84-128941 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Guidance on Software Maintenance.
Final rept.
R. J. Martin, and W. M. Osborne. Dec 83, 75p NBS-SP-500-106
Library of Congress catalog card no. 83-600611.

Keywords: Maintenance management, Quality control, Computer programming, *Computer software maintenance, Software tools, Federal information processing standards.

This report addresses issues and problems of software maintenance and suggests actions and procedures which can help software maintenance organizations meet the growing demands of maintaining existing systems. The report establishes a working definition for software maintenance and presents an overview of current problems and issues in that area. Tools and techniques that may be used to improve the control of software maintenance activities and the productivity of a software maintenance organization are discussed. Emphasis is placed on the need for strong, effective technical management control of the software maintenance process.

707,409
PB84-162742 CP **T02**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Codes for Named Populated Places, Primary County Divisions, and Other Locations Entities of the United States (Sixth Update); FIPS PUB 55.
Data file.
H. Tom. 1 Mar 84, mag tape NBS/DF-84/002
Supersedes PB83-170647.
Source tape is in ASCII or EBCDIC character set. Character set restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying character set and density. Call NTIS Computer Products if you have questions.

Keywords: *Data file, *Coding, Urban areas, Rural areas, Counties, Magnetic tapes, *Federal information processing standards, *Geographic areas, Geocoding.

This sixth update of the Federal Information Processing Standard (FIPS) 55 data file provides a two-character State code and five-character numeric place code to uniquely identify each listed entity. Areas of the United States covered are the fifty States, the District of Columbia, and all outlying territories with significant self-administration. An exhaustive list is carried of incorporated places, census designated places (CDP's), primary county divisions (such as townships, New England towns, and census county divisions), recognized Indian reservations and Alaska Native villages, and counties. The listing also includes unincorporated places, military bases, National parks, airports, and ground transportation points. A two-character class code distinguishes over seventy entity types. Each entity is identified by the county or counties in which it is located. All exhaustive categories and military bases are identified by Congressional District and, in most cases, by metropolitan statistical areas. Incorporated places, CDP's, and Indian and Alaska Native areas, are cross-referenced to U.S. Bureau of the Census files. ZIP codes are provided for all Post Offices.

707,410
PB84-216456 PC **A05**/MF **A01**
Computer Corp. of America, Cambridge, MA.
Logical Database Processor Interface Specifications.
Final rept.
F. A. Manola. Mar 84, 93p CCA-83-11, NBS-GCR-84-461
Contract NB79SBCA-0086
See also PB83-163394.

Keywords: *Standards, Specifications, Computer networks, *Data base management systems, Computer architecture, Data models, Schema, Query languages, Data definition languages, Tree models.

This report describes the interface specifications and processing functions of the logical Database Processor (LDBP) component of a DBMS component architecture developed by Computer Corporation of America for the National Bureau of Standards. The component architecture is intended to serve as a potential framework for developing DBMS standards. The LDBP component serves to implement the DBMS logical data model, and provides access to DBMS metadata for all components. The LDBP interface provides a common target for the development of DBMS user language facilities.

707,411
PB84-217116 PC **A09**/MF **A01**
Computer Corp. of America, Cambridge, MA.
Tree Query Language Flat (TQLF) Specifications.
Final rept.
F. Manola, and A. Pirotte. Mar 84, 180p CCA-83-05, NBS-GCR-83-455
Contract NB79-SBCA-0086
See also PB83-163394.

Keywords: *Standards, *Data base management systems, TQLF programming language, Query languages, Data models, Computer architecture, Tree models, Relational data bases.

TQLF is a high-level language for defining, accessing, and manipulating data in tree (hierarchical) model databases. TQLF has similarities to both the SQL and QUEL query languages, and was developed within the context of a program to develop a family of data models and database languages for those models. The intent is to provide maximum commonality among members of the family, so as to reduce difficulties when changing from one model to another. TQLF is the member of the family corresponding to the trees data model. NQLF and RQLF are other members of the family corresponding respectively to the network and relational data models.

707,412
PB84-217124 PC **A03**/MF **A01**
Computer Corp. of America, Cambridge, MA.
Model-Model Mappings and Conversion in a Family of Data Model Specifications.
Final rept.
F. A. Manola. Mar 84, 50p CCA-83-14, NBS-GCR-84-464
Contract NB79-SBCA-0086
See also PB83-163394.

Keywords: *Standards, Specifications, *Data base management systems, Data models, Schema, Tree models, Computer architecture, Data translation, Relational data base.

This report describes methods for transforming between data descriptions in different data models of the family of data model specifications developed by Computer Corporation of America for the National Bureau of Standards. The data models include the network, tree, and relational data models. In addition, guidelines are presented for converting databases corresponding to one of these data models to databases corresponding to another such model.

707,413
PB84-217405 PC **A07**/MF **A01**
Computer Corp. of America, Cambridge, MA.
Relational Query Language Flat (RQLF) Specifications.
Final rept.
F. A. Manola, and A. Pirotte. Mar 84, 137p CCA-83/06, NBS/GCR-83/454
Contract NB79-SBCA-0086
See also PB83-163394.

Keywords: *Computer languages, Computer networks, *Data base management systems, *Relational data bases, High level languages, Query languages, RQLF programming languages, Data models.

RQLF is a high-level language for defining accessing, and manipulating data in relational databases. RQLF has similarities to both the SQL and QUEL query languages, and was developed within the context of a program to develop a family of data models and database languages for those models. The intent is to provide maximum commonality among members of the family so as to reduce difficulties when changing from one model to another. RQLF is the member of the family corresponding members of the family corresponding respectively to the tree and network data models.

707,414
PB84-217538 PC **A09**/MF **A01**
Computer Corp. of America, Cambridge, MA.
Network Query Language Flat (NQLF) Specifications.
Final rept.
F. A. Manola, and A. Pirotte. Mar 84, 185p CCA-83/04, NBS/GCR-83/456
Contract NB79-SBCA-0086
See also PB83-163394.

Keywords: *Computer networks, *Data base management systems, Query languages, Data definition languages, Data models, Relational data bases, Computer architecture.

NQLF is a high-level language for defining accessing, and manipulating data in network model databases. NQLF has similarities to both the SQL and QUEL query languages, and was developed within the context of a program to develop a family of data models and database languages for those models. The intent is to provide maximum commonality among members of the family, so as to reduce difficulties when changing from one model to another. NQLF is the member of the family corresponding to the network data model. TQLF and RQLF are other members of the family corresponding respectively to the tree and relational data models.

707,415
PB84-217561 PC **A05**/MF **A01**
Computer Corp. of America, Cambridge, MA.
Physical Database Processor Preliminary Interface Specifications.
Final rept.
F. A. Manola. Mar 84, 77p CCA-83/12, NBS/GCR-84/462
Contract NB79-SBCA-0086
See also PB83-163394.

Keywords: *Standards, Specifications, *Data base management systems, Data models, Schema, Query languages, Data definition languages, Relational data bases, Computer architecture.

This report describes preliminary interfaces specifications and processing functions of the Physical Database Processor (PDBP) component of a DBMS component architecture developed by Computer Corporation of America for the National Bureau of Standards. The component architecture is intended to serve as a potential framework for the developing DBMS standards. The PDBP supports storage structure objects and operations for other components of the architecture. The report also describes tradeoffs involved in choosing various storage structures to support DBMS operations.

707,416
PB84-223593 PC **A05**/MF **A01**
Fiorello, Shaw and Associates, McLean, VA.
Standards for Commercially Emerging Technologies: A Preliminary Cost-Benefit Assessment for the Optical Digital Data Disk (OD3) Technology for Mass Data Storage Applications.
Final rept.
M. Fiorello. Apr 84, 88p NBS/GCR-84/469

Keywords: *Standards, *Benefit cost analysis, *Data storage, Assessments, Technology, Cost analysis, Forecasting, *Optical digital data disk.

This report presents a preliminary cost-benefit impact assessment of promulgating information processing standards for the commercially emerging Optical Digital Data Disk (OD sup 3) technology, as applied to machine readable information. The Federal Government perspective is emphasized. The analysis includes: estimates of the market penetration of the OD sup 3 technology; basic models of how standards can affect technology innovation and diffusion; and, a preliminary assessment of the cost-benefit to the Federal Government.

707,417
PB85-110120 Not available NTIS
National Bureau of Standards, Washington, DC.
Description of a Planned Federal Information Processing Standard for Transport Protocol.
Final rept.
J. F. Heafner, and R. P. Blanc. 1981, 9p
Pub. in Proceedings of Data Community Symposium (7th), Mexico City, Mexico, October 27-29, 1981, p2-10.

Keywords: *Computer networks, *Standards, Design, Services, Specifications, Procurement, Interfaces, *Federal information processing standards, Intercommunication systems, Transport, Protocols, Government agencies.

The National Bureau of Standards has developed service and design specifications for transport and session protocols for use in computer system and network procurements. These protocols reside in layers four and five of the International Organization for Standardization's (ISO) Reference Model for Open Systems Interconnection. This paper describes the services, interfaces, and internal behavior of the transport protocol. The transport (and session) protocol specifications were derived from the most recent developments within ISO on these protocols. Specific features were selected based on the needs of the agencies of the Federal Government within the United States, but they are consistent with the needs of any large organization engaged in the procurement or development of networks of heterogeneous computer systems.

707,418
PB85-140754 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Federal Standards in Risk Analysis and Contingency Planning.
Final rept.
S. K. Reed, and S. W. Katzke. 1980, 3p
Pub. in Data Manage. 18, n1 p20-22 Jan 80.

Keywords: *Standards, Data processing security, Reprints, *Federal information processing standards, Risk analysis, Contingency planning, Computer security.

Working under the mandate of Public Law 89-306, the Institute for Computer Sciences and Technology (ICST) provides Federal Information Processing Standards for Federal agencies to apply in the selection, acquisition, and utilization of computer hardware and software. A topic of special concern, especially relevant to utilization, but which to some extent also needs to be considered in selection and acquisition, is computer security. For this reason, standards must be provided for the physical, administrative and technical safeguards which address security. While some of these are for hardware and software, others are in areas which cannot be defined as either but fall into the category of procedures and supporting services. Two such areas are risk analysis and contingency planning.

707,419
PB85-152288 CP **T02**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Standard Abbreviations and Codes for States and Outlying Areas of the U.S. (FIPS PUB 5-1) and Counties and County Equivalents of the States of the United States and the District of Columbia (FIPS PUB 6-3).
Data file.
T. Henry. Jan 85, mag tape FIPS PUB 5-1, FIPS PUB 6-3, NBS/DF-85/006
Supersedes PB-190 119 and PB81-108623.
Source tape is in the EBCDIC or ASCII character set. This restricts preparation to 9 track one-half inch tape only. Identify recording mode by specifying density and character set. Call NTIS Computer Products if you have questions.

Keywords: *Data file, *Coding, Standards, Magnetic tapes, *Federal information processing standards, *Geocoding, States(United States), Counties.

This tape contains two files: FIPS PUB 5-1 (incl. change notices 1-4), Standard Abbreviations and Codes for States and Outlying Areas of the U.S., and FIPS PUB 6-3 (incl. change notices 1-4), Counties and County Equivalents of the States of the United States and the District of Columbia. Records in File 1 are sequenced in alphabetic order of the states (incl. D.C.), followed by the major outlying areas in alphabetic order, followed by the minor areas in alphabetic order. Progression of the numeric state code is consistent with alphabetic order of the states and major outlying areas. Minor outlying areas have no postal abbreviations and, in these cases, positions 51 and 52 of each record are blank. Records in File 2 are sequenced in alphabetic order of county name, within each state and outlying area. Progression of the numeric county code is consistent with alphabetic order of the counties within each state. States (incl. D.C.) and the major outlying areas are sequenced as in File 1. Minor outlying areas do not appear in File 2, as they have no county equivalent.

707,420
PB85-152312 CP **T02**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Codes for Named Populated Places, Primary County Divisions, and Other Locational Entities of the United States (FIPS PUB 55), 7th Update.
Data file.
H. Tom. Jan 85, mag tape FIPS PUB 55, NBS/DF-85/005
Supersedes PB84-162742.
Source tape is in the EBCDIC or ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density and character set. Call NTIS Computer Products if you have questions. Includes FIPS PUB 55 User Guide.

Keywords: *Data file, *Coding, *United States, Urban areas, Rural areas, Municipalities, Communities, Magnetic tapes, *Federal information processing standards, *Geocoding, Counties, ZIP codes.

This seventh update of the Federal Information Processing Standard (FIPS) 55 data file provides a two-character State code and five-character numeric place code to uniquely identify each listed entity. Areas of the United States covered are the fifty States, the District of Columbia, and all outlying territories with significant self-administration. An exhaustive list is carried of incorporated places, census designated places (CDP's), primary county divisions (such as townships, New England towns, and census county divisions), recognized Indian reservations and Alaska Native villages, and counties. The listing also includes unincorporated places, military bases, National parks, airports, and ground transportation points. A two-character class code distinguishes over seventy entity types. Each entity is identified by the county or counties in which it is located. All exhaustive categories and military bases are identified by Congressional (99th) District and by all new metropolitan statistical areas. Incorporated places, CDP's, and Indian and Alaska Native areas, are cross-referenced to U.S. Bureau of the Census files. ZIP codes are provided for all Post Offices.

707,421
PB85-183572 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Integrity and Security Standards Based on Cryptography.
Final rept.
D. K. Branstad, and M. E. Smid. 1982, 6p
Pub. in Computer Security 1, n3 p255-260 Nov 82.

Keywords: Security, Standards, Reprints, *Computer security, *Data Encryption Standard, *Cryptography, Federal Information Processing Standard, Authentication.

Since the Data Encryption Standard (DES) was published in January 1977, as a Federal Information Processing Standard (FIPS), it has become the basis for the development of several security and integrity standards. Seven DES based security standards have already been approved, and several others are in development. Five standards making organizations are now involved with DES based standards: the American Bankers Association (ABA), the American National Standards Institute (ANSI), the General Services Administration (GSA), the International Organization for Standardization (ISO), and the National Bureau of Standards (NBS). While these standards are all based on the DES, future standards may make provision for using other cryptographic algorithms. For example, public key cryptographic algorithms could offer some advantages over the traditional, secret key cryptographic algorithms in certain applications. In anticipation of this future requirement NBS has published a Solicitation for Public Key Cryptographic Algorithms to be based in special application standards.

707,422
PB86-111341 Not available NTIS
National Bureau of Standards, Boulder, CO.
Description of a Planned Federal Information Processing Standard for Data Presentation Protocol.
Final rept.
J. R. Moulton. 1982, 6p
Pub. in Proceedings of the International Conference on Computer Communication, Pathways to the Information Society (6th), London, England, September 7-10, 1982, p896-901.

Keywords: *Computer networks, *Standards, Specifications, Procurement, *Federal Information Processing Standards, *Open system interconnection, *Data presentation protocols.

The National Bureau of Standards has developed service and design specifications for internet, transport, session, data presentation, and file transfer protocols for use in computer systems and network procurements. These protocols reside in layers three, four, five, six and seven of the International Organization for Standardization's (ISO) Reference Model of Open Systems Interconnection. This paper describes the services and internal behavior of the data presentation protocol, as well as specifications for the other protocols, was derived from the most recent developments within ISO. Specific features were selected based on the needs of the agencies of the Federal Government of the United States. These needs are consistent with those of any large organization engaged in the procurements or development of networks of heterogeneous computer systems.

707,423
PB86-111390 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Network Architecture Div.
Description of a Planned Federal Information Processing Standard for the Session Protocol.
Final rept.
F. H. Nielsen, and J. F. Heafner. 1982, 7p
Pub. in Proceedings of COMPCOM 82, Digest of Papers Spring Conference on High Technology in the Information Industry, San Francisco, CA., February 22-25, 1982, p272-278.

Keywords: *Computer networks, *Standards, Specifications, Procurement, *Federal Information Processing Standards, *Open system interconnections, Session protocols.

The National Bureau of Standards has developed service and design specifications for internetwork, transport and session protocols for use in computer system and network procurements. These protocols reside in layers three, four, and five of the International Organization for Standardization's (ISO) Reference Model for Open Systems Interconnection. This paper describes the services and internal behavior of the session protocol. The session (and transport) protocol specifications were derived from the most recent developments within ISO on these protocols. Although specific features were selected based on the needs of U.S. Federal Government agencies, these needs are consistent with the needs of any large organization engaged in the procurement or development of networks of heterogeneous computer systems.

707,424
PB86-111408 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Network Architecture Div.
Description of a Planned Federal Information Processing Standard for File Transfer Protocol.
Final rept.
F. H. Nielsen, and J. R. Moulton. 1982, 9p
Pub. in Proceedings INFOCOM 82, Las Vegas, NV., March 30-April 1, 1982, p139-147.

Keywords: *Computer networks, *Standards, Specifications, Procurement, *Federal Information Processing Standards, *Open system interconnections, *File transfer protocols.

The National Bureau of Standards has developed service and design specifications for transport, session, data presentation, and file transfer protocols for use in computer system and network procurements. These protocols reside in layers four, five, six and seven of the International Organization for Standardization's (ISO) Reference Model of Open Systems Interconnection. This paper describes the services and internal behavior of the file transfer protocol. The specification of the file transfer protocol, as well as specifications for the remainder of the aforementioned protocols, was derived from the most recent developments within ISO on this protocol. Specific features were selected based on the needs of the agencies of the Federal Government within the United States, but these needs are consistent with those of any large organization engaged in the procurement or develop-

ment of networks of hetereogeneous computer systems.

707,425
PB86-203429 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Software Technology Div.
Software Engineering Standards: Motives and Mechanisms.
Final rept.
M. Branstad. 1983, 4p
Proceedings of Software Engineering Standards Application Workshop (2nd), San Francisco, CA., May 17-19, 1983, p83-86.

Keywords: *Standards, Groups, Workshops, *Software engineering.

In recent years there has been an increased interest in software engineering (SWE) standards. Many groups are establishing standards, often as apparently independent activities. The paper discusses standards in general and software engineering standards in particular, the groups who are developing software engineering standards, the needs that drive their standardization efforts, and the forces that influence and constrain the standards.

707,426
PB86-232097 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems Components Div.
New Computer-Based Self-Correcting Calibration System for Computer Storage Media Standard Reference Materials.
Final rept.
F. L. Podio. 1985, 6p
Pub. in Computers and Standards 4, n4 p231-236 1985.

Keywords: *Computer storage devices, *Magnetic tapes, *Standards, Calibrating, Automatic control, Self organizing systems, Reprints, National Bureau of Standards.

A new method for calibrating magnetic computer storage media Standard Reference Materials (SRMs) has been developed at the National Bureau of Standards (NBS). The calibration system applies to a new class of higher density Standard Reference Magnetic Computer Storage Media. The foundation of the method is based on both the analysis of and experience with the present well-established SRM calibration systems. Errors that would be introduced into the calibration process by unwanted system changes are prevented from doing so through the use of self-correcting techniques.

707,427
PB86-232311 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Automation Sensors Group.
Emerging Software Standards: Opportunity and Challenge.
Final rept.
H. M. Wood. 1986, 5p
Pub. in Proceedings of Computer Standards Conference, 1986-Striking a Balance between Technology, Economics, Politics, and Reality - For Substance, Not Form, San Francisco, CA., May 13-15, 1986, p122-126.

Keywords: *Standards, Vendors, Competition, Utilization, *Computer industry, *Information transfer, Computer software, International Organization for Standardization, User needs.

Although computer technology standards have been under development for over two decades, all too often the results of these activities were overlooked or underutilized. Now users are faced with differing proprietary products that inhibit transfer of information. Meanwhile, the U.S. computer industry is facing increased international competition, coupled with the threat of a variety of restrictive national standards. As a result, the demand for communications and software standards has surged--not only from users, but from vendors as well. Fortunately, a number of needed standards are flowing out of national and international standards organizations to meet the demand. The paper will consider emerging software standards and efforts to speed their development and use.

707,428
PB87-128286 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Network Architecture Div.
Testing OSI (Open Systems Interconnection) Protocols at the National Bureau of Standards.
Final rept.
R. J. Linn, and J. S. Nightingale. 1983, 4p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) 71, n12 p1431-1434 Dec 83.

Keywords: Tests, Protocols, Programming languages, *Open systems interconnections, *Federal information processing standards, National Bureau of Standards.

The Institute for Computer Sciences and Technology at the National Bureau of Standards has developed an architecture for testing implementations of OSI protocols, to establish conformance with the appropriate Federal Information Processing Standards. The paper gives a justification for specific design choices made, describes architectural elements and gives an example of a test language used to drive the test system.

707,429
PB87-142436 CP **T05**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Codes for Named Populated Places, Primary County Divisions, and other Locational Entities of the United States (FIPS PUB 55), 9th Update.
Data file.
1 Dec 86, mag tape NBS/DF/MT-87/003
Supersedes PB86-154002.
Data file is available in the EBCDIC and ASCII character sets on 9-track one-half inch tape. Identify recording mode by specifying density and character set. Call NTIS Computer Products if you have questions.

Keywords: *Data file, *Populations, *Coding, *States(United States), Urban areas, Communities, Magnetic tapes, *Federal Information Processing Standards, *Population distributions, *Geographic areas, *Standard metropolitan statistical areas, *Counties, Computer applications.

The ninth update of the Federal Information Processing Standard (FIPS) 55 data file provides a two-character State code and five-character numeric place code to uniquely identify each listed entity. Areas of the United States covered are the fifty States, the District of Columbia, and all outlying territories with significant self-administration. An exhaustive list is carried of incorporated places, census designated places (CDP's), primary county divisions (such as townships, New England towns, and census county divisions), recognized Indian reservations and Alaska native villages and counties. The listing also includes unincorporated places, military bases, National parks, airports, and ground transportation points. A two-character class code distinguishes over seventy entity types. Each entity is identified by the county or counties in which it is located. All exhaustive categories and military bases are identified by Congressional (99th) District and by all new metropolitan statistical areas. Incorporated places, CDP's and Indian and Alaska native areas, are cross-referenced to U.S. Bureau of the Census files. ZIP codes are provided for all post offices.

707,430
PB87-164067 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems Components Div.
Verifying Conformance to the X.25 Standard.
Final rept.,
G. E. Clark, and M. K. Wong. Apr 85, 5p
Pub in Data Communication 14, n4 p153-154, p157-158, p161 Apr 85.

Keywords: *Telecommunication, *Standards, Conformity, Tests, Reprints, *Federal information processing standards, *Computer program verification, *Packet switching, Compliance, Computer networks.

NBS has developed a set of verification techniques which can be applied by any organization to determine compliance with Federal Information Processing Standard 100, the government's standard for interfacing data terminals and computers to packet switched data terminals and computers to packet switched data networks. A fundamental objective of these verification tests is concerned with establishing uniform verification testing and unambiguous evaluation procedures to aid government users in acquiring ADP and telecommunications facilities or services based on the CCITT X.25 specifications. These tests are designed for use by vendors and suppliers so as to provide government users with assurance the products they acquire are in conformance with the FIPS 100/FS 1041 specifications and can interwork.

707,431
PB87-179891 PC **A04**/MF **A01**
National Bureau of Standards (ICST), Gaithersburg, MD. Center for Programming Science and Technology.
Report on the NBS (National Bureau of Standards) Software Acceptance Test Workshop, April 1-2, 1986.
Final rept.,
D. R. Wallace, and J. C. Cherniavsky. Mar 87, 52p
NBS/SP-500/146
Also available from Supt. of Docs as SN003-003-02793-6. Library of Congress catalog card no. 87-619806.

Keywords: *Standards, Tests, Standardization, Automation, Meetings, *Computer software, *Software tools, *Acceptability, *National Bureau of Standards, Computer program verification, Computer program reliability.

The document is a report on the Software Acceptance Test Workshop held at the National Bureau of Standards, April 1-2, 1986. The workshop consisted of eight sessions divided over two days. The topics of the first day's sessions were acceptance testing of off-shelf software, test case selection techniques, automated support for software acceptance testing, and software acceptance criteria. The topics of the second day's sessions were the management of software acceptance testing, standardization issues in software acceptance testing, research areas for software acceptance testing, and the state of practice in software acceptance testing. The report describes the charges given to all of the sessions, highlights of discussions from each of the sessions, and the conclusions of the workshop. The report is intended for those who purchase, market, develop or maintain software and for those who are responsible for software acceptance testing.

707,432
PB88-141130 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Center for Computer Systems Engineering.
NBS (National Bureau of Standards) Assistance to OSI (Open Systems Interconnection) Product Development.
Final rept.,
R. P. Blanc. 1986, 3p
Pub. in Comput. Stand. Interfaces 5, n4 p313-315 1986.

Keywords: *Computer networks, *Standards, Product development, Tests, Specifications, Compatability, Interfaces, Protocols, Performance tests, Conformity, Government policies, Requirements, Reprints, *Open systems interconnections, *Commercial sector, Industry, National Bureau of Standards.

A primary objective of the National Bureau of Standards (NBS) Computer Networking Program is to achieve Open Systems Interconnection (OSI), consistent with government requirements, through commercial products. The authors now have a number of OSI standards, but those standards are not really useful until they are implemented in commercial off-the-shelf systems. At NBS in the early days of OSI, most of the resources were devoted to the development of standard specifications. Now over 90% of the resources go into helping industry turn those paper specifications into products. Most of the activities are laboratory based. They are oriented toward developing testing mechanisms that industry can use in the development of compatible OSI products. They also help to organize the industry to make implementation decisions which are then reflected in user specifications such as the Manufacturing Automation Protocol (MAP), and Technical/Office Protocol (TOP), and Federal Information Processing Standards (FIPS). To assist implementors the authors are now conducting three primary activities: the OSI Implementors Workshop, performance testing, and conformance testing.

707,433
PB88-152475 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Network Architecture Div.

Implementation of OSI Protocols.
Final rept.,
J. Heafner, and R. Blanc. 1985, 5p
Pub. in Conference Record--IEEE (Institute of Electrical and Electronics Engineers) International Conference on Communications, Chicago, IL., June 23-26, 1985, p614-618.

Keywords: *Computer networks, *Standards, Tests, Specifications, Protocols, Implementation, *Open systems interconnections.

The paper describes a test methodology for testing the correctness of computer network protocols. It describes a procedure for arriving at consensus among interested parties concerning implementation details of a protocol specification. Then a formal process of testing is described. The results of this procedure are illustrated by the description of a multi-vendor demonstration of correctly operating protocols.

Information Theory

707,434
PB-264 323/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Application of the Homomorphic Deconvolution for the Separation of TDR Signals Occurring in Overlapping Time Windows.
Final rept.,
S. M. Riad, and N. S. Nahman. 1976, 4p
Pub. in IEEE Trans. Instrum. Meas. IM-25, n4 p388-391 Dec 76.

Keywords: *Signal processing, *Homomorphic deconvolution, Time domain reflectometry, Reprints.

The homomorphic transformation is used to separate a time domain reflectometry (TDR) signal into its rapidly and slowly varying components, respectively. The separation (deconvolution) technique is successful in the case where the multiple reflections cannot be viewed in non-overlapping time windows as is required by the conventional TDR method.

707,435
PB82-135153 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Deconvolution of Time Domain Waveforms in the Presence of Noise.
N. S. Nahman, and M. E. Guillaume. Oct 81, 125p
NBS-TN-1047

Keywords: *Transient response, Signal processing, Laplace transformation, Pulsation, Waveforms, Transmission lines, Broadband antennas, Deconvolution, Inverse filtering, Impulses, Time domain.

Deconvolution or inverse filtering was used to determine the impulse response of a system using noisy input and output time domain sequences (discrete data). Frequency and time domain methods were studied along with the synthesis of the filters required to obtain stable and smooth results. For the methods studied it was concluded that the superior technique was provided by an optimal frequency domain method implemented via the FFT. Also, it is pointed out that the time domain methods are only in their infancy and still retain the promise of avoiding transform domain filtering. Examples are presented in which the impulse responses are determined in the presence of varying degrees of noise for a coaxial transmission line, a wave-shaping filter, and a broadband antenna.

707,436
PB83-143800 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of Signal-Plus-Noise Detection Error in an Envelope Detector with Logarithmic Compression.
Final rept.
A. J. Estin, and W. C. Daywitt. 1982, 2p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Information Theory II-27, n5 p663-664 Sep 82.

Keywords: Detection, Errors, Random noise, Correction, Reprints, *Signal detection.

A correction factor is derived for the amplitude of the detected output of a modulated sinusoidal signal with added Gaussian noise, as processed by an envelope detector with logarithmic compression. Supporting experimental data are presented that were obtained using a typical system having such a detector.

Pattern Recognition & Image Processing

707,437
PATENT-4 601 055 Not available NTIS
Department of Commerce, Washington, DC.
Image Processor.
Patent.
E. W. Kent. Filed 10 Apr 84, patented 15 Jul 86, 24p
PB86-221843, PAT-APPL-6-598 602
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Patents, *Display devices, Television cameras, Robots, Mapping, *Image processing, PAT-CL-382-49, Computer applications.

An iconic-to-iconic low-level image processor is provided which comprises a plurality of identical sequential intermediate stages located between an input stage adapted to be connected to image sources such as analog or digital television cameras, ranging devices and conformal mapping arrays and an output stage adapted to be connected, e.g. to monitors, robot vision systems, iconic symbolic mapping devices and image processing computers. The intermediate stages are provided with forward pathway connections which afford sequential image processing as well as retrograde (feedback) pathway connections between adjacent stages in reverse sequence and within stage, recursive pathway connections for each stage. The stages each include neighborhood operators and image buffers and a number of operations are supported including neighborhood operations on images within each stage and between-stage operations on each pixel such as threshold, boolean and arithmetic operations, function mappings and the like.

707,438
PB-266 580/0 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Workshop on Standards for Image Pattern Recognition Held at Gaithersburg, Maryland on June 3-4, 1976.
Special pub.,
J. M. Evans, R. Kirsch, and R. N. Nagel. May 77, 115p NBS-SP-500-8
Sponsored in part by Electronic Industries Association, Washington, D.C., Institute of Electrical and Electronics Engineers, Inc., New York, and Association for Computing Machinery, New York. Prepared in Cooperation with National Institutes of Health, Bethesda, Md. Library of Congress catalog card no. 77-4773.

Keywords: *Image processing, *Pattern recognition, *Standards, *Meetings, Syntax, Programming languages, Radiography, Medicine, Tape formats.

Automatic image pattern recognition techniques have been successfully applied to improving productivity and quality in both manufacturing and service applications. Automatic Image Pattern Recognition Algorithms are often developed and tested using unique data bases for each specific application. Quantitative comparison of different approaches and extrapolation of existing techniques to new applications is difficult or impossible. To facilitate data interchange in this area a two day workshop was held at the National Bureau of Standards in Gaithersburg, Maryland on June 3 and 4, 1976. The workshop considered the issues involved with interchange of images as data in standard formats on magnetic tape. Specifically, the workshop addressed the following objectives: (1) To define mechanisms for achieving a standard format for magnetic tape interchange; (2) To define requirements for documentation of the recording environment of an image; (3) To recommend mechanisms for selecting and distributing prototype images; (4) To consider the requirements and to explore the prospect for a language to describe image content and structure.

707,439
PB-283 933/0 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Computer Science and Technology: The LX39 Latent Fingerprint Matcher.
Interim rept.,
J. H. Wegstein, and J. F. Rafferty. Aug 78, 23p NBS-SP-500-36
Library of Congress Catalog Card no. 78-606167.

Keywords: *Pattern recognition, Automation, Identifying, Hand(Anatomy), *Fingerprint recognition.

A procedure is described for automatically determining if a latent scene-of-crime fingerprint matches an inked, rolled file fingerprint. The procedure uses the x and y coordinates and the individual directions of the minutiae (ridge endings and bifurcations). The identity of the latent print with a print on file is indicated by a high score resulting from computations based on differences in angle and coordinate values of minutiae that are found in going from one of the fingerprints to the other.

707,440
PB80-108871 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Image Pattern Recognition in Industrial Inspection,
G. J. VanderBrug, and R. N. Nagel. Sep 79, 49p
NBSIR-79-1764

Keywords: *Pattern recognition, *Robots, Industrial engineering, Automation, Product inspection, Quality assurance, Image processing.

Most manufacturing processes require a visual inspection of some aspect of the process. In the most straight forward applications, a vision system is used to inspect for part completeness, or to check for flaws in the manufacturing product. In more sophisticated use of vision systems the inspection task may be secondary to tasks such as part location, identification, or determining part orientation. In general these tasks are important when the vision system is used in conjunction with a robot manipulator. In robot systems, vision is needed to allow the robot to acquire, manipulate, and inspect parts without the need for elaborate fixturing, or complex part delivery systems. The labor cost of manual inspection, and the high cost of special purpose part delivery systems for robots have led many manufacturers to investigate vision systems for use in manufacturing. Digital image processing and pattern recognition are providing the basis for a growing number of attempts to achieve an automated vision system. This paper begins with a brief historical perspective on image processing and pattern recognition. Next a series of state of the art examples of visual inspection system, and then robot vision systems is presented. The paper contains a list of other areas in manufacturing for the application of vision systems, and concludes with an assessment of the future of vision systems in manufacturing.

707,441
PB80-134919 Not available NTIS
National Bureau of Standards, Washington, DC.
Vision Systems for Manufacturing.
Final rept.,
G. J. VanderBrug, and R. N. Nagel. 1979, 11p
Pub. in Proceedings of the Joint Automatic Control Conference (1979) Held at Denver, CO., on June 17-21, 1979, p760-770 1979.

Keywords: *Robots, Visual perception, Pattern recognition, Automation, Industrial engineering, *Image processing, Scene analysis.

Most manufacturing processes require a visual inspection of some aspect of the process. In general these tasks are important when the vision system is used in conjunction with a robot manipulator. In robot systems, vision is needed to allow the robot to acquire, manipulate, and inspect parts without the need for elaborate fixturing, or complex part delivery systems. The labor cost of manual inspection, and the high cost of special purpose part delivery systems for robots have led many manufacturers to investigate vision systems, for use in manufacturing. Digital image processing and pattern recognition are providing the basis for a growing number of attempts to achieve an automated vision system. This paper begins with a brief historical perspective on image processing and pattern recognition. Next a series of state of the art examples of visual inspection systems, and then robot vision systems is presented. The paper contains a list of other areas in manufacturing for the application of vision systems,

and concludes with an assessment of the future of vision systems in manufacturing.

707,442
PB80-134935 Not available NTIS
National Bureau of Standards, Washington, DC.
Vision System for Real Time Control of Robots.
Final rept.,
G. J. VanderBrug, J. S. Albus, and E. Barkmeyer.
1979, 19p
Pub. in Proceedings of the International Symposium on Industrial Robots (9th) Held at Washington, DC., on March 13-15, 1979, p213-231 1979.

Keywords: *Robots, Microcomputers, Visual perception, Pattern recognition, Automation, *Image processing, Scene analysis, Edge detection.

This paper describes a robot vision system which consists of a solid state camera, a strobographic light source, and an 8-bit microprocessor. The camera is mounted obliquely at the wrist of the robot, so that its field of view covers a region extending from inside the finger tips out to a distance of one meter. The light source flashes a plane of light parallel to the wrist of the robot into this region. The plane of light strikes any object in this region and produces an image of line segments. The system computes a run length encoding representation of line segments. Interpretation algorithms are based on the fact that triangulation gives range data, the slope of the lines indicate the orientation of the object, and the end points of the lines give information on the edges to be grasped.

707,443
PB81-164758 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
M7: A General Pattern Matching Facility Users Manual.
A. R. Marriott, G. H. Skillman, S. B. Salazar, and W. T. Hardgrave. Jan 81, 40p NBSIR-80-2182

Keywords: *Pattern recognition, *Computer programming, Character recognition, Macroprogramming, *Software tools, Query languages, C programming language, Unix operating system, File maintenance, String processing, Text processing.

M7 is a general pattern matching and replacement facility. It is based on such macroprocessors as M6, MORTRAN, and STAGE 2, and has been implemented in the language C on UNIX. By incorporating such features as stacks, counters, and tags, M7 is particularly useful for translating or reformatting queries, languages and data.

707,444
PB82-177296 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Computer Science and Technology: Automated Fingerprint Identification System.
Final rept.
J. H. Wegstein. Feb 82, 50p NBS-SP-500-89
Library of Congress catalog card no. 81-600193. Sponsored in part by Federal Bureau of Investigation, Washington, DC.

Keywords: *Identification systems, *Computer programming, Pattern recognition, Recognition, Identifying, *Fingerprints.

Procedures are described for automatically identifying fingerprints. Machine-read ridge-direction and minutiae data are utilized in registering and enhancing search or file minutiae data. The quality of the data is measured. A procedure is then described for utilizing this minutiae data in determining whether two fingerprint impressions were made by the same finger.

707,445
PB85-242394 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
User's Manual for Division 746's Image Processing System.
D. P. Bentz, J. W. Martin, M. E. McKnight, E. J. Embree, and M. E. Batts. Jul 85, 33p NBSIR-85/3207
Prepared in cooperation with Paratech, Washington, DC.

Keywords: Software, *Image processing, Image analysis, Image enhancement, User manuals, Pixels.

An image analysis system has been developed which allows the user to evaluate images in either an interactive or a batch mode. The manual provides instructions for assessing the imaging system (hardware and software) and describes the structure and function of each of the available commands. The imaging software is for an 80826 based minicomputer operating under a multi-user operating system with five imaging boards. The interactive run time environment is menu driven. To execute the imaging system in batch format, commands of a specific structure are placed into a datafile from which they are subsequently read and executed one at a time.

707,446
PB86-128782 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Tomographic Image Reconstruction from Limited Projections Using Iterative Revisions in Image and Transform Spaces.
Final rept.
T. Sato, S. J. Norton, M. Linzer, O. Ikeda, and M. Hirama. 1981, 5p
Pub. in Applied Optics 20, n3 p395-399, 1 Feb 81.

Keywords: Fourier transformations, Ultrasonic radiation, Iterations, Reprints, *Image reconstruction, Tomography.

An iterative technique is proposed for improving the quality of reconstructions from projections when the number of projections is small, or the angular range of projections is limited. The technique consists oftransforming repeatedly between image and transform spaces and applying a priori object information at each iteration. Information which is often known a priori and may be used in this manner are the outer boundaries of the object and the limits on the range of variation of the physical parameters of interest. This process of forcing the image to conform to a priori object data can help to reduce artifacts arising from incomplete or limited data available in the Fourier transform plane. The results of computer simulations show clearly the effectiveness of the proposed approach.

707,447
PB86-133469 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Solid Modeling, Aspect Graphs, and Robot Vision.
Final rept.
G. M. Castore. 1984, 15p
Pub. in Solid Modeling by Computers: From Theory to Applications, p277-292 1984.

Keywords: *Pattern recognition, *Computer vision, *Robot vision, PADL-2 system, Geometric modelling.

At the National Bureau of Standards, a method is being developed for transferring sufficient information directly from the solid modeling system to the robot vision system to enable the robot to recognize a part. The information is encoded in the form of a graph, called an asptec graph,together with functions associated to each vertex of the graph. Aspect graphs were developed by J.J. Koenderink of the State University of Utrecht in the Netherlands, as part of an attempt to understand how shape information is represented by the human vision system. Currently the method is being developed for parts designed on the PADL-2 system. In particular, it does not yet handle contoured surfaces. Extensions to deal with contoured surfaces appear to be feasible and are mentioned briefly.

707,448
PB86-138385 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Pattern Recognition Using Incoherent OTF (Optical Transfer Function) Synthesis and Edge Enhancement.
Final rept.
Y. Katzir, M. Young, and I. Glaser. Mar 85, 5p
Pub. in Applied Optics 24, n6 p863-867, 15 Mar 85.

Keywords: *Pattern recognition, Character recognition, Holography, Reprints, Optical correlators, Optical transfer functions, Optical processing, Robot vision, Image enhancement.

The paper describes a system for pattern recognition using an incoherent-optical correlator. The system uses optical transfer function synthesis to perform correlations with an edge-enhanced image of the object or pattern being sought. The resulting correlations are free of bias and show good discrimination between objects. In addition, the difficult or time-consuming computations are performed before the operation of the system; this reduces the amount of postprocessing by computer and should allow real-time operation at video rates.

707,449
PB86-241940 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Image Quality Indicators.
Final rept.
D. Polansky. 1986, 3p
Pub. in Encyclopedia of Materials Science and Engineering, v3 p2263-2265 1986.

Keywords: *Images, Quality, Reprints.

No abstract available.

707,450
PB87-131843 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
PIPE (Pipelined Image Processing Engine).
Final rept.
E. W. Kent, M. O. Shneier, and R. Lumia. 1985, 29p
Pub. in J. Parallel Distrib. Comput. 2, n1 p50-78 Feb 85.

Keywords: Reprints, *Image processing, Computer vision, *PIPE(Pipelined Image Processing Engine).

The Sensory-Interactive Robotics Group of the National Bureau of Standards' Industrial Systems Division is designing and constructing an experimental multistage pipelined image processing device for research in machine vision. The device can acquire images from a variety of sources, such as analog or digital television cameras, ranging devices, and conformal mapping arrays. It can process sequences of images in real time, through a serial pipeline of operations, under the control of an external device. Its output can be presented to such devices as monitors, robot vision systems, iconic to symbolic mapping devices, and image processing computers. In addition to a forward flow of images through successive stages of operations in the pipeline, other paths between the stages of the device can permit recursive operations within a single stage, and feedback of the results of operation from a stage to the preceding stage. The architecture facilitates a variety of relaxation operations, interactions of images over time, and other interesting functions. Numerous operations can be supported.

707,451
PB87-132239 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Design and Function of the NBS (National Bureau of Standards) Pipelined Image Processing Engine.
Final rept.
E. W. Kent, M. O. Shneier, and R. Lumia. 1985, 18p
Pub. in Proceedings of Conference on Vision '85, Detroit, MI., March 25-28, 1985, p8.40-8.57.

Keywords: *Robots, Mapping, Arrays, Television cameras, Feedback, *Image processing, *Robot vision, *Parallel processing, Real time, National Bureau of Standards.

The Sensory-Interactive Robotics Group of the National Bureau of Standards is producing PIPE (Pipelined Image Processing Engine), an experimental, multistage, multi-pipelined image processing device for research in low-level machine vision. The device can acquire images from a variety of source, such as analog or digital television cameras, ranging devices, and conformal mapping arrays. It can process sequences of images in real time, through a series of local neighborhood and point operations, under the control of a host device. Its output can be presented to such devices as monitors, robot vision systems, iconic to symbolic mapping devices, and image processing computers.

707,452
PB87-149795 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Iterative Reconstruction Algorithms: Convergence as a Function of Spatial Frequency.
Final rept.,
S. J. Norton. 1985, 8p
Pub. in Jnl. of the Optical Society of American A-Optics and Image Science 2, n1 p6-13 1985.

Keywords: Algorithms, Reprints, *Image reconstruction, Image processing, Iterative methods.

An analysis is presented of two well-known iterative reconstruction-from-projections algorithms, ART (algebraic reconstruction technique) and SIRT (simultaneous iterative reconstruction technique), which demonstrates how individual spatial frequency components in the image converge at different rates to their respective object components. The analysis proceeds by considering the continuous versions of the ART and SIRT algorithms in the limit of continuous sampling along the projections and in angle. Explicit convergence formulas are derived which show that the continuous ART and SIRT algorithms converge to the correct solutions, that the convergence is geometric, and how the rate of convergence depends on spatial frequency.

707,453
PB87-150918 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Perimeter of a Fuzzy Set.
Final rept.,
A. Rosenfeld, and S. Haber. 1985, 6p
Pub. in Pattern Recognition 18, n2 p125-130 1985.

Keywords: *Pattern recognition, Generalized functions, Convex sets, Reprints, *Fuzzy sets, *Image processing.

In pattern recognition one often wants to measure the perimeters of regions in images. This is straightforward if the region is crisply defined, but if it is fuzzy, it is not obvious how its perimeter can be measured. The paper proposes a definition of perimeter for fuzzy subsets of the plane, and shows that it reduces to the standard definition if the fuzzy subset is an ordinary subset. The isoperimetric inequality does not generalize to fuzzy subsets, but certain properties of the perimeters of convex sets do generalize to fuzzy perimeters of convex fuzzy subsets.

707,454
PB87-151874 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Real-Time Iconic Image Processor.
Final rept.,
R. Lumia, M. O. Shneier, and E. W. Kent. 1985, 6p
Pub. in Proceedings of Institute of Electrical and Electronics Engineers International Conference on Robotics and Automation, St. Louis, MO., March 25-28, 1985. p873-878.

Keywords: Real time operations, Computer graphics, Data storage, *Robot vision, *Image processing, *Pipelining(Computers), Computer vision, Host computers, Input output processing, National Bureau of Standards.

The Sensory-Interactive Robotics Group at the National Bureau of Standards is producing PIPE, a pipelined image-processing engine, for research in low-level machine vision. PIPE processes sequences of images at field rates through a series of point and neighborhood operations. It is divided into a variable number of identical stages, each of which performs an independent set of operations on the image data stored in the stage. A stage control unit determines the sequence of operations performed within a stage on each image. The sequence is easily modified by a host computer during the inter-field interval when all of the stage control unites can be totally reconfigured. Images flow through PIPE in several ways. In addition to the (standard pipeline) 'forward' pathway, where an output image is sent to the next stage, an output image can also be sent to the same stage via a 'recursive' pathway and to the previous stage via a 'retrograde' pathway. As a result, PIPE can support relaxation operations, temporal neighborhood operations, and other local operations.

707,455
PB87-210035 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Image Processing for Optical Engineering Applications,
M. B. Weppner, and M. Young. Apr 87, 105p NBSIR-87/3065

Keywords: Fourier transformation, Fiber optics, Computer programs, *Image processing, Computer applications, Optical fibers, Single mode fibers.

The Internal Report describes the development and testing of image processing software designed for optical engineering applications. Image processing functions in this software include two-dimensional Fourier transforms, convolution, noise reduction, multiple image resolutions, and low-level image processing functions. The software also contains image information display tools including Gaussian beam and g-profile characterization for optical fiber measurements. The necessary image file input/output routines are presented in the software and are used to read and store images in conjunction with other image processing software, digitizing cameras, and output display devices.

707,456
PB88-147335 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems Components Div.
Digitizing Documents: Guidelines for Image Quality.
Final rept.,
T. C. Bagg. 1987, 4p
Pub. in Inform 1, n11 p6-9 Nov 87.

Keywords: Reprints, *Image quality, *Digitized images, Microimages, Quality index.

The paper relates the Quality Index method for determining microimage systems quality to the expected image quality when using raster scanners to digitize images

707,457
PB88-152897 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Incremental Reconstruction of 3D Scenes from Multiple, Complex Images.
Final rept.,
M. Herman, and T. Kanade. 1986, 53p
Pub. in Artificial Intelligence 30, n3 p289-341 1986.

Keywords: Aerial photographs, Photointerpretation, Reprints, *Image reconstruction, *Computer vision, Stereoscopic vision, Three dimensional.

The 3-D Mosiac system is a vision system that incrementally reconstructs complex 3D scenes from a sequence of images obtained from multiple viewpoints. The system encompasses several levels of the vision process, starting with images and ending with symbolic scene descriptions. The paper describes the various components of the system, including stereo analysis, monocular analysis, and constructing and updating the scene model. In addition, the representation of the scene model is described. The model is intended for tasks such as matching, display generation, planning paths through the scene, and making other decisions about the scene environment. Examples showing how the system is used to interpret complex aerial photographs of urban scenes are presented.

General

707,458
FIPS PUB 102 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Guideline for Computer Security Certification and Accreditation. Category: ADP (Automatic Data Processing) Operations. Subcategory: Computer Security.
Federal information processing standards (Final) Jan 81-Sep 82.
W. Neugent, and Z. G. Ruthberg. 27 Sep 83, 94p
Prepared in cooperation with System Development Corp., McLean, VA.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Guidelines, *Computers, *Security, Risk, Verifying, *Computer security, *Federal information processing standards.

This Guideline is intended for use by ADP managers and technical staff in establishing and carrying out a program and a technical process for computer security certification and accreditation of sensitive computer applications. It identifies and describes the steps involved in performing computer security certification and accreditation; it identifies and discusses important issues in managing a computer security certification and accreditation program; it identifies and describes the principal functional roles needed within an organization to carry out such a program; and it contains sample outlines of an Application Certification Plan and a Security Evaluation Report as well as a sample Accreditation Statement and sensitivity classification scheme. A discussion of recertification and reaccreditation and its relation to change control is also included. The Guideline also relates certification and accreditation to risk analysis, EDP audit, validation, verification and testing (VV&T), and the system life cycle. A comprehensive list of references is included.

707,459
FIPS PUB 65 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Guideline for Automatic Data Processing Risk Analysis. Category: ADP Operations. Subcategory: Computer Security.
Federal information processing standards (Final).
S. K. Reed. 1 Aug 79, 31p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Data processing security, Risk, National government, Guidelines, *Federal information processing standards, Risk assessment.

This document presents a technique for conducting a risk analysis of an ADP facility and related assets. Risk analysis produces annual loss exposure values based on estimated costs and potential losses. The annual loss exposure values are fundamental to the cost effective selection of safeguards for the security of the facility. An ADP facility of a hypothetical government agency is used for an example. The characteristics and attributes of a computer system which must be known in order to perform a risk analysis are described and an example is given of the process of analyzing some of the assets showing how the risk analysis can be handled.

707,460
PB-263 142/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Highways for CAMAC Systems - A Brief Introduction.
Final rept.,
L. Costrell. Oct 76, 7p
Pub. in U.S. NIM Committee on CAMAC Tutorial Articles, (Computer Automated Measurement and Control), ERDA Report No. TID-26618, 7p (Energy Research and Development Administration, Washington, D.C., Oct 76).

Keywords: *Computer applications, Interfaces, *CAMAC system, Reprints.

The interconnection between CAMAC crates and between the crates and a computer is called the CAMAC highway. The purpose of this paper is to present a brief summary of CAMAC highway configurations and to put in perspective the highway papers that follow and to serve as a starting point for the panel discussion on CAMAC highways.

707,461
PB-263 143/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
CAMAC (Computer Automated Measurement and Control) Instrumentation System - Introduction and General Description.
Final rept.,
L. Costrell. Oct 76, 8p
Pub. in U.S. NIM Committee on CAMAC (Computer Automated Measurement and Control), Tutorial Articles, ERDA Report No. TID-26618, 8p (Energy Research and Development Administration, Washington, D.C.).

Keywords: *Computer applications, Interfaces, *CAMAC system, Reprints.

The CAMAC instrumentation system is described in a general way in this introductory paper which is followed by papers that discuss the system in greater detail. This paper is an updated version of the introductory paper that appeared in the April 1973 IEEE Transactions on Nuclear Science.

707,462
PB-263 144/8 Not available NTIS

National Bureau of Standards, Gaithersburg, MD.
Evolution, Definition, and Status of IEEE Standard 583: Standard Modular Instrumentation and Digital Interface System (CAMAC).
Final rept.,
L. Costrell. 1976, 8p
Pub. in Proceedings Electro 76 Professional Program, Boston, Massachusetts, May 11-14, 1976, n29, Paper No. 4 p1-8 (Institute of Electrical and Electronics Engineers, Inc., New York, N.Y., 1976).

Keywords: *Computer applications, Interfaces, *CAMAC system.

Incompatible instruments have long been the rule in laboratories and industrial organizations. The problems they pose are enormous and expensive. The concern is with interfaces, mechanical, electrical, and from a signal standpoint. Besides the inefficiency inherent in a multiplicity of different interfaces, the man hours of design effort is staggering and this effort is needlessly repeated for installation after installation. IEEE Standard 583 defines a standardized instrumentation system designated CAMAC, for Computer Automated Measurement and Control, that has been developed to alleviate this problem and that is gaining wide international acceptance. The system features a fully specified data highway (Dataway) together with modular functional units that are completely compatible with each other and that are available from diverse sources. Additional levels of compatibility are achieved through the use of standardized parallel and serial highways that have been developed for use with the basic CAMAC system.

707,463
PB-263 526/6 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Ten Year History of National Bureau of Standards Activities under the Brooks Act (Public Law 89-306),
G. Burns, and S. Radack. Feb 77, 93p NBSIR-76-1113

Keywords: *Data processing equipment, *Computer systems hardware, *Computer programming, *Utilization, Legislation, Standards, Computation, Efficiency, *Brooks Act, Computer performance evaluation.

This report presents the principal findings of a National Bureau of Standards task force which reviewed the activities and accomplishments of NBS from 1965 to 1975 under Public Law 89-306, the Brooks Act. The Brooks Act is concerned with the effective use of computers by the Federal Govenment and assigns the National Bureau of Standards responsibility for providing scientific and technological advisory services for automatic data processing, developing uniform Federal ADP standards and undertaking necessary research in computer science and technology. Program activities and a history of funding for each of these three major responsibilities are covered. Also included are case studies of individual program initiatives.

707,464
PB-270 342/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Instrument Control by Digital Computers.
Final rept.,
J. R. DeVoe. 1973, 39p
Pub. in Proceedings Int. Conf. Computers in Chemical Research and Education, Ljubljana/Zagreb, Yugoslavia, July 12-17, 1973, Paper in Computers in Chemical Research and Education, n1 p1/99-1/137 1973.

Keywords: *Chemical analysis, *Computer applications, Control systems.

Digital computers now control and acquire data from a variety of scientific instruments. A major effort must be placed in specifying the computer-instrument interaction in detail. Implementation is best done so that versatility is not sacrified. The Analytical Chemistry Division's computer system provides a type of versatility and utility that retains the user's scientific discipline, but augments it via the understanding of computer control.

707,465
PB-270 586/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fast Approach to Network Data Assignment.
Final rept.,
S. R. Kimbleton. 1977, 12p
Pub. in Proceedings of Workshop on Distributed Data Management and Computer Networks (2nd), University of California, Berkeley, California, May 25-27, 1977, LBL 6416, p245-256 197.

Keywords: *Computer networks, *Data management.

The increasingly volatile network data environments promised by the emergence of Network operating systems require computationally efficient approaches to network data assignment for effective data access. This paper introduces the class of adaptive cost minimization policies having the properties of: computational simplicity provided by a table lookup based assignment approach; attractiveness to management through use of a process execution cost based formulation; and dynamic adaptiveness to changing access patterns. Exact forms of these policies are developed for environments in which the collection of accessing processes, but not necessarily the accessed data, are constrained to be resident on a single system. Asymptotically accurate approximate policies are developed for the case of multiple accessing processes located on multiple systems.

707,466
PB-271 744/5 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Systems and Software Div.
Report of the Workshop on Cryptography in Support of Computer Security Held at the National Bureau of Standards on September 21-22, 1976,
D. Branstad, J. Gait, and S. Katzke. Sep 77, 63p NBSIR-77-1291

Keywords: *Data processing security, *Cryptology, *Meetings, Logic design, Standards, Data encryption standards.

This publication reports on the Workshop on Cryptography in Support of Computer Security held at the National Bureau of Standards on September 21-22, 1976. The workshop was organized to obtain expert opinions on the mathematical and statistical characteristics of the proposed Data Encryption Standard (DES) as it relates to computer security. This report summarizes formal presentations that were made, outlines major issues that were raised, quotes statements that were made for the record and answers several of the major questions that were asked.

707,467
PB-272 190/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Taking Risks with Computers.
Final rept.,
R. M. Davis. 1976, 7p
Pub. in Proceedings Symposium on Man and the Computer, Dartmouth College, Hanover, New Hampshire, November 30-December 1-2, 1976, p28-34 1976.

Keywords: *Computer applications, *Risk, *Public opinion, Safety, Costs, Automation, Fear, Computer privacy, Personal privacy, Computer information security, Dehumanization.

Computers, as other technological developments, have given rise to certain dangers or risks associated with their use. Public perceptions of these risks have been manifested as fears about dehumanization, invasion of privacy and damage to individuals through the improper use of information. In order to deal with these fears, we need to develop ways to set acceptable levels of risks and to judge the safety of computer systems. The determination of safety or an acceptable level of risk is a consensus derived process in which public concerns, dangers, vulnerabilities, and costs of safeguards and comparison of alternatives are all factored together to yield a result. Efforts to make computer systems safer and to set acceptable levels of risks can help to restore confidence in computers.

707,468
PB-274 510/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS Computer Network Measurement System.
Interim rept.,
M. D. Abrams, I. W. Cotton, S. W. Watkins, R. Rosenthal, and D. E. Rippy. Oct 77, 10p
Pub. in IEEE Transactions on Commun., COM25 n10 p1189-1198 Oct 77.

Keywords: *Computer networks, Performance evaluation, Network Measurement System, *Computer performance evaluation, Teleprocessing, Reprints.

The NBS Computer Network Measurement System represents the implementation of a new approach to the measurement of computer networks, teleprocessing systems, and network services. By focusing on the service delivered to users rather than on the internal operating efficiency of the system, information is obtained to aid users in the quantitative evaluation of such systems and services. The Network Measurement System consists of a data acquisition system and a separate set of data analysis programs. This paper describes the approach to network measurement taken by this system, the models of user-system dialogue employed, and technical summary of the implementation of the data acquisition system and the data analysis programs.

707,469
PB-274 967/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
On-Line Password Techniques.
Interim rept.,
H. M. Wood. 1977, 14p
Pub. in Proc. Trends and Applications: 1977 - Computer Security and Integrity, Gaithersburg, Md. 19 May 77 p27-40 1977. (IEEE Computer Society, Long Beach, Calif.).

Keywords: *Data processing security, *Passwords, *On line systems, Access methods.

This paper classifies the features of on-line password schemes according to password selection/assignment techniques, lifetime, and content. Several password implementations are examined and their advantages and limitations discussed. The purpose of this review was not to judge any particular system as to overall security effectiveness, but rather to illustrate the wide range of implementations possible. Password protection is not considered.

707,470
PB-274 974/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Methodology for Interactive Computer Service Measurement.
Interim rept.,
M. D. Abrams, and S. Treu. Dec 77, 7p
Grant NSF-DCR72-01206-A05
Pub. in Communications of the ACM (Association of Computing Machinery), v20 n12 p936-944 Dec 77.

Keywords: *Data processing, *Computers, Performance evaluation, Measurement, Reprints, *Computer performance evaluation, *On line interactive systems.

A measurement methodology applicable to interactive computer service is described. Its primary service is described. Its primary purpose is to enable external, user-oriented assessment of computer performance, instead of the more frequently used internal system measurement techniques. The NBS Network Measurement System is employed as the external measurement tool. Example data have been collected and analyzed. A demonstration of the methodology, leading to a pragmatic figure-of-merit evaluation of results, is included.

707,471
PB-275 018/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Use of Passwords for Controlling Access to Remote Computer Systems and Services.
Interim rept.,,
H. M. Wood. 1977, 7p
Pub. in Proceedings of National Computer Conference, Dallas, Tex. 13-16 Jun 77. Paper in AFIPS Conference Proceedings, v46 p27-33 1977.

Keywords: *Data processing security, Coding, *Passwords, Access methods, Data encryption.

The widespread use of remote computer resources has made the problem of personal authentication most urgent. Systems without adequate access controls are vulnerable to threats including theft, fraud, and vandalism. Potential losses range from unauthorized use of computing time, to unauthorized modification or access to massive amounts of data. This paper examines the use of passwords for controlled access to computing resources. Password techniques, ways of protecting passwords, and attendant cost considerations are discussed. Similarities between passwords and data encryption keys are noted. General recommendations for the use of passwords are presented.

707,472
PB-275 611/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cost-Benefit Analysis of Interactive Systems.
Final rept.,
I. W. Cotton. Nov 77, 14p
Pub. in Computer Networks, v1 n6 p311-324 Nov 77.

Keywords: *Computer networks, *Benefit cost analysis, Optimization, *On line interactive systems, *Interactive computer systems, Computer performance evaluation, Reprints.

This report assesses the state-of-the-art in cost-benefit analyses of interactive systems and suggests an approach for developing improved methodology. Cost-benefit analyses are distinguished from analyses of system performance in that the latter are directed at optimizing system performance at a given level of investment, while the former are directed at justifying the investment itself. Methods of analyzing the performance and costs of computer systems in general and interactive systems in particular are discussed. With this information it is shown how cost-effectiveness analyses may be performed. The next crucial step is to conduct benefit analysis, an ill-defined art. The results of benefit analysis must be combined with cost-effectiveness analysis in order to perform the desired cost-benefit analysis. An experimental methodology is suggested for better performing benefit analyses of interactive systems. A more rigorous formulation of the cost-benefit procedure is then outlined. No attempt is made in this report to actually perform such an analysis.

707,473
PB-276 771/3 PC **A09**/MF **A01**
System Development Corp., Santa Monica, CA.
Computer Science and Technology: Design Alternatives for Computer Network Security.
Initial rept.,
G. D. Cole, and D. K. Branstad. Jan 78, 177p NBS-SP-500-21-Vol-1
Contract NBS-5-35934
See also Volume 2, PB-276 772.

Keywords: *Computer networks, *Data processing security, Cryptology, Minicomputers, Data encryption.

The security problems associated with a network of computers are an extension of those of stand-alone computer systems, but require additional security controls due to the distributed and autonomous nature of the network components. The purpose of this investigation was to generate a pre-development specification for such security mechanisms by determining the issues and tradeoffs related to network security over a broad range of network applications, topologies and communications technologies. The approach which was taken was that of using a dedicated network Security Controller (minicomputer) for checking the authentication of requestors, and, to some extent, for authorization checking as well. The enforcement of the Security Controller functions would be by means of Intelligent Cryptographic Devices, which could be remotely keyed by the Security Controller when a requested communication was authorized. The Intelligent Cryptographic Device would incorporate the National Bureau of Standards Data Encryption Standard algorithm. The investigation showed that this approach is a viable solution to the network security problems of a large class of computer networks, and that such security mechanisms should be developed for operational usage.

707,474
PB-276 772/1 PC **A04**/MF **A01**
System Development Corp., Santa Monica, CA.
Computer Science and Technology: The Network Security Center: A System Level Approach to Computer Network Security.
Final rept.,
F. Heinrich. Jan 78, 74p NBS-SP-500-21-Vol-2
Contract NBS-5-35934
See also Volume 1, PB-276 771.

Keywords: *Computer networks, *Data processing security, Cryptology, Network security centers, Network cryptographic devices.

This report describes a unique approach to the solution of computer network security problems, and provides guidance in the areas of network security architectural issues and implementation options. The approach is based on a network resource, called a Network Security Center (NSC), which performs the functions of user identification/authentication and access request authorization. The NSC works in concert with Network Cryptographic Devices (NCDs) to enforce access control policy through the creation or denial of logically separate cryptographic connections between subjects (users) and objects (resources). The use of a NSC in a network permits effective control over network access, provides for audit data collection, and provides protection against tampering or modification of the access control data base. The architecture presented permits multiple NSCs to operate together, thus addressing issues such as modular expandability, regional subnets, and local control over resources. Network Cryptographic Devices that use the NBS Data Encryption Standard algorithm and are capable of being remotely keyed are a vital part of the NSC security approach. NCDs provide end-to-end cryptographic message protection, source-destination authentication of identity and, through the remote keying capability, the enforcement mechanism for NSC access control decisions. Implementation options for a NSC are presented, covering the areas of data structures, I/O structure, control structure, and size and performance limitations.

707,475
PB-277 695/3 PC **A07**/MF **A01**
National Bureau of Standards, Washington, D.C. Systems and Software Div.
Computer Science and Technology: Computer Security and the Data Encryption Standard,
D. K. Branstad. Feb 78, 137p NBS-SP-500-27
Proceedings of the Conference on Computer Security and the Data Encryption Standard held at the National Bureau of Standards in Gaithersburg, Maryland on February 15, 1977. Sponsored in part by Civil Service Commission, Washington, D.C. Library of Congress Catalog Card no. 78-1403.

Keywords: *Data processing security, *Cryptology, *Meetings, Computer networks, Risk, Standards, *Data encryption, ARPA computer network, State of the art, Computer privacy, Computer information security.

These proceedings include papers or summaries of presentations of the fifteen speakers who participated in the Conference on Computer Security and the Data Encryption Standard held at the National Bureau of Standards on February 15, 1977. Representatives from Federal agencies and private industry presented technical information and guidance with respect to computer security and the Data Encryption Standard. Subjects of the papers and presentations include physical security, risk assessment, software security, computer network security, applications and implementation of the Data Encryption Standard. The questions raised at the conference and their answers are included in the proceedings.

707,476
PB-279 661/3 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Management of Data Elements in Information Processing.
Final rept.
H. E. McEwen. Apr 78, 155p NBSIR-78-1446
Proceedings of the National Symposium (3rd) Held at National Bureau of Standards, Gaithersburg, MD on September 28-30. 1977. See also report dated Apr 74, COM-74-10700.

Keywords: *Information systems, *Meetings, Data processing, Medical services, Energy, Commerce, Data base management systems, Data management, Information exchange systems, *Data element directories/dictionaries, *Data elements, *Information processing.

Accelerated technological advances in computers and communications make possible the integration of data systems and the exchange of data among them on an expanding scale. However, the full effect of these advances cannot be realized unless the need for uniform understanding of the common information (data elements) and their expression in data systems is recognized and a means provided to effectively manage this information. The increasing interrelationships among data systems of Federal, State and local governments, and with industry and the public add emphasis and dimension to the need for the improved management of data in information processing. These Proceedings are for the Third National Symposium on the Management of Data Elements in Information Processing held at the National Bureau of Standards on 1977 September 28-30. In these Proceedings, 27 speakers discuss data element management in the field of health care, energy, paperwork management, trade data standards and museum data.

707,477
PB-280 409/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hierarchical Interaction Between Behavior Generation and Pattern Recognition.
Final rept.,
J. S. Albus. 1977, 41p
Pub. in Proceedings of Annual Automation Imagery Pattern Recognition Symposium (7th), College Park, Md. 23-24 May 77 p343-383 1977.

Keywords: *CMAC devices, Robots, Artificial intelligence, Microprocessors, CMAC(Cerebellar Model Automatic Computers), Cerebellar model automatic computers, Data base management, Distributed processing.

CMAC (Cerebellar Model Automatic Computer) is a computing device which accepts up to 12 input variables and produces an output which is some function of those variables. It is based on a model of the cerebellum, which is a portion of the motor control system in the brain. CMAC can be implemented with inexpensive microprocessor technology. CMAC modules can be interconnected in a hierarchical structure to generate sensory-interactive goal-directed behavior in adaption, autonomous systems. It provides an entirely new approach to many significant problems in robot control, artificial intelligence, data base management, and large scale distributed computing systems.

707,478
PB-281 525/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Network Access Techniques: A Review.
Final rept.,
R. Rosenthal. Jun 76, 6p
Grant NSF-DCR72-01206
Pub. in 1976 National Computer Conference, New York, N.Y. 8 Jun 76, p495-500 Jun 76. (American Federation of Information Processing Societies, Montvale, N.J.).

Keywords: *Computer networks, Availability, Reviews, Protocols.

The computer industry's ability to serve a diverse and expanding user community is evidenced by the rapid growth of computer network services. Computer service providers design and market their own offerings as they deem best, given their own market and their own set of resources. This has led to a proliferation of similar resources requiring different user access procedures. With emphasis on currently operating and planned systems that assist users in accessing available network services, this paper identifies the techniques used in network access devices. By examining these devices, the trend toward improving the interface between the user and the computer is brought more clearly into focus and up to date.

707,479
PB-284 723/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Network Operating Systems: An Implementation Approach.
Final rept.,
S. R. Kimbleton, H. M. Wood, and M. L. Fitzgerald. 1978, 10p
Sponsored in part by Rome Air Development Center, Griffiss AFB, N.Y.
Pub. in Proceedings of 1978 National Computer Conference, Anaheim, Calif., June 5-8, 1978, Paper in AFIPS Conf. Proc. 47, p773-782.

Keywords: *Computer networks, Operating systems(Computers), *Network operating systems.

Network Operating Systems are required to afford ease of access to remote computer resources by masking many system differences from the user. To facilitate ease of access and utilization of systems, subnetworks, and services, an NOS must provide capabilities for job execution and data handling. This paper provides a perspective on the issues and implementation constraints implicit in providing a Network Operating System for a heterogeneous collection of host computers. An Experimental Network Operating System (XNOS), implemented at the National Bureau

of Standards, is described. XNOS uses Network Interface Machines to offload NOS support from the host and to facilitate centralized design, implementation, and support.

707,480
PB-291 890/2 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: A Methodology for the Selection of Interactive Computer Services.
Final rept.
S. A. Mamrak, and P. D. Amer. Jan 79, 86p NBS-SP-500-44
Library of Congress catalog card no. 78-600149.

Keywords: Computers, Selection, Criteria, Methodology, Statistical analysis, Tables(Data), *Computer performance evaluation, Computer services.

This publication addresses the comparison and selection of remote access interactive computer services. The comparison methodology presented relies principally on the statistical analysis of measurement data obtained from the interaction between a computer service and a user. One of the most important properties of the methodology is that it incorporates confidence statements about the probability of having made a correct selection. Experimental data are presented to illustrate an application of the methodology, and serve as a basis for a discussion of the cost and appropriateness of using the methodology in various procurement efforts.

707,481
PB-291 953/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microprocessor-Based Satellite-Controlled Clock.
Final rept. 1974-77.
D. W. Hanson, D. D. Davis, and J. V. Cateora. 1978, 4p
Pub. in Proceedings of the NBS-IEEE Microcomputer-Based Instrumentation Conference, Gaithersburg, Maryland, June 12-13, 1978, p83-86 1978.

Keywords: *Clocks, Control equipment, Microcomputers, Time signals, Microprocessors.

As a demonstration of the usefulness of the NBS-sponsored time signals from two U.S. weather satellites, NBS designed and built a 'Satellite-Controlled Clock.' The initial design used random logic requiring nearly 80 packages of TTL logic. With the advent of microprocessors, the clock was redesigned using a four bit microprocessor and a scientific calculator chip. Today, commercial versions of the NBS-designed clock are available and are finding use in the electric power industry, radio and television broadcasting, defense, communications, and geophysical monitoring. The evolution of the satellite-controlled clock from random logic to commercial products using eight bit microprocessors are discussed in some detail.

707,482
PB-294 845/3 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Guide to Technical Services and Information Sources for ADP Managers and Users.
S. M. Radack. Apr 79, 51p NBSIR-79-1734

Keywords: *Data processing, *National government, *Technical assistance, *Directories, Data processing equipment, Communication equipment, Information systems, Magnetic storage, Performance evaluation, Government policies, Guidelines, Procurement, Management, Data management, Information sources.

This publication contains brief descriptions of technical services and resources available to Federal ADP managers and users from other agencies in the U.S. Government. The names, addresses and telephone numbers of the agencies providing computer-related services and information are included. Subject areas covered include ADP standards, reports, management, performance evaluation, training, magnetic media, software, security and technical assistance. Also included is information about Federal Information Processing Standards, Federal Standards for data communications, OMB policy guidance for ADP, procurement regulations, and GSA regional services. Federally sponsored ADP users' groups are listed. Sources are given for the documents and publications are cited.

707,483
PB-298 299/9 PC **A20**/MF **A01**
Columbia Univ., New York. Dept. of Political Science.
Computer Science and Technology: Computers, Personnel Administration, and Citizen Rights.
Final rept.
A. F. Westin. Jul 79, 471p NBS/SP-500-50
Contract NBS-5-35886
See also report dated Dec 76, PB-262 497. Library of Congress catalog card no. 79-600081. Sponsored in part by Privacy Protection Study Commission, Washington, DC.

Keywords: *Personnel management, *Confidential information, *Information systems, Policies, Management methods, Information, Government employees, National government, Industries, Recommendations, Bibliographies, Privacy, Computer applications, Computer privacy.

This report investigates the impact of computers on citizen rights in the field of personnel record-keeping. Part one traces the changing patterns of employment and personnel administration in America from the 19th century to the present. Part two examines the trends in computer use in personnel administration starting with payroll processing in the mid 50s to the present day Human Resources Information Systems. The effect of organizational policies, computerization efforts, and socio-legal trends on citizen rights are highlighted in eight profiles (3 in-depth) of Federal Government and business organizations and a discussion of non-Federal Government and non-profit organizations in Part 3. Part 4 compares the overall effects of computer technology against the effects of current personnel administration policies (organizational and legislative) on the four key dimensions of employee rights; relevance of data collected, employee access to records, confidentiality of data collected, and disclosure of data to third parties. Part 5 discusses policy alternatives for observing fair employee information practices. An extensive bibliography (52 pages) of material compiled and used by the project in preparing this report is appended.

707,484
PB-300 468/6 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Computer Performance Evaluation Users Group (CPEUG).
Final rept.
J. E. Weatherbee. Oct 79, 243p NBS-SP-500-52
Library of Congress catalog card no. 79-600123. Proceedings of the Computer Performance Evaluation Users Group Meeting (15th) Held at San Diego, CA. on October 15-18, 1979. See also PB-297 848.

Keywords: *Data processing, *Meetings, Auditing, Proceurement, Installing, Computers, Computer programming, *Computer performance evaluation.

The Pjroceedings record the papers that were presented at the Fifteenth Meeting of the Computer Performance Evaluation Users Group (CPEUG 79) held October 15-18, 1979, in San Diego, California. With the theme 'The Expanding Scope of CPE,' CPEUG 79 focused on changes in CPE techniques that will occur in an era of increased use of distributed processing techniques. The program was divided into two parallel sessions with one session devoted to the presentation of technical papers on previously unpublished work and the other devoted to tutorials and case studies. The technical papers fall into one of two general categories. (1) application of CPE in installation management and (2) methods and tools of CPE as a technical discipline, and are presented in the Proceedings in their entirety. Summaries of several of the tutorials and case studies are also presented in the Proceedings.

707,485
PB80-101322 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Technology Assessment: ADP Installation Performance Measurement and Reporting.
Final rept.,
C. B. Wilson. Sep 79, 41p NBS-SP-500-53
Library of Congress catalog card no. 79-600154.

Keywords: Data processing, National government, Performance evaluation, Standards, Statistical analysis, *Computer performance evaluation, Data bases.

This report compares the current status of ADP installation performance measurement and reporting in the Federal ADP community with the best practices as found in the Federal and private sectors and described in the literature. The comparison reveals that more effort could be expended by Federal sites in the area of computer performance management. The principal obstacles to more and better performance programs are perceived to be the lack of needed measures on many systems and the magnitude of the effort involved in accessing and analyzing the measures which are available. The report discusses several underlying causes for these obstacles and makes three recommendations which could partically relieve the situation: (1) development of standard performance measures, (2) development of a Government-wide data base for normative performance ranges, and (3) development of statistical computer performance evaluation techniques.

707,486
PB80-104698 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: A Key Notarization System for Computer Networks.
Final rept.,
M. E. Smid. Oct 79, 39p NBS/SP-500-54
Library of Congress catalog card no. 79-600160.

Keywords: *Data processing security, *Computer networks, Cryptology, Coding, Key notarization systems, Data encryption.

A cryptographic key notarization system is proposed for computer networks to protect personal (nonshared) files, to communicate securely both on and off-line with local and remote users, to protect against key substitution, to authenticate system users, to authenticate data, and to provide a digital signature capability using a nonpublic key encryption algorithm. The system is implemented by the addition of key notarization facilities which give users the capability of exercising a set of commands for key management as well as for data encryption functions. Key notarization facilities perform notarization which, upon encryption, seals a key or password with the identities of the transmitter and intended receiver.

707,487
PB80-127947 Not available NTIS
National Bureau of Standards, Washington, DC.
Standardizing Computer Performance Measures.
Final rept.,
C. B. Wilson. Dec 79, 6p
Pub. in Proceedings of the CMG (Computer Measurement Group) International Conference on Controlled Resource Management Through Computer Performance Evaluation (10th) Held at Dallas, TX., on December 4-7, 1979, p67-72, Dec 79.

Keywords: Standards, Measurement, Performance evaluation, Data processing, *Computer performance evaluation.

Almost since the inception of performance measurement, the need for standard performance measures has been indicated. The underlying cause of many of the current inadequacies in the computer performance area can be attributed to a lack of standard performance measures and reporting formats. The Institute for Computer Sciences and Technology of the Natioal Bureau of Standards has recently embarked on a project to determine the feasibility of developing a set of standard performance measures, as well as an accompanying standard reporting format. This paper discusses the reasons behind the project and the methodology which is being employed in this task.

707,488
PB80-131006 Not available NTIS
National Bureau of Standards, Washington, DC.
Taxonomy for Valid Test Workload Generation.
Final rept.,
S. A. Mamrak, and M. D. Abrams. Dec 79, 6p
Pub. in Comput. Mag. 12, n12, p60-65, Dec 79.

Keywords: Bench marks, Computer programming, Performance evaluation, Reprints, *Computer performance evaluation.

The valid generation and use of a benchmark that adequately represents a real system workload as required for various computer performance evaluation studies is affected by the particular evaluation environment in which the benchmark is to be used. A taxonomy of test environments is presented in this paper, along with a specification of which test workload generation methods are valid in each evaluation context. The primary

impact of the taxonomy is the clear identification of the relatively small number of evaluation environments in which valid workload generation methodologies have been developed. The transfer of a valid methodology to a new environment is shown to often invalidate that methodology. A methodology based on statistical pattern recognition techniques is proposed as the best candidate for a general solution to the workload characterization problem in most evaluation environments.

707,489
PB80-150543 Not available NTIS
National Bureau of Standards, Washington, DC.
Techniques for the Implementation of the Data Encryption Standard.
Final rept.,
M. E. Smid. 1979, 4p
Pub. in Proceedings of the National Electronics Conference, Chicago, Illinois, October 19-31, 1979, p318-321.

Keywords: *Data processing security, Coding, Digital techniques, Standards, *Data encryption standards, Implementation.

In 1977 the National Bureau of Standards published a well-defined encryption algorithm, known as the Data Encryption Standard (DES), which became a standard for federal agencies for uses not involving national security matters. Since its publication, several companies have produced hardware devices which implement the standard, and there has been an increased awareness that, in certain applications, encryption offers the only effective means of protecting data. This paper summarizes three techniques for implementing the DES: character set encryption, key notarization, and digital signatures.

707,490
PB80-177678 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Audit and Evaluation of Computer Security II: System Vulnerabilities and Controls.
Final rept.,
Z. G. Ruthberg. Apr 80, 216p NBS-SP-500-57
Proceedings of the NBS Invitational Workshop Held at Miami Beach, Florida on November 28-30, 1978. Sponsored in part by General Accounting Office, Washington, DC. Library of Congress catalog card no. 80-600034.

Keywords: *Data processing security, *Meetings, Data processing terminals, Communication equipment, Operating systems(Computers), Data bases, Data base management systems.

The National Bureau of Standards, with the support of the U.S. General Accounting Office, sponsored a second invitational workshop on computer security audit, on November 28-30, 1978. A cross-section of highly qualified people in the computer science and EDP audit fields was assembled to develop material that would be directly usable for a Federal Information Processing Standard (FIPS) Guideline on the subject. In order to cover the material in a systematic fashion, the workshop was partitioned into three management sessions and five technical sessions. The management sessions addressed Managerial and Organizational Vulnerabilities and Controls at the staff level (1 session) and the line level (2 sessions). The technical sessions addressed vulnerabilities and controls in the areas of Terminal and Remote Peripherals, Communication Components, Operating Systems, Applications and Non-Integrated Data Files, and Data Base/Data Base Management Systems. These Proceedings are the reports developed by the eight sessions of the workshop.

707,491
PB80-600038 Not availabale NTIS
National Bureau of Standards, Gaithersburg, MD.
Computer System Used for Pulse-Height Analysis.
F. J. Schima. 1979, 10p
Pub. in Computers in Activation Analysis and Gamma-Ray Spectroscopy, DOE Symp. Series 49, p416-425 1979.

Keywords: *Analog-to-digital conversion, Computer systems, Data processing concurrent with data acquisition, Pulse-height analysis, On line.

A computer-based pulse-height-analysis system is described. The main components consist of: (1) a 4.5-musec digitizing-time analog-to-digital converter, (2) a computer with an external direct-access-to-memory channel, and (3) an interface which uses that channel to store the digital data by the increment-by-one mode. Data processing programs can be run concurrently with the data acquisition with a minimum time loss to interrupt service.

707,492
PB80-600040 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Minis, Midis, and Desk-Top Calculators.
J. R. DeVoe, and J. F. Barkley. 1979, 19p
Pub. in Computers in Activation Analysis and Gamma-Ray Spectroscopy, DOE Symp. Series 49, p563-581 1979.

Keywords: *Computer, Instrumentation, Laboratory automation, Scientific computation.

A brief survey of the spectrum of computing equipment appropriate for use in the modern laboratory is presented. The rapid decline in the cost of small computers (25% per year) is making automation available to every laboratory. Current equipment in three major categories, microprocessors, calculator, and minicomputers, is described along with a historical perspective of the development of devices in each class. Finally, the impact of recent developments in electronic and communications technology on the laboratory user is discussed.

707,493
PB81-137713 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: The Expert Assistance System for the NBS Network Access Machine.
Final rept.
S. W. Watkins. Nov 80, 48p NBS-SP-500-68
Library of Congress catalog card no. 80-600178.

Keywords: *Computer networks, Instructions, Interfaces, Command and control systems, Access methods, Protocols.

The Expert Assistance System (EAS) was developed at the National Bureau of Standards' as a prototype to assist network users. Network users are faced with the problem of learning different procedures in order to access similar services on different host systems. A great deal of research has been precipitated by the desire to simplify network usage and many tools have been developed to assist the network user. The EAS addresses the problem of building procedures for an intermediary machine. The EAS automatically generates procedures by recording an interaction between a user and network system and then translating this interaction into the commands required for execution on the intermediary machine. Development of the EAS was facilitated by the existence of an intermediary machine at the National Bureau of Standards--the NBS Network Access Machine (AM). This report briefly describes the motivation for the development of a network assistance technique, discusses the design and implementation of the EAS at NBS, and then concludes with a view of future enhancements to the current EAS. The context for the description of the EAS is the NBS NAM; however the concepts are applicable to the general field of network user assistance.

707,494
PB81-149809 Not available NTIS
National Bureau of Standards, Washington, DC.
Survey of Computer-Based Password Techniques.
Final rept.
H. M. Wood. 1980, 6p
Pub. in Chapter 7 in Advances in Computer Security Management, p140-145 1980.

Keywords: *Computer security, Identifying, Identification systems, Information systems, Data storage, Data transmission, *Passwords, Access methods, Computer networks.

The report surveys passwords and their effective application to the problem of controlling access to computer resources. After describing the need for and uses of passwords, password schemes are categorized according to selection technique, lifetime, physical characteristics, and information content. Password protection, both in storage and transmission, is dealt with in the next section, followed by brief sections on current implementations and cost considerations.

707,495
PB81-245938 Not available NTIS
National Bureau of Standards, Washington, DC.
Computer Aids for the Organization of Standards.
Final rept.
J. R. Harris, and R. N. Wright. 1980, 10p
Pub. in Proceedings of Conference Computing in Civil Engineering (2nd), Baltimore, MD., June 9-13, 1980, p112-121 1980.

Keywords: *Data processing, *Standards, Civil engineering, Computer programming, Coding, Specifications, Design standards, Data base management.

A decade of research has produced a systematic methodology for the analysis and representation of design standards. The methodology assists in the formulation, expression, and use of standards, specifications or legal code requirements. This paper reports on research for elements of that methodology for dealing with the scope and the arrangement of standards. Functional and structural descriptions of provisions provide rational bases for classification of each requirement of a standard. The classification is used as a database for computer software that produces an index and alternative outlines for the standard. A prototype program has been developed and implemented in Fortran on the UNIVAC 1108 at the National Bureau of Standards.

707,496
PB82-169566 PC **A15**/MF **A01**
Florida Univ., Gainesville.
DBMS Cost/Benefit Decision Model: Cost and Preference Parameters,
S. Y. W. Su, D. S. Batory, J. J. Dujmovic, R. Elnicki, S. B. Navathe, A. Olagunju, and J. Parkes. Jan 81, 342p NBS-GCR-82-373
Contract NB80-SBCA-0449

Keywords: *Benefit cost analysis, *Decision making, Computer programming, Computer systems hardware, Systems analysis, Data processing equipment, *Data management systems, File maintenance, Data base management.

This report presents the general cost and preference parameters for the evaluation, comparison, and selection of data management alternatives. The parameters are derived systematically by using a hierarchical decomposition technique. The decomposition process starts with the basic categories of system requirements and terminates when sufficiently simple cost and preference parameters are derived based on which costs and preference measures of data management alternatives can be determined. The derived parameters are to be used by a quantitative analytic decision model for complex data management system evaluation and comparison. The role of the decision model in the system life cycle is discussed and the concept of system-requirement-based analysis of cost and preference analysis is introduced. An exhaustive list of parameters is accompanied by an appropriate description and justification for the existence of each parameter.

707,497
PB82-254822 CP **T05**
National Bureau of Standards, Washington, DC.
Analysis of Smoke Control Systems (ASCOSI).
Model-Simulation.
J. H. Klote. 24 May 82, mag tape NBS/DF-82/003
Source tape is in ASCII character set. Character set restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation, PB82-254814.

Keywords: *Models-simulation, *Fires, *Air circulation, *Smoke, Elevators(Lifts), Stairways, Pressurizing, Fire safety, Air flow, Differential pressure, Fortran, *Building fires, *Smoke control UNIVAC-1100/82 computers.

This computer program was developed to analyze systems intended to control smoke in building fires. These systems include pressurized stairwells, and pressurized elevator shafts, zone smoke control systems and pressurized corridors. This program calculates air flows and differential pressures throughout a building. Assumptions and limitations of the program are also discussed. The appendices contain a program listing and examples...Software Description: The program is written in the FORTRAN programming language for

implementation on a UNIVAC 1100/82 computer using the 1100 OS (37R2B) operating system. 40K bytes of core storage are required to operate the system.

707,498
PB83-257618 PC **A11**/MF **A01**
Aurora Associates, Inc., Washington, DC.
Computer Science and Technology: Future Information Processing Technology - 1983.
Final rept.
P. Kay, and P. Powell. Aug 83, 246p NBS-SP-500-103
Contract NB80-SBCA-0450
Sponsored in part by Defense Intelligence Agency, Washington, DC. Prepared in cooperation with Little (Arthur D.), Inc., Cambridge, MA., International Data Corp., McLean, VA., and Kellogg Communications Corp., Littleton, CO. Library of Congress catalog card no. 83-600563.

Keywords: *Technology innovation, *Data processing, *Forecasting, Trends, Computer systems hardware, Data processing equipment, Microprocessors, *Information services, Computer software.

The document contains the 1983 Technical Forecast for the information processing industry through 1997. It consists of six parts. Part I forecasts the underlying technologies of hardware and software, contains a discussion of changes in the information industry and market, and forecasts products and systems of the future, e.g., general-purpose systems, distributed processing systems, office systems. Part II contains Federal agency staff comments on Part I. Part III summarizes a teleconference in which a number of industry ADP users and vendors reviewed Part I. Part IV provides cost estimates for computer systems, subsystems, and terminals through 1997. Part V discusses the current and potential rules and regulations of the Federal environment and how they may affect the Federal inventory of ADP equipment. Part VI discusses management strategies for the new information technologies with emphasis on microprocessors.

707,499
PB84-217033 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Document Interchange Format.
J. E. Knoerdel, and S. W. Watkins. Apr 84, 41p NBSIR-84-2836
Sponsored in part by Department of the Navy, Washington, DC.

Keywords: *Data processing, Computer codes, Standards, *Text processing, *Word processing, Interchange format.

In the absence of standards, both the private and public sectors have addressed document interchange among different vendors' text processing systems in a number of ways. In an attempt to solve this interchange problem with respect to encoding of control functions for the Department of the Navy, a project was originated by the Office of the Under Secretary of the Navy for Financial Management to determine the formatting requirements of the Department of the Navy and to translate those requirements to a representation that would be supported by text processing system providers. The encoded representation of the formatting control functions has become known as the Document Interchange Format (DIF). This paper describes the overall approach taken by the DIF and then provides definitions for and implementation details for DIF. The body of the paper is intended for overall understanding and as such is intended for managers and technical staff. Then, there are a number of appendices provided which are specifically written for those implementing DIF.

707,500
PB84-217546 PC **A04**/MF **A01**
Computer Corp. of America, Cambridge, MA.
Distributed Database Components in a DBMS (Database Management System) Component Architecture.
Final rept.
F. A. Manola. Mar 84, 75p CCA-83/13, NBS/GCR-84/463
Contract NB79-SBCA-0086
See also PB83-163394.

Keywords: *Standards, *Data base management systems, *Distributed data bases, Query languages, Computer architecture.

This report describes preliminary specifications and processing functions for distributed database processing components to be added to the DBMS component architecture developed by Computer Corporation of America for the National Bureau of Standards. The component architecture is intended to serve as a potential framework for developing DBMS standards. Functions to be performed by the additional components include distributed query processing, concurrency control, and recovery.

707,501
PB84-217819 PC **A03**/MF **A01**
System Development Corp., McLean, VA.
Computer Science and Technology: Overview of Computer Security Certification and Accreditation.
Final rept. Jan 81-Sep 82.
Z. G. Ruthberg, and W. Neugent. Apr 84, 26p NBS/SP-500/109
Contract NB80-SBCA-0323
Also available from Supt. of Docs as SN003-003-02567-4. Library of Congress catalog card no. 84-601002. See also FIPS-PUB-102.

Keywords: *Security, Secure communications, *Computer security, *Data processing security, Computer information security, Federal information processing standards.

This overview summarizes how to establish and carry out a program and a technical process for computer security certification and accreditation of sensitive computer applications. The overview identifies and briefly describes the steps involved in performing computer security certification and accreditation; it identifies and briefly discusses important issues in managing a computer security certification and accreditation program; and it identifies and briefly describes the principal functional roles needed within an organization to carry out such a program. Recertification and reaccreditation and its relation to change control are also touched upon. A discussion of evaluation techniques to be used for certification includes risk analysis, EDP audit, VV&T (verification, validation, and testing), and security safeguard reviews. The relation of these to the system lifecycle is indicated.

707,502
PB84-246057 Not available NTIS
National Bureau of Standards, Washington, DC.
Universal Test Sets for the Standard Encryption Algorithm.
Final rept.
J. Gait. Apr 82, 4p
Pub. in IEEE Transactions on Reliability R-31, n1 p5-8 Apr 82.

Keywords: *Cryptology, *Test sets, Algorithms, Reprints.

This paper describes the test sets that were devised at the United States National Bureau of Standards (NBS) for hardware implementations of the standard encryption algorithm. These tests consist of a validation test set, which is being used at NBS to certify the correctness of vendors' implementations of the algorithm, and a maintenance test set, which can be used to ensure reliability in the operation of such encryption devices in the field. Each of these test sets is universal in the sense that the tests are independent of any particular hardware implementation of the algorithm, but depend only on the abstract definition of the encryption function itself.

707,503
PB85-137735 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Systems and Network Architecture Div.
IEEE (Institute of Electrical and Electronics Engineers) 802.4 Token Bus Network Simulation.
J. L. Archambault. Oct 84, 78p NBSIR-84/2966

Keywords: *Computer networks, Performance evaluation, Standards, Simulation, Graphs(Charts), Token bus networks, Local area networks.

A discrete event simulation of token bus networks has been designed and implemented at the National Bureau of Standards, and used to analyze the performance of local area networks compliant with the IEEE 802.4 specifications. The model measures the utilization of the network, the rotation time, the waiting time of the data packets, and the queue lengths in the Medium Access Control sublayer. This paper presents the model, and studies the sensitivity of these variables to the offered load, the packet length, the target rotation times, and the number of stations.

707,504
PB85-142297 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
National Bureau of Standards and the National Standard Reference Data System.
Final rept.
H. J. White. 1981, 5p
Pub. in AIChE Symposium Series 77, n203 p39-43 1981.

Keywords: Reprints, *National Standard Reference Data System.

The National Standard Reference Data System was conceived as a decentralized national effort to provide critically evaluated reference data to the scientific and technical communities of the United States. Financial support and execution were expected to involve a variety of Government and private agencies. NBS was made responsible for overall planning and coordination. The Office of Standard Reference Data is the program management office within NBS. The current program in the National Standard Reference Data System and the activities of the Office of Standard Reference Data are reviewed briefly with emphasis on those activities which appear to be of particular interest to chemical engineers.

707,505
PB85-145217 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
User-Oriented Data Communication Performance Parameters.
Final rept.
D. S. Grubb, M. D. Abrams, and N. B. Seitz. 1981, 10p
Pub. in Proceedings of International Conference, Paris, France, September 14-16, 1981, Performance of Data Communication Systems and their Applications, p145-154.

Keywords: Performance, Networks, Standards, Telecommunication, *Computer networks, Computer communications, User needs.

This paper is a discussion of a newly developed set of parameters that define data communication performance from an end user viewpoint and in system independent terms. The parameters are the subject of a proposed American National Standard. Where possible, actual text from the proposed standard is used.

707,506
PB85-161040 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Security of Personal Computer Systems: A Management Guide.
Final rept.
D. D. Steinauer. Jan 85, 66p NBS/SP-500/120
Also available from Supt. of Docs as SN003-003-02627-1. Library of Congress catalog card no. 84-601156.

Keywords: Guidelines, *Personal computers, *Computer security, *Computer information security, Home computers, Cryptography, Office automation, Access control.

This document is a security guide for managers and users of personal computer systems. It describes the nature of information security problems involved in the use of personal and other small computer systems and provides guidance for addressing those problems.

707,507
PB85-161115 CP **T02**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
MSA: Metropolitan Statistical Areas Data Tape, February 1985 Version.
Data file.
H. Tom. Feb 85, mag tape NBS/DF-85/007
Supersedes PB84-121367.
Source tape is in the ASCII or EBCDIC character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying character set and density. Call NTIS Computer Products if you have questions.

Keywords: *Data file, *Metropolitan areas, *Coding, *Urban areas, Magnetic tapes, *Standard Metropolitan Statistical Areas, *Federal information processing standards, Geographical areas.

The Office of Management and Budget (OMB) announced revised definitions of the nation's metropolitan statistical areas (MSAs) effective June 30, 1983. Based on demographic data derived from the 1980 decennial census, a comprehensive review was undertaken by the Federal Committee on MSAs, which advises OMB on MSA matters. The previous term 'Standard Metropolitan Statistical Area (SMSA) has been shortened to 'Metropolitan Statistical Area' (MSA). Under the new standards, an area qualifies for recognition as an MSA in one of two ways: if there is a city of at least 50,000 population, or an urbanized area of at least 50,000 with a total metropolitan population of at least 100,000. If an area has more than 1 million population and meets certain other specified requirements, it now will be termed a 'Consolidated Metropolitan Statistical Area' (CMSA), consisting of major components recognized as 'Primary Metropolitan Statistical Areas' (PMSAs). A total of 257 MSAs are recognized. In addition, there are 23 CMSAs, consisting of 78 PMSAs. This tape contains computer files documenting titles, components and Federal Information Processing Standards (FIPS) codes for Metropolitan Statistical Areas and related statistical areas. It includes two computer files to convert titles, components, and FIPS codes for Standard Metropolitan Statistical Areas to June 30, 1983 MSA definitions.

707,508
PB85-165850 PC **A15**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Future Information Technology, 1984 Telecommunications.
Final rept.
P. Kay, and P. Powell. Dec 84, 343p NBS/SP-500/119
Also available from Supt. of Docs as SN003-003-02626-3. Library of Congress catalog card no. 84-601149. Prepared in cooperation with Little (Arthur D.), Inc., Cambridge, MA., Aurora Associates, Inc., Washington, DC., TITAN Systems, Inc., McLean, VA., and International Data Corp., McLean, VA.

Keywords: *Telecommunication, Technology, Computer networks, Management, Information, Trends, Forecasting, Data processing security, Divestiture.

This document, the second in a series, focuses on telecommunications technology and related areas in computer organizations. It contains four primary parts: the telecommunications forecast through 1999, three perspectives on the divestiture of AT&T, a discussion of the general impacts of technology on computer security, and the management implications of the trends in information technology. Additionally, it contains the summary of an industry workshop on this forecast, a brief update of the 1983 forecast, and a glossary of terms. This forecast is a companion to 'Future Information Processing Technology - 1983' which contains fifteen year projections of computer hardware and software.

707,509
PB85-201796 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Data Management and Programming Languages Div.
Tour of Computing Facilities in China.
Final rept.
H. M. Wood, D. J. Reifer, and M. Sloan. Jan 85, 8p
Pub. in Computer 18, n1 p80-87 Jan 85.

Keywords: *China, Computers, Facilities, Asia, Reprints, *Computer applications, *Technology utilization.

The First International Conference on Computers and Applications was held in Beijing, China, June 20-22, 1984. This report describes visits made to various computing-related sites in Beijing and Shanghai by three attendees from the conference. Its intention is to provide some representative examples of present computer use and some indicators of China's current priorities and strategies for harnessing that technology.

707,510
PB85-238244 PC **A12**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks Held at Gaithersburg, Maryland on April 29-30, 1985.
Final rept.
R. Rosenthal. Jun 85, 270p NBS/SP-500/127
See also PB85-238251 through PB85-238418. Also available from Supt. of Docs as SN003-003-02660-3. Library of Congress catalog card no. 85-600556.

Keywords: *Computer networks, Standards, Simulation, Meetings, *Token bus networks, *Local area networks.

Token bus Local area networking technology is anticipated for use by national and international organizations seeking standard solutions for process control and Laboratory and factory automation applications. Several token passing technologies have been described; but, only one emerging standard, the IEEE 802.4 Token Bus currently includes broadband communications utilizing a prioritized, robust and deterministic access method. The workshop proceedings report the deliberations of 39 participants from industry, academia, and the Federal Government who came to NBS to (1) encourage modeling of 802.4, (2) to build competence and confidence in 802.4 technology, (3) to provide public knowledge about the behavior, characteristics and performance of 802.4 and to highlight areas for further study on the NBS 802.4 test bed facility.

707,511
PB85-238251
(Order as PB85-238244, PC **A12**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Analytic and Simulation Modeling of IEEE 802.4 Token Bus.
R. Rosenthal. Jun 85, 2p
Included in Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks, p2-3 Jun 85.

Keywords: *Computer networks, Standards, Simulation, Meetings, *Token bus networks, *Local area networks.

Token bus technology is anticipated for use by national and international organizations seeking standard local area network solutions for factory, laboratory and process control automation applications. Several token passing technologies have been described: but, only one emerging token bus standard, the IEEE 802.4 Token Bus, currently includes broadband facilities.

707,512
PB85-238269
(Order as PB85-238244, PC **A12**/MF **A01**)
GMI Engineering and Management Inst., Flint, MI.
Performance Simulation of the IEEE Token Bus Protocol Using SIMAN.
J. R. Pimentel. Jun 85, 31p
Included in Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks, p5-35 Jun 85.

Keywords: *Computer networks, Standards, Simulation, Meetings, SIMAN simulation language, *Token bus networks.

The SIMAN simulation language is used to simulate the performance of the physical and data link layers of a local area network suitable for manufacturing. The protocol standards specified by the IEEE project 802.4 has been chosen for the study. A detailed network queueing model is developed and implemented using the process view approach provided by SIMAN. Simulation results are shown in terms of average number of frames awaiting transmission, average response time, and medium utilization versus traffic intensity.

707,513
PB85-238277
(Order as PB85-238244, PC **A12**/MF **A01**)
Boeing Computer Services Co., Seattle, WA.
Discrete Event Simulation of the IEEE 802.4 Token Bus LAN (Local Area Networks) Protocol: A Structured Analysis Approach.
E. R. Nugent. Apr 85, 17p
Included in Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks, p35-51 Jun 85.

Keywords: *Computer networks, Standards, Simulation, Meetings, *Token bus networks, *Local area networks.

Boeing Computer Services is developing a discrete event simulation of the IEEE 802.4 Token Bus Media Access Control protocol. NBS will use the simulation model as part of their token bus research project. The paper describes the BCS simulation approach. Topics include project background, objectives and the simulation methodology used.

707,514
PB85-238285
(Order as PB85-238244, PC **A12**/MF **A01**)
Rockwell International, Thousand Oaks, CA. Science Center.
Simulation of the IEEE 802.4 Token Passing Bus Protocol Using SIMSCRIPT.
A. R. K. Sastry, and M. W. Atkinson. Jun 85, 9p
Included in Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks, p52-61 Jun 85.

Keywords: *Computer networks, Standards, Simulation, Meetings, SIMSCRIPT, *Token bus networks, *Local area networks.

A simulation model has been developed for the performance evaluation of the IEEE 802.4 token passing bus local area network protocol using SIMSCRIPT. The model has indentifiable 'processes' corresponding to the four 'machines' of the protocol, i.e., access control, receive, transmit, and interface machines. In addition, a 'frame process' is used to simulate the signal flow on the bus. An initialization 'routine' serves to input the network parameters and to initially activate the processes in the proper order, while a statistics extraction routine gathers output data during a simulation run. The entire model is developed in an incremental mode, gradually increasing the detail and complexity so that code can be validated by 'walking through' at every stage of the development. Queues with four different priorities, a message generation process at each queue, random selection of frame lengths, and token rotation timers have been incorporated. Results from a number of simulation runs suggest the need to develop methodology to relate the timer values with the desired priorities under given traffic conditions, which seems to be a very significant user-oriented issue.

707,515
PB85-238293
(Order as PB85-238244, PC **A12**/MF **A01**)
Motorola Semiconductor Israel Ltd., Ramat-Gan.
Token Bus (IEEE Std. 802.4) Network Simulator.
O. Kremien. Jun 85, 7p
Included in Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks, p62-68 Jun 85.

Keywords: *Computer networks, Standards, Simulation, Meetings, *Token bus networks, *Local area networks.

The Token Bus Network Simulator (TBNS), developed by Motorola Semiconductor Israel (MSIL), is a software tool which aids in Token-Bus (IEEE 802.4) protocol developments, verification and performance evaluation. It is a discrete event-driven simulator that is coded in PASCAL and provides predictions of delay, throughout and many other performance measures as a fuction of offered load. The simulator implements the IEEE 802.4 (Rev. A, 1984) Token-Passing Bus Medium Access Control (MAC) Specification of protocols for local area networks. It models token-bus network behavior in batch mode and under interactive user control (MAC) Specification of protocols for local area networks. It models token-bus network behavior in batch mode and under interactive user control. The simulator can trace the progress through the network of each message/event to facilitate model validation and analysis. Use of the simulator at MSIL has resulted in the discovery of several protocol errors (including one deadlock situation) which were reported back to the IEEE 802.4 committee.

707,516
PB85-238301
(Order as PB85-238244, PC **A12**/MF **A01**)
Industrial Technology Inst., Ann Arbor, MI.
Performabllity Modeling Tools.
J. F. Meyer. Jun 85, 33p
Included in Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks, p69-101 Jun 85.

Keywords: *Computer networks, Performance evaluation, Standards, Simulation, Meetings, *Token bus networks, *Local area networks.

Methods/tools for modeling performability (unified performance-reliability) are described with application to the evaluation of real-time local area networks. Emphasis is placed on the use of stochastic activity networks (SANs), where the presentation includes precise definitions of a SAN and associated concepts. Construction of SAN-based performability models is then discussed and the use of the procedure is illustrated in the modeling of a local area network with timing constraints.

707,517
PB85-238319
(Order as PB85-238244, PC **A12**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Token Passing Networks and Starvation Issues.
A. Nakassis. Jun 85, 10p
Included in Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks, p102-112 Jun 85.

Keywords: *Computer networks, Standards, Simulation, Meetings, *Token bus networks, *Local area networks.

In the report the authors advance a necessary and sufficient condition for a low priority queue to eventually get and use the token. Then the authors will use some of the machinery they will develop in the proof of the above mentioned condition in order to explore issues of Target Rotation Time (TRT) allocation and fairness.

707,518
PB85-238327
(Order as PB85-238244, PC **A12**/MF **A01**)
Ungermann-Bass, Inc., Santa Clara, CA.
Performance Analysis of the 802.4 Token Bus Media Access Control Protocol.
J. Y. Chien. Jun 85, 41p
Included in Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks, p113-152 Jun 85.

Keywords: *Computer networks, Standards, Simulation, Meetings, *Token bus networks, *Local area networks.

IEEE Standard 802.4--1984 defines a local area network protocol based on the concept of token-passing for controlling access to a broadcast medium. A performance analysis of such a network using simulation techniques has been conducted. Performance is characterized in terms of stability, fairness, throughput, and acquisition delay. The paper is a report on some of those efforts. The authors analysis shows that the network remains stable as the load increases. Fairness can be attained if enough time is allowed for the system to become saturated. The acquisition delay is sensitive and degrades greatly as load increases. A comprehensive discussion of how the performance of the network is affected by system parameters like data length, network sizes, token hold time, and station delay is also included.

707,519
PB85-238335
(Order as PB85-233245, PC **A12**/MF **A01**)
Motorola, Inc., Phoenix, AZ. Semiconductor Group.
Performance Issues of 802.4 Token Bus LANs (Local Area Networks).
B. A. Loyer, and D. Kolton. Jun 85, 13p
Prepared in cooperation with Motorola Semiconductor Israel Ltd., Tel Aviv.
Included in Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks, p153-167 Jun 85.

Keywords: *Computer networks, Standards, Simulation, Meetings, *Token bus networks, *Local area networks.

The paper presents curves generated via a software simulator that deals with several aspects of 802.4 Token Bus performance. The areas considered include dependence on station address allocation, the number of stations, the cable length, the frame length, the number of stations transmitting, and the token hold time. A brief description of the simulator is first presented and each area of performance impact is then discussed.

707,520
PB85-238343
(Order as PB85-238244, PC **A12**/MF **A01**)
General Electric Corporate Research and Development, Schenectady, NY.
Simulation of a Token Passing Bus Using a Static Logical Ring.
M. E. Ulug, and N. R. Shapiro. Jun 85, 11p
Included in Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks, p168-179 Jun 85.

Keywords: *Computer networks, Standards, Simulation, Meetings, *Token bus networks, *Local area networks.

Process oriented and critically timed communications requirements necessitates a real-time, failure-proof network for factory automation. The ability to control the accessing at the data link level by assigning priorities and timers make token passing more advantageous in the factory environment. The performance of token passing schemes depends greatly on the value of various timers that can be controlled at the data link level. A hierarchical policy to assign values for various timers in token passing access method in an optimization framework is reported. The basic idea in the scheme is to decompose the decision making capability into two hierarchically arranged levels. In the higher level, a centralized linear programming problem is solved to maximize the overall bus utilization of the network. In the lower level, a distributed integer programming problem is solved at each station to maximize the buffer utilizations. The higher level problem is solved at a slower time scale compared to lower level problem.

707,521
PB85-238350
(Order as PB85-238244, PC **A12**/MF **A01**)
Industrial Technology Inst., Ann Arbor, MI.
Hierarchical Policy for Timer Assignments in IEEE 802.4 Network.
K. H. Muralidhar. Jun 85, 23p
Included in Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks, p180-202 Jun 85.

Keywords: *Computer networks, Standards, Simulation, Meetings, *Token bus networks, *Local area networks.

Process oriented and critically timed communications requirements necessitates a real-time, failure-proof network for factory automation. The ability to control the accessing at the data link level by assigning priorities and timers make token passing more advantageous in the factory environment. The performance of token passing schemes depends greatly on the value of various timers that can be controlled at the data link level. A hierarchical policy to assign values for various timers in token passing access method in an optimization framework is reported. The basic idea in the scheme is to decompose the decision making capability into two hierarchically arranged levels. In the higher level, a centralized linear programming problem is solved to maximize the overall bus utilization of the network. In the lower level, a distributed integer programming problem is solved at each station to maximize the buffer utilizations. The higher level problem is solved at a slower time scale compared to lower level problem.

707,522
PB85-238368
(Order as PB85-238244, PC **A12**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Stability of a Token Passing Network.
A. Nakassis. Jun 85, 14p
Included in Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks, p203-216 Jun 85.

Keywords: *Computer networks, Standards, Simulation, Meetings, *Token bus networks, *Local area networks.

In what follows the authors study the stability of token passing networks with a fixed number of queues and they deduce the average rotation time for the token and the average user time per queue, under the assumption that the system is stable. The results will then be used to derive system parameters that will make the network stable.

707,523
PB85-238376
(Order as PB85-238244, PC **A12**/MF **A01**)
Delaware Univ., Newark. Dept. of Computer and Information Sciences.
IEEE 802.4 Token Bus Emulator.
F. Sylvanus, and T. Saydam. Jun 85, 12p
Included in Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks, p217-228 Jun 85.

Keywords: *Computer networks, Standards, Simulation, Meetings.

A performance evaluation facility which emulates Media Access Control (MAC) portion of the IEEE 802.4 'token bus' standards is presented. The facility consists of an emulator that implements the MAC components of the token bus standards, and a representation of the physical layer of the standards as required to logically interconnect the MAC peer entities. The emulator also includes minimal implementations of the Logical Link Control and Network Management facilities as required to generate and monitor network traffic and intialize the emulator. Experiments intended to measure network delay under several network loading scenarios as a function of MAC parameters are suggested.

707,524
PB85-238384
(Order as PB85-238244, PC **A12**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Notes from the Factory Automation Applications Session.
Jun 85, 5p
Included in Workshop on Analytic and Simulation Modeling on IEEE 802.4 Token Bus Local Area Networks, p230-234 Jun 85.

Keywords: *Computer networks, Standards, Simulation, Meetings, *Token bus networks, *Local area networks.

No abstract available.

707,525
PB85-238392
(Order as PB85-238244, PC **A12**/MF **A01**)
Communications and Power Engineering, Inc., Calabasas, CA.
Terminology Dictionary and Baseline Variables for IEEE 802.4 Token Bus LAN (Local Area Networks) Simulation.
S. Dunford. Jun 85, 6p
Included in Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks, p241-246 Jun 85.

Keywords: *Computer networks, Standards, Simulation, Meetings, *Token bus networks, *Local area networks.

The working paper presents a first draft of a terminology dictionary and a set of baseline variables to be used in simulation modeling of IEEE 802.4 Token Bus so as to create a basis for comparison in future workshops. It will be refined and expanded in the future. Any suggestions and criticisms should be addressed to Stephen Dunford at the above address.

707,526
PB85-238400
(Order as PB85-238244, PC **A12**/MF **A01**)
Industrial Technology Inst., Ann Arbor, MI.
Minutes of Special Interest Group Meeting on Conformance Testing.
K. H. Muralidhar. Jun 85, 3p
Included in Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks, p248-250 Jun 85.

Keywords: *Computer networks, Standards, Simulation, Meetings, *Token bus networks, *Local area networks.

In the report, three main aspects of conformance testing of IEEE 802.4 protocol were discussed. The aspects discussed were, test architecture, test structure, and types of testing.

707,527
PB85-238418

(Order as PB85-238244, PC **A12**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Simulation Subgroup Summary.
Jun 85, 6p
Included in Workshop on Analytic and Simulation Modeling of IEEE 802.4 Token Bus Local Area Networks, p251-256 Jun 85.

Keywords: *Computer networks, Standards, Simulation, Meetings, *Token bus networks, *Local area networks.

No abstract available.

707,528
PB86-111887 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microcomputers and the Writing of Programs.
Final rept.
G. Lyon. 1982, 4p
Pub. in Proceedings of Trends and Applications 1982, Advances in Information Technology, Gaithersburg, MD., May 17, 1982, p65-68 1982.

Keywords: *Editing routines, Cost analysis, Microcomputers, Interactive programming.

Microcomputers are an inexpensive resource that will promote new ways of doing things, as opposed to doing older ways cheaper. An example illustrates how features of the attractive 'work sheet' programs can be extended to aid in program development via language-based constructors. Since microcomputer systems to support the heavy demands of these language-based methods are just becoming available, a brief examination is made of a suitable microcomputer configuration.

707,529
PB86-129954 PC **A10**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Technology Assessment: Methods for Measuring the Level of Computer Security.
Final rept. 1980-81.
W. Neugent, J. Gilligan, L. Hoffman, and Z. G. Ruthberg. c1985, 208p NBS/SP-500/133
See also FIPS PUB-102. Also available from Supt. of Docs as SN003-003-02686-7. Library of Congress catalog card no. 85-600600. Prepared in cooperation with System Development Corp., McLean, VA., and George Washington Univ., Washington, DC.

Keywords: Evaluation, Auditing, Guidelines, Risk, Verifying, *Computer security, *Federal information processing standards, Certification, Analysis.

The document is a companion to FIPS PUB 102, 'Guideline for Computer Security Certification and Accreditation.' Since a security certification depends upon a technical security evaluation, this document is meant to provide information on and insigt about twenty-five evaluation methods in common use today in the security, EDP audit, and risk analysis communities.

707,530
PB86-138500 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems and Software Technology Div.
Online Help Systems - A Conspectus.
Final rept.
R. C. Houghton. 1984, 8p
Pub. in Communications of the Association for Computing Machinery 27, n2 p126-133 1984.

Keywords: *Assistance, Human factors engineering, Reprints, *On line systems, *Help systems, Man machine systems.

Users of computer systems have become accustomed to the convenience of on-line help systems and, as a result, require the availability of help systems on computers they purchase. There are many types of assistance that can be provided by help systems and there are many issues to be considered by the developers of such systems. The types of assistance include command assistance, help assistance, error assistance, on-line tutors and on-line documentation. Development issues include the quality and style of the assistance, query-in depth, contextual assistance, use of natural language, use of simulation, consistency, and contextual mode switching. Experiments with help systems underline many of these issues.

707,531
PB86-140258 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems Components Div.
Supercomputers.
Final rept.
J. P. Riganati, and P. Schneck. 1984, 17p
Pub. in Computer 17, n10 p97-113 Oct 84.

Keywords: *Computers, United States, Japan, Trends, Reprints, *Supercomputers, Taxonomy.

The overview describes the development and current status of supercomputers. It considers fundamental and conjectured limitations, characterizes existing systems being produced in the U.S. and Japan and discusses the difficulties inherent in performance measurement and in creation of a suitable taxonomy. Current trends and future possibilities are briefly reviewed.

707,532
PB86-142494 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of Standards Code and Information.
National Bureau of Standards Computer Based Message Systems Standards Efforts: A Status Report.
Final rept.
S. W. Watkins. 1982, 6p
Pub. in Proceedings of International Conference Communications (6th), Pathways to the Information Society, London, England, September 7-10, 1982, p289-294.

Keywords: *Computers, *Standards, Reprints, *Message systems, National Bureau of Standards.

A major component of the National Bureau of Standard (NBS) Computer Based Office Systems program is devoted to the area of Computer Based Message Systems (CBMSs). A CBMS allows communication among entities using computers. The computer's role in this messaging process is threefold: assistance to the user for message creation, assistance to the user for message reading and storage, and mediation of the actual communications. This paper provides an overview of the NBS program for CBMS standards, discusses the technical specifications of the first proposed standard out of this program which is for message format for CBMS, and introduces NBS work on a message transfer protocol.

707,533
PB86-202579 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Network Architecture Div.
Evaluation of the ICST (Institute for Computer Sciences and Technology) Test Architecture after Testing Class 4 Transport.
Final rept.
R. J. Linn. 1985, 11p
Pub. in Proceedings of the IFIP WG 6.1 International Workshop on Protocol Specification, Testing, and Verification (4th). Skytop Lodge, PA., June 11-14, 1984. p611-621 1985.

Keywords: *Computers, *Architecture, Tests, *Protocols, *Computer networks.

At the Institute for Computer Sciences and Technology of the National Bureau of Standards, an architecture has been specified for testing protocols in layers four through seven of the ISO Basic Reference Model for Open Systems Interconnection. The paper describes the application of that test architecture to testing Class 4 Transport with thirteen vendors' implementations of the protocol. The test results are summarized and an evaluation of the architecture and individual tools are presented.

707,534
PB86-202587 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Network Architecture Div.
Use of ISO Class 4 Transport on Local Area Networks.
Final rept.
D. P. Stokesberry. 1983, 13p
Pub. in Proceedings of LOCALNET '83, Local Networks, Distributed Office and Factory Systems, New York, NY., June 27-29, 1983, p371-383.

Keywords: Computers, *Computer networks, *Local area networks, *Computer communications, Protocols.

At the request of a number of companies, the National Bureau of Standards has organized three workshops for local area computer network implementors to arrange a multi-vendor demonstration of ISO Class 4 Transport Protocol on local area networks that implement the IEEE 802 protocols. Eighty-nine people from 45 organizations attended at least one of the workshops. The participants agreed to establish two neutral sites to demonstrate the ISO Transport and IEEE 802 local area network protocols. One site, hosted by General Motors, will support the IEEE P-802.4 Token Bus local area network standard. The second site, hosted by NBS, will support the IEEE P-802.3 CSMA/CD standard. Both sites will implement IEEE P-802.2 type 1, class 1 logical link control service for layer 2, an octet of zero representing a null network independent convergence protocol for layer 3 and the mandatory portions of the NBS specification of ISO Class 4 transport for layer 4.

707,535
PB86-202595 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Network Architecture Div.
Characterization of Traffic on NBSNET.
Final rept.
D. P. Stokesberry. 1984, 40p
Pub. in Proceedings of a Workshop on Performance and Evaluation of Local Area Networks, Worcester, MA., March 24-25, 1983, p63-102 1984.

Keywords: *Computers, *Communication traffic, *Computer networks, *Local area networks, *Computer communications, Protocols.

The paper analyzes the traffic on a local area network in its third year of operation at the National Bureau of Standards. NBSNET is a one megabit per second broadcast network that uses a carrier sense multiple access with collision detection (CSMA/CD) protocol. It is approximately four kilometers in length. The network has over 250 user devices connected to it; these devices fall into six different categories -- main computer, minicomputer, microcomputer, word processor, graphics terminal and ordinary terminal. Over 2 million packets were observed during 39 data collection runs. One fourth of the packets and one third of the data are local, i.e., the source address and the destination address of the packets are located in the same building. The rest of the traffic is between buildings. The network is growing continuously and network traffic increases as the network grows.

707,536
PB86-213097 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Security for Dial-Up Lines.
Special pub. (Final).
E. F. Troy. May 86, 68p NBS/SP-500/137
Also available from Supt. of Docs as SN003-003-02723-5. Library of Congress catalog card no. 86-600531.

Keywords: *Data processing security, *Authentication, Dials, Modems, Telephone lines, Display devices, Computer system hardware, *Computer privacy, *Computer information security, *Computer security, *Data processing security, *Secure communications.

The publication describes a set of solutions to the problem of intrusion into government and private computers via dial-up telephone lines, the so-called 'hacker problem'. There are a number of minimum protection techniques against these people and more nefarious intruders that should be used in all systems that have dial-up communications. These techniques can usually be provided by a computer's operating system. If the computer, augmented by normal security procedures, does not have the capability to give adequate protection against dial-up intruders, then additional software or hardware should be used to shore up the system's access control security. There are several types of hardware devices which can be fitted to computers or used with their dial-up terminals to provide additional communications protection for non-classified computer systems.

707,537
PB86-231172 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Systems Components Div.

Using DES (Data Encryption Standard) in IBM PC Compatible Workstations.
Final rept.
M. E. Smid. 1986, 9p
Pub. in Proceedings of 1986 IEEE (Institute of Electrical and Electronics Engineers) Workstation Technology and Systems Conference, Atlantic City, NJ., March 17-20, 1986, p1-9, Supplement.

Keywords: *Data processing security, Standards, Algorithms, Compatability, *Cryptography, *Data encryption, Workstations, IBM PC computers, Personal computers.

The Data Encryption Standard (DES) cryptographic algorithm can be implemented in International Business Machines Corporation (IBM) PC compatible workstations to protect data from unauthorized disclosure and to detect unauthorized modifications. Commercial products are now available, or will soon be available, to perform the required cryptographic processing. System designers should consider several issues, including the following: what applications tasks are to be performed, which cryptographic processes are needed, what configuration is best for the required tasks, what requirements will be placed upon the system by the connected networks, how will cryptographic keys be managed, and which standards should be met by the cryptographic equipment.

707,538
PB86-247897 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Work Priority Scheme for EDP (Electronic Data Processing) Audit and Computer Security Review.
Z. G. Ruthberg, and B. T. Fisher. Jul 86, 61p NBSIR-86/3386
Prepared in cooperation with Department of Health and Human Services, Washington, DC. Office of the Inspector General.

Keywords: *Auditing, *Information systems, Reviews, Efficiency, *Risk analysis, *Computer security, *Computer information security, Priorities, Work measurement.

The report describes a high level risk analysis for Automated Information Systems (AISs) that can be used by computer security reviewers and EDP auditors to prioritize their non-discretionary and discretionary review activities for these AISs. It divides the risk analysis problem into five areas of risk concern (called dimensions) with each area defined by a set of characteristics. The five dimensions are: Criticality/Mission Impact, Size/Scale/Complexity, Environment/Stability, Reliability/Integrity, and Technology Integration. The report presents a possible two-level scoring scheme which calculates the level of risk for each dimension, uses the Criticality score as a first order system risk score, and then combines all five dimension risk scores for a second order system risk score. An approach for deriving an EDP audit or computer security review plan using these scores is outlined.

707,539
PB87-162103 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Security for Personal Computers: A Growing Concern.
Final rept.,
D. D. Steinauer. 1984, 8p
Pub. in Comput. Secur. Jnl. 3, n1 p33-40 1984.

Keywords: Microcomputers, Computers, Security, *Personal computers, *Computer security, *Cryptography.

The article provides an overview of the special problems associated with the security of personal computer systems. It focuses on key technical vulnerabilities and methods to mitigate their effects.

DETECTION & COUNTERMEASURES

Acoustic Detection

707,540
PATENT-4 517 665 Not available NTIS
Department of Health and Human Services, Washington, DC.
Acoustically Transparent Hydrophone Probe.
Patent,
A. S. DeReggi, and G. R. Harris. Filed 17 Nov 83, patented 14 May 85, 10p PB87-184339, PAT-APPL-6-553 387
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Hydrophones, *Probes, *Patents, Acoustic detection, Transparence, Electrodes, Polymeric films, Piezoelectric materials, Sensitivity, Vinylidene fluoride polymers, PAT-Cl-367-163.

The invention relates to hydrophones employing piezoelectrically active elements of the polymer membrane type which possess the property of nearly complete acoustical transparency.

707,541
PATENT-4 653 036 Not available NTIS
Department of Health and Human Services, Washington, DC.
Transducer Hydrophone with Filled Reservoir.
Patent,
G. R. Harris, and A. S. DeReggi. Filed 23 Oct 84, patented 24 Mar 87, 8p PB87-184321, PAT-APPL-6-663 969
Supersedes PB85-141778.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Hydrophones, *Patents, Probes, Ultrasonic radiation, Piezoelectric materials, Polymeric films, Vinylidene fluoride polymers, PAT-Cl-367-170.

A hydrophone device with one or more very small active spots located on a large continuous ferroelectric sheet, such as PVDF, overcomes many of the problems in prior art constructions associated with the high dielectric constant of various media in which the device is used. Additional improvements include increased signal to noise ratio and a sensitivity independent of the medium properties. The hydrophone device includes a piezoelectrically active sheet stretched and clamped on over the top of a hoop ring. A backing is attached to the back of the hoop ring. A low-dielectric material fills the space between the backing and the sheet. This material eliminates the capacitive loading effect which would otherwise be presented by the medium being probed.

707,542
PATENT-4 672 851 Not available NTIS
Department of Commerce, Washington, DC.
Acoustic Evaluation of Thermal Insulation.
Patent,
G. V. Blessing, and D. R. Flynn. Filed 30 May 86, patented 16 Jun 87, 10p PB87-203121, PAT-APPL-6-868 483
Supersedes PB86-220324.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Thermal insulation, *Patents, Acoustic measurement, Acoustic measuring instruments, Evaluation, PAT-CL-73-597.

An acoustic method for measuring the quantity and installed density of thermal insulation includes introducing a sensing apparatus comprised of one or two acoustic transducers which are so placed as to measure the attenuation and/or phone shift of acoustic waves passing through the insulation. The thermal conductivity for a given insulation material may be monitored as a function of insulation depth by relating the acoustic amplitude and/or phase to a predetermined relationship for that particular insulation material. The relationship may be simply a set of tabular guides relating the quantity of insulation to an amplitude or phase value. This method may be applied to material in an open space. In the case of an attic enclosure, the apparatus introduced through a small ceiling hole may be subsequently unfolded or manipulated to place the transducers and possibly a reflecting target in the desired location relative to each other for carrying out the desired measurements.

707,543
PB82-264383 Not available NTIS
National Bureau of Standards, Washington, DC.
Precondensation Phenomena in Acoustic Measurements.
Final rept.
J. B. Mehl, and M. R. Moldover. 1 Jul 82, 11p
Pub. in Jnl. of Chemical Physics, n1 p455-465, 1 Jul 82.

Keywords: *Acoustic resonators, *Acoustic measurement, Condensation, Propane, Adsorption, Reprints.

Theoretical and experimental studies of the behavior of acoustic resonators whose walls are coated with a film of condensed vapor are reported. As a sound wave is reflected from the resonator walls, further condensation and evaporation will alter the thickness of the condensed film during the course of an acoustic cycle. The authors demonstrate that the same inhomogeneous precondensation phenomena can be easily be seen in propane at ambient temperature. These precondensation phenomena will influence measurements of acoustic virials at low temperatures, as well as the behavior of certain acoustic thermometers. Measurements of acoustic dissipative processes are also strongly affected. We have observed an increase of reflection losses by more than a factor of 200 as the pressure of propane on an aluminum surface was increased from 90% to 99.5% of the saturated vapor pressure.

Electromagnetic & Acoustic Countermeasures

707,544
PB-299 576/9 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Technology Div.
Radar Absorber Measurement Techniques at Frequencies Above 20 GHz.
Final rept.
N. S. Nahman, C. M. Allred, J. R. Andrews, C. A. Hoer, and R. A. Lawton. Aug 79, 71p NBSIR-79-1613
Sponsored in part by Air Force Avionics Lab., Wright-Patterson AFB, OH.

Keywords: *Antiradar coatings, Measurement, Superhigh frequencies, Extremely high frequencies, Millimeter waves, Dielectric properties, Dielectrics, Magnetic materials, Network analyzers, Permittivity, Radiation absorption, Time domain, Frequency domain.

New methods for implementing automatic permittivity/permeability measurements of radar absorber materials for applications primarily above 20 GHz and into the millimeter wave region to about 100 GHz are discussed. A brief review of the state-of-the-art of dielectric and magnetic material measurements is given. Automated time domain and frequency domain methods are considered including time domain automatic network analyzers, correlation measurement systems using noise signal sources, and six-port network analyzers.

Infrared & Ultraviolet Detection

707,545
PB80-110042 Not available NTIS

National Bureau of Standards, Washington, DC.
LED Source for Determining Optical Detector Time Response at 1.06 Micrometers.
Final rept.,
D. L. Franzen, and G. W. Day. Aug 79, 3p
Sponsored in part by Department of Defense, Washington, DC.
Pub. in Reveiw of Scientific Instruments 50, n8, p1029-1031, Aug 79.

Keywords: *Optical measuring instruments, *Reaction time, Semiconductor diodes, Gallium arsenides, Indium arsenides, Near infrared radiation, Optical measurement, Reprints, *Light emitting diodes, Gallium indium arsenides.

A gallium indium arsenide light emitting diode (LED) is investigated as a source for determining optical detector time response at 1.06 micrometers. To obtain either impulse or step shaped waveforms, the diode is driven by a charged transmission line switched by a transistor operating in the avalanche mode. A pulse with a 2.5-ns full width at half-maximum and a step with a 3--4-ns transition time are produced at repetition rates to 1 kHz. The effects of wavelength change during the pulse (chirping) are discussed and evaluated.

707,546

PB81-135634 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of Synchrotron Radiation for Detector Calibrations.
E. B. Saloman. 1980, 9p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Nuclear Instruments and Methods, Part III Radiometry 172, p79-87 1980.

Keywords: *Ultraviolet detectors, *Far ultraviolet radiation, *Radiometry, *Calibrating, Synchrotron radiation, Standards, Accuracy, Reprints.

The National Bureau of Standards (NBS) VUV radiometric detector program calibrates photodiode detectors as radiometric transfer standards over the wavelength range between 50 and 2500 A (5-250 eV photon energy). Our calibration uncertainty is 10% or better over this full range. The source of radiation used for calibration in the spectral region below 600 A is synchrotron radiation from the NBS Synchrotron Ultraviolet Radiation Facility (SURF) while a duoplasmatron source is used above 600 A. A noble gas double ionization chamber is used as the absolute detector between 400-1000 A while a single ionization chamber is used below 400 A and a thermopile referred to the double ionization chamber is used above 1000 A.

707,547

PB82-149881 Not available NTIS
National Bureau of Standards, Washington, DC.
Errors in Passive Infrared Imaging Systems Due to Reflected Ambient Flux.
J. C. Richmond. 1980, 5p
Pub. in SPIE Infrared Imaging Syst. Technol. Proc., v226, p110-114 1980.

Keywords: *Reflection, Errors, Correction, Reprints, *Infrared imagery, Ambient temperature, Scene analysis.

Passive infrared imaging systems produce a signal in which the amplitude at a particular spot is related to the radiance of the corresponding spot in the scene viewed. The differences in signal levels in different areas of the image is usually interpreted in terms of radiance temperature differences in the scene viewed, and may be converted to true radiance temperatures if the scene includes an object whose radiance temperature is known. The radiance temperatures are usually converted to true temperatures by correcting for the emittance of objects in the scene. This would be correct in the absence of reflected ambient flux. However, for scenes at ambient temperatures, ambient flux is always present in significant amounts. Temperature errors due to reflected ambient flux are discussed from a theoretical standpoint, and a procedure for experimentally evaluating the ambient flux is suggested.

707,548

PB82-234907 Not available NTIS
National Bureau of Standards, Washington, DC.
Reduced Absolute Uncertainty in the Irradiance of SURF-II and Instrumentation for Measuring Linearity of X-Ray, XUV and UV Detectors.
Final rept.
L. R. Hughey, and A. R. Schaefer. 1982, 4p
Pub. in Nuclear Instruments and Methods 195, p367-370 1982.

Keywords: *Calibrating, *Ultraviolet detectors, Far ultraviolet radiation, Uncertainty, Electrons, Reprints, X-ray detection.

The uncertainty in the number of stored electrons was the major component of the absolute uncertainty (except at the shortest wavelengths) in the photon flux from SURF-II. A highly linear silicon diode with spectral sensitivity from 200 nm to 1150 nm, and a quartz window and lens which collect 70 mrad of radiation are used as a beam current monitor. The combination of the diode (selected ones known to be linear within 0.2% over nine decades), the wide band width and collection angle (providing a sensitivity of 0.2 pA per electron) is the foundation for the improvement in measurement accuracy. The high sensitivity is used to detect incremental changes in detector output as the number of stored electrons is reduced one by one for stored currents from 10,000 electrons to zero. The diode linearity is used to scale the current up to 5 x 10 to the 9th power electrons (45 mA). The use of these linear diodes (with in situ calibration), as SURF and other storage rings, to determine the linearity of photon detectors which are sensitive to any radiation emitted by that storage ring will be discussed.

707,549

PB84-138544 Not available NTIS
National Bureau of Standards, Washington, DC.
Photon Detectors for the Ultraviolet and X-Ray Region.
Final rept.
J. G. Timothy, and R. P. Madden. 1983, 52p
Pub. in Handbook on Synchrotron Radiation, Chapter 5, p315-366 1983.

Keywords: *Synchrotron radiation, *Ultraviolet detectors, Ionization chambers, Photodiodes, Gas ionization, Reprints, *X-ray detectors, X-ray detection.

Synchrotrons and storage rings provide intense sources of continuum radiation that are of particular importance at ultraviolet and X-ray wavelengths. A 4 GeV synchrotron-radiation source will provide significant power down to hard X-ray wavelengths as short as 0.25A (50 keV), and a 4 GeV machine boosted by a wiggler will emit at wavelengths as short as 0.15A (80 keV). In this chapter, the authors review the available photon detectors that are suitable for use with synchrotron radiation at ultraviolet and X-ray wavelengths between 3000A (4 eV) and 0.1A (124 keV). As this wavelength range covers more than four decades in photon energy, it is necessary to subdivide it into a number of distinct regions on the basis of a series of technical considerations.

Magnetic Detection

707,550

PB85-100295 Not available NTIS
National Bureau of Standards, Washington, DC.
Design Considerations for Broadband Magnetic-Field Sensors.
Final rept.
M. Kanda, F. X. Ries, L. D. Driver, and R. D. Orr. 1982, 3p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, 28 June-1 July, 1982, p11-13.

Keywords: *Magnetic measurement, *Magnetic detection, Magnetic fields, Loop antennas, Broadband, Sensitivity, Design.

Basic design considerations required to produce broadband magnetic-field sensors are discussed. Three different configurations are discussed. The advantages and disadvantages of each configuration are presented in terms of its sensitivity and bandwidth. A physical discussion is given for the operation of a shielded loop.

Optical Detection

707,551

PATENT-4 714 339 Not available NTIS
Department of Commerce, Washington, DC.
Three and Five Axis Laser Tracking Systems.
Patent,
K. C. Lau, and R. J. Hocken. Filed 28 Feb 86, patented 22 Dec 87, 15p PB88-153689, PAT-APPL-6-834 728
Supersedes PB86-199189.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.50.

Keywords: *Patents, *Optical tracking, Robots, Tracking, Position(Location), *Laser applications, Three degrees of freedom, Five degrees of freedom.

A tracking system for measuring at least the spatial coordinates of a target and possibly the angular orientation of the target. A collimated beam is directed to the target and a mirror attached to the target reflects this beam back to a tracking point. Photosensors attached to the tracking or target point provide error signals to a servo system which controls optics at the tracking or target points to provide the direction necessary to accomplish the coincidence of the beams. An interferometer interferes the source beam with the beam that has travelled twice between the tracking and target points in order to measure the separation. By measuring the directions of the beams relative to structure attached to the tracking and target points, the target point can be located in spatial coordinates and additionally the orientation of the target structure can be determined.

707,552

PB80-156318 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibration of an Optical Particle Counter by Particle Doppler Shift Spectrometry in the 4-8 Micrometer Range.
Final rept.,
R. A. Fletcher, G. W. Mulholland, I. Chabay, and D. S. Bright. 1980, 8p
Pub. in Journal of Aerosol Science 11, p53-60 1980.

Keywords: *Particle size, *Optical measuring instruments, Aerosols, Calibrating, Measurement, Doppler effect, Optical spectrometers, Reprints.

The particle Doppler shift spectrometer (PDSS) can be used to make an internally calibrated size measurement of aerosol particles. For low number concentrations of spherical particles, an accurate size distribution can be determined for particles from 3-30 micrometers diameter. In this work the PDSS is used to calibrate a commercial optical particle counter. Test aerosol samples with a very narrow size distribution are generated by a Berglund-Liu particle generator. The particle size as predicted by the particle generator parameters and the size measured by the optical particle counter are compared to the size determined by the PDSS.

Personnel Detection

707,553

PB-285 118/6 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
Test Method for the Evaluation of Metallic Window Foil for Intrusion Alarm Systems,
G. N. Stenbakken. Aug 78, 15p NBS-SP-480-34
Library of Congress Catalog Card no. 78-600067.

Keywords: *Warning systems, *Metal foils, Tests, Detectors, *Intrusion detectors, Burglar alarm systems, Test and evaluation.

The report describes a test method to evaluate metallic foil used as a sensor in intrusion alarm systems to detect the breakage of glass. Laboratory tests demonstrated that metallic window foil may not break when the glass upon which it is installed is broken. In addition to presenting a detailed test procedure for metallic window foil, evaluation criteria are also recommended.

707,554
PB83-143677 Not available NTIS
National Bureau of Standards, Washington, DC.
Tunnel Detection Utilizing Field-Stationary Gravity Gradiometers.
Final rept.
J. E. Faller. 1982, 11p
Sponsored in part by Air Force Geophysics Lab., Hanscom AFB, MA., and Army Engineering Center, Fort Belvoir, VA.
Pub. in Proceedings of a Symposium on Tunnel Detection, Colorado School of Mines, Golden, CO., Jul 21-23, 1981, p247-257 1982.

Keywords: *Tunnel detection, *Gravity, Gravimeters, Detection, *Gravity gradiometers, *Gradiometers, *Intrusion detection.

At the Joint Institute for Laboratory Astrophysics, we have developed a new type of torsion pendulum apparatus. The initial motivation was to improve the accuracy of the Eotvos (equivalence of gravitational and inertial mass) experiment. In this torsion pendulum apparatus, the traditional fiber is replaced with a surrogate in which the fiber's suspension role is provided entirely by a fluid while its restoring and centering functions are achieved by an appropriate electrode array subject to adjustable voltages. Slight modifications of this design result in a low cost gravity gradiometer of potentially very high sensitivity. We are now constructing -- for purposes of testing the concept -- two fluid gradiometers of a size such that, theoretically, their sensitivities will permit one to see the change in gravity gradient resulting from a tunnel at a distance of one kilometer. The status of this development will be discussed.

Radiofrequency Detection

707,555
AD-777 837/6 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Note on Resolution of Radar Targets in Clutter.
H. V. Cottony. 14 Sep 73, 57p Scientific-B-7, AFCRL-TR-73-0586
Contract PRO-Y-72-860

Keywords: *Radar targets, Radar clutter, Resolution, Targets, Power spectra, Frequency, Spectra.

The paper describes exploratory work towards resolution of radar returns in clutter which involves the analysis of the frequency spectrum of the return. However, the technique employed makes use of power spectrum without the phase information.

707,556
PATENT-4 067 015 Not available NTIS
National Aeronautics and Space Administration, Washington, D. C.
System and Method for Tracking a Signal Source.
Patent.
L. N. Mogavero, E. G. Johnson, J. M. Evans, and J. S. Albus. Filed 11 Jul 75, patented 3 Jan 78, 7p
N78-17140/2, PAT-APPL-595 254
Supersedes PAT-APPL-595 254-75, N75-30385 (13 - 21, p 2655).
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of Patent available Commissioner of patents, Washington, D.C. 20231 $0.50.

Keywords: Feedback control, *Tracking (Position), Amplifiers, Computers, Multipliers, *Patents, Phase detectors, Radio signals, Servomechanisms, Signal processing, Ultrasonic radiation, PAT-CL-343-225, *Radio tracking.

A system for tracking moving signal sources is disclosed, which is particularly adaptable for use in tracking stage performers. A miniature transmitter is attached to the person or object to be tracked and emits a detectable signal of a predetermined frequency. A plurality of detectors positioned in a preset pattern sense the signal and supply output information to a phase detector which applies signals representing the angular orientation of the transmitter to a computer. The computer provides command signals to a servo network which drives a device such as a motor driven mirror reflecting the beam of a spotlight, to track the moving transmitter.

707,557
PB81-236556 Not available NTIS
National Bureau of Standards, Washington, DC.
Synthesis of Broadband Antenna Arrays as Possible Over-the-Horizon Radars.
Final rept.
M. T. Ma. 1981, 22p
Pub. in Research Topics in Electromagnetic Wave Theory, Chapter 9, p188-209 (John Wiley and Sons, New York) 1981.

Keywords: *Antenna arrays, *Radar antennas, Over the horizon detection, Broadband antennas, Reprints.

Based on the requirements of broadband operation and other radiation characteristics, the side-terminated vertical half rhombic is selected as the antenna element in an array to be included as the central part of an over-the-horizon radar, which serves as a remote means for sea study. A nonuniformly spaced array of 25 elements is synthesized for the entire high-frequency band. The array has the capability of providing a maximum transmitting-receiving product gain in the order of 60 dB at low take-off angles, a product azimuth pattern with a nominal half-power beamwidth of 2 degrees, a product sidelobe level of -38 dB, and a grating-lobe level of at least -30 dB, and of covering an approximate range of 3,000 km and a sector area of 40 degrees.

707,558
PB84-226372 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of a Systematic Approach to an Investigation of HF Interference to a Shipboard Radar Set.
Final rept.
L. D. Driver, and G. R. Reeve. Apr 84, 8p
Pub. in Proc. 1984 IEEE Nat. Symp. Electro-magnetic Compatibility, San Antonio, Texas, April 24-26, 1984, IEEE Cat. No. 84CH2035-4, p211-218.

Keywords: *Radiofrequency interference, *Radar, *Shipborne detectors, Electromagnetic shielding, Field strength, Electromagnetic interference.

This paper describes an investigation of electromagnetic interference to a shipboard radar caused by a co-located HF, one kilowatt transmitter. The test procedures and analysis used to determine the points of EM field entry, the corrective measures taken, and the results achieved are described.

General

707,559
PB-281 963/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Piezoelectric and Pyroelectric Polymer Sensors.
Final rept.,
S. Edelman. Jul 77, 9p
Pub. in Proceedings of Conference on Sensor Technology for Battlefield and Physical Security Applications, Fort Belvoir, Va. 13-15 Jul 77 p204-212 Jul 77. (Army Mobility Equipment Research and Development Command, Ft. Belvoir, Va.).

Keywords: *Detectors, *Piezoelectricity, *Pyroelectricity, Polymers, Measuring instruments, Stress analysis, Strain tests, Monitors.

Sensors using polymer material as the active element can be piezoelectric and pyroelectric. Both effects have military uses. Poly(vinylidene fluoride) (PVDF) is the polymer usually used for both types of applications. As a piezoelectric material it has good response to dynamic stress or strain over a wide range of frequencies, is not likely to be harmed by the usual ambient conditions, salt water, soaps, common organic solvents, nearby explosions, or other mechanical shocks. It is readily available in relatively cheap, thin, light, flexible sheets of large area and is easily shaped for a particular application. Many of the same characteristics hold for its use as a pyroelectric material. It has good response to temperature changes caused by radiation of a wide range of wavelengths from infrared to ultraviolet. Piezoelectric polymer instruments can be used as microphones and sound sources in air, as hydrophones in water over the frequency range from a few hertz to many megahertz, as detectors of stress or strain in the soil, for a number of biomedical applications, as detectors of acoustic emission on a wide variety of materials and structures, as vibration detectors, to monitor the acoustic signature of components of machinery as a means of detecting incipient failure, and for intrusion detection.

ELECTROTECHNOLOGY

Antennas

707,560
AD-777 836/8 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Note on Radiation Patterns of Array Antennas.
H. V. Cottony. 13 Sep 73, 20p Scientific-B-6, AFCRL-TR-73-0579
Contract PRO-Y-72-860

Keywords: *Antenna radiation patterns, *Antenna arrays, Power gain, Polynomials.

The radiation patterns of array antennas are usually expressed as an electric field in the form of a polynomial of complex terms with phases presented in exponential form. This form has certain drawbacks from the analytical standpoint and, in practice, results in limiting the analytical study of arrays to symmetric forms. In this note it is demonstrated that the radiation pattern of an array antenna, whether linear or planar, can be expressed in terms of power as a polynomial of real terms. This form of presentation is shown to have certain advantages; an asymmetry in the array, whether in the positions of the elements or in the current distribution or both, has no effect on the form of the polynomial; each term of the polynomial has a readily recognizable physical significance. Some of the characteristics of this form of radiation pattern representation suggest that it may be more suitable for beam shaping and illumination synthesis. (Author)

707,561
PATENT-4 008 477 Not available NTIS
Department of Commerce, Washington, DC.
Antenna with Inherent Filtering Action.
Patent.
T. M. Babij, R. R. Bowman, and P. F. Wacker. Filed 25 Jun 75, patented 15 Feb 77, 6p PB-271 825/2, PAT-APPL-590 355
Supersedes COM-75-11201.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, D.C. 20231 $0.50.

Keywords: *Antennas, *Patents, Frequency response, Electric filters, PAT-CL-343-701.

The patent describes a novel antenna which provides inherent filtering action by which the frequency response curve of the antenna can be shaped. In the preferred inventive embodiment, the antenna comprises at least one elongated receiving element, and preferably two such elements in the form of a dipole, both elements being constructed, at least in part, of an electrically resistive material. A detector, such as a diode detector, is directly coupled to the receiving elements. The resistance of the receiving element and the capacitances of the receiving element and the detector form a distributed parameter RC filter, the values of which parameters can be carefully controlled so as to provide the desired frequency response curve shaping. In the preferred inventive embodiment, a conductive strip is disposed along the length of and preferably to both sides of each receiving element, with a layer of dielectric material being sandwiched therebetween, whereby the filtering action is enhanced.

707,562
PATENT-4 091 327 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Broadband Isotropic Antenna with Fiber-Optic Link to a Conventional Receiver.
Patent.
E. B. Larsen, J. R. Andrews, and E. E. Baldwin. Filed 2 Mar 77, patented 23 May 78, 8p PB78-600038, PAT-APPL-773 585

Keywords: *Electromagnetic field strength measurement, Fiber optics, Light-coupled antenna-receiver, Light emitting diodes.

A broadband active isotropic receiving antenna for use with a conventional electromagnetic interference receiver to measure weak near-zone electric fields of unknown polarization. The antenna consists of three mutually orthogonal active dipoles, including RF amplifier circuitry and light emitting diode means, located therein coupled to fiber optic waveguide means. The frequency range of each of the three field components is amplified and used to modulate respective light emitting diodes whose modulated infrared or visible signals are guided through the fiber optic waveguide means to photo-detectors at the far end of the fiber optic guides. These photodetectors recover the RF modulation from the IR carrier which is then time multiplexed for input to the electromagnetic interference receiver. The DC output from the receiver is processed to provide an output voltage proportional to the square root of the sum of the squares, i.e. the Hermitian magnitude of the three mutually orthogonal electric field components.

707,563
PB-263 150/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Non-Planar Near Field Measurements: Spherical Scanning.
Final rept. Oct 73-Jun 74,
P. F. Wacker. Apr 75, 55p
Contract F33615-74-M-6001
See also AD-A012 295.
Pub. in AFAL-TR-75-38, 55p (Air Force Avionics Laboratory, Air Force Systems Command, Wright-Patterson AFB, Ohio, Apr 75).

Keywords: *Antenna radiation patterns, Antennas, Electromagnetic fields, Measurement, Fourier transformation, Data reduction, Computation, Antenna arrays, Near field, Fast fourier transform.

The advantages and limitations of near-field antenna measurements are compared with those of conventional far-field measurements. Further, the advantages and limitations of planar, circular cylindrical, and spherical scanning are compared.

707,564
PB-271 687/6 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C.
Near-Field Antenna Measurements on a Cylindrical Surface: A Source Scattering-Matric Formulation,
A. D. Yaghjian. Jul 77, 40p NBS-TN-696

Keywords: *Antennas, *Electromagnetic fields, S matrix theory, Measurement, Cylindrical bodies, Scanning, Near field.

The theory for probe-corrected measurement of antennas by scanning on a circular cylindrical surface enclosing the test antenna in the near-field is formulated from a source scattering matrix description of the test and probe antennas. The basic transmission formula is derived without recourse to reciprocity, and from a common center approach which separates as an isolated problem the probe characterization and transformation. Moreover, it is shown how an experimental technique can, in principle, determine the required transformed probe coefficients without the use of addition theorems. Computer inversion of the transmission formula is accomplished accurately and efficiently with the aid of the sampling theorem and FFT algorithm.

707,565
PB-274 057/9 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Relatively Short Cylindrical Broadband Antenna with Tapered Resistive Loading for Picosecond Pulse Measurements,
M. Kanda. Aug 77, 47p NBSIR-77-861

Keywords: *Cylindrical antennas, *Broadband antennas, Load impedance, Electromagnetic interference, Measurement, Electromagnetic pulses, Computation, Picoseconds, Method of moments.

A relatively short cylindrical antenna with continuously tapered resistive loading has been studied for the purpose of picosecond pulse and extremely broadband CW measurements. The antenna considered is a nonconducting (glass) cylinder with continuously deposited, varying-conductivity, resistive loading. The current distributions on the antenna were numerically calculated using the method of moments. Using these current distributions, other quantities, such as input impedance, near-field and far-field radiation patterns, and radiation efficiency, were also numerically calculated and compared with the results using Wu-King's approximate current distribution. Agreement is relatively good except at high frequencies, $kh > pi/2$, where the method of moment appears to give better results. To verify the theoretical results, several resistively loaded antennas were fabricated, and their picosecond pulse and extremely broadband CW receiving characteristics were analyzed for the frequency range between 5 kHz and 5 GHz. The experimental results indicate excellent linear amplitude and phase response over the frequency range. This provides the unique capability of this antenna to measure fast time-varying electromagnetic fields with minimal pulse-shape distortion due to nonlinear amplitude of phase characteristics.

707,566
PB-274 352/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Recent Results with Spherical Near-Field Antenna Scanning at the National Bureau of Standards,
P. F. Wacker. 1977, 6p
Sponsored in part by Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
Pub. in Proceedings European Space Agency Symposium, Noordwijk (Netherlands), June 6-8, 1977, p159-164 1977.

Keywords: *Scanning, *Antenna radiation patterns, Data processing, Spherical scanning, Near field.

A Fast Fourier Transform multiplying matrix technique of processing near-field spherical scanning data has been programmed for the no-probe-correction case and is largely completed for the probe correction case, except for the complicated translational transformation of the probe pattern coefficients. (The elements of the multiplying matrices are constants independent of the angular and radial positions of the measurement points.) For an X-band antenna 23 wavelengths across with half-widths of 1.5-1.8 degrees, computations were carried out in 2 minutes. For a scanning radius R = 329.2 cm, the far field is in good agreement with that accurately known from planar scanning. For R = 50.9 cm, the agreement is less good, apparently due to lack of a probe correction. For delta theta x delta phi = 2 degrees x 6 degrees there is a small aliasing error at the larger radius, but essentially none at the smaller. Translation of the phi axis 0.36 lambda from intersection with the theta axis produced only moderate errors.

707,567
PB-274 353/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Symmetry Analysis Applied to Scattering, Inverse Scattering, and Antenna Patterns: Measurements, Moment Method, and Characteristic Modes.
Final rept.,
P. F. Wacker. 1977, 4p
Pub. in Proceedings of Institute of Electrical and Electronics Engineers/Antennas and Propagation Society Int. Symp., p177-180 1977.

Keywords: *Antenna radiation patterns, Symmetry, Analyzing, Scattering, Inverse scattering.

Constructive procedures are given for making full use of known symmetries in reducing the measurement or computational effort required to determine (1) the scattering properties of any mathematically linear scatterer (say electromagnetic or linearized acoustic), (2) the transmitting or receiving properties of an antenna, and (3) the characteristic modes of: Garbacz, the singularity expansion method, and n-ports. Procedures are also given for determining all the symmetries of a scatterer (or scattering operator) from scattering properties, even when the inverse scattering problem has a nondenumerable infinity of exact solutions. For (1) - (3) the modes are so chosen and ordered that the scattering matrix is partitioned into submatrices, a large fraction of which are known a priori to have only zero elements and each of the others known except for a complex multiplicative constant. The measurement or computational effort for (1) and (2) is thus reduced to determining these multiplicative constants. The mathematics (which is fundamental to the selection rules of quantum mechanics) is rigorously exact and applies to (a) both finite and continuous groups, (b) active and passive scatterers and (c) media which are lossy, inhomogeneous, anisotropic, nonreciprocal, and magnetoelectric, subject only to the assumed symmetries.

707,568
PB-274 357/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Symmetry Analysis Applied to Wave Theory.
Final rept.,
P. F. Wacker. 1977, 4p
Pub. in Proceedings Institute of Electrical and Electronics Engineers/Antennas and Propagation Society Int. Symp., p169-172 1977.

Keywords: *Antenna radiation patterns, Electromagnetic theory, Symmetry, Analyzing, Scanning, Data processing, Near field, Symmetry analysis.

Although symmetry analysis (SA) is little used in electromagnetic theory or engineering, it is one of the most powerful tools of physical science. Thus SA permits one to derive, from symmetry alone, Maxwell's equations and their exact complex vector spherical solutions, including transformation under coordinate rotation or translation, definitions of special functions, and orthogonalities between solutions and between the transformation coefficients. These two types of orthogonalities provide the basis for near-field spherical scanning with and without correction for the pattern of the measurement probe, including highly efficient computer programs. Being based upon relativistic invariance, SA provides deep and broad understanding. By pushing irrelevant details into the background, SA provides ready insight into complicated problems, say involving lossy, inhomogeneous, anisotropic, nonreciprocal, magnetoelectric media. These irrelevant details include mathematical formulation, many material properties, and, in large part, even the physical system, coordinate system, or whether the analysis is classical or quantum mechanical. This permits ready transfer of analysis and computer programs from one system to another. Thus, the mathematics of quantum mechanical selection rules may be used to reduce the effort required to determine scattering properties. Similarly, the noncrossing rule of spectroscopy may be applied to propagation constants of waveguides and resonant frequencies of cavities.

707,569
PB-274 358/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Advantages and Disadvantages of Planar, Circular Cylindrical, and Spherical Scanning and Description of the NBS Antenna Scanning Facilities,
P. F. Wacker, and A. C. Newell. 1977, 7p
Sponsored in part by Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
Pub. in Proceedings European Space Agency Symposium, Noordwijk (Netherlands), June 6-8, 1977, p115-121 1977.

Keywords: *Scanning, *Antenna radiation patterns, *Test facilities, Measurement, Near field.

Near-field scanning yields high accuracy because of laboratory-type control, fitting with linear combinations of exact solutions of Maxwell's equations, high signal to noise ratio, averaging over 10,000 or more measurements for each pattern value, full correction for proximity effects, and absence of ground and grazing angle reflections, as in an anechoic chamber. Further, it provides quite detailed pattern information, and it can yield phase and amplitude of each component of the electromagnetic six-vector for any distance, permitting computation of cosite interference. Not only is it independent of weather, it permits measurements to be made in a clean room and in atmospheric absorption bands. Planar, circular cylindrical, and spherical scanning are compared, and the NBS near-field scanning facilities are described, including the new circular cylindrical and spherical facilities and what the authors believe to be the world's most accurate planar scanner.

707,570
PB-274 364/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Results of Spherical Near-Field Measurements on Narrow-Beam Antennas.
Final rept.,
A. C. Newell, and A. Repjar. 1976, 4p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, p382-385 1976.

Keywords: *Antenna radiation patterns, Measurement, Antennas, Narrow beams(Radiation), Near field.

The first phase of a program has been completed to develop spherical near-field measurement techniques. Tests were performed to determine scan parameters, alignment procedures and estimates of errors. The results have shown that the required scan sector, the effect of the probe correction, and the required accuracy in knowing the radius of the measurement sphere R all decrease with R. Comparisons of results have been made with planar near-field results which indicate the accuracy of the technique.

707,571
PB-274 938/0 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Near-Field Antenna Measurements on a Cylindrical Surface: A Source Scattering-Matrix Formulation.
Technical note,
A. D. Yaghjian. Sep 77, 42p NBS-TN-696-Rev
Revises and supersedes report dated Jul 77, PB-271 687.

Keywords: *Antennas, *Electromagnetic fields, S matrix theory, Measurement, Cylindrical bodies, Scanning, Fourier transformation, Near field, Fast fourier transform.

The theory for probe-corrected measurement of antennas by scanning on a circular cylindrical surface enclosing the test antenna in the near-field is formulated from a source scattering matrix description of the test and probe antennas. The basic transmission formula is derived without recourse to reciprocity, and from a common center approach which separates as an isolated problem the probe characterization and transformation. Both an experimental technique and an approximate analytical technique are presented to determine the required transformed probe coefficients without the use of addition theorems. The approximate technique, which is developed from the exact addition theorem transformation, yields the probe coefficients directly in terms of the far-field of the probe, provided the rotation axis of the test antenna lies in the far-field of the probe. Computer inversion of the transmission formula is accomplished accurately and efficiently with the aid of the sampling theorem and FFT algorithm.

707,572
PB-277 319/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fixed and Base Station Antennas.
Final rept.,
M. J. Treado, H. E. Taggart, R. E. Nelson, and J. L. Workman. 1977, 16p
Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, D.C.
Pub. in NILECJ-STD-0204.00, 16p 1977.

Keywords: *Antennas, *Performance standards, Radio stations, Law enforcement.

The document is a voluntary performance standard for antennas used at fixed sites and base stations. It is intended for use by law enforcement agencies as an aid in the selection and procurement of this type of antenna. The standard includes the minimum performance requirements and methods of test to determine the effectiveness and suitability of these antennas for law enforcement use.

707,573
PB-279 640/7 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Transients in Resistively Loaded Antennas and Their Comparison with Conical Antennas and TEM Horns,
M. Kanda. Mar 78, 36p NBSIR-78-876

Keywords: *Conical antennas, *Horn antennas, Transient response, Load impedance, Transients, Fourier transformation, Transverse waves, Linear systems, Loading(Electronics), Time domain, Method of moments, Frequency domain, Fast fourier transformations.

The receiving and transmitting transient responses for a relatively short, linear antenna with continuous resistive loading are investigated theoretically and experimentally. The antenna considered is a nonconducting cylinder with continuously deposited, varying-conductivity, resistive loading. The current distribution, the corresponding effective length, and the driving point impedance are calculated by use of the method of moments and compared with the Wu-King approximation. The receiving and transmitting transient responses are calculated in the frequency domain using the results of the effective length and driving point impedance. The use of FFT then allows the determination of transient fields for a known input waveform. The receiving and transmitting responses for a conical antenna and a TEM horn are also investigated theoretically to compare with the transient response of the resistively loaded antenna. Time domain measurements were performed using a time domain antenna range with a time domain automatic network analyzer. The agreements between theory and experiments of the receiving and transmitting transient responses for the resistively loaded antenna, the conical antenna, and the TEM horn are very good. The receiving transient response of the resistively loaded antenna indicates that an impulse shape of 70 ps duration is well preserved. This provides the unique capability of this antenna to measure fast, time-varying, transient fields with minimal pulse-shape distortion due to nonlinear amplitude or phase characteristics.

707,574
PB-285 048/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Broadband Antenna with Tapered Resistive Loading for EMI Measurements.
Final rept.,
M. Kanda. 1977, 6p
Pub. in Proceedings IEEE Int. Symp. on Electromagnetic Compatibility, Held at Seattle, Washington, on August 2-4, 1977, p13-18.

Keywords: *Broadband antennas, *Electromagnetic interference, Measurement, Time domain, Load impedance, Electrical resistance, Radiofrequency interference, Loading(Electronics), Method of moments.

The characteristics of a relatively short cylindrical broadband antenna with continuous resistive loading are studied theoretically and experimentally for EMI measurements. The antenna considered is a non-conducting (glass) cylinder with continuously deposited, tapered, resistive loading. The current distribution on the resistively loaded antenna is calculated using the method of moments. Using the current distribution other quantities such as input impedance, near-field and far-field radiation patterns, and radiation efficiency are calculated and compared with experiments. These experimental results agree well with the theoretical results. Time domain measurements are performed using a time domain automatic network analyzer. The receiving characteristics of the resistively loaded antenna indicate that the impulse shape of 70 ps duration is well preserved. The resistively loaded antenna with a beam lead Schottky diode load is also examined. The frequency response is flat to plus or minus 3 dB from 700 kHz to 2 GHz. With proper response shaping, the resistively loaded antenna has a potential use for the frequency range between 10 kHz and 3 GHz without distorted antenna field patterns.

707,575
PB-285 320/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characteristics of a Relatively Short Broadband Linear Antenna with Tapered Resistive Loading,
M. Kanda. 1977, 4p
Pub. in Proc. Int. Symp. on Antennas and Propagation Society, Stanford, Calif., Jun 20-22, 1977. IEEE Antennas and Propagation Society Digest, p230-233, 1977.

Keywords: *Broadband antennas, *Cylindrical antennas, Linear systems, Antenna radiation patterns, Load impedance, Electrical resistivity, Near field, Method of moments.

The characteristics of a relatively short cylindrical broadband antenna with continuous resistive loading are studied theoretically and experimentally. The antenna considered is a nonconducting cylinder with continuously deposited, tapered, resistive loading. The current distribution on the resistively loaded antenna is calculated using the method of moments and compared with the Wu-King approximation. Experimental results indicate that the current distribution on the resistively loaded antenna agrees with the results of the method of moments. Using the current distributions obtained both by the method of moments and by the Wu and King approximation, other quantities such as input admittance, near-field and far-field radiation patterns, and radiation efficiency are calculated and compared with experiments. These experimental results agree with the results from the moment method. The receiving characteristics are examined using a TEM cell and a near-field extrapolation range to cover the frequency range from 5 kHz to 5 GHz. The resistively loaded antenna with a beam lead Schottky diode detector gives the frequency response flat within plus or minus 3 dB from 700 kHz to 2 GHz. With proper response shaping, the resistively loaded antenna has a potential use for the frequency range between 10 kHz and 3 GHz without distorting the antenna field patterns. The slow rolloff of the frequency response at the low end of the frequency range is due to the space-charge resistance and the spreading resistance of the Schottky diode. The very sharp cutoff at the high end of the frequency range is due to its depletion layer capacitance.

707,576
PB-287 462/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Relatively Short Cylindrical Broadband Antenna with Tapered Resistive Loading for Picosecond Pulse Measurements.
Final rept.,
M. Kanda. May 78, 9p NBSIR-77-861
Pub. in IEEE Trans. Antennas Propag. AP-26 n3 p439-447 May 1978.

Keywords: *Broadband antennas, *Measurement, Cylindrical antennas, Load impedance, Pulsation, Pulses, Picoseconds, Method of moments, Reprints.

A relatively short cylindrical antenna with continuously tapered resistive loading has been studied for the purpose of picosecond pulse measurements. The antenna considered is a nonconducting cylinder with continuously deposited varying-conductivity resistive loading. The current distributions on the antenna were numerically calculated using the method of moments. Using these current distributions, other quantities such as input admittance, near-field and far-field radiation patterns, and radiation efficiency, were also numerically calculated and compared with the results using the Wu-King's approximate current distribution. Agreement is relatively good except at high frequencies kh $>$ pi/2 where the method of moments appears to give better results. To verify the theoretical results, several resistively loaded antennas were fabricated, and their picosecond pulse receiving characteristics were analyzed for the frequency range between 5 kHz and 5 GHz. The experimental results indicate excellent linear amplitude and phase response over the frequency range. This provides the unique capability of this antenna to measure fast time-varying electromagnetic fields with minimal pulse-shape distortion due to nonlinear amplitude or phase characteristics.

707,577
PB-288 089/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Standards for the Measurement of Impulsive Fields Radiated by a TEM Horn Antenna.
Final rept.
R. A. Lawton, and A. R. Ondrejka. Dec 77, 4p
Pub. in Proceedings of Union Radio Scientifique Internationale Comm. A Symposium Held at Lannion, France on October 3-7, 1977. p1-4, Dec 1977.

Keywords: *Horn antennas, Transverse waves, Standards, Field strength, Measurement.

The report describes the construction and evaluation of a TEM horn antenna of NBS design. Our purpose in the evaluation was to analyze the different electrical field generation and measurement techniques thoroughly enough to determine the major sources of error and establish a standard of impulsive field strength having a well established statement of accuracy. The evaluation of this horn was done in two independent ways: by placing the horn in a conical transmission line and by a three antenna intercomparison. The two methods were found to agree within plus or minus 3 dB over the frequency range of 0.5 to 5 GHz. Part of this disagreement is due to the assumption of far-field conditions, and an experimental technique is described which determines the frequency range over which this assumption is valid.

707,578
PB-289 928/4 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Fields Div.

Analytical and Numerical Techniques for Analyzing an Electrically Short Dipole with a Nonlinear Load.
M. Kanda. Nov 78, 21p NBSIR-78-898

Keywords: *Dipole antennas, Nonlinear differential equations, Finite difference theory, Iteration, Load impedance, Dipoles.

An electrically short dipole with a nonlinear dipole load is analyzed theoretically using both the analytical and numerical techniques. The analytical solution is given in terms of the Anger function of imaginary order and imaginary argument, and is derived from the nonlinear differential equation for the Thevenin's equivalent circuit of a dipole with a diode. The numerical technique used was to solve the nodal equation using a time-stepping finite difference equation method. The nonlinear resistance of the diode is treated using an iteration technique. A comparison between the analytical and numerical solutions is given.

707,579
PB-291 733/4 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Technology Div.
Antennas and the Associated Time Domain Range for the Measurement of Impulsive Fields.
R. A. Lawton, and A. R. Ondrejka. Nov 78, 69p NBS-TN-1008

Keywords: *Horn antennas, *Electromagnetic fields, Field strength, Measurement, Accuracy, Standards.

This report describes the construction and evaluation of a TEM horn antenna designed at NBS to be used as a transfer standard to generate and measure impulsive electromagnetic fields. The purpose of the evaluation was to analyze the different electrical field generation and measurement techniques thoroughly enough to determine the major sources of error and establish a standard of impulsive field strength having a well established statement of accuracy. The evaluation of this horn was done in two independent ways; by placing the horn in the field of a conical transmission line, and by a three antenna intercomparison. The two methods were found to agree within + or - 3 dB over the range of 0.6 to 5 GHz. Part of this disagreement is due to the assumption of far field conditions, and an experimental technique is described which determines the frequency range over which this assumption is valid.

707,580
PB-291 948/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Testing of Electronic Industries Association Land-Mobile Communication Antenna Gain Standards at the National Bureau of Standards.
Final rept.,
H. E. Taggart, and J. F. Shafer. Nov 78, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Trans. on Vehicular Technology VT-27, nr p259-264, Nov 78.

Keywords: *Antennas, *Standards, Mobile equipment, Ground vehicle antennas, Gain, Tests, Land mobile communications, Reprints.

The Electronic Industries Association has a published standard, EIA RS-329A, Minimum Standards for Land-Mobile Communications Antennas, Dec. 1975. This standard details the minimum performance requirements and the test methods for evaluating the performance of fixed and base station antennas at frequencies from 25 to 1000 MHz. Also included in this standard are the specifications for a set of standard antennas for use in various frequency bands. The EIA Antenna Committee, TR8.11, requested the National Bureau of Standards to calibrate the gain of some of these antenna standards. Two antennas were calibrated in the 450-512 MHz band, and two antennas in the 800-900 MHz band. This paper describes in detail the techniques used throughout the measurement program, the results, and the measurement uncertainties. Two basic methods of measuring the gain of the EIA antennas were employed during this calibration. The three-antenna technique was used at some frequencies, and the standard field technique was used at other frequencies. Both techniques are described. The NBS antennas used for the measurements were standard-gain pyramidal, horn antennas. The antenna range used for the measurement is described. This is a vertical range using non-metallic towers and hardware, thus providing essentially free-space conditions in which reflections and multipath problems are minimized. The measurements were made in terms of absolute power gain, i.e., referenced to an isotropic radiator. These results are discussed and also compared to the gain figures listed in EIA standard RS-329A.

707,581
PB-296 207/4 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Fields Div.
Theoretical Study of Unbalanced Ground Effects on Receiving Dipoles.
M. T. Ma. May 79, 16p NBSIR-79-1605

Keywords: *Dipole antennas, Ground effect, Field strength, Performance, Mathematical models.

Balanced ground effects on the performance of some antenna systems are relatively well known and can be taken into account by the design engineer. Unbalanced ground effects on a measuring system are, however, more complicated and make a thorough understanding difficult. In this report, specific ground effects on the calibration of a dipole antenna with an arbitrary inclination angle with respect to the ground are analyzed by means of a theoretical model. Numerical results representing this undesired effect are also included.

707,582
PB78-600065 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Transients in Resistively Loaded Antennas, and Their Comparison with Conical Antennas and TEM Horns.
M. Kanda. 1978, 4p
Pub. in Proceedings 1978 Int. Symp. Digest, Washington, DC, May 15-19, 1978, p13-16 1978.

Keywords: *Conical antenna, Effective length, FFT, Moment method, Resistively loaded antennas, TEM horn, Time domain measurement, Transient response.

The receiving and transmitting transient responses for a relatively short linear antenna with continuous resistive loading are investigated theoretically and experimentally. The antenna considered is a nonconducting cylinder with continuously deposited, varying-conductivity, resistive loading. The current distribution, the corresponding effective length, and the driving point impedance are calculated by use of the method of moments and compared with the Wu-King approximation. The receiving and transmitting transient responses are calculated in the frequency domain using the results of the effective length and the driving point impedance. The final use of FFT then allows the determination of transient fields given a known input waveform. As a comparison, the receiving and transmitting transient responses for a conical antenna and a TEM horn are also investigated theoretically. Time domain measurements are performed using a time domain antenna range with a time domain automatic network analyzer. The agreements between theory and experiments of the receiving and transmitting transient responses for the resistively loaded antenna, the conical antenna, and the TEM horn are satisfactory. The receiving transient response of the resistively loaded antenna indicate that the impulse shape of 70 ps duration is well preserved. This provides the unique capability of this antenna to measure fast, time-varying, transient fields with minimal pulse-shape distortion due to nonlinear amplitude or phase characteristics.

707,583
PB80-103864 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Recent Near-Field Measurements at NBS.
Final rept.,
C. F. Stubenrauch. Sep 79, 25p
Pub. in Proceedings of the Antenna Applications Symposium (1979) Held at Urbana-Champaign, IL. on September 26-28, 1979, p1-25, Sep 79.

Keywords: *Antenna radiation patterns, Measurement, Antennas, Electromagnetic fields, Phased arrays, Scanning, Strip transmission lines, Microwave antennas, Near field, Far field.

Three topics relating to recent near-field scanning work at NBS are discussed. These are: a planar scan of a large microstrip phased array, results of measurements made using cylindrical scanning, and measurements of the far sidelobe region of an antenna using a hybrid planar-cylindrical scanning system. Results of these measurements are presented and discussed.

707,584
PB80-107386 Not available NTIS
National Bureau of Standards, Washington, DC.
'TEM' Horn with Continuously Tapered Resistive Loading for Picosecond Pulse Measurements.
Final rept.,
M. Kanda. 1979, 4p
Pub. in Proceedings Symposium and Tech. Exhibition on Electromagnetic Compability (3rd), Held at Rotterdam, The Netherlands, May 1-3, 1979, p67-70.

Keywords: *Pulse analyzers, *Horn antennas, Measurement, Picoseconds, Transverse electromagnetic waves.

For directional reception or transmission of picosecond pulses with minimal distortion, a short TEM horn with resistive loading was developed, and found to be broadband and nondispersive. Theoretical computations with the moment method and FFT were compared with time domain measurements.

707,585
PB80-117740 Not available NTIS
National Bureau of Standards, Washington, DC.
Characteristics of a Traveling-Wave, Linear Antenna with a Nonlinear Load.
Final rept.,
M. Kanda. 1979, 1p
Pub. in Proceedings of Symposium International Union of Radio Science National Radio Science Meeting, Seattle, WA., June 18-22, 1979, p314 1979.

Keywords: *Traveling wave antennas, Finite difference theory, Iteration, Linear systems, Newton-Raphson method, Fast Fourier transforms, Loading(Electronics), Time domain.

No abstract available.

707,586
PB80-169931 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Characterization of Electrically Small Radiating Sources by Tests Inside a Transmission Line Cell,
I. Sreenivasiah, D. C. Chang, and M. T. Ma. Feb 80, 71p NBS-TN-1017
Prepared in cooperation with Colorado Univ., Boulder.

Keywords: *Antennas, *Electromagnetic fields, Measurement, Dipoles, Electromagnetic radiation, Electrically small antennas, TEM cells.

An electrically small radiating source of arbitrary nature may be modeled by an equivalent dipole system consisting of three orthogonal electric dipoles and three orthogonal magnetic dipoles, each excited with arbitrary phase. An experimental procedure for determining the emission characteristics of such an equivalent dipole system by tests inside a single-mode transmission line cell is described in this report, followed by some experimental results.

707,587
PB80-215908 Not available NTIS
National Bureau of Standards, Washington, DC.
Analytical and Numerical Techniques for Analyzing an Electrically Short Dipole with a Nonlinear Load.
Final rept.,
M. Kanda. Jan 80, 8p
Pub. in IEEE Transactions on Antennas and Propagation AP-28, n1 p71-78 Jan 80.

Keywords: *Dipole antennas, Dipoles, Numerical analysis, Iteration, Reprints.

An electrically short dipole with a nonlinear dipole load is analyzed theoreticaly using both analytical and numerical techniques. The analytical solution is given in terms of the Anger function of imaginary order and imaginary argument and is derived from the nonlinear differential equation for the Thevenin's equivalent circuit of a dipole with a diode. The numerical technique is to solve the nodal equation using a time-stepping finite difference equation method. The nonlinear resistance of the diode is treated using the Newton-Raphson iteration technique. A comparison between the analytical and numerical solutions is given.

707,588
PB80-216500 Not available NTIS
National Bureau of Standards, Washington, DC.

Time-Domain Characteristics of a Traveling-Wave Linear Antenna with Linear and Nonlinear Parallel Loads,
M. Kanda. Mar 80, 10p
Pub. in IEEE Trans. Antennas Propag. AP-28, n2 p267-276 Mar 80.

Keywords: *Traveling wave antennas, Newton-Raphson method, Linear systems, Measurement, Reprints, Time domain, Fast Fourier transforms, Loading(Electronics).

The time-domain characteristics of a traveling-wave linear antenna with linear and nonlinear parallel loads are discussed. The fast Fourier transform (FFT) is used to analyze the antenna with a linear parallel load. A numerical time-stepping finite-difference equation method is use to analyze the antenna with a nonlinear parallel load. The nonlinear effect is treatd by the Newton-Raphson iteration technique. The effects of various linear and nonlinear parallel loads are examined. Physical insight into the nonlinear parallel loading of the antenna is also given in terms of detected time-domain sinusoidal electromagnetic (EM) waves.

707,589
PB80-216526 Not available NTIS
National Bureau of Standards, Washington, DC.
Transients in a Resistively Loaded Linear Antenna Compared with Those in a Conical Antenna and a TEM Horn.
Final rept.,
M. Kanda. Jan 80, 5p
Pub. in IEEE Trans. Antennas Propag. AP-28, n1 p132-136 Jan 80.

Keywords: *Conical antennas, *Horn antennas, Transient response, Linear systems, Reprints, Loading(Electronics), Fast Fourier transforms, Time domain.

The receiving and transmitting transient responses of the resistively loaded linear antenna, the TEM horn and the conical antenna are investigated theoretically and experimentally using the fast Fourier transform (FFT) technique. The receiving transient response of the resistively loaded linear antenna indicates that the shape of a 70-ps impulse is well preserved.

707,590
PB81-138786 Not available NTIS
National Bureau of Standards, Washington, DC.
Spherical Dipole for Radiating Standard Fields.
M. L. Crawford, and J. L. Workman. 1980, 6p
Pub. in Proceedings of the Conference on Precision Electromagnetic Measurements Held at Braunschweig, Federal Republic of Germany on June 23-27, 1980, IEEE Cat. No. 80CH1497-71M, p424-429 1980.

Keywords: *Dipole antennas, Electromagnetic interference, Measurement, Very high frequencies, Electromagnetic fields.

This paper describes a 10 cm diameter, self-contained, spherical dipole that radiates a constant, standard field at discrete frequencies between 30 MHz and 180 MHz. Results of the use of the dipole to compare radiated emission measurement performed in shielded enclosures and transverse electromagnetic (TEM) cells with an open-field are given.

707,591
PB81-200362 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Efficient Computation of the Far Field Radiated by an Arbitrary Rectangular-Aperture Distribution. Computer Program Documentation.
R. Lewis. Mar 81, 46p NBSIR-81-1643
Sponsored in part by Electromagnetic Compatibility Analysis Center, Annapolis, MD.

Keywords: *Computer programs, *Far field, Antenna radiation patterns, Apertures, Algorithms, Computation, Electric fields, Fast Fourier transform, NTISCOMNBS.

This report contains the computer documentation for calculating the far-zone electric field due to a user-prescribed electric-field distribution within a rectangular aperture. The far-field output is computed along two arbitrarily selected, perpendicular, spatial-frequency plane cuts. Program execution time is minimized by the use of fast Fourier transform (FFT) processing. The program was designed so that the required far-field output is obtained by processing only two, vector, one-dimensional FFTs. The far-field results are obtained in the form of elevation and azimuth vector components and electric-field-vector magnitude. A complete analytical discussion of the problem is presented, along with sample graphical output to illustrate how aliasing and output resolution limitations effect the graphical results.

707,592
PB81-200388 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Approximate Expression for the Principal Beamwidths of Directive Antennas in Terms of Aperture Fields,
A. D. Yaghjian. Mar 81, 15p NBSIR-81-1644

Keywords: *Beamwidth, *Directional antennas, Apertures, Computation, NTISCOMNBS.

An approximate, but general, formula for the half-power principal beamwidths of directive antennas is derived from the Fourier transform of the aperture electric field. The derivation, which can be accomplished by expanding the transform in a Taylor series, is greatly streamlined by introducing a Gaussian beam approximation. The formula, which also relates beamwidth to directivity indirectly through simple integrations of the aperture field, reduces to a very compact expression in terms of the zero and second order moments of the aperture distribution for linearly polarized, uniformly phased aperture fields.

707,593
PB81-245243 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
Plane-Wave Scattering-Matrix Theory of Antennas and Antenna-Antenna Interactions.
D. M. Kerns. Jun 81, 182p NBS-MONO-162
Library of Congress catalog card no. 81-600015.

Keywords: *Antennas, *Electromagnetic scattering, S matrix theory, Plane waves, Interactions, Network analysis.

This monograph is distinguished by the use of plane-wave spectra for the representation of fields in space and by the consideration of antenna-antenna (and antenna-scatterer) interactions at arbitrary separation distances. The plane-wave representation is eminently suitable for this purpose as well as for the expression of conventional asymptotic quantities of antenna theory, such as power gain, effective area, and polarization. The primary objective of the monograph is to facilitate the critical acceptance and proper application of antenna and field measurements techniques deriving more or less directly from the plane-wave scattering-matrix (PWSM) theory of antennas and antenna interactions. A secondary objective is to present some recent and some new theoretical results based on this theory.

707,594
PB81-246217 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
Determination of Mutual Coupling between Co-Sited Microwave Antennas and Calculation of Near-Zone Electric Field.
Rept. for Jul 76-Jun 78.
C. F. Stubenrauch, and A. D. Yaghjian. Jun 81, 177p NBSIR-80-1630
Sponsored in part by Army Communication-Electronics Engineering Installation Agency, Fort Huachuca, AZ.

Keywords: *Coupled antennas, *Microwave antennas, Electromagnetic fields, Computation, Computer programs, Near field.

The theory and computer programs which allow the efficient computation of coupling between co-sited antennas given their far-field patterns are developed. Coupling between two paraboloidal reflector antennas is computed using both measured far-field patterns and far-field patterns which were obtained from a physical optics (PO) model. These computed results are then compared to the coupling measured directly on an outdoor antenna range. Far fields calculated using the PO model are compared to those obtained from transformed near-field measurements for several reflector antennas. Theory and algorithms are also developed for calculating near-field patterns obtained from the PO model. Documentation of the near-field and coupling computer programs is presented in the appendices. Conclusions and recommendations for future work are included.

707,595
PB82-122052 Not available NTIS
National Bureau of Standards, Washington, DC.
Results of Planar Near-Field Measurements on a Compact Range at 18 and 54 GHz.
Final rept.
A. G. Repjar, and D. P. Kremer. 1980, 4p
Pub. in Proceedings of Antennas and Propagation, Quebec, Canada, June 2-6, 1980, Paper in Antennas and Propagation 1, IEEE No. 80 CH 1557-8 AP, p256-259 1980.

Keywords: *Electromagnetic fields, Measurement, Superhigh frequencies, Extremely high frequencies, Antennas, *Near field.

Significant progress in recent years has been made on planar near-field measurements for antenna calibrations. Such measurements are also useful in the alignment and evaluation of compact ranges because they provide more information than a limited number of analogue plots in one dimension. Contour plots of amplitude and phase data obtained from more complete 2-dimensional measurements precisely and accurately locate sources of problems in the range reflector, with phase contour plots being more useful as diagnostic tools. The goal of the compact range under test was to provide an approximate plane wave illumination over a measurement zone 120 cm square with less than 0.5 dB amplitude variation and less than 10 degree phase variation at any frequency in the 12 to 100 GHz range. The results of the planar near-field measurements were to determine if the goal could be achieved.

707,596
PB82-140856 Not available NTIS
National Bureau of Standards, Washington, DC.
Synthesized Isotropic Pattern Antennas for EM Field Measurements.
Final rept.
G. R. Reeve. 1981, 7p
Pub. in Proceedings of IEEE International Symposium Electromagnetic Compatibility, Boulder, Colorado, August 18-20, 1981, p36-42.

Keywords: *Antennas, *Electric fields, Measurement, Field strength, Isotropy.

This paper describes a set of EM field measurement antennas covering the range of 10 kHz to 1 GHz which, under microprocessor control, synthesize an isotropic response. Another antenna, covering the frequency range of 1 GHz to 18 GHz, synthesizes a wide vertical angle, omnidirectional, response for signals of any linear, and one circular, polarization. These antennas together with an appropriate instrumentation system allow rapid acquisition of ambient field strength data.

707,597
PB82-140930 Not available NTIS
National Bureau of Standards, Washington, DC.
Optimized Wavelength-Sized Scalar Horns as Antenna Radiation Standards.
Final rept.
A. J. Estin, C. F. Stubenrauch, A. G. Repjar, and A. C. Newell. 1981, 5p
Pub. in Proceedings of Electrical and Electronic Measurement and Test Instrument Conference and Expo., Ottawa, Canada, September 22-24, 1981, EEMTIC '81 Digest, 81CH1710-3, p64-68 1981.

Keywords: *Horn antennas, Standards, Electromagnetic radiation.

The properties of beamwidth, directivity, and polarization of wavelength-size scalar horns are analyzed and optimized theoretically and confirmed experimentally to determine the usefulness of such horns as standards. Agreement between theoretical predictions and measurements was good.

707,598
PB82-144072 Not available NTIS
National Bureau of Standards, Washington, DC.
Spherical-Wave Source-Scattering-Matrix Analysis of the Mutual Coupling between Two Antennas.
Final rept.
R. L. Lewis. 1981, 4p
Pub. in Proceedings of AP-S International Symposium 1981, Los Angeles, California, June 16-19, 1981, p261-264.

Keywords: *Coupled antennas, S matrix theory.

Expressions are given for the mutual coupling between two antennas in terms of each antenna's spherical-wave source-scattering-matrix representation. A comparison to the classical scattering matrix definition is given in sufficient detail to permit conversion back and forth between source-scattering-matrix representation and the classical scattering matrix representation. The paper concludes with expressions for the transmission formulas, showing the different expressions corresponding to changes in direction of propagation. However, if the two antennas are both reciprocal, then the two-port scattering matrix is a symetric matrix.

707,599
PB82-152554 Not available NTIS
National Bureau of Standards, Washington, DC.
Spherical Scanning Data Processing: An Algorithm for Halving the Data Processing Effort When the Radiation into the Back Hemisphere Is Negligible.
Final rept.
R. L. Lewis. Jun 81, 3p
Pub. in Proceedings of AP-S International Symposium Antennas and Propagation, Los Angeles, California, June 16-19, 1981, International Symposium Digest, 81CH 1672-5, 1, p247-249.

Keywords: *Antennas, Scanning, Data processing, Algorithm, Tests, Spherical scanning.

An algorithm has been developed, for probe-corrected spherical-scanning data processing, that halves the computational effort involved when the field is negligible in the back hemisphere of the antenna under test. As the algorithm is described, it is compared to the algorithm for data processing over the entire sphere, thus demonstrating that the computational effort involved is just half of that required by full-sphere data processing.

707,600
PB82-210238 Not available NTIS
National Bureau of Standards, Washington, DC.
Frequency Tracking, Tuned, Receiving Monopole,
G. R. Reeve, and A. E. Wainwright. 1981, 4p
Sponsored in part by Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, AZ.
Pub. in Proceedings of International Symposium on Antennas and Propagation, Los Angeles, CA, June 16-19, 1981, IEEE Conference Rec. 81CH1672-5, 1981 International Symposium Dig. 2, p578-581 1981.

Keywords: *Monopole antennas, Tuning, Adaptive systems.

This summary paper describes an active receiving antenna which is tuned to the receiving frequency. Tuning is accomplished by variable capacitive diodes and can be tracked to the receiving system over octave ranges. This results in reduced intermodulation distortion and improved rejection of out of band signals.

707,601
PB82-265620 Not available NTIS
National Bureau of Standards, Washington, DC.
Optimized Wavelength-Sized Scalar Horns as Antenna Radiation Standards.
Final rept.
A. J. Estin, C. F. Stubenrauch, A. G. Repjar, and A. C. Newell. Mar 82, 6p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Instrumentation and Measurement IM-31, n1 p53-56 Mar 82.

Keywords: *Horn antennas, *Standards, *Antenna radiation patterns, Measurement, Very high frequencies, Ultrahigh frequencies, Reprints.

The properties of beamwidth, directivity, and polarization of wavelength-size scalar horns are analyzed and optimized theoretically and confirmed experimentally to determine the usefulness of such horns as standards. Agreement between theoretical predictions and measurements was good.

707,602
PB82-265695 Not available NTIS
National Bureau of Standards, Washington, DC.
Accurate Evaluation of a Millimeter Wave Compact Range Using Planar Near-Field Scanning.
Final rept.
A. G. Repjar, and D. P. Kremer. May 82, 9p
Pub. in Institute of Electrical and Electronics Engineers Transactions Antennas Propag. AP-30, n3 p419-425 May 82.

Keywords: *Antennas, Measurement, Electromagnetic fields, Ranges(Facilities), Reprints, Near field.

Significant progress in recent years has been made on planar near-field measurements for antenna calibrations. Such measurements are also useful in the alignment and evaluation of compact ranges because they provide more information than a limited number of analogue plots in one dimension. Contour plots of amplitude and phase data obtained from more complete 2-dimensional measurements precisely and accurately locate sources of problems in the range reflector, with phase contour plots being more useful as diagnostic tools.

707,603
PB82-600054 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fixed and Base Station Antennas.
H. E. Taggart, and J. F. Shafer. 1977, 19p
Pub. in NIJ-Std-0204.01.

Keywords: *Antenna, Base station, Fixed antennas, Law enforcement, Performance standard, Radiation pattern, Relative antenna gain.

This standard is a voluntary performance standard for evaluating antennas used at base stations and other fixed sites. It is intended for use by law enforcement agencies and others as an aid in the selection and procurement of this type of antenna. The standard includes the most commonly used definitions, minimum performance requirements, most critical items of test equipment, and methods of test needed to determine the effectiveness and suitability of these antennas for law enforcement use. Parameters tested include antenna power rating, relative antenna gain, and the antenna vertical and horizontal radiation pattern. This standard is a revision of NILECJ-STD-0204.00 dated November 1977. This revision expands the standard to include antennas used in the 800-960 MHz frequency band and to include the design and construction details of two types of reference antennas.

707,604
PB83-103796 Not available NTIS
National Bureau of Standards, Washington, DC.
Microwave Antenna Measurement Services at the National Bureau of Standards.
Final rept.
R. C. Baird. 1981, 17p
Pub. in Proceedings of the Antenna Measurements Symposium, Danvers, Massachusetts, October 13-15, 1981, 17p.

Keywords: *Microwave antennas, Measurement, Amplification, Polarization, Antenna radiation patterns, Electromagnetic fields, Calibrating, Near field, National Bureau of Standards.

This paper reviews and summarizes the microwave antenna measurement services presently available at the National Bureau of Standards, Boulder, Colorado. The extrapolation technique, which is used for accurate calibrations of transfer-standard antennas, is described and its limitations pointed out.

707,605
PB83-106195 Not available NTIS
National Bureau of Standards, Washington, DC.
Antenna for Dual-Wavelength Radiometry at 21 and 32 GHz.
Final rept.
D. C. Hogg, F. O. Guiraud, J. Howard, A. C. Newell, D. P. Kremer, and A. G. Repjar. Nov 79, 8p
Pub. in IEEE Transactions on Antennas and Propagation AP-27, n6 p764-771 Nov 79.

Keywords: *Microwave antennas, Remote sensing, Superhigh frequencies, Extremely high frequencies, Radiometry, Meteorological instruments, Reprints.

Accurate multiwavelength remote sensing of the atmosphere requires antennas with the same beamwidth at the various frequencies of operation. A single offset antenna with a corrugated feed which meets this criterion at 20.6 and 31.65 GHz is described.

707,606
PB83-119776 PC **A02**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Bibliography of the NBS Electromagnetic Fields Division Publications.
K. A. Gibson, and C. K. S. Miller. Aug 82, 20p NBSIR-82-1673

Keywords: *Bibliographies, *Antennas, *Electromagnetic fields, Electromagnetic interference, Electromagnetic noise, Metrology, Radiation hazards, Electromagnetic properties.

This bibliography lists the publications of the personnel of the NBS Electromagnetic Fields Division in the period from January 1980 through December 1981.

707,607
PB83-125625 PC **A05**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Computation of Antenna Side-Lobe Coupling in the Near Field Using Approximate Far-Field Data.
M. H. Francis, and A. D. Yaghjian. Aug 82, 85p NBSIR-82-1674
Sponsored in part by Electromagnetic Compatibility Analysis Center, Annapolis, MD.

Keywords: *Coupled antennas, Computation, Loss, Sidelobes, Near field, CUPLNF computer program, CUPLZ computer program, Computer applications.

Computer programs, in particular CUPLNF and CUPLZ, are presently in existence to calculate the coupling loss between two antennas provided that the amplitude and phase of the far field are available. However, for many antennas the complex far field is not known accurately. In such cases it is nevertheless possible to specify approximate far fields from a knowledge of the side-lobe level of each antenna along the axis of separation, and the electrical size of each antenna. To determine the effectiveness of using approximate side-lobe level data instead of the detailed far fields, we chose as our test antennas two hypothetical, linearly polarized, uniformly illuminated circular antennas for which the exact far fields are given by a simple analytic expression. The exact far fields are supplied to the program CUPLNF to compute the exact near-field coupling loss. Approximate fields are supplied to a new program ENVLP developed for the purpose of computing the approximate near-field coupling loss.

707,608
PB83-164350 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Characterization of ARV Window Materials.
Interim rept. May-Oct 82.
H. P. R. Frederikse, A. L. Dragoo, and A. H. Kahn. Jan 83, 26p NBSIR-83-2646
Sponsored in part by Defense Nuclear Agency, Washington, DC. Prepared in cooperation with WRH Company, Poolesville, MD.

Keywords: *Boron nitrides, Microwaves, Transmissivity, Electrical resistivity, *Antenna windows, High temperature.

Boron nitride is a major candidate for use as a microwave window material. To assess its feasibility for this purpose, it is essential to know the electrical and dielectric properties at high temperatures. This report discusses the experimental approach to electrical conductivity measurements above 1800 C and presents some initial results. At the same time, computer calculations have been performed which have yielded values of the reflectivity, absorption, and transmission of boron nitride in the temperature range 2500-3000 C.

707,609
PB83-233999 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Approximate Formulas for the Far Fields and Gain of Open-Ended Rectangular Waveguide.
A. D. Yaghjian. May 83, 40p NBSIR-83-1689

Keywords: *Waveguides, *Far field, Antenna radiation patterns, Amplification, Approximation, Diffraction.

Approximate formulas are derived for the far field and gain of standard, open-ended, unflanged, rectangular waveguide probes operating within their recommended usable bandwidth of frequencies. (Such probes are commonly used in making probe-corrected near-field antenna measurements.) The formulas, which yield forward far-field power patterns and on-axis gains of X-band and larger waveguide probes to within about 2 dB

and 0.2 dB accuracy, respectively, assume (sin theta - cos theta) azimuthal angular dependence and an E-plane pattern given by the traditional aperture integration of the TE10 mode E- and H-fields in the Stratton-Chu equations.

707,610
PB83-600044 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
E-Fields Over Ground.
R. G. FitzGerrell. 1983, 4p
Pub. in Proceedings IEEE 1983 Int. Symp. on Electromagnetic Compatibility, Arlington, VA, Aug. 23-25, 1983, IEEE Cat. No. 83CH1838-2, p6-9 1983.

Keywords: *Antenna factor, EMI, Half-wave dipole.

Equations from a classic paper by K. A. Norton are used to generate plots of electric field strengths versus distance, at fixed heights above ground, from horizontal and vertical dipole antennas, These data are used to estimate the strength and pattern of electric fields over plane perfect and imperfect ground test sites. A preliminary measurement effort, designed with the aid of these calculated data, indicates that the half-wave dipole antenna factor is essentially independent of distance from short, horizontal dipole, E-field sources over a plane metal ground screen at 1 m to 10 m separation distances in the 30 MHz to 1000 MHz frequency range. Measured data also show the influence of the transmission line on the vertically polarized dipole antenna factor and source antenna E-field combined (combined because measurements cannot separate transmission line effects on dipole input impedance and antenna pattern).

707,611
PB84-101948 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Handbook for Broadband Isotropic Antenna System. Volume 1. Operation Manual.
W. D. Bensema. Jul 83, 74p NBSIR-83-1693

Keywords: *Broadband antennas, Microcomputers, Maintenance, Isothopy, Electromagnetic interference, Measurement, Field strength.

The manual describes the equipment operation and maintenance procedures to support the broadband isotropic* antenna system developed by the National Bureau of Standards for making EMI measurements in the frequency range from 10 kHz to 18 GHz. The system uses isotropic broadband antennas, a low power microcomputer, antenna switching units, commercially available receivers, and associated cabling. The system automatically switches antenna elements, computes the total scalar sum of the existing field strength, and automatically logs time, frequency, signal strength, and system configuration. The system reduces the number of personnel required to make searches for EMI, and includes a mode for unmanned monitoring.

707,612
PB84-134634 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Characteristics of Iris-Fed Millimeterwave Rectangular Microstrip Patch Antennas.
Technical note.
D. H. Greenlee, M. Kanda, and D. C. Chang. Oct 83, 52p NBS-TN-1063
Prepared in cooperation with Colorado Univ. at Boulder.

Keywords: *Microwave antennas, Antenna feeds, Irises(Mechanical apertures), Millimeter waves, Amplification, Mathematical models, Far field, *Microstrip antennas.

The fabrication of various iris-fed millimeterwave rectangular microstrip patch antennas is described. A model is proposed to describe the iris-fed antenna. Irises ranging in size from 15 percent of the area of the patch to the fully open waveguide are used to couple energy into the antenna. Resonance of the antenna is observed to be insensitive to the size of the iris for irises up to 115 percent of the size of the patch. A study is also made of the relationship of coupling to the antenna as a function of the position of the iris with respect to the transverse plane of the waveguide, the iris always being centered with respect to the patch. In general, the antenna has a VSWR in the waveguide feed on the order of 5:1 at resonance, except for the fully open waveguide which gives rise to a VSWR of 2.9:1 at resonance. Far-field antenna power patterns are observed to be quite broad with H-plane beamwidths on the order of 130 degrees. Maximum antenna gain is seen to be 4.5 dBi with 3 dBi typical. An initial study is made of the microstrip patch antenna fed from a longitudinal waveguide wall.

707,613
PB84-141308 Not available NTIS
National Bureau of Standards, Washington, DC.
Precision Measurement of Antenna System Noise Using Radio Stars.
Final rept.
D. F. Wait. Mar 83, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement, IM-32, n1 p110-116 Mar 83.

Keywords: *Antennas, Noise, Measurement, Reprints.

This paper reviews the National Bureau of Standards (NBS) precision noise measurements program for antenna systems which have been made using Cassiopeia A and the moon. The Earth Terminal Measurement System (EMTS) was developed by NBS to make measurements of figure of merit (G/T), and the noise equivalent flus NEF. The accuracy of the noise measurements are, typically, between 5 and 15 percent for systems with antenna gains between 51 and 65 dB and frequencies between 1 and 10 GHz.

707,614
PB84-217835 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Theory of Near-Field Phased Arrays for Electromagnetic Susceptibility Testing.
D. A. Hill. Feb 84, 112p NBS/TN-1072
Also available from Supt. of Docs as SN003-003-02559-3.

Keywords: *Phased arrays, *Antennas, *Electromagnetic fields, Feasibility, Huygens principle, Electromagnetic testing, Plane waves, *Electromagnetic susceptibility, Near field.

The feasibility of using a near-field array for electromagnetic susceptibility testing is studied. The basic objective is to control the element weightings such that a plane wave is generated within the test volume. The basic theory is developed for arbitrary array geometries, and numerical results are obtained for finite planar arrays. A general near-field array synthesis technique is developed, and the technique minimizes the mean square error in the test volume while constraining the array excitations. The constraint prevents large currents and is useful in minimizing the fields outside the test volume. The basic idea looks promising, but some practical considerations, such as bandwidth and angular scanning limitations, require further theoretical and experimental investigation.

707,615
PB84-218361 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Error Analysis for the Use of Presently Available Lunar Radio Flux Data in Broadbeam Antenna-System Measurements.
W. C. Daywitt. Feb 84, 39p NBS/TN-1073
Also available from Supt. of Docs as SN003-003-02555-1.

Keywords: *Error analysis, *Antennas, *Lunar communications, *Flux density, Temperature, Radio communications.

Simple, precise expressions for lunar diameter, average brightness temperature, flux density, and shape factor are presented. An analysis of the relationship between these parameters and corresponding errors are included. For broadbeam (HPBW>d) antennas, results show that flux density and shape factor can be determined with errors less than 13 percent and 0.4 percent respectively at frequencies below 10 GHz. Extension of the analysis to higher frequencies is indicated.

707,616
PB84-223817 Not available NTIS
National Bureau of Standards, Washington, DC.
Source of E and H Fields for Antenna Factor Calibration (A Loop Cell).
Final rept.
R. G. FitzGerrell. May 84, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electromagnetic Compatibility EMC-26, n2 p58-65 May 84.

Keywords: *Calibrating, Antennas, Electric fields, Magnetic fields, Tests, Reprints, *Antenna factors.

The loop cell is fabricated using two intersecting metal sheets joined at the intersection and forming a 36 deg angle. A section of a loop is mounted between two coaxial panel jacks, one on each sheet located at a distance equal to the loop radius from the intersection. A known current through this section of electrically small loop produces calculable E and H fields between the sheets in the plane of the loop. These known fields may be used to determine the antenna factor of small E and H antennas placed in the field if the mutual impedance due to the antenna images in the sheets is negligible and the antenna is not close to the open edges of the cell. Measured and calculated antenna factors agree within + or - 2 dB between 0.25 MHz and 1000 MHz.

707,617
PB84-224864 Not available NTIS
National Bureau of Standards, Washington, DC.
Antenna Gain Measurements by an Extended Version of the NBS (National Bureau of Standards) Extrapolation Method.
Final rept.
A. G. Repjar, A. C. Newell, and R. C. Baird. 1982, 3p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, CPEM Digest 1982, Boulder, Colorado, June 28-July 1, 1982, IEEE Cat. No. 82CH1737-6, pF-7-F-9.

Keywords: *Antennas, Microwave antennas, Gain, Calibrating, Measurement, Ground clutter.

A General Extrapolation Technique which eliminates the effects of ground reflections in absolute gain measurements is described. It uses the Extrapolation Method developed at NBS which, in its present form, uses only amplitude versus distance data. However, for broadbeam antennas such as those encountered below 1 GHz, ground reflections may produce unwanted oscillations in the amplitude versus distance data. Hence the data are not amenable to the curve fitting procedure of the Extrapolation Method. This problem can be overcome by including phase versus distance information to negate the effects of ground reflections.

707,618
PB84-243864 Not available NTIS
National Bureau of Standards, Washington, DC.
Efficient Computation of Antenna Coupling and Fields Within the Near-Field Region.
Final rept.
A. D. Yaghjian. Jan 82, 16p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Antennas and Propagation AP-30, n1 p113-128 Jan 82.

Keywords: *Antenna radiation patterns, Antennas, Electromagnetic fields, Computation, Electromagnetic interference, Reprints, Computer applications, Near field.

The theory, techniques, details of the important equations, and description of two computer programs are presented for calculating efficiently the mutual coupling at a single frequency between any two antennas arbitrarily oriented and separated in free space. Both programs emphasize efficiency and generality, and require, basically, the complex electric far field of each antenna, and the Eulerian angles designating the relative orientation of each antenna. Multiple reflections between the antennas are neglected but no other restrictive assumptions are involved. If an electric field component is desired instead of coupling, the receiving antenna is replaced by a virtual antenna with uniform far field.

707,619
PB84-244938 Not available NTIS
National Bureau of Standards, Boulder, CO.

Some Recent Near-Field Antenna Measurements at NBS (National Bureau of Standards).
Final rept.
C. F. Stubenrauch, and A. C. Newell. Nov 80, 6p
Pub. in Microwave J., Vol. 23, No. 11, pp. 37-42 (Nov. 1980).

Keywords: *Antenna radiation patterns, Measurement, Antennas, Electromagnetic fields, Scanning, Antenna lobes, Far field, Reprints.

The paper discusses three measurements recently completed at National Bureau of Standards (NBS) using near-field techniques. The first was a planar scan of a prototype microstrip array of a type used in satellite-borne synthetic aperture radars. The second topic consists of recent results obtained with probe corrected measurements made on a cylinder. The final section describes a hybrid technique which employs both planar and cylindrical scanning to allow sidelobes to be measured to greater angles off boresight than permitted by either planar or cylindrical scanning above.

707,620
PB85-105963 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Comparison of Measured and Calculated Mutual Coupling in the Near Field between Microwave Antennas.
C. F. Stubenrauch, and M. H. Francis. Jun 84, 57p
NBSIR-84/3010

Keywords: *Microwave antennas, Coupled antennas, Measurement, Antennas, Electromagnetic fields, Losses, Antenna radiation patterns.

Measurements of near-field mutual coupling were performed between two moderate sized microwave antennas and compared to coupling calculated using recently developed computer programs. Input data for the programs are the complex far-field radiation patterns of the antennas. Experimentally determined and calculated coupling as a function of both transverse displacement and separation agree closely except for a constant offset observed in some cases. In addition, coupling values computed using a program which approximates the far-field radiation patterns were compared to experiment and found to be satisfactory.

707,621
PB85-110203 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Resistive Loading of TEM (Transverse Electromagnetic) Horns.
Final rept.
M. Kanda. 1982, 11p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electromagnetic Compatibility 24, n2 pt2 p245-255 May 82.

Keywords: *Horn antennas, Transfer functions, Pulse analyzers, Reprints, Loading(Electronics), Fast fourier transforms, Picoseconds, Transverse electromagnetic waves.

For directional reception or transmission of picosecond pulses with minimal distortion, a short transverse electromagnetic (TEM) horn with continuously tapered resistive loading was developed, and found to be broadband and nondispersive with a low VSWR. The receiving transient response of the resistively loaded 'TEM' horn indicates that the shape of 70 ps impulse is well preserved. The theoretical analyses using the method of moments and the fast Fourier transform (FFT) technique were performed and agreed well with time domain measurements.

707,622
PB85-128148 PC **A02**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Preliminary Investigation into Using the Sun as a Source for G/T (Gain to System Noise Temperature) Measurements.
W. C. Daywitt. Aug 84, 23p NBSIR-84/3015

Keywords: *Microwave antennas, *Solar radio emission, Microwaves, Atmospheric attenuation, Sun, Error analysis, Correction, Electromagnetic noise, Amplification, Atmospheric correction, Earth terminal measurement system, G/T.

This report describes a preliminary investigation into determining the solar flux density, the atmospheric correction factor, and the star shape correction factor for use in G/T measurements above 5 GHz. An estimate of errors is also included. Preliminary results show: an improved algorithm for determining diffusive and refractive attenuation; a viable technique for estimating the solar flux density from daily AFGL flux density measurements and a centimeter/millimeter wave spectrum function; and the possibility of reducing star shape correction factor errors by use of an effective solar rf diameter.

707,623
PB85-129252 Not available NTIS
National Bureau of Standards, Washington, DC.
Relatively Short Cylindrical Broadband Antenna with Tapered Resistive Loading for Picosecond Pulse Measurements.
Final rept.
M. Kanda. 1978, 9p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Antennas and Propagation 26, n3 p439-447 May 78.

Keywords: *Broadband antennas, Measurement, Continuous radiation, Reprints, Picosecond pulses.

A relatively short cylindrical antenna with continuously tapered resistive loading has been studied for the purpose of picosecond pulse and extremely broadband CW measurements. The antenna considered is a nonconducting (glass) cylinder with continuously deposited, tapered, resistive loading. The characteristics of the antenna have been examined theoretically and experimentally. The current distributions on the antenna are numerically calculated using the method of moments. Using these current distributions, other quantities, such as input impedance, near-field and far-field radiation patterns, and radiation efficiency, are also numerically calculated and compared with the results using Wu-King's current distribution. Agreement is relatively good except at high frequencies. To verify the theoretical results, several resistive loaded antennas are fabricated, and their picosecond pulse and extremely broadband CW receiving characteristics are analyzed for the frequency range between 5 kHz and 5 GHz.

707,624
PB85-133999 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characteristics of a Linear Antenna with Tapered Resistive and Capacitive Loading.
Final rept.
M. Kanda. 1980, 4p
Pub. in APS. Int. Symp. Dig. Antennas and Propag., Univ. Laval, Quebec, Canada, June 2-6, 1980, IEEE Cat. No. 80-CH1557-8, p696-699.

Keywords: *Antennas, Linear systems, Load impedance.

The characteristics of a linear antenna with resistive and capacitive loading are investigated theoretically and experimentally. To implement the real part of impedance loading, the antenna element was made by depositing a tapered thin-film alloy on a glass rod. To achieve the imaginary part of impedance loading, the deposited thin-film alloy on the glass rod was cut by an argon laser to form a segmented antenna. The current distribution, the impedance, the far-field radiation pattern and the transfer function of a linear antenna with tapered resistive and capacitive loading are presented.

707,625
PB85-141455 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Probe Correction in Spherical Near-Field Scanning, Viewed as an Ideal Probe Measuring an Effective Field.
Final rept.
R. C. Wittmann. 1984, 4p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of the IEEE Antennas and Propagation Society, 1984 International Symposium, Boston, MA, Jun 25-28, 1984 p674-677.

Keywords: *Electromagnetic fields, Antennas, Measurement, Scanning, Probes, Corrections, Near field.

In order to reduce measurement and computation complexity, most probe-corrected, spherical near-field scanning facilities use a special 'symmetric' probe, the output of which exhibits a cos(chi)--sin(chi) dependence as the probe is rotated about its axis by an angle, chi. We show here that such a probe is mathematically equivalent to ideal dipole probes measuring an effective field. Computational efficiency and structural simplicity result since much of the effort concerns the calculation of the effective field, and this may be done with a no probe correction algorithm.

707,626
PB85-142230 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Time Domain Sensors for Radiated Impulsive EMI Measurements.
Final rept.
M. Kanda, and F. X. Ries. Sep 82, 6p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Symposium on Electromagnetic Compatibility, Santa Clara, CA., September, 8-10, 1982, p296-301.

Keywords: *Electromagnetic interference, *Antennas, Field strength, Detectors, Measurement, Transfer functions, Time domain.

The purpose of this paper is to review various sensors and radiators commonly used for time domain antenna measurements. For electric field strength measurements, linear antennas loaded nonuniformly and continuously with resistance, or both resistance and capacitance are discussed. Also a conical antenna and an asymptotic conical antenna are discussed from the standpoint of an improved characteristic. For an improved directivity, various types of TEM horns are discussed, e.g., a conducting TEM horn, a CALSPAN antenna, and a resistively loaded TEM horn.

707,627
PB85-142966 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Transients in a Resistively Loaded Loop Antenna.
Final rept.
M. Kanda. Oct 84, 5p
Pub. in Proceedings of International Symposium on Electromagnetic Compatability, Tokyo, Japan, October 16-18, 1984, IEEE (Institute of Electrical and Electronics Engineers) Cat. No. 84-CH2097-4, p286-290.

Keywords: *Loop antennas, Transients, Loading(Electronics).

Transient characteristics of a loop antenna loaded uniformly with a resistive material are analyzed. The current distribution of the antenna is obtained by the use of the Fourier series expansion technique. It is found that the distortion of the transient waveforms due to a resonance of a loop antenna can be reduced and the received transient waveforms can be tailored by resistive loading.

707,628
PB85-143592 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characteristics of Iris-Fed Millimeter-Wave Rectangular Microstrip Patch Antennas.
Final rept.
M. Kanda, D. C. Chang, and D. H. Greenlee. 1982, 3p
See also PB84-134634.
Pub. in Proceedings of Antennas and Propagation Society Symposium, Albuquerque, NM, May 24-28, 1982, IEEE Catalog No. 82-CH1783-0, p293-295.

Keywords: *Microwave antennas, Antenna radiation patterns, Impedance, Antenna feeds, Irises(Mechanical apertures), Microstrip antennas.

This paper describes the characteristics of iris-fed millimeter-wave rectangular microstrip patch antennas. A theoretical model is given to describe the iris-fed patch antenna based on aperture coupling to cavities. The impedance and antenna power patterns are given.

707,629
PB85-148013 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Arrays of Discrete Elements.
Final rept.
M. T. Ma. 1984, 34p
Pub. in Antenna Engineering Handbook, Second Edition, Chapter 3, p3 -1--3-34 1984.

Keywords: *Antenna arrays, Endfire arrays, Yagi antennas, Reprints, Antenna design.

This is an invited contribution, as Chapter 3, to Second Edition, Antenna Engineering Handbook to be published by McGraw-Hill Book Company.

707,630
PB85-191419 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Theory of Mutual Impedances and Multiple Reflections in an N-Element Array Environment.
Technical note.
L. A. Muth. Feb 85, 36p NBS-TN-1078
Also available from Supt. of Docs as SN003-003-02632-8.

Keywords: *Antenna arrays, Impedance, Theories, Reflection.

A general theoretical approach is formulated to describe the complex electromagnetic environment of an N-element array. The theory reveals the element-to-element interactions and multiple reflections within the array. From the formulation, it is found that the interaction between an excited element and an open-circuited element can be viewed as the sum of terms describing all possible signal paths within the array environment which start from the radiating element and terminate on the element under observation. Within all paths except the most direct one, multiple reflections between subgroups of elements take place. The resulting solution is highly structured and recursive and is discussed in detail in the text. Illustrative examples are provided to facilitate understanding of these ideas.

707,631
PB85-224475 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Out-of-Band Response of Reflector Antennas.
D. A. Hill. Apr 85, 76p NBSIR-85/3021
Sponsored by Defense Nuclear Agency, Washington, DC.

Keywords: *Antennas, Performance evaluation, Applications of mathematics, Responses, Parabolic antennas, Out of band response.

The response of reflector antennas to out-of-band frequencies has been analyzed using physical optics. A simple approximate expression has been obtained for the effective aperture, and the expression yields both the receiving pattern and the frequency dependence of the on-axis gain. The theory has been compared with published out-of-band measurements, and the pattern agreement is good, but the measured gain falls below the theory. The discrepancy is caused by mismatch loss in the coax-to-waveguide adapter, and the mismatch loss has been analyzed theoretically. The basic physical optics model for symmetrical reflectors has been extended to include offset and dual reflectors, reflector surface roughness, and transient excitation.

707,632
PB85-226892 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Bibliography of the NBS (National Bureau of Standards) Electromagnetic Fields Division Publications, January 1982 through December 1983.
K. A. Gibson, and C. K. S. Miller. Apr 85, 20p
NBSIR-85/3022
See also PB83-119776.

Keywords: *Antennas, *Electromagnetic interference, *Bibliographies, Electromagnatic fields, Electromagnetic noise, Waveforms, Metrology.

The bibliography lists the publications of the personnel of the NBS Electromagnetic Fields Division in the period from January 1982 through December 1983. Topic headings include Antennas, Electromagnetic Interference, Noise, Waveform Metrology, and miscellaneous.

707,633
PB86-102381 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Screenroom Measurements of Antenna Factors.
Final rept.
J. E. Cruz, and E. B. Larsen. Mar 85, 2p
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronic Engineers) Instrumentation and Measurement Technology Conference, Tampa, Florida, March 20-22, 1985, p208.

Keywords: *Antennas, *Electromagnetic fields, Measurement, Anechoic chambers.

The measurement of electromagnetic fields in a shielded enclosure (screenroom) has serious problems because of uncertain antenna factors and multipath reflections from conductive surfaces. Most electromagnetic interference antennas at NBS are calibrated in a known field at an open field site using the standard antenna method. Because these antenna factors are not necessarily applicable for making measurements in a screenroom, the measurement errors are difficult to determine. This paper presents the results for antenna factors determined in a screenroom using the two-antenna method. These antenna factors are compared with antenna factors determined at an open field site and in an anechoic chamber. Experimental data are presented to show the variability of antenna factor as a function of frequency and location in the screenroom, thereby providing an indication of error bounds.

707,634
PB86-102688 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Near-Field Array of Yagi-Uda Antennas for Electromagnetic Susceptibility Testing.
Technical note.
D. A. Hill, and G. H. Koepke. Jul 85, 84p NBS/TN-1082
Also available from Supt. of Docs as SN003-003-02669-7.

Keywords: *Antenna arrays, Yagi antennas, Electromagnetic fields, Electromagnetic susceptibility, Near field.

In electromagnetic susceptibility testing of electronic equipment, the ideal incident field is a plane wave. To approximate this condition, a seven-element array of Yagi-Uda antennas has been constructed and tested at a frequency of 500 MHz. The element weightings are determined by a near-field synthesis technique which optimizes the uniformity of the field throughout a rectangular test volume in the near field of the array. The amplitude and phase of the electric field have been measured throughout the test volume with a short dipole probe, and the agreement with the theory is excellent.

707,635
PB86-112885 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Orbiting Standards Package: A Recalibratable Satellite Instrument Assembly for Measuring Large Earth Station Antennas.
Final rept.
A. J. Estin, and R. C. Baird. 1982, 12p
Pub. in Proceedings of the Antenna Measurements Symposium, Las Cruces, New Mexico, October 5-7, 1982, p5-1 - 5-12.

Keywords: *Antennas, Artifical satellites, Measuring instruments, Electromagnetic radiation, Microwave communication, *Orbiting Standards Package, Earth terminals, Electromagnetic measurement.

The concept of an Orbiting Standards Package (OSP) has been discussed as a means of making direct measurements of fields, patterns, and polarization states of signals radiated from large earth station antennas. It would also have the capability of producing test fields of known intensitites and arbitrary but well-defined polarization states, thereby enabling the determination of such parameters as G/T and Effective Receiving Area of earth stations. Recent developments in microwave six-port networks and in standard antennas would permit the all-electronic generation and detection of these signals. Moreover, it appears possible to recalibrate the satellite standards package to laboratory state-of-the-art accuracy following launch.

707,636
PB86-115680 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Radio-Frequency Power Delivery System: Procedures for Error Analysis and Self-Calibration.
M. Kanda, and R. D. Orr. Aug 85, 28p NBS/TN-1083
Also available from Supt. of Docs as SN003-003-02670-1.

Keywords: *Radio frequency power, Antennas, Error analysis, Calibrating.

An expression is developed for net power delivered to a load in terms of the indicated forward and reflected power and the system S-parameters and reflection coefficients. The dual directional coupler is treated as nonideal with power reflections assumed between all ports. The system itself is used to evaluate the major S-parameter terms in net power computation, and uncertainty in the computed power is derived from origins in the power meter readings and incompletely known S-parameters.

707,637
PB86-122892 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Determination of Near-Field Correction Parameters for Circularly Polarized Probes.
Final rept.
A. C. Newell, M. H. Francis, and D. P. Kremer. 1984, 29p
Pub. in Proceedings of Annual Conference of the Antenna Measurement Techniques Association, San Diego, CA., October 2-4, 1984, p3A3-1 - 3A3-29.

Keywords: *Antennas, *Antenna radiation patterns, Measurement, Far field, Circular polarization, Near field.

In order to accurately determine the far-field of an antenna from near-field measurements the receiving pattern of the probe must be known so that probe correction can be performed. When the antenna to be tested is circularly polarized, the measurements are more accurate and efficient if circularly polarized probes are used. Further efficiency is obtained if one probe is dual polarized to allow for simultaneous measurements of both components. A procedure used by the National Bureau of Standards for determining the plane-wave receiving parameters of a dual-mode, circularly polarized probe is described herein. First, the on-axis gain of the probe is determined using the three antenna extrapolation technique. Second, the on-axis axial ratios and port-to-port comparison ratios are determined for both the probe and source antenna using a rotating linear horn. Far-field pattern measurements of both amplitude and phase are then made for both the main and cross components.

707,638
PB86-139797 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Practical Optical Modulator and Link for Antennas.
Final rept.
J. C. Wyss, and S. T. Sheeran. 1985, 6p
Pub. in Jnl. of Lightwave Technology LT-3, n2 p316-321 Apr 85.

Keywords: *Fiber optics transmission lines, Antennas, Electrooptics, Electromagnetic interference, Photodiodes, Reprints, Fiber optics.

The paper describes a practical application of a technique for coupling an antenna to a receiver using a passive fiber-optic link. This technique should avoid pickup and electromagnetic perturbations normally associated with the use of electrically conductive cables. Laser light (632.8 nm) is modulated at the antenna by an electrooptic lithiumtantalate crystal and is then transmitted with a fiber-optic cable to the receiver electronics. Using an avalanche photodiode, the amplitude modulated optical signal is converted to an electrical signal. The crystal is mounted directly on an antenna without amplifiers or other electrically powered components.

707,639
PB86-160140 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Array of Dipoles for Plane Wave Synthesis.
Final rept.
D. A. Hill, and G. H. Koepke. Aug 85, 4p
Sponsored by Commemorative Association for the Japan World Exposition.
Pub. in Proceedings of the International Symposium on Antennas and Propagation (1985), Kyoto, Japan, August 20-22, 1985, p177-180.

Keywords: *Plane waves, *Dipole antennas, *Dipoles, *Phased arrays, Electromagnetic fields, Synthesis, Near fields.

Phased arrays can be used to produce a nearly uniform plane wave in the near field. The paper describes a small array of dipoles which we have studied theoretically and experimentally. The element excitations

are determined from a near-field synthesis technique that optimizes the field uniformity throughout the test volume.

707,640
PB86-162021 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Measured Vehicular Antenna Performance.
Final rept.
R. L. Jesch. May 85, 11p
Pub. in IEEE (Institute of Electrical and Electronic Engineers) Transactions on Vehicular Technology VT-34, n2 p97-107 May 85.

Keywords: *Ground vehicle antennas, *Amplification, *Antenna radiation patterns, Power gain, Frequencies, Field tests, Reprints.

Power gain radiation patterns of mobile antennas mounted in six different locations on a test vehicle were measured with and without typical lights and sirens mounted on the roof. The measurements were performed at frequencies representing the frequency bands of 25 to 50, 150 to 174, 400 to 512, and 806 to 866 MHz. In addition, special antennas consisting of three disguised antennas operating at discrete frequencies of 40.27, 162.475, and 416.975 MHz and one slot antenna operating at 413 MHz were also measured. Plots of power gain radiation patterns are given for the mobile antennas mounted in six different locations on the test vehicle and for the special antennas. Results showing the effects of poor grounding characteristics are also included. Recommended locations for mounting the mobile antennas are given for specific frequency bands.

707,641
PB86-164357 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Development of Near-Field Test Procedures for Communication Satellite Antennas. Phase 1, Part 1.
A. C. Newell, and A. G. Repjar. Sep 85, 82p NBSIR-85/3031

Keywords: *Spacecraft antennas, Electromagnetic fields, Antennas, Tests, Measurement, Communication satellites, Near field.

The purpose of the program is to define and further develop the capabilities of near-field antenna test techniques, specifically for the requirements associated with the development and verification testing of reconfigurable, multibeam, frequency reuse, commercial satellite antennas. Phase I, Part 1 gives a general survey, definition, and description of near-field and compact range measurement methods as they apply to satellite antenna systems testing. Each of these methods is evaluated to determine how well they meet the measurement requirements. Included for each technique is a summary of the measurement method, discussions on probe correction and data processing, measurement hardware considerations, a results available section, and measurement accuracy and range certification considerations. The basis for the choice of the best measurement technique is established with the planar near-field measurement method receiving the best score for the directive antennas considered.

707,642
PB86-169083 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Site Attenuation.
R. G. FitzGerrell. Nov 85, 51p NBS/TN-1089
Also available from Supt. of Docs as SN003-003-02708-1.

Keywords: *Antennas, Attenuation, Measurement, Dipole antennas.

Site attenuation is a measure of performance of an open test site used at frequencies below about 1 GHz for antenna calibration and equipment emission and susceptibility testing. These sites typically consist of a large, obstruction-free ground plane and the hemisphere above it. Site attenuation of an ideal site is calculated and compared to data measured using the 30 m by 60 m NBS ground screen.

707,643
PB86-181963 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Efficient and Accurate Method for Calculating and Representing Power Density in the Near-Zone of Microwave Antennas.
R. L. Lewis, and A. C. Newell. Dec 85, 44p NBSIR-85/3036

Keywords: *Microwave antennas, *Field strength, Antennas, Electromagnetic fields, Power spectra, Apertures, Algorithms, Near field, Fresnel zone.

An algorithm is presented for calculating near-zone and Fresnel-region fields in front of microwave antennas from discrete numerical values of the radiated plane-wave spectrum (complex far-field pattern). That is, the near fields are calculated by numerically integrating the plane-wave spectrum representation of the field. The crux of the analysis consists of handing a numerical instability which arises from integrating discrete data. A criterion is developed for limiting the integration domain in order to exclude highly oscillatory regions of the integrand. In turn, this leads to restricting the applicable output range over which the field can be computed. With the numerical instability problem thus resolved, fast Fourier transform techniques are used to assure efficient numerical integration over a large (but restricted) output range.

707,644
PB86-189214 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Input Impedance of a Probe Antenna in a TEM (Transverse Electromagnetic) Cell.
Final rept.
P. F. Wilson, D. C. Chang, and M. T. Ma. 1984, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electromagnetic Compatibility, EMC-26 n4 p154-161 Nov 84.

Keywords: *Input impedance, *Antennas, Waveguides, Reprints, *Transverse electromagnetic cell.

The input impedance of a probe antenna exciting a transverse electromagnetic (TEM) cell is formulated via a variational approach. The resulting impedance is shown to consist of two distinct terms; an ordinary rectangular waveguide contribution and a gap perturbation. Numerical results for both are given and suggest that a simple algebraic approximation for the input impedance should normally suffice. The resistive portion is found to be proportional to the square of the probe length, while the reactive portion is largely capacitive.

707,645
PB86-214731 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Factors Influencing Material Shielding Effectiveness Measurements.
Final rept.
P. F. Wilson, and M. T. Ma. Aug 85, 5p
Pub. in Proceedings of IEEE International Symposium on Electromagnetic Compatibility, Wakefield, MA., August 20-22, 1985, p29-33.

Keywords: *Antennas, *Insertion loss, *Shielding, Electromagnetic shielding.

A material's shielding effectiveness is often measured in terms of insertion loss; that is, the field reduction between a transmitter and receiver achieved by introducing the shield material. The insertion loss concept is simply stated; however, ambiguities arise when one attempts to interpret specific insertion loss measurements. Insertion loss data depend not only on the shield material tested, but also on the measurement procedure. The antenna types used and their positioning, the incident waveform and its wave impedance, and the contact resistance between the test material and its mount (if any) can all affect insertion loss measurements, sometimes dramatically. These concepts are discussed based on the simple model of coupling through an electrically small aperture, loaded and unloaded, with the shield material.

707,646
PB86-230034 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
10-60 GHz G/T Measurements Using the Sun as a Source--A Preliminary Study.
Rept. for 1985-86.
W. C. Daywitt. Apr 86, 22p NBSIR-86/3046
Sponsored by Air Force Satellite Control Facility, Sunnyvale, CA.

Keywords: *Microwave antennas, *Solar radio emission, Microwaves, Atmospheric attenuation, Sun, Error analysis, Correction, Electromagnetic noise, Amplification, Atmospheric correction, Earth terminal measurement system, G/T.

Preliminary studies show that it may be possible (1) to determine the solar flux density incident on the earth's atmosphere using a simple algorithm with an uncertainty less than 8 percent; (2) to overcome a deteriorating accuracy in atmospheric loss calculations by using a 'tipping curve' measurement, and (3) to reduce star-shape correction factor uncertainty by using an equivalent solar diameter.

707,647
PB86-231438 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Receiving Antenna as a Linear Differential Operator: Application to Spherical Near-Field Scanning.
Final rept.
R. C. Wittmann, and A. R. Yaghjian. 1985, 11p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Antennas and Propagation AP33, n11 p1175-1185 Nov 85.

Keywords: *Antennas, Electromagnetic fields, Measurement, Scanning, Reprints, *Near field.

The general receiving antenna is represented as a linear differential operator converting the incident field and its spatial derivatives at a single point in space to an output voltage. The differential operator is specified explicitly in terms of the multipole coefficients of the antenna's complex receiving pattern. When the linear operator representation is applied to the special probes used in spherical near-field measurements, a probe-corrected spherical transmission formula is revealed that retains the form, applicability, and simplicity of the nonprobe-corrected equations. The new spherical transmission formula is shown to be consistent with the previous transmission formula derived from the rotational and translational addition theorems for spherical waves.

707,648
PB86-237203 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Interelement Interactions in Phased Arrays: Theory, Methods of Data Analysis, and Theoretical Simulations.
Technical note.
L. A. Muth. Dec 85, 50p NBS/TN-1091
Also available from Supt. of Docs. as SN003-003-02715-4.

Keywords: *Phased arrays, Antenna radiation patterns, Interactions, Reflection, Impedance.

The authors review theoretically the effects of multiple reflections and mutual impedances in array environments and study possible methods of far-field pattern data analysis to recover interaction effects. The authors use theoretical expressions derived earlier to calculate in a two-element linear array the mutual-impedance matrix and effective excitations of elements as functions of interelement separation and n sub max, the maximum mode number in the radiation pattern of the elements. Generalizations to two- and three-dimensional arrays are discussed.

707,649
PB86-247491 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Linear Gain - Standard Antennas Below 1000 MHz.
Technical note.
R. G. FitzGerrell. May 86, 43p NBS/TN-1098
Also available from Supt. of Docs as SN003-003-02736-7.

Keywords: *Antennas, *Amplification, Standards, Ultrahigh frequencies, High f frequencies, Very high frequencies, High frequencies, Medium frequencies.

Gain and antenna parameters related to input impedance are calculated using a computer program called HVD6. The program uses well documented equations to compute these parameters for gain-standard antennas used in relative-gain or gain-transfer measurements at frequencies below 1000 MHz. The utility of the program is that it calculates gain patterns and input impedances for linear dipoles above perfect or imper-

fectly conducting plane ground and in free space, and for monopoles on perfectly conducting plane ground. Examples are included to illustrate the use of the program. Uncertainties in the calculated parameters are estimated to be less than those of the measured parameters.

707,650
PB87-106407 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Numerical Method for Near-Field Array Synthesis.
Final rept.
D. A. Hill. 1985, 11p
Pub. in IEEE Transactions on Electromagnetic Compatibility EMC-27, n4 p201-211 Nov 85.

Keywords: *Phase arrays, Antennas, Electromagnetic fields, Numerical analysis, Plane waves, Reprints, Near field.

A numerical method for near-field array synthesis is developed for arbitrary array geometries. The intended application is for generating a planar field in a test volume for electromagnetic susceptibility testing, but the method is valid for arbitrary field distributions. A uniqueness theorem is utilized to allow the field conditions to be enforced on the surface of the test volume rather than throughout the volume. The synthesis method is a least-squares solution with a constraint on the source norm; the constraint keeps the field small outside the test volume. Numerical results are shown for the case of synthesizing a plane wave in the near field of an array of line sources.

707,651
PB87-125746 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Out-of-Band Response of Antenna Arrays.
D. A. Hill, and M. H. Francis. Jun 86, 37p NBSIR-86/3047
Sponsored by Defense Nuclear Agency, Washington, DC.

Keywords: *Antenna arrays, Orientation, Impedance matching, Polarization, Near field, Slotted waveguides, Out of band.

The response of antenna arrays to out-of-band frequencies has been analyzed using the effective aperture approach. An average value of effective aperture can be obtained by averaging the incidence angle and the polarization of the incidence field. Far-field patterns have also been calculated by treating the array element excitations as random variables. The randomness in the element excitations causes a decrease in directivity and an increase in sidelobe level. Out-of-band measurements of reflection coefficient and near-field response have been made on two large slotted-waveguide arrays for frequencies from 2 to 18 GHz. Both arrays are narrow band, and this is easily explained by the large impedance mismatch at out-of-band frequencies.

707,652
PB87-134375 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Displacement Errors in Antenna Near-Field Measurements and Their Effect on the Far Field.
L. A . Muth. Oct 86, 38p NBS/TN-1306
Also available from Supt. of Docs as SN003-003-02776-6.

Keywords: *Antenna radiation patterns, Error analysis, Far field, Electrical measurement, Near field.

The effects of probe displacement errors in the near-field measurement procedure on the far-field spectrum are studied. Expressions are derived for the displacement error functions that maximize the fractional error in the spectrum both for the on-axis and off-axis directions. Planar x-y and z-displacement errors are studied first and, consequently, the results are generalized to errors in spherical scanning. Some simple near-field models are used to obtain order of magnitude estimates for the fractional error as a function of relevant scale lengths of the near field, defined as the lengths over which significant variations occur.

707,653
PB87-152278 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Far-Field Transient Response of an Antenna from Near-Field Data,
D. A. Hill. Dec 86, 28p NBSIR-86/3063
Sponsored by Defense Nuclear Agency, Washington, DC.

Keywords: *Antennas, Far field, Transient response, Near field, Singularity expansion method, Time domain, Frequency domain.

The theory for calculating the transient far-field response of an antenna from planar near-field data in either the time domain or the frequency domain has been developed. A double integral must be evaluated if the authors begin with time-domain data, but a triple integral must be evaluated if they begin with frequency-domain data. However, the frequency-domain integrals are in a form that is suitable for three-dimensional FFT. Two idealized examples are studied, and identical results are obtained starting with frequency-domain or time-domain data. The main practical difficulty in determining the transient response is the large number of near-field samples that are required. If data are taken at only a few near-field points, then the singularity expansion method (SEM) presents a possible method of determining the complex resonances of the antenna under test.

707,654
PB87-161428 Not available NTiS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Directional Scanning of Complex Electromagnetic Environments.
Final rept.,
J. Randa, and M. Kanda. Dec 85, 4p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Antennas and Propagation AP-33, n12 p1413-11416 Dec 85.

Keywords: *Electromagnetic environments, Plane waves, Reprints, Directional scanning.

A directional scanning technique is formulated for determining characteristics of an electromagnetic (EM) environment with a relatively small number of measurements, and results of a simulated application are presented. The method relies on measurements with a directional probe to obtain information about the coefficients in a planewave expansion of the field within a large volume. The simulation indicates that although the spatial variation of the field can not be accurately determined, the spatial average of the field intensity can.

707,655
PB87-161436 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Calibration of Microwave Antenna Gain Standards.
Final rept.,
A. C. Newell, C. F. Stubenrauch, and R. C. Baird. Jan 86, 4p
Pub. in Proceedings of the Institute of Electrical and Electronics Engineers 74, n1 p129-132 Jan 86.

Keywords: *Microwave antennas, *Standards, Precision, *Antenna gain, *Calibration, Near field, Uncertainty.

Techniques for precision calibration of microwave antenna gain standards are described with discussions of applicability and associated uncertainties. Included are the three-antenna, extrapolation, swept-frequency, and near-field techniques.

707,656
PB87-161444 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Results of Planar near Field Testing with Ultralow Sidelobe Antennas.
Final rept.,
A. C. Newell, M. H. Francis, D. P. Kremer, and K. R. Grimm. 1985, 6p
Contract N00014-83-C-0671
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of 1985 AP-S International Symposium on Antennas and Propagation, Vancouver, Canada, June 17-21, 1985, v2 p693-698.

Keywords: *Antenna radiation patterns, Measurement, Tests, *Antenna lobes, *Sidelobes, Near field.

An investigation to demonstrate Planar Near Field (PNF) measurement accuracy for ultralow sidelobe antennas is nearing completion at the National Bureau of Standards, Boulder, CO. The existing NBS scanner has been modified to accommodate antennas up to 10m long and 4m high. Two antennas will be measured as a part of this research effort. They are the AWACS (U.S. Airborne Warning and Control System) and the ULSA (Ultra Low Sidelobe Antenna), traveling wave antennas which are respectively 8m X 1.5m and 6m X 1m. Results of tests to introduce controlled NF measurement error confirm predicted far field (FF) sidelobe accuracies at the -60dB level. Additional results show the utility of a new 2-element probe to extend sidelobe measurement accuracy by steering a probe pattern null in the direction of the test antenna's mainbeam.

707,657
PB87-161469 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Out-of-Band Response of Reflector Antennas.
Final rept.,
D. A. Hill. May 86, 10p
See also report dated April 1985, PB85-224475.
Pub. in Institute of Electrical and Electronics Engineers Transactions on Electromagnetic Compatibility EMC-28, n2 p80-89 May 86.

Keywords: *Antennas, Responses, Parabolic antennas, Reprints, Out of band response.

The response of reflector antennas to out-of-band frequencies has been analyzed using physical optics. A simple approximate expression has been obtained for the effective aperture, and this expression yields both the receiving pattern and the frequency dependence of the on-axis gain. The theory has been compared with published out-of-band measurements, and the pattern agreement is good, but the measured gain falls below the theory. This discrepancy is caused by mismatch loss in the coax-to-waveguide adapter.

707,658
PB87-161485 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Site Attenuation.
Final rept.,
R. G. FitzGerrell. Feb 86, 3p
See also report dated November 1985, PB86-169083.
Pub. in Institute of Electrical and Electronics Engineers Transactions on Electromagnetic Compatibility EMC-28, n1 p38-40 Feb 86.

Keywords: *Antennas, Attenuation, Measurement, Computation, Reprints, *Site attenuation.

Site attenuation is a measure of performance of an open test site at frequencies below about 1 GHz. These sites typically consist of a large obstruction-free ground plane and the hemisphere above it. Calculations of site attenuation are presented which provide a reference for measurements made on a 30- by 60-m wire-mesh ground screen. Measured data are compared to the calculated results.

707,659
PB87-172011 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Comparison of Measured and Calculated Mutual Coupling in the Near Field between Microwave Antennas.
Final rept.,
C. F. Stubenrauch, and M. H. Francis. Jul 86, 7p
See also report dated Jun 84, PB85-105963.
Pub. in Institute of Electrical and Electronics Engineers Transactions on Antennas and Propagation AP-34, n7 p952-958 Jul 86.

Keywords: *Microwave antennas, Coupled antennas, Antenna radiation patterns, Measurement, Far field, Comparison, Reprints, Near field.

Measurements of near-field mutual coupling between two moderate sized microwave antennas were performed and compared to coupling calculated using recently developed computer programs. Required input data for the programs are the complex far-field radiation patterns of the antennas and various geometrical factors describing the relative positions and orientations of the two antennas. Measured and calculated coupling as a function of both transverse and radial displacement showed good agreement.

707,660
PB87-172714 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Near-Field Array of Yagi-Uda Antennas for Electromagnetic Susceptibility Testing.
Final rept.,
D. A. Hill, and G. H. Koepke. Nov 86, 9p
See also report dated Jul 85, PB86-102688.
Pub. in Institute of Electrical and Electronics Engineers Transactions on Electromagnetic Compatibility EMC-28, n4 p170-178 Nov 86.

Keywords: *Antenna arrays, Yagi antennas, Electromagnetic fields, Electromagnetic susceptibility, Field tests, Reprints, Near field.

In electromagnetic-susceptibility testing of electronic equipment, the ideal incident field is a plane wave. To approximate this condition, a seven-element array of Yagi-Uda antennas has been constructed and tested at a frequency of 500 MHz. The element weightings are determined by a near-field synthesis technique, which optimizes the uniformity of the field throughout a rectangular test volume in the near field of the array. The amplitude and phase of the electric field have been measured throughout the test volume with a short-dipole probe, and the agreement with the theory is excellent.

707,661
PB87-172722 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Standard Linear Antennas, 30 MHz to 1000 MHz.
Final rept.,
R. G. FitzGerrell. 1986, 7p
Pub. in Proceedings of International Conference on Electromagnetic Compatibility (5th), York, England, October 1-3, 1986, p147-153.

Keywords: *Antennas, Very high frequencies, Ultrahigh frequencies, Linear systems, Monopole antennas, Dipole antennas.

Simple linear antennas are described that are designed to operate in the 30 MHz to 1000 MHz frequency range. Commercial coaxial hybrid junctions are used as balanced-to-unbalanced transmission line transformers (baluns) for the dipole antennas. The monopoles are fed unbalanced against a large ground screen. Calculated site attenuation (insertion loss) between pairs of these antennas over an assumed perfectly conducting plane ground is compared to insertion loss data measured using the 30 m by 60 m NBS ground screen.

707,662
PB87-182895 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Time-Domain Sensors and Radiators.
Final rept.,
M. Kanda. 1986, 53p
Pub. in Time-Domain Measurements in Electromagnetics, Chapter 5, p122-174 1986.

Keywords: *Antennas, *Detectors, Conical antennas, Loop antennas, Electrical measurement, Time domain.

The purpose of the chapter is to discuss various sensors and radiators commonly used for time domain antenna measurements. The sensors and radiators discussed here are passive, analog devices which convert the electromagnetic quantity of interest to a voltage or current at their terminal ports. Moreover, they are primary standards in the sense that their transfer functions can be calculated from their geometries and are flat (constant) across a wide frequency range. For their usefulness in electric field strength measurements, linear antennas loaded non-uniformly and continuously with resistance, or both resistance and capacitance, are discussed. Also, a conical antenna and an asymptotic conical antenna are discussed from the standpoint of improved antenna characteristics. Various types of TEM horns are considered for improved directivity, e.g., a conducting TEM horn, and a resistively loaded TEM horn. For the magnetic field strength measurements, a loop antenna with uniform resistive loading is discussed.

707,663
PB87-210233 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
NBS (National Bureau of Standards) Calibration Procedures for Horizontal Dipole Antennas (25 to 1000 MHz).
Technical note,
D. G. Camell, E. B. Larsen, and J. E. Cruz. Apr 87, 49p NBS/TN-1309
Also available from Supt. of Docs as SN003-003-02800-2.

Keywords: *Dipole antennas, Anechoic chambers, High frequencies, Very high frequencies, Ultrahigh frequencies, *Calibration, US NBS.

The publication describes the theoretical basis and test procedures for horizontally polarized dipole calibrations at the National Bureau of Standards. Two different techniques and two different test sites are used. The standard antenna method uses the calculation of a field strength level, from the response of a simple half-wave dipole, to calibrate an antenna. This method is used at an open field site in the frequency range of 25 to 1000 MHz. The standard field method applies the theoretical gain equations of waveguides to determine the field strength level. This latter method is used in an anechoic chamber in the frequency range of 200 to 1000 MHz. Procedures for both techniques are explained and measurement setups are illustrated. Measurement uncertainties are discussed. Sample reports are included for both methods.

707,664
PB87-232567 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Analysis of an Array of Log-Periodic Dipole Antennas for Generation Test Fields,
G. H. Koepke, D. A. Hill, and M. T. Ma. Jun 87, 40p NBSIR-87-3068
Sponsored by Naval Surface Weapons Center, Dahlgren, VA.

Keywords: *Dipole antennas, *Log periodic antennas, Electromagnetic fields, Phased arrays, Analysis.

An analysis of log-periodic dipole antennas was extended to study their use in arrays designed for electromagnetic susceptibility measurements. Parameters of an array of five log-periodic dipole antennas were calculated and in some cases compared to a single log-periodic dipole antenna. These parameters were used to evaluate the tradeoffs that exist in the design of an optimum transmitting antenna for susceptibility measurements.

707,665
PB87-233896 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Effect of Random Errors in Planar Near-Field Measurements.
Final rept.,
A. C. Newell, and C. F. Stubenrauch. 1986, 4p
Sponsored by National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Antenna and Propagation Society Symposium (1986), Philadelphia, PA., June 8-13, 19866H, p195-198.

Keywords: *Antennas, Random error, Phased arrays, Near field, Sidelobes.

Equations have previously been derived to predict the effect of systematic errors in planar near-field measurements. Similar expressions for random errors have not been generally available, although computer simulation has been used to study some specific cases. In the report, simple general expressions are derived to predict the effect of random errors that require only minimal information about the antenna and the error distributions.

707,666
PB88-120969 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Coupling between Two Antennas Separated by a Planar Interface.
Final rept.,
D. A. Hill, and K. H. Cavcey. 1987, 10p
Sponsored by Army Belvoir Research and Development Center, Fort Belvoir, VA.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Geoscience and Remote Sensing GE-25, n4 p422-431 Jul 87.

Keywords: *Antennas, Loop antennas, Dipole moments, Interfaces, Plane waves, Polarization, S matrix theory, Reprints, *Metal detectors, Buried objects.

The plane-wave spectrum technique is used to analyze the coupling between a pair of antennas separated by a planar interface. Multiple reflections between the antennas or between either antenna and the interface are included in the formulation. The formulation is used to model detection of buried objects, and a low-frequency metal detector example is analyzed in detail. For a transmitting loop and a buried oblate spheroid, the plane wave spectrum technique is shown to agree with well-known quasi-static approximations. Some experimental results from a 3-kHz metal detector are also shown.

707,667
PB88-121983 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Out-of-Band Response of Antenna Arrays.
Final rept.,
D. A. Hill. 1987, 4p
See also PB88-121991.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Symposium on Electromagnetic Compatibility, Atlanta, GA., August 25-27, 1987, p435-438.

Keywords: *Antenna arrays, Far field, Reflector antennas, Out of band.

The response of antenna arrays to out-of-band frequencies has been analyzed, using the effective aperture approach. An average value of effective aperture can be obtained by averaging the incidence angle and the polarization of the incident field. Far-field patterns have also been calculated by treating the array element excitations as random variables. The randomness in the element excitations causes a decrease in directivity, and an increase in sidelobe level.

707,668
PB88-121991 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Out-of-Band Response of Array Antennas.
Final rept.,
M. H. Francis, and D. A. Hill. 1987, 6p
See also PB88-121983.
Pub. in Proceedings of Antenna Measurement Techniques Association Meeting, Seattle, WA., September 28-October 2, 1987, p14-19.

Keywords: *Antenna arrays, Near field, Out of band.

The out-of-band response of array antennas was analyzed from both a theoretical and experimental point of view. Theory shows that the out-of-band response of an antenna depends primarily on two factors: the antenna's input impedance, and its directivity. Experiment shows that, for most practical purposes, the out-of-band response of an antenna can be estimated from a measurement of the antenna's input reflection coefficient alone. If the reflection coefficient is low, the antenna response will be good; if the reflection coefficient is high, the antenna response will be poor.

707,669
PB88-123732 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Extrapolation Range Measurements for Determining Antenna Gain and Polarization.
Technical note,
A. G. Repjar, A. C. Newell, and D. T. Tamura. Aug 87, 88p NBS/TN-1311
Also available from Supt. of Docs. as SN003-003-02826-6.

Keywords: *Antennas, Amplification, Polarization(Waves), Calibration, Near field.

The extrapolation range measurement technique for determining the power gain and polarization of antennas at reduced range distances is described. It is based on a generalized three-antenna approach and does not require quantitative a priori knowledge of the antennas. During the past decade, it has been extensively used by the National Bureau of Standards, Boulder, Colorado, to calibrate antenna gain standards for industry and other agencies within + or - 0.1 dB. To help one understand how calibrations of the accuracy are achieved, the extrapolation range description in-

cludes discussions on the required theory, the measurement procedures, the range configuration and instrumentation, the errors, and some measurement examples. Recent extensions of the extrapolation method required for swept/stepped frequency gain calibrations and for corrections to reduce ground reflection effects, are also presented.

Circuits

707,670
AD-A123 554/8 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Microwave Mixing and Direct Detection Using SIS and SIS' Quasiparticle Tunnel Junctions.
A. D. Smith, W. R. McGrath, P. L. Richards, R. E. Harris, and F. L. Lloyd. 30 Nov 82, 4p
Contract N00014-75-C-0496
Presented at the Applied Superconductivity Conference (1982). Prepared in cooperation with National Bureau of Standards, Boulder, CO. and Yale Univ., New Haven, CT.
Pub. in IEEE Trans. Magn. MAG-19, n3 p490-493 May 1983.

Keywords: *Microwave amplifiers, *Mixers(Electronics), *Tunneling(Electronics), *Junctions, Quantum electronics, Coupling(Interaction), Gain, Detectors, Superconductors, Leakage(Electrical), Microwave mixing, Quasiparticles.

Quasiparticle mixers have shown strong quantum effects, conversion gain, and noise levels approaching the quantum limit, but only in tunnel junctions with very low sub-gap 'leakage' conductance. It has been suggested that SIS' tunnel junctions, made from two different coductors with unequal gaps, will function as high gain mixers since the dynamic conductance below the gap is nagative.

707,671
PATENT-4 104 583 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Six-Port Measuring Circuit.
Patent.
G. F Engen. Filed 31 Aug 77, patented 1 Aug 78, 20p PB78-600039, PAT-APPL-829 381

Keywords: *Automatic network analyzer, Microwave measurements, Six-port.

A six-port measuring circuit includes only four hybrids coupling two input ports to four power measuring ports. A first hybrid is connected to one input port and to second and third hybrids; a second input port is connected to the second hybrid; the second and third hybrids are connected to a fourth hybrid; first and second measuring ports are connected respectively to the second and third hybrids; and third and fourth measuring ports are connected to the fourth hybrid. In one embodiment, the first hybrid is a 180 degree hybrid; and the second, third and fourth hybrids are quadrature hybrids. In a second embodiment, the first three hybrids are 180 degree hybrids and the fourth a quadrature hybrid. Another embodiment includes three quadrature hybrids as the first three hybrids and a 180 degree hybrid as the fourth hybrid. A fourth embodiment employs four quadrature hybrids. The basic six-port circuit is useful as a vector voltmeter and may be coupled to a transmission line by means of a directional coupler. Net power and the complex reflection coefficient gamma 1 may be computed from the power readings at the measuring ports.

707,672
PATENT-4 129 864 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Speed, Wide Dynamic Range Analog-to-Digital Conversion.
Patent.
R. J. Carpenter, and K. W. Yee. Filed 3 Nov 77, patented 12 Dec 78, 9p PB78-600041, PAT-APPL-848 041

Keywords: *Analog-to-digital converter, Two's complement analog-to-digital converters.

A wide dynamic range, wide bandwidth, analog-to-digital conversion system and method. A plurality of overlapped analog-to-digital converters are utilized in conjunction with scaling amplifiers to provide a plurality of output ranges. Means for selecting the set of output bits which provides a magnitude representation of the input signal are provided along with means for outputting a digital representation of the appropriate range.

707,673
PATENT-4 245 169 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sampling Circuit and Method Therefor.
Patent.
C. Hamilton. Filed 14 Mar 79, patented 13 Jan 81, 10p PB81-600036, PAT-APPL-6-020 359

Keywords: *Analog, Signal, Josephson junction, Sampling circuit, Sampling pulses.

A sampling circuit and method therefor including a first Josephson junction for producing a series of sampling pulses for activating a second Josephson junction that is receptive of both the analog current signal being sampled and a bias current. The first Josephson junction is continually triggered at a fixed time relative to the repetitive analog signal to provide a series of sampling pulses and before each sampling pulse the bias level to the second Josephson junction is changed until the sum of the current from the sampling pulse, from the analog signal, and from the bias source exceeds the critical current value of the second Josephson junction causing it to switch from one voltage state to another. The value of the bias current at the point of switching is proportional to the current in the analog signal. In one embodiment, the bias current is increased in a step-like fashion for each sampling pulse from the first Josephson junction until the critical value of the second Josephson is reached. The resolution of the analog signal for this embodiment is 1/N if there are N samples. In another embodiment where the analog signal is known to exist between two exremes, the bias current for the first sample is initially positioned at a mid-range value between the extremes. If, at the sample time, the second Josephson junction is switched, the bias current for the next sample is reduced by 1/2. If the second Josephson junction has not switched, the bias current is increased by 1/2 for the next sample. This process continues for N samples, the resulting resolution being 1/2 N.

707,674
PATENT-4 264 423 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fluidic Thermistor/Fugacity Device.
Patent.
T. Negas, and L. Domingues. Filed 17 Sep 79, patented 28 Apr 81, 7p PB81-600039, PAT-APPL-6-076 478

Keywords: *Device for measuring the fugacity of a material, E.M.F. measuring circuit, Solid electrolyte probe.

A device for measuring the fugacity of a a material, without requiring a separate device to measure temperature, is disclosed, wherein the device is a solid electrolyte probe, with the probe having a passageway therein, the metallic conductor leads on the outside of the probe and on the inside of the probe in the passageway. The metallic conductor leads are in contact with an E.M.F. measuring circuit, with the reference fluid being passed through the passageway. The passageway also includes a capillary restriction therein, and measuring devices are provided to measure the pressure drop of the reference fluid when flowing through the capillary, thereby permitting determination of temperature. The temperature determination combined with the E.M.F. measurement permit determination of the fugacity of the material.

707,675
PATENT-4 638 257 Not available NTIS
Department of Commerce, Washington, DC.
Amplification by a Phase Locked Array of Josephson Junctions.
Patent,
D. G. McDonald. Filed 26 Nov 85, patented 20 Jan 87, 9p PB87-150470, PAT-APPL-6-801 972
Supersedes PB86-166386.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Phase locked systems, *Amplifiers, *Josephson junction, *Patent applications, Amplification, *Phase locked arrays, PAT-CL-330-61R.

A Josephson junction amplifier comprises an array of series connected Josephson junctions which are maintained in a finite voltage, mutually electromagnetically phase-locked state. An input signal is applied across a first group of one or more but less than all of the Josephson junctions, and the output is taken across a second group of the junctions which has a greater number of junctions than the first group. Alternatively, two arrays may be connected in parallel to provide stable electromagnetic phase locking.

707,676
PB-263 632/2 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
Servo Techniques in Oscillators and Measurement Systems.
Technical note,
F. L. Walls, and S. R. Stein. Dec 76, 27p NBS-TN-692

Keywords: *Frequency standards, *Parametrons, *Feedback control, *Oscillators, Voltage controlled oscillators, Frequency discriminators, Phased locked systems, Frequency stability, Servomechanisms, Crystal oscillators, Time domain.

Nearly every precision oscillator includes a frequency or phase servo system. In the case of cesium standards, a crystal oscillator is frequency locked to a particular resonance line in atomic cesium; in the case of an oscillating hydrogen maser, a crystal oscillator is phase locked to the very weak signal coming from the microwave cavity. The first section of this note treats the errors and offsets of frequency-lock loops which result from background, noise and other effects. Third harmonic lock systems and square wave frequency modulation are analyzed as possible solutions to some of these problems. The second section is a general treatment of servo system response which is applicable to both frequency and phase-lock loops. The effects of noise on such servo systems are discussed in detail, and an example is given of how to obtain optimum performance from a pair of phase-locked oscillators. A simple circuit is suggested for phase-locking high quality oscillators, which has many advantages over previous circuits.

707,677
PB-265 404/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Phenomena in Thin-Film Josephson Junctions Coupled to a Contiguous Microstrip Resonator,
T. F. Finnegan, L. B. Holdeman, and S. Wahlsten. 1976, 4p
Pub. in IEEE Trans. Magn. MAG-13, n1 p392-395 Jan 77.

Keywords: *Solid state devices, Josephson junctions, Strip transmission lines, Thin films, Resonators, Microwave equipment, Coherent radiation, Plasma oscillations, Reprints.

A half-wavelength microstrip resonator has been used to couple microwave radiation between Josephson junctions and an external 50 ohm transmission line, and various microwave properties of these resonator-coupled junction devices have been studied. The advantages of these devices in applications including coherent radiation emission, 2e/h precision voltage sources, and parametric plasma-related effects are described.

707,678
PB-271 585/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Low-Noise Josephson Mixer for the 1 mm Wavelength Range.
Final rept.,
J. Edrich, D. B. Sullivan, and D. G. McDonald. 1977, 4p
Sponsored in part by National Science Foundation, Washington, D.C.
Pub. in IEEE Trans. Microwave Theory Tech. MTT-25, n6 p476-479 Jun 77.

Keywords: *Mixing circuits, Josephson junctions, Heterodyning, Millimeter waves, Microwave receivers, Superconductivity, Extremely high frequencies, Electromagnetic noise, Low noise, Reprints.

A report is given of the results of measurements at 300 GHz with a tunable heterodyne receiver which uses a Josephson junction mixer. Through direct evaluation of the receiver noise performance, the single sideband

noise temperature of the mixer and the conversion loss are found to be 57 K and 12 db.

707,679

PB-274 498/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Improved Circuit for Implementing the Six-Port Technique of Microwave Measurements.
Final rept.,
G. F. Engen. 1977, 3p
Pub. in Proceedings 1977 IEEE-MTT-S Int. Microwave Symposium, San Diego, California, June 21-23, 1977, p53-55 1977.

Keywords: *Network analyzers, Automation, Microwave equipment, Microwaves, Six port systems.

In a companion paper, circuit design criteria have been developed which will lead to optimal results in applying the six-port technique to the measurement of microwave parameters. This paper describes what promises, in many situations, to become the 'preferred' six-port circuit.

707,680

PB-274 502/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Network Analyzer Using Two 6-Port Reflectometers.
Final rept.,
C. A. Hoer. 1977, 3p
Pub. in Proceedings 1977 IEEE-MTT-S Int. Microwave Symposium, San Diego, California, June 21-23, 1977, p47-49 1977.

Keywords: *Network analyzers, Microwave equipment, Reflectometers, Calibrating.

Theory is presented for designing a microwave network analyzer which measures the circuit parameters of a 2-port device by connecting small portable 6-port reflectometers on each side of the 2-port. Several calibration techniques are described, including self-calibration.

707,681

PB-275 190/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High-Frequency Limitations of the Double-Junction SQUID Amplifier.
Final rept.,
J. E. Zimmerman, and D. B. Sullivan. Sep 77, 3p
Sponsored in part by Office of Naval Research, Washington, D.C.
Pub. in Applied Physics Letters, v31 n5 p360-362 Sep 77.

Keywords: *Parametric amplifiers, Josephson junctions, *Squid devices, Reprints.

The double junction SQUID is viewed as a parametric amplifier, and mechanisms which place an upper limit on the pump frequency (and thus gain) are investigated. Self-induced steps in the I-V characteristics, as well as damping of the Josephson oscillation, are shown to be two limiting mechanisms.

707,682

PB-282 887/9 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Boulder, Colo. Electromagnetic Technology Div.
UHF Impulse Generator,
J. R. Andrews, and E. E. Baldwin. Apr 78, 30p
NBSIR-78-880

Keywords: *Pulse generators, Ultrahigh frequencies, Transistors, Circuits, Network synthesis, Avalanche effects(Electronics), Circuit diagrams.

The UHF Impulse Generator generates a narrow impulse with a flat spectrum up to 1 GHz. The impulse amplitude is 55 volts and the duration is 365 ps. The maximum repetition rate is 1 MHz. This report describes the generator in detail and includes a complete parts list and printed circuit artwork.

707,683

PB-284 574/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Results with the Special-Purpose Ammonia Frequency Standard.
Final rept.,
D. J. Wineland, D. A. Howe, and M. B. Mohler. 1977, 12p
ARPA Order-3140
Pub. in Proceedings of Annual Symposium on Frequency Control (31st), 1977, Fort Monmouth, N.J., June 1-3, 1977, p562-573.

Keywords: *Frequency standards, Ammonia, Radiofrequency oscillators, Frequency control, Frequency stability.

A special purpose frequency standard and clock has been developed, featuring a novel combination of stability and accuracy performance, shock and temperature insensitivity, instant turn-on characteristics, and the potential for low weight, over power consumption, and low fabrication costs. This device is based on the well-known 3-3 transition in ammonia (approximately 23 GHz), which provides the frequency reference for a approximately 0.5 GHz stripline oscillator. Its output is multiplied in one step to K-band and injected into a waveguide cell containing ammonia. The detected absorption feature is used to frequency lock the 0.5 GHz oscillator to line center. A fixed output frequency between 5 and 10 MHz is provided by direct division from 0.5 GHz. Observed stability is 2 x 10 to the minus 10 power from 10 to 6000 sec., and reproducibility is estimated to be plus or minus 2 x 10 to the minus 9 power. The rather broad linewidth of ammonia (approximately 100 kHz) allows a short servo attack time, thus reducing the acceleration sensitivity of the primary 0.5 GHz oscillator. Power consumption should be < 3 W and expected size of a working device 1000 cu cm. With further development, improvements in performance can be expected.

707,684

PB-284 632/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Improved Circuit for Implementing the Six-Port Technique of Microwave Measurements.
Final rept.,
G. F. Engen. Dec 77, 4p
Pub. in IEEE Trans. Microwave Theory Tech. MTT-25 n12 p1080-1083 Dec 77.

Keywords: *Network analyzers, Circuits, Microwaves, Measurement, Automation, Reflectometers, Reprints.

In a companion paper, circuit design criteria were developed which lead to optimal performance in applying the six-port technique to the measurement of microwave parameters. A circuit which approximately satisfies these new design goals is described. Together with its several variants, it promises to become, in many applications, the preferred six-port circuit.

707,685

PB-284 720/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Field-Usable Sharpless Wafers for Josephson Effect Devices at Millimeter Waves.
Final rept.,
J. Edrich, J. D. Cupp, and D. G. McDonald. Jan 74, 3p
Sponsored in part by National Science Foundation, Washington, D.C.
Pub. in Revue de Physique Appliquee 9, n1 p195-197, Jan 74.

Keywords: *Wafers, *Josephson junctions, *Solid state devices, Millimeter waves, Microwave equipment, Reprints.

It is shown how modified Sharpless wafers can be used for point contact Josephson effect detectors, converters, oscillators and parametric amplifiers. First experimental data indicate that this method results in devices that are rugged, can be permanently adjusted at room temperature, and can be cycled in temperature.

707,686

PB-285 233/3 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Boulder, Colo. Electromagnetic Technology Div.
SHF Impulse Generator.
Final rept. May-Sep 77,
J. R. Andrews, and E. E. Baldwin. Jun 78, 76p
NBSIR-78-888
Sponsored in part by Air Force Avionics Lab., Wright-Patterson AFB, Ohio.

Keywords: *Pulse generators, *Waveform generators, Superhigh frequencies, Picoseconds, Time domain.

A super-high-frequency (SHF) impulse generator designed and built by the National Bureau of Standards, is described in detail. The generator produces three different waveforms. The first is a simple impulse of 1 volt amplitude (3 V option) and 60 ps duration with a useful spectrum (15 dB down) extending from low frequencies out to 9 GHz. The second waveform is a single cycle 5 GHz sine wave (doublet) of 0.8 volts peak-to-peak amplitude (1.6V option). Its useful spectrum extends from 0.5 GHz to 11.7 GHz. The third waveform is an exponentially damped rf pulse. It has a center frequency of 12.5 GHz and a damping time constant of 1/4 ns. The peak-to-peak amplitude is 0.8 volts. The useful spectrum extends from 6 GHz to 18 GHz.

707,687

PB-285 336/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Design of a Josephson-Junction Picosecond Pulser.
Final rept.,
D. G. McDonald, R. L. Peterson, and B. K. Bender.
Dec 77, 4p
Pub. in Jnl. Appl. Phys., v48 n12 p5366-5369, Dec 77.

Keywords: *Pulse generators, Josephson junctions, Design, Integrated circuits, Picoseconds, Reprints.

Calculations are described which show that a Josephson junction, when driven by a microwave source, will produce a continuous train of picosecond-wide pulses. Detailed circuit designs, incorporating the microscopic theory of the junction, indicate that it is probably practical to build such pulsers. Furthermore, the theory indicates that picosecond pulses can be produced by circuits with submicron linewidth lithography, if desired. Thus, the possibility of both extremely fast and extremely high-density integrated circuits is supported by these calculations.

707,688

PB-285 348/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Speed Non-Overloading Discriminator for High Accuracy Pulse Counting.
Final rept.,
R. W. Shideler. 1976, 7p
Pub. in Int. Jnl. Mass Spectron. Ion., v21 p213-219, 1976.

Keywords: *Pulse discriminators, Pulse counters, Radiation counters, Tunnel diodes, Reprints.

A high speed preamplifier discriminator for use with electron multiplier particle counters has a pulse-pair resolution of less than 15 nsec. The design combines high sensitivity and exceptional overload performance to provide a stable error-free instrument requiring little or no operator attention. The device can be utilized in all high speed counting applications where high accuracy and wide dynamic range are requirements. Sensitivity may be externally controlled for remote operation.

707,689

PB-290 016/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Frequency-Lock System for Improved Quartz Crystal Oscillator Performance.
Final rept.,
F. L. Walls, and S. R. Stein. 1978, 4p
Pub. in IEEE Trans Instrum. Meas., vIM-27 n3 p249-252, Sep 78.

Keywords: *Crystal oscillators, Quartz resonators, Frequency stability, Circuits, Locking, Reprints.

The intrinsic noise of the best quartz crystal resonators is significantly less than the noise observed in oscillators employing these resonators. Several problem areas common to traditional designs are pointed out and a new approach is suggested for their solution. Two circuits are described which frequency lock a spectrally pure quartz crystal oscillator to an independent quartz crystal resonator. The performance of the composite system is predicted based on the measured performance of its components.

707,690

PB-291 709/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Terminology Related to the Performance of S/H, A/D, and D/A Circuits.
Final rept.,
S. K. Tewksbury, F. C. Meyer, D. C. Rollenhagen, H. K. Schoenwetter, and T. M. Souders. Jul 78, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Trans. on Circuits and Systems CAS-25, n7 p419-426, Jul 78.

Keywords: *Analog to digital converters, *Digital to analog converters, *Terminology, Definitions, Performance evaluation, Standards, Samplers, Data sampling, *Sample and hold circuits, Reprints.

A review of terminology, often misunderstood or misused, concerning the performance of sample-and-hold circuits, analog-to-digital converters, and digital-to-analog converters is presented. Although a set of general definitions is presented, definitions consistent with the needs of users and with the measurement capabilities of manufacturers are not easily obtained. The definitions presented have been selected by the authors from among definitions suggested by members of the Subcommittee on A/D and D/A Converters of the IEEE Network Applications and Standards Committee. It is hoped that others interested in the problem of terminology will transmit their opinions to one of the authors before any final recommendations are made by the Subcommittee.

707,691
PB-294 121/9 Not available NTIS
National Bureau of Standards, Washington, DC.
New Switching Technique for Binary Resistive Dividers.
Final rept.,
R. D. Cutkosky. Dec 78, 2p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-27, n4, p421-422, Dec 78.

Keywords: *Networks, Circuits, Binary digits, Switching, *Divider networks, Reprints.

A binary resistive divider network has been found which uses N cascaded DPDT reversing switches plus one SPDT switch for an N-bit divider. The network features a simple and accurate method for internal calibration. With a fixed divider input voltage the power dissipated in each resistive element is independent of switch setting.

707,692
PB-295 150/7 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Speed Low-Noise 18-Bit Digital-to-Analog Converter.
Final rept.,
H. K. Schoenwetter. Dec 78, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-27, n4, p413-417, Dec 78.

Keywords: *Digital to analog converters, Design, Reprints.

An 18-bit digital-to-analog converter (DAC) with a full-scale current output of 100 mA and a compliance voltage range of plus or minus 12V has been designed for use as a precision voltage output DAC. The output noise and settling time of the new design are considerably lower than obtainable from conventional design approaches. An accurate method of measuring settling time also is described.

707,693
PB-299 823/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Analog-to-Digital Conversion with a SQUID: Conditions for a Countable Pulse Train.
Final rept.,
R. L. Peterson. Jun 79, 9p
Pub. in Jnl. of Applied Physics 50, n6, p4231-4239, Jun 79.

Keywords: *Analog to digital converters, Superconductors, Josephson junctions, Pulse generators, Reprints, Squid devices, Pulse trains.

A superconducting loop containing a Josephon junction develops voltage pulses when it admits and expels magnetic flux quanta, and thus may be used as an A/D converter. The authors develops and discusses several conditions which must be satisfied for the generation by the SQIUD of an unambiguously countable pulse train, from which the analog signal can be faithfully reconstructed. These conditions can be satisfied over a broad range of realizable values of inductance and resistance. the capacitance, however, must be carefully controlled. The results of simulations are also presented, illustrating the various ways in which the pulse trains are affected.

707,694
PB-299 989/4 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Speed Superconducting Electronics.
Final rept.
C. A. Hamilton, R. E. Harris, and D. B. Sullivan. 1979, 4p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of Government Microcircuit Applications Conference, Monterey, CA., November 14-16, 1978, GOMAC 1978 Digest of Papers VII, p29-32 1979.

Keywords: *Microelectronics, *Superconductivity, Josephson junctions, Logic circuits, Strip transmission lines, Digital computers.

Superconducting electronics is an emerging technology which offers significant performance advances in digital computers and high-speed instruments. These advantages include low dissipation, high speed and packing density, and disperionless transmission lines.

707,695
PB77-600060 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Self-balancing D.C.-Substitution Measuring System.
N. T. Larsen, and G. R. Reeve. Filed 17 Jun 75, patented 22 Feb 77, 9p PAT-APPL-587 565, PATENT-4 008 610

Keywords: Bolometer, *D.C.-substitution technique, Differential operational amplifiers, Microwave power meter, Self-balancing two amplifier power meter.

A self-balancing D.C.-substitution R.F. power measuring system includes first and second high gain differential operational amplifiers, a bolometer element, and a reference resistor element. The amplifiers and the two elements are connected in a current loop with one of the elements connected between the output terminals from the differential amplifiers and the other of the elements connected between center points of isolated dual power supplies associated with each of the amplifiers. The inputs to one amplifier are connected from an adjacent end of one of the elements and the far end of the other element, while the inputs to the second amplifier are connected to the far end of the one element and the adjacent end of the other element. Current flows out of one amplifier and into the other. The current is driven to a value which maintains the potential between the input terminals of the first amplifier essentially equal to zero and the potential between the input terminals of the second amplifier essentially equal to zero. Thus, the current drives the value of the bolometer element to a resistance which is equal to the resistance of the reference element. An output connection to a voltmeter may be taken between corresponding ends of the elements. The bolometer element may be a thermistor or a barretter. The system may also be used in a hot-wire anemometer. In another version of the system, the current loop is established with one of the elements connected between the output of one amplifier and the center point of the power supply of the other amplifier and the other of the elements connected between the output of the other amplifier and the center point of the power supply of the one amplifier, the input connections to the amplifiers are taken from the same points, but with the input leads to the second amplifier interchanged.

707,696
PB80-105331 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
20 Bit + Sign, Relay Switched D/A Converter,
T. M. Souders, and D. R. Flach. Oct 79, 25p NBS-TN-1105

Keywords: *Digital to analog converters, Design, Standards, Electric potential.

A multirange, 20-bit + sign, voltage output d/a converter is described. The converter exhibits less than 1 ppm (of full scale range) linearly error, and temperature coefficients of gain, offset and linearly of less than 0.5 ppm/C. The design is based on the R-2R ladder network in the current steering mode, using miniature latching relays with mercury wetted contacts for switching. Ten buffered, temperature-controlled unsaturated standard cells comprise the voltage reference. Techniques with design details are presented for minimizing errors due to relay thermal emf's, for implementing a self-calibration of linearity errors, and for obtaining optional coding formats. Calibration techniques are discussed and representative calibration data are presented.

707,697
PB80-126436 Not available NTIS
National Bureau of Standards, Washington, DC.
Superconducting Sampler for Josephson Logic Circuits.
Final rept.,
C. A. Hamilton, F. L. Lloyd, R. L. Peterson, and J. R. Andrews. 1 Nov 79, 2p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Applied Physics Letters 35, n9, p718-719, 1 Nov 79.

Keywords: *Samplers, Logic circuits, Superconductivity, Amplitude, Josephson junctions, Switching, Measurement, Reprints.

A method is described for automating a technique which is used to sample transition duration (rise time) in superconducting logic circuits. The method is based on measuring the time at which a biased Josephson junction switches under the influence of an applied signal. The system transition duration is limited primarily by time jitter which is estimated to be 7 ps. Transition durations of as little as 9 ps have been observed.

707,698
PB80-126451 Not available NTIS
National Bureau of Standards, Washington, DC.
Multiple-Quantum Interference Superconducting Analog-to-Digital.
Final rept.,
R. E. Harris, C. A. Hamilton, and F. L. Lloyd. 1 Nov 79, 2p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Applied Physics Letters 35, n9, p720-721, 1 Nov 79.

Keywords: *Analog to digital converters, Superconductivity, Interferometers, Digital systems, Reprints, Quantum interactions.

Multiple-quantum interference is a superconducting interferometer used for analog-to-digital conversion. The simple fully parallel four-bit converter which is described is the first known use of this effect in a digital circuit. Sampling rates of 2 x 10 to the 8th power per second were achieved, and much higher rates appear possible.

707,699
PB80-198328 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Schottky Diode Bridge Sampling Gate.
Final rept.,
A. G. Perrey, and H. K. Schoenwetter. May 80, 21p NBS-TN-1121

Keywords: *Gates(Circuits), Electric bridges, Delay circuits, Pulse generators, Schottky barrier devices.

A Schottky diode bridge and associated gating and delay circuits have been designed to facilitate the measurement of low level signals preceded by large signals without overdriving the measuring instrument. This measurement problem occurs in testing or evaluating operational amplifiers, digital-to-analog converters, sample/hold amplifiers and other similar active circuits.

707,700
PB80-223480 Not available NTIS
National Bureau of Standards, Washington, DC.
Space Applications of Superconductivity: Microwave and Infrared Detectors.
Final rept.,
C. A. Hamilton. May 80, 9p
Contract NASA-A-437018(JM)
Pub. in Cryogenics 20, n5 p235-243 May 80.

Keywords: *Superconductivity, *Infrared detectors, *Spaceborne detectors, Utilization, Detectors, Jo-

sephson junctions, Parametric amplifiers, Microwave equipment, Reprints.

This is the fifth of a seven part series on the potential applications of superconductivity in space. The potential of superconducting microwave and infrared detectors for space applications is reviewed. The devices considered include bolometers, super-Schottky diodes and Josephson junctions operating as oscillators, mixers, and parametric amplifiers. In each case the description includes the physical mechanism, theoretical limits and the current state-of-the-art for the superconductivity device as well as its nonsuperconductivity competitors.

707,701
PB81-119844 Not available NTIS
National Bureau of Standards, Washington, DC.
Space Applications of Superconductivity: Resonators for High Stability Oscillators and Other Applications.
Final rept.
S. R. Stein. Jul 80, 10p
Contract NASA-A-437018(JM)
Pub. in Cryogenics 22, n7 p363-372 Jul 80.

Keywords: *Superconductivity, *Oscillators, *Resonators, Frequency stability, Niobium, Frequency standards, Utilization, Reprints.

This is the last in a seven part series on the potential applications of superconductivity in space. Superconducting oscillators have achieved better frequency stability than any other device for averaging times of 10 s to 1000 s. This high stability results from the use of solid niobium resonators having Q factors greater than 10 to the 10th power. Such oscillators have direct applications as clocks and spectrally pure sources. They may also be used for accurate measurements of many physical quantities and to perform a variety of experiments on fundamental constants, relativity, and gravity waves.

707,702
PB81-174120 Not available NTIS
National Bureau of Standards, Washington, DC.
Least Squares Solution for Use in the Six-Port Measurement Technique.
Final rept.
G. F. Engen. Dec 80, 5p
Pub. in IEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques MTT-28, n12 p1473-1477 Dec 80.

Keywords: *Network analyzers, Least squares method, Measurement, Reprints, Six-port.

Although based on the use of simple amplitude detectors, it is possible to obtain complex values of reflection coefficient, via the six-port technique, from the intersection of three circles in the complex plane, in a typical case, the circle centers are determined primarily by the six-port design and are nominally constant, while the radii are proportional to the square root of the ratio of the output of three of the detectors to a fourth one. As a practical matter, however, these circles will not intersect in a point because of noise or other errors in the detectors. This paper develops a procedure for choosing Gamma in this context. Moreover, the question of what may be inferred about the system performance from the extent of this intersection failure is briefly considered.

707,703
PB81-179723 Not available NTIS
National Bureau of Standards, Washington, DC.
Technique for Measuring the Equivalent RMS Input Noise of A/D Converters.
Final rept.
T. M. Souders, and J. A. Lechner. Dec 80, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-29, n4 p251-256 Dec 80.

Keywords: *Analog to digital converters, Noise, Measurement, Reprints.

The measurements are made at input voltages corresponding to the test converter's decision levels, where the effects of noise are most pronounced. A feedback loop incorporating the unit under test locates and locks onto these levels. The method utilizes a theoretical relationship between the input noise and an expected number of counts derived digitally from the feedback loop response. A low-noise wide-band operational amplifier is the only critical component required.

707,704
PB81-197535 Not available NTIS
National Bureau of Standards, Washington, DC.
Voltage-Controlled Phase Shifter for Measuring Transfer Function in the Presence of Noise.
Final rept.
J. E. Potzick, and B. Robertson. Feb 81, 7p
Pub. in Review of Scientific Instruments 52, n2 p280-286 Feb 81.

Keywords: *Phase shift circuits, Transfer functions, Measurement, Voltage controlled oscillators, Feedback circuits, Reprints, NTISCOMNBS.

A linear voltage-controlled phase shifter has been constructed for use in a feedback loop to measure the amplitude and phase of a signal buried in noise.

707,705
PB81-207334 Not available NTIS
National Bureau of Standards, Washington, DC.
Analog Measurement Applications for High Speed Josephson Switches.
Final rept.
C. A. Hamilton, F. L. Lloyd, and R. L. Kautz. 1 Jan 81, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics MAG-17, n1 p577-582, 1 Jan 81.

Keywords: *Josephson junctions, *Analog to digital converters, Sampling, Circuits, Superconductivity, Reprints, *Electronic switches, NTISCOMNBS.

This paper reviews high speed analog applications of Josephson switching devices. The design and performance of two different analog sampling circuits is described. A method is proposed for delivering room temperature signals to these samplers with 30 GHz or more of bandwidth. An analog-to-digital converter based on quantum interference comparators is also described. This device has achieved conversion rates of 2 x 10 to the 9th power samples per second.

707,706
PB81-236267 Not available NTIS
National Bureau of Standards, Washington, DC.
Modeling of Tunnel Diode Oscillators.
Final rept.
C. T. Van Degrift, and D. P. Love. May 81, 12p
Pub. in Review of Scientific Instruments 52, n5 p712-723 May 81.

Keywords: *Oscillators, Tunnel diodes, Computerized simulation, Computation, Reprints.

The detailed behavior of tunnel diode LC oscillators is calculated by three different methods and compared with experiment. The authors present both analytic formulas and numerical methods which give corrections to the oscillator frequency calculated using the expression 1/(LC) to the 1/2 power and show that these corrections are often not negligible. The calculations also yield rf amplitude, bias current dependence, and other details necessary for the full realization of the performance of LC oscillators as transducers of pressure, temperature and other physical quantities.

707,707
PB81-236598 Not available NTIS
National Bureau of Standards, Washington, DC.
Turn-on Delays in Single Josephson Junction Devices.
Final rept.
R. L. Peterson. 1980, 28p
Pub. in Proceedings of International Conference Superconducting Quantum Devices (2nd), Berlin, Germany, F.R., May 6-9, 1980, Paper in Squid '80, p685-702 1980.

Keywords: *Circuits, *Superconductivity, Josephson junctions.

Previous calculations of turn-on delays in circuits containing Josephson junctions have assumed a current stepped up suddenly from the critical value for switching. The author examines the more general cases of the current starting below the critical current, as well as ramping through the critical value at a finite rate. Formulas are developed for the ramp-rate dependence of turn-on delay where applicable and establish criteria for determining whether overdrive or ramp rate is the more important.

707,708
PB81-243404 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Calibration Service for Analog-to-Digital and Digital-to-Analog Converters.
Final rept.
T. M. Souders, D. R. Flach, and B. A. Bell. Jul 81, 75p NBS-TN-1145
Sponsored in part by Department of Defense, Washington, DC.

Keywords: *Calibrating, *Analog to digital converters, *Digital to analog converters.

An NBS calibration service for high performance 12- to 18-bit analog-to-digital converters (ADC's) and digital-to-analog converters (DAC's) is described. The service offers comprehensive measurements of linearity, differential linearity, gain, offset, and rms input noise (for ADC's), with systematic uncertainties as low as 3 ppm. Measurements are made at a minimum of 1024 different codewords. The measurement approach, design features, test programs and data reduction techniques are documented, as are the methods of error estimation and quality control. Representative reports of tests are included for both DAC's and ADC's.

707,709
PB82-217183 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Benefits and Costs of Improved Measurements: The Case of Integrated-Circuit Photomask Linewidths.
Final rept.
C. C. Rawie. Mar 82, 83p NBSIR-82-2458

Keywords: *Product inspection, *Masking, Dimensional measurement, Integrated circuits, Benefit cost analysis, Line width, Quality control, Optical microscopes, Calibrating, *Photomasks.

Accurate dimensional measurements are vital to quality control in the semiconductor industry. This paper presents a method for estimating the dollar cost-savings from improving integrated-circuit photomask linewidth measurements. The method is illustrated with a case study of a hypothetical semiconductor device manufacturer who uses a Standard Reference Material (SRM) developed at the National Bureau of Standards for optical microscope calibration. Benefits of investing in improved photomask linewidth measurements include reducing disputes between mask maker and mask customer, reducing waste of good photomasks, and increasing device yields. For the hypothetical manufacturer described in the study, these benefits were much greater than costs of implementing the new measurement procedures. While the model is tailored to photomask linewidth measurements, its concepts can be applied to many other types of measurements.

707,710
PB82-233586 Not available NTIS
National Bureau of Standards, Washington, DC.
Pulsing of Tunnel Diode LC Oscillator Sensors.
Final rept.
C. T. Van Degrift. 1981, 2p
Pub. in Physica 108B, p1361-1362 1981.

Keywords: *Detectors, *Oscillators, Tunnel diodes, Pulsation, Reprints.

It is demonstrated that tunnel diode LC oscillator sensors may be turned on and measured within 33 ms while still retaining a frequency precision of 0.01 ppm. This allows their use in very low temperature applications where power dissipation is a serious problem or in magnetic resonance applications where a pulsed rf susceptometer might be desirable. Furthermore, this makes practical the rapid scanning of a large array of sensors with one dc power source and measurement system.

707,711
PB83-179390 Not available NTIS
National Bureau of Standards, Washington, DC.
100 GHz Binary Counter Based on DC SQUID's.
Final rept.
C. A. Hamilton, and F. L. Lloyd. Nov 82, 4p
Pub. in IEEE Electron Device Lett. EDL-3, n11 p335-338 Nov 82.

Keywords: *Counting circuits, Digital systems, Reprints, SQUID devices, Binary counters.

A binary counter using bistable DC SQUIDs as flip flop circuits is demonstrated. All of the functions: load, count, store, read and clear can be performed. The use of single flux quantum logic results in high sensitivity (10 to the minus 18th power J input pulse energy), high speed (100 GHz count rate) and low power (10 to the minus 7th power W at 100 GHz count rate).

707,712
PB83-236463 Not available NTIS
National Bureau of Standards, Washington, DC.
Automatic Test Set for the Dynamic Characterization of A/D Converters.
Final rept.
T. M. Souders, D. R. Flach, and T. C. Wong. Mar 83, 7p
Sponsored in part by Department of Defense Calibration Coordination Group, Redstone Arsenal, AL.
Pub. in Institute of Electrical and Electronics Engineers Transactions on Instrumentation and Measurement IM-32, n1 p180-186 Mar 83.

Keywords: *Analog to digital converters, *Test equipment, Dynamic tests, Resolution, Step response, Reprints, *Automatic test equipment.

An automatic test set is described for measuring the dynamic characteristics of A/D converters having up to 16 bits of resolution. The test converter is exercised with stepped input changes typical of the conditions of actual use. All dynamic test parameters are under program control, making it possible to separate and measure dynamic errors of various sources. Typical test results are included.

707,713
PB84-133495 Not available NTIS
National Bureau of Standards, Washington, DC.
Superconducting 6-bit Analog-to-Digital Converter with Operation to 2 x 10 to the 9th Power Samples/Second.
Final rept.
C. A. Hamilton, and F. L. Lloyd. May 80, 3p
Pub. in IEEE Electron Device Letters EDL-1, n5 p92-94 May 80.

Keywords: *Analog to digital converters, Comparators, Interferometers, Reprints, Superconducting devices.

The design and performance of a 6-bit superconducting A/D converter are described. The converter is based on double junction interferometers used as current comparators. The unique periodic response of these comparators makes possible a fully parallel N-bit converter requiring only N comparators. Conversion rates up to 2 x 10 to the 9th power samples per second have been demonstrated.

707,714
PB84-162163 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Reference Flat Pulse Generator.
Technical note.
J. R. Andrews, B. A. Bell, and E. E. Baldwin. Oct 83, 74p NBS-TN-1067

Keywords: *Pulse generators, Waveform generators, Standards, Design.

A reference step-like pulse generator is described which has been developed at NBS. This generator can be used for accurately characterizing the step response of various kinds of transient recording equipment (oscilloscopes, waveform recorders, transient digitizers, etc.). Basic design principles are given as well as complete circuit diagrams and descriptions. An analysis of the output stage of the generator is presented together with the circuit models for developing a time-domain computer simulation program using extended-SCEPTRE. Preliminary specifications indicate that the NBS Reference Flat Pulse Generator provides a negative-going reference transition duration (90 to 10 percent) of 600 ps, plus or minus 2 percent after 5 ns.

707,715
PB84-221662 Not available NTIS
National Bureau of Standards, Washington, DC.
8-Bit Superconducting A/D Converter.
Final rept.
C. A. Hamilton, and F. L. Lloyd. May 83, 3p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers), Transactions on Magnetics MAG-19, n3 p1259-1261 May 83.

Keywords: *Analog to digital converters, Superconductivity, Reprints, SQUID devices.

The design, fabrication and testing of a superconducting 8-bit converter are presented. Experimental results show essentially monotonic output code at conversion rates of a few megahertz. An algorithm for automatic adjustment and potential problems of higher speed operation are discussed.

707,716
PB84-227115 Not available NTIS
National Bureau of Standards, Washington, DC.
Power Gain of a SQUID (Superconducting Quantum Interference Device) Amplifier.
Final rept.
D. G. McDonald. 1 Mar 84, 3p
Pub. in Applied Physics Letters, v44 n5 p558-566, 1 Mar 84.

Keywords: *Microwave amplifiers, *Power gain, Superconductors, Reprints, *SQUID devices.

The power gain of a dc superconducting quantum interference device (SQUID) amplifier, with tuned input and output circuits, is computed as a function of the current and magnetic biases. A gain of 20300 is found at 1.5 GHz and 3470 at 3.0 GHz, implying a frequency dependence to the gain of approximately 1/(omega squared). The gain, as derived from the resistively shunted junction model, is compared with the gain of a simplified model based on the dc magnetic response (V sub phi). This comparison shows that the (V sub phi) description of the SQUID can lead to large errors.

707,717
PB84-227248 Not available NTIS
National Bureau of Standards, Washington, DC.
Dual Six-Port Network Analyzer Using Diode Detectors.
Final rept.
J. R. Juroshek, and C. A. Hoer. Jan 84, 5p
Sponsored in part by Aerospace Guidance and Metrology Center, Newark AFS, OH.
Pub. in IEEE Transactions on Microwave Theory and Techniques MTT-32, n1 p78-82 Jan 84.

Keywords: *Network analyzers, Attenuation, Microwave frequencies, Measurement, Performance, Electrical impedance, Diodes, Calibrating, Reprints.

The performance of a dual six-port network analyzer using diode detectors is described. The network analyzer operates over the 2-18 GHz band using commercially available, low-barrier, Schottky diodes. The paper describes the process for calibrating the diodes for deviation from square-law. Measurement results are presented showing the accuracy and precision of the six-port network analyzer when measuring 1-port and 2-port devices.

707,718
PB85-129328 Not available NTIS
National Bureau of Standards, Washington, DC.
Two-Port Network Representation Based on a Unsymmetry Factor, with Applications to Coaxial Measurement.
Final rept.
A. Millea. 1971, 4p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Instrumentation and Measurement 20, n2 p123-126 May 71.

Keywords: *Network synthesis, Equivalent circuits, Measurement, Reprints, Two ports.

A network representation for linear, passive and reciprocal two-port devices is described, using as parameters the longitudinal impedance z, the transverse admittance y and the unsymmetry factor k. This representation offers certain advantages in connection with high-frequency and microwave impedance measurements.

707,719
PB85-143519 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Conversion Gain in mm-Wave Quasiparticle Heterodyne Mixers.
Final rept.
T. M. Shen, P. L. Richards, R. E. Harris, and F. L. Lloyd. 1980, 3p
See also AD-A100 128.
Pub. in Applied Physics Letters 36, n9 p777-779, 1 May 80.

Keywords: *Microwave equipment, *Josephson junctions, Heterodyning, Millimeter waves, Radio astronomy, Radio receivers, Cryogenics, Reprints, *Mixers(Electronics).

The rapid onset of quasiparticle tunneling current in superconductor-insulator-superconductor (Josephson) junctions at voltages above the full energy gap has been used in previous experiments for millimeter wave heterodyne mixing. Very low mixer noise temperatures have been observed, but with low conversion efficiency so that the noise in available IF amplifiers strongly dominates the total receiver noise. J. R. Tucker has recently predicted that mixing can occur with conversion gain when such a mixer is operated in the quantum limit. In this letter the authors report the observation of stable mixing with significant conversion gain and with noise temperatures comparable with the photon noise limit. (Double-sideband, L sup -1 = 1.40 + or - 0.14 at 36 GHz, T sub M = or < 1.5 K).

707,720
PB85-187409 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Solid-State Reference Waveform Standard.
Final rept.
R. A. Lawton, N. N. Nahman, and J. M. Bigelow. Sep 84, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-33, n3 p201-205 Sep 84.

Keywords: *Waveforms, *Standards, Electric filters, Solid state devices, Reprints.

A solid-state reference waveform filter has been developed which uses the Maxwell-Wagner capacitor effect. This filter is realized in a stripline configuration with a lossy dielectric consisting of a thick (5 micrometers) layer of SiO2 on Si. The equivalent circuit of this filter is equivalent to that for previously developed filters which used a lossy liquid dielectric. A preliminary design has been completed and a filter fabricated for which the design characteristic impedance, 38 ohms, and transition duration (rise time), 300 ps, agree with measured values to within 2 and 17 percent, respectively. The temperature dependence of the filter transition duration has been estimated from the temperature dependence of the filter conductance to be about 1 percent/C.

707,721
PB86-112190 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Technique for Extending the Dynamic Range of the Dual Six-Port Network Analyzer.
Final rept.
J. R. Juroshek, and C. A. Hoer. Jun 85, 7p
Sponsored by Aerospace Guidance and Metrology Center, Newark AFS, OH.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques, MTT-33 n6 p453-459 Jun 85.

Keywords: *Network analyzers, Microwave equipment, Reprints.

The dynamic range of the six-port type of automatic network analyzer is typically limited to measuring two-port devices with a transmission coefficient in the range of 0 to -60 dB. The following describes a subcarrier approach for extending the dynamic range of the dual six-port network analyzer.

707,722
PB86-112752 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Fabrication of a Miniaturized DCL (Direct-Coupled-Logic) OR Gate.
Final rept.
R. H. Ono, J. A. Beall, and R. E. Harris. 1985, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics MAG-21, n2 p846-849 Mar 85.

Keywords: *Gates(Circuits), *Logic circuits, Josephson junctions, Superconductivity, Reprints, Electron beam lithography.

Using niobium edge junctions and electron beam lithography (EBL), the authors have made direct-coupled-logic (DCL) or gates with 1 micrometer minimum

line widths. The gate cell, containing an isolator and a buffer section, fits into an area of approximately 25 by 30 square micrometers. The computer simulations show that these gates can have switching times of less than 10 ps. The authors have simulated the DCL circuit with several values of the most space-consuming element, an inductor. The paper describes the results of these simulations and presents a detailed description of the 7-level fabrication process. The mix of optical and electron-beam lithography used relies heavily on an inexpensive, yet powerful, circuit layout program.

707,723
PB86-122801 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Automatic Frequency Response of Frequency-Modulated Generators Using the Bessel Null Method.
Final rept.
J. R. Major, E. M. Livingston, and R. T. Adair. 1985, 23p
Sponsored by Army Communications-Electronics Command, Fort Monmouth, NJ.
Pub. in Proceedings of ARFTG Conference (24th), Columbia, MD., December 5-6, 1984, p131-153 Mar 85.

Keywords: *Signal generators, *Frequency response, Frequency modulation, Curve fitting, Frequency meters, Bessel null.

The paper describes a Bessel null technique to measure the frequency response of a frequency-modulated rf carrier and a program to automate frequency response measurements of signal generators with output frequencies from 0.450 to 2000 MHz. The measurements obtained using this technique are more accurate than those obtained by a highly trained technician using a manual system. Automated measurement of this process is desirable since the manual method is subject to the following problems: (1) excessive time; (2) error in finding the null; and (3) lack of assurance that the null is the first Bessel null. Automated measurements can be performed using a system controller, a spectrum analyzer, a function generator, and a voltmeter (all of which are compatible and controllable remotely).

707,724
PB85-133444 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Sensitivity Analysis of SPICE Parameters Using an Eleven-Stage Ring Oscillator.
Final rept.
J. M. Cassard. 1984, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Jnl. of Solid State Circuits SC-19, n1 p130-135, 1 Feb 84.

Keywords: *Circuits, *Simulators, Wafers, Simulation, Dynamic response, Sensitivity, CMOS, Chips(Electronics).

The paper presents examples of how well model parameters extracted from a test chip can predict the ac response of a dynamic circuit element on the same wafer. Simulation results show which model parameters are critical to performance. A comparison between measurement and simulation results is given and the importance of intrachip and intra-wafer parameter variations is discussed. For the samples tested, the polysilicon gate linewidth variation was determined to be the primary cause of the ring oscillator frequency variation.

707,725
PB86-134889
(Order as PB86-134871, PC **A09**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Digital Waveform Synthesis Techniques.
N. M. Oldham. Oct 85, 13p
Included in Proceedings of Seminar on Digital Methods in Waveform Metrology, p1-13 Oct 83.

Keywords: *Waveform generators, Digital systems, Synthesis.

Digital waveform generators provide an economical means for producing stable, high fidelity signals over a limited frequency range. Some theoretical properties and practical limitations have been described, with emphasis on sinewave reconstruction. Digital synthesis, however, is particularly suited to the construction of complex waveforms which are extremely difficult to produce by conventional analog means. Instrumentation is commercially available which allows the user to program arbitrary waveforms with 8-12 bit resolution at sampling frequencies up to 5 MHz.

707,726
PB86-160686 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Wide-Band Transconductance Amplifier for Current Calibrations.
Final rept.
O. B. Laug. 1985, 5p
Pub. in IEEE (Institute of Electrical and Electronic Engineers) Transactions on Instrumentation and Measurement IM-34, n4 p639-643 Dec 85.

Keywords: *Current amplifiers, *Transconductance, Calibrating, Electric currents, Phase measurement, Reprints.

A wide-band transconductance amplifier for current calibrations is described. The amplifier will deliver a ground-referenced constant current of 5 A rms from dc to over 100 kHz. Its stable magnitude and phase permit it to be used in precise power calibration systems to provide the current component of a phantom power source. The amplifier also provides a ground-referenced voltage output of 1 V/A for monitoring the magnitude and phase of the output current.

707,727
PB86-202991 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
Automated Measurement of Frequency Response of Frequency-Modulated Generators Using the Bessel Null Method.
J. R. Major, E. M. Livingston, and R. T. Adair. Mar 86, 34p NBS/TN-1093
Also available from Supt. of Docs as SN003-003-02728-6. Sponsored by Army Communications-Electronics Command, Fort Monmouth, NJ.

Keywords: *Signal generators, *Frequency response, Frequency modulation, Measurement, Remote control, Measuring instruments, Bessel null.

The paper describes a Bessel null technique to measure the frequency response of a frequency-modulated rf carrier and a program to automate frequency response measurements of signal generators with output frequencies from 0.450 to 2000 MHz. The measurements obtained using the technique are more precise than those obtained by a highly trained technician using a manual system. Automated measurement of the process is desirable since the manual method is subject to the following problems: (1) excessive time, (2) error in finding the null, and (3) lack of assurance that the null is the first Bessel null. Automated measurements can be performed using a system controller, a spectrum analyzer, a function generator, and a voltmeter (all of which must be compatible and controllable remotely).

707,728
PB86-229796 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Broad-Band RF Match to a Millimeter-Wave SIS Quasi-Particle Mixer.
Final rept.
A. V. Raisanen, W. R. McGrath, P. L. Richards, and F. L. Lloyd. 1985, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques MTT-33, n12 p1495-1500 Dec 85.

Keywords: *Mixing circuits, Josephson junctions, Superconductivity, Millimeter waves, Radio astronomy, Reprints.

An integrated superconducting microstrip is shown to be a convenient, flexible, and well-characterized matching element for a super-conductor-insulator-superconductor (SIS) quasi-particle heterodyne mixer. The resonant interaction (Fiske modes) between the Josephson oscillations of a voltage-biased junction and the microstrip provides a convenient method for determining the electrical length of the microstrip line. An open-circuited microstrip stub that reflects a parallel inductance across the junction is used to broaden the bandwidth of the RF match of a 30-40-GHz SIS mixer. Measurements with Pb-alloy junctions in a full-height waveguide mixer with fixed mechanical tuning give an instantaneous bandwidth of 10 to 15 percent with a mixer noise temperature (T sub M) (DSB)= 10 + or - 2.5 K.

707,729
PB86-242005 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Multiport Network Analyzers.
Final rept.
C. A. Hoer. 1986, 4p
Pub. in McGraw-Hill Yearbook of Science and Technology, p289-292 1986.

Keywords: *Network analyzers, Reprints.

The paper is a tutorial summary of the principles of multiport network analyzers, their use in microwave measurements of reflection coefficient and scattering parameters, and the significance of this development for the field of microwave measurements.

707,730
PB87-106381 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Efficient Antialiasing Filter.
Final rept.
R. A. Lawton. 1985, 4p
Pub. in IEEE Transactions on Instrumentation and Measurement IM-34, n4 p570-573 Dec 85.

Keywords: *Electric filters, Waveforms, Measurement, Solid state devices, Reprints, Time domain.

The application of a solid-state reference filter as an efficient antialiasing filter is described. The analytical basis for the efficiency of the filter is described and a specific example of measuring a 1024-point waveform with an RC filter and the solid-state filter is given.

707,731
PB87-122321 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Surge Suppressors and Clamps.
Final rept.
F. D. Martzloff. 1986, 7p
Pub. in Proceedings of EMC EXPO 86 International Conference on Electromagnetic Compatibility, Washington, DC., June 16-19, 1986, pE01.1-E01.7.

Keywords: *Circuit protection, Avalanche diodes, Varistors, *Surge suppressors, Transients.

The paper presents a review of technologies developed for surge suppressor devices used in electronic circuits. Three generic types are described: crowbars, varistors, and avalanche diodes. The significant differences in their performance characteristics are pointed out, with guidance on proper application and measurements.

707,732
PB87-153839 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Modeling a Voltage-Locked Josephson Junction Array Amplifier: Gain, Input Impedance, and Bandwidth.
Final rept.,
D. G. McDonald. 1986, 11p
Pub. in Jnl. of Applied Physics 60, n9 p3247-3257, 1 Nov 86.

Keywords: *Josephson junctions, *Amplifiers, *Equivalent circuits, Superconductivity, Reprints.

Previously published experimental results are used to deduce an equivalent circuit for this amplifier, based on the shunted junction model. It is found that the very small inductances of the junction shunt resistors play an important role in determining the shape of the current-voltage curves in the voltage-locked region. Once the circuit is determined using the shunted junction model a combination of an approximation method (the method of slowly varying amplitudes) and the shunted junction model is used to approximately maximize the power gain of the circuit. The maximum gain achieved in these simulations of the two-junction amplifier is 11.3. The gain occurred with a negative resistance input impedance of -0.41R and a signal source impedance of 0.167R, where R is the junction shunt resistance. It is estimated that the bandwidth of the amplifier is about 1 GHz.

707,733
PB87-161550 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Quench Circuit for Electronic Instruments Used with Superconducting Magnets.
Final rept.,
R. G. Benson, R. B. Goldfarb, and E. S. Pittman. Sep 86, 2p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Cryogenics 26, p482-483 Aug-Sep 86.

Keywords: *Superconducting magnets, *Electrically powered instruments, Protection, Reprints, Quenching.

A multifunction circuit is described that protects instruments connected or coupled to a superconducting magnet in the event of a quench.

707,734
PB87-179420 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Wide-Band Low Noise MM-Wave SIS Mixers with a Single Tuning Element.
Final rept.,
A. V. Raisanen, D. G. Crete, P. L. Richards, and F. L. Lloyd. 1986, 18p
Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in International Jnl. of Infrared and Millimeter Waves 7, n12 p1835-1852 1986.

Keywords: Extremely high frequencies, Millimeter waves, Reprints, *Mixers(Electronics), Quasi particles, Low noise.

Several SIS quasiparticle mixers have been designed and tested for the frequency range from 80 to 115 GHz. The sliding backshort is the only adjustable RF tuning element. The RF filter reactance is used as a fixed RF matching element. A mixer which uses a single 2 x 2 micrometer squares Pb-alloy junction in a quarter-height waveguide mount has a coupled conversion gain of GM(DSB) equals 2.6 + or - 0.5 dB with an associated noise temperature of TM(DSB) = 16.4 +or - 1.8 K at the best DSB operation point. The receiver noise temperature TR(DSB) is 27.5 + or - for the mixer test apparatus. The mixer provides a SSB receiver noise temperature below 50K over the frequency range from 91 to 96 GHz, the minimum being TR(SSB) equals 44 + or - 4 K. Another mixer with an array of five 5 x 5 micrometers suares junction in series in a full-height waveguide mount has much lower noise temperature TM(DSB) equals 6.6 + or - 1.6 K, but less gain GM(DSB) = -5.1 + or - -5.1 + or - 0.5 dB.

707,735
PB87-180907 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Low Noise SIS Mixer with Gain for 80-115 GHz.
Final rept.,
A. V. Raisanen, D. G. Crete, P. L. Richards, and F. L. Lloyd. 1986, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Proceedings of ESA Workshop on a Space-Borne Sub-Millimetre Astronomy Mission, Segovia, Spain, June 4-7, 1986, p255-258

Keywords: Extremely high frequencies, Millimeter waves, *Mixers(Electronics), Quasi particles, Low noise.

Several SIS quasiparticle mixers have been designed and tested for the frequency range from 80 to 115 GHz. The sliding backshort is the only adjustable RF-tuning element. The RF-filter reactance is used as a fixed RF-matching element. A mixer which uses a single 2 x 2 micrometers squared Pb-alloy junction in a 1/4-height waveguide mount has a coupled conversion gain of GM(DSB) = 2.6 + or - 0.5 dB with an associated noise temperature of TM(DSB) =16.4 + or - 1.8 K at the best DSB operation point. The receiver noise temperature TR(DSB) is noise temperature below 50 K over the frequency range from 91 to 96 GHz, the minimum being TR(SSB) equals 44 + or - 4 K.

707,736
PB87-191052 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Performance of Arrays of SIS Junctions in Heterodyne Mixers.
Final rept.,
D. G. Crete, W. R. McGrath, P. L. Richards, and F. L. Lloyd. 1987, 6p
Sponsored by Office of Naval Research, Washington, DC., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques MTT-35, n4 p435-440 Apr 87.

Keywords: Josephson junctions, Millimeter waves, Extremely high frequencies, Performance, Arrays, Reprints, *Mixers(Electronics).

A systematic experimental study was made of the performance of millimeter-wave quasiparticle heterodyne mixers which use arrays of SIS tunnel junctions. Sets of arrays with N = 1, 5, 10, 25, and 50 junctions in series were fabricated by photolithography. All of the arrays in a given set were made on a single silicon wafer so that their response time parameter (omega sub s) (R sub N)C would be the same. Junction areas were scaled so that the total impedance was the same for each array in a set. Sets of arrays from four wafers with values of (omega sub s)(R sub N)C ranging from 2.6 to 13 were evaluated in mixers at 33 and 36 GHz.

707,737
PB87-191136 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Phase Lock of a Long Josephson Junction to an External Microwave Source.
Final rept.,
M. Cirillo, and F. L. Lloyd. 1987, 5p
Pub. in Jnl. of Applied Physics 61, n7 p2581-2585, 1 Apr 87.

Keywords: *Josephson junctions, *Microwave oscillators, *Phased locked systems, Reprints.

A long Josephson junction dc biased on a zero-field singularity and emitting radiation at microwave frequencies was irradiated with external microwave power. This power can be supplied either by a room-temperature oscillator or by another long junction. It was found that the oscillations of the junction can coherently lock to the external signal for frequency intervals ranging from 500 MHz. The dependence of the width of these intervals of coherence on the external microwave power was measured for the case in which the power is generated by a room-temperature oscillator.

707,738
PB87-201687 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Precision Power Amplifier for Power/Energy Calibration Applications.
Final rept.,
O. B. Laug. 1987, 6p
Pub. in Proceedings of the Institute of Electrical and Electronics Engineers Instrumentation and Measurement Technology Conference, Boston, MA, April 27-29, 1987, p129-134 1987.

Keywords: *Power amplifiers, Metal oxide transistors, Field effect transistors, MOSFET.

A precision power amplifier for use in power/energy calibration applications is described. The amplifier was primarily designed to boost the output amplitude of a dual-channel digital generator to provide the nominal 120 or 240 rms voltage component of a 'phantom' calibration power source. The amplifier has a fixed gain of 40 and can provide a maximum output voltage swing of 970 volts peak-to-peak or 340 V rms at 100 + or -5 rms. The bandwidth is from dc to 150 kHz and at 60 Hz the observed no-load, short-term amplitude and phase instabilities are + or - 5 ppm and + or - 5 microradians, respectively. The amplifier design uses high voltage N-channel MOSFETs in the output driver stage together with a unique circuit topology of opto-isolators between the low-level input stage and the high-level output stage.

707,739
PB88-109095 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Calibrating a Dual Six-Port or Four-Port for Measuring Two-Ports with Any Connectors.
Final rept.,
C. A. Hoer, and G. F. Engen. 1986, 4p
Pub. in 1986 IEEE (Institute of Electrical and Electronics Engineers) MTT-S Digest, p665-668 1986.

Keywords: *Network analyzers, Electrical measurement, Phase shift, Reflection, Scattering, Attenuation, Reprints, *Automatic network analyzers, Calibration, Six port, Four port, Two port.

A technique is described for calibrating a dual six-port or four-port ANA so that the scattering parameters of two-port devices having any combination of connectors can be measured. The technique is a generalization of the 'thru-reflect-line' (TRL) calibration technique in which the 'thru' is replaced with a second length of precision transmission line.

707,740
PB88-109152 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
On-Line Accuracy Assessment for the Dual Six-Port ANA (Automatic Network Analyzer): Background and Theory.
Final rept.,
G. F. Engen. 1987, 6p
See also PB88-109160.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p501-506 Jun 87.

Keywords: *Network analyzers, Electrical measurement, Microwave equipment, Metrology, Accuracy, Reprints, *Automatic network analyzers, On line systems, Six port.

One of the major challenges confronting the microwave metrologist today is that of providing an accuracy assessment for the automatic network analyzer (ANA). The paper provides the background and theory for the recently developed on-line solution now in use with the six-port systems at the National Bureau of Standards.

707,741
PB88-109160 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
On-Line Accuracy Assessment for the Dual Six-Port ANA (Automatic Network Analyzer): Background and Theory.
Final rept.,
G. F. Engen. 1986, 1p
See also PB88-109152.
Pub. in Proceedings of Conference on Precision Electromagnetic Measurement, Gaithersburg, MD., June 23-27, 1986, p236.

Keywords: *Network analyzers, Electrical measurement, Microwave equipment, Metrology, Accuracy, *Automatic network analyzers, On line systems, Six port.

One of the major challenges confronting the microwave metrologist today is that of providing an accuracy assessment for the automatic network analyzer (ANA). This provides the background and theory for the recently developed on-line solution now in use with the six-port systems at the National Bureau of Standards.

707,742
PB88-109202 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
On-Line Accuracy Assessment for the Dual Six-Port ANA (Automatic Network Analyzer): Extension to Nonmating Connectors.
Final rept.,
C. A. Hoer, and G. F. Engen. 1987, 6p
See also PB88-109210.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p524-529 Jun 87.

Keywords: *Network analyzers, Electrical measurement, Electrical impedance, Electric connectors, Error analysis, Reflection, Scattering, Accuracy, Reprints, *Automatic network analyzers, On line systems, Six port.

A technique is described for calibrating a dual six-port or four-port automatic network analyzer (ANA) so that the scattering parameters of two-port devices having

any combination of connectors can be measured. The technique is a generalization of the 'thru-reflect-line' (TRL) calibration technique in which the thru is replaced with a second length of precision transmission line. Expressions for errors associated with the second line are derived.

707,743
PB88-109210 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
On-Line Accuracy Assessment for the Dual Six-Port ANA (Automatic Network Analyzer): Extension to Non-Mating Connectors.
Final rept.,
C. A. Hoer, and G. F. Engen. 1986, 2p
See also PB88-109202.
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Gaithersburg, MD., June 23-27, 1986, p241-242.

Keywords: *Network analyzers, Electrical measurement, Electrical impedance, Electric connectors, Reflection, Scattering, Attenuation, Accuracy, *Automatic network analyzers, On line systems, Six port, Calibration.

In a series of companion papers the background, theory, and experimental results have been presented for a real-time on-line accuracy assessment for the dual six-port ANA. As formulated, however, the procedures are based on the thru-reflect-line (TRL) calibration procedure which, in turn, assumes that the connector interface is of the 'sexless' variety. The paper extends the methodology to mating (e.g. Type N) connector types and also to devices with 'non-insertable' connectors.

707,744
PB88-109228 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
On-Line Accuracy Assessment for the Dual Six-Port ANA (Automatic Network Analyzer): Treatment of Systematic Errors.
Final rept.,
C. A. Hoer. 1987, 6p
See also PB88-109236.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p514-519 Jun 87.

Keywords: *Network analyzers, Electrical measurement, Electrical impedance, Microwave equipment, Reflection, Scattering, Accuracy, Error analysis, Reflectometers, Reprints, *Automatic network analyzers, On line systems, Six port, Four port.

Expressions are derived for calculating estimates of the systematic errors in dual six-port or four-port measurements of reflection coefficient and scattering parameters due to imperfections in the transmission-line standard used to calibrate the system. A new mathematical model for a four-port reflectometer makes it easier to visualize and analyze these errors. In the new model, two of the three parameters needed to characterize a four-port can be determined without standards. All imperfections in the standard perturb only the third parameter which acts as an impedance transformer.

707,745
PB88-109236 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
On-Line Accuracy Assessment for the Dual Six-Port ANA (Automatic Network Analyzer): Treatment of Systematic Errors.
Final rept.,
C. A. Hoer. 1986, 2p
See also PB88-109228.
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Gaithersburg, MD., June 23-27, 1986, p238-239.

Keywords: *Network analyzers, Electrical measurement, Electrical impedance, Error analysis, Reflectometers, Reflection, Scattering, Accuracy, *Automatic network analyzers, On line systems, Six port, Four port.

Expressions are derived for calculating systematic errors in dual six-port or four-port measurements of reflection coefficient and scattering parameters due to imperfections in the transmission line standard used to calibrate the system. A new mathematical model for a four-port reflectometer makes it easier to visualize and analyze these errors.

707,746
PB88-109269 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
On-Line Accuracy Assessment for the Dual Six-Port ANA (Automatic Network Analyzer): Experimental Results.
Final rept.,
J. R. Juroshek. 1987, 4p
See also PB88-109277.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p520-523 Jun 87.

Keywords: *Network analyzers, Electrical measurement, Electrical impedance, Microwave equipment, Reflection, Accuracy, Estimates, Reprints, *Automatic network analyzers, On line systems, Six port.

The accuracy of a modern automatic network analyzer (ANA) is a function of a number of variables. Connector quality, operator technique, system hardware, and system calibration are just a few of the many parameters that affect the day-to-day accuracy of an automated system. The paper describes the results of the current efforts at NBS to implement on-line accuracy estimates for its dual six-port network analyzers. Results are presented showing uncertainty estimates obtained in quasi-real time during the measurement of customers devices.

707,747
PB88-109277 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
On-Line Accuracy Assessment for the Dual Six-Port ANA (Automatic Network Analyzer): Experimental Results.
Final rept.,
J. R. Juroshek. 1986, 1p
See also PB88-109269.
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Gaithersburg, MD., June 23-27, 1986, p240.

Keywords: *Network analyzers, Electrical measurement, Electrical impedance, Reflection, Accuracy, Estimates, *Automatic network analyzers, On line systems, Six port.

The accuracy of a modern automatic network analyzer is a function of a number of variables. Connector quality, operator technique, system hardware, and system calibration are just a few of the many variables that can affect the day-to-day accuracy. The talk describes the results of the current efforts at NBS to implement online accuracy estimates for its Dual Six-Port network analyzers. Results are presented showing uncertainty estimates obtained in quasi-real time during the measurement of customers' devices.

707,748
PB88-109285 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
On-Line Accuracy Assessment for the Dual Six-Port ANA (Automatic Network Analyzer): Statistical Methods for Random Errors.
Final rept.,
R. M. Judish, and G. F. Engen. Jun 87, 7p
See also PB88-109293.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p507-513 Jun 87.

Keywords: *Network analyzers, Electrical measurement, Random error, Standard deviation, Accuracy, Reprints, *Automatic network analyzers, Nonlinear estimation, Six port, Calibration, Uncertainty, On line systems.

A basic property of a measurement process is that repeated observations of the same quantity will not give identical results due to the presence of random errors. In order to assess the effects of random errors in the authors measurement process, they need to build in redundancy. The paper presents a brief summary of the statistical methods used to evaluate the random errors in dual six-port measurements of reflection coefficient and scattering parameters.

707,749
PB88-109293 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
On-Line Accuracy Assessment for the Dual Six-Port ANA (Automatic Network Analyzer): Statistical Methods for Random Errors.
Final rept.,
R. M. Judish. 1986, 1p
See also PB88-109285.
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Gaithersburg, MD., June 23-27, 1986, p237.

Keywords: *Network analyzer, Electrical measurement, Random error, Least squares method, Accuracy, *Automatic network analyzers, On line systems, Six port.

A basic property of a measurement process is that repeated observations of the same quantity will not give identical results due to the presence of random errors. In order to access the effects of random errors in the authors measurement process, they need to build in redundancy. The paper presents the statistical methods which convert the redundancy built into the Dual Six-Port Automatic Network Analyzer (ANA) into meaningful estimates of the random errors.

707,750
PB88-111182 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Test-Point Selection and Testability Measures via QR Factorization of Linear Models.
Final rept.,
G. N. Stenbakken, and T. M. Souders. 1987, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p406-410 Jun 87.

Keywords: Electrical faults, Selection, Mathematical models, Algorirthms, Reprints, *Electrical networks, Test methods, Factorization, Calibration.

An efficient algorithm is presented for selecting test points for use in applications such as calibration and fault diagnosis of electronic networks. The algorithm, based on QR factorization of the circuit sensitivity matrix, minimizes the prediction or estimation errors which result from random measurement error. A definition of testability based on the concept of minimum estimation error is also introduced. Practical examples are given.

707,751
PB88-111208 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Design and Characterization of a Programmable Step Generator with Very Fast Settling Performance.
Final rept.,
H. K. Schoenwetter. 1987, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p428-432 Jun 87.

Keywords: *Pulse generators, Step response, Precision, Design, Reprints, Computer applications.

A pulse generator for testing the step response of waveform recorders is described. The initial and final levels of voltage steps are each programmable within the range of plus or minus 1 V for a 50-ohm termination. Voltage steps within the range settle to within plus or minus 0.2 and plus or minus 0.1 percent of full-scale range (FSR) in approximately 4 and 6 ns, respectively. The 10-90 percent transition duration (TR) is approximately 1.7 ns.

707,752
PB88-111216 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Active High-Voltage Divider and Phase Shifter.
Final rept.,
O. Petersons, and S. P. Mehta. 1987, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p362-368 Jun 87.

Keywords: *Voltage dividers, *Phase shift circuits, Power measurement, Design, Reprints, Calibration.

An instrument combining the functions of an active high voltage divider and a phase shifter designed to yield small phase-angle uncertainties within 20 microrad is described. It is based on a circuit employing a

feedback amplifier and a controlled source. The presence of the controlled source greatly reduces the potential for dynamic instabilities of the feedback loop and effectively eliminates the errors associated with the finite gain of the amplifier. Design and construction details and the results of the accuracy evaluation are presented.

707,753
PB88-117577 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Series-Array Josephson Voltage Standards.
Final rept.,
R. L. Kautz, C. A. Hamilton, and F. L. Lloyd. 1987, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics MAG-23, n2 p883-890 Mar 87.

Keywords: *Josephson junctions, *Standards, Phase locked systems, Superconductivity, Reprints, *Voltage standards, Chaos.

Series arrays typically including 1500 Josephson junctions driven at 90 GHz have been used to generate quantized reference voltages in excess of I V. Such standards simplify the procedure and reduce the measurement uncertainities in the calibration of electrochemical cells.

707,754
PB88-124417
(Order as PB88-124409, PC **A04**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Automated Potentiometric System for Precision Measurement of the Quantized Hall Resistance,
G. M. Reedtz, and M. E. Cage. 1987, 8p
Prepared in cooperation with Istituto Elettrotecnico Nazionale Galileo Ferraris, Turin (Italy).
Included in Jnl. of Research of the National Bureau of Standards, v92 n5 p303-310 Sep-Oct 87.

Keywords: *Hall effect, *Potentiometers(Instruments), Electrical measurement, Precision, *Quantum Hall effect, Resistance standards, Ohm, Automatic.

The paper describes the development of an automated potentiometric measurement system that is used to compare the quantized Hall resistance with that of wire-wound reference resistors having the same nominal value. Conceptual considerations, along with the major practical problems associated with this method, are presented. The authors then report experimental results which demonstrate that this measurement system is accurate to within a 0.0007 ppm one standard deviation uncertainty.

707,755
PB88-138540
(Order as PB88-138516, PC **A04**/MF **A01**)
National Bureau of Standards, Boulder, CO.
Low Noise Cascode Amplifier,
S. R. Jefferts, and F. L. Walls. 1987, 4p
Prepared in cooperation with Joint Inst. for Lab. Astrophysics, Boulder, CO.
Included in Jnl. of Research of the National Bureau of Standards, v92 n6 p383-386 Nov-Dec 87.

Keywords: *Amplifiers, Transistor amplifiers, Field effect transistors, Equivalent circuits, Performance, Design, *Cascode amplifiers, Low noise, Schematic diagrams, Penning traps, Ion traps.

The article discusses the design, schematics, and performance of a very low noise FET cascode input amplifier. This amplifier has noise performance of less than 1.2 nV/(Hz to the 1/2 power) and 0.25 fA/(Hz to the 1/2 power) over the 500 Hz to 50 kHz frequency range. The amplifier is presently being used in conjunction with a Penning ion trap but is applicable to a wide variety of uses requiring low noise gain in the 1 Hz to 30 MHz frequency range.

707,756
PB88-138755 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
High Accuracy, 10 Hz - 1 MHz Automatic AC Voltage Calibration System.
Final rept.,
N. M. Oldham, M. E. Parker, A. Young, and A. G. Smith. 1987, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n4 p883-887 Dec 87.

Keywords: *Voltmeters, Voltage measuring instruments, Alternating current, Converters, Reprints, *Calibration, High accuracy, Automatic.

An automatic system for calibrating high-accuracy ac voltmeters and calibrators is described. The system is based on traditional coaxial, thermal voltage converters to provide ac voltage measurement uncertainties of 5-20 ppm in the audiofrequency range and 5-250 ppm over the full range from 10 Hz to 1 MHz at voltages between 0.5-600 V. Lower levels (0.01-0.5 V) are realized using wideband inductive dividers. Specialized hardware and measurement techniques make it possible to achieve these uncertainties in test periods of approximately 1 min. Random errors introduced by the measurement system are typically less than 2 ppm (one standard deviation).

707,757
PB88-152830 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Automated Thermal Voltage Converter Intercomparisons.
Final rept.,
J. R. Kinard, E. S. Williams, and T. E. Lipe. 1986, 3p
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) 74, n1 p105-107 Jan 86.

Keywords: Comparators, Automation, Reprints, *Voltage converters (Ac to AC), *Voltage converters (Dc to dc), Calibration, IEEE-488 standard, Intercomparison.

An automated system for the intercomparison of thermal voltage converters at the National Bureau of Standards-Gaithersburg is described. It employs a two-channel comparator with components interfaced using the IEEE-488 bus standard. The design and performance of the system are presented, and several advantages and disadvantages of this and other automated comparator systems are discussed.

707,758
PB88-153911 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Automatic Frequency Response of Frequency-Modulated Generators Using the Bessel Method.
Final rept.,
J. R. Major, E. M. Livingston, and R. T. Adair. 1985, 23p
See also PB86-122801. Sponsored by Army Communications-Electronics Command, Fort Monmouth, NJ.
Pub. in Proceedings of the Annual Test and Measurement World Expo (4th), San Jose, CA., May 14-16, 1985, v1 p78-100.

Keywords: *Signal generators, *Frequency response, Frequency modulation, Curve fitting, Frequency meters, Bessel null.

The paper describes a Bessel null technique to measure the frequency response of a frequency-modulated rf carrier and a program to automate frequency response measurements of signal generators with output frequencies from 0.450 to 2000 MHz. The measurements obtained using this technique are more accurate than those obtained by a highly trained technician using a manual system. Automated measurement of the process is desirable since the manual method is subject to the following problems: (1) excessive time; (2) error in finding the null; and, (3) lack of assurance that the null is the first Bessel null. Automated measurements can be performed using a system controller, a spectrum analyzer, a function generator, and a voltmeter (all of which are compatible and controllable remotely).

Electromechanical Devices

707,759
PB-264 326/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Scattering Parameters of SMA Coaxial Connector Pairs.
Final rept.,
A. J. Estin. 1976, 6p
Pub. in IEEE Trans. Instrum. Meas. IM-25, n4 p329-334 Dec 76.

Keywords: *Electric connectors, Microwave equipment, Coaxial cables, Scattering, Reflection, Insertion loss, Measurement, Reprints.

A technique is described for making reflection and insertion loss measurements on microwave connectors, without the need for reference to calibrated or precision standards. The effects of connectors used in the measuring system are removed from the results, thus providing a means for testing and selecting cables from a group for specific critical applications. Results are given for a group of eight sections of Type 141 solid dielectric line having SMA connectors, and generic behavior is predicted for the SMA connector.

707,760
PB-264 330/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Repeatability of SMA Coaxial Connectors.
Final rept.,
R. L. Jesch. 1976, 7p
Pub. in IEEE Trans. Instrum. Meas. IM-25, n4 p314-320 Dec 76.

Keywords: *Electric connectors, Coaxial cables, Insertion loss, Reflection, Coefficients, Microwave equipment, Reprints.

SMA connectors in three different configurations were investigated for variation of reflection coefficient magnitude and insertion loss for a given SMA connector connect-disconnect sequence. Repeatability measurements were taken over the frequency range of 2 to 18 GHz on the National Bureau of Standards' Automatic Network Analyzer. Plots are given that show the SMA connector repeatability for both reflection coefficient magnitude and insertion loss as a function of frequency.

707,761
PB-271 586/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermal Acoustic Oscillations in Current Leads Cooled with Supercritical Helium.
Final rept.,
D. E. Daney, P. R. Ludtke, and M. C. Jones. 1977, 4p
Contract E(49-18)-2128
Pub. in IEEE Trans. Magn. MAG-13, n1 p413-416 Jan 77.

Keywords: *Electric connectors, *Cryogenics, Thermal stability, Liquid helium, Oscillation, Reprints, Cryogenic refrigeration.

Observations are reported of pressure oscillations in model current leads cooled with supercritical helium. The oscillations are characterized and regions of the independent parameters in which the oscillations occurred are given. Different behavior depending on the design of each lead is noted. The effects of the thermodynamic state of the helium and the hydraulic diameter of each lead are in agreement with the theoretical predictions for simple tubes.

707,762
PB-272 195/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Versatile Multi-Contact Thin-Film Superconducting Switch.
Final rept.,
T. F. Finnegan, and L. B. Holdeman. Sep 77, 2p
Sponsored in part by Department of Defense Calibration Coordination Group, Redstone Arsenal, Ala.
Pub. in Review of Scientific Instruments 48, n9 p1212-1213 Sep 77.

Keywords: *Electric switches, Cryogenics, Thin films, Superconductivity, Electric contacts, Gold, Reprints, Superconducting devices.

A versatile mechanical superconducting switch which is suitable for use in various cryoelectronics applications has been developed. The switch design uses thin-films for compactness and proximity-layers of gold to prevent contact oxidation. A prototype four-pole, four-position switch is described in detail.

707,763
PB-272 528/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Specimen Preparation on the Calibration and Interpretation of Spreading Resistance Measurements.
Final rept.,
J. R. Ehrstein. 1977, 10p
Pub. in Proceedings of International Symposium on Silicon Materials Science and Technology (3rd), Philadel-

phia, Pa. 9-13 May 77. Paper in Semiconductor Silicon, v77 n2 p377-386 1977.

Keywords: *Electric contacts, Electrical resistance, Calibrating, Measurement, Semiconductors, Silicon.

Spreading resistance is related to, but is not directly a measure of, specimen resistivity. When interpreting such data, the effect of resistivity gradients with depth can be accounted for by the use of various published correction factors, as appropriate. Direct consideration of the effect of contact material, load and other less tangible parameters on metal-semiconductor barrier phenomena is circumvented by resorting to empirical calibration of spreading resistance on specimens of known resistivity. The form of the calibration relation depends on specimen crystal orientation, conductivity type and surface preparation as well as on probe material, contact size and load. This work is a study of the effect of surface preparation on the spreading resistance calibration of several principal combinations of silicon conductivity type and crystal orientation, and is done for several different probe materials at a single probe load. Results show that the effect which surface preparation has on spreading resistance measurements is clearly a function of the type of silicon considered. Results also indicate that certain probe dependences also exist at the moderate probe load used.

707,764
PB-273 577/7 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Exploratory Study of Glowing Electrical Connections.
Final rept.,
W. J. Meese, and R. W. Beausoliel. Oct 77, 31p NBS-BSS-103
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Assistant Secretary for Policy Development and Research. Library of Congress Catalog Card no. 77-608341. Supersedes rept. no. NBSIR-76-1011, PB-259 641.

Keywords: *Electric connectors, *Fire hazards, Fire safety, Wiring, Glow discharges, Electric contacts, Residential buildings.

The report describes and characterizes with quantifiable electrical and thermal measures the extent to which loose electrical connections in residential-type branch circuits have overheated in the laboratory. With loose electrical connections, which conceivably could be inadvertently duplicated in field installations, but with otherwise normal installation and operating conditions, visible glows have been observed under laboratory test conditions in normal 120-volt, 15 and 20 ampere branch circuits with both copper and aluminum wire. Characteristics of the glow condition are differentiated from arcing/sparking as sometimes observed in making or breaking electric circuits. Glowing electrical connections may dissipate as much as 35 watts of power with a current of 15 amps in the circuit and as much as 5 watts with a current of 0.8 amp in the circuit. Temperatures over 750 F were measured on the 'break-off tab' of receptacles. Metal outlet boxes housing glowing connections in an insulated wall test set-up representative of a common type of residential construction attained temperatures in excess of 450 F. In laboratory tests under repetitive, intermittent and periodic cycles, a connection on a steel wire-binding screw of a receptacle open to the air had sustained glow conditions maintained for over 100 hours. Glowing connections will not perceptibly affect the electrical performance function of lights, appliances or other electrical loads, and will not 'blow' fuses, trip circuit breakers or operate ground fault circuit interrupters.

707,765
PB-280 071/2 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Experimental Determinations of Temperatures and Power Losses at the Electrical Connections of Some Duplex Receptacles.
Final rept.,
G. W. Burns, M. G. Scroger, G. A. Evans, R. W. Beausoliel, and W. J. Meese. Apr 78, 66p NBSIR-77-1380
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Assistant Secretary for Policy Development and Research.

Keywords: *Electric connectors, *Electric outlets, Wiring, Residential buildings, Safety, Power loss, Temperature measurement, Overheating, Power supply circuits.

The data presented in this report compare the reliability of power loss determination with the reliability of temperature measurements as a means for determining the quality and adequacy of electrical connections on wiring devices used in branch circuit wiring. The basic premise for the tests presented here is that in the laboratory the determination of power loss is easier, quicker, and not nearly as dependent on environmental factors as temperature. This research indicates that, if power at a specific current level does not exceed some set value(s), temperatures will not be excessive. This investigation also illustrates the overheating problems associated with copper-wire electrical connections. No. 14 copper wire connections frequently showed significant rises in temperatures and significantly increased power losses when tightened to a torque of only 2 lbf-in, as compared to nominally tight connections (6 lbf-in. or more).

707,766
PB-289 019/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microelectronic Wire Bond Pull Test - How to Use It, How to Abuse It.
Final rept.,
G. G. Harman, and C. A. Cannon. Sep 78, 8p
Sponsored in part by Defense Advanced Research Projects Agency.
Pub. in IEEE Trans. Components, Hybrids, Manuf. Technol. CHMT-1 n3 p203-210 Sep 78.

Keywords: *Microelectronics, *Nondestructive testing, *Bonding, Electric connectors, Ultrasonic spot welds, Pull tests, Reprints.

The wire bond pull test is the most universally accepted method for controlling the quality of the wire bonding operation, and thereby offering added assurance that semiconductor devices will not fail in the field due to weak wire bonds. Specific test procedures and pull-force values are called out in military and other device purchase specifications and yet, until the present work, there has never been a carefully controlled interlaboratory comparison of this important test. The paper examines all of the variables that are known to affect the bond pull test including ones that cannot be treated theoretically, such as bond peeling and tearing; describes careless pulling methods and other abuses that affect test results; and gives the results of an eight-organization interlaboratory pull test experiment.

707,767
PB-290 491/0 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC.
Some Thoughts on Electrical Connections.
J. Rabinow. Aug 78, 35p NBSIR-78-1507

Keywords: *Electric connectors, Aluminum, Electric wire, Residential buildings, Electric terminals, Creep properties, Wiring.

The report is a subjective and personal statement of the author's experiences and thoughts regarding electrical connections, in general, and aluminum wiring for homes, in particular. It is not a statement of official position of the National Bureau of Standards (NBS). It is entirely possible that other members of the NBS staff may not agree with many statements made in this report. It is based on some considerable experience and, where the ideas expressed are not based on such experience, this is indicated. The author's conclusions are that present day technology of electrical distribution wiring in residences is not in keeping with good engineering practices available today. This is true relative to both copper and aluminum wiring.

707,768
PB-298 803/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fiberglass-Epoxy in a Conical Superconducting Field Magnet Support.
Final rept.
R. E. Schramm, and M. B. Kasen. 1978, 8p
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Proceedings of Int. Cryogenic Materials Conference (2nd), Boulder, CO., August 3-5, 1977, Paper E-3 in Advances in Cryogenic Engineering, 24, p271-278 1978.

Keywords: *Fiberglass reinforced plastics, Supports, Superconducting magnets, Mechanical properties, Cryogenics, Superconducting motors, Epoxy matrix composites.

A conical fiberglass-epoxy field magnet support was designed for use in a 2.2-MW (3000-hp) superconducting motor. The cone design was based upon cryogenic static mechanical property data published by Toth et al. for a type 1581 S-glass/E-787 epoxy resin composite. The cone tested in this program, however, was fabricated with type 1581 S-glass cloth in an epoxy resin system known as NASA Resin 2. To check the material properties against design criteria, flat panels of composites of the glass cloth were tested with both types of resin. All tests were run to failure in tension, compression, and shear at 350, 295, 76, and 4 K. The parameters measured were moduli, strengths, failure strains, and Poisson's ratios. Another objective was the measurement of the cone's axial spring constant at 295 and 76 K as a function of axial compressive force up to 89 kN (20,000 lb). Because the component EMPOL 1040 in the NASA Resin 2 formulation is known to decrease the composite strength above room temperature, the cone was also tested at 350 K.

707,769
PB80-212202 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Materials Studies for Superconducting Machinery Coil Composites.
Interim rept.,
J. W. Ekin, M. B. Kasen, D. T. Read, R. E. Schramm, R. L. Tobler, and A. F. Clark. Nov 79, 163p NBSIR-80-1633
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.

Keywords: *Composite materials, *Superconductors, Fiberglass reinforced plastics, Supports, Niobium intermetallics, Titanium intermetallics, Mechanical properties, *Superconducting composites, Superconducting coils, Epoxy matrix composites, Superconducting metals, Metal matrix composites.

The physical properties of a superconducting coil composite are studied to accurately predict the coil behavior under operating conditions. Emphasized in this third interim report are studies on the effect of stress and strain on the critical current of superconducting wires. The report also includes data on several fiberglass/epoxy support structures for the coil and its dewar. Preliminary results are also given for the effect of stress on small superconducting composite rings used to model the full sized coil behavior. A summary of the program results to date is included.

707,770
PB81-110710 Not available NTIS
National Bureau of Standards, Washington, DC.
Constriction Resistance Measuring System for Residential Branch Circuit Connections.
Final rept.
O. B. Laug. Sep 80, 7p
Pub. in Review of Scientific Instruments 51, n9 p1240-1246 Sep 80.

Keywords: *Electric measuring instruments, *Electric connectors, Electrical resistance, Electric contacts, Residential buildings, Reprints.

A constriction resistance measuring system was designed for evaluating the performance of residential branch wiring circuit connections. The measurement system separates the bulk from the constriction resistance by utilizing the nonlinear voltage-current behavior of a connection. The method overcomes some of the past problems with the nonlinear technique by employing a pulse stimulus current coupled to a high-speed data acquisition system under computer control. A least squares nonlinear fit program is used to obtain the best fit of the voltage-current data to an equation which serves as the nonlinear model. The model was verified by simulating connections with a true 4-wire crossed rod measurement technique. Measurements on connections formed with aluminum and copper conductors agree closely with the parameters predicted by the model. The method is shown to have the ability to accurately measure the constriction resistance of practical connectors in the presence of widely changing values of bulk resistance. A modification of the technique is proposed and shown to have a potential threefold increase in sensitivity.

707,771
PB81-197048 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.

Experimentally Determined Performance of Some Residential Circuit Breakers.
R. W. Beausoliel, and W. J. Meese. Apr 81, 50p
NBSIR-81-2221

Keywords: *Circuit breakers, Residential buildings, Performance tests, Fire safety, Wiring, Electric wire, NTISCOMNBS.

This investigation presents results from laboratory testing of residential type, single-pole, 20 A, thermal-magnetic circuit breakers. Standard 20 A plug fuses were tested for comparison with circuit breaker performance.

707,772
PB82-155219 Not available NTIS
National Bureau of Standards, Washington, DC.
Miniature Multipin Electrical Feedthrough for Vacuum Use.
Final rept.
R. B. Goldfarb. Dec 81, 1p
Pub. in Cryogenics 21, p746 Dec 81.

Keywords: *Electric connectors, Miniature electric equipment, Reprints, Electrical feedthroughs.

A miniature multipin electrical feedthrough for room-temperature vacuum use is made from commercially available components and an easily machined bushing.

707,773
PB83-136382 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Field Circuit Breaker Tester.
Final rept. Jan 80-Feb 81.
P. M. Fulcomer. May 82, 54p NBSIR-81-2301
Sponsored in part by Consumer Product Safety Commission, Washington, DC.

Keywords: *Test equipment, *Circuit breakers, Field tests, Residential buildings, Safety.

Test equipment developed at NBS for the Consumer Product Safety Commission (CPSC) to evaluate the performance of single-pole circuit breakers in residential installations is described in this report, along with instructions for its use. The procedures are intended to be carried out by a test crew of at least two persons.

707,774
PB83-162164 Not available NTIS
National Bureau of Standards, Washington, DC.
What is Causing Failures of Aluminum Wire Connections in Residential Circuits.
Final rept.
D. E. Newbury. Aug 82, 6p
Pub. in Analytical Chemistry, p1059A-1064A Aug 82.

Keywords: *Electric connectors, Wiring, Failure, Wire, Aluminum, Microanalysis, Reprints.

Scanning electron microscopy and electron probe x-ray microanalysis have been applied to the analysis of structures produced during glow failures of aluminum wire connections in household duplex electrical outlets. Model wire/screw systems and actual residential connections tested to failure in the laboratory have been studied by analyzing free surfaces of wires and metallographic cross sections through the components of interest.

707,775
PB84-106293 Not available NTIS
National Bureau of Standards, Washington, DC.
Study of Air-Gap Breakdown at 28.5 Kilohertz.
Final rept.
F. R. Kotter, and A. N. Smith. Jun 83, 8p
Pub. in IEEE Trans. Power Appar. Syst. PAS-102, n6 p1913-1920 Jun 83.

Keywords: *Air gaps, *Dielectric breakdown, Electrical insulators, Antennas, Circuit protection, Very low frequencies, Reprints.

Measurements of the electrical breakdown of both quasi-uniform and highly nonuniform-field air gaps at a frequency of 28.5 kHz are reported. Gaps between a variety of electrode geometries ranged from a few centimeters to over two meters in length. Breakdown voltages significantly below the corresponding 60 Hz values were observed with electrodes for which appreciable pre-breakdown discharges occurred, and a pattern of 'anomalous' flashovers at considerably lower than the normal breakdown voltages was noted with quasi-uniform field gaps. The results obtained appear to correlate well with the data found in the literature for higher frequencies but lower voltages. An annotated bibliography is included.

707,776
PB85-151678 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comments on 'Determining Specific Contact Resistivity from Contact End Resistance Measurements'.
Final rept.
J. A. Mazer, and L. W. Linholm. Sep 84, 2p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Electron Device Letters EDL-5, n9 p347-348 Sep 84.

Keywords: *Electric contacts, *Electrical resistivity, Measurement, Reprints.

A recent letter in this journal by Chern and Oldham discussed a method of determining specific contact resistance from measurements on a specifically designed test structure. The purpose of this letter is to comment on the application of the transmission-line model (TLM) in that letter and to comment on the interpretation of other work, specifically that of Proctor and Linholm that appears in that letter.

707,777
PB86-231453 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Standardization of Coaxial Connectors in the IEC (International Electrotechnical Commission).
Final rept.
N. J. Sladek, and R. L. Jesch. 1986, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Special Issue on Radio Measurement Methods and Standards 74, n1 p14-18 Jan 86.

Keywords: *Electric connectors, Coaxial cables, Standards, Standardization.

The paper reviews the requirements and standardization of coaxial connectors within the International Electrotechnical Commission (IEC) Subcommittee SC46D 'Connectors for RF Cables'. A list of published IEC connector standards and a list of IEC standards under consideration are included.

707,778
PB87-110243 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Errors in Servo Systems Using Sinusoidal Frequency (Phase) Modulation.
Final rept.
F. L. Walls. 1986, 5p
Sponsored by Naval Research Lab., Washington, DC.
Pub. in Proceedings of Annual Symposium on Frequency Control (39th), Philadelphia, PA., May 29-31, 1985, p91-95.

Keywords: *Servomotors, Errors, Phase modulation, Frequency modulation.

The paper reviews the errors in determining the center of a resonance line which are due to residual imperfections in practical electronic systems using sinosoidal frequency or phase modulation. In particular the effects of residual amplitude modulation, baseline distortion, and harmonic distortion in the modulation process and the demodulator are qualitatively analyzed for a Lorentzian line in the limit of small modulation index. This permits one to easily calculate analytically the frequency offsets as a function of modulation index and the transfer function of the fundamental and various harmonics of the modulation frequency. Using this model one can easily formulate accurate tests for experimentally measuring the frequency errors in practical servo systems, even if the original assumptions about small modulation index and a pure Lorentzian line are not exactly fulfilled.

707,779
PB87-116174 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Survey of Triaxial and Mode-Stirred Techniques for Measuring the Shielding Effectiveness of Connectors and Cables.
R. L. Jesch. Oct 86, 24p NBSIR-86/3060
Sponsored by Army Aviation Systems Command, St. Louis, MO.

Keywords: *Shielding, *Transmission lines, *Electric connectors, Connectors, Electrical faults, Tests, Triaxial tests, Effectiveness, Mode stirred techniques.

The report is the result of an extensive literature search conducted in the field of connectors and cables, and of the problem dealing with radio frequency leakage characteristics and the ability to measure the shielding effectiveness of these connectors and cables. It reviews two measurement techniques for determining the shielding effectiveness: the triaxial test technique that has been used for over 20 years and the mode-stirred test technique that recently has started to gain in popularity. From the survey, certain inferences are drawn about these techniques in terms of device configuration, frequency range, and ease of measurement and are presented in chart form for comparative purposes.

707,780
PB88-109251 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Study of Measurements of Connector Repeatability Using Highly Reflecting Loads.
Final rept.,
J. R. Juroshek. 1987, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques MTT-35, n4 p457-460 Apr 87.

Keywords: *Electric connectors, Electrical measurement, Radio frequencies, Transmission lines, Reproducibility, Network analyzers, Reprints, Reflection coefficients, Automatic network analyzers.

The paper investigates the repeatability of measurements of the reflection coefficient Gamma of highly reflecting devices with changes in the RF connector joint. The changes in the connector joint are due to disconnecting and reconnecting the connector pair. It is shown that many of the measurement discrepancies observed in practice can be explained with a simple connector model. The paper shows that the sensitivity of measuring RF connector changes can be increased by using highly reflecting loads. The basic principles described in the paper should be beneficial to connector designers who need to observe small changes in connector parameters and to the work of calibration standards designers, where small connector imperfections are a major part of their measurement uncertainty.

Electron Tubes

707,781
PB-291 959/5 PC **A07**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Tabulation of Published Data on Electron Devices of the U.S.S.R. Through December 1976.
Final rept. Jan 74-Dec 76.
C. P. Marsden. Dec 78, 139p NBSIR-78-1564
See also report dated Dec 73, COM-74-51229.

Keywords: *Electron tubes, *Semiconductor devices, *Catalogs(Publications), Thermocouples, Counters, USSR.

The tabulation includes data on U.S.S.R. electron devices as collected from publications, mostly handbooks published by the various ministries and institutes of the U.S.S.R. Information is given on all active devices ranging from receiving to microwave devices, semiconductor devices, and miscellaneous devices such as photographic flash tubes and thermistors.

Optoelectronic Devices & Systems

707,782
PB-264 307/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Measurement of the Absolute Spectral Response of Detectors.
Final rept.,
M. A. Lind. 1976, 4p
Pub. in Proceedings of the Technical Program - Electro-Optical Systems Design Conference 1976 - International Laser Exposition, New York, N.Y., September 14-16, 1976, p55-58 1976.

Keywords: *Photodetectors, Silicon, Photoconductivity, Measurement.

There are many parameters that affect the absolute spectral response of any photodetector. The question of how to measure these parameters and thereby characterize a detector is the subject of this paper. For brevity, this paper will confine itself to the discussion of the techniques used to measure those parameters which have the greatest potential effect on silicon photodiodes operated in the short circuit or current mode. In general, these same parameters also affect all other photodetectors to some extent.

707,783
PB78-600048 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Application of Electro-Optical Modulators in Optical Radiation Measurements.
J. Geist, and M. A. Lind. 1977, 1p
Pub. in Proc. Electro-Optics/Laser '77 Conf. and Exposition, Anaheim, CA, Oct. 25-27, 1977, p696 1977.

Keywords: *Electro-optical modulating, Measurement, Optical radiation, Optical radiation measurements, Radiation measurements, Optical.

No abstract available.

707,784
PB80-170228 Not available NTIS
National Bureau of Standards, Washington, DC.
Status Report: A Standard Method for Determining the Efficacy of Fluorescent X-Ray Intensifying Screens.
Final rept.,
R. C. Placious, E. Moser, R. S. Holland, and F. Masi. 1979, 3p
Pub. in Proceedings of SPIE/SPSE Application of Optical Instrumentation in Medicine (VI), Boston, MA, September 25-27, 1977, Jnl. of Applied Photographic Engineering 5, p157-159 1979.

Keywords: *Fluorescent screens, *X rays, Spectroradiometers, Standards, Comparison.

A proposed ANSI standard for classifying radiographic intensifying screens has been under test at the National Bureau of Standards. This standard establishes procedures for characterizing, on an absolute basis, the optical spectral output of fluorescent screens per unit of incident x-ray exposure. The testing procedure has undergone revision since an earlier status report was given. Calcium tungstate screens, however, still form the basis of comparison in this procedure because of the long acceptability and stable output qualities of this screen. The nature of the revisions and current output data on the screens will be described.

707,785
PB81-132607 Not available NTIS
National Bureau of Standards, Washington, DC.
Reflectance and External Quantum Efficiency Change of a Silicon Photodiode After Surface Cleaning.
A. R. Schaefer. Aug 79, 1p
Pub. in Applied Optics 18, n15 p2531, 1 Aug 79.

Keywords: *Photodiodes, Silicon, Quantum efficiency, Reflectance, Dirt, Films, Reprints.

A change in the reflectance of silicon photodiodes was observed and attributed to possible formation of an impurity coating on the detector surface.

707,786
PB81-138729 Not available NTIS
National Bureau of Standards, Washington, DC.
Silicon Photodiode Front Region Collection Efficiency Models.
J. Geist. Jul 80, 3p
Pub. in Jnl. of Applied Physics 51, n7 p3993-3995 Jul 80.

Keywords: *Photodiodes, Silicon, Quantum efficiency, Reprints.

The minority-carrier transport equations are solved numerically for a realistic model of the front region of a UV-enhanced silicon photodiode.

707,787
PB81-246019 Not available NTIS
National Bureau of Standards, Washington, DC.
Image Information Transfer Properties of X-ray Fluorescent Screens.
Final rept.
C. E. Dick, and J. W. Motz. 1981, 10p
Pub. in Medical Physics 8, n3 p337-346 May/Jun 81.

Keywords: *Fluorescent screens, X ray fluorescence, Images, Quantum efficiency.

The image information transfer efficiency for five x-ray fluorescent screens (calcium tungstate, barium halide, and three rare earth screens) has been experimentally determined with monoenergetic x-ray beams at energies of 18, 22, 32, 49, 51, 58, and 69 keV. The transfer efficiency, which is defined by the ratio of the output to input signal-to-noise ratios, was determined from measurements of (a) the fraction of incident x-rays absorbed in the screen and (b) the statistical distribution of the number of light photons emitted from the screen per absorbed x rays which was determined by light photon counting techniques. Comparisons of the information transfer efficiency, the average number of light photons emitted per absorbed x ray, and the light output energy per Roentgen are given for the above screens and x-ray energies.

707,788
PB83-135046 Not available NTIS
National Bureau of Standards, Washington, DC.
Physics of Photon Flux Measurements with Silicon Photodiodes.
Final rept.
J. Geist, W. K. Gladden, and E. F. Zalewski. Aug 82, 8p
Pub. in Jnl of the Optical Society of America 72, n8 p1068-1075 Aug 82.

Keywords: *Photodiodes, *Quantum efficiency, Band structure of solids, Silicon, Reprints.

A model of the quantum efficiency of a planar silicon photodiode that is useful in connection with high accuracy optical radiation measurements is developed. The model is based mostly on macroscopic (phenomenological) optical and electronic properties of the device that must be determined from experiments on the device, but the connection with the microscopic physical properties (band structure) of silicon is made. Consideration of the problem of measurement of radiation in light of this model leads to the conclusion that silicon photodiodes can be used to measure the rate of arrival of incident photons, but that the accuracy of the measurement will be limited by deviation from ideal behavior of the device as determined by the device properties.

707,789
PB84-103472 Not available NTIS
National Bureau of Standards, Washington, DC.
High Accuracy Settling Time Measurements.
Final rept.
H. K. Schoenwetter. Mar 83, 6p
Pub. in IEEE Transactions on Instrumentation and Measurement IM-32, n1 p22-27 Mar 83.

Keywords: *Time measurement, *Digital to analog converters, Operational amplifiers, Pulse generators, Errors, Reprints.

Methods are described for measuring the settling times and other dynamic characteristics of voltage and current output D/A converters (DAC's), operational amplifiers, and precision voltage step generators. Circuits are described for measuring voltage-output device settling times as short as 1 microsec to within plus or minus 2 ppm, and current-output device settling times as shown as 40 ns to within plus or minus 0.012%.

707,790
PB84-106707 Not available NTIS
National Bureau of Standards, Washington, DC.
Silicon Detector Nonlinearity and Related Effects.
Final rept.
A. R. Schaefer, E. F. Zalewski, and J. Geist. 15 Apr 83, 5p
Pub. in Applied Optics 22, n8 p1232-1236, 15 Apr 83.

Keywords: *Photodiodes, Silicon, Performance evaluation, Responses, Nonlinear systems, Reprints.

An explanation is put forth for the observed nonlinearity in the red spectral region of the response of silicon photodiodes. Experiments are described to support the explanation; and the results, implications, and precautions indicated for the use of these diodes are given. Correlation of nonlinearity with spatial nonuniformity of response is demonstrated.

707,791
PB84-222603 Not available NTIS
National Bureau of Standards, Washington, DC.
Degradation of Native Oxide Passivated Silicon Photodiodes by Repeated Oxide Bias.
Final rept.
J. Verdebout, and R. L. Booker. 15 Jan 84, 7p
Pub. in Jnl. of Applied Physics, v55 n2 p406-412, 15 Jan 84.

Keywords: *Photodiodes, Silicon, Degradation, Quantum efficiency, Reprints.

A thin, native oxide p-n photodiode was repeatedly subjected to combinations of negative and positive oxide bias in order to document on a larger scale the degradation noticed on a thicker-oxide photodiode used in a self-calibration procedure. The photodiode's quantum efficiency (QE) decreased considerably during the course of the measurements but could be partially restored by exposure to steam or hydrogen. These and other results are discussed in terms of a simple model of the front p+ region that distinguishes the influences of interface recombination velocity and the induced surface electric field on the QE. According to the model, the observed decrease in QE implies an increase of several orders of magnitude in the recombination velocity at the oxide-silicon interface. Some experimental observations indicate that a change also occurs in the charge density at the Si-SiO2 interface.

707,792
PB84-225440 Not available NTIS
National Bureau of Standards, Washington, DC.
Optical Modulator and Link for Broadband Antennas.
Final rept.
J. C. Wyss, M. Kanda, D. Melquist, and A. Ondrejka. 1982, 2p
Pub. in Proceedings of Conference Precision Electromagnetic Measurements, CPEM Digest 82, Boulder, CO., June 28-July 1, 1982, IEEE Cat. No. 82CH1737-6, p16-17.

Keywords: *Electrooptics, Broadband antennas, Frequency response, Fiber optics, Lithium inorganic compounds, Tantalates, Detectors, *Optical modulators, Light modulation, Laser radiation, Lithium tantalates.

To avoid pick-up and electromagnetic perturbation problems normally associated with the use of metallic cables between an antenna and receiver electronics, an optical modulator and optical link are used instead. Laser light (632.8 nm) is modulated at the antenna by an electro-optical, lithium tantalate crystal and is then transmitted optically to the receiver electronics where the laser light is detected using an avalanche phototransistor. The crystal is mounted directly on the antenna without amplifiers or other active components. In initial tests, a modulating voltage is applied directly to the antenna. The frequency response was tested to be flat (+ or - 3 dB) from 10 MHz to at least 430 MHz. The output signal was linear from 0.01 - 10 V input with a signal to noise ratio of 2:1 at 10 mV input.

707,793
PB85-110146 Not available NTIS
National Bureau of Standards, Washington, DC.
Physical Basis for the Self-Calibration of Silicon Photodiodes.
Final rept.
J. Geist. 1980, 5p
Pub. in Proceedings of Tech. Program Electro. Opt. Laser Conference Expo., Boston, MA., November 19-21, 1980, p203-207.

Keywords: *Photodiodes, Silicon, Calibrating, Photoelectric emission, Photoconductivity.

Recently a technique that is very accurate and completely independent of radiometric standards has been developed to measure the absolute spectral response of a silicon photodiode. The technique involves the measurement of the magnitude of the various loss mechanisms that reduce the absolute quantum efficiency. The structure and behavior of silicon photodiodes will be discussed from the standpoint of the de-

termination of true absolute quantum efficiency. The various effects that limit the collection efficiency will be described as well as the physics of the measurement of the magnitudes of these effects.

707,794
PB85-187458 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Use of LEDs (Light Emitting Diodes) as YAG Laser Simulators.
Final rept.
M. Young. 1981, 8p
Sponsored by Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
Pub. in Proceedings of the 1981 Electro-Optic/Laser Conf, and Expo., Anaheim, CA, November 17-19, 1981, p222-229.

Keywords: *Laser beams, *Simulators, Feasibility, *YAG lasers, *Light emitting diodes.

There is wide interest in using light emitting diodes (LEDs) for calibrating and testing detectors designed to measure weak, diffuse YAG laser beams. Differences of coherence and possible other differences have given rise to the question, is such use of an LED either practically or theoretically justifiable. The purpose of this paper is to examine the problem in some detail and to determine, if possible, the conditions under which suitably filtered LED radiation will adequately simulate a laser beam. The author concludes that, although there are certain areas that require special care, use of an LED as a laser simulator is entirely feasible.

707,795
PB85-187466 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Description and Verification of the Silicon Photodiode Self-Calibrating Procedure.
Final rept.
E. Zalewski. 1980, 4p
Pub. in Proceedings of the 1980 Electro-Optical Laser Conf. and Expo., Boston, MA, November 19-21, 1980, p208-211.

Keywords: *Photodiodes, *Calibrating, Photodetectors, Radiometry, Silicon, Quantum efficiency, Comparison, Power measurement, Self calibration.

The silicon photodiode self-calibration technique is unlike all other high accuracy absolute radiant power measurements in that it is simple to perform and does not require expensive and elaborate equipment. The steps in the self-calibration procedure for measuring the major quantum efficiency losses are described. Two intercomparisons with electrically calibrated cavity radiometers are presented. These were radiant power measurements in the 1 to 3 mW range at 568 and 633 nm. The agreement in each case was better than 0.1% between these two independent measurement techniques.

707,796
PB85-202794 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Fast Detectors and Modulators.
Final rept.
R. J. Phelan. 1984, 11p
Pub. in Semiconductors and Semimetals 21, Part D p249-259 1984.

Keywords: *Electrooptics, Amorphous materials, Amorphous silicon, Optical modulators, Optical detectors, Picosecond pulses.

It is interesting to determine if a-Si:H can be used to create useful electro-optic devices with picosecond response speeds. Although one normally does not associate fast devices with low mobility materials, subnanosecond optical detectors and modulators have been made using hydrogenated amorphous silicon. Fast speeds are achieved by using very short lifetime materials or by making the structures sufficiently small that transit times are the limiting factor. A major factor favoring a-Si:H is the fact that it can be deposited on a wide variety of substrates allowing for the fabrication of structures that would otherwise be very difficult to construct.

707,797
PB85-222073 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Recent Developments in the Technique for the Self-Calibration of Silicon Photodiodes.
E. F. Zalewski. 1982, 10p
Pub. in Proceedings of Int. Symp. Technical Committee on Photon-Detectors of the Int. Measurement Confederation (10th), Berlin, West Germany, September 20-22, 1982, p127-136.

Keywords: *Photodiodes, *Calibrating, Quantum efficiency, Silicon, *Self calibration.

Continuing research on the physics of silicon photodiodes has yielded a better understanding and several improvements in the technique for absolute response self-calibration. The author discusses the relationship between reverse bias measurements and the supralinearity effect, and shows how such measurements are a good test for diode quality. The author also discusses several new approaches to the oxide (front surface) bias measurements, and shows how the effects at the SiO2-Si interface are related to the long-term stability of silicon photodiodes.

707,798
PB85-222339 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Quantum Yield of Silicon in the Ultraviolet.
J. Geist. 1982, 5p
Pub. in Proceedings of Int. Symp. Technical Committee on Photon Detectors of the Int. Measurement Confederation (10th), Berlin, West Germany, September 20-22, 1982, p49-53.

Keywords: *Photodiodes, *Silicon, *Quantum efficiency, Ultraviolet radiation, Self calibration.

Charge carriers produced in silicon by photons with energies above 3.4 eV can produce a second electron-hole pair by impact ionization, leading to a quantum yield that is greater than unity and that increases with photon energy. Accurate values of the quantum yield are required in order to extend the technique of silicon photodiode self-calibration into the ultraviolet spectral region. The author reports on recent experimental and theoretical studies that have yielded new and more accurate values for the quantum yield of silicon in the ultraviolet.

707,799
PB86-123114 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Silicon Photodiode Self-Calibration as a Basis for Radiometry in the Infrared.
Final rept.
E. Zalewski, and M. Tufino. 1981, 5p
Pub. in Proceedings of the Society of Photo-Optical Instrumentation Engineers-International Society of Optical Engineers 308, p2-6 1981.

Keywords: *Photodiodes, *Radiometry, *Calibrating, Infrared radiation, Silicon, *Self calibration.

The recently developed, simple and highly accurate technique for self-calibration of the absolute response of a silicon photodiode is described. The silicon photodiode self-calibration (SPSC) technique is independent of both electrical substitution radiometers (ESR's) and blackbodies - the traditional standards of absolute radiometry. Using the SPSC technique one can obtain high accuracy over a limited wavelength range with a very small investment of time and money. This means that the SPSC technique can be conveniently used to calibrate an ESR, thus avoiding the long and tedious characterization measurements required to evaluate the radiant to electrical power calibration factor of an ESR.

707,800
PB86-134952
(Order as PB86-134871, PC **A09**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Approach to ATE (Automatic Test Equipment) Calibration via Performance Verification at the System Interface.
T. F. Leedy. Oct 85, 5p
Included in Proceedings of Seminar on Digital Methods in Waveform Metrology, pA50-A54 Oct 83.

Keywords: Gallium arsenides, Photoconductivity, Substrates, Pulse generators, *Optoelectronic switches.

The paper describes the design of a set of optoelectronic switches having an interdigitated electrode structure and implemented with high resistivity GaAs photoconductive substrates. A theoretical analysis is developed for determining the pulsed light ON state resistance (peak conductance), OFF state (dark) resistance, and the associated capacitances for the various designed gap geometries. Data are provided on the processing steps used in successfully fabricating a working set of switches based on the theoretical design. A test apparatus is used to make measurements of the pulsed light conductance of these devices having nominal gap spacing of 5, 10, 20, and 40 micrometers.

707,801
PB86-183555 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Low-Level Germanium Detector Transfer Standard at 1.064 Micrometers.
A. L. Rasmussen, and D. L. Franzen. Jan 86, 15p NBSIR-85/3041
Sponsored by Aerospace Guidance and Metrology Center, Newark AFS, OH.

Keywords: *Infrared detectors, *Photodiodes, *Calibrating, *Standards, Near infrared radiation, Light pulses, Germanium, *Transfer standards, Laser radiation, YAG lasers, Light emitting diodes.

Two germanium PIN photodiodes have been calibrated in the 1 to 250 fj/sq cm range with 15 percent uncertainty for 1.064 micrometer laser pulses of 10 to 100 ns duration. To do these calibrations, the authors used (1) an acousto-optically modulated cw Nd:YAG laser beam and a silicon PIN photodiode transfer standard to provide low-level laser pulses of known energy and (2) a pulsed micrometer LED beam. A l sq cm collecting lens and a ground glass diffuser were placed in front of each detector to improve sensitivity and spatial uniformity, respectively. In the future, these detectors may also be useful as transfer standards at wavelengths out to 1.7 micrometers.

707,802
PB86-195567 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Diamond Opto-Electronic Switch.
Final rept.
P. T. Ho, C. H. Lee, J. C. Stephenson, and R. R. Cavanagh. 1983, 3p
Pub. in Optics Communications 46, n3-4 p202-204, 1 Jul 83.

Keywords: *Switches, *Electrooptics, Ultraviolet radiation, Diamonds, Photoconductors, Light pulses, Reprints, Picosecond pulses, High voltage.

The authors have succeeded in using diamond as a photoconductor to switch out high voltage by picosecond ultraviolet light pulses with 80% efficiency.

707,803
PB86-196292 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Technology and Economic Assessment of Optoelectronics.
Planning rept. 23.
G. Tassey. Oct 85, 93p NBSIR-86/3369

Keywords: Electrooptics, Technology, Economic analysis, Marketing, Trends, *Foreign technology, *Optoelectronics, Research and development.

Future productivity advances in optoelectronics will come from integration of the various signal processing functions and from improved manufacturing technologies. 'Hybrid' integration, which uses oxide-based materials and integrates some of the signal processing functions, is close to commercialization. Total or 'monolithic' integration, based on gallium arsenide, may not reach commercialization for another 8-10 years. In both cases, the economic impact will be substantial. As a result, the U.S. and its major competitors, especially Japan, are making major R&D investments in optoelectronics. Worldwide R&D expenditures are expected to reach $1 billion by 1987. In terms of market penetration, fiberoptic systems will attain annual sales of more than $3 billion by 1989. The Japanese have made a national commitment to becoming the world leader in the market. Competitive positions in world markets will be determined by which countries rapidly advance all elements of the overall technological base. The base includes measurement-related methods and data which have been shown to have signifi-

cant effects on productivity growth in other technological areas. Optoelectronics is projected to be equally dependent on the technology element for rapid development and market penetration.

707,804
PB86-196805 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Induced Junction (Inversion Layer) Photodiode Self-Calibration.
Final rept.
R. L. Booker, and J. Geist. 1984, 6p
Pub. in Applied Optics 23, n12 p1940-1945 1984.

Keywords: *Photodiodes, Calibrating, Standards, Reprints.

The potential of a newly available oxide-n+-p inversion layer silicon photodiode as a radiometric standard is discussed. Data are presented relating the QE of these diodes as a function of oxide and reverse bias. The theory of a simple absolute reflectometer/detector device is described and reflectance corrections for one of the diodes is determined to establish its absolute response. Radiant power measured with this diode, at 10 wavelengths between 295 and 1014 nm, was then compared with that measured by reference to electrical substitution radiometry.

707,805
PB87-104949 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Low-Cost LCD Video Display for Optical Processing.
Final rept.
M. Young. 1 Apr 86, 3p
Pub. in Applied Optics 25, n7 p1024-1026, 1 Apr 86.

Keywords: *Holography, Holograms, Pattern recognition, Reprints, *Liquid crystal displays, Image processing.

The paper shows that a liquid gate and a low-pass filter are needed to use a new LCD video monitor effectively in a coherent-processing system, and demonstrates the results of some simple spatial-filtering experiments.

707,806
PB87-106688 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Photodiode Operating Mode Nomenclature.
Final rept.
J. Geist. 1986, 2p
Pub. in Applied Optics 25, n13 p2033-2034, 1 Jul 86.

Keywords: *Photodiodes, Optical measurement, Reprints.

Use of the word photoamperic is suggested as applicable to the configuration of photodiode, operational amplifier and feedback resistor that is used for high accuracy optical radiation measurements with silicon photodiodes.

707,807
PB87-161659 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Semiquantitative Model for the Oxide Bias Experiment and Its Application to the Study of p(1+)nn(1+) Photodiode Degradation.
Final rept.,
J. Verdebout. 1984, 6p
Pub. in Applied Optics 23, n23 p4339-4344, 1 Dec 84.

Keywords: *Photodiodes, Silicon dioxide, Silicon, Interfaces, Efficiency, Reprints.

A model is presented to explain the effect of oxide bias on photodiode collection efficiency. It attempts to distinguish the effects of charge density from those of recombination velocity at the Si-SiO2 interface. It has been tested by comparison with experimental oxide-bias curves recorded on a p(+)nn(+) photodiode with a thermally grown oxide at different stages of its degradation by excessive oxide bias and partial restoration by exposure to UV radiation. The results indicate that both the interface charge density and trap density are affected in the degradation process. This study has also shown that oxide bias does not restore the collection efficiency strictly to unity.

707,808
PB87-181277
(Order as PB87-181251, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Far Ultraviolet Detector Standards,
L. R. Canfield, and N. Swanson. 28 Nov 86, 16p
Included in Jnl. of Research of the National Bureau of Standards, v92 n2 p97-112 Mar-Apr 87.

Keywords: *Ultraviolet detectors, *Standards, *Far ultraviolet radiation, Photodiodes, Quantum efficiency, Calibration, Photoionization, US NBS.

A description is given of the NBS program in which special photodiodes for the far ultraviolet spectral region (5-254 nm) are made available as transfer standards. These detectors are calibrated in terms of quantum efficiency (photoelectrons per incident photon) as a function of wavelength. Descriptions are also given of the calibration principles, calibration systems, and photodiode types involved in this program. Calibrations reference to the photoionization of rare gases.

707,809
PB87-227609 PC **A05**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
NBS (National Bureau of Standards) Measurement Services: Far Ultraviolet Detector Standards.
Final rept.,
L. R. Canfield, and N. Swanson. Jun 87, 89p NBS/SP-250/2
See also PB87-179883. Also available from Supt. of Docs as SN003-003-02810-0. Library of Congress catalog card no. 87-619832.

Keywords: *Ultraviolet detectors, *Far ultraviolet radiation, *Photodiodes, *Standards, Quantum efficiency, *Calibration, Transfer standards, Photoionization, US NBS.

A description is given of the NBS program in which special photodiodes for the far ultraviolet spectral region (5-254nm) are made available as transfer standards. These detectors are calibrated in terms of quantum efficiency (photoelectrons per incident photon) as a function of wavelength. Descriptions are also given of the calibration principles, calibration systems, and photodiode types involved in this program. Calibrations reference to the photoionization of rare gases.

707,810
PB87-234001 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Photodiode Quantum Efficiency Enhancement.
Final rept.,
R. L. Booker, and J. C. Geist. Jul 82, 11p
Pub. in Optical Radiation News, n40 p1-11 Jul 82.

Keywords: *Photodiodes, Quantum efficiency, Reprints.

The newsletter contains descriptions of technical procedures and results of the NBS program in radiometry, photometry, and spectrophotometry, and reports of significant meetings in the field.

707,811
PB88-139027 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Silicon Photodiode Physics as a Basis for Accurate Radiometry.
Final rept.,
J. Geist. 1985, 4p
Pub. in Transducers '85: Proceedings of the International Conference on Solid-State Sensors and Actuators--Digest of Technical Papers, Philadelphia, PA., June 11-14, 1985, p266-269.

Keywords: *Photodiodes, *Radiometry, Silicon, Standards, Quantum efficiency, Reviews.

The physics behind the operation of silicon photodiodes is reviewed from the point of view of their use as standards of quantum efficiency in radiometric measurements.

707,812
PB88-147582 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Numerical Study of Currents and Fields in a Photoconductive Detector.
Final rept.,
R. L. Peterson. 1987, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Jnl. of Quantum Electronics QE-23, n7 p1185-1192 Jul 87.

Keywords: *Photoconductive cells, *Photodetectors, Reprints, Schottky diodes, Picosecond pulses, Successive overrelaxation method.

A numerical study of the current, field, and carrier density distributions within a photoconductive detector is presented. The photodetector, an interdigitated Schottky barrier diode, is made with metallic fingers of alternating voltage bias on a thin semiconductor layer grown on a transparent dielectric substrate. The Poisson and continuity equations for electrons and holes are treated in two dimensions. A modified successive line overrelaxation method, faster than the capacitance matrix method, is developed as the Poisson solver. A simple alternative to the Scharfetter-Gummel treatment of current density is also introduced. The authors investigate steady-state cases with and without optical illumination, and transient responses to picosecond optical pulses.

Power & Signal Transmission Devices

707,813
PB-265 406/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of AC Insulation Losses at Cryogenic Temperatures,
W. E. Anderson, and R. S. Davis. 1977, 4p
Contract E(49-18)-2052
Pub. in IEEE Trans. Elec. Insulation EI-12, n1 p51-54 Feb 77.

Keywords: *Electrical insulation, Transmission lines, Superconducting power transmission, Cryogenics, Alternating current, Dielectric properties, High voltage, Dissipation factor, Polymers, Superconducting cables, Reprints.

The design of superconducting high voltage transmission lines requires engineering data which, until recently, have been largely unavailable. The selection of a suitable dielectric for a tape-insulated ac cryogenic cable, for example, requires the knowledge of insulation dissipation factors at high voltage, which are typically 0.00002 or smaller. The authors present dissipation factor measurements made on several dielectric tapes under consideration by a superconducting power transmission line project as well as on epoxies which appear mechanically suitable as low-temperature bushing material. The measurement technique and instrumentation are described.

707,814
PB-265 672/6 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Corrosion and Electrodeposition Section.
Development of in-situ Techniques for the Detection and Measurement of Corrosion of Copper Concentric Neutrals in Underground Environments.
Annual rept. no. 1, 15 Jan 76-15 Jan 77,
J. Kruger, U. Bertocci, E. Escalante, and J. L. Mullen. Apr 77, 71p NBSIR-77-1232(ERDA)
Contract E(49-1)-3800

Keywords: *Underground corrosion, *Transmission lines, Copper, Measurement, Detection, Tests, Electric wire.

The report describes the work done on the first year of a three-year project, whose purpose is to develop in-situ methods for detecting corrosion on buried copper concentric neutral (CCN) wires. Specimens of the wire underwent long term corrosion tests. Environmental variables examined were: (a) composition of electrolyte, (b) composition of the gaseous atmosphere, (c) convective motion in solution, (d) superimposed a.c. signal, and (e) coupling with conducting polyethylene (CPE). The results showed that accelerated attack with pit formation was caused by a.c. signal and that oxygen availability and presence of chloride ions in solution favored the attack of the wires. Potentiodynamic scans on the wires as well as on pure copper and tin-

ning alloy were performed in various solutions. The development of a new measurement method, the analysis of the fluctuations of the corrosion potential, has been initiated in the laboratory with the aim of testing its potentiality as a corrosion detection method in the field. (Color illustrations reproduced in black and white.)

707,815
PB-279 054/1 PC **A03**/MF **A01**
Colorado Univ., Boulder. Dept. of Electrical Engineering.
Higher Order Modes in Rectangular Coaxial Line With Infinitely Thin Inner Conductor,
J. C. Tippet, and D. C. Chang. Mar 78, 41p NBSIR-78-873
Contract NBS-CST-8393

Keywords: *Coaxial cables, Wave propagation, Rectangular bodies, Strip transmission lines, Integral equations, Transverse waves, Modes.

The singular integral equation approach is used to derive the secular equations for both TE and TM waves in a rectangular coaxial line with zero thickness inner conductor. Approximations for the secular equations are found that reduce to simple expressions in terms of well-known special functions (elliptic integrals). When the strip width is exceedingly small or nearly equal to the width of the outer conductor, closed form expressions for the cut-off frequencies can be found by replacing the elliptic integrals by their asymptotic forms for modulus either near zero or one.

707,816
PB-283 708/6 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Corrosion and Electrodeposition Section.
Development of In-Situ Techniques for the Detection and Measurement of Corrosion of Copper Concentric Neutrals in Underground Environments.
Annual rept. 15 Jan 77-15 Jan 78,
J. Kruger, U. Bertocci, E. Escalante, and J. L. Mullen. Jun 78, 61p NBSIR-78-1486
Contract E(49-1)-3800
See also PB-265 672.

Keywords: *Underground corrosion, *Transmission lines, Copper, Measurement, Detection, Tests, Electric wire.

The report describes the work done on the second year of a three-year project whose purpose is to develop in-situ methods for detecting corrosion on buried copper concentric neutral (CCN) wires. Potential and polarization measurements on buried cables have been performed, and methods for distinguishing the signals of interest from interference due to a.c. applied to the cables, as well as d.c. earth currents, have been developed. The soil around one of the buried cables has been modified in order to make the environment more corrosive. Laboratory measurements to test possible corrosion detection techniques have been performed. Current-potential data so far obtained have been analyzed. Impedance measurements have also been tested, but results indicate that the method is not very well suited for corrosion detection. Analysis of electrochemical noise has been developed and tested, and measurements on some electrochemical systems carried out.

707,817
PB-284 711/9 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Center for Building Technology.
Exploratory Study of Temperatures Produced by Self-Heating of Residential Branch Circuit Wiring When Surrounded by Thermal Insulation.
Final rept.,
R. W. Beausoliel, W. J. Meese, and L. S. Galowin. Jul 78, 55p NBSIR-78-1477
Sponsored in part by Department of Energy, Washington, D.C.

Keywords: *Insulated wire, *Residential buildings, Wiring, Temperature, Heating.

The purpose of the work was to make preliminary determination under laboratory conditions of temperatures that might develop on residential electrical wiring covered by thermal insulation when carrying rated currents or currents slightly above rated values. The results show that temperatures on conductors surrounded by thermal insulation can greatly exceed the maximum service temperatures for the wire insulation. Results also show that some types of insulation currently used to retrofit buildings may fill wall outlet boxes and contact the current carrying elements and connections of duplex receptacles. This study indicates need for a concentrated study of temperatures that might develop on residential electrical wiring covered by thermal insulation.

707,818
PB-284 721/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Current Transfer in Multifilamentary Superconductors: Part II. Experimental Results.
Final rept.,
J. W. Ekin, A. F. Clark, and J. C. Ho. Jun 78, 3p
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, Md.
Pub. in Jnl. of Applied Physics 49, n6 p3410-3412, Jun 78.

Keywords: *Superconductors, Electric current, Superconductivity, Niobium intermetallics, Tin intermetallics, Titanium intermetallics, Copper, Bronze, Composite materials, *Superconducting cables, Niobium tin, Niobium titanium, Copper matrix composites, Metal matrix composites, Reprints.

Measurements are reported of the current-transfer effect in a 0.58 x 0.68 mm NbTi (180 filament) coppermatrix wire, and in a 0.33 x 0.66 mm Nb3Sn (3553 filament) bronze-matrix wire at magnetic fields from 2 T to 8 T. With a voltage sensitivity of 100 nV, the effect of current-transfer in the copper:NbTi wire was too small to be measured at a distance 1 cm from the current contact. In the bronze:Nb3Sn wire, however, the effect was relatively large and resulted in voltage-current characteristics which had an extensive linear region. The slope of the linear region decreased with distance, x, from the current contact as x to the minus 2 power plus or minus 0.3 and reached a value of 10 to the minus 12 ohms cm, for example, at a distance of 3 cm plus or minus 0.5 cm. Both the magnitude and functional dependence of the measured current-transfer effects correspond closely to that predicted by theory.

707,819
PB-284 722/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Current Transfer in Multifilamentary Superconductors: Part I. Theory.
Final rept.,
J. W. Ekin. Jun 78, 4p
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, Md.
Pub. in Jnl. of Applied Physics 49, n6 p3406-3409, Jun 78.

Keywords: *Superconductors, Electric current, Theory, Niobium intermetallics, Tin intermetallics, Titanium intermetallics, Superconductivity, Copper, Bronze, Composite materials, *Superconducting cables, Niobium tin, Niobium titanium, Reprints, Copper matrix composites, Metal matrix composites.

In short specimen critical current measurements, inadequate separation between current and voltage contacts results in a finite linear slope in the measured voltage-current characteristic at low currents. A simple approximate analytic expression is developed for estimating the magnitude of this slope from wire parameters. Current-transfer lengths are evaluated for multifilamentary NbTi and Nb3Sn composite superconductors.

707,820
PB-288 857/6 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Thermal and Service Systems Div.
Exploratory Study of Dielectric Breakdown Voltages for Residential Wiring.
Final rept.
J. E. V. Raduan, R. W. Beausoliel, and W. J. Meese. Oct 78, 35p NBSIR-78-1537
Sponsored in part by Instituto de Pesquisas Tecnologicas, Sao Paulo (Brazil).

Keywords: *Dielectric breakdown, *Wiring, Electric wire, Residential buildings, Electric potential, Surges, Power supply circuits, Transmission lines, Tests, Voltage, Electric cables.

Residential electric circuits are subjected to surge voltages resulting from load switching in buildings, and from external causes such as lightning. Laboratory test data are presented on high voltage breakdown values for armored cable (type AC cable), nonmetallic-sheathed cable (type NM), flat conductor cable, and duplex receptacles. Dielectric withstand voltage test requirements in current standards for residential wiring devices vary over a wide range. In some cases, the standard test voltage values for both wiring and wiring devices are less than surge voltages recorded on wiring in residences. Also, field-recorded voltage wave forms and rates of their application are different from those used in standard withstand voltage tests.

707,821
PB-290 082/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Approximation for the Capacitance of a Rectangular, Coaxial, Strip Transmission Line.
Final rept.,
J. C. Tippet, and D. C. Chang. Sep 76, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques, p602-604, Sep 76.

Keywords: *Strip transmission lines, *Capacitance, Conformal mapping, Rectangular bodies, Reprints.

The method of conformal transformation is used to obtain the exact capacitance of a regular, coaxial strip transmission line. An approximate form, which includes the edge interaction capacitance of the strip, is obtained and is shown to reduce in an appropriate limit to a form obtained by other authors.

707,822
PB-291 945/4 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Evaluation of Low-Loss/Low-Reflection Two-Port Devices or Adapters by Automated Measurement Techniques.
Final rept. Jul 74-Feb 76.
R. L. Jesch. Dec 77, 16p NBSIR-78-870
Contract CCG-72-72(B)

Keywords: *Adapters, Waveguides, Waveguide couplers, Microwave equipment, Scattering, Measurement, Reflection, Coefficients, Test sets.

With the addition of a hardware modification on the National Bureau of Standards (NBS) Automatic Network Analyzer (ANA) and the incorporation of diagnostic procedures in the adapter software program, accurate values of adapter scattering parameters can now be obtained up to 12.4 GHz. Measurement results that verify the adapter scattering parameters are given along with a data base that was accumulated at 8 to 10 GHz for three 7mm to Type N female adapters from different manufacturers. Statistical methods were applied to this measurement data and an inference made about this family group of adapters.

707,823
PB-291 971/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dissipation Factor Measurements on Dielectric Materials at Liquid Helium Temperatures.
Interim rept. Jul-Sep 75.
W. E. Anderson, and R. S. Davis. 1978, 6p
Contract DOE-E(49-18)-2052
Pub. in Proceedings Conf. on Electrical Insulation and Dielectric Phenomena, Gaithersburg, MD. on Nov 3-6, 1975, p151-156 (National Academy of Sciences, Washington, DC, 1978).

Keywords: *Electrical insulation, *Dissipation factor, *Electric bridges, Power lines, High voltage, Cryogenics, Dielectrics, Superconduction cables.

The designers of high voltage superconducting a.c. cables need accurate dissipation factor measurements of proposed insulating materials. A technique for making these measurements at high voltage using a current comparator bridge is described. Dissipation factor data at 60 Hz and 4.2 K is presented for several polymers. The estimated uncertainty in the dissipation factor is plus or minus 5 x 10 to the minus 6 power.

707,824
PB-295 137/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Attenuation in Superconducting Striplines.
Final rept.,
R. L. Kautz. Jan 79, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics 15, n1, p566-569, Jan 79.

Keywords: *Strip transmission lines, Attenuation, Superconductivity, Dielectric properties, Microelectronics, Cryogenics, Niobium, Niobium oxides, Lead, Reprints.

Measurements of the Q of stripline resonators yield values for the attenuation of Nb-(Nb2O5)-Pb striplines typical of those used in superconducting microcircuits. At 4K the attenuation between 50 and 500 MHz is proportional to frequency and probably results from dielectric losses. Near the transition temperature of Pb, the attenuation begins to show the frequency-squared dependence associated with superconducting losses.

707,825
PB-299 808/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Characteristic Impedance of a Rectangular Coaxial Line with Offset Inner Conductor.
Final rept.,
J. C. Tippet, and D. C. Chang. Nov 78, 8p
Pub. in Jnl. IEEE Trans. Microwave Theory Tech., vMTT-26 n11 p876-883 Nov 78.

Keywords: *Coaxial cables, Capacitance, Characteristic impedance, Integral equations, Rectangular bodies, Reprints.

The singular-integral-equation technique is used to derive the capacitance and, hence, characteristic impedance of a rectangular coaxial line with a zero-thickness inner conductor. The position of the inner conductor is arbitrary, but its orientation is assumed to be parallel to the top and bottom walls of the outer conductor. Simple yet very accurate formulas for the capacitance and characteristic impedance are found in terms of complete elliptic integrals.

707,826
PB78-600063 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
RF Coaxial Cable Assemblies for Mobile Transceivers.
H. E. Taggart, and R. M. Jickling. 1975, 9p
Pub. in NILECJ-Std-0212.00.

Keywords: *Cable assembly, Coaxial cable, Insertion loss, Mobile antenna, Mobile transceiver, Transmission.

This standard specifies the connector plug at the mobile transceiver for an rf coaxial cable lead-in from a mobile antenna. Four performance requirements are listed, with a detailed test methods for measuring characteristics such as standing wave ratio and insertion loss.

707,827
PB80-205073 Not available NTIS
National Bureau of Standards, Washington, DC.
Porous Polymer Tape Screening Program.
Final rept.,
A. J. Bur. 1979, 47p
Prepared in cooperation with Electric Power Research Institute, Washington, DC.
Pub. in EL-1259, 47p (Electric Power Research Institute, Palo Alto, CA 1979).

Keywords: *Electrical insulation, *Power transmission lines, High voltage, Selection, Tapes, Porous materials, Polymers, Polypropylene, Papers, Laminates, Impregnating, Materials tests, Insulating oil, Polyethylene, Reprints.

A screening program has been developed for porous polymer tapes which are considered to be candidates for a tape-oil insulation system in a high-voltage transmission cable. The program consists of 21 tests for measuring mechanical, electrical and physical properties. Descriptions of most of these tests have been published in ASTM test schedules or in other literature sources. Two of the tests had to be developed in our laboratories. They are the degree-of-void-filling test and the solubility test.

707,828
PB81-101800 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
Development of In-Situ Techniques for the Detection and Measurements of Corrosion of Copper Concentric Neutrals in Underground Environments.
Final technical rept. 15 Jan 76-15 Jan 79.
J. Kruger, U. Bertocci, E. Escalante, and J. L. Mullen. Jun 80, 135p NBSIR-80-2083
See also report dated Jun 78, PB-283 708.

Keywords: *Underground corrosion, *Transmission lines, Copper, Measurement, Detection, Tests, Electric wire.

The titles of the papers included are: (1) Final Technical Report on the Development of In-Situ Techniques...Underground Environments; (2) Electrochemical and Corrosion Studies on Copper Concentric Neutral Wires; (3) Laboratory Corrosion Studies on Tinned Copper Concentric Neutral Wires; (4) Corrosion Induced by an Alternating Voltage. A Comparison Between Theoretical Predictions and Experimental Results; (5) Detection and Analysis of Electrochemical Noise for Corrosion Studies; (6) Applications of a Low-Noise Potentiostat in Electrochemical Measurements; (7) A Low-Noise Potentiostat for the Study of Small Amplitude Signals in Electrochemistry; (8) Corrosion Enhancement Due to Large Voltage Modulations. Frequency Analysis of the Response of Electrodes Under Charge-Transfer Control; (9) Studies of Passive Film Breakdown by Detection and Analysis of Electrochemical Noise; (10) A Field Study on the Corrosion of Concentric Neutral Cable; (11) AC Induced Corrosion. The Effect of an Alternation Voltage on Electrodes Under Charge-Transfer Control.

707,829
PB81-136772 Not available NTIS
National Bureau of Standards, Washington, DC.
Cool-Down of Superconducting Power Transmission Lines with Single Phase Helium.
M. C. Jones. Mar 80, 7p
Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems, and Brookhaven National Lab., Upton, NY.
Pub. in Cryogenics 20, n3 p139-145 Mar 80.

Keywords: *Power transmission lines, *Cooling, Fluid flow, Numerical analysis, Helium, Reprints, *Superconducting cables, Superconducting power transmission, Conservation equations, Cooldown.

Numerical solutions of the one-dimensional conservation equations of fluid flow are given for the problem of the cool-down of superconducting power transmission cables.

707,830
PB81-164832 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Cycle Tests of a Modeled Superconducting Transmission Line.
Final rept.
C. F. Sindt, and P. R. Ludtke. 1980, 12p
Pub. in Proceedings of the 1979 Cryogenic Engineering Conference, Madison, Wisconsin, August 21-24, 1979. Paper in Advances in Cryogenic Engineering 25, p69-80 1980.

Keywords: *Electric terminals, Fatigue tests, Thermal fatigue, Power transmission lines, Cryogenics, *Superconducting cables.

The thermoelastic behavior of two sections of a model of a superconducting transmission cable was investigated by subjecting them to repeated thermal and pressure cycles between ambient and operating conditions. To simulate the installed condition of fixed ends, the 3.5 meter long cable section was held at a constant length. A second test objective was to evaluate the end clamp assembly design. Two of these clamps were subjected to mechanical loads, to thermal cycles and assembly cycles and they maintained a gas tight seal to the lead gas jacket of the cable throughout the tests. This successful end clamp and the installation of the clamp are described.

707,831
PB81-188005 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
Technical Contributions to the Development of Incipient Fault Detection/Location Instrumentation, 1980.
Annual rept. 1 Oct 79-30 Sep 80.
W. E. Anderson, and J. D. Ramboz. Mar 81, 133p NBSIR-81-2235
Contract DE-EA-77-01-6010

Keywords: *Electrical fault location, *Power transmission lines, Instruments, Computer programs, Power lines, Electrical faults, Detection, Wave propagation, Underground power transmission.

Technical barriers exist in the development of instrumentation to detect and locate incipient faults in underground transmission cables. Knowledge is required of the physical, chemical, and electromagnetic properties of cables which precede breakdown, of the manner in which characteristic rf signals propagate in cables, and of appropriate methods of coupling detection systems to operating transmission cables. A measurement program has been initiated that will provide data on the rf properties of cables and on the characteristics of some forms of incipient faults. Preliminary measurements demonstrate the limitations of frequency- or time-domain-reflectometry techniques in the detection of incipient faults. Software is presented which permits the Fourier transform of step-like waveforms.

707,832
PB81-245979 Not available NTIS
National Bureau of Standards, Washington, DC.
Cool Down of Cryogenic Power Transmission Lines.
D. E. Daney, P. R. Ludtke, V. M. Eroshenko, and L. A. Yaskin. 1980, 7p
Pub. in Proceedings of Int. Congress of Refrigeration, Venice, Italy, September 23-29, 1979, Paper 19 in Progress in Refrigeration Science and Technology, Session A 1/2, 7p 1980.

Keywords: *Power transmission lines, Cooling, Heat exchangers, *Cryogenic cables, Superconducting cables.

The time required to cool down a superconducting (or cryoresistive) power transmission line is critical to the success of such lines since excessive cool down times would result in unacceptably long interruptions of service when repairs are required. The authors consider two cooling configurations: single stream (thermally-uncoupled return stream) and counterflow (thermally-coupled return stream).

707,833
PB81-600052 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Preliminary Tests of Psychoacoustic Facilities and Techniques for Studying the Human Response to Transmission Line Audible Noise.
J. A. Molino, G. A. Zerdy, N. D. Lerner, and D. L. Harwood. 1977, 70p
Pub. in Energy Tech. HCP/T-6010/E2, 70 pages 1977.

Keywords: *Corona noise, Environmental noise, High voltage transmission lines, Human response to noise, Listening room.

Progress during the first year of the DOE-NBS project on transmission line audible noise is documented. Some overall background for the project is provided. Three pilot experiments are described in which techniques to measure the human response to high-voltage transmission line audible noise are evaluated. A new, DOE-NBS 'realistic' listening room facility to be employed in future psychoacoustic experiments, is also described.

707,834
PB82-101254 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Expansion of Multifilamentary Nb3Sn and V3Ga Superconductive Cables and Fiberglass-epoxy and Cotton-phenolic Composite Materials.
Final rept.
G. Fujii, M. A. Ranney, and A. F. Clark. Apr 81, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Applied Physics (Japan) 20, n4 pL267-L270 Apr 81.

Keywords: *Composite materials, *Thermal expansion, Niobium intermetallics, Gallium intermetallics, Vanadium intermetallics, Fiberglass reinforced plastics, Cryogenics, Reprints, *Superconducting cables, Niobium tin, Epoxy matrix composites, Phenolic matrix composites.

The thermal contraction of multifilamentary Nb3Sn and V3Ga and the composite materials, fiberglass-epoxy and cotton-phenolic, was measured from room temperature to 4 K. Both the thermal expansion coefficient were tabulated as a function of temperature. The thermal contraction to 4 K of V3Ga was slightly greater than that of Nb3Sn. For the composites, thermal contraction to 4 K was 2.8 times higher transverse to the fibers than parallel to them.

707,835
PB82-123696 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
WR-10 Single Six-Port Measurement System.
M. P. Weidman. Sep 81, 12p NBSIR-81-1650

Keywords: *Waveguides, Measurement, Millimeter waves, Coefficients, Six-port.

A six-port system has been developed and used to measure effective efficiency and complex reflection coefficient in WR-10 (75-110 GHz) waveguide at frequencies in the 93.5-96.5 GHz range. The system is automated except for the control of the mm-wave klystron source. This report includes a brief description and background of the measurement system and a preliminary analysis of uncertainties.

707,836
PB82-135187 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Corrosion Evaluation of Underground Telephone Cable Shielding Materials.
Progress rept. 1976-80.
W. F. Gerhold, and J. L. Fink. Apr 81, 77p NBSIR-81-2243
See also report for 1976, PB-258 227. Sponsored in part by Department of Agriculture, Washington, DC.

Keywords: *Telephone cables, *Shielding, *Underground corrosion, Protective coating, Aluminum, Copper, Steels, Stainless steels.

Corrosion data is given on the performance of base and plastic coated metals intended for use as cable shields for buried telephone cable. The materials investigated on specially prepared specimens were buried for periods up to six years in six dfferent soil environments. Metals tested included homogeneous plastic-bonded and metallurgically-bonded laminates. Some specimens were exposed bare (uncoated), while others had plastic coatings or other types of coatings on either one or both sides. Metals studied included aluminum, copper, low carbon steel and stainless steel alloys.

707,837
PB82-227075 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Development of Power System Measurements: Quarterly Report - October 1, 1981 to Decmber 31, 1981.
R. E. Hebner. May 82, 23p NBSIR-82-2501
Contract DE-EA77-A016010
See also PB81-220261.

Keywords: *Power lines, Measurement, Electric fields, Ion density(Concentration), Electrical insulation, Dielectric breakdown, Insulating oil, Sulfur fluorides, Space charge, Electrical faults, Electrical fault location.

The report emphasized measurements of ion density in air, the use of signals above 1GHz to detect incipient faults in cables, the measurement of the by-products which develop during partial discharge activity in SF6, and the determination of the breakdown behavior of an oil-paper interface.

707,838
PB82-245838 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Corrosion Evaluation of Underground Telephone Cable Shielding Materials.
J. L. Fink, E. Escalante, and W. F. Gerhold. Jun 82, 88p NBSIR-82-2509
Sponsored in part by Rural Electrification Administration, Washington, DC. See also PB-258 227.

Keywords: *Telephone cables, *Shielding, *Underground corrosion, Protective coatings, Plastic coatings, Aluminum, Copper, Steels, Stainless steels.

Corrosion data are given on the performance of base and plastic-coated metals intended for use as cable shields for buried telephone cable. The materials investigated on specially prepared specimens were buried for periods up to six years in six different soil environments. Metals tested included homogeneous plastic-bonded and metallurgically-bonded laminates. Some specimens were exposed bare (uncoated), while others had plastic coatings or other types of coatings on either one or both sides. Metals studied included aluminum, copper, low carbon steel, and stainless steel alloys.

707,839
PB82-600061 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Detection of Incipient Faults in Transmission Cables Using Time Domain Reflectometry Techniques: Technical Challenges.
W. E. Anderson, J. D. Ramboz, and A. R. Ondrejka. 1982, 7p
Pub. in IEEE Trans. Power Appar. Syst. PAS-101, n7 p1928-1934 Jul 1982.

Keywords: *Aging, Dielectric, Distribution, Electrical failure, Polyethylene, Reflectometry, rf characteristics, Transmission, Treeing.

The location and repair of faults in underground transmission lines is a difficult and time-consuming operation. The Department of Energy has sponsored research in the development of instrumentation to detect and locate incipient fault sites. Some of these methods rely on reflectometry techniques in either the time or frequency domain. NBS has investigated the feasibility of using such methods in extruded polyethylene cables.

707,840
PB83-220038 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Corrosion Evaluation of Underground Telephone Cable Shielding Materials.
J. L. Fink, and E. Escalante. May 83, 100p NBSIR-83-2702
Sponsored in part by Rural Electrification Administration, Washington, DC. See also PB82-245838.

Keywords: *Telephone cables, *Shielding, *Underground corrosion, Protective coatings, Plastic coatings, Aluminum, Copper, Steels, Stainless steels, Data.

Corrosion data are given on the performance of base and plastic-coated metals intended for use as cable shields for buried telephone cable. The materials investigated on specially prepared specimens were buried for periods up to six years in six different soil environments. Metals tested included homogeneous plastic-bonded and metallurgically bonded laminates. Some specimens were exposed bare (uncoated), while others had plastic coatings or other types of coatings on either one or both sides. Metals studied included aluminum, copper, low carbon steel, and stainless steel alloys.

707,841
PB84-153352 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Stainless Steel Reinforcement on the Critical-Current Versus Strain Characteristic of Multifilamentary Nb3Sn Superconducters.
Final rept.
J. W. Ekin, R. Flukiger, and W. Specking. May 83, 4p
Pub. in Jnl. of Applied Physics 54, n5 p2869-2871 May 83.

Keywords: *Superconductors, *Strains, *Reinforcing materials, Niobium intermetallics, Stainless steels, Reprints, *Niobium tin, *Critical current.

A series of multifilamentary Nb3Sn superconductors were fabricated containing from 0% to 52 vol.% stainless steel reinforcement strands as an integral part of the conductor. Critical-current versus strain measurements are reported which show that the stainless steel introduces a relatively large compressive prestrain into the superconductor. Accompanying this high compressive prestrain in the reinforced conductors is a large degradation of the conductor's critical current, I(c). Several methods are discussed for reducing the large I(c) degradation in A15 superconductors containing integral reinforcement.

707,842
PB85-113017 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Electronics and Electrical Engineering.
Evaluation of Transient Measurement Methods in Gas-Insulated Transmission Lines.
Final rept.
R. H. McKnight, and H. K. Schoenwetter. Aug 83, 77p NBSIR-83/2753
Sponsored in part by Bonneville Power Administration, Portland, OR.

Keywords: *Transmission lines, Surges, Power lines, Measurement, Detectors, High voltage, *Gas-insulated cables.

Capacitive sensors suitable for measuring transients in gas-insulated transmission lines have been studied in the laboratory. Measurements of the step response of three different sensors were made with a test line using both low voltage (200 V) and high voltage (10 kV) signals. Sensor designs were based on those used in pulse power measurements. The use of active electronics at the sensor output in the form of fast buffer ampiifiers or commercial FET input probes was investigated as a means of extending low frequency cutoff. Lumped parameter models were used to provide theoretical analysis of experimental results.

707,843
PB85-114924
(Order as PB85-114700, PC **E07**/MF **E01**)
KDD Research and Development Labs., Tokyo (Japan).
Long-Term High-Stable Optical Fiber Loss Measuring Equipment.
Y. Namihira, H. Wakabayashi, and H. Yamamoto. Oct 84, 4p
Prepared in cooperation with Ando Electric Co. Ltd., Tokyo (Japan).
Included in Technical Digest - Symposium on Optical Fiber Measurements, p99-102 1984.

Keywords: *Communication cables, *Submarine cables, Losses, Measuring instruments, Optical measurement, *Optical fibers, *Fiber optics transmission lines.

Optical fiber submarine cable systems are promising for international transmission lines because of the possibility of a more economical high-capacity digital lines compared with the conventional submarine systems. Optical fiber submarine cable development requires the precise evaluation of cable transmission characteristics over a long period under various environmental conditions such as tensile force, water pressure and ambient temperature. For this reason, cable testing facility which can simulate the ocean bottom conditions are used to evaluate the effects of external conditions on loss. Physical limitations on the cable testing facility, however, limit the cable length to no more than 100 to 200 meters, and, with lengths of cable in this order, a loss measurement resolution of 0.001 dB is required. The authors have developed a technique making use of an LED light source and a high-stability constant-temperature box capable of control to within 0.1 deg C to perform measurements with a dynamic range of approximately 10 dB, a resolution of 0.001 dB and a stability of + or - 0.001 dB over a 5-hour-period. This paper describes a comparison measuring method which enables the measurement of very small variations in optical fiber loss, a capability not available with previously used direct measuring method.

707,844
PB85-114932
(Order as PB85-114700, PC **E07**/MF **E01**)
Standard Telecommunication Labs. Ltd., Harlow (Enland).
Accurate Determination of Optical Fibre Length from Measurements in the Frequency Domain.
D. L. Walters. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p103-106 1984.

Keywords: *Fiber optics, *Dimensional measurement, *Strains, Length, *Optical fibers.

The precise measurement of the length of an optical fiber at various stages of processing, cabling, handling and installation yields important information which can be used to help to predict the long-term mechanical and optical performance of the finished cable. The large-scale routine manufacturing of a wide variety of optical cables which is not taking place made desirable the development of equipment which could be used regularly to evaluate fiber strain in factory and laaboratory environments, and in the field. This paper describes the operation and application of such a measurement system.

707,845
PB85-114973
(Order as PB85-114700, PC **E07**/MF **E01**)
Kokusai Denshin Denwa Co. Ltd., Tokyo (Japan).

High Accurate Automatic Measurement Equipment for Chromatic Dispersion Making Use of the Phase-Shift Technique with LDs.
K. Tatekura, H. Nishikawa, M. Fujise, and H. Wakabayashi. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p119-122 1984.

Keywords: *Communication cables, *Submarine cables, *Optical dispersion, Optical measurement, Fiber optics, *Optical fibers, *Fiber optics transmission lines, Automatic.

In the long haul optical fiber submarine cable system, the accurate knowledge of chromatic dispersion in single-mode fibers is necessary because the mode partition noise can be the dominant limitation on a system error rate as well as transmission loss. Many techniques for the chromatic dispersion measurement have been developed; most of them could be hardly adapted to industrial stage or in the field environment because of complex set-ups and/or delicate operation. In this paper, a high accurate measurement equipment, that makes use of sinusoidally modulated LDs, is demonstrated. It is likely to match all the requirements in respect to the repeatability and absolute accuracy of measurement, the dynamic range, and the easiness in operation.

707,846
PB85-118594 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO.
Critical Current Measurements on an NbTi Superconducting Wire: Standard Reference Material.
Final rept.
L. F. Goodrich, D. F. Vecchia, E. S. Pittman, J. W. Ekin, and A. F. Clark. Sep 84, 70p NBS/SP-260/91
Also available from Supt. of Docs as SN003-003-02614-0. Sponsored in part by Department of Energy, Washington, DC. Library of Congress catalog card no. 84-601108.

Keywords: Niobium intermetallics, Titanium intermetallics, Magnetic fields, Electric fields, Cryogenics, *Standard reference materials, *Critical current, *Superconducting wires, *Niobium tin.

This report reviews the selection and certification by NBS of a Standard Reference Material (SRM) for the measurement of superconducting critical current. Procedures for preparing and measuring five candidate conductors are described. Evaluation criteria are discussed by which one of the five conductors was selected for the critical current SRM. The designated superconducting wire, SRM 1457, has been subdivided and wound onto 500 spools for distribution. Certified critical current measurements were made on a sample of these spools. Material variability, or inhomogeneity, along the whole wire is included in a statistical model based on the dependence of critical current on temperature and electric field. Critical currents for SRM 1457 are certified at magnetic fields of 2, 4, 6, and 8 T for temperatures from 3.90 to 4.24 K and electric field criteria from 0.05 to 0.2 microV/cm. Statistical tolerance limits and estimated systematic errors are combined to give an overall uncertainty in the certified values. The total uncertainty is no greater than 2.57 percent of the reported critical current at any of the four magnetic fields.

707,847
PB85-136976 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Critical Current Measurements on a NbTi Superconducting Wire Standard Reference Material.
Final rept.
L. F. Goodrich, D. F. Vecchia, E. S. Pittman, and A. F. Clark. Jul 84, 8p
Pub. in Advances in Cryogenic Engineering 30, p953-960 Jul 84.

Keywords: *Standards, Niobium intermetallics, Titanium intermetallics, Cryogenics, Reprints, *Standard reference materials, *Superconducting wires, *Critical current, *Niobium titanium.

The experimental evaluation of five candidate conductors for a standard reference material is presented. Data on the variations in the critical current are given for the conductor chosen to be the SRM. The goal is to present the data that led to the selection and to provide preliminary results on the NbTi superconducting wire standard reference material.

707,848
PB85-141018 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stability and Thermal Quenches in Force-Cooled Superconducting Cables.
Final rept.
V. D. Arp. May 79, 15p
Sponsored by Massachusetts Inst. of Tech., Cambridge. Francis Bitter National Magnet Lab.
Pub. in Proceedings of Superconducting MHD Magnet Design Conference, Cambridge, MA, Oct. 18-19, 1978, p142-156 May 79.

Keywords: *Heat transfer, Liquid helium, Thermal stability, Hydrodynamics, Cooling, *Superconducting cables, Temperature dependence, Transients.

This paper describes the active heat transfer and hydrodynamic processes occurring when a cable-in-conduit superconductor is subjected to a localized, time dependent, thermal perturbation. The coupled partial differential equations describing the superconductor temperature and the helium pressure, temperature, and flow are integrated numerically for several practical geometries. The program can be used to predict both the stability limit and the subsequent quench behavior of the system. Comparison with existing multiple-stability data suggests that the predictions are close but further refinements in the heat transfer parameterization are necessary. Predicted quench behavior will be tested in experiments planned for late 1980.

707,849
PB85-142446 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Research Opportunities in Superconductivity.
Final rept.
M. Tinkham, M. R. Beasley, D. C. Larbalestier, A. F. Clark, and D. K. Finnemore. Jul 84, 11p
Pub. in Cryogenics 24, p378-388 1984.

Keywords: *Superconductors, *Research, Superconductivity, Materials, Reprints, *Superconducting devices.

Opportunities for research in the field of superconductivity are identified in this report of a 'Workshop on Problems in Superconductivity' held at Copper Mountain, Colorado, August 22-23, 1983. Key problems in superconductivity, high payoff areas of research, barriers to progress, and the need for new facilities are outlined in the three areas of basic physics, materials, and devices.

707,850
PB85-205169 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Operation of Ion Counters Near High Voltage DC Transmission Lines.
Final rept.
R. H. McKnight, and P. M. Fulcomer. Jan 85, 3p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Int. Symposium on High Voltage Engineering (4th), Athens, Greece, September 5-9, 1983, Paper 64.03, 3p, Jan 85.

Keywords: *Power transmission lines, High voltage, Direct current, *Ion counters.

Measurements of electrical quantities such as electric field, vertical current density, and space charge density are necessary to characterize the electrical environment around high voltage dc transmission lines. Ion counters are used to measure space charge densities. A monopolar line has been used in the laboratory to study the effects of external electric fields on the operation of ion counters located above ground. Space charge densities were determined as functions of counter air flow, electrical potential, and inlet geometry. The effects of counter potential were not large until the potential was approximately equal to that of the space potential near the counter, when the indicated ion density dropped significantly. A dependence on flow rate was observed, which appears to be due to the large external electric fields existing at the inlet to the ion counter causing a loss of ions to the counter walls at lower flow rates.

707,851
PB86-164571 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Mode Coupling by a Longitudinal Slot for a Class of Planar Waveguiding Structures. Part 2. Applications.
Final rept.
P. F. Wilson, and D. C. Chang. Oct 85, 6p
See also PB86-164589.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques MTT-33, n10 p988-993 Oct 85.

Keywords: *Waveguide slots, *Waveguide couplers, Trip transmission lines, Reprints, *Planar waveguides.

Coupling between two parallel-plate waveguides is investigated. Mutual excitation is due to a longitudinal slot in a common plate. The introduction of reflecting boundaries parallel to the slot allows one to model a number of planar waveguiding structures featuring a common coupling mechanism. Part II of the paper presents specific examples of the above approach along with numerical results. Examples include a rectangular coaxial transmission line, broadwall-coupled rectangular waveguides, coupled microstrips, and coupled microstrip and rectangular waveguide.

707,852
PB86-164589 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Mode Coupling by a Longitudinal Slot for a Class of Planar Waveguiding Structures. Part 1. Theory.
Final rept.
P. F. Wilson, and D. C. Chang. Oct 85, 7p
See also PB86-164571.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques MTT-33, n10 p981-987 Oct 85.

Keywords: *Waveguide slots, *Waveguide couplers, Reprints, *Planar waveguides, Integral equations, Theory.

Coupling between two parallel-plate waveguides is investigated. Mutual excitation is due to a longitudinal slot in a common plate. The introduction of reflecting boundaries parallel to the slot allows one to model a number of planar waveguiding structures featuring a common coupling mechanism. Part I of the paper details the analysis of the basic slot scattering problem based on the singular integral equation method. If one assumes that the slot is small, then closed-form algebraic model equations follow. These model equations are well-adapted to numerical parametric studies.

707,853
PB86-209319 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Influence of Oxygen on the Decomposition Rate of SF6 in Corona.
Final rept.
M. C. Siddagangappa, R. J. Van Brunt, and A. V. Phelps. 1986, 5p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Conference Record 1986 IEEE (Institute of Electrical and Electronics Engineers) International Symposium on Electrical Insulation, Washington, DC., June 9-11, 1986, p225-229.

Keywords: *Sulfur hexafluoride, *Electrical insulation, Decomposition, Coronas, Oxygen.

The absolute charge rates-of-production of discharge generated gaseous by-products SOF4, SOF2, SO2F2, SO2, and CO2 have been measured in compressed SF6/O2 mixtures at a constant pressure. The normalized total rate of oxyfluorides plus SO2 production per SF6 mole does not increase significantly with the addition of O2 up to 50% in SF6 and increases slowly for (O2)>50%. The formation of SO2 in all SF6/O2 mixtures was insignificant. Instead, the deposition of sulfur (S(+)ions) on the anode increased with O2 concentration. The yield of CO2 from oxidation of carbon on the electrode was also observed to increase, with O2 content. Probable mechanisms for the formation of SOF2, SO2F2, SOF4, S(+)ions, and CO2 are discussed. The measured by-product yield as a function of percent O2 are compared with the calculated maximum rate of SF6 decomposition induced by electron collision in the discharge. The theoretical model used to calculate the rate of SF6 decomposition in SF6/O2 mixtures is briefly discussed. As observed for SF6/N2 and SF6/Ne mixtures, the primary effect of O2 on SF6 decomposition appears to be retardation of the recombination of SF6 dissociation products due to dilution.

707,854
PB86-246154 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Final Report: Technical Contributions to the Development of Incipient Fault Detection/Location Instrumentation.
W. E. Anderson, J. D. Ramboz, and A. R. Ondrejka.
Apr 86, 84p NBSIR-86/3392
See also PB81-188005. Sponsored by Department of Energy, Washington, DC.

Keywords: *Electrical fault location, *Power transmission lines, Instruments, Computer programs, Power lines, Electrical faults, Detection, Underground power transmission.

The transmission of electrical energy by use of underground cables is increasing. Fault location techniques have certain limitations; incipient fault detection and location would help reduce the maintenance cost of these lines as well as improve the reliability of service. The report discusses some test results related to RF-probing techniques applied to high-voltage transmission lines. The high frequency losses and attenuation in high voltage cables places certain ultimate limitations on RF-probing techniques for incipient fault detection. Time domain reflectrometry methods were employed to assess the RF-transmission properties of high voltage cables at frequencies as high as 6 GHz. Fast Fourier transform deconvolution were used to obtain loss measurements as a function of frequency. The loss mechanisms were identified. The measurement hardware and methods are discussed as well as analysis approach leading to the conclusions.

707,855
PB87-106399 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Out-of-Band Response of a Coax-to-Waveguide Adapter.
Final rept.
D. A. Hill. 1986, 3p
Pub. in IEEE Transactions on Electromagnetic Compatibility EMC-28, n3 p156-158 Aug 86.

Keywords: *Adapters, *Waveguide couplers, Microwave equipment, Responses, Reprints.

The input impedance and transmission coefficients of a coax-to-waveguide adapter are analyzed for out-of-band frequencies. Numerical results are shown for an S-band adapter for frequencies from 2 to 10 GHz. The above-band response is frequency sensitive because of the presence of higher order propagating modes in the waveguide.

707,856
PB87-161501 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Approach for Evaluating Effects of Wall Losses on Quarter-Wave Short-Circuit Impedance Standards.
Final rept.,
H. B. Sequeira, and B. C. Yates. Nov 85, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques MTT-33, n11 p1106-1109 Nov 85.

Keywords: *Waveguides, *Electrical impedance, *Standards, Perturbation theory, Transmission loss, Power loss, Reflection, Reprints, Coaxial configurations.

The conservation of energy principle and first-order perturbation theory have been applied to obtain formulas for the physical lengths and reflection coefficient magnitudes of quarter-wave coaxial and rectangular waveguide short-circuit impedance standards. The expressions for the physical lengths ensure zero phase angle at the mating interface when wall losses are present. The method can be extended to include small dielectric and magnetic losses, and requires only knowledge of the loss-free solutions. It can also be applied to other waveguiding structures which support uncoupled modes.

707,857
PB88-131677 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Investigation of a Ray-Mode Representation of the Green's Function in a Rectangular Cavity.
Technical note,
D. I. Wu, and D. C. Chang. Sep 87, 48p NBS/TN-1312
Also available from Supt. of Docs as SN003-003-02832-1. Prepared in cooperation with Colorado Univ. at Boulder.

Keywords: *Green's function, *Reverberation chambers, Poisson transformation, Modal response, Rectangular waveguides, Numerical solution.

It is known that a point-source excited field in a rectangular cavity can be represented either in terms of summation of modes or in terms of rays produced by the equivalent image sources. Both representations involve series that are slowly convergent, so computation of fields inside the cavity is difficult. To obtain a numerically efficient scheme, a hybrid ray-mode representation is developed here using the finite Poisson summation formula. The modal representation is modified in such a way that all the modes near resonance are retained while the truncated remainder of the mode series is expressed in terms of a weighted contribution of rays. For a large cavity, the contribution of rays from far away images becomes small, therefore the ray sum can be approximated by one or two dominant terms without a loss of numerical accuracy. To illustrate the accuracy and the computational simplification of this ray-mode representation, numerical examples are included with the conventional mode series (summed at the expense of long computation time) serving as a reference.

707,858
PB88-139142 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Screening the Performance of Organic Insulators under Cryogenic Neutron Irradiation.
Final rept.,
M. B. Kasen, and R. B. Stoddard. 1986, 7p
Sponsored by Department of Energy, Washington, DC.
Pub. in Advances in Cryogenic Engineering Materials, v32 p153-159 1986.

Keywords: *Electrical insulation, *Neutron irradiation, *Radiation damage, Superconducting magnets, Cryogenics, Fiber composites, Polyimide resins, *Physical radiation effects.

Specimens and test procedures are being developed for determining the significant parameters influencing resistance of organic insulators to neutron irradiation at 4 K. The specimens are 3.2-mm-diameter rods of exceptionally high quality produced by a method allowing a large number of experimental variables to be evaluated. Flexural and torsional shear tests performed with these specimens indicate that such tests will be useful in studying cryogenic neutron irradiation damage to the fiber-matrix interface. Results of 76-K tests on unreinforced and glass-fiber reinforced epoxy and polyimide materials are presented.

707,859
PB88-147301 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Simple Technique for Determining Joint Losses on a Coaxial Line from Swept-Frequency Reflection Data.
Final rept.,
W. C. Daywitt. 1987, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p468-473 Jun 87.

Keywords: *Coaxial cables, Electrical measurement, Electric connectors, Attenuation, Reflectometers, Reprints, Automatic network analyzers.

A need to separate connector loss from swept-frequency automatic network analyzer (ANA) measurements to check an attenuation calculation for a low-loss coaxial line has led to a simple graphical technique for determining joint losses. Measurements show that in addition to the connector loss, it is also possible to determine joint losses around center conductor bead supports on the line itself. Preliminary results indicate that losses in the millidecibel range can be determined to a precision of a few tenths of a millidecibel or better, even though the data are obscured by considerable connector loss and calibration error. Results were checked by independent measurements and show excellent agreement.

707,860
PB88-147590 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Studies of NbTi Strands Extracted from Coreless Rutherford Cables.
Final rept.,
L. F. Goodrich, E. S. Pittman, J. W. Ekin, and R. M. Scanlan. 1987, 4p
Contract DE-AI05-85ER40240
Sponsored by Department of Energy, Washington, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics MAG-23, n2 p1642-1645 Mar 87.

Keywords: Niobium intermetallics, Titanium intermetallics, Degradation, Reprints, *Superconducting cables, Critical current, Niobium titanium.

The electromechanical properties of NbTi strands extracted from coreless Rutherford cables were studied to clarify the relative effects of strand location and field angle on current degradation that occurs in cables that have been compacted into a keystone shape. Detailed critical-current measurements were made on two samples which were fabricated under controlled conditions. These are prototype cables for high energy physics applications. Specific factors that are addressed are the nature, location, and amount of degradation. The information is intended to lead to methods for reducing the amount of critical-current degradation in cable manufacture.

707,861
PB88-152848 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Complex Admittance of a Lossy Coaxial Open Circuit with a Hollow Center Conductor.
Final rept.,
W. C. Daywitt. 1987, 10p
Pub. in Metrologia 24, p13-22 1987.

Keywords: *Coaxial cables, *Electrical impedance, Reflectance, Reprints, *Admittance.

The reflection coefficient and complex discontinuity admittance of a coaxial open circuit with a hollow center conductor are derived from fields correct to first order in the skin depth. Results show an admittance terminating the line at the plane of the discontinuity and consisting of a resistance in parallel with a capacitive reactance. The first-order fields are also used to derive equations for the characteristic admittance, series impedance, and shunt admittance of the line. These equations include terms neglected in the well-known expressions used to calculate the line parameters, enabling error limits to be assigned to the latter.

707,862
PB88-155791 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Center for Electronics and Electrical Engineering.
Measurement of Shielding Effectiveness of Different Cable and Shielding Configurations by Mode-Stirred Techniques,
R. L. Jesch. Oct 87, 24p NBSIR-87/3076
Sponsored by Army Aviation Systems Command, St. Louis, MO.

Keywords: *Transmission lines, *Electric connectors, *Electromagnetic shielding, Radiofrequency interference, Very high frequencies, Ultrahigh frequencies, Superhigh frequencies, Helicopters, Avionics, *Electric cables.

The shielding effectiveness of cable configurations having different shielding arrangements and of shielding configurations used to terminate cable shields for helicopter wiring were measured by mode-stirred techniques. The mode-stirred measurements were taken at discrete frequencies between 200 MHz and 6 GHz. In addition, shielding effectiveness data on the shielding configurations were also obtained in a TEM cell down to 1 MHz. A description of the cable and shielding configurations is given, along with plots of the measured shielding effectiveness data as a function of frequency.

Resistive, Capacitive, & Inductive Components

707,863
AD-P002 479/4 PC **A02**/MF **A01**

National Bureau of Standards, Washington, DC.
Excess Noise in Quartz Crystal Resonators.
J. J. Gagnepain, M. Olivier, and F. L. Walls. 1983, 8p
Pub. in Proceedings of the Annual Symposium on Frequency Control (37th), 1-3 Jun 83, Marriott Hotel, Philadelphia, PA., AD-A136 673, p218-225.

Keywords: *Quartz resonators, *Noise(Electrical and electromagnetic), Crystal oscillators, Resonant frequency, Frequency response, White noise, Measurement, *Foreign technology, Component Reports.

Frequency and phase noise in quartz crystal resonators are studied as a function of the driving power. At low power, where the crystal behaves linearly, 1/f fluctuations of the resonance frequency are observed. At medium power the nonlinearities of the crystal significantly increase the phase fluctuations at low Fourier frequencies. At high power, thermal instabilities and chaotic behavior occur characterized by the generation of high level white noise.

707,864
PATENT-4 001 681 Not available NTIS
Vector Voltmeter.
Patent.
C. A. Hoer, and G. F. Engen. Filed 28 Jan 76, patented 4 Jan 77, 6p AD-D003 572/5, PAT-APPL-652 957-77

Keywords: *Microwave voltmeter, Phase angle measurements, Six-port voltmeter, Vector voltmeter.

A vector voltmeter for measuring the amplitude and phase difference between two signals. A first signal is fed to a power divider in which one of its outputs is measured with a power detector and the other output is fed to a second divider, each output thereof being fed one each to a third and fourth power divider.

707,865
PATENT-4 087 738 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Magnetic Resonance Detection Method and Apparatus.
Patent.
C. T. Van Degrift, and D. B. Utton. Filed 3 Mar 77, patented 2 May 78, 7p PB78-600037, PAT-APPL-774 094

Keywords: *Frequency measurement, Nuclear magnetic resonance, Reentrant cavity resonator, Static magnetic susceptibility measurements, Tunnel diode oscillator.

A method and apparatus for detecting magnetic resonance of a sample. The apparatus utilizes an exceptionally stable tunnel diode rf oscillator incorporating a LC reentrant cavity resonator. The method entails measuring a magnetic resonance of the sample through the frequency of the oscillator. The resulting dispersion curve can be utilized to obtain the static magnetic susceptibility of the sample. From the value of the static magnetic susceptibility additional parameters may be determined such as material density, temperature or particle spin. The method and apparatus has applications in NMR, NQR and ESR measurements.

707,866
PATENT-4 122 408 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Frequency Stabilization Utilizing Multiple Modulation.
Patent.
F. L. Walls. Filed 14 Nov 77, patented 2 May 78, 7p PB78-600040, PAT-APPL-851 326

Keywords: *Frequency stabilization, Hydrogen frequency standard, Multiple modulation.

A system and method is disclosed for achieving frequency stabilization. A tunable element, such as a cavity structure, is stabilized through the use of multiple modulation to stabilize both the resonant frequency of the cavity structure and the probe signal coupled to an atomic, molecular or other reference resonance line. Said reference resonance line can be internal or external to the cavity structure. A local oscillator provides a carrier signal, which typically can be at a frequency of 5 MHz, with the carrier signal being phase or frequency modulated by multiple modulating signals, such as, for example, by modulating signals with frequencies of 12.2 KHz and 0.4 Hz, and the multiple modulated carrier signal then processed and the resulting probe signal coupled to the cavity structure substantially at a preselected frequency, which frequency can be approximately 1420 MHz for a hydrogen frequency standard useful for atomic clocks. The output signal coupled from the cavity structure is amplitude modulated with the modulation at the fundamental and odd harmonics of the first modulation frequency having a level proportional to any frequency offset between the probe signal and the atomic, molecular or other reference resonance line, and the modulation at the fundamental and odd harmonics of the second modulation frequency having a level proportional to any frequency offset between the cavity frequency and the frequency of the probe signal. The output signal from the cavity is processed and ultimately rectified so that various amplitude modulations on the output signal can be recovered. The error signal resulting from synchronous detection of the amplitude modulation signal of the second frequency, 12.2 KHz in this example, or odd harmonics thereof, is coupled to the tuning element of the cavity tuning control circuitry to precisely tune the resonant frequency of the cavity to the frequency of the probe signal and the error signal resulting from synchronous detection of the amplitude modulation signal of first frequency, 0.4 Hz in this example, or odd harmonics thereof, is coupled to the local oscillator to adjust the frequency so that the probe signal is maintained at the center of the resonance of the atomic, molecular or other reference resonance and to thereby stabilize the resonant frequency of the cavity and the output frequency of the device over a long term.

707,867
PATENT-4 143 520 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cryogenic Refrigeration System.
Patent.
J. E. Zimmerman. Filed 23 Dec 77, patented 13 Mar 79, 8p PB79-600040, PAT-APPL-863 840

Keywords: *Low input power cyclic cryogenic refrigerator, Multi-stage displacer, Stirling machine, Superconducting quantum interfering devices (SQUID).

A simply constructed low input power cyclic cryogenic refrigerator suitable for cooling superconducting quantum interfering devices (SQUID) and similar instruments is provided. A Stirling machine having a multistage displacer and a piston as its only essential moving parts, with helium gas as the working fluid, achieves and maintains a temperature of substantially 8.5 K. The working cylinder and displacer are separated by a tube and are fitted together precisely at steady-state operation rather than at room temperature. The displacer preferably is made of nylon and its cylinder of an epoxy-glass composite to provide the nearly optimum clearance required to maintain the 8.5 K temperature for continuous periods on the order of several weeks.

707,868
PATENT-4 168 441 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Picosecond Pulse Generator Utilizing a Josephson Junction.
Patent.
D. G. McDonald, and R. L. Peterson. Filed 20 Dec 77, patented 18 Sep 79, 6p PB79-600047, PAT-APPL-862 311

Keywords: *Ac current, High frequency oscillator, Josephson junction, Picosecond pulse generator.

A picosecond pulse generator for producing pulses having widths in the order of 10 to the minus 12th power seconds utilizes a Josephson junction that has an external load resistor connected in shunt therwith by a balanced transmission line. The Josephson junction is driven by a high frequency oscillator, and the AC current I1, flowing through it is adapted to have its amplitude varied with respect to Ic, the critical current of the junction. As the value of I1/Ic exceeds one and increases, first a single and then an increasing number of picosecond pulses are produced during each half cycle of the high frequency oscillator.

707,869
PATENT-4 437 080 Not available NTIS
Department of the Air Force, Washington, DC.
Method and Apparatus Utilizing Crystalline Compound Superconducting Elements Having Extended Strain Operating Range Capabilities without Critical Current Degradation.
Patent.
J. W. Ekin, J. R. Gavaler, and A. I. Braginski. Filed 14 Feb 83, patented 13 Mar 84, 12p AD-D011 007/2, PAT-APPL-6-465 942
Supersedes PAT-APPL-6-465 942.
Availability: This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Patents, *Superconductors, *Crystals, Electric current, Elastic properties, Strain(Mechanics), Crystal structure, Electromagnets, High density, Magnetic fields, Superconductivity, Magnet coils, Alloys, PAT-CL-335-216.

A method and apparatus are disclosed utilizing superconducting elements with extended strain operating range capabilities. The superconducting element is formed from a crystalline compound superconductive material that does not exhibit appreciable critical current degradation in the presence of high elastic strains imposed on the element. Such a crystalline compound superconductive material is selected from materials in the B1 and C15 crystal structure classes. The thus formed superconducting element is particularly useful in electromagnets requiring high magnetic fields for operation in the intended manner.

707,870
PATENT-4 575 690 Not available NTIS
Department of the Army, Washington, DC.
Acceleration Insensitive Oscillator.
Patent.
F. L. Walls, and J. R. Vig. Filed 25 Mar 85, patented 11 Mar 86, 6p PB86-182581, PAT-APPL-6-715 862
Supersedes AD-D011 621.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Crystal oscillators, *Patents, Sensitivity, Acceleration tolerance, PAT-CL-331-162.

A crystal oscillator, including two crystals of unequal acceleration sensitivity magnitude and mounted such that their respective acceleration sensitivity vectors are aligned in an anti-parallel relationship, further includes at least one electrical reactance, such as a variable capacitor, coupled to one of the crystals for providing cancellation of acceleration sensitivities. After the acceleration sensitivity vectors of the two crystals are aligned anti-parallel, the variable capacitor is adjusted until the net or resultant acceleration sensitivity vector of the pair of resonators is reduced to zero. A second electrical reactance, such as a variable capacitor, is utilized as a tuning capacitor for adjusting the oscillator's output frequency to the desired value, while maintaining the cancellation of acceleration sensitivities.

707,871
PB-265 075/2 PC **A02**/MF **A01**
National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
Quartz Crystal Oscillators with Low Acceleration Sensitivity,
J. J. Gagnepain, and F. L. Walls. Mar 77, 17p
NBSIR-77-855

Keywords: *Crystal oscillators, *Quartz resonators, Sensitivity, Acceleration tolerance, Frequency stability, Computation.

The acceleration sensitivity of quartz crystal resonators imposes severe limitation on their use in non-laboratory environments. This work shows that by using two resonators connected in series and properly orientated with respect to one another, it is possible to substantially reduce the net acceleration sensitivity of the composite or compound crystal resonator. First qualitative experimental results on acceleration, also some experimental theories of studies related to the introduction of the two resonators comprising the compound resonator, are presented. From these studies it appears feasible to fabricate compound crystal resonators exhibiting acceleration sensitivities at least 10 times smaller than the resonators used individually.

707,872
PB-269 735/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comments on 'Electroacoustic Transducers with Piezoelectric High Polymer Films'.
Final rept.,
S. Edelman, and A. S. De Reggi. Sep 76, 2p
Pub. in the Jnl. of the Audio Engineering Society, v24 n7 p577-578 Sep 76.

Keywords: *Electroacoustic transducers, Polymeric films, Piezoelectric transducers, Piezoelectric materials, Vibration, Microphones, Loudspeakers, Sound transducers, Reprints.

The subject paper describes how the small combined thickness and extensional vibrations of a piezoelectric polymer sheet can be used to generate a large pulsating movement by curving the sheet. An analysis based on more realistic assumptions results in a different description of the motion of a curved piezoelectric sheet pinned at the edges which agrees better with physical institution.

707,873
PB-271 591/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stresses in Superconducting Solenoids.
Final rept.,
V. Arp. 1977, 12p
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, Md.
Pub. in Jul of Applied Physics, 48, n5 p2026-2036 May 77.

Keywords: *Solenoids, *Stresses, Superconductivity, Cryogenics, Anisotropy, Superconducting magnets, Orthotropism, Strains, Reprints.

The paper develops analytical techniques for calculating radially dependent stress and strain in superconducting solenoids having anisotropic (orthotropic) mechanical and thermal properties. The analysis considers stresses due to fabrication procedures, cooldown to helium temperature, and magnetic forces. Representative calculations for a particular superconducting coil are presented.

707,874
PB-273 082/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Numerical Analysis of Various Cross Sheet Resistor Test Structures.
Final rept.,
J. M. David, and M. G. Buehler. 1977, 5p
ARPA Order-2397
Pub. in Solid-State Electronics 20, p539-543 1977.

Keywords: *Tests, *Resistors, Numerical analysis, Sheets, Electrical resistance, Reprints.

Various four-terminal cross sheet resistor test structures were analyzed to determine the effect of the contact arm width and length on the measured sheet resistance. A nine-point finite difference approximation to the Laplace equation was used with a six-resistor equivalent circuit to solve for the sheet resistance measurement error. The error indicates the difference between the true sheet resistance and the sheet resistance calculated from the van der Pauw formula. The analysis demonstrates that many novel designs are possible. In particular, the Greek-cross sheet resistor is a valid van der Pauw test structure if the length of the arms are greater than the width of an arm. This test structure is important in that it allows the accurate measurement of the sheet resistance of a very small region whose width is limited only by fabrication technology.

707,875
PB-273 129/7 Not available NTIS
National Bureau of Standards, Boulder, CO.
Fundamental Noise Studies of Quartz Crystal Resonators.
Final rept.,
J. J. Gagnepain. 1976, 8p
Pub. in Proceedings Annual Symposium on Frequency Control (30th), Ft. Monmouth, New Jersey, June 1976, p84-91 1976.

Keywords: *Quartz resonators, Frequency stability, Frequency shift, Resonant frequency.

The studies of quartz crystal oscillator frequency instabilities show they are not entirely due to electronics noise but the quartz resonator itself must be considered as a noise source. The previous investigations of resonator frequency noises (given by F. Walls) gave an important indication about their levels. This work presents the results of measurements of frequency fluctuations of quartz resonators used as passive fourports. The noise is characterized in the frequency domain. Several noise sources contribute to the frequency fluctuations. Correlation with external perturbations as vibrations and temperature fluctuations are studied. In the power density spectra the noise at the lowest Fourier frequencies is related with thermal effects and mainly with thermal stress. The flicker noise level is partially related with the resonator design. Different kinds of resonators at different frequencies are used with particular plating types and shapes.

707,876
PB-275 618/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Foreword.
Final rept.,
B. W. Birmingham. Oct 77, 2p
Sponsored in part by Plenum Publishing Corp., New York.
Pub. in Book, Stabilization of Superconducting Magnetic Systems, pv-vi (Plenum Press, New York, N.Y.) Oct 77.

Keywords: *Superconducting magnets, Superconductivity, Stability, Superconductors.

The material prepared is to be used as a Foreword to a book translated from the Russian language entitled 'Stabilization of Superconducting Magnetic Systems.' This Foreword sets the stage with a brief history of superconductivity, the attempts at commercialization and the stability problems encountered in developing superconducting magnetic systems.

707,877
PB-282 137/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultra-Stable LC Oscillators and Their Applications in Metrology.
Final rept.,
C. T. Van Degrift. 1977, 10p
Pub. in Proceedings Annual Symp. on Frequency Control (31st), Held at Fort Monmouth, New Jersey on June 1-3, 1977, p375-384.

Keywords: *Oscillators, *Transducers, Tunnel diodes, Stability, Metrology, Measuring instruments.

A review of the use of extremely stable tunnel diode LC oscillators in a wide variety of transducer applications is presented. A general discussion of the circuit design is first given followed by a listing of its three inherent frequency noise sources. Two types of low frequency circuits are described - one used for the measurement of the dielectric constant of liquid 4He at 4 MHz and one used to study electrical resistivity of a single crystal of copper. A detailed digital computer modeling of this latter circuit is then presented. Tunnel diode oscillators which have LC circuits in the form of reentrant resonators are then discussed. They are particularly well-suited for sensing pressure, temperature, acceleration, linear motion, and humidity with the capacitive region of their resonators. Furthermore, they also can be used to make absolute nuclear susceptibility measurements with the inductive region. Finally, we list projects currently under way in this laboratory which test the extent to which these circuits can be further improved and to determine their ultimate practically attainable performance in transducer applications.

707,878
PB-282 139/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Bridge and van der Pauw Sheet Resistors for Characterizing the Line Width of Conducting Layers.
Final rept.,
M. G. Buehler, S. D. Grant, and W. R. Thurber. Apr 78, 5p
ARPA-2397
Sponsored in part by Defense Nuclear Agency, Washington, D.C.
Pub. in Jnl. of Electrochemical Society, v125 n4 p650-654 Apr 78.

Keywords: *Test equipment, *Resistors, Diffusion, Measurement, Electrical resistance, Line width, Boron nitrides, Test patterns, Reprints.

It is shown that the line width of conducting layers can be computed from simple dc electrical measurements made on bridge and van der Pauw shaped test structures. A compact, six-contact, cross-bridge sheet resistor test structure was developed to make this measurement directly. Line widths measured on boron nitride diffused layers indicate that the method is sensitive to width variations of the order of plus or minus 0.1 micrometers (plus or minus 4 microinches).

707,879
PB-282 143/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Experimental Study of Various Cross Sheet Resistor Test Structures.
Final rept.,
M. G. Buehler, and W. R. Thurber. Apr 78, 6p
ARPA Order-2397
Sponsored in part by Defense Nuclear Agency, Washington, D.C.
Pub. in Jnl. of Electrochemical Society, v125 n4 p645-650 Apr 78.

Keywords: *Test equipment, *Resistors, Electrical resistance, Diffusion, Layers, Boron, Phosphorus, Test patterns, Reprints.

Newly designed cross sheet resistors are shown to give the same (within 0.5 percent) measured sheet resistance as conventional van der Pauw structures. Diffused boron and phosphorus layers with sheet resistances near 200 ohms/square were studied with the sampled areas varying from a square 6.4 micrometers (0.25 mil) on a side to a circle 762 micrometers (30.0 mil) in diameter. An increase in measured sheet resistance values was observed due to surface leakage currents, and an equivalent circuit model was developed to explain the results. The effect of joule heating on measured sheet resistance values was observed in both large and small cross structures.

707,880
PB-286 730/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Properties of a Superconducting Coil Composite and Its Components.
Final rept.
A. F. Clark, V. D. Arp, and J. W. Ekin. 1978, 7p
Sponsored in part Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Proceedings of International Conference on Magnet Technology (MT-6), held at Bratislava, Czechoslovakia, on August 29-September 2, 1977, v2, p673-679 (ALFA, Bratislava, Czechoslovakia, 1978).

Keywords: *Superconducting magnets, *Magnet coils, *Superconductors, *Composite materials, Copper, Niobium intermetallics, Titanium intermetallics, Fiberglass reinforced plastics, Physical properties, Stress analysis, Mechanical properties, *Superconducting coils, *Superconducting composites, Epoxy matrix composites.

The physical and mechanical properties of a superconducting coil composite and its components are systematically studied in order to accurately predict the coil behavior from the constituent material behavior. Multidirectional measurements of the Young's modulus, Poisson's ratio, shear modulus, thermal conductivity, thermal expansion, specific heat and the critical current behavior under stress were made on a Cu:NbTi and fiberglass-epoxy composite superconducting coil. Similar measurements were performed on the superconducting wire, fiberglass and epoxy in order to establish the role of each component. A stress analysis for manufacture, cool down, and operation of the coil can be used to predict behavior under operating conditions from component properties.

707,881
PB-288 034/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of Prebreakdown Electric Fields in Liquid Insulants.
Final rept.
E. F. Kelley, and R. E. Hebner. 1978, 7p
Pub. in Proceedings of 1978 Annual Report, Conference of Electrical Insulation and Dielectric Phenomena, Pocona Manor, PA. Oct 30-Nov 2, 1978 p206-212 (National Academy of Sciences, Washington, DC.) 1978.

Keywords: *Electrical insulation, *Dielectric breakdown, Electric fields, Electrical faults, Liquids, Insulating oil, Water, Nitrobenzenes, Space charge.

Prebreakdown events in liquid insulants are investigated by combining time-resolved shadowgraphs with time-resolved electric field measurements using the electro-optic Kerr effect. The fluids studied are transformer oil, water, and nitrobenzene. In transformer oil and nitrobenzene, three types of prebreakdown phenomena are observed: the cathode bush, the cathode streamer, and the anode tree. In water, no cathode streamer was identified.

707,882
PB-289 961/5 Not available NTIS
Ultrasonic Transducer Power Output by Modulated Radiation Pressure (with details).
M. Greenspan, F. R. Breckenridge, and C. E. Tschiegg. Jul 78, 53p NBSIR-78-1520

Keywords: Calibration of transducers, Medical ultrasonics, Modulated radiation pressure, *Nondestructive evaluation, Radiation pressure, *Transducers, Ultrasonic transducers.

An apparatus for the measurement of total sound power output of a piezoelectric transducer radiating into water is described.

707,883
PB-298 654/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Electronic Ratio Error Set for Current Transformer Calibrations.
Final rept.,
R. L. Kahler. Jun 79, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement. Short Papers IM-28, n2, p162-164, Jun 79.

Keywords: *Comparators, Current transformers, Calibrating, Errors, Reprints.

A direct-reading electronic ratio error set for current transformer calibrations is described. It is capable of generating direct and quadrature error currents from 1 ppm to 5 percent of transformer secondary currents up to 10 A. The uncertainty is less than one percent of the generated current. The set features electronic display of the direct and quadrature components with three digits each and is direct reading at 50, 60, and 400 Hz.

707,884
PB-299 812/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Superconducting Resonators: High Stability Oscillators and Applications to Fundamental Physics and Metrology.
Final rept.
S. R. Stein, and J. P. Turneaure. Apr 79, 22p
Pub. in Proceedings of a Conference on Future Trends in Superconductive Electronics, Held at San Diego, CA. on March 27-28, 1979, p192-213, Apr 79.

Keywords: *Resonators, *Superconductivity, *Oscillators, Frequency stability, *Superconducting cavity resonators.

Superconducting oscillators have achieved better frequency stability than any other device for averaging times of 10 1.c.c to 1000 1.c.s. This high stability results from the use of solid niobium resonators having Q factors greater than 10 to the 10th power. Such oscillators have direct applications as clocks and spectrally pure sources. They may also be used for accurate measurements of many physical quantities and to perform a variety of experiments on fundamental constants, relativity, and gravity waves.

707,885
PB-299 813/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Systems Approach to High Performance Oscillators.
Final rept.
S. R. Stein, C. M. Manney, F. L. Walls, J. E. Gray, and R. J. Besson. 1978, 4p
Pub. in Proceedings of the Annual Symposium on Frequency Control (32nd) Held at Atlantic City, NJ. on May 31-June 2, 1978, p527-530 1978.

Keywords: *Resonators, *Oscillators, Stability, Systems analysis, Quartz resonators, Frequency stability.

The purpose of the paper is to show how systems composed of multiple oscillators and resonators can achieve superior performance compared to a single oscillator. Experimental results are presented for two systems based on quartz crystals which provide state-of-the-art stability over a much wider range of averaging times than has been previously achieved. One system has achieved a factor of five improvement in noise floor compared to all previously reported results.

707,886
PB-300 553/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of the Dielectric Relaxation Time in a Debye Binary Liquid by Pulse Measurements.
Final rept.
R. P. Bagozzi, W. R. Ives, and N. S. Nahman. 1971, 9p
Pub. in Progress in Radio Science 1966-1969, n2, p257-265 1971.

Keywords: *Dielectrics, *Electrical measurement, Dielectric properties, Relaxation time, Solutions, Ketones, Heptanes, Coaxial cables, Heptanones, Time domain.

The dispersive properties of a lossy coaxial transmission line were used to deduce the Debye relaxation time for dilute solutions of (polar) 2-heptanone in (nonpolar) normal heptane. The step responses of a liquid filled coaxial line were measured and compared with the Debye model in order to deduce the relaxation time. Over the concentration range of 0.1 to 1.1, 1KHz capacitance molal measurements showed that the static dielectric constant varied linearly with increasing concentration from 1.98 to 2.54; also, the deduced relaxation time varied from 1.36 to 5.4 picoseconds.

707,887
PB-300 570/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Strain of Epoxy-Impregnated Superconducting Composites.
Final rept.
J. W. Ekin, R. E. Schramm, and A. F. Clark. 1979, 8p
Pub. in Proc. ICMC Symp. on Nonmetallic Materials and Composites at Low Temperatures, Munich, W. Germany, July 10-11, 1978, Paper in Nonmetallic Materials and Composites at Low Temperatures, p301-308 1979.

Keywords: *Superconducting magnets, Epoxy resins, Impregnating, Strains, Superconductivity, Potting compounds, Magnet coils.

Mechanical property data are reported for three epoxy materials of the type used to impregnate superconducting solenoids: a filled epoxy, a flexibilized epoxy, and a low viscoscity epoxy suitable for vacum impregnation. Impregnated superconducting test rings were also constructed using each type of epoxy. The critical current and training behavior of each composite ring was then measured as a function of hoop stress applied to the ring and correlated with the tensile propertis of the corresponding epoxy. The ultimate strain, epsilon sub u, of the epoxy impregnate was a primary controlling factor in the superconductiang performance of each composite ring. At strains below epsilon sub u, both critical-current degradation and training were negligible. At strains near epsilon sub u, however, training became a serious problem with 5 to 10 quenches required to reach full critical current. These data would indicate that the training behavior of potted superconducting magnets is associated with a process involving relief of stress concentration within the epoxy impregnant.

707,888
PB78-600056 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Beam Induced Currents in Metal Oxide Silicon Devices.
P. Roitman. 1978, 3p
Pub. in Proceedings 13th Annual Conf. Microbeam Analysis Society, Ann Arbor, MI, June 19-23, 1978, p36A-36C 1978.

Keywords: *Electron beam induced currents, Metal-oxide-silicon capacitor, Oxidation-induced stacking faults, Scanning electron microscope.

No abstract available.

707,889
PB80-107303 Not available NTIS
National Bureau of Standards, Washington, DC.
Portable System Calibrates CCVTs.
Final rept.,
D. L. Hillhouse. 15 Jun 78, 3p
Pub. in Electrical World (U.S.) 189, n12, p44-46, 15 Jun 78.

Keywords: *Potential transformers, Calibrating, Portable equipment, Reprints.

A prototype field calibration system has been developed. The system contains a high voltage transfer standard divider made up of CCVT (Coupling Capacitor Voltage Transformer) capacitor modules, a current comparator bridge, a high voltage standard capacitor, and a resonant power supply which are transported and operated from a closed calibration truck. The modular divider is assembled and connected to the CCVT bus for the calibration. The system is compact, requires only a two-man crew plus utility operating crews, and can be set up and taken down quickly on site. System accuracy is 0.05% and 0.3 milliradians. It has successfully undergone two complete field tests in which a total of six CCVTs and six PTs were calibrated. Feasibility of a considerably simpler and less costly system has been demonstrated.

707,890
PB80-115835 Not available NTIS
National Bureau of Standards, Washington, DC.
Prototype System for On-Site Calibration of Coupling Capacitor Voltage Transformers (CCVTs).
Final rept.,
D. L. Hillhouse, O. Petersons, and W. C. Sze. Jun 79, 11p
Pub. in Proc. IEEE Power Engineering Society Summer Meeting, Held at Los Angeles, CA on Jul 16-21, 1978. IEEE Trans. Power Appar. Syst., vPAS-98 n3 p1026-1036 May/Jun 79.

Keywords: *Potential transformers, Calibrating, Portable equipment.

In recent years, the coupling capacitor voltage transformer (CCVT) has come into wide use for 0.3% accuracy extra-high voltage (EHV) revenue metering in interties between utilities. Considerable user experience raised doubts as to its adequacy for this application and suggested the need for periodic calibration. As the CCVT is permanently installed, this calibration must be done on-site. A prototype field calibration system for CCVTs has been developed. The system contains a high voltage transfer standard divider made up of CCVT capacitor modules, a current comparator bridge, a high voltage standard capacitor, and a resonant power supply which are transported and operated from a closed calibration truck. The modular divider is assembled and connected to the CCVT bus for the calibration. The system is compact, requires only a two-man crew plus utility operating crews, and can be set up and taken down quickly on site. System accuracy is 0.05% and 0.3 milliradians. It has successfully undergone two complete field tests in which a total of six CCVTs and six PTs were calibrated. Feasibility of a considerably simpler and less costly system has been demonstrated.

707,891
PB80-131063 Not available NTIS
National Bureau of Standards, Washington, DC.
Losses in Electrode Surface Films in Gas Dielectric Capacitors.
Final rept.,
E. So, and J. Q. Shields. Dec 79, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 28, n4, p279-284, Dec 79.

Keywords: *Electrodes, *Capacitors, Losses, Surface properties, Films, Stainless steels, Brass, Reprints.

The surface characteristic of a number of electrode materials including stainless steel, brass, brass with various plated surfaces, aluminum, and anodized aluminum has been examined over a wide range of humidity. The measurements of surface characteristic, expressed in microradian millimeters, have an estimated uncertainty of 0.01 microrad(mm).

707,892
PB80-134596 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
Measurements on Insulating Materials at Cryogenic Temperatures.
Final rept.,
W. E. Anderson, and R. S. Davis. Aug 79, 165p
NBSIR-79-1950
Contract DOE-EA-77-A-01-6010
See also CONS-2062-1.

Keywords: *Electrical insulation, Dielectric properties, Cryogenics, Measurement, Polyamide resins, Polycarbonate resins, Polyethylene, Sulfones, Polyethers, Polymeric films, Epoxy resins, Computer programs, Electric discharges, BASIC programming language.

The report describes the results of a four-year effort to study the high voltage dielectric behavior of various materials at cryogenic temperatures. Dissipation fac-

tors at 60 Hz were measured for polymer tapes and epoxy samples at 4.2 K, atmospheric pressure. Multilayer polymer samples in coaxial geometries at temperatures from 7 to 10 K and helium pressures up to 1.5 megapascals were also studied. The measurements were performed at stresses up to 40 MV/m. Since partial discharges were a major source of losses at the higher stresses and their presence was possibly detrimental to the integrity of the insulation, instrumentation was developed and implemented to study these discharges under conditions found in proposed ac superconducting power-transmission lines.

707,893
PB80-157894 Not available NTIS
National Bureau of Standards, Washington, DC.
Suppression of Measurement Interferences from Interface States and Mobile Ions in Thermally Stimulated Current Measurements in an MOS Capacitor.
Final rept.,
W. E. Phillips, R. Y. Koyama, and M G. Buehler. Nov 79, 3p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA., and Department of Energy, Washington, DC.
Pub. in Jnl. Electrochem. Soc., v126 n11 1979-1981 (Nov 79).

Keywords: *Capacitors, Electrical measurement, Reprints, Metal oxide semiconductors.

A study was made of the effectiveness of different procedures for suppressing measurement interferences from interface states at the oxide-silicon interface and from mobile ions in the oxide layer of MOS capacitors during thermally stimulated current measurements. It was found that the interface states can be activated or deactivated by the choice of biasing sequences and that the interference of mobile ions can be suppressed by bias temperature stress procedures which move the mobile ions to the metal electrode.

707,894
PB80-159122 Not available NTIS
National Bureau of Standards, Washington, DC.
Structures, Insulators and Conductors for Large Superconducting Magnets.
Final rept.,
F. R. Fickett, R. P. Reed, and E. N. C. Dalder. 1979, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Nuclear Materials 85 and 86, p353-360 1979.

Keywords: *Superconducting magnets, Austenitic stainless steels, Fiberglass reinforced plastics, Laminates, Cryogenics, Materials tests, Construction materials, Reprints.

As the size of superconducting magnet systems increases, the structural aspects become of increasing importance. The authors are engaged in a program to acquire low temperature mechanical and physical property data on a wide range of materials. Thepresent status of this data base is reviewed and results from the test program are described. Emphasis was placed on the austenitic stainless steels as the primary structural material, although data have also been acquired on a few aluminum alloys. Particular stress has been placed on the fracture characteristics of both the base metal and weldments where appropriate. Achieving a good match between weld and base metal at 4 K is proving to be a difficult task. Several industrial fiberglass-epoxy laminates of fixed composition have been produced as a result of this program. These materials, G10 CR, G11 CR and G11 CR(BF) have been tested at 4 K and the results are presented. Recent measurements on the effect of stress and fatigue on matrix materials for superconductor stabilization are also briefly reviewed. A new handbook of data on the properties of structural materials for superconducting magnet systems is described.

707,895
PB80-163777 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of Flammability Criteria for Transformer Dielectric Fluids.
Final rept.,
R. G. Gann. Feb 80, 56p NBSIR-80-1992
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Fire safety, *Dielectrics, *Insulating oil, Siloxanes, Fire hazards, Transformers, Flammability.

With the recent ban on the use of polychlorinated biphenyls, it has become necessary to examine the fire safety requirements for electrical insulating fluids. The hazards are delineated and the magnitude of the transformer fire problem is assessed. The current fire code and standard test methods are shown to be inadequate. Approaches to fluid fire performance testing are presented, as is a basis for evaluating the economic impact of alternative fire safety strategies. The report concludes with recommendations for further work.

707,896
PB80-163975 Not available NTIS
National Bureau of Standards, Washington, DC.
Space Applications of Superconductivity: High Field Magnets.
Final rept.,
F. R. Fickett. Dec 79, 11p
Contract NASA-A-437018(JM)
See also report dated Nov 79, PB80-126428.
Pub. in Journal of Cryogenics 19, n12, p691-701, Dec 79.

Keywords: *Superconducting magnets, *Spacecraft instruments, Utilization, Reprints.

This is the second of a seven part series on the potential applications of superconductivity in space. A very general review of superconductivity magnet technology is given, followed by a description of proposed magnet applications in space. The few programs which actually flew magnets are also described. It is thought that many interesting possibilities exist for the future, but that their early realization will require a new direction for magnet research -- toward very light, often very large structures with large amounts of stored energy.

707,897
PB80-182108 PC **A05**/MF **A01**
SRI International, Menlo Park, CA.
Application of Decision Analysis to a Regulatory Problem; Fire Safety Standards for Liquid Insulated Transformers,
D. Levinthal. Dec 79, 98p NBS-GCR-80-198
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Transformers, *Fire safety, *Standards, Insulating oil, Dielectrics, Regulations, Decision making.

This analysis is an illustrative application of the methodology of decision analysis to the complex regulatory problem of setting fire safety standards for liquid-insulated transformers. The analysis provides a preliminary structuring of the decision problem. The losses that would ensue under selected alternative safety measures are estimated by the use of a decision tree with probability assignments derived from the expert judgment of transformer manufacturers, developers of insulating fluids, researchers at insurance companies, fire engineers, and available statistical data. Alternative safety measures are evaluated in terms of their cost, the degree of property damage, and level of human losses. Despite the fire community's professed lack of knowledge concerning transformer fires, it was possible to develop a rigorous framework for making this difficult regulatory decision. Although there are significant technological uncertainties, the analysis shows that the critical factor affecting the choice of fire safety standards for liquid-insulated transformers is the level of risk tolerance.

707,898
PB80-192875 PC **A06**/MF **A01**
South Carolina Univ., Columbia. High Voltage Lab.
Electro-Optical Measurements of Solid Insulator Surface Fields and Surface Charging in Vacuum.
Technical rept.,
D. M. Hyslop, J. E. Thompson, and T. S. Sudarshan. 21 Apr 80, 113p NBS/GCR-80-203
Contract NB80-NADA-1015, Grant NBS-G8-9009

Keywords: *Electrical insulators, *Flashover, Electric fields, Measurement, Dielectric breakdown, Electrooptics, Birefringence.

Electro-optical measurements of the electric field along insulator surfaces and in the bulk of insulator materials have been made to determine the mechanisms associated with insulator surface flashover. The Pockels effect in KDP has been used in conjunction with a polarization interferometer and a pulsed laser to measure interfacial and bulk fields for KDP/vacuum interfaces. The results show that the solid insulator surface and bulk electric field distributions are spatially non-uniform. The electric field at the cathode is considerably enhanced while the field at the anode is reduced. The time evolution and steady state behavior of the insulator electric field distributions for DC, 60 Hz AC, and pulsed excitations will be presented.

707,899
PB80-226699 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Breakdown Between Bare Electrodes with an Oil-Paper Interface.
Interim rept. Jun 79-Mar 80,
E. F. Kelley, and R. E. Hebner. Jun 80, 34p NBSIR-80-2071
Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Dielectric breakdown, Electrodes, Interfaces, Insulating oil, Electrical insulating papers, Electrical faults.

This report describes experimental measurements of the location of electrical breakdown in a composite insulating system. For these measurements a paper sample was mounted so that it connected the two electrodes. Electrode structures ranging from plane-plane to sphere-sphere were used. The electrode-paper system was tested in oil in an attempt to determine the properties of an oil-paper interface. The data indicated that in a carefully prepared system the breakdown will not necessarily occur at the interface. In addition, it was found that the breakdown voltages were not significantly lower for those breakdowns which occurred at the interface than for those which did not. It was noted that if the paper interface was not dried or if many gaseous voids were left in or on the paper, the breakdown will regularly occur at the interface and at a lower voltage.

707,900
PB81-106544
(Order as PB81-106536, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Proposed Coil System for the Improved Realization of the Absolute Ampere,
P. T. Olsen, W. D. Phillips, and E. R. Williams. 1 Apr 80, 16p
Included in Jnl. of Research of the National Bureau of Standards, v85 n4 p257-272 Jul-Aug 80.

Keywords: *Electric current, *Units of measurement, Superconducting magnets, Magnet coils, *Superconducting coils.

In order to resolve the discrepancies which presently exist between the directly measured values of the absolute or SI ampere and the calculated values obtained indirectly from other fundamental physical constant determinations, one must design an absolute ampere experiment which will produce a result with an uncertainty of one half part per million or less. A new approach recently proposed by Kibble promises such sub-ppm accuracy. Presented here is the design and evaluation of a coil system which will fulfill the requirements of this new approach.

707,901
PB81-110652 Not available NTIS
National Bureau of Standards, Washington, DC.
Dielectric Measurements in a Shielded Open Circuit Coaxial Line.
Final rept.
H. E. Bussey. Jun 80, 5p
Pub. in IEEE Trans. Instrum. Meas. IM-29, n2 p120-124 Jun 80.

Keywords: *Coaxial cables, *Dielectrics, Measurement, Dielectric properties, Liquids, Reprints.

A coaxial transmission line terminated by a shielded open circuit is convenient for dielectric measurements over a frequency range from quasi-static to microwave in a single sample holder. The transmission line analysis including the open circuit termination covered by lossy dielectric is outlined. Examples of measurements of known liquids are given. Errors may arise because the support bead of a coaxial connector may excite various higher modes depending on the perfection of

the symmetry and on the product frequency times refractive index of the sample. Criteria are given for the onset of higher modes.

707,902
PB81-121006 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of High Efficiency CsI and CuI Photocathodes for Soft X-Ray Diagnostics.
Final rept.
E. B. Saloman, J. S. Pearlman, and B. L. Henke. Mar 80, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Applied Optics 19, n5 p749-753, 1 Mar 80.

Keywords: *Photocathodes, Evaluation, Efficiency, X rays, Reprints, Copper iodides, Cesium iodides.

The photoefficiency of CsI and CuI photocathodes have been measured for photons in the energy range 22-240 eV (50-560 A). The within batch and batch-to-batch variation in photoefficiency has been studied as has the sensitivity of the samples to storage under dry nitrogen. The effect of exposure to air has been investigated. The shape of the photoefficiency curves has been found to agree quite well with that expected from the photoabsorption cross sections of the materials. CsI in particular appears to be useful as a detector for use in soft x-ray diagnostics especially for use as a narrow band detector in the 100 eV photon energy range where peak measured efficiencies can exceed 300%.

707,903
PB81-126286 Not available NTIS
National Bureau of Standards, Washington, DC.
Influence of K2O on the Cerium Oxide-ZrO2 System.
T. Negas, R. S. Roth, C. L. McDaniel, H. S. Parker, and C. D. Olson. 1976, 10p
Pub. in Proceedings of the Rare Earth Research Conference (12th) Held at Vail, CO. on 18-22 Jul 76, Session J-T, p605-614 1976.

Keywords: *Electrodes, *Ceramics, *Cerium oxides, *Zirconium oxides, Magnetohydrodynamics, Potassium oxides, Perovskites, Chemical reactions, High temperature tests.

Cerium electrode bodies (cathode and anode) containing 82 (mol %) ZrO2-18CeO2, 50ZrO2-50CeO2, and 25ZrO2-75CeO2 were among materials recently tested (127 hrs) at the U-02 MHD (magnetohydrodynamics) facility in Moscow as part of a joint US-USSR effort. Materials were subjected to surface temperatures as high as 1750 C and a plasma seeded with potassium. This laboratory participated actively in the pre- and post-test chemical characterization of the materials utilized.

707,904
PB81-137168 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of DC and 60 Hz AC Positive and Negative Partial Discharge Inceptions in SF6.
R. J. Van Brunt, and M. Misakian. 1980, 9p
Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Proceedings of the Conference on Electrical Insulation and Dielectric Phenomena, 1980 Annual Report Held at Boston, MA. on Oct 26-29, p461-469 1980.

Keywords: *Sulfur hexafluoride, *Electric corona, Gases, Space charge, Direct current, Alternating current.

Measurements have been performed on inception of positive and negative partial discharge (corona) inception for dc and 60 Hz voltages in gaseous SF6 for absolute pressures in the range of 50 to 500 kPa using polished stainless steel point-plane electrodes with gap spacings between 1.25 and 2.28 cm.

707,905
PB81-140337 Not available NTIS
National Bureau of Standards, Washington, DC.
Interlaboratory Comparison of EHV Shunt Reactor Loss Measurements.
R. Malewski, W. E. Anderson, and W. J. M. Moore. Aug 80, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems PAS-99, n4 p1634-1641 Jul-Aug 80.

Keywords: *Electric reactors, Bypasses, Losses, Electrical measurements, Electric bridges, Extra high voltage, Reprints, *Shunt reactors.

A comparison of loss measurements on a 0.002 power factor, 110 MVA, 735 kV shunt reactor at the Hydro-Quebec Institute of Research using four different bridges from three independent laboratories, is described.

707,906
PB81-187866 Not available NTIS
National Bureau of Standards, Washington, DC.
Prebreakdown Phenomena Between Sphere-Sphere Electrodes in Transformer Oil.
Final rept.
E. F. Kelley, and R. E. Hebner. 15 Feb 81, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Applied Physics Letter 38, n4 p231-233, 15 Feb 81.

Keywords: *Insulating oil, *Dielectric breakdown, Electric discharges, Measurement, Reprints.

Measurements have been made of the propagation velocities of both cathode and anode streamers in transformer oil using sphere-sphere electrodes.

707,907
PB81-216343 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Optical Measurements for Interfacial Conduction and Breakdown (1980).
Annual rept.
R. E. Hebner, E. F. Kelley, J. E. Thompson, T. S. Sudarshan, and T. B. Jones. May 81, 90p NBSIR-81-2275
Sponsored in part by Department of Energy, Washington, DC. Prepared in cooperation with South Carolina Univ., Columbia, and Colorado State Univ., Fort Collins.

Keywords: *Electrical insulators, *Dielectrics, Interfaces, Measurement, Dielectric breakdown, Insulating oil, Electric fields, Kerr electrooptical effect, Birefringence.

Techniques have been developed to measure the electric field distribution along an interface between insulating materials. Specifically, systems have been developed to measure the fields in transformer oil using the Kerr effect and to measure the surface charge at a gas-solid interface using the Pockels effect. Measurements are supplemented by calculations of the distortion produced by selected interfacial charge distributions. The relatively pure transformer oil used in these studies showed little space charge distortion of the electric field. THere also was no statistically significant preference for breakdown in the vicinity of the interface. At vacuum-solid interfaces, however, interfacial breakdown was observed and surface charging was measured. As gas is introduced into the system, the surface charge is removed so that no effect of surface charging was detected at atmospheric pressure. At pressures above atmospheric, there is evidence that surface charging may again become important.

707,908
PB81-248585 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrical Breakdown in Composite Insulating Systems: Liquid-Solid Interface Parallel to the Field.
Final rept.
E. F. Kelley, and R. E. Hebner. 1981, 7p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in IEEE Transaction on Electrical Insulation EI-6, n4 p297-303 1981.

Keywords: *Electrical insulation, Electrical faults, Interfaces, Paper, Insulating oil, Reprints.

The location of electrical breakdown in a composite insulating system has been measured. In these experiments, a paper sample was mounted so that it connected the two electrodes. Electrode structures ranging from plane-plane to sphere-sphere were used. The electrode-paper system was tested in oil to determine the properties of an oil-paper interface. The data indicated that, in a carefully prepared system, the breakdown will not necessarily occur at the interface. In addition, it was found that breakdown voltages were not significantly lower for those breakdowns which occurred at the interface than for those which did not. It was noted that if the paper were not dried or if many gaseous voids were left in or on the paper, the breakdown regularly occurred at the interface and at a lower voltage.

707,909
PB82-134354 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Technical Assistance for Future Insulation Systems Research, 1980.
Annual rept.
R. J. Van Brunt, M. Misakian, D. A. Leep, K. J. Moy, and E. C. Beaty. Apr 81, 106p NBSIR-81-2242
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Dielectrics, *Sulfur hexafluorides, Electrical insulation, Electric corona, Nitrogen, Byproducts.

An experimental technique has been developed to quantify the electrical characteristics of pulse-type partial discharges (corona) in compressed electronegative gases. By this method the pulse repetition rates, shapes, and height distributions are determined together with the average current. The technique has been applied to the investigation of corona behavior in compressed SF6 and SF6/N2 for both dc and 60-Hz ac voltages. A gas chromatograph-mass spectrometer has been employed to monitor production of trace contaminants by corona-induced degradation of SF6. The most abundant gaseous by-products that were detected from dc corona were H2O, SOF2, and SO2F2.

707,910
PB82-140831 Not available NTIS
National Bureau of Standards, Washington, DC.
Structural Materials for Large Superconducting Magnets.
Final rept.
F. R. Fickett, and H. I. McHenry. Sep 81, 8p
Pub. in Proceedings of International Conference Magnet Technology (7th), Karlsruhe, Germany, F.R., March 30-April 5, 1981, IEEE Trans. Mag. MAG-17, n5 p2297-2304 Sep 81.

Keywords: *Superconducting magnets, Construction materials, Aluminum, Stainless steels, Reviews.

Insuring structural integrity of large superconducting magnet systems requires detailed knowledge of the low temperature behavior of many materials. This review describes recent research on alloys, nonmetallics and conductor composites related to their structural roles in these magnets. Special attention is paid to joining methods and their effect on the structure. It is encouraging to note that a reasonable amount of data is now available on a number of commercial alloys. It is somewhat disconcerting to see a rapid increase in design stress levels over the past several years, during which time very few large magnets have been put into operation.

707,911
PB82-143975 Not available NTIS
National Bureau of Standards, Washington, DC.
Hydrodynamic Shock Wave Propagation After Electrical Breakdown.
Final rept.
M. Zahn, E. O. Forster, E. F. Kelley, and R. E. Hebner. 1981, 6p
Pub. in Proceedings of International Conference on Conduction and Breakdown in Dielectric Liquids (7th), Berlin, Germany, F.R., July 27-31, 1981, p398-403.

Keywords: *Dielectrics, Dielectric breakdown, Shock waves, Insulating oil.

Laser schlieren measurements in liquid dielectrics have been used to examine the radial expansion of both the acoustic shock wave and the conductive breakdown channel during the first few microseconds after electrical breakdown under high voltage impulse conditions.

707,912
PB82-144015 Not available NTIS
National Bureau of Standards, Washington, DC.

Dielectric Properties of PVDF (Polyvinylidene Fluoride)-Low-Field and High-Field Phenomena and Time Effects.
Final rept.
M. G. Broadhurst, G. T. Davis, and A. S. DeReggi. 1981, 11p
Pub. in Proceedings of Symposium on High-Energy-Density Capacitors and Dielectric Materials, Boston, Massachusetts, October 28, 1980, p67-77 1981.

Keywords: *Dielectrics, Dielectric properties, Dielectric breakdown, Capacitors, Polarization, *Vinylidene fluoride polymers.

The electrical properties of polyvinylidene fluoride (PVDF) are reviewed in view of its consideration as a dielectric in high energy density capacitors. PVDF is a semicrystalline polymer which is known to crystallize in at least four different crystal phases. Electrical properties of this polymer depend upon the amount and type of crystals present as well as their orientation which makes the properties of PVDF much more dependent on processing conditions than is the case for completely amorphous polymers. Dielectric properties of the polymer as a function of temperature, frequency, and orientation are reviewed. Remnant polarization, ferroelectric switching, piezoelectric and pyroelectric activity, and electrode effects in PVDF and copolymers of vinylidene fluoride with trifluorethylene or tetrafluorethylene are discussed.

707,913
PB82-152711 Not available NTIS
National Bureau of Standards, Washington, DC.
Characterization of Point-Plane Corona Pulses in SF6.
R. J. Van Brunt, and D. A. Leep. Nov 81, 13p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Applied Physics 52, n11 p6588-6600 Nov 81.

Keywords: *Sulfur hexafluoride, *Electric corona, Dielectrics, Dielectric breakdown, Avalanche breakdown, Zeta potential, Reprints.

The properties of streamer or electron avalanche pulses have been investigated for point-plane, positive and negative dc corona discharges in gaseous SF6 over the pressure range of 50 to 500 kPa. Measurements were made of the voltage and pressure dependence of electrically-detected corona pulse-height-distributions, pulse shapes and repetition rates. Positive corona pulses appear at onset as low level electron avalanches which, at higher voltages, develop into large streamers usually followed by a burst of many smaller pulses. The burst characteristics of positive corona show a definite dependence on pressure and voltage which is evident in the pulse height distribution data. Negative corona displays characteristics which are sensitive to cathode surface conditions. For a point electrode that is either exposed to uv radiation or has been conditioned by prior discharges, the negative corona appears predominately in a quasi-glow mode consisting of relatively low-level pulses of high repetition rate.

707,914
PB82-155169 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Expansion of Several Materials for Superconducting Magnets.
Final rept.
A. F. Clark, G. Fujii, and M. A. Ranney. Sep 81, 4p
Pub. in Proceedings of Int. Conf. Magnet Technology Held at Karlsruhe, West Germany on March 30-April 5, 1981, IEEE Trans. Magn. MAG-17, n5 p2316-2319 Sep 81.

Keywords: *Superconducting magnets, *Thermal expansion, Niobium intermetallics, Reinforced plastics, Composite materials, Superconductors, Epoxy matrix composites, Phenolic matrix composites.

The thermal expansion of several materials used in the construction of high field superconducting magnets has been measured from 4 K to room temperature. The materials were a NbTi and two A15 multifilamentary conductors and several nonmetallic composites made from linen/phenolic, fiberglass/epoxy and superconducting wire/epoxy.

707,915
PB82-600062 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Conductor Qualification Tests for the 30-MJ Bonneville Power Administration SMES Coil.
R. I. Schermer, H. J. Boenig, M. Henke, R. D. Turner, and R. Schramm. 1981, 4p
Pub. in IEEE Trans. Magn. MAG-17, n1 p356-359 Jan 1981.

Keywords: *Cable assembly, Fatigue, Stability, Storage coil, Superconductor, Useful life.

The 30-MJ energy storage coil for the Bonneville Power Administration requires a low-loss, cryostable conductor that is able to carry 4.9 kA in a field of 2.8 T and will maintain its properties over 10 to the 8th power partial discharge cycles. The multi-level cable which satisfies these requirements has been extensively tested at various stages in its development and in its final form. Tests have been performed to determine the effect of manufacturing options on ac losses, low temperature electrical resistivity, stability, and fatigue resistance of the insulated conductor. This paper will concentrate on the stability and fatigue tests which have not previously been reported.

707,916
PB83-134981 Not available NTIS
National Bureau of Standards, Washington, DC.
Modified 'Allan Variance' with Increased Oscillator Characterization Ability.
Final rept.
D. W. Allan, and J. A. Barnes. 1981, 6p
Pub. in Proceedings of the Annual Frequency Control Symposium (35th) May 27-29 1981, p470-475.

Keywords: *Oscillators, *Crystal oscillators, *Frequency stability, White noise, Masers, Hydrogen masers, Allan variance.

It is shown that, with the modified Allan Variance developed in this paper, one can easily distinguish between white phase noise and flicker phase noise commonly occurring for the short term instabilities of quartz crystal oscillators and active hydrogen masers.

707,917
PB83-135236 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibration of CCVTs in the Substation.
Final rept.
D. L. Hillhouse, and W. C. Sze. 1978, 10p
Pub. in Proceedings of the Annual International Conference of Doble Clients (45th) Boston, MA. Apr 10-14, 1978, Section 9, p501-509.

Keywords: *Transformers, Calibrating, *Coupling capacitor voltage transformers.

A system for calibration of coupling capacitor voltage transformers (CCVTs) in the substation has been developed. It contains a modular transfer standard divider made up of CCVT capacitors, a current comparator bridge, a high voltage standard capacitor, and a resonant power supply, transported and operated from a closed truck. The divider is stacked up and connected to the CCVT bus for the calibration. The system is compact, requires only two operators plus utility crews, and can be assembled and disassembled quickly on site. Accuracy is 0.05% and 0.3 milliradian. It has successfully undergone field tests. Feasibility of a simpler system has been demonstrated in the laboratory.

707,918
PB83-149187 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
1981 Annual Report: Technical Assistance for Future Insulation Systems Research.
R. J. Van Brunt, M. Misakian, D. A. Leep, E. C. Beaty, J. W. Gallagher, C. M. Cooke, K. Wyatt, and R. G. Gels. Nov 82, 159p NBSIR-82-2555
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Electrical insulation, *Sulfur hexafluoride, Degradation, Electric corona, Electric discharges.

The objective for this project is to develop measurement and diagnostic techniques for monitoring, identifying, and predicting degradation in future compressed gas electrical insulating systems under normal operating conditions. The focus is on providing fundamental information and data needed to improve test design and performance evaluation criteria for gaseous dielectrics. The emphasis of the studies reported here has been on the electrical and chemical properties of SF6 because of its recent widespread use as an insulant, in advanced high-voltage systems.

707,919
PB83-149385 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Testing to Quantify the Effects of Handling of Gas Dielectric Standard Capacitors.
C. R. Levy. Oct 82, 48p NBS-TN-1161

Keywords: *Capacitors, *Calibrating, Tests, Standards, Reference standards.

A test method known as the 'Handling and Stability Test' is currently being used at NBS as part of the requirement for the five-part-per-million calibration of gas-dielectric standard capacitors. This test is used to achieve qualitative information on the effects of mechanical shock from shipping and handling on standard capacitors and to rank them quantitatively with respect to these effects.

707,920
PB83-177477 Not available NTIS
National Bureau of Standards, Washington, DC.
Training Studies of Epoxy-Impregnated Superconductor Windings.
Final rept.
J. W. Ekin, E. S. Pittman, M. J. Superczynski, and D. J. Waltman. 1982, 10p
Pub. in Proceedings of International Cryogenic Materials Conference (4th), San Diego, California, August 10-14, 1981, Paper in Advances in Cryogenic Engineering 28, p719-728 1982.

Keywords: *Superconducting magnets, *Magnet coils, Impregnating, Epoxy resins, Niobium intermetallics, Titanium intermetallics, Coils.

A systematic study of training is being carried out in epoxy-impregnated NbTi superconductor windings. The effects of the following factors on training are reported: (1) coating the superconductor with an epoxy release agent, (2) adding a milled fiberglass filler to the epoxy impregnant, (3) prestressing the superconductor prior to winding, (4) room temperature cycling of a trained winding, and (5) vacuum impregnating superconductor windings with wax instead of epoxy. The results indicate that a major source of training in epoxy impregnated magnets is microfracture of the epoxy resin.

707,921
PB83-193110 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Annual Report, 1981: Optical Measurements for Interfacial Conduction and Breakdown.
Final rept.
R. E. Hebner, E. F. Kelley, and J. N. Hagler. Jan 83, 80p NBSIR-82-2629
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Electrical insulation, Space charge, Electric charge, Dielectric breakdown, Measurement, Interfaces, Nitrobenzenes, Insulating oil, Electric fields, Computation, Kerr electrooptical effect.

The report presents measurements and calculations contributing to the understanding of space and surface charges in practical insulation systems. Calculations are presented which indicate the size of charge densities necessary to appreciably modify the electric field from what would be calculated from geometrical considerations alone. Experimental data is also presented which locates the breakdown in an electrode system with a paper sample bridging the gap between the electrodes. It is found that with careful handling, the breakdown does not necessarily occur along the interface even if heavily contaminated oil is used. The effects of space charge in the bulk liquid are electro-optically examined in nitrobenzene and transformer oil. Several levels of contamination in transformer oil are investigated. Whereas much space charge can be observed in nitrobenzene, very little space charge, if any, can be observed in the transformer oil samples even at temperatures near 100 degrees C.

707,922
PB83-215715 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.

Fabrication of Ultra-Drawn Thick PVDF (Polyvinylidene Fluoride) Transducers.
Final rept.
A. J. Bur, and A. K. Tsao. Dec 81, 25p NBSIR-81-2318
Sponsored in part by Naval Ocean Systems Center, San Diego, CA.

Keywords: *Piezoelectric transducers, Fabrication, Drawing, Piezoelectricity, Polarization, Vinyl plastics, Vinylidene fluoride polymers.

Ultra-drawn PVDF (polyvinylidene fluoride) transducers have been fabricated from pellet resin material with thicknesses of 0.23, 0.30 and 0.50 mm. The samples were mechanically ultra-drawn beyond their natural 4:1 draw ratio to a 7:1 ratio in order to enhance the molecular orientation and thereby optimize the piezoelectric activity. The samples were characterized using modulus and x-ray measurements which showed that modulus increases with increasing draw ratio and that the crystalline portion of the 7:1 drawn material was mostly beta phase. Ten out of fourteen samples were successfully poled at room temperature with fields ranging from 1.6 to 2.5 MV/cm. The pyroelectric activities ranged from 2.0 to 4.1 NC/c(m squared)k and the hydrostatic piezoelectric coefficients ranged from 8.6 to 15.6 pC/N.

707,923
PB83-235887 Not available NTIS
National Bureau of Standards, Washington, DC.
Hydrodynamic Shock Wave Propagation after Electrical Breakdown.
Final rept.
M. Zahn, E. O. Forster, E. F. Kelley, and R. E. Hebner. 1982, 12p
Pub. in Jnl. of Electrostatics 12, p535-546 1982.

Keywords: *Shock waves, *Dielectric breakdown, High voltage, Insulating oils, Wave propagation, Reprints.

Laser schlieren measurements in liquid dielectrics have been used to examine the radial expansion of both the acoustic shock wave and the conductive breakdown channel during the first few microseconds after electrical breakdown under high voltage impulse conditions. It was found that the acoustic shock wave expands at a constant velocity while the expanding radius of the breakdown channel is proportional to the fourth root of the energy and the square root of time. These dependencies are predicted by modeling the breakdown channel as an expanding adiabatic ideal gas with an instantaneous input of energy.

707,924
PB83-600045 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison of Open-Field, Anechoic chamber and TEM Cell Facilities/Techniques for Performing Electromagnetic Radiated Emissions Measurements.
M. L. Crawford. 1983, 6p
Pub. in Proceedings 1983 Int. Symp. on Electromagnetic Compatibility, Arlington, VA, Aug. 23-25, 1983, IEEE Cat. No. 83CH1838-2, p413-418 1983.

Keywords: *Anechoic chamber, Electromagnetic compatibility measurements, Open-field, Transverse electromagnetic cell.

This paper compares the results of measurements performed at discrete frequencies between 30 MHz to 300 MHz using a spherical dipole reference standard radiator to evaluate: 1) a 6.0 m x 9.0 m ground screen open-field site, 2) a 3.0 m x 4.88 m x 6.1 m anechoically quieted shielded enclosure, and 3) a 2.8 m x 2.8 m x 5.6 m anechoically quieted TEM cell for use in measuring radiated rf emissions from electronic equipment. The paper briefly describes each facility, the test techniques, and the test configuration used. The results given provide a comparison of the radiated measurement uncertainty anticipated from a point source radiator for each facility, when all known correction factors (assuming far-field conditions) are applied.

707,925
PB84-153261 Not available NTIS
National Bureau of Standards, Washington, DC.
Voltage and Current Expressions for a Two-Junction Superconducting Interferometer.
Final rept.
R. L. Peterson, and D. G. McDonald. Feb 83, 5p
Grant N00014-81-F-0012
Pub. in Jnl. of Applied Physics 54, n2 p992-996 Feb 1983.

Keywords: *Josephson junctions, *Interferometers, Electric current, Electric potential, Reprints, *Superconducting interferometers, SQUID devices, Voltage, Electromagnetic noise.

The average voltage and circulating current of a superconducting interferometer containing two Josephson junctions (a dc SQUID) are calculated analytically, in various approximations, as functions of bias current and applied magnetic field or control current. The results are useful in calculations of the noise characteristics of the dc SQUID, as well as in other applications.

707,926
PB84-216902 PC **A02**/MF **A01**
National Bureau of Standards (NML), Washington, DC. Electrical Measurements and Standards Div.
Transportable 1000 pF Standard for the NBS (National Bureau of Standards) Capacitance Measurement Assurance Program.
Final rept.
G. Free, and J. Morrow. Oct 82, 19p NBS-TN-1162
Also available from Supt. of Docs as SN003-003-02444-9.

Keywords: *Standards, *Capacitors, *Calibrating, Capacitance, Portable equipment, Performance, Stability, Reference standards, Measurement assurance program.

A capacitance transport standard has been constructed for use in the National Bureau of Standards Measurement Assurance Program. The transport standard was designed so that variations in ambient temperature and mechanical shock would have a minimal effect on the value of the internal reference capacitors. A significant improvement in stability of 1000 pF capacitors during shipment and in the laboratory has been achieved through this design.

707,927
PB84-223429 Not available NTIS
National Bureau of Standards, Washington, DC.
Conductors for Advanced Energy Systems, Annual Report 1982.
Final rept.
F. R. Fickett. 1983, 104p
Sponsored in part by International Copper Research Association, Inc., New York.
Pub. in International Copper Research Association, Project No. 312A, pi-97 1983.

Keywords: *Superconducting magnets, *Copper, Electric conductors, Electrical resistivity, Magnetoresistivity, Superconductors, Cryogenics, Annealing, Stresses, Strains.

The coppers that are almost always chosen for stabilizing superconductors are the oxygen-free grades, usually CDA 102 in the U.S. As the copper undergoes considerable deformation and thermal treatment in the production of the conductor, it is essential that information be available that will allow the magnet designers to determine the amount of copper required for optimum protection and maximum current density. It is this problem that is addressed in the experimental program reported here. Data are presented on the resistance and magneto-resistance at 4 K of various coppers and how these parameters are affected by temper, anneal, and strains induced by several methods.

707,928
PB84-224096 Not available NTIS
National Bureau of Standards, Washington, DC.
Understanding the Purcell Filter.
Final rept.
P. Debenham. Sep 81, 4p
Pub. in Proceedings of Workshop on High-Resolution, Large-Acceptance Spectrometers, Argonne, Illinois, September 8-11, 1981, pIII.H-1-III.H-4.

Keywords: *Magnets, Design, *Purcell filters.

The observation that H-magnets with Purcell filters do not automatically produce a homogeneous magnetic field is explained. The importance of proper design of the pole-end and coil geometry is shown.

707,929
PB84-225580 Not available NTIS
National Bureau of Standards, Washington, DC.

Fabrication and Characterization of Ultra-Drawn Thick PVDF (Polyvinylidene Fluoride) Transducers.
Final rept.
A. J. Bur, and A. K. Tsao. 1982, 1p
Pub. in Proceedings of Int. Union Pure Appl. Chem., Macromolecular Sympoium (28th), University of Massachussets, Amherst, MA., July 12-16, 1982, p457.

Keywords: *Piezoelectric transducers, *Transducers, *Pyroelectricity, Fluorine organic compounds, Piezoelectric crystals, Fabrication, Drawing, *Vinylidene fluoride polymers.

Ultra-drawn PVDF (polyvinylidene fluoride) transducers have been fabricated from pellet resin material with thicknesses of 0.23, 0.30 and 0.50 mm. The samples were mechanically ultra-drawn beyond their natural 4:1 draw ratio to a 7:1 ratio in order to enhance the molecular orientation and thereby optimize the piezoelectric activity. The samples were characterized using modulus and x-ray measurements which showed that modulus increases with increasing draw ratio and that the crystalline portion of the 7:1 drawn material was mostly beta phase. Ten out of fourteen samples were successfully poled at room temperature with fields ranging from 1.6 to 2.5 MV/cm. The pyroelectric activities ranged from 2.0 to 4.1 nc/(sq cm)K and the hydrostatic piezoelectric coefficients ranged from 8.6 to 15.6 pC/N.

707,930
PB84-226794 Not available NTIS
National Bureau of Standards, Washington, DC.
Double Transformer Coupling to a Very Low Noise SQUID.
B. Muhlfelder, W. Johnson, and M. W. Cromar. May 83, 5p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Magnetics MAG-19, n3 p303-307 May 83.

Keywords: *Coupling circuits, Superconductors, Josephson junctions, Transformers, Reprints, *SQUID devices.

The authors demonstrate a new way to couple efficiently to a low-inductance, low-noise SQUID. They built and tested a planar dc SQUID with an integral matching transformer. The measured coupling agrees with their calculations. They demonstrate that this configuration can efficiently couple a 1 (mu)H signal source to a 16 pH SQUID loop. They have also built an uncoupled SQUID of this design that has an energy sensitivity, referred to the SQUID inductor, of 1.3 x (10 to the -32 power) J/Hz = 20 h over a flux range of about 0.15 (phi sub D).

707,931
PB84-244953 Not available NTIS
National Bureau of Standards, Washington, DC.
Quartz Crystal Resonators and Oscillators, Recent Developments and Future Trends.
Final rept.
R. J. Besson, J. M. Groslambert, and F. L. Walls. 1982, 9p
Pub. in Ferroelectrics 43, p57-65 1982.

Keywords: *Quartz resonators, *Crystal oscillators, Development, Trends, Reprints.

The paper deals only with the most recent and significant developments in the field, because excellent review papers on crystal resonators and oscillators are available and given in reference. A short historical review providing general concepts is presented first. Then, since important advances have recently been made in the resonator and oscillator field as well, the most significant improvements are pointed out and discussed.

707,932
PB85-100204 Not available NTIS
National Bureau of Standards, Washington, DC.
Electro-Optic Electric-Field Measurements near Oil-Pressboard Interfaces.
Final rept.
R. E. Hebner, and E. F. Kelley. Jun 84, 4p
Pub. in Proceedings of 1984 IEEE International Symposium on Electrical Insulation, Montreal, Canada, June 11-13, 1984, p311-314.

Keywords: *Electric fields, *Measurement, Dielectrics, Electrical insulation, Insulating oil, Kerr electrooptical effect, Space charge.

Electro-optical Kerr-effect measurements are made to characterize the electric field in the vicinity of pressboard interfaces in transformer oil. The interfaces are placed between parallel plate electrodes and are oriented parallel to the field direction. In the case where the interface is parallel to the field it is in contact with both electrodes. The electric field enhancement in the liquid alone (due to space charge) is compared with the enhancement with interfaces installed. These results serve to better define the roles of space charge and interfacial surface charging in pressboard/transformer-oil high-voltage systems.

707,933
PB85-113108 PC **A05**/MF **A01**
Charles River Associates, Inc., Boston, MA.
Technological and Economic Assessment of Advanced Ceramic Materials. Volume 3. A Case Study of Ceramic Capacitors.
Planning rept. no. 19 (Final).
Aug 84, 90p CRA-684-VOL-3, NBS/GCR-84/470/3
Contract NB82-SBCA-1637
See also Volume 2, PB85-113090, and Volume 4, PB85-113116.
Also available in set of 6 reports PC E99, PB85-113074.

Keywords: *Ceramics, *Ceramic capacitors, Technology assessment, Economic analysis, Industries.

This report is organized into five chapters including this introductory chapter. Chapter 2 discusess the technologies used in producing ceramic capacitors. Chapter 3 analyzes the U.S. multilayer ceramic capacitor industry. Chapter 4 draws on information in Chapters 2 and 3 to assess the economic benefits of anticipated future technological advance in multilayer ceramic capacitors. The major findings of the study, including a discussion of the primary measurement-related barriers, are presented in Chapter 5.

707,934
PB85-118453 Not available NTIS
National Bureau of Standards, Washington, DC.
Two Theoretical Results Suggesting a Method for Calibrating Ultrasonic Transducers By Measuring the Total Nearfield Force.
Final rept.
E. B. Miller, and A. D. Yaghjian. 1979, 8p
Pub. in Jnl. of the Acoustical Society of America 66, n6 p1601-1608 Dec 79.

Keywords: *Electroacoustic transducers, Calibrating, Ultrasonic frequencies, Evaluation, Measurement, Reprints, Near fields, Ultrasonics.

Theory and preliminary experiments are outlined relating to a near-field method of evaluating electro-acoustic transducers. The theoretical results are conveniently organized into two theorems. These state: (1) The total complex force on all infinite planes to one side of a transducer and perpendicular to an arbitrary direction, has a constant magnitude equal to the far-field pressure amplitude in that same direction multiplied by the wavelength. (2) The output voltage of a baffled, reciprocal, plane-piston receiver is proportional to the total incident force perpendicular to its face.

707,935
PB85-136240 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Training Studies of Epoxy-Impregnated Superconductor Windings. Part III. Epoxies, Conductor Insulations, and Copper Ratio.
Final rept.
J. W. Ekin, E. S. Pittman, R. B. Goldfarb, M. J. Superczynski, and D. J. Waltman. Jul 84, 8p
See also PB83-177477.
Pub. in Advances in Cryogenic Engineering 30, p977-984 Jul 84.

Keywords: *Superconducting magnets, *Magnet coils, Impregnating, Epoxy resins, Niobium intermetallics, Titanium intermetallics, Coils, Superconductors, Reprints.

A systematic study of the materials and construction factors that affect training in epoxy-impregnated superconductor windings are reported. Using relatively small test rings (18 cm diam), the training rate was measured for several epoxies currently used in magnet construction. These training data correlated well with the strain at fracture measured on these same epoxy materials at 4 K. Results are also reported on the dependence of the training rate on the fiberglass cloth configuration in the winding, the type of superconductor insulation, and the copper-to-superconductor ratio of the conductor.

707,936
PB85-142206 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Problems Associated with Interpreting Shielding Effectiveness Measurement Results.
Final rept.
P. F. Wilson, and M. T. Ma. 1984, 10p
Pub. in Proceedings of EMI/RFI Shielding Plastics, Rosemont, IL., June 18-20, 1984, p9-18.

Keywords: *Electromagnetic shielding, Effectiveness, Measurement, Insertion loss.

Shielding effectiveness is usually measured in terms of insertion loss, that is, the reduction in the fields coupled between a transmitter and receiver achieved by introducing the shield material or case, etc. Although the insertion loss concept is simply stated, problems arise when one attempts to interpret specific insertion loss measurements. Insertion loss depends not only on the shield introduced but also on antenna types used and their positioning, the waveform incident on the shield, and contact resistance. Variations in these factors can yield almost any level of insertion loss for the same shield sample. These concepts will be discussed to emphasize both the difficulty in making even relative insertion loss comparisons and the importance of controlling and understanding insertion loss parameters.

707,937
PB85-148120 Not available NTIS
National Bureau of Standards, Boulder, CO.
Microwave-Induced Constant-Voltage Steps at One Volt from a Series Array of Josephson Junctions.
Final rept.
J. Niemeyer, J. H. Hinken, and R. L. Kautz. 15 Aug 84, 3p
Pub. in Applied Physics Letters 45, n4 p478-480, 15 Aug 84.

Keywords: *Josephson junctions, Superconductivity, Cryogenics, Microwaves, Standards, Reprints, *Voltage standards.

It is demonstrated that a series array of 1474 Josephson junctions can produce quantized voltages up to 1.2 V when driven by microwaves at 90 GHz in the absence of a dc bias. This result brings closer the possibility of a practical Josephson voltage standard at the 1-V level.

707,938
PB85-182566 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Outline of CCVT (Coupling Capacitor Voltage Transformer) Calibration Procedure, EPRI-NBS (Electric Power Research Institute/National Bureau of Standards) Prototype System - Supplement to EPRI Report EL-690 (Field Calibration System for CCVTs, April 1978).
D. L. Hillhouse. Aug 84, 17p NBSIR-84/2987

Keywords: *Transformers, *Calibrating, *Coupling capacitor voltage transformers.

The report contains, in outline form, the step-by-step procedure for use of the EPRI-NBS Prototype Field Calibration System for Coupling Capacitor Voltage Transformers (CCVTs) in the calibration of CCVTs in the substation.

707,939
PB85-187805 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Behavior of the DC Impedance of an RF-Biased Resistive SQUID.
Final rept.
D. Van Vechten, R. J. Soulen, and R. L. Peterson. 1980, 4p
Sponsored by Physikalisch-Technische Bundesanstalt, Berlin (Germany, F.R.), and European Physical Society, Geneva (Switzerland).
Pub. in Proceedings of IC SQUID Int. Conference on Superconducting Quantum Devices (2nd), Berlin, Germany, May 6-9, 1980, p186-189.

Keywords: *Electrical impedance, Josephson junctions, Nonlinear differential equations, Direct current, *SQUID devices, Superconducting weak links.

The authors have measured the dc impedance of an rf biased R-SQUID as a function of applied dc bias current, rf frequency and amplitude, and the critical current of the weak link. They conclude that the inclusion of an rf driving current, as required for parametric upconversion influences, in an as yet incompletely modeled way, the dc impedance of an R-SQUID.

707,940
PB85-201523 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microprocessor-Based Technique for Transducer Linearization.
Final rept.
J. V. Moskaitis, and D. S. Blomquist. 1983, 4p
Pub. in Precis. Eng. 5, n1 p5-8 Jan 83.

Keywords: *Transducers, *Calibrating, Microcomputers, Nonlinear algebraic equations, Cubic equations, Displacement, Detectors, Reprints, Sensors, Microprocessor, Computer software.

A linearization technique has been developed at the National Bureau of Standards (NBS) that is applicable to a wide range of transducers with calibration curves containing nonlinear regions. This technique was applied to a microcomputer-based, displacement sensor system that achieve accuracies of 1 part in 4096. By increasing the resolution of the ADC from 12 to 16 bits, a linearization of 1 part in 65,000 can be achieved.

707,941
PB85-206688
(Order as PB85-206324, PC **A13**/MF **A01**)
Rome Air Development Center, Hanscom AFB, MA. Solid State Sciences Div.
Infrared Characterization of Defect Centers in Quartz.
H. G. Lipson. Apr 85, 5p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p145-149 Apr 85.

Keywords: *Quartz, *Crystal defects, *Crystal oscillators, *Infrared spectroscopy, Radiation effects, Frequency shift.

The radiation hardness and ageing properties of quartz oscillator devices depend strongly on the impurity and defect content of the synthetic quartz material. Low temperature infrared Fourier spectroscopy is a powerful tool for characterizing changes in quartz defect centers introduced by ionizing radiation and processing techniques such as electrodiffusion (sweeping). The technique of scanning large crystals normal to the growth of sweeping axis reported in this paper has revealed localized changes in defect center distribution produced by irradiation and the effect of impurity concentration on vacuum sweeping.

707,942
PB85-229839 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
EPRI-NBS (Electric Power Research Institute-National Bureau of Standards) Coupling Capacitor Voltage Transformer Calibration Systems.
Final rept.
D. L. Hillhouse. 1985, 25p
Sponsored by Electric Power Research Inst., Palo Alto, CA.
Pub. in Proceedings Workshop: Metering-type Coupling Capacitor Voltage Transformers (CCVTs), Gaithersburg, Maryland, June 2-3, 1983, p7-1--7-25 Apr 85.

Keywords: *Transformers, Calibrating, *Coupling capacitor voltage transformers, Metering.

The paper describes briefly a prototype system for field calibration of CCVTs developed by NBS in EPRI project RP-134-1, and in more detail, a simplified, less costly system developed later with partial support from the Pennsylvania Power and Light Co. The latter system was breadboarded as part of the above EPRI project. The prototype system contains five major dedicated components: (1) a current-comparator bridge, (2) a modular capacitive transfer standard divider, (3) a compressed-gas standard capacitor, (4) a resonant power supply, and (5) a calibration truck. Its field accuracy is estimated to be 0.1% and 0.3 mrad, but it would be extremely expensive to reproduce. The simplified system contains only three major components: (1) the transfer standard divider above, (2) a voltage comparator, and (3) a combined standard-power transformer module. The latter two items repre-

sent much less cost and weight than items (2), (3) and (4) in the prototype system, which they replace.

707,943
PB85-229870 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
NBS (National Bureau of Standards) Experience, Field Calibration of Coupling Capacitor Voltage Transformers.
Final rept.
D. L. Hillhouse. 1985, 14p
Sponsored by Electric Power Research Inst., Palo Alto, CA.
Pub. in Proceedings Workshop: Metering-type Coupling Capacitor Voltage Transformers (CCVTs), Gaithersburg, Maryland, June 2-3, 1983, p1-1--1-14 Apr 85.

Keywords: *Transformers, Calibrating, Coupling capacitor voltage transformers, Metering.

Since its completion in 1976, the EPRI-NBS field calibration system for coupling capacitor voltage transformers (CCVTs) has been in NBS custody and has been used in field calibrations at six utilities. Measurements have been performed on 61 CCVTs, including 51 of metering class (12 of which were not using the X1X3 metering tap) and on nine metering VTs. The paper discusses the measurements at the six utilities, and summarizes all zero burden and connected burden results on metering windings. A large proportion of these CCVTs were found to be out of metering tolerance at both zero and connected burdens. However, the data base is not large enough to allow extension of these results to metering CCVTs in general.

707,944
PB86-105715 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
High Voltage Divider and Resistor Calibrations.
Final rept.
M. Misakian. Jul 85, 34p NBS/TN-1215
Also available from Supt. of Docs as SN003-003-02672-7.

Keywords: *Voltage dividers, *Resistors, Electric reactors, High voltage, Direct current, Calibrating, Electrical properties, Standardization.

An NBS calibration service for determining the ratio of high voltage dc dividers and the resistance of high voltage resistors is described. Calibrations are performed with a Wheatstone bridge apparatus with a simple guard system. Sources of systematic error are identified and methods for characterizing the NBS standard high voltage resistors are discussed. Ratio and resistance values can be determined between the voltages of 10 kV and 150 kV with an uncertainty of less than + or -0.01%.

707,945
PB86-112786 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Well Coupled, Low Noise, DC SQUIDs (Superconducting Quantum Interference Device).
Final rept.
B. Muhlfelder, J. A. Beall, M. W. Cromar, R. H. Ono, and W. W. Johnson. 1985, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics MAG-21, n2 p427-429 Mar 85.

Keywords: Direct current, Reprints, *SQUID (Detectors).

The authors have designed, fabricated, and tested a Double Transformer (DT) coupled dc SQUID (Superconducting Quantum Interference Device) with low noise, an input inductance of 1 microH and a smooth input-output characteristic. A transmission line model is presented to explain a resonance in the input-output characteristic of early versions of this device. Guided by the results of numerical simulations a new version of this device has been built and tested. Experimental results are presented that show that the resonance can be moved to a higher voltage by reducing the area of the SQUID loop. The minimum detectable energy per unit bandwidth (MDE) referred to the SQUID loop, is 10h, where h is Planck's constant. Computer simulations indicate an MDE of 6h.

707,946
PB86-119278 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Chaos and Thermal Noise in the rf-Biased Josephson Junction.
Final rept.
R. L. Kautz. 1985, 17p
Contract N00014-84-F-0038
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Applied Physics 58, n1 p424-440, 1 Jul 85.

Keywords: *Josephson junctions, Superconductivity, Reprints, Johnson noise, Chaos.

The effect of thermal noise on chaotic behavior in the rf-biased Josephson junction is studied through digital simulations. In instances for which chaotic behavior occurs in the noise-free system, it is found that the dynamics of the system are almost unchanged by the addition of thermal noise unless the level of thermal noise exceeds that of the chaotic state. In instances for which the only stable states of the noise-free system are periodic solutions, small amounts of thermal noise can induce the junction to hop between two different dynamical states, producing a low-frequency noise level much higher than that of the thermal noise. Such noise-induced hopping can occur either between two periodic solutions or between a periodic solution and a metastable chaotic solution. When a metastable chaotic state is involved, temperatures somewhat higher than those which produce hopping can destablize the periodic solution to the point where the system spends virtually all of its time in the metastable chaotic state, creating noise-induced chaos. The similarities between chaotic behavior at zero temperature and noise-induced chaos are sufficiently strong that it may be difficult to distinguish the two cases experimentally.

707,947
PB86-129616 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Superconductor-Insulator-Superconductor Quasiparticle Junctions as Microwave Photon Detectors.
Final rept.
P. L. Richards, T. M. Shen, R. E. Harris, and F. L. Lloyd. 1980, 3p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Applied Physics Letters 36, n6 p480-482, 15 Mar 80.

Keywords: Microwave equipment, Electron tunneling, Superconductors, Detectors, Reprints, *Microwave sensors, Quasiparticles.

The strong nonlinearity of the quasiparticle tunneling current in superconductor-insulator-superconductor junctions near the full-gap voltage 2 delta/e can be used for direct detection of microwave signals. Measurements at 36 GHz yielded a current responsivity of 3500 A/W, which is within a factor of 2 of the quantum-limited value e/(h bar)omega. The measured NEP of 2.6 + or - 0.8x10 to the -16th power W/(Hz sup 1/2) is the lowest value reported to date and can probably be improved significantly. The experimental results are compared with both the standard classical analysis and photon-assisted tunneling theory.

707,948
PB86-138039 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Magnetic Field Mapping with a SQUID (Superconducting Quantum Interference Device) Device.
Final rept.
F. R. Fickett, and T. E. Capobianco. 1985, 10p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v4A p401-410 1985.

Keywords: *Magnetic fields, *Magnetic measurement, Nondestructive tests, Eddy currents, Reprints, *SQUID (Detectors), SQUID devices.

Results of tests applying a SQUID (superconducting quantum interference device) system to measurement of the magnetic near field of commercial eddy current coils is reported. The SQUID system offers some significant advantages over more conventional techniques in that very small coils can be used and the calibration of the system is tied to the quantum of flux.

707,949
PB86-139953 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Amplification by a Voltage Locked Array of Josephson Junctions.
Final rept.
D. G. McDonald, and N. V. Frederick. Sep 85, 3p
Pub. in Applied Physics Letters 47, n5 p530-532, 1 Sep 85.

Keywords: *Amplifiers, Josephson junctions, Superconductivity, Reprints.

The authors have studied a new type of Josephson junction amplifier which is based on a two-junction array; the junctions are mutually phase locked at the Josephson self-oscillation frequency. With the frequency at 82 GHz, the voltages of the junctions remain equal (locked) for a bias current range as large as 60% of the critical current. Over a much smaller bias range, with an applied signal frequency of 1 kHz, a small-signal power gain of 19 dB was measured, accompanied by a negative resistance input impedance. The performance is consistent with a quasistatic theory of the amplifier.

707,950
PB86-139961 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Amplification by the Phase-Locking Mechanism in a Four-Junction SQUID.
Final rept.
D. G. McDonald. Dec 84, 3p
Pub. in Applied Physics Letters 45, n11 p1243-1245, 1 Dec 84.

Keywords: *Amplifiers, Josephson junctions, Microwaves, Superconductivity, Reprints, SQUID devices.

It is shown that the phase-locking property of an array of Josephson junctions can be used as a basis for amplification. The particular device simulated is a superconducting quantum interference device (SQUID) with four junctions in the loop, rather than the usual one or two. Novel consequences of the design are that it allows direct rather than inductive coupling to the SQUID and, because of its potentially compact form, it probably can have a bandwidth well into the gigahertz range, in agreement with the simulations.

707,951
PB86-193810 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
International Comparison of Current Transformer Calibrations.
Final rept.
W. Schwitz, R. Kampfer, A. Braun, T. M. Souders, W. J. M. Moore, B. R. Cassidy, and T. A. Deacon. 1985, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM34, p234-238 Jun 85.

Keywords: *Current transformers, Calibrating, Reprints.

An international comparison of current transformer calibrations between five metrology laboratories has been conducted. The measurements were made at current ratios ranging from 1 A:1 A to 200 A:1 A at 10, 100, and 200 percent of rated current and from 5 A:5 A to 200 A:5 A at 1, 10, 100, and 200 percent of rated current, at a frequency of 50 Hz. Several ratios have also been compared at 60 Hz.

707,952
PB86-210259 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Self-Heated Thermistor Flowmeter for Flow Measurement in a Thermosyphon Solar Hot Water System.
Final rept.
A. H. Fanney, and B. P. Dougherty. 1986, 14p
Pub. in Proceedings of ASME (American Society of Mechanical Engineers) Solar Energy Conference (SED 8th Annual), Anaheim, CA., April 13-16, 1986, p1-10.

Keywords: *Thermistors, Flowmeters, Flow measurement, Calibrating, Dissipation factor, *Solar water-heaters, Thermosyphons.

The development and calibration of a self-heated thermistor anemometer is described. The variation in thermistor power dissipation as a function of fluid temperature and velocity is presented. A thermal analysis

of the glass-encapsulated thermistor bead is described which leads to an experimental technique for determining the effective radius and thermal conductivity of the thermistor probe. A dimensionless heat transfer analysis is performed and the results compared to empirical correlations. The thermistor flowmeter, which evolves from the investigation, is used to measure the buoyancy-induced flow in a thermosyphon solar hot water system.

707,953
PB86-214228 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inst. for Materials Science and Engineering.
Fourier Analysis of Impedance Spectra for Electroded Solid Electrolytes.
Final rept.
A. D. Franklin, and H. J. deBruin. 1983, 10p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physica Status Solidi A-Applied Research 75, n2 p647-656 1983.

Keywords: *Solid electrolytes, *Electrolytic cells, Fourier analysis, Impedance, Spectra, Electrical properties, Frequency response, Reprints.

The electrical properties of a solid conductor with its attached electrodes can often be represented by an equivalent circuit involving only a few parameters. The cell's frequency response, which is imposed by its materials' behavior, can then be expressed in terms of these circuit parameters. Critical elements in the logical chain then are the degree of fit of the equivalent circuit to the data, and the relationship of the circuit parameters to the material properties. The paper will be concerned with the first of these critical elements, the fitting of the circuit to the data.

707,954
PB86-231446 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Measurements of the Electromagnetic Shielding Capabilities of Materials.
Final rept.
P. F. Wilson, J. W. Adams, and M. T. Ma. 1986, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Special Issue on Radio Measurement Methods and Standards 74, n1 p112-115 Jan 86.

Keywords: *Electromagnetic shielding, Measurement.

Electromagnetic shielding is typically measured in terms of insertion loss, that is, the reduction in the fields coupled between a transmitter and a receiver which results from interposing the shield material. Although the insertion loss concept is simply stated, questions arise when one attempts to interpret specific insertion loss measurements. Insertion loss data depend not only on the inherent shielding effectiveness of the material, but also on the antenna types used for the measurement, the incident field distribution, the sample size, a possible contact impedance between the test material and its mount, and other factors. For a given sample of shield material, varying these factors can lead to a large range of possible measured insertion loss values. Both the above considerations and existing shielding effectiveness measurement systems will be discussed briefly in the paper. The emphasis will be on the potential difficulties in making even relative comparisons of results and on the importance of understanding how the measurement system used affects data.

707,955
PB86-240744 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Ultrasonic Transducers.
Final rept.
W. Sachse, and N. Hsu. 1986, 7p
Pub. in Encyclopedia of Materials Science and Engineering, v7 p5192-5198 1986.

Keywords: *Transducers, Ultrasonic frequencies, Reprints.

No abstract available.

707,956
PB86-244183 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Center for Electronics and Electrical Engineering.
Study of Techniques for Measuring the Electromagnetic Shielding Effectiveness of Materials.
Technical note.
P. F. Wilson, and M. T. Ma. May 86, 72p NBS/TN-1095
Also available from Supt. of Docs as SN003-003-02735-9 Sponsored by Army Aviation Systems Command, St. Louis, MO.

Keywords: *Electromagnetic shielding, Measurement, Shielding, Mathematical models.

The report covers a number of measurement approaches which are studied, including the use of a shielded room, coaxial transmission line holders, time domain signals, the dual TEM cell, and an apertured TEM cell in a reverberation chamber. In each case the system's frequency range, test sample requirements, test field type, dynamic range, time required, analytical background, and present data taken on a common set of materials are considered.

707,957
PB87-110078 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Discussion on 81 SM 322-7 'Breakdown of Rod-Plane Gaps in SF6 under Positive Switching Impulses' by H. Aris and K. D. Srivastava.
Final rept.
R. J. Van Brunt. Mar 82, 1p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Power Apparatus and Systems PAS-101, n3 p546 Mar 82.

Keywords: *Sulfur hexafluoride, Dielectric breakdown, Electric insulation, Surges.

No abstract available.

707,958
PB87-114914 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Use of Deconvolution Methods in Characterizing Electrical Sensors.
Final rept.
R. H. McKnight, C. Fenimore, and J. Lagnese. 1986, 3p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Institute of Electrical and Electronics Engineers Pulsed Power Conference (5th), Arlington, VA., June 10-12, 1985, p176-178 1986.

Keywords: *Detectors, *Electronic engineering, *Voltage dividers, Resistors, Capacitors, Measurement.

Deconvolution methods have been applied to measurements made with different electrical sensors including resistive and capacitive dividers. Deconvolved and directly measured waveforms have been compared with good results.

707,959
PB87-115416 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Onset of Chaos in the rf-Biased Josephson Junction.
Final rept.
R. L. Kautz, and J. C. Macfarlane. 1986, 12p
Pub. in Physical Review A 33, n1 p498-509 Jan 86.

Keywords: *Josephson junctions, Superconductivity, Reprints, Chaos, Melnikov method.

The onset of chaos in the rf-biased Josephson junction is studied through numerical simulations. It is shown that the chaotic region predicted by the method of Melnikov spans only a narrow region of rf amplitudes and consists of weakly chaotic solutions which maintain phase lock with the rf bias. The experimentally observed threshold of chaos is shown to coincide with the onset of unlocked chaotic behavior at higher rf amplitudes.

707,960
PB87-132734 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Irradiation Effects on Organic Insulators.
Progress rept. 1 Oct 84-1 Oct 85.
M. B. Kasen. 1986, 8p
Contract DE-AC01-84ER52112
Sponsored by Department of Energy, Washington, DC. Div. of Magnetic Fusion Energy.
Pub. in Annual Progress Report on Special Purpose Material for Magnetically Confined Fusion Reactors (8th), DOE/ER-0113/5 p25-32 1986.

Keywords: *Electrical insulation, Cable insulation, Superconducting magnets, Cryogenics, Neutron irradiation, Torsion, Shear strength, Fracture properties, *Physical radiation effects, Fusion reactors.

Progress in development of specimens and test methods required for studies of the significant parameters influencing mechanical property degradation of organic insulators under combined cryogenic temperature and neutron irradiation is reported. Standard specimens in rod form, 3.2 mm diameter in both neat resin form and as uniaxially reinforced composites have been produced in several epoxy systems and in one bismaleimide polyimide system. Test methods permitting assessment of irradiation influence by torsional testing have been developed. A method for determining the influence on fracture energy has also been developed.

707,961
PB87-151619 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Some Notions Concerning the Behavior of Transducers.
Final rept.,
F. R. Breckenridge, T. M. Proctor, N. N. Hsu, and D. G. Eitzen. 1986, 10p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Progress in Acoustic Emission III, p675-684 1986.

Keywords: *Transducers, Nondestructive tests, Performance.

The ideal receiving transducer would produce an output waveform exactly proportional to the displacement (or velocity) of a point on the medium in one of the three principal directions, and the transducer, itself, would not alter the motion of the point. Real receiving transducers may fail these criteria in several ways: Here, the authors report on how these limitations affect transducer performance and describe the authors efforts to overcome, or at least, measure the transducer shortcomings. The relation between sources and receivers is considered. Finally, the authors describe a type of transducer constructed at NBS.

707,962
PB87-161139 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
More Recent Improvements on the NBS (National Bureau of Standards) Conical Transducer.
Final rept.,
T. M. Proctor. Dec 86, 9p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Acoustic Emission 5, n4 p134-142 Oct-Dec 86.

Keywords: *Transducers, Reprints, *Acoustic emission testing, Acoustic emissions, US NBS.

In 1980 the author developed a point contact high fidelity transducer as an acoustic emission receiver. Early details of the construction and its response were given in the Journal (Proctor, 1982). Improvements to the original design have been made to the frequency and time responses. A reduction in physical size has also been achieved, and the electrode durability has been improved. A new electrode system, and an improved system for attaching the active element to the back, are described. The use of compound backings is also discussed.

707,963
PB87-161147 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
NBS (National Bureau of Standards) Conical Transducer: Analysis.
Final rept.,
M. Greenspan. Jan 87, 11p
Pub. in Jnl. of the Acoustical Society of America 81, n1 p173-183 Jan 87.

Keywords: *Transducers, Reprints, *Acoustic emission testing.

The NBS conical transducer is a sensitive, broadband device for the measurement of surface displacement as a function of time. Its uses include acoustic-emission testing. Here, the operation of this transducer is subjected to a straightforward analysis. Although several approximations, some more dubious than others, are made, the model predicts the main features rather well. The important parameters are the size and shape of the active element, the source impedance (looking into the area whose deflection is being measured), and the terminating impedance (back load).

707,964
PB87-161493 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Shielding Effectiveness Measurements of Plastics.
Final rept.,
J. W. Adams, and E. Vanzura. Oct 86, 4p
See also report dated January 1986, PB86-183605.
Pub. in EMC Technology and Interference Control News 5, n5 p39, 42-44 Sep-Oct 86.

Keywords: *Plastics, *Electromagnetic shielding, Measurement, Effectiveness, Reprints.

Measurement of shielding effectiveness (SE) of plastic materials presents problems because of the insulating nature of many plastics. A method of making the measurements using a flanged coaxial holder overcomes these limitations.

707,965
PB87-161519 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Very Low Noise, Tightly Coupled, dc SQUID Amplifiers.
Final rept.,
B. Muhlfelder, J. A. Beall, M. W. Cromar, and R. H. Ono. 27 Oct 86, 3p
Pub. in Applied Physics Letters 49, n17 p1118-1120 27 Oct 86.

Keywords: Josephson junctions, Magnetometers, Superconductors, Reprints, *SQUID devices.

The authors have fabricated and tested thin film, niobium edge junction, double transformer, dc superconducting quantum interference devices (SQUID's) that were stable under room-temperature storage and thermal cycling and that had very good noise performance. The input inductance, approximately 1.7 micro H, was large enough to facilitate good matching to many experiments. When the SQUID was operated as a small-signal amplifier, the minimum detectable energy per unit bandwidth (Se) was 5 x 10 to the -33rd power J/Hz at 100 kHz, referred to the SQUID loop (uncoupled). The minimum detectable energy per unit bandwidth was 1.8 x 10 to the -31st power J/Hz at 100 kHz, referred to the input coil. The SQUID's had good characteristics for flux-locked operation since the small signal Se was low over a substantial range of bias current and magnetic flux. For operation in a flux-locked feedback circuit, Se was 6 x 10 to the -32nd power J/Hz at 1 kHz.

707,966
PB87-161618 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Vector Transducer Calibration.
Final rept.,
J. A. Simmons, and H. N. G. Wadley. 1984, 8p
Pub. in Proceedings of Annual Review of Progress in Quantitative Nondestructive Evaluation Conference (10th), Santa Cruz, CA., August 7-12, 1983, p699-706 1984.

Keywords: *Transducers, Ultrasonic radiation, *Calibration, Acoustic emissions, Deconvolution, Elastodynamics.

A receiving ultrasonic or acoustic emission transducer converts a vector property of an elastic wave (particle displacement, velocity or acceleration) to a scalar voltage that is then subsequently processed and analyzed. Recent theoretical advances have enabled prediction of these vector wave quantities and attempts are underway to make accurate measurements that can be compared with theory. An essential step in the process is the calibration of transducers; not just for spectral sensitivity, but for their absolute vector response. A simple scheme for determining the vector calibration of a transducer is derived here from the properties of the Green's tensor of an isotropic elastic body.

707,967
PB87-165585 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Center for Electronics and Electrical Engineering.
Electromechanical Properties of Superconductors for High-Energy Physics Applications,
J. W. Ekin, L. F. Goodrich, J. Moreland, E. S. Pittman, and A. F. Clark. Dec 86, 112p NBSIR-86/3061
Sponsored by Department of Energy, Washington, DC.

Keywords: *Superconducting magnets, Superconductors, Niobium intermetallics, Titanium intermetallics, Stresses, *Superconducting cables, *Superconducting wires, *High energy physics, *Niobium titanium.

The report covers the first year of a 33-month project to establish a systematic base of experimental data on electromechanical effects in super conducting wire and cables for high-energy-physics magnet applications. The research is focused in four general research areas: electromechanical relationships in NbTi, studies of NbTi strands extracted from cables, sausaging effects in NbTi, and studies of the NbTi energy gap.

707,968
PB87-181822 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Disclinations: Their Relation to the Anisotropies of Rare-Earth Hard Magnets.
Final rept.,
M. Melamud, L. H. Bennett, and R. E. Watson. 1987, 4p
Pub. in Scripta Metallurgica 21, p573-576 1987.

Keywords: *Magnets, Magnetic anisotropy, Rare earth elements, Reprints, *Disclinations, Wigner-Seitz method.

It is shown that the disclination pattern obtained by a Wigner-Seitz analysis of the local environments in rare-earth transition-metal crystal structures are correlated with the observed magnetic anisotropies.

707,969
PB87-230975 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 92, Number 4, July-August 1987.
Aug 87, 56p
See also PB87-230983 through PB87-231015, and PB87-181251. Also available from Supt. of Docs as SN703-027-00017-2.

Keywords: Superconductivity, Gas chromatography, Wave propagation, Stresses, Concrete, Failure, Nondestructive tests, *SQUID devices, SQUID(Detectors), *Catalytic cracking, *Impact-echo method.

No abstract available.

707,970
PB87-230983
(Order as PB87-230975, PC **A04**/MF **A01**)
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Sinusoidal Response of dc SQUIDs (Superconducting Quantum Interference Devices) for rf Power Measurements,
R. L. Peterson. 28 Jan 87, 7p
Included in Jnl. of Research of the National Bureau of Standards, v92 n4 p253-259 Jul-Aug 87.

Keywords: Radiofrequency power, Superconductivity, Attenuation, *SQUID devices, *SQUID(Detectors), Sine waves, Voltage.

Current, power, and attenuation measurements with rf SQUIDs are based on the fact that the voltage from the microwave readout circuit can be made a nearly sinusoidal function of the magnetic flux threading the SQUID. The authors point out here that an asymmetric dc SQUID with sufficiently low inductance can achieve a very sinusoidal output voltage with good modulation depth. The spectral purity of the sinusoid can be substantially better than that obtained with rf SQUID systems.

707,971
PB88-117544 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Operation of a Y-Ba-Cu-O rf SQUID (Superconducting Quantum Interference Device) at 81 K.
Final rept.,
J. E. Zimmerman, J. A. Beall, M. W. Cromar, and R. H. Ono. 1987, 2p
Pub. in Applied Physics Letters 51, n8 p617-618, 24 Aug 87.

Keywords: Barium oxides, Yttrium oxides, Copper oxides, Critical temperature, Superconductors, Reprints, *Squid devices, *Barium copper yttrium oxides.

An rf superconducting quantum interference device (SQUID) has been made from bulk Y-Ba-Cu-O. The device displays quantum interference effects and operates with useful signal levels up to 81 K. The SQUID is formed from a ring of Y-Ba-Cu-O which is broken in the cryogenic environment and then recontacted. Estimates of the SQUID noise performance are given.

707,972
PB88-117585 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Global Stability of Phase Lock Near a Chaotic Crisis in the rf-Biased Josephson Junction.
Final rept.,
R. L. Kautz. 1987, 14p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Applied Physics 62, n1 p198-211, 1 Jul 87.

Keywords: *Josephson junctions, Phase locked systems, Digital simulation, Superconductivity, Stability, Reprints, Voltage standards, Chaos.

The global stability of phase lock in the rf-biased Josephson junction is studied through digital simulations. Global stability is determined by calculating the lifetime of the phase-locked state in the presence of thermal noise. The results are used to determine the optimum critical-current density for series-array voltage standards.

707,973
PB88-120951 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Current-Voltage Characteristics of Nanoampere Josephson Junctions.
Final rept.,
R. H. Ono, M. W. Cromar, R. L. Kautz, R. J. Soulen, J. H. Colwell, and W. E. Fogle. 1987, 4p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics MAG-23, n2 p1670-1673 Mar 87.

Keywords: *Josephson junctions, Electron tunneling, Electric current, Reprints, Voltage.

The authors have studied the current-voltage characteristics of small area tunnel junctions at temperatures below 1 K. The junctions were made in an edge geometry with a Nb base electrode and had areas less than .05 micrometer squared, and critical currents in the nA range. Although the measured 1-V characteristics resemble those of ordinary hysteretic junctions, the supposed zero-voltage portion of the curve proved to have a finite slope and to deviate from zero voltage. For these junctions it is apparently possible for occasion 2pi phase slips to occur without switching to the usual voltage state. The behavior can be explained either by macroscopic quantum tunneling, or by a model in which the effective shunt conductance of the junction is frequency dependent.

707,974
PB88-141122 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Electrical Failures Due to Cracks in Multilayer Ceramic Capacitors.
Final rept.,
S. W. Freiman, and A. C. Gonzalez. 1986, 11p
Contract N00014-84-F-0019
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Multilayer Ceramic Society, p191-201 1986.

Keywords: *Ceramic capacitors, *Capacitors, Electrical faults, Crack propagation, Fractures(Materials), Dielectrics, Reprints.

The purpose of the study was to relate electrical failure to the growth of cracks in multilayer ceramic capaci-

tors. Indentation procedures were used to determine K(IC) in both NPO and X7R capacitor compositions. The presence of the metal electrodes in the capacitor was shown to retard crack growth, making the material look 'tougher' than the ceramics alone. It was also shown that a crack intersecting two electrodes would cause electrical failure if, and only if, a conducting medium was present. A test was devised which could separate 'good' capacitors from those containing large enough cracks to eventually lead to failure. The failure-time predictions are in good agreement with actual times-to-failure determined by loading a specimen slowly in a testing machine while monitoring the leakage current.

707,975
PB88-141189 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Design and Calibration of a Novel Piezoelectric Point Contact High Fidelity Ultrasonic Transducer.
Final rept.,
S. E. Fick, N. N. Hsu, and T. M. Proctor. 1985, 3p
Pub. in Through the Eyes of an Eagle: Proceedings of the World Conference on Nondestructive Testing (11th), Las Vegas, NV., November 3-8, 1985, p891-893.

Keywords: *Piezoelectric transducers, Waveforms, Design, *Ultrasonic wave transducers, *Calibration.

The report describes the design and construction of a transducer which can generate a point contact normal force whose waveform faithfully reproduces that of the electrical drive signal, and produces an electrical output whose voltage waveform faithfully reproduces the time waveform of the vertical displacement at the point of mechanical contact. The transducer uses a small conical active element with a massive backing. Details of the associated electronic circuitry are presented. Novel applications to which the new transducer is uniquely suited are also discussed.

707,976
PB88-156070 PC **A03**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Preparation of Thin Film Polyvinylidene Fluoride Shock Wave Pressure Transducers.
Annual rept.,
A. J. Bur, and S. C. Roth. Dec 87, 24p NBSIR-87/3680
Sponsored by Naval Surface Weapons Center, Silver Spring, MD.

Keywords: *Pressure sensors, *Piezoelectric gages, Ferroelectric materials, Shock waves, Transducers, Vinyl plastics, Fluorine compounds, *Vinylidene fluoride polymers.

Thin film polyvinylidene fluoride transducers have been prepared by a poling procedure which involves the repeated cycling of the applied electric field over the ferroelectric hysteresis curve. Using the procedure, it is possible to prepare a uniformly poled transducer and to establish, with precision, the final remnant polarization. The remnant or permanent polarization is calculated by measuring the total poling charge and subtracting from it that which arises from the resistance and capacitance of the specimen. By this method the authors were able to prepare ten gages with the same remnant polarization with a precision of 0.5%. X-ray observations and measurements of density on an unpoled specimen show that the film is biaxially oriented, contains both alpha and beta phase crystals, and is 50% crystalline.

Semiconductor Devices

707,977
AD-A040 688/4 PC **A03**/MF **A01**
National Bureau of Standards Washington D C Electronic Technology Div
Measurement of Transistor Collector-Emitter Saturation Voltage.
Final rept. Jul 76-Jan 77.
K. Leedy. Jun 77, 47p Rept no. NBSIR-77-1231

Keywords: *Transistors, *Electrical measurement, Voltage, Saturation, Standardization.

This report presents a detailed method for the measurement of collector-emitter saturation voltage. The method which is included in the Appendix is proposed for standardization. The report also contains a description of the laboratory confirmation of the method and a discussion of the precautions to be taken to assure repeatability of the measurement. Emphasized is the necessity to determine that the conditions for saturation are met during the measurement. (Author)

707,978
PATENT-4 227 096 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Integrated Circuit for Josephson Voltage Standards.
Patent.
L. B. Holdeman, J. Toots, and C. C. Chang. Filed 31 Aug 78, patented 7 Oct 80, 6p PB80-600031, PAT-APPL-938 298

Keywords: *Josephson junctions, Microstrip, Microwave integrated circuit, Stripline transmission line.

A microwave integrated circuit, comprised of one or more Josephson junctions and short sections of microstrip or stripline transmission line, is fabricated from thin layers of superconducting metal on a dielectric substrate. The short sections of transmission line are combined to form the elements of the circuit, and particularly, two microwave resonators. The Josephson junctions are located between the resonators, and the impedance of the Josephson junctions forms part of the circuitry that couples the two resonators. The microwave integrated circuit has an application in Josephson voltage standards. In this application, the device is asymetrically driven at a selected frequency (approximately equal to the resonance frequency of the resonators), and a D.C. bias is applied to the junction. By observing the current-voltage characteristic of the junction, a precise voltage, proportional to the frequency of the microwave drive signal, is obtained.

707,979
PB-263 990/4 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Semiconductor Measurement Technology: A Laser Scanner for Semiconductor Devices.
Final rept.,
D. E. Sawyer, and D. W. Berning. Feb 77, 74p NBS-SP-400-24
ARPA Order 2397
Library of Congress Catalog Card no. 76-608408.

Keywords: *Optical scanners, *Infrared scanners, *Helium neon lasers, *Semiconductor devices, Reliability(Electronics), Manuals, Test equipment, Integrated circuits, Nondestructive tests.

The report is a construction guide and operators manual for a laser scanner built for semiconductor device studies. A very brief discussion of the theory of operation of the scanner is given. The scanner's operation from a systems point of view is described in detail with emphasis on block diagrams. The scanner is described from a hardware point of view with a detailed description of the function of the various controls on the electronic equipment that was built for the laser scanner. A quick guide for the use of the scanner is given so that a person unfamiliar with the instrument can use it effectively. Specifications relating to the scanner's data gathering ability are also given. Mechanical drawings and circuit schematics are given to enable others to build a similar scanner. The optics and their alignment are discussed. Various display modes including color are discussed to enhance operator viewing.

707,980
PB-264 939/0 PC **A06**/MF **A01**
RCA Labs., Princeton, NJ.
Semiconductor Measurement Technology: Techniques for Measuring the Integrity of Passivation Overcoats on Integrated Circuits.
Final rept. 24 Apr 75-30 Apr 76,
W. Kern, and R. B. Comizzoli. Mar 77, 124p NBS--SP-400-31
Contract NBS-5-35913, ARPA Order-2397
Library of Congress catalog card no. 76-608229.

Keywords: *Integrated circuits, *Passivity, *Quality control, Glass coatings, Test methods, Defects, Dielectrics, Etching, Coronas, Electrophoretic coating, Charging, Semiconductor devices, Reliability(Electronics).

Conventional test methods to evaluate the quality of glass passivation overcoats on semiconductor devices are generally inadequate and/or destructive. Three new methods have been devised that overcome these problems: (1) Sequential selective chemical etching of metal/dielectric structures to detect buried, latent, or partial defects as a function of dielectric layer depth. (2) Electrophoretic cell decoration with uv phosphor particles suspended in an insulating liquid, the sample forming one electrode of the cell. (3) Electrostatic corona charging to selectively deposit surface ions from a high voltage dc discharge on the insulating surfaces of the sample, followed by placing of the charged sample in a suspension of charged carbon black particles in an insulating liquid; depending on the polarity of the ions the particles can be deposited on the insulator surface or at the defect sites.

707,981
PB-266 857/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Use of Acoustic Emission in a Test for Beam Lead Bond Integrity,
G. G. Harman. 1976, 12p
ARPA Order-2397
Pub. in Proceedings of Annual IEEE Reliability Physics Symposium (14th), Las Vegas, Nevada, April 20-22, 1976, p86-97 1976.

Keywords: *Microelectronics, *Sonic tests, *Ultrasonic tests, Nondestructive tests, Stress waves, Integrated circuits, Hybrid circuits, Reliability(Electronics), Bonding, Acoustic emissions, Beam lead technology, Beam lead devices, Tape bonding.

The use of Acoustic Emission (AE) in a test for beam lead bond integrity has been investigated. AE refers to emission of broad band stress waves when materials are broken, cracked, or deformed. The main difficulty in the present work was to develop means of nondestructively stressing the delicate, irregularly extending beam leads. The most promising of the methods investigated are a silicone rubber (SR) pull test, a push down test on SR encapsulated devices, and various probe methods of applying force to the beams without contacting the chip. AE bursts from weak bonds or beam anchors are detected with a substrate detector operating at 375 kHz or a probe detector operating at 1.1 MHz or both. The study has revealed considerable differences in the mechanical integrity of beam lead bond-anchor systems. General deterioration of the beam-anchor system begins at pull forces per beam of from approximately 1.0 to 2.5 gf, depending on the manufacturer's procedure. The forces applied to the beam-anchor system for all methods of stressing, except the pull test, are dependent upon the shape of the individual beams as they extend from the chip, as well as the uniformity of the bugging height. There are many other potential uses of AE in electronics, such as to insure the bonding integrity of flip chips, capacitor chips in hybrids, and bonds on automated tape-bonded integrated circuits.

707,982
PB-266 860/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Bibliography on Electron Beam Induced Current Analysis of Semiconductor Devices,
K. O. Leedy. 1977, 4p
ARPA Order-2397
Pub. in Solid State Tech., v20 n2 p45-48 Feb 77.

Keywords: *Semiconductor devices, *Electron microscopy, *Bibliographies, Microelectronics, Semiconductor junctions, Scanning electron microscopy, Electron beam induced current, Reprints.

A bibliography has been compiled on the applications of the scanning electron microscope used in the electron-beam-induced-current mode in the analysis of semiconductor devices. Covering the period from December 1, 1963 when the first article appeared describing an application of EBIC through March, 1976, the literature survey included a search of the abstracts appearing in Electrical and Electronics Abstracts, Physics Abstracts and the Engineering Index.

707,983
PB-266 862/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radiation Dose Due to Electron-Gun Metallization Systems,
S. Mayo, K. F. Galloway, and T. F. Leedy. 1976, 6p
Sponsored in part by Defense Nuclear Agency, Washington, D.C.
Pub. in Proceedings of IEEE Annual Conference on Nuclear and Space Effects, San Diego, California, July

27-30, 1976, IEEE Trans. Nucl. Sci. NS-23, n6 p1875-1880 Dec 76.

Keywords: *Semiconductor devices, *Metallizing, *Radiation damage, Radiation dosage, Electron beams, Metal oxide semiconductors, Silicon dioxide, Films.

Electron beam evaporation is often selected as a method for depositing the gate metal for metal-oxide-semiconductor (MOS) devices. X-rays generated by electron impact on the metal to be evaporated may produce damage in the gate oxide. Several experimenters have reported that radiation-hardened MOS devices metallized in electron-gun systems appear to degrade at a faster rate than devices fabricated identically except for the metallization technique used. In order to examine ways of minimizing the damage introduced by electron beam systems and to develop a basis for understanding the physical phenomena observed, the physics of the x-ray energy deposition during the metallization process was explored. Details of the calculational procedure, the data necessary to calculate the x-ray absorbed dose in the oxide layer due to the electron-gun deposition of aluminum and chromium, and the calculations are presented. The results of experimental measurements of the x-ray dose are included for comparison. The implications of the results including the differences in the radiation susceptibility of MOS devices prepared with different gate metals are discussed.

707,984
PB-266 867/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurements of Power Transistor Thermal Instabilities, Stable Hot-Spots, and Second-Breakdown,
D. L. Blackburn, S. Rubin, and G. J. Rogers. 1976, 4p
Pub. in Proceedings Int. Electron Devices Meeting, Washington, D.C. December 6-8, 1976, IEDM Tech. Digest, p151-154 1976.

Keywords: *Transistors, *Thermal stability, Reliability(Electronics), Nondestructive tests, Second breakdown, Power transistors, Breakdown(Electronic threshold).

The relationships of thermal instability, stable hot spots, and second breakdown in power transistors are discussed. A rationale is also given for using thermal instability as opposed to second breakdown as the specified limit of safe operation for power transistors. It is shown that the limit of thermal instability can be accurately predicted and the simple device measurements required to do this are described. A rapid, easy, nondestructive test is also described for experimentally determining the limit.

707,985
PB-269 345/5 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Electronic Technology Div.
Measurement Techniques for High Power Semiconductor Materials and Devices.
Annual rept. 1 Jan-31 Dec 76,
D. L. Blackburn, R. Y. Koyama, F. F. Oettinger, and G. J. Rogers. Mar 77, 95p NBSIR-77-1249
Contract E(49-1)-3800

Keywords: *Semiconductor devices, *Semiconductors, Measurement, Nondestructive tests, Photovoltaic effect, Silicon, Thyristors, Rectifiers.

The annual report describes NBS activities directed toward the development of measurement methods for semiconductor materials and devices which will lead to more effective use of high power semiconductor devices in applications for energy generation, transmission, conversion, and conservation. It responds to national needs arising from rapidly increasing demands for electricity and the present crisis in meeting long-term energy demands. Emphasis is on the development of measurement methods for thyristors and rectifier diodes. The major tasks under this project are (1) to evaluate the feasibility of the photovoltaic method as a rapid, nondestructive technique for characterizing the resistivity uniformity of high-resistivity, large-diameter silicon wafers and (2) to evaluate the use of thermally stimulated current and capacitance measurements as a means for characterizing lifetime controlling or leakage source defects in power device grade silicon wafers.

707,986
PB-269 731/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hermetic Test Procedures and Standards for Semiconductor Electronics.
Final rept.,
S. Ruthberg. Jun 77, 14p
Pub. in Proceedings of Symposium on Nondestructive Testing Standards, Gaithersburg, Md. 19-21 May 76 p246-259 Jun 77. (American Society for Testing and Materials, Special Technical Publication 624. Nondestructive Testing Standards - A Review).

Keywords: *Semiconductor devices, *Hermetic seals, *Tests, Standards, Nondestructive tests, Leakage.

The hermetic testing of semiconductor devices is a challenging subject area because of the need for leak testing large numbers of sealed packages to very fine leak rates, where the packages are of a wide range of materials and internal volumes. The types of measurement methods to be discussed are those presently in use and are represented in both military and voluntary standards. Four of these methods are assessed briefly along with the relevant standards as to advantages, disadvantages, range, precision, and agreement. The four methods are bubble, weight gain, helium leak detector, and radioisotope test procedures. Present interlaboratory test efforts that have been undertaken to provide suitable test data for guidance in the drafting of new American Society for Testing and Materials (ASTM) standards are summarized. Future directions are indicated.

707,987
PB-270 128/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron-Beam-Induced-Currents in Simple Device Structures.
Final rept.,
K. F. Galloway, K. O. Leedy, and W. J. Keery. 1976, 3p
ARPA Order-2397
Pub. in Proceedings Electronic Components Conference (26th), San Francisco, Calif. 26-28 Apr 76 p257-262 1976.

Keywords: *Semiconductor devices, *Electron microscopy, Microelectronics, Semiconductor junctions, Inspection, Electron beam induced current, Scanning electron microscopy.

Electron-Beam-Induced-Current (EBIC) in semiconductor devices produced by the electron beam of a scanning electron microscope (SEM) can be used to image subsurface device features and to measure certain material parameters. This paper presents a simple model for estimating the magnitude of EBIC signals. EBIC signals from silicon p-n junction diodes are compared with the predictions of the model. The application of EBIC to more complicated device structures is discussed.

707,988
PB-272 255/1 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Electronic Technology Div.
Semiconductor Measurement Technology: Safe Operating Area Limits for Power Transistors: Videotape Script.
Special pub.,
D. L. Blackburn. Sep 77, 20p NBS-SP-400-44
ARPA Order-2397
Library of Congress catalog card no. 77-608172.

Keywords: *Transistors, Reliability(Electronics), Limits, Thermal stability, Measurement, *Power transistors, Safe operating limits, Second breakdown.

This is a script of a videotape presentation which addresses deficiencies of present methods for measuring and specifying the power dissipation capabilities and safe operating area (SOA) limits for power transistors. These deficiencies result from not including adequately the effects of significant temperature nonuniformities which occur, primarily for high-voltage, low-current conditions. Firstly, the specified thermal resistance of a transistor can be applied strictly only when the junction temperature is relatively uniform, otherwise the power capability of the device can be grossly overestimated. Secondly, the use of the standard method for measuring junction temperature can lead to a serious underestimate of the peak junction temperature if the temperature distribution is not uniform. Finally, the traditional SOA limits do not consider the phenomenon of thermal instability and the hot spots that ensue. As a result, devices can operate with potentially dangerous hot spots within operating limits that traditionally have been considered to be safe. It is proposed that the SOA limits be revised to exclude operating conditions where thermal instability and hot spots can occur. A method for detecting the onset of thermal instability and triggering a circuit to turn-off the transistor under test is described. This approach can be used to develop the revised SOA limits in a nondestructive way.

707,989
PB-275 128/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dopant Profiles Determined from Enhancement Mode MOSFET D-C Measurements.
Final rept.,
M. G. Buehler. Dec 77, 3p
ARPA Order-2397
Sponsored in part by Defense Nuclear Agency, Washington, D.C.
Pub. in Applied Physics Letters, v31 p848-850 Dec 77.

Keywords: *Semiconductor doping, Metal oxide transistors, Field effect transistors, Density(Number/volume), Computation, Electrical measurement, Metal oxide semiconductors, Reprints, Ion implantation.

A new method is presented for the determination of the dopant profile in the gate region of a four-terminal enhancement mode metal-oxide-silicon field effect transistor (MOSFET). The method calls for the direct-current (D-C) measurement of the source-body voltage, V sub SB, as a function of the gate-source voltage, V sub GS, for a fixed minority carrier channel current. The method is illustrated by the profile of a phosphorus layer implanted in an n-type silicon substrate.

707,990
PB-281 723/7 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Measurement Techniques for High Power Semiconductor Materials and Devices: Annual Report, January 1 to December 31, 1977.
F. F. Oettinger. May 78, 84p NBSIR-78-1474
ARPA Order-2397

Keywords: *Semiconductor devices, *Semiconductors, *Measurement, Nondestructive tests, Silicon, Electrical resistivity, Thyristors, Defects.

The annual report describes NBS activities directed toward the development of measurement methods for semiconductor materials and devices which will lead to more effective use of high power semiconductor devices in applications for energy generation, transmission, conversion, and conservation. It responds to national needs arising from rapidly increasing demands for electricity and the present crisis in meeting long-term energy demands. Emphasis is on the development of measurement methods for thyristors and rectifier diodes. The major tasks under this project are (1) to evaluate the feasibility of the photovoltaic method as a rapid, nondestructive technique for characterizing the resistivity uniformity of high-resistivity, large-diameter silicon wafers, (2) to evaluate the use of thermally stimulated current and capacitance measurements and other deep level measurement techniques as a means for characterizing lifetime controlling or leakage source defects in power grade silicon material and devices, and (3) to develop procedures to enable spreading resistance measurements of thyristor starting material and layer profiles to be made on a reliable basis.

707,991
PB-281 924/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microelectronic Test Patterns for Use in Procuring Custom and Highly Reproducible Integrated Circuits.
Final rept.,
M. G. Buehler. Oct 77, 13p
ARPA Order-2397
Sponsored in part by Defense Nuclear Agency, Washington, D.C.
Pub. in Proceedings of Symposium on Utilization of Large Scale Integrated Circuits in Military Systems, Arlington, Va., Aug. 9-11, 1977, IDA Paper P-1296, Pt. II, pIII-105-III-117, Oct. 1977.

Keywords: *Test equipment, *Integrated circuits, Line width, Electrical resistance, Silicon, Wafers, *Test patterns, Transistor transistor logic.

A different approach is under development for use in the procurement of custom integrated circuits. It involves the process validation wafer (PVW) which is used to evaluate a fabrication technology in terms of

the uniformity of various process and device parameters across a silicon wafer. Improved uniformity is a key to built-in reliability and predictable system performance. The PVW concept is illustrated by the NBS-7 test pattern designed to assess a TTL fabrication process. Wafer maps of various parameters are presented and their use in pinpointing fabrication problems is demonstrated. In addition, random fault test structures for evaluating various fault densities are discussed. Finally, the use of the PVW in procuring integrated circuits is mentioned.

707,992
PB-283 223/6 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C.
Government Programs on Advanced Technology and Manufacturing Techniques: Comments on U.S.A., Japan, and Europe,
W. M. Bullis. Jun 78, 17p NBSIR-78-1482

Keywords: *Semiconductor devices, *Government funds, *Technology, Economic analysis, Competition, Foreign countries, Integrated circuits, Research and development, Government policies, VLSI project.

For many years the U.S. semiconductor industry benefited significantly from government-financed technology developments, principally in the areas of defense and space. In recent years, however, government policies and actions have tended to reduce both the level of direct government support of device research and the incentives for private sector investment in this area. At the same time intense competition from foreign producers and major government-financed programs to advance integrated circuit technology, especially in Japan, have threatened the U.S. technological lead in semiconductor device technology. These international challenges are being viewed by many in the industry as requiring responsive efforts by the Federal Government. One such response could be in the form of technological cooperation between government and industry in areas where the industry may desire assistance in solving generic design, manufacturing, or testing problems. The Department of Commerce is considering new mechanisms for carrying out such cooperative efforts. These mechanisms are described following a brief review of other past and present government programs in advanced technology and manufacturing techniques - both here and abroad.

707,993
PB-283 984/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Compatibility of X-Ray Lithography and SOS Device Fabrication.
Final rept.,
K. F. Galloway, and S. Mayo. May 78, 2p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in IEEE Transactions on Electron Devices ED-25, n5 p549-550 May 78.

Keywords: *Semiconductor devices, *Lithography, X rays, Radiation damage, Fabrication, Silicon, Sapphire, Reprints, *Silicon on sapphire.

If X-ray lithography is applied to the fabrication of silicon-on-sapphire devices (SOS), the average radiation absorbed dose in the sapphire at the silicon-sapphire interface is in excess of ten Mrad. Recent experiments indicate that the resulting radiation damage may not be easily annealed. These results suggest that X-ray lithography and SOS may not be compatible technologies.

707,994
PB-285 045/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photolithographic Fabrication of Thin Film Metal-Oxide-Metal Diodes with Submicrometer-Square Junction Areas.
Final rept.,
R. H. Havemann. Apr 78, 3p
Pub. in Jnl. Vac. Sci. Technol. 15, n2 p389-391 Mar/Apr 78.

Keywords: *Junction diodes, Photolithography, Thin films, Electron tunneling, Reprints.

A technique is described which uses conventional photolithography in fabricating metal-oxide-metal diodes with submicrometer-square junction areas. The junction is formed at the edge of the first thin film electrode, thereby reducing one dimension of the junction by an order of magnitude or more over linewidths obtainable by conventional photolithographic methods. Although the technique is applied specifically to the fabrication of a metal-oxide-metal diode array, it is generally applicable to other thin film devices requiring submicrometer-square junction areas.

707,995
PB-285 154/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Saturation of Silicon Photodiodes at High Modulation Frequency.
Final rept.,
M. Young, and R. A. Lawton. 1 Apr 78, 4p
Pub. in Jnl. Appl. Opt., v17 p1103-1106, 1 Apr 78.

Keywords: *Photodiodes, Silicon, Saturation, Frequency response, Beat frequencies, Helium neon lasers, Reprints.

The authors have used the constant-amplitude, 600-MHz beat note of a 2-mW He-Ne laser to measure the rms current delivered by silicon photodiodes at 600 MHz. They found that this current first rises with increasing radiant power, saturates, and then begins to decrease at average irradiances > or approximately 100 W/sq cm, even though the direct (or average) current remains linear with radiant power. They have also scanned across the faces of the diodes; the authors find that uniform dc responsivity need not imply uniform 600-MHz responsivity and that saturation of rf responsivity takes place first in regions of high dc responsivity. The response of photodiode at 600 MHz may drop an order of magnitude at an average irradiance of approximately 1000 W/sq cm, they have observed that the impulse response at roughly the same irradiance is accordingly lengthened.

707,996
PB-285 400/8
(Order as PB-285 398/4, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Investigation of the Stability of Thermistors.
S. D. Wood, B. W. Mangum, J. J. Filliben, and S. B. Tillett. 30 Nov 77, 17p
Included in Jnl. of Research of the National Bureau of Standards, v83 n3 p247-264, May-Jun 78.

Keywords: *Thermistors, Stability, Data, Resistance thermometers, Aging tests(Materials).

In order to better characterize thermistors, a group of 405 bead-in-glass and disc thermistors were aged in constant temperature baths. Samples of 135 thermistors were aged in each of three constant temperature baths held at 0, 30, and 60C. Each sample was composed of 65 bead-in-glass and 70 disc thermistors which represented a total of six manufacturers and six resistance values. The thermistors were maintained at temperature for 550 to 770 days and their resistances and the bath temperatures were periodically monitored. Analysis of the data revealed systematic differences between bead-in-glass and disc thermistors upon aging and indicated a dependence of aging behavior on bath temperature and resistance value. Drift rates within groups of thermistors from each manufacturer were fairly uniform. Large initial changes in the drift rate for the disc thermistors at 30 and 60C (and to a much lesser extent in the bead-in-glass thermistors) require that thermistors for use at an accuracy level of a few tens of millikelvins be aged prior to use.

707,997
PB-287 450/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Saturation of Optical Detectors at High Modulation Frequency.
Final rept.
M. Young, and R. A. Lawton. 1977, 1p
Pub. in Proceedings Annual Meeting Optical Society of America, Held at Toronto, Canada on Oct 12, 1977. Jnl. Opt. Soc. Am. v67 p1398 1977.

Keywords: *Photodiodes, Frequency response, Saturation, *Optical detectors.

The authors find that high-frequency responsivity of a typical photodiode saturates at high irradiance and that uniform dc responsivity need not imply uniform high-frequency responsivity.

707,998
PB-288 730/5 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Assessment of High-Power Thyristor Technology. Summary rept. (Final).
R. I. Scace. Oct 78, 42p NBSIR-78-1559
Contract DOEEA-77-A-01-6010

Keywords: *Thyristors, *Technology assessment, Electric switches, High voltage, Silicon, Silicon controlled rectifiers, High power.

The current state of the technology for designing and making high-power thyristors is reviewed. The discussion is confined primarily to thyristors having voltage ratings of 2000 V or greater, and current ratings above a few hundred amperes. Particular attention is given to describing the factors which limit the performance of such devices and to discussing recent work aimed at solving these problems.

707,999
PB-289 014/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microelectronic Test Pattern for Analyzing Automated Wafer Probing and Probe Card Problems.
Final rept. 1 Jan-31 Dec 77,
R. L. Mattis, and M. R. Doggett. Nov 78, 4p
ARPA Order-2397
Pub. in Solid State Technol., v21 n11 p76-79 Nov 78.

Keywords: *Integrated circuits, *Wafers, *Tests, Probes, Automation, Analyzing, Test patterns, Reprints.

The testing of integrated circuits or test patterns at the wafer level requires reliable probing capability in order that apparent defects or device failures can be confidently attributed to processing problems rather than probing problems. A test pattern has been developed which consists primarily of interconnected probe pads of several sizes. Using this pattern, high-speed probing capability can be evaluated, and probing problems such as misorientation between wafer and probes and prober run-out can be detected.

708,000
PB-290 679/0 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electrosystems Div.
Loose-Particle Detection in Microelectronic Devices.
Final rept. Jul 77-Jun 78.
J. S. Hilten, P. S. Lederer, J. F. Mayo-Wells, and C. F. Vezzetti. Oct 78, 69p NBSIR-78-1590
Prepared for National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.

Keywords: *Microelectronics, *Packed circuits, *Nondestructive tests, Acoustic detection, Particles, Impact, Acoustic emission testing.

The work described constitutes an evaluation of the test procedures and apparatus specified in MIL-STD-883, Test Method 2020, Particle Impact Noise Detection Test. The major experimental effort described - a comparison of procedures and apparatus - is based on the use of specially prepared specimen device packages known either to have or not to have a particle present. Other experimental efforts reported include characterization of the accelerations imparted to a specimen device by pre- and co-shock apparatus, a brief study of the effectiveness of couplant materials in transmitting mechanical energy to the specimen device, and a comparison of the output signal level from four different ultrasonic detection transducers under otherwise identical test conditions. As part of the plan of work, 252 of the specially prepared devices, representing six package types, were characterized (as containing particles or not) by several test procedures in order to provide a set of specimens for use by the sponsor in a proposed interlaboratory evaluation of PIND testing. Problems associated with this effort are discussed. Results of the work are presented, together with conclusions and recommendations for further work. A result of interest is that the acceleration imparted by the single sample of the pre-test shock apparatus tested is on the order of 1.5 times the maximum specified by the Test Method.

708,001
PB-291 011/5 PC **A02**/MF **A01**
RCA Labs., Princeton, NJ.

Extended Range MIS C(V) Measurement: A Technique for Monitoring Semiconductor Device Processing.
Final rept. 24 Apr 75-30 Sep 76.
A. M. Goodman. Jan 79, 19p NBS/GCR-78/155
Contract NBS-5-35912

Keywords: *Semiconductor devices, *Electrical measurement, Capacitance, Electrical resistance, High voltage, Silicon on sapphire.

Equipment has been developed which allows the straightforward implementation of extended-range MIS C(V) and G(V) measurements for a variety of applications at applied-bias voltage magnitudes as large as 25 kV. This report briefly summarizes the objectives and the resulting accomplishments leading to the development of the apparatus. It also provides corrections and additions to previously published documents to aid in the construction and operation of the apparatus.

708,002
PB-291 790/4 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Semiconductor Measurement Technology: Microelectronic Processing Laboratory at NBS.
Interim rept. 1973-78.
T. F. Leedy, and Y. M. Liu. Dec 78, 37p NBS-SP-400/53
ARPA Order-2397
Library of Congress catalog card no. 78-26038.

Keywords: *Transistors, Silicon, Planar devices, Fabrication, Diffusion, Metallizing, Photolithography, National Bureau of Standards.

The report describes the facilities and processes used at NBS for the fabrication of npn silicon transistors in support of the Electron Devices Division's program in process control and measurement technology. The description of the processes includes details of techniques used for contamination control, and the various steps required for the preparation of planar silicon transistors. A description of the electrical properties of the devices is also presented.

708,003
PB-292 681/4 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Semiconductor Technology Program, Progress Briefs.
Interim rept. Apr 78-Jun 78.
W. M. Bullis. Oct 78, 16p NBSIR-78-1444-3
ARPA Order-2397
Sponsored in part by Department of Energy, Washington, DC., Defense Nuclear Agency, Washington, DC., and Charles Stark Draper Lab., Inc., Cambridge, MA. See also report dated Jul 78, PB-284 478.

Keywords: *Semiconductors(Materials), *Semiconductor devices, Measurement, Tests, Electrical resistivity, Semiconductor doping, Line width, Optical measurement, Solar cells, Radiation damage, Semiconductor diodes, Rectifiers, Gates(Circuits), Process control.

This report provides information on the current status of NBS work in measurement technology for semiconductor materials, process control, and devices. Results of both in-house and contract research are covered. Highlighted activities include: determination of resistivity-dopant density relationships in silicon; measurement of ion-implanted dopant profiles by spreading resistance; optical measurement of line widths on chrome photomasks, iron-oxide photomasks, and silicon wafers; additional data on sulfur impurity levels in silicon; conduct of a workshop on stability of thin film solar cells; analysis of leakage currents in gated diode test structures; calculations of the radiation dose incurred by oxide layers during x-ray and e-beam lithographic steps; correlation of selected electrical parameters on commercial rectifier diode wafers; and availability of a test pattern for determining alignment between mask levels. In addition, brief descriptions of new and selected on-going projects are given. The report is not meant to be exhaustive; contacts for obtaining further information are listed. Compilations of recent publications and publications in press are also included.

708,004
PB-293 487/5 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.

CMOS/SOS Test Patterns for Process Evaluation and Control: Annual Report, March 1 to November 1, 1978.
L. W. Linholm. 1 Jan 79, 52p NBSIR-79-1595
Sponsored in part by Air Force Avionics Lab., Wright-Patterson AFB, OH.

Keywords: *Integrated circuits, *Process control, *Tests, Computer graphics, Test patterns, Silicon on sapphire, Complementary metal oxide semiconductors, Radiation hardening.

The National Bureau of Standards in collaboration with the Jet Propulsion Laboratory, Pasadena, CA and RCA, Somerville, NJ, has designed a CMOS/SOS test pattern, NBS-16, and the necessary measurement techniques. RCA is required to process one test pattern wafer with each CMOS/SOS wafer lot being fabricated for the radiation hardened microprocessor chip set. Each test pattern is to be tested at NBS and JPL and recommendations for improvements made to the Air Force Avionics Laboratory (AFAL), the Air Force Materials Laboratory (AFML), and RCA. A second generation test pattern will be designed later based on information and experience obtained from the first. To date, the NBS-16 test pattern has been designed, a pattern generator tape has been delivered to RCA, and the testing hardware and software has been developed. A program schedule and a description and illustration of each test structure are found in the appendices.

708,005
PB-294 161/5 Not available NTIS
National Bureau of Standards, Washington, DC.
VLSI Processing, Radiation, and Hardening.
Final rept.,
K. F. Galloway. Dec 78, 4p
Sponsored in part by Defense Nuclear Agency, Washington, DC., and Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science, NS-25, n6, p1469-1472, Dec 78.

Keywords: *Silicon dioxide, *Integrated circuits, *Radiation damage, Dielectric films, Lithography, Etching, Large scale integrated circuits, Very large scale integration, Ion implantation, Radiation hardening, Reprints.

Process-induced radiation damage to silicon dioxide films is expected to be commonplace for VLSI circuit fabrication. This might be expected to be most serious for the production of radiation-hardened VLSI. In this paper, the oxide damage due to ion processing is reviewed and the radiation levels associated with advanced lithographic techniques are estimated. Implications for radiation-hardened VLSI circuits are considered.

708,006
PB-294 248/0 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Semiconductor Measurement Technology: A Reverse-Bias Safe Operating Area Transistor Tester.
Final rept. Dec 76-Jun 78.
D. W. Berning. Mar 79, 47p NBS-SP-400-54
Library of Congress catalog card no. 78-600157.

Keywords: *Test equipment, *Transistors, Nondestructive testing, Electronic switches, Drives(Electronics), Breakdown(Electronic threshold).

This is a construction guide for a reverse-bias safe operating area (RBSOA) transistor tester for npn switching transistors. Principles of operation for various circuits in the tester are discussed, as well as those of the complete system. System specifications are given. Extensive construction notes are given with hints on chassis layout. Complete circuit schematics are given with additional detail pertaining to power supply and grounding interconnections. Mechanical drawings of the tester enclosure are given. Photographs are included as additional help in building the tester. Special components such as the collector load inductor are described. Finally, a section on the use of the tester includes waveforms generated by a typical test that would be made on a transistor with this equipment.

708,007
PB-294 846/1 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.

Semiconductor Technology Program, Progress Briefs.
Interim rept. Jul-Sep 78.
W. M. Bullis. Jan 79, 12p NBSIR-79-1591
ARPA-Order-2397
See also report dated Oct 78, PB-292 681. Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA., Department of Energy, Washington, DC., Defense Nuclear Agency, Washington, DC., and Charles Stark Draper Lab., Inc., Cambridge, MA.

Keywords: *Semiconductors(Materials), *Semiconductor devices, Measurement, Tests, Annealing, Laser beams, Silicon, Electrical resistivity, Hall effect, Semiconductor doping, Line width, Process control, Silicon dioxide, Impurities.

This report provides information on the current status of NBS work on measurement technology for semiconductor materials, process control, and devices. Results of both in-house and contract research are covered. Highlighted activities include studies of: laser annealing of low-fluence implants in silicon; analysis techniques for spreading resistance profiling measurements; Hall effect measurements in two-layer structures; incorporation of hydrogen and hydroxyl impurities in silicon dioxide films; an integrated gated-diode electrometer test structure; defect-density profiling by constant-capacitance deep-level transient spectroscopy; and a spatial integrity test pattern for electrical measurement of intra- and inter-die line-width variations. In addition, brief descriptions of new and selected on-going projects are given. The report is not meant to be exhaustive; contacts for obtaining further information are listed. Compilations of recent publications and publications in press are also included.

708,008
PB-295 156/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Microelectronic Test Patterns for Use in Procuring LSICs.
Final rept.
M. G. Buehler. Apr 78, 3p
Pub. in Proceedings of the Industry/Joint Services Automatic Test Conference and Workshop on Advanced Test Technology Management Acquisition Support Held at San Diego, CA. on April 5, 1978, p233-235.

Keywords: *Integrated circuits, *Reliability(Electronics), Wafers, Gain, Silicon, Transistors, Performance tests, Microelectronics, Process validation wafer method, Large scale integrated circuits, Test patterns.

The complexity of today's integrated circuits requires new procedures for evaluating the performance of emerging fabrication processes and for insuring that reliability is built into mature components. One approach, currently being developed at NBS, involves the Process Validation Wafer (PVW) concept which is useful in assessing the merits of a new technology and in establishing the base-line performance of an existing process. One key to built-in reliability is parameter uniformity. This is illustrated by a wafer map showing the variability in bipolar transistor gain across a silicon wafer.

708,009
PB-295 588/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Automated Photovoltaic Technique for Nondestructively Measuring Resistivity Variations of High Resistivity Silicon Slices.
Final rept.
D. L. Blackburn, and R. D. Larrabee. 1978, 12p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the Topical Conference on Characterization Techniques for Semiconductor Materials and Devices Held at Seattle, WA. on May 21-26, 1978, p168-179 1978.

Keywords: *Electrical measurement, *Silicon, Electrical resistivity, Photovoltaic effect, Automation.

An automated, nondestructive, photovoltaic technique for measuring the resistivity variation of high resistivity slices is described. The physics of the bulk photovoltaic effect is reviewed, an improved mathematical analysis of the bulk photovoltaic effect due to a small light spot on a large circular slice is discussed, the computer-controlled measurement system is de-

scribed, and comparisons between photovoltaic and four-probe resistivity profiles on float-zoned silicon slices with average resistivity between 10 and 150 Ohm cm are given.

708,010
PB-296 167/0 PC **A04**/MF **A01**
National Engineering Lab.(NBS), Washington, DC. Electron Devices Div.
Development of Test Structures for Characterization of the Fabrication and Performance of Radiation-Hardened CCD Imagers.
Final rept. 1 Mar-30 Nov 78.
G. P. Carver, and M. G. Buehler. May 79, 55p NBSIR-79-1744
Prepared for Charles Stark Draper Lab., Inc., Cambridge, MA.

Keywords: *Semiconductor devices, *Test equipment, Tests, Electrometers, Electric measuring instruments, Semiconductor doping, *Charge coupled devices, Radiation hardening, Test patterns.

A set of production-oriented parametric test structures has been proposed for use in the evaluation of the radiation-hardened processes for radiation-hardened CCD imagers. The proposed test structures specified in this report include advanced test structures which were developed during this program, improved versions of existing NBS test structures, and various other commonly used test structures. Some of the designs for test structures were modified for compatibility with the radiation-hardened processes and with radiation testing. Procedures are described for testing the test structures using high-speed computer-controlled data acquisition techniques. Two of the test structures developed for this program represent new and unique test vehicles which allow the determination of relevant physical parameters which are difficult to obtain by other methods.

708,011
PB-298 063/9 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Semiconductor Technology Program, Progress Briefs.
W. M. Bullis. Mar 79, 12p NBSIR-79-1591-2
See also report dated Jan 79, PB-294 846 and PB-298 064. Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA., Department of Energy, Washington, DC. Div. of Electric Energy Systems, Defense Nuclear Agency, Washington, DC., and Charles Stark Draper Lab., Inc., Cambridge, MA.

Keywords: *Semiconductors(Materials), *Semiconductor devices, Radiation damage, Semiconductor doping, Electrical resistivity, Silicon, Resistors, Tests, Measurement, Integrated circuits.

This report provides information on the current status of NBS work on measurement technology for semiconductor materials, process control, and devices. Results of both in-house and contract research are covered. Highlighted activities include studies of process-induced radiation damage, resistivity-dopant density relationships in silicon, spreading resistance measurements, spreading resistance profiling, cross-bridge sheet resistor test structure, PIND test, moisture infusion into hermetic packages, and conduct of a workshop on power semiconductor devices. In addition, brief descriptions of new and selected ongoing projects are given. Compilations of recent publications and publications in press are also included.

708,012
PB-298 064/7 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Semiconductor Technology Program, Progress Briefs.
W. M. Bullis. Jun 79, 12p NBSIR-79-1591-3
See also PB-298 063. Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA., Department of Energy, Washington, DC. Div. of Electric Energy Systems, Defense Nuclear Agency, Washington, DC. and Charles Stark Draper Lab., Inc., Cambridge, MA.

Keywords: *Semiconductor(Materials), *Semiconductor devices, Dielectric breakdown, Electrometers, Line width, Integrated circuits, Photoresistors, Electrical resistivity, Silicon, Tests, Measurement.

This report provides information on the current status of NBS work on measurement technology for semiconductor materials, process control, and devices. Results of both in-house and contract research are covered. Highlighted activities include studies of reverse-bias second breakdown, an integrated gated-diode electrometer, random fault measurements, pattern generator positional accuracy, intrachip linewidth variation, transient upset in TTL circuits, photoresist sensitometry, optical linewidth measurements, spreading resistance profiling, model spreading resistance data, silicon resistivity SRMs, and sheet resistance measurements. In addition, brief descriptions of new and selected on-going projects are given. Compilations of recent publications and publications in press are also included.

708,013
PB-298 318/7 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Semiconductor Measurement Technology: Thermal Resistance Measurements on Power Transistors.
Final rept.
S. Rubin, and F. F. Oettinger. Apr 79, 73p NBS-SP-400/14

Keywords: *Transistors, Thermal resistance, Semiconductor junctions, Performance evaluation, Temperature measurement, *Power transistors.

A brief description of the idealized concept of thermal resistance is given along with the problems and pitfalls encountered in applying the concept to power transistors. In addition, the advantages and disadvantages of various electrical techniques for measuring junction temperature (thermal resistance) are described, and a preferred technique, in which the forward-biased emitter-base junction is used as the temperature-sensitive parameter, is usable on all types of bipolar transistors. The measurement procedure is relatively simple and lends itself to industrial measurements as well as for referee purposes. The power interruption circuitry is also relatively fast and simple since only one device terminal is switched. The preferred technique that was developed for measuring the thermal resistance of power transistors has been adopted as EIA Recommended Standard RS-313-B on Thermal Resistance Measurements of Conduction Cooled Power Transistors, dated October 1975.

708,014
PB-298 574/5 PC **A07**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Measurement Techniques for High Power Semiconductor Materials and Devices: Annual Report, October 1, 1977 to September 30, 1978.
F. F. Oettinger. Jun 79, 146p NBSIR-79-1756
Contract DOE-EA-77-A-01-6010
See also report dated May 78, PB-281 723.

Keywords: *Semiconductor devices, *Semiconductors, *Measurement, Silicon, Electrical resistivity, Thyristors, Defects.

This annual report describes NBS activities directed toward the development of measurement methods for semiconductor materials and devices which will lead to more effective use of high power semiconductor devices in applications for energy generation, transmission, conversion, and conservation. It responds to national needs arising from rapidly increasing demands for electricity and the present crisis in meeting long-term energy demands. Emphasis is on the development of measurement methods for thyristors and rectifier diodes. The major tasks under this project are (1) to evaluate the use of thermally stimulated current and capacitance measurements and other deep level measurement techniques as a means for characterizing lifetime controlling or leakage source defects in power grade silicon material and devices, and (2) to develop procedures to enable spreading resistance measurements of thyristor starting material and layer profiles to be made on a reliable basis.

708,015
PB-298 607/3 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Large Scale Integration Digital Testing - Annotated Bibliography, 1969-1978.
Final rept.
T. F. Leedy. Aug 79, 45p NBS-TN-1102

Keywords: *Integrated circuits, *Tests, *Bibliographies, Digital techniques, Microcomputers, Computer storage devices, Large scale integrated circuits.

This annotated bibliography covers articles published in the field of semiconductor device testing. The bibliography contains (1) entries divided into six economics of testing, (2) monolithic circuit testing, (3) the testing of subsystems of large scale integrated circuits such as microcomputer boards and memory arrays, (4) various test strategies used to locate a defective LSI circuit, (5) test equipment available for LSI testing, and (6) various measurement methods that may be of interest to the test engineer.

708,016
PB-298 661/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Optical Linewidth Measurement - A Basic Understanding.
Final rept.
D. Nyyssonen, and J. M. Jerke. 1979, 16p
Pub. in Proceedings of the Microelectronics Measurement Technology Seminar Held at San Jose, CA. on February 6-7, 1979, p251-266 1979.

Keywords: *Optical measuring instruments, Line width, Measurement, Masking, Integrated circuits, Wafers.

Optical systems used for micromeasurement of linewidths on integrated circuit photomasks and wafers have shown measurement differences as large as 1.0 micrometer. Modeling of the diversity of measurement methods used for edge detection has shown that these measurement differences may be attributed to both differences in the optical images formed by different microscope systems and differences in edge detection criteria. New techniques developed at NBS for accurate edge detection and calibration of optical linewidth measurement systems are discussed.

708,017
PB-299 172/7 PC **A04**/MF **A01**
Martin Marietta Aerospace, Orlando, FL.
Investigation of Moisture Measurements, Failure Rate and Leak Rate and a Study of Moisture Infusion.
Final rept.
R. L. Sulouff. Aug 79, 57p NBS/GCR-79/170
Contract NBS-5-35880, ARPA Order-2397

Keywords: *Semiconductor devices, *Reliability(Electronics), *Moisture, Life tests, Leakage, Failure, Microelectronics.

A preliminary study of the relationships between moisture infusion, leak size, and device reliability has been completed. Two sets of experiments were conducted. In one, packages constructed with a controlled leak and an oxide-type moisture sensor were placed in a controlled humidity environment and the water vapor content measured as a function of time. The packages tested had leak sizes in the range between 10 to the minus 9 power and 0.00001 atm cc/s. The second experiment was a 5,000-h life test in which 186 packages, each of which contained unpassivated 741 operational amplifier chips, were subjected to an atmosphere with 85-percent relative humidity at 85C. In this case, the packages had measured leak sizes between 10 to the minus 9 power and 0.001 atm cc/s. The results exhibited a great amount of scatter, both because of the primitive nature of the measurement methods available for use in this type of experiment and because of the large variability in both water vapor infusion and the reactions of water vapor on device surfaces. Nevertheless, it can be safely concluded that present leak rate limits for large packages are not low enough to insure that the maximum permissible moisture level will not be exceeded during a reasonable service life.

708,018
PB-300 718-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Effect of the Parameters of Cadmium Sulfide Starting Material on the Operating Efficiency of Piezoelectric Transducers with a Diffusion Layer(Vliyanie Parametrov Iskhodnogo Materiala Sul'fida Kaprmya na Effektivnost' Paboty P'ezopreobr Azovatelei na Diffuzionnom Sloe).
Y. A. Obakhovskii, M. S. Fainer, L. A. Sysoev, and G. D. Grigorenko. 1979, 9p DMDC-19005, TT-79-58088
Trans. of Monokristalli i Tekhnika (USSR) n3 p207-210 1970. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Cadmium sulfides, *Transducers, Piezoelectric crystals, Piezoelectricity, Semiconductor doping, Indium, Gallium, Aluminum, Lithium, Efficiency, Translations, *Piezoelectric transducers.

A study of the operating efficiency of piezoelectric transducers, prepared from raw materials with different concentrations of donor impurities, showed that the most efficient ones are the piezoelectric transducers prepared from crystals grown from the raw material of the type 'semiconductor purity' with Al additions. Similar results have been achieved with In and Ga additions. The operating efficiency of piezoelectric transducers, prepared from 'pure' semiconductor crystals, are found nearly at the same level as those containing impurities; however, an increase of resonance frequency is noticed. This could be explained by the decrease of diffusion coefficient of Li in CdS, in the presence of aluminium.

708,019
PB-300 779/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Effects of Base Current on Transistor Switching and Reverse-Bias Second Breakdown.
Final rept.
D. L. Blackburn, and D. W. Berning. 1978, 5p
Pub. in Proceedings of the International Electron Devices Meeting, Washington, DC., December 4-6, 1978, p671-675 1978.

Keywords: *Transistors, *Nondestructive tests, Switching, Electrical faults, Reliability(Electronics), Electronic test equipment, Breakdown(Electronic threshold), Second breakdown.

Some experimental observations of the switching characteristics and second breakdown susceptibility of high-voltage, fast-switching power transistors are discussed. A unique test circuit is described which permits devices to be taken into reverse-bias second breakdown many times with little or no apparent degradation. Evidence for the constriction of emitter current to the centers of the emitter fingers during the time associated with the extraction of stored charge is presented, three modes of reverse-bias second breakdown are shown, and reverse-bias safe-operating-area limits which have been nondestructively determined are shown.

708,020
PB77-600064 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measuring and Minimizing Diode Detector Nonlinearity.
C. A. Hoer, K. C. Roe, and C. M. Allred. 1976, 5p
Pub. in IEEE Trans. Instrum. Meas. IM-25, n4 p324-329 1976.

Keywords: *Diode detector, Diode model, Temperature compensation.

This paper describes two techniques for measuring the linearity of amplitude detectors in general, and for measuring the deviation from square-law E of point-contact diode detectors in particular. A general mathematical model is given for determining the RF input power as a function of the detector output voltage. It is shown how to choose the value and the temperature coefficient of the video load resistance to minimize E and make E independent of temperature.

708,021
PB80-101801 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Measurement Technology: Nondestructive Tests Used to Insure the Integrity of Semiconductor Devices, with Emphasis on Acoustic Emission Techniques.
Final rept.,
G. G. Harman. Sep 79, 75p NBS-SP-400-59
ARPA Order-2397
Library of Congress catalog card no. 79-600131.

Keywords: *Semiconductor devices, *Nondestructive tests, Microelectronics, Hybrid circuits, Integrated circuits, *Acoustic emission testing, Acoustic emissions, Beam lead devices, Hybrid microcircuits.

The discussion is divided into two major sections. The first consists of an introduction to device assembly techniques and problems followed by a review of six important nondestructive tests used during and after device packaging to insure the mechanical integrity of completed electronic devices. Most of these tests are called out in the military testing standard, MIL-STD-883 and are generally classified as screens. The first section concludes with a brief introduction to the economic and other factors that result in the choice of one screen over another and to production line statistical sampling (LTPD) appropriate to special high reliability device lots such as those used for space flight. The second section begins with an introduction to acoustic emission, the status of theory as it can be applied to microelectronics. Then the published papers that have applied AE as a nondestructive test in electronics applications will be reviewed. Finally, passive AE techniques are applied to establishing the mechanical bond integrity of beam lead, flip chip, and tape-bonded integrated circuits as well as components in hybrid microcircuits.

708,022
PB80-104177 Not available NTIS
National Bureau of Standards, Washington, DC.
Limitations and Applications of the DC MOSFET Dopant Profile Method.
Final rept.,
M. G. Buehler. 1978, 12p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA., and Defense Nuclear Agency, Washington, DC.
Pub. in Semiconductor Characterization Techniques, 78-3, p241-252 1978.

Keywords: *Metal oxide transistors, *Field effect transistors, *Semiconductor doping, Metal oxide semiconductors, Silicon, Profiles, Electrical measurement.

Dopant profiles can be determined from dc measurements on a four terminal surface-channel MOSFET. The region from about three Debye lengths from the oxide-silicon interface to a maximum depth, limited by the avalanche breakdown in silicon, can be profiled by this method. Within three Debye lengths of the surface, the depletion approximation fails, and in this region the profile has a characteristic dip which is easily recognized. Other limitations include effects due to the field dependence of the channel mobility, short channel effects, and the lack of parallelism of the depletion edge with the interface. The method is illustrated by dopant profiles of bulk wafers, implanted layers, and a diffused layer. The dopant densities covered by these profiles vary from (6 x 10 to the 14th power/cu cm to 2 x 10 to the 18th power/cu cm).

708,023
PB80-142987 Not available NTIS
National Bureau of Standards, Washington, DC.
Non-Destructive Tests Used to Insure the Integrity of Semiconductor Devices with Emphasis on Passive Acoustic Techniques.
Final rept.,
G. G. Harman. 1979, 62p
Pub. in Proceedings of the NATO Advanced Study Institute on Nondestructive Evaluation of Semiconductor Materials and Devices, Villa Tuscolano, Italy, September 19-29, 1978, Chapter 13 in Nondestructive Evaluation of Semiconductor Materials and Devices, J. N. Zemel, Ed., P677-738 1979.

Keywords: *Nondestructive tests, *Semiconductor devices, Integrated circuits, Microelectronics, *Acoustic emission testing, Hybrid microcircuits.

The discussion is divided into two major sections. The first consists of an introduction to device assembly techniques and problems followed by a review of six important nondestructive tests used during and after device packaging to insure the mechanical integrity of completed electronic devices. Most of these tests are called out in the military testing standard, MIL-STD-883 and are generally classified as screens. The second section begins with an introduction to acoustic emission, the status of theory as it can be applied to microelectronics. Then the published papers that have applied AE as a nondestructive test in electronics applications will be reviewed. Finally passive AE techniques are applied to establishing the mechanical bond integrity of beam lead, flip chip, and tape bonded integrated circuits as well as components in hybrid microcircuits.

708,024
PB80-144645 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Zinc Oxide Varistors for Lightning Arrester Service.
Final rept. Oct 78-Sep 79,
R. I. Scace. Dec 79, 25p NBSIR-79-1939
Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Varistors, *Lightning arrestors, Zinc oxides, Power lines, Surges, Suppressors, Microstructure, Electrical properties.

The application of zinc oxide (ZnO) varistors to high-power surge arresters for electrical transmission lines is considered, with particular attention to the special measurement problems posed by the application and by the unique properties of these varistors. The development of ZnO varistors and the present theory of ZnO varistor action are discussed. Consideration is given to the need for further elaboration of the theory.

708,025
PB80-147952 PC **A16**/MF **A01**
RCA Labs., Princeton, NJ.
Semiconductor Measurement Technology: Comprehensive Test Pattern and Approach for Characterizing SOS Technology.
Final rept.,
W. E. Ham. Jan 80, 370p NBS-SP-400-56
Contract NBS-5-35916

Keywords: *Integrated circuits, Semiconductor devices, Silicon, Sapphire, Tests, Masking, Flow charts, *Silicon on sapphire, Computer applications, *Test patterns.

This report contains detailed information concerning a comprehensive approach to parametric process characterization for IC processes. This includes defining the general areas of importance, devising structures which are sensitive to these areas, devising methods for testing the structures, documenting the structures, tests, and results, producing suitable data reduction and presentation schemes, and considering the implementation of the methods in a practical sense. Proper methods for automatically testing some of these structures are explored. Seven divisions were created for the general types of test structure: (1) individual structures of nominal dimensions, (2) closely spaced identical structures, (3) structures of various sizes, (4) series and parallel combinations of structures, (5) structures especially sensitive to lithographic properties, (6) basic circuit building blocks, and (7) small area test circuits.

708,026
PB80-151517 Not available NTIS
National Bureau of Standards, Washington, DC.
Reverse-Bias Second Breakdown in Power Transistors.
Final rept.,
D. L. Blackburn, and D. W. Berning. 1979, 6p
Pub. in Proceedings of Electrical Overstress/Electrostatic Discharge Symposium, Denver, CO., Sep 24-27, 1979, Ordering No. EOS-1, p116-121 1979.

Keywords: *Transistors, *Nondestructive tests, Electrical faults, Electric current, Focusing, *Second breakdown, Power transistors.

The construction and operation of a unique facility for testing power transistors for reverse-bias second breakdown with minimal device degradation are described. Some experimental results obtained using the circuit are discussed. Reverse-bias safe operating limits that have been determined nondestructively are shown, a method for qualitatively observing the focusing (crowding) of current to the centers of the emitter fingers is described, and some observations on the focusing of the current during the collector current storage time are discussed.

708,027
PB80-157860 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiation Levels Associated with Advanced Lithographic Techniques.
Final rept.,
K. F. Galloway, S. Mayo, and P. Roitman. Dec 79, 4p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Jnl. Electrochem. Soc., v126 n12 p2245-2248, Dec 79.

Keywords: *Lithography, *Semiconductor devices, *Radiation damage, X rays, Electron beams, Radiation dosage, Reprints, Metal oxide semiconductors.

Estimates of the radiation absorbed dose in critical device oxide layers due to x-ray and direct-write electron beam lithography are developed. Layered structures of photoresist, aluminum, silicon dioxide, and silicon are used for explicit calculations. It is shown that radiation levels in the Megarad (SiO_2) range can be

expected for both of these advanced lithographic techniques. The consequences of this process-induced radiation damage are briefly considered.

708,028
PB80-157886 Not available NTIS
National Bureau of Standards, Washington, DC.
Spatial Coherence: The Key to Accurate Optical Micrometrology.
Final rept.,
D. Nyyssonen. 1979, 11p
ARPA Order-2397
Pub. in Proceedings of Society of Photo-Optical Instrumentation Engineers, Held at San Diego, CA on Aug 29-30, 1979. Paper in Applications of Optical Coherence, v194 p34-44, 1979.

Keywords: *Optical measuring instruments, Line width, Wafers, Optical microscopes, Integrated circuits, Micrometrology, *Spatial coherence, Photomasks, Edge detection.

The accurate measurement of micrometer-size linewidths on integrated-circuit photomasks and wafer requires more accurate edge detection techniques than traditional optical measuring systems can achieve. A scanning photometric optical microscope has the capability of determining edge location using an optical threshold with a resulting linewidth error much smaller than the Airy disc radius of the imaging objective. However, the threshold corresponding to edge location is dependent upon the spatial coherence of the illumination. Analysis using the theory of partial coherence has led to threshold equations with corrections for contrast and optical phase difference at the line edge. Both the theory and instrumentation which have been developed for measurements on both photomasks and wafers are described. Linewidths as small as 0.5 micrometer can be measured with a sensitivity of 0.01 micrometer and an estimated uncertainty of 0.05 micrometer.

708,029
PB80-157902 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of Microelectronic Test Structures to Characterize IC Materials, Processes, and Processing Equipment.
Final rept.,
L. W. Linholm, G. P. Carver, and T. J. Russell. 1979, 22p
Prepared in cooperation with Department of the Air Force, Washington, DC., Department of the Navy, Washington, DC., and Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings Measurement Sciences Conf., Held at San Louis Obispo, CA on Nov 30, 1979, p129-150.

Keywords: *Integrated circuits, *Tests, Microelectronics, Test equipment.

With the increasing complexity of large scale integrated circuits, it is becoming more difficult to fully characterize circuit performance. Microelectronic test structures offer an important source of reliable data for circuit characterization. When properly designed, test structures can be used to evaluate material, process, process equipment, and device parameters to provide the necessary information for circuit characterization. The National Bureau of Standards is conducting a program to develop well-designed test structures and methods to test these structures. The test structures are modular and can be tested with computer-controlled data acquisition systems; they can be used to obtain unambiguous information on the parameter the structure is intended to measure. Data from these test structures can be applied to circuit characterization, process control, technology assessment, and yield analysis. Examples of the test structures in some of these applications are presented.

708,030
PB80-160708 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of Test Structures for Characterization of the Fabrication and Performance of Radiation-Hardened Charge-Coupled Device (CCD) Imagers: Annual Report, December 1, 1978 to November 30, 1979,
G. P. Carver, and S. Rubin. Mar 80, 23p NBSIR-80-2000
Sponsored in part by Charles Stark Draper Lab., Inc., Cambridge, MA. See also report dated May 79, PB-296 167.

Keywords: *Test equipment, Tests, Electrometers, Metal oxide transistors, Electric measuring instruments, Semiconductor doping, *Charged coupled imagers, Charged coupled devices, Radiation hardening, Test patterns.

The project is to evaluate new test structures and test methods useful for the characterization of radiation-hardened CCD imagers. During the period covered by this report, consultation was provided to the Charles Stark Draper Laboratory, Inc. (CSDL) and to CSDL contractors on the implementation of test structures developed during the previous year of this project. In addition, the results of measurements on buried channel gated diodes and buried layer metal-oxide-semiconductor field-effect transistor (MOSFET) direct-current (dc) profilers are reported. Further advances in the development of the integrated gated-diode electrometer are also reported.

708,031
PB80-165749 Not available NTIS
National Bureau of Standards, Washington, DC.
Technology of Semiconductor Manufacturing, Product Development, and Product Types.
Final rept.,
R. I. Scace. 1979, 25p
Pub. in Journal Appendix in DIBA Pub., U.S. Semiconductor Industry, p105-129, Sep 79.

Keywords: *Semiconductor devices, *Semiconductors, Technology, Manufacturing, Processing, Silicon, Electronics industry, Reprints.

A presentation is made of the technological basis of the semiconductor industry, in non-technical terms. The materials, processes, and principal types of devices commonly encountered are described. Significant technical problems are briefly mentioned, as is the annual sales volume for the various kinds of products.

708,032
PB80-166952 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Measurement Technology: Modulation Measurements for Microwave Mixers.
Final rept. 1 Jan 70-31 Mar 74,
J. M. Kenney. Feb 80, 90p NBS-SP-400-16
Sponsored in part by Naval Electronic Systems Command, Washington, DC. Library of Congress catalog card no. 79-600161.

Keywords: *Crystal mixers, Measurement, Modulation, Semiconductor diodes, Losses, Microwave equipment, Schottky barrier devices.

The measurement of mixer conversion loss using periodic or incremental modulation of the local oscillator, and the evaluation and minimization of the associated systematic and random uncertainties, are discussed in terms of an X-band mixer measurement system constructed at NBS. It is shown that the systematic uncertainty in the incremental modulation method of measuring conversion loss results largely from the uncertainties in the calibration of microwave attenuation and power. It is also shown that the modulation (periodic modulation) and incremental (incremental modulation) methods of measuring conversion loss are essentially identical, the only practical distinction being in the somewhat different instrumentation required by the different modulation rates. Several improvements in the periodic and incremental modulation techniques are introduced. Novel circuits for measuring intermediate-frequency output conductance and local-oscillator return loss are described which may also be useful for other immittance measurements.

708,033
PB80-204159 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Measurement Technology: Metrology for Submicrometer Devices and Circuits.
Final rept.,
W. M. Bullis. Jun 80, 45p NBS-SP-400-61

Keywords: *Metrology, *Microelectronics, Semiconductor devices, Integrated circuits.

The metrological requirements of semiconductor microelectronics, always challenging, are made even more stringent by the trend toward submicrometer devices and structures. This comes about not only because of the obvious demands associated with the smaller feature sizes of circuit elements but also because of the attendant requirements for more efficient design verification aids, computer simulations, and process validation and control techniques and because of the concurrent trend toward larger die and package sizes. This paper examines the types of metrological requirements associated with submicrometer devices and structures, summarizes the present state of the art in selected critical areas of metrology, and reviews current research and development efforts on advanced measurement technology, especially those at the National Bureau of Standards.

708,034
PB80-207038 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Technology Program. Progress Briefs.
Interim rept. Jan-Mar 80,
W. M. Bullis. Jun 80, 13p NBSIR-80-2006-2
ARPA Order-2397
See also report for Jul-Sep 78, PB-294 846, and report dated Apr 80, PB80-191521. Sponsored in part by Department of Energy, Washington, DC., Defense Nuclear Agency, Washington, DC., and Charles Stark Draper Lab., Inc., Cambridge, MA.

Keywords: *Semiconductors(Materials), *Semiconductor devices, Measurement, Semiconductor doping, Silicon, Line width, Process control, Microelectronics, Wafers, Radiation damage, Acoustic emission testing.

This report provides information on the current status of NBS work on measurement technology for semiconductor materials, process control, and devices. Results of both in-house and contract research are covered. Highlighted activities include: studies of MOSFET dc profiler, heavy doping effects in silicon, PVW applications, ion-implanted dopant profiles, optical linewidth measurements on wafers, process-induced radiation damage, translator switching characteristics, and acoustic emission testing. Brief descriptions of selected on-going projects are included, and recent publications and publications in press are listed. The report is not meant to be exhaustive, contacts for obtaining further information are listed.

708,035
PB80-211972 Not available NTIS
National Bureau of Standards, Washington, DC.
D-C MOSFET Dopant Profile Method,
M. G. Buehler. Mar 80, 4p
Pub. in Jnl. of the Electrochemical Society 127, n3 p701-704 Mar 80.

Keywords: *Metal oxide transistors, *Semiconductor doping, Profiles, Determination, Measurement, Wafers, Reprints.

Dopant profiles can be determined from dc measurements on a four-terminal surface-channel MOSFET. The region from about three Debye lengths from the oxide-silicon interface to a maximum depth, limited by the avalanche breakdown in silicon, can be profiled by this method. Within three Debye lengths of the surface, the depletion approximation fails, and in this region the profile has a characteristic dip which is easily recognized. Other limitations include effects due to the field dependence of the channel mobility, short channel effects, and the lack of parallelism of the depletion edge with the interface. The method is illustrated by dopant profiles of bulk wafers, implanted layers, and a diffused layer. The dopant densities covered by these profiles vary from 6 x 10 to the 14th power/cu cm to 2 x 10 to the 18th power/cu cm.

708,036
PB80-217623 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Measurement Techniques for High Power Semiconductor Materials and Devices: Annual Report, October 1, 1978 to September 30, 1979,
F. F. Oettinger, and R. D. Larrabee. Aug 80, 63p
NBSIR-80-2061
Contract DOE-EA-77-A-01-6010
See also report dated Jun 79, PB-298 574.

Keywords: *Semiconductor devices, *Semiconductors, *Measurement, Silicon, Defects, Electrical resistivity, Thyristors, Zinc oxides, Varistors.

The major tasks under this project are (1) to evaluate procedures for the effective utilization of deep-level

measurements to detect and characterize defects which reduce lifetime or contribute to leakage current in power-device-grade silicon, (2) to coordinate standardization activities of preferred procedures for specimen preparation for spreading resistance measurements on thyristor-grade silicon and structures, (3) to determine technical impediments to a more effective utilization of neutron transmutation doped silicon for thyristor production, and (4) to determine the measurement and analysis needs to aid in the application of zinc oxide varistor technology for the manufacture of high voltage limiters for lightning arrester application.

708,037
PB81-133936 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiation Damage Estimates and Control in Ion-Beam Lithography.
K. F. Galloway. Aug 80, 3p
Pub. in Jnl. of Electrochemical Society 127, n8 p1862-1864 Aug 80.

Keywords: *Integrated circuits, *Radiation damage, Radiation dosage, Lithography, Ion beams, Reprints.

Estimates of the radiation dose absorbed in critical device dielectric layers during the application of ion-beam lithography are given. For typical device and beam parameters, the radiation absorbed dose can be 200 Mrad (SiO2). Proper adjustment of the ion-beam parameters can significantly reduce or eliminate this radiation damage.

708,038
PB81-179749 Not available NTIS
National Bureau of Standards, Washington, DC.
Correction of Differential Capacitance Profiles for Debye-Length Effects.
Final rept.
C. L. Wilson. Dec 80, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices ED-27, n12 p2262-2267 Dec 80.

Keywords: *Capacitance, *Semiconductor doping, Finite element analysis, Numerial analysis, Data reduction, Reprints.

Conventional differential capacitance-voltage (C-V) profiling methods are limited in resolution by the method used to convert C-V data to profile data. A new method of numerical calculation of C-V data, using cubic finite elements, is presented which allows a more exact relationship between C-V data and profile data to be calculated. This new method of data reduction allows the resolution of differential C-V profiling method to be extended to dimensions near the local extrinsic Debye length.

708,039
PB81-181901 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Measurement Technology: Test Patterns NBS-28 and NBS-28A: Random Fault Interconnect Step Coverage and Other Structures.
M. A. Mitchell, and L. W. Linholm. Mar 81, 39p NBS-SP-400-65
Sponsored in part by Naval Air Systems Command, Arlington, VA., and Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH.

Keywords: *Electrical fault location, *Integrated circuits, Microelectronics, Circuit interconnections, Tests, *Test patterns.

This report describes microelectronic test structures for detection of random faults in interconnect step coverage and associated process parametric and physical analysis test structures included in two test patterns, NBS-28 and NBS-28A, recently designed under the device test structure program at the National Bureau of Standards. Information about the geometry and application of the test structures in these two test patterns is provided for those who wish to fabricate or utilize the test patterns prior to their complete evaluation at NBS.

708,040
PB81-182859 Not available NTIS
National Bureau of Standards, Washington, DC.
Considerations of Ion Channeling for Semiconductor Microstructure Fabrication.
Final rept.
D. R. Myers, R. G. Wilson, and J. Comas. Dec 79, 4p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Jnl. of Vacuum Science and Technology 16, n6 p1893-1896 Nov/Dec 1979.

Keywords: *Semiconductor doping, Semiconductor devices, Fabrication, Silicon, Single crystals, Reprints, Ion implantation.

In this paper, limitations on the control of dopant distributions resulting from implantation into single-crystal silicon due to ion channeling are examined for a range of ion atomic numbers and energies characteristic of semiconductor device fabrication.

708,041
PB81-188203 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Advancement of Reliability, Processing and Automation for Integrated Circuits with the National Bureau of Standards (ARPA/IC/NBS).
Final rept. Jan 73-Oct 79.
W. M. Bullis. Mar 81, 51p NBSIR-81-2224

Keywords: *Integrated circuits, *Reliability, *Metrology, Microelectronics, Semiconductors, Silicon, Automation.

The program described in this report was undertaken in 1973 to develop the measurement technology necessary to enable device manufacturers to exert more effective control over the materials and processes they use to make integrated circuits with the ultimate aim of providing increased reliability at reasonable cost. Work was carried out in 12 technical areas: resistivity and dopant characterization; crystal defects and contaminants; oxides and other insulator films; physical analysis techniques; film and layer thickness; materials for infrared detector arrays; materials and procedures for wafer processing; photolithography; microelectronic test patterns; wafer inspection and test; die and interconnection bonding; and hermeticity.

708,042
PB81-196347 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Power Transistor Switching Characterization.
Annual rept. 1 Jul 79-30 Jun 80.
D. L. Blackburn. Apr 81, 29p NBSIR-81-2204
Sponsored in part by National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.

Keywords: *Transistors, Switching, Degradation, *Power transistors, Second breakdown, NTISCOMNBS, NTISNASA.

The results of the first year of an experimental investigation of the switching characteristics of power transistors are discussed. The devices studied were housed in TO-3 cases and were of an n(+)-p-n(-)-n(+) vertical dopant structure. The effects of the magnitude of the reverse-base current and temperature on the reverse-bias second breakdown characteristics are discussed. Brief discussions of device degradation due to second breakdown and of a constant voltage turn-off circuit are included. A description of a vacuum tube voltage clamp circuit which reduces clamped collector voltage overshoot is given.

708,043
PB81-197550 Not available NTIS
National Bureau of Standards, Washington, DC.
Recent Progress in Cryoelectronics.
Final rept.
D. B. Sullivan, C. A. Hamilton, and R. L. Kautz. Dec 80, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-29, n4 p319-323 Dec 80.

Keywords: *Superconductivity, Microelectronics, Metrology, Standards, Analog to digital converters, Integrated circuits, Reprints, NTISCOMNBS.

Superconductivity has played a significant role in the advancement of electrical standards and measurement instrumentation. With the development of a superconducting integrated circuit technology for computer applications, new concepts and opportunities for advanced measurement systems are now emerging. In this paper the authors discuss some of these systems as well as the computer technology which has made them possible.

708,044
PB81-220733 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Measurement Technology: ARPA/NBS Workshop 5, Moisture Measurement Technology for Hermetic Semiconductor Devices.
Final rept.
H. A.(Schafft, S. Ruthberg, and E. C. Cohen. May 81, 206p NBS-SP-400-69
ARPA Order no. 2397
See also no. 4, PB-251349.

Keywords: *Semiconductor devices, *Meetings, Moisture, Measurement, Quality control, Detectors, Mass spectroscopy, Encapsulating.

The workshop, fifth in a series concerned with measurement problems in integrated circuit processing and assembly, served as a forum to examine present problems with the measurement of moisture in hermetic semiconductor devices. Manuscripts and summaries are provided of 19 talks, panel meetings, and group encounters on three major topics: mass spectrometer measurements of internal package moisture, moisture sensors, and package analysis and quality assurance.

708,045
PB81-229155 PC **A05**/MF **A01**
Westinghouse Electric Corp., Baltimore, MD. Advanced Technology Labs.
Advanced Planar Silicon Test Structures.
Final rept. 1 Jan 78-31 Oct 79.
D. McCarthy, J. Acevedo, and D. Herman. Jul 81, 94p NBS/GCR-81-327
Contract NBS-6-35766, Grant ARPA Order-2397

Keywords: *Integrated circuits, *Wafers, Silicon, Semiconductor diodes, Tests, Integrated systems.

An integrated test structure that can be used to measure pn junction reverse-bias leakage current has been implemented in modular test chips to investigate the effects of certain design parameters on the leakage measurements. The test structure is composed of a gated diode, a reset switch, and an integrally connected source-follower MOSFET which functions as an electrometer. The automated measurement procedure is discussed, and data obtained using the test structure are analyzed to determine the bulk generation lifetime and the surface recombination velocity in processed silicon wafers.

708,046
PB81-239535 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Some Considerations Regarding Film Thickness Standards for the Semiconductor Industry.
J. R. Ehrstein. Nov 80, 15p NBSIR-80-2158

Keywords: *Thin films, *Standards, Integrated circuits, Semiconducting films, Dielectric films, Standard reference materials.

The paper first considers some of the requisite properties of Standard Reference Materials (SRMs) for effective use in improving the uniformity of measurements. It then considers some of the limitations imposed by real-world thin film specimens and our state of understanding of their properties as well as by the different types of measurements available. Finally, the need for improved measurement control will be related to the SRM program in light of these limitations.

708,047
PB81-241291 Not available NTIS
National Bureau of Standards, Washington, DC.
Experimental Study of Reverse-Bias Second Breakdown.
Final rept.
D. L. Blackburn, and D. W. Berning. Dec 80, 5p
Sponsored in part by National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.
Pub. in Proceedings of International Electron Devices Meeting, Washington, DC., December 8-10, 1980, p297-301 1980.

Keywords: *Transistors, *Second breakdown.

Experimental results showing the influence of reverse-base current, case temperature, collector inductance, and peak collector current on the reverse-bias second breakdown (RBSB) behavior of high-voltage n(+)-p-n(-)-n(+) power transistors are presented.

708,048
PB81-244071 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of Test Structures for Characterization of the Fabrication and Performance of Radiation-Hardened Charge-Coupled Device (CCD) Imagers: Annual Report, May 15, 1980 to May 14, 1981.
G. P. Carver. Aug 81, 27p NBSIR-81-2319
See also PB80-160708. Sponsored in part by Charles Stark Draper Lab., Inc., Cambridge, MA.

Keywords: *Test equipment, Tests, Electrometers, Metal oxide transistors, Electric measuring instruments, Semiconductor doping, *Charged coupled imagers, Charged coupled devices, Radiation hardening, Test patterns.

The purpose of this project is to evaluate new test structures and test methods useful for the characterization of radiation-hardened CCD imagers. The results of measurements on CCD imager wafers using the surface-channel and buried-channel, integrated gated-diode electrometers, before and after exposure to Co60 radiation, and using the cross bridge/electrical alignment test structures are reported. Examples of cross sections of the CCDs made by beveling and staining are also presented.

708,049
PB81-245342 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Measurement Technology: The Design, Testing, and Analysis of a Comprehensive Test Pattern for Measuring CMOS/SOS Process Performance and Control.
Final rept.
L. W. Linholm. Aug 81, 148p NBS-SP-400-66
Sponsored in part by Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH., and Defense Nuclear Agency, Washington, DC. Library of Congress catalog card no. 81-600078. See also PB81-181901.

Keywords: *Electrical fault location, *Integrated circuits, *Quality control, Microelectronics, Circuit interconnections, Test, Wafers, Test patterns.

A Process Validation Wafer (PVW) is a wafer containing only test patterns. One PVW accompanies a product lot during the fabrication process. Test patterns NBS-16 and NBS-26 are designed to be used on PVWs. They contain both process parameter test structures and random fault test structures. Eighteen NBS-16 PVWs were fabricated in a radiation-hardened silicon-gate CMOS/SOS process. These PVWs were tested on a high-speed computer-controlled dc test system. Test results from the process parameter test structures were used to establish the baseline electrical parameters for each product lot and to produce an eight-level gray scale wafer map for these parameters. Based on correlations of selected wafer maps, it was possible to identify specific yield-related process problems otherwise unknown to the manufacturer or user. Test results from two random fault test structures were used to establish a statistically significant data base for identifying and evaluating major yield-limiting fault mechanisms in the process. Test results from a developmental random access fault structure and a gate dielectric integrity array are presented. The results are analyzed for selected PVWs and a major yield-limiting fault mechanism detected.

708,050
PB81-600061 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Low-Noise Tunnel Junction dc SQUID's.
M. W. Cromar, and P. Carelli. 1981, 3p
Pub. in Appl. Phys. Lett. 38, n9 p2723-2725 May 1981.

Keywords: *Integrated circuits, Josephson devices, Magnetometers, SQUID's, Superconductivity, Thin films.

The authors present the results of an investigation of thin-film dc superconducting quantum interference device (SQUID's) with very high energy resolution. The SQUID's were fabricated using integrated-circuit techniques appropriate for superconducting devices. A weakly coupled SQUID with very low inductance (1 pH) had an intrinsic energy sensitivity 6x10 to the minus 34th power J/Hz=0.9 h. A well-coupled SQUID (coupling constant a=0.43) had an energy sensitivity referred to the input coil of 4.7x10 to the minus 34th power J/Hz=71 h.

708,051
PB81-600063 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Superconductive Energy Gap of AuAl2.
R. J. Soulen, D. Van Vechten, G. Costabile, T. Jach, and L. B. Holdeman. 1981, 2p
Pub. in Physica 108B, p823-824 1981.

Keywords: *AuAl2, Energy gap, Superconductivity, Tunneling.

The authors have prepared 200 nm films of AuAl2. The superconductive transition determined by resistive measurements was found to vary from film to film, from 177 to 184 mK. Film surfaces were oxidized by the Greiner process and Al counter electrodes were deposited in order to produce tunnel junctions. The temperature dependence of the energy gap of AuAl2 was measured and found to agree well with BCS theory.

708,052
PB82-117706 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Measurement Techniques for High Power Semiconductor Materials and Devices: Annual Report, October 1, 1979 to September 30, 1980.
R. C. Larrabee, W. E. Phillips, and W. R. Thurber.
Sep 81, 53p NBSIR-81-2325
Contract DOE-EA-77-A-01-6010
See also report for Oct 77-Sep 78, PB-298 574.

Keywords: *Semiconductor devices, *Semiconductors, *Measurement, Silicon, Wafers, Defects, Thyrestors, Electrical properties.

The presence of deep-level impurities in semiconductor power devices is a consequence of their unintentional introduction during crystal growth and during the wafer fabrication procedure or their intentional introduction in order to adjust the switching properties of the device. Measurement techniques to detect, characterize, and identify such deep levels are required in order to monitor the presence of unintentional contamination or to characterize and understand the behavior of intentionally added impurities. This effort is divided into two ongoing tasks concerned with (1) the introduction of specific impurities into silicon wafers and the characterization of the resulting deep levels and (2) the correlation of the results of these deep-level characterization techniques with the electrical properties of devices. A third task concerned with the standardization of preferred procedures for specimen preparation for spreading resistance measurements on thyristor-grade silicon was essentially completed during the year.

708,053
PB82-135922 PC **A02**/MF **A01**
Stanford Univ., CA. Stanford Electronics Labs.
Innovative Measurement Technology for the Semiconductor Device Industry Based on Electron Spectroscopy.
Final rept. 1 Jul 75-31 Dec 78.
C. R. Helms, S. A. Schwarz, W. E. Spicer, and N. J. Taylor. Nov 81, 12p NBS-GCR-81-345
Contract NBS-5-35944, ARPA Order-2397
Prepared in cooperation with Varian Associates, Inc., Palo Alto, CA.

Keywords: *Spectroscopy, *Semiconductor devices, Measurement, Silicon, Auger electrons, Integrated circuits, Interfaces, Semiconductors, Profiles, Technology innovation, *Electron spectroscopy.

This report summarizes the results of a 3-1/2 year research effort on electron spectroscopy techniques used in conjunction with ion etching for characterizing materials and structures used in semiconductor device technology. Results include both the establishment of the capabilities and limitations of these techniques and their application in studies of the chemistry, stoichiometry, and morphology of interfaces present in MOS device structures. A list of 27 publications which provide details of the various results is included in the report.

708,054
PB82-183575 PC **A04**/MF **A01**
Hughes Research Labs., Malibu, CA.

Semiconductor Measurement Technology: Differential Capacity-Voltage Profiling of Schottky Barrier Diodes for Measuring Implanted Depth Distributions in Silicon.
R. G. Wilson, and D. M. Jamba. Feb 82, 61p NBS/SP-400-71
Contract NBS-5-35891
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA. Library of Congress catalog Card no. 81-600162.

Keywords: *Semiconductors, *Silicon, Measurement, Charge carriers, Profiles, Schottky barrier devices, Ion implantation.

This report discusses experimental and analytical aspects of differential capacitance-voltage profiling of ion-implanted carrier depth distributions using reverse-biased Schottky barrier diodes and the associated accuracies, experimental errors, and ranges of applicability.

708,055
PB82-192485 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of Vacuum Tubes in Test Instrumentation for Measuring Characteristics of Fast High-Voltage Semiconductor Devices.
Final rept.
D. Berning. Sep 81, 2p
Contract NASA-C-32818-D
Pub. in IEEE Transactions on Instrumentation and Measurement IM-30, n3 p226-227 Sep 81.

Keywords: *Semiconductor devices, *Test equipment, Nondestructive tests, Circuits, Transistors, Reprints, Second breakdown.

Circuits are described that permit measurement of fast events occurring in power semiconductors. These circuits were developed for the dynamic characterization of transistors used in inductive-load switching applications. Fast voltage clamping using vacuum diodes is discussed, and reference is made to a unique circuit that was built for performing nondestructive, reverse-bias, second-breakdown tests on transistors.

708,056
PB82-198623 Not Available NTIS
National Bureau of Standards, Washington, DC.
Characterizing and Analyzing Critical Integrated Circuit Process Parameters.
Final rept.
L. W. Linholm, R. L. Mattis, R. C. Frisch, and C. P. Reeve. May 81, 15p
Prepared in cooperation with Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH.*Defense Nuclear Agency, Washington, DC.
Pub. in Semiconductors and Silicon, 81-5 p906-920 May 1981.

Keywords: *Integrated circuits, Microelectronics, Process control, Wafers, Tests, Reprints.

Microelectronic test structures are frequently used to measure the degree of process control in developmental integrated circuit processes. Test results from these structures must be obtained and interpreted in a timely fashion in order to be used for correcting or improving the process. This paper describes techniques for determining and displaying critical process parameters in forms convenient for characterizing the intrawafer variation of these parameters.

708,057
PB82-205709 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
CS1: A Two-Dimensional Finite Element Charge-Sheet Model of a Short-Channel MOS Transistor.
C. L. Wilson, and J. L. Blue. Apr 82, 63p NBSIR-82-2471

Keywords: *Metal oxide transistors, Mathematical models, Finite element analysis, Electric charge, Computer applications, Interactive graphics.

A two-dimensional charge-sheet model for short-channel MOS transistors has been developed. The unique feature of the model is that the effect of channel inversion layer charge is included as a nonlinear integral boundary condition on the two-dimensional electrostatic field in the transistor. The average inversion layer charge density and source-drain current are obtained directly from the model rather than from the

electron density or electron quasi-Fermi level. The model retains all of the physical detail of more complex two-dimensional models such as sensitivity to source-drain profile shape, channel profile, and oxide field shape. This allows the model to represent the changes in drain current associated with short-channel effects while still allowing simple comparison with long-channel models. For long-channel transistors, the results of this model are identical to Brews' long-channel charge-sheet model. The accuracy of this model is verified by modelling a sequence of transistors with channel lengths between 4.6 and 1.1 micrometers. In short-channel transistors, effects previously attributed to high field mobility are explained by simple two-dimensional electrostatics.

708,058
PB82-217985 PC **A14**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Measurement Technology: NBS/RADC Workshop Moisture Measurement Technology for Hermetic Semiconductor Devices, II.
Final rept.
E. C. Cohen, and S. Ruthberg. Apr 82, 305p NBS-SP-400-72
Proceedings of a Workshop Held at NBS, Gaithersburg, Maryland, Nov 5-7, 1980. Library of Congress catalog card no. 82-600503. Sponsored in part by Rome Air Development Center, Griffiss AFB, NY.

Keywords: *Semiconductor devices, *Meetings, Measurement, Moisture content, Hermetic seals, Mass spectroscopy, Mass spectrometers, Moisture meters, Packaging.

The Workshop, one of a series concerned with measurement problems in integrated circuit processing and assembly, served as a forum to examine the progress that has been made in the measurement and control of moisture in hermetically packaged semiconductor devices. While moisture-induced failure modes and mechanisms have been extensively documented, the lack of accurate and reliable measurement of the moisture content itself has been a major obstacle to meaningful efforts to limit and control this pervasive contaminant. Manuscripts are provided of 36 presentations which detail the progress that has been made in mass spectrometer measurements and calibration of internal package moisture, in increased assurance with moisture sensors, in testing, and in package control.

708,059
PB82-226358
(Order as PB82-226333, PC **A09**/MF **A01**)
IBM Thomas J. Watson Research Center, Yorktown Heights, NY.
Highlights in Semiconductor Device Development.
L. Esaki. 4 Aug 81, 6p
Included in Jnl. of Research of the National Bureau of Standards, v86 n6 p565-570 4 Nov-Dec 81.

Following a brief description of early semiconductor history, the invention of the transitor and subsequent important events are presented in perspective, with emphasis on the semiconductor physics in device development.

708,060
PB82-236175 Not available NTIS
National Bureau of Standards, Washington, DC.
VDMOS Power Transistor Drain-Source Resistance Radiation Dependence.
Final rept.
D. L. Blackburn, T. C. Robbins, and K. F. Galloway. Dec 81, 6p
Pub. in IEEE Transactions on Nuclear Science, NS-28 n6 p4354-4359 Dec 81.

Keywords: *Metal oxide transistors, Radiation effects, Electrical resistance, Reprints.

Data on the effects of neutron and gamma radiation on the drain-source resistance characteristics of power VDMOS transistors is presented. The change in resistance with neutron exposure is related to the resistivity of the drain material, which in turn can be related to the drain-source breakdown voltage. A device with a 450-V rating experienced a factor of 13 increase in resistance on exposure to a neutron fluence of 10 to the 14th power/sq cm whereas one with a breakdown voltage of 150 V experiences no increase in resistance. Threshold voltage shifts of about 2 V occurred at 100,000 rad (Si) without bias and was accelerated by positive gate bias. All of these data can be correlated when compared with the predictions of a simple model illustrates a general separability of neutron and gamma effects on power VDMOS devices. The systems implications for using this type device in a radiation environment is briefly addressed.

708,061
PB82-237652 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Evaluation of a CMOS/SOS Process Using Process Validation Wafers.
Annual rept.
J. S. Suehle, L. W. Linholm, and G. M. Marshall. Jun 82, 47p NBSIR-82-2514
Sponsored in part by Defense Nuclear Agency, Washington, DC.

Keywords: *Integrated circuits, *Process control, Microelectronics, Wafers, Tests, Silicon on sapphire, Complementary metal oxide semiconductors, Chips(Electronics), Test patterns.

The objective of this work was to determine baseline electrical parameters that could be used to evaluate a fabrication process. Two lots of wafers containing NBS-16 test chips were fabricated at a commercial vendor in a radiation-hard, CMOS/SOS process. These wafers were then returned to NBS for testing and evaluation. Testing was performed using an automated computer-controlled integrated circuit test system. Test results were evaluated using analysis techniques which provided a statistical estimate of selected parameters and identified spatial correlations between data sets. Further analysis was then performed in order to identify process irregularities. A complete description of the test results and analysis procedure can be found in the appendices.

708,062
PB82-239096 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Considerations Regarding Thin Film Standards for the Semiconductor Industry.
Final rept.
J. R. Ehrstein. 1980, 8p
Pub. in Proceedings of Microelectronics Measurement Technology Seminar, San Jose, CA, March 11-12, 1980, p324-331.

Keywords: *Standards, *Thin films, Electronics industry, Thickness, Silicon, Silicon dioxide, Silicon nitrides, Measurement, Standard reference materials.

This paper will first consider some of the requisite properties of Standard Reference Materials (SRM's) for effective use in improving the uniformity of measurements. It will then consider some of the limitations imposed by real world thin film specimens and our state of understanding of their properties as well as by the different types of measurements available. Finally, the need for improved measurement control will be related to the SRM program in light of these limitations.

708,063
PB82-248105 Not available NTIS
National Bureau of Standards, Washington, DC.
Improved Spreading Resistance Analysis of Power Control Devices.
Final rept.
J. R. Ehrstein. 1979, 2p
Contract DOE-EA-77-A-01-6010
Pub. in Proceedings of Electrochemical Society Meeting, Los Angeles, CA, October 14-19, 1979, Extended Abstract No. 619, p1555-1556 1979.

Keywords: *Semiconductor doping, Measurement, Electrical resistance, Silicon, Thyristors, Profiles.

Several recent improvements in the practice and analysis of spreading resistance measurements have particular importance for measurements on thyristors and similar power control devices. These include a procedure for obtaining greatly improved measurement precision on high resistivity n-type layers, improved understanding of the calibration of aluminum and gallium-doped layers, and an extremely efficient, yet accurate, algorithm for extracting dopant profiles from measurements. These improvements will be discussed and their impact on the use of spreading resistance-derived profiles for device modelling will be considered.

708,064
PB83-100321 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Measurement Techniques for High Power Semiconductor Materials and Devices: Annual Report, October 1, 1980 to December 31, 1981.
Interim rept.
W. R. Thurber, W. E. Phillips, and R. D. Larrabee.
Aug 82, 67p NBSIR-82-2552
Contract DOE-EA-77-A-01-6010
See also PB82-117706.

Keywords: *Semiconductor devices, *Semiconductors, *Measurement, Silicon, Rectifiers, Computer programs, Defects, Impurities, Carrier lifetime.

This annual report describes results of NBS research directed toward the development of measurement methods for semiconductor materials and devices which will lead to more effective use of high-power semiconductor devices in applications for energy generation, transmission, conversion, and conservation. Emphasis is on the development of measurement methods for power-device grade silicon. Major accomplishments during this reporting period were: (1) characterizing by deep level transient spectroscopy (DLTS) the energy levels in silicon power rectifier diodes, (2) writing of a computer program to predict lifetime-related parameters using as input the measured properties of the deep energy levels, (3) developing a novel method to detect nonexponential transients using a conventional double-boxcar DLTS system, (4) analyzing transient capacitance measurements to extend the techniques to nonexponential decays, (5) using a platinum resistance thermometer to calibrate temperature sensing diodes to obtain the precision needed for careful isothermal capacitance measurements, and (6) utilizing trap changing time as a technique to resolve overlapping DLTS peaks in sulfur-doped silicon.

708,065
PB83-164970 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Introduction to Noise in Solid State Devices.
Technical note (Final).
J. Cohen. Dec 82, 67p NBS-TN-1169

Keywords: *Solid state devices, *Electromagnetic noise, Thermal noise, Crystal rectifiers, Transistors, Photodetectors.

This is a short didactic monograph on electronic noise which aims to impart a 'feel for the subject'. The work is divided into two parts. The first, Theory, deals in detail with the principal noises found in solid state devices, namely shot noise, thermal noise, 1/f noise, and generation-recombination noise. The second part, Applications, is a systematic treatment of noise in selected solid state devices. Analyses progress from a single noise source in a circuit element to four noises in a device; concomittantly equivalent circuits are developed to facilitate the solution of various complex noise problems. Examples treated in this part include resistors, rectifiers, transistors, and photo-detectors. The work concludes with a recapitulation and useful references.

708,066
PB83-179440 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Speed, Low-Crosstalk Chip Holder for Josephson Integrated Circuits.
Final rept.
C. A. Hamilton. Jun 82, 3p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Instrumentation and Measurement IM-31, n2 p129-131 Jun 82.

Keywords: *Holders, *Integrated circuits, Josephson junctions, Reprints.

The paper describes the construction and performance of a compact chip mount for making multiple, high-speed, low-crosstalk contacts to a Josephson integrated circuit. The mount has a rise time of about 32 ps and worst case crosstalk between lines of -33 dB.

708,067
PB83-200956 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.

Description of a CMOS Test Chip, NBS-39.
T. J. Russell. Apr 83, 38p NBSIR-83-2683

Keywords: *Metal oxide transistors, Scaling, Test equipment, *Complementary metal oxide semiconductors, Chips(Electronics).

Test chip NBS-39 was designed to analyze the scaling properties of short-channel metal-oxide-semiconductor field effect transistors (MOSFETs). This report is a guide for identifying and locating each test structure included on the test chip. There is a table with each test structure identified by name, number, parameter measured, and a reference of how to perform the measurement when appropriate. The test chip can be fabricated by a junction-isolated (JI) silicon complementary metal-oxide semiconductor (CMOS) p-well process and by a local oxidation of silicon (LOCOS) CMOS p-well process. The modifications required to go from a JI-CMOS fabrication process to a LOCOS-CMOS are discussed.

708,068
PB83-235036 Not available NTIS
National Bureau of Standards, Washington, DC.
Modeling of Ionizing Radiation Effects in Short-Channel MOSFETs.
Final rept.
C. L. Wilson, and J. L. Blue. Dec 82, 5p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Nuclear Science NS-29, n6 p1672-1680 December 82.

Keywords: *Metal oxide transistors, Ionizing radiation, Stimulation, Radiation effects, Reprints.

The effect of ionizing radiation on short-channel MOSFETs is modeled using a charge-sheet approach. The primary effect of ionizing radiation is the introduction of oxide trapped charge (OTC) and interface trapped charge (ITC). Using a two-dimensional charge-sheet model transistors with channel lengths between 4.65 micrometers and 0.27 micrometers were studied. A range of net OTC and ITC values of plus and minus 4.0 x 10 to 11 power/square cm was used to study dose effects corresponding to approximately equal to 100,000 rad(SiO2).

708,069
PB83-263764 PC **E04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Measurement Technology: A FORTRAN Program for Analysis of Data from Microelectronic Test Structures.
Final rept.
R. L. Mattis. Jul 83, 66p NBS-SP-400-75
Library of Congress catalog card no. 83-600548.

Keywords: *Integrated circuits, *Computer programs, Statistical analysis, Microcomputers, Computation, Tests, Microelectronics, Data processing.

A computer program, STAT2, is described which performs the following functions: reads data as a two-dimensional array; calculates mean, sample standard deviation, and median; identifies outliers; calculates replacement values for outliers; makes a gray-tone, numerical and contour data maps on a line printer; makes a numerical map on the user's terminal; makes a histogram on a line printer; constructs a data base for examining correlations among various data sets; and searches the data base for correlations using several selective keys. The emphasis in this document is on program usage, and detailed descriptions of the commands are given. Data input requirements are addressed. Guidance regarding several types of program modifications is provided.

708,070
PB84-103670 Not available NTIS
National Bureau of Standards, Washington, DC.
Power MOSFET Temperature Measurements.
Final rept.
D. L. Blackburn, and D. W. Berning. Jun 82, 8p
Pub. in Proceedings of the 1982 Institute of Electrical and Electronics Engineers Power Electronics Specialists Conference, PESC, Cambridge, MA., June 14-17, 1982, p400-407.

Keywords: *Temperature measurement, *Metal oxide transistors, Semiconductor devices, Electrical properties, Thermodynamic properties, Comparison.

Three temperature-sensitive electrical parameters are compared as thermometers for power MOSFET devices. The parameters are the forward drain-body diode voltage, the source-gate voltage, and the on-resistance. The results are also compared with temperatures measured with an infrared microradiometer. The procedure, apparatus, and circuits required to use each of the parameters as a thermometer are described. Some general considerations for measuring the temperature of power semiconductor devices are also discussed. Each parameter is found to be satisfactory for measuring the temperature of power MOSFETs.

708,071
PB84-106947 Not available NTIS
National Bureau of Standards, Washington, DC.
Relationship between Deep-Level Measurements and Lifetime in Devices.
Final rept.
J. R. Lowney, R. D. Larrabee, and W. R. Thurber. 1983, 5p
Pub. in Proceedings of Custom Integrated Circuits Conference (1983), Rochester, NY, May 23-25, 1983, IEEE Cat. No. 83CH1859-8, p152-156.

Keywords: *Semiconductor devices, Silicon, Performance, Mathematical models, Computerized simulation, Semiconductor diodes, Platinum, Impurities, *Minority carriers, *Carrier lifetime, Deep levels.

The minority-carrier lifetime in silicon devices affects performance by influencing such lifetime-related quantities as switching times, storage times, and reverse-leakage currents. A computer program has been developed to model the behavior of deep-level recombination centers that control the minority-carrier lifetime. The input parameters that characterize the deep levels can be measured by capacitive-transient techniques coupled with a measurement of the low-injection level lifetime. These parameters can be used for deep-level identification and diagnostic purposes and, as input to the program, for predicting lifetime under different injection-level conditions. This technique of deep-level characterization is illustrated for n(+)p and p(+)n diodes containing deep levels from intentionally added platinum.

708,072
PB84-127455 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Release Notes for STAT2 Version 1.31: An Addendum to NBS (National Bureau of Standards) Special Publication 400-75.
R. L. Mattis, and R. Zucker. Nov 83, 28p NBSIR-83-2779
See also PB83-263764.

Keywords: *Revisions, Integrated circuits, Statistical analysis, Tests, Wafers, STAT2 computer program.

This document describes the changes which have been made in the STAT2 computer program. The new version contains several new features which provide a more powerful data base capability, improved displays, and greater compatibility with the automatic tester. In going from the original version 1.01 to version 1.31, the DATA array has been redefined and new REA command formats have been added to be compatible with new data acquisition equipment. A new circular shaded map has been added which gives a more realistic representation of data variation over a wafer surface. New map and histogram scaling options allow greater flexibility in specifying the scale of data displays. A new format for two data base commands allows greater flexibility in selectively listing and correlating data base entries. The capability has been added for eliminating some unwanted printout, and for creating macro command files within a STAT2 run. Finally, a new method of specifying the directory containing the Help files makes STAT2 easier to install. Following the description of the changes is an annotated listing of new error messages.

708,073
PB84-135995 Not available NTIS
National Bureau of Standards, Washington, DC.
Department of Commerce and the Role of Government Standards.
Final rept.
W. M. Bullis, and R. I. Scace. 1981, 6p
Pub. in VLSI (Very Large Scale Integration) Electronics Microstructure Science, Chapter 2, 1, p281-286 1981.

Keywords: *Integrated circuits, *Standards, Metrology, Semiconductors(Materials), Reprints, National Bureau of Standards, Very large scale integration.

The Semiconductor Technology Program at NBS is described briefly; several examples of past successful programs and their significance are given. The work is planned to be expanded significantly beginning in FY 1981. An outline of the present plans for this expansion to cover the problems of very large scale integration (VLSI) is presented. Note: This material represents four pages of 30 in a chapter covering the role of the U.S. Government in VLSI development. The book is to include 20 other chapters from authors in both industry and universities.

708,074
PB84-137819 Not available NTIS
National Bureau of Standards, Washington, DC.
Direct Measurement of Interfacial Contact Resistance.
Final rept.
S. J. Proctor, and L. W. Linholm. Oct 82, 3p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in IEEE Electron Device Letters EDL-3, n10 p294-296, Oct 82.

Keywords: *Electric contacts, Electrical resistance, Tests, Semiconductor devices, Integrated circuits, Interfaces, Measurement, Reprints, Test structures.

A four-terminal microelectronic test structure and test method is described for electrically determining the degree of uniformity of the interfacial layer in metal-semiconductor contacts and for directly measuring the interfacial contact resistance. A two-dimensional resistor network model is used to obtain the relationship between the specific contact resistance and the measured interfacial contact resistance for contacts with a uniform interfacial layer. A new six-terminal test structure is used for the direct measurement of end contact resistance and the subsequent determination of front contact resistance. A methodology is described for reducing the effects of both contact-window mask misalignment and parasitic resistance associated with these measurements. Measurement results are given for 98.5% Al/1.5% Si and 100% Al contacts on n-type silicon.

708,075
PB84-153634 Not available NTIS
National Bureau of Standards, Washington, DC.
Two-Dimensional Analysis of Semiconductor Devices Using General-Purpose Interactive PDE Software.
Final rept.
J. L. Blue, and C. L. Wilson. Sep 83, 15p
Pub. in IEEE Transactions on Electron Devices ED-30, n9 p1056-1070 Sep 83.

Keywords: *Semiconductor devices, *Integrated circuits, *Nonlinear differential equations, *Elliptic differential equations, Finite element analysis, Partial differential equations, Numerical integration, Metal oxide transistors, Semiconductor junctions, Minicomputers, Reprints, *Very large scale integration, Two-dimensional calculations, Computer applications.

Analyzing currents and fields in VLSI devices requires solving three coupled nonlinear elliptic partial differential equations in two dimensions. Historically, these equations have been solved using a special-purpose program and batch runs on a large, fast computer. The authors use a general-purpose program and interactive runs on a large minicomputer. They discuss the physical formulation of the semiconductor equations, and give three example solutions: a short-channel MOSFET near punch-through, a DMOS power transistor in the on state, and a beveled p-n junction. These examples demonstrate that solutions to a very general class of semiconductor device problems can be obtained by using these methods.

708,076
PB84-216506 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Semiconductor Devices and Circuits Div.
NMOS Test Chip for a Course in Semiconductor Parameter Measurements.
K. P. Roenker, and L. W. Linholm. Apr 84, 50p NBSIR-84-2822
Prepared in cooperation with Cincinnati Univ., OH.

Keywords: *Integrated circuits, *Microelectronics, Measurement, Tests.

This report describes an NMOS test chip, NBS-40, which was developed to be used in graduate level

electronics engineering courses involving semiconductor parameter measurements associated with the fabrication of integrated circuits. The 35 test structures included in the test chip and their use in materials, device, and process parameter measurements are described. Details of the silicon gate NMOS process used in the chip fabrication are also provided.

708,077
PB84-216944 Not available NTIS
National Bureau of Standards, Washington, DC.
Verification of Models for Fabrication of Arsenic Source-Drains in VLSI MOSFETs.
Final rept.
J. Albers, P. Roitman, and C. L. Wilson. Nov 83, 10p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices ED30, n11 p1453-1462 Nov 83.

Keywords: *Field effect transistors, *Metal oxide transistors, *Semiconductor junctions, Integrated circuits, Silicon, Arsenic, Annealing, Measurement, Reprints, Very large scale integration, Ion implantation, Secondary ion mass spectroscopy, Rutherford backscattering, Spreading resistance.

The understanding of the effects of both low- and high-temperature anneals of arsenic implanted into silicon is critical in the calculation of p-n junction profiles of sources and drains in short-channel MOSFET's. The work reported here uses a sample matrix of arsenic implanted into silicon over a wide range of fluences and annealed in both the low- and high-temperature regimes. This matrix of samples was measured by means of Rutherford Backscattering Spectrometry (RBS), spreading resistance (Rsp), and Secondary Ion Mass Spectrometry (SIMS). The measurement techniques are compared with each other, with the predictions of ion-implantation models, and with the annealing/diffusion models.

708,078
PB84-217165 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Ionizing Radiation on the Breakdown Voltage of Power MOSFETs.
Final rept.
D. L. Blackburn, J. M. Benedetto, and K. F. Galloway. Dec 83, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS30, n6 p4116-4121 Dec 83.

Keywords: *Field effect transistors, *Metal oxide transistors, *Ionizing radiation, *Electrical faults, Electric potential, Reprints, *Breakdown voltage, *Breakdown(Electronic threshold), *Physical radiation effects, Voltage.

It is shown that the drain-source breakdown voltage of power MOSFETs is a strong function of the total dose of ionizing radiation to which the device has been exposed. For the n-channel MOSFETs studied, the breakdown voltage after exposure is reduced from the unirradiated value. The cause for the effect is postulated to be the trapping of radiation generated charge in the field oxide and the generation of traps at the field oxide-silicon interface. The devices studied varied in breakdown voltage between 60 to 500 V and used field plates and/or field rings to terminate the high voltage junction.

708,079
PB84-217264 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Simple Approximations and Numerical Solutions for the Threshold Voltage of Ion-Implanted Long-Channel MOSFETs.
Final rept.
B. P. Brodfuehrer, K. F. Galloway, and C. L. Wilson. Feb 84, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Education E27, n1 p3-6 Feb 84.

Keywords: *Metal oxide transistors, Electric potential, Approximation, Reprints.

The very simple approximations used for calculating the threshold voltage shifts for ion-implanted long-channel MOSFETs in classroom discussions are compared with the results of a more exact numerical simulation. Limited experimental measurements are compared with the calculated threshold voltage shifts.

708,080
PB84-219559 PC **A15/MF A01**
National Bureau of Standards (NEL), Washington, DC. Semiconductor Materials and Processes Div.
RADC/NBS (Rome Air Development Center/National Bureau of Standards) Workshop. Moisture Measurement and Control for Semiconductor Devices, 3.
B. A. Moore, and S. Ruthberg. May 84, 329p NBSIR-84/2852
Sponsored in part by Rome Air Development Center, Griffiss AFB, NY. Proceedings of the RADC/NBS Workshop held at Gaithersburg, MD, on 2-4 November 1983.See also PB82-217985.

Keywords: *Semiconductor devices, *Integrated circuits, *Moisture content, *Meetings, Measurement, Hermetic seals, Mass spectroscopy, Moisture meters, Packaging, Quality control, Reliability(Electronics).

The workshop, one of a series concerned with measurement problems in integrated circuit processing and assembly, served as a forum to examine the continuing progress that has been made in the measurement and control of moisture in hermetically packaged semiconductor devices. Thirty-four presentations are included which contain detailed information for securing hermetic packages with low moisture content. Agreement in measurement has been obtained with the mass spectrometer for cerdip and metal packages at the 5000 ppmv level of moisture through the use of suitable moisture generators, a 3-volume calibrator, calibrated dewpoint hygrometers, and appropriate operational procedures. An approach is given for a reproducible and reliable transfer package. However, the increased use of organic materials in new and rapidly expanding technologies such as VLSI/VHSIC and hybrid packaging presents new and more complex challenges to accurate measurement of interior moisture.

708,081
PB84-221043 Not available NTIS
National Bureau of Standards, Washington, DC.
Direct Measurements of Interfacial Contact Resistance, End Contact Resistance, and Interfacial Contact Layer Uniformity.
Final rept.
S. J. Proctor, L. W. Linholm, and J. A. Mazer. Nov 83, 8p
Pub. in IEEE Transactions on Electron Devices ED-30, n11 p1535-1542 Nov 83.

Keywords: *Electric contacts, Integrated circuits, Semiconductor devices, Tests, Microelectronics, Electrical resistance, Reprints.

A four-terminal microelectronic test structure and test method is described for electrically determining the degree of uniformity of the interfacial layer in metal-semiconductor contacts and for directly measuring the interfacial contact resistance. A two-dimensional resistor network model is used to obtain the relationship between the specific contact resistance and the measured interfacial contact resistance for contacts with a uniform interfacial layer. A new six-terminal test structure is used for the direct measurement of end contact resistance and the subsequent determination of front contact resistance. A methodology is described for reducing the effects of both contact-window mask misalignment and parasitic resistance associated with these measurements. Measurement results are given for 98.5% Al/1.5% Si and 100% Al contacts on n-type silicon.

708,082
PB84-221654 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Evaluation of VLSI Packages Using Test Chips: A Critical Review.
Final rept.
F. F. Oettinger. Feb 84, 11p
Pub. in Solid State Technology, p169-179 Feb 84.

Keywords: *Thermal measurement, *Integrated circuits, Nondestructive tests, Semiconductor junctions, Reprints, Very large scale integration, Test chips.

The design, analysis, and utilization of test chips for the thermal evaluation of VLSI packages are discussed. The factors that determine the thermal performance of microelectronic devices are the circuit type, the fabrication technology, the die size, the die attachment method, the package and heat dissipater design, and the ambient environment. Thermal test chips are extensively used in characterizing new package designs for VLSI chips in the 1 to 10 W range. The information discussed should allow the engineer to rationally choose a particular test chip design and to understand the implications of measurements to thermally characterize a particular chip-package system.

708,083
PB84-221753 Not available NTIS
National Bureau of Standards, Washington, DC.
Method for Selecting a Minimum Test Chip Sample Size to Characterize Microelectronic Process Parameters.
Final rept.
J. S. Suehle, L. W. Linholm, and K. Kafadar. May 83, 5p
Pub. in Proceedings of IEEE Custom Integrated Circuits, Rochester, New York, May 23-25, 1983, IEEE Cat. No. 83CH1859-8, p308-312.

Keywords: *Integrated circuits, Sampling, Microelectronics, Tests, Estimates, *CMOS.

A method for determining a test chip sample size to estimate effectively the electrical parameter distributions on an integrated circuit wafer is presented. This method gives relations among sample size and the figure of merit for four statistical techniques (trimmed mean, biweighted mean, median, and arithmetic mean) by which estimates are calculated. To demonstrate the use of this method, it has been applied to the evaluation of a CMOS fabrication process.

708,084
PB84-222132 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of the Spatial Variation of Interface Trapped Charge Using Short-Channel MOSFET's.
Final rept.
T. J. Russell, C. L. Wilson, and M. Gaitan. Dec 83, 10p
Pub. in IEEE Transactions on Electron Devices ED-30, n12 p1662-1671 Dec 83.

Keywords: *Field effect transistors, *Metal oxide transistors, Mathematical models, Interfaces, Silicon, Reprints, *Interface trapped charge, Two dimensional.

Previous measurements of interface trapped charge (ITC) by charge pumping used long-channel metal gate transistors. In this paper charge pumping is extended to short-channel self-aligned polysilicon gate transistors and used to determine the spatial variation of ITC on wafers. Only the MOSFET gate area and a pulse frequency are required to calculate ITC density from the charge pumping current.

708,085
PB84-224716 Not available NTIS
National Bureau of Standards, Washington, DC.
Peak Conductance Measurements of GaAs Switching Devices.
Final rept.
B. A. Bell, and A. G. Perrey. Aug 83, 12p
Pub. in Proceedings of SPIE (Society of Photo-Optical Engineers), San Diego, CA., August 24-26, 1983, p128-139.

Keywords: *Photoconductive cells, Photoconductivity, Measurement, Computerized simulation, Gallium arsenides, Electric switches, Comparison, Tests.

This paper describes the test apparatus and circuitry used to make measurements of pulsed light conductance on samples of high resistivity (10 to the 7th power ohm-cm) gallium arsenide switching devices, having nominal 25 micrometer and 700 micrometer gap spacings. Differences in conductance are observed on variously grown samples. Comparisons are made between the observed pulse measurements and the pulse waveforms generated by computer simulation using a model based on a theoretical analysis of the relationships between photoconductance and irradiated optical power.

708,086
PB84-225242 Not available NTIS
National Bureau of Standards, Washington, DC.
Cross-Bridge Test Structure for Evaluating the Linewidth Uniformity of an Integrated Circuit Lithography System.
Final rept.
D. Yen, L. W. Linholm, and M. G. Buehler. Oct 82, 7p
Sponsored in part by Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH., Naval Air Systems

Command, Washington, DC., and Army Electronics Technology and Devices Lab., Fort Monmouth, NJ.
Pub. in Jnl. of the Electrochemical Society, v129 n10 p2312-2318 Oct 82.

Keywords: *Integrated circuits, *Line width, *Lithography, Wafers, Microelectronics, Tests, Measurement, Reprints, Photomasks.

This paper describes an electrical measurement method using the cross-bridge test structure to evaluate linewidth variation associated with integrated circuit lithography. Arrays of cross-bridge test structures are used to measure the uniformity of linewidth across a wafer. Using this test structure array and high speed electrical test methods, sufficient quantities of data are obtained to make statistical comparisons and to evaluate a step-and-repeat system used to fabricate photomasks. In this study the variation in linewidth, which was systematic and repetitive from sample to sample, was several tenths of a micrometer across a wafer, and the linewidth measurement precision with the cross-bridge test structure was shown to be better than 0.03 micrometer.

708,087
PB84-225408 Not available NTIS
National Bureau of Standards, Washington, DC.
Two-Dimensional Analysis of Semiconductor Devices Using General-Purpose Interactive PDE Software.
Final rept.
J. L. Blue, and C. L. Wilson. Sep 83, 23p
Pub. in SIAM (Society for Industrial and Applied Mathematics) Jnl. of Scientific Statistical Computers, v4 n3 p462-484 Sep 83.

Keywords: *Semiconductor devices, *Integrated circuits, *Nonlinear differential equations, *Partial differential equations, *Elliptic differential equations, Mathematical models, Metal oxide transistors, Field effect transistors, Semiconductor junctions, Minicomputers, Reprints, Very large scale integration, Two dimensional calculations, Computer software.

Analyzing currents and fields in VLSI devices requires solving three coupled nonlinear elliptic partial differential equations in two dimensions. Historically, these equations have been solved using a special-purpose program and batch runs on a large fast computer. The authors use a general-purpose program and interactive runs on a large minicomputer. They discuss the physical formulation of the semiconductor equations and give three example solutions: a short-channel MOSFET near punchthrough, a DMOS power transistor in the ON state, and a beveled p-a junction. These examples demonstrate that solutions to a very general class of semiconductor-device problems can be obtained using these methods.

708,088
PB84-226380 Not available NTIS
National Bureau of Standards, Washington, DC.
Numerical Methods for Solving Coupled Semiconductor Equations on a Minicomputer.
Final rept.
J. L. Blue, and C. L. Wilson. 1984, 10p
Pub. in Elliptic Problem Solvers 2, p521-530 1984.

Keywords: *Semiconductor devices, *Mathematical models, *Nonlinear differential equations, *Elliptic differential equations, Partial differential equations, Finite element analysis, Numerical integration, Electric current, Iteration, Minicomputers, Reprints, Newton method, Interactive graphics, Two dimensional calculations.

A general mathematical model for analyzing currents and fields in semiconductor devices requires three coupled nonlinear elliptic partial differential equations in two dimensions. A general-purpose solver for systems of coupled nonlinear elliptic PDEs is used. The numerical framework is linear elements on triangles, with nonuniform triangulations. The nonlinear finite element equations are solved by approximate Newton methods; the linearized equations are solved by sparse Gaussian elimination and by multi-level iteration. For accurate solutions, triangle refinements are generated adaptively.

708,089
PB84-226786 Not available NTIS
National Bureau of Standards, Washington, DC.
Microelectronic Ball-Bond Shear Test - A Critical Review and Comprehensive Guide to Its Use.
Final rept.
G. G. Harman. Oct 83, 15p
Pub. in Proceedings of 1983 International Microelectronics Symposium, Philadelphia, Pennsylvania, October 31-November 2, 1983, International Jnl. of Hybrid Microelectronics 6, n1 p127-141.

Keywords: *Microelectronics, *Shear tests, *Bonding, Reliability(Electronics), Gold, Aluminum, Bonding strength, *Ball bond shear tests.

The microelectronic ball bond shear test was first developed in 1967. Since then, it has been used to study the effects of contamination on bondability, to characterize the reliability of gold-aluminum intermetallic formation, to control bonding machine parameters for device production, and to troubleshoot such production problems as poor metallization adherence and contamination. This paper critically reviews all of these uses and identifies ways that the shear test can be implemented to improve bond yield and assure long-term bond reliability. A manual shear probe is described that can be quickly made from the blade of a jeweler's screwdriver. This probe was instrumented with a strain gage and the shear test results compared within 10% of those obtained from a machine. The paper also presents data obtained from shearing both aluminum-ball and -wedge bonds and determines how the shear testing machine requirements for these differ from those required to test gold ball bonds.

708,090
PB84-243856 Not available NTIS
National Bureau of Standards, Washington, DC.
Ionizing Radiation Effects on Power MOSFETs during High Speed Switching.
Final rept.
D. L. Blackburn, D. W. Berning, J. M. Benedetto, and K. F. Galloway. Dec 82, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-29, n6 p1555-1558 Dec 82.

Keywords: *Metal oxide transistors, Radiation effects, Integrated circuits, Reprints.

Data on the effects of gamma radiation on the electrical characteristics of power VDMOS transistors are presented. The devices were exposed to radiation while the gate voltage was switching at 100 kHz or while held at a dc voltage. Several drain voltage configurations were also explored.

708,091
PB84-244250 Not available NTIS
National Bureau of Standards, Washington, DC.
Using Linewidth Measurement Test Structures to Evaluate Lithographic Processes and Equipment.
Final rept.
D. Yen, and L. W. Linholm. Mar 84, 14p
Pub. in Test Measurement World 4, n3 p48-61 Mar 84.

Keywords: *Line width, *Semiconductors, *Lithography, *Integrated circuits, Reprints.

Test structures included on the wafer during semiconductor fabrication can help the process engineer evaluate semiconductor materials, process control and process equipment. One of the most important test methods used is the measurement of linewidth. In many cases, the results from electrical measurements on a cross-bridge sheet resistor can be used to determine the electrical linewidth of a conducting layer. Test chips that contain arrays of identical cross bridges can also help determine the uniformity of a lithographic process.

708,092
PB84-244862 Not available NTIS
National Bureau of Standards, Washington, DC.
Superconducting Current Injection Transistor.
Final rept.
B. J. Van Zeghbroeck. 15 Apr 83, 3p
Pub. in Applied Physics Letters 42, n8 p736-738, 15 Apr 83.

Keywords: *Transistors, Superconductivity, Josephson junctions, Reprints.

A new superconducting transistor has been investigated, both theoretically and experimentally. The device has a current gain of 10 and an estimated power-delay product of 90 aJ. It is shown that in principle, the gain of the device is limited only by its length. Possible applications include analog amplification and digital logic.

708,093
PB85-108652 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Magnetic Package Leads on the Measurement of Thermal Resistance of Semiconductor Devices.
Final rept.
D. W. Berning, and D. L. Blackburn. May 81, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices ED-28, n5 p609-611 May 81.

Keywords: *Semiconductor devices, Thermal resistance, Measurement, Electric leads, Reprints.

Magnetic package leads can cause errors in the measurement of the thermal resistance of semiconductor devices. The errors are the result of distortions of the voltage waveforms apparently caused by an increase in the impedance of the leads at short times after switching. This is related to the skin effect, which is the tendency of currents to concentrate on the surface of and decay exponentially into the leads. The concentration increases as the magnetic permeability increases. The influence of the skin effect in the magnetic leads on the measured waveforms and on the measured thermal resistance is shown. A technique for correcting the measured thermal resistance is demonstrated.

708,094
PB85-111862 Not available NTIS
National Bureau of Standards, Washington, DC.
Quantitative Sub-Micrometer Linewidth Determination using Electron Microscopy.
Final rept.
S. Jensen, G. Hembree, J. Marchiando, and D. Swyt. 1981, 9p
Pub. in SPIE International Society of Optical Engineers 275, p100-108 1981.

Keywords: *Line width, *Semiconductor devices, Electron microscopy, Monte Carlo method, Automation, Minicomputers, Measurement, Reprints, *Photomasks, Scanning electron microscopy, Computer applications, Laser interferometry.

Quantitative determination of sub-micrometer linewidths in semiconductor devices and masks is demonstrated using an approach employing complementary experimental measurements and theoretical modeling. Experimental measurements are performed using the Microlength Calibrating Electron Probe (MCEP), a new facility at the National Bureau of Standards consisting of a scanning electron microscope modified to incorporate a scanning stage and laser-interferometer position measurement system. Automated data acquisition and analysis for the MCEP are achieved through interfacing to a laboratory minicomputer. Theoretical modeling based on Monte Carlo calculations provides a basis for selection of the threshold level in the experimentally measured backscatter electron intensity profile which corresponds to the actual material line edge. A measurement on a photomask is shown which illustrates the utility of the MCEP facility and the Monte Carlo modeling calculations for accurate measurement of sub-micrometer linewidths.

708,095
PB85-129278 Not available NTIS
National Bureau of Standards, Washington, DC.
Off-Line, Built-In Test Techniques for VLSI (Very Large Scale Integrated) Circuits.
Final rept.
M. G. Buehler, and M. W. Sievers. 1982, 14p
Pub. in Computer 15, n6 p69-82 Jun 82.

Keywords: *Integrated circuits, Comparators, Reprints, *Built in test equipment, Very large scale integration.

Very large scale integrated (VLSI) circuits make possible the use of additional on-chip circuits for improving the testability of the entire circuit. This effort presents a study of the trade-offs in using five off-line, built-in test techniques: self-oscillation, self-comparison, partition, scan path, and built-in logic block observer (BILBO). The techniques were studied by applying them to the test of a two-bit adder with ripple carry. The relative merits of each technique are compared with respect to (a) whether the test generator and test analyzer are on- or off-chip, (b) the number of gates (transistors) needed to implement the test circuitry, (c) fault coverage, (d) self-testability, and (e) applicability to VLSI circuits. Highlights reveal that the self-oscillation test technique requires the fewest components to imple-

ment the test circuitry, is applicable to the highest speed circuitry, but has less than 100 percent fault coverage.

708,096
PB85-137701 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
TERRY-2: A Test Chip for Characterization of the Performance of Buried-Channel Charge-Coupled Device (CCD) Imagers.
Rept. for 1 Dec 82-30 Nov 83.
G. P. Carver, and R. A. Wachnik. Dec 84, 137p
NBSIR-84/2894
Sponsored in part by Charles Stark Draper Lab., Inc., Cambridge, MA.

Keywords: Microelectronics, Automatic test equipment, *Test chips, Charge coupled devices, Test patterns, Test structures.

Test chip TERRY-2 is intended to be used for characterization of the performance of buried-channel charge coupled device (CCD) imagers fabricated with a double-polysilicon-gate process which includes several implants. Test structures in TERRY-2 address two areas judged to be key ones for CCD performance, device parameters and process parameters, including material properties. TERRY-2 is a modular chip designed for automated testability; wire bonding of selected devices for radiation effects testing; thinning of a region containing test structures, in the same manner a back-side-illuminated CCD would be thinned; and beveling of large devices for spreading resistance or analytical analysis. This report describes the features of TERRY-2, the test structure designs, and the measurement procedures. The technique of charge pumping for measuring interface state density is discussed in an appendix.

708,097
PB85-141331 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Two-Dimensional Finite Element Charge-Sheet Model of a Short-Channel MOS Transistor.
Final rept.
C. L. Wilson, and J. L. Blue. 1982, 17p
Pub. in Solid State Electronics 25, n6 p461-477 Jun 82.

Keywords: *Field effect transistors, *Metal oxide transistors, *Mathematical models, Partial differential equations, Finite element analysis, Computation, Reprints, Nonlinear analysis.

A two-dimensional charge-sheet model for short-channel MOS transistors has been developed which extends the one-dimensional charge-sheet model, developed by Brews, to transistors of 1-micrometer channel length. The model is formulated to include the effect of channel inversion layer charge as a nonlinear integral boundary condition on the two-dimensional electrostatic fields in the transistor. This formulation allows the drain current and electrostatic potential to be computed simultaneously without including the full electron current continuity equation. This simplification results in significant increases in computational efficiency. The accuracy of this model is verified by modeling a sequence of transistors with channel lengths between 4.6 micrometers and 1.1 micrometers. The triode and saturation region characteristics of these transistors are calculated and found to be in good agreement with the experimentally measured characteristics.

708,098
PB85-142933 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Role of Test Chips in Coordinating Logic and Circuit Design and Layout Aids for VLSI.
Final rept.
M. G. Buehler, and L. W. Linholm. 1981, 7p
Pub. in Solid State Technology 24, n9 p68-74 Sep 81.

Keywords: *Integrated circuits, Simulation, Design, Reprints, Test chips, Very large scale integration.

The paper emphasizes the need for multipurpose test chips and comprehensive procedures for use in supplying accurate input data to both logic and circuit simulators and chip layout aids. It is shown that the location of test structures within test chips is critical in obtaining representative data, because geometrical distortions introduced during the photomasking process can lead to significant intrachip parameter variations. In order to transfer test chip designs quickly, accurately, and economically, a commonly accepted portable chip layout notation and commonly accepted parametric tester language are needed. In order to measure test chips more accurately and more rapidly, parametric testers with improved architecture need to be developed in conjunction with innovative test structures with on-chip signal conditioning.

708,099
PB85-143410 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of the Drain-Source Voltage on Dopant Profiles Obtained from the DC MOSFET Profile Method.
Final rept.
M. G. Buehler. 1980, 5p
DARPA Order-2397
Pub. in IEEE Transactions on Electron Devices 27, n12 p2273-2277 Dec 80.

Keywords: *Metal oxide transistors, *Field effect transistors, *Semiconductor doping, Direct current, Additives, Profiles, Reprints, Drain source voltage.

An analysis, developed for the influence of a finite drain-source voltage, V(DS), on dopant profiles derived from the dc MOSFET profile method, indicates that the measured profile falls below the true profile near the surface. The effect occurs because the edge of the depletion region in the silicon is not parallel to the oxide-silicon interface for a finite V(DS). For the case of uniformly doped silicon near room temperature, the analysis indicates, for reverse bias applied across the silicon, that the error in the measured dopant density due to a finite V(DS) is less than one percent if V(DS) = or < 0.5 for the built-in voltage, a condition that is easily met in practice. The analysis also reveals that the profile depth determined from the depth profile equation is a simple average of the depletion widths at the source and drain ends of the channel in uniformly doped silicon. Experimental results are presented which confirm the general trends indicated by the analysis.

708,100
PB85-182913 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Improved Concepts for Predicting the Electrical Behavior of Bipolar Structures in Silicon.
Final rept.
H. S. Bennett. 1983, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices 30, n8 p920-927 1983.

Keywords: *Field effect transistors, Silicon, Electrical properties, Carrier mobility, Predictions, Reprints.

Most bipolar device models contain empirical methods for computing the effective intrinsic carrier concentration, n sub ie, mobility, and lifetime. These methods usually are based upon electrical measurements, assume that the majority hole (electron) mobility equals the minority hole (electron) mobility at high doping densities, use Boltzmann statistics, and assume that the carrier lifetime is much greater than the carrier transit time. More physically correct concepts are reported in this paper and are applied to bipolar transistors in silicon. These concepts use the perturbed densities of states and nonparabolic bands which arise from a quantum-mechanical description of bandgap narrowing to compute n sub ie and the carrier mobility separately, use minority carrier lifetimes which agree much better with measured lifetimes in processed silicon, and use Fermi-Dirac statistics. When these concepts are incorporated into a device analysis code such as SEDAN and then used to compute the dc common-emitter gain of two npn transistors, the predicted gains agree very well with the measured gains. In addition, these concepts offer potential improvements in predicting the temperature dependence of the gain.

708,101
PB85-184752 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reverse-Bias Second Breakdown of High Power Darlington Transistors.
Final rept.
D. Y. Chen, F. C. Lee, D. L. Blackburn, and D. W. Berning. 1983, 8p
Prepared in cooperation with Virginia Polytechnic Inst. and State Univ., Blacksburg.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Aerospace and Electronics Systems 19, n6 p840-847 Nov 83.

Keywords: *Transistors, Nondestructive tests, Reprints, *Second breakdown, *Darlington transistors, *Power transistors.

The reverse-bias second breakdown (RBSB) characteristics of high power Darlington transistors are discussed. The Darlingtons investigated are rated at 400 V maximum voltage and 100 A maximum current. Devices both with and without speed-up diodes (connected between the bases of the input and output transistor) were studied. A nondestructive system for characterizing the RBSB behavior of these devices is described. The RBSB behavior was found to vary in an unpredictable manner with varying reverse base current magnitude. It was also found that the RBSB behavior of the Darlingtons was a function of the forward base current magnitude. This is in marked contrast to what has been found for discrete devices. The presence of a speed-up diode also influenced the RBSB behavior of these devices.

708,102
PB85-187839 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Semiconductor Device Simulation.
Final rept.
C. L. Wilson, and J. L. Blue. 1981, 5p
Sponsored by Los Alamos Scientific Lab., NM.
Pub. in Elliptic Problem Solvers, p435-439 1981.

Keywords: *Semiconductor devices, *Mathematical models, Elliptic differential equations, Partial differential equations, Nonlinear differential equations, Metal oxide transistors, Solar cells, Simulation, Bipolar transistors, Mesh generation.

The static simulation of semiconductor devices requires the solution of a system of three coupled nonlinear elliptic partial differential equations in two space dimensions. The solution of this system of equations is essential in simulation of bipolar and MOS transistors and more specialized devices such as large area photovoltaic cells and power transistors. This application presents two unusual problems which are a consequence of the exponential non-linearities which couple the system of equations. The exponential nature of the coupling imposes stringent accuracy requirements. These requirements are discussed in detail using a single elliptic equation in one space dimension. Extension of one-dimensional methods to two-dimensions requires some form of non-uniform, preferably adaptive, mesh generation so that reasonable accuracy can be obtained in the memory space of existing computers. The solution is also characterized by steep fronts whose location is strongly dependent on the value of the boundary condition. Small changes in these boundary values commonly result in large displacements of these fronts.

708,103
PB85-197622 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Temperature Dependence of Transient Electron Radiation Upset in TTL NAND Gates.
Final rept.
T. Leedy, G. McLane, and C. Guenzer. 1981, 9p
Sponsored by Defense Nuclear Agency, Washington, DC.
Pub. in IEEE Transactions on Nuclear Science 28, n6 p4597-4605 Dec 81.

Keywords: *Integrated circuits, Radiation effects, Electron irradiation, Logic circuits, Gates(Circuits), Reprints, Transistor transistor logic.

The temperature dependence of transient upset caused by a 40-MeV electron flux was investigated for junction-isolated gold-doped and nongold-doped TTL NAND gate devices in the temperature range from 20 to 125C. Data for five devices are presented.

708,104
PB85-229961 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Improved Test Structure and Kelvin-Measurement Method for the Determination of Integrated Circuit Front Contact Resistance.
Final rept.
J. A. Mazer, L. W. Linholm, and A. N. Saxena. 1985, 4p
Pub. in Jnl. of the Electrochemical Society 132, n2 p440-443 Feb 85.

Keywords: *Integrated circuits, Electrical resistance, Electric contacts, Measurement, Test equipment, Reprints.

The use of an improved microelectronic test structure and associated Kelvin measurement method for determining front contact resistance (circuit loading resistance) of a metal/semiconductor ohmic contact is described. The values of front contact resistance for aluminum/silicon contacts are determined using this Kelvin-cross contact resistance test structure and are compared with values determined by a two-terminal contact chain method and with values determined by a Kelvin voltage divider method. The values of front contact resistance using the Kelvin-cross structure and associated measurement method are shown to be less sensitive to photolithographic process variations and electrical measurement errors than those determined using the other two structures and measurement methods.

708,105
PB86-102696 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
MOS1: A Program for Two-Dimensional Analysis of Si MOSFETs.
Final rept.
C. L. Wilson, and J. L. Blue. Apr 85, 63p NBS/SP-400/77
Also available from Supt. of Docs as SN003-003-02657-3. Library of Congress catalog card no. 85-600520.Color illustrations reproduced in black and white.

Keywords: *Metal oxide transistors, *Integrated circuits, Finite element analysis, Nonlinear differential equations, Partial differential equations, Computerized simulation, Electric current, Computer programs, *MOSFET, *Very large scale integration, MOS1 computer program, Fortran 77 programming language.

The MOS1 program is a portable FORTRAN 77 program suitable for analysis of currents and fields in VLSI devices. The program solves three coupled nonlinear elliptic partial differential semiconductor device equations in two dimensions. Historically, these equations have been solved using a special-purpose program and batch runs on a large, fast computer. The authors use a general-purpose program which runs on a large minicomputer or scientific workstation. This report discusses the physical formulation of the semiconductor equations and the methods used to select the solution strategy.

708,106
PB86-106739 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Generalizing the D-Algorithm.
J. S. Provan, and P. Domich. Sep 83, 129p NBSIR-83/2794

Keywords: *Integrated circuits, *Electrical faults, Reliability(Electronics), Tests, *Very large scale integration, *D algorithm, Fortran 77 programming language, Univac 1108 computers.

The authors consider the d-algorithm of J. P. Roth, which tests for specific faulty behavior in the integrated circuit. They develop a formal and general mathematical description of the algorithm, which allows a large degree of flexibility and extension in its implementation. They include a subsequent FORTRAN coding of such an extended d-algorithm, along with some sample testing.

708,107
PB86-119310 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Integrated-Circuit Metrology.
Final rept.
W. M. Bullis. 1981, 3p
Pub. in EDN 26, n20 p120-122, 127, 14 Oct 81.

Keywords: *Integrated circuits, *Metrology, Silicon, Reprints, Semiconductors.

Projected trends in integrated circuit metrology during the next quarter century are discussed. The picture that emerges for the IC factory of 2006 is one of extensive computer control of both fabrication and characterization based on more complete understanding of the materials and processes employed. The metrological advances which will occur in the next quarter century may be expected both to enhance our fundamental understanding of the solid state and to provide the means for reliable and economical manufacture of more complex and more powerful integrated circuits.

708,108
PB86-124955 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Hermetic Testing of Large Hybrid Packages.
Final rept.
S. Ruthberg. 1982, 18p
Pub. in Proceedings of International Microelectronics Symposium, Reno, NV., November 15-17, 1982, International Jnl. of Hybrid Microelectronics 5, n2 p215-232.

Keywords: *Leak detectors, *Microelectronics, Semiconductor devices, Tests, *Hybrid circuits, *Hermetic seals, Krypton 85.

Hermetic testing is a routine operation in the microelectronics industry with millions of packages being screened each year. Yet disagreements in test results between supplier and user are common, different test methods provide different results for the same leak range on the same parts, results are dependent on package configuration, and the specified reject limits as set forth in the standards are somewhat arbitrary. The leak rate reject level for the larger package is considered from the viewpoint of moisture infusion rates, and their impact on test parameters is examined. Range, efficiency, and usefulness are examined for such popular test procedures as the helium leak detector, radioisotope, weight gain, and bubble methods as well as for others such as the tracer probe, differential pressure, and rapid cycle methods that are more appropriate for the larger package. The issues described above are discussed with the aid of graphical solutions and actual test data.

708,109
PB86-132610 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Turn-Off Failure of Power MOSFETs.
Final rept.
D. L. Blackburn. 1985, 7p
Pub. in Proceedings of Annual IEEE (Institute of Electrical and Electronics Engineers) Power Electronics Specialists Conference (16th), Toulouse, France, June 24-28, 1985, p429-435.

Keywords: *Field effect transistors, Reliability(Electronics), Failure, *MOSFET, Bipolar transistors, Second breakdown.

Experimental results of the failure of power MOSFETs during inductive turn-off are discussed. The elctrical characteristics of these devices during failure are shown to be identical to those of a bipolar transistor undergoing second breakdown. Other comparisons of the power MOSFET failure and bipolar second breakdown are made. A nondestructive measurement system is used which allows repeated measurements of the failure characteristics as a function of various parameters to be made on a single device.

708,110
PB86-133436 Not available NTIS
National Bureau of Standards (NEL), Washington, DC. Semiconductor Devices and Circuits Div.
Sensitivity of SPICE Simulations to Input Parameter Variations.
Final rept.
J. M. Cassard. 1983, 5p
Pub. in Proceedings of 1983 Custom Integrated Circuits Conference, Rochester, NY., May 23-25, 1983, p224-228.

Keywords: *Integrated circuits, *Simulators, Wafers, Simulation, Dynamic response, Sensitivity, CMOS, Chips(Electronics).

The paper presents examples of how well input parameters extracted from a test chip can predict the ac response of a dynamic circuit element on the same wafer. Simulation results show which model parameters are critical to performance. A comparison of measurement and simulation results is given and the importance of intra-chip and intra-wafer parameter variations is discussed.

708,111
PB86-139854 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Total Dose Effects on Circuit Speed Measurements.
Final rept.
M. D. Lantz, and K. F. Galloway. 1983, 6p
Pub. in IEEE Trans. Nuclear Science 30, n6 p4264-4269 1983.

Keywords: *Integrated circuits, *Radiation effects, Ionizing radiation, Radiation dosage, Time lag, Metal oxide transistors, Reprints, *Physical radiation effects, Delay, CMOS.

Measurements of propagation delay as a function of total ionizing dose were made using ring-oscillators, inverter chains, and NAND chains fabricated on the same CMOS test chip. The data illustrate the impact of the bias conditions of the MOS transistors during irradiation on the propagation delay time of the circuits. The data show no difference in propagation delay time for the three circuit types if comparable bias conditions are maintained during radiation exposure. The threshold voltage shift of the n-channel transistor in the 'ON' state appears to be the dominant factor controlling the decrease in propagation delay as the total dose increased. The ultimate failure of the test circuits is due to the shift of the n-channel transistors to a negative threshold voltage.

708,112
PB86-164480 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
High-Accuracy Physical Modeling of Submicrometer MOSFETs.
Final rept.
C. L. Wilson, P. Roitman, and J. L. Blue. 1985, 13p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices ED-32, n7 p1246-1258 Jul 85.

Keywords: *Metal oxide transistors, *Field effect transistors, *Mathematical models, Finite element analysis, Simulation, Reprints, *MOSFET.

When short-channel MOSFET transistor models are compared to experimental data, the uncertainty in some of the physical input variables often requires that some of the input variables be adjusted to fit the data. This uncertainty is increased by a lack of knowledge of process sensitivity information on critical parameters. These uncertainties have been eliminated using a two-dimensional finite-element model of a MOSFET with no free parameters. The model is compared to four self-aligned silicon-gate n-channel MOSFET's with channel lengths of 0.80, 1.83, 2.19, and 8.17 micrometers. The 0.80, 1.83, and 8.17 micrometer devices have phosphorus sources and drains. The 2.19-micrometer device has an arsenic source and drain. Using the data obtained from the measurements described in the work, it is possible to model the drain current for all of the transistors studied without adjustable parameters. If sufficiently accurate parameters are available, these methods allow the characteristics of submicrometer transistors to be predicted with + or - 5-percent accuracy. These simulations show that the observed short-channel effects can be accounted for by existing mobility data and a simple empirical model of these data.

708,113
PB86-166634 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
CSFIT: A FORTRAN Program for Charge-Sheet Model Fitting of MOSFET Data.
L. C. Witte. Nov 85, 38p NBSIR-85/3145
Sponsored by Defense Nuclear Agency, Washington, DC.

Keywords: *Metal oxide transistors, *Field effect transistors, *Computer programs, Electric current, Electric potential, Fortran, *MOSFET, CSFIT computer program, Charge sheet model, Voltage.

A FORTRAN program, CSFIT, has been developed for fitting an expression for the current-voltage (I-V) characteristics of a long-channel MOSFET to experimental I-V curves. The one-dimensional charge-sheet model developed by Brews provides the basis for the I-V characteristics. The I-V characteristics given by this model are optimized with respect to a set of experimental data using the flatband voltage and the mobility as the only adjustable parameters. The program is written so that multiple sets of I-V data can be fit simultaneously if desired. The user must supply, in specified

formats, a current-voltage data file, a device parameter file, and a starting value file.

708,114
PB86-182482 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Release Notes for STAT2 Version 2.00A: An Addendum to NBS Special Publication 400-75. Documentation.
C. H. Ellenwood, and R. L. Mattis. Jan 86, 19p
NBSIR-85/3292A, NBS/SW/DK-86/005A
For system on diskette, see PB86-182490.

Keywords: *Wafers, *Computer programs, Statistical analysis, Semiconductor devices, Test equipment, Data processing, Map.

STAT2 is a FORTRAN program which is used to analyze and display data from microelectronic test structures fabricated on semiconductor wafers. The program reads data as a two-dimensional array, extracts sample statistical values, identifies outliers, calculates replacement values for outliers, and makes histograms and circular gray-tone data maps. Version 2.00A is an adaptation of STAT2 to run under Version 3.2 of the RSX-11M operating system. The operating system is used on the automatic tester which acquires the test structure data. Data can then be taken and analyzed on the same system.

708,115
PB86-182490 CP **T99**
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Release Notes for STAT2 Version 2.00A: An Addendum to NBS Special Publication 400-75 (for Microcomputers).
Software.
R. L. Mattis, and C. H. Ellenwood. Jan 86, 2 diskettes NBSIR-85/3292, NBS/SW/DK-86/005
See also PB84-127455.
The software is contained on 8 1/4-inch diskette, single sided, double density, compatible with the DEC LSI-11/23 microcomputer. Diskettes are in thr ASCII format. Call NTIS Computer Products for price. Price includes documentation, PB86-182482.

Keywords: *Software, Integrated circuits, Statistical analysis, Tests, Wafers, STAT2 computer program.

STAT2 is a FORTRAN program which is used to analyze and display data from microelectronic test structures fabricated on semiconductor wafers. The program reads data as a two-dimensional array, extracts sample statistical values, identifies outliers, calculates replacement values for outliers, and makes histograms and circular gray-tone data maps. Version 2.00A is an adaptation of STAT2 to run under Version 3.2 of the RSX-11M operating system. The operating system is used on the automatic tester which acquires the test structure data. Data can therefore be taken and analyzed on the same system...Software Description: The Software is written in the FORTRAN programming language for implementation on a DEC LSI - 11/23 microcomputer using the RSX - 11M/3.2 operating system. Memory requirement is 30K.

708,116
PB86-188489 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Comparison of Microelectronic Test Structures for Propagation Delay Measurements.
Final rept.
D. J. Radack, C. T. Yao, L. W. Linholm, K. F. Galloway, and H. C. Lin. 1985, 8p
Pub. in Microelectronics Jnl. 16, n6 p39-46 1985.

Keywords: *Integrated circuits, Test equipment, Propagation, Inverters, Reprints, *Very large scale integration, Delay, CMOS.

Propagation delay is a parameter which needs to be accurately measured for characterization of VLSI fabrication technologies and VLSI circuit design. In the experiment, three different microelectronic test structures or test circuits were used to measure the propagation delay of a minimally sized CMOS inverter. The measured results and a comparison of the test circuits are presented.

708,117
PB86-193851 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Focused-Beam vs. Conventional Bright-Field Scanning Microscopy for Integrated Circuit Metrology.
Final rept.
D. Nyyssonen. 1985, 6p
Pub. in SPIE Micron and Submicron Integrated Circuit Metrology 565, p102-107 1985.

Keywords: *Integrated circuits, *Dimensional measurement, Metrology, Microscopy, Line width, Reprints.

Current optical instrumentation being developed for critical dimension measurements in the integrated circuit industry is following one of two very different optical designs, i.e., either a focused laser beam which scans the wafer or the more conventional bright-field microscope. Traditional optical design lore has described these systems as 'equivalent' based on the principle of reciprocity. More recent research has shown that the responses of these two types of systems are not equivalent for imaging of structures patterned in thin films such as those found in integrated circuit wafer fabrication. This lack of reciprocity is the result of the dependence of the diffraction pattern on the angle of incidence of the illumination. The impact of the lack of reciprocity on the design and calibration of critical dimension measurement systems is discussed.

708,118
PB86-202561 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
VLSI Package Reliability Workshop Report.
Final rept.
D. D. Zimmerman, and H. A. Schafft. 1983, 4p
Pub. in Proceedings of the Annual Symposium on Reliability Physics (21st), Phoenix, AZ., April 5-7, 1983, p320-323.

Keywords: *Integrated circuits, *Electronic packaging, Reliability, Semiconductor devices, Materials, Moisture, Packaging, Very large scale integration.

The report summarizes remarks made by six panelists in an evening workshop meeting held as part of the 1983 International Reliability Physics Symposium. The panelists provided an overview of package design and measurement considerations that arise because of special requirements of packaging VLSI semiconductor chips. Considerations in the following areas were discussed: package materials, design, and construction; thermal management and characterization; and moisture and hermeticity measurements.

708,119
PB86-214723 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Center for Electronics and Electrical Engineering.
Model for the Charge-Pumping Current Based on Small Rectangular Voltage Pulses.
Final rept.
R. A. Wachnik, and J. R. Lowney. 1986, 14p
Pub. in Solid State Electronics 29, n4 p447-460 1986.

Keywords: *Metal oxide transistors, *Field effect transistors, Models, Bandwidth, Reprints, *MOSFET, Charge pumping, Current leakage, Voltage pulses.

The charge-pumping current results from recombination associated with the silicon oxide interface traps under the gate of a MOSFET when a voltage pulse is applied to the gate. A model is proposed which predicts this current as a function of the frequency, amplitude, and average voltage of pulses with peak-to-peak amplitudes less than the difference between the flatband and inversion voltages and with pulse transitions fast enough so that negligible capture or emission occurs during the transition. The model is based on Shockley-Read-Hall traps segregated by energy and capture cross section into traps which capture only and traps which tend to emit before capture. It predicts the dominant behavior of the measured current and with the inclusion of surface potential fluctuations and a distribution of cross sections it agrees well with experiment.

708,120
PB86-231107 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Accurate Current Calculation in Two-Dimensional MOSFET Models.
Final rept.
C. L. Wilson, and J. L. Blue. 1985, 9p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices ED-32, n10 p2060-2068 Oct 85.

Keywords: *Metal oxide transistors, *Mathematical models, *Electric current, Finite element analysis, Partial differential equations, Integrated circuits, Simulation, Reprints, *MOSFET, Very large scale integration, Two dimensional.

Two-dimensional simulations of MOSFET's are widely used for the design of short-channel transistors used in VLSI circuits. These models use low order methods of discretization of solution variables. In the paper, a method of current calculation is presented which works with these methods and yields good accuracy. The method uses integration of the solution variables, rather than differentiation, and is similar to applying Ohm's law in two dimensions.

708,121
PB86-231115 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Boron Diffusion in Silicon.
Final rept.
J. F. Marchiando, P. Roitman, and J. Albers. 1985, 9p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices ED-32, n11 p2322-2330 Nov 85.

Keywords: *Silicon, *Boron, Metal oxide transistors, Diffusion, Reprints, *Ion implantation, MOSFET, Two dimensional.

Well-defined control of high- and low-temperature anneals of boron implanted in silicon is important in the calculation of shallow p-n junction profiles used in MOSFET's. Here, a sample matrix of boron implanted into silicon over a range of fluences and annealing temperatures is considered. The matrix of samples was measured by SIMS (secondary ion mass spectrometry). The measured profiles were compared with simulations from an annealing/diffusion model. Calculations of the annealed profiles were found to be in agreement with the SIMS data at temperatures greater than 1000 C. At lower temperatures, the profiles exhibit effects due to implantation damage which are not included in the diffusion model.

708,122
PB86-239266 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Modeling GaAs/AlGaAs Devices: A Critical Review.
Final rept.
H. S. Bennett. Jan 85, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Circuits Devices Magazine 1, n1 p35-42 Jan 85.

Keywords: *Transistors, *Gallium arsenides, Semiconductor devices, Monte Carlo method, Reprints, Aluminum gallium arsenides.

Device models for GaAs devices and GaAs/AlGaAs heterostructures are much less advanced than those for silicon devices. The paper critically reviews recent advances in the modeling of GaAs/AlGaAs devices. It is based on the examination of five selected device models which contain features common to the majority of device models for heterostructure bipolar and field effect transistors. Areas requiring improved measurement techniques on processed GaAs and improved physical concepts for GaAs/AlGaAs device models are identified.

708,123
PB86-239274 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Improved Physics for Simulating Sub-Micron Bipolar-Devices.
Final rept.
H. S. Bennett, and D. E. Fuoss. 1985, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices 32, n10 p2069-2075 1985.

Keywords: *Field effect transistors, Semiconductor doping, Mathematical models, Reprints.

The conventional device physics in most numerical simulations of bipolar transistors may not predict correctly the measured electrical performance of shallow, heavily doped emitters and bases. The paper presents improved device physics for numerical simulations of solid-state devices with densities up to about 3 x 10 to the 20th power/cucm and with junction depths as small as 0.1 micrometers. This improved device physics pertains to bandgap narrowing, effective intrinsic carrier concentrations, carrier mobilities, and lifetimes. When this improved device physics is incorporated into device analysis codes such as SEDAN and then used to compute the electrical performance of npn transistors, the predicted values agree very well with the measured values of the current-voltage characteristics and dc common emitter gains for junction depths between 10 micrometers and 0.16 micrometers.

708,124
PB87-119590 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Simple Model for Separating Interface and Oxide Charge Effects in MOS Device Characteristics.
Final rept.
K. F. Galloway, M. Gaitan, and T. J. Russell. 1984, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-31, n6 p1497-1501 Dec 84.

Keywords: *Interfaces, *Metal oxide transistors, *Radiation effects, *Field effect transistors, Traps, Density(Mass/volume), Reprints.

A simple model to describe radiation effects on MOSFET electrical characteristics is presented. The key assumption is that mobility degradation in an enhancement mode MOSFET is predominantly due to charged interface traps. Model predictions are compared with measured values of interface trap density and device I-V curves.

708,125
PB87-119608 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Measurement of Radiation-Induced Interface Traps Using MOSFETs.
Final rept.
M. Gaitan, and T. J. Russell. 1984, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-31, n6 p1256-1260 Dec 84.

Keywords: *Radiation effects, *Traps, *Interfaces, *Measurement, Gamma irradiation, Irradiation, Silicon, Silicon oxides, Density(Mass/volume), Metal oxide transistors, Field effect transistors, Reprints.

The effect of gamma irradiation on the density of SiO2/Si interface traps was measured using n- and p-channel MOSFETs. The density of traps was measured by a charge pumping measurement method and by a technique based on the slope of the transistor In (Id)-Vg characteristics in weak inversion. An increase in the density of interface traps with dose is observed with a greater increase just above compared to just below the center of the silicon bandgap.

708,126
PB87-122404 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
ASTM (American Society of Testing and Materials) Standard Test Methods for the Semiconductor Industry.
Final rept.
R. I. Scace. 1980, 8p
Pub. in Proceedings of Semicon/Europa 1980 Technical Symposium, Zurich, Switzerland, March 13, 1980, p202-209.

Keywords: *Standards, *Semiconductor industry, *Test methods, International cooperation.

The unique characteristics of the U.S. voluntary standards system, as distinct from the standards systems of most other countries, are described. The roles of JEDEC, ISHM, SAE, and the MIL standards system are briefly reviewed. The work of ASTM Committee F-1 over the past 24 years in developing standards for the semiconductor industry is described in detail. The process of standards development is described, and the value of inter-laboratory tests in evaluating the precision and accuracy of test methods is pointed out. The close relationship which has been maintained with both DIN Normenausschuss Materialprufung 221 and the Semiconductor Equipment and Materials Institute standards committee is described in detail. An appendix contains listings of the ASTM standards for semiconductor applications, classified by topic.

708,127
PB87-122693 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Electron Detection Modes and Their Relation to Linewidth Measurement in the Scanning Electron Microscope.
Final rept.
M. T. Postek. 1986, 4p
Pub. in Proceedings of the Annual Meeting of the Electron Microscopy Society of America (44th), Albuquerque, NM., August 10-15, 1986, p646-649.

Keywords: *Backscattering, *Electron microscopy, *Electron microscopy, *Semiconductors, Line width, Electron beams, Scanning, Research projects, Measurement, *Electron detection.

The basic premise underlying the use of the scanning electron microscope for linewidth measurement for semiconductor research and production applications is that the video image acquired, displayed, and ultimately measured reflects accurately the structure of interest. The paper demonstrates that depending upon the mode of electron detection (secondary, backscattered, or converted backscattered secondary electrons) and accelerating voltage used to image and measure the structure of interest, a variety of results can be obtained. The reasons for these differences are discussed relative to the coupling of the type of work with electron beam/sample interaction modeling to enable the acquisition of more precise linewidth measurements.

708,128
PB87-122701 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Wafer Mapping of Electrically Active Defects.
Final rept.
R. Y. Koyama. 1978, 9p
Sponsored by Department of Energy, Washington, DC., and Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings of ECS Topical Conference on Characterization Techniques for Semiconductor Materials and Science, Seattle, WA., May 21-24, 1978, p220-228.

Keywords: *Wafers, Mapping, Defects, Semiconductor devices, Measurement.

Although deep level measurements on packaged devices are common practice, these measurements cannot generally be made at the wafer level because the required apparatus has not been available. However, such wafer level measurements would provide to the process engineer a valuable analytical tool for process control or process diagnostics. Appropriate apparatus to allow deep level measurements on processed wafers has been designed and constructed. Its use is illustrated by the measurement of wafer maps showing the variation of electrically active defect density across a wafer and the correlation of defect density with device electrical characteristics.

708,129
PB87-122719 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Techniques for Characterizing Defects in Starting Silicon Wafers Using TSM (Thermally Stimulated Current and Capacitance Measurements).
Final rept.
R. Y. Koyama. 1978, 8p
Sponsored by Department of Energy, Washington, DC., and Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings of ECS Topical Conference on Characterization Techniques for Semiconductor Materials and Science, Seattle, WA., May 21-24, 1978, p53-60.

Keywords: *Silicon, *Metal oxide transistors, Waters, Capacitance, Semiconductors, *Defects(Materials), Low temperature research, Silicon dioxide, Vapor deposition, Measurements, *Metal oxide semiconductors, *Defects(Materials).

Since thermally stimulated current and capacitance measurements (TSM) can utilize a metal-oxide-semiconductor (MOS) capacitor as the test vehicle for defect characterization, an MOS capacitor fabricated with relatively low temperature processes should be useful for studying defects in starting material. Several processes were investigated. The process which yielded the most consistent devices utilized chemical vapor deposition (CVD) of silicon dioxide at 400C along with a 400C microalloy treatment. Thermally stimulated current measurements on MOS capacitors fabricated in this way were successful in detecting gold which was purposely introduced into a starting wafer.

708,130
PB87-122743 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Use of Acoustic Emission as a Test Method for Electronic Interconnections and Joints.
Final rept.
G. G. Harman. 1981, 7p
Pub. in Proceedings of International Conference on Soft Soldering in Electronics and Precision Mechanics, Munich, Germany, November 11-12, 1981, p104-110.

Keywords: *Welded joints, *Acoustic detectors, *Microelectronics, *Circuit interconnections, Joints(Junctions), Monitors, Nondestructive tests, Stresses, Surface waves, Sensitivity, *Acoustic emissions.

The use of acoustic emission (AE) to determine the integrity of various microelectronic joints is relatively new. Considerable success has been achieved using AE as an in-process production monitor, and some of these uses are reviewed. However, implementation problems have been experienced using AE as an after-production screen. These problems result from the small size of the electronic components as well as the difficulty of applying an appropriate nondestructive mechanical or thermal stress to the tiny joints. The small size also causes difficulty in interpreting the AE signals. These and other problems are discussed and various solutions proposed. The paper describes a newly designed miniature AE detector in a TO-5 sized package appropriate for microelectronic use that has high sensitivity to surface waves and contains its own built-in 40-dB preamplifier.

708,131
PB87-127957 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Use of Charge Pumping to Characterize Generation by Interface Traps.
Final rept.
R. A. Wachnik. 1986, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices ED-33, n7 p1054-1061 Jul 86.

Keywords: Semiconductor diodes, Electric current, Silicon, Silicon dioxide, Interfaces, Field effect transistors, Reprints, *Charge pumping, MOSFET.

A small rectangular pulse technique for measuring charge-pumping current has been proposed as a method to characterize interface traps near midgap. It is shown theoretically and experimentally that the small rectangular pulse technique can be used to predict the surface generation current measured on a MOSFET or a gated diode. The new technique has the advantage that the measured current is at least 10 to 100 times larger than the surface generation current.

708,132
PB87-131488 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Modeling MOS Capacitors to Extract Si-SiO2 Interface Trap Densities in the Presence of Arbitrary Doping Profiles.
Final rept.
H. S. Bennett, M. Gaitan, P. Roitman, T. J. Russell, and J. S. Suehle. 1986, 7p
Sponsored by Defense Nuclear Agency, Washington, DC.

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices ED 33, n6 p759-765 Jun 86.

Keywords: *Electron traps, *Hole traps, *Capacitors, *Interfaces, Gamma rays, Semiconductor doping, Silicon dioxide, Silicon, Reprints, Metal oxide semiconductors.

A conventional Poisson solver has been used to calculate the quasi-static capacitance of an MOS capacitor. The effects of an energy dependent Si-SiO2 interface trap density and of an arbitrary silicon substrate doping profile have been included. The model has been used to calculate the quasi-static C-V characteristics and to compare them with those measured using Kuhn's technique for as-received and for gamma-irradiated p-type and n-type silicon MOS capacitors. The substrate doping profiles were obtained from high-frequency C-V curves. Experimental and theoretical C-V curves were made to agree by varying the voltage offset due to fixed oxide charge and both the magnitude and the energy distribution of interface trapped charge.

708,133

PB87-134896 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Performance Trade-Off for the Insulated Gate Bipolar Transistor: Buffer Layer Versus Base Lifetime Reduction.
Final rept.
A. R. Hefner, and D. L. Blackburn. 1986, 12p
Pub. in Proceedings of Annual IEEE (Institute of Electrical and Electronics Engineers) Power Electronics Specialists Conference (17th), Vancouver, Canada, June 23-27, 1986, p27-38.

Keywords: *Transistors, Mathematical models, *Bipolar transistors, Power transistors, One dimensional, Transients.

A one-dimensional analytic model for the Insulated Gate Bipolar Transistor (IGBT) which includes a high-doped buffer layer in the low-doped bipolar transistor base is developed. The model is used to perform a theoretical trade-off study between IGBTs with and without the buffer layer. The study is performed for devices of equal breakdown voltages, and the critical parameters chosen to 'trade-off' are turn-off switching energy loss (related to turn-off time) and on-state voltage, both at a given current. In the study, as in reality, the two critical parameters are varied by: (1) adjusting the doping concentration and thickness of a buffer layer included as part of the bipolar transistor base, (2) adjusting the lifetime in the lowly doped bipolar transistor base with no buffer layer included, or by (3) a combination of (1) and (2). The results of the model predict that for equal breakdown voltages, an optimized device with a buffer layer has less switching energy loss for a given on-state voltage than an optimized device with no buffer layer.

708,134

PB87-134904 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Power MOSFET Failure during Turn-Off: The Effect of Forward Biasing the Drain-Source Diode.
Final rept.
D. W. Berning, and D. L. Blackburn. 1986, 5p
Pub. in Proceedings of Conference Record 1986 IEEE (Institute of Electrical and Electronics Engineers) Industry Applications Society Annual Meeting, Denver, CO., September 28-October 3, 1986, p335-339.

Keywords: *Metal oxide transistors, *Field effect transistors, Nondestructive tests, Failure, Reliability(Electronics), *MOSFET, Second breakdown, Power transistors.

The effects on the turn-off failure of power MOSFETs which result from forward biasing the intrinsic drain-source diode immediately prior to turn-off are discussed. A nondestructive test circuit is used to measure the turn-off characteristics of individual devices under a variety of conditions. It is shown that the drain voltage at which the device fails decreases as either the diode forward current or the reverse recovery current is increased. If the diode is forward biased, the voltage at failure can be less than one-half of the voltage at which the device fails if the diode has not been forward biased (and often less than one-half the manufacturer-rated voltage capability for the device). Also, if turn-off of the MOSFET is attempted with the diode conducting, the device loses its fast turn-off capability due to charge storage effects. A parallel resonant power converter circuit is employed to demonstrate how the intrinsic drain-source diode may and may not be used safely in practical applications.

708,135

PB87-140307 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Cobalt-60 Facilities Available for Hardness Assurance Testing.
Final rept.
J. C. Humphreys, and C. M. Dozier. Nov 86, 31p
NBSIR-86/3480
Sponsored by Defense Nuclear Agency, Washington, DC.

Keywords: *Microelectronics, *Test facilities, Cobalt 60, Gamma rays, *Irradiation devices, *Radiation hardening, *Gamma sources.

The report contains a list of cobalt-60 gamma-ray irradiation facilities that are available for hardness assurance testing of electronic devices. A summary of source type, absorbed-dose rates, experimental volume available, and other pertinent information is given for each facility.

708,136

PB87-150744 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Microelectronics Dimensional Metrology in the Scanning Electron Microscope. Part 1.
Final rept.,
M. T. Postek, and D. C. Joy. Nov 86, 6p
Pub. in Solid State Technology 29, n11 p145-150 Nov 86.

Keywords: *Microelectronics, *Line width, *Dimensional measurement, *Metrology, Reprints, *Very large scale integration, *VHSIC circuits, *Scanning electron microscopes, Defects(Materials).

The increasing integration of microelectronics into the submicrometer region for VHSIC and VLSI applications necessitates the examination of these structures both for linewidth measurement and for defect inspection by systems other than the optical microscope. The low beam-voltage scanning electron microscope has been employed recently in this work due to its potentially high spatial resolution and to its large depth of field. The applications of the scanning electron microscope to microelectronics inspection and metrology are discussed in light of the present instrument specifications and capabilities, and the processing controls required for submicrometer processing are examined.

708,137

PB87-153862 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Electrical Linewidth Measurement in the Near- and Sub-Micron Linewidth Region.
Final rept.,
L. W. Linholm, D. Yen, and M. W. Cresswell. 1985, 10p
Pub. in Proceedings of International Symposium on Very Large Scale Integration Science and Technology (3rd), Toronto, Ontario, Canada, May 13-16, 1985, p299-308.

Keywords: *Integrated circuits, *Line width, *Lithography, Silicon, Electrical measurement.

The measurement accuracy of the cross-bridge resistor test structure and test method has been compared to well-characterized optical measurements for samples with near-micrometer and sub-micrometer design dimensions patterned in polysilicon films. Results are presented which show that the electrical measurements agree with the corresponding optical measurements to within the respective uncertainties of both measurements.

708,138

PB87-161873 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Electromigration and the Current Density Dependence.
Final rept.,
H. A. Schafft, T. C. Grant, A. N. Saxena, and C. Y. Kao. 1985, 7p
Pub. in Proceedings of Annual Reliability Physics Symposium (23rd), Orlando, FL., March 26-28, 1985, p93-99.

Keywords: *Integrated circuits, *Microelectronics, Circuit interconnections, Reliability(Electronics), Current density, *Electromigration.

Three papers have proposed theoretical models which attribute the variation of n observed to Joule heating. Such heating must be included when determining the accelerated stress temperature. The present work was begun to test experimentally these proposed explanations. Results indicate that an unambiguous determination of t(50) at use conditions can be made using n = 1.4 as the exponent for the stress current density. In order to make the determination, one must take proper account of the effects of Joule heating and of increases in current density and temperature due to resistance increases of the test line during the test.

708,139

PB87-163622 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Modeling of the Process Sensitivity of Submicron Silicon MOSFETs.
Final rept.,
C. L. Wilson, P. Roitman, J. F. Marchiando, and J. L. Blue. 1984, 2p
Pub. in Electrochemical Society Extended Abstracts 84-2, p709-710 1984.

Keywords: *Field effect transistors, *Metal oxide transistors, Semiconductor junctions, Finite element analysis, Mathematical models, Silicon, Reprints, *MOSFET, Two-dimensional calculations.

When short-channel MOSFET transistor models are compared to experimental data, the uncertainty in the process models used as inputs often requires that some of the process model parameters be adjusted to fit the data. In the work the process sensitivity of the source-drain junction is modeled. It was found that sensitivity of the saturated drain current to the source-drain junction depth increases sharply at some critical value of the junction depth. The value of junction depth is reached when the junction depth is equal to the zero biased depletion regiona width. As the contribution of the source drain junction to the sum of the depletion width and the junction depth becomes significant, the total change in channel field caused by the source-drain junction is a maximum.

708,140

PB87-163630 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Two-Dimensional Modeling of N-Channel MOSFETs Including Radiation-Induced Interface and Oxide Charge.
Final rept.,
C. L. Wilson, and J. L. Blue. 1984, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science 31, n6 p1448-1452 1984.

Keywords: *Field effect transistors, *Metal oxide transistors, Mathematical models, Finite element analysis, Reprints, *MOSFET, Two-dimensional calculations, Physical radiation effects, Interactive graphics.

A model of the radiation-induced charges produced in n-channel MOSFETS is presented. The model is applicable for the unirradiated device and accurately predicts device characteristics for doses of up to 500 krad(Si). The model is verified by comparing the results obtained with the model to n-channel MOSFETs for doses of 0, 10, 50, 100, and 500 krad(Si). Detailed comparison of the model with a 7.8 micrometer channel length transistor, to eliminate short-channel effects, shows excellent agreement between the model and measured current-voltage characteristics in the subthreshold region, the triode region, and the saturation region. Analysis of the model parameters shows that the oxide charge and interface trap density are linear with dose in these devices. The mobility decrease used in the model can best be accounted for by the combined effects of scattering from oxide and interface charge in the channel.

708,141
PB87-165197 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Semiconductor Measurement Technology: A Bibliography of NBS (National Bureau of Standards) Publications for the Years 1962-1986,
J. Walters. Feb 87, 124p NBSIR-87/3522
See also PB87-112298.

Keywords: *Semiconductor devices, *Semiconductors(Materials), *Bibliographies, Integrated circuits, Metrology, Measurement, Reliability(Electronics), Dimensional measurement, Interfaces, Silicon, Germanium, Gallium arsenides, Packaging, Mathematical models, US NBS, Test methods, Listings.

The list of publications contains reports of work performed at the National Bureau of Standards (NBS) in the field of Semiconductor Measurement Technology. The publications are grouped by author in a given year, with the current year appearing first in the listing. An index by topic area is provided. Each topic is followed by year and reference number of the appropriate publication. For the reader's convenience, a list by author is also given. Most of the publications listed herein resulted from work carried out as part of the NB Semiconductor Technology Program (STP). The Program serves to focus NBS research on improved measurement technology for the use of the semiconductor device community in specifying materials, equipment, and devices in national and international commerce, and in monitoring and controlling device fabrication and assembly. The research leads to carefully evaluated, well-documented measurement methods, data, reference artifacts, models and theory, and associated technology which when applied by the industry are expected to contribute to higher yields, lower cost, and higher reliability of semiconductor devices and to provide a basis for controlled improvements in fabrication processes and device performance.

708,142
PB87-173738 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Device Physics for Modeling GaAs Bipolar Transistors.
Final rept.,
H. S. Bennett. 1986, 15p
Pub. in Proceedings of Semiconductor Research Corporation Topical Research Conference, Tempe, AZ., April 24-25, 1986, p1-15.

Keywords: *Mathematical models, Gallium arsenides, Silicon, *Bipolar transistors.

The accuracy and reliability of predictions from numerical simulations of advanced bipolar transistors depend on model input parameters. These parameters include the variations with doping and carrier concentrations in both n-type and p-type material of (1) the valence and conduction band edges, (2) the effective intrinsic carrier concentrations, (3) the minority carrier mobilities, and (4) the minority carrier lifetimes. The paper contains a summary of recent advances in device physics for modeling silicon bipolar transistors with submicrometer dimensions and high concentrations of dopant ions and carriers. It also contains preliminary results in device physics for modeling those regions of GaAs bipolar transistors which have high concentrations of either dopant ions or carriers. The latter results are based on lessons learned from modeling advanced silicon bipolar devices.

708,143
PB87-199352 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Nondestructive Submicron Dimensional Metrology Using the Scanning Electron Microscope.
Final rept.,
M. T. Postek. 1987, 12p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v6B p1327-1338 1987.

Keywords: *Microelectronics, *Integrated circuits, *Nondestructive tests, *Dimensional measurement, *Line width, Metrology, *Scanning electron microscopy, *Very large scale integration, *Very high speed integrated circuits, *VASIC (Circuits).

The increasing evolution of microelectronics into the submicron region necessitates non-destructive examination of these structures both for linewidth measurement and defect inspection by systems other than the optical microscope. The scanning electron microscope operated in the low beam-voltage mode has been recently employed in this work due to its potentially high spatial resolution and depth of field. The paper discusses the realistic applications of the scanning electron microscope to non-destructive microelectronics inspection and metrology in light of the present instrument specifications and capabilities, and relates it to the processing controls required for submicron metrology.

708,144
PB87-200333 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Monte Carlo Calculation of Primary Kinematic Knock-On in SIMS (Secondary Ion Mass Spectrometry).
Final rept.,
J. Albers. 1987, 23p
Pub. in American Society for Testing and Materials Special Technical Publication 960, p535-557 1987.

Keywords: Semiconductor devices, Monte Carlo method, Sputtering, Reprints, *Secondary ion mass spectroscopy, Recoils, Ion implantation.

Secondary Ion Mass Spectrometry (SIMS) occupies a central position in atomic profiling of semiconductor device structures. One of the possibilities for distortion of the profiles is the phenomenon of knock-on where the incident sputtering ion transfers enough kinetic energy to the impurity atoms to push them deeper into the material before they can be sputtered and counted. The effects of sputtering and primary kinematic knock-on are investigated by means of a Monte Carlo code previously used to study ion implantation processes. In particular, the dependence of the primary kinematic knock-on on the mass and energy of the sputtering ion, as well as the mass of the impurity atom, are presented.

708,145
PB87-200341 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Some Aspects of Spreading Resistance Profile Analysis.
Final rept.,
J. Albers. 1987, 22p
Pub. in American Society for Testing and Materials Special Technical Publication 960, p480-501 1987.

Keywords: *Electrical resistivity, *Semiconductor devices, *Integrated circuits, Mathematical models, Finite element analysis, Reprints, *Spreading resistance, Very large scale integration, Laplace equation, Poisson equation.

The calculation of resistivity profiles (and carrier density profiles) from spreading resistance requires the use of a correction factor. The present status of the calculation of the correction factor based upon the Schumann and Gardner multilayer solution of Laplace's equation is reviewed and discussed. Recent calculations of carrier densities from atomic densities are also discussed. In particular, the numerical solutions of the semiconductor equations are reviewed, and their implications in the interpretation of spreading resistance measurements for profiling shallow layers are presented. The limitations of the multilayer Laplace equation analysis of spreading resistance in VLSI profiling are also discussed.

708,146
PB87-200358 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Ellipsometric Instrumentation for Optical Metrology of Thin Films.
Final rept.,
D. Chandler-Horowitz, and G. A. Candela. 1987, 7p
Pub. in Proceedings of SEMICON/West 1987, San Mateo, CA., May 19-21, 1987, p126-132.

Keywords: *Ellipsometers, *Semiconductor devices, *Thin films, Optical measurement, Polarimetry, Substrates, Metrology, Refractive index.

Nondestructive optical characterization of thin film structures on substrates by ellipsometry is a precise measurement technique which may lead to accurate metrology. In order to study problems important to semiconductor technology, the authors have built a spectroscopic, multi-angle of incidence, rotating analyser ellipsometer. The primary metrological requirement for accuracy is to obtain the uncertainties in the instrumental data for a particular sample surface. These data are the ellipsometric values for delta, psi, the angle of incidence phi, and the wavelength lambda. Then a mathematical analysis involving surface modeling is performed to find both the best values of the film parameters and their uncertainties. The ability of this instrument with its increased accuracy can lead to a better understanding of complex multilayered samples, such as possible semiconductor device materials like SIMOX.

708,147
PB87-201646 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Submicrometer Optical Linewidth Metrology.
Final rept.,
R. D. Larrabee. 1987, 10p
Pub. in Proceedings of the 1987 Measurement Science Conference, Irvine, CA, pV-D(1)-V-D(10), January 29-30, 1987.

Keywords: *Integrated circuits, *Line width, *Optical measurement, *Standards, *Dimensional measurement, Metrology, Very large scale integration, Edge detection.

The National Bureau of Standards (NBS) has had a continuing program to develop optical linewidth standards for the integrated-circuit industry for over 10 years. The past work has concentrated on the development and the certification of photomask linewidth and pitch standards. The recent work is directed at extending the feature sizes on these standards to cover the range from 0.5 to 30 micrometers, and at doubling the certification accuracy to 0.025 micrometers. Features with heights larger than approximately 1/4 wavelength of light cannot be modeled as zero-thickness layers as is done for photomasks. The development of models to handle this thick-layer case and to develop practical edge-detection criteria are currently under development at NBS. However, at the present time, it is generally not possible to interpret the image profiles of thick features and thereby measure an accurate linewidth. The basic obstacles that must be overcome to achieve accurate submicrometer feature size measurements for these features are reviewed and the prospects for future NBS optical standards for features such as photoresist lines on silicon wafers are assessed. Some suggestions about what to do until these standards become available are given.

708,148
PB87-213476 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 92, Number 3, May-June 1987.
Jun 87, 94p
See also PB87-213484 through PB87-213526 and PB87-181251. Also available from Supt. of Docs as SN703-027-00016-4.

Keywords: *Research, Weight measurement, Mass, Error analysis, Integrated circuits, Dimensional measurement, Optical measurement, Line width, Microelectronics, Nondestructive tests, Argon ions, Scanning electron microscopy, Very large scale integration, Very high speed integrated circuits, VHSIC(Circuits), Charge-exchange reactions, Ion-molecule collisions.

Articles:
- Two theories of experimental error;
- Submicrometer linewidth metrology in the optical microscope;
- Submicrometer microelectronics dimensional metrology--Scanning electron microscopy;
- Instrument-independent CAD spectral databases--Absolute cross-section measurements in QQQ instruments;
- Note on the choice of a sensitivity weight in precision weighing.

708,149
PB87-213492
(Order as PB87-213476, PC **A05**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.

Submicrometer Linewidth Metrology in the Optical Microscope,
D. Nyyssonen, and R. D. Larrabee. 9 Jan 87, 18p
Prepared in cooperation with CD Metrology, Inc., Germantown, MD.
Included in Jnl. of Research of the National Bureau of Standards, v92 n3 p187-204 May-Jun 87.

Keywords: *Integrated circuits, *Dimensional measurement, *Optical measurement, *Line width, Process control, Metrology, Very large scale integration.

Although submicrometer optical linewidth measurement is possible for 0.3 micrometer feature sizes, current instrumentation and linewidth standards, particularly for wafers, will have to radically improve in accuracy as well as in precision to meet the anticipated needs of the integrated circuit (IC) industry for submicrometer dimensional metrology. The paper discusses the effects of inadequate precision and accuracy on process control in IC fabrication and suggests some ways of circumventing these limitations until better instrumentation and standards become available.

708,150
PB87-213500
(Order as PB87-213476, PC **A05**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Submicrometer Microelectronics Dimensional Metrology: Scanning Electron Microscopy,
M. T. Postek, and D. C. Joy. 9 Jan 87, 24p
Prepared in cooperation with A.T. and T. Bell Labs., Murray Hill, NJ.
Included in Jnl. of Research of the National Bureau of Standards, v92 n3 p205-228 May-Jun 87.

Keywords: *Microelectronics, *Integrated circuits, *Dimensional measurement, *Nondestructive tests, *Line width, Metrology, *Scanning electron microscopy, *Very large scale integration, *Very high speed integrated circuits, *VHSIC(Circuits).

The increasing integration of microelectronics into the submicrometer region for VHSIC and VLSI applications necessitates the examination of these structures both for linewidth measurement and defect inspection by systems other than the optical microscope. The low beam-voltage scanning electron microscope has been recently employed in this work due to its potentially high spatial resolution and large depth of field. The paper discusses applications of the scanning electron microscope to microelectronics inspection and metrology in light of the present instrument specifications and capabilities, and relates the scanning electron microscope to the controls required for submicrometer processing.

708,151
PB87-223749 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Double-Level Metallization: Annual Report for October 1, 1985 to September 30, 1986,
G. P. Carver, D. B. Novotny, R. Hershey, and J. E. Luther. Jun 87, 25p NBSIR-87/3579

Keywords: *Integrated circuits, *Microelectronics, *Metallizing, *Semiconductor devices, Fabrication, Polyimide resins, Aluminum silicon alloys, Silicon dioxide, Tests, Chemical vapor deposition.

An outline for a double-level metal process for the fabrication of circuits having a minimum linewidth of 3 micrometers is described. The process is designed to be implemented in the Microelectronics Processing Facility at Fort Meade, Maryland, where single-level metallization circuits are already in production. A summary is included of the research performed in the Semiconductor Processing Research Laboratory at the National Bureau of Standards.

708,152
PB87-224143 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Spreading Resistance Measurements - An Overview.
Final rept.,
J. R. Ehrstein. 1987, 27p
Pub. in American Society for Testing and Materials Special Technical Publication 960, p453-479 1987.

Keywords: *Silicon, Electrical measurement, Reviews, Reprints, *Spreading resistance, Ion implantation, Depth profiles, Doped materials.

Spreading Resistance is the most versatile electrical technique for characterizing depth profiles in silicon. However, it is being increasingly challenged as an analytical method by shrinking device geometries. Consequently, refinement of such aspects as probe conditioning, sample preparation, and bevel angle measurement is needed, and traditional practice regarding calibration, algorithms, and profile interpretation must be reexamined. Based on examples drawn from the author's work, multilaboratory experiments, and recent literature to illustrate and discuss these topics, this paper attempts to summarize the current status of the measurement and its interpretation, showing both strong points and apparent limitations.

708,153
PB87-224614 PC **A15**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
RADC/NBS (Rome Air Development Center/National Bureau of Standards) Workshop. Moisture Measurement and Control for Microelectronics (4),
D. Kane, B. A. Moore, and E. J. Walters. Jun 87, 343p NBSIR-87/3588
See also report dated May 84, PB84-219559. Sponsored by Rome Air Development Center, Griffiss AFB, NY.

Keywords: *Semiconductor devices, *Integrated circuits, *Moisture content, *Meetings, Measurement, Hermetic seals, Mass spectroscopy, Moisture meters, Packaging, Quality control, Reliability(Electronics).

The fourth Workshop on Moisture Measurement and Control for Microelectronics served as a forum on moisture and/or materials reliability problems and on ways to control them or measure their extent. Twenty-two presentations are included which contain detailed information on hermeticity measurement and definition; development of standard packages for mass spectrometric calibrations; moisture interaction with various materials; and techniques that can be used to measure moisture microelectronics. It was clear from several presentations in the workshop that a very systematic approach is needed when organic materials are involved; all the variables must be identified and studied one at a time. This is the key to lot-to-lot reproducibility, materials selection, and control; hence a better reliability at the design phase will decrease the need for testing; hence the cost, thus resulting in a greater satisfaction to the customer.

708,154
PB88-109061 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Fundamental Principles for Gallium Arsenide Devices.
Final rept.,
H. S. Bennett. 1987, 3p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Symposium on Circuits and Systems, Philadelphia, PA., May 4-7, 1987, p12-14 1987.

Keywords: *Field effect transistors, *Gallium arsenides, Mathematical models, Simulation, Silicon, Bipolar transistors, Heterojunctions.

Recent advances in physics for submicron silicon devices suggest lessons or principles that are valid when numerically simulating the behavior of GaAs devices. These lessons from physics for silicon devices are summarized, and their implications for GaAs devices are given.

708,155
PB88-109103 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Thermal Analysis of Electromigration Test Structures.
Final rept.,
H. A. Schafft. 1987, 9p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices ED-34, n3 p664-672 Mar 87.

Keywords: *Microelectronics, Electronic test equipment, Thermal analysis, Reprints, *Electromigration, Metallization, Temperature profiles.

Analytical expressions are derived for estimating the temperature profile along a straight-line resistor test structure due to the joule heating generated by a high current-density stress, such as is used in accelerated stress tests to characterize metallizations for electromigration. It is shown how an improved estimate of the mean metallization stress temperature may be made and how the thickness and thermal conductivity of the underlying electrical insulator affect the temperature profile of the metallization. Recommendations for the design of electromigration test structures are developed that will promote reduced temperature gradients in the metallization during stress testing and improved reproducibility of electromigration characterizations.

708,156
PB88-109111 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Comprehensive Test Chip for the Characterization of Multi-Level Interconnect Processes.
Final rept.,
D. J. Radack, J. C. Swartz, L. W. Linholm, and M. W. Cresswell. 1987, 7p
Pub. in Proceedings of International IEEE (Institute of Electrical and Electronics Engineers) VLSI Multilevel Interconnection Conference (4th), Santa Clara, CA., June 15-16, 1987, p238-244 1987.

Keywords: *Integrated circuits, *Circuit interconnections, Electronic test equipment, Performance, Evaluation, *Very large scale integration, Chips(Electronics), Test methods.

A test chip for the evaluation and characterization of multi-level interconnect processes has been developed. The test chip contains test structures which allow a process engineer to make comparative, quantitative measurements for evaluating the performance of selected processes and equipment. The paper describes the design and testing of selected test structures and presents initial test results.

708,157
PB88-109129 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Sub-Micron Lithography Characterization Using an Expert System.
Final rept.,
M. W. Cresswell, N. Pessall, R. J. Betsch, L. W. Linholm, and D. J. Radack. 1987, 8p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) Integrated Circuit Metrology, Inspection, and Process Control Conference, Santa Clara, CA., March 4-6, 1987, p304-311 1987.

Keywords: *Integrated circuits, *Semiconductor devices, *Lithography, Artificial intelligence, Performance, Automation, Expert systems, Test methods, Chips(Electronics).

The paper describes a test chip, test results, rule generation techniques, and an expert system for characterizing the performance of a sub-micron lithography process. Examples of test results, data reduction techniques, and expert system output are given. The objective of the work is to develop a system for automatic process diagnosis.

708,158
PB88-109137 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Innovative Measurement of Specific Contact Resistivity Confirms Lower Aluminum-Silicon Contact Resistance.
Final rept.,
G. P. Carver, D. B. Novotny, and J. J. Kopanski. 1987, 7p
Pub. in Proceedings of International IEEE (Institute of Electrical and Electronics Engineers) VLSI Multilevel Interconnection Conference (4th), Santa Clara, CA., June 15-16, 1987, p337-343 1987.

Keywords: *Integrated circuits, *Electric contacts, Electrical resistivity, Aluminum, Silicon, *Contact resistance, Schottky barriers, Schottky diodes, Spreading resistance.

New accurate measurements prove that the value of the aluminum-silicon specific contact resistivity is much smaller than the value determined previously by the use of two-level planar contact resistor structures. Values of the specific contact resistivity between an aluminum alloy containing 1.5 percent silicon and silicon wafers were measured for p-type silicon resistivities in the range from 0.006 to 25 ohm-cm and for n-type silicon resistivities in the range from 0.0014 to

0.0026 ohm-cm. The specific contact resistivity values obtained are about five times smaller than values reported from two-level planar structures, suggesting that aluminum may be useful for contact dimensions as small as 0.5 micrometer on a side. With the new results, multilevel conductor systems can be designed for optimal performance.

708,159
PB88-110697 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Submicrometer Optical Linewidth Metrology.
Final rept.,
R. D. Larrabee. 1987, 5p
See also PB87-201646.
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) Integrated Circuit Metrology, Inspection, and Control, Santa Clara, CA., March 4-6, 1987, p46-50 1987.

Keywords: *Integrated circuits, *Line width, *Dimensional measurement, Optical measurement, Metrology, Standards, *Very large scale integration, Edge detection.

The National Bureau of Standards (NBS) has had a continuing program to develop optical linewidth standards for the integrated circuit industry for over 10 years. The past work has concentrated on the development and the certification of photomask linewidth and pitch standards. The recent work is directed at extending the feature sizes on these standards to cover the range from 0.5 to 30 micrometers, and at doubling the certification accuracy to 0.025 micrometer. The basic obstacles that must be overcome to achieve accurate submicrometer feature size measurements for these features are reviewed, and the prospects for future NBS optical standards for features such as photoresist lines on silicon wafers are assessed. Some suggestions about what to do until these standards become available are given.

708,160
PB88-121918 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Submicrometer Dimensional Metrology in the Scanning Electron Microscope.
Final rept.,
M. T. Postek. 1987, 6p
Pub. in SPIE (Society of Photo-Optical Instrumentation Engineers) - Integrated Circuit Metrology, Inspection, and Process Control, v775 p166-171 1987.

Keywords: *Integrated circuits, *Line width, *Dimensional measurement, Metrology, Standards, Reprints, *Scanning electron microscopes, Scanning electron microscopy.

The National Bureau of Standards has initiated a program to develop scanning electron microscope linewidth measurement standards for the integrated circuit community. The program involves the development of: a scanning electron microscope-based linewidth measurement and standard reference material certification instrument, the necessary electron beam/sample interaction modelling, and the appropriate micrometer and submicrometer artifacts. The basic problems that must be overcome to achieve accurate submicrometer feature size measurements in the scanning electron microscope for these artifacts will be reviewed and some suggestions of what can be done to 'bridge-the-gap' until such standards become available will be given.

708,161
PB88-138805 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Alternative EMI (Electromagnetic Interference) Measurement Techniques for Microelectronic Circuits.
Final rept.,
G. R. Reeve. 1986, 4p
Pub. in Proceedings of International Conference on Electromagnetic Compatibility, EMC EXPO 86, Washington, DC., June 16-19, 1986, pT26.1-T26.4.

Keywords: *Integrated circuits, *Electromagnetic interference, Microelectronics, Very large scale integration, Very high speed integrated circuits, Reverberation chambers, Optoelectronic devices.

With increasingly complex integrated circuits being designed for the Very Large Scale Integrated Circuit (VLSI), and the Very High Speed Integrated Circuit (VHSIC) programs, using larger chip areas and smaller device geometries, there is some concern that these units, either by themselves or in application circuits, will prove more susceptible to the effects of electromagnetic interference (EMI). Existing techniques using pin voltage upset measurements may not be sufficient to properly characterize the behavior of these integrated circuits (ICs) in the presence of EMI. Some possible adaptations of EMI measurement techniques presently in use or being developed at the National Bureau of Standards (NBS) and other laboratories are presented for consideration.

708,162
PB88-138839 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Status: Interlaboratory Electromigration Experiment.
Final rept.,
H. A. Schafft. 1985, 4p
Pub. in Proceedings of the Wafer Reliability Assessment Workshop, Lake Tahoe, CA., October 20-23, 1985, p213-216.

Keywords: *Electromigration, Test methods.

The purpose of the experiment is to assess the reproducibility of electromigration characterizations, the median-time-to-failure, t(50). Of more lasting importance, the purpose is also to develop guidelines for the design of test structures, for methods to measure t(50), and for reporting characterization results.

708,163
PB88-138847 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Measurements for VLSI Models.
Final rept.,
K. F. Galloway. 1985, 8p
Pub. in Proceedings of the International Workshop on the Physics of Semiconductor Devices (2nd), Delhi, India, December 5-10, 1983, p98-105 1985.

Keywords: *Integrated circuits, Computerized simulation, Measurement, *Very large scale integration, Computer aided design.

The complexity of VLSI makes an experimental approach to design and fabrication unrealistic. Accurate, computer-based models for simulating processes, devices, and circuits are required to competively develop VLSI technologies. The effectiveness of these models is often limited by the accuracy of the physical parameters used as input for the simulations. The paper summarizes results from two recent projects on measurement technology for obtaining parameters for VLSI models to illustrate the research in this area at the National Bureau of Standards.

708,164
PB88-138854 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Metrological Challenges in Semiconductor Technology: Electrical Measurements of Dimensions and Materials Properties Using Integrated Circuit Test Structures.
Final rept.,
K. F. Galloway, S. E. Diehl, and L. W. Linholm. 1987, 3p
Pub. in Proceedings of the International Conference on Semiconductor and Integrated Circuit Technology, Beijing, China, October 19-26, 1986, p685-687 1987.

Keywords: *Integrated circuits, *Microelectronics, *Dimensional measurement, Electrical measurement, Metrology, Wafers, *Very large scale integration, Chips(Electronics).

The effective characterization and control of the materials, processes, devices, and circuits for very-large-scale integration (VLSI) is a major concern for semiconductor technology development. The paper reviews the types of metrological requirements associated with VLSI semiconductor technology and examines dimensional measurements and materials characterization at the wafer or chip level. Integrated circuit test structures for electrical measurements of dimensions and material properties are described.

708,165
PB88-141338 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Submicron Device Physics for Numerical Simulations.
Final rept.,
H. S. Bennett. 1987, 7p
Pub. in Physics of Amorphous Semiconductor Devices, SPIE (Society of Photo-Optical Instrumentation Engineers), v763 p134-140 1987.

Keywords: *Semiconductor devices, Mathematical models, Simulation, Bipolar transistors, Amorphous silicon, Subminiaturization, Heterojunctions, Amorphous materials, Numerical solution.

Recent advances in physics for submicron, bipolar-crystalline devices suggest principles that are valid when modeling bipolar devices with noncrystalline regions such as those with polysilicon, polycrystalline silicon, and hydrogenated amorphous silicon emitters. These principles from crystalline device physics are summarized, and their implications for the noncrystalline regions of bipolar devices are given.

708,166
PB88-147418 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Charge-Sheet Model Fitting to Extract Radiation-Induced Oxide and Interface Charge.
Final rept.,
K. F. Galloway, C. L. Wilson, and L. C. Witte. 1985, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science 32, n6 p4461-4465 1985.

Keywords: *Metal oxide transistors, *Electric charge, Mathematical models, Reprints, *MOSFET, One-dimensional calculations, Physical radiation effects, Charge sheet model.

A method for extracting values of oxide and interface charge from the current-voltage (I-V) characteristics of long-channel MOSFETs is described. The one-dimensional charge-sheet model developed by Brews provides the basis for the I-V characteristics. The I-V characteristics given by this model are optimized with respect to a set of experimental data for an irradiated device with the flatband voltage and the mobility the only free parameters. Simple relationships between these parameters and the radiation-induced interface and oxide charge are assumed.

708,167
PB88-147426 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Modeling Silicon Emitters for VLSI Transistors.
Final rept.,
H. S. Bennett. 1987, 5p
Pub. in Solid-State Electronics 30, n11 p1137-1141 1987.

Keywords: *Integrated circuits, Carrier mobility, Silicon, Reprints, *Very large scale integration, *Bipolar transistors, Density of states, Carrier lifetime, Band theory.

The accuracy and reliability of predictions from numerical simulations of advanced bipolar transistors for VLSI applications depend on model input parameters. These parameters include the variations with doping and carrier concentrations in both n-type and p-type silicon of (1) the valance and conduction band edges, (2) the effective intrinsic carrier concentrations, (3) the minority carrier mobilities, and (4) the minority carrier lifetimes. This paper reviews recent advances in device physics for modeling the emitters of bipolar transistors with submicrometer dimensions and high concentrations of dopant ions and carriers.

708,168
PB88-147434 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Testability Measures for the Design of Digital ICs (Integrated Circuits).
Final rept.,
M. E. Zaghloul. 1987, 11p
Pub. in Semicustom Design Guide II, n2 p98-108 1987.

Keywords: *Integrated circuits, Design, Tests, Algorithms, Comparison, Reprints, Digital circuits.

The paper is an overview of testability measures in the design of digital integrated circuits. Commercial testability algorithms are described and compared. Recent developments on testability measures which enhance the role of testability are discussed.

708,169
PB88-152780 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Time Perturbation Analysis for the MOS (Metal-Oxide-Silicon) System.
Final rept.,
M. Gaitan, and I. D. Mayergoyz. 1987, 7p
Pub. in Fundamental Research on the Numerical Modelling of Semiconductor Devices and Processes, p77-83 1987.

Keywords: *Capacitors, Electron traps, Hole traps, Interfaces, Silicon, Silicon dioxide, *Metal oxide semiconductors.

The development of a numerical implementation of the small signal response of the MOS (Metal-Oxide-Silicon) capacitor using time perturbation analysis is discussed. The effects of nonconstant doping profiles and interface and bulk traps are included. The model uses Fermi-Dirac statistics to describe the occupancy of the interface and bulk traps. The oxide region is considered to have no mobile carriers and any fixed oxide charge distribution is modeled as a charge sheet at the Si-SiO2 interface. The technique can be used to find the small signal response of the device from the static solution.

708,170
PB88-152798 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Effect of Selected Aqueous Semiconductor Reagents on Commercial Piping of Perfluoroalkoxy Fluorocarbon Resin and of Ethylene-Chlorotrifluoroethylene Fluoropolymer Resin.
Final rept.,
J. F. Imbalzano, J. R. Moody, and R. L. McKenzie. 1986, 3p
Sponsored by Du Pont de Nemours (E.I.) and Co., Wilmington, DE.
Pub. in Solid State Technology 29, n8 p135-137 Aug 86.

Keywords: *Semiconductor devices, *Fluorohydrocarbons, Contamination, Water, Polymers, Materials tests, Chemical attack, Reprints, *Fluoropolymers, *Fluorohydrocarbon resins, Reagents, Acids, Alkalies.

Eliminating contamination in semiconductor devices requires that the polymeric materials which contact the harsh aqueous reagents used in their production be unaffected by those reagents. A comparative study was conducted of the effects of aqueous acid, aqueous alkali, and 18 megohm water, at concentrations and conditions common in the semiconductor industry, on commercial piping of perfluoroalkoxy (PFA) fluorocarbon resin, and of ethylene-chlorotrifluoroethylene (ECTFE) fluoropolymer resin. The results are discussed.

708,171
PB88-153960 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Scanning Electron Microscope Linewidth Measurement Standards Program at the National Bureau of Standards.
Final rept.,
M. T. Postek, R. D. Larrabee, and W. J. Keery. 1987, 6p
Pub. in EMSA (Electron Microscope Society of America) Bulletin 17, n2 p59-64 Nov 87.

Keywords: *Electron microscopy, *Line width, *Dimensional measurement, Metrology, Reprints, *Scanning electron microscopes.

The development of the linewidth measurement standards requires the development of: (1) a scanning electron microscope based linewidth measurement certification instrument; (2) computer models to predict the electron beam/sample/instrument interaction within the SEM; and (3) the actual micrometer and submicrometer feature-size standards per se. The presentation outlines some of the basic problems that must be overcome to achieve accurate submicrometer feature-size measurements in the scanning electron microscope, and offers some suggestions of what can be done until suitable standards for such measurements become available.

708,172
PB88-154745 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Reproducibility of Electromigration Measurements.
Final rept.,
H. Schafft, T. Staton, J. Mandel, and J. Shott. 1987, 9p
See also AD-A177 369. Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices ED-34, n3 p673-681 Mar 87.

Keywords: *Integrated circuits, Electrical measurement, Metallizing, Precision, Reliability(Electronics), Reproducibility, Reprints, *Very large scale integration, *Electromigration, Interlaboratory comparisons.

The reproducibility of median-time-to-failure (t(50)) measurements was determined in an interlaboratory experiment in which 11 laboratories and a reference laboratory took part. Each laboratory used a method of its choosing to test equivalent samples under the same conditions of current density and oven temperature. The between-laboratory reproducibility of t(50) measurements normalized to one metallization temperature was dependent on current-density stress; at 1.0 MA/sq cm it was within 15 percent, while at 2.5 MA/sq cm it was generally within 50 percent. The primary source for variability is in estimating the temperature rise of the test metallization due to joule heating. Recommendations are given for the design and test of electromigration test structures to improve the reproducibility of t(50) measurements.

708,173
PB88-155767 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Low Accelerating Voltage Pitch Standard Based on the Modification of NBS (National Bureau of Standards) SRM (Standard Reference Material) 484,
M. T. Postek. Nov 87, 14p NBSIR-87/3665
Sponsored by Harry Diamond Labs., Adelphi, MD.

Keywords: *Standards, Dimensional measurement, Integrated circuits, Nondestructive tests, Line width, Metrology, Wafers, *Scanning electron microscopes, *Standard reference materials.

The National Bureau of Standards (NBS) is actively developing micrometer and submicrometer standards for the scanning electron microscope (SEM). This report summarizes the progress made to extend the imaging range of the presently available SRM 484 for use as an interim standard for low accelerating voltage magnification calibration applications for this instrument. NBS is actively developing micrometer and submicrometer standards for dimensional metrology in the SEM. The only magnification standard reference material (SRM) presently available for calibrating scanning electron microscopes is SRM 484. The standard provides a known pitch between gold lines in a nickel matrix and has proven useful for many SEM applications. However, SRM 484 was developed prior to the recent interest in nondestructive, low accelerating voltage SEM operation. The driving force for nondestructive inspection at low accelerating voltages has been the semiconductor industry for integrated circuit mask and wafer inspection and measurement.

708,174
PB88-155783 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Effect of the Gate Oxide Thickness on the Speed of MOS Integrated Circuits,
J. S. Kim. Dec 87, 19p NBSIR-87/3668

Keywords: *Integrated circuits, Metal oxide transistors, Velocity, Thickness, Oxides, Gates(Circuits), *Very large scale integration, MOSFET.

A simple analysis is presented for the effect of the gate oxide thickness on the circuit speed in a short-channel CMOS/inverter delay circuit. The present analysis is performed within the first-order theory of the MOS transistor. The result of the analysis shows that an optimum value of the gate oxide thickness exists, beyond which a further scaling of the gate oxide will not improve but degrade the circuit speed. The circuit speed corresponding to this optimum oxide thickness is the ultimate upper limit theoretically possible in a given MOS integrated circuit. The optimum value of the gate oxide thickness, to the first order approximation, is proportional to the channel width W, but it is independent of the channel length L. In particular, for wide channel devices, this optimum value exceeds the 5 nm - 30 nm range, which is of practical significance in the design and processing of advanced VLSI circuits.

708,175
PB88-156716 PC **A10**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Silicon-on-Insulator: A Categorized Bibliography Including Abstracts.
Special pub.,
A. Baghdadi, and E. J. Walters. Dec 87, 215p NBS/SP-400/80
Also available from Supt. of Docs. as SN003-003-02839-8. Library of Congress catalog card no. 87-619901. Sponsored by Army Strategic Defense Command, Huntsville, AL.

Keywords: *Bibliographies, Thin films, Materials, Silicon nitrides, Abstracts, *SOI (Semiconductors), SOS (Semiconductors), Recrystallization, Epitaxial growth, Molecular beam epitaxy, Polysilicons, INSPEC data base, Engineering index data base, Chemical abstracts data base.

The bibliography of silicon-on-insulator SOI technology was compiled from a literature search of three data bases: INSPEC, Engineering Index, and Chemical Abstracts. The bibliography has been categorized according to the technique used to produce the SOI substrate. It includes the abstracts for most of the papers. It can either be used to obtain a quick evaluation of the 'state of the art' in a particular SOI technique, or as a guide for further in-depth study.

General

708,176
AD-A036 669/0 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Radiation-Hardness Testing of Electronic Devices: A Survey of Facility Dosimetry Practices.
Final rept. Jan-Sep 76.
J. C. Humphreys, and S. E. Chappell. Sep 76, 26p
Rept no. NBSIR-76-1135

Keywords: *Radiation hardening, *Electronic equipment, *Dosimetry, *Dosimeters, Gamma rays, Radioactive isotopes, Irradiation, Test methods.

As part of a program to develop better quality assurance in the measurement of total dose in the field of radiation-hardness testing of electronic devices, a survey was conducted at twelve radiation test facilities. The survey was carried out through personal visits during which various characteristics of the test facilities and dosimetry procedures were noted. This report summarizes the results of the survey. Particular attention is given to the types of dosimetry problems perceived by the dosimetry personnel at the facilities as well as to general observations by the surveyor. The observations and information obtained through this survey led to some conclusions on where problems in total-dose measurements may occur. Some specific recommendations result and give direction to the program plan for developing more consistent measurement procedures within the radiation-hardness testing community. (Author)

708,177
PATENT-4 165 183 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fringe Counting Interferometric System for High Accuracy Measurements.
Patent.
J. L. Hall, and S. A. Lee. Filed 26 Aug 77, patented 21 Aug 79, 15p PB79-600045, PAT-APPL-827 996

Keywords: *Counting and control circuitry, Fringe counting interferometric method and apparatus, Michelson interferometer, Phase locked oscillators, Retroreflectors.

A fringe counting interferometric method and apparatus is disclosed. The apparatus comprises a fringe-counting Michelson interferometer employing a velocity-stable carriage means for translating the two corner-cube retroreflectors, two phase locked oscillators and counting and control circuitry. Fringe intensity signals are counted for both a reference and unknown beam, and high accuracy is obtained by multiplying reference beam fringe signals by a fixed integral multiplier employing a phase-lock circuit. In comparing the unknown wavelength with the reference, the convenience of direct readout in wavelength units arises from the use of a high resolution present counter.

708,178
PATENT-4 315 255 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Multiple-Quantum Interference Superconducting Analog-to-Digital Converter.
Patent.
R. E. Harris, and A. Clark. Filed 27 Oct 80, patented 9 Feb 82, 6p PB82-600035, PAT-APPL-6-201 669

Keywords: *Analog to digital converter, Superconducting interferometers.

An analog-to-digital converter using superconducting interferometers connected in parallel, each interferometer being identical. The coupling of the analog signal to each successive interferometer is increased in the ratio of 1:2:4:8:16:32, etc. The application of a pulsed power supply to the parallel connected interferometer generates output voltages on the interferometers. The output voltages are a Gray Code representation of the analog signal.

708,179
PATENT-4 520 320 Not available NTIS
Department of Commerce, Washington, DC.
Synchronous Phase Marker and Amplitude Detector.
Patent.
J. E. Potzick, and B. Robertson. Filed 22 Feb 84, patented 28 May 85, 30p PB85-211621, PAT-APPL-6-571 288
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Phase meters, Phase shift, Amplitude, PAT-CL-328-133.

Disclosed is an electronic circuit for determining the phase difference between an input signal and a reference signal where both signals are of the same frequency. Furthermore, the circuit provides an amplitude output indicative of the input signal even when that signal is obscured by noise.

708,180
PB-262 611/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Techniques for Measurement of Electromagnetic Radiation and Susceptibility of Electronic Equipment.
Final rept.,
M. L. Crawford. 1975, 7p
Pub. in Proceedings of Symp. and Technical Exhibition on Electromagnetic Compatibility (1st), Montreux, Switzerland, May 20-22, 1975, p38-44 1975.

Keywords: *Electromagnetic compatibility, *Radiation hazards, Electronic equipment, Electromagnetic radiation, Measurement, Radiation measuring instruments.

The paper describes two alternative approaches to conventional screen room measurements for determining radiation from electronic equipment and the susceptibility of equipment to continuous wave and pulsed electromagnetic fields. Details of EMC measurements performed using the two techniques: (1) use of underground mine tunnels (low-Q enclosure), and (2) use of TEM transmission cells, are given along with a brief discussion of factors influencing the measurement results. The TEM cell is particularly high-lighted because of its potential for making accurate (= or < 1-2 dB for radiated susceptibility at levels up to 600 V/m, and 3-5 dB for radiated emission at levels down to 10 microvolts/m) measurements with a minimum of additional equipment.

708,181
PB-262 612/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Improved Solid State Noise Source.
Final rept.,
M. Kanda. Jun 76, 3p
Pub. in Proceedings of the Institute of Electrical and Electronics Engineers-MTT-S Microwave Symp., Cherry Hill, N.J., June 14-16, 1976, p224-226 Jun 76.

Keywords: *Noise generators, Solid state devices, Avalanche diodes, Heat sinks, Impedance matching, Stability.

An improved solid state noise source is discussed. By implementing such modifications as (1) heat sinking of a silicon avalanche noise diode, (2) proper DC RF decoupling, and (3) impedance matching, the stability of the NBS solid state noise source is improved significantly over that of typical commercial solid state noise sources. The paper describes these modifications, how they are implemented, and the resulting improvement in stability.

708,182
PB-263 254/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermal Current Converters for Accurate AC Current Measurement.
Final rept.,
E. S. Williams. Dec 76, 5p
Pub. in IEEE Trans. Instrum. Meas. IM-25, n4 p519-523 Dec 76.

Keywords: *Electric measuring instruments, Electric current, Comparators, Thermocouples, Electrical measurement, Alternating current, Reprints.

A new 14-range set of thermal current converters consisting of shunted thermoelements has been constructed to measure ac-dc difference and ac current from 10 mA to 20A at 20 Hz to 50 kHz. The ac-dc difference corrections for all ranges can be determined relative to two ranges by a 7-step intercomparison of certain adjacent ranges.

708,183
PB-263 255/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laboratory Voltage Standard Based on 2e/h.
Final rept.,
B. F. Field, and V. W. Hesterman. Dec 76, 3p
Pub. in IEEE Trans. Instrum. Meas. IM-25, n4 p509-511 Dec 76.

Keywords: *Standards, Electrical potential, Josephson junctions, Calibrating, Standard cells, Reprints.

The increased dependence of a standards laboratory on a stable voltage reference has made the maintenance of a volt by standard cells a costly and time consuming process. The paper describes an instrument designed to calibrate cadmium-sulfate standard cells directly against a time-invariant superconducting Josephson junction voltage reference, thus replacing the large groups of cells typically used as a voltage reference. An induced voltage of 5.2 mV is produced across the Josephson junction by irradiating the junction with microwaves of a known frequency. A specially designed potentiometer is used to scale this voltage up to 1.01+ volts where it can be compared to a standard cell. The overall accuracy (2 sigma) of the system is 0.4 ppm or better.

708,184
PB-263 269/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Investigation of Multijunction Thermal Converters.
Final rept.,
F. L. Hermach, and D. R. Flach. Dec 76, 5p
Pub. in IEEE Transactions on Instrumentation and Measurements, IM25 n4 p524-528 Dec 76.

Keywords: *Electrical measurement, *Thermoelectric generators, AC to DC converters, Alternating current, Electric potential, Comparators, Standards, Reprints.

The relative ac-dc differences of a group of multijunction thermal converters (MJTCs) have been determined over the frequency range 30 Hz - 10 kHz. These MJTCs are of different ranges and were obtained from several sources. Differences were observed at low frequencies when converters of various ranges were intercompared. For voltage measurements, the use of matched resistors in series with the MJTC heater resistors greatly reduced these errors and contributed to the reduction of other errors as well. It is believed that the average ac-dc difference of this group is less than 0.3 ppm at 160 Hz and 0.5 ppm up to 10 kHz.

708,185
PB-263 270/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
AC-DC Comparators for Audio-Frequency Current and Voltage Measurements of High Accuracy.
Final rept.,
F. L. Hermach. Dec 76, 6p
Pub. in IEEE Transactions on Instrumentation and Measurements, IM25 n4 p489-494 Dec 76.

Keywords: *Comparators, Electrical measurement, Alternating current, Electric potential, Standards, AC to DC converters, Accuracy, Thermoelectric generators, Reprints.

The paper surveys recent development in high-accuracy ac-dc comparators, the basic standards for ac current and voltage measurements at audio and higher frequencies. These instruments compare the unknown ac quantity with a dc reference. The ac-dc transfer characteristics of thermal converters, the most widely used comparators, can be evaluated to about 10 parts per million (ppm) at audio frequencies in national metrology laboratories. With recent developments even better accuracies, and greater convenience with automatic comparisons, are feasible.

708,186
PB-263 532/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Resistive Ratio Standard for Measuring Direct Voltages to 10 kV.
Final rept.,
C. B. Childers, R. F. Dziuba, and L. H. Lee. Dec 76, 4p
Pub. in IEEE Transactions on Instrumentation and Measurement, vIM25 n4 p505-508 Dec 76.

Keywords: *Voltage measuring instruments, Standards, High voltage, Electrical measurement, Voltage dividers, Ratios, Reprints.

A highly accurate, guarded voltage-ratio standard has been developed for measuring direct voltages from the range of a standard cell to 10 kV. The ratio standard has a resolution capability of 0.1 ppm for ratios of 1:1 to 10,000:1 with an estimated uncertainty of 0.2 ppm. It is designed for operation at a rating of 2 kiloohms/volt and consists of an adjustable reference section in series with three resistance groups each containing nine nominally equal sections. The resistance ratios are determined by a self-calibration technique using a 1:1 bridge. A series-parallel mode of calibration provides an additional check on the accuracies of the ratios. The standard is housed in a temperature-controlled oil bath whose oil is filtered to remove moisture and contaminants.

708,187
PB-263 533/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS Automated One-Ohm Resistance Measurements.
Final rept.,
J. J. Morrow. Nov 76, 4p
Pub. in Quality Progress, v9 n11 p22-25 Nov 76.

Keywords: *Electrical resistance meters, Electrical resistance, Electrical measurement, Comparators, Voltmeters, Automation, Reprints.

A one-ohm resistance measurement system at NBS uses a d.c. current comparator potentiometer and a digital nanovoltmeter (DNM) with a sensitivity of one nanovolt. The circuit configuration for automated measurements is the same as that for manually balanced measurements except that the DNM replaces the galvanometer and the circuit is not balanced. Accuracies of 1 part in 10 to the 7th power are easily achieved with the system.

708,188
PB-264 327/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of Microwave Phase and Amplitude from Power Measurements.
Final rept.,
G. F. Engen. 1976, 5p
Pub. in IEEE Trans. Instrum. Meas. IM-25, n4 p414-418 Dec 76.

Keywords: *Network analyzers, Automation, Microwave frequencies, Power measurement, Phase meas-

urement, Amplitude, Automatic network analyzers, Reprints.

Although straightforward in principle, the extension of existing designs for automatic network analyzers (ANA's) to the higher microwave frequencies is difficult in the current state of the art. What appears to be needed is a basically different approach to the microwave detection problem. One promising alternative is provided by the so-called 'six-port' techniques, which eliminate the need for modulation or for frequency conversion, local oscillators, phase detectors, etc. Recent theoretical studies have provided new insights into the basic concept and lead to five-port configurations which require three instead of four amplitude detectors. Of particular interest is the projected measurement dynamic range of 50-60 dB corresponding to a dynamic range requirement in the amplitude detectors of a nominal 20 dB or less.

708,189
PB-264 328/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Impulse Generator Spectrum Amplitude Measurement Techniques.
Final rept.,
J. R. Andrews. 1976, 5p
Pub. in IEEE Trans. Instrum. Meas. IM-25, n4 p380-384 Dec 76.

Keywords: *Pulse generators, *Spectrum analyzers, Calibrating, Radiometers, Oscilloscopes, Electromagnetic interference, Fourier transformation, Measurement, Reprints, Spectrum amplitude, Fast fourier transform.

Various techniques that have been used to calibrate impulse generators and to measure spectrum amplitude are surveyed. A summary of experiments comparing the various techniques is included. The NBS measurement service for calibrating impulse generators is described.

708,190
PB-264 329/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Self-Balancing DC-Substitution RF Power Meter.
Final rept.,
N. T. Larsen. 1976, 5p
Pub. in IEEE Trans. Instrum. Meas. IM-25, n4 p343-347 Dec 76.

Keywords: *Power meters, Radiofrequency power, Microwave frequencies, Power measurement, Bolometers, Reprints.

Problems intrinsic in self-balancing Wheatstone bridges have led to the development of a new dc substitution microwave power meter. The new instrument allows four-terminal measurement of bolometer resistance and affords improved accuracy and lower noise at a lower cost than earlier instruments. Measurement errors due to imperfect behavior of the servo system are typically less than 0.01%.

708,191
PB-264 331/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Present Capabilities of the NBS Automatic Pulse Measurement System.
Final rept.,
W. L. Gans. 1976, 5p
Pub. in IEEE Trans. Instrum. Meas. IM-25, n4 p384-388 Dec 76.

Keywords: *Pulse analyzers, Automation, Oscilloscopes, Pulse generators, Measurement, Reprints, Spectrum amplitude.

In 1972, NBS began development of an Automatic Pulse Measurement System (APMS) consisting essentially of a minicomputer-controlled wide-band sampling oscilloscope. The objective of the work was to produce a fast general purpose pulse waveform acquisition and processing instrument with spectral capability in the frequency range dc-18 GHz. The purpose of this paper is to report the highlights of work done on the APMS from early 1975 to present. The measurement applications of the APMS now consist of both publicly offered calibration services and in-house experimental measurements. In the first category, calibration services are available for the following physical parameters: (a) Impulse generator spectrum amplitude; (b) Wide-band coaxial attenuation/gain; (c) Pulse generator transition time. Still in the experimental stage are measurements involving reflection coefficient and impedance, group delay, pulse distortion, and wide-band antenna characteristics.

708,192
PB-266 474/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Superconducting Devices for Metrology and Standards,
R. A. Kamper. 1977, 59p
Pub. in Superconductor Applications: Squids and Machines, c5 p189-247 1977.

Keywords: *Measuring instruments, Metrology, Superconductivity, Electrical potential, Electrical measurement, Standards, Comparators, Radiofrequency power, Attenuation, Frequency measurement, Temperature measurement.

The topic falls naturally into five almost independent parts, which are discussed separately. They are: (1) Voltage standards; (2) Current comparators and measurements of ratios of current and voltage; (3) Measurements of RF power and attenuation; (4) Noise thermometry; (5) Measurements of frequency.

708,193
PB-272 527/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Synchronous Marker for Measuring Phase in the Presence of Noise.
Final rept.,
B. Robertson, and J. E. Potzick. Oct 77, 5p
Pub. in Review of Scientific Instruments, v48 n10 p1290-1294 Oct 77.

Keywords: *Phase detectors, *Correlators, Phase measurement, Noise, Reprints.

A circuit has been constructed to mark the phase of a sinusoidal signal even when it is obscured by noise. The time jitter of the marker signal due to the noise can be reduced as much as desired in trade for slowed response time of the circuit. A theoretical description of the performance of the circuit and an error analysis are presented. Results of tests on the circuit agree approximately with the theoretical description.

708,194
PB-273 130/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Design Considerations in State-of-the-Art Signal Processing and Phase Noise Measurement Systems.
Final rept.,
F. L. Walls, S. R. Stein, J. E. Gray, and D. J. Glaze. 1976, 6p
Pub. in Proceedings Annual Symposium on Frequency Control (30th), Ft. Monmouth, New Jersey, June 1976, p269-274 1976.

Keywords: *Signal processing, *Phase measurement, Phase locked systems, Buffers, Amplifiers, Design.

A general method which allows one to estimate the phase noise of analog and digital signal handling equipment is presented. As a specific example, this approach is applied to a new buffer amplifier and the estimates are compared with actual measurements. This amplifier achieves isolation of $>$ 120 dB at 5 MHz, has a phase noise floor below -170 dB, and is on a printed circuit card 3.25 cm by 9 cm. Double balanced mixers are used extensively in noise measurement and signal processing equipment. Several circuits using these devices are discussed and data is given, showing typical signal to noise realized. New circuits show 15 to 25 dB improvement over some traditional circuits. Single sideband noise floors lower than -183 dB can be achieved using double balanced mixers. Quite often it is desirable to phase lock two oscillators. Design considerations for choosing the unity gain point, and the slope of the gain roll-off is given. In particular it is shown that a gain slope of -12 dB/octave which decreases to -6 dB/octave at a point 1 to 3 octaves below the unity gain point has many advantages over single slope approaches.

708,195
PB-274 328/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Six-Port Reflectometer: An Alternative Network Analyzer.
Final rept.,
G. F. Engen. 1977, 3p
Pub. in Proceedings 1977 IEEE-MTT-S Int. Microwave Symposium, San Diego, California, June 21-23, 1977, p44-46 1977.

Keywords: *Reflectometers, *Network analyzers, Automation, Microwaves, Measurement, Junctions, Six port junctions.

Although the six-port measurement technique is rapidly gaining the attention of the microwave community, the theoretical development, to date, yields but limited practical insight into its operation. Following a brief review of the prior art, such that the six-port techniques may be placed in proper perspective, this paper presents an alternative introduction leading to much better insight, and to design criteria for a six-port circuit which optimally exploits the concept.

708,196
PB-274 329/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Application of the Six-Port Reflectometer to Precision Measurement of Microwave One-Port Parameters.
Final rept.,
E. L. Komarek. 1977, 2p
Pub. in Proceedings 1977 IEEE-MTT-S Int. Microwave Symposium, San Diego, California, June 21-23, 1977, p56-57 1977.

Keywords: *Power measurement, *Microwaves, Junctions, Reflection, Reflectometers, Six port junctions.

The arbitrary six-port junction concept has been applied to an automated broadband system in the 1-18 GHz frequency range for the measurement of microwave power and reflection coefficient. Performance evaluation results show an improvement in precision over automated and manually operated measurement systems used at the National Bureau of Standards.

708,197
PB-274 359/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Experimental Evaluation of the Radiation Characteristics of Dipole Sources Enclosed in a TEM Transmission Cell.
Final rept.,
M. L. Crawford. 1976, 3p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, p57-59 1976.

Keywords: *Electromagnetic radiation, *Electric equipment, Measurement, Tests, Test equipment, Cells, Transverse electromagnetic transmission cells, TEM cells.

The paper describes measurements to verify theoretical formulation of the changes in the radiation resistance of electronic equipment enclosed inside a special type shielded enclosure, a rectangular TEM cell. The measurements were made, assuming the device under test (DUT) could be modeled by dipole sources, using a monopole antenna mounted at various locations inside a typical cell. The predicted radiated power from the monopole antenna mounted inside the cell was within plus or minus 2 dB of the energy coupled to the cell's output ports. These results are contained in the paper and give credibility to the ability to relate such measurements to free space radiation conditions.

708,198
PB-274 456/3 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
NBS Type IV RF Power Meter Operation and Maintenance,
N. T. Larsen. Oct 77, 39p NBSIR-77-866

Keywords: *Power meters, Bolometers, Radiofrequency power, Microwaves, Maintenance, Calibrating.

Operating, maintenance, and calibration procedures are provided for the NBS Type IV Power Meter. This is a recently developed instrument for rf power measurement by means of dc substitution in a bolometer (thermistor type only). Complete parts lists, schematic diagrams, and parts placement drawings are provided. Mechanical drawings are not included, but are available from National Technical Information Service, U.S. Department of Commerce, Springfield, Va. 22161.

708,199
PB-274 457/1 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Characteristics of Broadband, Isotropic Electrical Field and Magnetic Field Probes,
M. Kanda. Nov 77, 35p NBSIR-77-868

Keywords: *Probes, Broadband, Electric fields, Magnetic fields, Design, Dipole antennas, Loop antennas, Radio waves.

A feasibility study and a preliminary engineering test program have been conducted to establish performance specification limits and preliminary engineering design for broadband, isotropic, receiving, electric field and magnetic field probes for electromagnetic emission measurements. Three electric field probes cover the frequency range from 20 Hz to 12 GHz. Two magnetic field probes cover the frequency range from 20 Hz to 32 MHz. The tangential sensitivities and the dynamic range of these broadband isotropic electric field and magnetic field probes are specified. Preliminary engineering design and supporting test data are also included.

708,200
PB-274 497/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characterization of a HF Probe for Integrated Circuits Measurements.
Final rept.,
R. L. Jesch, R. A. Bailey, and H. J. Tausch. 1974, 2p
Pub. in Proceedings, Government Micro-circuit Applications Conference, Boulder, Colo. 25-27 Jun 74 p120-121 1974.

Keywords: *Probes, *Transistors, Integrated circuits, High frequency.

A special probe assembly is available which can make high frequency measurements on individual integrated circuit transistors. In order to determine and correct for the effects of the probe assemblies on transistor parameter measurements, a technique was developed to determine experimentally the element values in an equivalent circuit representing the probe assembly. Using the above model, correct two-port data can be obtained from probe/transistor measurements.

708,201
PB-274 501/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Semi-Automated Six-Port for Measuring Millimeter Wave Power and Complex Reflection Coefficient.
Final rept.,
M. P. Weidman. 1977, 3p
Pub. in Proceedings 1977 IEEE MTT-S Int. Microwave Symposium, San Diego, California, June 21-23, 1977, p58-60, 1977.

Keywords: *Wavemeters, Waveguides, Microwave equipment, Millimeter waves, Waveguides, Power measurement, Reflection, Six port systems.

A six-port system has been developed and applied to the precision measurement of power and complex reflection coefficient in WR-15 (50-75 GHz) waveguide. The system is automated except for frequency and switching control for the signal source. This system provides a time saving factor of at least five as compared to a tuned reflectometer with little if any degradation in accuracy.

708,202
PB-275 606/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Converting a Rectangular Shielded Enclosure into a TEM Transmission Cell for EMI Measurements.
Final rept.,
M. L. Crawford, and C. L. Thomas. 1977, 6p
Pub. in Proceedings of EMC Conference, Seattle, Wash 31 Jul-2 Aug 77 p1-6 1977.

Keywords: *Test chambers, Electromagnetic interference, Measurement, TEM cells.

The paper describes the modifications needed to convert a rectangular shielded enclosure into a TEM moded EMI test chamber. The resulting chamber resembles existing TEM cells (i.e., is a 50-ohm transmission line) with the exception that the rf transmission line characteristics are achieved without the common tapering schemes used to facilitate a transition from coaxial cable to shielded stripline. The modified shielded enclosure or cell, discussed in this paper, is a scaled model of a screen room and is evaluated by showing measurement results such as VSWR and test field uniformity as a function of frequency. The modifications described allow use of a conventional shielded enclosure as a broadband transducer for either establishing susceptibility test fields or for measuring radiated emission from equipment under test.

708,203
PB-275 607/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Generation of EM Susceptibility Test Fields Using a Large Absorber-Loaded TEM Cell.
Final rept.,
M. L. Crawford, J. L. Workman, and C. L. Thomas. Sep 77, 6p
Pub. in IEEE Transactions on Instrumentation and Measurement, IM26 n3 p225-230 Sep 77.

Keywords: *Radiofrequency generators, *Electromagnetic compatibility, Simulators, Radiofrequency interference, Electronic equipment, Test equipment, Electromagnetic interference, TEM cells, Reprints.

The paper discusses the development of an Electromagnetic Simulator for accurate generation of broadband susceptibility test fields within a shielded environment. The simulator consists of a large, 3m x 3m x 6m, rectangular, transverse electromagnetic (TEM), transmission cell, that is loaded with rf absorber to suppress multimoding at frequencies above the cell's waveguide cut-off or resonant frequencies. The paper describes the measurement facility and technique, and the experimental verification of pertinent test parameters such as system VSWR, insertion loss, and test field uniformity. The measurement system is anticipated to provide swept, automated susceptibility measurements of electronic equipment to CW, pulsed, and EMP fields within the frequency band, 10 kHz to 1 GHz.

708,204
PB-280 527/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Service Lives of Major Appliances.
Interim rept.,
T. J. Wang, and S. W. Stiefel. 1977, 4p
Prepared in cooperation with Missouri Univ.-Columbia. American Council on Consumer Interests.
Pub. in Proceedings of Annual Conference of American Council on Consumer Interests (23rd), Denver, Colo., Apr. 20-23, 1977, p14-17.

Keywords: *Consumer affairs, *Electric equipment, *Service life, Household goods, Disposal, Demands(Economics), Manufacturers, Durability, Operating costs, Purchasing, *Household appliances, Life cycle costs.

Information on retention and on disposal of major household appliances will assist in determining both the demands of consumers and the requirements of manufacturers for product durability. Preliminary results of studies in progress indicate that almost all managers of rental properties tend to retain the original appliances in their properties as long as possible, whereas a significant number of individual home owners dispose of appliances after only relatively short periods. Efforts are under way to develop data on several-year operating costs of appliances so that consumers might be able to use life-cycle costing considerations in the purchase of new appliances.

708,205
PB-282 879/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optical Methods of Electrical Measurement at High Voltage Levels.
Final rept.,
R. E. Hebner, R. Malewski, and E. C. Cassidy. Nov 77, 25p
Pub. in Proceedings of IEEE, v65 n11 p1524-1548 Nov 77.

Keywords: *Electrical measurement, *Optical measuring instruments, High voltage, Faraday effect, Kerr magnetooptical effect, Electrooptics, Birefringence.

Optical methods to measure electric parameters and transmit the information from high voltage circuits to ground potential are described and evaluated in the light of the specific requirements of high voltage measurement applications. The history and physics of a variety of opto-electrical methods found suitable for electrical measurement applications are introduced. Existing optical devices for measuring alternating, direct, and impulse currents and voltages in high voltage circuits are reviewed with emphasis on the operation and features of several selected methods. The use of these techniques in high voltage and industrial power systems, in research laboratory apparatus, and in reference standards laboratories is discussed.

708,206
PB-282 921/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Where We Stand and Where We Need to Go: Electronic Technology.
Final rept.,
J. C. French. 1976, 1p
Pub. in Proceedings of 1976 Symposium of the National Conference of Standards Laboratories, National Bureau of Standards, Gaithersburg, Md. October 6-8, 1976.

Keywords: *Electronics, Technology assessment, Forecasting, Measurement.

The growth of electronics and its spread as a valuable tool throughout society's endeavors have been remarkable. Its growth and pervasiveness are expected to continue as the technology advances in the future. These advances, however, will enlarge a problem to which standards laboratories should increasingly direct their attention: the inadequacy of measurement methods needed to control the properties of materials and equipment as they enter into and are used on a manufacturing line, and those needed to characterize the manufactured product. These inadequacies are inhibiting productivity and the uniformity and reliability of products to a degree that concerns both the manufacturers and users of these products.

708,207
PB-282 937/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Review of Electromagnetic Measurements Using the Josephson Effect.
Final rept.,
R. A. Kamper. 1974, 8p
Pub. in Proceedings ISA Int. Instrumentation-Automation Conference, Held at New York, N.Y. on October 28-31, 1974, p1-8.

Keywords: *Measuring instruments, Josephson junctions, Superconductivity, Measurement, Cryostats.

Practical systems are now at various stages of development to measure voltage, current, rf power and attenuation, sub-millimeter wave frequency, noise temperature, magnetic susceptibility, and the magnetic activities of the earth and the human body. All these systems employ the Josephson effect in superconductors. Their widespread adoption will take liquid helium cryostats to places where they have never been seen before.

708,208
PB-283 541/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Automatic Network Measurements in the Time Domain,
J. R. Andrews. Apr 78, 10p
Pub. in Proceedings of IEEE, v66 n4 p414-423 Apr 78.

Keywords: *Network analyzers, Pulse generators, Minicomputers, Scattering, Measurement, Automation, Time domain, Fast fourier transforms.

The Time Domain Automatic Network Analyzer (TDANA) is described. It utilizes time domain measurements and the fast Fourier transform to obtain frequency domain scattering parameters. A TDANA consists of a pulse generator, sampling oscilloscope and a minicomputer. The present state of the art for TDANAs includes frequency coverage from dc to 18 GHz in a single instrument and a complex scattering parameter measurement uncertainties of the order of 1 percent.

708,209
PB-283 842/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Advances in Microwave Measurement Science.
Final rept.
G. F. Engen. Apr 78, 11p NBS-276.01
Pub. in Proc. IEEE v66 n4 p374-384 Apr 78.

Keywords: *Microwaves, *Measurement, Network analyzers, Connectors, Digital techniques, Power equations, Reprints.

With the recent impact of digital technology, a review of the subject of microwave measurements is timely. Following a brief summary of those features which make this a unique science, the current status of the

so-called basic standards for microwave measurements is noted. This is followed by a review of the use of digital techniques, power equation concepts, connector problems, and related developments. Finally, certain projections for the future are made.

708,210
PB-283 983/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Miniature ELF Electric Field Probe.
Final rept.,
M. Misakian, F. R. Kotter, and R. L. Kahler. Jul 78, 3p
Sponsored in part by Department of Energy, Washington, D.C.
Pub. in Review of Scientific Instruments, v49 n7 p933-935 Jul 78.

Keywords: *Probes, Electric fields, Alternating current, Measurement, Miniature electronic equipment, Laboratory equipment, Extremely low frequency, Reprints.

A miniature AC electric field probe, having direct electrical connections with its battery operated electronics, is described. Because its small size introduces little field perturbation, fields generated by relatively small electrode structures in laboratory environments can readily be characterized.

708,211
PB-284 484/3 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Boulder, Colo. Electromagnetic Technology Div.
Calibrating Two 6-Port Reflectometers with Only One Impedance Standard.
Technical note,
C. A. Hoer. Jun 78, 48p NBS-TN-1004
Contract CCG-77-99

Keywords: *Reflectometers, Calibrating, Standards, Network analyzers, Impedance.

The paper describes a technique for calibrating a pair of 6-port reflectometers for measuring the reflection coefficient of 1-port devices, or the scattering parameters of reciprocal 2-port devices. The operations in the calibration consist of connecting the two 6-ports together, connecting each 6-port to a calibration circuit consisting of two terminations of unknown impedance and a leveling loop, and then connecting the standard. The standard can be one termination whose complex impedance is known, or a precision length of transmission line whose cross-sectional dimensions are known. The length and loss of the line are not required. The solution for the constants which characterize each 6-port is closed, requiring no iteration.

708,212
PB-285 031/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Semiautomated Six Port for Measuring Millimeter-Wave Power and Complex Reflection Coefficient.
Final rept.,
M. P. Weidman. Dec 77, 3p
Pub. in IEEE Trans. Microwave Theory Tech. MTT-25, n12 p1083-1085 Dec 77.

Keywords: *Reflectometers, Millimeter waves, Radio-frequency power, Measurement, Junctions, Microwave equipment, Power measurement, Reprints, Six port junctions.

A six-port system has been developed and applied to the precision measurement of power and complex reflection coefficient in WR-15 (50-75 GHz) waveguide. The system is automated except for frequency and switching control for the signal source. This system provides a time-saving factor of at least five as compared to a tuned reflectometer with little, if any, degradation in accuracy.

708,213
PB-285 046/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Six-Port Measurement Technique: A Status Report.
Final rept.,
G. F. Engen. May 78, 7p
Pub. in Microwave Jnl. 21, n5 p18, 21-22, 24, 84, 87, 89.

Keywords: *Network analyzers, Microwave equipment, Junctions, Measurement, Reprints, Six port junctions.

Following a brief review of microwave measurement problems, the six-port is introduced as an alternative method for implementing the automatic network analyzer. Its advantages are discussed and the application to both one-port and two-port measurements described. This is followed by a description of practical six-port circuits, and the solution to their associated calibration problems. Finally, the status and performance of existing six-port measurement systems is presented.

708,214
PB-285 206/9 PC **A10**/MF **A01**
National Engineering Lab. (NBS), Boulder, Colo. Electromagnetic Technology Div.
Applications of the Homomorphic Transformation to Time Domain Measurement Problems,
S. M. Riad, and N. S. Nahman. Jun 78, 208p NBSIR-78-881
Sponsored in part by Colorado Univ., Boulder. Dept. of Electrical Engineering.

Keywords: *Signal processing, *Electromagnetic scattering, Fourier transformation, Laplace transformation, Nonlinear systems, Computer programs, Subroutines, Transmission lines, Antennas, *Homomorphic transformation, *Time domain, *Homomorphic systems, Homomorphic deconvolution, TDNA computer program, SMPL computer program, HDT subroutine, HDF subroutine.

The report presents a study of the theory and application of the homomorphic transformation to deconvolution problems occurring in time domain measurements in the picosecond time domain. A homomorphic deconvolution transform was developed and applied successfully to remove the time-windowing restriction required in many time domain measurements. Examples were presented including problems in time domain analysis of linear networks and dielectric spectroscopy, and scattering and multiple reflection in antenna (radiation) systems were considered and treated. Also considered was the development of a model for a 28 picosecond resolution feed through sampling-head, and the model's step response was computed. Simulation studies were performed using typical input waveforms and the oscilloscope model. The homomorphic transformation was used to deconvolve the model's impulse response from the simulated output. Comparison of the deconvolved output waveforms with the input waveforms showed agreement within the accuracy of the sampled-data simulation.

708,215
PB-285 225/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Network Analyzer Incorporating Two Six-Port Reflectometers.
Final rept.,
C. A. Hoer. Dec 77, 5p
Pub. in IEEE Trans. Microwave Theory Tech. MIT-25 n12 p1070-1074 Dec 77.

Keywords: *Network analyzers, Microwave equipment, Reflectometers, Junctions, Measurement, Reprints, Six port junctions.

This paper outlines the theory and design of a microwave network analyzer capable of measuring the network parameters of any linear reciprocal or nonreciprocal, active or passive two port. An RF signal from one source is applied at the same time to two six-port reflectometers which measure the incident and reflected waves at the ports of the two port being measured. An experimental dual six-port network analyzer for the 2-18-GHz range has been completed and is described briefly. Some advantages of the proposed design over existing network analyzer designs are (1) only one source is needed, (2) no phase detectors are required, (3) no flexible cables or arms are used between the reflectometers and the two port being measured, and (4) self-calibration techniques are readily applied.

708,216
PB-288 103/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of Pulse Transition Duration.
Final rept.
J. R. Andrews, and N. S. Nahman. Dec 77, 6p
Contract CCG-77-124
Pub. in Proceedings of Union Radio Scientifique Internationale Comm. A Symp., Lannion, France, 3-7 Oct 77 p159-164 Dec 1977. (International Union of Radio Science, Parks, France).

Keywords: *Pulsation, Measurement, Standards, Pulse generators, Low pass filters, Calibrating.

Pulse transition duration (10%-90% risetime) is a parameter that all engineers understand intuitively. However it is one of the more difficult parameters to precisely measure due to the difficulty in determining the baseline and topline (0% and 100% levels). The currently accepted standard for pulse terms, definitions, and measurements is IEC publication 469, issued in 1974. This paper discusses how NBS has implemented IEC-469 to establish a measurement service to calibrate transition duration transfer standards such as pulse generators and low pass filters. NBS designed transfer standards are also discussed.

708,217
PB-288 281/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
RMS Digital Voltmeter/Calibrator for Very Low Frequencies.
Final rept.,
H. K. Schoenwetter. Sep 78, 10p
Sponsored in part by Department of Defense Calibration Coordination Group, Redstone Arsenal, AL.
Pub. in Jnl. IEEE Trans. Instrum. Meas. IM-27, n3 p259-268 Sep 78.

Keywords: *Voltmeters, Calibrating, Digital systems, Portable equipment, Low voltage, Reprints.

A portable rms digital voltmeter was developed at NBS to support vibration measurements over the ranges of 0.1 Hz to 50 Hz and 2 mV to 10 V. A self-contained calibrator provides for self-calibration and may be used for calibrating other very low frequency voltmeters. The calibrator basically consists of a Kelvin-Varley divider fed by a reference voltage (either dc or sine-wave generated by a ROM-DAC combination). A multijunction thermal converter (MJTC) was selected as the sensing device in the rms/dc converter of the DVM since its low ac/dc difference facilitates calibration of the ac calibrator. Factors affecting accuracy and response time are analyzed . The DVM response time is 40s for the lowest input frequency. Its accuracy (percent of reading) is 0.1% above 0.5 Hz and 5 mV and 0.2% below these values. The ac calibrator accuracy is 0.025. Measurement accuracy improves by a factor of about 4 for transfer measurements (comparing input voltages with ac calibrator voltages). Means for extending this accuracy to 0.01% are discussed.

708,218
PB-289 089/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Design Considerations for Automatic Network Analyzers Based on the Six-Port Concept.
Final rept.
G. F. Engen. 1977, 2p
Pub. in Proceedings of Conference IEE Euromeas 77, Sussex (England) 5-9 Sep 77 p110-111 1977. (Institution of Electrical Engineers, London, England).

Keywords: *Network analyzers, Automatic control, Microwaves, Measurement, Six port.

Although the six-port measurement technique is rapidly gaining the attention of the microwave community, the theories developed to date yield but limited insight into the question of how best to design the six-port so as to best exploit the concept. This paper presents an alternative introduction to the general subject which yields substantially improved insight into the design question.

708,219
PB-289 090/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Expanding the Bandwidth of TEM Cells for EMC Measurements.
Final rept.,
M. L. Crawford, J. L. Workman, and C. L. Thomas. Aug 78, 8p
Pub. in IEEE Transactions on Electro-Magnetic Compatibility EMC20 n3 p368-375 Aug 78.

Keywords: *Electronic test equipment, *Electromagnetic interference, Electromagnetic compatibility, Bandwidth, Measurement, Standing wave ratios, Insertion loss, *TEM cells.

The paper discusses the development of a modified (absorber-loaded) transverse electromagnetic TEM cell with expanded bandwidth for use in accurately characterizing electromagnetic interference (EMI) fields within a shielded environment. The cell is analyzed experimentally, both before and after the modification, to determine its radio-frequency (FR) charac-

teristics, both as an RF transmission line and as an electromagnetic (EM) field simulator or detector. Comparative measurements are given to show the performance of the modified versus the unmodified cell in parameters such as voltage standing-wave ratio (VSWR), insertion loss, test-field uniformity, and reverse-coupling characteristics. The results of these measurements indicate an approximate two-fold increase in the upper useful frequency of the modified cell. An example of using the cell to evaluate the radiated emissions from a common electronic module (microprocessor timing circuit) is given. Finally, the technique of absorber loading is extended to larger cells, specifically a 3- x 3- x 6-m cell.

708,220

PB-289 094/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Instrumentation: Six Ports Simplify Network.
Final rept.,
G. F. Engen. Jan 78, 2p
Pub. in Microwave Syst. News, p54-55 Jan 78.

Keywords: *Network analyzers, Automatic control, Microwaves, Measurement.

The concept of the 6-port microwave measuring system is introduced and placed in the context of the evolution of microwave measurement technique.

708,221

PB-293 490/9 PC **A06**/MF **A01**
RCA Labs., Princeton, NJ.
High-Speed Spreading Resistance Probe.
Final rept. 24 Apr 75-30 Jun 76.
N. Goldsmith, and A. Mayer. Mar 79, 112p NBS/GCR-79/166
Contracts NBS-5-35914, ARPA Order-2397

Keywords: *Probes, *Electrical resistance meters, Silicon, Wafers, Semiconductor doping, Analog to digital converters, Continuous spreading resistance probes.

The application of the continuous spreading resistance (CSR) measurement concept instead of the point-by-point measurement of SR was shown to be feasible. The continuous spreading resistance (CSR) probe developed is capable of measuring the SR 5 to 20 times faster than existing commercial probes. Probes made from a tungsten carbide-cobalt alloy have been evaluated for use as a CSR probe and can be used for extended periods of time. A novel mechanical system of keeping the points of the probes in firm contact while the specimen is continuously moved under them was put into operation. A digitizer parallel-to-series converter was constructed that forms the basic building block for a computerized data-handling system. The few data obtained from specially prepared deep-diffused specimens indicate that this may well prove to be a very useful method of rapidly standardizing SR measurement. The resolution of the CSR instrument is at least as good as that of the stepping probe and shows promise as a method of resolving doping profiles of extremely thin layers.

708,222

PB-294 120/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Fast Response Low-Frequency Voltmeter.
Final rept.,
B. F. Field. Dec 78, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-27, n4, p368-372, Dec 78.

Keywords: *Voltmeters, Alternating current, Reaction time, Wave analyzers, Reprints, Microprocessors.

A sampling voltmeter implemented with a microprocessor has been developed to perform as a true rms voltmeter and waveform analyzer. The instrument measures to 0.1 percent accuracy the true rms voltage of approximately sinusoidal inputs at voltages from 2 mV to 10 V and frequencies from 0.1 to 120 Hz. The major feature of the instrument is fast response time, with a total autoranging, settling, and measurement time of two signal periods for frequencies below 10 Hz.

708,223

PB-294 992/3 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Technology Div.
Calibrating a Six-Port Reflectometer with Four Impedance Standards.
Technical note.
C. A. Hoer. Mar 79, 23p NBS-TN-1012

Keywords: *Reflectometers, Calibrating, Standards, Impedance, Coefficients.

The report is a theoretical study showing how four terminations of known impedance can be used to calibrate a six-port reflectometer for measuring other terminations of unknown impedance. The equations for obtaining the calibration constants are exact but nonlinear, requiring an iterative solution. Several ways are described for using these constants to calculate the impedance of terminations being measured with the six-port reflectometer.

708,224

PB-295 517/7 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Construction of a Large Transverse Electromagnetic Cell.
W. F. Decker, W. A. Wilson, and M. L. Crawford. Feb 79, 89p NBS-TN-1011

Keywords: *Test chambers, Construction, Electromagnetic interference, Drawings, Fabrication, Design, *Transverse electromagnetic cells.

In support of the electromagnetic interference studies underway in the Electromagnetic Fields Division of the National Bureau of Standards, a 2.8 meter transverse electromagnetic (TEM) cell was constructed by the Instrument Shops Division of the NBS Boulder Laboratories. The cell requirements, design concepts, and fabrication procedures were developed through the coordination of both the Electromagnetic Fields Division personnel and the Instrument Shops Division personnel. This paper provides the sequential procedure used to fabricate this cell, in conjunction with a complete set of detail and assembly drawings used to illustrate the complete fabrication process. The purpose of this publication is to provide documented information sufficient for any outside vendor, with the proper facilities, to construct a similar TEM cell.

708,225

PB-295 589/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Bridge Circuit for the Dynamic Characterization of Sample/Hold Amplifiers.
Final rept.,
T. M. Souders. Dec 78, 5p
Sponsored in part by Department of Defense, Washington, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-27, n4, p409-413, Dec 78.

Keywords: *Electric bridges, Amplifiers, Sampling, Tests, Reprints.

A transformer bridge technique is described for measuring the dynamic performance of sample/hold amplifiers (S/H's). The technique accurately measures dynamic gain errors, signal delay, aperture time delay and jitter, and acquisition time. These parameters are of particular importance to simultaneous data acquisition. The bridge is self-calibrating, and the voltage and time resolution are primarily limited only by the oscilloscope which serves as a detector.

708,226

PB-296 108/4 Not available NTIS
National Bureau of Standards, Washington, DC.
International Comparison of Power Measurements at 120 V, 5 A, and 60 Hz.
Final rept.,
R. C. McAuliff, K. J. Lentner, W. J. M. Moore, and G. Schuster. Dec 78, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 27, n4, p445-449, Dec 78.

Keywords: *Power measurement, Alternating current, Wattmeters, Comparison, Metrology, Reprints.

An international comparison of ac power measurements between metrology laboratories at the Physikalisch-Technische Bundesanstalt--Institut Berlin, (PTB(IB)), the Electrosystems Division of the National Bureau of Standards (NBS), and the Division of Electrical Engineering at the National Research Council of Canada (NRC(EE)) is described. The three calibration systems, each of different design and developed independently, are discussed, and estimates of the systematic uncertainties are given. The transfer standard was a recently developed thermal wattmeter of high stability. No laboratory differed by more than plus or minus 15 parts per million (ppm) from the average, with reference to apparent power at unity and 0.5 power factors, lead, and lag. This is consistent with the error limits estimated by each of the participants.

708,227

PB-296 114/2 Not available NTIS
National Bureau of Standards, Washington, DC.
International Comparison of High Voltage Capacitor Calibrations.
Final rept.,
W. E. Anderson, R. S. Davis, O. Petersons, and W. J. M. Moore. 1978, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems PAS-97, n4, p1217-1223, Jul/Aug 78.

Keywords: *Capacitors, *Calibrating, Comparison, High voltage, Standards, Reprints.

The suitability of a commercially available, compressed-gas-insulated, high voltage capacitor for precise measurement of ac voltages has been examined by national laboratories in the U.S.A. and Canada. The voltage, temperature, and pressure dependences and the mechanical stability of the capacitor were determined. It was found that, by taking proper precautions, the device is competitive with other methods. As a result of this research, it was also found that high voltage capacitance measurements at the two laboratories involved are in agreement.

708,228

PB-296 324/7 PC **A03**/MF **A01**
Colorado Univ., Boulder. Dept. of Electrical Engineering.
Variational Expression for the Scattering Matrix of a Coaxial Line Step Discontinuity and Its Application to an Over Moded Coaxial TEM Cell.
Rept. for Aug 78-Jan 79.
I. Sreenivasiah, and D. C. Chang. May 79, 48p NBSIR-79-1606

Keywords: *Test facilities, *S matrix theory, Electromagnetic interference, Electromagnetic compatibility, Coaxial cables, Equivalent circuits, Transverse electromagnetic cells, Transmission lines.

A step discontinuity in a coaxial transmission line, where one of the sections is large enough to support both TEM and TM(01) modes, may be modeled as a 3-port junction. A variational expression for the (3x3) scattering matrix of such a junction is obtained in simple closed form. The scattering matrix, so obtained, is used to analyze the transmission characteristics of a coaxial TEM cell beyond the cutoff point of the TM(01) mode. Finally, an equivalent circuit, along with the expressions for the circuit parameters, is given for the general case where the number of propagating modes in each section is finite but arbitrary.

708,229

PB-296 325/4 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Fields Div.
Using a TEM Cell for EMC Measurements of Electronic Equipment.
M. L. Crawford, and J. L. Workman. Apr 79, 72p NBS-TN-1013

Keywords: *Electric equipment, *Test facilities, *Electromagnetic compatibility, Electromagnetic interference, Measurement, Transverse electromagnetic cells.

The publication describes the physical design and electrical evaluation of pertinent parameters which influence the use and operation of a transverse electromagnetic (TEM) cell. Detailed, step by step procedures are given for using a TEM cell for performing either radiated EM susceptibility testing or for measuring radiated EM emissions from electronic/electro-mechanical equipment. These measurement procedures provide guidelines to potential users and also indicate precautions to observe to minimize problems often encountered when performing EMC measurements and hence to enhance the cell's usefulness. Where available, a brief error analysis associated with the measurement technique is included.

708,230
PB-297 933/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calibrating Two Six-Port Reflectometers With an Unknown Length of Precision Transmission Line.
Final rept.
C. A. Hoer. 1978, 3p
Pub. in Proceedings IEEE MIT-S Int. Microwave Symp. Digest, Held at Ottawa, Canada on Jun 27-29, 1978, p176-178.

Keywords: *Reflectometers, Calibrating, Network analyzers, Six ports.

The paper describes a technique for calibrating a pair of 6-port reflectometers for measuring the complex reflection coefficient of 1-port devices, or the scattering parameters of reciprocal 2-port devices. The operations in the calibration consist of connecting the two 6-ports together, connecting each 6-port to a calibration circuit consisting of two unknown terminations and a leveling loop, and then connecting the standard. The standard can be one termination whose complex impedance is known, or a length of precision transmission line whose cross-sectional dimensions are known. The length and loss of the line are not required. The solution for the constants which characterize each 6-port is closed, requiring no iteration.

708,231
PB-297 934/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Performance of a Dual Six-Port Automatic Network Analyzer.
Final rept.
C. A. Hoer. 1979, 3p
Pub. in Proceedings IEEE MTT-S 1979, Int. Microwave Symp. Digest: The World of Microwaves, Orlando, FL., Apr 30-May 2, 1979; IEEE Cat. No. 79CHI439-9 MIT-S.

Keywords: *Network analyzers, Microwave equipment, Six ports, Reflectometers.

The precision, accuracy, and stability of an experimental dual 6-port automatic network analyzer operating in the 2-18 GHz range are given. Accuracy of 0.001 in reflection coefficient and 0.003 dB in attenuation have been maintained at 3 GHz over a 10 week period without recalibration.

708,232
PB-297 999/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Asymmetric Versus Symmetric TEM Cells for EMI Measurements.
Final rept.
M. L. Crawford, and J. L. Workman. 1979, 7p
Pub. in Proceedings IEEE Int. Symp. on Electromagnetic Compatibility, Held at Atlanta, GA. on Jun 20-22, 1978, p204-210 1979.

Keywords: *Electromagnetic interference, Measurement, Electromagnetic compatibility, Measuring instruments, TEM cells.

The paper discusses the option of designing a transverse electromagnetic (TEM) transmission cell with an off-set septum as a multipurpose chamber for performing electromagnetic interference (EMI) measurements. The design and electrical performance characteristics of such a cell are given and compared with a similar sized symmetric cell.

708,233
PB-298 002/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison and Selection of Techniques for Measuring EM Radiated Emissions and Susceptibility of Large Equipment.
Final rept.
M. L. Crawford. May 79, 8p
Pub. in Proceedings Symp. and Technical Exhibition on Electromagnetic Compatibility (3rd), Held at Rotterdam (The Netherlands), on May 1-3, 1979. Paper in Electromagnetic Compatibility 1979, p115-122 May 79.

Keywords: *Electromagnetic radiation, Measurement, Electromagnetic compatibility.

The paper gives an overview of a number of techniques that could be used for measuring electromagnetic radiated emissions or susceptibility of large equipment. Each technique is assessed relative to operational and measurement parameters. Six techniques are selected as being optimum for specific applications.

708,234
PB-299 158/6 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Electricity Div.
National Measurement System for Electricity.
Final rept.
N. B. Belecki, B. L. Dunfee, and O. Petersons. Sep 78, 87p NBSIR-75-935

Keywords: *Electricity, *Measurement, Standards, National measurement system.

The National Electrical Measurement System, by which all measurements of electrical quantities are made in the U.S., is reviewed. This overview, based on the results of a four-year study, details the organizational structure of the system; the technical aspects of realizing, maintaining, dissemination and using the units for measurements; and the economic characteristics of its basic industry, the instrumentation industry, and the system's user constituency. Documentary standards and the organizations producing them are discussed, concluding with a survey of presently adopted documents. Its two major components, the electronics subset and the electric power subset, are defined, described, and contrasted. Major technical, management, and logistics problems facing the system are delineated. An in-depth view of the Electricity Division, which supplies the measurement base of the system, is given. Finally, recommendations for technical and management action by NBS in a number of areas are given.

708,235
PB-299 764/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements on Pulses and Pulse Transmission Media, Circuits and Components. Time-Domain Measurements.
Final rept.,
J. R. Andrews. 1978, 1p
Pub. in Review of Radio Science 1975-1977, p9 1978.

Keywords: *Pulse transmitters, Reviews, Measurement, Reprints, *Time domain, Pulses, Pulse measurement.

This is a short review, including references, of the advances in the stare of the art in time domain measurements. Both electrical and optical measurements are discussed.

708,236
PB-299 773/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Overview of the Six-Port Measurement Technique.
Final rept.
G. F. Engen. 1978, 2p
Pub. in Proceedings of 1978 IEEE MTT-S International Microwave Symposium Digest, Ottawa, Canada, June 27-29, 1978, p174-175 1978.

Keywords: *Network analyzers, *Microwave reflectometers, Microwaves, Measurement, Metrology, Six ports.

The advent of digital technology and the automatic network analyzer has had a major impact on the evolving microwave metrology. The six-port measurement technique provides an alternative method for implementing the automatic network analyzer, which yields significant advantages. This paper reviews the major features of this measurement approach.

708,237
PB-299 774/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibrating the Six-Port Reflectometer.
Final rept.
G. F. Engen. 1978, 2p
Pub. in Proceedings of 1978 IEEE MTT-S International Microwave Symposium Digest, Ottawa, Canada, June 27-29, 1978, p182-183 1978.

Keywords: *Reflectometers, Calibrating, Network analyzers, Microwaves, Measurement, Six ports.

Because complex heterodyne methods may be replaced by simple amplitude detectors, the six-port technique promises to have a major impact on the next generation of automatic network analyzers. This projection, however, is predicated upon the existence or development of calibration techiques which permit one to conveniently and accurately obtain the parameters which characterize the six-port. This paper describes a number of substantial refinements to a previously described procedure which is based upon the use of sliding terminations.

708,238
PB-299 775/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibrating the Six-Port Reflectometer by Means of Sliding Terminations.
Final rept.,
G. F. Engen. 1978, 7p
Pub. in IEEE Trans. Microwave Theory Tech. MTT-26, n12 p951-957 Dec 78.

Keywords: *Reflectometers, Calibrating, Network analyzers, Microwaves, Measurement, Reprints, Six ports.

The six-port technique promises to have a major impact on the next generation of automatic network analyzers because complex heterodyne methods may be replaced by simple amplitude detectors. This projection, however, is predicated upon the existence or development of calibration techniques which permit one to conveniently and accurately obtain the parameters which characterize the six-port. This paper describes a number of substantial refinements to a previously described procedure which is based upon the use of sliding terminations.

708,239
PB-299 776/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of 'Thru-Short-Delay' to the Calibration of the Dual Six-Port.
Final rept.
G. F. Engen, C. A. Hoer, and R. A. Speciale. 1978, 2p
Pub. in Proceedings of 1978 IEEE MTT-S International Microwave Symposium Digest, Ottawa, Canada, June 27-29, 1978, p184-185 1978.

Keywords: *Reflectometers, Calibrating, Network analyzers, Microwaves, Measurement, Six ports.

In a companion paper, in this digest, a scheme for reducing the (single) six-port calibration problem to that of an equivalent four-port reflectometer has been described. This now makes its possible to apply existing four-port calibration schemes. One such method is the 'thru-short-delay' (TSD) procedure. This paper briefly outlines this calibration approach.

708,240
PB-299 783/1 Not available NTIS
National Bureau of Standards, Washington, DC.
International Comparison of Inductive Voltage Divider Calibration Methods between 10 kHz and 100 kHz.
Final rept.,
K. Grohmann, and T. L. Zapf. 1979, 7p
Pub. in Met. 15, p69-75 1979.

Keywords: *Voltage dividers, Calibrating, Very low frequencies, Low frequencies, Reprints.

A comparison of methods used for the calibration of inductive voltage dividers at the National Bureau of Standards and the Physikalisch-Technische Bundesanstalt is presented in the frequency range between 10 kHz and 100 kHz. The error determinations performed on three transportable test dividers using two different calibration procedures agree well within the measurement uncertainity of plus or minus 3 x 10 to the minus 7 power, making evident the lack of systematic errors in both methods.

708,241
PB-299 786/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Advantages of the Six-Port Reflectometer for RF/Microwave Power Measurement in Operational Systems.
Final rept.
E. L. Komarek. 1978, 4p
Pub. in Proceedings of Government Microcircuit Applications Conference, Monterey, CA., November 14-16, 1978, 1978 GOMAC Digest of Papers VII, p39-42 Nov 78.

Keywords: *Microwave reflectometers, Microwaves, Power measurement, Six ports.

All methods have errors associated with them but because the six-port is completely calibratable, it is suggested as the most accurate option available to the microwave system designer. The three-port power monitor, four-port reflectometer and six-port reflectometer are reviewed and an example is used to illustrate the magnitude of maximum possible errors associated with each method. Also included in this paper is a suggested configuration of the six-port reflectometer suitable for integration into an operational microwave system.

708,242
PB-299 810/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Cryocoolers for Superconductive Electronics.
Final rept.
J. E. Zimmerman. 1979, 9p
Pub. in Proceedings AIP Conf. on Future Trends in Superconductive Electronics (44th), Held at Charlottesville, VA. on March 23-25, 1978, Section 7, p412-420 1979.

Keywords: *Cryogenics, Refrigerators, Superconductors, Josephson junctions, *Cryogenic refrigeration, *Cryocoolers, Squid devices.

Superconductive electronic devices are generally operated and will continue to be operated in liquid-helium cryostats. Appropriate small closed-cycle cryocoolers for these devices do not exist. Development of cryocoolers, including efficient use of conventional gas refrigeration cycles and innovative thoughts on new and unconventional methods, could greatly enhance the usefulness of small-scale superconductive electronics. Large cryocoolers are already well-developed and can be adapted to the requirements of large-scale systems, such as computers, requiring a watt or more of refrigeration.

708,243
PB-300 556/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of Calibration Techniques for Multimegavolt Impulse Dividers.
Final rept.
R. E. Hebner, and S. Annestrand. Aug 79, 4p
Pub. in Proceedings of the International Symposium on High Voltage Engineering (3rd) Held at Milan, Italy on August 28-31, 1979, p1-4, Aug 79.

Keywords: *Dividers, Calibrating, Pulsation, High voltage, Electric measuring instruments.

The calibration of a 4.5 MV impulse divider was evaluated by measuring both the input and the output waveforms and the response of the divider to a low voltage step. The measured output was compared to that which was found from a Duhamel's integral calculation using the input waveform and the measured response to a step. The validity of this approach for this large measurement system was demonstrated for the specific waveforms studied.

708,244
PB79-600058 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Discussion of F 78 169-5, 'Analysis of the Proximity Effects in Electric Field Measurements'.
M. Misakian, and F. R. Kotter. 1978, 2p
Pub. in IEEE Trans. Poser Appar. Syst. PAS-97, n6 p2175-2176 1978.

Keywords: *Electric field measurements, Instrumentation, Measurement procedures, Observer proximity effects, Power transmission lines, Russian measurement technique.

No abstract available.

708,245
PB80-103898 Not available NTIS
National Bureau of Standards, Washington, DC.
New Approach to Spectral Radiometry Based on Opto-Electronics.
Final rept.,
J. Geist, M. A. Lind, A. R. Schaefer, and E. F. Zalewski. 1976, 19p
Pub. in Proceedings of the International Symposium of the Technical Committee on Photon-Detectors, Held at Braunschweig (Germany, F.R.), on May 17-21, 1976, p149-167 1976.

Keywords: *Radiometry, Electrooptics, Power measurement, Photodetectors, Silicon, Lasers, Spectral radiometry.

Progress in developing a new approach to radiometry based on electro-optical technology is discussed. A feasibility experiment that demonstrates and motivates the new approach is described. The laser-based, characterization facility that plays a central role in the new approach, including the electrically calibrated pyroelectric radiometer that provides the absolute radiant power measurements, and recent investigations of silicon photovoltaic detectors that were performed on the facility are all described. Alternatives for extending the wavelength range of the new approach are also discussed.

708,246
PB80-105141 PC **A03**/MF **A01**
Colorado Univ., Boulder. Dept. of Electrical Engineering.
Dispersion and Attenuation Characteristics of Modes in a TEM-Cell with a Lossy Dielectric Slab,
J. C. Tippet, and D. C. Chang. Aug 79, 38p NBSIR-79/1615
Contract NBS-CST-8447

Keywords: *Electronic test equipment, Attenuation, Dielectrics, Lossy materials, TEM cells.

Dispersion and attenuation characteristics of the dominant mode in a TEM cell, loaded with a lossy dielectric slab, are investigated. It is shown that, while the insertion of the lossy material can indeed lower the Q-factor of the higher-order modes, the attenuation of the dominant mode also increases drastically as frequency increases. Correction to that effect must be taken before measurements in the cell are used to correlate to those taken in a free-space environment.

708,247
PB80-107436 Not available NTIS
National Bureau of Standards, Washington, DC.
'Thru-load-delay': An Improved Technique for Calibrating the Dual Six-port.
Final rept.,
G. F. Engen, and C. A. Hoer. 1979, 1p
Pub. in Proceedings Conf. on The World of Microwaves, Held at Orlando, FL on Apr 30-May 2, 1979; IEEE MTT-S 1979 Internatl. Microwave Symp. Digest, p53.

Keywords: *Network analyzers, Calibrating, Six ports.

In some earlier papers the use of a thru-short-delay technique for calibrating the dual six-port was described. Another scheme required only a length of precision transmission line and a calibration circuit. The better features of these two somewhat different approaches have now been combined and the requirement for either a known short, or a 'calibration circuit' eliminated. This paper will discuss this new procedure and also describe its application in a practical dual six-port system.

708,248
PB80-108533 Not available NTIS
National Bureau of Standards, Washington, DC.
Fast Superconducting Instruments.
Final rept.,
R. E. Harris, and C. A. Hamilton. 1978, 11p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of the AIP Conference on Future Trends in Superconductive Electronics (44th), Charlottesville, VA, March 23-25, 1978. Paper in Future Trends in Superconductive Electronics, p448-458 1978.

Keywords: *Instruments, Integrated circuits, Superconductivity, Josephson junctions, *Superconducting devices.

The emerging technology for fabricating superconducting integrated circuits offers the possibility of remarkable new instruments. The advantages of this form of electronics are high device speed and low dissipation, combined with lossless, dispersionless, properly terminated transmission lines. A number of possible new instruments are presented. It is shown that a small group can successfully fabricate the superconducting integrated circuits required for these new instruments.

708,249
PB80-117716 Not available NTIS
National Bureau of Standards, Washington, DC.
Modified Multimeter Measures Precise Voltage Ratios.
Final rept.,
D. Brenner. 1979, 3p
Pub. in Electronic Design 27, n21 p162-163, p165, 11 Oct 79.

Keywords: *Electrical measurement, *Multimeters, Ratios, Digital systems, Errors, Electrical potential, Reprints.

The article describes how a single wiring change can enable many dual-slope digital voltmeters to measure voltage ratios. A short discussion of resulting instrument errors is also presented, along with easily implemented techniques to correct for these errors. As a demonstration, an inexpensive 19 999 count digital multimeter was thus modified and used, with the result that voltage ratio measurements were not more than two counts (i.e., 0.01% of full scale) in error. The errors increased however, when the voltage that was the denominator of the ratio was too small (for the demonstration meter, less than about 8% of full scale).

708,250
PB80-119720 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Evaluation of a Multimegavolt Impulse Measurement System,
R. E. Hebner, D. L. Hillhouse, and R. A. Bullock. 15 Oct 79, 102p NBSIR-79-1933
Sponsored in part by Bonneville Power Administration, Portland, OR.

Keywords: *Electric measuring instruments, Pulsation, High voltage, Surges, Calibrating, Reaction time, Step response, Evaluation, Computer programs.

The calibration of a 4.5 MV impulse divider was evaluated by measuring both the input and output waveforms and the response of the divider to a low voltage step. The measured output was compared to an output calculated from the step response and the measured input waveform using Duhamel's Integral. The validity of the approach for this large measurement system was demonstrated for the specific waveforms studied.

708,251
PB80-123276 Not available NTIS
National Bureau of Standards, Washington, DC.
Compact Capacitor for Wide-Range Dielectric Constant Measurements on Small Amounts of Fluids.
Final rept.,
G. C. Straty, and B. A. Younglove. Oct 79, 2p
Pub. in Review of Scientific Instruments 50, n10, p1309-1310, Oct 79.

Keywords: *Electric measuring instruments, Capacitors, Dielectric properties, Fluids, Measurement, Reprints.

A stable parallel-plate capacitor of unusually simple design is described which is suitable for wide-range dielectric constant measurements on fluids.

708,252
PB80-131071 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS Provides Voltage Calibration Service in 0.1--10-Hz Range Using AC Voltmeter/Calibrator.
Final rept.,
H. K. Schoenwetter. Dec 79, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 28, n4, p327-331, Dec 79.

Keywords: *Voltmeters, *Electric potential, *Calibrating, Standards, Reprints, Voltage.

Prompted by the need to support vibration and pressure measurements at frequencies down to 0.5 Hz (with expected future needs to 0.1 Hz), NBS now offers a calibration service for voltage standards and rms voltmeters in the range of 0.1-10 Hz. The means for the service is an ac Voltmeter/Calibrator, an NBS-developed instrument containing an rms digital voltmeter and ac and dc voltage calibrators. The methods used to calibrate the ac voltage calibrator are discussed; also, application of the ac Voltmeter/Calibrator to the calibration of customers' voltage and voltmeter standards is described. Finally, a multifrequency voltage reference source with frequency-independent amplitude is proposed as a more suitable transfer standard than

thermal voltage converters (TVC's) for the 0.1-10 Hz range.

708,253
PB80-132780 Not available NTIS
National Bureau of Standards, Washington, DC.
Automated Test Set for High Resolution Analog-to-Digital and Digital-to-Analog Converters.
Final rept.,
T. M. Souders, and D. R. Flach. Dec 79, 6p
Sponsored in part by Department of Defense, Washington, DC. Calibration Coordination Group.
Pub. in IEEE Trans. Instrum. Meas. 28, n4, p239-244, Dec 79.

Keywords: *Test sets, Analog to digital converters, Digital to analog converters, Automation, Electronic test equipment, Reprints.

An automated test set is described for characterizing the static performance of high resolution ADC's and DAC's. Measured parameters include gain, offset, linearity, and equivalent ADC input noise with uncertainities of 2-4 ppm. Measurements to full accuracy can be made at a rate up to 40/s. A 20-bit DAC serves as a comparison standard.

708,254
PB80-188568 Not available NTIS
National Bureau of Standards, Washington, DC.
'Thru-Reflect-Line': An Improved Technique for Calibrating the Dual Six-Port Automatic Network Analyzer.
Final rept.,
G. F. Engen, and C. A. Hoer. 12 Dec 79, 7p
Pub. in IEEE Trans. Microwave Theory Tech. MTT-27, n12 p987-993, 12 Dec 79.

Keywords: *Network analyzers, Calibrating, Reprints, Six port.

In an earlier paper, the use of a thru-short-delay (TSD) technique for calibrating the dual six-port automatic network analyzer was described. Another scheme required only a length of precision transmission line and a calibration circuit. The better features of these two somewhat different approaches have now been combined and the requirement for either a known short, or a calibration circuit eliminated. This paper will develop the theory for this new procedure.

708,255
PB80-200686 Not avaliable NITS
National Bureau of Standards, Washington, DC.
Proposed Josephson-Effect Voltage Standard at Zero Current Bias.
Final rept.,
R. L. Kautz. 1 Mar 80, 3p
Pub. in. Applied Physics Letters 36, n5 p386-388, 1 Mar 80.

Keywords: *Standards, Electric potential, Josephson junctions, Reprints.

A voltage standard has been proposed which uses a series array of Josephson junctions locked to rf-induced constant-voltage steps at zero current bias. The feasibility of this proposal is examined in theory and experiment by determining the conditions under which rf-induced steps cross the zero current axis and the stability of phase lock under the zero bias condition.

708,256
PB80-223472 Not available NTIS
National Bureau of Standards, Washington, DC.
Space Applications of Superconductivity: Digital Electronics.
Final rept.,
R. E. Harris. Apr 80, 12p
Contract NASA-A-437018
Pub. in Cryogenics 20, n4 p171-182 Apr 80.

Keywords: *Superconductivity, *Electric equipment, Digital systems, Utilization, Josephson junctions, Reprints, Computer applications.

This is the fourth of a seven part series on the potential applications of superconductivity in space. Superconducting electronics offers a variety of remarkable properties including exceptionally high speed and low dissipation. The technology can be applied to both high speed computing and measurement. Its attributes may make it attractive for both ground-based and space applications.

708,257
PB81-104473 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser to Microwave Frequency Division Using Synchrotron Radiation II.
Final rept.
J. C. Bergquist, and D. J. Wineland. 1979, 4p
Pub. in Proc. Annual Frequency Control Symposium (32nd), Atlantic City, NJ., May 3-June 1, 1979, p494-497 1979.

Keywords: *Frequency dividers, Computation, Microwave frequencies, Infrared radiation, Feasibility, Synchrotron radiation.

The authors present a review of theoretical calculations which demonstrate the feasibility of obtaining one step frequency division from optical or infra-red laser frequencies to a subharmonic in the microwave spectral region, and include current experimental designs toward a practical realization of this goal.

708,258
PB81-109209 PC **A02**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Evaluation of Three-Terminal and Four-Terminal Pair Capacitors at High Frequencies.
Technical note.
R. N. Jones. Sep 80, 22p NBS-TN-1024

Keywords: *Capacitance, Calibrating, Standards, Electrical impedance.

The low frequency (1 kHz) capacitance values of three-terminal and four-terminal pair air dielectric capacitors can be extrapolated to higher frequencies if the residual series inductance is known. A resonance method for evaluating the residual series inductance of these capacitor types, together with the extrapolation procedure, is described. For the region where the product of capacitance in farads and frequency in hertz is 0.01 or less, uncertainties of one percent or less may be obtained.

708,259
PB81-110728 Not available NTIS
National Bureau of Standards, Washington, DC.
Wideband RF Voltage Comparator.
Final rept.
L. D. Driver, and F. X. Ries. 1980, 2p
Pub. in Proc. Conf. on Precision Electromagnetic Measurements, Held at Braunschweig, (Germany, F.R.) on June 23-27, 1980. IEEE No. 80CH1497-71M p487-488 1980.

Keywords: *Comparators, *Voltage measuring instruments, Radiofrequency power, Broadband.

A wideband rf voltage comparator is described which enables highly accurate rf voltage measurements over the range of 10 mV rms to 20 V rms from less than 100 kHz to beyond 1 GHz. This device uses a pair of matched Schottky-barrier diodes in each of two independent dual channel configurations. The coaxial line sections are impedance compensated to assure a VSWR of less than 1.03 up to 1 GHz.

708,260
PB81-118515 Not available NTIS
National Bureau of Standards, Washington, DC.
Review of the Six-Port Network Analyzer Development at NBS.
Final rept.
G. F. Engen. 1980, 2p
Pub. in Proc. Conf. on Precision Electromagnetic Measurements, Braunschweig (Germany, F.R.) Jun 23-27, 1980, IEEE Cat. No. 80CH1497-71M, p323-324 1980.

Keywords: *Network analyzers, Reviews, Six port.

In recent years a network analyzer, providing both amplitude and phase, has been developed which is based upon the use of a non-ideal six-port network and four detectors which provide amplitude response only. The interest in this method is reflected by a bibliography of more than forty items which span the past seven years. This paper will review this development, highlight the important features, and identify remaining problem areas.

708,261
PB81-179731 Not available NTIS
National Bureau of Standards, Washington, DC.
Semiautomatic System for AC/DC Difference Calibration.
Final rept.
K. J. Lentner, C. B. Childers, and S. G. Tremaine. Dec 80, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-29, n4 p400-405 Dec 80.

Keywords: *Electrical measurement, Alternating current, Calibrating, Reprints.

A semiautomatic ac/dc difference calibration system is described. The system operates over a frequency range of 20 Hz to 100 kHz, covering the voltage range from 0.5 V to 1 kV. For all voltages at frequencies in the range from 20 Hz to 20 kHz, the total uncertainty is 50 ppm and 100 ppm for voltages at frequencies between 20 kHz and 100 kHz. In addition to ac/dc difference testing, the system can be readily adapted to calibrate precision ac digital voltmeters or ac calibrators.

708,262
PB81-181257 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Evaluation of a Reverberation Chamber Facility for Performing EM Radiated Fields Susceptibility Measurements.
M. L. Crawford. Feb 81, 43p NBSIR-81-1638

Keywords: *Test chambers, Reverberation, Electromagnetic fields, Cavity resonators, Electric equipment, Electromagnetic susceptibility.

This report describes measurement procedures and results for evaluation of a large 2.44m x 3.05m x 7.62m reverberating chamber facility in the frequency range (100-1000) MHz. This facility, referred to as a translational electromagnetic environment chamber, 'TEMEC', is a mode tuned chamber developed for use in measuring electronic equipment susceptibility to EM radiated fields.

708,263
PB81-207219 Not available NTIS
National Bureau of Standards, Washington, DC.
Simple Parallel Interface Between an Optical Multichannel Analyser Detector Controller and a Microprocessor.
Final rept.
S. E. Bialkowski. Jun 80, 2p
Pub. in Review of Scientific Instruments 51, n6 p850-851 Jun 80.

Keywords: *Pulse height analyzers, Interfaces, Controllers, Data transmission, Reprints, Microprocessors, NTISCOMNBS.

A simple circuit is given which will allow data transfer from a LSI-11 DRV11 parallel interface unit to a PARC 1216 Optical Multichannel Detector Controller. The Circuit for OMA to LSI-11 data transfer is slightly more complicated. Data buffering is used so that data transfer can occur without time-out loss due to the dynamic memory refresh cycle of the LSI-11. The circuit may be constructed and mounted within the PARC 1216 unit with only minor, noncritical, modifications to the controller unit. The unit is able to transmit data from the 1216 controller running at dwell times as short as 40 microsecs/channel.

708,264
PB81-207326 Not available NTIS
National Bureau of Standards, Washington, DC.
Josephson Voltage Standard Using a Series Array of 100 Junctions.
Final rept.
R. L. Kautz, and G. Costabile. 1 Jan 81, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics MAG-17, n1 p780-783, 1 Jan 81.

Keywords: *Standards, *Josephson junctions, Superconductivity, Electrical potential, Arrays, Reprints, *Voltage standards.

The design and operation of a 100 junction array fabricated using photolithography is described.

708,265
PB81-207896 PC **A06**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.

Design and Calibration of the NBS Isotropic Electric-Field Monitor (EFM-5), 0.2 to 1000 MHz.
E. B. Larsen, and F. X. Ries. Mar 81, 113p NBS-TN-1033
Sponsored in part by Department of the Army, Washington, DC.

Keywords: *Monitors, Field strength, Electromagnetic fields, Antennas, Measurement, Probes, Design, Calibrating.

A broadband rf radiation monitor was developed at NBS for the frequency range of 200 kHz to 1000 MHz. The isotropic antenna unit consists of three mutually-orthogonal dipoles, each 5 cm long by 2 mm wide. The receiver described in this paper has an accurate measurement range of 1 to 1000 V/m. The readout indication is in terms of the Hermitian or total magnitude of the electric (E) field strength, which is equal to the root-sum-square value of three perpendicular E-field components at the measurement point.

708,266

PB81-207904 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Excitation of a TEM (Transverse Electromagnetic) Cell by a Vertical Electric Hertzian Dipole.
P. F. Wilson, D. C. Chang, and M. T. Ma. Mar 81, 44p NBS-TN-1037
Prepared in cooperation with Colorado Univ. at Boulder.

Keywords: Excitation, Dipoles, Electromagnetic fields, Impedance, *TEM cells.

The excitation of a transverse electromagnetic (TEM) cell by a vertical electric Hertzian dipole is analyzed where the gap between the septum and side wall is assumed to be small. Approximate expressions for the field distribution and characteristic impedance are derived. These expressions are numerically evaluated for some typical geometries, and good agreement with previously published results is shown. The formation also allows a vertical offset for the septum position, thus offering more flexibility of increasing the size of the test area to accommodate larger pieces of test equipment.

708,267

PB81-209256 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Theoretical and Experimental Investigations of Electromagnetic Field Distortion Due to a Perfectly Conducting Rectangular Cylinder in a Transverse Electromagnetic Cell.
M. Kanda. Apr 81, 50p NBS-TN-1028

Keywords: Electromagnetic compatibility, Electromagnetic fields, Distortion, *TEM cells.

The purpose of this paper is to discuss the loading ef fects, i.e., the electromagnetic field distortion caused by an object under test in a TEM cell.

708,268

PB81-211286 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Amplitude Calibrator for Oscilloscopes.
J. R. Andrews, and E. E. Baldwin. Apr 81, 32p NBSIR-81-1646

Keywords: *Calibrating, *Oscilloscopes, Instruments.

The amplitude calibrator is designed to provide known dc voltage levels or 1 kHz square waves from plus or minus 1 mV to plus or minus 5 V. It features selectable output impedances of < 0.1 ohms, 50 ohms, and 1 M ohms. The instrument is designed with sufficient current capability to deliver its indicated voltage into a 50 ohms termination. To protect delicate sampling oscilloscopes, a limiter circuit can also be activated to limit the output voltage to plus or minus 1.8 V.

708,269

PB81-212862 PC **A04**/MF **A01**
Colorado Univ. at Boulder. Electromagnetics Lab.
Method of Determining the Emission and Susceptibility Levels of Electrically Small Objects Using a TEM Cell.
Technical note.
I. Sreenivasiah, D. C. Chang, and M. T. Ma. Apr 81, 55p NBS-TN-1040

Keywords: *Electromagnetic radiation, Sources, Electronic test equipment, Dipoles, Radiofrequency power, Mathematical analysis, Measurement, TEM cells.

An electrically small radiating source of arbitrary shape may, to a first order, be modeled by an equivalent dipole system consisting of three orthogonal electric dipoles and three orthogonal magnetic dipoles each excited with arbitrary amplitude and phase. Determination of the individual electric dipole moments and the cross-components of such an equivalent dipole system for the emission case by tests inside a TEM cell, was described in an earlier work by Sreenivasiah, Chang and Ma, assuming a constant TEM modal field distribution in the space occupied by the test object. A method of accounting for the first-order variation in the TEM modal field distribution is presented in this report. This involves the inclusion of electric quadrupole terms in the modeling of the test object. Using the reciprocity principle, the same method is extended to the determination of susceptibility levels of electrically small test objects. Some experimental results for the susceptibility test, demonstrating the importance of the quadrupole terms, are presented.

708,270

PB81-214892 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Microelectronic Test Patterns NBS-12 and NBS-24.
G. P . Carver, R. L. Mattis, and M. G. Buehler. May 81, 41p NBSIR-81-2234

Keywords: Resistors, Field effect transistors, Metal oxide transistors, Microelectronics, Electrometers, *Test patterns.

Microelectronic test patterns NBS-12 and NBS-24 are modular developmental patterns for experimentally evaluating improved designs of certain test structures. NBS-12 addresses geometric design considerations for the cross-bridge sheet resistor test structure. NBS-24 contains a variety of preliminary designs for the integrated gated-diode electrometer and a series of variations on the design of the MOSFET dc profiler. Both patterns also include assorted process parameter test structures. Tables of design parameters, functional descriptions of the test structures in each pattern, and computer-composed outline drawings showing all of the test structures are included.

708,271

PB81-220444 Not available NTIS
National Bureau of Standards, Washington, DC.
International Comparison of Thermal Converters as AC-DC Transfer Standards.
Final rept.
O. P. Galakhova, S. Harkness, F. L. Hermach, H. Hirayama, P. Martin, T. H. Rozdestvenskaya, and E. S. Williams. 4 Dec 80, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-29, n4 p396-399, 4 Dec 80.

Keywords: *Electric converters, Standards, Electric current, Electric potential, Measurement, Comparison, Thermoelectric generators, Reprints.

The ac-dc differences of 4 sets of thermal current and voltage converters were determined at 40 Hz, 20 kHz, ad 50 kHz with reference to the standards of the national metrology laboratories of the United Kingdom, Japan, the Soviet Union, and the United States. For each voltage and current range and at each frequency, the average ac-dc difference determined by each laboratory for the 4 sets differed from the average of all laboratories by less than 10 ppm.

708,272

PB81-220451 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermoelement Comparator for Automatic AC-DC Difference Measurements.
Final rept.
E. S. Williams. 4 Dec 80, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-29, n4 p405-409, 4 Dec 80.

Keywords: *Comparators, *Electric converters, Calibrating, Electrical measurement, Voltmeters, Thermoelectric generators, Reprints.

AC-DC differences in thermal voltage converters (TVC's) are determined relative to a similar instrument, from imbalance EMF's measured in a divider circuit to which both instrument outputs are connected. These EMF's are more stable than the input voltages to the converters, because input voltage fluctuations produce nearly equal proportional changes in the converter outputs. The divider balance is therefore affected only slightly. The divider and a Lindeck potentiometer for monitoring the test instrument output are driven by stepping motors and balanced automatically. AC and DC voltages are applied by programmable power supplies whose outputs are adjusted, in response to imbalance EMF's in the potentiometer circuit, to produce equal output from the test instrument. The system automatically calibrates one voltage range at one or more frequencies, but requires an operator to change ranges and to enter the test parameter at a computer terminal.

708,273

PB81-233736 Not available NTIS
National Bureau of Standards, Washington, DC.
Challenges of EMI Measurements.
Final rept.
C. K. S. Miller. Mar 81, 8p
Pub. in Proceedings of Workshop and Symposium National Conference of Standards Laboratories (1980), Gaithersburg, MD., September 22-25, 1980, Paper in NCSL Newsletter 21, n1 p16-23 Mar 81.

Keywords: *Electromagnetic interference, Measurement.

In recent years there has been increasing publicity devoted to the proliferating problems associated with electromagnetic interference (EMI). The first step in understanding the nature of the EMI problem and ultimately controlling or regulating the sources is being able to quantify the problem through accurate measurement. EMI measurements are difficult to make because of the wide range of field strengths and frequencies, the complex waveforms, transient sources, field condition, etc. NBS has had an active program underway for some time to upgrade the state-of-the-art for EMI measurements and this program is producing important results. This paper reviews the EMI problem, describes the measurement challenges and NBS' response, and discusses the implications of EMI measurements for the metrology community.

708,274

PB81-240285 Not available NTIS
National Bureau of Standards, Washington, DC.
Discussion of 'Measuring Voltage and Current Harmonics on Distribution Systems' by M. F. McGranaghan, J. H. Shaw, and R. E. Owen.
Final rept.
D. A. Leep, and F. R. Kotter. Jul 81, 10p
Pub. in IEEE Transactions on Power Apparatus and Systems (PAS-100) n7 p3599-3608 Jul 81.

Keywords: *Electrical measurement, Reprints.

Comments and questions concerning voltage-measurement techniques used by the authors.

708,275

PB81-244857 PC **A04**/MF A01
National Bureau of Standards, Washington, DC. National Engineering Lab.
Using a TEM (Transverse Electromagnetic) Cell for EMC (Electromagnetic Compatibility) Measurements of Electronic Equipment.
M. L. Crawford, and J. L. Workman. Jul 81, 71p NBS-TN-1013
Supersedes PB-296 325.

Keywords: *Electric equipment, *Test facilities, *Electromagnetic compatibility, Electromagnetic interference, Measurement, Transverse electromagnetic cells.

This publication describes the physical design and electrical evaluation of pertinent parameters which influence the use and operation of a transverse electromagnetic (TEM) cell. Detailed, step-by-step procedures are given for using a TEM cell for performing either radiated EM susceptibility testing or for measuring radiated EM emissions from electronic/electro-mechanical equipment.

708,276
PB81-244899 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
NBS Phase Angle Calibration Standard.
Technical note (Final).
R. S. Turgel, N. M. Oldham, G. N. Stenbakken, and T. H. Kibalo. Jul 81, 130p NBS-TN-1144
Sponsored in part by Department of Defense Calibration Coordination Group, Redstone Arsenal, AL.

Keywords: *Phase angle, Calibrating, Standards.

A detailed description is given of the construction and operation of a calibration standard designed for use with phase meters. The resolution of the calibrator is approximately 2 millidegrees and its accuracy is of the order of 5-10 millidegrees depending somewhat on frequency and amplitude ratio of the output.

708,277
PB81-246639 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
WR 10 Millimeter Wave Microcalorimeter.
M. P. Weidman, and P. A. Hudson. Jun 81, 18p NBS-TN-1044

Keywords: *Calorimeters, Millimeter waves, Power, Standards.

A microcalorimeter has been built in WR 10 waveguide, 75-110 GHz, to serve as a power standard at the National Bureau of Standards (NBS). Included here is an evaluation of the errors in using the microcalorimeter for the measurement of effective efficiency of bolometer mounts.

708,278
PB82-105305 PC **A19**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
International Conference (6th) on Noise in Physical Systems.
Final rept.
P. H. E. Meijer, R. D. Mountain, and R. J. Soulen. Sep 81, 429p NBS-SP-614
Library of Congress catalog card no. 81-600084. Sponsored in part by National Science Foundation, Washington, DC., and Catholic Univ. of America, Washington, DC. Held at Gaithersburg, Maryland on April 6-10, 1981.

Keywords: *Noise, *Meetings, Theory, Measurement, Thermal noise, Electromagnetic noise, Quantum noise, Hot carrier noise.

This document contains the full text of papers submitted to the Sixth International Conference on Noise in Physical Systems. There are six categories of papers: theory; devices; 1/f noise; applications and measurement techniques; quantum noise; hot carrier noise.

708,279
PB82-137399 Not available NTIS
National Bureau of Standards, Washington, DC.
Simple Control Circuit for Temperature Regulation and Other Bridge Applications.
Final rept.
R. D. Cutkosky, and R. S. Davis. Sep 81, 3p
Pub. in Review of Scientific Instruments 52, n9 p1403-1405 Sep 81.

Keywords: *Temperature control, *Circuits, Electric bridges, Load cells, Resistance thermometers, Temperature measurement, Reprints.

A circuit is presented that makes use of low frequency square waves for exciting resistance bridges, detecting their departure from balance, and providing an output voltage for measurement or control purposes. Applications in several areas of precision metrology have been found.

708,280
PB82-137472 Not available NTIS
National Bureau of Standards, Washington, DC.
Critical Study of Emission and Susceptibility Levels of Electrically Small Objects from Tests Inside a TEM Cell.
Final rept.
I. Sreenivasiah, D. C. Chang, and M. T. Ma. 1981, 9p
Pub. in Proceedings of IEEE International Symposium on Electromagnetic Compatibility (1981), Boulder, Colorado, August 18-20, 1981, p499-507.

Keywords: *Electromagnetic compatibility, Measurement, Dipole moments, Electromagnetic radiation, Emission, TEM cells.

An electrically small radiating source of arbitrary shape may, to a first order, be modeled by an equivalent dipole system consisting of three orthogonal electric dipoles and three orthogonal magnetic dipoles each excited with arbitrary amplitude and phase. Determination of the individual electric dipole moments and the cross-components of such an equivalent dipole system for the emission case by tests inside a TEM cell, was described in an earlier work by Sreenivasiah, Chang and Ma, assuming a constant TEM modal field distribution in the space occupied by the test object. A method of accounting for the first-order variation in the TEM modal field distribution is presented in this report. This involves the inclusion of electric quadrupole terms in the modeling of the test object. Using the reciprocity principle, the same method is extended to the determination of susceptibility levels of electrically small test objects. Some experimental results for the susceptibility test, demonstrating the importance of the quadrupole terms, are presented.

708,281
PB82-137480 Not available NTIS
National Bureau of Standards, Washington, DC.
Free-Space Transmission Loss of Anechoic Chamber Performance Evaluation.
Final rept.
R. G. FitzGerrell. 1981, 2p
Pub. in Proceedings of IEEE International Symposium on Electromagnetic Compatibility (1981), Boulder, Colorado, August 18-20, 1981, p110-111.

Keywords: *Anechoic chambers, Evaluation, Transmission loss.

A longitudinal probe scan of an anechoic chamber yields a plot of measured transmission loss. Any deviation of this curve from calculated free-space transmission loss can be attributed to chamber reflections or, at small separation distances, to finite-range source antenna gain corrections or to source-probe interactions.

708,282
PB82-143959 Not available NTIS
National Bureau of Standards, Washington, DC.
Singularities in the Calibration of Six-Port Network Analyzers.
Final rept.
H. F. Ebbesen, and G. F. Engen. 1981, 2p
Pub. in Proceedings of IEEE MTT-S International Microwave Symposium (1981), Los Angeles, California, June 15-19, 1981, Paper in IEEE MTT-S International Microwave Symposium Digest, IEEE Cat. No. 81CH1592-5, p149-150.

Keywords: *Network analyzers, Calibrating, Six-port.

Numerical difficulties may be encountered when applying the TRL calibration algorithm to dual six-port analyzers. The possible occurrence of singularities is explained, and means of avoiding these are proposed.

708,283
PB82-144056 Not available NTIS
National Bureau of Standards, Washington, DC.
Design, Construction, and Calibration of the Broadband Electric Field Monitor (EFM-5).
Final rept.
J. E. Cruz. 1981, 6p
Pub. in Proceedings IEEE International Symposium on Electromagnetic Compatibility (1981), Boulder, Colorado, August 18-20, 1981, p439-444.

Keywords: *Field strength, Monitors, Electric fields, Design, Calibrating.

A broadband electric field monitor (EFM) in the frequency range of 200 kHz to 1 GHz has been developed with an isotropic response pattern and a 60 dB dynamic range (1 volt/meter to 1000 volts/meter). The readout is in terms of the total electric field magnitude. The EFM is designed to not perturb the field being measured and can measure average cw fields. This paper emphasizes the design and calibration of the EFM-5.

708,284
PB82-178989 PC **A09**/MF **A01**
National Bureau of Standards, Boulder, CO.
NBS 30/60 Megahertz Noise Measurement System Operation and Service Manual.
G. Counas, and T. Bremer. Dec 81, 181p NBSIR-81-1656

Keywords: *Electromagnetic noise, Measurement, Automation, Radiometers, Computer programs, Very high frequencies.

Calibration of coaxial noise sources at 30 and 60 MHz is now being accomplished using a total power radiometer designed to operate under computer control. Use of the IEEE 488 Instrument Bus and structured software techniques allows use and substitution of commercially available components with a minimum of hardware and software modification. This manual addresses the general theory of operation, operating procedures, and maintenance procedures for the NBS 30/60 MHz automated noise measurement system using a commercially available desktop calculator as the controller.

708,285
PB82-199431 Not available NTIS
National Bureau of Standards, Washington, DC.
Reference Materials and the Semiconductor Industry.
Final rept.
W. M. Bullis, and J. R. Ehrstein. Nov 81, 8p
Pub. in Solid State Technology, p56-63 Nov 81.

Keywords: Semiconductors, Silicon, Measurement, Microelectronics, Reprints, *Standard reference materials.

The Standard Reference Material (SRM) program at the National Bureau of Standards, which provides calibrated artifacts to various user communities, is one approach for improving measurement accuracy and compatibility. This article describes the SRM program at NBS and the requirements for effective utilization of SRMs. Application of the SRM program to the semiconductor industry is discussed both with respect to present and planned SRMs and with regard to meeting the more extensive and longer range needs of the industry.

708,286
PB82-210188 Not available NTIS
National Bureau of Standards, Washington, DC.
Background and Present Status of NBS Research on Isotropic E Field Probes.
Final rept.
E. B. Larsen. 1981, 5p
Pub. in Proceedings of IEEE International Symposium on Electromagnetic Compatibility, 'Rising to Greater Heights', Boulder, CO., August 18-20, 1981, IEEE Transactions on Electromagnetic Compatibility No. 81CH1675, p434-438 1981.

Keywords: *Radiation measuring instruments, Probes, Field strength, Radio field strength, Monitors.

A discussion is given of past rf probe development work at NBS. A new radiation monitor is described which has good isotropy over a 60 dB dynamic range (1 to 1000 V/m). The frequency range for flat response (within + or - 2 dB) is 0.2 to 1000 MHz. Electronic circuitry obtains the total magnitude of all field polarizations and frequency components. The special features, performance and essentials of design are given. The needs and direction of future probe research at NBS are also discussed. This paper emphasizes the background and early research on rf probes at NBS.

708,287
PB82-210428 Not available NTIS
National Bureau of Standards, Washington, DC.
Free-Space Transmission Loss for Anechoic Chamber Performance Evaluation.
Final rept.
R. G. FitzGerrell. 1981, 2p
Pub. in Proceedings of IEEE International Symposium on Electromagnetic Compatibility, 'Rising to Greater Heights', Boulder, CO, August 18-20, 1981, IEEE Transactions on Electromagnetic Compatibility No. 81CH1675-8, p110-111 1981.

Keywords: *Anechoic chambers, Calibrating, Errors, Transmission loss.

A longitudinal probe scan of an anechoic chamber yields a plot of measured transmission loss. Any deviation of this curve from calculated free-space transmission loss can be attributed to chamber reflections

or, at small separation distances, to finite-range source antenna gain corrections or to source-probe interactions.

708,288
PB82-210915 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamic Test Method for High Resolution A/D Converters.
Final rept.
T. M. Souders. Mar 82, 3p
Pub. in IEEE Transactions on Instrumentation and Measurement IM-31, n1 p3-5 Mar 82.

Keywords: *Tests, *Analog to digital converters, Step response, Reprints, High resolution.

A dynamic test method is described for A/D converters having up to 16 bits of resolution. The technique exercises the test converter with stepped input changes, simulating the output of an S/H amplifier. Dynamic errors as low as 4 ppm can be measured within 4 microseconds following a step change as large as 20 V.

708,289
PB82-210998 Not available NTIS
National Bureau of Standards, Washington, DC.
Microelectronic Test Chips and Associated Parametric Testers: Present and Future.
Final rept.
M. G. Buehler, and D. S. Perloff. 1981, 9p
Pub. in Semicond. Silicon 81-5, p859-867 1981.

Keywords: *Test equipment, *Microelectronics, Integrated circuits, Tests, Reprints, Test chips.

Microelectronic test chips for the characterization of materials, process and device parameters are becoming increasingly important tools for the design and production of integrated circuits. Because test chips are implemented using a variety of design criteria and testing approaches, substantial differences may exist in the usefulness of the information they provide. This paper summarizes the present practices in test chip usage and describes the parametric testers now available for test chip characterization. Emphasis is given to the technological changes which will contribute to the more effective use of test chips in the future, including: improved parametric testers, advanced test structures, comprehensive statistical analysis and data presentation techniques, and standards for test structures, test methods, and test languages.

708,290
PB82-233552 Not available NTIS
National Bureau of Standards, Washington, DC.
Options to Open-Field and Shielded Enclosure Electromagnetic Compatibility Measurements.
Final rept.
M. L. Crawford. 1981, 6p
Pub. in Proceedings of Symposium and Technical Exhibition on Electromagnetic Compatibility (4th), Zurich, Switzerland, March 10-12, 1981, p383-388.

Keywords: *Electromagnetic compatibility, Measurement, Test chambers, Transverse electromagnetic cells.

This paper discusses optional measurement techniques that are being investigated as potential alternatives to using open-field sites and conventional shielded enclosures for performing EMC measurements. Techniques discussed include: (1) low-Q underground or buried test chambers, (2) transverse electromagnetic (TEM) transmission line cells, and (3) reverberating or mode tuned/stirred enclosures.

708,291
PB82-233560 Not available NTIS
National Bureau of Standards, Washington, DC.
Predicting Free-Space Radiated Emissions from Electronic Equipment Using TEM Cell and Open-Field Site Measurements.
Final rept.
M. L. Crawford, and J. L. Workman. 1980, 6p
Pub. in Proceedings of 1980 International Symposium on Electromagnetic Compatibility, Baltimore, MD, October 7-9, 1980, IEEE Cat. No. 80CH1538-8EMC, p80-85.

Keywords: *Radiofrequency interference, Electric equipment, Predictions, Measurement, Electromagnetic compatibility, Transverse electromagnetic cells.

This paper gives an analysis for determining equivalent free-space (reference environment) radiated emissions from electronic equipment using transverse electromagnetic (TEM) cells and open-field site measurements. Test results and an estimate of the accuracy of emission measurements made using a 'control standard emitter' in TEM cells and on an open-field site are given and compared with the standard emitter's theoretically predicted free-space emissions.

708,292
PB82-234121 PC **A18**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Measurement of Electrical Quantities in Pulse Power Systems.
Final rept.
R. H. McKnight, and R. E. Hebner. Jun 82, 423p
NBS-SP-628
Proceedings of the Workshop on Measurement of Electrical Quantities in Pulse Power Systems Held at the NBS, Boulder, CO., Mar 2-4, 1981. Library of Congress catalog card no. 82-600535. Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DARPA Projects Agency, Arl., VA., DOE, Washington, DC., Naval Surface Weapons Center, Silver Spring, MD., and Harry Diamond Labs., Adelphi.

Keywords: *Electrical measurement, *Meetings, Electric current, Electric power, Energy, Data acquisition, Surges, Pulses, State of the art.

The Workshop on Measurement of Electrical Quantities in Pulse Power Systems addressed measurements in pulse systems having the characteristics of pulse duration less than a millisecond, system voltages greater than 10 kilovolts, and system currents greater than 10 kiloamperes. The presented papers were divided into four categories: voltage measurements; current measurements; power and energy measurements, and data acquisition. Included are discussions of applications of conventional measurement techniques and state-of-the-art systems.

708,293
PB82-234477 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Input Impedance of a Probe Antenna Exciting a TEM Cell.
Technical note.
P. F. Wilson, D. C. Chang, and M. T. Ma. Apr 82, 54p
NBS-TN-1054

Keywords: *Probes, Electrical impedance, Antennas, Test equipment, Greens function, Excitation, Transverse electromagnetic cells.

The input impedance of a probe antenna exciting a transverse electromagnetic (TEM) transmission line cell is formulated by a variational approach. The formulation also utilizes the results from a previous work on the field distribution inside a TEM cell excited by a vertical electrical Hertzian dipole. The final result of impedance is shown to consist of two distinct terms, which are respectively contributed by the ordinary rectangular waveguide and the gap perturbation. Numerical results for both the real and imaginary parts of the impedance are given. The resistive part is found to be proportional to the square of the probe length, and the reactive part largely capacitive.

708,294
PB82-238353 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Facility to Produce Uniform Space Charge for Evaluating Ion Measuring Instruments.
Final rept.
R. H. McKnight, and F. R. Kotter. Jun 82, 37p
NBSIR-82-2517
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Test facilities, *Space charge, Ion density(Concentration), Measuring instruments, Ion sources, Wind tunnels.

A low-speed wind tunnel containing space charge has been constructed and evaluated. The facility is used for testing the performance of ion counters and net space charge measuring devices. Depending on location within the system, space charge densities range from 2 -7 x 10 to the minus 8 power C/cu m. The space charge density is spatially uniform within plus or minus 5% over more than 90% of the cross sectional area of the test volume, but decreases by approximately 20% between two positions separated by 1 m. Ion densities achieved in this system are comparable to those found near high voltage dc transmission lines but are free from the accompanying large electric fields.

708,295
PB82-264003 Not available NTIS
National Bureau of Standards, Washington, DC.
Analytical Expression for the Evaluation of Leakage Current in the Integrated Gated-Diode Electrometer.
Final rept.
G. P. Carver, and M. G. Buehler. Dec 80, 8p
Pub. in IEEE Trans. Electron Devices ED-27, n12 p2245-2252 Dec 80.

Keywords: *Electrometers, *Semiconductor junctions, Electrical faults, Microelectronics, Test equipment, Test structures.

The integrated gated-diode electrometer microelectronic test structure permits automated measurement of leakage currents in p-n junctions. The test method incorporates on-chip signal processing using an electrometer amplifier. An analysis of the equivalent circuit, which includes the effects of loading by the electrometer, yields the working equations required for the interpretation of the measurements and the determination of the generation lifetime and surface-recombination velocity. In certain situations, the generation lifetime can be determined independently of the diode area, allowing the device size to be scaled down without sacrificing the signal amplitude.

708,296
PB83-104521 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Measurement of Electromagnetic Radiation from Electric-Rail Cars.
J. W. Adams. Aug 82, 23p NBSIR-82-1669
Sponsored in part by Transportation Systems Center, Cambridge, MA.

Keywords: *Electromagnetic radiation, Measurement, Electromagnetic interference, Rapid transit railways, Electric railroads, Railroad cars.

Existing Electromagnetic Compatibility (EMC) standards are not directly applicable for measuring Electromagnetic Interference (EMI) from an electric-rail vehicle. This report describes a measurement system and procedure that have potential for making the needed improvements. This system and procedure need further evaluation, use, and improvement before they could be considered for general use. The problems that were considered are discussed, and those that need additional work are given. Sample measured data from a Metropolitan Atlanta Rapid Transit Authority (MARTA) rail car are given. The measurements were performed at the Department of Transportation Test Center near Pueblo, Colorado.

708,297
PB83-107011 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fast Response, Low-Frequency Sampling Voltmeter.
Final rept.
B. A. Bell, B. F. Field, and T. H. Kibalo. Aug 82, 116p
NBS-TN-1159
Sponsored in part by Department of Defense, Washington, DC.

Keywords: *Voltmeters, Sampling, Distortion, Analyzers, Microprocessors.

A low-frequency voltmeter utilizing a sampling technique implemented with microprocessor-based electronics has been developed to perform as a true rms ac voltmeter and distortion analyzer. The instrument makes measurements accurate to plus or minus 1 percent (of reading) of the fundamental frequency, total harmonic distortion, and true rms voltage of approximately sinusoidal inputs from 2 mV to 10 V and frequencies from 0.1 to 120 Hz. A major feature of this instrument is the special window crossing and error function algorithms which provide a software means for completing a measurement within two signal periods at frequencies below 10 Hz.

708,298
PB83-133637 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.

Practical Uses of AC-DC Transfer Instruments.
Technical note (Final).
E. S. Williams. Oct 82, 41p NBS-TN-1166

Keywords: *Electrical measurement, *Comparators, Alternating current, Electrical potential.

Alternating currents and voltages are measured most accurately at this time when they are compared with nominally equal and known dc currents and voltages. The comparisons are usually made with thermal transfer instruments which respond nearly equally to ac and dc quantities. Practical information and recommended procedures are given for using these instruments along with diagrams of apparatus and examples of typical data and calculations. Methods for minimizing difficulties caused by dc reversal differences, thermal drift, energy picked up from local electromagnetic fields, and the deviation from square-law response of these instruments are considered. Causes of ac-dc differences are discussed, and methods for measuring them and applying corrections are also described.

708,299
PB83-146845 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Semiconductor Measurement Technology: Graphical Solution for the Helium Leak Detector and Radioisotope Methods of Hermetic Test - Master Graphs and Instructions.
Final rept.
S. Ruthberg. Nov 82, 40p NBS-SP-400-73
Library of Congress catalog card no. 82-600626.

Keywords: *Tests, *Hermetic seals, Leak detectors, Radioactive isotopes, Back pressure, Graphic methods, Electronic packaging, Helium.

A graphical procedure for solution of the molecular flow approximation for the back pressurization method of hermetic test makes use of a set of characteristic curves and a test line. The characteristic curves are appropriate for both the helium leak detector and the radioisotope methods of test, although the form of the test line differs between the two methods. Master graphs of the characteristic curves and test lines are now provided in a scale and format appropriate for producing suitable worksheets with a copier. Step-by-step instructions are given for their use in obtaining solutions for various examples relative to the test specifications in acceptance standards such as MIL-STD 883B, etc. One set of characteristics is provided specifically for the helium leak detector mode as expressed directly in terms of air leak rate; a second set is provided specifically for the krypton-85 radioisotope mode also in terms of air leak rate; and a third set is retained in the original form for use with any tracer gas.

708,300
PB83-165274 PC **A04**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Method to Quantify the Radiation Characteristics of an Unknown Interference Source.
Technical note.
M. T. Ma, and G. H. Koepke. Oct 82, 63p TN-1059
Portions of this document are not fully legible.

Keywords: *Electromagnetic interference, Electric equipment, Leakage, Measurement, Electronic equipment.

A new method for determining the radiation characteristics of leakage from electronic equipment for interference studies is described in this report. Basically, an unintentional leakage source is considered to be electrically small, and may be characterized by three equivalent orthogonal electric dipole moments and three equivalent orthogonal magnetic dipole moments.

708,301
PB83-165472 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Wave Form Simulations for Josephson Junction Circuits Used for Noise Thermometry.
F. Sullivan, D. Kahaner, H. A. Fowler, and J. Knapp-Cordes. Jan 83, 58p NBSIR-83-2643

Keywords: Josephson junctions, Mathematical models, Approximation, Waveform, Simulation, *Noise thermometry, Computer applications.

The authors are interested in numerical approximations to the solutions of the non-linear equation which is a model for simulating the behavior of the circuit consisting of a series connection of an inductor, a resistor and a Josephson junction (used as a noise thermometer).

708,302
PB83-179549 Not available NTIS
National Bureau of Standards, Washington, DC.
Performance of an Automated High Accuracy Phase Measurement System.
Final rept.
S. Stein, D. Glaze, J. Levine, J. Gray, D. Hilliard, D. Howe, and L. Erb. 1982, 7p
Pub. in Proceedings of Annual Symposium Frequency Control (36th), Philadelphia, PA. June 2-4, 1982, p314-320.

Keywords: *Phase measurement, Automation, Accuracy, Mixing circuits.

A fully automated measurement system has been developed that combines many properties previously realized with separate techniques. This system is an extension of the dual mixer time difference technique, and maintains its important features: zero dead time, absolute phase difference measurement, very high precision, the ability to measure oscillators of equal frequency and the ability to make measurements at the time of the operator's choice.

708,303
PB83-180224 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiautomatic AC/DC Thermal Voltage Converter Calibration System.
Final rept.
K. J. Lentner, and S. G. Tremaine. Sep 82, 64p
NBSIR-82-2576
Sponsored in part by Department of Defense Calibration Coordination Group, Redstone Arsenal, AL.

Keywords: *Calibrating, *Voltage measuring instruments, Electrical measurement, Thermal voltage converters, AC/DC difference.

A semiautomatic ac/dc difference calibration system is described. The system operates over a frequency range of 20 Hz to 100 kHz, covering the voltage range from 0.5 V to 1 kV. For all voltages at frequencies in the range from 20 Hz to 20 kHz, the total uncertainty is 50 parts per million (ppm), and 100 ppm for voltages at frequencies between 20 kHz and 100 kHz. In addition to ac/dc difference testing, the system can be readily adapted to calibrate precision ac digital voltmeters or ac calibrators. Results of extensive intercomparison testing of the new system against a manual test system are reported, using a multirange thermal transfer instrument as a transport standard. The results indicate that the ac/dc differences measured are well within the combined total uncertainty limits of the two systems.

708,304
PB83-182733 Not available NTIS
National Bureau of Standards, Washington, DC.
Sensitive Analog Comparator.
Final rept.
H. K. Schoenwetter. Dec 82, 4p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Instrumentation and Measurement IM-31, n4 p266-269 Dec 82.

Keywords: *Comparators, Analog systems, Electric potential, Reprints, Voltage comparators.

A strobed sensitive analog comparator has been developed for use in the NBS Data Converter Test Facility. The comparator has a sensitivity of 1.5 microvolts and a response time of 30 microseconds to within 10 microvolts, following input steps up 20 V. Signal voltages up to plus or minus 10 V are compared with reference voltage levels of opposite polarity, using a precision resistive divider. The input offset has a temperature coefficient of -1 microvolts/C and changes less than plus or minus 5 microvolts under worst case dynamic conditions. Following a strobe pulse, the digital output is retained until the next strobe pulse. Optical isolators provide isolation between the analog and digital circuits.

708,305
PB83-192682 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Effects of High-Voltage Switching on the EPRI-NBS (Electric Power Research Institute-National Bureau of Standards) Coupling Capacitor Voltage Transformer (CCVT) Calibration System Standard Divider.
D. L. Hillhouse. Mar 83, 39p NBSIR-83-2666
Sponsored in part by Electric Power Research Inst., Palo Alto, CA.

Keywords: *Voltage dividers, Calibrating, Switching, High voltage, Tests, Electrical measurement, Coupling capacitor voltage transformers.

The report presents the results of tests of the effects of high-voltage switching on the EPRI-NBS CCVT calibration system's capacitive standard divider, completing an investigation stemming from the results of three calibrations at a Gulf States Utilities substation.

708,306
PB83-233965 Not available NTIS
National Bureau of Standards, Washington, DC.
50-ppm AC Reference Standard Which Spans 1 Hz to 50 kHz.
Final rept.
N. M. Oldham. Mar 83, 4p
Sponsored in part by Department of Defense, Washington, DC.
Pub. in IEEE Transactions on Instrumentation and Measurement IM-32, n1 p176-179 Mar 83.

Keywords: *Standards, *Waveform generators, Digital to analog converters, Microcomputers. Reprints.

A digital sinewave generator which spans 1 Hz to 50 kHz is described. The rms amplitude is characterized by an internal thermal converter and corrected by a microcomputer to an uncertainty of 50 ppm. Amplitude is programmable from 0 - 7.07 V rms.

708,307
PB83-234179 Not available NTIS
National Bureau of Standards, Boulder, CO.
Choosing Line Lengths for Calibrating Network Analyzers.
Final rept.
C. A. Hoer. Jan 83, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques 31, n1 p76-78 Jan 83.

Keywords: *Network analyzers, *Calibrating, Transmission lines, Computation, Reprints.

Equations, examples, and a table are given to help choose the best length for a precision transmission line which is used in calibrating a network analyzer. One line will cover a frequency range of about 10:1. Two lines will cover a range of about 65:1.

708,308
PB83-241158 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Signals and Systems Program, April 1982 - September 1982.
J. F. Mayo-Wells. May 83, 20p NBSIR-83-2719-2

Keywords: *Electrical engineering, *Electronics, *Metrology, Electromagnetic interference, Signals.

This is the second issue of an abstract bulletin to be issued quarterly by the Center for Electronics and Electrical Engineering, National Bureau of Standards. The issue covers the work of the Center's Signals and Systems Program for the second half of Federal fiscal year 1982. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

708,309
PB83-244160 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Center for Electronics and Electrical Engineering Technical Progress Bulletin, Covering Signals and Systems Program, October 1981-March 1982.
J. F. Mayo-Wells. May 83, 16p NBSIR-83-2719-1

Keywords: *Abstracts, *Metrology, Signals, Electric power, Periodicals, Systems engineering.

This is the first issue of a new abstract bulletin to be issued quarterly by the Center for Electronics and

Electrical Engineering, National Bureau of Standards. This issue covers the work of the Center's Signals and Systems Program for the first half of Federal fiscal year 1982. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

708,310
PB83-252395 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Uncertainties in Extracting Radiation Parameters for an Unknown Interference Source Based on Power and Phase Measurements.
Technical note.
M. T. Ma, and G. H. Koepke. Jun 83, 51p NBS-TN-1064

Keywords: *Electromagnetic interference, *Phase measurement, Power measurement, Mathematical models, Dipole moments, Determination, Error analysis.

A method for determining the radiation characteristics of a leaking interference source has been reported in a previous publication (1), in which the unintentional, electrically small leakage source was modeled by two vectors representing a combination of equivalent electric and magnetic dipole moments. The report presents the mathematical analysis of the uncertainties in the final, extracted results when the experimental data are degraded by the background noise and measurement inaccuracies.

708,311
PB83-252536 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Calibration Service for Wattmeters and Watthour Meters.
Final rept.
J. D. Ramboz, and R. C. McAuliff. Jul 83, 114p NBS-TN-1179

Keywords: *Wattmeters, *Watthour meters, Calibrating, Standards, Power factor, Measuring instruments, Error analysis.

An NBS calibration service for wattmeters and watthour meters is described. The service offers measurements of percentage registration for watthour meters and percentage correction for wattmeters over a range of voltages and currents at a frequency of 60 Hz. Measurements are limited to power factors of 1.0 and 0.5, leading and lagging. The Measurement Assurance Program (MAP) for electric energy is discussed. National standards for electric energy, NBS services, special equipment and instruments, and measurement methods and procedures are described, as are error estimates and quality control. A representative Report of Calibration is included.

708,312
PB84-103654 Not available NTIS
National Bureau of Standards, Washington, DC.
Automatic System for AC/DC Calibration.
Final rept.
K. J. Lentner, and D. R. Flach. Mar 83, 6p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Instrumentation and Measurement IM-32, n1 p51-56 Mar 83.

Keywords: *Calibrating, *Voltage measuring instruments, Automation, Alternating current, Direct current.

An automatic ac/dc difference calibration system using direct measurement of thermoelement emfs is described. The system operates over a frequency range of 20 Hz to 100 kHz, covering the voltage range from 0.5 V to 1 kV. For all voltages at frequencies in the range from 20 Hz to 20 kHz, the total uncertainty is 50 ppm, and 100 ppm for voltages at frequencies between 20 kHz and 100 kHz. In addition to ac/dc difference testing, the system can be used to measure some important characteristics of thermoelements. Also, it can be used to calibrate ac voltage calibrators and precision voltmeters. Results of intercomparisons between the new system and the manual NBS calibration system using single-range, coaxial-type, thermal voltage converters as transfer standards, are reported. The results indicate that the ac/dc differences measured are accurate to well within the combined total uncertainty limits of the two systems.

708,313
PB84-109867 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
AC Voltage Calibrations for the 0.1 Hz to 10 Hz Frequency Range.
Technical note (Final).
H. K. Schoenwetter. Sep 83, 64p NBS-TN-1182
Sponsored in part by Department of Defense Calibration Coordination Group, Redstone Arsenal, AL.

Keywords: *Electric potential, *Calibrating, Measurement, Standards, Frequency response, Alternating current, *Foreign technology, Voltage measurement.

The development of voltmeters to meet the need for rms voltage measurements in the infrasonic frequency range is discussed as well as the need to trace these measurements to the U.S. legal unit of voltage. A new method for supporting voltage measurements in the 0.1 Hz - 10 Hz range was described in a 1979 paper and is discussed further. The principles of the method are embodied in detailed procedures given for calibrating sine-wave voltage standards and rms voltmeters over the 0.1 Hz - 10 Hz frequency range, using the NBS AC Voltmeter/Calibrator. The sine-wave calibrator of this instrument, used for these calibrations, has an accuracy of 0.020 percent over the 0.5 mV - 7 V range.

708,314
PB84-116011 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Picosecond Time Difference Measurements Utilizing CAMAC-Based ANSI/IEEE-488 Data Acquisition Hardware. Operating Manual IE3 Version 1.0.
Technical note.
D. J. Glaze, and S. R. Stein. Aug 83, 38p NBS-TN-1056

Keywords: *Time measurement, Data acquisition, Automation, *Time difference measurement, Picoseconds.

Automated time-difference measurements at the picosecond level have been achieved. The system described combines the best properties of three common methods: the single heterodyne measurement technique, the frequency divider, and the dual-mixer time-difference measurement system. This particular system combines two instrumentation standards, ANSI/IEEE-583 and ANSI/IEEE-488 with new, modular dual-mixer time-difference measurement hardware. The modular, standardized hardware together with the new measurement techniques permit the data acquisition modules to be contained in a standard CAMAC crate. This system, along with an external controller, is capable of measuring eight clocks, at the present time, and is expandable to twenty-four clocks with modified software and additional measurement modules.

708,315
PB84-128016 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Eigenmodes and the Composite Quality Factor of a Reverberating Chamber.
Technical note.
B. H. Liu, D. C. Chang, and M. T. Ma. Aug 83, 56p NBS-TN-1066
Prepared in cooperation with Colorado Univ. at Boulder. Dept. of Electrical Engineering.

Keywords: *Test chambers, Reverberation, Electromagnetic fields, Reverberating chambers, Egenmodes.

The total number N of electromagnetic eigenmodes, with eigenfrequencies not greater than some given value, which can exist inside a rectangular mode-stirred or mode-tuned reverberating chamber is important in that it reveals how many modes can be available at an operating frequency for the 'stirring' or tuning purpose. This is calculated analytically via a lattice-point counting technique in the k-space (k = wave number), leading to an exact expression for N, which can be split into a smooth component and a fluctuating part. The former contains, in addition to Weyl's volume term, an edge term as a second-order correction. The latter is sensitive to the dimensions of the chamber. Simple design criteria are then derived in view of the number of available modes and the uniformity of their distribution. To take into account the ohmic loss in metal walls of the chamber, a composite Q-factor is also proposed for design purposes.

708,316
PB84-133479 Not available NTIS
National Bureau of Standards, Washington, DC.
ac Josephson Effect in Hysteretic Junctions: Range and Stability of Phase Lock.
Final rept.
R. L. Kautz. May 81, 14p
Pub. in Jnl. of Applied Physics 52, n5 p3528-3541 May 81.

Keywords: Phase locked systems, Alternating current, Stability, Electron tunneling, Reprints, *Josephson effect, Voltage standards, Tunneling(Electronics).

The rf-induced constant voltage steps generated by the ac Josephson effect are studied within the context of the Stewart-McCumber model. Simulations are used to determine the range of current bias over which phase lock occurs for model parameters appropriate to hysteretic tunnel junctions. The effect of noise on phase lock is also considered. The results are applied to a zero-bias voltage standard proposed by Levinsen et al.

708,317
PB84-135979 Not available NTIS
National Bureau of Standards, Washington, DC.
Dedicated Multiprocessor System for Calculating Josephson Junction Noise Thermometer Frequency Variances at High Speed.
Final rept.
R. D. Cutkosky. Jul 83, 4p
Pub. in Review of Scientific Instruments 54, n7 p886-889 Jul 83.

Keywords: Josephson junctions, Variations, Computation, Reprints, *Noise thermometers, Multiprocessors.

A Josephson junction noise thermometer produces a sequence of frequency readings from whose variations the temperature of the thermometer may be calculated. A preprocessor system has been constructed to collect the frequency readings delivered to an IEEE 488 bus by an ordinary counter operating at up to 1000 readings per second, perform the required calculations, and send summary information to a desk calculator or minicomputer on another 488 bus at a more convenient rate.

708,318
PB84-137322 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, October - December 1982.
J. F. Mayo-Wells. Jul 83, 27p NBSIR-83-2719-3
See also PB83-241158.

Keywords: *Electrical engineering, *Electronics, *Metrology, Semiconductors(Materials), Signals, Electromagnetic interference.

This is the third issue of an abstract bulletin to be issued quarterly by the Center for Electronics and Electrical Engineering, National Bureau of Standards. This issue covers the work of the Center's programs for the first quarter of Federal fiscal year 1983. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

708,319
PB84-139195 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement and Deconvolution of Time Jitter in Equilvalent-Time Waveform Samplers.
Final rept.
W. L. Gans. May 83, 8p
Pub. in IEEE Transactions on Instrumentation and Measurement IM-32, n1 p126-133 Mar 83.

Keywords: Oscilloscopes, Vibration, Reprints, *Waveform samplers, Deconvolution.

The presence of time jitter between the trigger signal and the sampling strobe in an equivalent-time sampling oscilloscope can cause appreciable distortion of the recorded waveform. Under additive signal averaging conditions, a method has been developed to reduce this distortion. The method consists essentially of deconvolving a jitter-related effective impulse response from the recorded waveform data.

708,320
PB84-151844 Not available NTIS
National Bureau of Standards, Washington, DC.

Improving the Repeatability of EM Susceptibility Measurements of Electronic Components When Using TEM (Transverse Electromagnetic) Cells.
Final rept.
M. L. Crawford. 1983, 8p
Pub. in Proceedings of Society of Automotive Engineers Int. Cong. and Exposition, Detroit, MI, Feb 28-Mar 4 1983, p1-8.

Keywords: *Electromagnetic compatibility, Electric equipment, Components, Measurement, Electromagnetic susceptibility, Transverse electromagnetic cells.

The paper outlines a systematic approach, using a TEM cell, for evaluating the electromagnetic (EM) radiated susceptibility of electronic equipment. The purpose of the paper is to provide guidelines, for those using TEM cells for performing EM susceptibility measurements, to improve the repeatability and, hence, the value of their test results. The paper describes the test setup, details the step-by-step procedures to use in performing susceptibility measurements, and discusses pertinent information related to the range of application and limitations associated with the use of TEM cells.

708,321
PB84-154962 Not available NTIS
National Bureau of Standards, Washington, DC.
International Intercomparison of Electric Field Strength at 100 MHz.
Final rept.
C. F. Stubenrauch, P. G. Galliano, and T. M. Babij. Mar 83, 3p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Instrumentation and Measurement IM-32, p235-237 Mar 83.

Keywords: *Field strength, Electric fields, Comparison, Measurement, Reprints.

This paper discusses an international intercomparison of electric field strength at 100 MHz. Laboratories in four countries participated in the intercomparison. Measurements from each of the laboratories fell within a range of +0.75 to -0.5 dB with respect to the overall average. The transfer standard used in the measurement is described and the details of the results are presented.

708,322
PB84-154970 Not available NTIS
National Bureau of Standards, Washington, DC.
Automated High Accuracy Phase Measurement System.
Final rept.
S. Stein, D. Glaze, J. Levine, J. Gray, D. Hilliard, D. Howe, and J. Bollinger. Mar 83, 5p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Instrumentation and Measurement IM-32, n1 p227-231 Mar 83.

Keywords: *Phase measurement, Automation, Accuracy, Reprints.

The new system has the low noise and high resolution properties of a single heterodyne system: the rms time deviation for a single measurement is typically 2 ps and the theoretical resolution is 0.2ps for the particular design parameters we have chosen. But a single heterodyne system is seriously limited since it can only make a measurement at the time of a zero crossing between the oscillators under test, or at the time of the operato choice. As a result of the addition of a transfer oscillator, the new system, like the dual mixer system, makes measurements within 0.1 s of any selected time and like a divider, the new measurement system stores the time of each clock in hardware and requires readout by a computer very infrequently. For example, no ambiguity occurs before 19 days have elapsed. The hardware utilizes the ANSI/IEEE-583 (CAMAC) interface standard.

708,323
PB84-156744 Not available NTIS
National Bureau of Standards, Washington, DC.
Design Consideration of Reverberating Chambers for Electromagnetic Interference Measurements.
Final rept.
B. H. Liu, D. C. Chang, and M. T. Ma. 1983, 5p
Pub. in Proceedings of IEEE 1983 International Symposium on Electromagnetic Compatibility, Washington, DC, Aug 23, IEEE Catalog No. 83CH1838-2, p508-512.

Keywords: *Test chambers, *Electromagnetic interference, Design, Reverberation, Measurement.

Two aspects pertaining to the design of rectangular, mode-stirred or mode-tuned reverberating chambers are considered in this paper, namely the spectral distribution of resonant modes and the composite quality factor of the chamber. After obtaining the total number of eigenmodes with eigenfrequencies less than or equal to any given value and an exact expression for the mode density, the solution of the total number of modes is seen to consist of smooth and fluctuating parts. Then simple criteria are identified for designing the shape of the chamber. To take into account the conductor loss of the walls, a simple, closed-form composite quality factor is also proposed. These results are useful as design guidelines of reverberating chambers.

708,324
PB84-156769 Not available NTIS
National Bureau of Standards, Washington, DC.
New Method for Determining the Emission Characteristics of an Unknown Interference Source.
Final rept.
G. H. Koepke, and M. T. Ma. 1983, 6p
Pub. in Proceedings of Symposium and Technical Exhibition on Electromagnetic Compatibility, (5th), Zurich, Switzerland, Mar 8-10, 1983 p35-40.

Keywords: *Electromagnetic interference, *Measurement, Phase measurement, Radio field strength, Power, Dipole moments, TEM cells.

Quantitative determination of the radiation characteristics of an unknown interference source is of importance to the users, manufacturers, and regulatory authorities. The theoretical background and measurement procedures for a new method to achieve this objective are presented with experimental results.

708,325
PB84-161397 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Design and Error Analysis for the WR10 Thermal Noise Standard.
Final rept.
W. C. Daywitt. Dec 83, 49p NBS-TN-1071

Keywords: *Thermal noise, *Standards, Cryogenics.

This note describes the design and error analysis of a WR10 thermal noise power standard. The standard is designed to operate at the boiling point of liquid nitrogen with a noise temperature output accurate to plus or minus 1 K.

708,326
PB84-165158 PC **A12**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
2.0 GHz to 4.0 GHz Automated Radiometer Operation and Service Manual.
G. J. Counas. Jan 84, 266p NBSIR-83-1697

Keywords: *Radiometers, Microwave frequencies, Manuals, Noise measurement, Standards, Cryogenics, Automation, Reflectometers.

The equipment described by this manual is the 2.0 to 4.0 GHz subsystem of the automated radiometer. This section of the multiband automated radiometer is a coaxial total power radiometer which implements a six-port reflectometer for impedance characterization and correction and utilizes a newly developed broadband cryogenic noise standard. NBS noise measurement capability in this frequency band has been expanded by the addition of this system which adds continuous frequency coverage to existing services along with the capability to measure cryogenic noise sources. This manual describes the 2.0 to 4.0 GHz frequency band of the NBS automated radiometer and provides operation and service information.

708,327
PB84-218056 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, April - June 1983.
J. F. Mayo-Wells. Jun 84, 19p NBSIR-84/2857/2
See also PB83-244160 and PB84-219716.

Keywords: *Electrical engineering, *Electronics, *Metrology, Semiconductors(Materials), Signals, Electromagnetic interference.

This is the third issue of a quarterly abstract journal covering the work of the National Bureau of Standards Center for Electronics and Electrical Engineering. This issue of the CEEE Technical Progress Bulletin covers the second quarter of calendar year 1983. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

708,328
PB84-219716 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, July - September 1983.
J. F. Mayo-Wells. Jun 84, 16p NBSIR-84/2857/3
See also PB83-241158 and PB84-218056.

Keywords: *Electrical engineering, *Electronics, *Metrology, Semiconductors(Materials), Signals, Electromagnetic interference.

This is the fourth issue of a quarterly abstract journal covering the work of the National Bureau of Standards Center for Electronics and Electrical Engineering. This issue of the CEEE Technical Progress Bulletin covers the third quarter of calendar year 1983. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

708,329
PB84-219823 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Nonuniform Power Frequency Electric Fields.
Final rept.
M. Misakian, and P. M. Fulcomer. Dec 83, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers), Trans. Electr. Insul. EI-18, n6 p657-661 Dec 83.

Keywords: *Electric fields, Measurement, Frequency measurement, Power lines, Reprints.

The performance of free-body electric fieldmeters which have been calibrated for use in nearly uniform power frequency electric fields is examined under non-uniform field conditions. Theoretical and experimental results are presented which indicate that measurements can be made with small error.

708,330
PB84-220946 Not available NTIS
National Bureau of Standards, Washington, DC.
Precision Time-Domain Dielectric Spectrometer.
Final rept.
F. I. Mopsik. Jan 84, 9p
Pub. in Review of Scientific Instruments 55, n1 p79-87 Jan 84.

Keywords: *Dielectric properties, Measurement, Dielectrics, Step response, Laplace transformation, Reprints, Time domain.

A description is given for an automated method for determining dielectric constant and loss by the measurement of the time response of the dielectric to a step voltage. Attention is paid to the circuits necessary to achieve high accuracy (0.1%) and high sensitivity (tan delta = 0.00001) over audio and subaudio frequencies (10,000 Hz to 0.0001 Hz). These include a 100 V step generator accurate to 5 ppm, a charge detector with a time-independent bias current of 30 fA and a clock that can control sampling time for 5 microsec to 10 s. In addition, a numerical Laplace Transform, based on a cubic spline, is described that preserves the accuracy of the time data when they are transformed into the frequency domain.

708,331
PB84-221266 Not available NTIS
National Bureau of Standards, Washington, DC.
Theoretical and Experimental Analysis of Coupling Characteristics of Dual TEM Cells.
Final rept.
P. F. Wilson, D. C. Chang, M. T. Ma, and M. L. Crawford. 1983, 5p
Pub. in Proceedings Institute of Electrical and Electronics Engineers, International Conf. on Electromagnetic Compatibility held at Washington, DC. on August 23-25, 1983, p513-517 1983.

Keywords: *Electromagnetic shielding, Effectiveness, TEM cells.

A standardized method for quantitatively evaluating a test material's shielding effectiveness is a topic of widespread interest to the electromagnetic interference community. Field penetration through materials may significantly affect the designed performance of devices contained inside the material. To take advantage of the known properties of a TEM cell, a shielding effectiveness measurement procedure based on coupling power between a pair of TEM cells via material laden aperture is being proposed in industry. No theoretical basis, however, has been formulated to provide guidelines for properly designing such a dual TEM cell structure and for interpreting the measured results. To gain a better understanding of the structure's basic properties, the theoretical analysis and experimental results of an unloaded aperture case (with no material present) are presented.

708,332
PB84-221860 Not available NTIS
National Bureau of Standards, Boulder, CO.
Redundancy: A Monitor of Six-Port Performance.
Final rept.
G. F. Engen. 1983, 2p
Pub. in Proceedings of Advances in S-Parameter Measurement Micro-Wavelengths, London, England, May 23, 1983, p4-1-4-2.

Keywords: *Network analyzers, *Six port.

By almost any standard of comparison, today's automated network analyzers represent a highly complex and sophisticated measuring instrument, with its own set of maintenance problems and potential failure modes. While certain types of malfunction are immediately evident to the operator, there may be others whose effect is less obvious. One of the more interesting features of the six-port network analyzer is that its response is 'overdetermined' in the sense that four (scalar) detectors are employed to obtain three pieces of information--namely the emergent wave amplitude and the complex reflection coefficient as they exist at the measurement port. With proper interpretation, this additional piece of information can be used, not only to improve the overall accuracy, but also as a continuous monitor of the system performance, and to flag a very large fraction of potential malfunctions. (While some reference to this feature has been made in earlier papers, it apparently is still not fully appreciated by the microwave community).

708,333
PB84-222785 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, January-March 1984 with 1984 CEEE Events Calendar.
J. F. Mayo-Wells. May 84, 20p NBSIR-84/2877/1
See also PB84-137322.

Keywords: *Electrical engineering, *Electronics, *Metrology, Semiconductors(Materials), Signals, Electromagnetic interference, Antennas, Standard reference materials.

This is the sixth issue of a quarterly abstract journal covering the work of the National Bureau of Standards Center for Electronics and Electrical Engineering. This issue of the Center for Electronics and Electrical Engineering Technical Progress Bulletin covers the first quarter of calendar year 1984. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

708,334
PB84-223684 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, October-December 1983 with 1984 CEEE Events Calendar.
J. F. Mayo-Wells. Apr 84, 22p NBSIR-84/2857/4
See also PB83-241158.

Keywords: *Electrical engineering, *Electronics, *Metrology, Semiconductors(Materials), Signals, Electromagnetic interference, Antennas, Standard reference materials.

This is the fifth issue of a quarterly abstract journal covering the work of the National Bureau of Standards Center for Electronics and Electrical Engineering. This issue of the Center for Electronics and Electrical Engineering Technical Progress Bulletin covers the fourth quarter of calendar year 1983. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

708,335
PB84-223841 Not available NTIS
National Bureau of Standards, Washington, DC.
Performance Standards for Waveform Recorders.
Final rept.
R. A. Lawton. Feb 83, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-30, n1 p263-266 Feb 83.

Keywords: *Recording instruments, *Oscilloscopes, *Performance standards, *Standards, Transmission lines, Waveforms, Electric filters, Reprints.

A new technical committee for the Instrumentation and Measurement Society of the IEEE has been formed and is called Waveform Measurements and Analysis. The first task is to develop a performance standard for waveform recorders to satisfy a growing need for specifying the performance of the many new waveform recorders (transient digitizers, digital oscilloscopes, etc.) now coming on the market. The work of the committee to date will be described, together with the efforts of the Electromagnetic Waveform Metrology Group at the National Bureau of Standards in Waveform Standards Development.

708,336
PB84-223908 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiated EMI Instrumentation Errors.
Final rept.
H. E. Taggart. Oct 82, 10p
Pub. in EMC Technology, v1 n4 p26-35 Oct 82.

Keywords: *Electromagnetic interference, Instruments, Errors, Antennas, Calibrating, Reprints.

The purpose of this article is to address the various types of instrumentation errors that can be encountered when performing EMI measurements. The various type of errors associated with the instrumentation will be discussed and suggestions made as to how they can be reduced. Since the instrumentation consists of basically an antenna connected to a receiver, the errors associated with the antenna, the receiver, and connecting cables will be addressed. Calibration errors associated with the various parts of an EMI measuring system are discussed. These include: (1) antenna calibration errors (loops, monopoles, and dipoles) (2) receiver calibration errors (rf voltmeter, attenuator, and linearity), (3) mismatch errors (antenna and receiver) and (4) antenna ground effect errors. A table summarizing these errors is included in the conclusions.

708,337
PB84-226182 Not available NTIS
National Bureau of Standards, Washington, DC.
Chaos in Josephson Circuits.
Final rept.
R. L. Kautz. May 83, 10p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics MAG-19, n3 p465-474 May 83.

Keywords: *Josephson junctions, Superconductivity, Reprints, Chaos, Fractals.

Chaotic behavior in Josephson circuits is reviewed using the rf-driven junction as an example. Topics include the effect of chaos on the I-V characteristic, the period doubling route to chaos, and power spectra for the chaotic state. Liapunov exponents and the fractal geometry of strange attractors are also discussed.

708,338
PB84-227057 Not available NTIS
National Bureau of Standards, Washington, DC.
Reference Waveform Flat Pulse Generator.
Final rept.
J. R. Andrews, B. A. Bell, N. S. Nahman, and E. E. Baldwin. Mar 83, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-32, n1 p27-32 Mar 83.

Keywords: *Pulse generators, *Standards, *Waveform generators, *Calibrating, Waveforms, Measurement, Reprints.

The NBS Reference Flat Pulse Generator is used to transfer dc voltage and resistance standards to the nanosecond domain. It provides a step amplitude of 1.000 V (open circuit) from a source impedance of 50.0 ohms. The transition duration is 600 ps and all perturbations are damped out to less than + or - 10 mV volts within 5 ns. It can also be used as a time interval transfer standard.

708,339
PB84-227313 Not available NTIS
National Bureau of Standards, Washington, DC.
Shielding Effectiveness (SE) Measurement Techniques.
Final rept.
A. R. Ondrejka, and J. W. Adams. Apr 84, 8p
Pub. in Proceedings of IEEE Natl. Symp. Electromagnetic Compatibility, San Antonio, TX, Apr 24-26, 1984, IEEE Cat. No. 84CH2035-4, p249-256.

Keywords: *Electromagnetic shielding, Effectiveness, Measurement, Time domain.

Five methods of measuring shielding effectiveness of a lossy material are compared. Comparative measurement data is shown, and insights are offered as to why the results do or do not agree. This is a preliminary analysis, not a definitive work.

708,340
PB84-227321 Not available NTIS
National Bureau of Standards, Washington, DC.
Small Aperture Analysis of the Dual TEM Cell.
Final rept.
P. F. Wilson. Apr 84, 5p
Pub. in Proceedings of IEEE Natl. Symp. Electromagnetic Compatibility, San Antonio, TX, Apr 24-26, 1984, IEEE Cat. No. 84CH2035-4, p365-369.

Keywords: Apertures, Analyzing, *TEM cells, Bethe's aperture theory.

This paper describes an analysis of dual TEM cell coupling based on Bethe's small aperture theory. This approach allows one to model a variety of possible aperture shapes (circular, elliptical, square etc.), including material loaded apertures of finite thickness. Measurements demonstrate that the theory accurately predicts coupling for an unloaded aperture.

708,341
PB84-231224 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, January-March 1983.
J. F. Mayo-Wells. Jun 84, 17p NBSIR-84/2857/1
See also PB84-137322.

Keywords: *Electrical engineering, *Electronics, *Metrology, Microwaves, Semiconductors(Semiconductors), Gallium arsenides, Signal processing, Superconductors, Electric power, Laser materials, Fiber optics, Antennas, Electromagnetic interference, Semiconductor devices, Electromagnetic noise, National Bureau of Standards.

This is the second issue of a quarterly abstract journal covering the work of the National Bureau of Standards Center for Electronics and Electrical Engineering. This issue of the CEEE Technical Progress Bulletin covers the first quarter of calendar year 1983. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

708,342
PB84-239334 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Thermal Insulation Penetrating Electrical Boxes.
Final rept.
J. R. Clifton, R. W. Beausoliel, and W. J. Meese. 1982, 21p
Pub. in American Society for Testing Materials Special Technical Publication 779, p241-261 1982.

Keywords: *Thermal insulation, *Electric outlets, *Switchgear, Hazards, Corrosion, Reprints.

When residential walls are retrofitted with 'foamed-in' urea-formaldehyde or 'blown-in' cellulose thermal insulations, the insulation may enter electrical outlet and switch boxes. The effects of these thermal insulations

on electrical components such as outlet and switch boxes were studied

708,343
PB85-100444 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Electronics and Electrical Engineering.
High-Current Measurement Techniques.
J. D. Ramboz, and D. R. Flach. May 84, 23p NBSIR-84/2881
Sponsored in part by Sandia National Labs., Albuquerque, NM.

Keywords: *Electrical measurement, *Electric current, Electric coils, Bypasses, Circuits, Alternating current, Rogowski coils.

The measurement of very high ac currents presents special problems in the selection of current sensors, instrumentation, and techniques. This report discusses initial test results for Rogowski coils and high-capacity current shunts often used to measure large ac currents.

708,344
PB85-112985 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Metrology for Electromagnetic Technology: A Bibliography of NBS (National Bureau of Standards) Publications.
R. A. Kamper, and K. E. Kline. Jul 84, 66p NBSIR-84/3014
See also PB83-111658.

Keywords: *Metrology, *Bibliographies, Microwaves, Fiber optics, Lasers, Electromagnetic radiation, Superconductors, Waveforms, Superconductivity, Cryogenics, Magnetic materials, Josephson junctions, Time domain, National Bureau of Standards.

This bibliography lists the publications of the personnel of the Electromagnetic Technology Division of NBS in the period from January 1970 through December 1983. A few earlier references that are directly related to the present work of the Division are included.

708,345
PB85-128122 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO Electromagnetic Technology Div.
Generalized Method for the Calibration of Four-Terminal-Pair Type Digital Impedance Meters.
Rept. for 19 Apr-30 Sep 83.
R. M. Judish, and R. N. Jones. Aug 84, 60p NBSIR-84/3016
Sponsored in part by Sandia National Labs., Albuquerque, NM.

Keywords: *Electrical impedance meters, *Calibrating, Digital systems, Measurement.

The paper describes a calibration procedure having such a background and illustrates its use. The calibration is accomplished through the use of impedance standards which relate instrument readings to the values of the standards through a known functional relationship. The calibration procedure described estimates the parameters associated with the functional relationship and requires the use of a computer. Calibration is accomplished at the reference plane of the impedance standards and any adapter required to connect the standards to the instrument is assumed to be an integral part of the impedance meter.

708,346
PB85-129013 Not available NTIS
National Bureau of Standards, Washington, DC.
Discussion of 82 WM 255-8 Reconstruction of High Impulse Voltages Considering the Step Response of the Measuring System.
Final rept
R. E. Hebner, and J. N. Hagler. May 82, 2p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Power Apparatus and Systems 101,p4134-4155 May 82.

Keywords: High voltage, Convolution integrals, Response, Algorithms, Pulsation, Reprints, *Pulse measurement

This discussion requests from the authors of the original paper further information about the accuracy of and the distinctions between the two deconvolution algorithms described in the original paper.

708,347
PB85-129286 Not available NTIS
National Bureau of Standards, Washington, DC.
Liquid Nitrogen Cooled Microwave Noise Standard.
Final rept
C. L. Trembath, W. J. Foote, and D. F. Wait. 1971, 2p
Pub. in Review of Scientific Instruments 42, n8 p1261-1262 Aug 71.

Keywords: *Microwaves, *Standards, Cryogenics, Reprints, *Noise standards.

A liquid-nitrogen-cooled reference noise standard in WR-51 waveguide size is described. At 20 GHz, the output noise temperature available at the useable waveguide flange is 4.1 kelvins above the boiling point of liquid nitrogen and is known to be plus or minus 0.4 kelvins. The VSWR over the frequency range 17-22 GHz is less than 1:05:1.

708,348
PB85-135408 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Power Factor Standard Using Digital Waveform Generation.
Final rept.
N. M. Oldham, and R. S. Turgel. 1981, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems 100, n11 p4435-4438 Nov 81.

Keywords: *Power factor, *Standards, Waveform generators, Digital techniques, Wattmeters, Phase angle, Reprints.

A measurement technique is described which uses the adjustable linear phase relationship between two digitally generated waveforms to establish power factor with an uncertainty of less than 50 ppm. Results of comparisons with thermal, electrodynamic and electronic wattmeters are summarized.

708,349
PB85-135952
(Order as PB85-135929, PC **A04**/MF **A01**)
Maxwell Labs., Inc., San Diego, CA.
Absolute Electric Current Probe Based on the Faraday Effect.
W. Caton, and J. Katzenstein. 24 Apr 84, 8p
Included in Jnl. of Research of the National Bureau of Standards, v89 n3 p265-272 May-Jun 84.

Keywords: *Electric current meters, *Faraday effect, Measurement, Polarized light, Verdet constants.

This paper describes the design, construction, and testing of a probe for the measurement of electric current in a circuit. This measurement is performed by using Faraday rotation produced in a beam of polarized light that encircles the current-carrying conductor. Such a probe is an absolute instrument whose calibration only depends upon the Verdet constant of the rotative medium and is independent of the dimensions or positions of the light path relative to the current. The time resolution of the probe is the optical transit time about the closed path and can in practice be reduced to a few nanoseconds.

708,350
PB85-140978 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Programmable Precision Voltage-Step Generator for Testing Waveform Recorders.
Final rept.
H. K. Schoenwetter. Sep 84, 5p
Pub. in IEEE Transactions on Instrumentation and Measurement IM-33, n3 p196-200 Sep 84.

Keywords: *Pulse generators, Test equipment, Waveforms, Reprints.

A pulse generator for testing the approximate step-response of waveform recorders is described. The initial and final levels of voltage steps are each programmable within the range of plus or minus 1 V for 50 ohm termination and within plus or minus 5 V for a high impedance load. Voltage steps within these ranges settle to within plus or minus 0.02% of full-scale range (FSR) in less than 30 ns and 40 ns, respectively, for a load capacitance < or = 30 pF. The corresponding 10-90 percent transition durations are approximately 7 ns and 12 ns.

708,351
PB85-141893 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Small Obstacle Loading in a TEM (Transverse Electromagnetic) Cell.
Final rept.
P. F. Wilson, and M. T. Ma. 1984, 6p
Pub. in Proceedings of the International Symposium on Electromagnetic Compatibility, Tokyo, Japan, Oct 16-18, 1984, p30-35.

Keywords: Measurement, Scattering, *TEM cells, Loading(Electronics).

A typical transverse electromagnetic (TEM) cell measurement procedure involves calibrating an empty cell and introducing a test object. The loading effect due to the test object presence is normally assumed to be negligible. This paper examines the effect of the test object and the validity of the 'non-perturbing' assumption. The analysis utilizes the small aperture theory, as applied to the dual problem of small obstacle scattering. The result is an equivalent T-network representation of the test loading which allows the overall transmission line circuit to be studied. In addition, evaluating the scattered modes gives the field perturbation due to the test object.

708,352
PB85-142487 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photoconductive Switches Used for Waveform Generation at the National Bureau of Standards.
Final rept.
R. A. Lawton. 1983, 7p
Pub. in SPIE 439, p88-94 1983.

Keywords: *Waveform generators, *Standards, Photoconductors, Switches, Reprints.

The characterization of waveform measurement systems and the development of reference waveforms is now underway at the National Bureau of Standards (NBS). Efforts to upgrade the state of the art of fast waveform measurements at NBS has resulted in the development of the first photoconductive switch using GaAs in addition to a patent on the sampling of electrical signals with optical signals and vice versa. These photoconductive switches are now being applied to the development of reference waveform generators in the form of a Maxwell-Wagner two-layer capacitor in silicon stripline to complement the liquid-filled coaxial line filters developed previously.

708,353
PB85-142941 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of the NBS (National Bureau of Standards) Isotropic Magnetic-Field Meter (MFM-10), 300 kHz to 100 MHz.
Final rept.
L. D. Driver, and J. E. Cruz. 1982, 8p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Symposium on Electromagnetic Compatibility, San Jose, CA., September 8-10, 1982, IEEE Cat. No. 82-CH1718-6, p460-467.

Keywords: *Measuring instruments, *Field strength, Magnetic fields, Antennas, Electromagnetic fields.

An isotropic magnetic-field meter is described which provides accurate near-zone measurements of H-fields over the range of 0.01 sq A/sq m to 250 sq A/sq m from 300 kHz to 100 MHz. This instrument's many advanced features include (1) wide frequency coverage, (2) large dynamic range, (3) flat frequency response, (4) high overload capacity, and (5) the capability of measuring each of the three orthogonal H-vectors, as well as their Hermitian magnitude.

708,354
PB85-143451 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Simultaneous Electric and Magnetic Field Sensor for Near-Field Electromagnetic Field Measurements.
Final rept.
M. Kanda, F. X. Ries, L. D. Driver, and R. D. Orr. 1983, 4p
Pub. in Proceedings of Symposium and Technical Exhibition on Electromagnetic Compatibility (5th), Zurich, Switzerland, March 8-10, 1983, p263-266.

Keywords: *Detectors, Electric fields, Magnetic fields, Field strength, Measurement, Electromagnetic fields, Antennas, Electromagnetic interference, Load impedance, Near field.

This paper describes a concept for a single sensor to perform simultaneous near-field electric and magnetic field measurements. The theory indicates that it is possible to obtain the loop-mode and dipole-mode currents using a loop terminated with identical loads at diametrically opposite points. The theory also indicates that it is possible to adjust the load impedance, and thus obtain an ideal load impedance for achieving equal electric and magnetic field responses of the loop. Preliminary experiments have been performed using plane waves to verify these results.

708,355
PB85-143469 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Time Domain Sensors for Radiated Impulsive EMI (Electromagnetic Interference) Measurements.
Final rept.
M. Kanda. 1983, 7p
Pub. in IEEE Transactions on Antennas and Propagation AP-31, n3 p438-444 May 83.

Keywords: *Detectors, *Electromagnetic interference, Measurement, Field strength, Antennas, Transfer functions, Reprints, Time domain, Reciprocity theorem.

Discussion of various sensors and radiators commonly used for time domain antenna measurements is presented. The sensors and radiators discussed here are passive and analog devices which convert the electromagnetic quantity of interest to a voltage or current at their terminal ports. Moreover they are primary standards in the sense that their transfer functions can be calculated from their geometries and are flat (constant) across a wide frequency range. One of the major requirements for these sensors and radiators is that the electromagnetic far field, transmitted or received, is a replica or high fidelity derivative of the original pulse.

708,356
PB85-143840 Not available NTIS
National Bureau of Standards, Gaithersburg, MD
Measurements of DC Electric Fields and Ion Related Quantities.
Final rept.
R. H. McKnight. Jul 84, 28p
Pub. in Proceedings of Conference on Environmental Ions and Related Biological Effects, Philadelphia, PA., October 30, 1982, p34-61 Jul 84.

Keywords: *Power transmission lines, Electric fields, Measurement, Current density, Space charge, Ions, Direct current, High voltage, HVDC systems.

Measurement techniques developed by atmospheric scientists for characterizing the earth's electrical environment are useful for measuring various electrical parameters near high voltage dc (HVDC) transmission lines. Parameters of primary interest are the electric field, vertical current density, and polar space charge density. Other quantities which have been measured include conductivity, net space charge density and the mobility spectrum of ions making up the space charge. Errors associated with the various measurements are discussed, including those which result from the high electric fields and space charge densities existing near the lines. In addition, these measurement techniques are being used to characterize the operation of biological exposure systems.

708,357
PB85-144855 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Wideband Sampling Wattmeter.
Final rept.
G. N. Stenbakken. Oct 84, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems PAS-103, n10 p2919-2926 Oct 84.

Keywords: *Wattmeters, Broadband, Sampling, Calibrating, Reprints, Microprocessors.

The design and operation of a wideband sampling wattmeter capable of measuring distorted power signals with fundamental frequencies from 1 Hz to 10 kHz and harmonics up to 100 kHz is described. The microprocessor controlled wattmeter uses asynchronous sampling of the voltage and current signals. The errors associated with this type of operation are described as are various methods of correcting for some of these errors. The wattmeter uses a both a hardware multiplier-accumulator and a direct-memory-access unit to capture the data. Differential time delays in the input channels can be compensated by programmable time delay circuits. Performance checks show that measurement uncertainties of less than plus or minus .1 percent of full-scale range (FSR) are obtainable.

708,358
PB85-144913 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of High Current and Voltage Pulses.
Final rept.
R. E. Hebner. 1984, 45p
Grant AFOSR-78-3675
Sponsored by Air Force Aero Propulsion Lab., Wright-Patterson AFB, OH., and Air Force Weapons Lab., Kirtland AFB, NM.
Pub. in Air Force Pulsed Power Lecture Series, Lecture No. 25, 45p 1984.

Keywords: *Electrical measurement, High voltage, Waveforms, High current, *Pulse measurement.

The note introduces some of the fundamental approaches to the measurement of voltage or current pulses. The evaluation of the measurement process and the properties of selected devices -- resistive and capacitive probes, shunts, and transformers -- are highlighted. Electro-optical measurement of voltage and magneto-optical measurement of current are also discussed.

708,359
PB85-144962 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Capacitive Sensors for Voltage Measurements in Pulse Power Systems.
Final rept.
R. H. McKnight, and H. K. Schoenwetter. 1984, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Conf. Record of 1984 Sixteen Power Modulator Symp., Arlington, VA., June 18-20, 1984 Cat. No. CH84 2056-0, p284-287 1984.

Keywords: *Electrical measurement, High voltage, Surges, Transmission lines, Waveforms, Reprints, Capacitive sensors.

Capacitive E-Field sensors are frequently used in pulse power systems to measure voltage waveforms. Even though these sensors, often called 'E-dot' sensors, are intrinsically simple in design and application, accepted techniques to evaluate their performance are not generally available. A laboratory test line has been constructed to facilitate detailed examination of the electrical characteristics of the sensors and to allow investigation of methods of calibrating such devices. Both discrete frequency and step-like signals can be placed on the line and the response of the sensor determined. Two different probe geometries have been studied with each showing the characteristic behavior of the capacitive sensor, including nanosecond rise time. The use of active electronic techniques has also been explored to extend the low frequency bandwidth of the measuring system. Sensors with a wide bandwidth are required for measurements of disconnect transients in gas-insulated power frequency equipment.

708,360
PB85-147999 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Error Analysis of Radiation Characteristics of an Unknown Interference Source Based on Power Measurements.
Final rept.
M. T. Ma. 1984, 6p
Pub. in Proceedings of the 1984 International Symposium on Electromagnetic Compatibility, Tokyo, Japan, October 16-18, 1984, p39-44.

Keywords: *Radiofrequency interference, Error analysis, Power measurement, TEM cells, Electrically small sources.

Theoretical derivations for analyzing the uncertainties in the source parameters and radiation characteristics of an unknown electrically small interference source, extracted from the power measurements made inside a transverse electromagnetic (TEM) cell are given. Numerical examples with assumed unbiased and biased measurement errors, and for the worst case are also presented.

708,361
PB85-159952 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Small Aperture Analysis of the Dual TEM (Transverse Electromagnetic) Cell and an Investigation of Test Object Scattering in a Single TEM Cell.
P. F. Wilson, and M. T. Ma. Oct 84, 63p NBS/TN-1076
Also available from Supt. of Docs.

Keywords: Test equipment, Transverse waves, Electromagnetic shielding, Electromagnetic scattering, *TEM cells, Small aperture theory.

Small aperture theory is used to investigate the dual TEM cell. Analyzing coupling through an empty versus a loaded aperture leads to a model of dual TEM cell shielding effectiveness measurements. Small obstacle scattering yields results for both the field perturbation and the change in a cell's transmission line characteristics due to the presence of a test object in a TEM cell. In each case, theoretical values are compared to experimental data.

708,362
PB85-182574 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Automatic AC/DC Thermal Voltage Converter and AC Voltage Calibration System.
Final rept.
K. J. Lentner, D. R. Flach, and B. A. Bell. Nov 84, 46p NBSIR-84/2973
Sponsored by Department of Defense Calibration Coordination Group, Redstone Arsenal, AL.

Keywords: *Calibrating, *Electrical measurement, Electric potential, Automation, Alternating current, Thermal voltage converters.

An automatic ac/dc difference calibration system is described which uses direct measurement of thermoelement emfs. In addition to ac/dc difference testing, the system can be used to measure some important characteristics of thermoelements, as well as to calibrate ac voltage calibrators and precision voltmeters. The system operates over a frequency range from 20 Hz to 100 kHz, covering the voltage range from 0.5 V to 1 kV. For all voltages the total measurement uncertainties expected (including the uncertainty of the specific reference thermal converters used) were 50 parts per million (ppm) at frequencies from 20 Hz to 20 kHz, inclusive, and 100 ppm at higher frequencies up to 100 kHz. The results of initial intercomparisons between the new system and the manual NBS calibration system, using single-range, coaxial-type, thermal voltage converters as transfer standards, are reported. The results show that the agreement between the two systems is better than the uncertainties originally expected, since the intercomparison of ac/dc differences differed by no more than 15 ppm.

708,363
PB85-183275 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Discussion of Paper: Analysis of Calibration Arrangements for AC Field Strength Meters.
Final rept.
M. Misakian. Feb 85, 1p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems PAS-104, p496 Feb 85.

Keywords: *Field strength, *Calibrating, Measuring instruments, Alternating current, Electric fields, Transmission lines, Reprints, Field strength meters.

The manuscript is a published discussion of a paper which was presented at the IEEE Power Engineering Society 1984 Summer Meeting. The discussion compares the results of model calculations in the paper with experimental measurements made at NBS.

708,364
PB85-187540 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.

Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, April-June 1984 with 1984 CEEE (Center for Electronics and Electrical Engineering) Events Calendar.
J. F. Mayo-Wells. Jul 84, 26p NBSIR-84/2877/2
See also PB84-222785.

Keywords: *Electrical engineering, *Electronics, *Metrology, Semiconductors(Materials), Signals, Electromagnetic interference, Antennas, Standard reference materials.

This is the seventh issue of a quarterly abstract journal covering the work of the National Bureau of Standards Center for Electronics and Electrical Engineering. This issue of the Center for Electronics and Electrical Engineering Technical Progress Bulletin covers the second quarter of calendar year 1984. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

708,365
PB85-189280 Not available NTIS
National Bureau of Standards (NEL), Washington, DC. Electrosystems Div.
Measurement Applications. Part 2.
Final rept.
R. E. Hebner. 1984, 6p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Tutorial Course 84 EH0225-3-PWR, Fiber Optic Applications in Electrical Power Systems, pF5-F10 1984.

Keywords: *Voltage measuring instruments, *Electric current meters, *Fiber optics, Electric potential, Electric current, Measurement, Electric fields, Magnetic fields, Birefringence, Electrooptics, Faraday effect, Kerr magnetooptical effect, Magnetooptics, Space charge, *Optical fibers.

This paper introduces the physics of photonic systems used to measure voltage and currents and some of the engineering aspects of the systems which must be considered in their application. Sensors based on the Faraday effect, the Pockels effect, and the Kerr effect, as well as those based on mechanical effects are presented. The requirements imposed on the optical fibers by the measurement application are discussed. Selected systems are described to highlight various aspects of the measurement approach.

708,366
PB85-191393 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, July - September 1984 with 1985 CEEE Events Calendar.
J. F. Mayo-Wells. Dec 84, 25p NBSIR-84/2877-3
See also PB84-222785.

Keywords: *Electrical engineering, *Electronics, *Metrology, Semiconductors(Materials), Signals, Antennas, Electromagnetic interference, Standard reference materials.

This is the eighth issue of a quarterly abstract journal covering the work of the National Bureau of Standards Center for Electronics and Electrical Engineering. This issue of the Center for Electronics and Electrical Engineering Technical Progress Bulletin covers the third quarter of calendar year 1984. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

708,367
PB85-200178 PC **A06**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Investigation of the Uncertainties of the NBS (National Bureau of Standards) Thermal Voltage and Current Converters.
Final rept.
F. L. Hermach. Apr 85, 124p NBSIR-84/2903

Keywords: *Standards, *Electrical measurement, Accuracy, Calibrating, Thermoelectric generators, Converters, Transfer standards.

The uncertainties of the NBS reference and working standards for ac-dc current and voltage transfer measurements have been redetermined, to 50 and 100 kHz, respectively, by means of a set of multijunction thermal converters (MJTCs), an improved emf comparator, and extensive series of intercomparisons. Numerous supporting investigations have also been performed. As a result of this work the accuracy of the NBS standards and the output of its calibration service for ac-dc current and voltage transfer are considered to be on a much firmer and better documented basis than heretofore. Improvement by factors of two to five in the calibration accuracy for high-quality, single-range thermoelements and thermal voltage converters is possible for certain ranges of current, voltage, and frequency. For very special tests, such as international comparisons, accuracies approaching 1 ppm are within reach.

708,368
PB85-202109 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Automated NBS (National Bureau of Standards) 1-Omega Measurement System.
Final rept.
K. R. Baker, and R. F. Dziuba. 1983, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 32, n1 p154-158 1983.

Keywords: *Electric measuring instruments, Calibrating, Resistors, Microcomputers, Comparators, Reprints, Computer applications.

A microcomputer controlled measurement system has been developed for calibrating stable, 1-ohm standard resistors. It consists of a direct current comparator potentiometer, a self-balancing detector circuit, and special switching networks. The measurement system is capable of comparing resistors to a precision of better than 0.01 ppm.

708,369
PB85-207421 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Measurement of Net Space Charge Density Using Air Filtration Methods.
Final rept.
R. H. McKnight. Apr 85, 6p
Sponsored by Department of Energy, Washington, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems PAS-104, n4 p971-976 Apr 85.

Keywords: *Space charge, Measurement, Filteration, Air flow, Density(Number/volume), Reprints.

The efficiency of a high efficiency particulate air (HEPA) or absolute filter for removing charge from an air stream has been measured for a variety of space charge and air flow conditions. Ion densities ranged from 100,000 to 1,000,000/cu cm and were for positive and negative space charge as well as mixtures. The space charge was made up predominantly of ions with mobilities greater than 0.000001 sq m/Vs. For all conditions studied, the transmission of the filter was less than 0.1%. For space charge consisting of ions of one polarity, space charge density measurements made using HEPA filters and ion counters may be compared directly. The filter is well suited for accurate measurements of net space charge density.

708,370
PB86-112810 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Point Contact Diode at Laser Frequencies.
Final rept.
K. M. Evenson, M. Inguscio, and D. A. Jennings. 1 Feb 85, 5p
Pub. in Jnl. of Applied Physics 57, n3 p956-960, 1 Feb 85.

Keywords: Tungsten, Nickel oxides, Reprints, *MIM diodes, *Point contact diodes.

Dramatic improvements in the stability of the metal-insulator-metal point contact diode has been achieved by the use of blunter whisker tips. The optimum values for tip radius and diode resistance were experimentally determined. Both sensitivity and high-speed response of W-NiO-Ni point contact diodes were investigated at different laser frequencies and mixing orders as a function of tip radius, resistance, and coupling. The tip radii were changed by more than an order of magnitude, and surprisingly, the sensitivity and the harmonic generation up to 88 THz were not significantly affected. A conical antenna was found to be superior to the conventional longwire antenna at wavelengths shorter than 10 micrometers. Responsivity measurements as a function of the diode resistance showed evidence for two different physical mechanisms responsible for the operation of the diode.

708,371
PB86-113057 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD.
Informal Survey of Federal Government Microelectronics Processing Facilities.
Final rept.
M. C. Peckerar, and K. F. Galloway. 1981, 7p
Sponsored by Naval Research Lab., Washington, DC.
Pub. in Proceedings of University, Government, Industry, Microelectronics Symposium, Starkville, MI., May 26-28, 1981, p3.24-3.30.

Keywords: *Microelectronics, National government, Laboratories, Processing, Facilities, Survey, Universities, Statistical data.

A number of microelectronics processing facilities associated with Federal Government laboratories or installations have been surveyed by telephone. Data is presented on available equipment, general missions, and possibilities for university personnel to interact with these facilities.

708,372
PB86-115557 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Accurate Noise Measurements of Superconducting Quasiparticle Array Mixers.
Final rept.
W. R. McGrath, A. V. Raisanen, P. L. Richards, R. E. Harris, and F. L. Lloyd. 1985, 4p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics MAG-21, n2 p212-215 Mar 85.

Keywords: *Mixing circuits, *Electromagnetic noise, *Josephson junctions, Microwave equipment, Superconductors, Measurement, Reprints, Microwave sensors.

The authors have constructed a 30-40 GHz test apparatus which allows us to measure the noise temperatures of SIS mixers with an accuracy of better than + or - 1 K. This is a factor of six improvement over earlier measurements. In addition, SIS mixers employing arrays of N = 1, 5, 10, 25, and 50 tunnel junctions in series have been tested. The input power required to saturate the array mixers was found to increase as N squared, and the gain and noise temperature of the array mixers were independent of N.

708,373
PB86-122751 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
E and H Fields in Transmission Lines and Coils for Susceptibility Testing, Probe Calibration, and RF Exposure Chambers.
Final rept.
E. B. Larsen, and J. E. Cruz. 1985, 1p
Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Instrumentation and Measurement Technology Conference (IMTC '85), Tampa, FL., March 20-22, 1985, p199.

Keywords: *Electromagnetic compatibility, Transmission lines, Electromagnetic fields, Measurement, Transverse waves, Calibrating, Electric coils, Test equipment, Tests, TEM cells.

The paper deals with the instrumentation and design equations for several systems used to generate calculable electric (E) and magnetic (H) fields for electromagnetic compatibility (EMC) testing. These 'standard' electromagnetic (EM) fields with known magnitude are used to: (a) test the susceptibility of electronic equipment to radiated fields, (b) calibrate E and H field probes for measuring and mapping fields, and (c) expose biological specimens in a known EM environment.

708,374
PB86-122934 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

Standards for Measurement of Electromagnetic Fields.
Final rept.
M. Kanda, and N. S. Nahman. 1985, 4p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Instrumentation and Measurement Technology Conference (IMTC '85), Tampa, FL., March 20-22, 1985, p20-23.

Keywords: *Electromagnetic fields, Measurement, Anechoic chambers, Standards.

The standards developed at NBS for measurements of electromagnetic fields will be reviewed along with the industrial applications that engendered their development. Some attention will be given to future measurement requirements and the NBS programs to meet them.

708,375
PB86-123015 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Ultra-High Resolution Frequency Meter.
Final rept.
J. J. Snyder. 1981, 6p
Pub. in Proceedings of Annual Frequency Control Symposium (35th), Philadelphia, PA., May 27-29, 1981, p464-469.

Keywords: *Frequency meters, Frequency measurement, Random noise, Signal to noise ratio.

The authors have recently developed a novel instrument for measuring the frequency of a periodic signal contaminated by random phase noise. This frequency meter averages overlapping time intervals using a simple algorithm implemented with standard logic circuits. Because of the signal-to-noise improvement inherent in the averaging process, the standard deviation of a single measurement contaminated by, e.g., white phase noise is proportional to tau to the minus 1.5 power, tau is the time for the measurement. In contrast, the uncertainty in the measurement of the frequency of a noisy signal using a standard frequency counter is proportional to 1/tau. For many potential applications of the frequency meter, the measurement uncertainty due to contaminating noise may thereby be reduced by several orders of magnitude in comparison with a measurement over the same time interval using presently available instruments.

708,376
PB86-128790 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Leak Testing of Hermetically Sealed Electronic Components.
Final rept.
S. Ruthberg. 1982, 6p
Pub. in Proceedings of American Society for Nondestructive Testing Spring Conference, Boston, MA., March 22-25, 1982, and Fall Conference, Pittsburgh, PA., October 4-7, 1982, p431-436.

Keywords: *Electronic packaging, *Leakage(Electrical), Tests, Hermetic seals, Electric devices.

In the electronics industry the requirements are for leak testing large numbers of relatively small sealed packages to very fine leak rates. A wide variety of package materials are used; internal volumes range from less than 0.001 cubic cm. to greater than 10 cubic cm.; and the leak size reject level may be less than 1 x 10 to the minus 9 power Pa cubic m/s. No single test can cover the leak size range. Present preferred methods such as the radioisotope, helium leak detector, and others are assessed as to range, precision, efficiency, and usefulness as based upon fluid transport mechanisms and experimental data.

708,377
PB86-129053 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Broadband Noise Source Applications.
Final rept.
W. C. Daywitt. 1985, 2p
Pub. in Proceedings of Institute of Electrical and Electronics Engineers 1985 Instrumentation and Measurement Technology Conference, Tampa, FL., March 20-22, 1985, p165-166.

Keywords: *Thermal noise, *Standards, Measurement, Telecommunication, Communication satellites, *Noise temperature, Spacecraft communications.

Accurate noise characterization of amplifiers and communication systems requires the use of thermal noise standards. The note is a brief review of the use of such standards as a basis for the measurement of effective input noise temperature and the G/T of a satellite earth terminal receiving system.

708,378
PB86-129756 PC **A02**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Radiometric Calibration Procedures Using the NBS (National Bureau of Standards) MARBLE Electronics Package.
Final rept.
M. E. Mickelson, L. E. Larson, and J. Fowler. Sep 85, 23p NBS/TN-1216
Also available from Supt. of Docs as SN003-003-02692-1. Prepared in cooperation with Denison Univ., Granville, OH.

Keywords: *Radiometry, *Calibrating, Photodiodes, Marble.

The NBS MARBLE Electronics Package, which is designed to support calibration of radiometric detectors, including self-calibration of Si photodiodes, is described.

708,379
PB86-130234 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Metrology for Electromagnetic Technology: A Bibliography of NBS (National Bureau of Standards) Publications.
K. E. Kline, and M. E. DeWeese. Jul 85, 70p NBSIR-85/3029
Supersedes PB85-112985, and PB83-111658.

Keywords: *Metrology, *Bibliographies, Fiber optics, Electromagnetic radiation, Superconductors, Lasers, Cryogenics, Josephson junctions, Microwaves, Waveforms, Time domain, National Bureau of Standards, SQUID devices.

The bibliography lists the publications of the personnel of the Electromagnetic Technology Division of NBS in the period from January 1970 through December 1984. A few earlier references that are directly related to the present work of the Division are included.

708,380
PB86-132032 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Calibration of Test Systems for Measuring Power Losses of Transformers.
Final rept.
O. Petersons, and S. P. Mehta. Sep 85, 108p NBS/TN-1204
Also available from Supt. of Docs as SN003-003-02677-8. Prepared in cooperation with ASEA Electric, Inc., Waukesha, WI.

Keywords: *Calibrating, *Test equipment, Power loss, Measurement, Power transformers.

A calibration system for accuracy verification and alignment of test systems for measuring transformer losses is described. Methodologies are presented for assessing measurement uncertainties and for evaluating overall accuracy of test systems. Procedures are suggested for continuing maintenance and calibration of standard instruments and test systems to ensure traceable measurements.

708,381
PB86-134871 PC **A09**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Proceedings of Seminar on Digital Methods in Waveform Metrology Held at Gaithersburg, Maryland on October 18-19, 1983.
B. A. Bell. Oct 85, 177p NBS/SP-707
See also PB86-134889 through PB86-134962. Also available from Supt. of Docs as SN003-003-02694-8. Library of Congress catalog card no. 85-600591.

Keywords: *Metrology, *Meetings, *Waveforms, Synthesis, Sampling, Data converters, Electronic test equipment, Standards, Calibrating.

The special publication contains complete papers on the subjects presented at the seminar, providing more of the technical details. For the sessions on Precisioin Waveform Synthesis, Precision Waveform Sampling, and Data Converter Characterization, six formal papers are given describing the hardware and software techniques used for developing NBS laboratory standards and apparatus for testing ac sources and voltmeters, phase angle meters, transient waveform recorders, wideband wattmeters, and digital-to-analog and analog-to-digital converters. For the informal session on Instrumentation Metrology, three subsequent papers have been written for publication which are included for completeness in the Appendices.

708,382
PB86-134897
(Order as PB86-134871, PC **A09**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Phase Angle Standards and Calibration Methods.
R. S. Turgel. Oct 85, 15p
Included in Proceedings of Seminar on Digital Methods in Waveform Metrology, p15-29 Oct 83.

Keywords: *Phase angle, Standards, Calibrating, Measurement.

Topics include measurement principles, source or error, phase-angle calibration standards, NBS phase-angle calibration standard, other digital phase standards, and calibration strategies.

708,383
PB86-134913
(Order as PB86-134871, PC **A09**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Dual-Channel Sampling Systems.
G. N. Stenbakken. Oct 85, 19p
Included in Proceedings of Seminar on Digital Methods in Waveform Metrology, p55-73 Oct 83.

Keywords: *Electronic test equipment, *Sampling, Electric power, Measurement.

The paper will concentrate mainly on the application of dual-channel sampling techniques to the measurement of electrical power and, to a lesser extent, on the application to electrical phase angle measurements. Theoretical relationships are developed for describing these sampling measurements and their associated errors. The procedures that can be used to calibrate such dual-channel instruments for these applications will be described as well.

708,384
PB86-134921
(Order as PB86-134871, PC **A09**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Data Converter Test Methods.
T. M. Souders. Oct 85, 11p
Included in Proceedings of Seminar on Digital Methods in Waveform Metrology, p75-85 Oct 83.

Keywords: Calibrating, *Automatic test equipment.

A method of verifying the performance of automatic test equipment (ATE) in its normal operating environmental and configuration is presented as the best approach to achieving an overall system calibration. The method consists of the transport of well-characterized signal sources to the ATE station and the application of these electrical stimuli directly to a well-defined electrical interface on the test station. Data is presented on tpical accuracies that have been obtained on limited parameters and ranges during the testing process, using calibrated commercial equipment.

708,385
PB86-134939
(Order as PB86-134871, PC **A09**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Settling Time Measurements.
H. K. Schoenwetter. Oct 85, 23p
Included in Proceedings of Seminar on Digital Methods in Waveform Metrology, p87-109 Oct 83.

Keywords: *Data converters, Tests, Instruments.

A/D and D/A converters are presently being produced in a vast array of types and models, exhibiting a wide range of design approaches, operating speeds, and accuracies for a wide variety of applications. As might be expected, an equally large number of test methods has been developed, with each addressing the measurement of some specific characteristics of one or

more of these types or models. It is the intent of this tutorial to review the more useful, and hence more widely used, test methods pertinent to the characterization of data converters for use in measurement or control instrumentation applications.

708,386
PB86-134947
(Order as PB86-134871, PC **A09**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Automatic AC/DC Thermal Voltage Converter and AC Voltage Calibration System.
K. J. Lentner, D. R. Flach, and B. A. Bell. Oct 85, 27p
Included in Proceedings of Seminar on Digital Methods in Waveform Metrology, pA1-A27 Oct 83.

Keywords: *Electrical measurement, Settling time, Microseconds.

Methods of measuring device settling times (STs) from 5 microseconds to less than 20 ns with corresponding accuracies of 1 ppm and 0.1% are described. Most of these methods are thought to represent state-of-the-art techniques, developed at NBS and in industry. Some of the ST measurement methods discussed are described in a March, 1983 paper. Only a brief review of these methods will be given, showing only the salient features. Some of the NBS work has been concerned with measuring thermally induced transients and offsets in devices under test (DUTs). Methods of measuring these effects with ST measuring circuits are described.

708,387
PB86-134954
(Order as PB86-134871, PC **A09**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Gallium Arsenide (GaAs)-Based Photoconductive Switches for Pulse Generation and Sampling Applications in the Nanosecond Regime.
B. A. Bell, A. G. Perrey, and R. A. Sandler. Oct 85, 22p
Prepared in cooperation with ITT Gallium Arsenide Technology Center, Roanoke, VA.
Included in Proceedings of Seminar on Digital Methods in Waveform Metrology, pA28-A49 Oct 83.

Keywords: *Electric potential, Calibrating, Voltage converters, Voltage, Automatic test equipment.

An automatic ac/dc difference calibration system is described which uses direct measurement of thermoelement emfs. In addition to ac/dc difference testing, the system can be used to measure some important characteristics or thermoelements, as well as to calibrate ac voltage calibrators and precision voltmeters. The system operates over a frequency range from 20 Hz to 100 kHz, covering the voltage range from 0.5 V to 1 kV. For all voltages the total measurement uncertainties expected (including the uncertainty of the specific reference thermal converters used) were 50 parts per million (ppm) at frequencies from 20 Hz to 20 kHz, inclusive, and 100 ppm at higher frequencies up to 100 kHz.

708,388
PB86-138179 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Picosecond Pulse Measurements at NBS (National Bureau of Standards).
Final rept.
W. L. Gans. 1985, 3p
Pub. in Proceedings of IMTC '85 IEEE Instrumentation and Measurement Technology Conference, Tampa, FL., March 20-22, 1985, p142-144.

Keywords: *Electrical measurement, Minicomputers, Errors, *Picosecond pulses, Computer applications, Deconvolution.

The primary system used at NBS, Boulder, to measure fast (picosecond-nanosecond), repetitive, electrical pulse parameters consists essentially of a wideband (dc-18GHz) sampling oscilloscope interfaced to a minicomputer. The paper describes the techniques employed at NBS to reduce the effects of two major sources of pulse measurement error. These two sources are the distortions caused by the sampling head circuitry and by sample timing jitter. The techniques employed are based on the deconvolution methods of Tikhonov.

708,389
PB86-138492 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Estimation of True Power Ratios in Six-Port Network Analyzers Using Diode Detectors.
Final rept.
D. R. Holt, and C. A. Hoer. 1985, 2p
Pub. in Proceedings of IMTC '85 IEEE Instrumentation and Measurement Technology Conference, Tampa, Florida, March 20-22, 1985, p140-141.

Keywords: *Network analyzers, Estimating, Detectors, *Diodes.

A model for detector nonlinearity is included in the determination of six-port parameters without using additional standards. A computer simulation was performed assuming that the true power into each six-port detector is related to the power observed by the detector. Simultaneous estimation of the six-port and detector parameters is accomplished through a nonlinear least squares algorithm. Results of the simulation compare Gamma computed from corrected power readings and Gamma calculated from observed power readings.

708,390
PB86-139912 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Review of Electromagnetic Compatibility/Interference Measurement Methodologies.
Final rept.
M. T. Ma, M. Kanda, M. L. Crawford, and E. B. Larsen. 1985, 24p
Pub. in Proceedings of IEEE, v73 n3 p388-411 Mar 85.

Keywords: *Electromagnetic interference, *Electromagnetic compatibility, Measurement, Electric devices, Reprints.

The paper presents a review summary of radiated emission and susceptibility measurement methodologies currently used for assessing the electromagnetic compatibility/interference (EMC/EMI) characteristics of electronic devices and systems. In particular, measurement methods using open sites, transverse electromagnetic (TEM) cells, reverberating chambers, and anechoic chambers are discussed, in light of their technical justifications and bases, their strengths and limitations, and interpretation of the measured results.

708,391
PB86-139946 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
EMI (Electromagnetic Interference) Measurement Challenge.
Final rept.
C. K. S. Miller. 1983, 9p
Pub. in Proceedings of Measurement Science Conference (1983), Accuracy and Automation, Palo Alto, California, January 20-21, 1983, p189-197.

Keywords: *Electromagnetic interference, Measurement, Electromagnetic environments, Electromagnetic radiation, Electromagnetic compatibility.

With the increasing proliferation of radiating sources to the electromagnetic (EM) environment and the increased use of semiconductor technology in consumer and industrial products, incidents of electromagnetic interference (EMI) to electronic products have increased. Current EMI measurement difficulties are reviewed and a description is given of the National Bureau of Standards' (NBS) measurement research, both planned and in process.

708,392
PB86-140001 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Efficient Calibration Strategy for Linear, Time Invariant Systems.
Final rept.
G. N. Stenbakken, T. M. Souders, and J. A. Lechner. 1984, 1p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Delft, The Netherlands, August 20-24, 1984, p215.

Keywords: *Frequency response, *Calibrating, Linear systems, Regression analysis, Optimization, Tests, Time invariant systems.

An efficient strategy for accurately characterizing the frequency response of linear, time invariant (LTI) systems is presented. The approach, based on circuit modeling, design-of-experiments theory, and nonlinear regression analysis, optimizes calibration confidence with respect to test effort. The analytical tools and methodology needed for designing the strategy will be included, together with experimental results. The approach can be particularly beneficial in volume testing of instruments such as oscilloscopes, precision ac voltmeters, waveform recorders, and wideband wattmeters.

708,393
PB86-142700 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Efficient Calibration Strategies for Linear, Time Invariant Systems.
Final rept.
G. N. Stenbakken, T. M. Souders, J. A. Lechner, and P. T. Boggs. 1985, 6p
Pub. in Proceedings of Autotestcon '85 IEEE International Automatic Testing Conference, Uniondale, NY., October 22-24, 1985, p361-366.

Keywords: *Frequency response, *Calibrating, Linear systems, Tests, Time invariant systems, Parameter estimation.

An efficient strategy for accurately characterizing the frequency response of linear, time invariant systems is presented. The approach, based on circuit modeling, test point selection, and parameter estimation, optimizes calibration confidence with respect to test effort. The analytic tools and methodology needed for designing the strategy are included, together with experimental results. The approach can be particularly beneficial in volume testing of devices such as amplifiers, attenuators and filters, or systems whose frequency response is dominated by such devices.

708,394
PB86-142783 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Emerging New Requirements for Electric Power and Energy Measurements.
Final rept.
J. D. Ramboz, and O. Petersons. 1985, 10p
Pub. in Proceedings of the National Conference of Standards Laboratories Workshop and Symposium (1985), Boulder, Colorado, July 15-18, 1985, p3-12.

Keywords: *Electric measuring instruments, *Electric energy meters, Calibrating, Measuring instruments, Precision, Measurements, Electric power meters, Watt hour meters.

Advances in electronic instrumentation technology have brought greater stability and precision to transducers that are utilized for measuring electric power and energy. An advantage of instruments based on electronic transducers is that they can be readily adapted to the measurement of other quantities such as current, voltage, reactive and apparent power, power factor, demand, time-of-day readings, etc. The calibration accuracies requested from NBS for power and energy measurements have increased at least fivefold (uncertainty reduction from + or - 0.05% to + or - 0.01%) within the past several years. Calibrations for different quantities and values are being requested. These changing calibration requirements and the response of NBS to meet the requests of its calibration clientele are discussed.

708,395
PB86-142809 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Influence of Electromagnetic Interference on Electronic Devices.
Final rept.
F. X. Ries, and C. K. S. Miller. 1981, 11p
Pub. in Bulletin OIML No. 85, p1-11 Dec 81.

Keywords: *Electromagnetic interference, *Electric devices, Electromagnetic radiation, Reprints.

The paper is intended to give the legal metrology weights and measures community an elementary understanding of the electromagnetic interference (EMI) problem associated with electronic devices. The approach followed here will be to first present a brief understanding of what electromagnetic (EM) waves are

and the complexities involved in the understanding of their associated parameters. Following this is a discussion of the electromagnetic spectrum and its general pervasiveness and the effects changing technologies have had on electronic devices over the past forty years. A brief outline of the different types of testing methods and facilities will be presented.

708,396
PB86-143757 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Power Calibration Standard Based on Digitally Synthesized Sinewaves.
Final rept.
N. M. Oldham. Nov 85, 5p
Pub. in IEEE Transactions on Power Apparatus and Systems PAS-104, n11 p3117-3121 Nov 85.

Keywords: *Digital to analog converters, Inverters, Phase angle, Measurements, Reprints, *Calibration, *Calibration standards, Sine waves.

The unit of electric power at 60 Hz is often derived using impedance bridge techniques in which the alternating voltage is referred to the direct voltage standard through a thermal converter. An alternative calibration technique is described in which the ac to dc transfer is made through digital-to-analog converters (DACs) in the form of a dual-channel digital sinewave generator. The power is calculated from measurements of voltage, current, and phase angle, all of which rely on the accuracy of the digital generator and ultimately on the accuracy of the DACs.

708,397
PB86-144136 PC **A99**/MF **E04**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Precision Measurement and Calibration: Electricity. Selected Papers on the Realization and Maintenance of the Fundamental Electrical Units and Related Topics.
Final rept.
A. O. McCoubrey. Oct 85, 860p NBS/SP-705
See also N70-31104. Library of Congress catalog card no. 85-600580.

Keywords: *Electricity, Units of measurement, Electrical measurement, Calibrating, Electromagnetism, Quantum electronics.

The present volume in the field of electricity, includes 66 more recent papers by NBS authors and 16 abstracts of closely related papers by authors from other organizations. In view of the expansion of measurement technologies used in electricity and electromagnetism it has been necessary to reduce the range of topics for the selection of papers in the new compilation. In the connection an emphasis has been placed upon the realization and maintenance of fundamental electrical units and the related scientific advances, particularly in quantum physics. However, in the interest of completeness, three appendices also provide up-to-date bibliographies of publications by NBS authors in different areas of electromagnetism.

708,398
PB86-156585 PC **A08**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Electrical Performance Tests for Audio Distortion Analyzers.
Final rept.
O. B. Laug, G. N. Stenbakken, and T. F. Leedy. Nov 85, 158p NBSIR-85/3269
Sponsored by Army Communications-Electronics Command, Fort Monmouth, NJ.

Keywords: *Distortion, *Sound analyzers, High pass filters, Low pass filters, Performance tests.

Electrical performance test procedures for audio distortion analyzers were developed by the National Bureau of Standards for the U.S. Army Communications-Electronics Command. The report provides detailed, step-by-step test procedures that are based on specifications supplied by the Army for purposes of evaluating audio distortion analyzer bid samples. The report discusses the philosphy of each measurement procedure with a view toward providing an understanding of the basic metrology required to perform the measurements. In addition, the sources of measurement error are discussed. The primary applications and basic principles of modern audio distortion analyzers are also presented.

708,399
PB86-160967 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Near-Zero Bias Arrays of Josephson Tunnel Junctions Providing Standard Voltages up to 1 V.
Final rept.
J. Niemeyer, J. H. Hinken, and R. L. Kautz. Jun 85, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-34, n2 p185-187 Jun 85.

Keywords: *Josephson junctions, Integrated circuits, Superconductivity, Microwave equipment, Reprints, *Voltage standards.

Josephson voltage standards use microwave-induced constant voltage steps occurring due to the ac Josephson effect. Existing standards can be considerably simplified and their accuracy improved by using a large number of series-connected Josephson tunnel junctions which are operated in the zero current step mode. For this purpose superconducting millimeter wave integrated circuits have been designed, fabricated, and tested. The circuits consist of a broadband taper between the rectangular waveguide and the planar structure, the Josephson junction series, a well-matched load, and dc pads. Circuits with various numbers of junctions have been fabricated by photo-lithographic techniques and tested at 4.2 K in liquid helium. The version with 1474 junctions produced voltages up to 1.2 V when operated at 90 GHz.

708,400
PB86-163607 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Calibration of Standard Wattmeters Using a Capacitance Bridge and a Digital Generator.
Final rept.
N. M. Oldham, and O. Petersons. Dec 85, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-34, n4 p521-524 Dec 85.

Keywords: *Wattmeters, *Capacitance bridges, *Calibrating, Digital systems, Signal generators, Reprints, Comparators.

A method for calibrating high-accuracy wattmeters is described. The technique is a modification of a previously described approach that utilizes a power bridge based on a current comparator. In such a bridge the test current of the wattmeter is balanced with a known current that is proportional to the test voltage. The measurement circuit described employs a high-voltage capacitance bridge in place of a special current comparator that was used in the previous system. High sensitivity and large ratios of the capacitance bridge enable using high impedances, such as stable gas-dielectric capacitors and resistors having low-power dissipation for the generation of reference currents. The voltage on the standard impedances is adjusted with inductive dividers to obtain any power factor between zero and one, lead and lag. A digitally synthesized dual-channel signal source serves as a stable source of voltage and current, and thus of 'phantom' power.

708,401
PB86-164472 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Shielding-Effectiveness Measurements with a Dual TEM (Transverse Electromagnetic) Cell.
Final rept.
P. F. Wilson, and M. T. Ma. Aug 85, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electromagnetic Compatibility EMC-27, n3 p137-142 Aug 85.

Keywords: *Electromagnetic shielding, Measurement, Reprints, *Transverse electromagnetic cell.

Small-aperture theory is used to investigate the dual transverse electromagnetic (TEM) cell. Analyzing coupling through an empty versus loaded aperture leads to a simple model of dual-TEM-cell material shielding-effectiveness (SE) measurements. Experimental data are compared to theory with good agreement in the case of an empty aperture. Some of the difficulties in analyzing a loaded aperture are discussed.

708,402
PB86-164563 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Dual-Channel Automated Comparator for AC-DC Difference Measurements.
Final rept.
E. S. Williams, and J. R. Kinard. Jun 85, 5p
Sponsored by Department of Defense, Washington, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-34, n2 p290-294 Jun 85.

Keywords: *Comparators, *Calibrating, Electrical measuring instruments, Reprints.

An automated ac-dc difference calibration system is described. The system incorporates a new electronic comparator which determines ac-dc differences of thermal voltage converters (TVC's) by simultaneously measuring the difference between nearly equal ac and dc voltages with both the test and standard instruments. The comparator consists essentially of two practically identical channels each containing a digital-to-analog converter balancing circuit, an operational amplifier to amplify voltage imbalance, and an integrator circuit in which a capacitor is charged during an accurately controlled 10-s period. The difference between the ac and dc voltages applied to the test and standard TVC's is computed from differences in capacitor voltages, and the ac-dc difference is derived from the variation between the test and standard channel indications of the voltage difference. Measurements are made in about half the time required for our manual procedures.

708,403
PB86-166618 PC **A08**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
U.S. Access to Japanese Technical Literature: Electronics and Electrical Engineering. Proceedings of a Seminar Held at Gaithersburg, Maryland on June 24-25, 1985. Volume 1. Selected Presentations.
Final rept.
E. L. Brady. Jan 86, 151p NBS/SP-710
Also available from Supt. of Docs as SN003-003-02709-0. Library of Congress catalog card no. 85-600637. Sponsored by Institute of Electrical and Electronics Engineers, Inc., New York.

Keywords: *Technical reports, *Electrical engineering, *Electronic engineering, Availability, Japan.

On June 24-25, 1985, NBS and IEEE cosponsored a seminar at NBS to examine the need for improved access to Japanese technical information and to explore possible approaches to satisfy those needs. To limit the discussion to practical dimensions, the technical subject matter was restricted to electrical and electronics engineering. The program was designed to provide an opportunity for individuals representing Congress, the practicing engineering community, industry, and the educational community to voice their concerns and their needs.

708,404
PB86-166725 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Finline Diode Six-Port: Fundamentals and Design Information.
M. Weidman. Dec 85, 43p NBS/TN-1090
Also available from Supt. of Docs as SN003-003-02714-6.

Keywords: Network analyzers, Millimeter waves, Integrated circuits, Planar devices, Design, *Six ports.

The preliminary design and testing of a planar circuit six-port with diode detectors is described. The planar circuit medium was chosen to be finline, and all preliminary work was done in WR-42 waveguide (18-26.5 GHz). The finline substrate was alumina, and initially commercial beam-lead diodes were bonded to the finline metalization. The goal is to design an integrated circuit which could be fabricated on one chip (with diode detectors) and used as part of a six-port network analyzer in the waveguide bands above 18 GHz. Initial designs proved to be unsatisfactory because of high losses and reflections. Most of the problems have been solved, and a usable integrated finline circuit is a good possibility for a millimeter wave six-port.

708,405
PB86-191814 PC **A05**/MF **A01**

National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Research for Electric Energy Systems - An Annual Report (1985).
R. E. Hebner. Mar 86, 88p NBSIR-86/3316
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Electric power, Electric measuring instruments, Dielectrics, Dielectric breakdown, Sulfur hexafluoride, Electrical insulation, Interfaces, Space charge, Insulating oil, Electric fields, Magnetic fields.

The report documents the technical progress in the five investigations which make up the project 'Support of Research Projects for Electrical Energy Systems,' Department of Energy Task Order Number 137, funded by the U.S. Department of Energy's Office of Energy Systems Research and performed in the Electrosystems Division of the U.S. National Bureau of Standards.

708,406
PB86-193802 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Length and Mass Div.
Automatic High-Precision Audiofrequency Capacitance Bridge.
Final rept.
R. D. Cutkosky. 1985, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-34, n3 p383-389 Sep 85.

Keywords: *Capacitance bridges, Audio frequencies, Reprints.

A compact transformer-ratio-arm bridge has been built in which the balance point is automatically determined with the aid of an internal microprocessor. The instrument described in the paper can operate from 20 Hz to 20 kHz, and has three ranges; 12, 120, and 1200 pF. The instrument can resolve one part in 10 to the 8th power of full scale above 400 Hz, and can be fully controlled over its IEEE-488 bus interface.

708,407
PB86-195757 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Precision Phase Angle Calibration Standard for Frequencies up to 50 kHz.
Final rept.
R. S. Turgel. Dec 85, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-34, n4 p509-516 Dec 85.

Keywords: *Standards, *Calibrating, *Frequency measurement, Waveforms, Radiofrequency generators, Phase angle, Phase meters, Reprints.

A Phase Angle Calibration Standard covering a frequency range from 2 Hz to 50 kHz has been designed and constructed. Digital waveform generation is used to provide sinusoidal analog outputs having precisely settable phase angles. Output voltages are independently adjustable from 0.5 to 100 V rms on both channels. An auto-zero feed back loop compensates for differential phase errors of the output amplifiers.

708,408
PB86-201811 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Ellipsometric Metrology of Ultrathin Films: Dual Angle of Incidence.
Final rept.
D. Chandler-Horowitz. 1985, 5p
Pub. in Proceedings of the SPIE (Society for Photo-Optical Instrumentation Engineers) International Conference on Micron and Submicron Integrated Circuit Metrology, San Diego, CA., August 22-23, 1985, v565 p93-97.

Keywords: *Thin films, *Metrology, Measurement, Incidence, Error analysis, Substrates, Silicon, Ellipsometric metrology, Ultrathin films.

Single angle of incidence ellipsometric measurements have been extended to dual angle measurements on our newly constructed multi-method precision ellipsometer in order to better determine the optical constants of a substrate. Following the measurement error analysis that was prescribed in an earlier paper for single angle of incidence and fixed wavelength measurements, the results for dual angle of incidence are presented here. Using an Explicit Error Analysis (EEA) method, involving the differentials of the measurable optical constants of the surface, it is possible to find a well-defined pair of incident angles to perform the measurement. Without a measurement error analysis, there would be no way of knowing what the absolute measurement uncertainty is or which angles of incidence could provide optimum measurement conditions. As in the case of single angle of incidence measurement where we were able to select an optimum angle of incidence to assure the highest measurement accuracy, the dual angle of incidence measurement also predicts optimum angles of incidence. It was found that in the case of single angle of incidence ellipsometry the principal angle of incidence can sharply define the optimum angle for measuring bare substrates and very thin films on a substrate. Likewise, for the dual angle of incidence measurement, there can also be two sharply defined angles for certain sample surface models. Here we present a dual angle ellipsometric measurement of the real part of the refractive index of a silicon substrate at the wavelength of 632.8 nm. A silicon dioxide film thickness between 125 and 150 nm and the two angles of incidence, 68 and 72 deg, optimized the measurement.

708,409
PB86-202447 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Publication Announcements, Covering Center Programs, April - June 1984 with 1984 CEEE Events Calendar.
J. F. Mayo-Wells. Aug 84, 16p NBSIR-84/2927

Keywords: *Electronics, *Electrical engineering, Documents, Standards, Abstracts, Research projects, Semiconductors(Materials), Metrology, Signal processing.

The first issue of a quarterly abstract journal covering the work of the National Bureau of Standards Center for Electronics and Electrical Engineering. The issue of the Center for Electronics and Electrical Engineering Technical Publication Announcements covers the second quarter of calendar year 1984. Abstracts are provided by technical area for papers published the quarter.

708,410
PB86-202553 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Effects of Phosphorus Contact Doping and Sheet Resistance Variations on Al/Si Interfacial Contact Resistance.
Final rept.
J. A. Mazer, L. W. Linholm, D. Pramanik, S. Tsai, and A. N. Saxena. 1983, 4p
Sponsored by Institute of Electrical and Electronics Engineers, Inc., Rochester, NY. Rochester Section.
Pub. in Proceedings of the Custom Integrated Circuits Conference, Rochester, NY., May 23-25, 1983, p291-294.

Keywords: *Integrated circuits, Semiconductor doping, Additives, Contacting, Reliability, Silicon, Aluminum, Phosphous, Metallizing, *Contact resistance, Very large scale integration.

The effects of phosphorus-contact doping and sheet resistance variations on interfacial contact resistance R sub C and on interfacial layer uniformity are investigated using a microelectronic test structure and electrical measurement method. Measurement results indicate that phosphorus-contact doping lowers the value of R sub C by as much as a factor of two without sacrificing the uniformity of the interfacial layer. The specific contact resistance is shown to be approximately directly proportional to the sheet resistance of the silicon in the contact window.

708,411
PB86-210549 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Washington, DC.
Center for Electronics and Electrical Engineering Technical Publication Announcements: Covering Center Programs, April-June 1985 with 1986 CEEE Events Calendar.
E. J. Walters. Jan 86, 13p NBSIR-86/3310
See also PB86-201290.

Keywords: *Electronics, *Electrical engineering, Documents, Standards, Abstracts, Research projects, Semiconductors(Materials), Metrology, Signal processing.

This is the fifth issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. The issue of the Center for Electronics and Electrical Engineering Technical Publication Announcements covers the second quarter of calendar year 1985. Abstracts are provided by technical area for papers published this quarter.

708,412
PB86-213147 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Calibration of Aspirator-Type Ion Counters and Measurement of Unipolar Charge Densities.
Final rept.
M. Misakian, R. H. McKnight, and C. Fenimore. May 86, 77p NBS/TN-1223
Also available from Supt. of Docs as SN003-0003-02732-4.

Keywords: *Calibrating, Power transmission lines, Measurement, *Ion counters, *Ion density, *Ion detection, HVDC systems.

The characterization of a parallel plate apparatus which can produce a unipolar ion density that is suitable for calibrating aspirator-type ion counters operating in the ground plane is described. The influence of a dc electric field, air motion, Coulomb repulsion and diffusion on the transport of ions into the ion counter are examined to determine their effects on instrument calibration and measurements in the vicinity of high voltage dc transmission lines. An ion density which is known with an uncertainty of less than + or - 9% is used to check the performance of an ion counter with and without a duct at its entrance. The results of laboratory measurements of ion density under a monopolar high voltage line, which complement the studies with the parallel-plate apparatus, are also described.

708,413
PB86-227410 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Design, Evaluation, and Use of a Reverberation Chamber For Performing Electromagnetic Susceptibility/Vulnerability Measurements.
Technical note.
M. L. Crawford, and G. H. Koepke. Apr 86, 149p NBS/TN-1092
Also available from Supt. of Docs as SN003-003-02734-1. Sponsored by Naval Surface Weapons Center, Dahlgren, VA., and Rome Air Development Center, Griffiss AFB, NY.

Keywords: *Test facilities, Reverberation, Electomagnetic radiation, Vulnerability, Electromagnetic susceptibility, Reverberation chambers.

The report presents the results of work at the National Bureau of Standards, Boulder, Colorado, to carefully evaluate, document, develop (when necessary), and describe the methodology for performing radiated susceptibility/vulnerability measurements using a reverberation chamber. The report describes the reverberation chamber theory of operation, evaluation, functional operation, and use for performing immunity measurements. It includes an estimate of measurement uncertainties derived empirically from test results and from comparisons with anechoic chamber measurements. Finally, it discusses the limitations and advantages of the measurement technique to assist potential users in determining the applicability for the technique to their electromagnetic compatibility (EMC) measurement needs.

708,414
PB86-229358 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Josephson Series Array Voltage Standard at One Volt.
Final rept.
C. A. Hamilton, R. L. Kautz, and F. L. Lloyd. 1985, 7p
Pub. in Proceedings of NCSL 1985 Workshop and Symposium, Boulder, CO., July 15-18, 1985, p71-77.

Keywords: *Josephson junctions, *Standards, Superconductivity, Substrates, Silicon, *Voltage standards.

Josephson voltage standards have long been limited by their low 1-10 mV output level. A new method for operating 1000 or more Josephson junctions in series has produced a practical standard at the one volt level. The junction array is in the form of a microstrip which is finline coupled to a waveguide at one end and is terminated at the other end. The whole circuit is fabricated on a 6 by 12 mm silicon substrate. With applied radiation at 72 GHz, the junction array produces up to 8000 quantized levels at the voltages nhf/2e. (In the United States 2e/h has an assigned value of 483593.420 GHz/V(NBS)). Any voltage from 0.1 to 1.2 volts can be obtained by selecting the level, n, and fine tuning the frequency, f. The high output voltage eliminates the need for a voltage divider and greatly reduces errors due to thermal voltages. When fully evaluated, the new standard is expected to have a precision of a few parts in a billion.

708,415
PB86-229366 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Practical Josephson Voltage Standard at 1 V.
Final rept.
C. A. Hamilton, R. L. Kautz, R. L. Steiner, and F. L. Lloyd. 1985, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Electron Device Letters, EDL-6, n12 p623-625 Dec 85.

Keywords: *Standards, *Josephson junctions, Superconductivity, Reprints, *Voltage standards.

A series array of 1484 pairs of Josephson junctions, biased by microwaves at 72 GHz, is demonstrated to provide stable quantized voltages at the 1 V level. The niobium/lead-alloy junctions used in the array are not affected by thermal cycling.

708,416
PB86-229374 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Sensitive, High Frequency, Electromagnetic Field Probe Using a Semiconductor Laser in a Small Loop Antenna.
Final rept.
R. J. Phelan, D. R. Larson, and P. A. Simpson. 1985, 7p
Pub. in Proceedings of the Society of Photo-Optical Instrumentation Engineers, San Diego, CA., August 20-23, 1985, v566 p300-306.

Keywords: *Electromagnetic fields, Microwaves, Semiconductor lasers, Loop antennas, Avalanche diodes, Photodiodes, *Probes(Electromagnetic), Laser applications, Optical fibers.

Using a loop antenna in series with a semiconductor laser, an optically coupled electromagnetic field probe has demonstrated sensitivities better than 3 microV/(m.(Hz to the 1/2 power)). The probes outside dimensions are equal to 5.7 x 5.7 x 1.3 cc. It can be used to measure fields with frequencies as high as 2 GHz. The dynamic range is estimated to exceed 6 orders of magnitude for incident microwave powers.

708,417
PB86-231164 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Intrinsic and Extrinsic Noise Sources in an RF Biased R-SQUID (Resistive-SQUID).
Final rept.
H. Seppa, J. H. Colwell, and R. J. Soulen. 1983, 5p
Pub. in Proceedings of International Conference on Noise in Physical Systems (7th), and International Conference on 1/f Noise (3rd), Montpellier, France, May 17-20, 1983, p399-403.

Keywords: *Temperature measuring instruments, Josephson junctions, Cryogenics, *Noise thermometers, SQUID devices.

The authors have modelled the influence of external circuit noise on the performance of a resistive-SQUID noise thermometer. The predictions of the model are in such good agreement with experimental results that one can reduce their influence to such an extent that noise thermometry free of systematic errors may be conducted to the 0.1% level from 1 mK to 500 mK.

708,418
PB86-231461 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Measurements of Unintentional Electromagnetic Emissions.
Final rept.
M. T. Ma, and G. H. Koepke. 1986, 2p
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) 74, n1 p110-111 Jan 86.

Keywords: *Electromagnetic radiation, *Electromagnetic interference, Measurement, TEM cells.

A summary of a new method for determining the radiation characteristics of leakage from electronic equipment or other unintentional radiators of interference is presented. The theoretical background and specific measurement procedures for the method using a transverse electromagnetic cell are outlined. The theory and measurements have been verified in referenced work by the results of a simulated theoretical example and an experiment using a spherical dipole radiator. Mathematical analysis of the uncertainties in the final, extracted results when the experimental data are degraded by the background noise and measurement imperfections is also available.

708,419
PB86-231610 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Optical Fiber Sensors for the Measurement of Pulsed Electric Currents.
Final rept.
G. W. Day, J. D. O. McFadden, L. R. Veeser, G. I. Chandler, and R. W. Cernosek. 1985, 9p
Sponsored by Department of Energy, Washington, DC., Sandia National Labs., Albuquerque, NM., and Bonneville Power Administration, Portland, OR.
Pub. in Guided Optical Structures in the Military Environment (AGARD-CPP-383), Istanbul, Turkey, September 23-27, 1985, p8-1-8-9 1985.

Keywords: *Electric current, *Electrical measurement, Fiber optics, *Electric pulses.

Recent progress in the design of fiber sensors for pulsed electric currents is reviewed. Several of the most useful sensor configurations are described and compared. Models are used to predict the transfer function of these sensors, their sensitivity to non-ideal fiber properties, particularly linear birefringence, and methods for overcoming these problems. Other recent research is examined to suggest the prospect for sensors with improved sensitivity and stability.

708,420
PB86-238680 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Optically Pumped Small Cesium Beam Standards: A Status Report.
Final rept.
A. Derbyshire, R. E. Drullinger, M. Feldman, D. J. Glaze, D. Hilliard, D. A. Howe, L. L. Lewis, and J. H. Shirley. 1986, 4p
Pub. in Proceedings of Annual Symposium on Frequency Control (39th), May 29-31, 1985, Philadelphia, PA., p18-21 1986.

Keywords: *Frequency standards, Cesium, Optical pumping, Laser pumping.

The authors report on their project to study and to demonstrate the potential performance achievable in cesium beam frequency standards in which laser driven optical pumping is used for the atomic state selection and state detection in place of the conventional magnetic state selection. The beam tubes used have been derived from commercial devices. In the first unit the only functional change was a simple replacement of state selection magnets with optics. In a second unit, the magnetic shields and c-field have been extended to include the regions of optical pumping.

708,421
PB86-238698 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Beam Reversal Experiment on NBS-6 (National Bureau of Standards) Primary Cs Standard Including Rabi Pulling Evaluation.
Final rept.
A. DeMarchi, G. D. Rovera, R. Drullinger, and D. A. Howe. 1986, 5p
Pub. in Proceedings of Annual Symposium on Frequency Control (39th), May 29-31, 1985, Philadelphia, PA., p3-7 1986.

Keywords: *Frequency standards, Cesium.

An improvement in the evaluation of the Cs beam primary frequency standard NBS-6 is being attempted through a reevaluation of Rabi pulling using a recently published theory. Time of flight distribution measurements and frequency measurements at various C-field values have been performed in both beam directions. This allows the authors to model Rabi pulling and hence more clearly study other systematic effects.

708,422
PB86-238706 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Recirculating Oven for Atomic Beam Frequency Standards.
Final rept.
R. E. Drullinger, D. J. Glaze, and D. B. Sullivan. 1986, 5p
Sponsored by Space Div., Los Angeles AFS, CA.
Pub. in Proceedings of Annual Symposium Frequency Control (39th), May 29-31, 1985, Philadelphia, PA., p13-17 1986.

Keywords: *Frequency standards, Atomic beams, Ovens.

The paper describes a simple recirculating oven which produces an atomic beam which can be better collimated than that from a conventional oven with equivalent collimation ratio. The oven is spill proof and requires only modest power for operation. Under suitable conditions the total beam flux can be significantly less than for conventional cesium ovens. This translates into more efficient use of the cesium charge and less contamination of the beam tube.

708,423
PB86-239290 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Current NBS Metrology Capabilities and Limitations at Millimeter Wave Frequencies.
Final rept.
G. R. Reeve, and C. K. S. Miller. 1985, 13p
Pub. in Precision Measurements Association Newsnotes 2, p55-67 1985.

Keywords: *Metrology, Millimeter waves, Extremely high frequencies, Standards, Reprints, National Bureau of Standards.

The National Bureau of Standards (NBS) establishes national artifact standards and provides a metrology base for U.S. industry and technology. In the millimeter wave frequency spectrum, NBS has not established all of the required metrology to meet the needs of industry or government for this technology. It is the intent of the paper to describe the technical demands of responding to the challenges of millimeter wave technology.

708,424
PB86-240777 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Fluorescent Light Shift in Optically Pumped Cesium Standards.
Final rept.
J. Shirley. 1986, 2p
Pub. in Proceedings of Annual Symposium on Frequency Control (39th), May 29-31, 1985, Philadelphia, PA., p22-23 1986.

Keywords: *Frequency standards, Cesium, Optical pumping.

The authors have calculated the light shift in an optically pumped cesium beam frequency standard caused by fluorescence co-propagating with the atomic beam. Both scalar and tensor contributions are included to give the dependence on light polarization. The results provide design criteria for proposed new standards.

708,425
PB86-247608 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.

Center for Electronics and Electrical Engineering Technical Publication Announcements Covering Center Programs, October to December 1985 with 1986 CEEE Events Calendar.
E. J. Walters. Jul 86, 28p NBSIR-86/3424
See also PB86-201290.

Keywords: *Electronics, *Electrical engineering, Semiconductor devices, Metrology, Signal processing, Bibliographies.

This is the seventh issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. This issue of the Center for Electronics and Electrical Engineering Technical Publication Announcements covers the fourth quarter of calendar year 1985. Abstracts are provided by technical area for papers published this quarter.

708,426
PB87-102489 PC **A09**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Electromagnetic Compatibility and Interference Metrology.
M. T. Ma, and M. Kanda. Jul 86, 180p NBS/TN-1099
Also available from Supt. of Docs as SN003-003-02760-0.

Keywords: *Electromagnetic compatibility, *Electromagnetic interference, *Metrology, Measurement.

The material included in the report is intended for a short course on electromagnetic compatibility/interference (EMC/EMI) metrology. The entire course is presented in nine chapters with the introductory part given as Chapter 1. The particular measurement topics to be covered are: (i) open sites (Chapters 2 and 6), (ii) transverse electromagnetic cells (Chapter 3), (iii) techniques for measuring the electromagnetic shielding of materials (Chapter 4), (iv) anechoic chambers (Chapter 5), and (v) reverberating chambers (Chapter 8). In addition, since small probe antennas play an important role in some of the EMC/EMI measurements covered herein, a separate chapter on various probe systems developed at NBS is given in Chapter 7. Selected contemporary EMI topics such as the characterization and measurement of a complex EM environment, interferences in the form of out-of-band receptions to an antenna, and some conducted EMI problems are also briefly discussed (Chapter 9).

708,427
PB87-104923 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Quench Detector Circuit for Superconductor Testing.
Final rept.
W. P. Dube, and L. F. Goodrich. Apr 86, 3p
Sponsored by Department of Energy, Washington, DC.
Pub. in Review of Scientific Instruments 57, n4 p680-682 Apr 86.

Keywords: *Superconductors, Reprints, *Quench detectors, Critical current.

A quench detector is a device that interrupts the flow of current through a superconductor in the event the superconductor reverts to the normal, resistive state. The new design has adjustable filtering and sensitivity. The input is well isolated from the output, eliminating any possible ground loop through the detector. It also has excellent noise immunity. A detector has operated with no false trips for more than two years, detecting hundreds of quenches.

708,428
PB87-104931 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Annealing of Bend-Induced Birefringence in Fiber Current Sensors.
Final rept.
G. W. Day, and S. M. Etzel. 1985, 4p
Sponsored by Department of Energy, Washington, DC.
Pub. in International Conference on Integrated Optics and Optical Fibre Communication (5th) - Technical Digest, v1 p871-874, Venice, Italy, 1-4 Oct 85.

Keywords: *Ammeters, *Fiber optics, *Birefringence, Electric current, Magnetic fields, Magnetic measurement, Detectors, Faraday effect, *Optical fibers.

The bend-induced linear birefringence in coils of single mode optical fiber has been greatly reduced by annealing. This should allow the construction of electric current sensors that are much more compact and potentially more sensitive than previously possible.

708,429
PB87-106027 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Performing EM (Electromagnetic) Susceptibility/Vulnerability Measurements Using a Reverberation Chamber.
Final rept.
M. L. Crawford, and G. H. Koepke. 1986, 8p
Pub. in EMC EXPO 86 International Conference on Electromagnetic Compatibility, Washington, DC., June 16-19, 1986, pT28.7-T28.14.

Keywords: *Electromagnetic compatibility, Measurement, Vulnerability, *Electromagnetic susceptibility, Reverberation chambers.

The paper discusses the design, evaluation, and use of a reverberation chamber for performing electromagnetic susceptibility (EMS) measurements of electronic equipment. Included are brief descriptions of the test procedures, application advantages and limitations, some EMS test results, intrepretation of test results relative to free-space test methods, and an estimate of measurement uncertainties.

708,430
PB87-106159 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
National Bureau of Standards Josephson Array Voltage Standard.
Final rept.
C. A. Hamilton, R. L. Kautz, and F. L. Lloyd. 1986, 2p
Pub. in Proceedings of 1986 Conference on Precision Electromagnetic Measurements, Gaithersburg, MD., June 23-27, 1986, p108-109.

Keywords: *Josephson junctions, *Standards, *Voltage standards, *Calibration standards, Josephson effect.

A Josephson voltage standard based on a series array of 2076 junctions is described. With a 15 mW input at 96 GHz, the array produces 15,000 quantized levels between -1.5 and 1.5 V. Initial results on high precision comparisons with a Zener reference standard are given.

708,431
PB87-106373 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Pulse and Time-Domain Measurements.
Final rept.
R. A. Lawton, S. M. Riad, and J. R. Andrews. 1986, 5p
Pub. in Proceedings of the Institute of Electrical and Electronics Engineers 74, n1 p77-81 Jan 86.

Keywords: *Time domain, Measurement, Reviews, Pulses.

A review of the state of the art and science of pulse parameter measurements is given including recent advances in the use of real-time oscilloscopes, waveform recorders, equivalent time sampling oscilloscopes, and counter timers in the measurement of repetitive and single transient signals. Recent advances in the use of artifact waveform standards and modern signal analysis techniques to compensate for measurement distortion are highlighted. The formation and progress of an IEEE committee which is developing a performance standard for waveform recorders is also described.

708,432
PB87-107355 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Test of the Quantum Hall Effect as a Resistance Standard.
Final rept.
M. E. Cage, R. F. Dziuba, and B. F. Field. 1985, 3p
Pub. in IEEE Transactions on Instrumentation and Measurement IM-34, n2 p301-303 Jun 85.

Keywords: *Standards, *Electrical resistance, Electrical measurement, Hall effect, Reprints.

The paper demonstrates that the quantum Hall effect can be used to monitor a laboratory unit of resistance. A 6,453.2 ohms room temperature reference resistor was calibrated relative to two quantum Hall effect devices with a 0.017 ppm (1 sigma) uncertainty for each one hour measurement period. The accuracy was acheived by correcting for a measurement system offset error and for the temperature dependences of each quantum Hall device. Hamon series-parallel resistor networks were then used to calibrate the 6,453.2 ohms resistor in terms of the five one ohm resistors which comprise the NBS ohm. The total 1 sigma accuracy for the transfer between the quantum Hall devices and the one ohm resistors was 0.047 ppm.

708,433
PB87-108676 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Estimation of True Power Ratios in Six-Port Network Analyzers Using Diode Detectors.
Final rept.
D. R. Holt, and C. A. Hoer. Dec 85, 6p
Pub. in IEEE Transactions on Instrumentation and Measurement IM-34, n4 p558-563 Dec 85.

Keywords: *Network analyzers, Estimating, Detectors, Diodes, Reprints.

A model for detector nonlinearity is included in the determination of six-port parameters without using additional standards. A computer simulation was performed assuming that the true power into each six-port detector is related to the power observed by the detector. Simultaneous estimation of the six-port and detector parameters is accomplished through a nonlinear least squares algorithm. Results of the simulation compare Gamma computed from corrected power readings and Gamma calculated from observed power readings.

708,434
PB87-110060 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Discussion of 'Four-Terminal Impedance Current Transformer Bridge with Resistive Ratio Arm' by Franco Castelli.
Final rept.
O. Petersons, and T. M. Souders. 1979, 2p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Power Apparatus and Systems PAS-98, n3 p980-981 May/Jun 79.

Keywords: *Impedance bridges, *Electrical impedance, Current transformers, Electrical measurement, Reprints.

The advantages and disadvantages of a measurement technique for low value 4-terminal impedances is discussed. The method uses current transformer scaling and mixed ratio arms.

708,435
PB87-110128 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Electromagnetic Shielding Effectiveness: Measurement Techniques and Interpretations.
Final rept.
P. F. Wilson, and M. T. Ma. 1986, 14p
Pub. in Institute of Electrical and Electronics Engineers Regional Conference and Exhibition on Electromagnetic Compatibility, Anaheim, CA., February 6, 1986, p1-14.

Keywords: *Electromagnetic shielding, Effectiveness, Measurement, Insertion loss.

A material's shielding capability is generally measured in terms of insertion loss: the field reduction between a transmitter and a receiver achieved by introducing the shield material. Ambiguities often arise when one attempts to interpret specific measurement results. Insertion loss data depend not only on the shield material tested, but also on the measurement procedure and other parameters such as the antenna types (both transmitting and receiving) used and their positioning, the incident waveform and its wave impedance, transient effects, and the contact resistance between the test material and its mount, if any.

708,436
PB87-110136 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

Methods for Measuring the Near-Field and Far-Field Shielding Effectiveness of Materials.
Final rept.
P. F. Wilson, and M. T. Ma. 1986, 6p
Pub. in EMC EXPO '86, Washington, DC., June 16-19, 1986, pT28.1-T28.6.

Keywords: *Electromagnetic shielding, Far field, Measurement, TEM cells, Near field.

Techniques for measuring the shielding effectiveness of materials are investigated. Specific approaches considered are coaxial transmission line holders and the use of a time-domain signal for simulating plane wave shielding performance, and the dual TEM cell and an apertured TEM cell in a reverberation chamber for the simulation of near-field shielding capability. The advantages and limitations of each technique are summarized.

708,437
PB87-110144 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Simple Approximate Expressions for Higher Order Mode Cutoff and Resonant Frequencies in TEM (Tranverse Electromagnetic) Cells.
Final rept.
P. F. Wilson, and M. T. Ma. 1986, 6p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Electromagnetic Compatibility EMC-28, n3 p125-130 Aug 86.

Keywords: Resonant frequency, *TEM cells.

Simple approximate expressions for determining the cutoff frequencies of the first few higher order modes and the associated resonant frequencies in transverse electromagnetic (TEM) cells are presented. Both symmetric (seven TE and two TM modes) and asymmetric (three TE modes) cells are discussed.

708,438
PB87-115408 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Uncertainty Charts for RF and Microwave Measurements.
Final rept.
R. A. Kamper. 1986, 6p
Pub. in Proceedings of the Institute of Electrical and Electronics Engineers 74, n1 p27-32 Jan 86.

Keywords: *Electrical measurement, *Calibrating, Radio frequencies, Microwave frequencies, Reprints, US NBS, Uncertainty.

The scope of the calibration services for electrical quantities in the range of frequency from 0 to 100 GHz that are available from the National Bureau of Standards is discussed briefly in a historical context. Some plans for improved services that will be available in the near future are noted. Charts showing the variation of uncertainty with magnitude over the full range of the respective calibration services are presented.

708,439
PB87-121356
(Order as PB87-121315, PC **A04**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Possible Changes in the U.S. Legal Units of Voltage and Resistance.
B. N. Taylor. 31 Jul 86, 7p
Included in Jnl. of Research of the National Bureau of Standards, v91 n5 p299-305 Sep-Oct 86.

Keywords: *Standards, *Units of measurement, *Quantum Hall effect, *Josephson effect, *Volt, *Ohm, *Voltage standards, *Resistance standards, International system of units.

The Consultative Committee on Electricity of the International Committee on Weights and Measures is considerding adopting sometime in the future (1) a new value for the Josephson frequency-voltage ratio 2e/h (e is the elementary charge and h is the Planck constant) and (2) a value for the quantized Hall resistance RH=h/e(2). Both values are to be chosen as consistent with their International System of Units (SI) values as possible and would be used by every national standards laboratory which employs the Josephson and quantum Hall effects to define and maintain their national or legal units of voltage and resistance. Based on current knowledge, this would lead to an increase in the U.S. Legal Volt of about nine parts-per-millin (ppm) and an increase in the U.S. Legal Ohm of about 1.5 ppm. It is the purpose of the paper to review in some detail the basis for these proposed and potentially significant changes.

708,440
PB87-125761 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Electromagnetic Radiation Test Facilities Evaluation of Reverberation Chambers Located at NSWC (Naval Surface Weapons Center), Dahlgren, Virginia.
M. L. Crawford, and G. H. Koepke. Jun 86, 43p NBSIR-86/3051
Sponsored by Naval Surface Weapons Center, Dahlgren, VA. Dahlgren Labs.

Keywords: Electromagnetic shielding, Vulnerability, *Reverberation chambers, Electromagnetic susceptibility, Naval Surface Weapons Center.

The facilities were developed by the NSWC for use in measuring and analyzing the electromagnetic susceptibility/vulnerability (EMS/V) of weapon systems and the shielding effectiveness of enclosures and shielding materials. A brief description of each facility is given including the instrumentation used for performing the evaluation and calibration of the facilities by the National Bureau of Standards (NBS). Conclusions given indicate that the NSWC chambers can be used at frequencies down to approximately 150 MHz. Estimates are given of the measurement uncertainties derived empirically from the test results.

708,441
PB87-134367 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Evaluation of Off-Axis Measurements Performed in an Anechoic Chamber.
Technical note.
M. Kanda, and J. C. Wyss. Oct 86, 42p NBS/TN-1305
Also available from Supt. of Docs as SN003-003-02779-1.

Keywords: *Anechoic chambers, Waveguides, Ultrahigh frequencies, Horns.

Field strength versus distance from various source antennas is measured in a rectangular rf anechoic chamber on axes parallel to the boresight axis. An electrically small field probe is repeatedly scanned longitudinally away from the launch antenna and into the chamber. With each scan various parameters are changed, including: (1) horizontal and vertical position of the probe with respect to the center line of the launch antenna; (2) frequency; and (3) type of launch antenna. With the probe located 1 m off the center line and scanning between 2 and 6 m from the launch horn, the uncertainty due to being off the center line ranges from plus or minus 1 dB at 250 MHz to plus or minus 5.0 dB at 800 MHz and above. If the probe is within plus or minus 50 cm of center line, the uncertainty is no more than plus or minus 1.5 dB at 800 MHz; and, for plus or minus 25 cm from center line the uncertainty is further reduced to plus or minus 0.5 dB at 800 MHz.

708,442
PB87-138384 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Design of the National Bureau of Standards Isotropic Magnetic Field Meter (MFM-10) 300 kHz to 100 MHz.
J. E. Cruz, L. D. Driver, and M. Kanda. Oct 85, 57p NBS-TN-1085
Also available from Supt. of Docs as SN003-003-02770-7.

Keywords: *Magnetic fields, *Magnetic measurement, Electromagnetic interference, Field strength, Electromagnetic fields, Electric measuring instruments, Performance, Design, Microwave sensors, Near field.

A broadband magnetic field meter has been developed at the National Bureau of Standards (NBS) for the frequency range of 300 kHz to 100 MHz. The isotropic antenna unit consists of three mutually orthogonal loops, each 10 cm in diameter. The magnetic field probe described in the paper has a measurement range of 0.1 to 30 A/m. The readout of the meter is in terms of the Hermitian or 'total' magnitude of the magnetic field strength which is equal to the root-sum-square value of the three orthogonal magnetic field components at the measurement point. This magnetic field meter is nearly isotropic over its dynamic range. The electronic circuitry of the meter obtains the total magnitude of all field polarizations for all cw signals in the entire frequency band. The sensor is isotropic and is well suited for measuring the near field of an emitter, including regions of multiple reflections and standing waves. The meter can be used to monitor either the plane wave fields in the far zone of a transmitter, or the complicated fields very close to an rf leakage source. The report describes the design, performance and operating instructions for the MFM-10.

708,443
PB87-140273 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Technical Publication Announcements Covering Center Programs, January to March 1986.
E. J. Walters. Nov 86, 24p NBSIR-86/3486
See also PB86-247608.

Keywords: *Electronics, *Bibliographies, Semiconductor devices, Metrology, Integrated circuits, Signal processing, Antennas, Fiber optics, Lasers, Microwaves, Superconductors, Electromagnetic interference, Electric power, Abstracts.

This is the eighth issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. The issue of the Center for Electronics and Electrical Engineering Technical Publication Announcements covers the first quarter of calendar year 1986. Abstracts are provided by technical area for papers published this quarter.

708,444
PB87-140729 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Handbook for Operation and Maintenance of an NBS (National Bureau of Standards) Multisensor Automated EM (Electromagnetic) Field Measurement System.
W. D. Bensema, G. H. Koepke, and H. W. Medley. Oct 86, 70p NBSIR-86/3056

Keywords: *Electromagnetic fields, *Handbooks, Detectors, Operation, Maintenance, Automation, Microcomputers, Computer programs, *Electromagnetic measurement, Computer applications, Hewlett-Packard computers.

A system is described that monitors and collects electromagnetic (EM) field strength information at five (optionally 10) locations simultaneously. The system has two modes of operation: (1) for sampling EM fields that are stationary for times of the order of 200 ms, and (2) for sampling changing EM fields with a system resolution of 10 microsec. Sensing elements for Mode 1 consist of three electrically short orthogonal dipoles mounted together, single dipole elements, or small loop antennas. Each element feeds a separate data input channel for a total of 15 (optionally 30) channels. Rf energy is converted to dc by a diode detector at each dipole. Mode 2 sensors will be diode detectors driven by broadband antennas. Real time system data processing includes calculation of field strength based on probe calibrations and processing of resultant data to satisfy measurement goals.

708,445
PB87-150777 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
NBS (National Bureau of Standards) Absolute Ampere Experiment.
Final rept.,
P. T. Olsen, V. E. Bower, W. D. Phillips, E. R. Williams, and G. R. Jones. Jun 85, 7p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Instrumentation and Measurement IM-34, n2 p175-181 Jun 85.

Keywords: Electrical measurement, Fundamental constants, Precision, Reprints, *Ampere, Current balances, Superconducting coils.

A current balance was constructed with superconducting field coils, for the realization of the SI ampere by comparing mechanical to electrical work. The estimated ultimate accuracy of the realization is 0.1 ppm. Preliminary results obtained with a room temperature version of the apparatus are presented and discussed.

708,446
PB87-151460 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
Measurement Assurance and Accreditation.
Final rept.,
J. W. Locke. Jan 86, 3p
Pub. in Proceedings of the Institute of Electrical and Electronics Engineers 74, n1 p21-23 Jan 86.

Keywords: *Microwaves, Attenuation, Power, Reflection, Calibrating, *Measurement assurance problems, *Accreditation.

The National Bureau of Standards has offered to accredit laboratories for making microwave power, attenuation, and reflection coefficients. The accreditation would be based upon full documentation of the applicant laboratory's procedures and participation in appropriate measurement assurance programs. Although five calibration laboratories expressed interest in the program, a source of funding for developing the measurement assurance programs has not been found.

708,447
PB87-152161 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Precision Programmable Step Generator for Use in Automated Test Systems.
Technical note,
H. K. Schoenwetter, D. R. Flach, T. M. Souders, and B. A. Bell. Dec 86, 99p NBS/TN-1230
Also available from Supt. of Docs as SN003-003-02786-3. Sponsored by Sandia National Labs., Albuquerque, NM.

Keywords: Pulse generators, Transient response, *Step generators, *Waveform recorders, *Automatic test equipment.

A precision voltage step generator has been designed for use in automated systems to test the dynamic response of waveform recorders and other instruments. The programmable pulse parameters include transition polarity, pulse length, and repetition rate. The initial and final levels of voltage steps are each programmable within the range of + or - 1 V for a 50 ohm termination and within + or - 5 V for a high impedance load. Voltage steps within these ranges settle to within + or - 0.02% of full scale range (FSR) in less than 22 and 26 ns, respectively, for small load capacitance. The corresponding transition durations are approximately 6 and 7 ns.

708,448
PB87-157095 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Directional Scanning Technique for Characterization of Complex Electromagnetic Environments.
Final rept.,
J. Randa, and M. Kanda. 1985, 4p
Pub. in Proceedings of AP-S International Symposium on Antennas and Propagation-Symposium Digest, Vancouver, Canada, June 17-19, 1985, p521-524.

Keywords: *Electromagnetic environments, Electromagnetic compatibility, Electromagnetic interference, Plane waves, Electric fields, Simulation, *Directional scanning.

The problem of characterizing complicated electromagnetic environments without actually measuring the field(s) throughout the entire volume of interest is of great practical importance in the areas of EMI/EMC electromagnetic hazard assessment, etc. The question is how to obtain useful information about the volume of interest from a reasonably small number of measurements. A recent suggestion which appears to hold considerable promise is to use a directional probe to measure at one point the field incident from different directions and then to reconstruct or bound the field throughout the volume by using these measurements in conjunction with a plane-wave expansion of the field. The authors have now completed the formulation and performed simulations for the (vector) electric field, and they report the results in this paper. Simulation results are encouraging.

708,449
PB87-157103 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Multiple-Source, Multiple-Frequency Error of an Electric Field Meter.
Final rept.,
J. Randa, and M. Kanda. 1985, 8p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Antennas and Propagation AP-33, n1 p2-9 Jan 85.

Keywords: *Electric fields, *Electric measuring instruments, Dipole antennas, Error analysis, Reprints, Electric field strength.

Electric field meters (EFM's) are typically calibrated using single-frequency, single-source standard fields. The response to multiple sources or nonsinusoidal time dependence may be different, however. Possible errors in a multiple-source, multiple-frequency environment are analyzed for an EFM consisting of an electrically short dipole antenna with a diode load and an RF filter transmission line. Also considered are errors in the assumption of equal electric and magnetic energy densities in a multiple plane-wave environment. Typical errors of field intensity measurements are about one to three dB but in some circumstances they can exceed 10 dB.

708,450
PB87-161410 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Impact of Automation on NBS (National Bureau of Standards) Noise Temperature Measurements.
Final rept.,
D. F. Wait. Jan 86, 4p
Pub. in Proceedings of the Institute of Electrical and Electronics Engineers 74, n1 p117-120 Jan 86.

Keywords: *Standards, *Calibrating, Reflectometers, Linearity, Automation, Reprints, *Thermal noise, *Noise temperature.

The accuracy of calibrating a thermal noise source using the National Bureau of Standard's automated radiometer and cryogenic, primary noise standards is typically + or - 2%, compared with + or - 3% for corresponding services that used manual radiometers and hot primary standards. Using the automated radiometer, a noise source can typically be calibrated at three frequencies in the time a manual radiometer requires to calibrate one. The automated radiometer contains a 6-port reflectometer, and noise sources with reflection coefficients as great as 0.3 can be tolerated without significantly effecting the calibration accuracy. This makes it practical to use a single broad-band coaxial noise standard from 0.03 GHz to 14 GHz.

708,451
PB87-161451 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Standards for Electromagnetic Field Measurements.
Final rept.,
M. Kanda, E. B. Larsen, M. Borsero, P. G. Galliano, and I. Yokoshima. Jan 86, 9p
Pub. in Proceedings of the Institute of Electrical and Electronics Engineers 74, n1 p120-128 Jan 86.

Keywords: *Electromagnetic fields, *Standards, Anechoic chambers, Electric fields, Magnetic fields, Probes, Electromagnetic measurement, Calibration.

The paper describes the methodology for standard electromagnetic field measurements using anechoic chambers, open-sites, guided wave structures, and probes as transfer standards.

708,452
PB87-162046 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Electrical Units, Fundamental Constants, and the 1983 Least-Squares Adjustment.
Final rept.,
B. N. Taylor. Jun 85, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-34, n2 p155-162 Jun 85.

Keywords: *Fundamental constants, *Units of measurement, *Standards, Reprints, Josephson effect, Quantum Hall effect, Volt, Ohm, Ampere.

The review touches upon four topics: (1) The International System or SI electrical units, specifically, the volt, ohm, and ampere, and so called laboratory or as maintained units for the same quantities; (2) the relationships between these laboratory units, experiments to realize their SI definitions, and the fundamental constants of nature; (3) the 1983 least-squares adjustment of the constants; and (4) future electrical measurements research which can improve our knowledge of the constants.

708,453
PB87-164026 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Finite-Element Action Approach to the Characterization of Complex Electromagnetic Environments.
Final rept.,
J. Randa, and M. Kanda. 1985, 6p
Pub. in Proceedings of International Symposium on Antennas and EM Theory, Beijing, Peoples' Republic of China, August 1985, p48-53.

Keywords: *Electromagnetic environments, Finite element analysis, Numerical solution.

The authors outline an approach to the characterization of complicated electromagnetic environments based on a finite-element approximation to the action functional of the electromagnetic field. A stationary point of the action is found by a numerical search, subject to constraints imposed by boundary conditions and by measurements of the field at some number of points. The technique is illustrated by a simple example.

708,454
PB87-164034 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Summary of NBS (National Bureau of Standards) Calibration Services and Systems.
Final rept.,
C. A. Hoer. Jan 86, 4p
Pub. in Proceedings of the Institute of Electrical and Electronics Engineers 74, n1 p32-35 Jan 86.

Keywords: Standards, Attenuation, Phase shift, Electrical impedance, Power, Millimeter waves, Microwave frequencies, *Calibration, National Bureau of Standards, Voltage.

This paper gives a brief summary of the calibration services available at the Boulder Laboratories of the National Bureau of Standards for attenuation, phase shift, impedance, power, and voltage at RF and microwave frequencies.

708,455
PB87-166450
(Order as PB87-166401, PC **A05**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Report on the Session of the Consultative Committee on Electricity (17th),
B. N. Taylor. 11 Dec 86, 7p
Included in Jnl. of Research of the National Bureau of Standards, v92 n1 p55-61 Jan-Feb 87.

Keywords: *Units of measurement, Meetings, Consultative Committee on Electricity, Quantum Hall effect, Josephson effect, Volt, Ohm.

The report provides the background for and summarizes the main results of the 17th session of the Consultative Committee on Electricity (CCE) of the International Committee of Weights and Measures held in September 1986. Included are decisions made by the CCE which promise to have a profound effect on the standardization of national representations of the volt and ohm and thus on the international compatibility of electrical measurements. In particular, on January 1, 1990, worldwide changes in the basis for such representations are planned which will lead to an increase in the U.S. legal unit of voltage of about 9 parts-per-million (ppm) and in the U.S. legal unit of resistance of about 1.5 ppm.

708,456
PB87-171708 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Techniques and Instruments for Automated Electrical Measurements.
Final rept.,
N. M. Oldham. 1986, 3p
Pub. in Jnl. of Metrology Society of India 1, n1 p25-27 1986.

Keywords: *Electric measuring instruments, Automation, Reprints.

No abstract available.

708,457
PB87-172003 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Error Bound for Near-Field Array Synthesis.
Final rept.,
D. A. Hill. Nov 86, 4p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Electromagnetic Compatibility EMC-28, n4 p273-276 Nov 86.

Keywords: *Electromagnetic fields, Arrays, Synthesis, Error analysis, Reprints, Near field.

An expression for the upper bound of any component of the electric or magnetic field at any point in a region is derived in terms of a product of two surface field integrals. The result is most useful for bounding errors in near-field array synthesis, but might have other applications where upper bounds on field magnitudes are desired.

708,458
PB87-179388 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Calibration of Aspirator-Type Ion Counters and Measurement of Unipolar Charge Densities.
Final rept.,
M. Misakian, R. H. McKnight, and C. Fenimore. Feb 87, 12p
See also report dated May 86, PB86-213147. Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Applied Physics 61, n4 p1276-1287, 15 Feb 87.

Keywords: *Calibrating, Power transmission lines, Measurement, Reprints, *Ion counters, *Ion density, *Ion detection, HVDC systems.

The characterization of a parallel plate apparatus which can produce a unipolar charge density that is suitable for calibrating aspirator-type ion counters operating in the ground plane is described. The influence of a dc electric field, air motion, Coulomb repulsion, and diffusion on the transport of ions into the ion counter are examined to determine their effects on instrument calibration and measurements in the vicinity of high-voltage dc transmission lines. A charge density which is known with an uncertainty of less than + or - 9% is used to check the performance of an ion counter with and without a duct at its entrance.

708,459
PB87-180899 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Compact Fiber Sensors for the Measurement of Low Level Electric Currents.
Final rept.,
G. W. Day. 1986, 4p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of International Conference on Optical Fiber Sensors (4th), Tokyo, Japan, October 7-9, 1986, p81-84.

Keywords: *Electric current, *Ammeters, Electrical measurement, Faraday effect, Birefringence, Fiber optics, Detectors, Optical fibers.

Recent progress in the development of fiber current sensors includes the fabrication of low loss, low birefringence, 3 cm dia. coils by annealing, and the demonstration of a noise equivalent current of 180 microamperes per root Hertz.

708,460
PB87-181293
(Order as PB87-181251, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Free-Field Reciprocity Calibration of Microphones,
E. D. Burnett, and V. Nedzelnitsky. 24 Dec 86, 22p
Included in Jnl. of Research of the National Bureau of Standards, v92 n2 p129-151 Mar-Apr 87.

Keywords: *Microphones, *Acoustic measurement, Anechoic chambers, *Calibration.

Standardized methods for the primary free-field calibration of laboratory standard microphones deal with Type L (ANSI S1.10-1967, R1977) 'one-inch' diameter microphones. However, the use of '1/2-inch' diameter microphones for measurement of the sound pressure level in acoustic fields is increasing. Consequently, the NBS has developed a fixed-cost measurement service for the free-field calibration of these microphones by the reciprocity method over the range 2.5 kHz to 20 kHz. For this service, the apparatus and procedures, including essential properties of the anechoic chamber in which the calibrations are performed, are described.

708,461
PB87-183083 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Status and Future Directions of Picosecond Domain Waveform Measurements.
Final rept.,
N. S. Nahman. 1986, 27p
Pub. in Time-Domain Measurements in Electromagnetics, Chapter 2, p45-71 1986.

Keywords: *Waveforms, Electrical measurement, Optical measurement, *Picosecond pulses, Time domain.

A review of the state-of-the-art of picosecond time domain waveform measurements is presented which includes measurements in both the electrical and optical regions of the electromagnetic spectrum. The review is the latest edition of a series of reviews on high speed pulse measurements compiled by the author since 1967.

708,462
PB87-195418 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, April to June 1986 with 1987 CEEE Events Calendar,
E. J. Walters. May 87, 35p NBSIR-87/3556
See also PB86-247608.

Keywords: *Electronics, *Electrical engineering, Metrology, Signal processing, Bibliographies.

This is the fifteenth issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. This issue of the CEEE Technical Progress Bulletin covers the second quarter of calendar year 1986. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

708,463
PB87-199311 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Precision Calibration of Phase Meters.
Final rept.,
R. S. Turgel, and D. F. Vecchia. 1987, 3p
Pub. in Proceedings of IEEE Instrumentation and Measurement Conference, Boston, MA, April 27-29, 1987, p135-137.

Keywords: *Phase meters, Statistical analysis, *Calibration.

A procedure and statistical analysis for the calibration of precision phase meters has been developed. The method can be applied equally to the calibration of any instrument that has a nominally linear response characteristic. Using statistical tests, the method checks whether the calibration data fits a linear model and then determines the linear equation from which the corrected calibration values are computed. Because random fluctuations tend to mask the limiting mean of the instrument response, the corrections are based on the values computed from the calibration curve, rather than on the actual calibration data.

708,464
PB87-201653 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Characterizing Square and Triangular Waveforms.
Final rept.,
G. N. Stenbakken. 1987, 3p
Pub. in Proceedings of the Institute of Electrical and Electronics Engineers Instrumentation and Measurement Conference, Boston, MA, p9-11, April 27-29, 1987.

Keywords: *Waveforms, *Square waves, Measurement, Sampling, *Triangle waves.

A method has been developed for determining the parameters and errors of square and triangular waveforms relative to idealized waveforms, even when the waveforms are highly distorted. The method is based on measurements obtained by sampling the waveform. Then, an idealized waveform is fitted to this sampled data using a least-squared-error algorithm. The errors in the waveform are defined as the deviations between the data samples and the ideal waveform. Also, the parameters of the measured waveform are defined as the corresponding parameters of the fitted ideal waveform.

708,465
PB87-201661 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Characterization of a Sampling Voltage Tracker for Measuring Fast, Repetitive Signals.
Final rept.,
T. M. Souders, H. K. Schoenwetter, and P. S. Hetrick. 1987, 4p
Pub. in Institute of Electronics and Electrical Engineers Instrumentation and Measurement Conference, Boston, MA, p24-243, April 27-29, 1987.

Keywords: Frequency response, Tests, *Sampling voltage trackers.

An equivalent time sampling and digitizing system is described, together with test methods for characterizing its dynamic performance. Time base errors, linearity errors, step response parameters, and frequency response are considered, and typical measurement results are included. The system is capable of state of the art measurements at rf frequencies.

708,466
PB87-203808 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Method for Measuring Complex Permeability at Radio Frequencies.
Final rept.,
R. B. Goldfarb, and H. E. Bussey. 1987, 4p
Pub. in Review of Scientific Instruments 58, n4 p624-627 Apr 87.

Keywords: *Magnetic permeability, Radio frequencies, Ferrites, Reprints, *Impedance measurement.

An established method for measuring complex rf magnetic permeability is based on the change in inductance and resistance of a coaxial transmission line upon insertion of a sample toroid. It is not necessary to wind coils on the toroid or correct for geometric demagnetization factors. The use of modern commercial impedance analyzers, as described in the paper, makes measurements from 1 kHz to 1 GHz particularly easy, fast, and accurate.

708,467
PB87-210324 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
NBS (National Bureau of Standards) Wideband Sampling Wattmeter.
Technical note (Final),
G. N. Stenbakken, O. B. Laug, T. H. Kibalo, B. A. Bell, and A. G. Perrey. May 87, 116p NBS/TN-1221
Also available from Supt. of Docs as SN003-003-02796-1.

Keywords: *Wattmeters, Power measurement, Computer programs, Schematic diagrams, Design, Performance, Sampling, Pascal programming language, Calibration.

The design and operation of a wideband sampling wattmeter capable of measuring distorted power signals with fundamental frequencies from 1 Hz to 10 kHz and harmonics up to 100 kHz is described. The microcomputer controlled wattmeter uses asynchronous sampling of the voltage and current signals. The errors associated with this type of operation are described, as are various methods of correcting some of these errors. A hardware multiplier-accumulator allows a large number of power signal samples to be integrated for each measurement. Sampling rates are variable up

to a maximum of 300 kHz. A direct-memory-access unit is used to capture 4096 samples of both the voltage and current signals. These data are used to calculate the average and rms values of these signals. The technical note gives schematic diagrams of the circuits used in this wattmeter and describes their operation. The software is also described, and flow charts and selected program listings are provided for the programs written in Pascal. The results of calibration of the instrument over the past year are also presented.

708,468
PB87-210340 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, July to September 1986 with 1987 CEEE Events Calendar,
E. J. Walters. Jun 87, 29p NBSIR-87/3563
See also PB87-195418.

Keywords: *Electronics, *Electrical engineering, Metrology, Signal processing, Bibliographies.

This is the sixteenth issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. The issue of the CEEE Technical Progress Bulletin covers the third quarter of calendar year 1986. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

708,469
PB87-212536 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Limits to the Precision of Electro-Optic and Magneto-Optic Sensors.
Technical note,
G. W. Day, P. D. Hale, M. Deeter, T. E. Milner, and D. Conrad. Mar 87, 123p NBS/TN-1307
Also available from Supt. of Docs as SN003-003-02801-1. Sponsored by Bonneville Power Administration, Portland, OR., Empire State Electric Energy Research Corp., New York, and Electric Power Research Inst., Palo Alto, CA.

Keywords: *Detectors, *Electrooptics, *Magnetooptics, *Voltage measuring instruments, *Electric current meters, *Fiber optics, Electric power, Reproducibility, Precision, Stability, Optical fibers.

The principles of electro-optic and magneto-optic sensors suitable for use in power system applications are reviewed with particular attention to the properties of materials and components that limit the precision of such sensors. Data on a number of materials are collected and presented. For high-precision electro-optic sensors, it is recommended that crystals of point symmetry (bar 4)3m be used. For high-precision magneto-optic sensors, a lead glass with a low stress-optic coefficient is recommended. Choices for other components are also suggested. For both types of sensors, a precision of roughly plus or minus 1 percent over a 100 C temperature range should be attainable. To achieve a precision better than that, it will be necessary to use temperature compensation techniques, several of which are proposed and discussed.

708,470
PB87-223442 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Publication Announcements Covering Center Programs, July to September 1986 with 1987 CEEE Events Calendar,
E. J. Walters. Jul 87, 19p NBSIR-87/3600
See also PB86-247608.

Keywords: *Electronics, *Electrical engineering, *Semiconductor devices, Metrology, Signal processing, Bibliographies.

This is the tenth issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. This issue of the Center for Electronics and Electrical Engineering Technical Publication Announcements covers the third quarter of calendar year 1986. Abstracts are provided by technical area for papers published this quarter.

708,471
PB87-224648 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, January to March 1987 with 1987 CEEE Events Calendar,
E. J. Walters. Jul 87, 26p NBSIR-87/3589
See also PB87-195418.

Keywords: *Electronics, *Electrical engineering, Metrology, Signal processing, Bibliographies, Superconductors.

This is the eighteenth issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. This issue of the CEEE Technical Progress Bulletin covers the first quarter of calendar year 1987. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

708,472
PB87-225397 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
High Accuracy, 10 Hz-1 MHz Automatic AC Voltage Calibration System.
Final rept.,
N. M. Oldham, M. E. Parker, A. Young, and A. G. Smith. 1987, 3p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Instrumentation and Measurement Technology Conference (1987), Boston, MA., April 27-29, 1987, p279-281.

Keywords: *Voltmeters, Alternating current, *Calibration, Automatic.

An automatic system for calibrating high accuracy ac voltmeters and calibrators is described. The system is based on traditional coaxial thermal voltage converters to provide measurement uncertainties of 5-20 ppm in the audio frequency range and 5-150 ppm over the full range from 10 Hz-MHz. Specialized hardware and measurement techniques make it possible to achieve these uncertainties in test periods of approximately one minute. Random errors introduced by the system are typically less than 2 ppm (one standard deviation).

708,473
PB87-226890 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, October to December 1986 with 1987 CEEE Events Calendar,
E. J. Walters. Jul 87, 29p NBSIR-87/3577
See also PB87-210340.

Keywords: *Electronics, Electrical engineering, Metrology, Signal processing, Bibliographies.

This is the seventeenth issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. This issue of the CEEE Technical Progress Bulletin covers the fourth quarter of calendar year 1986. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

708,474
PB87-232047 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Prebreakdown Cathode Processes in Liquid Hydrocarbons.
Final rept.,
G. J. FitzPatrick, E. O. Forster, R. E. Hebner, and E. F. Kelley. 1987, 6p
Sponsored by Department of Energy, Washington, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electrical Insulation EI-22, n4 p453-458 Aug 87.

Keywords: *Electric discharges, *Dielectric breakdown, *Hydrocarbons, *Electrical insulation, High speed photography, Toluene, Liquids, Cathodes, Reprints, *Breakdown(Electronic threshold).

Measurements are presented of the initiation of prebreakdown streamers at a point cathode in liquid hydrocarbons. Using a computer implementation of the method of images, the electric field is computed for selected geometries to confirm that the field strengths in the vicinity of these streamers are probably high enough so that electron multiplication processes can occur. High magnification photographs of streamer initiation show that the initial streamer velocity is (2.8+0.4) x 10 to the 4th power cm/s in toluene.

708,475
PB87-232054 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
NBS (National Bureau of Standards) Josephson Array Voltage Standard.
Final rept.,
C. A. Hamilton, R. L. Kautz, F. L. Lloyd, R. L. Steiner, and B. F. Field. 1987, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p258-261 Jun 87.

Keywords: *Josephson junctions, *Standards, Arrays, Reprints, *Voltage standards.

A Josephson voltage standard based on a series array of 2076 junctions is described. When irradiated with a 15-mW signal at a frequency of 96 GHz, the array produces 15 000 quantized levels between -1.5 and 1.5 V. Initial results on high-precision comparisons with a Zener reference standard are given.

708,476
PB87-233607 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
AC Voltage and Current Measurements.
Final rept.,
N. M. Oldham. 1986, 2p
Pub. in Jnl. of Metrology Society of India 1, n3 p17-18 1986.

Keywords: *Voltage measuring instruments, *Electric current meters, *Voltmeters, *Ammeters, Electrical measurement, Alternating current, Reprints.

Definitions and various measurement techniques for the measurement of ac voltage and current are given.

708,477
PB87-233862 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Report on the NBS/CEEE (National Bureau of Standards/Center for Electronics and Electrical Engineering) Survey of Electronic Measurement Needs Below 10 MHz.
Final rept.,
B. A. Bell. 1987, 14p
Pub. in Proceedings of National Conference of Standards Laboratories Workshop and Symposium (1987) 'Innovation: Key to the Future', Denver, CO., July 12-16, 1987, p75-1--75-14.

Keywords: *Electromagnetic interference, Electric measuring instruments, Surveys, *Automatic test equipment.

The paper describes the results of a recent survey conducted by the Electrosystems Division of the Center for Electronics and Electrical Engineering (CEEE) at the National Bureau of Standards (NBS). A summary analysis is provided of the data obtained on questions concerning (1) critical electrical quantities and associated instrumentation and devices, (2) Automatic Test Equipment (ATE)/complex measurement systems, and (3) conducted electromagnetic interference.

708,478
PB87-233870 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
NBS (National Bureau of Standards) Calibration System for AC Voltage.
Final rept.,
N. M. Oldham, and M. E. Parker. 1987, 6p
Pub. in Proceedings of National Conference of Standards Laboratories Workshop and Symposium (1987) 'Innovation: Key to the Future', Denver, CO. July 12-16, 1987, p47-1--47-6.

Keywords: *Voltage measuring instruments, *Voltmeters, Alternating current, *Calibration, Automatic.

An automatic system for calibrating high accuracy ac voltmeters and calibrators is described. The system

relies on measurements using coaxial thermal voltage converters to achieve ac-voltage uncertainties of 5-150 ppm from 0.01-600 volts over the frequency range of 10 Hz-1 MHz. Specialized hardware and measurement techniques make it possible to achieve these uncertainties in test periods of approximately one minute. Random errors introduced by the system are typically less than 2 ppm (one standard deviation).

708,479
PB88-109178 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Expanding Need for Microwave and Millimeter Wave Calibration Services.
Final rept.,
R. T. Adair, G. Reeve, and L. E. Gatterer. 1987, 11p
Pub. in NCSL Newsletter 27, n1 p21-31 Jan 87.

Keywords: *Millimeter waves, *Microwaves, Standards, Surveys, Ultrahigh frequencies, Superhigh frequencies, Extremely high frequencies, Reprints, *Calibration.

Several technology surveys concerning microwave and millimeter wave measurement needs and capabilities have recently been conducted by the National Bureau of Standards, Boulder Laboratories, and other organizations. The results of some of these studies, which covered the frequency range from 1 GHz to above 200 GHz, are summarized. Current microwave and millimeter wave standards and calibration capabilities at the National Bureau of Standards are reviewed and compared with national needs. The lack of national standards in certain frequency bands may lead to problems with the specification, acceptance testing, calibration, and critical use of some components and systems. Plans to fulfill unmet needs in the frequency range are also presented.

708,480
PB88-109194 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
In Search of a More Realistic Accuracy Statement for Microwave Metrology.
Final rept.,
G. F. Engen. 1986, 3p
Pub. in Proceedings of Conference on Automated Radio Frequency Task Group (27th), Baltimore, MD., June 5-6, 1986, p181-183.

Keywords: *Microwave equipment, *Metrology, Electrical measurement, Electric connectors, Accuracy.

Historically, the accuracy achieved by the microwave metrologist has been limited by detector performance, hardware imperfections, and connector problems. Today the effect of hardware imperfections has been largely eliminated by more complete modeling. Moreover, the performance of the detection systems has been improved to the point where in many cases the non-ideal connector behavior is the major error source. Although important refinements in the connectors have also been realized, it is quite possible that these have not kept pace with the other developments. In any case it is useful to pose the following question: Assume a measurement system which, apart from being fitted with connectors typical of those in general use, is otherwise perfect. How much measurement accuracy can one realistically claim for it.

708,481
PB88-109244 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
1.25-MHz Attenuation Measurement System.
Final rept.,
R. A. Ginley, and C. M. Allred. 1986, 4p
Contract CCG-156
Sponsored by Department of Defense Calibration Coordination Group, Redstone Arsenal, AL.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-35, n4 p463-466 Dec 86.

Keywords: *Attenuation, Electrical measurement, Medium frequencies, Reprints.

A system has been developed to make highly accurate measurements of nominally 6-dB increments of attenuation at 1.25 MHz. Initial experiments indicate a typical systematic error of 5 micro B (1 micro B = 0.00001 dB) with a resolution of 1 micro B. A special linearity measurement system (LMS) using NBS-constructed linear tuned hybrids and power detectors has been used to determine the nonlinearity of a tuned 1.25-MHz power detector. The detector utilizes a single thermistor bead design with thermal isolation to obtain nearly linear tracking of a 4:1 change in input power. The nonlinear correction for this change, determined by the LMS, is on the order of 13 micro B for the detector presently in use. This calibrated detector and another of similar design are used in the attenuation measurement system (AMS) to make power ratio measurements to determine the change in attenuation of the device under test (DUT).

708,482
PB88-110226 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Horn Design Equations for the NBS (National Bureau of Standards) Horn-Type Noise Standards,
W. C. Daywitt. Aug 87, 18p NBSIR-87/3073
Sponsored by Department of the Air Force, Washington, DC., and Naval Ocean Systems Center, San Diego, CA.

Keywords: *Horns, Millimeter waves, Electromagnetic noise, Reflection, Attenuation, Computation, Noise standards, Braun equations.

Equations are given for calculating the interior dimensions of the horn pickup in the NBS millimeter wave noise standards. These dimensions insure negligible internal horn reflections, resulting in an accurate calculation of the horn attenuation. Measurements in the WR10 horn show a reflection of magnitude less than 0.001.

708,483
PB88-110366 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Survey of Electronic Measurement Needs Below 10 MHz,
J. R. Sorrells. Jun 87, 92p NBSIR-87/3549

Keywords: *High frequencies, *Electronic equipment, Electrically powered instruments, Precision, Surveys, Test equipment, Measuring instruments.

The results of a survey to assess the electronic measurement needs from dc to 10 MHz are presented. The questionnaire used in the survey covered three broad areas of measurement need: (1) basic electrical quantities and related precision instruments; (2) automatic test equipment and other complex measurement systems; and (3) conducted electromagnetic interference. The data provided by 527 respondents are summarized, and the results of various analyses are described. Several conclusions, suggested by the analyses, are also discussed.

708,484
PB88-111174 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Effect of Pressure on Streamer Inception and Propagation in Liquid Hydrocarbons.
Final rept.,
R. E. Hebner, E. F. Kelley, G. J. FitzPatrick, and E. O. Forster. 1987, 5p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of International Conference on Conduction and Breakdown in Dielectric Liquids (9th), Salford, United Kingdom, July 27-31, 1987, 5p 1987.

Keywords: *Dielectric breakdown, *Electrical faults, *Hexanes, *Toluene, *Breakdown(Electronic threshold).

The paper shows that for pressures between 0.1 and 5.0 MPa, the structure of a streamer originating from a cathode is significantly modified while that initiating from an anode is relatively unchanged, in toluene and hexane. For cathode streamers, the inception voltage increased from 40 + or -6kV at 0.1 MPa to 99 + or - 22kV at 5.0 MPa. For anode streamers, the inception voltage increased from 53 + or - 6kV at 0.1 MPa to 123 + or - 55kV at 5.0 MPa.

708,485
PB88-111224 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Digitally Synthesized Power Calibration Source.
Final rept.,
N. M. Oldham, O. B. Laug, and B. C. Waltrip. 1987, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p341-346 Jun 87.

Keywords: *Waveform generators, *Watt hour meters, *Wattmeters, *Electric power meters, Digital systems, Energy, Power measurement, Reprints, *Calibration.

A digitally synthesized source of 'phantom' power for calibrating electrical power and energy meters is described. Independent sources of voltage, current, and phase angle are programmable between 0 and 240 V, 0 and 5 A, and 0 and 360 deg respectively. The accuracy of the active and reactive power is estimated to be within + or - 100 ppm of the full-scale apparent power (volt-amperes).

708,486
PB88-113782 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electrosystems Div.
Research for Electric Energy Systems - An Annual Report (1986),
R. E. Hebner. Sep 87, 80p NBSIR-87/3643
See also report for 1985, PB86-191814. Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Electric power, Electric measuring instruments, Dielectrics, Dielectric breakdown, Sulfur hexafluoride, Electrical insulation, Interfaces, Space charge, Insulating oil.

The report documents the technical progress in the five investigations which make up the project 'Support of Research Projects for Electrical Energy Systems', funded by the U.S. Department of Energy. To support the measurement of ions in the dc transmission line environment, techniques to measure ion mobility were evaluated. In addition, techniques were developed to determine the sensitivity of an AM radio to detect partial discharges in a biolological exposure facility. Within the project to develop measurement techniques and obtain basic data for gaseous dielectrics, a theoretical method was developed to evaluate the consistency among electron collision, transport, and dielectric strength data for binary gas mixtures; the gas phase hydrolysis rates for SOF2 and SOF4 were measured; the corona discharge oxidation mechanisms were identified and the role of negative ions on the SOF4 yield was determined. Progress in interfacial measurements included the optical measurement of the electric field distribution as a streamer initiates. Progress in developing measurements for nanosecond dielectrics was in the characterization of the errors in the measurement of voltage pulses using E-dot probes and the identification of the reducation of breakdown voltage in oil for faster pulses.

708,487
PB88-117643 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Assessment of Future Optical Measurements of Voltage and Current in Electric Power Systems.
Final rept.,
D. L. Hillhouse. 1987, 70p
Sponsored by Electric Power Research Inst., Palo Alto, CA., Bonneville Power Administration, Portland, OR., and Empire State Electric Energy Research Corp., New York.
Pub. in Optical Power Line Voltage and Current Measurement Systems, EPRI EL-5431, v2 70p Sep 87.

Keywords: *Electric current meters, *Voltage measuring instruments, *Electrooptics, *Magnetooptics, Power measurement, Birefringence, Reprints.

The report summarizes the results of an investigation into the technical and economic reasons for improving power system voltage and current measurements, with special emphasis on the prospects for using optical technology. The investigation assesses information from interviews with representatives of utilities and manufacturing companies, along with other information from published sources. The report concludes with a recommendation for a carefully structured and coordinated program of research and development.

708,488
PB88-121967 Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Software Correction of Measured Pulse Data.
Final rept.,
N. S. Nahman. 1986, 67p
Pub. in Fast Electrical and Optical Measurements, v1, NATO ASI Series E, n108 p351-417 1986.

Keywords: *Waveforms, *Electromagnetic pulses, Light pulses, Convolutional integrals, Signal processing, Correction, Ill posed problems, Deconvolution, Computer applications.

The fundamental concern in the software correction of measured pulse waveform data is the solution of an ill-posed deconvolution problem which arises when one (or both) of the known waveforms is (are) corrupted by errors due to interference, noise, instrumentation drift, etc. The variables concerned are related to each other by the convolution integral. When one of the integrand functions is unknown while the other two functions are known, the convolution equation becomes an integral equation for the unknown waveform. Solution of an ill-posed deconvolution problem is obtained by signal processing or filtering and at most yields an estimate for the unknown waveform. The objective of the discussion is to bring out the ideas of ill-posedness and to give examples of applications to pulse measurement problems which require deconvolution, i.e., the removal (correction) of pulse source effects and/or measurement system effects as encountered in signal pulse waveform measurements and system impulse response measurements.

708,489
PB88-121975 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Calibration and Error Analysis of a Picosecond Pulse Waveform Measurement System at NBS (National Bureau of Standards).
Final rept.,
W. L. Gans. 1986, 5p
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) 74, n1 p86-90 Jan 86.

Keywords: *Electromagnetic pulses, *Waveforms, Electrical measurement, Error analysis, *Calibration, Deconvolution, Picosecond pulses.

The primary system used at NBS, Boulder, CO, to measure fast (picosecond-nanosecond range), repetitive, electrical pulse parameters consists essentially of a wide-band (dc-18 GHz) sampling oscilloscope interfaced to a minicomputer. The paper describes the major calibration and analysis techniques used to reduce the effects of errors inherent in the system, both deterministic and random in nature.

708,490
PB88-123690 PC **A04**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
NBS (National Bureau of Standards) Measurement Services: Standard Cell Calibrations.
Special pub. (Final),
B. F. Field. Oct 87, 56p NBS/SP-250/24
Also available from Supt. of Docs. as SN003-003-02825-8. See also PB88-123708. Library of Congress catalog card no. 87-619872.

Keywords: Direct current, *Standard cells, *Calibration, *Voltage standards, Josephson effect, US NBS.

The note describes the procedures used at NBS to calibrate standard cells in terms of the U.S. Legal Volt. The two calibration services that are offered by the Electricity Division are discussed; Regular Calibration of client standards at NBS, and the Volt Transfer Program which is a process to determine the difference between the U.S. Legal Volt and the volt as maintained by a client laboratory. The operational procedures used to compare standard cells and to maintain the U.S. Legal Volt via the ac Josephson effect are discussed in detail.

708,491
PB88-123757 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Solid-State Voltage Standard Performance and Design Guidelines.
Technical note (Final),
B. F. Field. Sep 87, 29p NBS/TN-1239
Also available from Supt. of Docs. as SN003-003-02822-3. Sponsored by Department of Defense, Washington, DC.

Keywords: *Standards, Avalanche diodes, Direct current, Recommendations, *Voltage standards, Standard cells.

The Electricity Division has examined and analyzed the performance of all presently available high-quality solid-state (Zener) dc voltage standards. Based on these examinations and the authors knowledge of standards laboratory requirements, the authors have developed a set of guidelines to define what is needed in a modern solid-state standard to supplement or replace cadmium-sulfate standard cells. Specific design goals are presented to serve as a guide for writing a detailed solid-state voltage standard specification, and also as a guide to anyone evaluating such a standard.

708,492
PB88-129929 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
AC Power and Energy Measurements.
Final rept.,
N. M. Oldham. 1986, 3p
Pub. in MAPAN--Jnl. of Metrology Society of India 1, n4 p5-7 1986.

Keywords: *Power measurement, Electrical measurement, Alternating current, Reprints.

Definitions and various techniques for the measurement of active and reactive electrical power are given.

708,493
PB88-130315 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, April to June 1987, with 1987 CEEE Events Calendar,
E. J. Walters. Oct 87, 43p NBSIR-87/3644
See also PB87-224648.

Keywords: *Electronics, *Electrical engineering, Metrology, Signal processing, Bibliographies, Superconductors.

This is the nineteenth issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. This issue of the CEEE Technical Progress Bulletin covers the second quarter of calendar year 1987. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

708,494
PB88-130323 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Publication Announcements Covering Center Programs, January to March 1987, with 1987 CEEE Events Calendar,
E. J. Walters. Aug 87, 20p NBSIR-87/3655
See also PB87-223442

Keywords: *Electronics, *Electrical engineering, *Semiconductor devices, Metrology, Signal processing, Bibliographies.

This is the twelfth issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. This issue of the Center for Electronics and Electrical Engineering Technical Publication Announcements covers the first quarter of calendar year 1987. Abstracts are provided by technical area for papers published this quarter.

708,495
PB88-138748 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Simultaneous Measurement of Light Emission, Current Pulses and Growth of Prebreakdown Streamers in Hexane.
Final rept.,
E. F. Kelley, M. Nehmadi, R. E. Hebner, P. J. McKenny, and E. O. Forster. 1987, 6p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Annual Report Conference on Electrical Insulation and Dielectric Phenomena, Gaithersburg, MD., October 18-22, 1987, p132-137.

Keywords: *Hexanes, High speed photography, Dielectric breakdown, Light pulses, Optical measurement, Electric current, Electrical measurement, *Breakdown(Electronic threshold).

High-speed, image-converter photography is used to document the growth characteristics of prebreakdown phenomena emanating from a cathode needle in a needle-sphere electrode system placed in a liquid. The cathode streamer growth characteristics are compared to the pulsed nature of the current feeding the streamer and light emission from the streamer. The fact that there is a strong temporal correlation between the current and light pulses is confirmed. However, it is found that no strong correlation exists between this pulse-like behavior and the growth of the prebreakdown event, but that the streamer is found to grow rather uniformly despite the discreet nature of the current supplied. This information should contribute to the development of theoretical modeling efforts on the generation and development of prebreakdown phenomena in liquids.

708,496
PB88-138763 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Techniques for Measuring the Shielding Effectiveness of Materials.
Final rept.,
P. F. Wilson, and M. T. Ma. 1987, 6p
Pub. in Proceedings of the International Zurich Symposium and Technical Exhibition on Electromagnetic Compatibility (7th), Zurich, Switzerland, March 3-5, 1987, p547-552.

Keywords: *Electromagnetic shielding, Transmission lines, Electrical measurement, Effectiveness, Reverberation chambers, Time domain.

Four methods for measuring the shielding effectiveness of materials under various conditions are considered. Coaxial transmission line holders and a time-domain systems are used to simulate plane-wave shielding performance. The dual TEM cell and an apertured TEM cell in a reverberating chamber are used to investigate near-field shielding capability. Both theoretical and experimental results are discussed.

708,497
PB88-138771 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Shielding Effectiveness Measurements Using an Apertured TEM Cell in a Reverberation Chamber.
Final rept.,
P. F. Wilson, and M. T. Ma. 1986, 5p
Pub. in Proceedings of the IEEE (International Electrical and Electronics Engineers) International Symposium on Electromagnetic Compatibility, San Diego, CA., September 16-18, 1986, p265-269.

Keywords: *Electromagnetic shielding, Electrical measurement, Effectiveness, Reverberation chambers, Near field.

Near-field shielding effectiveness measurements are performed in a reverberation chamber using an apertured transverse electromagnetic cell as the receiver. The configuration allows one to investigate the electric and magnetic field shielding properties of a material simultaneously. Coupling to the cell is modeled using small aperture theory, and predicted results agree well with measured data.

708,498
PB88-138789 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Preliminary Evaluation of Reverberation Chamber Method for Pulsed RF Immunity Testing.
Final rept.,
M. L. Crawford, and G. H. Koepke. 1986, 9p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronic Engineers) International Symposium on Electromagnetic Compatibility, San Diego, CA., September 16-18, 1986, p270-278.

Keywords: *Electromagnetic compatibility, Radiofrequency pulses, *Reverberation chambers, Test methods.

The paper describes the evaluation of the performance characteristics of a reverberation chamber excited by pulsed rf (1.0 microsec to 10 microsec, 0.001

duty cycle) in the frequency range, 0.9 GHz to 10 GHz. The purpose of the work was to investigate the potential use of a reverberation chamber for pulsed rf immunity testing of electronic equipment. Information given includes a description of the reverberation chamber evaluated, the instrumentation used for performing the measurements, and results obtained showing the pulse dispersion characteristics of the chamber.

708,499
PB88-138797 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Measuring Electromagnetic Interference. Part 1. Open-Field Sites and TEM Cells.
Final rept.,
M. T. Ma, M. Kanda, M. L. Crawford, and E. B. Larsen. 1986, 13p
Pub. in Test and Measurement World, p72-84 Feb 86.

Keywords: *Electromagnetic interference, Electrical measurement, Reprints.

Measuring radiated electromagnetic power is essential to demonstrate conformance to regulations and specifications. A number of methods are available – open-field sites, TEM cells, reverberating chambers and anechoic chambers. Selection of a suitable technique requires a knowledge of the strengths and limitations of each. Proper interpretation of measured results then requires an intimate knowledge of the characteristics of the chosen site.

708,500
PB88-147392 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Should the Classical Variance Be Used as a Basic Measure in Standards Metrology.
Final rept.,
D. W. Allan. 1987, 9p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p646-654 Jun 87.

Keywords: *Metrology, Electrical measurement, Standard deviation, Statistics, Variance(Statistics), Standards, Reprints, Uncertainty.

Studies of frequency standards, standard-volt cells, and gauge blocks provide examples of long-term random-correlated time series which indicate behavior that is not 'white' (not random and uncorrelated). The paper outlines and illustrates a straightforward time-domain statistical approach, which for power-law spectra yields an alternative estimation method for most of the important random power-law processes encountered. Knowing the spectrum provides for clearer uncertainty assessment in the presence of correlated random deviations. The statistical approach outlined also provides a simple test for a white spectrum, thus allowing a metrologist to know whether use of the classical variance is suitable or whether to incorporate better uncertainty assessment procedures, e.g., as outlined in the paper.

708,501
PB88-147442 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Physical Measurement Services.
MM-Wave Measurement and Standards Requirements for Defense Technology.
Final rept.,
B. C. Belanger. 1985, 3p
Pub. in Microwave Jnl. 28, n7 p30-32 Jul 85.

Keywords: *Millimeter waves, Electrical measurement, Microwaves, Meetings, Standards, Reprints.

The paper describes a seminar on millimeter wave measurement requirements held at Harry Diamond Laboratories in April of 1985.

708,502
PB88-152814 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Operation of an Ion Counter in the Ground Plane under a Monopolar High-Voltage Line.
Final rept.,
R. H. McKnight. 1987, 8p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of the Hanford Life Sciences Symposium on Interaction of Biological Systems with Static and ELF Electric and Magnetic Fields (23rd), Richland, WA., October 2-4, 1984, p1-8 1987.

Keywords: *Transmission lines, Electric corona, Ion currents, Space charge, *Ion counters, HVDC systems, High voltage.

Studies have been made of the operation of an ion counter with the inlet located in the ground plane near a monopolar high-voltage line. Electric-field values at the ground plane ranged between 14.8 kV/m and 29.8 kV/m, while ion current densities varied from 0.1 to 0.43 (micro A/m squared). An observed variation in measured ion density with volumetric flow rate through the counter appears to be primarily due to losses in the duct between the ground-plane opening and the ion-counter inlet.

708,503
PB88-152855 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Dynamic Performance of Digital Recorders Used for Monitoring High Voltage Impulse Tests.
Final rept.,
J. Kuffel, R. Malewski, R. Van Heeswijk, and R. A. Lawton. 1986, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-35, n4 p591-595 Dec 86.

Keywords: *Recording instruments, Electrical measurement, Monitors, Performance, Reprints, *Digitizers, Recorders, High voltage.

Frequency and time domain characteristics of digital transient recorders (in short digitizers) are discussed in order to establish the requirements on digitizers used for high voltage testing. Results of an experimental study performed on a 200 MHz, 8-bit digitizer (Tektronix 7612D) are presented and related to the design features of the instrument. The inherent design characteristics and their influence on the digitizer dynamic performance are analyzed in view of simulation of the digitizer through a computer model.

708,504
PB88-153952 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Precision Calibration of Phase Meters.
Final rept.,
R. S. Turgel, and D. F. Vecchia. 1987, 4p
See also PB87-199311.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n4 p918-922 Dec 87.

Keywords: Statistical analysis, Reprints, *Calibration, *Phase meters, Linear model.

Using the calibration of a phase meter with a nominally linear response as an example, a statistical approach is discussed for predicting worst-case offsets of the meter response characteristic from the value of the reference standard. A linear calibration curve is used to model the meter response, and statistical tests are described which test the appropriateness of the model and whether the calculated calibration curve differs significantly from the ideal. Various levels of corrections to be applied can then be determined on the basis of these tests, and limits to offsets are calculated for each of the levels. By extending the approach, it is possible to predict limits of uncertainty when using the calibrated meter to make measurements.

708,505
PB88-162524 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Gallium Arsenide (GaAs)-Based Photoconductive Switches for Pulse Generation and Sampling Applications in the Nanosecond Regime.
Final rept.,
B. A. Bell, and A. G. Perrey. 1985, 2p
See also PB86-134954. Sponsored by Institute of Electrical and Electronics Engineers, Inc., New York.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Instrumentation and Measurement Technology Conference (IMTC '85), Tampa, FL., March 20-22, 1985 p216-217.

Keywords: *Electric potential, Calibrating, *Dielectric constant, Voltage converters, Voltage, Automatic test equipment.

The paper describes the design of a set of optoelectronic switches having an interdigitated electrode structure and implemented with high resistivity GaAs photoconductive substrates. A theoretical analysis is developed for determining the pulsed light ON state resistance (peak conductance), OFF state (dark) resistance and the associated capacitances for the various designed gap geometries. Data are provided on the processing steps used in successfully fabricating a working set of switches based on the theoretical design. A test apparatus is used to make measurements of the pulsed light conductance of these devices having nominal gap spacings of 5, 10, 20, and 40 micromede.

ENERGY

Batteries & Components

708,506
PATENT-4 576 882 Not available NTIS
Department of the Navy, Washington, DC.
Polyethylene Imine-Metal Salt Solid Electrolyte.
Patent.
G. T. Davis, C. K. Chiang, J. M. Antonucci, and T. Takahashi. Filed 28 Feb 85, patented 19 Mar 86, 8p
PB86-183530, PAT-APPL-6-706 811
Supersedes AD-D011 678.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Patents, *Solid electrolytes, *Electric batteries, Imines, Metals, Electrolytes, Polymers, Salts, Polyethylene.

The invention is a solid polymer electrolyte having (a) a matrix of linear poly(ethylene imine) having the formula (-CH2CH2NH-)n; and (b) a metal salt which is LiI, LiClO4, NaI, NaBr, KI, CsSCN, AgNO3, CuCl2, CoCl2, or Mg(ClO4)2, wherein the salt is dissolved in and distributed throughout the poly(ethylene imine) matrix and from more than zero to 0.10 moles of salt are used per mole of monomer repeat unit, -CH2CH2NH-.

708,507
PB-272 690/9 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Microcalorimetric Study of Cardiac Pacemakers and Batteries.
Final rept.,
E. J. Prosen, and J. C. Colbert. Sep 77, 21p NBSIR-77-1310

Keywords: *Calorimeters, *Electric batteries, Measuring instruments, Heart, Feasibility studies, Energy dissipation, Implants, Pulse rate, Electric discharges, Alkaline batteries, Nondestructive tests, *Microcalorimetry, *Cardiac pacemakers, Cardiac assist devices, Mercury cells, Shelf life.

A feasibility study was carried out to determine if microcalorimetry could be used to measure the energy loss or self-discharge of cardiac pacemakers and power cells. Alkaline and mercury batteries, camera and watch type, were measured both under external load and open-circuit conditions. The results indicate that microcalorimetry can be both a sensitive and useful tool for measuring the self-discharge of cardiac pacemakers and power cells. Microcalorimetry can also be used to measure nondestructively, the power output from the completed (sealed) pacemaker itself.

708,508
PB80-207723
(Order as PB80-207707, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC.
Microcalorimeter for Measuring Self-Discharge of Pacemakers and Pacemaker Power Cells,
E. J. Prosen, and J. C. Colbert. 23 Jan 80, 11p
Included in Jnl. of Research of the National Bureau of Standards, v85 n3 p193-203, May-Jun 80.

Keywords: *Heat measurement, *Electric batteries, *Calorimeters, Design, Performance evaluation, *Pacemakers.

Batteries & Components

The self-discharge heat losses of cardiac pacemaker power cells and pacemakers were investigated by microcalorimetry. Results were obtained with small alkaline, mercury and lithium-iodine batteries under open-circuit and external load conditions to monitor their heat loss characteristics and to gather information on the self-discharge mechanism. Results obtained with 'complete pacemakers' are also reported.

708,509
PB82-140880 Not available NTIS
National Bureau of Standards, Washington, DC.
All-Polymeric Solid State Battery.
Final rept.
C. K. Chiang. Nov 81, 3p
Pub. in Polymer 22, p1454-1456 Nov 81.

Keywords: *Electric batteries, *Polymers, Electrodes, Electrolytes, Performance evaluation, Design criteria, Polyoxyethylene, Reprints, Polyacetylenes.

An all-polymeric solid state battery was constructed using doped polyacetylene as the electrodes and polyethylene-oxide alkali metal complexes as the electrolyte. The experimental results indicated that this cell can produce a power density of at least 10-20 watt/kg.

708,510
PB84-224740 Not available NTIS
National Bureau of Standards, Washington, DC.
Polyacetylene as an Electrode in Solid State Batteries.
Final rept.
C. K. Chiang. 1983, 2p
Pub. in Solid State Ionics 9 and 10, p445-446 1983.

Keywords: *Electrodes, *Solid state devices, *Electric batteries, Additives, Ions, Conductivity, Reprints, *Polyethynylene, *Solid state batteries.

Highly conducting polyacetylene can be used as an electrode in a solid state cell. The solid electrode processes are the doping and the undoping of the polymer by the mobile ions. The solid state doping and the emf of the Na/(CH)x cell are examined. The emf of the Na/(CH)x cell versus concentration curve resembles that of Li/TiS2.

708,511
PB85-201945 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron Powder Diffraction Study of alpha- and beta-PbO2 in the Positive Electrode Material of Lead-Acid Batteries.
Final rept.
A. Santoro, P. D'Antonio, and S. M. Caulder. 1983, 9p
Pub. in Jnl. of the Electrochemical Society 130, n7 p1451-1459 Jul 83.

Keywords: *Lead acid batteries, *Neutron diffraction, *Electrochemistry, *Electrodes, *Cations, Molecular structure, Lead oxides, Reprints.

A neutron powder diffraction study of alpha-and beta-PbO2, both chemically prepared and electrochemically formed in cycled battery plates, was carried out to correlate the electrochemical activity of the lead-acid battery with the atomic arrangement of the electrode constituents. The authors results indicate that there are neither lead nor oxygen deficiencies, and therefore, any hydrogen which is present must be accompanied by a reduction of Pb(+4). In addition, they have observed a significant increase in the lattice parameter a of beta-PbO2 in cycled battery electrodes relative to the value in chemically prepared beta-PbO2. No change in the c parameter, however, was detected. This suggests that the OH groups present in the structure are probably oriented perpendicular to c along (110). This configuration is similar to that observed in SnO2.

Electric Power Production

708,512
PB-264 427/6 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
HUD Utilities Demonstration Series. Volume Eleven. Performance of the Engine-Generators Used in the Jersey City Total Energy Plant.
Final rept.,
J. B. Coble, M. E. Kuklewicz, and J. H. Hebrank. Oct 76, 22p NBSIR-77-1207
Prepared in cooperation with Department of Housing and Urban Development, Washington, D.C. Policy Development and Research.

Keywords: *Total energy systems, *Diesel electric power generation, Fossil-fuel power plants, Diesel engines, Electric generators, Efficiency, Performance tests, Heat recovery, New Jersey, Jersey City(New Jersey).

Each of five 600-kilowatt (kW), diesel engine-generators which were to be installed in a total energy plant was performance tested under NBS direction at the engine-generator vendor's plant. These tests provided a basis for acceptance of the engine-generators and for comparison with installed performance. This testing was performed as a part of a comprehensive study to assess engineering, economic, and environmental aspects of a total energy plant which supplies all electrical power, hot water, and chilled water to an apartment complex in Jersey City, New Jersey. Under sponsorship of the Department of Housing and Urban Development (HUD), the National Bureau of Standards (NBS) has instrumented the total energy site for engineering data and is collecting economic and environmental data. The engines were tested at seven power levels ranging from 0 to 110% rated electrical load. In the tests, fuel consumption, electrical output, and jacket-water heat recovery were measured, as well as many other parameters. Results are reported for fuel consumption, electrical efficiency, and electrical-plus-thermal efficiency, and comparisons are made with measured data from the total energy plant.

708,513
PB-269 517/9 PC **A09**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
HUD Utilities Demonstration Series. Volume Seven. Performance Analysis of the Jersey City Total Energy Site.
Interim rept.,
J. Hebrank, C. W. Hurley, J. D. Ryan, W. Obright, and W. Rippey. Jul 77, 176p NBSIR-77-1243
Prepared in cooperation with Department of Housing and Urban Development, Washington, D.C. Policy Development and Research. See also PB-264 427.

Keywords: *Total energy systems, *Diesel electric power generation, Fossil-fuel power plants, Performance, New Jersey, Buildings, Economic analysis, Cost comparison, Unit costs, Heating, Cooling, Reliability, *Modular integrated utility systems, Jersey City(New Jersey).

The National Bureau of Standards (NBS) has gathered engineering and economic data from an operating diesel total energy plant which supplies all electrical power, hot water, and chilled water to a 485-unit apartment/commercial building complex in Jersey City, New Jersey. Engineering data has been continuously collected since April 1975 by a data acquisition system (DAS) which monitors approximately 200 sensors located in the plant and site buildings. In this report, data for a one-year period from November 1975 through October 1976 is presented. Electrical and thermal demands by the site and plant equipment efficiencies have been determined from this data and are reported. Reliability data is also reported. Relative fuel savings by the total energy plant have been determined from the engineering data. Economic data describing the capital, operating, owning, and maintenance costs during the one-year period are also presented. Unit costs of electrical, heating and cooling energy commodities are determined and compared to conventionally-supplied energy unit costs.

708,514
PB-300 770/5 PC **A06**/MF **A01**
Temple, Barker and Sloane, Inc., Lexington, MA.
Overview Report: Experiment in Computer Applications for Regulatory Agencies.
Final rept.
Sep 79, 117p NBS-GCR-ETIP-79-70
Contract NBS-5-35894
Report on Experimental Technology Incentives Program Project No. 76.

Keywords: *Technological innovation, *Regulations, *Electric utilities, Data processing, Sales, Incentives, Performance evaluation, Productivity, Management methods, Planning, Decision making, Rates(Costs), *Computer applications.

The purpose of the Project was to provide improved analytical and managerial techniques for use in the electric utility regulatory process to learn how technological innovation could be promoted among regulated industries. Computerized tools that would reduce the time required for various analyses undertaken in rate cases and in other regulatory decision problems were developed. The study also considered the need for improvements in the quality and scope of analysis. A secondary emphasis was on managerial and administrative procedures in regulatory commissions. Four specific areas addressed were regulatory lag, rate design, performance evaluation and factor productivity analysis, and long-range planning.

708,515
PB80-183445 PC **A14**/MF **A01**
Nottingham (H.D.) and Associates, Inc., McLean, VA.
HUD Utilities Demonstration Series. Volume 15, Part 1. Design Cost and Operating Data for Alternative Energy Systems for the Summit Plaza Complex, Jersey City, NJ.
Final rept.
May 79, 315p NBS/GCR-80/164
Contract NBS-5-35870
See also Volume 15, Part 2, PB80-183452 and Volume 11, PB-264 427. Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research.

Keywords: *Diesel electric power generation, Substitutes, Design, Systems analysis, Cost analysis, Systems engineering, Data, Heating, Cooling systems, *Total energy systems, Jersey City(New Jersey).

This report develops basic design and operating data for a comparison of alternative methods of supplying heating, cooling and electric power to a residential/commercial complex. The community complex studied is the Summit Plaza Development located in Jersey City, New Jersey which has been served since January, 1974, by a Total Energy (TE) plant. The Summit Plaza TE project is a demonstration effort of the U.S. Department of Housing and Urban Development (HUD) currently being administered by the National Bureau of Standards (NBS) for analysis of the performance and overall viability of the Total Energy facility. Included in the scope of this study is the following: (1) Analysis of the installed energy system; (2) Conceptual design of alternate energy systems; (3) Estimates of the capital costs of the existing system and each alternate system; (4) Estimates of the operation and maintenance costs of the existing system and alternate systems; (5) Simulation of the energy systems operating through a typical year to determine energy demands and consumptions. The data in this report are incorporated into the Final Report being prepared by NBS for the HUD Total Energy Demonstration Project. The Final Report will compare the energy, economic, reliability, and environmental viability of each energy system.

708,516
PB80-183452 PC **A07**/MF **A01**
Nottingham (H.D.) and Associates, Inc., McLean, VA.
HUD Utilities Demonstration Series. Volume 15, Part 2. Detailed Initial Cost Data for Alternative Energy Systems for the Summit Plaza Complex, Jersey City, NJ.
Final rept.
May 79, 142p NBS/GCR-80/165
Contract NBS-5-35870
See also Volume 15, Part 1, PB80-183445 and PB-183 445. Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research.

Keywords: *Diesel electric power generation, Substitutes, Cost analysis, Cost estimates, Construction costs, Cooling systems, Heating, Systems analysis, *Total energy systems, Jersey City(New Jersey).

This report presents detailed estimates of the construction cost of 12 alternative energy systems which could supply heating, cooling and electrical services to the Summit Plaza Complex. Construction costs are developed for each system in the report by a quantity take-off for all major and minor equipment for each energy system including the individual electrical and mechanical components of the energy conversion equipment, site distribution, equipment, building termi-

nal equipment etc. The detailed data in the report is summarized in a related report in which the energy performance and costs for the energy system were developed: Design, Cost and Operating data for Alternative Energy Systems for the Summit Plaza Complex, Jersey City, NJ.

708,517
PB82-201401 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Performance Analysis of the Jersey City Total Energy Site: Executive Summary.
C. W. Hurley, and J. D. Ryan. Apr 82, 61p NBSIR-82-2483
See also Volume 15, PB80-183452. Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: Diesel electric power generation, Performance, Systems analysis, Commercial buildings, Apartment buildings, Coat analysis, New Jersey, *Total energy systems, Jersey City(New Jersey).

The National Bureau of Standards gathered engineering and economic data from an apartment/commercial complex located on a 6.35 acre (2.6 hectare) site in Jersey City, New Jersey. Economic, reliability and environmental data were also collected and analyzed by NBS in conjunction with an analysis of the engineering data. This report presents an 'Executive Summary' of the final report on the performance analysis of the Jersey City Total Energy Project. The reader is encouraged to refer to that final report for further details. The analysis of the engineering data clearly indicates a significant savings in fuel by using the total energy concept in the plant. Several areas were also identified by this analysis where minor modifications in the plant operation could result in additional fuel savings. Three of the modifications have already been incorporated in the present plant operational procedures.

708,518
PB82-260381 PC **A18**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Performance Analysis of the Jersey City Total Energy Site: Final Report.
C. W. Hurley, J. D. Ryan, and C. W. Phillips. Aug 82, 408p NBSIR-82-2474
See also Volume 11, PB-264 427. Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research.

Keywords: Diesel electric power generation, New Jersey, Heat recovery, Performance evaluation, Data, Economic analysis, *Total energy systems, Waste heat utilization, Jersey City(New Jersey).

The National Bureau of Standards was responsible for designing and installing the instrumentation and a data acquisition system (DAS) to determine fundamental engineering data from the plant and site buildings. The DAS was put on line in April 1975. The raw data from the DAS was processed by a minicomputer at NBS to obtain a broad spectrum of engineering results. This report describes these systems and presents the appropriate data and a performance analysis of the plant and size. The analysis of the data indicates a significant savings in fuel is possible by minor modifications in plant procedures. This report also includes the results of an analysis of the quality of utility services supplied to the consumers on the site and an analysis of a series of environmental tests made for the effects of the plant on air quality and noise. In general, these analyses reflected favorable results for the total energy plant. Economic and energy analyses are presented for the plant as operated during the period of the study and on a comparative basis with twelve alternative system designs applicable for providing the tenants on the site with equivalent utility services.

Electric Power Transmission

708,519
DE87014558 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Optical Power Line Voltage and Current Measurement Systems: Volume 1, Limits to the Precision of Electro-Optic and Magneto-Optic Sensors: Final Report.
G. W. Day, P. D. Hale, M. Deeter, T. E. Milner, and D. Conrad. Sep 87, 122p EPRI-EL-5431-V.1
See also PB87-212536.

Keywords: *Power Transmission Lines, Accuracy, Ammeters, Calibration, Design, Electro-Optical Effects, Magneto-Optical Effects, Monitors, Optical Fibers, Polarization, Temperature Dependence, Transfer Functions, Voltmeters, ERDA/200300, Electric measuring instruments.

This study began with a central question, "What precision can be achieved with an electro-optic voltage sensor or a magneto-optic current sensor." The answer has been pursued in numerous ways - through an investigation of the basic properties of materials and components (both as reported in the literature and new data generated in our laboratory), through attempts to demonstrate the feasibility of overcoming certain limitations in the properties of components, through analysis of some fundamental limitations, through the proposal of new or refined designs, and through discussions with numerous other investigators. It was concluded that ease of obtaining high precision (in a power systems context) is not included among the advantages of using optical sensors for measurement of electromagnetic quantities. The principal difficulty was that sensors have to maintain their calibration over broad temperature ranges (at least 100 sup 0 C) without the possibility of temperature stabilization. Specifically, using relatively standard approaches and an appropriate definition of precision, a precision not better than about +-1% can be expected. Achieving this level of precision will require wise choices of materials, components, and design; numerous suggestions are offered. (ERA citation 12:045329)

708,520
HCP/T6010-E1 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
AC Transmission Line Field Measurements.
F. R. Kotter, and M. Misakian. Nov 77, 79p
Contract EA-77-A-01-6010

Keywords: *Hvac systems, *Power transmission lines, Calibration, Electric fields, Electric measuring instruments, Environmental effects, Magnetic fields, Magnetometers, Operation, Performance, ERDA/200301, Alternating current.

The concern in recent years over the environmental effects of electric and magnetic fields from high voltage transmission lines has also focused attention on the accuracy of measurements of these fields. Electric field meters are discussed in terms of theory of operation, parameters affecting performance, meter performance under field and laboratory conditions, and calibration procedures. The performance and calibration of magnetic field meters is described. (ERA citation 03:021550)

708,521
PB-265 076/0 PC **A05**/MF **A01**
National Bureau of Standards, Boulder, Colo. Cryogenics Div.
Helium Research in Support of Superconducting Power Transmission.
Annual rept. no. 2, Jul 75-Sep 76,
M. C. Jones, V. D. Arp, W. R. Parrish, D. E. Daney, P. R. Ludtke, N. V. Frederick, and B. A. Hands. Feb 77, 100p NBSIR-77-853, CONS-3800-1
Contract E(49-1)-3800
See also report dated Oct 75, PB-246 658.

Keywords: *Superconducting power transmission, *Helium, *Gas cooling, Cryogenics, Supercritical flow, Electric terminals, Data transmission, Thermal conductivity, Impurities, Pressure sensors, Test facilities, Computerized simulation, Superconducting cables, Cryogenic cables.

This report is the second annual report of research on helium related problems in support of superconducting power transmission development. The report is in four sections. In the first section; results are presented from xperimental and computer modeling of the performance of current leads cooled with supercritical helium gas. Performance characteristics studied are burn-out conditions and existence of oscillation in the helium gas. The second section, on helium measurements, reports some conclusions on the feasibility of data transmission from high-voltage regions to grounded read-out instrumentation, on thermometry and on helium impurity measurements. A major part of this section is a detailed description with test results of microwave cavity pressure transducers for use at helium temperatures. A third section, on helium properties, reports some improvements in computer codes for helium properties and discusses some recent data on the thermal conductivity of helium. In the final section, a description is given of a recently completed flow facility which has been built for research on flow and heat transfer dynamics of supercritical helium in channels of high aspect ratio modeling superconducting power transmission line channels.

708,522
PB-285 027/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of Electric and Magnetic Fields from Alternating Current Power Lines.
Final rept.,
M. Misakian, F. R. Kotter, L. Zafanella, R. Baishiki, and B. Whitney. Aug 78, 11p
Pub. in IEEE Trans. Power Apparatus Systems, PAS-97 n4 p1104-1114 Jul/Aug 78.

Keywords: *Power lines, Measurement, Electric fields, Magnetic fields, Calibrating, Alternating current, Reprints.

No abstract available.

708,523
PB-285 313/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Transient Behavior of Helium-Cooled Current Leads for Super-Conducting Power Transmission.
Final rept.,
M. C. Jones, V. M. Yeroshenko, A. Starostin, and L. A. Yaskin. Jun 78, 7p
Contract DOE-EA-77-A-01-6010
Pub. in Jnl. Cryogenics, v18 n6 p337-343, Jun 78.

Keywords: *Electric connectors, *Superconducting power transmission, Transient response, Surges, Overcurrent, Computations, Burnout, Helium, Cooling, Reprints.

Based upon time dependent differential equations, numerical calculations are presented which allow, first, the determination of burn-out conditions for a helium cooled current lead. Secondly, the response of the lead to an overload current may be examined, both during the overload and during subsequent time when the normal current again persists. Representing the temperature dependent resistivity and thermal conductivity of the copper conductor as a function of its purity (residual resistivity ratio) the results are parameterized by dimensionless mass flow rate, current and residual resistivity ratio. Defining the burn-out temperature as 500K and an operating current as 85% of the burn-out current, it is shown that although all residual resistivity ratios between 5 and 100 are suitable, there is a limit on the mass flow rate number which can be used. This results from secondary temperature surges occurring after the overload, the conditions for which are rather complicated. It is concluded in particular that, within the permissible range of mass flow rates, no damage should result from a 10X current overload for periods up to 0.2 seconds.

708,524
PB-285 323/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Prototype Field Calibration System for Coupling Capacitor Voltage Transformers (CCVTs).
Final rept. Nov 73-Jun 77,
D. L. Hillhouse, O. Petersons, and W. C. Sze. Apr 78, 203p
Prepared in cooperation with Electric Power Research Inst., Palo Alto, Calif.
Pub. in EPRI EL-690, 203p Apr 78.

Keywords: *Potential transformers, Calibrating, Portable equipment, Extra high voltage, Measuring instruments, Revenue, Electric utilities, Coupling capacitor voltage transformers.

In recent years, the coupling capacitor voltage transformer (CCVT) has come into wide use for 0.3% accuracy extra-high voltage (EHV) revenue metering in interties between utilities, a function performed for many years by the inductive potential transformer (PT). Whereas the PT has been thoroughly proven in this application, the CCVT has not. Considerable user ex-

perience has raised very reasonable doubts as to its adequacy and suggested the need for periodic calibration. Since the CCVT is permanently installed in the substation, this calibration must be done on-site. A prototype field calibration system for CCVTs has been developed. The system consists of (1) CCVT capacitor modules; (2) a high voltage (100 kV) capacitor standard; (3) a current comparator bridge; and, (4) a resonant power supply, all of which are transported in a closed truck. At the substation site, the capacitor modules are removed from the truck and stacked up to form a capacitive divider with a rating that matches the system voltage for calibrating purposes. This divider is used as a transfer standard since it is first calibrated against the high accuracy, high voltage capacitor standard (2) located in the truck. Then it is connected to the high voltage bus to calibrate the substation CCVTs.

708,525
PB80-114101 Not available NTIS
National Bureau of Standards, Washington, DC.
Discussion on F 77 696-8 'Transient Measurement Techniques in EHV Systems' by R. Malewski and G. R. Nourse.
Final rept.,
R. E. Hebner, D. L. Hillhouse, and F. R. Kotter. 1978, 1p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems 97, n3, p901, May/June 1978.

Keywords: *Surges, *Electric power transmission, Measurement, High voltage, Reprints.

No abstract available.

708,526
PB80-116502 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO.
Helium Research in Support of Superconducting Power Transmission.
Annual rept. Oct 77-Sep 78,
D. E. Daney. Oct 79, 64p NBSIR-79/1618
Prepared in cooperation with Brookhaven National Lab., Upton, NY.

Keywords: *Helium, *Gas cooling, Power lines, Thermal cycling tests, Electric terminals, Clamps, *Superconducting power transmission, *Cryogenic cables, *Superconducting cables.

During FY 78, the NBS Thermophysical Properties Division program of supporting research for Superconducting Power Transmission Line (SPTL) development focused on three tasks: (1) Numerical computation of SPTL cool down by both single stream and counter flow methods; (2) Experimental modeling of counterflow SPTL cool down; (3) Thermal cycling of lengths of lead-sheathed model cable destined for testing in the BNL 5th Ave. facility. The preparation of computer codes and numerical computation of SPTL cool down were completed and the results are given in Section 3. These calculations confirm our original intuitive judgment that cool-down times for the counterflow arrangement can be long--twenty days or more. Greater than anticipated computer run times and costs required a reduction of effort on experimental modeling of counterflow cool down. Consequently, completion of this task will be delayed until FY 79. Two sections of cable underwent extensive thermal cycling, and the results of these tests are given in Section 1. The complex structure of the cable leads to unusual (although reproducible) load vs time curves.

708,527
PB80-170251 Not available NTIS
National Bureau of Standards, Washington, DC.
Characterization of the Electric Environment Under HVDC Transmission Lines: Instrumentation and Measurement.
Final rept.,
F. R. Kotter. Aug 79, 29p
Pub. in Proceedings of the Workshop on Electrical and Biological Effects Related to HVDC Transmission, Richland, WA, October 19-20, 1978, Paper PNL-3121, UC97a, p2.1-2.29 1979.

Keywords: *Electric measuring instruments, *Electrical measurement, Atmospheric electricity, Power transmission lines, High voltage, Charge measuring instruments, Field strength, Direct current.

The instrumentation and measurement techniques used in atmospheric electricity research which have possible application for use in studying conditions in the vicinity of high-voltage direct-current transmission lines are reviewed. Thirty-four references are given.

708,528
PB81-156606 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO.
Helium Research in Support of Superconducting Power Transmission.
Annual rept. 1 Oct 78-30 Sep 79.
D. E. Daney. Dec 80, 59p NBSIR-80-1637
Sponsored in part by Brookhaven National Lab., Upton, NY. See also PB80-116502.

Keywords: *Gas cooling, Helium, Computation, Power lines, *Superconducting power transmission, *Cryogenic cables, *Superconducting cables.

The authors have completed the first phase of our investigation of SPTL cool-down in which the aim was to develop a fundamental understanding of the counterflow method of cool-down. The excellent agreement of our analytical, numerical, and experimental results gives us confidence that we can accurately model the cool-down of full-scale SPTL's. The cable permeability measurements indicate that any significant rupture of the lead gas barrier of the cable will lead to an unacceptably high leak rate from the pressurized core.

708,529
PB81-161929 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Generation and Measurement of DC Electric Fields with Space Charge.
M. Misakian. Jan 81, 45p NBSIR-80-2177
Contract DOE-EA-77-01-6010

Keywords: *Electric fields, Power transmission lines, Direct current, High voltage, Space charge, Measurement.

Characterization of the electrical environment in the vicinity of high voltage dc transmission lines requires measurement of a number of electrical parameters associated with the lines. These parameters include the electric field strength with significant space charge contributions. This report describes an experimental effort to generate known dc electric fields containing controlled amounts of space charge. An apparatus which has been built for this purpose is described and two types of field probes currently used for transmission line field measurements are examined with the apparatus. Limitations on the operation of one type of probe in the presence of very large current densities are identified and discussed.

708,530
PB81-220261 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Development of Power System Measurements.
Quarterly rept. 1 Jan-31 Mar 81.
R. E. Hebner. Apr 81, 20p NBSIR-81-2283

Keywords: *Power lines, Measurement, Electric fields, Ion density(Concentration), Electrical fault location, Electrical insulation, Dielectric breakdown, Insulating oil, Sulfur fluorides.

This report emphasizes the errors associated with measurements of the vertical current density in an electrical environment consisting of a dc field with space charge, the measurement of rf attenuation in distribution cables, the onset characteristics of positive and negative corona in compressed SF6 gas, and the measurement of the space charge density in transformer oil subjected to 60-Hz excitation.

708,531
PB81-246860 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Development of Power System Measurements.
Quarterly rept. 1 Apr 81-30 Jun 81.
R. E. Hebner. Jun 81, 21p NBSIR-81-2334
Contract DOE-EA-77-A-01-6010
See also PB81-220261.

Keywords: *Power lines, Measurement, Electrical fault location, Electrical insulation, Dielectric breakdown, Ion density(Concentration), Insulating oil, Sulfur fluorides.

The report emphasizes measurements of ion density in air, the use of signals above 1 GHz to detect incipient faults in cables, the measurement of the by-products which develop during partial discharge activity in SF sub 6, and the determination of the breakdown behavior of an oil-paper interface.

708,532
PB81-600060 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Generation and Measurement of dc Electric Fields with Space Charge.
M. Misakian. 1981, 10p
Pub. in Jnl. Appl. Phys. 52, n5 p3135-3144 May 1981.

Keywords: *Calibration, dc transmission lines, Electric field, Electric field meters, Electric field strength, Electric power transmission, Measurements, Space charge.

Characterization of the electrical environment is the vicinity of high voltage dc transmission lines requires measurement of a number of electrical parameters associated with the lines. These parameters include the electric field strength with significant space-charge contributions. The report describes an experimental effort to generate known dc electric fields containing controlled amounts of space charge. An apparatus which has been built for this purpose is described, and two types of field probes currently used for transmission line field measurements are examined with the apparatus. Limitations on the operation of one type of probe in the presence of very large current densities are identified and discussed.

708,533
PB82-112558 Not available NTIS
National Bureau of Standards, Washington, DC.
Counterflow Cool Down of Cryogenic Power Transmission Lines.
Final rept.
D. E. Daney, and M. C. Jones. Aug 81, 11p
Pub. in Cryogenics 21, n8 p463-473 Aug 81.

Keywords: *Power transmission lines, Cooling, Heat exchangers, Reprints, Cryogenic cables, Superconducting power transmission.

Cooling down of cryogenic power transmission lines which use a counterflow cooling arrangement is investigated analytically, numerically, and experimentally.

708,534
PB82-122987 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Helium Research in Support of Superconducting Power Transmission.
Annual rept. 1 Oct 79-1 Sep 80.
D. E. Daney. Sep 81, 45p NBSIR-81-1649
See also PB81-156606. Sponsored in part by Brookhaven National Lab., Upton, NY.

Keywords: *Gas cooling, Helium, Computation, Power lines, *Superconducting power transmission, *Cryogenic cables, *Superconducting cables.

During FY 80, the NBS Thermophysical Properties Division program of research for superconducting power transmission line (SPTL) development focused on two tasks: (1) Development of SPTL cool-down strategies; (2) Experimental evaluation of thermal flux meters as a possible technique for determining enclosure heat leak. In developing SPTL cool-down strategies, we used a computer code (previously developed at NBS) to explore cool-down times for a wide variety of realistic boundary conditions. Cool-down times of 10 days are feasible with only minor modification to previously proposed refrigeration systems if cooling channel lengths are reduced to two thirds or one half those dictated by steady-state considerations. Evaluation of thermal flux meters was concluded. Below ground field tests revealed large effects due to seasonal variation in the soil heat flux. These effects can be largely cancelled by algebraic addition of the signals from a pair of horizontally opposed sensors. A brief above ground field evaluation indicated that diurnal variations in the heat flux completely mask heat fluxes typical of the anticipated enclosure heat flux.

708,535
PB82-133554 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
AC Transmission Line Field Measurements.
Interim rept. Apr 75-Aug 77.
F. R. Kotter, and M. Misakian. Oct 81, 84p NBSIR-77-1311
Contract DOE-EA-77-A-01-6010

Keywords: *Power transmission lines, Electrical measuring instruments, Electric fields, Field strength, Cali-

brating, Magnetic fields, Electric power transmission, *HVAC systems.

The influence of temperature, relative humidity, frequency, waveform, proximity of the observer, as well as other parameters, on the accuracy of a small number of two commercially available ac electric field meters is documented. Procedures for the calibration of these instruments are reviewed and guidance is given for the construction of a calibration facility suitable for use in achieving calibrations to an accuracy of 1 percent. Measurement errors which develop when these meters are used in a highly nonuniform single-phase field are investigated theoretically and experimentally. The performance of a magnetic field probe provided as an accessory with one of the field meters is described, and an analysis of the accuracy to be expected from the use of simple multi-turn rectangular loops for the calibration of such magnetic field meters is given.

708,536
PB82-156993 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Measurement of Ion Current Density at Ground Level in the Vicinity of High Voltage DC Transmission Lines.
R. H. McKnight, F. R. Kotter, and M. Misakian. Dec 81, 29p NBSIR-81-2410
Contract DOE-FA-77-A-01-6010

Keywords: *Power transmission lines, High voltage, Direct current, Ion currents, Current density, Measurement, Electric corona, Detectors, Wilson plates.

Sensors for measuring vertical current density at ground level near high voltage dc (HVDC) transmission lines are subject to error when the sensor is not in the ground plane. The magnitude of this error, for guarded and unguarded sensors, has been investigated using both dc electric fields with space charge and ac electric fields in a parallel plate facility. For conditions like those expected under HVDC transmission lines, the results obtained using ac and dc methods agreed to within experimental uncertainty. The measured errors are as large as 25 percent for guarded sensors and significantly larger for unguarded sensors. Data for various sensor elevations and guarding are presented in graphs to aid the designer.

708,537
PB82-209776 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Analysis of the Calibration of Metering CCVTs in a Utility Substation.
Final rept.
D. L. Hillhouse, and D. A. Leep. Oct 81, 55p NBSIR-81-2360
Sponsored in part by Electric Power Research Inst., Palo Alto, CA.

Keywords: *Power transformers, Calibrating, Electric substations, Extra high voltage, Measurement, Electric utilities.

This report presents the results of an investigation of unexpected variations in nine 500 kV metering CCVTs, tested for Gulf States Utilities at Baton Rouge, LA. These measurements were performed on three occasions - May 1979, March 1980, and December 1980.

708,538
PB82-215419 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Simplified System for Calibration of CCVTs in the Substation.
Final rept.
D. L. Hillhouse, O. Petersons, and W. C. Sze. May 82, 61p NBS-TN-1155
Sponsored in part by Pennsylvania Power and Light Co., Allentown.

Keywords: *Power transformers, Calibrating, Electric power transmission, Extra high voltage, Electric substations, Measurement, Coupling capacitor voltage transformers.

Coupling capacitor voltage transformers (CCVTs) are widely used for the revenue metering of energy exchanged between utilities at EHV (345-500 kV) interties. These devices are installed permanently in substations, and must be calibrated there. Allowable error is plus or minus 0.3 percent and plus or minus 4.6 mrad (milliradians). This report describes a simplified, lighter, and less costly CCVT calibration system, newly developed and field tested by NBS. The principal elements of this system are a portable reference standard transformer and moderate voltage power supply (14.4 kV), a modular capacitive transfer standard divider, and a voltage comparator. Results obtained with this system agree with the prototype to within plus or minus 0.03 percent and plus or minus 0.1 mrad.

708,539
PB82-229352 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of Power System Measurements.
Quarterly rept. 1 Jan 82-31 Mar 82.
R. E. Hebner. Jun 82, 23p NBSIR-82-2528
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Power lines, Measurement, Electrical fault location, Electrical insulation, Dielectric breakdown, Ion density(Concentration), Insulating oil, Sulfur fluorides.

This report documents the progress on four technical investigations sponsored by the Department of Energy and performed by the Electrosystems Division, the National Bureau of Standards. The work described covers the period from January 1, 1982 to March 31, 1982. The report emphasizes the calibration of instruments designed to measure the 60-Hz electric field in biological exposure facilities, selected errors inherent in the use of time-domain reflectometry to determine the rf characteristics of power cables, the measurement of the rate of decomposition of SF6 in positive dc-corona discharges, and in the measurement of space charge in transformer oil between 100C and 150C.

708,540
PB83-124891 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Development of Power System Measurements - Quarterly Report, April 1, 1982 to June 30, 1982.
R. E. Hebner. Oct 82, 28p NBSIR-82-2586
See also PB82-229352.

Keywords: *Power lines, Measurement, Radiofrequency, Attenuation, Power distribution lines, Electrical fault location, Ion density(Concentration), Insulating oil, Space charge.

This report documents the progress on four technical investigations sponsored by the Department of Energy and performed by the Electrosystems Division, the National Bureau of Standards. The work described covers the period April 1, 1982 to June 30, 1982. This report emphasizes the errors associated with measurements of space charge near dc transmission lines, the measurement of rf attenuation in distribution cables, the characteristics of positive and negative corona in compressed SF6 gas, and the measurement of the space charge density in transformer oil subjected to 60-Hz excitation.

708,541
PB83-179242 Not available NTIS
National Bureau of Standards, Washington, DC.
Improving Geotechnical Investigations for Underground Transmission Lines.
Final rept.
L. A. Salomone. 1982, 15p
Sponsored in part by Department of Energy, Columbus, OH.
Pub. in Proceedings of Symposium Underground Cable Thermal Backfill, Toronto, Ontario, Canada, Sep 17-18, 1981, Chapter 3 in Underground Cable Thermal Backfill, p57-71 1982.

Keywords: *Soil mechanics, Power transmission lines, Thermal conductivity, Design, *Underground power transmission.

An evaluation of the thermal properties of the soils that surround underground transmission lines is an important part of existing design procedures for underground power cables. Geotechnical investigations consisting of in-situ and laboratory thermal probe tests, soil sampling and determinations of moisture and density are frequently performed to evaluate the thermal resistivity of soils encountered along proposed transmission line routes. These investigations often are based on routine procedures adopted over the years but not necessarily reflecting all the information and techniques now available in the fields of agronomy and geotechnical engineering. The paper demonstrates how information and techniques used by agronomists and geotechnical engineers can be correlated and then used to improve our capability of predicting in-situ thermal soil properties. Also, suggestions for improving existing procedures for evaluating the thermal resistivity of soils are provided.

708,542
PB83-210609 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Development of Power System Measurements - Quarterly Report July 1, 1982 to September 30, 1982.
R. E. Hebner. May 83, 26p NBSIR-83-2705
See also report for Apr-Jun 1982, PB83-124891. Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Electric fields, Electric measuring instruments, Electric corona, Insulating oil, Space charge, Avalanche breakdown, Electrical fault location, Sulfur hexafluoride.

The report emphasizes the calibration of instruments designed to measure the 60-Hz electric field in biological exposure facilities, the determination of the role of photodetachment of SF6 corona discharges, the measurement of failure mechanisms in liquid/solid insulating systems, and the development and behavior of active insulators.

708,543
PB83-234583 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Ion Current Density at Ground Level in the Vicinity of High Voltage DC Transmission Lines.
Final rept.
R. H. McKnight, F. R. Kotter, and M. Misakian. Apr 83, 8p
See also PB82-156993. Sponsored in part by Department of Energy, Washington, DC.
Pub. in Institute of Electrical and Electronics Engineers Power Apparatus and Systems PAS-102, n4 p934-941 Apr 83.

Keywords: *Power transmission lines, *High voltage, *Ion currents, Measurement, Electric corona, Detectors, Current density, Reprints, Wilson plates.

Sensors for measuring vertical current density at ground level near high voltage dc (HVDC) transmission lines are subject to error when the sensor is not in the ground plane. The magnitude of this error, for guarded and unguarded sensors, has been investigated using both dc electric fields with space charge and ac electric fields in a parallel plate facility. For conditions like those expected under HVDC transmission lines, the results obtained using ac and dc methods agreed to within experimental uncertainty. The measured errors are as large as 25 percent for guarded sensors and significantly larger for unguarded sensors. Data for various sensor elevations and guarding are presented in graphs to aid the designer. Comparisons with results from an IEEE Working Group field day are also presented.

708,544
PB84-109891 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Development of Power System Measurements - Quarterly Report October 1, 1982 to December 31, 1982.
R. E. Hebner. Sep 83, 42p NBSIR-83-2755
See also PB83-210609. Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Electric fields, Electric measuring instruments, Electric corona, Insulating oil, Space charge, Avalanche breakdown, Electrical fault location, Sulfur hexaflouoride.

The report emphasizes the calibration of instruments designed to measure the 60-Hz electric and magnetic fields in biological exposure facilities, the measurement of the rate of decomposition of SF6 in positive dc-corona discharges, and in the measurement of space charge in transformer oil between 100C and 150C.

708,545
PB84-115104 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.

Development of Power System Measurements - Quarterly Report January 1, 1983 to March 31, 1983.
R. E. Hebner. Oct 83, 28p NBSIR-83-2761
See also PB84-109891. Sponsored in part by Department of Energy, Washington, DC. Div. of Electrical Energy Systems.

Keywords: *Electric fields, *Electrical measurement, Electric measuring instruments, Electrical insulation, Electrical insulators, Interfaces, Magnetic fields, Sulfur hexafluoride.

Contents:
Electric and magnetic field measurements;
Technical assistance for future insulation systems research;
Optical measurements for interfacial conduction and breakdown in insulating systems;
Active insulators;
and Investigation of insulators surface flashover in gas.

708,546
PB84-197300 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of Power System Measurements--Quarterly Report, October 1, 1983 to December 31, 1983.
R. E. Hebner. May 84, 27p NBSIR-84-2861
See also PB84-115104 and PB84-109891. Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Electric fields, Electric measuring instruments, Magnetic fields, Errors, Electric corona, Insulating oil, Sulfur hexafluoride, Electric insulation.

This report documents the progress of three technical investigations sponsored by the Department of Energy and performed by or under a grant from the Electrosystems Division, the National Bureau of Standards. The work described covers the period October 1, 1983 to December 31, 1983. This report emphasizes the errors associated with measurements of electric and magnetic fields, the properties of corona in compressed SF6 gas, and the measurement of interfacial phenomena in transformer oil.

708,547
PB84-216530 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Electrosystems Div.
Development of Power System Measurements, Quarterly Report, April 1, 1983 to June 30, 1983.
R. E. Hebner. Feb 84, 42p NBSIR-84-2809
Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Electric fields, *Electrical measuring instruments, *Electric corona, *Electric insulation, Calibrating, High voltage, Insulating oil, Sulfur hexafluoride, Dielectric breakdown, Electrical insulators.

The report emphasizes the calibration of instruments designed to measure the 60-Hz electric field in biological exposure facilities, the effect of water on SF6 corona discharges, the measurement of failure mechanisms in liquid/solid and gas/solid insulating systems, and the development and behavior of active insulators.

708,548
PB84-217439 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Electrosystems Div.
Development of Power System Measurements - Quarterly Report, July 1, 1983 to September 30, 1983.
R. E. Hebner. Feb 84, 28p NBSIR-84-2818
See also PB84-197300. Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Electric fields, *Electric insulation, Measurement, Space charge, Electric corona, Insulating oil, Sulfur hexafluoride, Dielectric breakdown, High voltage.

The report emphasizes the measurement of the 60-Hz electric and magnetic field in biological exposure facilities, the measurement of water vapor, the production rates of oxyfluorides in SF6 corona discharges, and in the measurement of space charge in transformer oil.

708,549
PB84-226174 Not available NTIS
National Bureau of Standards, Washington, DC.
Simplified System for Calibration of Coupling Capacitor Voltage Transformers.
Final rept.
D. L. Hillhouse, O. Petersons, and W. C. Sze. May 84, 7p
Sponsored in part by Pennsylvania Power and Light Co., Allentown.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems PAS-103, n5 p1092-1098 May 84.

Keywords: *Transformers, *Calibrating, Standards, Reprints, EHV AC systems.

Metering accuracy coupling capacitor voltage transformers (CCVTs) are installed permanently in 230-500 kV substations and must be calibrated in place. Several years ago, NBS developed a prototype field calibration system, with uncertainties of + or - 0.1% and + or - 0.3 milliradians (mrad). This paper describes a simpler system, consisting of a 15 kV standard transformer and its power supply, a capacitive transfer standard divider, and a voltage comparator. In field tests, this system agreed with the prototype to within + or - 0.03% and + or - 0.1 milliradians. The new system could be transported in a non-dedicated truck, and operated from the substation control house or a van.

708,550
PB85-182582 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Development of Power System Measurements - Quarterly Report January 1, 1984 to March 31, 1984.
R. E. Hebner. Jul 84, 30p NBSIR-84/2898
Previously announced as DE84-017001. See also PB85-182590. Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Electric fields, *Electrical measuring instruments, *Power transmission lines, Electric insulation, Dielectric breakdown, Insulating oil, Space charge, Sulfur hexafluoride, HVDC Systems, Ion counters.

The report documents the progress on three technical investigations sponsored by the Department of Energy and performed by the Electrosystems Division, the National Bureau of Standards. The work described covers the period from January 1, 1984 to March 31, 1984. The report emphasizes the performance of ion counters like those used to measure the ions near dc transmission lines, the production rates of oxyfluorides in SF6 corona discharges, and the measurement of space charge associated with a pressboard interface in transformer oil.

708,551
PB85-182590 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Development of Power System Measurements - Quarterly Report April 1, 1984 to June 30, 1984.
R. E. Hebner. Mar 85, 40p NBSIR-85/3112
See also PB85-182582. Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Electric fields, *Power transmission lines, Electrical measurement, Electrical insulation, Electric discharges, Sulfur hexafluoride, HVDC systems.

The report emphasizes the errors associated with measurements of dc electric fields, the properties of corona in compressed SF6 gas, and the measurement of voltage pulses on nanosecond time scales.

708,552
PB85-184893 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Development of Power System Measurements - Quarterly Report July 1, 1984 to September 30, 1984.
R. E. Hebner. Mar 85, 40p NBSIR-85/3111
See also DE84-017001.

Keywords: *Power transmission lines, *Sulfur hexafluoride, Measurement, Electric fields, Magnetic fields, Electrical insulation, Interfaces, Insulating oil, Electric discharges, *HVDC systems.

The report documents the progress on four technical investigations sponsored by the Department of Energy and performed by or under a grant from the Electrosystems Division, the National Bureau of Standards. The work described covers the period from July 1, 1984 to September 30, 1984. The report emphasizes the errors associated with measurements of electric and magnetic fields, the properties of corona in compressed SF6 gas, the measurement of interfacila phenomena in transformer oil, and the measurement of dielectric properties on nanosecond time scales.

708,553
PB86-231156 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Discussion of 'A Fast Response Impulse Voltage Measuring System for Testing of Gas Insulated Substations Equipment'.
Final rept.
R. H. McKnight. 1986, 1p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Delivery PWRD-1, n3 p47 Jul 86.

Keywords: *Electrical measurement, High voltage, Substations, Frequency response, Step response, Reprints.

The contribution is a discussion of a technical paper presented at the winter meeting of the Power Engineering Society, IEEE. It questions some of the authors assumptions, and references other applications of the measurement method described.

708,554
PB87-131884 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Calibration of Test Systems for Measuring Power Losses of Transformers.
Final rept.
S. P. Mehta, and O. Petersons. 1986, 9p
See also PB86-132032.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Delivery PWRD-1, n4 p215-223 Oct 86.

Keywords: *Power transformers, *Power loss, Electrical measurement, Power factor, Calibrating, Reprints, Test methods.

Two years of development work by ASEA Electric, under the auspices of the Industrial Research Associate Program of the National Bureau of Standards has resulted in a verifiable method of determining overall accuracy of test systems used in the measurement of transformer losses. The technical achievement is important to the industry because of the present trend towards lower power factors which makes loss measurements exceedingly difficult with desirable test system accuracy that is traceable. The technical details of the work are presented in NBS Technical Note 1204 (over 100 page document). The intent of the IEEE paper is to present the basic principles embodied in the Technical Note. A calibration system for accuracy verification and alignment of test systems is described. Methodologies and data for evaluating accuracy of test systems are summarized.

708,555
PB87-172748 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Reconductoring Study Using Reliability Assessments.
Final rept.,
M. E. Criswell, E. M. Hendrickson, and J. R. Goodman. 1984, 4p
Sponsored by Electric Power Research Inst., Palo Alto, CA.
Pub. in Proceedings of ASCE Specialty Conference on Probabilistic Mechanics and Structural Reliability (4th), Berkeley, CA., January 11-13, 1984, p123-126.

Keywords: *Transmission lines, *Reliability, Wind loads.

Both deterministic and reliability assessments were utilized to investigate the feasibility of reconductoring an 11-1/2 mile (18.5 km) long transmission line located near Fort Collins, Colorado. Reliability index values for each of the 67 single-pole tubular steel tangent structures were determined for four possible reconductoring options. Structural adequacy of these structures to resist high wind loadings was of primary interest. Significant potential cost savings, ranging from 37

to 63% of the replacement costs of these 67 structures, were found using reliability assessment techniques rather than conventional design procedures.

708,556
PB87-201679 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Power Quality Site Surveys: Fiction and Fallacies.
Final rept.,
F. D. Martzloff, and T. M. Gruzs. 1987, 13p
Pub. in Proceedings of the Industrial and Commercial Power Systems Technical Conference, Nashville, TN, p21-33, May 4-7, 1987.

Keywords: *Power lines, *Surges, *Overvoltage, *Site surveys, Disturbances, Monitors, Transients.

The quality of the power supplied to sensitive electronic equipment is an important issue. Monitoring disturbances of the power supply has been the objective of various site surveys, but results often appear to be instrument- or site-dependent, making comparisons difficult. After a review of the origins and types of disturbances, the types of monitoring instruments are described; a summary of nine published surveys reported in the last 20 years is presented. A close examination of underlying assumptions allows meaningful comparisons which can reconcile some of the differences. Finally, the paper makes an appeal for improved definitions and applications in the use of monitoring instruments.

708,557
PB87-225405 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Fast Transient Tests - Trivial or Terminal Pursuit.
Final rept.,
F. D. Martzloff, and P. F. Wilson. 1987, 6p
Pub. in Proceedings of Electromagnetic Compatibility Symposium (1987), Zurich, Switzerland, March 3-5, 1987, p283-288.

Keywords: *Power lines, Surges, Attenuation, Transients.

Measurements, augmented by theoretical simulation techniques, have been performed to determine the attenuation of fast-transients propagating in typical power lines. The rise time of the applied pulses ranged from 0.7 to 50 ns. Theory and measurements agree and confirm that pulse attenuation increases significantly for shorter pulses.

Energy Use, Supply, & Demand

708,558
PB-266 069/4 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Evaluation of Ventilation Requirements and Energy Consumption in Existing New York City School Buildings.
Building science series (Final),
S. T. Liu, C. M. Hunt, and F. J. Powell. Apr 77, 73p NBS-BSS-97
Sponsored in part by National Science Foundation, Washington, D.C. Div. of Advanced Technology Applications. Library of Congress Catalog Card No. 77-608072.

Keywords: *Energy consumption, *Fuel consumption, *School buildings, Ventilation, Air conditioning, Illuminating, Space heating, Electricity, New York, *Electric power consumption.

A detailed computer thermal analysis of a selected school was made to determine the breakdown of its energy usage with respect to lighting, heating, ventilation, and equipment operation. The report also gives the results of a one-week ventilation test conducted in a typical urban classroom in New York City to determine the effect of reduced ventilation on the interior environment, including the concentrations of carbon dioxide and oxygen, the change in dry-bulb temperature, the variation of relative humidity, and the activity and response of the students.

708,559
PB-267 829/0 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Comparison of Computer-Predicted and Observed Energy Uses in a Multi-Family High-Rise Apartment Building.
Final rept.,
J. P. Barnett, and S. T. Liu. Jun 77, 38p NBSIR-76-1177
Prepared in cooperation with Department of Housing and Urban Development, Washington, D.C. Policy Development and Research.

Keywords: *Energy consumption, *Fuel consumption, *Apartment buildings, Residential buildings, Electricity, Space heating, Air conditioning, Hot water heating, Electric appliances, Illuminating, Mathematical models, Computerized simulation, Monitoring, Computer programming, Comparison, Nebraska, Electric power consumption, NBSLD computer program, E-CUBE computer program, Omaha(Nebraska).

A comparison was made of the results of two computer programs, the National Bureau of Standards Load Determination Program (NBSLD) and the American Gas Associations E-CUBE program, in predicting the energy consumption of a multi-family high-rise apartment building located in Omaha, Nebraska. Results are given on a monthly basis for the computed energy values and compared with average monthly values of metered data obtained over a five-year period.

708,560
PB-278 413/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of the Test Procedure for Television Set Energy Consumption.
Final rept.,
K. W. Yee. 1978, 4p
Pub. in Appliance 35, n2 p58-61 Feb 78.

Keywords: *Television receivers, *Energy consumption, *Tests, Electric power consumption, Reprints.

Television sets are one of the consumer products which will soon be labeled to show the estimated annual operating cost for energy. This cost will be the product of an average cost per kilowatt hour times the average annual energy consumed as measured by a standard test procedure. A final test procedure for television sets was promulgated by the Federal Energy Administration (FEA) on September 14, 1977 in the Federal Register. This procedure is based on a test procedure recommended to FEA by the National Bureau of Standards (NBS). Energy consumption measured by this test procedure will also be used to monitor an efficiency program and will be the basis of measurement if efficiency standards are imposed. The State of California has already proposed maximum power consumption standards for televisions. This test procedure supersedes any state test procedure which is not the same.

708,561
PB-285 012/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fundamentals of Building Heat Transfer.
Final rept.,
T. Kusuda. 1978, 18p
Pub. in Proceedings Int. Conf. Heat and Mass Transfer, Held at Dubrovnik, Yugoslavia on August 29-September 1977. Paper in Energy Conservation in Heating, Cooling and Ventilating Buildings, v1 p321-338 1978.

Keywords: *Buildings, *Heat transfer, Energy consumption, Heating loads, Cooling loads, Heat loss, Space heating.

Basic problems and unique features of building heat transfer are described in relation to the heating and cooling load calculation, which is a starting point for building energy consumption analysis and equipment sizing. Detailed discussion is given of the relationship between heat loss (heat gain) and heating load (cooling load). Also outlined is a discussion of the multi-space heat transfer problem in which the air and heat exchange equations among adjacent spaces in a building are solved simultaneously with the radiant heat exchange equations for the surfaces of each room.

708,562
PB-285 016/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Usage Conditions on Household Refrigerator and Freezer Energy Consumption.
Final rept.,
J. W. Grimes, W. J. Mulroy, and B. L. Shomaker. 1977, 11p
Pub. in ASHRAE Trans., v83 pt1 p818-828 1977.

Keywords: *Energy consumption, *Refrigerators, *Freezers, Defrosting, Thermoregulation, Temperature control, Humidity, Electric appliances, Utilization.

A study was made of an automatic and a manual-defrost refrigerator/freezer combination, and an upright and a chest freezer to measure the effect on energy consumption of five variable usage conditions: thermostat setting, ambient temperature, food load, door-opening frequency, and relative humidity. No evaluation was made of the effect of frost build-up.

708,563
PB-285 260/6 PC **A99**/MF **A01**
Reznek (Ben), Silver Spring, Md.
Annotated Compilation of the Sources of Information Related to the Usage of Electricity in Non-Industrial Applications.
Final rept.,
B. Reznek. Jul 78, 690p NBS/GCR-78/130
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Energy, Building Technology, and Standards Div.

Keywords: *Electric power, *Bibliographies, Utilization, Electricity, Electric power demand, Load control, Residential buildings, Commercial buildings, Information, Abstracts, Load management, *Electric power consumption, Energy use.

The report is a thorough compilation of the sources of information related to the usage of electricity in non-industrial applications, as available in the open literature and from the U.S. electrical power industry. The report's scope encompasses all aspects of: electric load management; end-use; and the various methods of acquisition, analysis, and implementation of electricity usage data. There are over 400 abstracts; 156 from LRC/AEIC reports, and 264 from the open literature. The abstracts cover references containing over 12,000 pages plus about 2,500 references and 6,200 graphs and tables pertinent to electricity usage in non-industrial applications. In addition to the LRC/AEIC abstracts, this document identifies over 100 sources of directly relevant information (in contrast to general interest sources and material of secondary relevance).

708,564
PB-289 927/6 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Climate Data Abbreviation for the Computerized Calculation of Heating and Cooling Requirements in Buildings.
E. A. Arens, and D. H. Nall. Dec 78, 67p NBSIR-78-1525

Keywords: *Buildings, *Weather, Heating load, Cooling load, Thermal efficiency, Energy efficiency, Climatic changes, Climate, Diurnal variations, Graphs(Charts), Drawings, Design, Computer programs, *Energy consumption, Heat consumption.

This report documents the development of a climate data abbreviation technique for building thermal analysis. It discusses the characteristics of computerized building thermal simulations and the requirements for abbreviated data. The technique is then described together with the statistical analyses used to develop it. A series of tests of the representativeness of the abbreviated climate data are documented and the limitations and potentials of the abbreviation technique are discussed.

708,565
PB-294 880/0 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Consumer Sciences Div.
Kitchen Range Energy Consumption.
Final rept.
J. V. Fechter, and L. G. Porter. Jun 78, 70p NBSIR-78-1556
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Electric stoves, *Gas appliances, *Stoves, *Electric appliances, *Thermal efficiency, *Fuel consumption, Electric power demand, Performance tests,

Performance evaluation, *Energy efficiency, *Energy consumption, *Electric power consumption.

In support of the national appliance energy conservation program, the National Bureau of Standards (NBS) has been developing, evaluating, and recommending standard methods for measuring appliance energy efficiency. This report describes a study where 58 nonprofessional cooks prepared 21 standard meals each on kitchen ranges, and compares the results with a laboratory test method which does not use such cooks. Ten different ranges were tested--five gas and five electric.

708,566
PB-298 052/2 PC **A07**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Quantified Occupant-Use Factors Affecting Energy Consumption in Residences.
R. E. Clark, and S. R. Hastings. Jul 79, 145p NBSIR-78-1501
Contract DOE-EA-77-A-01-6010

Keywords: *Households, Space heating, Hot water heating, Electric appliances, Illuminating, Air conditioning, Ventilation, Gas appliances, Electric lighting, Surveys, Statistical data, *Energy consumption, Heat consumption.

This report assembles residential energy-use data, as could be found, from field metering studies, surveys, utility company estimates, and government sponsored statistical projections. From these data the authors have determined recommended occupant-use values. Data, and assessment of their validity for input in models for predicting energy consumption, are organized into six groups by energy end-use: (1) heating, (2) service hot water, (3) appliances, (4) lighting, (5) air conditioning, and (6) ventilation.

708,567
PB-299 058/8 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Thermal and Service Systems Div.
Field Performance of Residential Refrigerators and Combination Refrigerator-Freezers.
Y. M. L. Chang, and R. A. Grot. Jul 79, 46p NBSIR-79-1781

Keywords: *Electric refrigerators, *Freezers, Residential buildings, Utilization, Electric power demand, Evaluation, Energy consumption.

Evaluation of the performance of household refrigerators and combination refrigerator-freezers was undertaken in a field experiment to determine the effect of room environment and occupant-usage habits on energy consumption of these appliances. This report presents the results of such an experiment in ten townhouses at Twin Rivers, NJ. One-door manual defrost and two-door frost-free models of various sizes were studied. Energy consumption, kitchen temperature, refrigerator temperature and door openings were measured for each model by data acquisition systems located in the townhouse basements. Both daily and hourly averages and variations about the average for each variable were calculated to determine occupant-usage patterns. Statistical techniques were used to obtain the effect of parameters on energy consumption of these appliances by linear regression of both one- and two-parameter models.

708,568
PB-300 314/2 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Consumer Sciences Div.
Investigation of Preferences for Various Types of Energy Cost Feedback.
Final rept.
A. Ramey-Smith, and J. L. Gagnon. Aug 79, 71p NBSIR-79-1771
Sponsored in part by Department of Energy, Washington, DC. Consumer Motivation Branch.

Keywords: Fuel consumption, Electric power demand, Households, Cost analysis, Monitoring, Public opinion, *Energy accounting, Energy analysis, *Energy consumption, Energy conservation.

The present study addressed the issue of consumer preferences for various types of energy cost feedback for individual consumers. Its purpose was to provide human factors recommendations to DOE related to the performance characteristics of energy cost feedback devices for use by DOE in testing energy cost feedback meters. Simulaton and interview techniques were used to provide consumer reaction to cumulative, instantaneous, and projected feedback presented as dollar and cent values. Recommendations for feedback types as well as some performance characteristics of energy cost feedback meters for further testing by DOE are discussed.

708,569
PB80-123151 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison Between a Simplified Daylighting Calculation Procedure and a Comprehensive Interreflection Model Calculation Procedure.
Final rept.,
T. Kusuda, and J. W. Bean. 1978, 10p
Pub. in Proceedings of the International Symposium Use of Computers for Environmental Engineering Related to Buildings (3rd) Held at Alberta, Canada on May 10-12, 1978, CNRC Pub. 17376, p569-578 1978.

Keywords: *Daylighting, Electric power demand, Heating load, Cooling load, Windows, Mathematical models, Computation, Energy consumption, Energy conservation, GLIM model.

A simplified calculation methodology for daylighting was developed as a subroutine to the annual energy calculation of buildings. Several sets of sample calculations were performed to compare the results of the simplified calculation with those obtained by a rigorous multiple interreflection model called GLIM (General Lighting Interreflection Model) for a sample office module with different ratios of window to exterior wall area. The simplified daylight calculation procedure then was used to determine the effect of daylight utilization on annual heating and cooling energy consumption on NBSLD, National Bureau of Standards heating and cooling load calculation program. The calculation includes the reduction of light heat gain and electric power demand as a result of daylight utilization.

708,570
PB80-165772 Not available NTIS
National Bureau of Standards, Washington, DC.
Representativeness of TRY Data in Predicting Mean Annual Heating and Cooling Requirements.
Final rept.,
E. A. Arens, D. H. Nall, and W. L. Carroll. 1979, 14p
Pub. in Proceedings of the ASHRAE Semi Annual Meeting, Philadelphia, Pennsylvania, Jan. 1979, ASHRAE Trans., 85, pt. 1, p707-721 1979.

Keywords: *Heating load, *Cooling load, *Buildings, Climate, Weather, Energy consumption, Test Reference Year.

The report assesses 'Test Reference Year' (TRY) hourly climate date tapes to determine how well they represent long term average climate when used for estimating average annual heating and cooling requirements. A method is presented to adjust the heating and cooling requirements of a typical building type that have been computed using TRY data, in order to make them represent long term average heating and cooling requirements.

708,571
PB80-213424 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Geographical Extrapolation of Typical Hourly Weather Data for Energy Calculation in Buildings.
Building science series (Final),
E. A. Arens, L. E. Flynn, D. N. Nall, and K. Ruberg. Aug 80, 124p NBS-BSS-126
Library of Congress catalog card no. 80-600059. Prepared in cooperation with Berkeley Solar Group, CA.

Keywords: *Weather, *Heating load, *Cooling load, Climate, Climatology, Buildings, Temperature, Wind velocity, Computer programs, Variations, SELECT computer program, Fortran, ADJUST computer program, Energy consumption.

Two techniques are developed and tested for creating composite and synthetic hourly weather data for a wide range of sites. The first technique selects real weather data segments from a source multiyear weather record, and links them into a composite synthetic year, in which the hourly values are unchanged from the source. The second technique adjusts the real hourly data values of the source to create a more completely synthetic year. The techniques may be applied individually or in combination. The resulting synthetic year or years can be used to provide data that is representative of long-term climate for building energy prediction either at the first-order station where the source hourly weather data were recorded, or at a nearby second-order station for which only summarized climate averages are available. Additionally, the adjustment technique can generate synthetic data to represent specific time periods at second-order stations for use in energy audits and experiments. The effectiveness of extrapolating weather data from one location to another is assessed, and the uses of the two techniques are described. The user-interative Fortran programs, SELECT and ADJUST are appended.

708,572
PB81-114068 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Household Appliance Usage Data.
Final rept.
A. D. Davies, R. V. Kelly, A. C. Lewis, C. D. Lovett, and T. J. Wang. Feb 80, 138p NBSIR-80-1994
Sponsored in part by Department of Energy, Washington, DC.

Keywords: Refrigerators, Freezers, Dishwashers, Water heaters, Washing machines, Humidifiers, Dehumidifiers, Air conditioners, Furnaces, Stoves, Ovens, Television systems, Heat pumps, Households, *Appliances, *Energy efficiency, Energy Policy and Conservation Act, Residential sector, Energy consumption.

The Energy Policy and Conservation Act (EPCA) requires the development of test procedures for the measurement of the energy efficiencies and the computation of Estimated Annual Operating Costs (EAOC's) of consumer products covered by the EPCA. These products are refrigerators, refrigerator-freezers, dishwashers, clothes dryers, water heaters, room air conditioners, home heating equipment, television sets, kitchen ranges and ovens, clothes washers, humidifiers, dehumidifiers, central air conditioning and furnaces. Each test procedure contains one or more factors that are determined by the consumer and include such items as uses per year, outdoor and indoor environment, household operating practices and ground water temperature. This report is a compilation of the sources and background for the consumer usage factors contained in the current test procedures. Uncertainties in these factors are discussed, and for selected base cases, the corresponding uncertainties in EAOC's are computed. A substantial bibliography is included.

708,573
PB81-131922 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Analysis of Computer-Simulated Thermal Performance of the Norris Cotton Federal Office Building.
Final rept.
W. B. May, and L. G. Spielvogel. Nov 80, 64p NBSIR-80-2093
Prepared in cooperation with Spielvogel (Lawrence G.), Inc., Wyncote, PA. Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Office buildings, *Fuel consumption, Thermal efficiency, Heating load, Cooling load, National government, New Hampshire, Computerized simulation, Tables(Data), Graphs(Charts), *Energy audits, *Energy consumption, Government buildings, Norris Cotton Federal Office Building, Energy analysis, Manchester(New Hampshire), Energy conservation.

Five computer-based simulations of the Norris Cotton Federal Office Building (NCFOB) in Manchester, New Hampshire, were performed using the Ross Meriwether Energy Systems Analysis Program. The NCFOB is a medium-size office building, occupied in September, 1976, designed to serve as a demonstration of and feasibility test for energy-conserving building features. The simulations included two simulations in accordance with the original design--with and without a solar system; a simulation of the building as actually operated; a simulation of the building with modifications to actual operation; and a simulation of an alternative building design. Results of the five simulations are summarized.

708,574
PB81-166514 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.

Energy Analysis of a Prototype Single-Family Detached Residence: The Effects of Climate, House Size, Orientation, Internal Heat Release, and Natural Cooling.
J. P. Barnett. Jan 81, 47p NBSIR-80-2184
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Residential buildings, Heating load, Cooling load, Degree days, Design, Orientation, Computerized simulation, *Energy analysis.

A computer study was done to determine how the annual heating and cooling requirements of a prototypical ranch-style house are affected by changes in four energy use parameters: climate, floor area, orientation, and internal heat generation. In addition, the effects of natural cooling on the annual cooling requirement were investigated.

708,575
PB81-179160 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Energy Consumption and Usage Characteristics from Field Measurements of Residential Dishwashers, Clothes Washers and Clothes Dryers.
Y. M. L. Chang, and R. A. Grot. Oct 80, 34p NBSIR-80-2136
See also report dated Apr 79, PB-295 431.

Keywords: *Dishwashers, *Clothes driers, *Washing machines, Electric appliances, Gas appliances, Water consumption, Hot water heating, Statistical data, Tables(Data), *Energy consumption, Clothes dryers.

The measured energy consumption and usage characteristics for household dishwashers, clothes washers, and clothes dryers for ten townhouses at Twin Rivers, N.J., are presented. Whenever the dishwashers and/or clothes washers were in use, the energy consumption, water consumption, frequency of usage, and water temperature were measured by a data acquisition system. The electrical energy of electric clothes dryers and the gas consumption of gas clothes dryers were measured, as well as their frequency and duration of use, and exhaust temperature. Typical household usage patterns of these major appliances are included.

708,576
PB81-185688 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Commentary on the Instrumentation for Building Energy Monitoring and Control Systems (EMCS).
Final rept.
J. Y. Kao, and D. W. Baker. Sep 80, 28p NBSIR-80-2104
Sponsored in part by Naval Construction Battalion Center, Port Hueneme, CA. Civil Engineering Lab.

Keywords: *Energy, *Monitoring, Detectors, Instrumentation, Buildings, Flow measurement, Temperature measurement, Hygrometers, Monitors, Steam flow, Water flow.

This paper reviews sensors generally used for building energy monitoring and control systems (EMCS). The sensor operating principles, performances, calibration, maintenance, installation precautions, failure modes and their suitability for building EMCS use are discussed. Sensors covered in the paper include orifices, flow nozzles, Venturis, vortex shedding meters, and turbine meters for flow measurements, liquid-in-glass thermometers, resistance thermometers, and thermocouples for temperature measurements, and salt-phase transition hygrometers, impedance hygrometers, and dimensional change hygrometers for humidity measurements.

708,577
PB81-207888 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Savings in Electric Cooling Energy by the Use of a Whole-House Fan.
Final rept.
T. Kusuda, and J. W. Bean. May 81, 44p NBS-TN-1138
Errata sheet inserted.

Keywords: *Cooling fans, *Residential buildings, Houses, Ventilation fans, Cooling load, Heat transfer, Thermal efficiency, Performance evaluation, Computerized simulation, Energy conservation, Energy consumption, Comfort index, NTISCOMNBS.

Hour-by-hour cooling performances of a typical ranch house, with and without the use of a whole-house fan, were compared for the climate conditions throughout the contiguous United States. The comparative analyses were made by the use of NBSWHF, a modified version of NBSLD, to simulate the complex thermal coupling of whole-house-fan ventilated attic space. The calculations were performed for two operational modes: a cyclic fan mode and a stepwise continuous mode.

708,578
PB81-220477 Not available NTIS
National Bureau of Standards, Washington, DC.
Energy Cost Feedback: Consumer Preferences.
Final rept.
A. M. Ramey-Smith, and J. L. Gagnon. 1981, 21p
Proceedings of the Human Factors and Industrial Design in Consumer Products held at Medford, MA., on May 28-30, 1980, p96-116 1981.

Keywords: *Demand meters, *Electric power demand, Public opinion, Measurement, Monitoring, Accounting, Energy accounting, Electric power consumption, Energy consumption.

The present study addressed the issue of consumer preferences for various types of energy cost feedback for individual consumers. Its purpose was to provide human factors recommendations related to the performance characteristics of energy cost feedback devices for use in testing energy cost feedback meters. Simulation and interview techniques were used to provide consumer reaction to cumulative, instantaneous, and projected feedback presented as dollar and cent value.

708,579
PB82-152588 Not available NTIS
National Bureau of Standards, Washington, DC.
Estimating Residential Seasonal Cooling Requirements.
W. H. Parken, and G. E. Kelly. 1981, 18p
Pub. in Proceedings of ASHRAE 1981 Semiannual Meeting, Chicago, Illinois, January 25-29, 1981, ASHRAE Transactions 87, Pt. 1, p473-490 1981.

Keywords: *Cooling loads, Residential buildings, Periodic variations, Computation, Seasonal variations, Geographic locations.

A method is presented (referred to as the modified building load and temperature bin method, MBLTBM) for calculating residential building cooling loads and seasonal cooling requirements for varius geographical regions. The method incorporates the effects of solar radiation, internal heat gains, outdoor temperature, infiltration, and thermal response on the cooling load for different periods of the day. The MBLTBM can be used with improved precision over existing simple calculation procedures without the use of large, sophisticated and time consuming computer programs. The increased precision in determining seasonal cooling requirements can result in improved estimates of the cost of operating air conditioning equipment. The method requires little additional data to what are presently required for calculating design cooling requirements. For the region of interest, temperature bin data (the number of hours during the cooling season the temperature, in 5 degree F (2.8 degree C) increments, occurs), the summer daily average temperature, and the average daily extreme temperatures are required and readily obtainable. Also needed for the calculation procedure are the solar heat gain factors for windows and incident solar radiation on vertical and horizontal opaque surfaces.

708,580
PB82-178971 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
CSA (Community Services Administration) Weatherization Demonstration Data Base: Contents and Descriptions.
Final rept.
R. E. Clark. Feb 82, 163p NBS-TN-1156
Contract DE-AI01-76PR06010

Keywords: *Residential buildings, *Fuel consumption, Houses, Electric power demand, Low income groups, *Energy consumption, *Weatherization, Energy conservation.

In addition to recording overall energy consumption (for the 1975-1980 period), the demonstration collected considerable additional energy-related measurements from approximately 240 houses (including some 40 unweatherized control houses) at 12 sites. These measurements probably constitute the most extensive and comprehensive data base on real energy usage of real houses extant. The report describes the various measurements that were obtained and how they were obtained. It contains house-by-house inventories of the data actually present in the data base and, as an access aid for further study of the data, it describes the media in which the data exist.

708,581
PB82-234139 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Oil and Gas Supply Modeling.
Final rept.
S. I. Gass. May 82, 781p NBS-SP-631
Proceedings of a Symposium at the Department of Commerce, Washington, DC. June 88-20,1980. Library of Congress catalog card no. 82-600508. Sponsored in part by the Department of Energy, Washington, DC. Energy Information Administration.

Keywords: *Meetings, Gas production, Predictions, Forcasting, Exploration, Resources, Economic analysis, Oil recovery, *Energy models, *Supply models, Energy forecasts, State of the art.

The symposium on Oil and Gas Supply Modeling, held at the Department of Commerce, Washington, DC (June 18-20, 1980), was funded by the Energy Information Administration of the Department of Energy and co-sponsored by the National Bureau of Standards' Operations Research Division. The symposium was organized to be a forum in which the theoretical and applied state-of-the-art of oil and gas supply models could be presented and discussed. Speakers addressed the following areas: the realities of oil and gas supply, prediction of oil and gas production, problems in oil and gas modeling, resource appraisal procedures, forecasting field size and production, investment and production strategies, estimating cost and production schedules for undiscovered fields, production regulations, resource data, sensitivity analysis of forecasts, econometric analysis of resource depletion, oil and gas finding rates, and various models of oil and gas supply. This volume documents the proceedings (papers and discussion) of the symposium.

708,582
PB83-134338 Not available NTIS
National Bureau of Standards, Washington, DC.
Two Compact Meters for Field Surveys of Appliance Usage.
Final rept.
O. B. Laug. Aug 78, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings IEEE Appliance Technical Conference, Columbus, Ohio, May 16-17, Appliance Engineering 35, n8 p70-73 1978.

Keywords: *Electric appliances, *Watt hour meters, *Timing devices, *Counters, Utilization, Surveys, *Energy consumption.

Two separate compact instruments have been designed for obtaining appliance usage information; one for measuring energy consumption and the other for measuring elapsed time and number of use cycles. A watt-hour energy meter was designed for use in surveys where it is desirable to obtain an estimate of the energy used by an appliance in the home environment. The in-line timer and counter was designed to obtain usage information of various 120 volt appliances in the home.

708,583
PB84-224302 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Strategies for Energy Conservation for a School Building.
J. Y. Kao. Mar 84, 78p NBSIR-84-2831
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Buildings, Heating, Air conditioning, United States, Regions, Comparison, Evaluation, Computerized simulation, *Energy conservation, *School buildings, BLAST computer program, Energy consumption.

A comparative analysis is made of the thermal performance of selected HVAC systems and control strategies commonly employed in education buildings. The

comparisons are made for six geographical locations representing wide climatic variations within the continental United States. Hour-by-hour simulations with the BLAST computer program are used to obtain the yearly heating, cooling, and fan energy consumption of an elementary school. The HVAC systems simulated are constant volume reheat, variable air volume, dual-duct, and unit ventilator systems. The control strategies tested are dry-bulb temperature economy cycle, enthalpy economy cycle, supply air temperature resetting, and the combinations of these strategies. The results of these simulations are presented and discussed. Substantial energy consumption differences are shown to exist.

708,584
PB85-145407 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Climate Data Abbreviation for the Computerised Calculation of Heating and Cooling Requirements in Buildings.
Final rept.
D. H. Nall, and E. A. Arens. 1979, 15p
See also PB-289 927.
Pub. in Energy and Buildings 2, n2 p135-149 Apr 79.

Keywords: *Heating load, *Cooling load, *Climate, Weather, Thermal analysis, Buildings, Data, Computation, Reprints, *Energy consumption.

This paper documents the development of a climate data abbreviation technique for building thermal analysis. The paper first discusses the need for and requirements of abbreviated data. The technique is then described together with the statistical analyses used to develop it. A series of tests of the representativeness of the abbreviated climate data are documented. Finally, the limitations and potentials of the abbreviation technique are discussed.

708,585
PB85-197465 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Method to Abbreviate Hourly Climate Data for Computer Simulation of Annual Energy Use in Buildings.
Final rept.
E. Arens, L. Flynn, and D. Nall. 1979, 5p
Pub. in Proceedings of National Passive Solar Conference (4th), Kansas City, MO., October 3-5, 1979, p282-286.

Keywords: *Buildings, Statistical analysis, Data, Climate, Thermal analysis, Predictions, Computerized simulation, *Energy consumption.

A building's future energy performance is commonly estimated by simulating its thermal behavior over a 'typical' year representative of the most statistically probable future climate. A technique is presented to abbreviate the hourly climate data used in such analysis. It is incorporated in a computer program that selects from each month of a full year's climate record a shorter segment that represents the month. The technique's empirical basis is reported, followed by the results of various tests of its effectiveness at representing full-length data. The results suggest how far one can actually abbreviate climate data before the thermal lag of the building begins to distort predicted energy. The paper finally discusses the potential for using the technique for other applications, such as creating typical years and synthesizing hourly data for sites for which there is only summarized data.

708,586
PB85-230837 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measured Data on Energy Consumption in Single Family Detached Homes Across the United States.
Final rept.
R. Crenshaw. 1980, 5p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of the National Passive Solar Conference (5th), Amherst, Massachusetts, October 19-26, 1980, p670-674.

Keywords: *Residential buildings, Urban areas, Solar energy, Heat balance, Statistical data, *Energy consumption, Energy conservation, Weatherization, Retrofitting.

Two hundred and twenty houses were selected in 14 cities across the country to be weatherized and evaluated. Infiltration rates, mechanical efficiencies, building dimensions, solar data and energy consumption data before and after weatherization were collected on each of these houses. This paper presents the before weatherization data on 33 houses at Charleston, S.C., Colorado Springs, CO, and Fargo, N.D. It also compares modified steady-state heat balance calculations which include solar data to the utility data of each of these houses.

708,587
PB88-109913 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Energy Prices and Discount Factors for Life-Cycle Cost Analysis: Annual Supplement to NBS (National Bureau of Standards) Handbook 135 and NBS Special Publication 709, 1987 Edition.
Annual rept.,
B. C. Lippiatt, and R. T. Ruegg. Jun 87, 97p NBSIR-85/3273-2
See also report dated Nov 85, PB86-142148. Sponsored by Department of Energy, Washington, DC. Assistant Secretary for Conservation and Renewable Energy.

Keywords: Buildings, Fuels, *Energy conservation, *Life cycle costs, Government buildings, Federal Energy Management Program, Average fuel prices, Energy price forecasts.

The report provides the 1987 annual edition of the energy price and discount factor tables used to supplement both the Federal life-cycle costing methodology as described in NBS Handbook 135 (HB 135) and private sector life-cycle cost analysis as described in NBS Special Publication 709 (SP 709). Tables A (7%), Ba, and C represent revisions of appendices A, B, and C, respectively, of HB 135. They should be used in life-cycle cost analyses of Federal energy conservation projects. Tables A (10%), Bb, and C are for use in life-cycle cost analyses of Federal non-energy conservation projects that require energy price forecasts. The last section of the report, the supplement for private sector life-cycle cost analysis, represents revisions to appendix B, Part I of SP 709 and is provided for the convenience of private sector analysts wishing to make use of Federal energy price forecasts.

Environmental Studies

708,588
PB81-218182 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Electric and Magnetic Field Measurements.
Annual rept. 80.
R. H. McKnight, F. R. Kotter, M. Misakian, and P. Ortiz. May 81, 73p NBSIR-81-2267

Keywords: *Transmission lines, *Radiation hazards, *Measuring instruments, Electric fields, Magnetic fields, High voltage, Direct current, Ion density(Concentration).

The NBS program is concerned with developing methods for evaluating and calibrating instrumentation for use in measuring the electric field and various ion-related electrical quantities in the vicinity of high-voltage direct current (HVDC) transmission lines and in apparatus designed to simulate the transmission line environment.

708,589
PB82-263377 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Electric and Magnetic Field Measurements: 1981 Annual Report.
R. H. McKnight, F. R. Kotter, M. Misakian, and J. N. Hagler. Jul 82, 50p NBSIR-82-2527
See also PB81-218182. Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Transmission lines, *Radiation hazards, Measurement, Current, High voltage, Direct current, Ion density(Concentration), Space charge, Radiation counters.

The NBS program is concerned with developing methods for evaluating and calibrating instrumentation for use in measuring the electric field and various ion-related electrical quantities in the vicinity of high voltage direct current (HVDC) transmission lines and in apparatus designed to simulate the transmission line environment.

708,590
PB83-119503 PC **A12**/MF **A01**
New York City Dept. of Sanitation.
Feasibility Study for Resource Recovery: Southwest Brooklyn Incinerator.
Final rept.
W. H. Chesner, M. A. Barbara, K. J. Danz, E. O. Smith, and K. E. Trout. Sep 82, 258p NBS-GCR-82-409
Contract NB81-NADA-2043
Prepared in cooperation with WESTON Designers-Consultants, Roslyn, NY., and Black and Veatch Consulting Engineers, Kansas City, MO.

Keywords: *Solid waste disposal, *Incinerators, *Sewage disposal, Electric power generation, Feasibility, New York, Cost analysis, Materials recovery, Furnaces, Air pollution control, Substitutes, Performance evaluation, *Refuse derived fuels, New York City(New York), Energy technology.

The primary purpose of this investigation was to examine both the technical and economic feasibility of exploiting the heating value of the refuse and the material value of the incinerator ash processed at the Southwest Brooklyn Incinerator. Based on the results of field testing, the combustion of municipal refuse at Southwest Brooklyn would be capable of generating 2.2 trillion Btu of energy annually. A detailed review of potential corrosion problems, and mitigating measures, as well as the expected waste heat boiler operational life, was undertaken to determine process modifications and equipment requirements to minimize the impact of corrosion on heat recovery operation. A market survey of potential energy users within a three-quarter mile radius of the incinerator was implemented to determine the available steam market.

Fuel Conversion Processes

708,591
DE85013673 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. Metallurgy Div.
Evaluation of the Performance of Materials and Components Used in the CO sub 2 Acceptor Process Gasification Pilot Plant.
Final rept.
R. C. Dobbyn, H. M. Ondik, W. A. Willard, W. S. Brower, and I. J. Feinberg. Apr 78, 169p DOE/ET/10253-T1
Contract AC01-76ET10253

Keywords: *Carbon Dioxide Acceptor Process, *Coal Gasification Plants, Alloys, Experimental Data, Flowsheets, Lignite, Materials, Performance, Pilot Plants, Recommendations, Refractories, South Dakota, ERDA/010404, ERDA/360100, ERDA/360200.

This report addresses the performance of materials and components used in the operation of the Conoco Lignite Gasification Pilot Plant, located in Rapid City, South Dakota. Facts relating this performance over the five and one-half years of plant operation were acquired primarily from the plant operating records. Run reports, lists of shutdown work performed between runs, inspection reports and monthly reports to project sponsors were read and operating events were identified, classified and abstracted. In addition, other documents, generated over the life of the plant, were analyzed; these include the plant construction report, Conoco failure reports, annual reports and other memoranda. Several visits to the plant were made and discussions of some of the unique features of this plant were held on several occasions with Conoco and Stearns-Roger personnel. Performance histories and assessments of this performance have been given for all materials and components for which there was sufficient information contained in these plant records. Performance is summarized under each major component or class of components in the body of the report. A plan for sampling selected materials of construction, both metals and refractories, for laboratory analysis was submitted to plant management and project sponsors and resulted in a laboratory analysis limited to the refractory lining of the gasifier vessel. A report of the findings of this laboratory evaluation has been made an appendix to this report. Conclusions and recommendations for future efforts in developing perform-

ance information are given. 6 refs., 29 figs., 5 tabs. (ERA citation 10:035895)

708,592
FE-1749-8 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Materials Research for Clean Utilization of Coal. Quarterly Progress Report, July 1976.
S. J. Schneider. 1976, 73p
Contract E(49-18)-1749

Keywords: *Ceramics, *Coal, *Coal gas, *Coal gasification plants, *Coal liquids, *Incoloy 800, *Inconel alloys, *Metals, *Stainless steel, Aluminium oxides, Coal gasification, Corrosion, Corrosive effects, Erosion, Failure mode analysis, Failures, Fluid flow, Materials, Materials testing, Particles, Pilot plants, Research programs, Strains, Stress corrosion, Stresses, Transport, Wear, ERDA/010404, ERDA/360105, ERDA/360205, Steel 304, Steel 310, Steel 316, Steel 446, Nickel alloys.

Coal gasification processes require the handling and containment of corrosive gases and liquids at high temperature and pressures, and also the handling of flowing coal particles in this environment. These severe environments cause materials failures which inhibit successful and long-time operation of the gasification systems. The project will entail investigations on the wear, corrosion, chemical degradation, fracture, and deformation processes which lead to the breakdown of metals and ceramics currently being utilized in pilot plants (and suffering failures). Studies will also be carried out on new candidate materials considered for improved performance. Special emphasis will be devoted to the development of test methods, especially short-time procedures, to evaluate the durability of materials in the gasification environments. These methods will focus on wear, impact erosion, stress corrosion, strength, deformation, slow crack growth and chemical degradation of refractories. Failure analysis of gasifier components, both metal and ceramic, will be conducted as necessary. Failure reports from gasifiers will be compiled, abstracted and recommendations made to ERDA as to the appropriate action to be taken. All studies will be correlated with field inspections and failure analysis on in-service materials. Active consultation and proposal review services to ERDA and associated contractors will be provided. (ERA citation 02:028275)

708,593
FE-3800-9 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Materials Research for Clean Utilization of Coal. Quarterly Progress Report.
S. J. Schneider. Oct 76, 32p
Contract E(49-1)-3800

Keywords: *Aluminium oxides, *Calcium oxides, *Ceramics, Coal, Coal gas, Coal liquids, *Hydrogen sulfides, *Incoloy 800, *Metals, *Stainless steel, *Coal gasification, Coal gasification plants, Corrosion, Corrosive effects, Erosion, Failure, Fluid flow, Materials testing, Particles, Pilot plants, Research programs, Silicon carbides, Slags, Strains, Stress corrosion, Stresses, Transport, Wear, ERDA/010404, ERDA/360105, ERDA/360205, Steel 347, Steel 310, Refractory materials.

Coal gasification processes require the handling and containment of corrosive gases and liquids at high temperature and pressures, and also the handling of flowing coal particles in this environment. These severe environments cause materials failures which inhibit successful and long-time operation of the gasification systems. This project entails investigations on the wear, corrosion, chemical degradation, fracture, and deformation processes which lead to the breakdown of metals and ceramics currently being utilized in pilot plants. Studies will also be carried out on new candidate materials considered for improved performance. Special emphasis will be devoted to the development of test methods, especially short-time procedures, to evaluate the durability of materials in the gasification environments. These methods will focus on wear, impact erosion, stress corrosion, strength, deformation, slow crack growth and chemical degradation of refractories. A system has been initiated to abstract and compile all significant operating incidents from coal conversion plants. This program will provide a central information center where problems of common interest can be identified and analyzed to avoid unnecessary failures and lead to the selection of improved materials for coal conversion and utilization. Active consultation to ERDA and associated contractors will be provided as requested. (ERA citation 02:033609)

708,594
PB81-221319 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Alkali Vapor Transport in Coal Conversion and Combustion Systems.
Interim rept.
J. W. Hastie, E. R. Plante, and D. W. Bonnell. May 81, 80p NBSIR-81-2279

Keywords: *Alkaline earth metals, *Coal gasification, *Thermodynamic properties, Combustion, Fluidized bed processing, Vaporization, Slags, Transport properties, Construction materials, Glass, Heterogeneous reactions.

Alkali metal-containing vapor species are ubiquitous in coal coversion and combustion systems. These species originate from coal mineral and atmospheric impurities (organic and inorganic) and from ceramic construction materials. Alternatively, they are present as additives, such as with potassium seeding for MHD or with bulk glass as a particle absorbing medium, or with dolomite in fluidized bed systems. Alkali vapor transport over representative slag, glass, and simple halide, hydroxide, and sulfate systems is discussed in relation to materials and process limitations in coal-supported energy systems. Problems associated with molecular-level vapor transport measurements are also considered.

708,595
PB81-600055 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Materials Research for Clean Utilization of Coal. Quarterly Progress Report January-March 1979.
S. J. Schneider. 1979, 34p
Pub. in DOE Report EA-6010-19 1979.

Keywords: *Ceramic corrosion, Ceramic erosion, Ceramic fracture, Chemical degradation, Coal gasification material, Failure avoidance, Metal corrosion, Metal erosion and vaporization processes.

The report covers work on metal corrosion, metal erosion, ceramic deformation, fracture, erosion, and chemical degradation as related to coal gasification systems. The report also covers the failure avoidance program for DOE coal conversion pilot plants.

708,596
PB82-241415 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Review of Needs for Thermophysical Property Data on Solid Feedstocks: 1. Coal.
Final rept.
J. E. Callanan. May 82, 32p NBSIR-82-1666

Keywords: *Thermophysical properties, *Coal, Heat of combustion, Specific heat, Thermal conductivity, Thermal expansion, Thermal diffusivity, Sampling, Surveys, Heat of wetting, Energy conversion.

In January 1981, a comprehensive survey was undertaken to determine the need for thermophysical properties of the following solid feedstocks/fuels: coal, oil shale, tar sands, gas hydrates. This report deals with that portion of the survey which concerns coal and includes the results of broad consultation with industrial, government, and academic groups as indicated. This survey shows the need for experimental work on heat of combustion, heat capacity/enthalpy, thermal conductivity, and heat of wetting for both well-characterized premium coal samples and for samples of the type which will be used directly in conversion processes. Widely accepted, standardized measurement techniques do not exist for these properties, with the exception of heat of combustion, and must be developed; in addition, reliable data must be generated for efficient use of coal as a feedstock. Theoretical studies which will allow for modeling of properties should proceed along with the experimental investigations to allow for improvement in prediction of coal properties for process design.

708,597
PB83-177360 Not available NTIS
National Bureau of Standards, Washington, DC.
Capillary Column Gas Chromatographic Resolution of Isomeric Polycyclic Aromatic Sulfur Heterocycles in a Coal Liquid.
Final rept.
R. C. Kong, M. L. Lee, Y. Tominaga, R. Pratap, M. Iwao, R. N. Castle, and S. A. Wise. Nov 82, 9p
Contract DE-AC02-76EV10237
Pub. in Jnl. of Chromatographic Science 20, p502-510 Nov 82.

Keywords: *Aromatic polycyclic hydrocarbons, *Coal liquids, *Chemical analysis, Separation, Gas chromatography, Mass spectroscopy, Reprints.

Fused silica capillary columns coated with nonpolar (SE-52); polar (Superox 20M); and liquid crystal (BBBT, BMBT, and BHxBT) stationary phases and their mixtures were evaluated for the separation of isomeric polycyclic aromatic sulfur heterocycles containing three to five rings.

708,598
PB86-102985 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Thermal Conductivity of Coal-Derived Liquids and Petroleum Fractions.
Final rept.
M. E. Baltatu, J. F. Ely, H. J. M. Hanley, M. S. Graboski, R. A. Perkins, and E. D. Sloan. 1985, 8p
Sponsored by Gas Research Inst., Chicago, IL., and Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Industrial and Engineering Chemistry Process Design and Development 24, n2 p325-332 1985.

Keywords: *Petroleum products, *Thermal conductivity, *Coal liquids, Specific heat, Experimental data, Ideal gas, Comparison, Reprints, *Pseudopotential theory.

Thermal conductivity coefficients of coal-derived liquids and petroleum fractions are calculated by an extended corresponding states, conformal solution technique. The method requires as input pseudocritical parameters, molecular weight and acentric factor, and a pseudo-ideal gas heat capacity for each pseudocomponent or fraction. These quantities are estimated here from the mean average boiling point and specific gravity of the fractions using the techniques proposed by Riazi-Daubert, Kesler-Lee, and Winn: the relationship between the estimated conductivity and the choice of the method is noted. Predicted thermal conductivities are compared with data for three coal liquid samples measured at the Colorado School of Mines and with literature data. Agreement between prediction and experiment is generally within 10%, depending on the method used to calculate the input parameters. Some literature petroleum fractions data are also compared with the model. Again, agreement is within 10%.

708,599
PB86-195609 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Free Radicals in Coal Conversion.
Final rept.
S. E. Stein. 1985, 32p
Pub. in Chem. Coal Convers., p13-44 1985.

Keywords: *Coal, *Free radicals, Pyrolysis, Kinetics, Reprints.

It is generally accepted that free radicals are the key reactive intermediates in thermal coal chemistry. This view is supported by the general observation that free-radical reactions control the pyrolysis chemistry of most organic substances. General kinetic features of coal liquefaction have also been used to support this view. A detailed consideration of the chemical structure of coal and its reaction products also strongly suggests that free-radical reactions control coal chemistry. The aromatic and hydroaromatic units found in coal tars and liquids and presumed to be dominant structures in coal itself are known to be very reactive toward free radicals. Moreover, resonance stabilized radicals derived from these structures are formed and react readily at coal decomposition temperatures. Methyl and hydroxyl substituents serve to increase the overall free-radical reactivity of the molecules to which they are attached.

708,600
PB87-104220 Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Viscosities and Densities of Selected Organic Compounds and Mixtures of Interest in Coal Liquefaction Studies.
Final rept.
Y. Oshmyansky, H. J. M. Hanley, J. F. Ely, and A. J. Kidnay. 1986, 10p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in International Jnl. of Thermophysics 7, n3 p500-608 1986.

Keywords: *Viscosity, *Density(Mass/volume), Thermophysical properties, Organic compounds, Xylene, Thiophene, Quinoline, Cresols, Reprints, *Coal liquefaction, Naphthalene/methyl, Tetralin, Tetrahydrofuran, Coal liquids.

Experimental measurements are presented for the density and viscosity of selected organic compounds and mixtures at ambient pressure (0.083 M Pa) and at temperatures of 298, 318, 338, and 358 K. The compounds studied were decalin, 1-methylnaphthalene, tetralin, m-xylene, tetrahydrofuran, thiophene, quinoline 2,6-lutidine, and m-cresol. Measurements were also made on three mixtures of the compounds decalin, 1-methylnaphthalene, tetralin, m-xylene, and m-cresol. The experimental results are compared with predictions made using a modified corresponding states procedure called TRAPP. The density predictions for the individual compounds and mixtures are good in all cases. For the viscosity, however, the predictions are in reasonable agreement with experiment only for nonassociating compounds and mixtures at reduced densities less than 3. These results suggest that TRAPP may prove very useful as a screening test to distinguish between nonassociating and highly associating mixtures. Such a test would be extremely useful when dealing with mixtures of unknown composition, such as coal liquids.

708,601
PB87-208732 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Review of Needs for Thermophysical Property Data on Solid Feedstocks. 2. Oil Shale,
J. E. Callanan. Apr 87, 62p NBSIR-87/3064
See also PB82-241415.

Keywords: Heat of combustion, Thermal conductivity, Thermophysical properties, *Oil shales, Solid fuels.

The report, a comprehensive survey concerning oil shale, is the second in a series dealing with needs, particularly for thermophysical properties, for solid fuels/feedstocks. The survey shows the need for experimental work on heat of combustion, heat of retorting, heat capacity/enthalpy, thermal conductivity, thermal expansion and heat of immersion for raw, spent and burnt shale, for kerogen and for the mineral matter found in shale. These studies should be preceded by agreement on the properties necessary for good characterization of the shale and on the methods of measuring these properties; the thermal properties measurements should be made on well-characterized samples. Standardized measurement techniques do not exist for thermal properties, with the possible exception of heat of combustion, and must be developed. Existing data must be evaluated and reliable data generated. Theoretical studies that will allow for modeling of thermal properties should proceed along with the experimental investigations to improve the ability to predict shale properties for process design. Recommendations for work appropriate to the National Bureau of Standards are included.

Fuels

708,602
PATENT-4 447 743 Not available NTIS
Department of Energy, Washington, DC.
High Pressure Liquid Level Monitor.
Patent.
V. E. Bean, and F. G. Long. Filed 28 Apr 82, patented 8 May 84, 12p PB85-149680, PAT-APPL-6-372 861
Supersedes DE83-006900. Prepared in cooperation with National Bureau of Standards, Gaithersburg, MD. This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *High pressure tests, *Patents, *Monitors, Design criteria, Performance evaluation, Coal, Magnetic fields, PAT-CL-307-118, *Fuel slurries.

A liquid level monitor for tracking the level of a coal slurry in a high-pressure vessel including a toroidal-shaped float with magnetically permeable bands thereon disposed within the vessel, two pairs of magnetic field generators and detectors disposed outside the vessel adjacent the top and bottom thereof and magnetically coupled to the magnetically permeable bands on the float, and signal processing circuitry for combining signals from the top and bottom detectors for generating a monotonically increasing analog control signal which is a function of liquid level. The control signal may be utilized to operate high-pressure control valves associated with processes in which the high-pressure vessel is used.

708,603
PB-274 058/7 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, Colo. Cryogenics Div.
Studies of Hydrogen Liquefier Efficiency and the Recovery of the Liquefaction Energy,
R. O. Voth, and W. R. Parrish. Aug 77, 63p NBSIR-77-862

Keywords: *Liquid hydrogen, *Liquefiers, Cost analysis, Performance evaluation, Efficiency, Fuels, Design criteria, Cryogenics, *Energy conservation, Gas liquefaction.

Liquid hydrogen is a potential synthetic fuel. It is nonfossil, its production and storage technology is well developed, and it is inherently nonpolluting. However, the economics of liquefying hydrogen are costly both in the energy required to produce the liquid and in the capital costs of the liquefier. These costs could be reduced by increasing the liquefier efficiency and/or by recovering a portion of the liquefaction energy at the use site. This paper provides the maximum hydrogen liquefier efficiency based on the efficiency of available components and the fraction of original liquefaction energy that can be recovered at the use site. Since the inefficient compressors and expanders are the major cause of liquefier inefficiency, no increase in liquefier efficiency above the current 30 to 35 percent is probable without a corresponding increase in compressor and expander efficiency -- a difficult task since both the compressors and expanders have a long and stable history of development. However, roughly one-third to one-half of the actual energy required to liquefy hydrogen can be recovered at the use site and this represents a cost credit for liquid hydrogen.

708,604
PB-286 726/5 Not Available NTIS
National Bureau of Standards, Gaithersburg, MD.
Is Hydrogen a Safe Fuel.
Final rept.,
J. Hord. 1978, 20p
Pub. in International Jnl. Hydrogen Energy v3, no. 2, p157-176 (1978).

Keywords: *Hydrogen, *Safety, Fuels, Physical properties, Chemical properties, Explosions, Fire hazards, Methane, Gasoline, Comparison, Storage, *Hydrogen fuels, Air fuel ratio, Reprints.

The safety aspects of hydrogen are systematically examined and compared with those of methane and gasoline. Physical and chemical property data for all three fuels are compiled and used to provide a basis for comparing their various safety features. Each fuel is examined to evaluate its fire hazard, fire damage, explosive hazard and explosive damage characteristics.

708,605
PB-296 928/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
LNG Thermophysical Properties Data and Custody Transfer.
Final rept.
D. E. Diller. 1978, 16p
Pub. in GASTECH 78, Proc. Int. LNG/LPG Conf. and Exhibition (6th), Held at Monte Carlo, Monaco on 7-10 Nov, 1978, 1, Session 2A, Presentation 1, p1-16 (GASTECH Exhibitions Ltd., Rickmansworth, England, 1979).

Keywords: *Liquefied natural gas, *Thermophysical properties, Transport properties, Thermodynamic properties, Density(Mass/volume), Specific heat, Flow rates, Heating.

Developments in LNG thermophysical properties data research are reviewed. NBS projects on the PVT, thermodynamic and transport properties of pure LNG components; on the phase equilibria and orthobaric liquid densities of mixtures of LNG components; and on predictive calculation methods for the thermophysical properties of commercial LNG compositions, are discussed. Developments in LNG custody transfer measurement research are reviewed, with emphasis on accurate methods for determining LNG composition, density, specific heating value, ship tank capacity tables, liquid level and flow rates for LNG custody transfer. The uncertainties in the determination of the heating value of large quantities of LNG in tanks and pipelines are discussed.

708,606
PB-298 665/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Numerical Physical Property Data for Metal Hydrides Utilized for Hydrogen Storage.
Final rept.
L. J. Swartzendruber, G. C. Carter, D. J. Kahan, M. E. Read, and J. R. Manning. 1978, 38p
Pub. in Proceedings of the World Hydrogen Energy Conference (2nd) Held at Zurich, Switzerland on August 21-24, 1978, p1973-2011 1978.

Keywords: *Hydrogen storage, *Hydrides, Physical properties, Intermetallic compounds, Chemical equilibrium, Dissociation, Heat of reaction, Reaction kinetics, Diffusion, Thermal conductivity, Heat transfer, Density(Mass/volume), Phase diagrams, Iron intermetallics, Energy storage, Lanthanum intermetallics, Iron titanium, Lanthanum nickel, Magnesium nickel.

Physical property data are presented for three intermetallic compounds which are considered primary candidate materials for safe hydrogen storage in stationary and mobile applications. The materials are FeTi, LaNi5, and Mg2Ni. The properties cover equilibrium dissociation pressures, van't Hoff equation parameters, heats of reaction, reaction rates, diffusion, thermal conductivities, heat transfer coefficients, hydride densities, lattice parameters and expansion upon hydriding, and phase diagrams.

708,607
PB77-600058 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Estimation of Net Enthalpies of Combustion of Some Aviation Fuels Expressed in the International System of Units.
R. L. Nuttall, and G. T. Armstrong. 1977, 63p NBS-TN-937

Keywords: Aniline point, API gravity, Aviation fuel, *Enthalpy of combustion, Fuels, Gasoline, Gravity, Heat content, Heat of combustion, Kerosine.

A new correlation has been made of the net enthalpy of combustion of some aviation fuels with their aniline point, density, and sulfur content. Previous correlations gave a set of five equations relating the enthalpy of combustion to the aniline point gravity product for five classes of fuels ranging from aviation gasoline to kerosine. These equations were in non-SI units. The correlation reported here gives similar sets of equations using SI units and also gives a single equation which can be used to adequately predict the net enthalpy of combustion of all five classes of fuels from measurements of aniline point, density and sulfur content.

708,608
PB80-103906 Not available NTIS
National Bureau of Standards, Washington, DC.
Density of Liquefied Natural Gas.
Final rept.,
W. M. Haynes, and R. D. McCarty. 1979, 7p
Pub. in Proceedings of the Gas Processors Association Annual Convention (58th) Held at Denver, CO. on March 19-21, 1979, p10-16 1979.

Keywords: *Liquefied natural gas, *Density(Mass/volume), Mathematical models, Densitometers.

A project has been carried out at the National Bureau of Standards to provide a means for the accurate determination of the density of liquefied natural gas (LNG) that would serve as a basis for equitable custody transfer of this valuable commodity. A magnetic

suspension densimeter was used to obtain a consistent set of density data for LNG components and their mixtures with a total uncertainty in density of less than 0.1%. These data were used to optimize and test mathematical models for LNG density calculations. Three mathematical models for the calculation of LNG densities have been optimized, tested, and compared. These models are an extended corresponding states model, a hard sphere model, and an empirical model due to Klosek and McKinley.

708,609
PB80-103914 Not available NTIS
National Bureau of Standards, Washington, DC.
How Safe Is Hydrogen.
Final rept.,
J. Hord. Jan 79, 31p
Pub. in Proceedings of the Hydrogen for Energy Distribution Symposium Held at Chicago, IL. on July 24-28, 1978, p613-643, Jan 79.

Keywords: *Hydrogen, *Safety, *Meetings, Reviews, Comparison, Methane, Gasoline, Fuels, Explosions, Flammability, Fuel storage, Leaking, Guidelines, Reprints, Air fuel ratios, State of the art.

Just mention hydrogen and the subject of safety will arise. In this symposium, the safety features of hydrogen are systematically reviewed and compared with those of methane and gasoline. Intercomparisons with conventional fuels are necessary for us to assess the relative safety of hydrogen fuel. The basic technical data, available to the safety analyst, will be reviewed in this symposium. In addition, practical procedures, guidelines, standards, and regulations (applicable to the handling, storage and distribution of hydrogen) will be presented. Analytical and experimental research needs, relative to hydrogen safety, are defined and a state-of-the-art summary of hydrogen safety is given. Specifically, the following aspects of hydrogen safety will be addressed: safety procedures (handling, combustible gas detectors, H2 fire detectors, etc.); physical, chemical and combustion properties; leakage characteristics (flow mode, diffusion, buoyancy); ignition sources (weak and strong); fire and explosion hazards (fireball size and duration, thermal radiation, explosive potential, vapor cloud yields, overpressure, shrapnel, hazard summary charts); and mandatory and voluntary codes.

708,610
PB80-104383 Not available NTIS
National Bureau of Standards, Washington, DC.
Test of Densimeters for Use in the Custody Transfer of LNG.
Final rept.,
J. D. Siegwarth, J. F. LaBrecque, and B. A. Younglove. 1978, 6p
Pub. in Proceedings of the International School of Hydrocarbon Measurement (53rd) Held at Norman, OK. on April 11-13, 1978, p385-390 1978.

Keywords: *Liquefied natural gas, *Densimeters, Density(Mass/volume), Methane, Ethane, Propane, Butanes, Nitrogen, Temperature, Pressure, Performance evaluation.

The NBS cryogenic fluids density reference system has been used to evaluate three basic types of densimeters: the vibrating element type, the dielectric cell type, and the displacement type. These meters were used to measure densities in liquid methane and liquid methane mixtures with ethane, propane, normal butane, and nitrogen. Measurements were made over the density range from 400 to 480 kg/cu m, temperatures from 108 to 130 K, and pressures from 1 to 3 bar. A hundred measurements were made at various densities, temperatures, pressures and compositions.

708,611
PB80-107337 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS Research on LNG Thermophysical Properties Data and Custody Transfer Measurement Methods.
Final rept.,
D. E. Diller. 1978, 6p
Pub. in Proceedings of the Storage and Transfer of LNG Conference, Boumerdes, Algeria, April 4-5, 1978, p125-130 1978.

Keywords: *Liquefied natural gas, *Thermophysical properties, Pressure, Volume, Temperature, Thermodynamic properties, Transport properties, Electromagnetic properties, Equilibrium, Density(Mass/volume), Chemical composition, Specific heat, Flow rate, Mixtures.

Developments in LNG thermophysical properties data research at NBS are reviewed and discussed. These include projects on the PVT, thermodynamic, electromagnetic and transport properties of pure LNG components; and on the liquid-vapor equilibrium properties and orthobaric liquid densities of mixtures of LNG components. Developments in LNG custody transfer measurement research are reviewed, with emphasis on accurate methods for determining LNG composition, density, specific heating value, flow rate and ship tank capacity tables for LNG custody transfer. The uncertainties in the determination of the total heating value of large quantities of LNG in tanks and pipelines are discussed.

708,612
PB80-163959 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Science and Catalysis: The Catalytic Methanation Reaction (Abstract).
Final rept.,
T. E. Madey, D. W. Goodman, and R. D. Kelley. Apr 79, 2p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Journal of Vacuum Science and Technology 16, n2, p433-434, Apr 79.

Keywords: *Methanation, *Catalysts, Nickel, Reviews, Chemical reactions, Reprints.

A review of recent NBS work related to catalytic methanation over single crystals of Ni is presented.

708,613
PB80-215536 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Recycled Oil Program: Phase I - Test Procedures for Recycled Oil Used as Burner Fuel.
Final rept.,
D. A. Becker, and J. J. Comeford. Aug 80, 97p NBS-TN-1130

Keywords: *Fuel oil, *Fuels, Recycling, Oil burners, Physical properties, Chemical properties, Performance tests, *Waste oils.

The Energy Policy and Conservation Act requires the National Bureau of Standards (NBS) to develop test procedures which can be used establish the substantial equivalence of recycled oils with new oils. This report covers the first phase of the NBS program, and contains test procedures which may be used for establishing the substantial equivalency of recycled petroleum oils (including blends of recycled oils with new oils) to new oils for use as a burner fuel. Test procedures were selected and evaluated for their ability to reliably measure the property under test.

708,614
PB81-120990 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Individual Organic Compounds in Shale Oil.
Final rept.
H. S. Hertz, J. M. Brown, S. N. Chesler, F. R. Guenther, L. R. Hilpert, W. E. May, R. M. Parris, and S. A. Wise. Sep 80, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Analytical Chemistry 52, n11 p1650-1657 Sep 80.

Keywords: *Chemical analysis, *Shale oil, *Organic compounds, Extraction, Gas chromatography, Mass spectroscopy, Phenol, Cresols, Pyrenes, Reprints, High performance liquid chromatography, Benzopyrenes, Pyridine/trimethyl, Fluoranthenes.

Several techniques have been investigated for quantitating individual organic compounds in shale oil. Acid-bas extraction and high performance liquid chromatography were emphasized as independent methods of shale oil fractionation. Gas chromatography, gas chromatograph-mass spectrometry, and high performance liquid chromatography were used for individual compound quantitation utilizing external and/or internal standards or standard addition techniques. The following compounds were measured in the shale oil: pyrene, fluoranthene, benzo(e)pyrene, benzo(a)pyrene, phenol, o-cresol, acridine, and 2,4,6,-trimethylpyridine. Comparable results were obtained by the various methods for extraction and quantitation.

708,615
PB81-161903 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Four Mathematical Models for the Prediction of LNG Densities.
R. D. McCarty. Dec 80, 84p NBS-TN-1030

Keywords: *Mathematical models, *Equations of state, *Liquefied natural gas, *Density(Mass/volume), Computer programs, Pressure, Volume, Temperature, Mixtures, Numerical solution.

Four mathematical models of the equation of state for LNG like mixtures are presented. The four models include an extended corresponding states model, a cell model, a hard sphere model and a revised Klosek and McKinley model. Each of the models has been optimized to the same experimental data set which included data for pure nitrogen, methane, ethane, propane, iso and normal butane, iso and normal pentane and mixtures thereof. For LNG like mixtures (mixtures of the orthobaric liquid state at temperatures of 120 K or less and containing at least 60% methane, less than 4% nitrogen, less than 4% each of iso and normal butane and less than 2% total of iso and normal pentane), all of the models are estimated to predict densities to within 0.1% of the true value. The revised Klosek and McKinley model is valid only for mixtures within the range of temperature and composition specified above while the other three models are valid for a broader range of pressure, temperature and composition. The experimental PVTx data set used in the optimization together with comparisons are given and listings of computer programs for each of the models are included.

708,616
PB81-199176 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Phenolic Compounds in Alternate Fuel Matrices.
Final rept.
F. R. Guenther, R. M. Parris, S. N. Chesler, and L. R. Hilpert. 1981, 6p
Sponsored in part by Department of Energy, Washington, DC., and Environmental Protection Agency, Washington, DC.
Pub. in Jnl. of Chromatography 207, p256-261 1981.

Keywords: *Phenols, *Chemical analysis, *Shale oil, Extraction, Gas chromatography, Separated, Mass spectroscopy, Reprints, *Solvent refined coal, NTISCOMNBS, NTISDE, NTISEPAG.

The gas-chromatographic determination of underivatized, methyl substituted phenols in shale oil and solvent refined coal is described. A simple acid/base extraction procedure was followed by injection onto a 20 meter Pluronic L64 capillary column. Fourteen phenols were separated and identified including phenol, the cresols, and all the dimethyl phenols. Identification was done on a GC/MS equipped with a Pluronic L64 capillary column. Isomers were further verified by comparison of pure standard retention times. Quantitation was done utilizing an internal standard procedure. Quantitative data is given for seven phenols in the range of 168 microgram/g to 29100 microgram/g.

708,617
PB81-236234 Not available NTIS
National Bureau of Standards, Washington, DC.
Optical Tomography for Flow Field Diagnostics.
Final rept.
R. J. Santoro, H. G. Semerjian, P. J. Emmerman, and R. Goulard. 1981, 12p
Pub. in International Jnl. of Heat and Mass Transfer 24, n7 p1139-1150 1981.

Keywords: *Methane, *Flow distribution, Concentration(Composition), Absorption, Combustion, Reprints, *Optical tomography.

Optical tomography has been applied to an off-axis turbulent methane-air free jet to determine the mean methane concentration throughout the mixing region. Optical tomography is a multi-angular absorption technique which involves making M line of sight absorption measurements (projections) at N angles. These MxN measurements are then used to reconstruct the original two-dimensional flow field. Absorption measurements were made on the methane using the near-resonance 3.39 micrometers line of a He-Ne laser. Mean concentration measurements were obtained at three

positions downstream of the jet exit plane. Comparisons with the results of previous workers for the axial and radial mean concentration profiles show good agreement. Additionally, the sensitivity of the reconstructed results to the number of angles and scans used is briefly described. The results demonstrate the unique capabilities of optical tomography for flow field diagnostics.

708,618
PB82-112574 Not available NTIS
National Bureau of Standards, Washington, DC.
LNG (Liquefied Natural Gas) Densities for Custody Transfer.
Final rept
R. D. McCarty. 1981, 3p
Pub. in Proceedings of the International School of Hydrocarbon Measurement (56th) held at Norman, OK., on April 14-16, 1981, p515-517 1981.

Keywords: *Liquefied natural gas, *Density(Mass/volume), Mathematical models, Densimeters, Portable equipment, Standard reference materials, Numerical solution.

Work has been carried out over the past eight years at the National Bureau of Standards to provide alternate methods for the accurate determination of the density of liquefied natural gas (LNG) that would serve as a basis for equitable custody transfer. A magnetic suspension densimeter was used to obtain density data for LNG components and their mixtures with a total uncertainty in density of less than 0.1%. These data were used to optimize and test mathematical models for LNG density calculations. Four mathematical models for the calculation of LNG densities have been optimized, tested, and compared. A density reference system (DRS) was constructed to determine the uncertainty of measurements made by several different types of densimeters proposed for use in the commercial trade of LNG. A portable reference densimeter (PRD) has been developed specifically for calibrating LNG densimeters 'in place.' The measurements of density using the two systems, DRS and PRD, are statistically indistinguishable.

708,619
PB82-152539 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Tetraalkyllead Compounds in Gasoline by Liquid Chromatography--Atomic Absorption Spectrometry.
Final rept.
J. D. Messman, and T. C. Rains. Sep 81, 5p
Pub. in Analytical Chemistry 53, n11 p1632-1636 Sep 81.

Keywords: *Gasoline, *Lead organic compounds, *Chemical analysis, Atomic spectroscopy, Reprints, Liquid chromatography, Atomic absorption spectroscopy.

A liquid chromatography--atomic absorption spectrometry (LC-AAS) hybrid analytical technique is presented for metal speciation measurements on complex liquid samples. The versatility and inherent metal selectivity of the technique are illustrated by the rapid determination of five tetraalkyllead compounds in commercial gasoline. Separation of the individual tetraalkyllead species is achieved by reversed-phase liquid chromatography using an acetonitrile/water mobile phase. The effluent from the liquid chromatograph is introduced directly into the aspiration uptake capillary of the nebulizer of an air/acetylene flame atomic absorption spectrometer. Spectral interferences due to coeluting hydrocarbon matrix constituents were not observed at the 283.3 nm resonance line of lead used for analysis. Detection limits of this LC-AAS hybrid analytical technique, based on a 20-microliter injection, are approximately 10 ng Pb for each tetraalkyllead compound.

708,620
PB82-234873 Not available NTIS
National Bureau of Standards, Washington, DC.
Gasohol: The Real Issue is B.T.U.'s.
Final rept.
P. A. Donvito. 13 Jul 80, 1p
Pub. in the New York Times, p4, 13 Jul 80.

Keywords: *Ethyl alcohol, Fuels, Reprints, *Energy balance, *Energy use.

A distinction is drawn between technical efficiency and economic efficiency within the context of producing ethanol for fuel. There is a question as to whether the energy used for ethanol production exceeds the energy produced. In this paper, it is maintained that the input and output ratio is not relevant, if the value of the energy output exceeds the value of the energy plus the other necessities for ethanol production.

708,621
PB82-238452 PC **A03**/MF **A01**
Factory Mutual Research Corp., Norwood, MA.
Quantification of Fire Properties of Fuels and Interaction with Fire Environments.
Technical rept.
A. Tewarson. Jun 82, 39p NBS-GCR-82-395
Grant NB79-NADA-0014

Keywords: *Fuels, *Fire tests, Heat of combustion.

Concepts for the quantification of fire properties of fuels and interaction with fire environments are presented. It is shown that certain fire properties, i.e., actual heat of combustion and yield of fire products, are independent of fire size as long as the fire remains overventilated. Small-scale measurements of asymptotic values of generation rates of fuel vapors and fire products, per unit area of fuel, obtained by oxygen enrichment, are shown to agree reasonably well with the generation rates measured directly on a large scale in ambient air.

708,622
PB82-259375 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
Heating Values of Natural Gas and Its Components.
Technical rept.
G. T. Armstrong, and T. L. Jobe. May 82, 168p
NBSIR-82-2401
Sponsored in part by Groupe Internationale des Importateurs de Gaz Natural Liquefie.

Keywords: *Natural gas, *Calorific value, Enthalpy, Hydrocarbons, Ideal gas, Thermodynamics, Virial coefficients, Numerical solution.

The standard enthalpies of combustion of the pure hydrocarbons C1 to C6 at 298.15 K and 101 325 Pa selected from the literature, with reference to a more detailed document, are used to derive heating values for the ideal gas and the real gas on molar, mass, and volumetric bases at five reference conditions involving other temperatures and pressures. Values can be obtained at both dry and water saturated conditions. The second virial coefficients and their first derivatives are used to calculate the effects of non-ideality. Procedures are given and illustrated for calculating the heating values of mixtures from the composition and the data given for the pure compounds. The relationships between the quantities presented in the tables are illustrated by charts. A procedure is given for estimating the uncertainties of the calculated results.

708,623
PB83-161414 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO.
Heat Capacity Measurements on Structure I and II Pure Hydrates at Low Pressures and Below Room Temperature.
Final rept. Oct 81-Sep 82.
J. E. Callanan, and E. D. Sloan. Sep 82, 35p NBSIR-83-1682, GRI-81/0102
Contract GRI-5081-360-0487

Keywords: *Natural gas, *Specific heat, *Hydrates, Ethylene oxide, Cyclopropane, Heat measurement, Furan/tetrahydro.

World resources of natural gas in hydrate form are on the order of trillions of cubic meters. Thermophysical property measurements are vital to the determination of the exploitability of this resource. The natural gas hydrates are clathrates; the hydrate lattice exists in one of two special structures (I and II), both of which are different from any of the known forms of ice. The hydrate lattice forms with cavities or cages in which molecules in specific size ranges can be trapped. Heat capacities as a function of temperature and, where appropriate, heats of dissociation have been measured for tetrahydrofuran (II), ethylene oxide (I), and cyclopropane (I and II) hydrates by differential scanning calorimetry. The heat capacities were found to vary both with structure and with guest. Scanning calorimetric techniques and sample handling techniques suitable for dealing with hydrates in the subambient region were developed.

708,624
PB83-162149 Not available NTIS
National Bureau of Standards, Washington, DC.
Oxygen Flow Calorimeter for Combustion of Kilogram-Size Samples of Municipal Solid Waste.-Part I: A 25 Gram Capacity Combustion Flow Calorimeter for Determining the Calorific Value of Refuse-Derived Fuels.
Final rept.
M. L. Reilly, K. L. Churney, D. R. Kirklin, A. E. Ledford, and E. S. Domalski. 1982, 11p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Resources Conserv. 8, p147-157 1982.

Keywords: *Sewage, *Calorimeters, Design criteria, Performance evaluation, Enthalpy, Sampling, Reprints, *Solid wastes, *Refuse derived fuels.

A new calorimeter is under development at the National Bureau of Standards to determine the enthalpies of combustion of kilogram-size samples of minimally processed municipal solid waste (MSW) in flowing oxygen near atmospheric pressure. A small prototype calorimeter is described in which the organic fraction of 25 gram pellets of highly processed MSW has been burned in pure oxygen to CO2 and H20. The basic measurement equation used to calculate the enthalpy of combustion from the observed data is discussed. An error analysis is presented. The results obtained with the prototype calorimeter are shown to agree with those obtained with bomb calorimetry within their respective overall uncertainties. Pure cellulose was found to be a satisfactory chemical calibrant material.

708,625
PB83-176982 Not available NTIS
National Bureau of Standards, Washington, DC.
Mathematical Models for the Prediction of Liquefied Natural Gas Densities.
Final rept.
R. D. McCarty. 1982, 18p
Pub. in Jnl. of Chemical Thermodynamics 14, n9 p837-854 1982.

Keywords: *Mathematical models, *Liquefied natural gas, *Density(Mass/volume), Equations of state, Comparison, Reprints.

Three mathematical models of the equation of state for liquid mixtures simulating liquefied natural gas (LNG) are discussed and compared.

708,626
PB83-182592 Not available NTIS
National Bureau of Standards, Washington, DC.
Modulation of Fossil Fuel Production by Global Temperature Variations.
Final rept.
B. W. Rust, and B. L. Kirk. 1982, 4p
Pub. in Environment International 7, n6 p419-422 1982.

Keywords: *Fossil fuels, *Atmospheric temperature, Manufacturing, Carbon dioxide, Air pollution, Reprints.

An analysis of the fossil fuel production record since 1860 shows that the exponential growth in production is modulated in the inverse sense by variations in global average temperature. Taking this modulation into account shows that the underlying rate of increase is about 25% less than the widely quoted 4.3% annual rate. This modulation may also produce a partially ameliorating feedback if the often predicted carbon dioxide greenhouse effect actually materializes.

708,627
PB83-195081 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Thermophysical Properties of Fluids for the Gas Industry.
Annual rept. Jan-Dec 82.
H. J. M. Hanley. 10 Jan 83, 70p GRI-82/0042
Contract GRI-5014-361-0131

Keywords: *Thermophysical properties, *Gas industry, Gases, Liquids, Fuels, Technology, Natural gas, Liquefied natural gas, Coal, Heavy oils, Bituminous sands, Thermodynamic properties, Chemical feedstocks, Synthetic fuels.

To provide the gas and related industries with a data base and a means to predict the thermophysical properties of gases and liquids.

708,628
PB83-213470 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Thermal Radiative Ignition of Liquid Fuels by a CO2 Laser.
Final rept. 1 Oct 79-30 Sep 82.
T. Kashiwagi, T. J. Ohlemiller, T. Kashiwagi, and W. W. Jones. May 83, 82p NBSIR-83-2689
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.

Keywords: *Fuels, *Laser beams, *Ignition, Irradiation, Temperature, Infraredspectroscopy, Interferometers, Vaporization.

This report summarizes progress in the study of the ignition mechanism of a liquid fuel by CW CO2 laser; the period covered is from October 1, 1979 to September 30, 1982. It describes (1) new observations of liquid fuel behavior near and at the liquid/air interface during the laser irradiation with incident fluxes from 260 to 2500 W/sq cm, (2) new time-resolved measurements of distributions of temperature and vapor concentration in the gas phase using a newly-developed, high speed, two-wavelength holographic interferometer and (3) the development of a technique to measure infrared absorption spectra of fuel vapors at elevated temperatures.

708,629
PB83-235804 Not available NTIS
National Bureau of Standards, Washington, DC.
Metrology and Availability of Thermophysical Property Data for Liquefied Natural Gas.
Final rept.
N. A. Olien, D. B. Mann, J. A. Brennan, J. D. Siegwarth, and J. F. La Brecque. 1983, 14p
Sponsored in part by Gas Research Inst., Chicago, IL.
Pub. in Proceedings World Gas Conference (15th) Lausanne, Switzerland IGU/H7-82, p1-4 June 14-18 82.

Keywords: *Liquefied natural gas, *Thermophysical properties, Sources, Density(Mass/volume).

The increasing international trade in liquefied natural gas (LNG) and the rising price of LNG has placed ever increasing importance on reducing the inaccuracies associated with the transfer of ownership (custody transfer) of this important energy commodity. This paper summarizes the available sources of accurate and wide-range data for the thermophysical properties of LNG and its constituents. The constituents include the lower alkanes, methane through butanes, as well as nitrogen, carbon dioxide and helium. Special emphasis is placed on accurate predictive techniques for properties, especially density, of LNG and its constituents. Part II of the paper discusses the methods used to determine, in the field, static volume in tanks, static and dynamic density and heating value. The uncertainties associated with each measurement are discussed in the context of the total custody transfer measurement process.

708,630
PB83-259580 PC **A09**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Compilation and Evaluation of Available Data on Phase Equilibria of Natural and Synthetic Gas Mixtures.
F. R. Williamson, and N. A. Olien. Jun 83, 182p NBSIR-83-1692
Sponsored in part by Gas Research Inst., Chicago, IL., and Texas A and M Research Foundation, College Station.

Keywords: *Natural gas, *Chemical equilibrium, *Liquid phases, *Vapor phases, Binary system(Material), Tables(Data), *Synthetic fuels.

This report summarizes the results of a two-year effort to identify, compile, and evaluate the data available in the open literature for the liquid-vapor equilibria for binary and multicomponent mixtures of He, H sub 2, C sub 1 - C sub 5 alkanes, N sub 2, CO, CO sub 2, NH sub 3, H sub 2 S, H sub 2 O, CS sub 2, COS, binary systems relevant to the gas industry. The result of the evaluation is that there are: 46 systems for which data are imperative and 104 systems for which data are needed but not imperative. The report lists the data needs in temperature and pressure range for each system for both Priority 1 and 1. The report includes three appendices: A - a listing of the ranges and quality of all available data for binary systems; B - the same for all multicomponent systems; and C - a complete bibliography of the 543 citations identified in the project.

708,631
PB84-115815
(Order as PB84-115799, PC **A05**/MF **A01**)
National Bureau of Standards, Boulder, CO.
Estimated Uncertainty of Calculated Liquefied Natural Gas Density from a Comparison of NBS and Gaz de France Densimeter Test Facilities.
M. Roncier, R.Philippe, J. Saint-Just, F. Dewerdt, J. D. Siegwarth, and J. F. LaBrecque. 16 Dec 82, 8p
Included in Jnl. of Research of the National Bureau of Standards, v88 n3 p163-170, May-Jun 83.

Keywords: *Liquefied natural gas, *Density(Mass/volume), Comparison, Chemical composition, Temperature, Densimeters, Portable equipment, Mixtures, Numerical solution.

Liquefied natural gas (LNG) densities can be measured directly but are usually determined indirectly in custody transfer measurement by using a density correlation based on temperature and composition measurements. An LNG densimeter test facility at the National Bureau of Standards uses an absolute densimeter based on the Archimedes principle, while a test facility at Gaz de France uses a correlation method based on measurement of composition and density. A comparison between these two test facilities using a portable version of the absolute densimeter provides an experimental estimate of the uncertainty of the indirect method of density measurement for the first time, on a large (32 L) sample. The two test facilities agree for pure methane to within about 0.02%. For the LNG-like mixtures consisting of methane, ethane, propane, and nitrogen with the methane concentrations always higher than 86%, the calculated density is within 0.25% of the directly measured density 95% of the time.

708,632
PB84-151588 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Conductivity of Coal Derived Liquids.
Final rept.
M. E. Baltatu, J. F. Ely, M. S. Graboski, H. J. M. Hanley, R. A. Perkins, and E. D. Sloan. 1983, 5p
Sponsored in part by Gas Research Inst., Chicago, IL. and Department of Energy, Washington, DC.
Pub. in Proceedings of the 1983 Int. Conference on Coal Science, Pittsburgh, PA., August 17, 1983, p757-760 1983.

Keywords: *Thermal conductivity, *Coal liquids, *Petroleum products, Critical point.

The thermal conductivity of petroleum fractions and of coal derived liquids is calculated by the extended corresponding states procedure of Ely and Hanley. The method requires as input, pseudo critical parameters, a pseudo ideal gas specific heat, and molecular weight. These input parameters are estimated here from the normal boiling point and specific gravity of the fraction using the techniques of Lee-Kesler, Riazi and Winn. The relationship between the final value of the conductivity and the choice of the method discussed.

708,633
PB84-154715 Not available NTIS
National Bureau of Standards, Washington, DC.
Prediction of Liquefied-Natural-Gas (LNG) Densities from New Experimental Dielectric Constant Data.
Final rept.
W. M. Haynes, and R. D. McCarty. Aug 83, 7p
Sponsored in part by Columbia Gas System Service Corp., Columbus, OH., Southern California Gas Co., Los Angeles, Chicago Bridge and Iron Co., Plainfield, IL. and American Gas Association, Inc., Arlington, VA.
Pub. in Cryogenics, p421-426 Aug 83.

Keywords: *Liquefied natural gas, *Density(Mass/volume), *Dielectric properties, Reprints.

A concentric cylinder capacitor has been used to measure the orthobaric liquid dielectric constants of multicomponent mixtures of the major components of liquefied natural gas (LNG) to an accuracy of approximately + or - 0.05% at temperatures from 110 to 130 K.

708,634
PB84-202647 PC **A11**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Chemical Engineering Science Div.
Liquefied Natural Gas Densities: Summary of Research Program at the National Bureau of Standards.
Final rept.
W. M. Haynes, R. D. McCarty, and M. J. Hiza. Oct 83, 249p NBS/MONO-172
Also available from Supt. of Docs as SN003-003-02587-9. Library of Congress catalog card no. 83-600608.

Keywords: *Liquefied natural gas, *Density(Mass/volume), Mixtures, Binary systems(Materials), Research projects, Dielectric properties, Fuels, Mathematical models, Volume, Numerical solution.

This report summarizes the results of a project concerning the densities of liquefied natural gas (LNG) and its components. This project, initiated in the Properties of Fluids Section of the Cryogenics Division of the National Bureau of Standards in July 1972, was carried out under the sponsorship of a consortium of eighteen energy companies. The density data have been used to optimize, test, and compare several mathematical models as to their suitability for the calculation of LNG densities for custody transfer. Models selectedfor optimization and testing included an extended corresponding states method, a hard sphere model, a cell model, and an empirical model due to Klosek and McKinley. The ultimate goal of this project was to produce one or more mathematical models that could be used to predict the density of any LNG mixture to within an uncertainty of 0.1 percent from an input of pressure, temperature, and composition. After revisions based on the new experimental data from this project, each of the models investigated here satisfy this goal for typical LNG compositions. The limitations and ranges of validity of the various models are discussed. Also presented are techniques for predicting LNG densities from dielectric constant measurements and from excess volume calculations. The last section of this report consists of publications that provide a complete and detailed account of the results of this project.

708,635
PB84-216977 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Estimating Large Pool Fire Burning Rates.
Final rept.
V. Babrauskas. Nov 83, 11p
Pub. in Fire Technology, v19 n4 p251-261 Nov 83.

Keywords: *Flammable liquids, *Burning rate, Jet engine fuels, Predictions, Flame propagation, *Pool fires.

Data for predicting the burning rate and heat output of large pool fires (Diameter greater or equal to 0.2 m) are compiled and evaluated. Attention is also focused on areas where further research is most needed in order to improve predictability.

708,636
PB85-102259 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement Techniques for Fuel Stability Characterization.
Final rept.
A. L. Cummings, P. Pei, and S. M. Hsu. 1983, 16p
Pub. in American Society for Testing and Materials, Special Technical Publication 809, p335-350 1983.

Keywords: *Fuels, *Oxidation tests, *Chemical stabilization, *Chemical analysis, Comparison, Stability, Distillation, Chromatographic analysis, Reprints, Liquid chromatography, Differential scanning calorimetry.

A measurement technique has been developed to characterize the oxidation stability of liquid fuels under various conditions. The technique is based on high pressure differential scanning calorimetry. It is shown to be sensitive to the chemical compositions of some fuels, including shale-derived jet fuel and a marine diesel fuel. These fuels were subsequently fractionated according to molecular type using liquid chromatography. Using the procedure developed, the oxidation characterizations of the fuel fractions were examined. Results suggested that different amount of various molecular types present in different fuels may affect the overall stability of the fuels. Comparison of results from these tests with the results from commonly used stability tests (JFTOT and accelerated stability) sug-

gests qualitative agreement. The technique offers many advantages in terms of precision, sample size requirement, as well as number of parameters measured.

708,637
PB85-102754 Not available NTIS
National Bureau of Standards, Washington, DC.
Semi-Quantitative Ion Microprobe Mass Analysis (IMMA) of Mineral-Rich Particles in the Upper Freeport Coal.
Final rept.
R. B. Finkelman, F. T. Dulong, R. W. Stanton, D. S. Simons, and E. B. Steel. 1984, 11p
Sponsored in part by Geological Survey, Reston, VA.
Pub. in International Jnl. of Coal Geology 3, p279-289 1984.

Keywords: *Coal, *Chemical analysis, *Clay minerals, Trace elements, Electron microscope, Sampling, Reprints, *Ion microprobe mass analyzers.

An ion microprobe mass analyzer has been used to quantitatively analyze clay-rich particles from two facies in the Upper Freeport coal bed. Accuracy is estimated to be + or - 20 percent (one standard deviation) for those elements with abundances above 0.1 weight percent and + or - 50 percent (one standard deviation) for the remaining elements. Statistically significant differences between the two samples were found for six of the 25 elements detected. For some of these elements (Fe, Li, Mn), the differences seen in the clay-rich particles are similar to the differences found in whole-coal analyses. In other cases differences between the two samples are attributable to irregular distributions of an inorganic phase (Ce, La) or different modes of occurrence of an element (Ca). Differences between the clay-rich phases and bulk analysis are significant for only five elements (Fe, Ca, Na, Ti, K) and are attributable to irregular distributions and/or different modes of occurrence. The authors conclude that quantitative ion microprobe analysis can provide insight into the distribution and mode of occurrence of many trace elements in coal.

708,638
PB85-115541 Not available NTIS
National Bureau of Standards, Washington, DC.
Nuclear Magnetic Resonance Studies of Ancient Buried Wood 1. Observations on the Origin of Coal to the Brown Coal Stage.
Final rept.
P. G. Hatcher, I. A. Breger, and W. L. Earl. 1981, 7p
Pub. in Organic Geochemistry 3, n1-2 p49-55 Jan-Apr 81.

Keywords: *Nuclear magnetic resonance, *Wood, *Anaerobic processes, *Geochemistry, Sediments, Reprints, *Coalification.

Various wood fragments buried in sediments under anaerobic conditions for 450 years to approximately 8 million years have been examined by solid-state nuclear magnetic resonance. Celiulose and other carbohydrates, the major components of Holocene wood, have been shown to be gradually hydrolyzed under the conditions of burial. Lignin structures, however, are preserved relatively unchanged and become concentrated by differences as the carbohydrates disappear. Thus, a fragment of coalified wood isolated from a Miocene brown coal was found to be still composed of approximately 75% lignin and 25% cellulose. On the basis of our observations, we suggest that coalification of woody tissue progresses directly from lignin to coal and that such coalification may not occur until most of the cellulose disappears.

708,639
PB85-141489 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Gas Orifice Meter Discharge Coefficients as Determined by Mass Flow Measurements.
Final rept.
D. B. Mann, J. A. Brennan, C. F. Sindt, J. F. LaBrecque, S. E. McManus, and C. H. Kneebone. 1984, 20p
Contract GRI-5080-353-0422
Pub. in Proceedings of the International Conference on the Metering of Natural Gas and Liquefied Hydrocarbon Gases, London, England, Feb 1-2, 1984, p1-20.

Keywords: *Orifice meters, *Gas meters, Gas flow, Performance, Data, Flow rate, Natural gas, Gas industry, Measurement, *Discharge coefficient.

A summary of orifice meter performance data and system descriptions are provided. A U.S. gas industry supported program has generated gas orifice meter performance data for four nominal orifice meter run sizes from 2 to 6 inches with up to six beta ratio of from 0.2 to 0.75. Two meter runs for each of the four nominal line sizes and two sets of orifice plates were interchanged in order to develop full meter performance characteristics. The data have been developed using nitrogen gas as the process fluid and a unique NBS gas flow reference facility capable of directly measuring the mass of gas metered by the orifice meter.

708,640
PB85-143584 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ignition of a Liquid Fuel Under High Intensity Radiation.
Final rept.
T. Kashiwagi. 1980, 9p
Pub. in Combustion Science and Technology 21, n3-4 p131-139 1980.

Keywords: *Fuels, *Ignition, Reprints.

This describes an experimental study of the key process of the ignition. First, the effect of the container size on ignition was studied to determine the appropriate container size to avoid wall effects. Then, high speed photographs were taken to observe the events through the preheating period to ignition. Finally the effect on ignition of the incident angle of the laser beam with respect to the liquid surface was studied. Results obtained from these experiments are described.

708,641
PB85-189421 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Determination of Ultratrace Levels of Lead in Reference Fuels by Graphite Furnace Atomic Absorption.
Final rept.
M. S. Epstein. 1983, 2p
Pub. in At. Spectrosc. 4, n2 p62-63 1983.

Keywords: *Lead(Metal), *Trace elements, *Gasoline, *Chemical analysis, Standards, Exhaust emissions, Air pollution, Reprints, *Graphite furnace atomic spectroscopy, *Air pollution detection, Standard reference materials.

A modification of ASTM Standard Test Method D-1368-64 is used to determine levels of lead in isooctane and heptane less than a part-per-billion. The modification greatly simplifies the Test Method and reduces blank levels by almost two orders of magnitude. The accuracy of the method is confirmed by the determination of lead in NBS SRM 1636a (Lead in Reference Fuel).

708,642
PB85-206043 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
MARKET: A Model for Anlayzing the Production, Transmission, and Distribution of Natural Gas.
Technical note (Final).
C. Witzgall, and P. B. Saunders. Apr 85, 168p NBS/TN-1209
Also available from Supt. of Docs as SN003-003-02644-1. Sponsored by Department of Energy, Washington, DC.

Keywords: *Natural gas, *Gas industry, Gas production, Marketing, Gas distribution, Policies, Prices, Supply(Economics), Demand(Economics), Regulations, Reserves, Mathematical models.

This report describes the MARKET submodel, one of three that combine to form the Gas Analysis Modeling System (GAMS). GAMS was developed for use by the Energy Information Administration of the U.S. Department of Energy. It provides a tool for analyzing the regional effects on the domestic natural gas market of various policies for regulating the price of natural gas at the wellhead. MARKET is concerned with the production of gas reserves and the transmission and distribution of gas to consumers. It solves a network equilibration problem to arrive at estimates of production quantities and prices.

708,643
PB85-207223 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Application of Perdeuterated Polycyclic Aromatic Hydrocarbons (PAH) as Internal Standards for the Liquid Chromatographic Determination of PAH in a Petroleum Crude Oil and Other Complex Mixtures.
Final rept.
W. F. Kline, S. A. Wise, and W. E. May. 1985, 15p
Sponsored by Department of Energy, Washington, DC. Office of Health and Environmental Research.
Pub. in Jnl. of Liquid Chromatography 8, n2 p223-237 1985.

Keywords: *Aromatic polycyclic hydrocarbons, *Chromatographical analysis, *Standards, Chemical analysis, Petroleum products, Crude oil, Reprints, *Liquid chromatography, *Standard reference materials, Air pollution detection.

A sequential liquid chromatographic (LC) procedure for the determination of polycyclic aromatic hydrocarbons (PAH) in a petroleum crude oil and other complex mixtures is described. The procedure includes normal-phase LC on an animosilane column to isolate fractions containing isomeric PAH and reversed-phase LC on a polymeric C18 column to separate the individual PAH isomers. Appropriate perdeuterated PAH are added to the sample so that each isomeric fraction will contain one internal standard. The perdeuterated PAH are excellent internal standards for this sequential LC procedure. Perdeuterated PAH have normal-phase and reversed-phase LC retention characteristics similar to those of the parent PAH. In the normal-phase LC separation, the perdeuterated PAH elute in the same fraction as the parent PAH. In the reversed-phase LC separation, the perdeuterated PAH elute first and are generally resolved from the parent PAH. The optimized spectrofluorometric detection of each PAH analyte is accomplished by programming appropriate sets of excitation and emission wavelengths to correspond with the elution time of each analyte on the polymeric C18 column. The analytical results obtained from this procedure for the analysis of a shale oil sample (Standard Reference Material (SRM) 1580) and a petroleum crude oil (SRM 1582) are compared to values obtained by gas chromatography-mass spectrometry.

708,644
PB85-230860 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Speciation of Inorganic Arsenic and Organoarsenic Compounds in Fossil Fuel Precursors and Products.
Final rept.
F. E. Brinckman, C. S. Weiss, and R. H. Fish. 1983, 19p
Sponsored by American Chemical Society, Washington, DC.
Pub. in Proceedings of the American Chemical Society Meeting Chemical Congress of the North American Continent, Las Vegas, Nevada, August 24, 1980, Chapter 13 in Chemical and Geochemical Aspects of Fossil Energy Extraction, p197-214 1983.

Keywords: *Arsenic inorganic compounds, *Arsenic organic compounds, *Fossil fuels, *Trace elements, Metal containing organic compounds, Chemical analysis, Atomic spectroscopy, Absorption spectra, Shale oil, Oil shale, Chemical reactions, Stability, Catalysts, *Chemical reaction mechanisms.

The molecular forms of trace metal(loid)s in fossil deposits are complex, probably consisting of varying proportions of inorganic, metallo-organic, and true organometallic chemical species residing in unspecified sites within the carbonaceous matrix. Modern industrial processing of fossil materials requires a refined understanding of the original form of the selected element, its relationship to other matrix elements, and the pathways by which processing can alter the elements original form. From the standpoint of its environmental impact or its ability to poison catalysts used to upgrade crude oils, arsenic is a key element for which an urgent need exists to determine its chemical form(s) and transformations during fossil fuel processing. The underlying analytical requirements for the speciation of trace elements in fossil materials will be discussed along with a review of the present status of trace element speciation in these materials. Recent work performed in our laboratories on the speciation of arsenic compounds in shale oil, oil shale retort waters and oil shale kerogen is presented in this context.

708,645
PB86-102258 PC **A06**/MF **A01**

National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Development of a Model for the Heat Release Rate of Wood - A Status Report.
W. J. Parker. Jul 85, 107p NBSIR-85/3163
Contract EMW-E-1239

Keywords: *Wood, *Heats of combustion, *Mathematical models, Pyrolysis, Moisture contents, Exposure, Thermal conductivity, Fuels.

The report describes the status of the development of a method for predicting the heat release rate of wood for different thicknesses, moisture contents, and exposure conditions. A computer model has been set up on a microcomputer. Experimental techniques have been devised to obtain the input data required by the model. These include (1) the thermal conductivity as a function of temperature and percent loss, (2) the kinetic constants needed to describe the mass loss rate, (3) the heat of combustion of the volatile pyrolysis products, and (4) the contraction factors due to charring. Sufficient data on these parameters were taken to exercise the model. Heat release rates and effective heats of combustion were measured as a function of external radiant flux on 12.5 mm thick dry vertical specimens of Douglas fir particle board. The calculated and measured peak heat release rate curves are similar in shape and amplitude but differ significantly in time scale. This may be due to the lack of thermal conductivity data on the char in the high temperature range. There is very good agreement between the calculated and measured effective heats of combustion. The initial results with the model are promising.

708,646
PB86-110095 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Internal Friction and Dynamic Young Modulus of a Bituminous Coal.
Final rept.
H. M. Ledbetter, M. W. Austin, and J. E. Callanan. 1985, 7p
Pub. in Proceedings of the American Chemical Society Fuel Division Symposium on Physical Methods for Fossil Fuels, Miami Beach, FL., April 28, 1985, American Chemical Society, Division of Fuel Chemistry 30, n1 p127-133 1985.

Keywords: *Bituminous coal, *Internal friction, *Modulus of elasticity, Physical properties, Polymers, Specific heat, Thermal expansion, Debye temperature.

Internal friction provides a well-known probe of defects in solids. The companion property--elastic modulus--provides valuable material characterization. This modulus relates in turn to a wide variety of other solid-state physical properties: specific heat, thermal expansivity, Debye temperature. Here the authors report preliminary measurements of these two physical properties between 295 and 76 K. Specimens consisted of square-cross-section rods approximately 5 mm by 30 mm. Apparatus consisted of a Marx oscillator at frequencies near 50 kHz. They found two internal-friction peaks, one centered near 220 K and one below 76 K. The preliminary results support the view that coal exhibits strong polymeric character.

708,647
PB86-124971 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Thermometry in Coal Utilization.
Final rept.
J. F. Schooley. 1982, 8p
Pub. in Proceedings of Symposium on Instrumentation and Control for Fossil Energy Processes, Houston, TX., June 7-9, 1982, p161-168.

Keywords: *Coal preparation, *Temperature measurement, Substitutes.

Thermometry techniques suitable for use in coal processing are discussed. Common problems encountered in the use of thermocouple thermometers are summarized. Alternative methods, including velocity-of-sound, Johnson noise, and various blackbody and spectroscopic measurements are outlined. Some 27 references to literature on these topics are included.

708,648
PB86-162112 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
LNG (Liquefied Natural Gas) Property Data and Metrology Technology.
Final rept.
D. Mann, and J. A. Brennan. 1985, 10p
Sponsored by Groupe Internationale des Importateurs de Gas Natural Liquefie, and Southern California Gas Co., Los Angeles.
Pub. in Proceedings of the World Gas Conference (16th), Munich, West Germany, June 24-27, 1985, p1-10.

Keywords: *Liquefied natural gas, Chemical properties, Reviews, Physical properties, Technology, Measurement instrumentation, Tables(Data).

Results of National Bureau of Standards (NBS) research programs concerning Liquefied Natural Gas (LNG) are presented and reviewed. In addition to previously reported information on LNG materials and fluids property data in graphic format, these more recent programs provide information on combustion enthapies of the LNG components and mixtures for molecular weights of methane through the hexanes, real gas mixture densities, both measured and calculated and other thermophysical properties correlations, tabulations, and equations of state. The metrology of custody transfer is presented in context of previously completed NBS research programs dealing with LNG. These include LNG sampling and analysis, LNG density measurement both direct and calculated, liquid level instrumentation, ship and shore tank strapping and liquid flowmetering. Each of these measurement processes are examined for accuracy and precision. Propagation of error is presented with sample calculations and assessed for the various custody transfer situations such as ship tank unloading, pipeline flowmetering, shore tank storage and vaporization and gas flow measurements.

708,649
PB86-193158 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Laboratory-Scale Controlled-Atmosphere Chamber for Use with Premium Coal Samples.
Final rept.
B. J. Filla, and J. E. Callanan. 1985, 4p
Pub. in Review of Scientific Instruments 56, p592-595 Apr 85.

Keywords: *Laboratory equipment, *Atmosphere control, Coal, Recirculating system, Reprints, *Controlled atmosphere chamber, Glove box.

The recent availability of premium coal samples makes it desirable to have the capability for working with these materials, in one's own laboratory, in an atmosphere which can be controlled. A controlled-atmosphere chamber, large enough to allow for processing samples yet small enough to fit easily in an ordinary laboratory, has been designed and fabricated. The overall cost of the controlled-atmosphere chamber was competitive with commercially available systems. The major advantages of the specific system include: convenient size and reversible design for use in a limited work space; incorporation of a full vacuum antechamber that minimizes loss of the working chamber purified atmosphere; and a recirculating system with a bypass valve arrangement allowing separate or combined operation of oxygen and moisture removal systems. The design features were combined to create a unique apparatus capable of both the specific use for which it was intended and general controlled-atmosphere chamber applications. Compatible modular-design work chambers could have been purchased from commercial vendors; however, it still would have been necessary to custom fabricate both the antechamber and recirculation system to meet the requirements of the anticipated experimental work.

708,650
PB86-208386 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Gel Model for Coal.
Final rept.
R. A. MacDonald, and R. D. Mountain. 1985, 7p
Pub. in International Jnl. of Thermophysics 6, n6 p673-679 Nov 85.

Keywords: *Coal, Aggregates, Density functions, Density(Mass/volume), Thermodynamic properties, Gels, Reprints.

Coal is a sedimentary, organic 'rock' which is almost never in a state of thermal equilibrium. Because of its importance, the thermal properties of this ill-characterized substance are of great interest. Recent work has shown that coal has many of the characteristics of a gel-type structure. We have made this observation the basis for a model study of the thermal properties of a gel system, using the equation-of-motion method to determine the density of states for the system and, thereby, its heat capacity. The model has one of the essential features of a model of coal, namely, a porous structure. With a hexagonal close-packed lattice as the basis for our gel, we have calculated the frequency spectrum for several particle densities.

708,651
PB86-208493 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Physical Properties of Pure Components of Natural Gas.
Final rept.
K. N. Marsh. 1986, 15p
Pub. in Gas Quality, p59-73 1986.

Keywords: *Natural gas, Physical properties, Combustion, Reprints.

The principal physical properties of components of natural gas that are of importance to the gas industry are those related to heating value and to volume. New recommendations for the heating values and molar volumes of components of natural gas and for their molar volumes are reported. These are based on a reassessment of the available experimental data.

708,652
PB86-209673 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Comparison of Single Component Standards to Multi-Component Standards for Use in Analysis of Natural Gas.
Final rept.
G. C. Rhoderick, and E. E. Hughes. 1986, 9p
Pub. in Gas Quality, Proceedings of International Congress on Gas Quality-Specification and Measurement of Physical and Chemical Properties of Natural Gas, Groningen (Netherlands), April 22-25, 1986, p711-719.

Keywords: *Natural gas, *Standards, Simulation, Comparison, Gravimetric analysis.

The precise analysis of natural gas requires the identification and quantification of a large number of components. A simulated natural gas mixture consisting of methane and seven higher hydrocarbons together with nitrogen and carbon dioxide has been prepared. Thirty gaseous standards have been prepared by a gravimetric technique. These standards consist of several concentrations each of the single components and two standards containing all of the components. Analyses were performed on the simulated natural gas and on samples of natural gas. The analysis resulting from calibration with the binary standards was compared to analytical results obtained using the multi-component standards.

708,653
PB86-232709 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
LNG (Liquefied Natural Gas) Densities for Custody Transfer.
Final rept.
R. D. McCarty. 1983, 3p
See also PB82-112574.
Pub. in Proceedings of International School of Hydrocarbon Measurement (58th), Norman, OK., April 12-14, 1983, p121-123.

Keywords: *Liquefied natural gas, *Density(Mass/volume), Densimeters, Standard reference materials, Numerical solution.

Work has been carried out over the past ten years at the National Bureau of Standards to provide alternate methods for the accurate determination of the density of liquefied n natural gas (LNG) that would serve as a basis for equitable custody transfer. A magnetic suspension densimeter was used to obtain density data for LNG components and their mixtures with a total uncertainty in density of less than 0.1%. These data were used to optimize and test mathematical models for LNG density calculations. Four mathematical models for the calculation of LNG densities have been optimized, tested, and compared.

708,654
PB86-233269 PC **A15**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
LNG (Liquefied Natural Gas) Measurement: A User's Manual for Custody Transfer.
Final rept.
D. Mann. Jun 86, 327p NBSIR-85/3028
Color illustrations reproduced in black and white. Sponsored by Groupe Internationale des Importateurs de Gaz Natural Liquefie.

Keywords: *Liquefied natural gas, Density(Mass/volume), Measurement, Instruments, Data.

The LNG Measurement Manual will provide measurement engineers and others with a source of critically evaluated basic physical property data, a description of recent relevant measurement research and detailed examples of several methods of establishing the quantity and quality of liquefied natural gas (LNG) as a commercial commodity at the custody transfer point of sale. The contents of the manual are edited condensations of published research on properties and measurement processes.

708,655
PB87-104246 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Equation of State Model for Pure CO2 and CO2 Rich Mixtures.
Final rept.
J. F. Ely. 1986, 8p
Pub. in Proceedings of Annual Convention of the Gas Processors Association (65th), San Antonio, TX., March 1986, p185-192.

Keywords: *Carbon dioxide, *Equations of state, Mathematical models, Thermophysical properties, Reprints, *Enhanced oil recovery.

Enhanced oil recovery using carbon dioxide and associated carbon dioxide pipeline and gas processing interests have generated a great demand for accurate thermophysical property data for systems containing CO2. In an attempt to meet these demands, an experimental measurement and model development program has been undertaken at the National Bureau of Standards dealing with pure carbon dioxide and CO2 rich mixtures. The entire fluid range of conditions has been studied in the work but special attention has been paid to single phase properties such as densities and enthalpies in the near but supercritical region. In the report, a new equation of state for pure carbon dioxide and an accurate equation of state model for CO2 rich mixtures will be discussed.

708,656
PB87-118097 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Tests of Models for Shear Viscosity Coefficients.
Final rept.
D. E. Diller, and L. J. van Poolen. 1985, 6p
Sponsored by Gas Research Inst., Chicago, IL., and Department of Energy, Washington, DC.
Pub. in High Temperatures-High Pressures 17, p139-143 1985.

Keywords: *Viscosity, *Gases, Density(Mass/Volume), Temperature, Reprints, Compressed gases.

Recent measurements of the dynamic shear viscosity of compressed and liquefied hydrocarbon gases are compared with a global extended corresponding states model. At densities approx less than 2.5 rho sub c, the measurements and model generally differ by less than 7%. At higher densities, however, the differences are substantially larger, and increase with increasing density. Our data for liquid isobutane are satisfactorily correlated by using the Hildebrand equation. A good correlation was found between the fluidities (viscosity) of the liquids examined and their mean molecular radius of gyration.

708,657
PB87-128302 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
NBS (National Bureau of Standards)-Boulder Basic Gas Metering Project.
Final rept.
J. A. Brennan, B. R. Bateman, S. E. McManus, C. F. Sindt, and I. Vazquez. 1986, 8p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in American Gas Association 1986 Operating Section Proceedings, p773-780.

Keywords: *Gas flow, *Orifice meters, *Flowmeters, Laboratories, Flow measurement, Experimental data, Mass flow, Pipes, Comparisons, *Data bases, European economic community.

Recent developments in the multi-year gas flow measurement program include new experimental orifice meter coefficient data, an archival orifice meter data base, an interlaboratory comparison with flow facilities in the European Economic Community (EEC), and tests on five flow conditioners. The current status of these tasks is described and some examples are presented that may be useful in future revisions of the orifice flow measurement standard.

708,658
PB87-132056 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Characterization of Refuse-Derived Fuel at Various Stages of Processing.
Final rept.
D. R. Kirklin, P. H. Decker, and E. S. Domalski. 1985, 7p
Pub. in Resour. Conserv. 11, n3-4 p255-261 1985.

Keywords: Sulfur, Chlorine, Separation, Calorimetry, Calorific value, Reprints, *Refused derived fuels, Municipal solid wastes.

The combustible fraction was separated from a municipal solid waste (MSW) sample from New Castle County, Delaware at the Bureau of Mines (BuM) pilot resource recovery plant in College Park, Maryland. The combustible fraction was collected at seven points after various stages of processing through air classifiers and trommels. The calorific value, moisture, ash, sulfur and chlorine contents were measured by NBS and BuM laboratories and the results analyzed to determine if these properties were characteristic of or altered by the type of processing that the refuse-derived fuel (RDF) had under gone. The NBS analysis concluded that some of the RDF properties are characteristic of or altered by the type of processing that the RDF had undergone. Air classifiers were very effective in separating the light components of RDF (i.e., paper and plastic films) from the heavier components of RDF. A trommel in the RDF separation scheme removes some of the undesirable characteristics of RDF, namely, the non-combustible, sulfur and chlorine containing components of RDF.

708,659
PB87-141487 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Natural Gas Handbook.
P. R. Ludtke. Aug 86, 109p NBSIR-86/3057
Sponsored by Air Force Engineering and Services Center, Tyndall AFB, FL.

Keywords: *Natural gas, Moisture content, Hydrogen sulfide, Concentration(Composition), Compressibility, Handbooks, Measuring instruments.

A Natural Gas Handbook has been prepared to help Air Force BCE personnel better understand the principles of metering and selling natural gas on an energy content basis. The various aspects of natural gas such as heating value, moisture content, and hydrogen sulfide content are discussed. The characteristics of the various types of meters currently used for flow measurements are given. The correct procedures for calculating gas utility bills, including compressibility corrections, are presented. The responsibility of the gas utility to periodically check the gas meter and instrument accuracy is discussed. A list of information that should appear on the gas utility bill is given, and the various methods of selling natural gas are discussed.

708,660
PB87-151247 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Gas Analysis Modeling System (GAMS).
Final rept.,
R. P. O'Neill, J. Heinkel, W. G. Kurator, B. Mariner-Volpe, R. Stokes, A. Tawshunsky, W. Trapmann, L. Joel, P. Saunders, C. Witzgall, W. C. Mylander, and W. R. Stewart. Dec 84, 10p
Sponsored by Department of Energy, Washington, DC.
Pub. in Operations Research Letters 3, n5 p227-236 Dec 84.

Keywords: *Natural gas, *Linear programming, *Dynamic programming, Mathematical models, Industries, Evaluation, Import, Economic factors, Simulation, Legislation, United States, Reprints, *Network analysis.

The paper gives an overview of a large integrated model of the natural gas industry in the United States. The system described has been used to evaluate the impacts of natural gas legislation before the U.S. Congress. Many common operations research tools such as linear programming, dynamic programming and network flow theory are used as various stages in the model.

708,661
PB87-193660 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Physical Properties of Pure Components of Natural Gas.
Final rept.,
D. Garvin, E. S. Domalski, R. C. Wilhoit, G. R. Somayajulu, and K. N. Marsh. 1986, 15p
Previously announced as PB86-208493.
Pub. in Gas Quality, p59-73 1986.

Keywords: *Natural gas, Physical properties, Combustion, Reprints.

The principal physical properties of components of natural gas that are of importance to the gas industry are those related to heating value and to volume. New recommendations for the heating values and molar volumes of components of natural gas and for their molar volumes are reported. These are based on a reassessment of the available experimental data. The new recommendations are valid for the temperature range from 0 to 25 deg C and for pressures up to about one atmosphere. The sources of the data are indicated and factors considered in the reassessment are presented. Heating values of components of natural gas are known to reach no better than 0.02 to 0.04 percent.

708,662
PB87-211959 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Basic Gas Metering. Annual Report April 1984-March 1985,
J. A. Brennan, S. E. McManus, C. F. Sindt, B. R. Bateman, and I. Vazquez. May 87, 84p GRI-87/0104
Contract GRI-5081-353-0422
Sponsored by Gas Research Inst., Chicago, IL.

Keywords: *Natural gas, Measurement, Orifice meters, Gas flow, *Metering, Gas meters.

This is a status report on the work sponsored by the Gas Research Institute (GRI) on basic gas metering. The work was either completed at or subcontracted by the National Bureau of Standards in Boulder, CO (NBS-B). Tasks dealing with flow conditioning, secondary flow standards, an orifice data base, mathematical modeling and interlaboratory comparisons are continuing efforts. Tasks dealing with a theoretical base for the orifice meter, sonic nozzle calibrations, orifice water calibrations, and orifice air calibrations are complete. The task dealing with the laboratory quality orifice meter is in the final stages of completion. With the exception of the sonic nozzle calibrations, the status of each of these tasks is described below. The report on the sonic nozzle calibration will be published soon.

708,663
PB88-109871 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Self Heating Properties of Coal,
E. Braun. Aug 87, 109p NBSIR-87/3554
Sponsored by Bureau of Mines, Pittsburgh, PA.

Keywords: *Coal, *Autoignition, *Spontaneous combustion, Fire tests, Oxidation.

Three methodologies for predicting the likely occurrence of self-heating in underground coal mining environments were analyzed. No method was found to be completely satisfactory for general coal mine applications. One evaluation system was found to provide excellent guidelines for preplanning procedures prior to initiating full scale coal mine operations, but it relied on past mining experience. Another evaluation system used standard coal characterization parameters, while the third system used a thermal test method a predic-

tor of self-heating potential. The self-heating properties of eight samples of western bituminous coal were determined using the Adiabatic Furnace and the Crossing Point Method. A brief review of pertinent literature is presented to provide an understanding of those factors affecting oxidative heating of coal.

Geothermal Energy

708,664
DE85000385 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Thermophysical Properties of Working Fluids for Binary Geothermal Cycles. Final Report.
D. E. Diller, J. S. Gallagher, B. Kamger-Parsi, G. Morrison, and J. M. H. Levelt Sengers. Jul 84, 150p NBSIR-85/3124-DOE, DOE/RA-50241-11
Contract AT01-80RA50241
Portions are illegible in microfiche product. Original copy available until stock is exhausted.

Keywords: *2-Methylbutane, *2-Methylpropane, Binary-Fluid Systems, Geothermal power plants, Hydrocarbons, Mixtures, Scaling laws, Thermodynamic properties, Viscosity, Working fluids, ERDA/150802, ERDA/360603.

The following are presented: thermodynamic properties of isobutane and isobutane-isopentane mixtures; a scaled fundamental equation for mixtures of isobutane and isopentane near gas-liquid critical line; and viscosities of hydrocarbons and their mixtures. (ERA citation 10:006697)

708,665
PB82-157009 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Testing Geothermal-Well Cements: Strength Measurements Following Exposures to Simulated Geothermal Fluids.
Interim rept. Jul 80.
R. F. Krause, and E. R. Fuller. Dec 81, 29p NBSIR-80-2099-4
Contract DOE-FA-77-A-01-6010

Keywords: *Geothermal prospecting, *Well casings, *Cements, Compressive strength, Tensile strength, Environmental tests, High temperature tests, Pressure, *Geothermal wells.

Compressive and splitting tensile strengths were measured for several set cements at room temperature after they had been exposed for periods of 1 week and 1 month to a 20 wt percent salt solution pressurized to 20 MPa and heated to 300C. The compressive strength was also measured following exposures for identical periods to distilled water pressurized to 20 MPa and heated to 200C. Prior to the exposures, the cements had been set-cured for 2 days in molds immersed in water under the same pressure and temperature as the distilled water exposure. These measurements are part of a project being carried out to evaluate certain physical properties of cements which are candidates for use in finishing geothermal wells.

708,666
PB87-227583 PC **A09**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Thermodynamic Properties of a Geothermal Working Fluid; 90% Isobutane-10% Isopentane.
Final rept.,
J. S. Gallagher, D. Linsky, G. Morrison, and J. M. H. Levelt Sengers. Jun 87, 194p NBS/TN-1234
Also available from Supt. of Docs as SN003-003-02809-6. Prepared in cooperation with Department of Energy, Oakland, CA. Div. of Geothermal and Hydropower Technology.

Keywords: Butanes, Pentanes, Tables(Data), Thermodynamic properties, Mixtures, *Geothermal power plants, *Working fluids.

Tables of thermodynamic properties, and dew and bubble properties, of a mixture of 90 mol % isobutane and 10 mol % isopentane, a working fluid in a binary geothermal power cycle are presented. The tables are generated by a formulation of the Helmholtz free energy, in which the mixture properties are mapped onto the known properties of pure isobutane by means of the principle of generalized corresponding states. The data base for the helmholtz free energy formulation is new. The authors report data obtained in three different apparatus: critical-line and isopentane vapor pressure data obtained in a visual cell; vapor-liquid equilibria data obtained in a mercury-operated variable-volume cell; and pressure-volume-temperature data for the 90 mol %--10 mol % mixture obtained in a semi-automated Burnett-isochoric apparatus. The principles of the methods, and estimates of the reliability, are discussed and all experimental data are compared with the surface. The results are tables of specific volume, enthalpy, entropy, specific heat and density and temperature derivatives of the pressure at 10 K temperature increments from 240 to 600 K along isobars from 0.01 to 20 MPa. Separate tables are prepared from the dew and bubble properties of the 90-10 mixture.

708,667
PB88-120944 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Semi-Automated Burnett Facility: PVT of a Geothermal Working Fluid Mixture.
Final rept.,
D. Linsky, J. M. H. Levelt Sengers, and J. S. Gallagher. 1987, 17p
Contract DOE-EA-77-A-01-6010
Sponsored by Department of Energy, Washington, DC. Pub. in Fluid Phase Equilibria 36, p149-165 1987.

Keywords: *Binary fluid systems, *Working fluids, *Geothermal energy conversion, Bourdon tubes, Critical pressure, Critical volume, Critical temperature, Test equipment, Isochoric processes, Reprints, Burnett apparatus.

A high-quality Burnett PVT facility for the range of 0-200 C has been partially automated by coupling automated isochoric runs to a manually determined Burnett reference isotherm. An automated pressure injector, a voltage-operated capacitor for adjusting the transducer null, a Ruska spiral Bourdon gage, a programmable ratio transformer for temperature selection and control, and a laboratory computer form the ingredients of the semi-automated facility. The performance of the apparatus is demonstrated by PVT data acquired on a geoothermal working fluid mixture in a range around its critical point of 141 degs c.

708,668
PB88-121959 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Semi-Automated Burnett PVT Apparatus: Properties of a Geothermal Working Fluid.
Final rept.,
D. Linsky, J. M. H. Levelt Sengers, and H. A. Davis. 1987, 11p
Contract DOE-EA-77-A-01-6010
Sponsored by Department of Energy, Washington, DC. Pub. in Proceedings of Symposium on Energy Engineering Sciences Instrumentation, Diagnostics and Material Behavior (5th), Argonne, IL., June 17-19, 1987, p26-36.

Keywords: *Geothermal fluids, *Thermodynamic properties, Pressure, Volume, Temperature, Binary fluid systems, Reprints, *Foreign technology.

A Burnett-isochoric facility has been constructed in which the equation of state of fluids and fluid mixtures can be obtained in automatic fashion along paths of constant volume. The apparatus has been used for the determination of the thermodynamic properties of a working fluid mixture for a binary geothermal power cycle.

Heating & Cooling Systems

708,669
PATENT-4 687 588 Not available NTIS
Department of Commerce, Washington, DC.
Refrigerant Mixture of Trichlorofluoromethane and Dichlorohexafluoropropane.
Patent,
M. O. McLinden, D. A. Didion, and C. D. MacCracken. Filed 5 Aug 86, patented 18 Aug 87, 4p PB88-111125, PAT-APPL-6-893 380
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.50.

Keywords: *Patents, *Refrigerants, Chlorine organic compounds, *Methane/trichlorofluoro, *Propane/dichlorohexafluoro.

The invention is a refrigerant mixture consisting essentially of trichlorofluoromethane(R-11) and dichlorohexafluoropropane (R-216) which has a higher saturated vapor density than that of pure R-11 and which exhibits an azeotrope at approximately 74% by weight of R-11 and 26% by weight of R-216.

708,670
PB-264 259/3 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Building Environment Div.
Infrared Technique for Heat-Loss Measurement,
D. M. Burch, T. Kusuda, and D. G. Blum. Apr 77, 55p NBS-TN-933
Prepared in cooperation with Federal Energy Administration, Washington, D.C.

Keywords: *Thermography, *Infrared thermal detectors, *Heat loss, *Buildings, Thermal insulation, Thermal measurements, Television display systems, Thermal efficiency, Energy conservation, Monitors.

This paper describes a newly developed technique for estimating heat-loss rate using an infrared television system. A device called a heat-flow reference pad was developed that makes it possible to estimate quantitatively the heat-loss rate at the surface of a building without the need for a conventional heat-flow meter to be mounted on the surface. Technical considerations for the design of a heat-flow reference pad are presented. The infrared measurement technique predicted heat-loss rates in the laboratory and field within approximately 12%.

708,671
PB-264 932/5 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Dynamic Performance of a Residential Air-to-Air Heat Pump.
Final rept.,
G. E. Kelly, and J. Bean. Mar 77, 18p NBS-BSS-93
Sponsored in part by Federal Energy Administration, Washington, D.C. Library of Congress catalog card no. 76-50050.

Keywords: *Heat pumps, Residential buildings, Performance, Coefficients, Heating, Cooling, Performance tests, Seasonal variations, Air to air heat pumps.

Information is presented on the dynamic performance of a 5-ton air-to-air heat pump, which was installed in a residence in the Washington, D.C. area. The effect of part-load operation on the heat pump's COOLING and HEATING coefficients of performance (COP) was determined. When the pump operated in the heating mode at outdoor temperatures below 40F (4.4C), a considerable discrepancy was found to exist between the measured performance and the performance data supplied by the manufacturers. This discrepancy is apparently due to the adverse effects of frost buildup and defrosting of the outdoor coil. The seasonal performance factor (SPF) of the heat pump was estimated and then traced back to the power plant to obtain an EFFECTIVE SPF which is then compared with the performance which might be expected from fossil-fuel heating equipment.

708,672
PB-264 959/8 PC **A09**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of Energy Conservation.
Waste Heat Management Guidebook.
Final rept.,
K. G. Kreider, and M. B. McNeil. Feb 77, 176p NBS-HB-121
Library of Congress catalog card no. 76-608201.

Keywords: *Energy conservation, *Heat recovery, *Manuals, Waste heat, Thermodynamics, Heat trans-

fer, Benefit cost analysis, Cost effectiveness, Systems analysis, Surveys, Reviewing, Glass industry, Furnaces, Regenerators, Gas plants, Rubber industry, Dairies, Dairy buildings, Canneries, Asphalt plants, Food processing, Food industry, Electrical industry, Incinerators, Boilers, Industrial plants, Industries, *Waste heat utilization, Industrial sector.

Sources of waste (i.e., discarded) heat in industrial processes are reviewed, and an overview of off-the-shelf technology available for its use is given. Discussions of waste heat measurement technology and economics are included, as are fourteen case studies of successful industrial waste-heat recovery installations.

708,673
PB-267 281/4 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Thermal Engineering Section.
Transpiration Heat Transfer in Thermal Energy Storage Devices,
B. A. Peavy, and W. E. Dressler. May 77, 32p
NBSIR-77-1237

Keywords: *Heat storage systems, *Heat transfer, Energy dissipation, Thermal efficiency, Sands, Water, Heat loss, Porous materials, Mathematical models, Performance evaluation, Waste heat, Solar heating, Solar water heating.

The storage of thermal energy at a suitable temperature level from sources such as solar energy or waste heat processes can make that energy available for space heating at a later time period. This report is concerned with sensible heat transfer that takes place in a thermal storage device composed of a porous material with a fluid (water) transpiring through it. Experiments were performed on a prototype thermal storage device and the results were compared to numerical values computed from an analytical model.

708,674
PB-268 340/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
DEPAF - A Computer Model for Design and Performance Analysis of Furnaces.
Conference paper 1 Jun 76-15 Jan 77,
J. Chi. 1977, 9p
Sponsored in part by Federal Energy Administration, Washington, D.C.
Pub. in Proceedings of Conference on AIChE-ASME Heat Transfer, Salt Lake City, Utah, 15-17 Aug 77, p1-9 1977.

Keywords: *Gas furnaces, *Computer programs, Computerized simulation, Residential buildings, Fossil fuels, Operating costs, Performance, Energy conservation, Fuel economy, DEPAF computer program, Computer aided design, Computer aided analysis.

The report covers the development of a computer simulation program DEPAF (Design and Performance Analysis of Furnaces) for residential fossil-fuel-fired furnaces. DEPAF is based upon an analytical model which accounts for cyclic (on-and-off) operation of furnace burner and blower. Transmission of heat at on-cycle uses the theory of radiative and convective heat transfer; transmission of heat at off-cycle uses the theories of turbulent and free convective heat transfer. Confidence in DEPAF was established by the use of available experimental data on a gas-fired forced-warm-air furnace. While the theory of transient heat transfer in combustion is complex in nature, theoretical results based upon quasi-steady-state analysis are in excellent agreement with experiments. If the building heat loss is known DEPAF can be used to calculate the annual performance and operating cost for residential heating systems with furnaces. Examples are given to illustrate applications of DEPAF to examine quantitatively the effect of design and operating variables on annual performance and operating costs of residential forced-warm-air furnaces. It was found that considerable savings in fuel and operating costs can often be achieved by performing certain modifications to existing furnaces.

708,675
PB-268 425/6 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Sensory Environment Section.
Some Institutional Factors Affecting MIUS - A Case Study and Annotated Bibliography.
Final rept.,
J. Elder. Jun 77, 66p NBSIR-76-1103
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Assistant Secretary for Policy Development and Research.

Keywords: *MIUS, *Total energy systems, *Bibliographies, Electric utilities, Project planning, Public opinion, Environmental impacts, History, Institutional factors.

This report considers some of the institutional factors which might affect the development and implementation of an innovative utility project and in particular of a Modular Integrated Utility System (MIUS). A case study of the planning and implementation stages of a major utility project was undertaken along with several studies of less complex utility projects. An annotated bibliography exploring the literature on institutional response to existing or proposed utility projects and to innovation in general is included.

708,676
PB-270 313/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Factors Affecting the Performance of a Residential Air-to-Air Heat Pump.
Final rept.,
W. H. Parken, R. W. Beausoliel, and G. E. Kelly. 1977, 11p
Sponsored in part by Federal Energy Administration, Washington, D.C.
Pub. in Proceedings Symp. on Seasonal Operating Performance of Central Forced Air Heating and Cooling Systems, ASHRAE Annual Meeting, Chicago, Illinois, February 13-17, 1977, ASHRAE Trans. 83, Part 1, p839-849 1977.

Keywords: *Heat pumps, Residential buildings, Space heating, Air conditioning, Heating load, Cooling load, Performance.

An experimental investigation was conducted to determine the performance of a 3-ton (1.055 E+04W) air-to-air heat pump. Coefficients of performance of the heat pump were determined in the laboratory under steady and cyclic conditions in both heating and cooling modes of operation for a range of simulated outdoor conditions. The results indicate a significent reduction in performance for both heating and cooling modes under cyclic operation. Full-load heating performance results were found to be slightly higher than the manufacturer's published ratings for outdoor temperatures above 42F (5.5C). The results show a lower heating capacity and coefficient of performance than the manufacturer's published ratings for outdoor temperatures ranging from 42F (5.55C) to 17F (-8.3C), tending towards agreement at the lower temperatures. This discrepancy in results for outdoor temperatures below 42F (5.5C) is due to the effects of frosting and defrosting of the outdoor coil.

708,677
PB-271 526/6 PC **A08**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Abstracted Reports and Articles of the HUD Modular Integrated Utility Systems (MIUS) Program.
Interim rept. 1970-Aug 76,
J. D. Ryan, and B. Reznek. Aug 77, 157p NBS-SP-489
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Assistant Secretary for Policy Development and Research.

Keywords: *MIUS, *Total energy systems, *Bibliographies, Energy conservation, Space heating, Air conditioning, Public utilities, Research projects, Abstracts, Modular integrated utility systems, Department of Housing and Urban Development, HUD-MIUS project.

This document provides a complete listing of reports and articles relating to the HUD-MIUS Program. Reports from 1970 through August, 1976 are included. The entry for each report contains an abstract and other pertinent information, including procurement sources and procedures. Reports are presented by 4 general subject categories: Program and Concept Description, Systems Analysis, Technology Evaluation, and Hardware Evaluation and Demonstration. The reports are further classified into 3 publication/availability categories: government publications (Published Reports), non-government publications and articles (Outside Publications) and unpublished reports and data (Open-File Reports).

708,678
PB-272 500/0 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Provisional Flat Plate Solar Collector Testing Procedures.
Interim rept.
Sep 77, 57p NBSIR-77-1305
Contract ERDA-EA-77-A-01-6010

Keywords: *Flat plate collectors, Tests, Performance, Reliability, Safety, Durability, Ratings, Criteria, *Solar collectors.

The test methods contained in this report and the provisional rating criteria presented in an appendix are intended for use in determining the thermal performance, and to aid in the assessment of the safety and durability/reliability of flat plate solar collectors. These test methods and rating criteria have been selected after the review of over 400 accepted industry standards and are consistent with the intent of the U.S. Department of Housing and Urban Development (HUD) Minimum Property Standards (MPS) and the Interim Performance Criteria (IPC) prepared by the National Bureau of Standards (NBS) for ERDA and HUD respectively. These test methods and rating criteria do not, however, represent a consensus of industry and are therefore provisional in nature. It is intended that revisions will be made as more experience is gained and inputs received from appropriate industry representatives, testing laboratories, designers, etc.

708,679
PB-275 131/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Method of Testing for Rating Thermal Storage Devices Based on Thermal Performance.
Final rept.,
J. E. Hill, G. E. Kelly, and B. A. Peavy. 1977, 12p
Sponsored in part by National Science Foundation, Washington, D.C.
Pub. in Solar Energy, v19 p721-732 1977.

Keywords: *Thermal energy storage equipment, Tests, Performance standards, Heat storage, Ratings, Reprints.

The paper describes a proposed test method for determining the effective capacity and heat loss characteristics of thermal storage devices. The prescribed series of tests should provide useful data for the rating of thermal storage devices based on thermal performance. The apparatuses and major components used in the tests have been prescribed so a liquid or air can be used as the transfer fluid. The series of tests to be conducted consist of one steady-state test to determine the heat loss characteristics and eight transient tests to determine the 'effective capacity' for both heat storage and heat removal. During the transient tests, the entering fluid temperature is changed in a step-wise manner and amount of energy either stored or removed over a specified test time is determined. Sample experimental data are given in the paper to demonstrate the concept of the transient tests.

708,680
PB-277 704/3 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of Energy Conservation.
Energy Management for Furnaces, Kilns, and Ovens.
Final rept.,
L. A. Wood, J. F. Ward, and K. G. Kreider. Jan 78, 47p NBS-HB-124
Library of Congress Catalog Card no. 77-608122.
Sponsored in part by Department of Energy, Washington, D.C.

Keywords: *Energy conservation, *Furnaces, *Kilns, *Ovens, *Handbooks, Net energy, Numerical analysis, Industries, Industrial plants, Thermal insulation, Heat recovery, Heat loss, Guidelines, Recommendations, Benefit cost analysis.

This handbook is a guide to making decisions as to just what actions are appropriate and effective for energy savings in equipment such as furnaces, kilns, and ovens. The major technique described is the heat balance. Examples of heat balances are used to identify energy losses on a batch furnace, a continuous paint dryer oven, and a slot forging furnace. Typical energy conservation opportunities in combustion control, insulation, etc. are discussed. Simplified methods of calculation and measurement are given. Benefit/cost analysis and the time required to recoup investment are described as means of evaluating energy-saving investments.

708,681
PB-280 107/4 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Method of Testing, Rating and Estimating the Seasonal Performance of Central Air Conditioners and Heat Pumps Operating in the Cooling Mode.
Final rept.,
G. E. Kelly, and W. H. Parken. Apr 78, 77p NBSIR-77-1271
Sponsored in part by Federal Energy Administration, Washington, D.C.

Keywords: *Air conditioners, *Heat pumps, Performance evaluation, Tests, Seasonal variations, Ratings, Operating costs, Efficiency, Residential buildings, Central air conditioners, Test and evaluation.

The National Bureau of Standards has made a study of the part-load and seasonal performance of residential central air conditioners and heat pumps operating in the cooling mode. This document outlines methods for testing and rating these units which account for the variation in performance due to part-load operation and change in outdoor air temperature. A calculation procedure is presented which can be used to estimate the seasonal performance and seasonal cost of operation of residential central-cooling equipment.

708,682
PB-280 586/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Oilburner Modification Cuts Costs.
Final rept.,
D. F. Quigley, and G. E. Kelly. Sep 77, 2p
Pub. in Fueloil Oil Heat, p50 and 52 Sep 77.

Keywords: *Oil burners, Furnaces, Residential buildings, Efficiency, Revisions, Burning rate, Heating, Reprints.

The paper discusses the results of a field study of residential oil heating systems. The study showed that most oil burners are overfired for the heating load. This overfiring causes low seasonal efficiencies. The article presents a method for optimizing firing rates for improved efficiency.

708,683
PB-283 428/1 PC **A06**/MF **A01**
NATO Committee on the Challenges of Modern Society, Brussels (Belgium).
Committee on the Challenges of Modern Society Rational Use of Energy Pilot Study Modular Integrated Utility Systems Project. Volume 1, Description, Activities, and Products.
Final rept.,
M. H. Nimmo, and C. W. Phillips. 1978, 105p NBSIR-78-1468-1, NATO/CCMS-74/1
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Div. of Energy, Building Technology and Standards. See also Volume 2, PB-283 429.

Keywords: *MIUS, *Technology transfer, *Meetings, Research projects, Forms(Paper), Data acquisition, Performance evaluation, Dictionaries, Methodology, Objectives, History.

This report includes a description of the project, its objectives, the chronology of the project, a description of its activities and products, copies of its products, and minutes of its meetings. This report further discusses the progress of each activity and product.

708,684
PB-283 429/9 PC **A07**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Center for Mechanical Engineering and Process Technology.
Committee on the Challenges of Modern Society Rational Use of Energy Pilot Study Modular Integrated Utility Systems Project. Volume 2. Minutes of Project Meetings.
Final rept.,
M. Nimmo, and C. W. Phillips. Jun 78, 147p NBSIR-78-1468-2, NATO/CCMS-74/2
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Div of Energy, Building Technology and Standards. See also Volume 1, PB-283 428.

Keywords: *MIUS, *Technology transfer, *Meetings, Research projects, Forms(paper), Data acquisition, International relations, Foreign governments, Proceedings, International information exchange.

This report includes a description of the project, its objectives, the chronology of the project, a description of its activities and products, copies of its products (appendices A-E), and minutes of its meetings. It further discusses the progress of each activity and product and gives the committee's recommendations. (Portions of this document are not fully legible)

708,685
PB-283 477/8 PC **A20**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
International Project Catalog of Modular Integrated Utility Systems,
M. H. Nimmo, and C. W. Phillips. Jul 78, 458p NBS-SP-515
Library of Congress Catalog Card no. 78-600056.

Keywords: *MIUS, *Indexes(Documentation), Total energy systems, Research projects, Project management, Project control, Research management, Space heating, Air conditioning, Electric power generation.

The International Project Catalog is a compilation of project descriptions on more than 200 Modular Integrated Utility Systems (MIUS) type of projects being conducted in the participating countries. Each Summary Form includes a description of the project, its status, the approach, expected results, some technical data, the principal investigator, an indication whether or not data is/or will be available, and other miscellaneous project information.

708,686
PB-284 491/8 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C.
Degradation of Gas-Fired Water Heaters.
Final rept.,
G. F. Sushinsky. Jun 78, 46p NBSIR-78-1460

Keywords: *Water heaters, Gas heaters, Degradation, Efficiency, Gas burners, Thermal efficiency, Deposits, Failure, Performance evaluation.

The energy efficiency degradation of gas-fired water heaters was measured in laboratory tests of old water heaters collected from different sections of the country. Three other forms of degradation (lifetime, safety, and performance degradation) were also identified. The causes and potential effects of each degraded condition were assessed through literature surveys. Supplementary laboratory evaluations were conducted in the areas of energy efficiency and performance degradation. Reductions in the recovery efficiency of water heaters of 5 percentage points were measured, while simulated performance declines in excess of 20 percent were noted. Larger decreases in recovery efficiency are expected for water heaters containing significant deposits of scale or sediment. (Portions of this document are not fully legible)

708,687
PB-285 021/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Seasonal Operating Performance of Gas-Fired Hydronic Heating Systems with Certain Energy-Saving Features.
Final rept.,
J. Chi. 1978, 10p
Pub. in Proceedings Center for Heating and Mass Transfer, Held at Dubrovnik, Yugoslavia on August 29-September 3, 1977. Paper in Energy Conservation in Heating, Cooling, and Ventilating Buildings 1 p495-504, 1978.

Keywords: *Hot water heating, *Computerized simulation, Boilers, Energy conservation, Performance evaluation, Residential buildings, Seasonal variations, DEPAB computer program.

DEPAB (Design and Performance Analysis of Boilers) is an NBS computer program for simulation of fossil-fuel-fired boilers for residential heating systems. It is based upon an analytical model which accounts for cyclic (on-and-off) operation of a boiler fuel burner and water circulating pump. The paper illustrates the use of DEPAB for evaluating quantitatively the effectiveness of several selected energy-saving features for gas-fired hydronic heating systems. Sufficient information is also provided to demonstrate the important factors of the simulation program DEPAB.

708,688
PB-285 650/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laboratory Investigation of a Stirling Engine-Driven Heat Pump.
Final rept.,
D. Didion, B. Maxwell, and D. Ward. 1978, 14p
Pub. in Proceedings International Conference Centre Heat and Mass Transfer, Dubrovnik, Yugoslavia, August 29-September 2, 1977, Paper in Energy Conservation in Heating, Cooling, and Ventilating Building, New Techniques in Heating and Cooling of Buildings 2, p583-596 1978.

Keywords: *Heat pumps, *Stirling cycle engines, Space heating, Residential buildings, Energy conservation, Performance evaluation.

An experimental investigation was conducted for an air-to-air heat pump powered by a single-cylinder, seven-horsepower, water-cooled Stirling engine. The steady-state part-load performance of the engine-driven heat pump system was determined in both the heating and cooling modes of operation. The unit was operated over a broad range of outdoor temperatures, and corresponding coefficients of performance (COP) and seasonal performance factors (SPF) were determined. The energy rejected to the engine's cooling water was measured and included in the heating mode calculations.

708,689
PB-287 410/5 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Economics and Regulatory Technology Div.
State-of-the-Art Study of Heat Exchangers Used with Solar Assisted Domestic Hot Water Systems (Potential Contamination of Potable Water Supply).
Final rept.
F. E. Metz, and M. J. Orloski. Oct 78, 82p NBSIR-78-1542
Sponsored in part by Department of Energy, Washington, DC. Assistant Secretary for Conservation and Solar Applications.

Keywords: *Heat exchangers, *Solar water heaters, Hot water heating, Solar water heating, Potable water, Contamination, Reviews, Interfaces, Heat transfer, Fluids, Toxicity, Corrosion, Standards, Additives, State of the art reviews.

The report presents the results of a non quantitative state-of-the-art with solar assisted domestic hot water systems where a heat exchanger interface exists between the potable water supply and heat transfer fluid. Emphasis is placed on the potential for contaminating the potable water supply if failures should occur. The study considers (1) characteristics of various heat exchanger types and their relative safety; (2) characteristics of heat exchanger fluids (toxicity, corrosivity, thermal properties, etc.); (3) regulatory considerations; and (4) designs of similar systems with potential for contamination.

708,690
PB-289 484/8 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Center for Building Technology.
Recommended Testing and Calculation Procedures for Determining the Seasonal Performance of Residential Central Furnaces and Boilers.
G. E. Kelley, J. Chi, and M. E. Kuklewicz. Oct 78, 111p NBSIR-78-1543
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Boilers, *Furnaces, Residential buildings, Performance tests, Performance evaluation, Seasonal variations, Computer programs, Fortran, Computation, Ratings, Operating costs, Efficiency, NBSFBS5 computer program, Fortran 5 programming language, Univac-1108 computers.

As part of the requirements of the Energy Policy and Conservation Act (PL 94-163) passed by Congress in December 1975, the Department of Energy (formerly Federal Energy Administration) directed the National Bureau of Standards to develop test procedures for certain covered consumer products, including residential central furnaces and boilers. This report summarizes NBS recommendations on how these central heating appliances may be tested in the laboratory and the resulting data used to calculate their annual fuel utilization efficiencies and annual operating costs.

708,691
PB-289 783/3 PC **A05**/MF **A01**

National Bureau of Standards, Washington, DC. Center for Building Technology.
Performance Guidelines for a Modular Integrated Utility System.
D. J. Mitchell. Nov 78, 93p NBSIR-78-1395
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology, and Standards.

Keywords: *Performance standards, Electric power, Electricity, Space heating, Potable water, Sewage treatment, Safety, Environmental impacts, Acceptability, Requirements, Guidelines, *MIUS, *Total energy systems, Water pollution control, Solid waste management.

This document defines generic performance of a MIUS serving a residential/commercial development. These performance requirements, criteria, and evaluations identify engineering parameters and other constraints associated with electrical service, thermal energy, solid waste management, potable water management, and wastewater management provided by a single, local, integrated source. There are also performance requirements, criteria, and evaluations for end-use considerations such as environmental impact, health, safety, and subjective acceptability.

708,692
PB-290 024/9 Not available NTIS
National Bureau of Standards, Washington, DC.
System Performance Measurements for a Packaged Solar Space Heating System Equipped with Air-Heating Collectors.
Final rept.
D. E. Jones. 1978, 10p
Sponsored in part by Dept. of Housing and Urban Development, Washington, DC.
Pub. in Proceedings of a Conference on Performance Monitoring Techniques for Evaluation of Solar Heating and Cooling Systems, Held at Washington, DC. on April 2-5, 1978, p105-114 1978.

Keywords: *Solar heating, *Space heating, Air heaters, Accumulators, Performance tests, *Solar space heating.

The paper describes the approach and instrumentation used at the National Bureau of Standards for determining system performance of a packaged solar space heating system equipped with air heating collectors. A method of measuring air flow rate accurately without disturbing system performance through use of the collector as a flow measuring element is the major unique feature of the experimental approach.

708,693
PB-290 030/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Experimental Validation of the Solar Simulation Program TRNSYS for a Solar Domestic Hot Water Heating System.
Final rept.
S. T. Liu, K. Shih, and B. D. Wood. 1978, 2p
Sponsored in part by Dept. of Energy, Washington, DC. Office of Conservation and Solar Applications.
Pub. in Proceedings of a Dept. of Energy (DOE) Symposium on Systems Simulation and Economic Analysis for Solar Heating and Cooling, Held at San Diego, CA., on June 27-29, 1978, p193-194 1978.

Keywords: *Hot water heating, *Solar heating, *Computerized simulation, Water heaters, Proving, Solar water heaters, TRNSYS computer program, Domestic energy.

The primary objective of a project currently underway at the National Bureau of Standards is to carry out experiments to validate the TRNSYS program for solar domestic water heating systems. Two approaches are being taken. One is to use the program to predict the performance of six representative solar water heating systems and then to gather long-term experimental data (12 months) on these systems in actual operation at an outdoor test site in Gaithersburg, MD. The second approach is to use a laboratory apparatus which has been designed around the typical components simulated in TRNSYS and to gather detailed short-term experimental data on the performance of these components when subjected to closely controlled experiments. The results are then compared with the predictions of TRNSYS for the same experiments. This paper presents some of the initial results of comparisons obtained using the laboratory apparatus and associated TRNSYS simulation. The specially-designed indoor test configuration will be described. Comparison of test results for several different combinations of hot water use schedule, piping configuration, and assumed solar collector output with those predicted by the applicable component models in TRNSYS under similar conditions will be shown. Emphasis has been placed on comparing the degree of temperature stratification in the storage tanks and heat loss from the tanks.

708,694
PB-290 675/8 PC **A03**/MF **A01**
Geiringer (Paul L) and Associates, Roslyn, NY.
Community Application of Integrated Energy/Utility Systems.
Oct 78, 34p
Contract DHEW-100-77-0014
Sponsored in part by National Engineering Lab. (NBS), Washington, DC. Center for Field Methods, and Department of Energy, Washington, DC. Div. of Buildings and Community Systems.

Keywords: Electric power generation, Solid waste disposal, Space heating, Sewage treatment, Water treatment, Planning, Reviewing, Feasibility, Systems analysis, Recommendations, Constraints, *Total energy systems, District heating, Waste heat utilization, Energy conservation, Integrated Energy/Utility System, IEUS system.

This report concludes four years of work at the Department of HEW on the Integrated Energy/Utility System project. Its purpose is to provide prospective IEUS participants with sufficient information to determine the feasibility of an IEUS project that would fit their specific needs. The report summarizes past studies made at the University of Florida and Central Michigan, and examines in detail the Burlington, Vermont study for lessons learned and recommendations on how to design and implement a successful IEUS project.

708,695
PB-291 441/4 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Guidelines for Evaluation of a MIUS Demonstration.
R. A. Grot, D. J. Mitchell, J. R. Schaefgen, A. C. Chao, M. E. Kuklewicz, and S. F. Weber. Dec 78, 46p NBSIR-78-1563
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: Electric power generation, Space heating, Potable water, Solid waste disposal, Guidelines, Experimental design, *MIUS, *Total energy systems, Waste water reuse, Co-generation, Waste heat utilization, Saint Charles(Maryland).

This document is a guideline for the development of a detailed evaluation plant for a MIUS facility which was planned for demonstration at St. Charles, Maryland. The generic types of technical, institutional, and economic issues are discussed. General performance measures for the total system and each subsystem are indicated. The classes of data that will be required and the types of data analyses to be employed are outlined.

708,696
PB-291 970/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Method for Estimating the Seasonal Performance of Residential Gas and Oil-Fired Heating Systems.
Final rept.,
J. Chi, and G. E. Kelly. 1978, 16p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in ASHRAE Trans., v84 pt1 p405-420, 1978.

Keywords: *Furnaces, *Space heating, Gas furnaces, Residential buildings, Efficiency, Seasonal variations, Performance evaluation, Oil furnaces, Reprints.

An evaluation procedure is described for estimating the seasonal efficiency of a gas- or oil-fired furnace which is located in an indoor heated space and uses conditioned air for combustion and draft control. It involves carrying out the following four tasks: (1) measuring the flue gas temperature and CO2 concentration during steady-state operation; (2) obtaining information on the shape of the flue gas temperature-vs-time curves as a unit cools-down and warms-up from steady-state conditions; (3) assigning values to various factors which describe the off-period air flow rate, the degree of furnace oversizing, and the effect of furnace operation on infiltration, and (4) carrying out the calculation procedure described herein to determine the various on-period and off-period losses and the seasonal efficiency of a furnace or boiler operating in a given climatic region. Several examples are worked out to illustrate the nature of this simplified procedure.

708,697
PB-292 363/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Testing of Water Tanks for Thermal Storage According to ASHRAE Standard 94-77.
Final rept.
B. J. Hunt, T. E. Richtmyer, J. E. Hill, and E. A. Franklin. 1979, 20p
Sponsored in part by Department of Energy, Washington, DC. Research and Development Branch for Solar Heating and Cooling.
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.) Transactions 85, Part 1, PH-79-5, n1 p20 1979.

Keywords: *Water tanks, *Tests, *Standards, *Heat storage, Solar heating, Evaluation.

The National Bureau of Standards proposed a standard test procedure for rating thermal storage devices in mid-1975. Early in 1977, the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) adopted ASHRAE Standard 94-77, Methods of Testing Thermal Storage Devices Based on Thermal Performance, which is based substantially on the NBS procedure. In order to evaluate the Standard, NBS has conducted an experiment in which a 1.9 cu m (500 gal) water tank, built as part of a residential solar heating and cooling system, was tested in accordance with this Standard. A description of the test apparatus, test procedure, and detailed test results are given. It was found that there were no major problems encountered in using the Standard for this kind of thermal storage device. In addition, suggestions are made for minor modifications in the Standard.

708,698
PB-292 770/5 PC **A08**/MF **A01**
System Planning Corp., Arlington, VA.
Real-Time Case History of ETIP Project 67 - Integrated Utility System Application.
Final rept.
J. G. Taylor, and L. Q. C. Lamar. Mar 78, 151p NBS-GCR-ETIP-78-59
Contract NBS-4-416151

Keywords: Site surveys, Planning, Constraints, Space heating, Electric power generation, Reviewing, *MIUS, *Integrated utility systems.

The major purpose of this report is to provide the real-time case history of ETIP Project 67--Integrated Utility System (IUS) and to provide the information that would permit lessons learned to be derived that, in turn, would be applicable to other ETIP projects. The Office of Facilities Engineering and Property Management (OFEPM) of the Department of Health, Education and Welfare initiated discussions with ETIP in 1973 to undertake a feasibility study and conceptual design of the Modular Integrated Utilities System (MIUS) for university/medical complexes. These discussions resulted in OFEPM submitting a proposal to ETIP in March 1974 requesting funds for the MIUS Application Project and the transfer of $220,000 by ETIP to OFEPM in June 1974. The IUS concept is on-site integration of five basic utility subsystems that serve building complexes: electrical power generation; heating and cooling; water supply; sewage treatment; and solid waste disposal.

708,699
PB-294 926/1 PC **A08**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Description of the Data Acquisition and Instrumentation Systems: Jersey City Total Energy Project.
C. Bulik, W. G. Rippey, C. W. Hurley, and D. E. Rorrer. Mar 79, 161p NBSIR-79-1709
See also Volume 7, PB-269 517. Sponsored in part by Department of Housing and Urban Development, Washington, DC. Assistant Secretary for Policy Development and Research.

Keywords: *Data acquisition, *Instrumentation, Temperature measuring instruments, Electric measuring instruments, Flowmeters, Meteorological instruments, Data processing, Photographs, Drawings, Design,

New Jersey, *Total energy systems, Jersey City(New Jersey).

This report describes the design and operation of the instrumentation system and the data acquisition system used to monitor the total energy plant and certain utility services to the site buildings. The report contains a description of the types, characteristics and locations of instruments used to measure physical variables. The capabilities and operational modes of the data acquisition system components are described in detail. The report also contains a brief description of the total energy plant and site, instrument costs, data processing procedures and some of the instrumentation problems encountered.

708,700
PB-296 482/3 PC **A06**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Data Reduction Processes for the Jersey City Total Energy Project.
D. E. Rorrer, W. G. Rippey, and Y. M. Chang. May 79, 118p NBSIR-79-1757
See also Volume 9, PB-294 926. Pub. as HUD Utilities Demonstration series Volume 10.

Keywords: *Data reduction, *Instrumentation, Data processing, Mathematical models, Computerized simulation, Temperature measuring instruments, Electric measuring instruments, New Jersey, *Total energy systems, Jersey City(New Jersey).

The major functions of the Jersey City total energy data editing and conversion software program developed by the National Bureau of Standards are described in some detail. Included are descriptions of the command structure, overall data flow, data editing, data conversions, error processing, and the creation of data output tapes for use in further analysis. The more important subroutines which are used to handle the individual operations are also discussed. The equations used in the calculation of engineering units are described, along with their derivations where appropriate.

708,701
PB79-600061 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Clothes Dryer Air Exchange.
A. J. Fowell. 1978, 3p
Pub. in Proceedings Conf. on Major Home Appliance Technology for Energy Conservation, West Lafayette, IN, Feb. 27-Mar. 1, 1978, p168-170 1978.

Keywords: *Appliance, Clothes dryer, Efficiency, Energy conservation, Heat recovery, Lint performance, Venting.

The opportunity for reducing the energy used in the clothes drying process is resented by utilizing periods of no heat or reduced heat drying coupled with provision for indoor or outdoor operation of the dryer inlet and exhause. The selection of the mode of operation is dependent on the time of year and build up of humidity in the house. The results of a pilot study on a clothes dryer coupled to the outdoors for both intake and exhaust are presented.

708,702
PB79-600062 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Field Performance of Gas and Electric Water Heaters.
R. A. Grot. 1978, 11p
Pub. in Proceedings Conf. on Major Home Appliance Technology for Energy Conservation, West Lafayette, IN, Feb. 27-Mar. 1, 1978, p110-120 1978.

Keywords: *Energy field measurements, Hot water heaters, Hot water usage, Residential water use.

The results of a field experiment for assessing the performance of gas and electric residential storage water heaters are presented. Energy requirements for hot water supply, hot water consumption and usage pattern data are presented and analyzed using statistical techniques in order to obtain average load curves and variations from the average. The effects of various retrofit measures such as wrapping the water heater with additional insulation and reducing the hot water temperature are assessed under actual usage conditions.

708,703
PB79-600063 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Utensil Interface for Electric Ranges.
C. P. Howard. 1978, 2p
Pub. in Proceedings Conf. on Major Home Appliance Technology for Energy Conservation, West Lafayette, IN, Feb. 27-Mar. 1, 1978 p9-10 1978.

Keywords: *Appliances, Cooking utensils, Energy conservation, Energy efficiency, Ranges and ovens.

An evaluation of utensil interface for electric ranges as a function utensil and surface unit designs is presented. Suggestions are made for improving utensil and surface until design to improve the interface.

708,704
PB79-600064 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Instrumentation Opportunities in Appliance Energy Conservation.
C. P. Howard. 1978, 2p
Pub. in Proceedings Conf. on Major Home Appliance Technology for Energy Conservation, West Lafayette, IN, Feb. 27-Mar. 1, 1978, p196-197 1978.

Keywords: *Appliances, Energy conservation, Energy instrumentation, Energy rate, Energy use.

The potential for energy conservation by providing energy rate and energy use instrumentation on major household appliances for consumer utilization is examinde. Those appliances which can be readily instrumented are identified.

708,705
PB80-103732 Not available NTIS
National Bureau of Standards, Washington, DC.
New Testing and Rating Procedures for Seasonal Performance of Heat Pumps.
Final rept.,
D. A. Didion. Sep 79, 11p
Pub. in Proceedings of the Carrier International Symposium on Heat Pumps and Space Conditioning in the 1990's Held at Syracuse, NY. on February 2-3, 1979, p37-47, Sep 79.

Keywords: *Heat exchangers, Performance tests, Performance evaluation, Seasonal variations, Standards, *Heat pumps.

Current Testing and rating procedures for heat pumps have served industry and the consumer well for many years. These steady-state (SS) full-load evaluation procedures allow for the capacity determination needed for sizing the unit to the building loads. They also serve as an efficiency evaluation for comparing the realtive merits of various units. However, with the need for energy conservation, and with increasing energy costs, buildings and their equipment have come to require a life-cycle-cost analysis instead of the traditional first-cost approach. In order to provide a better estimate of operational costs, the heat pump industry needs a more comprehensive evaluation technique to obtain data during part-load, cyclic operation. Although the wide variety of types of heat-pump installations and climates makes field performance impractical as a basis for this cost analysis, laboratory part-load simulation can increase the input for a reasonable testing investment. Part-load laboratory evaluation offers two added benefits; a more accurate estimate of energy usage on an absolute basis, hence a better comparison between heat pumps and other equipment, needed at least for the heating mode; and encouragement to manufacturers to develop a more efficient product, since they can get more credit for their innovations.

708,706
PB80-145212 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Energy Test Method Development for Electric Heat Pump Water Heaters.
Final rept. Mar 78-May 79,
C. A. Wan. Jan 80, 87p NBSIR-79-1951
Prepared for Department of Energy, Washington, DC.

Keywords: *Performance tests, *Water heaters, Heat pumps, Thermal efficiency, Legislation, Regulations, Revisions, Experimental design.

Modifications are proposed for the current U.S. Department of Energy test procedures for water heaters in order to make them applicable to electric heat pump water heaters. The modifications are in the areas of definitions and technical procedures. The latter includes the test conditions, test procedures and measurements, and calculations. Reasons for making these modifications and laboratory test data are provided to support the modifications in the technical procedures.

708,707
PB80-156904 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of ASHRAE Standard 94-77 for Testing Pebble-Bed and Phase-Change Thermal Energy Storage Devices.
Final rept.,
D. E. Jones, and J. E. Hill. 1979, 23p
Pub. in Proceedings of the ASHRAE Annual Meeting, Detroit, MI, June 1979, ASHRAE Trans. 85, Pt. 2, p607-620 1979.

Keywords: *Heat storage, Standards, Phase transformations, Pebble bed processors, Sodium sulfates, Hydrates, Recommendations, *Thermal energy storage equipment.

The American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) has recently adopted ASHRAE Standard 94-77 - Methods of Testing Thermal Storage Devices Based on Thermal Performance. Experiments have been completed at the National Bureau of Standards in which a 7 cu m (250 cu ft) pebble bed and a similarly-sized 264 MJ (250,000 Btu) phase-change unit utilizing sodium sulfate decahydrate, both using air as the transfer fluid, were tested in accordance with this Standard. A description of the test procedure, test apparatus, and detailed test results are given. Some problems were encountered in using the Standard for these kinds of thermal storage devices, and modifications to the Standard are recommended based on these experiments.

708,708
PB80-170525 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Recommended Guidelines for Safety Inspection of Construction of Concrete Cooling Towers.
H. S. Lew, S. G. Fattal, and B. J. Hunt. Feb 80, 37p NBSIR-80-1964
Sponsored in part by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Cooling towers, *Concrete construction, Safety, Inspection, Guidelines, Concrete structures, Regulations, Standards, Formwork(Construction), Hoists.

The guidelines furnished are based on existing OSHA regulations, but highlight their application to this type of construction by pointing out critical construction operations, their safety aspects, and needed compliance inspection procedures. Major regulatory provisions affecting the basic construction plans, safety aspects of design criteria and responsibilities, recordkeeping, and inspections are summarized. Special attention is given to construction loadings, construction sequences, hoisting systems, and personnel safety training. Detailed identification is made of items relating to concrete inspection, concrete control, formwork operations, construction loadings, hoisting systems, and construction safety planning.

708,709
PB80-221450 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparing Experimental and Computer-Predicted Performance of Solar Hot Water Systems.
Final rept.,
S. T. Liu, and A. H. Fanney. May 80, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in ASHRAE Jnl. 22, n5 p34-38 May 80.

Keywords: *Solar heating, Performance, Tests, Evaluation, Reprints, TRNSYS computer program, F-CHART computer program, SOLCOST computer program, Computer applications, Solar space heating, Solar water heating, Solar heating systems.

Currently three computer programs, TRNSYS, F-CHART, and SOLCOST, are being extensively used for the design and evaluation of solar space heating and domestic hot water systems. Although widely used, the accuracy of their predictions needs to be verified with experimental data. In order to provide data required for the validation of these computer programs for Solar domestic hot water systems, the staff of the National Bureau of Standards fabricated and in-

strumented six typical systems at its Gaithersburg, Maryland site. The systems have been operating since June, 1978. This paper describes the testing done, the experimental results, and compares the experimental results with the computer predictions for the first twelve months of operation.

708,710
PB80-223142 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Estimating the Heating Seasonal Operating Cost of Residential Hybrid Heat Pump Systems, Including Units Retrofitted to Oil, Gas and Electric Furnaces,
P. Domanski, and G. E. Kelly. Jul 80, 44p NBSIR-80-2090
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Heat pumps, Furnaces, Operating costs, Cost estimates, Cost analysis, Methodology, Mathematical models, *Hybrid systems, Retrofitting.

A method is presented for estimating the heating seasonal operating cost of a residential, hybrid heating system consisting of an electric heat pump and a warm-air furnace. The approach described is applicable to a heat pump/control system/gas or oil-fired furnace which is sold as a package or to a heat pump/control system which is intended to be added to an existing gas, oil, or electric furnace. Recommendations are made regarding how such systems can be rated and the type of information that would assist consumers in comparing the operating cost of a hybrid pump system with that of a conventional heat pump or furnace. Different control strategies are accounted for and examples are presented for estimating the heating seasonal operating cost of hybrid systems employing both single and two-speed compressors.

708,711
PB81-123564 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Procedures for Testing, Rating, and Estimating the Seasonal Performance of Engine-Driven Heat Pump Systems.
B. R. Maxwell. Sep 79, 61p NBSIR-79-1911
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Heat pumps, Space heating, Cooling systems, Buildings, Performance, Seasonal variations, Computation.

A generic test and rating procedure is developed for heat engine-driven air-to-air heat pump systems. The procedures are classified according to whether the systems have single-speed, two-speed, or variable-speed capability, and whether they are operating in the heating or cooling mode. The test requirements generally consist of a series of steady-state tests to establish the impact of outdoor temperature on performance, two or more part-load (cyclic) tests to determine the effect of 'on-off' cycling, two steady-state intermediate speed tests to determine part-speed performance, and a single frost accumulation test to estimate the effect of frost. A generalized calculation and rating procedure is developed. The system is rated in both modes based upon its steady-state performance at the ARI standard rating points, its seasonal performance factor, and its seasonal operating cost. A frost degradation coefficient is also established. The seasonal parameters are based upon either a residential or commercial/industrial building application which is located in either a generalized northern or southern climate.

708,712
PB81-158230 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Laboratory Study of a Gas-Fired Condensing Boiler.
Final rept.
G. E. Kelly, and M. E. Kuklewicz. Nov 80, 40p NBSIR-80-2094
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Boilers, Hot water heating, Residential buildings, Gas furnaces, Performance tests, Efficiency, Pulse combustion.

As a part of the Department of Energy's energy conservation program for consumer products, the National Bureau of Standards (NBS) developed test procedures for conventional gas- and oil-fired furnaces and boilers. The Department of Energy (DoE) published their finalized version of these procedures in the Federal Register on May 10, 1978. In an effort to update and refine these test procedures, DoE directed NBS to develop a method of testing condensing furnaces and boilers which could be used to compare the annual performance of condensing and non-condensing residential heating systems. This report summarizes the laboratory tests of a gas-fired pulse-combustion condensing boiler that were carried out as a part of the development effort.

708,713
PB81-197030 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Recommended Testing and Calculation Procedures for Estimating the Seasonal Performance of Residential Condensing Furnaces and Boilers.
Final rept.
G. E. Kelly, and M. E. Kuklewicz. Apr 81, 100p NBSIR-80-2110
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Boilers, *Furnaces, Space heating, Residential buildings, Performance tests, Thermal efficiency, Computer programs, Operating costs, Computation, Rating, Data, *Condensing furnaces, NTISCOMNBS, NTISDE.

Procedures are developed for testing and rating the performance of residential central furnaces and boilers of the condensing type. The test procedure is similar to one developed by the National Bureau of Standards for the Department of Energy covering non-condensing central heating equipment, except that it requires slightly tighter control of the laboratory temperature, a return water temperature of 120F (48.9C) with a 20 degree Fahrenheit (11.1 degree celsius) water temperature rise for hot water boilers, and offers an optional test procedure for condensing units having no off-period losses. The rating procedure provides a method for estimating the steady-state, part-load and annual fuel utilization efficiencies of condensing furnaces and boilers.

708,714
PB81-240608 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Using Microcomputers to Monitor the Field Performance of Residential Heat Pumps.
C. W. Hurley, G. E. Kelly, and P. A. Kopetka. Jun 81, 119p NBSIR-81-2285
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Heat pumps, Data acquisition, Performance evaluation, Monitoring, Field tests, Performance tests, Computer programming, *Microprocessors.

This report describes the procedures, instrumentation, and microprocessor-based data acquisition system (DAS) used for evaluating the field performance of three residential heat pumps located in the Washington, DC area. The instrumentation, signal conditioning unit and DAS are described in detail.

708,715
PB82-133810 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Engineering Economic Analysis of Improved Heat Pump Performance for Minimum Standards Development.
Final rept.
S. R. Petersen, K. A. Barnes, and G. E. Kelly. Jul 81, 68p NBSIR-81-2241
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Heat pumps, Performance standards, Standardization, Performance evaluation, Cost effectiveness, Optimization.

This report provides a methodology and seasonal performance data that could be used in the development of a reference basis for minimum efficiency standards for heat pumps that are economically justified on a life-cycle basis. Criteria for economic optimization are outlined. The methodology used to compute seasonal heating and cooling performance ratings and the annual energy savings resulting from efficiency improvements, by climate region, is detailed. The interdependence between efficiency ratings in the heating and cooling modes is explored using statistical analysis. An example of the procedure for determining maximum cost effective efficiency levels is demonstrated for a 36,000 Btu/h heat pump.

708,716
PB82-139361 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
NBS/ESDS - A Computer Model for the Simulation of Hot Water Systems.
C. A. Wan. Sep 81, 65p NBSIR-81-2303

Keywords: *Water heaters, Mathematical models, Computerized simulation, Potable water, Heat loss, Distribution systems, Heat transfer, Water distribution.

A computer model, entitled NBS/ESDS, has been developed using a finite difference method to simulate the generation, storage and distribution of a hot water system commonly found in many residences, commercial facilities or industrial facilities. The conduction heat equation which governs the heat transfer in the water heater during all modes of operation, and the heat transfer in the distribution pipe network during its cool-down periods, is solved. A solution is also obtained for the pipe flow equation which governs the heat transfer in the distribution pipe network during the draw periods. Thermal stratification of water is modeled. A plug flow model is used to simulate the draw of heated water from the water heater. A parametric study is also conducted on a given hot water system for a given draw schedule during a 24-hour period. The effects studied include insulating the hot water heater, insulating the distribution pipe, and incorporating a heat trap. Effects of concentrating the distributed draws to two short periods of time of the day on the hot water delivery and the heat loss with the same energy consumption are also studied.

708,717
PB82-161449 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of Energy Test Methods for a Dedicated Water-Heating Heat Pump.
C. A. Wan, R. L. Palla, and J. E. Harris. Jan 82, 54p NBSIR-81-2372
Sponsored in part by Department of Energy, Washington, DC., and Oak Ridge National Lab., TN.

Keywords: *Heat pumps, *Hot water heating, Tests, Energy use, Energy consumption, Energy conservation.

Modifications of the DOE test procedure for water heaters Uniform Test Method for Measuring the Energy Consumption of Water Heaters were made to include a dedicated water heating heat pump, system equipped with a 50 gallon electric water heater tank. Also presented are laboratory tests and results which provided the basis for the test methods used. Tests included determination of recovery efficiency, standby loss, and water heater jacket loss -- all under static or no-draw conditions -- and a synamic test in which water is withdrawn according to a 'typical-use' schedule. Energy requirements predicted by the proposed (static) procedure were in good agreement with measured energy consumption for the dynamic test in limited testing.

708,718
PB82-179029 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Economic Efficiency in the Sizing of Residential Heat Pumps.
Final rept.
J. Levy, and S. R. Petersen. Jul 81, 75p NBSIR-80-2176
Sponsored in part by Department of Energy, Washington, DC. Office of Building and Community Systems.

Keywords: *Heat pumps, Residential buildings, Selection, Benefit cost analysis, Energy conservation.

This report provides a methodology for determining the optimal heat pump size, in terms of heating output capacity, for residential installations having annual heating requirements significantly greater than annual cooling requirements. The optimal size heat pump is defined as the size for which total present value, life-cycle heating and cooling costs (including equipment costs) are minimized. Incremental energy savings from increasing the output capacity of the heat pump are

calculated using hourly simulation models of heat pump and building performance developed at NBS. The dollar value of the incremental savings, in present-value, life-cycle terms, is then calculated and compared with incremental costs to determine the optimal heat pump size. A base case analysis of an 1800 square-foot house in the Chicago climate shows that a slightly larger heat pump size than would typically be selected for air conditioning purposes alone is optimal for the assumptions specified. A number of sensitivity analyses are performed to show the effects of changes in load size, degradation coefficients, power utilization efficiency, economic assumptions and geographic location on the optimal heat pump size.

708,719
PB82-179037 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Simulated Service Testing for Corrosion in Solar Heating and Cooling Systems.
P. W. Brown, and J. W. Grimes. Sep 81, 35p NBSIR-81-2339
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Solar heating systems, Tests, Corrosion, Aluminum, Copper, Stainless steels, Glycols, Stability, *Solar collectors, Solar cooling systems, Heat transfer fluids.

This study was undertaken to evaluate a proposed ASTM simulated service test methodology to evaluate corrosion or heat transfer liquid degradation. The responses of aluminum, copper, and stainless steel to conditions simulating flow and stagnation in solar collector systems were evaluated. The chemical stabilities of ethylene and propylene glycol solutions at elevated temperature were also examined.

708,720
PB82-234857 Not available NTIS
National Bureau of Standards, Washington, DC.
HVAC Control Process Simulation.
Final rept.
B. A. Borresen. 1981, 12p
Sponsored in part by Department of Energy, Washington, DC., Civil Engineering Lab. (Navy), Port Hueneme, CA., and Norwegian Inst. of Technology, Trondheim. Pub. in Proceedings of ASHRAE 1981 Annual Meeting, Cincinnati, Ohio, Jun 28-July 1, 1981, ASHRAE Transactions 87, part 2, p871-882 1981.

Keywords: *Feedback control, *Air conditioning, Simulation, Buildings, Methodology, Heating, Ventilation.

The paper discusses the simulation of closed loop control systems and develops a methodology for modeling non-linear systems. The simulation is primarily characterized by a 'chaining process' and a 'transition process.' In the chaining process, all the elements in the system are coupled together and all non-linearities are accounted for. During the transition process, all the elements are decoupled, the inputs are held constant, and the outputs are calculated for one time step in the future. The primary structure of the simulation model is built up around time constants, transport delays and non-linear elements. The transition values are calculated based upon the response of elements with a single time constant to a step change in input. Both a linearized and an exponential approach are discussed. Simulation errors are presented as a function of time step size for both approaches using frequency responses. The usefulness of this simulation methodology is illustrated by presenting some results obtained by modeling the performance of a steam heated air coil controlled by an adaptive control algorithm. This example includes the steam valve, steam trap, and condensate build-up in the coil and is extremely nonlinear.

708,721
PB82-260456 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Economic Evaluation of Solar Energy Systems in Commercial Buildings: Methodology and Case Studies.
Final rept.
R. T. Ruegg, G. T. Sav, J. W. Powell, and E. T. Pierce. Jul 82, 207p NBSIR-82-2540
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Commercial buildings, Economic analysis, Computer programs, Methodology, Optimization, Computerized simulation, Solar energy, *Solar heating systems, Solar water heating, Solar space heating, Case studies.

This report develops a comprehensive economic optimization model for evaluating the economic feasibility of active solar energy systems to provide service hot water and combined space heating/service hot water in commercial buildings. The model is demonstrated in a number of case studies for office buildings and retail stores. Data and assumptions for use in the model are compiled for the selected case studies. Using these data, the model is applied to estimate present value net savings (or net losses) of the solar energy systems over a 20-year life cycle. Break-even values for hot water loads, solar energy system costs, and current and future energy prices are also calculated to determine the minimum conditions under which the solar energy systems become cost effective for the selected buildings. Economic optimization paths which show the optimal solar collector areas and the corresponding present value of net savings (or net losses) associated with a range of hot water loads are developed in the case studies. Sensitivity analysis is conducted for key variables. The relationship between total live-cycle costs and the solar fraction is tested for selected cities to demonstrate how net savings (net losses) change as the solar fraction is increased.

708,722
PB82-264078 Not available NTIS
National Bureau of Standards, Washington, DC.
Development of Equipment Seasonal Performance Models for Simplified Energy Analysis Methods.
Final rept.
T. Kusuda, T. Alereza, and L. Hovander. 1982, 13p
Prepared in cooperation with Department of Energy, Washington, DC.
Pub. in American Society of Heating, Refrigerating and Air-Conditioning Engineers Transactions Paper No. 2715, 82, Pt. 2, 13p 1982.

Keywords: *Mathematical models, *Furnaces, *Heat pumps, *Air conditioners, Computation, Seasonal variations, Performance, Reprints, *Energy analysis.

In pursuit of development of simplified energy calculation methodologies, seasonal performance models for residential heating and cooling systems were developed. Previous studies have shown that the variable-base degree-day (VBDD) method renders results close to those generated by hourly models, such as DOE-2. However, the results included only heating and cooling loads, not the energy use. The objective of this research was to develop a method for calculation of seasonal performance of residential HVAC equipment while it could be used within the framework of variable-base degree-day method. Using the results of DOE-2 on 60 residences representing 10 climatological conditions, seasonal performance models were developed for gas and oil furnaces, air conditioners, and heat pumps. These models utilize the heating and cooling loads calculated by VBDD, equipment specifications, and weather information, to calculate the seasonal efficiencies COP's for residential HVAC equipment. Results obtained using these seasonal models were mainly within 5 percent of those calculated hourly by DOE-2.

708,723
PB82-264458 Not available NTIS
National Bureau of Standards, Washington, DC.
Diffraction of Medium and Long Wavelength Horizontally Polarized Shear Waves by Edge Cracks.
Final rept.
S. K. Datta, A. H. Shah, and C. M. Fortunko. Apr 82, 8p
Sponsored in part by Department of Transportation, Washington, DC. and United Engineering Center, New York.
Pub. in Jnl. of Applied Physics 53, n4 p2895-2902 Apr 82.

Keywords: *Ultrasonic tests, *Acoustic scattering, Ultrasonic radiation, Nondestructive tests, Cracks, Secondary waves, Electroacoustic transducers, Reprints.

Scattering of horizontally polarized shear (SH) waves by edge cracks of length l and of different orientations relative to the free surface of the half-space is studied. A combined finite element and analytical technique is presented that is suitable for analyzing scattering by cracks or inhomogeneities in a semi-infinite elastic medium. Attention is focused in the range of wavelengths, lambda, when the ratio, l/lambda is $<$ or $=$ 1/2. Numerical results are presented for crack opening displacements and scattered fields on the surface when the medium is homogeneous or when the crack is located in an insert with different material properties. Comparison of the theoretical solution is also made with available experimental results. The experimental results are obtained using electromagnetic-acoustic transducers (EMAT's) that can efficiently generate and detect low frequency SH-waves in metals. The results are applicable to sizing and characterization of weld defects. Recent experimental evidence suggests that this can be accomplished when the wavelength is of the order of twice the crack length or longer.

708,724
PB83-111641 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Abstracted Reports and Articles of the HUD Modular Integrated Utility Systems (MIUS) Program, Supplement 1.
Special pub.
M. H. Nimmo, and B. Reznek. Aug 82, 123p NBS-SP-489-SUPL-1
Library of Congress catalog card no. 82-600571. Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research. See also PB-271 526.

Keywords: Space heating, Air conditioning, Public utilities, Research projects, Abstracts, *MIUS, *Total energy systems, *Modular integrated utility systems, Energy conservation.

This document provides an additional listing of reports and articles relating to the HUD-MIUS Program. Reports published and selected since the issuance of NBS SP-489 are listed. Also included, for the sake of completeness, are some earlier reports which had not been included in the original NBS SP-489. Both NBS SP-489 and this document are required for full coverage. The entry for each report contains an abstract and other pertinent information, including procurement sources and procedures. Reports are grouped by four general subject categories: Program/Concept Description; Systems Analysis; Technology Evaluation; and Hardware Evaluation and Demonstration. The reports are further classified into three publication/availability categories: government publications (Published Reports); non-government publications and articles (Outside Publications); and 'informal' reports and data (Open-File Reports). An overall subject index has been included which covers both NBS SP-489 and this document.

708,725
PB83-122663 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Performance Criteria for Solar Heating and Cooling Systems in Residential Buildings.
Building science series (Final).
Sep 82, 240p NBS-BSS-147
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research. Library of Congress catalog card no. 82-600581.

Keywords: *Solar heating, Performance, Standards, Residential buildings, Criteria, *Solar cooling systems.

This performance criteria, developed for the Department of Housing and Urban Development, is a baseline document for criteria and standards for the design, development, technical evaluation, and procurement of solar heating and cooling systems for residential buildings in accordance with the requirements of Section 8 of Public Law 93-409, the 'Solar Heating and Cooling Demonstration Act of 1974.' The document is intended to establish minimum levels of performance with regard to health and safety and the various aspects of technical performance. The criteria for health and safety put primary emphasis on compliance with existing codes and standards. The criteria on thermal and mechanical performance, durability/reliability and operation/servicing present performance requirements considered to be representative of acceptable levels.

708,726
PB83-137778 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.

Method of Testing, Rating and Estimating the Seasonal Performance of Ground-Water-Source Heat Pumps.
W. J. Mulroy. Nov 82, 60p NBSIR-81-2434
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Heat pumps, Tests, Ratings, Operating costs, Air conditioning equipment, Seasonal variations.

The National Bureau of Standards has made a study of the part-load and seasonal performance of residential ground water source heat pumps operating in both heating and cooling modes. This document outlines methods for testing and rating these units which account for the variation in performance due to part-load operation and change in source water temperature. A calculation procedure is presented which can be used to estimate the seasonal performance and seasonal cost of operation of residential ground water source heat pumps.

708,727
PB83-142042 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Adaptive Algorithm for the Control of a Building Air Handling Unit.
C. Park, and A. J. David. Nov 82, 50p NBSIR-82-2591
Sponsored in part by Department of Defense, Washington, DC., and Department of Energy, Washington, DC. Office of Building and Community Systems.

Keywords: *Automatic control, *Heating, *Cooling systems, Adaptive systems, Algorithms, Controllers, Buildings, Digital systems, Subroutines, Microprocessors, Computer applications.

The use of adaptive control algorithms was studied for microprocessor driven direct digital control of elementary heating and cooling subsystems. An algorithm was designed for digital regulation of a linear, time-invariant first-order system with a system dead time. A recursive least squares algorithm was used to estimate, on-line, the parameters of the time-invariant linear system. The parameter estimates were then used to calculate the feedback gains of a Proportional plus Integral (PI) controller.

708,728
PB83-162032 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Thermal Comfort Conditions in the NBS/DoE (National Bureau of Standards/Department of Energy) Direct Gain Passive Solar Test Facility.
S. T. Liu. Dec 82, 50p NBSIR-82-2621
Contract DE-A101-76PRO6010

Keywords: *Solar heating, Comfort, Test facilities, Space heating, Human factors engineering, Environmental engineering, Standards, *Thermal comfort, *Passive solar heating systems.

The thermal comfort conditions in a direct gain cell of the NBS/DoE passive solar test facility were analyzed in accordance with the criteria specified in the recently revised ASHRAE Comfort Standard 55-1981, using test data collected during the month of October 1981 and the month of January 1982. It was found that the daytime operative temperature (as measured by the black globe temperature sensors) in an area near the large south glazing exceeded the upper boundary of the ASHRAE comfort envelope by a large amount in a clear day during both the thermal transition month of October and the cold winter month of January. The generally accepted method of computing the mean radiant temperature based only on the interior surface temperatures was found to produce large errors. The reflected solar radiation from the interior surfaces and the snow covered ground was believed to play a significant role on the measured black globe temperature and should be included in the computation of the mean radiant temperature for a space with large glazed areas.

708,729
PB83-179010 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Field Test Results on the Performance of a Refrigerator-Freezer in a Single-Family Residence.
R. A. Wise. Feb 83, 25p NBSIR-83-2653
Sponsored in part by the Department of Energy, Washington, DC.

Keywords: *Performance evaluation, *Refrigerators, *Freezers, Refrigerating machinery, Defrosting, *Single family houses, Energy use.

The operation of a side-by-side 623 L (22 cubic foot) refrigerator-freezer in use in a single family residence was continuously monitored for over two years. During this time, the daily cumulative number of freezer and fresh-food door openings, icemaker operations, defrost cycles, and compressor cycles were recorded.

708,730
PB83-222703 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Performance of Add-On-Type Heat Pump Water Heaters Using Two Different Test Methods.
J. E. Harris. Jun 83, 34p NBSIR-83-2723
Sponsored in part by the Department of Energy, Washington, DC.

Keywords: *Water heaters, *Heat pumps, Storage tanks, Energy dissipation, Computer programs, Temperature gradients, *Energy conservation.

Two different makes of add-on (without tank) heat pump water heaters (HPWH) were tested. Each of the HPWH's was subjected to a series of recovery tests similar to the Department of Energy (DOE) recovery test for conventional electric water heaters. The results of the tests (recovery efficiency, standby loss, input power, storage tank capacity and energy used) were used to compute an energy factor which could be used to calculate the estimated annual operating cost of such HPWH's. The energy factor was also determined by a series of simulated use tests consisting of four equal draws totaling 64.3 gallons of hot water per day.

708,731
PB84-182146 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Laboratory Evaluation of the Steady-State and Part Load Performance of Absorption Type Heating and Cooling Equipment.
R. Radermacher, M. McLinden, S. Klein, and D. Didion. Mar 84, 93p NBSIR-84-2816
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Heat pumps, *Water chillers, Flow rate, Temperature gradients, Cooling load, Mathematical models, Valves, Seasonal variations, Computer applications.

In this investigation, an absorption water chiller and an absorption heat pump were extensively tested under steady-state and cyclic operating conditions. Since the tests were performed on two different units, one for a cooling only and one for a heating only application, the report is set up in two parts discussing the results of the testing of each unit separately.

708,732
PB84-221647 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Electromagnetic-Acoustic Transducer Arrays for Nondestructive Evaluation of Thick Metal Sections and Weldments.
Final rept.
C. M. Fortunko, and R. E. Schramm. 1983, 24p
Sponsored in part by Naval Sea Systems Command, Washington, DC. and Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings of Review Progress in Quantitative Non-Destructive Evaluation held at San Diego, California on August 1-6, 1982, p283-307 1983.

Keywords: *Ultrasonic tests, *Transducers, Arrays, Nondestructive tests, Welded joints.

A new type of electromagnetic-acoustic transducer (EMAT) has been developed that may be particularly suitable for use as an element of ultrasonic arrays. The new transducer can generate and receive compact ultrasonic pulses that exhibit a component of polarization parallel to the free surface. In the plane of symmetry that is normal to the free surface and bisects the EMAT (the sagittal plane), the ultrasonic signals generated by the new transducer are SH waves. In addition, the new transducer can effecently receive ultrasonic signals from a very wide range of direction in the sagittal plane. This property is required to realize very long synthetic aperture lengths, which are needed to maximize the transverse resolution of ultrasonic inspection systems. The focusing performance of different linear synthetic array configurations using the new EMAT is compared analytically with that of a linear end-fire system using periodic-permanent-magnet (PPM) EMATs that have been used in the past in weld inspection. The advantages and inherent limitations of such systems are examined using analytical and numerical methods.

708,733
PB84-224344 PC **A11**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
Performance Criteria for Solar Heating and Cooling Systems in Commercial Buildings.
Final rept.
Apr 84, 232p NBS/TN-1187
Contract DE-AI01-76PRO6010
Also available from Supt. of Docs as SN003-003-02579-8.

Keywords: *Solar heating, Commercial building, Design, Development, Technology, Performance, Criteria, Solar water heating, Solar space heating, Solar air conditioning.

This document establishes baseline criteria for the design, development, technical evaluation and procurement of solar heating and cooling systems for commercial buildings. These performance criteria were developed in accordance with Public Law 93-409 the 'Solar Heating and Cooling Demonstration Act of 1975.' The document is intended as a resource for use in establishing minimum acceptance levels of performance for solar heating and cooling systems. Criteria which deal with public health and safety are in compliance with general building codes and standards. The criteria on thermal and mechanical performance, durability/reliability and operation/servicing present performance requirements considered to be representative of acceptable levels for conventional space conditioning equipment. By the use of performance language in the document, it is believed that sufficient latitude has been provided to allow innovation and flexibility that is essential for the stimulation of a viable solar industry.

708,734
PB84-225549 Not available NTIS
National Bureau of Standards, Washington, DC.
Inversion of Eddy Current Signals in a Nonuniform Probe Field.
Final rept.
F. Muennemann, B. A. Auld, C. M. Fortunko, and S. A. Padget. 1983, 26p
Sponsored in part by Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH.
Pub. in Proceedings of Review of Progress Quantitative Nondestructive Evaluation, University of California, San Diego, California, 1-6 August 1982, n2B p1501-1526 1983.

Keywords: *Eddy current tests, Nondestructive tests, Born approximation.

The authors present a simple analytical method for predicting the eddy current signal produced by a surface flaw of known dimensions, when interrogated by a probe with spatially varying magnetic field. The model is easily parameterized, and we use it to construct inversion schemes which can extract overall flaw dimensions from multi-position, multifrequency measurements. The method is a type of Born approximation, in which the authors assume that the probe's magnetic field at the mouth of the flaw can be used as a boundary condition on the electromagnetic field solutions inside the flaw. To simplify the calculation the authors have chosen a 'rectangular' 3-dimensional flaw geometry for our model. The authors describe experimental measurements made with a new broadband probe on a variety of flaws. This probe operates in a frequency range of 200 kHz to 20 MHz and was designed to make the multifrequency measurements necessary for inversion purposes. Since inversion requires knowledge of the probe's magnetic field shape, the authors describe experimental methods which determine the interrogating field geometry for any eddy current probe.

708,735
PB84-226075 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.

Performance and Selection Criteria for Mechanical Energy Saving Retrofit Options for Single-Family Residences.
E. Kweller, and S. Silberstein. Jun 84, 77p NBSIR-84-2870
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Residential buildings, *Heating systems, Houses, Water heaters, Heat pumps, Space heating, Insulation, Weathering, Performance evaluation, Standards, Cost analysis, Furnaces, Oil burners, Gas furnaces, *Energy conservation, Renewable energy sources, Waste heat utilization.

Under the Weatherization Assistance Program the U. S. Department of Energy (DoE) provides funds for energy-conserving building improvements in homes of low-income persons. In proposing to modify the program to also provide funds for energy-conserving mechanical options, DoE requested that the National Bureau of Standards investigate energy-conserving mechanical options that may be suitable for inclusion in the Weatherization Assistance Program. This report estimates energy savings, and provides performance and selection criteria, standards, and installed costs for mechanical equipment options for single-family homes; all from prior studies reported in the literature. Performance and selection criteria are presented as advantages, disadvantages and limitations for each option. Four broad categories of energy-saving mechanical options were investigated: space heating, water heating retrofit options, heat pump water heaters, and recovery of central air conditioner waste heat by desuperheaters. Gas- and oil-fueled forced-air furnaces and hydronic (hot water) space-heating equipment were treated in this report.

708,736
PB84-241496 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Building Equipment Div.
Test Results and a Recommended Test Procedure for Heat Traps.
J. E. Harris. Mar 84, 30p NBSIR-84/2851
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Water heaters, Gas appliances, Tests, Heat loss, Traps, Performance evaluation, *Energy conservation, *Heat traps, Procedures.

A series of standby loss tests was conducted on a 40 gallon gas water heater to determine the standby losses and the variability of those losses. Tests were run with both inlet and outlet plugged and insulated to determine the jacket losses, then tests were conducted with bare and insulated, vertical copper pipe, with and without heat traps. It was determined that the variability of the heat losses was large enough to conclude that the possible heat loss reduction by the use of heat traps could not be accurately detected and therefore the effectiveness of heat traps could not be accurately tested on gas water heaters. A recommended test procedure for heat traps was developed using a water heater simulator and then a number of tests were conducted with four different heat traps, in a variety of pipe sizes and material, bare and insulated, in vertical and horizontal orientations. It was recommended that the water heater simulator be used for any heat trap testing. It was also recommended that the heat trap credits currently given in the DOE water heater test procedure be dropped since any benefit of heat traps will be shown by the test results.

708,737
PB84-243997 Not available NTIS
National Bureau of Standards, Washington, DC.
Procedures for Determining Annual Efficiency for Furnaces and Vented Household Heaters with Modulating-Type Controls.
Final rept.
E. Kweller. Jun 83, 18p
Pub. in ASHRAE Transactions 89, Pt. 1-B, p301-318 Jun 83.

Keywords: *Furnaces, *Heating equipment, *Modulators, *Combustors, Households, Performance evaluation, Design criteria, Ignition time, *Energy conservation, Consumer products, Procedures.

As annual operating efficiency of vented heating equipment is affected by burner fuel and combustion air modulation, it is important to differentiate between the various types of controls in determining annual energy requirements. Test procedures for evaluating annual efficiency have already been developed and implemented by the Department of Energy (DOE) for furnaces with single-stage thermostat control. A modified test procedure is necessary to account for operation with fuel modulation. A revised procedure that accommodates two types of fuel-modulating controls has recently been developed. Tests are conducted at reduced and maximum firing rates, and part-load efficiencies for the two firing rates are calculated and weighted to obtain a weighted annual efficiency. A analysis of weather data is used to obtain outdoor average temperatures for calculating infiltration losses and for the weighting fractions used. These test methods and calculation procedures are based on and are an extension of the current DOE test procedures for the single-stage type of thermostat control of central warm air furnaces.

708,738
PB85-102788 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermographic Inspection of Exterior Wall Insulation Retrofits.
Final rept.
R. A. Grot, and Y. M. L. Chang. 1983, 16p
Sponsored in part by American Society for Testing and Materials, Philadelphia, PA., Department of Energy, Washington, DC. and Oak Ridge National Lab., TN.
Pub. in Proceedings of Thermal Insulation, Materials, and Systems for Energy Conservation in the 1980's, Clearwater, FL., December 8-11, 1981, p321-336 1983.

Keywords: *Heat loss, *Houses, Airtightness, Thermal insulation, Quality control, Analysis of variance, Houses, Thermal measurements, Low income groups, Defects, Reprints, Retrofitting, Weatherization.

A national demonstration of the effectiveness of an optimal weatherization program for low-income families was conducted by the Community Services Administration and the National Bureau of Standards. Of the original 200 some homes as participants, over 100 single-family dwellings in 12 cities in the continental United States were retrofitted and inspected with thermography equipment. The weatherization techniques included air infiltration reducing measures such as caulking & weatherstripping, additional attic insulation, storm windows, exterior wall insulation, basement/crawl space insulation, & modification or replacement of the heating systems. In order to assess the quality of the workmanship of the energy reducing measures applied to the building envelope, and in particular the quality of the installation of cavity wall insulation, thermographic surveys were performed after the completion of the weatherization work.

708,739
PB85-109627 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Building Equipment Div.
Fortran 77 Computer Program for Test Procedure Calculations of Vented Heaters.
R. A. Wise, and F. C. Parsons. Sep 84, 53p NBSIR-84/2918
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Space heaters, *Computer programs, Tests, Fortran, Vented heaters.

The Fortran 77 computer program described in the report is to be used to calculate results from tests run on vented heaters. The Department of Energy recently published a revised test procedure for such heaters but which contains a simplified method for testing with a number of testing options that allow more detailed tests to be run. The new procedure also provides for the testing of units with manual controls of two types, modulating controls of two types, and the testing of units incorporating thermal stack dampers as well as electro-mechanical dampers. Once input selections have been made, the program performs the calculations required and prints out the results.

708,740
PB85-141430 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Performances of Different Passive Solar Systems at the NBS (National Bureau of Standards) Test Facility.
Final rept.
B. M. Mahajan, S. T. Liu, and K. A. Reed. 1984, 6p
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.
Pub. in American Society of Mechanical Engineers Technical Paper 84-WA/Sol-3, 6p 1984.

Keywords: *Solar heating, Performance evaluation, Temperature, Wind velocity, Wind direction, Test facilities, Instruments, Reprints, *Passive solar heating systems, Trombe walls, Air infiltration, Energy consumption.

This paper compares the measured winter-time performances of three full-sized adjoining rooms each with a different south-facing passive solar feature. These rooms are a direct gain cell, a control cell, and a Trombe wall cell in the NBS passive solar test facility. The performances of these three cells were monitored for a period of three weeks during January-February, 1984 under the following experimental conditions: lower-bound temperature fixed and upper-bound temperature free floating in all cells; and vents of the Trombe wall blocked. During the experiment data from about 426 sensors are collected. The data include: auxiliary energy supplied, continuous air infiltration, temperatures, and wind speed and direction. This paper briefly describes the test facility, instrumentation, data acquisition system and procedures, and presents representative results from the performance monitoring experiment.

708,741
PB85-153849 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Potential Energy Savings in Residential Oil-Fired Heating Systems in the U.S.
Final rept.
G. E. Kelly, D. A. Didion, D. Quigley, and B. Collins. Dec 84, 62p NBS/BSS-163
Also available from Supt. of Docs as SN003-003-02623-9. Sponsored by Department of Energy, Washington, DC. Library of Congress catalog card no. 84-601145.

Keywords: *Oil burners, *Heating equipment, Residential buildings, Thermal efficiency, Performance, Maintenance, Fuel consumption, Nozzles, Field tests, Data, Computerized simulation.

Recent studies of the performance of residential oil-fired heating systems in the New England area from 1974-1977 demonstrated that significant energy savings are achievable through better maintenance and simple system modifications. These studies showed that annual tune-up of the furnace or boiler would improve the seasonal efficiency of most units, while considerable energy savings are possible by reducing the firing rate of the burner. Reduction in nozzle size with burner modification or with the installation of a new flame retention burner was found to reduce oil consumption substantially. In addition, more innovative equipment modifications such as the use of stack dampers, sealed combustion systems, and heat recovery devices also resulted in fuel savings, although to a lesser extent. Both experimental field data and results from computer simulations of furnace performance are presented.

708,742
PB85-177871 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Prediction of Performance for a Fire-Tube Boiler with and without Turbulators.
D. Didion, and L. Chern. Aug 84, 25p NBSIR-84/2925
Sponsored by Army Facilities Engineering Support Agency, Fort Belvoir, VA. Technology Support Div.

Keywords: *Fire tube boilers, Performance, Computerized simulation, Efficiency, Turbulators, DEPAB2 computer program.

A series of computer runs were made using DEPAB2 (the boiler simulation computer program). They include the runs for a fire-tube boiler 'as is' (i.e., without turbulators), with wire-coil type turbulators, and with twisted-tape type turbulators, respectively. Output from these runs are used to evaluate the boiler seasonal performance values under the Washington, D.C. weather conditions. Results show that the turbulator increases the boiler seasonal efficiency from 2.87 to 6.08%.

708,743
PB85-184703 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Standards for Passive Solar Heating and Cooling Systems.
Final rept.
R. D. Dikkers, and B. C. Reeder. 1983, 6p
Sponsored by Department of Energy, Washington, DC. Passive and Hybrid Solar Energy Div., and American Society of Mechanical Engineers, New York. Solar Energy Div.
Pub. in Proceedings of the ASME Solar Energy Division Annual Conference (5th), New York, April 18-21, 1983 p103-108.

Keywords: *Standards, Planning, Materials, Components, Tests, Evaluation, *Passive solar cooling systems, *Passive solar heating systems, Assemblies.

The Department of Energy (DOE) Passive Solar Energy Program has been supporting research to develop a technology base for the preparation of uniform test methods, evaluation procedures and other standards for passive solar materials, components, assemblies, and systems. This paper describes the results of a DOE sponsored study to develop an initial planning framework for identifying existing voluntary standards which may be applicable to passive solar technologies as well as needed new standards. The framework described in the study consists of a matrix which can be used by standards writers, builders, manufacturers, engineers and building designers.

708,744
PB85-195964 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Summit Plaza Total Energy Demonstration: Four Years of Operating Experience.
Final rept.
J. D. Ryan. 1979, 17p
Sponsored by Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research.
Pub. in Proceedings of the International Total Energy Congress (2nd), Copenhagen, Denmark, October 8, 1979, Part 1, p39-55.

Keywords: Residential buildings, Heat recovery, District heating, Diesel engines, *Total energy systems, Cogeneration.

The paper presents a summary of the measured data and results of the U.S. Department of Housing and Urban Development's (HUD) Total Energy demonstration project at the Summit Plaza complex in Jersey City, N.J. Operation of the plant began in January, 1974. The National Bureau of Standards (NBS) monitored and collected data on the plant through October, 1978. This paper presents summary data on the operating thermal performance of plant components including diesel engine-generators, heat recovery, boilers, chillers, district heating system, etc. Also presented are electrical service reliability data including a comparative analysis with utility data. Environmental data (stack emissions and measured ground-level air quantity) and economic data (capital cost and operating and maintenance costs) are also included.

708,745
PB85-197556 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Flow Rate Calibration for Solar Heating and Cooling System Evaluation.
Final rept.
G. E. Mattingly. 1978, 7p
Pub. in Proceedings of Conference on Performance Monitoring Techniques for Evaluation of Solar Heating and Cooling Systems, Washington, DC., April 3-4, 1978, p299-305.

Keywords: *Calibrating, *Flow rate, Flow measurement, Flowmeters, Performance evaluation, Solar heating, *Solar collectors, Solar cooling systems.

A description is given of the flow metering calibration facilities at the National Bureau of Standards that pertain to solar collectors and the instrumentation required to evaluate their performance. Alternative methods are also briefly described for obtaining the quantified assurance that the pertinent flow measurements are as good as they are quoted to be. Flow metering problem areas are also discussed with suggestions for preventative or remedial action.

708,746
PB85-197663 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rating Procedure for Solar Domestic Water Heating Systems.
Final rept.
S. A. Klein, and A. H. Fanney. 1983, 10p
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.
Pub. in Jnl. of Solar Energy Engineering 105, n4 p430-439 Nov 83.

Keywords: Ratings, Standards, Tests, Reprints, *Solar water heating, Residential sector.

A rating procedure for solar domestic hot water systems is described which combines the advantages of short-term system tests and correlations of long-term thermal performance. The testing procedure consists of two indoor tests which are in accordance with ASHRAE Standard 95-1981 except for one additional measurement needed only for systems employing a heat exchanger between the collector fluid and the potable water. The test results are plotted in a manner in which they can be used to estimate the long-term performance of the solar water heating system for any location where site-specific monthly-average meteorological data are available. The annual solar fraction obtained in this manner provides the recommended rating indicator. The validity of this rating procedure is first demonstrated by simulations. Further support is provided by experiments conducted at the National Bureau of Standards.

708,747
PB85-205151 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Experimental and Analytical Evaluation of Collector Storage Walls in Passive Solar Applications.
Final rept.
M. E. McCabe, C. E. Hancock, and J. Seem. Oct 84, 5p
Sponsored by Department of Energy, Washington, DC. Passive and Hybrid Solar Energy Div.
Pub. in Proceedings of the Passive and Hybrid Solar Energy Update, Washington, DC., September 5-7, 1984, p38-42.

Keywords: *Walls, Concrete blocks, Masonry, Test facilities, Heat measurement, Calorimeters, Thermal measurements, Heat transfer, *Passive solar heating systems, *Energy storage, *Solar collectors.

Studies of the thermal performance of passive solar buildings have indicated a need for precise measurement of solar and thermal energy transfer in modular passive/hybrid solar components under conditions of actual use. A calorimetric test facility designed for performance testing of passive solar components provided test data for several passive solar components during 1983/1984 winter test season. A description of the test facility is presented along with a summary description of four collector-storage wall (CSW) components tested. One of these components, a CSW consisting of a double-glazed window and non-vented concrete masonry block wall with a radiatively selective foil on the outer surfaces was characterized using transfer function techniques. The study suggests that the transfer function analysis technique is well suited for correlating dynamic heat transfer measurements to the environmental variables of solar irradiance and ambient temperature.

708,748
PB85-205961 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD.
Test Methods and Procedures for Passive Solar Components and Materials.
Final rept.
R. D. Dikkers. 1982, 3p
Sponsored by Department of Energy, Washington, DC. Passive and Hybrid Solar Energy Div.
Pub. in Proceedings of U.S. Department of Energy Passive and Hybrid Solar Energy Program Update, Washington, DC., August 9-12, 1981, Conf-810832, p3.41-3.43 1982.

Keywords: *Solar heating, *Tests, Standards, Space heatings, Buildings, *Passive solar heating systems.

The National Bureau of Standards (NBS) is assisting the Department of Energy and other organizations in the development of test methods and evaluation procedures for passive solar systems, components and materials. This paper describes three pertinent NBS projects: (1) the development of a general plan to identify needed test methods and other standards; (2) the identification of health and safety issues and related building code provisions; and (3) the development of test methods to measure the thermal performance of passive/hybrid solar components.

708,749
PB85-207942 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Criteria for Mechanical Energy Saving Retrofit Options for Single-Family Residences.
Final rept.
E. Kweller, and S. Silberstein. Aug 84, 15p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of ACEEE 1984 Summer Study on Energy Efficiency in Buildings, New and Existing Single-Family Residences, Santa Cruz, CA., August 15-23, 1984, Volume B, pB-144--B-158.

Keywords: *Residential buildings, Heat recovery, Cost analysis, Space heating, Hot water heating, Air conditioning, *Retrofitting, *Energy conservation.

The report estimates energy savings, and provides performance and selection criteria, standards, and installed costs for mechanical equipment options for single-family homes; all from prior studies reported in the literature. Performance and selection criteria are presented as advantages, disadvantages and limitations for each option. Four broad categories of energy-saving mechanical options were investigated: space heating, water heating retrofit options, heat pump water heaters, and recovery of central air conditioner waste heat by desuperheaters. Gas- and oil-fueled forced-air furnaces and hydronic (hot water) space-heating equipment were treated in the report.

708,750
PB85-242204 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Round Robins on the Apparent Thermal Conductivity of Low-Density Glass Fiber Insulations Using Guarded Hot Plate and Heat Flow Meter Apparatus.
J. G. Hust, and C. M. Pelanne. May 85, 133p NBSIR-85/3026
Sponsored by Oak Ridge National Lab., TN., American Society for Testing and Materials, Philadelphia, PA., and Mineral Insulation Mfrs. Association, Summit, NJ. Prepared in cooperation with Thermal Insulation, Littleton, CO.

Keywords: *Thermal insulation, *Glass fibers, *Thermal conductivity, Measurement, Heat transmission, Thickness.

The report presents the results and the data analysis pertaining to the results for three round robins on the thermal performance of guarded hot plates and heat flow meters when measuring the thermal resistance properties of low density glass fibrous thermal insulations. The three round robins were carried out under the sponsorship of the American Society for Testing and Materials (ASTM) Subcommittee C-16.30 on Thermal Measurements and the Mineral Insulation Manufacturers Association (MIMA). The test results are compared to a reference equation and to each other to illustrate intralaboratory and interlaboratory reproducibility as well as the dependencies on temperature, density, plate emittance, specimen thickness, and fiber diameter.

708,751
PB86-108198 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Review of Energy Use Factors for Selected Household Appliances.
J. Greenberg, B. Reeder, and S. Silberstein. 19 Aug 85, 87p NBSIR-85/3220
Contract DE-AI01-76PR06010
Sponsored by Department of Energy, Washington, DC. Office of Buildings Energy R and D.

Keywords: *Buildings, *Electric appliances, Standardization, Tests, Furnaces, Water heaters, *Energy efficiency standards, Energy consumption, Consumption rate, Energy efficiency.

The Energy Policy and Conservation Act (EPCA) as amended by the National Energy Conservation Policy Act (NECPA) requires the development of test procedures, labeling rules, and energy efficiency standards for consumer appliances. The purpose of this report is

to re-evaluate selective parametric values through analysis of current data, and provide comment and recommendations. The parameters reviewed are: For water heaters - inlet water temperature, outlet water temperature, ambient air temperature, and hot water usage; for furnaces - outdoor design temperature and average annual heating hours; for room and central air conditioners - yearly hours of use. Each parameter reviewed is documented in an independent section in this report and indicates the current value, the historical basis for the current value, the approach used to review and update the value, the results and conclusions, and recommendations. The recommendations generally propose a new value for the parameter studied based upon the information analyzed.

708,752
PB86-111846 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Boiling Tests of Thermal Insulation in Conduit-Type Underground Heat Distribution Systems.
Final rept.
T. Kusuda, and W. M. Ellis. 1983, 17p
Pub. in Proceedings of Thermal Insulation, Materials, and Systems for Energy Conservation in the 80's, Clearwater Beach, FL., December 8-11, 1981, ASTM STP 789, p802-818 1983.

Keywords: *Heat distributing units, Boiling, Tests, Thermal insulation, Piping systems, Test equipment, Specifications, Energy conservation.

Thermal insulation in a conduit-type underground heat distribution system is expected to withstand severe boiling, which could occur in the case of conduit failure under high ground-water table. The U. S. Government specifies boiling-test criteria for the approval of commercial underground systems. The paper describes the test apparatus and procedure of Tri-Services and Federal Agencies' Specifications to evaluate thermal performance of various insulations after they are subjected to prolonged boiling conditions.

708,753
PB86-113628 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Thermal Testing of Passive/Hybrid Solar Components.
Final rept.
M. E. McCabe. 1982, 6p
Sponsored by Department of Energy, Washington, DC. Passive and Hybrid Solar Energy Div.
Pub. in Proceedings of Passive and Hybrid Solar Energy Update, Washington, DC., September 15-17, 1982, p251-256.

Keywords: *Test facilities, *Solar heating, Buildings, *Passive solar heating systems, Solar space heating.

Studies of thermal performance of passive solar buildings have indicated a need for precise field measurement of solar heat gain and thermal heat loss or gain for modular passive/hybrid solar components. A description of the conceptual design and the major assemblies and subsystems for a new calorimetric test facility is presented. The facility is designed for field testing of passive solar components at the National Bureau of Standards in Gaithersburg, MD. The test facility metering chamber can accommodate test articles having nominal dimensions up to 1.26 x 2.09 m corresponding to a standard sliding door, with thicknesses up to 0.41 m (16 in). The test articles are installed in the buildings envelope and can be oriented either to the vertical-south, or to the horizontal-upward facing direction. The metering chamber is designed to simulate an ideal indoor thermal environment by absorbing all the solar energy transmitted by the test article and by maintaining the indoor air and surface temperatures at controlled values between 15.6 and 26.7C (60 and 80F). A description of the passive/hybrid solar components proposed for testing in the calorimeter during the winter season of 1982-1983 is provided.

708,754
PB86-124930 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Operations Research Div.
Acoustical Benefits and Costs of Passive Solar Energy Design.
Final rept.
R. T. Ruegg, and W. F. Danner. 1982, 6p
Pub. in Proceedings of National Passive Solar Conference (7th), Knoxville, TN., August 30, 1982, p589-594.

Keywords: *Acoustics, *Benefit cost analysis, Buildings, Heating, *Passive solar heating systems.

The purpose of this paper is to develop a framework for the maximization of joint thermal and acoustical net benefits from passive solar design. The paper first identifies the circumstances in which acoustical benefits and costs tend to occur in conjunction with passive solar design, and outlines some simple steps for enhancing beneficial acoustical effects and reducing adverse effects. It then incorporates acoustical effects of passive solar design into a life-cycle benefit-cost framework.

708,755
PB86-136801 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Mathematical Model of an Air-to-Air Heat Pump Equipped with a Capillary Tube.
Final rept.
P. Domanski, and D. Didion. 1984, 7p
Pub. in International Jnl. of Refrigeration 7, n4 p249-255 Jul 84.

Keywords: Heat pumps, Capillary tubes, Computerized simulation, Reprints, *Air source heat pumps.

The paper describes in general a computer model for simulation of steady-state performance of a split, residential, air-to-air heat pump. Organization of the model is discussed and approach to modelling of main heat pump components is explained. The modelling effort emphasis was on the local phenomena to be described by fundamental thermodynamic, heat transfer and fluid mechanic relationships. The model has been verified in a wide range of operating conditions from high temperature cooling to low temperature heating.

708,756
PB86-155488 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Report on the NBS-DOE (National Bureau of Standards-Department of Energy) May 1984 Workshop on Thermal Metering.
Final rept.
G. E. Mattingly. Nov 85, 59p NBSIR-85/3242
Sponsored by Department of Energy, Washington, DC. Office of Conservation.

Keywords: *District heating, *Thermal measurement, Standards, Two-phase flow, *District cooling, Energy conservation.

A workshop on thermal metering (i.e., the flow of steam or of hot or chilled water) was convened in Gaithersburg, MD, May 21-22, 1984 to discuss and prioritize flow rate measurement problems and research programs which could lead to improved energy conservation through the development, acceptance, and use of district heating and cooling systems. The workshop brought together 60 attendees whose expertise spanned a broad range of interests. Included were flowmeter manufacturers, meter users, standards personnel, academicians, and consultants. Attendees listed current problem areas and measurement needs in thermal metering, discussed appropriate responses to these needs, and prioritized these according to their perceived potential for impacting thermal metering practices. Leading this list are: 'paper' standards with special emphasis on 'meter installation requirements', research on two-phase flow and its measurement, two-phase flow technology transfer and information dissemination.

708,757
PB86-166279 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Rating Procedure for Mixed Air Source Unitary Air Conditioners and Heat Pumps Operating in the Cooling Mode.
P. A. Domanski. Feb 86, 21p NBSIR-86/3301
Sponsored by Department of Energy, Washington, DC.

Keywords: *Air conditioners, *Heat pumps, *Ratings, Cooling.

A procedure is presented for rating split, residential air conditioners and heat pumps operating in the cooling mode which are made up of an evaporator unit combined with a condensing unit which has been rated under current procedures in conjunction with a different evaporator unit. The procedure allows calculation of capacity at the 95 degrees F rating point and seasonal energy efficiency ratio, SEER, without performing laboratory tests of the complete system.

708,758
PB86-168267 PC **A17**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Modeling of a Heat Pump Charged with a Non-Azeotropic Refrigerant Mixture.
Final rept.
P. Domanski. Jan 86, 396p NBS/TN-1218
Also available from Supt. of Docs as SN003-003-02716-2. Sponsored by Electric Power Research Inst., Palo Alto, CA.

Keywords: *Heat pumps, *Refrigerants, Air conditioning, Vapor compression refrigeration cycle.

An analysis of the vapor compression cycle and the main components of an air-to-air heat pump charged with a binary non-azeotropic mixture has been performed for steady-state operation. The general heat pump simulation model HPBI has been formulated which is based on independent, analytical models of system components and the logic linking them together. The logic of the program requires an iterative solution of refrigerant pressure and enthalpy balances, and refrigerant mixture and individual mixture component mass inventories. The modeling effort emphasis was on the local thermodynamic phenomena which were described by fundamental heat transfer equations and equation of state relationships among material properties. In the compressor model several refrigerant locations were identified and the processes taking place between these locations accounted for all significant heat and pressure losses.

708,759
PB86-192184 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Effect of a Time-Delayed Stack Damper on Off-Cycle Heat Losses for Residential Heating Equipment.
Final rept.
C. Park, D. A. Didion, and G. E. Kelly. 1983, 10p
Sponsored by American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA.
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions 89, pt2A-2B p373-382 1983.

Keywords: *Heating equipment, Time lag, Delay circuits, Residential buildings, Reprints, *Stack Damper.

Computer procedures were developed for modeling stack dampers with delayed operation between burner shut-off and damper closure. Correction factors for the time delay have been obtained and a quantitative theoretical rationale is used to evaluate the effect of the time delay on the seasonal efficiency of fossil fuel-fired residential heating equipment. Finally, an implementation procedure is outlined for incorporating this rationale into the existing DoE's furnace/boiler seasonal efficiency test and evaluation procedure.

708,760
PB86-192416 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Wall and Ceiling Protection for Heating Appliances.
Final rept.
J. J. Loftus, and R. D. Peacock. 1985, 17p
Pub. in Fire Technology 21, n3 p213-229 Aug 85.

Keywords: *Fire protection, *Radiant heating, Stoves, Chimneys, Ceiling(Architecture), Walls, Building codes, Reprints, *Radiant heat transfer.

An evaluation was made of the effects of radiant heat transfer from hot stove and chimney pipes to unprotected and protected room walls and ceilings. Pipe surface temperatures were 350 degrees C (662 degrees F) for normal operation, and 400-450 C degrees C (752-842 degrees F) to simulate overfire conditions. Recommendations for model building code specifications for wall and ceiling protection are provided.

708,761
PB86-203577 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.

Heating & Cooling Systems

Effect of Wall Mass on the Winter Heating Loads and Indoor Comfort: An Experimental Study.
Final rept.
D. M. Burch, D. F. Krintz, and R. S. Spain. 1984, 28p
Sponsored by American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA.
Pub. in Proceedings of 1984 Winter Meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA., January 29-February 1, 1984, ASHRAE Transactions 90, Pt. 1B, p94-121.

Keywords: *Residential buildings, *Walls, Model tests, Comfort, *Energy conservation, Energy consumption, Heating load.

Six test buildings were extensively instrumented for measuring heating loads and indoor comfort. These test buildings were exposed to a winter heating season and an intermediate heating season. During the winter season, when some space heating was supplied each hour of test, measured heating loads were predicted with a steady-state heat-transfer model which did not include the effect of thermal mass. The indoor comfort was not affected by wall mass. During the intermediate heating season, when the indoor temperatures floated above the thermostat set temperatures during warm day periods, a significant thermal mass effect was observed. Heavyweight buildings were observed to consume less heating energy than comparable lightweight buildings having equivalent wall thermal resistance. The effect was greater when wall mass was positioned inside as opposed to outside wall insulation. Wall mass was observed to reduce considerably overheating during warm day periods, and thereby produce more comfortable indoor conditions.

708,762
PB86-237104 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Verification of Public Domain Control Algorithms for Building Energy Management and Control Systems.
W. B. May, and G. E. Kelly. Dec 85, 142p NBSIR-85/3285
Sponsored by Department of Energy, Washington, DC., and Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Control equipment, *Buildings, *Computer programs, Algorithms, Field tests, Heating, Ventilation, Air conditioning, *Energy management.

Software is an important component of building energy management and control systems (EMCS). The National Bureau of Standards developed and documented eight public domain EMCS supervisory control algorithms. The testing and verification of these eight algorithms are described in the report. The algorithms tested cover dry bulb and enthalpy economizer cycles, optimum and scheduled start/stop, duty cycling, demand limiting, outside air supply air reset, and demand supply air reset.

708,763
PB86-247871 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Evaporation of a Water Droplet Deposited on a Hot High Thermal Conductivity Solid Surface.
M. di Marzo, and D. D. Evans. Aug 86, 34p NBSIR-86/3384
Prepared in cooperation with Maryland Univ., College Park. Dept. of Mechanical Engineering.

Keywords: *Evaporative cooling, *Evaporation, Surfaces, Thermal conductivity, Sprinkler systems, Sprayers, *Water droplet.

A model is presented that predicts major features of the evaporation of water droplets deposited on a hot non-porous solid surface. In the temperature range of interest, nucleate boiling heat transfer is fully suppressed, hence the model is only concerned with the evaporative process. In the model, the solid material is assumed to have high thermal conductivity and diffusivity, so that the surface temperature under the water droplet can be considered uniform. The temperature of the portion of a larger solid surface covered by the liquid is calculated from the classic solution for contact temperature between two semi-infinite bodies.

708,764
PB87-106619 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Proposed TC 4.7 Simplified Energy Analysis Procedures.
Final rept.
T. Kusuda, and I. Sud. 1982, 1p
Sponsored by Department of Energy, Washington, DC.
Pub. in ASHRAE (American Society of Heating, Refrigerating, and Air Conditioning Engineering) Transactions, v88 Pt2 p6 1982.

Keywords: Reprints, *Space HVAC systems, *Energy analysis, Energy conservation, Computer applications.

The general principle of a simplified energy analysis procedure suitable for use in a small engineering office with a desk-top or pocket calculator is developed for building energy conservation standards application. The procedure is based upon ASHRAE cooling load factor techniques for the load calculation, and standard psychrometric heat balance calculations for the HVAC system analysis and seasonal efficiency of equipment performance (which is found in the REAP methodology). The use of the procedure is illustrated for an office building with a VAV air distribution system connected to a centrifugal chiller and hot water boiler.

708,765
PB87-152286 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Performance of a Conventional Residential Sized Heat Pump Operating with a Nonazeotropic Binary Refrigerant Mixture,
W. Mulroy, and D. Didion. Oct 86, 67p NBSIR-86/3422
Contract DE-AC05-84OR21400
Sponsored by Department of Energy, Washington, DC.

Keywords: *Heat pumps, *Refrigerants, Air conditioning, Residential buildings.

The report presents laboratory performance measurements of a relatively unmodified residential heat pump designed for R22 when charged with a nonazeotropic, binary mixture of R13B1 and R152a. Results are presented for various sizes of fixed expansion devices. The effect of gliding temperature within the saturation zone was found to be small. The experimental investigation confirmed that flash distillation within the accumulator would improve low temperature heating performance. The measured performance was approximately 11% lower in both efficiency and capacity than R22 for air conditioning. The high temperature heating efficiency was 3% lower than R22. The low temperature heating capacity was 14% higher and efficiency 2% higher than R22. These results show a substantial improvement over R22 for heating applications at the expense of reduced cooling mode performance. Further performance enhancement for this or other mixtures is expected through various system modifications which remain to be studied.

708,766
PB88-139001 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Plan for the Development of Test Procedures for Differential Temperature Controllers Used in Solar Energy Systems.
Final rept.,
J. Greenberg. 1985, 6p
Contract DE-A101-76PR06010
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.
Pub. in Proceedings of Winter Annual Meeting American Society of Mechanical Engineers, Miami Beach, FL., November 17-21, 1985, 6p.

Keywords: *Solar heating, *Temperature control, *Control equipment, *Controllers, Solar energy, Environmental tests, Vibration tests, Thermistors, *Solar cooling systems, Sensors, Test methods.

From the inception of the active solar heating and cooling program, control system reliability problems have been identified as a major source of failure. Although the sensor elements of the control systems have contributed to a number of these failures and operational problems, recent reports indicate that the controllers themselves are a source of failure. Meetings with solar industry and government representatives cited solar controls as the highest ranked research area that is appropriate for Federal Government support and recommended, among other things, the development of standard test methods and evaluation procedures for controller hardware and controller interfaces. The paper discusses the various tests that are being considered in evaluating the performance of differential temperature controllers used in solar energy systems. The paper also addresses the various sensor types used in solar energy applications and recommends that the tests be performed using sensor simulators.

708,767
PB88-151931 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Simulation of a Heat Pump Operating with a Nonazeotropic Mixture.
Final rept.,
P. A. Domanski, and D. A. Didion. 1985, 15p
Sponsored by Electric Power Research Inst., Palo Alto, CA.
Pub. in ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Transactions, v91 pt2B p1368-1382 1985.

Keywords: *Heat pumps, *Binary mixtures, Simulation, Refrigerants, Reprints.

The paper provides an overview of the model developed for simulation of steady-state performance of a heat pump working with a nonazeotropic binary mixture. The modeled heat pump consists of a hermetic, reciprocating compressor, flat-finned tube heat exchangers, a constant flow area expansion device, an accumulator, a four-way valve, and connecting tubing. The paper discusses basic concepts in formulation of models of major heat pump components and overall program iteration scheme. Verification of the model is presented in the cooling and heating operating modes for a heat pump charged with R13B1/R152a mixture.

708,768
PB88-153721 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.
Calculations of Maximum Allowable Heat Losses for Various Shallow Trench Heat Distribution Systems,
J. B. Fang. Nov 87, 119p NBSIR-87/3617
Sponsored by Corps of Engineers, Washington, DC., Naval Facilities Engineering Command, Alexandria, VA., and Air Force Engineering and Services Center, Tyndall AFB, FL.

Keywords: *Heat distribution systems, *Heat losses, Trenches, Finite element analysis, Computer applications.

The calculation of heat losses for shallow trench underground heat distribution systems was performed using a finite element computer program. The finite element analysis solved a two-dimensional steady-state heat transfer problem for two insulated pipes in a rectangular trench with surrounding soil. A life-cycle cost analysis was performed to determine the cost of construction and annual energy cost associated with pipe heat loss for underground concrete trench systems of different trench dimensions and insulated pipe sizes.

Miscellaneous Energy Conversion & Storage

708,769
PB-267 041/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interaction of K2O with Slag in Open Cycle, Coal Fired MHD,
E. R. Plante, C. D. Olson, and T. Negas. 1975, 8p
Pub. in Proceedings International Conference on Magnetohydrodynamic Electrical Power Generation (6th), Washington, D.C., June 9-13, 1975, CONF750601-P2, II, p211-218 1975.

Keywords: *Magnetohydrodynamic generators, *Coal, *Open-cycle MHD generators, *Slags, *Potassium oxides, Silicon dioxide, Aluminum oxide, Phase transformations, Vapor pressure.

Measurements of the potassium pressure over K2O-SiO2 solutions and phases in the K2O-Al2O3 system are reported. These data, together with suitable assumptions are used to estimate the extent of seed-slag interaction in open cycle-coal fired MHD by comparing

the extrapolated measured activities in the two component solutions with those calculated for the plasma phase. The results indicate that a high degree of slag rejection at the combustor will be necessary in order to reduce seed losses to an acceptable level. A decreased conductivity of the plasma phase at temperatures below 2600 K and total pressures of about 5 atm also appears probable for the zero slag rejection system. The thin slag layer protecting the electrode and insulator structure of the MHD duct appears to be a problem area because of the expected high concentration of K2O dissolved at the relatively high pressures and cool wall temperatures.

708,770
PB-267 226/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electrodes and Insulators: Design and Materials Considerations,
H. P. R. Frederikse, and W. R. Hosler. 1977, 7p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Proceedings of Symposium, Engineering Aspects of Magnetohydrodynamics (MHD)(16th), Pittsburgh Univ., Pa. 16-18 May 77 pIV.4.22-IV.4.28 1977.

Keywords: *Magnetohydrodynamic generators, *Electrodes, Electrical insulation, Design, Materials.

Electrode/Insulator assemblies for MHD generators require a combination of careful design and appropriate materials. The first part of the paper lists the desired physical and chemical characteristics of ceramics and metals used in the fabrication of electrode systems. This is followed by a discussion of several different configurations, tested in a number of test rigs and MHD generators, which illustrates the various design problems.

708,771
PB-269 518/7 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
Materials for Fuel Cells.
Annual rept. Jan-Dec 76,
L. H. Bennett, M. I. Cohen, A. L. Dragoo, A. D. Franklin, A. J. McAlister, and K. F. Young. May 77, 64p NBSIR-77-1270
See also report dated Aug 76, PB-257 768.

Keywords: *Fuel cells, *Materials, Transition metal compounds, Carbides, Borides, Nitrides, Refractory materials, Solid electrolytes, Phosphoric acids, Electrodes, Corrosion resistance, Electrochemistry, Catalysis, Tantalum borides, Molybdenum carbides, Tungsten carbides, Tantalum nitrides, Test equipment, Cerium oxides, Yttrium oxides, Microcomputers, Computer applications.

This report describes the first year's progress of the NBS program on Materials for Fuel Cells. Transition metal carbides, borides and nitrides ('refractory hard metals') were examined with respect to stability and to catalytic oxidation of H2 as non-precious substitutes for Pt as fuel electrocatalysts. A versatile automated system for electrochemical analysis was designed and built, using the precision of digital control and readout techniques to perform essentially analog measurements. The automated system uses a microprocessor as the key element in the central processing unit. The various components and operation of the automated system are described. Studies of CeO2:Y2O3 ceramic electrolytes were designed to measure the influence of annealing and prolonged current passage on electrical properties of these materials. Work on a high temperature facility for these experiments and preparation of CeO2:Y2O3 ceramic specimens is described. AC impedance was measured on several CeO2:Y2O3 sintered specimens as a function of frequency using a network analyzer. The features of this instrument and the theory of the measurements are presented.

708,772
PB-278 944/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Joint Test of U.S. Electrode System in the U.S.S.R. U-02 Facility.
Final rept.,
W. D. Jackson, S. J. Schneider, W. E. Young, A. E. Sheindlin, G. P. Telegin, and D. K. Burenkov. 1976, 12p
Pub. in Proceedings of Symposium on Engineering Aspects of Magnetohydrodynamics (15th), Philadelphia, PA, May 24-26, 1976, Session I, pI.1.1-I.1.12 1976.

Keywords: *Magnetohydrodynamics, *Electrodes, Zirconium oxide, Yttrium oxide, Cerium oxide, Performance tests, Thermal properties, USSR.

The first (Phase I) joint U.S.-U.S.S.R. test of U.S. electrode materials was carried out in Moscow between Sept. 25 and Oct. 1, 1975 in the U.S.S.R. U-O2 MHD facility. The test procedure followed closely a predetermined work plan designed to test five different zirconia based materials in cathode and anode electrode wall modules under MHD operating conditions. The electrode materials were: (in Mol %) 88ZrO2-12Y2O3, 88ZrO2-18CeO2,50ZrO2-50CeO2, 25ZrO2-75CeO2 and 20ZrO2-78CeO2-2Ta2O5. Each of the five electrode materials had four different current densities established between the anode and cathode during the experiment which lasted a total of 127 hours; 100 hours under MHD power operational conditions.

708,773
PB-280 795/6 PC **A12**/MF **A01**
National Standard Reference Data System.
Physical Properties Data Compilations Relevant to Energy Storage. I. Molten Salts: Eutectic Data,
G. J. Janz, C. B. Allen, J. R. Downey, and R. P. T. Tomkins. cMar 78, 252p NSRDS-NBS-61-PT-1
Library of Congress Catalog Card no. 77-10824.

Keywords: *Molten salts, *Heat storage, *Phase change materials, *Eutectics, Melting points, Tables(Data), Bibliographies.

The potential of inorganic compounds and their mixtures is receiving consideration from various practical viewpoints, for example, the relatively large latent enthalpies that accompany the process of melting have directed consideration of such materials in the design of a series of 'second-generation' thermal energy storage subsystems of considerably greater capacity than the systems utilizing the storage capacity of fluids (such as water) and rocks. As molten salts, the features of large liquid state ranges, low vapor pressures, high electrical conductivities, and good viscosities are important considerations relative to diverse applications, such as heat transfer fluids, solvents, reaction media, and as molten electrolytes. The present compilation provides an authoritative compendium of melting points, and compositions of molten salt eutectic mixtures. Data for mixtures melting in the range - 138C to 2800C are reported. Value judgments have not been attempted. Titles of the articles in the literature citations and a system index are included for approximately 6000 eutectic entries.

708,774
PB-282 145/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interaction of Seed with Slag in Open Cycle MHD.
Final rept.,
E. R. Plante. 1974, 11p
Sponsored in part by Department of Energy, Washington, D.C.
Pub. in Proceedings of National Science Foundation - Office of Coal Research Engineering Workshop on MHD Materials, Cambridge, Mass. 20-22 Nov 74 p301-311 1974. (Massachusetts Inst. of Tech., Cambridge. Energy Lab.).

Keywords: *Open cycle MHD generators, *Seeded plasmas, Interactions, Slags, Potassium oxides, Potassium silicates, Silicon dioxide, Absorption, Materials recovery, Seedants.

A discussion of the factors involved in absorption of seed by slag in coal-fired open cycle MHD systems is given. Previous measurements and methods based on thermodynamics used to assess the extent and importance of this problem are reviewed. Some preliminary measurements on the evaporation of K(g) and O2(g) from silica melts are presented and used to estimate the amount of seed loss to slag. Predictions based on current data are limited to conditions for which the amount of seed absorbed by the slag is greater than 20 wt %. Directions for future studies of seed slag interaction are indicated.

708,775
PB-285 223/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rare Earth Ceramics for MHD-Power Generators.
Final rept.,
H. P. R. Frederikse, W. R. Hosler, and T. Negas. Aug 78, 9p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Proceedings Rare Earth Research Conference (13th), Oglebay Park, Wheeling, W. Va., Oct 13, 1977. Paper in Rare Earths in Modern Science and Technology, p45-53 Aug 78.

Keywords: *Electrodes, *Magnetohydrodynamic generators, Cerium oxides, Rare earth compounds, Design, Electrical ceramics, Materials, Chromates, Lanthanum compounds, Lanthanum chromates.

The hot-wall type of open-cycle MHD power generators requires electrode materials that are able to operate at temperatures up to 1800C in a highly corrosive atmosphere. Several compounds containing rare-earth elements, in particular, LaCrO3 and CeO2 with additions of other oxides, have shown to be promising candidates for this application. This paper describes the materials requirements in relation to the geometrical design of the electrodes, including their physical, chemical and structural properties. Results of evaluation experiments performed on LaCrO3(-) and ceria-based electrodes are discussed.

708,776
PB-285 341/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Compositional Modeling of MHD Channel Slag, with Preliminary Vapor Pressure Data.
Final rept.,
E. R. Plante, and L. P. Cook. 1978, 6p
Sponsored in part by Department of Energy, Washington, D.C.
Pub. in Proc. Symp. Engineering Aspects of Magnetohydrodynamics, Stanford, Calif., Mar 27-29, 1978, pC.1.1-C.1.6 (Stanford Univ., Stanford, Calif., 1978).

Keywords: *Magnetohydrodynamic generators, *Slags, *Ashes, Coal, Chemical composition, Calcium oxides, Iron oxides, Aluminum oxide, Chemical composition, Models, Vapor pressure, Coal-fired MHD generators.

Bulk compositional models for MHD channel slags are proposed on the basis of a statistical treatment of coal ash analyses and a consideration of available channel slag data. These model compositions reflect the relatively high CaO content of sub-bituminous ('Western') coal ash, the relatively high FeO(x) content of bituminous ('Eastern') coal ash, and the relative depletion of SiO2/(SiO2 + Al2O3) in the channel. KAlSiO4 is the dominant crystalline phase, resulting in high liquidus temperatures (in excess of 1600 C). Selective partitioning of iron, calcium and magnesium into the liquid phase with falling temperature is predicted. Vapor pressure measurements on the model Western channel slag were carried out during which the bulk composition of K2O decreased from 22.7 to 7 wt. percent.

708,777
PB-285 360/4 PC **A07**/MF **A01**
National Measurement Lab. (NBS), Washington, D.C.
Materials for Fuel Cells.
Annual rept. Jan 77-Dec 77,
L. H. Bennett, M. I. Cohen, A. L. Dragoo, A. D. Franklin, A. J. McAlister, and K. F. Young. Jul 78, 133p NBSIR-78-1472
See also report dated May 77, PB-269 518.

Keywords: *Fuel cells, *Storage batteries, *Materials, Electrodes, Catalysts, Solid electrolytes, Transition metal compounds, Carbides, Phosphides, Corrosion resistance, Electrochemistry, Tungsten carbides, Molybdenum carbides, Phosphoric acid, Test equipment, Cerium oxides, Microcomputers, Aluminum oxide, Fuel cell catalysts, Sodium sulfur cells, Computer applications.

The National Bureau of Standards has undertaken a program of research on materials for fuel cells and batteries. This program includes studies of electrocatalysis in liquid-electrolyte cells and of solid electrolytes, in high-temperature cells and in batteries. This report describes the results for the second year of the program. In most fuel cell applications a major contribution to the overvoltage, and therefore to a reduction in useful voltage and to efficiency, comes from electrode polarization. For use in hot H3PO4 no satisfactory substitutes for Pt have been found, but Pt is not completely satisfactory. In catalyst loadings sufficiently large to ensure adequate efficiency and lifetime it makes a significant contribution to the cost. At the anode its sensitivity to CO poisoning forces the use of higher temperatures and catalytic shift conversion in the fuel processing train. At the cathode a mixed potential situation seems to exist and the open-circuit voltage lies

below what should be possible. Thus a continued study of electrocatalysis and electrocatalysts in H3PO4 is worthwhile. This program studies refractory metal-metalloid compounds (e.g., WC) as potential anode catalysts. Work on oxide catalysts for use at the cathode was suspended for lack of funds, but some effort has gone into automating the electrochemical measurements used in studying electrocatalysis of either kind. These two lines of work are reported here.

708,778
PB-290 025/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Method of Testing for Rating Thermal Storage Devices on Thermal Performance.
Final rept.,
J. E. Hill, and E. Streed. 1976, 9p
Sponsored in part by National Science Foundation, Washington, DC., and Dept. of Energy, Washington, DC. Office of Conservation and Solar Applications. See also PB-275 131.
Pub. in Jnl of Solar Energy Science and Engineering 18, p421-429 1976.

Keywords: *Heat storage, *Solar collectors, Tests, Performance standards, Ratings, *Thermal energy storage equipment, Reprints.

The paper describes a proposed test method for determining the efficiency of solar collectors under specified outdoor steady-state conditions. The prescribed series of tests should provide useful data for the rating of solar collectors based on thermal performance. A study was made of existing theory, measurement practices and a number of collector test procedures in use prior to the publication of the proposed method. The test apparatuses and major components have been prescribed so a liquid or air can be used as the transfer fluid. The energy of the fluid entering and leaving the collector is determined by making appropriate measurements and these quantities are then compared to the energy incident upon the collector (also determined by measurement) in order to calculate the collector efficiency. The series of tests to be conducted consists of determining the average efficiency for 15 min periods (integrating the energy quantities) over a range of temperature differences between the average fluid temperature (average of inlet and outlet) and the ambient air. The test apparatuses have been designed so that the temperature of the fluid entering the collector can be controlled to a selected value. This feature is used to obtain the data over the temperature range desired. At least sixteen data points are required for a complete test series and they must be taken symmetrical with respect to solar noon (to prevent biased results due to possible transient effects).

708,779
PB-295 406/3 PC **A19**/MF **A01**
National Standard Reference Data System.
Physical Properties Data Compilations Relevant to Energy Storage. II. Molten Salts: Data on Single and Multi-Component Salt Systems.
G. J. Janz, C. B. Allen, N. P. Bansal, R. M. Murphy, and R. P. T. Tomkins. Apr 79, 445p NSRDS-NBS-61-PT-2
Prepared by Rensselaer Polytechnic Inst., Troy, NY. Molten Salts Data Center. Library of Congress catalog card no. 77-10824.

Keywords: *Molten salts, *Heat storage, Physical properties, Melting points, Phase diagrams, Density(Mass/volume), Interfacial tension, Viscosity, Electrical resistivity, Thermal conductivity, Hazards, Containment, Diffusion coefficient, Heat of fusion, Specific heat, Volume, Vapor pressure, Cryoscopy, Tables(Data).

The present work provides selected data with value judgements for a set of 49 salt systems of interest as candidate materials for thermal energy storage subsystems and for electrochemical energy storage systems. The physical properties assessed are: melting points; phase diagrams+ eutectic compositions; density; surface tension; viscosity; electrical conductivity; diffusion constants for ions; heat of fusion; heat capacity; volume change on fusion; vapor pressure; thermal conductivity (liquid and solid); and cryoscopic constant. The status of corrosion studies in the form of annotated bibliographic summaries, and salient observations on safety and hazards are also reported. A summarizing series of tables is provided as index to the data-gaps status for this set of candidate materials.

708,780
PB-295 898/1 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Thermal and Service Systems Div.
Testing of Pebble-Bed and Phase-Change Thermal Energy Storage Devices According to ASHRAE Standard 94-77.
Final rept.
D. E. Jones, and J. E. Hill. May 79, 45p NBSIR-79-1737
Sponsored in part by Department of Energy, Washington, DC. Office of Conservation and Solar Applications.

Keywords: Heat storage, Energy storage, Phase transformations, Sodium sulfates, Hydrates, *Thermal energy storage equipment, Pebble beds, Latent heat storage.

The American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) has recently adopted ASHRAE Standard 94-77--Methods of Testing Thermal Storage Devices Based on Thermal Performance. Experiments have been completed at the National Bureau of Standards in which a 7 cu m (250 cu ft) pebble-bed and a similarly-sized 264 MJ (250,000 Btu) phase-change unit using sodium sulfate decahydrate, both using air as the transfer fluid, were tested in accordance with this Standard. A description of the test procedure, test apparatus, and detailed test results is given. Some problems were encountered in using the Standard for these kinds of thermal energy storage devices, and modifications to the Standard are recommended based on these experiments.

708,781
PB80-182355 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Materials for Fuel Cells.
Annual rept. Jan-Dec 78,
L. H. Bennett, C. K. Chiang, M. I. Cohen, A. L. Dragoo, A. D. Franklin, and A. J. McAlister. Mar 80, 89p NBSIR-80-1991

Keywords: *Fuel cells, Transition metals, Electrochemistry, Catalysts, Electrodes, Additives, X ray diffraction, Revisions, Diffusion, Phosphoric acid, Supports, Design, Performance evauation.

The National Bureau of Standards has undertaken a program of research on materials for fuel cells and batteries. This program includes studies of electrocatalysis in liquid-electrolyte cells and of solid electrolytes, in high-temperature cells and in batteries. This report describes the results for the second year of this program. The Materials for Fuel Cells Program at NBS during this year consisted of three major elements, which taken together reinforce each other in techniques and concepts; these elements embrace: (1) Electrocatalysis, especially hydrogen oxidation, on non-noble metals and alloys; (2) Degradation mechanisms involving solid oxygen-transporting electrolytes; and (3) Development of instruments.

708,782
PB80-188543 Not available NTIS
National Bureau of Standards, Washington, DC.
Materials for Open Cycle MHD Generators.
Final rept.,
S. J. Schneider, H. P. R. Frederikse, and T. Negas. Mar 80, 61p
Pub. in Materials for Open Cycle MHD Generators (Chapter 3), Current Topics in Materials Science, 4 p89-149 1980.

Keywords: *Magnetohydrodynamic generators, *Electrodes, Ceramics, Zirconium oxides, Perovskites, Spinel, Contaminants, Cerium oxides, Reprints.

The purpose of the article is to set forth the current status of MHD generator materials development, the physical and chemical properties of candidate electrode materials and process contaminants (K-salts and coal slag) and finally descriptions of materials performance under real MHD conditions. Emphasis is placed on ceramic electrode applications particularly those involving ZrO2, CeO2, perovskites (LaCrO3), spinels (MgAl2O4), and some metals and alloys.

708,783
PB81-116949 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrical Conductivity Mechanisms in Iron-Containing Slags.
W. R. Hosler, G. S. White, and T. Negas. 1980, 6p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the International Conference on MHD Electrical Power Generation (7th) Held at Cambridge, MA. on June 16-20, 1980, p220-225 1980.

Keywords: *Slags, Electrical resistivity, Magnetohydrodynamic generation, Iron, Coal.

Understanding the electrical conductivity of coal slags of various compositions and the effect of current transport on the underlying materials at conditions found in an MHD generator channel is essential to the success of a generating power system. A unique method for determining the electrical conductivity of coal slag has been developed which eliminates the errors usually encountered due to surface oxidation or reduction and slag creep over the sides of the boat or slag container. Slag conductivities at high temperatures (above 1400C) are independent of oxygen pressure and of seed content up to amounts likely to be incorporated in the slag in an operating channel. The lack of O2 pressure dependence of the conductivity implies that the iron ion charge ratio is also not a dominant factor in the conductivity magnitude at high temperature.

708,784
PB82-249921 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Evaluation of Hydrated Calcium Aluminate Compounds as Energy Storage Media,
J. B. Ings, and P. W. Brown. Jun 82, 17p NBSIR-82-2531
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Hydrates, *Energy storage, Feasibility, Heat measurement, Dehydration, *Calcium aluminate.

Calcium aluminate hydrates and calcium aluminate hydrates containing other ions were investigated to determine the feasibility of their utilization as energy storage media. A series of these compounds were fabricated and analyzed for purity. The energy liberated on hydration of each compound was measured using conduction calorimetry and the dehydration temperature was measured using differential scanning calorimetry.

708,785
PB83-134270 Not available NTIS
National Bureau of Standards, Washington, DC.
Assessment of Materials Requirements and Research Needs for Open Cycle Magnetohydrodynamics (MHD) Systems.
Final rept.
S. J. Schneider, T. Negas, and H. P. R. Frederikse. 1982, 10p
Sponsored in part by the Department of Energy, Washington, DC.
Pub. in Pure and Applied Chemistry 54, n7 p1325-1334 1982.

Keywords: *Open cycle MHD generators, Magnetohydrodynamic generation, Fuel cells, Gas turbines, Materials, Assessments, High temperature research, Electrodes, Heat exchangers, Reprints.

This paper attempts to put the materials issues confronting MHD in proper perspective through a review of the development status of the overall system on a component-by-component basis. Pressing materials problems are defined and related to high temperature research needed to assist in their solution. Emphasis is placed on materials applications in the MHD generator (electrodes) and heat exchangers as these components present the most demanding service conditions.

708,786
PB83-137174 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Factors Affecting the Service Lives of Phase Change Storage Systems.
J. B. Ings, and P. W. Brown. Feb 82, 21p NBSIR-81-2422
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Energy storage, *Solar energy, Absorption, Encapsulating, Performance evaluation, Crystal growth, Inorganic compounds, Supercooling, *Phase change materials, Latent heat storage.

Phase change storage systems currently in use or which are in the advanced stages of development are identified. Various possible modes of degradation which may affect service lives are considered. Specifi-

cally, the effects of crystal growth, crystal segregation, supercooling, corrosion and thermal decomposition are discussed. The generic basis for the development of performance tests for inorganic phase change materials is described.

708,787
PB85-104651 Not available NTIS
National Bureau of Standards, Washington, DC.
Electro-Oxidation of Hydrogen on Mo-W Carbide Alloy Catalysts in Acid Electrolyte.
Final rept.
A. J. McAlister, and M. I. Cohen. 1980, 4p
Pub. in Electrochimica Acta 25, n12 p1685-1688 1980.

Keywords: *Electrochemistry, *Oxidation, *Hydrogen, *Fuel cells, Catalysts, Electrolytes, Carbides, Acids, Reprints.

The rates of anodic oxidation of H2 in acid electrolyte on WC and on the isostructural ternary alloy Mo(1-x)WxC, with Mo occupying 70 to 80% of the metal sites, have been compared experimentally. The ternary catalyzes the reaction as effectively as WC, by the same mechanism, and is equally tolerant of CO entrained in the H2 feed. Evidence is presented which indicates that proton discharge is rate limiting on these carbides, and that their performance is limited by scarcity of active sites and hence open to improvement by appropriate preparative technique.

708,788
PB85-111201 PC **A13**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Phase Change Thermal Energy Storage and the Model Building Codes.
Final rept.
J. Greenberg, and B. C. Reeder. Aug 84, 294p
NBSIR-84/2909
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Building codes, *Heating systems, *Cooling systems, Solar energy, Latent heat, Plumbing, Heat of fusion, Hydrates, Thermochemistry, Design criteria, Performance evaluation, *Thermal energy storage equipment, *Phase change materials.

Thermal energy systems using phase change materials are currently being developed and used for storing energy collected by solar and other means. This report is intended to bridge the gap between those who design and install phase change thermal storage devices and the building code official who evaluates these devices for code compliance. The initial pages of this report describe the more commonly accepted phase change materials and systems, present a taxonomy which is applicable to building construction, and describe the interface between the various model codes and the more advanced phase change system configurations. The report continues with an analysis of the model codes with a specific orientation to phase change thermal energy storage systems. The analysis is structured according to building, mechanical, and plumbing issues with topics relevant to phase change systems identified and specific code provisions applicable to each topic listed. To facilitate use by code officials in evaluating a system for compliance with a specific document, the appendix cross references relevant topics according to individual model code requirements.

708,789
PB86-105699 PC **A03**/MF **A01**
Scientific Consulting Services, Pullman, WA.
Mathematical Model for the Distribution of the Long-Term Efficiency of Phase-Change Materials and Its Application in Heat-Storage.
S. C. Lowell, and S. C. Saunders. 25 Aug 85, 41p
NBS/GCR-85-492
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology, and Department of Energy, Washington, DC. Office of Solar Heat Technologies.

Keywords: *Mathematical models, *Heat storage, *Phase transformation, Performance evaluation, Glauber's salt, *Phase change materials.

A mathematical model for the degradation in the thermal performance of a salt hydrate phase change storage system is discussed.

708,790
PB86-213568 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Report of Tests on Joseph Newman's Device.
R. E. Hebner, G. N. Stenbakken, and D. L. Hillhouse. Jun 86, 40p NBSIR-86/3405
Sponsored by Patent and Trademark Office, Washington, DC.

Keywords: *Power supplies, Electrical measurement, Electric converters, Efficiency, Power loss, Power, Signal generators, Spectrum analysis.

The report describes tests performed between March 1986 and June 1986 on a device submitted by Joseph Newman for testing at the National Bureau of Standards. The purpose of the testing was to determine if the output power of the device was greater than the input power.

708,791
PB87-122610 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Methodology for the Evaluation of the Thermal Performance of Phase-Change Storage Materials.
Final rept.
J. W. Grimes, P. W. Brown, and L. Kaetzel. 1985, 5p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Testing and Evaluation 13, n6 p429-433 Nov 85.

Keywords: *Sodium sulfates, Heat measurement, Performance, Thermal cycling tests, Hydrates, Reprints, *Thermal storage, *Phase change materials.

A methodology to evaluate the response of phase change thermal storage materials to repeated thermal cycling is described. The methodology is based on the utilization of a thermal cycling device to simulate in-service conditions and an isoperibolic calorimeter to measure the thermal storage capacities of the phase change specimens. The thermal cycling device was designed to operate over a range of predetermined conditions including heating and cooling rates and maximum and minimum cycle temperatures. The design and operating characteristics of the device is described. Data obtained by investigating the Na2SO4 10H2O phase change system indicate that the methodology can be used to assess the performance and durability of phase change storage systems.

708,792
PB87-128278 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Heats of Dehydration and Specific Heats of Compounds Found in Concrete and Their Potential for Thermal Energy Storage.
Final rept.
L. J. Struble, and P. W. Brown. 1986, 12p
Pub. in Solar Energy Materials 14, p1-12 1986.

Keywords: *Heat storage, *Concretes, Inorganic salts, Hydrates, Dehydration, Solar heating, Reprints, *Latent heat storage, Ettringite, Friedel's salt, Building materials.

Two classes of hydrated inorganic salts have been studied to assess their potential as materials for passive solar energy storage. The two classes of salt are typified by ettringite, a trisubstituted salt, and Friedel's salt, a monosubstituted salt, both of which are typically found in Portland cement concrete. The trisubstituted salts were studied to assess their potential for latent heat storage, utilizing a low-temperature dehydration reaction, and both classes were studied to assess their potential for sensible heat storage. Preliminary experiments indicate the dehydration of the trisubstituted salts is reversible, though additional tests are required. The thermal data demonstrate that the trisubstituted salts have potential as latent heat storage materials and both classes of salts have potential as sensible heat storage materials; furthermore, it is noted that the materials may be contained in conventional Portland cement concrete, making them particularly attractive for thermal energy storage.

Policies, Regulations & Studies

708,793
AD-A041 668/5 PC **A17**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Applied Technology.
Technical Guidelines for Energy Conservation.
Final rept. Dec 75-Mar 77.
D. Burch. Jun 77, 399p NBSIR-77-1238, AFCEC-TR-77-12
See also Rept. no. AFCEC-TR-77-11, AD-A041 086.

Keywords: *Energy conservation, Energy management, Heating plants, *Air Force facilities, *Buildings, Energy consumption, Maintenance management, Windows, Heat transfer, Solar energy, Air conditioning equipment, Cooling, Lighting equipment, Hot water, Space heaters, Cost effectiveness, Retrofitting, Computerized simulation, Resource management, Bibliographies, Literature surveys.

This report provides detailed technical material on various energy conservation actions for existing Air Force facilities and utility systems. It is specifically tailored to serve as a working document for Base engineers and technical personnel. The report covers energy conservation for Air Force facilities, including the equipment for providing hot water, space heating and cooling, lighting, and humidification. It also covers central plant systems and underground distribution systems (hot water, steam, and chilled water). This volume includes the following topics: Energy Conservation Measures for Exterior Building Envelopes; Modifying Mechanical Systems and Operating Practices for Energy Conservation; Conducting the Building Survey; Measurements for identifying Energy Conservation Potential; Economic Analysis; and Appendices--Heat transfer fundamentals, Solar energy systems for Air Force applications, Heat and Chilled water distribution systems, and Survey of computer programs for evaluating building and system performance.

708,794
PB-264 297/3 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Building Economics Section.
Equipment Maintenance for Energy Conservation.
Final rept.,
J. Levy. Feb 77, 55p NBSIR-77-1210
Sponsored in part by Federal Energy Administration, Washington, D.C. Office of Energy Conservation and Environment.

Keywords: *Maintenance equipment, *Energy conservation, Overhauling, Maintenance, Service life, Reconditioning, Maintainability, Preventive maintenance, Buildings, Stochastic processes, Cost analysis, Mathematical models, Computerized simulation, Computer programs, Markov processes, BASIC programming language, Markov decision processes.

A general model of equipment performance as a function of maintenance is developed that permits quantification of the optimal level of maintenance in terms of performance attainment and relative factor costs. The model formulation is that of a finite state, finite action Markovian decision process. The report supplies a listing for a program in BASIC of the policy improvement algorithm for finding a best policy. The model will help maintenance engineers, building managers and/or others responsible for making decisions concerning maintenance policies in selecting economically efficient levels of maintenance for elements of building service equipment. The report also contains an illustrative example applying the model to the maintenance of an air handling unit.

708,795
PB-265 033/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Calculations for Energy Conservation Design of Buildings.
Final rept.,
T. Kusuda. 1976, 5p
Pub. in APEC J. (Automated Procedures for Engineering Consultants), p18-22 1976-77.

Keywords: *Energy conservation, Buildings, Standards, Computerized simulation, Design.

Since energy calculation is an essential element of energy conservation standards, an accurate and comprehensive yet easy-to-use computer program for such calculation is most desirable. This paper reviews the existing state of energy-analysis procedures and identifies the areas for needed improvement. The paper also points out that the computational procedures suitable for new building design could be simpler

than those required to simulate the energy consumption performance of existing buildings.

708,796
PB-266 858/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Appliance Labeling and Efficiency,
M. R. Myerson. 1977, 7p
Pub. in Proceedings Electro 77 Programs for Energy Conservation, New York, N.Y., April 19-21, 1977, Paper 33/3, p1-7 1977.

Keywords: *Electric appliances, *Energy conservation, Marking, Operating costs, Thermal efficiency, Objectives, Energy consumption, Households, Energy Policy and Conservation Act, Energy use, Residential sector.

The usage of energy in residences and by specific major appliances in residences is described and related to overall National energy use. The Energy Policy and Conservation Act contains provisions designed to reduce consumption of energy by appliances. One provision consists of a labeling program to advise the consumers, at the point of sale, of the estimated annual operating costs of major appliances and a means of comparing these costs with competing brands. The other provision provides for the improvement of efficiency of specified appliances by an average amount of not less than 20% by the year 1980 as compared to 1972. Certain key features of the Act are described and the prescribed roles of FEA, FTC, and NBS are explained. The procedures being used by NBS to establish the efficiency improvement goals for 1980 are presented and the key role that consumers will play in the success of the program is described.

708,797
PB-266 907/5 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Applied Technology.
Recommended Criteria for Retrofit Materials and Products Eligible for Tax Credit.
Final rept.,
W. J. Rossiter, and R. Mathey. Apr 77, 59p NBSIR-75-795 Rev.
Supersedes report dated Nov 75 PB-246 866. Prepared for Federal Energy Administration, Washington, D.C.

Keywords: *Energy conservation, *Residential buildings, Insulation, Storm windows, Doors, Barrier coatings, Caulking, Weatherstripping, Thermostats, Temperature control, Incentives, Recommendations, *Retrofitting, Retrofit devices, Tax credits.

Criteria are recommended for materials and products considered eligible for proposed tax credit for retrofitting one and two family residences to conserve energy. The materials considered include insulation and vapor barriers, storm windows and doors, caulking and weatherstripping, and clock thermostats. A list of these retrofit materials was compiled by generic type and recommendations made on their installation. In addition to recommended criteria for materials and products eligible for tax credit, desired levels of performance for the retrofit materials are presented as a guide to homeowners to achieve maximum benefits in energy conservation through retrofitting.

708,798
PB-268 873/7 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of Building Standards and Codes Services.
Building Energy Conservation Programs: A Preliminary Examination of Regulatory Activities at the State Level.
Final rept.,
P. W. Cooke, and R. M. Eisenhard. Jun 77, 124p NBSIR-77-1259
Sponsored in part by Federal Energy Administration, Washington, D.C. Office of Energy Conservation and Environment, and Energy Research and Development Administration, Washington, D.C. Div. of Buildings and Industry.

Keywords: *Energy conservation, Buildings, Thermal efficiency, Legislation, Regulations, Government policies, State government, Energy policy, Standards, Solar energy, Reviewing, Surveys.

Background information on the current regulatory status and degree of implementation of building energy conservation programs at the state level are described, including those programs dealing with solar energy. This data base can be drawn upon to promote utilization of building thermal efficiency standards on a uniform basis throughout the country. From information collected in a survey of twenty-one states, the report presents the current state-of-the-art on common problems experienced at the state level in the promulgation and implementation of building energy conservation regulations. Based on these findings, several types of assistance that could facilitate the orderly adoption and implementation of uniform standards are identified.

708,799
PB-269 847/0 PC **A08**/MF **A01**
National Bureau of Standards, Washington, D.C. Thermal Engineering Section.
Retrofitting an Existing Wood Frame Residence for Energy Conservation--An Experimental Study.
Final rept.,
D. M. Burch, and C. M. Hunt. Jul 77, 160p NBSIR-77-1274
Sponsored in part by Federal Energy Administration, Washington, D.C.

Keywords: *Energy conservation, *Residential buildings, *Houses, Storm windows, Thermal insulation, Caulking, Weatherstripping, Carpets, Painting, Performance evaluation, Benefit cost analysis, Cost effectiveness, *Retrofitting.

A wood-frame residence having only limited insulation in the attic was retrofitted in three stages to reduce its energy requirements for heating and cooling. The three retrofit stages comprised: reducing air leaks; adding storm windows; and installing insulation in the floor, ceiling, and walls. The house was extensively instrumented to evaluate energy savings and other performance factors. An economic model was used to evaluate the cost effectiveness of the retrofit options and the number of years to pay back their initial investment.

708,800
PB-271 843/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Conservation in Buildings Through Life-Cycle Costing.
Final rept.,
H. E. Marshall, and R. T. Ruegg. Feb 77, 10p
Pub. in Jnl. Archit. Ed. 30, n3 p42-51 Feb 77.

Keywords: *Energy conservation, *Buildings, Service life, Life(Durability), Design, Cost estimates, Retrofitting.

This article provides practicing architects, architectural students, and others interested in the design process an overview of state-of-the-art methods for estimating the life-cycle cost (LCC) of alternative energy conservation techniques and a description of selected applications of LCC methods to energy conservation in buildings. Retrofitting existing residential buildings for energy conservation is examined in LCC terms. The design of envelope features and subsystems for energy conservation in new buildings is explored in the context of LCC analysis. Finally, energy standards for buildings are examined in the LCC context to show why varying climates and fuel prices must be considered in developing economically efficient standards.

708,801
PB-271 844/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Building Standards and Codes for Energy Conservation.
Final rept.,
J. G. Gross, and J. H. Pielert. 1977, 3p
Pub. in Jnl. Archit. Ed. 30, n3 p54-56 Feb 77.

Keywords: *Energy conservation, *Buildings, Standards, Building codes.

Over the last few years, public attention has been increasingly attracted to problems related to the shortage of energy. A major area where the conservation of energy would be possible is in the design and construction of new buildings and the retrofitting of existing buildings. Building standards and codes, traditionally written for health and safety, are viewed as a mechanism for accomplishing such conservation. The purpose of this paper is to review activities relative to this objective at the Federal level and within the various segments of the building regulatory community including State and local governments, model building code groups, standards developing organizations and building regulators.

708,802
PB-271 845/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Research in Energy Conservation.
Final rept.,
H. R. Trechsel. 1977, 3p
Pub. in Jnl. Archit. Ed. 30, n3 p31-33 Feb 77.

Keywords: *Energy conservation, *Buildings, Human factors engineering, Utilization, Design.

The paper discusses past and current energy conservation research dealing with engineering, human factor, and building use factors. The paper also indicates critical research needs and identifies a number of specific issues related to energy conservation, specifically the need to consider the effect of energy conservation on building environment and on human occupants, the need for multidisciplinary and interdisciplinary research, and the requirement for accounting for the scarcity of individual energy forms or resource impact factors.

708,803
PB-274 975/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of Performance-Based Energy Conservation Standards for Buildings.
Final rept.,
P. R. Achenbach, and J. L. Heldenbrand. 1976, 31p
Pub. in Proceedings of Canadian Building Congress on Energy and Buildings, Toronto, Canada, 25-27 Oct 76 p1-31 1976.

Keywords: *Energy conservation, *Buildings, Performance standards.

NBS is assisting the Department of Housing and Urban Development and the Energy Research and Development Administration in developing performance standards for energy conservation in buildings. The NBS concept is based on overall energy use and life-cycle cost of a building, supplemented by performance requirements related to thermal comfort, visual environment, indoor air quality, durability and health and safety considerations.

708,804
PB-274 976/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development and Application of Design Standards for Energy Conservation in Buildings.
Final rept.,
J. L. Heldenbrand. Aug 77, 12p
Pub. in Ind. Forum, v8 n3 p9-20 Aug 77.

Keywords: *Energy conservation, *Buildings, Design standards, Reprints.

One-third of the energy consumed in the United States is used to heat and cool buildings and to provide illumination, water heating, and other building services. About 40 percent of this energy can be saved without reducing building performance. The first comprehensive and nationally applicable design standards for energy conservation in buildings have recently been developed and applied, and they offer the opportunity for substantial energy savings.

708,805
PB-274 984/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Performance Evaluation of Window Strategies.
Final rept.,
S. R. Hastings. 1977, 10p
Pub. in Proceedings RILEM/ASTM/CIB Symposium on Evaluation of the Performance of External Vertical Surfaces of Buildings, Otaniemi, Finland, 28 Aug-2 Sep 77, v2 p113-122 (Technical Research Centre of Finland, Helsinki) 1977.

Keywords: *Energy conservation, *Buildings, *Windows, Design, Performance.

Windows can be an important determinant of the energy consumption of buildings. Properly designed windows can partially or wholly fulfill environmental requirements otherwise necessitating extensive purchased energy consumption by costly mechanical and illumination systems. The energy value of a window, considering the energy costs attributed to its limitations. To insure its value as a net asset, numerous design strategies are available to improve the conditions in which it performs. Adverse climatic forces can

be mitigated through site design or use of exterior appendages. Interior accessories can compensate for the limitations of glass. Finally, building interior design can increase the utility of a window's contribution.

708,806
PB-274 987/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Resource Impact Factors and the Optimal Energy Conservation Standard for Buildings.
Final rept.,
S. F. Weber. Oct 77, 13p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Energy Buildings, v1 n2 p1-13 Oct 77.

Keywords: *Energy conservation, *Buildings, Performance standards, Cost analysis, Economic models, Optimization, Social effect, Resource Impact Factors, Reprints.

The effects of using Resource Impact Factors (RIFs) in the determination of an optimal energy conservation performance standard for buildings are assessed. RIFs may be generally defined as indices constructed to reflect the full social costs of using various energy types. The major elements which RIF's should take into account are discussed as well as the appropriate method of formulating them. A cost minimization model for determining the optimal standard is used in conjunction with a range of RIF values so that a comparison can be made between a standard that is optimal from the private point of view (without RIFs) and one that is optimal from the social point of view (with RIFs). The comparison is made in terms of the amount of energy saved by each standard in climates of differing severity.

708,807
PB-276 747/3 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
New Look at Windows,
B. L. Collins, R. T. Ruegg, R. Chapman, and T. Kusuda. Jan 78, 41p NBSIR-77-1388

Keywords: *Windows, *Energy conservation, Houses, Daylighting, Service life, Thermal efficiency, Cost estimates, Energy accounting, Life(Durability), Residential buildings, Performance evaluation, District of Columbia.

This report presents new information on thermal loads, daylighting, management, and life-cycle costs which indicates that such recommendations may neglect important design and operational aspects of windows which can conserve energy resources and reduce life-cycle building costs. A case example is described in which energy consumption and life-cycle costs are given for windows in a typical house in the Washington, D.C. area.

708,808
PB-280 456/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Integrated Household Appliances and Utility Services for Energy Conservation in Dwellings.
Final rept.
R. A. Grot, and L. S. Galowin. Mar 78, 13p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Proceedings of ERDA Conference Div. of Bldgs. and Comm Services on Technical Opportunities for Energy Conservation in Appliances, Boston, MA., May 11, 1976, CONF ERDA 7605139, p109-121.

Keywords: *Energy conservation, *Appliances, Refrigerators, Water heaters, Air conditioners, Clothes washers, Washing machines, Dishwashers, Thermal efficiency, Energy efficiency, Households, Heat recovery.

The technical feasibility of combining various appliances now constructed separately into integral assemblies which permit more efficient energy design, utilizing waste heat and minimizing the impact of appliance operation on heating and cooling systems is considered. Alternative strategies are suggested to the ways in which energy-consuming services are supplied and utilized in residences. Particular attention is given to the combination of the refrigerator-water heater, air conditioner-water heater and the construction of appliances such as clothes washers and dishwashers which heat only the quantity of water required for their operation from a warm-water house system.

708,809
PB-280 584/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Economic Optimization in the Energy Conservation Design of Single-Family Housing.
Final rept.,
S. R. Petersen. 1976, 13p
Pub. in ASHRAE Transactions, v82 pt1 p446-458 1976.

Keywords: *Energy conservation, *Residential buildings, *Houses, *Life cycle costs, Thermal insulation, Storm windows, Economic analysis, Optimization.

This report examines the economic criteria for minimizing life-cycle costs for both independent and interdependent energy conservation techniques. An index number format with cost data is presented with which the economically optimal use of attic insulation, wall insulation, and storm windows can be estimated for various climatic and economic assumptions, including heating and cooling factors, energy costs, energy conservation costs, discount rates, fuel price increases, and building lifetimes.

708,810
PB-280 619/8 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Energy-Effective Windows.
Final rept.
H. R. Trechsel. Apr 78, 58p NBS-SP-512
Proceedings of a Joint DOE (ERDA)/NBS Conference/Round Table on Energy-Effective Windows Held at Washington, D.C., on April 13, 1977. Sponsored in part by Department of Energy, Washington, D.C. Div. of Buildings and Community Systems. Library of Congress Catalog Card no. 78-600034.

Keywords: *Windows, *Energy conservation, *Meetings, Design, Life-cycle cost, Heat loss, Thermal efficiency, Buildings, United Kingdom, Europe, Research projects.

The proceedings of the conference contain: An Introduction to Window Research and its Significance to Energy Conservation in Buildings by Dr. Maxine Savitz; An Overview of Window Research at NBS by Dr. Belinda L. Collins; DOE/LBL Window Research by Dr. Samuel M. Berman; An Architect's View of Energy-Effective Windows by Harwood Taylor, AIA; Window Research in the United Kingdom and in Europe by David A. Button; Summary of the Discussion by Panel Members; Summary and Conclusions by Dr. Richard N. Wright; and A List of Participants and Auditors.

708,811
PB-281 304/6 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Window Blinds as a Potential Energy Saver - A Case Study.
Building science series (Final),
A. I. Rubin, B. L. Collins, and R. L. Tibbott. May 78, 85p NBS-BSS-112
Library of Congress Catalog Card no. 77-600038.

Keywords: *Blinds, *Energy conservation, *Office buildings, Utilization, Orientation, Venetian blinds.

Window usage at the National Bureau of Standards was studied by photographing venetian blind positions in offices at different times of the day and year. While blind positions were quite stable during the week of each study phase, they were quickly altered by the room occupants when deliberately set at extreme positions by the researchers. Significant differences were observed among blinds depending on compass orientation of the window, view type, season, and nature of experimental treatment. The greatest determinant of blind position was orientation, with blinds on north-facing windows being more open than on the south. The results suggest that energy conservation programs which rely on the activities of building occupants may be feasible. Suggestions are made for improvements in blind use and design.

708,812
PB-284 461/1 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Building Economics and Regulatory Technology Div.
Role of Economic Analysis in the Development of Energy Standards for New Buildings,
S. R. Petersen. Jul 78, 49p NBSIR-78-1471
Sponsored in part by Department of Housing and Urban Development, Washington, D.C., and Department of Energy, Washington, D.C.

Keywords: *Energy conservation, *Performance standards, *Building codes, *Buildings, Life-cycle cost, Benefit cost analysis, Cost effectiveness, Optimization.

This report suggests that economic considerations be incorporated directly into the standards development process. A life-cycle benefit-cost approach to standards development can provide a systematic and objective framework for standards specification. Differences in climate, building type, energy cost, and operational requirements can be directly incorporated into the standard as they impact energy-related benefits and costs. It is shown that the life-cycle costs associated with any given overall conservation goal can be reduced by developing an economically balanced standard. In addition, it suggests that a standard which has as its goal the minimization of life-cycle costs will likely lead to greater effective energy savings than alternative approaches. Specific suggestions for the incorporation of economic analysis into the standards development process are made.

708,813
PB-284 631/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comprehensive Approach to Window Design for Energy Conservation.
Final rept.,
S. R. Hastings. Aug 78, 5p
Pub. in Proceedings National Conf. on Passive Solar Energy (2nd), Held at Philadelphia, Pennsylvania on March 15-19, 1978, p321-325 (American Section ICES, University of Delaware, Newark, Aug 78).

Keywords: *Windows, *Energy conservation, Design, Performance evaluation.

Six categories of design strategies to improve the energy performance of windows are presented. These design strategies are evaluated by their ability to improve one or more of six possible energy functions windows can perform. An example strategy is selected from each category to illustrate how substantially a window's performance can be improved.

708,814
PB-285 014/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Resource Impact Factor (RIF) Approach to Optimal Use of Energy Resources.
Final rept.,
R. R. Jones. Oct 76, 4p
Pub. in ASHRAE Jnl., v18 n10 p15-18 Oct 76.

Keywords: *Natural resources, *Energy management, Energy conservation, Buildings, Utilization, Optimization, Resource Impact Factor, Non renewable resources, Energy resources, Reprints.

One of the basic objectives of a national energy conservation effort is to optimize use of non-renewable resources. A careful analysis of the fuel and energy supplied to buildings is especially important since this sector accounts for about 30% of energy consumption in the US and since buildings have greater flexibility with regard to energy sources than do motor vehicles and industrial processes. It is the intent of this paper to present the Resource Impact Factor (RIF) concept as a means whereby, in the technical process of developing energy efficient building projects, a quantification could also be given to the social value of our resources in order to obtain wise utilization.

708,815
PB-285 144/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Economic Analysis of Alternative Window Strategies.
Final rept.,
R. T. Ruegg, and R. E. Chapman. 1977, 11p
Pub. in Proceedings RILEM/ASTM/CIB Symp. on Evaluation of the Performance of External Vertical Surfaces of Buildings, Otaniemi, Espoo, Finland, Aug 28-Sep 2, 1977, v1 p395-405 (Technical Research Centre of Finland, Helsinki, Finland 1977).

Keywords: *Windows, *Residential buildings, Energy conservation, Life cycle costs, Service life, Cost analysis, Benefit cost analysis, Performance evaluation.

The focus of this paper is the energy and economic performance of the glazed portions of external vertical surfaces in residential buildings. A life-cycle costing technique is used to evaluate the dollar costs of

energy, acquisition, maintenance and repair, for windows of alternative design, size, and location, with various accessories and modes of use. The method of evaluation is described briefly and is illustrated in a case example. The results of the case example, based on a 'typical' single family dwelling in Portland, Maine (4173 heating degree days and 131 cooling hours), provide some guidelines for window selection in a moderately cold climate.

708,816
PB-285 311/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Use of a Computer Model to Evaluate Energy Saving Potentials for Gas-Fired Furnaces.
Final rept.,
J. Chi, G. Kelly, and D. Didion. 1978, 6p
Pub. in Proc. ASME Internatl. Heat Transfer Conf. 1978, Toronto, Canada, Aug 7-11, 1978. Paper 4 n78-IHTC-77, p143-148, 1978.

Keywords: *Energy conservation, *Gas furnaces, Furnaces, Energy efficiency, Computer programming, Mathematical models, Residential buildings, Computerized simulation, DEPAF computer program.

DEPAF (Design and Performance Analysis of Furnaces) is an NBS computer program for simulation of fossil-fuel-fired furnaces for residential heating systems. It is based upon an analytical model which accounts for cyclic (on-and-off) operation of the burner and air circulating blower. This paper illustrates the use of DEPAF to evaluate quantitatively the effectiveness of 15 combinations of selected energy-saving features for gas-fired residential heating furnaces. Sufficient information is also provided to demonstrate the important features of the simulation program DEPAF.

708,817
PB-285 492/5 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Criteria for Retrofit Materials and Products for Weatherization of Residences.
Final rept.,
W. J. Rossiter, and R. G. Mathey. Sep 78, 79p NBS-TN-982
Sponsored by Department of Energy, Washington, D.C. Office of Weatherization Assistance. Supersedes report dated Apr 77, PB-266 907.

Keywords: *Energy conservation, *Residential buildings, Thermal insulation, Storm windows, Doors, Barrier coatings, Caulking, Weatherstripping, Thermostats, Temperature control, Criteria, Performance standards, Recommendations, *Retrofitting.

This report discusses criteria for retrofit materials and products which may be included in the DOE Weatherization Assistance Program; compiles a list of retrofit materials and products by generic type and indicates areas where they can be used; and points out precautions which should be followed in the application of the retrofit materials and products.

708,818
PB-286 909/7 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Center for Building Technology.
Effects of Resource Impact Factors on Energy Conservation Standards for Buildings.
Building science series (Final).
S. F. Weber. Sep 78, 61p NBS-BSS-114
Library of Congress Catalog Card no. 78-606072.

Keywords: *Energy conservation, *Buildings, Performance standards, Life-cycle cost, Service life, Cost effectiveness, Benefit cost analysis, Taxes, Thermal efficiency, Mathematical models, *Resource impact factors, Energy Conservation and Production Act of 1976.

This report addresses the question of the proper price for energy to be used in the development of optimum (i.e., cost-effective) energy conservation performance standards for buildings. It finds that the appropriate price for energy is its social value, which can be determined through the development and application of Resource Impact Factors (RIF's). Some guidelines are provided for the formulation and development of RIF's. A life-cycle cost minimization model for determining the optimum conservation standard is employed to show how the use of RIF's would generally lower the maximum allowable energy consumption specified in the standard. Finally, geometric and algebraic measures are derived for the net gain in economic efficiency that would result from using RIF's in developing energy conservation performance standards.

708,819
PB-286 989/9 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Retrofitting an Existing Wood-Frame Residence for Energy Conservation--An Experimental Study.
Final rept.
D. M. Burch, and C. M. Hunt. Jul 78, 85p NBS-BSS-105
Supersedes PB-269 847. Library of Congress catalog card no. 77-27819.

Keywords: *Energy conservation, *Retrofitting, *Residential buildings, *Houses, Storm windows, Thermal insulation, Caulking, Weatherstripping, Carpets, Painting, Heat transfer, Heat loss, Performance evaluation, Benefit cost analysis, Cost effectiveness.

A wood-frame residence having only limited insulation in the attic was retrofitted in three stages to reduce its energy requirements for heating and cooling. The three retrofit stages comprised: reducing air leaks; adding storm windows; and installing insulation in the floor, ceiling, and walls. The house was extensively instrumented to evaluate energy savings and other performance factors. An economic model was used to evaluate the cost effectiveness of the retrofit options and the number of years to pay back their initial investment.

708,820
PB-287 804/9 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Economics and Regulatory Technology Div.
Life-Cycle Costing. A Guide for Selecting Energy Conservation Projects for Public Buildings.
Building science series (Final).
R. T. Ruegg, J. S. McConnaughey, G. T. Sav, and K. A. Hockenbery. Sep 78, 84p NBS-BSS-113
Library of Congress Catalog Card no. 78-600094.
Sponsored in part by Dept. of Energy, Washington, DC. Office of Conservation and Solar Applications.

Keywords: *Life-cycle cost, *Energy conservation, *Public buildings, Retrofitting, Design, Cost engineering, Benefit cost analysis, Cost effectiveness, Economic analysis, Guidelines, Computer programs, BASIC programming language.

This report provides a step-by-step guide for conducting life-cycle cost evaluations of energy conservation projects for public buildings. It explains the use of life-cycle costing analysis to evaluate and rank the cost effectiveness of alternative energy conservation retrofit projects to existing public buildings, and to select the most cost-effective design for new buildings. Worksheets, illustrated with a realistic example, and a computer program are provided. This guide is compatible with a life-cycle costing guide prepared for the Department of Energy for use in the Federal Energy Management Program by Federal Agencies. The purpose of this report is to provide a guide to state and local governments for use in their energy conservation programs.

708,821
PB-289 204/0 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Center for Building Technology.
Geographical Variation in the Heating and Cooling Requirements of a Typical Single-Family House, and Correlation of These Requirements to Degree Days.
Building science series.
E. A. Arens, and W. L. Carroll. Nov 78, 64p NBS-BSS-116
Contract E(49-1)-3800
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Assistant Secretary for Policy Development and Research.

Keywords: *Heat load, *Cooling load, *Houses, Residential buildings, Climate, Variations, Differences, Degree days, Energy consumption, Heat consumption, Energy requirements, Heating load, Energy conservation.

The report has three main purposes: First, it assesses Test Reference Year (TRY) hourly climate data tapes to determine how well they represent long-term average climate when used for estimating average annual heating and cooling requirements. The report presents a method to adjust heating and cooling requirements that are computed using TRY data, in order to make them represent long-term average heating and cooling requirements. Second, the report quantifies the geographic variation of annual heating and cooling requirements across the U.S. by computing the heating and cooling requirements of a typical ranch-style residence for the 8760 hours of each of the 60 TRY tapes, and adjusting the results by the method described above. Third, the effectiveness of degree-day data for predicting these computed annual heating and cooling requirements is examined, and the variability of heating and cooling requirements within degree-day 'zones' of 1000 degree day width is presented.

708,822
PB-289 813/8 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Economics and Regulatory Technology Div.
Economic Analysis of the Norris Cotton Federal Office Building.
Final rept.
P. T. Chen. Nov 78, 62p NBSIR-78-1568
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Office buildings, *Cost effectiveness, Construction costs, Design criteria, Cost engineering, Cost comparison, Benefit cost analysis, Economic models, New Hampshire, *Energy conservation, Norris Cotton Federal Office Building, Manchester(New Hampshire), Life-cycle cost.

The Norris Cotton Federal Office Building in Manchester, New Hampshire, has been constructed and occupied by the General Services Administration to demonstrate energy conservation techniques in the design and operations of a contemporary office building. This post-occupancy economic evaluation conducted by the National Bureau of Standards shows that additional construction costs incurred in order to reduce the energy consumption of the building are adequately offset by the present value of the resulting annual energy savings. In the economic model, the actual construction cost and energy consumption of the constructed building are compared with the estimated construction cost and energy consumption of a hypothetical equivalent conventional building. The present value costs of the two buildings are calculated for each year during a 40-year study period.

708,823
PB-290 010/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Control Strategies for Energy Conservation in Buildings.
Final rept.
P. E. McNall, E. T. Pierce, and J. P. Barnett. 1978, 12p
Pub. in Proceedings Symp. Honoring A. Pharo Gagge, on Energy Conservation Strategies in Buildings: Comfort, Acceptability, and Health, Held at Hartford, CT on 25 Jan 78, p1-12 (J. B. Pierce Found. Labs., Hartford, CT 1978).

Keywords: *Commercial buildings, Temperature control, Computerized simulation, *Energy conservation.

Three control strategies allowing zone temperatures to drift between a minimum and a maximum set point, without energy use, were imposed on two example commercial buildings. Each building was simulated on a different computer load program in several locations in the U.S. Comparisons of the energy demands were made for the various cases, showing significant energy saving potentials while maintaining inside thermal conditions which could probably be made acceptable to the occupants.

708,824
PB-290 046/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Use of Simulation Models of Building in Assessing Energy Conservation Strategies.
Final rept.
T. Kusuda. 1978, 14p
Pub. in Proceedings Symposium Energy Conservation Strategies in Buildings: Comfort, Acceptability, and Health, New Haven CT., January 25, 1978, p143-156 1978.

Keywords: *Buildings, Heating load, Cooling load, Heat transfer, Thermal efficiency, Conservation, *Energy conservation, NBSLD computer program.

A comprehensive treatment of building heat transfer processes is employed by the National Bureau of Standards Heating and Cooling Load Calculation pro-

gram NBSLD to study the effect of various building parameters upon the resulting heating and cooling load and thermal comfort of occupants, in order to evaluate energy conservation strategies. The basis of the computation is the detailed solution of simultaneous heat balance equations at all of the interior surfaces of a room or space. Transient heat conduction through the exterior walls and in the interior structures is handled by using conduction transfer functions. Also mentioned in this paper is use of a hybrid computing system whereby simultaneous transfer of air, moisture, and heat in and through the building can be studied more efficiently than by the conventional digital computer.

708,825
PB-293 498/2 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
CSA Weatherization Demonstration Project Plan.
R. Crenshaw, R. Clark, R. Chapman, R. Grot, and M. Godette. Mar 79, 81p NBSIR-79-1706
Sponsored by Community Services Administration, Washington, DC.

Keywords: *Low income groups, Houses, Residential buildings, Project planning, *Energy conservation, *Retrofitting.

This report comprises the plan of a research and demonstration effort to determine the fraction of energy that may be saved by installing weatherization retrofits in poor peoples' homes throughout the United States. Two broad groups of weatherization retrofits are considered for application in each dwelling: (1) 'architectural,' those affecting the building shell; and (2) 'mechanical,' those affecting space heating and service hot water systems. The report presents the background of the demonstration, the research tasks associated with the demonstration, a description of the diagnostic tests to be used, the rationale for economic decisions, the tests for evaluating mechanical systems, and the calculation methods used in selecting architectural options.

708,826
PB-297 497/0 PC **A08**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Summer Attic and Whole-House Ventilation.
M. H. Reppert. Jul 79, 155p NBS-SP-548
Library of Congress catalog card no. 79-600086. Sponsored in part by Department of Energy, Washington, and Attic Ventilation Industry. Proceedings of a Workshop Held at Gaithersburg, MD. on July 13, 1978.

Keywords: *Ventilation, *Houses, *Meetings, Heating load, Cooling load, Ventilation fans, Cooling fans, Temperature measurement, Heat transfer, Residential buildings, Mathematical models, Solar heating, Computer programs, *Attics, Energy conservation, Wind turbines.

This report contains the proceedings of the Summer Attic and Whole-House Ventilation Workshop. The purpose of the Workshop was to provide a forum for technical discussion to assess summer energy savings that might be achieved from the use of static and powered attic ventilation and whole-house ventilation equipment. Papers on experimental and mathematical model studies relating to attic and whole-house ventilation were presented. In addition, a paper on roof solar absorbtance and its effect on the cooling requirement of a residence was presented.

708,827
PB-298 057/1 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Thermal and Service Systems Div.
Evaluation of Hand-Held Infrared Thermometers for Wall Thermal Resistance Determinations.
S. J. Treado, and D. M. Burch. Jul 79, 27p NBSIR-79-1736
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Thermal resistance, *Infrared thermistors, *Thermal measuring instruments, *Walls, Buildings, Surface temperature, Heat flow, Infrared detectors, Infrared equipment, Thermal insulation, Performance tests.

Hand-held infrared (IR) non-contact surface thermometers from two manufacturers were tested to evaluate their effectiveness in measuring surface temperatures for the determination of the thermal resistance of walls. Two phases of the test were performed, first a laboratory test of a wood-frame wall, followed by a field test of a brick veneer wood-frame wall. During both phases of testing, additional measurements of thermal resistance were made for comparative purposes, using multijunction thermopiles and heat flow meters. An error analysis of the thermal resistance measurement procedure using IR surface thermometers was also performed.

708,828
PB77-600076 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Technical Guidelines for Energy Conservation.
D. Burch. 1977, 403p

Keywords: Air Force facilities, *Building energy conservation, Energy management, Evaluation and monitoring, Survey of buildings.

This report provides detailed technical material on various energy conservation actions for existing Air Force facilities and utility systems. It is specifically tailored to serve as a working document for Base engineers and technical personnel. The report covers energy conservation for Air Force facilities, including the equipment for providing hot water, space heating and cooling, lighting, and humidification. It also covers central plant systems and underground distribution systems (hot water, steam, and chilled water). It does not cover energy conservation measures for tactical or mission-related equipment such as ground vehicles or fighter aircraft.

708,829
PB80-117203 Not available NTIS
National Bureau of Standards, Washington, DC.
Economics and the Selection and Development of Energy Standards for Buildings.
Final rept.,
H. E. Marshall, and S. R. Petersen. 1979, 11p
Pub. in Energy and Buildings 2, p89-99 1979.

Keywords: *Buildings, *Performance standards, Design, Economics, Reprints, *Energy conservation, Life-cycle cost.

Energy-conservation standards for new buildings will play a major role in federal and state conservation policies in the coming decade. This article discusses economic-efficiency considerations that can be incorporated into the selection and development of such standards. Three types of energy budgets - 'fixed energy budgets', 'partially variable energy budgets', and 'economically efficient energy budgets' (EEEB) - are examined for use as standards. Economic-efficiency criteria are presented for use in selecting an appropriate energy budget. An illustrative example shows the potential dollar losses in life-cycle terms from failing to apply an EEEB. Research and operational requirements for developing and implementing an energy budget are described. Three energy-budget standards are evaluated in terms of economic efficiency, administrative feasibility, equity, and consistency in design requirements. An EEEB appears optimal in that it ranks highest overall with respect to the four criteria. Failure to begin research for, and development of, EEEBs now would impose unnecessary social costs in the form of extra expenses to achieve any chosen target levels of energy conservation in buildings.

708,830
PB80-119076 Not available NTIS
National Bureau of Standards, Washington, DC.
Cost Effectiveness of Energy Conservation Investments in New United States Residences.
Final rept.,
S. F. Weber. May 79, 10p
Pub. in Proceedings of the International CIB Symposium on Energy Conservation in the Built Environment (2nd) Held at Copenhagen, Denmark on May 28-June 1, 1979, p1-10, May 79.

Keywords: *Residential buildings, Fixed investment, Cost engineering, Investments, Cost effectiveness, Benefit cost analysis, Return on investment, Break-even point, *Energy conservation, Life-cycle cost, Payback period.

This paper assesses the cost effectiveness of selected energy conservation investments in new single-family residences in the U.S. Alternative investment levels in the four major components of the building envelope are evaluated: (1) attics; (2) walls; (3) floors; and (4) windows. The analysis is conducted for five cities of widely diverse climate conditions and for the major forms of energy used for heating and cooling in the U.S. For each investment level the internal rate of return (IRR) is calculated on an incremental basis, that is, in comparison with the next lower level of investment for that component. This marginal IRR is used to rank alternative levels of investment for all four components so that economically optimal envelope designs can be selected for each city and energy type.

708,831
PB80-119084 Not available NTIS
National Bureau of Standards, Washington, DC.
Life-Cycle Costing Guide for Energy Conservation in Buildings.
Final rept.,
H. E. Marshall, and R. T. Ruegg. 1979, 20p
Pub. in Energy Conservation Through Building Design, Chapter 9, p162-181 1979.

Keywords: *Buildings, Design, Cost estimates, Standards, *Energy conservation, Life-cycle cost, Retrofitting.

Architects, engineers, building operators and owners, and others who make decisions about the design and use of buildings need cost information about alternative energy conservation designs for old and new buildings. Specifically, they need to know the cost over time from introducing energy conserving techniques as compared to the cost savings over time from reduced energy bills. Life-cycle costing of energy conservation alternatives in buildings can be applied at the working level to reduce the owning and operating costs of buildings, to reduce energy consumption, and to encourage the optimal retrofit of old and design of new buildings with respect to rising fuel costs. This article provides practicing architects, architectural students, and others interested in the design process an overview of state-of-the-art methods for estimating the life-cycle cost (LCC) of alternative energy conservation techniques and a description of selected applications of LCC methods to energy conservation in buildings. Retrofitting existing residential buildings for energy conservation is examined in LCC terms. The design of envelope features and subsystems for energy conservation in new buildings is explored in the context of LCC analysis. Finally, energy standards for buildings are examined in the LCC context to show why varying climates and fuel prices must be considered in developing economically efficient standards.

708,832
PB80-127202 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Potential for Energy Savings with Water Conservation Devices.
Final rept.,
R. L. Palla. Jul 79, 33p NBSIR-79-1770

Keywords: *Water, Hot water heating, Heat recovery, Water supply, Water consumption, Water conservation, Recycling, *Energy conservation, *Energy consumption.

Through a survey of water-related energy use, a relationship between water usage and energy consumption is developed. Results obtained indicate that energy requirements for water heating far exceed those for water supply and wastewater treatment. Based on estimates of residential water consumption with and without water conserving products, the potential for energy savings is assessed. Reduction in household water heating energy consumption of about 35 percent are predicted with the use of conventional water saving products. Also considered in this study are the energy saving potentials of grey water recycling and grey water heat recovery systems.

708,833
PB80-131055 Not available NTIS
National Bureau of Standards, Washington, DC.
Grand Scheme/An Economist's View of Energy Conservation.
Final rept.,
R. Ruegg. 1979, 19p
Pub. in Proceedings of the Conference Conservation: Energy Management by Design, Held at El Paso, TX., on March 1979, p1-19 1979.

Keywords: Buildings, Economic analysis, *Energy conservation.

This report gives an overview of the role of economics in planning and implementing energy conservation. It

explains how the economist seeks to find the economically efficient balance among the alternatives to nonrenewable energy use. It discusses the use of economic analysis to solve problems of importance to designers, engineers, builders, manufacturers, public utilities, government policy makers, and consumers. A brief case study of the life-cycle cost performance of alternative window systems is presented to show how economic analysis can guide decisions of mutual concern to different members of the building community.

708,834
PB80-133853 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Evaluation of Energy Conserving Modifications for Water Heaters.
Final rept.,
R. L. Palla. Jul 79, 53p NBSIR-79-1783

Keywords: *Water heaters, Residential buildings, Hot water heating, Gas heaters, Electric appliances, Oil burners, Thermal insulation, Temperature control, Revisions, *Energy conservation.

The effects of various energy-conserving modifications on water heating energy consumption were evaluated based on laboratory tests. Nine storage-type residential water heaters, representative of standard and 'energy-saving' electric, gas, and oil fueled models currently on the market, were obtained for testing. Federally-promulgated water heater test procedures were used to measure the energy consumption of each unit before and after modifications.

708,835
PB80-137920 PC **A07**/MF **A01**
Wilson (J.W.) and Associates, Inc., Washington, DC.
Automatic and Discretionary Adjustment Procedures for Electric Utility Rates, Volume I.
Final rept.,
R. E. Miller. Nov 79, 129p NBS-GCR-ETIP-79-77
Contract NBS-5-35894

Keywords: *Electric utilities, *Rates(Costs), *Adjusting, Technology innovation, Fuel consumption, Electric power generation, Incentives, Accounting, Cost analysis, Operating costs, Prices, Labor estimates, Taxes, Purchasing, Inflation(Economics).

The report explores the policy considerations relating to the use of interim adjustment procedures, both automatic and discretionary. The primary emphasis concerns fuel adjustment procedures which are the most common interim adjustments used for electric utilities. Section A explains how an interim adjustment procedure works. Section B is a brief but comprehensive statement of the advantages and disadvantages of interim adjustment procedures. Sections C through F relate specifically to fuel adjustment procedures. The components of fuel and purchased power costs are identified in Section C, and the three principal approaches to fuel adjustments are presented there. The advantages and disadvantages of these three approaches are discussed in Section D, and some problems in implementing fuel adjustments are identified. Section E is a discussion of the problem of preserving incentives when fuel adjustment procedures are utilized. Section F is a discussion of special considerations that are applicable to some electric utilities. Section G is a discussion of interim adjustment procedures for cost elements other than fuel. It focuses on labor costs, taxes, and the composite of all operating costs other than fuel and purchased power.

708,836
PB80-142102 PC **A08**/MF **A01**
Wilson (J.W.) and Associates, Inc., Washington, DC.
Use of a Future Test Year for Electric Utility Ratemaking Appendices A-D.
Final rept.,
R. E. Miller. Nov 79, 161p NBS-GCR-ETIP-79-76
Contract NBS-5-35894

Keywords: *Public administration, *Rates(Costs), *Electric utilities, Electric power demand, Bibliographies, Forecasting, Decision making, Incentives, Experimental Technology Incentives Program.

The report is one of a series involving work by the Experimental Technology Incentives Program (ETIP) designed to accelerate or otherwise improve decisions in electric utility rate cases in state regulatory commissions. The objective is to provide incentives for technological innovation. The future test year method has been found to reduce greatly the amount of time and personnel resources involved in a rate case and to extend the scope and quality of analyses performed. The method projects an electric utility's costs forward into the first full year when proposed new rates will be in effect so that rates can be matched to costs. The report explains how all the elements of a test year cost of services may be projected into the future. The other tools, described in published reports, deal with performance evaluation, productivity, automatic and discretionary adjustment, long range planning, and regulatory lag in general.

708,837
PB80-144181 Not available NTIS
National Bureau of Standards, Washington, DC.
Potential Energy Savings Using Comfort-Index Controls for Building Heating and Cooling Systems.
Final rept.,
T. Kusuda, J. W. Bean, and P. E. McNall. 1978, 21p
Pub. in Proc. Int. Indoor Climate Symp., Copenhagen, Denmark, Aug. 30-1 Sep 1978.

Keywords: *Buildings, Space heating, Environmental engineering, Comfort, Heating load, Cooling load, Temperature control, *Energy conservation, NBSPMV computer program.

Significant energy savings are possible through the use of thermal comfort index controls of building heating and cooling systems. In order to study the potential energy saving by comfort index controls, Fanger's Predicted Mean Vote (PMV) and Predicted PerCent Dissatisfied (PPD) indices have been incorporated into NBSLD (National Bureau of Standards Heating and Cooling Load Calculation Program) to determine hourly profiles of indoor thermal comfort conditions under various operating conditions which allow inside control points to vary. Discussed in this paper are the potential applications of this computer program (NBSPMV) for the evaluation of selected energy conservation options, from the standpoint of indoor habitability and energy conservation. These options include increased temperature deadband, natural cooling, nighttime thermostat setback, passive solar heating, evaporative cooling, temperature ramp controls, intermittent heating and cooling, and programmed heating and cooling.

708,838
PB80-147424 PC **A24**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Validation and Assessment Issues of Energy Models.
S. I. Gass. Feb 80, 564p NBS-SP-569
Proceedings of a Workshop Held at the National Bureau of Standards, Gaithersburg, Maryland on January 10-11,1979. Sponsored in part by Energy Information Administration, Washington, DC. Library of Congress catalog card no. 79-600216.

Keywords: *Meetings, Proving, Appraisals, Performance evaluation, Proceedings, *Energy models.

This bibliography cites reports on new designs of automobile engines. The engine types include gas turbines, stratified charged engines, steam engines, hybrid engines using electric motors or flywheels, and rotary engines. Many of these studies also cover the problem of improving fuel economy while lowering emissions. Retrofit devices are excluded. (This updated bibliography contains 100 abstracts, 94 of which are new entries to the previous edition.)

708,839
PB80-154719 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
MIUS (Modular Integrated Utility System) Feasibility - Five Exploratory Studies,
R. J. Mitchell. Jan 80, 159p NBSIR-79-1787
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: Houses, Space heating, Electric power generation, Environmental impacts, Feasibility, Cost analysis, *MIUS, Energy conservation.

This report highlights the collaborative efforts of the National Bureau of Standards, the National Aeronautics and Space Administration and their contractors in the analysis of a Modular Integrated Utility System (MIUS) and conventional utilities for five separate housing projects. The collaborative efforts consist of three separate tasks: (1) Comparative Environmental Analysis; (2) Comparative Energy Analysis; (3) Utility System Design and Cost Analysis.

708,840
PB80-162142 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Optimizing Weatherization Investments in Low-Income Housing: Economic Guidelines and Forecasts.
Final rept.,
R. E. Chapman, R. W. Crenshaw, K. A. Barnes, and P. T. Chen. Feb 80, 156p NBSIR-79-1948
Sponsored in part by Community Services Administration, Washington, DC.

Keywords: *Low income groups, *Residential buildings, *Houses, Thermal insulation, Weatherstripping, Caulking, Storm windows, Cost estimates, Cost effectiveness, Benefit cost analysis, *Weatherization, Storm doors, Energy conservation, Life-cycle costs.

This study establishes a framework for systematically analyzing the economic viability of alternative methods of weatherizing low-income housing. These methods include, but are not limited to insulation, weatherstripping and caulking, and installation of storm windows and doors. The economic framework is illustrated through the development of a series of forecasts (economic guidelines) which show the optimal level of weatherization for low-income residences in 15 cities across the nation.

708,841
PB80-170236 Not available NTIS
National Bureau of Standards, Washington, DC.
Economic Analysis of Alternative Envelope Designs for New Residences in the United States.
Final rept.,
S. F. Weber. 1980, 6p
Pub. in Proceedings of Int. CIB Symposium on Energy Conservation in the Built Environment (2nd), Copenhagen, Denmark, May 1979, Energy 5, n1 p63-68 1980.

Keywords: *Residential buildings, Houses, Walls, Floors, Windows, Investments, Benefit cost analysis, Cost effectiveness, *Energy conservation, Attics, Life-cycle cost, Payback period.

An economic evaluation is conducted for selected energy-conservation investments in the envelope design of new single-family housing in the U.S. Alternative investment levels in the four major components of the building envelope are evaluated: (1) attic, (2) walls, (3) floor, and (4) windows. The analysis is conducted for five cities of widely diverse climate conditions and for the major forms of energy used for heating and cooling in the U.S. For each investment level, the internal rate of return (IRR) is calculated on an incremental basis, that is, in comparison with the next lowest level of investment for that component. This marginal IRR is used to rank alternative levels of investment for all four components so that economically optimal envelope designs can be selected for each city and energy type. Two points of view are considered in the selection of optimal designs: that of an individual homebuyer and that of a public policy planner.

708,842
PB80-179245 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Simplified Energy Design Economics: Principles of Economics Applied to Energy Conservation and Solar Energy Investments in Buildings.
Final rept.,
H. E. Marshall, R. T. Ruegg, and F. Wilson. Jan 80, 55p NBS-SP-544

Keywords: *Buildings, *Handbooks, Economic analysis, Cost engineering, Investment, Return on investment, Heat pumps, Benefit cost analysis, *Energy conservation, Life-cycle cost, Payback period.

This handbook introduces the architect and engineer to economic analysis techniques for evaluating alternative energy conservation investments in buildings. Life-cycle cost, benefit-cost, savings-to-investment, payback, and rate-of-return analyses are explained and illustrated. The procedure for discounting is described for a heat pump investment. Formulas, tables of discount factors, and detailed instructions are provided to give the reader all information required to

make economic evaluations of energy conserving building designs.

708,843
PB80-182850 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
State Standards, Plans and Programs for Energy Conservation of Consumer Products.
Final rept.,
S. J. Chumas. Jan 80, 72p NBSIR-80-2017
Contract DOE-EA-77-A-01-6010

Keywords: *Government policies, State government, Surveys, Legislation, Regulations, Planning, Performance standards, *Energy policy, Energy conservation, Energy Extension Service.

States are responding to Federal requirements to develop procedures for public energy conservation measures and plans. This document furnishes evidence or absence of state energy conservation legislation, regulations, voluntary standards, plans, and programs for consumer products. It also identifies the states that are participating in the pilot Energy Extension Service (EES). The survey was based on seven questions asked of each state. This document contains the state responses to the inquiry and a bibliography of the materials submitted in response to the survey.

708,844
PB80-184229 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Energy Budget Procedures and Performance Criteria for Energy Conserving Building Illumination Systems,
A. T. Hattenburg, J. L. Heldenbrand, D. K. Ross, R. G. Stein, and W. Tao. May 80, 122p NBSIR-80-2052
Sponsored in part by Department of Energy, Washington, DC. Office of Building and Community Systems.

Keywords: *Commercial lighting, *Office buildings, *School buildings, *Residential lighting, Illuminating, Performance standards, Guidelines, *Energy conservation.

This report covers subsystem energy budget development procedures and performance criteria for building illumination which were developed by a consultant team of practitioners experienced in building illumination systems. A general procedure is described wherein the energy required for efficient illumination of a building is examined and corresponding power and annual energy budget guidelines are developed. This methodology is applied to three classes of building--offices, schools, and residences--to illustrate the method. Representative power and energy budgets are developed.

708,845
PB80-201601 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Energy Conservation in Buildings: An Economics Guidebook for Investment Decisions.
Final rept.,
H. E. Marshall, and R. T. Ruegg. May 80, 155p NBS-HB-132
Library of Congress catalog card no. 80-600056.

Keywords: *Buildings, Heat recovery, Solar energy, Windows, Heat pumps, Thermal insulation, Furnaces, Space heating, Economic analysis, Benefit cost analysis, Cost effectiveness, Guidelines, *Energy conservation, Waste heat utilization, Financial incentives, Life-cycle, Payback period.

This guidebook provides principles, techniques, step-by-step illustrations, and sample problems on how to evaluate the economics of energy conservation and solar energy investments. Techniques of economic evaluation including life-cycle costing, net benefits, savings-to-investment ratio, internal rate-of-return, and discounted payback analyses are described and compared in terms of their advantages and disadvantages. Discounting, a procedure for taking into account the time value of money, is illustrated in the analysis of an investment in heat pumps. Practice problems for discounting and for applying each of the five techniques are presented. Factors that affect benefits and costs, including time horizons, discount rates, inflation, incentives, taxes, salvage values, and measures of uncertainty, are discussed, and guidance is provided for selecting appropriate values for these factors when making economic evaluations. Comprehensive case illustrations for solar heating and for window design management are described. Appendices provide tables and formulae for evaluating the economics of alternative conservation investments.

708,846
PB80-203177 PC **A07**/MF **A01**
Wilson (J.W.) and Associates, Inc., Washington, DC.
Use of a Future Test Year for Electric Utility Ratemaking.
Final rept.,
R. E. Miller. Nov 79, 139p NBS-GCR-ETIP-79-75
Contract NBS-5-35894

Keywords: *Electric utilities, Public utilities, Operating costs, Revenue, Economic analysis, Econometrics, Sales, Forecasting, Decision making, *Rate structure.

This report is one of a series involving work by the Experimental Technology Incentives Program (ETIP) designed to accelerate or otherwise improve decisions in electric utility rate cases in state regulatory commissions. The objective is to provide incentives for technological innovation. The future test year method projects an electric utility's cost forward into the first full year when proposed new rates will be in effect so that rates can be matched to costs. The report explains how all the elements of a test year cost of services may be projected into the future.

708,847
PB80-208978 PC **A04**/MF **A01**
Wilson (J.W.) and Associates, Inc., Washington, DC.
Automatic and Discretionary Adjustment Procedures for Electric Utility Rates. Volume II.
Final rept.
Nov 79, 75p NBS-GCR-ETIP-79-78
Contract NBS-5-35894
See also Volume 1, PB80-137920.

Keywords: *Electric utilities, Rates(Costs), Cost analysis, Adjusting, Documentation, Fuel consumption, Electric power generation, Computation, Computer programming, Prices, Operating costs.

Volume II is the User's Guide to the computer software developed for analysis and computation of fuel adjustments calculated in accord with the three methods discussed in Volume I. The first section of this Volume is a discussion of the several factors that determine an electric utility's fuel cost, including a series of numerical examples. The second section is a pecise description of the three designs for fuel adjustment procedures which were introduced in Volume I. This description includes illustrations based on the numerical examples presented in the first section. The third section contains the instructions for using the computer software developed in this report for calculating fuel adjustments.

708,848
PB80-212749 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Economic Analysis of Efficiency Improvements to Residential Gas-and Oil-Fired Central Heating Equipment.
Final rept.,
S. R. Petersen, and G. E. Kelly. Jul 80, 56p NBSIR-80-2079
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Boilers, *Furnaces, *Gas furnaces, Oil burners, Design, Revisions, Performance standards, Benefit cost analysis, Cost effectiveness, Cost analysis, *Oil furnaces, *Energy efficiency, Residential sector, Life-cycle costs, Energy conservation.

Minimum performance standards for new residential gas- and oil-fired furnaces and boilers will be promulgated by the Department of Energy in the early 1980's. These standards will implicitly require that a number of design modifications be made to improve the seasonal efficiency of many basic furnace/boiler configurations. This report examines the potential improvement in seasonal efficiency due to a number of such modifications, as well as their life-cycle cost effectiveness. Included in the analysis are intermittent ignition devices (for gas-fired equipment), improved heat exchangers, stack dampers, external venting (with preheated air), and improved blower motor efficiencies (for forced-air furnaces). Minimum efficiency criteria for new furnaces and boilers are developed.

708,849
PB80-213986 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Simplified Heating and Cooling Energy Analysis Calculations for Residential Applications,
T. Kusuda, and T. Saitoh. Jul 80, 136p NBSIR-80-1961

Keywords: Houses, Residential buildings, Thermal insulation, Storm windows, Caulking, Computer programs, Algorithms, *Energy audits, *Retrofitting, *Energy conservation, Fortran, Solar collectors.

In order to shorten the lengthy computational labor and cost common to most existing hourly simulation computer programs, a simplified energy calculation procedure was developed for the evaluation of energy conservation effectiveness of home retrofitting. The procedure utilizes monthly normal weather parameters such as temperature, humidity, wind data, and solar radiation, in lieu of the traditional degree-day procedure. The thermal time constant was used to account for the effect of building thermal mass on seasonal heat transfer performance. In addition to standard retrofit procedures such as addition of thermal insulation, use of storm windows, and sealing of cracks, included in the procedure are the energy conservation effects due to the use of solar collectors, hot water tank insulation, and insulation around the heat distribution systems such as ducts and pipes.

708,850
PB80-216914 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Report on the Relevance of the Second Law of Thermodynamics to Energy Conservation.
Final rept.,
D. Didion, D. Garvin, and J. Snell. Aug 80, 56p NBS-TN-1115
Sponsored in part by Department of Energy, Washington, DC.

Keywords: Analyzing, Efficiency, Entropy, *Energy conservation, Second law of thermodynamics.

This is a study of the relevance to Federal energy conservation programs of the use of the concept of energy efficiency as being the ratio of the minimum available work necessary for accomplishing a given task to the available work in the actual fuel used to accomplish this task. Included within the study is a review of selected elements of thermodynamics and efficiency concepts, and identification of the technology pertinent to energy conservation programs. The study examines the potential benefits, if any, that would accrue from the application of Second Law of Thermodynamics principles to these technologies. Results indicate the positive value of the Second Law analytical techniques in the planning and design stages of system development, and the rather limited value of its use during the performance monitoring stage. Needs for advancing the acceptance and use of the Second Law analytical techniques are identified.

708,851
PB80-219819 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Review of Current Calculation Procedures for Building Energy Analysis,
T. Kusuda. Jul 80, 60p NBSIR-80-2068
Sponsored in part by Department of Energy, Washington, DC. Architectural and Engineering Systems Div.

Keywords: *Buildings, Surveys, Questionnaires, Methodology, Computerized simulation, *Energy analysis, Energy conservation.

Existing calculation procedures for building energy analysis, both computer-based and manual, were surveyed by questionnaires to determine the extent to which they were used and their technical content. It was found that most of the Nation's building energy consumption analyses are done by computerized simulation of HVAC system and equipment performance. This report provides brief descriptions of some energy analysis procedures which merit further study. It also identifies items not covered in the existing procedures which need to be developed for the improvement of energy calculation technology.

708,852
PB80-224330 PC **A06**/MF **A01**

National Bureau of Standards, Washington, DC. National Engineering Lab.
Expanded NBSLD (NBS Load Determination) Output for Analysis of Thermal Performance of Building Envelope Components.
Final rept.,
S. R. Petersen, and J. P. Barnett. Jul 80, 105p NBSIR-80-2076
Sponsored in part by Department of Energy, Washington, DC., and Department of Housing and Urban Development, Washington, DC.

Keywords: *Buildings, Thermal efficiency, Space heating, Heating load, Cooling load, Heat loss, Heat transfer, Computer programs, Computerized simulation, *Energy analysis, NBSLD-XO computer program.

The NBS Load Determination Program (NBSLD) for the calculation of space heating and cooling loads in buildings is a potentially useful tool for the improved thermal design of building envelopes. However, its usefulness is limited because only the net heating and cooling loads are determined. In order to design building envelopes which are to be, from inception, more energy efficient than existing buildings, the thermal performance of the individual envelope elements (e.g., walls, windows, ceilings and floors) must be known and the interrelationships among these components understood. NBSLD-XO is an expanded output version of NBSLD which provides this data on an hourly, daily, monthly and/or annual basis. This report outlines the NBSLD-XO program, format, and output and provides several examples of its use based on a prototypical single-family residential building.

708,853
PB81-105082 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
NBS Energy Model Assessment Project: Summary and Overview,
S. I. Gass, K. L. Hoffman, R. H. F. Jackson, L. S. Joel, and P. B. Saunders. Sep 80, 43p NBSIR-80-2128
Sponsored in part by Department of Energy, Washington, DC.

Keywords: Gas supply, Crude oil, Mathematical models, Scenarios, Forecasting, Performance evaluation, *Energy models, MOGSM model, Energy supplies.

This report is a summary of the activities and technical reports for the Energy Model Validation Procedure Development project undertaken by the Operations Research Division for the Department of Energy, using DOE's Midterm Oil and Gas Supply Modeling System (MOGSM) as a test vehicle. The reports cover: (1) assessment of the documentation of MOGSM; (2) analysis of (a) the model methodology, (b) characteristics of the input and other supporting data, (c) statistical procedures undergirding construction of the model, and (d) sensitivity of the outputs to variations in input; as well as (3) guidelines and recommendations for the role of these in model building and developing procedures for their evaluation.

708,854
PB81-133829 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Weatherization Investment Costs for Low-Income Housing.
Final rept.
S. F. Weber, M. J. Boehm, and B. C. Lippiatt. Nov 80, 83p NBSIR-80-2167
Sponsored in part by Community Services Administration, Washington, DC.

Keywords: *Houses, *Residential buildings, Low income groups, Cost analysis, Caulking, Weatherstripping, Thermal insulation, Tables(Data), *Weatherization, *Energy conservation, Storm windows, Retrofitting.

This report presents the results of a project involving the collection and tabulation of field data on the costs of retrofitting low-income houses for energy conservation. The program involves the installation and evaluation of a broad range of energy conservation techniques for over 200 single-family houses in 14 demonstration sites throughout the United States.

708,855
PB81-135642 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
'Reference Building' Approach to Building Energy Performance Standards for Single-Family Residences.
Final rept.
S. R. Petersen, and J. L. Heldenbrand. Oct 80, 40p NBSIR-80-2161
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Residential buildings, Buildings, Performance standards, Thermal efficiency, Houses, Energy efficiency, Energy conservation.

A reference building approach to building energy performance standards (BEPS) is described in this report which could serve as a framework for the further development of energy standards for new single-family residences. Each proposed new building design would be compared with a reference building design and operating profile. In order to comply with the standard, the design energy requirements of the new building would not be allowed to exceed those of the reference building, when evaluated by a parallel modeling process.

708,856
PB81-136269 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Life-Cycle Costing Manual for the Federal Energy Management Program.
Final rept.
R. T. Ruegg. Dec 80, 240p NBS-HB-135
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Manuals, Buildings, Cost effectiveness, Benefit cost analysis, Guidelines, Computer programs, *Life-cycle cost, *Energy conservation, Government buildings, Federal energy management program.

This manual is a guide to understanding the life-cycle costing method and an aid to calculating the measures required for evaluating energy conservation and renewable energy investments in all Federal buildings. It expands upon life-cycle costing criteria contained in the Program Rules of the Federal Energy Management Program (Subpart A of Part 436, Title 10, U.S. Code of Federal Regulations) and is consistent with those criteria. Its purpose is to facilitate the implementation of the Program Rules by explaining the life-cycle costing method, defining the measures, describing the assumptions and procedures to follow in performing evaluations, and giving examples. It provides worksheets, a computer program, and instructions for calculating the required measurements.

708,857
PB81-217804 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Control Strategies for Energy Conservation - A Case Study of the Materials Building, National Bureau of Standards.
Final rept.
J. Y. Kao, and E. T. Pierce. May 81, 48p NBSIR-81-2277

Keywords: Space heating, Air conditioning, Ventilation, Heat load, Cooling load, Buildings, *Energy management, BLAST-2 computer program, Energy conservation, Energy analysis, NTISCOMNBS.

The BLAST-2 Computer Program is used to investigate various heating, ventilating and air conditioning control strategies and their combinations to reduce the energy consumption of a laboratory building located at the National Bureau of Standards, Gaithersburg site. The techniques of modeling the building load and air system performance are explained. The results are presented and discussed. Control strategies investigated include dry-bulb and enthalpy economizer cycles, resetting supply air temperatures by outside temperature and zone demand, shutdown of fan systems selectively, and converting interior systems to VAV systems. By combining the various control strategies, eight percent, twenty-nine percent and eight percent of heating, cooling and fan energy respectively may be saved.

708,858
PB81-219321 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC.
Research and Innovation in the Building Regulatory Process.
Final rept.
S. A . Berry. May 81, 211p NBS-SP-608, NBS/SP-608
See also PB80-217632. Library of Congress Catalog Card no. 81-600044.
Praoceedings of the Annual NBS/NCSBCS Joint Conference (5th). Technical Seminar on Solar Energy Conservation held in Denver, Colorado on August 6, 1980.

Keywords: *Solar energy, *Meetings, Buildings, Houses, Design, Building codes, Legislation, Regulations, Performance standards, Proceedings, *Energy conservation, NTISCOMNBS.

These proceedings include papers on: Energy programs in the state of Colorado; Building energy performance standards concepts; State energy audits; Energy and building systems services; Solar energy and building codes.

708,859
PB81-246977 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Energy Conservation by Multiple Glazing on Heavy Masonry Buildings.
E. T. Pierce. Jun 81, 29p NBSIR-81-2317
Sponsored in part by Architect of the Captiol, Washington, DC.

Keywords: *Window glazing, Buildings, Heating load, Cooling load, *Energy conservation, Library of Congress.

The BLAST-2 computer program is used to investigate multiple glazing as a means to reduce the energy consumption of two buildings of the Library of Congress in Washington, DC. The Thomas Jefferson building is of very heavy masonry construction, and the John Adams building is of heavy masonry. The techniques of modeling the building load and air system performance are explained. The results are presented and discussed.

708,860
PB82-103656 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Energy Management and Control Systems (EMCS) - User Satisfaction Study.
G. W. Dickinson. Aug 81, 20p NBSIR-81-2346
Sponsored in part by Department of Energy, Washington, DC.

Keywords: Buildings, Control equipment, Performance, Surveys, *Energy management systems, Control systems, Energy conservation, Energy management.

A study of 86 energy management and control systems (EMCS) was made to determine users' satisfaction and perceived system reliability.

708,861
PB82-104712 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Criteria for the Installation of Energy Conservation Measures.
Final rept.
H. R. Trechsel, and S. J. Launey. Jul 81, 207p NBS-SP-606
Sponsored in part by Department of Energy, Washington, DC. Library of Congress catalog card no. 81-600055.

Keywords: *Residential buildings, Standards, Ventilation, Installing, Oil burners, Safety, Storm windows, Thermal insulation, Recommendations, Guidelines, *Energy conservation, Residential sector, Retrofitting.

Standard installation practices were developed to assist in assuring the effectiveness and safety of energy conservation measures installed under the Residential Conservation Service (RCS). They serve as mandatory standards under RCS but are recommended guides for all installations of the covered materials and products. The criteria are being used by DoE to develop training manuals for installers, inspectors, and energy auditors. Part I provides information on the intended use of the practices, outlines the RCS program, and discusses specific major technical and related issues that were considered in the development of the standards: moisture and building retrofit, attic ventilation, electrical wiring, recessed and sur-

face-mounted fixtures, the use of diagnostic tools (infrared thermography, air change rate, and window air leakage measurements), and product certification. Part II provides the actual practices together with commentary and additional recommendations. The products covered are loose-fill, batts and blankets, rigid foam boards, UF foam and reflective insulations, window devices, caulks and sealants, water heater insulation, oil burner replacements, and vent dampers.

708,862
PB82-105487 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Performance of the Norris Cotton Federal Office Building for the First 3 Years of Operation.
Building science series (Final).
J. E. Hill, W. B. May, T. E. Richtmyer, J. Elder, R. L. Tibbott, G. T. Yonemura, C. M. Hunt, and P. T. Chen. Aug 81, 143p NBS-BSS-133
Library of Congress catalog card no. 81-600082. Sponsored in part by Department of Energy, Washington, DC.

Keywords: Office buildings, Performance evaluation, Commercial buildings, Illuminating, Space heating, Ventilation, Monitoring, *Government buildings, *Energy conservation, Norris Cotton Federal Office Building, Manchester(New Hampshire), Solar heating systems.

The Norris Cotton Federal Office Building is located in Manchester, New Hampshire, and was designed to demonstrate a number of energy saving concepts. Some of the major energy conserving features of the building are the use of solar collectors; heavy masonry construction with exterior insulation; small overall window area; heat recovery from heat pumps, chillers, a natural gas-powered engine/generator, and the ventilation system; modular boilers; thermal storage tanks; and a variety of energy conserving lighting systems.

708,863
PB82-119884 Not available NTIS
National Bureau of Standards, Washington, DC.
Transient Thermal Response of an Intermittently Cooled Massive Building.
Final rept.
P. S. Gujral, R. J. Clark, and D. M. Burch. 1981, 6p
Pub. in Proceedings of the American Society of Heating, Refrigeration and Air-Conditioning Engineers/ Dept. of Energy/Oak Ridge National Lab. Conference on Thermal Performance Exterior Envelopes of Buildings, Orlando, FL., December 3-5, 1979. ASHRAE SP 28, p751-756 1981.

Keywords: *Air conditioning, Buildings, Cooling, Diurnal variations, Performance tests, *Energy conservation.

A single-room externally insulated masonry test house was built within the environmental chamber at the National Bureau of Standards. The structure was subjected to diurnal summer sol-air temperature cycles while two energy conservation schemes were monitored. Both schemes utilized the building thermal mass to store nighttime cooling energy; the first, through night mechanical cooling, and the second through the use of ambient air. The results indicate that mechanical cooling is effectively stored in the building mass during the night so that no additional daytime cooling is needed for even the most extreme summer conditions. The tests further indicate that circulation of night anbient air effectively cools the structure so that no mechanical cooling is needed for summer cycles typical of many regions in the United States.

708,864
PB82-119892 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Performance of the Norris Cotton Federal Building in Manchester, New Hampshire.
Final rept.
T. E. Richtmyer, W. B. May, C. M. Hunt, and J. E. Hill. 1981, 17p
Pub. in Proceedings of the American Society of Heatig, Refrigeration and Air-Conditioning Engineers/Dept. of Energy/Oak Ridge National Lab. Conference on Thermal Performance Exterior Envelopes of Buildings, Orlando, FL., December 3-5, 1979. ASHRAE SP 28, p781-797 1981.

Keywords: *Office buildings, Monitoring, Performance evaluation, National government, *Energy conservation, Manchester(New Hampshire), Government buildings.

The Norris Cotton Federal Office Building is a medium-size 7-story government office building. It is located in Manchester, New Hampshire and has been designed to demonstrate a number of energy saving concepts. Some of the major energy conserving features of the building are the use of solar collectors; heavy masonry construction with exterior insulation; small overall window area; heat recovery from heat pumps, chillers, a natural gas-powered engine/generator, and the ventilation system; modular boilers; thermal storage tanks; and a variety of energy conserving lighting systems. The staff of the National Bureau of Standards (NBS) has been monitoring the performance of the building since it was occupied in September, 1976. This paper describes the building's thermal performance for the first three years of operation.

708,865
PB82-119900 Not available NTIS
National Bureau of Standards, Washington, DC.
Air Leakage Characteristics and Weatherization Techniques for Low-Income Housing.
Final rept.
R. A. Grot, and R. E. Clark. 1981, 17p
Pub. in Proceedings of the American Society of Heating, Refrigeration and Air-Conditioning Engineers/ Dept. of Energy/Oak Ridge National Lab. Conference on Thermal Performance Exterior Envelopes of Buildings, Orlando, FL., December 3-5, 1979. ASHRAE SP 28, p178-194 1981.

Keywords: *Residential buildings, *Houses, Low income groups, Performance tests, Air infiltration, Weatherization, Energy conservation.

Data are presented on the air leakage characteristics of approximately 250 dwellings occupied by low-income households in 14 cities, in all major climatic zones of the United States. Two types of measurements were used: a tracer-gas decay technique using air sample bags, which was developed at the National Bureau of Standards to measure natural air infiltration; and a fan depressurization test that measures induced air exchange rates. The data presented here show that for this group of dwellings natural air infiltration rates are distributed approximately lognormally. The induced air exchange rates are a measure of the tightness of building envelopes. There is little correlation between the natural air infiltration rates and the induced air exchange rates in these dwellings, unless the buildings are divided into classes of similar buildings. The use of fan depressurization as a diagnostic tool to assist weatherization crews in tightening buildings is discussed. Preliminary estimates are presented of the reduction in induced air exchange rates that may be achieved by applying building weatherization techniques.

708,866
PB82-120304 PC **A15**/MF **A01**
National Bureau of Standards, Washington, DC.
Detection, Diagnosis and Prognosis: Contribution to the Energy Challenge.
Final rept.
T. R. Shives, and W. A. Willard. Oct 81, 341p NBS/SP-622
Proceedings of the Meeting of the Mechanical Failures Prevention Group, held at the Inn at Santa Monica, Santa Monica, CA, Oct 7-9, 1980 (32nd). Sponsored in part by Office of Naval Research, Arlington, VA., Naval Air SystemsCommand, Washington, DC., and National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center. Library of Congress catalog card no. 8 1-600125.

Keywords: *Failure, *Meetings, Energy, Detection, Monitoring, Detectors, Wear, Energy conservation.

The subject of the symposium was the contribution of failure detection, diagnosis and prognosis to the energy challenge. Areas of special emphasis included energy management, techniques for failure detection in energy related systems, improved prognostic techniques for energy related systems, and opportunities for detection, diagnosis and prognosis in the energy field.

708,867
PB82-121591 Not available NTIS
National Bureau of Standards, Washington, DC.
Energy Potential of Daylighting in the Classroom.
Final rept.
G. Gillette. 1981, 13p
Pub. in Proceedings of the American Society of Heating, Refrigeration and Air-Conditioning Engineers/ Dept. of Energy/Oak Ridge National Lab. Conference on Thermal Performance Exterior Envelopes of Buildings, Orlando, FL., December 3-5, 1979. ASHRAE SP 28, p368-380 1981.

Keywords: *Daylighting, Windows, School buildings, *Energy conservation, Passive solar energy systems.

An analysis is presented where a classroom of prescribed size and occupancy has various fenestration designs applied to it and the resulting thermal and daylighting energy performance calculated. An attempt is made to relate the heating/cooling requirements of a window opening with its potential as a source of natural light. The parameters glass area, glass type (double-pane, reflective, etc.), and ceiling height are evaluated for a classroom in Ann Arbor, Michigan operated over the course of a 9-month school year. Comparisons are made between the performance of a design based on ASHRAE Standard 90-75 and alternate fenestration designs. Although the computerized thermal analysis and the daylight analysis had to be done separately, actual weather data and corresponding daylight readings for Ann Arbor, Michigan are used for both. Results show a potential energy savings when daylighting is carefully integrated into the building's envelope design, especially for southern exposures, but such savings will be realized only if applied with the other energy variables in mind.

708,868
PB82-123951 PC **A12**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Validation and Assessment of Energy Models.
Final rept.
S. I. Gass. Oct 81, 262p NBS-SP-616
Sponsored in part by Department of Energy, Washington, DC. Energy Information Administration. Library of Congress catalog card no. 81-600087. Proceedings of a Symposium Held at the National Bureau of Standards, Gaithersburg, Maryland on May 19-21, 1980.

Keywords: *Meetings, Validity, Assessment, Mathematical models, Model tests, *Energy models.

The symposium was organized by NBS' Operations Research Division with a two-fold agenda: (1) to summarize the recent ideas and advances of model validation and assessment that have been applied to DOE energy models, and (2) to hold workshops on key open questions that are of concern to the validation and assessment research community. Speakers addressed current and future practices, the EIA model validation program, model structure and data, and model credibility. Full-day workshop sessions were held on the following topics: validating composite models, the measurement of model confidence, model structure and assessment, sensitivity and statistical analysis of models, and model assessment methodologies. This volume documents the symposium proceedings and includes the formal papers presented, discussant comments, panel discussions and questions and answers, and summaries of the issues and conclusions reached in the workshops.

708,869
PB82-126673 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Interim Report on Model Assessment Methodology: Documentation Assessment.
S. I. Gass, K. L. Hoffman, R. H. F. Jackson, L. S. Joel, and P. B. Saunders. Jan 80, 65p NBSIR-80-1971
Sponsored in part by Department of Energy, Washington, DC.

Keywords: Documentation, Methodology, Assessment, *Energy models, Energy supplies.

This report describes the results of the documentation assessment phase of a project to assess the Department of Energy's Midterm Oil and Gas Supply Model. The objective here is not merely to record our conclusions about the documentation of that model, but also to present a methodological approach to documentation assessment. These methodological investigations have resulted in a set of guidelines which can be used both to assist project sponsors in determining their documentation needs, and as a standard against which to compare existing model reports.

708,870
PB82-245820 PC **A04**/MF **A01**

National Bureau of Standards, Washington, DC. National Engineering Lab.
Strategies for Energy Conservation in Small Office Buildings.
W. H. Parken, J. Y. Kao, and G. E. Kelly. Jul 82, 56p NBSIR-82-2489
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Office buildings, Strategy, Space heating, Ventilation, Air conditioning, *Energy conservation.

A comparative analysis is made of the thermal performance of a small office building using various HVAC systems and commonly employed strategies. The comparisons are made for seven geographical locations representing wide climatic variations within the continental United States. Results were obtained for fan, space heating hot water, and chilled water energy consumption through hour-by-hour simulations using the BLAST computer program. A small office building model was used in the simulations along with several HVAC systems; a constant volume reheat unit (serving the entire building), dual constant volume reheat units (serving separate zones of the building), and a variable air volume reheat unit. The strategies investigated included supply air temperature reset (constant, zone-controlled, and outdoor air-controlled), economy cycles (temperature and enthalpy), continuous conditioning versus conditioning only during occupied hours, changes in reheat set point temperature, and changes in minimum variable air volume ratio.

708,871
PB83-115543 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Strategies for Energy Conservation for a Large Retail Store.
J. Y. Kao, W. H. Parken, and T. E. Pierce. Sep 82, 54p NBSIR-82-2580
Sponsored in part by Department of Energy, Washington, DC.

Keywords: Commercial buildings, Strategy, Control, Performance, *Energy conservation, HVAC systems.

A comparative analysis is made of the thermal performance of selected HVAC systems and control strategies commonly employed in large retail stores. The comparisons are made for six geographical locations representing wide climatic variations within the continental United States. Hour-by-hour simulations with the BLAST computer program were used to obtain the yearly heating, cooling and fan energy consumption of a two-story large retail store. The HVAC systems simulated were constant volume reheat, variable air volume, and with direct expansion coils. The control strategies tested were dry bulb temperature economy cycle, enthalpy economy cycle, supply air temperature resetting, lowered space heating temperature, VAV zoning variations, and the combinations of these strategies. The results of these simulations were given and discussed. Substantial energy consumption differences were shown.

708,872
PB84-155274 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
Intermediate Future Forecasting System.
Final rept.
S. I. Gass, F. H. Murphy, and S. H. Shaw. 19 Aug 82, 150p NBS-SP-670
Proceedings of a Symposium Held at the Department of Energy, Washington, DC on August 19, 1982. See also DE83-014505. Library of Congress catalog card no. 83-600615. Sponsored in part by the Department of Energy, Washington, DC. Energy Infromation Administration.

Keywords: *Energy management, *Meetings, *Energy models, Marketing, Forecasting, Coal, Electric utilities, Crude oil, Natural gas.

The Symposium on the Department of Energy's Intermediate Future Forecasting System IFFS was held in Washington, D.C. on August 19, 1982. It was funded by the Energy Information Administration of The Department of Energy (DOE) and organized by the Operations Research Division of the National Bureau of Standards. The purposes of the Symposium were (1) to present to the energy community details of DOE's new energy market model IFFS and (2) to have an open forum in which IFFS and its major elements could be reviewed and critiqued by external experts. DOE speakers discussed the total system, its software design, and the modeling aspects of oil and gas supply, refineries, electric utilities, coal, and the energy economy. Invited experts critiqued each of these topics and offered suggestions for modifications and improvement. This volume documents the Proceedings (papers and discussion) of the Symposium.

708,873
PB84-167675 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Demand Limiting Algorithms for Energy Management and Control Systems.
C. Park. Feb 84, 89p NBSIR-84-2826
Sponsored in part by Department of Energy, Washington, DC. Office of Building and Community Systems, and Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Electric power demand, Office buildings, Commercial buildings, Control equipment, Load control, Algorithms, Computer programs, *Energy management, Load management.

Demand limiting control is one of popular control strategies for electrical energy management in Energy Management and Control Systems (EMCS) in commercial/office buildings. The purpose of demand limiting is to maintain the peak demand level below a predetermined limit by shedding nonessential loads in a building during the peak demand period. In this present report, description of fixed interval metering and sliding window metering for electrical demands are included. Demand limiting calculation procedures discussed are the ideal rate, the predictive, and the instantaneous rate methods. Demand limiting algorithms, which were developed based on available information, are presented. Computer program listings of demand limiting control algorithms in Fortran 77 and an open-loop computer simulation result are included in the appendices.

708,874
PB85-170678 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Economics of Energy Management.
Final rept.
R. T. Ruegg. Sep 84, 11p
Sponsored by Department of Energy, Washington, DC. Pub. in Heating/Piping/Air Conditioning 56, n9 p63-73 Sep 84.

Keywords: *Economic analysis, Cost analysis, Economic factors, Return on investment, Decision making, Reprints, *Energy management, Life cycle costs.

This article promotes effective energy management by guiding the reader to ask the right economic questions, evaluate the cost effectiveness of alternative investments and find assistance along the way. It provides a tabular overview of various methods of economic evaluation, provides an anatomy of life-cycle costing, advises on compiling data and making assumptions, and guides the reader through successive levels of the decision-making process.

708,875
PB86-112729 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Industrial/Commercial Insulation for Mechanical Systems Applications.
Final rept.
F. J. Powell. 1981, 3p
Pub. in Proceedings of Energy Technology Conference and Exposition (8th), Washington, DC., March 9-11, 1981, p547-549.

Keywords: *Thermal insulation, *Energy conservation.

The article gives the potential for energy savings and the justifications for using industrial/commercial thermal insulations on mechanical systems and equipment such as pipes, ducts, tanks, vessels, boilers, furnaces, and surfaces at which heat is transferred within the temperature range of -300F to +2800F. A potential savings of 250 million equivalent barrels of oil per year exists with 104 million equivalent barrels per year by improving the insulation on industrial steam process pipes alone. For pipes, this would cost $6.2 billion with a payback in 30 months. Activities that feature the reduction of heat gain or loss in existing or new mechanical systems and their components by application of cost effective levels of thermal insulation and from effective installation, operation, and maintenance practices are suggested.

708,876
PB86-163458 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
New Software Aids Life Cycle Costing of Energy Conservation Projects.
Final rept.
R. T. Ruegg, and S. R. Petersen. Sep 85, 9p
Sponsored by Department of Energy, Washington, DC. Pub. in Heating/Piping/Air Conditioning 57, n9 p79-87 Sep 85.

Keywords: *Buildings, Reprints, *Computer software, *Life cycle costs, *Energy conservation, *Computer applications.

The article discusses briefly recent trends in computer software used in the building design process, and examines a new computer program for evaluating the life-cycle costs of alternative building designs and systems against this general perspective. The use of the Building Life-Cycle Cost (BLCC) computer program is illustrated in a case example, and its advances and limitations are noted. The point is made that though the move is towards expert systems, at this stage, expert knowledge on the part of the user continues to be required.

708,877
PB86-199957 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Measurement of Temperature, Humidity, and Fluid Flow.
Final rept.
C. W. Hurley. Mar 86, 16p
Pub. in Proceedings of National Workshop - Field Data Acquisition for Building and Equipment Energy-Use Monitoring, Dallas, TX., October 16-18, 1985, p43-58 1986.

Keywords: *Temperature measuring instruments, *Measuring instruments, Humidity, Fluid flow, Temperature, Calibrating, Maintenance, Reprints.

Laboratory and field experience, and surveys, have clearly indicated that computerized laboratory and field tests and HVAC installations enhanced with Energy Management and Control Systems (EMCS) often experience problems related to the accuracy and reliability of the system instrumentation. The paper is being presented to call attention to only a few of the many neglected characteristics of instrumentation used in EMCS that have been found in the field to be the basic cause of problems in EMCS in new and existing installations. The characteristics of some of the available temperature, moisture, and flow monitoring instrumentation pertaining to EMCS application will be presented followed by typical problems encountered in interfacing various monitoring and control instrumentation with computer controlled systems.

708,878
PB88-130307 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.
Study of Three Measures for Energy Efficiency of Fossil Fueled Furnaces and Boilers.
Final rept.,
E. Kweller. Oct 87, 44p NBSIR-87/3645
Sponsored by Department of Energy, Washington, DC.

Keywords: *Boilers, *Furnaces, Operating costs, Fossil fuels, Measurement, Tests, *Energy efficiency.

The effectiveness of three measures of energy efficiency for furnaces has been demonstrated by comparison of the results for predicted energy saving against the cost savings predicted by the calculated total annual cost of operation using DOE test procedures. Two of the efficiency measures currently prescribed by DOE - the Annual Fuel Utilization Efficiency (AFUE) and the DOE Energy Factor (EF) are compared with an industry proposed energy factor - Seasonal Energy Utilization Factor (SEUF).

708,879
PB88-138227 PC **A13**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.

Life-Cycle Costing Manual for the Federal Energy Management Program: A Guide for Evaluating the Cost Effectiveness of Energy Conservation and Renewable Energy Projects for New and Existing Federally Owned and Leased Buildings and Facilities,
R. T. Ruegg. Nov 87, 278p NBS/HB-135-REV-1987
Also available from Supt. of Docs as SN003-003-02833-9. Supersedes PB81-136269. Library of Congress catalog card no. 87-619884. Sponsored by Department of Energy, Washington, DC. Assistant Secretary for Conservation and Renewable Energy.

Keywords: *Federal buildings, Life cycle cost, Manuals, Energy conservation, Economic analysis, Energy management, Renewable energy sources.

The manual is a guide to understanding the life-cycle costing method and an aid to calculating the measures required for evaluating energy conservation and renewable energy investments in all Federal buildings. It expands upon the life-cycle costing criteria contained in the Program Rules of the Federal Energy Management Program and is consistent with those criteria. Its purpose is to facilitate the implementation of the Program Rules by explaining the life-cycle costing method, defining the measures, describing the assumptions and procedures to follow in performing evaluations, and giving examples. It provides worksheets, data tables, and other computational aids for calculating the required measurements.

Reserves

708,880
PB-271 185/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Exploring Energy Choices.
Final rept.,
R. Thomson. 1976, 9p
Pub. in Encyclopedia of Energy, p25-33 1976.

Keywords: *Energy sources, United States, Reviewing.

This is a summary of analyses and projections by M. K. Hubbert and others of the major energy resources in the United States and worldwide. Also, current thinking on the relative merits and shortcomings of alternative energy sources is reviewed.

708,881
PB85-202133 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
General Illuminance Model for Daylight Availability.
Final rept.
G. Gillette, W. Pierpoint, and S. Treado. 1984, 11p
Pub. in Jnl. of the Illuminating Engineering Society 13, n4 p330-340 Jul 84.

Keywords: *Daylight, *Illuminance, Solar radiation, Availability, Intensity, Reprints, Sky radiation.

Based largely on extensive sky measurements at the National Bureau of Standards, plots have been made of sky and sun illuminances as functions of solar altitude and time of year. Comparisons have also been made of how these plots relate to values currently used by the I.E.S., and against similar measurements made by others within the U.S. and abroad. A value of extraterrestrial illuminance and its atmospheric attenuation have also been developed using related solar principles. Algebraic expressions have been prepared for obtaining, (1) the extraterrestrial illuminance, (2) direct normal solar illuminance inside the atmosphere, and (3) horizontal sky illuminance without the sun. While the extraterrestrial and direct normal solar values have been found to be functions also of Julian date, all plots seem to show a consistent correlation with solar altitude.

708,882
PB88-162581 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Issue of Sky Conditions.
Final rept.,
G. Gillette, and S. Treado. 1985, 5p
Contract DE-AC05-84OR21400
See also DE85-010590. Sponsored by Department of Energy, Washington, DC.
Pub. in Lighting Design and Application 15, n3 p23-27 Mar 85.

Keywords: *Sky brightness, *Illuminance, *Daylighting, *Daylight, Cloud cover, Solar radiation, District of Columbia, Reprints, Washington DC.

The issue of sky conditions is explored as applied to current daylighting practice. Based on studies of hourly sky conditions in the Washington, DC area, an understanding was sought regarding the ability to estimate illuminances and sky luminances under skies of variable cloudiness. The meaning and validity of nonstandard, non-perfect skies is discussed, and limits of non-perfection are explored and compared against measurements of hourly sky luminance, illuminance, and solar radiation.

Selected Studies In Nuclear Technology

708,883
PB85-178051 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Computerizing Materials Data - A Workshop for the Nuclear Power Industry.
Final rept.
J. Rumble, and J. H. Westbrook. Jan 85, 48p NBS/SP-689
The Report of a Workshop Held at Knoxville, Tennessee on May 2-3, 1984. Also available from Supt. of Docs as SN003-003-02636-1. Sponsored by Metal Properties Council, Inc., New York, American Society for Metals, Metals Park , OH., American Society for Testing and Materials, Philadelphia, PA., and American Society of Mechanical Engineers, New York. Library of Congress catalog card no. 84-601161.

Keywords: *Materials, Information systems, Networks, Planning, Mechanical properties, Corrosion, Alloys, Ceramics, Polymers, Radiation effects, *Reactor materials, *Nuclear industry, *Data bases, Computer applications, On line systems.

This report summarizes the recommendations of a Workshop in Computerized Materials Data as related to engineers in the Nuclear Power Industry. Four areas of discussion are featured: the content of a proposed data system; its size and data sources; the user interfaces and system capabilities; and ways of making further progress. In addition, changes in the use of materials data in the Nuclear Power Industry and progress-to-date in computerizing these data are presented.

Solar Energy

708,884
DE85010590 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Issue of Sky Conditions.
G. Gillette, and S. Treado. Apr 85, 32p ORNL/Sub-81-22201/3
Contract AC05-840R21400

Keywords: *Solar Radiation, *Washington DC, Availability, Cloud Cover, Daylighting, ERDA/320100, ERDA/140100.

The issue of sky conditions is explored as applied to current daylighting practice. Based on studies of hourly sky conditions in the Washington, DC area an understanding was sought regarding the ability to estimate illuminances and sky luminances under skies of variable cloudiness. The meaning and validity of nonstandard, non-perfect skies is discussed, and limits of non-perfect are explored and compared against measurements of hourly sky luminance, illuminance, and solar radiation. (ERA citation 10:025762)

708,885
DE86006907 PC **A08**/MF **A01**
Technical Univ. of Denmark, Lyngby. Lab. for Varmeisolering.
Workshop on Service Life of Solar Collector Components and Materials Held at Lyngby, Denmark on 6 December 1983: Proceedings. Summaries.
P. V. Pedersen. Aug 84, 157p CONF-8312130-Sums.
IEA task workshop on service life of solar collector components and materials, Lyngby, Denmark, 6 Dec 1983.
Portions of this document are illegible in microfiche products.

Keywords: *Solar Collectors, Leading Abstract, Materials Testing, *Meetings, Performance, Service Life, Solar Absorbers, *Foreign technology, ERDA/141000.

This report presents the proceedings of the workshop on Service Life of Solar Collector Components and Materials held at the Technical University of Denmark in December 1983. 16 Participants from 10 different countries of the IEA Solar Heating and Cooling Programme, Task III were present at the workshop, and 15 papers were presented. The paper presentation and discussion covered: (1) accelerated material tests and service life testing, (2) complete collector tests, and (3) operational experience with solar collector systems. The report includes a short summary of each of the presented papers and discussion and conclusions reached in this connection. Each paper has been separately indexed for inclusion into the Energy Data Base. (ERA citation 11:022347)

708,886
PB-263 272/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development and Implementation of Standards for Solar Heating and Cooling Applications.
Final rept.,
R. D. Dikkers. 1976, 8p
Pub. in Proceedings of Joint Solar Energy Conference on Sharing the Sun 76, Solar Technology in the Seventies, Winnipeg, Manitoba (Canada) 15-20 Aug 76, v1 p83-90 1976.

Keywords: *Solar space heating, *Solar air conditioning, *Performance standards, Buildings, Standardization, *Solar water heating.

In support of the Energy Research and Development Administration (ERDA) and the Department of Housing and Urban Development's (HUD) solar energy research and demonstration programs, NBS has prepared interim performance criteria for residential solar energy systems, and test procedures for determining the thermal performance of solar collectors and thermal storage devices. Currently, NBS is developing: (1) interim performance criteria for commercial solar energy systems; (2) intermediate standards for solar heating and domestic hot water systems that can be used in conjunction with HUD's Minimum Property Standards; (3) draft standards for materials (i.e., sealants, cover plates, insulation) to be used in solar systems; (4) plans for establishing a solar collector testing laboratory accreditation program; and (5) plans for identifying and developing other needed standards in cooperation with various standards-writing organizations such as ASTM and ASHRAE.

708,887
PB-264 322/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interfacing Building Design and Solar Energy Research and Standards.
Final rept.,
J. K. Holton. 1976, 9p
Sponsored in part by International Solar Energy Society, Cape Canaveral, Fla. American Section.
Pub. in Proceedings 1976 Joint Solar Energy Conference on Sharing the Sun: Solar Technology in the Seventies, Winnipeg, Manitoba, Canada, August 15-20, 1976, v9 p74-82 1976.

Keywords: *Solar energy, Standards, Research projects.

An extensive program of solar energy research and standards development has been undertaken by the National Bureau of Standards in support of the national effort to expedite the introduction of solar usage. This paper examines a number of the programs being conducted at NBS, identifies the intended user groups, and describes some of the paths of communication that are being used. It is hoped that a clearer understanding of the research/user linkage will lead to more effective communication between those working in the field.

708,888
PB-271 758/5 PC **A08**/MF **A01**
National Bureau of Standards, Washington, D.C. Solar Energy Program.
Intermediate Standards for Solar Domestic Hot Water Systems/HUD Initiative.
Final rept.
J. K. Holton.Jul 77, 153p NBSIR-77-1272
See also EIS-AA-72-5667-D-1. Developed for Use in the HUD/States Solar Domestic Hot Water Initiative Program. Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Energy, Building Technology, and Standards Div.

Keywords: *Solar water heaters, *Hot water heating, *Standards, Solar collectors, Heat storage, Residential buildings, Thermal efficiency, Design, Performance, Solar water heating.

This report presents standards for the use of solar domestic hot water systems in residential applications. The standards have been developed for application in numerous housing programs of the Department of Housing and Urban Development and are a companion document to be used in conjunction with the HUD Minimum Property Standards for One and Two Family Dwellings, and Minimum Property Standards for Multifamily Housing. (Portions of this document are not fully legible)

708,889
PB-273 305/3 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Solar Energy Systems. Survey of Materials Performance.
Final rept.,
L. F. Skoda, and L. W. Masters. Oct 77, 115p
NBSIR-77-1314
Prepared in cooperation with Energy Research and Development Administration, Washington, D.C. Div. of Solar Energy.

Keywords: *Solar collectors, *Optical coatings, *Materials, Solar energy absorbers, Covers, Flat plate collectors, Glass, Thermal insulation, Polyurethane resins, Foam, Fiberglass, Questionnaires, Industries, Solar space heating, Solar air conditioning, Seals, Standards, Site surveys, Performance evaluation, Reflectors, Pipes, Polycarbonate resins, Hoses, Tests, Adhesives, Polyvinyl fluoride.

A study was performed to obtain data regarding the performance of materials in operational solar energy systems, to identify and assess available standards for evaluating materials, to provide recommendations for the development of test method standards for materials, and to provide guidelines to aid the selection of materials for use in solar energy systems. During the study, field inspections of approximately twenty-five operational solar energy systems were performed, and a questionnaire was sent to 459 manufacturers and installation contractors to obtain materials performance data. This report contains the findings of the study. A primary conclusion is that the process of selecting materials for specific applications within solar energy systems is hindered by the lack of an adequate data base of materials performance under the conditions experienced in solar systems and subsystems. Recommendations are made that would help in establishing an improved data base.

708,890
PB-273 899/5 PC **A12**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of Building Standards and Codes Services.
State Solar Energy Legislation of 1976: A Review of Statutes Relating to Buildings.
Final rept.,
R. M. Eisenhard. Sep 77, 258p NBSIR-77-1297
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Div. of Solar Energy, and Department of Housing and Urban Development, Washington, D.C. Energy, Building Technology, and Standards Div.

Keywords: *Solar energy, *Legislation, *Energy policy, *Government policies, Buildings, Financial incentives, Standards, Research management, Zoning, State government, Regulations, Reviewing, Planning.

This report reviews state legislation on solar energy use in buildings enacted in 1976. Acts involve tax incentives for the installation of solar devices, support for the proposed Solar Energy Research Institute called for in Public Law 93-473, solar standards, state energy offices, studies, building requirements and solar projects. The Acts are identified and abstracted, and responsible state officials are listed. (Portions of this document are not fully legible)

708,891
PB-275 576/7 PC **A05**/MF **A01**
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering.
Analysis of Data and Results for the Roundrobin Flat-Plate Collector Test Program.
Final rept.,
W. C. Thomas, and A. G. Dawson. 14 Dec 77, 87p
VPI-SU-ENG-77-23, NBS/GCR-77-109
Revison of report dated 31 Aug 77.

Keywords: *Solar collectors, *Flat plate collectors, Thermal efficiency, Performance tests, Performance evaluation, Mathematical models, Graphs(Charts), Tables(Data).

A roundrobin test program was conducted by the NBS to evaluate a proposed method for rating solar collectors with respect to thermal performance. The approach used was to reference the measured results to a common set of environmental and operating conditions using thermal performance theory. Environmental conditions are wind speed, ambient temperature, and the amount and structure of solar radiation. Operating conditions considered are the transfer fluid (composition and flow rate) and collector orientation.

708,892
PB-277 300/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Testing and Rating of Solar Collectors.
Final rept.,
J. E. Hill, and E. R. Streed. 1977, 18p
Pub. in Paper X in Applications of Solar Energy for Heating and Cooling of Buildings, Section 2: System Components and Performance, ASHRAE GPR 170, pX1-X18 1977.

Keywords: *Solar collectors, *Flat plate collectors, *Performance standards, Concentrating collectors, Performance evaluation, Performance tests, Ratings.

This report describes the fundamental approach to testing solar collectors, gives a brief description of testing activities that have been and are being conducted around the world, and gives the status as of 1975 of efforts being directed toward the adoption of a standard test method for testing and rating collectors. Attention is focused on the flat-plate collector but the basic approach is valid for concentrating collectors having a low concentration ratio.

708,893
PB-278 932/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optical Measurements of Selective Solar Absorber Coatings.
Final rept.,
J. C. Richmond. 1977, 14p
Pub. in Proceedings of D.O.E./D.S.T. Thermal Power Systems Workshop on Selective Absorber Coatings, Golden, CO., December 6-8, 1977, p143-156 1977.

Keywords: *Optical coatings, *Solar energy absorbers, Absorptivity, Reflectivity, Emittance, Mathematical models.

Methods of evaluating solar absorptance, solar reflectance and total hemispherical emittance are briefly described. An equation for the optical efficiency of a selective solar absorber is presented.

708,894
PB-280 025/8 PC **A05**/MF **A01**
ARI Foundation, Inc., Arlington, Va.
Report on Organization of Certification Program for Solar Collectors.
Final rept.,
G. R. Munger, and R. J. Evans. 30 Nov 77, 99p
NBS/GCR-78/125
Contract NBS-7-35734

Keywords: *Solar collectors, *Quality assurance, *Manuals, Product development, Standardization, Acceptable quality level, Performance standards, Marking, Safety, Ratings.

Proposed documentation is presented for the operation of a solar collector certification program. The documents included are an Equipment Rating Standard, a Certification Program Operational Manual, a Certification Laboratory Contract, and a Manufacturer's License Agreement. Also provided is a typical calendar for the initiation of a program and an estimate of the first annual budget for a certification program.

708,895
PB-280 114/0 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Structures, Materials and Safety Div.
Solar Energy Systems - Standards for Rubber Seals.
Final rept.,
R. D. Stiehler, A. Hockman, E. J. Embree, and L. W. Masters. Mar 78, 66p NBSIR-77-1437

Keywords: *Rubber seals, *Seals(Stoppers), *Solar collectors, Elastometers, Sealing, Performance standards, Performance tests, Specifications, Recommendations.

A study was performed to develop standards for rubber seals used in solar energy systems. Thirty preformed and liquid applied seals were evaluated in the laboratory using modified ASTM standard test methods to obtain data needed to prepare the standards. Also, studies were performed to develop a test method for determining the effects of outgassing on the transmittance of solar collector covers. The results of the laboratory tests are presented and standards for rubber seals in solar energy systems are proposed.

708,896
PB-280 182/7 PC **A07**/MF **A01**
National Bureau of Standards, Washington, D.C. Solar Energy Program.
Proposed Technical Data Requirements for the National Solar Heating and Cooling Demonstration Program.
May 77, 139p NBSIR-77-1247
Prepared in cooperation with Department of Housing and Urban Development, Washington, D.C., Energy Research and Development Administration, Washington, D.C.

Keywords: *Solar energy, *Data acquisition, Solar heating systems, Solar cooling systems, Legislation, Government policies, National government, Planning, Technology innovation, Buildings, Design criteria, Design standards, Performance, Solar Heating and Cooling Demonstration Act of 1974, *National Program for the Solar Heating and Cooling of Buildings, Residential sector, Commercial sector.

The Solar Heating and Cooling Demonstration Act of 1974 calls for the development of interim performance criteria for solar heating and cooling systems and the buildings in which they will be used. Section 8 of the law provides for the use of data from the demonstration program to develop definitive performance crtieria, as well as testing procedures whereby manufacturers can certify that their products conform to definitive performance criteria. Responsibility for the development of these definitive performance criteria has been assigned by the Energy Research and Development Administration and the Department of Housing and Urban Development to the National Bureau of Standards (NBS). The plan presented in this document was prepared in order to define the technical non-instrumentation (TNI) data required by NBS in order to effectively monitor the residential and commercial demonstration programs, mandated by PL 93-409, for feedback.

708,897
PB-280 430/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Establishing Technical Standards for Solar Installations.
Final rept.,
J. K. Holton. 1977, 10p
Sponsored in part by Energy Research and Development Administration, Washington, D.C. and Department of Housing and Urban Development, Washington, D.C.
Pub. in Proceedings on Overcoming Legal Barriers to the Utilization of Solar Energy, Manchester, N.H. 14 Apr 77, Paper in IDEA - Jnl. of Law Technology, v19 n1 p25-34 1977.

Keywords: *Solar heating systems, *Solar cooling systems, *Performance standards, Buildings, Thermal efficiency.

The Solar Heating and Cooling Demonstration Act of 1974 (PL 93-409) and the National Program for Solar Heating and Cooling (Residential and Commercial Ap-

plications), October 1975, recognizes the importance of developing performance criteria and standards to help stimulate the creation of a viable industrial and commercial capability to produce and distribute solar heating and cooling systems. Program activities relating to the development of performance criteria and standards for solar heating and cooling systems, components and materials which are being carried out by the National Bureau of Standards for the Energy Research and Development Administration (ERDA) and the Department of Housing and Urban Development (HUD) are described.

708,898
PB-280 461/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Based Characterization Facility for Silicon Photocell Studies.
Final rept.,
J. Geist, M. A. Lind, A. R. Schaefer, and E. F. Zalewski. 1976, 9p
Pub. in Proceedings of Terrestrial Photovoltaic Measurement Workshop, Baton Rouge, La, Nov 10-12, 1976, p223-231.

Keywords: *Silicon solar cells, *Photodetectors, *Optical measurement, Lasers, Experimental design, Power measurement, Luminous intensity, Photovoltaic cells, Test facilities, Radiometry, Monitors, Solar flux, Solar energy conversion, Pyroelectric detectors, Remote detectors.

A laser-based facility for characterization of photocells, and some studies performed on it are described with emphasis towards results of the greatest interest to the silicon solar cell community.

708,899
PB-282 118/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Results of a Roundrobin Flat-Plate Collector Test Program.
Interim rept.,
E. R. Streed. Sep 77, 13p
Pub. in Proceedings 1977 Flat-Plate Solar Collector Conf., Held at Orlando, Florida on February 28-March 2, 1977, p267-279 (Florida Solar Energy Center Publications Auxiliary, 300 State Road 401, Cape Canaveral, Florida, September 1977).

Keywords: *Solar collectors, *Tests, Thermal properties, Flat plate collectors, Heat flux, Least squares method, Performance evaluation, Standards.

A roundrobin solar energy collector test program has been conducted to evaluate a proposed test method to rate collectors on the basis of thermal performance. Two liquid-type collectors were distributed to 21 organizations in the United States to obtain data in various climatic regions using the prescribed apparatus under allowable ranges of environmental conditions. Plots of the efficiency as a function of the difference in average fluid temperature and ambient temperature divided by the insulation were used to obtain performance curves for each collector. The overall transmittance-absorptance product and the overall heat loss coefficient were determined by each participant using a least-squares analysis of the data. The mean and standard deviation for each of these parameters are calculated and the significance with respect to the testing and rating of collectors is discussed.

708,900
PB-283 237/6 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Center for Building Technology.
Plan for the Development and Implementation of Standards for Solar Heating and Cooling Applications.
Interim rept.,
D. Waksman, J. H. Pielert, R. D. Dikkers, E. R. Streed, and W. J. Niessing. Jun 78, 58p NBSIR-78-1143A
Contract DOE-EA-77-A-1-6010
Supersedes report dated Aug 76, NBSIR-76-1143, PB-257 769.

Keywords: *Solar space heating, *Solar air conditioning, *Standards, Building codes, Performance standards, Solar heating systems, Solar cooling systems, Service life, Reliability, Engineering standards, Safety, Design standards, Planning.

Overviews of the building regulatory system in the United States are given along with a listing of the various standards which will be required for the various solar systems, subsystems, components and materials. A list of training activities and manuals of accepted practice is presented. The development of standards for solar applications by the Federal Government is outlined, as well as the potential interface and utilization of the existing consensus standards generating organizations.

708,901
PB-283 721/9 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Center for Building Technology.
Provisional Flat Plate Solar Collector Testing Procedures: First Revision.
Interim rept.,
D. Waksman, E. R. Streed, T. Reichard, and L. E. Cattaneo. Jun 78, 66p NBSIR-78-1305A
Contract DOE-EA-77-A-01-6010
Supersedes PB-272 500.

Keywords: *Flat plate collectors, *Solar collectors, Performance tests, Performance evaluation, Reliability, Safety, Durability, Ratings.

The test methods contained in this report and the provisional rating criteria presented in an appendix are intended for use in determining the thermal performance, and to aid in the assessment of the safety and durability/reliability of flat plate solar collectors.

708,902
PB-283 881/1 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Electron Devices Div.
Measurement Techniques for Solar Cells, Quarterly Report: September 15 to December 31, 1977.
Quarterly Rept. (Final) Sep-Dec 77,
D. E. Sawyer, H. K. Kessler, and H. A. Schafft. Jul 78, 34p NBSIR-78-1488
Sponsored in part by Department of Energy, Washington, D.C. Advanced Materials R and D Branch.

Keywords: *Solar cells, *Photovoltaic cells, *Optical measurement, *Semiconductor junctions, Lasers, Optical scanners, Experimental design, Electric contacts, Test equipment, Instrumentation, Photoconductivity, Solar energy conversion, Photovoltaic conversion, Simulation, Light sources, Sheets.

Several possible applications of the laser flying-spot scanner to solar cells are discussed including measurement of the spatial variation in cell response versus bias light to map cell behavior under various insolation conditions, measuring magnitude and spatial variation in cell emitter sheet resistance, and determining emitter metallization regions making poor ohmic contact. Additions and modifications to the optical and mechanical portions of the scanner made to enhance its usefulness for solar cells are described. An analysis is presented for scanning, with light modulated at high frequencies, the most common solar cell geometry. The results predict that the cell emitter sheet resistance can be obtained by analyzing the laser display screen presentation. Scanner background information is included in an appendix.

708,903
PB-285 215/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Design of a Solar Heating and Cooling Data Center.
Final rept.,
D. R. Deutsch. 1973, 6p
Contract DOE-EA-77-A-01-6010
Pub. in Proc. OECD Specialist Study on the Use of Generalized Data Management Systems for Handling Scientific Information, Paris, France, Jan 11-13, 1977 and Lawrence Berkeley Lab., Berkeley, Calif., Oct 5-7, 1977. Paper in Generalized Data Management Systems and Scientific Information, CONF 771062 p257-262 (Director of Information, OECD Nuclear Energy Agency, Paris, France, 1978).

Keywords: *Information systems, *Solar energy, Solar heating systems, Solar cooling systems, Computer systems programs, Data processing.

The National Bureau of Standards designed and operates a Data Center serving the Federal Solar Energy Research, Development and Demonstration Program. The design effort included thorough consideration of the applicability of generalized data base management software. The functional requirements for the Data Center and the factors influencing the data base decision are described. A modified data base approach is presented and reasons for its adoption by the Data Center are discussed.

708,904
PB-285 654/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Existing Standards Inadequate for Solar Collector Use.
Final rept.,
R. D. Stiehler, A. Hockman, E. J. Embree, and L. W. Masters. 1978, 3p NBSIR-77-1437
Sponsored in part by Department of Energy, Washington, D.C. Assistant Secretary for Conservation and Solar Applications.
Pub. in Solar Eng. 3, n8 p35-37 Aug 78.

Keywords: *Rubber seals, *Seals(Stoppers), Solar collectors, Solar heating systems, Durability, Life(Durability), Service life, Laboratory tests, Standards, Performance evaluation, Reprints.

A study was performed to develop standards for rubber seals used in solar energy systems. Thirty-one preformed and liquid applied seals were evaluated in the laboratory using modified ASTM standard test methods to obtain data needed to evaluate those materials and prepare new standards. Also, studies were performed to develop a test method for determining the effects of outgassing on the transmittance of solar collector covers. This report is a summary of the findings of NBSIR Solar Energy Systems - Standards for Rubber Seals, in which standards for rubber seals in solar energy systems are proposed.

708,905
PB-286 532/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Updating Solar Performance Criteria and Standards.
Final rept.
J. K. Holton. 1978, 8p
Pub. in Proceedings 1978 Annual Meeting American Society Int. Solar Energy Society, Inc., Devern, CO., August 28-31, 1978, p514-521 Sep 78.

Keywords: *Solar heating systems, *Solar cooling systems, *Performance standards, Heat loss, Control equipment, Safety, Maintenance, Components, Heat transfer, Criteria, Performance evaluation, Residential buildings, Commercial buildings, Thermosiphoning.

The two solar performance criteria, '(HUD Intermediate Minimum Property Standards (S/MPS)' and the 'Interim Performance Criteria (IPC)' both residential and commercial, were developed by the National Bureau of Standards (NBS) early in the federal solar demonstration program to be of assistance in promoting the manufacture and widespread use of solar energy systems. Findings are presented from the residential and commercial demonstration program and from a public commentary process that have led to the updating of numerous sections of the criteria and standards. A comparison is presented of the original criteria, the practical problems, and the revised criteria. Topics covered include: system performance covering thermal losses, operating energy, system back-up, thermosyphoning, flow balancing controls, safety, maintenance and check-out procedures; and component performance covering freeze protection, stratification, stagnation, materials deterioration, and heat transfer fluid quality.

708,906
PB-287 452/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Solar Spectral Irradiance at Ground Level.
Final rept.
A. T. Mecherikunnel, and J. C. Richmond. 1978, 25p
Pub. in Proceedings Seminar on Testing Solar Energy Materials and Systems, Held at Gaithersburg, MD. on May 22-24, 1978 p83-107.

Keywords: *Solar energy, *Solar radiation, *Irradiance, Mathematical analysis, Atmospheric attenuation, Turbidity, Air pollution, Atmospheric transmissivity.

Available quantitative data on solar total and spectral irradiance is examined in the context of use of solar irradiance for terrestrial applications of solar energy. A brief review is given on the extraterrestrial solar total and spectral irradiance values. Computed values of solar spectral irradiance at ground level for different air mass values and various levels of atmospheric pollution or turbidity are also presented. Wavelengths are given for computation of solar absorptance, transmittance and reflectance by the 100-selected-ordinate method and by the 50-selected ordinate method from

air mass two solar spectral irradiance for the four degrees of atmospheric pollution. Total solar spectral irradiance measured with a prism monochromator is examined to evaluate the direct solar spectral irradiance for a surface normal to the sun's rays and to compare the computed spectrum with the experimentally observed one.

708,907
PB-287 519/3 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Measurement Techniques for Solar Cells.
Quarterly rept. 1 Jan 78-31 Mar 78.
D. E. Sawyer, H. K. Kessler, and H. A. Schafft. Sep 78, 18p NBSIR-78-1513
Sponsored in part by Department of Energy, Washington, DC. ADVANCED Materials R and D Branch. See also PB-283 881.

Keywords: *Solar cells, *Photovoltaic cells, *Optical measurement, *Semiconductor junctions, Lasers, Optical scanners, Electric contacts, Test equipment, Solar energy conversion, Photovoltaic conversion.

A technique simpler than the one using light modulated at high frequencies, described in the previous quarterly report, is set forth which employs forward-biasing solar cells during scanning to pin-point certain cell defects and to obtain values of cell quantities such as emitter sheet resistance. An analysis appropriate for laser scanning forward-biased cells with a line source is presented. Results from initial experiments suggest that the new technique should work quite well on real-world solar cells. Apparatus development work included the design and initial construction of a high-sun insolation source for forward-biasing cells by light while scanning, and the construction of a matching network to couple the low-impedance illuminated cell to the scanner display electronics. The announcement and program for the May 1-3, 1978 Workshop on the Stability of (Thin Film) Solar Cells and Materials at NBS is presented.

708,908
PB-288 536/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Critical Performance Standards for Passive Solar Buildings.
Final rept.
J. K. Holton. 1978, 5p
Pub. in Proceedings Passive Solar Buildings (2nd), Philadelphia, PA 16-18 Mar 78, v2 p294-297 (Univ. of Delaware, Newark, 1978).

Keywords: *Buildings, Thermal efficiency, Safety, Performance standards, Performance evaluation, *Passive solar heating systems, *Passive solar cooling systems.

An outline of a limited number of performance standards and evaluation criteria for passive solar buildings is presented. Three levels of criteria are described which are intended to categorize these into a few most needed criteria concerning basic thermal performance, health and safety, and two levels of additional criteria that are thought desirable to assess long term usefulness of passive installations. Status of development of the criteria is also discussed.

708,909
PB-289 137/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Testing of Solar Collectors According to ASHRAE Standard 93-77.
Final rept.,
J. E. Hill, J. P. Jenkins, and D. E. Jones. 1978, 20p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in ASHRAE Trans., v84 pt2 p107-126, 1978.

Keywords: *Solar collectors, *Performance standards, Performance tests, Performance evaluation, Test facilities, Heat transfer, Ratings, ASHRAE standard 93-77, ASHRAE standards, Reprints.

A proposed procedure for testing and rating solar collectors was published by the National Bureau of Standards (NBS) in 1974. In early 1977, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) adopted ASHRAE Standard 93-77, which is a modified version of the NBS procedure. A test facility for water-cooled collectors and air heaters has been built at NBS in accordance with this Standard. The purpose of this paper is to briefly explain the recently adopted test procedure, describe the NBS test facility, and to give typical test results for commercially available collectors.

708,910
PB-289 138/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Initial Test Results for a Solar-Cooled Townhouse in the Mid-Atlantic Region.
Final rept.,
J. E. Hill, T. E. Richtmyer, and J. P. Jenkins. 1976, 16p
Sponsored in part by Energy Research and Development Administration, Washington, DC. Div. of Solar Energy.
Pub. in ASHRAE Trans., v82 pt2 p398-404, 1976.

Keywords: Solar heating, Space heating, Air conditioning, Hot water heating, Residential buildings, Houses, Performance evaluation, *Townhouses, *Solar space heating, *Solar air conditioning, *Solar water heating, Reprints.

A factory-produced four-bedroom townhouse unit equipped with a solar heating, cooling, and domestic hot water supply system is currently under test at the National Bureau of Standards in Gaithersburg, Maryland. The solar system consists of a double-glazed, flat-plate solar collector having a non-selective coating on the absorber, a water-to-air heat exchanger in a forced-air distribution system for space heating, two large water tanks for thermal storage, and a lithium-bromide absorption refrigeration unit. In addition, domestic hot water is preheated from the solar system through a water-to-water heat exchanger. Results are given for the first summer's cooling tests.

708,911
PB-289 729/6 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Economics and Regulatory Technology Div.
Laboratories Technically Qualified to Test Solar Collectors in Accordance with ASHRAE Standard 93-77: A Summary Report.
Final rept.
W. J. Niessing. Nov 78, 40p NBSIR-78-1535
Sponsored in part by Department of Energy, Washington, DC. Assistant Secretary for Conservation and Solar Applications.

Keywords: *Test facilities, Performance standards, Performance evaluation, Performance tests, Quality assurance, Product inspection, Quality control, Acceptable quality level, *Solar collectors, ASHRAE Standard 93-77.

This summary report covers the identification of qualified solar collector testing laboratories. It discusses the procedures used by ARI Foundation, Inc. (ARIF), the results of their evaluation, and lists the laboratories evaluated as qualified to test solar collectors in accordance with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 93-77.

708,912
PB-289 823/7 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Economics and Regulatory Technology Div.
Solar Building Regulatory Study, Volume I.
Final rept.
J. Greenberg. Nov 78, 93p NBS/GCR-78/141/1
Contract DOE-EA-77-A-01-6010
Prepared in cooperation with National Inst. of Building Sciences, Washington, DC. See also Volume 2, PB-289 824.

Keywords: Building codes, Design standards, Regulations, Buildings, Solar heating, Air conditioning, Hot water heating, Performance standards, Surveys, Recommendations, Planning, Solar heating systems, Solar cooling systems.

This report documents the results of a project oriented toward obtaining the views of organizations representing diversified interests within the building community regarding: (1) the need for a solar regulatory system; and (2) the form such a system should take if indeed a solar regulatory system were recommended.

708,913
PB-289 824/5 PC **A17**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Economics and Regulatory Technology Div.
Solar Building Regulatory Study, Volume II.
Final rept.
J. Greenberg. Nov 78, 385p NBS/GCR-78/141/2
Contract DOE-EA-77-A-01-6010
Prepared in cooperation with AIA Research Corp., Washington, DC., American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., New York, and National Conference of States on Building Codes and Standards, Inc., McLean, VA. See also Volume 1, PB-289 823.

Keywords: *Building codes, *Design standards, *Regulations, *Buildings, Solar heating, Air conditioning, Hot water heating, Performance standards, Surveys, Recommendations, Planning, Solar heating systems, Solar cooling systems.

This report documents the results of a project oriented toward obtaining the views of organizations representing diversified interests within the building community regarding: (1) the need for a solar regulatory systems; and (2) the form such a system should take if indeed a solar regulatory system were recommended. (Portions of this document are not fully legible)

708,914
PB-289 912/8 PC **A07**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Experimental Verification of a Standard Test Procedure for Solar Collectors.
Building science series.
J. E. Hill, J. P. Jenkins, and D. E. Jones. Jan 79, 131p NBS-BSS-117
Library of Congress Catalog Card no. 78-600138.
Sponsored in part by Department of Energy, Washington, DC. Research and Development Branch for Solar Heating and Cooling.

Keywords: *Performance tests, Thermal efficiency, Experimental design, Test facilities, Performance standards, Numerical analysis, Photographs, Drawings, *Solar collectors, ASHRAE standard 93-77.

A proposed procedure for testing and rating solar collectors based on thermal performance was published by the National Bureau of Standards (NBS) in 1974. Subsequently, the American Society of Heating, Refrigerating, and Air Conditioning (ASHRAE) developed a modified version of the NBS procedure which was adopted in early 1977 as ASHRAE Standard 93-77. A test facility for water-heating and air-heating collectors has been built at NBS and was used to support the development of Standard 93-77. The purpose of this report is to describe the recently adopted test procedure, the NBS test facility, and the tests that were conducted to support the development of the procedure.

708,915
PB-289 967/2 PC **A06**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Economics and Regulatory Technology Div.
Interim Performance Criteria for Solar Heating and Cooling Systems in Residential Buildings (Second Edition).
Final rept.
J. K. Holton. Nov 78, 113p NBSIR-78-1562
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards. See also report for Nov 76, PB-262 114.

Keywords: *Performance standards, *Residential buildings, Solar heating, Space heating, Air conditioning, Hot water heating, Mechanical efficiency, Quality control, Acceptability, Safety, Design standards, Quality assurance, Reliability, Maintenance, Site surveys, Planning, *Solar heating systems, *Solar cooling systems, *Solar water heating, Solar Heating and Cooling Demonstration Act of 1974.

The interim performance criteria, developed for the Department of Housing and Urban Development, are criteria and standards for the design, development, technical evaluation and procurement of the solar heating and cooling systems to be used in residential buildings during the solar heating and cooling demonstration program authorized by the Solar Heating and Cooling Demonstration Act of 1974. These interim criteria are intended primarily for use in the solar residential demonstration program and as a basis for the preparation of definitive performance criteria.

708,916
PB-290 026/4 Not available NTIS

National Bureau of Standards, Washington, DC.
Testing of Flat-Plate Air Heaters According to ASHRAE Standard 93-77.
Final rept.
D. E. Jones, and J. E. Hill. 1977, 5p
Sponsored in part by Dept. of Energy, Washington, DC. Office of Conservation and Solar Applications.
Pub. in Proceedings of the 1977 Annual Meeting of the International Solar Energy Society, A Solar World Held at Orlando, FL. on June 6-10, 1977 p2-1-2.4 1977.

Keywords: Performance tests, Performance standards, Performance evaluation, Thermal efficiency, Test facilities, Ratings, *Flat plate collectors, *Solar collectors, Solar air heaters, ASHRAE Standard 93-77, National Bureau of Standards.

A proposed procedure for testing and rating solar collectors was published by the National Bureau of Standards (NBS) in 1975. In early 1977, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) adopted ASHRAE Standard 93-77 which is a modified version of the NBS procedure. A test facility for air heaters has been built at NBS in accordance with this Standard. This paper explains briefly the recently adopted test procedure, describes the NBS test facility, and gives typical test results for a commercially available air-cooled solar collector.

708,917
PB-290 027/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Flat-Plate Solar Collector Thermal Performance Data Obtained Indoors and Outdoors.
Final rept.
E. R. Streed. 1978, 10p
Sponsored in part by Dept. of Energy, Washington, DC. Office of Conservation and Applications.
Pub. in Proceedings of the 1978 Annual Meeting of the International Solar Energy Society Held at Denver, CO. on August 28-31, 1978, 2.1, p352-361 1978.

Keywords: Thermal efficiency, Performance tests, Heat loss, Comparison, *Flat plate collectors, *Solar collectors.

In this report, a comparison is made of pertinent data obtained within the United States for the thermal efficiency of several state-of-the-art water-heating flat-plate solar collectors. The data was obtained both outdoors as well as indoors using solar simulator. In addition, the values of the collector heat loss coefficient obtained indoors and outdoors both under non-irradiated conditions is compared with values indicated from the outdoor tests to determine thermal efficiency (irradiated conditions).

708,918
PB-290 028/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of ASHRAE Standard 93-77 to Concentrating Collectors.
Final rept.
J. E. Hill, and J. P. Jenkins. 1977, 11p
Sponsored in part by Dept. of Energy, Washington, DC. Office of Conservation and Solar Applications.
Pub. in Proceedings of the ERDA Conference on Concentrating Solar Collectors Held at Atlanta, GA. on September 26-28, 1977, p6-1-6-8 1977.

Keywords: *Performance tests, Solar energy concentrators, Performance standards, Thermal efficiency, *Concentrating collectors, Solar collectors, ASHRAE Standard 93-77.

The American Society of Heating, Refrigerating, and Air-Conditioning Engineers, (ASHRAE) has recently adopted ASHRAE Standard 93-77 for testing and rating of solar collectors based on thermal performance. Four separate tests are required to be conducted. This paper explains briefly the tests, and indicates how they might be adapted for use with concentrating collectors.

708,919
PB-290 032/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Data Requirements and Performance Evaluation Procedures for Passive Buildings.
Final rept.
W. Ducas, E. Streed, J. Holton, and W. Angel. 1978, 20p
Sponsored in part by Dept. of Energy, Washington, DC. Office of Conservation and Solar Applications.
Pub. in Proceedings of the National Conference on Passive Solar Heating and Cooling (2nd) Held at Philadelphia, PA. on March 16-18, 1978, v2, p411-430 1978.

Keywords: *Temperature measurement, *Data acquisition, Buildings, Performance evaluation, Thermal efficiency, Temperature measuring instruments, Performance standards, *Passive solar heating systems, Energy consumption.

A systematic classification of passive solar buildings and performance factors are proposed to standardize evaluation procedures for these buildings. Two measurement levels are described with appropriate sensors and data acquisition systems to obtain either detailed data for complete component and system evaluation or to obtain critical data for evaluating the energy saved at many sites.

708,920
PB-290 033/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of Computer-Controlled Data Acquisition Systems in Determining Solar Heating and Cooling System Performance.
Final rept.
T. E. Richtmyer. 1978, 10p
Sponsored in part by Dept. of Energy, Washington, DC. Office of Conservation and Solar Applications.
Pub. in Proceedings of Monitoring Techniques for Evaluation of Solar Heating and Cooling Systems, Held at Washington, DC. on April 2-5, 1978, p95-104 1978.

Keywords: *Temperature measurement, *Data acquisition, Buildings, Performance evaluation, Thermal efficiency, Recommendations, *Solar heating systems, *Solar cooling systems, Monitoring.

For the past few years, NBS has been conducting a number of solar energy related projects. Two, in particular, are solar heated and cooled buildings that use computer controlled data acquisition systems. This report describes those buildings, their data acquisition systems, and discusses problems that have been experienced. Finally, a list of recommendations and suggestions are offered based on those experiences that should help prevent similar problems on future projects.

708,921
PB-292 115/3 PC **A06**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Results and Analysis of a Round-Robin Test Program for Liquid-Heating Flat-Plate Solar Collectors.
Technical note.
E. R. Streed, W. C. Thomas, A. G. Dawson, B. D. Wood, and J. E. Hill. Aug 78, 122p NBS/TN-975
Prepared in cooperation with Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering, and Arizona State Univ., Tempe. Dept. of Mechanical Engineering. Sponsored in part by Department of Energy, Washington, DC. Assistant Secretary for Conservation and Solar Applications.

Keywords: Thermal efficiency, Design, Performance tests, Numerical analysis, Mathematical models, Graphs(Charts), Tables(Data), Statistical data, Test facilities, *Flat plate collectors, *Solar collectors.

A round robin test program was conducted at 21 United States test facilities, using a common test procedure, to determine the intercomparability of thermal performance data pertaining to two liquid-heating flat-plate solar collectors.

708,922
PB-292 364/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Proposed Technique for Correlating the Performance of Solar Domestic Water Heating Systems.
Final rept.
S. T. Liu, and J. E. Hill. 1979, 13p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.) Transactions 85, Part 1, n2516, 13p 1979.

Keywords: *Data acquisition, Hot water heating, Computerized simulation, Performance evaluation, *Solar water heaters, TRNSYS computer program, Solar water heating.

A theoretical study was conducted to determine how experimental data might be collected on solar domestic water heating systems over a short period of time, and then used to characterize the performance of the system. The analysis involved simulating typical state-of-the-art systems using the computer program TRNSYS. The simulations and associated analyses were successful in indicating a method of correlating the fraction of the hot water load supplied by solar energy with the primary independent variables governing the system performance. Actual test data for a commercially available system were then used to substantiate the value of the correlation.

708,923
PB-295 148/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of Solar Absorbers, Reflectors and Transmitters - Physical Reflectance Standards.
Final rept.,
J. C. Richmond. 1979, 5p
Pub. in Proceedings of the Conference of the 25th Annual Technical Meeting Learning to Use Our Environment (1979) Held at Seattle, WA. on April 30-May 2, 1979, p2-6.

Keywords: *Optical materials, *Standards, Absorptivity, Reflectivity, Solar radiation, Transmittance, Solar energy concentrators, Solar reflectors, *Solar collectors.

The classical method of evaluating solar optical properties of materials (reflectance, absorptance, and transmittance) is to measure the spectral property of interest (absorptance is taken as one minus reflectance) under conditions of directional irradiation and hemispherical collection, and compute the solar property as the weighted average spectral property, with the solar spectral irradiance as the weighting function. Integrating sphere reflectometers are almost universally used for measuring spectral directional-hemispherical reflectance. Such instruments define, for accuracy, on the use of calibrated reference standards of absolute directional-hemispherical reflectance. Terrestrial solar spectral irradiance varies widely with changes in the path length of the sun's rays through the atmosphere. There is no generally accepted terrestrial solar spectral irradiance distribution. This paper briefly describes the work now in progress by the Solar Optical Materials Program Planning Committee of the Department of Energy to recommend for adopiion a standard terrestrial solar spectral distribution and to make available, through the Office of Standard Reference Materials of the National Bureau of Standards, calibrated reference standards of spectral directional-hemispherical reflectance and of specular spectral reflectance.

708,924
PB-295 642/3 PC **A17**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Economics and Regulatory Technology Div.
State Solar Energy Legislation of 1977: A Review of Statutes Relating to Buildings.
Final rept.
R. M. Eisenhard, and L. A. Santucci. Feb 79, 398p NBSIR-79-1705
See also report dated Sep 77, PB-273 899. Sponsored in part by Department of Energy, Washington, DC. Office of Conservation and Solar Applications, and Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Solar energy, *Legislation, *Government policies, Buildings, Financial incentives, Standards, Research management, Zoning, State government, Regulations, Reviewing, Planning, *Energy policy.

This report reviews state legislation on solar energy, as applied to buildings, which was enacted in 1977. Acts involve tax incentives, sun rights, standards for solar units, and state support of promotion of solar research, solar demonstrations, and solar loans. The Acts are identified and abstracted, and responsible state agencies and officials identified. The Acts, supporting forms and other documents are included in the Appendices.

708,925
PB-296 274/4 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.

Standards for Photovoltaic Energy Conversion Systems.
Final rept. Feb Sep 78.
H. A. Schafft. May 79, 19p NBSIR-79-1743
Contract DOE-EG-77-C-01-4042

Keywords: *Standards, Reliability, Durability, Mechanical properties, Electric batteries, Power equipment, Safety, Solar cells, Structural analysis, Bibliographies, *Solar arrays, *Photovoltaic conversion, Power systems.

This report provides the results of a search for existing domestic standards and related documents for possible application in the development of a standards base for photovoltaic energy conversion systems. The search resulted in locating about 150 test methods, recommended practices, standards, solar-thermal performance criteria, and other standards-related documents. They are listed by topic areas in the appendix. The listing was prepared to assist those involved in developing performance criteria for photovoltaic systems and in identifying methods to test system performance against these criteria. It is clear from the results of the search that few standards are directly applicable to terrestrial solar photovoltaic systems and that much standard development is required to support the commercialization of such systems.

708,926
PB-297 396/4 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Perspective of a Workshop on Stability of (Thin Film) Solar Cells and Materials.
Final rept.
H. A. Schafft, and D. E. Sawyer. Jun 79, 17p NBSIR-79-1778
Sponsored in part by Department of Energy, Washington, DC. Advanced Materials R and D Branch.

Keywords: *Solar cells, *Semiconductors(Materials), Thin films, Copper inorganic compounds, Indium phosphides, Silicon, Gallium arsenides, Meetings, Stability, Cadmium sulfides, Zinc sulfides, Silicon solar cells, Cadmium sulfide solar cells, Gallium arsenide solar cells, Copper sulfides.

The results of a workshop on the stability of (thin film) solar cells and materials are reviewed from a measurements perspective. Solar cells of the following three material groupings were considered at the workshop: (1) Cu2S/(CdZn)S, Cu-ternaries/CdS, InP/CdS, and amorphous Si; (2) polycrystalline, MIS, and conducting-oxide Si; and (3) polycrystalline and AMOS GaAs. Considering the relative state of immaturity of these developing cells and the goal for high reliability and stability, two general areas of work are recommended. One is to develop an improved understanding of cell operation and of component structures of these cells. The other is to develop an improved measurements base. Specific needs and recommendations are provided.

708,927
PB-297 471/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of Standards for Evaluating Solar Absorptive Coatings.
Final rept.
L. W. Masters, J. F. Seiler, and W. E. Roberts. 1979, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the Division of Organic Coatings and Plastics Chemistry at the American Chemical Society/Chemical Society of Japan Chemical Congress Held at Honolulu, Hawaii on April 1-6, 1979. Paper in Organic Coatings and Plastics Chemistry 40, p507-510 1979.

Keywords: *Optical coatings, Absorbers(Materials), Solar heating, Cooling systems, Materials, Degradation, Standards, *Solar absorbers, Solar cooling.

Absorptive coatings used in solar heating and cooling systems absorb energy from the sun and convert it to thermal energy. It is essential that coatings used for this purpose be durable for extended periods of time. However, the environment in which absorptive coatings are used can cause rapid degradation. Numerous problems in solar energy systems have clearly shown the need for standards by which solar absorptive coatings can be evaluated. The Center for Building Technology of the National Bureau of Standards is performing research to develop draft standards for absorptive coatings. The standards will be submitted to the American Society for Testing and Materials for consideration as consensus standards. Fourteen selective and nonselective absorbers have been evaluated in laboratory and field tests to obtain data needed to prepare the draft standards. The laboratory tests have emphasized thermal stability, moisture stability, uv stability, and compatibility with substrates. Field tests, in which coatings are exposed to stagnation conditions in three different climates, are also being performed. Absorptance and emittance are measured before and after the laboratory and field exposures. The data obtained, the test methods used, and two interim test method standards prepared as result of the research are discussed.

708,928
PB-297 582/9 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Residential Solar Data Center - Data Resources and Reports.
P. M. Christopher, and J. E. Krzewick. Jun 79, 69p NBSIR-79-1762
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Solar energy, *Data acquisition, *Information systems, Residential buildings, Information retrieval, Data processing, *Residential Solar Data Center, National Bureau of Standards, Solar heating systems, Solar cooling systems, Solar water heating, Data bases.

The Residential Solar Data Center (SDC) is responsible for the establishment and operation of a computerized data base containing non-instrumented residential data collected from the DOE/HUD Solar Heating and Cooling Demonstration Program. This document includes a summary of the history and background of the SDC and its role in the Demonstration Program, a list of the computer reports which are available and sample pages of representative reports, a description of the data files which comprise the solar data base, a description of the interactive access to the solar data base, a set of figures showing the amount of data on the computer, and a list of other Solar Data Center publications.

708,929
PB-298 753/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Solar Cell Measurement Technique Development and Other Services.
Final rept.
D. E. Sawyer, H. K. Kessler, and H. A. Schafft. Jan 79, 10p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings Photovoltaic Advanced Materials Review Meeting, Held at Vail, CO. on Oct 24-26, 1978, p41-50.

Keywords: *Solar cells, Performance evaluation, Measurement, Reliability, Optical measurement, Silicon solar cells, Gallium arsenide solar cells, Cadmium sulfide solar cells, Solar concentrators, Flat plate collectors, Laser applications, MIS(Semiconductors).

This is a summary of work performed in the period September 15, 1977 - September 30, 1978. The objectives of the program are to assist the DOE thin-film photovoltaic effort by developing solar cell device and material measurement techniques using the NBS-developed laser flying-spot scanner, and by assisting DOE in organizing and hosting appropriate workshops and symposia and providing general consultation and liaison services. A new technique is set forth which employs forward-biasing solar cells during scanning to spatially map cell operating and locate certain cell defects such as cracks, and poor emitter ohmic contacts. This technique has been applied with success to a variety of solar cell types including flat-plate Si, GaAs concentrator, GaAs MIS, CdS/Cu2S, and polycrystalline Si. Equipment has been constructed and ancillary techniques have been developed for effective cell scanning and quantification of scanning results. Cells with diameters up to 10 cm may now be scanned without any change in scanner adjustment. A novel, low-noise high-intensity light source for biasing cells optically has been completed. Other project activities, which include planning, organizing, and conducting workshops are outlined in the text.

708,930
PB-298 754/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Performance Criteria for Photovoltaic Power Conditioning, Control, and Storage.
Final rept.
H. A. Schafft. 1978, 13p
Contract DOE-EG-77-C-01-4042
Pub. in Proceedings DOE Photovoltaics Technology Development and Applications Program Review Conf., Held at Arlington, VA. on Nov 7-9, 1978, p2-39, 2-51, 1978.

Keywords: *Photovoltaic cells, Performance, Control, Solar cells, Storage, Power conditioning, Electric energy storage.

As part of an effort managed by the Solar Energy Research Institute for the development of preliminary performance criteria and test standards for photovoltaic systems, two subcommittees - one on Power Conditioning, Control, and Cabling, and one on Storage - met on June 22-23, 1978 in Vail, CO. to make initial identifications of performance criteria. This paper reports on the highlights of and directions taken by these two subcommittees.

708,931
PB-299 964/7 PC **A09**/MF **A01**
National Engineering Lab. (NBS), Washington, DC.
Semiconductor Measurement Technology: NBS/DOE Workshop, Stability of (Thin Film) Solar Cells and Materials.
D. E. Sawyer, and H. A. Schafft. Aug 79, 184p NBS-SP-400-58
Sponsored in part by Department of Energy, Washington, DC. Advanced Materials R and D Branch. Library of Congress catalog card no. 79-600098.

Keywords: *Solar cells, *Meetings, Semiconductors(Materials), Thin films, Indium phosphides, Zinc sulfides, Cadmium sulfide solar cells, Silicon solar cells, Gallium arsenide solar cells, Copper sulfides, Metal oxide semiconductors, MIS(Semiconductors).

A workshop was held to discuss what needs to be done to achieve and measure long term stability of terrestrial solar cells using thin film materials and device technologies. Under this theme, researchers in the field and invited speakers from related device technologies presented papers and took part in discussions related to solar cells of the following three material groupings: (1) Cu2S/(CdZn)S, Cu-ternaries/CdS, and amorphous Si; (2) polycrystalline, metal-insulator-semiconductor (MIS), and conducting-oxide Si; and (3) polycrystalline and antireflection-coated metal-oxide-semiconductor (AMOS) GaAs. This workshop report contains the 18 papers presented and the reports of three discussion groups; it also includes a section on the highlights of these papers and reports. The many needs identified by the workshop participants can be organized into two general areas of work to be done. One area of work is in the development of an improved understanding of cell operation and of component structures of these cells. The other is in the development of an improved measurements base.

708,932
PB-300 890/1 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Performance of a Packaged Solar Space-Heating System Used with a Mobile Home.
D. E. Jones, and J. E. Hill. Aug 79, 45p NBSIR-79-1799
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: Houses, Trailers, Performance tests, Performance evaluation, Design, Drawings, *Mobile homes, *Solar heating systems, *Solar space heating, Solar collectors, Flat plate collectors, Solar air heaters, Rock beds.

As part of a continuing program to develop test methods for solar heating equipment, NBS is now developing a standard test procedure for packaged solar space-heating systems similar to test procedures now used for solar collectors and thermal storage devices, and now under development for packaged solar water-heating systems. As a first step, a mobile home, which was previously tested for thermal performance in an

environmental chamber, was equipped with a packaged solar space-heating system using air-heating collectors and pebble-bed storage. The system was fully instrumented and data were collected over the 1977-78 heating season at the NBS site in Gaithersburg, Maryland. The performance of the system was determined and various methods of correlating performance were explored.

708,933
PB-301 309/1 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Measurement Techniques for Solar Cells, Quarterly Report: April 1 to June 30, 1978.
D. E. Sawyer, H. K. Kessler, and H. A. Schafft. Oct 79, 26p NBSIR-79-1909
Prepared for Department of Energy, Washington, DC. Advanced Materials R and D Branch.

Keywords: *Solar cells, Measurement, Test equipment, Optical scanners, Nondestructive tests, Defects.

The objectives of the program are to assist the DOE thin-film photo-voltaic effort by developing solar cell device and material measurement techniques using the NBS-developed laser flying-spot scanner, by assisting DOE in organizing and hosting appropriate workships and symposia, and by providing general consultation and liaison services.

708,934
PB79-600049 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Solar Cell Measurement Technique Development and Other Services.
D. E. Sawyer. 1978, 6p
Pub. in Proceedings Photovoltaics Program Semi-Annual Review Advanced Materials R&D Branch, Golden, CO, Oct. 4-6, 1977, p708-713 1978.

Keywords: *Laser scanner, Measurement development, Photovoltaics, Reliability, Solar arrays, Solar cells, Workshops.

The development of solar cell measurement techniques using a laser scanner is a major portion of a new program which will be initiated for ERDA. The other portion is to assist ERDA with supportive activities such as helping organize workshops and symposia and hosting these events.

708,935
PB80-100878 Not available NTIS
National Bureau of Standards, Washington, DC.
Testing of Water-Heating Collectors According to ASHRAE Standard 93-77.
Final rept.,
J. P. Jenkins, and J. E. Hill. 1978, 8p
Pub. in SUN: Mankind's Future Source of Energy, n2, p1021-1028 1978.

Keywords: *Performance tests, *Test facilities, Performance standards, *Solar collectors.

A proposed procedure for testing and rating solar collectors was published by the National Bureau of Standards (NBS) in 1974. In early 1977, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) adopted ASHRAE Standard 93-77 which is a modified version of the NBS procedure. A test facility for water-heating collectors has been built at NBS in accordance with this Standard. The purpose of this paper is to briefly explain the recently adopted test procedure, describe the NBS test facility, and to give typical test results for collectors commercially available in the United States.

708,936
PB80-103880 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Based Characterization Facility for Silicon Photocell Studies.
Final rept.,
J. Geist, M. A. Lind, A. R. Schaefer, and E. F. Zalewski. 1976, 9p
Pub. in Proceedings of a Workshop on Terrestrial Photovoltaic Measurements, II, Held at Baton Rouge, LA. on November 10-12, 1976, p223-231 1976.

Keywords: *Optical measuring instruments, Test facilities, Solar cells, Optical measurement, Optical tests, Laser beams, Laser applications, Silicon solar cells.

A laser-based facility for characterization of photocells, and some studies performed on it, are described, with emphasis towards results of the greatest interest to the silicon solar cell community.

708,937
PB80-107477 Not available NTIS
National Bureau of Standards, Washington, DC.
Capabilities for Reflectance and Transmittance Measurements (NBS).
Final rept.,
J. J. Hsia, and W. H. Venable. 1978, 3p
Pub. in Proceedings Seminar on Testing Solar Energy Materials and Systems, Held at Gaithersburg, MD on May 22-24, 1978 p258-260.

Keywords: *Optical materials, *Reflectance, *Transmittance, Measurement, Optical properties, Standard reference materials, Solar collectors, Solar energy conversion, US NBS.

A description is given of the current and planned NBS measurement capabilities for reflectance and transmittance measurements of interest to engineers of solar energy collection and conversion devices. Details to be included are spectral ranges, instrument geometries, and estimated uncertainties in the data. Related Standard Reference Materials are also described.

708,938
PB80-113749 PC **A06**/MF **A01**
CEDAR Associates, Evanston, IL.
Snow and Ice Accumulation at Solar Collector Installations in the Chicago Metropolitan Area.
Final rept.,
R. B. Corotis, C. H. Dowding, and E. C. Rossow. Aug 79, 109p NBS-GCR-79-181
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Snowfall, Snowstorms, Ice formation, Surveys, Data acquisition, Photographs, Performance evaluation, *Flat plate collectors, Solar collectors, Chicago(Illinois).

This report presents observations and data concerning snow and ice on eighteen flat plate solar collector installations in the Chicago area. The data was collected in February and March of 1979, following a record snowfall in January. Nearly all of the installations were on the roofs of buildings, and about half were mounted flush with the roof. The remainder were mounted on racks at an angle to the roof. Sketches and photographs of the buildings and snow accumulation, weather data for the entire winter, and comments of the owners are included, as well as a technique for the extraction of linear measurements from the photographs.

708,939
PB80-114168 Not available NTIS
National Bureau of Standards, Washington, DC.
Daylighting - Conflicts and Synergies of Architectural Solutions.
Final rept.,
S. R. Hastings. Jun 79, 4p
Pub. in Proceedings of the Topical Solar Glazing Conference (1979) Held at Pomona, NJ. on June 22-23, 1979, pF-21-F-24, Jun 79.

Keywords: *Daylighting, Windows, Architecture, Solar energy, Design, *Energy conservation.

Design solutions which enhance daylighting may enhance or detract from a window's performance of other functions. Five energy control functions and five non-energy functions of windows are defined. Then, inherent conflicts and synergies between daylighting and other window functions are examined. Various design or hardware solutions to minimize conflict and/or improve overall performance are discussed. Daylighting solutions need not compromise other window functions, given the multitude of design or hardware options available today.

708,940
PB80-117344 Not available NTIS
National Bureau of Standards, Washington, DC.
Passive Solar Design for Urban Commercial Environments.
Final rept.,
S. R. Hastings. 1979, 4p
Pub. in Proceedings of the National Passive Solar Conference (4th) Held at Kansas City, Missouri on October 3-5, 1979, Section 3, p303-306 1979.

Keywords: *Commercial buildings, Urban areas, *Passive solar heating systems, *Solar space heating.

To investigate the passive use of solar energy in urban commercial environments, five generic environments and five passive solar configurations have been defined. Common solar energy issues are summarized. Two of the five generic environments are then examined regarding energy use characteristics, passive solar configurations, and constraints.

708,941
PB80-119159 Not available NTIS
National Bureau of Standards, Washington, DC.
Economic Evaluation of Passive Solar Designs for Urban Environments.
Final rept.,
J. W. Powell. 1979, 5p
Pub. in Proceedings of the National Passive Solar Conference (4th) Held at Kansas City, MO. on October 3-5, 1979, p1-5 1979.

Keywords: *Commercial buildings, Economic models, Cost effectiveness, Benefit cost analysis, *Passive solar heating systems, Retrofitting, Solar space heating.

This paper outlines an economic model for evaluating passive solar designs for commercial buildings and applies the model in several case studies of retrofit systems. Taking into account tax effects, incentive programs available to urban rehabilitation projects, and non-thermal as well as thermal benefits of selected passive solar energy systems for space heating, the evaluations show that these systems are cost effective over a wide range of conditions.

708,942
PB80-119928 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Residential Solar Data Center Grant Reports.
Rept. for Sep 78-Sep 79,
P. M. Christopher, and M. J. Aronoff. Oct 79, 75p NBSIR-79-1923
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Solar heating, *Grants, Solar energy, Residential buildings, Apartment buildings, Houses, *Solar cooling, Solar houses.

The Residential Solar Data Center project staff in the Center for Building Technology, National Bureau of Standards, is responsible for the establishment and operation of a computerized database containing non-instrumented residential data generated by the Solar Heating and Cooling Demonstration Program sponsored by the Department of Energy and the Department of Housing and Urban Development (HUD). This document includes computer reports of data contained in the Grant file, one of six computer files comprising the database. These reports contain data recorded on applications submitted to HUD by organizations or individual builders applying for grants to build solar energy systems in new and/or existing homes. To date, approximately 450 grants have been awarded in the first four award cycles.

708,943
PB80-120173 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Data Requirements and Thermal Performance Evaluation Procedures for Solar Heating and Cooling Systems,
E. R. Streed. Aug 79, 87p NBSIR-80-1980
Sponsored in part by Department of Energy, Washington, DC. Prepared in cooperation with Technical Univ. of Denmark, Lyngby., Royal Inst. of Tech., Stockholm (Sweden), and Ecole Polytechnique Federale de Lausanne (Switzerland). See also report dated Aug 76, PB-257 770.

Keywords: Buildings, Hot water heating, Performance evaluation, Thermal efficiency, Solar collectors, Heat storage, Sensor characteristics, Systems analysis, Monitoring, Mathematical models, *Solar space heating, *Solar air conditioning, *Solar water heating, Solar heating systems, Solar cooling systems.

This document provides standardized nomenclature and procedures to serve as a guide to monitor and evaluate research or demonstration type solar hot water or heated and/or cooled systems, components and buildings. Performance factors, data requirements, measurement parameters and data analysis

methods are described for typical solar energy systems.

708,944
PB80-120900 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Test Results for Flat-Plate Water-Heating Solar Collectors Using the BSE and ASHRAE Procedures.
Final rept.,
J. P. Jenkins, and J. E. Hill. 1979, 13p
Sponsored in part by Department of Energy, Washington, DC. Assistant Secretary for Conservation and Solar Applications.
Pub. in Proceedings of ASME Winter Annual Meeting, New York, NY., December 2-7, 1979, 79-WA/SoL-4, p1-13 1979.

Keywords: *Performance tests, *Performance standards, Thermal efficiency, Experimental design, Methodology, *Flat plate collectors, Solar collectors, ASHRAE 93-77, German Bundesverb and Solarenergie.

The German Bundesverb and Solarenergie (BSE) Working Group recently adopted and published a procedure for testing solar collectors based on thermal performance. Research facilities for testing flat-plate water-heating collectors have been built at NBS in accordance with the BSE procedure and the existing ASHRAE Standard 93-77. The purpose of this paper is to describe the BSE test procedure and compare experimental test results with those obtained using the existing ASHRAE Standard 93-77. Included is a description of the collector test facilities at NBS and the results obtained from testing five commercially available flat-plate water-heating collectors using both procedures.

708,945
PB80-125891 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Solar Collector Fluid Parameter Study.
Final rept. Nov 78-Jun 79,
W. W. Youngblood, W. Schultz, and R. Barber. Oct 79, 130p NBS-GCR-79-184
Contract DOE-EG-77-C-01-4050
Prepared by Wyle Labs., Huntsville, AL.

Keywords: Heat transfer, Fluids, Liquids, Water, Ethylene glycol, Thermal efficiency, Performance tests, Data, *Flat plate collectors, Solar collectors, SLYTHERM 444, Therminol 44.

A series of instantaneous thermal performance tests were performed on four differently constructed, commercially available flat plate solar collectors with each of four commonly used heat transfer fluids. The tests were designed to illustrate the magnitude of fluid parameter effects on the thermal performance of flat plate solar collectors. The configurations were selected to provide a broad variety of flow conditions. The heat transfer fluids used were as follows: (1) water; (2) an ethylene glycol (Prestone 11) - water solution (50 percent by weight); (3) a silicone based heat transfer fluid (SLYTHERM 444); and (4) a synthetic hydrocarbon (Therminol 44).

708,946
PB80-127053 PC **A04**/MF **A01**
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Civil Engineering.
Snow and Ice Accumulation Around Solar Collector Installations.
Final rept.,
M. J. O'Rourke. Aug 79, 75p NBS-GCR-79-180
Contract NB79-NAAA-6099
See also P80-113749. Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Buildings, *Snow, *Ice, Roofs, Loads(Forces), Structural design, Structural engineering, Photographs, *Flat plate collectors, Solar collectors.

Half the installations had the collectors mounted flush with the roof surface, while the remainder had collectors mounted on racks at an angle to the roof. Contours of snow depth on the roof, snow densities, measurements of snow on the ground adjacent to the buildings, sketches and photographs of the roofs, and comments of the owners of the installations are included in the report, in addition to a discussion of the state of the art of predicting snow accumulation on roofs of buildings. The effect of solar collectors on the design of roof structures for the support of snow loads is discussed and recommendations for future research are made.

708,947
PB80-129828 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Solar Energy Systems--Standards for Rubber Hose,
R. D. Stiehler, and J. L. Michalak. Nov 79, 38p
NBSIR-79-1917
Sponsored in part by Department of Energy, Washington, DC. Assistant Secretary for Conservation and Solar Applications.

Keywords: *Hoses, *Solar heating, Standards, Solar collectors, Solar heating systems.

A study of commercial rubber hose was made to develop standards for hose used in solar energy systems. Twelve hoses were evaluated by cycling between temperatures of about 100C and temperatures as low as -40C during a period of about seven months. Laboratory tests for bursting strength, compatibility with metals, compression set, ozone resistance, and water vapor transmission were also made. The results of this study and tests are presented. Based on these findings, a standard for rubber hose used in solar energy systems is proposed.

708,948
PB80-132038 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Solar Energy Systems: Test Methods for Collector Insulations.
Final rept.,
M. Godette, J. Lee, and J. Fearn. Oct 79, 40p
NBSIR-79-1908
Sponsored in part by Department of Energy, Washington, DC. Office of Conservation and Solar Applications.

Keywords: *Thermal insulation, Tests, *Solar collectors, Flat plate collectors, Solar heating systems.

A preliminary study was performed to evaluate potential procedures for screening the insulation used in solar collectors. Both ASTM standard test methods and newly developed non-standard procedures were used to evaluate twenty-one insulation materials. The insulation parameters measured in this study were selected on the basis of how and to what extent they were affected by the unique environmental conditions within solar collectors. Results of the laboratory tests are discussed and those procedures which offer a potential for screening insulations used in solar collectors are presented. It is intended that these procedures fulfill the first step in the development of a standard set of test methods for evaluating insulations for solar collectors.

708,949
PB80-132897 Not available NTIS
National Bureau of Standards, Washington, DC.
Calculating the Solar Dollar Gains: Ins and Outs of Life Cycle Costing.
Final rept.,
R. Ruegg. Jul 79, 4p
Sponsored in part by Department of Energy, Washington, DC. Office of Conservation and Solar Applications.
Pub. in Sol. Eng. Mag., p11-14, Jul 79.

Keywords: *Solar energy, Life(Durability), Service life, Government buildings, National government, Reprints, *Life-cycle cost, Energy conservation.

This article provides an overview of life-cycle costing and describes briefly how the federal government is applying the technique to different kinds of investment decisions in its programs to conserve non-renewable energy and to demonstrate the use of solar energy in federal buildings.

708,950
PB80-140536 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire Experiments and Flash Point Criteria for Solar Heat Transfer Liquids.
Final rept.,
B. T. Lee, and W. D. Walton. Nov 79, 42p NBSIR-79-1931
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Fire hazards, *Flash point, Liquids, Heat transfer, Solar energy, Flammability, Fire safety, Temperature measurement, *Solar heating, Solar collectors.

To help provide a rational basis for developing flammability criteria for heat transfer fluids used in solar energy collection systems, fire tests were performed using simulated accident scenarios involving spills, flowing leaks, spray leaks, and soaked insulation. These experiments indicated that the flash point temperatures, as measured with the Pensky-Martens closed cup apparatus, are close to the minimum temperatures at which pools of the fluids will support a flame when they are exposed to a small pilot igniting flame in a room. The heat release from moderate sized burning pools of these liquids is sufficient to cause flashover in a room. Interim flash point criteria of at least 28 deg C (50 deg F) greater than the maximum operating temperature and not more than 111 deg C (200 deg F) below the maximum no-flow temperature are proposed to reduce the risk of fire in the use of solar heat transfer liquids.

708,951
PB80-153968 MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Analysis of Code Related Responses From the Solar Demonstration Program.
Final rept.,
J. Greenberg. Jan 80, 154p NBSIR-79-1957
Prepared in cooperation with Department of Housing and Urban Development, Washington, DC., and Department of Energy, Washington, DC.
Available Microfiche only because of poor quality.

Keywords: *Building codes, *Residential buildings, *Solar energy, Houses, Regulations, Surveys, Constraints.

This report documents and analyzes the building regulatory information gathered during the course of the Residential Solar Demonstration Program from inception of the program through September 30, 1978. The report is based primarily on data collected by HUD contractor personnel and are data which have been transmitted to NBS for inclusion in the NBS Solar Data Base. The report concludes that existing codes do not present a barrier to the installation and acceptance of solar systems; however, code officials need additional training and better back-up material to properly evaluate solar systems.

708,952
PB80-170244 Not available NTIS
National Bureau of Standards, Washington, DC.
Updating Solar Performance Criteria and Standards.
Final rept.,
J. K. Holton. 1978, 8p
Pub. in Proceedings of Annual Meeting of the American Section of the Int. Solar Energy Soc., Inc. (1978), Denver, CO, August 28-31, 1978, p514-521 1978.

Keywords: *Performance standards, Revisions, *Solar heating systems.

Findings are presented from the residential and commercial demonstration program and from a public commentary process that have led to the updating of numerous sections of the criteria and standards. A comparison is presented of the original criteria, the practical problems and the revised criteria. Topics covered include: system performance covering thermal losses, operating energy, system back-up, thermosyphoning, flow balancing, controls, safety, maintenance and check-out procedures; and component performance covering freeze protection, stratification, stagnation, materials deterioration, and heat transfer fluid quality.

708,953
PB80-194426 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Test Results for Flat-Plate Water-Heating Solar Collectors Using the Bundesverband Solarenergie (BSE) and ASHRAE Procedures.
Final rept.,
J. P. Jenkins. 1979, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the International Congress International Solar Energy Society, Atlanta, Georgia,

May 28-June 1, 1979, Paper in SUN II 1, p365-369 1979.

Keywords: Performance tests, *Flat plate collectors, Solar collectors.

The German Bundesverband Solarenergie (BSE) Working Group recently adopted and published a procedure for testing solar collectors based on thermal performance. Research facilities for testing flat-plate water-heating collectors have been built at NBS in accordance with the BSE procedure and the existing ASHRAE Standard 93-77. The purpose of this paper is to describe the BSE test procedure and compare experimental test results with those obtained using the existing ASHRAE Standard 93-77. Included is a description of the collector test facilities at NBS and the results obtained from testing five commercially available flat-plate water-heating collectors using both procedures.

708,954
PB80-199532 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Economic Model for Passive Solar Designs in Commercial Environments.
Building science series,
J. W. Powell. Jun 80, 150p NBS-BSS-125
Sponsored in part by Department of Energy, Washington, DC.

Keywords: Economic models, Economic analysis, Commercial buildings, *Passive solar heating systems, Life-cycle costs, Financial incentives.

The report presents an economic model for evaluating passive solar designs in commercial environments. It discusses the literature on this topic and draws upon this literature to develop a general methodological framework. The model incorporates a life-cycle costing approach that focuses on the costs of purchase, installation, maintenance, repairs, replacement, and energy. It includes a detailed analysis of tax laws affecting the use of solar energy in commercial buildings. Possible methods of treating difficult-to-measure benefits and costs, such as effects of the passive solar design on resale value of the building and on lighting costs, rental income from the building, and the use of commercial space, are presented. The model is illustrated in two case examples of prototypical solar designs for low-rise commercial buildings in an urban setting.

708,955
PB80-201254 Not available NTIS
National Bureau of Standards, Washington, DC.
Economic Feasibility of Solar Applications to Office Buildings and Retail Stores.
Final rept.,
R. T. Ruegg. 1980, 7p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proc. Solar Energy Market Analysis and Evaluation Contractor's Review Meeting, Washington, DC., p1-7, Apr 8-10, 1980.

Keywords: *Commercial buildings, *Office buildings, Economic models, Benefit cost analysis, Cost effectiveness, *Solar water heating, *Solar space heating.

Comprehensive economic optimization models and a computer program for evaluating the economic feasibility of active solar energy for commercial buildings are developed by this study. Data and assumptions for use in the models are compiled. The models are applied to assess the economic feasibility of active solar hot water and combined space heating and hot water systems for a new and an existing office building and retail store in 13 U.S. cities. Net savings (or losses) of the solar energy systems are estimated in present value dollars over a 20 year life cycle, based on a set of representative data and assumptions. Break-even values of system costs, energy prices, and future energy price escalation rates are also calculated to determine the minimum conditions under which the solar energy systems become cost effective for the selected office buildings and retail stores. Sensitivity analysis is conducted for other key variables. The relationship between net savings (losses) and the solar fraction is tested for selected cities.

708,956
PB80-203086 Not available NTIS
National Bureau of Standards, Washington, DC.
Test Results on Hot Water Systems Show Effects of System Design.
Final rept.,
A. H. Fanney, and S. T. Liu. May 80, 5p
Pub. in Proc. Symp. on Solar Hot Water Systems, Los Angeles, CA, 3-7 Feb 80, Solar Eng., p25-39 May 80.

Keywords: Performance tests, *Solar water heaters, Solar water heating, TRNSYS computer program, f-CHART computer program, SOLCOST computer program.

Currently three computer programs, TRNSYS, f-CHART, and SOLCOST, are being extensively used for the design and evaluation of solar space heating and domestic hot water systems. Although widely used, the accuracy of their predictions needs to be verified with experimental data. In order to provide data required for the validation of these computer programs for solar domestic hot water systems, the staff of the National Bureau of Standards fabricated and instrumented six typical systems at its Gaithersburg, Maryland site. The systems have been operating since June, 1978. This paper describes the testing done, the experimental results, and compares the experimental results with the computer predictions for the first twelve months of operation.

708,957
PB80-203391 Not available NTIS
National Bureau of Standards, Washington, DC.
Solar Heating Standards Activities in the United States.
Final rept.,
D. Waksman, and R. D. Dikkers. 1980, 10p
Pub. in Proceedings of Technical Meeting on Solar Energy Codes of Practice and Test Procedures, London (England), April 25, 1980, p89-98 1980.

Keywords: *Performance Standards, Buildings, Specifications, *Solar heating systems.

This paper provides an overview of efforts that are currently underway in the United States to develop and implement standards for solar heating applications. A summary of standards development and building regulatory systems used in the United States is also provided.

708,958
PB80-205099 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Solar Simulator and Outdoor ASHRAE Standard 93 Thermal Performance Tests.
Final rept.,
E. Streed, D. Waksman, A. Dawson, and A. Lunde. 1980, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of American Section/International Solar Energy Society 1980 Annual Meeting, Phoenix, AZ p405-409, 2-6 Jun 80.

Keywords: Thermal efficiency, Performance tests, Comparison, *Solar collectors, ASHRAE Standard 93, Solar simulators.

Standard test methods for determination of solar collector thermal performance permit the use of solar simulators. A comparison of efficiency measurements for seven collectors of varying construction and materials is used to illustrate the high bias in results when using two types of solar simulators as compared to outdoor measurements. Spectral distribution, sky temperature and collector tilt angle are shown to be parameters that must be considered in addition to the normal environmental test conditions of wind, irradiance, diffuse fraction and ambient temperature when comparing indoor and outdoor test results.

708,959
PB80-205131 Not available NTIS
National Bureau of Standards, Washington, DC.
Influence of Environmental Exposure on Solar Collectors and Their Materials.
Final rept.,
D. Waksman, E. Streed, and A. Dawson. 1980, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of American Section/International Solar Energy Society 1980 Annual Meeting, Phoenix, AZ p415-419, 2-6 Jun 80.

Keywords: Materials tests, Aging tests(Materials), Accelerated tests, Environmental tests, Field tests, Life tests, Life(Durability), Degradation, Standards, *Flat plate collectors, *Solar absorbers.

Efforts in the development of reliability/durability tests for solar collectors and their materials have been hampered by the lack of data on the real time and accelerated degradation of these materials. The focus of this paper is upon research related to the development of standards for evaluating the reliability and durability of cover plate and absorber materials used in flat plate solar collectors. In this research, several different types of collectors, cover plates and absorbers are being studied in laboratory and field tests. Optical property measurements are being performed in conjunction with aging tests intended to induce degradation in the materials. The aging tests include accelerated laboratory exposure of material specimens and outdoor exposure of these materials in simulated solar collectors. Full-size solar collectors in which several of these materials are used are being concurrently subjected to outdoor and solar simulator exposure. Changes in thermal performance at the collector level are being compared with changes in optical properties at the materials level. The results obtained in the first year of this study are presented.

708,960
PB80-205693 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Drafting Test Methods for Photovoltaic Systems,
W. F. Lankford, and H. A. Schafft. Jun 80, 20p
NBSIR-80-2060
Contract DOE-EG-77-C-1-4042
Sponsored in part by Solar Energy Research Inst., Golden, CO.

Keywords: *Photovoltaic cells, *Tests, Solar cells, Standards.

General guidance and a step-by-step procedure are provided as aids in the development of initial drafts of test methods for photovoltaic energy components and systems. It is intended that these drafts will be referred to the appropriate technical committees of organizations writing voluntary consensus standards. This approach is designed to facilitate the expeditious development of consensus test method standards for photovoltaic systems. The procedure is therefore designed to be compatible with the requirements of existing standards organizations.

708,961
PB80-215650 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Scanning of Solar Cells for the Display of Cell Operating Characteristics and Detection of Cell Defects.
D. E. Sawyer, and H. K. Kessler. Apr 80, 9p
Pub. in IEEE Transactions on Electron Devices, ED-27, n4 p864-872 Apr 80. Sponsored in part by Department of Energy, Washington, DC. Div. of Distributed Solar Technology.

Keywords: *Solar cells, *Nondestructive tests, Scanning, Lasers, Optical scanners, Inspection, Reprints.

A new optical scanning technique was developed to map solar-cell operation over the cell area and reveal several types of cell defects. The technique, which makes use of the distributed nature of the cell, an intrinsic property shared by all cells, allows one to detect potentially harmful cracks with a sensitivity greater than any other optical technique reported previously, and it permits one, for the first time, to locate regions of poor metallization. It has also been used to determine efficacy of cell design and to study cell degradation processes. The new scanning technique employs forward biasing of the cell during scanning. Biasing may be achieved through the use of a steady-state light source, or for cells made using conventional semiconductor materials, e.g., silicon and gallium arsenide, by use of an external current source. The scanning technique is nondamaging; it requires no electrical contacts to the cell other than those already present, and it can be used on encapsulated or unencapsulated cells in almost any laboratory or test environment.

708,962
PB80-216955 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS Solar Collector Durability/Reliability Program.
Final rept.,
E. R. Streed, and D. Waksman. 1978, 24p
Sponsored in part by Department of Energy, Washington, DC.

Pub. in Proceedings of the International Conference on Durability of Building Materials and Components (1st), Ottawa, Canada, August 21-23, 1978, Paper in Durability of Building Materials and Components, p219-242 1978.

Keywords: Durability, Reliability, Degradation, Life(Durability), Performance tests, *Solar collectors.

There is evidence that significant deterioration in solar collectors used for residential and commercial building applications can occur as a result of exposure to environmental conditions. This problem indicates the need for validated testing and evaluation procedures that can be used to assess the deterioration of solar collectors and their associated materials. A program is being undertaken at the National Bureau of Standards (funded by the Department of Energy) to develop meaningful collector durability/reliability tests. Both laboratory and outdoor field exposure tests will be performed on collectors and collector materials. These tests will take into account the deterioration that can occur at the collector level as a result of exposure to stagnation conditions, thermal shock, moisture, wind, and snow loads, etc. Materials tests in the laboratory or field include ultraviolet (UV) degradation, thermal degradation, and moisture resistance. Correlations will be made between actual and simulated degradation for both collectors and their materials.

708,963
PB80-216971 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Experimental and Computer-Predicted Performance for Six Solar Domestic Hot Water Systems.
Final rept.,
A. H. Fanney, and S. T. Liu. 1980, 13p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the Symposia on Solar Hot Water Systems, Los Angeles, CA, February 3-7, 1980, ASHRAE Transactions 86, pt1 p823-835 1980.

Keywords: Performance tests, Performance evaluation, Computerized simulation, Comparison, *Solar water heaters, Solar water heating, TRNSYS computer program, f-CHART computer program, SOLCOST computer program.

Currently three computer programs, TRNSYS, f-CHART, and SOLCOST, are being extensively used for the design and evaluation of solar space heating and domestic hot water systems. Although widely used, the accuracy of their predictions needs to be verified with experimental data. In order to provide data required for the validation of these computer programs for solar domestic hot water systems, the staff of the National Bureau of Standards fabricated and instrumented six typical systems at its Gaithersburg, Maryland site. The systems have been operating since June, 1978. This paper describes the testing done, the experimental results, and compares the experimental results with the computer predictions for the first twelve months of operation.

708,964
PB80-217615 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Information and Guidelines for a Proposed Laboratory Accreditation and Product Certification Program for Photovoltaic Energy Conversion Systems.
D. B. Thomas. Aug 80, 36p NBSIR-80-2028

Keywords: *Photovoltaic cells, *Solar cells, *Laboratories, Solar energy, Guidelines, Accreditation, Energy conversion, Solar collectors, Product certification.

This report provides information and guidelines for use in preparing and implementing a laboratory evaluation and product certificate program for photovoltaic products, as required in the Department of Energy's work plan for the National Photovoltaic Energy Program. The report presents an overview of the advantages and disadvantages of laboratory accreditation and product certification including economic factors that should be considered for such programs. Detailed information is also provided on the two national programs for accrediting laboratories, the Department of Commerce National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (AALA). Information on the California and Florida state programs for laboratory accreditation and product certification of solar collector systems is given as examples of programs that have been in operation for several years.

708,965
PB80-223134 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Measurement Techniques for Solar Cells, Annual Report September 15, 1977 to December 14, 1978.
Interim rept.,
D. E. Sawyer, H. K. Kessler, and H. A. Schafft. Jul 80, 70p NBSIR-80-2027
Sponsored in part by Department of Energy, Washington, DC. Advanced Materials R and D Branch.

Keywords: *Solar cells, *Measurement, Scanning, Lasers, Metallizing, Nondestructive tests, Stability, Photovoltaic cells.

The objectives of the program are to assist the DOE thin film photovoltaic effort by developing solar cell device and material measurement techniques using the NBS-developed laser flying-spot scanner, by assisting DOE in organizing and hosting appropriate workshops and symposia, and by providing general consultation and liaison service. A technique was developed which employs forward biasing during laser scanning of the solar cell to reveal defects including cracks, metallization breaks, and regions of metallization not in ohmic contact with the underlying semiconductor. The technique also has provided information useful to cell designers. The experimental results obtained are consistent with predictions made by a first-order theory developed in-house, and by subsequent mathematical modeling performed by the University of Southern California under subcontract. Single-crystal silicon artifacts have been designed to couple laser scanning measurements with mathematical analyses to define quantatively the capabilities of the laser scanner techniques to detect cell defects and spatial nonuniformaties of cell performance.

708,966
PB80-600046 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison of Test Results for Flat-Plate Water-Heating Solar Collectors Using the BSE and ASHRAE Procedures.
J. P. Jenkins, and J. E. Hill. 1980, 14p
Pub. in Jnl. Sol. Energy Eng. 102/1, p2-15 1980.

Keywords: *Collector efficiency, Environmental simulation for solar collector testing, Optical and thermal loss characteristics of solar collectors, Solar collectors, Wind speed and sky temperature effects on solar collector performance.

Five solar collectors were tested according to the BSE and ASHRAE test procedures and the results compared. All five collectors tested were modular, flat-plate, water heating, and included single- and double-glazed designs with and without selectively coated absorbers. In both procedures, collector efficiency curves are determined. The ASHRAE procedure consists exclusively of outdoor testing whereas the BSE procedure requires a combination of outdoor and indoor testing (no irradiation) to determine the collector's optical and thermal loss characteristics, respectively. During the indoor testing in this study, the environmental test conditions were controlled and regulated by use of specially built environmental simulators to investigate the effect of wind speed and 'sky' temperature on the thermal loss characteristics of the collectors.

708,967
PB81-104457 Not available NTIS
National Bureau of Standards, Washington, DC.
Solar Collector Industry and Solar Energy.
Final rept.
W. L. Warnick, and J. E. Hill. Feb 80, 6p
Pub. in Monthly Energy Review, DOE-EIA Report 0035-02 (80), p1-6 Feb. 1978.

Keywords: Industries, Solar energy, Production, Reprints, *Solar collectors, Energy consumption.

From a 1974 level of 1.3 million square feet, the production of solar collectors increased over ten-fold to 13.9 million square feet in 1979 (based upon the first 8-months' data). However, shipments of the various types of collectors, while increasing overall, show sporadic growth patterns over the 5 1/2-year period. Furthermore, a 4-year period of exponential growth appears to have ended. Solar energy incident on the Nation's inventory of solar collectors during 1979 was less than 0.03 quadrillion British thermal units (Btu). It is estimated that during 1979 the usable energy-output from solar collectors in the United States was about 0.008 quadrillion Btu. between 0.01 and 0.02 percent of domestic energy consumption.

708,968
PB81-104770 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Testing Flat-Plate Water Heating Solar Collectors in Accordance with the BSE and ASHRAE Procedures.
Final rept.
J. P. Jenkins, and J. E. Hill. Aug 80, 82p NBSIR-80-2087
Sponsored in part by Department of Energy, Washington, DC.

Keywords: Heat loss, Thermal efficiency, Performance tests, Performance evaluation, Performance standards, *Flat plate collectors, Solar collectors, ASHRAE 93-77 test procedures, BSE test procedures.

Five solar collectors were tested according to the BSE and ASHRAE test procedures and the results compared. All five collectors tested were modular, flat-plate, and water-heating, and included single- and double-glazed designs with and without selectively-coated absorbers. In both procedures, collector efficiency curves are determined.

708,969
PB81-106312 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Dimensional Considerations in Solar Installations.
Final rept.
H. J. Milton. Sep 80, 155p NBSIR-80-2116
Sponsored in part by the Department of Energy, Washington, DC.

Keywords: Dimensions, Installing, Dimensional measurement, Size determination, Manufacturers, Heat storage, Storage tanks, Tables(Data), Statistical data, *Flat plate collectors, Solar collectors.

The Interim Report contains a study of dimensional considerations in solar installations using non-integrated flat plate collectors. Special attention is given to sizes of collectors and their constituent materials, to dimensions that affect the collector array, and to sizes for thermal storage tanks.

708,970
PB81-119935 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Guidelines for the Installation of Solar Components on Low-Sloped Roofs.
Final rept.
R. G. Mathey, and W. J. Rossiter. Nov 80, 85p NBS-TN-1134
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Commercial buildings, *Industrial buildings, Roofs, Installing, Guidelines, Photographs, Drawings, *Solar collectors, Retrofitting.

Guidelines were prepared for the installation of solar collectors and related equipment on low-sloped roofs of commercial and industrial type buildings. The guidelines are concerned primarily with the waterproofing integrity of the roofing system, access to the collectors and roofing, attachment of different types of collector support frames and safety. Technical information from the literature, building codes, roofing field surveys and acceptable roofing practice provided the basis for the guidelines. The guidelines include recommendations for the design of the solar installation with regard to roofing performance, workmanship during collector installation and maintenance of roofs with solar components.

708,971
PB81-121899 Not available NTIS
National Bureau of Standards, Washington, DC.
Computer Modeling of Air Leakage in a Solar Air Heating System.
J. G. Shingleton, D. E. Cassel, and M. E. McCabe. 1980, 7p
Pub. in Proceedings of the Annual Systems Simulation and Economic Analysis Conference (2nd) Held at San Diego, CA. on Jan 23-25, 1980, p265-271 1980.

Keywords: Air flow, Leakage, Performance tests, Computerized simulation, *Solar heating systems, Solar air heaters, TRNSYS computer model.

A detailed TRNSYS computer model developed to permit evaluation of the effects of air leaks on the performance of a solar air heating system is described. The model was developed to define reasonable limits of air leakage for specification in performance criteria for solar heating and cooling systems in commercial and residential buildings.

708.972
PB81-121907 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of Operational Results to Identify Potential Improvements in the Thermal Performance of Air Solar Heating Systems and to Establish Performance Criteria.
J. G. Shingleton, D. E. Cassel, and M. E. McCabe. 1980, 7p
Pub. in Proceedings of the Conference on Solar Heating and Cooling Systems, Operational Results Held at Colorado Springs, CO, on Nov 27-30, 1979, p208-209 1980.

Keywords: *Air flow, Leakage, Thermal efficiency, Performance tests, *Solar heating systems, Solar air heaters.

The National Bureau of Standards is developing definitive performance criteria for solar heating, cooling, and hot water systems. This study was performed to quantify the effect of air leakage on the thermal performance of air type solar heating systems.

708.973
PB81-132268 PC A07/MF A01
National Bureau of Standards, Washington, DC. National Engineering Lab.
Residential Solar Data Center-- MIRADS User's Guide.
Final rept.
P. M. Christopher, M. Vogt, and D. Hall. Oct 80, 145p NBSIR-80-2144
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Solar energy, *Information systems, *Manuals, Residential buildings, Information retrieval, Data processing, Residential Solar Heating and Cooling Demonstration Program, MIRADS, National Bureau of Standards.

The Residential Solar Data Center Project staff in the Center for Building Technology, National Bureau of Standards, maintains a computerized data base containing non-instrumented residential data from the DoE/HUD Solar Heating and Cooling Demonstration Program. Data contained in the solar data base are accessible online to users of the NBS Center Computer via remote terminals with a data base retrieval software package called MIRADS (Marshall Information Retrieval And Display System). This document is a self-teaching user's guide to the solar data base. It is complete with the basic MIRADS language rules, examples of use, and a step-by-step walk-through of a typical interactive session. Appendices contain all the data element names and coded values needed to use the solar data with MIRADS, as well as many examples of actual computer sessions.

708.974
PB81-135584 Not available NTIS
National Bureau of Standards, Washington, DC.
Solar Cell Spectral Response Characterization.
E. F. Zalewski, and J. Geist. Dec 79, 6p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Applied Optics 18, n23 p3942-3947, 1 Dec 79.

Keywords: *Solar cells, Photoconductivity, Measurement, Reprints.

The absolute spectral response of solar cells is reported in the 400-1000 nm spectral region. Measurements were performed using two different types of monochromatic sources: amplitude-stabilized cw laser lines and interference filters with an incandescent lamp.

708.975
PB81-138745 Not available NTIS
National Bureau of Standards, Washington, DC.
Solar Demonstration Program : Technical Issues and Constraints.
J. Greenberg, Aug 80, 2p
Pub. in ASHRAE Jn, 22, n8 p30-31 Aug 80.

Keywords: Regulations, Constraints, Building codes, *Solar heating systems.

Regulatory information was abstracted from HUD contractor developed questionnaires and analyzed to determine perceived regulatory constraints which might inhibit, impede, or otherwise adversely affect the installation and use of solar hot water and space and/or cooling systems.

708.976
PB81-144701 Not available NTIS
National Bureau of Standards, Washington, DC.
Standard Procedures for Collector Performance Testing. Chapter 15.
J. E. Hill, 1980, 24p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Chapter 15 in Solar Energy Technology Handbook, Part A, Engineering Fundamentals, Energy, Power and Environment/6, p457-480 1980.

Keywords: Performance tests, Thermal efficiency, Performance standards, *Solar collectors, Flat plate collectors, Concentrating collectors, ASHRAE Standard 93-77.

This paper reviews the basic concepts used in testing solar collectors for thermal performance and then describes in detail the adopted consensus standard test method, ASHRAE Standard 93-77. It presents typical results obtained for flat-plate collectors using the Standard, how the method can be used for concentrating collectors, how to calculate cooling performance for a collector using the test results, and some recent developments in the collector testing field.

708.977
PB81-145450 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Thermal Performance Characteristics of Modular Passive Solar Storage Walls.
Final rept.
W. Kennish, M. Ahmed, M. McCabe, and M. McKinstry, Oct 80, 5p
Pub. in Proceedings of the American Society of the International Solar Energy Society and National Passive Solar Conference Annual Tech. Conference Passive Systems Div., (5th), University of Massachusetts Amherst, October 19-26, 1980, p976-979 Oct 80

Keywords: Heat storage, Thermal efficiency, Performance tests, *Trombe walls, *Passive solar heating systems.

A conceptual study of testing procedures to determine thermal performance characteristics of Trombe-wall-type passive solar storage wall systems has been performed in the study, a finite-difference thermal model of a passive solar storage wall in a test facility was used to predict the wall thermal performance in a particular climatic location. The simulated test results were used in a multiple regression analysis to characterize the thermal performance of a test wall. These characteristics were then used in a simplified calculation procedure to predict the thermal performance of the solar storage wall in different climatic regions.

708.978
PB81-145567 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of Proposed Modification to F Chart Method to Include Collector Array Air Leakage.
R. L. Overton, D. E. Cassel, and M. E. McCabe. 1980, 10p
Sponsored in part by Department of Housing and Urban Development, Washington, DC.
Pub. in Proceedings of the Winter Annual Meeting Solar Energy Division, American Society of Mechanical Engineers, Chicago, IL, November 16-21, 1980, Paper 80-WA/Sol-12, p1-10 1980.

Keywords: Performance tests, Thermal efficiency, Performance evaluation, Residential buildings, Commercial buildings, *Solar air heaters, Solar heating systems, Solar collectors, Air leakage.

Field measurements of air leakage reported for a number of residential and commercial solar air heating systems suggests that air leakage occurs in most collector arrays. However, standard analytical techniques to predict solar energy system performance such as the f-chart method do not consider the effects of air leakage on system thermal performance. A proposed method for incorporating collector array leakage considerations into the f-chart method of system evaluation was determined to be effective.

708.979
PB81-147290 PC A08/MF A01
National Bureau of Standards, Washington, DC. National Engineering Lab.
Solar Energy Systems - Standards for Cover Plates for Flat Plate Solar Collectors.
Final rept.
E. J. Clark, W. E. Roberts, J. W. Grimes, and E. J. Embree, Dec 80, 161p NBS-TN-1132
Sponsored in part by Department of Energy, Washington, DC.

Keywords: Coverings, Performance tests, Performance standards, Glass, Plastics, Acrylic resins, Durability, Performance evaluation, *Flat plate collectors, *Solar collectors.

Laboratory studies were performed to obtain data needed for the development of standards to evaluate the performance and durability of cover plates for flat plate solar collectors used in solar heating and cooling systems. Ten cover plate materials were evaluated to assess their durability after exposure to heat aging, natural weathering and accelerated weathering. Laboratory tests included measurement of solar energy transmittance, linear dimensional stability, warpage and the effect of the dimensions. The temperatures cover plate materials attain on solar collectors were determined by measurement and by computer simulations. A procedure was developed for the natural weathering exposure of cover plate materials at elevated temperatures within approximate stagnation conditions of solar collectors. The results of the laboratory tests are presented and draft standards for evaluating cover plate materials for flat plate solar collectors are proposed.

708.980
PB81-149825 Not available NTIS
National Bureau of Standards, Washington, DC.
Development of Thermal Performance Criteria for Residential Passive Solar Buildings.
Final rept.
P. A. Sapatuck, and M. McCabe, Oct 80, 4p
Pub. in Proceedings of the American Society of the International Solar Energy Society and National Passive Solar Conference Annual Tech. Conference Passive Systems Div., (5th), University of Massachusetts Amherst, October 19-26, 1980, p621-624 Oct 80

Keywords: *Residential buildings, Thermal efficiency, Performance evaluation, Design, *Passive solar heating systems.

In support of the development of thermal performance criteria for residential passive solar buildings, thermal design characteristics and anticipated performance for 266 projects in the HUD Passive Residential Design Competition and the HUD Cycle 5 Demonstration Program were analyzed. A number of performance measures were examined, including net solar contribution, solar fraction, and auxiliary energy use. These and other design and climate-related parameters were statistically correlated using the 'DATAPLOT' computer program and standard statistical analysis techniques.

708.981
PB81-149858 Not available NTIS
National Bureau of Standards, Washington, DC.
Review of Thermal Performance Test Procedures for Testing Passive/Hybrid Solar Components.
Final rept.
W. Dudas, M. McCabe, and A. DeDome, Oct 80, 5p
Pub. in Proceedings of the American Society of the International Solar Energy Society and National Passive Solar Conference Annual Tech. Conference Passive Systems Div., (5th), University of Massachusetts Amherst, October 19-26, 1980, p970-974 Oct 80

Keywords: Buildings, Performance tests, Thermal efficiency, *Passive solar heating systems.

Existing test methods have been reviewed for their application as thermal performance test procedures for modular passive/hybrid solar components. These methods cover the thermal performance of building envelope assemblies such as walls and windows, and tests developed for thermal storage assemblies. A

classification of passive components is identified, recommendations are made for testing several types of passive components, and recommendations for new test procedures are identified.

708,982
PB81-149866 Not available NTIS
National Bureau of Standards, Washington, DC.
Performance Evaluation of Passive/Hybrid Solar Heating and Cooling.
Final rept.
M. McKinstry, T. Richtmyer, and W. Ducas. Oct 80, 5p
Pub. in Proceedings of the American Society of the International Solar Energy Society and National Passive Solar Conference Annual Tech. Conference Passive Systems Div. (5th), University of Massachusetts, Amherst, October 19-26, 1980, p346-350 Oct 80.

Keywords: Buildings, Performance evaluation, *Passive solar heating systems, *Passive solar cooling systems.

Two levels of passive/hybrid solar heating and cooling performance evaluation are discussed. Both levels use a subtractive calculation for passive heating or cooling used by the building, although, with the more detailed method, heat flux to or from primary storage elements is monitored so that an approximate additive calculation can be done.

708,983
PB81-163875 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Measurement Techniques for Solar Cells, Annual Report December 15, 1978 to December 14, 1979.
Final rept.
D. E. Sawyer, H. K. Kessler, T. J. Russell, W. F. Lankford, and H. A. Schafft. Jan 81, 61p NBSIR-80-2181
Sponsored in part by Solar Energy Research Inst., Golden, CO. See also PB80-223134.

Keywords: *Solar cells, *Measurement, Scanning, Nondestructive tests, Photovoltaic cells, Laser applications.

The NBS-developed laser scanner was used to examine a variety of devices: Cu2S/CdS cells, silicon tandem junction cells, Zn3P2 Schottky diode specimens, and edge-fed growth polycrystalline silicon cells. The results show that it is possible to detect cell design- and processing-induced losses in conversion efficiency, areas of missing antireflection coating, lack of ohmic contact of the metallization to the cell, breaks in cell metallization fingers, fine cracks, scratches, and silicon carbide inclusions.

708,984
PB81-163891 PC **A04**/MF **A01**
University of Southern California, Los Angeles. Dept. of Electrical Engineering.
Solar Cell Mathematical Analysis and Computer Simulation.
Final rept.
K. Lehovec, and A. Fedotowsky. Jan 81, 74p NBS-GCR-80-285
Contract NB79-SBCA-0062
Sponsored in part by Solar Energy Research Inst., Golden, CO.

Keywords: *Solar cells, Mathematical analysis, Computerized simulation, Nondestructive tests, Electrical resistance.

Procedures have been established which permit the calculation of cell output by spot illumination for various boundary conditions imposed by faults, provided the attenuation length is independent of position. The attenuation length is the distance over which the photosignal from the illuminated point diminishes to 1/e of its value due to the back flow of current over the distributed junction network modeled for the solar cell. Faults explicitly treated so far are: cracks with and without leakage current across the exposed junction, point shorts, and partial electrode lift-offs. The authors also have established procedures for calculating the effect of variation of the attenuation length with distance from the grid electrodes on the cell output.

708,985
PB81-164550 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Wind, Earthquake, Snow, and Hail Loads on Solar Collectors.
L. Cattaneo, J. R. Harris, T. A. Reinhold, E. Simiu, and C. W. C. Yancey. Jan 81, 95p NBSIR-81-2199
Sponsored in part by Department of Energy, Washington, DC.

Keywords: Wind(Meteorology), Snow, Snowfall, Hail, Earthquakes, Loads(Forces), Structural engineering, Field tests, Performance evaluation, *Flat plate collectors, *Solar collectors.

The report describes and interprets wind-tunnel, full-scale, and field studies of wind and snow loads on flat plate solar collectors, conducted under contract for the National Bureau of Standards, and uses results of these studies and other data available in the literature to develop information, guidelines, and criteria for the design of flat plate collectors subjected to the action of wind, snow, and earthquake loads. Also given in the report are data on hail loads, based on information and studies available in the literature.

708,986
PB81-166571 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
NBS Solar Collector Durability/Reliability Test Program Plan.
Final rept.
D. Waksman, E. Streed, and J. Seiler. Jan 81, 90p NBS-TN-1136
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Performance tests, Quality assurance, Reliability, Durability, Deterioration, Degradation, Project planning, *Solar collectors.

The test program described in this plan is designed to evaluate both approved and proposed solar collector test procedures and to correlate laboratory, accelerated field and simulated operational exposures with actual field data. The tests and exposure procedures described hereing are intended to determine the influence of environmental exposure parameters that could affect the degradation of solar collectors and their materials. They are also intended, to the extent possible, to provide a correlation between changes that occur at the materials and the collector component levels.

708,987
PB81-174369 Not available NTIS
National Bureau of Standards, Washington, DC.
Experimental System Performance and Comparison with Computer Predictions for Six Solar Domestic Hot Water Systems.
Final rept.
A. H. Fanney, and S. T. Liu. 1979, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the International Solar Energy Society Silver Jubilee Congress Held at Atlanta, GA., on May 29-June 1, 1979, Paper in Sun II 1, p972-976 1979.

Keywords: Performance tests, Performance evaluation, Test facilities, Comparison, *Solar water heaters, Solar water heating, SOLOCOST computer program, F-CHART computer program, TRNSYS computer program.

Currently three computer programs, F-CHART (1), SOLOCOST (2), and TRNSYS (3), are being extensively utilized for the design and evaluation of solar space heating and domestic hot water systems. Although widely used, the accuracy of their predictions needs to be verified with experimental data. In order to provide data required for the validation of these computer codes for solar domestic hot water (SDHW) systems, the staff at the National Bureau of Standards has fabricated and instrumented a solar hot water test facility at its Gaithersburg, Maryland site. This paper describes the test facility, the experimental results, and compares the experimental results with the computer predictions for the first eight months of operation.

708,988
PB81-176380 PC **A09**/MF **A01**
Mueller Associates, Inc., Baltimore, MD.
Air Leakage in Residential Solar Heating Systems.
J. G. Shingleton, D. E. Cassel, and R. L. Overton. Feb 81, 200p NBS-GCR-81-302
Contract NBS-78-3534
Sponsored in part by Department of Energy, Washington, DC., and Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research.Portions of this document are not fully legible.

Keywords: *Residential buildings, Air flow, Heat transfer, Thermal efficiency, Performance evaluation, Computerized simulation, *Solar heating systems, *Air infiltration, Solar collectors, Rock beds.

A series of computer simulations was performed to evaluate the effects of component air leakage on system thermal performance for a typical residential solar heating system, located in Madison, Wisconsin. Auxiliary energy required to supplement solar energy for space heating was determined using the TRNSYS computer program, for a range of air leakage rates at the solar collector and pebble-bed storage unit. The study included the effects of heat transfer and mass transfer between the solar equipment room and the heated building, and also determined the effect of reduced air infiltration into the building due to pressurization by the solar air heating system. A simple method of estimating the effect of collector array air leakage on system thermal performance was evaluated, using the f CHART method.

708,989
PB81-180267 PC **A05**/MF **A01**
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mining and Minerals Engineering.
Effects of Test Fluid Composition and Flow Rates on the Thermal Efficiency of Solar Collectors.
Final rept.
W. C. Thomas. Aug 80, 93p VPI/SU-80-03, NBS-GCR-80-254
Sponsored in part by Department of Energy, Washington, DC.Portions of this document are not fully legible.

Keywords: Thermal efficiency, Heat transfer, Antifreezes, Mineral oils, Flow rate, Solar collectors, *Flat plate collectors.

Experimental and analytical investigations were carried out to determine the significance of the heat transfer fluid and mass flow rate on the thermal performance of two liquid-heating flat-plate solar collectors. The collector thermal performance was lowered significantly for high concentrations of glycol and mineral-base oil. Heat losses measured with oil were less than the losses measured from the ASHRAE prescribed procedures.

708,990
PB81-182867 Not available NTIS
National Bureau of Standards, Washington, DC.
Performance of Six Solar Domestic Hot Water Systems in the Mid-Atlantic Region.
Final rept.
A. H. Fanney, and S. T. Liu. Nov 79, 7p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the Conference on Solar Heating and Cooling Systems Operational Results Held at Colorado Springs, CO., on Nov 27-30, 1979, p25-31 Nov 79.

Keywords: Residential buildings, Performance tests, Performance evaluation, *Solar water heaters, Solar water heating.

In order to provide data required for the validation of computer programs for solar domestic hot water systems, the staff of the National Bureau of Standards (NBS) fabricated and instrumented six typical residential-size systems at its Gaithersburg, Maryland site. Three of the six systems utilize a single hot water tank and the other three utilize two tanks. Three different methods of freeze protection are being utilized among the systems: water-ethylene glycol mixture in the collector loop with an intermediate heat exchanger, draindown using solenoid valves to dump the water from the collectors, and air-heating collectors in conjunction with an air-water heat exchanger. One system relies on the thermosyphon principle while the other five require electric power for fans or pumps. The systems have been operating since June, 1978. This paper describes the testing done and gives the experimental results for the first year of operation.

708,991
PB81-187122 Not available NTIS
National Bureau of Standards, Washington, DC.

Collector Sizing Procedure for Residential Solar Hot Water Systems with Prescribed Thermal Performance Requirements.
Final rept.
M. E. McCabe. 1980, 20p
Pub. in Proceedings of the ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Semiannual Meeting Held at Los Angeles, CA., on Feb 3-7, 1980, ASHRAE Transactions 86, pt1 p420-439 1980.

Keywords: Thermal efficiency, Performance standards, *Solar collectors, *Solar water heaters.

A graphical procedure was developed based on the f-chart design method to determine whether solar domestic water heating systems proposed for use in the HUD Hot Water Initiative Program have sufficient collector area to provide 50% of the load as prescribed by the thermal performance requirements of the Program. The procedure was specifically developed for the 11 states participating in the HUD initiative (the New-England and Mid-Atlantic States and Florida), however, it should be applicable for the sizing of the collectors for solar water heaters in other locations with similar climates.

708,992
PB81-188278 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Solar Energy Systems - Standards for Absorber Materials.
Final rept.
L. W. Masters, J. F. Seiler, E. J. Embree, and W. E. Roberts. Jan 81, 68p NBSIR-81-2232
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Performance standards, Optical coatings, Field tests, Performance tests, Performance evaluation, *Solar absorbers.

A study was performed to aid in the development of accelerated test methods needed for the evaluation of absorber materials and to incorporate the methods into draft standards for consideration as consensus standards by the American Society for Testing and Materials (ASTM). After identifying the performance requirements for absorber materials, laboratory and field studies were performed to measure performance according to the requirements. The data obtained, using twelve absorber materials, were used as the technical basis for two draft standards. This report presents the results of the research, including the proposed draft standards.

708,993
PB81-197477 Not available NTIS
National Bureau of Standards, Washington, DC.
Life-Cycle Costing of Solar Energy Investments.
Final rept.
J. Powell, and R. Ruegg. Jan 81, 8p
Pub. in Chapter II in Solar Design Workbook, Solar Federal Buildings Program, Section II Solar System Evaluation, p11,1-11,8 Jan 81.

Keywords: *Solar energy, Cost effectiveness, *Life-cycle cost.

This chapter provides an overview of the life-cycle costing method of evaluating investments in solar energy. It describes the use of the method in determining the economically efficient design and size for a solar energy system, the cost effectiveness of a given system, and the establishment of project priorities.

708,994
PB81-197501 Not available NTIS
National Bureau of Standards, Washington, DC.
Calculation of Performance of N Collectors in Series from Test Data on a Single Collector.
Final rept.
R. L. Oonk, D. E. Jones, and B. E. Cole-Appel. 1979, 2p
Pub. in Solar Energy Technical Note 23, n6 p535-536 1979.

Keywords: Performance tests, Performance evaluation, Thermal efficiency, *Solar collectors.

Solar collector arrays are often arranged so that fluid flows through the collectors in a combined series and parallel fashion. Often the data supplied by a collector manufacturer is the performance for a single collector. Because it is unreasonable to expect measured test data for all possible array arrangements, a method is needed for calculating the array slope and intercept from performance data on a single collector. This paper presents a method of extrapolating the calculation from a single collector to an array, with a correction factor CFN to predict the performance of N panels in series.

708,995
PB81-199184 Not available NTIS
National Bureau of Standards, Washington, DC.
Microeconomics of Solar Energy.
Final rept.
R. T. Ruegg, and G. T. Sav. 1981, 42p
Pub. in Chapter 28 in Solar Energy Handbook, p28,1-28,42 1981.

Keywords: Cost effectiveness, Economic analysis, Discounted cash flow, Cost estimates, Design, Size determination, Performance evaluation, *Solar heating systems, Life-cycle cost, Financial incentives.

The purpose of this chapter is to explain and illustrate how the techniques of microeconomic analysis can be used in the design, sizing, and evaluation of solar energy systems. For the purpose of exposition, the focus is on solar hot-water and space-heating systems for residential and commercial buildings. However, the basic concepts and procedures will generally apply to the analysis of solar energy in diverse applications, e.g., industrial process heat systems, power production, and total energy systems.

708,996
PB81-205452 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Uncertainty in Determining Thermal Performance of Liquid-Heating Flat-Plate Solar Collectors.
Final rept.
E. Streed, and D. Waksman. Apr 81, 102p NBS-TN-1140
Sponsored in part by Department of Energy, Washington, DC.

Keywords: Performance tests, Thermal efficiency, Tables(Data), Statistical data, *Flat plate collectors, *Solar collectors, NTISCOMNBS, NTISDE.

Thermal performance measurements of eight liquid-heating flat-plate solar collectors were conducted with two to four collectors of each type at four outdoor test sites. Tests were performed in accordance with the procedure prescribed by ASHRAE Standard 93-77. Statistical analysis of data sets for each collector type within test sites and between test sites was done using ASTM recommended methods to evaluate test method measurement uncertainty. Illustrations of the influence of thermal performance data uncertainty are presented for collector material degradation, collector rating and calculated system performance.

708,997
PB81-214157 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Laser Scanning Measurements on Solar Cell Test Pattern NBS-22.
Final rept. 1 Jun 80-30 Nov 81.
W. F. Lankford, P. Kowalski, and H. A. Schafft. May 81, 53p NBSIR-81-2260
Sponsored in part by Solar Energy Research Inst., Golden, CO.

Keywords: *Solar cells, *Scanning, Electrical resistance, Test patterns, Laser applications.

The NBS laser scanner has been used to make measurements on the solar cell test pattern, NBS-22, to verify the theoretical calculations of Sawyer, Lehovec, and Fedotowski. The photovoltaic response from cells with controlled sheet resistance step changes and breaks in the metallization contact to the cell was measured and compared to the theoretical predictions. Laser scanner limits of resolution were identified and proposed improvements were discussed. Preliminary measurements indicate that it is possible to measure the sheet resistance of the emitter layer of solar cells with an accuracy of several percent, using the laser scanner.

708,998
PB81-217010 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Use of FCHART Version 3.0 to Predict Auxiliary Energy Use in Residential Solar Energy Systems.
J. B. Carlock. May 81, 107p NBS/GCR-81-321
Contract NBS-78-3534
Prepared by Mueller Associates, Inc., Baltimore, MD. Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research.

Keywords: Residential buildings, Houses, Heating load, Thermal efficiency, Performance evaluation, Mathematical models, *Solar heating systems, Solar space heating, Solar water heating, FCHART computer program, Energy consumption, Auxiliary heating, NTISCOMNBS, NTISHUDPDR.

Thermal performance predictions for five residential buildings with solar space heating and hot water systems using the FCHART computer program are compared with measured thermal performance data from each site. The FCHART calculations are based on measured meteorological data and on space heating loads that are both measured and calculated using building thermal envelope data and the modified degree day method.

708,999
PB81-220386 Not available NTIS
National Bureau of Standards, Washington, DC.
Guidelines for Installation of Solar Components on Low-Sloped Roofs--A Summary.
Final rept.
W. J. Rossiter, and R. G. Mathey. Apr 81, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the NBS/NRCA Conference on Roofing Technology (6th) held at Gaithersburg, MD., on April 30-May 1, 1981, p58-62 1981.

Keywords: Installing, Residential buildings, Commercial buildings, Industrial buildings, Guidelines, *Solar collectors.

This paper presents guidelines for installation of solar collectors and related equipment on low-sloped roofs of commercial, industrial, and multi-family type buildings. The guidelines are concerned primarily with the waterproofing integrity of the roofing system, access to the collectors and roofing, attachment of different types of collector support frames and roofing field surveys, and information from the literature, building codes, roofing field surveys, and acceptable roofing practice provided the basis for the guidelines. The guidelines include recommendations for design of the solar installation with regard to roofing performance, workmanship during collector installation, and maintenance of roofs with solar components.

709,000
PB81-227886 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Passive/Hybrid Solar Components: An Approach to Standard Thermal Test Methods.
M. E. McCabe, W. Ducas, M. J. Orloski, and K. N. Decorte. Jul 81, 87p NBSIR-81-2300
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Performance tests, Thermal efficiency, Performance evaluation, Standardization, *Passive solar heating systems, Hybrid systems.

As part of a continuing program to develop standard test procedures to measure thermal performance of solar heating and cooling equipment, NBS has developed a plan and methodology that will be utilized for passive/hybrid solar components. A survey of passive solar products currently available or under development enabled the development of an interim classification system consisting of ten component classifications for purposes of thermal testing. A survey of currently available thermal test procedures was performed to assess the applicability of these test methods for passive/hybrid solar components. Existing test procedures that are useful for the Direct Gain Fenestration System classification are identified, and recommendations are made for evaluation of these laboratory-based procedures by comparison with field-based testing of components under controlled interior conditions. Recommendations are also made for the development of new test procedures for passive/hybrid components classifications for which existing test methods are not applicable. A proposed program to

develop testing procedures for the Storage Wall Module classification is provided.

709,001
PB81-247314 Not available NTIS
National Bureau of Standards, Washington, DC.
Snow Accumulation on and Around Solar Collectors.
Final rept.
J. R. Harris. 1981, 12p
Pub. in Proceedings of the Eastern Snow Conference (37th) Held at Peterborough, Ontario, Canada on June 5-6, 1980, p54-65 1981.

Keywords: *Snowfall, Buildings, Snowdrifts, Structural engineering, Roofs, Loads(Forces), *Solar collectors, *Flat plate collectors.

Studies of the accumulation of snow and ice on buildings with flat plate solar collectors were carried out during the winter of 1979. Although the studies were generally qualitative, preliminary guidelines for snow load criteria were developed.

709,002
PB81-600054 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Uncertainty in Determining Thermal Performance of Liquid-Heating Flat-Plate Solar Collectors.
E. R. Streed, and D. Waksman. 1981, 9p
Pub. in Trans. ASME 1103, p126-134 May 1981.

Keywords: *Collector rating, Measurement, Solar collector, Standards, Thermal performance, Uncertainty.

Thermal performance measurements of eight types of liquid-heating flat-plate solar collectors were conducted with two to four collectors of each type of four outdoor test sites. Tests were performed in accordance with the procedure prescribed by ASHRAE Standard 93-77. Statistical analysis of data sets for each collector type within test sites and between tests sites was done using ASTM recommended methods to evaluate test method measurement uncertainty.

709,003
PB81-600064 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Solar Collector Certification Activities and Experiences.
D. Waksman. 1981, 11p
Pub. in Proceedings Commercial Photovoltaics Measurements Workshop, Vail, CO, July 27-29, 1981, p279-289 Nov 1981.

Keywords: *Certification, Experiences, Issues and concerns, Laboratory accreditation, Solar collector, Standards.

The paper is intended to provide organizations which may be involved in the development of certification programs for photovoltaic (PV) solar modules with the benefit of the experience gained to date in the development of certification programs for solar collectors. The various public and private sector certification activities that have been undertaken for solar collectors along with issues and concerns that have arisen from their use are presented.

709,004
PB82-100264 Not available NTIS
National Bureau of Standards, Washington, DC.
Two Examples of Passive Solar Retrofit for Historic Structures.
Final rept.
F. E. Metz. 1980, 2p
Pub. in Proceedings of National Passive Solar Conference (5th), Amherst, MA., October 19-26, 1980, Extended Abstract in Passive Solar 1980, 5.2, p1305-1306 1980.

Keywords: Buildings, *Passive solar heating systems, *Historic buildings, Retrofitting.

Passive application for existing buildings is a multi-faceted challenge. The retrofit of structures in historic districts compounds this challenge. In spite of the many problems, the greatest potential for passive/hybrid applications may be within the vast abundance of our existing buildings.

709,005
PB82-101239 Not available NTIS
National Bureau of Standards, Washington, DC.
Health and Safety Criteria for Passive Solar Systems.
Final rept.
F. E. Metz. 1980, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of National Passive Solar Conference (5th), Amherst, MA., 19-26 October, 1980. Extended Abstract in Passive Solar 1980, 5.2 p945-949 1980.

Keywords: Building codes, Fire safety, Health, Hazards, Constraints, *Passive solar heating systems, Air quality.

Passive solar technologies may introduce new and unusual health and safety concerns within the building environment. Conversely, existing building code requirements may present constraints to the effective use of some passive technologies, Some of the health and safety topics to be covered include: fire safety, physical hazards, air quality and environmental health factors. The solar industry will be confronted with even more restrictive health and safety requirements as passive construction becomes more prevalent and is extended to non-residential building types. This paper presents some of these constraints and identifies possible hazards.

709,006
PB82-107012 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
FEDSOL: Program User's Manual and Economic Optimization Guide for Solar Federal Buildings Projects.
Final rept.
J. W. Powell, and R. C. Rodgers. Aug 81, 113p NBSIR-81-2342
Sponsored in part by Department of Energy, Washington, DC. Prepared in cooperation with Rodgers (Richard C.), Jr.

Keywords: Cost analysis, Economic analysis, Thermal efficiency, Performance evaluation, National government, Computer programs, *Government buildings, *Solar heating systems, FEDSOL computer program, Users manual, Life-cycle cost.

This report provides a user's manual for the FEDSOL computer program and a guide for designing and sizing solar energy projects for Federal buildings. The FEDSOL program determines the economically optimal size of a solar energy system for a user-specified building, location, system type, and set of economic conditions; it conducts numerous breakeven and sensitivity analyses; and it calculates measures of economic performance as required under the Federal Rules. The economic model in the program is linked with the SLR (Solar Load Ratio) design method developed at Los Alamos National Laboratory to predict the performance of active systems. The economics portion of the program can, however, be used apart from the SLR method, with performance data provided by the user. An environmental data file for 243 U.S. cities is included in the program. Highly user oriented, the FEDSOL program is intended as a design and sizing tool for use by architects, engineers, and facilities managers in developing plans for Federal solar energy projects.

709,007
PB82-113259 PC **A07**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Preliminary Guidelines for Condition Assessment of Buildings Being Considered for Solar Retrofit.
F. H. Lerchen, J. H. Pielert, and P. T. Chen. Jul 81, 142p NBSIR-81-2289
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Buildings, *Solar heating, Heating, Ventilation, Air conditioning, Plumbing, Electric wire, Wiring, Structural engineering, Performance evaluation, Assessment, Guidelines, *Retrofitting.

The report contains a general description of methods currently available for condition assessment of the structural; heating, ventilating, and air conditioning (HVAC); electrical; and plumbing systems of an existing building, in order to determine the feasibility of rehabilitation for solar retrofit.

709,008
PB82-118639 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Investigation of Solar Collector Fire Incident.
W. D. Walton. Sep 81, 48p NBSIR-81-2326
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Fires, Buildings, Autoignition, Fire safety, Safety engineering, *Solar collectors.

In May 1980, a fire involving a solar collector occurred in Boulder, Colorado in an unoccupied single family dwelling. Damage due to the fire was limited to a single solar collector and adjacent roofing and framing materials. Collectors of the same model on three other dwellings at the site showed signs of degradation which may have led to similar fires. The collector, installation, conditions leading to the fire, and events following the fire are described. The most likely point of ignition has been identified as the plywood collector backing. Results of a 30-day stagnation test and solar simulator testing are discussed. Recommendations to prevent future occurrences of this type of fire are presented.

709,009
PB82-130063 PC **A03**/MF **A01**
Wyle Labs., Huntsville, AL.
Terrestrial Solar Simulators for Photovoltaic and Combined Photovoltaic and Thermal Device Measurement and Evaluation.
Final rept.
S. Patrick, and R. Giuntini. Oct 80, 50p WR-80-34, NBS/GCR-80-279
Contract NB79-SBCA-0079
Sponsored in part by Solar Energy Research Inst., Golden, CO.

Keywords: *Solar simulators, Photovoltaic cells, Measurement, Calibrating, Solar cells, Tests.

The use of terrestrial solar simulators used for testing photovoltaic and combined photovoltaic/thermal devices by a representative cross section of the photovoltaics community is reviewed. Measurements-related needs identified by this comaunity are also reviewed. Among the needs identified are major improvements in the area of standardized test and calibration procedures. Also identified is the need for a source dedicated to providing reference cells to the photovoltaics community and for workshops to address measurements-related problems and developments. Included are tables that review the type and use of terrestrial solar simulators used and that list data-sheet information about these simulators.

709,010
PB82-130139 PC **A05**/MF **A01**
Mueller Associates, Inc., Baltimore, MD.
Multi-Family Solar Domestic Hot Water Analysis.
D. R. Wedekind. May 81, 100p MAI-199, NBS/GCR-81-322
Contract NBS-78-3534
Portions of this document are not fully legible.

Keywords: Potable water, Thermal efficiency, Performance evaluation, Computerized simulation, Residential buildings, *Solar water heaters, Solar water heating.

The National Bureau of Standards is presently reviewing the Definitive Performance Criteria for Residential Solar Heating, Cooling and Hot Water Systems. In support of that effort, this report describes a study designed to quantify the effect of daily domestic hot water loads and system design on the performance of multi-family solar domestic hot water systems. Two multi-family solar domestic hot water systems judged representative of the systems funded by the HUD Residential Solar Demonstration Program, along with possible modifications to these systems, are modeled using the TRNSYS simulation computer program. The effects of collector array efficiency, storage capacity, and distribution heat losses were studied over a range of daily domestic hot water loads from 11 to 190 L/day-unit.

709,011
PB82-133703 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.

Solar Industrial Process Heat Systems - An Assessment of Standards for Materials and Components.
W. J. Rossiter, and W. E. Shipp. Sep 81, 98p NBSIR-81-2381
Sponsored in part by Department of Energy, Washington, DC. Assistant Secretary for Conservation and Renewable Energy.

Keywords: Components, Structural members, Materials specifications, Performance standards, Performance evaluation, Recommendations, *Solar process heat, Solar collectors.

A study was conducted to obtain information on the performance of materials and components in operational solar industrial process heat (IPH) systems, and to provide recommendations for the development of standards including evaluative test procedures for materials and components. An assessment of the needs for standards for evaluating the long-term performance of materials and components of IPH systems was made. The assessment was based on the availability of existing standards, and information obtained from a field survey of operational systems, the literature, and discussions with individuals in the industry. Field inspections of 10 operational IPH systems were performed. The study did not address the thermal efficiencies and health and safety considerations of IPH systems.

709,012
PB82-135260 CP **T05**
National Bureau of Standards, Washington, DC.
FEDSOL: Economic Optimization Guide for Solar Federal Buildings Projects.
Model-Simulation.
J. W. Powell, R. C. Rodgers, and K. A. Barnes. 1981, mag tape NBS/DF-81/007
Source tape is in ASCII character set. Character set restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions.

Keywords: *Models-simulation, Buildings, Cost effectiveness, Benefit cost analysis, Economic models, Magnetic tapes, *Solar heating systems, FEDSOL computer program, Life-cycle cost.

The FEDSOL program determines the economically optimal size of a solar energy system for a user-specified building, location, system type, and set of economic conditions; it conducts numerous breakeven and sensitivity analyses; and it calculates measures of economic performance as required under the Federal Rules. The economic model in the program is linked with the SLR (Solar Load Ratio) design method developed at Los Alamos National Laboratory to predict the performance of active systems. The economics portion of the program can, however, be used apart from the SLR method, with performance data provided by the user. An environmental data file for 243 U.S. cities is included in the program. Highly user oriented, the FEDSOL program is intended as a design and sizing tool for use by architects, engineers, and facilities managers in developing plans for Federal solar energy projects...Software Description: The program is written in the BASIC programming language for implementation on a CYBER 170/720 computer using the NOS Level 531 operating system. 47K bytes of core storage are required to operate the model.

709,013
PB82-144106 Not available NTIS
National Bureau of Standards, Washington, DC.
Simulation of Thermal Performance of Solar Collector Arrays.
Final rept.
A. H. Fanney, and W. C. Thomas. Aug 81, 10p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Trans. ASME 103, p258-267 Aug 81.

Keywords: Thermal efficiency, Performance tests, *Solar collectors, Solar water heating.

An experimental method is described for simulating the useful energy supplied by collector arrays during tests of solar water heating systems. The method uses an electric heat source to simulate the absorbed solar energy in series with nonirradiated collectors to simulate the concurrent heat losses. This configuration maintains the collector-loop flow characteristics which are important for system tests. Expressions are developed for programming the heat source for collector arrays connected in parallel and series combinations with the heat source located either upstream or downstream from the nonirradiated array. Thermal modelling of representative arrays is used to investigate the consequences of using linearized collector efficiency curves to program the heat source and of using nonirradiated collectors to simulate heat losses.

709,014
PB82-165184 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Effects of Air Mass and Integration Methods on Results for Optical Property Measurements of Solar Cover Plate and Absorber Materials.
W. E. Roberts, L. W. Masters, and E. J. Clark. Jan 82, 48p NBSIR-81-2448
Sponsored in part by Department of Energy, Washington, DC.

Keywords: Solar radiation, Transmittance, Reflectance, Spectrophotometry, *Solar absorbers, *Solar collectors, ASTM E 424.

This study was undertaken to compare methods of calculating the transmittance of cover plate materials and the reflectance of absorber materials. Optical data were obtained for both aged and unaged test specimens using an integrating sphere spectrophotometer. The data were integrated using: (1) the weighted and selected ordinate methods in ASTM E 424, Method A, at air mass 2.0, and (2) the selected ordinate method at air mass 1.5 and 1.0. The Solar reflectance and solar transmittance values calculated using the various methods are presented in this report along with discussions of the impact of the data in terms of possible revisions to ASTM E 424.

709,015
PB82-178955 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Residential Solar Data Center: Data Dictionary/Directory.
P. M. Christopher. Aug 81, 101p NBSIR-81-2357
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: Data acquisition, Data processing, Dictionaries, Directories, Residential buildings, *Data collection, *Residential Solar Data Center, National Bureau of Standards, Residential Solar Heating and Cooling Demonstration Program, Department of Housing and Urban Development, Residential sector.

The Residential Solar Data Center project staff in the Center for Building Technology, National Bureau of Standards, maintains a computerized data base containing non-instrumented residential data from the DoE/HUD Solar Heating and Cooling Demonstration Program. This document provides a dictionary of data elements collected as part of the Residential Solar Program and a directory of the specific files which contain the data elements. This data dictionary/directory was produced by a computer program written in ASCII COBOL. The automated procedure is briefly described in an appendix.

709,016
PB82-180142 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Analysis of Thermal Comfort in a Passive Solar Heated Residence.
S. T. Liu. Nov 81, 36p NBSIR-81-2393
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Solar heating, Residential buildings, Comfort, Human factors engineering, Environmental engineering, Trombe walls, *Passive solar heating systems.

An analytical investigation was conducted on the thermal comfort conditions in a passive solar heated residence of the popular Trombe Wall configuration. The National Bureau of Standards Load Determination Program (NBSLD) was used to simulate the indoor thermal environment of an actual passive solar residence, using the Typical Meteorological Year (TMY) weather data tape as input at three locations of different climatic conditions. The relevant thermal comfort parameters such as the space air temperature, mean radiant temperatures, operative temperatures, radiant temperature asymmetry, and temperature drifts of the occupied zone, were computed for a prime heating month, a transition month, and a prime cooling month of a typical weather year at the three locations. These parameters were analyzed in accordance with the criteria specified in the recently revised ASHRAE Comfort Standard 55-81.

709,017
PB82-180845 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Residential Solar Data Center: Data Resources and Reports.
Final rept. Sep 79-Sep 81.
P. M. Christopher, and A. O. Houser. Oct 81, 67p NBSIR-81-2369
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards. Supersedes PB-297582.

Keywords: Solar energy, Grants, Research projects, Marketing, Data processing, Residential buildings, Data acquisition, *Residential Solar Data Center, Solar heating systems, Solar cooling systems, Data collection.

The Residential Solar Data Center (SDC) was responsible for the establishment and operation of a computerized data base containing non-instrumented residential data collected from the DoE/HUD Solar Heating and Cooling Demonstration Program. This document includes a summary of the history and background of the SDC and its role in the demonstration program, a list of the final computer reports which are available, sample pages of representative reports, and a description of the data files which comprised the solar data base.

709,018
PB82-180910 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Residential Solar Data Center: Grant Reports.
P. M. Christopher, and L. L. Charlton. Sep 81, 145p NBSIR-81-2376
See also PB80-119928. Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Solar heating, *Grants, Solar energy, Residential buildings, Apartment buildings, Houses, Space heating, *Solar cooling, Solar houses.

The Residential Solar Data Center project staff in the Center for Building Technology, National Bureau of Standards, has been responsible for the establishment and operation of a computerized data base containing non-instrumented residential data generated by the Solar Heating and Cooling Demonstration Program sponsored by the Department of Energy (DoE) and the Department of Housing and Urban Development (HUD). This document includes computer reports of data contained in the Grant file, one of six computer files comprising the data base. These reports contain data recorded on applications submitted to HUD by organizations or individual builders applying for grants to build solar energy systems in new and/or existing homes. Approximately 668 grants have been awarded in six award cycles.

709,019
PB82-184839 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
Analytical and Experimental Analysis of Procedures for Testing Solar Domestic Hot Water Systems.
Final rept.
A. H. Fanney, W. C. Thomas, C. A. Scarbrough, and C. P. Terlizzi. Feb 82, 161p NBS-BSS-140
Library of Congress catalog card no. 81-600191. Prepared in cooperation with Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering. Sponsored in part by Department of Energy, Washington, DC.

Keywords: Potable water, Performance tests, Performance evaluation, Methodology, *Solar water heaters, Solar water heating.

A repeatable test method independent of outdoor environmental conditions and laboratory geographical location is required in order to provide a means by which solar domestic hot water systems may be rated and compared. Three experimental techniques which allow the net thermal output of an irradiated solar collector

array to be reproduced indoors without the use of a solar simulator are investigated. These techniques include use of an electric heat source only, use of a nonirradiated collector array in series with an electric heat source, and the use of electric strip heaters which are attached to the back of nonirradiated absorber plates. Expressions are developed to compute the input power required for each experimental technique. Solar collectors connected in parallel and series combinations are considered.

709,020

PB82-184995 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Comparative Analysis of Economic Models in Selected Solar Energy Computer Programs.
Final rept.
J. W. Powell, and K. A. Barnes. Jan 82, 83p NBSIR-81-2379
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Solar energy, *Economic models, *Computerized simulation, Comparison, Cost analysis, F-CHART 3.0 computer program, F-CHART 4.0 computer program, SOLCOST computer program, BLAST computer program, DOE-2 computer program, FEDSOL computer program, Life cycle costs.

A variety of computer simulation models exists for the design and study of thermal performance and economic feasibility of solar domestic hot water and space heating systems. Several studies have indicated that the thermal performance algorithms contained in the different models produce similar results. However, little comparative analysis has been done of the economic algorithms in these programs. This report compares the economic evaluation models in five computer programs widely used for analyzing solar energy systems: F-CHART 3.0, F-CHART 4.0, SOLCOST, BLAST, and DOE-2. Differences in analysis techniques and assumptions among the programs are assessed from the point of view of consistency with the Federal requirements for life-cycle costing (10 CFR Part 436), effect on predicted economic performance and optimal system size, ease of use, and general applicability to diverse system types and building types. The FEDSOL program developed by the National Bureau of Standards specifically to meet the Federal life-cycle cost requirements serves as a basis for the comparison.

709,021

PB82-202201 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Solar Availability in Cities and Towns: A Computer Model.
Final rept.
K. Ruberg. Mar 82, 237p NBSIR-82-2498
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Solar radiation, *Computer programs, *Urban areas, Daylighting, Fortran, Insolation, SOLITE computer program, Univac-1108 computers.

An interactive computer program, SOLITE, has been written to determine the incident solar radiation on urban building surfaces, street surfaces and rooms facing urban street canyons. Hourly weather data and surface descriptors are interactively entered by the user. Solar radiation data are calculated with NOAA weather tape (TMY or TRY) cloud data using the Kimura/Stephenson cloud cover algorithm. SOLITE also calculates solar radiation transmission through user specified glazing assemblies. Shadows cast by surrounding buildings and overhangs are computed, as are the interreflection effects in street canyons. In addition, internal heat gains from occupants and lighting, and daylight availability on the workplane of a room are calculated. Output options include weather data summaries, incident insolation, occupant heat gain in rooms and useable hours of daylight in a room with a given occupancy. Either hourly or daily values may be specified as output.

709,022

PB82-212168 Not available NTIS
National Bureau of Standards, Washington, DC.
Three Experimental Techniques to Duplicate the Net Thermal Output of an Irradiated Collector Array.
Final rept.
A. H. Fanney, and W. C. Thomas. Apr 82, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Annual Conference of the ASME Solar Energy Division (4th), Albuquerque, New Mexico, April 26-29, 1982, p511-518.

Keywords: Performance tests, Performance evaluation, Ratings, Performance standards, Acceptability, Ranking, *Solar collectors, Solar water heaters.

A relevant and repeatable test method is required to provide a means for rating solar domestic hot water systems. The test method should be independent of the geographical location of the laboratory and the prevailing outdoor environment. Three experimental techniques which reproduce the net thermal output of a normally irradiated solar collector without the use of a solar simulator are investigated. These techniques include the use of an in-line electrical heat source only, use of a nonirradiated collector array in series with a heat source, and the use of electrical strip heaters attached to the back of nonirradiated absorber plates.

709,023

PB82-237660 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Comparison of Unglazed Flat Plate Liquid Solar Collector Thermal Performance Using the ASHRAE Standard 96-1980 and Modified BSE Test Procedures,
J. P. Jenkins, and K. A. Reed. May 82, 36p NBSIR-82-2522
Sponsored in part by Department of Energy, Washington, DC.

Keywords: Performance tests, Heat loss, Thermal efficiency, *Flat plate collectors, *Solar collectors, ASHRAE Standard 96-1980.

The report reviews the BSE procedure and summarizes the ASHRAE Standard 96-1980 for testing unglazed solar collectors. The ASHRAE procedure consists exclusively of outdoor testing, whereas the BSE procedure requires a combination of outdoor and indoor testing (no irradiation) to determine the collector optical and thermal loss characteristics, respectively. Two unglazed flat plate liquid solar collectors were tested according to ASHRAE Standard 96-1980 and BSE procedures and the results compared. During the indoor BSE thermal loss tests blowers were used to simulate winds of 0-3.9 m/s (0-8.72 mi/hr) to investigate the wind effect upon collector thermal losses.

709,024

PB82-240227 Not available NTIS
National Bureau of Standards, Washington, DC.
Standards for Solar Energy Systems.
Final rept.
R. D. Dikkers. 1980, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of 1980 ASQC Technical Conference Transactions, Atlanta, GA, May 20-22, 1980, p201-208.

Keywords: *Solar energy, *Standards, Solar heating, Photovoltaic cells, Performance standards, Biomass, Solar cooling systems, Wind power.

One of the major findings reported in the Domestic Policy Review of Solar Energy was that 'limited public awareness of and confidence in solar technologies is a major barrier to accelerated solar energy use.' Accordingly, President Carter has recommended that private sector and governmental activities to develop equipment performance standards, testing and certification need to be coordinated and accelerated. This paper describes some of the major program efforts which are underway in both the public and private sectors to develop and evaluate standards for various solar energy systems (heating and cooling, photovoltaics, wind, biomass). Some of the important program accomplishments are also discussed.

709,025

PB82-240235 Not available NTIS
National Bureau of Standards, Washington, DC.
Passive Solar Standards, Performance Criteria and Code Provisions.
Final rept.
R. D. Dikkers. 1980, 3p
Contract DOE-EA-77-A-01-6010
Pub. in Proceedings of U.S. Dept. of Energy Passive and Hybrid Solar Energy Program Update Meeting, Washington, DC, September 21-24, 1980, p2-9--2-11.

Keywords: *Solar energy, *Standards, Performance, Criteria, Tests, Passive systems.

The development of performance standards and criteria for solar energy systems, subsystems and components is one of the key objectives identified in the Department of Energy National Program for Solar Heating and Cooling of Buildings. This paper briefly describes various standards needs, planning efforts and some of the current activities which are underway relating to passive solar standards, performance criteria and code provisions.

709,026

PB82-260100 PC **A08**/MF **A01**
Mueller Associates, Inc., Baltimore, MD.
Thermal Performance Case Studies for Residential Solar Heating and Cooling Systems.
Final rept.
A. H. Cremeans, and R. E. Hedden. Jun 82, 167p
MAI-213, NBS/GCR-82-397
Contract NBS-78-3534
Sponsored in part by Department of Housing and Urban Development, Washington, DC.

Keywords: Residential buildings, Thermal efficiency, Criteria, Evaluation, *Solar heating systems, *Solar cooling systems, Solar space heating, Solar water heating.

This document presents five case studies on thermal performance of selected solar system designs which served as a vehicle for examining the applicability of the Draft Performance Criteria for Solar Heating and Cooling Systems in Residential Buildings. The purpose of this document was to identify shortcomings in the draft version of the performance criteria by means of attempting to implement the criteria. Those aspects of the criteria that require revision were highlighted.

709,027

PB82-264250 Not available NTIS
National Bureau of Standards, Washington, DC.
Fire Testing of Solar Collectors by ASTM E 108.
Final rept.
D. Waksman, and W. D. Walton. May 82, 14p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Fire Technology 18, n2 p174-187 May 82.

Keywords: *Fire tests, Roofs, Fire resistance, Reprints, *Solar collectors.

A study was undertaken to investigate the use of ASTM E 108 (NFPA 256, UL 790), Fire Tests of Roof Coverings, for testing roof-mounted solar energy collectors. The collectors were tested with three types of mountings: integrally as the roof, directly on the roof covering, and on standoffs above the roof covering. Data are presented showing the results of the testing conducted. An evaluation of the testing procedures as they apply to roof-mounted solar collectors is given.

709,028

PB83-104745 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Hail Impact Testing Procedure for Solar Collector Covers.
D. R. Jenkins, and R. G. Mathey. Apr 82, 87p
NBSIR-82-2487
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Coverings, Impact tests, Hail, *Solar collectors.

This report presents laboratory test results which simulate hail impact on solar collector covers. The general objective of the work is to contribute to the development of a test method for evaluating the resistance of solar collector covers to this type of loading. A procedure for such testing is described as well as results obtained with ice balls impacting four typical collector cover materials. Aspects which are discussed include the preparation of ice balls, the design and operation

of a launcher for ice ball propulsion, the method of mounting cover panel specimens, the selection of ice ball velocity and impact location, and techniques for failure or damage assessment.

709,029
PB83-124560 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Outdoor Exposure Tests of Solar Absorptive Coatings.
L. W. Masters, J. F. Seiler, and W. E. Roberts. Oct 82, 24p NBSIR-82-2583
See also PB81-188278. Sponsored in part by Department of Energy, Washington, DC.

Keywords: Optical coatings, Performance tests, Performance evaluation, Field tests, Absorbers(Materials), *Solar absorbers, Solar collectors.

This report is a follow up to an earlier report (NBSIR 81-2232, January 1981) in which data on the performance of selected absorptive coatings in both accelerated laboratory exposures and outdoor exposures at three sites were presented. The research presented in this report focuses upon the results obtained by continuing the outdoor exposures of absorptive coatings using ASTM E781-81, Standard Practice for Evaluating Absorptive Solar Receiver Materials When Exposed to Conditions Simulating Stagnation in Solar Collectors with Cover Plates. Comparison of the results of the outdoor exposures with those obtained in accelerated laboratory exposures indicated that (1) the accelerated exposures, as described in ASTM E744-80, Standard Practice for Evaluating Solar Absorptive Materials for Thermal Applications, provide more severe exposure conditions than outdoor exposures, and (2) the degradation processes induced by outdoor exposure are adequately addressed by the accelerated laboratory exposures.

709,030
PB83-134312 Not available NTIS
National Bureau of Standards, Washington, DC.
Proposed Procedure of Testing for Rating Solar Domestic Hot Water Systems.
Final rept.
J. E. Hill, and A. H. Fanney. 1980, 18p
Prepared in cooperation with Department of Energy, Washington, DC.
Pub. in American Society of Heating, Refrigeration and Airconditioning Engineers Transactions 86, p805-822 1980.

Keywords: *Tests, Ratings, Heat transfer, Reprints, *Solar water heaters, Residential sector.

The purpose of this paper is to describe the proposed test procedure, suggest alternate ways the simulation of the collector array thermal output can be accomplished in the laboratory, and report on progress being made at the National Bureau of Standards to validate the procedure.

709,031
PB83-135095 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Incident Angle Modifiers for Flat-Plate Solar Collectors.
Final rept.
W. C. Thomas, A. G. Dawson, D. Waksman, and E. R. Streed. 1982, 10p
Pub. in Proceedings of the ASME Solar Energy Division Annual Conference (4th), Albuquerque, New Mexico, 26-29, 1982, p501-510.

Keywords: *Angle of incidence, Performance evaluation, Measurement, *Solar collectors, *Flat plate collectors.

Existing test procedures for measuring and rating thermal performance require the determination of the angular response of collectors in order to account for non-normal incident beam irradiance. Angular response measurements for four different types of collectors, each type tested by three different laboratories, are presented and analyzed. Substantial differences, both within and between laboratories, are reported for the same type collectors.

709,032
PB83-135368 Not available NTIS
National Bureau of Standards, Washington, DC.
Instrumentation for Thermal Performance Measurements: Striving for Measurement Assurance in Solar Collector Testing.
Final rept.
K. A. Reed. Apr 82, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Annual Conference of the ASME Solar Energy Division (4th), Albuquerque, New Mexico, April 26-29, 1982, p337-340.

Keywords: *Measuring instruments, Fluid flow, Irradiance, Temperature, Tests, *Solar collectors.

This paper reviews the instrumentation commonly used to measure the primary physical variables needed to determine the thermal performance of active solar energy equipment, especially liquid-type solar collectors. These variables include fluid flow, temperature difference, and irradiance. Measurement techniques and difficulties are discussed, as are typical measurement uncertainties.

709,033
PB83-164988 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Weathering Performance of Cover Materials for Flat Plate Solar Collectors.
Technical note (Final).
E. J. Clark, and W. E. Roberts. Nov 82, 84p NBS-TN-1170
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Coverings, Weathering, Performance evaluation, Materials tests, *Flat plate collectors, Solar collectors.

Weathering studies were performed to obtain data on the performance and durability of cover plate materials for flat plate solar collectors used in solar heating and cooling systems. Ten materials were evaluated to assess their durability after natural weathering and artificial weathering with a xenon arc light. The materials were weathered for four years on small mini-collectors in Arizona, Florida, and Maryland after which the solar energy transmittance and the effect of dirt on the transmittance were measured. The tensile properties of selected film materials were also assessed after weathering. The effects of the natural weathering are compared: (1) for materials exposed as inner and outer cover plates for each weathering site; (2) for the three weathering sites; and (3) with materials artificially weathered with a xenon arc light.

709,034
PB83-234245 Not available NTIS
National Bureau of Standards, Washington, DC.
Initial Results from the NBS (National Bureau of Standards) Passive Solar Test Facility.
Final rept.
B. M. Mahajan, and S. T. Liu. Apr 83, 7p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of ASME (American Society of Mechanical Engineering) Solar Energy Division Annual Conference (5th) held at Orlando, Florida on April 18-20, 1983, p109-115.

Keywords: *Solar energy, Tests, Performance evaluation, Test equipment, Thermal storage, *Passive solar heating systems.

The paper briefly describes the test facility, instrumentation, experimental conditions for the initial tests, and planned experimental work. The paper contains representative results from the initial test data and a discussion of the data. The performance of the concrete floor as the thermal storage media, the occurrence of overheating, and the thermal comfort conditions within the cell are discussed.

709,035
PB84-103613 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements for Commercial Photovoltaics - A Status Report.
Final rept.
H. A. Schafft. Nov 82, 24p
Sponsored in part by Solar Energy Research Inst., Golden, CO.
Pub. in Solar Cells 7, n1-2, p23-46, Nov 82.

Keywords: *Photovaltaic cells, Measurement, Solar cells, Standards, Quality assurance, Silicon, Reprints.

The first part of the report discusses how reliable measurements play an important role along the chain of supplier-user links that make up the photovoltaics industry and its customers. The second part reviews the results of industry visits to identify measurements-related issues that effect the expeditious development and application of photovoltaics. The third part of the report provides an overview of measurement and standards development activities. The intent of this is to promote an awareness of such work to encourage thereby greater participation and also timely use of the results of this work.

709,036
PB84-133354 Not available NTIS
National Bureau of Standards, Washington, DC.
Greenhouse Effect.
Final rept.
M. Young. Mar 83, 2p
Pub. in Physics Teacher p194-195 March 83.

Keywords: *Greenhouse effect, Solar energy, Convection, Thermal radiation, Heat loss, Reprints, *Radiation trapping, Solar collectors.

Answer to the question whether the greenhouse effect is a 'hoax,' submitted at the request of the associate editor of the journal. The greenhouse effect (radiation trapping) is not a hoax, although reduced convection plays a major role.

709,037
PB84-154780 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Materials Research Activities at the National Bureau of Standards (1975-1982) Pertaining to Active Solar Heating and Cooling Systems.
C. W. C. Yancey. Nov 83, 75p NBSIR-83-2782
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Solar heating, Thermal insulation, Heat storage, Materials, Heat transfer, Solar collectors, Working fluids, Solar cooling systems, Solar heating systems.

A summary of the solar energy materials-related research projects conducted by the National Bureau of Standards, for the U.S. Department of Energy, since 1975 is presented. Research studies concerned with materials that are utilized in the collector, transport and storage subsystems are summarized. Materials research areas covered by the documentation include: cover plates, absorber coatings, thermal insulation, sealants, containment materials, heat transfer fluids, hoses and storage media materials. The primary objectives, scope and principal results of the various studies are presented. The relationship between test results and subsequent consensus standard adoption or revision is drawn where applicable.

709,038
PB84-165299 PC **A07**/MF **A01**
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering.
Solar Collector Test Procedures: Development of a Method to Refer Measured Efficiencies to Standardized Test Conditions.
Final rept. 1977-80.
W. C. Thomas. Feb 84, 150p VPI-E-80-23, NBS-GCR-84-459
Grant NBS-G8-9022

Keywords: Tests, Efficiency, Performance tests, *Solar collectors.

An analytical procedure has been developed for referring collector efficiency measurements, obtained under different test conditions, to a common, or 'standard' set of conditions. The procedure applies to flat-plate liquid-type collectors of conventional tube-in-sheet design. The basic Hottel-Whillier-Bliss theory is used with appropriate extensions to account for serpentine flow configurations and glazing materials with high infrared transmittance. The procedure includes a systematic method for deriving two invariant collector parameters directly from ASHRAE Standard 93-77 test results. The two parameters selected are the plate absorptance and back loss coefficient. A set of standard conditions is recommended which corresponds to favorable test conditions.

709,039
PB84-217447 PC **A07**/MF **A01**

National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
Test Methods and Standards Development for Active Solar Heating and Cooling Systems.
Final rept.
H. R. Trechsel, and B. L. Collins. Apr 84, 145p
NBSIR-84-2845
Contract DE-AI01-76PR06010

Keywords: *Solar heating, Tests, Standards, Heat storage, Materials, Residential buildings, Solar collectors, *Solar water heating, Solar absorbers.

Since test methods and standards for active solar heating and cooling systems did not exist in 1976, the Department of Energy sponsored research at the National Bureau of Standards (NBS) and other laboratories to aid in the development of research-based standards. This research was intended to facilitate a sound data base for the development of national consensus standards and test methods. In the present report, research by NBS and other laboratories is described for solar domestic hot water systems, solar collectors, thermal storage devices and collector materials. For collectors, the report describes research and test methods for determining the performance of cover plates, absorber materials, collector insulation, gaskets and sealants, rubber hose, containment materials, and heat transfer fluids.

709,040
PB84-223932 Not available NTIS
National Bureau of Standards, Washington, DC.
Commercial Photovoltaic Measurement Workshop Proceedings.
Final rept.
H. A. Schafft, and S. Hogan. Nov 82, 20p
Sponsored in part by Solar Energy Research Inst., Golden, CO. See also DE82-003754.
Pub. in Solar Cells, v7 n1-2 p3-22 Nov 82.

Keywords: *Solar cells, *Photovoltaic cells, *Measurement, Symposia, Silicon, Quality assurance, Photoconductivity, Standards, Reprints.

A workshop was held to provide the photovoltaics industry and others with a vehicle to examine the status and the needs for the development of measurements and standards for flat-plate solar cells, modules, and systems. Over 80 participants from the photovoltaics community took part in presentations and discussions on the following topics: measurement equipment needs, interactions with customers of photovoltaic products, quality assurance, silicon materials characterization, solar data, reference cells, cell and module output measurements, module certification, and the role of the Government in measurements. This report includes the presentations given, the results of the discussion sessions, and overview and assessment statements.

709,041
PB84-244631 Not available NTIS
National Bureau of Standards, Washington, DC.
Nondestructive Measurement of Solar Cell Sheet Resistance Using a Laser Scanner.
Final rept.
P. Kowalski, W. F. Lankford, and H. A. Schafft. May 84, 5p
Sponsored in part by Solar Energy Research Inst., Golden, CO.
Pub. in IEEE Transactions on Electron Devices ED-31, n5 p566-570 May 84.

Keywords: *Solar cells, *Optical scanners, Nondestructive tests, Measurement, Electrical resistance, Reprints, Laser applications.

Experimental data have shown that a laser scanner can be used as a probe to make nondestructive measurements of solar cell sheet resistance with an accuracy of several percent. The photovoltaic response from cells with controlled sheet resistance was measured using the scanner and compared with the theoretical predictions made by other workers. Several limitations in this technique are identified and a measurement methodology is suggested.

709,042
PB85-100451 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Building Equipment Div.
National Bureau of Standards Passive Solar Test Facility - Instrumentation and Site Handbook.
B. M. Mahajan. Aug 84, 89p NBSIR-84/2911
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Test facilities, *Solar energy, Detectors, Passive systems.

This handbook provides a complete description of the test building, thermophysical properties of the building material, location of the sensors installed at the test facility, and data acquisition system and procedures.

709,043
PB85-108488 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Evaluation of Infrared Reflectance as a Technique for Measuring Absorber Materials Degradation.
D. Waksman, and W. E. Roberts. Sep 84, 47p
NBSIR-84/2916
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Antireflection coatings, Reflectance, Measurement, Degradation, Infrared spectra, *Solar absorbers, Solar collectors.

Current ASTM standards concerned with the durability and reliability of absorptive coatings rely on integrated solar absorptance and emittance as the primary methods for assessing changes in absorber optical performance resulting from environmental exposure. This study was undertaken to determine if infrared reflectance measurements are a more sensitive technique for detecting absorber materials degradation. Spectral measurements were made to identify factors that could affect the reproducibility of infrared reflectance measurements and to compare their ability to detect changes with currently used methods for absorber materials. Recommendations are made concerning the use and limitations of infrared reflectance measurements for this purpose.

709,044
PB85-113603 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
NBS (National Bureau of Standards) Solar Collector Durability/Reliability Test Program: Final Report.
D. Waksman, W. C. Thomas, and E. R. Streed. Sep 84, 153p NBS/TN-1196
Also available from Supt. of Docs as SN003-003-02611-5. Sponsored in part by Department of Energy, Washington, DC. Prepared in cooperation with Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering. Errata sheet inserted. See also PB81-166571.

Keywords: *Performance tests, Quality assurance, Reliability, Durability, Deterioration, Degradation, Project planning, *Solar collectors.

In this research, eight different types of flat-plate solar collectors were exposed outdoors at four sites located in different climatic regions. Small scale cover and absorber materials coupon specimens consisting of samples taken from a collector of each of the eight types used and a number of additional materials were exposed concurrently with the full-size collectors. Periodic measurements were made of collector and materials performance as a function of outdoor exposure time. Indoor laboratory aging tests were conducted concurrently on specimens of the same materials to provide a basis for comparison with the outdoor exposure tests. This report presents the results obtained in this test program. Recommendations are made regarding the use and limitations of performance measurements and environmental exposure tests for assessing the durability of solar collectors and absorber and cover materials.

709,045
PB85-119469 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Measurement Techniques for Evaluating Solar Reflector Materials.
Final rept.
J. C. Richmond. Sep 84, 74p NBS/GCR-84/475
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Solar reflectors, *Materials, Measurement, Evaluation, Service life, Performance tests, Manufacturing, Bibliographies, Mirrors.

Solar reflector materials are used to concentrate the terrestrial solar irradiance on a solar receiver in order to increase the temperature of the working fluid in a solar energy system. To ensure acceptable performance and service life of the materials used in reflectors, data must be available prior to the design, construction and use of reflectors. These data must be generated by reliable measurement techniques. This report assesses the current state-of-the-art of technology associated with the manufacture and evaluation of solar reflector materials and includes an identification of numerous research needs and a bibliography of 124 relevant documents.

709,046
PB85-129435 Not available NTIS
National Bureau of Standards, Washington, DC.
Semiconductor Equipment and Materials Institute Specification for Solar Cell Silicon.
Final rept.
R. I. Scace. 1983, 2p
Pub. in Solar Cells 7, p77-78 1982-83.

Keywords: *Silicon, Specifications, Solar cells, Reprints.

The specification for solar cell silicon slices under development by the Semiconductor Equipment and Materials Institute is described. The specification covers physical and dimensional but not electrical attributes of the material. Work to establish standardized dimensions of slices is continuing.

709,047
PB85-145266 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Certification Program for Photovoltaic Modules.
Final rept.
D. B. Thomas. 1982, 3p
Sponsored by Solar Energy Research Inst., Golden, CO.
Pub. in Solar Cells: Their Science Technology, Applic., and Econ. 7, n1-2 p183-185 Nov 82.

Keywords: *Photovoltaic cells, Evaluation, Laboratories, Solar cells, Tests, Test facilities, Quality assurance, Reprints, *Certification, Accreditation.

A brief discussion of the basic concepts of product certification is presented followed by a discussion of prerequisites for a proposed certification program for photovoltaic modules. One independent approved laboratory would serve as the certifier for the program with additional laboratories being approved if they are warranted by a demand for additional testing services. If the module certification program eventually needs a large number of laboratories for this type of testing, the approved laboratory program should be replaced by an accreditation program such as the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the Department of Commerce.

709,048
PB85-145274 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Approved Laboratory Program for Photovoltaic Reference Cell Development.
Final rept.
D. B. Thomas. 1982, 4p
Sponsored by Solar Energy Research Inst., Golden, CO.
Pub. in Solar Cells: Their Science Technology, Appl., and Econ. 7, n1-2 p131-134 Nov 82.

Keywords: *Photovoltaic cells, Fabrication, Laboratories, Calibrating, Solar cells, Verification inspection, Test facilities, Tests, Evaluation, Reprints, Certification.

A program is proposed for establishing at least one approved laboratory for the fabrication, calibration, and certification of photovoltaic reference cells used in measuring the electrical output of solar cells and modules. The approved laboratory would be evaluated by NBS and monitored for proficiency by using a reference laboratory for reference cell verification testing.

709,049
PB85-146868 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.

Multi-Year Plan for Experimental Systems Research-Passive and Hybrid Solar Energy Program.
J. Greenberg. Nov 84, 53p NBSIR-84/2972
Contract DE-A101-76PR06010

Keywords: *Solar energy, *Research management, Project planning, Facilities, Economic factors, Performance, Buildings, Passive solar heating systems, Passive solar cooling systems, Hybrid systems.

This report addresses the development of a multi-year plan for Experimental Systems Research focused at gaining the necessary knowledge to advance the understanding of passive and hybrid solar energy technology. This understanding includes the ability to acquire building performance data under controlled conditions so that the fundamental mechanism of the driving forces that effect change, along with the resulting change, can be studied. It includes the process whereby through a series of working meetings and exchange of correspondence, a list of candidate research areas were identified for both heating and cooling technologies. These research areas are defined and ranked and a resulting list of priorities established. This report articulates the results of this effort and details the recommended Experimental Systems Research Activities for solar passive and hybrid technologies for FY85 and beyond.

709,050
PB85-146876 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Evaluation of Ettringite and Related Compounds for Use in Solar Energy Storage.
Progress rept.
L. J. Struble, and P. W. Brown. Oct 84, 46p NBSIR-84/2942
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.

Keywords: *Solar energy, *Energy storage, *Synthesis(Chemistry), Performance evaluation, Phase transformation, Enthalpy, Specific heat, Temperature, *Phase change materials, *Latent heat storage, *Ettringite.

This report describes an investigation of ettringite and related phases for potential application in solar energy storage. The specific objective is to evaluate the potential of ettringite dehydration and rehydration as a phase change for energy storage. Synthesis procedures have been developed, and a number of ettringite-type phases have been prepared. The heat capacity of each phase was approximately 0.3 calories per gram per degree Celcius. Studies of the dehydration of these phases at atmospheric pressure indicate that the material has good potential as a phase change material for solar energy storage. Dehydration occurred at temperatures in the range between approximately 30C and 55C, with changes in enthalpy ranging between 100 and 240 calories per gram sample. In addition, ettringite was found to have a reversible hydrothermal reaction at approximately 50C, with an enthalpy change of approximately 4 calories per gram sample. Future work during the remainder of this program will involve completing the work described in the present progress report.

709,051
PB85-183374 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Self-Heating to Ignition Measurements and Computation of Critical Size for Solar Energy Collector Materials.
Final rept.
J. J. Loftus. Mar 85, 39p NBSIR-85/3122
Sponsored by Department of Energy, Washington, DC.

Keywords: *Plywood, *Cellular plastics, *Ignition, Critical temperature, Hazards, Polyurethane resins, *Solar collectors.

Kinetic constants of the self-heating reaction were determined for plywood, a retardant treated plywood, and eight samples of polyurethane foam representing possibly two different kinds of foam materials. Under the assumption that self-heating follows a first order reaction, these constants were used to calculate the critical half thickness of slabs of these materials for surface temperatures likely to be experienced during long term use in solar energy collectors. Based on these calculations, estimates are provided on the self-heating or ignition hazards associated with the size and use of these materials in solar energy systems.

709,052
PB85-184638 Not available NTIS
Department of Energy, Washington, DC. Office of Solar Heat Technologies.
Performance of Solar Domestic Hot Water Systems at the National Bureau of Standards: Measurements and Predictions.
Final rept.
A. H. Fanney, and S. A. Klein. 1983, 11p
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.
Pub. in Jnl. of Solar Energy Engineering Transactions ASME 105, n3 p311-321 Aug 83.

Keywords: Performance, Measurement, Predictions, Thermodynamic properties, Reprints, *Solar water heating.

This paper includes a detailed description of the hot-water systems, experimental test results, and comparisons with computer predictions using the f-Chart method. The system configurations include an evacuated-tube air system with a cross-flow heat exchanger and two storage tanks, a single-tank direct system, a double-tank direct system, a single-tank indirect system with a wrap-around heat exchanger, a double-tank indirect system with a coil-in-tank heat exchanger, and a thermosyphon system.

709,053
PB85-184679 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation of Absorber Stagnation Temperature as a Characteristic Performance Parameter of Flat-Plate Solar Collectors.
Final rept.
A. G. Dawson, W. C. Thomas, and D. Waksman. 1982, 10p
Sponsored by American Society of Mechanical Engineers, New York.
Pub. in Proceedings of the American Society of Mechanical Engineers Winter Annual Meeting 1982, Phoenix, AZ., November 14-19, 1982, Paper No. 82-WA/So1-5, 10p.

Keywords: *Thermal degradation, Performance tests, Evaluation, Materials, Temperature measurement, Spectral emittance, Thermal conductivity, Absorptance, Transmittance, Meetings, *Solar collectors, *Flat plates, *Stagnation temperature.

An analytical and experimental investigation was undertaken to evaluate an alternate method for measuring the thermal degradation of materials used in flat-plate collectors. This test method is based on measuring the temperature of the absorber under a no-flow condition before and after prolonged exposure. The primary material properties of interest are cover transmittance, solar absorptance and infrared emittance of the absorber, and thermal conductivity of insulation.

709,054
PB85-186906 PC **A11**/MF **A01**
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering.
Thermal Performance Testing and Mathematically Modeling of Integral Collector Storage Solar Hot Water Systems.
Final rept.
W. C. Thomas. Feb 85, 234p VPI-E-85-5, NBS/GCR-85/490
Grant NB82-NADA-3018
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.

Keywords: *Thermal measurements, Test equipment, Performance tests, Mathematical models, Efficiency, Irradiance, Temperature, Predictions, *Solar water heating, *Solar collectors.

An investigation was carried out to evaluate a possible alternative test method for integral collector storage solar hot water systems. The new test method is an alternative to the established consensus standard method which requires that integral collector storage systems be tested using a solar irradiance simulator. The concept behind the alternative method is to characterize the thermal performance of the solar collection elements in the integral system using standard test methods for conventional solar collectors. After measuring the efficiency and incident angle response, the integral collector storage hot water system would be tested using an electrical heat source to simulate the absorbed solar energy. The research included both experimental and analytical investigations on the collector elements and on the complete system. All-day tests were performed on two commercial integral collector storage solar domestic hot water systems. Tests were performed under a variety of ambient conditions and irradiance levels. An analytical model was developed to predict the thermal performance of one of the systems. Predicted performance was compared with experimental results.

709,055
PB85-187441 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Temperature Calibration for Solar Heating and Cooling System Evaluation.
Final rept.
J. F. Schooley. 1978, 5p
Pub. in Proc. Conference on Performance Monitoring Techniques for Evaluation of Solar Heating and Cooling Systems, Washington, DC, April 3-4, 1978, p307-311.

Keywords: *Calibrating, *Temperature measuring instruments, *Solar heating, Monitors, Performance evaluation, *Solar cooling systems.

Problems associated with the calibration of temperature instrumentation for performance monitoring of solar systems are briefly discussed. A short outline is presented of thermometer calibration services and associated programs available at the National Bureau of Standards.

709,056
PB86-113610 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Development of Standards for Evaluating Solar Absorber Materials.
Final rept.
L. Masters, and D. Waksman. 1979, 21p
Sponsored by Department of Energy, Washington, DC. Office of Conservation and Solar Energy.
Pub. in Proceedings of the American Electroplaters Society Coatings for Solar Collectors Symposium (2nd), St. Louis, MO., October 16-17, 1979, 21p.

Keywords: *Standards, *Solar absorbers, Solar space heating, Solar cooling systems, Solar collectors.

Absorber materials used in solar heating and cooling systems absorb energy from the sun and convert it to thermal energy. It is essential that materials used for this purpose be durable for extended periods of time. However, the environment in which absorber materials are used can cause rapid degradation. Numerous problems in solar energy systems have clearly shown the need for standards by which solar absorber materials and other materials can be evaluated. The Center for Building Technology of the National Bureau of Standards is performing research, under Department of Energy sponsorship, to develop the measurement technology needed for standards, both at the solar collector level and the functional materials level. This paper addresses the ongoing research, the findings to date, and draft standards that have resulted from the research.

709,057
PB86-119211 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Laboratory Simulated Service Testing of Flat Plate Solar Heat Transfer Liquid Containment Systems.
Final rept.
P. W. Brown. 1980, 8p
Sponsored by Department of Energy, Washington, DC. Office of Solar Applications and Commercialization.
Pub. in Proceedings of International Corrosion Forum Devoted Exclusively to the Protection and Performance of Materials, Chicago, IL., May 3-7, 1980, p102.1-102.8.

Keywords: Accelerated tests, Simulators, Ethylene, Glycols, *Solar collectors, *Heat transfer fluids, Flat plate collectors.

The design of an accelerated test simulative of the operation of a solar collector system requires consideration of a variety of possible design and operating parameters. These include operating and stagnation temperatures, flow rate, mode of heat transfer and degree of aeration. Cognizant of these parameters, a simulated service test, which allows stagnant empty and full conditions to be simulated at temperatures either above or below the boiling temperature of the

heat transfer liquid, has been developed. The chemical and thermal stabilities of ethylene and propylene glycol have also been examined.

709,058
PB86-122868 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Method of Testing Passive Storage Walls to Determine Thermal Performance.
Final rept.
M. McCabe, M. McKinstry, and P. Wormser. 1979, 3p
Sponsored by Department of Energy, Washington, DC. Office of Conservation and Solar Energy.
Pub. in Proceedings of National Passive Solar Conference (4th), Kansas City, MO., October 3-5, 1979, p736-738.

Keywords: *Thermal analysis, Performance tests, Finite difference theory, Walls, Buildings, Heat storage, Computerized simulation, *Trombe walls, *Passive solar heating systems.

A conceptual thermal performance test for passive solar storage walls is described. The test procedure applied to a Trombe-Wall is evaluated by computer simulation, using a finite-difference thermal model. A simple calculation procedure for a building using the Trombe-Wall pseudo test results is described and the thermal performance estimates are shown to compare reasonably well with the results predicted by the detailed computer model simulation.

709,059
PB86-123049 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Testing Solar Collector Materials Durability by Integrated Day-Long Stagnation Temperature Measurements.
Final rept.
W. C. Thomas, A. G. Dawson, and D. Waksman. 1983, 7p
Pub. in Proceedings of ASME (American Society of Mechanical Engineers) Solar Energy Division Annual Conference (5th), Orlando, FL., April 18-21, 1983, p301-307.

Keywords: *Solar collectors, Materials tests, Durability, Tests, Temperature measurement, Degradation.

Measurements of the maximum temperatures reached by solar energy absorbing surfaces provide a useful method for detecting possible degradation in the optical and heat transfer properties of materials used in collectors. The test method is based on measuring the absorber temperature continuously over a period of several days along with total daily solar irradiation. The absorber temperature rise above ambient is integrated to determine daily values. The investigation shows that the all-day integration method is a viable approach which has advantages over alternative test methods based on steady-state measurements of either absorber stagnation temperature or collector energy output.

709,060
PB86-137999 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Experimental-Technique for Testing Thermosyphon Solar Hot Water Systems.
Final rept.
A. H. Fanney. 1984, 8p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Solar Energy Engineering-Transactions of the ASME (American Society of Mechanical Engineers) 106, 4 p457-464 1984.

Keywords: *Performance tests, Evaluation, Ratings, Reprints, *Solar water heating, *Thermosyphon effect, Solar collectors.

An experimental technique for testing thermosyphon solar hot water systems is described which allows testing of the system indoors under nonirradiated conditions. The technique described is applicable to thermosyphon systems which utilize flat-plate solar collectors. Energy normally absorbed by the irradiated solar collectors is supplied by electric strip heaters attached to the back side of the absorber plates. Analytical expressions are developed which allow the power input to the strip heaters to be calculated for various environmental conditions. A description of the experimental apparatus and test procedure is given. Results are presented which show that the performance of a thermosyphon system tested indoors using the electric strip heater technique closely duplicates system performance under outdoor irradiated conditions.

709,061
PB86-138005 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Review of Solar Domestic Hot Water System Test and Rating Procedures.
Final rept.
A. H. Fanney. 1983, 9p
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.
Pub. in Proceedings of Annual Conference of American Society of Mechanical Engineers Solar Energy Division (5th) -- Solar Engineering 1983, Orlando, FL., April 18-21, 1983, p169-177.

Keywords: *Tests, *Ratings, Standards, Hot water heating, *Solar water heating, Solar water heaters.

The paper reviews various test methods and rating standards which are currently (October 1982) being considered for solar hot water systems. Test and rating standards proposed in America, Australia, Canada, and South Africa are discussed.

709,062
PB86-139987 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Wind Loads on Solar Collectors: Development of Design Guidelines.
Final rept.
T. A. Reinhold. 1981, 8p
Pub. in Proceedings of U.S. National Conference on Wind Engineering Research (4th), Seattle, Washington, July 26-29, 1981, p313-320.

Keywords: Wind pressure, Design, Guidelines, Structural engineering, *Solar collectors.

Measurements obtained from model and full-scale tests are used to develop guidelines for determining minimum design wind loads on solar collectors. The approach followed is to use the proposed 1980 draft revisions to ANSI A58.1, 'Building Code Requirements for Minimum Design Loads in Buildings and Other Structures' as a base document. Guidelines are then developed which will extend the use of tables in the 1980 Draft ANSI A58.1 Provisions to the specification of minimum wind loads on solar collectors in a variety of installations. This paper includes comparisons of model with full-scale test results. Also included are comparisons of roof and wall pressures specified in the 1980 Draft ANSI A58.1 Provisions with corresponding measured pressures. These comparisons are used to evaluate the validity of the model test results and to develop pressure coefficients compatible with the 1980 Draft ANSI A58.1 Provisions.

709,063
PB86-199965 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Results from the NBS (National Bureau of Standards) Passive Test Building: A Status Report.
Final rept.
B. M. Mahajan, and S. T. Liu. 1983, 9p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Passive and Hybrid Solar Energy Program Update Conference, Washington, DC., September 26, 1983, p70-78.

Keywords: *Buildings, Data, Tests, *Passive solar cooling systems, *Passive solar heating systems, Solar architecture.

The National Bureau of Standards Passive Solar Test Building, constructed under the sponsorship of the U.S. Department of Energy, has been operational since October 1981. The test building has been constructed for the purpose of acquiring class A performance monitoring data for various passive systems under different experimental conditions. The report briefly describes the test building, instrumentation and data acquisition system, continuous air infiltration monitoring system and experimental work conducted in fiscal year 1983. The report contains representative data, and briefly describes the research activities planned for the future.

709,064
PB86-201282 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Inorganic Compounds for Passive Solar Energy Storage - Solid-State Dehydration Materials and High Specific Heat Materials.
Progress rept.
L. Struble, and P. Brown. Apr 86, 71p NBSIR-86/3325
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.

Keywords: *Energy storage, Solar energy, Inorganic salts, Dehydration, Specific heat, Passive systems, Sensible heat storage.

Two classes of hydrated inorganic salts have been studied to assess their potential as materials for passive solar energy storage. The materials are part of the quaternary system CaO-A12O3-SO3-h2O and related chemical systems, and the two classes are typified by ettringite, a trisubstituted salt, and Friedel's salt, a monosubstituted salt. The trisubstituted salts were studied for their possible application in latent heat storage, utilizing a low-temperature dehydration reaction, and both classes were studies for their application in sensible heat storage. In order to assess their potential for energy storage, the salts have been synthesized, characterized by several analytical techniques, and thermal properties measured. The dehydration data of the trisubstituted salts vary somewhat with chemical composition, with the temperature of the onset of dehydration ranging from 6 degrees C to 33 degrees C, and enthalpy changes on dehydration ranging from 60 to 200 cal/g. Heat capacity is less variable with composition; values for the trisubstituted phases are 30 cal/g/degrees C and for the monosubstituted phases between 0.23 and 0.28 cal/g/degrees C.

709,065
PB86-210226 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Convection between Zones with Non-Linear Temperature Distributions.
Final rept.
D. D. Hill, and B. M. Mahajan. 1986, 7p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Air Movement and Distribution Conference, Lafayette, IN., May 27-29, 1986, p109-115 May 86.

Keywords: *Convection, Heat transmission, Buildings, Doors, *Solar equipment.

Interzonal natural convection is an important process in the redistribution of thermal energy in passive solar enclosures. In the paper, interzonal natural convection in a two zone full scale building with non-linear zone temperature distributions is analyzed. Measurements of interzonal convection were taken in a doorway joining two rooms of the National Bureau of Standards Passive Solar Test Facility. A bernoulli interzonal air flow model based on isothermal zone temperatures is modified to account for the non-linear zone temperature distributions.

709,066
PB86-244167 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Experimental and Analytical Investigation of Solar Radiant Flux Distribution on Interior Surfaces of a Sunspace.
S. T. Liu. Mar 86, 26p NBSIR-86/3378
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.

Keywords: Solar radiation, Measurement, Experimental data, *Solar flux, Passive solar heating systems, SUNFLUX computer program.

The short wave solar radiant flux distribution inside a sun-space model with a large south opening was studied experimentally under clear sky conditions. Miniature photovoltaic pyranometer sensors responsive to short wave radiation were mounted at various locations on the interior surfaces of the enclosure. An NBS developed solar flux distribution program was tested against the experimental results and was found to give good agreement. The computer program can be used as a design tool for the evaluation of thermal storage location and solar physical properties of floor and walls in a passive solar structure.

709,067
PB87-107090 Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Degraded Aqueous Glycol Solutions: pH Values and the Effects of Common Ions on Suppressing pH Decreases.
Final rept.
J. R. Clifton, W. J. Rossiter, and P. W. Brown. 1985, 10p
Sponsored by Department of Energy, Washington, DC.
Pub. in Solar Energy Materials 12, n1 p77-86 1985.

Keywords: *pH, *Ethylene glycols, Glycols, Chemical reactions, Reprints, *Solar collectors, *Heat transfer fluids, *Glycol/propylene, *Common ions effect, *Flat plate collectors, Thermal analysis.

Aqueous solutions of ethylene glycol and propylene glycol are used as heat transfer liquids in flat-plate solar collector systems. Both of the glycols are susceptible to thermo-oxidative reactions, which produce organic acids with a resulting decrease in pH of the solutions. The effects of temperature, metals, common ions, and oxidation conditions on the thermal stability of the glycol solutions were evaluated based on measuring changes in pH. Aerated heated glycol solutions produced acidic solutions within 3360 hours (140 days) of testing, when in contact with either metallic aluminum or copper. Common ions (anions of the acid degradation products) were effective in suppressing decreases in pH, especially when aluminum was present.

709,068
PB87-107108 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Evaluation of the Variation in Thermal Performance in a Na2SO4. 10H20 Phase-Change System.
Final rept.
P. W. Brown, J. W. Grimes, and L. Kaetzel. 1986, 9p
Sponsored by Department of Energy, Washington, DC.
Pub. in Solar Energy Materials 13, n6 p453-461 1986.

Keywords: *Hydrates, *Sodium sulfates, Variations, Phase transformation, Microstructure, Thermodynamic properties, Crystal growth, Solar energy, Reprints.

The relationship between the microstructural changes occurring in a nucleated and thickening Na2SO4-10H2O phase change system, the phase change temperature, and the number of thermal cycles has been investigated. With an increasing number of thermal cycles, the phase change on cooling becomes increasingly athermal in nature. Although this is accompanied by an increase in size of the Na2SO4-10H2O crystals, these variations in phase change temperature appear to be more closely related to the segregation of the nucleating agent.

709,069
PB87-108650 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Life-Cycle Costing of Solar Energy Investments.
Final rept.
G. T. Sav, R. T. Ruegg, and J. W. Powell. Jun 81, 8p
Contract DOE-EG-77-C-01-4042
Sponsored by Department of Energy, Washington, DC.
Pub. in Solar Design Workbook, Ch11 p11-1 - 11-8 1981.

Keywords: *Solar energy, *Federal buildings, *Life-cycle cost.

The paper consists of two chapters on solar energy economics prepared for the Solar in Federal Buildings Demonstration Program. The first chapter, 'Life-Cycle Costing of Solar Energy Investments', provides an overview of the life-cycle cost method of evaluating investments in solar energy. Its emphasis is on promoting a general understanding of the approach and is applicable to most solar energy projects. The second chapter, 'Life-Cycle Cost Evaluation of Solar Demonstration Projects', focuses specifically on the application of the life-cycle costing method to projects proposed under the Solar in Federal Buildings Program.

709,070
PB87-109476 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Solar Collector Industry and Solar Energy.
Final rept.
W. L. Warnick, and J. E. Hill. Feb 80, 6p
Pub. in Monthly Energy Review, pi-vi Feb 80.

Keywords: Solar energy, Estimating, Economic analysis, Reprints, *Solar industry, *Solar collectors.

From a 1974 level of 1.3 million square feet, the production of solar collectors increased over ten-fold to 13.9 million square feet in 1979 (based upon the first 6-months' data). However, shipments of the various types of collectors, while increasing overall, show sporadic growth patterns over the 5 1/2-year period. Furthermore, a 4-year period of exponential growth appears to have ended.

709,071
PB87-118089 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Design and Evaluation of Thermosiphon Solar Hot Water Heating Systems.
Final rept.
J. E. Braun, and A. H. Fanney. 1983, 6p
Sponsored by Department of Energy, Washington, DC.
Pub. in Progress in Solar Energy, v6 p283-288 1984.

Keywords: *Hot water heating, Mathematical models, Reprints, *Thermosiphons, *Solar heating systems, US NBS, TRNSYS computer program.

In the paper, a detailed model for a thermosiphon water heater, to be included in version 12 of the TRNSYS hourly simulation program, is presented. The model utilizes collector parameters determined from standard tests. The component is general for systems with or without in-tank auxiliary heaters. Results of the model compare well with experimental results for both auxiliary energy usage and thermosiphon flow rates and temperatures. TRNSYS is then used to investigate the design and performance of thermosiphon systems for a variety of conditions.

709,072
PB87-119624 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Testing of Refrigerant-Charged Solar Domestic Hot Water-Systems.
Final rept.
A. H. Fanney, and C. P. Terlizzi. 1985, 14p
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.
Pub. in Solar Energy 35, n4 p353-366 1985.

Keywords: *Solar heating, *Hot water heating, Refrigerants, Simulation, Tests, Water, Reprints, Hot-water systems.

A repeatable test method independent of outdoor environmental conditions and laboratory geographical location is required in order to provide a means by which solar domestic hot water systems may be rated and compared. The experimental investigation presented in the paper describes two techniques which meet the above criteria for a refrigerant-charged solar domestic hot water system.

709,073
PB87-151627 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Application of Transparent Enclosure Theory to Solar Energy Absorption by Cylindrical-Tubes in Sunspaces.
Final rept.,
M. E. McCabe, and M. Van Migom. 1985, 5p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Solar Energy Engineering-Transactions of the ASME 107, n1 p5-9 1985.

Keywords: *Solar energy, Reprints, Solar irradiance, Transparent enclosure.

A general matrix formulation for beam and diffuse radiative solar transfer is presented for an enclosure containing partially transparent walls. A two-dimensional model is formulated for the sunspace in which a typical cylindrical absorber tube is subdivided into a number of uniform elements and the window and sunspace surfaces are each represented as single elements. The matrix expressions are evaluated for incident solar flux conditions typical for a south vertical window on a clear winter day. The results are presented as dimensionless ratios of absorbed-to-incident solar flux as a function of the tube spacing to radius ratio. The spatial distribution of absorbed solar flux is presented at discrete time intervals for the cylindrical-tube. Space and time averaged values of absorbed solar flux are also presented for the cylinder, the window and the room. The potential application of these results for thermal modeling in passive solar applications is discussed.

709,074
PB87-153078 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Investigation of the Degradation of Aqueous Ethylene Glycol and Propylene Glycol Solutions Using Ion Chromatography.
Final rept.,
W. Rossiter, M. Godette, P. Brown, and K. Galuk. 1985, 13p
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.
Pub. in Solar Energy Materials 11, n5-6 p455-467 1985.

Keywords: *Degradation, *Ethylene glycol, Glycols, Reprints, *Propylene glycol, Solar collectors, Thermo-oxidation.

Aqueous solutions of ethylene glycol and propylene glycol produce acidic degradation products upon thermo-oxidation. The increase in the concentrations of degradation products in solution was measured over time using the ion-chromatography exclusion (ICE) method analysis. Variables effecting the thermo-oxidation considered in the investigation were temperature, the presence of metals, and oxidative conditions. Comparisons were made with the pH values of the thermo-oxidatively degraded glycol solutions and the concentration of degradation products. It was found that different solutions having comparable pH values contained significantly different amounts of degradation products. It was concluded that the extent of degradation of the glycol can not be used as an indicator of the magnitude of the decrease in pH which the glycol solution may undergo during thermo-oxidation in the presence of metals.

709,075
PB87-161766 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Conclusions and Recommendations for the Testing of Flat-Plate Solar Collector Thermal Performance and Durability.
Final rept.,
D. Waksman, and W. C. Thomas. 1984, 6p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Winter Annual Mtg. American Society of Mechanical Engineers, New Orleans, LA, December 9-14, 1984, 6p 1984.

Keywords: Thermal measurements, Durability, Performance evaluation, *Solar collectors, *Flat plate collectors, Stagnation, U.S. NBS.

Efforts in the development of reliability/durability tests for solar collectors and their materials have been hampered by the lack of real time and accelerated degradation data that can be correlated with in-use conditions. In 1977, the Solar Collector Reliability/Durability Test Program was initiated at the National Bureau of Standards (NBS) to help generate the data required to develop methods for predicting the long term durability and reliability of flat-plate solar collectors and their materials. The paper summarizes the results obtained in this test program for full-size solar collectors. Recommendations are made regarding the use and limitations of thermal performance measurements and environmental exposure tests for assessing the durability of flat-plate solar collectors.

709,076
PB87-161774 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Assessment of Durability Testing Procedures for the Covers of Flat-Plate Solar Collectors.
Final rept.,
D. Waksman, W. E. Roberts, and W. E. Byrd. Jul 85, 21p
Sponsored by Department of Energy, Washington, DC.
Pub. in Durability of Building Materials 3, n1 p1-21 Jul 85.

Keywords: Coverings, Durability, Tests, Glazes, Reprints, *Flat plate collectors, *Solar collectors.

Efforts in the development of reliability/durability tests for solar collectors and their materials have been hampered by the lack of real time and accelerated degradation data that can be correlated with in-use conditions. In 1977, the Solar Collector Reliability/Durability Test Program was initiated at the National Bureau of

Standards (NBS) to help generate the data required to develop methods for predicting the long term durability and reliability of flat-plate solar collectors and their materials. The paper summarizes the results obtained in the test program for cover materials used in flat-plate solar collectors. Recommendations are made regarding the environmental exposure of these materials and the measurement of changes in their performance.

709,077
PB87-161782 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Experimental Research at the NBS (National Bureau of Standards) Passive Solar Test Facility.
Final rept.,
B. M. Mahajan, and S. T. Liu. 1984, 7p
See also report dated Oct 84, DE85-003442. Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Conference on Passive and Hybrid Solar Energy Update, Washington, DC., September 5-7, 1984, p166-172 Oct 84.

Keywords: Research, Experimentation, Data acquisition, *Passive solar test facility, US NBS.

The National Bureau of Standards Passive Solar Test Building, constructed under the sponsorship of the U.S. Department of Energy, has been operational since October 1981. This test building has been constructed for the purpose of acquiring class A performance monitoring data for various passive systems under different experimental conditions. The performances of the three test cells in the building, each with different south-facing passive solar features, was monitored for two short periods during January-March of 1984. This paper briefly describes the test facility, data acquisition procedures, test conditions for the experiments. The paper presents representative results from these experiments, compares the performances of the three cells. The paper also compares data with the predicted values of the ratios of solar radiation quantities and energy requirements. The data and predicted values show good agreement suggesting that the procedures outlined in the Volume Three of Passive Solar Design Handbook for predicting these quantities are valid.

709,078
PB87-199337 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Initial Results from Testing Passive Solar Components in the NBS (National Bureau of Standards) Calorimeter,
M. E. McCabe, and C. E. Hancock. 1983, 8p
Sponsored by Department of Energy, Washington, DC. Passive and Hybrid Solar Energy Div.
Pub. in Proceedings of Conference Passive and Hybrid Solar Energy Update, Washington, DC. September 26-28, 1983, p239-246.

Keywords: *Test facilities, Heat transfer, Thermal measurements, Windows, *Passive solar heating systems, *Calorimetry, Hybrid systems, US NBS, U values.

Studies of the thermal performance of passive solar buildings have indicated a need for precise measurement of solar and thermal energy transfer in modular passive/hybrid solar components under conditions of actual use. A description of the design and initial operational results for a new calorimetric test facility is presented in this paper. The facility is designed for testing of passive solar components at the National Bureau of Standards in Gaithersburg, MD. It is anticipated that the test facility will provide a substantial improvement in the measuring techniques for passive and hybrid solar components over other methods currently in use and thereby provide a firm technical basis from which laboratory test procedures can be evaluated.

709,079
PB88-141155 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Measured Performance of Solar Hot Water Systems Subjected to Various Collector Array Flow Rates.
Final rept.,
A. H. Fanney. 1985, 8p
Sponsored by Department of Energy, Washington, DC. Office of Solar Heat Technologies.
Pub. in Proceedings of Solar Buildings Conference, Washington, DC., March 18-20, 1985, p123-130.

Keywords: *Solar water heaters, *Solar collectors, Water heating, Performance evaluation, Thermodynamic properties, Reprints.

The thermal performance of solar domestic hot water (DSHW) systems is influenced by the solar collector array flow rate. An experimental investigation has been conducted at the National Bureau of Standards to quantitatively evaluate the effect. The paper describes the selection of the optimum collector array flow rate based on both analytical and experimental considerations, describes the experimental apparatus, and presents data which illustrates the increase in thermal performance possible by utilizing the optimal flow rate.

General

709,080
PB-267 040/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Applications of Thermography in Industry,
C. W. Hurley, and K. G. Kreider. 1977, 7p
Pub. in Proceedings Biennial Infrared Information Exchange (3rd), St. Louis, Mo., August 24-26, 1976, p53-59 1977.

Keywords: *Heat losses, *Industrial plants, Radiometry, Infrared detectors, Furnaces, Energy conservation, Thermography.

The Bureau of Standards has been conducting a project to develop a method for assessing heat losses in industrial equipment. This project is part of the NBS industrial energy conservation program. The IR surveys have included industrial facilities such as tire, cement, copper, brick, and paper plants as well as foundries and forging plants. The infrared survey was used to detect heat losses which require maintenance and repair or improvement. Several examples are presented. In addition the IR thermographic mapping was used to analyze the total heat losses of industrial furnaces as part of the energy balance on the furnace. This quantitative heat loss study is discussed as an in-progress report.

709,081
PB-267 225/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Economic Aspects of U.S. Energy Independence in the Coming Decade,
K. D. Timmerhaus, and D. H. Weitzel. 1977, 14p
Pub. in Proceedings, International Cryogenic Materials Conference (1st), Kingston, Ontario (Canada) 22-25 Jul 75, Paper D-1 in Advances in Cryogenic Engineering, v22 p166-179 1977.

Keywords: *Energy, Economic analysis, Reviewing.

There is no doubt that energy is a subject on the minds of many today. A great deal of what is being said about energy not only bears repeating, but requires careful evaluation and should be followed by constructive action. Energy research and development will play a central role in most of this nation's scientific, technological, and industrial endeavors for years, if not decades, to come. This is true not only because of the overwhelming importance of energy to the nation but because our energy problems-both immediate and long-range-are complex. It is also true because the urgency of dealing with these problems must be brought home to the public and to people at all levels of responsibility in government, industry, and education. These problems have not vanished with the end of the oil embargo and the disappearance of lines at the gas stations. The United States will be living with them and working to solve them for a long time. Before turning to some of the solutions that might be considered for the coming decade, it is useful to make a few observations to illustrate the national and global impact of the energy situation.

709,082
PB-271 846/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation of Energy-Related Inventions.
Final rept.,
G. P. Lewett. 1977, 6p
Pub. in Int. Marketing Infor. Series, Comm. News for the Foreign Serv. CNFS Spec. Issue, p7-12 Mar/Apr 77.

Keywords: *Technology, *Energy, *Equipment, Inventions, Projects, Development, Evaluation, Reprints.

The report contains a discussion and description of the NBS energy-related invention evaluation program. The program was legislated under the Federal Nonnuclear Energy Research and Development Act of 1974, and the Office of Energy-Related Inventions (OERI) began operating in April 1975. As of the date of publication OERI had received some 3700 inventions and had made 16 recommendations to ERDA.

709,083
PB-289 084/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Opportunities to Apply Physics to Energy Conservation Problems in Process Industries. Examples from Textiles and Papermaking.
Final rept.,
T. P. Sheahen. 1978, 6p
Pub. in Proceedings of Conference on Physics Careers, Employment and Education, State College, PA, 1-3 Aug 77 p201-206 1978. (American Physical Society, New York, NY.)

Keywords: *Energy conservation, *Industrial plants, *Measurement, Manufacturing, Textile industry, Paper industry, Moisture content, Alignment, Moire effects.

The large mills that convert raw materials into finished products are generally thought of as engineering wonders, with no need for physics beyond classical mechanics. However, there are many improvements possible through the application of new measurement concepts that are only now emerging from the research laboratories (laser optics is an obvious example). This paper suggests that there are many such applications, and illustrates the point with two specific cases, both of which deal with means of industrial energy conservation: (1) The process of making paper is predominantly a matter of water removal. Moisture gauges can easily be fooled by impurities in the input pulp, especially where paper is recycled; and thus substantial energy can be wasted by overdrying paper. Application of remarkably simple physical insight helps to overcome this problem. (2) Textiles must be held very straight while being heat-set in order to lead to good quality clothing, and either discarding or re-setting misaligned cloth wastes labor as well as energy. When combined with properly designed plates, the threads comprising the fabric generate Moire patterns that can be used to observe and regulate textile straightness. The limitations of the applications of physics are set by limits of imagination, not in training.

709,084
PB81-169989 Not available NTIS
National Bureau of Standards, Washington, DC.
Cold Utilization from Liquefied Natural Gas (LNG).
Final rept.
T. M. Flynn, and K. D. Timmerhaus. 1980, 7p
Pub. in Proceedings of the International Congress of Refrigeration (15th) Held at Venice, Italy on Sep 23-29, 1979, Session A 3/27 in Progress in Refrigeration Science and Technology, 7p 1980.

Keywords: *Liquefied natural gas, *Refrigerating, *Energy conservation.

One of the most striking characteristics of liquefied natural gas (LNG) is the vast amount of cold, or potential refrigeration, available which is now almost completely wasted. LNG, at -125C, when referenced to a +15C datum plane, has approximately the same potential thermodynamic credit as low pressure steam at about 160C. However, very little has actually been done in this field of energy conservation. There are over 100 large LNG facilities in the world. Of these, only about four use the refrigeration potential in LNG, and none of these are in the United States. The four commercial facilities known to use the available refrigeration in LNG are: (1) the LNG receiving facility in Barcelona, Spain, which uses an LNG cryogenic process to recover heavy hydrocarbons from Libyan LNG /1/; (2) a similar operation at La Spezia, Italy /2/; (3) a Japanese facility which produces liquid oxygen, liquid nitrogen and affords warehouse refrigeration for frozen food as well /3/; and (4) an LNG assisted air separation plant in France /4/. The important aspects of these four ventures together with some other potential applications of this relatively unused energy source will be discussed in this paper.

709,085
PB82-118050 Not available NTIS
National Bureau of Standards, Washington, DC.

Comparison of Energy Calculation Procedures.
Final rept.
T. A. Kusuda. Aug 81, 4p
Pub. in ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Jnl., n8 p21-24 Aug 81.

Keywords: *Computerized simulation, Calculators, Computation, Computer programming, Reprints, *Energy analysis.

ASHRAE's Technical Committee on Energy Calculations (TC 4.7) has developed a proposed simplified procedure suitable for manual or pocket calculators. The proposed simplified procedure was compared with seven detailed computer simulation energy analysis programs - AXCESS, BLAST, BLDSIM, DOE-2, E-CUBE, ESAS, and TRACE. The comparative calculations were done on a Washington, DC office building, for four typical HVAC systems. Discrepancies between the results using the seven computer simulation methods involving seven separate analysts were generally greater than the differences between the simplified method and a single computer simulation method when both were used by the same analyst. Major reasons for discrepancies between the proposed TC 4.7 simplified method and the detailed computer simulation methods are discussed, as well as the difficulties in using the simplified procedure.

709,086
PB86-122918 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Noise Temperature Measurements at the National Bureau of Standards.
Final rept.
S. Perera. 1985, 2p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Instrumentation and Measurement Technology Conference (IMTC '85), Tampa, FL., March 20-22, 1985, p159-160.

Keywords: *Thermal noise, *Radiometers, Measurement, Sources.

Thermal noise presents the ultimate limitation in the reception and detection of low level electromagnetic signals. This paper briefly reviews the physics of thermal noise, devices that generate noise, and measurement methods to characterize noise sources.

ENVIRONMENTAL POLLUTION & CONTROL

Air Pollution & Control

709,087
AD-A091 631/2 PC **A21**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Chemical Kinetic and Photochemical Data Sheets for Atmospheric Reactions.
R. F. Hampson. Apr 80, 488p FAA/EE-80-17
Contract DOT-FA79WAI-005
See also Rept. nos. NBSIR-73-203, NBSIR-74-430, NBS-TN-866 and NBS-SP-513.

Keywords: *Atmospheric chemistry, *Reaction kinetics, *Photochemical reactions, *Physical chemistry, *Data bases, *Atmosphere models, Air pollution, Troposphere, Stratosphere, Data processing, Input, Constants, Quantum efficiency.

A set of individual data sheets for gas phase chemical reactions and photochemistry of neutral species is presented. These data sheets give preferred values for reaction rate constants, photoabsorption cross sections and quantum yields with a brief statement discussing the basis for the preferred value. Recent experimental results are also given. The coverage of this initial set of data sheets issued in February 1980 corresponds to the approximately 400 reactions listed in NBS Special Publication 513, R. F. Hampson and D. Garvin, May 1978. For approximately one quarter of these reactions the data entry has been updated to include the 1979 recommendations of the NASA Panel for Data Evaluation and the CODATA Task Group on Chemical Kinetics. They are intended to provide the basic physical chemical data needed as input data for calculations modeling atmospheric chemistry. Revisions and additions for specific reactions will be published as new information becomes available.

709,088
PB-263 534/0 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Survey of Calibration Techniques for Atmospheric Ozone Monitors.
Final rept.,
J. A. Hodgeson. Dec 76, 31p NBSIR-76-1191

Keywords: *Calibrating, *Ozone, *Monitors, Chemical analysis, Gas analysis, Concentration(Composition), Trace elements, Air pollution, Photometry, Ultraviolet radiation, Volumetric analysis, Atmospheric composition, Iodine, *Air pollution detection, Procedures, Iodometry.

A survey is presented of recent studies on calibration techniques for atmospheric ozone (O3) monitors. These calibration techniques are based on iodometry, ultraviolet photometry (UV) and gas phase titration (GPT). The iodometric procedures include the 1 percent neutral buffered potassium iodide (NBKI) technique used by the Environmental Protection Agency (EPA), a 2 percent NBKI method of the California Air Resources Board and a 1 percent unbuffered KI technique previously used by the Los Angeles Air Pollution Control District (LAAPCD). The UV and GPT approaches are of rather recent application and brief descriptions of the calibration procedures are given. In summary the data show excellent agreement between O3 determinations by UV or GPT and demonstrate that absolute measurements of trace O3 concentrations can be made by either technique. On the other hand, the NBKI methods yield O3 measurements 1 to 13 percent higher than absolute values when O3 in dry air is analyzed. In the presence of humid air the NBKI measurements are high by factors ranging from 15 to 30 percent.

709,089
PB-264 309/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Methodology for Standardization of Atmospheric Ozone Measurements.
Final rept.,
J. A. Hodgeson, E. E. Hughes, W. P. Schmidt, and A. M. Bass. Jan 77, 10p
Pub. in Proceedings of International Conference on Photochemical Oxidant Pollution and Its Control, Research Triangle Park, N.C. 12-17 Sep 76, EPA/600/3-77/001a, Ecological Research Series 1 p3-12, Environmental Sciences Research Lab., Research Triangle Park, N.C. Jan 77.

Keywords: *Ozone, *Calibrating, *Monitors, Chemical analysis, Gas analysis, Atmospheric composition, Methodology, Photometry, Volumetric analysis, *Air pollution detection, Procedures.

Preliminary intercomparisons have been made among several techniques for the calibration of atmospheric ozone monitors. These procedures include the 1 percent neutral buffered potassium iodide method; a modification of this method employing 0.1 molar boric acid rather than the phosphate buffer; a 3-meter double-beam ultraviolet photometer; and gas phase titration. The potassium iodide reagent with boric acid gave a more stable color development and much closer agreement with the ultraviolet measurements than that obtained with the neutral buffered reagent. Ozone calibration data with the 3-meter photometer agreed within 1 and 2 percent with gas phase titration and ultraviolet photometric ozone measurements respectively made at the Environmental Protection Agency facility in Research Triangle Park, North Carolina.

709,090
PB-264 893/9 PC **A07**/MF **A01**
FluiDyne Engineering Corp., Minneapolis, MN.
Effective Sampling Techniques for Particulate Emissions from Atypical Stationary Sources.
Interim rept. Jun 75-Sep 76.
H. A. Hanson, and D. P. Saari. Feb 77, 131p EPA/600/2-77/036
Grant EPA-68-02-1796

Keywords: *Particles, Reviews, Air pollution, Industrial wastes, Combustion products, Sampling, Field tests, Scrubbers, Monitors, Samplers, Standards, Incinerators, Ventilators, Concentration(Composition), Methodology, Mathematical models, Experimental design, Environmental simulators, Probes, Performance evaluation, Stationary sources, *Air pollution sampling, Wet methods, Grain dryers.

Techniques and instrumentation for sampling strategies to measure particulate emissions from 'atypical' stationary sources were developed. The four atypical source categories are low effluent streams, extended dimensions, partially or totally unconfined flow, and saturated gas streams or gas streams with entrained liquid droplets. The research program included literature surveys, laboratory model testing, and field testing of several atypical stationary sources. Techniques and instruments were evaluated as to the degree of reliability of measured emissions and applicability to general situations. Three specific sources--gravity roof ventilators, grain dryers, and wet scrubbers--were selected to provide the basis for the research program of the four atypical source categories. Basic characteristics of these sources were identified through literature and personal contact surveys. A program of model testing and field testing of roof ventilator emissions was completed, and a similar program was undertaken for wet scrubbers. The sampling strategy recommended for roof ventilator emission measurement on the basis of the test program includes a high volume particulate sampler and a heated thermopile anemometer deployed near the base of the ventilator.

709,091
PB-270 856/8 PC **A08**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Test and Evaluation of the Smoke Control Capabilities of the San Diego Veterans Administration Hospital.
Final rept.,
F. C. W. Fung, and R. H. Zile. Apr 77, 168p NBSIR-77-1225
Sponsored in part by Veterans Administration, Washington, D.C. Office of Construction.

Keywords: *Smoke abatement, *Fire fighting, *Hospitals, Research, Simulation, Pressurizing, Control, Data acquisition, Computerized simulation, Doors, California, *Smoke control, San Diego(California), Compartments.

A study was made by the National Bureau of Standards to evaluate the smoke control capabilities of the San Diego Veterans Administration Hospital. A unique feature of the hospital is the presence of independent air-handling units for each floor and each wing. This feature allows the air-handling units to be manipulated for smoke control following the systematic pressurization concept. Systematic pressurization is a means of smoke control whereby a building is divided into either vertical or horizontal compartmented zones such that the air-handling systems are designed to exhaust the immediate fire zone and pressurize the adjacent surrounding zones upon detection of smoke. An experimental technique of smoke simulation and smoke movement measurement was used for the study. The effectiveness of the systematic pressurization smoke control concept is demonstrated by the simulated smoke concentration profiles and pressure measurements.

709,092
PB-272 530/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
How Well Can We Measure Significant Deterioration of Air Quality.
Final rept.,
J. A. Hodgeson. 1977, 16p
Pub. in Proceedings of ASME Air Pollution Control Division National Symposium Preventing Signification Deterioration: What Does It Mean. What are Its Impacts (5th), Pittsburgh, Pennsylvania, May 11-12, 1977, p30-45 1977.

Keywords: *Particles, *Sulfur dioxide, *Air pollution, Sensitivity, Trace elements, Regulations, Technology,

Dusts, Winds, Performance evaluation, Concentration(Composition), Reprints, *Air quality, Inadequate instrumentation, *Significant deterioration(Air pollution), *Air pollution sampling.

Current reference methods for ambient sulfur dioxide (SO2) and particulates are limited in their ability to measure the small incremental increases in these pollutants allowed by Significant Deterioration regulations. The Pararosaniline Method for SO2 has inadequate sensitivity and the High-Volume Particulate Method gives misleading results in remote areas where wind-blown dusts are prevalent. Advanced methods which overcome these limitations are discussed.

709,093
PB-274 330/0 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C.
Physical Properties of Smokes Pertinent to Smoke Detector Technology.
Final rept.,
T. G. K. Lee, and G. Mulholland. Nov 77, 47p
NBSIR-77-1312

Keywords: *Aerosols, *Smoke, Physical properties, Air pollution, Gas detectors, Concentration(Composition), Particle size distribution, Monitors, Heptane, Cellulosic resins, Performance evaluation, Mass, Pyrolysis, Aging(Materials), Design criteria, *Smoke detectors, *Air pollution detection.

Several commercially available aerosol instruments including the electrical aerosol analyzer, nuclei condensation monitor, quartz mass monitor, and optical particle counter were used to measure particle size distribution of smokes from burning heptane and cellulosic materials. Some limitations of these instruments are discussed. Parameters such as mode of exposure (flaming versus smoldering), pyrolysis temperature, air velocity at smoke emitting site, and aging were found to have a large effect on the smoke particle size distribution. Mass and number concentrations of smokes from cotton lamp wick as a function of smoke obscuration in the standard UL 217 detector test chamber were determined. The maximum alarm threshold obscuration of 0.06 OD/m (4% per ft), required for detector approval, was found to correspond to lamp wick aerosol mass concentration of 40 mg/cu m and particle concentration of about 4,000,000/cc with the peak size in the number distribution of about 0.15 micrometer. The present UL 217 test method was shown to be affected by smoke coagulation and did not provide a complete measure of sensitivity in smoke detectors. An algebraic model size distribution, with number and mass concentration the only free parameters, was shown to provide a good estimate for all the smoke size distributions measured.

709,094
PB-276 102/1 PC **A04**/MF **A01**
York Research Corp., Stamford, Conn.
Exhaust Emission Evaluation of Three Caterpillar Tractor D-398 Diesel-Electric Sets.
Final rept.,
C. E. Kitson, and R. S. Egdall. Nov 77, 73p Y-7881, NBS/GCR-77-104
Grant NBS-2-35932
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Energy, Building Technology, and Standards Div. Previously announced as PB-274 387. Pub. as HUD Utilities Demonstration Series Volume 14.

Keywords: *Diesel engines, *Exhaust emissions, Concentration(Composition), Sampling, Air pollution, Particles, Carbon monoxide, Nitrogen oxides, Hydrocarbons, Particles, Tables(Data), Carbon dioxide, Oxygen, Tests, *Air pollution sampling.

Gaseous and particulate emissions testing was conducted on three Caterpillar D-398 600 kW-rated generator sets at varying operating loads which included 0%, 20%, 40%, 59%, 79%, 100%, and 110%. These engines were designed to provide the dual functions of electric generation, and heat supply through exhaust heat exchangers. Water jacket cooling water temperatures were maintained at two levels depending on engine load; i.e., = or < 200 degrees F at loads of 100% and 110%, and < 228 degrees F at 79% and below. Measured parameters included carbon monoxide, nitrogen oxides, hydrocarbons, and particulate matter. The measurement techniques and resulting emission data are presented herein. (Portions of this document are not fully legible)

709,095
PB-280 469/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Detection and Quantitation in X-Ray Fluorescence Spectrometry.
Final rept.,
L. A. Currie. 1977, 18p
Pub. in X-Ray Fluorescence Analysis of Environmental Samples, Chapter 25, p289-306 1977.

Keywords: *X ray fluorescence, *Gas analysis, X ray analysis, Chemical analysis, Air pollution, Trace elements, Particles, Error analysis, Sampling, Reprints, *Air pollution detection.

Detection and quantitation limits may be computed for x-ray fluorescence (XRF) measurements given the assumption of normal, random errors, an estimate of the standard deviation of the blank, and the sensitivity (calibration) function. Comparison of XRF techniques may be made numerically or by a graphical approach in which reduced concentration (signal/background) is plotted vs background counts; this results in a single family of curves which are independent of time, sensitivity or background rate. Both approaches have been illustrated for four XRF methods for potassium. Background equivalent concentration (BEC) and signal/background at the detection limit (r sub D) have proved helpful in considering sensitivity to non-Poisson variations. Factors such as sampling errors, chemical recovery, interference and contamination, matrix absorption and scattering and data reduction models all pose limitations to the above assumptions. Assessment of imprecision via replication, and assessment of bias via intercomparison yields information concerning the range over which the Poisson assumption may be safely applied. The above criteria were applied to the evaluation of measurement adequacy for nine trace elements appearing in typical urban particles.

709,096
PB-280 598/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Differential Thermoanalysis (DTA) Survey Method for Traces of Chrysotile Asbestos.
Final rept.,
O. Menis, J. A. Mackey, and P. D. Garn. 1978, 5p
Pub. in Proceedings of Joint Conference on Sensing of Environmental Pollutants (4th), New Orleans, La., Nov 7-10, 1977, p899-903 1978.

Keywords: *Serpentine, *Asbestos, *Differential thermal analysis, Air pollution, Monitors, Design criteria, Performance evaluation, Air pollution sampling.

A practical survey method was developed for chrysotile asbestos by an improved design of the differential thermoanalytical instrument and a modified procedure. Under the new condition, the measurement of the endothermic peak area of the hydroxylation of chrysotile at 640C region provides a selective and sensitive method for traces of this asbestos form. The method distinguishes between chrysotile and amphiboles. The proposed approach should provide a potentially objective, efficient and inexpensive survey method.

709,097
PB-281 359/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultraviolet Photometer for Ozone Calibration.
Final rept.,
A. M. Bass, A. E. Ledford, and J. K. Whittaker. Jan 77, 5p
Pub. in Proceedings of International Conference on Photochemical Oxidant Pollution and Its Control, Research Triangle Park, N.C. 12-17 Sep 76, rept. no. EPA/600/3-77/001a, Ecological Research Series, v1 p13-17 Jan 77. (Environmental Sciences Research Lab., Research Triangle Park, N.C.).

Keywords: *Photometers, *Ozone, *Gas analysis, Ultraviolet radiation, Air pollution, Chemical analysis, Design criteria, Performance evaluation, Monitoring, *Air pollution detection.

In order to provide a facility for photometric ozone measurements, the authors have designed and constructed a double-beam photometer for ozone concentrations in the range 0.025 - 1.0 ppm. The sample path length in this instrument is approximately 300 cm. The instrument measures changes in ozonized-air sample transmissions of mercury radiation at 253.7 nanometers where the photo-absorption cross-section of ozone has been well determined. Radiation at wavelengths other than 253.7 nanometers from the mercury lamp is removed by passing the light through a narrow-band interference filter. The light is collimated and passed through a beam splitter which directs approximately equal intensity beams through the two cells. Clean air flows through one cell into the ozone generator and then the ozonized air flows through the second cell. The light beams are recombined on the face of a photomultiplier tube used in the photon counting mode. A rotating chopper allows the two beams to be detected sequentially so that the transmissions of the two cells may be directly observed. Tests indicate that measurements may be made at the 0.05 ppm level with a precision of 10% or better.

709,098
PB-281 438/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chemical Identification of Airborne Particulates by Laser Raman Spectroscopy.
Final rept.,
E. S. Etz, W. C. Cunningham, and G. J. Rosasco. Nov 76, 3p
Pub. in Proceedings of 1976 Federation of Analytical Chemistry and Spectroscopy Societies, Philadelphia, Pa. 15-19 Nov 76 (Abstract only), 1976 FACSS Abstracts, Paper-246 Nov 76.

Keywords: *Gas analysis, *Particles, Chemical analysis, Air pollution, Raman spectroscopy, Sulfates, Inorganic phosphates, Nitrates, Carbonates, Urban areas, Dust, Electric power plants, *Air pollution detection, Laser raman spectroscopy.

A recently developed micro-Raman spectrometer has been applied to the study of individual micro-particles of environmental significance. Detection and identification via the Raman spectrum is demonstrated for a variety of inorganic sulfate, phosphate, nitrate and carbonate micro-particles derived from laboratory quality materials. Preliminary results on the analysis of individual particles from urban dusts and power plant emissions are also discussed.

709,099
PB-281 439/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chemical Identification of Airborne Particles by Laser Raman Spectroscopy.
Final rept.,
E. S. Etz, G. J. Rosasco, and W. C. Cunningham. 1977, 46p
Pub. in Environmental Analysis, p295-340 1977.

Keywords: *Gas analysis, *Particles, Chemical analysis, Raman spectroscopy, Sulfur inorganic compounds, Air pollution, Sampling, Aerosols, Reprints, *Air pollution detection, Laser Raman spectroscopy.

Single, micrometer-size particles are routinely analyzed for molecular constituents in a recently developed Raman microprobe. Identification as to the principal molecular species present in such samples is made on the basis of the recorded Raman spectrum. Considerations important to successful analysis of microparticles by Raman spectroscopy and the unique aspects of the design of the new microprobe are described. Present capabilities for the detection and identification of various types of environmentally significant species are demonstrated. Raman spectra are discussed for single particles, down to 1 micrometers in size, of common inorganic compounds, minerals and selected organic compounds. Emphasis is placed on the speciation of sulfur (e.g., HSO4(-), SO4(-2), SO3(-2)) in microparticles.

709,100
PB-281 627/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement Standards for Air Pollution Monitoring and Control Associated with Energy Production.
Final rept.,
W. H. Kirchhoff. Nov 77, 2p
Sponsored in part by Environmental Protection Agency, Washington, D.C.
Pub. in Proceedings of National Conference on Interagency/Environmental Research and Development, (2nd), Washington, D.C. 6-7 Jun 77 p425-426 Nov 77.

Keywords: *Gas analysis, *Standards, Energy consumption, Air pollution, Particles, Concentration(Composition), Chemical analysis, Monitoring, Laboratory equipment, Gas detectors, Sulfur di-

oxide, Nitrogen dioxide, Carbon monoxide, *Standard reference materials, *Air pollution detection.

A new instrument for monitoring atmospheric particulates containing sulfur has been developed which combines electrostatic precipitation with flame photometric detection as its principle of operation. Standard Reference Materials (SRM's) applicable to the measurement of stack concentrations of SO2 have been developed and progress has been made on similar standards for NO2. SRM's for CO in air in the concentration range of 10 to 50 ppm are also near completion. Methods are being investigated to develop SRM's for the X-ray fluorescence analysis of particulates on filter papers. To this end, techniques for fabricating glass microspheres of known composition have been developed and sputtering techniques for producing thin films of known composition have been investigated.

709,101
PB-282 905/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stopped-Flow Study of the Gas-Phase Reaction of Ozone with Organic Sulfides: Dimethyl Sulfide.
Final rept.,
R. I. Martinez, and J. T. Herron. 1978, 20p
Pub. in International Jnl. of Chemical Kinetics, v10 p433-452 1978.

Keywords: *Ozone, *Air pollution, Sulfur organic compounds, Formaldehyde, Water, Carbon monoxide, Sulfur dioxide, Reaction kinetics, Concentration(Composition), Atmospheric composition, Free radicals, *Sulfide/dimethyl, *Atmospheric chemistry, Reprints.

The autoinhibiting reaction of ozone with dimethyl sulfide (DMS), DMS + O3 yields products (1) has been studied at 296K and 1.1 kPa (8 torr) as a function of the concentrations of both reactants. The major products of the reaction are H2CO, H2O, CO, and SO2. The specific rate of primary attack of O3 on DMS is immeasurably slow. It is suggested that the rapid overall rate observed for this reaction is due to a chain reaction initiated by the very slow primary reaction. It is concluded that reaction (1) cannot be important under atmospheric conditions and that the major loss process for DMS in the atmosphere is probably reaction with photochemically generated free radicals.

709,102
PB-282 939/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Observation of the Raman Effect from Small, Single Particles: Its Use in the Chemical Identification of Airborne Particulates.
Final rept.,
E. S. Etz, G. J. Rosasco, and J. J. Blaha. Apr 78, 44p
Pub. in Environmental Pollutants, pp. 413-456.

Keywords: *Gas analysis, *Particles, *Probes, *Raman spectroscopy, Chemical analysis, Samples, Sulfur inorganic compounds, Nitrogen inorganic compounds, Carbon, Vanadium oxides, Silicates, Chlorine organic compounds, Hydrocarbons, Electric power plants, Industrial wastes, Combustion products, Pesticides, *Air pollution detection, Oil fired power plants, Reprints.

A Raman microprobe developed at NBS is used to observe the normal Raman effect from single microparticles of size 1 micrometer and larger. The instrument and technique are applied to molecular microanalysis of individual particles in various types of environmental particulate samples. Results are discussed on the detection and identification of major constituents of particles in the primary size fraction (2 micrometers) of ambient air particulate dusts. These include the speciation of inorganic sulfur (e.g., SO4(-2) and nitrogen NO3(-) compounds and the detection of a form of environmental carbon (e.g., soot) or residual hydrocarbon matter as a common material found with airborne particles. In micro-mineralogical studies performed with the Raman microprobe, a number of chain-and sheet silicates are investigated in the form of fibrous and nonfibrous microparticles. A third application of the probe has involved the molecular characterization of particulate emissions from oil-fired power plants. Raman spectra observed from single microcrystals formed on the collection substrate show vanadium pentoxide (V2O5) as a principal molecular constituent of the stack emissions. Finally, the extension of the technique to the analysis of microparticulate organic pollutants is discussed and identification of microparticulate chlorocarbon pesticides is demonstrated. Prospects for future work in the application of the probe are outlined as the more important limitations of the technique are noted.

709,103
PB-284 624/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Secondary Ion Mass Spectrometry for Particulate Analysis.
Final rept.,
D. E. Newbury. 1977, 32p
Pub. in Proceedings Intern. Conf. on Environmental Toxicity (10th), Held at Rochester, New York on May 23-25, 1977. Paper in Environmental Pollutants, v13 p317-348 1977.

Keywords: *Chemical analysis, *Particles, *Mass spectroscopy, Surfaces, Air pollution, Lead(Metal), Hydrogen, Barium, *Air pollution detection, Secondary ion mass spectroscopy.

Analysis of individual environmental particulates can be carried out by secondary ion mass spectrometry (SIMS). Information can be gained on all elements in the sample, including hydrogen. The analysis can be confined to a thin surface layer, and the distribution in depth of elements can be determined. In special cases, information on molecular constituents in the sample can be obtained. Through the use of empirical procedures based on the determination of relative elemental sensitivity factors, quantitative analysis can be carried out with relative errors less than a factor of two in most cases. Detection limits for a wide variety of elements in an oxidized matrix range from 0.1-100 ppm when the analyzed volume is of the order of one micrometer diameter and 10 nm deep. Examples of positive and negative SIMS spectra from urban particulates show a great number of elements present. An elemental depth distribution from an individual particle showed a marked surface predominance of elements such as lead and barium.

709,104
PB-286 534/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy-Dispersive X-Ray Spectrometric Analysis of Environmental Samples After Borate Fusion.
Final rept.,
P. A. Pella, K. E. Lorber, and K. F. J. Heinrich. Aug 78, 4p
Pub. in Jnl. Anal. Chem., v50 n9 p1268-1271, Aug 78.

Keywords: *X ray analysis, *Fly ash, *Particles, *Gas analysis, Chemical analysis, Borates, Fusion, Samples, Concentration(Composition), Air pollution, *Energy dispersive x ray spectrometry, *Air pollution detection, Reprints, Procedures.

In order to overcome particle-size and sample inhomogeneity effects in the analysis of environmental samples by energy-dispersive x-ray spectrometry, an automated borate fusion procedure was investigated and applied to the analysis of NBS-SRM 1633 Fly Ash and NBS-SRM 1648 Particulate Matter. Twelve elements in each sample were determined and the results are in agreement with NBS certified values and/or those of other workers, usually within + or minus 5 to 10% for most elements over the concentration range from 70 ppm to 15%. Fly Ash samples were fused with the heavy absorbers La2O3 or WO3 and analyzed using a linear calibration curve, assuming no matrix effects. The particulate samples, however, were fused with lithium tetraborate only and the data were corrected for x-ray absorption and K x-ray line interferences by a NBS mathematical procedure. The limits of detection of this procedure for most of the elements analyzed in the sample were between 10 to 100 ppm.

709,105
PB-286 791/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Raman Microprobe Characterization of Residual Carbonaceous Material from Urban Airborne Particulates.
Final rept.,
J. J. Blaha, G. J. Rosasco, and I. S. Etz. 1978, 6p
Pub. in Applied Spectroscopy, v32, no. 3, p292-297 (1978).

Keywords: *Gas analysis, *Particles, *Raman spectroscopy, Microanalysis, Chemical analysis, Carbon, *Air pollution detection, Matrix isolation technique, Reprints.

Analyses of individual urban airborne particulates were conducted in the Raman microprobe. In addition to the spectral features characteristic of the particle, two features at about 1350 and about 1600/cm have been observed. The appearance of these bands is found to vary as a function of the laser irradiance. By modeling experiments, it is demonstrated that these two bands can be explained by the presence of carbon in a form analogous to polycrystalline graphite. In air particulates the source of the carbon can be either 'graphitic soot' or an organic 'contaminant' which converts to polycrystalline graphite upon exposure to the laser beam.

709,106
PB-286 941/0 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Analytical Chemistry Div.
Chemical Analysis of Stationary Source Particulate Pollutants by Micro-Raman Spectroscopy.
Interim rept. Apr 76-Mar 77.
E. S. Etz, G. J. Rosasco, and K. F. J. Heinrich. Aug 78, 44p EPA/600/2-78/193

Keywords: *Gas analysis, *Particles, *Raman spectroscopy, Chemical analysis, Sulfates, Inorganic nitrates, Carbonates, Oxides, Electric power plants, Industrial wastes, Combustion products, Vanadium oxides, Fly ash, Design criteria, Performance evaluation, Air pollution, Stationary sources, *Coal fired power plants, *Oil fired power plants, *Air pollution detection.

Analytical capability to identify the principal molecular species present in microparticles is demonstrated on the basis of Raman spectra of selected compounds and materials. Among the inorganic species studied are sulfates, nitrates, carbonates and oxides, for which Raman spectra are discussed for single, solid particles of size down to 1 micrometer. The method of micro-Raman analysis is applied to the molecular characterization of individual microparticles from power plant emissions. Raman spectra have been obtained from microparticles of oil-fired power plant emissions collected by the EPA with cascade impaction samplers. Vanadium pentoxide, V2O5, has been identified as a major component of microparticles present in such samples. The presence of certain other vanadium containing species such as vanadyl, VO(+2), and orthovanadate, VO4(-3), is not indicated from the results of these measurements. Other Raman spectra show evidence of crystalline sulfate, SO4(-2), as a species present in major proportions. However, the exact nature of the associated cation specie(s) has not been determined. Many of the spectra obtained from fly ash particles show Raman bands characteristic of polycrystalline graphite apparently due to the presence of carbonaceous material associated with the particles.

709,107
PB-287 493/1 PC **A17**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.
Air and Water Pollution--Annual Report, FY 74-76.
Technical note.
W. H. Kirchhoff, and E. Myers. Oct 78, 390p NBS-TN-963

Keywords: *Air pollution, *Water pollution, *Chemical analysis, Photometry, Monitors, Radioactive contaminants, Standards, Concentration(Composition), Physical properties, Chemical properties, Mathematical models, Polymers, Nitrogen oxide(NO), Fluorescence, Reaction kinetics, Exhaust emissions, Infrared spectroscopy, Gas analysis, Water analysis, Photochemistry, Fossil fuels, Calibrating, Decomposition, Laboratory equipment, Lead(Metal), Hydrocarbons, Isotopic labeling, Neutron activation analysis, X ray analysis, Dust, Mass spectroscopy, Particles, Light scattering, Trace elements, Mercury(Metal), Heavy metals, Sediments, Marine atmospheres, DDT, Standard reference materials, *Air pollution detection, Freons, Chlorine atoms, Atmospheric chemistry, *Water pollution detection, Procedures.

The projects covered in this report deal specifically with the following: Air--Research leading to development of SRM's (Standard Reference Materials) or other means for ensuring the accuracy of air measurement methods; Development of laboratory methods with improved accuracy, sensitivity and specificity for air pollution measurements; Generation, evaluation, compilation and dissemination of data and technical information needed to relate the substances emitted from sources of pollution to those found in the atmosphere after chemical reactions have occurred. Water--Evaluation of the accuracy of methods for measuring water velocity and flow in open and closed channels;

Development of radioactivity standards; Development of Standard Reference Materials for evaluating the accuracy of instruments and methods for measuring the concentration of pollutants in water and sediments; Measurement evaluation and compilation of physical and chemical properties of known pollutants.

709,108
PB-289 966/4 PC **A03**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.
Interagency Comparison of Ultraviolet Photometric Standards for Measuring Ozone Concentrations.
J. Wendt, J. Kowalski, A. M. Bass, C. Ellis, and M. Patapoff. Dec 78, 30p NBS-SP-529
Prepared in cooperation with California State Air Resources Board, Sacramento, Environmental Protection Agency, Research Triangle Park, NC., and Jet Propulsion Lab., Pasadena, CA. Library of Congress Catalog Card no. 78-600126.

Keywords: *Ozone, *Gas analysis, *Spectrophotometers, *Ultraviolet spectroscopy, Monitoring, Chemical analysis, Concentration(Composition), Design criteria, Air pollution, Comparison, Performance evaluation, *Air pollution detection.

In August 1977, an interlaboratory comparison study was initiated after the California Air Resources Board and the Environmental Protection Agency, Research Triangle Park independently designed and constructed ozone absolute ultraviolet photometers. These units augmented the photometers already designed and in use by the National Bureau of Standards and the Jet Propulsion Laboratory. Previous ozone comparisons involving indometry, ultraviolet photometry and gas phase titration have reported results differing by as much as + or - 30%. The protocol of this study, was a multipoint comparison using the NBS photometer as the standard. The results of the data analysis indicate excellent agreement with a total variation of 2.8%. Compared to the NBS photometer the EPA-RTP photometer read 1.3% low, the JPL photometer read 1.5% high, and the ARB photometer read 0.4% low. The correlation coefficients of the same data sets were 1.0000, 1.0000, and 0.9999 respectively.

709,109
PB-299 439/0 PC **A06**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.
Chemical Kinetic Data Needs for Modeling the Lower Troposphere.
Final rept.
J. T. Herron, R. E. Huie, and J. A. Hodgeson. Aug 79, 111p NBS-SP-557
Library of Congress catalog card no. 79-600125. Proceedings of a Workshop held at Reston, Virginia on May 15-17, 1978. Sponsored in part by Environmental Protection Agency, Research Triangle Park, NC.

Keywords: *Air pollution, *Troposphere, *Reaction kinetics, *Mathematical models, *Meetings, Chemical reactions, Ozone, Aldehydes, Free radicals, Nitrogen oxides, Sulfur oxides, Aldehydes, Alkene hydrocarbons, Aromatic compounds, Atmospheric models, Homogeneous reactions, Atmospheric chemistry, Hydroxyl radicals.

This is a report of the proceedings of a workshop on chemical kinetic data needs for modeling the lower troposphere, held at Reston, Virginia, May 15-17, 1978. The meeting focussed on six key problem areas in tropospheric chemistry: reactions of olefins with hydroxyl radicals and ozone, reactions of aldehydes, free radical reactions, reactions of oxides of nitrogen, reactions of aromatic compounds, and reactions of oxides of sulfur. The report includes a summary and list of major recommendations for further work, review papers, discussion summaries, contributed comments, recommendations, and an attendance list.

709,110
PB-300 835/6 PC **A06**/MF **A01**
Urban Inst., Washington, DC.
Balancing the Objectives of Clean Air and Economic Growth: Regulated Markets in Emission Reductions.
Interim rept.
W. A. Foskett, D. M. Klaus, and J. Haberle. Jun 79, 105p NBS/GCR/ETIP-79/62
Contract NBS-7-35822

Keywords: *Air pollution, *Economic development, Regulations, Legislation, Technology innovation, Incentives, Economic impact, Government policies, Emission, Economic factors, Organization theory, Resource allocation.

The document reports work in progress toward the evaluation of implementation and effects of market mechanisms for regulation of major stationary sources of air pollution. The first chapter introduces and synopsizes the report. The second chapter describes the context in which market mechanisms are being introduced. The third chapter discusses the underlying logic of various market mechanisms and an operating prototype of a market mechanism. The fourth chapter discusses potential effects of market mechanisms on air pollution regulation. The fifth chapter reports expectations associated with EPA's introduction of a prototype market mechanism offset policy. Chapter six describes the general direction of continuing work on this particular project.

709,111
PB80-114176 Not available NTIS
National Bureau of Standards, Washington, DC.
Trace Element Characterization of the NBS Urban Particulate Matter Standard Reference Material by Instrumental Neutron Activation Analysis.
Final rept.,
R. R. Greenberg. Oct 79, 3p
Pub. in Analytical Chemistry 51, n12, p2004-2006, Oct 79.

Keywords: *Chemical analysis, *Particles, *Neutron activation analysis, *Trace elements, Performance evaluation, Urban areas, Laboratory equipment, Error analysis, Air pollution, Reprints, *Standard reference materials, *Air pollution detection.

The Urban Particulate Matter, SRM 1648, recently prepared by the National Bureau of Standards, with partial support from the Environmental Protection Agency, has been analyzed by instrumental neutron activation (INAA) for 32 elements. Special attention has been given to reducing and evaluating the analytical errors. SRM 1632, Trace Elements In Coal, was also analyzed and the results were compared with literature and NBS certified values.

709,112
PB80-119134 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser-Raman Microprobe Analysis of Particles in Pollution Studies.
Final rept.,
E. S. Etz, and J. J. Blaha. Nov 79, 2p
Pub. in Transactions of the American Nuclear Society 33, p241-242, Nov 79.

Keywords: *Gas analysis, *Raman spectroscopy, *Particles, *Probes, *Microanalysis, Chemical analysis, Air pollution, Samples, Laboratory equipment, *Air pollution detection.

The paper refers to ongoing work at the National Bureau of Standards in the application of Raman microprobe spectroscopy to the molecular analysis of single particles in pollution particulate samples. Results of NBS research in the analysis of particles from power plant emissions are presented. Discussed are the chief attributes and limitations of Raman microanalysis as well as instrumentation developed at NBS and elsewhere.

709,113
PB80-165558 Not available NTIS
National Bureau of Standards, Washington, DC.
Ventilation Measurements in the Norris Cotton Federal Office Building in Manchester, NH.
Final rept.,
C. M. Hunt. Jun 79, 12p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the ASHRAE Semi Annual Meeting Symposium on Air Leakage, Philadelphia, Pennsylvania, January 1979, ASHRAE Trans. 85, pt. 1, p828-839, Jun 79.

Keywords: *Ventilation, *Meetings, *Buildings, Air circulation, Environmental engineering, Measurement, Concentration(Composition), Carbon dioxide, Winter, Manchester(New Hampshire).

Winter ventilation measurements were made in the Norris Cotton Building in Manchester, N.H. Air exchange rates, averaged for the entire building, were of the order of 0.7 to 0.8 air changes per hour by the SF6 tracer techniques. This was obtained with outside air dampers closed. From this estimate and from counts of the number of occupants, ventilation rates of the order of 41 to 58 cfm (0.95 to 1.34 cu. m/min) per person were calculated. The use of measured CO2 concentration as an index of ventilation was reexamined. About 65 percent of the concentrations in selected rooms on each floor were between 700 and 1,200 ppm. In one room where 11 people were taking an examination, 2440 ppm CO2 was found. Ventilation rates per person, calculated from CO2 concentrations, were less than those estimated from the overall building ventilation rate, but nevertheless met the requirements in the ASHRAE Ventilation Standard 62-73 when the building was operated with the outside air dampers closed.

709,114
PB80-186083 PC **A03**/MF **A01**
Performance Development Inst., Washington, DC.
Market Mechanisms for Emission Regulation and Enforcement of Emission Limits: Deterrence and Demand.
W. H. Foskett. May 80, 32p NBS-GCR-ETIP-80-87

Keywords: *Air pollution, *Regulations, Law enforcement, Marketing, Economic analysis, Stationary sources.

This report focuses on the necessity of strong enforcement of air pollution emission limits for the creation of a marketplace demand for market mechanisms, such as offsets. Both trading and direct pricing types of market mechanisms for stationary source emission reduction will require strong, even enforcement of individual source emission limits. Enforcement will likewise influence the degree to which the private sector will organize and invest in the research and development work underlying technological innovation in air pollution control. Present enforcement inconsistencies, such as those among regional offices, and remedial actions are noted. If an EPA effort to strengthen detection of violations can be successfully implemented, its effect on a regulatee's perceived probability of getting caught could contribute to market participation. If the probability of detection and penalty is high, purchase of emission reductions on the market may be a more appealing alternative to regulatees than evasion or litigation.

709,115
PB80-187610 PC **A03**/MF **A01**
Performance Development Inst., Washington, DC.
Incentives for Technological Innovation in Air Pollution Reduction: An ETIP Policy Research Series. Volume 1: Emission Offset Policy at Work: A Summary Analysis of Eight Cases.
Final rept.,
W. H. Foskett. Apr 80, 50p NBS-GCR-ETIP-80-86
Contract NBS-78-3603

Keywords: *Air pollution, *Regulations, Mathematical models, Trends, Management planning, State government, Industrial wastes, Stationary sources.

The Emission Offset Interpretative Ruling of 1976 is analyzed into its administrative components. Eight permit applications involving emission offsets provide data describing the administrative functioning of the offset policy in terms of these components. In the eight cases presented here, offsets were easy to find, but the process for determining Lowest Achievable Emission Reduction (LAER) was typically quite complex. Offsets were not bought and sold in any of these cases. Third parties promoting local economic development were an important factor in locating offsets. In these eight cases, technological innovation involved development of new control techniques and diffusion of known technology to hitherto uncontrolled sources of emissions. 'Technology-forcing' standards, such as LAER, and offset requirements contributed to the development of innovative control techniques.

709,116
PB80-198799 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Kinetic and Photochemical Data for Atmospheric Chemistry Reactions of the Nitrogen Oxides.
Final rept. Jan-Dec 79,
R. F. Hampson. May 80, 95p NBSIR-80-2032
Contract DOT-FA79WAI-005
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.

Keywords: *Air pollution, *Reaction kinetics, *Photochemical reactions, *Nitrogen oxides, *Atmospheric chemistry.

This report contains 24 individual data sheets for thermal and photochemical reactions of importance in the atmospheric chemistry of the nitrogen oxides. For each reaction the available experimental data are summarized and critically evaluated, and a preferred value of the rate coefficient is given. The selection of the preferred value is discussed and an estimate of its accuracy is given. For the photochemical process the data are summarized, and preferred values for the photoabsorption cross section and primary quantum yields are given. These data sheets were prepared by the author for the evaluation by the CODATA Task Group on Chemical Kinetics to be published in the Journal of Physical and Chemical Reference Data.

709,117
PB80-203730 PC **A04**/MF **A01**
Performance Development Inst., Washington, DC.
Analysis of the Rationale and Public Comment Regarding EPA's Proposed Regulation on Regional Consistency.
Final rept.,
J. Evans, and W. H. Foskett. May 80, 62p NBS-GCR-ETIP-80-89
Contract NBS-78-3603
See also Volume 1, PB80-187610.

Keywords: *Air pollution abatement, *Regulations, Legislation, Incentives, Public opinion, Regional planning, Consistency, *Clean Air Act Amendments of 1977, Environmental Protection Agency, Implementation air pollution planning, Financial incentives, Clean Air Act of 1977.

This report focuses on the proposed regulation for regional consistency in administration of regulations under the Clean Air Act of 1977. The origin of this proposed regulation is described. The proposed regulation is analyzed into logical components which structure a descriptive analysis of its specific administrative provisions. Public comments on the advance notice and subsequent notice of proposed rulemaking are also reviewed and analyzed with reference to the administrative components of the proposed regulation. Copies of the public comments and other pertinent documentation are appended.

709,118
PB80-205024 PC **A06**/MF **A01**
Performance Development Inst., Washington, DC.
Opportunities for Innovation: Administration of Sections 111(j) and 113(d) (4) of the Clean Air Act and Industry's Development of Innovative Control Technology.
Final rept.,
J. Evans. Apr 80, 107p NBS-GCR-ETIP-80-88
Contract NBS-78-3603
See also report dated May 80, PB80-186083.

Keywords: *Air pollution abatement, *Technology innovation, Air pollution control, Legislation, Government policies, National government, Stationary sources, Clean Air Act Amendments of 1977, Financial incentives, Industrial sector.

The report describes the administration of two provisions of the Clean Air Act Amendments of 1977, Section 111(j) and 113(d)(4), which allow short-term emissions violations by companies installing innovative technology for air pollution reduction. The waivers are intended to induce industry to risk development of better air pollution control technology without the fear of prosecution or penalties for emissions violations expected during the debugging of innovative technology. The report has four parts: review of legislation and statutory requirements; review of the administration of these sections as reported by EPA and regulated companies; summary and observations resulting from these reviews; and, presented as an annex, a detailed case study of one Section 111(j) waiver application.

709,119
PB80-205610 PC **A03**/MF **A01**
Performance Development Inst., Washington, DC.
Annotated Bibliography of Literature on Market Mechanisms and Economic Incentives for Environmental Regulation.
Final rept.,
S. Watson. Apr 80, 32p NBS-GCR-ETIP-80-90
Contract NBS-78-3603
See also Volume 2, PB80-186083.

Keywords: *Air pollution abatement, *Bibliographies, *Regulations, Marketing, Economics, Abstracts, Financial incentives, Stationary sources.

This bibliography cites and annotates literature regarding market mechanisms and economic incentives for environmental regulation. References emphasize air pollution and stationary source regulation. Primary attention is given to regulatory tactics that could entail internal or external trading in emission reductions, such as emission fees are included but not emphasized. Scholarly literature as well as government reports and articles from other sources are included in the bibliography.

709,120
PB80-220239 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Development of Potential Thin Standards for Calibration of X-Ray Fluorescence Spectrometry.
Final rept.,
P. A. Pella. Jun 80, 50p EPA-600/7-80-123

Keywords: *Gas analysis, *X ray spectrometers, X ray fluorescence, Standards, Calibrating, Sampling, Thin films, Air pollution, Glass fibers, Chemical analysis, *Air pollution detection.

Thin films containing known concentrations of metals are important for the calibration of X-ray Fluorescence Spectrometry (XRF), especially for the analysis of collected airborne particulate matter. A focused ion-beam sputtering technique has been investigated as a candidate method for fabricating thin glass films containing know concentrations of metals on polycarbonate substrates. Glass targets were fabricated at NBS for these studies, and parameters such as ion-acceleration voltage and ion current were systematically varied to determine any changes in film composition. It was found that rather severe changes in instrumental parameters do not affect the elemental composition of the films appreciably. Up to eight substrates were coated at one time and the compositional reproducibility as measured by XRF for Si, Ca, Zn, and Pb for 13 samples was within five percent relative standard deviation at mass loadings of glass from 160 190 micrograms/cm. Glass films containing phosphorous and sulfur were also prepared to demonstrate the feasibility of preparing glass films containing such elements of low atomic number. Additional studies consisted of the deposition of finely ground synthetic glasses on membrane filters, and the characterization of some selected commercial thin films prepared by thermal evaporation.

709,121
PB81-102923 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Highway Noise Criteria Study: Outdoor/Indoor Noise Isolation.
Final rept.
P. R. Donavan, D. R. Flynn, and S. L. Yaniv. Aug 80, 183p NBS-TN-1113-2

Keywords: *Noise reduction, Measurement, Houses, Criteria, Data, *Highway noise.

This report documents a series of measurements of the outdoor-to-indoor noise isolation provided by nine houses in the Washington, DC. area. These measurements were carried out as part of a large research program developed to identify and quantify the important physical parameters which affect human response to time-varying traffic noise and to investigate various procedures for rating such noise so as to enable reliable predictions of subjective response to the noise. While a small truck was driven past each test house, simultaneous recordings were made of the sound level at three outdoor microphones and at four indoor microphones (three of which were positioned at representative listener positions). These recordings were analyzed to yield one-third octave band sound levels as functions of time and from these levels outdoor-to-indoor level differences were computed. Analyses are given of the influence of different experimental variables. It is found that microphone placement, both indoors and outdoors, is the major source of measurement uncertainty. The data from this study are in good agreement with sound isolation data reported in the literature for houses in colder climates.

709,122
PB81-104416 Not available NTIS
National Bureau of Standards, Washington, DC.
Products of the Reaction of Hydroxyl Radicals with Trans-2-Butene in the Presence of Oxygen and Nitrogen Dioxide.
Final rept.
R. I. Martinez, R. E. Huie, and J. T. Herron. 15 Jun 80, 5p
Pub. in Chem. Phys. Lett., 72 n3 p443-447, 15 Jun 80.

Keywords: *Butenes, *Air pollution, Chemical reaction, Smog, Ozone, Reprints, *Hydroxyl radicals.

The reactions of hydroxy-substituted alkyl radicals, formed as secondary products in the reaction of ozone with trans-2-butene, have been identified in photoionization mass spectrometry studies, using acetaldehyde and nitrogen dioxide as free-radical scavengers. Products derived from 2-hydroxy-1-methylpropyl in the absence of scavengers include 2,3-butanedione(diacetyl),3-hydroxy-w-butanone (acetoin), and 2,3-butanediol. In the presence of added acetaldehyde or nitrogen dioxide, the formation of these products is suppressed. In addition, with added nitrogen dioxide, new products are formed which have been identified as a series of oxalkyl and hydroxy-substituted-alkyl nitrates and preoxynitrates. These observations may have an important bearing on the chemistry of photochemical smog.

709,123
PB81-113144 Not available NTIS
National Bureau of Standards, Washington, DC.
Normal and Reverse-Phase Liquid Chromatographic Separations of Polycyclic Aromatic Hydrocarbons.
Final rept.
S. A. Wise, W. J. Bonnett, and W. E. May. 1980, 16p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the International Symposium on Polynuclear Aromatic Hydrocarbons (4th), Columbus, OH., Oct 4-6, 1979, and Paper in Polynuclear Aromatic Hydrocarbons: Chemistry and Biological Effects, p791-806 1980.

Keywords: *Aromatic polycyclic hydrocarbons, *Gas analysis, Separations, Particles, Air pollution, Chemical analysis, *High performance liquid chromatography, *Air pollution detection.

The high performance liquid chromatographic (HPLC) retention indices, based on polycyclic aromatic hydrocarbon (PAH) standards, are reported for over 80 PAH on two octadecylsilane (C18) reverse phase columns and on an aminosilane (NH2) column. Several C18 reverse phase columns were compared and found to have different selectivities for PAH. Normal phase HPLC on an NH2 column and reverse phase HPLC on a C18 column were utilized to analyze a mixture of PAH extracted from urban air particulates.

709,124
PB81-119414 Not available NTIS
National Bureau of Standards, Washington, DC.
Atmospheric Particulate Measurement Development at the National Bureau of Standards.
Final rept.
W. Cassatt. 1979, 3p
Pub. in Proceedings of the Annual Technical Meeting, 'Learning to Use Our Environment' (25th) Held at Seattle, WA. on April 30-May 2, 1979, p275-277 1979.

Keywords: *Chemical analysis, *Particles, Fines, Standards, Air pollution, Dust, Absorption, Samples, Calibrating, *Air pollution detection, Standard reference materials.

The atmospheric particulate measurement development efforts at the National Bureau of Standards focus upon three areas, namely experimental measurement techniques, Standard Reference Materials (SRM's) and theory. Areas of application that are addressed by Bureau scientists in their atmospheric particulate measurement research include smoke particle characterization, the sizing of particles produced by aerosol generators, the calibration of fine particle detectors, standards for urban dust analysis, chemical characterization of bulk samples or discrete particles collected from atmospheric aerosols, and the investigation of resonance absorption of light by micrometer size particles.

709,125
PB81-119877 Not available NTIS
National Bureau of Standards, Washington, DC.

Analysis of Carbonaceous Particulates and Characterization of Their Sources by Low-Level Radiocarbon Counting and Pyrolysis/Gas Chromatography/Mass Spectrometry.
Final rept.
L. A. Currie, S. M. Kunen, K. J. Voorhees, R. B. Murphy, and W. F. Koch. Jun 79, 13p
Pub. in Proceedings of Conference on Carbonaceous Particles in the Atmosphere, University of California, Berkeley, CA., March 20-22, 1978, 13p Jun 79.

Keywords: *Particles, *Hydrocarbons, *Chemical analysis, Air pollution, Gas chromatography, Mass spectroscopy, Sampling, Pyrolysis, *Indoor air pollution, *Air pollution detection.

The chemical nature and fossil fuel contribution to urban, rural and indoor atmospheric carbonaceous particulate matter has been studied by a combination of pyrolysis/gas chromatography/mass spectrometry, Py/GC/MS and low-level mini-radiocarbon counting. The latter method is applied here for the first time to just milligram amounts of atmospheric particulate material (about 10 mg carbon), and it has shown a striking difference between the biogenic/fossil carbon content of urban and desert samples. Application of Py/GC/MS to the insoluble carbonaceous fraction has provided information on sources and characteristics of the primary carbonaceous material.

709,126
PB81-123622 Not available NTIS
National Bureau of Standards, Washington, DC.
Atmospheric Quenching of Vibrationally Excited 02(1 Delta).
O. Klais, A. H. Laufer, and M. J. Kurylo. Sep 80, 4p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Physics 73, n6 p2696-2699, 15 Sep 80.

Keywords: *Ozone, *Air pollution, *Photolysis, *Oxygen, Reaction kinetics, Absorption spectra, Fluorescence, Reprints, *Atmospheric chemistry.

Flash photolysis of O3 in the Hartley band has been coupled with absorption spectroscopic detection of O2((1) delta, v=0) and resonance fluorescence detection of O((3)p) to analyze the fate of O2((1)delta, v greater than or equal to 1) in an atmospheric environment. The results indicate a rapid vibrational deactivation under atmospheric conditions. The same analysis permits an estimate of the relative quantum yield of O2((1) delta), v greater than or equal to 1) in the photoysis. Similarly, an upper limit for the channel of the O(((1)D) + 0, reaction yielding O2(((1)sigma)) is derived.

709,127
PB81-130189 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Small Radiocarbon Samples: Power of Alternative Methods for Tracing Atmospheric Hydrocarbons.
L. A. Currie, J. E. Noakes, and D. N. Breiter. 1979, 18p
Pub. in Proceedings of the International Conference on Radiocarbon Dating (9th) Held at Los Angeles and La Jolla, CA. on June 28-July 2, 1976, Paper in Radiocarbon Dating, p158-175 1979.

Keywords: *Hydrocarbons, *Air pollution, Dust, Samples, Monitors, *Tracer studies, Liquid scintillation counters, Gas scintillation counters.

The special problem of measuring very small radiocarbon samples arises whenever samples have a high specific 'cost' -- i.e., very limited in supply, or very difficult to collect. One such problem, where collection difficulties are limiting, is the measurement of carbonaceous species in the atmosphere in order to resolve the relative contributions of man and nature. The characteristics of miniature gas proportional and liquid scintillation counters, specially developed for this work, have been evaluated and shown adequate for the measurement of 10 mg of contemporary carbon. A graphical means for assessing the relative performance of an entire set of small counters has been introduced, and used to deduce the equimerit curve for the best gas and liquid scintillation counters. Preliminary results on the carbonaceous fraction of an urban dust sample have been compared with those of earlier workers.

709,128
PB81-135238 Not available NTIS
National Bureau of Standards, Washington, DC.
Raman Microprobe Characterization of South Pole Aerosol.
W. C. Cunningham, E. S. Etz, and W. H. Zoller. 1979, 7p
Prepared in cooperation with Maryland Univ., College Park. Dept. of Chemistry.
Pub. in Proceedings of the Annual Conference of the Microbeam Analysis Society (14th) Held at San Antonio, TX. on Aug 13-17 1979, Paper in Microbeam Analysis 1979, p148-154 1979.

Keywords: *Raman spectroscopy, *Aerosols, *Antarctic regions, Air pollution, Probes, Sampling, Microanalysis, Particles, Sulfur, Concentration(Composition), Chemical analysis, *Laser spectroscopy, *Air pollution detection, *South Pole.

The NBS laser-Raman microprobe has been applied to the study of the major molecular species present in particulate matter from the South Pole atmosphere. Aerosol samples were collected by ground-based equipment for characterization by optical microscopy, SEM/x-ray microanalysis and micro-Raman specroscopy. Most of the aerosol is of submicrometer size and shows high concentrations of sulfur. These results are the first direct indication of acid sulfate species in the Antarctic atmospheric aerosol and support the indirect identifications of these compounds made by other workers.

709,129
PB81-144727 Not available NTIS
National Bureau of Standards, Washington, DC.
Decomposition of N2O Over Particulate Matter.
R. E. Rebbert, and P. Ausloos. Sep 79, 4p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Geophysical Research Letter 5, n9, p761-764 Sep 78.

Keywords: *Nitrogen oxide(N2O), *Decomposition, *Particles, *Air pollution, Surface chemistry, Adsorption, Photochemistry, Troposphere, Sand, Reprints.

Nitrous oxide is shown to undergo both a thermal and a photochemical decomposition at 296 K when it is adsorbed on various dry sands. The photochemical process occurs with light of wavelengths greater than 280 nm where gaseous N2O does not absorb. These results indicate that various types of particulate matter in the troposphere may be responsible for the decomposition of nitrous oxide and hence act as an atmospheric sink for N2O.

709,130
PB81-164469 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Analysis of Mathematical Models of Integrating Monitoring Devices.
Final rept. 1 Feb-30 Jun 76.
R. J. Rubin. Jan 80, 37p NBSIR-80-1975

Keywords: *Mathematical models, *Dosimeters, Gas detectors, Concentration(Composition), Monitoring, Ozone, Sulfur dioxide, Nitrogen dioxide, Carbon monoxide, Solubility, Diffusion coefficient, Air pollution, *Air pollution detection, Numerical solution.

Two mathematical models of a personal monitoring device are analyzed. The purpose of the device, which is to be worn by an individual, is to indicate the level of exposure to various criteria air pollutants such as O3, SO2, NO2, CO during the time period which might range from 24 hours to a week or longer. The goal of the analysis of the models is to determine how the quantity of pollutant which is collected is related to the average pollutant concentration and how material constants such as solubility and diffusion coefficients affect the operation of the device.

709,131
PB81-178782 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Microanalysis of Individual Layered Particles by Secondary Ion Mass Spectrometry.
Final rept.
D. E. Newbury. Jun 80, 70p EPA-600/7-80-122

Keywords: *Air pollution, *Microanalysis, *Particles, Molecular structure, Chemical composition, Sampling, Comparison, Chemical analysis, Glass, *Secondary ion mass spectroscopy, *Air pollution detection.

Secondary ion mass spectrometry is evaluated for application to the determination of the composition and structure of individual particles. Analyses of many elemental constituents at the ppm level can be obtained in individual particles as small as micrometers in diameter. Molecular signals, both organic and inorganic, can be detected from particles above 20 micrometers in diameter. Quantitative analyses of elemental constituents can be made with a relative accuracy of 25 percent by means of empirical relative sensitivity factors and within a factor of two by means of a physical model. Multielement depth profiles can be obtained from individual particles as small as 4 micrometers in diameter. Depth profiles of individual particles from SRM 1648 Urban Air Particulate reveal pronounced surface concentrations of lead and barium. Implementation of SIMS depth profiling requires automation to make use of the full spectral information and to eliminate matrix effects by normalization.

709,132
PB81-218117 PC **A03**/MF **A01**
Performance Development Inst., Washington, DC.
Periodic Review and Technological Escalation of Performance Standards: New Source Performance Standards Review Process.
Interim rept.
W. H. Foskett, and T. Olesen. Dec 80, 43p NBS-GCR-ETIP-81-94
Contract NBS-78-3603
See also Volume 1, PB80-187610.

Keywords: *Air pollution, *Regulations, Industrial wastes, Reviews, Technology, Revisions, *New source performance standards, Clean Air Act.

This study is part of a research series by ETIP about the impacts of air pollution regulation on industrial innovation and creativity. It treats the results of periodic review of standards for new source performance. This review was mandated in order to incorporate technological advances that take place since the standards' original formulation. In fact, the study shows that revisions are seldom made raising the question as to whether technological advances are overlooked or are non-existent.

709,133
PB81-218273 PC **A06**/MF **A01**
Performance Development Inst., Washington, DC.
Controlled Trading and Site-Specific SIP Revisions: Competing for Attention in a Crowded Administrative Route.
Interim rept.
J. Evans. Dec 80, 108p NBS-GCR-ETIP-81-95
Contract NBS-78-3603

Keywords: *Air pollution, *Regulations, Technology, Revisions, *State implementation plan, Clean Air Act.

This report, one of a series of factors regarding the impacts on innovation of new regulatory incentives, deals with the administrative route being followed by 'controlled trading' incentives. The report presents case studies and analysis showing how the success of these new reforms is endangered by the slowness of the administrative route for approval in a State Implementation Plan (SIP).

709,134
PB81-221616 PC **A07**/MF **A01**
Performance Development Inst., Washington, DC.
Innovation by Regulation: The Administration of Control Technology Requirements Under the Clean Air Act.
Interim rept.
W. H. Foskett, A. Jamieson, and J. Evans. Mar 81, 148p NBS-GCR-ETIP-81-93
Contract NBS-78-3603
See also Volume 7, PB81-218117.

Keywords: *Air pollution control, *Regulations, Technology, Forecasting, *Clean Air Act.

This report, one of a series on factors affecting innovation through regulatory reform, presents case histories and analysis regarding the impact on innovation and technology of certain provisions of the Clean Air Act. Since new reforms are built on these requirements, their future is dependent on how they work. The report finds problems in the linkage between the Clean Air Act and industrial innovation.

709,135
PB81-227860 PC **A09**/MF **A01**

National Bureau of Standards, Washington, DC. National Measurement Lab.
Technical Activities of the Office of Environmental Measurements--1980.
W. H. Kirchhoff. May 81, 195p NBSIR-81-2280

Keywords: *Air pollution, *Water pollution, *Standards.

This report summarizes the technical activities of the National Bureau of Standards' Environmental Measurements Program during Fiscal Year 1980. This activities fall into four program categories: (1) Water Measurements - Standards Development; (2) Water Measurements - Methods Development; (3) Air Measurements - Standards Development; (4) Air Measurements - Methods Development.

709,136
PB81-241226 Not available NTIS
National Bureau of Standards, Washington, DC.
Air Infiltration: A Review of Some Existing Measurements Techniques and Data.
Final rept.
C. M. Hunt. Oct 80, 22p
Pub. in Proceedings of Symposium Building Air Change Rate and Infiltration Measurements, Washington, DC., March 12, 1978, American Society for Testing and Materials Special Technical Pub. 719, p3-24 Oct 1980.

Keywords: *Reviews, *Ventilation, Air pollution, Temperature, Sampling, *Air infiltration, *Indoor air pollution, Tracer techniques.

This paper reviews the state of the art in the measurement of ventilation and air infiltration. It considers tracer gas techniques and discusses some of the tracer gases used as well as some of the potential sources of error. It also discusses fan pressurization/evacuation procedures for measuring building tightness and compares fan and tracer measurements. It discusses the ASHRAE crack method. It also considers a number of factors influencing infiltration rates and finally reviews a few of the empirical equations which have been developed to correlate infiltration rate with wind velocity and inside-outside temperature difference.

709,137
PB81-241234 Not available NTIS
National Bureau of Standards, Washington, DC.
Low-Cost Method for Measuring Air Infiltration Rates in a Large Sample of Buildings.
Final rept.
R. A. Grot. Oct 80, 10p
Pub. in Proceedings of Symposium Building Air Change Rate and Infiltration Measurements, Washington, DC., March 12, 1978, American Society for Testing and Materials Special Technical Pub. 719, p50-59 Oct 80.

Keywords: Sampling, Sites, Residential buildings, Cost analysis, Air pollution, *Air infiltration, *Indoor air pollution, Tracer techniques.

A method for collecting air infiltration data in a large sample of dwellings is presented. The method consists of tracer gas dilution technique employing air sample bags which are analyzed in a central laboratory. The method will be applied to a Community Services Administration optimal weatherization demonstration in approximately 300 dwellings at 16 sites throughout the United States. The method will yield air exchange rates under typical heating season conditions for each dwelling in the demonstration. Preliminary data on air infiltration rates in low-income housing in Portland, Maine are presented.

709,138
PB82-127770 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement Assurance Program for Weighings of Respirable Coal Mine Dust Samples at MSHA, Pittsburgh.
Final rept.
P. Parobeck, T. Tomb, H. Ku, and J. Cameron. Jul 81, 9p
Pub. in Jnl. of Quality Technology 13, n3 p157-165 Jul 81.

Keywords: *Dust, *Coal mining, Air pollution, Sampling, Pittsburgh, Concentration(Composition), Reprints, *Indoor air pollution.

A program is presented to control the weighing of respirable coal mine dust samples and to provide information on a continuing basis on the quality of the weighing operation. In addition to the description of such monitoring procedures, measurements are included to check the adequacy of assumptions made about the test items, such as, effects of aging, environmental and other factors related to the handling of the test items. The set of procedures presented in this article provides a measurement assurance program by which the uncertainty attached to each measurement can be scientifically demonstrated. An analysis of data giving the status of the process is presented.

709,139
PB82-184904 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Report on Some Thermodynamic Data for Desulfurization Processes.
Final rept.
V. B. Parker, B. R. Staples, T. L. Jobe, and D. B. Neumann. Sep 81, 91p NBSIR-81-2345
Sponsored in part by Department of Energy, Morgantown, WV. Morgantown Energy Technology Center.

Keywords: *Thermodynamic properties, *Air pollution, Combustion products, Industrial wastes, Tables(Data), Ions, *Flue gas desulfurization, Hydroxyl ions, Sulfur trioxide ions, Hydrogen sulfate ions, Sulfurous acid ions, Hydrogen ions, Manganese ions, Iron ions, Magnesium ions, Calcium ions, Potassium ions.

In this report tables of values of thermochemical properties and processes at 298.15 K for substances of interest to DOE for flue gas desulfurization processes are presented. This work is part of an ongoing evaluation of the various systems of interest. An analysis of the more recent data is underway and these data will be incorporated into tables in a way which will preserve the total unity and consistency of the tables. The substances covered are: (1) the aqueous ions: OH(-), SO3(-2), HSO3(-), SO4(-2), HSO4(-), CO3(-2), HCO3(-), H(+), Mn(+2), Fe(+2), Mg(+2), Ca(+2), Na(+), and K(+), and (2) solid, liquid, aqueous, and gaseous compounds or species formed from these ions.

709,140
PB82-208372 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Experimental Technology Incentives Program.
Internal Offsets and Technological Innovation: Six Case Studies.
M. E. Mogee. Apr 82, 73p NBSIR-82-2475
See also Volume 8, PB81-218273.

Keywords: *Air pollution, *Regulations, Technology, Industrial wastes, *Experimental technology incentives program.

This report describes the experiences of six industrial firms with the new Federal policy of internal offsets. Offsets are part of a group of regulatory reforms initiated by the Environmental Protection Agency and called by the generic title of 'emission trading'. Offsets were introduced to allow continued economic growth in nonattainment areas and to stimulate innovation in pollution control and process technology by making it profitable for firms to create more reductions than the law now requires. The report discusses the problems of defining and measuring innovation as well as presenting industrial firm perceptions of innovation associated with offset cases.

709,141
PB82-234782 Not available NTIS
National Bureau of Standards, Washington, DC.
Mini-Radiocarbon Measurements, Chemical Selectivity, and the Impact of Man on Environmental Pollution and Climate.
Final rept.
L. A. Currie, G. A. Klouda, and J. A. Cooper. 1980, 14p
Pub. in Radiocarbon 22, n2 p349-362 1980.

Keywords: *Air pollution, Aerosols, Particles, Sources, Chemistry, Reprints, Air pollution effects(Humans).

Carbonaceous gases and particles in the atmosphere have serious health effects related to aerosol inhalation and photochemical smog formation. Longer-lived tropospheric species, such as methane, may alter the stratospheric ozone layer; and the trace gases and particles may influence the earth's climate directly through 'greenhouse' and albedo effects or indirectly through cloud nucleation. The objective of the program is to use isotopic and chemical methods of characterization to assess the strengths of the primary sources for these atmospheric contaminants, with special emphasis on the relative importance of anthropogenic and natural emissions, and consequent perturbations of the carbon cycle.

709,142
PB82-236050 Not available NTIS
National Bureau of Standards, Washington, DC.
Assessment of Contemporary Carbon Combustion Source Contributions to Urban Air Particulate Levels Using Carbon-14 Measurements.
Final rept.
J. A. Cooper, L. A. Currie, and G. A. Klouda. Sep 81, 6p
Pub. in Environ. Sci. Technol. v15 n9 p1045-1050 Sep. 81.

Keywords: *Air pollution, *Hydrocarbons, Assessments, Sources, Particles, Urban areas, Reprints, *Air quality, *Tracer techniques.

Measurement of carbon-14 activities with new low-level counting methods have been demonstrated to be an effective tool for assessing the contribution of contemporary carbon sources to the mass collected with typical high volume air samplers.

709,143
PB82-264375 Not available NTIS
National Bureau of Standards, Washington, DC.
Aerosol Characterization of a Smoldering Source.
Final rept.
G. Mulholland, and T. J. Ohlemiller. 1982, 13p
Pub. in Aerosol Science Technology 1, p59-71 1982.

Keywords: *Air pollution, *Aerosols, Smoke, Particle size, Insulation, Cellular materials, Reprints.

The aerosol emitted by a moderately large smoldering combustion source (16 cm in diameter) has been characterized in detail. The fuel is a permeable bed of cellulosic insulation (wood fibers) receiving its primary air supply by flow up from the bottom of the bed while the smolder wave propagates downward. The decreasing aerosol emissions with wave depth or air flow rate are plausibly explained by filtration effects in the smolder bed.

709,144
PB83-134098 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Frequency Measurements on the C10 Fundamental Band.
Final rept.
A. G. Maki, F. J. Lovas, and W. B. Olson. 1982, 9p
Sponsored in part by National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Pub. in Jnl. of Molecular Spectroscopy 92, p410-418 1982.

Keywords: *Air pollution, Chlorine oxides, Molecular energy levels, Infrared spectroscopy, Least squares method, Reprints, *Chlorine monoxide, *Laser spectroscopy, Atmospheric chemistry.

By means of a tunable diode laser, new frequency measurements have been made on the 1-0 band of (35)ClO and (37)ClO in the region from 829 to 881/cm. The new measurements are calibrated against recently measured OCS absorption frequency standards. Measurements on over 40 1-0 band transitions are combined with 2-0 band measurements and with the results of microwave measurements in a least-squares analysis.

709,145
PB83-155580 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Characterization of Air Particulate Material for Polycyclic Aromatic Compounds.
Final rept.
S. A. Wise, C. F. Allen, S. N. Chesler, H. S. Hertz, L. R. Hilpert, W. E. May, R. E. Robbert, and C. R. Vogt. Jan 83, 59p NBSIR-82-2595
Sponsored in part by Environmental Monitoring Systems Lab., Research Triangle Park, NC.

Keywords: *Aromatic polycyclic hydrocarbons, *Particles, *Air pollution, *Gas analysis, Ecology, Public health, Bioassays, Mutagens, Antineoplastic agents, Chemical analysis, Gas chromatography, Mass spectroscopy, Fluorescence, *Air pollution detection, Liquid chromatography.

In studies to evaluate the potential health and ecological effects of atmospheric emissions, bioassays have been employed in conjunction with chemical characterization to correlate mutagenic and/or carcinogenic activity with chemical composition. The complexity of an air particulate extract necessitates the prefractionation of the mixture into suitable subfractures or chemical classes prior to chemical characterization and/or biological testing. The goal of this project was to evaluate such a fractionation scheme for air particulate material with respect to chemical characterization of the various fractions with particular emphasis on the identification of polycyclic aromatic hydrocarbons (PAH). In this study the authors have used three chromatographic approaches to separate, identify, and quantify the complex mixture of PAH extracted from SRM 1649 (Urban Dust/Organics): (1) capillary GC, (2) LC with selective fluorescence detection, and (3) multidimensional chromatographic techniques.

709,146

PB83-162214 Not available NTIS
National Bureau of Standards, Washington, DC.
Certified Reference Materials for Continuous Emission Monitoring.
Final rept.
E. E. Hughes. Jul 82, 4p
Pub. in Proceedings of APCA Specialty Meeting on Continuous Emission Monitoring, Denver, Colorado, November 12, 1981, p708-711 Jul 82.

Keywords: *Standards, *Air pollution, Gas analysis, *Standard reference materials, *Certified reference materials, *Air pollution detection.

The Certified Reference Material Program for gaseous standards jointly developed by the National Bureau of Standards and the Environmental Protection Agency is intended to increase the supply of accurate gas standards for environmental monitoring. The gaseous Certified Reference Materials (CRM's) are gas mixtures prepared and analyzed by specialty gas manufacturers according to guidelines set forth by NBS and the EPA. Certified Reference Materials are prepared at concentrations within + or -1% relative of existing gaseous Standard Reference Materials (SRM's) and are analyzed by comparison to SRM's. Experimental batches of CRM's prepared by two different manufacturers have been evaluated. These CRM's, 50 ppm of carbon monoxide in nitrogen, were found to be stable and homogeneous and the concentration claimed by the manufacturer were confirmed by the independent laboratory. Data from these sets will be presented, demonstrating the rigorous treatment required of the manufacturer and the independent laboratories. Future CRM's will include nitric oxide in nitrogen, sulfur dioxide in nitrogen and propane in air.

709,147

PB83-162230 Not available NTIS
National Bureau of Standards, Washington, DC.
Analytical Methods for the Determination of Polycyclic Aromatic Hydrocarbons on Air Particulate Matter.
Final rept.
S. A. Wise, S. L. Bowie, S. N. Chesler, W. F. Cuthrell, W. E. May, and R. E. Rebbert. 1982, 11p
Sponsored in part by Environmental Protection Agency, Washington, DC.
Pub. in Proceedings of Polynuclear Aromatic Hydrocarbons. International Symposium on Physical and Biological Chemistry, Columbus, Ohio, October 26-29, 1981, p 919-929 1982.

Keywords: *Aromatic polycyclic hydrocarbons, *Chemical analysis, *Air pollution, *Particles, Gas chromatography, Urban areas, *Standard reference materials, *Air pollution detection.

Analytical methods for the determination of polycyclic aromatic hydrocarbons (PAH) on urban air particulate matter are described. These methods consist of extraction, isolation of PAH by normal-phase liquid chromatography (LC) followed by analysis by gas chromatography (GC) and reversed-phase LC. Quantitative results obtained by GC and LC for an air particulate material, which will be issued as a Standard Reference Material, are compared.

709,148

PB83-165019 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
NBS (National Bureau of Standards) Portable Ambient Particulate Sampler.
Final rept.
R. A. Fletcher, and D. S. Bright. Jan 83, 44p NBSIR-82-2561
Sponsored in part by Environmental Monitoring Systems Lab., Research Triangle Park, NC.

Keywords: *Samplers, *Particles, *Air pollution, Portable equipment, Aerosols, Probes, Performance evaluation, Design criteria.

The NBS portable ambient particulate sampler is designed to collect the respirable and inhalable particle size fractions at a sampling rate of 6 L/min for 24 hour sampling periods. Particulates are fractionated and collected by series filtration. The collection efficiency of the inlet is measured by comparison with isokinetic probes in the wind tunnel. The collection efficiency and sampling size characteristics of two small personal cyclone samplers are also reported.

709,149

PB83-242230 PC **A04**/MF **A01**
Woods (James E.), Ames, IA.
NBS (National Bureau of Standards) Workshop: Environmental Control for Archival Records Storage, January 19-20, 1983.
Final rept.
W. B. Johnson, W. P. Lull, C. A. Madson, A. Turk, K. L. Westlin, J. E. Woods, and P. N. Banks. Aug 83, 54p NBS-GCR-83-438
Sponsored in part by General Services Administration, Washington, DC., and National Archives and Records Service, Washington, DC.

Keywords: *Environmental engineering, *Meetings, *Archives, *Records management, Storage, Temperature, Humidity, Performance evaluation, *Air pollution effects(Materials), *Air quality.

A summary of the January 19-20, 1983 National Bureau of Standards Workshop on Environmental Conditions for Archival Records Storage is presented that proposes criteria and addresses control of environmental conditions in spaces used for storage of paper-based archival records. The objectives of the Workshop were to explore rationale for establishing levels of air quality for archival storage and to review equipment technology regarding its capability to provide optimum environmental conditions for archival storage facilities. Methods of thermal and air quality control are discussed and recommendations made for performance evaluation of environmental conditioning systems. Monitoring and assessment procedures to evaluate performance of environmental conditioning systems and components are addressed.

709,150

PB84-107028 Not available NTIS
National Bureau of Standards, Washington, DC.
Production and Fate of Volatile in the Molecular Species Environment: Metals and Metalloids.
Final rept.
F. E. Brinckman, G. J. Olson, and W. P. Iverson. 1982, 19p
Pub. in Atomospheric Chemistry, p231-249.

Keywords: *Metals, *Metalloids, Transport properties, Degradation, Sorption, Thermodynamics, Oxidation reduction reactions, *Air-Water interfaces, *Path of pollutants, Atmospheric chemistry.

Forms of volatile environmental metal (loid)s cannot be predicted from thermodynamic considerations of redox conditions. In their transport to and from the atmosphere, they may be degraded, sorbed, or regenerated by both chemical and biological events at rates largely unknown, though measurable. Trapping and escape of these elements at ubiquitous aquatic surface microlayers can now be reconciled with new progress in correlating molecular geometries with air-water transport and the biogeochemistry of microenvironments.

709,151

PB84-135615 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Measurement of the Concentration of Sulfur Dioxide, Nitrogen Oxides, and Ozone in the National Archives Building.
Final rept.
E. E. Hughes, and R. Myers. Oct 83, 25p NBSIR-83-2767
Sponsored in part by General Services Administration, Washington, DC.

Keywords: *Archives, *Air pollution, Concentration(Composition), Sulfur dioxide, Nitrogen oxides, Ozone, Ventilating systems, *Indoor air pollution, *Air pollution effects(Materials).

Continuous measurements of nitrogen oxides, sulfur dioxide and ozone were made consecutively at locations in the stack areas of the National Archives building in Washington, DC. Similar measurements were made at single locations in the Madison Building of the Library of Congress and the East Wing of the National Gallery of Art. The results indicate that the ventilating system of the National Archives has no effect on the concentration of nitrogen oxides or sulfur dioxide drawn into the building. The results for ozone were inconclusive. The newer ventilating systems of the Madison Building and the East Wing are effective in removing sulfur dioxide but not the oxides of nitrogen.

709,152

PB84-140508 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC.
Characterization of the Chesapeake Bay: A Systematic Analysis of Toxic Trace Elements.
H. M. Kingston, R. R. Greenberg, E. S. Beary, B. R. Hardas, J. R. Moody, T. C. Rains, and W. S. Liggett. Nov 83, 227p NBSIR-83-2698
Sponsored in part by Environmental Protection Agency, Washington, DC.

Keywords: *Water pollution, *Trace elements, *Water analysis, Concentration(Composition), Chemical analysis, Neutron activation analysis, Sampling, Separation, *Chesapeake Bay, *Toxic substances, *Water pollution detection, Graphite furnace atomic spectroscopy.

As part of a multidisciplinary study of the Chesapeake Bay, the National Bureau of Standards (NBS) was asked to develop the techniques and procedures necessary to measure the trace and toxic element concentrations within the water column through the entire length of the Chesapeake Bay. The Inorganic Analytical Research Division of the Center for Analytical Chemistry at NBS has completed the analysis for selected elements (Cd, Ce, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sc, Sn, Th, U, and Zn), including some elements at concentrations consistently below one picogram per milliter (part per trillion).

709,153

PB84-217090 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Fire Research.
Containment of Dioxin Emissions from Refuse Fired Thermal Processing Units: Prospects and Technical Issues.
W. M. Shaub. Apr 84, 151p NBSIR-84-2872

Keywords: *Air pollution control, *Incinerators, *Boilers, *Chemisorption, *Furans, *Solid waste disposal, Feasibility, Field tests, Reaction kinetics, Chemical equilibrium, Chlorine organic compounds, Industrial wastes, Physical properties, Chemical properties, Chemical reactions, Combustion products, *Dioxins, *Polychlorinated dibenzodioxins, Chemical reaction mechanisms, Numerical solution.

This report reviews and addresses the prospects for and technical issues concerned with the utilization of chemisorption as a technique for containment of dioxin emissions from refuse fired thermal processing units. The results developed in this report suggest that containment, through chemisorption of dioxin emissions from refuse fired thermal processing units, may be technically feasible. Suggestions for research objectives and full scale tests are outlined. Refuse fired thermal processing units equipped for energy recovery may be more preferable than those units which are not equipped for energy recovery, if chemisorption occurs more efficiently at temperatures which are substantially lower than furnace gas exit temperatures.

709,154

PB84-217793 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Electrosystems Div.
Electrical Parameters in 60-Hz Biological Exposure Systems and Their Measurement: A Primer.
Final rept.
M. Misakian. Apr 84, 47p NBS/TN-1191
Also available from Supt. of Docs as SN003-003-02581-0. Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Biological effects, *Coronas, Transmission lines, Exposure, Measurement, Electric fields, Magnetic fields, Simulation, Surveys, Air pollution effects.

The report presents material which is intended to provide assistance in the measurement of a number of electrical parameters that are of importance during bioeffects research involving 60-Hz electric and magnetic fields. The parameters that are considered are the electric field strength E, the magnetic induction or flux density B, field uniformity, harmonic content, phase relations between field components, and corona. Descriptions of the fields and methods for their laboratory generation are surveyed. The text is purposely elementary with references provided to aid the interested reader in obtaining a fuller understanding of many of the topics. It is shown that using relatively simple instrumentation, it is possible to characterize reasonably well the electric and magnetic fields used in animal exposure studies.

709,155
PB84-219948 Not available NTIS
National Bureau of Standards, Washington, DC.
Liquid Chromatographic Determination of Polycyclic Aromatic Hydrocarbons in Air Particulate Extracts.
Final rept.
W. E. May, and S. A. Wise. 1984, 8p
Pub. in Analytical Chemistry 56, n2 p225-232 1984.

Keywords: *Aromatic polycyclic hydrocarbons, *Particles, *Chemical analysis, Urban areas, Air pollution, Fluorescence, Exhaust emissions, Chromatographic analysis, Reprints, *Standard reference materials, *Air pollution detection, *Reversed phase liquid chromatography, High performance liquid chromatography, Diesel engine exhaust.

Reversed-phase liquid chromatography (LC) with fluorescence detection was used for the determination of 13 polycyclic aromatic hydrocarbons (PAH) in urban air particulate material as part of the process of certifying this material as Standard Reference Material (SRM) 1649. The fluorescence excitation and emission wavelengths were changed during the chromatographic analysis to optimize the selectivity for Individual PAH. A second approach was employed which involves normal-phase LC on an aminosilane phase to isolate PAH fractions based on the number of aromatic carbons, followed by analysis of these fractions by reversed-phase LC with UV or fluorescence detection. Results obtained by use of these LC methods are compared with results obtained by gas chromatography. Analytical results obtained by using these LC methods are presented for the analysis of a second urban particulate material (SRM 1648) and a diesel exhaust particulate sample.

709,156
PB84-219955 Not available NTIS
National Bureau of Standards, Washington, DC.
Characterization of Polycyclic Aromatic Hydrocarbons in Air Particulate Extracts by Liquid Gas Chromatographic Methods.
Final rept.
W. E. May, S. N. Chesler, H. S. Hertz, L. R. Hilpert, R. E. Rebbert, C. R. Vogt, and S. A. Wise. 1984, 32p
Pub. in Identification and Analysis of Organic Pollutants in Air, Chapter 13, p197-230 1984.

Keywords: *Aromatic polycyclic hydrocarbons, *Particles, *Gas chromatography, *Chemical analysis, Mass spectroscopy, Urban areas, Air pollution, Sulfur organic compounds, Solvent extraction, Reprints, *Standard reference materials, *Air pollution detection.

Liquid chromatographic, gas chromatographic, and gas chromatographic/mass spectrometric methods for the analysis of polynuclear aromatic hydrocarbons (PAH) and polynuclear aromatic sulfur heterocycles (PASH) in an urban air particulate sample are described. Quantitative data derived from the use of two independent solvent extraction schemes will be given for the PAH. Qualitative data is reported for the PASH.

709,157
PB84-222108 Not available NTIS
National Bureau of Standards, Washington, DC.
Recent Indoor Air Quality Research in the United States.
Final rept.
S. Silberstein. 15 Jun 84, 8p
Pub. in Proceedings of Workshop on Indoor Air Quality Energy Conservation, Otaniemi, Finland, June 15, 1984, pIX-1-IX-8.

Keywords: *Air pollution, *Houses, *Office buildings, United States, Research projects, Residential buildings, *Indoor air pollution, *Air quality.

Representative examples of indoor air quality research in the United States are described in order to illustrate recent developments.

709,158
PB84-245869 Not available NTIS
National Bureau of Standards, Washington, DC.
Coagulation of Smoke Aerosol in a Buoyant Plume.
Final rept.
H. R. Baum, and G. W. Mulholland. 1979, 13p
Pub. in Jnl. of Colloid and Interface Science 72, n1 p1-12 1979.

Keywords: *Aerosols, *Coagulation, *Plumes, *Air pollution, Particle size distribution, Smoke, Chimneys, Reprints.

The mechanism of particulate coagulation in a turbulent plume is studied by combining the Morton-Taylor-Turner theory of turbulent buoyant plumes with the present authors earlier analysis of coagulation in a homogeneous system. The conservation of fluid mass, particulate matter, momentum, and energy lead to a set of differential equations for horizontal averages of hydrodynamic quantities. These relations are combined with the horizontally averaged coagulation equation to yield an equation which is transformed to be exactly equivalent to the problem of coagulation in a homogeneous medium. The effective time scale is a known function of the vertical plume height which is determined by solving the plume hydrodynamic equations. This permits the coagulation process in a homogeneous system to be quantitatively related to that in a buoyant plume. Sample calculations are performed illustrating the effects of the initial number and mass concentrations of the particulate, rate of heat release, initial plume momentum, and atmospheric stratification on the aging process. Results indicate that the coagulation process can be 'frozen' if the entrainment of uncontaminated air into the plume sufficiently dilutes the particulate concentration. The parameters controlling the 'freezing' effect are identified and the magnitude of their influence is assessed.

709,159
PB85-104719 Not available NTIS
National Bureau of Standards, Washington, DC.
Gas-Phase Reaction of SO2 with a Criegee Intermediate in the Presence of Water Vapor.
Final rept.
R. I. Martinez, and J. T. Herron. 1981, 14p
Pub. in Jnl. of Environmental Science and Health. Part A: Environmental Science and Engineering 16, n6 p623-636 1981.

Keywords: *Sulfuric acid, *Air pollution control, Sulfur dioxide, Industrial wastes, Combustion products, Flue gases, Electric power plants, Scrubbing, Aerosols, Water vapor, Reprints, *Criegee intermediate, Chemical reaction mechanisms, Flue gas desulfurization.

A reaction scheme is proposed to explain the H2SO4 aerosol formation experimentally observed in O3-alkene-SO2 systems in terms of adduct formation between SO2 and a Criegee intermediate. The reaction scheme also provides the basis for a homogeneous gas-phase flue-gas desulfurization process of great potential utility in that it may greatly facilitate the use of high-sulfur fuels.

709,160
PB85-118321 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Initial Size Distribution on Aerosol Coagulation.
Final rept.
G. W. Mulholland, and H. R. Baum. 1980, 3p
Pub. in Physical Review Letters 45, n9 p761-763 Sep 80.

Keywords: *Aerosols, *Coagulation, *Particles, *Air pollution, Particle size distribution, Smoke, Reprints.

The effect of particle coagulation on an aerosol with a truncated Junge initial size distribution was calculated for arbitrary particle size and time by obtaining an exact analytical solution to the Smoluchowski equation. It is found that for times corresponding to values of the coagulation parameter lambda < 1 there is a memory effect for large particle size and for lambda < 1 the distribution approaches an exponential form. The persistence of a Junge type size distribution for atmospheric aerosols and smoke aerosols is shown to be consistent with coagulation theory.

709,161
PB85-133981 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Procedure for Tristimulus Color Measurements on Building Stone.
L. I. Knab. Oct 84, 30p NBSIR-84/2961
Sponsored in part by National Park Service, Washington, DC.

Keywords: *Building stones, *Colorimetric analysis, *Air pollution, Surfaces, Exposure, Field tests, *Air pollution effects(Materials), *Acid rain.

This report describes a procedure used to measure the color of building stone surfaces using a specific tristimulus colorimeter with three color filters. Color changes are to be monitored during a ten year or more outdoor exposure period to determine the effects of acid rain on stone color. A step-by-step procedure is provided, including equipment calibrations and checks using standard reflectance panels, equipment checks using standard stone surfaces, and color measurements of stone surfaces which are to be, or have been exposed at field sites.

709,162
PB85-140804 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamics Properties of Selected Species for Flue Gas Scrubbing Processes.
Final rept.
B. R. Staples. 1981, 18p
Contract DE-AT21-79MC11593
Pub. in Proceedings of Conference on Flue Gas Desulfurization, Morgantown, West Virginia, November 6-7, 1980, p248-265 1981.

Keywords: *Scrubbing, *Air pollution control, *Thermodynamic properties, Flue gases, Activity coefficient, Enthalpy, Entropy, Solutions, Gibbs free energy, Cations, Anions, Chemical reactions, Flue gas desulfurization.

A critically evaluated and self consistent data base is needed for the thermodynamic properties (delta H, delta G, delta S, delta Cp, gamma, phi, K(eq)) of chemical species important in flue gas desulfurization systems. Such a data base can form the foundation for the design of flue gas washing units and the modeling and predictive schemes used to describe the chemical processes and speciation occurring in these units. The evaluation of the thermodynamic properties of SO2, CO2, and for compounds formed from all combinations of the cations of Ca, Mg, Na, K, Fe, and Mn with the anions SO3(-2), HSO3(-1), SO4(-2), HSO4(-1), CO3(-1), HCO3(-1), and OH(-1) is discussed.

709,163
PB85-144905 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Impact of Building Codes and Regulations on Indoor Air Quality.
Final rept.
P. E. McNall. 1984, 5p
Sponsored by American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA.
Pub. in Proceedings of Engineering Foundation Conference on Management of Atmospheres in Tightly Enclosed Spaces, Santa Barbara, CA., October 17-21, 1983, p57-61 Jun 84.

Keywords: *Building codes, *Air pollution, Standards, Design criteria, Ventilation, Regulations, Assessments, *Indoor air pollution, *Air quality.

In the United States there is a comprehensive complex and often inconsistent system of regulations which relates to building design, construction and occupancy. These regulations, in the various states, are examined to assess the technical bases for their ventilation provisions and to determine if they permit innovation in indoor and air quality technology.

709,164
PB85-148039 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Development of Reference Materials for Acid Rain Research.
Final rept.
W. F. Koch, G. Marinenko, and Y. C. Wu. 1984, 5p
Pub. in Environment International 10, p117-121 1984.

Keywords: *Rain, *Air pollution, *Water analysis, Standards, Trace elements, Chemical analysis, Reprints, *Standard reference materials, *Acid rain, *Air pollution detection.

The Center for Analytical Chemistry of the National Bureau of Standards is actively engaged in research to provide the basis for quality assurance in chemical measurements of rain water. Several types of SRM's are currently available which have direct applicability to atmospheric deposition programs. In addition, research is proceeding to develop an SRM specifically for rain-water analyses. Initial attempts, using a single solution containing all the components of rain and stored in glass ampoules, were unsuccessful due to the chemical instability of the solution. Current efforts are directed to improving the stability by using polyethylene bottles to store the solutions, and by preparing two separate solutions, one for the major components of rain (sulfate, nitrate, chloride, sodium, potassium, calcium, magnesium, ammonium, and hydrogen ions), and the other for the trace metals. Preliminary results on the stability of a pilot set of simulated rainwater solutions are encouraging.

709,165
PB85-178309 PC **A02**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Evaluation of Methods Used for the Determination of Acidity in 'Acid Rain' Samples.
G. Marinenko, and W. F. Koch. Mar 85, 19p NBSIR-85/3114
Sponsored by Environmental Research Center, Research Triangle Park, NC.

Keywords: *Acidity, *Volumetric analysis, *Air pollution, Automation, Performance evaluation, pH, Samples, Ions, *Acid rain, Closed loop systems.

Five methods for the determination of acidity of acid solutions of low concentration (down to .00001 mol/kg) were investigated. Four of the methods provide satisfactory results. Method (3), Gran's plot end-point detection using .001 m NaOH titrant, suffers from the inability to control exactly the size of reagent increments, which is essential for this method. Automated titration systems could remedy this deficiency.

709,166
PB85-197754 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Critical Review of Measurement Practices for the Determination of pH and Acidity of Atmospheric Precipitation.
Final rept.
G. Marinenko, and W. F. Koch. 1984, 5p
Sponsored by Environmental Protection Agency, Washington, DC.
Pub. in Environment International 10, p315-319 1984.

Keywords: *Air pollution, *pH, *Acidity, *Precipitation(Meteorology), Reviews, Standards, Volumetric analysis, Reprints, *Acid rain, Atmospheric chemistry.

This review surveys current literature on the measurement of pH and acidity of atmospheric precipitation. Current practices for calibrating pH-measuring systems for atmospheric precipitation applications are reviewed and possible sources of error are discussed. Determinations of acidity are grouped in accordance with the type of end-point selected for titration: color indicator, fixed pH, Gran plot, and closed loop.

709,167
PB85-212306 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Indoor Air Quality Modeling Workshop Report.
P. E. McNall. May 85, 16p NBSIR-85/3150
Sponsored by Environmental Monitoring Systems Lab., Research Triangle Park, NC.

Keywords: *Air pollution control, *Mathematical models, *Regulations, Absorption, Air circulation, National government, *Indoor air pollution, *Air quality.

Comprehensive modeling of emission, absorption, movement, and controls of indoor air contaminants is essential for developing national policy for IAQ assessment and controls. This report describes several topics discussed in a workshop on indoor air quality, which was held on February 11, 1985 at the National Bureau of Standards. Researchers on IAQ modeling were invited to state their current activities, identify future research needs and recommend specific parameters and contaminants to be included in the IAQ models. The input thus obtained in this workshop will be incorporated in an advanced simulation model for IAQ, to be developed by NBS under a contract with EPA.

709,168
PB85-226520 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Products of Wood Gasification.
T. J. Ohlemiller, T. Kashiwagi, and K. Werner. Apr 85, 115p NBSIR-85/3127
Sponsored by Department of Energy, Washington, DC.

Keywords: *Stoves, *Gasification, *Air pollution, *Pyrolysis, *Wood, Combustion products, Gas chromatography, Chromatographic analysis, Heating equipment, Residential buildings, Gas analysis, Thermal degradation, *Wood burning appliances, *Air pollution detection, Path of pollutants, Solid wastes.

The increasing problem of pollution from wood-burning stoves has prompted this examination of the basic gasification process of wood under conditions encompassing those in stoves. Other variables were sample grain orientation, thickness, exposure time and moisture content. Sample weight was followed in some tests; sample temperature (5 thermocouples) was followed in others. In all tests, all evolved products were either monitored (H2O, CO, CO2, total hydrocarbons not condensible at -40C) or trapped and analyzed (condensible organic species) by gas chromatography and mass spectroscopy. Chromatographic fingerprints of the organic condensate indicated that its composition does not vary a great deal for the conditions examined here. The fingerprints from the radiative heating tests bear a strong resemblance to those of the smoke condensate from a wood stove.

709,169
PB85-230803 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Contemporary Particulate Carbon.
Final rept.
L. A. Currie. 1982, 17p
Sponsored by General Motors Research Labs., Warren, MI.
Pub. in Proceedings of the International Symposium on Particulate Carbon, Atmospheric Life Cycle, Warren, Michigan, October 13-14, 1980, p245-260 1982.

Keywords: *Particles, *Air pollution, *Isotopic labeling, *Carbon isotopes, *Chemical analysis, *Radiocarbon dating, Sources, Carbon 13, Fossil fuels, Wood, Urban areas, Rural areas, Biological aerosols, *Natural emissions.

Advances in natural radiocarbon measurement techniques have made it feasible, for the first time, to assess the contribution of biogenic (contemporary) carbonaceous sources to individual chemical fractions in milligram quantities of atmospheric particles. Isotopic measurements for source reconciliation are doubly important when dealing with pure species, such as methane, carbon monoxide or elemental carbon, because they represent the only compositional information obtainable. Elemental carbon is of special interest in this regard because of changing energy patterns associated with both contemporary (wood-burning) and fossil (diesel fuel and unleaded gasoline) carbon. Following a review of the assumptions underlying the use of radiocarbon as a biogenic tracer and the status of minicounter and accelerator techniques for the assay of milligram and microgram samples, a survey will be presented of recent observations on urban and rural carbonaceous particles. Results for these particles, which have been fractionated according to size or volatility, have exhibited the full range from fossil to biogenic source dominance.

709,170
PB85-230811 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Radiocarbon: Nature's Tracer for Carbonaceous Pollutants.
Final rept.
L. A. Currie, G. A. Klouda, and R. W. Gerlach. 1982, 22p
Pub. in Proceedings of the International Conference on Residential Solid Fuels, Environmental Impacts and Solutions, Portland, Oregon, June 1-4, 1981, p365-385 1982.

Keywords: *Radiocarbon dating, *Isotopic labeling, *Air pollution, *Environmental surveys, *Carbon isotopes, Carbon 12, Carbon 14, Urban areas, Rural areas, Biological aerosols, Residential buildings, Sampling, Sources, Combustion products, Wood, Biomass, Chemical analysis, Particle size, *Tracer studies, *Natural emissions, *Air pollution detection, Wood burning appliances.

Recent developments in radiocarbon dating techniques have made it feasible to determine 14C/12C ratios in samples containing milligram or even microgram quantities of carbon. As a result, it has become practicable to apply these techniques to the study of trace gases and particles in the atmosphere, as a means of resolving anthropogenic from natural source components. Interpretation of 14C data is straightforward: biospheric carbon (such as vegetation) is 'alive' with a 14C/12C ratio of about 1.5 x 10 to the 12th power, whereas fossil carbon is 'dead.' Beyond this dichotomous classification it becomes very interesting to combine the isotopic data with concurrent chemical data, as well as spatial and temporal distributions, in order to infer the strengths of specific sources of carbonaceous pollutants. A brief review will be presented of program on atmospheric gases and carbonaceous particles. For the latter, the authors have assayed individual chemical and size fractions, and samples collected in urban, rural, and remote locales. The biogenic carbon fraction -- presumably from wood-burning -- ranged from 10 percent to 100 percent for the urban samples analyzed.

709,171
PB86-105848 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Determination of Trace Element Forms in Solvent Refined Coal Products.
Final rept.
B. S. Carpenter, and R. H. Filby. 1982, 14p
Pub. in Proceedings of the American Nuclear Society Conference, At. Nuclear Methods Fossil Energy Research, p83-96 1982.

Keywords: *Trace elements, *Chemical analysis, Coal liquefaction, Metals, Neutron activation analysis, Chromatographic analysis, Atomic spectroscopy, Metal containing organic compounds, Complex compounds, *SRC process, *SRC II process, *Air pollution detection, High performance liquid chromatography, Heavy metals, Gel permeation chromatography.

The Solvent Refined Coal Processes SRC I and SRC II are designed to produce low ash, low sulfur solid (SRC I) and liquid fuels (SRC II) from coal. Both processes are currently undergoing scale-up to a 6000 tons per day demonstration plant stage. The fate and distribution of Ti, V, Ca, Mg, Al, Cl, Mn, As, Se, Sb, Hg, Br, Ni, Co, Cr, Fe, Na, Rb, Cs, K, Sc, Eu, Sm, Ce, La, Sr, Ba, Th, Hf, Ta, Zr and Cu in the SRC I and SRC II processes have been determined using neutron activation analysis. The nature of the chemical species of several elements has been investigated using fission track analysis for U and a combination of gel permeation chromatography, HPLC, activation analysis and atomic absorption spectroscopy for other elements. These elements were probably present as metal-organic complexes or complexed in the asphaltene or preasphaltene structure. The nature of these complexes could not be established, but for Ti and V there is a strong possibility of phenolic-type complexes.

709,172
PB86-111804 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Estimating the Impact of Atmospheric Carbonaceous Particulates on Urban and Rural Environments by Radiocarbon Measurements.
Final rept.
G. Klouda, L. Currie, R. Gerlach, R. Continetti, and G. Tompkins. 1982, 18p
Pub. in Proceedings of Residential Wood and Coal Combustion Specialty Conference, Louisville, KY., March 1-2, 1982, Spec. Conf. Proc. SP-45, p189-206.

Keywords: *Environmental surveys, *Radioactive age determination, *Radiocarbon dating, Isotopic labeling, Mass spectroscopy, Chemical analysis, Assessments, Particles, Urban areas, Rural areas, *Accelerator mass spectroscopy, *Air pollution detection, Natural emissions, Wood burning appliances, Tracer studies.

Natural radiocarbon ((14)C) has been extensively utilized to decipher the history of the earth and more recently to reconstruct episodes of environmental pollution. Radiocarbon measurements of atmospheric carbonaceous particulates via low-level counting (llc) have demonstrated its usefulness as a unique discriminator of fossil and biogenic contributions to the degradation of air quality. In addition, the revolution in ((14)C) single atom counting by Accelerator Mass Spectrometry (AMS) will allow one to investigate individual organic compounds for source identification. Preliminary steps in development of an analytical technique for AMS sample preparation are discussed. The dichotomous model of fossil/biogenic source contributions to air pollution is resolvable by identifying the fraction of contemporary carbon of carbonaceous particulates through radiocarbon measurements. Studies currently underway include characterizing the rural forested areas of Abastumani, USSR and the Shenandoah Valley, Virginia and source assessment of particles collected at Pt. Barrow, Alaska for examining the 'Arctic Haze' episodes. The power of ((14)C) as an environmental tracer is being enhanced by including this information in the Receptor Model approach. Research is underway to produce a simulated data set for fictitious receptor sites which can be used to validate existing models.

709,173
PB86-128832 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Calculations of the Dimerization of Aromatic Hydrocarbons: Implications for Soot Formation.
Final rept.
J. H. Miller, K. C. Smyth, and W. G. Mallard. 1984, 9p
Pub. in Proceedings of International Symposium on Combustion/The Combustion Institute (20th), Ann Arbor, MI., August 1984, p1139-1147 1985.

Keywords: *Aromatic polycyclic hydrocarbons, *Soot, *Air pollution, Combustion, Flames, Van der Waals forces, Equations of state, Nucleation, Concentration(Composition), Monomers, Hydrocarbons, Dimers, Chemical reaction mechanisms.

Polynuclear aromatic hydrocarbons (PAH) are found in all sooting hydrocarbon flames. These species are ideally suited to be chemical precursors and building blocks in soot formation, yet their possible role has not been elucidated. From a knowledge of the magnitude of the van der Waals interaction between pairs of PAH the equilibrium constants for dimer formation have been calculated. These values have been used with experimentally measured PAH concentrations to compute dimer concentrations, which were then compared to soot nuclei number densities to determine whether or not the dimers are numerous enough to serve as nucleation sites. The dimers of benzene coronene (7 rings), and circumcoronene (19 rings), as well as mixed dimer pairs, have been examined. Despite choosing monomer concentrations and theoretical approaches which favor dimer formation, the dimerization of PAH does not yield a sufficient number of nucleation sites to account for soot formation in a homogeneous nucleation mechanism. If PAH do participate in the early stages of soot formation, irreversible chemical steps must be important.

709,174
PB86-133386 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Passive Sampler for Ambient Levels of Nitrogen Dioxide.
Final rept.
B. C. Cadoff, and J. Hodgeson. 1983, 3p
Pub. in Analytical Chemistry 55, n13 p2083-2085 1983.

Keywords: *Nitrogen dioxide, *Monitors, *Air pollution, Sampling, Concentration(Composition), Laboratory equipment, Chemical analysis, Reprints, *Air pollution sampling, *Air pollution detection, *Passive monitors.

A precise, high-rate passive sampler for NO2 is described. It can be assembled from a commercially-available device, and can be used to reliably sample low ambient levels of NO2. Triethanolamine is used to collect the NO2, and the analysis method follows the traditional Saltzman procedure. The device is diffusion controlled and samples at a rate of approximately 110 mL/min. It has been evaluated at two levels of relative humidity and exhibits no interference in the presence of a large excess of NO. Sampling has been conducted at 2 concentrations between 61 and 335 ppb.

709,175
PB86-133626 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Interlaboratory Comparison of Source Apportionment Procedures - Results for Simulated Data Sets.
Final rept.
L. A. Currie, R. W. Gerlach, C. W. Lewis, W. D. Balfour, and J. A. Cooper. 1984, 21p
Pub. in Atmospheric Environment 18, n8 p1517-1537 1984.

Keywords: *Air pollution, *Aerosols, *Particles, Assessments, Sampling, Meteorology, Least square methods, Comparison, Sources, Reprints, State of the art, Intercomparison, Procedures.

Three sets of simulated compositional data for aerosol samples were prepared in order to (a) assess the current state of the art of source apportionment procedures, and (b) to provide initial sets of test data to aid in method development. The data sets were generated from reported source profile information, together with real meteorological data (St. Louis, 1976) and two constructed city plans. Following plume dispersion by means of the RAM model, forty 'samples' were generated having known source contributions and error structure. Deconvolution of the simulated data sets was undertaken by seven laboratories using numerical methods based primarily on least squares (Chemical Mass Balance) and multivariate (Factor Analysis and Multiple Linear Regression) techniques. Comparison of the interlaboratory results and estimated uncertainties with the known source contributions indicated consistency within about a factor of two (average about + or - 30%), and uncertainty estimates which ranged from much too conservative (broad) to much too small. No unique choice of method evolved from this exercise; the alternative methods appeared complementary and capable of resolving up to about 6-9 different sources. As a result of the intercomparison, suggestions are given for improving the simulation process per se, as well as the various methods of treating the data--especially with respect to the issue of estimated uncertainties.

709,176
PB86-138070 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Review of Personal/Portable Monitors and Samplers for Airborne Particles.
Final rept.
R. A. Fletcher. 1984, 3p
Pub. in Jnl. of the Air Pollution Control Association 34, n10 p1014-1016 Oct 84.

Keywords: *Monitors, *Air pollution, *Samplers, *Particles, Reviews, Design criteria, Performance evaluation, Reprints.

The operating characteristics of nineteen personal/portable particulate monitors are reviewed.

709,177
PB86-140514 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Validation of Models for Predicting Formaldehyde Concentrations in Residences Due to Pressed Wood Products. Phase 1.
R. A. Grot, S. Silberstein, and K. Ishiguro. Sep 85, 148p NBSIR-85/3255
Sponsored by Consumer Product Safety Commission, Washington, DC.

Keywords: *Formaldehyde, *Mathematical models, *Residential buildings, *Wood products, Safety, Houses, Air pollution, Temperature, Humidity, Assessments, Concentration(Composition), *Indoor air pollution, *Air quality, *Consumer products.

The interim report describes procedures and presents results of the first phase of a laboratory project undertaken at the National Bureau of Standards for the Consumer Product Safety Commission (CPSC). The purpose of the ongoing project is to assess the accuracy of emission and indoor air quality models to be used by CPSC in predicting formaldehyde (HCHO) concentrations in residences due to pressed-wood products made with urea-formaldehyde bonding resins, namely particleboard underlayment, hardwood-plywood paneling and medium-density fiberboard (MDF). In phase I, these products were characterized in 'medium-size' dynamic measuring chambers by measuring their HCHO surface emission rates over a range of HCHO concentrations, at 23C and 50% RH. They were then installed in a two-room prototype house and the equilibrium HCHO concentrations were monitored as a function of air exchange rate. Excellent agreement was obtained between measured HCHO concentrations and those predicted by a mass-balance indoor air quality model. In the next phase, the study will be repeated at various different temperatures and relative humidities so that models predicting HCHO surface emission rate as a function of temperature and humidity can be tested.

709,178
PB86-142684 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Spot Inception in a Methane/Air Diffusion Flame as Characterized by Detailed Species Profiles.
Final rept.
K. C. Smyth, J. H. Miller, R. C. Dorfman, W. G. Mallard, and R. J. Santoro. 1985, 25p
Pub. in Combustion and Flame 62, p157-191 1985.

Keywords: *Soot, *Air pollution, *Flammability testing, *Combustion products, *Gas analysis, Concentration(Composition), Ionization, Fluorescence, Rayleigh scattering, Mass spectroscopy, Diffusion, Reprints, *Air pollution detection, Laser induced fluorescence, Laser induced ionization, Hydroxyl radicals.

Detailed species concentration profiles have been measured using optical and mass spectrometric methods in an atmospheric pressure methane/air diffusion flame burning on a Wolfhard-Parker slot burner. Relative concentrations have been determined for OH by laser-induced fluorescence and, in addition, laser-induced production of C2 has been monitored by fluorescence measurements. Broadband ultraviolet and visible fluorescence have been observed, and both are attributed to PAH, although other molecules may be responsible for these emissions at elevated temperatures. Small soot particles were detected by laser-induced ionization. Using a direct sampling mass spectrometer, absolute concentrations have been measured for methane, oxygen, nitrogen, carbon dioxide, water, hydrogen, acetylene, butadiene, and toluene. Profile measurements of several additional intermediate hydrocarbons have also been made, including methylacetylene (and/or allene), vinylacetylene, diacetylene, triacetylene, benzene, and naphthalene. These profiles are combined with velocity, temperature, and Rayleigh scattering measurements to characterize the region of chemical growth in a luminous diffusion flame.

709,179
PB86-151941 PC **E17**/MF **E17**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Review of the Literature on the Gaseous Products and Toxicity Generated from the Pyrolysis and Combustion of Rigid Polyurethane Foams.
M. Paabo, and B. C. Levin. Dec 85, 113p NBSIR-85/3224
Sponsored by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Urethane resins, *Pyrolysis, *Flammability testing, *Air pollution, *Toxicity, Reviews, Combustion products, Foam, Biochemistry, Carbon monoxide, Hydrogen cyanide, Dosage, Indoor air pollution, Consumer products.

The literature on rigid polyurethane foam has been reviewed with an emphasis on the gaseous products generated under various thermal decomposition conditions and the toxicity of those products. The review is limited to publications in English through 1984. Carbon monoxide (CO) and hydrogen cyanide (HCN) were the predominant toxicants found among more than 100 other gaseous products. The generation of CO and HCN was found to increase with increasing combustion temperatures. Many test methods were used to assess the acute inhalation toxicity of combustion products from various rigid polyurethane foams. Letha-

lity, incapacitation, physiological, and biochemical parameters were employed as biological and points. In general, the combustion products generated from rigid polyurethane foam in the flaming mode appear to be more toxic than those produced in the non-flaming mode. The LC50 values for 30 minute exposures ranged from 10 to 17 mg/l in the flaming mode and were greater than 34 mg/l in the nonflaming mode. With the exception of one case in which a reactive type phosphorus containng fire retardant was used, the addition of fire retardants to rigid polyurethane foams does not appear to generate unusual toxic combustion products.

709,180
PB86-154598 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Rationale and Plan for Center for Building Technology Research to Improve Indoor Air Quality.
P. E. McNall. Jan 86, 89p NBSIR-86/3305

Keywords: Air pollution, Measurements, Buildings, *Indoor air pollution, *Air quality.

The report outlines a suggested five year research plan for the Center for Building Technology (CBT) in support of resolving the emerging indoor air quality problem. The problem is defined, and the past research is summarized. The important Federal responsibilities are identified. NBS contributions and capabilities are noted. Future research needs are covered, and these form the basis for the CBT research plan, in cooperation with other Federal agencies, state and local governments, and the private sector.

709,181
PB86-195500 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Smoke Control in VA (Veterans Administration) Hospitals.
Final rept.
J. H. Klote. 1985, 4p
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Jnl. 27, n4 p42-45 1985.

Keywords: *Smoke, *Air pollution control, *Air pollution detection, Reprints, *Veterans Administration Hospitals.

The Veterans Administration (VA) has sponsored a project at the Center for Fire Research of the National Bureau of Standards to study smoke control in VA hospitals and to develop new design approaches and methods of acceptance testing. The paper is a report of the ongoing project, and it presents the results of a field test on the San Diego VA Hospital.

709,182
PB86-206364 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 91, Number 1, January-February 1986.
Feb 86, 44p
See also PB86-206372 through PB86-206414, and PB86-165776. Also available from Supt. of Docs as SN703-027-00008-3.

Keywords: *Acidification, *Mechanical properties, *Precipitation(Meteorology), Durability, Test methods, pH, Raindrops, Chemical analysis, Standards, Mathematical models, Measurement, *Ruggedness, Acid rain.

Ruggedness Testing-Part I: Ignoring Interactions; Ruggedness Testing-Part II: Recognizing Interactions; Effect of Variables on pH Measurement in Acid-Rain-Like Solutions as Determined by Ruggedness Tests; An Interlaboratory Test of pH Measurements in Rainwater; Development of a Standard Reference Material for Rainwater Analysis. The Journal of Research of the National Bureau of Standards features advanes in measurement methodology and analyses consistent with the NBS responsiblity as the nation's measurement science laboratory. It includes reports on instrumentation for making accurate and precise measurements in fields of physical science and engineering, as well as the mathematical models of phenomena which enable the predictive determination of information in regions where measurements may be absent. Papers on critical data, calibration techniques, quality assurance programs, and well characterized reference materials reflect NBS programs in these areas.

709,183
PB86-206398
(Order as PB86-206364, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Effect of Variables on pH Measurement in Acid-Rain-Like Solutions as Determined by Ruggedness Tests.
G. Marinenko, R. C. Paule, W. F. Koch, and M. Knoerdel. 4 Nov 85, 6p
Included in Jnl. of Research of the National Bureau of Standards, v91 n1 p17-22 Jan-Feb 86.

Keywords: *Electrodes, *Measurement, *Durability, Glass, pH, Performance evaluation, Calibrating, Tables(Data), *Acid rain.

Ruggedness Test (RT) experiments were performed to assess the significance of the various main factors whiich affect pH measurements in low ionic strength aqueous solutions, as well as to establish the presence of interactions between the main factors. Stirring has an adverse effect on the measurement of pH, since it not only increases the random noise but also biases the measured value. Temperature control to the nearest 0.5 C is sufficient for maintaining measurements accurate to 0.01 pH. Addition of NaNO3 or KC1 can not be tolerated in accurate pH measurements. Three small two-factor interactions were also revealed.

709,184
PB86-206406
(Order as PB86-206364, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Interlaboratory Test of pH Measurements in Rainwater.
W. F. Koch, G. Marinenko, and R. C. Paule. 23 Oct 85, 10p
Included in Jnl. of Research of the National Bureau of Standards, v91 n1 p23-32 Jan-Feb 86.

Keywords: *pH, *Acidity, *Rain, Electrodes, Measurement, Reliability, Trends, *Rainwater, *Acid rain.

An interlaboratory test of pH measurements in rainwater has been conducted. Various types of electrodes and junction materials were used in the test. The results of the exercise verify that there are significant differences in the pH values of low ionic strength solutions reported by various laboratories.

709,185
PB86-206414
(Order as PB86-206364, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Development of a Standard Reference Material for Rainwater Analysis.
W. F. Koch, G. Marinenko, and R. C. Paule. 9 Oct 85, 9p
Included in Jnl. of Research of the National Bureau of Standards, v91 n1 p33-41 Jan-Feb 86.

Keywords: *Acidity, *Rain, pH, Chemical analysis, Statistical analysis, Standard reference material, Rainwater.

The paper describes the development of Standard Reference Material, SRM 2694, 'Simulated Rainwater,' intended to aid in the analysis of acidic rainfall. Details of the formulation and preparation of the two levels of solutions (2694-I and 2694-II) are given. The 10 analytical techniques used to measure the 12 components in the solutions are described in brief.

709,186
PB86-210556 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Smoke Control at Veterans Administration Hospitals.
J. H. Klote. Jan 86, 109p NBSIR-85/3297
Sponsored by Veterans Administration, Washington, DC.

Keywords: *Smoke, *Air pollution control, *Air pollution detection, *Veterans administration hospitals.

The Veterans Administration (VA) has sponsored a project at the Center for Fire Research of the National Bureau of Standards to study smoke control in VA hospitals and evaluate design system approaches and methods of acceptance testing. The report presents general background information that is believed to be of interest to those tasked with design, construction and acceptance testing of smoke control systems. The performance requirements of smoke control systems for VA hospitals are discussed. The results of field tests at five VA hospitals is presented and discussed. Based on the information gained from the field tests and the background information, different approaches to smoke control at VA hospitals and methods of acceptance testing are evaluated. General recommendations concerning smoke control at VA hospitals are made.

709,187
PB86-247483 PC **A05**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Methods and Procedures Used at the National Bureau of Standards to Prepare, Analyze and Certify SRM (Standard Reference Material) 2694, Simulated Rainwater, and Recommendations for Use.
Final rept.
W. F. Koch. Jul 86, 82p NBS/SP-260/106
Also available from Supt. of Docs as SN003-003-02750-2. Library of Congress catalog card no. 86-600562.

Keywords: *Acidity, *Rain, pH, Chemical analysis, Statistical analysis, Standard reference material, Rainwater.

The report describes the development, preparation, analysis and certification of Standard Reference Material, SRM 2694, Simulated Rain-water, intended to aid in the analysis of acidic rainfall. Details of the formulation and preparation of the two levels of solutions (2694-I and 2694-II) are given, as well as those of the precursor to the SRM, namely Research Material, RM 8409, Simulated Rainwater. The analytical techniques used to measure the twelve components in the solutions are described in detail. The data used in the statistical evaluation of the results are summarized and the recommended values for pH, specific conductance, acidity, fluoride, chloride, nitrate, sulfate, sodium, potassium, ammonium, calcium, and magnesium are tabulated. The instability of ammonium ion in acidic solutions is discussed. Recommendations for the use of SRM 2694, particularly with regard to the measurement of pH, are given.

709,188
PB87-106357 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Atmospheric Carbon: The Importance of AMS (Accelerator Mass Spectrometry).
Final rept.
L. A. Currie, G. A. Klouda, and K. J. Voorhees. 1984, 9p
Pub. in Nuclear Instruments and Methods in Physics Research B233, n2 p371-379 1984.

Keywords: *Air pollution, *Aerosols, *Carbon, Carbon 14, Particle size, Sources, Aromatic polycyclic hydrocarbons, Urban areas, Reprints, *Particulate sampling.

Knowledge of the sources, transport and sinks for carbonaceous gases and particles in the atmosphere is of great concern both for understanding the carbon cycle and for assessing man's influence on atmospheric visibility, health effects and climate. Carbon isotopes (notably (14)C) are extremely important in tracing such species and in validating models based on emissions inventories, dispersion algorithms, and trace inorganic or organic mass balance. Accelerator Mass Spectrometry (AMS) offers tremendous promise to this field, for useful sample size may be decreased by three orders magnitude, resulting in greatly improved spatial, temporal and chemical resolution. Special problems which have been attacked with the help of (14)C-AMS are reviewed, including the study of sources of elemental, organic (particulate), and gaseous carbon compounds in the atmosphere. The report concludes with a brief review of techniques which have been used for 10-100 micrometers carbon samples, and a discussion of special atmospheric (Urban Particulate) Standard Reference Materials.

709,189
PB87-116224 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Atmospheric Deposition Reference Materials: Measurement of pH and Acidity.
Final rept.
W. F. Koch, and G. Marinenko. 1983, 12p
Sponsored by Air Pollution Control Association, Pittsburgh, PA.
Pub. in Proceedings of Annual Meeting on Air Pollution Control Association (76th), Atlanta, GA., June 19-24, 1983, v3 12p.

Keywords: *pH, *Acidity, *Air pollution control, Chemical analysis, Atmospheric composition, Environments, Trace elements, *Acid rain, *Reference materials, Precipitation washout, Standard reference materials.

The Center for Analytical Chemistry of the National Bureau of Standards has the mandated responsibility to the nation for maintaining the quality assurance of chemical measurements. In the area of atmospheric deposition, this role includes methods development research, as well as analysis and issuance of standards. The measurement of pH in solutions of low ionic strength is being studied with an effort toward improving the precision, accuracy, and thermodynamic significance of the measured value. The determination of total acidity in rainfall is also being investigated with the focus on the reduction of errors associated with titrations of low levels of acid and endpoint location. Several Standard Reference Materials are currently available which have direct applicability to air-particulate, gas, and water analyses. In a cooperative effort with the Environmental Protection Agency, several sets of simulated precipitation reference materials have been produced and analyzed to be used as a means of intercalibrating atmospheric monitoring stations. Additional research is required to improve measurement protocols and to establish the standards needed to assure measurement comparability and consistency throughout the nation.

709,190
PB87-164141 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Quantification of Polycyclic Aromatic Hydrocarbons and Nitro-Substituted Polycyclic Aromatic Hydrocarbons and Mutagenicity Testing for the Characterization of Ambient Air Particulate Matter.
Final rept.,
S. A. Wise, S. N. Chesler, L. R. Hilpert, W. E. May, R. E. Rebbert, C. R. Vogt, M. G. Nishioka, A. Austin, and J. Lewtas. 1985, 14p
Pub. in Environmental International 11, n2-4 p147-160 1985.

Keywords: *Air pollution, *Aromatic polycyclic hydrocarbons, Chemical analysis, Concentration(Composition), Reprints, *Particulate sampling, Air sampling.

As part of a study to identify mutagenic and potentially carcinogenic compounds in urban air particulate extracts, the polycyclic aromatic hydrocarbon (PAH) mixture isolated from a large sample collected in Philadelphia, PA, was characterized by liquid chromatography (LC), gas chromatography (GC), and gas chromatography-mass spectrometry (GC-MS). After isolation of the aromatic fraction from the extract using classical liquid-liquid partitioning and silica gel column chromatography, the PAH fraction was isolated by normal-phase LC. A number of the major PAH constituents were quantified by GC and LC. Quantification of the minor constituents was accomplished by further subfractionation of the PAH mixture into eight fractions based on the number of aromatic carbons in the PAH. These fractions were then characterized by GC and GC-MS. More than 100 PAH components were quantified in this sample. Approximately 40 unsubstituted PAH and 10 methyl-substituted PAH were identified based on GC retention, LC retention, fluorescence, and/or mass spectral data. Several nitro-substituted PAH were also found in the PAH fraction and the more polar fractions isolated from the original aromatic fraction.

709,191
PB87-173407 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Collection and Analysis of Organic Compounds in Air: An Annotated Bibliography (1976-1986),
F. E. Jones. Feb 87, 58p NBSIR-87/3527
Sponsored by Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD.

Keywords: *Air pollution, *Chemical analysis, Bibliographies, Adsorption, Organic compounds, *Air sampling, *Volatile organic compounds, Semivolatile organic compounds.

This is a selected and annotated bibliography of sources of methodology for the collection and analysis of volatile and semi-volatile organic compounds present in air. The most prevalent methodology is the collection and preconcentration of organic compounds in a tube or cartridge containing an adsorbent, and subsequent thermal desorption of the collected compounds on the column of a gas chromatograph (GC), GC/mass spectrometer (MS), or GC/MS/computer system for analysis. The performance of adsorbents such as porous polymer adsorbents, and the optimization and standardization of methodology are of particular interest. The bibliography comprises 68 general citations and 17 standard operating procedures.

709,192
PB87-218921 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Ambient Impact of Residential Wood Combustion in Elverum, Norway.
Final rept.,
T. Ramdahl, J. Schjoldager, L. A. Currie, M. Moller, J. E. Hanssen, G. A. Klouda, and I. Alfheim. 1984, 10p
Pub. in Science of the Total Environment 36, p81-90 Jun 84.

Keywords: *Wood combustion, *Air pollution, Norway, Reprints, *Combustion products, Biogenic carbon, Radiocarbon, Trace analysis.

Air pollution from wood combustion has been studied in Elverum, Norway (10,000 inhab.) during January and February 1982. Carbon-14 was used as a unique tracer for biomass combustion. Other compounds determined included total carbon, polycyclic aromatic hydrocarbons, metals and sulfate. Many samples were tested for mutagenicity. Wood carbon contributed to Approx. 60% of the total carbon in ambient fine particles smaller than 3 micrometers diameter. The emission of PAH from wood combustion contributed 60-70% to the total PAH emitted in the winter half-year. 1-Methyl-7-isoporpyl-phenanthrene (retene) and methyl dehydroabietic acid may qualitatively be used as tracers for softwood combustion.

709,193
PB87-231346 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Wood Gasification at Fire Level Heat Fluxes.
Final rept.,
T. J. Ohlemiller, T. Kashiwagi, and K. Werner. 1987, 16p
Sponsored by Department of Energy, Washington, DC.
Pub. in Combustion and Flame 69, p155-170 1987.

Keywords: *Air pollution, *Wood, *Gasification, Stoves, Thermal degradation, Reprints, Radiative heat transfer, Smoldering combustion.

The study was motivated by a need to understand the source of pollutant species emitted by wood burning stoves; the results are relevant also to fire research. The study examines the products generated when wood is heated in controlled conditions, without flaming, in atmospheres of varying oxygen concentration (0-21% O2 in N2). Small wood samples (typically 4 x 4 cm exposed face, 2-4 cm thick; mainly white pine and red oak, but also two tests with yellow pine) were subjected to uniform radiative heat fluxes (2-7.8 W/sq. cm.) on one face. Sample weight was followed in some tests and sample temperature (5 thermocouples in depth) in others since the two measurements could not be made together. In all tests, all evolved products were either monitored (H2O, CO, CO2, total hydrocarbons not condensible at -40 C) or trapped and analyzed (condensible organic species) by gas chromatography and mass spectroscopy. Many of the trends of the major products (CO, CO2, H2O, THC, total organic condensible or tar) are qualitatively intelligible in terms of the expected impact of varying temperature or oxygen level, for example. The extent of change in these major products is rather limited (factor of two to four) over the range of variables explored here. The organic condensate was difficult to analyze; it is estimated that only 20% of it would pass through a gas chromatograph.

709,194
PB87-233458 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Infrared Measurements of the C10 Radical.
Final rept.,
J. B. Burkholder, P. D. Hammer, C. J. Howard, A. G. Maki, G. A. Thompson, and C. Chackerian. 1987, 23p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 124, p139-161 1987.

Keywords: *Air pollution, Chlorine monoxide, Infrared, Radical, Spectroscopy, Reprints, Atmospheric chemistry, Molecular spectroscopy, Absorption intensity.

High-resolution infrared spectra of the fundamental (upsilon = 1-0) and first overtone (upsilon = 2-0) bands of the ClO (X2II(3/2), 2II(1/2) radical have been observed using a Fourier transform spectrometer and a diode laser. Frequencies and relative absorption line intensities have been measured and analyzed. An improved set of rovibrational constants for both 35ClO and 37ClO and a table of line positions and intensities are given. Relative intensity measurements are used to determine the rotational dependence of the intensities, and thereby determine the Herman-Wallis effect. An integrated band intensity of 11.3 plus or minus 2.0 cm(-2) atm (-1) is determined for upsilon = 1-0 from the first Herman-Wallis constant in a manner independent of any concentration determination.

709,195
PB88-109145 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Determination of Polycyclic Aromatic Hydrocarbons and Alkylated-Polycyclic Aromatic Hydrocarbons in Particulate Extracts Using Negative Ion Chemical Ionization Mass Spectroscopy.
Final rept.,
L. R. Hilpert. 1987, 12p
Pub. in Biomedical and Environmental Mass Spectrometry 14, p383-394 1987.

Keywords: *Gas chromatography, *Mass spectrometry, Polycyclic aromatic hydrocarbons, Quantitative analysis, Reprints, Negative ion chemical ionization, Particulates, Diesel emissions.

Gas chromatography/mass spectrometry using a combination of electron impact (EI) and Negative Ion Chemical Ionization (NICI) was used for the determination of polycyclic aromatic hydrocarbons (PAH) and alkylated-PAH in extracts of two particulate materials which are Standard Reference Materials: SRM 1650 Diesel Particulate Matter, and SRM 1649 Urban Particulate Matter. The selectivity of NICI mass spectrometry for certain PAH enabled identification and selective determination of isomeric PAH and alkylated-PAH in the particulate SRMs. Quantitative determinations for methylfluoranthenes, methylpyrenes, methylbenzofluoranthenes and methylbenzo(a)pyrenes in the two particulates showed that the methyl-substituted species were present at levels as high as 30 percent of the parent-PAH concentrations. Similarities in the alkylated-PAH content of the air and diesel particulate materials are discussed in relation to the sources of the two materials.

709,196
PB88-110796 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Reference Filter Standards for the Analysis of Chrysotile Asbestos in Non-Occupational Environments.
Final rept.,
J. A. Small, and E. B. Steel. 1982, 13p
Pub. in Proceedings of International Colloquium on Dust Measuring Technique and Strategy (4th), Edinburgh, Scotland, September 1982, p343-355.

Keywords: *Filters, *Asbestos, *Serpentine, *Standards, Laboratories, Tests, *Foreign technology, *Air pollution sampling, Electron microscopy, Particulate sampling.

For the past four years the National Bureau of Standards (NBS) and the Environmental Protection Agency (EPA) of the United States have been cooperating on the development of standards to aid in the identification and characterization of asbestos in atmospheric samples. The final goal of this program is to provide a standard in the form of statistically predictable loading of chrysotile asbestos on a substrate suitable for sample preparation and counting with an electron mi-

croscope. Such a standard could be used by field laboratories to test sample preparation and asbestos counting procedures as well as for inter-laboratory comparisons. These standards consist of sections from Nuclepore filters which contain both a low loading and a medium loading of chrysotile asbestos in an urban air particulate matrix. In addition, each standard will also include a transmission electron microscope (TEM) grid prepared from the appropriate filter.

709,197
PB88-147533 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Power of 14C Measurements Combined with Chemical Characterization for Tracing Urban Aerosol in Norway.
Final rept.,
L. A. Currie, G. A. Klouda, J. Schjoldager, and T. Ramdahl. 1986, 8p
Pub. in Radiocarbon 28, n2A p673-680 1986.

Keywords: *Air pollution, *Aerosols, *Wood, *Aromatic polycyclic hydrocarbons, Norway, Measurements, Residential buildings, Reprints, *Carbon 14 compounds, Elverum(Norway).

Changing fuel patterns and increased awareness of health effects from combustion aerosols have generated considerable interest in the use of 14C as a biogenic-fossil aerosol source discriminator. Prior studies in the US demonstrated the importance of 14C measurement for estimating the woodburning contribution to urban aerosols. The present work treats a specific air pollution problem in the town of Elverum, Norway where large wintertime concentrations of aerosol carbon and polycyclic aromatic hydrocarbons (PAH) were suspected to come from residential wood combustion (RWC).

709,198
PB88-152871 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Source Apportionment of Carbonaceous Combustion Products by Micro-Radiocarbon Measurements for the Integrated Air Cancer Project (IACP).
Final rept.,
G. A. Klouda, L. A. Currie, A. E. Sheffield, S. A. Wise, B. A. Benner, R. K. Stevens, and R. G. Merrill. 1987, 8p
Pub. in Proceedings of the EPA/APCA Symposium on Measurement of Toxic and Related Air Pollutants, Research Triangle Park, NC., May 3-6, 1987, 8p.

Keywords: *Air pollution, *Combustion products, *Atmospheric models, *Radioactive contaminants, *Exhaust emissions, Sampling, Particulates, Carbon 14, Aerosols, Motor vehicles, *Air pollution sampling, *Cancer, Stationary sources.

Atmospheric particle samples were collected during the winter of 1984-1985 in Albuquerque, NM and Raleigh, NC by the EPA for the Integrated Air Cancer Project (IACP). Selected chemical fractions were analyzed for 14C to apportion mobile (motor vehicles) and stationary (residential wood combustion) sources. In addition, these results were used to validate the EPA Single Tracer Regression Model (STRM), also a technique for the source apportionment of aerosols.

709,199
PB88-152889 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Urban Atmospheric (14)CO and (14)CH4 Measurements by Accelerator Mass Spectrometry.
Final rept.,
G. Klouda, L. Currie, D. Donahue, A. Jull, and M. Naylor. 1986, 9p
Pub. in Radiocarbon 28, n2A p625-633 1986.

Keywords: *Air pollution, Exhaust emissions, Urban areas, Carbon 14, Mass spectroscopy, Winter, Carbon monoxide, Methane, Concentration(Composition), Reprints, Las Vegas(Nevada), Carbon 13.

Atmospheric gas samples (0.1 cubic m) were collected at ground level during January/February 1984 in Las Vegas, Nevada for (14)c/(13)c accelerator mass spectrometry measurements and total abundance of CO and CH4. During winter months in the locale, carbon monoxide concentrations occasionally exceed safe exposure levels, 10 to 100 times background, and are believed to result from vehicular emissions and/or residential wood burning. Carbon isotope measurements were carried out on two samples to estimate vehicle and wood burning source contributions to the air shed. Results of CO versus CH4 concentrations show a good correlation and preliminary (14C/(13)C results of both species from two samples suggest that vehicle emissions is the predominate source of air pollution.

709,200
PB88-153671 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.
Indoor Air Quality Modeling, Phase 2 Report. Residential Indoor Air Quality Simulation,
J. W. Axley. Oct 87, 158p NBSIR-87/3661
See also PB86-166626. Sponsored by Environmental Protection Agency, Washington, DC., and Department of Energy, Washington, DC.

Keywords: *Residential buildings, *Air pollution, Computerized simulation, Circulation, Mathematical models, Three dimensional flow, Computer programs, *Indoor air pollution, Space HVAC systems, CONTAM86 computer program, Fortran 77 programming language, Atmospheric dispersion.

The interim report presents the results of Phase II of the NBS General Indoor Air Pollution Concentration Model Project. It describes the theoretical basis of a general-purpose nonreactive contaminant dispersal analysis model for buildings, the computational implementation of a portion of this model in the program CONTAM86, and examples of the application of the model to practical problems of contaminant dispersal analysis. Presently the model is being extended to handle problems of reactive contaminant dispersal analysis and full computational implementation of all portions of the model is being completed. The contaminant dispersal analysis model is based upon the idealization of building air flow systems as an assemblages of flow elements connected to discrete system nodes corresponding to well-mixed air zones within the building and its HVAC system. Equations governing the air flow processes in the building (e.g., infiltration, exfiltration, HVAC system flow, and zone-to-zone flow) and equations governing the contaminant dispersal due to the flow, accounting for contaminant generation or removal, are formulated by assembling element equations so that the fundamental requirement of conservation of mass is satisfied in each zone. The character and solution of the resulting equations are discussed, and steady and dynamic solution methods are outlined.

709,201
PB88-155882 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.
Method for Measuring the Effectiveness of Gaseous Contaminant Removal Devices. Progress Report,
B. M. Mahajan. Sep 87, 22p NBSIR-87/3666

Keywords: *Effectiveness, *Indoor air pollution, *Pollution control equipment, Air filters, Gases, Contaminants, Removal, Activated carbon, Space HVAC systems, Aluminum oxides, Performance evaluation.

The progress report briefly describes the test apparatus designed for measuring the effectiveness of filter medias, various components of the test loop, instrumentation, and contaminant concentration measuring techniques. The report also describes various aspects of the planned testing scheme that will be followed to accomplish the goals of the research project.

Environmental Health & Safety

709,202
DOE/RA/29323-1 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Psychoacoustic Evaluation of Transmission Line Audible Noise: Building Attenuation Effects, Methodology Comparison, and Field Study Feasibility. January 1, 1979 to December 31, 1979, Volume 1.
J. A. Molino, G. A. Zerdy, and S. G. Tremaine. 1980, 85p
Contract AT01-77ET29323

Keywords: *Earth atmosphere, *Ehv ac systems, *Power transmission lines, *Uhv ac systems, Acoustic measurements, Corona discharges, Environmental effects, Human populations, Noise, Noise pollution, Overhead power transmission, ERDA/200200.

Research on evaluating the effects of corona noise from EHV and UHV power transmission lines on humans inside buildings is described. The corona noise from transmission lines was recorded, reproduced for human listeners in a simulated living room and the human response to the noise was measured in the room. It was found that: despite its low sound level, corona noise is somewhat more adversive to people than might be expected on the basis of physical measurements of the sound; corona noise may not be a problem inside a well-constructed and insulated house with the windows closed; high frequency hissing and crackling noises are more aversive than low-frequency humming and buzzing noise components; and more data is needed to evaluate the human response to corona sounds. (ERA citation 06:004765)

709,203
PB-287 772/8 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Solar Criteria and Standards Program.
Environmental and Safety Considerations for Solar Heating and Cooling Applications.
D. Waksman, and J. Holton. Sep 78, 34p NBSIR-78-1532
Contract DOE-EA-77-A-01-6010
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Solar heating systems, *Solar cooling systems, *Safety engineering, Hazardous materials, Structural design, Structural engineering, Heat transfer, Toxicity, Industrial hygiene, Protection, Public health, Fire safety, Flammable liquids, Flammability, Performance evaluation, Performance standards, *Environmental health, Toxic substances, Occupational safety and health.

The HUD Minimum Property Standards (MPS) and the residential and commercial interim performance criteria (IPC) prepared by the National Bureau of Standards address many health and safety considerations that need to be considered by solar heating and cooling system designers. For example, factors such as the toxicity and flammability of heat transfer fluids are often not considered in the design of systems. Similarly, attention is seldom paid to the safe disposal of these fluids. These problems are compounded by the lack of clear guidelines as to which fluids constitute hazards that warrant special consideration. This report is intended to create an increased sense of awareness of the health and safety aspects of solar heating and cooling applications by extracting and amalgamating pertinent provisions of the MPS and IPC documents. Some of the areas that are addressed include: structural safety, heat transfer fluid toxicity and flammability considerations including the protection of potable water, effects of solar equipment on the fire resistance of buildings, and protection from physical hazards.

709,204
PB-292 753/1 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Timely Development of Environmental, Safety, and Health Standards for Energy Technologies.
B. W. Steiner. Jan 79, 41p NBSIR-79-1703

Keywords: *Standards, Energy, Safety, Development, Public health, Specifications, Management, Research and development, *Environmental health, Department of Energy.

The Division of Operational and Environmental Safety (OES) was established in the spring of 1977 as a division of the former Energy Research and Development Administration. As one of its first tasks, OES commissioned the National Bureau of Standards to develop a comprehensive plan for the development of non-nuclear energy-related environmental, safety, and health standards for the Department of Energy. The objective was to provide assurance that the exploitation of new energy technologies by the private sector would not be hindered by the absence in the private sector of (1) all necessary environmental, safety, and health standards; or (2) the ability to comply with them. A detailed plan was submitted to the Division in September 1977. During the preparation of that report it became clear that the effort commissioned by the OES was representative of a broad transformation with great significance for the standards development process in the

United States. The present report consists of a paper describing that transformation in the role of standards, its significance, and the broad implications.

709,205
PB-300 551/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Firesafety Evaluation System for Health Care Facilities.
Final rept.
I. A. Benjamin. Mar 79, 6p
Pub. in Fire Jnl. 73, n2, p52-55, p95-96, Mar 79.

Keywords: *Hospitals, *Fire safety, Standards, United States, Smoke, Health care facilities, *Nursing homes, Reprints.

In the United States today there are about 16 000 nursing homes (homes for elderly) and 7 000 hospitals. Some of these facilities do not meet current standards for fire safety and therefore require upgrading. In an effort to achieve economical retrofit systems and to minimize disruption to the operation of the facility, waivers of the regulations have been granted. These waivers have been based on the use of alternate protection means to provide equivalency to the regulations. The difficult decision as to what constitutes equivalency has been left to the various local jurisdictions; and therefore there has been a lack of uniformity across the country in terms of what may be waived and what constitutes an adequate alternate to provide the required level of safety.

709,206
PB80-132012 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Institutional Plan for Developing National Standards with Special Reference to Environment, Safety, and Health,
B. W. Steiner. Sep 79, 42p NBS-MONO-165
Library of Congress catalog card no. 79-600116.

Keywords: *Standards, Energy, Plans, Development, United States, Safety, Environmental health, Compliance standards.

The plan was commissioned to provide a framework for the development of all essential non-nuclear energy-related, environmental, safety, and health (ES&H) standards for the private sector to coincide with the commercialization of new energy technologies. The development of such standards in the United States is a subset of the development of technological standards. Such standards consist of two basic types: 'limit standards,' which establish system performance criteria and 'compliance measurement standards,' which establish methods for the demonstration of compliance with 'limit standards.' The system addressed in this report encompasses four basic elements: (1) Hazards, (2) Limit Standards, (3) Evidence of Compliance, and (4) Compliance Measurement Standards. The unabridged version of the standards development process contains 39 discrete steps, each of which consists of intermediate stages. These are described here in the context of ten essential standards management functions. Some essential components in a comprehensive system, such as the voluntary standards bodies, already exist. However, to carry out many of the other functions effectively, new organizations would be required. The operation of the entire process is described in terms of a hypothetical example.

709,207
PB80-154958 Not available NTIS
National Bureau of Standards, Washington, DC.
Engineering and the Health Sciences.
Final rept.,
T. Kusuda. Nov 79, 1p
Pub. in ASHRAE J. 21, n11 p78 Nov 79.

Keywords: *Contaminants, *Construction materials, Reprints, *Environmental health, *Air quality.

Recently, Section 2 of the ASHRAE R&T Committee is concerned with such health problems as Legionnaires' disease (possibly carried by cooling tower effluents), effects of glass fiber from duct linings, indoor radioactivity due to radon emanation from building materials, and various other organic and inorganic contaminants coming from building materials and HVAC systems. Energy conservation measures have also created new environmental problems. For example, airtight buildings increase humidity which increases condensation and subsequent deterioration of building materials and growth of microorganisms; low ventilation rates lead to increased concentration of radon from building materials and of such termite treatments as chlordane; new thermostat settings can significantly affect thermal comfort and productivity. Although the biomedical or epidemiological aspects of environmental parameters are outside of the traditional ASHRAE members technical expertise, it is becoming increasingly imperative that Section 2 must deal with health and safety-related subjects.

709,208
PB80-160666 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Lead Chromate Pigments - A Literature Survey on Environmental and Toxic Effects,
M. A. Post, and P. G. Campbell. Feb 80, 44p NBSIR-80-1974
Sponsored in part by Federal Highway Administration, Washington, DC.

Keywords: *Environmental surveys, *Toxicology, Air pollution, Water pollution, Toxicity, Industrial hygiene, Pigments, Manufacturing, Design criteria, Paints, Laboratory animals, Runoff, Construction materials, Roads, Public health, Bioassay, *Lead chromates, *Toxic substances, Indoor air pollution.

In connection with an evaluation of the performance of possible alternative yellow pigments, a literature search was made on the toxicity and environmental effects of lead chromate pigments. The literature reveals that workers in chromate plants in the U.S., Europe and Japan have had a high incidence of lung cancer as well as other respiratory ailments. Further, reports on the biologic interactions of chromium show that chromium in its hexavalent state (chromate, dichromate) penetrates body membranes such as skin and the walls of red blood cells and is subsequently reduced to the trivalent state and complexed with organic molecules. While the carcinogen in the chromate manufacturing process has not been identified, animal experiments have shown that calcium chromate can produce cancer in rats. Information is presented on sources of chromium in air and water pollution. Also, the pollution aspects of lead and chromium in storm water runoff and as street contaminants are reviewed.

709,209
PB80-162886 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Forecasting Lead Paint Abatement Costs: A Computerized Approach.
Final rept.,
R. E. Chapman, and K. A. Barnes. Mar 80, 90p
NBSIR-80-1977
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of the Assistant Secretary for Policy Development and Research.

Keywords: *Lead(Metal), *Cost estimates, *Paints, Economic analysis, Construction materials, Hazards, Buildings, Lead poisoning, Toxic diseases, Residential buildings, Forecasting, Abatement, Contracts, Labor estimates, Material estimates, Computer programs, Bids, BASIC programming language, Environmental health, FACTS system.

The report describes a computerized procedure for estimating the cost of eliminating the lead-based paint hazard from buildings. This procedure is based on the results of an extensive field test program in which lead-based paint hazard abatement activities were carried out in approximately 200 dwelling units. The computerized cost estimation procedure which emerged is particularly useful because it takes into consideration both variations in the conditions of the dwelling unit as well as in the prices for labor and materials. As a result, it permits the least costly abatement technique to be identified under a wide variety of circumstances. In addition, when contract cost estimates are desired, the computer program groups dwelling units together into contracts in such a way that the sum of the expected bid prices is minimized. This report is intended to serve as a user's manual for staff members concerned with the problem of estimating lead-based paint abatement costs. Specific cases with respect to the preparation of cost estimates for individual dwelling units or of budget estimates for program managers, policy makers, or other decision makers, are treated.

709,210
PB84-244870 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Human Liver Specimens in the U.S. Pilot National Environmental Specimen Bank Program.
Final rept.
R. Zeisler, S. H. Harrison, and S. A. Wise. 1984, 21p
Pub. in Proceedings of International Workshop on Environmental Specimen Banking and Monitoring as Related to Banking, Saarbruecken, Federal Republic of Germany, May 10-15, 1982, p331-351 1984.

Keywords: *Chemical analysis, *Bioassay, *Environmental surveys, *Liver, Trace elements, Humans, Public health, Sampling, State of the art.

Integral part of the U.S. Pilot National Environmental Specimen Bank Program is the implementation of a valid chemical measurement strategy. During the first phase of working experience in the program a measurement system has been developed for human liver specimens, which includes the protocols for specimen collection as well as all aspects of the analytical measurements, i.e., the preparatory techniques, the analytical procedures, the quality assurance, and weight standardization. Goal of the strategy is the direct and unbiased relation of the data to the original sample. For contamination free homogenization of the specimens, a new brittle fracture procedure has been evaluated and implemented, providing 1 g analytical test portions with less than one percent error due to inhomogeneity. State-of-the-art analytical methodology is applied to determine more than thirty minerals and trace elements of biological and environmental importance in the tissue. The analytical methods are atomic absorption spectrometry, isotope dilution mass spectrometry, neutron activation analysis, and voltammetry. Data are presented for 36 individual liver specimens collected in the program. The large data base answers key issues of chemical measurements in the environmental and biological field and an interpretation is given on the quality of the developed measurement strategy.

709,211
PB85-104735 Not available NTIS
National Bureau of Standards, Washington, DC.
Piezoelectric-Crystal Mercury Monitor.
Final rept.
E. P. Scheide, and R. B. J. Warnar. 1978, 5p
Pub. in American Industrial Hygiene Association Jnl. 39, n9 p745-749 Sep 78.

Keywords: *Piezoelectric crystals, *Portable instruments, *Mercury(Metal), *Dosimeters, *Industrial hygiene, Air pollution, Exposure, Reprints, *Air pollution detection, *Occupational safety and health, *Indoor air pollution.

A hand calculator sized instrument with digital readout for measuring the mercury vapor concentration in air and/or personal exposure to mercury vapor has been developed and evaluated. This instrument is applicable to many industrial hygiene applications.

709,212
PB85-104743 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibration System for Producing Known Concentrations of Mercury Vapor in Air.
Final rept.
E. P. Scheide, E. E. Hughes, and J. K. Taylor. 1979, 7p
Pub. in American Industrial Hygiene Association Jnl. 40, n3 p180-186 Mar 79.

Keywords: *Monitors, *Mercury(Metal), *Calibrating, Industrial hygiene, Performance evaluation, Design criteria, Concentration(Composition), Air pollution, Reprints, Occupational safety and health.

This paper describes the construction and evaluation of a system capable of producing well-defined test mixtures of mercury in air, or other diluent gas, at mercury concentrations between zero and 16 mg/cu M. The various parameters that affect the generation system and their interactions are discussed and data is given for the calibration of several different mercury monitors.

709,213
PB85-110104 Not available NTIS
National Bureau of Standards, Washington, DC.

NBS (National Bureau of Standards) Personal Ambient Aerosol Sampler: Capabilities and Testing.
Final rept.
R. A. Fletcher, and D. S. Bright. 1981, 9p
Pub. in Proceedings of the Tech. Program International Powder and Bulk Solids Handling and Processing, Rosemont, IL., May 12-14, 1981, p323-331.

Keywords: *Samplers, *Portable equipment, *Aerosols, Particles, Filtration, Wind tunnels, Performance evaluation, Dosimeters, Air pollution, Exposure, Concentration(Composition), Dry cells, Calibrating, Industrial hygiene, *Indoor air pollution.

A portable, light weight, battery powered aerosol sampler has been developed at NBS. The sampler can be used to measure human exposure to ambient aerosol concentrations. Ambient aerosols are size separated by the sampler into two fractions, 15-2.5 micrometers diameter and below 2.5 micrometers diameter by series stack filtration. The first filtration stage, a 8 micrometers pore Nuclepore filter, size cuts at approximately 2.5 micrometers diameter. The back up filter collects the remaining particles <2.5 micrometers diameter. The minature pump, which is powered by dry cell batteries, gives the sampler a 6 L/min flow rate capability. Both filtration stages are weighable to a + or - 10 micrograms uncertainty and can be subsequently used for chemical analysis of the aerosol sample. An impactor type inlet removes particles >15 micrometers diameter and has been designed to minimize the effects of wind on sampling. Results of wind tunnel testing of the inlet will be discussed.

709,214

PB85-141422 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
National Bureau of Standards Toxicity Test Method.
Final rept.
B. C. Levin. Oct 84, 19p
Pub. in Proceedings of a Conference on Fire Safety Aspects of Products of Combustion/Hazard Assessment and Fire Testing, Baltimore, MD., Mar 20-23, 1983, p88-106 Oct 84.

Keywords: *Toxicity, *Standards, *Combustion products, *Air pollution, Experimental design, Assessment, Ignition, In vivo analysis, Fire resistant materials.

The National Bureau of Standards is developing a small-scale test method to assess the acute inhalation toxicity of combustion products under specified laboratory conditions. This presentation on March 22, 1983 to the Spring Conference of the Fire Retardant Chemicals Association describes the current test method, its uses and limitations, and the future plans of the National Bureau of Standards to overcome these limitations. Aspects of the test method that were discussed in detail were the temperatures of combustion (25C above and below the autoignition temperature), the current combustion system and two radiant-energy combustion systems, the achievement of the test method's objective, and the reproducibility of results as determined by an interlaboratory evaluation of the test by seven laboratories.

709,215

PB85-148021 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Priority Toxic Pollutants in Human Urine: Their Occurrence and Analysis.
Final rept.
A. J. Fatiadi. 1984, 31p
See also PB83-225888.
Pub. in Environment International 10, p175-205 1984.

Keywords: *Chemical compounds, *Pesticides, *Urine, *Chemical analysis, *Environmental surveys, Public health, Industrial wastes, Toxicity, Herbicides, Reprints, *Toxic substances.

This survey reviews and discusses the occurrence of priority pesticides and industrial chemicals in human urine. An overview of some recent analytical methodology for determination of selected toxic pollutants and their metabolites as they are found in human urine is also presented.

709,216

PB85-202596 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of a Personal Exposure Monitor for Two Sizes of Inhalable Particulates.
Final rept.
R. L. McKenzie, D. S. Bright, R. A. Fletcher, and J. A. Hodgeson. 1982, 5p
Pub. in Environment International 8, n1-6 p229-233 1982.

Keywords: *Monitors, *Particles, *Public health, *Air pollution, Exposure, Sampling, Nitrogen dioxide, Concentration(Composition), Wind tunnels, Reprints, *Indoor air pollution, *Air pollution sampling.

Measurement of personal exposure to ambient level particulate concentrations is often extremely difficult because of a lack of personal exposure monitors capable of collecting measurable quantities within a meaningful sampling period. A new personal exposure monitor for two fractions of inhalable particulates (i.e., the 3-15 micrometers aerodynamic diameter and the <3 micrometers or respirable fraction) has been developed and characterized. This monitor is capable of collecting a sample of each fraction that is quantifiable with ambient concentrations of inhalable/respirable particulates as low as 25 micrograms/cu m in a 24-h sampling period. Wind tunnel tests have been made on the particulate personal exposure monitor to determine sampling efficiency as a function of relative wind speed and orientation with respect to the sampler.

709,217

PB86-142676 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Preliminary Report of the NFPA Advisory Committee on the Toxicity of the Products of Combustion.
Final rept.
J. E. Snell. 1984, 6p
Pub. in Fire Jnl. 78, n5 p69-71, 73-76 Sep 84.

Keywords: *Combustion products, *Toxicity, *Air pollution, *Smoke, *Fire hazards, *Fire fighting, Hazardous materials, Safety, Public health, Reprints, *Air pollution effects(Humans), *Toxic substances, *Occupational safety and health.

The report summarizes the work of the Advisory Committee on the Toxicity of the Products of Combustion of the NFPA (hereinafter referred to as the TAC). It previews a preliminary report of the TAC that is expected to be available in the Fall. The authors have reached the point of making quantitative estimates of the magnitude of the life safety hazard of smoke toxicity relative to other life safety threats of fire for specified situations. The authors believe that such estimates can be made now. They will help to: (1) narrow the scope of the smoke toxicity debate to those issues that warrant attention; (2) identify the crucial parameters and related measurement and data needs; and (3) provide practical guidance to those responsible for resolving these issues.

Noise Pollution & Control

709,218

PB-263 258/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Environmental Effects on Microphones of Various Constructions.
Final rept.,
G. R. Hruska, E. B. Magrab, and W. B. Penzes. Jan 77, 5p
Sponsored in part by Environmental Protection Agency, Washington, D.C. Office of Noise Abatement and Control.
Pub. in J. Acoust. Soc. Am., v61 n1 p206-210 Jan 77.

Keywords: *Microphones, Sensitivity, Calibrating, Pressure, Capacitors, Ceramics, Electrets, Temperature, Humidity, Environmental tests, Reprints.

The pressure sensitivities of two 1/2-in. electret, two 1-in. ceramic, and two backvented 1-in. condenser microphones were measured for numerous combinations of temperature, percentage relative humidity, and frequency. The two condenser microphones were calibrated by the reciprocity technique at each combination of temperature, relative humidity, and frequency. The condenser microphones were then used as calibrated sources to determine the pressure sensitivities of the other microphones. Insert voltage techniques were used to eliminate the environmental effects on the electronics. It was found that the back-vented condenser microphones are insensitive to changes in relative humidity. At frequencies considerably below their resonance frequencies they exhibited only a very small change in sensitivity with temperature. At frequencies closer to the resonance frequency the temperature coefficient increases approximately fourfold. The temperature and humidity coefficient for the electret and ceramic microphones could not be determined due to the instability in their sensitivities which produced changes that were larger than those induced by the temperature and humidities.

709,219

PB-264 290/8 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Applied Acoustics Section.
National Measurement System for Acoustics,
D. S. Pallett, and M. A. Cadoff. Mar 77, 94p NBSIR-75-938

Keywords: *Acoustic measurement, Noise(Sound), Sound level meters, Audiometry, Ultrasonic tests, Sound pressure, Acoustic properties, Acoustic measuring instruments, Noise reduction, National measurement system, Acoustic emissions.

The report describes acoustical measurement processes which are motivated by societal concern over noise and which have broad relevance to our contemporary technological society. The emphasis of this study of the National Measurement System for Acoustics has been to review the status of the system in order to determine the adequacy of these important physical measurements and to promote improvements within the measurement system. The relevent physical quantities are indicated, and the interactions occurring between participants as well as the roles of acoustical standardization institutions are specified. Technological, social and economic impacts are outlined. Finally, the status and trends of the system and the NBS role in adapting to changing technology are discussed.

709,220

PB-264 667/7 PC **A09**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Noise Emission Measurements for Regulatory Purposes.
Handbook (Final),
D. R. Flynn, W. A. Leasure, A. I. Rubin, and M. A. Cadoff. Mar 77, 195p NBS-HB-122, EPA/550/9-77/401
Prepared in cooperation with Environmental Protection Agency, Washington, D.C. Office of Noise Abatement and Control. Library of Congress Catalog Card no. 76-608406.

Keywords: *Noise(Sound), *Acoustic measurement, Noise pollution, Noise reduction, Acoustics, Acoustic measuring instruments, Psychological effects, Environmental engineering, Human factors engineering, Regulations, *Environmental pollution, *Noise levels.

A review is given of the measurement needs attendant to regulation of the noise generated and emitted by commercial products. The emphasis is primarily on measurement procedures for use in conjunction with point-of-sale regulations as opposed to regulations on the noise which a source actually emits when in operation. The report is divided into three major parts. Part 1 is a discussion of overall measurement requirements and the type of data and information which are needed in order to promulgate regulations based on appropriate measurement techniques. Part 2 is designed as a checklist for the evaluation of the suitability of a noise measurement standard for a particular class of products or, in the absence of a suitable standard, as a framework for development of one. The intent is to identify and discuss in some detail those factors which can impact on the accuracy, precision, and applicability of a noise measurement process. Part 3 consists of a series of flow charts depicting the development of appropriate procedures for the measurement of product noise emission.

709,221

PB-273 306/1 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.

Rationale and Recommendations for Changes and Revisions to the HUD Noise Measurement Systems Specifications.
Final rept.,
D. S. Blomquist, and M. A. Cadoff. Oct 77, 57p
NBSIR-76-1169
Prepared in cooperation with Department of Housing and Urban Development, Washington, D.C.

Keywords: *Acoustic measurement, Specifications, Revisions, Acceptability, Dosimeters, Ambient noise, Standards, Maximum permissible exposure levels, Threshold limit value.

In 1973, the Office of Noise Abatement Research, Department of Housing and Urban Development, contracted with the Applied Acoustics Section of the National Bureau of Standards to develop a noise exposure measurement system. This system was subsequently developed, seventeen prototype units were procured, and a full-scale laboratory and field evaluation of the units were conducted. This report discusses the results of the evaluation, as well as the rationale behind and recommendations for changes and revisions to the HUD noise measurement system specifications.

709,222
PB-280 383/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Test Procedures for Future Tire Noise Regulations.
Final rept.,
R. D. Kilmer. 1977, 6p
Pub. in Proceedings SAE Highway Tire Noise Symposium, San Francisco, Calif., Nov 10-12, 1976, p281-286.

Keywords: *Noise reduction, *Tires, *Regulations, Highway transportation, Acoustic measurement, Pressure measurement, Loading procedures, Size determination, Noise pollution, State goverment, California, National goverment, Environmental Protection Agency, Transportation noise, Traffic noise, Tire noise.

Based on the actions of the U. S. Environmental Protection Agency and the State of California, it appears that Federal and/or state regulations on tire noise are imminent. Basic questions involving the measurement procedure and other technical problems are likely to arise in the development of such tire noise regulations. This paper treats two specific questions, the first dealing with the load/tire inflation pressure adjustments recommended in SAE J57 and the second with the effect of tire size on tire noise. Based on the limited set of data presented, it appears that testing using either the load/tire inflation pressure recommendations of SAE J57 or the more convenient alternative of maintaining the tire inflation pressure constant at the maximum rated value with reduced loading can be used provided the loads are greater than 70 to 75 percent of the maximum rated tire load. It also appears that compliance testing using a single tire size is feasible since sound level variations with size for tires with similar carcass construction and tread design are small.

709,223
PB-280 384/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Status Report on an Experimental Study of Environmental Effects on Truck Noise Measurements.
Final rept.,
R. D. Kilmer. 1977, 3p
Sponsored in part by Office of the Secretary of Transportation, Washington, D.C. Office of Noise Abatement.
Pub. in Proceeding of SAE Sound Measurement Workshop (3rd), St. Charles, Ill., Mar 31-Apr 1, 1977, p22-24.

Keywords: *Noise reduction, *Trucks, Acoustic measurement, Highway transportation, Variability, Project management, Noise pollution, Transportation noise, Traffic noise.

The National Bureau of Standards in conjunction with the Motor Vehicle Manufacturers Association, the Engine Manufacturers Association and the U. S. Department of Transportation is conducting a study on the effect of environmental variables on truck noise measurements. The paper briefly summarizes the objectives of this study and describes the test program that was developed. Following the description of the test program, the expected results of the study are outlined, and the current status of the program is discussed.

709,224
PB-280 392/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Empirical Model for Predicting In-Service Truck Tire Noise Levels.
Final rept.,
D. M. Corley. 1977, 7p
Sponsored in part by Department of Transportation, Washington, D.C. Office of the Secretary.
Pub. in Proceedings of Society of Automotive Engineers, Inc. Highway Tire Noise Symposium held in San Francisco, Calif. on Nov 10-12, 1976, p303-309 1977.

Keywords: *Noise pollution, *Highway transportation, *Trucks, Acoustic measurement, Sound pressure, Loudness, Ratings, Mathematical models, Tires, Noise reduction, Transportation noise, Tire noise.

SAE Recommended Practice J57 -- Sound Level of Highway Truck Tires -- specifies a simple, practical noise certification test procedure for tires which results in a single-number rating -- maximum A-weighted sound level -- of the coast by sound level measured according to prescribed procedures. Such a rating by itself, however, does not allow prediction of in-service noise levels. This report discusses the basic assumptions and necessary input data for a DOT/NBS developed empirical model which utilizes the certification test results to predict in-service noise levels. The usefulness and expected accuracy of the predictive model are shown through a comparison of measured versus predicted maximum A-weighted sound levels for a variety of truck/tire combinations.

709,225
PB-280 593/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
National Measurement System for Acoustics.
Final rept.,
D. S. Pallett, and M. A. Cadoff. Oct 77, 10p
Pub. in Sound and Vibration 11, n10 p20-25, 27-31, Oct 77.

Keywords: *Acoustic measurement, *Technology assessment, Standardization, Noise(Sound), Noise reduction, Measurement, National measurement system, Reprints.

Many recent acoustical measurement processes have been motivated by societal concern over noise and have broad relevance to our contemporary technological society. The emphasis of the study of the National Measurement for Acoustics has been to determine the adequacy of these important physical measurements and to promote improvements within the measurement system. The relevant physical quantities are indicated, and the interactions occuring between participants as well as the roles of acoustical standardization institutions are specified. Finally, the status and trends of the system and the NBS role in adapting to changing technology are discussed.

709,226
PB-288 033/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison of Sound Power Determinations Conducted in Four Different Acoustic Environments.
Final rept.
P. A. Mansbach. May 78, 8p
Sponsored in part by Environmental Protection Agency, Washington, DC. Office of Noise Abatement and Control.
Pub. in Proceedings of Inter-Noise 78 Conference, San Francisco, California May 8-10, 1978 p269-276 May 78. (Inst. of Noise Control Engineering, Poughkeepsie, NY.).

Keywords: *Acoustic measurement, Power measurement, Noise levels.

The sound power levels emitted by five vacuum cleaners and one reference sound source were determined in four different acoustic environments in accordance with appropriate domestic and international measurement standards, and also using only four measurement locations, to ascertain any differences between the various procedures. The study shows general agreement among the results, (rms differences between A-weighted sound power levels of 1.0 to 1.5 dB). Determinations conducted in the reverberation room appear systematically low by about 0.8 dB (A-weighted sound power level); determinations made using four microphones may be biased if the microphones are located too close to the source. Use of the comparison (reference sound source) method eliminated systematic bias and improved the agreement between environments (rms differences of 0.5 to 1.0 dB).

709,227
PB80-103807 Not available NTIS
National Bureau of Standards, Washington, DC.
Regulation of New Products Noise Emission.
Final rept.,
D. R. Flynn. Jan 79, 8p
Pub. in Handbook of Noise Control, Chapter 41, p41-1-41-8, Jan 79.

Keywords: *Noise(Sound), *Regulations, Noise pollution, Noise reduction, National government, Administrative law, Noise emissions.

This publication is a short book chapter for The Handbook of Noise Control, Second Edition (McGraw-Hill). A description is given of existing and pending Federal regulations on the noise emission from new products.

709,228
PB80-144264 Not available NTIS
National Bureau of Standards, Washington, DC.
Errors Due to Temporal Sampling.
Final rept.
P. A. Mansbach, and D. M. Corley. Nov 79, 11p
Pub. in Proc. American Society for Testing and Materials Symp. on Community Noise, Kansas City, MO, May 24-26, 1978, Am. Soc. Test. Mater. Spec. Tech. Publ. 692, p172-182 Nov 79.

Keywords: *Noise pollution, *Error analysis, Standard deviation, Errors, Field tests, Roads, Highways, Airports, *Noise measurement.

Statistical techniques allow the prediction of the error (expressed as a standard deviation about the measured energy equivalent sound level or time exceedance level) due to temporal sampling of a time-varying signal. These predicted standard deviations are compared with experimentally determined values, obtained by computer sampling of large sets of actual field data recorded at a highway, an airport, a suburban road, and a rural residence. The predicted standard deviations, for the example given, of sampling at 30 s intervals for 1 h, range from 0.3 to 8 dB. These values agree closely with the experimentally determined values, and the small remaining discrepancies are explained. For 'continuous' (or very frequent) sampling, an 'effective number' of independent samples is used, computed from the autocorrelation in the time-varying signal.

709,229
PB81-215782 Not available NTIS
National Bureau of Standards, Washington, DC.
Audible Noise from High-Voltage Transmission Lines: Psychoacoustic Findings.
J. A. Molino, N. D. Lerner, and G. A. Zerdy. Sep 79, 13p
Proceedings of U.S. Department of Energy Environmental Control Symposium, held at Washington, DC. on November 28-30, 1978. Sponsored in part by Department of Energy, Washington, DC.
Pub. in Solar Energy, Geothermal Energy, and Waste Heat Transmission, v3 p243-255 1979.

Keywords: *Power transmission lines, *Noise(Sound), Extra high voltage, Noise annoyance, Noise pollution.

The possible aversiveness of audible (corona) noise from extra-high voltage (EHV) transmission lines was investigated in a series of psychoacoustic experiments. Recordings of corona noise were made outdoors, generally at the edge of the property right-of-way. These recorded corona noise samples were then compared with other recorded environmental sounds, reference sounds, or spectrally-modified corona sounds, using a behavioral preference procedure. Results from three experiments, all employing the same general procedure, are presented here.

709,230
PB82-105057 Not available NTIS
National Bureau of Standards, Washington, DC.
Annoyance and Noise.
Final rept.
J. A. Molino. 1979, 9p
Pub. in Handbook of Noise Control, Chapter 16, Second Edition, p16-1--16-9 1979.

Noise Pollution & Control

Keywords: *Noise(Sound), *Psychological effects, *Acoustics, *Annoyance.

Psychophysical data are reviewed on the annoyance caused by noise. Annoyance varies with three primary acoustic factors: sound level, frequency, and duration. In addition, several secondary acoustic factors have an effect: spectral complexity, fluctuations in sound level, fluctuations in frequency, rise-time of the noise, and localization of the noise source. Non-acoustic factors also influence annoyance due to noise. These include physiology, adaptation, past experience, present activity, predictability, perceived necessity, individual differences, and personality.

709,231
PB86-166188 PC **A12**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Guidelines for the Prevention of Traffic Noise Problems.
F. F. Rudder, and S. L. Yaniv. Jan 86, 264p NBSIR-86/3311/DOT
Contract DTFH61-83-Y-10014
Sponsored by Federal Highway Administration, McLean, VA. Office of Implementation.

Keywords: Noise reduction, Transportation, Land use, Guidelines, *Traffic noise.

The guidelines describe a consistent methodology for the identification and prevention of traffic noise problems by emphasizing noise-compatible land development. The guidelines are a self-contained document. The methodology provides for the quantitative evaluation of both the severity of traffic noise problems and the mitigation of these problems. Although calculations are required, specialized training in acoustics or noise control is not necessary to utilize the methodology. Methods are provided for prediction of highway traffic, diesel-electric railway, and existing levels of environmental noise. These levels serve to identify the severity of the noise problem. Mitigation techniques are presented that may be utilized to reduce or eliminate traffic noise problems.

Pesticides Pollution & Control

709,232
PB83-225888 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Priority Toxic Pollutants in Human Urine: Their Occurrence and Analysis.
Final rept.
A. J. Fatiadi. Jun 83, 66p NBSIR-83-2690
Sponsored in part by Environmental Monitoring Systems Lab., Las Vegas, NV.

Keywords: *Chemical compounds, *Pesticides, *Urine, *Chemical analysis, *Environmental surveys, Public health, Industrial wastes, Toxicity, Herbicides, Phenols, Nitrophenols, Plasticizers, Aromatic compounds, *Toxic substances, Phenol/pentachloro.

The survey reviews and discusses the occurrence of priority pesticides and industrial chemicals in human urine. An overview of some recent analytical methodology for determination of selected toxic pollutants and their metabolites as they are found in human urine is also presented. The review includes 427 references.

Radiation Pollution & Control

709,233
PB-282 117/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Surveys of Electromagnetic Field Intensities Near Representative Higher-Power FAA Transmitting Antennas.
Final rept.,
E. B. Larsen, and J. F. Shafer. Dec 77, 115p NBS-276.03
Contract DOT-FA73WA-388
Pub. in FAA Rept. no. FAA-RD-77-179, AD-A051 717, 115p Dec 77, National Technical Information Service, Springfield, Va. 22161.

Keywords: *Antennas, *Field strength, Measurement, Air traffic control systems, Radiation hazards, Electromagnetic fields, Radar antennas.

The National Bureau of Standards has completed surveys of electromagnetic field intensities near the antennas of typical FAA transmitters. These include aircraft radars, ground surveillance radars, instrument landing systems, navigation equipment and communication antennas. The surveys were made with rf radiation monitors having isotropic response patterns. Commercial monitors with thermocouple sensors were used to measure electric fields between 0.5 and 24 GHz and magnetic fields between 10 and 300 MHz. Probes designed at NBS with diode detectors were used for electric field between 100 kHz and 10 GHz. These radiation monitors cannot measure (accurately) the pulse-peak field of a radar nor the field of a scanning antenna; therefore, most of the radar surveys involved fixed antennas. The intensity in the direct beam of air route surveillance radars was greater than 10 mW/sq cm at distances within about 14 meters from the antennas. The intensity of airport surveillance radars was about 10 mW/sq cm at distances ranging from 2 to 7 meters. If the time-averaging effect for antenna scanning is taken into consideration, these field values would be greatly reduced. Also, the near-zone beams of FAA antennas are not normally accessible to personnel. In accessible areas the measured fields were generally less than 1 mW/sq cm.

709,234
PB-282 192/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reliability and Traceability in Radioactivity Measurements.
Final rept.,
W. B. Mann. 1976, 8p
Pub. in Proceedings, Southeastern Workshop on the Utilization and Interpretation of Environmental Radiation Data, Orlando, Fla. 1-3 Mar 76 p199-207 1976.

Keywords: *Standards, *Radioactivity, Concentration(Composition).

The use of radioactivity standards as they relate to data documentation is discussed -- specifically in the utilization and interpretation of environmental radiation data. The reliability and traceability in radioactivity measurements is considered in some detail as is the role that the Radioactivity Section performs in this area.

709,235
PB-282 201/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Traceability and Standard Reference Materials.
Final rept.,
W. B. Mann, and J. P. Cali. Jun 75, 7p
Sponsored in part by Johns Hopkins Medical Institutions, Baltimore, Md., Food and Drug Administration, Washington, D.C. Veterans Administration, Washington, D.C. and American Coll. of Nuclear Physicians, Washington, D.C.
Pub. in Proceedings of Symposium on Standardization, Performance and Quality Control in Nuclear Medicine, Gaithersburg, Md. 12-14 Jun 75. Ch16 in Quality Control in Nuclear Medicine: Radiopharmaceuticals, Instrumentation, and In Vitro Assays, p147-153 1977.

Keywords: *Radioactivity, *Quality control, Programs, Dosimetry, Standards, Clinical medicine, Environments, Industries, Nuclear energy, Utilization, National government, *National Bureau of Standards, Radiopharmaceutical agents, Nuclear medicine.

A brief history of the National Bureau of Standards involvement in the quality control of radioactivity measurements in all of its varied applications (medicine, the environment, nuclear power and in industry) is given. The genealogical relationships (both domestic and international) implicit in the concept of traceability are discussed. A brief summary is also given of the NBS involvement in quality control programs carried out in cooperation with other laboratories, both private and government. The research associate program, a cooperative endeavor of eight industrial producers of radiopharmaceuticals, under the aegis of the Atomic Industrial Forum, and the Radioactivity Section, NBS, is defined.

709,236
PB80-188584 Not available NTIS
National Bureau of Standards, Washington, DC.
Treatment and Reporting of Uncertainties for Environmental Radiation Measurements.
Final rept.,
R. Colle. 1980, 8p
Pub. in Proceedings of Conf. on Analytical Chemistry in Energy Technology (23rd), Gatlinburg, TN. Oct 9-11, 1979, Paper in Radioelement Analysis, p387-394 1980.

Keywords: *Error analysis, Errors, Estimating, Radiation, *Radiation monitoring.

Recommendations for a practical and uniform method for treating and reporting uncertainties in environmental radiation measurements data are presented. The method requires that each reported measurement result include the value, a total propagated random uncertainty expressed as the standard deviation, and a combined overall uncertainty. The uncertainty assessment should be based on as nearly a complete assessment as possible and should include every conceivable or likely source of inaccuracy in the result. Guidelines are given for estimating random and systematic uncertainty components, and for propagating and combining them to form an overall uncertainty.

709,237
PB80-189046 Not available NTIS
National Bureau of Standards, Washington, DC.
Standards for the Assay of Radionuclides of Solid Environmental Samples.
Final rept.,
J. R. Noyce. 1980, 18p
Pub. in Proceedings of ASTM Conf. Effluent and Environmental Radiation Surveillance, Johnson, VT, July 9-14, 1978 Am. Soc. Test. Mater. Spec. Tech. Publ. 698, p309-326 1980.

Keywords: *Radioactive materials, Standards, Solids, Radioactivity, Radioactive isotopes, Chemical analysis, Nondestructive tests, Assaying, Natural radioactivity.

This paper discusses radioactivity standards in the form of naturally occurring solid materials for use in the assay of solid environmental samples for radioactivity. Topics include the selection and preparation of materials for these standards, spiking with radionuclides (if desired), induced segregation of particles, availability and proper use of these standards, and their application to both radiochemical and nondestructive types of assay. The role these standards have in quality assurance programs is also considered.

709,238
PB81-223455 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Requirements for an Effective National Nonionizing Radiation Measurement System.
Final rept.
H. E. Clark. Jun 81, 45p NBS-SP-613
Library of Congress Catalog Card no. 81-600070.

Keywords: *Electromagnetic radiation, *Measurement, Requirements, Calibrating, Dosimetry, Safety, *Nonionizing radiation.

The report provides a detailed assessment of the capabilities, limitations, and requirements of the National Nonionizing Radiation Measurement System. The priorities of these measurement requirements are assessed according to their ability to contribute (1) to the core competence of determining the electric and magnetic fields of a source or (2) to the associated capabilities for (a) generating and applying reference fields, (b) characterizing sources and reflectors, or (c) recording exposure histories. The report examines these measurement capabilities at all frequencies between dc and 300 GHz.

709,239
PB81-240079 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Field Strength Measurements of Speed Measuring Radar Units.
Interim rept. Jul 79-Jun 81.
R. C. Baird, R. L. Lewis, D. P. Kremer, and S. B. Kilgore. Jun 81, 65p NBSIR-81-2225, DOT-HS-805 928
Contract DOT-HS-7-01697

Keywords: *Motor vehicles, *Velocity measurement, *Doppler radar, *Radiation hazards, Microwave spectra, Power spectra, Flux density.

The objective of this project was to measure the microwave radiation emitted by speed measuring radar units to obtain a data base for evaluating the potential radiation hazards of these devices. Measurements were taken both in free-space and with the radar units mounted in typical operating positions inside or attached to a four-door sedan. The free-space measurements were made at four different distances to determine the field strength as a function of distance from the radar units. Calibrated radiation level probes were used to measure the field strength inside the automobile and scan the interior volume of the four-door sedan with particular attention to the driver and passenger locations. Twenty-two radar units were involved, and the data are presented in a power density format.

709,240
PB83-143735 Not available NTIS
National Bureau of Standards, Boulder, CO.
High-Power Dual Six-Port Automatic Network Analyzer Used in Determining Biological Effects of rf and Microwave Radiation.
Final rept.
C. A. Hoer. Dec 81, 9p
Sponsored in part by National Inst. for Occupational Safety and Health, Cincinnati, OH.
Pub. in Institute of Electrical and Electronics Engineers Transactions on Microwave Theory and Techniques MTT-29, n12 p1356-1364 Dec 81.

Keywords: *Network analyzers, *Bioinstrumentation, Radiation effects, Microwaves, Radio waves, Reprints, Six-port.

The design, calibration and performance of a high-power (1 to 1000W) automatic network analyzer based on the six-port concept are described for the 10-to-100-MHz range. Calibration is performed with a length of transmission line as the only impedance standard needed. A 10 mW thermistor mount is the standard of power.

709,241
PB85-141984 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High-Power Automatic Network Analyzer for Measuring the Power Absorbed by Biological Samples in a TEM (Transverse Electromagnetic) Cell.
Final rept.
J. R. Juroshek, and C. A. Hoer. Aug 84, 7p
Sponsored by National Inst. for Occupational Safety and Health, Cincinnati, OH.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques MTT-32, n8 p818-824 Aug 84.

Keywords: *Network analyzers, *Bioinstrumentation, Power measurement, Radiofrequency power, Reprints, TEM cells.

A device for measuring the radio frequency (rf) power absorbed by biological samples while they are being irradiated in a transverse electromagnetic (TEM) cell is described. The report discusses the design, calibration, and performance of this automated measurement system. The power absorption analyzer is based on a six-port type of automatic network analyzer, and operates at an incident power to the TEM cell of 1 to 1000 W, and a frequency range of 100 to 1000 MHz. Experiments show that an absorbed power of 0.02% to 0.05% of the incident power can be measured. Measurements of the power absorbed by a 1% saline solution were made using the power absorption analyzer and by an independent calorimetric measurement. The two measurement techniques show excellent agreement.

709,242
PB85-196954 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Miniature Signals and Miniature Counters: Accuracy Assurance via Micro-Processors and Multiparameter Control Techniques.
Final rept.
L. A. Currie, R. W. Gerlach, G. A. Klouda, R. C. Ruegg, and G. B. Tompkins. 1983, 12p
Pub. in Radiocarbon 25, n2 p553-564 1983.

Keywords: *Radioactive materials, *Air pollution, *Carbon, Gas sampling, Particles, Radiation counters, Quality control, Statistical distributions, Reprints, *Air pollution sampling, *Air pollution detection, Microprocessors, On-line measurement systems.

When radiocarbon signals approach background levels, the validity of assumptions concerning Poisson counting statistics and measurement system stability becomes crucial in interpreting the resultant low-level counting observations. The authors current work is directed toward the on-line monitoring of critical parameters which reflect both the (statistical) nature of the non-Poisson errors and their underlying (physical) causes. Their approach at NBS is based on a multidetector system which sends >60 bits of information/pulse to an on-line microprocessor, followed by the generation of two dimensional spectra and multiparameter correlation and control charts which make possible the identification of specific sources of difficulty within a single unattended counting period.

709,243
PB86-193091 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Determination of Iodine-129 at Natural Levels by Thermal Neutron Activation Analysis.
Final rept.
G. J. Lutz, H. L. Rook, and R. M. Lindstrom. 1984, 19p
Pub. in Jnl. of Trace Microprobe Tech. 2, n1 p33-51 1984.

Keywords: *Radioactive contaminants, *Radioactivation analysis, Reprints, *Iodine 129, *Activation analysis.

(129)I is a long-lived fission product (half-life = 15,900,000 years) produced from natural sources as well as from nuclear reactors and nuclear explosions. Neutron activation analysis is a very sensitive method for determining (129)I. A limiting factor of sensitivity is the decontamination of the product nuclide (130)I from (82)Br. The selective ion retention medium, hydrated manganese dioxide, is shown to be effective in achieving the separation. Decontamination of the order of 1,000,000 from (82)Br with a 90% yield of (130)I is realizable.

Solid Wastes Pollution & Control

709,244
AD-A139 213/3 PC **A06**/MF **A01**
National Bureau of Standards (NML), Washington, DC. Chemical Kinetics Div.
Combustion Technology for Incinerating Wastes from Air Force Industrial Processes.
Final rept. Jun 81-Jun 83.
W. M. Shaub, and W. Tsang. Feb 84, 121p AFESC/ESL-TR-83-14
Contract MIPR-N-8146

Keywords: *Waste disposal, *Waste management, Air Force facilities, Solid wastes, Hazardous materials, Combustion, Incinerators, Air pollution, Heat, Recovery, Utilization, *Incineration, Waste utilization.

Air Force bases, particularly Air Logistics Centers, generate significant amounts of process wastes from a variety of industrial operations. Some of these wastes are classified hazardous under the Resource Conservation and Recovery Act and are properly disposed at cost to the Air Force. Onsite incineration with heat recovery is being considered as a disposal option, to reduce the overall disposal costs. Since relatively small amounts of single wastes are generated at any one base, an incineration system must be flexible to handle a wide variety of materials. Results indicate a technical basis for using Air Force industrial wastes as supplemental fuels. Suggestions made in this report should enable Air Force personnel to design and execute programs to destroy such wastes, recover energy, and show empirically that applicable environmental laws and regulations have been properly taken into account. Furthermore, a technique to allow decision makers to select least-cost options to use the suggestions made in this report exists, i.e., a modified form of the resource recovery planning model (RRPLAN) developed at the National Bureau of Standards.

709,245
PB-284 659/0 PC **A08**/MF **A01**
National Measurement Lab. (NBS), Washington, D.C. Chemical Thermodynamics Data Center.
Thermodynamic Data for Waste Incineration.
Rept. for 1 Jan 75-31 Dec 76,
E. S. Domalski, W. H. Evans, and T. L. Jobe. Aug 78, 169p NBSIR-78-1479
Grant ASME-G-125-5

Keywords: *Thermodynamic properties, *Solid wastes, Chemical compounds, Polymers, Composites, Animals, Foods, Fuels, Explosives, Woods, Chemical composition, Heat of combustion, Specific heat, Vapor pressure, Tables(Data), *Liquid wastes, Incineration.

A table of thermodynamic data of 331 selected materials has been compiled for the purpose of providing engineers with information on materials which are not easily identifiable by a stoichiometric formula. Examples of such materials are: foods, wood species, oils, animals, plants, polymers, etc. The table is arranged alphabetically according to the names of the various materials, and whenever possible, the chief components or all readily identifiable components are supplied. In addition, the physical state, the kind of thermodynamic property, specific-property values, and citations to a list of 142 references are furnished. In order to assist the reader with finding a specific material or property, a material name and property index has been put together. A section on Units and Definitions explains the various thermodynamic properties being reported and the condition under which they apply. An appendix supplies auxiliary information on symbols for thermodynamic quantities, units, physical constants and atomic weights. The table is oriented more toward engineers involved in the disposal of municipal wastes than any other group; however, applications in other engineering and scientific sectors can easily be made.

709,246
PB-290 160/1 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Test Procedures for the Determination of the Gross Calorific Value of Refuse and Refuse-Derived-Fuels by Oxygen Bomb Calorimetry: Summary of the 1977 Fiscal Year Results.
Interim rept. 1 Apr-30 Sep 77.
D. R. Kirklin, D. J. Mitchell, J. Cohen, E. S. Domalski, and S. Abramowitz. Dec 78, 36p NBSIR-78-1494
Sponsored in part by Department of Energy, Washington, DC. Urban Waste Technology Branch, and Municipal Environmental Research Lab., Cincinnati, OH. Solid and Hazardous Waste Research Div.

Keywords: *Calorific value, *Solid waste disposal, Tests, Fuels, Calorimeters, Laboratory equipment, Sampling, *Refuse derived fuels, Procedures.

Gross calorific values have been determined for refuse-derived-fuels (RDF) from two manufacturers, Teledyne National and Combustion Equipment Associates. Test procedures used are modifications of those used for coal and coke. The calorific values (moisture- and ash-free basis) obtained for Teledyne National RDF ranged from 24.51 to 25.20 MJ kg (10539 to 10835 Btu lb) with a standard deviation of 0.8 percent. The calorific values (moisture- and ash-free basis) of Combustion Equipment Associates ECO-FUEL II RDF ranged from 21.93 to 22.16 MJ kg (9427 to 9528 Btu lb) with a standard deviation of 0.4 percent. Results of 23 laboratory samples are presented at various stages of sample preparation which were derived from single field samples from each of the two sources. Calorimetric results based on an equilibrated laboratory sample are presented along with some semi-quantitative spectrochemical results. The results indicate that the techniques of oxygen bomb calorimetry can be successfully applied to a non-homogeneous refuse stream after considerable processing to prepare a 'homogeneous' refuse-derived-fuel (RDF).

709,247
PB81-136178 PC **A16**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Joint Conference on Measurements and Standards for Recycled Oil/Systems Performance and Durability.
Final rept.
D. A. Becker. Nov 80, 356p NBS-SP-584
Sponsored in part by Office of Naval Research, Arlington, VA., Department of Energy, Washington, DC., National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center, and American Society for Testing and Materials, Philadelphia, PA. Library of Congress catalog card no. 80-600159.
Proceedings of a Conference Held at Gaithersburg, Maryland on October 23-26, 1979.

Keywords: *Lubricating oils, *Meetings, Monitoring, Particles, Performance evaluation, Standards, *Recycled materials, *Liquid wastes.

This publication is a formal report of the Joint Conference on Measurements and Standards for Recycled Oil/Systems Performance and Durability held at the National Bureau of Standards on October 23 through 26, 1979. There were seven sessions on specific areas, with a total of 32 technical presentations. The subject areas were as follows: (1) Recent Developments in Recycled Oil, (2) Engine Oil Evaluation, (3) Lube Oil Base Stock Characterization, (4) Oil Analysis for Engine Condition Monitoring, (5) Bench Test for Oil Evaluation - I, (6) Bench Tests for Oil Evaluation - II, and (7) Systems Performance and Durability. Included in this report are the entire texts of the various presentations, including figures and tables.

709,248
PB81-164907 Not available NTIS
National Bureau of Standards, Washington, DC.
Status Report on the Characterization of Re-refined Lubricating Base Oils.
Final rept.
S. M. Hsu, and D. A. Becker. 1980, 10p
Pub. in Proceedings of the Conference on Fuels and Lubricants, Baltimore, Maryland, October 20-23, 1980. Paper in SAE Technical Paper Series No. 801382, p1-10 1980.

Keywords: *Lubricating oils, Recirculation, Physical properties, Chemical properties, Hydrocarbons, Performance evaluation, Reprints, *Waste recycling.

The National Bureau of Standards (NBS) has been working on the development of test procedures for recycled petroleum oils since 1976. The first phase involved development and evaluation of tests for characterizing used oil recycled as burner fuel, and has been completed. The second phase, on re-refined motor oil, involves development of a set of test procedures capable of monitoring the quality, consistency, and additive response of re-refined lubricating oil basestocks. Test under investigation include physical property tests, chemical property tests, hydrocarbon type characterization methods, and bench scale performance tests primarily directed toward the measurement of additive response. Cooperative efforts include the ASTM/NBS Basestock Consistency Study (involving both re-refined and virgin lubricating oil basestocks), a study of engine deposits with the U.S. Army Fuel and Lubricants Research Laboratory, and microoxidation test research at Pennsylvania State University. This paper describes the current status of this program, and includes representative data obtained on re-refined oils.

709,249
PB81-600034 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Test Procedures for the Determination of the Gross Calorific Value of Refuse and Refuse-Derived-Fuel by Conventional Bomb and Large Bomb Calorimetry.
D. R. Kirklin, J. Colbert, P. Decker, S. Abramowitz, and E. S. Domalski. 1981, 218p NBSIR-81-2278

Keywords: *ASTM round robin testing, Bomb calorimetry, Higher heating value, Refused-derived-fuel, Sample characterization, Sample processing effects, 2.5 and 25 gram capacity bomb calorimeters.

The report provides the results of investigations during fiscal year 1979 to develop test procedures for the determination of the calorific value of refuse and refuse-derived-fuel (RDF) by means of oxygen bomb calorimetry. The results of 138 calorimetric measurements are discussed, along with 32 calorimeter calibration measurements, for 20 different RDF samples. In addition, determinations have been carried out on these RDF samples for air dry loss, residual moisture, furnace ash, bomb ash, and sulfur content to correct the calorimetric data for their presence; the latter group of measurements amounts to 283 experiments.

709,250
PB82-130295 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Benzo(a)pyrene in Recycled Oils by a Sequential HPLC Method.
Final rept.
J. M. Brown, S. A. Wise, and W. E. May. 1980, 11p
Pub. in Jnl. Environ. Sci. Health. A15, n6 p613-623 1980.

Keywords: *Lubricating oils, *Environmental surveys, Concentration(Composition), Reprints, *Benzopyrenes, *High performance liquid chromatography, Liquid wastes, Waste recycling.

Recently, several procedures have been developed at the National Bureau of Standards to measure some environmentally important contaminants in used lubricating oils. In this paper, a sequential high-performance liquid chromatographic method will be described which can be used to determine the concentration of benzo(a)pyrene in some virgin, used, and recycled oils.

709,251
PB82-163809 PC **A08**/MF **A01**
Association of State and Territorial Solid Waste Management Officials, Washington, DC.
States Measurement Needs Study. Part I: Final Report and Executive Summary.
Rept. for Sep 80-Sep 81.
30 Sep 81, 155p NBS/GCR-81-348
Contract NB80-NADA-1055
See also PB82-163817.Portions of this document are not fully legible.
Also available in set of 8 reports PC E99, PB82-163791.

Keywords: *Hazardous materials, *Guidelines, Management planning, State government, Technology, Regulations, National government, Urban areas, *Resource conservation and recovery act, *Solid wastes, *Liquid wastes.

The Association of State and Territorial Solid Waste Management Officials prepared a report on States' Measurement Needs in order to determine various measurement requirements under Subtitle C, Hazardous Waste Management Regulation; Subtitle D, Solid Waste Management and Subtitle E, Guidelines for Resource Recovery & Materials & Energy Recovery. The report consists of Part I: Final Report and Executive Summary; Part II: State Profiles (Texas, Louisiana, Oklahoma, Pennsylvania, Virginia, Mississippi); and, Part III: Analytical Operations Procedure Manual Model.

709,252
PB82-163817 PC **A07**/MF **A01**
Association of State and Territorial Solid Waste Management Officials, Washington, DC.
State Measurement Needs Study. Part II: State Profile (Louisiana).
Final rept. Sep 80-Sep 81.
30 Sep 81, 146p NBS-GCR-81-349
Contract NB80-NADA-1055
See also PB82-163809, and PB82-163825.
Also available in set of 8 reports PC E99, PB82-163791.

Keywords: *Hazardous materials, *Guidelines, *Louisiana, Management planning, State government, Technology, Regulations, National government, Urban areas, Standards, Law enforcement, *Resource conservation and recovery act, *Solid wastes, *Liquid wastes.

The Association of State and Territorial Solid Waste Management Officials prepared report on State Measurement Needs in order to determine various measurement requirements under Subtitle C, Hazardous Waste Management Regulations; Subtitle D, Solid Waste management, and Subtitle E, Guidelines for Resource Recovery and Materials and Energy Recovery. This volume profiles State of Louisiana program, including but not limited to: (1) State compliance with federal testing criteria under Subtitle C, RCRA; (2) State laboratory needs; (3) current training program and capabilities.

709,253
PB82-163825 PC **A08**/MF **A01**
Association of State and Territorial Solid Waste Management Officials, Washington, DC.
State Measurement Needs Study. Part II: State Profile (Mississippi).
Final rept. Sep 80-Sep 81.
30 Sep 81, 162p NBS-GCR-81-353
Contract NB80-NADA-1055
See also PB82-163817, and PB82-163833.
Also available in set of 8 reports PC E99, PB82-163791.

Keywords: *Hazardous materials, *Guidelines, *Mississippi, Management planning, State government, Technology, Regulations, National government, Urban areas, Law enforcement, Sampling, *Resource conservation and recovery act, *Solid wastes, *Liquid wastes.

The Association of State and Territorial Solid Waste Management Officials prepared report on State Measurement requirements under Subtitle C, Hazardous Waste Management Regulations; Subtitle D, Solid Waste Management, and Subtitle E, Guidelines for Resource Recovery and Materials and Energy Recovery. This volume profiles State of Mississippi program including but not limited to: (1) State compliance with federal testing criteria under Subtitle C, RCRA; (2) State laboratory needs; (3) current training program and capabilities.

709,254
PB82-163833 PC **A08**/MF **A01**
Association of State and Territorial Solid Waste Management Officials, Washington, DC.
State Measurement Needs Study. Part II: State Profile (Oklahoma).
Final rept. Sep 80-Sep 81.
30 Sep 81, 164p NBS-GCR-81-350
Contract NB80-NADA-1055
See also PB82-163825, and PB82-163841.Portions of this document are not fully legible.
Also available in set of 8 reports PC E99, PB82-163791.

Keywords: *Hazardous materials, *Guidelines, *Oklahoma, Management planning, State government, Technology, Regulations, National government, Urban areas, Public health, Industrial wastes, Cost analysis, Law enforcement, Process charting, *Resource conservation and recovery act, *Solid wastes, *Liquid wastes.

The Association of State and Territorial Solid Waste Management Officials prepared report on State Measurement Needs in order to determine various measurement requirements under Subtitle C, Hazardous Waste Management Regulations; Subtitle D, Solid Waste Management, and Subtitle E, Guidelines for Resource Recovery and Materials and Energy Recovery. This volume profiles State of Oklahoma program, including but not limited to: (1) State compliance with federal testing criteria under Subtitle C, RCRA; (2) State laboratory needs; (3) current training program and capabilities.

709,255
PB82-163841 PC **A08**/MF **A01**
Association of State and Territorial Solid Waste Management Officials, Washington, DC.
State Measurement Needs Study. Part II: State Profile (Pennsylvania).
Final rept. Sep 80-Sep 81.
30 Sep 81, 152p NBS-GCR-81-351
Contract NB80-NADA-1055
See also PB82-163833, and PB82-163858.
Also available in set of 8 reports PC E99, PB82-163791.

Keywords: *Hazardous materials, *Guidelines, *Pennsylvania, Management planning, State government, Technology, Regulations, National government, Urban areas, Law enforcement, Public health, *Resource conservation and recovery act, *Solid wastes, *Liquid wastes.

The Association of State and Territorial Solid Waste Management Officials prepared report on State Measurement Needs in order to determine various measurement requirements under Subtitle C, Hazardous Waste Management Regulations; Subtitle D, Solid Waste Management, and Subtitle E, Guidelines for Resource Recovery and Materials and Energy Recovery. This volume profiles State of Pennsylvania program, including but not limited to: (1) State compliance with federal testing criteria under Subtitle C, RCRA; (2) State laboratory needs; (3) current training program and capabilities.

709,256
PB82-163858 PC **A10**/MF **A01**
Association of State and Territorial Solid Waste Management Officials, Washington, DC.
State Measurements Need Study. Part II: State Profile (Texas).
Final rept. Sep 80-Sep 81.
30 Sep 81, 206p NBS-GCR-81-352
Contract NB80-NADA-1055
See also PB82-163841, and PB82-163866.

Also available in set of 8 reports PC E99, PB82-163791.

Keywords: *Hazardous materials, *Guidelines, *Texas, Management planning, State government, Technology, Regulations, National government, Urban areas, Law enforcement, Monitoring, Public health, Industrial wastes, Sites, *Resource conservation and recovery act, *Solid wastes, *Liquid wastes.

The Association of State & Territorial Solid Waste Management Officials prepared report on State Measurement Needs in order to determine various measurement requirements under Subtitle C, Hazardous Waste Management Regulations; Subtitle D, Solid Waste Management, and Subtitle E, Guidelines for Resource Recovery and Materials and Energy Recovery. This volume profiles State of Texas program, including but not limited to: (1) State compliance with federal testing criteria under Subtitle C, RCRA; (2) State laboratory needs; (3) current training program and capabilities.

709,257
PB82-163866 PC **A05**/MF **A01**
Association of State and Territorial Solid Waste Management Officials, Washington, DC.
State Measurement Needs Study. Part II: State Profile (Virginia).
Final rept. Sep 80-Sep 81.
30 Sep 81, 93p NBS-GCR-81-354
Contract NB80-NADA-1055
See also PB82-163858, and PB82-163874.Portions of this document are not fully legible.
Also available in set of 8 reports PC E99, PB82-163791.

Keywords: *Hazardous materials, *Guidelines, *Virginia, Management planning, State government, Technology, Regulations, National government, Urban areas, Law enforcement, Monitoring, *Resource conservation and recovery act, *Solid wastes, *Liquid wastes.

The Association of State and Territorial Solid Waste Management Officials prepared report on State Measurement Needs in order to determine various measurement requirements under Subtitle C, Hazardous Waste Management Regulations; Subtitle D, Solid Waste Management, and Subtitle E, Guidelines for Resource Recovery and Materials and Energy Recovery. This volume profiles State of Virginia program, including but not limited to: (1) State compliance with federal testing criteria under Subtitle C, RCRA; (2) State laboratory needs; (3) current training program and capabilities.

709,258
PB82-163874 PC **A08**/MF **A01**
Association of State and Territorial Solid Waste Management Officials, Washington, DC.
State Measurement Needs Study. Part III: Analytical Operations Procedure Manual Model.
Final rept. Sep 80-Sep 81.
30 Sep 81, 157p NBS-GCR-81-355
Contract NB80-NADA-1055
See also PB82-163866.
Also available in set of 8 reports PC E99, PB82-163791.

Keywords: *Hazardous materials, *Guidelines, *Chemical analysis, Management planning, State government, Technology, Regulations, National government, Urban areas, Monitoring, Concentration(Composition), Tables(Data), Environmental surveys, *Resource conservation and recovery act, *Solid wastes, *Liquid wastes, Procedures.

The Association of State and Territorial Solid Waste Management Officials identified the need for State-to-State consistency in implementing hazardous waste management regulations under Subtitle C, Resource Conservation and Recovery Act of 1976 (P.L. 94-580), as amended. The need for a technical guide for both the regulator and regulatee is necessary in order to provide for consistency and to guide the regulated community, particularly small businesses, in meeting the analytical regulatory requirements. The Association has proposed and details in this report such a framework. The report addresses: (1) identification of hazardous waste; (2) special test protocols; (3) hazardous constituents; (4) categories of wastes; (5) State measurement needs; analytical protocols and procedures and monitoring.

709,259
PB82-170382 PC **A05**/MF **A01**
Bureau of Industrial Economics, Washington, DC.
Waste Newspapers in Four South Atlantic States 1980.
Marketing information rept.
D. R. Barton, D. B. Friedman, H. A. Post, and F. E. Williams. Oct 81, 95p NBS/GCR-82-371

Keywords: *Materials recovery, *Waste papers, *Solid waste disposal, North Carolina, South Carolina, Georgia, Florida, Cellulose, *Waste recycling.

The report was prepared to provide data on the markets for wastepapers in North and South Carolina, Georgia and Florida. The report is not intended to promote one market over another or draw conclusions regarding whether or not a specific resource recovery facility should burn waste newspaper. Survey indicates growth in demand for waste newspapers. Bibliographics include directory of waste newspaper markets, glossary and old news standards; cellulose insulation demand.

709,260
PB82-178005 PC **A08**/MF **A01**
Florida State Dept. of Environmental Regulation, Tallahassee.
National Recycling Directory.
Final rept.
Jan 82, 159p NBS-GCR-82-366
Contract NB81-NAAH-7437

Keywords: *Solid waste disposal, *Directories, *Manufacturers, Glass, Metals, Papers, Plastics, Elastomers, Textiles, *Waste recycling, *Recycled materials.

The directory focuses on manufacturers and/or distributors of products made from waste materials. Companies listed in the directory manufacture products which contain some recycled or recovered material. The directory consists of separate sections for the types of recycled materials used: glass, ferrous metals, nonferrous metals, paper, plastic, rubber, and textiles. The states are listed alphabetically within each subsection, and the companies are listed alphabetically under the state in which they are located.

709,261
PB82-200536 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
25 Gram Capacity Combustion Flow Calorimeter.
Interim rept. 1 Oct 79-30 Sep 80.
E. S. Domalski, K. L. Churney, M. L. Reilly, D. R. Kirklin, A. E. Ledford, and D. D. Thornton. Mar 82, 50p NBSIR-82-2457

Keywords: *Combustion, *Heat measurement, Enthalpy, Carbon dioxide, Water, *Solid wastes, *Refuse derived fuels, Numerical solution.

A new calorimeter is being developed at the National Bureau of Standards to determine the enthalpies of combustion of kilogram-size samples of municipal solid waste (MSW) in flowing oxygen near atmospheric pressure. The organic fraction of 25 gram pellets of highly processed MSW has been burned in pure oxygen to CO2 and H2O in a small prototype flow calorimeter. The carbon content of the ash and the uncertainty in the amount of CO in the combustion products contribute calorimetric errors of 0.1 percent or less to the enthalpy of combustion.

709,262
PB82-226408
(Order as PB82-226333, PC **A09**/MF **A01**)
National Bureau of Standards, Washington, DC.
Enthalpy of Combustion of Microcrystalline Cellulose.
J. C. Colbert, H. Xiheng, and D. R. Kirklin. 14 Aug 81, 6p
Included in Jnl. of Research of the National Bureau of Standards, v86 n6 p655-660 Nov-Dec 81.

Keywords: *Enthalpy, *Cellulose, Combustion.

A test substance with characteristics and properties similar to those of cellulose-based solid waste products is needed to calibrate calorimeters and combustors which will be routinely burning these materials to determine their calirific values precisely for use in commerce. Micocrystalline cellulose deltaH at (25C), and its estimated uncertainty, was determined to be -2812.401+1.725 kJ/mol based upon the sample mass. A calculated heat of wetting correction of 1.514 kJ/mol was applied to the combustion data.

709,263
PB82-236258 Not available NTIS
National Bureau of Standards, Washington, DC.
Re-Refined Lubricating Base Oils: Establishing Consistency and Quality.
Final rept.
D. A. Becker. 1980, 5p
Pub. in Proceedings Refining Department 45th Midyear Meeting (1980), Houston, TX., May 12-15 59 p1-5.

Keywords: *Lubricating oils, Recirculation, *Recycled materials, *Liquid wastes.

The National Bureau of Standards' (NBS) Recycled Oil Program was established in 1976, in direct response to the Energy Policy and Conservation Act (42 U.S.C. 6363(c); P.L. 94-163). This Act requires NBS to develop test procedures'...for the determination of substantial equivalency of re-refined or otherwise processed used oil...with new oil for a particular end use...' and to report such test procedures to the Federal Trade Commission (FTC) as soon as practicable. Initial NBS efforts were on test procedures for recycled oil used as burner fuel, and a report on these was transmitted to the FTC on November 20, 1978. Immediately thereafter, work was initiated on the second phase of the NBS program, on re-refined oil to be used as motor oil. Significant progress has been made in this second phase, although substantial research and development remains and is in progress.

709,264
PB82-238338 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Test Procedures for the Determination of the Gross Calorific Value of Refuse and Refuse-Derived-Fuel of Kilogram-Size Samples Using Constant Pressure Flow Calorimetry: Summary of the 1980 Fiscal Year Results.
Rept. for 1 Sep 79-30 Sep 80.
D. R. Kirklin, J. C. Colbert, K. L. Churney, M. L. Reilly, D. D. Thornton, R. V Ryan, A. E. Ledford, and E. S. Domalski. Jun 82, 90p NBSIR-82-2491
Contract DE-EA-77-A-01-6010

Keywords: *Heat measurement, Sampling, Combustion, Sewage disposal, Fuels, *Refuse derived fuels, *Solid wastes.

This report describes the systematic approach used at the National Bureau of Standards to design, construct, and place into operation a constant pressure flow calorimeter which can accommodate kilogram-size samples. The contents of the report are divided into three parts: Part A- The Variability of Municipal Solid Waste and its Relationship to the Determination of the Calorific Value of Refuse-Derived Fuels; Part B - 25 Gram Capacity Combustion Flow Calorimeter; and Part C - Trial Combustions of Kilogram-Size Samples of Municipal Solid Waste. The primary objective of this effort is to develop a procedure for the determination of accurate calorific values for minimally processed MSW and to correlate these calorific values with those obtained on RDF samples which have been processed to a small particle size.

709,265
PB83-135129 Not available NTIS
National Bureau of Standards, Washington, DC.
Recycling (Oil).
Final rept.
D. A. Becker. 1982, 7p
Pub. in Encycl. Chem. Technol. 19, Third Edition, p979-985 1982.

Keywords: *Lubricating oils, *Oils, Reprints, *Waste recycling.

The term 'oil' can include animal oils, vegetable oils, and synthetic oils as well as the usual mineral oil, produced from petroleum. An oil which has been used and/or contaminated, but not consumed, can often be recycled in order to regain a useful material regardless of its origin. Due a variety of reasons, there is increasing interest in developing ways to conserve the valuable energy and resource content of these oils through recycling. The article reviews the current developments in used oil recycling, and describes methods for recycling these oils into useful products, particularly lubricating oils.

709,266
PB83-135301 Not available NTIS
National Bureau of Standards, Washington, DC.

Alternative Utilization: Recycled Oil Used as Fuel.
Final rept.
D. A. Becker. 1982, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the International Conference on Used Oil Recovery and Reuse (4th), Las Vegas, Nevada, 28 Sept 81, 1981 p221-223.

Keywords: *Fuels, *Lubricating oils, Substitutes, Burners, *Waste recycling, *Refuse derived fuels.

The National Bureau of Standards' (NBS) Recycled Oil Program issued a report on test procedures for use in evaluating used lubricating oil recycled for use as a burner fuel. This effort was in response to a Congressional mandate (P.L. 94-163, Section 383C) and was the first phase of a continuing effort to provide the technical basis for evaluating recycled petroleum oil products. While there is considerable controversy over which type of oil recycling (e.g., fuel vs. re-refining) is most appropriate, it is a fact that currently much of the used oil is burned as a fuel or fuel supplement. As a result of the NBS Report (Technical Note 1130), there have been changes in the Federal Specification VV-F-815D to accomodate used oil recycled as fuel. This paper describes those changes and the NBS report they were based on.

709,267
PB83-139212 Not available NTIS
National Bureau of Standards, Washington, DC.
Recycling (Ferrous Metals).
Final rept.
J. G. Early. 1982, 11p
Pub. in Encycloped. Chem. Technol. 19, Third Edition, p952-962 1982.

Keywords: *Iron, Iron and steel industry, Byproducts, Reprints, *Waste recycling, *Metal recycling, Solid wastes.

The secondary metals industry associated with the recycling of ferrous scrap is tied to the development in the 1850's of the acid-Bessemer furnace, the first large capacity steelmaking process. Within twenty-five years of this development, the recycling of ferrous scrap became an established industry. Processes and systems for the recovery of the ferrous fraction from municipal solid waste have been developed and a number of these facilities are presently producing about 200,000 tons of municipal ferrous scrap per year. Growth of this source of ferrous scrap, however, has been very slow due to both institutional and technical barriers. The real and potential markets for increased consumption of municipal ferrous scrap are discussed in terms of these barriers and the approaches available to decrease their influence. Finally, the important role of standards for municipal ferrous scrap in improving communications between buyers and sellers of this material is discussed.

709,268
PB83-139261 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS Research on Re-Refined Engine Oil Tests.
Final rept.
D. A. Becker. 1982, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of International Conference on Used Oil Recovery and Reuse (4th), Las Vegas, NV., 28 Sep-1 Oct 81, p300-303 1982.

Keywords: *Lubricating oil, Petroleum products, *Waste recycling.

The National Bureau of Standards' Recycled Oil Program has been developing and evaluating test procedures for re-refined engine oils for several years, in response to a Congressional mandate (P.L. 94-163, Section 383c). The strategy they have adopted is to attempt to provide a set of test procedures capable of adequately monitoring the consistency and additive response characteristics of the re-refined petroleum lubricating oil basestocks. These basestock tests will then be coupled with appropriate engine sequence testing. Progress in the evaluation of chemical and physical test procedures has been steady significant progress in research on bench tests for additive response has also been made. Progress in these areas are described in the paper.

709,269
PB83-143727 Not available NTIS
National Bureau of Standards, Washington, DC.
Variability of Municipal Solid Waste and Its Relationship to the Determination of the Calorific Value of Refuse-Derived-Fuels.
Final rept.
D. R. Kirklin, J. C. Colbert, P. H. Decker, A. E. Ledford, R. J. Ryan, and E. S. Domalski. 1982, 30p
Pub. in Research Conservation 9, p281-300 1982.

Keywords: *Sewage, *Calorific value, Fuels, Reprints, *Refuse derived fuels, Solid wastes.

A study was carried out to examine the variability, over a two-week period of municipal solid waste (MSW) at the Baltimore County Resource Recovery Facility in Cockeysville, MD. The results of the study showed that the daily variability (i.e., excluding the within bag variability of MSW is 36 percent and 37 percent for moisture and ash, respectively. The combustion fraction of MSW is directly related to the moisture and bomb-ash free higher heating value (HHV3-B) which has a daily variability (i.e., excluding the within bag variability) of only 4 percent.

709,270
PB83-198606 PC **A10**/MF **A01**
Florida State Dept. of Environmental Regulation, Tallahassee.
National Directory of Manufacturers Utilizing Recycled Materials.
Final rept.
Mar 83, 216p NBS-GCR-83-424
Contract NB81-NAAH-7437
See also PB82-178005.

Keywords: *Solid waste disposal, *Directories, Glass, Metals, Papers, Plastics, Elastomers, Textiles, *Waste recycling, *Recycled materials.

The directory focuses on manufacturers and/or distributors of products made from waste materials. Companies listed in the directory manufacture products which contain some recycled or recovered material. The directory consists of separate sections for the types of recycled materials used: glass, ferrous metals, nonferrous metals, paper, plastic, rubber, and textiles. The states are listed alphabetically within each subsection, and the companies are listed alphabetically under the state in which they are located. This is an update of the January 1982 edition entitled 'National Recycling Directory,' Report No. PB82-178005.

709,271
PB83-233098 Not available NTIS
National Bureau of Standards, Washington, DC.
Re-Refined Base Oil Characterization and Consistency Monitoring.
Final rept.
S. M. Hsu, C. S. Ku, and D. A. Becker. 1982, 18p
Pub. in Base Oils for Automotive Lubricants SP-526, p87-104 1982.

Keywords: *Lubricating oils, Molecular structure, Physical properties, Reprints, *Waste utilization, *Liquid wastes.

Re-refined lubricating base oils are base oils derived from reprocessing of used lubricating oils to remove contaminants, oxidized products, and additives. This paper describes the detailed characterization of these seventeen oils and discusses the various aspects of quality and consistency associated with re-refined base oils. Based on these results, a tentative set of test procedures is recommended for monitoring the quality and consistency of re-refined base oils for automotive applications.

709,272
PB83-235812 Not available NTIS
National Bureau of Standards, Washington, DC.
Used Lube Oil: Hazardous Waste Versus Valuable Resource.
Final rept.
D. A. Becker. 1983, 6p
Pub. in Proceedings of the Annual Conference Trace Substances in Environmental Health (16th) Columbia, Missouri, p22-27 May 31-June 3 1982.

Keywords: *Lubricating oils, *Environmental surveys, Resources, Hazardous materials, Lead(Metal), Halogens, *Waste utilization, Polychlorinated biphenyls, Liquid wastes.

Large amounts of used lubricating oil are generated in the United States each year. This oil is very widely dispersed throughout the country, especially by the 60 percent of motorists who change their own motor oil. Under current EPA regulations, the characteristics of most used oil would place it in the hazardous waste classification. This paper describes research on impurities and contaminants in used and recycled oil, including PCBs, lead and lead species, and the halogens chlorine and bromine. Additional data on the enviromental consequences of improper used oil disposal is needed, in order to help provide proper direction for the oil recycling industry and the appropriate regulatory agencies.

709,273
PB83-236331 Not available NTIS
National Bureau of Standards, Washington, DC.
Research Methodology in Used Oil Recycling.
Final rept.
D. A. Becker. 1982, 13p
Pub. in Proceedings of Conference Atomic Nuclear Methods in Fossil Energy Research, Mayaguez, Puerto Rico, December 1-4, 1980, p257-269 1982.

Keywords: *Lubricating oils, Neutron activation analysis, Chemical analysis, *Waste recycling, Liquid wastes.

Legislation and activities in the United States on the subject of used oil recycling have increased dramatically in the past several years. However, a substantial portion of both industry and government have some concerns about the lack of scientific and technical research and data on certain aspects of the quality and consistency of recycled petroleum oils, particularly re-refined engine oils. Further, there are some significant environmental concerns about pollution aspects of used oils and their recycling by-products and wastes. Since 1976, the (U.S.) National Bureau of Standards (NBS) has had a legislatively mandated program to '...develop test procedures for the determination of substantial equivalency of re-refined or otherwise processed used oil... with new oil for a particular end use' (42 U.S. Code 6363c). The NBS research includes identification of problem areas in the characterization of used and recycled oils, research into new measurement methods for determination of novel constituents in these materials, and the development and evaluation of appropriate test procedures and standards for recycled oil products. Constituents discussed in this paper include analysis of total elemental content and speciation studies on lead and on the halogens (chlorine and bromine), and hydrocarbon type characterization studies on lubricating oil fractions.

709,274
PB83-236349 Not available NTIS
National Bureau of Standards, Washington, DC.
Re-refined Lube Oil Consistency and Quality: The Ultimate Question.
Final rept.
D. A. Becker. 1981, 4p
Sponsored in part by Commission of the European Communities, Luxembourg.
Pub. in Proceedings of Second European Congr. Recycling of Used Oils, Paris, France, September 30-October 2, 1980, p171-174 1981.

Keywords: *Lubricating oils, *Waste recycling, Liquid wastes.

Legislation and activities in the United States on the subject of oil recycling have increased dramatically in the past several years. These activities are mostly positive in nature, encouraging the more efficient and effective utilization of a valuable natural resource, while minimizing the adverse environmental effects of improper reuse or disposal. However, a substantial fraction of both industry and government in the U.S. have some concerns about the lack of scientific and technical data on certain aspects of the quality and consistency of recycled lubricating oils, particularly re-refined engine oils. The NBS technical effort is currently focussed on the development and evaluation of test procedures capable of monitoring the quality, consistency and additive response of a re-refined oil basestock in-between qualification by means of engine sequence tests. The NBS research involves identification of the important characteristics which must be monitored, review and evaluation of existing tests for those required characteristics, and development of new or modified test procedures where necessary to adequately monitor an important characteristic or property.

709,275
PB83-240580 PC **A02**/MF **A01**

National Bureau of Standards, Washington, DC.
Trial Combustions of Kilogram-Size Samples of Municipal Solid Waste.
Interim rept. 1 Apr 80-31 Mar 81.
A. E. Ledford, R. V. Ryan, M. L. Reilly, E. S. Domalski, and K. L. Churney. Jun 83, 18p NBSIR-83-2711
Contract DOE-EA-77-A-01-6010

Keywords: *Sewage, *Combustion, *Enthalpy, *Calorimeters, Design criteria, Performance evaluation, *Solid wastes, *Refuse derived fuels.

A new calorimeter is being developed at the National Bureau of Standards to determine the enthalpies of combustion of kilogram-size samples of municipal solid waste (MSW) in flowing oxygen near atmospheric pressure. Experiments were carried out to develop a prototype combustor in which pellets of relatively unprocessed MSW can be rapidly and completely burned with minimal scattering of ash. Pellets of up to 2.2 kg mass with ash content between 20 and 35 percent have been successfully burned at a rate of 15 minutes per kilogram initial mass with CO/CO2 ratios not greater than 0.1 percent.

709,276
PB83-244913 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Program Documentation for the Resource Recovery Planning Model.
E. B. Berman, R. E. Chapman, and H. K. Hung. May 83, 144p NBSIR-83-2745

Keywords: *Mathematical models, Fortran, Economics, Feasibility, *Solid waste management, *Resource recovery.

The Resource Recovery Planning (RRPLAN) model is designed with three purposes in mind. First and foremost, is the ability to generate a preferred (optimal) plan for resource recovery. Second, is the capability to evaluate a scenario specified by the decision maker for technical and economic feasibility. Third, is its use as a tool to facilitate the decision making process by providing answers to many what-if questions through an in-depth sensitivity analysis. In order to find the optimal solution, however, it is necessary to address three interdependent issues. The first two issues are concerned with the siting and sizing of solid waste management facilities, whereas the third concerns how to allocate commodities among the various facilities and potential markets. The model is written in FORTRAN and complies with the American National Standards Institute X3.9-1978 standard for that language.

709,277
PB83-250670 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Resource Recovery Planning Model: A New Tool for Solid Waste Management.
Final rept.
R. E. Chapman, and E. B. Berman. Jul 83, 202p NBS-SP-657
Library of Congress catalog card no. 83-600544. Prepared in cooperation with Berman (Edward B.) Associates, Inc., Marblehead, MA.

Keywords: *Materials recovery, *Mathematical models, *Management planning, *Solid waste management, *Waste recycling, Computer applications.

The Resource Recovery Planning (RRPLAN) model is designed with three purposes in mind. First and foremost, is the ability to generate a preferred plan for resource recovery. Second is the capability to evaluate a scenario specified by the decision maker for technical and economic feasibility. Third is its use as a tool to facilitate the decision making process by providing answers to many what-if questions through an in-depth sensitivity analysis. This report presents a non-technical discussion of the RRPLAN model. The basic philosophy behind the model is one of optimization. This approach was taken because it permits the economic and engineering data associated with the problem (e.g., waste generation rates and the location of processing facilities) to be organized in an objective manner. Although the model can focus on energy as its main objective, the minimization of the costs of processing a region's solid waste stream is believed to be the objective most often emphasized by decision makers. An example based on this objective is critically analyzed and used to illustrate how the model would be applied in practice.

709,278
PB84-109958 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Gasification of Refuse Derived Fuel in a Paired Fluidized Bed Pyrolysis Unit.
Final rept.
S. Suzuki, and H. Yakowitz. Sep 83, 49p NBS-SP-664
Prepared in cooperation with Agency of Industrial Science and Technology, Tokyo (Japan). Library of Congress catalog card no. 83-600583.

Keywords: *Fluidized bed processing, *Gasification, *Sewage, *Industrial wastes, Pyrolysis, Solid waste disposal, Fuels, *Refuse derived fuels, *Waste processing, Resource recovery facilities, Waste utilization.

As part of the scientific interchange program initiated by the United States Government and the Government of Japan, the Department of Commerce was selected by the White House to be the pilot agency for a project concerned with resource recovery from discards originally destined for waste. Such discards include municipal waste and industrial waste. Under terms of the agreement signed by the President and the Prime Minister on May 2, 1980, the United States and Japan will exchange small teams of government scientists in order to examine resource recovery in the respective countries and to formulate possible joint research ventures. The Office of Recycled Materials of the National Bureau of Standards (NBS/ORM), which was charged with fulfilling the duties assigned to the Secretary of Commerce by Subtitle E of the Resource Conservation and Recovery Act as amended (P.L. 94-580; PL 96-482) was designated as the U.S. contact point for this project.

709,279
PB84-114446 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC.
National Bureau of Standards Office of Recycled Materials 1976-1982.
Final rept.
H. Yakowitz. Sep 83, 638p NBS/SP-662
Library of Congress catalog card no. 83-600573.

Keywords: *Solid waste disposal, *Hazardous materials, Substitutes, Recirculation, Lubricating oils, Materials recovery, Industrial wastes, Incinerators, Marketing, *Waste recycling, *Liquid wastes, Refuse derived fuels, Resource recovery facilities, Resource conservation and recovery act.

This report is meant to serve two purposes: (1) Summarize the activities and accomplishments of the Office of Recycled Materials of the National Bureau of Standards (NBS/ORM) undertaken in response to legislative directives from 1976 through 1982; (2) Provide a compilation of FY 1982 activities of NBS/ORM. During its six and one-half year lifetime, NBS/ORM fulfilled virtually all of the legislative directives with which NBS was charged. Waste oil and other materials destined for waste were the subject of requirements for test method development, evaluation and subsequent production of standards and guidelines for specifications. More than 125 publications and reports remain as a tangible legacy of NBS/ORM. In addition, the methods and standards developed under the guidance of NBS/ORM have been adopted throughout the recycling community. This report places major NBS/ORM activities in perspective and provides a point of embarkation for anyone wishing to utilize or adapt NBS/ORM results. In addition, the Report indicates that NBS fulfilled the legislative requirements in a timely, accurate, and efficient manner.

709,280
PB84-175470 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Assessing the Credibility of the Calorific Value of Municipal Solid Waste.
Interim rept. 1 Oct 80-30 Sep 83.
K. L. Churney, E. S. Domalski, A. E. Ledford, J. C. Colbert, S. S. Bruce, T. J. Buckley, and R. S. Paule. Feb 84, 51p NBSIR-84-2825(DOE)
Contract DE-AI01-76PR06010

Keywords: *Calorific value, Assessments, Fuels, Calorimetry, Enthalpy, Thermodynamic properties, Samples, Combustion, Laboratories, *Municipal wastes, *Solid wastes, *Refuse derived fuels.

A study has been made at the National Bureau of Standards to establish the limits of reliability of the calorific value of municipal solid waste (MSW) by the bomb calorimetric procedure currently used in commercial test laboratories. This procedure involves using gram-size samples derived from MSW that has been processed down to a particle size of 2 mm or less. Critics of the procedure argue that gram-size samples are too small to be representative of such a heterogeneous material, and that processing MSW alters its composition. To test the bomb calorimetric procedure, a 2.5 kg capacity combustion flow calorimeter was designed and constructed for the determination of the enthalpies of combustion of kilogram-size samples of MSW in flowing oxygen near atmospheric pressure.

709,281
PB84-235902 PC **A14**/MF **A01**
National Bureau of Standards (NML), Washington, DC. Center for Analytical Chemistry.
Measurements and Standards for Recycled Oil-4. Proceedings of a Conference Held at the National Bureau of Standards, Gaithersburg, Maryland on September 14-16, 1982.
Final rept.
D. A. Becker. Jul 84, 320p NBS/SP-674
See also PB84-235910 through PB84-236181 and PB-299951. Also available from Supt. of Docs as SN003-003-02595-0. Library of Congress catalog card no. 84-601070.

Keywords: *Meetings, *Standards, *Lubricating oils, Hydraulic fluids, Refining, Specifications, Petroleum products, Oils, Stability, *Waste recycling, *Oil wastes, Liquid wastes, Waste utilization.

This publication is a formal report of the fourth and last Conference on Measurements and Standards for Recycled Oil, held at the National Bureau of Standards on September 14 to 16, 1982. There were five sessions on specific subject areas, with a total of 28 presentations. This conference was designed to bring together all of the work by NBS and NBS cooperators on the development of test procedures for re-refined lubricating oil. This proceedings contains the entire texts of the various presentations, including figures and tables.

709,282
PB84-235910
(Order as PB84-235902, PC **A14**/MF **A01**)
Association of Petroleum Re-Refiners, Washington, DC.
Recent Factors Affecting the Oil Recycling Industry.
J. A. McBain. Jul 84, 2p
Included in Measurements and Standards for Recycled Oil-4, p5-6 1984.

Keywords: *Lubricating oils, Forecasting, Technology, *Waste recycling, *Waste utilization, *Oil wastes, Liquid wastes.

The topic--Recent Factors Affecting the Oil Recycling Industry is extremely broad, for more has happened in the past few years that affect this industry than has happened in the previous two decades. Oil recycling is not new. It dates back to the early 1900s. The industry and the use of re-refined oil grew rapidly. By the 1960s the industry contained almost 150 companies re-refining almost 300 million gallons of used oil per year, almost 18 percent of our nation's lubricating needs. By the late 1970s the industry had dwindled to less than 20 companies producing less than 100 million gallons of re-refined oil per year, or less than 10 percent of our lubricant needs. There are many reasons for the decline of the industry. A few are significant. The picture of an industry in change is not unique. It is no more than the process of industrial growth. But in the case of the oil recycling industry, technological growth was stunted by several limiting government actions. If the past three years were positive, the next few years should prove to be even more dramatic. Technology will experience advancement, and re-refining equipment will become more sophisticated. New companies will be entering the field and more of industry will be discovering the hidden asset in the reuse of oil. Whatever the changes, Association of Petroleum Re-Refiners (APR) will be involved, actively working on behalf of the industry. Working together, they further shape the legislative and regulatory environment in which the entire industry can prosper.

709,283
PB84-235928

(Order as PB84-235902, PC **A14**/MF **A01**)
California State Solid Waste Management Board, Sacramento.
California Used Oil Recycling Program.
G. W. Moskat. Jul 84, 5p
Included in Measurements and Standards for Recycled Oil-4, p7-11 1984.

Keywords: *Hazardous wastes, *Regulations, *Lubricating oils, California, *Waste recycling, *Oil wastes, Liquid wastes.

Used oil in California is classified as a hazardous waste material subject to the regulatory overview of many agencies. Because of its classification as such, used oil is regulated by the State Department of Health Services (DOHS), and subject to manifesting and vehicle registration requirements; the Air Resources Board (ARB), who regulates emission levels and hydrocarbon emissions from processing plants and fuel oil burners; the Regional Water Quality Control Boards who monitor oil disposal operations; the California Highway Patrol, who performs vehicle inspections of the hauling industry; and the State Solid Waste Management Board (SWMB), who regulates used oil recycling activities in the state. This report will focus upon the latter area of used oil recycling, and the program California has developed to effectively monitor the disposition of over 50.6 million gallons of used oil collected and recycled each year in the state. In addition, the author will discuss the efforts the state has made to promote the concept of oil recycling through public awareness and marketing activities.

709,284
PB84-235936
(Order as PB84-235902, PC **E14**/MF **A01**)
Department of Energy, Bartlesville, OK. Bartlesville Energy Technology Center.
Fate of Hazardous Wastes in Used Oil Recycling.
D. W. Brinkman, P. Fennelly, and N. Suprenant. Jul 84, 14p
Prepared in cooperation with GCA Corp., Bedford, MA.
Included in Measurements and Standards for Recycled Oil-4, p13-26 1984.

Keywords: *Hazardous materials, *Chemical analysis, Lubricating oils, Sampling, Oil wastes, *Waste recycling, *Path of pollutions, *Liquid waste disposal, Liquid wastes.

While it is known that used lubricating oils often contain one or more of the EPA priority pollutants, and it can be shown that this contamination frequently is introduced after the oil has been taken out of service, very little documentation exists on what happens to these hazardous species when the used oil is dumped, burned raw, or recycled. GCA Corporation has been working under contract to the U.S. Department of Energy, Office of Industrial Programs to (1) determine which hazardous contaminants tend to show up frequently in used oils, and (2) experimentally demonstrate the fate of these contaminants under number of scenarios. The scenarios under examination include dumping the used oil down a sewer, road oiling, open burning (no controls), reprocessing for fuel, and re-refining for use as lubricating oil basestock using several different methods. Because chemical analysis of samples is still in progress, the results shown in this paper are not complete and some data may be subject to further verification and possible modification.

709,285
PB84-235944
(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Center for Analytical Chemistry.
Analysis of PCBs (Polychlorinated Biphenyls) in Oil: Technique and SRM (Standard Reference Material) Development.
R. M. Parris, F. R. Guenther, W. E. May, and S. N. Chesler. Jul 84, 6p
Included in Measurements and Standards for Recycled Oil-4, p27-32 1984.

Keywords: *Lubricating oils, *Chemical analysis, Chlorine organic compounds, Sampling, Additives, Hazardous materials, *Oil wastes, *Polychlorinated biphenyls, *Liquid wastes, Aroclors, Electron capture detectors, Hall electrolytic conductivity detection, Waste recycling.

Polychlorinated biphenyls, PCBs, are toxic, persistent, global environmental contaminants. PCBs were formulated as complex mixtures of congeners and were manufactured until 1977 in the United States under the trade name of Aroclor. These mixtures have been extensively used in this country in high-voltage electrical components and may be introduced into the environment when these components are serviced, repaired or discarded. Since the PCB fluid physically resembles lubricating oils, there have been instances in which PCBs have been added to motor oils being collected for recycling purposes. An estimated 750 million pounds of PCBs are still in service in the United States. The use, transport and disposal of PCBs is regulated by the Environmental Protection Agency under the auspices of the Toxic Substances Control Act. Cairns and Siegmund recently reviewed the regulatory history and toxicity of PCBs and identified some of the problems of PCB analysis. Samples of used motor oil containing a wide range on concentrations and types of PCB contamination have been analyzed using this method; both electron capture (ECD) and Hall electrolytic conductivity detection (HECD) have been used. The ECD was found to be more sensitive than the HECD (by two orders of magnitude) and easier to maintain in a non-contaminated state. The HECD has a wider linearity range and is more selective because it responds only to halogenated compounds.

709,286
PB84-235951
(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Recycled Oil Program.
Analysis for PCBs (Polychlorinated Biphenyls) in Oil: The NBS/ASTM (National Bureau of Standards/American Society of Testing and Materials) Round Robin.
D. A. Becker. Jul 84, 9p
Included in Measurements and Standards for Recycled Oil-4, p33-41 1984.

Keywords: *Lubricating oils, *Chemical analysis, Sampling, Concentration(Composition), Chlorine organic compounds, *Oil wastes, *Polychlorinated biphenyls, *Waste recycling, Aroclors, Liquid wastes.

Early in 1982, a cooperative effort on the analysis of polychlorinated biphenyls (PCBs) in lubricating oil was initiated by the National Bureau of Standards (NBS) Recycled Oil Program and the American Society of Testing and Materials (ASTM), Technical Division P. The primary purpose of this cooperative effort was to help provide the necessary information and data to identify an accurate, relatively simple method for the determination of PCBs in used and re-refined lubricating oils. If identified, such a method could be developed into an ASTM Standard Method. A secondary purpose was to assist oil recyclers to identify an appropriate analytical methodology which could be utilized to obtain reliable PCB analyses in these types of samples. This paper is a further update on the progress and results obtained in this study, and supplements information provided previously at ASTM meetings.

709,287
PB84-235993
(Order as PB84-235902, PC **A14**/MF **A01**)
Southwest Research Inst., San Antonio, TX. Army Fuels and Lubricants Research Lab.
Development of Methodology for Engine Deposit Characterization.
K. B. Kohl, and E. A. Frame. Jul 84, 13p
Included in Measurements and Standards for Recycled Oil-4, p61-73 1984.

Keywords: *Lubricating oils, Regulations, Refining, National government, Fuels, *Oil wastes, *Waste recycling, Liquid wastes, Resource Conservation and Recovery Act, Fuel substitutes.

More than two billion gallons of lubricating oils are used each year in the United States. Approximately 50 percent of this total is consumed or otherwise lost during use. The remaining one billion gallons per year of the used lubricating oil are a significant and valuable resource. With proper re-refining treatment, used oil can be utilized as a fuel, or, more importantly, it can be reused as a lubricant or lubricant basestock. The U.S. government has enacted important legislation in recent years to encourage the utilization of this valuable natural resource.

709,288
PB84-236009
(Order as PB84-235902, PC **A14**/MF **A01**)
Franklin Research Center, Philadelphia, PA.
Development of a Bench Engine Screening Test for Motor Oils.
D. Heath. Jul 84, 9p
Included in Measurements and Standards for Recycled Oil-4, p75-83 1984.

Keywords: *Lubricating oils, Specification, Performance evaluation, *Oil wastes, *Waste recycling, *Engine tests, Liquid wastes.

This presentation is a status report of a cooperative project funded by the U.S. Army MERADCOM, NBS, and the Franklin Research Center. The initial phase of the project, the feasibility demonstration, will be completed within the next several weeks. The theme of this conference was so in line with our project that the author planned this presentation knowing that the initial test results might not be in-hand for today. The title, when the terms are explained, denotes the general concept which we are pursuing: specifically, to provide a screening tool for the Sequence V-D Test, and which may later be adapted to the other multicylinder and single cylinder oil specification engine tests.

709,289
PB85-131555 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Technical Issues Concerned with PCDD (Polychlorodibenzo-p-dioxins) and PCDF (Polychlorodibenzofuran) Formation and Destruction in MSW (Municipal Solid Waste) Fired Incinerators.
W. M. Shaub. Nov 84, 42p NBSIR-84/2975
Sponsored in part by New York City Dept. of Sanitation.

Keywords: *Incinerators, *Air pollution, *Solid waste disposal, Fly ash, Chlorine organic compounds, Combustion products, Concentration(Composition), Hydrogen chloride, Chemical reactions, Catalysis, *Municipal wastes, *Poly(dibenzofuran/chloro), *Poly(dibenzodioxin/chloro), Dioxins.

Technical issues concerned with underlying factors that can potentially affect the levels of PCDD and PCDF emissions from MSW fired incinerators have been analyzed. Major conclusions of this study are that presorting of municipal waste prior to incineration to remove chlorine does not appear to be a reasonable option and that PCDD and PCDF formation is not likely to take place in the stack of an incinerator.

709,290
PB85-189447 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Oxygen Flow Calorimeter for Kilogram-Size Samples of Municipal Solid Waste. Part 2. Trial Combustions of Kilogram-Size Samples.
Final rept.
A. E. Ledford, R. V. Ryan, M. L. Reilly, E. S. Domalski, and K. L. Churney. 1982, 7p
Sponsored by Department of Energy, Washington, DC.
Pub. in Resources and Conservation 8, p159-165 1982.

Keywords: *Calorimeters, *Enthalpy, *Combustion, Samples, Reprints, *Refuse derived fuels, *Solid wastes, Municipal wastes.

A new calorimeter is being developed at the National Bureau of Standards to determine the enthalpies of combustion of kilogram-size samples of municipal solid waste (MSW) in flowing oxygen near atmospheric pressure. Experiments were carried out to develop a prototype combustor in which pellets of relatively unprocessed MSW can be rapidly and completely burned with minimal scattering of ash. Pellets of up to 2.2 kg mass with ash contents between 20 and 35% have been successfully burned at a rate of 15 minutes per kilogram initial mass with CO/CO2 ratios not greater than 0.1%.

709,291
PB86-112380 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Statistical Aspects of Designs for Studying Sources of Contamination.
Final rept.
W. Liggett. 1985, 19p
Pub. in American Society for Testing and Materials, Special Technical Publication 867, p22-40 1985.

Keywords: *Statistical analysis, *Environmental surveys, *Ground water, *Waste management, *Solid waste disposal, Sources, Design criteria, Sampling, Sites, Experimental design, Water pollution, Assessments, Reprints, *Pollution monitoring, *Waste processing plants.

A design for studying sources of environmental contamination must start with a basis for distinguishing the contamination of interest from the background. As part of this basis, the design should provide a method for assessing the sampling and measurement error. Because of problems with reports of none detected, the design should also include a plan for analyzing intermediate laboratory results in addition to the reported values. This paper discusses these aspects of design in the context of monitoring the groundwater around a waste management facility. A design appropriate for spatially and temporally varying backgrounds is proposed and illustrated with monitoring results from Alabama and Florida. To assess the sampling error, the proposed design specifies resampling each well after a period of a few days. Experiments to check this procedure are suggested. The proposed design incorporates and supplements the Environmental Protection Agency laboratory method for total organic halide. In addition, this paper illustrates some difficult design problems that involve nonnormality and nonlinear measurement methods.

709,292
PB86-114063 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis and Modeling of the Leaching Process.
Final rept.
R. C. Paule. 1981, 24p
Sponsored by American Society for Testing and Materials, Philadelphia, PA.
Pub. in Proceedings of Conference on Hazardous Solid Waste Testing (1st), Fort Lauderdale, FL., January 14-15, 1981, ASTM STP 760, p112-135 1981.

Keywords: *Fly ash, *Leaching, *Extraction, *Environmental surveys, *Hazardous materials, Chemical equilibrium, Statistical analysis, Chemical analysis, Reprints, Solid wastes.

A statistical analysis has been made on data obtained in the study of the leaching process for the ASTM special fly ash sample using distilled water as the extractant. Two laboratories made extractions under a variety of conditions, and after acid stabilization, the leachates were analyzed by a third laboratory using ICP analysis. Fifteen elements were studied. Three types of experimental variables were examined: (1) the extractor (60 and 180 cycle/minute shaker tables, and the NBS mixer), (2) the liquid/solid ratio (4/1, 10/1, and 20/1), and (3) the time (24 and 48 hours). The data were examined in terms of three plausable extraction models.

709,293
PB86-119245 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation of Data on Higher Heating Values Determined during ASTM (American Society for Testing and Materials) Round Robin Testing of RDF-3 (Refuse-Derived-Fuel).
Final rept.
E. S. Domalski, and S. Abramowitz. Nov 80, 15p
Sponsored by Department of Energy, Washington, DC. Energy from Municipal Waste Div.
Pub. in Proceedings of Mineral Waste Utilization Symposium, Mineral and Mineral Process Waste - Urban Solid Waste - Industrial Waste Recovery - Scrap Metal Recovery, Chicago, IL., October 20-21, 1980, p69-83.

Keywords: *Standards, *Calorific value, Substitutes, Fuels, Chemical properties, Coal, Comparison, Tables(Data), Marketing, Statistical analysis, *Refuse derived fuels, *Round Robin tests, *Waste utilization, *Resource recovery facilities.

The potential application of RDF-3 as an alternative or supplemental fuel is dependent upon its acceptance as an article of commerce. ASTM Committee E-38 on Resource Recovery and its Subcommittee on Energy E-38.01 has been actively engaged in the development of concensus standards for this purpose since April 1974. Standard procedures for the characterization of RDF-3 are being developed. These procedures are based on those ASTM methods used in coal analysis. The procedures developed will insure a meaningful purchase - sales relationship between the buyer and seller. A variety of chemical and physical test procedures were studied by as many as 12 laboratories. Currently 20 editorial draft standards have been prepared and are being studied by the committee membership. The National Bureau of Standards in cooperation with ASTM subcommittee E38.01 has undertaken a technical review of a selected group of chemical properties of RDF-3. The property of principal interest is the higher heating value. In order to properly characterize this property, critical evaluation of methods to determine total moisture, residual moisture, and ash is also necessary. Intralab and interlab variations in these properties are discussed. A comparison of these results with those on round robin data for coal are also made. The results of this study identify the levels of precision for intralab and interlab agreement.

709,294
PB86-122819 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Statistical Analysis of Sampling and Measurement Errors in the Characterization of Refuse Derived Fuel.
Final rept.
J. Mandel, and R. C. Paule. 1981, 6p
Pub. in Proceedings of International Symposium on Materials and Energy from Refuse, Antwerp, Belgium, October 20, 1981, p6.25-6.30.

Keywords: *Statistical analysis, *Error analysis, *Calorific value, *Ash content, *Chemical analysis, Sampling, Graphs(Charts), Heat measurement, *Refuse derived fuels, *Municipal wastes, Numerical solution.

A statistical analysis is presented, giving results of a sampling experiment involving a production stream of Refuse Derived Fuel. Calorimetric and ash measurements were analyzed and statistical parameters were estimated. Measures were obtained for the variability of the material both within and between days of production, and for the errors of measurement. Particular attention was given to the relation between the ash and heat measurements. The results are presented in numerical and graphical form.

709,295
PB86-133527 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Operations Research Div.
Evaluating the Risks of Solid Waste Management Programs: A Suggested Approach.
Final rept.
R. E. Chapman, and H. Yakowitz. 1984, 18p
Pub. in Resour. Conserv. 11, n2 p77-94 Nov 84.

Keywords: *Waste management, *Mathematical models, Substitutes, Risks, Monte Carlo method, Cost analysis, Capitalized costs, Assessments, Reprints, *Solid wastes, *Resource recovery facilities.

The focus of the paper is on how the Resource Recovery Planning Model (RRPLAN) can be used to evaluate the risks associated with alternative solid waste management programs. The paper first discusses how RRPLAN uses a detailed cost accounting framework to weigh the consequences of decisions affecting siting, routing, marketing and financing. A case study of the tri-county area surrounding Jackson, Mississippi, where two waste-to-energy facilities are compared to an all landfill option, is then introduced. The case study shows how a coordinated sensitivity analysis can be used to develop a cost estimating relationship between the discounted cost per ton of processing at a waste-to-energy facility and three explanatory variables: (1) the capital cost of the facility; (2) the volume of waste processed; and (3) revenues from the sale of recoverables and any associated tipping fees. A Monte Carlo experiment is then performed to show how variations about the expected values for the three explanatory variables affect the risk of the program. The probability that the discounted cost per ton of the waste-to-energy facility exceeds that of the all landfill option is used as a risk assessment mechanism.

709,296
PB87-167185 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Hazardous Waste Aspects of MSW Combustion.
Final rept.,
W. Tsang. 1984, 10p
Pub. in Argonne National Laboratory Technical Report, ANL/CNSV-TM-144, Energy Munic. Waste Res., p259-268 1984.

Keywords: Combustion, Incineration, Reprints, *Hazardous wastes, *Combustors, Dioxin, Municipal solid wastes.

The paper is concerned with organic emissions from MSW combustors. The authors will begin with a brief survey of the basic principles that govern the high temperature oxidative destruction of organic compounds. This will be followed by a survey of the existing data concerning organic emissions from such devices. Serious problems with respect to measurement methodology and inadequacies in the nature of the information base will be discussed. The problem of dioxin emissions is discussed. Mechanisms for its formation and destruction will be described and the important controlling factors as well as major uncertainties indicated. The paper concludes by suggesting the type of laboratory measurements which can solve the many unanswered questions and the measurement strategies which may provide evidence for proper operation of MSW combustors.

709,297
PB87-233821 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
NBS (National Bureau of Standards) Approach for Improving the Quality of Leach Measurements on Solid Wastes.
Final rept.,
B. I. Diamondstone, R. W. Burke, and E. L. Garner. 1981, 11p
Pub. in Proceedings of International Conference on Solid Waste Sludges, and Residual Materials: Monitoring, Technology, and Management, Rome, Italy, June 17-20, 1981, p200-210.

Keywords: *Hazardous materials, *Leach measurements, *Solid wastes.

Historically, the National Bureau of Standards (NBS) has been charged with developing and maintaining the measurement capabilities that affect science and industry in the United States. In this capacity it frequently plays a third party role in which it utilizes its experience and expertise to develop standardized materials and methods to assess existing measurement needs. Recently, the United States Environmental Protection Agency and United States Department of Energy have sought to utilize the capability at NBS for improving the reliability of analytical measurements on solid wastes. The paper outlines the NBS approach towards improving the measurement capability in an area where little, if any, significant standardization exists. Specific topics to be discussed include the development of a new extractor design that improves the precision of commonly used leach tests and the preparation and characterization of a series of quality assurance standards for use in validating laboratory capabilities.

709,298
PB88-154646 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Assessing the Credibility of the Calorific Value of Municipal Solid Waste.
Final rept.,
K. L. Churney, E. S. Domalski, A. E. Ledford, J. C. Colbert, S. S. Bruce, T. J. Buckley, R. C. Paule, and M. L. Reilly. 1986, 7p
See also PB84-175470.
Pub. in Proceedings of the Biennial National Waste Processing Conference (12th), Denver, CO., June 1-4, 1986, p449-455.

Keywords: *Calorific value, Combustion, Laboratories, Reliability, Assessment, *Solid wastes, *Municipal wastes, *Refuse derived fuels, Technology assessment.

A study has been made at the National Bureau of Standards to establish the limits of reliability of the calorific value of municipal solid waste (MSW) determined by the bomb calorimetric procedure currently used in commercial test laboratories. To test the bomb calorimetric procedure, a 2.5 kg capacity combustion flow calorimeter was designed and constructed for the determination of the enthalpies of combustion of kilogram-size samples of MSW in flowing oxygen near atmospheric pressure. Calorimetric data from measurements using both the kilogram-size flow and a gram-size bomb calorimeter show that, if proper techniques are implemented, it is possible to determine the calorific value of a multiton pile of waste using gram-size test samples within + or - 3%.

709,299
PB88-155429 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Monitoring the Fate of Chlorine from MSW (Municipal Solid Waste) Sampling through Combustion. Part 1. Analysis of the Waste Stream for Chlorine.
Final rept.,
E. S. Domalski, K. L. Churney, A. E. Ledford, and S. S. Bruce. 1986, 16p
See also DE86-006829.
Pub. in Chemosphere 15, n9-12 p1339-1354 1986.

Keywords: *Chlorine, *Combustion products, *Waste treatment, Maryland, New York, Sampling, Environmental transport, Reprints, *Ecological concentration, *Environmental transport, *Municipal wastes, Brooklyn(New York), Solid wastes.

The total chlorine and water soluble chlorine contents of the components of municipal solid waste (MSW) have been determined from sampling studies carried out at two sites, Baltimore County, MD, and Brooklyn, NY, for a five-day period. The total chlorine contents of the MSW samples from Baltimore County, MD, and Brooklyn, NY, are 0.45 and 0.89 mass %, respectively.

Water Pollution & Control

709,300
AD-A100 587/5 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Chemical and Biodegradation Processes Group.
Ultratrace Speciation and Biogenesis of Methyltin Transport Species in Estuarine Waters.
Interim technical rept.
F. E. Brinckman, J. A. Jackson, W. R. Blair, G. J. Olson, and W. P. Iverson. 1981, 40p Rept no. NBS-5610406-TR-5
Contract N00014-81-F-0013

Keywords: *Organometallic compounds, *Tin compounds, *Marine atmospheres, *Estuaries, *Wastes(Industrial), *Water pollution, Bacteria, Methyl radicals, Chemical analysis, Reaction kinetics, Oxidation reduction reactions, Transport properties, Chesapeake Bay, Methyl tin hydrides, Tetramethyl tin, NTIS-DODXA.

Environmental tin, widely dispersed at low concentrations in waters, sediments, and biota, is now perceived to be a bioactive element susceptible to methylation and even hydridization by marine bacteria. Nonetheless, the redox cycle of tin in natural waters is poorly understood and recent advances in tin-specific molecular characterization fail to speciate Sn(II) and Sn(IV) reliably. On the other hand, such rapid developments in speciation methodology now permit growing numbers of studies of organotin distributions in aquatic systems, raising the question of the natural biogeochemical flux of methylstannanes in relation to increased anthropogenic organotin influx from industry and shipping. New methods for direct speciation of aquated or involatile organotins by liquid chromatography are compared with advances in purge-and-trap sampling of volatile or hydrophobic organotins speciated by gas chromatography. The work in our laboratory indicates that effective models for estuarine formation and transport may ultimately be developed, that the basic roadblocks to progress stem from inadequate descriptive aqueous organometallic chemistry and knowledge of critical kinetic parameters for the lifetimes of key organotin species in sea water. (Author)

709,301
PB-259 465/3 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
Petroleum Analysis: Methodology for Quantitative and Qualitative Assessment of Oil Spill.
Final rept.,
H. S. Hertz, W. E. May, S. N. Chesler, and B. H. Gump. Oct 75, 6p
Sponsored in part by National Oceanic and Atmospheric Administration, Boulder, Colo. Pub. in Environmental Science and Technology, v10 n9 p900-903 Sep 76.(PC A02/MF A01)

Keywords: *Oil pollution, *Chemical analysis, Gas chromatography, Crude oil, Sampling, Mass spectrometry, Qualitative analysis, Water pollution, Monitoring, Hydrocarbons, Quantitative analysis, Reprints, *Oil spills.

An integrated chromatographic technique for petroleum analysis compatible with long-term studies of oil spills is presented. Dynamic headspace sampling and the complementary analytical techniques of gas chromatography and coupled-column liquid chromatography are used for quantitation of petroleum containing samples. Gas chromatography-mass spectrometry is employed for identification of individual components in these samples. Analytical data obtained from a major oil spill are presented and discussed.

709,302
PB-265 036/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Indirect Determination of Sulfate in Natural Waters by Ion-Selective Electrode.
Final rept.,
E. P. Scheide, and R. A. Durst. 1977, 11p
Pub. in Anal. Lett., v10 n1 p55-65 1977.

Keywords: *Water analysis, *Sulfates, Water pollution, Chemical analysis, Sea water, Samples, *Ion selective electrodes, *Water pollution detection, Reprints.

The indirect determination of sulfate in natural waters (seawater and simulated rainwater) was accomplished by titration with lead nitrate solution using the lead ion-selective electrode as the titration sensor. The indirect determination of sulfate is based on the formation of PbSO4 which is quantified by measurements with a lead electrode. The measurements were carried out in 80 percent isopropanol using a double-junction reference electrode. The data evaluation was performed by a Gran plot of the titration of sulfate samples with standard lead nitrate. Samples containing between 2 and 100 ppm sulfate concentration analyzed directly, while samples of higher sulfate concentration were diluted prior to analysis. The seawater samples were diluted 100-fold prior to analysis.

709,303
PB-266 855/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hydrocarbon Burden in the Marine Environment Surrounding a Refinery Tanker Jetty,
B. H. Gump, H. S. Hertz, W. E. May, and S. N. Chesler. 1977, 9p
Pub. in J. Environ. Sci. Health, vA12 n3 p105-113 1977.

Keywords: *Petroleum products, *Hydrocarbons, Docks, Water pollution, Sediments, Samples, Water analysis, Chemical analysis, Concentration(Composition), Gas chromatography, Aromatic polycyclic hydrocarbons, Refineries, Reprints, *Water pollution detection, Benzopyrenes.

An investigation of the petroleum hydrocarbons in the vicinity of a refinery docking facility was undertaken. Surface and 10-m depth water samples showed essentially no contamination. Bottom sediment indicated low level hydrocarbon contamination. Of particular interest was the relative abundance of benzo(a)pyrene in this bottom sediment.

709,304
PB-267 608/8 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Heat Div.
Thermometry in the Control of Water Quality.
Final rept.,
S. D. Wood. May 77, 22p NBSIR-77-1227

Keywords: *Water quality, *Thermal pollution, *Temperature measurement, *Water analysis, Plumes, Electric power plants, Reservoir engineering, Fresh water biology, Water pollution, Standards, Steam power plants.

A limited study of thermometry in water pollution was made which focused on water analysis, thermal pollution, and the work of standards committees. It was concluded that the current needs in this field can be addressed most efficiently by the National Bureau of Standards with educational and calibration activities. Suggestions are made concerning possible contributions by NBS with an emphasis on those activities having large impacts for small investments of NBS resources.

709,305
PB-280 433/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interlaboratory Comparison of Determinations of Trace Level Petroleum Hydrocarbons in Marine Sediments.
Final rept.,
L. R. Hilpert, W. E. May, S. A. Wise, S. N. Chesler, and H. S. Hertz. Mar 78, 6p
Sponsored in part by Environmental Protection Agency, Washington, D.C. Office of Energy, Minerals and Industry, and Bureau of Land Management, Washington, D.C.
Pub. in Analytical Chemistry, v50 n3 p458-463 Mar 78.

Keywords: *Chemical analysis, *Sediments, *Hydrocarbons, Water pollution, Gas chromatography, Ocean environments, Sampling, Concentration(Composition), Petroleum products, Reprints, *Water pollution detection, Baseline measurements.

Results of analyses for petroleum hydrocarbons at the microgram/kg (ppb) level in marine sediments have been compared among eight laboratories. Values for concentrations of total extractable hydrocarbons scattered between 9 to 500 microgram/kg and 49 to 6625 micrograms/kg for the two sites examined. Scatter of results for hydrocarbons in the gas chromatographic elution range, for the most abundant aliphatic and aromatic hydrocarbons and for total polynuclear aromatic hydrocarbons (four rings and larger) were similar. Results for percent water and pristane/phytane ratio were somewhat more consistent. Sample inhomogeneity and analysis uncertainty contributed to an observed intralaboratory precision (1 delta) of + or - 25 percent for nine replicate analyses of one sediment sample. The data are discussed with regard to the reliability and comparability of current methods for environmental baseline measurements.

709,306
PB-281 362/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS Program for Standards for Trace Organic Analysis in the Marine Environment.
Final rept.,
H. S. Hertz, S. N. Chesler, W. E. May, S. A. Wise, L. R. Hilpert, J. Brown, A. Fatiadi, and F. Guenther. Oct 77, 16p
Sponsored in part by Environmental Protection Agency, Washington, D.C.
Pub. in Proceedings of Environmental Effects of Energy Related Activities on Marine/Estuarine Ecosystems, Newport, R.I. Mar 77 p227-242 Oct 77.

Keywords: *Water analysis, *Trace elements, Organic compounds, Chemical analysis, Petroleum products, Concentration(Composition), Water pollution, Standards, *Water pollution detection, Standard reference materials.

The National Bureau of Standards (NBS) is currently conducting a research program to develop standards for trace organic analysis in the marine environment. In this paper, the authors summarize the results of these analyses for petroleum-in-sediment and petroleum-in-biota reference materials, marker compounds, and concentration techniques for polar organic materials.

709,307
PB-281 436/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chemical and Bacterial Cycling of Heavy Metals in the Estuarine System.
Final rept.,
F. E. Brinckman, and W. P. Iverson. 1975, 24p
Pub. in the Proceedings Symposium, Middle Atlantic Region Meeting of the American Chemical Society (169th), Philadelphia, Pa. 8-10 Apr 75, ACM Symp. Ser18, Marine Chemistry in the Coastal Environment, Paper-18, p319-342 1975.

Keywords: *Metals, *Limnology, *Water pollution, *Estuaries, Marine microorganisms, Sediments, Crude oil, Methylation, Biochemical cycles, Sulfur, Mercury(Metal), Aerobic bacteria, Metabolism, *Path of pollutants.

Anthropogenic inputs of heavy metals into an estuary such as the Chesapeake Bay result in substantial partitioning between sediments, waters, and primary trophic levels. Many metals, including Hg, are concentrated in oil fractions isolated from some sediments. Although low concentrations of metals exist in the aqueous phase, significant transport by aquated metal species is believed to occur via combinations of both abiotic and biological transformations. The case for Hg pollutants is most developed, where it is shown that benthic

microorganisms can be responsible for volatilization and resolubilization of Hg(II) via metabolic gasesous Hg or methylmercurials. Evaluation of the intermediacy of other organometallic species has been conducted, with the recent finding of a bimetallic pathway involving transmethylation between tin and Hg. Here, aerobic marine bacteria directly methylate Sn(IV) (while reducing Hg(II)) to abiotically form subsequently methylmercury from available Hg(II).

709,308
PB-281 626/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement Standards for Water Monitoring Associated with Energy Production and Use.
Final rept.,
W. H. Kirchhoff. Nov 77, 3p
Sponsored in part by Environmental Protection Agency, Washington, D.C.
Pub. in Proceedings of National Conference on Interagency Energy/Environment Research and Development, Washington, D.C. (2nd), 6-7 Jun 77 p449-451 Nov 77.

Keywords: *Water analysis, *Trace elements, *Standards, Water pollution, Organic compounds, Sediments, Chemical analysis, Laboratory equipment, Sea water, Concentration(Composition), *Standard reference materials, *Water pollution detection.

In accord with the overall mission of the National Bureau of Standards to provide standards of measurement and means for making measurements consistent with those standards, NBS scientists are participating in the EPA administered program on environmental aspects of energy production and use by developing measurement methods and Standard Reference Materials (SRM's) for water pollution monitoring. Projects currently underway include the development of an SRM consisting of eighteen trace elements in water, the development of methods for the measurement of trace elements in sea water, the development of SRM's for the measurement of organic compounds in water and sediment and the development of methods for measuring polar organic compounds in water and for coupling liquid chromatography with mass spectroscopy for the identification of organic compounds in water. Methods for determining the chemical form (speciation) of trace elements in water are being investigated as are methods for determining the depth profile of trace elements in individual sediment particles using ion microprobe analysis.

709,309
PB-281 922/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of Trace Level Hydrocarbons in Marine Biota.
Final rept.,
S. N. Chesler, B. H. Gump, H. S. Hertz, W. E. May, and S. A. Wise. May 78, 6p
Sponsored in part by Environmental Protection Agency, Washington, D.C., and Bureau of Land Management, Washington, D.C.
Pub. in Analytical Chemistry 50, n6 p805-810, May 78.

Keywords: *Hydrocarbons, *Trace elements, *Petroleum products, Water pollution, Gas chromatography, Chemical analysis, Marine atmospheres, Aquatic animals, *Water pollution detection, *Water pollution effects(Animals), Baseline measurements, Reprints.

A method is described for the analysis of petroleum hydrocarbons in marine biota. The method is suitable for the determination of the low hydrocarbon levels encountered in pollution baseline studies as well as the higher levels found in organisms exposed to petroleum. The procedure utilizes dynamic headspace sampling of an aqueous caustic tissue homogenate to extract and collect volatile organic components. Interfering polar biogenic components are removed by normal-phase high-performance liquid chromatography(HPLC). Quantitation and identification of the individual compounds are accomplished using gas chromatography (GC) and gas chromatography-mass spectrometry (GC-MS). The non-volatile components remaining in the homogenate after headspace sampling are solvent extracted and analyzed by reversed-phase liquid chromatography.

709,310
PB-283 839/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis of Petroleum Hydrocarbons in the Marine Environment: Results of an Interlaboratory Calibration Exercise.
Final rept.,
W. E. May, S. N. Chesler, B. H. Gump, H. S. Hertz, and R. D. Searl. 1978, 8p
Pub. in Jnl. Environ. Sci. Health A13 n5 and 6 p403-410 1978.

Keywords: *Hydrocarbons, *Ocean environment, *Water analysis, Chemical analysis, Calibrating, Petroleum products, Sampling, Reprints, *Water pollution detection.

An interlaboratory comparison exercise, carried out by Exxon Research and Engineering and the National Bureau of Standards, is described. Marine water samples obtained on a joint cruise with each of the laboratories' water samplers were split and analyzed at both laboratories. Both samplers were found to be acceptable for the determination of hydrocarbons at micrograms/kg (ppb) levels. Differences in analyses were traceable to the analytical schemes employed by each laboratory.

709,311
PB-287 969/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation of the Applicability of Pyrolysis-Gas-Liquid Chromatography for the Identification of Microorganisms in Water and Sewage Treatment Plant Effluents.
Final rept.,
R. A. Symuleski. 1976, 5p
Sponsored in part by Department of Housing and Urban Development, Washington, DC.
Pub. in Proceedings National Conf. on Complete Water Reuse (3rd), Held at Cincinnati, OH. on Jun 27-30, 1976, p457-461.

Keywords: *Sewage treatment, *Water analysis, *Bacteria, *Water treatment, Gas chromatography, Potable water, Chemical analysis, Anaerobic process, Reprints, Liquid chromatography.

Recent studies have shown pyrolysis-gas-liquid chromatography to be a valuable tool in the rapid identification of bacteria. Most of the work to date has been involved with the detection of anaerobic bacteria in clinical samples. The present study indicates that the technique may also have promise in detecting those facultative bacteria present in samples of environmental origin. This paper describes on-going work in the evaluation of this procedure for the rapid identification of bacteria in water and sewage treatment plant effluents. Preliminary results from the analysis of one species of bacteria are presented along with a discussion of current problems encountered in the analytical procedure.

709,312
PB-290 519/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Separation of Eight Transition Elements from Alkali and Alkaline Earth Elements in Estuarine and Seawater with Chelating Resin and Their Determination by Graphite Furnace Atomic Absorption Spectrometry.
Final rept.,
H. M. Kingston, I. L. Barnes, T. J. Brady, T. C. Rains, and M. A. Champ. Dec 78, 7p
Pub. in Analytical Chemistry 50, n14, p2064-2070, Dec 78.

Keywords: *Water analysis, *Sea water, Estuaries, Trace elements, Chemical analysis, Cadmium, Cobalt, Copper, Iron, Nickel, Lead(Metal), Zinc, Manganese, Atomic spectroscopy, Absorption spectra, Chelating agents, Water pollution, Chesapeake Bay, Alaska Gulf, *Water pollution detection, Reprints.

A method is described for determining Cd, Co, Cu, Fe, Mn, Ni, Pb, and Zn in seawater using Chelex 100 resin and graphite furnace atomic absorption spectrometry. The pH of the seawater is adjusted to 5.0 to 5.5 and then passed through a Chelex 100 resin column. Alkali and alkaline earth metals are eluted from the resin with ammonium acetate and then the trace elements are eluted with two 5-ml aliquots of 2.5 M HNO3. The difficulties previously encountered with resin swelling and contracting have been overcome. By careful selection of the instrumental conditions, it is possible to determine subnanogram levels of these trace elements by graphite furnace atomic absorption spectrometry. The proposed method has been shown to separate quantitatively the elements desired from the alkali and alkaline earth metals and has been applied in the analysis of trace elements in estuarine water from the Chesapeake Bay and seawater from the Gulf of Alaska.

709,313
PB-292 365/4 Not available NTIS
National Bureau of Standards, Washington, DC. Environmental Protection Agency, Washington, DC.
Measurement of Organomercury Species in Biological Samples by Liquid Chromatography with Differential Pulse Electrochemical Detection.
Final rept.,
W. A. MacCrehan, and R. A. Durst. Dec 78, 5p
Sponsored in part by Environmental Protection Agency, Washington, DC.
Pub. in Analytical Chemistry 50, n14, p2108-2112, Dec 78.

Keywords: *Chemical analysis, *Mercury organic compounds, *Laboratory equipment, Fishes, Design criteria, Performance evaluation, Electrochemistry, Water pollution, Mercury/methyl, Mercury/ethyl, Mercury/phenyl, *Biological samples, Liquid chromatography, *Water pollution detection, Reprints.

A new measurement approach is described for organomercury cations, employing liquid chromatography with electrochemical detection. Special considerations in constructing apparatus to optimize reductive electrochemical measurement are outlined. The added selectivity of the differential pulse mode of detection is demonstrated. A charge-neutralization reverse-phase separation of methyl-, ethyl-, and phenylmercury cations has been developed. The limit of detection for methylmercury is 2 ng/g or 40 pg (190 fmol/20 microliter sample). Methylmercury is determined by the technique in two research materials--tuna fish and shark meat.

709,314
PB-297 499/6 PC **A09**/MF **A01**
Resources for the Future, Inc., Washington, DC.
Environmental Regulation in Theory and Practice: EPA's Process of Setting Best Practicable Control Technology Standards.
Interim rept.
W. A. Magat, L. P. Gianessi, and W. Harrington. Dec 79, 176p NBS-GCR-ETIP-79-63
Contract NBS-7-35822
Prepared in cooperation with Urban Inst., Washington, DC.

Keywords: *Regulations, *Water pollution, Technology, Law enforcement, Forecasting, Standards, National government, *Best technology, *Water pollution abatement.

This document is a report of work carefully laying out the rulemaking process that had been used at EPA to prepare a large number of highly technical regulations in the clean water area. Section 1 introduces the study of rulemaking and some of the reasons for carrying it out. Section 2 covers the 'Best Practicable Technology' rulemaking process in detail. Section 3 contains a review of much expert literature and its applicability here. Section 4 discusses a methodology for continuing the project. Much supporting material is contained in an appendix. ETIP's next steps to build on this work would be to expand it in a similar level of detail into industry and industrial effects and to work from both the industrial and rulemaking domains simultaneously.

709,315
PB80-103781 Not available NTIS
National Bureau of Standards, Washington, DC.
Direct Determination of Barium in Sea and Estuarine Water by Graphite Furnace Atomic Spectrometry.
Final rept.,
M. S. Epstein, and A. T. Zander. Jun 79, 4p
Pub. in Analytical Chemistry 51, n7, p915-918, Jun 79.

Keywords: *Water analysis, *Barium, *Atomic spectroscopy, Water pollution, Chemical analysis, York River, Alaska Gulf, Sea water, Absorption spectra, Virginia, Reprints, *Water pollution detection, *Graphite furnace atomic spectroscopy.

Seawater samples from the Gulf of Alaska and estuarine water samples from the York River in Virginia near the Chesapeake Bay are directly analyzed for barium concentration using graphite furnace atomic emission spectrometry. The accuracy of the method is evaluated by a correlation of results with data from analyses using line source and wavelength-modulation continu-

um-source atomic absorption spectrometry and graphite furnace atomization, as well as the analysis of a standard reference water sample. Interferences in the analysis and techniques used to overcome them are discussed.

709,316

PB80-169352 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Development of an Aqueous Trace Organic Standard Reference Material for Energy Related Applications: Investigation of the Aqueous Solubility Behavior of Polycyclic Aromatic Hydrocarbons.
Interim rept. Nov 76-May 78.
W. E. May. Feb 80, 90p EPA/600/7-80-031

Keywords: *Water pollution, *Aromatic polycyclic hydrocarbons, Solubility, Solvent extraction, Water analysis, Chemical analysis, *Standard reference materials, *Water pollution detection, Procedures.

The development of a Standard Reference Material for aqueous solutions of known concentration of polynuclear aromatic hydrocarbons is an extremely difficult procedure. This paper is one of a series discussing the development of a generator column technique at NBS for the production of Standard Reference Materials for PAH's in water. In addition to providing the basis for SRM development the aqueous solubility is a fundamental parameter in assessing the extent and rate of the dissolution of energy based polynuclear aromatic hydrocarbons and their persistence in the aquatic environment.

709,317

PB81-126278 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Trace Level Hydrocarbons in Marine Biota.
S. A. Wise, S. N. Chesler, H. S. Hertz, W. E. May, F. R. Guenther, and L. R. Hilpert. 1980, 11p
Pub. in Proceedings of the Conference of the International Congress on Analytical Techniques in Environmental Chemistry Held at Barcelona, Spain on 27-30 Nov 78, Paper in Analytical Techniques in Environmental Chemistry, p41-51 1980.

Keywords: *Water analysis, *Hydrocarbons, *Trace elements, Chemical analysis, Gas chromatography, Mass spectroscopy, Sampling, Water pollution, Tissues(Biology), Aromatic polycyclic hydrocarbons, Marine atmospheres, *Water pollution detection, High performance liquid chromatography, Volatile organic compounds.

A method is described for the determination of hydrocarbons in marine biota. This method utilizes dynamic headspace sampling of an aqueous caustic tissue homogenate to extract and collect volatile organic components.

709,318

PB81-163867 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Quantitative Ultratrace Transition Metal Analysis of High Salinity Waters Utilizing Chelating Resin Separation: Application to Energy-Related Environmental Samples.
H. M. Kingston. Aug 79, 87p EPA-600/7-79-174

Keywords: *Water pollution, *Water analysis, *Transition metals, *Offshore drilling, Separation, Sampling, Trace elements, Chelating resins, Chemical analysis, Sea water, Neutron activation analysis, Mass spectroscopy, Atomic spectroscopy, *Water pollution detection, Spark source mass spectroscopy.

In order to accurately evaluate the impact of energy related activities, such as offshore drilling on the sea water, it is necessary to measure trace element concentrations in the presence of considerably higher levels of alkali and alkaline earth elements. This report describes a technique which was developed for the elimination of the alkali and alkaline earth elements Na, K, Ca and Mg from the trace transition elements in sea water samples.

709,319

PB81-211393 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Onsite Wastewater Systems--Current Practices and a Proposed Basis for Evaluation.
Final rept.
F. Winter. Mar 81, 124p NBSIR-81-2210
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Sites, *Waste water reuse, *Water conservation, *Sewage treatment, *Reviews, Field tests, Evaluation, Monitoring, Requirements, Research projects, Recommendations, Waste disposal, Circulation, Toilet facilities, Irrigation, Septic tanks, Aerobic processes, Vacuum equipment, Packaged sewage treatment plants, Surfactants, Mineral oils, Incinerators, Composting, Rotation, Kitchen equipment and supplies, *Onsite, Grey water, Black water, Rotating disc process, NTISCOMNBS, NTISHUDPDR.

A review of onsite wastewater systems and wastewater recirculation/reuse devices based on the literature and field inspections of systems in actual settings and usage is presented. Based upon the observations, an evaluation basis for onsite wastewater systems is proposed. Criteria and requirements for conducting and monitoring demonstration projects is presented. Wastewater systems identified as potentials for demonstration projects are suggested. Topics requiring further study are identified and recommended for specific research.

709,320

PB81-247033
(Order as PB81-247017, PC **A04**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Generator Columns and High Pressure Liquid Chromatography for Determining Aqueous Solubilities and Octanol-Water Partition Coefficients of Hydrophobic Substances.
H. DeVoe, M. M. Miller, and S. P. Wasik. 16 Jul 80, 6p
Included in Jnl. of Research of the National Bureau of Standards, v86 n4 p361-366, Jul-Aug 81.

Keywords: *Solubility, *Organic compounds, Water pollution, *High pressure liquid chromatography, *Partition coefficients, Hydrophobic, Benzene/propyl.

Generator columns packed with a solid support and loaded with a liquid organic phase make it possible to rapidly and conveniently equilibrate water with the organic phase. By coupling the generator column to an extractor column for high pressure liquid chromatographic analysis of the aqueous solution, errors from surface adsorption and loss to the atmosphere are avoided. Using this method, the mean values and confidence limits at a 95 percent confidence level of the aqueous solubility, S, and the octanol-water partition coefficient, P, of n-propylbenzene at 25 C were found to be S = (4.32 + or - 0.02) X 10 to the -4th power and log P = 3.720 + or - 0.003.

709,321

PB82-264193 Not available NTIS
National Bureau of Standards, Washington, DC.
Fingerprinting Inorganic Arsenic and Organoarsenic Compounds in In Situ Oil Shale Retort and Process Waters Using a Liquid Chromatograph Coupled with an Atomic Absorption Spectrometer as a Detector.
Final rept.
R. H. Fish, F. E. Brinckman, and K. J. Jewett. Mar 82, 6p
Pub. in Environmental Science and Technology 16, n3 p174-179 Mar 82.

Keywords: *Oil shale, *Arsenic inorganic compounds, *Arsenic organic compounds, Leaching, Water pollution, Water analysis, Chemical analysis, Reprints, *Water pollution detection, *High performance liquid chromatography, *Solid wastes, In-situ retorting, Atomic absorption spectroscopy.

Oil shale retorting produces a number of wastes that can reach the environment through direct discharge or accidental spills. In situ pyrolysis processes result in quantities of shale oil plus water, the latter component providing a leaching vehicle for transport of toxic organics, trace metals, and organometals. The purpose of this program is to identify and quantify the organometallic and inorganic species present in various components of the oil shale retorting process: process waters, oils, solid wastes, and aquatic leachates. In collaboration with the Chemical and Biodegradation Processes Group, Center for Materials Science, National Bureau of Standards, a method for direct, element-selective speciation of one known toxic component of process waters has been demonstrated. For a variety of process waters from different sources, trace (ppm) quantities of inorganic (arsenate), methylarsonic acid, and phenylarsonic acids species have been observed. Possible 'fingerprint' patterns are seen with certain water samples which suggest future lines of investigation for arsenic as well as many other trace organometallic systems detectable by HPLC-GFAA.

709,322

PB83-183566 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of a Dissolved Oxygen Field Test Protocol.
Final rept.
G. Kulin, W. Schuk, and I. J. Kugelman. Feb 83, 9p
Sponsored in part by Municipal Environmental Research Lab., Cincinnati, OH.
Pub. in Jnl. of the Water Pollution Control Federation 55, n2 p178-186 Feb 83.

Keywords: *Monitors, *Dissolved gases, *Oxygen, *Activated sludge process, Field tests, Sewage treatment, Maintenance, Performance evaluation, Reprints.

A test protocol which was developed for on-line dissolved oxygen meters was evaluated in a 60-day field test conducted in an activated sludge aeration basin with thirteen meters from seven cooperating manufacturers. The paper discusses the important features of the test protocol and describes the procedures and results of the field test. These results provide information on methods for testing, calibrating and performance monitoring, information useful for developing specifications, and information on routine maintenance for on-line dissolved oxygen meters in a specific plant environment.

709,323

PB83-252262 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Characterization of Controlled Release Dynamics and Identification of Species Released from OMP (Organometallic Polymers) Impregnated Wood Pilings.
Final rept.
W. R. Blair, E. J. Parks, and F. E. Brinckman. Jul 83, 30p NBSIR-83-2733
Contract N68305-82-MP-20019

Keywords: *Tin organic compounds, *Chemical analysis, *Wood, *Pile structures, *Water pollution, Metal containing organic compounds, Preservative, Antifouling coatings, Leaching, Microorganisms, Polymers, High pressure liquid chromatography, Size exclusion chromatography, Cation exchange chromatography.

Organometallic polymers (omp) are becoming an increasingly important class of compounds finding application in marine environments as anti-fouling and preservative agents. To provide accurate estimates of reliability in service and service life, new analytical methods are needed for the identification and measurement of the toxic species being delivered by the OMP. This report is concerned with the following: identification of parent tin species; identification of species leached from OMP impregnated wood pilings; and preliminary determination of the rate of tin release from OMP impregnated pilings. Additionally, the influence of microbiological activities on the leachate is considered in assessing the effectiveness and ultimate fate of the toxic species responsible for the anti-fouling and preservative properties of the OMP formulation. Data from leach rate measurement experiments are presented, along with chromatograms providing speciation data on parent and leachate tin compounds, discussion of areas for continued research are presented.

709,324

PB84-245943 Not available NTIS
National Bureau of Standards, Washington, DC.
Gas Chromatographic Speciation of Methylstannanes in the Chesapeake Bay Using Purge and Trap Sampling with a Tin-Selective Detector.
Final rept.
J. A. Jackson, W. R. Blair, F. E. Brinckman, and W. P. Iverson. Feb 82, 10p
See also AD-A100 150.
Pub. in Environmental Science annd Technology 16, n2 p110-119 Feb 82.

Keywords: *Gas chromatography, *Water analysis, *Chesapeake bay, Chemical analysis, Traps, Mass spectroscopy, Sampling, Water pollution, Measuring instruments, In vivo analysis, Reprints, *Water pollution detection, *Purge flame photometric gas chromatography, *Water pollution sampling, Tin/tetramethyl, Tin hydride/methyl.

A method has been developed which permits simultaneous detection and speciation of both volatile and non-volatile organotins in aqueous media. The method employs a commercial gas chromatograph (GC) with a flame photometric detector (FPD) optimized for tin-selective detection. Solvated organotins are volatilized by hydride reduction with sodium borohydride during the purge cycle of a commercial automatic purge and trap sampler (P/T) which sparges volatile species from aqueous solutions with N2 while concentrating and trapping volatiles and species volatilized by hydridization on a Tenax-GC filled trap at ambient temperature. Any Me4Sn which is present in the sample is unaffected by the reduction process. The P/T-GC-FPD method was used to analyze water samples collected from the Chesapeake Bay. Varying amounts of methyltin compounds, including tetramethyltin and methyltin hydrides, were detected in polluted sites in Baltimore Harbor. Although tetramethyltin was identified, the detection and error limits are not yet satisfactory. Biogenic origins are suspected for the methylstannanes (Me(n)SnH(4-n), n=2,3) in the Chesapeake Bay. In vitro studies using GC-MS confirmed results of microbial methylation of inorganic Sn(IV) to form Me(n)SnH(4-n) (n=2,3,4), by a strain of Pseudomonas species isolated from the Chesapeake Bay.

709,325
PB85-134070 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sulfate-Reducing and Methanogenic Bacteria from Deep Aquifers in Montana.
Final rept.
G. J. Olson, W. S. Dockins, G. A. McFeters, and W. P. Iverson. 1981, 14p
Pub. in Geomicrobiol. Jnl. 2, n4 p327-340 1981.

Keywords: *Ground water, *Hydrogen sulfide, *Water pollution, Aquifers, Sulfate reducing bacteria, Bacteria, Detection, Water wells, Montana, Reprints.

Thermophilic sulfate reducing and methanogenic bacteria were detected in waters of the Madison Limestone, a deep aquifer underlying a large portion of the Northern Great Plains. Some sulfate reducing bacteria were isolated and tentatively identified as Desulfotomaculum nigrificans. These organisms are probably responsible for the hydrogen sulfide which occurs in the ground water. Microscopic counts of microorganisms in certain formation waters were about 1000/ml. Attempts to detect other aerobic and anaerobic bacteria were unsuccessful.

709,326
PB85-141349 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Transformations of Nitrogen in a Polluted Estuary: Non-Linearities in the Demand for Oxygen at Low Flow.
Final rept.
S. C. Wofsy, M. B. McElroy, and J. W. Elkins. 1981, 4p
Pub. in Science 213, n4509 p754-757 1981.

Keywords: *Water pollution, *Oxidation, *Sewage, *Bacteria, *Mathematical models, Potomac River, Nitrification, Reprints.

Oxidation of sewage NH4(+1) in the Potomac River is described in terms of a simple kinetic model with growth of nitrifying bacteria limited by supply of NH4(+1). The oxidation rate varies inversely with freshwater inflow, Q, and the associated demand for O2 varies as Q2. Similar behavior is observed for the Delaware River. The model accounts for observed concentrations of NH4(+1) and N2O.

709,327
PB85-187797 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Speciation of Arsenic in Fossil Fuels and Their Conversion Process Fluids.
Final rept.
C. S. Weiss, E. J. Parks, and F. E. Brinckman. 1983, 18p
Pub. in Chapter in Arsenic: Ind., Biomed., Environ. Perspect., p309-326 1983.

Keywords: *Arsenic, *Fossil fuels, *Chemical analysis, *Environmental surveys, *Arsenic inorganic compounds, *Arsenic organic compounds, Coal gasification, Petroleum industry, Oil shale, Industrial wastes, Combustion products, Trace elements, Metals, Retorting, Water pollution, Air pollution, *Gel permeation chromatography, Solid wastes, Coal liquefaction.

The increased use of coal and oil shale, both directly and following conversion processes, as alternatives to petroleum dictates the need to understand the chemistry and environmental fate of many toxic elements which are found at higher concentrations in these alternative fossil fuels and their processing products. These elements include As, Be, Cd, Cr, Ge, Hg and Se. The ultimate environmental availability of such elements found in these matrices will depend not only upon the molecular form originally present, but also on the chemical transformations occurring during the type of process used to convert these materials to conventional fuels, and during their final use. The concentration and nature of one principal bioactive element, As, in the source materials (petroleum, coal, and oil shale) will be reviewed, as will the distribution of As species among products, process waters, and residues during a variety of coal conversion and oil shale retorting processes. The methods developed at NBS to speciate As in both the products and process waters generated during synthetic fuel processes rely on the chromatographic separation of the product or process water with As-selective detection. The discrete molecular speciation of As is possible in some cases. However, complexes, colloids, or macromolecular As-containing species, evident in size-exclusion chromatograms of various shale oils, must be evaluated in terms of the extent and nature of the complexing capacity of the matrix for As as well as the stability of these As-containing compounds.

709,328
PB85-201952 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Anthropogenic Changes in Organic Carbon and Trace Metal Input to Lake Washington.
Final rept.
W. R. Schell, J. R. Swanson, and L. A. Currie. 1983, 8p
Pub. in Radiocarbon 25, n2 p621-628 1983.

Keywords: *Anthropology, *Sediments, *Water pollution, *Radiocarbon dating, Lakes, Air pollution, Concentration(Composition), Fuel consumption, Industrial wastes, Fallout, Reprints, *Lake Washington, Seattle(Washington).

An example of how man's contaminants are introduced, deposited and retained in sediments giving a chronological record of events has been developed for Lake Washington, Seattle. Introduction of significant amounts of both inorganic and organic compounds into the environment have been identified as originating from fossil fuel sources-such as power plants and motor vehicles. However, many organic compounds are introduced also from contemporary biogenic materials. Through the application of the combined carbon isotope analysis technique (CCIA), the authors can distinguish between fossil and contemporary carbon source classes (using 14C), and they can identify certain sources within each of these classes (using 13C). In order to establish the chronology of the organic carbon pollutant input to the lake sediment, the ages of the layers have been determined using 210 Pb dating techniques. The pattern observed in the sediment thus reflects the change in the local energy consumption pattern from a predominately coal to an oil based economy. From the plutonium profile they infer that mixing occurs for three or four years before the sediment layers are compacted.

709,329
PB86-124013 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Elemental Ratioing Technique for Assessing Concentration Data from a Complex Water System.
Final rept.
H. M. Kingston, and R. R. Greenberg. 1984, 9p
Pub. in Environment International 10, p153-161 1984.

Keywords: *Water analysis, Concentration(Composition), Sites, Sampling, Chemical analysis, Sediments, Particles, Assessments, Comparison, Reprints, *Water pollution sampling, *Water pollution detection.

Water samples have been collected at the surface and bottom layers at 51 locations throughout Chesapeake Bay. The suspended particulate and dissolved fractions of these samples have been analyzed for Cd, Ce, Co, Cu, Fe, Mn, Mo, Ni, Pb, Sc, Sn, Th, U, and Zn using neutron activation analysis and atomic absorption spectrometry. Special chemical procedures were used to preconcentrate the elements of interest in the dissolved samples and separate them from the salt water matrix. The elemental concentrations observed in the dissolved samples were evaluated by direct comparison to those found in coastal seawater; however, the elemental concentrations in the particulate samples (mass per volume of water) were strongly influenced by the total amount of particulate material suspended in the water at time of collection. A double normalization procedure was used to calculate crustal enrichment factors for each sample, and these enrichment factors provided both a means to observe sample-to-sample variations, and also allowed a crude comparison with the natural levels occurring in the earth's crust.

709,330
PB87-107124 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Biological Mediation of Marine Metal Cycles: The Case of Methyl Iodide.
Final rept.
F. E. Brinckman, G. J. Olson, and J. S. Thayer. 1985, 12p
Pub. in Marine Estauarine Geochemistry, p227-238 1985.

Keywords: *Water pollution, Sulfur inorganic compounds, Tin organic compounds, Metals, Transformations, Marine microorganisms, *Marine metal cycling, *Methyl iodide, Heavy metals.

Exocellular biogenic metabolites solubilize and methylate heavy metals and may be important in global metal cycling. The authors found that methyl iodide, ubiquitous in marine environments, though its biogenesis is poorly understood, solubilizes bulk metals and refractory binary and ternary metal sulfides, possibly represented by oceanic suspended particulates, producing methylated sulfur coproducts. With tin, among those elements forming water stable methyl derivatives, the authors report that stannous sulfide and chloride react with MeI to produce methyltin(IV) species and tin(IV) as cassiterite, a major tin ore (SnO2), is solubilized but not methylated by MeI. The authors find that dimethylpropiothetin, a common algal metabolite, reacts with cell-permeable I(1-) to produce MeI and with OH(1-) to form Me2S. Based on these results, the authors construct a model for environmental heterogeneous methylation reactions mediated by intracellular or extracellular MeI and methylsulfonium compounds which may bear on the frequency reported methylmetal(loid) species reported in marine environments.

General

709,331
PB-264 324/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Survey on Current Literature on Sampling, Sample Handling, for Environmental Materials and Long Term Storage.
Final rept.,
E. J. Maienthal, and D. A. Becker. 1976, 14p
Pub. in Interface 5, n4 p49-62 1976.

Keywords: *Sampling, *Environmental surveys, Materials handling, Storage, Pollution, Information systems, Chemical analysis, Trace elements, Reviews, Reprints.

In order to aid in the development of criteria for the possible establishment of a National Environmental Specimen Bank for the Environmental Protection Agency, a large portion of the recent literature concerning sampling and storage of environmental specimens has been examined. This has been done both manually and by use of bibliographical retrieval services such as Medline, Chemcon, Biosis, Cain, Defense Documentation Center and others. Also, the advice and opinion of workers in various aspects of the field has been obtained. A summary of the results of this survey is found below, separated into the various areas of concern.

709,332
PB-272 542/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Questions Concerning Environmental Mobility of Arsenic: Needs for a Chemical Data Base and Means for Speciation of Trace Organoarsenicals.
Final rept.,
F. E. Brinckman, G. E. Parris, W. R. Blair, K. L. Jewett, and W. P. Iverson. 1977, 14p
Sponsored in part by National Science Foundation, Washington, D.C.
Pub. in Environmental Health Perspec. 19, p11-24 Aug 77.

Keywords: *Arsenic, *Trace elements, Methylation, Organic compounds, Environmental surveys, Chemical analysis, Electrochemistry, Gas chromatography, Raman spectroscopy, Nuclear magnetic resonance, Atomic spectroscopy, Reprints, *Path of pollutants, Laser Raman spectroscopy.

Biomethylation of metals, including arsenic, apparently occurs as a global process. Health control strategies therefore depend on accurate analysis of arsenic's environmental mobility. Determining to what extent biotransformations occur and how resultant organometal(loids) are sequestered in food chains requires sophistication beyond present day total element determinations. Rather, active molecular forms of arsenic must be speciated for each environmental compartment, and it is necessary to quantify the dynamics of arsenic's mobility. Thus, new chemical facts are needed yielding rates of methylation or demethylation of arsenic; partition coefficients of organoarsenicals between air, water, and organic phases; and arsenic redox chemistry in polar media. NBS research in this context is reviewed with examples of recent results emphasizing speciation methodology. Topic areas discussed are: the nature of aquated methylarsenic species (NMR and laser-Raman spectroscopy); transport of methylarsenicals from aqueous media (gas chromatography-graphite furnace AA detection applied to metabolic Me3As formation); and speciation of involatile organoarsenicals in aqueous media (demonstration of HPLC utilizing element-specific AA detection and appraisal of electrochemical detectors).

709,333
PB-275 008/1 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Methods and Standards for Environmental Measurement.
Final rept.,
W. H. Kirchhoff. Nov 77, 653p NBS-SP-464
Proceedings of the Materials Research Symposium (8th) Held at the National Bureau of Standards, Gaithersburg, Maryland on September 20-24, 1976. Library of Congress Catalog Card no. LCCCN-76-608384.

Keywords: *Gas analysis, *Meetings, *Water analysis, Exhaust emissions, Doppler effect, Refuse, Aerosols, Chemical analysis, Standards, Performance evaluation, Accuracy, Ozone, Fines, Nitrogen oxides, Calibrating, Charcoal, Neutron activation analysis, Trace elements, Atomic spectroscopy, Spectrophotometry, Organic compounds, Mass spectroscopy, Hydrocarbons, Marine atmospheres, Carcinogens, Separation, Fluorescence, Activated carbon, Polyurethane resins, Concentration(Composition), X ray analysis, Mines, Sediments, Solvent extraction, Metals, Oils, Greases, Particle size distribution, Asbestos, Laboratory equipment, Impactors, Mercury(Metal), Sea water, Combustion products, Calorimetry, Industrial wastes, Monitoring, Optical radar, Remote sensing, Sulfates, Fly ash, Diffusion, Raman spectroscopy, Gas chromatography, Electrochemistry, Arsenic, Lead(Metal), Regression analysis, *Standard reference materials, *Water pollution detection, *Air pollution detection, Ion selective electrodes, Benzo(a)pyrene, Heavy metals, EPA method 2, Procedures, Laser spectroscopy, Long path infrared spectroscopy, Flameless atomic absorption analysis, Air quality.

This book presents the Proceedings of the 8th Materials Research Symposium on 'Methods and Standards for Environmental Measurement'. The volume contains extended abstracts of the invited and contributed papers in topics of concern at the time of the symposium: Accuracy, the analysis of trace organic compounds in water, multielement analysis, the physical and chemical characterization of aerosols, in situ methods for water analysis, the application of laser technology to atmospheric monitoring, ambient air quality monitoring, the chemical characterization of inorganic and organometallic constituents, reference materials for environmental measurement and finally, environmental laboratory certification and collaborative testing.

709,334
PB-281 725/2 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Survey of the Occurrence of Mercury, Lead, and Cadmium in the Washington, D.C. Area.
Final rept. May 76-Jul 77,
E. P. Scheide, J. J. Filliben, and J. K. Taylor. Sep 77, 96p NBSIR-78-1428
Sponsored in part by Environmental Protection Agency, Washington, D.C. Office of Toxic Substances.

Keywords: *Environmental surveys, *Mercury(Metal), *Lead(Metal), *Cadmium, *District of Columbia, Chemical analysis, Sampling, Soil analysis, *Toxic substances, *Air pollution detection, *Water pollution detection, Procedures.

This report describes the development of a plan to comprehensively survey the occurrence of potentially toxic substances in a defined geographical area and its application to the determination of the concentration levels of mercury, lead, and cadmium in various aspects of the environment in the Washington, D.C. area. It describes the basic philosophy of such a survey, the development of a sampling plan, and the identification of analytical methods adequate to obtain the required measurements. Methods of data reduction using the NBS computer are also described. The data are presented in tables and unique computer-generated plots which show the overall concentration profiles and spots of elevated concentration levels. No significantly hazardous conditions were found to exist. The approach followed and the data reduction techniques developed should be useful to surveys of these elements in other areas and also for surveys of ubiquitous hazardous materials in general.

709,335
PB-282 867/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Detectors for Liquid Chromatographic Analysis for Polynuclear Aromatic Hydrocarbons.
Final rept.,
R. G. Christensen, and W. E. May. 1978, 15p
Pub. in Jnl. Liq. Chromatogr., v1 n3 p385-399 1978.

Keywords: *Aromatic polynuclear hydrocarbons, *Detectors, *Environmental surveys, *Chemical analysis, Performance evaluation, Trace elements, Photometers, Reprints, Liquid chromatography, Fluorometer analysis.

A number of liquid chromatographic detectors of various types have been evaluated for both selectivity and sensitivity for the detection of polynuclear aromatic hydrocarbons (PAH). Detection limits for fixed and variable wave-length UV photometers, filter fluorimeters, and spectrofluorimeters have been determined. The utility of each of these types of detectors for use in tne reversed-phase HPLC analysis of environmental extracts containing trace levels of PAH's is discussed.

709,336
PB-286 728/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Simultaneous Determination of Arsenic, Antimony, Cadmium, Chromium, Copper, and Selenium in Environmental Material by Radiochemical Neutron Activation Analysis.
Final rept.,
M. Gallorini, R. R. Greenberg, and T. E. Gills. Sep 78, 3p
Pub. in Analytical Chemistry v50, no. 11, p1479-1481 (Sept. 1978).

Keywords: *Chemical analysis, *Neutron activation analysis, Environmental surveys, Arsenic, Antimony, Cadmium, Chromium, Copper, Selenium, Ion exchanging, Solvent extraction, Separation, Procedures, Reprints.

A multielement radioanalytical procedure for the simultaneous determination of As, Cr, Se, Sb, Cd and Cu has been developed. An inorganic ion exchanger coupled to a solvent extraction system was used for the selective separation of these elements from neutron activated matrices. The mthod has been used for both analysis and certification of environmental related NBS SRMS.

709,337
PB-287 973/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of Zinc, Cadmium and Lead in Biological and Environmental Materials by Isotope Dilution Mass Spectrometry.
Final rept.
J. W. Gramlich, L. A. Machlan, T. J. Murphy, and L. J. Moore. 1977, 5p
Pub. in Proceedings Annual Conf. Trace Substances in Environmental Health (11th), Held at Columbia, MO. on Jun 6-10, 1977, p376-380.

Keywords: *Zinc, *Cadmium, *Lead(Metal), *Biological extracts, *Environmental surveys, *Chemical analysis, Performance evaluation, Water pollution, Air pollution, Separation, Mass spectroscopy, Isotope dilution mass spectroscopy.

Techniques have been developed for the accurate and precise determination of the concentration of zinc, cadmium and lead using thermal ionization mass spectrometry. These techniques have been applied to the analysis of a variety of biological materials such as blood, hair and nails, and to environmentally related materials such as water, air particulates and fossil fuels. Uncertainty in the accuracy of the isotope dilution method is less than 0.5% for all three elements, and is nearly independent of element concentration from the % level down to the ng/g (ppb) range where the analytical blank becomes a significant contribution to the uncertainty. The mass spectrometric methodology and chemical separation procedures are presented along with examples showing the effect of sample impurities on the quality of the analytical data.

709,338
PB-291 254/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Spontaneous Deposition Radiochemical Separation for Platinum Determination in Biological Materials.
Final rept.
D. A. Becker, P. D. LaFleur, and A. LeRoy. 1976, 1p
Pub. in Proceedings of the International Nuclear and Atomic Activation Analysis Conference and Annual Meeting on Analytical Chemistry in Nuclear Technology (19th) Held at Gatlinburg, Tennessee on October 14-16, 1975, 1p.

Keywords: *Platinum, *Chemical analysis, *Biological extracts, *Environmental surveys, Exhaust emissions, Separation, Precious metals, Air pollution control, *Air pollution detection, Biomaterials.

The use of platinum and possibly other noble metals in motor vehicle emission control systems has recently been made public. The method developed and described is capable of quantitatively determining gold, platinum, and palladium in a wide variety of biological and environmental matrices. The analytical procedure entails wet-ashing with nitric-perchloric acids with carriers, redissolving the residue in aqua regia, and then plating out on silver metal powder. This technique is also currently being evaluated for possible use in simultaneous determination of additional noble metals.

709,339
PB-291 628/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Environmental Sample Banking-Research and Methodology.
Final rept.
D. A. Becker. 1976, 7p
Sponsored in part by Environmental Protection Agency, Washington, DC.
Pub. in Proceedings of a Symposium on Trace Substances in Environmental Health-X, Held at Columbia, MO., on June 8-10, 1976, p353-359 1976.

Keywords: *Environmental surveys, *Chemical analysis, Sampling, Guidelines, Trace elements, Cleaning, Storage, Materials handling.

The National Bureau of Standards (NBS), in cooperation with the Environment Protection Agency and the National Science Foundation, is engaged in a research program establishing methodology for environmental sample banking. This program is aimed toward evaluating the feasibility of a National Environment Specimen Bank (NESB). The program currently under way in the NBS Analytical Chemistry Division has 3 main components. The first is an extension survey of available literature concerning problems of contamination,

losses and storage. The second component is an experimental evaluation of contamination and losses during sampling and sample handling. The third component of this program is an evaluation of existing methodology for long-term sample storage. This program is a concerted effort to bring together many aspects of sampling, sample handling, and storage. The results seem to be useful not only for sample banking purposes but to the general trace substance analytical community as well.

709,340

PB-300 576/6 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS Role in Quality Assurance for Physical Measurements.
Final rept.
B. C. Belanger, and L. J. Kieffer. 1979, 5p
Pub. in Proceedings of National Conference on Quality Assurance of Environmental Measurements, Denver, CO., Nov 27-29, 1978, p18-22 1979.

Keywords: *Measurement, *Quality assurance, Research projects, Electromagnetic radiation, Ionizing radiation, Temperature, Noise(Sound), Environments, Measurement Assurance Programs, US NBS.

While the layman may think of environmental measurements primarily in terms of chemical and/or biological measurements, accurate measurements of quantities such as electromagnetic radiation, ionizing radiation, temperature, noise, etc., are becoming increasingly important to environmental scientists. For many years, NBS has provided calibration services for a wide variety of physical measurement quantities for those who need traceability to national standards. In recent years, requirements for higher accuracy and more rigorous quantificantion of measurement uncertainity have lead NBS to develop so-called Measurement Assurance Programs or MAP's , to provide a higher confidence level in the adequacy of the measurement accuracy for the intended application. This paper reviews those physical measurement services and MAP's that should be of interest to those concerned with accurate environmental measurements.

709,341

PB80-123383 Not available NTIS
National Bureau of Standards, Washington, DC.
Investigations into the Critical Measurement Aspects of Raman Microprobe Analysis.
Final rept.,
E. S. Etz, and J. J. Blaha. 1979, 12p
Pub. in Proceedings of the Annual Microbeam Analysis Society/1979 Conference (14th) Held at San Antonio, TX. on August 13-17, 1979, p173-184 1979.

Keywords: *Raman spectroscopy, *Microanalysis, Probes, Samples, Environmental surveys, Particles, Excitation, Fluorescence, Laser induced fluorescence, Laser spectroscopy.

In the course of NBS research in Raman microprobe analysis experiments have been performed to better define the critical measurement aspects of micro-Raman spectroscopy. Discussed are several experimental criteria and their relationship to successful molecular microanalysis. Spatial resolution of the probe measurement is discussed in terms of effective sampling volume determined by the design of the NBS microprobe. Effects of laser-induced sample heating and optical breakdown of microsamples are illustrated by examples from the analysis of environmental particles. Spectral interference from sample fluorescence are illustrated for microparticulate polynuclear aromatic hydrocarbons. Measurement problems arising from the chemical reactivity of microparticles are discussed with reference to sample modifications observed for hygroscopic particles. The question of weak signal measurements is examined from the point of view of the potential benefits to be derived from the application of optical multichannel analyzers as detection devices. Several areas requiring further experimental investigations are identified for the further enhancement of the field.

709,342

PB80-134943 Not available NTIS
National Bureau of Standards, Washington, DC.
Interlaboratory Comparison of Environmental Analyses Associated with Increased Energy Production.
Final rept.,
H. S. Hertz, L. R. Hilpert, W. E. May, S. A. Wise, J. M. Brown, S. N. Chesler, and F. R. Guenther. 1979, 11p
Pub. in American Society for Testing and Materials, Special Technical Publication 686, p291-301 1979.

Keywords: *Environmental surveys, *Chemical analysis, Comparison, Substitutes, Gas chromatography, Aromatic polycyclic hydrocarbons, Hexane, Phenols, Heterocyclic compounds, *Synthetic fuels.

In order to begin evaluating the state of the art of the determination of pollutants associated with the production of alternate fuels (for example, liquefied coal and shale oil), five collaborative studies have been conducted by the National Bureau of Standards. The aim of these initial studies was to ascertain how well participating laboratories could perform the chromatographic quantitation that is often the final step in a trace organic analytical scheme for priority pollutants. The materials examined in the collaborative studies were polynuclear aromatic hydrocarbons in hexane, phenols in water, phenols in hexane, and N-heterocyclic compounds in hexane. Each of these materials contained between five and eight pure compounds, each compound present at the 1 to 100 micrograms/ml (ppm) level.

709,343

PB80-177090 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Characterization of Particles.
Final rept.,
K. F. J. Heinrich. Apr 80, 222p NBS-SP-533
Proceedings of the Particle Analysis Session of the Annual Conference of the Microbeam Analysis Society (13th), Held at Ann Harbor, Michigan on June 22, 1978.

Keywords: *Particles, *Environmental surveys, *Meetings, Optical microscopes, Asbestos, X ray analysis, Electron beams, Electron probes, Chemical analysis, Electron microscopy, Monte Carlo method, Raman spectroscopy, Coal gasification, Body fluids, Auger electron spectroscopy, Secondary ion mass spectroscopy.

This document contains a series of invited papers on the subject of Particle Characterization. Part of the material presented here was presented orally at the Thirteenth Annual Conference of the Microbeam Analysis Society, at Ann Arbor, Michigan, on June 22, 1978. The publication describes microscopic and analytical techniques for the characterization of single microscopic particles. Applications of these techniques to problems of general interest are also included.

709,344

PB80-223126 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Summary of Oil Shale Activities at the National Bureau of Standards 1975-1979.
Final rept.
L. T. McClendon. Jun 80, 146p NBSIR-80-1986, EPA-600/7-80-125

Keywords: *Oil shale, *Meetings, *Environmental surveys, Trace elements, Organic compounds, Inorganic compounds, Forecasting, Chemical analysis, Water analysis, Monitoring, Sampling, Technology, Concentration(Composition), Standards, Sites, Mines, Chemical composition, Standard reference materials, Procedures.

This report provides a summary of NBS Oil Shale activities covering the period 1975 to 1979. At the start of this period a Workshop on Standard Reference Materials (SRM's) needed for Oil Shale Processing was held at NBS and served to provide the priority guidance for the future of this program. A summary of the recommendations of that Workshop, the manuscripts presented during the Workshop, and the list of attendees is included in this report. The status of the Oil Shale Research at NBS is also presented consisting of developmental work on the feasibility of producing an Oil Shale and a Shale Oil Standard Reference Materials characterized for both trace inorganic and trace organic constituents. Additionally, information is given dealing with the development of measurement methods appropriate for Oil Shale and Shale Oil trace inorganic and trace organic analysis. Several papers are also included giving additional details on these matters. Other NBS Standard Reference Materials, which may be appropriate for the use by the Oil Shale community, are described briefly within this document. Finally, recommendations for future Oil Shale projects dealing with the development of measurement methods and Standard Reference Materials at NBS are presented.

709,345

PB81-118572 Not available NTIS
National Bureau of Standards, Washington, DC.
Report on Reference Materials and Standard Solutions.
R. Alvarez. 1978, 1p
Pub. in Referee Reports: Jnl. Assoc. Off. Anal. Chem. 61, n2 p323 1978.

Keywords: *Chemical analysis, Environmental surveys, Food analysis, Water analysis, Concentration(Composition), Organic compounds, Reprints, *Standard reference materials.

As General Referee on Reference Materials and Standard Solutions for the Association of Official Analytical Chemists, the author has identified SRM's issued by NBS that are applicable to AOAC activities. These include: SRM 1643, a simulated fresh water with certified concentrations of 17 trace elements; SRM 1570, Spinach, and SRM 1575, which are certified for major, minor, and trace constituents; and SRM's 2661-2667, Organic Solvents on Charcoal which have certified amounts of organic toxic agents. The AOAC membership has been requested to communicate requirements for new SRM's.

709,346

PB81-118598 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of Standard Reference Materials for Quality Assurance of Environmental Measurements,
G. A. Uriano. 1979, 8p
Pub. in Proc. Natl. Conf. on Quality Assurance of Environmental Measurements, Denver, CO, Nov 27-29, 1978, p23-30 (Information Transfer, Inc., 9300 Columbia Blvd., Silver Spring, MD 20910, 1979).

Keywords: *Environmental surveys, *Standards, Quality assurance, Laboratory equipment, Calibrating, Gas analysis, Air pollution, Chemical analysis, Trace elements, Monitoring, *Standard reference materials.

Standard Reference Materials (SRM's) are well characterized, homogeneous, materials with specific properties such as chemical composition measured and certified by the National Bureau of Standards (NBS). Approximately 75 environmental SRM's are now available for use in various applications including: (1) calibration of instruments and measurement systems; (2) measurement quality control; and (3) assurance of long-term interlaboratory measurement compatibility. SRM's are also used to provide a reliable measurement base for the development and enforcement of environmental regulations. Available environmental SRM's now include: (1) a variety of analyzed gas mixtures used in applications involving monitoring of stationary sources, ambient air, and motor vehicle emissions; (2) a series of trace element standards for analyzing various matrices such as fuel oil, coal, fly ash, water as well as botanical and biological materials and (3) a number of materials certified for radio-nuclide activity used for calibration of counting instruments. This paper describes briefly, the procedures used by NBS to certify SRM's and the role of SRM's in Environmental Measurement Systems. Also given are a number of specific examples of the use of existing SRM's in environmental measurement applications. The environmental SRM's currently available from NBS are described as are NBS plans for the production of new environmental SRM's.

709,347

PB81-156333 Not available NTIS
National Bureau of Standards, Washington, DC.
Certified Reference Materials Program of the United States National Bureau of Standards.
Final rept.
G. A. Uriano. 1980, 18p
Pub. in Proceedings of International Symposium on the Production and Use of Reference Materials, Bundesanstalt foer Materialpruefung (BAM), Berlin, Germany, November 13-16, 1979, Paper in Production and Use of Reference Materials, p7-24 1980.

Keywords: *Environmental surveys, Standards, Forecasting, Monitoring, Public health, Toxicity, *Foreign technology, *Standard reference materials, *Certified reference materials.

The United States National Bureau of Standards (NBS) has been producing and distributing certified reference materials (CRM's) since 1906. NBS currently issues nearly 1,000 different CRM's for use in a variety of measurement applications. Over 38,000 CRM units were distributed by NBS in the last year to approximately 10,000 users throughout the world. Approximately 25% of the units were distributed outside the United States. NBS CRM's serve four major user categories: (1) industrial research and quality control laboratories, (2) environmental analysis and monitoring laboratories, (3) laboratories performing clinical or health related measurements (including nutrition and toxicity studies) and (4) laboratories engaged in basic metrological research. This paper briefly reviews the past, recent and planned activities of the NBS CRM program. The role of CRM's in helping to establish accuracy and/or compatibility of measurements on a national or international scale is discussed with emphasis on the systems approach to measurement compatibility. Also presented are some of the personal views of the author concerning future opportunities for enhancing international cooperation with regard to the production, certification and use of reference materials.

709,348
PB81-159899 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Technical Activities 1980--Office of Recycled Materials.
D. A. Becker, J. G. Berke, R. T. Matthews, and H. Yakowitz. Nov 80, 75p NBSIR-80-2178

Keywords: *Crude oil, *Petroleum products, *Environmental surveys, *Energy conservation, Forecasting, Recirculation, Lubricating oils, Standards, Regulations, *Recycled materials, Refuse derived fuels.

A review of recycled materials programs at NBS, for FY 1980 is presented in this annual report. This report contains the following: The Office of Recycled Materials - A plan for the future; The NBS recycled oil program--(Introduction, the NBS role in recycled oil, the current NBS program, plan, implementation, and discussion); The resource conservation and recovery program--(Introduction, needs, goal and objectives, plan, implementation, and discussion).

709,349
PB81-163156 Not available NTIS
National Bureau of Standards, Washington, DC.
Study of Particulates of Environmental Interest by Differential Thermal Analysis.
Final rept.
O. Menis, J. A. Mackey, and P. D. Garn. 1979, 12p
Pub. in Proceedings of Angewandte Chemische Thermodynamik und Thermoanalytik, Vortrage des Rapperswiler TA-Symposium (Experientia Supplementum; 37) Rapperswiler, Switzerland, April 18-20, 1979, p321-332 1979.

Keywords: *Particles, *Environmental surveys, Thermal analysis, Asbestos, Sediments, Laboratory equipment, Silicon dioxide, Chemical analysis, Quartz, Standard reference materials.

In this presentation the authors describe their current progress using thermoanalytical methods to study particulates of interest in environmental problems. The topics included are: (1) differential thermal analysis (DTA) of current NBS Standard Reference Material (SRM) 1645, River Sediment and NBS SRM 1648, Urban Particulate Matter (1); (2) studies of a suitable crystalline silica (alpha-quartz and cristobalite) as a potential SRM; (3) preparation of mixtures of chrysotile asbestos and quartz in a suitable matrix, and (4) a modified DTA apparatus including a design of a DTA cell for rapid sample changing and operation under regulated steam pressure.

709,350
PB81-245995 Not available NTIS
National Bureau of Standards, Washington, DC.
Modern Analytical Methods for Environmental Polycyclic Aromatic Compounds.
Final rept.
K. D. Bartle, M. L. Lee, and S. A. Wise. 1981, 45p
Pub. in Chemical Society Review 10, n1 p113-158 1981.

Keywords: *Chemical analysis, *Environmental surveys, *Aromatic polycyclic hydrocarbons, Sampling, Nuclear magnetic resonance, Gas chromatography, Mass spectroscopy, Infrared spectroscopy, Reprints, Procedures.

Polycyclic aromatic compounds (PAC) are ubiquitous environmental pollutants from both natural and anthropogenic sources. PAC mixtures can be extremely complex since they contain numerous isomers. This complexity increases for samples which contain alkylated, multisubstituted, and partially hydrogenated compounds in addition to the parent PAC. In this paper, the most important analytical techniques for the analysis of complex mixtures of PAC are reviewed (over 400 references) with emphasis on the more recent studies involving advanced analytical techniques. Topics discussed include: sample preparation techniques, chromatographic methods (both high-performance liquid chromatography and glass capillary gas chromatography), mass spectrometric methods, and spectroscopic techniques (luminescence, nuclear magnetic resonance, and infrared).

709,351
PB82-132770 PC **A15**/MF **A01**
National Bureau of Standards, Washington, DC.
Environmental Speciation and Monitoring Needs for Trace Metal-Containing Substances from Energy-Related Processes.
Final rept.
F. E. Brinckman, and R. H. Fish. Nov 81, 339p NBS-SP-618
Sponsored in part by Department of Energy, Washington, DC. Office of Health and Environmental Research.
Library of Congress catalog card no. 81-600140.Proceedings of the DOE/NBS Workshop Held at the National Bureau of Standards in Gaithersburg, Maryland on May 18-20, 1981.

Keywords: *Metal containing organic compounds, *Environmental impacts, *Trace elements, *Meetings, Monitoring, Fuels, Solid waste disposal, Forecasting, Bioassay, Standards, Complex compounds, Water pollution, Air pollution, Chemisorption.

This book presents the Proceedings of the DoE/NBS Workshop on Environmental Speciation and Monitoring Needs for Trace Metal-Containing Substances from Energy Related Processes held at the National Bureau of Standards , Gaithersburg, MD, on May 18-20, 1981. The Workshop was sponsored by the Office of Health and Environmental Research, DoE, and the Office of Recycled Materials, NBS. The volume contains refereed papers submitted by 24 invited speakers, along with substantially complete text of the discussion following the papers, edited by the Co-chairpersons. The Proceedings address three major topic areas forming the overall objective of the Workshop: (1) What are the general and specific types of metal- or metalloid-containing substances occurring in energy-related process materials such as coals, oil shales, and waste products. (2) What are the current status and future prospects of element- and compound-specific measurement methods suitable for speciation of trace (ppm, ppb) metal- and metalloid-containing substances transmitted to the environment by energy-processing or waste cycling technologies. (3) For what toxic molecular forms of speciated process effluents should biological dose-response data be generated to assure reliable environmental impact and monitoring measurements. Main questions focused on providing assurance that the speciation methods (or their development) fit basic bioassay criteria along with appropriate standard reference materials for meeting quantitative process and waste monitoring or control needs.

709,352
PB82-140898 Not available NTIS
National Bureau of Standards, Washington, DC.
Developments in the Analysis of Priority Pollutants by Liquid Chromatography/Mass Spectrometry and Immunoassay Procedures.
Final rept.
R. G. Christensen, H. S. Hertz, D. J. Reeder, and E. White. 1980, 7p
Pub. in Advances in the Identification and Analysis of Organic Pollutants in Water, Chapter 28, p447-453 1980.

Keywords: *Pollution, *Chemical analysis, *Organic compounds, Liquid chromatography, Mass spectroscopy, Design criteria, Performance evaluation, Fluorescence, Immunoassay, Phenol/dinitro.

Due to the increasing demands for measurements of organic priority pollutants, several approaches to the rapid analysis of these compounds are being examined at the National Bureau of Standards. A liquid chromatograph-mass spectrometry (LC-MS) system which allows the use of conventional LC flow rates, a wide range of solvents, and a conventional differentially pumped quadrupole mass spectrometer has been developed. The effluent from a liquid chromatograph is concentrated by allowing it to flow down an electrically heated wire. The bottom of the concentrator wire crosses a gap in a capillary tube through which the concentrated effluent is drawn into the ion source of the mass spectrometer. Solution flow rates into the ion source can be adjusted, allowing spectra of either purely CI or mixed EI/CI character to be obtained. In preliminary experiments with this system direct quantitative analysis of several phenolic compounds in complex alternate fuels has been possible. In trying to develop a rapid screening procedure for priority pollutants in water, immunoassay techniques are being explored. A fluoroimmunoassay system for dinitrophenols in water is being developed. Antibodies have been covalently bound to slide phase polymeric beads. Dinitrophenols, added to an incubation mixture containing these beads, and fluorescent tracer compete for antibody sites. Binding curves are generated from data obtained by photon counting.

709,353
PB82-166265 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Survey of the Recent Literature on Sampling for Chemical Analysis.
Final rept.
B. G. Kratochvil, and J. K. Taylor. Jan 82, 33p NBS-TN-1153

Keywords: *Sampling, *Surveys, *Documents, Chemical analysis, Agricultural products, Food industry, Air pollution, Water pollution.

Sampling is one of the most important steps in chemical analysis, yet it is often poorly planned and executed. One reason is that key information on sampling is scattered and relatively inaccessible. This article summarizes the more important published articles obtained as the result of a literature search to obtain essential background information for the design of sampling plans and protocols for the National Environmental Specimen Bank. Each reference is briefly described so that its applicability to a specific sampling question can be judged. The compilation consists of 56 references on general aspects of sampling, 9 references on sampling agricultural and food products, 14 references on sampling atmospheres and gases, 18 references on sampling water and waste water, and 18 references on sampling miscellaneous materials.

709,354
PB82-236183 Not availble NTIS
National Bureau of Standards, Washington, DC.
Biotransformation of Tin.
Final rept.
W. R. Blair, J. A. Jackson, G. J. Olson, F. E. Brinkman, and W. P. Iverson. Sep 81, 8p
Pub. in Proceedings of International Conference on Heavy Metals in the Environment (3rd), Amsterdam, The Netherlands. Sep 14-18, 1981, p235-242.

Keywords: *Tin, *Bacteria, *Methylation, Environmental surveys, Heavy metals.

The first evidence for the bacterial methylation of tin from inorganic Sn(IV) was presented in 1973 and recently has been verified by other investigators. Recent studies with the Pseudomonas strain, first employed in the initial observations, have indicated that the volatile methylated species produced by this organism from Sn(IV) and to a considerably lesser extent from Sn(II), include tetramethyl tin (Me4Sn) and a number of hydritic methylstannanes (Me(n)SnH(4-n), n = 2,3).

709,355
PB83-124693 PC **A18**/MF **A01**
Michigan Dept. of Commerce, Lansing.

Hazardous Waste Management in the Great Lakes Region: Opportunities for Economic Development and Resource Recovery.
R. B. Den Uyl, N. VanPoperin, D. Whitehill, A. Winter, P. Alsager, M. Deline, J. Hall, W. McGrath, and R. Strader. Sep 82, 412p NBS-GCR-82-405
Contract NB81-NADA-2063

Keywords: *Hazardous materials, *Great Lakes, *Economic impacts, Mathematical models, Electroplating, Solvents, Industrial wastes, Paints, Iron and steel industry, Regulations, Computer programs, Environmental surveys, *Waste management, Waste recycling.

The purpose of this study is to develop methodologies that evaluate the economic impacts associated with hazardous waste management costs and to assess the economic potential of resource recovery. The study concentrates on the states of the Great Lakes region. Two models were developed; one for the electroplating industry and the other analyzing options for solvent recovery. Both models were based on constrained economic optimization methodology. The computer model analyzing the electroplating industry compared the cost of five alternative treatment and resource recovery technologies for 24 electroplating shops in the Great Lakes region. A sensitivity analysis of the results of the electroplating model was conducted to determine what kind of financial incentives would induce greater adoption of resource recovery technologies. The model analyzing the economics of solvent recovery compared the cost of off-site disposal or incineration with off-site recovery of waste solvents and with recovery at the plant site. In order to determine the economic impact of hazardous waste management costs, a computer program for a financial impact model was developed. The study also developed a methodology to predict whether companies that generate hazardous wastes would be likely to relocate closer to treatment and disposal facilities to reduce transportation and disposal costs.

709,356
PB83-139063 Not available NTIS
National Bureau of Standards, Washington, DC.
Sample Handling for Trace Element Analysis.
Final rept.
J. R. Moody. Aug 81, 7p
Pub. in Analytical Proceedings (London) 18, n8 p337-339 Aug 81.

Keywords: *Trace elements, *Chemical analysis, Sampling, Environmental surveys.

In recent years, new instrumental advances have pushed instrumental detection limits to lower levels. At the same time, many matters of public concern have demanded more than conventional methodology was capable of handling from matrices as diverse as seawater, freshwater, botanical and biological samples, oils, coals, fly ash and various waste materials. Only rarely is an analyst able to take a real world sample and proceed to the measurement step without some sample processing chemistry. Unfortunately, in the real world, it is usually the magnitude of the analytical blank which determines the practical lower limit of elemental analysis. The size of the blank, in a large measure, will be function of the types of sample processing involved and the corresponding contamination for each step. By rigorous attention to detail it is often possible to provide a very significant reduction in the analytical blank, thus lowering the working analytical range for nearly all analytical techniques.

709,357
PB83-179622 Not available NTIS
National Bureau of Standards, Washington, DC.
Analytical Standards and Methods for the Determination of Polynuclear Aromatic Hydrocarbons in Environmental Samples.
Final rept.
W. E. May, S. N. Chesler, H. S. Hertz, and S. A. Wise. 1982, 17p
Pub. in International Jnl. of Environmental Analytical Chemistry 12, p259-275 1982.

Keywords: *Aromatic polycyclic hydrocarbons, *Chemical analysis, *Environmental surveys, Gas chromatography, Mass spectroscopy, Trace elements, Standards, Particles, Samples, Reprints, *Standard reference materials, High performance liquid chromatography.

Standard reference materials (SRM's) have been produced, certified, and issued by the United States National Bureau of Standards (NBS) since 1905. NBS currently issues more than 1000 SRM's of various types, including nuclear materials, rubber, clinical, and environmental trace metal standards. The most recent addition to this group is a series of environmental trace organic materials with certified concentrations of selected polynuclear aromatic hydrocarbons (PAH), phenols, and N-heterocyclic compounds. Until recently, trace organic SRM's were non-existent due to the lack of analytical methodology necessary for certification. Details concerning the analytical methods developed and used for certification of the concentrations of several PAH in SRM's 1580 (Organics in Shale Oil), 1644 (Generator Columns for PAH in Water), 1647 (PAH in Acetonitrile), and 1649 (Urban Particulate Matter) are given along with some suggested uses for these SRM's.

709,358
PB84-133446 Not available NTIS
National Bureau of Standards, Washington, DC.
Special Review, the Human Environment: Past, Present and Future.
Final rept.
W. B. Mann. 1983, 1p
Pub. in International Jnl. of Applied Radiation and Isotopes 34, n11 p1563, 1983.

Keywords: *Environmental surveys, *Radioactive contaminants, Reviews, Reprints.

The Seventh Lauriston S. Taylor lecture was delivered by Merril Eisenbud as part of the annual meeting of the National Council on Radiation Protection and Measurements held at the National Academy of Sciences in Washington, D.C., on April 6 and 7, 1983.

709,359
PB84-222835 Not available NTIS
National Bureau of Standards, Washington, DC.
Operation of the U.S. Pilot National Environmental Specimen Bank Program.
Final rept.
S. A. Wise, K. A. Fitzpatrick, S. H. Harrison, and R. Zeisler. 1984, 22p
Pub. in Proceedings of International Workshop on Environmental Specimen Banking and Monitoring as Related to Banking, Saarbruecken, Germany, F.R., May 10-15, 1982, p108-129 1984.

Keywords: *Environmental surveys, *Chemical analysis, *Trace elements, *Pesticides, Sampling, Gas chromatography, Liver, Chlorine organic compounds, Neutron activation analysis, *Specimen banks.

In 1979, a Pilot Environmental Specimen Bank was established at the National Bureau of Standards to evaluate the storage of biological and environmental specimens. This pilot effort was designed to provide actual working experience in all aspects of specimen banking. In this article, the experience gained during the pilot specimen bank program relating to sample collection, processing, storage, and analysis of the first sample type, human liver, is reviewed. Contamination-free protocols for sampling and homogenization of specimens were developed and implemented. The results of the analyses of 30 liver samples for trace elements and chlorinated pesticide residues are described. The potential advantages and uses of specimen banking as related to monitoring of the environment are discussed.

709,360
PB84-239912 Not available NTIS
National Bureau of Standards, Washington, DC.
X-Ray Photoemission Spectroscopy of Environmental Particles.
Final rept.
T. Jach, and C. J. Powell. Jan 84, 4p
Pub. in Jnl. of Environmental Science Technology 18, n1 p58-61 Jan 84.

Keywords: *Environmental surveys, *X ray analysis, *Particles, *Surfaces, Photoelectric emission, Sputtering, Reprints, *X ray photoelectron spectroscopy.

Particulate samples from three different environments were analyzed by x-ray photoemission spectroscopy. The surface constituents of particles were determined before and after repeated sputter-ion bombardment, and were compared to the elements reported by bulk analysis. Several sulfur and nitrogen compounds have been identified and changes of these with sputtering time is discussed.

709,361
PB85-116234 Not available NTIS
Texas Univ. at Austin.
Water Solubilities of Polynuclear Aromatic and Heteroaromatic Compounds.
R. S. Pearlman, S. H. Yalkowsky, and S. Banerjee. c1984, 8p
Prepared in cooperation with Arizona Univ., Tucson. Coll. of Pharmacy and Syracuse Research Corp., NY. Life and Environmental Sciences Div.
Included in Jnl. of Physical and Chemical Reference Data, v13 n2 p555-562 1984.

Keywords: *Aromatic polycyclic hydrocarbons, *Solubility, *Water, *Environmental surveys, Surfaces, Boiling points, Assessments, Adsorption, Physical properties.

With the projected increased use of coal derived energy sources, the health and environmental impact of compounds associated with coal will receive progressively greater attention. Some of these compounds such as the polynuclear aromatic hydrocarbons are potent mutagens or carcinogens, and reliable data on the physical properties of these compounds must be available for meaningful health and environmental assessment to be made. Possibly the most important property from this viewpoint is water solubility, since apart from its importance in its own right, several other parameters such as lipophilicity, adsorption, and bioconcentration can be related to it. We have compiled and reviewed values for several polynuclear compounds, tested them against available models, and reduced them to a set of validated data.

709,362
PB85-142214 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reference Materials and Environmental Analysis.
Final rept.
S. D. Rasberry, and W. P. Reed. 1984, 4p
Pub. in Environment International, v10 p87-90 1984.

Keywords: *Environmental surveys, *Standards, Chemical properties, Physical properties, Calibrating, Laboratory equipment, Quality control, Reprints, *Standard reference materials.

Accurate measurements are an important consideration in environmental analysis. The National Bureau of Standards (NBS) provides several types of services to aid analysts in obtaining accurate measurements and in validating the accuracy of measurement methods and measurement systems. The most well known of these services is Standard Reference Materials (SRMs). In general, SRMs are well-characterized homogeneous materials or simple artifacts with specific chemical or physical properties certified by NBS. This paper discusses various possible roles for the use of SRMs, together with a description of currently available SRMs. In addition, a brief discussion of the technology of certification has been included as well as some discussion of future activities.

709,363
PB85-145340 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Biological Methylation of Metals and Metalloids.
Final rept.
J. S. Thayer, and F. E. Brinckman. 1982, 44p
Pub. in Advances in Organometallic Chemistry 20, p313-356 1982.

Keywords: *Metals, *Metal containing organic compounds, *Environmental surveys, *Methylation, Reviews, Geochemistry, Enzymes, Chemical reactions, In vitro analysis, In vivo analysis, Reprints, *Biological processes.

The current state of understanding biological methylation of metals and metalloids is reviewed with 250 references. The subject is treated both from the viewpoint of organometallic chemists, with emphasis on aquatic transmethylation reactions occurring in vitro under abiotic and biological conditions, and from a phenomenological survey of corresponding in vivo processes occurring in environmental media such as pure cultures, soils, sediments, and animals. Against this background, mechanisms of transmethylation are inspected, and the relationship of trace organometallic speciation applied to biogeochemistry or to modelling environmental pollution are considered.

709,364
PB86-124773 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

General

Quality Assurance Measures for Environmental Data.
Final rept.
J. K. Taylor. 1980, 5p
Pub. in Proceedings of International Experts Discussion on Lead Occurrence, Fate, and Pollution in the Marine Environment, Rovinj, Yugoslavia, October 18-22, 1977, p1-5 1980.

Keywords: *Quality assurance, *Environmental surveys, *Chemical analysis, *Quality control, Sampling, *Toxic substances.

An understanding of the occurrence, fate, effects and pollution potential of a suspected toxic substance requires a wide variety of analytical data. Stringent requirements are placed upon its reliability if data are to be intercompared and correlated. The quality assurance measures with respect to sampling and measurement are discussed.

709,365
PB86-128741 PC **A04**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
International Review of Environmental Specimen Banking.
Final rept.
S. A. Wise, and R. L. Zeisler. Oct 85, 65p NBS/SP-706
Also available fom Supt. of Docs as SN003-003-02693-0. Library of Congress catalog card no. 85-600601. Sponsored by Environmental Protection Agency, Washington, DC.

Keywords: *Environmental surveys, *International relations, *Meetings, Reviews, Samples, Trends, Inorganic analysis, Organic analysis, Chemical analysis.

In September 1983, the '8th U.S. - German Seminar of State and Planning on Environmental Specimen Banking' and the 'International Review of Environmental Specimen Banking' were held at the National Bureau of Standards. At these meetings the current status of Environmental Specimen Banking Program in the U.S., Federal Republic of Germany (FRG), and other countries was presented and discussed. The publication contains a brief summary of these meetings and separate contributions describing the specimen banking activities in Canada, FRG, Japan, Sweden and the U.S.

709,366
PB86-133352 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Environmental Inorganic Chemistry of Main Group Elements with Special Emphasis on Their Occurrence as Methyl Derivatives.
Final rept.
F. E. Brinckman. 1985, 44p
Pub. in Proceedings of U.S. - Italy Joint Seminar and Workshop on Environmental Inorganic Chemistry, San Miniato, Italy, June 5-10, 1983, Environmental Inorganic Chemistry, p195-238 1985.

Keywords: *Environmental surveys, *Inorganic compounds, *Methanes, *Metal containing organic compounds, Reaction kinetics, Reviews, Geochemistry, Chemical reactions, Metabolism, Surface chemistry, Membranes, Transport properties, Comparison, *Clathrate compounds, Bioaccumulation, Path of pollutants, Natural emissions.

Deposition, relocation, transformations, biological uptake, and metabolism are among major kinds of information available for organic molecules in the environment, whether toxic or essential. Present-day information for comparable processes of metals and metalloids in environmental media in terms of their molecular processes lags far behind, though almost all Main Group elements play a crucial role in living organisms and geochemistry. The review emphasizes inorganic studies, many drawn from classical examples, as aids to surveying recent contributions to the environmental chemistry of Main Group metals and metalloids. Selected topics, including transmethylation kinetics, photomethylation, direct surface reactions, membrane attachment and lipophilicity, and naturally-occurring organometalloids and organo-metals, are discussed as a means to illustrate future needs and prospects in the field. The relationships between purely inorganic molecular species and their more labile methyl derivatives provides a useful range of comparisons, based upon over 150 references.

709,367
PB86-138476 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Quantitation of Individual Organic Compounds in Shale Oil.
Final rept.
L. R. Hilpert, H. S. Hertz, W. E. May, S. N. Chesler, S. A. Wise, F. R. Guether, J. M. Brown, and R. M. Parris. 1979, 8p
Pub. in Proceedings of Oil Shale Symposium on Sampling, Analysis and Quality Assurance, Denver, Colorado, March 1979, p355-362 1980.

Keywords: *Shale oil, *Chemical analysis, *Environmental impacts, *Organic compounds, Gas chromatography, Mass spectroscopy, Phenols, Aromatic polycyclic hydrocarbons, Extraction, *Alternate fuels, *Toxic substances, High performance liquid chromatography, Standard reference materials.

A serious and largely unknown complication of developing alternate fuels such as shale oil is the potentially deleterious impact on the environment. Identification and quantitation of toxic organic compounds in the feedstock, process streams, and plant effluents will become increasingly important as mutagenicity testing on chromatographic fractions generated from various fuels and effluents expands. In preparation for certifying a Standard Reference Material for toxic constituents in alternate fuels, our laboratory has been investigating various techniques for quantitating individual organic compounds in shale oil. Emphasis has focused on acid-base extraction and high performance liquid chromatography as independent methods of shale oil fractionation. Gas chromatographic, gas chromatographic-mass spectro-metric, and high performance liquid chromatographic methods have been used to quantitate several phenols, N-heterocyclics, and polynuclear aromatic hydrocarbons in shale oil.

709,368
PB86-186707 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Chemical Physics.
Environmental Measurements, Standards, and Decisions.
Final rept.
W. H. Kirchhoff. 1984, 6p
Pub. in AIChE (American Institute of Chemical Engineers) Symposium Series 80, n237 p6-11 1984.

Keywords: *Environments, Measurement, Standards, Regulations, Reprints, American Society for Testing and Materials, Uncertainty.

A pervasive and often ignored condition in the development and implementation of environmental policy is uncertainty. The paper will describe limitations of the measurement system, the role of standards in compensating for uncertainty, and features of the American Society for Testing and Materials, ASTM, and its process for setting standards which offer alternatives to litigation and confrontation as approaches to reaching consensus.

709,369
PB86-204005 PC **A05**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD.
Summary of the Environmental Research, Analysis, and Control Standards Issued by the National Bureau of Standards.
Final rept.
R. Mavrodineanu, and S. D. Rasberry. Mar 86, 95p NBS/SP-260/105
Also available from Supt. of Docs as SN003-003-02725-1. Library of Congress catalog card no. 86-600504.

Keywords: *Chemical composition, *Chemical analysis, Standards, Measurement, Quality control, Tables(Data), *Environmental research, *Standard reference materials, National Bureau of Standards.

The publication is a summary of the environmental research, analysis, and control standards issued by NBS as Standard Reference Materials (SRM's). The material, composition, certification, use, and remarks concerning each of the SRM's described are presented in tabular form. Copies of the certificates of these SRM's are contained in the appendix for more detailed information.

709,370
PB87-131421 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Resistance to Standards Development.
Final rept.
W. H. Kirchhoff. 1984, 3p
Pub. in ASTM (American Society for Testing and Materials) Standardization News 12, n6 p21-23 1984.

Keywords: *Standards, Resistance, Reprints, *Environmental assessment, American Society for Testing and Materials.

In the recent years, the American Society for Testing and Materials, ASTM, has experienced rapid growth in standards writing activities related to environmental assessment. The growth has brought into the membership of ASTM individuals from scientific disciplines new to ASTM and for whom ASTM was a strange and confusing society. Not surprisingly, many of these individuals initially resisted ASTM incursion into their field. The causes of the resistance have been interesting and have provided both guidance for approaching individuals from new disciplines and insight into the social dynamics of standards development. The paper will review the author's experience in dealing with the expansion of ASTM activities into environmental assessment.

HEALTH CARE

Community & Population Characteristics

709,371
PB82-210907 Not available NTIS
National Bureau of Standards, Washington, DC.
Code Compliance at Lower Costs: A Mathematical Programming Approach.
Final rept.
R. E. Chapman, and W. G. Hall. Feb 82, 13p
Pub. in Fire Technology 18, p77-89 Feb 82.

Keywords: *Hospitals, *Fire safety, Building codes, Economic analysis, Mathematical programming, Reprints, *Health facilities, *Nursing homes.

The identification of cost-effective levels of fire safety in health care facilities is a major concern to hospital administrators, fire safety engineers and public policy makers. The prohibitive costs of strict compliance to the prescriptive provisions of the Life Safety Code in hospitals and nursing homes has led to the development of an equivalency methodology, the Fire Safety Evaluation System. This methodology provides a framework for identifying how combinations of several widely accepted fire safety systems can be used to produce a level of safety equivalent to that of the Life Safety Code and for systematically analyzing the problem via mathematical optimization techniques. Three topics are described briefly in this paper. They are the Fire Safety Evaluation System, a mathematical programming procedure based on the Fire Safety Evaluation System which permits the least-cost means of achieving compliance to the Life Safety Code to be identified, and an indication of the cost-saving potential of the Fire Safety Evaluation System based on a case study of a typical general hospital.

709,372
PB86-110111 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Operations Research Div.
Application of the Performance Concept to Fire Safety in Health Care Facilities.
Final rept.
R. E. Chapman, and W. G. Hall. 1982, 11p
Sponsored by Department of Health and Human Services, Washington, DC.
Pub. in Proceedings of ASTM/CIB/RILEM Symposium (3rd), Lisbon, Portugal, March 29-April 2, 1982, on Performance Concept in Building: Advances in the Development of the Concept and Its Application in Rehabilitation, v1 p481-491.

Keywords: *Fire safety, *Hospitals, Economic analysis, Mathematical programming, Building codes, *Health facilities, Nursing homes.

The identification of cost-effective levels of fire safety in health care facilities is a major concern to hospital administrators, fire safety engineers and public policy makers. The prohibitive costs of strict compliance to the prescriptive provisions of the National Fire Protection Association's Life Safety Code (NFPA 101) in hospitals and nursing homes has led to the development of an equivalency methodology, the Fire Safety Evaluation System. Three topics are described briefly in this paper. They are: (1) The Fire Safety Evaluation System; (2) a mathematical programming procedure which identifies least-cost compliance strategies; and (3) an indication of the cost-saving potential of the Fire Safety Evaluation System.

Data & Information Systems

709,373
PB-263 102/6 PC **A04**/MF **A01**
Columbia Univ., New York. Dept. of Public Law and Government.
Policy Analysis of Citizen Rights Issues in Health Data Systems.
Final rept.,
A. F. Westin, and F. Isbell. Jan 77, 52p NBS-SP--469
Contract NBS-5-35886
Library of Congress catalog card no. 76-600001.

Keywords: *Medical records, *Confidential information, *Consumer affairs, Data processing systems, Policies, Sociology, Law(Jurisprudence), Foreign countries, Recommendations, Records management, *Medical information systems, Privacy, Computer security, Computer applications.

The report investigates the impact of computers on citizen rights in the health record keeping area. Part One describes the world of medical data and citizen rights within the framework of three zones--primary health care (by health professionals), service payers and health care reviewers and social uses of health data (such as in employment, life insurance, and welfare); Part Two treats patterns of computerization in health care in each of the above zones; Part Three contains the profiles of the six health-care organizations that were studied in depth; and Part Four analyzes the impact of computerization on personal health records, presents comparisons with six other democratic nations, and states 12 recommended management principles for health care data systems.

709,374
PB87-162194 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Occupational Health and Safety Div.
Selecting a PC (Personal Computer) Database Management System for Health Physics Applications.
Final rept.,
L. A. Slaback, and W. R. Webber. 1987, 10p
Pub. in Radiation Protection Management 4, n1 p23-32 Feb 87.

Keywords: *Dosimetry, Reprints, *Health physics, *Data base management systems, *Personal computers, Health programs, Data management, Computer software, National Bureau of Standards.

An integrated system of data management is a necessity for the variety and volume of data encountered in many health physics programs. A Personal Computer (PC) Database Management System (DBMS) can fill these data management needs if it is designed and constructed properly. The article presents a suggested approach to PC database design and outlines the specific features that should be examined when choosing DBMS software. The approach was used to set up a health physics database system at the National Bureau of Standards in 1985. The NBS system is described, and an example of dosimetry data entry is used to illustrate how the system works.

Environmental & Occupational Factors

709,375
PB-273 165/1 PC **A03**/MF **A01**
Washington Univ., Seattle. Dept. of Psychology.
Vocal Emergency Alarms in Hospitals and Nursing Facilities: Practice and Potential.
Final rept.,
J. P. Keating, and E. F. Loftus. Jul 77, 35p NBS/GCR-77-102
Grant NBS-6-9016

Keywords: *Warning systems, *Fire alarm systems, *Voice communication, Social communication, Safety engineering, Hospitals, Health care facilities, Recommendations, Guidelines, Development, Fire safety, Public address systems, Surveys, Questionnaires, Reviews, Personnel, Human behavior, Nursing homes.

The report reviews current usage of voice emergency alarms in nursing homes and hospitals, and recommends guidelines for the development of alarm messages, which should facilitate effective personnel response to fires in health care facilities. The seven guidelines for the development of effective alarm messages contained in this report were derived partly from what was learned through the review of current usage, and partly from established principles in the sciences of sociology and psychology. The final sample message was constructed to demonstrate the feasibility of using empirical techniques of psychology to develop messages consistent with the guidelines. The content of this message is recommended as optimal for health facilities which utilize vocal alarms to signal fire emergencies.

709,376
PB80-119530 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Evacuation of Non-Ambulatory Patients from Hospital and Nursing Home Fires: A Framework for A Model,
J. Archea, and S. T. Margulis. Nov 79, 64p NBSIR-79-1906
Sponsored in part by Public Health Service, Washington, DC.

Keywords: *Evacuating(Transportation), *Hospitals, *Fire safety, Patients, Models, Safety engineering, Behavior, Building codes, Health care facilities, *Nursing homes, Elderly persons, Handicapped persons.

The report is directed toward the problem of evacuating dependent, non-ambulatory persons from fires in nursing homes and other health care facilities. It deals only with those behavioral and building factors that bear on the activities that follow directly from a decision to evacuate patients from a fire zone in a nursing home or similar facility. The examination is based on the rejection of the model which is the basis for current life safety regulations because it assumes independent occupant mobility. This assumption does not apply to dependent, non-ambulatory persons. The major objective of the report is to identify those factors that must be considered in order to determine the ideal performance of a hospital or nursing home evacuation system for non-ambulatory patients when all components or persons in that system act as they are designed or trained to act. These factors are presented as part of an analysis of evacuation as a five phase process: manpower supply phase, patient preparation phase, patient removal phase, rest and recovery phase, and manpower resupply phase. Research findings are reviewed and a research agenda is proposed.

709,377
PB80-195795 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
System for Fire Safety Evaluation of Health Care Facilities.
Final rept.,
H. E. Nelson, and A. J. Shibe. May 80, 138p NBSIR-78-1555-1
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Fire safety, Hospitals, Fire prevention, Fire protection, Safety engineering, Buildings, Coding, Sprinklers, Building codes, Construction, Smoke, Detection, *Health facilities, Nursing homes.

A quantitative evaluation system for grading health care facilities in terms of fire safety is described. The system can be used to determine how combinations of widely accepted fire safety equipment and building construction features may provide a level of safety equivalent to that required by the widely accepted Life Safety Code of the National Fire Protection Association. The system will provide flexibility to both the designer of new facilities and to the renovator of existing health care facilities. Three major concepts form the basis for code equivalency: (1) Occupancy Risk - the number of people affected by a given fire, the level of fire they are likely to encounter and their ability to protect themselves; (2) Building Safety Features - the ability of the building and its fire protection systems to provide measures of safety commensurate with the risk; (3) Safety Redundancy - in-depth protection, through the simultaneous use of alternative safety methodologies such as containment, extinguishment, and people movement methodologies. The design of the complete fire safety system is intended to ensure that the failure of a single protection device or method will not result in a major failure of the entire system. In this system, equivalency is judged to exist when the total impact of the occupancy risk factors and the compensating building safety features produce a level of safety equal to or greater than that achieved by rigid conformance to the explicit requirements of the NFPA Life Safety Code. In this evaluation, safety performance is gauged both in terms of overall safety impact and depth of redundance.

709,378
PB80-199128 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
Safe Environments -Anthropometric, Biomechanical, and Activity Considerations.
Final rept.,
C. E. Jones, and J. V. Fechter. Sep 79, 154p NBSIR-80-2014
Report on HEW/NBS Fire/Life Safety Program.

Keywords: *Accidents, Characteristics, Anthropometry, Safety, Design, Mobility, Activity, Injuries, *Disabled persons, Disabilities, *Environmental health.

This report has been prepared for the National Bureau of Standards' Center for Fire Research as part of their support to the Office of Human Development Services of the U.S. Department of Health, Education and Welfare. The major objective of this report is to summarize data describing the physical characteristics of 'normal' and disabled people as actual or potential resident's of 'normal' homes, the space through which they move, their limits of bodily action, the causes of their injuries, and the factors influencing their use of residential time. The data have been obtained almost entirely from published literature. Specific and general evaluations of the applicability of the data to normal home activities are presented.

709,379
PB83-251447 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Programmer's Manual for the Fire Safety Evaluation System Cost Minimizer Computer Program.
R. E. Chapman, and W. G. Hall. Jul 83, 100p NBSIR-83-2749
Sponsored in part by Department of Health and Human Services, Washington, DC.

Keywords: *Hospitals, *Fire safety, Computer programming, Cost estimates, Guidelines, User needs, *Health care facilities, Nursing homes, FSESCM computer program.

The Fire Safety Evaluation System Cost Minimizer (FSESCM) computer program integrates engineering and economic considerations with a linear programming algorithm which permits the least-cost means of upgrading health care facilities to compliance with the Life Safety Code to be identified. A mathematical discussion of the application problem is used to introduce the basic philosophy behind the computer program.

Health Care Technology

709,380
PB-265 436/6 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.

Health Care Technology

U.S. Team Visit to France on Health Care Facilities.
Final rept.,
S. Kramer, and R. J. Kapsch. Apr 77, 57p NBSIR-77-1233

Keywords: *Health care facilities, *France, Health care technology, Planning, Design, Construction management, Reviews, Buildings, Hospitals, Architecture, Health care delivery systems, Bibliographies, Hospitals, Nursing homes, Health resources, Construction materials, Environments, Economics, United States.

The U.S. Center for Building Technology (CBT), Institute for Applied Technology, National Bureau of Standards, and the French Centre Scientifique et Technique du Batiment (CSTB) regularly exchange special study teams for selected areas of building technology. This report is on the visit of the U.S. team to France on health care facilities, held in April 1972. The U.S. team consisted of representatives from the Center for Building Technology; the Department of Defense; the Veterans Administration; and the Department of Health, Education and Welfare. The team visited health facilities in Paris, Meaux, Dijon, Beaune and Lyon. Innovative methods for the planning, design and construction of French health facilities were reviewed by the team participants. This report contains the findings and observations of the team. These findings and observations were originally recorded in a letter report which was exchanged with members of the U.S. team and the respective cooperating groups in France.

709,381
PB-287 096/2 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Color in the Health Care Environment.
B. C. Pierman. Sep 78, 38p NBS-SP-516
Library of Congress catalog card no. 78-14315. Proceddings of a Special Workshop Held at the National Bureau of Standards, Gaithersburg, Maryland, on November 16, 1976.

Keywords: *Meetings, *Color, *Light(Visible radiation), *Health care facilities, Hospitals, Environment, Effectiveness, Pediatrics, Psychiatry, Operating rooms, Buildings, Design, Health care technology, Physicians, Inpatient care, Human factors engineering, Oncology.

The proceedings contain invited papers regarding the use of color in health care environments. The subject matter includes the perspective of medical doctors, architects, designers, researchers, and standards writers concerning proper and effective color and light selection and use in all phases of hospitals and medical facilities. Particular problems and cautions are related regarding the use of colors in surgical theaters and pediatric as well as psychiatric wards.

Health-Related Costs

709,382
PB80-120165 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Economic Aspects of Fire Safety in Health Care Facilities: Guidelines for Cost-Effective Retrofits.
Final rept.,
R. E. Chapman, P. T. Chen, and W. G. Hall. Nov 79, 119p NBSIR-79-1902
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Fire safety, *Cost effectiveness, *Economic analysis, Building codes, Guidelines, Hospitals, Renovating, *Health care facilities, Compliance, Life safety code, Nursing homes.

The study focuses upon one aspect of the fire safety problem in health care facilities; the use of the Fire Safety Evaluation System developed by the Center for Fire Research at the National Bureau of Standards for determining equivalence to the Life Safety Code. The Life Safety Code, a voluntary code developed by the National Fire Protection Association, is currently the most widely used guide for identifying the minimum level of fire safety in buildings. Using the Fire Safety Evaluation System as a basis, this study develops a computerized procedure which permits the least-cost means of achieving compliance to the Life Safety Code in health care facilities to be identified. Since each of the parameters used in the Fire Safety Evaluation System has a unique value which corresponds to strict compliance, it is possible to quantify the cost savings attributable to the use of the Fire Safety Evaluation system over strict compliance to the Life Safety Code. Preliminary studies conducted by the National Bureau of Standards of prototypical hospital have concluded that the use of this computerized procedure can result in cost savings of 50 percent or more over those associated with strict compliance to the Life Safety Code.

709,383
PB87-117933 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Operations Research Div.
Assessing the Costs of Fire Protection in Health Care Facilities.
Final rept.
R. E. Chapman. 1985, 11p
Pub. in Fire Safety Jnl. 9, n2 p221-231 Jul 85.

Keywords: *Fire protection, *Health facilities, *Cost estimates, Reprints.

The identification of cost-effective levels of fire safety in health care facilities is a major concern to hospital administrators, fire safety engineers, and public policymakers. Rising construction and operating costs coupled with more stringent building codes and continuing advances in medical and building technology have complicated the issue, forcing health care facility administrators to assess carefully the alternative means through which they can design, construct, or update their facilities. The paper illustrates how the use of a performance-based approach to fire safety can dramatically reduce the costs of code compliance without reducing the safety and well-being of those housed in health care facilities.

Health Resources

709,384
PB82-258914 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Life-Cycle Cost Analysis Methodology for Fire Protection Systems in New Health Care Facilities,
L. P. Clark. Jul 82, 43p NBSIR-82-2558

Keywords: *Hospitals, *Fire protection, *Cost analysis, Building codes, Fire safety, Construction materials, Sprinkler systems, Construction costs, Service life, *Health care facilities, *Life cycle costs.

An analytical procedure is presented for conducting life-cycle cost (LCC) analyses of fire safety in new health care facilities. Comparative LCC evaluations of alternative fire safety systems can be obtained based on their initial costs, useful life times, operation and maintenance costs, salvage values, and corresponding fire insurance costs for the building and its contents.

709,385
PB84-166685 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
User's Manual for the Fire Safety Evaluation System Cost Minimizer Computer Program.
R. E. Chapman, and W. G. Hall. Dec 83, 133p NBSIR-83-2797
Sponsored in part by Department of Health and Human Services, Washington, DC.

Keywords: *Fire safety, *Hospitals, Manuals, Safety engineering, Building codes, Economic analysis, *Nonlinear programming, Health care facilities, Nursing homes.

The Fire Safety Evaluation System Cost Minimizer (FSESCM) computer program integrates engineering and economic considerations with a linear programming algorithm which permits the least-cost means of upgrading health care facilities to compliance with the Life Safety Code to be identified. This report is designed as a reference document for a nonprogramming FSESCM user. A description of the philosophy and methodology behind FSESCM is given first, followed by a discussion of the data requirements, the various options available to the user, as well as some of the limitations of the program. A detailed example in which all inputs to the FSESCM computer program are described is then given. The output associated with the example is then analyzed rigorously. The report concludes with a set of guidelines for making efficient use of the FSESCM computer program.

709,386
PB85-137727 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Field Tests of the Smoke Control System at the San Diego VA (Veterans Administration) Hospital.
J. H. Klote. Nov 84, 21p NBSIR-84/2948

Keywords: *Smoke abatement, *Hospitals, Fire safety, Field tests, Control equipment, Fans, Air flow, Design, Pressure, Acceptability, Smoke detectors.

The Veterans Administration (VA) has sponsored a project at the Center for Fire Research of the National Bureau of Standards to study smoke control in VA hospitals and to develop new design approaches and methods of acceptance testing. This paper is one report of this ongoing project. It presents the results of a field test on the San Diego VA Hospital.

INDUSTRIAL & MECHANICAL ENGINEERING

Environmental Engineering

709,387
PB-276 531/1 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C.
Levels of Illumination and Legibility.
G. T. Yonemura, W. M. Benson, and R. Tibbott. Nov 77, 32p NBSIR-77-1306
Previously announced as PB-274 652. Sponsored in part by Department of Energy, Washington, D.C. Architectural and Engineering Systems Branch.

Keywords: *Illumination, *Visibility, *Legibility, Illumination, Experimental data, Lightness, Luminance, Energy conservation, Thresholds(Perception), Contrast, Performance(Human), Visual perception, Visual acuity, Physiological psychology, *Work environments.

The visibility of tasks encountered in the working world ranges from easy to difficult to see objects. The assumption that experiments performed for threshold targets (difficult to see) can be extrapolated to higher contrast tasks (easy) was tested. The experiments indicate that threshold level studies should not be extrapolated to suprathreshold levels. The performance of the eye is not the same at the two levels. The threshold function is monotonic, that is, contrast required for detection decreases monotonically as luminance is increased, whereas the suprathreshold experiments result in a function with a minimum or optimum luminance level. Recommendations are made to expand the empirical base from which lighting level recommendations are derived to include the more commonly occurring situation involving visual task performance for suprathreshold tasks.

709,388
PB80-222714 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Lighting Issues in the 1980's: Summary and Proceedings of a Lighting Roundtable Held at New York, New York on June 14 and 15, 1979.
Final rept.,
A. I. Rubin. Aug 80, 178p NBS-SP-587
Sponsored in part by the Illuminating Engineering Society of North America, New York. Library of Congress catalog card no. 80-600087.

Keywords: *Meetings, *Illuminating, *Environmental engineering, Lighting control, Lighting equipment, Public relations, Government policies, Education, Illu-

minance, Human factors engineering, Energy conservation.

The Lighting Roundtable described in the report was conducted to foster an open discussion of the goals, issues, and responsibilities of the lighting community. It was not a problem-solving session, but rather a time to examine the long-term aspirations and objectives of lighting and barriers that may stand in the way of achieving them. Eight major issues were addressed by nine panelists and a number of invited auditors. The issues are as follows: (1) The Public Image of the Lighting Community; (2) U.S. Role in the Worldwide Lighting Community; (3) Factors Affecting Human Activities in the Built Environment; (4) Effect of Lighting on Environmental Quality; (5) Effects of Barriers; (6) Establishment of Illuminance Levels; (7) Integration of Subsystems; and (8) Professional Development and Lighting Education. The present publication consists of two parts: (1) A summary of the proceedings and (2) a complete transcript.

709,389
PB81-245052 Not available NTIS
National Bureau of Standards, Washington, DC.
Development of a Modeling Technique for Evaluation of Natural Convection and Ventilation in Rooms.
Final rept.
E. M. Barber, D. A. Bettge, and F. J. Powell. 1970, 4p
Pub. in Proceedings of Semiannual Meeting ASHREA Survival Shelter Problems, San Francisco, CA. January 19-22, 1970, p36-39 1970.

Keywords: *Ventilation, *Mathematical models, *Convection, Temperature, Particles.

An experimental technique is being developed by which natural convection and ventilation in rooms and shelters can be studied. The technique relies on the use of a small-scale model to simulate the actual room or shelter, on the use of high temperature water in place of the room air to simulate the convective patterns, on time-exposure photographs made of trace particles suspended in the water to reveal the convection, and on temperature measurements made inside the model. The technique is discussed in terms of its potential for yielding useful information on free convection in spaces such as inside rooms.

709,390
PB86-193059 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Indoor Humidity Calculations.
Final rept.
T. Kusuda. 1983, 1p
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Jnl. 25, n5 p64 1983.

Keywords: *Humidity, Humidity control, Computation, Dew point, Absorption, Desorption, Reprints.

Measured hourly data on indoor humidity is compared with the data obtained by the calculated values for NBS Houston test houses and for the high mass test building in an environmental chamber. The paper also introduced the Tsuchiya model that permits the evaluation of room surface moisture absorption capability. The model is based upon the detailed simulation calculation for the room moisture balance that includes the surface condensation evaporation and absorption/desorption coefficients. These coefficients were determined in such a manner that the measured room humidity levels coincide with the calculated values.

709,391
PB87-171716 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Application of the Carnahan-Starling-DeSantis Equation of State to Mixtures of Refrigerants.
Final rept.,
G. Morrison, and M. O. McLinden. 1986, 8p
Sponsored by Electric Power Research Inst., Palo Alto, CA.
Pub. in Proceedings of ASME (American Society of Mechanical Engineers) Winter Annual Meeting, Anaheim, CA., December 7-12, 1986, p1-8.

Keywords: *Refrigerants, *Thermodynamic properties, Equations of state, Binary systems(Materials), Mixtures, Ternary systems, Reprints, R22/R114 refrigerant mixture.

A modification to the Carnahan-Starling equation of state to describe the properties of refrigerant materials and their binary and ternary mixtures is discussed. A detailed discussion of the ability to fit and predict the thermodynamic properties of R22 is included. The representations arising from limited and extensive data sets are compared. The binary mixture R22/R114 is discussed and compared briefly to other binary refrigerant mixtures. The ability of the model to describe ternary mixtures without any ternary information is discussed. Present uses of the model are discussed.

Industrial Safety Engineering

709,392
PB-264 691/7 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Safety Problems Associated with Pressure Containers.
Final rept.,
S. K. Wakamiya, and N. J. Calvano. Mar 77, 43p NBSIR-77-1217
Prepared in cooperation with Consumer Products Safety Commission, Bethesda, Md.

Keywords: *Safety engineering, *Pressure vessels, *Tanks(Containers), Safety, Liquefied petroleum gases, Fire extinguishers, Hazards, Accident investigations, Standards, Data.

Accident reports from hospital emergency rooms and reports of interviews with accident victims were reviewed to determine the probable causes of accidents involving two types of pressure containers: fire extinguishers and liquefied petroleum (LP) gas tanks. The data collected and reviewed during the study suggests that some of the safety problems associated with fire extinguishers involve: (1) incompatibility of the contents of an extinguisher with its shell; (2) faulty method attachment of plastic pressure gages on some dry chemical extinguishers; and (3) widespread use of obsolete extinguishers. The primary hazard associated with LP gas containers appear to be leakage from various parts of the LP system. In many instances leaking gas accumulated in a closed area and was accidentally ignited, resulting in an explosion. Engineering standards relevant to the safety of fire extinguishers and LP gas tanks were reviewed. Although the present standards governing these pressure containers address most safety problems adequately, a few of the requirements in some of these standards appear to be of questionable value in preventing certain types of accidents.

709,393
PB-269 355/4 PC **A10**/MF **A01**
National Bureau of Standards, Washington, D.C. Product Systems Analysis Div.
Study of Personal Fall-Safety Equipment.
Final rept.,
H. L. Steinberg. Jun 77, 220p NBSIR-76-1146
Sponsored in part by Occupational Safety and Health Administration, Washington, D.C. Div. of Safety Standards Development.

Keywords: *Impact tests, *Industrial medicine, *Safety belts, *Personnel, Construction industry, Safety engineering, Regulations, Tension tests, Standards, Measuring instruments, Reviews, Physiological effects, Bibliographies, Recommendations, Procedures, Tables(Data), Wounds and injuries, Humans, Classifications, Evaluation, *Occupational safety and health, *Falling, Extensometers.

A study has been made of the basic requirements for personal safety equipment that is designed to protect workers at heights against the danger of falls. The project was undertaken for the Occupational Safety and Health Administration as part of an effort to update the Code of Federal Regulations on fall-safety equipment. The investigation included an intensive literature review, numerous field visits, and a limited laboratory examination of some components. Some unique testing and evaluation approaches were developed, and a novel extensometer was designed.

709,394
PB-275 083/4 PC **A04**/MF **A01**
Maryland Univ., College Park. Dept. of Fire Protection Engineering.
Effect of Selected Variables on the Distribution of Water from Automatic Sprinklers,
C. L. Beyler. Jun 77, 71p NBS/GCR-77-105
Grants NBS-4-36092, NBS-6-9008
Sponsored in part by Public Health Service, Washington, D.C.

Keywords: *Sprinkler systems, *Water distribution, Computer graphics, Flow rate, Fire protection, Automatic mapping, SYMAP computer program, Computer aided analysis.

The effects of flow rates, supply pipe size, direction of supply, deflector to ceiling clearance, orientation of sprinkler arms, angles of the sprinkler head, and sprinkler guards on the distribution of water from upright and pendant sprinkler heads have been studied. Three collection arrays were used to measure densities from one or two sprinklers. To evaluate the effects of the above variables, data from tests were used in conjunction with a Synagraphic Mapping System (SYMAP) computer program to produce isodensity mappings of sprinkler discharges.

709,395
PB-291 706/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analyzing Fire Extinguisher Failures.
Final rept.,
B. W. Christ, J. H. Smith, and C. H. Brady. Dec 78, 5p
Pub. in Metal Progress 114, n8 p28-32, Dec 78.

Keywords: *Fire extinguishers, *Circumferential stress, Failure, Materials tests, Hydrostatic tests, Metallographic structure, Stainless steels, Reprints.

Hydrostatic pressure testing and metallographic examination was carried out on stainless steel inverting type fire extinguishers to determine the cause of failures by circumferential tearing at the dome end of the extinguishers. Intergranular cracking of sensitized metal, perhaps over a period of 15-20 years, seemed to be the cause of these failures.

709,396
PB-298 787/3 PC **A07**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Guidelines for Stair Safety.
Building science series (Final).
J. Archea, B. L. Collins, and F. I. Stahl. May 79, 133p NBS-BSS-120
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD. Library of Congress catalog card no. 79-600057.

Keywords: *Stairways, *Safety, National government, Accident prevention, Safety engineering, Guidelines, Safety devices, Surfaces, Dimensions, Dimensional stability, Structural analysis, Environments, Standards, Design.

The report summarizes information and research in the area of stair use and provides design guidelines for improving stair safety. These guidelines are directed toward seven major categories of stairway design and construction: (1) structural integrity and quality of stairs, (2) physical attributes of stair surfaces, (3) appearance of stair surfaces, (4) handrails, (5) physical attributes of the surrounding stairway environment, (6) appearance of the surrounding stairway environment, and (7) signs and symbols.

709,397
PB-299 023/2 PC **A09**/MF **A01**
Loyola Univ. of Chicago, IL.
Evaluation of Planning and Training for Fire Safety in Health Care Facilities - Phase Two.
Final rept.
L. Bickman, E. Herz, P. Edelman, and D. Rivers. Aug 79, 181p NBS/GCR-79/179
Grant NBS-G6-9015
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Fire safety, Human behavior, Evaluation, Planning, Training programs, Fire protection, Fire prevention, Nurses, Health care facilities, Nursing homes.

Training for fire emergencies has always been assumed to appropriately affect knowledge and behavior. This assumption has not been systematically tested until now. Six nursing homes in Evanston, Illinois were matched and randomly assigned to experi-

mental and comparison groups. A quasi-experimental pretest-posttest research design was employed to evaluate the impact of training on knowledge (assessed with paper and pencil surveys) and behavior (drill observational assessments) of nursing home staff. Results indicated that training augmented knowledge in the experimental group, as expected. Various threats to the internal and external validity of the design, such as selection biases, sample attrition and pretesting by treatment interaction effects were ruled out, on a statistical basis, as plausible alternative explanations for the training effect. The results of the fire drill behavior analyses indicated a measurable impact of training on the overall behavior of the experimental group during the post-training fire drills. Several events, or procedures, that should take place during a fire emergency were evaluated on the basis of a content-related scheme and a time-related scheme. Specific behaviors of staff members during the drills were discussed. This study demonstrated that a modest investment in training produced changes in both knowledge and behavior. However, the impact of the training was not as strong as anticipated. A more detailed study of the various types of training is strongly recommended.

709,398
PB-300 604/6 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Selection and Application Guide to Commercial Intrusion Alarm Systems.
Special pub.
A. H. Sher, and G. N. Stenbakken. Aug 79, 45p
NBS-SP-480-14, NILECJ-GUIDE-0305.00
Library of Congress catalog card no. 78-21624.

Keywords: *Warning systems, Selection, Detectors, Systems engineering, Commercial buildings, Comparison, *Burglar alarms, *Intrusion detectors.

This set of guidelines outlines a procedure to help the person who must buy an alarm system to protect a store or business establishment to make a wise selection. The procedure takes him through the following considerations: (1) The type of threat (what is the protection for), (2) the types of protection (what methods are available), (3) the types of sensors (which characteristics are desirable), (4) the mode of alarm (how is the alarm signal to be transmitted) and, (5) the types of services (how do the police find out an alarm has been sounded).

709,399
PB77-600068 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sound Sensing Units for Intrusion Alarm Systems.
T. L. Quindry, and G. N. Stenbakken. 1977, 18p
Pub. in NILECJ-Std-0308.00.

Keywords: *Alarm, Audio alarm, Burglar alarm, Intrusion alarm, Intrusion detector, Sound sensing, Standard.

This standard establishes performance criteria for sound sensing alarms intended for use in protective intrusion systems to monitor for attempts to enter a room or building. These devices cause the initiation of an alarm signal to a police panel, central station, or local audible alarm device. Included are requirements and test methods for performance, electrical properties and materials. The characteristics addressed are those which affect the reliability of the devices with emphasis on those performance characteristics which affect their false alarm susceptibility and its tamper resistance.

709,400
PB81-218455 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Review of Literature, Applicable Test Methods, and Incident Data for the Evaluation of the Fire Performance of Central Telephone Office Equipment.
Final rept.
E. Braun. May 81, 42p NBSIR-81-2261

Keywords: *Telephone equipment, *Fire safety, Fire tests, Telephone exchanges, Fire resistance.

At the request of the Rural Electrification Administration, a program was initiated to evaluate the adequacy of current flammability specifications for electrical equipment used in telephone company central offices. The high reliance on telephone services for emergency communications necessitates that measures be considered to minimize the likelihood of fire related interruptions of service. This report provides a review of current test methods and specifications for central office equipment; a review of available fire test methods in various categories; a brief literature review of relevant fire research and fire testing of wiring, cables, and assemblies; and a review of fire incident data.

709,401
PB82-211053 Not available NTIS
National Bureau of Standards, Washington, DC.
Safety Sensor Systems for Industrial Robots.
Final rept.
R. D. Kilmer. Mar 82, 11p
Pub. in Proceedings of Conference Robotics VI, Detroit, MI, March 2-4, 1982, p479-491 1982.

Keywords: *Safety devices, *Robots, Detectors, Acoustic detection, Ultrasonic radiation, Transducers, Personnel detection, Safety.

With the increased use of industrial robots comes the concern for providing safe operating conditions so that collisions with the robot are avoided. One approach to solving this problem is to provide sensor systems which can detect intruders -- personnel and other objects -- that enter the workstation, and signal the robot control system so that an appropriate control action can be taken. These sensors systems can be classified according to region of detection into three levels: Level I - perimeter detection around the workstation; Level II - intruder detection within the workstation; and Level III - intruder detection very near the robot (a 'safety skin'). This paper discusses these three sensor system levels and their implications. Also described is the development of a prototype safety system consisting of Level I and Level II type sensors. The characteristics and limitations of these sensors are discussed and a description of the application of this system to one of the NBS research robots is presented.

709,402
PB85-101129 PC **A05**/MF **A01**
California Univ., Berkeley. Dept. of Mechanical Engineering.
Fire Propagation in Concurrent Flows.
Final progress rept. 1 Jun 83-31 May 84.
A. C. Fernandez-Pello. Aug 84, 85p NBS/GCR-84/471
Contract NB83-NADA-4020
See also PB84-100155.

Keywords: *Fire tests, *Flame propagation, Heat transfer, Fuels, Flow, Convection, Combustion, Burning rate, Enclosures.

Experimental and Theoretical Studies of the process of flow assisted fire spread over the surface of combustible surfaces have been carried out. Research efforts have concentrated on two aspects of this mode of fire spread: (1) Fire spread in a concurrent forced (or mixed) flow; and (2) Fire spread along the walls of an enclosure in natural convection. During this reporting period a series of experiments of the dependence on the velocity and oxygen concentration of the concurrent forced flow of the rate of flame spread over thick PMMA sheets have been completed. The results indicate that this form of fire spread is primarily controlled by heat transfer from the flame to the unburnt combustible. Experiments with thin paper sheets are currently underway. Efforts on the second task have concentrated on the numerical analysis of the structure of a diffusion flame, established over a burning fuel surface. The results indicate the existence of significant longitudinal diffusion of heat and species ahead of the flame front. An analysis on the spread of flames in an enclosure is currently in progress.

709,403
PB85-141869 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Control Units for Intrusion Alarm Systems.
Final rept.
M. L. Kite, M. Juberts, G. N. Stenbakken, and D. E. Frank. Jun 84, 15p
Sponsored by National Inst. of Justice, Washington, DC.
Pub. in NIJ (National Inst. of Justice) Standard-0321.00, 15p Jun 84.

Keywords: *Warning systems, *Control equipment, Standards, Performance, Reliability, Tests, Acceptability, Detection, Reprints, *Alarm systems, *Intrusion, Tamperproofing.

This standard establishes performance requirements and test methods for intrusion alarm control units used in protecting residential or commercial premises. Upon actuation of an intrusion sensing device or the detection of a trouble condition, the control unit may initiate a local audible alarm, transmit an alarm signal to a police department, or transmit an alarm signal to a central station. The performance characteristics addressed are those that affect the reliability of the device with emphasis on those that affect false alarms susceptibility and tamper resistance.

709,404
PB85-187581 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD.
Literature Survey on Drop Size Data, Measuring Equipment and Discussion of the Significance of Drop Size in Fire Extinguishment.
W. D. Hayes. Jan 85, 31p NBSIR-85/3100
Sponsored by Federal Emergency Management Agency, Washington, DC.

Keywords: *Drops(Liquids), *Fire extinguishing agents, Size determination, Measuring instruments, Spraying, Water, Nozzles, Fire fighting.

The literature was searched for information and data on the size of water droplets from fire fighting equipment, on instrumentation and techniques for measuring droplet size in dense sprays, and on the significance of droplet size in water sprays used for fire extinguishment. Included is a discussion of droplet size information on an impinging jet type fire hose nozzle. Droplet size analyzers that use shadowgraphic technique are likely to be best suited for measuring sprays from fire hose nozzles. The effects of droplet size in water sprays used for extinguishment in confined and unconfined spaces and with and without counterflowing air currents is discussed.

709,405
PB86-162153 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Ceiling Jet Properties and Wall Heat Transfer in Compartment Fires near Regions of Ceiling Jet-Wall Impingement.
L. Y. Cooper. Jan 86, 34p NBSIR-86/3307

Keywords: *Ceilings(Architecture), *Fires, Heat transfer, *Compartment fires, Fire models.

The problem of heat transfer to walls from fire plume-driven ceiling jets during compartment fires is introduced. An analogy is drawn between the flow dynamics and heat transfer at ceiling jet-wall impingement and at the line impingement of a wall and a two-dimensional, plane, free jet. Using the analogy, the literature on plane, free jet flows and corresponding wall stagnation heat transfer rates leads to readily useable estimates for the heat transfer from, and the mass, momentum, and enthalpy fluxes of the turned compartment fire ceiling jet as it begins its initial descent as a negatively buoyant flow along the compartment walls. Available data from a reduced-scale experiment provides some limited verification of the heat transfer estimate.

709,406
PB86-177722 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Basic Structure of the Fire Protection Design Assessment System.
H. E. Nelson, and W. D. Walton. Feb 86, 30p NBSIR-85/3298
Sponsored by Air Force Engineering and Services Center, Tyndall AFB, FL.

Keywords: *Fire protection, Systems engineering, Safety engineering, Smoke, Buildings, Fires, Compartment fires, Fire studies.

The purpose of the Fire Protection Design Assessment System is to provide design engineers with a tool to improve their ability to appraise the overall fire safety in a facility and evaluate the impact of fire protection measures. The system is based on deterministic fire prediction techniques and will be implemented through an interactive computer program. The report describes the components and basic structure of the system. The inputs to system include data on the building layout, combustible contents, fire resistance, detectors, sprinklers, smoke control system, occupants and the fire safety objectives. The outputs include the predicted fire generated conditions within the building

as a function of time and an evaluation of the user specified fire safety objectives.

709,407
PB86-181849 PC **A03**/MF **A01**
California Univ., Berkeley. Dept. of Mechanical Engineering.
Fire Propagation in Concurrent Flows. Final Progress Report June 1, 1984-May 31, 1985.
A. C. Fernandez-Pello. Feb 86, 50p NBS/GCR-86/505
Grant NB83-NADA-4020
See also PB85-101129. Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Flame propagation, *Fire tests, Flames, Flow, Heat transfer, Combustion.

A study is currently underway of the spread of flames over the surface of a solid combustion of a solid combustible in a mixed, forced and free, convective flow. Research efforts have concentrated primarily on a experimental study of the flow assisted spread of flames over thermally thin fuels, and a numerical analysis of the extinction of flames established over a flat combustible surface. The experimental results indicate that wind aided fire spread is primarily controlled by heat transfer from the flame to the unburnt combustible. The flame spread rate data can be correlated with and expression obtained from a heat transfer analysis of the flame spread process.

709,408
PB86-182292 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
ASKBUDJr: A Primitive Expert System for the Evaluation of the Fire Hazard of a Room.
R. L. Smith. Mar 86, 65p NBSIR-86/3319

Keywords: *Fire safety, Artificial intelligence, Computer programs, Fire hazards.

The Center for Fire Research (CFR) has a long-term project to develop expert systems as a technology transfer mechanism. CFR has as the long-term goal of the project: to develop a computer program which will make an expert estimate of the fire safety of a building based on CFR's deterministic physical models, technical data, and the expert judgement of its staff.

709,409
PB86-185246 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Toxic Hazard Evaluation of Plenum Cables.
Final rept.
R. W. Bukowski. Nov 85, 15p
Pub. in Fire Technology 21, n4 p252-266 Nov 85.

Keywords: *Toxicity, *Power lines, *Fire hazards, Electrical insulation, Reprints.

Code provisions covering the installation of low voltage cables in plenum spaces above suspended ceilings used for environmental air are reviewed. A calculation procedure which could be used to estimate the potential toxicity of the decomposition products from these cables relative to the toxicity of the compartment fire necessary to decompose the cable insulation is presented. These estimates are used in a four-step procedure for estimating Smoke Toxicity Hazard proposed by the NFPA Toxicity Advisory Committee which is described. Example calculations for some typical cases and a discussion of their limitations are included.

709,410
PB86-189743 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Finite Difference Calculations of Buoyant Convection in an Enclosure: Verification of the Nonlinear Algorithm.
Final rept.
R. G. Rehm, P. D. Barnett, H. R. Baum, and D. M. Corley. 1985, 15p
Pub. in Applied Numerical Mathematics 1, p515-529 1985.

Keywords: *Finite difference theory, *Buoyancy, *Convection, Fires, Enclosures, Reprints, Fire studies.

Solutions are presented to nonlinear finite difference equations used to represent fire-driven buoyant convection in enclosures. The solutions depend upon the fact that these difference equations permit the decomposition of the discretized velocity field into solenoidad and irrotational components. The irrotational field is shown to satisfy a finite difference analog of Bernoulli's equation when the density is constant. This leads to a three-dimensional time-dependent solution to the difference equations. The solenoidal field is shown to possess steady-state two-dimensional solutions corresponding to a constant non-zero value of the discretized vorticity. The two solutions, together with results presented elsewhere describing finite difference approximations to linear internal waves in enclosures, have been used in the development and testing of the computer-based algorithms used to solve these equations.

709,411
PB86-192390 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Significance of a Wall Effect in Enclosures with Growing Fires, 1984.
Final rept.
L. Y. Cooper. 1984, 21p
See also PB83-235671. Sponsored by Department of Health and Human Services, Washington, DC., and Department of the Interior, Washington, DC.
Pub. in Combustion Science and Technology 40, p19-39 1984.

Keywords: *Buildings, *Fires, Flame propagation, Reprints, *Compartment fires, Fire studies, Room fires, Wall flow.

The paper studies the significance of a wall effect that has been observed during the growth stage of enclosure fires. Relative to the two-layer phenomenon which tends to develop during such fires, the effect has to do with the near-wall downward injection of hot upper layer gases into the relatively cool uncontaminated lower layer. It is conjectured that these observed wall flows are buoyancy driven, and that they develop because of the relatively cool temperatures of the upper wall whose surfaces are in contact with the hot upper layer gases. The results of the analysis indicate the importance of taking the wall effect into account in two-layer zonal analyses of enclosure fire phenomena.

709,412
PB86-196417 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Salt Water Modeling of Fire Induced Flows in Multicompartment Enclosures.
K. D. Steckler, H. R. Baum, and J. G. Quintiere. Mar 86, 53p NBSIR-86/3327
Sponsored by David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.

Keywords: *Fires, *Model tests, Flow visualization, Salt water, Smoke, Buoyancy, Enclosures, *Fire models, Compartment fires.

Salt water modeling is used to study fire-induced flows in multicompartment structures. Scaling laws relating salt water flows and hot gas flows are developed. Results from 1/20 scale salt water simulations of fire-induced flows in a single-story multiroom structure are shown to be in good agreement with available full-scale results. Experiments involving a 1/20 scale model of a U.S. Navy ship demonstrate the feasibility of using the technique to study hot gas flows in compartmented structures too complex to study economically by other means.

709,413
PB86-203817 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Research Publications, 1985.
N. H. Jason. May 86, 46p NBSIR-86/3372
See also PB85-208502.

Keywords: *Fires, Fire safety, Smoke, Toxicity, Fire protection, *Fire studies, Compartment fires, Fire models.

'Fire Research Publications, 1985' is a supplement to previous editions: Earlier editions, i.e., 1969-1979, also are available in the National Technical Information Service (NTIS). Only publications prepared by members of the Center for Fire Research (CFR), by other National Bureau of Standards (NBS) personnel for CFR, or by external laboratories under contract or grant from the CFR are cited.

709,414
PB86-206570 PC **A24**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Evaluating Thermal Fire Detection Systems (English Units).
Final rept.
D. W. Stroup, D. D. Evans, and P. Martin. Apr 86, 559p NBS/SP-712
Also available from Supt. of Docs as SN003-003-02727-8. Library of Congress catalog card no. 86-600519

Keywords: *Fire detection systems, *Buildings, Fire damage, Fire protection, Fire resistance, Data, Computer programs, Computer applications.

The report presents a methodology for evaluating heat detection systems installed in buildings. Previous work for use primarily in designing new thermal fire detection systems was used as a starting point. The previous work was enhanced and supplemented to make it more useful for evaluating existing systems. The resulting equations were programmed into a user interactive computer program. The program is available in both BASIC and FORTRAN and will run on mainframes as well as personal computers. In addition, a modified version of the FORTRAN program was used to develop an extensive set of tables listing detector activation times for given building geometries, detector characteristics, and fire growth rates. These tables are useful for quick evaluation of alternative heat detector installations. Finally, practical examples are included to illustrate the use of the tables and computer programs.

709,415
PB86-210002 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Use of Fire Statistics in Assessing the Fire Risk of Products.
Final rept.
D. Gross. 1985, 8p
Pub. in Proceedings of International Conference on Flammability, INTERFLAM '85 Conference Workbook, Guildford (England, March 26-28, 1985, p22-18.

Keywords: *Statistical analysis, *Curtains, Fire tests, Fire hazards, Risk, Fire losses.

In assessing the fire risk of one or more specific products, fire incidence statistics provide an important base line measure of the extent of fire losses, and of the principal causative factors, including sources of ignition and the effects of occupancy and fire protective measures. Normalizing the incidence data in terms of the exposure time, the available exposed area of the product, and the number of persons at risk may permit more meaningful comparisons to be made. Analysis of the likely fire scenarios leading from ignition to an ultimate injury or loss provides insight into the fire response factors important in laboratory evaluation of a product.

709,416
PB86-212073 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Perimeter Safety Net Projection Requirements.
C. W. C. Yancey, N. J. Carino, and M. Sansalone. May 86, 61p NBSIR-85/3271
Sponsored by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Construction, *Nets, *Safety engineering, Requirements, Regulations, Tests, Mathematical models, Guidelines, Falling bodies, *Occupational safety and health.

Current construction-site safety net regulations set limitations on the minimum horizontal projection of perimeter nets and the maximum vertical distance between an elevated working surface and the net below. These limitations were arbitrarily established as no actual or simulated fall data existed. The adequacy of these requirements in ensuring construction worker safety has been questioned. Thus, a test program was carried out to determine the adequacy of existing regulations. Simulated fall tests were conducted using anthropomorphic dummies to represent falling workers. Results are presented to show the trajectory of the falling body and the maximum horizontal distance in the final landing position. An analytical model was developed to

simulate a falling worker. The model can be used to predict trajectories for a given set of initial conditions including worker height and weight, departure horizontal velocity and fall height. Guidelines are presented for revising existing regulations pertaining to the dimensional requirements for perimeter nets.

709,417
PB86-226594 PC **A10**/MF **A01**
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Examination of a Pressure Vessel that Ruptured at the Chicago Refinery of the Union Oil Company on July 23, 1984.
H. I. McHenry, T. R. Shives, D. T. Read, J. D. McColskey, C. H. Brady, and P. T. Purtscher. Mar 86, 205p NBSIR-86/3049
Sponsored by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Pressure vessels, Bursting, Examination, Corrosion, Hydrogen embrittlement, Fracture(Mechanics).

The pressure vessel fractured along a path that was weakened by extensive cracking adjacent to a repair weld joining a replacement section to the vessel. These pre-existing cracks initiated in areas of a hard microstructure known to be susceptible to hydrogen stress cracking. The microstructure formed during the repair welding of the replacement section, and at the surface, it was not tempered by subsequent weld passes or thermal treatment. The cracks grew through the vessel wall due to hydrogen pressure cracking. When the depth of the largest of these pre-existing cracks exceeded 90 to 95% of the wall thickness, leakage occurred because the thin ligament of steel remaining in the cracked section ruptured. Because of the uniform depth of the pre-existing crack, the thin ligament continued to tear, causing the through crack to grow to a length of about 800 mm. The crack triggered final fracture at the operating stress level of 35 MPa because the toughness of the vessel steel was reduced by hydrogen embrittlement.

709,418
PB86-230471 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Concepts for Life Safety Analysis.
Final rept.
H. E. Nelson. 1986, 19p
Pub. in Proceedings of Society of Fire Protection Engineers Symposium on Quantitative Methods for Life Safety Analysis (7th), College Park, MD., March 5-7, 1986, p1-19.

Keywords: *Fire protection, *Fire hazards, Fire safety, Smoke, Fire detection systems, Fire models, Fire studies.

An overview of the need, methods, and resources appropriate for life safety analysis of fire hazard is presented. An outline of the elements of a fire hazard analysis system with appropriate references is given.

709,419
PB86-230810 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Measure of Evacuation Difficulty.
Final rept.
B. M. Levin, H. E. Nelson, and N. E. Groner. 1982, 9p
Pub. in Proceedings of International Fire Protection Seminars (6th), Karlsruhe, Germany, September 21-24, 1982, p323-331.

Keywords: *Fire safety, *Fire protection, *Evacuating(Transportation), Building codes, Fire detection systems.

Fire safety requirements are being developed for buildings housing disabled people including the mentally retarded. Some disabled people can escape a building rapidly without assistance while others need someone to help them. More fire protection features need to be built into the building when the disabled residents require assistance to evacuate. A procedure has been developed to evaluate or measure the difficulty of evacuating residences housing disabled people. The measure is used to determine the fire protection features to be built into the building; the greater the evacuation difficulty, the more fire protection features required.

709,420
PB86-230828 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Progress Report on Fire Investigation.
Final rept.
A. Gomberg. 1982, 8p
Pub. in Proceedings of Joint Panel Meeting UJNR Panel on Fire Research and Safety (6th), Tokyo, Japan, May 10-14, 1982, p39-46.

Keywords: *Fires, *Fire investigation, Fire reporting, Fire studies.

Progress made on several fronts in the area of fire investigation in the U.S. in recent years is discussed. Improvements in both the quantity and quality of U.S. Fire Investigations is referenced, including fire reporting, post fire interviews and special studies.

709,421
PB86-232428 PC **A24**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Evaluating Thermal Fire Detection Systems (SI Units).
Final rept.
D. W. Stroup, D. D. Evans, and P. Martin. Apr 86, 560p NBS/SP-713
See also PB86-206570. Library of Congress catalog card no. 86-600520.

Keywords: *Fire detection systems, *Buildings, Fire damage, Fire protection, Fire resistance, Sprinkler systems, Fire safety, Fire alarm systems.

The report presents a methodology for evaluating heat detection systems installed in buildings. Previous work for use primarily in designing new thermal fire detection systems was used as a starting point. The previous work was enhanced and supplemented to make it more useful for evaluating existing systems.

709,422
PB86-232691 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
ASET - A Computer Program for Calculating Available Safe Egress Time.
Final rept.
L. Y. Cooper, and D. W. Stroup. 1985, 17p
Pub. in Fire Safety Jnl. 9, p29-45 1985.

Keywords: *Fire tests, Combustion products, Smoke, Reprints, *Fire studies, Compartment fires, Fire investigation, Room fires.

A user-oriented computer program which carries out the required simulations and provides estimates for the ASET has been developed. Describes the program and its use. For fire growth in a particular fuel assembly, a single program run can be used to evaluate the ASET from enclosures (which are assumed to contain the fuel assembly) of different heights and areas, and under a variety of different detection and hazard criteria.

709,423
PB86-240066 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Pillow Burning Rates.
Final rept.
V. Babrauskas. 1985, 2p
Pub. in Fire Safety Jnl. 8, n3 p199-200 1985.

Keywords: *Fire tests, *Burning rate, Fire safety, Combustion, Fire resistance, Reprints, *Fire studies, *Pillow.

Burning rates have been determined for four common pillow types and one of newer design, intended to be especially fire resistive. One replicate test was run and showed satisfactory reproducibility. The order of performance, best to worst, was: fiberfill (protected with fiberglass cover); feathers; fiberfill (ordinary construction); polyurethane foam; latex foam.

709,424
PB86-240082 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Some Characteristics of Fabrics for Heat Protective Garments.
Final rept.
J. F. Krasny. 1986, 12p
Pub. in ASTM (American Society for Testing and Materials) STP 900, p463-474 1986.

Keywords: *Protective clothing, Fire resistant textiles, Fire protection, Clothing, Reprints, Fire fighters.

Principles of protection afforded by clothing in fire situations are reviewed briefly. Several examples of measurements of heat protective properties are given. Materials covered are single layers of fabrics appropriate for work uniforms, the same type of fabric combined with four popular underwear fabrics, and typical fire fighters' turnout coat assemblies, consisting of a shell fabric, vapor barrier, and thermal barrier.

709,425
PB87-100996 PC **A09**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
User's Guide for RAPID, Reduction Algorithms for the Presentation of Incremental Fire Data.
Final rept.
J. N. Breese, and R. D. Peacock. Aug 86, 199p NBS/SP-722
Also available from Supt. of Docs as SN003-003-02752-9. Library of Congress catalog card no. 86-600565.

Keywords: *Fire tests, Algorithms, Computer systems programs, Computer programs, Data.

RAPID is a stand-alone program specifically designed to convert raw instrument voltages collected during such tests into meaningful units. The reduced data can also be used alone or in combinations to obtain quantities that require more than minimal data reduction.

709,426
PB87-105201 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
National Bureau of Standards Conference on Fire Research, 1981.
Final rept.
D. Gross. 1981, 2p
Pub. in Fire and Materials 5, n4 p180-181 1981.

Keywords: *Fire tests, Meetings, Soot, *Fire studies, Fire models.

The Fifth Annual Conference on Fire Research was held at the National Bureau of Standards on August 19-21, 1981. Sponsored by the NBS Center for Fire Research, this Conference permitted 25 CFR grantees from universities and research institutes to present short summaries of progress on their research activities on the more basic aspects of fire research.

709,427
PB87-107926 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Fire Safety.
Final rept.
B. Levin, R. Paulsen, and J. Klote. 1981, 8p
Pub. in Access Information Bulletin, p1-8 1981.

Keywords: *Fire safety, Buildings, Reprints, *Handicapped persons, Group homes.

The bulletin discusses two recent trends which have implications for fire safety: the movement of disabled persons from institutional to community settings, and the provision of increased accessibility to public buildings for disabled persons. The bulletin also presents some general principles which should guide emergency planners, and describes some specific hardware devices and systems to assist disabled persons in a fire emergency. It is emphasized that fire safety for disabled persons is a many-faceted problem.

709,428
PB87-107934 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Overview of Fire Modeling.
Final rept.
J. G. Quintiere. 1981, 22p
Pub. in SFPE Symposium 'Systems Applications for Fire Protection Engineers', College Park, MD., March 4-6, 1981, p1-22 1981.

Keywords: *Fire tests, *Fire models, Room fires, Fire studies.

A perspective on modeling fire is presented. The evolution of the use of a two-layer zone model to describe the developing fire in a room is traced. Some examples are given to illustrate the results from this type of model. Future implications are discussed.

709,429
PB87-109450 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
How Fire Research Programs are Formulated.
Final rept.
J. E. Snell. 1984, 13p
Grants NSF-CEE82-06605, NEA-32-4253-60074
Sponsored by National Science Foundation, Washington, DC., National Endowment for the Arts, Washington, DC., and Federal Emergency Management Agency, Washington, DC.
Pub. in Communications between the Fire Research Community and the Owner-Operators of Buildings--Proceedings Conference, Washington, DC., November 9-10, 1983, p31-43 1984.

Keywords: *Fire protection, Fire tests, Housing, Research management, Reprints.

The CFR research program is designed to provide powerful new capabilities for reducing fire losses and the costs of fire protection. It is based on an analysis of our own capabilities and a complex array of factors in the environment external to the Center for Fire Research. It represents a significant departure from the more conservative course of incremental improvement in those traditional practices for fire protection which have no basis in scientific fact. The course raises a number of issues. Four have been singled out: the need for a viable community of private and public sector researchers; departure from dependence on traditional practices; the need for new institutional mechanisms; and a directed assault on the toughest area of fire loss, in particular, existing residential occupancies. This is clearly not the most expedient nor the easiest course for us to follow. However, it is the one the Congress assigned us nearly a decade ago. Experience today affirms it remains the right one.

709,430
PB87-109468 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Transient Cooling of a Hot Surface by Droplet Evaporation.
Final rept.
A. K. Trehan, M. di Marzo, and D. D. Evans. 1985, 4p
Pub. in Proceedings of Fall Technical Meeting Chemical and Physical Processes in Combustion, Philadelphia, PA., November 4-6, 1985, p61-1-61-4.

Keywords: *Extinguishing, *Evaporative cooling, Aluminum, Drops(Liquids), Fire safety, Reprints.

The thermal behavior of a hot surface subjected to a cold liquid droplet impingement and evaporation was investigated using a heated aluminum block, and deionized and degasified water. Evaporation times and droplet radius on the aluminum surface were measured. A thermal conduction model for the cooling of the aluminum was coded to determine radial and in-depth transient temperatures in the area of the evaporating droplet.

709,431
PB87-119822 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Role of ASTM (American Society for Testing and Materials) in Fire Modeling.
Final rept.
A. J. Fowell. 1986, 3p
Pub. in American Society for Testing and Materials Standardization News 14, n9 p38-40 Sep 86.

Keywords: *Fire safety, *Mathematical models, Combustion, Heat transfer, Fluid flow, Reprints.

Recent rapid advances in the development of fire modeling techniques and recognition of their potential uses in fire safety have suggested a role for ASTM. The mathematical representation of the fire growth process and its effect on materials and people according to the appropriate mass and energy relationships of combustion, heat transfer, and fluid flow is fire modeling. The following examines the history and current direction of ASTM's role in fire modeling.

709,432
PB87-134730 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Cone Calorimeter: A Versatile Bench-Scale Tool for the Evaluation of Fire Properties.
Final rept.
V. Babrauskas. 1986, 10p
Pub. in New Technology to Reduce Fire Losses and Costs, p78-87 1986.

Keywords: *Calorimeters, *Fire detectors, Heat measurement, Ignition, Fire tests, Reprints, Toxic gas production.

The rate of heat release is probably the single most important measure of fire hazard. For fire testing purposes, the scale required even for bench-scale tests is large enough to have precluded affordable, yet competent calorimeters, having small, well-characterized errors. The application of the oxygen consumption principle has now permitted a new generation of heat release measurement apparatuses to be developed for fire testing purposes. The Cone Calorimeter was also seen as a suitable combustor to be used in making other fire hazard measurements. Thus, techniques have been developed for making measurements of ignitability, smoke obscuration, soot production, and the generation of toxic gas species. The promise is also held forth that properties descriptive of flame spread behavior may be simultaneously obtained.

709,433
PB87-145421 PC **A07**/MF **A01**
Maryland Univ., College Park. Dept. of Mechanical Engineering.
Transient Cooling of a Hot Surface by Droplets Evaporation. Final Report.
M. di Marzo, and A. K. Trehan. Jul 86, 133p REPT-86-7, NBS/GCR-86/516
Grant NANB-5-H0525
See also PB87-109468. Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Extinguishing, *Evaporative cooling, Aluminum, Drops(Liquids), Fire safety, Computerized simulation, Metal plates.

The thermal behavior of a hot aluminum surface subjected to cold water droplet impingement is investigated. Evaporation phenomena of a single droplet of pure water is studied for initial surface temperature ranging from 75 to 100 deg C (implying full suppression of nucleate boiling). The effect of droplet release height, initial surface temperature and, droplet volume on the geometrical configuration of the droplet is investigated. A computer model is developed to predict the cooling effect (volume of influence) induced by a single droplet in contact with the hot surface, using finite difference techniques. A model to predict the evaporation of water droplets deposited on a hot non-porous solid surface is derived. The water-vapor molar fraction in the air at the exposed surface of the water droplet is deduced from the coupled heat and mass transfer energy balance. Spacial and temporal integration of the overall droplet energy equation is used to predict the droplet evaporation time and the instantaneous evaporation rate. Model predictions agree well with experiments. The model is used to quantify spatial and temporal heat fluxes distribution at the exposed surface of the water droplet. The volume of influence is found to correlate linearly with the evaporation time. This funding is particular important in light of the modelling of multi-droplets cooling effect.

709,434
PB87-172276 PC **A09**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Toxicity Scaling,
E. Braun, B. C. Levin, M. Paabo, J. Gurman, and T. Holt. Feb 87, 198p NBSIR-87/3510
Sponsored by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Fire tests, *Toxicity, *Combustion products, *Polyurethane resins, Foams, Upholstery, Cotton fabrics, Concentration(Composition), Carbon dioxide, Carbon monoxide, Hydrogen cyanide, *Toxic substances, NBS Toxicity Test Method.

The toxicity of the thermal decomposition products from two flexible polyurethane foams (with and without a fire retardant) and a cotton upholstery fabric was evaluated by a series of small-scale and large-scale tests single mock-up upholstery chair tests during smoldering or flaming decomposition. In addition other fire property data such as rates of heat release, effective heats of combustion, specific gas species yields, and smoke obscuration were measured. The degree of toxicity observed during and following the flaming tests (both large-scale room burns and the NBS Toxicity Tests) could be explained by a 3-Gas Model which includes the combined toxicological effects of CO, CO2, and HCN. Essentially no animal deaths were noted during the thirty minute exposures to the non-flaming or smoldering combustion products produced in the NBS Toxicity Test Method or the large-scale room test. In the large-scale room tests, little toxicological difference was noted between decomposition products from the burn room and a second room 12 meters away.

709,435
PB87-179230 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Workshop on Fire Protection Technology: A Record of the U.S. Papers Prepared for the Workshop on Fire Protection Technology Held in Cairo, Egypt, April 27-28, 1986.
K. F. J. Heinrich, A. J. Fowell, D. M. Bluebond, I. A. Benjamin, and R. W. Bukowski. Apr 86, 71p NBSIR-86/3360
Sponsored by Agency for International Development, Washington, DC.

Keywords: *Fire protection, *Meetings, Fire detection systems, Fire safety.

A series of talks were given by the U.S. participants in the Workshop on Fire Protection Technology, within the framework of the cooperation of NBS with Egyptian institution. The Egyptian institution involved with this workshop is the National Institute for Standards. NBS proposed the Workshop in order to explain the value of fire safety to the intended audience. Papers presented include the following: The National Bureau of Standards and Its International Programs, Fire Tests in the United States, Fire Safety Codes in the United States, Engineering Applications for Fire Related Prediction Tools, Fire Detection and Alarm Systems, Fire Statistics and Their use in Fire Protection; Failure Analysis and Analytical Fire Investigation; Fire Organization in the United States, and Industrial Fire Suppression.

709,436
PB87-182010 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Introduction to Fire Hazard Modeling,
R. W. Bukowski. Mar 86, 103p NBSIR-86/3349

Keywords: *Fire hazards, Toxicity, Computerized simulation.

An overview of the development and current capabilities of predictive methods for fire hazard analysis is provided. This includes a range of methods from simple, algebraic equations to complex, computer simulation models. In each case the form, major simplifying assumptions, calculated parameters, and limitations will be discussed. The specific application of these predictive methods to hazard analysis, and the availability of the data resources necessary to conduct a hazard analysis is described. Information on the use of a number of available models, with particular emphasis on those which can be used on desk-top computers, is provided. A discussion of the predictive accuracy of selecte models is included. Some examples of hazard analyses using these methods are presented. The report is an overview of the author's previous publications on the subject.

709,437
PB87-197802 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Elevator Piston Effect and the Smoke Problem.
Final rept.,
J. H. Klote. 1986, 7p
Pub. in Fire Safety Jnl. 11, n3 p227-233 Dec 86.

Industrial Safety Engineering

Keywords: *Elevators(Lifts), *Smoke, *Evacuating(Transportation), Smoke abatement, Flow, Reprints, Handicapped persons, Piston effect.

The material in the paper is part of a joint project between the United States and Canada to evaluate the feasibility of elevator evacuation of the handicapped. The paper presents an analysis for the pressure differences produced by elevator car motion and it presents flow coefficients for flow around cars in elevator shafts based on test data. The results of an experiment to verify this piston effect analysis are presented. Also, practical considerations concerning piston effect and elevator smoke control are presented. An equation is developed to determine the upper limit of the pressure difference across an elevator lobby caused by piston effect.

709,438
PB87-199402 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
FIREDOC: A Fire Research Bibliographic Database.
Final rept.,
N. H. Jason. 1986, 8p
Pub. in New Technology to Reduce Fire Losses and Costs, p8-15 1986.

Keywords: *Fires, Reprints, Data bases, FIREDOC.

The fire research literature is very diversified and there is no 'simple' method to guarantee thorough literature searches on any given subject. The Center for Fire Research, National Bureau of Standards, has been involved in fire research since 1908. To increase the success rate of locating relevant documents and doing it in a more timely manner, the Center has implemented an on-line bibliographic database for its extensive and sometimes unique in-house literature collection. Using available supermicro hardware, FIREDOC was created as the on-line bibliographic database for the Fire Research Information Services (FRIS) collection. The steps that were taken to achieve an on-line system, the selection process for the hardware and software, and techniques on how to search the database are discussed.

709,439
PB88-153341 PC **A05**/MF **A01**
Maryland Univ., College Park. Dept. of Mechanical Engineering.
Transient Cooling of a Hot Surface by Droplets Evaporation, March 1986-March 1987,
Final rept.,
M. di Marzo, Z. Y. Wang, and W. H. Meng. Nov 87, 78p REPT-87-11, NBS/GCR-87/534
See also PB87-109468. Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Extinguishing, *Evaporative cooling, Aluminum, Drops(Liquids), Fire safety.

The report describes the research performed during the period March 1986-March 1987 under a joint research program between the Mechanical Engineering Department of the University of Maryland and the Center for Fire Research of the National Bureau of Standards. The study of droplet evaporation on a high thermal conductivity semi-infinite solid is investigated as well as the solid thermal behavior both theoretically and experimentally. The behavior of a low thermal conductivity solid is the objective of experimental studies. A coupled analytical model for the solid and the evaporating liquid is being derived to predict the cooling effect induced by the evaporating droplet.

709,440
PB88-155809 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Safety Inspection and Testing of Air Moving Systems,
J. H. Klote. Nov 87, 40p NBSIR-87/3660
Sponsored by Public Buildings Service, Washington, DC.

Keywords: *Fire safety, *Space HVAC systems, Inspection, Tests, Smoke abatement, Stairways.

The paper discusses fire safety inspection and testing procedures for air moving systems. These systems include heating, ventilating and air conditioning systems; zoned smoke control systems; and pressurized stairwells. The detailed methods for inspection and testing presented in the appendices are initial efforts in the evolution of such methodology and it is anticipated that users will modify them to suit their needs.

Laboratory & Test Facility Design & Operation

709,441
AD-A038 593/0 PC **A03**/MF **A01**
National Bureau of Standards Washington D C Mechanics Div
Positive Displacement Oscillatory Water Tunnel.
Miscellaneous rept.
K. E. B. Lofquist. Feb 77, 28p CERC-MR-77-1

Keywords: *Water tunnels, Sine waves, Oscillation, Prototypes, Performance(Engineering), Simulation, Tidal currents, Sediment transport, Sand.

The water tunnel described produces sinusoidal flow with peak velocities adjustable from 0 to at least 30 centimeters per second for any period between 3 and 25 seconds. The tunnel is of U-tube design with the middle horizontal part comprising the test section. The vertical end parts are two cylinders with tight-fitting pistons at one end, and two reservoirs open to air at the other. The pistons are driven by a variable-speed electric motor, with an adjustable counterweight permitting operation at resonance at any period. (Author)

709,442
AD-A046 831/4 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
RF Attenuation Measurement System Using a SQUID,
R. T. Adair, N. V. Frederick, and D. B. Sullivan. Sep 77, 157p NBSIR-77-863

Keywords: *Measuring instruments, *Attenuation, Radiofrequency, Superconductivity, Josephson junctions, Quantum electronics, Liquid helium, Accuracy, SQUID devices.

This report describes a unique portable system for measuring attenuation at 30 MHz over a range of 50 dB to an accuracy of 0.005 dB per 20 dB. This system does not require any reference standard. A SQUID (Superconducting Quantum Interference Device) with its associated instrumentation is used to determine attenuation in terms of Bessel Function Zeros. A SQUID is a loop of superconducting metal closed by a weak point contact called a Josephson junction, operating in liquid helium. The system specifications, description, and theory of operation are presented. A complete system operating procedure including data reduction techniques is given along with a discussion of sources of errors. Considerable additional information and diagrams are presented as an aid to the user in understanding and operating the system. (Author)

709,443
PATENT-4 139 933 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Method for Fabricating a Scanning Electron Microscope Micrometer Scale.
Patent.
D. B. Ballard, F. Ogburn, and J. P. Young. Filed 3 Nov 77, patented 20 Feb 79, 6p PB79-600038, PAT-APPL-848 176

Keywords: *Electrodeposited metal layers, Gold-nickel layers, Micrometer scale, Scanning electron microscope scale.

A microscopic length scale typically abaout 50 micrometers long and graduated in several intervals ranging from u micrometer to 20 micrometers. The scale is useful in calibrating the magnification of scanning electron microscopes (SEMs) and other electron imaging instruments. The scale comprises alternating layers of two metals deposited on a substrate. The two metals have substantially different electreon emission coefficients to provide constrasting emission signals when scanned by an electron beam. One of the metals, preferably gold, is deposited in uniform layers about 40-80 nm thick. The other metal, preferably nickel, is deposited in several layers ranging from u micrometer or so thick near the substrate to 20 micrometers thick in the outermost layer. The resultant multilayer composite is cut into one or more samples and each sample is mounted on edge. The exposed edge is ground and metallographically polished and a microscopic indentation is made in the substrate near the first gold layer. The indentation defines a reference region, and the distances between the first gold layer and the subsequent gold layers in the reference region are measured. The measurement is made using a similar sample which was previously calibrated with the aid of a polarizing layer interferometer.

709,444
PATENT-4 140 393 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Birefringent Crystal Thermometer.
Patent.
T. C. Cetas. Filed 5 May 77, patented 20 Feb 79, 9p PB79-600039, PAT-APPL-794 142

Keywords: *Aligned sheet polarizer, Birefringent crystal, Optical analyzer, Polarized light, Probe thermometer, Temperature sensitive parameter.

This invention relates to the use of a birefringent crystal as the sensing element in a probe thermometer constructed of certain basic optical components utilized in three separate modes. Thus, all of the modes of the invention are directed to a probe thermometer which uses the temperature dependence of the birefringence of certain single crystals as the temperature sensitive parameter. One such crystal is a Y-cut single crystal of LiTaO3. Alternative crystals having adequate sensitivity in the desired temperature range may be constructed from LiNbO3 of BaTiO3. Polarized light propagates through the crystal in two modes, the ordinary ray and the extraordinary ray, which have indices of refraction n(o) and n(e). For LiTaO3 at room temperature, n=2.2, B=n(e)-n(o)=0.004, and dBdT=4.4x10 to the minus 5th power/degree C. The intensity of light passed through a sandwich of aligned sheet polarizer, crystal, and optical analyzer is a function of B and hence also is temperature dependent. A thermometer probe is constructed by bonding this sandwich to a bundle of optical fibers along with a dielectric mirror so that the sensor will be at the probe tip. The probe has been constructed faor use in the presence of intense electromagnetic fields and also designed to eliminate the possible hazard of an electrical leakage back to the subject.

709,445
PATENT-4 315 433 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Polymer Film Accelerometer.
Patent.
S. Edelman, and B. F. Payne. Filed 19 Mar 80, patented 16 Feb 82, 4p PB82-600036, PAT-APPL-6-131 575

Keywords: *Accelerometer, Inertial mass, Piezoelectric polymer films.

An accelerometer is provided which utilizes at least one sheet of piezoelectric polymer film, supported under tension in a frame, for sensing the acceleration-responsive movements of an associated inertial mass and providing an electrical output in accordance therewith. The accelerometer preferably comprises a pair of such sheets with the inertial mass, e.g., a sphere, supported therebetween. Connections to an electrical measurement unit are made through a coaxial cable whose outer sheath and inner conductor are respectively connected to outer and inner electrodes formed by metallic coatings on the outer and inner surfaces of the sheets. The frame is preferably cylindrical and a pair of associated rings which fit within the frame serve to clamp the two sheets in place under tension.

709,446
PATENT-4 331 933 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Power Level Stabilizing Circuit for Cesium Beam Frequency Standards.
Patent.
D. W. Allan, and M. Garvey. Filed 19 Jun 80, patented 25 May 82, 8p PB82-600038, PAT-APPL-6-161 185

Keywords: *Atomic clock, Atomic resonance frequency error, Fixed offset frequency, Main atomic peak, Microwave power level changes, Servo, Sidelobe atomic peak.

Perceived atomic resonance frequency error resulting from microwave power level changes in atomic clocks is eliminated by controlling the device's microwave

power source output in response to deviations from a fixed frequency relationship between the main atomic peak and a sidelobe peak of the atomic beam frequency spectrum. This is accomplished by a microwave power control servo system that includes a time sharing interrogation circuit for detecting and monitoring the frequencies of the main atomic peak and the sidelobe peak and a comparator that compares the frequencies of the main atomic and sidelobe peaks and generates a feedback control signal in response to frequency differences between the two that deviate from a fixed difference frequency. The feedback signal is used to control the microwave power source output in a manner that constrains the main atomic peak and the sidelobe peak at a fixed offset frequency.

709,447
PATENT-4 433 400 Not available NTIS
Department of Health and Human Services, Washington, DC.
Acoustically Transparent Hydrophone Probe.
Patent.
A. S. DeReggi, and G. R. Harris. Filed 24 Nov 80, patented 21 Feb 84, 9p PB84-165638, PAT-APPL-6-210 044
Supersedes PB81-162299.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Hydrophones, *Patents, Probes, Piezoelectric materials, Membranes, Polymeric films, Vinylidene resins, PAT-CL-367-163.

An acoustically transparent hydrophone probe consisting of a rigid hoop structure in which is secured an assembly of very thin piezoelectric polymer sheet material, such as polyvinylidene fluoride, with one or more very small central sensitive portions. In its simplest form it consists of a single sheet with a small central poled piezoelectric area and with very thin metallic electrodes deposited on the sheet on opposite sides of the piezoelectric area and having fine conductive leads extending from the electrodes and adapted to be connected to a suitable amplifier or transmission line.

709,448
PB-262 582/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theorem Giving Limits for S22 When S11 and the Two-Port Efficiency are Known.
Final rept.,
G. F. Engen. 1971, 1p
Pub. in IEEE Trans. Instrum. Meas. IM-20, n1 p78 Feb 71.

Keywords: *Electromagnetic scattering, Theorems, Reprints.

A well-known condition on the scattering parameters of a lossless two-port may be written S(22) = S(11). For low-loss two-ports it may be expected that this condition is approximately satisfied; this result is of potential value in certain types of system evaluation.

709,449
PB-264 311/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Results on Limitations in Primary Cesium Standard Operation.
Final rept.,
D. J. Wineland, D. W. Allan, D. J. Glaze, H. W. Hellwig, and S. Jarvis. Dec 76, 6p
Pub. in IEEE Transactions on Instrumentation and Measurement, IM25 n4 p453-458 Dec 76.

Keywords: *Cesium frequency standards, Atomic clocks, Frequency stability, Reprints.

The authors report on the most recent design changes in their two primary cesium standards, their current operational use, results obtained, and limitations. NBS-4, the shorter device with an interaction length of L = 0.52m, has been extensively used for many months as a clock. After improvements in the magnetic shielding and microwave feed, they have obtained sigma sub y (1 week < tau < 2 weeks) = 7 x 10 to the minus 15th power in a 10-Hz bandwidth for its frequency stability. NBS-6, the longer, more accurate device (L = 3.75m), features a linewidth (< or approximately = to Hz), which is believed to be the narrowest linewidth ever reported for a cesium device. NBS-6 has been operated to give a short-term stability sigma sub y (1s) = 7 x 10 to the minus 13 power in a 10-Hz bandwidth and has capability of easy beam reversal. The current and past rates of the International Atomic Time (TAI) in terms of our primary cesium standards are reported and compared with the results of other laboratories. With NBS-6 the authors have calibrated the rate of the NBS time scale of an uncertainty of 0.9 x 10 to the minus 13 power.

709,450
PB-265 023/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS-4 and NBS-6: The NBS Primary Frequency Standards.
Final rept.,
D. J. Glaze, H. Hellwig, D. W. Allan, and S. Jarvis. Feb 77, 12p
Pub. in Metrologia, v13 p17-28 Feb 77.

Keywords: *Frequency standards, Frequency stability, Clocks, Accuracy, Reprints.

The NBS primary frequency standard NBS-4 has been operating since January 1973. NBS-5 operated from January 1973 until March 1974. At this time NBS-5 was modified significantly and redesignated NBS-6. The extent and character of these design changes are discussed. NBS-6 operation and evaluation began in March 1975. Results obtained from NBS-4, NBS-5 and NBS-6 are given, along with intercomparisons of some significant parameters. During 1975, NBS-4 was operated as a clock and a time dispersion of 2.5 ns was obtained for one day. The NBS approach to long term clock operation of the primary standards is discussed. These techniques will probably involve 'accuracy servo' methods, and may lead to very accurate clocks with time dispersion less than 1 ns per day.

709,451
PB-265 110/7 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Engineering Mechanics Section.
Interlaboratory Comparison of Force Calibrations Using ASTM Method E74-74. Phase I.
Summary rept. 1 Jun 74-1 Aug 75,
R. W. Peterson, and R. L. Bloss. Aug 76, 36p
NBSIR-76-1145

Keywords: *Loads(Forces), *Calibrating, Load cells, Force, Standards, Comparison.

The report covers the first phase of an intercomparison of force calibrations coordinated by the National Bureau of Standards in conjunction with Committee E28.01 of the American Society for Testing and Materials. Results obtained show that the provisions of ASTM Method E74-74, 'Standard Methods of Calibration of Force-Measuring Instruments for Verifying the Load Indication of Testing Machines' can be met by a variety of calibration laboratories. In general, uncertainties computed from the data are of the magnitude expected based upon the NBS results. An important by-product of the program is the mechanism for self-evaluation by each laboratory of its own force calibration capability.

709,452
PB-265 427/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Design Principles and Characteristics of Frequency and Time Standards,
H. Hellwig. 1976, 7p
Pub. in IEEE Trans. Nucl. Sci. NS-23, n6 p1629-1635 Dec 76.

Keywords: *Frequency standards, *Time standards, Atomic clocks, Rubidium frequency standards, Cesium frequency standards, Crystal oscillators, Gas masers, Design, Reprints.

Today's precision oscillators and clocks are discussed. They include cesium standards, rubidium standards, hydrogen masers, and quartz crystal oscillators. A brief review of their basic design philosophy and performance characteristics is given. Block diagrams or schematics of the physics packages as well as of the electronic systems are given, and it is pointed out quantitatively (where possible) which parameter changes cause frequency shifts and/or performance deterioration. Particular attention is focused on those parameters which are likely to change under nuclear radiation.

709,453
PB-265 429/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Simplified Magnetic Suspension Densimeter for Absolute Density Measurements.
Final rept. Oct 74-Jul 76,
W. M. Haynes. 1977, 3p
Sponsored in part by American Gas Association, Inc., Arlington, Va. LNG Density Project Steering Committee.
Pub. in Rev. Sci. Instrum., v48 n1 p39-41 Jan 77.

Keywords: *Density(Mass/volume), *Measuring instruments, *Instrumentation, Design, Reprints, *Densimeters.

A magnetic suspension densimeter, incorporating three support coils, has been reduced to a system using only one coil. This simplified considerably the design of the apparatus and the procedures involved in the measurements. This instrument can be used for absolute density measurements; i.e., it does not have to be calibrated with reference fluids of known density.

709,454
PB-265 477/0 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Engineering Mechanics Section.
Accelerometer Calibration - A Comparison Between CESTA and NBS.
Final rept.,
J. D. Pollard. Mar 77, 23p NBSIR-77-1229

Keywords: *Accelerometers, Calibrating, Vibration, Measurement, Standards.

This report describes a vibration measurement interchange between a French laboratory (CESTA) and the National Bureau of Standards (NBS). Methods of calibration at NBS and results of the calibration of two commercially available double ended or 'piggy-back' type accelerometers are discussed. No difficulties were encountered in the calibration of System 1; however, above 4000 Hz, difficulties were experienced in the calibration of System 2.

709,455
PB-265 769/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Production of Uniform Field Gradients for Magnetometers by Means of Current-Carrying Strips,
R. D. Spal. 1977, 4p
Pub. in J. Appl. Phys., v48 n3 p1338-1341 Mar 77.

Keywords: *Magnetometers, Design, Magnets, Magnetic fields, Gradients, Homogeneity, Reprints.

Current-carrying strips are a convenient means to produce a uniform field gradient for use in a Faraday magnetometer. An expression is derived for the magnetic field gradient, taking into account the images of the strips in the pole pieces. Tables are presented giving the magnitude and homogeneity of the gradient for various strip widths and locations. The performance in the laboratory of a set of strips is reported.

709,456
PB-266 132/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Elemental Mapping in the Microscopic Domain,
K. F. J. Heinrich. 1977, 10p
Pub. in Proceedings of Workshop on Analytical Electron Microscopy, Chicago, Ill. 28 Mar-1 Apr 77, Paper in Scanning Electron Microscopy I, p605-614 (IIT Research Inst., Chicago, Ill.) 1977.

Keywords: *Electron microscopy, *Electron probes, *Microanalysis, Surfaces, X ray spectroscopy, Microstructure, Ion microscopes, Auger electron spectroscopy.

The production of microscopic maps depicting the variation of specimen composition over a small specimen region is a valuable tool for characterizing the microstructure of many specimens. Such maps may show the distribution of isotopes (ion probe or ion microscope), elements (autoradiography, electron and ion probes, Auger probes, back-scattered electrons), or compounds (cathodoluminescence, laser-Raman probe). Elemental maps can be obtained by contract procedures, image-forming optics or scanning. Techniques and applications are described, and limitations in the evaluation are discussed.

709,457
PB-266 133/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Fundamentals of Scanning Electron Microscopy for Physicist: Contrast Mechanisms,
D. E. Newbury. 1977, 16p
Pub. in Proceedings of Workshop on Analytical Electron Microscopy, Chicago, Ill. 28 Mar-1 Apr 77, Paper in Scanning Electron Microscopy I, p553-568 (IIT Research Inst., Chicago, Ill.) 1977.

Keywords: *Electron microscopy, *Contrast, *Scanning electron microscopy.

Contrast arises in the scanning electron microscope from a variety of mechanisms: atomic number differences, topography, crystallinity, magnetic structure, surface potential, and beam induced effects. The nature of the contrast depends on the interaction of the beam electrons with the specimen and on the characteristics of the detector. Two general forms of contrast exist; those arising from differences in the number of electrons emitted from the sample and those arising from differences in the post-specimen trajectories.

709,458

PB-267 321/8 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 61, Number 5.
Monthly rept.
May 77, 35p NBS/DIM-61/5

Keywords: *Periodicals, *Research projects, Sound transmission, Spinach, Data processing security, Natural gas, Conservation, Law enforcement, General relativity, Liquefiers, Telecommunication, Hydrogen, Medical information systems, Computer privacy, *Technical news bulletins, Computer software.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Going to extremes in the study of sound; Things your mother never told you about spinach; Liquefied natural gas; NBS issues landmark study on privacy in health records; Resource conservation and recovery; Standards for law enforcement; Measurements of earth's motion agree with general relativity theory; Limits of hydrogen liquefier efficiency defined; NBS microcopy resolution test chart SRM accepted for international use; Polyethylene proposed for biocompatibility studies; Reference data report; Telecommunications technology and libraries conference; ACM/NBS systems and software symposium; New SRM price list available from NBS; Is hydrogen safe; Thermophysical properties data published.

709,459

PB-267 477/8 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 61, Number 4.
Monthly rept.
Apr 77, 37p NBS/DIM-61/4
See also report dated Mar 77, PB-266 997.

Keywords: *Periodicals, *Research projects, Television, Oceanographic data, Electroplating, Cryogenics, Dentistry, Laser beams, Nutrition, Chromium, Units of measurement, Standards, *Technical news bulletins.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Television watching could become meaningful; Out of the classroom, into the laboratory; New device aids deep ocean research; The state of NBS; NBS, alluminum association, and american electroplaters' society form program; NBS cryogenic flow measurement code approved; New technique for dental restorations; New calorimeter unit measures high laser energy; Use of vibrational spectroscopy for NDE; New standard reference materials to aid research on role of chromium on nutrition; Materials and space flight conference; Thermophysical properties symposium; Weights and measures standards of the United States, a brief history.

709,460

PB-268 130/2 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Surveillance Test Procedures.
Final rept.,
H. W. Almer, and J. Keller. Feb 76, 79p NBSIR-76-999

Keywords: *Standards, *Weight(Mass), Tests, Monitoring.

Surveillance tests are designed to monitor the values of mass standards between calibrations. Two types described; both consist of comparisons of the weights of an ordered set of mass standards with each other. The differences found are compared with those computed from the reported mass values. Surveillance limits based on the precision of both the calibration and the surveillance test processes are computed. These limits are estimates of the departure of the measured differences from the expected, or predicted, differences as computed from the reported values. A larger change is considered significant. Additional measurements to identify individual weights which have changed are required when a given comparison indicates that the mass of one or more of the weights involved has changed. Buoyancy corrections are used to correct for the difference in the buoyant effect on weights of differing densities. Records document the surveillance test results, and control charts help detect trends. Judgments concerning recalibration can be made based on the constancy of the weights and the use requirements.

709,461

PB-268 207/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Trend Relating to Verification of Testing Machines and Weighing Equipment,
R. L. Bloss. 1974, 19p
Pub. in Proceedings of IMEKO Int. Conf. (5th), Szeged, Hungary, 31 Aug 1974, Preprint pages 1-19 (1974).

Keywords: *Test equipment, Calibrating, Load cells, Tolerances(Mechanics).

Recent efforts in the United States pertaining to the verification of testing machines and the devices and methods used to determine their performance are discussed. A brief discussion of testing machine tolerances and the effect of calibrating device uncertainty is included.

709,462

PB-270 279/3 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 61, Number 6.
Monthly rept.
Jun 77, 36p NBS/DIM-61/6
See also Volume 61, Number 5, PB-267 321.

Keywords: *Periodicals, *Research projects, Buildings, Safety engineering, Measurement, Neutron diffraction, Hydrocarbons, Waste recycling, Oil wastes, Metrication, Passwords, Protocols.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Metrication Australian style; Recycling oil-a question of quality; What's the password; Building safety; Measurement assurance program; Measures for equity-NCWM; Profile analysis of neutron diffraction powder patterns; Fire modeling group organized; Hydrocarbon-in-air standard reference materials; Spectra of highly ionized molybdenum and heavy elements provided for fusion diagnostic; Mechanism for transferring federal technology to state and local governments; Research and innovation in the building process conference; Data elements management symposium; Landmark volume on ultrasonic tissue characterization published; Why waste heat. (Color illustrations reproduced in black and white.)

709,463

PB-270 336/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Techniques of Signal Processing in Scanning Electron Microscopy.
Final rept.,
C. E. Fiori, H. Yakowitz, and D. E. Newbury. 1974, 8p
Pub. in Proceedings Annual Scanning Electron Microscope Symp. (7th), Chicago, Illinois, April 4-11, 1974. Paper in Scanning Electron Microscopy/1974, Part I, p167-174 1974.

Keywords: *Electron microscopy, *Signal processing, Scanning electron microscopy.

Six signal processing operators--differential signal amplification (black level), nonlinear amplification (gamma), the first time derivative and its absolute value, the second time derivative, and Y-modulation--are discussed. The effects of the time derivative operators on the apparent illumination and image isotropy are considered. The first time derivative can provide enhanced contrast at edges and the appearance of oblique illumination. The second time derivative and the absolute value of the first time derivative produce enhanced contrast at edges and the appearance of vertical illumination. In conventional unidirectionally scanned images, the time derivatives exhibit anisotropy--all detail parallel to the scan line is lost. This anisotropy can be partially removed by superimposing scans at right angles (orthogonal scanning), and in the case of the second time derivative, an isotropic operator results.

709,464

PB-271 170/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Weights and Measures Play Vital Roles in Metrication.
Final rept.,
J. V. Odom. 1977, 3p
Pub. in Metric News, v4 n3, 5, 11, 29 n.p. May/Jun 77.

Keywords: *Metric system, Units of measures, Standards, Education, Management, Reprints.

The paper discusses the role weights and measures officials will play during the changeover to the metric system in the United States. Goals and objectives for the weights and measures community are outlined, and specific projects relating to the metric revision of Model Laws and Regulations and metric education for weights and measures officials is discussed.

709,465

PB-272 376/5 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Vibration Section.
Systematic Study of Vibration Standards - Mounting Effects.
Final rept.,
R. S. Koyanagi, J. D. Pollard, and J. D. Ramboz. Sep 73, 44p NBSIR-73-291
Sponsored in part by Department of Defense Calibration Coordination Group, Redstone Arsenal, Ala.

Keywords: *Standards, *Accelerometers, Vibration, Mountings, Calibrating.

The purpose of the study was to determine the extent of the sensitivity change of laboratory quality piezoelectric accelerometers for various mounting conditions. The mounting variables included the material upon which the accelerometer was mounted, geometry, the use of commercial insulated studs, and the use of mounting stud thread size adaptors. For the stated test conditions, the effect of different materials and geometry was insignificant below about 3000 Hz. For stainless steel, beryllium, alumina, and tungsten, the deviations were less than 0.5 percent up to 10,000 Hz. The aluminum alloy base showed an increase of about 2 percent at 10,000 Hz. The effect of insulated studs showed deviations beginning at about 3,000 Hz. No significant deviation was found between the different stud thread size adaptors.

709,466

PB-273 937/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS Pressure Transducer Characterization Program.
Final rept.,
V. E. Bean. 24 Apr 77, 23p
Pub. in Proceedings of Transducer Workshop (9th), Ft. Walton Beach, Fla. 26-28 Apr 77 p186-208 1977.

Keywords: *Pressure sensors, Performance, Evaluation.

As a step toward improved pressure measurement, the NBS Pressure and Vacuum Section has developed a program designed to determine the long-term performance of pressure transducers. Among the parameters determined in the eight months test are: warm up, zero drift, supply voltage dependence calibration, precision, pressure hysteresis, short and long term stability, shift of sensitivity and zero with temperature, temperature hysteresis, full scale drift, relaxation effects, effects due to pressure cycling, pressure fluid dependence, attitude dependence, etc. The philoso-

phy of the program, the test schedule, and examples of the data obtained are discussed.

709,467
PB-273 940/7 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
System for Computerized Surface Roughness Measurement.
Final rept.,
D. A. Swyt. 20 Feb 73, 63p NBSIR-73-106

Keywords: *Surface roughness, Measurement, Minicomputers, Computer applications.

An overall system for computerized surface roughness measurements, involving a commercial stylus profile instrument and a minicomputer, is described. The method allows: direct displacement calibration of the stylus instrument by means of interferometrically measured gage block steps; the elimination of roughness artifacts as calibration standards; and access to punched-tape surface profile data which may be given detailed analysis on a larger, faster computer. Details of system operation and precision are included. (Portions of this document are not fully legible)

709,468
PB-273 953/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Design and Results from a Prototype Passive Hydrogen Maser Frequency Standard.
Final rept.,
F. L. Walls. 1976, 12p
Pub. in Proceedings of Conference on Precision Time and Time Interval, Washington, D.C. 30 Nov-2 Dec 76, p369-380 1976.

Keywords: *Frequency standards, Gas masers, Hydrogen, Frequency stability, Design, Passive systems.

The basic design of a prototype passive hydrogen maser frequency standard is very briefly described and its unique features are outlined. The latest results on its long-term stability and environmental sensitivity is given. These results are particularly noteworthy for those interested in clocks for timekeeping applications as they were obtained without temperature control of any of the eletronics and only a single oven on the cavity. Further improvements in the electronics including temperature stability of critical control circuits should reduce the daily variations by a factor of five to ten and also improve the already excellent long-term stability. The design principles illustrated by this prototype can also be used to realize a miniature passive hydrogen maser frequency standard with little compromise in long-term stability.

709,469
PB-273 962/1 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Gage Block Flatness and Parallelism Measurement.
Final rept.,
J. S. Beers, and C. D. Tucker. Aug 73, 12p NBSIR-73-239

Keywords: *Surfaces, *Flatness, Measurement, Interferometers, Dimensions, Comparators, Length, *Gage blocks.

Geometric properties of gage blocks are important in many length measurement applications. Methods are described for measuring the flatness of gaging faces and the parallelism between opposing gaging faces. These methods, used for many years, employ interferometers and electro-mechanical gage block comparators.

709,470
PB-273 995/1 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Measurements of Cylindrical Standards.
Final rept.,
R. C. Veale. 14 Mar 73, 25p NBSIR-73-136

Keywords: *Standards, Cylindrical bodies, Wire, Measurement, Calibrating, Measuring instruments.

Cylinders are widely used in industry and standards labs as a form of length transfer. The measurement algorithm used by the dimensional technology section to determine the diameters of master cylinders is given in detail. It has been found that a mechanical transfer from interferometically measured gage blocks is the most satisfactory method.

709,471
PB-274 333/4 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C.
Calibration of High-Voltage Pulse Measurement Systems Based on the Kerr Effect.
Final rept. Jul 75-Oct 77,
R. E. Hebner, and M. Misakian. 16 Sep 77, 39p NBSIR-77-1317
Prepared by Sandia Corp., Albuquerque, N. Mex.

Keywords: *Kerr cells, *Electrical measurement, Pulsation, High voltage, Calibrating, Kerr electrooptical effect, Nitrobenzenes, Space charge.

High voltage pulse measurements have been performed using systems based on the electrooptic Kerr effect for a number of years. These systems permit state-of-the-art measurements (uncertainties approximately equal to + or - 1%). Because the precision of the measurement can be significantly better than the accuracy, an investigation of techniques to improve the calibration of the system was undertaken. The investigation focused on two areas. One was the experimental determination of correction factors which would account for differences in environmental factors between the calibration of the system and its use. These measurements yielded accurate corrections for variations in temperature and quantitative evidence of the magnitude of the wavelength dependence of a Kerr system's response. The second was further study into the feasibility of calibrating the Kerr system at a number of discrete frequencies and using this calibration for pulse measurement.

709,472
PB-274 504/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Unification of the Electromagnetic Scale.
Final rept.,
R. D. Deslattes. 1977, 18p
Pub. in Proceedings Colloq. Spectroscopicum Int./Anniversary (20th) and the Int. Conf. on Atomic Spectroscopy (7th), Prague (Czechoslovakia), August 30-September 7, 1977, p267-284 1977.

Keywords: *Electromagnetic spectra, Standards, Gamma rays, X rays.

Over the past ten years there have been several instances of notable progress in improving connections between different parts of the electromagnetic spectrum. These developments are reviewed and shown to already yield some of the results which might be hoped for from a well integrated wavelength or frequency scale defined by a single convention.

709,473
PB-275 027/1
National Bureau of Standards, Gaithersburg, MD.
Ultrasonic Manometers for Low and Medium Vacua under Development at the National Bureau of Standards.
Final rept.,
P. L. M. Heydemann, C. R. Tilford, and R. W. Hyland. Feb 77, 9p
Sponsored in part by Combined Calibration Group (USAF and USN), Washington, D.C.
Pub. in Jnl. of Vacuum Science and Technology, v14 n1 p597-605 Jan/Feb 77.

Keywords: *Manometers, Ultrasonic frequencies, Interferometers, Pressure measurement, Standards.

The first part of the paper describes the use of ultrasonic interferometry for the measurement of the lengths of manometer columns. The major known sources of errors of manometers are then analyzed, and design criteria which are developed at the National Bureau of Standards for measurements in the low and medium vacuum ranges are described. The ultrasonic mercury manometer, with a range of 13 kPa, has been operated with a resolution of 1.4 mPa.

709,474
PB-276 233/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comment on 'The Millman Effect in Cesium Beam Atomic Frequency Standards'.
Final rept.,
D. J. Wineland, and H. Hellwig. 1977, 2p
Pub. in Metrologia 13, p173-174 1977.

Keywords: *Cesium frequency standards, Atomic clocks, Magnetic resonance, Millman effect, Reprints.

In a recent paper entitled 'The Millman Effect in Cesium Beam Atomic Frequency Standards' (Mungall, A.G.: Metrologia 12, 151 (1976)) a systematic frequency shift was observed and explained in terms of the Millman effect. The purpose of this note is to suggest that an alternative explanation be sought for the observed results.

709,475
PB-276 395/1 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Calibration of Time Response of Thermometers: Concepts and Model Calculations.
Final technical note,
R. D. Mountain, and G. W. Mulholland. Jan 78, 38p NBS-TN-959

Keywords: *Thermometers, Reaction time, Calibrating, Computation, Laplace transformation.

Some of the conceptual problems associated with the calibration of the time response of a temperature sensor are examined in this report. The discussion is in terms of a time response function which characterizes the way a given sensor responds to changes in the temperature of its surroundings. A series of model calculations of the response function for idealized sensors are used to investigate the general features of the response functions. Important features are the sensitivity of these functions to (1) material properties of the sensor, (2) the type of thermal coupling of the sensor with the environment and (3) the geometry of the sensor. These features must be considered in the design of procedures for calibrating the time response of thermometers.

709,476
PB-276 494/2 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
Collected Executive Summaries: Studies of the National Measurement System 1972-75,
R. C. Sangster. Dec 77, 53p NBSIR-75-947-REV
Supersedes report dated Aug 76, PB-258 323.

Keywords: *Measurement, Standards, Abstracts, National Measurement System.

The report contains the Executive Summaries of the reports of the 1972-75 study by the NBS Institute for Basic Standards of the U.S. National Measurement System, which consists of all of the activities and mechanisms which provide physical measurement data required by our society. A series of microstudies focused on specific technical measurement sectors. A macroeconomic study looked at costs of instrumentation and labor for measurement-related activity in our economy. University economists were retained to assist the microstudy authors and to prepare an overall economics report. A central coordinator set a basic pattern for the microstudies, prepared an overall summary report, and generated several documents relating to the system as a whole. Abbreviated titles of the executive summaries are: Final summary report; Direct measurements transactions matrices; Economic analysis; Structure and functions of measurement system; Time and frequency; Length and related dimensional measurements; Vibration and shock; Surface finish; Mass, volume and density; Force; Fluid flow; Pressure; Temperature; Humidity and moisture; Thermodynamic properties of fluids; Cryogenics; Electricity; Electromagnetics; Medical ultrasonics; Acoustics; Radiometry and photometry; Spectrophotometry; Far ultraviolet radiometry; Optics; Physical properties of atoms and molecules; Surface properties; Ionizing radiation.

709,477
PB-280 538/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Uncertainties in Calibrating a Stylus Type Surface Texture Measuring Instrument with an Interferometrically Measured Step.
Final rept.,
E. C. Teague. 1978, 6p
Pub. in Metrologia 14, p39-44 1978.

Keywords: *Surface properties, *Interferometry, Geometry, Texture, Reprints.

This paper presents discussion and experimental data to demonstrate that: (1) Proper measurement of a step height with interferometry must include a determination of the geometry of the surfaces on both sides of the step in the neighborhood of the measured area; (2)

Uncertainty in a step-height measurement with the use of interferometry is determined both by uncertainty in the measurement of fringe displacement and uncertainty produced by the variation of step height measurements with fringe dispersion when specimen geometry is imperfect; (3) When specimen geometry is imperfect, uncertainty in calibrating the stylus instrument is produced by methods divergence between the height values measured with interferometry and with stylus instruments; (4) Uncertainty in assigning a height value to a stylus profile of a step is ultimately limited by and approximately equal to the RMS or R sub a value of the surface texture on both sides of the step.

709,478
PB-280 590/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Standard Method for Determining the Efficiency of Fluorescent X-Ray Intensifying Screens. Status Report.
Final rept.,
R. C. Placious, E. S. Moser, R. S. Holland, and F. Masi. 1977, 4p
Pub. in Proceedings of Application of Optical Instrumentation in Medicine VI, Boston, Mass. 25-27 Sep 77 p110-113 1977.

Keywords: *Fluorescent screens, Radiography, X ray fluorescence, Performance evaluation, Standards, Reprints.

A proposed ANSI standard for classifying radiographic intensifier screens has been under test at the National Bureau of Standards. This standard establishes procedures for characterizing, on an absolute basis, the optical spectral output of fluorescent screens per unit of incident x-ray exposure. The testing procedure has undergone revision since an earlier status report was given. Calcium tungstate screens, however, still form the basis of comparison in this procedure because of the long acceptability and stable output qualities of this screen. The nature of the revisions and current output data on the screens will be described.

709,479
PB-281 926/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pressure and Electrical Resistance Measurements in the Diamond Cell.
Final rept.,
S. Block, R. A. Forman, and G. J. Piermarini. 1977, 6p
Pub. in High-Pressure Research Applications in Geophysics, p503-508 1977.

Keywords: *Load cells, Electrical resistance, Pressure measurement, Electrical measurement, Semiconductors, Zinc sulfides, Gallium phosphides, Diamond cells, Reprints.

A method for measuring electrical resistance in the diamond anvil high pressure cell that employs gasketed samples and a fluid pressure transmitting medium has been developed. Measurements on the semiconductors, ZnS and GaP, both of which exhibit pressure-induced transitions to opaque phases have been made. A decrease in electrical resistance of several orders of magnitude has been measured with the appearance of the high pressure phase, thus indicating the formation of a metallic or semi-metallic state. These results are in agreement with our earlier work which indicated the need for downward revision of the fixed-point pressure scale.

709,480
PB-281 987/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ion and Electron Beam Interaction on Surfaces - A Detection Mechanism for Obtaining Visual Ion Beam Images.
Final rept.,
J. Fine, and R. Gorden. 1978, 5p
Pub. in Proceedings of International Conference on Ion Beam Analysis (3rd), Georgetown Univ., Washington, D.C. 27 Jun-1 Jul 77, Session 6B.6, Nuclear Instruments and Methods, v149 p679-683 1978.

Keywords: *Surfaces, *Ion beams, *Electron beams, *Electrical insulators, Ion irradiation, Electron irradiation, Optical images, Measurement, Tests, Alignment, Electron ion interactions, Surface analysis.

Two-dimensional images have been obtained of ion beam impact cross sections on solid surfaces by the coincident interaction of a rastered electron beam. This detection method is effective in producing images in real time on various insulator surfaces. The size of these images correlates well with ion beam current density profile measurements (at full width) and, therefore, can be very useful for ion beam diagnostics and alignment.

709,481
PB-281 994/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Visual Ion-Beam Images Produced by Electron and Ion-Beam Interaction on Surfaces.
Final rept.,
J. Fine, and R. Gorden. Mar 78, 5p
Pub. in Jnl. of Applied Physics, v49 n3 p1236-1240 Mar 78.

Keywords: *Optical images, *Surface properties, *Ion beams, *Electron beams, Optical measuring instruments, Reprints, Electron ion interactions.

Two-dimensional images of 1-5 keV ion beams incident on solid surfaces have been obtained by a method similar to that used in a scanning electron microscope. This easily applied technique produces visual, real-time images whose size correlates well with beam current profile measurements; actual photographs of two such images obtained for different width ion beams are presented. Various target materials have been examined, but only insulators were found effective in producing ion beam images by this method. The technique itself has direct application to ion beam alignment and diagnostics. The use of coincident ion and electron beams presents a new technique that is potentially useful for the investigation of surface interactions.

709,482
PB-282 136/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultrasonic Interferometer Manometers: 0.00001 Torr Resolution.
Final rept.,
P. Heydemann, C. Tilford, and W. Angel. 1976, 7p
Pub. in Proceedings Int. Instrumentation Symp. (22nd), Held at San Diego, California on May 25-27, 1976 p69-75.

Keywords: *Manometers, Interferometers, Ultrasonic radiation.

The principal tasks in operating a manometer are to locate the positions of the liquid menisci, to transfer the positions to a scale, and to measure the distance between these positions and a common reference line. In the ultrasonic manometer the positions of the liquid menisci are sensed by ultrasonic wave trains and the distances are measured in terms of the known wavelength of sound in the liquid. This measurement is performed automatically, rapidly, and without operator interference. A prototype instrument with a full scale range of 13 kPa (100 torr) and a resolution of 0.05 Pa (0.00005 torr) has been constructed and will be described.

709,483
PB-282 908/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Utility of Specimen Current Imaging in the SEM (Scanning Electron Microscope).
Final rept.,
D. E. Newbury. 1976, 10p
Pub. in Proceedings of Annual Scanning Electron Microscope Symposium (9th), Chicago, Ill. Apr 76 p111-120 (IIT Research Inst., Chicago, Ill.) 1976.

Keywords: *Electron microscopes, *Image intensifiers, Scanning electron microscopy.

Specimen current is one of the least used signals for image formation in the scanning electron microscope. Specimen current does, however, offer certain unique characteristics which can be of considerable value to the microscopist. Specimen current is sensitive only to the number of electrons which exit the specimen due to backscattering and secondary electron emission. Specimen current is not sensitive to the trajectories of the emitted electrons or to the resistivity differences of composite specimens composed of conductors and/or semiconductors. The insensitivity to trajectory effects has a marked influence on the contrast of specimen current images, particularly when topographic contrast is involved. The specimen current signal can be obtained in circumstances where the emitted electrons are difficult to collect, e.g., specimen proximity to the polepiece. Provided that image quality is not limited by the amplification instrumentation, the resolution observed in the specimen current image is identical to the emissive mode image if all emitted electrons were collected. Similarly, the depth sensitivity of the specimen current image is identical to the total emissive signal image.

709,484
PB-282 938/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characterization of the Electrically Calibrated Pyroelectric Radiometer.
Final rept.,
W. M. Doyle, B. C. McIntosh, and J. Geist. 1977, 5p
Pub. in Proceedings of Annual SPIE Symposium (19th), Held at San Diego, California on August 19-20, 1975. SPIE 62, p166-170 1977.

Keywords: *Radiometers, Calibrating, Pyroelectricity.

The paper is a discussion of the experimental techniques presently being used to characterize the Electrically Calibrated Pyroelectric Radiometer (ECPR) and of the degree of accuracy attained, to date, with these techniques. The resuls reported are an indication of the extent to which an ECPR can be regarded as an absolute radiometer for use an optical calibration standard in place of a standard source.

709,485
PB-283 535/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Precision Dielectric Measurements.
Final rept.,
M. G. Broadhurst, and W. P. Harris. 1978, 8p
Sponsored in part by Department of Energy, Washington, D.C.
Pub. in Proceedings, Conference on Electrical Insulation and Dielectric Phenomena, Gaithersburg, Md. 3-6 Nov 75, 1975 Annual Report p37-44 (National Academy of Sciences, Washington, D.C.) 1978.

Keywords: *Dielectric properties, *Measurement, Materials.

The dielectric properties of a material are a measure of how that material responds to an electric stress. Generally the response is observed as an electric current and the stress as an electric potential difference (voltage). Measurements of current and voltage are usually done with an electric circuit associated with a specimen of the material and the current and voltage in the material are inferred from geometric considerations. Errors may occur in the electrical measurements but more often the assumed connection between circuit response and material response is the major source of error. If one can optimize conditions such as the material's physical state, size and shape, measurement frequency and voltage level and ambient pressure and temperature, one can determine a material's dielectric constant to better than plus or minus 0.01%. Usually conditions are not optimum and one finds that techniques required for extreme measurement frequencies or for difficult specimen shapes and sizes may yield errors comparable in magnitude to the quantities being measured. Even worse than for a well defined quantity such as dielectric constant, high-field dielectric properties (e.g., breakdown) have the added uncertainty that the quantity being measured is not clearly defined and at best represents a statistical average of measured values. Thus, the degree to which a particular dielectric measurement is precise depends on the existing state-of-the-art for that measurement. The paper surveys some of these measurements of dielectric properties for optimum and extreme conditions, and try to indicate the source and magnitude of errors.

709,486
PB-283 986/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Surface Analysis by Electron Spectroscopy at High Pressures.
Final rept.,
C. J. Powell. 1978, 4p
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Div. of Biomedical and Environmental Research.
Pub. in Jnl. of Vacuum Science and Technology 15, n2 p549-552, Mar/Apr 78.

Keywords: *Surface properties, *Spectroscopic analysis, High pressure tests, Reprints, *Auger electron spectroscopy, *X ray photoelectron spectroscopy.

Surface analyses are now made by techniques such as Auger-electron spectroscopy (AES), x-ray photoelectron spectroscopy (XPS), and appearance potential spectroscopy (APS). These techniques use low-energy electrons and have high surface sensitivity but cannot be used at high pressures (approximately > 0.0001 torr). Optical techniques can be used at high pressures but their surface sensitivity is poor. It is proposed to combine these approaches by using the high-pressure gas as a converter. Two situations are considered. First, variable-energy x-rays are used to produce variable-energy photoelectrons from the gas which impinge on the sample; these electrons constitute a suitable source for APS. Second, the variable-energy x-rays produce photoelectrons from the sample (XPS) of variable energy; these electrons can be detected using the gas for APS. In both cases, the derivative of the x-ray yield from the gas-sample cell is measured as a function of incident x-ray energy; features in the derivative spectrum can be correlated with the core levels of surface atoms of the sample. Design calculations based on x-ray intensities from available sources indicate that the proposed method could only be useful for specialized applications.

709,487
PB-284 573/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Recent Progress in Microwave Frequency and Time Standards at the National Bureau of Standards.
Final rept.,
D. W. Allan, R. J. Besson, G. Busca, R. M. Garvey, H. Hellwig, D. A. Howe, S. Jarvis, A. Risley, S. R. Stein, F. L. Walls, and D. J. Wineland. Mar 78, 8p
Pub. in Proceedings Annual Precise Time and Time Interval (PTTI) Applications and Planning Meetings (9th), Held at NASA Goddard Space Flight Center, Greenbelt, Maryland on November 29-December 1, 1977, p343-350, 1978. Sponsored in part by Defense Advanced Research Projects Agency, Arlington, Va.

Keywords: *Frequency standards, *Time standards, Cesium frequency standards, Rubidium frequency standards, Gas masers, Hydrogen, Frequency stability, Crystal oscillators, Microwave frequencies.

Research and advanced development at the National Bureau of Standards (NBS) in the area of microwave frequency and time standards is discussed. New insights into the causes of flicker noise and long-term instability of cesium standards are discussed. A new cesium beam tube configuration is described with a potential accuracy of 10 to the minus 14 power. Results and design of a passive hydrogen maser system are given showing stabilities of better than 10 to the minus 14 power. Causes for frequency instabilities in rubidium gas cell standards and on line-asymetries are described. New quartz crystal standards and special purpose atomic standards for field use appear possible. Excellent short-term stability can be realized by superconducting cavity and quartz crystal oscillators.

709,488
PB-284 577/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Causes and Cures of Frequency Instabilities (Drift and Noise) in Cesium Beam Frequency Standards.
Final rept.,
D. W. Allan, H. Hellwig, S. Jarvis, D. A. Howe, and R. M. Garvey. 1977, 7p
Pub. in unidentified Jnl.

Keywords: *Cesium frequency standards, Frequency stability, Drift(Instrumentation), Noise, Frequency shift, Reprints.

Frequency drift of the order of several parts in 10 to the 13th power per year is often observed in commercial cesium beam frequency standards, and on some occasions significant changes in the white noise frequency modulation level is also observed. Recently at the National Bureau of Standards some standards with these types of problems have been analyzed and their velocity distributions measured. A comparison of the changes in drift and noise performance with measurements of the velocity distribution leads to some interesting interpretations: Changes in focusing voltage at or in the vicinity of the detector may cause the finite surface area of the detector to act like a velocity selector; i.e., the detection efficiency of cesium atoms mapped across the surface of the detector changes with time as a result of changing electric fields which focus the cesium ion-beam. Changes in the microwave power cause changes in the most probable cesium atom velocity, which transduce via the Ramsey cavity phase shift into frequency changes . The magnitude of the cavity phase shifts in a cavity was inferred by reversing the current through the C-field inducing mixing of the mF states.

709,489
PB-284 578/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Method to Eliminate Cavity Phase Shift in Cesium Beam Standards.
Final rept.,
D. J. Wineland, S. Jarvis, H. Hellwig, and R. M. Garvey. Mar 78, 7p
Pub. in Proceedings Annual Precise Time and Time Interval Applications and Planning Meetings (9th), NASA Goddard Space Flight Center, Greenbelt, Maryland, 29 Nov-1 Dec 1977, p571-577.

Keywords: *Cesium frequency standards, Phase shift, Cavities, Elimination.

In presently known laboratory and commercial cesium standards, the so-called Ramsey cavity is employed. The envelope of the associated Ramsey pattern is determined by the distribution of atomic velocities in the atomic beam. The wider the velocity distribution, the narrower will be the half-width of the envelope of the Ramsey pattern. The envelope of this Ramsey pattern is invariant against cavity phase shift. In other words, the center of the envelope - in contrast to the center of the main peak of the resonance - does not shift from cesium atomic resonance frequency when the cavity phase shift is varied. Therefore, it is suggested that the systematic frequency shift due to an rf phase difference between the two interaction regions of a normal Ramsey cavity can be eliminated by using simultaneously two different frequencies around the cesium resonance applied to two separated interaction regions which are not part of the same cavity. To the atom this is equivalent to a time-varying cavity phase shift between the two interaction regions. A modulation of the frequencies nu sub 1 and nu sub 2 applied to cavities 1 and 2 will produce signals symmetrically spaced around true line center of the cesium resonance. This technique is briefly described and the advantages are noted.

709,490
PB-284 593/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Many-Body Effects in Photoemission.
Final rept.,
J. W. Gadzuk. 1978, 26p
Pub. in Photoemission and the Electronic Properties of Surfaces, ch5 p111-136 1978.

Keywords: *Photoelectric emission, Many body problem, Photoelectron spectroscopy.

The document surveys the physical basis and current theoretical understanding of observable many-body effects in photoemission spectra from solids and surfaces.

709,491
PB-284 619/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Review of Methods of Analyzing Frequency Stability.
Final rept.,
J. A. Barnes. Mar 78, 24p
Pub. in Proceedings Annual Precise Time and Time Interval Applications and Planning Meeting (9th), Held at NASA Goddard Space Flight Center, Greenbelt, Maryland on November 29-December 1, 1977, p61-84.

Keywords: *Frequency stability, Measurement, Noise, Spectrum analysis.

Extensive research over the past years has provided a model for the description of frequency instabilities of clocks and oscillators. This model consists of the superposition of three distinct parts: (1) random, non-deterministic fluctuations described as noise; (2) long-term, systematic trends or aging; and (3) fluctuations induced by environmental sensitivities of the oscillator or clock. The random part of the model includes noises which have presented certain mathematical problems. The purpose of the measurement process is to estimate the levels and kinds of instabilities present in a given device--that is, to quantify the model. There are relatively simple means of analysis which are also commonly used--the two-sample variance and the power spectral density. Crucial to any measurement are the intended uses of the result. This includes the levels of accuracy and precision needed, as well as the intended application. For example one may wish only a relative comparison between two oscillators; and, thus, absolute accuracy (as opposed to precision) is of no interest. The specific application intended for the measurement will often influence the form in which the final quantified model is reported.

709,492
PB-284 628/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Methods of Microprobe Analysis.
Final rept.,
K. F. J. Heinrich. 1977, 13p
Pub. in Proceedings Intern. Conf. on Environmental Toxicity (10th), Held at Rochester, New York on May 23-25, 1977. Paper in Environmental Pollutants, v13 p241-253.

Keywords: *Microanalysis, *Spectroscopic analysis, X ray analysis, Electron probes, Raman spectroscopy, Electron probes, *Microprobe analysis, Ion microprobes.

Microprobe techniques are characterized by the interaction of a finely focused beam of particles or photons with a microscopic region of a solid specimen. The techniques may reveal microscopic topography and isotopic, elementary and molecular compositions as well as lattice parameters. Presently available techniques are listed and described, and their characteristics are tabulated.

709,493
PB-284 630/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Progress and Testing of a Monte Carlo Program for Electron Probe Analysis.
Final rept.,
K. F. J. Heinrich, R. L. Myklebust, and D. E. Newbury. 1976, 3p
Pub. in Proceedings Intern. Conf. on X-Ray Optics and Microanalysis, Held at Moscow, U.S.S.R. on July 7-16, 1974 p169-171 1976.

Keywords: *Electron probes, *Microanalysis, Monte Carlo method, Particles, Microprobe analysis, Particulates.

A Monte Carlo program has been developed for the characterization of electron distribution and x-ray generation in compound targets of varying shapes. The parameters of importance of the method, various applications, and comparisons of results with the theoretical prediction are discussed.

709,494
PB-284 976/8 PC **A08**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Nicrosil versus Nisil Thermocouple: Properties and Thermoelectric Reference Data.
Final rept.,
N. A. Burley, R. L. Powell, G. W. Burns, and M. G. Scroger. Apr 78, 171p NBS-MONO-161
Sponsored in part by Materials Research Labs., Maribyrnong (Australia). Library of Congress Catalog Card no. 77-14969.

Keywords: *Thermocouples, Nickel alloys, Chromium containing alloys, Silicon containing alloys, Thermoelectric properties, Standards, Nickel alloy 14.2Cr1.4Si, Nickel alloy 4.4Si 0.1Mg, Nickel alloy Nicrosil, Nickel alloy Nisil.

The monograph deals with the formulation and development of the new highly stable nickel-base thermocouple alloys Nicrosil (Ni-14.2Cr-1.4Si) and Nisil (Ni-4.4Si-0.1Mg). In the formulation of the new alloys, the main method was to use basic thermodynamic data to predict the conditions of solute concentration, temperature and oxygen pressure under which certain discrete oxide layers could form on the surface as highly efficacious passivating films. This work was the culmination of extensive research in which thermoelectric instability in existing nickel-base thermocouple alloys was correlated with their physical, chemical and metallurgical properties. The basic thermoelectric properties of Nicrosil and Nisil more recently have been the subject of a joint research project between NBS and MRL. The aim of this project, which was conducted under the terms of an Arrangement under the U.S./Australia Agreement relating to Scientific and Technical Co-operation, was to establish a body of standard reference data on the thermoelectric and other properties of the

new thermocouple alloys which could be recognized by various standards authorities around the world.

709,495
PB-285 013/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Performance Characteristics of an Automated Broad-Band Bolometer Unit Calibration System.
Final rept.,
E. L. Komarek. Dec 77, 6p
Pub. in IEEE Trans. Microwave Theory MTT-25 n12 p1122-1127 Dec 77.

Keywords: *Bolometers, *Calibrating, Automation, Broadband, Power measurement, Microwave equipment, Reflectometers, Junctions, Six port junctions, Reprints.

The arbitrary six-port reflectometer concept has been applied to an automated broadband system in the 1-18-GHz frequency range for the calibration of bolometer units. Performance evaluation results show an improvement in precision over other automated and manually operated measurement systems used at the National Bureau of Standards. Initial evaluation results reported here show a single measurement standard deviation of 0.02 to 0.41 percent from 2-18 GHz. The system is currently used for the calibration of coaxial and waveguide bolometer unit effective efficiency.

709,496
PB-285 023/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Modeling and Optimum Utilization of High Performance Clocks.
Final rept.,
D. W. Allan, and J. A. Barnes. 1974, 2p
Pub. in Proceedings Conf. Precision Electromagnetic Measurements, Held at London, England on July 1-5, 1974 p277-278 1974, (Institution of Electrical Engineers).

Keywords: *Clocks, Mathematical models, Utilization, Atomic clocks.

Modeling and optimum utilization of high performance clocks are discussed.

709,497
PB-285 029/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Josephson-Effect Absolute Noise Thermometer: Resolution of Unmodeled Errors.
Final rept.,
R. J. Soulen, and R. P. Giffard. Jun 78, 3p
Sponsored in part by Office of Naval Research, Washington, D.C.
Pub. in Appl. Phys. Lett. v32 n11 p770-772 Jun 78.

Keywords: *Temperature measuring instruments, Josephson junctions, Thermal noise, Cryogenics, Temperature measurement, *Noise thermometers, Reprints.

An absolute cryogenic temperature scale is being defined at the National Bureau of Standards using the linewidth of radiation emitted by a resistively shunted Josephson junction. The authors report careful measurements of the impedance of this noise thermometer and show that its behavior is in excellent agreement with the predictions of the resistively shunted junction model assuming a sinusoidal current-phase relationship. The implications for absolute noise thermometry are discussed.

709,498
PB-285 044/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Focusing and Dispersing Properties of a Stigmatic Cross-Field Energy Analyzer.
Final rept.,
A. Galejs, and C. E. Kuyatt. Jun 78, 3p
Pub. in Proceedings Symp. on Electron, Ion, and Photon Beam Technology (14th), Held at Palo Alto, California on May 25-27, 1977, Jnl. Vac. Sci. Technol., v15 n3 p865-867 May/Jun 78.

Keywords: *Electron microscopy, Optical filters, Electron energy, *Electron energy analyzers, Wien filters.

The electron-optical properties of a stigmatic cross-field energy analyzer (double-focusing Wien filter) have been obtained from exact trajectory calculations. The results are given in the form of focusing and dispersing coefficients to the second order. These coefficients enable the device designer or potential user to calculate the total beam transfer and evaluate the resulting beam quality without additional ray tracing. The specific device for which calculations are made employs a uniform electric field and a toroidal magnetic field. This analyzer is of special interest in our laboratory because it can be constructed with a very small stray magnetic field, and in addition to its dispersive properties it also rotates the spin of a polarized electron beam.

709,499
PB-285 052/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Monte Carlo Electron Trajectory Simulation - An Aid for Particle Analysis.
Final rept.,
R. L. Myklebust, D. E. Newbury, K. F. J. Heinrich, J. A. Small, and C. E. Fiori. Jun 78, 6p
Pub. in Proceedings Annual Conf. Microbeam Analysis Society (13th), Held at Ann Arbor, Michigan on June 19-23, 1978, p61A-61F.

Keywords: *Electron probes, *Microanalysis, X ray analysis, Monte Carlo method, Particles, Electron probe microanalysis.

Monte Carlo electron trajectory simulations are applied to the study of electron interactions in particles. Single scattering, multiple scattering, or a hybrid model can be used to describe elastic scattering. The Bethe continuous energy loss approximation is used to describe inelastic scattering. Monte Carlo calculations of x-ray intensities emitted from particles agree well with experiments on known systems. The x-ray emission from particles normalized to emission from bulk targets shows a peak above unity for soft radiation due to the decreased absorption path. Monte Carlo calculations reveal that the typical arrangement of the x-ray spectrometer in a scanning electron microscope, in which the detector axis is set at a right angle to the beam, can lead to anomalous x-ray intensities from particles. The normalized intensity goes through a peak and sharply decreases with increasing particle size due to an increased absorption length.

709,500
PB-285 148/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Two-Frequency Excitation for the Ramsey Separated Oscillatory Field Method.
Final rept.,
J. Jarvis, D. J. Wineland, and H. Hellwig. Dec 77, 2p
Pub. in Jnl. Appl. Phys. Commun., v48 n12 p5336-5337 Dec 77.

Keywords: *Frequency standards, Frequency shift, Phase shift, Elimination, Interactions, Excitation, Reprints.

It is suggested that the systematic frequency shift due to rf phase difference between the two interaction regions in Ramsey's separated oscillatory field technique may be eliminated by using different frequencies in the two interaction regions. The technique is briefly described, and the advantages are noted, particularly for frequency standards based on atomic beams.

709,501
PB-285 151/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Testing Basic Assumptions in the Measurement Process.
Final rept.,
J. J. Filliben. 1977, 84p
Pub. in Proc. Symp. Division of Analytical Chemistry Meeting of the American Chemical Society (171st), New York, N.Y. 5-6 Apr 76. Paper 2 in ACS Symposium Series 63, Validation of the Measurement Process, p30-113 (American Chemical Society, Washington, D.C. 1977).

Keywords: *Measurement, Statistical analysis, Probability theory.

This paper concerns itself with the important problem of testing the validity of the basic assumptions in a measurement process. The paper covers four principal areas in this regard: (1) what precisely are the assumptions that are typically made in a measurement process; (2) what are the consequences to the conclusions drawn from a measurement process if the assumptions do not hold; (3) what theoretical statistical tests exist for the checking of basic assumptions; and (4) what practical tools currently exist to facilitate the checking of basic assumptions. Examples of assumption-checking on data drawn from the chemical and physical sciences are included.

709,502
PB-285 222/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Special Purpose Atomic (Molecular) Standard.
Final rept.,
D. J. Wineland, D. A. Howe, and H. Hellwig. 1976, 19p
ARPA Order-3140
Pub. in Proceedings Annual Precise Time and Time Interval Applications and Planning Meeting (8th), Naval Research Lab., Washington, D.C. Nov 30-Dec 2, 1976, p429-447 (Goddard Space Flight Center, Greenbelt, Md., 1976.)

Keywords: *Frequency standards, Atomic clocks, Oscillators.

A special purpose frequency standard and clock is being developed featuring a novel combination of stability and accuracy performance, shock and temperature insensitivity, instant turn on characteristics and featuring low weight, power consumption, and potentially low fabrication costs.

709,503
PB-285 296/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Viscosity Measurements in the Diamond Anvil Pressure Cell.
Final rept.,
G. J. Piermarini, R. A. Forman, and S. Block. Aug 78, 6p
Pub. in Jnl. Rev. Sci. Instrum., v49 n8 p1061-1066, Aug 78.

Keywords: *Viscosimeters, Pressure sensors, Reprints.

The viscosity of liquids can be measured in the diamond-anvil pressure cell utilizing a falling-solid sphere method and the ruby technique for pressure measurement. The pressure dependence of the viscosity of a 4:1 mixture (by volume) of methanol:ethanol was determined to 70 kbar. The accuracy of the method is estimated from measurements made on a fluid of known viscosity.

709,504
PB-285 303/4 Not available NTIS
National Bureau of Standards, Boulder, CO.
Self-Calibration of Complex Ratio Measuring Systems.
Final rept.,
C. M. Allred, and C. H. Manney. 1973, 10p
Pub. in Proc. Int. Measurement Conf. on Measurement and Instrumentation, Dresden, Germany, Jun 17-23, 1973, ACTA IMEKO 1, p157-166, 1973.

Keywords: *Ratios, *Measurement, Calibrating, Adaptive systems, Complex ratios.

A technique for self-calibrating complex ratio measuring systems is described. No known standards are required; only reproducible, but unknown, insertion devices are needed. A potentially high calibration accuracy exists for systems with stable parameters.

709,505
PB-285 325/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Automatic 300-4 K Temperature Cycling Apparatus.
Final rept.,
C. A. Hamilton. May 78, 4p
Contract N00014-77-F-0048
Pub. in Jnl. Rev. Sci. Instrum. Notes, v49 n5 p674-677, May 78.

Keywords: *Laboratory equipment, Thermal cycling tests, Cryogenics, Dewar flasks, Automatic control, Reprints.

The apparatus described here automatically cycles small samples between 300 and 4 K by alternately raising and lowering the sample through the neck of a commercial liquid helium storage Dewar. A bellows, which is pressurized by the helium boil-off gas, provides all of the required mechanical motion. By using the cooling available from the boil-off gas, liquid helium consumption is limited to 0.03 l/cyc for a 12-g sample. Cycle times can be as short as 5 min.

709,506
PB-285 340/6 Not available NTIS

National Bureau of Standards, Gaithersburg, MD.
Picosecond-Domain Waveform Measurements.
Final rept.,
N. S. Nahman. Apr 78, 14p
Pub. in Proc. Conf. on Precision Electromagnetic Measurements, Ottawa, Canada, Jun 26-29, 1978. Proc. IEEE, v66 n4 p441-454, Apr 78.

Keywords: *Waveforms, Measurement, Time domain, Reviews, State of the art, Picoseconds.

A review of the state-of-the-art of picosecond time-domain measurements is presented which draws together techniques from the electrical and optical regions of the electromagnetic spectrum. Measurement methods are listed in categories which exhibit the commonality between electrical and optical methods. State-of-the-art values for temporal resolution are presented with reference citations to specific methods and related technical topics.

709,507
PB-287 454/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Discussion on F 77 205-8 'Cavity Resonance Effect in Large HV Laboratories Equipped with Electromagnetic Shield', by R. Malewski, D. Train, and A. Dechamplain.
Final rept.,
R. E. Hebner. Dec 77, 1p
Pub. in IEEE Trans. Power Appara. Syst. PAS-96 n6 p1870 Nov/Dec 77.

Keywords: *Cavity resonators, Laboratories, Electromagnetic shielding, High voltage, Measurement, Pulsation, Reprints.

The paper is a published discussion of a paper which was presented at the IEEE Power Engineering Society 1977 Winter Meeting. The discussion requests additional information concerning the measurement technique described in the original paper.

709,508
PB-287 455/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Discussion on F 76 455-6 'Automatic Data Acquisition of Power Network Overvoltages and of Laboratory Impulses' by B. Beaumont, J. Jouaire, and A. Sabot.
Final rept.,
R. E. Hebner. Apr 77, 1p
Pub. in IEEE Trans. Power Appara. Syst. PAS-96 n2 p381 Mar/Apr 77.

Keywords: *Data acquisition, Pulsation, Laboratories, Automation, Measurement, High voltage, Reprints.

The paper is a published discussion of a paper which was presented at the IEEE Power Engineering Society 1976 Summer Meeting. The discussion requests additional information concerning the accuracy of the devices described in the original paper.

709,509
PB-287 456/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Two-Frequency Separated Oscillating Fields Technique for Atomic and Molecular Beam Interrogation.
Final rept.
R. M. Garvey, H. Hellwig, S. Jarvis, and D. J. Wineland. 1978, 2p
Pub. in Proceedings Conf. on Precision Electromagnetic Measurements, Held at Ottawa, Canada on Jun 26-29 1978, IEEE Cat. No. 78CH 1320-1 IM, CPEM Digest p8-9.

Keywords: *Atomic spectroscopy, *Molecular spectroscopy, Cavities, Phase shift, Frequency standards.

The authors report on a novel method to reduce the effects of cavity phase shift upon atomic beam interrogation in Ramsey cavity configurations. Two distinct cavities driven at different frequencies are employed to produce a cavity phase shift which advances (or recedes) at a constant rate.

709,510
PB-287 975/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characterizing the Creep Response of Load Cells.
Final rept.
R. A. Mitchell, and S. M. Baker. 1978, 6p
Pub. in Proceedings Internatl. Measurement Confederation (IMEKO) Internatl. Conf. on Measurement of Force and Mass, Held at Braundschweig, Germany, F.R., Sep 13-15, 1978, p43-48.

Keywords: *Load cells, Creep recovery.

A procedure is being developed for characterizing the creep response of load cells. A constant force is applied to the load cell in a dead weight machine and the creep response is recorded using a high precision DC indicator. Initial test results on eleven load cells indicate a great variety in the magnitude, direction and complexity of creep and creep recovery. A rheological model consisting of multiple spring and dashpot elements in parallel and in series is fitted to the creep data. A search algorithm is used to solve the nonlinear least squares problem for the multiple stiffness and time constants of the rheological model. Within the limitations imposed by nonlinearity in the creep response, the fitted model can be used to estimate the creep response due to more general loading.

709,511
PB-288 108/4 Not available NTIS
National Bureau of Standards, Boulder, CO.
Transcontinental and Intercontinental Portable Clock Time Comparison.
Final rept.
H. Hellwig, D. W. Allan, S. R. Stein, and K. A. Prichard. Mar 78, 4p
Pub. in Proceedings of Annual Symposium on Frequency Control (31st), Atlantic City, NJ 1-3 Jun 77. Paper in IEEE Transactions on Instrumentation and Measurement IM-27 n1 p65-68 Mar 78.

Keywords: *Time standards, Comparison, Atomic clocks, Portable equipment.

Because of the relatively low transportation costs of the rubidium portable clock, a schedule of relatively frequent comparisons with two of the main counterparts of NBS (Boulder, Colorado) have been executed: nearly monthly comparisons with the U.S. Naval Observatory (USNO) in Washington, DC and trips every quarter year to the International Time Bureau (BIH) in Paris, France. The measurement results of the USNO and BIH comparisons are analyzed as a time series using a least squares quadratic fit. The measurements (time readings) yield a standard deviation of about 100 nano-seconds and indicate time scale drifts of about 1 x 10 to the minus 13 power per year. Comparison with Loran C data demonstrates the superior time comparison ability of portable clock trips, exceeding that of Loran C by up to one order of magnitude.

709,512
PB-289 011/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Flat-Cone Diffractometer Utilizing a Linear Position-Sensitive Detector.
Final rept.,
E. Prince, A. Wlodawer, and A. Santoro. 1978, 6p
Pub. in Jnl. Appl. Cryst. II, p173-178, 1978.

Keywords: *Diffractometers, X ray diffraction, Neutron diffraction, Efficiency, Position(Location), Conical bodies, Cones, Flat surfaces, Reprints.

The recent development of linear position-sensitive detectors for neutrons and X-rays leads to the possibility of large improvements in the efficiency of data collection in single-crystal diffractometers. In order to take advantage of the properties of a linear position-sensitive detector, it is desirable to use a diffraction geometry which causes the diffracted beams from many different reflecting planes to lie in a common plane. A design for a diffractometer using the flat-cone geometry is described, and the relevant mathematical formulas are summarized. An instrument using this design has been constructed as a modification to an existing four-circle diffractometer and is now operating. Practical details of its construction, of the collection and handling of data, and of data rates are discussed.

709,513
PB-289 870/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Piezodriven 50-Micrometer Range Stage with Subnanometer Resolution.
Final rept.,
F. E. Scire, and E. C. Teague. Dec 78, 6p
Pub. in Review of Scientific Instruments 49, n12, p1735-1740, Dec 78.

Keywords: *Manipulators, Microscopy, Instruments, Drives, Reprints.

A micropositioning stage has been developed for use with optical and electron microscopes in the accurate measurement of fine lines used by the microelectronics industry and microscopic objects such as biological cells, air pollution particles, and asbestos fibers. The stage combines a piezoelectric driving element and flexure pivoted lever arms to achieve a compact, vacuum compatible device with a resolution of 0.001 micrometers or less over a range of 50 micrometers.

709,514
PB-289 881/5 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC.
Dimensions/NBS. Volume 62, Number 11, November 1978.
Monthly rept.
Nov 78, 29p NBS/DIM-62/11
See also Volume 62, Number 10 dated Oct 78, PB-288 973.

Keywords: *Periodicals, Metrology, Neutron activation analysis, Measurement, Test equipment, Meetings, National Bureau of Standards, Standard reference materials.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: For Good Measure; Probing the Past with Neutrons; Chemical Fingerprints on File; Fibrous Glass Board Standard Reference Material; FAST Facility Available for Engineering Needs; New NBS-NIH Large-Molecule Diffractometer; Standard Reference Material for Electron Experiments; Conferences; Publications; News Briefs.

709,515
PB-290 023/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Piezoelectric Inchworm Operation in a Vacuum.
Final rept.
A. W. Hartman. Dec 78, 2p
Pub. in Opt. Eng. v17 n6 p645-646 (Nov-Dec 1978).

Keywords: *Instruments, Displacement, Piezoelectricity, Vacuum, Electron microscopes, Positioners, Scanning electron microscopy, Reprints.

An inchworm-type piezoelectric displacement device has been tested for operation in a vacuum. Comparative data are given for its operation at two pressures (1 atmosphere and 0.000001 to 0.000 0001 torr), three loads (0, 0.8, 1.5 kg), and four speeds (0.5 to 50 micrometers per second). The results are such that the device is now being applied successfully to drive an X-Y stage in a scanning electron microscope (SEM).

709,516
PB-290 042/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Time, Frequency and Our Physical Measurement System.
Final rept.,
H. Hellwig, K. M. Evenson, and D. J. Wineland. 1978, 8p
Pub. in Physics Today, p23-30 Dec 78.

Keywords: *Time measurement, *Frequency measurement, Measurement, Time standards, Frequency standards, Atomic clocks, Reprints.

Frequency, time, and wavelength measurements of precision have been brought about by fundamental advances in spectroscopy. These include: Sub-Doppler techniques, the stabilized laser, and the extension of direct frequency measurements to the near infrared region of the spectrum. In fact, significant changes in our system of physical measurements are taking place. This article attempts to focus on several of these developments, which, the authors feel, are likely to substantially impact many areas of science, technology, and physical measurement.

709,517
PB-290 047/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS Standards for Pressure, Temperature, and Humidity.
Final rept.
R. P. Hudson. 1978, 14p
Pub. in Proceedings Air Quality Meteorology and Atmospheric Ozone, Boulder, CO., July 31-August 6,

1977, American Society for Testing and Materials Special Technical Pub. 653, p13-26 1978.

Keywords: *Standards, *Humidity, *Pressure, *Temperature, Calibrating, Ozone.

A summary is presented of the metrological activities in the Heat Division of the National Bureau of Standards, covering the calibration and other service activities in temperature, pressure, and humidity, together with a description of some representative examples of related current research and developmental work.

709,518
PB-291 253/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of NBS in Traceability to National Standards for Advanced Measurement Systems.
Final rept.
B. C. Belanger. 1978, 2p
Pub. in Proceedings of the Industry/Joint Services Automatic Test Conference and Workshop on Advanced Test Technology Management and Support Held at San Diego, California on April 3-7, 1978, p295-296.

Keywords: *Test equipment, Automation, Standards, Automated test equipment.

NBS's role in traceability to national standards for automated test equipment (ATE) is described. The meaning of traceability vis-a-vis ATE is discussed.

709,519
PB-291 719/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optical Linewidth Measurements on Wafers.
Final rept.
D. Nyyssonen. 1978, 5p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in SPIE Seminar Proc., v135 p115-119, 1978.

Keywords: *Line width, Measurement, Wafers, Optical microscopes.

An optical scanning microscope system for accurate measurement of linewidth on wafers is described. The development of this system in both theory and experiment parallels the treatment of transmitted light measurements on see-through photomasks as previously described. Threshold equations for determining edge location have been developed which include corrections for contrast and phase. In reflected light, the wavelength dependence of these parameters due to thin film interference requires a much narrower spectral bandwidth. In addition, other light losses dictate the use of laser illumination. Control of the spatial coherence of the laser is discussed. A comparison of theoretical and experimental results is given along with a comparison of reflected and transmitted light measurements.

709,520
PB-292 020/5 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC.
Measurement Assurance for Gage Blocks.
Final rept.
C. Croarkin, J. Beers, and C. Tucker. Feb 79, 83p
NBS/MONO-163
Library of Congress catalog card no. 78-600162.

Keywords: *Measuring instruments, *Standards, Calibrating, Measurement, Acceptability, Errors, *Gage blocks.

This monograph is intended for those who need to know on a continuing basis the uncertainty of their gage block calibration procedure. A general discussion of the philosophy of measurement assurance is given first. Then three levels of measurement assurance programs are outlined showing how control over the measurement process can be maintained and how the offset (or systematic error) from the unit of length maintained by the National Bureau of Standards can be made negligible.

709,521
PB-292 185/6 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC.
Dimensions/NBS. Volume 62, Number 12, December 1978.
Monthly rept.
Dec 78, 32p NBS/DIM-62/12
See also Volume 62, Number 11 dated Nov 78, PB-289 881.

Keywords: *Periodicals, Electromagnetic interference, Tests, Solar heating, Cooling, Standards, Units of measurement, Corrosion tests, Coal gasification, Particle size, National Bureau of Standards, Solar cooling.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches, and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Testing for EMI; Solar heating and cooling--Standards for a maturing industry; News from the International Bureau of Weights and Measures; Corrosion test methods for coal gasification materials; Particle-sizing device for research and calibration.

709,522
PB-292 373/8 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Technology Div.
NBS RF Voltage Comparator.
L. D. Driver, F. X. Ries, and G. Rebuldela. Dec 78, 28p NBSIR-78-871
Sponsored in part by Army Metrology and Calibration Center, Redstone Arsenal, AL.

Keywords: *Comparators, Radio frequencies, Electric potential, Voltmeters, Signal generators, Calibrating.

This manual describes a wideband rf voltage comparator which covers the frequency range of 100 kHz to 1 GHz from 10 mV to 20 volts. This device uses a pair of matched Schottky-barrier diodes in each independent channel of a 2 dual-channel configuration. The coaxial line sections are impedance compensated to assure a VSWR less than 1.03 up to 1 GHz. Applications covered are calibration of signal generators and rf voltmeters. A troubleshooting and maintenance section is also included as well as illustrations and circuit diagrams to facilitate repair.

709,523
PB-292 579/0 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Precision Audio-Frequency Phase Calibration Standard.
Final rept.,
R. S. Turgel, and N. M. Oldham. Dec 78, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-27, n4, p460-464, Dec 78.

Keywords: *Standards, *Phase measurement, Calibrating, Phase meters, Audio frequencies, Phase angle, Signal generators, Microprocessors, Reprints.

A high precision standard for the calibration of audio frequency phase meters has been designed using a microprocessor to generate the test signals. The accuracy is better than 0.01 degree over a frequency band from dc to 5 kHz and decreases to 0.1 degree at high audio frequencies.

709,524
PB-293 383/6 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 63, Number 1/2, January/February 1979.
Monthly rept.
Feb 79, 32p NBS/DIM-63/1-2
See also Volume 62, Number 12 dated Dec 78, PB-292 185.

Keywords: *Periodicals, Dental materials, Measurement, Technology transfer, Electromagnetic interference, Building codes, Standards, Polymers, Chromatography, National Bureau of Standards, Standard reference materials.

The magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Good as gold, S. Washburn; Frontiers of measurement science, M. Baum; Getting federal research to the grass roots, G. Lindsteadt; Seeing the human side of science, S. Liberman; Government and industry officials discuss EMI problems, F. McGehan; New method for assessing building code benefits and costs, M. Heyman; Predicting materials properties of polymers, C. Hans; Tungsten concentrate standard reference material; New analytical chemistry technique being used at NBS--ion-chromatography, W. Koch.

709,525
PB-294 119/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Measurement of Loss Angle Using a Toroidal Cross Capacitor.
Final rept.,
J. Q. Shields. Dec 78, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-27, n4, p464-466, Dec 78.

Keywords: *Losses, *Measurement, Capacitors, Dielectric films, *Loss angles, Reprints.

An absolute measurement of loss angle has recently been completed at NBS. The measurement used a special toroidal cross capacitor in which the effects of dielectric films are greatly attenuated. The resulting unit of loss angle has an estimated uncertainty of 0.02 microrad at an optimum frequency of 1592 Hz.

709,526
PB-294 122/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Programmable Phase-Sensitive Detector for Automatic Bridge Applications.
Final rept.,
R. D. Cutkosky. Dec 78, 2p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-27, n4, p401-402, Dec 78.

Keywords: *Detectors, Electric bridges, *Phase sensitive detectors, Programmable detectors, Reprints.

A phase-sensitive detector is described which features programmable gain, digital output, and a resolution of 0.02 microvolts. The instrument suppresses harmonic sensitivity through the use of analog circuitry which multiplies the signal by constant amplitude sine and cosine waves derived from an external reference of arbitrary voltage and frequency.

709,527
PB-294 577/2 PC **A02**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.
Specifications and Tolerances for Reference Standards and Field Standard Weights and Measures. 3. Specifications and Tolerances for Graduated Neck Type Volumetric Field Standards.
B. C. Keysar. Mar 79, 25p NBS-HB-105-3
Supersedes COM-71-50259. See also COM-71-50065, and NBS-H-105-2. Library of Congress catalog card no. 78-600083.

Keywords: *Standards, *Units of measurement, Volume, Field tests, Specifications.

These specifications and tolerances are recommended as minimum requirements for standards used in the field by State and local weights and measures officials and others in quantity determinations of liquid commodities.

709,528
PB-295 157/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Solid-Dielectric Capacitive Pressure Transducer.
Final rept.
J. H. Colwell. 1979, 7p
Pub. in High-Pressure Science and Technology, 1, p798-804 1979. Proceedings of the AIRAPT Conference (6th) Held at Boulder, CO. on July 25-29, 1977.

Keywords: *Pressure sensors, Capacitors, Hydrostatic pressure, Capacitance.

A direct-reading pressure transducer is being developed that uses the change in capacitance with hydrostatic pressure of solid-dielectric capacitors. The transducer should be capable of reproducing the accuracy and long-term stability of the piston gauge at pressures of 14-700 MPa (2,000-100,000 psi). The large temperature dependence of earlier devices based on this principle have been largely overcome by using two selected capacitors of different materials in opposite arms of the measuring bridge.

709,529
PB-296 240/5 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 63, Number 4, April 1979.
Apr 79, 28p NBS/DIM-63/4
See also Volume 62, Number 12 dated Dec 78, PB-292 185, and Volume 63, Number 5, PB-296 268.Color illustrations reproduced in black and white.

Keywords: *Periodicals, Robots, Optical scanners, Buildings, Desert tests, Summer, Computer systems hardware, Standards, Cryogenics, Materials, Sediments, Aerosols, Urban areas, Energy conservation, Equipment interfaces, Interactive systems.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Giving a Robot the Eye, M. Baum; Arabian Days and Nights at NBS, M. Heyman; Summer Energy-Saving Tips, M. Heyman; Government Adopts Three Computer Interface Standards, S. Lichtenstein; Cryogenic Temperature Reference Device, R. Soulen; A Methodology for Selecting Interactive Computer Services, S. Mamrak; River Sediment and Urban Particulate SRM's; Conferences; Publications; News Briefs.

709,530
PB-296 268/6 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 63, Number 5, May 1979.
Monthly rept.
May 79, 32p NBS/DIM-63/5
See also Volume 62, Number 12 dated Dec 78, PB-292 185, and Volume 63, Number 4, PB-296 240.Color illustrations reproduced in black and white.

Keywords: *Periodicals, Decision making, Groups, Isotropy, Special relativity, Cryogenics, Minicomputers, Microcomputers, Steam, Thermodynamic properties, Electron microscopy, Standards, Materials, Aluminum alloys, Equipment interfaces, Standard reference materials.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Impossibility of Group Decisions, C. Johnson; Space Behaves as Einstein Expected, D. Orr; Colder Than Cold, K. Armstrong; Small Computer Systems Excluded from Interface Standards, S. Lichtenstein; A Powerhouse at NBS--Properties of Steam, A. L. Sengers; Standard Reference Material for Scanning Electron Microscopy Reissued, D. Ballard; Two Aluminum SRM's Available; Conferences; Publications; News Briefs.

709,531
PB-296 733/9 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 63, Number 3, March 1979.
Mar 79, 33p NBS/DIM-63/3
See also Volume 62, Number 12, PB-292 185.

Keywords: *Periodicals, Measurement, Standards, Nondestructive tests, Interferometers, Lasers, Snow, Plasma diagnostics, National Bureau of Standards.

The monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is--Microwave measurements on snowpacks, F. McGehan; NBS budget request, S. Washburn; Casting light on nature's ways, F. McGehan; Measurement services for ultrasonic non-destructive evaluation, D. Eitzen; National load standard being revised, M. Heyman; X-ray image magnification technique developed, M. Kuriyama; Evaluating pipeline welds, L. Mordfin; Fusion diagnostics-spectrum of molybdenum ion determined, J. Reader.

709,532
PB-296 925/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Status of RF and Microwave Calibration Services at NBS.
Final rept.,
R. A. Kamper. Dec 78, 1p
Pub. in NCSL Newsletter, v18 n3 p40, Dec 78.

Keywords: *Calibrating, *Microwave equipment, Radio frequencies, Standards, National Bureau of Standards, Reprints.

The brief note describes the present status of rf microwave calibration services at NBS, and gives a schedule for restoration of some services that had been temporarily closed down.

709,533
PB-297 836/9 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 63, Number 6, June 1979.
Monthly rept.
Jun 79, 37p NBS/DIM-63/6
See also Volume 63, Number 5 dated May 79, PB-296 268.Color illustrations reproduced in black and white.

Keywords: *Periodicals, Urban renewal, Toxicity, States(United States), Law(Jurisprudence), Solar energy, Aerosols, Antarctic regions, Raman spectroscopy, Radioactivity, Units of measurement, Power, Energy, Measurement, Energy technology.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Cities in Renaissance; Keeping Tabs on Toxicity; Wanted--Better Energy Ideas; NBS Publishes Updated Survey of State Solar Energy Legislation; Characterizing South Pole Aerosols with the Raman Microprobe; Conferences; Publications; News Briefs.

709,534
PB-297 939/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Noise Thermometry Using Josephson Junctions.
Final rept.
R. J. Soulen. 1978, 11p
Pub. in Proceedings Int. Conf. on Noise (5th), Held at Bad Nauheim (Germany, F.R.) on Mar 13-16, 1978. Paper in Noise in Physical Systems, p249-259, 1978.

Keywords: *Temperature measurement, Josephson junctions, Thermal noise, *Noise thermometers, SQUID devices.

Two methods for measurement of temperature using Johnson noise are reviewed and compared. The temperature scale developed with each is assessed.

709,535
PB-298 001/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Error Analysis for the Measurement of Satellite EIRP Using a Calibrated Radio Star.
Final rept.,
W. C. Daywitt. Sep 78, 6p
Pub. in Jnl. IEEE Trans. Instrum. Meas., vIM27 n3 p253-258 Sep 78.

Keywords: *Radiofrequency power, Measurement, Errors, Radio transmission, Artificial satellites, *Effective isotropic radiated power, Radio stars, Reprints.

An outline for the derivation of equations employed in a measurement and error analysis of satellite EIRP using a calibrated radio star is presented. A table showing analysis results at 7.55 GHz using Cassiopeia A for a satellite at a 12 degree elevation angle is given. The quadrature sum of the systematic errors appearing in the table is 10.1 percent. Also presented is a curve of the systematic errors as a function of elevation angle showing a 7.3-percent minimum at high elevation angles.

709,536
PB-298 372/4 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 63, Number 7/8, July/August 1979.
Monthly rept.
Aug 79, 33p NBS/DIM-63/7-8
See also Volume 63, Number 6 dated June 79, PB-297 836.

Keywords: *Periodicals, Metric system, Fire protection, General relativity, Navigation satellites, Data processing security, Computer networks, Autoradiography, Gamma ray spectroscopy, Graphic arts, Paints, Raman spectroscopy, Health care facilities.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Common Sense Approach to Metric Conversion; Fire Safety for Health Care Facilities; Einstein's Theories and a New Satellite System; NBS Seek Proposals for Computer Standards Development and for Systems Security Program; New Computer Network for NBS; Scientific Tools for the Art World--Autoradiography and Gamma-Ray Spectroscopy; Matrix-Isolation Raman Spectroscopy; Conferences; Publications; News Briefs.

709,537
PB-300 269/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Passive Hydrogen Maser Frequency Standard.
Final rept.
F. L. Walls, and D. A. Howe. 1979, 7p
Sponsored in part by Naval Research Lab., Washington, DC.
Pub. in Proceedings of Annual Symposium on Frequency Control (32nd), Atlantic City, NJ., May 31-June 2, 1978, p492-498 1978.

Keywords: *Frequency standards, Masers, Hydrogen, Frequency stability, Cavity resonators, Passive systems, Hydrogen masers.

Basic principles, circuit details, and measurements on a passive hydrogen maser frequency standard are presented. The perturbations to the output frequency are discussed and it is shown that the temperature coefficient of the microwave cavity is negligible in this system. Thus the fractional change in the output frequency is about 10 to the minus 13 power/K determined by the second order Doppler shift and the wall shift (10 to the minus 14 power/K is possible). A temperature stability of only .1 K is required in order to maintain a frequency stability of 1x10 to the minus 14 power.

709,538
PB79-600001
(Order as PB80-103674, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
High Precision Load Cell Mass Comparator.
R. M. Schoonover. 1979, 5p
Included in Jnl. of Research of the National Bureau of Standards, v84 n5 p347-351 1979.

Keywords: *Constant loading, Force, High precision, High-precision weighing, Load cell, Mass, Mass comparator, Mass difference, Strain-gage, Substitution weighing, Weighing, Weights.

Described here is a simple mechanical method used to fabricate a high precision mass comparator using a bonded strain gage load cell. Results indicate that a standard deviation of less than 0.0003% is readily attainable, and the device works well for objects normally considered too unwieldy for large high-precision balances.

709,539
PB79-600037 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ruler: 15 cm/6 in, With Metric-Customary Units and Equivalent.
1979, 2p NBS-SP-376

Keywords: *Centimeter, Conversion, Customary units, Inch, Metric units.

This ruler provides metric linear measure (15cm) and customary-unit linear equivalents (approximately 6 inches) plus conversion formula for effecting changes from customary to metri units.

709,540
PB80-104250 Not available NTIS
National Bureau of Standards, Washington, DC.
Techniques for Producing Standard EM Fields from 10 kHz to 10 GHz for Evaluating Radiation Monitors.
Final rept.,
E. B. Larsen. 1979, 17p
Pub. in Proceedings of the Symposium on Electromagnetic Fields in Biological Systems (1978) Held at Ottawa, Canada, on June 28-30, 1978, p96-112 1979.

Keywords: *Radiation measuring instruments, *Electromagnetic fields, Calibrating, Field strength, Standards, Horn antennas, Transverse electromagnetic cells.

The approach used at NBS for evaluating rf radiation monitors is to generate a calculable field and then immerse the probe being calibrated in this known field. The optimum instrumentation depends on the frequency and required accuracy. Up to 300 MHz a TEM cell is used, which is a large rectangular 'coaxial' transmission line. At these low frequencies, only the principal

wave (TEM mode) propagates through the cell and uniform electromagnetic fields are established. Both E and H field strengths can be calculated in terms of power, plate spacing and the cell characteristic impedance. In the 300 to 1000 MHz range a series of rectangular waveguide transmission lines is used. Power is transmitted through the guide to a matched resistive load. Operation is restricted to the TE sub 10 mode in which the E and H fields can be calculated approximately in terms of the frequency, guide dimensions and power flow. Calibrating fields above 500 MHz are generated in an anechoic chamber by a series of standard-gain pyramidal horns. Intense fields can be produced close to the antenna aperture even with low power transmitters. Simple equations are given for accurately calculating these near-zone fields, as determined empirically from the results of numerical integrations on a computer. The procedure involves a simple computation of the intensity produced by an in-phase aperture and then using algebraic equations to calculate near-zone correction factors. These gain reduction factors depend on frequency, horn dimensions and the distance to the field point. The above approach was checked experimentally and the worst case disagreement was 0.5 dB.

709,541
PB80-104334 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS Radiation Measurement Assurance Activities.
Final rept.,
E. H. Eisenhower. Apr 77, 7p
Pub. in HEW Publication (FDA) 77-8021, p391-397, Apr 77.

Keywords: *Radiation, *Measurement, National Bureau of Standards.

The role of the National Bureau of Standards as the national reference laboratory for radiation measurements is described, as well as the organizational structure and concepts for measurement traceability. Present NBS radiation measurement assurance programs are described briefly. Intended future measurement assurance activities are described generally, particularly those of interest to state radiation control programs.

709,542
PB80-104375 Not available NTIS
National Bureau of Standards, Washington, DC.
Convenient Standard for Low-Field Susceptibility Calibration.
Final rept.,
J. Rosenbaum, E. Larson, R. Hoblitt, and F. R. Fickett. Aug 79, 3p
Pub. in Review of Scientific Instruments 50, n8, p1027-1029, Aug 79.

Keywords: *Magnetic permeability, *Standards, Calibrating, Measurement, Iron oxides, Glass, Powders, Reprints, *Magnetic susceptibility.

Finely ground mixtures of magnetic iron oxide and glass provide a convenient calibration standard of moderate accuracy (approximately 5%) for low-field (<0.5 kA/m) magnetic susceptibility measurements. The use of powders allows fabrication of standards of nearly any shape and size. For our mixtures, which range from 0.063 to 11.8% iron oxide by weight, the susceptibility values vary from 2.65 x 10 to the minus 7 power to 5.77 x 0.0000577 cu m/kg, and are nearly linear with iron oxide concentration.

709,543
PB80-104425 Not available NTIS
National Bureau of Standards, Washington, DC.
Design of an Extended-Range, Three-Wavelength Distance-Measuring Instrument.
Final rept.,
S. E. Moody, and J. Levine. 1979, 6p
Grant NSG-7344
Pub. in Tectonophysics 52, p77-82 1979.

Keywords: *Distance measuring equipment, Design, Reprints.

The report describe an extension of current multiwavelength Electromagnetic Distance Measurement (EDM) techniques which should allow the range of multiwavelength measurements to be extended to approximately 50 km. The basic modification needed is the replacement of the retro-reflector commonly used by an active station containing lasers and a microwave source. Because the system will always be operated as a full three-wave-length instrument, accuracies of about 5 x 10 to the minus 8th power at 50 km should be obtainable on a routine basis under reasonably clear weather conditions.

709,544
PB80-109044 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 63, Number 10, October 1979.
Monthly rept.
Oct 79, 40p NBS/DIM-63/10
See also Volume 63, Number 6, dated Jun 79, PB-297 836.Color illustrations reproduced in black and white.

Keywords: *Periodicals, Fire safety, Computers, Semiconductors(Materials), Safety, Neutron radiography, Computer networks, Measurement, Molybdenum, Temperature, Proteins, Standards, Cardiac pacemakers, Standard reference materials.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Fighting Fire with Fire Research; The New, Improved Computer Standards Program; A Little Less Witchery, A Little More Craft; Science on Safety's Side; Neutron Radiography of Cardiac Pacemaker Batteries; The Network Measurement Instrument; Molybdenum Temperature Standard Reference Material; Two Total Protein Standards Available; Conferences; Publications; New Briefs.

709,545
PB80-114143 Not available NTIS
National Bureau of Standards, Washington, DC.
Future of Superconducting Instruments in Metrology.
Final rept.,
D. B. Sullivan, L. B. Holdeman, and R. J. Soulen. 1978, 11p
Pub. in Future Trends in Superconductive Electronics, p171-181 1978.

Keywords: *Measuring instruments, *Superconductivity, Measurement, Metrology, Temperature measurement, Technology innovation, Forecasting.

Superconductivity has played a major role in the development of useful new methods for standards and measurements, particularly for dc and high-frequency instruments and for thermometry. In this paper the authors speculate on future activities in this field, including the development of commercial instruments, the improvement of devices for standards laboratories, and the adaptation of some of these systems to small refrigerators.

709,546
PB80-115850 Not available NTIS
National Bureau of Standards, Washington, DC.
Review of Flicker Noise Frequency Instabilities in Precision Frequency Standards.
Final rept.,
D. W. Allan. 1977, 15p
Pub. in Proc. Symp. on 1/f Fluctuations, Held at Tokyo, Japan on Jul 11-13, 1977, p158-172 (IEE of Japan).

Keywords: *Frequency standards, Oscillators, Noise, Stability, Flicker noise.

Flicker noise has limited the performance of precision oscillators since their advent as a technological tool. Flicker noise in its common usage is defined as a noise process which has a spectral density which is inversely proportional to the Fourier frequency F ((S sub y)(f) = (1/hf)) where y(t) is a time varying process whose fluctuations are being characterized, 1/h is the proportionality constant (noise level).

709,547
PB80-117393 Not available NTIS
National Bureau of Standards, Washington, DC.
Microwave Time and Frequency Standards.
Final rept.,
H. Hellwig. 1979, 12p
Pub. in Radio Science 14, n4, p561-572, Jul-Aug 79.

Keywords: *Time standards, *Frequency standards, Atomic clocks, Cesium frequency standards, Crystal oscillators, Rubidium frequency standards, Hydrogen, Microwave frequencies, Reprints.

Today's time and frequency standards which are in active use, ranging from the definition of the second to spacecraft applications, are all based on atomic resonances in the microwave region controlling high-performance quartz crystal oscillators. The present status of these standards is presented, focusing in particular on cesium, hydrogen, and rubidium devices, as well as on new quartz crystal standards. A coherent picture of their physical principles and limitations is given, based on the common attempt to reduce perturbations and Doppler effects. The sharpness of the resonance line is linked to the flicker noise stability limit of the various standards, and some speculation is made on where and how much further improvements may occur. It is demonstrated how new design concepts and new physical methods most likely will significantly improve the accuracy, stability, and practical usefulness of time and frequency standards.

709,548
PB80-130701 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 63, Number 12, December 1979.
Monthly rept.
Dec 79, 37p NBS/DIM-63/12
See also Volume 63, Number 6 dated Jun 79, PB-297 836.

Keywords: *Periodicals, Data processing security, Resources, Units of measurement, Metric system, Concretes, Mechanical properties, Coal gasification, Recycling.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Protecting Citizens' Rights; Once is Enough; Guidelines for the Use of Modernized Metric System; Refractory Concrete Strength Measured Under Simulated Usage; Chemical Degradation of Refractory Liners in Coal Gasifier Systems; Data Centers Established to Aid Coal Conversion Industry; Conferences; Publications; Index; News Briefs.

709,549
PB80-131105 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of Stylus Radii.
Final rept.,
T. V. Vorburger, E. C. Teague, F. E. Scire, and F. W. Rosberry. 1979, 11p
Pub. in Wear 57, p39-49 1979.

Keywords: *Measurement, Radii, Surface roughness, Measuring instruments, Optical microscopes, Electron microscopy, Reprints.

In stylus measurements of surface texture the measured results for roughness depend on the stylus radius. Therefore it is important to determine the stylus radius. Since stylus tips are not perfectly spherical, the local radius of curvature varies significantly over the surface which makes the determination of an effective radius difficult. Both the techniques used to generate stylus profiles and the subsequent algorithms used to derive an effective radius are discussed. Comparisons are made between three techniques: sharp-edge traces, optical microscopy and scanning electron microscopy. Several algorithms, including that prescribed by the American National Standard ANSI B46-1, are discussed. It is concluded that the radius scale method is accurate, unambiguous and easy to use for routine measurements in the laboratory.

709,550
PB80-141542 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 63, Number 11, November 1979.
Monthly rept.
Nov 79, 41p NBS/DIM-63/11
See also Volume 63, Number 6 dated Jun 79, PB-297 836.Color illustrations reproduced in black and white.

Keywords: *Periodicals, Corrosion, Protons, Fire safety, Wood, Stoves, Auxiliary equipment(Computers), Photometry, Gas pipelines, Optical coatings, Solar energy, Absorption, Measurement, Wood burning furnaces, Equipment interfaces, Gyromagnetic ratio, Fundamental constants, Fine structure.

This monthly magazine features short summaries of major technical developments, highlights of work in

progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Meeting Mother Nature on Her Own Turf; The Precisely Precessing Proton; Fire Safety Tips for Wood-Burning Appliances; Tenth Anniversary of NBS-TAPPI Collaborative Reference Paper Program; NBS Announces Four Computer Interface Standards; New Photometric Calibrator Performs Direct Measurement; Girth Weld Standards for Alaskan Natural Gas Pipeline; 'Ultra-Black' Coating for High Absorptance of Solar Energy; Conferences, Publications; News Briefs.

709,551
PB80-144223 Not available NTIS
National Bureau of Standards, Washington, DC.
Precision and Replication: Critique I.
Final rept.,
H. J. Kostkowski. 1979, 11p
Pub. in Proc. Controlled Environments Working Conf., Madison, WI, Mar 12-14, 1979, p331-341 1979.

Keywords: *Meteorology, Accuracy, Calibrating, Errors, Precision, Standards, US NBS.

This paper consists of: (1) a summary of the standards and calibrations that are pertinent to measurements of controlled environments that are pertinent to measurements of controlled environments that are available from the National Bureau of Standards; (2) estimates of the state-of-the-art accuracy available with commercial instruments; (3) a discussion of why an accurate calibration does not insure an accurate measurement; and (4) some brief remarks about the uncertainty of error estimates.

709,552
PB80-162589 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Threshold Curves for Superconducting Interferometers.
Final rept.,
R. L. Peterson, and C. A. Hamilton. Dec 79, 8p
Pub. in Journal of Applied Physics 50, n12, p8135-8142, Dec 79.

Keywords: Interferometers, Josephson junctions, *Superconductivity, Reprints.

Threshold curves for multijunction superconducting interferometers have been calculated previously, showing general agreement with observed features, especially in symmetric cases. More details are added to the analysis, paying particular attention to the effects of asymmetrics in coupling, inductance, or critical currents. Feed-loop inductance and flux quantization in the feed loop can be important. A changing lobe pattern over many periods, asymmetries within a period, shifting patterns between runs spanning a warm-up, and sudden changes in pattern because of noise in the environment are all quantitatively explainable on the basis of this model. By use of a single calibration curve, the inductance for symmetric two- or three-junction interferometers can be obtained immediately.

709,553
PB80-169527 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 64, Number 1, February 1980.
Monthly rept.
Feb 80, 29p NBS/DIM-64/1
See also Volume 63, Number 12, PB80-130701.

Keywords: *Periodicals, Quality assurance, Fundamental constants, Measurement, Exhaust gases, Eddy currents, Nondestructive tests, Atomic properties, Atomic spectra, Line spectra, Calcium, Energy forecasts.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Equity Beyond the Marketplace, D. Johnson; Energy Forecasting: Improving on the Crystal Ball, M. Baum; In the Pursuit of Precision, M. Baum; NBS Measurement Seminars, M. Baum; Gas SRM's for Emissions Testing of Heavy Duty Vehicles, G. Porter; Eddy Current Imaging System, B. Field; Economical and Accurate Method for Calculation of Atomic Properties, S. Younger; Resolution of Photon-Recoil Components of Visible Spectral Line, R. Barger; Conferences, Publications, News briefs.

709,554
PB80-169535 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 64, Number 2, March 1980.
Monthly rept.
Mar 80, 40p NBS/DIM-64/2
See also Volume 64, Number 1, PB80-169527.

Keywords: *Periodicals, Symbols, Measurement, Industrial engineering, Antifouling coatings, X rays, Gamma rays, Magnetization, Surface properties, Serums.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Signs of the Times, L. Chen and B. Plocinik; Measurement and Industrial Development in the 1980's, T. Dillon; The End of the Free Ride, G. Porter; Improved X-Ray and Gamma-Ray Measurements Have Several Applications, R. Deslattes; NBS Opens New Industrial Furnace Facility, M. Baum; Surface Magnetism Studied Using Polarized Electrons, D. T. Pierce; Definitive Measurements of Constituents of Human Serum, E. White; Conferences, Publications, News briefs.

709,555
PB80-203433 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 64, Number 3, April 1980.
Monthly rept.
Apr 80, 28p NBS/DIM-64/3
See also report dated Mar 80, PB80-169535.

Keywords: *Periodicals, Gamma rays, Calibrating, Trace elements, Drugs, Chemical reactions, Antennas, Budgets, Standards, Raman spectroscopy, Laser enhanced reactions.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: So Near, Yet So Far, F. McGehan; NBS Budget Request, M. Heyman; These Are Gamma Rays Color Them Blue, M. Baum; New NBS Gas Flow Calibration Service is Referenced to Mass Flow Standards, K. Higgins; Laser-Initiated Chemical Chain Reactions, S. Leone; Trace Characterization of Drugs of Abuse, J. Blaha; Conferences; Publications; News Briefs.

709,556
PB80-212160 Not available NTIS
National Bureau of Standards, Washington, DC.
Limitations on Long-Term Stability and Accuracy in Atomic Clocks,
D. J. Wineland. 1979, 30p
Pub. in Proceedings of the Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (11th), Greenbelt, MD., November 27-29, 1979, NASA Conference Publications 2129, p81-110 1979.

Keywords: *Atomic clocks, Accuracy, Stability, Frequency standards.

The limits to accuracy and long-term stability in present atomic clocks are examined. In order to achieve a significant increase in performance, it appears that the limitations must be attacked on a fundamental level. For instance, the problem of residual first-order and second-order Doppler shifts has for many years been approached by asking how we can better measure these shifts. A more fundamental approach might be to ask how we can significantly lower the velocity of the atoms. An attempt will be made to put recent proposals for new frequency standards into perspective. The advantages and disadvantages of frequency standards based on such ideas as laser transitions, single atoms, and atom cooling are examined. In addition, the applicability of some of these new techniques to existing standards is discussed.

709,557
PB80-212178 Not available NTIS
National Bureau of Standards, Washington, DC.
Prospects for Advances in Microwave Atomic Frequency Standards,
F. L. Walls. 1979, 22p
Pub. in Proceedings of the Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (11th), Greenbelt, MD., November 27-29, 1979, NASA Conference Publications 2129, p619-640 1979.

Keywords: *Frequency standards, Microwave frequencies, Resonators.

This paper will focus on conceptual and component developments which could have a major impact on the performance of microwave atomic frequency standards. Traditional microwave standards based on rubidium, cesium and hydrogen have been greatly refined over the past decade, such that the frequency stability of the current generation of devices is generally limited by the basic concepts on which they are based, as well as with the performance of various key subsystems. Future advances in ultimate frequency stability and environmental performance will primarily come from new conceptual developments, and only secondarily from improved components. These new advances will be explored in some detail and projections for possible performance improvements made for microwave frequency standards based on rubidium, cesium and hydrogen. Brief mention of a new class of standards based on stored ions will be made.

709,558
PB80-215874 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Temperature.
Final rept.,
R. P. Hudson. Jul 80, 11p
Pub. in Review of Scientific Instruments 51, n7 p871-881 Jul 80.

Keywords: *Temperature measurement, Reviews, Reprints.

A general review of thermometry is presented. Topics covered include the concept of temperature and temperature scales; the International Practical Temperature Scale (IPTS); the roles played by the Advisory Committee on Thermometry and its parent International Committee on Weights and Measures; anticipated improvements in an extension of the IPTS; recent advances in primary thermometry; and current developments of practice (including fixed points and interpolation devices, and practical temperature measurements at the secondary level).

709,559
PB80-216492 Not available NTIS
National Bureau of Standards, Washington, DC.
Advances in High Pressure Research with the Diamond Anvil Cell.
Final rept.,
S. Block, G. J. Piermarini, and R. G. Munro. 1980, 8p
Pub. in La Recherche 11, n113 p806-813 1980.

Keywords: *Load cells, High pressure tests, Measurement, Diamonds, Reprints.

The significance of pressure as a research variable is reviewed at an introductory level. The role of the diamond anvil cell, which was developed at NBS, is described with illustrations of its many applications. The importance of the ruby pressure scale, also developed at NBS, is discussed in terms of its utility and its impact to high pressure research activity. The effects of pressure on the states of matter are examined in the context of serveral examples of recent works using diamond anvil cells. The applications that are mentioned include infrared, reman, and optical spectorscopy, x-ray diffraction, electrical resistance measurements, determinations of the viscosities and glass transition pressures of liquids, and the general topic of phase transitions. Trends for high pressure research in the immediate future are briefly outlined.

709,560
PB80-218498 Not available NTIS
National Bureau of Standards, Washington, DC.
Reference Wavelengths. Infra-red to Gamma-Rays, Avogadro's Constant, Mass and Density.
Final rept.,
R. D. Deslattes. Aug 80, 66p
Pub. in Proceedings of the Course LXVIII 'Metrology and Fundamental Constants' Summer School of Physics-Enrico Fermi, Varenna, Italy Jul 76, p38-113 1980.

Keywords: *Metrology.

The accompanying text reflects, with subsequent revision, lecture notes distributed at the course. These notes represent the most complete and up-to-date summary of the entire range of the activities in the field

of fundamental constants type work over the past decade.

709,561
PB80-222698 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 64, Number 4, May/June 1980.
Monthly rept.
Jun 80, 33p NBS/DIM-64/4
See also report dated Apr 80, PB80-203433.

Keywords: *Periodicals, Food packaging, Plastics, Measurement, Nondestructive tests, Acoustic signals, Chemical bonds, Nuclear fuels, Air pollution, Food contamination, *Acoustic emissions.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Wrapping It right, G. Porter; Report from the International Bureau of Weights and Measures, L. Barbrow; The Sounds of Failure, M. Baum; NBS and Martin Marietta Develop Program for Nondestructive Evaluations, G. Porter; Bond Energies and Chemical Reactivity, W. Tsang; Nuclear Fuel Assay Using Resonance Neutrons, R. Schrack; Standard for Lead on Filter Media, SRM; Oyster Tissue Standard Reference Material, SRM; Conferences; Publications; News Briefs.

709,562
PB80-228976 Not available NTIS
National Bureau of Standards, Washington, DC.
Innovation and U.S. Research: Problems and Recommendations.
Final rept.,
W. N. Smith, and C. F. Larson. 1980, 11p
Pub. in Proceedings of the Meeting of the American Chemical Society (178th), Washington, DC., 9-14 Sep 79, ACS Symposium Series 129, p159-169 1980.

Keywords: National government, *Research projects, History, National Bureau of Standards.

The talk covers experiences at the National Bureau of Standards during World War II and the years immediately following. It compares the administration of R&D at NBS and other Government laboratories with that period and the present day. The talk also touches on the present situation in the management of industrial R&D and points out some of the difficulties with management which is excessively oriented to short-term pay-off.

709,563
PB80-600045 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Small Gas Thermometer for Use at Low Temperatures.
C. T. Van Degrift, W. J. Bowers, D. G. Wildes, and P. B. Pipes. 1980, 5p
Pub. in ISA Trans. 19, n1 p15-19 1980.

Keywords: *Gas Thermometers, Low temperature, Microwave temperature sensor, Temperature transducer, Thermometer, Tunnel diode oscillators.

This paper describes a 2-cm dia X 5-cm long gas thermometer that uses an extremely stable tunnel diode oscillator. When biased with a dc current of 114 muA(15 muW), it emits a frequency between 456 and 463 MHz, depending on the pressure of its 0.39 ml sample of permanently trapped He3 gas. Measurements of the dependence of its frequency in temperature and magnetic field are presented, as well as preliminary tests of its drift and noise.

709,564
PB81-113201 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 64, Number 7, September 1980.
Monthly rept.
Sep 80, 33p NBS/DIM-64/7
See also Volume 64, Number 6 dated Aug 80, PB81-103632.

Keywords: *Periodicals, Research, Scientists, Standards, National Bureau of Standards.

Contents:
- I-R 100 awards to NBS inventors;
- Rabinow--Scientist of the Year;
- Energy efficiency studies at NBS;
- Voluntary product standards;
- NBS announces I/O interface verification guidance;
- Gas phase structure of sulfuric acid;
- Didymium glass filters;
- and Numerical control machine tools.

709,565
PB81-115370 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC.
Analysis of the Effects Dynamic and Static Forces Present in the NBS SI Volt Experiment.
Final rept.
M. E. Cage. Sep 80, 219p NBSIR-80-2143

Keywords: *Electrical measurement, *Units of measurements, Standards, Metrology, Equations of motion, Mathematical analysis, International system of units.

An analysis of the NBS SI volt experiment has been made first to obtain algebraic expressions for the electrical forces present on the suspended electrode of the electrometer. These forces, and the gravitational forces, are used in the Principle of Virtural Work and D'Alemberts Principle to obtain the second order, nonlinear, inhomogeneous, coupled differential equations of motion for the balance. Exact, analytical solutions of these equations of motion are obtained using small angle approximations and perturbation methods. Estimates are then made of the uncertainties that might result in both the slope and path integral methods in order to determine what requirements must be satisfied to reduce the systematic and random errors of the force determination and the capacitance measurements to acceptable levels so that the SI volt can be determined to within a few ppm.

709,566
PB81-133654 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 64, Number 8, October 1980.
Monthly rept.
Oct 80, 32p NBS/DIM-64/8
See also Volume 64, Number 7 dated Sep 80, PB81-113201.

Keywords: *Periodicals, Research, Standards, Safety, Tests, National Bureau of Standards.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: A Look at Federal Office Automation, S. Radack; Safer Practice Makes Perfect, K. Kuo; Electrical Wiring: Staying on the Safe Side, G. Porter; I-C Test Structures for Random Faults, M. Baum; Temperature Reference Materials Available, SRM; Degradation of Solar Absorber Coatings, L. Masters; Test of Radiation Exposure Calculation for Reactor Pressure Vessels, E. McGarry.

709,567
PB81-140212 Not available NTIS
National Bureau of Standards, Washington, DC.
ASTM Committee E36 Participation in Testing Laboratory Evaluation and Accreditation.
Final rept.
G. A. Berman. Dec 80, 3p
Pub. in American Society for Testing and Materials, Standards News 8, n12 p8-10 Dec 80.

Keywords: *Laboratories, Evaluation, Standards, Reprints, Accreditation.

ASTM Committee E36 on Criteria for the Evaluation of Testing Laboratories and Inspection Agencies was established in 1973 to develop generic standards which could be used by accreditors as a basis for laboratory evaluation.

709,568
PB81-142804 Not available NTIS
National Bureau of Standards, Washington, DC.
Proficiency Testing - An Essential Element of Laboratory Accreditation.
Rept. for 1977-79.
D. S. Kirkpatrick, and J. Horlick. Dec 80, 4p
Pub. in American Society Testing Material Standard News 8, n12 p14-17, 48, Dec 80.

Keywords: *Laboratories, Performance evaluation, Thermal insulation, Reprints, Accreditation.

The National Voluntary Laboratory Accreditation Program (NVLAP) is a laboratory performance program operated by the Department of Commerce which currently accredits, upon request, laboratories that test thermal insulation materials, carpets, and freshly mixed field concrete.

709,569
PB81-142911 Not available NTIS
National Bureau of Standards, Washington, DC.
Electroforming a Micrometer Scale of 50 Micrometers (2 mil) Overall Length.
J. P. Young, F. Ogburn, and D. B. Ballard. Aug 80, 3p
Pub. in Metal Finishing, p27-29 Aug 80.

Keywords: *Standards, *Units of measurement, Micrometers, Electroplating, Electron microscopes, Reprints.

A procedure is described for constructing an accurate micrometer scale by electroplating methods to form alternate layers of nickel and gold which show good contrast in an electron microscope.

709,570
PB81-145922 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions /NBS.Volume 64, Number 9, November 1980.
Nov 80, 33p NBS/DIM-64-9
See also Volume 64, Number 7, PB81-113201.

Keywords: *Periodicals, Research, National Bureau of Standards.

Contents:
- Putting it all together--Alaskan pipeline weld criteria;
- Testing without destruction--Nondestructive evaluation techniques;
- Progress toward a new scale of temperature;
- New Raman microprobe with multichannel detectors;
- Kinetic data base for atmospheric chemistry;
- Breakdown between bare electrodes;
- Optical nondestructive evaluation;
- Trace elements in water.

709,571
PB81-149437 Not available NTIS
National Bureau of Standards, Washington, DC.
Cavity Radiometer Reflectance.
E. F. Zalewski, J. Geist, and R. C. Willson. 1979, 7p
Pub. in Proceedings of Annual International Tech. Symposium of the SPIE (23rd), San Diego, CA., August 27-30, 1979, Paper in Measurements of Optical Radiations 197, p152-158 1979.

Keywords: *Radiometers, Reflectance, Calibrating.

The evolution of absorbing surfaces for electrically calibrated radiometers, and techniques for measuring their absorptance (reflectance) are described. A new reflectometer for cavity reflectance measurements, which is based on a ring-shaped silicon photodiode, is described. The results of reflectance measurements on a series of cavities which represent the evolution of cavity technology are presented, and the significance of the results for future research are discussed.

709,572
PB81-164881 Not available NTIS
National Bureau of Standards, Washington, DC.
Comments on the Paper 'NBS and Metrication', by A. A. Bartlett.
Final rept.
D. T. Goldman. Dec 80, 4p
Pub. in Jnl. Physics Today Letter, p70-72 Dec 80.

Keywords: *Metric system, Weight(Mass), Force, Reprints.

The NBS spokesman, Dr. David T. Goldman responds to each charge concluding that not to recognize the dual use of the term weight as both mass and force would mean that the Bureau was neglecting both important sectors of the economy and the experience of foreign countries who have been on the metric system for a long time. On the other hand, NBS has made the proper distinction between the International System of Units and the quantities to which they refer, using kilogram as the unit of mass and newton as the unit of force.

709,573
PB81-170276 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 64, Number 10, December 1980.
Monthly rept.
Dec 80, 37p NBS/DIM-64/10
See also Volume 64, Number 8, PB81-133614.Color illustrations reproduced in black and white.

Keywords: *Periodicals, Measurement, Solar heating, Detectors, Temperature measuring instruments, Neutron radiography, Standards.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: An Effective National Program, M. Baum; Southern Exposure, G. Metz; Arson Sniffers, E. Rudin; Neutron Radiography Used for Inspecting Jet Engines, G. Porter; Tracealloy Standard Issued, SRM; Activities in Wood-Heating Safety, R. Peacock, and Fluidic Temperature Sensors, T. Negas.

709,574
PB81-171910 Not available NTIS
National Bureau of Standards, Washington, DC.
Discussion--Panel on the Statistical Evaluation in the Course of Certification.
Final rept.
H. H. Ku. 1980, 4p
Pub. in Proceedings of the International Symposium on the Production and Use of Reference Materials, Bundesanstalt fuer Materialpruefung (BAM) Held at Berlin, Germany on Nov 13-16, 1979, Paper in Production and Use of Reference Materials, p497-500, 1980.

Keywords: Statistical analysis, Measurement, Precision, *Reference materials, Uncertainty.

Topics relating to some statistical problems encountered in the course of certification of Reference Materials: include (1) appropriate uncertainty statement on a certificate; (2) analysis leading to the value of uncertainty statement and the underlying assumptions; and, (3) a 'well-characterized' measurement system as basis of a 'well-characterized' reference material.

709,575
PB81-176570 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 65, Number 1, January/February 1981.
Monthly rept.
Feb 81, 32p NBS/DIM-65/1
See also Volume 64, Number 8, PB81-133654.

Keywords: *Periodicals, Research, Electrical insulators, Monitors, Air pollution, Standards, Tests, Measurement.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Insulators: Liquid, Solid, or Gas, E. Rudin; A Sample a Day..., G. Porter; Glass-Liquidus Temperature Testing, M. Cellarosi; Changes in SRM Inventory, S. Rasberry; Antenna Coupling Analyzed, A. Yaghjian; Research Improves Time-Domain Calibrations, N. Nahman; and Measurement Program for State Weights and Measures, H. Opperman.

709,576
PB81-178576 Not available NTIS
National Bureau of Standards, Washington, DC.
Fibrous Glass Board as a Standard Reference Material for Thermal Resistance Measurement System.
Final rept.
M. C. I. Siu. 1981, 18p
Pub. in Proceedings of the Symposium on Thermal Insulation Performance Held at Tampa, FL., on Oct 23-25, 1978, American Society for Testing and Materials, Special Technical Publication 718, p343-360 1981.

Keywords: *Standards, *Thermal resistance, Calibrating, Heat transmission, Thermal conductivity, *Standard reference materials.

Results of thermal measurements on over 300 pairs of fibrous glass board specimens, and statistical analysis of the data, are presented. This material is available as a Standard Reference Material (SRM) from the Office of Standard Reference Materials, National Bureau of Standards, Washington, D.C. 20234. Considerations are discussed for effective use of this SRM in the calibration of measurement systems such as the guarded hot-plate and heat flow meter apparatuses.

709,577
PB81-207201 Not available NTIS
National Bureau of Standards, Washington, DC.
Utilization of Monoenergetic X-Ray Beams to Examine the Properties of Radiographic Intensifying Screens.
Final rept.
C. E. Dick, and J. W. Motz. Apr 81, 5p
Proceedings of the Conference on Application of Accelerators in Research and Industry (6th) Held at Denton, TX., on November 3-5, 1980.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-28, n2 p1554-1558 Apr 81.

Keywords: *Screens(Displays), *X rays, NTIS-COMNBS.

Monoenergetic x-rays beams, produced by the direct electron excitation of characteristic K x rays in elemental targets, are important for measuring the response of different components of radiologic imaging systems. The technique of single photon counting is being employed to determine the relative probability distribution of the number of optical photons emitted from the screen after absorption of an incident x ray. These data can be used to determine the average number of light quanta emitted per absorbed x ray. In addition, the shape of these distributions can be used to determine the image information transfer properties of a particular screen. Results of these measurements for a typical calcium tungstate screen and one of the new rare-earth phosphor screens are presented.

709,578
PB81-211591 Not available NTIS
National Bureau of Standards, Washington, DC.
Sub-Micrometer Length Metrology: Problems, Techniques and Solutions.
Final rept.
S. Jensen, and D. Swyt. 1980, 14p
Pub. in Proceedings of Scanning Electron Microscopy held at Chicago, IL., on April 21-25, 1980, p393-406 1980.

Keywords: *Metrology, *Electron microscopy, Length, Line width, *Dimensional measurement, Scanning electron microscopy, Transmission electron microscopy, Optical microscopy, Reference standards, NTIS-COMNBS.

The need for accurate dimensional measurements of lateral features on micrometer sized objects such as planar structures and spherical particles is rapidly expanding. This has fostered a number of metrologic techniques using the SEM, the TEM, and optical microscopy. These techniques are reviewed and a comparison of their relative utility for sub-micrometer length metrology is made. Limitations inherent in each technique are explored. A review of presently available reference standards for both displacement and width measurements is made along with a discussion of the utility of each of these standards.

709,579
PB81-226847 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 65, Number 2, March 1981.
Monthly rept.
Mar 81, 33p NBS/DIM-65/2
See also Volume 64, Number 8 dated Oct 80, PB81-133654.

Keywords: *Periodicals, Research, Standards, Measurement, National Bureau of Standards.

Contents:
- NBS through the years;
- Fishing on the computer frontier, E. Rudin;
- Measuring through thick and thin, M. Heyman;
- Calibrating the FFTF, M. Baum;
- Planning for future SRM's, S. Rasberry;
- NBS develops new clock-synchronization technique, D. Allan;
- Program aids critical evaluation of single-crystal and powder data, J. Stalick;
- Cooling atomic ions with lasers, J. Bergquist.

709,580
PB81-233710 Not available NTIS
National Bureau of Standards, Washington, DC.
Implications of United States Participation in the International Organization of Legal Metrology (OIML).
Final rept.
D. E. Edgerly. Mar 81, 6p
Pub. in Proceedings of Workshop and Symposium National Conference of Standards Laboratories (1980), Gaithersburg, MD., September 22-25, 1980, Paper in NCSL Newsletter 21, n1 p32-37 Mar 81.

Keywords: *Metrology, Standards, International relations, Trends.

This paper examines the economics of the measurement instrument industry; provides an overview of domestic and international trends in standardization; and, finally, suggests the significance of the United States presence in the International Organization of Legal Metrology (OIML).

709,581
PB81-234684 Not available NTIS
National Bureau of Standards, Washington, DC.
Pulse Reference Waveform Standards Development at NBS.
Final rept.
J. R. Andrews. Jan 81, 7p
Pub. in Proceedings of ATE Seminar/Exhibit Automated Testing for Electronics Manufacturing, Pasadena Center, Pasadena, CA., January 19-22, 1981, pIV-13-IV-19 1981.

Keywords: *Waveform generators, Standards, Pulse generators.

NBS has developed a pulse reference waveform generator for use as a transfer standard. The generator consists of a tunnel diode, step generator (t sub d = 20dps) driving a low-pass filter. Three filters are available for t sub d = 50, 100 and 200 ps. The output is a clean, gaussian-like step waveform. The low-pass filters, of NBS design, are 30 cm long, 7 mm diameter, coaxial air lines filled with a lossy, Debye-type, liquid dielectric.

709,582
PB81-235053 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 65, Number 3, April 1981.
Monthly rept.
Apr 81, 29p NBS/DIM-65/3
See also Volume 54, Number 8, PB81-133654.

Keywords: *Periodicals, Measurement, Earthquakes, Physics, Fracture strength, Fire safety, Research, National Bureau of Standards, Consumer products, Solar collectors.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Swinging to the earth's tilt; Testing for technical competence; Physics at the measurement limits; New parameter proposed for fracture toughness; Study evaluates solar collector cover plates; Improved modeling of cement and concrete; Fire development in basement rooms, and Generation and measurement of DC electric field with space charges.

709,583
PB81-244873 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Analysis of Results of Mini Round Robin Reflectance Test.
J. C. Richmond. Aug 81, 34p NBSIR-81-2311

Keywords: *Reflectance, Tests, Standards.

A mini round robin test was conducted in which four national laboratories participated. The spectral directional-hemispherical reflectance for near-normal incidence of two samples, one black and one white, was measured in the wavelength range of 250 to 2500 nm. The solar reflectance of the white sample and the solar absorptance of the black sample was then computed. Each laboratory used a different procedure for making the computations. The measured samples had previously been calibrated in the Radiometric Physics

Division of the National Bureau of Standards for certification as reflectance standards.

709,584
PB82-120387 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS: Volume 65, Number 5, July 1981.
Jul 81, 29p NBS/DIM-65/5
See also Volume 65, Number 3, PB81-235053.

Keywords: *Periodicals, Metals, Alloys, Magnetic tape, Photographic film, Deterioration, Industries, Research management, Electromagnetic radiation, Standards, National Bureau of Standards, Solar collectors.

The monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is as follows: Getting more for less; Preserving the past; NBS Research forges strong link with industry; New NBS instrument monitors electromagnetic radiation; Verification procedures for federal interface standards; Hybrid planar-cylindrical scanning technique; Spin dependent-mean free paths; New SRM aids detection of PAH's; Copper 'Benchmark' SRM's available; Conferences; Publications; and Newsbriefs.

709,585
PB82-141490 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS, Volume 65, Number 6, August 1981.
Monthly rept.
Aug 81, 28p NBS/DIM-65/6
See also Volume 65, Number 2, PB82-226847.

Keywords: *Research, Fire fighting, Atomic mass, Oils, Faraday, Hot atom chemistry, Biphenyl/chloro, Polychlorinated biphenyls, National Bureau of Standards.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Firefighting in the computer age, Cohn; A blueprint for the future; A Faraday keeps the doctors astray, Baum; NBS develops cheap, effective method to predict drill failure, Baum; New method of probing 'hot' atom phenomena, Leone; Coal slurry level monitor developed; Measuring PCB's in lubricating and cooling oils, Chesler.

709,586
PB82-234675 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of a High Intensity Laboratory X-ray Source to EXAFS Spectroscopy.
Final rept.
G. G. Cohen, and R. D. Deslattes. 1982, 7p
Pub. in Nuclear Instruments and Methods 193, p33-39 1982.

Keywords: Design, Performance, *X ray absorption, EXAFS system, Operation.

A practically-oriented summary for the design and operation of a high-performance laboratory EXAFS (Extended X ray Absorption Fine Structure) system is presented. Emphasis is on an evaluation of total system performance, including both geometrical and crystal diffraction effects.

709,587
PB82-236837 Not available NTIS
National Bureau of Standards, Washington, DC.
First Time Balls.
Final rept.
I. R. Bartky, and S. J. Dick. 1981, 10p
Prepared in cooperation with Naval Observatory, Washington, DC.
Pub. in Jnl. Hist. Astron. xii, p155-164 1981.

Keywords: *Time signals, *Chronometers, History, Reprints, *Time balls.

The use of visual time signals, or time balls, to rate chronometers is described. An analysis of the 19th British naval literature and material in the National Archives of the United States shows that the first time ball was at the Portsmouth, England base in 1829, rather than the Royal Observatory, Greenwich in 1833. Other early time balls and the observatories associated with them are discussed.

709,588
PB82-236845 Not available NTIS
National Bureau of Standards, Washington, DC.
First North American Time Ball.
Final rept.
I. R. Bartky, and S. J. Dick. 1982, 5p
Prepared in cooperation with Naval Observatory, Washington, DC.
Pub. in Jnl. Hist. Astron. xiii, p50-54 1982.

Keywords: *Time signals, Navigation, Reprints, *Time balls, Naval Observatory.

Accurate time dissemination for sea navigation and the general public was effected by time signals from astronomical observatories. The time signal devices, or time balls, began in 1829. The first North American time ball was installed on the dome of the U.S. Naval Observatory in Washington between 1 April 1845 and 1 September 1846. It was apparently the prototype for all American time balls erected by the U.S. Navy.

709,589
PB82-600005
(Order as PB83-164541, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Report on the Sixth International Symposium on Temperature.
B. W. Mangum, and G. T. Furukawa. 1982, 20p
Included in Jnl. of Research of the National Bureau of Standards, v87 n5 p387-406 1982.

Keywords: *Fixed points, Symposium, Temperature scale, Thermometers, Thermometry.

This is a report on the Sixth International Symposium of Temperature which was held in Washington, DC, USA, March 15-18, 1982. Included is a brief introduction discussing the timeliness of the symposium, its sponsors, and the publication of the proceedings. The remainder of the report is devoted to a summary of the Plenary and Technical sessions of the symposium.

709,590
PB82-600055 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Introduction to Residual Stress Measurement.
L. Mordfin. 1981, 19p
Pub. in Proceedings Symp. on Nondestructive Measurement of Wheel/Axle Residual Stress, Cambridge, MA, June 16-17, 1981, p2.1.1-2.1.19 1981.

Keywords: *Barkhausen noise, Energy dispersive diffractometry, High-energy x rays, Hole-drilling method, Neutron diffraction, Nondestructive evaluation, Residual stress, Stress measurements, Ultrasonics, X-ray diffraction.

The origins and the effects of residual stresses are described, and several of the more prominent methods of measuring residual stresses are reviewed. Both destructive and nondestructive methods are included. The principal emphasis is on the relative capabilities and limitations of the various methods.

709,591
PB82-600063 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Standards for Residual Stress Measurement.
L. Mordfin. 1982, 7p
Pub. in Am. Soc. Test. Mater. Spec. Tech. Publ. 776, p6-12 1982.

Keywords: *Fatigue, Hole drilling, Nondestructive evaluation, Photoelasticity, Research needs, Residual stress, Standards, Stress measurement, Terminology, Ultrasonics, X-ray diffraction.

It has been long appreciated that residual stresses can exert significant influences on fatigue and fracture behavior, but only recently have analytical models been developed which enable the influences to be quantified. These new capabilities have fostered increased demands for residual stress measurements and these, in turn, have revealed that the reliability and the reproducibility of such measurements are often less than adequate. The need for standards for residual stress measurements is now recognized as being urgent. Few standards presently exist, and they do not provide the required levels of measurement reproducibility. Several organizations are attempting to respond to this critical need. This paper is a status report on the growing national effort to develop voluntary consensus standards to enhance the reproducibility of residual stress measurements. This effort has achieved noteworthy progress in only a few years, but it has also become evident that further progress will be increasingly more difficult because our understanding of some residual stress phenomena is limited. There is need for a national research effort to parallel and to support the standardization effort.

709,592
PB82-600064 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Noise Thermometry at NBS Using a Josephson Junction.
R. J. Soulen, and D. Van Vechten. 1982, 9p
Pub. in Temperature - Its Measurement and Control in Science and Industry 5, p115-123 1982.

Keywords: *Josephson effect, Noise thermometer, Nyquist equation, Superconducting fixed points, Thermodynamic temperature.

We have been measuring the Johnson noise generated by a resistor using a Josephson junction. From these measurements we have developed a temperature scale extending from 0.01 to 0.52 K. The estimated inaccuracy at the lower end is + or - 0.5%; at the higher end it is reduced to + or - 0.2%. These estimates are based in part on comparisons with a theta-ray anisotropy thermometer from 0.01 to 0.05 K and with a paramagnetic salt from 0.03 to 0.52 K. We also describe how extraneous noise sources may be detected and suppressed.

709,593
PB86-129624 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Nonparametric Calibration.
Final rept.
G. Knafl, J. Sacks, C. Spiegelman, and D. Ylvisaker. 1984, 9p
Pub. in Technometrics 26, n3 p233-241 Aug 84.

Keywords: *Calibrating, Mathematical models, Reprints, Systematic errors.

The paper deals with calibration when a linear model may not hold exactly. Usually, a calibration curve f is assumed to follow a linear model, e.g., $f(x) = a + bx$ or $f(x) = a + bx + c(x \text{ squared})$. As such calibration curves only approximate reality, there is a discrepancy between the assumed linear model and the true curve. This discrepancy produces systematic errors in the measurements obtained from the fitted calibration curve. The new procedures recommended here cope directly with such systematic errors, whereas the more traditional linear model approach cannot.

709,594
PB87-107082 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Coming Redefinition of Photometry.
Final rept.
G. L. Howett. 1986, 14p
Contract DE-AC03-76SF00098
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of the Illuminating Engineering Society 15, n2 p5-18 1986.

Keywords: *Photometry, Luminance, Brightness, Color, Reprints.

The paper is a relatively nontechnical tutorial explanation of the fundamental change in the definition of photometry that appears to be in the offing. The current definition of photometry is reviewed, and the problems with the definition are indicated, including the practical implications of the discrepancy between measured luminance and perceived brightness. The current theoretical explanation of these problems, based on the opponent-colors model, is summarized. The work of the CIE in the area is reviewed and the probable form of a new supplementary definition of photometry and of new photometric instruments is outlined. In order to facilitate coordination among visual scientists publishing in the field, new proposals concerning terminology and notation are offered. The relationship of current theory and data to 'visual sensitivity curves' is described.

709,595
PB87-107140 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Viscometer for Low Frequency, Low Shear Rate Measurements.
Final rept.
R. F. Berg, and M. R. Moldover. Aug 86, 6p
Contract NASA-C-86129-D
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Review of Scientific Instruments 57, n8 p1667-1672 Aug 86.

Keywords: *Viscometers, Shear rate, Measurement, Reprints.

The authors describe a torsion-oscillator viscometer whose low frequency (0.5 Hz) and very low shear rate (0.05/s) are required for measurements of shear sensitive fluids such as microemulsions, polymer melts and solutions gels, and liquid mixtures near critical points. The viscometer has a resolution of 0.2% when used with liquid samples and a resolution of 0.4% when used with a dense gaseous sample. The viscometer operates under computer control and is compatible with submillikelvin temperature control.

709,596
PB87-107165 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Miniature Contact Thermometer for Student Use.
Final rept.
T. J. Bruno, and J. G. Shepherd. 1986, 1p
Sponsored by Gas Research Inst., Chicago, IL., and Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Education 63, n5 p452 1986.

Keywords: *Temperature measuring instruments, Miniaturization, Reprints.

A miniature mercury contact switch for use in undergraduate chemistry teaching laboratories is presented. Details of construction of the switch are provided, as well as the circuit used with the switch. The advantages of the switch are discussed, in addition to some suggested applications.

709,597
PB87-107348 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Measurement Assurance Programs in a Field Environment.
Final rept.
W. G. Eicke, T. F. Leedy, B. R. Moore, and C. F. Brown. Mar 83, 5p
Sponsored by Army Missile Command, Redstone Arsenal, AL.
Pub. in National Conference of Standards Laboratories Newsletter 23, n1 p51-55 Mar 83.

Keywords: *Electrical measurement, Electric potential, Electric currents, Electrical resistance, Reprints.

To date most measurement assurance programs have been carried out between the National Bureau of Standards and various standards laboratories in the U.S. For the most part, these have been conducted at the highest accuracy levels. In the spring of 1982 the Army Missile Command and NBS conducted two special, lower accuracy, measurement assurance programs (S-MAP) at a field location at Redstone Arsenal, Alabama, in the areas of dc voltage, dc current, dc resistance, ac voltage, and ac current. The paper describes the experiments performed, presents the results, and discusses them in light of a number of externally imposed constraints.

709,598
PB87-108106 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Time-Resolved Magnetic Dispersion for Large Isotope Ratio Measurements in Resonance Ionization Mass Spectrometry.
Final rept.
J. D. Fassett, H. J. Zeininger, and L. J. Moore. 1986, 12p
Pub. in International Jnl. of Mass Spectrometry and Ion Processes 69, p285-296 1986.

Keywords: *Spectrometers, *Measurement, Isotopes, Ionization, Abundance, Sensitivity, Ion beams, Dispersions, Ratios, Reprints, Laser applications.

The principle of time-resolved magnetic dispersion of ions can be used to improve the abundance sensitivity for elemental ratio measurement with laser ionization. A pulsed laser tuned to a discrete electronic transition of an element efficiently and selectively produces a pulsed ion beam. The pulsed ion beam is focused through a magnetic sector and, thus, mass filtering due to time-of-flight dispersion and magnetic dispersion is combined. The time-resolved magnetic dispersion is demonstrated using rhenium. The origin of scattered ions which cause loss of abundance sensitivity is displayed graphically in the magnetic field/time plane. Increased abundance sensitivity is demonstrated using tantalum.

709,599
PB87-108155 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Development of a Temperature Compensated PVDF Transducer for Dynamic Pressure Measurements.
Final rept.
A. J. Bur, and S. C. Roth. 1984, 8p
Pub. in 1984 Annual Report--Conference on Electrical Insulation and Dielectric Phenomena, Wilmington, DE., October 21-25, 1984, p423-430.

Keywords: *Transducers, Dynamic pressure, Measurement, Temperature, Compensation, Thin films, Vinylidene chloride resins, Thermocouples, Adiabatic compression heating.

The pressure sensing element of the transducer is a thin film of polyvinylidene fluoride. The transducer is designed to measure dynamic pressures in the presence of thermal pulses which are produced by adiabatic compressional heating of the PVDF and its surroundings. Adiabatic heating of the PVDF will reduce its charge output by a constant 8%. Adiabatic heating of the surroundings will vary with each environment. Two approaches to compensating for environmental compressional heating are used.

709,600
PB87-110094 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Machine Representation of Standards.
Final rept.
R. N. Wright, and J. W. Lyons. Aug 86, 5p
Pub. in ASTM Standardization News 14, n8 p44-48 Aug 86.

Keywords: *Standards, Reprints.

No abstract available.

709,601
PB87-112298 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Semiconductor Measurement Technology: A Bibliography of NBS (National Bureau of Standards) Publications for the Years 1962-1985.
J. Walters. Oct 86, 107p NBSIR-86/3464

Keywords: *Measurement, *Semiconductor devices, Bibliographies, Metrology, Gallium arsenides, Insulation, Interfaces, Integrated circuits, Packaging, National Bureau of Standards, Listings.

The bibliography contains reports of work performed at the National Bureau of Standards in the field of Semiconductor Measurement Technology in the period from 1962 through December 1985.

709,602
PB87-113593 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Pulsed Laser Caliper for Noncontact Dimensional Measurement.
Final rept.
T. R. Lettieri. 1986, 7p
Pub. in Applied Optics 25, n9 p1443-1449, 1 May 86.

Keywords: *Dimensional measurement, Optical equipment, Reprints, *Laser applications, Noncontact measurement.

A new optical device for making caliperlike noncontact dimensional measurements on macroscopic objects is described. The device called a pulsed laser caliper, consists of a picosecond pulse laser, an ultrafast detector, various optical components, and a time-interval counter or high-speed sampling oscilloscope. Basically, a dimensional measurement is made by determining the time-of-flight difference between a reference laser pulse and another pulse which reflects off both sides of an object. Accuracy and limitations of the device are discussed briefly. Experimental results using a mode-locked argon laser and a sampling oscilloscope for pulse timing gave an accuracy of 0.075 cm in dimensional measurements of five gauge blocks with lengths from 1.9 to 10.2 cm.

709,603
PB87-116091 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Force Calibration at the National Bureau of Standards.
Final rept.
R. A. Mitchell. Aug 86, 30p NBS/TN-1227
Also available from Supt. of Docs as SN003-003-02764-2.

Keywords: *Loads(Forces), *Calibrating, Measurement, National Bureau of Standards.

Force calibration and force measurement services available at the National Bureau of Standards (NBS) are described. Direct deadweight calibration of force sensors are performed in both compression and tension up to one million lbf (4.4 MN). Comparison calibrations relative to force sensor transfer standards are performed in compression up to 12 million lbf (53 MN). In addition to force calibrations, the following tests are performed to further characterize force sensors: temperature sensitivity, pressure sensitivity, creep, and eccentric load sensitivity.

709,604
PB87-118154 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
High-Accuracy Automated Resistance Bridge for Measuring Quantum Hall Devices.
Final rept.
B. F. Field. 1985, 3p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Instrumentation and Measurement IM-34, n2 p320-322 Jun 85.

Keywords: *Resistance bridges, *Hall effect, Measurement, Accuracy, Semiconductor devices, Comparison, Electrical resistance, Reprints.

An automated resistance bridge has been constructed specifically to measure the Hall resistance of semiconductor devices which exhibit the quantum Hall effect. The bridge is used to perform a one-to-one comparison of the Hall resistance to a reference resistor of similar value. A measurement accuracy of 0.01 ppm or better is expected.

709,605
PB87-118162 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Sub-ppm Automated 1-10 Volt DC Measuring System.
Final rept.
B. F. Field. 1985, 4p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Instrumentation and Measurement IM-34, n2 p327-330 1985.

Keywords: *Voltage measuring instruments, Calibrating, Accuracy, Voltmeters, Standards, Direct current, Reprints.

An automated measuring system has been developed for calibrating arbitrary-voltage references in the range one to ten volts with an inherent measurement accuracy of : or - 0.22 ppm (3 omega). The paper discusses the design and uncertainty analysis of the system and presents data obtained on an available Zener voltage reference.

709,606
PB87-118774 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Calibration and Use of Optical Straight-Edges in the Metrology of Precision Machines.
Final rept.
W. T. Estler. 1985, 8p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Optical Engineering 24, n3 p372-379 1985.

Keywords: *Metrology, *Optical measuring instruments, Calibrating, Machine tools, Reprints.

The authors describe techniques used to measure straightness errors of precision machines. These measurements employ a dimensionally stable mechanical reference surface which is sampled with a laser interferometer - hence the term optical straightedge. The figure error of the reference surface and the straightness error motion of a coordinate measuring machine carriage in a horizontal plane are each measured with an estimated accuracy of 0.5 microinches (13 nm) over 40 inches (lm) of travel. When measuring straightness error in a vertical plane, the optical straightedge is deformed by gravitational forces. The authors use a computational algorithm, based upon simple beam theory, to correct straightness data for this distortion.

709,607
PB87-118840 PC **A12**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Report of the National Conference on Weights and Measures (71st), 1986.
Final rept.
A. D. Tholen, C. S. Brickenkamp, and A. P. Heffernan. Sep 86, 273p NBS/SP-725
See also PB86-150232. Also available from Supt. of Docs as SN003-003-02765-1. Library of Congress catalog card no. 26-27766.

Keywords: *Meetings, *Metrology, *Weight measurement, Measurement, Evaluation, Education, Tests, Electromagnetic interference.

Reports by the several standing and annual committees of the Conference comprise the major portion of the publication. Included also are papers presented by Conference officials and others. Major issues discussed at the Conference included the National Type Evaluation Program, the National Training Program, compliance test methods for products subject to moisture loss, an electronic bulletin board, new methods of sale, electromagnetic interference on weights and measures devices.

709,608
PB87-129003 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Note on the Results of the First Phase of an International Comparison in the Pressure Range 20 - 100 MPa Organized by the High-Pressure Working Group of the Comite Consultatif pour la Masse.
Final rept.
J. C. Legras, V. E. Bean, J. Jager, S. L. Lewis, and G. F. Molinar. 1985, 3p
Pub. in Jnl. of Physics E: Scientific Instruments 18, n4 p361-363 1985.

Keywords: *Pressure measurement, Comparison, Reprints, High pressure.

An international intercomparison in the pressure range 20 - 100 MPa has been organized under the auspices of the International Bureau of Weights and Measures. Given here is a brief outline of the results of the first of three phases in which the national standards laboratories of France, Italy, the United Kingdom, the United States of American and West Germany participated. These results show good agreement when considered in conjunction with the estimates of the uncertainty of measurement.

709,609
PB87-134888 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
National Basis of Accuracy in Humidity Measurements.
Final rept.
S. Hasegawa. 1985, 14p
Pub. in Proceedings of International Symposium on Moisture Humidity, p15-28 1985.

Keywords: *Standards, *Humidity, Moisture meters, Accuracy, Hygrometers, Chemical analysis.

The paper summarizes the activities in humidity standards at the National Bureau of Standards (NBS). Included in the discussion will be brief descriptions of the standard hygrometer, saturation vapor pressure formulations, enhancement factors, humidity generators, secondary standard hygrometers and humidity fixed points using saturated salt solutions.

709,610
PB87-151601 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Automation of Vibration Testing at the National Bureau of Standards.
Final rept.,
B. F. Payne. 1984, 5p
Pub. in Proceedings of Annual Technical Meeting (30th) Inst. of Environmental Sciences, Orlando, FL., May 1-3, 1984 p478-482.

Keywords: *Vibration tests, *Calibrating, Automation, Measurement, Transducers, Computer applications, National Bureau of Standards, US NBS.

The National Bureau of Standards has been involved in vibration testing and calibration for many years. The developments in small computers in recent years have made possible a great improvement in the quality as well as the quantity of the experiments which can be performed in a laboratory with a given number of technical personnel. Often several experiments can be conducted simultaneously by using small dedicated computers. Laboratory automation has been efficiently employed in the evaluation and calibration of vibration transducers, using both comparison and absolute measurements. These measurements are fully automated, with interactive programs for controlling the test, setting test parameters, collecting and storing data and producing reports and graphs. The paper discusses the types of experiments and tests which are automated at NBS in the area of vibration measurements.

709,611
PB87-151841 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Zero Stability of Spinning Rotor Vacuum Gauges.
Final rept.,
K. E. McCulloh, S. D. Wood, and C. R. Tilford. 1985, 4p
Pub. in Jnl. of Vacuum Science and Technology A-Vacuum Surfaces and Films 3, n3 p1738-1741 1985.

Keywords: *Vacuum gages, *Pressure measurement, Stability, Reprints.

Spinning rotor vacuum gages measure pressure by determining the rate of slowing of a magnetically suspended spinning ball over and above the slowing caused by a pressure independent residual drag. For accurate measurement in the high vacuum range, this residual drag must be determined and subtracted as an offset correction. The stability of this residual drag, temperature induced changes of the ball's moment of inertia, vibration, and random measurement noise will determine the stability and hence the lowest useable pressure of the gage. Examples are given of different types of instabilities and guidelines are presented for minimizing many of the sources of instability.

709,612
PB87-157178 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Fluxmeter Measurements at Low Thermal Levels: Some Problems.
Final rept.,
A. F. Robertson. 1985, 2p
Sponsored by Department of Transportation, Washington, DC.
Pub. in Fire Technology 21, n1 p75-76 1985.

Keywords: *Heat flux, *Fire tests, Measuring instruments, Error analysis, Reprints.

Letter to two journals to alert those using heat fluxmeters of possible errors. A brief note to alert users of heat fluxmeters to possible errors in measurement.

709,613
PB87-161816 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Fiber-Optic Thermometry.
Final rept.,
K. G. Kreider. 1985, 11p
Pub. in American Society for Testing and Materials, Special Technical Publication 895, p151-161 1985.

Keywords: *Temperature measuring instruments, Fiber optics, Sapphire, Reprints, Optical fibers, Calibration, High temperature.

A new type of temperature measuring device is being developed at NBS. The optical fiber thermometer is a contact sensor in which a thin film cup assumes the temperature of a fluid stream or contacted solid and emits blackbody radiation. The radiation is then conducted through a sapphire rod typically 1 mm in diameter and on to a photon detector. Research at NBS has focused on proving the feasibility of the system, developing calibration techniques, defining the precision, and optimizing the materials systems of the probe. The paper reviews the method of construction, calibration procedures for both single-wavelength and ratio thermometers, and evaluation of several tip geometries.

709,614
PB87-162152 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Length and Mass Div.
Force Balance Liquid Densimeter.
Final rept.,
R. M. Schoonover. 1984, 4p
Pub. in Proceedings of the International Conference of IMEKO Tech. Committee TC-3 on Measurement of Force and Mass (10th), Kobe, Japan, September 11-14, 1984, p107-110.

Keywords: *Liquids, *Flux density, *Densimeters, Density(Mass/Volume), Density measurement, Standards, Design.

The device described here represents a unique application of an electronic balance to determine the densities of liquids. The paper presented here is the design and analysis of this promising new liquid densimeter. The instrument is now under construction at the National Bureau of Standards and will undergo initial testing shortly. Upon completion, the densimeter will be used to certify liquid density standards that will be sold as Standard Reference Materials. The instrument should be able to provide standard density reference samples of liquid.

709,615
PB87-164075 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Design and Performance of a Ring-Shaped Clip Gauge for Fracture Mechanics Testing.
Final rept.,
R. L. Tobler, and J. A. Shepic. 1985, 4p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Testing and Evaluation 13, n4 p299-302 1985.

Keywords: *Fracture tests, *Strain gages, Cryogenics, Rings, Reprints, Fracture mechanics.

A ring-shaped clip-on displacement gage for fracture mechanics testing is described. The novel design of this gage offers advantages and operating conveniences compared to the conventional double-cantilever beam type gage referenced in ASTM fracture test standards. The construction of ring gages for room temperature and cryogenic applications is discussed.

709,616
PB87-166427
(Order as PB87-166401, PC **A05**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
NBS (National Bureau of Standards) Scale of Radiance Temperature,
W. R. Waters, J. H. Walker, and A. T. Hattenburg. 17 Oct 86, 10p
Included in Jnl. of Research of the National Bureau of Standards, v92 n1 p17-26 Jan-Feb 87.

Keywords: *Temperature measurement, *Standards, Blackbody radiation, International Practical Temperature scale, High temperature, Calibration.

The paper describes the measurement methods and instrumentation used in the realization and transfer of the International Practical Temperature Scale (IPTS-68) above the temperature of freezing gold. The determination of the ratios of spectral radiance of tungsten-strip lamps to a gold-point blackbody at a wavelength of 654.6 nm is detailed. The response linearity, spectral responsivity, scattering error, and polarization properties of the instrumentation are described. The analysis of sources of error and estimates of uncertainty are presented. The assigned uncertainties (three standard deviations) in radiance temperature range from + or - 2K at 2573 K to + or - 0.5 K at 1073 K.

709,617
PB87-167201 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Long-Term Stability of Two Types of Hot Cathode Ionization Gages.
Final rept.,
S. D. Wood, and C. R. Tilford. 1985, 4p
Pub. in Jnl. of Vacuum Science and Technology A-Vacuum Surfaces and Films 3, n3 p542-545 1985.

Keywords: *Ionization gages, Vacuum gages, Sensitivity, Stability, Nitrogen, Reprints.

The authors have monitored the nitrogen sensitivity of four gages each of two selected types of hot cathode ion gages over a 500 day test period. Gages of one type, a tungsten filament conventional triode, changed by about 12% during this time, with most of the decrease caused by 'high' pressure operation. Gages of the second type, a twin tungsten filament Bayard-Alpert gage, changed by no more than 6% and with no obvious correlation between sensitivity changes and 'high' pressure operation or exposure to air. There were also no significant differences in the sensitivity changes for the two filaments in a given Bayard-Alpert gage, although their operating times differed by a factor of ten.

709,618
PB87-167219 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Sensitivity of Hot Cathode Ionization Gauges.
Final rept.,
C. R. Tilford. 1985, 5p
Pub. in Jnl. of Vacuum Science and Technology A-Vacuum Surfaces and Films 3, n3 p546-550 1985.

Keywords: *Ionization gages, Vacuum gages, Standards, Performance, Sensitivity, Reprints, Calibration.

An experimental program of some years duration has attempted to characterize several hot cathode ionization gage types in the high vacuum range by the uniformity, linearity, and stability of their nitrogen sensitivity. Results for six commonly used types are summarized here. Of the gages tested, the most promising overall performance was obtained from tubulated Bayard-Alpert gages with two tungsten filaments mounted 180 degrees apart about the grid. Conventional triode gages with tungsten filaments came close to this level of performance and have superior high pressure linearity.

709,619
PB87-180394 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Description of NBS (National Bureau of Standards) Calibration Services in Mechanical Vibration and Shock.
Technical note,
D. C. Robinson, M. R. Serbyn, and B. F. Payne. Feb 87, 30p NBS/TN-1232
Also available from Supt. of Docs as SN003-003-02794-4.

Keywords: *Vibration meters, *Calibrating, Mechanical shock, Accelerometers.

Accurate calibration of accelerometers requires that accurate measurement techniques be developed and maintained. Calibrations of vibration exciters and pickups are performed by comparison with the response characteristics of NBS standard accelerometers or by absolute methods. The paper gives a summary of the various calibration procedures used in the calibration of accelerometers and reference exciters. The frequency ranges, vibration levels and accuracy statements for standardized tests designed to meet a variety of user needs are listed.

709,620
PB87-200317 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Apparatus for Quasihydrostatic Measurement of Piezoelectric d(sub h) Coefficient.
Final rept.,
K. F. Schoch, A. S. DeReggi, and S. C. Roth. 1986, 4p
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) International Symposium on Applications of Ferroelectrics (6th), Bethlehem, PA., June 8-11, 1986, p711-714 1986.

Keywords: *Piezoelectricity, Measuring instruments, Hydrostatics, Polymers, Composite materials.

Measurement of piezoelectric response of materials d(sub h) by a pressure pulse technique is described in the article. The sample is placed in a fluid-filled chamber fitted with a piston at one end. Impact on the piston creates a pressure pulse in the chamber, the duration and shape of which can be controlled. This method is effective with composite samples as well as polymer film samples.

709,621
PB87-201711 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Noncontacting Optical Probe.
Final rept.,
F. S. Jing, A. W. Hartman, and R. J. Hocken. 1987, 5p
Pub. in Review of Scientific Instruments 58, n5 p864-868 May 87.

Keywords: *Optical measuring instruments, *Distance measuring equipment, Optical microscopes, Linearity, Probes, Sensitivity, Reprints, *Proximity devices, Simon probes.

A description is given of an optical probe, consisting of an optical microscope with modified internal illumination, a dual chopper with its two edges straddling the image plane, and a dual area sensor mounted behind the chopper. An analysis shows that the sensitivity of this proximity probe is essentially the same as that of the Simon probe, while its linearity is much better. Also, its construction is much simpler. A prototype has shown resolution of 0.02 micrometer and linearity errors of 0.5 micrometer (at 100 micrometers range), respectively.

709,622
PB87-213526
(Order as PB87-213476, PC **A05**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Length and Mass Div.
Note on the Choice of a Sensitivity Weight in Precision Weighing,
R. S. Davis. 28 Nov 86, 4p
Included in Jnl. of Research of the National Bureau of Standards, v92 n3 p239-242 May-Jun 87.

Keywords: *Weight measurement, *Mass, Precision, Metrology, Sensitivity.

Good weighing practice usually dictates that, when using double-substitution weighing to determine the mass difference between two weights, the nominal value of the sensitivity weight used too calibrate the optical scale of the mass comparator be at least four times greater than the difference of the two weights being compared. However, there are times when other considerations must override this rule. The authors examine the theoretical basis for the rule and the penalty for violating it. Finally, they propose a modified weighing scheme which imposes a much less tringent rule for the size of the sensitivity weight. The new scheme requires an additional balance reading, but does not increase the overall measurement time significantly.

709,623
PB87-218962 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electrosystems Div.
View of Metrology Support for ATE (Automatic Test Equipment) Systems.
Final rept.,
T. F. Leedy. 1987, 1p
Pub. in Reflector 35, n9 p20, 1 May 87.

Keywords: *Metrology, Reprints, *Automatic test equipment, *Calibration.

For successful calibration of a test system, a combination of traditional laboratory calibration techniques and built-in test techniques is usually desired. This talk will include an overview of some of the activities that are relevant to the calibration of automatic test systems that are currently being performed by the Electrosystems Division of the National Bureau of Standards.

709,624
PB87-224457 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Polystyrene Absorbed-Dose-Rate Calorimeter.
Final rept.,
S. R. Domen, and W. Z. Ba. 1987, 4p
Pub. in Nuclear Instruments and Methods in Physics Research B24/25, p1054-1057 1987.

Keywords: *Calorimeters, Specific heat, Thermistors, Radiation, Reprints, *Absorbed dose, Cobalt 60, Polystyrene.

A simple portable calorimeter was constructed by embedding a calibrated thermistor on the axis of a polystyrene rod. The instrument was positioned on the axis of a cylindrical array of 60Co rods. The duration of the measurement was approx. 70 s. Absorbed dose rates of approx. 70 Gy/min were measured to a daily precision of several tenths of a percent standard deviation. The results are in good agreement with earlier measurements made with a graphite calorimeter. An absorbed dose of 620 kGy resulted in no detectable change in thermistor sensitivity. The specific heat capacity of the polystyrene presumably increased approx. 0.0024%/kGy. The use of a chart recorder was not necessary.

709,625
PB87-227591 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Acoustic Measurements Group.
Requirements for the Calibration of Mechanical Shock Transducers.
Technical note (Final),
D. C. Robinson. Jun 87, 22p NBS/TN-1233
Also available from Supt. of Docs. as SN003-003-02807-0. Sponsored by Department of Defense Calibration Coordination Group, Redstone Arsenal, AL.

Keywords: *Mechanical shock, *Transducers, Accelerometers, Calibrating, Standards.

The use of obsolete, inadequate, or nonexistent calibration standards during weapons system development and acquisition make DoD and its contractors unable to validate system performance legally during testing, evaluation and production acceptance. To correct current weakness and to meet the DoD calibration requirements of the immediate future in the area of mechanical shock new accelerometer calibration standards must be produced and existing standards must be improved. The report describes the results of a survey of various government agencies and government contractors who are actively engaged in the measurement of shock motions of 100 g or higher. As part of the effort to establish current needs for the calibration of accelerometers, a study was made of the accuracy requirements in various engineering applications for the measurement of shock motions up to 200,000 g, and an evaluation was made of the accuracy required to calibrate such transducers for various ranges of accelerations. Based on the study, several recommendations are made for improving the state of calibration standards for mechanical shock accelerometers.

709,626
PB87-227625 PC **A07**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
NBS (National Bureau of Standards) Measurement Services: Radiometric Standards in the Vacuum Ultraviolet.
Final rept.,
J. Z. Klose, J. M. Bridges, and W. R. Ott. Jun 87, 140p NBS/SP-250/3
Also available from Supt. of Docs as SN003-003-02806-1. See also PB87-174041. Library of Congress catalog card no. 87-619833.

Keywords: *Calibrating, *Measurement, Standards, Services, Quality assurance, Radiometry, Far ultraviolet radiation.

The radiometric calibration program carried out by the vacuum ultraviolet radiometry group in the Atomic and Plasma Radiation Division of the National Bureau of Standards is presented in detail. The calibration services are first listed, followed by descriptions of the primary standards, which are the hydrogen arc and the blackbody line arc, and the secondary standards, which are the argon mini- and maxi-arcs and the deuterium arc lamp. Next, the calibration methods involving both spectral radiance and irradiance are discussed along with their uncertainties. Finally, the intercomparison of standards as a method of quality control is described.

709,627
PB87-233680 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Microspheres and Focal Spots: Applications of Microspheres in Dimensional Metrology.
Final rept.,
A. W. Hartman, and F. S. Jing. Oct 86, 9p
Pub. in Precision Engineering 8, n4 p203-211 Oct 86.

Keywords: *Dimensional measurement, *Length, Optical microscopes, Magnification, Distortion, Reprints, *Microspheres, Calibration.

Besides containing size information, microspheres can also mark the end points of microlength with very high precision. These features are applied to micrometrology tasks that involve optical microscopy. Examined are length measurements in a microscope field of view, microlength scales with selectable length of their divisions, straightness of ways and runout of bearings. Microspheres have proven particularly useful in the precision determination of magnification and image distortion in optical microscopes.

709,628
PB87-233789 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Testing Tools: Development of Measurement Standards for Edge Characterization of Intraocular Lenses.
Final rept.,
E. C. Teague, F. E. Scire, D. W. Vahey, and E. P. Mueller. Jan 83, 7p
Pub. in Medical Devices: Measurements, Quality Assurance, and Standards, Chapter 6, p67-73 Jan 83.

Keywords: *Lenses, Reprints, *Testing tools, *Intraocular lenses.

No abstract available.

709,629
PB87-234084 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Standards for Particle Size.
Final rept.,
A. W. Hartman. 1987, 13p
Pub. in Proceedings of International Conference on Liquid Borne Particle Inspection and Metrology, Arlington, VA., May 11-13, 1987, p109-121.

Keywords: *Particle size, *Standards, Light scattering, Reviews, Calibration, Microspheres, US NBS.

An overview is given of particle size standards available from the National Bureau of Standards and from commercial sources. Both monodisperse and polydisperse materials are reviewed. A discussion is given of several measurement techniques used to calibrate these materials.

709,630
PB88-111190 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Accurate Frequency Response Determinations from Discrete Step Response Data.
Final rept.,
T. M. Souders, and D. R. Flach. 1987, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Tranactions on Instrumentation and Measurement IM-36 n2 p433-439 Jun 87.

Keywords: *Frequency response, Signal processing, Error analysis, Measurement, Transfer functions, Reprints.

An approach is presented for quickly obtaining the complex frequency response of a system from sampled step-response data. Digital signal processing techniques are used extensively. An analysis of errors resulting from sampling, quantization, first differencing, and record length is included.

709,631
PB88-123765 PC **A14**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices as Adopted by the 72nd National Conference on Weights and Measures, 1987 (1988 Edition),
H. V. Oppermann. Sep 87, 305p NBS/HB-44
Also available from Supt. of Docs. as SN003-003-02820-7. Supersedes PB87-108569.

Keywords: *Measuring instruments, *Weight indicators, *Handbooks, Specifications, Tolerances(Mechanics), Requirements, Standards.

Handbook 44 was first published in 1949, having been preceded by similar handbooks of various designations and in several forms beginning in 1918. The 1988 edition was developed by the Committee on Specifications and Tolerances of the National Conference on Weights and Measures, with the assistance of the Office of Weights and Measures of the National Bureau of Standards. It includes amendments adopted by the 72nd annual meeting of the National Conference on Weights and Measures in 1987. Handbook 44 is published in its entirety each year following the annual meeting of the National Conference on Weights and Measures.

709,632
PB88-138367 PC **A16**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
NBS (National Bureau of Standards) Measurement Services: Platinum Resistance Thermometer Calibrations.
Special rept.,
B. W. Mangum. Oct 87, 369p NBS/SP-250/22
Also available from Supt. of Docs as SN003-003-02831-2. Library of Congress catalog card no. 87-619875.

Keywords: *Resistance thermometers, *Temperature measurement, *Standards, Platinum, *Calibration, Uncertainty.

The document describes in detail the instruments and the measurement methods used in the realization and transfer of the International Practical Temperature Scale of 1968, Amended Edition of 1975 (IPTS-68(75)), as maintained at the NBS in the region from 13.81 K to 903.89 K. This is the region in which the platinum resistance thermometer, meeting certain specifications, is the standard instrument for interpolating between the defining fixed points of the scale at which it is calibrated. An analysis of the sources of error encountered in calibration, and estimates of uncertainty and its propagation, are presented.

709,633
PB88-139167 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
New Video-Optical Method for Whole-Field Strain Measurements.
Final rept.,
J. C. Moulder, D. T. Read, and J. F. Cardenas-Garcia. 1986, 6p
Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Proceedings of SEM (Society for Experimental Mechanics) Spring Conference on Experimental Mechanics, New Orleans, LA., June 8-13, 1986, p700-705.

Keywords: *Strain measurement, Optical measurement, Diffractometers, Metrology, Photographic analysis, Moire effects, Deformation.

A new method for measuring entire two-dimensional strain fields in either transparent or opaque solids is described. The method consists of applying strippable film grids to the specimen and recording their deformation during mechanical testing in 35-mm photographs. The photographs are analyzed point by point in an optical diffractometer that is interfaced to a computer with a video camera and a video digitizer. By determining the precise locations of first-order diffraction peaks for deformed grids and comparing with the results for the undeformed grid, the authors obtain all four components of the in-plane deformation tensor: longitudinal and transverse strains, shear strain, and rigid-body rotation. The method is illustrated with results for a center-cracked aluminum tensile panel. Full-field images were obtained on a grid of 21 by 21 points, each corresponding to a 3-mm square on the specimen. Optically determined strains agreed well with electrical strain gage results.

709,634
PB88-141221 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Activities and Plans of the Time and Frequency Division of the National Bureau of Standards.
Final rept.,
D. B. Sullivan. 1986, 10p
Pub. in Proceedings of the Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (18th), Washington, DC., December 2-4, 1986, p1-10.

Keywords: *Time standards, *Frequency standards, Calibrating, Measurement, Services, US NBS, Reprints.

In keeping with the other standards activities of the National Bureau of Standards, the Time and Frequency Division realizes and maintains the standards associated with its name, coordinates these standards nationally and internationally, provides access to the standards through a set of dissemination services, and develops new standards, measurement methods and dissemination methods in anticipation of future national requirements. The paper describes the current work of the division with emphasis on those activities which most directly concern the attendees of this conference. Projections for relevant future programs are also discussed.

709,635
PB88-147327 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Operation of a Bayard-Alpert Gauge in a Uniform 0-0.16 Tesla Magnetic Field.
Final rept.,
A. R. Filippelli. 1987, 6p
Pub. in Jnl. of Vacuum Science and Technology A-Vacuum Surfaces and Films 5, n2 p249-254 1987.

Keywords: Magnetic fields, Oscillations, Reprints, *Bayard-Alpert ionization gages.

The behavior of a widely-used Bayard-Alpert ionization gauge in a uniform magnetic field has been experimentally investigated for two cases: magnetic field orthogonal, and parallel to the axis of the grid. Filament emission, grid, and collector currents and, current to the wall surrounding the gauge, all at constant filament heating power, were measured as functions of field magnitude and direction for N2 in the pressure range 5 x 10 to the -8th power to 2 x 10 to the -4th power Pa. Gauge sensitivity was found to be strongly dependent on field magnitude and direction, but remained pressure independent.

709,636
PB88-147541 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Use of Simulation Data Sets for Assessing Interlaboratory Pattern Recognition Accuracy.
Final rept.,
L. A. Currie. 1985, 5p
Pub. in Optical Engineering 24, n6 p1004-1008 Nov/Dec 85.

Keywords: Pattern recognition, Gamma ray spectroscopy, Aerosols, Linear regression, Multivariate analysis, Simulation, Accuracy, Reprints, *Interlaboratory comparisons, Reference materials.

Interlaboratory comparisons using common (reference) materials of known composition are an established means for assessing overall measurement precision and accuracy. Intercomparisons based on common data sets are equally important and revealing when one is dealing with complex chemical patterns or spectra requiring significant numerical modeling and manipulation for component identification and quantification. Two case studies of 'chemometric intercomparison' using simulation test data (STD) are presented; one comprising STD vectors as applied to nuclear spectrometry; and the other, STD data matrices as applied to aerosol source apportionment.

709,637
PB88-152228 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Electrical and Thermodynamic Characterization of Water Vapor/Polymeric Film System for Humidity Sensing.
Final rept.,
P. H. Huang. 1985, 6p
Pub. in Sensors and Actuators 8, n1 p23-28 Sep 85.

Keywords: *Water vapor, Polymeric films, Membranes, Enthalpy, Entropy, Free energy, Reprints, *Humidity measurement, Electrical conductivity, Temperature dependence.

The electrical and thermodynamic characteristics of water vapor in pvc-styrene-sulfonate membranes have been investigated. The membrane is a cross-linked copolymer of styrenesulfonate with polyvinylchloride. Electrical conductance of the thin membrane is measured as a function of temperature at various relative humidities. Using the measured conductivity data, thermodynamic functions of free energy (delta G), enthalpy (delta H), and entropy (delta S) are determined. The method of combined electrical and thermodynamic characterization of a gas/polymer system may be used to provide a means for designing suitable polymeric materials for humidity sensing and may provide a method to model improved gas sensor behavior.

709,638
PB88-152376 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Another Step Toward an International Practical Pressure Scale (2nd AIRAPT IPPS Task Group Report).
Final rept.,
V. E. Bean, S. Akimoto, P. M. Bell, S. Block, W. B. Holzapfel, M. H. Manghnani, M. F. Nicol, and S. M. Stishov. 1986, 3p
Pub. in Physica 139 and 140B, p52-54 1986.

Keywords: *Pressure measurement, *Scale(Ratio), Fixed points(Mathematics), Reprints.

The AIRAPT Task Group on the International Practical Pressure Scale recommends the best experimental values for several pressure fixed points.

709,639
PB88-152384 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Elastic Distortion on Piston Gages.
Final rept.,
R. J. Lazos-Martinez, and V. E. Bean. 1986, 3p
Pub. in Physica B: Physics of Condensed Matter and C: Atomic, Molecular and Plasma Physics, Optics 139-140, p785-787 May 86.

Keywords: Pressure gages, Pressure measurement, Elastic deformation, Distortion, Reprints, *Piston gages.

The authors report herein their progress toward the development of a rigorous method to calculate the elastic distortion of piston gages in order to test the effect of the assumptions upon which present methods are based. Preliminary results show the two methods to agree within 2 percent.

709,640
PB88-152392 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Zero Stability and Calibration Results for a Group of Capacitance Diaphragm Gages.
Final rept.,
R. W. Hyland, and C. R. Tilford. 1985, 7p
Pub. in Jnl. of Vacuum Science and Technology A 3, n3 pt2 p1731-1737 May/Jun 85.

Keywords: *Diaphragms(Mechanics), *Gages, Calibrating, Vacuum gages, Capacitance, Reprints.

The lowest pressure which may be measured by a capacitance diaphragm gage is established by instabilities in the gage zero. The calibration records for 17 gages, for which the authors have two or more calibrations separated by intervals on the order of one year, show shifts ranging from essentially no change to about 2% with an average value of 0.45%. With one exception, these do not appear as a steady drift with time, but as random shifts between calibrations.

709,641
PB88-152400 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Pressure Metrology: Primary Standard Piston Gages.
Final rept.,
V. E. Bean. 1986, 4p
Pub. in Physica 139 and 140B, p739-742 1986.

Keywords: Pressure gages, Pressure measurement, Elastic deformation, Distortion, Reprints, *Piston gages.

Elastic distortion is the leading cause of uncertainty in primary standard piston gages. Recent pressure measurement intercomparisons between national standards laboratories demonstrate the non-equivalence of the methods used to determine the effects of distortion. New research efforts on this fundamental pressure metrology problem are described.

Manufacturing Processes & Materials Handling

709,642
PB-265 872/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characterization of Debris Particles Recovered from Wearing Systems,
A. W. Ruff. 1977, 14p
Sponsored in part by Naval Air Engineering Center, Philadelphia, Pa.
Pub. in Wear 42, p49-62 1977.

Keywords: *Wear, *Particles, Friction, Chemical analysis, X ray analysis, Particle size, Electron microscopy, Reprints.

Studies have been conducted on wear debris collected from various systems involving both sliding and rolling contacts. Results of size, shape and chemical composition analysis of typical debris particles are presented. Different techniques for debris recovery and analysis are discussed. Some results are presented on electron transmission studies of individual debris particles. The effect of small particle size on X-ray emission analysis is also described.

709,643
PB-266 609/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photoresist Exposure - Measurement and Control,
D. B. Novotny. 1976, 5p
ARPA Order-2397
Pub. in Proceedings of Developments in Semiconductor Microlithography, San Jose, Calif. 1-3 Jun 76 v80 p9-13 1976. (Society of Photo-Optical Engineers, Palos Verdes Estates, Calif.).

Keywords: *Masking, Photolithography, Irradiation, Control, Measurement, Photoresists.

Single parameter irradiance measurements commonly used for the determination of photoresist exposure times are incapable of giving unique values of either the broad band irradiance from a mercury-arc lamp, or the photoresist exposure times. Resolution of these measurement incapabilities through a series of irradiance measurements of narrow, approximately monochromatic radiation bands is discussed. A basis for establishing photoresist sensitivity indicies that can be used to calculate unambiguous exposure times by applying Van Kreveld's additivity law to these narrow band irradiance measurements is suggested. The thickness variation of photoresist films is included in the method of calculating exposure time. Conditions that may simplify the calculations of exposure times or reduce the number of irradiance measurements when a mercury lamp is used as the exposure source are discussed. Suggestions are made for the use of these indicies as photoresist specifications, and for the real-time automatic monitoring and control of exposure times in wafer fabrication where optical density variation in the photomasks and thickness variations in the photoresist films are automatically incorporated into the control by a microprocessor.

709,644
PB-266 945/5 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, Colo. Cryogenics Div.
Liquid Helium Storage at High Density and Discharge at High Flow Rates.
Final rept.,
D. E. Daney. Dec 76, 55p NBSIR-76-850
Sponsored in part by Air Force Weapons Lab., Kirtland AFB, N. Mex.

Keywords: *Liquid helium, *Storage tanks, Fluid flow, Supercriticality, Flow rate, Pressure, Cryogenics, *Cryogenic fluid storage.

Equipment to store supercritical helium at high density and to demonstrate pulsed discharge at high flow rates has been designed, fabricated and successfully tested. A storage density of 193 kg/cu m (12.03 lb/cu ft) at 8.3 MPa (81 atm) was achieved in a 135 liter (35 gal) dewar. Pulsed discharges of 2 seconds and 4 seconds duration were demonstrated at a flow rate of 1.0 kg/s (2.2 lb/s), and flow fluctuations of less than + or - 1 percent were achieved without feedback control. In general, the system operated in a very stable and well behaved manner.

709,645
PB-275 142/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sensitometry of Photoresists for Microelectronics.
Final rept.,
D. B. Novotny. Dec 77, 5p
ARPA-Order-2397
Pub. in Proceedings of SPSE Symposium, New York, N.Y. 16-17 Sep 76, Photographic Science and Engineering, v21 n6 p351-355 Nov/Dec 77.

Keywords: *Masking, Sensitivity, Exposure, Thickness, Microelectronics, Reprints, Photomasking, Photoresists.

Single parameter irradiance measurements commonly used for the determination of photo-resist exposure times are incapable of giving unique values of either the broad-band irradiance from a mercury-arc lamp, or the photoresist exposure times. Resolution of these measurement incapabilities through a series of irradiance measurements of narrow, approximately monochromatic radiation bands is discussed. A basis for establishing photoresist sensitivity indicies that can be used to calculate unambiguous exposure times by applying Van Kreveld's additivity law to these narrow band irradiance measurements is suggested. The thickness variation of photoresist films is included in the method of calculating exposure time. Suggestions are made for the use of these indicies as photoresist specifications, and for the real-time automatic monitoring and control of exposure times in wafer fabrication where optical density variation in the photomasks and thickness variations in the photoresist films are automatically incorporated into the control by a microprocessor.

709,646
PB-281 358/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultrasonic Welding Mechanism as Applied to Aluminum and Gold Wire-Bonding in Microelectronics.
Final rept.,
G. G. Harman, and J. Albers. Dec 77, 7p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in IEEE Trans. Parts, Hybrids, Packaging, PHP13 n4 p406-412 Dec 77.

Keywords: *Ultrasonic welding, *Microelectronics, Aluminum, Gold, Wire, Bonding, Reprints.

The paper represents a review as well as an extension of previous work concerned with the mechanism of microelectronic ultrasonic welding for both aluminum and gold wires. A series of experiments was carried out to determine the mechanism of gold to gold ultrasonic bonding. These experiments, including lift-off pattern studies, clamped-wire studies and bond deformation vs. ultrasonic vibration amplitude studies, indicate that gold ultrasonic bonding takes place primarily by means of a deformation mechanism as opposed to a heating or sliding mechanism. This is substantially the same result previously obtained from studies on the aluminum ultrasonic bonding mechanism. Further, it is shown that a deformation mechanism also holds for other forms of solid phase microelectronic bonding. Specific examples are taken from electric discharge 'tweezer-welds' and from thermocompression bonds. The role of contaminant removal and certain reliability aspects of ultrasonic bonding are also discussed.

709,647
PB-291 255/8 Not available NTIS
National Bureau of Standards, Washington, DC.

Assessing Permeation Performance of Industrial Plastic Shipping Containers.
Final rept.
J. D. Barnes. 1978, 3p
Pub. in Proceedings of the Annual Technical Conference Society of Plastics Engineers (36th) Held at Washington, DC. on April 24-27, 1978, p824-826 1978.

Keywords: *Plastics, *Shipping containers, *Standards, Permeating, Polyethylene, Performance evaluation, *Polymer gas permeability.

This paper presents a proposal for a standards-based measurement system for predicting the permeation performance of industrial plastic shipping containers. The scheme is based on early work which demonstrates that there is a systematic way (known as the 'permachor') to characterize the tendency of a given molecular species to permeate polyethylene. It is possible to establish a scale for calibrating a permachor measuring system and to establish standardized conditions for making the measurements. If such a system were operational, it would be expected that the measurements required to establish compatibility between a lading and a shipping container could be carried out more economically and with greater confidence. The number of holding tests of individual ladings in large shipping containers would also be much reduced under the proposed scheme.

709,648
PB79-600060 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Low Temperature Fracture Behavior of a Ti-6Al-4V Alloy and its Electron Beam Welds.
R. L. Tobler. 1978, 28p
Pub. in Am. Soc. Test. Mater. Spec. Tech. Publ. 651, p267-294 1978.

Keywords: *Electron beam welding, Fatigue (materials), Fracture properties, Low temperature tests, Mechanical properties, Titanium, Titanium alloys.

The effects of electron beam welding on the fracture behavior of a recrystallization annealed, extra-low interstitial Ti-6Al-4V alloy have been investigated at temperatures in the ambient-to-cryogenic range. Plane strain fracture toughness (K1r) and subcritical crack growth parameters were measured using compact specimens 10 to 25.4 mm thick. These parameters can be used to predict the safe operating lifetimes of cryogenic pressure vessels and other welded Ti-6Al-4V structures. At intermediate stress intensity factors and within the data scatter for replicate tests, the growth rates of fatigue cracks sited in the fusion and heat-affected zones of electron beam weldments were temperature insensitive and nearly equivalent to rates for the base metal. However, electron beam welding introduced a zone of low fracture toughness at the heat-affected-zone/fusion boundary. The K1r value for this boundary zone at liquid nitrogen temperature (76 K) was 51 MPa/m1/2, 16 percent lower than the base meta. The base metal fracture toughness increases between 4 and 295 K, with an abrupt transition to higher K1r values occuring at temperatures between 76 and 125 K. Static load cracking, temperature effects, and specimen orientation effects on the fracture behavior of this titanium alloy are central topics of discussion.

709,649
PB81-134017 Not available NTIS
National Bureau of Standards, Washington, DC.
Experimental Photoresist Sensitometry and Exposure Modeling.
D. B. Novotny. 1980, 10p
Pub. in Proceedings of the Society of Photo-Optical Instrumentation Engineers, San Jose, CA., March 17-18, 1980, Paper in Semiconductor Microconductor Microlithography V, 221, p184-193 1980.

Keywords: *Masking, Coatings, Photosensitivity, Reaction kinetics, Exposure, *Photoresists.

Sensitometric properties were measured for a positive diazo-type photoresist at wavelengths of 365, 405, and 436 nm.

709,650
PB81-220741 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.

Checking the Net Contents of Packaged Goods.
C. S. Brickenkamp, S. Hasko, and M. G. Natrella.
Jun 81, 166p NBS-HB-133

Keywords: *Packaging, *Marking, *Labels, *Handbooks, Regulations, Measurement, Inspection, Containers, Reporting, Standards, Sampling, Compliance.

Compliance testing of packaged goods is the determination of conformance of the results (that is, the packages produced) of a packaging, distribution, and/or retailing process with specified legal requirements. This handbook provides procedures to test (by using statistical sampling techniques) individual lots of packages for conformance with legal requirements. Anything that is put into a container, wrapped or banded, and labeled as to quantity may be inspected.

709,651
PB81-236200 Not available NTIS
National Bureau of Standards, Washington, DC.
Ion Bombardment Cleaning of Liquid Gallium Surfaces (Summary Abstract).
Final rept.
J. Fine, S. C. Hardy, and T. D. Andreadis. Apr 81, 2p
Pub. in Jnl. of Vacuum Science and Technology 18, n3 p1310-1311 Apr 81.

Keywords: *Cleaning, *Ion irradiation, Ion beams, Liquid metals, Gallium, Surfaces, Reprints.

The authors found that the preparation of clean surfaces on bulk liquid gallium can be accomplished by means of argon ion bombardment and that this process is accompanied by a newly observed type of surface phenomenon produced by ion impact - the rapid flow of impurity aggregates on a liquid metal surface. This unexpected mass flow, due entirely to the impact of the ion beam, is the mechanism that enables the ion beam to clean the entire liquid-vacuum interface. Because of this flow mechanism, ion bombardment may represent a new and significant method for cleaning other liquid metal surfaces and also could have application to the cleaning of nonmetallic liquids as well.

709,652
PB81-246001 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Sputtering Yield Measurement Methods: A Review.
Final rept.
J. Fine. 1980, 42p
Pub. in Invited Lectures and Progress Reports of SPIG '80, Dubrovnik, Yugoslavia, August 25-30, 1980, Paper in The Physics of Ionized Gases, p379-420 1980.

Keywords: *Sputtering, Ion irradiation, Ion beams, Yield, Measurement, Reprints.

In this review of the determination of sputtering yields, the importance of characterizing the parameters of the target and ion is stressed together with the need for yield data of improved accuracy and sensitivity. Five categories of yield measurement methods are discussed together with a total of sixteen techniques which can be used to implement certain of those methods. Various advantages and disadvantages are cited for each of the sixteen techniques, many of which were chosen to demonstrate that static, low-sensitivity yield measurements can be significantly improved.

709,653
PB82-248071 Not available NTIS
National Bureau of Standards, Washington, DC.
Instrumentation for XUV Lithography at SURF-II.
Final rept.
L. R. Hughey, R. T. Williams, J. C. Rife, D. J. Nagel, and M. C. Peckerar. 1982, 7p
Pub. in Nuclear Instruments and Methods 195, p267-273 1982.

Keywords: *Lithography, Synchrotron radiation, X rays, Performance, Design, Masking, Reprints, Synchrotron Ultraviolet Radiation Facility, Photoresist techniques, Microcircuits.

A new beam line X-ray Lithography, with photon energies near 100 eV, has been installed on the SURF-II storage ring at the National Bureau of Standards. Vacuum isolation of the ring from the exposure chamber is achieved using both a thin carbon window and baffle cooled to liquid nitrogen temperature. The design and performance of the beam line are described. Initial exposures of two photoresists of intermediate sensitivity show that the beam line will serve for production of test microcircuits.

709,654
PB82-261694 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiation Levels Associated with the Electron-Beam Metallization Process.
Final rept.
K. F. Galloway, and S. Mayo. May 79, 5p
Pub. in Solid State Technology, p96-100 May 79.

Keywords: *Metallizing, *Radiation damage, Electron beams, Ionizing radiation, Microelectronics, Reprints.

Ionizing radiation exposure is a natural consequence of the electron-beam metallization process used in device fabrication. Techniques for obtaining the radiation levels associated with electron-beam metallization and the levels for some typical situations are given in this paper. In addition, the consequences of this process-related radiation exposure are briefly discussed.

709,655
PB83-139022 Not available NTIS
National Bureau of Standards, Washington, DC.
Automated Manufacturing Research Facility of the National Bureau of Standards.
Final rept.
J. A. Simpson, R. J. Hocken, and J. S. Albus. 1982, 15p
Pub. in Jnl. Manuf. Syst. 1, n1 p17-31 1982.

Keywords: *Facilities, *Automation, Manufacturing, Machining, Research, Automatic control, Reprints, Computer aided manufacturing.

A major facility for manufacturing research is being established at the National Bureau of Standards (NBS). The facility is designed to provide extreme flexibility to be capable of emulating a wide variety of manufacturing cells typical of a small machine job shop. The control architecture adopted is hierarchical in nature and highly modular. The facility will be used for research on interface standards and metrology in an automated environment.

709,656
PB83-177279 Not available NTIS
National Bureau of Standards, Washington, DC.
Shielded Metal-Arc and Flux-Cored Metal-Arc Stainless-Steel Weldments: Magnet Cases for 4-K Service.
Final rept.
E. N. C. Dalder, O. W. Seth, and T. A. Whipple. 1982, 14p
Contract W-7405-eng-26
Pub. in Proceedings of International Cryogenic Materials Conference (4th), San Diego, California, August 10-14, 1981, Paper in Advances in Cryogenic Engineering 28, p839-852 1982.

Keywords: *Welding electrodes, *Shielded metal arc welding, *Gas metal arc welding, Stainless steels, Welds, Weldments, Superconducting magnets, Cryogenics, Fracture properties.

Load-bearing structures of superconducting magnet systems involve the manufacture of defect-free fusion welds in nitrogen-strengthened austenitic stainless steels in thicknesses up to 150mm. These welds must be capable of fracture- safe operation at 4 K at stresses close to the yield strength and must resist failure caused by growth of fatigue cracks to critical sizes and rapid propagation to fracture. This paper presents an evaluation of shielded metal-arc and flux-cored metal-arc welding consumables designed to deposit ferrite-free 316L stainless-steel weld metal in the flat position at high-deposition rates. The significance of the results to design and manufacture of the Mirror Fusion Test Facility superconducting magnet set is discussed.

709,657
PB83-234831 Not available NTIS
National Bureau of Standards, Washington, DC.
Optical Linewidth Measurements on Photomasks and Wafers.
Final rept.
W. M. Bullis, and D. Nyyssonen. Jan 82, 46p
Pub. in VLSI Electron.: Microstruct. Sci. 3, Chapter 7, p301-346 Jan 82.

Keywords: *Line width, Optical measurement, Integrated circuits, Microelectronics, Optical microscopes, Silicon, Errors, Calibrating, Reprints.

The chapter discusses the origins of systematic errors in optical linewidth measurement systems, outlines advances in modeling the linewidth measurement process including imaging in the optical microscope, describes a primary linewidth measurement system in use at the National Bureau of Standards (NBS), and discusses the use of primary measurements to calibrate less accurate systems conventionally used for linewidth measurements. Although emphasis is placed on measurements of patterns on antireflective (AR) chromium photomaks in transmitted light, measurements on other types of materials including see-through photomasks and wafers are also discussed.

709,658
PB84-224526 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Mfg. Engineering.
Publications of Center for Manufacturing Engineering (of the National Bureau of Standards) 1978-1983.
Bibliography rept.
P. Nanzetta, and J. Wellington. Mar 84, 68p NBSIR-84-2840

Keywords: *Manufacturing, *Bibliographies, Metrology, Robots, Automatic control equipment, Surface finishing, Documents, Authors, Robotics.

A list of publications by staff of the Center for Manufacturing Engineering for the period 1978-1983, indexed by subject area. Publications cover research done by the Center in the areas of high precision dimensional measurement; sensing and measurement of force, mass, sound, vibration, and surface finish characteristics; and application of advanced controls and sensing techniques to automated machines, manufacturing systems and robot manipulators.

709,659
PB84-224880 Not available NTIS
National Bureau of Standards, Washington, DC.
Bremsstrahlung Generators for Radiation Processing.
Final rept.
J. P. Farrell, S. M. Seltzer, and J. Silverman. 1983, 10p
Pub. in Radiation Physics and Chemistry, v22 n3-5 p469-478 1983.

Keywords: *Bremsstrahlung, Cobalt 60, Gamma rays, Comparison, Reprints, Industrial applications, Costs.

Bremsstrahlung generated by the stopping of high-energy electrons has been proposed as an alternative to (60)Co gammas for many years. However, it is only recently that advances in accelerator technology have justified serious consideration of this concept. Whether bremsstrahlung is a practical source for industrial radiation processing is ultimately a question of the cost per unit of product treated with a specified dose. In another paper (Seltzer, et al., 1983), we present calculations of bremsstrahlung yields, dose-depth curves, and production capacities within a specified maximum-to-minimum dose ratio for 4 and 5 MeV electron accelerators; the results are summarized in the next two sections. The emphasis of this paper is on the economics of processing by bremsstrahlung and a cost comparison of processing with (60)Co gammas.

709,660
PB85-129153 PC **A13**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Checking the Net Contents of Packaged Goods (Second Edition).
Final rept.
C. S. Brickenkamp, S. Hasko, and M. G. Natrella. Oct 84, 290p NBS/HB-133
Supersedes PB81-220741. Also available from Supt. of Docs as SN003-003-02616-6. Library of Congress catalog card no. 81-600051.

Keywords: *Handbooks, *Packaging, Sampling, Inspection, Measurement, Procedures, Computation, Compliance.

The second edition of NBS Handbook 133, like the first edition, is a procedural manual for compliance testing of the net contents statements on packaged goods. Packaged goods may be labeled by weight, volume, length, area, or count. Two categories of sampling plans are provided for packages subject to the average requirement. Other sampling plans are provided for special products. Test procedures are provided in detail for a wide variety of products. The manual contains information on equipment, test methods, calculations, and test reporting.

709,661
PB85-129419 Not available NTIS
National Bureau of Standards, Washington, DC.
Bremsstrahlung Beams from High-Power Electron Accelerators for Use in Radiation Processing.
Final rept.
S. M. Seltzer, J. P. Farrell, and J. Silverman. Apr 83, 5p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Nuclear Science NS-30, n2 p1629-1633 Apr 83.

Keywords: *Bremsstrahlung, Ultraviolet radiation, Electron accelerators, Electron beams, Cobalt 60, Industries, Comparison, Reprints, *Radiation sources.

In this paper, the authors present the results of calculations of bremsstrahlung produced by a high power electron beam that is incident on a water cooled target. The calculation yields the efficiency of conversion of electron beam power to bremsstrahlung, the energy and angular distributions of the photons, and the dose distribution of the resultant photon spectrum in a water phantom. The result is used to estimate radiation processing rates with bremsstrahlung photons and comparison is made with Co-60 radioisotope sources.

709,662
PB85-200061 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Weights and Measures.
Index to the Reports of the National Conference on Weights and Measures from the First to the Sixty-Ninth (1905 to 1984).
W. G. Mott. Apr 85, 91p NBS/SP-691
Supersedes COM73-50221. Also available from Supt. of Docs as SN003-003-02649-2. Library of Congress catalog card no. 85-600531.

Keywords: *Weight measurement, *Meetings, Technical reports, Indexes(Documentation), *Weights and measures.

This publication comprises a subject index and a speaker index for the Reports of the National Conference on Weights and Measures from the First (1905) through the Sixty-ninth (1984) and supersedes NBS Special Publication 377.

709,663
PB86-106754 PC **A05**/MF **A01**
Michigan Univ., Ann Arbor. Graduate School of Business Administration.
Survey of the Literature on Production Scheduling as it Pertains to Flexible Manufacturing Systems.
N. Raman. Aug 85, 89p NBS/GCR-85/499
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.

Keywords: *Reviews, *Production control, Manufacturing, Automation, Robots, Industrial plants, Production engineering, *Flexible manufacturing systems, Computer aided manufacturing.

The paper presents a survey of the existing literature on machine scheduling from the perspective flexible manufacturing systems. It is the first of a series of papers planned to document research in scheduling for the Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards. An overview of the hierarchical production planning process is given. The paper covers deterministic, non-preemptive scheduling of open shops, since a typical flexible manufacturing system (FMS) operates under these conditions. Both due-date based and flow-time based objectives are addressed for single stage single machine, single stage parallel machines, flow shops and job shops. Research in assembly line balancing is similarly covered since it is possible to treat an FMS as a transfer line for repetitive discrete manufacture. The analytical approaches to these problems have focussed primarily on the objectives of maximizing production rate, minimizing in-process inventory, and maximizing machine utilization.

709,664
PB86-108206 PC **A04**/MF **A01**
Michigan Univ., Ann Arbor. Graduate School of Business Administration.
Simulation Model for the Automated Manufacturing Research Facility.
N. Raman. Aug 85, 55p NBS/GCR-85/498
Sponsored by National Bureau of Standards, Gaithersburg, MD.

Keywords: *Industrial plants, *Manufacturing, Mathematical models, Automation, Robots, Production control, *Computer aided manufacturing, Microcomputers, Discrete event system, SIMAN programming language.

The paper presents a simulation model for investigating and validating the operating policies of the Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards for the June 1985 configuration. The model is written in SIMAN, and runs on any microcomputer which can be run under the MS-DOS operating system. The model represents the AMRF as a discrete-event system and consists of two segments. The values of the system parameters are presented in the Experimental Frame segment. The output includes pertinent statistics such as utilization of each workstation, number of jobs waiting at each workstation, average flow time and average tardiness of jobs of each part type. Procedures for interfacing the simulation output with the LOTUS 1-2-3 graphics package are also included. The impact of different operating policies and scheduling rules can be studied by making relatively minor changes in the Block Diagram. Alternatively, the effect of altering the values of the system parameters can be investigated by making suitable changes in the Experimental Frame.

709,665
PB86-108776 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Package Checking Field Manual to Accompany NBS (National Bureau of Standards) Handbook 133: Checking the Net Contents of Packaged Goods.
C. S. Brickenkamp, S. Hasko, and M. G. Natrella. Aug 85, 107p NBSIR-85/3172
See also PB85-129153.

Keywords: *Handbooks, *Packaging, Sampling, Inspection, Measurement, Procedures, Computation, Compliance.

Tables and report forms from NBS Handbook 133 have been rearranged in a convenient tabbed format for use by government inspectors in their field testing of prepackaged consumer and nonconsumer commodities. Outlines of the test procedures and examples of completed report forms and worksheets have been added, along with a variation on the 'Standard Pack Report Form' for weight only. There are eight sections: Test Procedure Outlines, Sampling Plans, Variable Tare, Weighing Rules, MAV's, Report Forms and Worksheets, Examples, and a Random Number Table.

709,666
PB86-111853 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Immersion Deposition Process.
Final rept.
D. S. Lashmore. 1982, 37p
Sponsored by Aluminum Association, Inc., Washington, DC., and American Electroplaters' Society, Inc., Winter Park, FL.
Pub. in Proceedings of Aluminum Finishing Seminar, St. Louis, MO., March 30-April 1, 1982, p501-537.

Keywords: *Electrodeposition, Surface finishing, Emmersion, Plating, Aluminum, Stannates, Coatings, Etching, Substrates.

The immersion deposition process for plating on aluminum will be reviewed with emphasis on recent findings concerning the deposition mechanisms. Both the zincate types of processes as well as the stannate types of processes will be discussed. Included in the text is a discussion of the role of the etching pretreatment, reasons for double zincating, morphology of the coating and relationship between coating morphology and substrate morphology, and finally a discussion of the reason why certain metals adhere well to aluminum while others adhere poorly.

709,667
PB86-193315 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.

Modeling the Optical Microscope Images of Thick Layers for the Purpose of Linewidth Measurement.
Final rept.
C. P. Kirk, and D. Nyyssonen. 1985, 9p
Pub. in Proceedings of the Society of Photo-Optical Instrumentation Engineers 538, p179-187 1985.

Keywords: *Dimensional measurement, *Line width, Metal oxide transistors, Optical microscopes.

A monochromatic, waveguide model is presented which can predict the optical microscope images of thick-layer objects including multilayer structures with sloping, curved, and undercut edges, granular structures such as polysilicon, and asymmetric objects. The model is used to illustrate the effects of line structure on the optical image. Qualitative agreement with experimentally obtained optical image profiles is demonstrated. Application of the model to study the effects of variations in layer thickness and edge geometry on linewidth measurements made at different stages of manufacturing an MOS device is discussed.

709,668
PB86-201399 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Electrodeposition of Nickel-Chromium Alloys.
Final rept.
D. S. Lashmore, and I. Weisshaus. 1984, 10p
Pub. in Proceedings of the Meeting of the Mechanical Failures Prevention Group (37th), Gaithersburg, MD., May 10-12, 1983, p39-48 1984.

Keywords: *Electrodeposition, Nickel alloys, Chromium alloys, Protective coatings, Wear resistance.

A process has been developed to electrodeposit nickel chromium alloys from aqueous solutions. The composition of this coating can be varied from 1% to about 60% (wt.) chromium by varying the deposition parameters. Coatings greater than 100 micrometers have been made. Dry sliding wear performance of the 20% chromium alloys is shown to be superior to electrodeposited nickel. The corrosion performance was characterized by the Potentiodynamic method. The alloy is a composition modulated materal with layers rich in chromium adjacent to layers poor in chromium. The layer spacings vary from between 100 and 1000 nanometers. The existence of layers is consistent with diffusion phenomena occurring in a two component system. These layers are thought to play a role in the corrosion performance of the coating.

709,669
PB87-219234 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Effect of Power Supply Response Characteristics on Droplet Transfer of GMA Welds.
Final rept.,
G. Kohn, and T. A. Siewert. 1986, 4p
Pub. in Proceedings of International Conference on Trends in Welding Research, Gatlinburg, TN., May 18-22, 1986, p299-302.

Keywords: *Gas metal-arc welding, *Droplets, Sputtering, Oscilloscopes, Lasers, Cameras, Fourier analysis, Power supplies, Control, Reprints.

The droplet transfer in gas metal arc welding was studied with a digital oscilloscope, laser backlighting, and a video camera. Fast Fourier transform of the digital current and voltage signals showed droplet transfer rates that were within 10% of the values determined with the video-tape record. A modified current controller with a variable upper current limit reduced the spatter in short circuiting welding by more than half.

709,670
PB88-113766 PC **A03**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Dynamic Microindentation of RDX (Cyclo-Trimethylene Trinitramine): Effect of Rate on Plasticity and Fracture.
Technical rept. (Final),
R. S. Polvani, A. W. Ruff, and J. C. Robbins. Jun 87, 32p NBSIR-87/3634
Contract N00014-86-F-0065
Sponsored by Office of Naval Research, Arlington, VA.

Keywords: *RDX, Fracture, Mechanical, *Dynamic properties, Energetic material, Microindentation, Plasticity.

Microindentation measurements have been made on RDX crystals to determine the effect of load and time of loading on their mechanical response. A spherical indenter tip was used. The results are compared to those obtained earlier using pyramidal Vickers indenters. At the shortest loading periods a higher than expected plastic response was found which may indicate that local heating resulted from the indentation process.

Nondestructive Testing

709,671
PATENT-4 287 473 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nondestructive Method for Detecting Defects in Photodetector and Solar Cell Devices.
Patent.
D. Sawyer. Filed 25 May 79, patented 1 Sep 81, 8p
PB81-600044, PAT-APPL-6-042 462

Keywords: *Forward-biasing, Internal resistance, Intrinsic distributed resistance, Semiconductor device defects.

The invention described herein is a method for locating semiconductor device defects and for measuring the internal resistance of such devices by making use of the intrinsic distributed resistance nature of the devices. The method provides for forward-biasing a solar cell or other device while it is scanning with an optical spot. The forward-biasing is achieved with either an illuminator light source or an external current source.

709,672
PATENT-4 699 551 Not available NTIS
Department of Commerce, Washington, DC.
Method and Apparatus for Measuring Machine Cutting Tool Positions.
Patent,
J. P. Peris. Filed 11 Mar 86, patented 13 Oct 87, 10p
PB88-121397, PAT-APPL-6-838 726
Supersedes PB86-199171.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.50.

Keywords: *Patents, *Positioning devices(Machinery), *Machine tools, Measurement, Cutting tools, Lathes, Drilling machines(Tools), Boring machines.

An apparatus and method are provided for on-line measurement of a lathe cutting tool position using a measuring head with a rotatable square plate engaged with three cylindrical plungers and a positioning mechanism for pivoting the measuring head. The positioning mechanism includes a movable member mounted on a base on the lathe headstock and a rotating unit for rotating the movable member about an axis. A stop member is provided to stop the movable member at a locating position. The measuring head includes a square plate supported inside a housing and rotatable about a y-axis therein. The plungers extend into the housing to contact the plate near its corners.

709,673
PB-263 531/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nondestructive Techniques for Evaluating Metallic Artifacts of Historical Interest.
Final rept.,
P. W. Brown, and J. R. Clifton. 1976, 20p
Pub. in the Bulletin of the Association for Preservation Technology, v8 n4 p2-21 1976.

Keywords: *Nondestructive tests, Compositions, Microstructure, Age determination, Metals, Artifacts, Reprints.

The paper describes a variety of nondestructive evaluation (NDE) techniques which can be used to characterize the compositions and methods of fabrication of metallic artifacts, to form a basis for approximating their ages and determining their sources. This paper was prepared with the objective of showing preservation technologists how NDE methods can be used in the course of their work.

709,674
PB-268 632/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NDE of Materials by Computerized Ultrasonic Tomography,
A. C. Kak, C. V. Jakowatz, and M. Linzer. 1976, 12p
Pub. in Proceedings of Conference on Automated Inspection and Product Control (2nd), Chicago, Ill., Oct. 19-21, 1976, p235-246 1976.

Keywords: *Nondestructive tests, *Materials, Ultrasonic tests, X ray analysis, Images, Display systems, Data processing, Optical scanners, *Tomography.

Recent developments in computer assisted tomography have opened up many new opportunities in automated NDE of materials. Computerized tomography basically consists of digitally constructing cross-sectional images of objects using projection data. For medical and material applications, this projection data may be obtained by using either x-ray or ultrasound. In this paper the basic principles of these techniques are first reviewed and then the potential applications of ultrasonic tomography to materials inspection are discussed.

709,675
PB-270 577/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
National Bureau of Standards Program in Nondestructive Evaluation.
Final rept.,
H. Berger. 1976, 11p
Pub. in Proceedings of Symp. on Nondestructive Testing Standards, Gaithersburg, Maryland, May 19-21, 1976, Am. Soc. Test. Mater. Spec. Tech. Publ. 624: Nondestructive Testing Standards - A Review, p317-327 Jun 77.

Keywords: *Nondestructive tests, Reviews, National Bureau of Standards.

The rationale and present technical content for the NBS program in nondestructive evaluation (NDE) is presented. Needs for improved NDE measurement reliability and accuracy, needs that led to the establishment of this new program, are discussed. The present technical program is described. It includes work related to acoustic-ultrasonic, radiography, visual, electrical-eddy-current, microwave, penetrant and thermal testing and wear debris analysis. The program content is summarized in two tables. Outputs from this program are indicated; these include standards and methods of measurement, calibration services and standard reference materials.

709,676
PB-270 578/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calibration of Radiation Sources for Radiography.
Final rept.,
E. H. Eisenhower. 1977, 7p
Pub. in Proceedings of Symp. on Nondestructive Testing Standards, Gaithersburg, Maryland, May 19-21, 1976, Am. Soc. Test. Mater. Spec. Tech. Publ. 624: Nondestructive Testing Standards - A Review, p82-88 Jun 77,

Keywords: *Radiography, *Standards, *Calibrating, Sources, Gamma rays, X rays, Nondestructive tests.

A survey was conducted to find and evaluate published national standards for calibration of radiation sources used in industrial radiography. No standards were found on this specific subject, although several standards for medical radiography were discovered and summarized. The latter are inadequate for industrial radiography, but serve as general guidance on the subject. The need for an industrial standard is discussed, and a specific mechanism for developing such a standard is suggested if the need is considered to be sufficient.

709,677
PB-271 338/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nondestructive Testing Standards - A Review.
Final rept.,
H. Berger. 1977, 352p
Pub. as American Society for Testing and Materials, Philadelphia, Pa., Special Technical Pub. 624.

Keywords: *Nondestructive tests, *Standards, Reviews, Reprints.

This 352-page book contains reviews, critiques, and general information on nondestructive testing standards. Background information on the standards prepa-

ration process and on the needs of various society and government organizations is followed by discussions of standards for specific nondestructive testing methods. These methods include radiography, ultrasonics, acoustic emission, liquid penetrant, magnetic particle, visual, optical, and leak testing. The final series of papers looks towards the future, for example, at needs for quantitative results and automated systems. Standards and specifications for nondestructive testing have evolved over a long period of time. The papers in this volume begin a long overdue examination of these standards. The problems of multiple standards and the confusion and inefficiency that brings with it are cited many times. Also, problems of reproducibility for many methods are indicated because variables associated with the methods are not under sufficient control. The book brings out these problems and hopefully will provide a stepping-off point for solutions and future improvements in nondestructive testing standards.

709,678

PB-271 842/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nondestructive Evaluation (NDE) National Bureau of Standards (NBS).
Final rept.,
H. Berger. 1977, 4p
Pub. in Nondestructive Testing Infor. Anal. Ctr. Newsletter 5, n2 p1-4 Aug 77.

Keywords: *Nondestructive tests, Standards, Reliability, Calibrating, Sonic tests, Ultrasonic tests, Evaluation, Transducers, Reprints, Standard reference materials, Acoustic emission.

The NBS-NDE Program is working to improve NDE measurement reliability and reproducibility, particularly in the areas of acoustic-ultrasonic, radiography, visual testing, electrical eddy-current testing, microwave method, penetrant testing, wear debris analysis and thermal testing. Calibration service for aluminum reference blocks is now available. Also available for sale are standard reference materials for coating thickness measurement and for calibration of densitometers. Short term future plans call for a loaner service for aluminum ultrasonic reference blocks, and calibration services for ultrasonic and acoustic emission transducers and for electrical conductivity. A recommended practice for thermal neutron radiography in collaboration with ASTM is in draft form.

709,679

PB-272 537/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Use of Acoustic Emission in a Test for Beam-Lead, TAB, and Hybrid Chip Capacitor Bond Integrity.
Final rept.,
G. G. Harman. 1977, 12p
ARPA Order-2397
Pub. in IEEE Trans. Parts, Hybrids, and Packaging PHP 13, n2 p116-127 Jun 77.

Keywords: *Sonic tests, *Ultrasonic tests, *Electric connectors, Nondestructive tests, Microelectronics, Bonding, Reprints, Beam lead devices, Acoustic emission.

The main achievement of the work was the development of means of nondestructively stressing the delicate, irregularly extending beam leads. The most promising of the methods investigated are a silicone rubber (SR) pull test, a push down test on SR encapsulated devices, and various probe methods of applying force to the beams without contacting the chip. AE bursts from weak bonds or beam anchors are detected with a substrate detector operating at 375 kHz or a probe detector operating at 1.1 MHz or both. The study has revealed considerable differences in the mechanical integrity of beam lead bond-anchor systems. General deterioration of the beam-anchor system begins at pull forces per beam of from approximately 1.0 to 2.5 gf, depending on the manufacturer's procedure. The forces applied to the beam-anchor system for all methods of stressing, except the pull test, are dependent upon the shape of the individual beams as they extend from the chip, as well as the uniformity of the bugging height.

709,680

PB-272 848/3 PC **A13**/MF **A01**
National Bureau of Standards, Washington, D.C. Metallurgy Div.
MFPG, Detection, Diagnosis and Prognosis,
T. R. Shives, and W. A. Willard. Sep 77, 299p NBS-SP-494
Proceedings of the Meeting of the Mechanical Failures Prevention Group (26th), Held at the IIT Research Inst., Chicago, Illinois on May 17-19, 1977. Sponsored in part by Office of Naval Research, Arlington, VA, Federal Aviation Administration, Washington, D.C. and National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center. See also AD-772 082.

Keywords: *Nondestructive tests, *Failure(Mechanics), *Meetings, Monitors, Lubricating oils, Wear, Fatigue(Materials), Detectors, Bearings, Diagnosis, Spectrum signatures, Test equipment, Ground vehicles, Vibration.

Consists of 25 papers as follows: Statistical Analysis of Wear Metal Concentration Measurements in Oil..., K. Scheller and K. Eisentraut; Effective Fluid Analysis of Oil Wetted Systems..., R. Tessmann and G. Maroney; Oil Analysis/Wear Particle Analysis, P. Senholzi; Application of Ferrographic Lube Oil Analysis..., G. Rester; Effectiveness of the Real Time Ferrograph..., R. Valori; Ferrographic Separation of Organic Compounds, E. Bowen and V. Wescott; Mechanical Signature Analysis..., J. Mitchell; Spectrum Analysis and Machinery Monitoring, G. Lang; Comparison of Vibration Signature..., J. Frarey; The Role of Signal Processing..., J. Hamilton; Diagnostic Techniques..., R. Bannister, et al; Experimental Determination of Radial..., R. Leon; A New Chip Detector..., T. Tauber; Time Waveform Analysis..., J. Catlin; The Advent of Sophisticated Fluid Power Systems..., M. Wigton; Tire Degradation Monitoring, W. Lichodziejeswki; Use of Microprocessors..., Pictorial History of the Development of Proximity Probes..., L. Hoogenboom; DOT System for Train Accident Reduction, J. O'Steen; Comparison of Vibration Analysis Techniques..., W. Waldron; Maintenance Management Through Diagnosis, R. Salter; Vehicle Monitoring System, S. Hadden, et al; Systemized Diesel Engine Diagnostics..., H. Mercik, Jr.; Remote Diagnostic Techniques Used in Viking Lander Operations, P. Stafford.

709,681

PB-273 081/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Scanning of Active Integrated Circuits and Discrete Semiconductor Devices.
Final rept.,
D. E. Sawyer, D. W. Berning, and D. C. Lewis. 1977, 6p
ARPA Order-2397
Pub. in Solid State Technology 48, p37-41 Jun 77.

Keywords: *Nondestructive tests, *Integrated circuits, *Semiconductor devices, *Scanning, Lasers, Optical scanners, *Optical scanning, Active systems, Reprints.

The device laser scanning work conducted in the Electronic Technology Division of the National Bureau of Standards (NBS) is described. The scanner constructed at NBS is sketched briefly; this is followed by illustrations demonstrating its usefulness for determining on a point-by-point basis the inner workings of active semiconductor devices. The scanner is non-damaging to all devices tried and it has been used to map d-c and high-frequency gain variations in transistors, reveal areas of the device operating in a nonlinear manner, electronically map temperatures within devices, determine internal logic states in ICs and selectively change these states at will. It has also been used to perform hitherto impossible measurements on flip-chip bonded devices, that is, seeing the circuit electrical operation and the metallization pattern through the backside of the chip. Applications to other structures and devices including solar cells are suggested.

709,682

PB-275 019/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Eddy-Current Losses Due to a Surface Crack in Conducting Material.
Final rept.,
A. H. Kahn, R. Spal, and A. Feldman. Nov 77, 6p
Pub. in Jnl. of Applied Physics, v48 n11 p4454-4459 Nov 77.

Keywords: *Eddy current tests, Nondestructive tests, Electromagnetic testing, Cracks, Surface defects, Reprints.

Calculations are reported for the spatial distribution of magnetic fields in the neighborhood of a long surface crack in a conductor, where a uniform ac magnetic field is applied parallel to the length of the crack. The problem is resolved into tractable parts consisting of the cases of eddy currents near a semi-infinite crack with a sharp tip and eddy currents near a square corner. The semi-infinite crack problem is solved exactly by a modification of Sommerfeld's diffraction theory and the corner problem is treated by a Green's function obtained by the method of images. The composite solution is valid for a crack of depth equal to four times the electromagnetic skin depth or greater. From the solution, the Poynting vector is calculated and its integral over the surface computed. The change in power dissipation relative to the 'uncracked' surface is given in a simple form.

709,683

PB-276 202/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nondestructive Evaluation Program at the National Bureau of Standards.
Final rept.,
H. Berger. Oct 77, 3p
Pub. in Jnl. of Non-Destructive Testing 10, n5 p277-279, Oct 77.

Keywords: *Nondestructive tests, Ultrasonic tests, Radiography, Standards, Transducers, Calibrating, Reprints, Acoustic emissions, Reference blocks.

The Nondestructive Evaluation Program at NBS is briefly reviewed for the readers of an international NDE journal. The aims of the program are outlined. The methods under study in the NDE Program are reviewed, emphasis being placed on the acoustic-ultrasonic and radiographic methods.

709,684

PB-280 311/2 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Evaluation of Search Units Used for Ultrasonic Reference Block Calibrations.
Interim rept. 1 Jun 77-21 Dec 77,
D. J. Chwirut, and G. D. Boswell. Feb 78, 30p
NBSIR-78-1454

Keywords: *Standards, *Ultrasonic tests, Calibrating, Test equipment, Units of measurement, Nondestructive testing, Transducers, Reference blocks.

The effects of using different (nominally identical) quartz search units in the evaluation of ASTM-type standard reference blocks are determined. Various characteristics of the search units are measured and correlated with the amplitude of the ultrasonic response from reference blocks to determine which characteristics must be specified if reproducible results are to be obtained. It is shown by a series of experiments that the exact shape of the distance-amplitude curve in water (axial profile) is a primary characteristic that must be considered. When operational corrections for differences in axial profiles are made, the variability in ultrasonic responses from reference blocks, measured with different search units, is reduced from about 25 percent to 4 percent.

709,685

PB-280 464/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Important Considerations for SEM Total Dose Testing.
Final rept.,
K. F. Galloway, and P. Roitman. Dec 77, 5p
Sponsored in part by Defense Nuclear Agency, Washington, D.C.
Pub. in IEEE Trans. Nucl. Sci. NS-24, n6 p2066-2070, Dec 77.

Keywords: *Radiation tests, *Nondestructive tests, *Semiconductor devices, Electron beams, Radiation dosage, Radiation effects, Radiation hardness, Scanning electron microscopes, Reprints.

The kilovolt electron beam used in a scanning electron microscope has been of interest as a tool for total dose screening of semiconductor devices for hardness assurance because of its convenience and because devices can be selectively irradiated directly at the wafer level. A number of factors such as the depth-dose distribution of kilovolt electrons, the dose-rate, uniformity of exposure, and device biasing must be considered when applying this technique. This paper is devoted to these and other aspects of SEM total dose testing.

709,686
PB-280 807/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NDT Method Using Piezoelectric Polymer Transducers and Computerized Vibrational Spectroscopy.
Final rept.,
D. H. Reneker, S. Edelman, A. DeReggi, and D. L. VanderHart. Feb 78, 2p
Pub. in NDT Intl., P15-16 Feb 78.

Keywords: *Nondestructive tests, *Vibrational spectra, Piezoelectric transducers, Piezoelectric materials, Polymers, Data processing, Normal modes, Reprints.

The normal mode vibrational spectrum of a particular object contains a wealth of information about the mechanical integrity of the object. The nondestructive evaluation of objects by observation of their vibrational spectra is facilitated by the combination of recently developed low mass, high compliance piezoelectric polymer transducers, a synchronized method for exciting the sample, and a small computer capable of making digital Fourier transforms which convert the complicated, oscillatory, decaying signal from the transducer into the intensities and frequencies of normal modes.

709,687
PB-280 817/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nondestructive Method for the Determination of Forward-Biased Safe-Operating-Area Limits for Power Transistors.
Final rept.,
D. L. Blackburn, and S. Rubin. Oct 77, 6p
Pub. in Proceedings of 1977 Power Electronics Specialists Conference, Palo Alto, Calif., Jun 14-16, 1977.

Keywords: *Nondestructive tests, *Transistors, Thermal stability, *Power transistors, Second breakdown, Safe operating areas.

It is proposed that the limit of thermal instability replace the traditional limit of second breakdown for the safe-operating-area limits of power transistors. A nondestructive method for measuring the limit of thermal instability is described. The relationships between thermal instability, stable hot spots, and second breakdown are reviewed and it is shown that stable hot-spot operating conditions can exist within the traditional safe operating area based upon second breakdown. The proposed safe-operating-area limit is shown to exclude these hot-spot operating conditions. The effect of thermal resistance on the thermal instability limit is briefly discussed.

709,688
PB-280 819/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Test Unit for the Nondestructive Determination of Forward-Biased Safe-Operating Area Limits for Power Transistors.
Final rept.,
S. Rubin, and D. L. Blackburn. Oct 77, 8p
Pub. in Proceedings of Conference of Industrial Applications Society Annual Meeting, Los Angeles, Calif., Oct 3-6, 1977, Paper 27-F, p666-673, Oct 77.

Keywords: *Nondestructive tests, *Transistors, Test equipment, Thermal stability, *Power transistors, Second breakdown, Safe operating areas.

A measurement technique is described and a detailed circuit description is given for using the onset of thermal instability to generate the safe operating area (SOA) limits of power transistors. The technique is nondestructive. The safe operating area generated using this method excludes operating conditions for which current nonuniformities and excessive junction temperatures (hot spots) occur. Comparisons are given between safe operating areas based upon the limit of thermal instability, the manufacturers specified SOA, and the measured limit of second-breakdown.

709,689
PB-281 343/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Method for the Experimental Evaluation of X-Ray Grids.
Final rept.,
C. E. Dick, and J. W. Motz. Apr 78, 8p
Pub. in Med. Phys., v5 n2 p133-140 Mar/Apr 78.

Keywords: *Radiography, *Grids(Coordinates), Evaluation, X rays.

The work describes a new method for the experimental evaluation of antiscatter x-ray grids in radiography. Five commercial grids are evaluated in terms of two parameters which are determined only by the construction of the grid and the x-ray energy. A comparison of the grid performances was made for the x-ray energies and scatter conditions that usually apply to chest radiography and mammography. The results show that for maximum scatter conditions the grid enhances the subject contrast by factors of approximately 6 and 2 in chest radiography and mammography, respectively, and that the contrast increases as the grid ratio increases. Also, in these examinations, the results show that, with improved grids, it is possible to reduce the patient exposures required for the no-grid case by approximately one-half without loss of the image-information content (signal-to-noise ratio).

709,690
PB-281 995/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Technological Development of Neutron Radiography.
Final rept.,
D. A. Garrett, and H. Berger. 1977, 18p
Pub. in Atomic Energy Review, v15 n2 p125-142 1977.

Keywords: *Neutron radiography, *Nondestructive tests, Reviews, Reprints.

Neutron radiography is a relatively recent technological development in the annals of nondestructive evaluation. The technique is placed in propective with regard to other non-destructive evaluation methods in this paper. The paper gives description of the general techniques that are characteristic of the neutron radiographic process. The breadth and extent of present neutron radiographic technology is discussed as a conclusion of the paper.

709,691
PB-282 903/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Three-Dimensional Thermal Neutron Radiography.
Final rept.,
H. Berger, W. L. Parker, N. P. Lapinski, and K. J. Reimann. 1977, 6p
Pub. in Proceedings of World Conference on Nondestructive Testing (8th), Cannes, France, 6-11 Sep 76 Sect3L4 p1-6 1977.

Keywords: *Neutron radiography, Thermal neutrons, Nondestructive tests, Resolution, Three dimensional.

Three-dimensional radiography with thermal neutrons is described. The laminagraphic method is shown to provide a spatial resolution better than 1 mm for complex objects as thick as 50 mm.

709,692
PB-282 912/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Inspection by Neutron Radiography.
Final rept.,
H. Berger. Aug 76, 5p
Pub. in Metals Handbook - 8th ed. v11, Non-destructive Inspection and Quality Control, p156-160 Aug 76.

Keywords: *Neutron radiography, Nondestructive tests, Inspection, Reprints.

Neutron radiography is a form of nondestructive inspection that employs a neutron beam to form a radiographic image of an object. The principles of the process and the role that it plays in the nondestructive evaluation of materials and components are the subjects of this article. The characteristics that differentiate neutron radiography form other radiographic methods and the complementary role that it plays in relation to other techniques are emphasized. Details of neutron beams and their interactions with matter, sources, the attenuation of neutron beams, neutron collimation and neutron beam imaging are included in this presentation. The applications of neutron radiography are presented in terms of its advantages for improved contrast on low-atomic-number material, discrimination between isotopes and elements, and the inspection of highly radioactive materials.

709,693
PB-282 919/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Real-Time Thermal Neutron Radiographic Detection Systems.
Final rept.,
H. Berger, and D. A. Bracher. 1977, 7p
Pub. in Proceedings of World Conference on Nondestructive Testing (8th), Cannes, France, 6-11 Sep 76, Sect3L6 p1-7 1977.

Keywords: *Neutron radiography, Nondestructive tests, Real time, Images, Detection, Thermal neutrons.

Systems for real-time detection of thermal neutron images are reviewed. Characteristics of one system are presented; the data include contrast, resolution and speed of response over the thermal neutron intensity range 2500n/sq cm to 10 to the 7th power n/sq cm.

709,694
PB-285 042/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Innovative and Advanced NDT Radiography.
Final rept.,
H. Berger. Aug 77, 3p
Pub. in NDT Int., v10 n6 p339-340 Aug 77.

Keywords: *Radiography, Nondestructive tests, Signal processing, Images, Neutron radiography, Reprints.

A review is given of an American Society for Nondestructive Testing topical conference, Innovative and Advanced NDT Radiography. The conference covered a number of topics of interest to radiographers. These included flash, high energy and neutron radiography, computer analysis, and image quality evaluation.

709,695
PB-285 153/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nondestructive Testing Standards - The Role of NBS.
Final rept.,
H. Berger. 1978, 2p
Pub. in Proceedings Annual Meeting American Nuclear Society on Nondestructive Testing in the Nuclear Power Industries, Held at San Diego, California on June 18-22, 1978, v28 p124-125 1978.

Keywords: *Nondestructive tests, *Standards, Measurement, National Bureau of Standards.

Reliable, reproducible and meaningful nondestructive inspection has been a goal of the nuclear power industry from the beginning. A new National Bureau of Standards (NBS) program, Nondestructive Evaluation (NDE), is beginning to contribute toward that goal for nuclear power and other quality-conscious industries. A near-term objective of the NBS-NDE program is to provide means to improve nondestructive measurement reliability and reproducibility. The long-term objective of the NBS work is to gain a better understanding of the meaning of NDE measurements in terms of material or system performance. Therefore, there is a strong materials emphasis in the program.

709,696
PB-285 301/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Californium-252 as a Source for Thermal Neutron Radiography.
Final rept.,
H. Berger. 1978, 13p
Pub. in Proc. Int. Symp. on Californium-252 Utilization, Paris, France, Apr 26-28, 1976, pV-1-V-14 (E. I. du Pont de Nemours and Co., Aiken, S.C., 1978).

Keywords: *Neutron radiography, *Neutron sources, *Californium isotopes, Nondestructive tests, Thermal neutrons, Californium 252.

Thermal neutron radiography is compared to other methods for nondestructive evaluation; it is shown to offer advantages in many aerospace and nuclear inspection areas. One example concerns problems such as detection of nonbonds or cracks open to the surface, where liquid contrast agents can be used to help image defect areas. Descriptions and economics of neutron sources including reactors, subcritical assemblies, accelerators and radioactive sources are given. All the sources can be considered for in-plant inspection use; the higher yield sources offer initial economic advantages. Radioactive sources are well suited for field applications. The inspection effectiveness of 252Cf has been demonstrated. This source seems

particularly useful where a peak thermal flux of > or = 10 to the 7th power n/sq cm.s is needed.

709,697
PB-287 968/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calibrations and Standards for Nondestructive Testing.
Final rept.
H. Berger, and L. Mordfin. Oct 78, 4p
Pub. in Proceedings American Soc. Nondestructive Testing, Natl. Fall Conf (37th), Held at Detroit, MI. Oct 3-6, 1977. Paper in Mater. Eval., v36 n11 p36-39.

Keywords: *Nondestructive tests, *Radiography, Standards, Calibrating, Welded joints.

Improved nondestructive testing (NDT) standards and calibrations are needed to provide greater reproducibility of NDT measurements and to provide improvements in the quantitative characterization of defects. Different calibration and standards concepts may be required to meet these two needs. This theme is developed and illustrated by radiographic measurements of Trans-Alaska oil pipeline girth welds.

709,698
PB-288 101/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron Radiographs Using the Ionographic Process.
Final rept.,
P. B. Scott, S. E. Johnson, G. W. Watson, and H. Berger. Oct 78, 3p
Pub. in Jnl. Applied Physics, v49 n10 p5078-5080 Oct 78.

Keywords: *Neutron radiography, Thermal neutrons, Ionography, Reprints.

Thermal neutron radiographs have been made using ionographic techniques. With an exposure of 10 to the 7th power neutrons/sq cm, image resolution of 4 line (1p)/mm was demonstrated. Apparatus for these demonstration experiments is described and alternative modes of operation are discussed. It appears possible to make ionographic neutron radiographs using a transmitted dose of 1,000,000 neutrons/sq cm.

709,699
PB-288 104/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
'New' Candidates for Ultrasonic NDE Standards and Calibrations.
Final rept.
G. Birnbaum. May 78, 5p
Pub. in Proceedings, ARPA/AFML Review of Progress in Quantitative NDE, Ithaca, NY, 14-17 Jun 77 p289-293 May 78.

Keywords: *Ultrasonic tests, Standards, Calibrating, Nondestructive tests, Acoustic emissions.

The National Bureau of Standards program in acoustic-ultrasonic calibrations and standards, aimed at solving some of the immediate problems, is reviewed. Work on acoustic emission transducers is directed at the determination of sensitivity and spectral response by the use of a reproducible stress impulse. Also in the area of acoustic emission is a program to develop a theoretical basis for acoustic emission signal analysis to characterize moving cracks or defects. Work on the characterization of ultrasonic transducers which should lead to formal calibration services in the near future includes determination of spectral characteristics by measuring the pressure of the ultrasonic radiation field, determination of the radiation pattern from near field measurements, and total power by calorimetry.

709,700
PB-289 755/1 PC **A03**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Office of Nondestructive Evaluation.
NDE (Nondestructive Evaluation) Publications: 1972-1977.
L. Mordfin. Nov 78, 36p NBSIR-78-1557

Keywords: *Nondestructive tests, *Bibliographies, Eddy current tests, Radiography, Ultrasonic tests, Acoustic emissions, National Bureau of Standards.

The report is a bibliography of 211 National Bureau of Standards (NBS) publications on nondestructive evaluation (NDE) and related technologies for the years 1972 through 1977. A detailed subject index is included, as well as information on how copies of many of the publications may be obtained. A preface by Harold Berger, Chief of the NBS Office of Nondestructive Evaluation, cites several early and significant NBS contributions to NDE, some of them dating back fifty years or more.

709,701
PB-290 522/2 Not available NTIS
National Bureau of Standards, Washington, DC.
X-Ray Magnifier.
Final rept.,
W. J. Boettinger, H. E. Burdette, and M. Kuriyama. Jun 79, 5p
Pub. in Review of Scientific Instruments 50, n1, p26-30, Jan 79.

Keywords: *Radiography, *Images, *Magnetification, X ray diffraction, Real time operations, Reprints.

A method for the magnification of x-ray radiographic images is described and demonstrated. This magnifier employs two successive asymmetric diffractions of an x-ray beam from highly perfect silicon crystals. The two diffractions magnify the beam in two perpendicular directions. A device with a magnification of 25x is demonstrated for CuK alpha radiation. This device preserves and sometimes improves the resolution inherent in the radiographic technique. The use of the x-ray magnifier is particularly useful in circumventing the relatively poor spatial resolution of electro-optical imaging systems needed for real-time observations. Basic limits on magnification and resolution using this method are described.

709,702
PB-291 946/2 PC **A04**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Office of Nondestructive Evaluation.
Annual Report 1978, Office of Nondestructive Evaluation.
Final rept.
H. Berger, and L. Mordfin. Nov 78, 59p NBSIR-78-1581

Keywords: *Nondestructive tests, Ultrasonic tests, Radiography, Eddy current tests, Fluorescent penetration tests, Electromagnetic testing, Wear debris analysis.

The report summarizes the activities of the National Bureau of Standards (NBS) Nondestructive Evaluation (NDE) Program. It emphasizes activities over the Fiscal Year, 1978. However, since this is the Program's first Annual Report, some material is included to summarize activities since the Program was formally instituted in June 1975.

709,703
PB-291 977/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Scattering of Elastic Pulses and the Non-Destructive Evaluation of Materials.
Final rept.
W. Sachse, and S. Golan. 1979, 21p
Pub. in Proceedings American Society of Mechanical Engineers Winter Annual Meeting, Held at San Francisco, CA. on Dec 10-15, 1978 p11-31 (Amer. Soc. of Mech. Engineers, New York, NY, 1979).

Keywords: *Ultrasonic tests, *Nondestructive tests, Materials tests, Elastic waves, Defects, Cracks.

This paper is a review of the results of experiments and their interpretation of the scattering of bulk ultrasonic pulses from various smooth and crack-like obstacles imbedded in an elastic solid. The scattering by circular and elliptical cylinders and multiple inclusions possessing a wide range of acoustic properties and crack-like defects of various sizes and orientations is described. For the smooth obstacles, it is shown that both arrival-time and spectral analysis of the scattered signals contain information regarding the characteristics of the scatterer and either can be used to characterize such obstacles. For the crack-like scatterers, the time-delays of various signals scattered by the crack are measured relative to reference signals from the specimen surfaces from which the crack size can be ascertained.

709,704
PB-295 140/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Accurate Calibration of Gold Film Standards by Neutron Activation and Gravimetry.
Final rept.,
R. M. Lindstrom, S. H. Harrison, and J. M. Harris. Dec 78, 6p
Pub. in Jnl. of Applied Physics 49, n12, p5903-5908, Dec 78.

Keywords: *Gold coatings, Mass, Thin films, Dimensional measurement, Thickness, Gravimetric analysis, Neutron activation analysis, Backscattering, Accuracy, Errors, *Measuring methods, Rutherford scattering, Reprints.

A set of evaporated gold films on silicon substrates has been prepared for use as standards in the measurement of film thickness by Rutherford backscattering. The mass of gold in the films was determined independently by gravimetry and by instrumental neutron activation. The area was measured with an optical comparator; film uniformity was assayed by backscattering. Systematic errors in the single-element comparator method of activation analysis have been assessed and either eliminated or compensated, with the result that the single-sample agreement in mass between the two methods was 0.3% and the mean relative bias was below the random errors, also 0.3%.

709,705
PB-296 278/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Microelectronic Test Pattern for Measuring Uniformity of an Integrated Circuit Fabrication Technology.
Final rept.
T. J. Russell, D. B. Maxwell, C. T. Reimann, and M. G. Buehler. Feb 79, 4p
ARPA Order-2397
Pub. in Proceedings of Government Microcircuit Application Conference Held at Monterey, CA. on November, 1978. Solid State Technology, 22, n2 p71-74, Feb 79.

Keywords: *Integrated circuits, *Electrical measurement, Fabrication, Electrical properties, Performance evaluation, Microelectronics, Nondestructive tests.

Dopant density, device and circuit parameters, and random-fault densities across the wafer are important considerations in integrated circuit processing. The application of process validation wafers to evaluate silicon fabrication technologies is being studied in terms of the uniformity of these parameters across the wafer. This concept is illustrated by measurements of selected test structures on the NBS-7 test pattern which was designed to assess a junction-isolated transistor-transistor logic process. Use of this pattern in identifying fabrication nonuniformities is demonstrated by means of wafer maps of values of key parameters.

709,706
PB-297 399/8 PC **A16**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Center for Materials Science.
MFPG - Detection, Diagnosis, and Prognosis.
T. R. Shives, and W. A. Willard. Jul 79, 371p NBS-SP-547
See also report dated Sep 77, PB-272 848. Library of Congress catalog card no. 79-600078. Sponsored in part by Office of Naval Research, Arlington, VA. Department of Energy, Washington, DC. Fossil Energy, and National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
Proceedings of the Meeting of the Mechanical Failures Prevention Group (28th), Held at San Antonio, Texas on November 18-30, 1978.

Keywords: *Nondestructive tests, *Failure(Mechanics), *Meetings, Detection, Prognosis, Aerospace engineering, Marine engineering, Industrial engineering, Motor vehicles, Diagnosis(General).

These proceedings consist of a group of twenty five submitted papers from the 28th meeting of the Mechanical Failures Prevention Group which was held in San Antonio, Texas, November 28-30, 1978. The central theme of the proceedings deals with detection, diagnosis, and prognosis as related to mechanical failure prevention. Special emphasis is on aerospace applications, land based applications, marine applications, and industrial application.

709,707
PB-298 809/5 PC **A04**/MF **A01**

National Measurement Lab. (NBS), Washington, DC. Office of Nondestructive Evaluation.
Comparison of American and European Ultrasonic Testing Standards.
S. Golan. Aug 79, 74p NBSIR-79-1790

Keywords: *Ultrasonic tests, Standards, Comparison, Utilization, Evaluation, *Foreign technology.

In this work twenty-seven general ultrasonic standards from eleven countries and international organizations were reviewed. Thirty-seven ultrasonic product standards from five countries were studied to evaluate the utilization of the general ultrasonic standards, i.e., to what extent the procedures outlined in the general standards are applied by the product standards.

709,708
PB-300 784/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Toward the Development of Improved Reference Fatigue Cracks for Use in Ultrasonic Nondestructive Evaluation.
Final rept.,
D. J. Chwirut, and D. G. Eitzen. 1979, 19p
Pub. in International Adv. Nondestructive Test. 6, p176-197 1979.

Keywords: Ultrasonic tests, *Fatigue(Materials), Cracks, Standards, Defects, *Nondestructive tests.

A rationale for the development of well-characterized fatigue cracks for use as standards for advanced ultrasonic flaw evaluation systems is presented. The primary parameters affecting the ultrasonic response from fatigue cracks are reviewed. A loading program to generate controlled cracks and to minimize the effects of some of these parameters is described. As determined by these techniques, measured crack lengths are accurate within a few percent. The specimens are being used as test objects in the development of a new technique for flaw evaluation by ultrasonics, radiography, and penetrants.

709,709
PB-301 346-T PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC.
Principles of Neutron Radiography.
N. D. Tyufyakov, and A. S. Shtan'. c1979, 206p TT-76-52048
Trans. of mono. Osnovy Neitronnoi Radiografii, Moscow, 1975, by A. K. Dabir. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Neutron radiography, Nondestructive tests, Neutron diffraction, Neutron counters, Radiation tests, Thermal neutrons, Neutrons, Translations.

This book discusses the physical and technological principles of neutron radiography with special reference to the nondestructive testing of materials and manufactured articles with the help of slow neutrons. The possibility of using different types of neutron source for neutron radiography and the parameters of the neutron beams to be used, the specifications of instruments for detecting neutron images by the direct exposure and transfer methods, types of intensitometer, analysis of neutron diffraction patterns, and related matters are examined in detail. The authors provide data on the flaw detection sensitivity of homogeneous and nonhomogeneous materials and discuss ways to improve it. They offer plan diagrams for neutron radiography based on different neutron sources and suggestions on nondestructive testing by the neutron radiography method.

709,710
PB78-600070 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Report on the Symposium on Nondestructive Testing Standards.
G. Birnbaum. 1977, 1p
Pub. in AFML-TR-77-44, p158 1977.

Keywords: *National Bureau of Standards, Nondestructive calibrations, Nondestructive evaluation, Nondestructive evaluation calibrations, Symposium.

A symposium on nondestructive testing (NDT) standards reflecting widespread current concern with this area was held at the National Bureau of Standards (NBS) May 19-21, 1976. The symposium was cosponsored by the National Bureau of Standards (NBS), the American Society for Testing and Materials (ASTM), the American Society for Nondestructive Testing (ASNT), with the American National Standards Institute (ANSI) cooperating. The meeting provided the first general forum encompassing discussions on the processes by which NDT codes, standards, and specifications become accepted, and discussions on the status and needs that exist in all NDT methods. Major themes included standards documents, the status of standards in the major methods used in NDT and future directions. A summary of this meeting is presented.

709,711
PB80-117401 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultrasonic Transducers for Materials Testing and Their Characterization.
Final rept.,
W. Sachse, and N. N. Hsu. 1979, 129p
Pub. in Physical Acoustics XIV, Chapter 4, p277-405 1979.

Keywords: *Transducers, *Ultrasonic tests, Reviews, Materials tests, Nondestructive tests, Ultrasonic radiation, Reprints.

The paper is a comprehensive review of ultrasonic transducers which are being used for materials testing and flaw detection. Emphasis is placed on the characterization of these transducers. The scope of this review is four-fold: (1) to consider the ultrasonic transducer coupled to various test media as an element in an ultrasonic system; (2) to survey the various methods of ultrasound transduction; (3) to summarize some of the techniques by which the characteristics of a transducer are modified; and (4) to review the techniques for transducer characterization. The emphasis is on transduction devices of bulk waves propagating in solids including contact, immersion and angle beam transducers.

709,712
PB80-161748 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Evaluation of a Proposed ASTM (American Society for Testing and Materials) Standard Guide to Assess the Compatibility of Metal-Heat Transfer Liquid Pairs in Solar Heating and Cooling Systems,
P. W. Brown, and J. W. Grimes. Nov 79, 46p NBSIR-79-1919
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Materials tests, Evaluation, Heat transfer, Corrosion, Tests, Standards, Solar heating, Compatibility, Solar cooling.

The study was undertaken as part of a round-robin evaluation of a proposed American Society for Testing and Materials (ASTM) testing methodology entitled, 'Standard Guide for Laboratory Screening of Metallic Containment Materials for Use with Liquids in Solar Heating and Cooling Systems.' This study was undertaken solely to evaluate the procedural aspects of each test method and the results of this study are not intended to provide an assessment of the suitability of any of the metals evaluated for use in solar heating and cooling systems. It was determined that the tests described in this Standard Practice can be carried out as a basis for evaluating metal-heat transfer liquid pair interactions under conditions simulative of various modes of solar containment system operation.

709,713
PB80-178049 Not available NTIS
National Bureau of Standards, Washington, DC.
Recent Progress in Eddy Current Testing.
Final rept.,
H. Berger, G. Birnbaum, and G. Free. 1980, 8p
Pub. in Proceedings of the International Symposium on New Methods of Non-Destructive Testing of Materials and their Application Especially in Nuclear Engineering, Saarbrucken, West Germany, September 17-19, 1979 p99-106 Mar 80.

Keywords: *Eddy current tests, Reviews, Automation, Data processing.

The effectiveness of eddy current nondestructive testing is being enhanced by recent advances in theoretical analysis, new measurement methods, and the use of automation and computers for data analysis. Progress has been made in these areas as evidenced by papers presented at a Symposium held September 79 in USA. This paper presents a survey of the symposium papers related to the nuclear industry dealing with theory and applications of multifrequency techniques, automation methods and data analysis including pattern recognition. Those areas in which increased emphasis in further research appear to be profitable will be indicated.

709,714
PB80-218563 Not available NITS
National Bureau of Standards, Washington, DC.
Nondestructive Testing in the 80's.
Final rept.,
H. Berger. Aug 80, 5p
Pub. in Mental Progress 118, n3 p33-37 Aug 80.

Keywords: *Nondestructive tests, Reviews, Automation, Radiography, Ultrasonic tests, Signal processing, Reprints, Tomography.

Present methods for nondestructive testing are reviewed briefly. The main emphasis in the paper is a look ahead toward the use of NDT in the immediate future. Increased use is seen for computer technology and signal processing, for the nondestructive characterization of both defects and material parameters, for traceable NDT measurements and continuous monitoring of machinery, engines and structures. Examples of NDT developments are given to support these predictions.

709,715
PB81-124984 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC.
Ultrasonic Materials Characterization.
Final rept.
H. Berger, and M. Linzer. Nov 80, 649p NBS/SP-596
Proceedings of the First International Symposium on Ultrasonic Materials Characterization Held at the National Bureau of Standards, Gaithersburg, MD. on June 7-9, 1978. Library of Congress catalog card no. 80-600148.

Keywords: *Ultrasonic tests, *Meetings, Defects, Nondestructive tests, Materials, Ultrasonic radiation, Velocity, Residual stresses, Signal processing, Microscopy, Acoustic scattering, Calibrating, Image processing, Laser applications.

Nondestructive testing has traditionally involved a search for flaws in materials or structures; it has long been appreciated that voids, cracks, inclusions, and similar flaws can lead to failure. Obviously, once a flaw has been detected, it is natural to consider methods that will give more information. What is the flaw size, type, location, or orientation. This information is necessary if a realistic assessment of the influence of the flaw on performance is to be made. In addition, it is now more widely recognized that parameters such as hardness, grain size, bonding, and residual stress can also have a strong influence on material performance. The use of ultrasonic nondestructive testing to characterize materials both in terms of properties and flaws is the subject of this volume. Therefore, this volume is about nondestructive characterization of parameters that influence the performance of materials.

709,716
PB81-126112 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultrasonic Diffraction Technique for Characterization of Fatigue Cracks.
S. Golan, L. Adler, K. V. Cook, R. K. Nanstad, and T. K. Bolland. 1980, 9p
Pub. in Jnl. Nondestr. Eval. 1, n1 p11-19 1980.

Keywords: *Ultrasonic tests, Fatigue(Materials), Cracking(Fracturing), Reprints.

This paper describes an ultrasonic diffraction technique for characterization of fatigue cracks. In a theoretical study the angular field of scattered energy was computed.

709,717
PB81-132466 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Technical Activities 1980, Office of Nondestructive Evaluation.
H. Berger, and L. Mordfin. Nov 80, 120p NBSIR-80-2162

Keywords: *Nondestructive tests, Reviews.

A review of nondestructive evaluation programs at NBS, for FY1980 is presented in this annual report.

709,718
PB81-134587 Not available NTIS
National Bureau of Standards, Washington, DC.
Three-Dimensional Radiographic Imaging.
W. A.Ellingson, and H. Berger. 1980, 38p
Pub. in Research Techniques in Nondestructive Testing IV, p1-38 1980.

Keywords: *Nondestructive tests, *Radiography, Images, Reprints, *Computerized axial tomography.

The various three-dimensional imaging methods will be described, with selected examples of NDT applications; also, the limitations of the more developed methods with respect to in-plane and plane-to-plane resolution will be pointed out.

709,719
PB81-135279 Not available NTIS
National Bureau of Standards, Washington, DC.
National and International Standards for NDT: to Achieve Improved Repeatability and Measures Related to Performance.
H. Berger. 1979, 12p
Pub. in Proceedings of the World Conference on Nondestructive Testing (9th) Held at Melbourne, Australia on Nov 18-23, 1979, 6-3, 12p 1979.

Keywords: *Nondestructive tests, Standards, Calibrating.

Nondestructive testing (NDT) standards provide a practical procedure to bring some measure of reproducibility to NDT measurements. Nevertheless, better standards are needed both to improve reproducibility and to provide quantitative data for performance-related analyses.

709,720
PB81-135295 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of NDT Standards in the US and USSR,
V. A. Koukhar, A. A. Maksimov, and H. A. Berger. 1979, 9p
Pub. in Proceedings of the World Conference on Nondestructive Testing (9th) Held at Melbourne, Australia on Nov 18-23, 1979, 6-3, 9p 1979.

Keywords: *Nondestructive tests, *Standards, Radiography, Ultrasonic tests.

An initial comparison and analysis is given for several radiographic and ultrasonic standards of the US (ASTM) and the USSR (GOST). This study is part of a joint US/USSR project on automated information systems in standardization. Differences between standards are pointed out.

709,721
PB81-142788 Not available NTIS
National Bureau of Standards, Washington, DC.
Basic Limits in Real-Time Industrial Radiographic Systems.
M. Kuriyama, W. J. Boettinger, and H. E. Burdette. 1980, 15p
Pub. in Proceedings of the Symposium on Real-Time Radiologic Imaging, Philadelphia, PA., Sep 1980, Paper in American Society Testing Materials Special Technical Publication STP716, p113-127 1980.

Keywords: *Radiography, Resolution, Collimation, Images, Magnification, Real time operations, Image intensifiers.

The paper discusses (1) collimation of primary radiation, including apparent size of sources, (2) monochromatic radiography to obtain true signals, (3) resolution improvement by a magnification of x-ray images before the radiation reaches the detecting (or viewing) system and briefly (4) intensification of signals when crystal collimation is used.

709,722
PB81-143232 Not available NTIS
National Bureau of Standards, Washington, DC.
Nondestructive Examination of a Defective Silver Braze Using Resonance-Neutron Radiography.
J. W. Behrens, R. A. Schrack, and C. D. Bowman. Nov 80, 5p
Sponsored in part by Nuclear Regulatory Commission, Washington, DC.
Pub. in Nuclear Technology 51, n1 p78-82 Nov 80.

Keywords: *Neutron radiography, *Brazed joints, Nondestructive tests, Silver, Reprints.

Resonance-neutron radiography is being developed for use in nondestructive evaluation and assay applications. To illustrate the method the authors determined the distribution and thickness of silver between two silver-brazed metal plates.

709,723
PB81-145484 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Diffraction and Small-Angle Scattering as Nondestructive Probes of the Microstructure of Materials.
C. J. Glinka, H. J. Prask, and C. S. Choi. 1980, 22p
Pub. in Proceedings of the Conference on Mechanics of Nondestructive Testing (1980), p143-164 1980.

Keywords: *Nondestructive tests, Materials tests, Neutron scattering, Microstructure, Residual stress.

This article gives a brief introduction to small-angle and wide-angle neutron scattering methods as they pertain to the nondestructive evaluation of materials properties.

709,724
PB81-145757 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Basis for Traceable NDE Measurements,
D. G. Eitzen, H. Berger, and G. Birnbaum. Dec 80, 18p NBSIR-80-2109

Keywords: *Nondestructive tests, *Ultrasonic tests, Calibrating, Standards, Eddy current tests, Radiography, Magnetic particle tests, Fluorescent penetration tests, Visual inspection, Acoustic emission testing, Traceability.

The National Bureau of Standards is beginning to provide a mechanism for traceability for a number of NDE measurement procedures, an activity that is expected to have a significant, positive impact on the reproducibility and accuracy of NDE measurements. Much of the NDE standards activity has been in ultrasonics and acoustic emission, these efforts leading to calibration services for ultrasonic reference blocks and ultrasonic and acoustic emission transducers. Additional NDE standards are also available or are being developed in radiography, eddy currents, magnetic particles, liquid penetrants and visual testing.

709,725
PB81-149841 Not available NTIS
National Bureau of Standards, Washington, DC.
Rapid Cycle Method for Gross Leak Testing with the Helium Leak Detector,
S. Ruthberg. 1980, 7p
Pub. in Proceedings of the 1980 Electronic Components Conference (30th), San Francisco, CA., April 28-30, 1980, p128-134 1980.

Keywords: *Nondestructive tests, *Hermetic seals, *Microelectronics, Semiconductor devices, Helium, Leak detectors, Hybrid microcircuits.

A new noncontaminating dry gas, quantitative test method has been developed that permits gross leak measurements on hermatic packages.

709,726
PB81-166654 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Eddy Current Nondestructive Testing.
Final rept.
G. M. Free. Jan 81, 168p NBS-SP-589
Library of Congress catalog card no. 80-600172.
Proceedings of the Workshop on Eddy Current Nondestructive Testing Held at Gaithersburg, Maryland on November 3-4, 1977

Keywords: *Eddy current tests, *Meetings, Nondestructive tests, Standards.

The proceedings of the Eddy Current Nondestructive Testing Workshop held at NBS in November, 1977 contains papers related to all areas of eddy current testing. A historical overview of the discipline from its inception until the present is given. Other papers discuss the use of eddy current testing in the primary metals industry (both ferrous and nonferrous metals), the use of eddy currents for the sorting of metals and for defect detection, the state-of-the-art in eddy current instrumentation, and the use of signal processing in the analysis of eddy current signals. The development and use of eddy current standards is discussed as well as several of the newer areas of eddy current development, i.e., multifrequency and pulsed eddy current techniques.

709,727
PB81-197691 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
NDE (Nondestructive Evaluation) Publications: 1978.
L. Mordfin. Dec 79, 25p NBSIR-80-2080
See also PB-289 755.

Keywords: *Nondestructive tests, *Bibliographies, Eddy current tests, Radiography, Ultrasonic tests, Acoustic emissions, National Bureau of Standards.

This report is a supplement to NBSIR 78-1557, NDE Publications: 1972-1977. It is a bibliography, with selected abstracts, of 72 National Bureau of Standards (NBS) publications on nondestructive evaluation (NDE) and related technologies, primarily for the calendar year 1978. A detailed subject index is included, as well as information on how copies of many of the publications may be obtained.

709,728
PB81-199663 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Residual Stresses: Problems and Opportunities.
Final rept.
L. Mordfin. 1981, 21p
Pub. in Proceedings of the Conference on Residual Stress for Designers and Metallurgists Held at Chicago, IL., on April 9-10, 1980, p189-209 1981.

Keywords: *Nondestructive tests, *Residual stress, Determination of stress, Measurement.

Residual stresses are present in virtually every manufactured article and assembled structure although their effects are often not evident until the article or the structure is subjected to external loads or exposed to an adverse environment. Tensile residual stresses are generally detrimental, increasing the susceptibility of a member to fatigue damage, stress corrosion and fracture. Compressive residual stresses are usually beneficial, tending to reduce these susceptibilities. The ability to measure residual stresses accurately, quickly and easily, would enable their magnitudes to be controlled--to some extent, at least--by the tailoring of manufacturing and construction processes, and would also enable designers to properly account for their presence.

709,729
PB81-207409 PC **A05**/MF **A01**
Michigan Univ., Ann Arbor.
Holographic NDE: Status and Future.
Final rept.
C. M. Vest. May 81, 78p NBS-GCR-81-318
Contract NB79-NAAB-4598

Keywords: *Holography, *Nondestructive tests, Reviews, Forecasting, Interferometers.

This is the final report of a research program whose objective was to examine the current role and future potential of optical holographic interferometry for nondestructive evaluation of materials and components. The primary task carried out to meet this objective was a detailed evaluative review of the directly relevant technical literature. The first section contains a description of the sources of data and information which formed the basis of the study, followed by a brief exposition of principles and techniques of holographic NDE. The technical literature is described and the cited references are categorized in a manner which is intended to assist the reader in locating those articles which are relevant to specific interests or applications. The next section is an analysis of the status and future of holographic NDE. Finally, conclusions are offered in the form of a response to the inquiries.

709,730
PB81-220428 Not available NTIS
National Bureau of Standards, Washington, DC.
Nondestructive Testing in the 80's.
Final rept.
H. Berger. Apr 81, 5p
Pub. in Can. Soc. Nondestr. Test. 2, n7 p14-18 Apr 81.

Keywords: *Nondestructive testing, Automation, Trends, Signal processing, Reprints, Computer applications.

Present methods for nondestructive testing are reviewed briefly. The main emphasis in the paper is a look ahead toward the use of NDT in the immediate future. Increased use is seen for computer technology and signal processing, for the nondestructive characterization of both defects and material parameters, for traceable NDT measurements and continuous monitoring of machinery, engines and structures. Examples of NDT developments are given to support these predictions.

709,731
PB81-227704 Not available NTIS
National Bureau of Standards, Washington, DC.
Acoustic Emission Signatures and Source Microstructure Using Indentation Fatigue and Stress Corrosion Cracking in Aluminum Alloys.
Final rept.
R. B. Clough, J. C. Chang, and J. P. Travis. 1981, 6p
Pub. in Scripta Metallurgica 15, p417-422 1981.

Keywords: *Aluminum alloys, Fatigue(Materials), Stress corrosion, Microstructure, Reprints, *Acoustic emission testing.

Acoustic emission due to indentation is a new NDE technique for directly correlating acoustic emission behavior with the microstructure of a particular source. Previous work with this method demonstrates that reproducible acoustic emission signals can be generated in embrittled steels by incremental growth of cracks. Here the technique is illustrated for use in more ductile materials through the new techniques of indentation fatigue and indentation stress corrosion cracking. By these methods a direct correlation can be made between a particular source microstructure and the resulting acoustic emission behavior.

709,732
PB81-233702 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Calibration in Nondestructive Evaluation.
Final rept.
H. Berger. Dec 80, 4p
Pub. in Proceedings of Workshop and Symposium National Conference of Standards Laboratories (1980), Gaithersburg, MD., September 22-25, 1980, Paper in NCSL Newsletter 20, n4 p32-35 Dec 80.

Keywords: *Nondestructive tests, Calibrating.

Improved procedures for Nondestructive evaluation (NDE), involving broadly used methods such as radiography, ultrasonics, eddy currents, liquid penetrants and magnetic particles, will play a key role in a move toward improved product quality. These NDE methods are briefly reviewed in this paper, with emphasis placed on calibration methods that are now available, or to be available shortly, to aid industry to achieve NDE measurement reproducibility.

709,733
PB81-234643 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic Leakage and Force Fields for Artificial Defects in Magnetic Particle Test Rings.
Final rept.
L. J. Swartzendruber. 1980, 13p
Pub. in Proceedings of the Symposium on Nondestructive Evaluation (12th) held at San Antonio, TX., on April 24-26, 1979, p150-162 1980.

Keywords: *Magnetic particle tests, Checking(Proving), Test equipment.

Magnetic particle inspection systems are often checked for performance and sensitivity using a test sample with artificial defects. One test sample consists of a steel ring with artificial defects introduced by drilling a series of small holes at varying depths below the sample surface. The magnetic leakage fields caused by these artificial defects have been calculated for the case of a linear isotropic magnetic material, and determined approximately for a non-linear material near saturation. Of greater importance for magnetic particle inspection, the force fields acting on small magnetic particles have been calculated. Lines of constant force have the approximate shape of an ellipse with small eccentricity centered at the defect. Using these results, the magnetic particle surface density which evolves around the artificial defects from a uniform low density cloud of magnetic particles is estimated for the case of dry particles. The calculated fields and powder patterns are on these results, the ability of such test rings to accurately gauge system performance is discussed.

709,734
PB81-236317 Not available NTIS
National Bureau of Standards, Washington, DC.
Dimensioning Flaws in Pipeline Girth Welds by Radiographic Methods.
Final rept.
R. C. Placious, D. A. Garrett, M. B. Kasen, and H. Berger. Jul 81, 5p
Sponsored in part by Department of Transportation, Washington, DC.
Pub. in Materials Evaluation 39, p755-759 Jul 81.

Keywords: *Welded joints, *Radiography, Pipelines, Nondestructive tests, Defects, Reprints.

Methods for field radiographic inspection of pipeline girth welds are reviewed with an eye toward the need for obtaining accurate defect dimensional information from the radiographs. Several methods used to determine weld defect size, particularly the through-wall dimension, are discussed; potential sources of error are indicated.

709,735
PB81-241242 Not available NTIS
National Bureau of Standards, Washington, DC.
Eddy-Current Characterization of Materials and Structures.
Final rept.
G. Birnbaum, and G. Free. Feb 81, 501p
Sponsored in part by American Society for Testing and Materials, Philadelphia, PA.
Pub. in Proceedings of Symposium Eddy-Current Characterization of Materials and Structures, Gaithersburg, MD., September 5-7, 1979, American Society for Testing and Materials, Special Technical Pub. 722, 501p Feb 81.

Keywords: *Eddy current tests, Nondestructive tests.

Eddy current testing in the industrial setting has been a common practice for many years. As industry has become more concerned about cost effectiveness, meaningful design criteria and the integrity of products, the role of eddy current testing has become more significant. In response to these concerns, there has been a virtual explosion of activity in all areas of eddy current NDE, including theory instrumentation, data analysis and applications.

709,736
PB81-245896 Not available NTIS
National Bureau of Standards, Washington, DC.
NDE (Nondestructive Evaluation) Standards for Nuclear Power Systems: An NBS Perspective.
Final rept.
L. Mordfin, and H. Berger. 1981, 16p
Pub. in Proceedings of International Nondestructive Evaluation in the Nuclear Industry (3rd), Salt Lake City, UT., February 11-13, 1980, p303-318 1981.

Keywords: *Nondestructive tests, Nuclear power plants, Pumps, Valves, Standards, Residual stress.

Several needs for better NDE measurement capabilities in the nuclear industry are identified. These include needs for new or improved methods for measuring residual stresses and for assuring the operability of pumps and valves. Exploratory research at NBS on nuclear and high-energy x-ray diffraction and on wear debris analysis, plus development work on polymer transducers and on leak testing standards, suggest approaches toward fulfilling these needs. The advantages of addressing the standardization requirements of a new NDE method as an integral part of the development of the measurement methodology are described. Other NDE-related standardization needs in the nuclear industry, of a non-method-specific nature, are also identified. These pertain to the procedures by which defect-detection capabilities are assessed, and to the reporting of inservice inspection data.

709,737
PB82-100165 Not available NTIS
National Bureau of Standards, Washington, DC.
Resonance Neutron Radiography Using an Electron Linac.
Final rept.
R. A. Schrack, J. W. Behrens, R. Johnson, and C. D. Bowman. Apr 81, 4p
Pub. in Proceedings of Conference on Application of Accelerators in Research and Industry (1980), North Texas State Univ., Denton, TX., November 3-5, 1980. IEEE Transactions in Nuclear Science NS-28, n2 p1640-1643 Apr 81.

Keywords: *Neutron radiography, Assaying, Images.

The NBS electron LINAC is being used to implement a resonance neutron radiography system. Position-sensitive proportional counters indicate location and time of arrival of neutrons transmitted through the material being radiographed, this information is stored in an on-line computer system in a million word storage array for later analysis. Neutron transmission data is collected for a region from about 3 to 12 eV neutron energy. Measurements have been made using silver, tungsten, gold, and the uranium isotopes.

709,738
PB82-101320 Not available NTIS
National Bureau of Standards, Washington, DC.
Basis for Traceable NDE Measurements, Part 1.
Final rept.
D. G. Eitzen, H. Berger, and G. Birnbaum. Aug 81, 2p
Pub. in Materials Evaluation 39, n9 p797-798 Aug 81.

Keywords: *Nondestructive tests, *Ultrasonic tests, Standards, Calibrating, Reprints.

The National Bureau of Standards is beginning to provide a mechanism for traceability for a number of NDE measurement procedures, an activity that is expected to have a significant, positive impact on the reproducibility and accuracy of NDE measurements. Much of the NDE standards activity has been in ultrasonics and acoustic emission; these efforts leading to calibration services for ultrasonic reference blocks and ultrasonic and acoustic emission transducers. Additional NDE standards are also available or are being developed in radiography, eddy currents, magnetic particles, liquid penetrants and visual testing. Part 1 deals with the standards activities in ultrasonics.

709,739
PB82-122060 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultrasonic Detection and Sizing of Two-Dimensional Weld Defects in the Long-Wavelength Limit.
Final rept.
C. M. Fortunko. 1980, 6p
Sponsored in part by Department of Transportation, Washington, DC. Materials Transportation Bureau.
Pub. in Proceedings of Ultrasonics Symposium (1980), Boston, Massachusetts, November 4-7, 1980, p862-867 1980.

Keywords: *Ultrasonic tests, *Weld defects, Nondestructive tests.

A new ultrasonic inspection technique is described for detecting elongated defects in butt-weldments. The technique can be used to detect and size two-dimensional defects which can potentially impair the fitness-for-purpose condition of pipeline girth welds. The defect sizing is accomplished by inverting long-wavelength scattering data obtained with shear-horizontal (SH) waves.

709,740
PB82-124751 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultrasonic Detection and Sizing of Two-Dimensional Defects at Long Wavelengths.
Final rept.
C. M. Fortunko. 1981, 3p
Sponsored in part by Department of Transportation, Washington, DC. Materials Transportation Bureau.
Pub. in Applied Physics Letters 38, n12 p980-982, 15 Jun 81.

Keywords: *Ultrasonic tests, Defects, Nondestructive tests, Reprints.

An ultrasonic technique is described for detecting and sizing of two-dimensional defects. The technique is particularly suitable for detecting two-dimensional defects in certain butt-weldments which cannot be fully inspected by conventional radiographic and ultrasonic methods. Use is made of noncontact, electromagnetic-acoustic transducers to excite and detect shear horizontal (SH) wave probing signals where wavelength is long compared to the defect depth dimensions. The new technique is demonstrated in conjunction with a weld fatigue testing investigation in which it is used to detect natural weld defects and to monitor crack initi-

ation and growth under tension-tension fatigue loading. An experimental calibration curve is given for sizing two-dimensional surface defects, and the experimental results are explained in terms of a reciprocity relationship evaluated in the elastostatic limit.

709,741
PB82-128364 Not available NTIS
National Bureau of Standards, Washington, DC.
Summary of Fundamental Developments for Quantitative Acoustic Emission Measurements.
Final rept.
D. G. Eitzen, F. R. Breckenridge, R. B. Clough, E. R. Fuller, N. N. Hsu, and J. A. Simmons. Jun 81, 100p
Pub. in Electric Power Research Institute Interim Report No. EPRI NP-1877, Project 608-1, 100p Jun 81.

Keywords: *Nondestructive tests, Measurement, Reprints, *Acoustic emission testing, Acoustic emissions.

This report summarizes a research program supported jointly by the Electric Power Research Institute and the National Bureau of Standards.

709,742
PB82-144098 Not available NTIS
National Bureau of Standards, Washington, DC.
New Look at the NBS Programme in NDE.
Final rept.
H. Berger. Oct 81, 2p
Pub. in NDTITDS 14, n5 p292-293 Oct 81.

Keywords: *Nondestructive tests, Calibrating, Reviews, Reprints, Standard reference materials, NDE program.

A brief review is presented of the NBS Nondestructive Evaluation (NDE) program. Emphasis is on progress in calibration and Standard Reference Material (SRM) activities, particularly as related to well-used methods for industrial NDE.

709,743
PB82-149865 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Calibration of Back-to-Back Accelerometers.
B. F. Payne. 1981, 6p
Pub. in Proceedings of International Instrumentation Symposium (27th), Indianapolis, Indiana, April 1981, Paper in Instrumentation in the Aerospace Industry 27, p 483-488 1981.

Keywords: *Accelerometers, *Calibration, Vibration meters, Resonant frequency, Measurement.

Back-to-back accelerometers are widely used as vibration standards. Some problems exist in accurate calibration of these accelerometers due to the effects of mass loading on the sensitivity. The previous calibration procedure was limited to comparison with a calibrated accelerometer. This was necessary in order to provide proper loading. A new method is presented here which describes a standard, absolute, interferometric calibration method using a dummy load. This method makes possible direct displacement measurements at the top mounting surface of the accelerometer under a loaded condition. In this paper experimental data are presented for three test conditions: (1) Comparison with a calibrated reference accelerometer, (2) absolute displacement measurements under a loaded condition, and (3) absolute displacement measurements under an unloaded condition. Data from these measurements are presented and compared for some typical back-to-back accelerometers.

709,744
PB82-152414 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Acoustic Emission.
J. A. Simmons, and R. B. Clough. 1981, 34p
Pub. in Proceedings of International Conference on Dislocation Modelling of Physical Systems, Gainesville, Florida, June 1980, p464-497 1981.

Keywords: Theory, Dislocations(Materials), Fractures(Materials), Nondestructive tests, Signal processing, Plastic properties, Crack propagation, Greens function, *Acoustic emissions, Acoustic emission testing.

A theory of acoustic emission is presented based on a Green's function type of formalism, rather than on the conventional count rate concept. Sources are represented by stress drop rate tensors and conditions are derived from which the source can be considered small in terms of wavelength and distance to the transducer. These 'pseudopoint' sources are examined over a restricted frequency bandwidth, called the 'informative bandwidth.' Such a bandlimited system may be described by a tensor transfer function type of formalism, facilitating the analysis and reducing the inverse problem--where the source is not known a priori--to a deconvolution operation.

709,745
PB82-152547 Not available NTIS
National Bureau of Standards, Washington, DC.
Overview: New Ideas in Nondestructive Evaluation.
Final rept.
H. Berger. 1981, 7p
Pub. in Proceedings Meeting Rubber Division American Chemical Society, Minneapolis, MN., June 2-5 1981, Rubber Chem. Technol. 54, n5 p996-1002 Nov/Dec 81.

Keywords: *Nondestructive tests, Technology innovation, Eddy current tests, Signal processing, *Product inspection, Tires, Acoustic emission testing, Ultrasonic imaging, Tomography.

Nondestructive evaluation (NDE) normally brings to mind six major methods in use in industrial quality control, visual/optical, x-ray, ultrasonic, penetrant, magnetic and eddy current techniques. While it is true that most NDE involves these basic methods, it is also true that major changes are taking place in terms of modifications of these standard methods and in terms of new inspection approaches. The discussion includes descriptions of modifications such as ultrasonic imaging, x-ray tomography, pulsed eddy current techniques and signal processing. In addition, novel NDE approaches that appear to offer advantages of tire inspection are discussed; these include acoustic emission, pulsed eddy currents, microwaves and vibrothermography.

709,746
PB82-152661 Not available NTIS
National Bureau of Standards, Washington, DC.
Reproducible Acoustic Emission Signatures by Indentation in Steels.
R. B. Clough, and J. A. Simmons. Oct 81, 6p
Sponsored in part by Electric Power Research Inst., Palo Alto, CA.
Pub. in Materials Evaluation 39, p1026-1031 Oct 81.

Keywords: *Steels, Nondestructive tests, Metal plates, Indentation, Reprints, *Acoustic emission testing, Steel A-533B.

Creating reproducible signals from defects is of great importance for quantitative studies of acoustic emission (AE). A method for doing so is presented here which consists of indentation of hardened steel plates.

709,747
PB82-155144 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultrasonic Evaluation of Austenitic Stainless Steel Welds Using Shear Horizontal Waves.
Final rept.
C. M. Fortunko. 1 Nov 81, 2p
Sponsored in part by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Applied Physics Letters 39, n9 p699-700, 1 Nov 81.

Keywords: *Ultrasonic tests, *Welded joints, Austenitic stainless steels, Secondary waves, Reprints.

The propagation of horizontally polarized shear (SH) waves through an austenitic stainless steel weld metal-base metal interface is described. It is shown that SH wave probing signals are particularly suitable for nondestructive evaluation of those stainless steel weldments that are very difficult to evaluate using vertically polarized shear and longitudinal wave probing signals. The SH wave technique is demonstrated experimentally on a 304L/316L stainless steel butt weldment using 454-kHz SH wave electromagnetic-acoustic transducers that excite SH wave probing signals at 70 degrees with respect to surface normal.

709,748
PB82-170499 PC **A02**/MF **A01**
Stanford Univ., CA.
Innovative Measurement Technology for the Semiconductor Device Industry: The Acoustic Microscope - A New Instrument for Viewing Integrated Circuits.
Final rept. 10 Oct 75-30 Sep 78.
C. F. Quate. May 80, 11p NBS-GCR-80-204
Contract NBS-5-35899, ARPA Order-2397

Keywords: *Integrated circuits, *Nondestructive tests, Acoustic signatures, Transducers, *Acoustic microscopes.

Developments in acoustic microscopy are reported. The operating frequency of scanning acoustic microscopes has been increased from 350 MHz to above 2 GHz, with a resulting improvement in resolution approximating that of the best optical microscopy. An instrument operating in the reflection mode was developed and its design and construction technology were transferred to a group working at the Hughes Research Laboratories on a related program. The utility of the instrument for examination of integrated circuits was demonstrated. The mechanisms by which contrast is produced in the acoustic microscope have been explained theoretically and verified experimentally. The theory has been used to understand the details of the 'signature' response of the instrument as the distance from the lens to the specimen is varied. These responses differ markedly for different specimen materials and for layered structures of varying layer thickness, and may have considerable value for materials analysis studies.

709,749
PB82-179003 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Technical Activities 1981, Office of Nondestructive Evaluation.
H. Berger, and L. Mordfin. Dec 81, 126p NBSIR-82-2449
See also PB81-132466.

Keywords: *Nondestructive tests, Reviews.

This is the fourth in a series of annual reports describing the technical activities of the nondestructive evaluation program at the National Bureau of Standards.

709,750
PB82-210196 Not available NTIS
National Bureau of Standards, Washington, DC.
Residual Stress Measurements Using Energy Dispersive Diffractometry and High Energy Incident Photons.
Final rept.
M. Kuriyama. 1981, 12p
Pub. in Proceedings of Symposium on Nondestructive Measurement of Wheel/Axle Residual Stress, Cambridge, MA, June 16-17, 1981, p2.10.1-2.10.13 1981.

Keywords: *Nondestructive tests, *Residual stress, Photons, Diffraction, Welded joints.

The application of energy dispersive diffractometry using high energy photons (up to 200 kev) to monitor the structural integrity of industrial materials is described. X-ray optical conditions and counting statistics are studied in several transmission experiments using commercial steel plates almost one inch (2.5 cm) thick. A residual stress distribution across a weld zone in an Alaskan pipe line segment is obtained by the energy dispersive diffractometry method. This result demonstrates the potential capability of this technique as an industrial inspection tool to predict flaws and cracks in materials with a given precision and in a nondestructive manner.

709,751
PB82-211301 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Measurement of Angular Vibration.
Final rept.
M. R. Serbyn. May 82, 11p
Pub. in Proceedings of Transducer Workshop (11th), Seattle, Washington, June 2-4, 1981, p260-270 May 82.

Keywords: *Accelerometers, *Calibration, Interferometers, *Angular vibration, Reciprocity calibration.

With new developments in angular-vibration instrumentation the demand for calibration services is expected to grow. This paper investigates the feasibility of measuring the magnitude of vibratory displacement

absolutely. The conclusion of a preliminary study is that a reciprocity and an interferometric calibration are not only both possible, but each offers specific advantages that tend to complement the other. It is an interim report on work that will be continued.

709,752
PB82-221672 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Ultrasonic Measurements of Titanium Elasticity and Attenuation in Welds and Plate.
Final rept.
G. V. Blessing. May 82, 17p NBSIR-82-2500
Sponsored in part by Office of Naval Research, Washington, DC.

Keywords: *Ultrasonic tests, *Titanium alloys, *Welded joints, Metal plates, Elastic properties, Attenuation, Porosity, Titanium alloy 6211.

Ultrasonic shear and longitudinal waves are used to evaluate the elasticity and attenuation of titanium weld and plate alloy. Wave speeds are used to measure the materials' elasticity and anisotropy, and the wave amplitude is used to measure relative levels of scattering in the weld and plate regions. Results obtained on a representative weld are compared with results obtained on oxygen contaminated specimens.

709,753
PB82-234485 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Semiconductor Measurement Technology: The Use of Acoustic Emission to Determine the Integrity of Large Kovar Glass-Sealed Microelectronic Packages.
Final rept.
G. G. Harman. May 82, 83p NBS-SP-400-70
Library of Congress catalog card no. 82-600528.
Sponsored in part by Naval Avionics Center, Indianapolis, IN.

Keywords: *Microelectronics, *Glass to metal seals, Hermetic seals, Containers, *Acoustic emission testing.

The general objective of this research was to develop tests to determine the integrity of large hybrid packages under various thermal and mechanical stresses that may be encountered during assembly, during installation in systems, or in operation. Several measurement techniques were investigated, but emphasis was placed on acoustic-emission test procedures. The accomplishments were: (1) The effects of avionics environmental vibration on the seals of hybrid packages mounted on printed-circuit (PC) boards were determined. A major conclusion of this section was that lead fatigue failure occurs before seal damage on packages from high quality lots. (2) A small acoustic-emission detector was developed that is sensitive to surface waves, but relatively insensitive to vibration induced cable noise. (3) A high-temperature (125C) open-package helium leak test method was successfully developed to observe marginal seal damage. (4) An acoustic-emission test for inspection of hybrid packages during high-temperature thermal shock was developed. (5) A study of possible damage to seals during thermocompression and thermosonic bonding, during lead forming, and during other assembly operations was carried out.

709,754
PB82-239153 Not available NTIS
National Bureau of Standards, Washington, DC.
Improved Piezoelectric Acoustic Emission Transducer.
Final rept.
T. M. Proctor. May 82, 6p
Pub. in Jnl. of the Acoustical Society of America 71, n5 p1163-1168 May 82.

Keywords: *Piezoelectric transducers, Reprints, *Acoustic emission testing.

A piezoelectric transducer has been designed and developed that has promise of being a high fidelity acoustic emission (AE) transducer. Small transducer contact area, elimination of acoustical interference effects associated with certain geometries, and redistribution of the arrival times of reflected signals originating from various elements of the transducer were the guiding criteria in the design. This transducer consists of a conical active element and an extended backing. The transducer's performance has been compared to a line capacitance transducer using surface wave signals. These comparisons indicate an amplitude response which is flat within plus or minus 3 dB for the frequency range of 50 kHz to 1 MHz. The over-all displacement sensitivity is nominally 2 x 10 to the 8th power V/m. Factors that influence frequency response such as backing geometry and aperture size have been experimentally investigated and results are reported.

709,755
PB82-261686 Not available NTIS
National Bureau of Standards, Washington, DC.
Traceable NDE Standards.
Final rept.
G. Birnbaum, H. Berger, and D. G. Eitzen. Sep 81, 4p
Pub. in NTIAC Newsletter 9, n3 p1-4 Sep 81.

Keywords: *Nondestructive tests, Standards, Calibrating, Eddy current tests, Neutron radiography, Acoustic emission testing.

Recent work at the National Bureau of Standards which has lead to NDE standards and calibrations as well as work in progress is reviewed. The NDE areas discussed include acoustic emission, x-ray and neutron radiography, eddy current, magnetic particles, liquid penetrants, visual acuity testing and leak rate measurements.

709,756
PB82-261835 Not available NTIS
National Bureau of Standards, Washington, DC.
What Is NBS Doing in NDE.
Final rept.
H. Berger, and L. Mordfin. 1982, 5p
Pub. in Proceedings of Annual Quality Congress Transactions (36th), Westin Hotel, Detroit, MI, May 2-5, 1982, p929-933.

Keywords: *Nondestructive tests, Transducers, Ultrasonic tests, National Bureau of Standards, Acoustic emission testing.

The National Bureau of Standards (NBS) has had an active program in nondestructive evaluation (NDE) for several years. The program has been directed toward the development of NDE standards and improved NDE measurement capabilities. Several NDE measurements are now traceable to NBS and others are planned. These procedures provide for more reliable NDE measurements in quality control programs.

709,757
PB82-261876 Not available NTIS
National Bureau of Standards, Washington, DC.
Inservice Data Reporting and Analysis for Pressure Vessels, Piping, Pumps and Valves.
Final rept.
J. T. Fong. 1978, 6p
Pub. in Proceedings of Winter Annual Meeting of American Society of Mechanical Engineers, San Francisco, CA, December 10-15, 1978, piii-vi.

Keywords: *Pressure vessels, *Pipes(Tubes), *Pumps, *Valves, Data, Data processing, Data acquisition, Failure, Nondestructive tests, Reliability, Inservice inspection, Risk analysis.

The goals of the symposium are: (a) To examine, on a world-wide basis, the current status of reporting, collection, and evaluation of failure data on pressure vessels, piping, pumps, and valves for the purpose of improving the science of estimating the probability of infrequent events such as the failure of mechanical components, (b) to discuss the various approaches currently used world-wide for reliability data collection and reporting on mechanical components in nuclear powerplants to ensure suitability of data to risk analysis. This special publication contains the original manuscripts of 20 contributors from France, Germany, United Kingdom, and United States in the form of 13 technical papers.

709,758
PB82-264268 Not available NTIS
National Bureau of Standards, Washington, DC.
Nondestructive Evaluation of Large Diameter Girth Welds Using Electromagnetic-Acoustic Transducers.
Final rept.
C. M. Fortunko, and R. E. Schramm. 1982, 9p
Sponsored in part by Department of Transportation, Washington, DC.
Pub. in Proceedings of Fitness for Purpose Validation of Welded Constructions, London, England, November 17-19, 1981, p P20-1-P20-8 1982.

Keywords: *Ultrasonic tests, *Welded joints, Nondestructive tests, Electroacoustic transducers, Butt welds, Secondary waves, Ultrasonic radiation.

A new ultrasonic inspection technique is described to detect elongated defects in butt welds. The technique uses noncoupling, electromagnetic-acoustic transducers (EMATs) which can operate on most unprepared surfaces and under adverse environmental conditions. The operation of the new technique is demonstrated in the context of the detection and sizing of elongated, two-dimensional defects in girth welds of 48in. diameter cross-country pipeline. The ultrasonic inspection is carried out at 454kHz using shear wave signals polarized in the plane of the weld (SH waves).

709,759
PB82-264292 Not available NTIS
National Bureau of Standards, Washington, DC.
Extended Variational Solution for Scattering from Flaws in Plates.
Final rept.
R. B. King, and C. M. Fortunko. May 82, 2p
Sponsored in part by United Engineering Center, New York.
Pub. in Jnl. of Applied Physics 53, n5 p3459-3460 May 82.

Keywords: *Ultrasonic tests, *Acoustic scattering, Cracks, Nondestructive tests, Calculus of variations, Secondary waves, Metal plates, Reprints.

A variational solution is obtained for scattering of horizontally polarized shear (SH) waves from cracks in plates. The solution permits a trial function for the displacement jump across the crack in the form of a series with arbitrary coefficients to be inserted in the variational expression for the scattering coefficients. This multiple term variational solution is preferable to one term solutions when increased accuracy is desired or when the form of the displacement jump across the crack is not apparent. Numerical results are presented for scattering from edge cracks in plates.

709,760
PB82-264326 Not available NTIS
National Bureau of Standards, Washington, DC.
Nondestructive Evaluation of Planar Defects in Plates Using Low Frequency Shear Horizontal Waves.
Final rept.
C. M. Fortunko, R. B. King, and M. Tan. May 82, 9p
Sponsored in part by Department of Transportation, Washington, DC. and United Engineering Center, New York.
Pub. in Jnl. of Applied Physics 53, n5 p3450-3458 May 82.

Keywords: *Ultrasonic tests, Nondestructive tests, Electroacoustic transducers, Cracks, Metal plates, Ultrasonic radiation, Acoustic scattering, Butt welds, Secondary waves, Reprints.

An ultrasonic technique is described that allows the determination of the through-thickness dimension and limited localization of planar defects (cracks) in an isotropic metal plate. The scattering of horizontally polarized shear plate waves by edge and buried planar defects is investigated using a variational integral expression. Numerical results are presented that allow the calculation of the SH plate wave signal amplitudes as a function of defect through-thickness dimension and location within a plate for two-dimensional cracks. It is shown that SH waves are particularly useful for detecting and sizing of crack-like defects. In addition, it is demonstrated that in plates, which can support a number of propagating SH plate waves, it is also possible to determine the relative position of a defect from interference phenomena. The numerical results are confirmed experimentally using an electromagnetic-acoustic transducer system to generate and detect 454-kHz SH wave signals along the meridian of a 1.22-m diameter steel pipe with a 15.9-mm wall thickness. The experimental results demonstrate the efficacy of using SH wave signals in quantitative nondestructive evaluation of butt welds.

709,761
PB82-264334 Not available NTIS
National Bureau of Standards, Washington, DC.

Ultrasonic Nondestructive Evaluation of Butt-Welds Using Electromagnetic-Acoustic Transducers.
Final rept.
C. M. Fortunko, and R. E. Schramm. Feb 82, 8p
Sponsored in part by Department of Transportation, Washington, DC.
Pub. in Welding Jnl., p39-46 1982.

Keywords: *Ultrasonic tests, *Butt welds, Electroacoustic transducers, Secondary waves, Reprints.

A new ultrasonic inspection technique is described for detecting elongated defects in butt welds. The technique uses noncoupling, electromagnetic-acoustic transducers (EMAT's) that can operate on most unprepared surfaces and under adverse environmental conditions. The operation of the new technique is demonstrated in the context of detection and sizing of elongated, two-dimensional defects in girth welds of 1.22-m (48-in) diameter cross-country pipeline. The ultrasonic inspection is carried out at 454 kHz using shear-wave signals polarized in the plane of the weld (SH-waves). The advantage of ultrasonic weld inspection at low frequencies (long wavelengths) is that the reflected ultrasonic amplitude is relatively insensitive to defect orientation and surface roughness.

709,762
PB82-264391 Not available NTIS
National Bureau of Standards, Washington, DC.
Sizing of Surface Cracks in a Plate Using SH Waves.
Final rept.
S. K. Datta, C. M. Fortunko, and R. B. King. Dec 81, 5p
Sponsored in part by United Engineering Center, New York.
Pub. in Proceedings of 1981 Ultrasonics Symposium, Chicago, IL, October 14-16, 1981, p863-867 Dec 81.

Keywords: *Ultrasonic tests, Nondestructive tests, Electroacoustic transducers, Cracks, Ultrasonic radiation, Acoustic scattering, Butt welds, Metal plates, Finite element analysis, Calculus of variations, Secondary waves.

The diffraction of SH waves by two-dimensional surface cracks in isotropic plates is studied in two different ways. First, a variational integral expression is used to calculate the reflection coefficients of the propagating modes. The scattered fields away from the crack are then obtained using modal superposition. Second, a combined finite element-analytical technique is used to calculate the scattered fields. The results of the two calculations are compared for the case of shallow cracks in the long wavelength limit. The theoretical results are also compared with experimental data that have been obtained using a low frequency (454 kHz) electromagnetic-acoustic transducer (EMAT) system. It is shown that SH waves may be particularly appropriate for detecting and sizing elongated planar defects in butt welds.

709,763
PB82-264417 Not available NTIS
National Bureau of Standards, Washington, DC.
Improvements in Flaw Detection in Austenitic Stainless Steel Weldments.
Final rept.
R. K. Elsley, and C. M. Fortunko. Dec 81, 8p
Pub. in Proceedings 1981 Ultrasonics Symposium, Chicago, IL. October 14-16, 1981, p892-899 Dec 81.

Keywords: *Ultrasonic tests, *Weldments, Austenitic stainless steels, Butt welds, Welded joints, Acoustic scattering, Electroacoustic transducers, Nondestructive tests, Ultrasonic radiation.

Inspection of austenitic stainless steel weldments by conventional ultrasonic means is fundamentally limited by the textured columnar grain structure of the weld metal. It is shown that for selected angles of incidence, shear waves polarized normal to the columnar grains can pass through the weld metal-base metal interface without partial reflection. As a consequence, the inspectability of stainless steel weldments can be improved. The use of low frequency probing signals is advantageous because it reduces the influence of nonuniform textures at the weld metal-base metal interface. The operation of a low frequency, ultrasonic system for stainless steel butt weldments using electromagnetic acoustic transducers (EMATs) is demonstrated. Digital signal processing techniques including signal averaging, subtraction and synthetic aperture imaging are used to further improve inspectability.

709,764
PB83-103721 Not available NTIS
National Bureau of Standards, Washington, DC.
New Magnetic Suspenson Densimeter for Determining Fluid Densities by Weighing.
Final rept.
R. Masui, H. A. Davis, and J. M. H. L. Sengers. Jul 82, 4p
Pub. in Proceedings of the Symposium on Thermophysical Properties (8th), National Bureau of Standards, Gaithersburg, Maryland, June 15-18, 1981, p128-133 Jul 82.

Keywords: *Densitometers, Feedback control, Fluids, Density(Mass/volume), Weight measurement, *Magnetic suspension.

A new magnetic-suspension densimeter has been developed for in situ measurement of density in pressurized fluids. A small coil, suspended from an electronic balance, surrounds a cylindrical sample cell which contains the sample fluid and a magnetic buoy. As in other magnetic densimeters, the buoy is suspended in the fluid by controlling the current through the coil using a sensing device and feed-back control; here, however, the force on the buoy is not obtained from the value of the support current, but from the increase in weight of the coil as the buoy is brought in support. Sample cell and coil are immersed in a thermostated bath fluid in order to improve thermal contact and to damp the motion of the coil.

709,765
PB83-135350 Not available NTIS
National Bureau of Standards, Washington, DC.
X-ray, Residual Stress Mapping in Industrial Materials by Energy Dispersive Diffractometry.
Final rept.
C. J. Bechtoldt, R. C. Placious, W. J. Boettinger, and M. Kuriyama. 1982, 10p
Pub. in Adv. X-ray Anal. 25, p329-338 1982.

Keywords: *Nondestructive tests, *Residual stress, *X ray diffraction, Stress analysis, Photons, Reprints, High energy x rays.

An application of energy dispersive diffractometry to the measurement of residual strains (stresses) in the interior of industrial materials is described with particular emphasis on the use of high energy (up to 250 keV) x-ray photons. The use of high energy photons permits better penetration into materials. Hence diffraction data for evaluating bulk residual strains can be obtained in the transmission geometry in contrast with the conventional angular dispersive diffractometry, which uses Bragg reflections from the surface of materials. The reliability and sensitivity (detectability of small strains) of the energy dispersive method are demonstrated through its application to mapping of residual stress distributions across weld zones in Alaskan pipe line segments (API5LX65) and an aluminum block 2.5 cm thick with holes (2024-T351). The detectability of strain variations within materials depends on x-ray optical resolution and statistics.

709,766
PB83-139204 Not available NTIS
National Bureau of Standards, Washington, DC.
Advanced Diffraction Techniques for the Nondestructive Evaluation of Internal Residual Stresses.
Final rept.
L. Mordfin. 1982, 2p
Pub. in Proceedings of the Conference on Experimental Stress Analysis (7th), Haifa, Israel, Aug 23-27 1982, p602-603.

Keywords: *Nondestructive tests, *Residual stress, *Neutron diffraction, *X ray diffraction, Stress analysis, High energy x rays.

Advanced techniques for the evaluation of stresses and strains in the interior of solid bodies are being developed at the U.S. National Bureau of Standards (NBS). These techniques, which are based upon Bragg diffraction, use thermal neutrons and high-energy x-rays to achieve depths of penetration not attainable by conventional x-ray diffraction techniques.

709,767
PB83-139832 PC **A09**
Hughes Research Labs., Malibu, CA.
Reflection Acoustic Microscopy.
Final rept. Apr 75-31 Mar 82.
R. G. Wilson, and R. D. Weglein. Oct 82, 188p NBS-GCR-82-401
Contract NBS-5-35898
Portions of this document are not fully legible.

Keywords: Nondestructive tests, Semiconductor devices, Integrated circuits, Inspection, Acoustic signatures, Photomicrographs, *Acoustic microscopy.

A developmental model of a pulsed reflection acoustic microscope was built, and techniques of nondestructive evaluation of surfaces and thin layered structures were studied. The image signal was enhanced 18 dB by the application of a quarter-wave acoustic antireflection coating to the surface of the lens. Many integrated circuits and device structures were studied in the scanning mode, leading to acoustic micrographs. Comparisons were made with optical and scanning electron micrographs. A static mode of operation was discovered and developed that allows us to obtain acoustic material signatures. This static mode of operation is expected to find useful applications in the future in material analysis and thin layer thickness measurement and control.

709,768
PB83-143362 Not available NTIS
National Bureau of Standards, Washington, DC.
NDT Measurements Traceable to NBS.
Final rept.
H. Berger, G. Birnbaum, and D. G. Eitzen. 1982, 8p
Pub. in Proceedings of the World Conference on Non-Destructive Testing (10th), Moscow, USSR, August 23-28, 1982, p58-65.

Keywords: *Nondestructive tests, Measurement, Calibrating, National Bureau of Standards.

Many nondestructive testing (NDT) measurements are now traceable through calibrations or Standard Reference Materials (SRM's) available from NBS. The NDT areas involved include acoustic emission, x-ray and neutron radiography, eddy current, magnetic particles, liquid penetrants, visual acuity testing and leak rate measurements.

709,769
PB83-145672 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Comparisons of Standards for Eddy Current Nondestructive Testing.
Final rept.
G. Free, G. Birnbaum, H. Berger, V. Kljuev, and Y. Fedosenko. Aug 82, 6p
Pub. in Proceedings of World Conference on Non-Destructive Testing (10th), Moscow, USSR, August 26, 1982, p261-266 Aug 82.

Keywords: *Eddy current tests, *Nondestructive tests, *Standards, Comparison, Standardization, United States, USSR.

Some problems of standardization of methods of eddy current nondestructive testing of non-ferrous metal products are discussed by comparing three standards each from the USA (ASTM) and the USSR (GOST).

709,770
PB83-155531 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Technical Activities 1982, Office of Nondestructive Evaluation.
H. T. Yolken. Dec 82, 187p NBSIR-82-2617
See also PB81-132466, and PB82-179003.

Keywords: *Nondestructive tests, Ultrasonic tests, Eddy current tests, Radiography, Infrared radiation, Reviews, Acoustic emissions.

A review of nondestructive evaluation programs at NBS, for FY1982 is presented in this annual report.

709,771
PB83-179408 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Details on the NBS Conical Transducer.
Final rept.
T. M. Proctor. 1982, 6p
Pub. in Jnl. of Acoust. Emiss., n3 p173-178 1982.

Keywords: *Piezoelectric transducers, Calibrating, Accuracy, Transfer functions, Reprints, Acoustic emission testing.

The authors have developed a piezoelectric transducer that responds with a high degree of accuracy to normal surface displacement over the frequency range of 50kHz to 1MHz. Although it does have some drawbacks (size and durability) this transducer design has high sensitivity over this band and relative ease of use. If care is taken the issue of the fragil nature can be resolved. Recent developments on this transducer indicate that the size can be reduced to as much as 1/4 the volume without appreciable loss of response quality. We have also found it extremely useful for the purpose of investigating transfer functions in AE work. Its faithful time wave response opens many new avenues for investigation.

709,772
PB83-181669 Not available NTIS
National Bureau of Standards, Washington, DC.
Variables Affecting Ultrasonic Reference Block Calibration.
Final rept.
G. V. Blessing, and D. G. Eitzen. 1982, 4p
Sponsored in part by Army Materials and Mechanics Research Center, Watertown, MA.
Pub. in Proceedings of American Society for Nondestructive Testing Fall Conference, Pittsburgh, PA.. October 4-7, p9-12, 1982.

Keywords: *Ultrasonic tests, *Calibrating, Standards, Nondestructive tests, *Reference blocks.

The variables affecting ultrasonic reference block calibrations are many. In a paper presented at the last ASNT conference, we suggested that they be divided into five principal categories: (1) the material, (2) the transducer, (3) the pulser/receiver, (4) the operator, and (5) block geometry. Of these, the transducer has received the most attention, and perhaps justifiably so. Sophisticated approaches toward parameterizing its behavior, however, have met with limited success. We will present a relatively simple empirical approach whereby the peak amplitude of the transducer's far-field center lobe is normalized to its Y + sub o value, and correction factors applied. An example of this approach follows, together with a discussion of the other principal system variables.

709,773
PB83-184622 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
NDE (Non-Destructive Evaluation) Publications, 1980.
L. Mordfin. Oct 81, 46p NBSIR-81-2364

Keywords: *Nondestructive tests, *Bibliographies, Eddy current tests, Radiography, Ultrasonic tests, Abstracts, Acoustic emissions, National Bureau of Standards.

This is the fourth in a series of bibliographies of NBS publications on nondestructive evaluation (NDE). It provides bibliographic citations, with selected abstracts, for 108 publications that appeared in the literature, primarily during calendar year 1980. A detailed subject index is included as well as information on how copies of many of the publications may be obtained.

709,774
PB83-184630 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
NDE (Non-Destructive Evaluation) Publications, 1979.
L. Mordfin. Sep 81, 32p NBSIR-81-2351
See also PB-289 755.

Keywords: *Nondestructive tests, *Bibliographies, Eddy current tests, Radiography, Ultrasonic tests, Abstracts, Acoustic emissions, National Bureau of Standards.

This is the third in a series of bibliographies of NBS publications on nondestructive evaluation (NDE). It provides bibliographic citations, with selected abstracts, for 114 publications that appeared in the open literature, primarily during calendar year 1979. A detailed subject index is included as well as information on how copies of many of the publications may be obtained.

709,775
PB83-202481 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Error Analysis for the National Bureau of Standards 1016 mm Guarded Hot Plate.
B. Rennex. Apr 83, 49p NBSIR-83-2674
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Insulation, *Temperature measuring instruments, Heat transmission, Thermal resistance, Uncertainty principle, Error analysis, *Hot plates, *Cold plates.

An error analysis is given for the 1-meter Guarded Hot Plate at the National Bureau of Standards. This apparatus is used to measure the thermal resistance of insulation materials. The individual contributions to uncertainty in thermal resistance are discussed in detail. The total uncertainty is estimated to be less than 0.5 percent at sample thicknesses up to 150 mm (6 inches) and less than 1 percent at a thickness of 300 mm (12 inches).

709,776
PB83-220806 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Elements of Thermography for Nondestructive Testing.
Final rept.
J. Cohen. May 83, 39p NBS-TN-1177

Keywords: *Nondestructive tests, *Thermography, Remote sensing, Thermal imaging systems.

The paper presents an elementary review of thermal imaging systems, with emphasis on the application of thermography to nondestructive testing. Topics discussed include heat radiation theory; early and contemporary thermal imaging systems; performance characteristics; effects of emissivity, background temperature, atmosphere, and field of view. Examples of various applications of thermography to nondestructive testing are given. A bibliography is included.

709,777
PB83-225870 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Assessment of Ultrasonic Reference Block Calibration Methodology.
Final rept.
G. V. Blessing. Jun 83, 25p NBSIR-83-2710

Keywords: *Ultrasonic tests, *Standards, Calibrating, Error analysis, Transducers, Methology, Aluminum, *Reference blocks.

The state of the art in aluminum ultrasonic reference block calibration practices is reviewed, especially as it has been guided by the recommended practices of ASTM for aluminum blocks. The principal system variable in the calibration procedures are identified, and recommendations for reducing their associated measurement errors are made. Quantitative evaluations of the limitations to improving measurement precision are made in light of present technology. Suggestions for improving present practices are made, and extensive reference to the relevant technical literature is made.

709,778
PB83-233924 Not available NTIS
National Bureau of Standards, Washington, DC.
Preliminary Report on the Evaluation of Selected Ultrasonic and Gyroscopic Flowmeters at Cryogenic Temperatures.
Final rept.
J. A. Brennan, and A. Takano. 1982, 4p
Sponsored in part by Compressed Gas Association, Inc., New York.
Pub. in Proceedings of International Cryogenic Engineering Conference, Kobe, Japan, May 11-14, 1982, p655-658 1982.

Keywords: *Flowmeters, Flow measurement, Cryogenics, Performance evaluation, *Foreign technology.

Several ultrasonic and gyroscopic flowmeters were tested on the cyrogenic flow facility at the National Bureau of Standards (NBS) in Boulder, Colorado. Meters were evaluated using liquid nitrogen with flow rates with temperatures ranging from 0.13 to 2.25 liters/second for small meters and from 1.45 to 13.1 liters/second for a larger meter, with pressures ranging from 0.41 to 0.80 MPa and 79 to 91 K. Results for the test showed flowmeters evaluated, with one exception, their applicability to cryogenic service with appropriate consideration of their characteristics at low temperatures.

709,779
PB83-234187 Not available NTIS
National Bureau of Standards, Washington, DC.
Analytical Approach to Reference Samples for Ultrasonic Residual Stress Measurement.
Final rept.
N. N. Hsu, T. M. Proctor, and G. V. Blessing. Sep 82, 5p
Pub. in Jnl. of Testing and Evaluation 10, n5 p230-234 Sep 82.

Keywords: *Residual stress, Ultrasonic tests, Calibrating, Samples, Determination of stress, Reprints.

While residual stress measurements using ultrasonic techniques have been under development for some time, practical applications are still limited. One of the difficulties is the lack of suitable reference samples for instrument calibration. The paper specifically addresses the question of how to produce a known stress-state reference sample, and ultrasonically determine its zero stress-state. The approach was to design and construct a sample possessing residual stresses that can be deduced from established theory. A shrink-fit ring-plug assembly was fabricated from carefully screened aluminum bar stock, forming a disk suitable for both longitudinal and shear wave calibration. Here we report results using longitudinal waves.

709,780
PB83-239574 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
NOE (Nondestructive Evaluation) Publications: 1981.
L. Mordfin. Jul 83, 47p NBSIR-83-2741
See also PB83-184622.

Keywords: *Nondestructive tests, *Bibliographies, Eddy current tests, Radiography, Ultrasonic tests, Abstracts, Acoustic emissions, National Bureau of Standards.

This is the fifth in a series of bibliographies of NBS publications on nondestructive evaluation (NDE). It provides bibliographic citations, with selected abstracts, for 172 publications that appeared in the open literature, primarily during calendar year 1981. A detailed subject index is included as well as information on how copies of many of the publications may be obtained.

709,781
PB84-105162 Not available NTIS
National Bureau of Standards, Washington, DC.
Recent Developments in Resonance Neutron Radiography.
Final rept.
R. A. Schrack, J. W. Behrens, A. D. Carlson, C. D. Bowman, and R. G. Johnson. 1983, 6p
Pub. in Proceedings of International Conference on Nondestructive Evaluation Nuclear Industry (5th) held at San Diego, CA. on May 10-13, 1982, p158-163 1983.

Keywords: *Neutron radiography, Resonance, Nondestructive tests, Performance evaluation.

An overview of developments in Resonance Neutron Radiography at the National Bureau of Standards is presented. The development of high-resolution, two-dimensional neutron detectors and their application in measurement systems using pulsed neutron sources is covered with special emphasis on the application to nuclear fuel material analysis and evaluation.

709,782
PB84-107010 Not available NTIS
National Bureau of Standards, Washington, DC.
Holographic Nondestructive Evaluation: Status and Future.
Final rept.
G. Birnbaum, and C. M. Vest. 1983, 18p
Pub. in International Advances in Nondestructive Testing 9, p257-282 1983.

Keywords: *Nondestructive tests, *Holography, Tires, Laser applications.

The results and conclusions of an extensive review of the literature and practice of holographic nondestrucive evaluation are reported. Although this technique

has several technically unique features, and has been shown to be a feasible nondestructive testing technique in a very large number of laboratory investigations, its commerical application is rare. A counter example is its prevalent use in testing of aircraft and heavy equipment tires. The status of the technique is reviewed, recent and potential technical advances are enumerated, and suggestions of activities which would enable full realization and evaluation of the potential of holographic NDE in the future are made.

709,783
PB84-109875 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
NVLAP (National Voluntary Laboratory Accreditation Program) Annual Report and Directory of Accredited Laboratories (6th).
W. A. Hall. Sep 83, 65p NBS-SP-654
See also PB-285 003. Library of Congress catalog card no. 83-600576.

Keywords: *Laboratories, *Acceptability, Test facilities, Standards.

The annual report of the National Voluntary Laboratory Accreditation Program (NVLAP) is prepared in accordance with NVLAP Procedures (Title 15 CFR Parts 7a, 7b, and 7c). Part I summarizes significant activities, including program changes, accreditation actions and ongoing discussions concerning laboratory accreditation on the national and international levels. Part II is a directory of laboratories currently accredited on behalf of the Secretary of Commerce.

709,784
PB84-133404 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of Pipeline Girth Welds Using Low-Frequency Horizontally Polarized Waves.
Final rept.
C. M. Fortunko, and R. E. Schramm. 17 Jan 83, 19p
Pub. in Jnl. of Nondestructive Evaluation 3, n3 p155-173, 17 Jan 83,

Keywords: *Welded joints, *Ultrasonic tests, Nondestructive tests, Pipelines, Reprints.

The practical implementation of alternative acceptance criteria for pipeline girth welds requires the use of inspection tools capable of determining the principal dimensions and positions of planar flaws. A new ultrasonic inspection method is described that permits complete volumetric inspection of the girth welds. The new system uses non-contacting electromagnetic-acoustic transducers (EMATs) that operate allow ultrasonic frequencies (454 kHz). Theoretical models of the measurements are developed and verified experimentally. In addition, practical performance limits of the new system are established in terms of minimum flaw sizes that can be detected. The results are related to accept-reject curves based on a model of the failure processes. An inspection protocol for field applications is also described.

709,785
PB84-190636 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO.
Residual-Stress Measurements Using Shear-Horizontal Waves from Electromagnetic Acoustic Transducers.
R. B. King, and C. M. Fortunko. Mar 84, 59p NBSIR-84-3002
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.

Keywords: *Ultrasonic tests, *Residual stress, Determination of stress, Transducers, Secondary waves.

The collection of technical papers covers a two-year effort on a novel approach to measuring residual stresses using changes in ultrasonic wave velocities of horizontally polarized shear waves produced by electromagnetic-acoustic transducers. The initial three papers deal with the theoretical developments pointing to the measurement of in-plane residual stress as well as preliminary experimental verification. The later two papers generalize this theory and extend it to include surface residual stress measurement in an arbitrary plane; again, empirical validation is included.

709,786
PB84-203322 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
NVLAP (National Voluntary Laboratory Accreditation Program) Annual Report and Directory of Accredited Laboratories (5th).
P. S. Unger. Sep 82, 61p NBS/SP-636
See also PB84-109875. Also available from Supt. of Docs as SN003-003-02421-0.

Keywords: *Laboratories, *Acceptability, Test facilities, Standards, Directories.

This annual report of the National Voluntary Laboratory Accreditation Program (NVLAP) is prepared in accordance with NVLAP Procedures (Title 15 CFR Parts 7a, 7b, and 7c). Part I summarizes significant activities, including program changes, accreditation actions, and ongoing discussions concerning laboratory accreditation on the national and international levels. Part II is a directory of laboratories currently accredited on behalf of the Secretary of Commerce.

709,787
PB84-217074 PC **A10**/MF **A01**
National Bureau of Standards (NML), Washington, DC. Office of Nondestructive Evaluation.
Technical Activities 1983, Office of Nondestructive Evaluation.
Annual rept.
L. Mordfin. Jan 84, 203p NBSIR-84-2815
See also PB81-132466.

Keywords: *Nondestructive tests, Reviews.

A review of the Nondestructive Evaluation Program at NBS, for FY 1983, is presented in this annual report.

709,788
PB84-217553 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Office of Product Standards Policy.
NVLAP (National Voluntary Laboratory Accreditation Program) Annual Report and Directory of Accredited Laboratories (7th).
Rept. for 1 Jan-31 Dec 83.
H. W. Berger. May 84, 77p NBS/SP-677
See also PB84-109875. Library of Congress catalog card no. 84-601041.

Keywords: *Laboratories, *Acceptability, Test facilities, Standards.

This annual report of the National Voluntary Laboratory Accreditation Program (NVLAP) is prepared in accordance with NVLAP Procedures (Title 15 CFR Parts 7a, 7b, and 7c). Part I summarizes significant activities, including program changes, accreditation actions and ongoing discussions concerning laboratory accreditation on national and international levels. Part II is a directory of laboratories currently accredited on behalf of the Secretary of Commerce.

709,789
PB84-219492 PC **A06**/MF **A01**
National Bureau of Standards (NML), Boulder, CO. Fracture and Deformation Div.
Electromagnetic-Acoustic-Transducer/Synthetic-Aperture System for Thick-Weld Inspection.
Final rept. 1 Jul 81-31 Dec 83.
C. M. Fortunko, R. E. Schramm, J. C. Moulder, and J. D. McColskey. May 84, 123p NBS/TN-1075
Sponsored in part by Ames Lab., IA. Also available from Supt. of Docs as SN003-003-02578-0.

Keywords: *Nondestructive tests, *Ultrasonic tests, *Weldments, *Welded joints, *Electroacoustic transducers, Signal processing, Computer programs, Basic programming language.

This report describes a system based on electromagnetic-acoustic transducers (EMATs) as an approach to automated nondestructive evaluation of thick weldments (= or > 25 mm). Applications include a new type of ultrasonic inspection system for thick, butt welds used in ship construction. Good signal-to-noise ratios, often a problem with EMATs, were possible through careful design of the transducers and associated electronic circuits and the use of signal averaging. At 454 kHz, the transducers produce shear-horizontal waves of approximately 7-mm wavelength in steel. The long wavelength permits determination of through-thickness flaw depth from the amplitudes of scattered ultrasonic waves. A minicomputer controlled transducer positioning and acquired the digitized ultrasonic waveforms for synthetic aperture processing. The synthetic aperture technique further improved signal quality and yielded flaw localization through the weld thickness. Measurements on artificial flaws demonstrated a detectability threshold of 0.5 mm (through thickness) and sizing ability up to 2.5 mm, in agreement with theoretical predictions. Details include the design of the transducers and electronics, as well as the mechanical positioner, signal processing algorithms, and complete computer program listings.

709,790
PB84-222066 Not available NTIS
National Bureau of Standards, Washington, DC.
Introduction to Papers Presented at the Symposium on Ultrasonic Measurements of Stress.
Final rept.
T. M. Proctor. Sep 82, 3p
Pub. in Jnl. of Testing and Evaluations 10, n5 p199-201 Sep 82.

Keywords: *Ultrasonic tests, *Determination of stress, Residual stress, Modulus of elasticity, Reprints.

Ultrasonic measurements of the variation of elastic modulus with stress have been done for more than 30 years. The inverse problem of measuring residual stress by ultrasonic means is still poorly understood. As a result, the measurement of residual stress by ultrasonic means has not been a successful engineering method. A symposium describing the present state of the art has been held and the written record of some of the contributors to it is presented by the following set of papers.

709,791
PB84-224005 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of In-Plane Residual Stress States in Plates Using Horizontally Polarized Shear Waves.
Final rept.
R. B. King, and C. M. Fortunko. Jun 83, 9p
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Jnl. of Applied Physics, v54 n6 p3027-3035 Jun 83.

Keywords: *Nondestructive tests, *Residual stress, Secondary waves, Elastic waves, Reprints.

In this paper a new approach for using acoustic measurements to evaluate residual stresses in the presence of unknown material property variation is presented. Procedures previously applied to the evaluation of stress with acoustic measurements are reviewed, and it is shown that these involve using measurements with bulk waves propagating along the normal to the surface of a plate and do not provide sufficient information to separate the influences of stress and material property variations. To overcome this fundamental limitation, an alternative theory is developed that governs the propagation of shear waves polarized horizontally with respect to the surface of a plate (SH waves), but propagating at oblique angles with respect to the surface normal. The question of separating the effects of residual stress and material properties on acoustic velocity is addressed in detail. A practical experimental procedure is developed that permits the evaluation of the in-plane components of the principal stresses in a plate exhibiting an unknown inhomogeneous initial anisotropy caused by material texture or microstructure. The procedure is then verified experimentally using an aluminum specimen with a known residual stress state, but unknown initial anisotropy.

709,792
PB84-225192 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal-Imaging System Performance Measures for Nondestructive Testing.
Final rept.
J. Cohen. 1984, 5p
Pub. in Society of Photo-Optical Instrumentation Engineers 446, p176-180 1984.

Keywords: *Nondestructive tests, *Thermography, Performance, Reprints, *Infrared inspection.

Thermal images result from temperature differences and/or emissivity differences (apparent temperature differences) in a scene or target. It is the function of a thermal-imaging system to reproduce an acceptable visible image of the scene or target from its thermal content. Thus, a thermal-imaging system is required to resolve spatial differences of temperature and emissivity. The performance of a thermal-imaging system may be specified by means of the fundamental performance measures, noise-equivalent temperature dif-

ference (NE(delta)T), minimum-resolvable temperature difference (MRTD), and/or minimum detectable temperature difference (MDTD). The measurement and the significance of each of these performance measures is discussed.

709,793

PB84-225531 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of Residual Stress States Using Horizontally Polarized Shear Waves.
Final rept.
R. B. King, and C. M. Fortunko. 1983, 12p
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Proceedings Review of Progress Quantitative Nondestructive Evaluation, University of California, San Diego, California, 1-6 August 1982, n2B p1327-1338 1983.

Keywords: *Residual stress, *Acoustic measurement, *Nondestructive tests, Aluminum, Anisotropy, Elastic waves, Polarization, S waves.

A new approach for using acoustic measurements to evaluate residual stresses in the presence of unknown material property variations is presented. It is shown that measurements using shear waves propagating along the normal to the surface of a plate do not provide sufficient information to separate the influences of stress and materials property variations. To overcome this fundamental limitation, an alternative theory is developed that governs the propagation of shear waves polarized horizontally with respect to the surface normal. The question of separating the effects of residual stress and materials properties on acoustic velocity is addressed in detail. In addition, a practical experimental procedure is developed that permits the evaluation of the in-plane components of the principal stresses in a plate exhibiting an unknown inhomogeneous initial anisotropy caused by material texture or microstructure. The procedure is then verified experimentally using an aluminum specimen with a known residual stress state, but unknown initial anisotropy.

709,794

PB84-226331 Not available NTIS
National Bureau of Standards, Washington, DC.
Impedance of a Coil in the Vicinity of a Crack.
Final rept.
A. H. Kahn. 1984, 9p
Pub. in Review of Progress in Quantitative Nondestructive Testing 3A, p579-587 1984.

Keywords: *Nondestructive tests, *Cracks, Defects(Materials), Electromagnetic fields, Electric coils, Electrical impedance, Reprints.

In the design of electromagnetic NDE systems for the detection and examination of cracks and other defects in conducting materials, it is desirable to have a quantitative description of the fields in the vicinity of the defect. In previous work by this author and co-workers, the fields in the vicinity of a crack were calculated for models based on excitation by a spatially uniform applied field, as in the interior of a solenoid. The present work reports on an improved model which includes non-uniformity of the field of the exciting coil and the effects of coil size and position relative to the crack.

709,795

PB84-226422 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of Residual States of Stress and Material Texture Using Ultrasonic Velocity Measurements with Electromagnetic Acoustic Transducers.
Final rept.
R. B. King, and C. M. Fortunko. 1982, 4p
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Proceedings of 1982 Ultrasonics Symp., San Diego, California, 27-29 October 1982, IEEE CAT. No. 82CH1823-4, n2 p885-888.

Keywords: *Residual stress, *Acoustic measurement, *Nondestructive tests, Aluminum, Anisotropy, Elastic waves, Ultrasonic radiation.

A new approach for using acoustic measurements to evaluate residual stresses in the presence of unknown material property variation is presented. Procedures previously applied to the evaluation of stress with acoustic measurements are reviewed and it is shown that these involve using measurements with bulk waves propagating along the normal to the surface of a plate and do not provide sufficient information to separate the influences of stress and material property variations. To overcome this fundamental limitation, an alternative theory is developed that governs the propagation of shear waves polarized horizontally with respect to the surface of a plate (SH-waves), but propagating at oblique angles with respect to the surface normal. The question of separating the effects of residual stress and material properties on acoustic velocity is addressed in detail. A practical experimental procedure is developed that permits the evaluation of the in-plane components of the principal stresses in a plate exhibiting an unknown inhomogeneous initial anisotropy caused by material texture or microstructure.

709,796

PB84-235530 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 89, Number 1, January-February, 1984.
Feb 84, 149p
See also PB84-235548 through PB84-235605 and PB84-160605. Also available from Supt. of Docs. SN003-003-72085-2.

Keywords: *Materials tests, Surface roughness, Neutron scattering, Ceramics, Creep properties, Cracks, Ultrasonic tests, Acoustic emission testing.

Contents:
- Surface roughness studies with DALLAS--Detector array for laser light angular scattering;
- Microstructural characterization of ceramic materials by small angle neutron scattering techniques;
- Characterization of creep damage in metals using small angle neutron scattering;
- Impedance of a coil in the vicinity of a crack;
- Theory of acoustic emission from phase transformations;
- Reconstructing internal temperature distributions from ultrasonic time-of-flight tomography and dimensional resonance measurements;
- Acoustic emission--Establishing the fundamentals.

709,797

PB84-235548
(Order as PB84-235530, PC **A07**/MF **A01**)
National Bureau of Standards (NEL), Washington, DC. Center for Mfg. Engineering.
Surface Roughness Studies with DALLAS-Detector Array for Laser Light Angular Scattering.
T. V. Vorburger, E. C. Teague, F. E. Scire, M. J. McLay, and D. E. Gilsinn. 14 Oct 83, 14p
Included in Jnl. of Research of the National Bureau of Standards, v89 n1 p3-16 Jan-Feb 84.

Keywords: *Surface roughness, Light scattering, Instruments, Fiber optics, Detectors, Laser applications.

An instrument has been developed to study surface roughness by measuring the angular distributions of scattered light. In our instrument, a beam from a He-Ne laser illuminates the surface at an angle of incidence which may be varied. The scattered light distribution is detected by an array of 87 fiber optic sensors positioned in a semicircular yoke which can be rotated about its axis so that the scattered radiation may be sampled over an entire hemisphere. The output from the detector array is digitized, stored, and analyzed in a laboratory computer. The initial experiments have concentrated on measurements of stainless steel surfaces which are highly two-dimensional and which yield scattering distributions that are localized in the plane of incidence. The results are analyzed by comparing the angular scattering data with theoretical angular scattering distributions computed from digitized roughness profiles measured by a stylus instrument. The theoretical distributions are calculated by substituting the roughness profiles into the operand of an integral equation for electromagnetic scattering developed by Beckmann and Spizzochino. This approach directly tests the accuracy of the basic optical theory.

709,798

PB84-235555
(Order as PB84-235530, PC **A07**/MF **A01**)
National Bureau of Standards, Washington, DC. Center for Materials Science.
Microstructural Characterization of Ceramic Materials by Small Angle Neutron Scattering Techniques.
K. Hardman-Rhyne, N. F. Berk, and E. R. Fuller. 1 Dec 83, 18p
Included in Jnl. of Research of the National Bureau of Standards, v89 n1 p17-34 Jan Feb 84.

Keywords: *Ceramics, *Neutron scattering, Microstructure, Porosity, Materials tests.

The use of small angle neutron scattering (SANS) techniques for ceramic materials is discussed. Two areas are emphasized: (1) diffraction for microstructural phenomena of less than 100 nm, and (2) beam broadening for microstructural phenomena greater than 90 nm.

709,799

PB84-235571
(Order as PB84-235530, PC **A07**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Impedance of a Coil in the Vicinity of a Crack.
A. H. Kahn. 16 Nov 83, 8p
Included in Jnl. of Research of the National Bureau of Standards, v89 n1 p47-54 Jan-Feb 84.

Keywords: *Electromagnetic testing, Cracks, Nondestructive tests, Electric coils, Impedance.

Calculations are presented for the impedance of a coil as it is moved in the vicinity of a v-groove crack in the surface of a metallic slab. The coil is modeled as a pair of parallel wires, oriented parallel to the crack, carrying equal and opposite currents. The inhomogeneous electromagnetic fields in the air above the slab and in the metal are determined by the boundary integral equation (BIE) method. This approach leads to a pair of coupled integral equations for the tangential components of the electric and magnetic field vectors on the surface of the slab containing the crack. The solutions, which are obtained by standard methods of discretization, are valid for arbitrary ratio of crack or coil dimensions to skin depth. Illustrations are presented of the Poynting vector distribution over the surface of the metal, including the crack faces. A plot of the complex impedance is given in the form of a coil scan across the crack.

709,800

PB84-235597
(Order as PB84-235530, PC **A07**/MF **A01**)
National Bureau of Standards, Washington, DC. Center for Materials Science.
Reconstructing Internal Temperature Distributions from Ultrasonic Time-of-Flight Tomography and Dimensional Resonance Measurements.
S. J. Norton, L. R. Testardi, and H. N. G. Wadley. 7 Nov 83, 10p
Included in Jnl. of Research of the National Bureau of Standards, v89 n1 p65-74 Jan-Feb 84.

Keywords: *Ultrasonic tests, Temperature distribution, Process control, Resonance, Measurement, Tomography.

Two ultrasonic techniques for reconstructing the internal temperature distribution in metal bodies--time-of-flight tomography and dimensional resonance profiling--are described. An analysis of the tomographic reconstruction of temperature (including ray refraction effects) in a cylindrical body is presented together with initial experimental results. Dimensional resonance profiling is a new technique that allows the reconstruction of a one-dimensional distribution of temperature in a structure from measurements of its resonant frequencies. While time-of-flight tomography is well suited for measuring temperature in a cylindrical geometry, a combination of dimensional resonance and (a restricted form of) tomography is the best method for measuring temperature profiles in the most practically important rectangular slab geometry.

709,801

PB84-235605
(Order as PB84-235530, PC **A07**/MF **A01**)
National Bureau of Standards, Washington, DC.
Acoustic Emission: Establishing the Fundamentals.
D. G. Eitzen, and H. N. G. Wadley. 23 Jan 84, 26p
Included in Jnl. of Research of the National Bureau of Standards, v89 n1 p75-100 Jan-Feb 84.

Keywords: Nondestructive tests, Monitoring, *Acoustic emissions, Signal processing.

In the mid-1970's a program of fundamental research was initiated at NBS to improve the scientific understanding of acoustic emission. Many individual results of this research have been reported in the literature and are beginning to be incorporated in a new generation of acoustic emission instrumentation, in improved test methodologies, and in the analysis of data. Here, we summarize the problems faced by acoustic emission midway through the last decade, review the accomplishments of the NBS program and related research programs, and outline the research that will be required in future years.

709,802
PB84-244813 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Techniques in NDE.
Final rept.
G. Birnbaum, and G. White. 1984, 107p
Pub. in Nondestructive Testing 7 (Chapter 8), p259-365 1984.

Keywords: *Nondestructive tests, Light scattering, Reflection, Semiconductors, Interferometers, Reprints, *Laser applications, Photoacoustic effect, Acoustic waves.

Laser techniques in NDE are reviewed. These methods include optical reflection and scattering, laser-induced thermal and acoustic waves, and laser induced electronic excitations in semiconductors. The theory of these methods, their experimental verification, and the NDE applications are discussed.

709,803
PB85-104727 Not available NTIS
National Bureau of Standards, Washington, DC.
Determining Stress and Strain and Texture Using Ultrasonic Velocity Measurements.
Final rept.
D. E. MacDonald. 1980, 2p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Sonics and Ultrasonics 27, n3 p172-173 1980.

Keywords: *Nondestructive testing, *Stress analysis, *Strain tests, *Ultrasonic radiation, *Anisotropy, Texture, Comparison, Reprints.

The application of ultrasonics to the nondestructive evaluation of residual stresses has been hindered by the question of whether the wave velocity is actually stress or strain dependent and by the difficulty of separating the stress/strain related anisotropy from that due to texture. The ultrasonic wave velocity is shown to depend directly on the stress as well as on the strain dependent second-order coefficients. This separate dependence on stress and strain is demonstrated with the aid of a mathematical model used to find the effect of finite strain on the wave velocities. A comparison of wave speeds for materials with isotropic, transversely isotropic, cubic and tetragonal symmetry and these same materials under uni-axial strain is presented which indicates how to separate the effects of stress and texture.

709,804
PB85-115764 Not available NTIS
National Bureau of Standards, Washington, DC.
Relief-Exposure Characteristics of Radiographs-in-Relief.
Final rept.
S. Mardix, M. Keene, D. A. Swyt, and E. C. Teague. 1978, 3p
Pub. in Jnl. of Applied Physics, v49 n2 p498-500 Feb 78.

Keywords: *Radiography, Radiographic film, Exposure, Images, Reprints.

Highly exposed radiographs are utilized in microradiography in order to increase the signal to noise ratio. Relief radiography enables the evaluation of these microradiographs. Relief-exposure characteristics are shown to follow relationship of the type R=R sub m(1-exp(-E/E sub m)) where R is the relief height, E the exposure, R sub m and E sub m are constants. The density of developed silver in Ilford L-4 nuclear emulsion if found from the value of R sub m to be 2.86. The constant E sub m is shown to give the exposure for maximum contrast. The experimental results are discussed and compared to those found in the literature.

709,805
PB85-123370 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultrasonic Reflectivity Tomography: Reconstruction with Circular Transducer Arrays.
Final rept.
S. J. Norton, and M. Linzer. 1979, 31p
Pub. in Ultrason. Imag. 1, n2 p154-184 1979.

Keywords: *Ultrasonic tests, Scattering, Reflectivity, Reprints, *Tomography, Image processing, Computer applications.

An analysis is presented of backprojection methods for reconstructing cross-sectional images of ultrasonic reflectivity from scattering measurements. A circular array of transducer elements is considered, using three basic modes of data acquisition and image reconstruction: (1) the same element serves as transmitter and receiver and data is backprojected along circular paths centered at the element; (2) distinct transmitter and receiver with fixed separation and backprojection along elliptical paths with the elements at the foci; and (3) distinct transmitter and receiver with varying separations and backprojection along corresponding elliptical paths.

709,806
PB85-139996 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Surface Roughness on Ultrasonic Echo Amplitude in Steel.
Final rept.
G. V. Blessing, P. P. Bagley, and J. E. James. Oct 84, 4p
Pub. in Materials Evaluation 42, n11 p1389-1392, 1400 Oct 84.

Keywords: *Ultrasonic tests, *Steels, Surface roughness, Nondestructive tests, Attenuation, Reprints.

The effect of surface roughness on the amplitude of ultrasonic echos has been studied for longitudinal waves in steel over a frequency range of 1 to 20 MHz. A set of five steel sample disks possessed (one-side) front surface roughnesses of a periodic nature ranging from 1 to 23 micrometers rms in height. Successive back-surface echo amplitudes were measured for the water-immersed samples using a multi-cycle tone burst technique. In addition, front surface echos were monitored as a function of roughness at 10 MHz in water, and at 2.3 MHz in air. The effects of several competing factors on echo amplitude were observed: scattering at the front (rough) surface, diffraction within the sample, and material attenuation. While at the lower frequencies, the surface roughnesses studied had little effect on echo amplitude, at 10 MHz and above the amplitude was observed to monotonically decrease with increasing roughness. For a given roughness value, diffraction effects dominated at the lower frequencies, while scattering and attenuation dominated at the higher frequencies.

709,807
PB85-140747 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
AC Magnetic Fields in the Vicinity of a Crack Calculated by Analytic and Numerical Methods.
Final rept.
A. H. Kahn, and R. Spal. 1982, 4p
Sponsored by Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings of the DARPA/AFML Review of Progress in Quantitative Nondest. Eval., La Jolla, CA., July 8-13, 1979, Air Force rept. no. AFWAL-TR-30-4078, p65-68 1980.

Keywords: *Eddy current tests, *Cracks, Nondestructive tests.

Calculations are reported of the impedance of a long solenoid which surrounds a cylinder of conducting material containing a radial surface crack. The calculation is accomplished by two independent methods. The first method expresses the field in the interior of the 'cracked' cylinder as an infinite series of cylindrical Bessel function. The coefficients in the series are determined in principle by boundary conditions; the most significant terms are calculated by solving the finite set of equations obtained by truncation of the series. The second method, applicable to any uniform geometrical cross-section, obtains the impedance from the normal derivative of the field on the boundary of the conductor. This normal derivative satisfies a (boundary) Fredholm integral equation of the first kind; a solution is obtained by discretizing and solving the resulting linear system of algebraic equations. The impedance is calculated for a wide range of values of the ratios of crack depth-to-radius and radius-to-skin depth. The results are displayed in graphical form giving the fractional charges of the real and imaginary parts of the complex impedance induced by the presence of the crack.

709,808
PB85-142503 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Advanced Methods for Noncontact Inspection of Welds Using Electromagnetic-Acoustic Transducers.
Final rept.
R. E. Schramm, C. M. Fortunko, and J. C. Moulder. 1984, 8p
Sponsored by Ames Lab., Iowa.
Pub. in Review of Progress in Quantitative Nondestructive Evaluation 3B, p1425-1432 1984.

Keywords: *Ultrasonic tests, *Weld defects, Nondestructive tests, Butt welds, Transducers, Reprints, Electromagnetic-acoustic transducers.

Electromagnetic-acoustic transducers (EMATs) offer several distinct advantages over more conventional means of acoustically interrogating large welded structures. They require no acoustic couplant and can operate without contact. They can also generate long wavelength shear horizontal waves. Proper design of transducers and electronics, supplemented with signal processing, results in a good signal-to-noise ratio. In this paper, the authors describe an improved EMAT configuration for use in an automated inspection system for butt weldments. A minicomputer controls transducer positioning, data acquisition, and digital signal processing to improve flaw detection, sizing, and localization. In particular, good detectability is possible with a synthetic aperture method that combines ultrasonic data from several transducer locations to produce a focusing effect and increase the signal-to-noise ratio.

709,809
PB85-178317 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
NVLAP (National Voluntary Laboratory Accreditation Program) Directory of Accredited Laboratories, 1984.
Rept. for Jan-Dec 84.
H. W. Berger. Feb 85, 83p NBS/SP-687
See also PB84-109875. Library of Congress catalog card no. 84-601165.

Keywords: *Directories, *Laboratories, Acceptability, Test facilities, Standards, Tests, *Accreditation, *National Voluntary Laboratory Accreditation Program.

Laboratories accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) are identified along with the specific test methods for which they are accredited. The current status of existing accreditation programs is given for laboratories that test thermal insulation, freshly mixed concrete, carpet, wood burning stoves, paint, and personnel radiation dosimeters, and that provide acoustical testing services. Indexes are provided for searching the Directory for laboratories accredited in specific testing areas or for specific test methods.

709,810
PB85-182780 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultrasonic Standard Reference Blocks: What future.
Final rept.
G. V. Blessing, and D. G. Eitzen. 1982, 4p
Sponsored by American Society for Nondestructive Testing, Columbus, OH.
Pub. in Proceedings of ASNT National Conference (Spring), Boston, MA., March 22-25, 1982, and (Fall), Pittsburgh, PA., October 4-7, 1982, p9-12 1982.

Keywords: *Ultrasonic tests, *Standards, *Reference blocks.

Flat-bottom-hole ultrasonic reference blocks have been used as reference standards in nondestructive testing for many years. A significant document for their application to aluminum is the ASTM standard recommended practice 'Fabricating and Checking Aluminum Alloy Ultrasonic Standard Reference Blocks.' While much effort has been expended to improve this prac-

tice, the block echo amplitude tolerances have in fact gradually increased from the original plus or minus 1 dB criteria in 1958 to their present level of plus 2 and minus 3 dB. This interim report will address the principal system variables which have led to these relaxed requirements, and discuss them quantitatively. Experimental results on a particularly unusual reference block set will be presented as an extremum case of block variability due to material properties.

709,811
PB85-189389 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.
Optical Techniques for On-Line Measurement of Surface Topography.
Final rept.
T. V. Vorburger, and E. C. Teague. 1981, 23p
Contract NASA-L-4718B
Pub. in Precision Engineering 3, n2 p61-83 Apr 81.

Keywords: *Surface roughness, *Optical measurement, *Nondestructive tests, Polarimetry, Optical interferometers, Reprints, Ellipsometry, Laser applications, Speckle, State of the art, On line systems.

Optical techniques offer great potential for non-destructive and on-line measurements of surface roughness during manufacturing. The current state of the art is reviewed for a number of optical techniques including specular reflectance, total integrated scatter, diffuseness, angular scattering distributions, speckle, ellipsometry, and interferometry. The paper draws the distinction between the more quantitative but slower profiling techniques and less quantitative parametric techniques, which are faster and hence more useful for high-speed monitoring of surfaces. In their present state of the art these parametric techniques are suitable as comparators rather than as true metrological tools. Speckle techniques hold perhaps the greatest potential as accurate, high-speed metrological tools.

709,812
PB85-200079 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
NVLAP (National Voluntary Laboratory Accreditation Program) Assessment and Evaluation Manual.
P. S. Unger. Apr 85, 21p NBSIR-85/3137
See also PB85-178317.

Keywords: *Laboratories, Standards, Tests, Test facilities, Manuals, Evaluation, Assessments, *Accreditation, *National Voluntary Laboratory Accreditation Program.

This manual explains the role of an assessor and evaluator under the National Voluntary Laboratory Accreditation Program (NVLAP). Policies, procedures, and techniques for conducting a NVLAP on-site assessment of a testing laboratory are described. Deficiencies (or departures from the accreditation criteria) and the technical evaluation leading to accreditation recommendations are also discussed.

709,813
PB85-202661 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optimum Applied Field for Magnetic Particle Inspection Using Direct Current.
Final rept.
C. L. Oehl, and L. J. Swartzendruber. 1982, 12p
Pub. in Jnl. of Nondestructive Evaluation 3, n3 p125-136 Sep 82.

Keywords: *Nondestructive tests, *Magnetic particle tests, Leakage flux, Inspection, Reprints.

Experimental measurements of leakage fields from cylindrical defects were obtained in a geometry which permitted simultaneous measurement of the magnetic induction of the material. The results obtained are compared with calculations using a nonlinear finite difference method. Both the experiments and the calculations indicate that the magnitude of the leakage field continues to grow nearlyin proportion with the applied field well into the saturation region of the magnetic material. The implications for magnetic particle inspection are discussed.

709,814
PB85-205227 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.
Development of High Fidelity Acoustic Emission Transducers.
Final rept.
T. Proctor, F. Breckenridge, and D. Eitzen. Dec 83, 9p
Sponsored by American Society for Metals, Metals Park, OH.
Pub. in Proceedings of Int. Conf. NDE in the Nuclear Industry (6th), Zurich, Switzerland, November 28-December 2, 1983, p329-337.

Keywords: *Transducers, Nondestructive tests, Displacement, Acoustic emission testing.

The development of a transducer which measures the normal displacement of a 'point' on a surface is reviewed. This transducer has sufficient bandwidth so that it can measure, with high sensitivity, the dynamic surface motion due to an AE event. Certain improvements in the design are discussed. Captured waveforms from the best model of the transducer are compared with theoretical elasticity predictions of surface displacement. The transducer will be made available for purchase as a transfer standard through the Standard Reference Materials Program of the National Bureau of Standards. Preliminary results from a new transducer for measuring tangential surface motion are also presented.

709,815
PB85-229896 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.
Deconvolution by Design - An Approach to the Inverse Problem of Ultrasonic Testing.
Final rept.
D. Eitzen, N. Hsu, A. Carasso, and T. Proctor. 1985, 10p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v4A p179-188 1985.

Keywords: *Nondestructive tests, *Ultrasonic tests, *Deconvolution, Inverse problems.

In the paper the authors present some preliminary results on a new approach to the problem of characterizing flaws using ultrasonics. The approach takes advantage of the fact that they have control over the time waveform of the probing pulse in an ultrasonic test. It also takes advantage of some special properties of the inverse Gaussian function and an effective, stable, continuous deconvolution procedure which is based on the special function. The procedure also has the special feature that the error in the resultant of the deconvolution, which contains all available information about the flaw-scatterer, can be estimated in a powerful way. First they present the problem formulation and the analytical reasoning. They then discuss the inverse Gaussian function, the deconvolution procedure based on the probe function, and point out some of the special features of the probe function and the procedure. They also present some numerical tests and results using the procedure, demonstrate that the tools necessary to implement the procedure are within grasp, and present some preliminary experimental results.

709,816
PB85-244069 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Nondestructive Evaluation.
NDE (Non-Destructive Evaluation) Publications, 1982.
L. Mordfin. Jun 85, 37p NBSIR-85/3183
See also PB83-184622.

Keywords: *Nondestructive tests, *Bibliographies, Abstracts, National Bureau of Standards.

This is the sixth in a series of bibliographies of NBS publications on nondestructive evaluation (NDE). It provides bibliographic citations, with selected abstracts, for 124 publications that appeared in the open literature, primarily during calendar year 1982. A detailed subject index is included as well as information on how copies of many of the publications may be obtained.

709,817
PB86-111770 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Impedance Changes Produced by a Crack in a Plane Surface.
Final rept.
A. H. Kahn. 1982, 5p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v1 p369-373 1982.

Keywords: *Eddy current tests, Cracking(Fracturing).

A report will be presented of calculations of eddy currents in the vicinity of a crack in a plane slab of conducting material. The exciting field is taken as uniform and parallel to the slab and the plane of the crack. In these calculations, the crack depth is arbitrary, as is its inclination to the plane of the slab. The eddy current problem was solved by a boundary integral equation method (also known as the boundary element method). The induced currents at the surface of the conductor and on the crack will be shown for selected crack depths representative of all ranges of the ratio of crack depth to the electromagnetic skin depth, and for selected angles of crack inclination. The total impedance change produced by the crack will be given for arbitrary crack depth and inclination.

709,818
PB86-123080 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Quantitative Acoustic Emission Studies for Materials Processing.
Final rept.
H. N. G. Wadley, C. K. Stockton, J. A. Simmons, M. Rosen, S. D. Ridder, and R. Mehrabian. 1982, 11p
Pub. in Proceedings of Air Force/Defense Advanced Research Projects Agency Symposium (8th), Boulder, CO., August 2-7, 1981, Review of Progress in Quantitative Nondestructive Evaluation 1, p421-431 1982.

Keywords: Acoustics, Q switched lasers, Greens function, Wave propagation, Nondestructive tests, *Acoustic emission testing, *Rapid solidification.

The techniques being developed in Rapid Solidification Technology (RST) can be used to improve and critically evaluate the performance of acoustic emission methods for nondestructive evaluation (NDE). In turn, these NDE techniques could play an important part in the development of advanced materials. The paper first describes the use of a Q-switched laser for the generation of predictable acoustic emission signals which are to be used to evaluate quantitative multichannel source characterization methods. Second, the laser generation of elastic waves is used to measure the speed of extensional wave propagation in metallic glass ribbons, and to thus deduce the degree of crystallization as a function of isothermal annealing.

709,819
PB86-129038 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Precision Measurement of Eddy Current Coil Parameters.
Final rept.
T. E. Capobianco, and F. R. Fickett. 1985, 8p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation 4A, p491-498 1985.

Keywords: *Coils, *Eddy current tests, Precision, Impedance, Phase angle, Inductance, Deformation, Oscilloscope, Reprints.

Precision measurements of impedance, phase angle, and dissipation factor of both commercial eddy current coils and specially prepared test coils by various techniques are described. Special emphasis is placed on use of the digital storage oscilloscope and commercial LCZ meter. Detection of the effect on the coil parameters of shorted turns, deformation, and ferrite defects is described.

709,820
PB86-132602 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of Nondestructive Evaluation.
Laser Generated and Detected Ultrasound and Holographic Methods.
Final rept.
G. Birnbaum, G. S. White, and C. M. Vest. 1985, 9p
Sponsored by American Society of Mechanical Engineers, New York.
Pub. in Pressure Vessel and Piping Technology 1985: A Decade of Progress, p661-669 1985.

Keywords: *Holography, *Ultrasonic tests, Nondestructive tests, Ultrasonic radiation, Inspection, Pressure vessels, Laser radiation.

Several methods using laser radiation for nondestructive evaluation (NDE) are discussed. These include the noncontact generation of ultrasonic waves by the interaction of laser radiation with metal surfaces, and the noncontact detection of surface deformation due to ultrasonic waves by laser interferometric and knife-edge techniques. In addition, optical holography, which has been used for the inspection of pressure vessels, is discussed. Several applications for laser generation of ultrasonic waves are described.

709,821
PB86-139862 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Texture in Stainless Steel Welds: An Ultrasonic Study.
Final rept.
H. M. Ledbetter, and M. W. Austin. 1985, 5p
Pub. in Jnl. of Materials Science 20, p1720-1724 1985.

Keywords: *Weldments, *Ultrasonic tests, Stainless steels, Texture, Elastic properties, Steel 316.

The authors studied texture effects in five AISI-316 stainless-steel welds. The authors measured nine independent ultrasonic velocities along the weld's principal axes. These velocities reveal a strong texture different from the <001> fibre-type usually attributed to these materials.

709,822
PB86-142882 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Nondestructive Evaluations of Steel Corrosion under Protective Coatings Using Thermal-Wave Imaging.
Final rept.
T. Nguyen. 1985, 10p
Pub. in Proceedings of the Defense Conference Nondestructive Testing (33rd), Morristown, New Jersey, November 27-29, 1984, p155-164 Aug 85.

Keywords: *Nondestructive tests, *Steels, Protective coatings, Corrosion, Organic coatings, Degradation, Reprints.

The authors have applied thermal-wave imaging, a recently-developed nondestructive technique, which is sensitive to minor variations in thermal conductivity of materials, and which can provide micrometer level resolution of subsurface features of opaque materials, to detect and assess degradation at the metal/coating interface. This paper will briefly review the technique of thermal-wave imaging and present preliminary results on the application of this method to imaging the corrosion of steel protected by organic coatings.

709,823
PB86-142890 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Thermal-Wave Microscopy and Its Application to Imaging the Microstructure and Corrosion of Cold-Rolled Steel.
Final rept.
T. Nguyen, and A. Rosencwaig. 1985, 18p
Pub. in Jnl. of Applied Surface Science 24, p57-74 1985.

Keywords: *Nondestructive tests, *Steels, Microscopy, Microstructure, Corrosion, Protective coatings, Reprints.

Thermal-wave microscopy (TWM), which employs heat flow to probe variations in the thermal properties of solid materials, can provide micron-level resolutions of subsurface features of opaque samples, this paper describes the principle of TWM, reviews its applications in material science, and presents the results of studies using this technique to imaging the microstructure and corrosion of cold-rolled steels. Preliminary results indicate that TWM can image the microstructure of cold-rolled steel with or without a corrosion layer. The results obtained also suggest that the technique can monitor and assess corrosion in its early stage of formation.

709,824
PB86-158003 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
NVLAP (National Voluntary Laboratory Accreditation Program) Directory of Accredited Laboratories, 1985-86.
H. W. Berger. Jan 86, 117p NBSIR-86/3315
See also PB85-178317.

Keywords: *Directories, *Laboratories, Test facilities, Accreditation.

The 1985-86 NVLAP Directory of Accredited Laboratories provides information on the activities of the National Bureau of Standards in administering the National Voluntary Laboratory Accreditation Program (NVLAP) during calendar year 1985. The status of current programs is briefly described and a summary of laboratory participation is provided. Indexes cross reference the laboratories by name, NVLAP Lab Code Number, test method, accreditation program, and geographical location and cross reference NVLAP code numbers with test method designations. The scope of accreditation of each laboratory, listing the test methods for which it is accredited, is provided along with a tabulation of test methods and the laboratories accredited for those test methods.

709,825
PB86-160553 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Comparing EM (Electromagnetic) Susceptibility Measurement Results Between Reverberation and Anechoic Chambers.
Final rept.
M. L. Crawford, and G. H. Koepke. Aug 85, 9p
Sponsored by Naval Surface Weapons Center, Dahlgren, VA., and Rome Air Development Center, Griffiss AFB, NY.
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronic Engineers) International Symposium on Electromagnetic Compatibility, Wakefield, MA., August 20-22, 1985, p152-160.

Keywords: *Anechoic chambers, Measurement, *Reverberation chambers, *Electromagnetic susceptibility.

The paper compares measurement results obtained using a 2.7 m x 3.1 m x 4.6 m reverberation chamber and a 4.9 m x 6.7 m x 8.5 m anechoic chamber to determine the EM susceptibility of equipment under test (EUT). The frequency range was 200 MHz - 18 GHz. The 'correlation factor' between the two techniques appears to be directly proportional to the gain of the EUT. Four sample EUTs included in the study were a one centimeter dipole probe, a ridged horn antenna, a small rectangular TEM transmission cell with an aperture and a modified 7.0 cm (2.75n) diameter folded fin aircraft rocket.

709,826
PB86-163474 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Weld Flaw Sizing Using Back-Scattered and Forward-Scattered Low Frequency Ultrasound.
Final rept.
R. E. Schramm, and T. A. Siewert. Nov 85, 8p
Sponsored by Ames Lab., IA.
Pub. in Proceedings of World Conference on Nondestructive Testing (11th), Las Vegas, NV., November 3-8, 1985, p1286-1293.

Keywords: *Ultrasonic tests, *Weld defects, Transducers.

Electromagnetic-acoustic transducers (EMATs) generating low frequency ultrasound can detect and size planar flaws in welds. The back-scattered signal carries information on the through-depth flaw size. Measurements on slits in 16-mm thick steel plates indicated a sensitivity to flaw depth sizes as small as 0.5 mm. In accordance with theory, the signal saturated at about 2.5 mm. This is a very important size range for many fracture mechanics considerations, but it is desirable to extend the range to still larger flaw sizes. The report describes the simultaneous use of the forward and back-scattered signals to extend the range. Processing the signals from two receiver transducers on either side of the flaw demonstrated a sizing ability for artificial flaws up to 11-mm deep. The technique has also been successfully applied to two welded plates, each containing intentional flaws such as inadequate joint penetration and incomplete fusion. The weld flaw sizes predicted by the EMAT signals and those determined by destructive metallography agree within 1 mm.

709,827
PB86-181369 PC **A99**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Thermometry.
Final rept.
J. F. Schooley. Mar 86, 634p NBSIR-85/3133

Keywords: *Temperature measurement, *Thermometry, *Thermometers.

The manuscript develops the concept of thermometry, including historical experiments and thermodynamics; the Kelvin thermodynamic temperature scale; international practical temperature scales; the thermodynamic methods used to realize the Kelvin scale; and modern types of thermometers. Nearly 400 bibliographic references are included.

709,828
PB86-182375 PC **A10**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Materials Science and Engineering.
Institute for Materials Science and Engineering, Nondestructive Evaluation: Technical Activities 1985.
Annual rept.
H. T. Yolken, L. Mordfin, and G. Birnbaum. Nov 85, 220p NBSIR-85/3187
See also PB84-217074.

Keywords: *Nondestructive tests, *Standards, Composite materials, Process control, Interfaces.

A review of the Nondestructive Evaluation Program at NBS, for fiscal year 1985, is presented in the annual report.

709,829
PB86-200953 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
International Organization of Legal Metrology.
Final rept.
D. R. Mackay. 1983, 5p
Pub. in Proceedings of Annual Conference Standards Engineering Society: The Spectrum of Evolving Standards, Dayton, OH., September 26-28, 1983, p44-48.

Keywords: *Metrology, *Organizations, Recommendations, Standards, International relations, *Legal metrology.

The International Organization of Legal Metrology (OIML) was founded in 1955 to promote intergovernmental cooperation in the field of legal metrology. The United States joined this organization in 1972 and the National Bureau of Standards was assigned the responsibility for managing the U.S. involvement in cooperation with the Department of State. The paper describes the functions of the International Conference of Legal Metrology, the International Committee of Legal Metrology, and the International Bureau of Legal Metrology. The organizational procedures for the development and approval of International Recommendations through the Pilot Secretariats and the Reporting Secretariats. The U.S. involvement and participation in the technical programs of OIML is discussed as well as the importance of both public and private sector participation in terms of the future exportation of U.S. manufactured products.

709,830
PB86-202082 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Status of NBS (National Bureau of Standards) Recognition of Calibration Capabilities.
Final rept.
J. W. Locke. 1983, 6p
Pub. in Proceedings of the National Conference of Standards Laboratories Workshop and Symposium (1983), Boulder, CO., July 18-21, 1983, p2.6A.1--2.6A.6.

Keywords: *Calibrating, National Bureau of Standards.

Describe the status of efforts at NBS related to domestic and international recognition of U.S. calibration facilities.

709,831
PB86-238359 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.

Mossbauer Techniques in Nondestructive Evaluation.
Final rept.
L. H. Bennett. 1986, 4p
Pub. in Encyclopedia of Materials Science and Engineering, v4 p3121-3124 1986.

Keywords: *Nondestructive tests, *Mossbauer effect, Materials tests, Reprints.

The Mossbauer effect, a nuclear-physics technique involving the emission and resonant absorption of gamma rays without recoil, is also known as nuclear gamma-ray resonance or nuclear resonance-fluorescence. It provides information on the local atomic environment which, in turn, relates to the properties of the materials. Mossbauer studies have been applied to a wide variety of problems, including catalysis, corrosion, magnetism, atomic structure, chemical kinetics, diffusion and biology. Many nuclear isotopes can be used for Mossbauer studies, but the most common is 57 Fe. For the reason, nondestructive evaluation studies in ferrous metallurgy is an important applications area for the Mossbauer technique.

709,832
PB86-238383 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Failure Analysis: Nondestructive Evaluation.
Final rept.
B. W. Christ. 1986, 3p
Pub. in Encyclopedia of Materials Science and Engineering, v3 p1617-1619 1986.

Keywords: *Nondestructive tests, Failure, Pressure vessels, Ultrasonic tests, Radiography, Inspection, Reprints.

The role of NDE in failure analysis is discussed. Some applications of the State-of-the-Art are described.

709,833
PB86-239381 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Microwave Nondestructive Evaluation.
Final rept.
D. A. Ellerbruch. 1986, 5p
Pub. in Encyclopedia of Materials Science and Engineering, v4 p3050-3054 1986.

Keywords: *Nondestructive tests, Electromagnetic tests, Microwaves, Scattering, Reprints.

The electromagnetic equations relevant to microwave nondestructive evaluation are given in this review paper. Microwave signal scattering and measurements in the time and frequency domain are discussed with respect to real measurement situations.

709,834
PB86-240785 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Texture: Nondestructive Characterization.
Final rept.
H. J. Prask, and C. S. Choi. 1986, 3p
Pub. in Encyclopedia of Materials Science and Engineering, v7 p4895-4897 1986.

Keywords: *Texture, *Nondestructive tests, *Materials tests, Anisotropy, Orientation, Diffraction, Reprints.

Texture is the term applied to the presence of a preferred crystallographic orientation of the crystallites (grains) in a polycrystalline material. Fibers become textured during growth or processing. Mechanical operations such as drawing, rolling or swaging induce texture. All such texturing introduces anisotropy in the mechanical properties of the aggregate which affects the response of the material during further forming, fabrication or in-service operations.

709,835
PB86-241759 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of Nondestructive Evaluation.
Residual Stresses: Nondestructive Evaluation.
Final rept.
L. Mordfin. 1986, 7p
Pub. in Encyclopedia of Materials Science and Engineering, v6 p4188-4194 1986.

Keywords: *Nondestructive tests, *Materials tests, Residual stress, X ray diffraction, Ultrasonic tests, Barkhausen effect, Neutron diffraction, Determination of stress, Reprints.

Following a brief description of the nature and the significance of residual stresses in materials, the physical bases of nondestructive methods for measuring residual stresses are presented. Principal emphases are on the conventional x-ray diffraction method and on the ultrasonic method. An approach based on Barkhausen noise analysis is briefly described. Recent research on the measurement of internal stresses by neutron diffraction and by high-energy x-ray diffraction is noted.

709,836
PB86-241965 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.
Optical Nondestructive Evaluation.
Final rept.
E. C. Teague, T. V. Vorburger, and G. Birnbaum. 1986, 5p
Pub. in Encyclopedia of Materials Science and Engineering, v5 p3312-3316 1986.

Keywords: *Nondestructive tests, *Optical tests, Surface properties, Reprints. .

The review deals with optical techniques for evaluating the surface flaws and surface roughness of solids, in short, the quality of solid surfaces. The wide variety of optical NDE techniques have been grouped into four classes; imaging, scattering, diffraction, and profiling. An illustrative example of each class is discussed and opto-acoustic NDE methods are briefly reviewed.

709,837
PB86-242575 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Magnetic Nondestructive Evaluation.
Final rept.
L. J. Swartzendruber. 1986, 5p
Pub. in Encyclopedia of Materials Science and Engineering, v4 p2694-2698 1986.

Keywords: *Nondestructive tests, *Magnetic tests, Magnetic fields, Magnetic properties, Reprints.

Magnetic methods of nondestructive evaluation utilize the relationship between material properties and static or slowly varying magnetic fields. They find wide application both on the production line and in the field and, where useable, provide a sensitive, rapid, and often relatively inexpensive test method. Uses include measurement of important metallurgical properties, detection of harmful defects, and measurement of coating thickness. This article will briefly review the properties of leakage fields and methods of their detection and the origin and measurement of magnetic properties.

709,838
PB87-104428 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Investigation of the Use of Nondestructive Methods for Inspection of Seams of Single-Ply Roofing Membranes.
W. J. Rossiter. Sep 86, 36p NBSIR-86/3455
Sponsored by Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Roofing, Detection, Ultrasonic tests, Seams(Joints), Nondestructive tests, Inspection, *Infrared thermography.

Investigations were conducted regarding the use of the ultrasonic pulse echo and the infrared thermography nondestructive evaluation (NDE) methods for detecting voids and delaminations in adhesive-bonded seams of single-ply roofing membranes. Results indicated that the ultrasonic pulse echo method using a wheel transducer can be useful as a field technique for assisting in the quality assessment of seams.

709,839
PB87-115432 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Mapping of Eddy Current Probe Fields.
Final rept.
T. E. Capobianco, F. R. Fickett, and J. C. Moulder. 1986, 7p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation 5A, p705-711 1986.

Keywords: *Eddy current tests, Magnetic fields, Electrical measurement, Nondestructive tests, Mapping, Probes, Eddy currents.

The magnetic fields produced by four different eddy current probes were mapped in the near field with very small (0.43) mm dia inductive magnetic field sensors. The four eddy current probes included two nominally identical, absolute, air core probes, an absolute ferrite core probe, a reflection probe with an air core excitation coil and two counterwound ferrite core pickup coils. Measured fields for the air core probes are compared with values calculated from the theory of Dodd and Deeds. All measurements were performed at 10 kHz; for the ferrite core probe the field intensity was also measured from 1 kHz to 100 kHz using conventional methods.

709,840
PB87-118766 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Inverse Problem of Acoustic Emission - Explicit Determination of Acoustic Emission Source Time-Functions.
Final rept.
N. N. Hsu, and D. G. Eitzen. 1982, 8p
Pub. in Review of Progress in Quantitative Nondestruction Evaluation 1, p405-412 1982.

Keywords: Signal processing, Reprints, *Acoustic emission testing.

The paper addresses the problem of determining the AE source time-function from the detected AE signal with a sensor located a short distance away from the source. The solution to the problem is in the form of an inverse filter (deconvolution filter) such that the explicit waveform of the source can be obtained by passing the detected AE signal through such a filter. In other words, by removing the effects of the reverberations of the structure and the particular characteristics of the sensor, the filter recovers the AE source signature which characterizes the source mechanism alone.

709,841
PB87-122206 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Acoustic Emission Chip-Form Monitor for Single-Point Turning.
Final rept.
K. W. Yee, D. S. Blomquist, D. A. Dornfeld, and C. S. Pan. 1986, 8p
Pub. in Proceedings of International Machine Tool Design and Research Conference (26th), Manchester, England, September 17-18, 1986, p305-312.

Keywords: Microcomputers, Algorithms, Chips, Breaking, Aluminum, Steels, Alloy steels, Machine tools, *Acoustic emissions, *Chips(Electronics), *Computer aided manufacturing, Monitoring.

An acoustic-emission-based microcomputer chip-form monitor has been designed and built at the National Bureau of Standards (NBS). The monitor implements algorithms based on research by the University of California, Berkeley. The ability to identify chip form in turning of three types of metal (aluminum, low-carbon steel, and an alloy steel) has been demonstrated at both institutions, each using different machine tools and different tooling. The monitor performs best for the soft, east-to-machine metals where chip breaking is most difficult and disastrous tangles are most likely.

709,842
PB87-131470 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Flaw Detection with a Magnetic Field Gradiometer.
Final rept.
T. E. Capobianco, J. C. Moulder, and F. R. Fickett. 1985, 6p
Pub. in Proceedings of Symposium on Nondestructive Evaluation (15th), San Antonio, TX., April 23-25, 1985, p15-20.

Keywords: *Eddy current tests, Nondestructive tests, Magnetic measurement, SQUID devices, Gradiometers, Defects(Materials).

When eddy currents are induced in a conductor, flaws deflect the eddy currents and perturb the associated electric and magnetic fields. In conventional eddy current testing, the perturbed fields associated with a flaw

are detected as a change in the impedance of the test coil used to induce the eddy currents. More direct methods for detecting and characterizing flaw-perturbed fields, both electric and magnetic, have also been developed. The authors describe a method for determining the normal component of the magnetic field gradient caused by a flaw. A novel feature of the measurement system is the use of a Superconducting Quantum Interference Device (SQUID). The SQUID provides more sensitivity than conventional detection methods, and the possibility of calibration based on a fundamental physical quantity: the flux quantum. Results are reported of a series of measurements on a fatigue crack and several manufactured defects in aluminum alloy specimens using the system. The effect of edge proximity compared to flaw signal and a figure of merit are also discussed.

709,843
PB87-132049 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Rayleigh Wave Propagation in Deformed Orthotropic Materials.
Final rept.
P. P. Delsanto, and A. V. Clark. 1986, 9p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation 5B, p1407-1414 1986.

Keywords: *Orthotropic plates, Surfaces, Propagation, Anisotropy, Nondestructive tests, Reprints, *Rayleigh waves.

A perturbation method is described for the investigation of the propagation of Rayleigh waves on the surface of a homogeneous anisotropic initally deformed material plate. The authors derive the Rayleigh wave phase velocity as a function of the propagation direction, the elastic constants and the initial stresses. The linearity of our formulas suggests that Rayleigh waves can be conveniently used as an experimental technique for the solution of the inverse problem of determining the elastic constants and/or the initial stresses in the material. The perturbation formalism is quite general and can be applied whenever other small effects, like slight temperature changes or external magnetic fields, affect the Rayleigh wave propagation velocity.

709,844
PB87-136701 PC **A05**/MF **A01**
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Institute for Materials Science and Engineering, Fracture and Deformation: Technical Activities 1986.
Oct 86, 77p NBSIR-86/3436
See also PB86-182375.

Keywords: *Deformation, *Nondestructive tests, *Fractures(materials), Fracture tests, Stress analysis, Fracture properties, Crack propagation, Welding, Cracking(Fatigue), Metallurgy, Composite materials, Grain boundaries, Mechanical properties, Technical activities.

The report summarizes the technical program of the Fracture and Deformation Division of the Institute for materials Science and Engineering, National Bureau of Standards for the fiscal year 1986. The division's two major program areas are elastic-plastic fracture mechanics and fracture mechanisms and analysis. Elastic-plastic fracture mechanics includes contributions from stress analysis, material properties, nondestructive evaluation, and welding. Division efforts in fracture physics, time-dependent properties, composite mechanics, mechanical metallurgy, physical properties, and material performance compose the second area, fracture mechanisms and analysis. Significant technical programs relating to each of these are presented. Major accomplishments are highlighted, including an interdisciplinary analysis of a major pressure vessel failure, extensive collaboration with the automotive industry to reduce costs associated with failure, successful large-scale experiments of dynamic crack arrest, and composite-modeling, material-property, and test-development research.

709,845
PB87-152260 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Institute for Materials Science and Engineering, Nondestructive Evaluation: Technical Activities 1986.
H. T. Yolken. Jan 87, 78p NBSIR-86/3434
See also report for 1985, PB86-182375.

Keywords: *Nondestructive tests, Eddy current tests, Ultrasonic tests, Radiography, Thermal measurements, Acoustic emissions.

A review of the Nondestructive Evaluation Program at NBS, for fiscal year 1986, is presented in the annual report.

709,846
PB87-165734 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Determination of Inhomogeneities of Elastic Modulus and Density for One-Dimensional Structures Using Acoustic Dimensional Resonances.
Final rept.,
L. R. Testardi, S. J. Norton, and T. Hsieh. Nov 84, 5p
Pub. in Jnl. of Applied Physics 56, n10 p2681-2685 Nov. 84.

Keywords: *Nondestructive tests, *Ultrasonic tests, Density(Mass/volume), Modulus of elasticity, Resonant frequency, Rods, Reprints, *Defects(Materials), One dimensional.

The authors derive a simple relation which allows the reconstruction of the inhomogeneity of the elastic modulus and density along a rod based only on the measured fundamental and overtone frequencies. The technique, analogous to one-dimensional tomography in the frequency domain, permits the quantitative detection of both continuous and localized defects. Experimental tests using impressed temperature profiles and drilled holes are reported. Observed sensitivities are found to be better than 1C for the former and 0.0001 (of the rod volume) for the latter.

709,847
PB87-166435
(Order as PB87-166401, PC **A05**/MF **A01**)
National Bureau of Standards, Boulder, CO.
Detection and Sizing of Surface Flaws with a SQUID-Based Eddy Current Probe,
J. C. Moulder, and T. E. Capobianco. 24 Sep 86, 7p
Included in Jnl. of Research of the National Bureau of Standards, v92 n1 p27-33 Jan-Feb 87.

Keywords: *Eddy current tests, *Surfaces, SQUID devices, Aluminum alloy 6061, Defects(Materials).

In a new approach to eddy current detection and sizing of surface-breaking flaws, we have coupled a conventional reflection probe to a superconducting quantum interference device (SQUID) to produce an eddy current probe with increased sensitivity and signal to noise ratio. The new probe was used to obtain flaw signals from a number of electrical-discharge machined slots in aluminum alloy 6061. Results indicated that by scanning the probe along the length of the flaw, the length could be determined from the extent of the flaw signal. The peak amplitude of the flaw signal was found to be proportional to the cross-sectional area of the flaw.

709,848
PB88-122155 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Proposed Military Standard for Commercial Eddy Current Probes Based on Performance Characterization.
Final rept.,
T. E. Capobianco, and F. R. Fickett. 1986, 7p
Sponsored by Army Materials Technology Lab., Watertown, MA.
Pub. in Proceedings of the Defense Conference on Nondestructive Testing (35th), Hill Air Force Base, UT., October 28-30, 1986, p135-141.

Keywords: *Nondestructive tests, *Eddy current tests, *Standards, *Probes(Electromagnetic), Military standards.

The latest results of the work being done on a draft military standard for characterizing commercial eddy current probes are reported. The authors discuss measurement techniques that have been evaluated for suitability as a characterization test method, such as field mapping and various electrical parameter measurements and the reasons for selecting the method which has been incorporated in the present draft. The authors conclusion is that the measurement of impedance change of a probe over a range of frequencies on two metals of different conductivities offers the best indicator of eddy current probe sensitivity and proper operating range.

709,849
PB88-138722 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Review of Eddy Current Research at the National Bureau of Standards in Boulder, Colorado.
Final rept.,
T. E. Capobianco. 1987, 10p
Pub. in Proceedings of Defense Conference on Nondestructive Testing (34th), Charleston, SC., October 29-31, 1985, p164-173 1987.

Keywords: *Eddy current tests, *Nondestructive tests, Cracking(Fracturing), Fatigue(Materials), Standards, Reviews, Probes(Electromagnetic), Artifacts, US NBS.

On going research in eddy current nondestructive evaluation at the National Bureau of Standards in Boulder, Colorado is reviewed. The most recent results and publications of experimental and theoretical studies are presented. This includes the areas of eddy current coil characterization and field mapping, experimental verification of eddy current-fatigue crack interaction, uniform field probe calibration, artifact standards, fatigue crack growth monitoring, and differential eddy current probe studies.

709,850
PB88-153622 PC **A05**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Fracture and Deformation Div.
Institute for Materials Science and Engineering, Fracture and Deformation Division: Technical Activities 1987.
1987, 80p NBSIR-87/3613
See also report for 1986, PB87-136701.

Keywords: *Deformation, *Nondestructive tests, *Fractures(Materials), Fracture tests, Stress analysis, Fracture properties, Crack propagation, Welding, Cracking(Fatigue), Metallurgy, Composite materials, Grain boundaries, Mechanical properties.

The report summarizes the 1987 fiscal-year programs of the Fracture and Deformation Division of the Institute for Materials Science and Engineering. Its two major programs are Elastic-Plastic Fracture Mechanics and Fracture Mechanisms and Analysis. Elastic-Plastic Fracture Mechanics includes nondestructive evaluation, welding, and thermomechanical processing. Fracture Mechanisms and Analysis consists of physical properties, fracture physics, composite mechanics, cryogenic materials, and material performance. The report summarizes the principal accomplishments in these research areas, including wide-plate crack-arrest tests, a new model of plastic fracture, design and evaluation of a capacitive-array probe, measurement of the natural frequency for short-circuiting transfer in gas-metal-arc welding, and a model for prediction of the elastic properties of porous ceramics.

709,851
PB88-153655 PC **A05**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD.
Institute for Materials Science and Engineering, Nondestructive Evaluation: Technical Activities 1987,
H. T. Yolken. 1987, 84p NBSIR-87/3611
See also report for 1986, PB87-136701

Keywords: *Deformation, *Nondestructive tests, *Fractures(Materials), Fracture tests, Stress analysis, Fracture properties, Crack propagation, Welding, Cracking(Fatigue), Metallurgy, Composite materials, Grain boundaries, Mechanical properties.

A review of the Nondestructive Evaluation Program at NBS, for fiscal year 1987, is presented in the annual report.

Plant Design & Maintenance

709,852
PB83-149450 PC **A22**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.

Plant Design & Maintenance

Innovation for Maintenance Technology Improvements.
Final rept.
T. R. Shives, and W. A. Willard. Oct 82, 511p NBS-SP-640
Proceedings of the Meeting of the Mechanical Failures Prevention Group (33rd), Held at the NBS, Gaithersburg, MD., April 21-23, 1981. Library of Congress catalog no. 82-600598. Sponsored in part by Naval Systems Command, Washington D.C., Office of Naval Research, Arlington, VA., and National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center. See also PB82-120304.

Keywords: *Maintenance, *Meetings, *Technology innovation, Maintenance management, Lubrication, Reliability, Manpower utilization, Fault detection.

These proceedings consist of a group of 34 submitted entries (32 papers and 2 abstracts) from the 33rd meeting of the Mechanical Failures Prevention Group which was held at the National Bureau of Standards, Gaithersburg, Maryland, April 21-23, 1981. The subject of the symposium was maintenance technology improvement through innovation. Areas of special emphasis included maintenance concepts, maintenance analysis systems, improved maintenance processes, innovative maintenance diagnostics and maintenance indicators, and technology improvements for power plant applications.

Production Planning & Process Controls

709,853
AD-A030 098/8 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Standards for Computer Aided Manufacturing.
Interim rept.
J. M. Evans, J. T. O'Neill, J. L. Little, J. S. Albus, A. J. Barbera, D. W. Fife, E. N. Fong, D. E. Gilsinn, F. E. Holberton, B. G. Lucas, G. E. Lyon, and B. A. Marron. Jun 76, 41p Rept no. NBSIR-76-1094

Keywords: *Manufacturing, *Computer applications, *Batch processing, *Standards, Systems engineering, Integrated systems, Digital computers, Data bases, Scheduling, Inventory control, CAM(Computer aided manufacturing), Computer aided manufacturing, Numerical control, Process control.

This report identifies and evaluates those existing and potential standards which will be useful to the Air Force in the development and implementation of integrated computer aided manufacturing (ICAM) systems. Such systems, when implemented by the Air Force and by Air Force contractors, will increase productivity in discrete part batch manufacturing by several thousand percent. The use and importance of standards are considered in the context of CAM systems. Since the Air Force will develop the detailed ICAM architecture after this study is complete, existing system concepts and architectures are examined to identify the common elements to guide the further presentation and discussion of relevant standards.

709,854
AD-P003 180/7 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Mfg. Engineering.
Data Distribution in the NBS (National Bureau of Standards) Automated Manufacturing Research Facility.
M. J. Mitchell, and E. J. Barkmeyer. 1984, 17p
Pub. in Proceedings IPAD II, Advances in Distributed Data Base Management for CAD/CAM, National Symposium Held in Denver, CO. on 17-19 Apr 84, AD-A140 614, p211-227.

Keywords: *Manufacturing, *Automation, *Research facilities, Data management, Data bases, Distributed data processing, Systems analysis, Computer architecture, Interfaces, Networks, Research management, Technology transfer, Computer aided design, Component Reports, NBS(National Bureau of Standards), Distributed data dictionaries, CAM(Computer Aided Manufacturing).

The NBS(National Bureau of Standards) AMRF(Automated Manufacturing Research Facility) exemplifies one approach to integrating a set of heterogeneous distributed databases. While the 1983 implementation is primitive, it provides real-time control processes with access to conventional databases, rapidly changing memory-resident data, and large binary files. It demonstrates the feasibility of front-ending existing data management systems with a Data Administration System implementing a common user interface, constructing process-dependent logical views of the data, and providing networked data access. The major shortcoming of the current implementation is the absence of a common data dictionary, and the major task of the near future is the development and automation of a distributed data dictionary system.

709,855
PB-267 035/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microcomputer Temperature Controller.
Final rept.,
W. T. Angel, and J. C. Houck. 1977, 5p
Pub. in Proceedings Control Valve Symposium and Process Control Technology (3rd), Anaheim, Calif., May 2-5, 1977, Paper in Final Control Elements 3, p139-143 1977.

Keywords: *Temperature control, Microcomputers, Electric bridges, Digital systems, Feedback control, Process control, Control equipment.

A temperature controller has been developed that uses a microcomputer to synchronously detect a temperature deviation signal derived from a standard AC bridge, and to apply proportional and integral feedback control to a heat source-sink via pulse width modulation. The controller has been interfaced with both resistance heaters and a thermoelectric heat pump. The main advantage of digital control in this application is the ability the controller provides to realize long time constants in conjunction with low long term set point drift for controlling various thermal masses precisely.

709,856
PB-282 877/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Standards for the NC User.
Final rept.,
J. M. Evans. 1976, 5p
Pub. in Proceedings of Annual Meeting and Technical Conference of the Numerical Control Society (13th), Cincinnati, Ohio 28-31 Mar 76, Paper in NC/CAM - The Industrial Revolution, p33-37 1976.

Keywords: *Numerical control, Standards, Manufacturing, Computer aided manufacturing.

The fields of numerical control and computer aided manufacturing are very fragmented, with incompatible components and technical information available from numerous sources. Standards seem the appropriate solution. However, the potential user finds that standards for these components, when they exist, are developed by many organizations and may not themselves be compatible. An overview is provided of the various standards setting organizations and their activities, and the importance of standards is emphasized. The activities of the NCS Standards Committee and the efforts of that committee and others to coordinate activities in the field of computer aided manufacturing are reviewed.

709,857
PB-282 915/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Control Strategies for Industrial Robot Systems.
Final rept.,
A. J. Barbera, J. S. Albus, and J. M. Evans. 1976, 10p
Pub. in Proceedings of Ind. Robot Conference and Exposition (1st), Chicago, Ill. 26-28 Oct 76, SME Tech. Paper MR76-616 p1-10 1976. (Society of Manufacturing Engineers, Dearborn, Mich.).

Keywords: *Robots, Automation, Feedback control, Microcomputers, Control equipment, Detectors.

The efficient control of complex automation systems requires that the control problem be partitioned into a hierarchy of subproblems. The National Bureau of Standards has developed a hierarchical control system of three levels that could be implemented on a microprocessor for any industrial robot system. This paper describes the various levels of the control hierarchy, evaluates their effectiveness, and discusses the use of sensory feedback to allow the robot to cope with uncertainties in its environment in real time.

709,858
PB-283 542/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Control Concepts for Industrial Robots in an Automatic Factory.
Final rept.,
J. Albus, A. J. Barbera, J. M. Evans, and G. J. VanderBrug. 1977, 14p
Pub. in Society of Manufacturing Engineers, Dearborn, Mich., SME Tech. paper MS77-745 p1-14 1977.

Keywords: *Robots, Automation, Manufacturing, Loading procedures, Materials handling equipment, Machine tools, Feedback control, Computer aided manufacturing, Reprints.

The NBS program in automation technology carries out research in sensors and computer control systems relevant to industrial robots. In particular, NBS has pursued the concept of industrial robots coupled with machine tools as the basis module of an automatic factory. Basic concepts of sensing and hierarchical control for machine tool loading and unloading are examined, and data from NBS experience in using a robot for tool loading is presented. In addition, the integration of robot/machine tool modules into integrated computer aided manufacturing system is discussed, with emphasis on the question of interfaces.

709,859
PB-283 843/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Robot Loading of an NC Machine Tool.
Final rept.,
J. M. Evans, J. S. Albus, and A. J. Barbera. 1977, 5p
Pub. in Proceedings Joint Automatic Control Conference, 1977, Held at San Francisco, Calif. on June 22-24, 1977, v2 n77CH 1220-3CS p720-724.

Keywords: *Robots, *Automation, *Feeding(Supplying), Automatic control, Machine tools, Numerical control, Automatic control equipment, Manufacturing, Loading, Batch manufacturing, Computer aided manufacturing, Job shops.

Robots have been widely used to load and unload parts from a variety of machine tools on an essentially dedicated basis. However, control capabilities of today's industrial robots have been inadequate to solve the machine loading problem for small lot production (< 100 parts) which composes the bulk of discrete part batch manufacturing. A multi-level hierarchical control system which embodies a higher level robot programming language is described, and the use of this system in machine loading in a job shop will be discussed.

709,860
PB-285 017/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Removing Barriers to the Application of Automation in Discrete Part Batch Manufacturing.
Final rept.,
J. M. Evans. 1977, 4p
Pub. in Proceedings Int. Federation of Automatic Control Symp., Held at Tokyo, Japan on October 17-20, 1977. Paper in Information Control Problems in Manufacturing Technology, p293-296 1977.

Keywords: *Manufacturing, *Automation, Batching, Numerical control, Machine tools, Productivity, Standards, Cost engineering, Computer aided manufacturing, Discrete part batch manufacturing.

The application of computer control systems in discrete part batch manufacturing operations can increase productivity by hundreds or even thousands of percents. Despite this phenomenal potential, we are not adequately using this technology. For example, numerically controlled machine tools typically increase productivity by 300 or 400 percent and yet account for only 1.3% of all machine tools in the United States after 25 years. Industry has identified high costs of NC tools and other automation systems as the primary barrier to increased use of this technology. This fact has been documented by the General Accounting Office (GAO). GAO and others have identified the lack of standards as one reason for this high cost. The National Bureau of Standards is working to develop interface standards, standards on programming languages, performance measures, and the basic technology of dynamic measurement and computer control for computer based automation systems. All of these products are aimed at reducing costs of computer aided manu-

facturing systems and hence at stimulating the use of this technology to increase productivity in manufacturing operations in both Government and industry. The NBS program is presented and the technical opportunities for a new generation of inexpensive computer controlled machine tools for the 1980's is considered in this paper.

709,861
PB-285 020/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Automation and Productivity in Discrete Part Manufacturing.
Final rept.,
J. M. Evans. 1976, 13p
Pub. in Proceedings Technical Symp. on Research and Engineering for Automation and Productivity in Shipbuilding, Held at Atlanta, Georgia on June 15-16, 1976 p223-235 (IIT Research Institute, Chicago, Illinois, 1976).

Keywords: *Manufacturing, *Automation, Batching, Productivity, Shipbuilding, Computer aided manufacturing, Integrated systems.

The introduction of computer aided manufacturing (CAM) systems in discrete part batch manufacturing, which includes shipbuilding, can increase productivity by hundreds or even thousands of percents. The importance of productivity improvements, the use of automation and particularly CAM to increase productivity, current CAM systems and technical strategies, and the NBS program to stimulate the diffusion of CAM technology in Government and industry are discussed.

709,862
PB-286 538/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
CAM Standards Directions.
Final rept.
J. M. Evans. 1978, 10p
Pub. in Proceedings CAD/CAM Conf. (6th), Held at Los Angeles, CA. on Sept 19-21, 1978, 10p.

Keywords: *Automation, *Manufacturing, *Standards, *Programming languages, Interfaces, Computers, Numerical control, Productivity, *Computer aided manufacturing.

The integration of computers into job shop manufacturing is having a profound impact on industrial productivity. However, a serious impediment to the increased use of CAM is the inability to interconnect modules procured from different vendors without undue engineering and/or software expense. The use of formal, well defined standards to describe the many interfaces in a CAM system holds the key to solution. Standards for programming languages and for digital data communications are examined in detail, and are shown to be adequate for present and near future needs.

709,863
PB-286 539/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Role of Standards in Integrated Manufacturing Systems.
Final rept.
J. M. Evans. May 75, 11p
Pub. in Proceedings Numerical Control Society Meeting, Held at Washington, DC. on May 19-21, 1975, 11p.

Keywords: *Automation, *Manufacturing, *Standards, Computers, Interfaces, *Computer aided manufacturing, Integrated systems.

Computer controlled integrated manufacturing systems offer increases in labor productivity of up to an order of magnitude of more and cost reductions of factors of 2 or 3 or more. Large user industries are building such systems; however, the cost of special engineering and computer programming and the risk involved preclude medium and small firms from gaining these benefits. The role of standards in constructing is discussed, and the NBS program aimed at the development of those standards is reviewed.

709,864
PB-286 540/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Strategies for Modular CAD/CAM Systems.
Final rept.
J. M. Evans, and B. M. Smith. Apr 78, 10p
Pub. in Proceedings Numerical Control Society Annual Meeting and Technical Conference (15th), Held at Chicago, IL. on Apr 9-12, 78, p29-38.

Keywords: *Automation, *Manufacturing, Interfaces, Standards, Numerical control, *Computer aided design, *Computer aided manufacturing, Automation Technology Program.

The paper describes work done in the Automation Technology Program at the National Bureau of Standards (NBS) toward defining the many interfaces present in a totally integrated CAD/CAM system. It describes those interfaces and identifies the standards which, in the author's opinion, apply to the use of computer based control systems for automation equipment. It is intended to serve both as a technical guide and as a summary of existing and forthcoming standards applicable to computer control systems.

709,865
PB80-208630 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Guidelines for Exchangeable APT Data Packages. Automation Technology Program.
Final rept.,
B. M. Smith. Jun 80, 18p NBSIR-80-2073
Sponsored in part by Sacramento Air Logistics Center, McClellan AFB, CA.

Keywords: *Automation, Numerical control, Programming languages, Machine tools, *Computer aided manufacturing, Adaptive programming technology.

A method of APT programming and postprocessor design is described which permits more efficient data preparation for numerical control (NC) machine tools and then allows this data to be quickly and easily exchanged among different NC machines. A rigorous specification is made of the APT postprocessor language based upon new ANSI standards for APT and is coupled with a comprehensive definition of the machining functions which should result from the use of each APT language statement. Individual postprocessors are modified to process each statement in the same manner. Thus, the original intent of the part programmer is always satisfied. A 23% increase in NC manufacturing efficiency is projected. The approach is demonstrated in production by processing a single APT data package on three different milling-drilling type machine tools. This Final Report details the approach taken and the benefits measured.

709,866
PB81-183634 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
NBS/RIA Robotics Research Workshop.
Final rept.
J. S. Albus, G. J. VanderBrug, A. J. Barbera, M. L. Fitzgerald, and T. E. Wheatley. Apr 81, 57p NBS-SP-602
Library of Congress catalog card no. 80-600192.
Sponsored in part by Robot Inst. of America, Dearborn, MI.
Proceedings of a Workshop Held at the national bureau of Standards, Gaithersburg, Maryland on November 13-15, 1979.

Keywords: *Robots, *Meetings, Manufacturing, Automation, Control equipment, Detectors, Forecasting, Computer aided manufacturing, Robotics.

The NBS/RIA Robotics Research Workshop had two objectives: (1) To provide a forum for structured discussions between researchers in robotics and manufacturers and users of robot systems and (2) To develop a consensus forecast of future developments in sensors and control systems for industrial robots.

709,867
PB81-219628 PC **A03**/MF **A01**
Hughes Research Labs., Malibu, CA.
Measurement Technology for Critical Ion Implantation Parameters.
Final rept. Apr 75-Jun 80.
R. G. Wilson. Jun 81, 45p NBS-GCR-81-325
Contract NBS-5-35801

Keywords: *Semiconductor doping, Process control, Measurement, Technology, *Ion implantation.

Practical information and experimental data are summarized on a research project on the control of ion-implantation doping to achieve accurate implantation doses and profiles.

709,868
PB81-238719 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Technical Briefing on the Initial Graphics Exchange Specification (IGES).
Rept. for Jan 80-Jun 81.
J. C. Kelly, R. Wolf, P. Kennicott, R. Nagel, and J. Wellington. Jul 81, 136p NBSIR-81-2297

Keywords: Specifications, Data, Interfaces, *Computer aided design, Computer aided manufacturing, *Interactive computer graphics.

This publication is a technical briefing on the Initial Graphics Exchange Specification (IGES) which was published as NBSIR 80-1978 (R). The briefing serves two purposes: (1) to give the reader a broad overview of the Initial Graphics Exchange Specification and (2) to provide material for use in preparing briefings about IGES for presentation to technical groups.

709,869
PB83-126623 PC **A06**/MF **A01**
Maryland Univ., College Park.
Expert Computer Systems, and Their Applicability to Automated Manufacturing.
D. S. Nau. Feb 82, 107p NBSIR-81-2466

Keywords: Artificial intelligence, Project planning, Problem solving, *Computer aided manufacturing, *Expert systems, Knowledge representation.

This paper contains two main parts: a tutorial on techniques used in expert systems and some recommendations for an automated process planning system for the Automated Manufacturing Research Facility at the National Bureau of Standards (NBS). The tutorial portion of the paper consists of Sections 2, 3, and 4. Sections 2 and 3 discuss AI problem solving and knowledge representation techniques. Section 4 describes ways in which these techniques have been used to build computer systems which achieve a high level of performance on problems which normally require significant human expertise for their solution. Section 5 contains a summary of the activities required for process planning in the Automated Manufacturing Research Facility (AMRF) at NBS, and recommendations for how to accomplish these activities. Section 6 contains recommendations for how an expert system could be designed to perform a process planning activity called process selection.

709,870
PB83-139170 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultrasonic Measurement of Solid/Liquid Interface Position during Solidification and Melting of Metals.
Final rept.
R. L. Parker. Jun 82, 18p
Pub. in Proceedings Physics in the Steel Industry, Lehigh University, Bethelehem, PA., October 5-7, 1981, AIP Conference 84, p254-271 Jun 82.

Keywords: *Ultrasonic tests, *Interfaces, Metals, Melting, Solidification, Measurement, Process control.

The use of pulse-echo ultrasonic flaw detectors to detect the presence and location of cracks, voids, and other flaws in metals and non-metals is well known. The solid-liquid interface in a melting or freezing metal can also be considered as a defect, in that there is a measurable difference in both sound velocity and density across the interface. For normal incidence of longitudinal waves in a typical case, about 10% of the pressure amplitude of the incident wave would be expected to be reflected. Thus such a technique, if it worked, could be considered as a method for measurement, feedback, and closed-loop process control in such applications as continuous casting of metals. To examine the feasibility of this technique, the melting and freezing of 99.9 Sn has been studied at NBS using pulse-echo equipment at 5 MHz.

709,871
PB84-136985 Not available NTIS
National Bureau of Standards, Washington, DC.
Research in Automated Manufacturing at NBS (National Bureau of Standards).
Final rept.
R. J. Hocken, and P. Nanzetta. Oct 83, 2p
Pub. in Manufacturing Engineering, p68-69 Oct 83.

Keywords: *Manufacturing, *Automatic control, *Research projects, Research management, Decision

making, Technology assessment, *Computer aided manufacturing.

This article provides a general survey of the technical work and policy decisions which have led to development of an Automated Manufacturing Research Facility at National Bureau of Standards.

709,872
PB85-230399 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Ultrasonic Measurement of Solid/Liquid Interface Position during Solidification and Melting of Iron and Steel.
Final rept.
R. L. Parker. 1984, 3p
See also PB83-139170.
Pub. in Proceedings of the Symposium on Application and Development of NDE for Use in Materials Processing, Philadelphia, Pennsylvania, October 3-4, 1983, p23-25 1984.

Keywords: *Ultrasonic tests, *Interfaces, Iron, Steels, Melting, Solidification, Measurement, Process control.

The solidification and melting of iron and stainless steel have been studied using a pulse-echo ultrasonic flaw detector, with longitudinal waves between 1 and 10 MHz. The change in acoustic impedance at the solid/liquid interface causes a portion of the beam energy to be reflected.

709,873
PB86-201738 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Acoustic Emission for In-Process Monitoring and Microstructure Control.
Final rept.
H. N. G. Wadley, and R. Mehrabian. 1984, 10p
Pub. in Proceedings of the Determ. Nondestr. Methods Mater., p26-27 1984.

Keywords: *Process control, *Metal finishing, Quality control, Microstructure, Cracking(Fracturing), Phase transformations, Plastic properties, Acoustic emissions, *Acoustic emission testing.

Acoustic emissions are the elastic waves emitted by sudden localized changes of stress by, for example, the formation of cracks, plasticity, and phase transformations. It is beginning to be considered a potential in-process monitoring technique for quality and productivity improvement as a sensor for closed loop feedback control systems. Applications of the technique are held back because of its complicated nature and because the signals are controlled rather subtly by microstructure. In the review the authors describe the theoretical framework that has begun to emerge and which now provides a physical understanding of acoustic emission. The authors then reconsider the results of laboratory studies and recent applications to assess, in the light of this understanding, the contribution acoustic emission methods might make toward in-process monitoring and microstructure control during metals processing.

Quality Control & Reliability

709,874
PB-264 929/1 PC **A04**/MF **A01**
Hi-Rel Labs., Monrovia, Calif.
Semiconductor Measurement Technology: Notes on SEM (Scanning Electron Microscope) Examination of Microelectronic Devices.
Summary rept.,
J. R. Devaney, K. O. Leedy, and W. J. Keery. Apr 77, 56p NBS-SP-400-35
Contract NBS-4-35897, ARPA Order-2397
Library of Congress catalog card no. 77-608011.

Keywords: *Electron microscopy, *Semiconductor devices, Quality control, Secondary emission, Electron emission, Backscattering, Electron microscopes, Scanning electron microscopes.

The report reviews selected scanning electron microscope (SEM) techniques which are appropriate for the examination of microelectronic devices. Illustrated are the results of individual variations in SEM operating parameters such as accelerating voltage, specimen tilt, scan line time, and frame time. Techniques which use secondary and backscattered electron emissions are compared and electron-beam-induced current and voltage contrast modes are discussed. Specimen preparation and beam-induced charging artifacts are also discussed. This report demonstrates the need for flexibility in selecting and using SEM parameters and analytic procedures to obtain the maximum information when examining semiconductor devices.

709,875
PB-266 238/5 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Measurement Assurance.
Final rept.,
J. M. Cameron. Apr 77, 16p NBSIR-77-1240

Keywords: *Measurement, *Quality assurance, Uncertainty, Errors.

The procedures by which one establishes that the uncertainty of individual measurements is adequate to their needs have been given the title measurement assurance. This note discusses the factors involved in achieving measurement assurance, beginning with the base line which serves as a standard or reference, the determination of the uncertainty relative to this basis, and the need for control of the measurement process to assure the continuing validity of the accepted process parameters.

709,876
PB-271 743/7 PC **A16**/MF **A01**
National Bureau of Standards, Washington, D.C. Metallurgy Div.
Engineering Design - Proceedings of the 25th Meeting of the Mechanical Failures Prevention Group Held at the National Bureau of Standards, Gaithersburg, Maryland on November 3-5, 1976,
T. R. Shives, and W. A. Willard. Aug 77, 370p NBS-SP-487
Library of Congress Catalog Card no. 77-21810. Sponsored in part by Office of Naval Research, Arlington, Va., Frankford Arsenal, Philadelphia, Pa., Federal Aviation Administration, Washington, D.C., and Energy Research and Development Administration, Washington, D.C.

Keywords: *Design, *Meetings, Design criteria, Failure, Prevention, Engineering, Reliability, Coatings, Composite materials, Engineering design.

Contents: A systems approach to materials in design (Bruce P. Bardes); Probabilistic methods in design (Edward B. Haugen); The finite element method in structural analysis (Harry G. Schaeffer); NASTRAN thermal analyzer in interdisciplinary thermo-structural analyses (Hwa-Ping Lee); The use of cathode ray tube graphics as a computer aided design tool (Alyce Branum); Review of the processing and properties of pan graphite-aluminum composites (Roger T. Pepper, H. Gigerenzer and T. A. Zack); Composite inlays for jet engines (W. Troha and K. Swain); Stress concentrations in composite materials (G. Kardos); Elastohydrodynamic lubrication (L. B. Sibley); Polyfluoroalkyl-alkyl polysiloxane grease for instrument lubrication (John B. Christian); Antiwear and lubricity additives for lubricants (S. M. Hsu); Piezoelectric polymers and their applications (Seymour Edelman); Exoelectron emission--past experience and future expectations (W. J. Baxter); Detecting structural degradation by acoustic emission (Michael P. Kelly and Robert J. Schlamp); Negligence charges in products liability law can be used in engineering as safety design criteria (Raymond R. Hagglund); Prescription to reduce products liability losses--the defendant and products liability (John P. Arness), the plaintiff and products liability (Milton Heller); Safety analysis--qualitative, quantitative and cost effective (H. D. Wolf); A failure mode and effect analysis program to reduce mechanical failures (Richard R. Landers); Fault tree analysis as a part of mechanical systems design (J. B. Fussell and D. P. Wagner); Ion plating--concepts and applications (D. M. Mattox); Sputtering (T. Spalvins).

709,877
PB-275 143/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison of Electrical and Visual Alignment Test Structures for Evaluating Photomask Alignment in Integrated Circuit Manufacturing.
Final rept.,
T. J. Russell, T. F. Leedy, and R. L. Mattis. 1977, 6p
ARPA-Order-2397
Pub. in Proceedings of International Electron Devices Meeting, Washington, D.C. 5-7 Dec 77 p7A-7F (IEEE) 1977.

Keywords: *Masking, *Alignment, *Intergrated circuits, Photolithography, Test equipment, Feasibility, Photomasking.

Various electrical alignment test structures were designed to conform to the NBS 2 x N probe pad array and are thus compatible with a class of other modular test structures. The object of this study is to determine the feasibility of this new layout, to compare results with visual alignment test structures, and to establish the limits of resolution. The structures can be used to determine the misalignment of two photomask steps and are applicable to two conducting layers that contact each other at a contact window. The electrical data are displayed as wafer vector maps which are useful in quantifying mask alignment problems.

709,878
PB-277 321/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Design of a Pattern on a Photomask-Like Physical Standard for Evaluation and Calibration of Linewidth-Measuring Systems.
Final rept.,
D. A. Swyt. 1978, 8p
DARPA Order-2397
Pub. in Solid State Technology, p35-42 Jan 78.

Keywords: *Patterns, Integrated circuits, Masking, Line width, Calibrating, Optical measuring instruments, Dimensional measurement, Microscopes, Photomasking, Reprints.

A photomask pattern, having among its elements lines of widths and spacings in the 1-to-10 micrometer range, has been developed for the evaluation and calibration of optical systems used by the integrated circuit industry for photomask linewidth measurements. The pattern has been designed with some essential, often fatally ignored, metrological and statistical principles in mind in order to meet the demanding requirements of an NBS measurement transfer program. Incorporated in a second generation of NBS prototype standards, the pattern has innovative and functionally important features: first, to test the suitability of an optical system for the linewidth measurement to be performed; second, to expose or counteract instrument and operator biases in the measurement process; and third to allow a transfer of line-width calibration values with a built-in test of the accuracy and precision of the transfer. The basic pattern can be scaled to micrometer and submicrometer geometries, formed on transmitting photomasks and opaque substrates, and used with linewidth-measuring devices of imaging or non-imaging, reflecting or transmitting, optical or electron types.

709,879
PB-279 065/7 PC **A03**/MF **A01**
Naval Research Lab., Washington, D.C.
Semiconductor Measurement Technology: Automated Scanning Low-Energy Electron Probe (ASLEEP) for Semiconductor Wafer Diagnostics.
Final rept. Aug 74-Sep 77,
A. Christou. Apr 78, 42p NBS/SP-400-30
Grants NBS-501718, NBS-711782
Library of Congress Catalog Card no. 78-2200. Prepared in cooperation with Advanced Research Projects Agency, Arlington, Va.

Keywords: *Electron probes, Semiconductors(Materials), Wafers, Scanning, Automation, Silicon, Gallium arsenides, Indium inorganic compounds, Phosphides, Electrical resistivity, Defects, Heterogenity, Oxides, Indium phosphides, Automated scanning low energy electron probes.

The report summarizes the results of a three-year effort in the development of a computer Automated Scanning Low-Energy Electron Probe (ASLEEP) for semiconductor wafer diagnostics. Experiments designed to explore the measurement capabilities of ASLEEP for measurements on silicon, gallium arsenide, and indium phosphide are described. Four areas were emphasized: (1) semiconductor resistivity, (2)

semiconductor defect density, (3) lateral inhomogeneities, and (4) oxide uniformity. Although oxide charging problems limit the utility of ASLEEP in its present form for silicon, defects and lateral inhomogeneities could be readily detected in gallium arsenide and indium phosphide.

709,880

PB-279 089/7 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Electronic Technology Div.
Semiconductor Measurement Technology: Microelectronic Test Pattern NBS-4,
W. R. Thurber, and M. G. Buehler. Apr 78, 70p NBS-SP-400-32
ARPA Order-2397
Library of Congress Catalog Card no. 78-606024. See also report dated Jun 76, PB-254 085.

Keywords: *Electronic test equipment, *Microelectronics, *Semiconductor doping, Silicon, Semiconductors(Materials), Patterns, Density(Mass/volume), Resistors, Capacitors, Semiconductor diodes, Transistors, Integrated circuits, Electrical resistivity, Solid state devices, Semiconductor junctions, *Test patterns.

Microelectronic test pattern NBS-4 is a revision of test pattern NBS-3 which was designed primarily for evaluation of the resistivity-dopant density relationship in silicon. Major changes include the addition of optional BASE-CONTACT and GATE masks and the incorporation of several new structures, some useful for the resistivity-dopant density work, and others, mostly sheet resistors, included for evaluation of new designs. The NBS-4 pattern contains 38 test structures such as planar four-probe resistors, sheet resistors, MOS capacitors, p-n junctions, bipolar and MOS transistors, Hall effect device, and process control structures. The overall pattern is a square 200 mil (5.08 mm) on a side and is divided into four quadrants which are separated by scribe lines. A detailed layout of each structure is presented including both a top view and a cross sectional view. Photomicrographs of each quadrant and the quadrants of the six masks used in the fabrication of the pattern are shown in an appendix.

709,881

PB-279 336/2 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Electronic Technology Div.
Semiconductor Measurement Technology: Automated Photomask Inspection,
D. B. Novotny, and D. R. Ciarlo. Apr 78, 41p NBS-SP-400-46
ARPA Order-2397
Prepared in cooperation with California Univ., Livermore. Lawrence Livermore Lab. Library of Congress Catalog Card no. 78-606023.

Keywords: *Inspection, *Masking, Automation, Alignment, Dimensional measurement, Defects, Visual inspection, *Photomasking, Photomasks.

Methods that may be suitable for automated photomask inspection for visual defects (spots, pinholes, etc.) or dimensional compliance are analyzed and discussed. The analysis of each method includes examinations of the physical principles upon which it is based and the amount of misalignment that can be tolerated. The size of the minimum visual defect to be detected was taken as 2 micrometers. The methods analyzed for visual defect inspection are the optical-overlay; the dual-beam, flying-spot-scanner; the TV-microscope; and the spatial-filtering methods. For dimensional inspection, an analysis of line-edge location and operating criteria for the microdensitometer are presented. The fabrication of photomasks with intentionally introduced and controlled defects is described together with preliminary results of automated inspections of these photomasks. It was concluded that: automated inspection systems should be dedicated either to inspection for visual defects or dimensional compliance, not both; and the dimensional tolerances on masks, both those of the feature dimensions in the die patterns as well as those in the dimensions between the dice, must be significantly smaller than the size of the minimum defect to be detected.

709,882

PB-280 576/0 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C.
Contact Deformation in Gage Block Comparisons.
Final rept.,
J. S. Beers, and J. E. Taylor. May 78, 49p NBS-TN-962

Keywords: *Standards, *Comparators, Calibrating, Measuring instruments, Deformation, *Gage blocks.

When calibrating gage blocks or when gaging objects with contact type comparators, local deformation occurs where the probe tip contacts the gaging surface. This deformation results in a measurement error only if the gage blocks or objects being compared are of different materials having different mechanical properties. This document presents formulas and nomographs for determining deformation magnitude, and instructions for applying deformation corrections. The formulas and nomographs are valid only for spherical probe tips. A method is given for evaluating tip geometry and it is recommended that non-spherical or flawed tips be replaced.

709,883

PB-282 142/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison of Linewidth Measurements on an SEM/Interferometer System and an Optical Linewidth-Measuring Microscope.
Final rept.,
J. M. Jerke, A. W. Hartman, D. Nyyssonen, R. Swing, R. D. Young, and W. J. Keery. 1977, 9p
ARPA Order-2397
Pub. in Proceedings of Conference on Developments in Semiconductor Microlithography II, San Jose, Calif. 4-5 Apr 77, SPIE Jnl., v100 p37-45 1977.

Keywords: *Line width, *Measurement, Electron microscopes, Optical microscopes, Interferometers, Microelectronics, Integrated circuits, Masking, Scanning electron microscopes, Photomasks.

In the current linewidth-measurement program at the National Bureau of Standards, the primary measurement of micrometer-wide lines on black-chromium artifacts is made with an interferometer located in a scanning electron microscope (SEM). The data output consists of a line-image profile from the electron detector and a fringe pattern from the interferometer. A correlation between edge location and fringe location is made for both line edges to give the linewidth in units of the wavelength of a He-Ne laser. A model has been developed to describe the interaction of the electrons with the material line and thereby relate a threshold value on the SEM image profile to a selected point on the material line. The optical linewidth-measuring microscope is used to transfer the primary measurements to secondary measurement artifacts; these artifacts are used to transfer the linewidth measurements to the integrated-circuit industry. Linewidth measurements from the SEM/interferometer system and the optical linewidth-measuring microscope are compared, and the level of measurement uncertainty for each system is discussed.

709,884

PB-285 018/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Keynote Address.
Final rept.,
J. M. Evans. 1976, 11p
Pub. in Proceedings Conf. Automatic Inspection and Product Control (2nd), Held at Chicago, Illinois, on October 19-21, 1976 p13-23 (IIT Research Institute) 1976.

Keywords: *Product inspection, *Automation, Quality control, Measurement, Dynamic tests, Automatic control.

Automatic inspection and product control in industry today is based on the use of mechanical gadgets and simple sensors to inspect the properties of manufactured goods after they have been processed and assembled. A perspective for examining examples of the state-of-the-art in automation is provided by a review of the history of measurement. This in turn provides a basis for extrapolating important trends for future developments. Three major trends in automatic measurement that are developed are the automation of inspection, the addition of computers to sensors to create smart sensors, and the increasing use of in-process inspection.

709,885

PB-289 005/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Standard Reference Materials and Quality Control.
Final rept.
G. A. Uriano. 1978, 10p
Pub. in Paper in Pursuit of Perfection p27-36 (American Society for Quality Control, Milwaukee, WI 1978), Proceedings Western Regional Conf. (25th) Held at Las Vegas, NV Oct 19-20, 1978.

Keywords: *Standards, *Quality control, Measurement, Accuracy, *Standard reference materials.

The use of NBS Standard Reference Materials (SRM's) in assuring the accuracy of measurements is reviewed with emphasis on the role of SRM's in production quality control. Examples are given of the use of recently developed SRM's in quality control applications involving the production of copper, electronic components, and clinical thermometers.

709,886

PB-291 427/3 PC **A05**/MF **A01**
Pennsylvania State Univ., University Park.
Development of Measurement Techniques for Monitoring Chemical Purity of Materials Used in Digital IC Processing.
Final rept. Sep 74-Dec 76.
J. Stach, M. B. Das, and R. E. Tressler. Sep 78, 88p NBS/GCR-78/134
Contracts NBS-5-35717, ARPA Order-2397

Keywords: *Silicon, *Semiconductors, *Thermal analysis, Diffusion, Oxidation, Reaction kinetics, Electrical measurement, Boron nitrides, Semiconductor doping, Glass, Silicon dioxide, Integrated circuits, Impurities, Mass transfer, SOLGAS computer program.

The report is in two principal parts: (1) The transport of impurities from specially prepared boron nitride diffusion sources onto silicon slices was investigated. The sources were of varying degrees of purity. No transport was detected by thermally stimulated capacitance and current measurements having an estimated detection limit of 10 to the 11th power/cc. Zinc, one of the more probable contaminating impurities, was introduced in excess and detected down to a level of 2 x 10 to the 13th power/cc. (2) The kinetics of silicon thermal oxidation in the presence of chlorine, from HCl gas or from trichloroethylene vapor, were studied using the SOLGAS computer program. Calculated data are presented to show the equilibrium partial pressures of the various chemical species in the diffusion furnace atmosphere as a function of temperature in the range 800 to 1300C for a variety of mixtures of gases. Experimental work was also done; parabolic rate coefficients, index of refraction, etch rate, and stored charge measurements are presented.

709,887

PB-294 118/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Statistics in Specifications.
Final rept.,
M. G. Natrella. Jan 79, 3p
Pub. in ASTM (American Society for Testing and Materials) Standarization News 7, n1, p10-11, 40, Jan 79.

Keywords: *Specifications, *Statistics, Quality control, Requirements, Standards, Reprints.

This article, one of a series in ASTM Standardization News describing the work of ASTM Committee E-11, is a discussion of the role of statistics in relation to specifications. It briefly considers the questions of what specification requirements are, what they apply to, how they are arrived at, how they are interpreted, and how statistics can help in the various stages of this process.

709,888

PB-295 199/4 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Semiconductor Measurement Technology: A Production-Compatible Microelectronic Test Pattern for Evaluating Photomask Misalignment.
Interim rept. Jan 77-Dec 78.
T. J. Russell, and D. A. Maxwell. Apr 79, 32p NBS-SP-400-51
ARPA Order-2397
See also report dated Nov 78, PB-289 134. Library of Congress catalog card no. 79-230.

Keywords: *Microelectronics, *Tests, Resistors, Alignment, Masking, Wafers, *Test patterns, Photomasking.

Microelectronic test pattern NBS-15 is composed of several potentiometric, production-compatible electrical alignment resistor test structures, visual alignment indicator test structures, cross bridge sheet resistors, and contact resistor test structures. The pattern was originally designed as a study vehicle for the electrical alignment resistor, but it was also demonstrated that, when stepped over an entire wafer, the pattern is suitable for use in evaluating misalignment which may result from photomask generation, photomask exposure, or other fabrication processes. This report summarizes the test structures that are included in the pattern and contains explanation of how each of the structures is measured.

709,889
PB80-148216 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Measurement Technology: Accurate Linewidth Measurements on Integrated-Circuit Photomasks.
Final rept.,
J. M. Jerke. Feb 80, 171p NBS-SP-400-43
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA. Library of Congress catalog card no. 79-600191.

Keywords: *Product inspection, *Masking, Dimensional measurement, Optical microscopes, Electron microscopes, Integrated circuits, Visual inspection, Calibrating, Line width, *Photomasks.

The progress of the NBS program to develop improved theory for accurate linewidth measurements with optical microscopes, to develop primary linewidth calibration of 1- to 10-micrometer wide lines on integrated-circuit (IC) photomasks, and to provide calibrated measurement artifacts and measurement procedures to the IC industry is discussed. This report covers the initial period from September 1974 through December 1976.

709,890
PB80-178833 Not available NTIS
National Bureau of Standards, Washington, DC.
Comprehensive Test Patterns with Modular Test Structures: The 2 by N Probe-Pad Array Approach.
Final rept.,
M. G. Buehler. Oct 79, 6p
ARPA Order-2397
Pub. in Solid State Technol. 22, n10 p89-94 Oct 79.

Keywords: *Test equipment, Microelectronics, Reprints, *Test patterns.

Industrial microelectronic test patterns have a multiplicity of probe-pad arrangements which make standard test structure design difficult. A useful arrangement was found to be the 2 by N probe-pad array where N is an arbitrary positive integer. The use of this arrangement is compared to the peripheral probe-pad array approach and is illustrated by a variety of test structures.

709,891
PB80-218555 Not available NTIS
National Bureau of Standards, Washington, DC.
In-Process and On-Line Measurements of Surface Finish.
Final rept.,
R. D. Young, T. V. Vorburger, and E. C. Teague. Aug 80, 6p
Pub. in CIRP Ann. 29, n1 p435-440 Aug 80.

Keywords: *Surface finishing, *Optical measurement, Surface roughness, Power spectra, Reprints.

Future trends in surface finish measurement for manufacturing are discussed. It is expected that optical techniques will be used increasingly for measurements of surface roughness and of other parameters as well because these techniques are inherently fast and three-dimensional. Four optical techniques are discussed and evaluated. Stylus techniques, however, will contine to play an important role in research and metrology. Statistical methods for the three dimensional characterization of surfaces are briefly reviewed.

709,892
PB81-216442 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Measurement Technology: A Manual Wafer Probe Station for an Integrated Circuit Test System.
G. P. Carver, and W. A. Cullins. May 81, 22p NBS-SP-400-68

Keywords: *Tests, *Integrated circuits, Wafers, Microelectronics, Visual inspection.

This report describes the design of a manual wafer probe station for wafer-level testing of integrated circuits, test structures, and test patterns. The station includes a translatable vacuum chuck, a probe assembly which can be used for probe cards or individual micropositioner-mounted probes, and a microscope holder. Except for a few components which are commercially available, construction details are provided for all parts.

709,893
PB81-234692 Not available NTIS
National Bureau of Standards, Washington, DC.
Error Criteria and the Use of Reference Waveforms.
Final rept.
N. S. Nahman. 1981, 8p
Pub. in Proceedings of ATE Seminar/Exhibit Automated Testing for Electronics Manufacturing, Pasadena Center, Pasadena, CA., January 19-22, 1981, pIV-21-IV-28 1981.

Keywords: *Waveforms, Measurement, Errors, Automatic test equipment.

For time dependent quantities such as pulses, ATE measurements require that a time resolved measured quantity be compared to some reference waveform at either selected points of the reference waveform or throughout the reference waveform's duration. The objective of the ATE measurement is to determine if the measured quantity (waveform) lies within certain bounds. Consequently, error criteria must be defined to obtain quantitative error data. This paper discusses error criteria based upon the continuous difference between a measured waveform and some prescribed reference waveform over the duration of the reference waveform. After the underlying ideas of the error criteria and the reference waveform generator concept are explained, examples are given from actual measurement situations and simulation studies.

709,894
PB82-118332 Not available NTIS
National Bureau of Standards, Washington, DC.
Light Scattering from Manufactured Surfaces.
Final rept.
E. C. Teague, T. V. Vorburger, and D. Maystre. Dec 81, 7p
Pub. in Ann. CIRP 30, n2 p1-7 Dec 81.

Keywords: *Surface roughness, *Light scattering, Measurement, Reprints.

An evaluation is made of light scattering theories and experimental techniques for measuring the roughness of manufactured surfaces. The goal was to define the ultimate capabilities and regions of validity of these methods for deducing surface microtopography. Available theories are evaluated in terms of a heuristic interpretation of direct electromagnetic scattering from surfaces. Experimental methods using specular reflectance, total integrated scatter, angular scattering distribution, and speckle are reviewed in terms of their spatial-bandwidth sampling of surface wavelengths and their roughness amplitude sensitivity and accuracy. Graphs in a slope/relative-wavelength space are used to intercompare the regions of validity of theories, regions of applicability for experimental methods and regions occupied by typical manufactured surfaces. A relatively unknown theory, valid in regions occupied by many manufactured surfaces but previously unused for this purpose, is briefly described.

709,895
PB82-165168 PC **A02**/MF **A01**
Hughes Research Labs., Malibu, CA.
Reflection Acoustic Microscope Measurement Technology.
Final rept. Apr 75-Sep 78.
R. G. Wilson, and R. D. Weglein. Dec 81, 8p NBS-GCR-81-363
Contract NBS-5-35898, ARPA Order-2397

Keywords: *Acoustic measurement, Nondestructive tests, Acoustic signatures, Semiconductor devices, Integrated circuits, Inspection, *Acoustic microscopy.

A scanning acoustic microscope operating at 0.4 GHz and employing water as an immersion fluid was developed for the inspection of semiconductor devices and integrated circuits. This instrument provides a new analysis technique that is sensitive to material properties, namely, the mass density and elastic stiffness. Research with this technique shows that acoustic microscopy will also find useful applications in material research and nondestructive evaluation in general. In particular, the authors discovered a mode of operation that characterizes materials by generating what they call acoustic emission signatures. Changes in the acoustic impedance at interfaces make shallow interfaces observable. With the acoustic microscope, it is possible to display some subsurface features that cannot be seen using optical or scanning electron microscopes. Factors that change the local density of materials, such as temperature or strain, also may affect the acoustic velocity and impedance and therefore the acoustic image.

709,896
PB82-182387 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Production-Compatible Microelectronic Test Structures for the Measurement of Interface State Density and Neutral Trap Density.
T. J. Russell. Feb 81, 42p NBSIR-81-2413
Sponsored in part by Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH. and Naval Air Systems Command, Washington, DC.

Keywords: *Microelectronics, *Tests, Integrated circuits, Defects, Semiconductor devices, Semiconductor traps, Test structures, Metal oxide semiconductors.

Interface states and oxide neutral traps are defects in metal-oxide-semiconductor (MOS) structures which adversely affect the operation of integrated circuits (IC). For very large scale integration (VLSI), the advanced techniques which are used to fabricate circuits with devices of submicrometer geometries expose the devices to ionizing radiation which can create these defects or alter the number of defects and their charge state and thus modify device operating characteristics. The physical identities of the defects which trap charge at the interface and in the bulk oxide are not well established. This means that one cannot a priori predict the behavior of the defects to a stress or fabrication process. Thus, it is desirable that the density of these defects be monitored routinely and that the measurement method used be easy to perform and fast and that it provide unambiguous results and be compatible with a production environment. The purpose of this study is to identify production-compatible measurement methods which can be used for routine measurement of neutral trap density and interface trapped charge. This study reviews the application of existing methods for quantifying the number of these defects. Methods determined to be most appropriate for the stated purpose are discussed in detail.

709,897
PB82-195157 Not available NTIS
National Bureau of Standards, Washington, DC.
Graphical Solution for the Back Pressurization Method of Hermetic Test.
Final rept.
S. Ruthberg. Jun 81, 8p
Pub. in IEEE Transactions on Components, Hybrids, and Manufacturing Technology CHMT-4, n2 p217-224 Jun 81.

Keywords: *Hermetic seals, *Tests, Leakage, Electric equipment, Back pressure, Reprints.

The back pressurization method for leak testing hermetically sealed electronic packages requires gas flow modeling to relate indicated leakage rates to true leak size. The molcular flow relationship which is appropriate for fine leak sizes is nonlinear and requires numerical solution, which is actual test application may involve either many trial calculations of the use of approximations that lead to limiting case values. A new graphical procedure is presented for complete solution of the molecular flow equation for any given test condition and package volume through the use of a single set of characteristic curves and a test line. The effects of repetitive testing and of prefill with tracer gas are also considered. The characteristic curves are appropriate for both the helium leak detector and the radioisotope methods of test, while the form of the test line distinguishes between the two methods.

709,898
PB82-198730 Not available NTIS
National Bureau of Standards, Washington, DC.
Toward a Standard Test Chip Methodology for Reliable, Custom Integrated Circuits.
Final rept.
M. G. Buehler, and L. W. Linholm. 1981, 5p
Sponsored in part by Institute of Electrical and Electronics Engineers, Inc., New York and Jet Propulsion Lab., Pasadena, CA.
Pub. in Proceedings Custom Integrated Circuits Conference, American Hotel, Rochester, New York, May 11-13,1981, p142-146, Institute of Electrical and Electronics Engineers, Rochester, NY.

Keywords: *Test equipment, *Integrated circuits, Standardization, Methodology, Microelectronics, Production inspection, *Chips(Electronics).

The microelectronic test chip is an important tool in the design and production of reliable, custom integrated circuits. The role of test chips is expanding from a wafer fabrication process control monitor to a vehicle which provides circuit design parameters needed for layout rule definition, circuit simulation, and logic simulation. The test chip is being used more extensively to verify that circuit design parameters are achieved during fabrication. Used in this way, the test chip serves as a transactional vehicle for use in the buying and selling of integrated circuit wafer fabrication services. Such transactions require standards which do not now exist. This paper describes a proposed test structure taxonomy, explores the need for test chips, and discusses the characteristics of a standard test chip methodology.

709,899
PB82-252347 PC **E03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Computer Program for Analysis of Data from Microelectronic Test Structures.
R. L. Mattis, L. J. Till, and R. C. Frisch. Jun 82, 40p NBSIR-82-2492
Includes two sheets of 24X reduction microfiche.

Keywords: *Data processing, Microelectronics, Wafers, Statistical analysis, Manuals, Process control, STAT2 computer program, Test structures.

A computer program, STAT2, is described which performs the following functions: reads data as a two-dimensional array; calculates mean, sample standard deviation, and median; identifies outliers; calculates replacement values for outliers; makes a gray-tone data map on a line printer; makes a character map on the user's terminal; constructs a data base for examining correlations among various data sets; and searches the data base for correlations using several selective keys. The emphasis in this document is on program usage, and detailed descriptions of the commands are given. Program portability and data input requirements are addressed. Guidance regarding several types of program modifications is provided.

709,900
PB82-252354 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Design Considerations for the Cross-Bridge Sheet Resistor.
G. P. Carver, R. L. Mattis, and M. G. Buehler. Jul 82, 23p NBSIR-82-2548

Keywords: *Test equipment, Microelectronics, Electrical resistance, Line width, Layers, Sheet resistance, Test patterns.

The cross-bridge sheet resistor test structure is used to obtain the sheet resistance and electrical linewidth of a conducting layer. It has been used to characterize various conducting layers found in an integrated circuit fabrication process and to evaluate lithographic equipment used for processing photomasks and wafers. Three geometrical design factors for the cross bridge have been investigated and are shown to cause systematic inaccuracies of less than one percent in the sheet resistance and linewidth measurements. Based upon experimental results from sequences of devices with incrementally different geometrical parameters, several design criteria for the cross-bridge sheet resistor have been established.

709,901
PB83-111070 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Measurement Assurance for Dimensional Measurements on Integrated-Circuit Photomasks.
Technical note (Final).
C. Croarkin, and R. N. Varner. Aug 82, 53p NBS-TN-1164

Keywords: *Dimensional measurement, Line width, Integrated circuits, Standards, Optical microscopes, Calibrating, *Photomasks.

Optical Microscope Linewidth-Measurement Standards, SRM-474 and SRM-475, have been developed by NBS for optical imaging systems capable of making line-spacing and linewidth measurements in the 0.5 micrometer - 12 micrometers regime on IC photomasks. Each artifact affords a means of reducing systematic errors via a calibration curve and keeping the optical system in statistical control. Procedures are given for accomplishing these goals along with a discussion of the uncertainty of the calibrated values.

709,902
PB83-179200 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrical Test Methods for Evaluating Lithographic Processes and Equipment.
Final rept.
D. Yen. 1982, 9p
Pub. in SPIE 342, p73-81 1982.

Keywords: *Tests, *Lithography, Line width, Measurement, Integrated circuits, Microelectronics, Reprints, Test structures.

The paper reviews previous work at NBS on the design, measurement, and application of two types of test structures that have been used for evaluating lithographic processes and lithographic equipment performance. First, the cross-bridge sheet-resistor test structure is described. Test results from electrical measurements on this structure can be used to determine the electrical linewidth of a conducting layer. The use of test chips containing arrays of identical cross bridges for determining the uniformity of a lithographic process will be described. Analysis of test results from these arrays has been used to identify and separate the contribution to linewidth nonuniformities introduced by individual equipment and processes. The precision to which linewidth can be determined using this structure will be discussed. Also, an electrical alignment test structure for determining the misalignment between two photomask steps will be described and an example of its use presented. Finally, an automated dc parametric test system used for measuring these structures will be described.

709,903
PB84-106970 Not available NTIS
National Bureau of Standards, Washington, DC.
Proficiency Testing for Thermal Insulation Materials in the National Voluntary Laboratory Accreditation Program.
Final rept.
D. Kirkpatrick, and J. Horlick. 1983, 10p
Pub. in Proceedings of International Conference on Thermal Conductivity (17th), Gaithersburg, MD, June 15-19, 1981, Thermal Conductivity 17, p497-506 1983.

Keywords: *Thermal insulation, *Laboratories, *Test facilities, Performance evaluation, Flammability testing, *Accreditation.

The National Voluntary Laboratory Accreditation Program (NVLAP) is administered by the Department of Commerce to accredit testing laboratories upon request. Accreditation is currently available for laboratories that test carpet, thermal insulation materials, and freshly mixed field concrete. Decisions to accredit laboratories are based on evaluation conducted by the National Bureau of Standards which include questionnaires, on-site examination and proficiency testing. This paper discusses the design and operation of the first two years of the proficiency testing portion of the evaluation of laboratories that test thermal insulation materials.

709,904
PB84-221407 Not available NTIS
National Bureau of Standards, Washington, DC.
Nondestructive Testing and Quality Improvement.
Final rept.
L. Mordfin, and H. T. Yolken. Nov 83, 8p
Pub. in Proceedings of Pan Pacific Conference on Non-Destructive Testing (4th) held at Sydney, Australia on November 15-18, 1983, Society of Automotive Engineers 1, 8p Nov 83.

Keywords: *Nondestructive tests, Ceramics, Process control, Quality control, Ultrasonic tests, Productivity, X ray diffraction.

Efforts to improve the quality of manufactured products and, at the same time, to achieve increased productivity, are nurturing changes in the role of nondestructive testing (NDT). It is becoming more and more evident that it is no longer adequate to use NDT merely to separate good parts from bad at the end of the manufacturing process. Instead, process controls are needed which will prevent the manufacture of defective products. A new role for NDT in the development of manufacturing process controls is proposed. This is illustrated by examples from the Non-destructive Evaluation Program of the National Bureau of Standards of the United States Department of Commerce.

709,905
PB85-108587 Not available NTIS
National Bureau of Standards, Washington, DC.
Renewal-Process Approach to Continuous Sampling Plans.
Final rept.
G. L. Yang. Feb 83, 9p
Pub. in Technometrics 25, n1 p59-67 Feb 83.

Keywords: *Quality control, *Sampling, Approximation, Inspection, Production, Reprints, Renewal theory.

A class of continuous sampling plans (CSP's) that switch between full and partial inspection of items in a production line is formulated in terms of discrete renewal processes. The renewal-theory framework facilitates studying both the long-run average outgoing quality (AOQ) and the average outgoing quality in a short production run of length t, AOQ(t). Renewal theory also leads to a computable approximation, AOQ*(t), to AOQ(t). By simulation it is found that AOQ greatly overestimates AOQ(t), for short runs, while the approximation AOQ*(t) is found to be sufficiently accurate in situations corresponding to actual practice. Formulas are derived enabling one to compute AOQ and AOQ*(t) for the Dodge sampling plans CSP-1 through CSP-5. Numerical illustrations for selected CSP's are presented.

709,906
PB85-141521 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Minimum Test Chip Sample Size Selection for Characterizing Process Parameters.
Final rept.
J. S. Suehle, L. W. Linholm, and K. Kafadar. Feb 84, 8p
Pub. in IEEE Jnl. of Solid-State Circuits SC-19, n1 p123-130 Feb 84.

Keywords: *Wafers, *Quality control, Sampling, Statistical analysis, Efficiency, Integrated circuits, Fabrication, Reprints, Complementary metal oxide semiconductors, Test chips.

A method for determining a test chip sample size to estimate effectively the electrical parameter distributions on an integrated circuit wafer is presented. This method gives relations among sample size and the figure of merit for four statistical techniques (trimmed mean, biweighted mean, median, and arithmetic mean) by which estimates are calculated. To demonstrate the use of this method, it has been applied to the evaluation of a CMOS fabrication process. Measurements on wafers completely patterned with identical test chips were used to determine actual parameter distributions for an entire wafer (true parameter values). Estimates of true parameters were determined using a site selection plan which is representative of sampling plans employed in industry.

709,907
PB85-182921 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Role of NBS (National Bureau of Standards) Calibrations in Quality Assurance.
Final rept.
B. C. Belanger. 1983, 6p
Pub. in Proceedings of Annual Technical Conference of American Society for Quality Control (37th), Boston, MA., May 24-26, 1983, paper in 37th Annual Technical Congress Transactions, p337-342.

Keywords: *Quality assurance, *Calibrating, Quality control, Metrology, National Bureau of Standards, Traceability.

Requirements for 'traceability to national standards can be found in a variety of regulations and standards. Since the agencies requiring traceability do not necessarily define or interpret these requirements uniformly, confusion concerning compliance with such requirements is not uncommon. This paper and a companion paper on Standard Reference Materials discuss the traceability issue from the perspective of the National Bureau of Standards (NBS). Traceability is only one aspect of a total quality assurance program. Statistical quality control techniques developed originally for industrial production processes can be employed to ensure accurate measurements on a continuing basis, using either standard reference materials or calibration services, where they are available from NBS or others.

709,908
PB85-202760 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Materials Measurements: Present Abilities and Future Needs.
Final rept.
R. I. Scace. Mar 85, 4p
Pub. in Solid State Technology 28, n3 p155-158 Mar 85.

Keywords: *Integrated circuits, *Standards, Quality control, Measurement, Semiconductors(Materials), Processing, Reprints, Very large scale integration.

Standard measurement methods and specifications for the semiconductor industry are reviewed and discussed with emphasis on applications to VLSI processes. The standards development process is an excellent way for material producers and users to develop good working relations and to solve their shared measurement problems; this process is described in some detail. Because the semiconductor industry is an international one, serious efforts have been made for a number of years to rationalize the technical differences between test method standards in Europe and the U.S. with considerable success. The present state of such cooperative activity with Japan, which has a more recent origin, is also reported.

709,909
PB86-110913 PC **A10**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
Private Sector Product Certification Programs in the United States.
Final rept.
M. A. Breitenberg. Aug 85, 225p NBS/SP-703
Also available from Supt. of Docs as SN003-003-02673-5. Library of Congress catalog card no. 85-600574.

Keywords: *Directories, *Product development, *Quality control, Standards, United States, Inspection, Specifications, Programs, *Certification.

The directory presents information from 109 private sector organizations in the United States which engage in product certification activities. Entries describe the type and purpose of each organization, the nature of the activity, products certified, standards used, certification requirements, availability and cost of services, and other relevant details. This directory is part of an ongoing NBS effort to establish and maintain a comprehensive database on standards, regulations, certification programs and related information. This material has been compiled to meet the needs of government, industry, and the public for information on private sector product certification programs in accordance with the requirements of the U.S. Trade Agreements Act of 1979.

709,910
PB86-112737 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Materials.
Role of NBS SRM's (National Bureau of Standards Standard Reference Materials) in Quality Assurance.
Final rept.
S. D. Rasberry. 1983, 6p
Sponsored by American Society for Quality Control, Inc., Milwaukee, WI.
Pub. in Proceedings of Annual American Society Quality Control Transactions (37th), Boston, MA., May 24-26, 1983, p343-348.

Keywords: *Quality assurance, Quality control, Measurement, Accuracy, *Standard reference materials, Traceability.

Requirements for 'traceability to NBS' can be found in a variety of regulations and standards. As the agencies requiring traceability do not necessarily define or interpret these requirements uniformly, confusion concerning compliance with such requirements is not uncommon. This paper and a companion paper on NBS Calibration Services discusses the traceability issue from NBS' perspective. Statistical quality control techniques developed originally for industrial production processes can be employed to ensure accurate measurements on a continuing basis using either Standard Reference Materials or calibration services where they are available from NBS.

709,911
PB86-114048 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electrical Test Structures for Characterization and Control of Microelectronics Processing.
Final rept.
M. A. Mitchell, L. W. Linholm, T. J. Russell, and G. P. Carver. 1981, 29p
Pub. in Proceedings of Annual Seminar on Microelectronics Measurement Technology (3rd), San Jose, CA., March 17-18, 1981, v6 p1-29.

Keywords: *Microelectronics, *Test equipment, Electronics industry, Integrated circuits, Measurement, Materials, Production control, Control equipment, Performance evaluation.

The trend toward smaller devices in larger integrated circuits makes assurance of product functionality increasingly difficult. The results of measurements from specially designed microelectronic test structures can be a critical ingredient in process characterization and control, two of the primary factors affecting circuit functionality. Test structures can be used to evaluate IC materials, to evaluate and control process uniformity, to measure and control device and circuit parameters, to quantify the occurrence of process-related random faults, and to evaluate processing equipment performance. Electrical test structures and test methodologies reviewed here have been developed for rapid automated measurement of a variety of parameters. Simple, fast, visual correlations of the parameters in the form of wafer maps provide information about yield-reducing variations in parameters. Examples of such correlations are discussed.

709,912
PB86-119393 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Characterization of NBS (National Bureau of Standards) Standard Reference Material 2135 for Sputter Depth Profile Analysis.
Final rept.
J. Fine, and B. Navinsek. 1985, 5p
Pub. in Jnl. of Vacuum Science and Technology A3, n3 p1408-1412 May/Jun 85.

Keywords: *Sputtering, Ion beams, Calibrating, Interfaces, Resolution, Thin films, Nickel, Chromium, Reprints, *Standard reference materials, Auger spectroscopy.

A Ni/Cr multilayered thin-film standard reference material (SRM) for sputter depth profile calibration has been developed jointly by the National Bureau of Standards, the Jozef Stefan Institute, and the American Society for Testing and Materials (ASTM) Committee E-42 on Surface Analysis. This perodically modulated structure can be effectively used to calibrate sputter erosion rates and depth of erosion scales in surface analysis as well as to monitor ion beam stability and to optimize sputtering conditions so as to achieve maximum interface resolution. Characterization results obtained on this first SRM for surface analysis to be issued by NBS indicate that the accuracy of its structure is known to better than 6% and that its sputter profiles are well defined and reproducible. Results of the calibration and compositional analysis of this SRM are presented regarding uniformity and periodicity of thin film layers, absolute film thickness, sputtered interface depth resolution, and relative Ni/Cr sputtering rates and yields. Measurement methods used to characterize this thin-film structure include EN(E) Auger sputter depth profiling, Rutherford backscattering spectrometry, and neutron activation analysis.

709,913
PB86-119401 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Interface Depth Resolution of Auger Sputter Profiled Ni/Cr Interfaces: Dependence on Ion Bombardment Parameters.
Final rept.
J. Fine, P. A. Lindfors, M. E. Gorman, R. L. Gerlach, B. Navinsek, D. F. Mitchell, and G. P. Chambers. 1985, 5p
Pub. in Jnl. of Vacuum Science and Technology A3, n3 p1413-1417 May/Jun 85.

Keywords: *Sputtering, *Interfaces, Thin films, Depth, Width, Nickel, Chromium, Ion beams, Reprints, Auger spectroscopy.

Interface broadening which often results as a consequence of sputter profiling can make it difficult to assess the structure of an original interface. There are a number of factors involved in this broadening which are associated with the parameters of the ion bombardment and which have not previously been evaluated. Sputter profile measurements obtained on a set of similarly fabricated Ni/Cr multilayered thin-film structures have shown that it is practical to systematically examine this interface broadening dependence on ion beam energy, ion current density, and angle of incidence, all as a function of sputtered depth. Results are presented of such a set of Auger sputter depth profile measurements and indicate that there can be dramatic changes in sputtered interface widths depending on the ion bombardment parameters used.

709,914
PB86-139821 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laboratory Evaluation Process of the National Voluntary Laboratory Accreditation Program.
Final rept.
M. V. Federline. 1983, 9p
Pub. in Proceedings of Symposium on Evaluation and Accreditation of Inspection and Test Activities, ASTM STP 814, p96-104 1983.

Keywords: *Test facilities, *Quality assurance, Laboratories, *Accreditation, National Voluntary Laboratory Accreditation Program, NVLAP program.

At least 70 laboratory accreditation systems exist in the United States today, many of which are directed at a single discipline or narrow spectrum of products. The increase in the number of these systems in response to a growing need for laboratory testing services indicates the viability of the laboratory accreditation concept. The National Voluntary Laboratory Accreditation Program (NVLAP) was established by the Department of Commerce to provide a national, multidisciplinary laboratory evaluation scheme. NVLAP evaluation is based upon compliance with criteria which reflect the latest technology in laboratory operation and management. These criteria are sufficiently flexible to accommodate such diverse testing areas as thermal insulation, carpet, and concrete. The evaluation of laboratories, conducted by the National Bureau of Standards uses a peer review. It combines elements of questionnaire, laboratory on-site survey, and testing of proficiency samples in a comprehensive examination to determine a laboratory's capability to perform specific tests. NVLAP, an interactive system between laboratory and accreditor, provides a mechanism for overall laboratory improvement.

709,915
PB86-140266 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
EMAT (Electromagnetic-Acoustic Transducer) Synthetic Aperture Approach to Thick-Weld Inspection.
Final rept.
R. E. Schramm, and J. C. Moulder. 1985, 8p
Sponsored by Naval Sea Systems Command, Washington, DC.
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v4A p225-232 1985.

Keywords: *Nondestructive tests, *Ultrasonic tests, Inspection, Weldments, Transducers, Ultrasonic frequencies, Signal to noise ratio, Computer applications.

The paper describes developments in a system based on electromagnetic-acoustic transducers (EMATs) as an approach to automated nondestructive evaluation of thick weldments. Good signal-to-noise ratios, were possible through careful design of the transducers and associated electronic circuits and the use of signal averaging. At 454 kHz, the transducers produce shear-

horizontal waves of approximately 7-mm wavelength in steel. The long wavelength permits determination of through-thickness flaw depth from the amplitudes of scattered ultrasonic waves. A minicomputer controlled transducer positioning and acquired the digitized ultrasonic waveforms for synthetic aperture processing. The synthetic aperture technique further improved signal quality and yielded flaw localization through the weld thickness.

709,916
PB86-202025 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
What Is Quality Assurance.
Final rept.
J. K. Taylor. 1985, 7p
Pub. in Proceedings of the Quality Assurance for Environmental Measurements Symposium, Boulder, CO., August 8-12, 1983, ASTM (American Society for Testing and Materials) Spec. Tech. Pub. 867, p5-11 1985.

Keywords: *Quality assurance, *Data processing, Accuracy, Quality control, Data.

The quality of data must be known and established before it can be used logically in any application. Data quality may be judged on the basis of its quantitative accuracy and on the confidence that can be placed in the qualitative identification of the parameters measured. This requires its production in a quality assurance program that permits the assignment of its statistically supported limits of uncertainty. The essential features of such a program, consisting of quality control and quality assessment techniques, are discussed in the paper.

709,917
PB87-163713 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Nature of Repeatability and Reproducibility.
Final rept.,
J. Mandel, and T. W. Lashof. Jan 87, 8p
Pub. in Jnl. of Quality Technology 19, n1 p29-36 Jan 87.

Keywords: *Precision, *Reproducibility, Laboratories, Quality, Reprints, *Test methods, Repeatability.

Repeatability and reproducibility are usually defined by the relation R = R(square root of 2) (S sub R), where R stands for repeatability or reproducibility and (S Sub R) is the corresponding standard deviation. It is then stated that the probability is C that a difference between two test results will lie between (-R) and (+R). For C = 0.95, which is the usual choice, the values that have been proposed for the multiplier k are 1.96, 2, or Student's t. However, C is actually a random variable with a highly skewed distribution. It is shown that regardless of the above choice of k, the probability that C will lie in the vicinity of 0.95, such as for example 0.92 to 0.97, is very small, unless the number of participating laboratories is large (30 or more). Nevertheless, for any given interval defining a 'vicinity of 0.95,' a value of k exists that maximizes the probability that C lies in that interval. For a number of reasonable choices for 'vicinity of 0.95' the optimal k is close to 1.96.

709,918
PB87-210654 PC **A05**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Office of Physical Measurement Services.
NBS (National Bureau of Standards) Calibration Services Users Guide: Fee Schedule.
Apr 87, 78p NBS/SP-250/A
See also PB87-174041.

Keywords: *Calibrating, Standards, Services, Quality assurance, *Fee schedules, National Bureau of Standards.

The physical measurement services of the National Bureau of Standards are designed to help the makers and users of precision instruments achieve the highest possible levels of measurement quality and productivity. The hundreds of individual services you will find listed in the Fee Schedule constitute the highest-order calibration services available in the United States. They directly link a customer's precision equipment or transfer standards to national measurement standards. These services are offered to public and private organizations and individuals alike. The Fee Schedule is a supplement to NBS Special Publication 250, Calibration Services Users Guide. These documents are designed to make the task of selecting and ordering an appropriate calibration service as quick and easy as possible.

709,919
PB88-110960 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Measurement Assurance Programs. Part 2: Development and Implementation.
Final rept.,
C. Croarkin. Apr 85, 128p NBS/SP-676-2
Also available from Supt. of Docs. as SN003-003-02654-9. Supersedes PB84-217876. See also PB84-217868.

Keywords: *Quality assurance, *Metrology, Standards, Random error, Statistical analysis, *Measurement assurance program, National Bureau of Standards, Calibration, Uncertainty.

The document is a guide to the logical development of a measurement assurance program in which the tie between a measurement and its reference base is satisfied by measurements on a transfer standard. The uncertainty of values reported by the measurement process is defined; and the validation of the uncertainty for single measurements is developed. Measurement sequences for executing the transfer with NBS and procedures for maintaining statistical control are outlined for eight specific measurement situations with emphasis on characterizing parameters of the measurement process through use of a check standard.

709,920
PB88-112347 PC **A10**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Process and Quality Control and Calibration Programs of the National Bureau of Standards.
Final rept.
Jun 87, 217p NBSIR-87/3596
Report to the Congress in Response to Public Law 99-574. Sponsored by Congress, Washington, DC.

Keywords: *Process control, *Quality control, *Calibration, US NBS, Standard reference materials.

The report responds to Public Law 99-574, which directed the NBS Director to ask the Bureau's major clients about their needs for research and services related to NBS 'process and quality control and calibration programs'; and to report findings and recommendations to the Bureau's Congressional authorizing committees. NBS found that American firms and government agencies believe that implementation of process control and quality assurance are and ought to be primarily the responsibility of the producers of the Nation's goods and services; and that to respond to global competitiveness, measurement services are needed at earlier stages in the product/program development process. Greater accuracies and broader coverage are needed for existing measurement services, and new technologies are creating demands for additional, often entirely new or different services. In general, customers are willing to pay costs directly related to the delivery of NBS services, but are opposed to subsidizing basic or generic research that might underlie several services. They see such research to be a mandated NBS mission, they expect it to be funded by NBS appropriations, and they expect services to be available when needed. Finally, the report lists customers' specific measurement-related needs in a variety of technical areas.

709,921
PB88-113725 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Associate Director of Industry and Standards.
NVLAP (National Voluntary Laboratory Accreditation Program) Assessor Selection and Training,
H. W. Berger. Sep 87, 12p NBSIR-87/3651

Keywords: Test facilities, *Laboratories, Selection, *Accreditation, *Training, National Voluntary Laboratory Accreditation Program, NVLAP program, Assessors.

The role and importance of 'peer' assessors in the National Voluntary Laboratory Accreditation Program (NVLAP) is discussed. Procedures for identification, evaluation, and selection of assessors are described, and the elements of assessor orientation and training are presented.

709,922
PB88-113733 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Associate Director of Industry and Standards.
Surveillance of Accredited Laboratories under Procedures of the National Voluntary Laboratory Accreditation Program (NVLAP),
H. W. Berger. Sep 87, 9p NBSIR-87/3652

Keywords: *Test facilities, *Quality assurance, *Laboratories, Surveillance, *Accreditation, National Voluntary Laboratory Accreditation Program.

The paper describes mechanisms by which the National Voluntary Laboratory Accreditation Program (NVLAP) seeks to assure continuing competence of accredited laboratories to perform specific test methods or types of tests. Surveillance of laboratories (defined as actions taken after initial accreditation to ensure continued compliance with accreditation criteria) is achieved through proficiency testing, on-site assessments, and emphasis on the laboratory's own quality assurance system.

Tooling, Machinery, & Tools

709,923
AD-A029 426/4 PC **A04**/MF **A01**
National Bureau of Standards Washington D C Mechanics Div
Component Parts Assembly with Joints, Adhesive-Mechanical. Part 4. Analysis and Test of Bonded and Weldbonded LAP Joints.
Final rept.
R. A. Mitchell, R. M. Woolley, and S. M. Baker. Mar 76, 75p NBSIR-76-1053, PTA-TR-4965

Keywords: *Bonded joints, *Adhesive bonding, *Welded joints, *Finite element analysis, Algorithms, Planform, Nonlinear analysis, Loads(Forces), Tensile properties, Fatigue tests(Mechanics), Failure(Mechanics), Mechanical properties, Stresses, Strain(Mechanics), Computer programs, Experimental data, Spot welds, Lap joints.

Finite element computer techniques were used to study the linear and nonlinear structural response of bonded and weldbonded lap joints. Although the techniques used are applicable to either single-lap or double-lap joints, the emphasis was on the single-lap joint problem with the attendant complication of joint bending. Nonlinear algorithms were developed to account for nonlinear stress-strain charcteristics of the adhesive, and the joined metal sheet, weld-heat softening of the metal sheet, progressive debonding of the adhesive, and nonlinear cyclic loading. The nonlinear modes of response were simulated by sequences of linear solutions. Eight different single-lap joint configurations, designed so as to constitute an experimental parameter study, were studied in a laboratory testing program. Representative specimens were subjected to quasi-static tensile strength and cyclic-load tests and to tensile fatigue tests. The quasi-static and fatigue data generally plot into clear S-N patterns that are in a reasonable relationship to the lap joint design parameters. For the most part, strains measured on the surfaces of the test specimens were in reasonably good agreement with those computed by finite element analysis, provided out-of-plane bending effects were accounted for. The dominant failure modes were consistent with the computer analyses. (Author)

709,924
PATENT-4 471 444 Not available NTIS
Department of Commerce, Washington, DC.
Rotating Tool Wear Monitoring Apparatus.
Patent.
K. W. Yee, and D. S. Blomquist. Filed 2 Apr 82, patented 11 Sep 84, 9p PB85-148534, PAT-APPL-6-364 944
Supersedes PB82-197708.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Cutting tools, *Wear, *Monitors, Predictions, Failure, Comparators, Microcomputers, Drills, Patent, PAT-CL-364-475, Computer aided manufacturing, Computer applications.

A system is provided for predicting when the failure of a rotating machine tool or part is imminent or when a

tool is worn. The system includes a transducer for producing an output related to the workpiece vibrations caused by the machine tool and an analog comparator which compares this output with a threshold signal related to the normal operation of the tool and established by a microcomputer which determines whether further signals which exceed the threshold are produced during each of a predetermined number of subsequent time intervals related to the rotational speed of the tool. If so, a 'failure' signal is produced which may be used, for example, to cause retraction of the tool.

709,925
PB-271 974/8 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Human Factors Section.
Power Lawn Mowers: Ease of Pull.
Final rept.,
V. J. Pezoldt, and J. J. Persensky. Jun 77, 32p NBSIR-77-1298
Sponsored in part by Consumer Product Safety Commission, Washington, D.C.

Keywords: *Consumer affairs, Force, Evaluation, Performance, Human factors engineering, Standards, Perception(Psychology), *Lawn mowers, Consumer products.

The study was designed to provide objective information about the subjective judgment of easy to pull as it relates to the effort required to restart manual pull-start power lawn mowers. Seventy-four lawn mower users performed a total of more than 10,000 pulls on two simulated pull-start mechanisms. The peak forces applied in the pulls were associated with the subjects' judgments about the ease or difficulty of the pulls. These data were used to generate sample distributions of the maximum forces judged easy and the minimum forces judged hard. While not providing a definitive answer to the question of what is easy to restart, the data generated in the study provide a practical basis upon which an upper force limit for easy to restart can be based.

709,926
PB-272 198/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Piston Gauge Weight Handler.
Final rept.,
H. Davis. Sep 77, 2p
Pub. in Review of Scientific Instruments 48, n9 p1220-1221 Sep 77.

Keywords: *Handling equipment, *Hoists, Hydraulic equipment, Measuring instruments, Reprints, Electromechanical devices, Weights.

An electromechanical hydraulic lift has been developed and subsequently used to load and unload weight stacks from precision piston gauges, without affecting the reliability or the operation of these gauges.

709,927
PB-272 507/5 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Human Factors Section.
Power Lawn Mowers: Evaluation of Anthropometric Foot Probes.
Final rept.,
J. J. Persensky, and A. M. Ramey. May 77, 58p NBSIR-77-1294
See also PB-271 974.

Keywords: *Consumer affairs, *Product safety, Human factors engineering, Tests, Performance, Design, *Lawn mowers, Consumer products.

The document is the final report for the Consumer Product Safety Commission of an evaluation of the adequacy of existing generic foot probes. The Human Factors Section at NBS compared the dynamic characteristics of three generic probes with those of potential lawn mower users' feet. Horizontal and vertical insertion distances for the generic probes and the foot data were used to develop safety envelopes for various simulated housing heights. Inspection of the safety envelopes at 6, 8, and 10 cm housing heights indicates that of the three generic probes, the UK probe most closely approximates the foot data. Only the UK probe passes through the area above the plane of the housing opening. However, a comparison of each individual's data (rather than aggregate data) was made with each generic probe to determine the percentage of participants who would be completely protected by each generic probe. These data indicate that at least one point of each individual's foot movement data would fall outside of the safe area defined by the generic probe envelopes. Therefore, a lawn mower meeting the criteria of any of the generic foot probes would not completely protect any of the participants in the study. Recommendations for a modification of the UK probe and for further research are discussed.

709,928
PB-278 618/4 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Electronic Technology Div.
ICST/IAT Automation Project Experimental Investigation of Drill-Bit Wear.
Rept. for 1 Dec 76-30 Apr 77,
J. S. Hilten, C. F. Vezzetti, J. F. Mayo-Wells, and P. S. Lederer. Feb 78, 26p NBSIR-78-1423

Keywords: *Drilling machines(Tools), *Twist drills, *Wear tests, Drill bits, Metal cutting, Mechanical tests, Force, Torque, *Cutting speeds.

The development of an experimental instrumentation system for a small drill press is described. The parameters measured are spindle speed, vertical spindle displacement, vertical spindle load, drilling torque, and drilling time. Several test fixtures were instrumented and used in drilling experiments. These experiments were conducted to examine the relationship between variations in the measured parameters and drill performance, more specifically to drill wear. Experimental data show a 10-percent increase in drilling time from the first hole to the last for a single set of 500 holes drilled in cold-rolled steel at a nominally constant load, although the drilling time began to decrease slightly after hole 300. Changes in drilling torque were also detected during the test runs, and in similar runs with a brass workpiece. It is suggested that with respect to the anomalous results in steel under the unlubricated, constant-force conditions employed, the cutting surfaces of the drill bit were in a sense being renewed as microflakes of material departed to reveal fresh, sharp unburnished sites.

709,929
PB-279 334/7 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: NBS/RIA Robotics Research Workshop,
J. M. Evans, J. S. Albus, and A. J. Barbera. Apr 78, 43p NBS-SP-500-29
Proceedings - Held at Williamsburg, Virginia on July 12-13, 1977. Prepared in cooperation with Robot Inst. of America, Dearborn, Mich. Library of Congress Catalog Card no. 78-606182.

Keywords: *Robots, *Meetings, Industrial engineering, Welding, Assembling, Feeding(Supplying), Unloading, Control equipment, Detectors, Industrial equipment, Industrial research.

The NBS/RIA Robotics Research Workshop had two objectives: (1) to provide a forum for structured discussions between researchers in robotics and manufacturers and users of robot systems; and (2) to develop a consensus forecast of future developments in sensors and control systems for industrial robots. The two day Workshop brought together 31 researchers, manufacturers, and users of industrial robots in order to determine the needs and priorities for future research in sensors and control techniques for industrial robots. There were no formal papers; instead, small group discussions and presentations and the preparation of a Delphi Forecast were used to address research needs and priorities.

709,930
PB-280 581/0 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Electronic Technology Div.
ICST/IAT Automation Project Bibliography and Brief Review of Literature on Machine-Tool Measurements for Automatic Control.
Interim rept. 1 Dec 76-30 Apr 77,
C. F. Vezzetti, J. F. Mayo-Wells, J. S. Hilten, and P. S. Lederer. Apr 78, 54p NBSIR-78-1424
See also report dated Feb 78, PB-278 618.

Keywords: *Numerical control, *Machine tools, *Wear, *Bibliographies, Dynamic loads, Cutters, Force, Torque, Wear tests, Automatic control, *Tool wear.

An English-language literature survey focused on machine-tool measurements related to wear was undertaken to ascertain the types of sensors used and measurements made by investigators throughout the world in support of machine-tool automation. The resulting review and bibliography constitute this document.

709,931
PB-285 019/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Industrial Robots in Computer Aided Manufacturing.
Final rept.,
J. M. Evans. Jan 77, 6p
Pub. in NC/CAM Jnl., 6 pages (Numerical Control Society, Inc., Glenview, Illinois, Jan 77).

Keywords: *Robots, *Manufacturing, Machine tools, Numerical control, Detectors, Utilization, Reprints, Computer aided manufacturing.

The paper discusses both industrial robots of today and the future and their relation to numerical control (NC) and computer aided manufacturing (CAM). Today's robots do not have any sensory capability, and this means that they cannot cope with uncertainties in the external environment. Today's robots can, however, be programmed to do a task and they will faithfully repeat that task over and over, without any variation. Robots in the future will have additional sensory capability to be able to cope with some uncertainties in the environment, such as parts slightly out of position, and will have self diagnostic and error recovery routines to prevent predictable problems. In this paper, the various classes of existing industrial robots are identified and discussed. It is pointed out that over the next few years, significant improvements can be expected in the areas of dynamic performance, programming, and sensors. With these improvements, new applications of industrial robots will be seen in automobile manufacturing, welding, machine loading, aerospace, and small part mechnical assembly.

709,932
PB-291 335/8 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Mechanical Engineering and Process Technology.
Proximity-Vision System for Protoflight Manipulator Arm.
Final rept.
J. S. Albus. Jan 79, 22p NBSIR-78-1576
Sponsored in part by National Aeronautics and Space Administration, Huntsville, AL. George C. Marshall Space Flight Center.

Keywords: *Manipulators, *Remote control, *Robots, *Remote sensing, Closed circuit television, Infrared detectors, Automatic control equipment, Television cameras, Proximity vision system.

The NBS Proximity-Vision System consists of two separate but complementary subsystems: (1) A solid-state TV camera with 128 x 128 resolution elements mounted on the manipulator wrist. Coordinated with this camera is a high intensity strobe flash system with optics which project a thin fan-shaped plane of light into the region viewed by the camera. (2) A pair of close-range infra-red proximity sensors mounted in the fingertips. The system is built for a manually controlled teleoperator. However, the design is also suitable for computer image analysis in the control of an autonomous robot manipulator.

709,933
PB81-130155 Not available NTIS
National Bureau of Standards, Washington, DC.
Experiments in Part Acquisition Using Robot Vision.
R. N. Nagel, G. J. VanderBrug, J. S. Albus, and E. Lowenfeld. 29 Oct 79, 15p
Sponsored in part by Society of Mfg. Engineers, Dearborn, MI.
Pub. in Proceedings of the Autofact II, Robots Conference (4th) Held at Detroit, MI. on Oct 29-Nov 1, 1979, Soc. Mfg. Tech. Paper MS79-784, p1-14 1979.

Keywords: *Robots, *Optical detection, Components, Television cameras, Acquisition, Handling, Automation.

The National Bureau of Standards (NBS) vision system is mounted on the wrist of the robot, and provides both depth and part orientation information to the robot control system. The principle components of the vision

system are a solid state camera, a structural light source, and a camera interface system.

709,934
PB81-161119 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Proceedings of NBS/Air Force ICAM Workshop on Robot Interfaces.
T. E. Wheatley, J. S. Albus, and R. N. Nagel. Jan 80, 84p NBSIR-80-2152
Sponsored in part by Air Force Materials Lab., Wright-Patterson AFB, OH.

Keywords: *Robots, *Meetings, Interfaces, Control equipment, Detectors, Standards.

This paper describes the proceedings of a workshop on robot interfaces held at the National Bureau of Standards on June 4-6, 1980. Five possible areas for standardization of interfaces were discussed: the Simple Sensor interface between simple peripheral devices and a robot control system, the Wrist Interface, between the robot wrist and the end effector; the Complex Sensor Interface that covers vision, complex touch, and other such sensors; the Common Robot Control interface, providing robot independent trajectory descriptions; and Future Guidelines towards Interfaces, covering data base, offline programming, and system integration interfaces. The goal was to define the areas ready for current standards, and those for which standards would be considered an impediment to developing technologies.

709,935
PB82-198714 Not available NTIS
National Bureau of Standards, Washington, DC.
On-Line Method of Determing Tool Wear by Time-Domain Analysis.
Final rept.
K. W. Yee, and D. S. Blomquist. 1982, 6p
Pub. in Soc. Manuf. Eng. Tech. Paper MR82-901, 6p 1982.

Keywords: *Monitors, *Cutting tools, Drills, Wear, Automation, Failure, Predicitions, Microcomputers, Vibrational spectra, Spectrum signatures, Reprints, Computer aided manufacturing, Time domain analysis, Computer applications.

A method for determining drill wear and predicting drill breakage has been implemented by applying time-domain analysis on a signal from an accelerometer mounted on the work-piece. This analysis is performed by a single-chip microcomputer. In 49 of 50 cases, the system predicted that the drill would fail 2 to 20 holes before actual failure of a 1-mm (0.04-inch) diameter drill used on a machining center with a 1.5-kW (20-horsepower) spindle motor and capable of 80,000 N (18,000 pounds) of downward force. This system is currently used by the Fabrication Technology Division in the National Bureau of Standards machine shops. More than 15,000 1-mm holes have been drilled with only a single drill failure, which occurred when the system was inadvertently disabled. Fifteen drills with worn or damaged cutting edges were detected. This device is a by-product of an effort at NBS to develop the theoretical basis and the experimental techniques to relate the finished dimensions of machined parts to the vibration signatures of the machine tool which manufactures the parts.

709,936
PB82-204439 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Overview of Artificial Intelligence and Robotics. Volume II: Robotics,
W. B. Gevarter. Mar 82, 103p NBSIR-82-2479
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.

Keywords: *Robots, Reviews, Manipulators, Research, Forecasting, Technology, Robotics, State of the art, Computer aided manufacturing, Robot vision.

This report provides an overview of the rapidly changing field of robotics. It is intended to be read by the technically oriented layman, such as engineering managers, government funding offices, and others who desire an overall perspective of the field but are unable to obtain it from the highly technical and unintegrated literature in the field, or from the more flamboyant but non-technical feature articles in the popular press. The report incorporates definitions of the various types of robots, a summary of the basic concepts utilized in each of the many technical areas, review of the state-of-the-art and statistics of robot manufacture and usage. Particular attention is paid to the status of robot development, the organizations involved, their activities, and their funding. A 5-10 year forecast of the emerging technology is also included. The majority of the material in this report is drawn from the activities in the U.S. and Japan, the principle players in the world of robotics.

709,937
PB83-111666 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Evaluation of Chain Saw Kickback Motion Using Optoelectronic Measurement System.
D. Robinson, and C. Federman. Aug 82, 73p NBSIR-82-2559
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Saws, Hazards, Hand tools, Human factors engineering, Test equipment, Responses, Energy levels, *Chain saws, Kickback motion.

In 1980 the Consumer Product Safety Commission initiated the in-house development of a mandatory standard to address chain saw kickback. Part of that effort involved relating known chain saw energy levels generated during kickback to the final angle that a saw might travel when held in the hands of a chain saw operator. The present report describes the experimental program developed at NBS to determine the relationship between kickback energy and chain saw motion during hand-held kickbacks for selected samples of consumer-type chain saws and volunteer test subjects. The measurement system employed in this research included a computer-controlled optoelectronic system for measuring the displacements of selected points on the test saws and test fixture during simulated kickbacks. Included in the report is a description of the test equipment and procedures, the experimental design, and analyses of the measured displacement data for chain saws having known values of kickback energy.

709,938
PB83-140186 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Guide for the Construction and Operation of Drill-Up,
K. W. Yee. Oct 82, 29p NBSIR-82-2590

Keywords: *Drilling machines(Tools), *Twist drills, Breaking load, Machine tools, Automatic control equipment, User needs, Computer programs, *Computer aided manufacturing, DRILLUP computer program, Computer applications.

This guide provides detailed information for the construction of a single-speed version of Drill-Up and instructions for its installation and operation. Drill-Up is an instrument designed to prevent breakage of small-diameter drills used on automatic-feed drilling machines with a spindle retract ability. The method and applications have been previously described in the references given. The hardware and software necessary to construct an instrument for use at a single selected drilling speed are described. The circuit diagram and source program are included.

709,939
PB83-183558 Not available NTIS
National Bureau of Standards, Washington, DC.
Hierarchical, Model-Driven, Vision System for Sensory-Interactive Robotics.
Final rept.
E. W. Kent. 1982, 10p
Pub. in Proceedings of COMPSAC82 Int. Conference (6th), Chicago, IL., November 8-12, 1982 p400-409 1982.

Keywords: Robots, Pattern recognition, *Computer vision, Microprocessors, Scene analysis, Computer applications.

A robot sensory system for industrial robotics, employing structured light vision techniques, is described. Alternate frames (one illuminated by two parallel planes of light, and one by a point source) are obtained, and analyzed by a hierarchically organized group of microprocessors. The system uses knowledge of ideal objects and of robot action to generate visual expectancies. At each level of the hierarchy, an interpretative process is guided by an expectancy-generating modeling process. The modeling process is itself driven by a store of a priori knowledge, by knowledge of the robot's movements, and by error feedback from the interpretative process. At higher levels, the interpretative and modeling processes describe the data with higher order constructs, and over longer time frames. All levels of the hierarchy provide output, in parallel, to guide corresponding levels of the robot's hierarchical control system. At the lowest level other senses (proximity, tactile, force) are handled separately; above this level, they are integrated with vision into a multi-modal world model.

709,940
PB84-106111 Not available NTIS
National Bureau of Standards, Washington, DC.
UHV Gasket Removal Tool.
Final rept.
B. J. Waclawski. Mar 83, 2p
Pub. in Jnl. of Vacuum Science and Technology A 1, n1 p99-100 Jan-Mar 83.

Keywords: *Vacuum apparatus, *Gaskets, *Removal, Tools, Quality assurance, Pliers, Reprints.

This note describes a safe, effective tool for removing copper gaskets from ultrahigh vacuum flanges. Use of the tool practically reduces to zero the chance of damaging the flange sealing surface, because all motion of the tool is away from the flange face, and force is required for gasket removal. In addition, the pliers maintain a positive grip on the gasket, keeping it from dropping onto delicate parts of any apparatus attached to the flange.

709,941
PB85-110393 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Mfg. Engineering.
Evaluation of Chain Saw Simulated Kickback Modes.
D. Robinson. Sep 83, 37p NBSIR-84/2823
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Saws, Hazards, Test equipment, Performance tests, Performance evaluation, Simulation, Safety, Tests.

For the past several years, the National Bureau of Standards (NBS) has supported the Consumer Product Safety Commission (CPSC) in the development of a performance standard to address the kickback hazard for chain saws. This process included participation of the Chain Saw Manufacturers Association (CSMA), CPSC, and NBS in the development of kickback testing equipment and procedures and the study of operator/saw interactions during simulated kickback trials. The present report describes an evaluation of the CSMA and CPSC procedures for simulating 'Classical' or rotational kickback motion based primarily on analyses of high-speed films of kickback trials, the development of test procedures for simulating 'pinch' or linear kickback motion, and the simulation of kickbacks for the actuation of chain brake systems for chain saws. Included in the report is a discussion of important kickback test parameters such as mechanical energy, saw inertia, handle spacing and the interrelationships among the various parameters.

709,942
PB85-145514 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Buckling Loads and Natural Frequencies of Drill Bits and Fluted Cutters.
Final rept.
E. B. Magrab, and D. E. Gilsinn. Aug 84, 9p
Pub. in Jnl. of Engineering for Industry, Transactions ASME 106, p196-204 Aug 84.

Keywords: *Drill bits, *Cutters, Buckling, Twisting, Loads(Forces), Resonant frequency, Drilling, Grooving, Reprints.

The buckling loads, natural frequencies and mode shapes of twist-drill bits and certain fluted cutters under a variety of combinations of twist angle, cross-section geometry and axial loading have been obtained. The drill bit is modelled as a twisted Euler beam under axial loading that is clamped at both ends. The governing system of differential equations is solved by the Galerkin procedure. Explicit forms for the basis functions used to generate the Galerkin coefficients are presented in general form in an appendix. They may be used for obtaining numerical results for that class of problems which use the Rayleigh-Ritz-Galerkin methods with beam-type functions as the basis functions. The representative set of modes obtained

exhibit a complex out-of-plane twisting-type motion that suggests a possible explanation for the out-of-roundness of certain drilled holes.

709,943
PB86-102373 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Industrial Systems Div.
Adjustment of Robot Joint Gear Backlash Using the Robot Joint Test Excitation Technique.
Final rept.
N. G. Dagalakis, and D. R. Myers. 1985, 15p
Contract N00014-83-K-0236
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in International Jnl. Robotics Research 4, n2 p65-79, 1985.

Keywords: *Robots, *Gears, Joints(Junctions), Adjusting, Backlash, Reprints, *Robotics, System identification.

A technique has been developed for the precise adjustment of gear backlash of the joints of an industrial robot. Band limited random excitation signals were injected into the drive system of the joint under test, and the output response of the joint link was monitored using an accelerometer. The coherence function was measured and used to adjust the joint gear backlash in order to minimize the effect of the backlash nonlinearity on the joint drive system. Tests were performed while the joint was both loaded and unloaded and for several different steady state positions. The test results indicate that this technique can be used for both the adjustment of the joint gears and the periodic automatic inspection of their condition.

709,944
PB86-103637 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Industrial Systems Div.
Robotics.
Final rept.
J. S. Albus. 1984, 29p
Sponsored by Department of the Army, Washington, DC.
Pub. in NATO Advanced Study Institute Series F11, p65-93 1984.

Keywords: *Robots, Visual perception, Reprints, *Robotics, Hierarchical control, Knowledge representation.

Major problems areas in robotics are enumerated: 1. Kinematics, dynamics, and mobility; 2. Sensors and Sensory Processing; 3. Control; 4. Knowledge Representation and Modeling; 5. Programing Methodology; 6. Interfaces and Communications. A hierarchical robot control architecture is described which partitions the task decomposition into eight levels; four in the robot (1) servo and coordinate transformation, (2) elemental movement, (3) simple task, (4) complex task; and four in the automatic factory, (5) task sequencing (work station), (6) part batch routing (cell), (7) long range scheduling (shop), (8) process planning, product design, and management coordination (factory). This model is used to tie together the dynamic interaction between control, sensory processing, modeling, and planning. A network architecture for robots in a small automated machine shop is used to illustrate the interface and communications issues.

709,945
PB86-123148 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Design and Testing of a Fast Tool Servo for Diamond Turning.
Final rept.
S. R. Patterson, and E. B. Magrab. 1985, 6p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Precision Engineering 7, n3 p123-128 Jul 85.

Keywords: *Diamonds, *Tools, *Servomechanism, Accuracy, Resolution, Reprints.

A self-contained and independently servo-operated diamond tool holder was built to increase the resolution and accuracy of a precision lathe. Its static and dynamic repeatability over a range of plus or minus 50 microinch (1.27 micrometer) is better than 0.05 microinch (1.3 micrometer). Its frequency distortion from 0-100 Hz is less than 1.0 microinch (25 micrometer) for a peak displacement of less than 28 microinch (0.71 micrometer).

709,946
PB87-118741 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Centrifugal Pump for Superfluid Helium.
Final rept.
W. G. Steward. 1986, 6p
Pub. in Cryogenics 26, p97-102 Feb 86.

Keywords: *Centrifugal pumps, Cryogenics, Liquid helium, Superfluidity, Reprints.

The paper summarizes and correlates the liquid helium pump data obtained previously in two separate test programs. In normal helium the second set of data shows a large performance improvement over the first set as a result of changes in measurement methods and in the pump itself. Peak pump efficiencies of 46% were measured. The pump appeared to perform approximately the same in He II as in He I; however, the He II data are not adequate for system design or analyses. Therefore, a new pump test program is planned to test the improved version of the pump in an apparatus designed specifically for He II.

709,947
PB87-152831 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Visualization of Machine Tool Vibratory Motion.
Final rept.,
E. B. Magrab. 1984, 13p
Pub. in Proceedings of Conference Some Perspectives on CAD/CAM in Mechanical Engineering, San Antonio, TX., June 17-21, 1984, p117-129.

Keywords: *Machine tools, Drill bits, *Vibration mode.

The improvement in the understanding of the complicated modal characteristics of machine tools with the proper visualization of the results is demonstrated with two examples: (i) a drill bit and (ii) a milling machine. The application of the results to machine tool diagnostics and design is indicated.

709,948
PB87-161113 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Magnetoresistive Skin for Robots.
Final rept.,
J. M. Vranish. 1984, 16p
See also report dated 17 May 84, PB84-114658.
Pub. in Proceedings of International Conference on Robot Vision and Sensory Controls (4th), London, England, October 9-11, 1984, p269-284.

Keywords: *Magnetoresistivity, *Thin films, *Skin(Structural member), *Manipulators, *Detectors, Touch, *Robots, *Robot vision, Tactile perception.

A tactile imaging skin for robot grippers based on magnetoresistive technology is proposed. In the design considered here, the skin would consist of a thin film magnetoresistive array with sensor elements 2.5 mm apart (density can be increased an order of magnitude) covered by a sheet of rubber and a row of flat wires etched on a mylar film. The paper describes design, operation and expected performance of the skin.

709,949
PB87-162061 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Representing Workspace and Model Knowledge for a Robot with Mobile Sensors.
Final rept.,
M. Shneier, E. Kent, and P. Mansbach. 1984, 4p
Pub. in Proceedings of International Conference on Pattern Recognition (7th), Montreal, Canada, July 30-August 2, 1984, p199-202.

Keywords: *Robots, *Manipulators, Pattern recognition, Models, *Robot vision, Representations, Workstations, Work environments, Scene analysis, Octal coding, Trees(Mathematics).

A representation is described for supplying a robot manipulator with information about its workspace. The information is obtained from sensors (primarily visual) that move with the manipulator, and is of two kinds, stored in two, linked, data structures. Spatial information is stored in an octree. This allows fast computation of which parts of the workspace are occupied, which are empty, and which are navigable. Information about properties of objects, their features, and relationships with other objects, is stored in a set of tables or attribute lists. This information is used to match objects in the world with stored models and to assign names to instances of objects and to features in the scene. Objects that have been recognized and objects that are unidentified are stored in the same way, so that all operations on the workspace model are uniform. The two representations are linked in a way that enables objects to be located in space by name, by description, or by position, and facilitates finding out what object occupies a particular volume in the workspace. The construction of the representations from model data and from successive sensor inputs is discussed, and their role in the total robot system is described.

General

709,950
N86-29155/6 PC **A05**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Stability of Some Epoxy-Encapsulated Diode Thermometers.
B. W. Mangum, and G. A. Evans. Feb 86, 99p NAS 1.26:178137, NBSIR-86-3337, NASA-CR-178137
NASA ORDER-L-83949B

Keywords: *Diodes, *Epoxy compounds, *Temperature effects, *Temperature gradients, *Thermometers, Airfoils, Calibrating, Cryogenics, Surface temperature, Temperature measurement.

The stability upon thermal cycling and handling of ten small, epoxy-encapsulated silicon diode thermometers at six temperatures in the range from liquid nitrogen temperatures to about 60 C. The nominal temperatures of measurement were -196, -78, 0, 20, 40, and 60 C, as measured on the International Practical Temperature Scale of 1968. Diodes were to be thermally cycled 15 to 20 times. Since NASA anticipates that the uncertainty in their temperature measurements will be + or - 50 mK, uncertainties as large as + or - 10 mK in the measurements of the evaluaton can be accommodated without deleteriously affecting the value of the results of the investigation.

709,951
PATENT-4 152 074 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Inverse Fourth Power Photometric calibrator.
Patent.
D. A. Swyt. Filed 10 Jan 78, patented 1 May 79, 6p
PB79-600043, PAT-APPL-868 176

Keywords: *Brake, Coupling device, Cutting blade, Deadman's handle, Disconnect element, Lawnmower, Motor shaft.

A photometric calibrator is disclosed wherein a known and continuously variable amount of light flux received at a detector is linearly proportional to the inverse fourth power of the optical path length between the detector and a primary, quasi-point source of the light flux. The calibrator includes a secondary, quasi-point light flux source wherein the total flux emitted therby is proportional to the flux received therby over a quasi-point detecting area located at some distance, d, from the primary source. The detector is located at an equal distance d from the secondary source.

709,952
PATENT-4 158 944 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rotary Blade Coupling for Lawn Mower.
Patent.
J. Rabinow. Filed 29 Sep 77, patented 26 Jun 79, 9p
PB79-600044, PAT-APPL-834 931

Keywords: *Brake, Coupling device, Cutting blade, Deadman's handle, Disconnect element, Lawnmower, Motorshaft.

This invention relates to a coupling device and especially a coupling device operable by a dead-man's handle on a lawnmower. When used in a lawnmower the coupling device couples the motor shaft to the cutting blade. A spool has a hole in it that surrounds the shaft. A rotary connecting device normally couples the spool to the shaft so that the spool and the shaft rotate together. A disconnect element and brake are operat-

ed when the dead-man's handle is released to disconnect the spool from the shaft and subsequently stop the spool. The cutting blade has a central hole through which the spool passes. The blade is in frictional contact with the flanges of the spool and is rotated therby.

709,953
PATENT-4 281 517 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Single Stage Twin Piston Cryogenic Refrigerator.
Patent.
J. E. Zimmerman, and D. B. Sullivan. Filed 27 Feb 80, patented 4 Aug 81, 8p PB81-600041, PAT-APPL-6-125 005

Keywords: *Cylinder, Helium, Inner piston, Outer piston, Regenerator gaps, Single stage, Twin piston cryogenic refrigerator, Two nested, Concentric pistons.

A single stage, twin piston cryogenic refrigerator for cooling superconducting devices. The refrigerator uses helium as the heat transfer medium and is constructed with two nested, concentric pistons, an inner piston and an outer piston, mounted in a cylinder and driven 90 degrees out of phase by a common crankshaft. The inner piston extends through and below the outer piston and is received in a stationary insert mounted in the cylinder. The outer piston has a first piston face which forms a compression space with the stationary insert while the inner piston has a second piston face which forms a expansion space with the cylinder and the insert. The inner piston is formed with upper and lower piston halves joined by a flexible joint positioned in the compression space. Cylindrical regenerator gaps are present at the interface of the inner piston with the stationary insert and at the interface of the stationary insert with the cylinder.

709,954
PATENT-4 423 768 Not available NTIS
Department of the Army, Washington, DC.
Piezoelectric Polymer Heat Exchanger.
Patent.
S. Edelman, and L. D. Ballard. Filed 20 Apr 83, patented 3 Jan 84, 6p AD-D011 301/9, PAT-APPL-6-370 027
Supersedes PAT-APPL-6-370 027, AD-D009 384.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231, $1.00.

Keywords: *Patents, *Heat exchangers, *Piezoelectric materials, *Polymers, Electrodes, Heat transfer, Sheets, Efficiency, Fluid flow, Channel flow, PAT-CL-165-84.

Disclosed is an apparatus for providing for increased heat transfer efficiency of a heat exchanger by separating contiguous fluid conductive channels by means of a flexible sheet fabricated from a piezoelectric polymer. An electrode pattern of predetermined configuration is applied to one or both sides of the piezoelectric sheet and an electrical signal applied thereto in order to set the sheet into a flexural resonance condition whereupon a standing wave pattern is established to not only break up the boundary layer of fluid which adheres to each side of the sheet, but also minimizing the thickness of the laminar sub-layer.

709,955
PATENT-4 445 389 Not available NTIS
Department of Commerce, Washington, DC.
Long Wavelength Acoustic Flowmeter.
Patent.
J. E. Potzick, and B. Robertson. Filed 10 Sep 81, patented 1 May 84, 19p PB84-187137, PAT-APPL-6-300 830
Supersedes PB82-197690.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Patents, *Flowmeters, *Acoustic measuring instruments, *Fluid flow, Pipes, Tubes, PAT-CL-73-861.27.

A nonintrusive instrument for measuring the volume flowrate of, and the speed of sound in, an arbitrary fluid in a pipe, tube, or duct. The sound speed measured is that of a stationary fluid even though the measurement is made while the fluid may be flowing. The instrument uses sound whose wavelength is much longer than the diameter of the pipe, tube or duct. As a result, the temperature and flow measurements are independent of the profiles of those quantities across the pipe profiles.

709,956
PATENT-4 494 563 Not available NTIS
Department of the Army, Washington, DC.
Fluid Safety Valve.
Patent.
J. F. N. Seiler. Filed 12 Nov 82, patented 22 Jan 85, 4p PB86-174539, PAT-APPL-6-441 311
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Valves, *Patents, Safety devices, Instruments, Pressure control, PAT-CL-137-496.

A typical embodiment of the invention provides a means for protecting delicate instruments from damage. A flexible membrane separates two chambers in which, during ordinary operation, the fluid pressures are the same. One of the two chambers also serves as a fluid conduit in the system. Pressure loss in the system causes the higher pressure chamber to flex the membrane which closes a port in the fluid conduit chamber, thereby preventing further system pressure loss and consequent equipment damage. The membrane, moreover, can have a small bleed to permit gradual, dampened fluid pressure release.

709,957
PATENT-4 501 319 Not available NTIS
Department of the Army, Washington, DC.
Piezoelectric Polymer Heat Exchanger.
Patent.
S. Edelman, and L. D. Ballard. Filed 24 Jan 83, patented 26 Feb 85, 6p PB86-174505, PAT-APPL-6-460 221
Supersedes AD-D010 056.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Heat exchangers, *Patents, Heat transfer, Efficiency, Piezoelectric materials, Polymeric films. PAT-CL-165-84.

Disclosed is apparatus for providing for increased heat transfer efficiency of a heat exchanger by separating contiguous fluid conductive channels by means of a flexible sheet fabricated from a piezoelectric polymer. An electrode pattern of predetermined configuration is applied to one or both sides of the piezoelectric sheet and an electrical signal applied thereto in order to set the sheet into a flexual resonance condition whereupon a standing wave pattern is established to not only break up the boundary layer of fluid which adheres to each side of the sheet, but also minimizing the thickness of the laminar sub-layer.

709,958
PATENT-4 576 486 Not available NTIS
Department of Commerce, Washington, DC.
Optical Fiber Thermometer.
Patent.
R. R. Dils. Filed 23 Aug 83, patented 18 Mar 86, 10p PB86-176575, PAT-APPL-6-525 771
Supersedes PB84-113760.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Temperature measuring instruments, *Patent application, Fiber optics, Ceramic fibers, Blackbody radiation, Photo dectors, PAT-CL-374-131.

A temperature measuring device suitable for high temperature measurements in the range of 500 - 2400 C. utilizing a blackbody cavity to emit radiation in the wavelength band of 0.3 microgram - 1.0 mircogram. The emitted light is transmitted to a photodector via a high temperature ceramic fiber which is transparent to the wavelength band radiated. The radiance of the cavity is utilized as a measure of its temperature.

709,959
PATENT-4 577 510 Not available NTIS
Department of the Air Force, Washington, DC.
Dynamic Polymer Pressure Transducer with Temperature Compensation.
Patent.
A. J. Bur, and S. C. Roth. Filed 6 Sep 84, patented 25 Mar 86, 6p AD-D012 285/3, PAT-APPL-6-647 782
Supersedes PAT-APPL-6-647 782, AD-D011 373.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Patents, *Pressure transducers, *Pressure gages, Polyvinylidenes, Fluoropolymers, Dynamic pressure, Temperature, Compensation, Thermal properties, Thermocouples, Signals, Amplifiers, Circuits, Accuracy, Polyvinylidene fluoride, PAT-CL-73-708.

Accurate dynamic pressure data in a changing thermal environment is obtained through the use of a pressure gage formed from polyvinylidene fluoride (PVDF) polymer material. The temperature compensation pressure gage has three major elements: an active PVDF transducer which obtains remote pressure readings which are uncorrected for thermal effects; a thermocouple having a short rise time allowing an output thermal signal which dynamically responds to changing thermal conditions; and a compensation amplifier circuit receiving uncorrected pressure readings and the dynamic thermal signal and producing on output signal representing accurate pressure data which is corrected for changing thermal conditions. Also disclosed are the details of making an active PVDF transducer.

709,960
PB-264 917/6 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of International Relations.
Report on an NBS/AID Survey of Standardization and Measurement Services in Thailand,
H. S. Peiser, and R. S. Marvin. Feb 77, 80p NBSIR-76-1190
Grant PASA-TA(CE)-5-71

Keywords: *Measurement, *Standardization, *Thailand, Surveys, Test facilities, Quality control.

A survey of standardization and measurement services available in Thailand was carried out in May and June of 1973 as part of a National Bureau of Standards program sponsored by the Office of Science and Technology of the Agency for International Development. The Survey Team included five NBS staff members, three third-country participants, and an approximately equal number of professional Thai participants, headed by the overall Survey Director, Dr. Charoen Vashrangsi of the Department of Science in the Thai Ministry of Industry. A total of universities, government departments and private organizations were visited by some or all of the Team. The schedule of visits was so heavy that no time was available for discussion and formulation of formal recommendations. Thus the report is largely a brief factual account of the various visits, although a few comments and suggestions are included.

709,961
PB-265 087/7 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of International Relations.
Standardization and Measurement Services in Guyana. (A Report of a Survey Conducted Jointly by the National Bureau of Standards and the Agency for International Development, Held on July 11-17, 1976).
Final rept.,
H. S. Peiser, N. C. Beck, and K. S. Stephens. Feb 77, 100p NBSIR-76-1180
Grant PASA-TA(CE)-5-71

Keywords: *Units of measurements, *Guyana, Surveys, Standards, Standardization, Services, Developing countries, International relations, Foreign aid, United States.

A survey of standardization and measurement services in Guyana was carried out in July, 1976, as part of a National Bureau of Standards program sponsored by the Office of Science and Technology of the Agency for International Development. The Survey Team included three members, one of whom was an NBS staff member and the other two, U.S. participants. The NBS team's specific objectives were: (1) to survey domestic and export oriented industries and related GOG and private sector organizations, and (2) to advise the

NSRC (National Science Research Council) on optimum means for establishing a National Bureau of Standards and related activities to effectively assist industrial development in Guyana.

709,962
PB-265 537/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermal Conductance of Indium Solder Joints at Low Temperatures,
R. Radebaugh. 1977, 2p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in Rev. Sci. Instrum., v48 n1 p93-94 Jan 77.

Keywords: *Soldered joints, Cryogenics, Thermal conductivity, Indium, Beryllium, Copper, Reprints.

The thermal conductances of two indium solder joints were measured between 2 and 130 K. One joint was between two copper pieces and the other joint between beryllium and copper. Both joints gave nearly the same results even though beryllium is much more difficult to wet with indium. The thermal conductances of the joints at 4 K were considerably higher than those of joints using alloy solders such as lead-tin. The maximum conductance per unit area was about 100 W/(sq cm)K, which occurred at about 20 K.

709,963
PB-265 622/1 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
Study of the National Measurement System. Final Summary Report, 1972-75,
R. C. Sangster. Dec 76, 49p NBSIR-75-925

Keywords: *Measurement, Systems analysis, Trends, Economic analysis, Assessments, *National Measurement System.

This is the summary report for the 1972-75 NBS Study of the National Measurement System; i.e., the activities and mechanisms that provide physical measurement data for creation of objective, quantitative knowledge for use in our personal lives, society, science, and technology. It includes structural and economic overviews of the system and summarizes results of microstudies of specific measurement sectors. The structural model of the system has five levels: conceptual system, basic technical infrastructure, realized measurement capabilities, institutional dissemination and enforcement network, and end-use measurement activities. Transactions in the system have been described in a matrix format. Measurement-related activities account for about 6% of Gross National Product and pervade all economic sectors. Indicative cost-benefit analyses are described. Measurement sectors covered by 24 microstudies include time and frequency; mechanical, thermal, electrical, electromagnetic acoustic, and optical quantities, and ionizing radiation. Major system trends are toward increased complexity and integration, improved quality control and information resources, automation, metrication, and consolidation of the recent scientific revolution in metrology.

709,964
PB-266 569/3 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Metrication and Dimensional Coordination - A Selected Bibliography.
Final rept.,
R. E. Clark, and C. L. Roat. Apr 77, 36p NBS-SP-458
Library of Congress Catalog Card No. 76-608345.

Keywords: *Units of measurement, *Metric system, *Construction industry, *Bibliographies, United States, Conversion, Standards, Benefit cost analysis, Surveys, Guidelines, Economic analysis, Handbooks, *Metrication.

The United States changeover to the use of the SI (International metric) measurement language presents our construction industry with the need to review and adapt many product standards and practices for the use of metric measurement units. These adaptations and changes can bring substantial benefits to the industry in the form of permanently recurring cost savings. A practice of potentially great benefit would be the incorporation of dimensional coordination in the new metric standards for sizes of building products. For such benefits to be realized, however, the involved issues must be effectively addressed and the requisite decisions made and implemented. This report aids construction industry consideration and resolution of metrication decisions by providing a guide to the best available sources relevant to the issues.

709,965
PB-269 774/6 PC **A14**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Report of the Proceedings of the National Conference on Weights and Measures, 1976 (61st) Held in Washington, D.C. on July 12-16, 1976.
Special publication (Final),
P. A. Raschella. Jul 77, 307p NBS-SP-471
Library of Congress Catalog Card No. 26-27766.

Keywords: *Standards, *Units of measurement, *Meetings, Metric system, Automation, Regulations, Tolerances(Mechanics), Commerce.

This is a report of the proceedings (edited) of the Sixty-first National Conference on Weights and Measures, sponsored by the National Bureau of Standards, held in Washington, D. C., July 12-16, 1976 and attended by state, county, and city weights and measures officials, the Federal Government, business, industry, and consumer organizations.

709,966
PB-270 523/4 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C.
Examination of Cap Screws from Currency Printing Press Flanges.
Failure Analysis rept.,
T. R. Shives. Jun 77, 28p NBSIR-77-1275
Sponsored in part by Bureau of Engraving and Printing, Washington, D.C. Office of Engineering.

Keywords: *Cap screws, Failure, Fatigue(Materials), Cyclic loads, Tensile strength, Flanges.

The Office of Engineering of the Bureau of Engraving and Printing submitted a number of failed and intact cap screws from printing press flanges to the NBS Mechanical Properties Section for examination. All of the cap screw failures examined were due to the initiation and propagation of fatigue cracks. Based on the results of hardness measurements, some of the cap screws of one manufacturer did not meet the minimum ultimate tensile strength requirements for DIN 12.9 screws. One cap screw with an ultimate tensile strength significantly below the specified minimum had yielded apparently while in service.

709,967
PB-270 867/5 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Laboratory Tests of Thermoplastic Piping Assemblies Subjected to Water Hammer and Intermittent Hot Water Flow.
Final rept.,
D. E. Rorrer, J. R. Shaver, and R. S. Wyly. Aug 77, 52p NBSIR-77-1261
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Energy, Building Technology and Standards Div.

Keywords: *Water pipes, *Polyvinyl chloride, *Water hammer, Pressure, Thermal shock, Fatigue life, *Hot water.

Evaluation procedures are described that were used at the National Bureau of Standards (NBS) for simulating the long-term effects of water hammer (shock pressure) and cycle hot water flow (thermal cycling) on chlorinated polyvinyl (CPVC) thermoplastic pressure piping assemblies. Also included are the procedures used to study the effects of thermal cycling of two (2) polyvinyl chloride (PVC) thermoplastic drainage stack assemblies. The results obtained using these test procedures are presented and, in addition, related work of other investigators is briefly reviewed. The shock pressure results show that a fatigue life curve can be established for CPVC as a function of temperature and pressure. As the temperature is decreased the number of shock pressure applications necessary to produce failure increases. An estimated use-life of at least 50 years was indicated at the maximum test temperature of 180 F (82C) with pressures of 150 psi (1034 kPa). With intermittent hot water flow all test assemblies were performing satisfactorily when the test was terminated after more than 1500 cycles had been completed.

709,968
PB-271 590/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Refrigeration Technology for Superconductors.
Final rept.,
T. R. Strobridge, and R. O. Voth. 1977, 5p
Pub. in IEEE Trans. Nucl. Sci. NS-24, n3 p1222-1226 Jun 77.

Keywords: *Refrigerators, Superconductors, Cryogenics, Reviews, *Cryogenic refrigeration, Reprints.

The paper reviews the large helium refrigerator purchases in the past several years; outlines the refrigerator research and development for the same period; and presents a model and method for predicting the maximum practical helium temperature refrigerator efficiency obtainable today.

709,969
PB-271 599/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Possible Cryocoolers for SQUID Magnetometers.
Final rept.,
J. E. Zimmerman, R. Radebaugh, and J. D. Siegwarth. 1977, 10p
Pub. in Proc. IC SQUID (1st), Berlin (Germany), October 5-8, 1976, Paper R-1044 in Superconducting Quantum Interference Devices and Their Applications, p287-296 1977.

Keywords: *Refrigerators, *Cryogenics, Magnetometers, Instrumentation, Stirling cycle engines, Cryogenic refrigeration, *Squid devices.

In a study to determine if a cyclic cryogenic refrigerator is suitable for cooling SQUID magnetometers and similar instruments, the authors have used a specially-designed Stirling machine with a three-stage displacer to achieve and maintain a temperature of 13K. The displacer and cylinder were made of low-susceptibility, non-conducting plastic to minimize magnetic interference. For the same reason, and also to minimize mechanical noise, the machine operates at low displacement and low speed, and it uses only about 10W of mechanical power, requiring 50W input to a typical small electronic motor. Since the temperature achieved is within the range of NbN and Nb3Sn SQUIDs, it can, in principle, be used to cool a SQUID. The estimated magnetic signal from the reciprocating displacer may not seriously affect the magnetometer sensitivity, but the signal due to the cyclic pressure-induced geometric distortion of the SQUID mounting in the earth field may be very difficult to eliminate.

709,970
PB-273 127/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Computer Simulation of Water Heater Standby Loss.
Final rept.,
C. A. Wan. 1977, 15p
Pub. in Proceedings 1977 ASME Winter Annual Meeting, Atlanta, Georgia, November 27-December 2, 1977, 15p 1977.

Keywords: *Water heaters, *Heat loss, Computerized simulation, Energy conservation, Intermittent operation, WHESTOD computer program, Conduction(Heat transfer).

A computer program called WHESTOD (Water Heater Energy Savings, Through Operation and Design) is under development at the Center for Consumer Product Technology, National Bureau of Standards. The program solves the axisymmetric heat conduction equation, applicable to a water heater, in the cylindrical coordinate system using an implicit, alternating direction method. It will ultimately be implemented to simulate water heaters of various designs and operating conditions. It has been used to study the standby phase of an electric water heater and a gas water heater without pilot. Laboratory tests were also conducted for these two water heaters. Good agreement has been found between the computer simulations and laboratory measurements under comparable conditions. However, a more detailed model and laboratory measurements are needed to achieve a complete water heater simulation as a versatile analysis tool.

709,971
PB-273 666/8 PC **A13**/MF **A01**
National Bureau of Standards, Washington, D.C. Special Activities Section.

Catalog of Artifacts on Display in the NBS Museum,
H. L. Mason. Nov 77, 293p NBSIR-76-1125

Keywords: *Museums, *Catalogs(Publications), Measurement, Measuring instruments, Standards, Units of measurements, Engineering, *Artifacts, National Bureau of Standards.

Apparatus and other memorabilia illustrative of the scientific and engineering achievements of NBS are described, with statements of their technical function and their historic place in the evolution of physical measurement.

709,972
PB-274 049/6 PC **A03**/MF **A01**
Colorado Univ., Boulder. Dept. of Economics.
Economic Analysis of the National Measurement System,
B. W. Poulson. Sep 77, 44p NBSIR-75-948
Report from the 1972-75 Study of the National Measurement System by the NBS Institute for Basic Standards.

Keywords: *Metrology, *Economic analysis, Benefit cost analysis, *National measurement system.

This report is a comprehensive summation of all relevant work known to NBS on the state of the art of economic analysis of the national measurement system. It is written for a mixed audience of economists and physical scientists. The first part deals with the concept of measurement for economic analysis, the quantitative dimensions of measurement in the economy, and the relationships between measurement and economic change. Measurement information is ubiquitous in the economy; it is used by producers and consumers and as an input at the interface between buyers and sellers. Resources used in making measurements cost about 6 percent of GNP in 1963, and all major economic sectors incurred substantial expenses. Industries with rapid rates of growth and productivity advance tend to be measurement intensive. Data from the NBS metric study provide supporting insights. The second part of the study examines the measurement system from the standpoint of the private sector, including the economic rationale for measurement by producers, consumers, and in sales transactions; and case studies of costs and benefits. The third part deals with the role of government, incorporating an economic rationale for measurement activities in the public sector, and case studies of costs and benefits of activities by NBS.

709,973
PB-275 561/9 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of International Relations.
Visiting Team Report on 1977 Industrial Survey in Korea on Precision Measurements and Standards.
Final rept.,
K. Chung, H. S. Peiser, and R. C. Sangster. Nov 77, 28p NBSIR-77-1382
Sponsored in part by Agency for International Development, Washington, D.C. Prepared in cooperation with Ministry of Commerce and Industry (Republic of Korea). Industrial Advancement Administration.

Keywords: *Metrology, *South Korea, *Meetings, Foreign aid, Economic assistance, Industrial management, Engineering standards, Questionnaires, *Industry surveys.

The Korean Standards Research Institute is a recently founded organization that is to serve functions in Korea generally equivalent to those of the Institute for Basic Standards of NBS in the U.S.A. To plan K-SRI's metrological services to industry and other Korean laboratories, a survey of industrial needs is being conducted with advice from NBS. This report describes some basic facts about K-SRI, the survey plan, as well as principally, conclusions and recommendations given by the authors during their brief consultation visit to Korea, May 22-28, 1977. A main questionnaire was drafted, with an accompanying letter for subsequent translation and adaptation to Korean public/private sector interaction. The survey should provide visibility for K-SRI, awareness of industrial needs to its staff, and means to develop a sound plan for its priority programs.

709,974
PB-276 207/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Note on the Relation Between Resistance Thermometer, Thermocouple, and Radiation Temperature Scales: 630-1064C.
Final rept.,
J. P. Evans. 1977, 2p
Pub. in Metrologia 13, p171-172 1977.

Keywords: *Temperature measurement, Resistance thermometers, Thermocouples, Temperature, Values, Reprints, Scales.

The note points out that values of temperature derived from a quadratic interpolation equation for high temperature platinum resistance thermometers and from a fifth degree polynomial interpolation equation for standard (Pt-10% Rh/Pt) thermocouples are in close agreement with reported values of thermodynamic temperature determined by radiation measurements in the region 630-1064C.

709,975
PB-276 397/7 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Human Factors Section.
Evaluation of Safety Standards for Gasoline and Kerosene Cans.
Final rept.,
C. E. Jones. Sep 77, 74p NBSIR-78-1414
Sponsored in part by Consumer Product Safety Commission, Bethesda, Md. Bureau of Engineering Sciences.

Keywords: *Containers, *Automotive fuels, *Safety, Consumer affairs, Standards, Accident prevention, Gasoline, Kerosine, Children, Ignition, Combustion, Flammable liquids, Safety engineering, Evaluation, Failure.

Accidents involving home use of gasoline and other flammable and combustible liquid containers were analyzed to define the functions a safe container should perform and how the containers failed to perform these functions. Safety standards were evaluated for applicability to these functional failures. The standards were considered inadequate to prevent child access to fluids in the containers, somewhat adequate for fluid management and isolation from ignition sources and very adequate for container structure and materials. (Portions of this document are not fully legible)

709,976
PB-277 304/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Classes of Units in the SI.
Final rept.,
C. H. Page. 1978, 2p
Pub. in American Jnl. of Physics 46, n1 p78-79 Jan 78.

Keywords: *Units of measurement, Standards, Reprints.

The mathematical nature of the categories of base, supplementary, and derived units in the SI is explained, and the usual definition of supplementary modified to be more precise. An argument is presented for adding neper to the SI as a supplementary unit.

709,977
PB-277 314/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Present Efforts in High Temperature Resistance Thermometry at the National Bureau of Standards.
Final rept.,
J. P. Evans. 1976, 6p
Pub. in Proceedings Session Comite Consultatif de Thermometrie (11th), Comite Int. des poids et Mesures, Sevres, France, June 15-16, 1976, Paper T 20 in Comite Consultatif de Thermometrie, pT167-T172 1976.

Keywords: *Temperature measurement, *Resistance thermometers, Platinum, High temperature, Platinum resistance thermometers.

Work now in progress or planned for the near future at the National Bureau of Standards is aimed at developing superior platinum resistance thermometers for use at high temperatures and at encouraging their commercial production. Present efforts are concentrated on the design and construction of thermometers having a resistance at 0C of 2.5 ohm and intended for use up to at least 700C. The report describes some of the features of the thermometer construction, including the use of laser machining to make silica glass supporting parts.

709,978
PB-277 315/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Appraisal of Interpolation Instruments for a Practical Temperature Scale from 630.74 C to 1064.43 C.
Final rept.,
L. A. Guildner, H. J. Kostkowski, and J. P. Evans. 1976, 13p
Pub. in Proceedings Session Comite Consultatif de Thermometrie (11th), Comite Int. des Poids et Mesures, Sevres, France, June 15-16, 1976, Paper T 21 in Comite Consultatif de Thermometrie, pT173-T185 1976.

Keywords: *Temperature measurement, Interpolation, Pyrometers, Resistance thermometers, Thermocouples, Evaluation, Standards, Temperature measuring instruments, Temperature scales, High temperature.

From the standpoint of reproducibility, ease and economy of use, and the extent to which such a scale would be used broadly by technical workers, the platinum resistance thermometer has significant advantages over the photoelectric spectral pyrometer. If it were used now in the range 630.74 to 1064.43C, the platinum resistance thermometer could yield values of temperature that would not differ significantly from the realization of the present scale when these values are derived from an already established equation. The authors recommend that the CCT encourage such use as a means of broadening the acceptance of this instrument. If its use becomes broad enough by the time that a new scale is formulated, the high temperature platinum resistance thermometer should replace the thermocouple for the new IPTS up to the temperature of the gold point.

709,979
PB-277 318/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Freezing Point of Aluminum as a Fixed Point for Platinum Resistance Thermometry.
Final rept.,
G. T. Furukawa, W. R. Bigge, J. L. Riddle, and M. L. Reilly. 1976, 4p
Pub. in Proceedings Session Comite Consultatif de Thermometrie (11th), Comite Int. des Poids et Mesures, Sevres, France, June 15-16, 1976, Paper T 19 in Comite Consultatif de Thermometrie, pT163-T166 1976.

Keywords: *Temperature measurement, *Standards, Melting points, Aluminum, Resistance thermometers.

The range of the freezing points for five aluminum specimens was found to be 0.51 mK. The equation $W(t') = 1 + At' + Bt'$ squared was extrapolated to the aluminum point. The range of the values of t' (Al) computed for five platinum resistance thermometers (SPRT) was 3.3 mK. The enhancement of the reproducibility of SPRT temperature scales by applying the aluminum point is described.

709,980
PB-277 747/2 PC **A09**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
From Sundials to Atomic Clocks: Understanding Time and Frequency.
Final rept.,
J. Jespersen, and J. Fitz-Randolph. Dec 77, 178p NBS-MONO-155
Library of Congress Catalog Card no. 77-600056.

Keywords: *Time, *Time measuring instruments, Time signals, Utilization, Time measurement, Clocks, Time standards.

This book is a layman's introduction to time: its generation, its uses, its distribution, and its physical and scientific nature. The book begins with an historical review of clocks and watches, leading into a discussion of today's most sophisticated 'time piece,' the atomic clock. The need for highly accurate atomic time, to a millionth of a second or better, is described as it relates to a number of modern-day activities and systems such as advanced electronic communication systems, satellite navigation systems, and precise scientific measurements in radio astronomy and in tests of the theory of relativity. Several chapters are devoted to the legal aspects of time, both national and international. Who, for example, decides the length of a second, and why was the leap second introduced. Another portion of the book describes a variety of special short-wave broadcasts of time which are maintained

by many nations of the world. There is also a discussion of the impact of satellites on time broadcasts. The book concludes with a discussion of the relationship of time to mathematics, physics, astronomy, and automation. It is shown how the science of time measurement has both contributed to and profited from advancements in each of these disciplines.

709,981
PB-278 955/0 Not available NTIS
National Bureau of Standards, Boulder, CO.
Current State of Primary Standards at the National Bureau of Standards.
Final rept.,
J. A. Barnes. 1974, 5p
Pub. in Proceedings of Session Comite Consultatif pour la Definition de la Seconde (7th), Sevres, France, July 9-11, 1974, Annexe S 9, p66-70 1974.

Keywords: *Time standards, *Primary standards, International relations, National Bureau of Standards.

Three questions of current interest to CCDS are considered and a recommended position is presented. The recommended positions are: (1) It is reasonable to have legal time in the Meter Convention countries be tied to UTC; however, this does not seem to imply any changes in U.S. laws; (2) TAI could be reset by 32 seconds to bring it into agreement with ET but there is a need to investigate more completely the implications of such a change; and (3) the name change from 'Coordinated Universal Time' to 'International Time' is desirable and CCDS should recommend such an action to the CCIR.

709,982
PB-279 459/2 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of Measurement Services.
Calibration and Related Measurement Services of the National Bureau of Standards,
Special pub.,
B. C. Belanger. Apr 78, 106p NBS-SP-250-1978
Supersedes NBS Special Publication 250, 1970 Edition. Library of Congress Catalog Card no. 63-60099.

Keywords: *Measurement, *Calibrating, Standards, Services, *National Bureau of Standards.

This publication provides detailed descriptions of the currently available NBS calibration services, measurement assurance programs, and other measurement services. In addition, each section describing specific services contains references to additional publications giving even more detail about the measurements techniques and procedures used. This revised edition reflects the services available as of the fourth quarter of 1977. NBS Special Publication 250 was last issued in 1970. The Appendix to SP 250 is reviewed every six months (June and December). It lists current prices for the services described in this publication and the NBS points of contact (addresses and phone numbers) from whom additional information can be obtained.

709,983
PB-280 175/1 PC **A11**/MF **A01**
National Bureau of Standards, Boulder, Colo. Cryogenics Div.
Applications of Closed-Cycle Cryocoolers to Small Superconducting Devices,
J. E. Zimmerman, and T. M. Flynn. Apr 78, 241p NBS-SP-508
Proceedings of a Conference Held at the National Bureau of Standards, Boulder, Colorado on October 3-4, 1977. Sponsored in part by Office of Naval Research, Arlington, VA. Library of Congress Catalog Card no. 78-606017.

Keywords: *Refrigerators, *Meetings, *Cryogenics, Superconductivity, Coolers, Refrigerating, Utilization, *Superconducting devices, *Cryogenic refrigerators, Cryocoolers, Squid devices, Closed cycle systems.

Contents:
- Refrigeration Fundamentals, by R. Radebaugh;
- Concepts for Cooling Small Superconducting Devices Using Closed-Cycle Regenerative Refrigerators, by R.C. Longsworth;
- Operation of a SQUID in a Very Low-Power Cryocooler, by J.E. Zimmerman and R. Radebaugh;
- Shuttle Heat Transfer in Plastic Displacers at Low Speeds, by R. Radebaugh and J.E. Zimmerman;
- Scaling of Miniature Cryocoolers to Microminiature Size, by W.A. Little;
- Small Magnetic Refrigerators to Pump Heat from Helium Temperatures to above 10 K, by W.A. Steyert;
- Electrocaloric Refrigeration for the 4-20 K Temperature Range, by R. Radebaugh;
- One Million Hours at 4.5 Kelvin, by W.H. Higa and E. Wiebe;
- Design Compromises in the Selection of Closed-Cycle Cryocoolers, by F.F. Chellis;
- Magnetic and Vibrational Characteristics of a Closed Cycle Refrigerator, by J.E. Cox and S.A. Wolf;
- Closed-Cycle Refrigerator for a Superconducting Susceptometer, by D.A. Vincent;
- Cryogenic Applications of Closed-Cycle Mechanical and Adsorption Refrigeration, by W.H. Hartwig;
- Cryogenic Cooling Requirements of Photoconductive Infrared Detectors for Orbiting Astronomical Telescopes, by J.W. Vorreiter and C.R. McCreight;
- Cooling of Josephson MM- and SubMM-Wave Systems:
- Requirements, Results and Applications, by J. Edrich;
- Progress Report on High-T sub c Superconducting Devices, by M.R. Beasley;
- Application of SQUID Detectors in Biomagnetism, by S.J. Williamson and L. Kaufman;
- Cryogenic Techniques and Geophysical Measurements, by W.D. Stanley;
- Cryocoolers for Use with Superconducting Instruments:
- Some Estimates of Requirements, by M.B. Simmonds;
- Refrigerator Requirements for Potential Josephson Data Processing Systems, by B.J.C. van der Hoeven, Jr. and W. Anacker;
- Liters, Kilograms, Watts and Seconds:
- Design Goals for a Refrigerator for Use with Superconductive Systems, by M. Nisenoff;
- Potential Scientific Uses of Cryogens in Space in the Temperature Range from 1mK to 10 K, by E. Tward;
- Josephson Voltage Standards - An Application for Cryocoolers, by L. B. Holdeman and C.C. Chang.

709,984
PB-280 379/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pressure Measurements and Services at NBS.
Final rept.,
P. L. M. Heydemann. 1976, 17p
Pub. in Proceedings of Fluid Power Testing Symposium (1976), Milwaukee School of Engineering, Milwaukee, Wis., Aug 16-18, 1976, p2.4.1-2.4.17.

Keywords: *Pressure measurement, *Standards, Calibration, Instrumentation, Training programs, Research and development.

Pressure is one of the most important thermodynamic variables. Numerous industrial manufacturing processes and the operation of many different types of machines depend on its measurement. The very large number of pressure measurements made in industry requires an elaborate national measurement system to ensure that measurements at the point of use can be performed with sufficient accuracy. The Pressure and Vacuum Section of the National Bureau of Standards maintains the primary standards to which most pressure measurements in the U.S.A. are referred. These standards cover a range from 0.0001 Pa (0.01 torr) to 5 billion Pa (50 kbar). This report describes the physical principles used in these standards, the calibration services available to industry, the training facilities, reports and papers, the extensive consultation services, as well as research and development programs in the field of pressure measurements.

709,985
PB-280 431/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Three Dimensional Metrology.
Final rept.,
R. Hocken, J. Simpson, B. Borchardt, J. Lazar, C. Reeve, and P. Stein. Aug 77, 6p
Pub. in Proceedings of CIRP Conference, New Delhi, India 25-30 Aug 77, Ann. Int. Inst. Prod. Eng. Res. v26 n2 p403-408 1977.

Keywords: *Metrology, Algorithms, Dimensional measurement, Optical interferometers, Lasers, Three dimensional.

The paper presents the results of research into the three dimensional measurement process using a classically designed measuring machine. This machine has been retrofitted with laser interferometers to provide a stable metric and is controlled by a minicomputer. Machine motions are programable in a high level interactive language. Data links are provided to a larger computer for sophisticated data processing. The authors have pursued the objective of creating, with the lasers, a machine independent coordinate system based at a point. Measurements made in this reference frame are transformed into the coordinate system of the measured object using the techniques of rigid body kinematics. The error terms inherent to the mechanical design (yaw, pitch, straightness, etc.) are measured over the machine volume, 48 inches x 24 inches x 10 inches, on a cubic lattice of spacing two (2) inches. These error terms are stored as matrices and used to correct the data during a measurement. A measurement history on these error terms is being compiled. Real time instrumental drifts due to temperature and other external effects are removed using cross referenced measurement algorithms. Errors that cannot be accessed by calibration, such as axis non-orthogonality, are obtained by measuring the object in different angular positions within the measurement volume. This technique, which we call multiple redundancy, allows the accessment of all metric errors which do commute with the finite rotation matrix.

709,986
PB-280 799/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Standards Information Service of the National Bureau of Standards.
Final rept.,
W. J. Slattery. Oct 76, 3p
Pub. in Jnl. of Quality Technology, v8 n4 p232-234 Oct 76.

Keywords: *Standards, *Standardization, *Information services, *Information retrieval, National government, Specifications, Tests, Methodology, Reprints, National Bureau of Standards.

The National Bureau of Standards maintains a collection of over 200,000 documents relating to standards, specifications, test methods, codes, and recommended practices. This note describes the services available in retrieving information on standards and standardization activities.

709,987
PB-280 800/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS-SIS: Everything You Wanted to Know About Standards---and More.
Final rept.,
W. J. Slattery. Jun 77, 3p
Pub. in Metric News, v4 n3 p18-20 May/Jun 77.

Keywords: *Standards, *Standardization, *Information services, *Information retrieval, National government, Specifications, Tests, Methodology, Reprints, National Bureau of Standards.

The National Bureau of Standards maintains a reference collection of more than 240,000 U.S., foreign national and international standards, specifications, test methods, codes and recommended practices. This article describes the services available in retrieving information on standards and standardization activities.

709,988
PB-280 801/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Information Center Profile. Standards Information Service.
Final rept.,
W. J. Slattery. Oct 76, 2p
Pub. in Information Hotline, v8 n9 p30-31 Oct 76.

Keywords: *Standards, *Information services, Information retrieval, National government, Standardization, Engineering standards, Reprints, National Bureau of Standards.

This article describes the background leading to the establishment of the NBS Standards Information Services (NBS-SIS). It also discusses the purpose and scope of NBS-SIS activities, services and programs, and lists the publications compiled and their availability.

709,989
PB-280 829/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
State-of-the-Art of Instrumentation for High Temperature Thermometry.
Final rept.,
J. F. Schooley. 1978, 25p
Prepared in cooperation with Argonne National Lab., Ill., and Instrument Society of America, Chicago, Ill. Chicago Section.
Pub. in Proceedings of 1977 Symposium on Instrumentation and Process Control for Fossil Demonstration Plants, Chicago, Ill., Jul 13-15, 1977, p323-347.

Keywords: *Temperature measuring instruments, Temperature measurement, Thermocouples, Thermal noise, Coal, Conversion, Reviews, High temperature.

Current pilot-plant coal conversion operations have exposed several deficiencies in the present practice of industrial temperature measurement. Among these are the limited high-temperature performance (both ultimate temperature limit and rate of failure or of decalibration) of thermocouples which are presently in common use, response time of thermowell-protected temperature sensors, and measurement errors associated with radiation pyrometry. Some of these problems will be discussed in other talks, particularly that of N. Pitcher. Recent innovations in high-temperature thermometry may help to improve both the quality and efficiency of coal conversion processes. The use of specially-prepared tungsten-rhenium alloy thermocouples and platinum-rhodium alloy thermocouples for extended-term temperature measurements above 1200 C is discussed. The use of a new nickel-based (Nicrosil-Nisil) thermocouple for similar measurements below 1200 C is discussed. Also discussed are both the use of velocity-of-sound thermometry, and temperature measurement employing the detection of Johnson noise in resistors. Finally, some general remarks on radiation pyrometry are presented.

709,990
PB-281 337/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stability of Germanium Resistance Thermometers at 20 K.
Final rept.,
L. M. Besley, and H. H. Plumb. Jan 78, 6p
Sponsored in part by Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). National Measurement Lab.
Pub. in Review of Scientific Instruments, v49 n1 p68-73 Jan 78.

Keywords: *Resistance thermometers, Germanium, Resistors, Cryogenics, Stability, Thermal cycling tests.

Thirty germanium resistance thermometers have been thermally cycled 100 times between 20 K and 300 K, and their stability at 20 K has been evaluated. The results reveal a wide range of stabilities, ranging from 0.1 mK to 20 mK. Five different modes of behavior have been provisionally classified as stable, drifting, jumping, bidomal and irregular.

709,991
PB-281 357/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Transportable 1000 pF Capacitance Standard.
Final rept.,
G. Free, and J. Morrow. 1976, 3p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Boulder, Colo. 28 Jun-1 Jul 76, CPEM 1976, IEEE Cat. no. 76CH1099-1 IM p6-8 1976.

Keywords: *Standards, *Capacitance, Stability, Measurement assurance program, Transportable.

A capacitance transport standard has been constructed for use in the NBS MAP's program. The transport was designed so that variations in ambient temperature, and mechanical shock would have a minimal effect on the value of the capacitors. A significant improvement in stability of 1000 pF capacitors during shipment and while in the laboratory has been achieved through this design.

709,992
PB-281 437/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS Physical Standard for the Calibration of Photomask Linewidth Measuring Systems.
Final rept.,
D. A. Swyt. 1977, 8p
Pub. in Society of Photo-Opt. Instrum. Eng., v129 p98-105 1977.

Keywords: *Standards, *Calibrating, *Optical measuring instruments, *Optical microscopes, Line width, Dimensional measurement, Integrated circuits, Masking.

In the final stages of development at the National Bureau of Standards (NBS) is a photomask-like physical standard for the evaluation and calibration of linewidth-measuring optical microscopes, including those of the automatic, closed-circuit TV types. The standard bears clear and opaque lines in the 1 to 10 micrometer (40 to 400 micrometer) range. Primary calibrations of the standard are done on an electron microscope/laser interferometer system with secondary calibrations done on a high-performance photometric optical microscope. The NBS linewidth standard, having line-widths and linespacings distributed in a special way over the range where serious problems in industrial linewidth measurements occur, can be used to detect systematic errors and the biases within measuring systems which cause them. Given in this paper is a constructed numerical example, based on observed effects, of how use of the standard can reveal a number of different types of systematic errors within a single system and can point to likely sources of biases which cause these errors.

709,993
PB-281 974/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Primary Temperature Scale and How to Use It at Low Temperatures.
Final rept.,
R. J. Soulen. 1976, 8p
Pub. in Proceedings ISA-76 Int. Conf. and Exhibit, Houston, TX 11-14 Oct 76, p1-8.

Keywords: *Temperature measurement, Cryogenics, Temperature scales.

Three international practical temperature scales have evolved since 1927. The latest version (IPTS 68), established in 1968, extends from 13.8K to well above room temperature. This scale is maintained by the National Bureau of Standards as the legal basis for all temperature measurements within the United States. This article describes how the scale is made available to a user by means of thermometers calibrated by NBS. It also outlines the process by which the temperature scale is continually revised and improved. Efforts to extend the scale deeper into the cryogenic region as well as to develop suitable fixed points over the full range are reviewed.

709,994
PB-283 169/1 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C.
National Measurement System for Mass, Volume and Density.
Final rept.,
P. E. Pontius, J. R. Whetstone, and J. A. Simpson. May 78, 73p NBSIR-75-928

Keywords: *Measurement, Mass, Volume, Density(Mass/volume), National Measurement System.

This document, one of several similar documents resulting from the NBS study of the National Measurement System, reflects the results of intensive studies carried out from 1972-1975 relative to Mass, Volume and Density measurements in the United States. The history and the current status of these measurements are discussed as well as the relative role of NBS. A bibliography is included.

709,995
PB-283 929/8 PC **A08**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of International Relations.
Standardization in Support of Development,
H. S. Peiser, and J. A. Birch. May 78, 172p NBS-SP-507
Proceedings of a Seminar, Held at the National Bureau of Standards, Gaithersburg, Maryland on October 17-18, 1977. Library of Congress Catalog Card no. 78-7249. Prepared in cooperation with Agency for International Development, Washington, D.C., American National Standards Inst., New York, and American Society for Testing and Materials, Philadelphia, Pa.

Keywords: *Developing countries, *Standardization, *Measurement, *Meetings, Engineering, Industries, Quality control, Argentina, Bangladesh, Bolivia, Egypt, Ghana, Indonesia, Iran, Kenya, Korea, Philippines, Thailand, National Bureau of Standards, Government programs.

The National Bureau of Standards held a two-day Seminar in an effort to appraise the benefits derived form six years of a cooperative program with developing countries designed to improve their standardization and measurement services. With financial support from the Agency for International Development, participants came from Argentina, Bangladesh, Bolivia, Egypt, Ghana, Indonesia, Iran, Kenya, Korea, the Philippines, and Thailand; from regional and international organizations; from key U.S. standards writing bodies; and from industries, professional societies and government in the United States. The papers presented and the discussions were organized around the session titles: Six Years of National Bureau of Standards and Agency for International Development Programs, and Standardization in the U.S.A.--A Resource for Development. It was concluded that the developing countries concerned with this program had benefited in a variety of ways from the standards surveys and workshops conducted by the National Bureau of Standards in cooperation with them, and that efforts should be made to continue the program with full support. Questions were raised, but no consensus reached on the desirability of standardization being proposed as a distinct topic for the U.N. Conference on Science and Technology for Development.

709,996
PB-285 112/9 PC **A14**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Report of the 62d National Conference on Weights and Measures, 1977.
Final rept.
Aug 78, 306p NBS-SP-517
Held at Dallas, Texas on July 17-22, 1977. Library of Congress Catalog Card no. 26-27766.

Keywords: *Units of measurement, *Standards, *Meetings, Weight measurement, Dimensional measurement, Inspection, Specifications, Tolerances(Mechanics), Marking, Metric system, Packaging, United States, *Weights and measures, *Metrication.

This is a report of the proceedings (edited) of the 62nd National Conference on Weights and Measures, sponsored by the National Bureau of Standards, held in Dallas, Texas, July 17-22, 1977, and attended by state, county, and city weights and measures officials, the Federal Government, business, industry, and consumer organizations. Major issues discussed at this Conference metric conversion in the United States; problems relating to the quantity fill, labeling, and inspection of packaged commodities; requirements covering the design and performance of new weighing and measuring technology; and recommendations for improvement in weights and measures administration.

709,997
PB-285 217/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cryogenic Pressure Regulator.
Final rept.,
D. E. Daney. Apr 78, 2p
Pub. in Jnl. Cryogenics, v18 n4 p234-235, Apr 78.

Keywords: *Pressure regulators, Cryogenics, Flow control, High vacuum, Liquid helium, Reprints.

A simple, dome-loaded pressure regulating valve suitable for use in a low temperature, high vacuum environment is described. Design principles and operating characteristics are given as well.

709,998
PB-285 371/1
Order as PB-281 311/1, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Comments on Units in Magnetism.
L. H. Bennett, C. H. Page, and L. J. Swartzendruber. 26 Aug 77, 4p
Included in Jnl. of Research of the National Bureau of Standards, v83 n1 p9-12, Jan-Feb 78.

Keywords: *Magnetism, *Units of measurement, Magnetic properties.

Suggestions are given on how to express magnetic quantities in SI units.

709,999
PB-285 404/0
(Order as PB-285 398/4, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Equations of Motion for Thermally Driven, Buoyant Flows.
R. G. Rehm, and H. R. Baum. 17 Jan 78, 12p
Included in Jnl. of Research of the National Bureau of Standards, v83 n3 p297-308, May-Jun 78.

Keywords: *Fires, *Gas flow, Equations of motion, Flow fields, Approximation, *Fire research, Buoyant flow.

In this paper a set of approximate equations is derived which is applicable to very nonadiabatic, nondissipative, buoyant flows of a perfect gas. The flows are assumed to be generated by a heat source in which the heat is added slowly. The study is motivated by the occurrence of such flows in fires. There, the time scale associated with the fire growth and resultant fluid motion is usually long compared with the transit time of an acoustic signal (based on the temperature derived from the heat added) across the spatial extent of the fire. The approximate equations are characterized by a spatially uniform mean pressure appearing in both the energy equation and the equation of state with the spatially nonuniform portion of the pressure only appearing in the momentum equation. Therefore, the pressure remains almost constant in space while significant density and temperature variations, such as might occur in a fire, are allowed. The approximate equations are shown to reduce to the Boussinesq equations when the heat addition is mild. These equations are also shown in general to admit internal-wave motions while 'filtering out' high-frequency, acoustic waves. In addition, they are shown to be expressible in conservation form, the pressure satisfying an elliptic equation whose homogeneous terms are derivable from the wave equation by letting the sound speed become infinite. An equation for the mean pressure is also obtained. For the special case of a room heated at a uniform rate with a small leak to the outside, an approximate solution for the mean pressure is determined explicitly.

710,000
PB-286 790/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Recent Advances in Cryothermometry at NBS.
Final rept.,
R. P. Hudson. 1978, 6p
Pub. in Advances in Refrigeration at the Lowest Temperatures p137-142. International Inst. of Refrigeration, Paris, France. 1978.

Keywords: *Temperature measurement, *Cryogenics, Standards, Reprints, Scale.

When the International Practical Temperature Scale of 1968 is replaced in the future it will be extended below its present limit of 13.81K, perhaps to 0.001K. At NBS, several studies are in progress which are aimed to furnish the information which will facilitate that extension. A brief summary is given of the present situation in these researches which bear upon thermometry using noise, nuclear orientation, NMR, gas expansion, and germanium resistance, and upon superconducting fixed points.

710,001
PB-287 496/4 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Fluid Engineering Div.
Low Velocity Performance of a Compact Impact-Deflection Anemometer.
Task rept.
L. P. Purtell. Sep 78, 29p NBSIR-78-1544
Contract H0166198

Keywords: *Anemometers, *Calibration, Air flow, Wind tunnel tests, Speed indicators, Standard deviation, Test facilities, Laser velocimeters, Low velocity.

Performance of a compact impact-deflection anemometer is evaluated over the speed range of 50.8 to 716 feet per minute. The tests were performed in the NBS Low Velocity Airflow Facility which provides a uniform flow of low turbulence and uses a laser velocimeter as the velocity standard.

710,002
PB-287 932/8 PC **A06**/MF **A01**
Public Interest Economics Center, Washington, DC.
Taxonomy of Incentive Approaches for Stimulating Innovation.
Final rept.
J. Booth, Z. Cook, and A. R. Ferguson. Aug 78, 103p
NBS-GCR-ETIP-78-53
Contract 8-12548

Keywords: *Air pollution, *Industrial wastes, *Technology innovation, *Incentives, Grants, Investments, Decision making, Contracts, Performance standards, Taxes, *Subsidies, *Tax credits.

This report consists of a taxonomy of incentive approaches for stimulating technological innovation in the private sector with an example of how the table can be used. The example used is the need to spur new technology for stationary air pollution abatement.

710,003
PB-288 091/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Signal Waveform Metrology at NBS.
Final rept.
N. S. Nahman. 1977, 3p
Pub. in Proceedings of WESCON/77, Electronics at the Golden Gate, Held at San Francisco, CA. on September 19-21, 1977 10p.

Keywords: *Waveforms, Metrology, Measurement, Time domain.

The Electromagnetics Division of the National Bureau of Standards (Boulder, Colorado) has a major effort in time domain measurements within the Signal Waveform Metrology Section. The technical responsibilities of the section include physical standards and measurement methods relevant to the characterization of both electrical and optical waveforms, their measurement systems, and the time domain responses of components and networks through which such waveforms pass. The technical activities of the program are reviewed relative to picosecond/nanosecond domain, continuous and sampled data measurements in real and equivalent time for both electrical and optical signal waveforms. Applications of the NBS Automatic Pulse Measurement System/Time Domain Automatic Network Analyzer (APMS/TDANA) to such measurements are presented.

710,004
PB-288 534/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
EPT-76: A Provisional Temperature Scale for the Region 0.5K to 30K.
Final rept.
R. P. Hudson. 1978, 5p
Pub. in Proceedings ISA-78 Natl. Conf. and Exhibit, Philadelphia, PA 15-19 Oct 78, p7-11. (Instrument Society of America, Pittsburgh, PA, 1978).

Keywords: *Temperature measurement, *Cryogenics, Units of measurement, Temperature scale.

The Advisory Committee on Thermometry (CCT) of the International Committee on Weights & Measures (CIPM) has developed a provisional low temperature scale to cover the range 0.5K to 30K. This scale is intended to serve low temperature scientists in the period between now and the next revision of the International Practical Temperature Scale. The development and implementation of PTS-76 are discussed.

710,005
PB-288 661/2 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Precision Laboratory Standards of Mass and Laboratory Weights.
T. W. Lashof, and L. B. Macurdy. Oct 78, 30p
NBSIR-78-1476
See also Rept. no. NBS-SP-250-1978, dated Apr 78, PB-279 459.

Keywords: *Standards, *Mass, *Weight(Mass), Laboratories.

National Bureau of Standards, Circular 547 Section 1, Precision Laboratory Standards of Mass and Laboratory Weights, served for many years as a defining authority for various classes of weights and associated adjustment tolerances. Technological and organizational changes which occurred within a few years after the issuance gradually led to its obsolescence and consequently, it has been out of print for some time. In the interim, a new standard ASTM E617-78, 'Lab Weights Precision Mass Standards,' has been issued updating the same subject matter. There are still numerous requests for Circular 547 since it is widely referenced in the literature. While the document is reprinted in its entirety in NBS Handbook 77, this source is also out of print and available only at certain repository libraries. Because of technical content and historical value of Circular 547, it is being issued in the NBSIR series of documents, to be available through NTIS. It should be noted, however, that for matters concerning calibration, one should refer to the latest copy of NBS SP250, Calibration and Test Services of the National Bureau of Standards, available from the Office of Measurement Services.

710,006
PB-288 793/3 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Thermal and Service Systems Div.
Evaluation of ASHRAE Standard 94-77 for Testing Water Tanks for Thermal Storage.
B. J. Hunt, T. E. Richtmyer, and J. E. Hill. Oct 78, 75p NBSIR-78-1548
Sponsored in part by Department of Energy, Washington, DC. Research and Development Branch for Solar Heating and Cooling.

Keywords: *Water tanks, *Standards, Tests, Heat storage, Evaluation, Solar heating, Thermal efficiency, Heat loss, Thermal energy storage equipment.

The National Bureau of Standards proposed a standard test procedure for rating thermal storage devices, in mid-1975. Early in 1977, the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) adopted ASHRAE Standard 94-77 Method of Testing Thermal Storage Devices Based on Thermal Performance, which is based substantially on the NBS procedure. In order to evaluate the Standard, NBS has conducted an experiment in which a 1.9 cu m (500 gal) water tank, built as part of a residential solar heating and cooling system, was tested in accordance with this Standard. A description of the test apparatus, test procedure, and detailed test results are given. It was found that there were no major problems encountered in using the Standard for this kind of thermal storage device. In addition, suggestions are made for minor modifications in the Standard.

710,007
PB-294 364/5 PC **A08**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Metrology in Industry and Government: How to Find Out Who Needs What Services.
H. S. Peiser, R. C. Sangster, and W. Jung. Apr 79, 173p NBS-SP-539
Sponsored in part by Korea Standards Research Inst., Dae Jeon, Agency for International Development, Washington, DC., Ministry of Commerce and Industry (Republic of Korea). Industrial Advancement Administration., and Ministry of Science and Technology, Seoul (Korea). Library of Congress catalog card no. 79-600040.

Keywords: *Metrology, *Meetings, Measurement, Requirements, Industries, Korea.

A regional seminar sponsored by the Korea Standards Research Institute, the National Bureau of Standards, and the U.S. Agency for International Development was held at the new K-SRI Laboratories at Daeduk near Dae Jeon in the Republic of Korea on September 27-28, 1978. The participants representing most of the countries in the South Asian and Western Pacific Region discussed the importance of providing services in measurement science and technology (metrology) to governmental and industrial organizations in the region. The consensus was that a need for a central national capability in metrology existed in countries at all levels of development, and that that central organization could be a focal point for intra- and international cooperation, which alone could lead to compatibility of measurements, a prerequisite for quality control for all kinds of products in domestic and international markets. Australia and New Zealand had established a group of accredited test laboratories to disseminate the accuracies inherent in the national measurement system. Industry was increasingly aware that metrology was essential to development, but the specific needs at appropriate accuracies needed to be established by surveys. The Korean Government strongly supported the establishment of metrological services as is well illustrated by the new K-SRI laboratories.

710,008
PB-296 044/1 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Mechanical Engineering and Process Technology.
Recent Improvements to the ASTM-type Ultrasonic Reference Block System.
Final rept.
D. J. Chwirut. Apr 79, 54p NBSIR-79-1742
Contract F33615-76-F-6751
Sponsored in part by Air Force Materials Lab., Wright-Patterson AFB, OH., Army Materials and Mechanics Research Center, Watertown, MA., and National Aeronautics and Space Administration, Washington, DC.

Keywords: *Standards, Ultrasonic radiation, Transducers, Aluminum, Quartz, Steels, Titanium, Calibrating, Measurement, Reference blocks, Measurement assurance program.

Recent activities aimed toward improving the ASTM-type ultrasonic reference block system are described. On the aluminum block system (ASTM E 127 and NBS TN 924), efforts were focused on better definition of the measurement equipment (transducer and instrument), the implementation of a Measurement Assurance Program and Loaner Block Service, and modeling of the distance-amplitude relationship. It is shown that a large increase in the precision of reference block readings is easily achievable by implementing simple changes and controls in the measurement procedure. On steel and titanium blocks (e.g. ASTM E-428), efforts were directed toward quantifying the extent of reproducibility possible among blocks fabricated by both conventional drilling and by diffusion bonding. Reasonable reproducibility is achieved by both, with the diffusion-bonding process offering both advantages and disadvantages.

710,009
PB-296 236/3 PC **A15**/MF **A01**
National Bureau of Standards, Washington, DC.
Report of the National Conference on Weights and Measures (63rd).
H. F. Wollin, L. E. Barbrow, and A. P. Heffernan. Feb 79, 326p NBS-SP-532
Library of Congress catalog card no. 26-27766. See also 62nd Conference dated Aug 78, PB-285 112.

Keywords: *Units of measurement, *Standards, *Meetings, Weight measurement, Dimensional measurement, Inspection, Specifications, Tolerances(Mechanics), Marking, Metric system, Electromagnetic interference, Packaging, United States, Consumer affairs, *Weights and measures, *Metrication.

Major issues discussed at this Conference included metric conversion in the United States; problems relating to the quantity fill, labeling, and inspection of packaged commodities; requirements covering the design and performance of new weighing and measuring technology; and recommendations for improvement in weights and measures administration.

710,010
PB-297 151/3 PC **A04**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Office of Measurement Services.
Catalog of Federal Metrology and Calibration Capabilities, 1979 Edition.
K. O. Leedy. Jun 79, 57p NBS/SP-546
Library of Congress catalog card no. 79-600075.

Keywords: *Test facilities, *Laboratories, Metrology, Calibrating, National government, Directories, United States.

This publication lists Federal laboratories involved in metrology and calibration. Included is the name of a person at each laboratory to contact for more information as well as the laboratory telephone number and address. The capabilities of each laboratory are indicated in a tabular listing by agency. To provide geographical distribution, the laboratories are listed by States. In addition, the laboratories are shown on a map by coded number. Other references are described.

710,011
PB-297 708/0 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC.
Calibration of a Roundness Standard.
Final rept.
C. P. Reeve. Jun 79, 23p NBSIR-79-1758

Keywords: *Circles(Geometry), *Metrology, *Calibrating, Standards, Accuracy, Measurement, Spheres, Hemispheres, Cylindrical bodies, Mathematical models.

For the past decade the National Bureau of Standards has been making high precision roundness measurements using an algorithm which allows the spindle out-of-roundness to be separated from the true profile of the workpiece. The algorithm requires multiple traces on a roundness measuring instrument, and the resulting redundancy provides an estimate of the measurement precision. The primary purpose of this paper is to describe in detail the mathematical model used for this measurement process. Some related topics are discussed briefly and an example is given.

710,012
PB-298 373/2 CP **T05**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Program Package for Metric Conversion.
Software.
J. O. Harrison. Jul 75, mag tape NBS/DF-79/002
Source tape is in EBCDIC character set. Tapes can be prepared in most standard 7 or 9 track recording modes for one-half inch tape. Identify recording mode desired by specifying character set, track, density, and parity. Call NTIS Computer Products if you have questions. Price includes documentation, COM 75-10960.

Keywords: *Software, *Metric system, Conversion, Magnetic tapes, Fortran, Univac-1108 computers.

The programs in this package are designed to convert dimensions and other quantities appearing on engineering drawings from metric to U.S. customary units and vice versa. They were developed by Caterpillar Tractor Co. and General Motors Corporation. In addition to the programs themselves, the package contains documentation explaining how to get the programs running on different computers and how to use them, and test problems to permit users to verify that the programs run correctly on their own computers. The Caterpillar program converts 31 different metric units to their U.S. customary equivalents. In contrast, the General Motors programs convert in both directions but work with millimetres and inches only. The General Motors programs also use rounding conventions differing somewhat from those employed in the Caterpillar program. Both the Caterpillar and the General Motors programs are written in American National Standard Fortran and are suitable for use on a wide range of computers with little or no modification. The Caterpillar program is operated in batch mode while the General Motors programs are interactive...Software Description: The program is written in the Fortran programming language for implementation on a UNIVAC 1108 computer using the Execu 8 operating system. 64K bytes of core storage are required to operate the model.

710,013
PB-298 883/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fracture Mechanics Analysis of Pipeline Girthwelds.
Final rept.,
H. I. McHenry, D. T. Read, and J. A. Begley. 1979, 11p
Sponsored in part by Department of Transportation, Washington, DC. Materials Transportation Bureau.
Pub. in American Society for Testing and Materials, Special Technical Publication 668, p632-642 1979.

Keywords: *Pipelines, *Welded joints, Pipe joints, Weld defects, Fracture(Materials), Toughness, Manganese steels, Reprints, Fracture(Mechanics).

Size limits for surface flaws in pipeline girthwelds are calculated on the basis of fracture mechanics analysis. Parameters for the analysis were selected from data on a 1.22-m-diameter (48 in.), 12-mm-thick (0.46 in.) pipe welded by the shielded metal-arc process. The minimum fracture toughness of the welds as determined by the crack opening displacement (COD) method was 0.1 and 0.18 mm (0.004 and 0.007 in.), depending on the flaw location. The yield strength of the welds was 413 MPa (60 ksi). Because the toughness to yield strength ratio was high, elastic-plastic fracture mechanics analysis methods were required to determine critical flaw sizes.

710,014
PB-300 579/0 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Analysis of the Pneumatic Burst of a Large Seamless Steel Pressure Vessel in Natural Gas Service.
Failure analysis rept. (Final).
B. W. Christ. Mar 79, 121p NBSIR-78-1589, DOT/MTB/OHMR-78/4, DOT/RSPA/MTB-78/4
Contract DOT-AS-40034
Color illustrations reproduced in black and white.

Keywords: *Gas cylinders, *Pressure vessels, Bursting, Tank trucks, Fractures(Materials), Stress analysis, Analyzing, Natural gas, Stress corrosion.

A metallurgical evaluation and fracture analysis was made of a pneumatically-burst seamless steel compressed gas cylinder which was used for over-the-highway transport of natural gas. The relevant specification for this pressure vessel is Specification DOT 3T. The cylinder was 34-feet long by 22-inches diameter, with a wall thickness of about 1/2-inch. It was new and had been in service for about a week. The cylinder burst during filling. Reported burst pressure was believed to be 2,200 to 2,500 psi. Expected burst pressure was 6,800 psi. Tensile strength of this quenched and tempered low alloy steel pressure vessel (0.44 carbon - 0.92 manganese - 0.98 chromium - 0.20 molybdenum) ranged between 136,200 and 170,500 psi. The cylinder ruptured due to environmentally-assisted cracking. The fracture originated at a part-through crack in a region of high tensile strength. At the time of rupture, the fracture origin was about 1.3-inches long and penetrated half the wall thickness from the inside. Four other part-through cracks were found in the vicinity of the fracture origin. They were linked to tiny circumferential cracks (blister cracks) in rather hard microzones (HRC 40 to 45) within about 0.01-inches of the inside wall. Up to 500 ppm by volume of hydrogen sulfide was detected in gas samples taken from the natural gas wells after the incident. Evidence of sulfur was found on the fracture origin and on the inside wall. It was concluded that the rupture was due to the internal gas pressure acting on the region of the fracture origin.

710,015
PB-300 702/8 Not available NTIS
National Bureau of Standards, Washington, DC.
New Testing and Rating Procedures for Seasonal Performance of Heat Pumps.
Final rept.,
D. A. Didion, and G. E. Kelly. 1979, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in ASHRAE Jnl., p40-44 Sep 79.

Keywords: *Heating equipment, Performance tests, Seasonal variations, Standards, Ratings, Reprints, *Heat pumps.

Current testing and rating procedures for heat pumps have served industry and the consumer well for many years. These steady-state (SS) full-load evaluation procedures allow for the capacity determination needed for sizing the unit to the building loads. They also serve as an efficiency evaluation for comparing the relative merits of various units. However, with the ned for energy conservation, and with increasing energy costs, buildings and their equipment have come to require a life-cycle-cost analysis instead of the traditional first-cost approach. In order to provide a better estimate of operational costs, the heat pump industry needs a more comprehensive evaluation technique to obtain data during part-load, cyclic operation. Although the wide variety of types of heat-pump installations and climates makes field performance impractical as a basis for this cost analysis, laboratory part-load simulation can increase the input for a reasonable testing investment. Part-load laboratory evaluation offers two added benefits; a more accurate estimate of energy usage on an absolute basis, hence a better comparison between heat pumps and other equipment, needed at least for the heating mode; and encouragement to manufacturers to develop a more efficient product, since they can get more credit for their innovations.

710,016
PB80-103823 Not available NTIS
National Bureau of Standards, Washington, DC.

General

Review of Hydrodynamics and Heat Transfer for Large Helium Cooling Systems.
Final rept.,
M. C. Jones, and V. D. Arp. Aug 78, 8p
Pub. in Cryogenics 18, n8, p483-490, Aug 78.

Keywords: *Cooling systems, Helium, Heat transfer, Hydrodynamics, Magnets, AC generators, Power transmission lines, Reprints.

The paper is a review of recent experimental results and computational methods needed for the fluid engineering aspects of helium cooling systems for power applications. The discussion is illustrated by three different applications: large magnets; power transmission lines, and ac generators. An attempt is made to put recent research into perspective, considering the requirements of each application, and problems in need of further research are pointed out.

710,017
PB80-104359 Not available NTIS
National Bureau of Standards, Washington, DC.
Fitness for Purpose Evaluation of Defects in Pipeline Girthwelds.
Final rept.,
H. I. McHenry. 1979, 6p
Pub. in Proceedings of the Structural Integrity Technology Conference Held at Washington, DC. on May 9-11, 1979, p39-44 1979.

Keywords: *Welded joints, *Weld defects, Pipelines, Computation, Fractures(Materials), Evaluation.

Fracture-mechanics principles are used to calculate allowable-flaw-size curves according to guidelines set by OPSO. All flaws are considered to be surface cracks. Initially, the curves are calculated by determining the largest flaw that would not grow through the pipe thickness during thirty years of worst-case operation. The curves are then modified by incorporating safety factors contained in the OPSO documents. This procedure defines accept and reject regions on a flaw-length versus flaw-depth plot. Curves defining these regions are developed using four distinct elastic-plastic fracture-mechanics methods: a critical crack-opening-displacement model, the Draft British Standard method, a plastic-instability model, and a semi-empirical model. Maximum stress, worst-case fatigue, a minimum toughness are assumed in all models. Separate sets of curves are developed for planar flaws, for non-planar flaws, and for arc burns.

710,018
PB80-121296 Not available NTIS
National Bureau of Standards, Washington, DC.
Differential Capacitance Sensor as Position Detector for a Magnetic Suspension Densimeter.
Final rept.,
N. V. Frederick, and W. M. Haynes. Sep 79, 2p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC. Prepared in cooperation with American Gas Association, Inc., Arlington, VA.
Pub. in Rev. Sci. Instrum. 50, n9 p1154-1155 Sep 79.

Keywords: *Densitometers, Detectors, Position finding, Reprints, Magnetic suspension, Differential capacitance sensors.

A differential capacitance sensor has been used in the servosystem of a magnetic suspension densimeter to detect the position of a magnetic buoy. This type of sensor has not previously been used in this application. Its design, performance, and advantages are described.

710,019
PB80-127962 Not available NTIS
National Bureau of Standards, Washington, DC.
Thoughts on the Stability of Strain Gages and Strain Gage Based Transducers Under Load.
Final rept.,
R. L. Bloss. 1976, 3p
Pub. in Proceedings of the Technical Committee on Strain Gages in Field Test Environments Held at Silver Spring, MD., on May 10, 1976, p16-18 1976.

Keywords: *Strain gages, Stability, Transducers, Loads(Forces).

Although information exists on the change of strain gage and transducer response with time during storage and when occasional load cycles are imposed, there is almost no published information on the changes that occur when loads are sustained for long periods of time (week to years). This paper speculates on factors that could cause various changes and suggests that an effort should be made to evaluate some of these factors.

710,020
PB80-131022 Not available NTIS
National Bureau of Standards, Washington, DC.
Spherical Acoustic Resonators for Temperature and Thermophysical Property Measurements.
Final rept.,
M. R. Moldover, M. Waxman, and M. Greenspan. 1979, 12p
Pub. in High Temperature - High Pressures 11, p75-86 1979.

Keywords: *Cavity resonators, Temperature measurement, Thermophysical properties, Measuring instruments, Gases, Acoustic velocity.

A theoretical and experimental study is reported of the advantages and limitations of using the acoustic radial resonances in a spherical cavity to obtain thermophysical property data in dilute gases. The velocity of sound in dilute gases (0.1-0.5 MPa) is now measured with an accuracy of 0.02% and a precision of 0.001%, and a significant increase in accuracy is anticipated. The measurements are at sufficiently low frequencies (3-15 kHz) to be of value in determining thermophysical properties in many polyatomic gases.

710,021
PB80-131030 Not available NTIS
National Bureau of Standards, Washington, DC.
Accurate Thermocouple Thermometry.
Final rept.,
L. A. Guildner, and G. W. Burns. 1979, 20p
Pub. in High Temperature - High Pressures 11, p173-192 1979.

Keywords: *Temperature measurement, *Thermocouples, Accuracy, Tungsten alloys, Rhenium containing alloys, Platinum alloys, Rhodium containing alloys, Tungsten alloy 3Re, Tungsten alloy 25Re.

To obtain high accuracy by thermocouple thermometry, a combination of factors must be satisfied: a choice of thermocouple consistent with the chemical and physical conditions of the experiment; its annealing, verification of homogeneity and subsequent calibration; the selection of insulators and sheaths; and an installation to achieve adequate temperating and sensing of the desired temperature. Thermocouples that have been standardized are reviewed along with research and development work on W-3%Re/W-25%Re, Nicrosil/Nisil and Pt-Rh combinations that have given improved high-temperature measurements. Thermocouples for high accuracy and stability are recommended for a given temperature range and conditions of experiment, with their sensitivities, stability, and compatible choices of insulators and sheaths.

710,022
PB80-132772 Not available NTIS
National Bureau of Standards, Washington, DC.
Anomalous Cooling Power of Dilution Refrigerators and the Heat of Transport of He3-He4 Solutions.
Final rept.,
E. Polturak, R. Rosenbaum, and R. J. Soulen. Dec 79, 10p
Sponsored in part by Israel Commission for Basic Research United States--Israel Binational Science Foundation, Jerusalem.
Pub. in Cryogenics 19, n12, p715-724, Dec 79.

Keywords: *Refrigerators, Cooling, Liquid helium, Cryogenics, Helium 3, Helium 4, Refrigerating, Reprints, *Dilution refrigerators.

The experimental cooling power of a dilution refrigerator employing two mixing chambers was found to exceed the theoretical cooling power by as much as 50%: with a single mixing chamber the experimental cooling power exceeded the theoretical value by 15%. This excess cooling power is explained by assuming that the He3 flow is partially diffusive. Information concerning the thermal diffusion ratio and the He3 relaxation time in a He(3)-He(4) solution is extracted from the data.

710,023
PB80-142995 Not available NTIS
National Bureau of Standards, Washington, DC.
Metrology for Submicrometer Devices and Structures.
Final rept.,
W. M. Bullis. 1979, 12p
Pub. in Proceedings of the Microcircuit Engineering Microstructure Fabrication Conference, 1979, Aachen, West Germany, September 25-27, 1979, p271-282 1979.

Keywords: *Metrology, *Microelectronics, Reviews.

The metrological requirements of semiconductor microelectronics, always challenging, are made even more stringent by the trend toward submicrometer devices and structures. This comes about not only because of the obvious demands associated with the smaller feature sizes of circuit elements but also because of the attendant requirements for more efficient design verification aids, computer simulations, and process validation and control techniques and because of the concurrent trend toward larger die and package sizes. This paper examines the types of metrological requirements associated with submicrometer devices and structures, summarizes the present state of the art in selected critical areas of metrology, and reviews current research and development efforts on advanced measurement technology, especially those at the National Bureau of Standards.

710,024
PB80-146129 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Metrology for Electromagnetic Technology: A Bibliography of NBS Publications.
R. A. Kamper. Jan 80, 43p NBSIR-79-1625
See also PB-246 439.

Keywords: *Bibliographies, *Metrology, Microwaves, Lasers, Fiber optics, Electromagnetic radiation, Cryogenics, Measuring instruments, Electronics, Superconductors, Josephson junctions, Time domain, National Bureau of Standards.

This bibliography lists the publications of the present personnel of the Electromagnetic Technology Division of NBS in the period from January 1970 through September 1979. The following topics are considered: Microwave metrology; Optical electronic metrology; Time domain metrology; Cryoelectronic metrology. A few earlier references that are directly related to the present work of the division are included.

710,025
PB80-156912 Not available NTIS
National Bureau of Standards, Washington, DC.
International Practical Temperature Scale.
Final rept.,
H. H. Plumb. Sep 74, 5p
Pub. in Journal of Metric System Guide Bull. No. 11, p1-5, Sep 74.

Keywords: *Units of measurement, *Temperature measurement, Reprints.

Many individuals and manufacturers of thermometers use the degree Fahrenheit as the unit of temperature. However, the trend, as judged by textbooks and courses at schools and universities, is to express temperature in degrees Celsius. The reason for this conversion is that the degree Celsius is used in international temperature scales, such as IPTS-68. This temperature scale and its relation to the Fahrenheit and Celsius scales are explained in this article.

710,026
PB80-161755 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Defect Characterization and Dimensioning of Cracks in Welds by the Ultrasonic Diffraction Method,
S. Golan. Mar 80, 27p NBSIR-80-1983

Keywords: *Welded joints, *Ultrasonic tests, Cracks, Nondestructive tests, Feasibility.

The possibility of applying an ultrasonic diffraction method for dimensioning of crack-line defects in welds was investigated. A feasibility study was carried out and optimum test conditions were established using a series of test specimens with narrow slits. A series of welded specimens with in-weld cracks were tested. The possibility of using a quantitative diffraction tech-

nique for nondestructive examination of pipeline welds in field conditions is discussed.

710,027
PB80-166267 PC **A15**/MF **A01**
National Bureau of Standards, Washington, DC. Office of International Relations.
Standardization and Measurement Services in Indonesia.
Final rept.,
H. S. Peiser, N. J. Raufaste, R. C. Sangster, B. M. Gutterman, and P. M. Odar. Sep 79, 350p NBSIR-78-1583
Grant PASA-TA(CE)-6-71

Keywords: *Measurement, *Standards, *Indonesia, Standardization, Calibrating, Metrology.

At the request of the Indonesian State Minister for Research and Technology, the National Bureau of Standards conducted a two-week survey of standardization and measurement systems in support of industrialization. There were six topics of specialization: (1) Food and Food Safety, (2) Building and Construction, (3) Quality Control in Industry, (4) Safety Standards, (5) Calibration, Instrumentation, and Metrology, and (6) Industrial Measurement Techniques. In the executive summary the appraisal of the existing systems for standardization and measurement is coupled with recommendations. A background section is followed by one with the Indonesian specialists' assessments of needs and opportunities.

710,028
PB80-175128 PC **A14**/MF **A01**
National Bureau of Standards, Washington, DC.
Report of the National Conference on Weights and Measures (64th).
H. F. Wollin, L. E. Barbrow, and A. P. Heffernan. Mar 80, 316p NBS-SP-566
Held at Portland, Oregon, on July 23-27, 1979. See also 63rd Conference dated Feb 79, PB-296 236. Library of Congress catalog card no. 26-27766.

Keywords: *Units of measurement, *Standards, *Meetings, Weight measurement, Dimensional measurement, Inspection, Specifications, Tolerances(Mechanics), Metric system, Packaging, Consumer affairs, United States, *Weights and measures, *Metrication.

This is a report of the proceedings (edited) of the Sixty-fourth National Conference on Weights and Measures attended by State, county, and city weights and measures officials, and representatives of the Federal Government, business, industry, and consumer organizations. Major issues discussed at this Conference included metric conversion in the United States, particularly the conversion of gasoline dispensers, problems relating to the quantity fill of packaged commodities, especially as affected by moisture loss, statistical approach to package checking, Federal grain inspection, and a legal metrology control system.

710,029
PB80-181811 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fluid Friction Losses in Two Sets of Black Steel Pipe of Recent Manufacture.
Final rept.,
J. R. Whetstone. May 80, 46p NBSIR-80-2041
Sponsored in part by American Iron and Steel Inst., Washington, DC.

Keywords: *Metal pipe, *Fluid friction, Pipe flow, Friction tests, Pressure gradients, Flow rate, *Friction loss.

Two sets of black steel pipes have been tested at the National Bureau of Standards (NBS) to determine their frictional loss characteristics. Twenty foot lengths of pipe furnished by the American Iron and Steel Institute ranging from one to three inches nominal pipe size were tested using water in the primary flow measurement facilities at NBS. These facilities use static gravimetric techniques with precision timing to determine flow rates to within plus or minus 0.13% based upon three standard deviations. Pipe pressure losses were measured using water and mercury manometers for pipe flow velocities ranging from 4 to 16 feet per second. Frictional loss characteristics of each pipe were characterized using the conventional Hazen-Williams formulation at each flowrate.

710,030
PB80-182132 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Calibration of Angle Blocks by Intercomparison.
Final rept.,
C. P. Reeve. Apr 80, 27p NBSIR-80-1967

Keywords: *Geometric surfaces, *Angles(Geometry), *Calibration, Flatness, Measurement, Angular resolution, Mathematical models, Standard deviation, *Angle blocks, *Test blocks.

One service performed by the National Bureau of Standards is the calibration of angle blocks. Test blocks normally come in sets of 16 nominal sizes from 1 second to 45 degrees. Their angular values are calibrated by intercomparison with NBS master angle blocks and other test blocks of the same nominal size. Each test block is also measured for its maximum out-of-flatness and out-of-squareness. Statistical tests are performed in order to maintain control over the short-term and long-term variability of the measurement process. A complete description of the measurement process is given with special attention paid to the mathematical model for the measurements and the least squares estimation of the angular values. The method for determining the standard deviations of the short-term and long-term errors is also given.

710,031
PB80-187206 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Office of International Relations.
National Bureau of Standards and Agency for International Development (NBS/AID) Course on Weights and Measures Services.
Final rept.,
H. S. Peiser, C. C. Raley, A. D. Tholen, and P. M. Odar. Apr 80, 86p NBSIR-80-2022
Grant PASA-TA(CE)-6-71

Keywords: *Standards, *Units of measurement, *Meetings, Developing countries, United States, Measurement, Weight measurement, Measuring instruments, *Weights and measures, Training.

The report concerns a course held during the period July 15-27, 1979, on weights and measures services. The object of the course was to give weights and measures officials of industrializing nations insight into the weights and measures systems of the United States and the role of the National Bureau of Standards, so that these officials might consider what parts of the U.S. system might usefully be adapted to conditions in their home countries. An exchange of experience in each of the participant's countries was presented by delivered papers which are reproduced here. Countries represented included Egypt, Honduras, India, Liberia, Mexico, Nigeria, Sri Lanka, Sudan, Thailand, and Tunisia.

710,032
PB80-191380 Not available NTIS
National Bureau of Standards, Washington, DC.
Refrigeration for Small Superconductive Devices.
Final rept.,
J. E. Zimmerman, R. Radebaugh, and J. D. Siegwarth. 1976, 8p
Sponsored in part by Office of Naval Research, Arlington, VA. and Naval Electronics Systems Lab., Washington, DC.
Pub. in Proc. Intl. Inst. of Refrigeration Commission A 1-2 und Deutscher Kaelte- und Klimatechnischer-Verein Commission I Joint Meeting, Munich (Germany, F.R.), Oct. 76. Paper in Developments in Cryogenic Techniques in the 1-20K Range, p53-60. International Inst. of Refrigeration, Paris (France) 1976.

Keywords: *Refrigerators, Cryogenics, *Cryogenic refrigerators, Superconducting devices, Low cost.

The present state of the art is such that the greatest cost in using small superconducting devices, in many applications, is the expense and inconvenience of the associated cryogenic system. The practicality of such devices would be greatly enhanced, therefore, if a practical and economical self-contained, closed-cycle cryocooler could be made compatible with such devices. An experimental cryocooler has been built; its unique features (non-magnetic materials and very low input power) may represent a partial solution to the problem.

710,033
PB80-192586 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Investigating Diffusion Bonded Joints of Some Heterogeneous Metals by Micro-Radiospectroscopy (Issledovanie Diffuzionn'ikh soedinenii Nekotor'ikh Raznorodn'ikh Metallov Metodom Mikroenttenospektral'nogo Analiza),
M. E. Venzorskii, and A. A. Oleinikov. 1974, 16p
DMDC-11255, TT-74-53224
Trans. of Svarochnoe Proizvodstvo (USSR) v37(5) p16-18 1967. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Bonded joints, *Diffusion welding, *Diffusion, Diffusion coefficient, Copper, Molybdenum, Steels, Nickel, Titanium, Translations.

The diffusion welding of Cu and Mo, Cu and Steel, Cu and Ni, Ti and Ni, and Mo and Steel was investigated under several experimental parameters. The results of bonding were examined with metallography, x-rays, and microhardness tests. A Matano Analysis was applied to the concentration profiles to obtain diffusion coefficients in the weld zone. The role of various diffusion processes occurring during solid state welding was discussed.

710,034
PB80-199342 PC **A08**/MF **A01**
Recognition Systems, Inc., Van Nuys, CA.
Linewidth Measurement by Diffraction Pattern Analysis.
Final rept. Jan 75-Dec 76,
H. L. Kasdan. Apr 80, 159p NBS-GCR-79-175
Contract NBS-5-35890, ARPA Order-2397

Keywords: Line width, Measurement, Fourier analysis, *Diffraction analysis, Photomasking.

Measurements on photomask linewidths of 1 to 10 micrometers are made using a technique of diffraction pattern analysis. This technique consists of Fourier analyzing the diffraction pattern produced by coherent light of wavelength 632.8 nm diffracting from a 1- to 10-micrometers wide photomask line. The technique is applied to both clear and opaque lines. Linewidth dimensions are obtained by numerical inversion of the measured Fourier diffraction spectrum to form the autocorrelation function and then statistically determining the x-axis intercept of this function. The effects of the variables of detector linearity, laser intensity variation and focusing on the measurement precision are investigated. The measurement linearity and repeatability are evaluated as functions of nominal linewidth dimensions, repeated focusing, and instrument aperture width for clear and opaque lines. The effects on the measured dimensions of a nonzero transmittance of the background for clear lines are calculated from theory.

710,035
PB80-200132 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
NBS Gage Block Calibration Process Using a Measurement Assurance Program,
C. D. Tucker. Jun 80, 10p NBSIR-80-2078

Keywords: *Calibrating, *Gage blocks.

The calibration method for gage blocks, employing a measurement assurance program, is described for the user of an NBS calibration report. The various parameters and their significance to the calibration process are discussed.

710,036
PB80-201122 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
Critical Materials and Fabrication Issues for Pressure Vessels, Piping, Pumps, and Valves.
Final rept.,
J. T. Fong, R. C. Dobbyn, and L. Mordfin. Jun 80, 127p NBS-SP-588
Library of Congress catalog card no. 80-600094.

Keywords: *Pressure vessels, *Piping systems, *Pumps, *Valves, *Meetings, Fabrication, Quality control, Design standards, Failure, quality assurance.

Through an intensive two-year series of debates, meetings, presentations, and reviews, a total of twelve issues on the materials and fabrication aspects of technical problems in the pressure vessels and piping industry were identified. The twelve issues are: (1) The role of engineering judgment and the computer in the

management of material property data; (2) Curve-fitting vs. modeling for formulating design rules; (3) New material property data: Terminal vs. incremental tests; (4) Variability of data: Standards for applications; (5) On-line monitoring of critical components to improve reliability; (6) Upgrading welders' skill and educational level: How and why; (7) Reliability of nondestructive evaluation; (8) Characterization of the subjective component of inservice data; (9) Should there be a methodology for failure analysis; (10) Accelerated development of a more rational basis for nonlinear fracture mechanis; (11) Safety factors in Fatigue Design: Arbitrary or Rational; (12) The ASME Code and product liability: Should compliance create a rebuttable presumption of proper design. This report contains extended abstracts of the twelve issue papers and summaries of reviewers' comments.

710,037
PB80-201239 Not available NTIS
National Bureau of Standards, Washington, DC.
Very Low-Power Stirling Cryocoolers Using Plastic and Composite Materials.
Final rept.,
D. B. Sullivan, and J. E. Zimmerman. Nov 79, 3p
Sponsored in part by Naval Air Systems, Washington, DC.
Pub. in Proc. Int. Congress of Refrigeration (15th), Venice, Italy, Sep 79, Int. J. Refrig. 2, n6 p211-213 Nov 79.

Keywords: *Refrigerators, Stirling cycle, Reprints, *Cryocoolers, Cryogenic refrigerators, Superconducting devices.

An experimental investigation of several concepts for very-low-power cryocoolers for operating highly-sensitive superconducting devices has been undertaken. The devices to be cooled are those using Josephson junctions, such as SQUID magnetometers, voltage standards and A/D converters. The common basic feature of the concepts is that very low levels of magnetic, electric, and mechanical interference are potentially realizable.

710,038
PB80-208051 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Analysis of Erosion-Related Failure Information from Coal Gasification Systems.
Final rept.,
A. W. Ruff. 10 Mar 80, 40p NBSIR-80-2045
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Erosion, *Piping(Erosion), Coal gasification, Pumps, Valves, Wear, Failure, Steels, Ceramics.

Failure information reports concerning erosion that are contained in the NBS-DOE Failure Information Center have been analyzed for the purpose of identifying critical and common factors associated with erosion in coal gasification applications. Emphasis was placed on the components most frequently identified in erosion failure reports - piping, valves, pumps, cyclones - and on three of the principal processes. Recommendations are presented on a minimum set of erosion-related information needed to analyze erosion behavior. A brief review of solid particle erosion and several bibliographic references are also included.

710,039
PB80-214265 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Use of Infrared Thermography for Industrial Heat Balance Calculations.
Final rept.,
K. G. Kreider, and T. P. Sheahen. Jul 80, 42p NBS-TN-1129
Color illustrations reproduced in black and white.

Keywords: *Induction furnaces, *Metallurgical furnaces, *Heat balance, *Thermography, Infrared equipment, Heat transfer, Computation.

Infrared thermography has been used to estimate the radiant heat loss from a channel induction furnace containing molten iron. Using this infrared data, the surface temperature was mapped and the convective heat loss was calculated on the basis of a mixed forced and free-convection model. Additional calculations were performed to include the heat conducted away through a water jacket, and the heat lost by infiltration. The furnace energy input was 255 kW, all electrical. The sum of radiation, convection, conduction, and infiltration losses was 246 kW, but the water cooling alone had plus or minus 30 kW associated with it. The radiative and convective losses (89 kW) were compared with the losses expected on the basis of the original design (107 kW), which is fair agreement. The value of infrared thermography for doing heat balances on industrial furnaces was assessed.

710,040
PB81-102956 PC **A12**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
State-of-the-Art of Thermal Analysis.
Final rept.
O. Menis, H. L. Rook, and P. D. Garn. Aug 80, 268p NBS-SP-580
Prepared in cooperation with Akron Univ., OH. Library of Congress catalog card no. 80-600099.
Proceedings of a Workshop Held at Gaithersburg, Maryland on May 21-22, 1979.

Keywords: *Thermal analysis, *Meetings, Reviews, Utilization, Quality control, Energy conservation, Environmental health.

A workshop on the State-of-the Art of Thermal Analysis was held at the National Bureau of Standards, May 21-22, 1979. This volume contains the texts of the invited lectures with summaries by the rapporteurs. Topics covered include the variety of uses of thermal analysis in industrial processing, such as the measurement of the temperature coefficients needed for pilot plant design in the chemical industry, quality control and product testing in the rubber industry, a review of instrumental developments, descriptions of enthalpimetry, high pressure thermogravimetry using large samples, reports on polymer ignition, energy conservation in ceramic processing, industrial adsorbents, coordination compounds, and studies of ancient paper technology. Also, a poster session was provided for contributed presentation; these included a dynamic mechanical analysis system, high pressure DTA to study glass transitions, aluminum alloy microstructure, characterization of thermoplastics, and simultaneous thermogravimetry and differential scanning calorimetry. Abstracts of the poster presentations are included.

710,041
PB81-108516 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Catalog of Federal Metrology and Calibration Capabilities (1980 Edition).
Final rept.
K. O. Leedy. Sep 80, 74p NBS-SP-546
Supersedes PB-297 151. Library of Congress catalog card no. 80-600149.

Keywords: *Laboratories, *Metrology, *Calibrating, National government, Directories, Test facilities.

This publication lists Federal laboratories involved in metrology and calibration. Included is the name of a person at each laboratory to contact for more information as well as the laboratory telephone number and address. The capabilities of each laboratory are indicated in a tabular listing by agency. To provide geographical distribution, the laboratories are listed by States. In addition, the laboratories are shown on a map by coded number. Other references are described.

710,042
PB81-109597 PC **A06**/MF **A01**
Raytheon Service Co., Burlington, MA.
Optimizing Calibration Recall Intervals and Algorithms.
Final rept.
12 Aug 80, 112p NBS-GCR-80-283
Contract NB79-SBCA-0061
See also PB81-110181.

Keywords: *Calibrating, Measuring instruments, Test equipment, Substitutes, Computer programs, Intervals.

This report describes methods currently used for establishing and/or adjusting calibration intervals within the Federal government and private industry. Each interval method is analyzed in some detail and recommendations of feasibility for use are presented. Data for the report were gathered from visits to 23 government and industry calibration laboratories and survey questionnaires received from 51 representative calibration labs in the Federal government.

710,043
PB81-110181 PC **A05**/MF **A01**
Raytheon Service Co., Burlington, MA.
Alternatives to PMTE (Precision Measuring and Test Equipment) Out-of-Service Calibrations.
Final rept.
12 Aug 80, 98p NBS-GCR-80-282
Contract NB79-SBCA-0061
See also PB81-109597.

Keywords: *Calibrating, Measuring instruments, Test equipment, Substitutes.

This report describes various alternatives to out-of-service calibration within the Federal government and private industry. Current calibration practices and recommendations for improvement are presented. Findings and recommendations are based on data gathered from visits to 23 government and industry calibration laboratories and survey questionnaires received from 51 representative calibration labs in the Federal government.

710,044
PB81-121824 Not available NTIS
National Bureau of Standards, Washington, DC.
Units, Physical.
A. O. McCoubrey, and T. D. Goldman. 1980, 3p
Pub. in Academic American Encyclopedia 19 (TUV), p465-465 1980.

Keywords: *Metric system, Units of measurement, Reviews, History, Trends, Reprints.

The article reviews the historical development of the Metric System of measurements, the basis for its structure and trends for the future.

710,045
PB81-126302 Not available NTIS
National Bureau of Standards, Washington, DC.
Metric System: Costs vs. Benefits: A Summary Overview,
D. T. Goldman. 1980, 7p
Pub. in Proceedings of AAAS Symp. of the Metric System: Cost vs. Benefits, Houston, TX., Jan 3, 1979, Paper in the Metric Debate, p117-125 1980.

Keywords: *Metric system, Benefit cost analysis.

The author's views on the desirability of conversion to the Metric System are presented as the summary paper of a session of the American Association for the Advancement of Science. The Metric System or rather the SI version is internationally agreed upon, simple to use, and will ease communication. These benefits far outweigh the disadvantages inherent upon changing from the familiar. The economic benefit to industry has been the driving force towards the adoption of SI in this country and will continue to be gathering momentum as more sectors convert.

710,046
PB81-135618 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of Double-Torsion Testing-Experimental,
B. J. Pletka, E. R. Fuller, and B. G. Koepke. Jun 78, 19p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Proceedings of the Nat. Symp. Fracture Mechanics (11th) Held at Blacksburg, VA. on June 12-14, 1978, p19-37 Jun 78.

Keywords: *Torsion tests, Evaluation, Fractures(Materials), Brittleness, Toughness.

Aspects of the DT test are critically examined with the objective of defining the conditions under which the data are valid. Among the topics discussed are specimen and loading geometry, precracking techniques, data reproductivity, slow crack growth measurements and comparisons of DT data with other techniques.

710,047
PB81-135626 Not available NTIS
National Bureau of Standards, Washington, DC.
Metallurgical Factors Affecting the Toughness of 316L SMA Weldments at Cryogenic Temperatures.
D. T. Read, H. I. McHenry, P. A. Steinmeyer, and R. D. Thomas. Apr 80, 10p
Sponsored in part by Department of Energy, Washington, DC.

Pub. in Welding Jnl. Research Supplement 59, n4 p104S-113S Apr 80.

Keywords: *Welded joints, Stainless steels, Toughness, Cryogenics, Ferrite, Tensile properties, Reprints, Steel 316.

The effects of delta ferrite content, ferrite morphology, carbon content, and sensitization on the fracture toughness and tensile properties of AWS E316L and E316 shielded metal arc (SMA) weldments at 295, 76, and 4 K were investigated.

710,048
PB81-136814 Not available NTIS
National Bureau of Standards, Washington, DC.
Interim Report on the Significance of Blunt Flaws in Pipeline Girth Welds.
M. B. Kasen, and R. P. Mikesell. 1980, 8p
Sponsored in part by Department of Transportation, Washington, DC. Office of Pipeline Safety Operations.
Pub. in Proceedings of International Conference on Pipeline and Energy Plant Piping, Calgary, Alberta, Canada, November 10-13, 1980, 8p.

Keywords: *Weld defects, *Welded joints, *Pipelines, Brittle fracturing, Porosity, Slags.

Experiments are being performed to determine if slag, porosity or arc strikes are significant contributors to brittle fracture of pipeline girth welds.

710,049
PB81-137143 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibration of Optical Systems for Linewidth Measurements on Wafers.
D. Nyyssonen. 1980, 8p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of the Society of Photo-Optical Instrumentation Engineers Held at San Jose, CA. on Mar 17-18, 1980, Paper in Semiconductor Microconductor Microlithography V, n221 p119-126 1980.

Keywords: *Optical measuring instruments, Calibrating, Line width, Wafers, Microscopy.

In contrast to earlier work with nearly opaque photomasks, optical linewidth measurements on wafers encompass materials with a much wider variation in optical parameters and material profiles. Accurate optical edge detection requires corrections for both the relative reflectance and phase at the line edge because of the partial coherence present in optical microscopes. However, measurement systems which cannot provide the appropriate corrections and cannot detect edge location accurately can be calibrated. Since the correction curve is material dependent, calibrated standards are theoretically required for each step in the wafer fabrication process where linewidths are measured. In the proposed approach for thin layers (less than 200 nm), a small number of etched silicon-dioxide-on-silicon wafers can be used for calibration of a large class of wafer materials. Examples of wafer calibration data for filar, image-splitting and image-scanning systems are given. The problems associated with accurate linewidth measurement and calibration for thick layers are also discussed.

710,050
PB81-138521 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of Double-Torsion Testing-Analysis,
E. R. Fuller. Jun 78, 16p
Pub. in Proceedings of the National Symposium for Fracture Mechanics (11th) Held at Blacksburg, VA. on June 12-14, 1978, p3-18 Jun 78.

Keywords: *Torsion tests, Evaluation, Fractures(Materials), Crack propagation, Toughness.

Before double-torsion testing can be adopted as a standard configuration, a number of unresolved questions need to be answered about the double-torsion specimen and about the experimental techniques involved in its use.

710,051
PB81-138562 Not available NTIS
National Bureau of Standards, Washington, DC.
Aspects of a National Program Plan for Industrial/Commercial Insulation for Mechanical Systems Applications.
F. J. Powell. Oct 80, 2p
Pub. in ASHRAE Jnl. 22, n10 p58-59 Oct 80.

Keywords: *Thermal insulation, Industrial engineering, Planning, Pipes(Tubes), Ducts, Containers, Tanks(Containers), Reprints.

The need for and nature of a national program plan for industrial/commercial thermal insulation in mechanical systems such as piping, ducts, vessels, tanks, and equipment is presented for the temperature range -300F tc +2800F.

710,052
PB81-142820 Not available NTIS
National Bureau of Standards, Washington, DC.
Metric System.
A. O. McCoubrey. Aug 80, 3p
Pub. in Academic American Encyclopedia 13, p345-347 Aug 80.

Keywords: *Metric system, Reviews, Reprints.

The article reviews the historical development of the Metric System of mesurements, the basis for its structure and trends for the future.

710,053
PB81-151656 PC **A14**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Report of the National Conference on Weights and Measures 1980 (65th).
H. F. Wollin, L. E. Barbrow, and A. P. Heffernan. Jan 81, 319p NBS-SP-599
Library of Congress catalog card no. 26-27766. See also PB80-175128.

Keywords: *Units of measurement, *Standards, *Meetings, Weight measurement, Dimensional measurement, Inspection, Specifications, Tolerances(Mechanics), Metric system, Packaging, Consumer affairs, United States, *Weights and measures, *Metrication.

This is the proceedings of the 65th National Conference on Weights and Measures, sponsored by the National Bureau of Standards, held in Washington, DC., June 22-27, 1980, and attended by State, county, and city weights and measures officials, and representatives of the Federal Government, business, industry, and consumer organizations. The publication includes papers presented by Conference officials and other top authorities from Government and industry in the United States and several foreign countries. Reports by the several standing and annual committees of the Conference are also included. Major issues discussed at the National Conference include measurement science education, enforcement uniformity, national type approval, computers and microelectronics, new design and performance requirements for weighing and measuring technology, radiation measurements, metric conversion of retail gasoline dispensers, and weights and measures program evaluation.

710,054
PB81-153280 Not available NTIS
National Bureau of Standards, Washington, DC.
Fracture Analysis of a Pneumatically Burst Seamless-Steel Compressed Gas Container.
Final rept.
B. W. Christ, J. H. Smith, and G. E. Hicho. 1979, 12p
Contract DOT-AS-40034
Pub. in American Society for Testing Materials, Special Technical Publication 677, p734-745 1979.

Keywords: *Gas cylinders, Fractures(Materials), Steels, Pressure vessels, Fracture properties, Analyzing, Reprints.

This paper describes the fracture analysis of a seamless steel compressed gas container which burst at a reported pressure of 17.3 MPa (2500 psi) during filling. Design burst pressure was about 35.2 MPa (5100 psi). The container was made of a quenched and tempered carbon-manganese steel with yield and tensile strengths of 517 and 687 MPa (75,000 and 99,800 psi), respectively. The vessel had been in service for about 6 months and had been filled perhaps twice before it burst. The fracture origin was a pair of part-through cracks in a gouged region on the outside surface. Fracture at the origin was ductile and the fast fracture was also ductile. The empirical methodology developed at Battelle-Columbus for analyzing the burst of line pipe was utilized to analyze the ductile fracture initiation of this compressed gas container. Kaub c, J sub Ic and K sub Ic were estimated for this carbon-manganese pressure vessel steel.

710,055
PB81-163065 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Fundamentals of Desuperheaters.
Final rept.
C. P. Howard. 1981, 3p
Pub. in Proceedings of Conference on Waste Heat Recovery for Energy Conservation (1980), West Lafayette, IN., September 15-17, 1980, 3p.

Keywords: *Heat exchangers, Design, Heat recovery.

A methodology of heat exchanger design for desuperheating heat exchangers (heat recovery units) is developed to utilize heat transfer and pressure loss characteristics for surfaces in counterflow arrangements with a non-condensing refrigerant and water as the working fluids. The analysis should provide a basis for testing non-condensing heat recovery units.

710,056
PB81-164865 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Regenerator Inefficiency for Stirling-Cycle Refrigerators with Plastic Displacers.
Final rept.
R. Radebaugh. 1980, 6p
Pub. in Proceedings of the International Conference of Refrigeration (15th), Venice, Italy, September 23-29, 1979, Session A 1/2 Paper 16 in Progress in Refrigeration Science and Technology, 6 pages 1980.

Keywords: *Regenerators, *Refrigerators, Stirling cycle, Efficiency, Cryogenics, Heat transfer, Cryogenic refrigerators.

The major source of heat flow in a Stirling-cycle refrigerator operating below about 15 K is due to regenerator inefficiency. This paper analyzes the heat flow due to regenerator inefficiency when the materials have low thermal diffusivity.

710,057
PB81-176125 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Temperature Probe for Radio-Frequency Heated Material,
R. R. Bowman. Jan 81, 34p NBSIR-80-1634

Keywords: *Temperature measurement, Probes, Radiofrequency heating, Thermistors.

One approach to measuring temperature in radio-frequency (rf) heated material employs thermocouple or thermistor sensors connected to suitable electronics by means of leads of such slight conductivity that they cause negligible field distortion and measurement artifacts. The particular type of probe discussed here uses a thermistor. Four leads are used to allow the thermistor resistance to be sensed despite the large and unstable lead resistances. Though difficult to construct, small probes (about 1.1 mm in diameter) for use in biological tissue can be made that cause measurement artifacts so slight (about 0.01C or less) that they are difficult to measure. Theory and experimental results are presented to show that these probes are very effective for use in materials with high water content. In most situations of interest, the short term stability is better than 0.01C, and the long term stability is about 0.1C.

710,058
PB81-176133 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Effective Thermal Conductivity of a Glass Fiberblanket Standard Reference Material.
D. R. Smith, J. G. Hust, and L. J. Van Poolen. Feb 81, 31p NBSIR-81-1640
Sponsored in part by Department of Energy, Oak Ridge, TN. Oak Ridge Operations Office.

Keywords: *Standards, *Thermal insulation, Thermal conductivity, Glass cloth, Standard reference materials.

This paper describes the results of thermal conductivity measurements at temperatures from 84 K to 360 K on a glass fiberblanket insulation which is intended to be a Standard Reference Material (SRM). The measurements were performed in an atmosphere of dry nitrogen at a pressure near 84 kPa (630 mm Hg). The results are analyzed and compared to literature data

for similar material. An annotated bibliography of literature sources is included.

710,059
PB81-178626 Not available NTIS
National Bureau of Standards, Washington, DC.
Regional Measurement Assurance Programs for Physical Measurements.
Final rept.
B. C. Belanger, and L. J. Kieffer. 1980, 8p
Pub. in Proceedings of the IMEKO Congress (8th) Held at Moscow, USSR on May 21-27, 1979, Paper in Acta Imeko, p649-656 1980.

Keywords: Standards, Errors, Accuracy, *Measurement Assurance Program.

A Measurement Assurance Program (MAP) is a measurement quality assurance program that allows one to demonstrate that the total measurement uncertainty including both random error and systematic components of error relative to national or other designated standards is quantified, and sufficiently small to meet the requirements for the measurement process. In this paper a particularly effective approach to MAP's involving groups of participating laboratories in particular regions of the U.S. is described and compared to more traditional approaches to the achievement of traceability to national standards.

710,060
PB81-181240 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Effective Thermal Conductivity of a Glass Fiberboard Standard Reference Material.
D. R. Smith, and J. G. Hust. Feb 81, 33p NBSIR-81-1639
Sponsored in part by Department of Energy, Oak Ridge, TN. Oak Ridge Operations Office.

Keywords: *Standards, *Thermal insulation, Thermal conductivity, Fiberboards, Glass fibers, Standard reference materials.

This paper describes the results of thermal conductivity measurements on NBS SRM 1450 glass fiberboard insulation (1970 lot) at temperatures from 87 K to 340 K. The measurements were performed in an atmosphere of dry nitrogen at a pressure near 84 kPa (630 mm Hg). The results are analyzed and compared to NBS certification data and to literature data for similar material. An annotated bibliography of literature sources is included.

710,061
PB81-181661 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Nature and Growth Kinetics of the Diffusion Layer of Copper Joints Soldered by Tin-Lead Solders.
I. I. Il'evskii. 1980, 14p DMDC-21154, TT-80-58227
Trans. of Svarochnoe Proizvodstvo (USSR) n10 p13-16 1966. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Soldered joints, *Diffusion, Copper, Solders, Tin alloys, Lead alloys, Reaction kinetics, Microstructure, Translations.

Copper is joined by tin and Pb-Sn solders under a variety of experimental variables. The soldered joints are then examined in the optical microscope and with an electron probe microanalyzer. Microhardness traverses are made in the diffusion zone. Phases are determined and their growth kinetics recorded. The soldered joints are pulled apart in a mechanical test of their strength.

710,062
PB81-182792 Not available NTIS
National Bureau of Standards, Washington, DC.
Automatic Resistance Thermometer Bridge.
Final rept.
R. D. Cutkosky. Dec 80, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-29, n4 p330-333 Dec 80.

Keywords: *Resistance bridges, Temperature measuring instruments, Transformers, Automation, Ohmmeters, Reprints.

A microprocessor-controlled bridge is described that utilizes a 15-Hz or 30-Hz square waves to excite a shielded multistage transformer. Transformer taps are relay selected to null the detector. The reading, up to 32 ohms in steps of 1 microohms is then displayed. An IEEE-488 bus provides remote operation.

710,063
PB81-202749 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
Models for the Migration of Low Molecular Weight Additives in Polyolefins.
Annual rept. 1 Oct 79-30 Sep 80.
L. E. Smith, S. S. Chang, F. L. McCrackin, G. A. Senich, and F. W. Wang. Apr 81, 144p NBSIR-81-2264
Contract PHS-FDA-224-77-2443

Keywords: *Packaging materials, *Food packaging, *Mathematical models, *Olefin resins, Diffusion coefficient, Additives, Concentration(Composition), Gas chromatography, Isotopic labeling, Polyethylene, Numerical solution, Tracer studies, NTISCOMNBS, NTISFDAHFD.

Food Packaging is an important encounter in the daily life. The low molecular weight components in the packaging materials may migrate into the foods. This program, sponsored by the Bureau of Foods of the Food and Drug Administration, tends to provide theoretical models, reliable data base, and methodology to study the migration phenomena and to provide reasonable worst-case estimates for the concentrations of the indirect additives in food. In this annual report the authors present a relationship of diffusion coefficients of gaseous diffusants in polyolefins based on free volume theory, procedures and results of inverse gas chromatography for migrant-polymer interaction parameters and diffusivities of oligomers in polyethylene, methods and preliminary results of spectrofluorimetry on the migration of antioxidants in polyethylene, results and correlations of extraction experiments with radioactive labeled migrants. It was found that anhydrous ethanol and lower numbers of pure triglycerides can successfully simulate the extractive behavior of food oils. The accelerating action of n-heptane over that of the food oil is quantified.

710,064
PB81-204844 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Refrigeration for Cryogenic Sensors and Electronic Systems.
Final rept.
J. E. Zimmerman, D. B. Sullivan, and S. E. McCarthy. May 81, 225p NBS-SP-607
Proceedings of a Conference held at Boulder, CO. on October 6-7, 1980. Sponsored in part by International Inst. of Refrigeration and Office of Naval Research, Arlington, VA. Library of Congress catalog card no. 81-600038.

Keywords: Cryogenic refrigerators, Cryocoolers, *Cryogenic sensors, Superconducting devices, Squid devices, Electronic equipment, NTISCOMNBS, NTISDODN.

The purpose of the meeting was to discuss progress in the development of refrigeration systems which have been specialized for use with cryogenic sensors and electronic systems. The meeting focused primarily on the temperature range below 20 K and cooling capacity below 10 W.

710,065
PB81-207763
(Order as PB81-207748, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Models of Quasi-Steady and Unsteady Discharge from Plumbing Fixtures.
B. M. Mahajan, L. S. Galowin, and P. A. Kopetka. 20 Aug 80, 9p
Included in Jnl. of Research of the National Bureau of Standards, v86 n2 p171-179, Mar-Apr 81.

Keywords: *Plumbing, *Piping systems, *Pipe flow, Drains, Fluid flow, Mathematical models, Friction factor, Waste water, NTISCOMNBS.

Modeling methods are developed to predict the discharge characteristics of simulated simplified configurations for plumbing fixtures connected to horizontal drain branch piping. Computations are carried out to illustrate several methods of determining the effect of various loss coefficients of the drain connection, pipe length, pipe diameter, and friction factor. Solutions are obtained for the case of a fixture with a constant head (continuous refill) and a falling head (emptying of a sink). Numerical solution of the non-linear differential equation for the falling head case was obtained by the Runge-Kutta method. Discharge characteristics are presented for a range of flows and pipe diameter-to-length ratios representative of plumbing installations. The feasibility of developing predictive models for hydraulic characteristics of interconnected plumbing fixture and drainage piping systems is shown. The variations of efflux rate with the drain pipe diameter, length, and slope obtained from the assumed models are similar in trend to the available experimental data.

710,066
PB81-220410 Not available NTIS
National Bureau of Standards, Washington, DC.
Enhanced Reliability and Reproducibility of Measurements of Machinery Vibrations.
Final rept.
L. Mordfin, B. F. Payne, and S. Edelman. Sep 80, 22p
Proceedings of the Machinery Dynamics Seminar; Vibration Standards and Current Techniques for Flexible Rotor Balancing (6th) held at Toronto, Canada on September 22-23, 1980, p4-0--4-22 Sep 80.

Keywords: *Vibration, *Measurement, Machinery, Accelerometers, Vibration meters, Piezoelectric polymers.

Using vibration measurements to monitor the condition of machinery and machine elements offers several advantages over traditional methods of nondestructive evaluation. This paper reviews some of the activities being carried out at the U.S. National Bureau of Standards (NBS) in support of this rapidly advancing measurement technology. NBS has established and maintains a calibration service for vibration pickups over the frequency range from 2 Hz to 10,000 Hz. The calibration procedures are based on the principle of reciprocity and on the interferometric measurement of displacement amplitude. These techniques are absolute, so that users of the service acquire both traceability and enhanced reproducibility in their vibration measurements. NBS research and development studies on piezoelectric polymer gages have pointed the way toward enhanced reliability in vibration monitoring applications. One particular study, in which polymer gages helped to avoid inaccuracies that would be introduced by conventional accelerometers, is described.

710,067
PB81-220907
(Order as PB81-220899, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Foundations of Metrology.
J. A. Simpson. 7 Jan 81, 12p
Included in Jnl. of Research of the National Bureau of Standards, v86 n3 p281-292, May-Jun 81.

Keywords: *Metrology, Measurement, Reviews.

The theory of measurement has attracted the attention of a number of philosophers whose works remain largely unknown to metrologist. Recent work in the development of Measurement Assurance Programs has demonstrated the power of this theory as a tool for guiding the development of measurement systems. The elements of the theory, especially that of Carnap and its applications to metrology, are developed as an aid to program planning and evluation.

710,068
PB81-221715 Not available NTIS
National Bureau of Standards, Washington, DC.
Force Sensor-Machine Interaction.
Final rept.
R. A. Mitchell, and P. E. Pontius. 1981, 8p
Proceedings of the International Instrumentation Symposium (27th) held at Indianapolis, IN., on April 27-30, 1981.
Pub. in Instrumentation in the Aerospace Industry 2 and Advances in Test Measurement 18, p225-232 1981.

Keywords: *Measuring instruments, Force, Detectors, Interactions, Calibrating, Load cells.

Although a force sensor is designed to respond primarily to an axial component of applied force, the sensor may also produce a significant error signal in response to non-axial load components that result from small

misalignments in the loading setup. There may also be significant time-dependent machine-sensor-interaction errors involving creep or mechanical oscillation. This paper describes techniques that are being used to reveal, identify, and quantify these sources of error. The techniques involve the use of high-resolution readout instruments and a dedicated microcomputer/graphics system to make rapid comparisons of the response of force sensors to different loading conditions.

710,069
PB81-241176 Not available NTIS
National Bureau of Standards, Washington, DC.
Metrology for Submicrometer Devices and Structures.
Final rept.
W. M. Bullis. 1979, 12p
Pub. in Proceedings of Microcircuit Engineering (1979), Microstructure Fabrication, Aachen, Germany, F.R., September 25-27, 1979, p271-282.

Keywords: *Metrology, *Microelectronics, Integrated circuits.

This paper examines the types of metrological requirements associated with submicrometer devices and structures, summarizes the present state of the art in selected critical areas of metrology, and reviews current research and development efforts on advanced measurement technology, especially those at the National Bureau of Standards.

710,070
PB81-248478 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Technical Activities 1980--Center for Absolute Physical Quantities.
K. G. Kessler. Oct 80, 236p NBSIR-80-2165

Keywords: *Measurement, *Standards, Electrical measurement, Temperature, Pressure, Time, Metrology.

This report summarizes research projects, measurement method development, calibration and data evaluation activities carried during Fiscal Year 1980 in the NBS Center for Absolute Physical Quantities. These activities fall in the areas of: quantum metrology; measurements and standards for the electrical units, temperature and pressure, length and mass, time and frequency; and quantum physics.

710,071
PB81-600065 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Design of a Regenerator Test Apparatus for Temperatures Down to 4 K.
R. Radebaugh, D. Linenberger, and R. O. Voth. 1981, 60p
Pub. in AFWAL-TR-81-0350, 60 pages Jun 1981.

Keywords: *Cryogenics, Gifford-McMahon cryocoolers, Heat capacity, Heat transfer, Helium, Refrigerators, Regenerators, Stirling cryocoolers, Thermal conductance, Vuillemier cryocoolers.

The regenerator ineffectiveness is usually the dominant heat loss term in regenerative-cycle refrigerators which operate below 15 K, but systematic measurements of regenerator ineffectiveness have never been done in this temperature range. The report introduces the proper definition of ineffectiveness, which is valid for non-ideal gases and systems where a pressure wave exists. Previous methods used and proposed for the measurement of regenerator ineffectiveness at cryogenic temperatures are reviewed and their limitations discussed. A new method, utilizing a variable expansion space, is presented which for the first time will allow measurements at all phase angles between the mass flow rate and the pressure wave. Temperatures emphasized are those between 4 and 35 K.

710,072
PB82-105974 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
New Technology Challenges Metrology.
J. C. French. Jul 81, 93p NBS-SP-611
Library of Congress catalog card no. 81-600063. Sponsored in part by Organization of American States, Washington, DC. Presented at the Interamerican Metrology Conference, Marking the Formal Establishment of the Interamerican Metrology System, held in Buenos Aires, Argentina, September 4-7, 1979.

Keywords: *Metrology, Calibrating, Measurement, Technology.

Assurance of measurement quality to meet requirements for regulatory agencies, marketplace equity, and productivity and quality control in manufacturing and research is challenged by unprecedented demands for sensitivity, speed, precision, and accuracy over wide ranges of properties and signal characteristics. New approaches are needed. Examples of NBS response, principally in electrical and electronic engineering are described.

710,073
PB82-115973 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Measurement and Evaluation Methods for an Angular Accelerometer.
Final rept. 1 Aug-30 Dec 80.
J. D. Ramboz. Aug 81, 75p NBSIR-81-2337
Contract DOT-HS-9-02193IA

Keywords: *Angular acceleration, *Accelerometers, Calibration, Transfer functions, Frequency response, Specifications.

A transducer which measures angular acceleration along one axis was investigated to assess three of its performance characteristics, viz., sensitivity factor, amplitude linearity, and response to linear (non-angular) input accelerations. Accelerometer specifications and response theory are presented. Test philosophy and methodology are discussed along with measurement results. Tests were conducted over a frequency range from 1.5 to 100 Hz and an acceleration range from 64 to 5000 rad/square second. Generally, the performance observed was in agreement with the manufacturer's preliminary specifications.

710,074
PB82-116229 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Materials for Instrumentation for Fossil Energy Technologies.
H. P. R. Frederikse, P. K. Schenck, G. W. Burns, R. R. Dils, and J. R. Whetstone. Sep 81, 135p NBSIR-81-2348
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Instruments, Materials, Detectors, Requirements, Energy conversion.

This report reviews the materials problems related to instrumentation for Fossil Energy Facilities. It discusses requirements for measurement of process parameters (flow, temperature, pressure, chemical composition), of construction material properties, and of fuel characteristics. The main part of the report is a suggested program plan for pertinent materials R&D. Short descriptions of the various Fossil Energy Processes, listing of present research activities, and a set of 6 Case studies are presented in an appendix.

710,075
PB82-116377 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Characterizing Measuring Machine Geometry.
Final rept.
R. J. Hocken, and B. R. Borchardt. Jun 79, 25p NBSIR-79-1752

Keywords: *Metrology, *Measuring instruments, Grids(Coordinates), Errors, Measurement, Least squares method, Computer programs.

A simple method for removing axis nonorthogonality and checking for length dependent scale errors in two-dimensional measurements is presented. Use of this method requires that a two-dimensional master gage (ball or grid plate, for example) be measured in two positions which differ by a rotation of the plate 90 degrees with respect to the measuring machine axes. The method is similar to that proposed by Reeve, but requires only linear least squares fitting on a small computer.

710,076
PB82-119827 Not available NTIS
National Bureau of Standards, Washington, DC.
Fracture Behavior of Ferrite-Free Stainless Steel Welds in Liquid Helium.
Final rept.
T. A. Whipple, H. I. McHenry, and D. T. Read. Apr 81, 7p
Pub. in Proceedings of the AWS Annual Meeting (61st), Los Angeles, CA., April 13-18, 1980. Paper in Welding Research Supplement 60, n4 p72-a--78-s Apr 81.

Keywords: *Welded joints, Fractures(Materials), Stainless steels, Cryogenics, Microstructure, Fatigue(Materials).

In this paper it has been shown that a wide variation in fracture toughness occurs in 316L weldments that contain no delta ferrite, and only small differences in nitrogen concentration. This shows that welding parameters and minor compositional variability must also have significant influences. Optical microscopy has revealed a strong correlation between cryogenic fracture toughness and fusion zone grain width, which is controlled by welding parameters and weld-metal composition. An increase in grain size reduces the toughness.

710,077
PB82-128356 Not available NTIS
National Bureau of Standards, Washington, DC.
Guarding Techniques for Resistance Thermometers.
Final rept.
R. D. Cutkosky. Sep 81, 4p
Pub. in IEEE Trans. Instrum. Meas. IM-30, n3 p217-220 Sep 81.

Keywords: *Resistance thermometers, Reliability, Reprints.

Theoretical and practical aspects of the application of electrical guards to resistance thermometers are discussed, with a view toward suppressing errors caused by imperfect electrical insulation at high temperatures. Some simple techniques for modifying existing resistance thermometer bridges are described.

710,078
PB82-136235 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Heat Transfer Analysis of Underground Heat and Chilled-Water Distribution Systems.
T. Kusuda. Nov 81, 63p NBSIR-81-2378
Sponsored in part by Naval Facilities Engineering Command, Alexandria, VA., Department of the Air Force, Washington, DC., and Department of the Army, Washington, DC.

Keywords: *Subsurface structures, *Piping systems, Heat transfer, Water pipes, Thermal insulation, Seasonal variations, Economic analysis, Fortran, Computer programs, COSTK computer program.

Simplified calculation procedures for determining heat exchange between the earth and a multiplicity of buried pipes having different temperature and thermal insulation are presented. The procedures deal with cases where pipes are buried side by side, as well as those when several pipes are bundled in a conduit. The effects of seasonal variation of earth temperature are treated in a quasi-steady-state equation that includes the soil thermal properties, depth of burial, pipe sizes, and relative locations of pipes. Sample calculations are included, together with the Fortran program listing and thermal properties of earth to be used for the calculations.

710,079
PB82-149907 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS Line-Heat Source Guarded-Hot-Plate Apparatus.
M. C. I. Siu, and C. Bulik. Nov 81, 8p
Pub. in Review of Scientific Instruments 52, n11 p1709-1716 Nov 81.

Keywords: *Gas heaters, *Thermal measuring instruments, Thermal conductivity, Insulation, Test equipment, Reprints, *Hot plates.

A description is given of a line-heat-source guarded-hot-plate apparatus for determining the effective thermal conductivity of insulation materials in the temperature range from 250 K to 400 K. Measurements made on fibrous glass boards are in good agreement with results obtained from the guarded-hot-plate apparatus

in operation at the National Bureau of Standards for over 40 years.

710,080
PB82-152505 Not available NTIS
National Bureau of Standards, Washington, DC.
Maximum Practical Efficiency of Helium Temperature Refrigerators.
Final rept.
R. O. Voth. Nov 81, 6p
Pub. in Cryogenics 21, n11 p635-640 Nov 81.

Keywords: *Gas refrigerators, Efficiency, Cryogenics, Reprints, *Cryogenic refrigerators.

An ideal refrigerator, using a perfect gas working fluid, is defined which gives the efficiency of a refrigerator as a function of compressor and expander efficiency, heat exchanger temperature difference, and heat exchanger pressure drop. Although not suited to detailed hardware design, this approach clearly relates the overall cycle efficiency to component efficiencies. In contrast, computer studies of specific cycles using real fluid properties are usually such that the details tend to overshadow major trends. The results of the study show that in an efficient cycle, the major losses are in the compressor and the cold end expansion device. For current compressor and expander efficiencies, the maximum practical helium temperature refrigerator efficiency is about 37% of Carnot.

710,081
PB82-154584 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
International System of Units (SI), Fourth Edition,
D. T. Goldman, and R. J. Bell. Dec 81, 57p NBS-SP-330
Trans. of mono. Le Systeme International d'Unites, Paris, 1981. Prepared in cooperation with National Physical Lab., Teddington (England).

Keywords: *Metric system, Units of measurement, Primary standards, Translations, *Foreign technology, *International system of units.

This is a translation of the French Le Systeme Interlational d'Unites (SI), 4th Edition. It is a revision of the 3rd edition, published in 1977 and takes into account recent decisions of the General Conference on Weights and Measures (1979), of the International Committee for Weights and Measures (1977, 1978, 1980) and revisions suggested by the Consultative Committee for Units (1978, 1980). Included are an exposition of a coherent system of units, a definition of supplementary units, a new definition of the base unit, the candela, and a new unit of dose equivalent, the sievert.

710,082
PB82-165499 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
High Security Locking Devices: A State-of-the-Art Report.
J. S. Stroik. Jan 82, 170p NBSIR-81-2233
Sponsored in part by Civil Engineering Lab. (Navy), Port Hueneme, CA., and Defense Nuclear Agency, Washington, DC.

Keywords: *Security, *Doors, *Locks(Fasteners), Internal security, Structural design, Equipment specifications, Staybolts, Locking, Keys(Splines), Installation, *Antiintrusion devices, Area security, Facility security.

An investigation was made of the literature and information related to high security, internal locking devices. The purpose of this work was to identify and document the present state-of-the-art of these devices and systems used on doors. This document supports an R & D effort to develop a locking system for sensitive ordnance structure doorways that will take the place of existing surface mounted padlocks and hasps. Locking systems were investigated both overall and their subsystem components, including boltworks, bolt-work driving subsystems, locking mechanisms and the protective envelope. Usual categories of lock types are presented, and a new combined summary of locking device classifications is suggested to act as a standard basis for future research and development of standards. This classification divides locks by their operation, installation and component characteristics. A review of the literature includes an annotated bibliography, annotated lists of standards and specifications, national organizations and locksmith schools, a selected list of manufacturers and a glossary compiled from available glossaries. An appendix includes selected samples of manufacturers' catalogue information. As a result of this investigation, the author provides specific recommendations concerning the needs of more technical study and research together with suggested development and implementation of standard test methods.

710,083
PB82-169921 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Guarded-Hot-Plate Apparatus for Measuring Effective Thermal Conductivity of Insulations Between 80 K and 360 K,
D. R. Smith, J. G. Hust, and L. J. Van Poolen. Jan 82, 57p NBSIR-81-1657
Sponsored in part by Energy Research and Development Administration, Oak Ridge, TN. Oak Ridge Operations Office.

Keywords: *Test equipment, *Thermal insulation, Glass fibers, Thermal conductivity, Measurement, Cryogenics.

This report describes a guarded-hot-plate apparatus used to determine the effective thermal conductivity of glass fiber insulations. Measurements can be performed at temperatures from 80 K to 360 K, from atmospheric pressure to a vacuum of 0.0001 Pa (1 x 0.000001 torr). Various fill gases such as air, nitrogen, argon, and helium can be utilized. Overall uncertainties of thermal conductivities at atmospheric pressure are 1% at the higher temperatures and 5% at the lower cryogenic temperatures. The modifications of the commercial apparatus described in this report resulted in approximately a four-fold improvement in uncertainty.

710,084
PB82-178997 PC **A13**/MF **A01**
National Bureau of Standards, Washington, DC.
Report of the 66th National Conference on Weights and Measures, 1981.
H. F. Wollin, L. E. Barbrow, and A. P. Heffernan. Dec 81, 279p NBS-SP-629
See also PB81-151656. Library of Congress Catalog Card No. 26-27766.

Keywords: *Units of measurement, *Meetings, Size determination, Metric system, Standards, Packaging, Weight measurement, Consumer affairs, Marking, Labels, *Weights and measures, Metrication.

These are the proceedings of the 66th National Conference on Weights and Measures, sponsored by the National Bureau of Standards, held in St. Louis, Mo., July 13-17, 1981. Reports by the several standing and annual committees of the Conference comprise the major portion of the publication. Included also are papers presented by Conference officials and other authorities from Government and industry. Major issues discussed at the National Conference included measurement science education, enforcement uniformity, national type approval, inch-pound and metric labeling provisions, new design and performance requirements for weighing and measuring technology, metric conversion of retail gasoline dispensers, weights and measures program evaluation studies of model State laws and regulations and their adoption by citation or other means by State and local jurisdictions, and a report of States conducting grain moisture meter testing programs.

710,085
PB82-197039 PC **A07**/MF **A01**
National Research Council, Washington, DC.
Evaluative Report on the National Measurement Laboratory, National Bureau of Standards - Fiscal Year 1981.
Final rept.
Dec 81, 137p
Contract EO-A01-78-00-3501
See also PB82-197047.

Keywords: *Laboratories, Evaluation, Measurement, National Bureau of Standards, National Measurement Laboratory.

This report presents an evaluation of the technical functions and programs of the National Measurement Laboratory (NML), one of the major organizational units of the National Bureau of Standards. It represents the work of twelve Panels. One of the Panels is for the NML as a whole and performs an overview function for the Academy. The other eleven Panels review specific activities within NML.

710,086
PB82-197047 PC **A04**/MF **A01**
National Research Council, Washington, DC.
Evaluative Report on the National Engineering Laboratory, National Bureau of Standards - Fiscal Year 1981.
Final rept.
Jan 82, 73p
Contract EO-A01-00-3501
See also PB82-197039.

Keywords: *Laboratories, Engineering, Evaluation, National Bureau of Standards, National Engineering Laboratory.

This report presents an evaluation of the technical functions and programs of the National Engineering Laboratory (NEL), one of the major organizational units of the National Bureau of Standards. It represents the work of seven Panels. One of the Panels is for the NEL as a whole and performs an overview function for the Academy. The other six Panels review specific activities within NEL.

710,087
PB82-211186 Not available NTIS
National Bureau of Standards, Washington, DC.
Future of Quartz Resonator Thermometry.
Final rept.
F. L. Walls. 1981, 9p
Pub. in Proceedings of the Workshop on Techniques for Measurement of Thermodynamic Properties, Albany, OR., Aug 21-23, 1979, Bur. Mines Info. Circ. 8853, p51-61 1981.

Keywords: *Temperature measurement, Temperature measuring instruments, Quartz resonators, Hysteresis, Predictions.

This paper will attempt to predict the future of precision thermometry based on quartz crystal resonators used as thermal sensors. At present, quartz resonator thermal sensors exhibit considerable hysteresis after temperature cycling and, therefore, are not generally used for precision thermometry. However, we have shown that the sensors can be used to detect temperature fluctuations of approximately 20 microkelvins over many seconds. Moreover, major advances in quartz resonators, including new crystallographic cuts, hold promise of producing quartz resonators with greatly reduced hysteresis. These new advances will be discussed in terms of their implication for thermometry from approximately 100 to 400 K. A new technique for utilizing quartz resonators for thermal measurements will be discussed in detail. It is expected that a few of these improved resonators will become available for testing within a few months.

710,088
PB82-211228 Not available NTIS
National Bureau of Standards, Washington, DC.
Current Trends in NBS Calibration Services.
Final rept.
R. A. Kamper. Mar 82, 2p
Pub. in NCSL Newsletter 22, n1 p38-39 Mar 82.

Keywords: *Calibrating, Quality control, Metrology, Reprints, *National Bureau of Standards.

Recently, the management of NBS has given close attention to Calibration Services and has started several actions to improve quality and responsiveness in the future.

710,089
PB82-215450 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Study of Design Principles for Refrigerators for Low-Power Cryoelectronic Devices,
J. E. Zimmerman, and D. B. Sullivan. Jan 82, 116p NBS-TN-1049

Keywords: *Refrigerators, Cryogenics, Design, Stirling cycle, Superconducting devices, Cryocoolers.

This report summarizes a five-year effort at NBS which has been directed toward the development of low-power cryocoolers suited to the support of super-conducting instruments. The report deals with a variety of aspects of construction and operation of refrigerators as well as with a model which allows one to optimize the design for minimum drive power. The publications

generated by the program are included as an appendix.

710,090
PB82-225723 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Measurement of Net Space Charge Density Using Air Filtration Methods,
R. H. McKnight. Apr 82, 30p NBSIR-82-2486
Contract DE-EA77-016010

Keywords: *Air filters, Performance evaluation, Ion density(Concentration), Electrostatics, Laboratory equipment, *HEPA filters, *Net space charge density.

The efficiency of a high efficiency particulate air (HEPA) or absolute filter for removing charge from an airstream has been measured for a variety of space charge and air flow conditions. Ion densities ranged from 100,000 to 1,000,000/cc and were for positive and negative space charge as well as mixtures. For all conditions studied, the transmission of the filter was less than 0.1%. For space charge consisting predominantly of ions of one polarity, space charge density measurements made using HEPA filters and ion counters may be compared directly. The filter is well suited for all accurate measurements of net space charge density. Three other types of fibrous filters also have been studied.

710,091
PB82-236118 Not available NTIS
National Bureau of Standards, Washington, DC.
Toward an International Practical Pressure Scale: An AIRAPT Task Group Report.
Final rept.
V. E. Bean, S. Akimoto, P. M. Bell, S . Block, W. B. Holzapfel, J. C. Jamieson, M. H. Manghnani, M. F. Nicol, G. J. Piermarini, and S, M. Stishov. 1982, 8p
Pub. in Proceedings Conf. of the Int. Assoc. for the Advancement of High Pressure Science and Technology (8th) and the Conf. of the European High Pressure Research Group (19th), Uppsala, Sweden, Aug. 17-22, 1981, 1 p144-151 1982.

Keywords: *Pressure measurement, Calibrating, Metrology, Standards.

The International Association for the Advancement of High Pressure Research and Technology has established a task group with the charge to examine what recommendations could be made with regard to an international practical pressure scale. This task group report is a review of high pressure metrology with recommendations at the conclusion.

710,092
PB82-236795 Not available NTIS
National Bureau of Standards, Washington, DC.
Challenges in Achieving ATE Traceability to NBS.
Final rept.
B. Bell, M. Souders, B. Belanger, and R. Kamper.
Sep 79, 3p
Pub. in Proceedings AUTOTESTCON 1979, Minneapolis, Minnesota, September 19-21, 1979, p233-238 Sep 79.

Keywords: Calibrating, Standards, Metrology, *Automatic test equipment.

For many years, government regulations and contractual agreements have required that measuring and test equipment be calibrated utilizing reference standards traceable to national standards. The advent of automatic test equipment (ATE) has introduced new complexities into the realization of traceability. This paper describes the problems inherent in achieving meaningful traceability for ATE as perceived by NBS, describes on going, selected R&D activities at NBS that are providing the national reference standards and test techniques needed for supporting ATE calibration, and discusses a plan that is being proposed for providing more direct metrology support from NBS in this field.

710,093
PB82-236803 Not available NTIS
National Bureau of Standards, Washington, DC.
Precision Electronic Test Equipment Calibration Standards at NBS.
Final rept.
B. A. Bell. Jan 80, 3p
Pub. in Proceedings of Automated Testing for Electronics Manufacturing and Test Instruments Conference, Pasadena Center, Pasadena, CA, January 7-10, 1980, p138-168 Jan 80.

Keywords: *Electronic test equipment, *Standards, *Calibrating, Metrology.

The application of sophisticated digital sampling and synthesis techniques to the implementation of precision electronic test, measurement, and diagnostic equipment imposes requirements for improved methods and standards to provide adequate metrology support. Several projects at NBS are described in this paper which deal with the investigation and development of means for evaluating the performance of certain classes of low frequency, audio, and lower RF instrumentation.

710,094
PB82-236829 Not available NTIS
National Bureau of Standards, Washington, DC.
ATE Calibration by Means of Dynamic Transport Standards.
Final rept.
B. A. Bell, and O. Petersons. 1981, 8p
Pub. in Proceedings of AUTOTESTCON 1981, Orlando Hyatt House, Orlando, Florida, October 19-21, 1981, p280-287 1981.

Keywords: *Calibrating, *Standards, *Automatic test equipment.

The concept of dynamic transport standards for calibration of ATE in the field is discussed, with emphasis on ensuring the traceability of the calibrations to the basic physical standards as maintained by NBS. The technical details of the proposed transport standard for dc and low frequencies are outlined. The calibration support at NBS and at the standards laboratory and self-checks in the field are discussed for this transport standard. Implementation of the calibration system for ATE based on the dynamic transport standard is discussed.

710,095
PB82-236878 Not available NTIS
National Bureau of Standards, Washington, DC.
Transducers for Very High Pessures.
Final rept.
V. E. Bean. 1980, 3p
Pub. in Proceedings of International Conference on High Pressure Engineering (2nd), University of Sussex, Brighton, England, July 8-10, 1975, p29-31 1980.

Keywords: *Pressure sensors, Standards, Calibrating, Very high pressure.

Two new pressure transducers are currently being developed at NBS. In one the sensor is a parallel plate capacitor; in the other it is an ultrasonic delay line. Both have properties superior to the manganin gage and are being developed to be used as transfer standards in our calibration service.

710,096
PB82-236886 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Research Above 0 deg C at the National Bureau of Standards.
Final rept.
G. T. Furukawa, G. W. Burns, R. D. Cutkosky, R. E. Edsinger, J. P. Evans, L. A. Guildner, and B. W. Mangum. 1981, 9p
Pub. in Proceedings of Temperature Measurement in Industry and Science IMEKO TC 12 Symposium, Karlovv Vary, Czechoslovakia, October 20-22, 1981, p39-47 1981.

Keywords: *Temperature measurement, Resistance bridges, Thermometers, Transition points.

This paper presents a summary of current work at the U.S. National Bureau of Standards in the field of thermometry above 0C. It describes temperature fixed point developments, including work on the triple points of water, Ga, Rb, In, and succinonitrile and on the freezing points of Sn, Zn, Al, and Cd; studies of nicrosil/nisil thermocouple thermometers; thermodynamic gas thermometry; the development of precision resistance thermometers for use up to 1100C; the development of new, automatic resistance bridges; and studies of thermistor and small platinum resistance thermometers.

710,097
PB82-261868 Not available NTIS
National Bureau of Standards, Washington, DC.
Inservice Data Reporting Standards for Engineering Reliability and Risk Analysis.
Final rept.
J. T. Fong. 1980, 6p
Pub. in Nuclear Engineering and Design 60, p159-161 1980.

Keywords: *Standards, *Data, *Reliability, Mathematical models, Safety, Mechanical engineering, Structural engineering, Reprints, Risk analysis, In-service inspection.

On two recent occasions, structural and mechanical engineers were challenged either to come up with a solution to the data base problem of the reliability analysis methodology or to avoid using the tool as a serious mathematical model to resolve issues of safety and productivity. This paper is a direct response to the challenge. The notion of an adequate data base is first defined in terms of three essential elements. It is then demonstrated via a medical analogy that an 'optimal' plan of data reporting and some national or international standards for such reporting are desirable. A formula for estimating variabilities based on a combination of inservice and failure data is proposed.

710,098
PB82-263625 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Accuracy Statement for a Facility Used to Calibrate Static Pressure Transducers and Differential Pressure Transducers at High Base Pressure,
C. F. Sindt, and J. F. LaBrecque. Jun 82, 45p NBS-TN-1052
Sponsored in part by American Gas Association, Inc., Arlington, VA., and Gas Research Inst., Chicago, IL.

Keywords: *Pressure sensors, Calibrating, Accuracy, Standards.

A facility has been developed to calibrate pressure transducers that are used in the NBS Gas Mass Flow Facility. Both static and differential pressure transducers can be calibrated. An air dead weight tester is the standard for static transducers in the range from 3.8 to 4.5 MPa. An air dead weight tester is also the standard for the differential pressure transducers in the range of 2.5 kPa to 50 MPa; a cistern manometer. This, plus the uncertainties in the high pressure corrections to the cistern manometer and our measurement of the mercury temperature, contributes plus or minus 690 ppm to the uncertainty of the differential pressure transducer calibrations.

710,099
PB82-264219 Not available NTIS
National Bureau of Standards, Washington, DC.
Metric System: Its Status and Future.
Final rept.
D. T. Goldman. Apr 82, 4p
Pub. in IEEE Spectrum 18, n4 p60-63 Apr 82.

Keywords: *Metric system, Evaluation, Predictions, Reprints.

No abstract available.

710,100
PB82-265653 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of the NBS and the Helsinki Temperature Scales and Its Effect on the Heat Capacity of Liquid (3)He Below 10 mK.
Final rept.
E. Lhota, M. T. Manninen, J. P. Pekola, A. T. Soinne, and R. J. Soulen. Aug 81, 5p
Prepared in cooperation with Finnish Academy, Helsinki.
Pub. in Physical Review Letters 47, p590-592, 24 Aug 81.

Keywords: *Temperature measurement, *Specific heat, Liquid helium, Comparison, Transition temperature, Reprints.

The Helsinki temperature scale, used earlier in measurements of the heat capacity of liquid He3 between 1 and 10 mK, is compared with the NBS noise and NO temperature scale. The superfluid transition temperature of He3 at zero pressure and superconductive transition temperatures of tungsten and beryllium samples were used as fixed points. The value for T sub c on the extrapolated NBS scale was found to be 1.025 plus or minus 0.02 mK, in close agreement with the Helsinki

value 1.04 mK. The results support the Helsinki data on the heat capacity of He3.

710,101
PB83-106112 Not available NTIS
National Bureau of Standards, Washington, DC.
Fitness-for-Purpose Research at the National Bureau of Standards.
Final rept.
H. I. McHenry, D. T. Read, and M. G. Dawes. 1982, 10p
Sponsored in part by Naval Sea Systems Command, Washington, DC., and Department of Transportation, Washington, DC. Office of Pipeline Safety Regulation. Pub. in Proceedings of Fitness for Purpose Validation of Welded Constructions, London, England, November 17-19, 1981, pP19-1--P19-10, 1982.

Keywords: *Welded joints, Standards, Reliability, Finite element analysis, Fracture(Mechanics), J integrals.

Fitness-for-purpose standards are based on fracture-mechanics relationships between applied strain, required toughness, and flaw size. The approach used here to establish such a relationship for the elastic-plastic case is to measure the driving force for fracture (i.e., the required toughness) as a function of strain in tensile panels for a variety of flaw sizes and configurations.

710,102
PB83-106161 Not available NTIS
National Bureau of Standards, Washington, DC.
1976 NBS Study of Girth Welds in the Trans-Alaska Oil Pipeline.
Final rept.
H. Berger. 1981, 3p
Pub. in Proceedings of ASNT Fall Conference, Atlanta, Georgia, October 12-15, 1981, ASNT Paper Summary, p198-200 1981.

Keywords: *Welded joints, *Petroleum pipelines, Pipe joints, Weld defects, Nondestructive tests, Radiography, Regulations, Fracture properties, Trans-Alaska oil pipeline, Fracture(Mechanics).

The purpose of this paper is to introduce a regulatory case stud in which technical information played a key role. The problem concerned field-made girth welds in the Trans-Alaska oil pipeline. The study involved properties of the steel pipe and welds, fracture mechanics analysis and nondestructive measurements to size detected weld discontinuities. NBS-furnished results to DoT played a major role in the regulatory decision to waive requirements for 3 welds, thereby setting a precedent for a waiver based on fracture mechanics analysis.

710,103
PB83-109652 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Accuracy Statement for a Facility Used to Calibrate Static Pressure Transducers and Differential Pressure Transducers at High Base Pressure,
C. F. Sindt, and J. F. LaBrecque. Feb 82, 45p NBS-TN-1052
See also PB82-263625. Sponsored in part by American Gas Association, Inc., Arlington, VA. and Gas Research Inst., Chicago, IL.

Keywords: *Pressure sensors, Calibrating, Accuracy, Standards, Test facilities, Test equipment.

A facility has been developed to calibrate pressure transducers that are used in the NBS Gas Mass Flow Facility. Both static and differential pressure transducers can be calibrated. An air dead weight tester is the standard for static transducers in the range from 3.8 to 4.5 MPa. An air dead weight tester is also the standard for the differential pressure transducers in the range of 2.5 kPa to 50 MPa; a cistern manometer provides the transfer for the standard to a base operating pressure of 4.1 MPa. The calibration of the air dead weight gage adds plus or minus ppm to the calibration of the cistern manometer. This, plus the uncertainties in the high pressure corrections to the cistern manometer and our measurement of the mercury temperature, contributes plus or minus ppm to the uncertainty of the differential pressure transducer calibrations.

710,104
PB83-111658 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Metrology for Electromagnetic Technology: A Bibliography of NBS Publications.
R. A. Kamper, and K. E. Kline. Aug 82, 64p NBSIR-82-1677
See also COM73-11971.

Keywords: *Metrology, *Bibliographies, Electronics, Cryogenics, Electromagnetic radiation, Lasers, Fiber optics, Superconductors, Microwaves, Time domain, National Bureau of Standards.

This bibliography lists the publications of the personnel of the Electromagnetic Technology Division of NBS in the period from January 1970 through December 1981. A few earlier references that are directly related to the present work of the division are included.

710,105
PB83-117267 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Migration of Low Molecular Weight Additives in Polymers.
Semi-annual rept. 1 Oct 80-31 Mar 81.
L. E. Smith, S. S. Chang, and G. A. Senich. Sep 81, 44p NBSIR-81-2314
Contract FDA-224-77-2443
See also PB82-202749.

Keywords: *Polymers, *Additives, *Packaging materials, *Food packaging, Diffusion coefficient, Polyethylene, Polyvinyl chloride, *Low molecular weights, Octadecane, Dotriacontane, Creosol/dibutyl.

Migration of three additives, n-octadecan, n-dotriacontane, and butylated hydroxytoluene (BHT), from linear (LPE) and branched polyethylene (BPE) into several oil-simulating solvents is studied at 30 to 60C. Diffusion coefficients of the three migrants from BPE into n-octanol are about the same as those into ethanol. A literature survey on the migration of organotin compounds, particularly di-n-octyltin stabilizers, from poly(vinyl chloride) into foods and food-simulants is also given.

710,106
PB83-117325 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Standard Reference Materials: Application of Some Metal SRM's as Thermometric Fixed Points.
Special pub. (Final).
G. T. Furukawa, J. L. Riddle, W. R. Bigge, and E. R. Pfeiffer. Aug 82, 144p NBS-SP-260-77
Library of Congress catalog card no. 82-600578.

Keywords: *Temperature measurement, Resistance thermometers, Melting points, Zinc, Tin, Aluminum, Cadmium, Mercury, *Standard reference materials.

Equipment and procedures are described for the realization of liquid-solid phase equilibrium states of some pure metals as thermometric fixed points for platinum resistance thermometry. The design and techniques for assembling fixed-point cells using Standard Reference Materials (SRM) 740 (zinc), 43h (zinc), 42g (tin), 741 (tin), 44f (aluminum), 746 (cadmium), and 743 (mercury) are given and the results of the measurements using the purer of these metal SRM's are analyzed and evaluated. The reproducibility of temperature measurements with these metal SRM's is shown to be about plus or minus 0.1 mK.

710,107
PB83-137158 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Application Information on Typical Hygrometers Used in Heating, Ventilating and Air Conditioning (HVAC) Systems.
J. Y. Kao, and W. J. Snyder. Jan 82, 44p NBSIR-81-2460
Sponsored in part by Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Hygrometers, Buildings, Heating, Ventilation, Air conditioning, Moisture meters, Performance evaluation, *Energy consumption.

This report provides hygrometer selection information for application in heating, ventilating and air-conditioning (HVAC) systems. A general review of hygrometer literature has been provided and the most commonly used ones for HVAC are discussed. Typical hygrometer parameters are listed to indicate the type of performance that can be expected. Laboratory test results of self-regulating, salt-phase transition hygrometers are presented and discussed in detail.

710,108
PB83-137448 PC**$25.75**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Initial Graphics Exchange Specification (IGES) Version 2.0.
Rept. for May 80-Nov 82.
B. Smith, K. Brauner, P. Kennicott, M. Liewald, and J. Wellington. Feb 83, 341p NBSIR-82-2631
Sponsored in part by Air Force ICAM Program, Wright-Patterson AFB, OH.

Keywords: *Computer graphics, Specifications, *Computer aided manufacturing, *File maintenance, *Data interchange, Data structures, Computer aided design.

This document contains Version 2.0 of the Initial Graphics Exchange Specification, a defined format for the creation of a file which enables data found in today's commercially available CAD/CAM systems to be exchanged or archived. IGES, Version 1.0, published as NBSIR 80-1978 (R) in January 1980, consisted of entity definitions for geometry, drafting and structural information. Definition entities were provided as a means of expanding the utility of IGES. Version 2.0 of the Specification has been extended in the advanced geometry, electrical, and finite element modeling areas. In addition, the Specification has been reformatted and clarified to enable the user to reference the document more easily.

710,109
PB83-139287 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Computer Software for Measurement Assurance of Gage Blocks.
Final rept.
R. N. Varner. Oct 82, 62p NBS-TN-1168

Keywords: *Computer systems programs, Calibrating, Measurement, Statistical tests, Fortran, Quality assurance, *Gage blocks.

This document is intended for those who are interested in computer software needed to provide, on a continual basis, a measurement assurance procedure for calibrating gage blocks where a test set of gage blocks is measured against two standard sets with control being on the difference of the two standards. A thorough discussion is given of the software including its implementation and usage. A hard copy or a magnetic tape of the software is available on request.

710,110
PB83-143081 Not available NTIS
National Bureau of Standards, Washington, DC.
Two-Color Microsecond Pyrometer for 2000-6000 K.
Final rept.
G. M. Foley, M. S. Morse, and A. Cezairliyan. 1982, 6p
Pub. in Proceedings of Int. Symposium on Temperature (6th), Washington, DC., March 15-18, 1982, Paper in Temperature - Its Measurement and Control in Science and Industry, p447-452 1982.

Keywords: *Radiation pyrometers, *Temperature measuring instruments, Performance evaluation, *Pyrometers, High speed.

An accurate pyrometer has been developed for measurements on solid and liquid specimens in the range 2000 to 6000 K. The pyrometer measures spectral radiance temperature near 0.65 and 0.9 micrometer. Fiber optic cables transmit the radiation to silicon diode detectors. In each channel, a set of three linear amplifiers with high-speed automatic gain switching give high resolution and wide temperature range. Signals are digitally recorded with 0.1% resolution at 1.5 microsec intervals. Linearity of measurements of radiance has been confirmed using a calibrated tungsten strip lamp and the sun. Characteristics and performance of the pyrometer are discussed and results on pulse heating of metallic specimens beyond the melting point are presented.

710,111
PB83-143370 Not available NTIS
National Bureau of Standards, Washington, DC.

Automation of Measurements in a Low Temperature Laboratory.
Final rept.
C. T. Van Degrift, and R. S. Kaeser. 1982, 7p
Pub. in Proceedings of the International Symposium on Temperature (6th), Washington, DC., March 15-18, 1982. Paper in Temperature - Its Measurement and Control in Science and Industry, p1299-1305 1982.

Keywords: *Laboratories, *Automation, *Low temperature research, Temperature measurement, Magnetic fields, Cryogenics, Measurement, Computer applications.

The general software and hardware architecture and performance of our versatile automatic low temperature laboratory control and calibration system is described. The system has been used for measurement of P(T,V,H) on solid He-3 in one laboratory and for the intercomparison of superconductive fixed points and germanium, rhodium-iron, and platinum thermometers in another. Temperature measurements can be performed with an accuracy which meets the needs of the primary standards laboratory. Magnetic field measurements made with a cryogenic Hall probe have a resolution of 20 micro T at a field of 8 T. Several tunnel diode oscillators sensing pressure, dielectric constant, magnetic susceptibility or temperature can be tracked and monitored with better than 0.001 ppm frequency resolution. Provisions are made for the scheduling of complex combinations of measurements including the control of multiple heaters in a sweeping or stepwise manner. A companion program performs preliminary data analysis doing the necessary time interpolation and system calibration.

710,112
PB83-143388 Not available NTIS
National Bureau of Standards, Washington, DC.
Nicrosil Versus Nisil Thermocouple: Recent Developments and Present Status.
Final rept.
G. W. Burns. 1982, 7p
Pub. in Proceedings of the International Symposium on Temperature (6th), Washington, DC., March 15-18, 1982. Paper in Temperature - Its Measurement and Control in Science and Industry, p1121-1127 1982.

Keywords: *Thermocouples, *Nickel alloys, Standardization, Chromium containing alloys, Silicon containing alloys, Nickel alloy Nicrosil, Nickel alloy Nisil.

Some new nickel-base thermocouple alloys called nicrosil and nisil were described by Burley, of the Materials Research Laboratories (MRL, Australia), at the 5th Symposium on Temperature in 1971. Since 1971, these thermocouple alloys have undergone further development, and their properties and performance have also been the subject of considerable study at various government and private laboratories around the world. The studies conducted on the thermocouple alloys since 1971 are reviewed, and the present status of the use, availability, and standardization of the nicrosil/nisil thermocouple in the United States is discussed.

710,113
PB83-143396 Not available NTIS
National Bureau of Standards, Washington, DC.
Investigation of the Stability of Small Platinum Resistance Thermometers.
Final rept.
B. W. Mangum, and G. A. Evans. 1982, 5p
Pub. in Proceedings of the International Symposium on Temperature (6th), Washington, DC., March 15-18, 1982. Paper in Temperature - Its Measurement and Control in Science and Industry, p795-799 1982.

Keywords: *Resistance thermometers, Platinum, Stability, Performance.

The authors have investigated the stability of a selection of small platinum resistance thermometers (RTDs) upon thermal cycling and handling. Sixty thermometers obtained from five manufacturers were studied. Several models or types were included in the investigation. Comparisons are made of the differences in the stability of the products from the different companies. Also, comparisons are made of the differences in the stability of the thermometers of different R0 values. It appears to be possible to select RTDs which are stable upon thermal cycling, but the presence of moisture is definitely a problem if it is desired to use RTDs for precision thermometry.

710,114
PB83-143404 Not available NTIS
National Bureau of Standards, Washington, DC.
Experiences with High Temperature Platinum Resistance Thermometers.
Final rept.
J. P. Evans. 1982, 11p
Pub. in Proceedings of the International Symposium on Temperature (6th), Washington, DC., March 15-18, 1982. Paper in Temperature - Its Measurement and Control in Science and Industry, p771-781 1982.

Keywords: *Resistance thermometers, High temperature tests, Platinum, Stability, Performance.

As part of an effort to develop high temperature platinum resistance thermometers suitable for use as defining instruments to the gold point on a practical temperature scale, we have built and tested thermometers with nominal resistance at 0C of 2.5 ohm. The thermometers are made with silica-glass insulating parts and protecting sheaths. Resistors of the single layer bifilar helix design and of other designs have been employed, and a guarded lead structure has been developed. The thermometers have proven to be satisfactory in some respects but deficient in others, when exposed to 1100C for long periods of time. The stability and other characteristics of the thermometers, and the behavior of the thermometers in thermometric fixed points cells, are discussed.

710,115
PB83-143412 Not available NTIS
National Bureau of Standards, Washington, DC.
Automatic Resistance Thermometer Bridges for New and Special Applications.
Final rept.
R. D. Cutkosky. 1982, 3p
Pub. in Proceedings of the International Symposium on Temperature (6th), Washington, DC., March 15-18, 1982. Paper in Temperature - Its Measurement and Control in Science and Industry, p711-713 1982.

Keywords: *Resistance thermometers, *Resistance bridges, Field tests, Design, Performance, Automatic.

Extensive field tests of several automatic resistance thermometer bridges constructed along the lines described in a recent paper have demonstrated the practicality and versatility of the design. Two new versions of the original instrument are now available. In one of these, the resistance range has been extended to over 100 ohms, and in the other, the lowest available measuring current has been reduced to 1/8 mA. Some critical aspects of the design and construction of these instruments are described.

710,116
PB83-143479 Not available NTIS
National Bureau of Standards, Washington, DC.
Realization of the 1976 Provisional 0.5 K to 30 K Temperature Scale at the National Bureau of Standards.
Final rept.
E. R. Pfeiffer, and R. S. Kaeser. 1982, 9p
Pub. in Proceedings of the International Symposium on Temperature (6th), Washington, DC., March 15-18, 1982. Paper in Temperature - Its Measurement and Control in Science and Industry, p159-167 1982.

Keywords: *Temperature measurement, *Cryogenics, *Calibrating, Resistance thermometers, Superconductivity, Standards, Fixed points.

The National Bureau of Standards presently disseminates a version of the 1976 Provisional 0.5 K to 30 K Temperature scale (EPT-76) which is maintained on two rhodium-iron resistance thermometers. Calibrations on the EPT-76 are made using an automated cryostat-regulation and data-acquisition system under the control of a dedicated laboratory minicomputer. Maintenance of the scale is periodically checked against realization of the superconducting transition points of NBS SRM 767 (which comprises 5 of the 11 defining reference points of the EPT-76). In addition, versions of the EPT-76 derived from the NBS 2-20 K Scale (maintained on germanium resistance thermometers) and from the NBS version of IPTS-68 (maintained on platinum resistance thermometers) have been realized and compared with the rhodium-iron based scale over their respective overlapping regions. From those checks and comparisons, and from similar data from other sources, it is concluded that the EPT-76 is non-unique by as much as 1 mK at several places over its 0.5 K to 30 K range. Thus, an uncertainty of + or - 1 mK has been assigned to the EPT-76 currently being disseminated by NBS. These are tolerable limits considering the provisional status of the scale.

710,117
PB83-152314 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Model of the Steady-State Performance of an Absorption Heat Pump.
S. A. Klein. Oct 82, 58p NBSIR-82-2606
Sponsored in part by Department of Energy, Washington, DC., and Oak Ridge National Lab., TN.

Keywords: *Heat pumps, Mathematical models, Water coolers, Performance, Absorption heat pumps.

A mathematical model of the steady-state performance of an absorption heat pump is described. The model is compared with experimental data from a residential-sized water chiller. It is also used to determine the sensitivity of the heat pump performance to its design variables.

710,118
PB83-162354 PC **A03**/MF **A01**
Putnam, Hayes and Bartlett, Inc., Cambridge, MA.
Impact of Private Voluntary Standards on Industrial Innovation. Planning Report 13. Volume I: Final Report.
Jan 83, 44p NBS-GCR-82-420

Keywords: *Technology innovation, *Industries, Standards, Growth, Competition, Policies.

A conceptual basis is developed for analyzing the impacts of industrial standards on innovation and subsequent diffusion. The framework relates the functions performed by standards to the investment decisions by firms with respect to innovation or the adoption of innovations. The four major functions performed by standards in technology-based industries are providing information, promoting compatibility, reducing product variety, and assuring certain quality or performance levels. Three case studies of technology-based areas of industrial activity are studied to determine the usefulness of the conceptual framework. The three areas are semiconductors, lubricating oils, and corrosion inhibitors.

710,119
PB83-162388 PC **A12**/MF **A01**
Putnam, Hayes and Bartlett, Inc., Cambridge, MA.
Impact of Private Voluntary Standards on Industrial Innovation. Planning Report 13. Volume I: Appendices.
Nov 82, 264p NBS-GCR-82-420-APP

Keywords: *Technology innovation, *Industries, Standards, Growth, Competition, Policies.

This study represents the initiation of a systematic study on the relationship between voluntary standards and innovation.

710,120
PB83-164392 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
Semiconductor Measurement Technology: Interlaboratory Study on Linewidth Measurements for Antireflective Chromium Photomasks.
J. M. Jerke, M. C. Croarkin, and R. N. Varner. Oct 82, 194p NBS/SP-400-74
ARPA Order-2397

Keywords: *Line width, *Measurement, Standards, Calibrating, Integrated circuits, Micrometers, *Photomasks.

The report discusses the results of an interlaboratory study to evaluate a National Bureau of Standards (NBS) prototype calibration standard for linewidth measurements on IC photomasks and procedures for adjusting and calibrating optical-microscope systems in the 0.5- to 12-micrometer measurement range. Using procedures furnished by NBS, industrial participants measured line spacings and linewidths on NBS antireflective-chromium artifacts.

710,121
PB83-165480 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Commercial Heating Boiler Transient Analysis Simulation Model (DEPAB2).
J. Chi, and D. Didion. Jan 83, 96p NBSIR-83-2638
Sponsored in part by Department of Energy, Washington, DC., and Department of the Army, Washington,

DC. Prepared in cooperation with HCP Systems, Rockville, MD.

Keywords: *Boilers, *Computerized simulation, Surges, Computer programs, Heat transfer, Transients, Energy conservation, DEPAB2 computer program.

The report documents a second generation boiler transient analysis computer program DEPAB2. It treats in detail the boiler controllers and different modes of heat transfer (which include conductive, convective and radiative) in the boiler environment; and it is built upon 7 principal subroutines for the controller and interface flux calculations and 16 auxiliary subroutines for fluid properties, fuel/air combustion and heat transfer parameters. Also included is a guide on using DEPAB2.

710,122
PB83-167148 PC **A15**/MF **A01**
National Bureau of Standards, Washington, DC.
Report of the National Conference on Weights and Measures (67th), 1982.
A. D. Tholen, L. E. Barbrow, and A. P. Heffernan.
Oct 82, 332p NBS-SP-645
See also PB82-178997. Library of Congress catalog card no. 26-27766.

Keywords: *Units of measurement, *Meetings, Size determination, Metric system, Standards. Packaging, Weight measurement, Consumer affairs, Marking, *Weights and measures, Metrication.

These are the proceedings of the 67th National Conference on Weights and Measures, held in Atlanta, Ga., July 12-16, 1982. Reports by the several standing and annual committees of the Conference comprise the major portion of the publication. Included also are papers presented by Conference officials and others. Major issues discussed at the National Conference included long-range plans for training, enforcement uniformity, national type evaluation programs and a new publication on type evaluation examinations, new design and performance requirements for commercial weighing and measuring instruments, cash and credit sales at retail motor fuel outlets, studies of model State laws and regulations, a tentative code for grain moisture meters, and adoption of several NBS Handbooks by NCWM.

710,123
PB83-176958 Not available NTIS
National Bureau of Standards, Washington, DC.
O-Ring Sealed Rotary Feedthrough for UHV Applications.
Final rept.
A. Pararas, S. T. Ceyer, and J. T. Yates. 1982, 1p
Pub. in Jnl. of Vacuum Science and Technology 21, n4 p1031 Nov/Dec 82.

Keywords: Fittings, Vacuum apparatus, Ultrahigh vacuum, Rotary seals, O ring seals, Vacuum seals, Reprints, *Feedthroughs.

A differentially pumped o-ring sealed rotary feedthrough for ultrahigh vacuum applications is described. Its simplified design results in a significant reduction in machining requirements compared to previous designs.

710,124
PB83-177352 Not available NTIS
National Bureau of Standards, Washington, DC.
Report on the International Symposium on Temperature (6th).
Final rept.
B. W. Mangum, and G. T. Furukawa. 1982, 8p
Pub. in Metrologia 18, p161-168 1982.

Keywords: *Temperature, Temperature measuring instruments, Temperature measurement, Meetings, Reprints.

This is a report on the Sixth International Symposium on Temperature which was held in Washington, DC, USA, March 15-18, 1982. This includes a brief introduction, indicating the timeliness of the Symposium, its sponsors and the publication of its Proceedings. The remainder of the report is devoted to a summary of the Plenary and Technical Sessions of the Symposium.

710,125
PB83-177402 Not available NTIS
National Bureau of Standards, Washington, DC.
Cooling Capacity of Stirling Cryocoolers - The Split Cycle and Nonideal Gas Effects.
Final rept.
D. E. Daney. Oct 82, 5p
Pub. in Cryogenics 22, n10 p531-535 Oct 82.

Keywords: *Coolers, *Cryogenics, Performance evaluation, Reprints, *Stirling coolers.

The general expression for the cooling capacity of a Stirling cooler operating with a non-ideal gas is derived. The results demonstrate that thermodynamic regions of negative Joule-Thomson coefficient should be avoided. It is also shown that heat transfer to the expansion space occurs during three of the four steps of the ideal Stirling cycle.

710,126
PB83-177436 Not available NTIS
National Bureau of Standards, Washington, DC.
Interferometric Phase Calibration of Vibration Pickups.
Final rept.
M. R. Serbyn. 1982, 7p
Pub. in Proceedings of International Modal Analysis Conference (1st), Orlando, Florida, November 8-10, 1982, Paper in ISA Trans., p223-229 1982.

Keywords: *Vibration, *Calibrating, Detectors, Optical interferometers, Phase measurement.

The paper describes a method for performing the phase calibration of a vibration pickup by optical interferometry. The paper discusses the theory and implementation of the technique, illustrating them with results of measurements.

710,127
PB83-177519 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical Property Measurements at Low Temperatures.
Final rept.
D. T. Read, and R. L. Tobler. 1982, 12p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of International Cryogenic Materials Conference (4th), San Diego, California, August 10-14, 1981, Paper in Advances in Cryogenic Engineering 28, p17-28 1982.

Keywords: *Mechanical tests, *Materials tests, *Cryogenics, Fracture tests, Fatigue tests, Crack propagation, Tension tests, Elastic properties, Yield strength, J integrals.

Mechanical test methods for the liquid helium temperature range are discussed. Fracture toughness testing and the use of toughness data will be emphasized. Facilities and test methods for fracture toughness, fatigue crack growth rate, tensile, and elastic properties at NBS/Boulder are described. Apparatus and techniques for temperature measurement and control during mechanical tests are discussed.

710,128
PB83-178780 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Expression of the Uncertainties of Final Measurement Results: Reprints.
Final rept.
C. Eisenhart, H. H. Ku, and R. Colle. Jan 83, 23p
NBS-SP-644
Library of Congress catalog card no. 82-600655.

Keywords: *Measurement, Accuracy, Errors, Probability theory.

The publication reprints and collects in one convenient source three articles, by NBS authors, that present a philosophical basis, general guidelines, and specific recommendations for expressing the uncertainties of final measurement results.

710,129
PB83-179218 Not available NTIS
National Bureau of Standards, Washington, DC.
Single-Crystal Elastic Constants in Nondestructive Evaluation of Welds.
Final rept.
H. M. Ledbetter. 1982, 6p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Air Force/Defense Advanced Research Projects Agency (8th) (AF/DARPA) Symposium on Quantitative Nondestructive Evaluation, University of Colorado, Boulder, Aug 2-7, 1981. Paper in Quantitative Nondestructive Evaluation 1, p619-624 1982.

Keywords: *Welded joints, *Nondestructive tests, Elastic properties, Elastic waves, Single crystals, Steels.

For studying welds nondestructively using elastic waves, the authors describe the importance of knowing the material's single-crystal elastic constants, the Cjj's. Where these are not known, the authors give some guidelines for estimating them from polycrystalline elastic constants such as Young's modulus and the shear modulus. The authors consider the important case of (100) texture. Being transversely isotropic, this case exhibits five macroscopic elastic constants, which the authors relate to the three cubic elastic constants: C11, C12, C44. From these five constants the authors compute the angular variations of Young's modulus, the torsional modulus, and the sound velocities.

710,130
PB83-179234 Not available NTIS
National Bureau of Standards, Washington, DC.
Design of an Optical Linewidth Standard Reference Material for Wafers.
Final rept.
D. Nyyssonen. 1982, 8p
Pub. in SPIE 342, p27-34 1982.

Keywords: *Line width, *Standards, *Wafers, Optical measurement, Design, Lithography, Reprints, *Standard reference materials, Edge detection.

Optical linewidth measurements on patterned wafers are complicated by the wide variety of materials and correspondingly wide variation in optical parameters, complex refractive index and thickness, used in the manufacture of integrated circuits. To achieve the measurement precision and accuracy required for VLSI dimensions (e.g., 10 percent tolerance for 1 micrometer linewidths), it is necessary to control coherence, spectral bandpass, and image integrity as well as to achieve reproducible edge detection and focus criteria. When a system can be operated without further operator intervention despite changes in the materials being measured, it is possible to calibrate the linewidth measurement system using a standard fabricated from only a few materials representing a range of image characteristics. The desirable characteristics of such a standard are discussed with respect to durability, edge definition, and equivalence of the image characteristics to materials used in the manufacture of ICs. A prototype design consisting of combinations of SiO2 and chromium layers on a silicon substrate is presented.

710,131
PB83-179341 Not available NTIS
National Bureau of Standards, Washington, DC.
Interferometric Measurement of Length Scales at the National Bureau of Standards.
Final rept.
J. S. Beers, and K. B. Lee. Oct 82, 10p
Pub. in Precis. Eng. 4,, n4 p205-214 Oct 82.

Keywords: *Length, *Calibrating, *Interferometers, Measurement, Precision, Accuracy, Reprints.

The interferometric comparator for calibrating length scales at the National Bureau of Standards is described. Its origins and early development are traced, and recent modernization and automation are detailed. A statistically based measurement assurance program is used to evaluate precision, accuracy and long term performances.

710,132
PB83-179465 Not available NTIS
National Bureau of Standards, Washington, DC.
Thin Platinum Film for Transient Heat Transfer Studies.
Final rept.
P. J. Giarratano, F. L. Lloyd, L. O. Mullen, and G. B. Chen. 1982, 5p
Pub. in Proceedings of the International Symposium on Temperature (6th), Washington, DC, Mar 15-18, 1982. Paper in Temperature - Its Measurement and Control in Science and Industry, V, p859-863 1982.

Keywords: *Temperature measuring instruments, Platinum, Metal films, Thin film, Detectors, Heat transfer, Surges, Electric heating elements.

This paper describes the construction and performance of a platinum film (37mm X 8mm X 18nm) which is used simultaneously as a heater surface and thermometer for transient heat transfer studies. Nominal resistance ranges from 25 ohms at room temperature to 10 ohms at liquid nitrogen temperature. Typical resistance versus temperature from 75.7 to 293 K, stability, and time response of the film are presented. A description of a transient method for determining the thermal conductivity of the quartz substrate is also included in the discussion.

710,133
PB83-179481 Not available NTIS
National Bureau of Standards, Washington, DC.
Inherent Problems in Force Measurement.
Final rept.
P. E. Pontius, and R. A. Mitchell. Mar 82, 8p
Pub. in Experimental Mechanics 22, n3 p81-88 Mar 82.

Keywords: *Force, *Measurement, Detectors, Calibrating, Hysteresis, Load cells, Test equipment, Errors, Reprints.

A force sensor is ordinarily used as a part of a larger system such as a testing machine, test stand, weighing system or process control system. When a force sensor is calibrated in a standards laboratory and then installed and used in a different system, there may be a significant shift in sensor response due to differences in many factors such as machine-sensor mechanical interaction, loading sequence, loading rate and environmental conditions. NBS research is directed toward establishing the magnitude of the errors due to these factors and developing methods for controlling these errors. Some initial results in the study of machine-sensor interaction, hysteresis, thermoelastic effect and creep are discussed here. A long range objective is to enable users to make informed judgements about the adequacy of their own force measurements, based on an understanding of their own measurement process rather than based only on a routine calibration at a standards laboratory.

710,134
PB83-181636 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Optical and Mechanical Methods of Thickness Measurement.
Final rept.
A. Feldman, and T. Vorburger. 1982, 8p
Pub. in Proceedings of SPIE Technical Symposium East 1982, Integrated Circuit Metrology, Arlington, VA., May 3-7, 1982, 342, p92-99 1982.

Keywords: *Dimensional measurement, *Thin films, Thickness, Interferometers, Profilometers, Polarimetry.

A variety of techniques is used for the measurement of thin film thicknesses of the order of one micrometer. These techniques include stylus profilometry, multiple beam interferometry, dual beam interferometry, guided waves, channel spectra and ellipsometry. The principles underlying each of the techniques are discussed and where available, experimental comparisons of the techniques are presented. Advantages, disadvantages, and sources of error are also discussed.

710,135
PB83-181693 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of the National Bureau of Standards (NBS) Antireflective (AR)-Chromium Optical Linewidth Standard for Measurements on Other Types of Chromium Photomasks.
Final rept.
J. M. Jerke, and C. E. Wendell. 1982, 12p
Pub. in Proceedings of SPIE (International Society for Optical Engineers) Integrated Circuit Metrology, Arlington, VA., May 4-5, 1982, 342, p15-26 1982.

Keywords: *Line width, *Standards, *Optical measurement, Chromium, Calibrating, Integrated circuits, *Photomasks.

The suitability of using a calibration curve based on an AR-chromium optical linewidth-measurement standard (SRM 474) from the National Bureau of Standards (NBS) to correct linewidth measurements on other types of photomasks is discussed. Linewidths on each of three chromium photomasks of different chromium thicknesses were measured on four different types of optical microscope linewidth measurement systems. These measurements were corrected using an SRM 474 and compared with measurements made on the NBS optical linewidth calibration system.

710,136
PB83-181701 Not available NTIS
National Bureau of Standards, Washington, DC.
Ellipsometric Accuracy and the Principal Angle of Incidence.
Final rept.
D. Chandler-Horowitz. 1982, 10p
Pub. in Proceedings of SPIE International Society for Optical Engineers Integrated Circuit Metrology, Arlington, VA., May 4-5, 1982, 342, p121-130 1982.

Keywords: *Polarimetry, *Thin films, Dimensional measurement, Thickness, Angle of incidence, Accuracy, Refractivity, Measurement.

The effects of improving the accuracy of the angle of incidence on the ellipsometric determination of thickness and refractive index of oxide and nitride films on a silicon substrate are analyzed. It is found that the accuracy of a determination of a film's parameters, thickness and refractive index, depends as much or more on the accuracy of the angle of incidence measurement as on the accuracy of the measurement of the ellipsometric angles delta and psi. If measurements of delta and psi are made close to the principal angle of incidence, the accuracy of the determined film parameters can be improved by measuring the incident angle to an accuracy better than delta and psi. This is especially true for thin films of oxide less than a few tens of nanometers. Because of the higher refractive index of silicon nitride relative to silicon dioxide, a nitride film's thickness can be determined more accurately than an oxide film's thickness. Therefore, silicon nitride may make a good candidate film for a standard thickness sample.

710,137
PB83-183574 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultrasonic Inspection of Stainless Steel Butt Welds Using Horizontally Polarized Shear Waves.
Final rept.
C. M. Fortunko, and J. C. Moulder. May 82, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Ultrasonics, p113-117 May 82.

Keywords: *Butt welds, *Ultrasonic tests, Stainless steels, Secondary waves, Nondestructive tests, Reprints.

Inspection of austenitic stainless steel weldments by conventional ultrasonic means is fundamentally limited by the textured, columnar grain structure of the weld metal. It is shown that, for selected angles of incidence, shear waves normally polarized with respect to the columnar grains can pass through the weld metal-base metal interface without partial reflection. As consequence, the inspectability of stainless steel weldments can be improved. The operation of a low frequency, ultrasonic system for stainless steel butt welds is demonstrated.

710,138
PB83-208082 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Publications of the Mechanical Production Metrology Division in 1980-1982.
M. A. Cadoff. May 83, 20p NBSIR-83-2699

Keywords: *Metrology, *Bibliographies.

This bibliography lists the publications of the personnel of the Mechanical Production Metrology Division from January 1980 through December 1982. Included in it are publications for which one or more authors were in the Division during this period, as well as a few publications that were written in support of Division programs, even though none of the authors were members of the Division.

710,139
PB83-240838 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
FASTMENU: A Set of FORTRAN Programs for Analyzing Surface Texture.
T. V. Vorburger. Jul 83, 127p NBSIR-83-2703

Keywords: *Surface properties, *Computer programs, Data acquisition, Statistical analysis, Surface roughness, Autocorrelation, Digital techniques, FORTRAN, Minicomputers, ROUGHNES computer program, STEPHGHT computer program, WHATSON computer program, AVRGRA computer program, SMORGAS computer program, PLOTSVIL computer program, ADF computer program, PSD computer program, ACF computer program.

A set of FORTRAN programs for surface texture analysis is described. These programs were developed for use with a minicomputer that is interfaced to stylus type instruments. The programs (1) perform data acquisition from the stylus instruments, (2) store the data on magnetic disk, and (3) perform statistical analyses for parameters such as the roughness average Ra, rms roughness Rq, and for the autocorrelation function and amplitude density function.

710,140
PB84-110998 PC **A16**/MF **A01**
National Bureau of Standards, Washington, DC.
Report of the 68th National Conference on Weights and Measures, 1983.
A. D. Tholen, L. E. Barbrow, and A. P. Heffernan.
Sep 83, 356p NBS/SP-663
See also PB82-178997. Library of Congress catalog card no. 26-27766.

Keywords: *Units of measurement, *Meetings, Size determination, Metric system, Standards, Packaging, Weight measurement, Consumer affairs, Marking, Labels, *Weights and measures, Metrication, Training, Instructional materials.

These are the proceedings of the 68th National Conference on Weights and Measures sponsored by the National Bureau of Standards and held July 17-22, 1983. Reports by the several standing and annual committees of the Conference comprise the major portion of the publication. Included also are papers presented by Conference officials and others. Major issues discussed at the Conference included labeling of gasoline containing alcohol, national type evaluation, and development of training materials.

710,141
PB84-115765
(Order as PB84-115757, PC **A04**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Ultrasonic Continuous-Wave Beam-Power Measurements: International Intercomparison.
C. E. Tschiegg, M. Greenspan, and D. G. Eitzen. Apr 83, 13p
Included in Jnl. of Research of the National Bureau of Standards, v88 n2 p91-103, Mar-Apr 83.

Keywords: *Ultrasonic radiation, *Standards, Power measurement, Ultrasonic transducers.

Some quartz transducers designed and fabricated at the National Bureau of Standards as transmitters of ultrasonic power appear to be sufficiently stable and linear to serve as standards. Therefore, an international intercomparison of measurements of the continuous-wave (cw) power emitted by these standards was arranged. Each of the seven participating laboratories performed such measurements using one or more methods representing its practice and reported the results to the National Bureau of Standards which served as the pilot laboratory. We present the results mostly in the form of tables. Some remarks on stability are appended.

710,142
PB84-115864
(Order as PB84-115849, PC **A04**/MF **A01**)
National Bureau of Standards, Washington, DC.
Intercomparison of Pressure Standards between the Instituto di Metrologia 'G. Colonnetti' and the National Bureau of Standards.
J. C. Houck, G. F. Molinar, and R. Maghenzani. 26 Apr 83, 7p
Included in Jnl. of Research of the National Bureau of Standards, v88 n4 p253-259, Jul-Aug 83.

Keywords: *Pressure gages, *Standards, Correlation techniques, Pressure gradients, Comparison.

Intercomparisons were performed between a primary standard gas piston gauge of the Instituto di Metrologia 'G. Colonnetti' (IMGC) and two gauges at the National Bureau of Standards. The agreement between the average pressure generated by the IMGC primary standard and the NBS transfer gauge was within 7 ppm (over the range 0.75 to 5.0 MPa) and the agreement between the IMGC primary standard and the NBS primary standard was within 6 ppm (over the range 0.5 to 1.5 MPa). The agreement is well within the estimated uncertainties of the gauges: 24 ppm for the

IMGC primary gauge, 30 ppm for the NBS transfer gauge, and 28 ppm for the NBS primary gauge.

710,143
PB84-164110 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Techniques in High-Temperature Resistance Thermometry: 1. Construction of the NBS-Design High-Temperature Platinum Resistance Thermometer. 2. Toroidal Resistor for High-Temperature Platinum Resistance Thermometers.
Final rept.
N. Bass, J. P. Evans, and S. B. Tillett. Jan 84, 20p NBS-TN-1183
Also available from Supt. of Docs. as SN003-003-02549-6.

Keywords: *Resistance thermometers, Design, Resistors, Platinum, High temperature.

This Technical Note consists of two papers dealing with design and construction aspects of high-temperature platinum resistance thermometers intended for use as standard interpolating instruments up to the gold point (1064 C). Performance experience with the thermometers has been or will be presented elsewhere. The first paper describes the construction of a thermometer utilizing a resistor of reference-grade platinum wire wound in a single-layer, bifilar helix. The supports and insulators are made of high-purity fused silica, and the thermometer incorporates an electrical guard system to minimize the effects of electrical leakage. The second paper describes a new type of resistor for high-temperature platinum resistance thermometers, the 'toroidal' resistor. The resistor is designed to be easy to make from readily available materials, and it features robustness, small size, and freedom from strain.

710,144
PB84-217017 PC **A03**/MF **A01**
National Bureau of Standards (NML), Washington, DC. Polymers Div.
Development of a Polymer Pressure Gage with Temperature Compensation.
A. J. Bur, and S. C. Roth. Apr 84, 32p NBSIR-84-2862
Sponsored in part by Air Force Armament Lab., Eglin AFB, FL.

Keywords: *Pressure gages, Thin films, Vinylidene resins, Temperature compensation.

The development of a temperature compensated pressure transducer is described. The pressure sensing element of this transducer is a thin film of polyvinylidene fluoride which is both piezoelectrically and pyroelectrically active. In order to measure a pressure pulse which is also accompanied by a temperature pulse due to adiabatic heating, it is necessary to correct for the pyroelectric signal. The temperature compensation technique which we use is to measure the temperature with a fast response thermocouple, to amplify the thermocouple signal in accordance to the pyroelectric response to the transducer and to combine the transducer and amplified thermocouple signals to produce an output voltage proportional to pressure only. A compensation circuit with a frequency range of 1 Hz to 10,000 Hz was constructed and tested. The transducer was calibrated and tested using pressure pulses whose peak value was 2.1 x 10 to the 7th power Pa (3000 psi) and whose pulse width was aproximately 5 to 10 ms.

710,145
PB84-217298 Not available NTIS
National Bureau of Standards, Washington, DC.
Production of Gold-Thickness Standard Reference Materials.
Final rept.
H. Brown, D. Lashmore, and F. Ogburn. Sep 83, 3p
Pub. in Plating and Surface Finishing, v70 n9 p76-78 Sep 83.

Keywords: *Thickness, *Standards, *Gold, Electrodeposition, Reprints, *Standard reference materials.

The procedure used to fabricate Gold Standard Reference Materials is reviewed along with the procedure used to certify their thickness. Among the topics presented are (a) the purpose of the standards, (b) the electrodeposition technology used in their fabrication, and (c) quality control and the certification procedures used. Both beta backscatter and x-ray fluorescence techniques are employed in the certification process and each will be discussed as will automation of the certification process.

710,146
PB84-217827 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Applied Mathematics.
Economic Model of Calibration Improvements for Automatic Test Equipment.
Final rept.
S. F. Weber, and A. P. Hillstrom. Apr 84, 98p NBS/SP-673
Also available from Supt. of Docs as SN003-003-02580-1. Library of Congress catalog card no. 84-601027.

Keywords: *Calibrating, *Economic models, *Test equipment, Performance evaluation, Automation, Specifications, Maintenance, Mathematical models, Error analysis, Computer programs, *Automatic test equipment, Numerical solution.

This paper presents a model for measuring the benefits of improved accuracy in test equipment. The model permits calculation of the probability of accepting a unit under test (UUT) that is out of specifications (i.e., Consumer's Loss) and the probability of rejecting a UUT that is within specifications (i.e., Producer's Loss) for alternative levels of test equipment accuracy. Accuracy is defined in terms of both the systematic and the random measurement error of the equipment. Other parameters that are taken into account by the model are the mean and variance of the UUT attribute of interest, the performance specifications of the UUT, and the test specifications which define acceptance and rejection in terms of test measurement results. A discussion of the economic consequences of Consumer's Loss and Producer's Loss is included. The model may be used to optimize both procurement policy for new test equipment as well as maintenance and calibration policy for existing test equipment.

710,147
PB84-217868 PC **A04**/MF **A01**
National Bureau of Standards (NML), Washington, DC. Office of Physical Measurement Services.
Measurement Assurance Programs. Part 1: General Introduction.
Final rept.
B. Belanger. May 84, 74p NBS/SP-676-1
See also PB84-217876. Also available from Supt. of Docs as SN003-003-02587-9. Library of Congress catalog card no. 84-601030.

Keywords: *Quality assurance, *Metrology, *Calibrating, Measurement, Quality control, *Measurement assurance program, National Bureau of Standards.

This publication is Part I of a two-part guide describing NBS Measurement Assurance Program (MAP) Services and how to use them for measurement quality control. Part I describes the general philosophy of MAP Services and how they are used; Part II (Development and Implementation, by C. Croarkin) describes the statistical tools used in MAP's. MAP's constitute a more rigorous method for ascertaining and controlling measurement uncertainty than traditional NBS calibration services.

710,148
PB84-217876 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Statistical Engineering Div.
Measurement Assurance Programs. Part 2: Development and Implementation.
Final rept.
C. Croarkin. Apr 84, 128p NBS/SP-676-2
See also PB84-217868. Also available from Supt. of Docs as SN003-003-02574-1.

Keywords: *Quality assurance, *Metrology, *Calibrating, *Statistical analysis, Measurement, Random error, Quality control, *Measurement assurance program, National Bureau of Standards, Systematic errors, Uncertainty.

This document is a guide to the logical development of a measurement assurance program in which the tie between a measurement and its reference base is satisfied by measurements on a transfer standard. The uncertainty of values reported by the measurement process is defined; and the validation of this uncertainty for single measurements is developed. Measurement sequences for executing the transfer with NBS and procedures for maintaining statistical control are outlined for eight specific measurement situations with emphasis on characterizing parameters of the measurement process through use of a check standard.

710,149
PB84-220896 Not available NTIS
National Bureau of Standards, Washington, DC.
Fitness-for-Purpose Criteria for Pipeline Girth Welds.
Final rept.
M. B. Kasen, and C. M. Fortunko. Sep 82, 12p
Sponsored in part by Department of Transportation, Washington, DC. Office of Pipeline Safety Operations and Welding Research Council, New York.
Pub. in Proceedings of Pipeline Welding Inspection Conference, Houston, Texas, September 21-22, 1982, p181-192.

Keywords: *Welded joints, Weld defects, Nondestructive tests, Pipelines, Radiography, Ultrasonic tests, Fracture(Mechanics).

Results of a program to provide the basis for applying fracture mechanics principles assessment of flaw significance in pipeline girth welds are reviewed. Subjects discussed are: (i) development of appropriate allowable flaw size curves; (ii) development of an improved ultrasonic technique for sizing of sharp flaws; (iii) the significance of blunt flaws; and (iv) the demonstration of inherent limitations on the through-wall depths of blunt flaws. A series of technical options for field implementation of the results is provided and discussed.

710,150
PB84-221613 Not available NTIS
National Bureau of Standards, Washington, DC.
Study of Fitness-for-Purpose Criteria Shows Promise for Pipeline Girth-Weld Quality.
Final rept.
M. B. Kasen, and C. M. Fortunko. 4 Jul 83, 11p
Sponsored in part by Department of Transportation, Washington, DC. Office of Pipeline Safety Operations and Welding Research Council, New York.
Pub. in Oil Gas Jnl., p83-93, 4 Jul 83.

Keywords: *Welded joints, Weld defects, Nondestructive tests, Pipelines, Radiography, Ultrasonic tests, Reprints.

Results of a program to provide the basis for applying fracture mechanics principles to assessment of flaw significance in pipeline girth welds are reviewed. Subjects discussed are: (i) development of appropriate allowable flaw size curves; (ii) development of an improved ultrasonic technique for sizing of sharp flaws; (iii) the significance of blunt flaws; and (iv) the demonstration of inherent limitations on the through-wall depths of blunt flaws. A series of technical options for field implementation of the results is provided and discussed.

710,151
PB84-221928 Not available NTIS
National Bureau of Standards, Washington, DC.
Rutherford Backscatter Analysis of Multilayered Cr-Ni Structures to Be Used for Sputtering Standards.
Final rept.
D. G. Simons, M. D. Brown, J. Fine, T. D. Andreadis, and B. Navinsek. 1983, 4p
Sponsored in part by Department of the Navy, Washington, DC.
Pub. in Nuclear Instruments and Methods in Physics Research 218, p585-588 1983.

Keywords: *Sputtering, *Standards, *Thin films, *Laminates, Backscattering, Metal films, Chromium, Nickel, *Standard reference materials, *Rutherford scattering.

Rutherford backscatter spectrometry (RBS) has been used to characterize multi-layered Cr/Ni structures which are being prepared for future distribution as sputter profiling standards. The ability to resolve the periodic bilayered structure provides a sensitive determination of the component film thicknesses by direct comparison with computer simulated spectra. The RBS analyses show that the sample preparation was well controlled and that film thicknesses of like layers of any one sample, as well as between any two samples, were uniform to better than 3%. This accuracy holds for any two samples within one batch or from batch to batch.

710,152
PB84-223940 Not available NTIS
National Bureau of Standards, Washington, DC.

Long Wavelength Ultrasonic Technique for Detecting and Sizing Weld Defects.
Final rept.
C. M. Fortunko, and R. E. Schramm. 1981, 6p
Sponsored in part by Welding Research Council, New York.
Pub. in Proceedings 1981 ANTS (American Society for Nondestructive Testing) National Fall Conference, Atlanta, GA., October 12-15, 1981, p346-348.

Keywords: *Ultrasonic tests, *Weld defects, Welded joints, Nondestructive tests, Pipelines.

A new ultrasonic inspection technique is described for detecting elongated defects in butt welds. The technique uses noncoupling, electromagnetic-acoustic transducers (EMATs) that can operate on most unprepared surfaces and under adverse environmental conditions. The operation of the new technique is demonstrated in the context of detection and sizing of elongated, two-dimensional defects in girth welds of 1.22-m (48-in) diameter cross-country pipeline. The ultrasonic inspection is carried out at 454 kHz using shear wave signals polarized in the plane of the weld (SH-waves). The advantage of ultrasonic weld inspections at low frequencies (long-wavelengths) is that the reflected ultrasonic amplitude is relatively insensitive to defect orientation and surface roughness. Since SH waves can propagate at near-grazing angles, the sensitivity to through-wall, two-dimensional defects can be maximized. These features of the SH-wave-EMAT system are particularly attractive when fitness-for-service criteria are used to evaluate welded butt joints.

710,153
PB84-225226 Not available NTIS
National Bureau of Standards, Washington, DC.
Approach to Optimization of Low-Power Stirling Cryocoolers.
Final rept.
D. B. Sullivan, R. Radebaugh, D. E. Daney, and J. E. Zimmerman. 1983, 24p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of Biennial Conference Refrigeration Cryogenic Sensors Electronic Systems (2nd), Greenbelt, MD., Dec 7-8, 1982, p107-130 1983.

Keywords: *Refrigerators, Stirling cycle, Optimization, Design, Cryogenics, *Cryocoolers, Cryogenic refrigerators.

The authors describe a method for optimizing the design (shape of the displacer) of low-power Stirling cryocoolers relative to the power required to operate the systems. A variational calculation which includes static conduction, shuttle, and radiation losses, as well as regenerator inefficiency, has been completed for coolers operating in the 300 K to 10 K range. While the calculations apply to tapered displacer machines, comparison of the results with stepped-displacer cryocoolers indicates reasonable agreement.

710,154
PB84-225572 Not available NTIS
National Bureau of Standards, Washington, DC.
NVLAP (National Voluntary Laboratory Accreditation Program) and NATA (National Association of Testing Authorities) Assessment Procedures.
Final rept.
P. Postal, and P. Unger. Jun 83, 4p
Sponsored in part by American Society for Testing and Materials, Philadelphia, PA.
Pub. in American Society for Testing and Materials Standardization News p32-34, 37 Jun 83.

Keywords: *Laboratories, Tests, Comparison, Assessments, Reprints, *National voluntary laboratory accreditation program, *National association of testing authorities, Procedures.

The National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Bureau of Standards (NBS) and the National Association of Testing Authorities (NATA) of Australia use on-site assessment procedures of equivalent rigor to accredit laboratories in their respective jurisdictions. This and the fact that both systems use comparable accreditation criteria formed the basis for a bilateral agreement to provide mutual recognition of test results produced by each other's accredited laboratories. The paper compares and contrasts each system's assessment procedures. The authors, who are representatives from the two systems conclude that as both NVLAP and NATA learn from each other and from international efforts, their assessment procedures can be expected to converge.

710,155
PB84-226133 Not available NTIS
National Bureau of Standards, Washington, DC.
Gas/Oil Interface and High Sensitivity Differential Pressure Indicator Used for the Comparison of Gas with Oil Piston Gauges.
Final rept.
C. R. Tilford, and D. F. Martin. Jan 84, 4p
Pub. in Review of Scientific Instruments, v55 n1 p95-98 Jan 84.

Keywords: *Pressure gages, *Pistons, *Measuring instruments, Comparison, Calibrating, Standards, Pressure measurement, Gas-liquid ratio, Reprints.

A free surface gas/oil pressure interface has been constructed to aid in the comparison of gas with oil piston gages. A coaxial three-terminal capacitor partially immersed in the oil and partially in the gas permits the determination of hydrostatic heads and differential pressures between the piston gages. The interface has been used in the comparison of primary standard gas and oil piston gages with an average standard deviation about mean pressures of 4.5 Pa (0.00065 psi) over the range of 0.4 to 4 MPa (60 to 600 psi).

710,156
PB84-227305 Not available NTIS
National Bureau of Standards, Washington, DC.
Inherent Through-Wall Depth Limitations on Blunt Discontinuities in Welds.
Final rept.
M. B. Kasen, G. E. Hicho, and R. C. Placious. Jun 84, 21p
Sponsored in part by Welding Research Council, New York.
Pub. in Welding Jnl. 63, n6 p1845-1865 Jun 84.

Keywords: *Weld defects, Pipelines, Porosity, Nondestructive tests, Dimensions, Reprints.

The through-wall depth of weld flaws is required for a fitness-for-purpose analysis of flaw significance. This study examines the extent to which the through-wall depth of porosity and slag can be inferred from projected radiographic dimensions, and the validity of assuming that maximum depth is limited by the welding process. It is found that the width of slag stringers is always less than the slag depth, while the width of porosity is always equal to or larger than porosity depth. The projected size of porosity can therefore serve as an upper limit to porosity depth, but a similar assumption is not valid for slag. It is concluded that the through-wall depth of both types of flaws will not exceed that of the weld pass in which it occurs, or that of the average weld pass depth in a multipass weld. The latter can therefore be conservatively taken as an upper bound on the through-wall dimensions of such flaws.

710,157
PB84-227461 Not available NTIS
National Bureau of Standards, Washington, DC.
Cryocooler for Applications Requiring Low Magnetic and Mechanical Interference.
Final rept.
J. E. Zimmerman, D. E. Daney, and D. B. Sullivan. Dec 82, 11p
Pub. in Proceedings of Biennial Conf. Refrigeration Cryogenic Sensors (2nd) Electronic Systems, NASA Goddard Space Flight Center, Greenbelt, MD. Dec 7-8, 1982, NASA Conference Publication 2287, p95-105.

Keywords: *Refrigerators, Stirling cycle, Design, Cryogenics, *Cryocoolers, Cryogenic refrigerators.

A very low-power low-interference Stirling cryocooler is being developed based on principles and techniques developed over the last four years and described in several previous publications. It differs in several important details from those built previously. It uses a tapered displacer based upon an analytical optimization procedure. The displacer is driven by an auxiliary piston and cylinder (rather than by mechanical linkage) using some of the working fluid itself to provide the driving force. This provides smooth, vibration-free motion, and, more importantly, allows complete mechanical and spatial separation of the cryostat from the pressure-wave generator. Either of two different pressure-wave generators can be used. One uses a non-contaminating unlubricated ceramic piston and cylinder. The other uses a compressed-air-operated rubber diaphragm and motor-driven valves to cycle the pressure between appropriate limits.

710,158
PB84-235704 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
NBS (National Bureau of Standards) and WR62 and WR90 Reference Noise Standards.
Final rept.
C. K. S. Miller, and W. C. Daywitt. May 84, 25p
NBSIR-84/3005

Keywords: Standards, Waveguides, *Reference standards, *Thermal noise.

The basis for the National Bureau of Standards (NBS) WR90 and WR62 Waveguide Reference Noise Standards and the corresponding error analyses are described. The standards are heated (1270 K) thermal noise generators, and a derivation of their output noise temperature equations is also presented. Results of comparisons of the NBS WR90 standard with those of Sweden, England, Australia, and Japan are included. The text is extracted from course notes presented at NBS in 1970, and hence does not include descriptions of standards constructed at NBS since that time.

710,159
PB84-235894 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
NBS (National Bureau of Standards) Switching Radiometers.
Final rept.
C. K. S. Miller, and W. C. Daywitt. May 84, 24p
NBSIR-84/3004

Keywords: *Radiometers, Error analysis, Measurement, Reprints, Noise temperature.

An error analysis for the Dicke radiometers used by the National Bureau of Standards (NBS) in their WR90 waveguide noise calibration services for sources with noise temperatures above 1000 kelvin is discussed. A list of measurement frequencies currently available in the WR90 and WR62 bands is presented.

710,160
PB84-244672 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Sputtering Yields by a New Procedure for Depth Profiling of Multilayered Structures.
Final rept.
B. Navinsek, P. Panjan, A. Zabkar, and J. Fine. 1984, 4p
Pub. in Nuclear Instruments and Methods in Physics Research B2, p670-673 1984.

Keywords: *Sputtering, *Depth finding, *Laminates, *Thin films, *Thickness, Nickel, Chromium, Silver, Argon, Measurement, Ion irradiation, Surfaces, Reprints.

Sputtering yield data were obtained from a new procedure for determination of depth profiles of multilayered thin film structures. Depth profiling was performed with a mass analysed low energy ion beam and a quartz crystal oscillator microbalance. Yield data for 4-12 keV argon ions on Ni, Cr and Ag were measured as functions of ion dose (from 'zero' yield to 'equilibrium'), surface roughness and film thickness. In combination with AES, X-ray and RBS depth profiling, this method shows possibilities for obtaining higher depth resolution, and good prospects for the development of related standard reference materials for sputtering rate ('true depth scale') and depth profile calibration.

710,161
PB85-100253 Not available NTIS
National Bureau of Standards, Washington, DC.
Objective Measurement and Characterization of Scratch Standards.
Final rept.
M. Young. 1982, 7p
Sponsored in part by Army Armament Research and Development Command, Dover, NJ.
Pub. in Society of Photo-Optical Instrumentation Engineers 362, p86-92 1982.

Keywords: *Light scattering, *Diffraction, *Scratches, *Standards, Measurement, Surfaces, Reprints.

The manufacture of scratch standards for use with MIL-0-13830A has been hampered by the lack of an objective measurement technique. The U.S. National Bureau of Standards has therefore undertaken a comprehensive program to provide quantitative measurements of the light scattered by the scratches and to

correlate them with assessments made by trained observers. In this paper, the author applies scalar diffraction theory to developing design criteria for a polar scanning apparatus, describes the apparatus, and shows scans from one full set of secondary standards. Comparing these scans with the visual assessments is not straightforward.

710,162
PB85-115442
(Order as PB85-115426, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Iterative Calibration Curve Procedure.
C. H. Spiegelman. 13 Mar 84, 6p
Also available from Supt. of Docs as SN003-003-72086-1.
Included in Jnl. of Research of the National Bureau of Standards, v89 n2 p187-192 Mar-Apr 84.

Keywords: *Calibrating, Curve fitting, Iteration, Measurement.

Calibration curves are an important part of many measurement processes. The user of a fitted calibrating curve must know its precision and accuracy. These are determined in a timely fashion using the data iteratively. This paper gives a method that divides the data into training and test groups. The test group is iteratively checked to see that a prechosen nominal confidence interval probability of coverage is met. If on the basis of this check the calibration experiment is completed, the nominal probability level is shown to still be valid.

710,163
PB85-115459
(Order as PB85-115426, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Determination of the Viscoelastic Shear Modulus Using Forced Torsional Vibrations.
E. B. Magrab. 12 Dec 83, 15p
Also available from Supt. of Docs as SN003-003-72086-1.
Included in Jnl. of Research of the National Bureau of Standards, v89 n2 p193-207 Mar-Apr 84.

Keywords: *Shear modulus, Vibration, Viscoelasticity, Torsion.

A forced torsional vibration system has been developed to measure the shear storage and loss moduli on right circular cylindrical specimens whose diameter can vary from 2 to 9 cm and whose length can vary from 2 to 15 cm. The method and apparatus are usable over a frequency range of 80 to 550 Hz and a temperature range of 20C to 80C.

710,164
PB85-115467
(Order as PB85-115426, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Ultrasonic Absolute Power Transfer Standard.
S. E. Fick, F. R. Breckenridge, C. E. Tschiegg, and D. G. Eitzen. 6 Jan 84, 4p
Also available from Supt. of Docs as SN003-003-72086-1.
Included in Jnl. of Research of the National Bureau of Standards, v89 n2 p209-312 Mar-Apr 84.

Keywords: *Standards, Power, Transferring, Ultrasonic radiation, Transducers.

In response to increased interest in the use of calibrated sources of ultrasonic energy, we have developed a system comprising components grouped to facilitate the accurate transfer of calibration. Electronic circuitry supplied with and built into each ultrasonic transducer obviates both the use of not-readily-available radio-frequency equipment and the measurement of anything more exotic than dc voltage. Prototype transducers have shown good output at frequencies up to 78 MHz. Units now available to the public can be calibrated at output powers ranging from 5 mW to 500 mW at frequencies between 1 and 20 MHz.

710,165
PB85-118370 Not available NTIS
National Bureau of Standards, Washington, DC.
Fabrication, Testing, and Evaluation of Prototype Fluidic Capillary Pyrometer Systems.
Final rept.
T. Negas, H. S. Parker, R. M. Phillippi, T. M. Drzewiecki, and L. P. Domingues. 1981, 9p
Pub. in Jnl. of Dynamic Systems, Measurement, and Control Transactions ASME 103, n4 p308-316, 4 Dec 81.

Keywords: *Temperature measuring instruments, Sensor characteristics, Detectors, Probes, High temperature tests, Design, Evaluation, Fabrication, Field tests, Refractory materials, Reprints, *Pyrometers.

Prototype fluidic capillary pyrometers (FCP) were designed and fabricated to measure elevated temperatures for several field applications. The device utilizes a viscosity and, hence, temperature-sensitive fluid resistor or capillary tube as the sensing probe combined with a simple fluid resistor bridge. Small pressure changes due to temperature are then amplified to a usable level with fluidic laminar amplifier circuitry. Monolithic FCP sensors for low thermal stress applications were constructed from several refractory oxides. Other sensors, for high thermal shock duty, were constructed from molybdenum protected with ceramic oxide coatings. This demonstrated that fabrication is feasible and permitted the evaluation of performance at elevated temperature. Two monolithic sensors were installed at the Scranton Army Ammo Plant and have, to date, successfully operated for over 5,000 hours. A coated molybdenum sensor was tested in various environments which included rapid immersion in an inductively heated molten gray iron bath. This sensor accumulated over 48 hours at temperatures up to 1550C and made measurements for six hours in the molten iron. Materials and design options for high temperature probes are outlined and pertinent fluidic circuitry is detailed.

710,166
PB85-120756 Not available NTIS
National Bureau of Standards, Washington, DC.
Fracture-Mechanics Evaluation of Flaws in Pipeline Girthwelds.
Final rept.
R. P. Reed, H. I. McHenry, M. B. Kasen, and H. M. Ledbetter. 1979, 23p
Pub. in Welding Research Council Bulletin, n245 23p 1979.

Keywords: *Pipelines, *Weld defects, Weldments, Pipeline transportation, Welded joints, Shielded metal arc welding, Fracture tests, Mechanical tests, Fracture properties, Fatigue(Materials), Radiography, Inspection, Regulations, Reprints.

Fracture-mechanics analysis was used to evaluate flaws in a buried arctic oil pipeline. The pipe is 1.22-m-diameter, API 5LX-65 steel with nominal wall thicknesses of 12 and 14 mm. It was field welded by a shielded metal-arc process using AWS E7010G and E8010G electrodes. Mechanical-property and simulated-service tests were made on welds cut from the pipeline. Methods were assessed for estimating weld-flaw depths and arc-burn depths from field radiographs. Fracture-mechanics analyses were used to calculate allowable flaw-size curves in accordance with worst-case requirements set by the Office of Pipeline Safety Operations. Allowable flaw-size curves were used to evaluate girth-weld flaws whose size exceeded the weld-quality requirements of API Standard 1104 and arc burns, which are prohibited by Federal Regulation 49CFR195.

710,167
PB85-123446 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser-Micrometrology for Integrated Circuits.
Final rept.
D. Nyyssonen. 1982, 7p
Pub. in Proceedings of Inspection, Measurement, and Control Symposium, Boston, Massachusetts, September 20-23, 1982, p24-30.

Keywords: *Line width, *Measurement, Lithography, Integrated circuits, Microscopy, Reprints, Laser applications.

The optical microscope measurement of micrometer and submicrometer linewidths during integrated-circuit fabrication utilizes a wide variety of optical microscope system designs including bright-field, dark-field, and focused laser beam scanning systems. The present paper deals with the principle of equivalence in optical system design of both conventional microscope imaging systems and focused-spot scanning systems.

710,168
PB85-124246 Not available NTIS
National Bureau of Standards, Washington, DC.
Method to Determine the Pressure Dependent Distortion of a Simple Piston Gage Based on Dimensional Metrology.
Final rept.
B. E. Welch, and V. E. Bean. 1984, 4p
Pub. in Proceedings of AIRAPT Ineractive High Pressure Conference (9th), Albany, NY., July 24-29, 1984, pt 2, p261-264.

Keywords: Pressure gages, Pressure measurement, Distortion, *Piston gages.

Elastic distortion of the piston and cylinder is the leading cause of inaccuracy in piston gages at higher pressures. The distortion depends upon pressure profile between the piston and the cylinder. One possible method of determining the pressure profile is demonstrated.

710,169
PB85-124303 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Viscosity, Temperature, and Rate of Rotation on the Operation of a Controlled-Clearance Piston Gauge.
Final rept.
J. K. N. Sharma, K. K. Jain, V. E. Bean, B. E. Welch, and R. J. Lazos. 1984, 4p
Pub. in Proceedings of AIRAPT Interactive High Pressure Conference (9th), Albany, NY., July 24-29, 1983, pt. 2, p265-268 1984.

Keywords: Pressure gages, Pressure measurement, Viscosity, *Piston gages.

The calculation of the pressure generated by a controlled-clearance piston gauge depends upon the jacket pressure corresponding to zero clearance between the piston and cylinder, P sub z. The dependence of P sub z on the viscosity of the pressure transmitting fluid, the temperature, and the rate of piston rotation have been measured. The value of P sub z is nearly independent of viscosity below 60 cp. Above 60 cp, P sub z depends strongly upon viscosity. Variations of P sub z with temperature and rate of rotation are more severe at higher viscosities. These results are a clear indication, that for the most accurate pressure measurements, a controlled-clearance piston gauge must be characterized using the same operational and environmental conditions with the same fluid as are used in normal operation.

710,170
PB85-127827 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Magnetic Measurements, Calibrations, and Standards: Report on a Survey.
F. R. Fickett. Oct 84, 25p NBSIR-84/3018

Keywords: *Standards, *Calibration, *Industries, *Magnetic measurement, Surveys, *Standard reference materials.

The report summarizes the analysis of responses to a survey of industrial needs for magnetic services and research.

710,171
PB85-129617
(Order as PB85-129591, PC **A03**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Stability of Small Industrial Platinum Resistance Thermometers.
B. W. Mangum. 10 Apr 84, 12p
Included in Jnl. of Research of the National Bureau of Standards, v89 n4 p305-316 Jul-Aug 84.

Keywords: *Resistance thermometers, Platinum, Stability.

The paper reports the results of an investigation of the stability of a selection of small industrial platinum resistance thermometers (IPRTs) upon heat treatment and handling. Ninety-four IPRTs, of several models, obtained from five manufacturers were studied. Most of the IPRTs exhibited calibration drifts and also effects due to the presence of moisture or strain. There was no apparent improvement in the stability if the resistance ratio, R(t)/Ro=W(t), instead of resistance were used as the criterion. Comparisons are made of the relative stability of the products of the five companies.

710,172
PB85-132322 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Advanced Thin Film Thermocouples.
K. G. Kreider, S. Semancik, and C. Olson. Oct 84, 85p NBSIR-84/2949
Contract NASA-C-54715

Keywords: *Thermocouples, Thin films, Platinum, Rhodium, Temperature measuring instruments, Gas turbines, Detectors.

The fabrication, materials characterization, and performance of thin film platinum-platinum rhodium thermocouples on gas turbine engine alloys has been investigated. The materials chosen for the study were the turbine blade alloy systems MAR M200+Hf with NiCoCrAlY and FeCrAlY coatings; and vane alloy systems MAR M509 with FeCrAlY. Research was focussed on making improvements in the problem areas of coating-substrate stability, adhesion, and insulation reliability and durability. Diffusion profiles between the substrate and coating with and without barrier coatings of Al2O3 are reported. The relationships between fabrication parameters of thermal oxidation and sputtering of the insulator and its characterization and performance are described. The best thin film thermocouples were fabricated with the NiCoCrAlY coatings which were thermally oxidized and sputter coated with Al2O3.

710,173
PB85-140473 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Linewidth Measurement Spotlight.
Final rept.
D. Nyyssonen. 1980, 18p
Pub. in Semiconductors and Insulators 3, n3 p39-56 Mar 80.

Keywords: *Line width, *Measurement, Integrated circuits, Metrology, Reprints.

In order to meet VLSI and VHSIC design requirements for tolerances of 10 percent or less on 1- and 2-m line geometries, more accurate and precise linewidth measurement techniques than those prevalent in the IC industry are needed. This paper reviews state-of-the-art optical linewidth measurement techniques, discusses sources of poor accuracy and precision and shows what improvement can be expected from linewidth calibration as opposed to line scale calibration.

710,174
PB85-140705 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of the Optical Properties of Solar Energy Materials.
Final rept.
J. C. Richmond. 1980, 12p
Sponsored by Solar Energy Research Inst., Golden, CO.
Pub. in High Temperature-High Pressures 12, n4 p465-476 1980.

Keywords: *Optical properties, Measurement, Solar energy, Absorptivity, Reflectance, Irradiance, Transmittance, Reprints.

The optical properties of interest for solar energy applications are the solar absorptance of receivers, the solar reflectance of concentrating mirrors and the solar transmittance of cover plates and refracting concentrators. These properties are normally evaluated by measuring the spectral property and then computing the weighted average, with the terrestrial solar spectral irradiance as the weighting function. Differences in values reported by different laboratories for the same materials are due to errors in measurement, differences in the terrestrial solar irradiance used, and the methods of computations.

710,175
PB85-140796 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Microscope Based System for Accurate Microdimensional Measurements.
Final rept.
D. A. Swyt, and S. W. Jensen. 1981, 5p
Pub. in Precis. Eng. 3, n1 p11-15 1981.

Keywords: *Dimensional measurement, *Calibrating, Electron microscopes, Length, Accuracy, Metrology, Reprints, Computerized control systems, Scanning electron microscopy.

A new facility at the U.S. National Bureau of Standards provides calibration measurements of linear dimensions in the range 0.1 to 100 micrometers by means of a high-resolution, electron microscope-scanning specimen stage system. Computer-controlled, with a stationary electron beam and interferometric measurement of stage position, the system can provide point-to-point measurements accurate to 0.01 micrometer. It also forms the basis for development and certification of calibrated standards for planar objects, particles, and other microscopic objects and features.

710,176
PB85-141463 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Review of Ultrahigh Resolution Sizing of Single Droplets by Resonance Light Scattering.
Final rept.
T. R. Lettieri, and W. D. Jenkins. 1984, 11p
Pub. in American Society for Testing and Materials, Special Technical Publication 848, p98-108 1984.

Keywords: *Aerosols, *Dimensional measurement, *Light scattering, *Particle size, *Drops(Liquids), *Size determination, Resolution, Reprints, Resonance scattering.

Resonance light scattering as a means for ultrahigh resolution sizing of liquid droplets in the 5 to 50 micrometer diameter range is reviewed. So far, the technique has been used to make relative size measurements with resolutions of 30 ppm on individual, nonevaporating droplets and 300 ppm on individual, evaporating droplets. The calculated existence of resonances sharper than those observed thus far offers the possibility of size resolutions approaching 0.1 ppm on highly transparent spherical droplets. The paper also reviews the relatively small amount of reported work on resonance light scattering from aerosols and from individual aspheres.

710,177
PB85-141943 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fracture Toughness of 25Mn Austenitic Steel Weldments at 4 K.
Final rept.
Y. W. Cheng, H. I. McHenry, P. N. Li, T. Inoue, and T. Ogawa. 1984, 8p
Sponsored by Department of Energy, Washington, DC.
Pub. in Advances in Cryogenic Engineering 30, p303-310 1984.

Keywords: *Weldments, Welded joints, Toughness, Cryogenics, Austenitic steels, Reprints, *Fracture toughness.

The fracture toughness of 25Mn steel weldments was measured at 4 K using the single-specimen J-integral procedure. The highest J sub Ic value obtained was from the gas-tungsten-arc weld, followed by the shielded-metal-arc weld; the submerged arc weld had the lowest J sub Ic value. Degradation of fracture toughness of the heat-affected zone was observed because of carbide precipitation along the grain boundary.

710,178
PB85-141950 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Post Yield Crack-Opening Displacement of Surface Cracks in Steel Weldments.
Final rept.
Y. W. Cheng, R. B. King, D. T. Read, and H. I. McHenry. 1984, 16p
Sponsored by Department of Transportation, Washington, DC. Office of Pipeline Safety Regulation.
Pub. in American Society for Testing and Materials STP 833, p666-681 1984.

Keywords: *Weldments, Welded joints, Steels, Cracks, Cracking(Fracturing), Reprints, Fracture(Mechanics).

Crack-mouth-opening displacements (CMOD) of surface cracks are measured as function of stress and strain in tensile panels of API 5LX-70 steel plates and welded pipe segments. The experimental results are compared with analytical predictions. For CMOD versus stress, a previously developed model provides good agreement between experiment and analysis for the base metal and the welds. At stresses above net-section yielding, it is observed in 7 of the 9 base metal tests that all of the remote displacement is transferred to the crack tip through slip bands extending from the crack tip to the plate edges at 45 degree angles; the two exceptions are in specimens with small (less than 5 percent of the cross-sectional area) cracks where yielding occurred in the gross section. A model based on this observation is used to calculate CMOD vs. strain for net-section yielding; analysis and experiment agree in the intended range, i.e. net-section yielding.

710,179
PB85-142172 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nondestructive Evaluation of Thick Austenitic Stainless Steel Weldments by Shear Horizontal Acoustic Waves.
Final rept.
R. E. Schramm, J. C. Moulder, and C. M. Fortunko. 1984, 8p
Sponsored by Naval Sea Systems Command, Washington, DC.
Pub. in Advances in Cryogenic Engineering 30, p119-126 1984.

Keywords: *Weldments, *Ultrasonic tests, Signal processing, Nondestructive tests, Welded joints, Austenitic stainless steels, Reprints.

Austenitic stainless steel weldments exhibit a textured columnar structure. Because of this, shear horizontal acoustic waves can be a valuable complement to conventional longitudinal waves. Developments in electromagnetic-acoustic transducers (EMATs) have made it possible to use these SH-waves. Digital processing techniques, particularly synthetic aperture techniques, can improve the detection, sizing and localization of flaws.

710,180
PB85-142362 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nonideal Regenerator Performance: The Effect of Void Volume Fluid Heat Capacity.
Final rept.
D. E. Daney, and R. Radebaugh. Sep 84, 3p
Sponsored by Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH.
Pub. in Cryogenics 24, n9 p499-501 Sep 84.

Keywords: *Regenerators, Heat exchangers, Specific heat, Thermal efficiency, Refrigerating, Reprints.

The performance of thermal regenerators is analyzed for a range of parameters of particular interest for low temperature refrigeration. Using a time-dependent, one-dimensional, incompressible flow, numerical model we show that the void volume fluid heat capacity can strongly influence regenerator behavior. Inclusion of the void volume term gives significant improvements in the predicted effectiveness when the void volume and matrix heat capacities are of the same order. For some regimes of low thermal loads increasing the matrix heat capacity may actually reduce the effectiveness.

710,181
PB85-142461 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Automated Pressure Regulator.
Final rept.
M. Waxman, H. A. Davis, M. Horowitz, and B. Everhart. Sep 84, 4p
Contract DOE-EA-77-A-01-6010
Pub. in Review of Scientific Instruments 55, n9 p1467-1470 Sep 84.

Keywords: *Pressure regulators, Automatic control, Pressure measurement, Automation, Control equipment, Indicating instruments, Rigidity, Pumps, Pressure sensors, Experimentation, Reprints.

A pressure regulator has been constructed that automatically nulls a sensitive differential pressure indicator of the type used in high-quality PVT experiments, thus permitting at least partial automation of such experiments. Distinguishing features are: high resolution, sufficient rigidity for operation in a pressure range up to 100 MPa, and a control logic that permits nulling of the pressure transducer even if the initial state is very far from balance.

710,182
PB85-142628 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

General

Volume Uncertainty of a Large Tank Calibrated by Photogrammetry.
Final rept.
J. D. Siegwarth, J. F. LaBrecque, and C. L. Carroll.
Aug 84, 8p
Sponsored by Maritime Administration, Washington, DC.
Pub. in Photogrammetric Engineering and Remote Sensing 50, n8 p1127-1134 Aug 84.

Keywords: *Liquefied natural gas, *Photogrammetry, *Storage tanks, *Volume, Calibrating, Standards, Reprints.

The volume calibration uncertainty of large (30,000 cu m) liquefied natural gas tanks calibrated by photogrammetry has been independently estimated by the National Bureau of Standards. The independent estimates were obtained using surveying tapes.

710,183
PB85-144376 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Simple Vacuum Pump Exhaust Filter.
Final rept.
R. A. Forman, and H. D. Krantz. Sep 84, 1p
Pub. in Review of Scientific Instruments 55, n9 p1503 Sep 84.

Keywords: *Filters, Vacuum pumps, Laboratory equipment, Reprints.

A simple high throughput, exhaust filter for oil-filled mechanical vacuum pumps is described. The design allows easy connection to external systems. Inexpensive filter elements, available anywhere, are a further feature of the system.

710,184
PB85-178432 PC **A15**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
National Conference on Weights and Measures (69th), 1984.
A. D. Tholen, L. E. Barbrow, and A. P. Heffernan.
Jan 85, 342p NBS/SP-684
See also PB82-178997. Also available from Supt. of Docs as SN003-003-02637-9. Library of Congress catalog card no. 26-27766.

Keywords: *Metrology, *Meetings, Size determination, Metric system, Packaging, Standards, Weight measurement, Tolerances(Mechanics), Specifications, Consumer affairs, Marking, Labels, Regulations, Law(Jurisprudence), *Weights and measures, Legal metrology, Metrication.

The theme of the meeting was 'Transferring Technology for Trade: A Team Effort.' Adoption of a NCWM Constitution and By-laws and a new Scales Code were major actions taken by the membership. The new Scales Code, which will be effective January 1, 1986, represented a significant advancement for device control. Other items addressed included such issues as labeling of gasoline-alcohol blends and national type evaluation. Special meetings included those of the Task Force on Package Control, Metrologists' Workshops, the Associate Membership Committee, the Scale Manufacturers Association, the Industry Committee on Packaging and Labeling, the State regional weights and measures associations, and OIML Pilot Secretariat 20 (Prepackaged Products). Reports by the several standing and annual committees of the Conference comprise the major portion of the publication. Also included are the addresses and technical papers delivered by Conference officials and other authorities from Government and industry.

710,185
PB85-184711 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Temperature Optical Fiber Thermometer.
Final rept.
R. R. Dils. 1983, 4p
Pub. in Jnl. of Applied Physics 54, n3 p1198-1201 Mar 83.

Keywords: *Temperature measuring instruments, Fiber optics, Single crystals, Sapphire, Gases, Gas turbines, Bandwidth, Reprints, *Thermometers, Optical fibers, High temperature.

A high temperature optical fiber thermometer made from single crystal sapphire has been developed for use from 600 to approximately 2000C. The device consists of a small blackbody cavity which is sputtered on the end of a thin (0.25 mm to 1.25 mm diameter, 0.05 to 0.30 mm long) sapphire fiber, a connecting low temperature fiber and a conventional optical detector. The radiance from the cavity is used to measure its temperature. The present instrument is calibrated at a single temperature and uses the fundamental radiation laws to interpolate to other temperatures. It is accurate and has a high sensitivity and rapid temporal response. There appear to be a number of applications of the device in both science and industry.

710,186
PB85-186971 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.
Simple and Effective Acoustic Emission Source Location System.
Final rept.
M. Barsky, and N. N. Hsu. Jan 85, 3p
Sponsored by Electric Power Research Inst., Palo Alto, CA.
Pub. in Materials Evaluation 43, n1 p108-110 Jan 85.

Keywords: *Acoustic detectors, Reprints, Acoustic emissions.

A simple acoustic emission (AE) source location system has been designed, constructed, and demonstrated. It will indicate the approximate location of an AE source inside a square area at a fast rate. The system requires no computer support, is totally self-contained, and can be built with inexpensive, readily available integrated circuits.

710,187
PB85-187326 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Fitness-for-Service Criteria for Pipeline Girth-Weld Quality.
Final rept.
R. P. Reed, M. B. Kasen, H. I. McHenry, C. M. Fortunko, and D. T. Read. Jul 84, 80p
See also PB84-165448. Sponsored by Department of Transportation, Washington, DC. Office of Pipeline Safety Regulation.
Pub. in Welding Research Council Bulletin No. 296, 80p Jul 84.

Keywords: *Welded joints, *Pipelines, Weld defects, Quality assurance, Criteria, Nondestructive tests, Ultrasonic tests, Crack initiation, Fatigue(Materials), Inspection, Acceptability, Weldments, Reprints.

Criteria have been developed for applying fitness-for-service analyses to flaws in girth welds. A critical crack-opening-displacement elastic-plastic fracture mechanics model was developed and experimentally verified. Procedures for constructing flaw acceptance curves based on this model are provided. A significantly improved ultrasonic method for detecting and dimensioning significant weld flaws was developed. The probability of crack initiation from blunt flaws was shown to be very low under severe low-cycle fatigue. Suggestions are offered for technical implementation of field inspection procedures and for practical implementation of the flaw acceptance criteria.

710,188
PB85-187607 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Using Infrared Thermography for Industrial Energy Conservation.
Final rept.
T. P. Sheahen, Y. Y. Haimes, and M. A. H. Ruffner. 1979, 42p
Pub. in Proceedings of Energy Auditing Conservation: Methods, Measurements, Management, and Case Studies Conference, Cleveland, OH., March 14, 1979, p59-100.

Keywords: *Infrared thermal detectors, *Industrial heating, *Thermography, Furnaces, Heat loss, Temperature distribution, Measurement, Heat balance, Ovens, Numerical analysis, Measuring instruments, *Energy conservation.

The experimental techniques of infrared thermography have been used in factories to locate heat losses from furnaces, ovens and similar industrial equipment. Infrared thermography data have been used to generate temperature maps of furnaces, based on precise measurements made with a calibrated instrument. From these temperature maps, we have calculated total radiation losses, and have estimated convective heat losses as well. By combining these calculations with other numerically estimated losses, we have carried out a full heat-balance on a furnace, leaving no 'unaccounted' amount as in typical calculations of the past. This paper explains how infrared thermography works, and gives a variety of examples from both qualitative applications (leakage, hotspot identification, etc.) and quantitative measurements of heat balances.

710,189
PB85-191401 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Interlaboratory Comparison of Force Calibrations Using ASTM (American Society for Testing and Materials) Method E74-74.
Technical note (Final).
R. W. Peterson, L. Jenkins, and R. A. Mitchell. Apr 85, 25p NBS/TN-1211
Also available from Supt. of Docs as SN003-003-02645-0.

Keywords: *Force, *Calibrating, Detectors, Load cells, Comparison.

A comparison of force calibrations performed by the National Bureau of Standards and 27 other laboratories located in the United States is reported. Force sensors of four different capacities were calibrated in both tension and compression, repeatedly by NBS with deadweight and one time each by the other participating laboratories. The force sensor capacities were 0.5, 5, 20, and 100 klbf (2.2, 22, 89, and 445 kN). Deadweight machines (with and without force multiplication) and force sensor transfer standards (used in a testing machine or a loading frame) were the force standards represented in the study. The force calibration procedure used was Method E74-74 of the American Society for Testing and Materials.

710,190
PB85-201812 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Effect of Multiregion Crack Growth on Proof Testing.
Final rept.
S. M. Wiederhorn, S. W. Freiman, E. R. Fuller, and H. Richter. 1984, 22p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in American Society for Testing and Materials, Special Technical Publication 844, p95-116 1984.

Keywords: *Tests, Crack propagation, Cracks, Glass, Strength, Weibull density functions, Reprints, Fracture(Mechanics).

The effect of subcritical crack growth on proof testing is examined. Crack velocity curves obtained by fracture mechanics techniques are used to predict theoretical strength distributions for specimens that survive proof testing. These theoretical distributions are compared with experimental distributions obtained on soda lime silica glass slides. The comparison reveals a surprising sensitivity of the proof test results to the exact position and shape of the crack growth curve. Minor changes in the crack growth curve results in major shifts in position and shape of the strength distribution curves after proof testing. The importance of crack geometry and specimen configuration to crack growth behavior, and hence, to the strength distribution is emphasized.

710,191
PB85-201838 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Pressure and Temperature Measurements in the Annulus Between the Piston and Cylinder of a Simple Dead-Weight Piston Gauge.
Final rept.
B. E. Welch, and V. E. Bean. Dec 84, 9p
Pub. in Review of Scientific Instruments 55, n12 p1901-1909 Dec 84.

Keywords: *Pressure measurement, *Temperature measurement, *Measuring instruments, Pistons, Cylinders, Metrology, Fluid flow, Pressure gradients, Temperature gradients, Accuracy, Reprints.

Precise and fundamental pressure measurements are obtained using piston gages. Elastic distortion of the piston and cylinder is the leading cause of inaccuracy in measurement of higher pressures. The equation used for calculating the distortion contains the ratio of the pressure in the annulus between the piston and the cylinder to the pressure under the piston. As the

proper value of this ratio or a method to determine it were unknown, the practice has been to assume a value of 0.5. In this work, the pressure and temperature of the fluid in the annulus has been measured along the working length of the piston and the cylinder. The model for the pressure ratio proposed by Bass on the basis of dimensional metrology is an excellent agreement with the pressure measurements.

710,192
PB85-203453 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measures and Measurement Systems.
Final rept.
A. O. McCoubrey. 1984, 14p
Sponsored by Grolier, Inc., Danbury, CT.
Pub. in Encyclopedia Americana, p584-597 1984.

Keywords: *Units of measurement, *Metric system, *Measurement, Reviews.

The article reviews the history of measurements and the evolution of measurement systems. The development of the metric system is traced from the beginnings to the present International System of Units. The history of measurements in the United States is discussed with attention to the consideration of the metric system and its utilization. The relationship of English and the United States measurement units is described and tables give customary units. The International System of Units is also described and extensive tables are included.

710,193
PB85-205805 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sinusoidal Profile Precision Roughness Specimens.
Final rept.
E. C. Teague, F. E. Scire, and T. V. Vorburger. 1982, 13p
Pub. in Wear 83, n1-2 p61-73 Dec 82.

Keywords: *Surface roughness, *Roughness, *Calibrating, Metrology, Precision, Reprints.

The design, specifications, fabrication, testing, and potential use of a series of sinusoidal profile precision roughness specimens are described. These specimens have been designed primarily to provide a means for optimum transfer of an accurate roughness average, (R sub a), value from primary to secondary laboratories. However, properties of the specimens also make them very useful for evaluating instrumentation and computational algorithms designed to measure the statistical parameters and functions now being investigated in many laboratories. Specimens with an (R sub a) value of 1.0 micrometer and spatial wavelengths of 40,100 and 800 micrometers are being fabricated. For the 100 micrometer wavelength, specimens are also being fabricated with (R sub a) values of 3.0 and 0.3 micrometers. Fabrication with numerically controlled diamond lathes has produced specimens with very high quality sinusoidal profile waveforms, with uniform (R sub a) values across the surfaces and with very low amounts of waviness over a test area of about 2 sq cm.

710,194
PB85-205813 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Three Dimensional Stylus Profilometry.
Final rept.
E. C. Teague, F. E. Scire, S. M. Baker, and S. W. Jensen. 1982, 12p
Pub. in Wear 83, n1-2 p1-12 Dec 82.

Keywords: *Surface roughness, Metrology, Reprints, *Profilometry, Three dimensional.

Work at the NBS to acquire surface microtopographic data using 3-D stylus profilometry and to display the data as intensity variations on a television monitor is described. Images of the data are generated from an array of 512 by 512, 8 bit digitized surface height values. The surface slope and wavelength capabilities of stylus instruments are compared with other surface microtopography measurement techniques to highlight their unique high vertical resolution capabilities for low sloped surfaces. Finally, examples of some alternative means for displaying 3-D data sets are given for three types of surface irregularities; a discrete feature, a periodic profile surface, and a random profile surface. These representations of the topography are also compared with scanning electron micrographs of the same surface irregularities.

710,195
PB85-207371 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Nonmetallic Composites in Space Dewars.
Final rept.
M. B. Kasen. 1984, 9p
Pub. in Proceedings of 1983 Space Helium Dewar Conf., Huntsville, AL., August 24-26, 1984, p171-179.

Keywords: *Dewar flasks, *Composite materials, Pressure vessels, Epoxy matrix composites.

A review of past and present usage of nonmetallic composites in cryogenic dewars and pressure vessels is presented. Particular attention is paid to the extent to which advances in cryogenic composite technology offer new approaches to fabricating thermally efficient systems. It is concluded that more efficient dewar support members can be fabricated by correct utilization of materials in particular temperature ranges. It is further concluded that fabrication of improved cryogenic container vessels is possible utilizing current knowledge of the factors influencing cryogenic performance under thermal and mechanical cyclic loading.

710,196
PB85-208007 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Monocrystal Elastic Constants in the Ultrasonic Study of Welds.
Final rept.
H. M. Ledbetter. Jan 85, 5p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Ultrasonics 23, p9-13 Jan 85.

Keywords: *Welded joints, *Ultrasonic tests, Elastic properties, Reprints.

For studying welds ultrasonically, the importance of knowing the material's single-crystal elastic constants, the C sub ijs, is explained. Where these constants are not known, some guidelines are given for estimating them from polycrystalline elastic constants such as Young's modulus and the shear modulus. The important case of (001) fiber texture is considered. Being transversely isotropic, the case exhibits five macroscopic elastic constants, which are related to the three cubic elastic constants: Csub 11, Csub 12, Csub 44. From the five constants the angular variations of Young's modulus, the torsional modulus, and the sound velocities can be computed. For the same (001) fiber texture, results are given for a standard well-characterized material--copper, where the C sub ijb are well known.

710,197
PB85-222107 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Measurement of a Piezoelectric d Constant for Poly(Vinylidene Fluoride) Transducers Using Pressure Pulses.
Final rept.
A. J. Bur, and S. C. Roth. 1 Jan 85, 6p
Sponsored by Air Force Armament Lab., Eglin AFB, FL.
Pub. in Jnl. of Applied Physics 57, n1 p113-118, 1 Jan 85.

Keywords: *Transducers, Piezoelectricity, Measurement, Vinylidene chloride resins, Reprints.

The hydrostatic piezoelectric coefficient d sub h has been measured for biaxially-oriented poly(vinylidene fluoride) transducers using pressure pulses having peak values of 1.8 X 10 to the 7th power Pa (2600 psi) and a pulse width of approximately 10 ms. For these measurements, the sample was placed in an oil pressure chamber at room temperature and the pressure pulse was initiated by dropping a 16-kg mass onto a plunger in the chamber. Since adiabatic compressional heating accompanies the pressure pulse, temperature compensation of the transducer was necessary. This was achieved by incorporating a thermocouple in the bilaminate configuration of the transducer and by amplifying the thermocouple signal appropriately to account for the pyroelectric response due to adiabatic heating, which was approximately 15% of the transducer signal. The calculation of d sub h shows that the response of the bilaminate transducer is linear up to 1.8 X 10 to the 7th power Pa(2600 psi).

710,198
PB85-227098 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Ductile-to-Brittle Transition in Steel Weldments for Arctic Structures.
F. Zia-Ebrahimi. Apr 85, 66p NBSIR-85/3020
Sponsored by Minerals Management Service, Reston, VA.

Keywords: *Weldments, *Welded joints, Fracture properties, Steels, Ductile brittle transition, Cold weather construction, Microstructure, Crack initiation.

The report summarizes the work performed in support of the development of fracture criteria for steel weldments in arctic structures. The ductile-to-brittle transition behavior of a shielded metal-arc weld, typical of steel weldments in arctic structures, has been studied. Fracture toughness, Charpy V-notch impact energy, and tensile properties have been measured as a function of temperature throughout the ductile-to-brittle transition range. The effect of geometric dimensions on fracture toughness has been studied for three geometries of single-edge-notch-bend (SENB) specimens. The fracture surfaces of broken specimens have been characterized by scanning electron microscopy (SEM). The microstructure of the multiple-pass weldment has been studied by optical microscopy. The mechanical properties of the steel weldment have been compared to the base metal, an ABS grade EH36 steel in normalized condition.

710,199
PB85-230027 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Optical Linewidth Measurement on Patterned Metal Layers.
Final rept.
D. Nyyssonen. 1984, 6p
Pub. in SPIE 480, p65-70 1984.

Keywords: *Line width, Optical measurement, Lithography, Integrated circuits, Wafers, Reprints.

In a previous paper, a waveguide model was developed for the imaging of micrometer-sized lines patterned in thick layers of dielectric materials (silicon dioxide) with application to linewidth measurement on integrated-circuit wafers. The paper describes the extension of this work to metals characterized by their complex index of refraction, n + iK, as well as the inclusion of a sublayer such as a silicon dioxide insulating layer. This extension allows the modeling of optical imaging and linewidth measurement on metal-on-silicon (MOS) structures. It is shown that the image structure for metals at and near focus is different from that for dielectrics. Thick and thin layer (less than 200 nm) imaging is compared. Experimental image profiles of metal lines at and near focus are also shown. The experimental data were obtained from a bright-field microscope using a laser source (530 nm) and controlled spatial coherence.

710,200
PB85-230381 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
National Bureau of Standards, a Review of NBS's Activities in the Area of Linewidth Measurement.
Final rept.
D. Nyyssonen. 1984, 7p
Pub. in Proceedings of the Scientific Apparatus Makers Association, The Future of Optical Technologies in the Semiconductor Industry, Sunnyvale, California, May 23, 1983, p1-7 Mar 84.

Keywords: *Line width, *Measurement, Optical measurement, Calibrating, Standard reference materials.

The manuscript is a summary of a talk covering current NBS activities in linewidth measurement including research, calibration of standard reference materials (SRMs), development of calibration procedures and test methods, and technology transfer. The current status of photomask linewidth SRMs is discussed (anti-reflective 'gold' chromium SRMs 474 and 475, bright chromium SRM 476, and the 3X reticle SRM 1830). Wafer linewidth measurements are divided into two categories, thin layers (less than approximately 200 nm) and thick layers. The design of the linewidth standard for thin layers is described. Research problems remaining for thick layers are described along

with current NBS waveguide modeling. Instrumentation used for both photomask and wafer calibrations is also described. NBS plans for development of SEM/e-beam instrumentation and SRMs are also included.

710,201
PB85-230878 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Polymer Pressure Gage for Dynamic Pressure Measurements.
Final rept.
A. J. Bur, and S. C. Roth. 1985, 6p
Pub. in Proceedings of the Symposium on Interaction of Non-Nuclear Munitions with Structures (2nd), Panama City, Florida, April 15-18, 1985, p291-295.

Keywords: *Pressure gages, Thin films, Polyvinyl fluoride, Pressure sensors.

The pressure sensing element of this transducer is a thin film of polyvinylidene fluoride. The transducer is designed to measure dynamic pressures in the presence of thermal pulses which are produced by adiabatic compressional heating of the PVDF and its surroundings. Adiabatic heating of the PVDF will reduce its charge output by a constant 8%. Adiabatic heating of the surroundings will vary with each environment. Two approaches to compensating for environmental compressional heating are used.

710,202
PB85-237121 PC **A05**/MF **A01**
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Experimental Results for Fitness-for-Service Assessment of HY130 Weldments.
Final rept. Oct 81-Sep 82.
D. T. Read. Mar 84, 95p NBSIR-84/1699
Sponsored by Naval Sea Systems Command, Washington, DC.

Keywords: *Weldments, *Quality assurance, Assessments, Welded joints, Steels, Cracks, Residual stress, Steel HY130, Fracture(Mechanics), J integrals.

Applied J-integral values for through and surface cracks in HY130 weldments and for surface cracks in HY130 base metal have been measured using a previously developed technique. The applied J-integral is taken as a measure of the crack driving force. The results confirmed previous conclusions, namely, the strong effect of deformation pattern on applied J-integral values, the utility of the J-integral estimation curve for fitness-for-service assessment in cases of gross section yielding (crack size less than 1 percent of load-bearing cross-section), and the need to consider ligament yielding behind surface cracks.

710,203
PB85-239218 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
NVLAP (National Voluntary Laboratory Accreditation Program) Director of Accredited Laboratories Midyear Update.
H. W. Berger. Jul 85, 53p NBSIR-85/3204

Keywords: *Directories, *Laboratories, Sites, Projects, Test facilities, Tests, *Accreditation, *National Voluntary Laboratory Accreditation Program.

The directory is an update of the 1984 NVLAP Directory of Accredited Laboratories. It provides information on the activities of the National Bureau of Standards in administering the National Voluntary Laboratory Accreditation Program (NVLAP) during calendar year 1985. The status of current programs is briefly described and a summary of laboratory participation is provided. All accredited laboratories are listed along with the test methods for which they are accredited. Four Indexes cross reference the laboratories by name, NVLAP Lab Code Number, test method, accreditation program, and geographical location.

710,204
PB86-124153 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Preliminary Industrial Evaluation of the Fluidic Capillary Pyrometer.
Final rept.
R. M. Phillippi, and T. Negas. 1980, 6p
Sponsored by Harry Diamond Labs., Adelphi, MD.
Pub. in Proceedings of Winter Annual Meeting of ASME (American Society of Mechanical Engineers) Anniv. Fluid Symposium, Chicago, IL., November 16-21, 1980, p31-36.

Keywords: Temperature measuring instruments, Evaluation, *Fluidic temperature sensors.

The paper presents results from a preliminary field evaluation of the fluidic capillary pyrometer (FCP). The device uses a viscosity and hence temperature-sensitive fluid resistor, or capillary tube as the sensing element in a simple fluid resistor bridge. Resultant pressure changes due to temperature (typically quite small for a gas) are then amplified to a useful level with fluidic laminar pressure amplifiers. Data are shown for over 2000 hours of operation, accumulated by two FCP units in a U.S. Army rotary hearth forging furnace (1200 C) with sensing probes of alumina operating on air.

710,205
PB86-124823 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Development of Some Analytical Fracture Mechanics Models for Pipeline Girth Welds.
Final rept.
R. de Wit, and J. H. Smith. 1980, 16p
Sponsored by Department of Transportation, Washington, DC. Office of Pipeline Safety Regulation.
Pub. in American Society for Testing and Materials, Special Technical Publication 700, p513-528 1980.

Keywords: Fracture properties, *Pipelines, *Welded joints, Mechanical properties, Cracking(Fracturing), Failure, Defects, Reprints, *Fracture(Mechanics).

Fracture mechanics methods have been used to provide a basis for assessing the significance of defects in pipeline girth welds. Analytical models based on fracture mechanics technology are developed to establish predicted critical defect sizes for sharp, circumferential defects in pressurized pipe. The general problem considered here is that of a surface defect in a plate, i.e. they use the flat plate analogy for a pipeline. Failure is considered to occur when the ligament ruptures and provides a leakage path. The fracture mechanics model used, called the collapsed ligament model, is based on the work of Erdogan and Bakioglu which is in turn based on the Dugdale model. The collapsed ligament model assumes plastic collapse in the depth direction, but any fracture mechanics model in the length direction.

710,206
PB86-128824 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Fluidic Capillary Temperature Sensors: Materials, Design and Fabrication.
Final rept.
T. Negas, H. S. Parker, W. S. Brower, R. M. Phillippi, T. M. Drzewiecki, and L. P. Domingues. 1980, 7p
Pub. in Proceedings of ASME (American Society of Mechanical Engineers) Symposium on Fluid (20th), Chicago, IL., November 16-21, 1980, p37-43.

Keywords: Temperature measuring instruments, Capillary flow, Refractory metal alloys, Molybdenum, Detectors, Design, Fabrication, *Fluidic temperature sensors.

Prototype fluidic capillary pyrometers (FCP) were designed and fabricated to measure temperature well above 1200 degrees C. Monolithic ceramic sensors were constructed from several refractory oxides to demonstrate that processing is feasible and to evaluate performance of the FCP at elevated temperature. Sensors, constructed from refractory metals such as molybdenum, are attractive for applications where rapid response and resistance to high thermal stress are important factors.

710,207
PB86-138633 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Estimating Diverter Valve Corrections.
Final rept.
F. E. Jones. 1984, 4p
Pub. in International Jnl. of Heat and Fluid Flow 5, n4 p247-250 Dec 84.

Keywords: *Valves, *Estimating, *Correction, Diverters, Mass flow, Gravimetric analysis, Liquid flow, Measurement, Reprints.

A new method has been developed for estimating the corrections to be made to the measured time interval for diverter valves used in primary liquid flow measurement facilities. The model relates the mass flowrate, m, to the measured mass of liquid collected and the effective collection time.

710,208
PB86-140209 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Special Applications.
Final rept.
F. L. Walls, and J. J. Gagnepain. 1984, 10p
Pub. in Precision Frequency Control, v2 ch15 p287-296 1984.

Keywords: *Quartz resonators, *Frequency measurement, Microbalances, Monitors, Deposition, Pressure sensors, Temperature measuring instruments, Accelerometers, Vibration meters.

The high resolution achievable with frequency metrology often makes it attractive to connect the measurement of physical parameters to a frequency measurement via a suitable transducer. Quartz crystal resonators are sensitive to mass loading and via nonlinear effects, to temperature and stress. The sensitivities are generally low; however, the excellent short-term stability of precision quartz resonators makes high-resolution measurements of temperature, pressure, vibration, acceleration, film thickness, some gas-phase chemical rates, and absorption feasible.

710,209
PB86-142411 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Scratch Standard Is Not a Performance Standard.
Final rept.
M. Young. 1985, 2p
Pub. in Proceedings of Optical Fabrication and Testing Workshop, Cherry Hill, NJ., June 12-13, 1985, pTHAA4-1-THAA4-2.

Keywords: *Standards, *Surfaces, *Optical tests, Scratches, *Scratch standards, Cosmetic standards, MIL standards.

The history and description of the scratch standard is given showing that the scratch number should never be related to its width, and that the standard is cosmetic only.

710,210
PB86-142429 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Tunable Scratch Standards.
Final rept.
M. Young, E. G. Johnson, and R. Goldgraben. 1985, 8p
Sponsored by Department of Defense, Washington, DC.
Pub. in Proceedings of SPIE Measurement and Effects of Surface Defects and Quality of Polish, Los Angeles, CA., January 21-22, 1985, p70-77.

Keywords: *Standards, *Surfaces, *Optical tests, Scratches, *Scratch standards, Cosmetic standards, MIL standards.

The scratch standard (MIL-O-13830A) is a cosmetic standard that is effected by a visual comparison with a set of submasters that is in turn evaluated by comparison with a set of master standards. Both manufacture and certification of the submasters are somewhat unreliable. In the paper, the authors show that the submasters can be classified according to the relative power scattered at a relatively small angle. They have designed etched gratings with which to replace the submasters; these gratings have the appearance of scratches but diffract a broad peak between 5 and 10 degrees off the axis of the incident beam. They have classified some prototypes both by comparison with the master standards and by a photoelectric measurement; agreement between the two methods is good. The authors suggest that such gratings be used as the submasters and possibly that they be classified by a photoelectric rather than visual measurement.

710,211
PB86-142874 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Comparison of Sputtered Ni/Cr Interface Depth Resolution as Obtained by the Quartz Crystal Microbalance Mass-Loss Method and Auger Spectroscopy.
Final rept.
B. Navinsek, P. Panjan, A. Zabkar, and J. Fine. 1985, 3p
Pub. in Jnl. of Vacuum Science and Technology A3, n3 p671-673 May/Jun 85,

Keywords: *Interfaces, *Depth finding, Nickel, Chromium, Microbalances, Quartz, Sputtering, Metal films, Thin films, Comparison, Reprints, Auger electron spectroscopy.

Sputter depth profiles of interfaces have been obtained by monitoring the change in sputtering rate as a function of sputtered depth. One very sensitive technique which we use to measure sputtering rates is the quartz crystal microbalance mass-loss method; it has been used to characterize Ni/Cr interfaces sputtered with a mass-analyzed 6 to 12 keV argon ion beam. Interface widths or interface depth resolution (90 to 10% points) obtained from the mass-loss depth profile data are compared to Auger sputter depth profile widths (1 to 4.5 keV argon ions) obtained on similar Ni/Cr thin-film materials. The somewhat narrower widths found with the mass-loss method indicate that this type of depth profiling can be used to characterize interface structures and to estimate the abruptness of an original, unsputtered interface.

710,212

PB86-150232 PC **A12**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
National Conference on Weights and Measures (70th), 1985.
Final rept.
A. D. Tholen, L. E. Barbrow, and A. P. Heffernan. Nov 85, 267p NBS/SP-704
See also PB85-178432. Library of Congress catalog card no. 26-27766.

Keywords: *Metrology, *Meetings, Weight measurement, Metric system, Standards, Measurement.

These are the proceedings of the 70th Annual Meeting of the National Conference on Weights and Measures. Reports by the several standing and annual committees of the Conference comprise the major portion of the publication. Included also are papers presented by Conference officials and others. Major issues discussed at the Conference included a new Scales Code to be effective January 1, 1986, method of sale of commodities, labeling of gasoline-alcohol blends, national type evaluation, and development of training materials.

710,213

PB86-160579 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Characterization of Polyvinylidene Fluoride Pressure Transducers.
Final rept.
A. J. Bur, and S. C. Roth. 1985, 6p
Pub. in Proceedings of the International Symposium on Electrets (5th), Heidelberg, West Germany, 1985, p712-717.

Keywords: *Pressure gages, Shear stress, Piezoelectricity, Meeting, *Vinylidene fluoride polymers.

The construction, calibration and use of a polyvinylidene fluoride (PVDF) pressure gage is described. The transducer material, PVDF, is in the form of 12 micrometer films with active areas 1 cm in diameter. The gage consists of two films whose active regions are laminated together face-to-face and subsequently laminated between protective layers of polycarbonate or another suitable polymer material. Temperature compensation, which is achieved by both active and passive techniques, is described. The response of the PVDF gage to shear stresses is found to be significant but small compared to the response to an equivalent hydrostatic pressure.

710,214

PB86-162039 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.

Handling Blunt Flaws in a Fitness-for-Service Assessment of Pipeline Weld Quality.
Final rept.
M. B. Kasen, and G. E. Hicho. 1985, 16p
Pub. in Proceedings of the Fracture Mechanics Seminar School (3rd): Fracture Mechanics of Weldments, Apandelova, Yugoslavia, June 25-29, 1984, p339-354.

Keywords: *Welded joints, *Pipelines, *Weldments, Weld defects, Crack propagation, Fracture(Mechanics).

The significance of porosity, slag and arc burns on pipeline integrity is evaluated by assessing the probability of their contributing to crack initiation and to accelerated crack growth during low cycle fatigue. It is found that such flaws are essentially innocuous in tough weldments where failure is dominated by the geometric discontinuity created by the weld reinforcement. It is shown that the maximum through-wall depth of slag and porosity is limited to the depth of the weld pass in which they occur. This provides an upper limit to flaw depth that greatly simplifies assessment of flaw significance by fracture mechanics principles, should it be desired to do so. Suggestions are offered for approaches to treating the presence of blunt flaws during field inspections of pipelines.

710,215

PB86-162179 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Measurement Technology for Automation in Construction and Large Scale Assembly.
J. M. Evans. Aug 85, 67p NBSIR-85/3310
Proceedings of a workshop held at Washington, DC. on February 5-6, 1985. Sponsored by Transitions Research Corp., Hartford, CT.

Keywords: *Metrology, Automation, Construction, Robots, Assembling, Technology, Numerical control.

The workshop, sponsored by the National Bureau of Standards and Transitions Research Corporation, concluded that: New technology achievable in the near term would have a major benefit in the construction and large scale assembly industries. The key to this benefit is the application of computers to data management and process control both off-site for design and planning and on-site for inventory management, production control and creation of an as-built data base. The achievement of this new technology requires research carried out on the integration of systems for measurement and automated control of on-site construction and assembly tasks.

710,216

PB86-164555 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Economic Model for Automatic Test Equipment Calibration.
Final rept.
S. F. Weber. 1985, 6p
Pub. in Proceedings of Autotestcon '85 IEEE (Institute of Electrical and Electronics Engineers) International Automatic Testing Conference, Long Island, NY., October 22-24, 1985, p347-352.

Keywords: *Calibrating, *Automatic test equipment.

A model for estimating the benefits of improved ATE calibration is presented and illustrated. The benefits are stated in terms of reduced probabilities of the two types of errors possible in every test situation: Consumer's Loss (CL) and Producer's Loss (PL). CL is the probability of accepting a bad unit under test (UUT) and PL is the probability of rejecting a good UUT. The model expresses both probabilities, CL and PL, as explicit functions of measurement bias (systematic error), represented by the mean of measurement error, and of measurement imprecision, represented by the standard deviation of measurement error. The model can directly translate any changes in bias and/or precision resulting from a calibration improvement into changes inthe probabilities, CL and PL. When applied to a case study, the economic value of the improvement, in terms of dollars saved per UUT tested, can be established from these probabilities.

710,217

PB86-171139 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Procedure for Calibration of Ferrite Gaps in Magnetic Tape Heads Traceable to NBS (National Bureau of Standards) AR-Chromium Optical Linewidth SRMs.
D. Nyyssonen. Feb 86, 8p NBSIR-86-3306

Keywords: Dimensional measurement, *Magnetic tapes, Calibrating, Line width.

Accurate calibration of micrometer and submicrometer optical line-width measuring systems requires that the calibration standard match the properties of the line to be measured. The NBS photomask linewidth standards have been designed for use by the integrated circuit community and are not directly suitable for use in other applications. A method of calibrating systems for measuring the width of ferrite gaps in magnetic tape heads has been developed that involves a two-step calibration using the NBS antireflecting-chromium photomask as the primary reference standard. This primary standard is used in transmitted green light to calibrate the linewidths on a secondary black-chromium photomask.

710,218

PB86-177714 PC **A05**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Thermometer Calibration: A Model for State Calibration Laboratories.
Final rept.
J. A. Wise, and R. J. Soulen. Jan 86, 91p NBS/MONO-174
Also available from Supt. of Docs as SN003-003-02707-3. Library of Congress catalog card no. 85-600636.

Keywords: *Thermometers, Calibrating.

The document describes the means by which a state calibration laboratory can establish a calibration service based on liquid-in-glass thermometers. Discussed are: ice-point baths, controlled-temperature baths, thermometer inspection, calibration techniques, and control chart procedures.

710,219

PB86-188497 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Heat-Pump Cycles with Refrigerant Non-Azeotropic Mixtures in Thermodynamic Diagrams.
Final rept.
R. Radermacher. 1984, 1p
Sponsored by Electric Power Research Inst., Palo Alto, CA.
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers) Jnl. EN-26, n5 p52 1984.

Keywords: *Heat pumps, Distillation, Refrigerants, Thermodynamics, Reprints, Thermodynamic diagrams.

Various thermodynamic diagrams that are well known in absorption heat pump design and distillation techniques are introduced in the paper for non-azeotropic halogenated hydrocarbon mixtures. As an example, a typical compressor heat pump cycle for refrigerant mixtures is displayed and the cycle itself discussed using these diagrams. It is shown that virtually all the necessary thermodynamic design information can be obtained from the enthalpy-composition diagram. It offers the possibility to determine the amount of heat, pressures, temperatures and compositions involved by simple geometric constructions even when the refrigerant flow rate varies in certain components. Furthermore, it is shown by an example that thermodynamic diagrams provide a basic understanding of the influence of refrigerant properties on the heat pump cycle.

710,220

PB86-192002 PC **A09**/MF **A01**
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Industrial Time Service Study.
D. W. Hanson, and D. A. Howe. Feb 86, 194p NBSIR-86/3042
Sponsored by Bonneville Power Administration, Portland, OR.

Keywords: *Time standards, *Frequency standards, Accuracy, Time signals, Time dissemination, Time broadcast service.

General

The study examines options for delivery of accurate time and frequency information to industrial users. The study is sponsored by the Bonneville Power Administration (BPA) who finds a need for accurate timing to the one microsecond level. Prospective existing and future dissemination methods (Loran-C, GOES, USRDSS, GPS, etc.) are discussed in detail. The study produces a system architecture and preliminary design for a new time service using the widely available U.S. fixed satellite service (FSS) in which customers shall assume full costs of its operation through subscriber fees. The study elaborates on three viable options: (1) FSS, (2) GPS, and (3) USRDSS. Based on the study, conclusions can be drawn regarding a timing system which will most satisfactorily meet the long range goals of most industrial users.

710,221
PB86-192127 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Toward an Efficient Operation of a Series Solar Heat Pump System.
Final rept.
T. Y. Bong. 1983, 11p
Sponsored by Department of Energy, Washington, DC.
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions 89, pt2A-2B p617-627 1983.

Keywords: *Heat pumps, Solar energy, Efficiency, Temperature control, Reprints.

In operating a series solar heat pump system, a common practice is to use direct solar heating instead of the heat pump whenever the temperature of the solar-heated water exceeds a certain value called the switch-over temperature. The switch over temperature setting has a significant effect on the system's energy consumption. It is shown in the analytical study that the ideal switch-over temperature increases with the building load, but that it has a maximum value determined completely by the characteristics of the water-to-air heat pump. If because of its controller, a series solar heat pump system is to have a fixed switch-over temperature independent of the building load, then the temperature should not exceed the ideal switch-over temperature corresponding to the building design load if the energy consumption of the system is to be minimized.

710,222
PB86-192234 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Brief History of Measurement Systems with a Chart of the Modernized Metric System.
Final rept.
D. Goldman. Mar 86, 6p NBS/SP-304A
See also PB86-192242. Also available from Supt. of Docs as SN003-003-02696-4.Color illustrations reproduced in black and white.

Keywords: *Metric system, *Units of measurement, Charts.

The chart presents a popularized yet technically accurate guide to SI base units, supplementary units, multiples and prefixes, and common conversions. The intended audience is (mainly) school children and the general public.

710,223
PB86-192242 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Modernized Metric System (Chart).
Final rept.
D. Goldman. Mar 86, 2p NBS/SP-304
See also PB86-192234. Also available from Supt. of Docs as SN003-003-02695-6.Color illustrations reproduced in black and white.

Keywords: *Metric system, *Units of measurement, Charts.

The chart presents a popularized yet technically accurate guide to SI base units, supplementary units, multiples and prefixes, and common conversions. The intended audience is (mainly) school children and the general public.

710,224
PB86-193109 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
International Laboratory Accreditation Conference.
Final rept.
S. I. Warshaw. Jan 86, 3p
Sponsored by American Society for Testing and Materials, Philadelphia, PA.
Pub. in ASTM (American Society for Testing and Materials) Standardization News 14, n1 p42-44 Jan 86.

Keywords: *Laboratories, Test facilities, Standards, Measurement, Meetings, Reprints, *Accreditation.

A description is given of the organization and activity of the International Laboratory Accreditation Conference. Included is a listing of respresentation from the United States, international organizations, and other nations.

710,225
PB86-193604 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Measurement of the Silver Freezing Point with an Optical Fiber Thermometer: Proof of Concept.
Final rept.
R. R. Dils, J. Geist, and M. L. Reilly. 15 Feb 86, 8p
Pub. in Jnl. of Applied Physics 59, n4 p1005-1012, 15 Feb 86.

Keywords: *Melting points, *Silver, *Temperature measuring instruments, Gold, Reprints, *Thermometers, Optical fibers.

Measurements were made at the gold and silver freezing points to demonstrate the accuracy of the new optical fiber thermometer (OFT). It is shown that the output signal from the OFT is related to the radiance from a blackbody source in a simple manner, and that the temperature interval between the gold and silver freezing points, as determined with the OFT, is close to other recent results.

710,226
PB86-195971 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Low-Cost Tubular Sapphire Optical-Cells for Study of Phase-Separation in Fluid Mixtures.
Final rept.
H. A. Davis. 1983, 2p
Pub. in Review of Scientific Instruments 54, n10 p1412-1413 1983.

Keywords: Laboratory equipment, Reprints, *Optical cells.

The construction of low-cost optical cells using the thin-walled sapphire tubing, which are used for observation of phase separation in fluid mixtures, are described.

710,227
PB86-196763 PC **A05**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD.
Measurement Evaluation.
Special pub.
J. Mandel, and L. F. Nanni. Mar 86, 77p NBS/SP-700/2
See also HRP-0029178. Also available from Supt. of Docs as SN003-003-02720-1. Library of Congress catalog card no. 86-600510.

Keywords: *Measurement, Evaluation, Statistical analysis, Quality control.

The paper was published originally as a chapter in the book entitled 'Quality Assurance Practices for Health Laboratories'. It is for that reason that the examples used as illustrations are taken from health-related fields of research. However, the statistical concepts and methods presented here are entirely general and therefore also applicable to measurements originating in physics, chemistry, engineering, and other technical disciplines. The reader should have no difficulty in applying the material of this paper to the systems of measurement in his particular field of activity.

710,228
PB86-197365 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Temperature Distribution in the Diamond Anvil Pressure Cell at High Temperature.
Final rept.
R. G. Munro, S. Block, G. J. Piermarini, and F. A. Mauer. 1 Jan 84, 5p
Pub. in Jnl. of Applied Physics 55, n1 p4-8, 1 Jan 84.

Keywords: *Load cells, Diamonds, Temperature distribution, Thermal diffusion, Heating equipment, Reprints, Finite difference methods.

The temperature distribution in a diamond anvil pressure cell is investigated theoretically for a realistic model cell having a cylindrical external heater. For a heater surface at 1000 absolute degrees above the ambient temperature, it is found, at steady state, that the region of the sample chamber is, for all practical purposes, isothermal at a temperature of about 11 degrees below the temperature of the heater. When the heater temperature is subsequently incremented instantaneously by ten degrees, a new steady state is reached in about 30 seconds.

710,229
PB86-201274 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
NBS (National Bureau of Standards) 50 kHz Phase Angle Calibration Standard.
Final rept.
R. S. Turgel. Apr 86, 85p NBS/TN-1220
Also available from Supt. of Docs as SN003-003-02726-0. Sponsored by Department of Defense Calibration Coordination Group, Redstone Arsenal, AL.

Keywords: *Phase angle, *Calibrating, Standards, Phase meters, Waveforms, Waveform generators.

A detailed description is given of the features of an electrical phase angle calibration standard designed for operation over a frequency span of 2 Hz to 50 kHz. The phase resolution of the calibrator extends from just below 2 millidegrees at the low end of the frequency range to about 5 millidegrees at the high end. The uncertainty in the phase angle is a function of frequency, amplitude, and amplitude ratio of the two outputs. It varies from 5-50 millidegrees.

710,230
PB86-202108 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Iodine Stabilized Laser as a Realization of the Length Unit.
Final rept.
H. P. Layer. 1978, 1p
Pub. in Proceedings of the SPIE Conference on Effective Utilization of Optics in Quality Assurance, Arlington Heights, IL., November 14-16, 1977, v129 p9-11 1978.

Keywords: *Helium neon lasers, *Dimensional measurement, *Length, *Standards, Stabilization, Length.

The iodine stabilized helium-neon laser is the most accurate and stable standard of length that is available for general metrological use today. Although the krypton discharge lamp is still the basis for international agreements which define the meter as the length standard, the independent reproducibility of the iodine stabilized helium-neon laser has been shown to exceed that of the krypton lamp when international intercomparisons are made. Because of its superior performance, the iodine stabilized helium-neon laser is used in most national standards laboratories to realize the stand of length. A value for its wavelength which is consistent with the value for the wavelength of the krypton lamp has been agreed upon by the metrological community through consultation with the International Bureau of Weights and Measures.

710,231
PB86-206372
(Order as PB86-206364, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Ruggedness Testing - Part 1: Ignoring Interactions.
R. C. Paule, G. Marinenko, M. Knoerdel, and W. F. Koch. 29 Aug 85, 6p
Included in Jnl. of Research of the National Bureau of Standards, v91 n1 p3-8 Jan-Feb 86.

Keywords: *Durability, *Mechanical properties, Electrodes, Mathematical models, Field tests, Design, Statistical analysis, pH, Hydrochloric acid.

A straightforward explanation of the statistical technique of ruggedness testing is presented. Efficient Plackett-Burman designs are used in ruggedness tests. These designs involve the simultaneous change of levels ofa number of variables. The designs allow the ruggedness test user to determine the effect of the separated variables on the measurement process.

710,232
PB86-206380
(Order as PB86-206364, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Ruggedness Testing - Part 2: Recognizing Interactions.
R. C. Paule, G. Marinenko, M. Knoerdel, and W. F. Koch. 28 Aug 85, 7p
Included in Jnl. of Research of the National Bureau of Standards, v91 n1 p9-15 Jan-Feb 86.

Keywords: *Electrodes, *Durability, Test methods, Measurement, pH, Acidity, Interactions, Ruggedness.

The paper is a continuation of the preceeding article which introduced the reader to the general concepts of ruggedness testing. The current paper describes the effects of interactions on the measurement process, and presents procedures for the separation of the main effects from the two-factor interactions. The general characteristics of interactions are described in some detail. A short-cut procedure is presented for the calculations. A number of examples of glass electrode measurements of pH of dilute acid solutions are used to illustrate ruggedness testing proceudres.

710,233
PB86-213006 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Summary of the Second Biennial Conference on Refrigeration for Cryogenic Sensors and Electronic Systems.
Final rept.
J. E. Zimmerman. 1983, 2p
Pub. in Cryogenics 23, n5 p281-282 1983.

Keywords: *Meetings, *Refrigerating, Cryogenics, Detectors, Electric equipment, Reprints.

The report is a summary of the Second Biennial Conference on Refrigeration for Cryogenic Sensors and Electronic Systems held at NASA Goodard Space Flight Center, Greenbelt, MD.

710,234
PB86-214707 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Use of Back-to-Back Accelerometers as Precision Vibration Standards.
Final rept.
B. F. Payne. 1982, 4p
Pub. in Proceedings of International Modal Analysis Conference and Exhibit (1st), Orlando, FL., November 8-10, 1982, p212-215.

Keywords: *Accelerometers, *Calibrating, Vibration, Vibration meters, Standards.

Precision vibration measurements depend on accurate and repeatable calibration methods. Standardization of calibration test equipment and measurement techniques ensures more accurate and repeatable measurements. The use of the back-to-back accelerometer as a laboratory standard has become wide-spread. However this use has been somewhat limited because of inadequate calibration methods. Recent developments in improved calibration methods has given the back-to-back accelerometer a greater potential as an accurate, repeatable, and stable vibration standard. As a vibration standard, the back-to-back accelerometer should prove to be a valuable asset for laboratories involved in vibration measurements and vibration transducer calibrations. Recent work at NBS in this area is presented with some examples of transducer calibrations on these standards.

710,235
PB86-215167 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Minimum Life Cycle Cost Heat Losses for Shallow Trench Underground Heat Distribution Systems.
J. B. Fang. May 86, 46p NBSIR-86/3381
Sponsored by Corps of Engineers, Washington, DC., Naval Facilities Engineering Command, Alexandria, VA., and Air Force Engineering and Services Center, Tyndall AFB, FL.

Keywords: *Pipes(Tubes), *Heat loss, Thermal insulation, Heat transfer, Life cycles, Service life, *Heat pipes.

The rates of heat loss from two underground insulated pipes installed in a shallow trench were calculated using a computer program developed based on the application of the finite element method to solution of two-dimensional steady heat conduction problems. The calculated results of pipe heat loss under a specified ground temperature condition are summarized for a range of pipe insulation thickness, different sizes of shallow trench, and various pipe fluid temperatures. Methods of determining the minimum life-cycle cost heat loss and the corresponding economic insulation thickness for shallow trench heat distribution systems are presented. Life-cycle costing analysis was performed for two insulated pipes in a concrete trench to determine the cost of construction, annual energy cost associated with pipe heat loss, and yearly operating and maintenance costs.

710,236
PB86-231511 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Polyvinylidene Fluoride Transducer for Dynamic Pressure Measurements.
Final rept.
E. R. Lemar, J. W. Forbes, D. G. Tasker, and A. J. Bur. 1985, 6p
Pub. in Proceedings of Topical Conference on Shock Waves in Condensed Matter, Spokane, WA., July 22-25, 1985, p1-6.

Keywords: *Pressure sensors, Pressure gages, Piezoelectric transducers, Vinylidene fluoride polymers.

A number of light gas gun experiments have been performed to measure the charge output of electrically poled polyvinylidene fluoride (PVDF) as a function of uniaxial strain. The .05 mm thick gage package was epoxied between two 1.27 thick plexiglas discs. The plexiglas was impacted by 6061 T6 aluminum projectiles resulting in pressures ranging from 0 to 15 kbars. The charge output from the gage was observed to have an initial step with rise time of 0.1 microsec. Nonlinear response at high pressures is observed.

710,237
PB86-232295 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Applications of Radiation Thermometry.
Final rept.
J. C. Richmond, and D. P. DeWitt. 1986, 171p
Pub. in Proceedings of Symposium on Applications of Radiation Thermometry, Gaithersburg, MD., May 8, 1984, ASTM Special Publication 895 - Applications of Radiation Thermometry, 171p 1986.

Keywords: *Temperature measurement, Temperature measuring instruments, Temperature control, Fiber optics, Calibrating, Laboratories, Glass, Crystal growth, Steels, Reheating, Ovens, Welding, Pyrometers, Semiconductors, Imaging techniques.

Contents: Radiation thermometry--the measurement problem; Methods of calibration at a national laboratory; Establishing a calibration laboratory for industrial radiation thermometry; Radiation thermometry--status and trends; Mold temperature measurement for glass-pressing processes; Use of infrared radiation thermometers for temperature control of plastic and paper webs in electric infrared ovens; Radiation thermometry for semiconductor crystal growing furnaces; Thermal imaging systems for measuring temperature distribution; A review of temperature measurement in the steel reheat furnace; Closed-loop temperature control for high-frequency electric-resistance tube and pipe welding mills; Recent advances and research activities in Japan; Fiber-optic thermometry; Panel discussion.

710,238
PB86-232444 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Measuring Linewidths with an Optical Microscope.
Final rept.
C. P. Kirk, and D. Nyyssonen. 1986, 12p
Pub. in Test and Measurement World, p68-79 Jan 86.

Keywords: *Line width, *Optical measurement, Reprints.

No abstract available.

710,239
PB86-238813 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of the Director.
Measurement Accuracy - RF to Optical.
Final rept.
E. Ambler. Jan 86, 2p
Sponsored by Institute of Electrical and Electronics Engineers, Inc., Washington, DC.
Pub. in Proceedings of Institute of Electrical and Electronics Engineers 74, n1 p7-8 Jan 86.

Keywords: *Metrology, Measurement, Calibrating, Microwaves, Optical communication.

Various developments in microwave and optical metrology that have been stimulated by the needs of satellite and optical fiber telecommunications are discussed. A few recent examples of the symbiosis of science, technology, and metrology in the microwave and optical fields are noted. Meeting the challenge of providing calibration support to the new automated measurement systems is seen to require a high degree of cooperation among government, industry, and the universities.

710,240
PB86-241932 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Radiation Gauging.
Final rept.
J. H. Hubbell. 1986, 3p
Pub. in Encyclopedia of Materials Science and Engineering, v6 p4040-4042 1986.

Keywords: *Measuring instruments, X rays, Gamma rays, Electrons, Neutrons, Radiometry, Reprints.

Gauges employing penetrating radiation such as x- or gamma-rays, electrons, or neutrons, are discussed. Such a gauge consists of a radiation source and a radiation sensor which detects the fraction of source radiation transmitted by the examined material, or in some applications detects secondary radiation such as scattered or fluorescence photons resulting from interactions of the source-radiation with atoms of the material. Some examples of currently-used radiation gauges are mentioned.

710,241
PB86-241957 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Ultrasonic Reference Blocks.
Final rept.
D. G. Eitzen, and G. V. Blessing. 1986, 5p
Pub. in Encyclopedia of Materials Science and Engineering, v7 p5182-5186 1986.

Keywords: *Standards, Nondestructive tests, Ultrasonic tests, Reprints, *Reference blocks.

The article describes the functions of ultrasonic reference artifacts as a tool for setting ultrasonic test sensitivity, as an aid in interpreting signals and as a tool for classifying test parts. The design considerations of reference blocks relating to material, outer geometry, and reflector geometry are described. The most common reference blocks, the IIW Block and the ASTM E-127 Block, are described. References for additional information are listed.

710,242
PB86-244159 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
International System of Units (SI).
Special pub.
D. T. Goldman, and R. J. Bell. Jul 86, 61p NBS/SP-330
Supersedes PB82-154584. Also available from Supt. of Docs as SN003--003-02739-1. Prepared in cooperation with National Physical Lab., Teddington (England).

Keywords: *Metric system, Units of measurement, Primary standards, Translations, *Foreign technology, *International system of units.

The booklet is the United States edition of the English translation of the fifth edition of 'Le Systeme International d'Unites (SI),' the definitive publication in the French language issued in 1985 by the International Bureau of Weights and Measures (BIPM). This U.S. edition, which conforms in substance with the British edition that follows the French text in the BIPM document is the result of a joint effort by the National Bureau of Standards(NBS) of the United States and

the National Physical Laboratory (NPL) in the United Kingdom.

710,243

PB87-103313 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Tensile Properties of Pleated Synthetic Rope.
S. G. Fattal. Sep 86, 44p NBSIR-86/3375
Sponsored by Aberdeen Proving Ground, MD.

Keywords: *Rope, Nylon fibers, Tensile properties, Breaking load, Elongation.

Pleated nylon ropes of two sizes and approximately the same length were tensioned to rupture in a universal testing machine. Several of the ropes were tested at room temperature. The others were subjected to specified high and low temperatures before testing. Deformation measurements of all the specimens were recorded while testing was in progress. The results were used to evaluate the breaking strength, ultimate elongation, and load-deformation properties, and to develop criteria for possible application in the recovery of mired vehicles.

710,244

PB87-108429 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Comparison of Three Types of Pulse Tube Refrigerators: New Methods for Reaching 60 K.
Final rept.
R. Radebaugh, J. Zimmerman, D. R. Smith, and B. Louie. 1986, 11p
Contract NASA-A-14746-C
Sponsored by National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.
Pub. in Advances in Cryogenic Engineering 31, p779-789 1986.

Keywords: *Refrigerators, Cryogenics, Reprints, *Pulse tube refrigerators.

The paper compares the three types with each other and with common refrigerators such as Joule-Thomson and Stirling refrigerators. An apparatus is described which can measure the intrinsic behavior of the different types from temperatures of about 30 K to 300 K. Overall cycle efficiency as well as sources of loss such as conduction and regenerator ineffectiveness are discussed and the advantages of various phase shifting techniques to increase refrigeration capacity are compared.

710,245

PB87-111688 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Fitness-for-Service Assessment of Pipeline Girth Welds with Emphasis on Nondestructive Inspection.
Final rept.
R. P. Reed, and R. E. Schramm. 1986, 7p
Sponsored by Department of Transportation, Washington, DC. Materials Transportation Bureau, Naval Sea Systems Command, Washington, DC., and Welding Research Council, New York.
Pub. in Proceedings of International Conference and Exposition on Fatigue, Corrosion Cracking, Fracture Mechanics and Failure Analysis, Salt Lake City, UT., December 2-6, 1985, p255-263 1986.

Keywords: *Welded joints, Pipelines, Nondestructive tests, Inspection.

A review of fitness-for-service assessment of pipeline girth welds is presented. The U.S., British, Japanese, and Canadian approaches are summarized and compared in terms of allowable flaw sizes. Included is an in-depth discussion of nondestructive inspection of girth welds, using electromagnetic-acoustic transducers (EMATs), EMATs have great potential as an inspection tool for sharp flaws, those flaws that most affect weld structural integrity.

710,246

PB87-111837 PC **A11**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Impact-Echo: A Method for Flaw Detection in Concrete Using Transient Stress Waves.
M. Sansalone, and N. J. Carino. Sep 86, 237p
NBSIR-86/3452
Supersedes PB87-104444.

Keywords: *Nondestructive tests, *Concretes, Finite element analysis, Greens function, Stress waves, Plates(Structural members), *Flaw detection.

The report covers a nondestructive test method for heterogeneous solids. Analytical, numerical, and laboratory studies of transient stress wave propagation in plain plates and in plates containing flaws are presented. The test method involves introducing transient stress waves into a test object by mechanical point impact and monitoring reflections of the waves from internal defects and external boundaries using a point receiver.

710,247

PB87-128195 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Electrochemical Noise as an Indicator of Anaerobic Corrosion.
Final rept.
W. P. Iverson, and L. Heverly. 1986, 13p
Pub. in American Society for Testing and Materials STP 908--Corrosion Monitoring in Industrial Plants Using Nondestructive Testing and Electrochemical Methods, p459-471 1986.

Keywords: *Pipelines, *Corrosion, *Anaerobic bacteria, Reprints, Microbial corrosion, Desulfovibrio, Electrochemical noise, Sulfate reducing bacteria.

Anaerobic (bacterial) corrosion is an important cause of failures of underground structures, such as pipelines. Pipeline failures could be prevented if better methods for determining the presence and location of areas of bacterial corrosion existed. A technique was developed which permits the detection and recording of rapid potential fluctuations (noise) produced in a corroding metal. It is believed that the noise is mainly caused by the breaking of protective films on the metal surface. Anaerobic bacterial corrosion also produces a type of noise, probably due to the breaking of iron sulfide films. Preliminary evidence indicates that detection and production of the noise on pipelines may offer promise in locating areas of microbial corrosion as well as other types of corrosion. Differences in the type of noise signal could enable differentiation between biological and nonbiological corrosion.

710,248

PB87-131314 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Measurements of the Efficiency and Refrigeration Power of Pulse-Tube Refrigerators.
S. Herrmann, and R. Radebaugh. Sep 86, 54p NBS/TN-1301
Also available from Supt. of Docs as SN003-003-02771-5. Sponsored by National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.

Keywords: *Refrigerators, Cryogenics, *Cryocoolers, Regenerative cooling.

Pulse-tube or thermoacoustic refrigerators have the potential for high reliability since they require only one moving part--an oscillating piston or diaphragm at room temperature. If a tube is closed at one end and connected to a pressure wave generator at the open end, and if the phase angle between mass flow and pressure is shifted from 90 deg, then refrigeration occurs at the open end. The shift in phase angle can be realized by thermal relaxation between the gas and the tube walls or by an orifice at the closed end. A low temperature of 60 K using helium gas in a one stage orifice pulse tube has been achieved at NBS. The report describes the first measurements of the efficiency, refrigeration power, and refrigeration power per unit mass flow, for three pulse-tube refrigerators. Three tube sizes, differing in length and diameter, were studied over a frequency range of 3 to 11.5 Hz. Cooling efficiencies as high as 90% of the Carnot efficiency were obtained when compressor and regenerator losses are neglected.

710,249

PB87-174041 PC **A10**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Office of Physical Measurement Services.
NBS (National Bureau of Standards) Calibration Services Users Guide 1986-1988 Edition (Revised).
Special pub.,
G. A. Uriano, E. L. Garner, R. K. Kirby, and W. P. Reed. Jan 87, 205p NBS/SP-250-REV
Supersedes PB86-246162. Also available from Supt. of Docs as SN003-003-02789-8.Color illustrations reproduced in black and white.

Keywords: *Calibrating, *Measurement, Standards, Services, Quality assurance, National Bureau of Standards.

The NBS Calibration Service Users Guide provides detailed descriptions of the currently available NBS calibration services, special test services, and measurement assurance programs. The document is a revised edition of NBS Special Publication 250. It describes the NBS services available as of the second quarter of 1986 and reflects a number of important changes since the 1982 edition was published. A detailed description is given of each measurement service. A new numbering system is used to uniquely identify each of the services. Addendum I to the document is a cross-reference index that links the new NBS test numbers to those used previously to identify the services. Also cited are a large number of NBS technical experts (including addresses and telephone numbers) who may be contacted for further information concerning services or measurement problems. Future editions will be published periodically as NBS services change. The document also presents a detailed description of a number of Measurement Assurance Program (MAP) services.

710,250

PB87-233763 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Factory of the Future.
Final rept.,
J. A. Simpson. 1982, 23p
See also AD-A124 104.
Pub. in Proceedings of Manufacturing Technology and Productivity Conference (1982): The Revitalization of U.S. Manufacturing, Troy, NY., June 3-4, 1982, p191-213.

Keywords: *Management planning and control, Industrial plants, Manufacturing, Materials handling, Automata, Productivity, Robots, *Automated factories.

Despite uncertainty as to exact economic circumstances of the future, certain characteristics of the factory of the future can be predicted. It will be efficient in materials and energy, it will emphasize quality and it will be flexible towards product mix. Software costs will rise relative to hardware cost, and labor productivity will become less a matter of concern. These conclusions are discussed.

710,251

PB88-147277 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Future Directions for Reactor Based Research.
Final rept.,
R. S. Carter. 1985, 2p
Pub. in Transactions of the American Nuclear Society 50, p196-197 1985.

Keywords: *Research, Nuclear reactors, Reprints, Condensed matter physics.

Reactor based research is moving in many directions with the development of a variety of new instruments and detectors. The development of intense sources of long wavelength neutrons (cold sources) has opened the way for advanced research in material science, condensed matter physics, chemistry, and structural biology. Other instrument developments are making it possible to explore new areas in trace analysis, crystal structure, and magnetic materials. These new research directions are illustrated by selected examples.

LIBRARY & INFORMATION SCIENCES

Information Systems

710,252
FIPS PUB 76 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Guideline for Planning and Using a Data Dictionary System. Category: Software. Subcategory: Data Management Applications.
Federal information processing standards (Final).
20 Aug 80, 20p
Three ring FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Management planning, Standards, Budgeting, Government policies, Coordination, *Data dictionaries, *Federal information processing standards, Data management, Data base management.

The guideline provides assistance to Federal ADP management and technical staff in planning and using a Data Dictionary System (DDS). A DDS is a computer software system that is used to assist in organization-wide data management, without restriction to computer data. This document describes the capabilities of a DDS; addresses selection considerations; provides guidance for pre-implementation planning, including such management issues as DDS policies and budgeting, data standardization and control, and coordination of the DDS contents. The document also presents initiation and operation considerations for using a DDS.

710,253
PB-262 887/3 PC **A12**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of Standard Reference Data.
Materials Information Programs. An Interagency Review of Federal Agency Activities on Technical Information about Materials.
Final rept.,
S. A. Rossmassler. Jan 77, 273p NBS-SP-463
Sponsored in part by Interagency Council for Materials. Working Group on Materials Information Data. Library of Congress catalog card no. 76-51310.

Keywords: *Materials, *Research management, *Information centers, Meetings, Government, National government, Agriculture, Wood, Wood products, Data processing, Information retrieval, Hazardous materials, Toxicity, Air pollution, Chemical compounds, Water pollution, Radiation shielding materials, Rare earth elements, Plastics, Test facilities, Concretes, Metals, Machinability, Fabrics, Flammability, Electrical properties, Technology assessment, Standard Reference Materials.

Contents: Keynote address--The national significance of materials information; U.S. Department of Agriculture session--(Materials information in the forest service, The Current Research Information System (CRIS) as a source for materials information in the agricultural and allied sciences, How the Extension Service-Land Grant University-ARS-USDA Information Exchange functions); Atomic Energy Commission session--(materials information in the Radiation Shielding Information Center, Rare-Earth Information Center (RIC), The Research Materials Information Center, Materials information services of the Environmental Information System Office and the Toxic Materials Information Center, Government-industry data exchange program); Department of Defense session--(The DoD program for technical information about materials, Metals and Ceramics Information Center, Plastics Technical Evaluation Center (PLASTEC), Thermophysical and Electronic Properties Information Analysis Center (TEPIAC), Machinability Data Center - data publications and services, Nondestructive Testing Information Analysis Center, Concrete Technology Information Analysis Center (CTIAC), The Mechanical Properties Data Center products, services and informational content); Department of Interior session--(Water Resources Scientific Information Center (WRSIC), Materials activity in the Office of Saline Water, Bureau of Mines information-publication program); National Aeronautics and Space Administration session--(Materials information in the NASA Scientific and Technical Information System, Department of Commerce session--(The National Standard Reference Data System as a materials information resource, The Flammable Fabric Accident Case and Testing System (FFACTS), National Technical Information Service--its products and services, Standard Reference Materials--the data and the material, NBS Standards Information Services - description of data, information system and services); Library of Congress session--(The Library of Congress MARC system, The National Referral Center); Summary session--Increased demand for information and data in the materials cycle.

710,254
PB-263 681/9 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 61, Number 1.
Monthly rept.
Jan 77, 37p NBS/DIM-61/01
See also PB-263 136.

Keywords: *Periodicals, *Research projects, Computers, Identification systems, Security, Alaska, Offshore drilling, Hydrocarbons, Petroleum geology, Clothing, Consumer affairs, Metric system, Standards, Lasers, Energy conservation, Technical news bulletins.

The monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Will the real John Hancock please sign in; Meeting a measurement challenge in Alaska; Utilizing consumer insight; Good data, bad data; Transition to Ametrica; Fire research with the gypsum industry; The U.S. voluntary standards system--NBS role may be changing; Highly efficient laser ionization of dense vapors achieved; A winning invention--the cerebellar model arithmetic computer; Neutron diffraction for NDE being studied; Standard reference materials for electron probe microanalysis; Humidity calibration service extended to broader temperature, pressure range; Extended calibration service available for low vacuum gages; Put a damper on noise--prevent deafness.

710,255
PB-264 961/4 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 61, Number 2.
Monthly rept.
Feb 77, 37p NBS/DIM-61/2
See also PB-263 136.

Keywords: *Periodicals, *Research projects, Energy conservation, Office buildings, Solar cells, Metric system, Semiconductor devices, Electronics, Structural engineering, Dentistry, Alloys, Computers, Security, Lasers, Pressure sensors, Synchrotrons, Dielectric properties, Cryogenics, Electron microscopy, Thermography, Metals, Organic dye lasers, Space shuttles, Technical news bulletins, Standard reference materials.

The monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: New Energy Efficient Office Building; The measurement challenge in electronic technology; Destroying to build better; Cooperative research in dentistry; First federal computer security standard; Interferometric wavemeter for CW dye lasers developed; Dynamic calibration methods developed for space shuttle pressure transducers; Synchrotron radiation facility now available to outside users; Dielectric measurements at cryogenic temperatures; Standard reference materials for scanning electron microscopy; A new Metric Style Guide from NBS; Applications of thermography for industrial energy conservation; Critical survey of data sources on electric and magnetic properties of metals; Accuracy in trace analysis proceedings.

710,256
PB-266 997/6 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 61, Number 3.
Monthly rept.
Mar 77, 37p NBS/DIM-61/3
See also PB-263 136.

Keywords: *Periodicals, *Research projects, Solar heating, Air pollution, Halohydrocarbons, Infrared lasers, Corrosion, Management, Radiation hazards, *Technical news bulletins, Smoke detectors, Fingerprint readers.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Evaluating incentives for solar heating systems; Clearing the air on smoke detectors; A legacy of adobe; The state of NBS, Part 1--technical quality and problem solving; How sweet it is; Copper benchmark standard reference materials; Thermal neutron xeroradiography; Possible mechanism for removal of halocarbons from lower atmosphere; Electrically tuned far infrared lasers; The graphic pen--an economical semiautomatic fingerprint reader; New air pollution standard reference materials; Electrical measurement seminar; Conference on corrosion; New energy management guide for small business; Measures for radiation safety.

710,257
PB-267 036/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Government Information Systems: Only the Automated Will Survive,
R. M. Davis. 1976, 3p
Pub. in Gov. Data Syst., v5 n1 p14, 16, 27 Mar-Apr 76.

Keywords: *Information systems, *Records management, National government, Computers, Security, Attitudes, Public opinion, Services, Reprints.

The Federal Government collects and processes information to perform essential public service, to protect the public and to be accountable to the public. Many government functions, involving the collection of large amounts of data, would be impossible to accomplish without computers. However, the use of computers has aroused public concerns about loss of privacy and government intrusion into citizen's private lives. Information collection is often perceived as conflicting with individual rights. Some national attempts to balance individual rights with society's rights have resulted in legislation protecting privacy and regulating credit records. Areas such as privacy in medical records and welfare benefits remain to be addressed. The resolution of these and other conflicts will require the interaction of Congress, the Executive Branch, the information industry and the public. This paper suggests one approach to the resolution of these issues through the assessment of computer use in terms of the associated risks and benefits.

710,258
PB-270 703/2 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 61, Number 7.
Monthly rept.
Jul 77, 37p NBS/DIM-61/7
See also Volume 61, Number 5, PB-267 321.

Keywords: *Periodicals, *Research projects, Energy conservation, Inventions, Crystallography, Neutron beams, Dosimeters, Microscopes, Cryogenics, Speech scrambling, Radio receivers, Heterodyning, *Technical news bulletins, National Bureau of Standards.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: A primer on pressure; Summer tips for saving energy and money; When is a product portable; The key to marketing new energy-related inventions; An international standards code for products; Single-crystal method for identifying crystalline materials; NBS standard neutron beams extend energy range for personnel dosimeter calibrations; New Piezo-Flex micropositioning stage permits smooth control of displacements in microscope systems; Improved heterodyne receiver at 300 GHz developed; New thermodynamic tables being prepared; 1977 combined cryogenic conference; NCSL annual meeting at Boulder, Colorado; Comprehensive review on NMR Knight Shifts; A guide for law enforcement agencies on use of voice scramblers; Prevention of failures in coal conversion systems.

710,259
PB-272 357/5 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C.
Dimensions/NBS. Volume 61, Number 8.
Monthly rept.
Aug 77, 36p NBS/DIM-61/8
See also Volume 61, Number 7, PB-270 703.

Keywords: *Periodicals, *Research projects, Preserving, Architecture, Pressure sensors, Computer storage devices, Particulates, Roofing, Time measurement, *Technical news bulletins, Residential security alarms, Computer performance evaluation, Teacher aids.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Preserving Stone Art and Architecture; User's Guide to Pressure Measurement Services; Profile of an Inventor - Louis Marzetta; Home Security Alarms; NBS/ASTM Research Associate Program Develops Urgently Needed SRM's; Shedding More Light on the Ultraviolet; Molecular Identity of Power Plant Stack Particulates; Technology Assessment of Computer Memories; A New Self Balancing DC-Substitution RF Power Meter; Time and Frequency Seminar; Roofing Symposium; Computer Performance Evaluation Users Group; Teacher Aids.

710,260
PB-273 107/3 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 61, Number 9.
Monthly pub.
Sep 77, 37p NBS/DIM-61/9
See also Volume 61, Number 8, PB-272 357.

Keywords: *Periodicals, *Research projects, Ultraviolet radiation, Consumers, Energy conservation, Calibrating, Gas lasers, *Technical news bulletins, Metrication.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Ultraviolet Radiation-Problems and Issues; Let the Buyer Be Aware; Material Aspects of the Energy Problem; Don't Let Your Furnace Guzzle Oil; Participants Wanted for IC Linewidth Calibration Study; Coordination of Federal Screw Thread Standards Shifts to GSA; Glass Developments for SHIVA Laser; Worldwide Timekeeping Better Than Previously Believed; NBS, NIH Offer New Mass Spectra Data Base; Study of Grain Moisture Meters Begun; Silicon for Infrared Imaging Creates New Measurement Problems; New Calibration Services for Radiation Sterilizing and Processing Industries; Cardiac Pacemakers Workshop; 9th Materials Research Symposium Papers Solicited; Metric Conversion Guidelines for Building Community; Teacher Aids. (Color illustrations reproduced in black and white)

710,261
PB-273 121/4 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 61, Number 10.
Monthly pub.
Oct 77, 37p NBS/DIM-61/10
See also Volume 61, Number 9, PB-273 107.

Keywords: *Periodicals, *Research projects, Energy conservation, Inventions, Electromagnetic interference, Cryostats, *Technical news bulletins, Metrication.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: NBS Inventiveness-Still a Winning Commodity; Energy Tips for Winter Savings; Harnessing Technology for State and Local Use; NBS Guidelines for Use of the Metric System; Industry Calas for More Federal Initiative in Solving EMI Problems; Conversion of U.S. Customary Units of Length, Area, and Volume to SI; Data Center Investigates Oxygen and Sulfur in Copper; Cryocooler Invention Disclosed; Reference Materials Available for Calibrating Lead Detection Instruments; NBS Undertakes Data Work for Energy Problems; Exchange Program for State and Local Government Employees; Materials for Coal Conversion and Utilization Conference; Winter Simulation Conference; New Edition of Official Publication on the International System of Units (SI); Orthopaedic Implants Publication.

710,262
PB-274 514/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Communicating Quantitative Scientific Knowledge.
Final rept.,
S. P. Fivozinsky, and D. R. Lide. 1977, 2p
Pub. in Tech. Commun., p10-11 4th Qtr. 77.

Keywords: *Research, Evaluation, Utilization, Technology, Information, Information transfer, Reprints.

The results of scientific research are of limited use for the advancement of technology unless a critical evaluation of these results is made to insure their reliability to workers in many varied areas. In turn, there must be an effective dissemination mechanism to insure an interdisciplinary transfer of knowledge.

710,263
PB-274 598/2 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 61, Number 11.
Monthly pub.
Nov 77, 36p NBS/DIM-61/11
See also Volume 61, Number 10, PB-273 121.

Keywords: *Periodicals, *Research projects, Smog, Air pollution, Fire safety, Dental materials, *Technical news bulletins, Metrication, Data encryption standards, Ozone-ethylene reaction.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Scientific detectives track smog formation; Operation firestop; What won't change as we 'go metric'; The dental materials of tomorrow are here today; Validating data encryption device; Temperature SRM will aid accuracy of clinical tests; Miniature electric field probe developed; Two-year study begun on attic ventilation; Radiometric detector calibration capability increased; Air pollution research focuses on organic sulfur chemistry; Micromeasurement for IC industry seminar; IEEE/NBS computer networking symposium; SI revisited.

710,264
PB-274 629/5 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Applied Mathematics Div.
National Network Data Base System.
Final rept.,
R. H. F. Jackson. Sep 75, 61p NBSIR-75-911
Supported in part by the Office of the Secretary of Transportation, Washington, D.C., and the Office of the Chief of Engineers (Army), Washington, D.C.

Keywords: *Passenger transportation, *Cargo transportation, *Information systems, Fortran, Computer programs, Subroutines, United States, Univac-1108 computers, Commodity flow, Data bases, Freight mode choice, Market split, Modal choices, Modal freight flows, National transport analyses, Regional transport analyses, *Transportation networks.

The report documents a data base 'system' created at the National Bureau of Standards. The National Network Data Base System (NNDBS) provides information on flows of freight and passengers throughout the transportation system of the United States. It consists of a set of Fortran programs written for the NBS Univac 1108 (but transportable) and some basic data tapes. In addition to providing basic data on the transportation network, the NNDBS can produce modal splits, aggregations over certain 'zones' in the U.S., and is capable of easy extension to other uses. The report is intended as a user's guide and includes discussions of the data tapes and each of the programs. Complete listings and tape formats are also included.

710,265
PB-275 467/9 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C.
Dimensions/NBS. Volume 61, Number 12.
Monthly pub.
Dec 77, 33p NBS/DIM-61/12
See also Volume 61, Number 11, PB-274 598.

Keywords: *Periodicals, *Research projects, Windows, Environmental monitoring, Health, Photodetectors, Voltage measuring instruments, Voltmeters, *Technical news bulletins, Radiopharmaceuticals.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Making the Most of Windows; Toward a National Environmental Monitoring System; Ultraviolet Radiation Standards for Health Safety; Radiopharmaceuticals; Photodetectors Lose Dynamic Range With Modulated Signals; AC High Voltage Measurements on Firmer Footing; AC Voltmeter/Calibrator Developed; Upcoming Dimensional Standard Aimed at Needs of Microelectronic Industry; New SRMs Aid Industrial Hygiene Analysts; Research Material Now Available for Marine Studies; Precision Thermometry Seminars. (Color illustrations reproduced in black and white)

710,266
PB-276 528/7 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 62, Number 1.
Monthly rept.
Jan 78, 37p NBS/DIM-62/1
See also Volume 61, Number 12, PB-275 467 and PB-269 847.

Keywords: *Periodicals, Energy conservation, Solar energy, Metric system, Units of measurement, Objectives, Meetings, Documents, Research projects, Recommendations, *Technical News Bulletins, National Bureau of Standards.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: It's Never Too Late to Insulate; Perspectives on NBS: The Future of NBS--Jordan J. Baruch; Problems, Prospects, and the Search for a Proper Balance--Ernest Ambler; Warnings and Recommendations--Charles E. Peck; A Current Assessment--William O. Baker; Progress Is Being Made in Solar Energy Standards Development; CIPM Meeting Report; Vibrational Chemiluminescence Detected from Ion-Molecule Reactions; New Understanding of Molecular Structure; Standard Reference Material Issued for Purity of Drinking Water; Low Frequency Electrical Measurements; Ionizing Radiation Measurements; Selected Bibliography on Metric for Building Community; Hourly Solar Radiation Data for U.S. and Canada; NBS Publication Helps Put Windows to Work to Conserve Energy. (Color illustrations reproduced in black and white)

710,267
PB-277 312/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NSRDS and Data Banks.
Final rept.,
H. J. White. 1977, 6p
Pub. in Proceedings Asilomar Conf., Pacific Grove, California, January 16-21, 1977, Paper 27 in Phase Equilibria and Fluid Properties in the Chemical Industry, ACS Symposium Series No. 60, p468-473 1977.

Keywords: *Information systems, Chemical industry, Thermophysical properties, Reprints, *National Standard Reference Data System.

The National Standard Reference Data System (NSRDS) is described, and it is pointed out that the output of the NSRDS is in itself a data bank (unautomated). The relationship of this data bank to various mission-oriented data banks including a data bank of thermophysical properties for fluids for the chemical industry is discussed. Recent initiatives of the NSRDS to meet the data needs of the chemical industry including 'Project Evergreen' are discussed.

710,268
PB-278 023/7 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 62, Number 2.
Monthly rept.
Feb 78, 35p NBS/DIM-62/2
See also Volume 62, Number 1, PB-276 528.

Keywords: *Periodicals, Piezoelectric materials, Piezoelectricity, Information systems, Safety engineering, Catalysis, Accelerating(Chemistry), Magnetic detection, Photometry, Photometers, Meetings, documents,

Research projects, Ozone, Computers, *Technical news bulletins, National Bureau of Standards.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Working under pressure; Dynamics of information systems and users; Bottle safety now the subject of two voluntary standards; New techniques in the measurement of catalytic activity; NBS detects magnetic auditory evoked responses; Ultraviolet photometer for ozone calibration; 10th Materials research symposium; Call for papers American conference on crystal growth; Guideline on computer performance management; Users manual for LNG materials and fluids.

710,269

PB-279 050/9 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C.
Dimensions/NBS. Volume 62, Number 3.
Monthly rept.
Mar 78, 33p NBS/DIM-62/3
See also Volume 62, Number 2, PB-278 023.

Keywords: *Periodicals, Electromagnetic interference, Copyrights, Metric system, Fluorescence, Air pollution, Monitoring, Lasers, Cells(Biology), Computers, Financing, Meetings, Research projects, Documents, *Technical news bulletins, National Bureau of Standards.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: A Problem of Growing Concern - EMI; Copyright and the Computer; Exploding ₀ Metric Myth; Metric Speakers Are Available; A New Director for NBS; Cleaner Air Depends on Accurate Measurements; Stimulated Collision-Induced Fluorescence Observed; Laser-Raman Probe Microanalysis of Biological Tissue Made; New Phase Transition in Oxygen Discovered; NBS Expands Data for space Shuttle; Budget Increase Requested for NBS; Symposium on Radiologic Imaging; New Computing Tools Symposium; Seminar on Testing of Solar Energy Materials and Systems; Special Bullets for Indoor Firing Ranges; Flow Measurement Symposium Papers.

710,270

PB-279 066/5 PC **A08**/MF **A01**
National Bureau of Standards, Washington, D.C. Applied Mathematics Div.
Comparison of the Performance of Three Algorithms for Use in an Automated Transit Information System (ATIS).
Final rept.,
J. F. Gilsinn, E. L. Leyendecker, and D. R. Shier. Mar 78, 164p NBSIR-78-1426
Sponsored in part by Urban Mass Transportation Administration, Washington, D.C.

Keywords: *Urban transportation, *Routing, *Information system, Algorithms, Mass transportation, Rapid transit railways, User needs, Comparison.

This paper compares the performance of three algorithms for computing trip itineraries for use in an automated transit information system. One of the approaches (TIMEXD) is based on a time-expanded network. The other two both compute paths in a bipartite route/stop network; one algorithm (LABCOR) is based on the label-correcting approach and the other (LABSET) on the label-setting approach. The transit networks upon which the performance comparison is based are of two types: a grid network with specified, possibly non-uniform, distances between streets, and a spider web type of network. TIMEXD is fastest on all the larger networks, but it requires most computer storage and outputs paths with more transfers. LABCOR is the slowest, but is guaranteed to produce the best routing, since it always outputs an optimal path with fewest transfers. Computation time estimates extrapolated to large transit networks indicate times of 1.5 to 2.5 seconds per itinerary for TIMEXD and LABSET respectively, well within the acceptable range for such networks.

710,271

PB-281 033/1 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 62, Number 4.
Monthly rept.
Apr 78, 35p NBS/DIM-62/4
See also Volume 62, Number 3 dated Mar 78, PB-279 050.

Keywords: *Periodicals, *Research projects, Telescopes, Measurement, Thermonuclear reactors, Standards, Reaction kinetics, Meetings, Test equipment, *Technical news bulletins, National Bureau of Standards, Standard reference materials.

The monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: The Fly's Eye Telescope, F. McGehan; Measuring With Microwaves, K. Armstrong; Fusion Reactors in Out Future, M. Baum; New Instrument for Field Testing Smoke Detectors, D. Chaffee; Standard For Codes Cities, Towns, Related Places, S. Lichtenstein; Non-Intrusive Technique Measures Concentration Fluctuations in Turbulent Gas Flow, I. Chabay, G. Rosasco, and T. Kashiwagi; The Central Role of Chemical Kinetics Research in Atmospheric Modeling and Environmental Regulation, M. Kurylo; A New Analytical and Spectroscopic Tool: The Opto-Galvanic Effect, P. Schenck, J. Travis, K. Smyth, and D. King; Stainless Steel Standard Reference Materials; Conferences; Publications; News Briefs. (Color illustrations reproduced in black and white)

710,272

PB-283 138/6 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Dimensions/NBS. Volume 62, Number 5.
Monthly rept.
May 78, 33p NBS/DIM-62/5
See also Volume 62, Number 4 dated Apr 78, PB-281 033.

Keywords: *Periodicals, *Research projects, Measurement, Universe, Metric system, Packaging, Electromagnetic interference, Gas flow, Velocity measurement, Strain measurement, Technical news bulletins, National Bureau of Standards.

The monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: A scientist on capitol hill; Time and astronomy; Metric milk and bread--What sizes; NBS Research Associate Maurice Ducloux--The French connection; Group formed on electromagnetic interference; New gas flow measurement method uses cryogenic technique; Research begun on police radar and other speed measuring equipment; Strain tide spectroscopy.

710,273

PB-283 576/7 MF **A01**
National Bureau of Standards, Washington, D.C.
Dimensions/NBS. Volume 62, Number 6.
Monthly rept.
Jun 78, 32p NBS/DIM-62/6
See also Volume 62, Number 5 dated May 78, PB-283 138.

Keywords: *Periodicals, *Research projects, Corrosion, Standards, Metrology, Metric system, Alloys, Information systems, Graphite, Measurement, Lasers, Test equipment, Meetings, Fuel economy, Thermal expansion, Phase transformations, *Technical news bulletins, *National Bureau of Standards, Standard reference materials, Computer networks.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Reorganization - A new look for NBS, M. Jacobs; The economic effects of corrosion, M. Baum; Metric vs. customary - Which is more accurate, J. Odom; NBS, ASM, join to improve phase alloy information, M. Baum; NBS investigates graphite as future standard reference material, K. Higgins; The NBS computer network measurement system, S. Raddack; Advances in understanding of laser spectra of symmetric molecules, D. Orr; New NBS standards aid measurement system; New thermal expansion SRM available; Conferences; Publications; News briefs.

710,274

PB-285 116/0 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C.
Dimensions/NBS. Volume 62, Numbers 7/8.
Monthly rept.
Aug 78, 36p NBS/DIM-62/7/8
See also Volume 62, Number 6 dated Jun 78, PB-283 576.

Keywords: *Periodicals, *Research projects, Automation, Time signals, Coding, Standards, Lasers, Microelectronics, Test equipment, Rheology, Fire safety, Computers, *Technical news bulletins, National Bureau of Standards, Standard reference materials.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Automation in the Marketplace; Science for Life's Sake; Time-Who Needs It; NBS Assists Electronics Firm in Meeting European Standard; Standards Save Tax Money; Encryption Standard-Validating Hardware Techniques; New Apparatus for Cryogenic Measurements; A Simple Model for Stable High Density Discharges for Lasers; Standard Polymer Solutions for Rheology; Superconducting Microcircuit Fabrication; Standard Reference Materials for Cereal Foods; Two Nickel Standard Reference Materials; Conferences; Publications; New Briefs.

710,275

PB-287 208/3 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC.
Dimensions/NBS. Volume 62, Number 9, September 1978.
Monthly rept.
Sep 78, 36p NBS/DIM-62/9
See also Volume 62, Numbers 7/8 dated Aug 78, PB-285 116.

Keywords: *Periodicals, *Research projects, Corrosion, Thermal insulation, Measurement, Standards, Food packaging, National measurement system, Standard reference materials.

The monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Corrosion facts for the consumer; Insulation insomnia--a cure; The National Measurement System; Nuclear safeguards and NBS; New measurement concept for the electronics industry; Program on Migration behavior of plastic food-packaging materials; Toward a new scale of temperature; New steel standard reference material; Standard reference material for metals industry. (Color illustrations reproduced in black and white)

710,276

PB-288 532/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Computer Network Protocol at the Application Level for Libraries and Other Information Science Services.
Final rept.,
J. L. Little. Sep 78, 7p
Pub. in Jnl. of Library Automation, 11, n3, p239-245, Sep 78.

Keywords: *Computer networks, *Libraries, Information systems, Information services, *Protocols, Information flow, Communications networks, Reprints.

This paper outlines the essential details of a computer network protocol at the application level for interchanging information between host computers in the community of libraries, including book publishers and bibliographic service centers. The protocol was developed by a task force of seven experts appointed by the National Commission on Libraries and Information Science, with technical assistance from the National Bureau of Standards and from selected consultants. The protocol is confined to the header portion of control and data messages at the application level, which is independent of the topology of the communications subnetwork supporting the network. Control header structure is detailed and a skeleton outline is given for 20 header field types and 15 control message types.

710,277

PB-288 540/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Libraries and the Consumer Communications Reform Act.
Final rept.,
R. M. Crowder. Sep 78, 17p
Pub. in Jnl. Libr. Autom., v11 n3 p206-222 Sep 78.

Keywords: *Libraries, *Telecommunication, Regulations, Legislation, *Consumer Communications Reform Act, Bell Bill, Communications networks, Reprints.

The communications industry is heavily shaped by decisions of the Federal Communications Commission (FCC) and its counterpart commissions in the various states. Responding to liberalized regulations that allowed increased competition, A T & T and other independent carriers supported a bill in the last session of Congress called the Consumer Communications Reform Act (CCRA), familiarly known as the Bell Bill. Although the bill was never acted on, and the focus of congressional attention is now on the Communications Act of 1978, it is important to understand the issues that the bill addressed. This article reviews the history of federal regulation in the communications industry, places the Bell Bill in some historical perspective, and relates the significance of activities in the regulatory sphere to the concerns of libraries.

710,278
PB-288 973/1 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC.
Dimensions/NBS. Volume 62, Number 10, October 1978.
Monthly rept.
Oct 78, 35p NBS/DIM-62/10
See also Volume 62, Number 9 dated Sep 78, PB-287 208.

Keywords: *Periodicals, *Research projects, Metric system, Information systems, Thermal insulation, Standards, Iron, Computers, *Technical news bulletins, National Bureau of Standards, Standard reference materials.

The monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Going Metric--What's In It For Me, J. Odom; Information Systems Revisited, F. Huddle; Are You On the Wanted List, M. Jacobs; The State of Standard Reference Data, D. Johnson; NBS Researchers Win Three 1978 I-R 100 Awards, M. Baum; Digital Sine-Cosine Mini-Stepping Drive, H. Layer; Iron Metal Standard Reference Material; and Managing Information Resources, B. Leong-Hong.

710,279
PB-290 349/0 PC **A13**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Office of Standard Reference Data.
OMNIDATA: An Interactive System for Data Retrieval, Statistical and Graphical Analysis, and Data-Base Management. A User's Manual.
J. Hilsenrath, and B. Breen. Sep 78, 294p NBS-HB-125
Library of Congress Catalog Card no. 78-600076.

Keywords: *Information retrieval, *Computer programming, Data retrieval, Manuals, Search theory, BASIC programming language, Statistical analysis, Curve fitting, Boolean logic, *OMNIDATA system, XBASIC programming language, Data bases, Univac 1108 computers, OMNITAB 2 system, File maintenance.

The Omnidata system, consisting of 45 individual programs written in XBASIC, provides an interactive user-oriented facility for: data retrieval and report generation; plotting and other graphical analysis; arithmetic and statistical analysis; curve fitting and multiple linear regression; data coding and decoding; survey and questionnaire analysis; author, title, and keyword indexing of bibliographic files; a variety of univariate analyses and two-way crosstabulations; and numerous utility modules for file definition, file updating, and file maintenance. The SEARCH module which performs a serial search through a file allows for: the usual Boolean operations; string searching on text fragments, stems, or roots in either the anchored or unanchored mode; specification of syntatical order and proximity of words or phrases, as well as variable length ellipsis; and ignoring one or more of a specified list of characters in its matching operation. Four of the modules interface with the OMNITAB II system for versatile plotting, very accurate least-squares fitting, and a comprehensive statistical analysis.

710,280
PB-292 782/0 PC **A06**/MF **A01**
Burnette (Charles) and Associates, Philadelphia, PA.
Making Information Useful to Architects.
Final rept.
C. H. Burnette. Mar 79, 101p NBS/GCR-78/154
Sponsored in part by ALA Research Corp., Washington, DC.

Keywords: *Professional personnel, *Architects, Technology, Technological intelligence, Information systems, User needs, Communicating, *Information transfer.

The purpose of this report is to present rationales, practical formats and dissemination guidelines to foster the successful delivery of information to practicing architects by those in commerce, government, research organizations and trade or professional associations who produce and supply information useful to them. This report is intended as a complement to 'Architect's Access to Information: Constraints on the Architect's Capacity to Seek, Obtain, Translate and Apply Information.' It presents a comprehensive spectrum of exemplary practices in such a way as to provide a coordinated basis for both informal and formal actions to improve the delivery of information to architects. It is, therefore, an independent explanatory critique of the state of the art of current practice intended as a useful reference for those considering the structure, content, form and delivery of information services. A bibliography is included.

710,281
PB-293 170/7 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Data Bases Available at the National Bureau of Standards Library.
D. Cunningham. Mar 79, 53p NBSIR-78-1577

Keywords: Information systems, National government, Directories, Listings, *Data bases, *National Bureau of Standards, US NBS, On line systems.

This report is a listing of data bases available on-line at the National Bureau of Standards (NBS) Library. The list is alphabetical by either the acronym or the full title of the data base, whichever is most commonly used. This section includes such information as name of data base, dates of coverage, brief description of the data base, the principal sources employed in forming the data base information, the producer(s) of the data base, the corresponding hard copy, and the vendor(s) who distribute the various data bases. A list of vendors with addresses and telephone numbers precedes the data base list. The General Subject Index, which follows the list of data bases, is arranged alphabetically by broad subject categories with references to the corresponding data bases. The Cross Reference Index lists variant forms of the names of the data bases in the left hand column with cross references to the name of the data bases used in this report on the right.

710,282
PB-294 984/0 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. Office of International Relations.
Technological Knowledge Base for Industrializing Countries.
Final rept.
R. C. Sangster. Apr 79, 241p NBS-SP-543
Grant PASA-TA(CE)-6-71
Sponsored in part by U.S. Coordinator for the UN Conference on Science and Technology for Development, and Agency for International Development, Washington, DC. Library of Congress catalog card no. 79-600058. Proceddings of the NBS/AID UNCSTD (United Nations Conference on Science and Technology for Development) Seminar Held at Gaithersburg, Maryland on October 16-17, 1978.

Keywords: *Technological intelligence, *Industries, *Meetings, Measurement, Developing countries, Quality control, Production management, Technology assessment, Health, Safety, Performance standards, Utilization, International law, Management analysis, *Data base administration, *Industrial technology, Commercial development, Developed nations.

The report contains the proceedings of a seminar held on the topic of establishing a technological knowledge base for industrializing countries. The areas of interest discussed are: Measurement capabilities and services required by technological industry; National and international standards required by industrializing nations; Acquisition of commercial industrial technology; and Industrial quality control.

710,283
PB-297 937/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Beyond Data Retrieval: An Outline of the Unique Data Analysis Features of the NBS Omnidata System.
Final rept.
B. B. Molino, and J. Hilsenrath. Jun 79, 7p
Sponsored in part by Association for Computing Machinery, Washington, DC.
Pub. in Proceedings Annual Tech. Symp. on Information Systems (18th), Held at Gaithersburg, MD. on 21 Jun 79, p159-165.

Keywords: Data retrieval, Data processing, *Data base management systems, *Omnidata system.

Omnidata is an interactive, general-purpose system for data retrieval, data analysis, and data file maintenance. The system is specifically designed so that individuals with little or no background in computers are able to search data files, do analysis on these files, and prepare ad hoc or periodic reports. At the same time, the system provides the computer professional and data-base administrator with tools for proper maintenance of those data bases under his control. This wide spectrum of functions of varying complexity is provided by the modularity of the system. In addition to the 'usual' capabilities of a data management system - searching, reporting, sorting, updating - there are close to 40 distinct modules to provide detailed statistical and graphical analysis, data manipulation, and file management. Discussion includes descriptions of some of these unique data manipulation and analysis modules, including AGGREGATE, CROSSTAB, DISTRIBUTE, SURVEY, and TALLY. Also included is a discussion of how Omnidata interfaces with the OMNITAB statistical and plotting programs.

710,284
PB80-103724 Not available NTIS
National Bureau of Standards, Washington, DC.
Architectural Considerations for Federal Database Standards.
Final rept.,
S. Jeffery, D. Fife, D. Deutsch, and G. Sockut. 1979, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Catalog No. 79 CH1393-8C, p139-143 1979.

Keywords: National government, Standards, *Data base management systems, Data bases.

Planning is underway for Federal government-wide standardization of database management systems. This paper discusses the objectives of database management standardization, and basic considerations in developing Federal standards in this field. After a brief review of the current possibilities for standards, the opportunities for near-term NBS action are described. The paper indicates specific studies NBS is planning.

710,285
PB80-115876 Not available NTIS
National Bureau of Standards, Washington, DC.
Technology's Help in Putting Information to Work.
Final rept.,
M. M. Henderson. Oct 79, 4p
Pub. in Bull. Amer. Soc. Inf. Science, v6 n1 p32-35 Oct 79.

Keywords: *Information retrieval, Technology assessment, Computers, Telecommunication, Data storage devices, Microfilm, Reviews, Reprints.

Computer, telecommunications, and microform technologies combine to facilitate information handling today. The development of these technologies, their current trends, and their impact on information handling tasks are briefly reviewed here.

710,286
PB80-130537 Not available NTIS
National Bureau of Standards, Washington, DC.
Database Reorganization -- Principles and Practice.
Final rept.,
G. H. Sockut, and R. P. Goldberg. Dec 79, 25p
Pub. in ACM Comput. Surv. 11, n4, p371-395, Dec 79.

Keywords: Reprints, *Data base management, Data bases, Data management, File maintenance(Computers), File organization.

Database reorganization can be defined as changing some aspect of the way in which a database is arranged logically and/or physically. An example is changing from a one-to-one to a one-to-many relationship. Reorganization is a necessary function in a database system. This paper introduces the basic concepts of reorganization, including why it is performed. Many types of reorganization are described and classified into logical/physical levels. Then pragmatic issues such as reorganization strategies, a survey of several commercial reorganization facilities, case studies, and database administration considerations are covered. Finally, several research efforts are surveyed.

710,287
PB80-130990 Not available NTIS
National Bureau of Standards, Washington, DC.
Criterion for Packing Hash Tables.
Final rept.,
G. Lyon. May 79, 4p
Pub. in Proceedings of the Conference on Information Sciences and Systems (1979) Held at Baltimore, MD., on March 28-30, 1979, p262-265, May 79.

Keywords: *Search theory, Searching, Data retrieval, Information retrieval, Optimization.

One can minimize worst case searches for 'open addressing' hashing while perturbing average retrieval only slightly. Applying this observation to tables with buckets provides excellent search performances. Once bucket size equals four or more records, even worst cases--occurring perhaps for a fifth of the items--should not require more than two table probes.

710,288
PB80-178056 Not available NTIS
National Bureau of Standards, Washington, DC.
Federal Data Banks as Potential Information Resources to Meet the Needs of Local Communities.
Final rept.,
P. W. Berger. Feb 80, 6p
Pub. in Journal of Spec. Lib. 71 n2 p77-82 Feb 80.

Keywords: *Information services, *National government, *Libraries, Availability, Meetings, Library science, Network analysis theory, Reprints, Data bases.

The article reports potential impacts of the November, 1979 White House Conference on Library and Information Services deliberations on Federal libraries and Federal information services. Public access to Federal libraries, data bases and information services was a major concern to the Conference Delegates, as were questions of networking and network design.

710,289
PB80-197221 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Symposium on International Standards Information and ISONET.
Final rept.,
C. B. Phucas. Jun 80, 65p NBS-SP-579
Sponsored in part by American National Standards Inst., New York. Library of Congress catalog card no. 80-600073. Proceedings of a Symposium Held at the National Bureau of Standards, Gaithersburg, Maryland on October 11-12, 1979.

Keywords: *Standards, *Standardization, *Information systems, *Meetings, *International trade, Foreign countries, Exports, Coordination, Cooperation, Information services, Imports, Data acquisition, Regulations, Tariffs, General Agreement on Tariffs and Trade.

The American National Standards Institute (ANSI) and NBS have been working cooperatively with the International Organization for Standardization (ISO) to provide United States input to the development of an International Standards Information Network called ISONET. Symposium participants had an opportunity to learn more about existing international standards information systems as well as the plans for the further development of ISONET. Through question and answer discussions, participants were able to learn about new developments in U.S. trade policy, especially those policies pertaining to standards and certification systems.

710,290
PB80-205909 Not available NTIS
National Bureau of Standards, Washington, DC.
Managing Revolutions - Coping with Evolving Information Technologies.
Final rept.,
P. W. Berger. 1980, 26p
Pub. in Proceeding of the Annual Conf. of the Special Libraries Association (71st), Washington, DC., 26p, 10 Jun 80.

Keywords: *Technology innovation, *Libraries, Information systems, Telecommunication, Reprography, Library science, Information sciences, Library automation.

The report presents an overview of the impacts - past, present and future - of the newer information technologies on special libraries.

710,291
PB81-103624 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 64, Number 5, July 1980.
Monthly rept.
Jul 80, 33p NBS/DIM-64/5
See also Volume 64, Number 3, PB80-203433.

Keywords: *Periodicals, *Research projects, Thermophysical properties, Water conservation, Instrument landing systems, Data transmission, Standards, Technical news bulletins, National Bureau of Standards.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issues is: Some Like It Very Hot, G. Porter; Water, Water Everywhere...And Not a Drop to Spare, M. Heyman; Happy Landings, F. McGehan; New Surface Science Research Tool Developed by NBS and IBM, G. Porter; New Federal Standard Defines Data Communications Link Control Procedures, S. Lichtenstein; Trace Level Organic Constituents in Alternate Fuels, W. May; Erosion of Brittle Materials by Solid Particle Impact, S. Wiederhorn; and Reflectance Properties of Pressed Tetrafluoroethylene Powder, J. Hisa.

710,292
PB81-103632 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS. Volume 64, Number 6, August 1980.
Monthly rept.
Aug 80, 29p NBS/DIM-64/6

Keywords: *Periodicals, *Research projects, Measurement, Buildings, Design, Shale oil, *Technical news bulletins, National Bureau of Standards, Standard reference materials.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Decade of the Marketplace; Are You a Daylighter; Chill-Cast Stainless Steel Standard Reference Materials; New Shale Oil Reference Materials; Planar Near-Field Measurements on a Compact Range; Toward Safer Medical X-Ray Exams; XNDM: An Experimental Network Data Manager.

710,293
PB81-104218 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Computer Data Base System for Indexing Research Papers.
Final rept.
L. J. Kaetzel, R. A. Glass, and G. R. Smith. Oct 80, 94p NBS-TN-1123

Keywords: *Subject index terms, *Minicomputers, Information retrieval, Computer programming, Data processing, Automation, Data bases.

The KGS data base system allows the indexing and retrieval of scientific research papers through the use of a minicomputer system in an interactive mode. Criteria are entered through the user's computer terminal which produces subsets of the data base in a report format as well as statistical summaries of data base elements.

710,294
PB81-114076 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Data Base Directions / The Conversion Problem.
Final rept.
J. L. Berg. Sep 80, 107p NBS-SP-500-64
Sponsored in part by Association for Computing Machinery, New York. Proceedings of the Workshop Held at Fort Lauderdale, Florida on November 1-3, 1977.

Keywords: *Meetings, Conversion, Management methods, Technology assessment, Computer programming, Benefit cost analysis, *Data base/management, Data bases, File management.

What information can help a manager assess the impact a conversion will have on a data base system, and of what aid will a data base system be during a conversion. At a workshop on the data base conversion problem held in November 1977, approximately seventy-five participants provided the decision makers with useful data. The workshop explore data base conversion from four perspectives: management, previous experience, standards, and system technology. Each perspective was covered by a workshop panel that produced a report included here.

710,295
PB81-115511 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Summary of On-Line or Interactive Physico-Chemical Numerical Data Systems.
Final rept.
J. Hilsenrath. Oct 80, 29p NBS-TN-1122

Keywords: *Chemical properties, *Physical properties, *Information systems, Tables(Data), Thermodynamic properties, Transport properties.

A brief description is given of 51 interactive physicochemical numerical data systems, most of which are on line on international computer networks. The systems are listed under five headings: those useful for identification of substances from spectroscopic data; those providing thermodynamic and transport properties of pure components and mixtures; those which perform metallurgical calculations and draw phase diagrams; systems producing complete tables of thermodynamic properties of individual substances; and those for chemical process simulation, optimization, and design. References to published descriptions of the systems, where they exist, are also given.

710,296
PB81-132870 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Data Bases Available at the National Bureau of Standards Library.
D. Cunningham. Oct 80, 69p NBSIR-80-2133
See also report dated Mar 79, PB-293 170.

Keywords: *Information systems, *Directories, National government, *Data bases, *National Bureau of Standards, US NBS, On line systems, Listings.

An alphabetical listing of data bases available on-line at the National Bureau of Standards (NBS) Library is listed by either acronym or full title of the data base. Other additional information includes description of the data base, period of coverage, producer(s), corresponding hard copy, principal sources and vendors. A general subject and a cross reference index to the data bases is also supplied.

710,297
PB81-135220 Not available NTIS
National Bureau of Standards, Washington, DC.
Special Features of NBS's Omnidata System Applicable to the Retrieval, Analysis, and Dissemination of Chemical Data.
B. B. Molino. Aug 80, 3p
Pub. in Division of Chemical Information Symp. on Techniques and Problems in Retrieval of Numerical Data, National Meeting (178th), American Chemical Society, Washington, DC., Sep 12, 1979, Jnl. of Chemical Information and Computer Sciences 20, p136-138 Aug 80.

Keywords: *Information systems, Computer programming, Data retrieval, Information retrieval, Statistical analysis, Computer graphics, Data processing, Reprints, *Omnidata system, File maintenance, Data base management.

Omnidata is an interactive, general-purpose system for data retrieval, data analysis, and file maintenance, developed at NBS. The system allows individuals with little background in computers to search and analyze data files and prepare reports. In addition to the 'typical' searching, reporting, sorting, and updating, there are roughly 30 modules providing statistical and graphical analysis, data manipulation, and file management. Many are specifically designed and have unique features to aid the chemist in the retrieval, analysis, and dissemination of data. Some of these are discussed and illustrated on files of chemical data.

710,298
PB81-138356 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 85, Number 5, September-October 1980.
Bi-monthly rept.
1980, 92p
See also Volume 85, Number 2, PB80-185036. Library of Congress catalog card no. 63-37059.

Keywords: *Research.

Contents:
- A simple gravimetric method to determine barometer corrections;
- Investigation of epitaxy relationships between Ca5(PO4)3OH and other calcium orthophosphates;
- A univariate extension of Jensen's inequality;
- The numerical solution of a nonseparable elliptic partial differential equation by preconditioned conjugate gradients;
- Player aggregation in noncooperative games.

710,299
PB81-149338 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrolyte Data Center.
B. R. Staples. Apr 79, 1p
Pub. in SSIE Science Newsletter VIII, n6 p5 Apr 79.

Keywords: Electrolytes, Reprints, *Electrolyte data center.

A short description of the activites and kinds of output of the Electrolyte Data Center, NBS, is provided.

710,300
PB81-180986 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Design of Information Systems Using Scenario-Driver Techniques.
W. T. Hardgrave, S. B. Salazar, and E. J. Beller. Mar 81, 25p NBSIR-81-2240

Keywords: *Information systems, *Scenarios, Design, On line systems, User needs, Requirements, Data bases.

The paper describes a technique for developing information systems using a scenario-driven design approach. The approach emphasizes client (that is, the user who is purchasing the system) participation in the design process. The first step is to develop a collection of 'scenarios' which document the interaction between the computer and the human user. Using the scenarios, information-flow diagrams and database designs may be constructed. After the client has approved these documents, they can be used to establish disk capacity requirements and transaction rates, and finally to specify all hardware and software requirements. The primary advantage of this approach is that the scenarios provide a good indication of the ultimate usefulness and cost of the system. The client can review these documents and approve, modify, or reject the system design before any software is generated. This paper describes the scenarios, the information flow technique, and the database design approach using, as an example, a small business application.

710,301
PB81-185159 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Computer Science and Technology: Database Architectures--A Feasibility Workshop Report.
Final rept.
J. L. Berg, M. Graham, and K. Whitney. Apr 81, 70p NBS-SP-500-76
Library of Congress catalog card no. 81-600004. Prepared in cooperation with Little (Arthur D.), Cambridge, MA.

Keywords: *Meetings, Computer programming, Systems analysis, Description, *Data base management systems, *Architecture(Computers), File maintenance, Data bases, Data dictionaries, Query languages.

To help the decision maker evaluate the potential benefits and pitfalls in moving forward with database technology, the National Bureau of Standards organized two workshops whose results are presented in this report. The workshops, held in August 1978, explored the progress plan and potential pitfalls involved in specifying, designing, and implementing systems based on the ANSI/X3/SPARC framework and the CODASYL JOD languages specification. Workshop 1 investigated the general topic of data independence, and Workshop 2 examined supporting topics such as query languages, data dictionaries, and database conversion.

710,302
PB81-197568 Not available NTIS
National Bureau of Standards, Washington, DC.
Management of Online Reference Search Services in Federal Libraries.
Final rept.
P. W. Berger, and E. Cerutti. 1980, 26p
Pub. in Science and Technology Libraries 1, n1 p81-107 1980.

Keywords: *Libraries, *Services, Information systems, Searching, National government, Bibliographies, Computer programming, Information retrieval, NTIS-COMNBS.

The various aspects of planning for online service are discussed from the viewpoint of sci-tech libraries operating in the Executive Branch of the Federal government, not including the special cases of the three national (or quasi-national) libraries. The effects of statutory and geographic requirements on Federal libraries' online service are made clear, followed by such elements of planning as selling the program, integrating the service with others, selection of databases, staffing, equipment selection, and impact of the service.

710,303
PB81-207250 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison and Mapping of the Relational and CODASYL Data Models--An Annotated Bibliography.
Final rept.
G. H. Sockut. Apr 81, 14p
Pub. in SIGMOD Record 11, n3 p55-68 Apr 81.

Keywords: Computer programming, *CODASYL model, *Data base management, Data structures, Computer networks, Relational data bases, NTIS-COMNBS.

Two of the best-known data models are the relational model and the CODASYL model (sometimes called the DBTG, network, or data structure set model). There have been many efforts at comparing the two models and at defining mappings between them. The publications listed in this bibliography describe some of these efforts and some related topics.

710,304
PB81-247637 PC **A06**/MF **A01**
Michigan Univ., Ann Arbor. Graduate School of Business Administration.
Draft Specification for a Structured Data Interchange Form.
Interim rept.
J. P. Fry, W. P Chiang, D. A. DeSmith, D. S. Leder, D. K. Nguyen, and R. W. Perreault. Jul 81, 125p NBSIR-81-2315
Contract NB79-SBCA-0201

Keywords: Data transmission, Coding, Descriptions, Data storage, *Data interchange, *File maintenance, Computer communications, Data base management systems.

This report defines the format of a self-describing data interchange file that is media and machine independent, and that would facilitate the transfer of structured data between dissimilar computing systems and software. The specification is intended for interchanging data that has been structured under the discipline of a database management system, although it may also prove applicable to interchanging data that has been structured under other software disciplines, such as the COBOL programming language. The specification covers the three principal types of database management systems, namely the hierarchical, network, and relational types, but it is believed to be sufficiently general to accommodate data from other database management systems. The data interchange file consists not only of the data occurrences or values to be transferred, but also a description of their logical and physical characteristics and the relationships within the data. This minimizes or eliminates the need for additional, non-standardized information transfer in order to successfully perform a database transfer.

710,305
PB82-118035 Not available NTIS
National Bureau of Standards, Washington, DC.
Critical Data for Critical Needs.
Final rept.
D. R. Lide. 1981, 7p
Pub. in Science 212, p1343-1349, 19 Jun 81.

Keywords: Quality control, Information systems, Information centers, Reprints, *Data management, Data base management.

Various types of scientific and technical data are required for the solution of key societal problems such as energy supply, environmental quality, and industrial productivity. Assurance of quality control of these data bases is essential. Modern computer and telecommunications technology offers opportunities for major improvements in the dissemination of factual data to users, but a higher level of consciousness regarding data management is needed from the scientific community, industry, and government.

710,306
PB82-128869 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Computer Science and Technology: Costs and Benefits of Database Management: Federal Experience.
Special pub.
J. M. Draper. Nov 81, 110p NBS-SP-500-84
Library of Congress catalog card no. 81-600152.

Keywords: *Benefit cost analysis, National government, Expenses, *Data base management, *Federal agencies, Software engineering, File maintenance, Data base management systems.

The Federal Government has a large investment in a wide variety of database management systems (DBMS's) and in diverse applications using those systems. The amount of cost/benefit analysis an agency needs before deciding to buy a DBMS increases with the complexity of the application. The experiences of the interviewed agencies, together with a structured list of cost/benefit parameters, should help Federal managers in understanding the potential value of DBMS technology and in defining their requirements for data management.

710,307
PB82-129438 PC **A15**/MF **A01**
National Bureau of Standards, Washington, DC.
Computer Science and Technology: Proceedings of the Compute. Performance Evaluation Users Group (CPEUG) Meeting (17th): Increasing Organizational Productivity.
Final rept.
T. W. Potter. Nov 81, 343p NBS-SP-500-83
See also PB81-106486, and PB-290 701. Library of Congress catalog card no. 81-600155. Proceedings of a conference held at San Antonio, Texas on November 16-19, 1981.

Keywords: *Information services, *Meetings, *Productivity, Organization theory, Telecommunication, Data processing, Word processing.

The Proceedings reflects the critical role of information services in the productivity and survival of today's organization, as well as such trends as increasing personnel costs, limited budgets, and the convergence of data processing, communications, and word processing technologies. The program was divided into three parallel sessions and included technical papers on previously unpublished works, case studies, tutorials, and panels. Technical papers are presented in the Proceedings in their entirety.

710,308
PB82-143991 Not available NTIS
National Bureau of Standards, Washington, DC.

DBMS Standards: Current Status and Future Directions.
Final rept.
D. R. Deutsch, and E. K. Clemons. 1980, 3p
Pub. in Proceedings of International Conference on Very Large Databases (6th), Montreal, Canada, October 1-3, 1980, p431-433.

Keywords: *Standards, Trends, Organizations, *Data base management systems, Data base management.

This paper surveys the database standardization arena; major organizations involved in developing database standards and their current activities are briefly described. These discussions provide a framework for comments and debate by panelists representing diverse parts of the DBMS community.

710,309
PB82-158692 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS, Volume 65, Number 7, September 1981.
Monthly rept.
Sep 81, 29p NBS/DIM-65/7
See also Volume 65, Number 5, PB82-120387.

Keywords: *Research projects, Stellar evolution, Radiography, Periodicals, National Bureau of Standards.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Listening to the Stars, McGehan; NBS Inventors are Honored, Webber; Charting the World of Radiography, Cohen; Fracture Mechanics Research Aims at Lowering Construction Costs, Smith; New Source for Testing Neutron Dosimeters, Baum; Molecular Processes Affecting Durability of Polymers Studied, Fanconi; Neomycin B Studied, Botto; SERS Used to Study Molecular Interactions, Bunding; New Gamma-Ray SRM's Have Greater Lifetimes, SRM.

710,310
PB82-165804 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Dimensions/NBS, Volume 65, Number 8, October 1981.
Final issue.
Oct 81, 33p NBS/DIM-65/8
See also Volume 65, Number 2, PB81-226847.

Keywords: *Periodicals, Research projects, Quantum chemistry, Radioactivity, Materials shortages.

This monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications. The table of contents for the current issue is: Playing the Numbers, G. Porter; Meeting the Critical Materials Shortage, J. Wachtman; Using Natural Materials to Measure Radioactivity, M. Baum; Alloy Phase Diagrams: 'Going Public', M. Baum; LC/MS Interface Capability Extended, R. Christensen; NBS Study Completed on Energy Conserving Office Building, J. Hill; First Direct Measurement of Carbon Ground-State Fine Structure, K. Evenson.

710,311
PB83-115634 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Data Base Directions Information Resource Management - Strategies and Tools.
Special pub. (Final).
A. H. Goldfine. Sep 82, 177p NBS-SP-500-92
Proceedings of the Workshop of the National Bureau of Standards and the Association for Computing Machinery, Held October 20-22, 1980, at Fort Lauderdale, Florida. See also PB81-114076.Library of Congress catalog card no. 82-600584. Sponsored in part by Association for Computing Machinery, New York.

Keywords: *Meetings, Resource allocation, Information systems, Management methods, *Information resource management, *Data management, Data base management, Data dictionaries.

This report constitutes the results of a three-day workshop on information resource management tools, held in Fort Lauderdale, Florida on October 20-22, 1980. This workshop investigated how managers can evaluate, select, and effectively use information resource management tools, especially data dictionary systems. The approximately seventy workshop participants were organized into four working panels, which met to discuss uses of the Data Dictionary System, IRM Policies and Controls, Logical Database Design, and Physical Database Design.

710,312
PB83-135079 Not available NTIS
National Bureau of Standards, Washington, DC.
Quality Control of Data in the National Standard Reference Data System.
Final rept.
D. R. Lide. 1977, 5p
Pub. in Proceedings of the Annual Meeting of the American Society for Information Sciences (ASIS) (40th), Chicago, Illinois, September 26-October 1, 1977. Paper in Information Management in the 1980's 14, p117.

Keywords: *Information systems, *Quality control, *Chemical properties, *Physical properties, Reprints, Information dissemination, Data collection.

The National Standard Reference Data System comprises the set of data centers and other data evaluation projects administered or coordinated by the National Bureau of Standards. The primary aim of this program is to provide critically evaluated numerical data, in a convenient and accessible form, to the scientific and technical community of the United States. The technical scope of the program is restricted to well-defined physical and chemical properties of substances and systems which are well characterized. The program emphasizes quality control of the data. Experts in each field evaluate all data retrieved from the literature and present recommended values which represent the best professional judgment of the evaluators. The dissemination of such critical tables becomes increasingly important as the traditional disciplinary boundaries break down and users require data from fields outside their own technical competence.

710,313
PB83-146944 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Use of Decision Analysis in Arson Program Planning.
S. W. Stiefel. Nov 82, 24p NBSIR-82-2596
Sponsored in part by Federal Emergency Management Agency, Washington, DC.

Keywords: *Information systems, *Decision making, Crimes, Fires, Fire prevention, Project management, Cost analysis, *Arson.

A decision analysis approach is formulated and demonstrated to provide a planning tool for decision makers in a city or community concerned with selection and application of arson strategies. The Arson Information Management System (AIMS) is used to provide information to describe the arson problem (classify causes/motivation, incidence and magnitude for each area in the city/community) and to establish which strategies are appropriate to address the causes. This AIMS data plus an assessment of the cost and effectiveness of arson strategies are combined in a decision analysis framework. The framework specifies data requirements and provides a data analysis structure. The decision analysis has been designed to provide a measure of the net benefits for various strategies for each area in the city/community. A method for using the outputs from the decision analysis to provide the most cost-effective use of an arson budget has been developed.

710,314
PB83-155986 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Library Div.
Data Bases Available at the National Bureau of Standards Library (Third Edition).
D. Cunningham. Oct 82, 104p NBSIR-82-2594
Supersedes 1980 edition, PB81-132870.

Keywords: *Information systems, *Directories, National government, *Data bases, *National Bureau of Standards, On line systems, Listings.

An alphabetical listing of data bases available on-line at the National Bureau of Standards (NBS) Library is listed by either acronym or full title of the data base. Other additional information includes description of the data base, period of coverage, producer(s), corresponding hard copy, principal sources and vendors. A general subject and a cross reference index to the data bases are also supplied.

710,315
PB83-181594 Not available NTIS
National Bureau of Standards, Washington, DC.
Information Exchange - The Operation of the U.S. Inquiry Point for Standards and Certification Information.
Final rept.
J. Debelius. 1982, 4p
Pub. in Proceedings of Annual Conference 1982 Standards Engineering Society (31st), Ottawa, Ontario, Canada, September 20-22, 1982, p42-45 1982.

Keywords: *Information systems, *Standards, *Regulations, *International trade, Information retrieval, Exports, Specifications.

NBS has established several programs to disseminate information about and encourage comments on proposed foreign government regulations and certification systems which may create trade barriers. Since 1965, NBS has maintained a standards reference collection containing over 240,000 documents. Information on standards, test methods, specifications, and analytical methods can be obtained from the collection. NBS' responsibilities as inquiry point include: reporting trade-significant proposed U.S. regulations to the GATT Secretariat; receiving and disseminating notifications of proposed foreign technical regulations; providing copies of the full text of the regulations upon request; transmitting comments by U.S. organizations on proposed regulations to the appropriate foreign government; and maintaining a hotline on foreign notifications.

710,316
PB84-154566 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Scientific Littoral Data Management Study Summary Report.
R. E. Schofer, and F. F. Goodyear. Dec 83, 16p
NBSIR-83-2806
Prepared in cooperation with Fisk Systems, Bethesda, MD. Sponsored in part by Army Engineer Waterways Experiment Station, Vicksburg, MS.

Keywords: *Information systems, *Littoral zone, Index terms, Cataloging, Systems management, Computer programming, Data banks.

The report describes a review of management procedures for scientific littoral data, and lists recommendations for their improvement. Recommendations include both good general management practice and specific detailed actions. Indexing and cataloging of data are recommended in order to obtain broader data utilization and to remove the dependence of institutional memory on specific individuals. Development of a methodology for identifying and releasing obsolete data is detailed. A list is provided of data catalog files, which were created to describe unautomated data, and of the computer programs which were developed to build and manipulate these catalog files.

710,317
PB84-159870 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Management Guide for Software Documentation.
Final rept.
A. J. Neumann. Jan 82, 48p NBS-SP-500-87
Library of Congress catalog card no. 81-600196.

Keywords: *Documentation, *Computer programming, Specifications, Standards, Manuals, Policies.

This guide is to assist managers in the establishment of policies and procedures for effective preparation, distribution, control, and maintenance of documentation which will aid in re-use, transfer, conversion, correction and enhancement of computer programs. Such documentation, together with the computer programs themselves, will provide software product packages which can be transferred and used by people other than the originators of the programs. 'Software' and 'documentation' are defined, some documentation problems are discussed, and policies, procedures, and applicable standards are outlined. Appendices provide checklists in support of documentation policies and procedures, and references to relevant guidelines,

standards, and the literature. A glossary of terms is included.

710,318
PB85-111771 Not available NTIS
National Bureau of Standards, Washington, DC.
Summary of Current NBS (National Bureau of Standards) Protocol Specifications.
Final rept.
J. F. Heafner, and R. P. Blanc. 1981, 6p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) National Telecommunications Conference, New Orleans, LA., November 29-December 3, 1981, F8.2/1-6 V3.

Keywords: *Specifications, *Federal Information Processing Standards, FIPS, *National Bureau of Standards, Protocols.

This paper summarizes network protocols developed by the National Bureau of Standards (NBS) which will soon be proposed as Federal Information Processing Standards (FIPS). These protocol specifications are based on the work of the International Organization for Standardization (ISO). The protocols summarized here include internetwork, transport, session, data presentation and file transfer which correspond to layers 3 - 7 of the ISO Reference Model for Open Systems Interconnection.

710,319
PB85-123453 Not available NTIS
National Bureau of Standards, Washington, DC.
Introducing and Implementing On-Line Bibliographic Retrieval Services in a Scientific Research and Development Organization.
Final rept.
M. J. Ruhl, and E. J. Yeates. 1976, 4p
Pub. in Jnl. of Chemical Information and Computer Sciences 16, n3 p147-150 1976.

Keywords: *Information systems, *Research and development, Implementation, Reprints, *On-line retrieval.

The paper describes the experience of the National Bureau of Standards Library in implementing on-line bibliographic retrieval services. Methods are given to orient and aid users in availing themselves of the services. Results are presented, based on appraisal of the services by users: value to users; most-used data bases; problems requiring search revision; reasons for unsatisfactory results; purposes for requests and use of search results; impact on subsequent library use; and future searching requirements. The paper concludes with a brief discussion of implications on-line capability on library financing as a whole and on the library role in the community.

710,320
PB85-145597 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Planning, Budgeting and Personnel Management in a Scientific Library of the Federal Government.
Final rept.
M. A. Bond. 1984, 16p
Pub. in Sci. Technol. Libraries 4, n3/4 p45-60 1984.

Keywords: National government, Executives, Libraries, Planning, Budgeting, Cycles, Personnel management, Reprints, *Library management, *Scientific library, Federal agencies.

Planning, budgeting, and personnel management as practiced in a sci-tech library of an Executive Agency in the Federal government are discussed. Examples of particular planning accomplishments are provided, a budget cycle is detailed, and some of the dynamics of the personnel process are reviewed.

710,321
PB85-177640 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
National Archives and Records Service (NARS) Twenty Year Preservation Plan.
A. Calmes, R. Schofer, and K. R. Eberhardt. 10 Jan 85, 70p NBSIR-85/2999
Sponsored by National Archives and Records Service, Washington, DC.

Keywords: *Maintainability, *Archives, *Documents, *Conservation, Preserving, Evaluation, Inventory control, *National Archives and Records Service, *Preservation plan.

The purpose of this preservation plan is to identify types, extent of programs and resource requirements to bring the preservation needs of the National Archives and Records Service (NARS) to a current status at the end of twenty-two years. Data for developing the plan was derived from a scientific survey of holdings, data obtained from interviews with NARS' archivists, earlier studies and observation of operations. The recommended plan is divided into nine action categories: (1) environmental control; (2) holdings maintenance of current holdings; (3) holdings maintenance as a part of the accessioning process; (4) interception, assessment and protection at time of use; (5) systematic duplication of impermanent documents; (6) reproduction of frequently used documents; (7) laboratory treatment of intrinsically valuable documents; (8) laboratory conservation of treasures; and (9) preservation of nontextual records. The 22 year cost of the Preservation Plan in 1984 dollars is estimated at $209.1 million.

710,322
PB85-191948 PC **A11**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Information Resources and Services Div.
NBS (National Bureau of Standards) Library Serial Holdings 1985.
M. L. Kingston. Feb 85, 229p NBSIR-84/2922

Keywords: *Libraries, Proceedings, Periodicals, Documents, Standards, *National Bureau of Standards.

This publication contains holdings information for approximately 4,600 titles held in the NBS Library, representing current and noncurrent journals, periodicals, annuals, memoirs, proceedings, and transactions.

710,323
PB85-221927 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Guide to Locating Sources of Foreign Scientific and Technical Publications.
Final rept.
J. C. Tucker, and E. Cerutti. 1982, 33p
Pub. in Science and Technology Libraries 4, n2, p79-111 1982.

Keywords: *Information retrieval, Libraries, Bibliographies, Guidelines, Verifying, Sources, Reprints, *Interlibrary loan, *Technical reports, *Foreign documents.

As a result of improved bibliographic reference systems, reduction of library budgets and rising prices of publications, greater demands are made on interlibrary loan staffs to locate material outside the library to satisfy information needs. Traditionally, publications produced outside the United States; particularly by foreign publishers and organizations, have been the most difficult to identify and obtain. The paper investigates different mechanisms for verifying citations to foreign publications and locating sources, including national libraries, online, and commercial sources.

710,324
PB86-113677 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Computerized Standard Reference Data.
Final rept.
B. B. Molino. 1983, 8p
Pub. in Proceedings of International Conference on Computers in Chemical Research and Education (6th), Washington, DC., July 11-16, 1982, Analytical Chemistry Symposia Series, v15 p143-150 1983.

Keywords: *Technological intelligence, Evaluation, Automation, Economic factors, Pricing, *Data management, *Numeric scientific data, *On line systems, References(Standards), Computer applications, Data banks.

In this paper the authors discuss the role of the Office of Standard Reference Data in the critical step of data evaluation in addition to the coordination and stimulation of data activities in the scientific disciplines and technical areas. The authors examine the alterations in these areas of data evaluation and data dissemination which have occurred in the last decade due to advances in computing. The computerization of standard reference data has occurred at all stages of the process, from the automation of the data centers right through the output mechanisms. The advantages of computerized data are discussed, along with a description of the problems encountered. Finally, an overview is given of present products of the Standard Reference Data System, and plans and pricing policies for the future are outlined.

710,325
PB86-113685 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Activities of the Office of Standard Reference Data in Relation to the Online Distribution of Scientific Numeric Data.
Final rept.
B. B. Molino, J. R. Rumble, and D. R. Lide. 1982, 9p
Pub. in Proceedings of National Online Meeting, New York, NY., March 31-April 1, 1982, p371-379.

Keywords: *Technological intelligence, Pricing, Evaluation, *Data bases, *Numeric scientific data, *Computer graphics, On line systems, National Bureau of Standards, References(Standards), User needs.

The Office of Standard Reference Data (OSRD) at the National Bureau of Standards administers one of the largest data evaluation networks in the world, the National Standard Reference Data System. Over the last decade, advances in computing have drastically altered both the data evaluation processes and the methods of disseminating these data to the user community. In this paper the authors discuss the implications of these changes on the scientific data community, especially with regard to numeric and graphic data. Two specific areas will be dealt with in detail. The first area to be covered deals with the unique features of numeric scientific data, including material descriptions, data modeling, and graphical displays. The key role of scientists in building these data bases is discussed. The second topic is concerned with various economic issues involved with online data systems and numeric scientific data in particular. The cost and price structure for these important data bases will also be discussed.

710,326
PB86-131794 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Issues in the Management of Microcomputer Systems.
Final rept.
J. Barkley, and L. S. Rosenthal. Sep 85, 56p NBS-SP-500/125
Library of Congress catalog card no. 85-600588.

Keywords: *Microcomputers, *Information systems, Systems management, Data processing, Organizations, *Technology, Strategies.

The document provides general guidance on the management of microcomputer systems. It addresses the need for establishing a management policy and presents background, issues and alternatives which can help an organization in its management and support of microcomputers.

710,327
PB86-154002 CP **T02**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Codes for Named Populated Places, Primary County Divisions, and Other Locational Entities of the United States (FIPS PUB 55), 8th Update.
Data file.
H. Tom. Feb 86, mag tape FIPS PUB 55, NBS/DF/MT-86/003
Supersedes PB85-152312.
Source tape is in the EBCDIC or ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions.

Keywords: *Data file, *Coding, *United States, Urban areas, Rural areas, Municipalities, Communities, States(United States), Magnetic tapes, *Federal information processing standards, *Geocoding, Standard metropolitan statistical areas, Counties, ZIP codes.

The eighth update of the Federal Information Processing Standard (FIPS) 55 data file provides a two-character State code and five-character numeric place code to uniquely identify each listed entity. Areas of the United States covered are the fifty States, the District of Columbia, and all outlying territories with significant self-administration. An exhaustive list is carried of incorporated places, census designated places (CDP's), primary county divisions (such as townships, New England towns, and census county divisions), recognized Indian reservations and Alaska Native villages, and

counties. The listing also includes unincorporated places, military bases, National parks, airports, and ground transportation points.

710,328
PB86-212982 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Data Base Management Systems. Part 1: A Quick Overview.
Final rept.
D. B. Neumann. 1985, 13p
Pub. in Nonbibliographic Data Banks in Science and Technology, p139-151 1985.

Keywords: *Chemistry, Data processing, Reprints, *Data base management systems, *Numeric data bases, Data bases, Data banks.

An overview of data-base management systems (DBMS's) is presented. Examples are drawn primarily from a single case: a two-level network-type system. The terminology of data-base systems, their access methods, and their structures are introduced.

710,329
PB86-212990 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Data Base Management Systems. Part 2. An Application to Scientific Technical Data and Its Associated Bibliographic Data.
Final rept.
D. B. Neumann. 1985, 13p
Pub. in Nonbibliographic Data Banks in Science and Technology, p153-165 1985.

Keywords: *Thermochemistry, Chemistry, Data processing, Networks, Bibliographies, Reprints, *Data base management systems, Numeric data bases, Data structures, Data bases, Hewlett-Packard computers.

A data-base management system (DBMS) permitting only a two-level network schema has been applied to a relatively complex data base. Such an application to a thermochemical data base is described here. The test case studied was the Hewlett-Packard IMAGE/1000 DBMS. The logical and physical structure of the thermochemical data base is described. Methods used to overcome the limitations of the two-level network DBMS are also discussed.

710,330
PB87-120036 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Automation Sensors Group.
Database Conversions Demand Common Standards for Data Structure.
Final rept.
L. J. Gallagher. 1985, 6p
Pub. in Data Management 23, n1 p22 and p24-28 Jan 85.

Keywords: *Standards, *Conversion, *Data processing, Programming languages, Specifications, Translations, Information systems, Decentralization, Work, Reprints, *Data bases, *Data structures, *Distributed processing, *Applications programs(Computers).

The proliferation of small and medium sized computers has made it possible to decentralize the data processing work load into a number of smaller distributed tasks. With this decentralization, there is an increasing need to translate data and application programs from one computer processing environment to another. To serve this need there has been welcome progress in the specification of national and international standards for data definition, data manipulation, and data interchange. The paper discusses standard specifications for database languages recently completed by technical committee X3H2 of the American National Standards Institute and for data interchange forms recently adopted by the International Organization for Standardization. It shows by example how a complete database application can be transported or shared in a standard manner among different computer processing environments.

710,331
PB87-136677 PC **A07**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Materials Information for Science and Technology (MIST): Project Overview.
Final rept.
W. Grattidge, J. Westbrook, J. McCarthy, C. Northrup, and J. Rumble. Nov 86, 132p NBS/SP-726 Also available from Supt. of Docs as SN003-003-02780-4. Library of Congress catalog card no. 86-600590. Prepared in cooperation with Sci-Tech Knowledge Systems, Inc., Scotia, NY., Lawrence Berkeley Lab., CA., and Sandia National Labs., Albuquerque, NM.

Keywords: *Materials, *Information systems, Engineering, Data processing, Computer networks, *Data base management, *Data bases, *MIST data base, *Science and Technology development, Numeric data base, Access, Department of Energy, National Bureau of Standards, Distributed computer systems.

The report documents the initial phases of the MIST database, which is a demonstration project jointly supported by the Department of Energy and the National Bureau of Standards. The purpose of the Materials Information for Science and Technology (MIST) is to demonstrate the power and utility of computer access to materials property data. The initial goals include: to exercise the concept of a computer network of materials databases and to build a demonstration of such a system in a way as to be suitable for use as the core of operational systems in the future. Phases I and II are described in detail. In addition, a discussion is given of the expected usage of the databases.

710,332
PB87-156725 PC **A09**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Data Base Directions: Information Resource Management - Making It Work. Proceedings of a Workshop on Information Resource Management (IRM) Held at Fort Lauderdale, Florida on October 21-23, 1985.
Final rept.,
E. N. Fong, and A. H. Goldfine. Jun 86, 187p NBS/SP-500/139
See also PB83-115634. Library of Congress catalog card no. 86-600559. Also available from Supt. of Docs as SN003-003-02738-3.

Keywords: *Meetings, Resource allocation, Information systems, Management methods, *Information resource management, *Data management, Data base management, Data directories.

The report constitutes the results of a three-day workshop on how to make information resource management work, held in Fort Lauderdale, Florida, on October 21-23, 1985. The workshop was sponsored by the Institute for Computer Sciences and Technology (ICST) of the National Bureau of Standards (NBS), in cooperation with the Association for Computing Machinery, the IEEE Computer Society, and the Federal Data Management Users Group. Patterned after the three previous Data Base Directions workshops, this workshop, Data Base Directions: Information Resource Management -- Making it Work, evaluated current practice to identify problem areas, reviewed important technologies and tools and when to apply them to information resource management, and explored the motivation and inhibitors to decentralized and distributed environments. The approximately seventy workshop participants were organized into four working panels, which met to discuss IRM in the 1990s, IRM and the System Life Cycle, Technologies for IRM, and IRM in a Decentralized and Distributed Environment.

710,333
PB87-163978 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
FIREDOC: An Automated Bibliographic Database.
Final rept.,
N. H. Jason. 1986, 8p
Pub. in Proceedings of 1986 SFPE Fire Protection Engineering Seminars, Atlanta, GA., May 19-22, 1986, p1-8.

Keywords: *Fires, Research, *Data bases, *FIREDOC data base.

The creation of an automated fire research bibliographic database, FIREDOC, is discussed in this paper. FIREDOC is the automated 'card catalog' to the Fire Research Information Services collection at the Center for Fire Research. In the report, a sample reference question in answered by using different search techniques to illustrate how the user can obtain an answer.

Marketing & User Services

710,334
PB-273 131/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
On-Line Bibliographic Retrieval System Use.
Final rept.,
C. P. Brown. 1977, 6p
Pub. in Spec. Lib. 68, n4 p155-160 Apr 77.

Keywords: *Information systems, *User needs, Information retrieval, Libraries, Evaluation, Program effectiveness, Satisfaction, Scientists, Surveys, Reprints, On line systems.

Online systems for bibliographic retrieval have been increasingly used in special libraries since 1972. In spite of the convenience and speed of these systems, not all scientific users have shown enthusiasm. An evaluative survey conducted in one library implies a need for continued publicity and training to promote interest and familiarity among the user community.

710,335
PB80-200678 Not available NTIS
National Bureau of Standards, Washington, DC.
Integration of an Information System: Chaos or Control. How to Select a System.
Final rept.,
P. W. Berger. 1980, 40p
Pub. in Proc. of National Information Conference and Exposition (4th), Washington, DC., 40p, 29 May 80.

Keywords: *Information systems, *Selection, Automation, Data processing, Information services, Libraries, Information retrieval, Evaluation.

With the bewildering array of options available to information managers, selection of an information system is critical. Failing to appreciate the impact automated information services will have on the library and information center may indeed cause chaos.

710,336
PB86-202116 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Center for Programming Science and Technology.
Information Resource Centers - Organizing to Serve End Users.
Final rept.
T. N. Pyke. 1983, 4p
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronics Engineers, Inc.) Computer Society International Conference (27th) COMPCON 83 Fall: Delivering Computer Power to End Users, Arlington, VA., September 25-29, 1983, p22-25.

Keywords: *Information centers, Organizations, Microcomputers, Access, Systems engineering, Services, *Mainframe computers, *User needs, End use.

The paper summarizes the motivation for and issues associated with organizing to support end user direct access to computing resources. A combination of information center functions to provide access to large mainframes and support to end users in their access to microcomputers is included. Various issues are identified and discussed that will help organizations develop supporting organizational structures for end user computing.

Operations & Planning

710,337
PB-263 176/0 PC **A10**/MF **A01**
Operating Systems, Inc., Woodland, Calif.

Operations & Planning

Accessing Individual Records from Personal Data Files Using Non-Unique Identifiers.
Final rept. 31 Mar 76,
G. B. Moore, J. L. Kuhns, J. L. Trefftzs, and C. A. Montgomery. Feb 77, 206p NBS-SP--500-2
Contract NBS-5-35928
Library of Congress catalog card no. 76-57950.

Keywords: *Information systems, *Data processing security, Data storage, Data retrieval, Records management, Computer programs, Management information systems, Mathematical models, Sampling, Statistical analysis, Phonology, Coding, Fortran, *Privacy Act(1974), *Computer privacy, *Computer information security, Data elements, File management.

The Privacy Act of 1974 places restrictions on the Federal, state and local agencies' use of the Social Security account number as an identifier. For some agencies, compliance will involve changes in implementation of retrieval algorithms. This report describes methodology applicable to these changes in the more general context of the problem of retrieving individual records from files using non-unique identifiers. State-of-the-art retrieval techniques are discussed, a method for assigning reliability weights to various personal data elements is presented, file validation techniques for the error and omission rates of data items are suggested, and a retrieval probability model--designed to show likelihood of retrieval of a subject's record given a variety of populations, combinations of identifiers, and error/omission rates--is described. A methodology is developed for forming confidence factors from the established error/omission rates for combinations of nonunique identifiers that are candidates for use as retrieval keys. Use of these confidence factors as indices into the precision tables produced by the probability model is described.

710,338
PB78-600006 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hashing with Linear Probing and Frequency Ordering.
G. Lyon. 1978,3p
Included in Jnl. of Research of the National Bureau of Standards, v83 n5 p445-447 Sep-Oct 1978.

Keywords: *Hashing, Linear probing, Nonuniform frequencies, Open addressing, Optimal packing, Retrieval improvement.

A simple linear probing and exchanging method of Burkhard locally rearranges hash tables to account for reference frequencies. Examples demonstrate how frequency-sensitive rearrangements that depend upon linear probing can significantly enhance searches.

710,339
PB80-106420 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
NBS Library Handbook for NBS Staff,
N. H. Knight. 1978, 75p NBSIR-79-1928

Keywords: *Libraries, *Services, Policies, Resources, Personnel management, Books, Periodicals, Handbooks, National Bureau of Standards, Library collections.

This publication describes NBS Library services, policies, resources, and lists personnel.

710,340
PB81-140394 Not available NTIS
National Bureau of Standards, Washington, DC.
Computer Data Base System for Indexing Research Papers,
R. A. Glass, L. J. Kaetzel, and G. R. Smith. 1980, 2p
Pub. in Behavioral Research Methods Instrument Letter 12, n5 p547-548 1980.

Keywords: *Subject indexing, *Information systems, Minicomputers, Subject index terms, Information retrieval, Library science, Index terms, Technological intelligence, Data processing, Reprints, *Data entry.

The KGS data base system allows the indexing and retrieval of scientific research papers through the use of a minicomputer system in an interactive mode. Criteria are entered through the user's computer terminal which produces subsets of the data base in a report format as well as statistical summaries of data base elements.

710,341
PB81-167645 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: Investigation of Technology-Based Improvement of the ERIC System.
S. Treu. Jun 80, 121p NBSIR-80-2005
Sponsored in part by National Inst. of Education, Washington, DC.

Keywords: *Technology assessment, *Information centers, Systems analysis, Information systems, Education, Data sources, User needs, Data storage devices, Microfilm, *Educational Resources Information Center, *ERIC system, Data entry.

Results of a study to identify potential technology-based improvements in the operation, access, and utilization of the Educational Resources Information Center (ERIC) are described. Both current problem areas and future possibilities are considered with regard to the dichotomy: system components and the total system. Emphasis is on characterizing the component functions of data input and data output as well as the total system operation in terms of applicable criteria (data type, volume, purpose, performance). Technological alternatives are then discussed with reference to those criteria. The report concludes with a structured summary of observations, recommendations, and possible follow-up studies.

710,342
PB83-131581 Not available NTIS
National Bureau of Standards, Washington, DC.
Information Retrieval Theory and Design Based on a Model of User's Concept Relations.
Final rept.
M. B. Koll. 1981, 17p
Pub. in Proceedings Symposium on Research and Development in Information Retrieval, Cambridge, England, June 23-27 1980, p77-93 1981.

Keywords: *Information retrieval, *Data retrieval, Search structuring, Document acquisition, Terminology, Automatic indexing, Index terms, Subject index terms, Reprints, *Foreign technology.

Viewing IR systems as models of human assessment of the similarity between requests and documents contributes to development of theory for IR and can aid in development of IR systems. This paper reports on the development and testing of a theory of IR based on this system-as-model view. The principal claim of the theory is that the ability of an IR system to retrieve relevant documents is dependent on the agreement between the system's and users' models of concept relations. The theory provides an explanation for the value of co-occurrence data. Results of an experiment provide support for the theory, and for using co-occurrence data in retrieval systems. Implications for IR research and development are considered.

710,343
PB83-137851 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Computer Data Base System for Indexing Research Papers.
Final rept.
J. T. Calabrese, L. J. Kaetzel, R. A. Glass, and G. R. Smith. Oct 82, 105p NBS-TN-1167
Supersedes PB81-104218.

Keywords: *Subject indexing, *Indexes(Documentation), *Information systems, *Computer programming, Document acquisition, Library science, Information retrieval, Data retrieval, Subject index terms, Data bases, Fortran 7 programming language, KGS system.

This report represents a significant revision to NBS Technical Note 1123 published in 1980. In that report, the Kaetzel, Glass, Smith (KGS) data base system permitted users to index, edit, classify, and retrieve scientific research paper citations. During the past 15 months, the system was modified and enhanced. All programs are written in standard FORTRAN VII Level I programming language providing transportability among computer systems. Retrieval time has been greatly reduced by changing from a sequential access method to an indexed, directory look-up file structure which allows faster and more efficient random access. The file structure is machine independent. Because of the responsiveness of the extract mode, the one-key retrieval is unnecessary and has been deleted from the revised system. The keyword mode has been replaced by the information mode which provides statistics on authors and keywords. A file maintenance mode has been added to ensure data base integrity. The KGS system has been separated from the larger Publications Data Base and the select data base mode has been removed. Software has been tailored to meet KGS users' needs. Overall, the revised system is faster and uses resources more efficiently than the original data base.

710,344
PB83-139006 Not available NTIS
National Bureau of Standards, Washington, DC.
Complying with Copyright in Scientific Libraries: The National Bureau of Standards Experience.
Final rept.
P. W. Berger. May 82, 22p
Sponsored in part by American Chemical Society, Washington, DC.
Pub. in Jnl. of Chemical Information and Computer Sciences 22, n2 p74-78, May 82.

Keywords: *Library science, *Document circulation, Cooperation, Libraries, Copyrights, Legislation, User needs, Periodicals, Reprints, Interlibrary loans.

Applying a worst case, analysis of interlibrary borrowing in the NBS library for the years 1976-1979, the report demonstrates that the dangers of interlibrary lending to the interests of authors and publishers is slight, compared to the clerical burden imposed on libraries by Secs. 107 and 108 of the Copyright Law of 1976. Further, there is evidence of publisher, author and library user disaffection with the law, as well as instances of abuse by publishers of charges for photocopies of materials under copyright.

710,345
PB86-191152 PC **A12**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Data Administration Workshop Proceedings.
F. E. Spielman. Feb 86, 256p NBSIR-86/3324
Proceedings of a workshop held at Gaithersburg, Maryland on March 27-28, 1985.

Keywords: *Meetings, Costs, Planning, Tools, Standards, *Data administration.

The Special Publication constitutes the proceedings of a two-day workshop on Data Administration, held at the National Bureau of Standards, Gaithersburg, Maryland, on March 27-28, 1985. The workshop was sponsored by the National Bureau of Standards under the auspices of the Federal Data Management Users' Group (FEDMUG). The purpose of the workshop was to provide a forum for Federal, State, and local government Program Managers, Information Resource Managers, Data Processing Managers, and Data Administrators to hear nationally prominent speakers and to discuss and share data administration ideas and experiences.

710,346
PB86-247582 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Information Resources and Services Div.
NBS (National Bureau of Standards) Research Information Center Handbook for NBS Staff (Fourth Edition).
L. S. Maruyama. Aug 86, 69p NBSIR-86/3394

Keywords: *Information centers, Libraries, Handbooks, Services, Resources, National Bureau of Standards, Federal libraries.

The directory describes the information resources and services of the National Bureau of Standards Research Information Center.

Reference Materials

710,347
FIPS-PUB-11-1 PC **A08**/MF **A01**
National Bureau of Standards, Washington, D.C.

Federal Information Processing Standards Publication: Dictionary for Information Processing.
Federal information processing standards (Final),
J. Walkowicz. 30 Sep 77, 173p
Supersedes FIPS-PUB-11. Also available in 3 ring vinyl FIPS binder, $6.25 North American Continent price; all others write for quote.

Keywords: *Dictionaries, *Data processing, Standards, *Federal information processing standards, *Information processing.

This publication adopts X3/TR-1, American National Dictionary for Information Processing, which provides a common reference within the Federal Government for terms and definitions used in such information processing activities as the representation, communication, interpretation and processing of data by human or automatic means. The Dictionary consists of a single alphabetic listing of over 4000 terms and their definitions. The usage label (ISO) is used in the Dictionary to indicate terms and definitions that have been approved by the International Organization for Standardization.

710,348

FIPS PUB 11-2 PC **A08**
American National Standards Committee, New York.
Guideline: American National Dictionary for Information Processing Systems. Category: Software. Subcategory: Documentation.
Federal information processing standards (Final).
J. L. Walkowicz. c1982, 159p X3/TR-1-82
Supersedes FIPS PUB 11-1. Library of Congress catalog card no. 83-071024.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Dictionaries, Definitions, National government, Standards, Terminiology, *Federal information processing standards, *Information processing, *Data processing systems.

This publication adopts X3TR-1-82 as a FIPS Guideline. It provides a common reference within the Federal Government for terms and definitions used in such information processing activities as the representation, communication, interpretation and processing of data by human or automatic means. The DICTIONARY consists of a single alphabetic listing of over 4000 terms and their definitions. The label (ISO) is used in the DICTIONARY to indicate terms and definitions that have been approved by the International Organization for Standardization.

710,349

FIPS PUB 55-2 PC **A03**/MF **A01**
National Bureau of Standards (ICST), Gaithersburg, MD.
Guideline: Codes for Named Populated Places, Primary County Divisions, and Other Locational Entities of the United States and Outlying Areas. Category: Data Standards and Guidelines. Subcategory: Representations and Codes.
Federal information processing standards (Final),
R. G. Saltman. Feb 87, 34p
Supersedes FIPS PUB 55-1.
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Geography, *Guidelines, *Coding, Municipalities, Counties, States(United States), Information systems, Census, Magnetic tapes, Standards.

The guideline implements ANSI X3.47-1977 and provides a two-character FIPS State Code and a five-character FIPS numeric place code to uniquely identify each listed entity. An exhaustive list is carried of names of incorporated places, census designated places (CDPs), primary county divisions (such as townships, New England towns, and census county divisions), counties, and recognized Indian reservations and Alaska Native villages. The listing also includes names of all populated places in the files of the Geographic Names Information System of the U.S. Geological Survey, as well as names of airports, military bases, national parks, and U.S. Post Offices. A two-character class code distinguishes over fifty entity types.

710,350

PB-264 814/5 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Perspective on Standards. Activities of the National Bureau of Standards.
Final rept. 1976,
M. Jacobs, and S. A. Washburn. 1976, 44p NBS-SP-467
Supersedes PB-248 258.

Keywords: *Commerce, *Periodicals, *Standards, Measurement, Technology transfer, Materials, Environmental impacts, Energy conservation, Consumer affairs, Product development, Fire safety, Computers, Research, National Bureau of Standards.

This publication highlights the major achievements of the National Bureau of Standards and shows how this work contributes to the solution of many problems of national concern. In addition, the report contains sections featuring the Bureau's interaction with the public and private sectors and emphasizes the historical perspective in relation to the Bureau's 75th anniversary and the Nation's bicentennial. Sections of the report feature: Increasing measurement capabilities; Transferring research and technology; Promoting better materials use; Aiding environmental protection; Conserving energy resources; Advancing building technology; Protecting public safety; Improving product performance; Expanding computer applications; Providing information resources.

710,351

PB-267 655/9 PC **A07**/MF **A01**
Notre Dame Univ., Ind. Radiation Chemistry Data Center.
Thesaurus for Radiation Chemistry,
A. B. Ross. Mar 77, 103p UND-RCDC-1
Sponsored in part by National Bureau of Standards, Washington, D.C., and Energy Research and Development Administration, Washington, D.C. Revision of report dated Aug 1972, COO-38-621.

Keywords: *Radiation chemistry, *Thesauri, Subject index terms, Photochemistry.

This document is an updated version (1977) of previous thesauri used by the Radiation Chemistry Data Center (RCDC) to describe the indexing system employed to prepare its documents, particularly the Biweekly List of Papers on Radiation Chemistry and the Annual Cumulation. It contains the terminology for indexing documents in radiation chemistry and related subjects. New terms have been added as necessary.

710,352

PB-269 534/4 PC **A11**/MF **A01**
National Bureau of Standards, Washington, D.C. Library Div.
NBS Serial Holdings 1977.
J. C. Tucker. Apr 77, 241p NBSIR-77-1215

Keywords: *Periodicals, *Bibliographies, Libraries, Collection, Library collections.

This publication contains holdings information for approximately 4600 titles representing current and noncurrent journals, periodicals, annuals, memoirs, proceedings, and transactions. The holdings of the NBS Library and 4 collections specializing in fire research, computer information, standards, and diffusion in metals are represented.

710,353

PB-272 475/5 PC **A07**/MF **A01**
National Bureau of Standards, Washington, D.C.
Fire Research Specialists: A Directory,
N. H. Jason. Sep 77, 139p NBSIR-77-1264, NASA-CR-135089
NASA Order C-97823-B

Keywords: *Fire safety, *Professional personnel, *Directories, Research, Authors, Instructors, Consultants, Project management, United States, Canada, Classifications, Sources, *Fire research, *Specialists, Names and addresses.

This Directory lists specialists from the United States and Canada who have made recent contributions to the fire literature, to the teaching of fire science or related subjects, or who have participated in or supported fire research programs. This work is an update of the 1973 'Directory of Workers in the Fire Field' by Boris W. Kuvshinoff, Stephen B. McLeod, and Richard G. Katz. The Directory is divided into three parts. The first part, the Specialists Index, is arranged alphabetically giving the specialist's affiliation, mailing address, and telephone number. The second part, the Subject Specialty Index, alphabetically lists the subject areas and the corresponding specialist names. The third part, the Affiliations Index, alphabetically lists the corporate sources, noting the specialists therein.

710,354

PB-272 830/1 PC **A99**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Publications of the National Bureau of Standards, 1976 Catalog. A Compilation of Abstracts and Key Work and Author Indexes.
Special pub.,
B. L. Burris. Jun 77, 733p NBS-SP-305-Suppl-8
See also report dated Jun 76, PB-255 879. Library of Congress catalog card no. 48-47112.

Keywords: *Research, *Bibliographies, Abstracts, Catalogs(Publications), Periodicals, Indexes(Documentation), Authors, National government, Words(Language), Subject index terms, National Bureau of Standards, Author indexes, Key words.

This supplement to Special Publication 305 supplements 1 through 7 of the National Bureau of Standards lists the publications of the Bureau issued between January 1, 1976 and December 31, 1976. It includes an abstract of each publication (plus some earlier papers omitted from Special Publication 305 Supplement 7), key-word and author indexes; and general information and instructions about NBS publications.

710,355

PB-282 044/7 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Science on Its Way to Work.
Annual rept. 1 Oct 76-30 Sep 77,
M. A. Baum, and S. A. Washburn. Apr 78, 49p NBS-SP-498
Supersedes rept. no. NBS-SP-467, PB-264 814.

Keywords: *Commerce, *Periodicals, *Standards, National government, Measurement, Technology transfer, Television broadcasting, Auditory defects, Liquefied natural gas, Materials recovery, Consumer affairs, Magnetohydrodynamics, Electric power plants, Metrology, Energy conservation, Automobiles, Exhaust emissions, Computers, Fire safety, Buildings, Dental materials, Air pollution, National Bureau of Standards.

The report describes the activities of the National Bureau of Standards during the fiscal year ending September 30, 1977. Particular attention is paid to the impact of these programs on industry, government, and the international scene, as well as our everyday lives. Emphasis is also placed on the transfer mechanisms how technology gets from here to there. The report includes a people section, a list of selected publications, a financial statement, staff statistics, a summary of legislation on which NBS missions are based, and a directory listing the Bureau's major programs and divisions with managers and their phone numbers.

710,356

PB-283 800/1 PC **A99**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Publications of the National Bureau of Standards 1977 Catalog. A Compilation of Abstracts and Key Word and Author Indexes.
Special pub.,
B. L. Burris. Jun 78, 610p NBS-SP-305-Suppl-9
See also report dated Jun 77, PB-272 830. Library of Congress Catalog Card no. 48-47112.

Keywords: *Research, *Bibliographies, Abstracts, Catalogs(Publications), Periodicals, Indexes(Documentation), Authors, National government, Words(Language), Subject index terms, National Bureau of Standards, Author indexes, Key words.

This supplement to special publication 305 supplements 1 through 8 of the National Bureau of Standards lists the publications of the Bureau issued between January 1 - December 31, 1977. It includes an abstract of each publication (plus some earlier papers omitted from special publication 305 supplement 8), key-word and author indexes; and general information and instructions about NBS publications.

710,357

PB-295 736/3 PC **A08**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.

Journal of Research of the National Bureau of Standards. Volume 84, Number 1, January-February 1979.
Bi-monthly rept.
1979. 161p
See also Volume 83, Number 2, PB-283 996.

Keywords: *Research, Ribosomes, Escherichia coli, Eye(Anatomy), Wounds and injuries, Matrices(Matrices), Fortran, Hypercubes.

Contents:
- Diffusion coefficients of the 45S and 50S states of the large ribosomal subunit of E. coli by quasielastic light scattering;
- System for assessing eye injury potential of propelled objects;
- Enhancing Fortran to aid manipulation of large structure matrices;
- Cutting the d-cube;
- Publications of the National Bureau of Standards.

710,358

PB-297 424/4 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC. Technical Information and Publications Div.
Publications of the National Bureau of Standards 1978 Catalog. A Compilation of Abstracts and Key Word and Author Indexes.
Rept. for Jan-Dec 78.
B. L. Burris, and R. J. Morehouse. Jun 79, 685p
NBS-SP-305-SUPPL-10
See also Supplement no. 9, PB-283 800. Library of Congress catalog card no. 48-47112.

Keywords: *Bibliographies, *Catalogs(Publications), *Research, Abstracts, Periodicals, Indexes(Documentation), Authors, National government, Subject index terms, Physics, Mathematics, Chemistry, Engineering, Computers, *National Bureau of Standards, *Scientific research, Keywords, Author indexes.

The supplement lists the publications of the Bureau issued between January 1 - December 31, 1978. It includes an abstract of each publication, key-word and author indexes, and general information and instructions about NBS publications.

710,359

PB-299 456/4 MF**$8.00**
National Bureau of Standards, Washington, DC. Technical Information and Publications Div.
Publications of the National Bureau of Standards, 1966-1976 Catalog. Volume 1 (Parts 1 and 2): Citations and Abstracts.
Rept. for Jan 66-Dec 76.
B. L. Burris, and R. J. Morehouse. 1978, 1911p NBS-SP-535-VOL-1-PT-1/2
See also Supplement 8, PB-272 830 and Volume 2, PB-299 457. Paper copy available from Supt. of Docs. Sold in set of 2 Volumes only. Library of Congress catalog card no. 76-600145.

Keywords: *Research, *Bibliographies, Abstracts, Catalogs(Publications), Periodicals, Indexes(Documentation), Authors, National government, Words(Language), Subject index terms, National Bureau of Standards, Author indexes, Keywords.

The published output of NBS for 1966 through 1976 is cataloged and indexed in this two-volume publication. Parts 1 and 2 of Volume 1 consist of reprints of abstracts and full citations of all published papers during the 11-year period as they originally appeared in the NBS annual publication catalogs - NBS SP 305 and its Supplements 1 through 8. Volume 2 is a consolidated permuted key word index which directs the researcher of NBS literature either to the citations and abstracts of Volume 1 or to the same information in the nine annual catalogs issued during the 11-year period. Annual supplements to SP 305 will continue to update the NBS published output; the 1977 supplement is now available as NBS SP 305, Supplement 9.

710,360

PB-299 457/2 MF**$7.00**
National Bureau of Standards, Washington, DC. Technical Information and Publications Div.
Publications of the National Bureau of Standards, 1966-1976 Catalog. Volume 2: Key Word Index (A through L; M through Z).
Rept. for Jan 66-Dec 76.
B. L. Burris, and R. J. Morehouse. 1978, 1615p NBS-SP-535-VOL-2-PT-1/2
See also Volume 1, PB-299 456. Paper copy available from Supt. of Docs. Sold in set of 2 Volumes only. Library of Congress catalog card no. 78-600145.

Keywords: *Research, *Bibliographies, Abstracts, Catalogs(Publications), Periodicals, Indexes(Documentation), Authors, National government, Words(Language), Subject index terms, National Bureau of Standards, Keywords.

The published output of NBS for 1966 through 1976 is cataloged and indexed in this two-volume publication. Volume 2 is a consolidated permuted key word index which directs the researcher of NBS literature either to the citations and abstracts of Volume 1 or to the same information in the nine annual catalogs issued during the 11-year period.

710,361

PB77-600081 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 82, Number 1, July-August 1977.
1977, 202p
See also PB77-600011 through PB77-600029.

Keywords: *Research.

No abstract available.

710,362

PB80-132525 PC **A13**/MF **A01**
National Bureau of Standards, Washington, DC. Library Div.
NBS Serial Holdings 1979,
J. C. Tucker. Nov 79, 297p NBSIR-79-1932
See also report for 1977, PB-269 534.

Keywords: *Periodicals, *Bibliographies, Libraries, Collection, Library collections.

The publication contains holdings information for approximately 4600 titles representing current and noncurrent journals, periodicals, annuals, memoirs, proceedings, and transactions. The holdings of the NBS Library and 4 collections specializing in fire research, computer information, standards, and diffusion in metals are represented.

710,363

PB80-147556 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
NVLAP (National Voluntary Laboratory Accreditation Program) Glossary of Terms for Laboratory Accreditation, Product Certification and Standardization,
D. B. Thomas. Jan 80, 27p NBSIR-79-1956

Keywords: *Dictionaries, *Terminology, *Standardization, Laboratories, Quality control, Accreditation, Certification.

The glossary provides definitions of terms commonly used in many laboratory accreditation programs, specifically the Department of Commerce National Voluntary Laboratory Accreditation Program (NVLAP), as well as product certification and standardization programs. The successful development and administration of these programs require a clear understanding of the terms frequently used in describing laboratory criteria, evaluation methodology, proficiency testing, compliance testing, quality control and standardization.

710,364

PB80-169329 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Library Div.
Abstract and Index Collection - National Bureau of Standards Library,
D. Cunningham. Jan 80, 63p NBSIR-80-2009

Keywords: *Libraries, *Indexes(Documentation), Services, Abstracts, National government, Periodicals, National Bureau of Standards, Library collections.

An alphabetical arrangement of abstracts and indexes available at the National Bureau of Standards (NBS) Library is listed by most current title of the publication. Other information includes description of the abstract or index, library holdings, principal sources, publisher or association, corresponding data base and the classification number. A general subject index follows the main text of the report.

710,365

PB80-202948 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC. Technical Information and Publications Div.
Publications of the National Bureau of Standards, 1979 Catalog; a Compilation of Abstracts and Key Word and Author Indexes.
Rept. for Jan-Dec 79,
B. L. Burris, and R. J. Morehouse. Feb 80, 622p
NBS-SP-305-SUPPL-11
See also 1978 catalog, PB-297 424. Library of Congress catalog card no. 48-47112.

Keywords: *Bibliographies, *Catalogs(Publications), *Research, Abstracts, Periodicals, Indexes(Documentation), Authors, National government, Subject index terms, Physics, Mathematics, Chemistry, Engineering, Computers, *National Bureau of Standards, *Scientific research.

The 11th supplement to Special Publication 305 of the National Bureau of Standards lists the publications of the Bureau issued between January 1-December 31, 1979. It includes an abstract of each publication (plus some earlier papers omitted from Special Publication 305 Supplement 10), key-word and author indexes; and general information and instructions about NBS publications.

710,366

PB81-203739 PC **A13**/MF **A01**
National Bureau of Standards, Washington, DC. Library Div.
NBS Serial Holdings 1981.
Annual rept.
M. L. Kingston. Mar 81, 285p NBSIR-81-2226
Supersedes PB80-132525.

Keywords: *Periodicals, *Bibliographies, Libraries, Collection, Library collections.

The publication contains holdings information for approximately 4600 titles representing current and noncurrent journals, periodicals, annuals, memoirs, proceedings, and transactions. The holdings of the NBS Library and 3 collections specializing in fire research, standards, and diffusion in metals are represented.

710,367

PB82-104688 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC. Technical Information and Publications Div.
Publications of the National Bureau of Standards 1980 Catalog: A Compilation of Abstracts and Key Word and Author Indexes.
Rept. for Jan-Dec 80.
B. L. Burris, and R. J. Morehouse. Jun 81, 664p
NBS-SP-305-SUPPL-12
Library of Congress catalog card no. 48-47112. See also Supplement no. 11, PB80-202948, and Supplement no. 10, PB-297 424.

Keywords: *Bibliographies, *Research, *Indexes(Documentation), Catalogs(Publications), Abstracts, Periodicals, Authors, National government, Subject index terms, Physics, Mathematics, Chemistry, Engineering, Computers, National Bureau of Standards, *Scientific research, Keywords.

The supplement lists the publications of the Bureau issued between January 1 - December 31, 1980. It includes an abstract of each publication, key word and author indexes, and general information about NBS publications.

710,368

PB82-170168 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
Human Behavior and Fire Emergencies: An Annotated Bibliography.
R. L. Paulsen. Dec 81, 135p NBSIR-81-2438
Sponsored in part by Department of Health and Human Services, Washington, DC.

Keywords: *Fires, *Bibliographies, Fire alarm systems, Evacuating(Transportation), Human behavior, Hospitals, Meetings, Indexes(Documentation), Nursing homes.

The report contains an annotated listing of 161 selected references pertaining to human behavior and fire emergencies. The scope is broad: the references cover the full range of behavioral responses through the different stages of a fire emergency in the context of a variety of occupancy settings. Health care institutions are the most frequently represented occupancy type. Many research approaches are included; e.g., case studies of individual incidents, survey studies of large numbers of incidents, theoretical analyses and representations of the fire situation, computer models, literature surveys, and psychological studies of selected populations. The work of researchers from many nations, including the United States, Great Britain, Japan, West Germany, France, Belgium, and the U.S.S.R., is referenced. Annotations for papers from the first two international conferences on human behavior in fires (March 1977 and October 1978) are contained in this bibliography. There is a topical index to provide the reader with a preliminary guide to those references regarding a particular occupancy type, research approach, design feature, or category of behavioral response. An introductory essay provides an overview of the field of human behavior and fires and develops some common themes found in the literature.

710,369
PB82-242462 PC **A21**/MF **A01**
National Bureau of Standards, Washington, DC. Technical Information and Publications Div.
Publications of the National Bureau of Standards 1981 Catalog: A Compilation of Abstracts and Key Word and Author Indexes.
Rept. for Jan-Dec 81.
B. L. Burris, and R. J. Morehouse. May 82, 476p NBS-SP-305-SUPPL-13
See also 1980 Catalog, PB82-104688. Library of Congress catalog card no. 48-47112.

Keywords: *Bibliographies, *Research, *Indexes(Documentation), Catalogs(Publications), Abstracts, Periodicals, Authors, National government, Subject index terms, Physics, Mathematics, Chemistry, Engineering, Computers, National Bureau of Standards, *Scientific research, Keywords.

The report is the 13th Supplement to Special Publication 305 which lists the 1981 papers reflecting the results of the National Bureau of Standards programs. Also included are those NBS papers published prior to 1981 but not reported in previous supplements of SP305. In addition to bibliographic data, key words, and abstracts for each publication and/or paper, the catalog provides an author and key word index.

710,370
PB82-251216 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Glossary of Terms for Robotics.
Interim technical rept. Jan 79-Mar 80.
B. M. Smith, T. B. Sheridan, J. S. Albus, A. J. Barbera, and G. J. Vanderbrug. Oct 80, 90p NBSIR-81-2340
Contract MIPR-SY-1455-78-00003

Keywords: *Robots, *Dictionaries, Automation, Manufacturing, Computer programming.

The use of emerging robotics technology along with that of numerical control of machining processes offers enormous promise for improving productivity in discrete part batch manufacturing operations. This glossary of terms has been assembled in order that users, vendors, researchers, students, teachers, and others involved with the rapidly developing field of robotics may communicate in terms which are shared and understood in common. There is no claim that the definitions provided are in any sense standards accepted by any official body.

710,371
PB83-132704 PC **A13**/MF **A01**
National Bureau of Standards, Washington, DC.
NBS Serial Holdings 1982.
M. L. Kingston. Sep 82, 290p NBSIR-82-2575
Supersedes PB81-203739.

Keywords: *Periodicals, *Bibliographies, Libraries, Collection, National government, Library collections, National Bureau of Standards.

This publication contains holdings information for approximately 4600 titles representing current and noncurrent journals, periodicals, annuals, memoirs, proceedings, and transactions. The holdings of the NBS Library and 3 collections specializing in fire research, standards, and diffusion in metals are represented.

710,372
PB83-215632 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Coal Taxonomy Thesaurus of Terms.
Final rept.
A. D. Davies, and A. P. Cramp. Dec 81, 83p NBSIR-81-2405
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Coal, *Thesaurus, *Information retrieval, Coal mining, Safety, Health, Environmental impact, Terminology, Data retrieval, Index terms.

This report contains a thesaurus to help public and private users find and retrieve information on regulations and standards which apply both to coal technologies and coal-related environmental, safety and health issues. Document indexers may also find it helpful. The thesaurus was designed to be structurally compatible with the document storage and retrieval systems now in use by the Department of Energy (DOE) so that absorption into DOE's system could be convenient and practical. The arrangement of the thesaurus, the code system that represents the terms used in the indexing and search processes, and instructions for its use are described. The hierarchies of index terms in the thesaurus are illustrated.

710,373
PB83-233106 Not available NTIS
National Bureau of Standards, Washington, DC.
GAMS Classification Scheme for Mathematical and Statistical Software.
Final rept.
R. F. Boisvert, S. E. Howe, and D. Kahaner. Jan 83, 9p
Pub. in SIGNUM Newslett. 18, n1, p10-18 Jan 83.

Keywords: *Classifications, Mathematical programming, Statistical analysis, Coding, *Computer software, *GAMS classification scheme.

An extensive tree-structured problem-oriented scheme for classifying mathematical and statistical software is presented. The scheme is a substantially modified version of a scheme proposed by Bolstad, which was based on the widely-used SHARE system. In an attempt to reflect more accurately the current state of mathematical and statistical software, this scheme reflects a substantial reorganization of broad subject areas as well as considerable tuning at more detailed levels. Our changes resulted from using the Bolstad scheme as the basis for the NBS Guide to Available Mathematical Software (GAMS), which provides NBS scientists information about subprograms in the IMSL, NAG, and PORT libraries, and in dozens of public-domain subprogram packages.

710,374
PB84-202670 PC **A19**/MF **A01**
National Bureau of Standards, Washington, DC. Technical Information and Publications Div.
Publications of the National Bureau of Standards, 1982 Catalog.
Special pub. Jan-Dec 82.
R. J. Morehouse. Jun 83, 445p NBS/SP-305-SUPPL-14
Also available from Supt. of Docs as SN003-003-02501-1. Library of Congress catalog card no. 48-47112. See also PB82-242462.

Keywords: *Bibliographies, *Research, *Indexes(Documentation), Catalogs(Publications), Periodicals, Abstracts, Authors, National government, Subject index terms, Physics, Mathematics, Chemistry, Engineering, Computers, *Scientific research, Keywords, National Bureau of Standards.

The 14th Supplement to Special Publication 305 lists the 1982 papers which reflect the results of the National Bureau of Standards programs. Also included are those NBS papers published prior to 1982 but not reported in previous supplements of SP305. In addition to bibliographic data, key words, and abstracts for each publication and/or paper, the catalog provides an author and key word index.

710,375
PB84-203439 PC **A16**/MF **A01**
National Bureau of Standards, Washington, DC.
Directory of International and Regional Organizations Conducting Standards-Related Activities.
Final rept.
M. A. Breitenberg. Apr 83, 370p NBS/SP-649
Library of Congress catalog card no. 83-600511.

Keywords: *Directories, *Standardization, Foreign countries, Organizations, International relations.

This directory contains information on 272 international and regional organizations which conduct standardization, certification, laboratory accreditation, or other standards-related activities. This volume describes their work in these areas, as well as the scope of each organization, national affiliations of members, U.S. participants, restrictions on membership, as well as the availability of any standards in English. This volume summarizes an effort by the National Bureau of Standards to obtain information relevant to monitoring U.S. participation in the many international organizations active in standardization. It is designed to serve the needs to Federal agencies and standards writers for information on international and regional organizations involved in standardization and related activities. It may also be useful to manufacturers, engineers, purchasing agents, and others.

710,376
PB84-246073 Not available NTIS
National Bureau of Standards, Washington, DC.
Robot: An Entry in the Encyclopedia Americana.
Final rept.
J. S. Albus. 1983, 12p
Pub. in Encyclopedia Americana 23, p582-583 1983.

Keywords: *Robots, *Artificial intelligence, Automata theory, Utilization, Encyclopedias, Reviews, Reprints, Robotics.

A robot is defined. A short history of automata and a review of the literature dealing with robots is given. Common industrial robot applications are listed, and a brief outline of some of the leading research topics in robotics is presented.

710,377
PB85-119501 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Information Resources and Services Div.
Abstract and Index Collection - National Bureau of Standards Library (Second Edition).
D. Cunningham. Aug 84, 48p NBSIR-84/2933

Keywords: *Abstracts, *Indexes(Documentation), Collection, Descriptions, *National Bureau of Standards.

An alphabetical arrangement of abstracts and indexes available at the National Bureau of Standards (NBS) Library is listed by most current title of the publication. Other information includes description of the abstract or index, library holdings, principal sources, publisher or association, corresponding data base and the classification number. A general subject and former title index follow the main text of the report.

710,378
PB85-245678 PC **A19**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Information Resources and Services Div.
Publications of the National Bureau of Standards, 1984 Catalog.
Rept. for Jan-Dec 84.
R. J. Morehouse. Jun 85, 441p NBS/SP-305-SUPPL-16
See also PB84-218031. Also available from Supt. of Docs as SN003-003-02667-1.

Keywords: *Catalogs(Publications), Aeronautics, Astronomy, Astrophysics, Atmospherics, Medicine, Sociology, Chemistry, Electronics, Electrical engineering, Materials, Physics, Mechanical engineering, Fuels, Propulsion, Abstracts, US NBS.

The 16th Supplement to Special Publication 305 lists the 1984 papers which reflect the results of National Bureau of Standards programs. Also included are those NBS papers published prior to 1984 but not reported in previous supplements of SP305. In addition to bibliographic data, key words, and abstracts for each publication and/or paper, the catalog provides author, key word, title, and NTIS order/report number indexes.

710,379
PB86-129707 PC **A03**/MF **A01**

National Bureau of Standards, Gaithersburg, MD. Public Information Div.
NBS (National Bureau of Standards) Research Reports, September 1985.
S. Shaffer. Sep 85, 37p NBS/SP-680-4
See also PB85-236354. Library of Congress catalog card no. 85-600575.

Keywords: *Research projects, Ceramics, Fiber optics, Antennas, Optical communication, Preserving, Freezing, Pollution, Magnetic domains, Imaging techniques, Computer software, National Bureau of Standards.

Contents: Research Update; NBS High-Tech Ceramics Program Geared to Needs of Industry; NBS Advanced-Ceramics Expertise, Facilities Available to Industry; Fiber Optics-Lighting the Way to a Communications Revolution; New Technique for Measuring Antenna Performance Pays Off; Seven NBS Inventions Picked as Significant Technological Advances; Assets Frozen as Researchers Put Pollution Problems on Ice; New Instrument Allows Observation of Surface Magnetic Microstructure; Open Systems in Software; New Publications; Conference Calendar.

710,380
PB86-154408 MF **E04**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
KWIC Index of U.S. Voluntary Engineering Standards.
Jan 86, 2664p
Supersedes COM 71-50172.
Microfiche copies only (ten sheets of 48X reduction).

Keywords: *Engineering, *Standards, Indexes(Documentation).

The index contains the permuted titles of more than 28,000 standards, specifications, test methods and recommended practices published by 422 U.S. standards-developing organizations. Each title can be found under all the significant key words which it contains. These key words are arranged alphabetically down the center of each page together with their surrounding context. The date of publication or last revision, the standard number and an acronym designating the standards-issuing organization appear as part of each entry.

710,381
PB86-165354 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
FIREDOC Vocabulary List.
N. H. Jason. Sep 85, 112p NBSIR-85/3231

Keywords: *Terminology, *Fire safety, Fires, Indexes(Documentation), Information retrieval.

The FIREDOC Vocabulary List contains over 4000 entries and reflects the subject matter of published reports, articles and documents comprising the Fire Research Information Services (FRIS). The keywords are geared toward the needs of the users of this collection. The vocabulary was originally used to develop a small fire safety database for NASA/ASRDI (Aerospace Safety Research and Data Institute). FIREDOC is the on-line bibliographic data of this collection.

710,382
PB86-191871 PC **A08**/MF **A01**
Toth (R.B.) Associates, McLean, VA.
Federal Government Certification Programs for Products and Services.
Final rept.
R. B. Toth. Apr 86, 160p NBS/SP-714
Also available from Supt. of Docs as SN003-003-02719-7. Library of Congress catalog card no. 86-600516. Sponsored by National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.

Keywords: *Directories, *National Government, *Services, Regulations, Standards, Inspection, Industries, Data bases, *Certification, *Commodities.

The directory presents information on 61 U.S. Government certification programs for products and services. Entries describe the scope and nature of each certification program, testing and inspection practices, standards used, methods of identification and enforcement, reciprocal recognition or acceptance of certification, and other relevant details. The directory is part of an ongoing NBS effort to establish and maintain a comprehensive database on standards, regulations, certification programs and related information. The material has been compiled to meet the needs of government, industry, and the public for information on U.S. Government certification programs in accordance with the requirements of the U.S. Trade Agreements Act of 1979.

710,383
PB86-193083 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
National Standard Reference Data System of the United States.
Final rept.
D. R. Lide. 1984, 4p
Pub. in Computer Physics Communications 33, n1-3 p207-210 Aug/Sep 84.

Keywords: *Standards, *Physics, Information centers, United States, Evaluation, Reprints, *Standard reference data.

The operation of the National Standard Reference Data program is described. A list of data centers of interest to the physics community is given.

710,384
PB86-201290 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Publication Announcements Covering Center Programs, July to September 1985 with 1986 CEEE Events Calendar.
E. J. Walters. Apr 86, 22p NBSIR-86/3366

Keywords: *Bibliographies, *Electronics, *Electrical engineering, National Bureau of Standards.

This is the sixth issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. The issue of the CEEE Technical Publication Announcements covers the third quarter of calendar year 1985.

710,385
PB86-215142 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Public Information Div.
NBS (National Bureau of Standards) Research Reports, May 1986.
May 86, 34p NBS/SP-680/5
See also PB86-129707. Library of Congress catalog card no. 86-600534.

Keywords: *Research projects, Surface roughness, Polymers, Standards, Commerce, International trade, Algae, Diets, Stellar magnetic fields, Image processing, Flare stars, US NBS.

Contents:
- Research update;
- A perspective on the future of NBS;
- Surface roughness monitor for advanced manufacturing developed;
- Artificial vision device performs high-speed processing of images;
- Taking the 'guesswork' out of making polymer blends;
- Standards and global trade--a government perspective;
- Counterfeit chlorophyll, artificial algae-the perfect energy device;
- Burgers, fries, pizza pies--all part of massive study of worldwide diets;
- JILA astronomers first to detect magnetic fields on a flare star;
- New publications;
- Conference calendar.

710,386
PB86-232006 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, October-December 1985 with 1986 CEEE Events Calendar.
E. J. Walters. Jun 86, 36p NBSIR-86/3344/2
See also PB85-191393.

Keywords: *Electronics, *Electrical engineering, *Bibliographies, National Bureau of Standards.

This is the thirteenth issue of a quarterly publication providing information on the technical work of the National Bureau of Standards Center for Electronics and Electrical Engineering. The issue of the CEEE Technical Progress Bulletin covers the fourth quarter of calendar year 1985. Abstracts are provided by technical area for both published papers and papers approved by NBS for publication.

710,387
PB86-237260 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Public Information Div.
NBS (National Bureau of Standards) Research Reports, February 1985.
S. Shaffer. Feb 85, 36p NBS/SP-680/2
See also PB85-127421. Library of Congress catalog card no. 84-601166.

Keywords: *Research projects, *Technology assessment, Computer networks, Earthquakes, Radiation, Metal industry, Alloys, National Bureau of Standards.

This report covers the following topics: Research update; NBS and steel producers join in high-risk research; Metals-processing technology for the future; Diagrams for designing alloys; Radiation: Keeping the genie under control; Tools and technology for the building industry; New facility used to simulate earthquake forces; Welcome to the new computer age: The era of networks; NBS perspective on open systems interconnection; NBS adds credibility to energy-related inventions; New publications, and Conference calendar.

710,388
PB86-247616 PC **A07**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Information Resources and Services Div.
Data Bases Available at the National Bureau of Standards Research Information Center (Fifth Edition).
D. Cunningham. Jul 86, 135p NBSIR-86/3428
See also 3rd edition, PB83-155986.

Keywords: *Information systems, *Directories, Information centers, Indexes(Documentation), *Bibliographic data bases, *Data bases, National Bureau of Standards.

An alphabetical listing of data bases available online at the National Bureau of Standards (NBS) Research Information Center is listed by either acronym or full title of the data base. Other additional information includes description of the data base, period of coverage, producer(s), corresponding hard copy, principal sources and vendors. A general subject index and a cross reference index to the data bases are also supplied.

710,389
PB87-106720 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Journal of Research of the National Bureau of Standards.
Final rept.
C. Eisenhart. 1985, 6p
Pub. in Encyclopedia of Statistical Sciences v6, p150-155 1985.

Keywords: *Periodicals, Research, National Bureau of Standards.

The founding of the Bureau, its primary mission and expanded scope through subsequent legislation. History of its Journal of Research, with particular attention to papers published from 1947 through 1982 that contain material on probability theory, statistical theory and methodology, or applications thereof of potential interest to statisticians and teachers of statistics.

710,390
PB87-129011 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Materials.
CODATA Role in International and Interdisciplinary Cooperation.
Final rept.
D. R. Lide. 1984, 2p
Pub. in Computer Physics Communications 33, n1-3 p205-206 Aug/Sep 84.

Keywords: Scientific societies, Experimental data, Data processing, Standards, Distributing, Reprints, *Scientific data, *Interdisciplinary cooperation, Inter-

national cooperation, Data compilation, Disseminating, References(Standards).

International cooperation in the compilation of scientific data is briefly reviewed. The organization and administrative structure of CODATA are described. Several types of CODATA activities are summarized.

710,391
PB87-133377 MF **E06**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
KWIC Index of U.S. Voluntary Engineering Standards.
Mar 87, 3007p
Supersedes PB86-154408.
Microfiche copies only (twelve sheets of 48X reduction).

Keywords: *Engineering, *Standards, Indexes(Documentation), Subject index terms, Specifications, Tests, United States, Engineering standards, Product standards.

The index contains the permuted titles of more than 28,000 standards, specifications, test methods, and recommended practices published by approximately 400 U.S. standards-developing organizations. Each title can be found under all the significant key words which it contains. These key words are arranged alphabetically down the center of each page together with their surrounding context. The date of publication or last revision, the standard number and an acronym designating the standards-issuing organization appear as part of each entry.

710,392
PB87-166401 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 92, Number 1, January-February 1987.
Feb 87, 84p
See also PB87-166419 through PB87-166476, and PB87-137154. Also available from Supt. of Docs as SN703-027-00014-8.

Keywords: *Research, Temperature measurement, Eddy current tests, Surfaces, Water vapor, Steam, Thermodynamic properties, Units of measurement, Data processing security, Fiber optics, Optical communication, Standards, Light speed, SQUID devices, Computer security, Optical fibers.

Contents: The continuity of the meter--The redefinition of the meter and the speed of visible light; The NBS scale of radiance temperature; Detection and sizing of surface flaws with a SQUID-based eddy current probe; Ideal gas thermodynamic functions for water; Report on the 17th session of the consultative committee on electricity; Computer security-for today...and for tomorrow; Symposium on optical fiber measurements.

710,393
PB87-181251 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 92, Number 2, March-April 1987.
Apr 87, 85p
See also PB87-181269 through PB87-181293, and PB87-166401. Also available from Supt. of Docs as SN703-027-00015-6.

Keywords: *Research, Fundamental constants, Ultraviolet detectors, Far ultraviolet radiation, Standards, Microphones, Acoustic measurement, Phase transformations, Membranes, Raman spectroscopy.

Articles included within this Journal include the following: The 1986 CODATA Recommended Values Of the Fundamental Physical Constants; Far Ultraviolet Detector Standards; Description of the Thermotropic Behavior Of Membrane Bilayers In Terms of Raman Spectral Parameters: A Two-State Model; Free-Field Reciprocity Calibration Of Microphones.

710,394
PB87-181988 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
FIREDOC Vocabulary List, 2nd Edition,
N. H. Jason. Apr 87, 116p NBSIR-87/3545
See also report dated Sep 85, PB86-165354.

Keywords: *Terminology, *Fire safety, Fires, Indexes(Documentation), Information retrieval, *FIREDOC vocabulary.

The second edition of the FIREDOC Vocabulary List contains over 4000 entries and reflects the subject matter of published reports, articles and documents comprising the Fire Research Information Services (FRIS) collection. As the database becomes more retrospective, the keywords will reflect the addition of these references from the collection.

710,395
PB87-210258 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
NBS (National Bureau of Standards) Research Reports (April 1987).
Special pub.
Apr 87, 37p NBS/SP-721
Library of Congress catalog card no. 86-600603.

Keywords: *Research projects, Surface properties, Microstructure, Malignant neoplasms, Prevention, Manufacturing, Physical properties, Hotels, Fire prevention, Air pollution, Documents, Meetings, US NBS, Parallel processing(Computers).

The table of contents includes: Research update; Surface science: Thin is in; Mapping microstructures: A quest for the 'smoking gun'; Parallel processing research: Turning supercomputing promise into practice; Cancer prevention research examines micronutrient levels in the body; Manufacturing technology for the second industrial revolution; New values recommended for the fundamental physical constants; Equations and models used to investigate hotel fire; Atmospheric contaminants targets in NBS version of 'dating' game; New publications; and Conference calendar.

710,396
PB88-113774 PC **A11**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Information Resources and Services Div.
NBS (National Bureau of Standards) Serial Holdings 1987,
M. L. Kingston. Sep 87, 235p NBSIR-87/3590
Supersedes PB83-132704.

Keywords: *Periodicals, *Bibliographies, Libraries, Collection, National government, Library collections, National Bureau of Standards.

The publication contains holdings information for approximately 5,000 titles held in the NBS Research Information Center, representing current and noncurrent journals, periodicals, annuals, memoirs, proceedings and transactions.

710,397
PB88-124409 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 92, Number 5, September-October 1987.
1987, 58p
Also available from Supt. of Docs. as SN703-027-00018-1. See also PB88-124417 through PB88-124441.

Keywords: *Research, Hall effect, Potentiometers(Instruments), Alpha particle detectors, Radiation counters, Mossbauer effect, Photometry, Quantum Hall effect, Image reconstruction, Tomography, Luminous intensity, Candela.

Articles include the following: An automated potentiometric system for precision measurement of the quantized hall resistance; The NBS large-area alpha-particle counting system; Mossbauer imaging; International intercomparisons of photometric base units.

710,398
PB88-153754 PC **A07**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Information Resources and Services Div.
Data Bases Available at the National Bureau of Standards Research Information Center (Sixth Edition),
D. Cunningham, and C. Kline. Jul 87, 147p NBSIR-87/3658
Supersedes PB86-247616.

Keywords: *Information systems, *Directories, Information centers, *Bibliographic data bases, *Data bases, *National Bureau of Standards.

Data bases available online at the National Bureau of Standards (NBS) Research Information Center are listed by acronym and by full title. In addition, descriptions of the data bases, periods of coverage, producers, corresponding hard copy titles and principal sources and vendors are listed. A general subject index and a cross reference index are also supplied.

General

710,399
AD-A133 294/9 Not available NTIS
National Bureau of Standards, Washington, DC. National Measurement Lab.
Ab Initio Determination of the Ground State Potential Energy Curve for Ar2.
M. Krauss, and W. J. Stevens. 22 Jan 82, 6p
Pub. in Chemical Physics Letters, v85 n4 p423-427, 22 Jan 82.

Keywords: *Argon, *Ground state, *Potential energy, Distribution curves, Dispersion relations, Reprints, NTISDODXR, NTISDODAF.

No abstract available.

710,400
COM-74-10950 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
LEAA Police Equipment Survey of 1972. Volume II. Communications Equipment and Supplies.
Final rept.
S. Mumford, P. Klaus, E. Bunten, and R. Cunitz.
1973, 166p

Keywords: *Police, *Communication equipment, Radio equipment, Helmets, Portable equipment, Mobility, Standards, Power supplies.

The report outlines the methodology of and summarizes a portion of the data from the LEAA Police Equipment Survey of 1972. One of a series of seven reports resulting from this nationwide mail survey of a stratified random sample of police departments, the present report summarizes the answers of 428 police departments concerning their communications equipment and supplies: Use of mobile radios and portable radios; power supplies for portable radios; scramblers; portable/mobile radios; helmets with built-in communications; and needs for standards and problems associated with communications equipment and supplies. The data are presented by all responding departments and by seven department types.

710,401
COM-74-11009 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
LEAA Police Equipment Survey of 1972. Volume III. Sirens and Emergency Warning Lights.
Final rept.
P. C. Klaus, and E. Bunten. Sep 73, 146p

Keywords: *Police vehicles, *Sirens, *Warning systems, *Lighting equipment, Surveys, Police, Questionnaires, Mail canvasses, Basic training, Classifications, Data acquisition, Methodology, *Warning lights, *Police equipment.

The report outlines the methodology of and summarizes a portion of the data from the LEAA Police Equipment Survey of 1972. One of a series of seven reports resulting from this nationwide mail survey of a stratified random sample of police departments, the present report summarizes the answers of 437 police departments concerning their sirens and emergency warning lights: use of sirens and lights; experience with most commonly used electronic sirens, electromechanical sirens, and emergency warning lights; purchasing, repair and replacement of this equipment; and training of officers in use of this equipment. The data are presented by all responding departments and by seven department types.

710,402
COM-74-11010 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
LEAA Police Equipment Survey of 1972. Volume VI. Body Armor and Confiscated Weapons.
G. Hare, E. Bunten, and P. Klaus. Oct 73, 102p

Keywords: *Police, *Body armor, *Weapons, Surveys, Questionnaires, Mail canvasses, Protection, Data ac-

quisition, Classification, Gunshot wounds, Statistical data, *Police equipment, Confiscated weapons.

The report outlines the methodology of and summarizes a portion of the data from the LEAA Police Equipment Survey of 1972. One of a series of seven reports resulting from a nationwide mail survey of a stratified random sample of police departments, it summarizes the answers of 440 police departments concerning body armor and confiscated weapons: Preference for hidden or visible body armor; Use of other ballistic protective equipment; Routine operations where body armor would be most useful; Current problems and failures with present equipment; Needs for standards for the testing and assessment of penetration capabilities of body armor; Disposition of confiscated weapons. The data are presented by all responding departments and by seven department types.

710,403
COM-74-11011 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
LEAA Police Equipment Survey of 1972. Volume VII. Patrolcars.
E. Bunten, and P. Klaus. Jul 73, 148p

Keywords: *Police vehicles, *Facilities management, Surveys, Questionnaires, Mail canvasses, Urban areas, Purchasing, Methodologies, Accessories, Equipment, Utilization characteristics, Standards, Requirements, Classifications, Information systems, *Police equipment, Patrol cars.

The report outlines the methodology of and summarizes a portion of the data from the LEAA Police Equipment Survey of 1972. One of a series of seven reports resulting from this nationwide mail survey of a stratified random sample of police departments, the present report summarizes the answers of 449 police departments concerning their patrolcars: Purchasing practices; types of options and accessories usually selected; types of equipment stored in the patrolcar; typical patterns of use; and needs for standards for systems or aspects of patrolcars. The data are presented by all responding departments and by seven department types.

710,404
COM-74-11239 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
LEAA Police Equipment Survey of 1972. Volume V. Handguns and Handgun Ammunition.
S. Bergsman, E. Bunten, and P. Klaus. 1973, 104p

Keywords: *Police, *Revolvers, *Small arms ammunition, Equipment, Surveys, Questionnaires, Utilization, Classifications, Problem solving, Officer personnel, *Police equipment, *Handguns, *Handgun ammunition, Calibers.

The report outlines the methodology of and summarizes a portion of the data from the LEAA Police Equipment Survey of 1972. One of a series of seven reports resulting from this nationwide mail survey of a stratified random sample of police departments, the present report summarizes the answers of 445 police departments concerning their officers' use of handguns and handgun ammunition: on-duty and off-duty use, types and calibers in use, and problems encountered. The data are presented by all responding departments and by seven department types.

710,405
COM-74-11480 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation of Structural Properties of Masonry in Existing Buildings.
S. G. Fattal, and L. E. Cattaneo. Jul 74, 126p

Keywords: Analysis, Compressive strength, Deflection, Design, Flexural strength, *Masonry walls, Racking strength, Seismic loading, Shear strength, Shear wall, Stiffness.

The current state of knowledge on the structural behavior of masonry is synthesized to develop a methodology for the evaluation of the load capacity of masonry walls in existing buildings. A procedure is described for direct sampling and testing of specimens removed from masonry walls of buildings to determine their strength in shear, flexure and compression, and to measure their load-deformation characteristics. A documentation of strength and stiffness properties obtained from available test data is included to provide an alternate source of information on masonry of comparable construction. Sample calculations of masonry building analysis for seismic forces are given in Appendices A and B.

710,406
COM-74-11767 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
LEAA Police Equipment Survey of 1972. Volume I. The Need for Standards - Priorities for Police Equipment.
R. Ku, E. Bunten, and P. Klaus. Jul 73, 206p

Keywords: *Police, *Law enforcement equipment, Standards, Mail canvasses, Surveys, Security, Geographic area, Protection, Communication equipment, Weapons, Vehicles, Buildings, Warning systems, Rescue equipment, Surveillance, Detection, Priorities.

The report describes methodology and summarizes a portion of the data from the LEAA police equipment survey of 1972. One of a series of seven reports resulting from this nationwide mail survey of a stratified random sample of 1386 police departments, it summarizes the answers of 1100 police departments concerning the need for performance standards for items of law enforcement used in their departments. Each sample department was asked to rank one list of equipment categories and nine lists of equipment items within those categories in terms of the need for standards for those equipment within their own departments. The data are presented by seven department types and ten LEAA geographical regions.

710,407
COM-74-11771 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
LEAA Police Equipment Survey of 1972. Volume IV. Alarms, Security Equipment, Surveillance Equipment.
J. L. Eldreth, E. D. Bunten, and P. A. Klaus. Jul 74, 149p

Keywords: *Police, *Law enforcement equipment, Mail canvasses, Surveys, Warning systems, Night vision, Closed circuit television, Video tapes, Cameras, Standards, Surveillance, Security, Questionnaires.

The report outlines the methodology of and summarizes a portion of the data from the LEAA Police Equipment Survey of 1972. One of a series of seven reports resulting from this nationwide mail survey of a stratified random sample of police departments, the present report summarizes the answers of 447 police departments concerning their use of alarm systems, cameras, security equipment, and surveillance equipment: purchasing practices, typical patterns of use, and needs for standards for such equipment. The data are presented by all responding departments and by seven department types.

710,408
COM-74-51150 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of Force Fields by Analysis of Centrifugal Distortion in Microwave Spectra.
W. H. Kirchhoff. 1974, 11p

Keywords: *Molecular vibration, Spectrum analysis, Microwave spectra, Carbenes, Ozone, Sulfur dioxide, Methylene carbenel difluore, Oxygen fluoride(OF2), Silicon fluorides, Oxygen chlorides, Sulfur fluorides, *Force constants, Reprints.

The paper describes the accuracy of molecular force fields derived from centrifugal distortion constants. Only bent, symmetric, triatomic molecules are discussed. The discussion deals primarily with the discrimination between the effects of measurement and model errors. The accuracy of the force field is judged by calculating from the force constants of the harmonic, fundamental vibrational frequencies and comparing these with the harmonic frequencies obtained from the infrared spectrum. This comparison, in turn, is measured against measurement errors arising from a statistical analysis of the microwave spectra. The particular molecular species for which such an analysis has been performed are SO2, OF2, SiF2, O3, OCl2, CF2, and SF2.

710,409
COM-75-50520 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Finite Difference Techniques for Diffusion and Redistribution Problems with Segregation-Type Boundary Conditions.
R. Kraft. 1975, 6p

Keywords: *Semiconductors(Materials), *Impurities, *Diffusion theory, Boron, Silicon, Partial differential equations, Finite difference theory, Computation.

Finite difference techniques and a particular computer algorithm are given for a one dimensional diffusion problem in a composite domain with time dependent domain and moving interfacial boundary. The physical problem involves the redistribution of an impurity (boron) caused by the oxidation of a semiconducting crystal (silicon). The boundary conditions at the interfacial boundary express conservation of mass and the propensity of the impurity to be dissolved in one rather than the other of the two adjacent materials (the segregation condition). The novel feature of the algorithm is its employment of the integral form of the conservation of mass boundary condition instead of the conventionally used differential form.

710,410
CONF-780421 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Computers in Activation Analysis and Gamma-ray Spectroscopy.
B. S. Carpenter, M. D. D'Agostino, and H. P. Yule. 1979, 905p

Keywords: *Activation analysis, Computers, Data processing, Gamma-ray spectroscopy, X-ray spectroscopy.

The increased utilization of nuclear analytical techniques in industrial, biomedical, security, and research fields has resulted in a heavy reliance on computers for providing the speed, accuracy, and automation required by current-day demands. Fortunately, the advent of minicomputers and microcomputers has greatly facilitated the implementation of control and data-reduction functions relating to activation analysis and gamma-ray and x-ray spectroscopy. However, the ever increasing availability and widespread use of these computers also have resulted in a 'computer in every lab', and with it the inevitable overlap in the development of software, the occasional 'reinvention of the wheel,' and the raising of questions on how to best make use of newly acquired capability. Of the few symposiums held on this subject, the last one, Applications of Computers to Nuclear and Radiochemistry, was held in 1962. Included in the proceedings of that conference (published in 1963) were papers on decay-curve analysis, unfolding of pulse-height spectra, least-squares analysis of beta-ray and gamma-ray spectra, and programs to obtain quantitative results from activation-analysis spectra. Although the many advances made in these areas over the past 15 years have been reported in the proceedings of other symposia, such as the Modern Trends in Neutron Activation Analysis conferences, or in the scattered open literature, there has not been available a single reference source on this subject matter.

710,411
DE84750351 Not available NTIS
Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).
Perspectives in High Energy Nuclear Collisions.
J. Rafelski, and M. Danos. Aug 83, 80p

Keywords: *Deep inelastic heavy ion reactions, *Nuclear reactions, *Quark matter, Gluon model, Kaons minus, Kaons plus, Multiple production, Multiplicity, Nuclear matter, Phase transformations, Quark model, Relativistic plasma, Relativistic range, Reviews, Thermodynamics, *Foreign technology, ERDA/653003, ERDA/645204, NTISDEE.

This report gives an overview of some aspects of hadronic physics relevant for the conception of a research facility devoted to the study of high energy nuclear collisions. Several concepts to be studied in nuclear collisions are selected, with emphasis placed on the properties and nature of the quark-gluon plasma, the formation of the plasma state in the central region and its anticipated lifetime, and the observability, through strangeness content of this new form of nuclear matter.

710,412
ERDA-76/154 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Joint U.S.--U.S.S.R. Test of U.S. Mhd Electrode Systems in U.S.S.R. U-02 Mhd Facility (Phase I). Final Report.
Final rept.
W. R. Hosler. 1976, 262p

Keywords: *Cerium oxides, *Mhd generators, *Tantalum oxides, *Yttrium oxides, *Zirconium oxides, Chemical composition, Coordinated research programs, Cracks, Crystal structure, Current density, Design, Electric conductivity, Electrodes, Fractures, Materials, Microstructure, Performance testing, Phase transformations, Physical properties, Plasma seeding, Porosity, Service life, Test facilities, Thermal diffusivity, Thermal expansion, USA, USSR, ERDA/300103, ERDA/360204, ERDA/360205, *Magnetohydrodynamics.

This report was jointly prepared for the Energy Research and Development Administration by the Battelle Pacific Northwest Laboratory, the National Bureau of Standards, the Westinghouse Research and Development Laboratory and the U.S.S.R. Institute of High Temperatures. The report presents the results of the first joint U.S.-U.S.S.R. test of U.S. MHD electrode materials in the U.S.S.R. U-02 MHD Facility. The electrode walls were designed and built by the Westinghouse Research and Development Laboratory. The joint test was conducted in implementation of the understanding regarding open-cycle MHD cooperation reached between representatives of the U.S. and U.S.S.R. Joint Working Group for Energy held in Moscow, October 6, 1972, and endorsed as a cooperative program by the U.S.-U.S.S.R. Joint Committee for Scientific and Technical Cooperation at its meeting in Washington, D.C., March 21, 1973. Work on the program was affirmed by the U.S.-U.S.S.R. Joint Committee on Energy at its October 3-4, 1974 meeting in Washington, D.C.

710,413
FIPS PUB 10-3 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Countries, Dependencies, Areas of Special Sovereignty, and Their Principal Administrative Divisions. Category: Data Standards and Guidelines. Subcategory: Representations and Codes.
Federal information processing standards (Final).
S. S. Shaw, and J. L. Walkowicz. 9 Feb 84, 70p
Supersedes FIPS PUB 10-2. Errata sheet inserted.
Three ring binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Coding, *Countries, Standards, Data, Information processing, *Federal information processing standards, *Geographic areas, Geocoding.

The Standard sets forth a list of the basic geopolitical entities in the world, together with the principal divisions that comprise each entity. The generic name of each division type is given. The Standard also provides a four-character alphanumeric identifier for each division listed. The two-character alphabetic portion of this identifier serves as the country code of a basic entity. This code is identical to that published in Federal Information Processing Standard (FIPS) 10-2, Countries, Dependencies, and Areas of Special Sovereignty. The remainder of the identifier, primarily numerical, differentiates the principal divisions in each basic entity. This Standard supersedes FIPS 10-2 in its entirety.

710,414
FIPS PUB 84 PC **E04**
National Bureau of Standards, Washington, DC.
Microfilm Readers. Category: Hardware Standard. Subcategory: Computer Output Microfilm Readers.
Federal information processing standards (Final).
T. C. Bagg. c1979, 14p
Three ring vinyl FIPS binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Microfilm reader-printers, Standards, National government, Film readers, Data displays, *Federal information processing standards, *Computer output microfilm.

The objective of this standard is to facilitate effective information interchange when the information is recorded on microforms generated by computer systems. The standard defines the minimum acceptable image quality for microfilm reading devices for the display of computer output microforms. It also sets requirements for heat and noise factors associated with the safe use of such reading devices. This standard adopts in whole the American National Standard for Microfilm Readers (ANSI/NMA MS20-1979). (Copyright (c) 1979 by the National Micrographics Association.)

710,415
N78-16119/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamic and Related Properties of Oxygen from the Triple Point to 300 K at Pressures to 1000 Bar.
L. A. Weber. Dec 77, 164p
Pub. in NASA Reference Pub. 1011 1977.

Keywords: *Oxygen, Pressure, *Thermodynamic properties, Acoustic velocity, Density(Mass/volume), Enthalpy, Entropy, Specific heat, *Triple point.

The results of an experimental program are presented in the form of PVT data in the temperature range 58 to 300 K at pressures up to 800 bar. Tables of the derived thermodynamic properties on isobars to 1000 bar are given, including density, internal energy, enthalpy, entropy, specific heats at constant volume and constant pressure, velocity of sound, and the surface derivatives (delta P/delta T) sub rho and (delta P/delta Rho) sub T. Auxiliary tables in engineering units are also given. The accuracy of the data is discussed and comparisons are made with previous data.

710,416
PB-264 315/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Federal Sector.
Final rept.,
M. M. Henderson. 1976, 31p
Pub. in The Information Age: Its Development, Its Impact p91-121 1976.

Keywords: *Libraries, *Information services, Technology innovation, Librarians, Documentalists, National government, Growth, Reviews, Federal agencies.

The chapter reviews the significant accomplishments in library and information sciences in the Federal Government over a ten year period (1965-1975). Federal librarians and information scientists were faced with a number of problems but also offered some special promises: major support for innovative developments came from Federal sources, for example, and cooperative programs have resulted in resource sharing on a number of fronts. The chapter follows a chronological path to trace developments and activities; those discussed in different context in other chapters are not covered in detail in this one. A list of sources and recommended reading is included for the reader's reference.

710,417
PB-276 907/3 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Library Div.
Impact of the New Copyright Law on Interlibrary Loan in a Research Library,
E. Cerutti, and J. C. Tucker. 26 Jan 78, 21p NBSIR-78-1427

Keywords: *Copyright, *Periodicals, *Loans, Purchasing, Libraries, Cost effectiveness, Legislation, Photocopying, Law(Jurisprudence), *Interlibrary loans, National Bureau of Standards.

A study of interlibrary loan borrowing at the National Bureau of Standards Library in 1976 was made, to forecast the impact of the new copyright law on the Library budget. The study indicates that the majority of journals are requested only once, and that a number of foreign journals are requested. An analysis of subscription cost compared to interlibrary loan cost suggests criteria for management decisions on subscription, as well as testing the fairness of the CONTU guidelines in their economic impact on libraries.

710,418
PB-281 929/0 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Transfer of Monochrome Video Information from Magnetic Tape to Motion Picture Film for Archival Storage,
J. C. Richmond. May 78, 17p NBS-SP-480-31
Prepared for National Inst. of Law Enforcement and Criminal Justice, Washington, D.C. Library of Congress Catalog Card no. 78-600045.

Keywords: *Photographic recording, Transferring, Archives, Storage, Picture tubes, Motion picture film, Video tapes, Synchronism, Laser beam recording, *Electron beam recording.

Magnetic tape, and particularly video magnetic tape, is not an archival material. Measurable deterioration occurs in a period of five years, and noticeable deterioration in 20 years. Motion picture film, on the other hand, is considered to be an archival material when properly processed. This report describes the methods used to transfer video information from magnetic tape to motion picture film, which include kinescope recording, using the midfield splice or rapid pulldown method of synchronizing frame rates, electron beam recording and laser scanner recording.

710,419
PB-292 201/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Case Study: NBS' Center for Building Technology.
Final rept.,
N. J. Raufaste, and K. M. Olmert. 1979, 4p
Pub. in Words 7, n3, p34-37 Feb-Mar 79.

Keywords: *Words(Language), Centers, Documents, Editing, Reprints, *Word processing centers.

Word Processing Centers (WPC) are more and more being created in business and government as a way of coping with large typing loads. However, making the transition from the idea of a WPC to one that is fully operational is difficult. This paper presents the Center for Building Technology's experience in this transition.

710,420
PB-294 855/2 PC **A05**/MF **A01**
Burnette (Charles) and Associates, Philadelphia, PA.
Architect's Access to Information.
Final rept.
C. H. Burnette. Mar 79, 97p NBS-GCR-78-153
Sponsored in part by AIA Research Corp., Washington, DC. See also report dated Mar 79, PB-292 782.

Keywords: *Information systems, *Architects, Availability, Communicating, Design, Building industry, Cooperation, Professional personnel.

The purpose of the report is to provide an overview and some insight into the circumstances which constrain and influence architects when they must obtain information during the course of the design and construction process. It is intended for those outside the profession who wish to understand the conditions which influence the use of the information they provide to architects, and for architects who would consider the nature and context of their difficulties in obtaining information as they need it. It is, a brief guide to the major features of the problems and to the nature of their effects.

710,421
PB77-600061 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
National Standard Reference Data System.
S. A. Rossmassler. 1976, 3p
Pub. in Proceedings AGARD Conf. on Advancements in Retrieval Technology as Related to Information Systems, Arlington, VA, Oct. 20-21, 1976, AGARD-CP-207, p10-1 - 10-4 Dec 1976.

Keywords: Data compilation, Data evaluation, Information retrieval, NSRDS, Omnidata, Reference data, *National Standard Reference Data System.

The National Standard Reference Data System is a coordinated, but decentralized, effort to increase the reliability and availability of numerical data used in and produced by the physical sciences and engineering. Individual data projects on specific technical subjects are established to extract, evaluate, and compile, in a systematic manner, all relevant data from the scientific journal and technical report literature. The evaluation process compresses the original data, and the systematic treatment aids the user in filling his data needs. Sophisticated data-handling capabilities--including online information and data retrieval--are developed in individual data centers and also in a central data systems design group.

710,422
PB79-600075 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

General

Library and Information Services for Improving Organizations and professions.
P. W. Berger, P. A. Sprague, and P. Zurkowski. 1979, 1p
Available as a cassette. Pub. in Proceedings White House Conf. on Library and Information Services - Dialogues on the Future of Library and Information Services, Washington, DC, Nov. 15-19, 1979, Cassette 2 Side 1 1979.

Keywords: *Information services, Libraries.

No abstract available.

710,423
PB80-149073 PC **A08**/MF **A01**
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
Use of Technical Analysis in Editing.
Civil engineering studies,
L. Tavis, and J. W. Melin. Jan 80, 159p
STRUCTURAL RESEARCH SER-473, UILU-ENG-80-2003, NBS/GCR-80-259

Keywords: *Editing, Technology assessment, Semantics, Concepts, Mathematical logic, Computer programming.

There now are technological procedures available to assist in the sensitive task of editing public documents--specifically to assist in reducing the substantial risk of imprecision present in the process of editing through deliberation and consensus. It is the objective of this manual to make these editing procedures available for clerical application guided by professionals. Meeting this objective fully, however, requires an understanding of these procedures that goes beyond a mechanical description of their application: applying the procedures requires some understanding of their substance. The manual, therefore, is divided into two main parts. Part I, provides the background of substance necessary to the application of the procedures. Part II, describes the mechanics of applying the technological procedures available.

710,424
PB81-168916 Not available NTIS
National Bureau of Standards, Washington, DC.
Writing Standards that Meet Regulatory Needs.
Final rept.
C. C. Rawie. Sep 80, 4p
Pub. in ASTM (American Society for Testing and Materials) Standardization News 8, n9 p13-16 Sep 80.

Keywords: *Technical writing, *Standards, Regulations, Civilian personnel.

The article urges discussion of certain issues arising from the use by regulatory agencies of standards developed by nongovernment standards-writing committees. The issues addressed are related to the technical and economic basis for nongovernment standards and documentation of such standards. Problems in these areas prevent regulatory agencies from taking full advantage of the expertise and resources that nongovernment standards-writing groups dedicate to writing standards. The aim of this paper is to promote discussion that will aid in resolving these problems and thus advance the regulatory use of nongovernment standards.

710,425
PB81-191892 Not available NTIS
National Bureau of Standards, Washington, DC.
Survey on Research Needs on Personal Samplers for Toxic Organic Compounds.
Final rept.
J. A. Hodgeson, and A. J. Fatiadi. Aug 80, 38p

Keywords: *Organic compounds, *Monitors, Air pollution, Surveys, Environments, Concentration(Composition), Chloromethanes, Benzene, Carbon tetrachloride, Chloroform, *Air pollution monitors, *Toxic substances, Ethane/dichloro, Ethylene/trichloro, Ethane/trichloro, Research and development, *Air samplers, NTISEPAORD.

A survey is presented on the research and development needs for personal monitoring devices for toxic organic compounds in the ambient atmosphere. This survey includes a description of organic compounds and their ambient concentrations, individual compounds of high priority, a summary of a literature survey, a description of commercially available samplers, a summary of recent developments in ambient personal monitoring and recommendations on major research needs. The high priority compounds identified were: methyl chloride, dichloromethane, benzene, carbon tetrachloride, chloroform, dichlorobenzenes, 1,2-dichloroethane, methyl chloroform, trichloroethylene and perchloroethylene. The literature survey covers the period, 1974-79. Commercially available personal samplers described are Dupont's Pro-Tek organic vapor badge, Abcor's gas badge, 3-M's organic vapor monitor and the Minimonitor (P.W. West, Louisiana State University). Recent activities include a description of an EPA sponsored program at Monsanto Research Corporation on development of personal samplers for organics. A description is also given of several recent field studies on sampling and analysis for benzene and chlorinated hydrocarbons. The survey concludes with recommendations for research and development activities in the following areas: evaluation of sorbent materials, development of analytical techniques based on electron capture-gas chromatography, evaluation of available active and passive samplers, development of passive samplers and development of standard mixtures for evaluation of personal exposure devices.

710,426
PB81-236184 Not available NTIS
National Bureau of Standards, Washington, DC.
Unambiguous and Complete: Applying Information Science to Specifications.
Final rept.
J. R. Harris, and R. N. Wright. Apr 81, 8p
Pub. in Construction Specifer 34, n4 p55-62 Apr 81.

Keywords: *Technical writing, *Specifications, Construction industry, Communicating, Decisions, Information systems.

Specifications are a primary means of technical communication in the construction community. This article is concerned with improving the organization, expression and interpretation of the information contained in construction specifications. The application to construction specifications of techniques previously developed for modeling standards is described. The techniques provide an objective and rigorous representation of the meaning of a specification and allow it to be tested for aspects of clarity, completeness, and consistency. Furthermore, the techniques allow alternative organizations and expressions to fit the needs of various users with assurance that meanings remain unchanged and that users will readily find and understand all provisions even in a new or unfamiliar standard.

710,427
PB82-105891 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Computer Science and Technology: A Survey of Standardization Efforts of Coded Character Sets for Text Processing.
Final rept.
J. E. Knoerdel. Sep 81, 55p NBS-SP-500-81
Library of Congress catalog card no. 81-600108.

Keywords: *Coding, *Symbols, Standardization, Standards, Editing, Computer programming, *Text processing, Word processing.

The report includes, first of all, a brief description of the major national and international standards organizations which develop code standards. Next, it describes the various code standards according to the following categories: basic code sets for information interchange, methods of augmenting those basic code sets, additional control characters to be used with the basic code sets, and code sets developed specifically for text communications. Finally, the summary of the report discusses a number of limitations which still exist when interchanging information via communicating text processors.

710,428
PB83-112672 PC **A06**/MF **A01**
National Research Council, Washington, DC.
Toward the Electronic Office.
Final rept.
Jul 80, 111p
Contract NB80-NAGE-8884
Proceedings of a symposium held at the National Academy of Sciences, Washington, DC. on June 23, 1980.

Keywords: *Office equipment, Human factors engineering, Data processing equipment, Productivity, Cost effectiveness, Efficiency, Information systems, *Data processing systems, *Computer applications, *Organizational effectiveness.

The report contains the proceedings of a symposium on integrated, computer-based office systems addressing three themes: (1) productivity, cost effectiveness, efficiency, and correct uses and applications of information in office environments; (2) organization and operation of offices to take advantage of all the capabilities of electronic information systems, including making the workplace more interesting and enjoyable; and (3) top-down systems planning. Eight papers from universities, manufacturers, industrial and government users are discussed.

710,429
PB84-103704 Not available NTIS
National Bureau of Standards, Washington, DC.
National Libraries - National Necessities.
Final rept.
P. W. Berger. 1983, 20p
Sponsored in part by National Agricultural Library, Beltsville, MD.
Pub. in Agricultural Library Information Notes 9, n1-2 p1-20, Jan-Feb 1983.

Keywords: *Libraries, *National government, Economic analysis, Survival, User needs, Networks.

The report is a discussion of survival strategies for the three U.S. National Libraries during periods of fiscal reduction and restraint.

710,430
PB84-105964 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of Inelastic Scattering of eV Neutrons.
Final rept.
C. D. Bowman, and R. G. Johnson. 1982, 3p
Pub. in Proceedings of IPNS Neutron Scattering, Argonne National Laboratory, Argonne, IL., August 12-14, 1981, p84-86 1982.

Keywords: *Neutron scattering, Inelastic scattering, Benzene, Molecular vibration, Momentum transfer, EV range 01-10, EV range 10-100, NTISCOMNBS.

A technique has been demonstrated for studying the inelastic scattering of eV neutrons using a pulsed white source. Measurements have been completed on benzene for incident energies in the range 1.5 to 15 eV and for a range of q values. Details of the method and possibilities for improvement and extension are presented.

710,431
PB84-107234 Not available NTIS
National Bureau of Standards, Washington, DC.
New Federalism: How It Is Changing the Library Profession in the United States.
Final rept.
P. W. Berger. 1983, 6p
Sponsored in part by Bowker (R.R.) Co., New York.
Pub. in the Bowker Annual of Library and Book Trade Information, 28th Edition, p36-41 1983.

Keywords: *Librarians, *Standards, National government, Libraries, Library science, Information scientists, Professional personnel, Reprints.

The article describes the potential impacts on librarianship of both the Office of Personnel Management's (OPM) proposed new standards for library and information service workers and the Office of Management and Buget's (OMB) proposed new version to its Circular No. A-76.

710,432
PB85-226918 CP **T02**
National Bureau of Standards, Gaithersburg, MD.
Implementation of ANSI (American National Standards Institute) Codes for the Representation of Names of Countries, Dependencies, and Areas of Special Sovereignty for Information Interchange (FIPS PUB 104).
Data file.
J. Newton. 1985, mag tape FIPS PUB-104, NBS/DF/MT-85/002
Data file is available in the EBCDIC and ASCII character sets on 9-track one-half inch tape. Identify recording mode by specifying density and character set. Call NTIS Computer Products if you have questions.

Keywords: *Data file, *Coding, *Countries, Standards, Data, Information processing, Magnetic tapes, *Federal information processing standards, *Geographic areas, Geocoding.

The file contains data from Table 1, updated, of FIPS PUB 104, 'Implementation of ANSI Codes for the Representation of Names of Countries, Dependencies, and Areas of Special Sovereignty for Information Interchange.' The File contains the names, alphabetic two-character codes, and alphabetic three-character codes of each entity listed in FIPS PUB 104. Lack of a code is shown by hyphens (-- or ---). In addition, asterisks for some records indicate whether there is a reserved code for the entity in ISO 3166. A comment field gives additional information about entity, including its name in ISO 3166, if different from that used in FIPS PUB 104. The comments are condensed from the printed version of FIPS PUB 104. Entities are sequenced in alphabetic order of their names as they appear in FIPS PUB 104. All names and codes are represented in UPPER CASE. Comments appear in Mixed Case, unless they are alternate names, which appear in UPPER CASE. US BGN is an abbreviation for U.S. Board on Geographic Names.

710,433

PB86-231487 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Information Resources and Services Div.
Federal Government Libraries and Information Centers.
P. W. Berger. 1986, 13p
Pub. in Education for Professional Librarians, Chapter 8, p141-153 1986.

Keywords: *Librarians, *Technical information specialists, Education, Standards, Reprints, *Federal librarians, Federal government.

The report is a chapter in a book edited by Herbert White. The chapter reviews the development and applications of educational standards for librarians and technical information specialists in the federal government since 1966. Some conspicuous developmental and application failures are discussed as well, and a possible hedge against future disasters is suggested.

710,434

PB87-140604 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Cost Comparison of Selected Alternatives for Preserving Historic Pension Files.
Final rept.
R. E. Schofer. Jul 86, 59p NBSIR-86/3335
Sponsored by National Archives and Records Administration, Washington, DC.

Keywords: *Records management, *Cost estimates, Systems analysis, Archives, Labor estimates, Microfilm, Preservation, Services, Historic pension files.

The report describes the results of a cost study of three selected alternatives for preserving the historic pension files. The three alternatives evaluated comprise three levels of technology: Hand retrieval of original paper documents; Hand retrieval of microfiche copies of the original documents; and Automatic retrieval of microfiche copies. Results indicate that the microcopy alternatives substantially reduce storage space requirements and the labor cost of providing reference service. The automated-retrieval-alternative reduction in labor cost is very substantial. However, the extremely high cost of converting the files to microfiche more than cancels out the savings in both space and operating costs, except under very high reference usage. Improving the storage environment and continuing reference service with the original documents is an attractive alternative. At current usage rates, each file is requested, on the average, every 65 years. At these rates, preservation experts do not expect the documents to deteriorate from reference usage.

MANUFACTURING TECHNOLOGY

Computer Aided Design (CAD)

710,435

PB83-175075 PC **A06**/MF **A01**
Bolt Beranek and Newman, Inc., Cambridge, MA.
Hierarchical Control System Emulation: Applications Guide.
Final rept. Nov 81-Oct 82.
T. L. Johnson, S. D. Milligan, and T. E. Fortmann.
Oct 82, 123p NBS-GCR-82-410
Contract NB81-SBCA-0826

Keywords: Control simulation, Fortran, Computer programs, Industrial engineering, *Computer aided design, Computer aided manufacturing, PRAXIS programming language, User manuals(Computer programs).

The Hierarchical Control System Emulation is a collection of computer programs written in the high-level Praxis language for use on a Digital Equipment Company VAX 11/780 processor under the VMS operating system. These programs allow the user to write, debug, and concurrently emulate modules of a hierarchical control system and to simulate the physical plant which is controlled. The emulation executes in real time and interactive display and data logging capabilities are included. The emulation is intended as a computer-aided control system design tool for the NBS Automated Manufacturing Research Facility. The Applications Guide provides a case study of the Hierarchical Control System Emulation applied to an automated machining example, involving 14 modules.

710,436

PB86-209897 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
IGES (Initial Graphics Exchange Specification), a Key Interface Specification for CAD/CAM Systems Integration.
Final rept.
B. Smith, and J. Wellington. 1984, 8p
Pub. in Proceedings of Annual Conference and Exposition - National Computer Graphics Association, Computer Graphics '84 (5th), Anaheim, CA., May 13-17, 1984, p548-555.

Keywords: *Computer graphics, *Data displays, Standardization, Specifications, *Computer aided design, *Computer aided manufacturing, Data exchange, Vendors.

The Initial Graphics Exchange Specification (IGES) program has focused the efforts of 52 companies on the development and documentation of a means of graphics database exchange among present day CAD/CAM systems. The project's brief history has seen the evolution of the Specification into preliminary industrial usage marked by public demonstrations of vendor capability, mandatory requests in procurement actions, and a formalization into an American National Standard in September 1981. Recent events have demonstrated intersystem data exchange among seven vendor systems with a total of 30 vendors committing to offer IGES capability. A full range of documentation supports the IGES project and the recently approved IGES Version 2.0 of the Specification.

710,437

PB87-134334 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Current Ability of the Architecture, Engineering, and Construction Industry to Exchange CAD (Computer-Aided Design) Data Sets Digitally.
Final rept.
M. E. Palmer. Oct 86, 38p NBSIR-86/3476
Contract N68305-86-W-R60132
Sponsored by Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Computer graphics, *Construction industry, Architecture, Engineering, Standards, Guidelines, Specifications, *Computer aided design, *Data exchange, *Translators, Digital data, Software tools, Computer program documentation.

The current ability of the AEC industry to exchange CAD information digitally has been assessed through discussions with AEC CAD users and consultants, site visits to CAD installations, and reviews of CAD software and translator documentation. The principal conclusions and recommendations of the report are as follows: (1) In order to take fully advantage of CAD and to maximize the utilization of digital project information, this industry requires a dependable method for the digital data exchange; (2) The current generation of translator tools is inadequate for comprehensive AEC CAD operations, incomplete translators, insufficient documentation, and differing interpretations of specifications have prevented accurate and complete data set exchanges and; (3) There is a critical need for a public program to validate translator software, to identify problems in current implementations, and to develop guidelines for the use of computer data exchange standards.

710,438

PB87-224515 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Using Available Curve-Shaped Information with a Non-Uniform B-Spline.
Final rept.,
M. Roche, and S. Beusan. 1987, 7p
Pub. in Computers in Mechanical Engineering 6, n1 p63-69 Jul/Aug 87.

Keywords: Reprints, *Computer aided design, Approximation, *B spline, Continuity conditions, Curve shape, Defining polygon, Interpolate.

The B-spline is a commonly used tool for solving problems in computer-aided design. A procedure for describing the curve shape and discontinuity conditions at input coordinate locations is outlined for non-uniform B-splines.

710,439

PB88-157680 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Strategies for Implementing IGES (Initial Graphics Exchange Specification) for the Operations of NAVFAC (Naval Facilities Engineering Command).
Final rept.,
M. E. Palmer. Jan 88, 44p NBSIR-88/3693
Sponsored by Naval Facilities Engineering Command, Alexandria, VA.

Keywords: *Drafting(Drawing), Digital data, Information management, Computer graphics, Translators, Construction, Civil engineering, Specifications, *Computer aided design, IGES(Initial Graphics Exchange Specification), NAVFAC(Naval Facilities Engineering Command).

As part of the transition from the current paper-intensive processes to a highly automated and integrated mode of operation, the Navy is adopting the Initial Graphics Exchange Specification (IGES) for certain digital data exchanges among elements of the Navy and Navy contractors. The report provides strategies and recommendations for implementing IGES for exchanging and archiving digital representations of Naval Facilities Engineering Command (NAVFAC) projects. NAVFAC plans to benefit from the use of computer-aided design and drafting (CADD) by encouraging outside architecture, engineering, and construction (AEC) firms to acquire CADD capabilities and by requiring the delivery of certain project documentation in digital form. The ability to transmit drawings and specifications between different CADD systems is expected to reduce the time (and resources) that NAVFAC and outside personnel spend reviewing, changing, and managing projects and also to improve the quality of the projects.

Computer Aided Manufacturing (CAM)

710,440

PB83-203802 PC **A04**/MF **A01**

National Bureau of Standards, Washington, DC. National Engineering Lab.
Simulation Development for Automated Manufacturing Control Systems.
A. D. Davies, and R. G. Hendrickson. Jan 83, 55p NBSIR-82-2633

Keywords: *Control simulation, *Manufacturing, *Automation, Control equipment, Command and control, Mathematic logic, Systems engineering.

This report presents a conceptual development of a simulation of an automated manufacturing facility. The concept addresses the operations, the planning, and the architecture of the underlying computer command and control system associated with automated processes. The objective of the simulation is to provide a research tool for testing facility design concepts, to develop specifications for emulators and computer control functions, and to analyze data flow and module interface problems. The simulation integrates the production activities of manufacturing parts and the underlying command and control structure of the detailed operations into a unified representation of workshop elements, processes, and architecture. This report is based on a specific requirement to analyze automated manufacturing processes in order to develop standards for command and control requirements, specific features of equipment needs, and interfacing elements of the workshop facility.

710,441
PB86-113651 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Industrial Systems Div.
Virtual Manufacturing Cell.
Final rept.
C. R. McLean, H. M. Bloom, and T. H. Hopp. 1983, 9p
Pub. in Proceedings of the IFAC/IFIP Symposium on Information Control Problems in Manufacturing Technology 1982 (4th), Gaithersburg, MD., October 26-28, 1982, p207-215 1983.

Keywords: *Production control, *Manufacturing, Automation, Routing, Scheduling, Artifical intelligence, Machining, *Computer aided control systems, Computer files, National Bureau of Standards.

A virtual manufacturing cell is being developed at the National Bureau of Standards as part of the control software for the Automated Manufacturing Research Facility (AMRF) project. The traditional group technology cell has evolved from the need to provide the flexibility to manufacture a family of parts while maintaining the efficiency associated with a single process flow line. Group technology cells normally require a fixed physical grouping of machining workstations for each class of parts. A shop based upon virtual manufacturing cells provides greater flexibility than existing shop configurations through the time sharing of machining workstations. Virtual cells are not identifiable as fixed physical groupings of machinery, but as data files and processes in the control computer. Given this structure, the shop level control system must now schedule the activation of job cells and the allocation of workstations to these cells. In this configuration, a workstation will always be under the control of a particular virtual cell or a pool cell (that is composed of idle, untasked workstations). Functions that the virtual cell will perform include analysis, reporting, routing, scheduling, dispatching, and monitoring.

710,442
PB86-124856 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Rational Approach to Deburring for Flexible Manufacturing Systems.
Final rept.
C. A. Wan. 1982, 18p
Pub. in Proceedings of AUTOFACT 4 Conference, Philadelphia, PA., November 30-December 2, 1982, p7.54-7.71.

Keywords: *Adaptive systems, *Deburring, Automatic control, Robots, Machine tools, Manufacturing, Tool life, *Flexible manufacturing systems, Computer aided manufacturing.

No abstract available.

710,443
PB86-199759 PC **A22**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Initial Graphics Exchange Specification (IGES), Version 3.0.
Rept. for Jan 83-Dec 85.
B. Smith, and J. Wellington. Apr 86, 525p NBSIR-86/3359
See also PB83-137448. Errata sheet inserted.

Keywords: *Computer graphics, Specifications, *Computer aided manufacturing, *File maintenance, *Data interchange, Data structures, Computer aided design.

The document contains Version 3.0 of the Initial Graphics Exchange Specification, a defined format for the creation of a file which enables data found in today's commercially available CAD/CAM systems to be exchanged or archived. IGES, Version 1.0, published as NBSIR 80-1978 (R) in January 1980, consisted of entity definitions for geometry, drafting and structural information. Definition entities were provided as a means of expanding the utility of IGES. Version 3.0 further refines the concept and offers increased capability in both geometry and non-geometry data exchange. The applications of printed wiring boards and finite element models are well supported in addition to enhancements for mechanical products.

710,444
PB86-232402 PC **A04**/MF **A01**
Michigan Univ., Ann Arbor. Graduate School of Business Administration.
Simulation Model for the Automatic Turning Station at the Automated Manufacturing Research Facility.
N. Raman, F. B. Talbot, and R. V. Rachamadugu. Mar 86, 62p NBS/GCR-86/513
See also PB86-231305. Sponsored by National Bureau of Standards, Gaithersburg, MD.

Keywords: *Turning(Machining), *Computerized simulation, Automation, Computer programs, Scheduling, Real time operations, Robots.

The report is part of the ongoing project on the real-time scheduling of the Automated Manufacturing Research Facility at the National Bureau of Standards in Gaithersburg, Maryland. In an earlier paper, Rachamadugu, Raman and Talbot (1986) reported on the performance of the Automatic Turning Station (ATS) under nine dispatching procedures and presented a simulation-based evaluation of these procedures. The paper presents the simulation model used in the study mentioned above and presents the steps required to execute the model.

710,445
PB86-238821 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Control System for an Automated Manufacturing Research Facility.
Final rept.
J. S. Albus, A. J. Barbera, and M. L. Fitzgerald. 1984, 17p
Sponsored by Society of Mfg. Engineers, Dearborn, MI.
Pub. in Proceedings of Conference on Robots 8, Detroit, MI., June 4-7, 1984, Volume 2: Future Considerations, p13.28-13.44.

Keywords: *Control equipment, *Automation, Robots, Real time operations, *Computer aided manufacturing.

A hierarchical architecture for real-time planning and control has been implemented in the first Cell of an Automated Manufacturing Research Facility at the National Bureau of Standards. Three workstations (A horizontal milling, a turning, and a materials handling workstation) have been implemented. The horizontal and the turning workstations have robots, and the horizontal has a 6-D robot vision system interfaced with a RCS (Real-time Control System) robot controller. A communications network, a distributed data base and a simulator/emulator have also been implemented.

710,446
PB87-103263 PC **A10**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Survey of Flexible Manufacturing Systems Implementations.
W. P. Darrow. Jul 86, 203p NBSIR-86/3413

Keywords: *Surveys, *Flexible manufacturing systems, *Computer aided manufacturing.

The report presents descriptive data on three hundred manufacturing facilities that are using computer integrated manufacturing (CIM) techniques to machine component parts for commercial, industrial, and military products. Of these, 258 were categorized as Flexible Manufacturing Systems (FMS). Key descriptive statistics were gathered for each system. The data is organized into records by the user's country, company, and geographic location. Each record is made up of 24 fields that describe the facility, the product, and the operating parameters, as well as providing a reference to the source(s) of information.

710,447
PB87-107363 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Emulation as a Design Tool in the Development of Real-Time Control Systems.
Final rept.
H. M. Bloom, C. M. Furlani, and A. J. Barbera. 1984, 10p
Pub. in Proceedings of 1984 Winter Simulation Conference, Dallas, TX., November 28-30, 1984, p627-636.

Keywords: *Automation, Real time operations, Control equipment, Robots, *Computer aided manufacturing.

A major facility for manufacturing research is being established at the National Bureau of Standards. The Automated Manufacturing Research Facility (AMRF) will provide a testbed where measurement research of computer integrated manufacturing systems can be performed. The control architecture of the facility is based on a sensory-interactive modular hierarchical feedback system. Each module is represented as a finite state machine that interacts through a shared time-sliced common-memory where command, feedback and database information is stored. A hierarchical control system emulator (HCSE) has been developed that allows the system to be designed and tested before the implementation on the actual hardware. The HCSE has been successfully used in the AMRF project as a design management tool where the entire specification of the control software is available and as a testing aid that allows for a given module such as a robot control system to interact with the emulator when the other AMRF hardware is unavailable.

710,448
PB87-108536 PC **A21**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD.
Real-Time Optimization in Automated Manufacturing Facilities. Proceedings of a Symposium Held at the National Bureau of Standards, Gaithersburg, Maryland, January 21-22, 1986.
Final rept.
R. H. F. Jackson, and A. W. T. Jones. Sep 86, 487p NBS/SP-724
Also available from Supt. of Docs as SN003-003-02759-6. Library of Congress catalog card no. 86-600580. Sponsored by Department of the Navy, Washington, DC.

Keywords: *Meetings, *Automation, Real time operations, Optimization, Scheduling, Production control, *Computer aided manufacturing, *Flexible manufacturing systems.

The Symposium on Real-Time Optimization in Automated Manufacturing Facilities was held at the National Bureau of Standards, Gaithersburg, Maryland, January 21-22, 1986. It was jointly sponsored by the Center for Manufacturing Engineering (with funds obtained from the Navy Manufacturing Technology Program) and the Center for Applied Mathematics. It was designed to bring together those who design and test optimization procedures for solving planning, scheduling, and routing problems with those who must use these procedures in a real-time manufacturing environment.

710,449
PB87-129029 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Real-Time Error Compensation System for a Computerized Numerical Control Turning Center.
Final rept.
M. A. Donmez, K. Lee, C. R. Liu, and M. M. Barash. 1986, 8p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Conference on Robotics and Automation, San Francisco, CA., April 7-10, 1986, 8p.

Keywords: *Turning(Machining), *Numerical control, *Machine tools, Detectors, Microcomputers, Interfaces, *Real time system, *Error correcting devices, *Computerized control systems, Data analysis, High level language, PLM programming language, Computer software.

A real-time compensation scheme for geometric and thermally-induced errors of a computerized numerical control (CNC) turning center is described. The compensation system predicts these errors using a combination of data taken from various sensors on the machine tool and previously established relationships (transfer functions). The system translates these errors into servo counts and injects them into the control loops of the machine tool controller in real-time. A single-board microcomputer interfaced to the machine tool controller and the sensors is the workhorse of the system. The system control software written in PLM, a high level programming language, is modular, flexible, and easily maintainable.

710,450
PB87-131850 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Finite Element Analysis of Flexible Fixturing System.
Final rept.
J. D. Lee, and L. S. Haynes. 1986, 6p
Pub. in Proceedings of Japan-USA Symposium on Flexible Automation, Osaka (Japan), July 14-18 1986, p579-584.

Keywords: *Fixtures, *Machining, Finite element analysis, Computer graphics, Automation, *Computer aided design, *Computer aided manufacturing.

A computer system has been developed for the analysis and design of fixtures. The software can lead the designer to the optimal design of the fixturing system which minimizes the total work done on the workpart, the fixturing force, the deformation index, or the maximum effective stress. The workpart is modelled as a linear isotropic elastic solid. The machining forces are simulated by specifying applied forces acting on part of the surface of the workpart. The fixturing system consists of a number of fixture elements, each in contact with the workpart with specified location and area of contact. At the interface of contact, Coulomb's law of friction is employed. The boundary conditions at the interface of contact are treated exactly. The computer software system is composed of a finite element program and computer graphic program which displays the undeformed and deformed workpart with hidden lines removed. Three sample problems have been solved and the numerical results are presented in the paper.

710,451
PB87-134706 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Cell Control System for the AMRF (Automated Manufacturing Research Facility).
Final rept.
A. T. Jones, and C. R. McLean. 1984, 7p
Pub. in Proceedings of 1984 International Computers in Engineering Conference and Exhibit, Las Vegas, NV., August 12-15, 1984, p353-359.

Keywords: Real time operations, Interfaces, Command and control, Feedback control, *Control systems, *Cell control systems, *Command and control systems, *Manufacturing automation control, Database management systems, Operator command system, Network Communications system, Information Display system, Data structures, Computer applications, National Bureau of Standards.

The paper describes the Cell Control System developed for the Automated Manufacturing Research Facility using hierarchical task-decomposition and real-time sensory-interactive control techniques developed at NBS. The primary functions of the cell are to manage and coordinate the activities at all workstations and interface to the existing Operator Command System, Database Management System, Network Communications System, and Information Display System. In addition, the data structures developed for the command/feedback interfaces between control modules, the database transactions developed to perform inventory and job status updates, and the mailgram structures developed to transmit information over the current network, are outlined.

710,452
PB87-161121 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Workstation Control in a Computer Integrated Manufacturing System.
Final rept.,
H. Scott, and K. Strouse. 1984, 22p
Pub. in SME Technical Paper MS84-786, 22p 1984.

Keywords: *Manufacturing, *Automatic control, *Machining, *Robots, Automation, Numerical control, Controllers, *Computer aided control systems, *Computer aided manufacturing, Control systems, Real time, National Bureau of Standards.

Computer control of an automated machining workstation is one area of research being performed at the Automated Manufacturing Research Facility (AMRF) of the National Bureau of Standards (NBS). A finite state machine controller has been developed to provide the required real-time control. The architecture of the workstation control system was developed in particular to address the problems of system integration in a machining workstation containing components with greatly differing interface characteristics and capabilities. Such components include an advanced industrial robot system, a numerically controlled machining center, an automated fixturing system, a material and tool delivery and retrieval system, various sensor systems, a higher level of control (cell control), a distributed data base system, and an off-line programming system. The flexibility and extensibility of the controller architecture have allowed such integrations to be performed. The software, hardware, and user interfaces are described.

710,453
PB87-165189 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Using the AMRF (Automated Manufacturing Research Facility) Part Model Report,
S. Ressler. Feb 87, 26p NBSIR-87/3531

Keywords: *Manufacturing, *Components, Characteristics, Automation, *Computer aided manufacturing, *AMRF data base, *Data bases.

One mechanism used in the AMRF (Automated Manufacturing Research Facility) to facilitate the communication of information about the parts to be manufactured is the AMRF Part Model. This is a description of a variety of characteristics of a part which may be obtained by making a request to the AMRF Data Base. The part model report serves as the primary mechanism for obtaining information about the part. The paper describes the uses of a parser which interprets the part model report and transforms it into a set of data structures for use in a variety of applications.

710,454
PB87-165809 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Knowledge Representation Scheme for Processes in an Automated Manufacturing Environment.
Final rept.,
S. Ray. 1986, 5p
Pub. in Proceedings of Institute of Electrical and Electronics Engineers International Conference on Systems, Man, and Cybernetics, Atlanta, GA, October 14-17, 1986, p1169-1173.

Keywords: *Process control, *Manufacturing, *Machining, *Automation, *Artificial intelligence, Subroutines, *Computer aided manufacturing, *Knowledge representation, *Computerized control systems, Programming, Expert systems, Hierarchies, National Bureau of Standards, Work measurement.

A key factor in applying advanced programming concepts to an industrial manufacturing environment is the establishment of a language to specify the process steps involved. In the Automated Manufacturing Research Facility at NBS, these process steps are described in terms of 'work elements'. Work elements are specified in process plans which are passed to controllers throughout the facility. The paper describes the properties which were considered in the definition of work elements from the perspective of automated process planning and the control system implementation at NBS. The control system is based upon a philosophy of hierarchical control, where high level goals are decomposed through a succession of levels, each producing sequences of simpler goals to the next lower level, with the lowest level generating drive signals to robots, grippers and other actuators. The work elements are implemented with different software at each stage in the manufacturing sequence: process planning, communication, and execution.

710,455
PB87-172961 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Hierarchical Decision-Making in the Factory of the Future,
R. H. F. Jackson, and A. W. T. Jones. Feb 87, 25p NBSIR-87/3511

Keywords: *Manufacturing, *Automatic control, *Scheduling, Facilities, Decision making, Planning, Hierarchies, Standards, Measurement, Research projects, Optimization, *Factory automation, *Flexible manufacturing, Computer aided manufacturing, National Bureau of Standards.

A major manufacturing research facility is being established at the National Bureau of Standards. The Automated Manufacturing Research Facility will address the standards and measurement needs for the factory of the future. A five-layer hierarchical control architecture is under development to manage all production and support activities within the facility. The proper execution of many of these activities requires the solution to one or more optimization problems. The paper describes a hierarchical planning architecture and the decision-making problems that exist at each level within that architecture.

710,456
PB87-174298 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
AMPLE (Automated Manufacturing Programming Language Environment) Project,
J. C. Boudreaux. Mar 87, 17p NBSIR-86/3496

Keywords: Automatic control, Programming languages, Economic analysis, *Computer aided manufacturing, *Flexible manufacturing, *Manufacturing automation control, *AMPLE system, National Bureau of Standards.

The report describes the Automated Manufacturing Programming Language Environment (AMPLE) system, being developed within the Center for Manufacturing Engineering of the National Bureau of Standards. The development of this system is being undertaken to provide a precise, conceptually transparent medium for the construction of control interfaces to industrial processes; and to address the technical and economic requirements of small-batch flexible manufacturing systems.

710,457
PB87-200382 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
National Forum on the Future of Automated Materials Processing in U.S. Industry. The Role of Process Models, Artificial Intelligence and Computer Integration. Report of a Workshop (2nd) Held at Gaithersburg, Maryland on May 19-20, 1986,
H. M. Bloom, and N. R. Kuchar. Apr 87, 50p NBSIR-87/3544
See also report dated Dec 85, PB86-212040. Prepared in cooperation with General Electric Co., Schenectady, NY. Sponsored by Industrial Research Inst., Inc., New York, and Office of Science and Technology Policy, Washington, DC.

Keywords: *Materials handling, *Artificial intelligence, Automation, Competitiveness, Models, Detectors, Computer integration, Process models.

The workshop was the second of two workshops sponsored by the Industrial Research Institute and the White House Office of Science and Technology Policy, Committee on Materials, Working Group on Automation of Materials Processing. The first workshop, held in December, 1985 was devoted to the role of process sensors. Together, the workshops addressed several technologies which can play important roles in improving the competitiveness of U.S. process industries through automation. The goals of the workshops were threefold: to assess the state of the art in key technologies needed for process automation, including sensors, process modeling, artificial intelligence and computer integration; to identify broad issues and generic

needs for advancing these technologies and applying them in U.S. industry; and to develop information and recommendations for National direction aimed at enhancing the competitiveness of U.S. process industries.

710,458
PB87-201877 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Part Geometry Data in the AMRF (Automated Manufacturing Research Facility),
J. S. Tu, and T. H. Hopp. Apr 87, 19p NBSIR-87/3551

Keywords: Manufacturing, Automation, Components, Geometric forms, *Computer aided manufacturing, Computer aided design, AMRF(Automated Manufacturing Research Facility).

The paper is an overview of the approach being taken toward the modeling and management of part geometry data in the NBS Automated Manufacturing Research Facility (AMRF). It describes the Geometry Data System, that achieves the objectives of having a uniform representation of part geometry data to allow data sharing and data exchange with the AMRF. The paper describes the approach to the implementation of the Geometry Data System, the applications supported by the system, and how the geometry data flow through the AMRF.

710,459
PB87-202933 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Integration of Material Buffering Devices in an Automated Factory.
Final rept.,
D. Fishman, H. Scott, and R. Bunch. 1987, 35p
Pub. in Proceedings of International Conference on Robotics and Factories of the Future (2nd), San Diego, CA., July 18-31, 1987, p1-35.

Keywords: *Industrial plants, *Automatic control, Machining, Materials handling, Reprints, Hierarchical control.

A generic control architecture for integrating material bufferring devices (MBDs) in an automated factory is described. The architecture is designed to support material bufferring devices that serve as interfaces between workstations and a facility-wide material transport system. The architecture developed for a Material Bufferring Controller (MBC) is based on the observation that MBDs are in a class of equipment different from any other device already on the shop floor. Since an MBD serves as an interface to equipment-level components of both machining and material transport workstations, it is considered a shared resource between those workstations (like a data base), rather than as an equipment-level component of either workstation. The shared resource method of integrating a Material Bufferring Controller into an automated factory provides independence between the activities of a factory-wide transport system and those of a machining workstation. An application of this architecture in the Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards (NBS) is presented. Included is a description of the data files and the command and status interfaces that will be used in the integration of a Material Bufferring Controller into the AMRF. Specific examples of typical operations involving an MBC are also given.

710,460
PB87-202974 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Data-Driven Automation. A Computer Architecture for Small-Batch Manufacturing.
Final rept.,
C. R. McLean, M. J. Mitchell, and E. J. Barkmeyer. 1983, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Spectrum 20, n5 p59-64 May 83.

Keywords: Data management systems, Communications systems, Artificial intelligence, Expert systems, User interfaces, Reprints, *Computing architectures, *Manufacturing control systems.

The development of fully automated small batch manufacturing systems has been slowed by a number of technical and economic problems. The most significant problem is the lack of a standard information processing systems architecture that addresses consumer and vendor needs. The National Bureau of Standards has a project underway to construct a testbed manufacturing systems, the Automated Manufacturing Research Facility (AMRF), to investigate these problems. The paper discusses four major component technologies of the AMRF information processing architecture: Manufacturing Systems Control, Distributed Data Administration, Communications Systems, and Task-Oriented User Interfaces.

710,461
PB87-218277 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Interactive Process Planning in the AMRF (Automated Manufacturing Research Facility).
Final rept.,
P. F. Brown, and C. R. McLean. 1986, 18p
Pub. in Knowledge-Based Expert Systems for Manufacturing, PED-v24 p245-262 1986.

Keywords: *Artificial intelligence, *Machining, Reprints, *Automated machining, Expert systems, Process planning.

As more intelligent automated control systems are introduced into discrete parts manufacturing facilities, it will become increasingly difficult to maintain the centralized process planning systems in use today. A new approach is required that will permit distributed manufacturing operations planning via a network of cooperating, intelligent, process engineering systems. Expert planning modules should be developed for each controller or class of controllers that are or will be used in manufacturing installation. To accomplish this goal of distributed, intelligent planning modules, work has started with the development of a semi-automatic interactive process planning system. This system has several unique features. First, a hierarchical planning system has been developed for multi-level factory architecture. Second, all activities within the factory are described by work elements. Third, standard interfaces have been defined to allow the passing of information between planning and modules and controllers. Fourth- a semi-intelligent editor for the manupulation of these process planning data structures.

710,462
PB87-218350 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Cell Control Architecture for Flexible Manufacturing.
Final rept.,
C. R. McLean. 1987, 14p
Pub. in Proceedings of 1987 Advanced Manufacturing Systems Exposition and Conference, Chicago, IL., June 23-25, 1987, p622-635.

Keywords: *Manufacturing automation, Architectures, *Cell control systems, Interface standards.

The software architecture of the cell control system in the Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards is presented. The cell control system manages production and support operations for an automated small batch manufacturing system that produces machined parts. The cell is the highest level of control that is currently implemented within the AMRF. It is programmed in the C language and runs on IBM (tm) personal computer systems and compatibles. The cell is comprised of modules which decompose and sequence manufacturing work orders and which provide interfaces to communications, global databases, process planning and other control systems. The architecture of the cell is generic. It is designed to be applicable for control system implementations at any level in the AMRF hierarchy.

710,463
PB87-218368 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Vertical Machining Workstation of the AMRF (Automated Manufacturing Research Facility): Software Integration.
Final rept.,
C. R. McLean. 1986, 16p
Pub. in Integrated and Intelligent Manufacturing, PED-v21 p101-116 1986.

Keywords: *Manufacturing automation, Architectures, Reprints, *Vertical machining, Process planning, Interface standards.

The software architecture of the Vertical Machining Workstation (VWS) in the Automated Manufacturing Research Facility (AMRF) at the National Bureau of Standards is presented. The prototype system demonstrates flexible computer-integrated manufacturing for a family of prismatic parts. The workstation software components include: a feature-based design system for defining part geometries, an automatic process planning and NC code generation system, a state machine-based hierarchical control system which executes process plans, a diagnostic tools package, and mailbox communications software. The mechanical components of the workstation, described in a companion paper (1), include: a CNC vertical machining center, a robot and locally implemented gripper system, a pneumatic vise, a vacuum chip removal system, local part storage, and tray roller tables for a robot cart materials delivery system. The system is capable of running in stand-alone mode as a single station computer-integrated manufacturing system, or remotely under the AMRF cell controller.

710,464
PB87-232039 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Automated Manufacturing Research Facility at the National Bureau of Standards.
Final rept.,
C. R. McLean, and P. F. Brown. 1987, 27p
See also PB83-139022. Sponsored by International Federation for Information Processing, Geneva (Switzerland).
Pub. in New Technologies for Production Management Systems, Chapter 9 p177-203 1987.

Keywords: *Facilities, *Automation, Manufacturing, Machining, Research, Automatic control, Reprints, Computer aided manufacturing.

The Automated Manufacturing Research Facility (AMRF) at the U.S. National Bureau of Standards (NBS) is a major government laboratory for research in computer integrated manufacturing. The AMRF is designed to support the NBS role of providing measurement standards for American industry. The facility, located at Gaithersburg, Maryland, has close ties with industry, university, and government engineers and scientists.

710,465
PB87-234050 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Process Planning in the AMRF (Automated Manufacturing Research Facility).
Final rept.,
C. R. McLean, and P. F. Brown. Aug 87, 4p
Sponsored by Society of Manufacturing Engineers, Dearborn, MI.
Pub. in CIM Technology, pCT-23--CT-26 Aug 87.

Keywords: Process control, Reprints, *Automated Manufacturing Research facility, AMRF project, Computerized control systems.

As more intelligent automated control systems are introduced into discrete parts manufacturing facilities, it will become increasingly difficult to maintain the centralized process planning systems in use today. A new approach is required that will permit distributed manufacturing operations planning via a network of cooperating, intelligent, process engineering systems. Research on such systems is underway as a part of the Automated Manufacturing Research Facility (AMRF) project at the National Bureau of Standards (NBS). The article discusses: (1) the role of process planning in manufacturing facilities, (2) system architectures for planning and control, (3) the work element concept, (4) process plan data exchange formats, (5) feature-based manufacturing and (6) the current implementation of the planning system.

710,466
PB88-122015 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Research Issues in Process Planning at the National Bureau of Standards.
Final rept.,
P. F. Brown, and S. R. Ray. 1987, 9p
Pub. in Proceedings of CIRP International Seminar on Manufacturing Systems (19th), Pennsylvania State University, PA., June 1-2, 1987, p111-119.

Keywords: *Process control, *Manufacturing, *Robots, *Machine tools, Automation, *Computer aided manufacturing, Expert systems, National Bureau of Standards, Factory automation.

Several years ago, the Automated Manufacturing Research Facility (AMRF) project was established at the Gaithersburg site of the National Bureau of Standards (NBS). The facility is unique in several ways: first, all manufacturing activities are under direct computer control; second, all manufacturing data preparation systems and control systems are linked through a complex data administration and communication system; third, all manufacturing operations are carried out by robots and machine tools with a minimum of human intervention. This last constraint requires that all manufacturing data be complete and unambiguous. It was necessary to develop a process planning system which was capable of supporting the particular requirements and manufacturing capabilities of the AMRF. The paper describes the research agenda of NBS and its cooperative efforts over the past few years in the area of Automated Process Planning.

710,467
PB88-152731 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Production Control Module for the AMRF (Automated Manufacturing Research Facility).
Final rept.,
A. T. Jones, and C. R. McLean. 1985, 6p
Pub. in Proceedings of the International Computers in Engineering Conference and Exhibit, Boston, MA., August 4-8, 1985, p445-450.

Keywords: Computer aided manufacturing, Automation, Research and development, Industrial plants, Production control, Process control, Reprints, *Flexible manufacturing systems, Hierarchical control, US NBS, AMRF(Automated Manufacturing Research Facility).

The Automated Manufacturing Research Facility (AMRF) is being established at the National Bureau of Standards. The manufacturing testbed provides a means for conducting research in automated metrology and interface standards for the factory of the future. A five layer control hierarchy has been proposed to manage the real-time control of the facility. A careful examination of the functions performed at each level within the hierarchy indicates that a standard internal structure for control modules is possible. The paper describes the internal structure, external interfaces, and implementation techniques for such a production control module which can be utilized at each level in the hierarchy.

710,468
PB88-152749 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Proposed Hierarchical Control Model for Automated Manufacturing Systems.
Final rept.,
A. T. Jones, and C. R. McLean. 1986, 11p
Pub. in Jnl. of Manufacturing Systems 5, n1 p15-25 1986.

Keywords: Computer aided manufacturing, Automation, Research and development, Industrial plants, Production control, Process control, Reprints, *Flexible manufacturing systems, Hierarchical control, US NBS, AMRF(Automated Manufacturing Research Facility).

The Automated Manufacturing Research Facility is being constructed at the National Bureau of Standards. This small, integrated, flexible manufacturing system will serve as a research testbed to aid in the identification, design, and testing of standards for the automated factory of the future. The paper describes the five layer hierarchical production control model proposed to manage these factories. It includes a discussion of the philosophy behind the model, the functional requirements of each layer within the model, a brief description of the data services needed to support the approach, and an overview of the techniques used to implement existing subsystems.

710,469
PB88-155742 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
AMRF (Automated Manufacturing Research Facility) Database Report Format: Part Model,
T. H. Hopp. Nov 87, 77p NBSIR-87/3672

Keywords: *Report generators, Computer systems programs, Specifications, Programmers, AMRF(Automated Manufacturing Research Facility), Computer aided manufacturing, AMRF data base, Application programs(Computers), Format, User manuals(Computer programs).

The document specifies the format of Part Model database reports. These reports are used throughout the AMRF to communicate part model data between application processes and the global AMRF database. Part model data consists of basic shape data (topology and geometry), features, and functionality (tolerances). This document is organized in five sections. This document is intended for use by programmers implementing systems that make use of AMRF part model data. It is also intended as an introduction to the capabilities of the part model for systems analysts who must decide what applications can be supported by the AMRF part model.

Computer Software

710,470
PB87-122826 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
DATAX: A Prototype Software for Engineering Data Evaluation and Decision Support.
Final rept.
J. T. Fong, R. S. Cramer, and D. F. Redmiles. 1984, 4p
Pub. in Proceedings of 1984 American Society of Mechanical Engineers Pressure Vessels and Piping Conference and Exhibition, San Antonio, TX., June 17-21, 1984, v96 p115-118.

Keywords: *Computer graphics, *Pressure vessels, Pipes(Tubes), Computer networks, Prototypes, Decision making, *Computer aided design, *DATAX programming language, *Computer aided manufacturing, Data base management systems, On-line systems, Formats, High level languages, Access methods, Computer software.

The extended abstract is for an invited presentation at an ASME symposium on 'Engineering Databases: Software for On-Line Applications', where a preliminary design of a prototype software named DATAX is presented. The research on DATAX was motivated by a recent study of an ASME task force on a need for developing new software and data format standards for engineering database development (ASME spec. pub. MPC-20, pp. 75-105, 1983). As a proposed software for specific use in data evaluation, DATAX is a Fortran-based high-level language designed to integrate six hitherto separate software: (1) data analysis and graphics, (2) database management system, (3) text formatting and report preparation, (4) user-driven, free-format, interactive creation of data file, (5) analysis and modeling, and (6) network access.

710,471
PB87-122834 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Engineering Databases: Software for On-Line Applications.
Final rept.
J. T. Fong. 1984, 128p
Sponsored by American Society of Mechanical Engineers, New York.
Pub. in Proceedings of 1984 American Society of Mechanical Engineers Pressure Vessels and Piping Conference and Exhibition, San Antonio, TX., June 17-21, 1984, v96 128p.

Keywords: *Mechanical engineering, *Programming languages, Pressure vessels, Pipes(Tubes), *Computer aided manufacturing, *Data bases, Computer software, On-line systems, Data base management systems, Computer aided design, Failure(Electronics).

The book is divided into 3 chapters. The first chapter contains 6 papers of which 5 are related to either some currently working on-line systems or some state-of-the-art software languages that are of direct interest to engineering database developers. The second chapter contains 3 papers and 3 extended abstracts on some new design concepts where the proposed databases are at various stages of implementation. The final chapter consists of an invited paper on the 'proprietary and liability aspects of on-line information and analysis systems,' and a preview of a panel session on 'new opportunities in software development and analysis systems,' and a preview of a panel session on 'new opportunities in software development and issues on copyrights.

Engineering Materials

710,472
PB87-128807 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Compressive Properties of Silica Aerogel at 295, 76, and 20 K.
Final rept.
J. M. Arvidson, and L. L. Scull. 1986, 8p
Pub. in Advances in Cryogenic Engineering Materials 32, p243-250 1986.

Keywords: *Compressive properties, *Silica gels, Modulus of elasticity, Compression tests, Compressive strength, Stress strain diagrams, Fractures, Reprints, *Silica aerogel.

Specimens of silica aerogel were tested in compression at 295, 76, and 20 K in a helium gas environment. The properties reported include Young's modulus, the proportional limit, and yield strength. Compressive stress-versus-strain curves at these temperatures are also given. A test apparatus was developed specifically to determine the compressive properties of low strength materials. To measure specimen strain a concentric, overlapping-cylinder, capacitance extensometer was developed. This frictionless device has the capability to conduct variable temperature tests at any temperature from 1.8 to 295 K. Results from the compression tests indicate that at low temperatures the material is not only stronger, but tougher. During 295-K compression tests, the samples fractured and, in some cases, crumbled. After 76- or 20-K compression tests, the specimens remained intact.

Job Environment

710,473
PB87-232070 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Some Tools for Fire Model Validation.
Final rept.,
A. D. Davies. 1987, 20p
Pub. in Fire Technology 23, n2 p95-114 May 87.

Keywords: *Fire tests, Models, Errors, Graphic methods, Reprints, *Foreign technology.

General ideas are offered for describing fire model validity prior to starting product design. Validation of independent test results is part of the phase. Differences between comparable results, graphical methods, and distinctions between random and systematic errors are discussed.

710,474
PB88-129648 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Quantitative Fire Hazards Analysis: An Overview of Needs, Methods and Limitations.
Final rept.,
E. K. Budnick. 1986, 12p
Pub. in Fire Safety Jnl. 11, n1-2 p3-14 Jul-Sep 86.

Keywords: *Fire hazards, *Safety engineering, Mathematical models, Computerized simulation, Reprints.

This year's SFPE symposium Techniques for Quantitative Fire Hazard Analysis focuses on available analytical techniques for fire hazard prediction. Topics include damageability factors, calculations for discrete fire hazards, prediction of fire effects in enclosures, ap-

plications of computer models and the basics of probabilistic and statistical methods for addressing uncertainty. The introductory paper provides an overview addressing such issues as the need for quantitative methods, the technical basis for development of these methods, and a review of the more popular methods available to the fire protection community.

Joining

710,475
PATENT-4 491 014 Not available NTIS
Department of the Army, Washington, DC.
Bond Testing Apparatus.
Patent.
J. F. N. Seiler. Filed 12 Nov 82, patented 1 Jan 85, 5p PB86-174521, PAT-APPL-6-441 310
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Test equipment, *Patents, *Bonding, Laminates, Substrates, PAT-CL-73-150.

An apparatus for measuring the strength of a bond between a lamina and its substrate, or the like is shown and described. Air, or some other fluid under pressure, causes a gasket to protrude from a piston to seal the atmosphere from a chamber within the piston and the adjacent exposed lamina surface. The fluid also pressurizes this chamber to pull a loading fixture and a portion of the lamina attached thereto away from the substrate. The force required to pull the lamina from the substrate is equal to the strength of the bond.

710,476
PATENT-4 559 717 Not available NTIS
Department of Commerce, Washington, DC.
Flexure Hinge.
Patent.
F. E. Scire, and C. Teague. Filed 21 Feb 84, patented 24 Dec 85, 10p PB86-141090, PAT-APPL-6-581 831
Supersedes PB84-178557.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Hinges, *Patents, Flexing, PAT-CL-33-568.

The invention relates to improved flexure devices as well as to the use of such devices in instrument stages capable of independent movement in each of two orthogonally/related dimensions. More particularly, the invention relates to an instrument stage having an output device form capable of independent xy motion in a single plane and which is virtually free of pitch, roll and yaw and of motion perpendicular to the plane of motion.

710,477
PB85-196095 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Serviceability Limit States - Connection Slip.
Final rept.
T. V. Galambos, T. A. Reinhold, and B. Ellingwood. 1982, 13p
Pub. in Jnl. of the Structural Division, American Society of Civil Engineers 108, n12 p2668-2680 Dec 82.

Keywords: *Service life, *Joints(Junctions), Mechanical properties, Probability theory, Statistical analysis, Bolted joints, Limits, Design criteria, Resistance, Steels, Reprints, *Slip.

The serviceability limit state for slip of bolted steel joints is the slip-resistance. The statistical properties of the parameters which define this resistance are presented and discussed. Based on these properties and using First-Order Second-Moment probabilistic analysis, limit-states design criteria are developed for friction-grip bolted joints.

710,478
PB86-163797 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Use of Laser Microprobe Mass Analysis for Nickel Speciation in Individual Particles of Micrometer Size.
Final rept.
I. H. Musselman, R. W. Linton, and D. S. Simons. 1985, 5p
Pub. in Proceedings of Microbeam Analysis - 1985, Louisville, KY., August 5-9, 1985, p337-341.

Keywords: *Nickel, Particles, Micrometers, *Laser microprobe analysis.

Positive and negative ion spectra of micrometer-size particles of nickel metal and four nickel compounds are examined to determine the feasibility of nickel speciation by LAMMA. The four nickel compounds include nickel oxide, nickel sulfate heptahydrate, nickel sulfide, and nickel subsulfide. Diagnostic ions in both the positive and negative ion 'fingerprint' spectra distinguish nickel metal, nickel oxide, and nickel sulfate heptahydrate from nickel sulfide and nickel subsulfide. The positive and negative ion spectra of nickel sulfide and nickel subsulfide are qualitatively identical. The difficulty in differentiating the nickel sulfide and nickel subsulfide spectra using positive atomic ion intensity ratios as a reflection of compound stoichiometry is related to variations in laser power deposition and possible inhomogeneity in sample composition.

710,479
PB86-232667 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Fusion Line Shape Versus Toughness in HY-80 GMA (Gas Metal Arc) Welds.
T. A. Siewert, R. E. Trevisan, and P. T. Purtscher. Apr 86, 48p NBSIR-86/3043
Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.

Keywords: *Arc seam welds, Welded joints, Toughness, Gas metal arc welding, Steel HY-80.

The report describes the effect of the electrode weave procedure on both the fusion-line shape and toughness of reduced-gap gas metal arc (GMA welds. To study the variation in toughness, four GMA welds were produced in 25-mm-thick HY-80 plate using MIL 100S-1 electrode and following the weld procedure listed in the electrode specification, MIL-E-23765/2C. These four welds were used to compare stringer beads with various weave procedures using both manually controlled and adaptively controlled welding systems.

710,480
PB87-119137 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Production and Sizing of Uniform Two-Dimensional Flaws in Welds for NDE (Nondestructive Evaluation) Calibration.
Final rept.
R. E. Schramm, and T. A. Siewert. 1986, 3p
Sponsored by Naval Sea Systems Command, Washington, DC.
Pub. in Materials Evaluation 44, n9 p1136-1138 Aug 86.

Keywords: *Welded joints, *Ultrasonic tests, Nondestructive tests, Calibrating, Steels, Ultrasonic frequencies, Reprints, *Flaws.

The paper describes a procedure for the production of various uniform two-dimensional flaws for NDE calibration and their evaluation by both an electromagnetic-acoustic transducer system and metallographic sectioning.

710,481
PB87-122602 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Fracture Mechanics Analysis and Critical Flaw Size Curves for Surface Flaws in Pipelines.
Final rept.
D. T. Read. 1986, 8p
Sponsored by Department of Transportation, Washington, DC.
Pub. in Proceedings of International Conference and Exposition on Fatigue, Corrosion Cracking, Fracture Mechanics and Failure Analysis, Salt Lake City, UT., December 2-6, 1985, p561-568 1986.

Keywords: *Standards, *Fracture tests, *Pipelines, Toughness, Stress analysis, Mechanical properties, Weld defects, Inspection, Nondestructive tests, Quality assurance, Flaw detection.

Fitness-for-purpose standards for weld inspection and flaw repair criteria offer means for rational, quantitative balance among the three critical parameters governing fracture safety; material toughness, flaw size, and applied stress. The results of fitness-for-purpose analysis can be expressed as curves dividing all possible flaws into two categories, those that must be repaired and those that may safely be left unrepaired. Such flaw tolerance curves are obtained by calculations using elastic-plastic fracture mechanics analysis. Required input for such calculations includes material strength and toughness characterization and accurate values for imposed stress.

710,482
PB87-199345 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Fracture Toughness of Weldments: Elastic-Plastic Fracture Analysis.
Final rept.,
D. T. Read. 1984, 15p
Sponsored by Metal Properties Council, Inc., New York.
Pub. in Proceedings of 1984 Pressure Vessels and Piping Conference and Exhibition, San Antonio, TX, June 17-21, 1984, p75-89.

Keywords: *Weldments, *Fracture(Materials), Toughness, Elastic properties, Plastic properties, Welding, Metal plates, Stresses, Failure, Reprints.

Elastic-plastic fracture mechanics (EPFM) analysis of the results of tests of four welded wide plate specimens of one size with one surface crack geometry was attempted on three levels; simple correlation of wide plate results with small-specimen EPFM toughness; comparison of predicted and measured wide plate crack mouth opening displacement (CMOD) and J-integral; and comparison of EPFM-predicted wide plate failure stresses with experimental results. The failure loads of the three as-welded plates were correlated with both critical J-integral and critical crack tip opening displacement (CTOD). The stress-relieved specimen had a higher failure load than expected from both J and CTOD.

710,483
PB87-219200 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Compressive Stress Effects on the Ultrasonic Detection of Cracks in Welds.
Interim rept.,
T. A. Siewert, and R. E. Schramm. 1987, 8p
Contract N00167-86-WR6-0038
Sponsored by David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v6B p1593-1600 1987.

Keywords: *Ultrasonic tests, *Welding, Weld defects, Residual stress, Compresssing, Cracks, Reprints.

Ultrasonic inspection techniques are often used to search for cracks and other flaws in welds. These inspections are dependent on an impedance mismatch giving rise to reflection and scatter of ultrasound in the vicinity of the defect. The study investigates the effect of varying compressive stress across a flaw face on ultrasound of both very high frequency (from a piezoelectric transducer) and low frequency (from an electromagnetic-acoustic transducer, or EMAT). The test specimen had a shallow weld to serve as a hinge and specially machined faces between the two plates. Varying the bending force through this hinge changed the compressive loading across the flaw face. As this contact pressure increasd, both reflected amplitudes decreased but there were marked differences between the two frequencies. The nature of these differences depended on the transducer location along the weld, possibly due to changes in the nature of the bearing surfaces.

710,484
PB88-129697 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Sizing Canted Flaws in Weldments Using Low-Frequency EMATs (Electromagnetic-Acoustic Transducers).
Final rept.,
R. E. Schramm, and T. A. Siewert. 1987, 6p
Sponsored by David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v6B p1731-1736 1987.

Keywords: *Weldments, *Nondestructive tests, Ultrasonic frequencies, Reprints, EMAT(Electromagnetic acoustic transducer).

Techniques for detecting and sizing flaws with electromagnetic-acoustic transducers (EMATs), previously used successfully for normal planar flaws, were applied to canted flaws in steel plates. Comparisons were made between metallographic and ultrasonic measurements on specially prepared welds. Results indicated a high probability of detecting canted flaws (> 0.5-mm deep) with EMATs. The EMAT sizing was highly repeatable and, for the most part, very accurate. Some, as yet unexplained, inaccuracies did show up, however, in some weld sections. There is a possibility that the calibration curve may be more complex for canted flaws than for normal flaws.

710,485
PB88-139175 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Effects of Deoxidation Practice on the Transformation Behavior and Toughness of Steel Welds.
Final rept.,
O. Grong, T. A. Siewert, and G. R. Edwards. 1986, 19p
Pub. in Welding Jnl. 65, n11 p279s-288s Nov 86.

Keywords: *Weldments, *Microstructure, Deoxidizing, Toughness, Steels, Manganese, Gas metal arc welding, Silicon, Reprints.

The fundamental factors controlling the development of microstructures in C-Mn steel weldments were studied, with particular emphasis on gas metal arc (GMA) welding. The authors conclude that the major role of manganese in the weld metal transformation kinetics is to restrict the growth rate of the grain boundary ferrite allotriomorphs (and indirectly Widmanstatten ferrite) until the degree of undercooling reaches the point where intergranular nucleation of acicular ferrite is energetically feasible. Silicon, on the other hand, increases the growth rate of grain boundary ferrite and promotes the formation of proeutectoid ferrite.

710,486
PB88-141171 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Sensors for Batch Manufacturing of Metal Parts.
Final rept.,
D. S. Blomquist. 1985, 4p
Pub. in Proceedings of Conference on High Productivity Machining: Materials and Processes, New Orleans, LA., May 7-9, 1985, p277-280.

Keywords: *Sensors, *Manufacturing, *Metal products, *Monitors, Detectors, Transducers, Microcomputers, Computer aided manufacturing, Reprints.

Reliable and effective sensors are important elements of both manned and unmanned batch manufacturing of metal parts. The increased speed in microcomputers and the decreased costs of memory have allowed significant changes to be made in the type of sensors that can be considered. By the proper application of microcomputers, transducer mechanisms that were previously discarded can now be used because the microcomputer can process information in a short enough time to influence the process being monitored and can provide increased accuracy by data analysis or linearization.

Manufacturing, Planning, Processing & Control

710,487
PATENT-4 461 680 Not available NTIS
Department of Commerce, Washington, DC.
Process and Bath for Electroplating Nickel-Chromium Alloys.
Patent.
D. S. Lashmore. Filed 30 Dec 83, patented 24 Jul 84, 10p PB85-100113, PAT-APPL-6-567 451
Supersedes PB84-159953.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Electroplating, *Patents, *Nickel chromium alloys, Baths, Formic acid, Boric acids, Electrolytes, Nickel chlorides, Chromium chlorides, Sodium citrates, PAT-CL-204-41.

A process for the electrodeposition of a nickel chromium alloy on a cathodic substrate comprises: contacting the substrate with an aqueous electrolyte containing: about 50-125 g/l of CrCl3,6H2O; about 10-125 g/l of NiCl2,6H2O; about 10-115 g/l of formic acid; about 25-50 g/l of boric acid; and about 50-100 g/l of sodium citrate dihydrate; adjusting the pH of the bath to about 1-5 and the temperature to about 20-60C; and passing a sufficient current through the solution and to the substrate to effect deposition thereon of a nickel-chromium alloy.

710,488
PB83-252254 PC **A07**/MF **A01**
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Industrial Engineering and Operations Research.
Advances in Computer-Aided Process Planning.
T. C. Chang. Jul 83, 139p NBS-GCR-83-441
Grant NBS-DA-3010

Keywords: *Planning, Automation, Production engineering, *Process planning, Computer applications, Computer aided manufacturing, Computer aided design.

Modern industry is in need of the computer-aided process planning for two major reasons; the labor demand, and the technological demand. In the AMRF (Automated Manufacturing Research Facility) of the National Bureau of Standards, close interaction between process planning and production planning and control is required - a computer-aided system is essential. In the report, current state-of-the-art process planning systems are reviewed. Approaches used in current systems are also discussed. A modular system structure is proposed for AMRF. The structure is capable of accommodating all the necessary planning functions. The report also discusses the technical difficulties of implementing such a proposed process planning system. A glossary containing process planning terminologies is also included.

710,489
PB85-115475 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoresist Sensitometry and Exposure Modeling.
Final rept.
D. B. Novotny. 1981, 1p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Solid State Technology, v24 n3 p83 1981.

Keywords: Exposure, Photolysis, Sensitivity, Reprints, *Photoresists.

Sensitometric properties were measured for a positive diazo-type photoresist at wavelengths of 365, 405, and 436 nm. It is shown that the exposure data at these three wavelengths may be combined according to Van Kreveld's additivity law to accurately predict both simultaneous and successive exposures made with combinations of these wavelengths. Exposure modeling using Beer's law and first order photolysis kinetics, when combined with the measured sensitometric properties, supports the validity of Van Kreveld's law for simultaneous and successive exposures. The combined modeling and experimental data also support the existence of a critical inhibitor concentration that defines complete exposure and is the same for all wavelengths as well as for monochromatic simultaneous and successive exposures. Applications of characteristic curves of exposure depth as a function of exposure are outlined.

710,490
PB85-187821 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sensory Interactive Control Systems for Advanced Manufacturing.
Final rept.
G. J. Vanderbrug, J. S. Albus, and A. J. Barbera.
1980, 9p
Sponsored by International Federation of Automatic Control, Laxenburg (Austria) and International Federation for Information Processing, Geneva (Switzerland).
Pub. in Information Control Problems in Manufacturing Technology, p137-145 1980.

Keywords: *Robots, *Control equipment, Detectors, Manufacturing, Interactive systems, Robot vision.

Fundamental understanding of sensory interactive control systems is an important step in applying advanced manufacturing techniques. Functional requirements and an architecture for a sensory interactive robot control system are presented. A model for studying the interaction between the control and sensory parts of a system is presented. The model consists of parallel control decomposition and sensory analysis hierarchies. A robot vision system is described, with special emphasis on the nature of its interaction with the control part of the system.

710,491
PB86-124765 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
National Bureau of Standards' Automation Research Program.
Final rept.
J. A. Simpson. 1983, 5p
Pub. in Proceedings of IFAC/IFIP Symposium (4th) on Information Control Problems in Manufacturing Technology, Gaithersburg, MD., October 26-28, 1982, p9-13 1983.

Keywords: *Standards, *Industrial plants, Automation, Machine tools, Process control, *Flexible manufacturing systems, *Research facilities, Computer aided manufacturing.

The program focuses on two problems lying close to the core mission of the National Bureau of Standards. First, how will the automated factory ensure that its products are dimensionally compatible with national standards. Second, what new national standards must be developed by the private sector to permit the increased productivity promised by automation to be realized in a free market economy. To explore these problems, an extremely flexible manufacturing research facility, with hierarchical, highly modular control architecture is being installed. This facility is designed to be capable of emulating a wide variety of manufacturing cells typical of a small machine shop.

710,492
PB86-203973 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Linewidth Calibration for Bright-Chromium Photomasks.
D. Nyyssonen. May 86, 25p NBSIR-86/3357

Keywords: *Line width, Masking, Calibrating, Measurement, Chromium, Standards, Flares, Detectors, *Photomasks.

Linewidth measurement errors are introduced when an anti-reflective (AR) chromium photomask standard such as the NBS SRM 474/475 is used to calibrate an optical linewidth measurement system for subsequent measurements on another material such as bright chromium whose optical properties (index of refraction, thickness, reflectance, and edge geometry) do not match those of the calibration standard. In addition to differences in the optical properties of the materials, the magnitude of these errors varies from system to system and depends upon resolution, choice of edge-detection criterion, flare light in the optical system, and detector response. These errors are greatest when measurements are made in reflected light due to the greater sensitivity to the mismatch in optical parameters of the materials between the calibration standard (AR-chromium) and the material to be measured (bright chromium). The report, therefore, recommends use of transmitted light for linewidth measurements on photomasks and as close a match as possible between the material parameters of the calibration standard and those of the part being measured in order to ensure a realistic assessment of the accuracy and precision of subsequent measurements.

710,493
PB86-212040 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
National Forum on the Future of Automated Materials Processing in U.S. Industry: The Role of Sensors. Report of a Workshop (1st) Held at Santa Barbara, California on December 16-17, 1985.
H. T. Yolken, and R. Mehrabian. Dec 85, 79p NBSIR-86/3341
Prepared in cooperation with California Univ., Santa Barbara. Sponsored by Industrial Research Inst., New York, and Office of Science and Technology Policy, Washington, DC.

Keywords: *Material handling, *Detectors, Automation, Ceramics, Composite materials, Metals, Polymers, Optical materials.

This is the proceedings of the workshop 'A National Forum on the Future of Automated Materials Processing in U.S. Industry - The Role of Sensors'. This is the first of two workshops to be sponsored by the Industrial Research Institute and the White House Office of Science and Technology Policy, Committee on Materials Working Group on Automation of Materials Processing. The second workshop will address the other two key components required for automated materials processing, process models and artificial intelligence coupled with computer integration of the system. The objective of these workshops is to identify and assess important issues affecting the competitive position of U.S. industry related to its ability to automate production processes for basic and advanced materials and to develop approaches for improved capability through cooperative R&D and associated efforts.

710,494
PB86-229945 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Electrical Measurement Technique for Estimating Proximity Effects in Electron-Beam Lithography.
Final rept.
D. Yen, L. W. Linholm, W. B. Glendinning, and J. F. Bass. 1983, 1p
Pub. in Jnl. of the Electrochemical Society 130, n8 p319 c1983.

Keywords: *Lithography, Electron beams, Line width, Measurement, Reprints.

An electrical test structure and test method is described for estimating the magnitude of proximity effects in electron-beam lithography. The test structure consists of van der Pauw cross resistor for measuring sheet resistance, a bridge resistor for measuring electrical linewidth, and a second bridge resistor simulating a close line-space environment for measuring electrical linewidth where proximity exposure effects from nearby patterns may be encountered. These test structures were delineated in a metal layer on a silicon wafer using electron beam exposure and wet chemical etching. Electrical measurements are compared to optical measurements. The technique provides an alternative to optical measurements for determining effective linewidth in a dense circuit environment and can be used to estimate parameters for the double Gaussian model used in proximity correction algorithm.

710,495
PB87-153060 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Design of a Conformal Tactile Sensing Array.
Final rept.,
I. McCammon. 1984, 6p
Pub. in Proceedings of Conference on Intelligent Robots and Computer Vision, Cambridge, MA., November 5-8, 1984, p296-301.

Keywords: *Pneumatic control, *Manufacturing, Arrays, Matrix methods, Displacement, Pins, Air flow, Stiffness, Measurement, Standards, Hysteresis, *Tactile sensation, *Robotics, *Optoelectronic sensors.

In the course of the National Bureau of Standards' program in measurements and standards for automated manufacturing and robotics, a tactile sensing array with a high degree of conformability has been developed. The array consists of a pneumatically controlled matrix of displacement pins which provides a deformable grasping surface, and a corresponding array of optoelectronic proximity sensors which determine workpiece orientation and geometry. Regulation of air flow into the finger to control grasping stiffness permits the sensing and handling of very delicate of complex objects. Additional features of the design include programmable array rigidity, zero mechanical hysteresis, and gripper mounted packaging.

710,496
PB87-161196 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Hierarchical Control and Real-Time Optimization in Automated Manufacturing Systems,
R. H. F. Jackson, and A. W. T. Jones. Feb 87, 22p NBSIR-86/3503

Keywords: *Pilot plants, *Manufacturing, *Production management, *Industrial plants, Scheduling, Routing, Standards, Measurement, Optimization, Models, Research, Facilities, Prototypes, *Factory automation, *Hierarchical control, *Flexible manufacturing, *Technology innovation, Real time, National Bureau of Standards.

A major manufacturing research facility is being established at the National Bureau of Standards. The Automated Manufacturing Research Facility will address the standards and measurement needs for the factory of the future. A five-layer hierarchical control architecture is under development to manage all production and support activities within the facility. The proper execution of many of these activities requires the solution to one or more optimization problems. The paper partitions these problems into levels consistent with the control architecture and reports on early work undertaken to solve some of them.

710,497
PB87-161881 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Measurement of the Separation Distance in Contact and Proximity Lithography.
Final rept.,
D. B. Novotny. Dec 86, 6p
Pub. in Jnl. of the Electrochemical Society 133, n12 p2600-2605 Dec 86.

Keywords: *Lithography, Substrates, Separation, Masking, Diffraction, Reprints.

A method is presented for measuring the separation distance between the substrate surface and the mask surface in contact and proximity optical lithography. The method uses the analysis of the Fresnel diffraction pattern produced by a slit aperture in the mask and physically replicated in the photoresist. From the analysis, the image distance producing the observed Fresnel diffraction pattern is obtained and is used to calculate the separation distance. The conditions for the application of this method are presented, and an easy method for computer-generation of the Fresnel diffraction patterns is described. A simplified method for estimating the separation distance from the number of diffraction pattern peaks and valleys is also given. Results are presented showing that a finite separation distance may exist in hard 'contact' lithography, and that this measurement method is applicable from separation distance from near zero to 20 or more micrometers.

710,498
PB87-191045 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
Need for a Standard in Package Inspection.
Final rept.,
C. S. Brickenkamp. 1984, 7p
Pub. in Transactions of the Annual Quality Congress (38th), Chicago, IL., p420-426, May 14-16, 1984.

Keywords: *Packaging, *Standards, Quality control, Labels, Reprints, Content.

The National Bureau of Standards (NBS) Handbook 133 'Checking the Net contents of Packaged Goods' is a procedural manual on package testing for State and local weights and measures officials. The context within which the handbook was developed, including the legal requirements, definitions of acceptable lot, and traditional compliance testing approaches are presented. Intercomparisons are made among the Handbook 133 compliance testing procedures (including individual package limits), older methods in the United States, and the directives issued by the European Economic Community (EEC). Recommendations that could significantly increase the productivity of regulatory agencies along with opportunities for cost savings in the packaging industries are outlined.

710,499
PB87-218376 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Office of Nondestructive Evaluation.
Advances Toward the Standardization of Residual Stress Measurements.
Final rept.,
L. Mordfin. 1987, 5p
Pub. in Advances in Surface Treatments, v4 p341-345 1987.

Keywords: *Surface finishing, *Residual stress, *Standards, Reprints, US NBS, American Society for Testing and Materials(ASTM).

Advance toward the standardization of residual stress measurements since 1982 are described. Most of the advances in standard methods have been achieved through the American Society for Testing and Materials (ASTM) -- notably in its Subcommittee E28.13 -- while research at the US National Bureau of Standards (NBS) has been directed toward physical measurement standards. Current activities in these organizations and plans for the near future are also discussed. Additional participants for this work are solicited.

710,500
PB87-233615 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Effect of Electrode Weave Procedure on HY-80 GMA (Gas Metal Arc) Welds.
Final rept.,
T. A. Siewert, R. E. Trevisan, and P. T. Purtscher. Jul 87, 7p
Sponsored by David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.
Pub. in Welding Jnl. 66, n7 p203-s--209-s Jul 87.

Keywords: *Gas metal arc welding, Fracture tests, Toughness, Reprints, *Foreign technology, Steel HY-80.

The report describes the effect of electrode weave procedure on both the weld interface shape and the toughness of gas metal arc (GMA) welds on HY-80 steel. To evaluate the variation in weld interface shape, the HY-80 welds were simulated by substituting a Type 309 stainless steel electrode for the HY-80 electrode, while reproducing the weave pattern and the weld pool dimensions. When the HY-80 base material was dissolved from around the weld, the entire fusion surface could be examined. This technique revealed the two-dimensional weld interface surface rather than the one-dimensional weld interface normally seen by metallographic techniques. The weld interface surface in the direction of welding was smooth for conventional (stringer bead) welds and convoluted for welds with a transverse weave pattern. Only small differences were observed in welds that were deposited using three different weave patterns.

710,501
PB88-122064 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Standardization Suggested by the AMRF - A Research Testbed for the Factory of the Future.
Final rept.,
H. M. Bloom, and C. R. McLean. 1985, 23p
Pub. in Automated Manufacturing, Chapter 4, 23p 1985.

Keywords: *Factory automation, *Manufacturing, Computer systems hardware, Interfaces, Standardization, Research, Test facilities, *Computer aided manufacturing, Computer software, Computer aided design, Hierarchical control.

A research effort has been initiated at the National Bureau of Standards to develop a small batch manufacturing system to support study and experimentation in automated metrology and interface standards for the computer integrated factory of the future. When completed, the resulting testbed system will be made available for fundamental studies in manufacturing technology by scientists and engineers from government, industry, and universities. The paper will report on the progress of major software and hardware subprojects that are being carried out in support of the construction of the AMRF.

710,502
PB88-140975 Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Some Observations on Tool Sharpness and Sub-Surface Damage in Single Point Diamond Turning.
Final rept.,
C. Evans, R. Polvani, M. Postek, and R. R. Rhorer. 1987, 15p
Pub. in SPIE (Society of Photo-Optical Instrumentation Engineers)-in-Process Optical Metrology for Precision Machining, v802 p52-66 1987.

Keywords: *Precision finishing, *Machining, Electron microscopy, Damage assessment, Reprints.

Simple techniques for an assessment of the depth and intensity of plastic work, or subsurface damage, in single point diamond turned components are described. Based on microhardness measurement techniques, the approach outlined here gives good qualitative correlation with conventional metallographic approaches for sub-surface damage assessment.

710,503
PB88-153358 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Study of Die Polishing for United States Mint Phase 3.
Final rept.,
K. Ousterhout. Oct 87, 35p NBSIR-87/3664

Keywords: *Dies, *Polishing, Automation, *United States Mint.

The research was undertaken to determine the feasibility of automating the polishing process of proof dies at the United States Mint. The dies polished during the research endeavor were the obverse Kennedy half-dollar dies. The main goals of the research are: (1) Develop a method of mechanically polishing proof dies which results in a quality level equal to or better than that now achieved by current manual methods; (2) Develop the optimum production rate that can be achieved in mechanically polishing proof dies; (3) Utilize a machine tool with at least 4 axes of motion; and, (4) Exercise initiative and ingenuity in the use of conventional and computer technologies, and develop through experimentation the best polishing compounds and materials, tooling, tool paths, speeds, masking techniques or other methods of protecting areas not to be polished.

Optics & Lasers

710,504
PB84-245976 Not available NTIS
National Bureau of Standards, Washington, DC.
Real-Time Three-Dimensional Vision for Parts Acquisition.
Final rept.
J. S. Albus, R. Haar, M. Nashman, M. Shneier, and S. Nagalia. 1981, 5p
Prepared in cooperation with Maryland Univ., College Park. Computer Center. Sponsored in part by SPIE-The International Society for Optical Engineering, Bellingham, WA.
Pub. in Society of Photo-Optical Instrumentation Engineers 283, p56-60 1981.

Keywords: *Optical detection, Components, Automation, Cameras, Industrial plants, Manufacturing, Reprints.

The National Bureau of Standards is developing a vision system for use in an automated factory environment. The emphasis of the project is on the real-time acquisition of three-dimensional parts using visual feedback. The system employs multiple light sources in conjunction with object models to establish the position and orientation of an object in the camera's field of view. A flood flash enables shape information to be obtained from an image, while a plane of light can be used to find the three-dimensional positions of points on the object. Because there are only a small number of object types and the objects all have predefined nominal locations, a model can be used to predict how the scene should look from a given viewpoint using a particular light source. This prediction can be compared with the actual image, and the differences used to establish position information. Models are expected to be particularly useful in reducing the number of views of an object necessary to calculate its three-dimensional position.

Plant Design & Maintenance

710,505
PB88-110747 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems Components Div.
Multi-Microprocessor Guard Control Station.
Final rept.,
A. Mink, G. Nacht, A. Holt, A. Koenig, and R. Moore. 1983, 11p
Sponsored by Defense Nuclear Agency, Washington, DC.
Pub. in Proceedings of Annual Technical Symposium of the Washington, DC. Chapter of the ACM (Association for Computing Machinery) (22nd), 'Microcomputer Systems: Tools or Toys', Gaithersburg, MD., June 23, 1983, pF.2.1-F.2.11.

Keywords: *Security, *Internal security, *Guards(Personnel), Facilities management, Control equipment, *Area security, *Multiprocessors, Interactive systems, Real time operations.

The implementation and evaluation of a Guard Control Station that is part of a Computerized Site Security Monitor and Response System is described. The implementation used three microprocessors interconnected via communication channels in an arrangement that permitted simulation of physical security scenarios in a real-time, interactive mode.

Quality Control & Reliability

710,506
PB83-207696 PC **A12**/MF **A01**
National Bureau of Standards, Washington, DC.
NBS: Processing/Microstructure/Property Relationships in 2024 Aluminum Alloy Plates.
Technical rept.
L. K. Ives, L. J. Swartzendruber, W. J. Boettinger, M. Rosen, S. D. Ridder, F. Biancaniello, R. Reno, D. Ballard, and R. Mehrabian. Apr 83, 270p NBSIR-83-2669
NASA Order-W-14637

Keywords: *Aluminum alloys, *Microstructure, *Metallography, Metal plates, Nondestructive tests, Ultrasonic tests, Eddy current tests, Mechanical properties, Aluminum alloy 2024, Transmission electron microscopy.

The report describes the details on the 2024 aluminum alloy under the following subheadings; Studies on as - received plates of 2024 aluminum alloy; Solidification-segregation studies, microsegregation and macrosegregation in laboratory and commercially cast ingots; C-curves and nondestructive evaluation, time-temperature precipitation diagrams and the relationships between mechanical properties and NDE measurements; Transmission electron microscopy studies, and the relationship between microstructure and properties; Ultrasonic characterization; Eddy-current conductivity characterization, the study of aging process by means of dynamic eddy current measurements, and Heat flow--property predictions, property degradations due to improper quench from the solution heat treatment temperature.

710,507
PB85-100121 Not available NTIS
National Bureau of Standards, Washington, DC.
AE (Acoustic Emission) Signal Analysis - Laboratory Experiments into the Physical Processes of Acoustic Emission.
Final rept.
N. N. Hsu, and D. G. Eitzen. 1980, 12p
Sponsored in part by Japan Society for Non-Destructive Inspection, Tokyo, Atomic Energy Society of Japan, Tokyo, High Pressure Inst. of Japan, Tokyo, and Japan Society of Civil Engineers, Tokyo.
Pub. in Proceedings of International Acoustic Emission Symposium (5th) Held at Tokyo, Japan on November 18-20, 1980, p67-78.

Keywords: *Transfer functions, Signal processing, *Acoustic emission testing, Acoustic emissions.

A goal of acoustic emission (AE) signal analysis is to reliably assess and monitor the integrity of structures. In order to achieve this goal, we feel that it is necessary to quantitatively determine the source mechanisms by transforming the detected signals into a precise measurement of the source function. Only through this determination will the reliability of AE technology be sufficiently assured. To pursue this goal, we have studied the details of the physical processes of an AE from the generation of the stress waves at the source to the wave propagation in the structure, to the conversion into electrical voltage signals through a combination of analysis, design and conduct of controlled experiments.

710,508
PB85-108595 Not available NTIS
National Bureau of Standards, Washington, DC.
Graphical Signatures for Manufactured Surfaces.
Final rept.
Y. Tanimura, E. C. Teague, F. E. Scire, R. D. Young, and T. V. Vorburger. Oct 82, 5p
Pub. in Jnl. of Lubrication Technology 104, p533-537 Oct 82.

Keywords: *Surface properties, Signatures, Manufacturing, Topography, Precision finishing, Reprints.

Three dimensional surface signatures were calculated from radial profile measurements of two lapped specimens, two ground specimens and a milled specimen. These signatures are polar autocorrelation function (ACF) maps and R sub a maps. The ACF maps were obtained by plotting contours of equal autocorrelation values. The ACF maps reveal more structure than the R sub a maps and their shapes appear to be characteristic of the corresponding manufacturing methods. Therefore, radial profile measurement together with the use of ACF maps is a useful technique for relating surface topographies to manufacturing processes.

710,509
PB85-183523 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Future Directions of Ultrasonic NDE Standards in the U.S.
Final rept.
G. Birnbaum, and D. G. Eitzen. 1982, 6p
Pub. in Proceedings of the World Conference on Non-Destructive Testing (10th), Moscow, USSR, August 23-27, 1982, p267-272.

Keywords: *Ultrasonic tests, Standards, Calibrating.

The purpose of this report is to examine the current status and future requirements for ultrasonic NDE standards and calibrations. Considerations along this line have been discussed previously (1) but much of the emphasis was on an analysis of the subject; here the authors attempt to emphasize the progress on ultrasonic NDE standards and consider three aspects of the subject. (a) The authors review improvements of accepted standards such as those proposed by ASTM, those traceable to NBS, and those widely used in practice. Improvements in these standards, in the underlying theory and in their relation to practice will have significant impact on future systems. (b) The authors consider proposed methods which are new rather than improvements to those considered in (a). (c) Finally, the authors consider standards and calibration needs for evolving and future ultrasonic NDE methods.

710,510
PB85-196160 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Acoustic-Emission-Monitored Tests for TAB Inner Lead Bond Quality.
Final rept.
G. G. Harman. 1982, 9p
Sponsored by Department of Energy, Washington, DC. Energy Information Administration, and Components, Hybrids and Manufacturing Technology Society (IEEE), New York.
Pub. in Proceedings of Electronic Components Conference (32nd), San Diego, CA, May 10-12, 1982, p268-276.

Keywords: Quality, Integrated circuits, Semiconductor devices, Bonding, Fatigue tests, Nondestructive tests, *Acoustic emission testing.

The paper gives a brief introduction to acoustic-emission (AE) based tests applied to quality control in the electronics industry and describes some recent research on this testing technique. Equipment and circuits are described that may be used to implement such AE-monitored testing. Acoustic-emission monitored tests to determine the inner lead bond quality for

Tape Automated Bonding (TAB) have been developed. These include a pull tester and a microfatigue tester for off-line evaluation of bond quality and metallurgical system reliability as well as an automatic on-line production bond quality tester. The microfatigue tester for TAB leads can apply a small oscillatory (up to 80 Hz) force on top of a constant force bias of a few grams.

710,511
PB85-208106 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Comparison of Depth Profiling of (10)B in Silicon Using Spreading Resistance Profiling, Secondary Ion Mass Spectrometry, and Neutron Depth Profiling.
Final rept.
J. R. Ehrstein, R. G. Downing, B. R. Stallard, D. S. Simons, and R. F. Fleming. 1984, 15p
Pub. in American Society for Testing and Materials, Special Technical Publication 850, p409-425 Oct 84.

Keywords: *Silicon, *Semiconductor doping, Reprints, *Boron 10, *Ion implantation, Secondary ion mass spectroscopy, Spreading resistance.

Depth profiling of intentional dopants is an important measurement in the semiconductor industry both for process and device modeling and for process control. A comparison of (10)B implants into silicon as measured by Spreading Resistance Profiling (SRP), Secondary Ion Mass Spectrometry (SIMS) and by Neutron Depth Profiling (NDP) is presented. The boron implantations were done at several fluences and energies into bare silicon and through several thicknesses of thermally grown oxides. Sources of error and their relation to observed differences among the techniques will be discussed.

710,512
PB86-102241 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Sizing of Polystyrene Spheres Produced in Microgravity.
G. Mulholland, G. Hembree, and A. Hartman. Jul 85, 26p NBSIR-84/2914

Keywords: *Latex, *Polystyrene, *Spheres, *Size determination, Standard deviation, Weightlessness, *Space manufacturing, Space shuttles, Transmission electron microscopy.

The standard deviation of the size distribution was determined for a polystyrene latex produced in a space shuttle experiment and in an earth-bound control experiment. Values determined from direct measurement of transmission electron micrographs, corrected for magnification distortion, were 0.035 micrometer for the space grown material and 0.15 micrometer for the control. The standard deviations obtained from an aerodynamic particle sizer were only slightly greater than those obtained by TEM; 0.042 micrometer and 0.20 micrometer for the shuttle and ground material respectively. However these values were produced in a few hours versus the several weeks it took for the electron microscopy. Both of the techniques used here resulted in measured standard deviations significantly smaller than those previously reported for this material.

710,513
PB86-122777 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Approach to ATE (Automatic Test Equipment) Calibration via Performance Verification at the System Interface.
Final rept.
T. F. Leedy. 1985, 4p
Pub. in Proceedings of 1985 Measurement Science Conference, Santa Clara, CA., January 17-18, 1985, p198-201.

Keywords: Performance evaluation, Calibrating, *Automatic test equipment.

A method of verifying the performance of automatic test equipment (ATE) in its normal operating environment and configuration is presented as the best approach to achieving an overall system calibration. The method consists of the transport of well-characterized signal sources to the ATE station and the application of these electrical stimuli directly to a well-defined electrical interface on the test station.

710,514
PB86-122884 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Calibration Methods for Eddy Current Measurement Systems.
Final rept.
J. C. Moulder, J. C. Gerlitz, B. A. Auld, M. Riaziat, S. Jeffries, and G. McFetridge. 1985, 10p
Pub. in Proceedings of Review of Progress in Quantitative Nondestructive Evaluation, San Diego, CA., July 8-13, 1984, v4A p411-420 1985.

Keywords: *Eddy currents, Calibrating, Nondestructive tests, Measurement.

Quantitative inversion of eddy current signals to obtain flaw sizes from actual measurements requires methods for calibrating eddy current measurement systems. In performing flaw-signal inversion it is not sufficient to know the phase of the flaw signal relative to liftoff: rather, the absolute phase of Delta Z is required. The authors explore three possible approaches to this problem: absolute electrical calibration of the measurement system, measurements of probe liftoff signals, and measurements on actual or simulated flaws. Air core, circular coils of rectangular cross-section are used to facilitate comparisons of theory and observation. Results of liftoff measurements are found to agree with analytical solutions obtained by Dodd and Deeds. Flaw signals for rectangular-shaped, surface-breaking flaws agree with the predictions of the nonuniform-probe-field theory of Muennemann and Auld.

710,515
PB86-143732 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Practical Method for Edge Detection and Focusing for Linewidth Measurements on Wafers.
Final rept.
D. Nyyssonen. 1985, 7p
Pub. in SPIE Optical Microlithography IV 538, p172-178 1985.

Keywords: *Line width, *Optical measurement, *Dimensional measurement, *Lithography, Optical microscopes, Focusing, Wafers, Micrometers, Reprints, *Edge detection.

Lack of precision and accuracy of in-process critical dimension (CD) measurements of linewidth continues to be a serious problem at micrometer and submicrometer dimensions. The paper proposes a new dual-threshold method for edge detection and focusing, based on image theory, which can be adapted to most optical microscope-based measurement systems. It does not require knowledge of the phase difference at the line edge. The accuracy of this criterion is compared to two more widely used criteria, (1) the minimum and (2) 50% threshold, and it is concluded that, when the phase difference is unknown and varies with normal processing, the new dual-threshold method is the superior method.

710,516
PB86-181864 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Methodology for Statistical Control of the Anechoic Chamber Field Generation System.
D. S. Friday. Jan 86, 20p NBSIR-85/3033

Keywords: *Anechoic chambers, *Control charts, Electromagnetic fields, Standards, *Statistical control.

The microwave anechoic chamber is a National Bureau of Standards laboratory facility in which standard electromagnetic fields are generated. The chamber enables special measurements and electromagnetic compatibility tests to be conducted on antennas and other devices. The paper is concerned with methodology for assuring that the standard field patterns generated in the chamber are repeatable. Procedures are proposed for developing a data base from measurements obtained by placing the system, which generates the fields, in certain relevant reference configurations. Methodology is presented for developing statistical control charts to monitor both the location and the scale parameters of these data over time.

710,517
PB86-228616 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Release Notes for STAT2 Version 1.7: An Addendum to NBS (National Bureau of Standards) Special Publication 400-75.
R. L. Mattis. Mar 86, 41p NBSIR-86/3333
For system on diskette, see PB86-182490. Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Computer programs, Wafers, Computer systems programs, STAT2 computer program, Automatic test equipment.

The document describes the changes which have been made in the STAT2 computer program since its documentation in NBS Special Publication 400-75, Semiconductor Measurement Technology: A FORTRAN Program for Analysis of Data from Microelectronic Test Structures, and NBS Internal Report 83-2779, Release Notes for STAT2 Version 1.31. It is assumed that the reader has these documents, and no attempt is made to review STAT2 features or operation. The changes extend the functionality and versatility of the program. More specifically, the new features added in version 1.7 include data base extension, an input data format suitable for test sites not in a periodic array, an outlier exclusion algorithm suitable for small numbers of sites, common site exclusions for related data sets, a vector map, a scatter plot, a trend chart, extended macro command file capability, and other changes. Following the description of the changes is an annotated listing of new error messages. The document and the two previous publications cited constitute the documentation of version 1.7 of STAT2.

710,518
PB86-229960 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of Nondestructive Evaluation.
Nondestructive Evaluation.
Final rept.
L. Mordfin. 1985, 25p
Pub. in Materials and Processes (3rd Edition), Part B, Chapter 30, p1495-1519 1985.

Keywords: *Nondestructive tests, Evaluation, Reprints.

No abstract available.

710,519
PB87-113601 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
SEM-Based (Scanning Electron Microscope-Based) System for Calibration of Linewidth SRMs (Standard Reference Materials) for the IC (Integrated Circuit) Industry.
Final rept.
D. Nyyssonen, and M. T. Postek. 1985, 7p
Pub. in SPIE 565, p180-186 1985.

Keywords: *Linewidth, Electron microscopes, Calibrating, Integrated circuits, Reprints, Standard reference materials, Scanning electron microscopy.

The National Bureau of Standards is currently developing a new scanning electron microscope-based linewidth measurement system for future calibration of standard reference materials for the IC industry. This system incorporates a piezo/interferometric stage for precise translational motion and the monitoring of distance, improved vibration-isolation, microprocessor stage control system, and computer data analysis. The specifications incorporated into the system are designed for the measurement of linewidth dimensions from 0.1 to 2 um with a precision of 0.002 um. The design philosophy of the system is discussed along with the current limitations of accurate edge detection in SEM-based systems.

710,520
PB87-118758 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Laser Simulation of Buried AE (Acoustic Emission) Sources.
Final rept.
D. A. Hutchins, K. Lundgren, R. P. Young, and N. N. Hsu. 1986, 5p
Pub. in Jnl. of Acoustic Emission 5, n3 pS29-S33 Jul/Sep 86.

Keywords: Greens function, Light pulses, Simulation, Reprints, *Acoustic emissions, Acoustooptics, Buried objects, Laser radiation.

A pulsed laser has been used to simulate AE sources both buried within metallic plates and at various solid surfaces. Waveforms detected by either interferometric or piezoelectric sensors are then discussed in terms of AE detection and source location. A comparison to wave propagation theory is also presented for the buried sources, yielding good agreement.

710,521
PB87-151593 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Three Dimensional Strain Measurements with X-ray Energy Dispersive Spectroscopy.
Final rept.,
D. R. Black, C. J. Bechtoldt, R. C. Placious, and M. Kuriyama. 1985, 5p
Pub. in Jnl. of Nondestructive Evaluation 5, n1 p21-25 1985.

Keywords: *Nondestructive tests, *Strain measurement, *X ray diffraction, Gradients, Curve fitting, Steels, Residual stress, Bars, Reprints, Three dimensional.

A feasibility study was performed to show the ability of energy dispersive x-ray diffraction (EDXRD) to measure three dimensional strain distributions in thick industrial materials. Photon energies up to 130 keV were used to guarantee penetration through the sample and curve fitting techniques applied to peak position determination. The system was used to measure the strain gradient through the thickness of a 9.5 mm thick cantilevered steel bar.

710,522
PB87-201406 PC A03/MF A01
National Bureau of Standards (IMSE), Gaithersburg, MD. Office of Nondestructive Evaluation.
NDE (Non-Destructive Evaluation) Publications, 1984,
L. Mordfin. Apr 87, 32p NBSIR-87/3552
See also report for 1982, PB85-244069.

Keywords: *Nondestructive tests, *Bibliographies, Abstracts, National Bureau of Standards.

This is the eighth in a series of bibliographies of NBS publications on nondestructive evaluation (NDE). It provides bibliographic citations, with selected abstracts, for 103 publications that appeared in the open literature, primarily during calendar year 1984. A detailed subject index is included as well as information on how copies of many of the publications may be obtained.

710,523
PB87-219226 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Plate Modes Generated by EMATs for NDE of Planar Flaws.
Interim rept.,
S. K. Datta, R. E. Schramm, and Z. Abduljabbar. 1987, 8p
Contract N00167-86-WR6-0038
Sponsored by David W. Taylor Naval Ship Research and Development Center, Bethesda, MD., National Science Foundation, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v6A p101-108 1987.

Keywords: *Nondestructive tests, Waveforms, Diffraction, Plates, Ultrasonic tests, Transducers, Reprints.

In recent years several investigators have reported on the propagation and scattering of SH waves in a plate. The theory of SH wave generation by EMATs and the representation of the waveform in propagating plate modes is well understood. Scattering of SH waves by planar flaws has also been studied theoretically and experimentally. In the paper, the authors have examined how the various plate modes form as a function of frequency, geometry, and transducer configuration, then combine into a waveform. Careful selection of the parameters simplifies subsequent analysis and determines optimal positions for the transducers relative to each other and any reflector. Calculations based on a hybrid finite element and model expansion technique are presented for scattering by canted cracks that might be expected in a plate. Experimental comparisons have been made on slotted plates.

710,524
PB87-232062 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Digital Image Processing for Improved Detection and Diagnosis of Hidden Flaws.
Final rept.,
R. C. Placious, D. Polansky, and J. H. Sparrow. 1983, 9p
Pub. in Technology Advances in Engineering and Their Impact on Detection, Diagnosis and Prognosis Methods, p100-108 1983.

Keywords: *Nondestructive tests, *Radiography, Digital systems, *Image processing, *Flaw detection.

The conversion of a radiographic image to a digitized form is discussed. The transformation permits one to perform mathematical operations on the digital data by use of a microprocessor or a computer. A transformed image can then be displayed on a suitable video monitor for viewing or analysis. A sophisticated technology has been developed by the image processing industry for the enhancement of images. Many of these techniques are useful in NDT work for the detection of material or fabrication flaws which could result in mechanical failures.

710,525
PB87-233847 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Field Mapping and Performance Characterization of Commercial Eddy Current Probes.
Final rept.,
T. E. Capobianco. 1987, 8p
Sponsored by Army Materials Technology Lab., Watertown, MA.
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v6A p687-694 1987.

Keywords: *Eddy current tests, Magnetic fields, Mapping, Performance, Sensitivity, Reprints, *Probes(Electromagnetic), US NBS.

Variations in the sensitivity of commercial eddy current probes are common, and this fact can cause reliability problems for those using eddy current inspection techniques. The National Bureau of Standards in Boulder, Colorado, is conducting research to characterize eddy current probe performance. The authors have developed a unique capability to map the near magnetic field of these probes, and results are presented comparing field maps to measurements of electrical and other performance parameters. They show that the magnetic field intensity per unit of excitation current has a direct relationship to the strength of the probe response to a simulated defect (electrical discharge machined notches) when probe/coil misalignments are corrected for. Performance tests are reported which can account for coil misalignments as well as other factors affecting the strength of the defect response. The inclusion of these tests in a proposed military standard for eddy current probe characterization is also discussed.

710,526
PB87-233854 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Pickup Coil Spacing Effects on Eddy Current Reflection Probe Sensitivity.
Final rept.,
T. E. Capobianco, and K. Yu. 1987, 5p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v6A p721-725 1987.

Keywords: *Eddy current tests, Performance, Sensitivity, Reprints, *Probes(Electromagnetic).

The authors report the results of an experiment investigating the effect of pickup coil spacing on differential probe sensitivity. The probe configuration for these experiments consists of an air core excitation coil surrounding two air core pickup coils. All three coils have vertical axes with respect to the flat plate test piece. Measurements were taken for three different pickup coil spacings on an aluminum test piece with four electrical discharge machined (EDM) notches. The effect of pickup coil unbalance on probe response is also reported.

710,527
PB87-233987 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.

Calibration of Acoustic Emission Transducers: Comparison of Two Methods.
Final rept.,
F. R. Breckenridge, T. Watanabe, and H. Hatano. 1982, 11p
Sponsored by Nippon Steel Corp., Tokyo, Japan Welding Engineering Society, Tokyo, Electric Power Research Inst., Palo Alto, CA., and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of International Acoustic Emission Symposium (6th), Susono, Japan, October 31-November 3, 1982, p448-458.

Keywords: *Calibrating, *Transducers, Reprints, *Foreign technology, Acoustic emission.

An endeavor to compare two types of calibration of acoustic emission transducers was undertaken jointly by the Nippon Steel Corporation in Japan and the National Bureau of Standards in the United States. For the purpose of comparison, six transducers, of two very different types, were calibrated each three times by the surface-pulse method of the National Bureau of Standards and each three times by the reciprocity method of the Nippon Steel Corporation. They were then recalibrated at NBS to assure that no changes had occurred. A brief discussion of the two methods is given and the frequency response curves are compared.

710,528
PB88-117551 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Design and Characterization of Uniform Field Eddy Current Probes.
Final rept.,
P. J. Shull, T. E. Capobianco, and J. C. Moulder. 1987, 9p
Sponsored by Ames Lab., IA., and Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH. Materials Lab.
Pub. in Quantitative Nondestructive Evaluation, v6A p695-703 1987.

Keywords: *Nondestructive tests, *Eddy current tests, Performance, Reprints, *Probes(Electromagnetic).

Uniform field eddy current probes operate by interrogating flaws with a spatially uniform electromagnetic field. Their use in quantitative NDE is particularly attractive because theoretical models of the field-flaw interaction are greatly simplified by the assumption of a uniform field. This leads to much simpler inversion protocols for determining flaw sizes from measurements. Yet, most eddy current probes in use today have highly nonuniform field distributions: the design of probes to produce a uniform field distribution while retaining high sensitivity to flaws remains a relatively unexplored area. The report here recent progress at NBS in the design, fabrication, and characterization of uniform field eddy current probes. Factors that were considered and evaluated include sensitivity, field uniformity, operating frequency, size and shape, ferrite properties, electrical characteristics, and noise. They also evaluated the sensitivity of the probes to liftoff, tilt, and proximity to edges. To evaluate field uniformity, the magnetic fields of some probes were mapped in three dimensions.

710,529
PB88-117668 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Uniform Field Eddy Current Probe: Experiments and Inversion for Realistic Flaws.
Final rept.,
J. C. Moulder, P. J. Shull, and T. E. Capobianco. 1987, 10p
Sponsored by Ames Lab., IA., and Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH. Materials Lab.
Pub. in Quantitative Nondestructive Evaluation, v6A p601-610 1987.

Keywords: *Nondestructive tests, *Eddy current tests, *Titanium alloys, Electromagnetic fields, Surface defects, Reprints, *Foreign technology, Titanium alloy 6Al 4V.

The analysis of the interaction of electromagnetic fields with surface-connected flaws is greatly simplified when the magnetic field of the interrogating probe is spatially uniform. This has led to the development of uniform field eddy current probes for quantitative NDE

applications. The probes were calibrated with shallow cylindrical and spherical recesses formed by electrical-discharge machining (EDM). Both fatigue cracks and semi-elliptical EDM slots in Ti-6Al-4V were studied. Flaws ranged in length from 0.5 to 3.0 mm and in depth from 0.25 to 1.5 mm. All measurements and calibrations were performed with an automatic network analyzer.

710,530
PB88-122312 CP **T05**
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
STAT2: A Fortran Program for Analysis of Data from Microelectronic Test Structures.
Software,
R. L. Mattis. Mar 86, mag tape NBS/SW/MT-88/002 See also PB86-182490.
Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NITS Computer Products if you have questions. Price includes documentation, PB84-127455, PB86-22861, and PB83-263764.

Keywords: *Software, Computer programs, Wafers, Computer systems programs, STAT2 computer program, Automatic test equipment, L=Fortran, H=VAX-11/785.

STAT2 is a computer program which performs the following functions: reads data as a two-dimensional array; calculates mean, sample standard deviation, and median; identifies outliers using statistically sound algorithms; calculates replacement values for outliers; makes gray-tone, numerical and contour data maps on a line printer; makes a numerical map on the user's terminal; makes a histogram on a line printer; constructs a data base for examining correlations among various data sets; searches the data base for correlations using several selective keys; makes a vector map, scatter plot and trend chart.

710,531
PB88-123724 PC **A09**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Uniform Laws and Regulations as Adopted by the National Conference on Weights and Measures (72nd), 1987.
Final rept.,
C. S. Brickenkamp. Sep 87, 193p NBS/HB-130-1988 Also available from Supt. of Docs. as SN003-003-02814-2. Supersedes PB87-103248.

Keywords: *Weight measurement, *Regulations, Standardization, Handbooks, Units of measurement, Packaging, Labels, Commodities, Sales, Prices, Consumer affairs, Automotive fuels, *Weights and measures, Open dating, Unit pricing.

The handbook, revised annually, compiles the uniform laws and regulations developed by the Committee on Laws and Regulations of the National Conference on Weights and Measures (NCWM). The compilation itself was approved by the NCWM in 1979, and this edition includes amendments adopted by the Conference at its annual meeting in 1987. The edition also contains a new motor fuel inspection law and regulation. The NCWM recommends adoption and promulgation by the states of these uniform laws and regulations as updated in the handbook.

710,532
PB88-141213 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Comparison of Several Ultrasonic Techniques for Absolute Stress Determination in the Presence of Texture.
Final rept.,
A. V. Clark, J. C. Moulder, R. B. Mignogna, and P. P. DelSanto. 1987, 16p
Pub. in Proceedings of ONR Symposium on Solid Mechanics Research for QNDE, Evanston, IL., September 18-20, 1985, p345-360 1987.

Keywords: *Stress analysis, *Ultrasonic tests, Nondestructive tests, Acoustic measurement, Texture, Reprints.

Most ultrasonic stress measurement techniques measure some combination of stresses, such as the sum or difference of principal stresses, relative to some (possibly unknown) stress state. In order to apply fracture mechanics methods to failure/life assessment of flawed structures, stresses must be determined absolutely. Ultrasonic stress measurement methods rely on the acoustoelastic effect (stress induced change in phase velocity). Unfortunately, texture also has a comparable effect. This has limited most application to measurement of applied (as opposed to residual) stress. The authors consider several methods of eliminating texture and develop criteria which must be met to achieve a desired (absolute) stress resolution. Illustrations will be given for several techniques by using data from acoustoelastic experiments.

710,533
PB88-147459 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Energetics of AE (Acoustic Emission) Source Characterization.
Final rept.,
R. B. Clough. May 87, 8p
Pub. in Materials Evaluation 45, n5 p556-563 May 87.

Keywords: *Nondestructive tests, *Acoustic emissions, Calibrating, Materials tests, Reprints.

An acoustic emission system is modeled as an energy flow process. An examination of the energy method is made which permits system calibration so that the source may be characterized in terms of joules or watts. The entire acoustic emission system--source, specimen, sensor, and instrumentation--is calibrated using an energy source such as a dropped ball or pulsed infrared laser. Over the 63 to 200 kHz bandpass, the system is linear in power and the measured energy is found to be approximately independent of specimen size and shape, as well as source and sensor positions. The technique appears to have a wide variety of possible applications in materials processing, structural monitoring, and materials science studies.

710,534
PB88-153705 PC **A05**/MF **A01**
CD Metrology, Inc., Germantown, MD.
Computer Software for the Computation of the Scattered Field and the Optical Microscope Image of Line Objects Patterned in Thick Layers,
D. Nyyssonen. Dec 87, 89p NBSIR-87/3618
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.

Keywords: *Dimensional measurement, *Integrated circuits, *Line width, Optical microscopes, Optical measurement, Metrology, Computation, Computer programs, Wafers, Algorithms, THKIMAG computer program, Fortran 77 programming language.

The report contains computer software for calculating optical microscope images of line objects patterned in thick layers (> lambda/4 thick). The algorithms used are based on a monochromatic, waveguide model which can predict the images of line objects with arbitrary edge geometry including multilayer structures with sloped, curved, asymmetric, and undercut edges. Along with the computer software listing, the mathematics of the model, a short description of its structure and use, and test cases for help in implementation are given. The computer software described in the report was written in conjunction with the NBS project to develop fundamentally accurate optical measurement techniques for the width of micrometer and submicrometer lines patterned on integrated circuit wafers.

Robotics/Robots

710,535
PATENT-4 694 230 Not available NTIS
Department of Commerce, Washington, DC.
Micromanipulator System.
Patent,
A. H. Slocum, and J. P. Peris. Filed 11 Mar 86, patented 15 Sep 87, 13p PB88-110275, PAT-APPL-6-838 748
Supersedes PB86-234382.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.50.

Keywords: *Patents, *Robots, Manipulators, Positioning.

The invention is a micromanipulator system for precisely positioning an object in an xz plane and then grossly moving the object in the y direction into a hole z. The micro-manipulator system includes a base and a platform mounted to the base having five different degrees of movement (in the x direction, y direction, z direction, about the x axis, and about the z axis). Suitable moving mechanisms are provided for reversibly moving the platform in the five degrees of movement. Four of the degrees of movement being for fine or precise positioning of the platform and the fifth degree of movement in the y direction being a coarse positioning movement.

710,536
PB85-100139 Not available NTIS
National Bureau of Standards, Washington, DC.
Sensory Interactive Robots.
Final rept.
J. S. Albus, A. J. Barbera, M. L. Fitzgerald, and M. Nashman. 1981, 4p
Pub. in Ann. CIRP 30, n2 p559-562 1981.

Keywords: *Robots, Automatic control, Interactions, Microcomputers, Reprints, *Hierarchical control, Computer applications.

For robots to operate effectively in the partially unconstrained environment of manufacturing, they must be equipped with control systems that have sensory capabilities. The paper describes a control system that consists of three parallel cross coupled hierarchies. First is a control hierarchy which decomposes high level tasks into primitive actions. Second is a sensory processing hierarchy that analyses data from the environment. Third is a world model processing hierarchy. Deviations between expected and observed data is used by the control hierarchy to modify its task decomposition strategies so as to generate sensory-interaction goal-directed behavior. This system has been implemented on a research robot, using a network of microcomputers and real-time vision system mounted on the robot wrist.

710,537
PB85-128940 Not available NTIS
National Bureau of Standards, Washington, DC.
Industrial Robot Technology and Productivity Improvement.
Final rept.
J. S. Albus. 1982, 28p
Sponsored in part by Office of Technology Assessment, Washington, DC.
Pub. in Exploratory Workshop on the Social Impacts of Robotics: Summary and Issues, p62-89 Feb 82.

Keywords: *Robots, Technology, Productivity, Automation, *Robotics, Computer aided manufacturing.

Eight principal technical problem areas in industrial robotics are identified as: (1) absolute positioning accuracy, (2) manipulator dynamics, (3) sensors, (4) control systems, (5) world modeling, (6) software development, (7) interface standards, and (8) mobility. A brief survey of current work in each of these areas is given for university, non-profit, industry, and government laboratories. Future prospects for productivity improvement resulting from robotics in manufacturing and construction are outlined and some of the socio-economic issues addressed.

710,538
PB85-128965 Not available NTIS
National Bureau of Standards, Washington, DC.
Hierarchical Control for Sensory Interactive Robots.
Final rept.
J. S. Albus, A. J. Barbera, and M. L. Fitzgerald. 1981, 9p
Pub. in Proceedings of International Symposium on Industrial Robots (11th), Tokyo, Japan, October 5-16, 1981, p497-505.

Keywords: *Robots, Microcomputers, Computer networks, Controllers, Real time operations, *Hierarchical control, Control systems, Computer applications.

For robots to operate effectively in the partially unconstrained environment of manufacturing, they must be equipped with control systems that have sensory capabilities. This paper describes a control system that consists of three parallel cross coupled hierarchies. First is a control hierarchy which decomposes high level tasks into primitive actions. Second is a sensory processing hierarchy that analyses data from the envi-

ronment. Third is a world model hierarchy which generates expectations. These are compared against the sensory data at each level of the sensory processing hierarchy. Deviations between expected and observed data is used by the control hierarchy to modify its task decomposition strategies so as to generate sensory-interactive goal-directed behavior. This system has been implemented on a research robot, using a network of microcomputers and real-time vision system mounted on the robot wrist.

710,539
PB85-135457 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement and Control Model for Adaptive Robots.
Final rept.
J. S. Albus, A. J. Barbera, M. L. Fitzgerald, R. N. Nagel, G. J. VanderBrug, and T. E. Wheatley. 3 Mar 80, 5p
Pub. in Proceedings of International Symposium on Industrial Robots and Exhibition (10th), Milan, Italy, March 5-7, 1980, p35-39.

Keywords: *Robots, Control equipment, Measurement, Adaptive systems.

For robots to operate effectively in the partially unconstrained environments of manufacturing, they must be equipped with control systems that have measurement and sensory capabilities. This paper presents a model for such a system. It consists of parallel control and measurement hierarchies. The control hierarchy decomposes tasks into subtasks, and the measurement hierarchy analyzes data from sensors. At each level the control hierarchy sends expectations to the measurement hierarchy, which returns computed values of the deviation between the observed and expected data. The control hierarchy uses this information to modify its task decomposition strategies so as to generate sensory-interactive goal-directed behavior. The system has been partially implemented on a research robot using a network of microcomputers and a real-time vision system mounted on the robot's wrist.

710,540
PB85-142875 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hierarchical Control for Robots in an Automated Factory.
Final rept.
J. S. Albus, C. R. McLean, A. J. Barbera, and M. L. Fitzgerald. 1983, 15p
Sponsored by Society of Mfg. Engineers, Dearborn, MI., Robotics International, Dearborn, MI., and Robot Inst. of America, Dearborn, MI.
Pub. in Proceedings of International Symposium on Industrial Robots and Robots 7 (13th), Chicago, IL., April 17-21, 1983, Volume 2: Future Directions, p13.29-13.43.

Keywords: *Robots, *Control, Adaptive systems, Automation, Industrial plants, Hierarchical control.

A hierarchical architecture for real-time sensory-interactive control of robots, machine tools, inspection machines, and materials transport and inventory systems is described. Computer-aided design, computer-aided process planning, and management information systems make up the top level in the hierarchy where the highest level goals are selected and the longest range planning horizons exist. Commands and goals generated at this highest level are decomposed through a series of levels (SHOP, CELL, WORKSTATION and EQUIPMENT) until at the lowest level there are generated a series of drive signals to individual actuators on robots, machine tools, and other equipments. Feedback from sensors and from the control hierarchy itself are used at all levels to produce real-time goal seeking behavior. Apriori knowledge and sensor data are combined in a world model which is used to generate expectations and to plan alternate strategies at every level.

710,541
PB85-182707 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis of Robot Performance Operation.
Final rept.
N. G. Dagalakis. 1983, 23p
Sponsored by Robotics International, Dearborn, MI.
Pub. in Proceedings of International Symposium on Industrial Robots and Robots 7 (13th), Chicago, IL., April 17-21, 1983, Applications Worldwide, v1 p 7.73-7.95.

Keywords: *Robots, Performance, Detection, Defects.

The use of two techniques for the detection of the presence of defects in robot arms was investigated. Two different types of defects were simulated on a PUMA 600 robot. A defect on the operation of the robot wrist joint controller and loosening of the robot end effector. Both techniques were able to detect the presence of the defects. Ways are suggested for determining the seriousness of each defect. At least in the case of the end effector loosening, the nature and seriousness of the defect seem to be easy to determine.

710,542
PB85-182830 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Six-Dimensional Vision System.
Final rept.
J. Albus, E. Kent, M. Nashman, P. Mansbach, L. Palombo, and M. Shneier. 1982, 12p
Sponsored by Computer Society (IEEE), Los Alamitos, CA., and Society of Photo-Optical Instrumentation Engineers, Bellingham, WA.
Pub. in Proceedings of SPIE Technical Symposium East '82, 336 p142-153 1982.

Keywords: Robots, Cameras, *Robot vision, Six degrees of freedom.

There are six degrees of freedom that define the position and orientation of any object relative to a robot gripper. All six need to be determined for the robot to grasp the object in a uniquely specified manner. A robot vision system under development at the National Bureau of Standards is designed to measure all six of these degrees of freedom using two frames of video data taken sequentially from the same camera position. The system employs structured light techniques; in the first frame, the scene is illuminated by two parallel planes of light, and in the second frame by a point source of light.

710,543
PB85-182848 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Architecture for Real-Time Sensory-Interactive Control Robots in a Manufacturing Facility.
Final rept.
J. S. Albus, C. R. McLean, A. J. Barbera, and M. L. Fitzgerald. 1983, 10p
Sponsored by International Federation of Automatic Control, Laxenburg (Austria).
Pub. in Proceeding of the IFAC/IFIP Symposium, Gaithersburg, MD., October 26-28, 1982, Information Control Problems in Manufacturing Technology 1982, p81-90 1983.

Keywords: *Control equipment, *Robots, Detectors, Control theory, *Interactive control, Real time, Hierarchies.

A hierarchical architecture is described for a robot integrated into a real-time sensory interactive factory control system. In this architecture, high level goals are decomposed through a succession of levels, each producing strings of simpler commands to the next lower level. The bottom level generates the drive signals to the robot actuators. Each control level is a separate process with a limited scope of responsibility. Each performs the generic control function of sampling its input and generating appropriate outputs. The input is characterized by three types of data - a command from the next higher level, processed sensory data, and status feedback from the next lower level. The outputs are of three types - a command to the next lower level, a request for sensory information to the processing module at the same level, and a status feedback to the next higher level. This paper describes this generic control structure and its implementation in a real-time sensory-interactive control system for a manufacturing facility.

710,544
PB85-182871 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Concepts for a Real-Time Sensory-Interactive Control System Architecture.
Final rept.
A. J. Barbera, M. L. Fitzgerald, and J. S. Albus. 1982, 6p
Sponsored by Virginia Polytechnic Inst. and State Univ., Blacksburg, VA., Dept. of Electrical Engineering, and Computer Society (IEEE), Los Alamitos, CA.
Pub. in Proceedings of Annual Southeastern Symposium on System Theory (14th), Blacksburg, VA., April 15-16, 1982, p121-126.

Keywords: *Control equipment, *Feedback control, Robots, Real time, *Interactive control, Hierarchies.

The paper describes concepts used in defining an architecture for a real-time sensory-interactive control system. These concepts were arrived at from testing and evaluating different control system strategies at the National Bureau of Standards. A hierarchical task decomposition architecture has been used to structure the complex information processing for real-time sensory interactive robot control in a manageable form. This structure consists of a number of generic control levels. The task of a generic control level is to sample its input state and generate an appropriate response output state which results in a partial decomposition of its task command. Sensory feedback is provided by a processing structure of modules that are coupled with the appropriate control levels. The requirement that the system must be designed for ease of human comprehension has led to an implementation using a state-table processing structure. Real-time response results from a multiple processor implementation using synchronized communications through a common memory.

710,545
PB85-202570 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Kinematic Equations for Industrial Manipulators.
Final rept.
D. R. Myers, and D. F. Gordon. 1982, 4p
Pub. in Ind. Robot. 9, n3 p162-165 Sep 82.

Keywords: *Robots, Equations of motion, Kinematics, Manipulators, Automation, Control, Reprints, Computer applications.

A method is presented for developing the kinematic equations of motion for a six degree-of-freedom manipulator in a manner which can be generalized for application to most commercially available robots. In using this method, Cartesian coordinate frames are assigned to each link such that the number of transcendental and arithmetic operations needed to transform from coordinates in one frame to those in any other frame is minimized. Also presented is a method to solve the kinematic equations for each of the joint angles.

710,546
PB86-102365 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Industrial Systems Div.
Adjustment of Robot Joint Gears Using Encoder Velocity and Position Information.
Final rept.
N. G. Dagalakis, and D. R. Myers. 1985, 6p
Pub. in International Jnl. of Robotic Systems 2, n2 p229-234, 1985.

Keywords: *Robots, Gears, Setting(Adjusting), Algorithms, Linkages, Systems engineering, Reprints.

A new technique for the adjustment of joint gears in industrial robots is presented. Band-limited random excitation signals were injected into the drive system of the joint under test, and both the actuator shaft velocity and position were monitored. The coherence functions between the voltage at the terminals of the electric actuator and the position and velocity signals were determined. The change in the coherence functions was studied for various joint gear settings. An algorithm is proposed for determining the gear setting which results in the most linear operation of the joint drive system. This algorithm was tested on the adjustment of the gears of the wrist rotation joint of a PUMA 560 robot arm.

710,547
PB86-123007 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Industrial Systems Div.
Visual Feedback for Robot Control.
Final rept.
M. Shneier, S. Nagalia, J. Albus, and R. Haar. 1982, 5p
Sponsored by Institute of Electrical and Electronics Engineers, Inc., New York.
Pub. in Proceedings of 1982 Workshop Industrial Applications of Machine Vision, Research Triangle Park, NC., May 3-5, 1982, p232-236.

Keywords: *Robots, *Feedback control, Visual perception, Positioning, Rangefinding, Sensory perception.

The roles of three kinds of visual information in robot control are discussed. Range information, obtained from a plane-of-light triangulation system is used in conjunction with floodlighting to find the three dimensional positions and orientations of parts and to calculate their shape properties. Information obtained from successive frames is used in a simple manner to provide feedback in approaching and acquiring a part. The three kinds of information, acting together, provide for fast and reliable object acquisition.

710,548
PB86-195534 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Industrial Systems Div.
Servoed World Models as Interfaces between Robot Control Systems and Sensory Data.
Final rept.
E. W. Kent, and J. S. Albus. 1984, 9p
Pub. in Robotica 2, pt1 p17-25 1984.

Keywords: *Robots, Control equipment, Feedback, Detectors, Reprints, World models.

A hierarchical robot sensory system being developed for industrial robotics is described. At each level of the hierarchy, sensory interpretative processes are guided by expectancy-generating modeling processes. The modeling processes are driven by a priori knowledge (object prototypes), by knowledge of the robot's movements (feedforward from the control system), and by feedback from the interpretative processes (prior state of the sensory world). At the lowest level, the senses (vision, proximity, tactile, force, joint angle, etc.) are handled separately; above the level, they are integrated into a multi-modal world model. At successively higher levels, the interpretative and modeling processes describe the world with successively higher order constructs, and over successively longer time periods. Each level of the corresponding levels of a hierarchical robot control system.

710,549
PB86-202009 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Robot Control System Based on FORTH.
Final rept.
J. L. Michaloski, and B. A. Warsaw. May 86, 5p
Pub. in Robotics Engineering, p22-26 May 86.

Keywords: *Robots, *Real time operations, Computer programming, Control equipment, Reprints, Computer applications, Computer program verification.

The benefits of developing a real-time control system (RCS) using FORTH is discussed. FORTH software development is achieved through the use of small, verifiably correct modules. The FORTH programming environment is highly interactive, completely open, and easily extensible. A real time robot control system requires much software integration, fine-tuning, hardware interfacing, and robot error handling. RCS was developed using and extending FORTH because FORTH best handled the broad and diverse programming needs of a robot control system. With FORTH as a base system, RCS provides a robot programming environment geared to reducing software complexity, simplifying program testing, and transfering the burden of programming from the user to the computer.

710,550
PB86-202041 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Industrial Systems Div.
Hierarchical Control of Robot Vision by Internal Models.
Final rept.
E. W. Kent. 1983, 7p
Pub. in Proceedings of the Annual Control Engineering Conference, Rosemont, IL., May 24-26, 1983, p263-269.

Keywords: *Robots, *Control equipment, Visual perception, Perception, Mathematical models, *Machine vision, Computer vision.

A robot sensory system developed for industrial robotics is described. Television frames and inputs from other sensors are interpreted by a hierarchically organized group of microprocessors. The system uses knowledge of object prototypes, and of robot action, to generate visual expectancies for each frame. At each level of the hierarchy, interpretative processes are guided by expectancy-generating modeling processes. The modeling processes are driven by a priori knowledge, by knowledge of the robot's movements, and by feedback from the interpretative processes. At the lowest level, other senses (proximity, tactile, force) are handled separately; above the level, they are integrated with vision into a multi-modal world model. At successively higher levels, the interpretative and modeling processes describe the world with successively higher order constructs, and over longer time periods. All levels of the hierarchy provide output, in parallel, to guide corresponding levels of a hierarchical robot control system.

710,551
PB86-202058 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Industrial Systems Div.
Robot Sensing for a Hierarchical Control System.
Final rept.
M. Shneier, E. Kent, J. Albus, P. Mansbach, L. Palombo, M. Nashman, W. Rutowski, and T. Wheatley. 1983, 17p
Sponsored by Robotics International, Dearborn, MI.
Pub. in Proceedings of the International Symposium on Industrial Robots and Robots 7 (13th), Chicago, IL., April 17-21, 1983, v2 p14.50-14.66.

Keywords: *Robots, *Control equipment, Manipulators, Visual perception, Perception, Detectors, *Machine vision.

An hierarchical sensory system is described that is tailored to the special needs of a robot manipulator. It uses geometric models of objects and knowledge of the robot's position to generate expectations about the environment. The expectations are matched with sensory input from a variety of sources, including visual, tactile, proximity, and force and torque sensors. In the implementation, the visual sensor makes use of structured light techniques to calculate three-dimensional properties of objects. The sensory hierarchy is such that low levels deal with less-processed information than higher levels, and are expected to perform simpler tasks. At each level, the sensor input is matched with the expectations derived from the models, and the differences are used to update the understanding of the environment. Each level in the sensory-processing hierarchy communicates information to corresponding levels in the hierarchical control system that drives the manipulator.

710,552
PB86-238847 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
RCS (Robot Control Systems): The NBS (National Bureau of Standards) Real-Time Control System.
Final rept.
A. J. Barbera, M. L. Fitzgerald, J. S. Albus, and L. S. Haynes. 1984, 3p
Sponsored by Society of Mfg. Engineers, Dearborn, MI.
Pub. in Proceedings of Conference on Robots 8, Detroit, MI., June 4-7, 1984, Volume 2: Future Considerations, p19.1-19.3.

Keywords: *Robots, *Control equipment, Real time operations, Interactive systems.

The National Bureau of Standards, Industrial Systems Division has designed the Real-Time Control System where high level goals are decomposed through a succession of levels, each producing strings of simpler commands to the next lower level. The bottom level generates the drive signals to the robot, gripper, and other actuators. Each control level is a separate process with a limited scope of responsibility, independent of the details at other levels, thus providing a foundation for future modular, 'plug compatible' hardware and software for robotics and other real-time sensory interactive control applications.

710,553
PB86-238854 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Application Example of the NBS (National Bureau of Standards) Robot Control System.
Final rept.
L. S. Haynes, A. J. Barbera, J. S. Albus, M. L. Fitzgerald, and H. G. McCain. 1984, 15p
Sponsored by Naval Material Command, Washington, DC.
Pub. in Int. Jnl. of Robotics and Computer Integrated Manufacturing 1, n1 p81-95 1984.

Keywords: *Robots, *Control equipment, Automation, Reprints, *Computer aided manufacturing.

The National Bureau of Standards, Industrial Systems Division has designed the Robot Control System where high level goals are decomposed through a succession of levels, each producing strings of simpler commands to the next lower level. The bottom level generates the drive signals to the robot, gripper, and other actuators. Each control level is a separate process with a limited scope of responsibility, independent of the details at other levels, thus providing a foundation for future modular, 'plug compatible' hardware and software for robotics and other real-time sensory interactive control applications. The paper describes the first application of the NBS Robot Control System in a realistic factory environment, fully integrated with a workstation control system, database system, safety computer, gripper control system, vision system, and network.

710,554
PB86-242567 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Development of a Flexible Automated Fixturing System.
Technical rept. Jan 84-Jun 85.
A. H. Slocum, J. Peris, and A. Donmez. 1986, 18p
Pub. in SME Technical Paper MR86-126, p1-18 1986.

Keywords: *Robots, Fixtures, Positioning devices(Machinery), Reprints, Computer applications.

A computer-controlled flexible fixturing methodology is presented and a detailed design application is described. As implemented, the fixture is a vise-type system which has one fixed and one moving jaw, with robot changeable jaw faces. The system can locate and clamp most types of prismatic parts by utilizing two servocontrolled orthogonal mechanical planes and two sets of discretely located stops. The planes are: a moving jaw which is supported by a fully constrained bearing system and actuated by a hydraulic gerolermotor-powered ballscrew; and two hydraulically actuated leveling bars. The discrete stops are four sets of hydraulically actuated stops located on each jaw.

710,555
PB87-128393 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Estimation of the Dynamic Parameters of a Robot Joint Drive System.
Final rept.
N. Dagalakis, and D. R. Myers. 1986, 5p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Conference on Systems, Man, and Cybernetics, Atlanta, GA., October 1986, p655-659.

Keywords: *Joint(Junctions), *Robots, Systems analysis, Dynamics, Drives, Random processes, Accelerometers, Frequency response, Estimating, Parameters, Data analysis.

A system identification technique has been developed for estimating the dynamic parameters of an industrial robot joint drive system. Band limited random excitation was injected through the power amplifier of the joint drive system being analyzed. The motion of the robot link was monitored by a pair of accelerometers. The frequency response of two portions of the joint drive system was determined for two different loads.

710,556
PB87-134714 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Watchdog Safety Computer Design and Implementation.
Final rept.
R. Kilmer, H. McCain, M. Juberts, and S. Legowik. 1984, 21p
Pub. in Proceedings of Conference on Robots 8, Volume 2: Future Considerations, Detroit, MI., June 4-7, 1984, p13.56-13.76.

Keywords: *Machining, *Robots, *Safety engineering, *Monitors, Automatic control, Performance evaluation, Auxiliary equipment(Computers), Equipment, Industrial sector, Computer applications.

There are many different aspects of safety to consider when utilizing a robot in an industrial application. In

general, however, these can be categorized into the areas of personnel safety and equipment safety. The paper addresses the later category and presents one approach of providing equipment safety through the use of an auxiliary computer to monitor operations in the workstation. Such a computer system can be used to check robot operations during programming, automatic cycling, and debugging and repair to prevent unwanted conditions from occurring. The basic concepts, design and implementation of such an auxiliary computer on a robot operating in a machining workstation are described here.

710,557
PB87-161105 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Quick Change System for Robots.
Final rept. 1 Aug 82-1 Dec 85,
J. M. Vranish. 1984, 24p
Pub. in Proceedings of Conference on Robots 8, Detroit, MI, June 4-7, 1984, v2 p17.74-17.97.

Keywords: *Robots, Automations, Hydraulics, Pneumatics, Manufacturing, Facilities, *Robotics, Robot vision, National Bureau of Standards.

The National Bureau of Standards has developed and conducted preliminary tests of a versatile robot quick change system for use in its Automated Manufacturing Research Facility. These tests indicate: the quick change is capable of interfacing multiple hydraulic as well as multiple pneumatic lines; it has mating repeatability sufficient to facilitate the use of a sophisticated vision sensor; it can pass multiple electronics and fiber optics channels; it can store grippers at the robot wrist in holsters by using a unique compliance technique. Modified commercial components are used throughout and the device is suitable for industrial use. The paper discusses technical details of the system.

710,558
PB87-161824 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Update - NBS (National Bureau of Standards) Research Facility Addresses Problems in Set-Ups for Small Batch Manufacturing.
Final rept.,
P. Nanzetta. 1984, 6p
Pub. in Industrial Engineering 16, n6 p68-73 1984.

Keywords: *Manufacturing, *Automation, *Robots, *Machining, *Materials handling equipment, Inspection, Deburring, Cleaning, Automation, Research, Facilities, *Computer aided manufacturing, Hierarchical control, Data base management systems, Computer networks, National Bureau of Standards.

The AMRF consists of 5 basic workstations, 3 machining, 1 cleaning and deburring, and 1 inspection; an automated materials handling system; a cell level of control; a network manager; and a database manager. Almost all of the major equipment is inplace on the floor of the NBS Instrument Shop; the first major integration stage within the AMRF has been publicly tested; and the authors are finding that the fundamental approach described in the beginning of the project appears to be rich enough to support development of the complete system.

710,559
PB88-134523 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Split Rail Parallel Gripper.
Final rept.,
W. R. Bunch, and J. M. Vranish. 1985, 14p
See also PB86-220316.
Pub. in Proceedings of Conference on Robots 9, Detroit, MI., June 2-6, 1985, p6-1--6-14.

Keywords: *Robots, Clamps, Holders, Clasps, Servomechanisms, *Grippers, Stepper motors.

A wide throw parallel action gripper is described. The gripper uses a unique 'split rail' design concept in conjunction with a pair of preloaded commercial recirculating ball bearing linear slides. The prototype is compact enough to be used on small payload robots, 4.5 Kg (10 lbs), yet was found to have the strength, rigidity and immunity to jamming from side torques necessary for use on large payload robots 90 Kg (200 lbs). It can be used as a simple open/close air actuated gripper; yet has repeatability and responsiveness that make it ideal for use with stepping motors and D.C. servo motors. It cannot be fouled by oil or chips when used in a material cutting environment. The paper describes the design and operation of the gripper and discusses the results of initial tests.

710,560
PB88-139019 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Programming a Hierarchical Robot Control System.
Final rept.,
J. S. Albus, A. J. Barbera, and M. L. Fitzgerald. 1982, 13p
Pub. in Proceedings of International Symposium on Industrial Robots (12th), Paris, France, June 1982, p505-517.

Keywords: *Robots, *Computer programming, Real time operations, Algorithms, *Control systems, Finite state machines, Hierarchical control.

A hierarchical architecture for real-time sensory-interactive robot control system provides a method for partitioning the control problem into modules so that each module can be implemented as a finite-state automation. Programs in each module can be expressed as state-transition tables. The paper describes several advantages and disadvantages of the representation, particularly in regards to the issue of error recovery. A algorithm is given by which programs written in a conventional robot programming language can be translated into the state-table representation.

710,561
PB88-141239 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Low-Level Control Interface for Robot Manipulators.
Final rept.,
M. L. Fitzgerald, and A. J. Barbera. 1985, 13p
Pub. in Robotics and Comput.-Integrated Manuf. 2, n3-4 p201-213 1985.

Keywords: *Manipulators, *Robots, Control, Interfaces, Reprints.

The paper will discuss a possible low-level control interface for a robot manipulator. The first section will present background information describing a proposed system modularization and the capabilities and limitations afforded by the use of interfaces. The next section presents three possible low-level robot control interfaces within the system. These will be elaborated on including a specification of the interface information and its use, timing considerations, and potential limitations. The paper concludes with a summary discussion and recommendation.

710,562
PB88-141247 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Hierarchical Control for Robots and Teleoperators.
Final rept.,
J. S. Albus, C. R. McLean, A. J. Barbera, and M. L. Fitzgerald. 1986, 11p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Workshop on Intelligent Control, Troy, NY., August 26, 1985, p39-49 1986.

Keywords: *Robots, *Control systems design, Computer aided manufacturing, Reprints, Hierarchical control.

The basic structure of a hierarchical control system is a tree, wherein each computational module has a single superior, and one or more subordinate modules. The top module is where the highest level decisions are made and the longest planning horizon exists. Goals and plans generated at this highest level are transmitted to the next lower level where they are decomposed into sequences of subgoals. In general, the decomposition at each level takes into account information derived from: (a) processed input data from sensors that measure the state of the environment, (b) reports from lower control levels as to the state of the control hierarchy itself, and (c) predictions (or expectations) generated by models, knowledge bases, or inference engines.

710,563
PB88-152038 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Automatic Laser Tracking Interferometer System for Robot Metrology.
Final rept.,
K. Lau, R. J. Hocken, and W. Haight. 1986, 6p
Pub. in Precision Engineering 8, n1 p3-8 Jan 86.

Keywords: *Robots, *Robotics, *Metrology, *Laser tracking, Laser applications, Tracking(Position), Standards, Performance tests, Reprints.

The growing utilization of robots in manufacturing has created the need for standard procedures, instruments and terminologies to measure and describe robot performance. In response to this, a research group has recently been formed at the National Bureau of Standards (NBS) whose function is to devise methodologies, instruments, and standard test procedures for characterizing the accuracy, repeatability and dynamic performance of robots. The paper describes the concept of the automatic laser tracking system and presents preliminary results obtained from an experimental version of the system.

710,564
PB88-152046 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Robot Performance Measurements Using Automatic Laser Tracking Techniques.
Final rept.,
K. Lau, R. Hocken, and L. Haynes. 1985, 10p
Pub. in Robotics and Computer-Integrated Manufacturing 2, n3-4 p227-236 1985.

Keywords: *Robots, *Laser tracking, Position(Location), Interferometers, Performance evaluation, Precision, Reprints.

The paper describes a robot end point position sensing laser tracking system currently under development at the National Bureau of Standards. Testing thus far indicates that the final system should be able to determine the position of the end effector of a robot to better than 1 part in 100,000 (i.e., .0002 inch to .0005 inch for a medium to large size robot) in X-, Y-, and Z-axes, and the pitch and yaw to within a few seconds of arc. The laser tracking system is simple enough that it would be economically feasible to exploit as an integral part of a robot, providing robot position independent of the robot members and joint encoders.

710,565
PB88-152905 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Incrementally Constructing a Spatial Representation Using a Moving Camera.
Final rept.,
T. H. Hong, and M. O. Shneier. 1985, 6p
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronic Engineers) Computer Society Conference on Computer Vision and Pattern Recognition (1985), San Francisco, CA., June 19-23, 1985, p591-596.

Keywords: *Manipulators, Trajectories, *Robot vision, Spatial representation, Image reconstruction, Three dimensional motion, Octrees.

A method is described for using a sequence of views of a scene to construct a representation of the world in terms of space occupied by objects and space that is empty. The world is represented by an octree, and it is assumed that each view is taken from an arbitrary, but known, location. The spatial representation is part of the description of the world required for sensory-interactive control of a robot manipulator. It is useful for trajectory planning and provides a spatial index of the objects in the world.

710,566
PB88-152913 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Real-Time Cooperative Interaction between Structured-Light and Reflectance Ranging for Robot Guidance.
Final rept.,
E. W. Kent, T. E. Wheatley, and M. Nashman. 1985, 5p
Pub. in Robotica 3, pt1 p7-11 Jan-Mar 85.

Keywords: *Manipulators, Target acquisition, Range finding, Real time operations, Reprints, *Robot vision.

When applied to rapidly moving objects with complex trajectories, the information-rate limitation imposed by video-camera frame rates impairs the effectiveness of structured-light techniques in real-time robot servoing. To improve the performance of such systems, the use of fast infrared proximity detectors to augment visual guidance in the final phase of target acquisition was explored. It was found that the approach was limited by the necessity of employing a different range/intensity calibration curve for the proximity detectors for every object and for every angle of approach to complex objects. A technique was devised for cooperative interaction between modalities, in which the vision sense provided on-the-fly determination of calibration parameters for the proximity detectors, for every approach to a target, before passing control of the sytem to the other modality. The technique provided a three hundred percent increase in useful manipulator velocity, and improved performance during the transition of control from one modality to the other.

710,567
PB88-152921 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Rotation and Translation of Objects Represented by Octrees.
Final rept.,
T. H. Hong, and M. O. Shneier. 1987, 6p
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronic Engineers) International Conference on Robotics and Automation (1987), Raleigh, NC., March 31-April 3, 1987, v2 p947-952.

Keywords: *Rotation, Algorithms, *Translational motion, Spatial representation, Octrees.

The paper describes an algorithm for performing arbitrary translations and rotations of objects represented by octrees. Given an octree in a standard position and a transformation, the algorithm builds a new tree in a top down fashion, visiting each node in the new tree only once, and constructing only those nodes that appear in the final tree. It works by projecting the transformed space over the original tree, and labeling the new nodes according to the labels of the nodes in the underlying untransformed tree.

710,568
PB88-152939 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Repeatability Measurements of a Vision Servoed Manipulator Using an Optoelectronic Remote 3D Tracking System.
Final rept.,
M. Juberts. 1985, 8p
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronic Engineers) International Conference on Cybernetics and Society (1985), Tucson, AZ., November 12-15, 1985, p948-955.

Keywords: *Manipulators, Robots, Workplace layout, Real time operations, Position finding, Orientation, Reproducibility, Robotics, Light emitting diodes, Control systems, Three dimensional, Calibration.

The paper presents an application of a two camera optoelectronic three dimensional remote measuring system, developed by the National Bureau of Standards (NBS), for precisely measuring the position and orientation of a robots end-effector. The measurements were used to evaluate the repeatability performance of a vision served industrial manipulator whose task was to automatically insert a peg into a hole with .127 mm (.005 inch) clearance. Vision camera data is processed to find the position and orientation of the end-effector (peg) with respect to the hole, and control signals are sent to the robot controller to orient and position the peg at a selected distance above the hole. The remote measuring system was also used to measure the industrial manipulators repeatability. An NBS developed Real-Time Control System was used for robot control. A brief description of the opto electronic remote measurement system is given, along with the 3D calibration procedure for establishing a calibrated work volume.

710,569
PB88-153051 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Accurate Remote Measurement of Robot Trajectory Motion.
Final rept.,
A. Dainis, and M. Juberts. 1985, 8p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronic Engineers) International Conference on Robotics and Automation (1985), St. Louis, MO., March 25-28, 1985, p92-99.

Keywords: *Robots, Workplace layouts, Position finding, Trajectories, Photodiodes, Measurement, Robotics, Three dimensional motion, Light emitting diodes, Calibration, Remote systems.

The paper discusses a two camera electronic remote measuring system, developed by the National Bureau of Standards, for accurately measuring robot trajectory motion and position in three dimensions. An approach being developed by NBS uses a remote measuring system to measure robot trajectory motion and position within a calibrated work volume and to compare these values against the robots programmed trajectories and positions. The measuring system precisely tracks, in three dimensions, the location of infrared emitting LEDs, attached to points on the robot. The system, which uses two tetra-lateral photodiode cameras, has a resolution of approximately 0.01 percent and absolute accuracy of 0.1 percent along each of the three dimensions of a work volume as measured on a coordinate positioning and measurement machine. Data collection rate is 3.3 KHz for one data point (LED) location measurement. Implementation and analysis procedures are also discussed.

710,570
PB88-153077 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Describing a Robot's Workspace Using a Sequence of Views from a Moving Camera.
Final rept.,
T. H. Hong, and M. O. Shneier. 1985, 6p
Pub. in IEEE (Institute of Electrical and Electronic Engineers) Transactions on Pattern Analysis and Machine Intelligence PAMI-7, n6 p721-726 Nov 85.

Keywords: Workplace layout, Trajectories, Reprints, *Robotics, *Robot vision, Spatial representation, Three dimensional, Octrees.

A method is described of building and maintaining a spatial representation for the workspace of a robot, using a sensor that moves about in the world. From the known camera position at which an image is obtained and two-dimensional silhouettes of the objects in the image, a series of cones are projected to describe the possible positions of the objects in the space. When an object is seen from several viewpoints, the intersections of the cones constrain the position and size of the object. After several views have been processed, the object begins to resemble its true shape. At all times, the spatial representation contains the best guess of the true situation in the world, with uncertainties in position and shape explicitly represented. An octree is used as the data structure for the representation. It provides a relatively compact representation, and allows fast access to information. The purpose of constructing the representation is to describe the volumes in the workspace that are occupied, and those that are empty. This enables trajectory planning to be carried out, and also provides a means of spatially indexing objects.

710,571
PB88-153085 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Fast, Three-Dimensional, Collision-Free Motion Planning.
Final rept.,
M. Herman. 1986, 8p
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronic Engineers) International Conference on Robotics and Automation (1986), San Francisco, CA., April 7-10, 1986, p1056-1063.

Keywords: *Robots, Collision avoidance, Search theory, Algorithms, *Robotics, *Obstacle avoidance, Three dimensional motion, Octrees.

Issues dealing with fast, 3-D, collision-free motion planning are discussed, and a fast path planning system under development at NBS is described. The components of a general motion planner are outlined, and some of their computational aspects are discussed. It is argued that an octree representation of the obstacles in the world leads to fast path planning algorithms. The system they are developing uses such an octree representation. The robot and its swept-volume paths are approximated by primitive shapes so as to result in fast collision detection algorithms. The search for a path is performed in the octree space, and combines hypothesize and test, hill climbing, and A*.

710,572
PB88-153762 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
National Bureau of Standards Programmers Guide for the Field Material-Handling Robot (FMR),
S. Szabo. Sep 87, 59p NBSIR-87/3624
Sponsored by Human Engineering Lab., Aberdeen Proving Ground, MD.

Keywords: *Robots, *Materials handling, *Material, Forklift vehicles, User manuals(Computer programs).

The document is a programmers guide for the NBS Real-Time Control System (RCS) used in the Field Material Handling Robot (FMR). The FMR is sponsored by the U.S. Army Human Engineering Laboratory. The RCS (version 2) is a high level, sensory interactive controller which enables the robot to perform automaticly as a stationary fork lift. The Robot Sensor Language (RSL) provides the RCS a mechanism for sensor integration and task planning.

Tooling, Machinery, & Tools

710,573
PATENT-4 685 661 Not available NTIS
Department of Commerce, Washington, DC.
Method and Mechanism for Fixturing Objects.
Patent,
A. H. Slocum, and J. P. Peris. Filed 21 Jun 85, patented 11 Aug 87, 15p PB87-230652, PAT-APPL-6-747 486
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Patents, Robots, *Vises, Pat-Cl-269-20.

A programmably controllable vise has mechanisms for automatic adjustment of workpiece position relative to three orthogonal axes. The positions of the vise jaws (during clamping) establish workpiece position along a first axis, and stop members (e.g., piston actuated stops) selectively extendable from the jaws establish workpiece position along a second axis. Two levelling bars supported adjacent the jaws by respective servo-actuators (e.g., double-acting piston type actuators) which adjust the bars along the jaws establish workpiece position along the third axis, as well as workpiece tilt about the first and second axes. Because the adjustments may be made automatically, the vise may operate unattended, with workpieces being loaded and unloaded by a robot. The vise jaws preferably incorporate replaceable jaw elements which are constructed for attachment and removal by a robot and which may be machined to accommodate non-prismatic workpieces. One of the jaws may be fixed to a housing of the vise, with the other jaw being supported on a movable carriage driven by a feedback-controlled linear drive. An open side of the housing adjacent the jaws is protectively covered by a sheet metal band wrapped around the housing and having opposite ends respectively attached to the front and rear of the carriage. The band circulates around the housing with movement of the carriage, and the open side of the housing thus remains covered to avoid the entry of contaminants.

710,574
PATENT-4 707 013 Not available NTIS
Department of Commerce, Washington, DC.
Split Rail Parallel Gripper.
Patent,
J. M. Vranish, W. R. Bunch, and W. L. Johns. Filed 30 May 86, patented 17 Nov 87, 10p PB88-166848, PAT-APPL-6-868 485
Supersedes PB86-220316.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of

patent available Commissioner of Patents, Washington, DC 20231 $1.50.

Keywords: *Patents, *Machine tools, Pneumatic servomechanisms, Holders, Clamps, PAT-CL-294-119.

A wide-throw parallel-action gripper of the split-rail design is disclosed. The gripper includes a pair of preloaded linear bearings which engage the outward surfaces of each rail and two roller bearings spaced on either side of a pinion, all mounted onto a pinion shaft, which engage the inward sides of each rail. A single finger is mounted at opposed ends of each rail and an actuator is connected either to one of the rails or to the central pinion. The actuators can include a pneumatic cylinder of electrical stepping motors or D.C. servo motors.

710,575
PB85-144988 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Use of Drill-Up for On-Line Determination of Drill Wear.
Final rept.
K. W. Yee. 1984, 12p
Pub. in Society of Manufacturing Engineers Technical Paper MS84-914, p1-12 1984.

Keywords: *Drills, Wear, Instruments, Detectors, Failure, Drilling, Reprints.

Drill-Up is an instrument for determining drill wear and predicting drill breakage by applying time-domain analysis to a signal from an accelerometer coupled to the workpiece. The potential of Drill-Up as a drill wear-out sensor for automated drilling machines has been demonstrated for a limited range of drill sizes and materials. Worn-out drills in moderately hard steel can be readily detected. In softer low-carbon steel, detection is possible if the techniques suggested are used to overcome practical problems.

710,576
PB85-184596 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Low Cost Interferometer System for Machine Tool Applications.
Final rept.
A. Dorsey, R. J. Hocken, and M. Horowitz. 1983, 3p
Pub. in Precis. Eng. 5, n1 p29-31 Jan 83.

Keywords: *Interferometers, Machine tools, Polarization, Reprints, Laser applications.

A compact low cost laser interferometer system with sub-micron resolution is described and first performance evaluations reported. The off-set adjust from the four photodiode detector system can also provide a sensitive, simultaneous indication of straightness in 2 axes. The prototype laser interferometer system described here uses a standard He-Ne laser as a source for short distance measurements and should cost less than $1,000. With a more expensive laser, the same system should be useful over larger distances.

710,577
PB87-161097 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Drill-Up, an Alternative for On-Line Determination of End-Mill Wear.
Final rept.,
K. W. Yee, and L. Evans. 1985, 6p
Pub. in Proceedings of North American Manufacturing Research Conference (13th), Berkeley, CA, May 19-22, 1985, p304-309.

Keywords: *Tools, *Wear, *Milling(Machining), Cutting machines(Tools), Spindles.

The use of Drill-Up, an instrument for detecting tool wear by applying time-domain analysis to vibration signals sensed by an accelerometer coupled to the workpiece, as an alternative to spindle power consumption and axis-feed force measurements for determining end-mill wear, has been investigated for three hardness levels of steel. The potential of Drill-Up as a wear-out sensor for end mills has been shown. Some significant reasons for choosing spindle-power consumption rather than feed force as an end-mill wear-out indicator have been identified. For any given application, Drill-Up or spindle cutting-power consumption measurements may be suitable for wear-out detection.

710,578
PB87-230918 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Accurate Positional Servo for Use with Pneumatically Supported Masses and Vibrationally Isolated Tables.
Final rept.,
G. L. Greene. 1987, 3p
Pub. in Review of Scientific Instruments 58, n7 p1303-1305 Jul 87.

Keywords: *Pneumatic servomechanisms, *Vibration isolators, Positioning, Reprints, *Foreign technology.

A noncontacting electropneumatic servosystem for the positional control of vibrationally isolated tables is described. Employing a 'live zero', integrating servo, the system has been used to position an 'air spring' supported optical table to within a few microns and a few seconds of arc for a period of several months. If needed, the system can be extended to provide for control of all six degrees of freedom. The system provides an improvement in positional stability of between 2 and 3 orders of magnitude over typical commercial systems.

710,579
PB88-138938 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Alternatives for Sensing Tool Wear in Peripheral and Slot End-Milling.
Final rept.,
L. Evans, and K. W. Yee. 1985, 18p
Pub. in Tech. Pap. Soc. Manuf. Eng., MS85-1001, 18p 1985.

Keywords: *Tools, *Wear, *Milling machines, Steels, Monitors, Vibration, Reprints.

Cutting power, feed force, and Drill-Up, an instrument based on time-domain vibration analysis, are examined as three alternatives for sensing tool wear during peripheral and slot milling for heavy cuts in two steels of different hardnesses using 1/2-inch diameter high-speed steel end mills.

Tribology

710,580
PB85-182798 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Studies of the Friction Transients During Break-In of Sliding Metals.
Final rept.
P. J. Blau. 1981, 9p
Pub. in Proceedings of Leeds-Lyons Conference on Running-In Process in Tribology (8th), Lyon, France, September 8-11, 1981 p175-183 1982.

Keywords: *Friction, *Copper alloys, *Aluminum alloys, Steels, Friction tests, Microstructure, Wear, Sliding friction, Copper alloy 15Ag, Aluminum alloy 4.5Cu 17Si.

A ball-on-flat, stroke-by-stroke friction tester (tribometer) was used to study the initial friction changes which occurred when 52100 steel balls were slid unlubricated on several alloys: Cu-15wt%Ag, Al-17wt%Si-4.5wt%Cu, and a dual phase steel with 0.14wt%C-1.56wt%Mn-0.63Si and rare earth additions. Computer test control, recording of data, and plotting of data aided analysis of various break-in effects on friction coefficient: air versus Argon environments, surface finishes, and applied loads. Differences in the properties of the tested materials and their microstructures were used to interpret the differences in their sliding friction behavior. The shapes of friction coefficient versus number of stroke plots were used in these interpretations.

710,581
PB86-239118 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.
Functional Needs, Machining Conditions, and Economics of Surface Finishing.
Final rept.
J. Bielle, T. Vorburger, and V. Roy. 1985, 7p
Pub. in Precision Engineering 7, n1 p31-37 1985.

Keywords: *Cutting tools, *Surface finishing, Machining, Wear, Service life, Reprints, Tribology.

The authors discuss two applications of surface finish technology to industrial problems. The first involves the deterioration of tools used to shape large numbers of parts in a turning operation. After preliminary observations, the authors concluded that the waviness of the cutting surface of the tool was impeding the flow of the chip over the tool and reducing the usable life. After a change in the tool finishing conditions, its waviness was reduced considerably and the lifetime of the tool between sharpenings increased from 8000 to 53000 parts. The second case involves the degradation of flat steel tracks for rolling needle bearings in a molding machine.

710,582
PB87-218285 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Real-Time Evaluation of Wear Particles Using Electromagnetic Forced Rotation and Laser Scattering.
Final rept.,
T. Sato, O. Ikeda, T. Hatsuzawa, and M. Linzer.
1987, 12p
Pub. in Wear 115, n3 p273-284 1987.

Keywords: *Oils, *Metals, *Particles, *Wear, Particle size, Evaluation, Reprints, *Electromagnetic rotation, *Laser scattering.

A real-time method has been developed to measure the size, shape and number of metallic wear particles in oil.

710,583
PB87-224556 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Design to Limit Thermal Effects on Linear Motion Bearing Performance.
Final rept.,
A. H. Slocum. 1987, 7p
Pub. in Int. Jnl. Mach. Tools Manufact. 27, n2 p239-245 1987.

Keywords: *Roller bearings, Thermal stresses, Design standards, Reprints.

By tuning the geometry of a linear motion bearing to the metallurgical and geometric properties of a structure, the effects of temperature changes on bearing geometry and performance can be minimized. This is illustrated in the design of a recirculating-roller, linear motion bearing that was designed for use on a flexible automated fixturing system. The main structure of the fixturing system was made of aluminum and steel and powered by hydraulics. Due to temperature rise caused by the hydraulics, thermal growth effects on bearing preload had to be controlled in order to maintain accuracy of the system.

710,584
PB88-152251 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Descriptive Lubrication Model for Concentrated Contacts under Boundary Conditions.
Final rept.,
S. M. Hsu. 1985, 10p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of the Symposium on Energy Engineering Sciences (3rd): Thermofluids and Solid Mechanics, University Park, PA., October 8, 1985, p213-222.

Keywords: *Lubrication, Wear, Probability theory, Contacting, Models, Reprints.

The processes of lubrication are systematically analyzed and explained with the aid of recent experimental discoveries. Effective lubrication often involves surface chemical reactions which are dependent on contact geometry, load, speed, and environmental influences. Materials properties such as hardness, elasticity and others also affect the wear outcome. Fluid mechanics under the influence of interfacial pressures and temperatures also control a significant portion of the wearing processes. A conceptual model is proposed to link all these factors in a line of defense framework, and to discuss how wear can be predicted based on a probabilistic model.

General

710,585
PB85-186955 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Equation-of-State-Based Thermodynamic Charts for Nonazeotropic Refrigerant Mixtures.
Final rept.
P. A. Domanski, and D. A. Didion. 1985, 9p
Sponsored by Department of Energy, Washington, DC. and Oak Ridge National Lab., TN.
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions 91, pt. 1, 9p 1985.

Keywords: *Refrigerants, *Thermodynamic properties, Refrigerating machinery, Azeotrope, Mixtures, Charts, Enthalpy, Entropy, Temperature, Pressure, Equations of state, Liquid phases, Vapor phases, Chemical composition, Reprints.

This paper presents thermodynamic charts developed for a nonazeotropic mixture, R13B1/R152a. The developed charts (pressure-enthalpy, temperature-entropy, and enthalpy-composition) offer important insight for understanding vapor compression cycles for different compositions. An equation of state capable of describing both the liquid and vapor phases, property algorithms and iteration schemes used in determination of the nonazeotropic mixture thermodynamic properties have been explained.

710,586
PB86-113958 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Laboratory Study of Gas-Fueled Condensing Furnaces.
E. R. Kweller, and R. A. Wise. Jul 85, 51p NBSIR-85/3225
Sponsored by Department of Energy, Washington, DC. Office of Buildings Energy R and D.

Keywords: *Gas furnaces, *Steam condensers, Performance evaluation, Experimental design, Temperature measurement, Humidity, Design criteria.

The objective of the study was to determine if the direct measurement method of condensate collection that was developed during prior testing of a condensing boiler would be adequate for direct measurement of the condensate from gas fueled forced warm air condensing furnaces. Results of these tests were for purposes of supporting a test procedure proposed by the Department of Energy and responding to questions raised in comments to the proposed procedures. Another objective of these tests was to quantify the effects of varying test room ambient temperatures and relative humidity in the rate of condensate collected with condensing furnaces.

710,587
PB87-145272 PC **A17**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Information Resources and Services Div.
Publications of the National Bureau of Standards, 1985 Catalog.
Rept. for Jan-Dec 85.
R. J. Pardee. Jun 86, 394p NBS/SP-305-SUPPL-17
See also 1984 Catalog, PB85-245678. Also available from Supt. of Docs as SN003-003-02737-5. Library of Congress catalog card no. 48-47112.

Keywords: *Catalogs(Publications), *Bibliographies, Aeronautics, Astronomy, Astrophysics, Atmospherics, Electronics, Electrical engineering, Physics, Mechanical engineering, *National Bureau of Standards, US NBS.

The 17th Supplement to Special Publication 305 contains full bibliographic citations including keywords and abstracts for National Bureau of Standards (NBS) 1985 papers published and entered into the National Technical Information Service (NTIS) collection. (Also included are NBS papers published prior to 1985 but not reported in previous supplements of this annual catalog.) Four indexes are included to allow the user to identify NBS papers by personal author, keywords, title, and NTIS order/report number.

710,588
PB87-209961 PC **A17**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Information Resources and Services Div.
Publications of the National Bureau of Standards, 1986 Catalog.
Rept. for Jan-Dec 86,
R. J. Pardee. Jun 87, 389p NBS/SP-305-SUPPL-18
See also PB87-145272. Also available from Supt. of Docs as SN003-003-02798-7.

Keywords: *Catalogs(Publications), *Bibliographies, Aeronautics, Astronomy, Astrophysics, Atmospherics, Electronics, Electrical engineering, Physics, Mechanical engineering, *National Bureau of Standards, US NBS.

The 18th Supplement to Special Publication 305 contains full bibliographic citations including keywords and abstracts for National Bureau of Standards (NBS) 1986 papers published and entered into the National Technical Information Service (NTIS) collection. (Also included are NBS papers published prior to 1986 but not reported in previous supplements of this annual catalog.) Four indexes are included to allow the user to identify NBS papers by personal author, keywords, title, and NTIS order/report number.

710,589
PB87-219101 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Slit Pulsed Valve for Generation of Long-Path-Length Supersonic Expansions.
Final rept.,
C. M. Lovejoy, and D. J. Nesbitt. 1987, 5p
Grant NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Review of Scientific Instruments 58, n5 p807-811 May 87.

Keywords: *Values, Reprints, *Long path length absorption, *Pulsed valve, *Slit expansion.

The authors describe a valve for production of jet-cooled species in a pulsed, long-path-length (1.2-cm) supersonic expansion. The valve produces 150 600-microsec-duration pulses at repetition rates up to 60 Hz from a nozzle with variable slit width, and is suitable for use with corrosive gases and vapors.

710,590
PB87-230827 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Indicating Rupture Disk for Gas Cylinders.
Final rept.,
T. J. Bruno. 1987, 1p
Pub. in Jnl. of Chemical Education 64, n6 p557 Jun 87.

Keywords: *Gas cylinders, *Relief valves, Failure, Corrosion.

The failure of a frangible rupture disk (in the safety head of a gas cylinder), and resulting rapid venting of the contents of the cylinder, can be extremely destructive to laboratories and dangerous to personnel. The most common cause of spontaneous disk failure is the development of corrosion stresses in the disk itself. In this note, a device is suggested that will allow the tracking of corrosion in rupture disk, and may help to prevent their failure.

MATERIALS SCIENCES

Ablative Materials & Ablation

710,591
PB-280 813/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Smoldering Combustion of Wood Fibers: Cause and Prevention.
Final rept.,
R. J. McCarter. Jan 78, 8p
Pub. in Jnl. of Fire Flammability, v9 p119-126 Jan 78.

Keywords: *Combustion, *Fiberboards, *Ignition, Wood products, Calcium, Inorganic salts, Magnesium, Combustion, Reprints, Smoldering.

Means were sought to reduce the smolder tendency of porous wood fiberboard, which has been the ignition source in serious fires. Vulnerability to smolder was found to result from inclusion of carboxylic metal salts, principally those of calcium and magnesium, in the alpha-cellulose content of wood fibers. Displacement of detrimental metal cations by hydrogen, ammonium, or aluminum cations depleted the smolder tendency of the fibers. Process modifications to effect this displacement are suggested. Methods to test smolder tendency are discussed.

710,592
PB84-217215 Not available NTIS
National Bureau of Standards, Washington, DC.
Adhesive Bonding by Surface Initiation of Polymerization.
Final rept.
R. L. Bowen, E. N. Cobb, and D. N. Misra. Mar 84, 4p
Sponsored in part by American Dental Association, Chicago, IL.
Pub. in Industrial and Engineering Chemistry, Product Research and Development, p78-81 Mar 84.

Keywords: *Polymerization, *Adhesive bonding, *Surfaces, Composite materials, Dental materials, Chemical bonds, Reprints, Glycine/N-(tolyl), Methacrylic acid/glycidyl, Methacrylic acid/hydroxyethyl.

Strong adhesion between composites and dentin or enamel is obtained by the sequential applications of ferric oxalate, NTG-GMA (adduct of N(p-tolyl)glycine and glycidyl methacrylate), and PMDM (adduct of hydroxyethyl methacrylate and pyromellitic dianhydride). Bond-strength measurements, hardening-time tests, SEM observations, and other methods were used for the purpose of gaining an understanding of the essential mechanisms. So far, the evidence leads to the following working hypotheses. The aqueous Fe2(C2O4)3 solution apparently rebuilds the surface to provide a hard, microporous structure contiguous with the apatite-collagen substrate. The observed 'spontaneous' polymerization may be initiated by radicals produced by redox reactions involving the reduction of ferric ions. Complexation by NTG-GMA might promote this reaction and, together with the intimate adsorption of PMDM, provide proximal methacrylate groups for polymerization that propagates outward from this surface.

Adhesives & Sealants

710,593
N77-20257/0 PC **A08**/MF **A01**
National Aeronautics and Space Administration, Washington, D. C.
Cryogenic Adhesives and Sealants: Abstracted Publications.
F. R. Williamson, and N. A. Olien. 1977, 156p NASA-SP-3101

Keywords: *Abstracts, *Adhesives, *Bonding, *Cryogenic equipment, *Low temperature tests, *Sealers, Cryogenic fluid storage, Mechanical properties, Thermodynamic properties, Thermoelasticity, *Bibliographies.

Abstracts of primary documents containing original experimental data on the properties of adhesives and sealants at cryogenic temperatures are presented. The most important references mentioned in each document are cited. In addition, a brief annotation is given for documents considered secondary in nature, such as republications or variations of original reports, progress reports leading to final reports included as primary documents, and experimental data on adhesive properties at temperatures between about 130 K and room temperature.

710,594
PATENT-4 393 699 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pneumatic Adhesion Tester.
Patent.
J. F. N. Seiler. Filed 11 Jun 81, patented 19 Jul 83, 5p PB83-600036, PAT-APPL-6-272 231

Keywords: *Adhesion tester.

This tester comprises a fixture which is bonded to a coating or surface, and a plate and a membrane which are sealed together along their peripheries. A hole ex-

tends through the membrane and at least into the plate for receiving the fixture so that its bonding surface is flush with the membrane. The plate has a gas opening which is connectable with a source of pressurized gas.

710,595
PB-268 947/9 Not available NTIS
National Bureau of Standards, Washington, D.C.
Gas Infusion into Doubled Hermetic Enclosures,
S. Ruthberg. Jun 77, 7p
Pub. in IEEE Trans. Parts, Hybrids, Packaging PHP-13 No. 2 p110-116 1977.

Keywords: *Hermetic seals, *Enclosures, *Semiconductor devices, Leakage, Encapsulating, Gases, Computation, Packaging, Reprints.

In certain critical applications it is current practice to incorporate sealed electron devices within an outer hermetic enclosure for increased seal assurance. An exact solution is now given for the gas influx into such a doubled hermetic enclosure when each enclosure has a given leak size. This solution allows comparison to be made between the leakage into a single isolated semiconductor package and that into the same package when it is protected by an outer enclosure.

710,596
PB-273 930/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Adhesive Bonding of Various Materials to Hard Tooth Tissues. XII. Adsorption of N-(2-Hydroxy-3-Methacryloxypropyl)-N-Phenylglycine (NPG-GMA) on Hydroxyapatite.
Final rept.,
D. N. Misra, and R. L. Bowen. Aug 77, 7p
Contract N01-DE-0-2494-09
Sponsored in part by American Dental Association Health Foundation, Chicago, Ill.
Pub. in Jnl. of Colloid Interface Science, v61 n1 p14-20 Aug 77.

Keywords: *Adhesives, Adsorption, Polymers, Chemisorption, Hydroxyapatite, Dental materials, Reprints, *Glycine/N-(hydroxy-methacryloxypropyl)-N-phenyl.

Adsorption of an adhesion-promoting compound, N-(2-hydroxy-3-methacryloxypropyl)-N-phenylglycine (NPG-GMA), was studied on synthetic hydroxyapatite from ethanol solution. The adsorption isotherm is very steep initially, followed by a step and then a Langmuir-type isotherm. The nature of adsorption is irreversible up to the step and reversible thereafter. The maximum amounts of the irreversibly adsorbed and the reversibly adsorbed materials are about the same. The irreversibly adsorbed material may be chemisorbed. If the irreversibility is effected by the chelating ligand groups of the molecule which rotates about the calcium ion site (centered on the nitrogen ligand) in a fully extended configuration, the area of the hydroxyapatite thus obtained corresponds to its BET (N2) area. An additional reversible adsorption may take place on the irreversibly adsorbed apatite at higher concentrations if the irreversibly adsorbed molecules are reduced in their areal domain by a folding of their methacrylate groups. Polymer filled with synthetic hydroxyapatite covered with the irreversibly adsorbed NPG-GMA has a tensile strength about 50% greater than that of the polymer filled with untreated apatite.

710,597
PB-275 141/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radioisotope Hermetic Test Precision.
Final rept.,
S. Ruthberg, G. R. Neff, and B. D. Martin. 1977, 7p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, Va. and ASTM (American Society for Testing and Materials), Philadelphia, Pa.
Pub. in Proceedings of International Microelectronics Symposium (1977), Baltimore, Md. 24-26 Oct 77, p131-137 1977. (International Society for Hybrid Microelectronics, Montgomery, Ala.).

Keywords: *Leak detection, *Hermetic seals, Tests, Standards, Radioactive isotopes.

Leak testing is an essential element of the screening process for hermetic devices, where test methods are designed to reject all devices with leak rates greater than some prescribed value; nevertheless, poor measurement correlations between test methods and between test installations continue to be a major problem. An effort within ASTM Committee F-1 on Electronics is being made to resolve such measurements problems. An interlaboratory comparison has been completed on the radioisotope test method using commercial test equipment and commercial glass-sealed ceramic packages (Cerdip). One hundred test packages with indicated leaks ranging from $< 1 \times 10$ to the minus 8 power atm.cc/s to approximately 5 x 10 to the minus 5 power atm.cc/s were tested sequentially by 11 laboratories using a 2-step sequence in a specified procedure. These test results demonstrate conclusively that an interlaboratory comparison of hermetic packages can be accomplished under appropriate guidelines with a precision (one standard deviation) ranging from 0.5 x 10 to the minus 8 power at 1 x 10 to the minus 8 power atm.cc/s to 3.2 x 10 to the minus 5 power at 5 x 10 to the minus 5 power atm.cc/s. It is demonstrated that this precision could be increased significantly through elimination of the individual laboratory biases that were found to occur.

710,598
PB-288 528/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Adhesive Bonding of Various Materials to Hard Tooth Tissues XV: Sorption of Mordant Ions Evaluated by Neutron Activation Analysis.
Final rept.,
R. L. Bowen, L. T. McClendon, and T. E. Gills. Feb 78, 6p
Grant PHS-DE-02494-10
Pub. in Jnl. of Dental Research 57, n2 p255-260, Feb 78.

Keywords: *Dental materials, *Chlorides, *Adhesion, *Dentin, Adsorption, Interactions, Reprints.

Five metallic chlorides were compared simultaneously, with regard to their interaction with dentin surfaces. Neutron activation analysis was used to measure the quantities absorbed. Each metal was bound by dentin to some extent during a 60-second exposure, and was not removed during a 20-second rinse with distilled water. Quantitatively, the gram-atom amounts of ions sorbed increased in the order $Co < Al < Zn$ approximately equal to $Cu < Fe$. These mordant salts warrant further study as a possible means of improving adhesive bonding between dental resins (via polyfunctional surface-active comonomers) and dentin.

710,599
PB-295 590/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Adhesive Bonding of Various Materials to Hard Tooth Tissues XVIII: Synthesis of a Polyfunctional Surface-Active Comonomer.
Final rept.,
R. L. Bowen. Mar 79, 6p
Grant PHS-DE-02494-11
See also report dated Feb 78, PB-288 528.
Pub. in Jnl. of Dental Research 58, 3n, p1101-1107, Mar 79,

Keywords: *Dental materials, *Adhesion, *Acrylates, Interactions, Reprints.

A facile synthesis regimen was developed for the preparation of a resin that, apparently, has the characteristics of a polyfunctional surface-active comonomer. The first reaction involves the addition of acrylic acid to half of the epoxy groups of a commercial diglycidyl ether of a bisphenol A oligomer. The product is then reacted stoiciometrically with the amino groups of lithium o-aminobenzoate in a protic, mixed solvent containing stabilizers and catalysts. Preliminary qualitative tests of the product were favorable. Further analytical procedures and testing will be required to determine if it meets the criteria for improving adhesion by a chemical mechanism.

710,600
PB78-600061 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Coupling Agents for Improved Bonding of Dental Composites (Annotation).
W. V. Loebenstein. 1978, 1p
Pub. in Jnl. Dent. Res. 57, n3 p480 Mar 1978.

Keywords: *Coupling agent, Dental adhesives, Dental composites, Dental polymer, Polymerization coupler, Tensile strength.

No abstract available.

710,601
PB80-120926 Not available NTIS
National Bureau of Standards, Washington, DC.
Bonding of Acrylic Resins to Dentin with 2-Cyanoacrylate Esters.
Final rept.,
G. M. Brauer, J. A. Jackson, and D. J. Termini. Sep 79, 8p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. Dental Research 58, n9 p1900-1907 Sep 79.

Keywords: *Dental materials, *Dentin, *Acrylic resins, *Acid bonded reaction cements, Acrylates, Adhesives, Reprints, *Acrylic acid/(isobutyl-ester)-cyano.

Strength and durability of the dentin-acrylic resin joint cemented with 2-cyanoacrylate esters were studied. Maximum adhesion is obtained with isobutyl 2-cyanoacrylate after 1 percent acid pretreatment of the dentin. Hydrolytic stability is somewhat improved by addition of polymer to the adhesive or coating around the joint.

710,602
PB80-178825 Not available NTIS
National Bureau of Standards, Washington, DC.
Adhesive Bonding of Various Materials to Hard Tooth Tissues. XX. Calcium-to-Calcium Distances in Hydroxyapatite.
Final rept.,
L. W. Schroeder, R. L. Bowen, and J. S. Ferris. 1980, 8p
Grants PHS-DE-00572, PHS-DE-02494-10
See also report dated Mar 79, PB-295 590.
Pub. in Jnl. Biomed. Mater. Res. 14, p83-90 1980.

Keywords: *Dental materials, *Adhesion, Chemical bonding, Crystal structure, Reprints, *Calcium ions, *Hydroxyapatites.

Distributions of Ca-to-Ca distances have been obtained from the crystal structure of hydroxyapatite for all biologically significant planes. Most frequently, calcium ions are separated by about 4, 6.3, 7.9, and 9.0 to 9.6 A. Frequent occurrence of distances at 10.4, 11.8 and 12.6 A result from a Ca ion in one repeating unit being paired with a Ca in another unit cell.

710,603
PB81-245078 Not available NTIS
National Bureau of Standards, Washington, DC.
Adhesive Bonding of Various Materials to Hard Tooth Tissues XXIV; Recent Developments in Adhesive Resin Formulations for Dentin.
Final rept.
R. L. Bowen. 1981, 8p
Pub. in Proceedings of Int. Congress of Implantology and Biomaterials in Stomatology, Kyoto, Japan, June 9-11, 1980, p66-73 1981.

Keywords: *Adhesives, *Dental materials, *Dentin, Chemical bonds, Solubility, Surface chemistry, Monomers.

Strong and durable adhesive bonding of restorative materials to dentin could simplify cavity preparation and the repair of cervical and other lesions. Cut dentin has a disturbed or 'smeared' surface layer that can be removed by physiological (isotonic) acidic solutions. Bonding to this cleaned dentinal surface can be improved by the subsequent use of a 'mordant,' such as isotonic aqueous ferric chloride. A third factor that can improve adhesion to dentin is the use of surface-active comonomers which can bond to these surface-held cations and can copolymerize with dental resins. Formulations containing these can be isotonic with tissue fluids by selecting monomers with respect to their water solubility and by using a mixture which will yield a solubility of 0.31 molar in water. Such a mixture saturated with water will be isotonic with a normal physiological saline solution or body fluids.

710,604
PB82-108036 Not available NTIS
National Bureau of Standards, Washington, DC.
Accelerative and Adhesive Bonding Capabilities of Surface-Active Accelerators.
Final rept.
J. M. Antonucci, D. N. Misra, and R. J. Peckoo. Jul 81, 11p
Pub. in Jnl. of Dental Research 60, n7 p1332-1342 Jul 81.

Keywords: *Adhesives, *Dental materials, *Surfactants, *Amines, Chemical bonds, Tensile strength, Polymerization, Reprints.

PolySAM-1, a multifunctional surface-active amine polymerization accelerator, and several simpler surface-active amine promoters were evaluated for their accelerative and adhesion-promoting potentials. Diamteral tensile strength measurements, performed on composites prepared from a bis-GMA resin formulation with tribasic calcium phosphate as the filler, were used to assess the adhesive bonding capabilities of these amines.

710,605

PB82-210543 Not available NTIS
National Bureau of Standards, Washington, DC.
Composite and Sealant Resins, Past, Present, and Future.
Final rept.
R. L. Bowen. 1982, 6p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Pediatr. Dent. 4, n1 p10-15 1982.

Keywords: *Sealants, *Composite materials, *Dental materials, Forecasting, Adhesives, Reprints, Methyl methacrylate.

Composite dental filling materials were developed in response to the shortcomings of silicate cements and unfilled resins (based on methyl methacrylate and its polymer). A hybrid monomer, which came to be known as 'BIS-GMA' in the dental literature, was synthesized; this molecule resembles an epoxy resin except that the epoxy groups are replaced by methacrylate groups. BIS-GMA formulations can polymerize rapidly under oral conditions, and they have polymerization shrinkage less than that of methyl methacrylate. BIS-GMA resins are used as binders for glass, porcelain, or quartz particles to form relatively durable direct esthetic filling materials. In combination with the acid-etch technique, developed elsewhere, BIS-GMA formulations are used in the repair of fractured incisor teeth. The combination is also useful to bind orthodontic brackets directly to teeth and for surgical procedures in which teeth are not properly placed or aligned for eruption. This resin without filler is also used to prevent decay by the filling of developmental pits and fissures in teeth which would otherwise have a high susceptibility to caries. Improvements in the glass filler for composite resins may lead to greater durability in their clinical uses. Recent developments in adhesive bonding to teeth will also widen the utility of composites.

710,606

PB83-143685 Not available NTIS
National Bureau of Standards, Washington, DC.
Adhesive Bonding of Various Materials to Hard Tooth Tissues: Improvement in Bond Strength to Dentin.
Final rept.
R. L. Bowen, E. N. Cobb, and J. E. Rapson. Sep 82, 7p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl of Dental Research 61, n9 p1070-1076, Sep 82.

Keywords: *Adhesives, *Dentin, Chemical bonds, Dental materials, Coupling agents, Polymers, Reprints.

Enhanced adhesive bonding of composite restorative materials can improve treatment of cervical erosions, root caries, and other conditions with minimal cutting of dentin. Materials and methods have been developed which increase the strengths of adhesive bonds to the dentin of extracted teeth. The strong bonds were obtained by the use of an aqueous ferric oxalate mordant solution followed in sequence by acetone solutions of two coupling agents. Evidence from scanning electron micrography suggests that the first treatment dissolves the disturbed surface layer and precipitates insoluble material in the openings of the dentinal tubules. The coupling agents apparently provide molecules which are bound to the surface and can polymerize with the resin of the composite material applied subsequently. The dentinal tubules are neither enlarged nor filled to any significant depth with the adhesive or polymeric materials. With the new process adhesive bond strengths to dentin have averaged over 11 MPa (1,600 psi) after storage in distilled water at room temperature for 1 to 10 days.

710,607

PB84-225564 Not available NTIS
National Bureau of Standards, Washington, DC.
Development of High-Strength, Acrylic Resin-Compatible Adhesive Cements.
Final rept.
G. M. Brauer, J. W. Stansbury, and H. Argentar. Mar 83, 5p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. of Dental Research, v62 n3 p366-370 Mar 83.

Keywords: *Adhesives, *Dental materials, *Acrylic resins, Performance evaluation, Chelating agents, Reprints.

The reaction of vanillate esters dissolved in chelating agents with zinc oxide yields hard cementitious materials. Hexyl vanillate-EBA (o-ethoxybenzoic acid) mixed with ZnO-Al2O3-hydrogenated rosin gives a high-strength, low water-soluble cement that does not inhibit polymerization and adheres to non-precious metals and composites.

710,608

PB85-203578 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Safety Considerations, Oral and Systemic.
Final rept.
R. L. Bowen, N. W. Rupp, and W. G. de Rijk. 1984, 3p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Education 48, n2 p32-34 1984.

Keywords: *Dental materials, *Sealants, *Polymeric films, Performance evaluation, Preventive medicine, Decay, Reprints.

A survey of the literature shows no test results in vitro or in vivo that contraindicates the use of pit and fissure sealant resins. The consensus of the authors given here is based not only on a thorough literature search but also on many years of first-hand experience with these materials. Furthermore, during the last decade during which many hundreds of thousands of applications of sealants have been made by other dentists together with their appropriately-trained auxilliary personnel, there have been no reports of untoward reactions either in the patients receiving the treatments or those administering them. There should be more widespread use of this valuable prevention method, which together with the proper use of fluorides, could nearly eliminate dental decay.

710,609

PB86-112182 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Viscoelastic Fracture Behaviour for Different Rubber-Modified Epoxy Adhesive Formulations.
Final rept.
D. L. Hunston, and G. W. Bullman. Apr 85, 6p
Pub. in International Jnl. of Adhesion and Adhesives 5, n2 p69-74 Apr 85.

Keywords: *Viscoelasticity, *Epoxy resins, *Adhesives, *Fracture tests, Elastomers, Rheology properties, Reprints.

The viscoelastic fracture behaviour of various rubber-modified epoxy formulations was analysed using a time-temperature superposition approach. The shift factors for all of these systems were quite similar. In addition, an equivalent analysis of yield stress data was performed for one of the samples; it gave shift factors similar to those from the fracture experiments thus indicating a close correlation between yield and toughening. A simple empirical equation was found to describe the fracture data for all the materials and, consequently, the parameters in this equation provide a good method to characterize the fracture behaviour and to compare different materials.

710,610

PB87-122263 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Developing Failure Criteria for the Polymers Used in Structural Adhesives.
Final rept.
D. L. Hunston, J. L. Rushford, S. S. Wang, and A. J. Kinloch. 1982, 5p
Pub. in Annual Conference of Reinforced Plastics/Composites Institute, the Society of the Plastics Industry, Inc. (37th), January 11-15, 1982, p1-5.

Keywords: *Adhesives, Polymers, Stress analysis, Epoxy compounds, Viscoelasticity, Reprints.

The desire to use adhesives and composites in structural applications has led to a need for a failure prediction capability for the polymers used in such systems. The initial phase of this study considered rising load experiments at different cross-head speeds and temperatures for neat and adhesive bond specimens. The results demonstrate that the data can be fit to empirical models that provide estimates of mode-1 fracture behavior. Current studies are now examining more complex loading histories and composite specimens.

710,611

PB87-196895 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Effect of Volume Fraction of Dispersed Rubbery Phase on the Toughness of Rubber-Toughened Epoxy Polymers.
Final rept.,
A. J. Kinloch, and D. L. Hunston. 1987, 9p
Pub. in Jnl. of Materials Science Letters 6, p131-139 1987.

Keywords: *Adhesion, *Composite materials, Adhesives, Epoxy, Fracture, Morphology, Temperature dependence, Reprints.

Rubber-modified epoxy polymers are increasingly utilized in structural adhesives and composites because they combine high fracture energy with other important properties, such as good modulus and high temperature behavior. The properties of these materials depend on their two phase morphologies which consist of rubber particles dispersed in and bonded to an epoxy matrix. In this work the relationship between the morphologies of four model systems and their fracture behaviors was studied. Previous publications have suggested that the volume fraction of phase separated rubber determines the material's behavior. In the present study, however, it is shown that no unique relationship can exist between these two parameters because the fracture behavior depends on the temperature and loading rate. In addition, the particle size distribution is found to influence the fracture properties. More detailed work is needed therefore before quantitative relationships between morphology and performance can be established.

Carbon & Graphite

710,612

PB80-218514 Not available NTIS
National Bureau of Standards, Washington, DC.
International Cooperation on Characterization and Terminology of Carbon and Graphite.
Final rept.,
W. S. Horton. 1979, 14p
Pub. in Pure Applied Chemistry 51, p1561-1574 1979.

Keywords: *Carbon, *Graphite, *Terminology, Standards, Characteristics, Monmenclature, Reprints, *Foreign technology.

A brief progress report is presented on the activities of the International Committee for Characterization and Terminology of Carbon. The first efforts have produced a table of characterization methods for carbon and graphite used in the U.S.A., the Federal Republic of Germay, Italy, The United Kingdom, and by the International Organization for Standardization. A cross index is provided enabling the reader to associate the test numbers for a similar method from these sources.

710,613

PB85-112886 PC **A06**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Fine-Grained, Isotropic Graphite for Use as NBS (National Bureau of Standards) Thermophysical Property RM's from 5 to 2500 K.
Final rept.
J. G. Hust. Sep 84, 120p NBS/SP-260/89
Library of Congress catalog card no. 84-601106. Also available from Supt. of Docs as SN003-003-02608-5.

Keywords: *Graphite, *Thermophysical properties, *Research projects, Standards, Electrical resistivity, Fines, *Standard reference materials.

The Chemical Engineering Science Division (Boulder, Colorado) in conjunction with the Office of Standard Reference Materials (Gaithersburg, Maryland) of the National Bureau of Standards, and the CODATA Task Group on Thermal Transport Properties have investigated graphite as a potential, extended temperature range, Research Material (RM). A large number of isotropic, fine-grained graphite rods in various diameters were obtained for these investigations. In Phase I, electrical resistivity and density measurements were performed on numerous rods at temperatures from 4 to 300 K. In Phase II, thermal conductivity measurements were performed on thirteen specimens at about 20C. In Phase III, a large number of specimens were characterized for room temperature electrical resistivity and density. These measurements were in preparation for the world-wide distribution of specimens to participants that agreed to make thermal and electrical property measurements. Phase IV describes the results of the measurements from the various participants. Phase V describes the analysis of these data.

710,614
PB85-203511 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Relationships between Knoop and Scratch Micro-Indentation Hardness and Implications for Abrasive Wear.
Final rept.
P. J. Blau. 1985, 21p
Pub. in Microstructural Science 12, p293-313 1985.

Keywords: *Microhardness tests, *Abrasion resistance, *Indentation hardness tests, *Wear, *Metals, Coatings. Loads(Forces), Correlations, Scratch hardness tests.

Micro-indentation hardness test methods are an important tool for the evaluation of thin metallic layers and coatings. Both vertically moving and horizonally moving (scratch) indentation methods are currently in wide use. An investigation was conducted on pure samples of Cu, Fe, Sn, Cd, Ni, and Co and on 1010 steel, 52100 steel, 638 bronze, 688 bronze, and Nitinol (NiTi alloy) to study the relationships between vertical and horizontal (scratch) micro-indentation hardness numbers. Indenter loads between 0.0098 and 0.196 N (10-200 g) were used. A standard Knoop indenter was used for vertical testing and a 90 degree cone was used for scratch testing on a commercial scratch testing machine. Correlations between vertical and scratch hardness numbers varied with the testpiece material and the applied load. Microstructural features of the scratches were studied to analyze the cause of these variations. The implications of these variations for abrasive wear/microhardness number correlations are discussed.

710,615
PB85-229987 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Comment on 'Measurement of Thermodynamic Parameters of Graphite by Pulsed-Laser Melting and Ion Channeling'.
Final rept.
A. Cezairliyan. 1985, 1p
Pub. in Physical Review Letters 54, n11 p1208, 18 Mar 85.

Keywords: *Graphite, *Thermodynamic properties, Melting, Reprints, Laser applications, Ion channeling.

The work of Venkatesan et al. is briefly discussed and commented upon in light of similar research at the National Bureau of Standards.

710,616
PB86-133485 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Heat Capacity and Electrical Resistivity of POCO AXM-5Q1 Graphite in the Range 1500-3000 K by a Pulse-Heating Technique.
Final rept.
A. Cezairliyan, and A. P. Miiller. 1985, 16p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in International Jnl. of Thermophysics 6, n3 p285-300 May 85.

Keywords: *Graphite, *Specific heat, *Electrical resistivity, High temperature tests, Pulse heating, Reprints.

Measurements of the heat capacity and electrical resistivity of POCO AXM-5Q1 graphite in the temperature range 1500-3000 K by a subsecond-duration pulse-heating technique are described.

710,617
PB87-201380 PC **A03**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Thermochemistry of Materials by Laser Vaporization Mass Spectrometry, Part 2 - Graphite.
Final rept.,
J. W. Hastie, D. W. Bonnell, and P. K. Schenck. Jun 87, 45p NBSIR-87/3561

Keywords: *Graphite, *High temperature, *Lasers, Thermochemistry.

In an earlier study (Part I of this series) an experimental approach which couples laser heating of refractory materials under vacuum with mass spectrometric detection of the vapor plume, for thermochemical determinations, of 2900 K was demonstrated using the BN refractory system at 2900 K. The paper describes the results of a similar study on graphite at temperatures around 4100 K and total species pressures in the vicinity of an atmosphere (1 atm = 1.01325 x 10 to the 5th power Nm-2). A Nd/YAG laser system, focused to power densities in the range of 10 to the 9th power - 10 to the 10th power W/sq. cm., was found to be a convenient energy source for producing controlled vapor plumes and with negligible post-vaporization perturbation of the neutral species identity and concentration. The principal vapor species were found to be Cn (n = 1 - 9) and their relative intensities were found to be more consistent with the JANAF Thermochemical Tables than more recent literature assessments and results.

Ceramics, Refractories, & Glass

710,618
AD-A032 656/1 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Fracture of Brittle Materials at High Temperature.
Final rept. 1 Oct 72-31 Dec 75.
S. M. Wiederhorn. Aug 76, 20p AFML-TR-76-139
Contract F33615-73-M-6501

Keywords: *Fracture(Mechanics), *Refractory materials, *Gas turbines, Silicon carbides, Silicon nitrides, High temperature, Test methods, Test equipment, Design criteria.

To assure the reliability of silicon carbide and silicon nitride in turbine applications, their mechanical properties at high temperatures must be understood. Fracture properties are particularly important. Because the experimental techniques for the measurement of these properties had not yet been developed, at the start of this program, there existed little information on the fracture properties of silicon carbide and silicon nitride at high temperatures. This summary of work conducted at NBS over the past three years presents a considerable body of knowledge on these materials as a result of the improvement and development of new techniques of measurement.

710,619
AD-A050 252/6 PC **A03**/MF **A01**
United Telecontrol Electronics, Inc., Asbury Park, NJ.
Erosion of Brittle Materials by Solid Particle Impact.
Interim rept.,
B. J. Hockey, S. M. Wiederhorn, and H. Johnson. 1 Dec 77, 26p NBSIR-77-1396

Keywords: *Brittleness, *Ceramic materials, *Erosion, *Alumina, *Silicon nitrides, Cracking(Fracturing), Plastic deformation, Fracture(Mechanics), Hardness, Particles, Temperature, Impact, Angles, Electron microscopy, Aluminum oxide.

Results are presented which show, that in addition to fracture, plastic deformation occurs and plays an important role in the erosion of brittle materials by solid particle impact. These conclusions are supported by transmission electron microscopy studies of impact damage produced in a wide variety of brittle materials and by erosive wear studies on silicon nitride and alumina. The erosive wear studies also indicate that while erosion resistance is primarily determined by fracture toughness and hardness, the relative importance of these materials parameters depends on the test conditions (e.g. temperature and angle of particle impingement). (Author)

710,620
PATENT-4 606 902 Not available NTIS
Department of Commerce, Washington, DC.
Process for Preparing Refractory Borides and Carbides.
Patent.
J. J. Ritter. Filed 3 Oct 85, patented 19 Aug 86, 5p PB86-241288, PAT-APPL-6-783 503
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Refractory materials, *Synthesis(Chemistry), *Borides, *Carbides, *Patents, PAT-CL-423-345.

Refractory borides or carbides are prepared by contacting an alkali-metal reducible metal chloride or silicon tetrachloride with boron trichloride or carbon tetrachloride in an inert solvent in the presence of an alkali metal, the metal chloride or silicon tetrachloride and the boron trichloride or carbon tetrachloride being present in an amount about stoichiometrically equivalent to the boride or carbide to be prepared and the alkali metal being present in an amount about stoichiometrically equivalent to the amount of chloride in the metal chloride or silicon tetrachloride and the boron trichloride or carbon tetrachloride, until all chloride present has reacted with the alkali metal to form alkali metal chloride.

710,621
PATENT-4 606 906 Not available NTIS
Department of Commerce, Washington, DC.
Process of Synthesizing Mixed BAO-TIO2 Based Powders for Ceramic Applications.
Patent.
J. J. Ritter, R. S. Roth, and T. Negas. Filed 15 Nov 84, patented 19 Aug 86, 6p PB86-241270, PAT-APPL-6-671 539
Supersedes PB85-141752.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Barium titanates, *Dielectrics, *Patents, Roasting, Precipitation(Chemistry), Ferroelectric materials, Precursors, PAT-CL-423-598.

A process for producing any desired Ba/Ti mixture to be formulated as an amorphous solid which crystallizes at very low temperatures to yield a desired phase or phases is disclosed. The process yields products free of undesirable impurities and allows macroscopic production of certain phases in the baria-titania system, having exceptional high frequency dielectric properties, that were previously unattainable through solid-state high temperature production techniques.

710,622
PB-261 014-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion of Co60 in Cobalt Ferrites (Diffuziya Co60 v Ferritakh Kobalta),
A. I. Borisenko, and E. I. Morozov. 1974, 14p DMDC-8267, TT-74-53234
Trans. of Akademiya Nauk SSSR. Doklady, n105 p1274-77 1955. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Cobalt, *Diffusion, *Ferrates, Cobalt inorganic compounds, Isotopic labeling, Cobalt isotopes, Activation energy, Translations, USSR.

The diffusion of Co-60 in ferrites of different compositions (3 CoO-2 Fe2O3, Co-Fe2O3, CoO-2 FeO3, 2 CoO-5 Fe2O3, and CoO -3 Fe2O3) was measured at temperatures of 1200, 1250, 1300, and 1350C. Activation energies are calculated from the diffusion coefficients measured with the residual activity experimental technique.

710,623
PB-263 149/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Strength Degradation of Brittle Surfaces: Sharp Indenters.
Interim rept. Jul 74-30 Jun 75,
B. R. Lawn, E. R. Fuller, and S. M. Wiederhorn. Jun 76, 5p
Sponsored in part by Office of Naval Research, Arlington, Va. See also AD-A021 066.
Pub. in Am. Ceram. Soc., v58 n5-6 p193-197 May/Jun 76.

Keywords: *Ceramic materials, *Fractures(Materials), *Glass, Indentation, Crack propagation, Surface properties, Reprints, *Indenters, Sharp bodies.

A theory of strength loss for brittle surfaces in contact situations, developed in a previous paper for 'blunt' indenters, is here extended to the case of 'sharp' indenters. A prior fracture mechanics analysis of crack growth beneath ideal cone indenters serves as the basis for predetermining the prospective surface degradation of ceramic components in service. Compared to blunt indenters, severe degradation can occur at the lower contact loads. However, at high loads the extent of degradation becomes remarkably insensitive to indenter geometry. Essential theoretical predictions are verified by bend tests on glass slabs. The effect of indenter 'sharpness' and initial specimen surface flaw state are investigated systematically, along with some secondary rate effects in the contact process.

710,624
PB-269 281/2 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Workshop on Applications of Phase Diagrams in Metallurgy and Ceramics.
Final summary rept.,
L. H. Bennett, and G. C. Carter. Apr 77, 234p NBSIR-77-1239
Sponsored in part by National Science Foundation, Washington, D.C., Office of Naval Research, Arlington, Va., National Aeronautics and Space Administration, Washington, D.C., Army Research Office, Arlington, Va., and Energy Research and Development Administration, Washington, D.C. See also report dated Jan 77, CONF-770116-2.

Keywords: *Phase diagrams, *Meetings, Ceramic materials, Semiconductors, Metals, Alloys, Thermodynamics, Data processing, Computer applications.

A workshop was held at the National Bureau of Standards, Gaithersburg, Md., January 10-12, 1977, to assess the current national and international status of phase diagram determinations and evaluations for alloys, ceramics and semiconductors; to determine the needs and priorities, especially technological, for phase diagram determinations and evaluations; and to estimate the resources being used and potentially available for phase diagram evaluation. A one-day meeting was held following the workshop for the international data center representatives from France, Germany, Canada, the U.K., Japan, the USSR, and the USA, in a further attempt to assess currently on-going phase diagram data evaluation activities and to stimulate interaction and cooperation between these centers. This report includes highlights of the workshop, description of a new poster board design used in the poster sessions, lists of attendees and demonstrations, the program, and descriptions of the presentations.

710,625
PB-270 202/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Hydrothermal Environments on the Erosion of Castable Refractories.
Final rept.,
S. M. Wiederhorn, E. R. Fuller, J. M. Bukowski, and C. R. Robbins. 1977, 4p
Pub. in Proceedings Winter Annual Meeting of the American Society of Mechanical Engineers, New York, New York, December 5-10, 1976, Jnl. Eng. Mater. Technol., v99 p143-146 Apr 77.

Keywords: *Coal gasification plants, *Refractory materials, *Erosion, Wear, Chemical attack, Phase transformations, Cements.

Hydrothermal environments are expected to adversely affect the erosive resistance of castable refractories intended for use in high wear areas of coal gasification plants. The erosive wear behavior of two grades of refractory intended for such use was studied at room temperature after exposure of the refractories to high-pressure steam. Wear occurs primarily in the cement phase that bonds the more wear-resistant aggregate. The wear resistance of the refractories depended on chemical interactions between the cement and the high pressure steam. Although chemical and phase transformations were observed to occur in both refractories, the wear resistance was found to decrease only in those cases for which the strength of the cement phase was substantially reduced.

710,626
PB-270 587/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Erosion Behavior of Ceramics.
Final rept.,
S. M. Wiederhorn. 1975, 24p
Pub. in Proceedings of Workshop on Ceramics for Energy Applications, Columbus, Ohio, November 24-25, 1976, CONF-751194, p83-106 1975.

Keywords: *Refractory materials, *Coal gasification plants, *Erosion, High temperature tests, Reviews.

This review is concerned with the development of erosion resistant refractories for coal gasification applications. Because of their potential use of coal gasification systems, some current design practices used to solve erosion problems in the petrochemical industry are described. Theoretical treatments of erosion are discussed with reference to data obtained on both metals and ceramics. Finally, an overview of current erosion research is given, stressing the need for new equipment to study erosion in hostile environments.

710,627
PB-270 973/1 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C.
User Evaluation of Phase Diagrams for Ceramists and Implications for Related Data and Research Programs,
R. S. Roth, L. P. Cook, T. Negas, G. W. Cleek, and J. B. Wachtman. Aug 77, 74p NBS-SP-486
Library of Congress Catalog Card no. LCCCN-77-10496.

Keywords: *Ceramic materials, *Phase diagrams, *Research management, *Information centers, Electrical porcelain, Oxides, Halides, Scientists, Data processing, Surveys, Personnel, Utilization, Universities, Silicates, Experimental design, Questionnaires, American Ceramic Society, Standard Industrial Categories.

A survey was made of the needs of the users of 'Phase Diagrams for Ceramists,' a continuing special publication series published by the American Ceramic Society under the general editorship of the National Bureau of Standards. The results overwhelmingly support continuation of the series, but point to needs for expanded coverage, fuller commentaries, and reduced publication time. The results also identify needs for greater effort on specific types of experimental and theoretical phase equilibria studies including the effects of variable oxygen pressure and complex metal-ceramic systems.

710,628
PB-271 146/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Water Vapor on Sodium Vaporization from Two Silica-Based Glasses.
Final rept.,
D. M. Sanders, and W. K. Haller. 1977, 4p
Pub. in J. Am. Ceram. Soc., v60 n3-4 p138-141 Mar/Apr 77.

Keywords: *Activation energy, *Sodium, *Glass, Metal vapors, Water vapor, Hydrostatic pressure, Vaporization, Reprints.

The influence of water vapor pressure on the equilibrium sodium vapor densities over well-stirred silica-based glass melts was investigated. Sodium was assumed to be present in the vapor as Na and NaOH molecules, and the activity of Na2O in the melt was calculated as a function of water vapor pressure above the melt.

710,629
PB-271 182/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Design Techniques for Brittle Materials.
Final rept.,
S. M. Wiederhorn, N. J. Tighe, and A. G. Evans. 1976, 15p
Pub. in Proc. Meeting of the Structures and Materials Panel of AGARD (43rd), Neuilly sur Seine (France), October 1976. Paper in AGARD Report No. 651, Mechanical Properties of Ceramics for High Temperature Applications, p41-55 1976.

Keywords: *Ceramics, Reliability, Structural engineering, Design, Brittleness.

Methods of design for improving the reliability of ceramics in structural applications are described. Based on the science of fracture mechanics, these methods provide a rational basis for estimating the lifetime of structural components that are subjected to applied loads. Data obtained by standard strength or fracture mechanics techniques are used to develop design diagrams from which component performance is evaluated. Three types of diagrams are described, depending on whether the critical flaw size in a component is estimated by nondestructive evaluation, proof testing, or statistical evaluation. The validity of the theory has been tested experimentally, and, on the whole, agreement between theory and experiment is satisfactory. However, additional experimentation is suggested to fully evaluate the limits of the theory.

710,630
PB-271 574/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characterization of Flaws Produced by Mechanical Grinding of Silicon Nitride.
Final rept.,
N. J. Tighe. 1977, 2p
Contract F33615-76-F-6752
Pub. in Proc. of Ann. Proc. Electron Microscopy Society of America (35th), Boston, Mass., Aug. 18-26, 1977, p144-145 1977.

Keywords: *Silicon nitrides, Surface defects, Grinding, Electron microscopy, Cracks, Dislocations(Materials), Oxidation, Damage, Foils(Materials).

Flaws near the ground surfaces of silicon nitride were characterized by electron microscopy. The grinding produced cracks and a high density of dislocations. The change in the flaw population by oxidation of the surface is described.

710,631
PB-273 955/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Acoustic Emission in Brittle Materials.
Final rept.,
A. G. Evans, and M. Linzer. 1977, 30p
Sponsored in part by Rockwell International Independent Research and Development Program, Thousand Oaks, Calif.
Pub. in Annual Review of Materials Science, v7 p179-208 1977.

Keywords: *Ceramic materials, *Fractures(Materials), *Deformation, Reprints, *Acoustic emission testing.

This paper examines the acoustic emission from deformation and fracture processes in brittle materials. The origins of acoustic emission in such materials, their relation to the various test variables, and the deficiencies in existing knowledge are described. Typical applications of acoustic emission are discussed.

710,632
PB-274 653/5 PC **A02**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Inorganic Materials Div.
Structure of Slow Crack Interfaces in Silicon Nitride.
Interim rept. 1 Jan-31 Mar 76,
N. J. Tighe. May 76, 24p NBSIR-76-1075
Sponsored in part by Air Force Materials Lab., Wright-Patterson AFB, Ohio.

Keywords: *Silicon nitrides, *Fractures(Materials), Crack propagation, Electron microscopy, Plastic deformation, Magnesium oxide, Fabrication, High temperature tests.

Cracks in hot-pressed silicon nitride (HPSN) and in reaction bonded silicon nitride were studied by light and electron microscopy. Slow crack growth, resulting from plastic deformation, occurred in HPSN at 1400C. However, the RBSN exhibited brittle fracture at this temperature. This difference in behavior can be explained by the effects of compositional and microstructural differences between the two materials. The MgO additions to HPSN promoted sintering but its presence contributed to plastic deformation. The RBSN was made without added phases. It does not sinter as completely as

the HPSN and the grain size is an order of magnitude smaller. The small grained regions offered no resistance to fracture.

710,633
PB-276 652/5 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C.
Application of Proof Tests to Silicon Nitride,
N. J. Tighe, S. M. Wiederhorn, and L. R. Russell. Mar 77, 12p NBSIR-77-1202
Contract F33615-76-F-6752

Keywords: *Silicon nitrides, *Yield strength, *Gas turbines, Mechanical tests, Design criteria, Reliability.

In the ceramic turbine program, the high cost of turbine components and the disastrous effect of component failure require development of both destructive and nondestructive tests for detecting and rejecting defective components. Proof tests, in which a load is applied to break weak components, will ensure that the survivors will have a possibility of failure that is acceptable for the design requirements. Thus, the development of a reliable proof test program requires testing a statistically significant number of specimens. Proof tests have been applied to assure the reliability of glass components and are being developed for polycrystalline ceramic components, such as silicon nitride. The initial proof tests are being done with 4 Pt bend specimens of hot-pressed and reaction-bonded silicon nitride. The tests are conducted at room temperature and at the maximum useful temperature of the materials.

710,634
PB-278 405/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Subcritical Crack Growth in Glass-Ceramics.
Final rept.,
B. J. Pletka, and S. M. Wiederhorn. 1978, 15p
Prepared in cooperation with Pennsylvania State Univ., University Park. Dept. of Materials Science.
Pub. in Proceedings of Int. Symposium on Fracture Mechanics (2nd), State College, PA., July 26-29, 1977, Paper in Fracture Mechanics of Ceramics, n4 p745-759 1978.

Keywords: *Devitrified glass, *Fractures(Materials), *Crack propagation, Breaking, Predictions, Lithium aluminosilicates, Magnesium aluminosilicates, Aluminosilicic acid/(lithium-salt), Aluminosilicic acid/(magnesium-salt).

As part of a program to evaluate failure prediction theories for ceramic materials, the crack propagation parameter, n, was determined by fracture mechanics and strength techniques for a lithium aluminosilicate and a magnesium aluminosilicate glass-ceramic. In the magnesium aluminosilicate glass-ceramic, n was influenced by the crack morphology, which probably resulted from an interaction of the crack with particles present in the micro-structure. For both glass-ceramics, values of n determined from four-point bending and biaxial tension strength data were smaller than values determined from crack velocity data. This result raises doubts as to the direct applicability of fracture mechanics data to failure prediction methods. It is recommended that for any material, the equivalence of strength and fracture mechanics data be proven before the latter are used for failure prediction purposes.

710,635
PB-278 938/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Lattice Theories of Fracture.
Final rept.,
E. R. Fuller, and R. M. Thomson. 1978, 42p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in Proceedings International Symposium on Fracture Mechanics (2nd), State College, Pa., July 26-29, 1977, Paper in Fracture Mechanics of Ceramics, n4 p507-548 1978.

Keywords: *Fractures(Materials), *Ceramic materials, Crystal structure, Lattice parameters, Crack propagation.

This paper briefly reviews current understanding of the role of physics in elementary crack-tip processes. Particular attention is given to the influence of atomic discreteness on brittle fracture and crack propagation. One-dimensional lattice models are used to illustrate the phenomenon of 'lattice trapping', whereby a crack is stably trapped by the atomic structure. These models are also used to discuss the role of thermodynamic surface energy in the brittle fracture process and in a microscopic Griffith criterion for fracture. Finally, two atomic mechanisms of subcritical crack growth are discussed with reference to a crack that is trapped by a lattice. One mechanism of crack growth results from thermal activation over the lattice-trapping energy barriers; and the other mechanism results from quantum tunneling through the barrier.

710,636
PB-278 939/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mechanisms of Subcritical Crack Growth in Glass.
Final rept.,
S. M. Wiederhorn. 1978, 32p
Prepared in cooperation with Pennsylvania State Univ., University Park. Dept. of Materials Science.
Pub. in Proceedings of International Symposium on Fracture Mechanics (2nd), State College, PA., July 26-29, 1977, Paper in Fracture Mechanics of Ceramics, n4 p549-580 1978.

Keywords: *Glass, *Crack propagation, Diffusion, Cracking(Fracturing).

Mechanisms of subcritical crack growth are divided into two groups: those that occur near the crack tip; and those that occur some distance from the crack tip. In the first group are diffusion mechanisms, plastic flow mechanisms, and chemical mechanisms of crack growth. In the second group are physical processes that control the transport of active agents to the crack tip, and chemical processes that control the composition of the crack tip environment. Other factors that influence subcritical crack growth are the structure of the crack tip and the type of rate limiting reaction that occurs during crack growth. In this paper, the above phenomena are discussed with regard to data on crack growth in glass. It is noted that although water is the main cause of subcritical crack growth in glass, there is still considerable controversy as to the dominant mechanism of fracture in glass.

710,637
PB-280 244/5 PC **A99**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Applications of Phase Diagrams in Metallurgy and Ceramics. Volume 1,
G. C. Carter. Mar 78, 767p NBS-SP-496-Vol-1
Proceedings of a Workshop Held at the National Bureau of Standards, Gaithersburg, Maryland, January 10-12, 1977. Sponsored in part by National Science Foundation, Washington, D.C. Defense Advanced Research Projects Agency, Arlington, Va., Office of Naval Research, Arlington, VA, and National Aeronautics and Space Administration, Washington, D.C. Library of Congress Catalog Card no. 78-2201.

Keywords: *Ceramics, *Semiconductors, *Alloys, *Phase diagrams, *Meetings, High pressure tests, Metals, Binary systems, Oxides, Thermodynamic properties, Chemical equilibrium, Coatings, Hyperfine structure, Solidification, High temperature tests, Numerical analysis, Phase studies, Scanning electron microscopy.

The proceedings of a Workshop on Applications of Phase Diagrams in Metallurgy and Ceramics, held at the National Bureau of Standards, Gaithersburg, Maryland, on January 10-12, 1977, is presented in this NBS Special Publication. The Workshop was co-sponsored by the Institute for Materials Research and the Office of Standard Reference Data, NBS, and the National Science Foundation, the Defense Advanced Research Projects Agency, the Office of Naval Research, the National Aeronautics and Space Administration, the Energy Research and Development Administration, and the U.S. Army Research Office. The purpose of the Workshop was to assess the current national and international status of phase diagram determinations and evaluations for alloys, ceramics and semiconductors; to determine the needs and priorities, especially technological, for phase diagram determinations and evaluations; and to estimate the resources being used and potentially available for phase diagram evaluation. These proceedings reflect the detailed contents of the Workshop for both the tutorial and review sessions as well as four poster sessions and four panel sessions covering the subjects; critical phase diagram availability, user needs of phase diagrams, experimental methods of determination, theoretical methods of calculation and prediction, methods of phase diagram representations of calculation and prediction, methods of phase diagram representations (especially multicomponent) and distribution to the user. Three of the panels addressed the subject of phase diagram needs in industrial applications.

710,638
PB-280 245/2 PC **A99**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Applications of Phase Diagrams in Metallurgy and Ceramics. Volume 2.
G. C. Carter. Mar 78, 847p NBS-SP-496-VOL-2
Proceedings of a Workshop Held at the National Bureau of Standards, Gaithersburg, Maryland, January 10-12, 1977. Sponsored in part by National Science Foundation, Washington, D.C., Defense Advanced Research Projects Agency, Arlington, VA, Office of Naval Research, Arlington, VA and National Aeronautics and Space Administration, Washington, D.C. Library of Congress Catalog Card no. 78-2201.

Keywords: *Ceramics, *Meetings, *Alloys, *Semiconductors, *Phase diagrams, Catalysis, High pressure tests, Numerical analysis, Metals, Stability, Synthesis(Chemistry), Thermodynamic properties, Chemical equilibrium, Copper, Oxides, Binary systems, Coatings, Solidification, Gibbs free energy, Technology, Phase studies.

The purpose of the Workshop was to assess the current national and international status of phase diagram determinations and evaluations for alloys, ceramics and semiconductors; to determine the needs and priorities, especially technological, for phase diagram determinations and evaluations; and to estimate the resources being used and potentially available for phase diagram evaluation. These proceedings reflect the detailed contents of the Workshop for both the tutorial and review sessions as well as four poster sessions and four panel sessions covering the subjects; critical phase diagram availability, user needs of phase diagrams, experimental methods of determination, theoretical methods of calculation and prediction, methods of phase diagram representations of calculation and prediction, methods of phase diagram representations (especially multicomponent) and distribution to the user. Three of the panels addressed the subject of phase diagram needs in industrial applications. These proceedings represent documentation of this assessment, and constitute a valuable resource to workers in these areas, especially those planning to initiate phase diagram programs. Most subjects within the overall scope have been dealt with substantially in these proceedings; a few specialized topics such as surface and small particle phases, needed for the study of catalysis, have not been treated in detail. As the Alloy Data Center maintains a continuing phase diagram program, the authors would like to receive suggestions for similar topics of current and future interest, descriptions of new needs, or addenda and corrigenda to these proceedings. A tear-off sheet has been provided at the end of these proceedings for this purpose to be sent to the NBS Alloy Data Center. (Portions of this document are not fully legible)

710,639
PB-280 439/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of a Potential Electrode Material for MHD: Yttrium Orthoferrite.
Final rept.,
L. P. Domingues, T. Negas, A. J. Armstrong, and W. R. Hosler. Mar 78, 5p
Sponsored in part by Department of Energy, Washington, D.C.
Pub. in Proceedings of Symposium Engineering Aspects of Magnetohydrodynamics (17th), March 27-29, 1978, pG.6.1-G.6.5.

Keywords: *Magnetohydrodynamic generators, *Electrodes, Yttrium compounds, Calcium inorganic compounds, Ferrates, Zirconates, Microstructure, Electrical conductivity, Yttrium ferrates, Calcium ferrates, Calcium zirconates.

Yttria-based ceramics have not been developed fully for MHD applications. As part of an expanded program, this paper presents some exploratory data related to YFeO3-type materials. Preparation and microchemical/microstructural details together with relevant electrical conductivity and thermal expansion data are given. Emphasis is on YFeO3-CaFeO2.5-CaZrO3 solid solutions and composites.

710,640
PB-280 458/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Spectroscopic Technique for the Measurement of Residual Stress in Sintered Al2O3.
Final rept.,
L. H. Grabner. Feb 78, 4p
Pub. in Jnl. of Applied Physics 49, n2 p580-583, Feb 78.

Keywords: *Aluminum oxide, *Residual stress, *Measurement, Fluorescence, Chromium, Reprints, Tracer studies.

Using the R-line fluorescence of trace Cr(3+) in sintered Al2O3 as an example, a method of analysis is outlined for determining the residual microstress and macrostress in a polycrystalline aggregate. It uses the shift and broadening, induced by residual stress, of a line due to a transition in an atomic system dissolved in the aggregate. For sintered Al2O3 from three different manufacturers, but made for the same purpose, the isotropic and shearing components of the residual microstress and macrostress are listed in tabular form. For the isotropic component of the microstress a distribution is found, with a mean value of about 2 kbar, in which tension and compression are equally probable.

710,641
PB-280 539/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microstructural Aspects of Deformation and Oxidation of Magnesia Doped Silicon Nitride.
Final rept.,
N. J. Tighe. 1977, 8p
Contract F33615-76-F-6752
Pub. in NATO Advanced Study Institute on Nitrogen Ceramics, Canterbury, England, Aug 16-27, 1976, 1977.

Keywords: *Silicon nitrides, *Crack propagation, *Oxidation, *Plastic deformation, Electron microscopy, Cracking(Fracturing), Microstructure, Oxides, Ceramics, Transmission electron microscopy.

The microstructural changes that occurred in silicon nitride as a result of slow crack growth, plastic deformation and oxidation were studied by transmission electron microscopy. Examination of specimens which exhibited slow crack growth showed extensive crack branching along the fracture path and ahead of the primary crack tip. These primary and secondary cracks followed intragranular paths and, where a crack arrested before reaching a triple junction, dislocation pileups and networks were found in adjoining grains. Cracks were filled with oxide produced during the tests. In samples which were deformed by bending at 1400C, extensive dislocation arrays were found as well as evidence for grain boundary migration and grain boundary sliding. The oxides formed at 1400C did not produce a protective film, and grew by a process involving rapid diffusion of impurities into the oxide. At lower temperatures, crystalline and amorphous silica formed a semi-protective layer on the silicon nitride surfaces.

710,642
PB-281 967/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ceramics in the Future.
Final rept.,
J. B. Wachtman, and J. R. Johnson. 1976, 27p
Pub. in Science, Technology, and the Modern Navy, 30th Anniversary 1946-76, ONR-37, p388-414 1976. (Office of Naval Research, Arlington, Va.).

Keywords: *Ceramics, Forecasting, Technology, Pollution, Electromagnetic properties, Toxic substances.

Ceramics in the broad sense of inorganic, non-metallic materials already play many vital roles in military and civilian technology. The first thirty years of the Office of Naval Research's existence coincided with great progress in the development of advanced ceramics for specialized applications such as computers, optics, electronics, etc. Important developments in ceramics for bulk uses have also occurred, e.g., refractories for the basic oxygen process and glass reinforcing fibers. Prospects for future development are discussed in terms of a matrix structure which considers promising scientific opportunities as one dimension and promising technologies as another. The discussion is developed in an overall context of concern with energy, declining supplies of some high-grade ores, general pollution effects, and specific concern for toxic substances. It is concluded that further advances in high-technology ceramics with important practical payoffs should occur. In addition, high volume use of advanced bulk ceramics seems possible. The extent of such use may be determined as much by public attitudes as by strict technical advantage.

710,643
PB-282 013/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Phase Diagrams for Ceramists.
Final rept.,
E. M. Levin, and H. F. McMurdie. 1975, 513p
Pub. as 1975 supplement, 513p (American Ceramic Society, Inc.) 1975.

Keywords: *Ceramics, *Phase diagrams, Reprints.

This volume is a supplement to previous publications. It contains phase diagrams on 749 systems from the literature, references to original work and commentaries outlining the method of study, accuracy, and relation to other studies in the area.

710,644
PB-282 909/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quantitative Analysis of Glasses by Secondary Ion Mass Spectrometry (Abstract).
Final rept.,
D. E. Newbury. Aug 77, 6p
Pub. in Proceedings of International Conference X-ray Optical Microanalysis (8th) and Annual Conference Microbeam Analysis Society (12th), Boston, Mass. 18-24 Aug 77 p140A-140F Aug 77.

Keywords: *Glass, *Quantitative analysis, Surface properties, Secondary ion mass spectroscopy.

Quantitative analysis by secondary ion mass spectrometry has been tested by analyzing a series of NBS research material glasses. Spectral intensities have been converted to compositional values by use of a physical model of the secondary ion emission process, the local thermal equilibrium (LTE) model, and by use of experimentally derived elemental sensitivity factors. The analyses with the local thermal equilibrium model show an error distribution such that 50 percent of the analyses fall within a factor of two of known values and percent within a factor of five. Analysis with average sensitivity factors derived from several different glasses yields compositional values within a factor of two in 83 percent of the cases and within a factor of five in 99 percent of the cases.

710,645
PB-282 910/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quantitative Analysis by Secondary Ion Mass Spectrometry.
Final rept.,
D. E. Newbury. Feb 78, 23p
Pub. in Proceedings of the American Society for Testing and Materials Symposium on Quantitative Surface Analysis of Materials, Cleveland, Ohio 2-3 Mar 77 as Special Technical Pub. 643, p127-149 Feb 78.

Keywords: *Glass, *Quantitative analysis, Accuracy, Surface properties, Secondary ion mass spectroscopy.

Quantitative analysis by secondary ion mass spectrometry (SIMS) involves reduction of spectral intensities to compositional values by the use of either empirical sensitivity factors or a physical model of ion emission. Of the several physical models available, the Local Thermal Equilibrium (LTE) model is the one most easily applied to the analysis of an arbitrary multi-element specimen. The accuracy of SIMS analysis by both the LTE model and by sensitivity factors has been compared on a series of well-characterized glass samples. Error factor histograms have been prepared for several hundred elemental determinations. For the LTE analysis, approximately 50% of the analyses fall within a factor of two of the accepted value, and 80% fall within a factor of five. For analysis with elemental sensitivity factors derived from the glasses, approximately 80% of the analyses lie within a factor of two and over 95% within a factor of five of known values.

710,646
PB-282 911/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Strength Degradation of Glass Resulting from Impact with Spheres.
Final rept.,
S. M. Wiederhorn, and B. R. Lawn. Oct 77, 8p
Sponsored in part by Office of Naval Research, Arlington, Va.
Pub. in Jnl. of the American Ceramic Society, v60 n9-10 p451-458 Sep-Oct 77.

Keywords: *Glass, *Impact tests, Fractures(Materials), Erosion, Mathematical prediction, Reprints.

A study has been made of the nature and extent of degradation incurred by glass surfaces impacted with spheres of steel and tungsten carbide. The residual strength after impact depends on the velocity, radius and density of the projectile, on the toughness and (indirectly) the hardness of the target, and (to a lesser extent) on the pre-existing mechanical condition of the surface. Generally, the damage morphology is complex, consisting of the basic Hertzian (cone) crack pattern modified by median (radial) cracks and crushed glass at the impact site. A theoretical analysis of residual strength as a function of impact velocity, as derived from indentation fracture mechanics, predicts all the essential features of the degradation. In particular, a threshold velocity for significant strength loss, above which further strength falloff occurs at a relatively slight rate, is accounted for. It is suggested that quasistatically-based theory can be used to obtain a safe estimate of the strength of structural ceramics in small-particle impact situations.

710,647
PB-285 286/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Proof-Testing of Hot-Pressed Silicon Nitride.
Final rept.,
S. M. Wiederhorn, and N. J. Tighe. 1978, 12p
NBSIR-77-1400
Pub. in Jnl. of Materials Science, v13 p1781-1792 1978.

Keywords: *Silicon nitrides, *Yield strength, Fractures(Materials), Mechanical tests, Quality control, Reprints.

Proof testing was investigated as a method for insuring the reliability of hot-pressed silicon nitride in high temperature structural applications. The objective of the study was to determine if the strength distribution of a population of test specimens could be truncated by proof-testing. To achieve this objective, the strength of silicon nitride was measured at 25C and 1200C, both with and without proof-testing. At 25C the strength distribution was effectively truncated by proof-testing. At 1200C, however, the effectiveness of proof-testing as a means of truncating the strength distribution was determined by the resistance of the silicon nitride to oxidation. Although oxidation removes machining flaws that limit the strength of silicon nitride, long term exposure to high temperature oxidizing conditions resulted in the formation of surface pits that severely degraded the strength. Provided the effects of high temperature exposure are taken into account, proof-testing is shown to be useful for hot-pressed silicon nitride at elevated temperatures.

710,648
PB77-600006
(Order as PB-275 037, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Thermodynamics of the Densification Process for Polymer Glasses.
J. E. McKinney, and R. Simha. 1977, 15p
Included in Jnl. of Research of the National Bureau of Standards, v81A n2 and 3 p283-297 1977.

Keywords: Compressibility, Densification, *Glass, Glass transition, Liquid, Polymer, Pressure, PVT, Pryrolysis, Refractive index, Thermal expansion, Thermodynamic.

A quantitative description is given for the densification process of glasses resulting from glass formation at elevated pressures. Phenomenological relations are derived, or justified, which allow estimation of the densification rate Kappa (with respect to formation pressure) from various thermodynamic quantities and glass transition behavior. In addition, the estimation of Kappa may be facilitated by the application of the hole theory of Simha and Someynsky. Using these relations Kappa is estimated, and the results from the different methods are compared for data from 23 different organic polymers with glass transition temperatures ranging from 150 to 455 K. The amount of densification appears to be limited by the apparent convergence of the glass temperature and effective decomposition temperature with increasing pressure. Some estimates of limiting values are presented. Finally, changes of refractive index resulting from densification

are estimated from the observed, or predicted, densification rates.

710,649
PB78-600050 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mechanical Properties of Glass.
S. M. Wiederhorn. 1977, 16p
Pub. in Proceedings ERDA Workshop on Ceramic and Glass Radioactive Waste Forms, Germantown, MD, Jan 4-5, 1977.

Keywords: *Brittle fracture, Fracture, Glass, Radioactive waste disposal, Static fatigue, Strength, Stress corrosion cracking.

The fracture of glass is reviewed and related to problems of nuclear waste disposal. Although there is a dearth of information on glasses intended for radioactive waste disposal, many of the techniques that have been developed to characterize the strength of glass and to improve the reliability of structural glasses will be applicable to problems of waste disposal. Suggested areas for research include: characterization of the mechanical behavior of glasses for waste disposal; characterization of the effect of radiation damage on mechanical properties; evaluation of the effect of recrystallization and phase separation on the strength of glass.

710,650
PB78-600052 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Erosion of Brittle Materials by Solid Particle Impact.
B. J. Hockey, S. M. Wiederhorn, and H. Johnson. 1978, 24p
Pub. in Fracture Mechanics of Ceramics 3, p379-402 1978.

Keywords: *Ceramics, Erosion, Fracture, Plastic flow, Solid particle impact, Transmission electron microscopy.

Results are presented which show, that in addition to fracture, plastic deformation occurs and plays an important role in the erosion of brittle materials by solid particle impact. These conclusions are supported by transmission electron microscopy studies of impact damage produced in a wide variety of brittle materials and by erosive wear studies on silicon nitride and alumina. The erosive wear studies also indicate that while erosion resistance is primarily determined by fracture toughness and hardness, the relative importance of these materials parameters depends on the test conditions (e.g. temperature and angle of particle impingement).

710,651
PB80-110133 PC **A23**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Science of Ceramic Machining and Surface Finishing II,
B. J. Hockey, and R. W. Rice. Oct 79, 528p NBS-SP-562
Prepared in cooperation with Naval Research Lab., Washington, DC. Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC., American Ceramic Society, Columbus, OH., and Office of Naval Research, Arlington, VA. Proceedings of a Symposium Held at Gaithersburg, MD. on November 13-15, 1978. Library of Congress catalog card no. 79-600149. See also COM-72-50763.

Keywords: *Ceramics, *Abrasive machining, *Surface finishing, *Meetings, Machining, Surface properties, Hardness.

The volume presents the proceedings of the Second Symposium on the Science of Ceramic Machining and Surface Finishing held at the National Bureau of Standards in Gaithersburg, Maryland, on November 13-15, 1978. The symposium was jointly sponsored by the Air Force Office of Scientific Research, the American Ceramic Society, the Office of Naval Research, and the National Bureau of Standards. The purpose of the symposium was to review recent progress by discussion of current problems and research efforts. The proceedings contain forty of forty-three research papers, together with floor discussions, presented at the Symposium. Specific topics covered include: (1) mechanisms of abrasive machining and surface finishing; (2) technology of machining and surface finishing; (3) characterization of machined surfaces; and (4) effects of machining on the properties of ceramics. Also included is an edited discussion on hardness and its relation to machining.

710,652
PB80-115587 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Conductivity of Glass at the Solid/Liquid Interface.
Final rept.,
J. Jednacak-Biscan, V. Mikac-Dadic, V. Pravdic, and W. Haller. 1979, 10p
Sponsored in part by Community for Scientific Research of SR of Croatia, Yugoslovia.
Pub. in Jnl. of Colloid and Interface Science 70, n1 p18-27 1979.

Keywords: *Borosilicate glass, *Sulfur resistivity, *Silica glass, Glasses, Electrokinetics, Reprints, Electrical conductivity.

The electrokinetic phenomenon of surface conductivity was studied for capillaries of pure fused silica and of a borosilicate glass, in water, dilute aqueous solutions of HCl and NaCl, in methanol and acetonitrile. Surface conductivity was calculated from the total specific conductivity measured by two bright platinum electrodes at the mouths of the capillary and from the specific bulk conductivity of the liquid medium measured by a separate pair of Pt electrodes at the same temperature. The results were interpreted on the basis of the assumption that protonic conductivity is the predominant mode of surface charge transfer, with the rotation of water molecules in the first liquid layer as the rate-determining step.

710,653
PB80-122914 Not available NTIS
National Bureau of Standards, Washington, DC.
X-Ray Powder Diffraction Measurements in Reactive Atmospheres at 1000C and 7 MPa (1000 PSIG).
Final rept.,
F. A. Mauer, and C. R. Robbins. 1979, 12p
Pub. in Advances in X-Ray Analysis, n22 p19-30 1979.

Keywords: *X ray diffraction, *Castable refractories, *Phase transformations, *Flexural strength, Coal gasification, High temperature tests, High pressure tests, Reprints.

Studies of changes in the flexural strength and phase composition of castable refractories are being carried out in simulated coal gasification reactor environments. This paper describes a pressure vessel in which x-ray powder diffraction measurements can be made by an energy dispersive method while the specimen is being heated to temperatures as high as 1000 C in atmospheres containing H20, CO, H2, CH4, NH3, and H2S at pressures up to 7 MPa (1000 psig).

710,654
PB80-157548 Not available NTIS
National Bureau of Standards, Washington, DC.
Influence of PO2 on Vaporization of Sodium Disilicate at 1345 C.
Final rept.,
D. M. Sanders, and W. K. Haller. Aug 79, 2p
Pub. in Jnl. Am. Ceram. Soc., v62 n7-8 p424-425 Jul-Aug 79.

Keywords: *Sodium silicates, *Partial pressure, Density(Mass/volume), Glass, Vaporization, Dissociation, Reprints.

The dependence of sodium vapor density on oxygen partial pressure was determined for sodium disilicate glass at 1345C. It was found this density varied with 1/ fourth root of P sub (O2) suggesting that sodium oxide dissociates on vaporization.

710,655
PB80-165566 Not available NTIS
National Bureau of Standards, Washington, DC.
Development of Fluorophosphate Optical Glasses.
Final rept.,
J. T. Wenzel, D. H. Blackburn, W. Haller, S. Stokowski, and M. J. Weber. 1979, 7p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Journal of SPIE Physics Prop. Optical Material 204, p59-65 1979.

Keywords: *Optical glass, Laser materials, Optical materials, Fabrication, Aluminum phosphate, Aluminum halides, Magnesium fluorides, Calcium fluorides, Optical properties, Reprints, Aluminum fluorides, Strontium fluorides, Barium fluorides.

The requirements of high-energy laser systems have stimulated the development of low-refractive index, low-dispersion optical glasses, thus extending the range of available glasses in the Abbe diagram. Fluorophosphate glasses are the prime candidates to meet these requirements, but their preparation is complicated by fluorine volatilization on melting and devitrification and cracking on casting. The latter difficulties are caused by low viscosity at the crystallization temperature and by high thermal expansion. Exploration of glassforming regions and simultaneous optimization of the optical properties has led to the identification of compositions with commercial potential.

710,656
PB80-212343 Not available NTIS
National Bureau of Standards, Washington, DC.
Slow Transient Phenomenon in Y-Doped CeO2,
C. K. Chiang, A. L. Dragoo, and A. D. Franklin. 1979, 3p
Pub. in Proceedings of the International Conference on Fast Ion Transport in Solids, Electrodes and Electrolytes, Lake Geneva, WI., May 21-25 p661-663 1979.

Keywords: *Cerium oxides, Ceramics, Diffusion, Transport properties, Additives, Yttrium, Electrical resistivity.

Four-probe dc conductivity measurements on some ceramic Y-doped CeO2 specimens exhibit a slow transient voltage under constant current conditions. This transient has the characteristics of a diffusion-controlled process, with diffusion coefficients typical of solid state transport. The most probable mechanism appears to involve some form of diffusion of neutral oxygen atoms.

710,657
PB80-212368 Not available NTIS
National Bureau of Standards, Washington, DC.
Internal Friction and Sodium Transport in Beta Alumina,
J. H. Simmons, A. D. Franklin, K. F. Young, and M. Linzer. Feb 80, 6p
Pub. in Jnl. of the American Chemical Society 63, n1-2 p78-83 Feb 80.

Keywords: *Aluminum oxide, *Sodium, Internal friction, Interstitials, Ionic mobility, Single crystals, Reprints.

Internal friction peaks near 100K were observed for melt-grown single-crystal sodium beta-alumina with a <110> stress at 12 and 16 kHz. These data, combined with those of Barmatz and preexponential factor for the relaxation time, viz, 20 kJ/mol and 5.6 x 10 to the minus 16 power and 23 kJ/mol and 7.4 x 10 to the minus 18 power. Split-interstitial Na+ ions on mid-oxygen sites could produce these peaks, but not simple interstitials on anti-Beevers-Ross sites. A relaxation mode calculation is given for the relaxation frequency in the internal friction experiment and for the electrical conductivity in the conducting plane for the split interstitial model.

710,658
PB80-213549 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Application of Fracture Mechanics in Assuring Against Fatigue Failure of Ceramic Components,
J. E. Ritter, S. M. Wiederhorn, N. J. Tighe, and E. R. Fuller. Jun 80, 35p NBSIR-80-2047
Prepared in cooperation with Massachusetts Univ., Amherst. Dept. of Mechanical Engineering.

Keywords: *Ceramics, *Fractures(Materials), Failure, Mechanics, Theory, Design, Components, Fatigue life.

This paper will review the application of fracture mechanics theory to the prevention of delayed failure of ceramics. Three successful applications of this theory of assuring the mechanical reliability of ceramics are discussed in order to demonstrate the viability of the theory for purposes of engineering design. Finally, a description is presented of practical limitations of the theory with regard to heat engine application. Methods of overcoming these limitations through modification of test procedures, and application of statistical theory are then presented.

710,659
PB80-218191 PC **A02**/MF **A01**

National Bureau of Standards, Washington, DC. National Measurement Lab.
'In Situ' Oxidation of Y2O3-doped Si3N4.
Interim rept.,
N. J. Tighe, K. Kuroda, T. E. Mitchell, and A. H. Heuer. Aug 80, 12p NBSIR-80-2075
Sponsored in part by Department of Energy, Washington, DC. Prepared in cooperation with Case Western Reserve Univ., Cleveland, OH.

Keywords: *Silicon nitrides, Yttrium oxides, Additives, Ceramics, Oxidation.

Specimens of Y2O3-doped Si3N4 were oxidized in an environmental cell in a 600 kV electron microscope. This ceramic oxidizes passively at temperatures greater than 1000 degrees C but oxidizes catastrophically at approximately 750 degrees C. The in situ experiments showed that oxidation occurs by nucleation and growth of SiO2 and Si2N2O on the Beta Si3N4 surfaces and by volatilization of W inclusions. The paper discusses the HVEM methodology and the oxidation results.

710,660
PB80-220445 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Investigation of the Scaling Resistance of Some Materials on a Nickel Substrate,
I. M. Fedorchenko, and E. T. Denisenko. 1979, 16p DMDC-18445, TT-79-53194
Trans. of Poroshkovaya Metallurgiya (USSR) v5(3) p35-41 1965. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Cermets, *Packaging(Seals), Nickel, Zinc oxides, Graphite, Talc, Oxidation resistance, Translations.

An investigation is made of the oxidation resistance of sintered materials in air and steam at temperatures of 500, 600, & 700C for a periods of up to 2000 hours. The sintered systems were Ni/ZnO, Ni/graphite, and Ni/talcum. The sintering process variables are given. Weight-gain corrosion studies were performed. Material density was an important experimental parameter. The Ni/ZnO system offered some positive features for oxidation resistance. The Ni/graphite system suffered from an embrittlement phenomena.

710,661
PB81-112963 Not available NTIS
National Bureau of Standards, Washington, DC.
Vaporisation in an Unstirred Soda-Lime-Silica Glass Melt.
Final rept.
S. Muria, J. Wenzel, and D. Sanders. Aug 80, 6p
Pub. in Physics and Chemistry of Glasses 21, n4 p150-155 Aug 80.

Keywords: *Glass, *Vaporizing, Melting, Sodium, Transpiration, Reprints.

Vaporization of a 16-10-74 soda-lime-silica glass was studied by following the mass loss of an unstirred melt in a transpiration experiment at 1335C using a nitrogen-water carrier gas. Measurements were made at twelve carrier gas flow rates between 20 and 2,500 ml/min. A large number of sample boats was included to verify that the carrier gas was saturated with glass vapor at all flow rates. At the lowest flow rate the sodium vapor density had a value characteristic of the stirred melt. As the flow rate increased to 800 ml/min, the vapor density decreased monotonically to about half of its stirred value, and at higher flow rates, the vapor density remained constant. For a congruently vaporizing substance this behavior would indicate that carrier gas saturation and the absence of gas phase diffusion were achieved only at flow rates in excess of 800 ml/min. However, independent tests showed saturation at all flow rates and the absence of diffusion at low flow rates, so an alternative explanation must be introduced.

710,662
PB81-115271 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser-Induced Fluorescence Line Narrowing of Eu3+ in Lithium Borate Glass.
Final rept.
M. J. Weber, J. Hegarty, and D. H. Blackburn. 1978, 12p
Pub. in Proceedings of the Conference on Boron in Glass and Glass Ceramics Held at Alfred, NY in June, 1977, Paper in Borate Glasses: Structure, Properties, Applications, p215-226 1978.

Keywords: *Europium, *Alkali glass, Line width, *Laser induced fluorescence, *Laser spectroscopy.

The energy levels and transition probabilities of Eu3+ ions in an alkali borate glass are investigated using laser-induced fluorescence line narrowing. Because of site-to-site variations in the local fields, spectroscopic properties of paramagnetic ions in glass are characterized by large inhomogeneous linewidths and nonexponential excited-state decays. When a narrowband laser is used, only those ions resonant to within the homogeneous linewidth are excited. If the laser is pulsed and the emission is observed before any ion-ion cross relaxation occurs, a line-narrowed fluorescence arising from a selected subset of ions is observed. By tuning the laser within an inhomogeneous absorption band, the full range of local environments in the glass is probed.

710,663
PB81-119851 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Effects in Sharp-Particle Contact.
Final rept.
B. R. Lawn, B. J. Hockey, and S. M. Wiederhorn. 1980, 3p
Pub. in Jnl. of the American Ceramic Society, Discussion and Notes 63, n5-6 p356-358 May-Jun 80.

Keywords: *Glass, Impact, Melting, Adiabatic conditions, Indentation, Reprints.

At sufficiently high loading rates, the penetration of solid surfaces with sharp indenters or particles often results in melting at the contact site. This phenomenon can be explained in terms of localized energy dissipation during elastic-plastic contacts. In this paper, a model describing the adiabatic temperature rise is developed in terms of indentation theory, with specific reference to contact data for soda-lime-silicate glass.

710,664
PB81-121493 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Particle Impact Angle on Strength Degradation of Glass.
Final rept.
S. M. Wiederhorn, B. R. Lawn, and B. J. Hockey. Dec 79, 2p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Jnl. of The American Ceramic Society 62, n11-12 p639-640 Nov-Dec 79.

Keywords: *Glass, Impact strength, Degradation, Reprints.

No Abstract Available.

710,665
PB81-121527 Not available NTIS
National Bureau of Standards, Washington, DC.
Strength Degradation of Glass Impacted with Sharp Particles: I, Annealed Surfaces.
Final rept.
S. M. Wiederhorn, and B. R. Lawn. 1979, 5p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Jnl. of The American Ceramic Society 62, n1-2 p66-70 1979.

Keywords: *Glass, Impact strength, Degradation, Theory, Reprints.

The strength characteristics of annealed brittle surfaces impacted with sharp particles were studied. A theory of the degradation process is constructed in three steps: (1) A sharp particle delivers an impulsive load to the target surface via a plastic contact; (2) the contact loading initiates and propagates median cracks in the surface; (3) the cracks thus induced reduce the strength of the material. Static indentation tests provide essential contact parameters for the degradation equations, thereby allowing for prediction of strengths under in-service conditions. Strength tests on soda-lime glass laths impacted with SiC grit confirm basic predictions of the theory. Higher toughness and lower hardness are the main material requirements for improved resistance to degradation. Initial flaw population in the target surface and projectile geometry are not important factors in the damage process. The study shows that impact energy is the important service variable in determining the extent of strength loss.

710,666
PB81-121543 Not available NTIS
National Bureau of Standards, Washington, DC.
Plastic Deformation of Fine-Grained Alumina (Al2O3): II, Basal Slip and Nonaccommodated Grain-Boundary Sliding.
A. H. Heuer, N. J. Tighe, and R. M. Cannon. Feb 80, 6p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC. and Naval Air Systems Command, Washington, DC.
Pub. in Jnl. of The American Ceramic Society 63, n1-2 p53-58 Jan-Feb 80.

Keywords: *Aluminum oxide, Plastic deformation, Reprints.

Plastic deformation in fine-grained alumina polycrystals (grain sizes 1-15 microns) has been studied; several deformation mechanisms occur simultaneously. This paper is concerned with basal slip and unaccommodated grain boundary sliding (GBS). The basal slip can give rise to a deformation texture. Cavitation occurs due to the occurrence of both unaccommodated GBS and basal slip, because of the marked plastic anisotropy of alumina.

710,667
PB81-123663 Not available NTIS
National Bureau of Standards, Washington, DC.
In Situ Oxidation of Y2O3-Doped Si3N4.
Interim rept.
N. J. Tighe, K. Kuroda, T. E. Mitchell, and A. H. Heuer. Sep 80, 3p
Sponsored in part by Department of Energy Washington, DC. See also report dated Aug 80, PB80-218191.
Pub. in Electron Microsc. 1980 4, p310-312 1980.

Keywords: *Silicon nitrides, *Oxidation, Yttrium oxides, Ceramics, Electron microscopy, Reprints, Doped materials.

Specimens of Y2O3-doped Si3N4 were oxidized in an environmental cell in a 600 kV electron microscope. This ceramic oxidizes passively at temperatures greater than 1000C but oxidizes catastrophically at about 750C. The in situ experiments showed that oxidation occurs by nucleation and growth of SiO2 and Si2N2O on the beta Si3N4 surfaces and by volatization of W inclusions. The paper discusses the HUEM methodology and the oxidation results.

710,668
PB81-129132 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of Fracture Mechanics Concepts to Structural Ceramics.
S. M. Wiederhorn, and J. E. Ritter. Jun 79, 13p
Sponsored in part by National Science Foundation, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of the National Symposium Fracture Mechanics (11th) Held at Blacksburg, VA. on Jun 12-14, 1978, Paper in Fracture Mechanics Applied to Brittle Materials, p202-214 Jun 79.

Keywords: *Ceramics, Fractures(Materials), Crack propagation, Failure, Reliability, Construction materials.

Techniques of improving the reliability of ceramic materials in structural applications are described.

710,669
PB81-129140 Not available NTIS
National Bureau of Standards, Washington, DC.
Chemistry of Ceramic Oxide MHD Electrodes.
T. Negas. 1978, 11p
Sponsored in part by Energy Research and Development Agency, Washington, DC.
Pub. in Proceedings of the ACS National Meeting - Materials from a Chemical Viewpoint (173rd) Held at New Orleans, LA. on Mar 21-22, 1977, Paper in Materials and National Policy, p55-65 1978.

Keywords: *Electrodes, *Ceramic compounds, Magnetohydrodynamics, Spinel, Zirconium oxides, Chemical reactions, Lanthanum chromites.

Laboratory experiments remain important to define potentially deleterious chemical reactions to be expected and which should be minimized, if possible, by thoughtful material fabrication and electrode design. Pre- and post-test chemical aspects of several real electrode

oxide materials will be explored. These include zirconia/ceria, iron oxide-containing spinels, and LaCrO3.

710,670
PB81-133456 Not available NTIS
National Bureau of Standards, Washington, DC.
Micromechanisms of Crack Growth in Ceramics and Glasses in Corrosive Environments.
S. M. Wiederhorn, E. R. Fuller, and R. Thomson. Sep 80, 9p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Metal Science, p450-458, Aug-Sep 80.

Keywords: *Ceramics, *Glasses, *Crack growth, Water, Stress corrosion, Reaction kinetics, Reprints.

At normal temperatures and pressures, water is known to have a strong influence on the strength of ceramics and glasses. Behaving as a stress-corrosion agent, water causes these materials to fail prematurely as a consequence of subcritical crack growth. A basic premise of this paper is that stress-corrosion cracking of ceramics is a chemical process that involves a stress-enhanced chemical reaction between the water and the highly stressed ceramic near the crack tip. Plastic deformation is believed to play no role in this fracture process. After a brief survey of chemical reaction rate theory, the basic rate equation from this theory is modified to reflect physical and chemical processes that occur at crack tips. Modification of the rate equation is based on the assumption that the crack tip can be modelled as an elastic continuum, an assumption that is supported by a simple atomistic model of crack growth. When tested against experimental data collected on glass, the theory was found to be consistent with measurements of the crack-growth dependence on temperature, applied stress intensity factor, and concentration of reactive species in the environment.

710,671
PB81-138737 Not available NTIS
National Bureau of Standards, Washington, DC.
Fracture Mechanics Applied to Structural Ceramics.
S. W. Freiman, and S. M. Wiederhorn. 1978, 18p
Pub. in Proceedings of the Conference on Fracture and Fatigue Mechanics Held at Blacksburg, VA. on June 1978, Paper in Fracture Mechanics, p299-316 1978.

Keywords: *Ceramics, Fractures(Materials), Fracture properties, Construction materials, Crack propagation, Erosion.

Applications of fracture mechanics techniques to ceramic materials is discussed. These techniques are compared with more standard strength techniques and their relevance to failure prediction is analyzed.

710,672
PB81-138760 Not available NTIS
National Bureau of Standards, Washington, DC.
Production and Characterization of Glass Fibers and Spheres for Microanalysis,
J. A. Small, K. F. J. Heinrich, C. E. Fiori, R. L. Myklebust, D. E. Newbury, and M. F. Dilmore. 1978, 9p
Pub. in Proceedings of the Annual Conference on Scanning Electron Microscopy, 1978 (4th) Held at Los Angeles, CA. on April 17-21, 1978, Paper in Scanning Electron Microscopy 1, p445-453, 1978.

Keywords: *Glass fibers, *Spheres, *Microanalysis, Chemical composition, Chemical analysis, Monte Carlo method, Electron probes, Particles, Reprints.

Microscopic fibers and spheres have been fabricated from bulk glasses of known composition. Electron and ion probe microanalysis has confirmed composition as the parent glass. The fibers and microspheres are also being used to study the quantitative electron probe analysis of single particles. The experimental results agree with the theoretical curves within the uncertainties of the Monte Carlo routine and single-particle analysis techniques.

710,673
PB81-140410 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Striae on the Strength of Glass,
W. Capps, H. A. Schaeffer, and D. J. Cronin. Oct 80, 4p
Pub. in Jnl. of the American Ceramic Society 63, n9-10 p570-573 Sep-Oct 80.

Keywords: *Glass, Striations, Mechanical properties, Reprints, Strength.

Severe striations caused by compositional inhomogeneity had no significant effect on the strength of either annealed glass disks or those strengthened by an ion-exchange surface compression technique.

710,674
PB81-166670 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Effect of Strain Rate on the Fracture Toughness of Silicon Nitride at 1400 Degrees C.
Interim rept.
R. J. Fields, N. J. Tighe, and E. R. Fuller. Oct 80, 25p NBSIR-79-1960
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Silicon nitrides, High temperature tests, Crack propagation, Fracture properties, Strain rate.

The critical stress intensity factor for fracture, K sub IC was measured in Si3N4 at 1400C as a function of strain rate. It was found that K sub IC increased with decreasing rates of bending of notched bars. This effect could be approximately predicted using a time dependent plastic zone correction to K sub IC.

710,675
PB81-168908 Not available NTIS
National Bureau of Standards, Washington, DC.
Erosion of Ceramics.
Final rept.
S. M. Wiederhorn. 1979, 36p
Pub. in Proceedings of the NACE (National Association of Corrosion Engineers, Houston, Texas) Conference on Corrosion/Erosion of Coal Conversion System Materials Held at Berkeley, CA. on Jan 24-26, 1979, p444-479 1979.

Keywords: *Ceramics, *Erosion, Crack propagation, Crushing, Hardness, Toughness.

This paper reviews current research on the erosion of ceramics for engineering applications. Two types of erosion are described: that resulting from chipping and crack propagation typical of dense homogeneous ceramics; and that resulting from crushing of porous bonding phases so typical of castable refractories.

710,676
PB82-152745 Not available NTIS
National Bureau of Standards, Washington, DC.
Time Correlation Functions and Molecular Motions in Glasses.
R. D. Mountain. 1981, 9p
Pub. in Annals of the New York Academy of Sciences 371, p252-260 1981.

Keywords: *Glasses, *Molecular relaxation, Diffusion, Light scattering, Supercooling, Dielectric properties, Reprints.

The value of time correlation functions as a way to represent molecular motions in liquids and glasses will be illustrated by examining examples involving computer simulations, infrared absorption and dielectric relaxation and light scattering. A computer simulation is used to produce self-diffusion coefficient and the velocity autocorrelation function of a supercooled liquid state and a glassy state of a model of rubidium. With the accuracy of the simulation, in the self-diffusion coefficient of the glass is zero, indicating the need for special initial conditions to study the dynamics of diffusion in glass by molecular dynamics simulations. Various aspects of orientational motions are probed by infrared absorption, dielectric relaxation and depolarized light scattering. The connections of these three probes are examined with emphasis on depolarized light scattering. Experimental work on boron trioxide glass and supercooled benzel-benzoate are discussed within the framework of 'lower order' theory. This set of measurements illustrates the role of structural relaxation in governing the reorientation of molecules in supercooled liquids.

710,677
PB82-183005 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Application of Proof Testing to Brittle Materials at High Temperatures.
Final rept.
N. J. Tighe, and S. M. Wiederhorn. Dec 81, 201p NBSIR-81-2445
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Brittleness, *Silicon nitrides, High temperature tests, Proving, Ceramics, Failure, Fatigue(Materials), Oxidation, Fracture strength, Weibull density functions, Sialon, Structural ceramics.

The report contains the publications prepared during the contract period. The publications concern the theories of proof testing for assuring reliability and present experimental results obtained on silicon nitride tested at 1200C. The important conclusion from the research is that the flow population which causes failure changes during exposure and produces new population. An approach which includes dynamic flow population was developed and is included in the report. The experimental data is presented in the form of a map which displays strength vs. time under load.

710,678
PB82-211095 Not available NTIS
National Bureau of Standards, Washington, DC.
Diffusive Crack Growth Model for Creep Fracture.
Final rept.
T. Chuang. Feb 82, 11p
Contract DE-A105-80OR20679
Pub. in Jnl. of the American Ceramic Society 65, n2 p93-103 Feb 1982.

Keywords: *Crack propagation, Mathematical models, Grain boundaries, Fractures(Materials), Creep properties, Reprints, Aluminum silicon oxynitride, Sialon, J integrals.

A grain boundary creep crack growth model is presented here based on the assumptions that the crack propagates along the grain boundary by a coupled process of surface and grain-boundary self-diffusion; the adjoining grains behave elastically; and steady state conditions prevail. Under the action of the applied stress, atoms on the crack surfaces are driven by surface diffusion toward the crack tip from where they are deposited non-uniformly by grain-boundary diffusion along the grain interface so that the grain boundary opens up in a wedge shape ahead of the advancing tip which in turn produces a misfit stress field.

710,679
PB82-235896 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Effects of Water and Other Dielectrics on Crack Growth.
Interim rept.
S. M. Wiederhorn, S. W. Freiman, E. R. Fuller, and C. J. Simmons. Jun 82, 63p NBSIR-82-2524
Sponsored in part by Office of Naval Research, Arlington, VA.

Keywords: *Alkali glass, *Crack propagation, Water, Dielectrics, Liquids, Reaction kinetics.

The effect of water and a variety of organic liquids on the crack growth rate in soda lime silica glass was investigated. When water is present in organic liquids, it is usually the principal agent that promotes subcritical primarily by the chemical potential of the water in the liquid; whereas in the region II, crack growth is controlled by the concentration of water and the viscosity of the solution formed by the water and the organic liquid. In region III, where water does not affect crack growth, the slope of the crack growth curves can be correlated with the dielectric constant of the liquid. It is suggested that these latter results can be explained by electrostatic interactions between the environment and charges that form during the rupture of Si-O bonds.

710,680
PB82-237678 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.

Effects of Crack Growth on the Load-Displacement Characteristics of Precracked Specimens Under Bending.
T. J. Chuang, E. R. Fuller, R. J. Fields, and L. Chuck. May 82, 41p NBSIR-82-2504
Contract DE-A105-800R20679

Keywords: *Ceramics, *Crack propagation, Fracture tests, Bend tests.

A critical evaluation of the feasibility of obtaining crack growth parameters from bend tests is presented. First derived are the governing differential equations which characterize the time-history of bend test parameters for a given elastic material exhibiting power law crack growth behavior. A numerical solution scheme is then developed which is capable of solving the initial value problem, thus quantitatively assessing the influence of crack growth on the load-displacement output. The results of this analysis indicate that for high N materials (where N is the exponent in the power law crack growth equation) the flexural test method gives a broad error band in N prediction and hence is not a reliable technique. However, it can be used by a designer to quickly screen the new materials with high N values which are potential candidates for structural application.

710,681
PB82-239211 Not available NTIS
National Bureau of Standards, Washington, DC.
Sodium and Boron Vaporization from a Boric Oxide and a Borosilicate Glass Melt.
Final rept.
J. T. Wenzel, and D. M. Sanders. Apr 82, 6p
Pub. in Physics and Chemistry of Glasses 23, n2 p47-52 Apr 82.

Keywords: *Vaporization, *Boron oxides, Glass, Thermodynamics, Melts, Reprints, *Sodium borosilicate.

Reactive vaporization studies of a boric oxide and a 1:1:4 sodium borosilicate glass melt were conducted using a stirrable transpiration apparatus which allowed the melt surface to be replenished continuously. Both boron and sodium vapor densities could be measured as a function of water vapor pressure. Water vapor enhances the vaporization of boric oxide due to the formation of boric and metaboric acids, but it has little effect on the vaporization of sodium and boron from the sodium borosilicate. If this latter melt is left unstirred, the vapor density decreases because of surface depletion of sodium borate.

710,682
PB83-134197 Not available NTIS
National Bureau of Standards, Washington, DC.
Unusual Luminescence Behavior of Terbium Phosphate Glasses.
Final rept.
D. J. Cronin, D. H. Blackburn, and W. K. Haller. 25 Feb 82, 3p
Pub. in Nature 295, n5851 p680-682, 25 Feb 82.

Keywords: *Terbium compounds, *Inorganic phosphates, *Glass, *Luminescence, Melts, Oxidation, Reprints.

While preparing a terbium-containing phosphate glass, an intense emission of green light was observed when the melt was poured into a metal mould. This emission was easily visible to the naked eye and was only observed on quenching of the melts. To our knowledge this phenomenon, termed 'cooling-induced luminescence (CIL)', has not previously been reported. Experimental evidence suggests that the CIL may be related to a thermally induced shift in the oxidation-reduction balance in the melt. A similar phenomenon was also observed with europium phosphate melts.

710,683
PB83-178699 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Analysis of Oxide Plus Matrix Interfaces in Silicon Nitride.
N. J. Tighe. Jul 82, 28p NBSIR-82-2574
Sponsored in part by Department of Energy, Washington, DC. Div. of Fossil Fuel Utilization.

Keywords: *Silicon nitrides, Interfaces, Microstructure, Oxidation, Electron microscopy, Oxides, Phase, Inclusions.

In the study, these three interfacial layers were removed and analyzed using transmission electron microscopy, light microscopy, x-ray energy analysis and x-ray diffraction. Oxide scales were produced on hot-pressed silicon nitride samples by heating in air at 1000C, 1200C, and 1400C for 1/2 to 1000 hr. The phases in the oxide scale were found to occur in layers that were ordered according to the phase diagrams for the oxide mixtures. Crystalline and amorphous phases were present in all specimens examined. The oxynitride and amorphous phases are present in as-pressed billets at triple junctions and along grain boundaries. The elements in the amorphous phases were identified using energy dispersive x-ray analysis. In the paper, the phases found in the oxide scales are characterized and the relationships between the oxide scale, the oxide:matrix interface and the mechanical properties are discussed.

710,684
PB83-182667 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Deuterium Oxide on Crack Growth in Soda-Lime-Silica Glass.
Final rept.
S. M. Wiederhorn. Dec 82, 2p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Jnl. of the American Ceramic Society 65, n12 pC-202-C-203 Dec 82.

Keywords: *Alkali glass, *Silica glass, *Crack propagation, Heavy water, Reprints.

The paper reports the results of crack growth studies made in acidic and basic deuterium oxide solutions. An isotopic effect is observed for studies in basic deuterium oxide solutions, but not in acidic deuterium oxide solutions. The results suggest that the rate limiting step for crack growth is different for basic and acidic environments.

710,685
PB83-192666 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Structural Reliability of Yttria-Doped, Hot-Pressed Silicon Nitride at Elevated Temperatures.
Annual rept. 1 Oct 81-30 Sep 82.
S. M. Wiederhorn, and N. J. Tighe. Mar 83, 31p NBSIR-83-2664
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.

Keywords: *Silicon nitrides, Additives, Yttrium oxides, Ceramics, Creep properties, Strength, Degradation, Failure, High temperature.

The strength of yttria-doped, hot-pressed silicon nitride was investigated as a function of temperature and applied load. Data collected at 1200C are presented in the form of a strength degradation diagram for an applied load of 350 MPa. At this temperature, the behavior of the yttria-doped material is found to be superior to that of magnesia-doped silicon nitride, in which creep results in the formation of microcracks that lead to strength degradation. By contrast, the yttria-doped material does not suffer from microcrack formation, or strength degradation at 1200C. At higher temperatures strength degradation does occur, and as a consequence, an upper limit of 1200C is recommended for yttria-doped, hot-pressed silicon nitride in structural applications.

710,686
PB83-234658 Not available NTIS
National Bureau of Standards, Washington, DC.
Physics of Fracture.
Final rept.
B. R. Lawn. Feb 83, 8p
Pub. in Jnl. of The American Ceramic Society 66, n2 p83-91 Feb 83.

Keywords: *Fractures(Materials), Cracks, Crack propagation, Toughness, Ceramics, Reprints, *Fracture(Mechanics), Transmission electron microscopy.

The underlying physical bases of present day fracture theory are examined. It is proposed that the atomically sharp crack should be taken as the cornerstone for modelling propagation processes at the fundamental level. Transmission electron microscopy evidence is presented in support of this contention. Linear continuum fracture mechanics is shown to have intrinsic limitations in its capacity to describe crack-tip phenomena; a more realistic description is provided by lattice statics, incorporating the picture of a crack as a narrow slit terminated by nonlinear linkage bonds. This description establishes a powerful starting point for understanding and predicting the effects of important crack-tip interaction processes. Two such processes, chemically-enhanced slow crack growth and process-zone toughening, are discussed in this light. Finally, the nature of strength-controlling flaws in brittle ceramics is considered, with particular reference to the validity of the widely adopted hypothesis that such flaws may be regarded as true microcracks.

710,687
PB84-105733 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Oxidation on the Reliability of Silicon Nitride.
Final rept.
N. J. Tighe, and S. M. Wiederhorn. 1983, 21p
Contract DOE-EA-77-A-01-6010
Pub. in Fracture Mechanics of Ceramics 5, p403-423 1983.

Keywords: *Silicon nitrides, *Oxidation, Reliability, Crack propagation, Creep properties, Failure, Deformation, Static load, Life(Durability), Defects, Reprints.

Oxidation at 1200C affects the strength and reliability of hot-pressed, magnesia-doped silicon nitride by modifying the flaw population. Static load data, and microstructural examination are used to identify the new flaw populations and to describe the failure mechanisms. The analysis is displayed graphically by means of a strength degradation map which delineates specific regions for the failures due to pit formation, crack growth, cavitation, and creep rupture.

710,688
PB84-105840 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Fatigue for Brittle Flaws Originating from Residual Stress Concentrations.
Final rept.
E. R. Fuller, B. R. Lawn, and R. F. Cook. May 83, 8p
Pub. in Jnl. of American Ceramic Society 66, n5 p314-321 May 83.

Keywords: *Fatigue, Crack initiation, Residual stress, Stress concentration, Crack propagation, Ceramics, Theory, Defects, Reprints.

A theory is formulated for the general fatigue response of brittle flaws which experience residual stress concentrations. The indentation crack is taken as a model flaw system for the purpose of setting up the basic fracture mechanics equations, but the essential results are expected to have a wider range of applicability in the strength characterization of ceramics. A starting fatigue differential equation is first set up by combining an appropriate stress intensity factor for point- or line-contact flaws with a power-law crack velocity function. Analytical solutions are then obtained for the case of static fatigue. The resulting relation between lifetime and failure stress is shown to have exactly the same power-law form as the conventional solution for Griffith (residual-stress-free) flaws.

710,689
PB84-105857 Not available NTIS
National Bureau of Standards, Washington, DC.
Indentation Analysis: Applications in the Strength and Wear of Brittle Materials.
Final rept.
B. R. Lawn, B. J. Hockey, and H. Richter. Jun 83, 14p
Pub. in Jnl. of Microscopy 130, pt3 p295-308, Jun 83.

Keywords: *Brittleness, *Strength, *Wear, Mechanical properties, Crack propagation, Residual stress, Ceramics, Plastic properties, Defects, Reprints, Fracture(Mechanics).

Some recent developments in the principles and applications of indentation fracture in brittle materials are surveyed. Attention is focussed on 'sharp' indenters, for which precursor 'plasticity' is an essential element of the crack development. A major consequence of this plasticity is a residual contact stress field which exerts a dominant influence on ensuing mechanical behavior. This influence is discussed in relation to strength and wear properties of brittle ceramics. Emphasis is placed on the advantages of the indentation method as a means of producing controlled cracks for evaluating material fracture parameters and for gaining insight into flaw micromechanics.

710,690
PB84-106061 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Material Parameters on the Erosion Resistance of Brittle Materials.
Final rept.
S. M. Wiederhorn, and B. J. Hockey. 1983, 15p
Pub. in Jnl. of Materials Science 18, p766-780 1983.

Keywords: *Brittleness, *Erosion, Erosion corrosion, Regression analysis, Plastic deformation, Hardness, Stresses, Reprints.

Erosion data are compared with two theories that have been suggested to explain the erosive behaviour of solids. A dimensional analysis is applied to the variables that are important to erosion, and a multivariate, linear regression analysis is used to fit the data to the dimensional analysis. The results of the linear regression analyses are compared with the two theories in order to evaluate the applicability of these theories to erosion. Although semi-quantitative agreement of the data with the theories is obtained, some discrepancies are apparent. In particular, the dependence of erosion rate on hardness and critical stress intensity factor is greater than predicted by either of the two theories. These discrepancies are attributed primarily to microstructural aspects of erosion that are not modelled by either of the theories.

710,691
PB84-106145 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamic Fatigue of Brittle Materials Containing Indentation Line Flaws.
Final rept.
B. L. Symonds, R. F. Cook, and B. R. Lawn. 1983, 9p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Materials Science 18, p1306-1314 1983.

Keywords: *Fatigue, *Brittleness, Tunsten carbides, Residual stress, Damage, Strength, Crack propagation, Defects, Reprints.

A study is made of the dynamic fatigue response of brittle materials containing indentation-induced line flaws. The theoretical fracture mechanics of 'median' crack evolution to failure under applied tension are first developed, with special emphasis on the role of residual contact stresses. In particular, it is shown that use of fatigue curves to evaluate the exponent in an assumed power-law crack velocity function may result in systematic error, by as much as a factor of two, if proper account is not taken of this residual contact contribution. Data from strength tests on soda-lime glass bars in water, using a tungsten carbide cutting wheel to introduce the median pre-cracks, confirm the basic predictions. The results suggest that extreme care needs to be exercised when using surfaces with a contact history, e.g. as with machining damage, in fatigue test programs for materials analysis.

710,692
PB84-106178 Not available NTIS
National Bureau of Standards, Washington, DC.
Relation between Multi-Region Crack Growth and Dynamic Fatigue of Glass Using Identation Flaws.
Final rept.
P. Chantikul, B. R. Lawn, H. Richter, and S. W. Freiman. Jul 83, 4p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of the American Ceramic Society 66, n7 p515-518 Jul 83.

Keywords: *Glass, *Fatigue, *Crack propagation, Strength, Mechanical properties, Defects, Reprints.

The influence of transport-limited kinetic crack growth in the fatigue properties of soda-lime glass is examined. Dynamic fatigue data are taken on specimens with controlled indentation flaws and are compared with the predicted response from measured crack velocity characteristics. Heptane is used as the operational test environment because of its pronounced crack velocity plateau; control tests in water serve to establish a baseline reference for comparing the results. Fractographic observations using a stress wave marker technique show a complex growth history for flaws broken in heptane compared to that for flaws broken in water. The magnitude of the predicted region II influence is too small to be detected in the dynamic fatigue results, even allowing for the relatively high degree of data reproducibility. The implications of this conclusion for lifetime predictions are discussed.

710,693
PB84-106525 Not available NTIS
National Bureau of Standards, Washington, DC.
Crack Healing in Brittle Materials.
Final rept.
B. J. Hockey. 1983, 22p
Sponsored in part by Army Research Office, Research Triangle Park, NC.
Pub. in Proceedings of Fracture Mechanics of Ceramics 6, p637-658 1983.

Keywords: *Brittleness, *Ceramics, Cracks, Dislocations(Materials), Indentation, Impact tests, Crystal defects, *Crack healing, Transmission electron microscopy.

Transmission electron microscopy has been used to examine cracks produced in A1203, SiC, Si, and Ge by room temperature indentation or solid particle impact. While most cracks are dislocation-free, a small but significant fraction (approximately equal to 25%) are found to end in a network of dislocations. In this paper, the nature and origin of these dislocations is investigated, and it is concluded that they are interfacial mismatch dislocations which form as a result of spontaneous crack healing. Unlike dislocation structures resulting from slip, these dislocation networks exhibit no preferred orientation dependence. Instead, they join continuously with cracks of arbitrary orientation and morphology, and thus clearly define extended portions of the residual crack interface. These dislocation networks, moreover, are generally composed of widely separated partial dislocation segments, so that much of the defined area is faulted.

710,694
PB84-135961 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Crack Growth on the Load-Displacement Characteristics of Precracked Specimens under Bending.
Final rept.
T. J. Chuang, E. R. Fuller, R. J. Fields, and L. Chuck. 1983, 10p
Contract DE-A105-80OR20679
See also PB83-237678.
Pub. in Engineering Fracture Mechanics 18, n6 p1099-1109 1983.

Keywords: *Ceramics, *Crack propagation, Fracture tests, Reprints.

A critical evaluation of the applicability of pursuing the data on crack growth parameters from bend test method is presented. Control equations are derived which characterize the time history of bend test parameters for a given elastic material exhibiting power law crack growth. A numerical solution scheme was developed which is capable of solving this initial value problem and further assessing the influence of crack growth on the load-displacement output. The results of this analysis indicate that for high N materials (where N is the exponent in power law equation of crack growth) the flexural test method gives a broad error band in N prediction and hence is not a reliable technique. However, it can be used by designer to quickly screen the new materials of high N values which are potential candidates for structural applications.

710,695
PB84-138361 Not available NTIS
National Bureau of Standards, Washington, DC.
Kinetics of Shear-Activated Indentation Crack Initiation in Soda-Lime Glass.
Final rept.
B. R. Lawn, T. P. Dabbs, and C. J. Fairbanks. 1983, 13p
Pub. in Jnl. of Material Science 18, p2785-2797 1983.

Keywords: *Alkali glass, Kinetics, Crack initiation, Indentation, Reprints.

The initiation of radial cracks in Vickers indentation of soda-lime glass is found to be strongly rate dependent. For long contact durations the radial cracks pop in during the indentation event, at a reproducible stage of the unloading half-cycle; for short contacts the pop-in occurs after the event, with considerable scatter in delay time. The phenomenon is interpreted in terms of an incubation time to develop a critical nucleus for the ensuing fracture. Increasing either the water content of the environment or the peak contact load diminishes the incubation time. Scanning electron microscopy of the indentation patterns indicates that the sources of the crack nuclei are constrained sl ear faults within the deformation zone. A qualitative model is developed in terms of a two-step process, precursor faulting followed by crack growth to pop-in instability. Moisture may influence both these steps, in the first by interfacial decohesion and in the second by slow crack growth.

710,696
PB84-218809 Not available NTIS
National Bureau of Standards, Washington, DC.
Critical Evaluation of Fracture Mechanics Techniques for Brittle Materials.
Final rept.
S. W. Freiman. 1983, 19p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Fracture Mechanics of Ceramics 6, p27-45 1983.

Keywords: *Ceramics, *Brittleness, Crack propagation, Toughness, Tests, Reprints, *Fracture(Mechanics), Fracture toughness.

A significant number of techniques for determining the crack growth resistance of brittle materials have been developed in recent years. Many of these are intended for both the determination of critical values of fracture toughness, as well as obtaining subcritical crack growth data. Positive and negative aspects of test geometrics including double torsion, double cantilever beam, notched beam, short rod, indentation, etc., are presented. The effects of loading procedures, e.g. constant load, load relaxation, constant loading rate, on subcritical crack growth curves are discussed. The microstructure of polycrystalline ceramics is shown to significantly affect measured values of crack growth parameters. The parameter K sub IC is commonly determined using most fracture mechanics techniques. The question 'Is K sub IC a unique materials' constant, or is it dependent on specimen geometry, loading rate, environment, etc.' is discussed.

710,697
PB84-218973 Not available NTIS
National Bureau of Standards, Washington, DC.
Modified Indentation Toughness Technique.
Final rept.
R. F. Cook, and B. R. Lawn. Nov 83, 2p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of the American Ceramic Society, v66 n11 pC-200-C-201 Nov 83.

Keywords: *Ceramics, *Toughness, Measurement, Residual stress, Indentation, Reprints.

A modified indentation technique for measuring toughness is described. The method retains the elastic/plastic basis of previous contact fracture descriptions, but eliminates explicit reference to residual stress parameters in the toughness formulation. Accordingly, improved correlations between indentation data and 'conventional' K sub c values are obtained, even for materials (e.g. anomalous glasses) with non-ideal deformation responses.

710,698
PB84-222686 Not available NTIS
National Bureau of Standards, Washington, DC.
Structural Reliability of Yttria-Doped Hot-Pressed Silicon Nitride at Elevated Temperatures.
Final rept.
S. M. Wiederhorn, and N. J. Tighe. Dec 83, 6p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC. See also PB83-192666.
Pub. in Jnl. of the American Ceramic Society, v66 n12 p884-889 Dec 84.

Keywords: *Silicon nitrides, Ceramics, Creep properties, Fracture(Materials), Mechanical properties, Reprints.

The strength of yttria-doped, hot-pressed silicon nitride was investigated as a function of temperature and applied load. Data collected at 1200C are presented in the form of a strength degradation diagram for an applied load of 350 MPa. At this temperature, the behavior of the yttria-doped material is found to be superior to that of magnesia-doped silicon nitride, in which creep results in the formation of microcracks that lead to strength degradation. By contrast, the yttria-doped material does not suffer from microcrack formation, or strength degradation at 1200C. At higher temperatures

strength degradation does occur, and as a consequence, an upper limit of 1200C is recommended for yttria-doped, hot-pressed silicon nitride in structural applications.

710,699
PB84-222827 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Chemical Environments on Slow Crack Growth in Glasses and Ceramics.
Final rept.
S. W. Freiman. 10 Jun 84, 5p
Pub. in Jnl. of Geophysical Research, v89 nB6 p4072-4076, 10 Jun 84.

Keywords: *Ceramics, *Glass, Crack propagation, Stress corrosion, Reprints, Fracture(Mechanics).

This paper presents a review of our current understanding of environmentally induced slow crack growth in glasses, single crystals and polycrystalline ceramics. It is shown that the rate of crack growth is controlled by the chemical activity of the active species in the environment as well as by the stress intensity at the crack tip. A recently developed molecular model of stress induced chemical reaction between vitreous silica and water is described. The implications of this model for the effects of other chemical species on crack growth are discussed. Finally, the complications introduced by the presence of grain boundaries in polycrystalline ceramics are pointed out.

710,700
PB84-223213 Not available NTIS
National Bureau of Standards, Washington, DC.
Lifetime Predictions for Solar Glasses.
Final rept.
S. W. Freiman, A. C. Gonzalez, and S. M. Wiederhorn. Apr 84, 3p
Contract DE-AC04-76DP00789
Pub. in American Ceramic Society Bulletin 63, n4 p597-599 Apr 84.

Keywords: *Glass, *Mirrors, Solar energy, Crack propagation, Fractures(Materials), Life(Durability), Predictions.

Crack growth and strength data of three candidate glass compositions for solar mirrors were used to estimate allowable stress levels for a lifetime of 20 years. Crack growth data were obtained by both double cantilever beam and stressing rate techniques. Based on the lower bound to 95 percent confidence bands associated with the lifetime prediction curves, allowable stresses for the mirrors range from about 6 MPa (0.9 KSi) to about 9 MPa (1.3 KSi). Because the crack growth and strength data were collected in water, this estimate of the allowable stresses is considered to be conservative.

710,701
PB84-224799 Not available NTIS
National Bureau of Standards, Washington, DC.
Universal Fatigue Curves for Ceramics Using Indentation Flaws.
Final rept.
H. Multhopp, R. F. Cook, and B. R. Lawn. 1983, 2p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Materials Science Letters 2, p683-684 1983.

Keywords: *Ceramics, *Fatigue(Materials), Silicon carbides, Aluminum oxide, Glass, Microstructure, Comparison, Reprints.

A scheme for constructing universal fatigue curves for ceramics, using an indentation technique, is described. Three materials, silicon carbide, alumina, and a glass ceramic, are studied. The data are plotted using reduced variables in a way particularly useful for material intercomparisons. The scatter in the data provide a simple indicator of microstructural effects in the flaw response.

710,702
PB84-246024 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of Controlled Pore Glass in Solid Phase Biochemistry.
Final rept.
W. Haller. 1983, 63p
Pub. in Chemical Solid Phase Biochemistry: Analytical Synthetic Aspects (Chapter 11), p535-597 May 83.

Keywords: *Chemical analysis, *Biochemistry, *Porous materials, *Glasses, Adsorption, Chromatographic analysis, Solid phases, Utilization, Permeatibility, Reprints.

The use of porous glass in such biochemical applications as permeation-, adsorption-, affinity-chromatography, support for radioimmunoassays, extracorporal perfusion is reviewed. The preparation of porous glasses as well as its physical, chemical and structural background is described.

710,703
PB85-102713 Not available NTIS
National Bureau of Standards, Washington, DC.
Prigogine-Defay Ratio for Inhomogeneous Systems with a Single Internal Parameter.
Final rept.
P. K. Guptka, and J. W. Haus. 1977, 5p
Pub. in Jnl. of Non-Crystalline Solids 24, n2 p291-295 1977.

Keywords: *Glass, *Free energy, Reprints.

The authors develop the free energy for an inhomogeneous system with a single internal parameter. Under the restrictive condition of an infinite quenched state, it is shown that the Prigogine-Defay ratio, (delta C sub p)((delta K sub T)/TV)((delta alpha)sup 2), is greater than unity for this system.

710,704
PB85-104800 Not available NTIS
National Bureau of Standards, Washington, DC.
Inhomogeneity Contribution to the Electrical Properties of Y-Doped CeO2 Ceramics: Comparison of AC and DC Measurements.
Final rept.
C. K. Chiang, J. R. Bethin, A. L. Dragoo, A. D. Franklin, and K. F. Young. 1982, 7p
Pub. in Jnl. of the Electrochemical Society 129, n9 p2113-2119 Sep 82.

Keywords: *Ceramics, *Electrical properties, *Additives, Transport properties, Grain boundaries, Reprints, *Impedance spectroscopy.

The impedance of ceramic specimens of Ce(1-x)Y(x)O(2-x/2), with x near 0.1 or 0.2, was measured at frequencies from 10 Hz to 13 MHz, at temperatures from about 250C to 800C, and in oxygen partial pressures from 0.02 MPa to about 10 Pa (0.2 to about .0001 atm). The frequency dependence of that part of the impedance attributable to the bulk of the specimen reveals two relaxations, one arising from the intrinsic transport properties internal to the crystal grains and the other from inhomogeneities. The inhomogeneity impedance is sensitive to how the ceramic was prepared. For ceramics made by sintering mixed oxides, the ratio of the inhomogeneity resistance to the intrinsic resistance is roughly proportional to the closed porosity, but cannot be accounted for on the basis of simple dispersed-pore models. For ceramics made by sintering chemically coprecipitated carbonates from trichloroacetate solution, the inhomogeneity capacitance is significantly larger than for mixed oxide ceramics, and may reflect the chemistry of the grain boundaries.

710,705
PB85-113074 PC **E99**
Charles River Associates, Inc., Boston, MA.
Technological and Economic Assessment of Advanced Ceramic Materials.
Aug 84, 484p-in 6v
Set includes PB85-113082 through PB85-113132.

Keywords: *Ceramics, *Technology assessment, Economic analysis.

No abstract available.

710,706
PB85-113082 PC **A05**/MF **A01**
Charles River Associates, Inc., Boston, MA.
Technological and Economic Assessment of Advanced Ceramic Materials. Volume 1. Summary and Conclusions.
Planning rept. no. 19 (Final).
Aug 84, 79p CRA-684-VOL-1, NBS/GCR-84/470/1
Contract NB82-SBCA-1637
See also Volume 2, PB85-113090.
Also available in set of 6 reports PC E99, PB85-113074.

Keywords: *Ceramics, Technology assessment, Economic analysis, Engines, Capacitors, Gas detectors, Cutting tools, Integrated optics.

The six volumes, of which this volume is a part, constitute a technology and economic assessment of advanced ceramic materials. Volumes 2 thru 6 examine specific applications. These applications are heat engines, capacitors, integrated optics, gas sensors, and cutting tools. The assessments include current and projected trends in technological advances and the economic impacts in terms of rate and directions of growth of the relevant markets. Volume 1 contains the summary and conclusions.

710,707
PB85-113090 PC **A06**/MF **A01**
Charles River Associates, Inc., Boston, MA.
Technological and Economic Assessment of Advanced Ceramic Materials. Volume 2. A Case Study of Ceramics in Heat Engine Applications.
Planning rept. no. 19 (Final).
Aug 84, 103p CRA-684-VOL-2, NBS/GCR-84/470/2
Contract NB82-SBCA-1637
See also Volume 1, PB85-113082, and Volume 3, PB85-113108.
Also available in set of 6 reports PC E99, PB85-113074.

Keywords: *Ceramics, *Engines, Technology assessment, Economic analysis, Marketing, Social effect, Processing.

The report contains three chapters in addition to this introductory chapter. Chapter 2 provides an overview of the technological issues involved in the application of ceramics to heat engines. Chapter 3 contains a discussion of the market for heat engines and components. The final chapter presents an assessment of the potential social benefits of the use of ceramics in heat engines.

710,708
PB85-113116 PC **A04**/MF **A01**
Charles River Associates, Inc., Boston, MA.
Technological and Economic Assessment of Advanced Ceramic Materials. Volume 4. A Case Study of Integrated Optic Devices.
Planning rept. no. 19 (Final).
Aug 84, 66p CRA-684-VOL-4, NBS/GCR-84/470/4
Contract NB82-SBCA-1637
See also Volume 3, PB85-113108, and Volume 5, PB85-113124.
Also available in set of 6 reports PC E99, PB85-113074.

Keywords: *Ceramics, Technology assessment, Social effect, Industries, Economic analysis, Fiber optics, Electrooptics, *Foreign technology, *Integrated optics.

The six volumes, of which this volume is a part, constitute a technology and economic assessment of advanced ceramic materials. Volumes 2 thru 6 examine specific applications. These applications are heat engines, capacitors, integrated optics, gas sensors, and cutting tools. The assessments include current and projected trends in technological advances and the economic impacts in terms of rate and directions of growth of the relevant markets. Volume 1 contains the summary and conclusions.

710,709
PB85-113124 PC **A04**/MF **A01**
Charles River Associates, Inc., Boston, MA.
Technological and Economic Assessment of Advanced Ceramic Materials. Volume 5. A Case Study of Ceramic Toxic and Combustible Gas Sensors.
Planning rept. no. 19 (Final).
Aug 84, 67p CRA-684-VOL-5, NBS/GCR-84/470/5
Contract NB82-SBCA-1637
See also Volume 4, PB85-113116, and Volume 6, PB85-113132.
Also available in set of 6 reports PC E99, PB85-113074.

Keywords: *Gas detectors, *Ceramics, Reviews, Technology assessment, Industries, Economic analysis.

The report contains three additional chapters in addition to this introductory chapter. Chapter 2 provides an overview of ceramic sensors. The third chapter provides a brief background discussion of ceramic gas sensor technology. Chapter 4 discusses the world ceramic industry and the potential economic impacts of technological change.

710,710
PB85-113132 PC **A05**/MF **A01**
Charles River Associates, Inc., Boston, MA.
Technological and Economic Assessment of Advanced Ceramic Materials. Volume 6. A Case Study of Ceramic Cutting Tools.
Planning rept. no. 19 (Final).
Aug 84, 79p CRA-684-VOL-6, NBS/GCR-84/470/6
Contract NB82-SBCA-1637
See also Volume 5, PB85-113124.
Also available in set of 6 reports PC E99, PB85-113074.

Keywords: *Ceramics, *Cutting tools, Technology assessment, Industries, Social effect, Economic analysis.

Chapter 2 provides a background discussion of advanced ceramic cutting tool technology and draws conclusions concerning the major technical barriers to commercial diffusion of these tools. Chapter 3 provides an overview of the advanced ceramic cutting tool industry. The purpose of this chapter is to provide background material for discussions of the potential benefits of advanced ceramic cutting tools and international competitiveness that follow in Chapter 4. The final chapter presents an analysis of the potential social (economy-wide) benefits of advanced ceramic cutting tools.

710,711
PB85-120665 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Ceramics in Energy Systems.
Final rept.
J. B. Wachtman, S. J. Schneider, and A. D. Franklin.
1975, 54p
Sponsored in part by Energy Research and Development Administration, Washington, DC.
Pub. in Proc. Conf. on Ceramics for Energy Applications, Columbus, Ohio, p11-64, 24 Nov 75.

Keywords: *Ceramics, *Tests, Electric batteries, Coal gasification, Fuel cells, *Energy systems, Coal liquefaction.

The National Plan for Energy Research, Development, and Demonstration put forth by the Energy Research and Development Administration calls for a massive increase in the use of coal and for the maximum possible electrification. These plans imply the rapid development of a synthetic liquid and gaseous fuel industry based on coal, and for improvements in the generation of electricity in the form of new topping cycles (e.g., MHD) and load-following techniques (e.g., fuels cells or base-load generation with battery storage). Electrification of autos will require battery development. In coal gasification, ceramics as chamber liners will encounter hot, moist, highly corrosive atmospheres, with possibly severe erosion problems. Fuel cells and batteries offer some opportunities for ceramics to function in exotic ways, as electrocatalysts to replace noble metals in the reduction of oxygen or as O(-2) and Na(+1) ion conductors. The major problems, however, have to do with maintaining mechanical and chemical integrity in use and with the development of fabrication methods capable of optimizing electrical and mechanical properties at reasonable cost.

710,712
PB85-124311 Not available NTIS
National Bureau of Standards, Washington, DC.
Creep Cavitation and Crack Growth in Silicon Nitride.
Final rept.
N. J. Tighe, S. M. Wiederhorn, T. J. Chuang, and C. L. McDaniel. 1984, 18p
Sponsored in part by Army Materials and Mechanics Research Center, Watertown, MA., Department of Energy, Oak Ridge, TN., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Paper in Deformation of Ceramics II, p587-604 1984.

Keywords: *Silicon nitrides, *Creep properties, *Crack propagation, *Cavities, Additives, Electron microscopy, Plastic deformation, Reprints.

Cavities and microcracks occur in hot-pressed MgO doped and Y2O3 doped Si3N4 during high temperature creep. Specimens selected from static load experiments at 1200C and 1300C were examined by transmission electron microscopy. In the MgO doped Si3N4 an amorphous MgO:SiO2 phase, which bonded the grains, softened and cavitated readily at 1200 C leading to a creep exponent of 4.2. In the Y2O3 doped Si3N4 a crystalline yttrium-silica-oxynitride phase bonded the Si3N4 grains. Cavitation started at the triple junctions where these phases were present. Crack-like cavities also started at triple junctions and grew between the Si3N4 grains. The nucleation and growth stages of creep cavitation in both materials are related to failure mechanisms.

710,713
PB85-128783 Not available NTIS
National Bureau of Standards, Washington, DC.
Probabilistic Framework for Structural Design.
Final rept.
S. M. Wiederhorn. 1983, 29p
Pub. in Fracture Mechanics of Ceramics 5, p197-226 1983.

Keywords: *Ceramics, Crack propagation, Structural design, Reprints.

Recent experiments on structural ceramics at elevated temperatures suggest that time dependent processes such as creep crack growth, cavitation and pit formation have an important influence on the long term reliability of these materials. Since these processes are inherently stochastic, fracture mechanics based theories of structural reliability are not as useful at elevated temperatures as they are at low temperatures. In this paper, an alternative approach to structural design at elevated temperatures is recommended. Although, the approach is probabilistic in nature and suggests the use of probability density functions to describe the time evolution of strength, concepts of fracture mechanics can be factored into the approach.

710,714
PB85-128833 Not available NTIS
National Bureau of Standards, Washington, DC.
Indentation Crack as a Model Surface Flaw.
Final rept.
B. R. Lawn. 1983, 25p
Pub. in Fracture Mechanics of Ceramics 5, p1-25 1983.

Keywords: *Ceramics, *Cracks, Defects, Nondestructive tests, Reprints, Fracture(Mechanics).

Recent developments in sharp-indenter fracture techniques for the controlled study of strength-related properties of ceramics and glasses are reviewed. The mechanics of 'radial--median' crack evolution are first outlined, thereby establishing the base for a model surface flaw. The response of such cracks to subsequent tensile loading is then described. A key point in the analysis is the vital role played by residual contact stresses in the radial crack growth to failure. Major consideration is given to applications in two areas of strength analysis: flaw characterization and materials evaluation. For the first, surface-stress states associated with multiple-contact processes (e.g. machining), mirror fractography and flaw detection by acoustic wave scattering are topics in which residual-stress effects are manifest. For the second area, the use of indentation flaws for determining basic fracture parameters, such as toughness and crack-velocity exponent, is given special emphasis.

710,715
PB85-129377 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Oxide and Oxide/Matrix Interfaces in Silicon Nitride.
Final rept.
N. J. Tighe. 1983, 12p
See also PB83-178699.
Pub. in Adv. Ceram. 6, p151-162 1983.

Keywords: *Silicon nitrides, Interfaces, Oxides, Crack propagation, Creep rupture strength, Ceramics, Reprints.

In order to understand the strength and microstructural changes that are produced during oxidation, it is necessary to examine the oxide scale, the oxide/silicon nitride interface, and the silicon nitride below the oxide/matrix interface. In the present study, these three interfacial layers were removed and analyzed by using transmission electron microscopy, light microscopy, X-ray energy analysis, and X-ray diffraction.

710,716
PB85-137412 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Brittle Fracture and Toughening Mechanisms in Ceramics.
Final rept.
S. M. Wiederhorn. 1984, 30p
Pub. in Annual Review of Materials and Science 14, p373-403 1984.

Keywords: *Ceramics, *Brittle fracturing, Brittleness, Crack propagation, Cracks, Toughness, Reprints.

The paper discusses the fracture of ceramic materials from a fundamental point of view. Treating ceramics as completely brittle materials, the importance of cohesive forces to crack growth is noted. Applications of brittle fracture theory to toughening mechanisms are discussed and evaluated.

710,717
PB85-140945 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Sliding Friction Forces on the Strength of Brittle Materials.
Final rept.
B. R. Lawn, S. M. Wiederhorn, and D. E. Roberts.
1984, 9p
Pub. in Jnl. of Materials Science 19, p2561-2569 1984.

Keywords: *Brittleness, *Sliding friction, Mathematical models, Mechanical properties, Strength, Reprints, Fracture(Mechanics).

A model is developed for the strength degradation of brittle surfaces in sliding contact with spherical indenters. The loss of strength is associated with the propagation of partial cone cracks in the wake of the indenter. Detailed fracture mechanics calculations are circumvented by working in the limit of ideal point-load contacts, with the key proposition that the crack dimensions remain insensitive to rotations of the cone axis relative to the specimen free surface. In this way the simple Roesler solution for classical, well-developed cone cracks may be retained as a convenient 'reference state' for a more general theoretical description, whereby the superposition of a tangential friction force onto the normal loading is accommodated via a straightforward coordinate transformation operation.

710,718
PB85-142321 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Temperature Dependence in Air of Fe2+ Concentration and Its Relation to Electrical Conductivity in a Natural Eastern Coal Slag.
Final rept.
G. S. White, W. R. Hosler, and T. J. Castellano.
1981, 4p
Pub. in Jnl. of the American Ceramic Society 64, n11 p649-652 Nov 81.

Keywords: *Slags, Electrical resistivity, Iron, Iron oxides, Coal, Reprints.

Ferrous iron concentration in a coal slag obtained from Bow, NH, was studied as a function of heat treatment in air. Results indicate that the concentration varies continuously between 1300 and 1600C; the slag becoming more oxidized as the temperature drops from 1600C. For lower temperatures at which the slag is solid or highly viscous, oxidation still occurs but at an extremely slow rate. An apparent chemical phase change occurs between 1300C and 900C when the coal slag is cooled slowly from temperatures above 1300C. No such change is observed for fast quenches. This interpretation is consistent with observed DC electrical conductivity data obtained from similar samples.

710,719
PB85-142867 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Revised ThO2-Nb2O5 Phase Diagram.
Final rept.
R. J. Cava, R. S. Roth, and D. B. Minor. 1981, 2p
Pub. in Jnl. of the American Ceramic Society 64, n4 p64-65 Apr 81.

Keywords: *Niobium oxides, *Thorium oxides, *Phase diagrams, *Crystal structure, Monoclinic lattices, Eutectics, X ray diffraction, Reprints.

The phase equilibrium diagram of the system ThO2-Nb2O5 was redetermined near the composition Th2Nb2O9. This phase was found to melt incongruently at 1362C, with a peritectic at about 64 mol % ThO2.

The eutectic was found at about 1350C and 63 mol % ThO2. From single crystal and powder x-ray diffraction data, Th2Nb2O9 was found to have a primitive monoclinic unit cell with a = 6,711(1), b = 25.254(5), c = 7.757(1)A, beta = 90.461(14) degrees.

710,720
PB85-179067
(Order as PB85-179042, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD. Center for Materials Science.
Controlled Indentation Flaws for the Construction of Toughness and Fatigue Master Maps.
R. F. Cook, and B. R. Lawn. 30 Aug 84, 13p
Sponsored by Office of Naval Research, Arlington, VA. Prepared in cooperation with New South Wales Univ., Kensington (Australia).
Included in Jnl. of Research of the National Bureau of Standards, v89 n6 p453-465 Nov-Dec 84.

Keywords: *Nondestructive testing, *Ceramics, *Toughness, *Fatigue(Materials), Glasses.

A simple and economical procedure for accurate determinations of toughness and lifetime parameters of ceramics is described. Indentation flaws are introduced into strength test pieces, which are then taken to failure under specified stressing and environmental conditions. By controlling the size of the critical flaw, via the contact load, material characteristics can be represented universally on 'master maps' without the need for statistical considerations. This paper surveys both the theoretical background and the experimental methodology associated with the scheme. The theory is developed for 'point' flaws for dynamic and static fatigue, incorporating load explicitly into the analysis. A vital element of the fracture mechanics is the role played by residual contact stresses in driving the cracks to failure. Experimental data on a range of Vickers-indented glasses and ceramics are included to illustrate the power of the method as a means of graphic materials evaluation. It is demonstrated that basic fracture mechanics parameters can be measured directly from the slopes, intercepts and plateaus on the master maps, and that these parameters are consistent, within experimental error, with macroscopic crack growth laws.

710,721
PB85-183234 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Measurement of Thin-Layer Surface Stresses by Indentation Fracture.
Final rept.
B. R. Lawn, and E. R. Fuller. 1984, 7p
Pub. in Jnl. of Materials Science 19, p4061-4067 1984.

Keywords: *Glass, *Brittleness, *Stresses, Measurement, Surface properties, Indentation, Fractures(Materials), Reprints.

A model is developed for evaluating stresses in the surfaces of brittle materials from changes in indentation crack dimensions. The underlying basis of the model is a stress intensity formulation incorporating the solution for a penny-like crack system subjected to a constant stress over a relatively thin surface layer. Results from a previous study of surface damage in proton-irradiated glass are used to illustrate the scope of the method. The indentation fracture analysis also provides some fresh insight into the susceptibility of brittle surfaces to spontaneous cracking. Implications of the study concerning the potential effect of surface stresses on mechanical properties, such as strength, erosion and wear, are briefly discussed.

710,722
PB85-183291 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Microscale Homogeneity and Compositional Profiling of Borosilicate Glass Materials.
Final rept.
J. W. Mitchell, J. E. Riley, and B. S. Carpenter. 1983, 9p
Pub. in Mikrochimica Acta III, p253-261 1983.

Keywords: *Borosilicate glass, *Glass, *Boron, Nondestructive tests, Optical fibers, Measurement, Reprints.

The instrumental analytical methods most widely used for providing information on the microscale homogeneity and depth profile distribution of major elements have deficiencies for characterizing borosilicate glasses. Several nuclear methods provide particularly specific, high sensitivity, and high resolution detection of boron. Thermal neutron bombardment with detection of promptly emitted alphas using silicon surface barrier detectors provides depth profile information on trace boron levels. The alternative, determination of boron by detecting emitted alpha particles by the track counting technique, is particularly attractive for establishing compositional homogeneity of trace boron distribution. This paper describes the use of the method for the detection of boron when present as a major constituent. The examples selected to demonstrate applicability of the method include characterization of commercial glasses, synthesized rods, and optical fibers. The potential of the nuclear track counting technique as a new method for quantitative non-destructive determination of boron as a major constituent is also being assessed in continuing work.

710,723
PB85-183309 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Deformation-Induced Crack Initiation by Indentation of Silicate Materials.
Final rept.
H. Multhopp, B. R. Lawn, and T. P. Dabbs. 1984, 13p
Sponsored by Office of Naval Research, Arlington, VA. Pub. in Deformation of Ceramic Materials II, p681-693 1984.

Keywords: *Glass, *Silicon dioxide, *Quartz, *Crack initiation, Indentation, Kinetics, Reprints.

The micromechanics of radial crack initiation produced in indentation of soda-lime glass, fused silica and quartz are discussed in terms of a two-step, nucleation and growth model. Particular attention is focussed on the strong rate effects in the presence of environmental water, as manifested by a tendency to delayed crack pop in with decreasing contact duration. Microscopic examination of the indentations indicates that deformation 'shear faults', which accommodate the intense strains associated with the penetrating indenter, control the kinetics of the initiation process. The geometrical constraints which determine the stress concentrations for crack nucleation from these faults are structure-sensitive.

710,724
PB85-183408 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Estimation of Power-Law Creep Parameters from Bend Test Data.
T. J. Chuang. Feb 85, 44p NBSIR-85/2997
Contract DE-AI05-80OR20679
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.

Keywords: *Ceramics, *Creep properties, Creep tests, Aluminum oxide, Applications of mathematics.

Power-law creep parameters of brittle ceramic materials are commonly deduced from load-point displacement data generated by four-point bend experiment, under the assumption that tensile and compressive behaviors obey the same constitutive law. However, thanks to different roles played by microcracking and cavitation, it is now well recognized that this premise on occasions may not be valid. The present paper undertakes an analysis which takes the differences into account. Governing equations are first derived for the locations of neutral axis of a beam under bending and for the creep responses in terms of both curvature rate and load point displacement rate as functions of the applied moment and power-law creep parameters. Numerical solutions are obtained for any given set of materials constants over a wide range of applied moments.

710,725
PB85-184620 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Rate Effects in Hardness.
Final rept.
C. J. Fairbanks, R. S. Polvani, S. M. Wiederhorn, B. J. Hockey, and B. R. Lawn. 1982, 3p
Pub. in Jnl. Mater. Sci. Lett. 1, n9 p391-393 Sep 82.

Keywords: *Hardness, Copper, Tungsten, Glass, Indentation, Deformation, Kinetics, Reprints.

Some preliminary results showing rate effects in the hardness of selected materials are reported. Copper, tungsten and soda-lime glass all show a decline in hardness with duration of contact. The observations offer a new avenue for studying deformation processes in materials.

710,726
PB85-184794 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Powder Processing of Potassium Aluminosilicates.
Final rept.
L. P. Cook. 1982, 9p
Sponsored by Metallurgical Society of AIME, Warrendale, PA., and American Ceramic Society, Columbus, OH. Basic Science Div.
Pub. in Proceedings of Symposium on Metal and Ceramic Powders, Louisville, KY., October 12-14, 1981, Processing of Metal and Ceramic Powders, p137-145, 1982.

Keywords: *Densification, Ceramics, Sintering, Processing, *Potassium aluminosilicates.

Two processing alternatives have been investigated for overcoming the poor densification obtained during sintering of potassium aluminosilicates: 1--reaction sintering, imploying KAlSi2O6 glass and KAlO2 in the proper proportions to yield KAlSi2O6 or KAlSiO4 and 2--use of submicron-sized single phase powders of KAlSi2O6 and KAlSiO4. Method 2 yields densities approaching 90 percent theoretical density for both KAlSi2O6 and KAlSiO4, provided powder particle sizes are below a certain threshold. Data describing the kinetics of these enhanced densifications at 1400C have been obtained.

710,727
PB85-184810 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microcrack Healing During the Temperature Cycling of Single Phase Ceramics.
Final rept.
E. D. Case, J. R. Smyth, and O. Hunter. 1983, 24p
Grant NSF-DMR78-01584
Pub. in Proceedings of the International Symposium on the Fracture Mechanics of Ceramics, University Park, PA., July 15-17, 1981, Surface Flaws, Statistics, and Microcracking, v5 p507-530 1983.

Keywords: *Ceramics, *Heat treatment, Magnesium titanates, Aluminum oxide, Cooling curves, Acoustic resonance, Measurement, Temperature, Modulus of elasticity, Meetings, Extrapolation, *Microcracks, Gadolinium oxides.

The healing of microcracks in single phase Al203, Gd203, and MgTi205 was studied by measuring Young's modulus versus temperature via a sonic resonance technique. Similar data was examined for Eu203, Nb205 and Hf02. For a variety of grain sizes for each material, the linear portions of the modulus-temperature cooling curves were extrapolated to room temperature. These extrapolated modulus values Y sub RT, were corrected to zero porosity (Y sub C) by empirical modulus-porosity relations.

710,728
PB85-187425 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Corrosion Processes on Subcritical Crack Growth in Glass.
Final rept.
C. J. Simmons, and S. W. Freiman. 1981, 4p
Pub. in Jnl. of American Ceramics Society 64, n11 p683-686 1981.

Keywords: *Glass, *Crack propagation, Corrosion, Fracture properties, Reprints, Fracture(Mechanics).

Crack growth studies were conducted on soda lime silica, soda borosilicate and two binary soda silica glasses immersed in solutions of 1 Molar Li(+), 1 Molar Cs(+) or deionized water at different pH values. A definite effect of the Li(+) and Cs(+) was observed on the V-K sub I curves in all but the soda lime glass. A plateau in crack velocity in the range 0.00000001 to 0.0000000001 m/sec was measured on the binary soda-silica glasses for K sub I $<$ 0.35 MPam to the 1/2 power. These data are analyzed in terms of both the ion exchange and SiO2 dissolution steps of the corrosion process. A model of crack growth in corrosive conditions is proposed.

710,729
PB85-195915 Not available NTIS

National Bureau of Standards, Gaithersburg, MD.
Comparison of Failure Predictions by Strength and Fracture Mechanics.
Final rept.
B. J. Pletka, and S. M. Wiederhorn. 1982, 22p
Pub. in Jnl. of Materials Science 17, n5 p1247-1268, 5 May 82.

Keywords: *Ceramics, *Failure, Strength, Predictions, Mechanical properties, Data, Stressing, Crack propagation, Confidence limits, Micro structure, Life(Durability), Reprints, Fracture mechanics.

Failure predictions for five ceramic materials were compared using fracture mechanics and strength techniques. Double torsion specimens were used to obtain the fracture mechanics data and stressing rate experiments were used to obtain the strength data. An error analysis based on the error propagation law was performed to determine confidence limits for the failure predictions. The implications of these results with regard to microstructural effects on crack propagation and design applications are discussed.

710,730
PB85-196053 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Deformation on the Fracture of Si3N4 and Sialon.
Final rept.
R. J. Fields, T. J. Chuang, E. R. Fuller, and N. J. Tighe. 1983, 8p
Sponsored by North Atlantic Treaty Organization, Brussels (Belgium).
Pub. in Proceedings of the NATO Conference on Nitrogen Ceramics (2nd), Falmer, Sussex, England, July 27-August 7, 1981, p507-514 1983.

Keywords: *Silicon nitrides, Ceramics, Fracture properties, Creep properties, Toughness, Deformation, *Sialon, *Aluminum silicon oxynitride.

At high temperatures, ceramics can deform inelastically by time-dependent processes such as creep. The resulting strains are stress and time dependent, and must be added to the elastic strain to calculate the total strain. Whether or not it is appropriate to apply linear elastic fracture mechanics depends on the extent of the creep deformation zone relative to certain specimen dimensions. With this in mind, the loading-rate dependences of the fracture toughness of silicon nitride and various sialons were investigated at elevated temperatures. The resulting variations in toughness are explained in terms of possible micromechanisms of deformation and fracture. Schemes are presented for estimating the toughness in the case of small scale creep deformation and in the case of general creep deformation, in which the creep strain exceeds the elastic strain throughout the body.

710,731
PB85-196194 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Erosion of Ceramic Materials: The Role of Plastic Flow.
B. J. Hockey, and S. M. Wiederhorn. 1979, 27p
Pub. in Proceedings of International Conference on Erosion by Liquid and Solid Impact (5th), Cambridge, England, September 3-6, 1979, p1-26.

Keywords: *Ceramics, *Erosion, Wear, Aluminum oxide, Plastic flow, Glass, Silicon carbide, Magnesium oxides.

Plastic flow has been shown recently to play a crucial role in the erosive wear of ceramic materials that are brittle at room temperature. In this paper, evidence for plastic flow during the erosion of brittle solids by solid particles is reviewed and discussed. Evidence for plastic flow comes from three sources: optical and scanning electron microscopy studies of single particle impact sites; investigations of erosion rate as a function of impact angle; and investigations of impact sites by transmission electron microscopy. This discussion of plastic flow will include an evaluation of several recent theories developed to explain the erosion of ceramic materials. The importance of dynamic values of both the hardness and the critical stress intensity factor to the erosion process is emphasized.

710,732
PB85-202885 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Investigation of the Phase Transition in ZrTiO4 and ZrTiO4-SnO2 Solid Solutions.
Final rept.
A. E. McHale, and R. S. Roth. Feb 83, 3p
Pub. in Jnl. of the American Ceramic Society 66, n2 p18-20 Feb 83.

Keywords: *Tin oxides, *Solid solutions, *Phase transformations, *Crystal structure, X-ray diffraction, Titanium dioxide, Reprints, *Zirconium titanates.

A 'continuous' phase transition was found to occur in ZrTiO(4), with a major discontinuity at 1125 plus or minus 10 degrees C. The space group of both forms of ZrTiO(4) is Pcnb. For specimens quenched from high temperatures, the volume of the unit cell was found to decrease linearly from about 1450 degrees C to the discontinuity with the major change occurring in the c-axis. The volume decreases considerably at this temperature and again continues to decrease with lower temperature annealing. The maximum unit cell dimensions in the high temperature structure are a = 4.806, b = 5.035, and c = 5.498A with the minimum unit cell values of a = 4.828, b = 5.035 and c = 5.348A in the low temperature form. Substitutional tin in solid solution was found to stabilize the high temperature structure type.

710,733
PB85-203396 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Chevron-Notch Bend Testing in Glass: Some Experimental Problems.
Final rept.
L. Chuck, E. R. Fuller, and S. W. Freiman. 1984, 8p
Contract DE-A105-80OR20679
Pub. in American Society for Testing and Materials Special Technical Publication 855, p167-175 1984.

Keywords: *Glass, Environments, Fracture strength, Flexing, Tests, Loads(Forces), Crack propagation, Brittleness, Reprints.

The study describes experimental difficulties in the use of the chevronnotch bend test to determine the plane-strain fracture toughness, for brittle materials. Four-point flexure tests were performed on soda-lime-silica glass and vitreous silica in both 'wet' and 'dry' environments and at various loading rates.

710,734
PB85-203404 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Fatigue Properties of Ceramics with Natural and Controlled Flaws: A Study of Alumina.
Final rept.
A. C. Gonzalez, H. Multhopp, R. F. Cook, B. R. Lawn, and S. W. Freiman. 1984, 14p
Pub. in American Society for Testing and Materials Special Technical Publication 844, p43-56 1984.

Keywords: *Ceramics, *Fatigue(Materials), *Aluminum oxide, Strength, Defects, Stresses, Tests, Life(Durability), Loads(Forces), Predictions, Reprints.

A systematic study of the fatigue properties of an as-fired polycrystalline alumina containing either 'natural' (sawing damage) or indentation-induced (Vickers) strength-controlling flaws has been made. All fatigue strengths were measured in four-point bending in water. The study is presented in three steps: first, comparative Weibull analyses are made of inert strength data for the two flaw types, both to demonstrate the reduction in scatter that attends the indentation method and to characterize the flaw distributions for the as-sawn surfaces; next, fatigue data are taken on indented surfaces to determine relatively accurate fracture parameters for the alumina and to confirm that constant stressing rate tests can be used as a base for predicting the response in static loading; finally, the results from the two previous, independent steps are combined to generate lifetime responses for the surfaces with natural flaws, and fatigue data taken on such surfaces are used to evaluate these predictions.

710,735
PB85-205318 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Controlled Indentation Flaws for Construction of Toughness and Fatigue Master Maps.
Final rept.
R. F. Cook, and B. R. Lawn. 1984, 21p
See also PB85-179042. Sponsored by Office of Naval Research, Arlington, VA.
Pub. in American Society for Testing and Materials, Special Technical Publication 844, p22-42 1984.

Keywords: *Toughness, *Fatigue(Life), *Life(Durability), *Defects, Indentation, Crack propagation, Predictions, Graphs(Charts), Failure, Stresses, Reprints.

A simple and economical procedure for accurate determinations of toughness and lifetime parameters is described. Indentation flaws are introduced into strength test pieces, which are then taken to failure under specified stressing and environmental conditions. By controlling the size of the critical flaw, via the contact load, material characteristics can be represented universally on 'master maps' without the need for statistical considerations. The paper surveys both the theoretical background and the experimental methodology associated with the scheme. The theory is developed for 'point' flaws for dynamic and static fatigue, incorporating load explicity into the analysis. A vital element of the fracture mechanics is the role played by residual contact stresses in driving the cracks to failure. Experimental data on a range of Vickers-indented glasses and ceramics are included to illustrate the power of the method as a means of graphic materials evaluation. It is demonstrated that basic fracture mechanics parameters can be measured directly from the slopes, intercepts and plateaus on the master maps, and that these parameters are consistent, within experimental error, with macroscopic crack growth laws.

710,736
PB85-205326 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Subthreshold Indentation Flaws in the Study of Fatigue Properties of Ultrahigh-Strength Glass.
Final rept.
T. P. Dabbs, C. J. Fairbanks, and B. R. Lawn. 1984, 12p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in American Society for Testing and Materials Special Technical Publication 844, p142-143 1984.

Keywords: *Defects, *Fatigue(Materials), *Glass, Crack propagation, Stresses, Failure, Strength, Fiber optics, Reprints.

The rate-dependent characteristics of subthreshold indentation flaws in glass are surveyed. In the first part, the kinetics of radial crack initiation within the indentation field are described. In the second part of the presentation, the fatigue properties of specimens with indentation flaws on either side of the threshold are discussed. Finally, the implications of the results concerning design criteria for the ultra-high strength domain of optical fibers are considered.

710,737
PB85-205904 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effects of Water and Other Dielectrics on Crack-Growth.
Final rept.
S. M. Wiederhorn, S. W. Freiman, E. R. Fuller, and C. J. Simmons. 1982, 19p
See also PB82-235896.
Pub. in Jnl. of Materials Science 17, n12 p3460-3478 1982.

Keywords: *Alkali glass, *Crack propagation, Water, Dielectrics, Silica glass, Fractures(Materials), Reprints.

The effect of water and a variety of organic liquids on the crack growth rate in soda lime silica glass was investigated. When water is present in organic liquids, it is usually the principal agent that promotes subcritical crack growth in glass. In region I, subcritical crack growth is controlled primarily by the chemical potential of the water in the liquid; whereas in region II, crack growth is controlled by the concentration of water and the viscosity of the solution formed by the water and the organic liquid. In region III, where water does not affect crack growth, the slope of the crack growth curves can be correlated with the dielectric constant of the liquid. It is suggested that these latter results can be explained by electrostatic interactions between the environment and charges that form during the rupture of Si-O bonds.

710,738
PB85-207959 Not available NTIS

National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Sharp vs. Blunt Crack Hypotheses in the Strength of Glass: A Critical Study Using Indentation Flaws.
Final rept.
B. R. Lawn, K. Jakus, and A. C. Gonzalez. 1985, 10p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of American Ceramic Society 68, n1 p25-34 1985

Keywords: *Glass, Cracks, Strength, Defects, Indentation, Reprints.

The fundamental question as to whether the tip structure of brittle cracks is atomically sharp or has a rounded contour is examined in relation to current descriptions of strength-controlling flaws. The distinction between the two opposing viewpoints lies in the controlling flaw dimensions in the strength formulation; crack length in the first and tip radius in the second. Definitive evidence on the issue is obtained from aging tests on soda-lime glass, using indentations as controlled flaws.

710,739
PB85-222016 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High-Temperature Toughness of Silicon Carbide Materials in a Controlled Gaseous Environment.
Final rept.
R. F. Krause, L. Chuck, and E. R. Fuller. 1982, 1p
Sponsored by Department of Energy, Washington, DC., Gas Research Inst., Chicago, IL., and Electric Power Research Inst., Palo Alto, CA.
Pub. in Proceedings of Annual Conf. on Materials for Coal Conversion and Utilization (7th), Gaithersburg, MD., November 16-18, 1982, p159.

Keywords: *Silicon carbides, Toughness, Controlled atmospheres.

The fracture toughness of three silicon carbide materials was measured in a controlled gaseous environment at elevated temperatures up to 1500C. Chevron-notched, four-point bend specimens were fractured at different displacement rates to obtain both a measure of fracture toughness and an indication of environmental crack growth and/or of crack-tip creep deformation. Experiments were conducted both in air and in a gaseous mixture of steam, carbon dioxide, sulfur dioxide, oxygen, and nitrogen thereby simulating the combustion of a producer gas.

710,740
PB85-222263 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tectosilicates - New Data on Processing, Physical and Electronic Properties, and Chemical Durability.
Final rept.
L. P. Cook, C. K. Chiang, and T. Hahn. 1982, 6p
Sponsored by Department of Energy, Washington, DC., Gas Research Inst., Chicago, IL., and Electric Power Research Inst, Palo Alto, CA.
Pub. in Proceedings of Annual Conf. on Materials for Coal Conversion and Utilization (7th), Gaithersburg, MD., November 16-18, 1982, p137-142.

Keywords: *Silicates, *Materials tests, Corrosion, Chemical attack, Ceramics, High temperature tests, Physical properties, Electronic properties, Durability, Magnetohydrodynamics, *Tectosilicates.

The extended abstract outlines the second of a series of papers aimed at defining the potential of the structural family of compounds known as the tectosilicates for MHD ceramic materials applications at moderate to high temperatures.

710,741
PB85-222297 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reaction of Silicon Carbide with Product Gases of Coal Combustion.
Final rept.
A. L. Dragoo, and J. L. Waring. 1982, 16p
Sponsored by Department of Energy, Washington, DC., Gas Research Inst., Chicago, IL., and Electric Power Research Inst., Palo Alto, CA.
Pub. in Proceedings of Annual Conf. on Materials for Coal Conversion and Utilization (7th), Gaithersburg, MD., November 16-18, 1982, p161-176.

Keywords: *Silicon carbides, *Materials tests, *Coal gasification, Ceramics, Nitridation, Oxidation, Chemical reactions.

The reactions of commercially manufactured silicon carbide ceramics--two materials without free silicon and two materials with free silicon('siliconized')--with air, N2 + SO2, and a simulated coal-combustion gas containing about seven volume percent O2 were investigated. Samples were annealed in air and N2 + SO2 at 1400C for successive annealing times up to a total time of 12 hours. Samples were annealed in the simulated combustion gas at 1350C for four hours. For anneals in air and in simulated combustion gas, low critobalite and, possibly, some tridymite were the main reaction products. The presence of SO2 in N2 appears to promote the nitridation of the silicon carbide ceramics.

710,742
PB85-222362 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamic Activity and Vapor Pressure Models for Silicate Systems Including Coal Slags.
Final rept.
J. W. Hastie, D. W. Bonnell, E. R. Plante, and W. S. Horton. 1982, 16p
Sponsored by Department of Energy, Washington, DC., Gas Research Inst., Chicago, IL., and Electric Power Research Inst., Palo Alto, CA.
Pub. in Proceedings of Annual Conf. on Materials for Coal Conversion and Utilization (7th), Gaithersburg, MD., November 16-18, 1982, p265-280.

Keywords: *Thermodynamics, *Silicates, *Vapor pressure, *Mathematical models, High temperature tests, Experimental design, Comparison, Complex compounds, Ceramics, *Slags.

A new modeling approach is described for thermodynamic predictions of multicomponent, multiphase high temperature silicate systems including coal slags. The model, which attributes negative deviations from ideal solution behavior to the formation of complex liquids and solids, is demonstrated for quarternary systems containing K2O, Al2O3, CaO, and SiO2. Good agreement between the model predictions and experimental vapor pressure data is found.

710,743
PB85-227080 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Computerized Fracture Mechanics Database for Oxide Glasses.
Technical note (Final).
S. W. Freiman, T. L. Baker, and J. B. Wachtman. Jun 85, 95p NBS/TN-1212
Also available from Supt. of Docs as SN003-003-02663-8. Prepared in cooperation with Rutgers - The State Univ., Piscataway, NJ. Center for Ceramics Research.

Keywords: *Fracture properties, *Glass, *Information systems, Oxides, Crack propagation, Modulus of elasticity, Chemical composition, Tables(Data), Ceramics, *Data bases, Computer applications.

Values of critical fracture toughness, fracture energy, subcritical crack growth exponents and Young's modulus, are compiled and tabulated for a wide variety of oxide glasses. A computerized data retrieval system has been formulated to allow for selection of data by either glass composition, investigator, or experimental technique, and year.

710,744
PB85-229318 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Elastic Constants of Two Dental Porcelains.
Final rept.
H. R. Kase, J. A. Tesk, and E. D. Case. 1985, 8p
Pub. in Jnl. of Materials Science 20, p524-531 1985.

Keywords: *Dental materials, *Acid bonded reaction cements, *Determination of stress, *Porcelain, *Elastic properties, Temperature coefficient, Stress strain diagrams, Forecasting, Dynamic modulus of elasticity, Sonic tests, Reprints, *Ceramic metal seals, Numerical solution.

The development of stress that affects the bonding in porcelain-fused-to-metal (PFM) systems can be influenced by the temperature dependence of the elastic constants of both systems. Instead of using the normal, static procedure, e.g. determining the slope of a stress-strain curve, and measuring the lateral and vertical strains, in the study the sonic resonance technique was used to determine the elastic moduli for two dental body-porcelains. Young's and shear moduli for two dental porcelains obtained in the range from 20C (293 K) to 500C (773 K) are presented in the study. The data may in the future be used for refined stress calculations in PFM systems.

710,745
PB85-230845 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of Potassium Aluminosilicate Ceramics for MHD (Magnetohydrodynamics) Application.
Final rept.
L. P. Cook. 1981, 15p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of the Symposium on Engineering Aspects of Magnetohydrodynamics (19th), Tullahoma, Tennessee, June 15-17, 1982, p1-15 1981.

Keywords: *Silicate refractories, Ceramics, Magnetohydrodynamic generators, *Potassium aluminosilicates.

Refractory potassium aluminosilicate phases with reported melting points in excess of 1690C include KAlSi2O6, KAlSiO4 and K(1+x)Al(1+x)Si(1+x)O4. From a purely chemical standpoint these materials are expected to have substantial resistance to corrosion by MHD slag. A method for processing ceramics of these materials is being developed which results in densification without the use of additives. Using this method relatively well-sintered KAlSi2O6 ceramics (density 77-83% of theoretical) with moderate strength (35-45 MPa) have been produced.

710,746
PB86-110152 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Crack Growth in Sialon.
Final rept.
R. J. Fields, E. R. Fuller, T. J. Chuang, and L. Chuck. 1983, 11p
Sponsored by Army Research Office, Arlington, VA., National Science Foundation, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of International Symposium on Fracture Mechanics of Ceramics (3rd), University Park, PA., Jul 15-17, 1981, Measurements, Transformations, and High Temperature Fracture, v6 p463-473 1983.

Keywords: *Crack propagation, *High temperature tests, *Bending stress, Fractures(Materials), Loads(Forces), *Sialon.

An analysis of the bending of notched bars is presented for determining crack growth behavior directly from load-displacement records. The analysis is evaluated by experiments on glass bars in water. The analysis is then applied to the slow fracture of various sialon compositions. Micrographs of the resulting fracture surfaces are presented together with a discussion of a possible mechanism of crack growth in these materials.

710,747
PB86-136843 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Microstructure and Electrical Properties of Ceria-Based Ceramic Electrolytes.
Final rept.
A. L. Dragoo, and C. K. Chiang. 1983, 14p
Pub. in Proceedings of Conference on High Temperature Solid Oxide Electrolytes, Upton, NY., August 16, 1983, v1 p268-281 1983.

Keywords: *Cerium dioxide, *Ceramics, *Electrical properties, *Electrolytes, Fuel cells, Molecular structure, Additives.

High-density, yttria- and gadolinia-doped ceria ceramics were found to exhibit notable differences in electrical properties which correlated with differences in the processing methods used to form the materials. Dopant concentrations of 8.5, 20 and 30 mol percent, with respect to cation concentration, were prepared. Three chemical processes were used to prepare well-mixed precursors which were calcined to oxide powders. Following forming and isostatic compaction, most samples were thermally sintered. Inhomogeneity impedance appeared to be influenced by calcination temperature, densification method, and dopant concentration. Microstructure examination and elemental analysis of samples by means of a scanning electron

microscope (SEM) equipped with an analytical x-ray apparatus suggested Al as a source of the different lattice impedance of the hot-pressed material and showed high Si concentrations associated with regions of large pores in gadolinia-doped materials.

710,748
PB86-175833 PC **A07**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Materials Science and Engineering.
National Prospectus on the Future of the U.S. Advanced Ceramics Industry. Proceedings of a Conference Held at Gaithersburg, Maryland on July 10-11, 1985.
E. Ambler, L. H. Schwartz, and S. J. Schneider. Mar 86, 132p NBSIR-85/3240
Sponsored by Department of Commerce, Washington, DC. Office of Productivity, Technology and Innovation.

Keywords: *Ceramics, *Meetings, Industries, Marketing, Technology, Research and development.

Advanced ceramics are a new generation of high performance materials, widely believed to hold promise of multi-billion dollar markets. The U.S. competitive position, however, has been eroded in recent years with the prognosis for the future equally dim. To address this problem, the Department of Commerce held an industrially oriented conference, July 10-11, 1985, at which leaders in the ceramic field assessed critical competitive issues from both a technological and business viewpoint and developed approaches for improved U.S. market posture. The Conference considered electronic and structural advanced ceramic markets, with focus on cooperative mechanisms for industrial R&D. A consensus was reached on the most critical areas for research and on the necessity for inter- and intra-industrial collaboration. Assistance from DOC was requested to facilitate the implementation of cooperative research ventures. The report constitutes the Proceedings of the Conference and includes the papers presented and summary of the workshop sessions.

710,749
PB86-185261 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Microstructure-Strength Properties in Ceramics: 1. Effect of Crack Size on Toughness.
Final rept.
R. F. Cook, B. R. Lawn, and C. J. Fairbanks. Nov 85, 12p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of the American Ceramic Society 68, n11 p604-615 Nov 85.

Keywords: *Ceramics, *Cracking(Fracturing), Mechanical properties, Aluminum oxide, Barium titanates, Glass, Microstructure, *Foreign technology.

A systematic study of the inert-strength characteristics of ceramics as a function of crack size relative to grain size has been made using controlled indentation flaws. The focus of the test program is on aluminas, with barium titanates and glass-ceramics providing support data in confirmation of general trends. On progressively diminishing the indentation load, the strengths first show a steady increase, but subsequently tend to a plateau, as the contact size begins to approach the characteristic grain size. A simple extension of conventional indentation fracture mechanics theory (incorporating residual contact stresses) is developed to describe this scale transition. The basis of the analysis is the postulated existence of a 'microstructural driving force,' grain-localized at the center of the pennylike radial crack, in direct analogy to the indentation driving force. This description provides closed-form solutions to the fracture mechanics equations, such that the data are interpretable in terms of an apparent R-curve function. Only two quantities are required to specify the function completely, one relating to the macroscopic toughness determined from large-scale crack specimens and the other to a microstructure-associated stress intensity factor. These quantities are advocated as useful reliability parameters. It is found that the second quantity can vary widely from material to material, even within a given class, to the extent that materials which show superior strength characteristics at large indentation loads may be dramatically weaker at low loads. The indications are that, at least for aluminas, the key to such weakening effects is to be found in the grain-boundary structures. The study emphasizes the need for extreme caution in extrapolating macroscopic-crack data unconditionally into the microscopic-flaw region, and for more fundamental investigations into the underlying physical processes actually responsible for the microstructural driving forces.

710,750
PB86-192176 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Defects in Silicon Carbide Whiskers.
Final rept.
S. R. Nutt. 1984, 4p
Pub. in Jnl. of the American Ceramic Society 67, n6 p428-431 1984.

Keywords: *Silicon carbides, *Whiskers(Single crystals), Crystal defects, Twining, Reprints.

Defects in silicon carbide whiskers made from rice hulls were identified and analyzed using transmission electron microscopy. The whiskers were characterized by a high density of planar faults lying on close-packed plans perpendicular to the whisker axis. The faulting resulted in complex mixtures of beta and alpha polytypes arranged in thin lamellae normal to the whisker axis. Core regions of whiskers were often filled with small cavities ranging in size from 1-20 nm. Partial dislocations accompanied the cavities and were analyzed through specimen tilting experiments.

710,751
PB86-193554 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Microstructure-Strength Properties in Ceramics: 2. Fatigue Relations.
Final rept.
R. F. Cook, B. R. Lawn, and C. J. Fairbanks. 1985, 8p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of the American Ceramic Society 68, n11 p616-623 Nov 85.

Keywords: *Ceramics, *Fatigue(Materials), Microstructure, Aluminum oxide, Cracking(Fracturing), Reprints.

The study of crack-size effects in aluminas and other selected ceramics in Part I is here extended to dynamic fatigue properties. Controlled flaws are used to measure the fatigue response in the large-crack (indentation-controlled) and small-crack (microstructure-controlled) regions. It is demonstrated that the 'microstructural driving forces' responsible for the R-curve behavior are readily accommodated into existing indentation fracture theories of fatigue strengths. The modified theory provides well-defined solutions for the strengths in terms of stressing rate and indentation load. Two load-invariant quantities, relating to the exponent and coefficient in an assumed power-law crack velocity function, are sufficient to define the entire data set for a given material, at all stressing rates and loads. This is demonstrated graphically by reducing such data sets onto universal fatigue diagrams.

710,752
PB86-193752 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Structural Reliability of Ceramic Materials.
Final rept.
S. M. Wiederhorn, and E. R. Fuller. 1985, 18p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Department of Energy, Oak Ridge, TN. Advanced Research and Technology Fossil Energy Materials Program.
Pub. in Materials Science and Engineering 71, p169-186 1985.

Keywords: *Ceramics, Crack propagation, Creep rupture strength, Fracture properties, Reliability, Reprints.

The effect of materials properties on the structural reliability of ceramics is reviewed. For low temperature applications, methods for estimating reliability are in an advanced state of development. The parametric equations that are used to describe failure can be explained in terms of a crack growth model in which failure occurs primarily as the result of the growth of defects from a subcritical to a critical size.

710,753
PB86-196771 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Materials Science and Engineering.
Institute for Materials Science and Engineering, Ceramics: Technical Activities 1985.
S. M. Hsu, and C. R. Hubbard. Feb 86, 81p NBSIR-85/3188

Keywords: *Ceramics, Physical properties, Performance, Chemistry, Processing, Stability.

Contents: Properties/performance, Mechanical properties; Glass and composites; Tribology; Optical properties; Structure/stability--High temperature chemistry; Structural chemistry; Ceramic powder characterization; Surface chemistry and bioprocesses; Processing--Structural science; Ceramic chemistry.

710,754
PB86-202843 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Mechanical Properties Group.
Creep and Fracture of Vitreous-Bonded Aluminum Oxide.
Final rept.
S. M. Wiederhorn, B. J. Hockey, R. F. Krause, and K. Jakus. 1986, 15p
Sponsored by Department of Energy, Oak Ridge, TN. Advanced Research and Technology Fossil Energy Materials Program, and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Materials Science 21, p810-824 1986.

Keywords: *Ceramics, *Aluminum oxide, Creep rupture strength, Fractures(Materials), Cracks, Creep properties, Reprints.

Creep and creep-rupture behavior of a commercial grade of glass-bonded, 96% aluminum oxide was characterized as a function of temperature and applied stress. The creep data were fitted to the classical empirical relation usually used to describe the phenomenon. None of the available theories of creep rupture provided a satisfactory description of the present set of data. Analytical electron microscopy was used to characterize the composition and structure of the material. In the as-received material the intergranular phase was a glass of nearly uniform composition. During high-temperature exposure, devitrification of the glass resulted in the formation of various crystalline phases within the intergranular region of the material. Devitrification depended on both the proximity to the surface, where it was most pronounced, and on the state of stress. From the composition of the retained glass, estimates of the viscosity of the glass at the grain boundaries were made and used, in combination with microstructural information, to compare the creep behavior with available theories of creep. The results of the paper are consistent with percolation and solution precipitation mechanisms of creep deformation.

710,755
PB86-203569 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Ceramic Materials Characterization Using Small Angle Neutron Scattering Techniques.
Final rept.
K. A. Hardman-Rhyne, and N. F. Berk. 1986, 13p
Pub. in Proceedings of Sagamore Army Research Conference (31st), Lake Luzerne, NY., August 13-17, 1986, p257-269.

Keywords: *Ceramics, Neutron scattering, Nondestructive tests, Defects, Porosity, Densification.

The future of new high technology ceramic materials depend on understanding the structure of ceramic materials. Often ceramics have several microstructural components such as residual voids from the sintering process, inclusions or impurities from starting materials, second phases, and microcracks or cavities from temperature and/or pressure treatments. Intensive efforts in synthesizing new reproducible ceramics have resulted in fewer microstructural defects. Nevertheless the effects of temperature and pressure on these defects are not understood and can be studied with SANS facilities. The densification process can be studied in-situ for alternative procedures to eliminate defects at earlier stages of the process. These defects include the initial porosity, agglomeration and impurity effects in the compacted power which can monitor a fragile green state ceramic through the densification process in a nondestructive manner. With the use of theoretical and experimental SANS methods developed at NBS, particle and/or void sizes (0.001 to 10 microm) and volume fractions can be studied quantitatively.

710,756
PB86-208519 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Ring-on-Ring Tests and the Modeling of Cladding Glass Strength by the Weibull Distribution.
Final rept.
E. Simiu, and D. A. Reed. 1985, 7p
Pub. in Proceedings of IUTAM Symposium on Probabilistic Methods in the Mechanics of Solids and Structures, Stockholm, Sweden, June 19-21 1984.

Keywords: *Glass, Construction materials, Strength, Loads(Forces), Fractures(Materials), Stresses, Probability distribution functions, Failure, Mathematical models.

Although ring-on-ring test results have been used in the past to obtain information on the strength of glass, no methodology has so far been developed in the literature relating explicitly such results to the load capacity of cladding glass. The main purpose of the report is to propose such a methodology. The proposed methodology makes use of recent advances in the modeling of the fracture mechanics behavior of glass and the calculation of stresses in plates exhibiting geometric nonlinearity. Two interesting findings are noted. First, owing to the way in which results of ring-on-ring tests are utilized, the relatively large varibilities typical of fracture mechanics parameters, as well as the uncertainities with respect to the shapes of surface flaws, have a minor effect on the estimation of load capacities. Second, two-parameter Weibull distributions, previously used in the literature to model the strength of glass and the load capacity of cladding panels, are not consistent with experimental results. On the other hand, three-parameter Weibull distributions model the observed glass behavior credibly.

710,757
PB86-209186 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Compressive Strength and Creep Behavior of a Magnesium Chromite Refractory.
Final rept.
R. F. Krause. 1986, 9p
Sponsored by Department of Energy, Oak Ridge, TN. Advanced Research and Technology Fossil Energy Materials Program.
Pub. in Ceramic Engineering and Science Proceedings 7, n1-2 p220-228 1986.

Keywords: *Refractories, *Chromites, Creep properties, Strength, Strains, Compressive strength, Magnesium chromites, High temperature.

The compressive strength of a magnesium chromite refractory in nitrogen was measured by rapidly loading specimens to failure at several temperatures up to 1600C. Strength retrogression was observed at temperatures above 1200C. The creep behavior of the refractory in nitrogen was measured as a function of compressive stress in the range from 1.4 to 5.6 MPa and as a function of temperature in the range from 1300 to 1600C. A nitrogen atmosphere was used to suppress distillation of CrO sub 3. Generally, the experiments were terminated when the specimens sustained from 0.01 to 0.02 creep strain. The creep strain (epsilon) at a given stress (omicron) and a given absolute temperature (T) was represented by the following function of time (t), epsilon = C traised to the m power, where (C) depends on stress and temperature. The time exponent (m) was evaluated as less than unity, indicating a strain-hardening model, and was independent of stress and temperature within the precision of measurements.

710,758
PB86-209194 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Microstructural Analysis of Creep Failure in Si3N4 and SiC.
Final rept.
N. J. Tighe. 1984, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Army Materials and Mechanics Research Center, Watertown, MA.
Pub. in Proceedings of Annual Conference of the Microbeam Analysis Society (19th), Bethlehem, PA., July 16-20, 1984, Microbeam Analysis-1984, p127-130.

Keywords: *Ceramics, *Service life, Silicon carbides, Silicon nitrides, Fractures(Materials), Micro structure, Crack propagation, Electron microscopy, Creep properties, Failure, High temperature.

Advanced ceramics such as silicon nitride and silicon carbide are being used in high-temperature, high-stress heat-engine applications where catastophic failure must be avoided. It is necessary to develop the required design parameters and to predict lifetimes for these materials. Identification of the microstructural elements that cause failure is being carried out by analytical scanning transmission electron microscopy (STEM). Silicon carbide and silicon nitride fail by mechanisms that involve crack propagation from pre-existing flaws or from flaws that develop during the exposure to a simulated service environment. The pre-existing flaw population consists of inclusions, pores, and surface preparation damage; the flaw population that develops during exposure includes cavities, oxidation pits, microcracks, and reaction products from bonding phases and inclusions. Silicon nitride and silicon carbide are compounds of several crystalline and amorphous phases and the identification of the microstructural elements that relate to the failure mechanisms requires considerable structural and chemical analysis.

710,759
PB86-214673 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Contact Fracture in Brittle Materials.
Final rept.
B. R. Lawn, and S. M. Wiederhorn. 1983, 15p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of International Symposium on Contact Mechanics and Wear of Rail/Wheel Systems, Vancouver, British Columbia, July 6-9, 1982, p133-147 1983.

Keywords: *Brittleness, Fractures(Materials), Contacting, Strength, Erosion, Surface defects, Deformation, Reprints, *Brittle materials.

The nature of contact-induced surface damage in brittle materials, and the fracture mechanics principles used to describe the damage, are surveyed. The importance of understanding the elastic and plastic deformation processes which precede fracture is emphasized. Strength and erosive wear properties are intimately connected to the contact damage mechanics.

710,760
PB86-230950 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Dry-Coupled Ultrasonic Elasticity Measurements of Sintered Ceramics and Their Green States.
Final rept.
M. P. Jones, G. V. Blessing, and C. R. Robbins. 1986, 4p
Pub. in Materials Evaluation, n44 p859-862 Jun 86.

Keywords: *Ceramics, Nondestructive tests, Modulus of elasticity, Reprints.

Original techniques have been developed enabling both shear and longitudinal ultrasonic waves to be dry-coupled, using minimal pressure, into green and sintered-state ceramics via elastomers. These techniques permitted the velocity measurements to be made at megahertz frequencies, from which the elastic moduli were calculated by use of independent density measurements. Velocity differences between samples composed completely of hard agglomerates and samples composed completely of soft agglomerates were observed for the green and intermediate sintered states but were not observed for the (near) dense states.

710,761
PB86-232972 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Fatigue Strength of Glass: A Controlled Flaw Study.
Final rept.
B. R. Lawn, D. B. Marshall, and T. P. Dabbs. 1985, 12p
Pub. in Strength of Inorganic Glass, p249-260 1985.

Keywords: *Glass, *Fatigue strength at N cycles, Defects, Indentation, Reprints, Fracture(Mechanics).

The fatigue strength properties of glass containing Vickers indentation flaws are described. The responses are found to be highly sensitive to the state of the flaws, notably to the presence or otherwise of irreversible contact stresses or of deformation-induced radial cracks. When radial cracks are present (postthreshold state) the data can be described completely in terms of conventional fracture mechanics laws. Removal of the residual stresses (by annealing) results in higher strengths and reduced fatigue susceptibility. When radial cracks are not present (subthreshold state), as is the case at sufficiently small contact loads, the data deviate from the extrapolated predictions of macroscopic crack theory. The observed strengths are higher than equivalent postthreshold levels, with increased fatigue susceptibility and greater scatter. It is concluded that the sharp-crack concept of flaws remains valid down to the threshold load for crack initiation, but that below the threshold it is the crack precursor processes which control the failure properties. Implications of these results concerning the mechanical response of optical fibers are considered.

710,762
PB86-232980 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Indentation: Deformation and Fracture Processes.
Final rept.
B. R. Lawn. 1985, 20p
Pub. in Strength of Inorganic Glass, p67-86 1985.

Keywords: *Glass, *Indentation, Deformation, Fracturing, Cracks, Reprints.

A summary of recent developments in the study of indentation processes in glass is presented. Attention is focussed on ideally 'sharp' indenters, in which the contact deformation contains both reversible and irreversible components. The relative amounts of these two components are determined by the ratio of hardness to elastic modulus, and are directly measurable from the depth recovery of the impression. At high loading rates the plastic work rate may be sufficient to cause local surface 'melting'.

710,763
PB86-232998 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Environmentally Enhanced Crack Growth in Glasses.
Final rept.
S. W. Freiman. 1985, 21p
Pub. in Proceedings of NATO Advanced Research Workshop entitled Strength of Glass, Algarve, Portugal, March 21-25, 1983, p197-217 1985.

Keywords: *Glass, *Crack propagation, Fracturing, Stress corrosion, Fracture(Mechanics).

The paper reviews current understanding of environmentally enhanced crack growth in glasses. The process is shown to lend itself to analysis by chemical reaction rate theory. The environmental dependence of the lower end of the crack velocity regime, Region I, is shown to fit a recent molecular model for a stress induced chemical reaction in SiO2. Crack growth in Region II is shown to be transport rate controlled, while above Region II, a recently proposed electrostatic model is shown to fit the data for soda-lime-silica glass. Effects of experimental variables such as pH and temperature on the slope and portion of crack growth curves are discussed.

710,764
PB86-237823 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
High-Pressure Transformation Toughening: A Case Study on Zirconia.
Final rept.
S. Block, G. J. Piermarini, B. J. Hockey, B. R. Lawn, and R. G. Munro. Jun 86, 2p
Pub. in Jnl. of the American Ceramic Society 69, n6 pC-125-C-126 Jun 86.

Keywords: *Zirconium oxides, Ceramics, Sintering, Reprints, High pressure.

Transformation-toughened zirconia compacts have been produced using a pressure-induced phase of zirconia as the toughening agent. The high-pressure phase is retained metastably after compaction at 8.6 GPa and sintering at temperatures as low as 250C. High-pressure processing offers potential for new transformation-toughening phases in other ceramic materials.

710,765
PB86-237831 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Pressure-Temperature Phase-Diagram of Zirconia.
Final rept.
S. Block, J. A. H. da Jornada, and G. J. Piermarini. 1985, 3p
Pub. in Jnl. of the American Ceramic Society 68, n9 p497-499 1985.

Keywords: *Zirconium oxides, Phase diagrams, Ceramics, Reprints.

The pressure-temperature phase diagram of zirconia (ZrO2) was determined under equilibrium conditions in a diamond anvil high pressure cell (DAC) equipped for heating, by optical microscopy and x-ray diffraction techniques. At room temperature zirconia transforms from the monoclinic (M) phase to a tetragonal (T') phase which is related to the well-known high temperature tetragonal structure (T) stable above 1170C at one atmosphere. The transition to the high pressure T' form is accompanied by a volume change of -3.5%. The transformation pressure is cycle dependent and also depends on whether pressure to induce the transformation is increasing or decreasing. At higher pressures (>16.6 GPa), the T' form transforms to the orthorhombic cotunnite (PbCl2) structure. The volume change at the transition is -6.7%. With increasing temperature the T' form transforms to the high temperature tetragonal form (T). The M-T' and T'-T phase boundaries were determined under hydrostatic conditions using single crystal samples. For increasing P and T, the M-T-T' triple point was located at T = 596 + or - 18 deg C and P = 2.26 + or - 0.28 GPa, while for decreasing P and T, the triple point is at T = 535 + or - 25 deg C and P = 1.7 + or - 0.28 GPa.

710,766
PB86-237849 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Effect of Chemical Composition on Sintering of Ceramics.
Final rept.
J. E. Blendell, and C. A. Handwerker. 1986, 23p
Pub. in Jnl. of Crystal Growth 75, p138-160 1986.

Keywords: *Ceramics, Aluminum oxide, Sintering, Chemical composition, Grain boundaries, Reprints.

Recent advances have been made in the understanding of sintering of ceramics. The primary advances have been in the modelling of grain boundary and surface properties and in the measurement of the effect of low levels of impurities and dopants on the energies and properties of interfaces. These results indicate that sintering is strongly affected by crystalline anisotropy, multiple transport mechanisms, complex geometries and impurity effects. In particular the effect of variable concentrations of impurities at the trace level have been found to mask the effects of changing most other systems parameters in ceramics with low intrinsic concentrations of defects. Experiments are described which can be used to isolate specific parameters or processes involved in sintering, such as the surface-grain boundary dihedral angle. Specific examples of impurity effects in MgO and alpha-Al2O3 are presented.

710,767
PB86-238425 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Subcritical Crack Growth in Ceramics.
Final rept.
S. M. Wiederhorn. 1986, 7p
Pub. in Encyclopedia of Materials Science and Engineering, v6 p4714-4720 1986.

Keywords: *Ceramics, *Crack propagation, Fractures(Materials), Reprints.

The fracture of ceramic materials is often preceeded by subcritical crack growth that originates from flaws or cracks contained in the surfaces of these materials. Subcritical crack growth is usually the result of a stressed enhanced reaction between the ceramic and water in the air, and has been observed in a wide variety of ceramic materials: glasses, porcelains, oxides, silicate minerals and titanates. Because subcritical crack growth preceeds catastrophic fracture, the strength of ceramic materials is often found to be time dependent: delayed failure is observed when ceramics are subjected to a load, and strength of ceramics is observed to depend on loading rate. The effect of subcritical crack growth on the strength of ceramics can be understood by using the science of fracture mechanics, which provides methods for quantifying crack growth. Fracture mechanics also provides a logical framework for predicting the lifetime of structural ceramics that are subjected to either static or dynamic loads.

710,768
PB86-240470 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Surfaces and Interfaces: Effects on Mechanical Properties of Ceramics and Glasses.
Final rept.
S. M. Wiederhorn. 1986, 4p
Pub. in Encyclopedia of Materials Science and Engineering, v6 p4817-4820 1986.

Keywords: *Ceramics, *Glass, Interfaces, Surface properties, Microstructure, Fracture properties, Creep properties, Reprints.

The mechanical behavior of ceramic materials at both low and elevated temperatures is influenced by the presence of surfaces and interfaces. At low temperatures where ceramics are brittle, mechanical perfection of surfaces determines the strength of ceramic materials. At elevated temperatures, where atoms move and react freely, factors such as creep and surface reactivity play a role in determining mechanical behavior. In the article, low temperature mechanical behavior of ceramic materials is discussed in terms of the microstructure of surfaces and the effect of machining, polishing and processing on the microstructure. High temperature mechanical behavior is discussed in terms of surface reactivity and grain boundary mobility and the importance of these processes to fracture, creep, and creep fracture.

710,769
PB86-241718 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Fracture Toughness Testing of Brittle Materials.
Final rept.
S. W. Freiman. 1986, 4p
Pub. in Encyclopedia of Materials Science and Engineering, v3 p1868-1871 1986.

Keywords: *Brittleness, Toughness, Fracture properties, Tests, Reprints, Fracture toughness.

No abstract available.

710,770
PB87-104915 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Problems with Cryogenic Operation of Piezoelectric Bending Elements.
Final rept.
C. L. Duffield, J. Moreland, and F. R. Fickett. May 86, 3p
Pub. in Review of Science Instruments 57, n5 p990-992 May 86.

Keywords: Ceramics, Cryogenics, Bending, Reprints, *Lead titanate zirconates, Bimorphs, Micropositioners.

Piezoelectric bimorphs constructed from lead titanate-zirconate (PZT) ceramic bonded to a brass sheet have been tested at cryogenic temperatures to determine their suitability for use in a low-temperature micropositioner. Experimental data are presented on bimorph sensitivity (displacement per volt) as a function of the number of temperature cycles. Results indicate that bimorphs of this type cannot be calibrated because of irreversible changes in the bending characteristics that occur while cycling from room temperature to 4 K.

710,771
PB87-105029 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Characterization of Microcracks in Yttrium Chromate (III) Using Small-Angle Neutron Scattering and Elasticity Measurements.
Final rept.
E. D. Case, and C. J. Glinka. 1984, 7p
Pub. in Jnl. of Materials Science 19, n9 p2962-2968 1984.

Keywords: *Ceramics, *Cracks, Neutron scattering, Elastic properties, Polycrystals, Reprints, *Yttrium chromates.

The mean crack radius, crack opening displacement, number density, and volume fraction have been estimated for a population of microcracks in polycrystalline YCrO3 using small angle neutron scattering in tandem with elasticity measurements.

710,772
PB87-106050 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Complex Permittivity of Beryllium-Oxide between 100-K and 300-K at 9.3 GHZ.
Final rept.
W. C. Daywitt. 1985, 2p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Instrumentation and Measurement 34, n1 p98-99 1985.

Keywords: *Beryllium oxides, Ceramics, Dielectric properties, Reprints.

9.3 gigahertz measurement results of the relative dielectric constant and loss tangent of ceramic beryllium oxide at 99, 145, 223, and 300 kelvins are reported.

710,773
PB87-118535 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Monocrystal Elastic Constants of NbC.
Final rept.
H. M. Ledbetter, S. Chevacharoenkul, and R. F. Davis. 1986, 4p
Pub. in Jnl. of Applied Physics 60, n5 p1614-1617, 1 Sep 86.

Keywords: *Niobium carbides, Elastic properties, Reprints.

Using ultrasonic methods at ambient temperatures, for niobium carbide the authors determined the monocrystalline elastic stiffnesses: C sub 11, C sub 12 and C sub 44 in Voigt's contracted notation. From these, the authors calculated the quasi-isotropic (polycrystalline) elastic constants and the elastic Debye characteristic temperature. Results derived from a blackman diagram suggest that ionic forces contribute significantly to the elastic constants and to interatomic bonding. This conclusion applies not only to NbC but also to other MX carbides with an NaCl-type crystal structure.

710,774
PB87-118931 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Electrical Resistivity and Microwave Transmission of Hexagonal Boron-Nitride.
Final rept.
H. Frederikse, A. Kahn, A. Dragoo, and W. Hosler. 1985, 5p
Sponsored by Defense Nuclear Agency, Washington, DC.
Pub. in Jnl. of the American Ceramic Society 68, n3 p131-135 1985.

Keywords: *Boron nitrides, Electrical resistivity, Semiconductors, High temperature research, Energy gap, Wave propagation, Microwaves, Reprints.

The dc conductivity of hexagonal boron-nitride (BN) and BN-containing composites was measured as a function of temperature up to 2400 deg C. The results confirm that at high temperatures BN is an intrinsic semiconductor with an energy gap of 6.2 plus or minus 0.4 eV at T = 0 K. Extrapolated values for the resistivity of BN in the range 2600 to 3000 deg C are used to analyze the absorption, reflectivity, and transmissivity of a BN window when subjected to microwave radiation under atmospheric reentry conditions. It appears that the transmissivity is of the order of 1 to 10 percent at these temperatures due mainly to the high conductivity in a very thin, very hot surface layer. The transmissivity can be improved by using a composite made of boron-nitride and silica.

710,775
PB87-118949 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.

Environmentally Enhanced Crack-Growth in Soda-Lime Glass.
Final rept.
S. W. Freiman, G. S. White, and E. R. Fuller. 1985, 5p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of the American Ceramic Society 68, n3 p108-112 1985.

Keywords: *Glass, Crack propagation, Reprints.

Crack-growth data is presented for soda-lime glass in various chemical environments. It is shown that the same environments which govern crack-growth rates in vitreous silica also do so in soda-lime glass. Modifier ions are shown to affect slopes and positions of the soda-lime crack-growth curves, either through changes in the properties of the Si-0 bond or through changes in the elastic properties of the bridging network. Sodium ion exchange and silica dissolution are also shown to be important, particularly at low crack velocities.

710,776
PB87-119749 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Comparison of the Liquid-Nitrogen Strength and the High-Stressing-Rate Strength of Soda-Lime Glass.
Final rept.
D. H. Roach. 1986, 2p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of the American Ceramic Society 69, n8 pC-168-C-169 1986.

Keywords: *Alkali glass, *Fatigue(Materials), Ceramics, Crack propagation, Fracture strength, Reprints, *Liquid nitrogen strength, Soda lime glass.

Indentation strength testing is used to compare two methods of avoiding slow crack growth: a high-stressing-rate test under ambient conditions vs testing under liquid nitrogen. The liquid-nitrogen strength of soda-lime glass is found to be 9% greater than the high-stressing-rate strength. This is consistent with previous measurements of an increase in K(sub c) of 9.3% at liquid-nitrogen temperature. The implication of this finding regarding time-to-failure calculations is discussed.

710,777
PB87-122651 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Predictive Phase Equilibrium Model for Multicomponent Oxide Mixtures, Part 2. Oxides of Sodium, Potassium, Calcium, Magnesium, Aluminum, and Silicon.
Final rept.
J. W. Hastie, and D. W. Bonnell. 1985, 32p
Pub. in High Temperature Science 19, n3 p275-306 1985.

Keywords: *Ceramics, Thermodynamics, Sodium oxides, Potassium oxides, Calcium oxides, Magnesium oxides, Aluminum oxides, Silicon oxides, Mathematical models, Reprints, *Phase equilibrium.

A new modeling approach, described in Part I of this series, for thermodynamic predictions of multicomponent, multiphase high temperature ceramic systems has been extended to include the binary to sexternary oxide mixtures of Na, K, Ca, Mg, Al, and Si. The model, which attributes negative deviations from ideal solution behavior to the formation of complex liquids and solids, is demonstrated for systems important in high temperature materials and energy technology, including coal slags, glasses, and minerals. Good agreement between the model predictions and experimental vapor pressure data is found. Predictions and comparisons with experiment concerning melting and phase composition are also given.

710,778
PB87-135208 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Local Atomic Structure in Transition Metal/Metalloid Glasses: Ni-P.
Final rept.
L. H. Bennett, G. G. Long, M. Kuriyama, and A. I. Goldman. 1986, 25p
Pub. in Structure and Bonding in Noncrystalline Solids, p385-409 1986.

Keywords: *Glass, *Atomic structure, Chemical bonds, Density(Mass/volume), Nuclear magnetic resonance, Reprints, *Amorphous metals, *Nickel phosphorus alloys, Fine structure.

Details of the local atomic structure and some aspects of the chemical bonding have been explored in alloys representative of the important class of metallic glasses formed from transition-metals and metalloids. A large number of binary Ni-P alloys were formed as glasses over a wide composition range by many different preparation processes. NMR experiments revealed that two distinct types of glasses were formed. A representative of each type of glass was examined by EXAFS, revealing differences in structure and bonding.

710,779
PB87-136628 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Static Fatigue Limit at Elevated Temperature.
Final rept.
T. J. Chuang, R. E. Tressler, and E. J. Minford. 1986, 9p
Grant DE-A105-800R20679
Sponsored by Department of Energy, Washington, DC.
Pub. in Materials Science and Engineering 82, p187-195 1986.

Keywords: *Ceramics, *Crack(Propagation), Crack(Fracturing), Fatigue(Materials), Construction materials, Static tests, Grain boundaries, Reprints, *Static fatigue limit.

The static fatigue limit, defined as the stress level below which prolonged service life is expected, is derived first from irreversible thermodynamics and found to be sensitive to kinetics. Existing theories of crack growth based on distinct mechanisms are summarized and discussed to give various values of the predicted static fatigue limit. Data for the static fatigue limit measured from alpha-SiC bend bar specimens tested at 1200 C are compared with those theoretical predictions. The results suggest that, for structural ceramics crept at elevated temperatures, diffusive crack growth along the grain boundary dominates the static fatigue process and provides the fundamental level for the static fatigue limit.

710,780
PB87-136636 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Real-Time Ultrasonic Nondestructive Evaluation of Green State Ceramic Powders during Compaction.
Final rept.
M. P. Jones, and G. V. Blessing. 1986, 14p
Pub. in Nondestructive Testing Communications 2, p155-168 1986.

Keywords: *Nondestructive tests, *Ceramics, Compacting, Ultrasonic tests, Reprints.

A real-time ultrasonic technique for the nondestructive evaluation of ceramic powders during compaction has been demonstrated. Initial results indicate that this technique can detect the presence of hard agglomerates in a spray-dried alumina powder. The proposed sensor could be employed by industry to spot flawed parts prior to removing them from the die, and to provide on-line criteria for control of compaction parameters.

710,781
PB87-156980 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Summary of Ellipsometric and Electrochemical Studies of the Delamination of Organic Coatings from Iron and Steel.
Final rept.,
J. Ritter. 1985, 8p
Pub. in Proceedings of a Conference on Technical Symposia - Corrosion 85, held at Boston, MA, March 25-29, 1985, p56.1-56.8 1985.

Keywords: *Coatings, *Delaminating, *Iron, *Steels, Corrosion resistance, Electrochemistry.

Ellipsometric and electrochemical techniques for the in situ study of the corrosion of coated iron and steel is described. The results of these studies, an interpretation of the data and the extension of the technique to the study of inhibited coatings systems are summarized. It is concluded that interfacial oxide dissolution constitutes an important mechanism of coating delamination.

710,782
PB87-162319 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Effect of Overaging on the Room Temperature Strength of Partially Stabilized Zirconia.
Final rept.,
L. J. Schioler, R. N. Katz, A.C. Gonzalez, and B. R. Lawn. 1985, 2p
Pub. in American Ceramic Society Bulletin 64, n2 p326-327 1985.

Keywords: *Zirconium oxides, Aging tests(Materials), Toughness, Ceramics, Heat treatment, Reprints.

Commercially available partially stabilized zirconias were tested in their as-received state and after heat treatment at 1000 degrees C for 100 and 500 hr. The strengths of specimens with and without controlled flaws showed marked variations with time-at-temperature. The changes in the strength are linked to the changes in the phase content due to heat treatment. It is concluded that in-service aging effects could jeopardize long-lifetime applications of these materials at intermediate temperatures.

710,783
PB87-163739 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Corrosion and Crack Growth in 33% Na2O-67% SiO2 and 33% Li2O-67% SiO2 Glasses.
Final rept.,
G. S. White, D. C. Greenspan, and S. W. Freiman. 1986, 7p
Contract N00014-79-F-0030
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of the American Ceramic Society 69, n1 p38-44 1986.

Keywords: *Silica glass, *Crack propagation, *Corrosion, Spectroscopic analysis, Glass, Reprints.

Environmentally enhanced crack growth data in 33% Na2O-67% SiO2 and 33% Li2O-67% SiO2 have been correlated with corrosion data of the same glasses as determined by infrared reflection spectroscopy and atomic absorption spectroscopy. It was determined that, of the tested environments, those environments and only those environments which caused surface corrosion also enhanced crack growth. Crack growth curves were more complicated in these materials than in fused silica and water dominated regions occurred even in some environments which are known to enhance crack growth.

710,784
PB87-164166 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Nucleation and Growth of Cracks in Vitreous-Bonded Aluminum Oxide at Elevated Temperatures.
Final rept.,
K. Jakus, S. M. Wiederhorn, and B. J. Hockey. Oct 86, 7p
Sponsored by Department of Energy, Oak Ridge, TN. Fossil Energy Program.
Pub. in Jnl. of the American Ceramic Society 69, n10 p725-731 Oct 86.

Keywords: *Ceramics, *Aluminum oxide, *Crack propagation, Fractures(Materials), Creep rupture strength, Reprints.

The nucleation and growth of cracks was studied at elevated temperatures on a grade of vitreous-bonded aluminum oxide that contained approx. 8% vol glass at the grain boundaries. Cracks were observed to nucleate within the vitreous phase, close to the tensile surface of the flexural test specimens used in these experiments. Crack nucleation occurred at a strain of approx. 0.08% to 0.12% which corresponded to a crack nucleation time of approx. 35% of the time to failure by creep rupture. Once nucleated, cracks propagated along grain boundaries, as long as the stress for crack propagation was maintained.

710,785
PB87-191003 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Creep Rupture of Siliconized Silicon Carbide.
Final rept.,
S. M. Wiederhorn, L. Chuck, E. R. Fuller, and N. J. Tighe. 1986, 19p
Sponsored by Department of Energy, Oak Ridge, TN. Fossil Energy Program.
Pub. in Tailoring Multiphase and Composite Ceramics, p755-773 1986.

Keywords: *Silicon carbides, *Creep rupture strength, Fracture properties, Deformation, Reprints.

Creep and creep-rupture of siliconized silicon carbide were studied in flexure as a function of temperature and applied stress. Cavity formation during creep caused a significant reduction in the room temperature strength. By contrast, the strength at elevated temperatures did not decrease until extensive cavity linkage occurred at creep times that approached the creep-rupture life.

710,786
PB87-193595 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Inorganic Materials Div.
Estimation of Power-Law Creep Parameters from Bend Test Data.
Final rept.,
T. J. Chuang. 1986, 11p
Contract DE-AI05-800R206799
See also report dated Feb 85, PB85-183408. Sponsored by Department of Energy, Washington, DC., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Materials Science 21, p165-175 1986.

Keywords: *Ceramics, *Creep properties, Creep tests, Aluminium oxide, Applications of mathematics, Reprints.

Power-law creep parameters of brittle ceramic materials are commonly deduced from load-point displacement data generated by four-point bend experiments, under the assumption that tensile and compressive behaviors obey the same constitutive law. However, because of microcracking and cavitation, it is now well recognized that this premise may not always be valid. The paper presents an analysis which takes the differences into account.

710,787
PB87-197752 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Characterization of Active Sites at Chemically Modified Glass Surfaces.
Final rept.,
D. Cukman, J. Jednacak-Biscan, Z. Veksli, and W. Haller. 1987, 5p
Pub. in Jnl. of Colloid and Interface Science 115, n2 p357-361 Feb 87.

Keywords: *Adsorption, *Glass, Silanization, Surfaces, Reprints.

Chemically modified surfaces of silica glass samples of controlled pore size (CPG) were studied by gas (argon, H2O) adsorption, and by adsorption of organic amino and hydroxyl functional compounds having ESR active nitroxide groups. Chemical modification of surfaces was achieved using triethoxy or trichloro alkyl, allyl, and phenyl silanes. The results allow the quantitative and qualitative estimation of the number of active sites on modified surfaces of CPG.

710,788
PB87-201554 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Toughness and Flaw Responses in Nontransforming Ceramics: Implications for NDE.
Final rept.,
B. R. Lawn, and C. J. Fairbanks. 1987, 10p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v6B p1023-1032 1987.

Keywords: *Ceramics, *Microstructure, *Toughness, Nondestructive tests, Fracture mechanics.

The relationship between toughness and microstructure of ceramics is described. A bridging mechanism was found responsible for rising T-curve behavior, and a model has been developed. The implications of this work to the NDE field are discussed.

710,789
PB87-201562 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Development of a Ceramic Phase Diagram and Thermodynamic Data Bank.
Final rept.,
J. W. Hastie, H. Ondik, and D. W. Bonnell. 1987, 11p
Pub. in Proceedings of the Int. Conference on User Applications of Alloy Phase Diagrams, Lake Buena Vista, FL, October 4-9, 1986, p1-11 1987.

Keywords: *Ceramics, *Phase diagrams, *Thermodynamics, *Data bases, Computer applications, US NBS.

Ceramic phase diagrams are indispensible summaries of multiphase, multicomponent materials thermochemistry. A large body of experimental data exists for ceramic phase equilibria but its utility is limited by the difficulty of accessing the data and by the lack of reliability assessments for the data. The paper describes recent progress at the National Bureau of Standards (NBS) towards development of a comprehensive, evaluated, computer-accessible data bank of ceramic phase diagram information--bibliographic, graphic, and thermodynamic. Examples of applications of the partially complete data bank are also given.

710,790
PB87-201570 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Transient Behavior of Structural Ceramics under Flexural Creep.
Final rept.,
T. J. Chuang, S. M. Wiederhorn, and C. F. Chen. 1987, 17p
Contract DE-AI05-85OR21569
Sponsored by Department of Energy, Oak Ridge, TN.
Pub. in Proceedings of the Int. Conference on Creep and Fracture of Engineering Materials and Structures (3rd), Swansea, UK, April 5-10, 1987, p957-973 1987.

Keywords: *Ceramics, *Creep properties, Silicon carbides, Transient response, Stresses, Strains.

The transient creep of a ceramic bend bar under constant load is analyzed using a scheme developed earlier by Cohrt et al. The methodology assumes that the beam is formed by an infinite number of parallel fibers, each modelled as a Maxwell fluid consisting of an elastic spring and a dashpot connected in series. The numerical solution produces a time history of stress along the beam depth, ranging from a linear (elastic) distribution at initial loading to a nonlinear distribution at steady state. Also available from the solutions are the transient periods and the time-dependent migration of the neutral planes in stress and strain, the latter being measurable and thus experimentally verifiable. Qualitative agreement is obtained when the analysis is compared to a set of experimental data on siliconized silicon carbide.

710,791
PB87-203899 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Effect of Surface Tension on the Toughness of Glass.
Final rept.,
T. J. Chuang. 1987, 5p
Pub. in Jnl. of the American Ceramic Society 70, n3 p160-164 Mar 87.

Keywords: *Glass, *Interfacial tension, Cracks, Toughness, Silica glass, Mechanical properties, Reprints, Surface tension.

Mechanical stresses (i.e., surface tension) inherently exist on a general free surface because its atomic structure differs from its bulk counterpart. The effect of surface tension is amplified at a crack tip because of curvature enhancement. An integral equation describing this effect on the toughness of glass is derived and first-order approximations using a weight function technique were made. The qualitative results indicate that the geometry-induced toughening is linearly proportional to surface tension and crack tip curvature and to the square root of crack tip zone size. An illustrative example of a recently observed crack tip in SiO2 glass is given which shows that toughness is enhanced by approximately 3 times the intrinsic K1c value.

710,792
PB87-203907 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Crack-Interface Grain Bridging as a Fracture Resistance Mechanism in Ceramics: 2. Theoretical Fracture Mechanics Model.
Final rept.,
Y. W. Mai, and B. R. Lawn. 1987, 6p
See also PB87-203915. Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of the American Ceramic Society 70, n4 p289-294 Apr 87.

Keywords: *Ceramics, *Aluminum oxide, Toughness, Cracking(Fracturing), Models, Bridging, Reprints.

A fracture mechanics models is developed for nontransforming ceramics that show an increasing toughness with crack extension (R-curve, or T-curve, behavior). The model derives from the observations in Part I, treating the increased crack resistance as the cumulative effect of grain bridging restraints operating behind the advancing tip. An element of discreteness is incorporated into the formal distribution function for the crack-plane restraining stresses, to account for the primary discontinuities in the observed crack growth. A trial force-separation function for the local bridge microrupture process is adopted, such that an expression for the microstructure-associated crack driving (or rather, crack closing) force may be obtained in analytical form. The description can be made to fit the main trends in the measured toughness curve for a coarse-grained alumina.

710,793
PB87-203915 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Crack-Interface Grain Bridging as a Fracture Resistance Mechanism in Ceramics: 1. Experimental Study on Alumina.
Final rept.,
P. L. Swanson, C. J. Fairbanks, B. R. Lawn, Y. W. Mai, and B. J. Hockey. 1987, 11p
See also PB87-203907. Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of the American Ceramic Society 70, n4 p279-289 Apr 87.

Keywords: *Aluminum oxide, *Ceramics, Bridging, Toughness, Reprints, Interfacial energy.

Direct microscopic evidence is presented in support of an explanation of R-curve behavior in monophase ceramics by grain-localized bridging across the newly formed crack interface. In situ observations are made of crack growth in tapered cantilever beam and indented flexure specimens of a coarse-grained alumina. The fractures are observed to be highly stable, typical of a material with a strongly increasing resistance characteristic, but are discontinuous at the microstructural level. Associated with this discontinuity is the appearance of overlapping segments in the surface fracture trace around bridging grains; the mean spacing of such 'activity sites' along the trace is about 2 to 5 grain diameters. These segments link up with the primary crack beneath the specimen surface, and continue to evolve toward rupture of the bridge as fracture proceeds.

710,794
PB87-224226 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Microstructural Effects on Grinding of Alumina and Glass-Ceramics.
Final rept.,
D. B. Marshall, B. R. Lawn, and R. F. Cook. Jun 87, 2p
Sponsored by Army Research Office, Research Triangle Park, NC.
Pub. in Jnl. of the American Ceramic Society 70, No. 6 pC-139 - C-140 Jun 87.

Keywords: *Devitrified glass, *Aluminum oxide, Grinding(Comminution), Machinability, Cracks, Reprints.

Grinding forces were measured in aluminas and glass-ceramics with various microstructures. The microstructures were found to exert a profound influence on the machinability. In particular, the controlling toughness variable is that which pertains to small cracks, not that conventionally measured in a large-scale fracture specimen.

710,795
PB87-225447 Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Development of a Test Method to Evaluate the Penetration Resistance of High-Security Glazing Subjected to Mechanical Impact and Heat.
Final rept.,
L. I. Knab, S. Fischler, J. R. Clifton, and N. E. Waters. Nov 86, 44p
Pub. in NIJ Report 300-85, p1-44 Nov 86.

Keywords: *Glazing, Penetration, Impact, Heat, Tests, Glass, Laminated glass, Polycarbonates, Reprints, High security glazing.

The report describes the development of a laboratory test method for transparent, high-security glazing. The test method was developed to evaluate the penetration resistance of glazing materials subjected to a simultaneous attack of mechanical impact with a sharp-nosed tool and heat application. The rationale for the determination of the test parameters and realistic parameter levels is given. Glazing panels, measuring 12 X 12 in, are simultaneously subjected to repeated impacts by a pendulum with a chisel-nosed impactor and a continuous diffusion (yellow) flame delivered by propane gas torches until the chisel nose penetrates the panel. Test results indicated a wide range in the number of impacts (1 to 116) required to penetrate the glazing. Increases in polycarbonate thickness resulted in increases in the number of impacts required for penetration. It was concluded that (a) the test method can be used to evaluate the penetration resistance of glazing materials when they are subjected to the specified test conditions, and (b) the test results can be used to rank the penetration resistance of the glazing materials, provided the variability of the test results is incorporated in the ranking.

710,796
PB87-230884 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Microstructure and the Strength of Ceramics.
Final rept.,
C. J. Fairbanks, B. R. Lawn, R. F. Cook, and Y. W. Mai. 1986, 15p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Fracture Mechanics of Ceramics, v8 p23-37 1986.

Keywords: *Ceramics, *Fracture properties, Microstructure, Cracks, Fatigue(Materials), Reprints, *Foreign technology.

Microstructural influences on ceramic strength become significant at small flaw sizes. These influences are readily quantified by strength testing with controlled indentation flaws. Data are presented here for alumina and glass-ceramic specimens broken under both inert and fatigue conditions. As the flaw size is systematically reduced there is a tendency to a reduction in strength relative to that predicted from macroscopic toughness measurements, reflecting R-curve behavior. This tendency is critically dependent on the microstructural detail, e.g. presence of glassy phases at the grain boundaries in the aluminas. However, the fatigue susceptibility is found to be relatively insensitive to the microstructural influence over the same flaw-size range. A fracture mechanics framework for incorporating a 'microstructural stress intensity factor' is outlined.

710,797
PB87-233664 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Effect of a Liquid Phase on the Morphology of Grain Growth in Alumina.
Final rept.,
W. A. Kaysser, M. Sprissler, C. A. Handwerker, and J. E. Blendell. May 87, 5p
Pub. in Jnl. of the American Ceramic Society 70, n5 p339-343 May 87.

Keywords: *Aluminum oxides, Sintering, Grain refinement, Reprints, *Foreign technology.

In the investigation the authors have studied how the presence of a liquid phase affects the grain morphology and grain growth kinetics in Al2O3 at 1800 deg C using the growth of both matrix grains and large spherical single-crystal seeds growing into the matrix. The growth rates of the matrix grains were found to decrease in the following order: undoped Al2O3, Al2O3 with anorthite, Al2O3 with anorthite and MgO, and Al2O3 with MgO. Except for the samples doped with MgO alone, the matrix grains were faceted and appeared tabular in polished sections. In samples containing anorthite both with and without MgO, the single-crystal seeds exhibit basal facets with continuous liquid films and slow growth in the (0001) relative to all other crystallographic directions. When only MgO is added, the growth of the single-crystal seeds was not isotropic; however, no faceting was observed. The authors discuss how anisotropic growth rates caused by the anorthite additions can stimulate discontinuous grain growth in Al2O3.

710,798
PB88-111166 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Examination of Thin Films in the ZrO2-SiO2 System by Transmission Electron Microscopy and X-ray Diffraction Techniques.
Final rept.,
E. N. Farabaugh, A. Feldman, J. Sun, and Y. N. Sun. 1987, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Vacuum Science and Technology A 5, n4 p1671-1674 Jul/Aug 87.

Keywords: *Zirconium oxides, *Silicon dioxide, X ray diffraction, Surface roughness, Thin films, Microstructure, Reprints, Transmission electron microscopy.

The microstructure of thin films of ZrO2 and ZrO2-SiO2 formed by electron-beam coevaporation have been examined by x-ray diffraction and transmission electron microscopy. Results of these examinations suggest that films composed of 100% ZrO2 grow by the formation of tapered polycrystalline columns. Near the substrate the columns are of small diameter and contain a single crystalline phase, but at increasing distances from the substrate the column diameters increase and material with two crystalline phases occurs. Small additions of SiO2 to the film composition result in a smaller column diameter at a given distance from the substrate. Films with greater than 30% SiO2 by volume, which earlier had been shown to display an amorphous x-ray diffraction pattern, have been shown to display an amorphous electron diffraction pattern as well. The surfaces of the amorphous films are nearly featureless and are significantly smoother than the surfaces of 100% ZrO2 films.

710,799
PB88-121066 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Metastable Retention of a High-Pressure Phase of Zirconia.
Final rept.,
J. A. H. da Jornada, G. J. Piermarini, and S. Block. 1987, 3p
Pub. in Jnl. of the American Ceramic Society 70, n9 p628-630 1987.

Keywords: *Zirconium oxides, Metastable state, Nucleation, Reprints, Phase studies, High pressure.

A high-pressure phase of zirconia, stable above 3.3 GPa at room temperature, can be retained metastably, at ambient room conditions of pressure and temperature by appropriate thermal/pressure treatments. The amount of high-pressure phase retained depends on the thermal treatment, hydrostatic environment, and particle size of the starting powder. The results support the idea that the high-pressure transformation in zirconia is initiated at nucleation centers whose population can be minimized by appropriate thermal treatments. The results also point out the importance of high pressure as a source of controllable driving force to induce the transformation in zirconia, thus permitting the use of annealing treatments to change the population of defects involved in nucleating the transition.

710,800
PB88-141098 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Role of Surface Forces in Fracture.
Final rept.,
D. R. Clarke, B. R. Lawn, and D. H. Roach. 1986, 10p
Pub. in Proceedings of the International Symposium on Fracture Mechanics of Ceramics (4th), Blacksburg, VA., June 19-21, 1985, v8 p341-350 1986.

Keywords: *Ceramics, *Fractures(Materials), Cracking(Fracturing), Surfaces, Force, Crack propagation, Stresses, Reprints.

The role of surface forces in fracture is considered by specifically including the contribution of the surface forces acting between the walls of the crack in the overall force balance on a crack and then evaluating the net driving force. It is shown that attractive surface forces will lead to a threshold stress intensity below which a crack will heal. In addition, as surface forces modify the overall crack driving force they will affect the kinetics of slow crack growth. Of fundamental significance is that crack growth may provide an alternative experimental method for measuring surface forces.

710,801
PB88-141114 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Fracture Mechanisms in Lead Zirconate Titanate Ceramics.
Final rept.,
S. W. Freiman, L. Chuck, J. J. Mecholsky, D. L. Shelleman, and L. J. Storz. 1986, 11p
Pub. in Proceedings of the International Symposium on Fracture Mechanics of Ceramics (4th), Blacksburg, VA., June 19-21, 1985, p175-185 1986.

Keywords: *Fracture strength, Ferroelectric crystals, Microstructure, *Lead titanate zirconates, *Lead zirconate titanates.

Lead Zirconate Titanate (PZT) ceramics can be formed over a wide range of PbTiO2/PbZrO3 ratios and exist in a number of crystal structures. The study involved the use of various fracture mechanics techniques to determine critical fracture toughness, K(IC) as a function of composition, microstructure, temperature, and electrical and thermal history. The results of these experiments indicate that variations in K(IC) are related to phase transformations in the material as well as to other toughening mechanisms such as twinning and microcracking. In addition, the strength and fracture toughness of selected PZT ceramics were determined using specimens in which a crack was introduced by a Vicker's hardness indentor.

710,802
PB88-147632 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Effect of Microstructure on Reliability Predictions for Glass-Ceramics.
Final rept.,
R. F. Cook, S. W. Freiman, and T. L. Baker. 1986, 14p
Sponsored by Sandia National Labs., Albuquerque, NM.
Pub. in Materials Science and Engineering 77, p199-212 Jan 86.

Keywords: *Devitrified glass, Microstructure, Reliability, Indentation, Fracture properties, Crack propagation, Grain size, Reprints.

A study is made of the fracture properties of a range of three lithia-silica glass-ceramics with different grain sizes. Both equilibrium and kinetic crack-propagation parameters are evaluated using the controlled flaw indentation technique with a view to making reliability predictions. Fracture toughness in the well-behaved, large contact flaw range is found to increase with increasing grain-size. The results suggest that caution must be exercised when reliability predictions are made for materials showing the effects of crack/microstructure interaction, especially in extrapolations to low contact loads.

710,803
PB88-147640 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
High Temperature Mechanical Properties SiAlON Ceramic: Creep Characterization.
Final rept.,
C. F. Chen, and T. J. Chuang. 1987, 9p
Pub. in Ceramic Engineering and Science Proceedings 8, n7-8 p796-804 Jul/Aug 87.

Keywords: *Ceramics, *Mechanical properties, High temperature tests, Creep strength, Tension, Reprints, Sialon.

Creep resistance of an annealed Beta sub 10-7G SiAlON at 1170 deg C was characterized as a function of applied stress. By using a statistical least-square method to minimize the differences between predicted and measured creep rates, different power law creep parameters for simple tension and simple compression were obtained. The agreements between measured migration of neutral axes and theoretical predictions further confirm the estimated values.

710,804
PB88-152244 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Applications of Multiple Small Angle Neutron Scattering to Studies of Ceramic Processing.
Final rept.,
K. A. Hardman-Rhyne, K. G. Frase, and N. F. Berk. 1986, 3p
Pub. in Physica B and C 136, n1-3 p223-225 Jan/Feb 86.

Keywords: *Sintering, *Ceramics, *Processing, Neutron scattering, Porosity, Reprints.

The sintering process for ceramic materials including unfired compacted powder samples ('green' state ceramics) with 50% porosity can be studied non-destructively by small angle neutron scattering techniques. These volume fractions and pore sizes (-1.0 micrometer) are much larger than can be seen with traditional single particle diffraction techniques in small angle scattering. The authors have employed multiple scattering methods to elucidate microstructural information including pore size, size distribution, porosity, and surface areas.

710,805
PB88-152269 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Laser Induced Vaporization Mass Spectrometry of Refractories.
Final rept.,
D. W. Bonnell, P. K. Schenck, and J. W. Hastie. 1986, 2p
Pub. in AIP (American Institute of Physics) Conference Proceedings, n146 p728-729 1986.

Keywords: *Refractory materials, *Mass spectroscopy, Boron nitrides, Graphite, Vaporizing, Molecular beams, Temperature measurement, Reprints, *Laser heating, High temperature.

Many of the measurement problems inherent in the study of refractory materials at very high temperatures can be overcome with the use of lasers as heat sources. The paper reports the development of a Laser Induced Vaporization (LIV) system with very high speed pumping in the vaporization region, coupled to a mass spectrometer by multiple differential pumping regions to miminize sampling artifacts. The system can mass analyze the molecular beam which result from vaporization caused by laser energy absorption in refractory substrates. The technique is demonstrated here for the BN and graphite systems. Results include species identification for boron- and carbon-containing molecules, evidence for local thermodynamic equilibrium in the vaporization process and a comprehensive analysis of system temperatures.

710,806
PB88-152277 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Predictive Thermodynamic Model of Oxide and Halide Glass Phase-Equilibria.
Final rept.,
J. W. Hastie, and D. W. Bonnell. 1986, 8p
Pub. in Jnl. of Non-Crystalline Solids 84, n1-3 p151-158 1986.

Keywords: *Glass, Thermodynamics, Vapor pressure, Lithium oxides, Sodium oxides, Potassium oxides, Calcium oxides, Magnesium oxides, Aluminum oxide, Iron oxides, Silicon dioxide, Fused salts, Sodium bromide, Potassium bromide, Reprints, Molten salts, Lead bromides.

Basic information on the processing and performance of silicate, borate, and halide glass systems is relatively sparse, owing to the adverse experimental conditions of high temperature, chemical reactivity, and complex multiphase interactions. A thermodynamic model is described for the prediction of phase equilibria and vapor pressures for a wide variety of glass systems. Systems tested to date include mixtures of Li2O, Na2O, K2O, CaO, MgO, Al2O3, Fe2O3, and SiO2, in addition to molten salts. The model is based on the formation of actual, or hypothetical chemical complexes in the liquid and solid phases. As such, it is similar, though not identical, to the associate liquid model used successfully for alloys. The model and its thermodynamic data base have been validated by comparison with experimental activity data for well-characterized solid and liquid glass systems.

710,807
PB88-152285 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Ultrasonic Evaluation of Spray-Dried Ceramic Powders during Compaction.
Final rept.,
M. P. Jones, and G. V. Blessing. 1987, 9p
Pub. in Nondestructive Characterization of Materials 2, p139-147 1987.

Keywords: *Ceramics, *Powder(Particles), Nondestructive tests, Compacting, Ultrasonic tests, Reprints.

A new technique has been developed that enables ultrasonic wave speed measurements (shear and longitudinal) to be made on spray-dried ceramic powders while they are being compacted into shape. Ultrasonic velocity data is used together with independent density measurements to calculate the shear, bulk, and Young's moduli, and Poisson's ratio of the powders during their compaction. The goal of the study is to gauge the quality of the powder by its elasticity as measured during compaction. Spray-dried ceramic powders contain polymers that allow ceramic particles to flow more evenly during compaction than those without the polymers. The extent to which the polymer affects particle-particle contact will be studied.

710,808
PB88-152301 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Simulation of Microstructure Development during the Hydration of a Cement Compound.
Final rept.,
H. M. Jennings, and S. K. Johnson. 1986, 6p
Pub. in Jnl. of the American Ceramic Society 69, n11 p790-795 Nov 86.

Keywords: *Ceramics, *Calcium silicates, *Hydration, Cements, Microstructure, Computerized simulation, Reprints.

A mathematical model which simulates the development of microstructure during the hydration of tricalcium silicate (C35) is described. It is part of a program to develop a model which will quantitatively connect variables associated with different observable characteristics in cement-based systems, from the time of mixing onwards. It might also serve as a prototype for other materials which are formed through reaction bonding of powder compacts, including fired ceramics, chemically bonded ceramics, and products of powder metallurgy.

710,809
PB88-152319 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Aqueous Solubility Relationships for Two Types of Calcium Silicate Hydrate.
Final rept.,
H. Jennings. 1986, 5p
Pub. in Jnl. of the American Ceramic Society 69, n8 p614-618 Aug 86.

Keywords: *Calcium silicates, *Hydration, Ceramics, Lime cements, Equilibrium, Phase diagrams, Reprints.

There are many published values for the concentrations of lime and silica in the aqueous phase which is in contact with calcium silicate hydrate. These have been collected, carefully analysed, and found often to be apparently inconsistent. When, however, they are interpreted as having come from an aqueous phase which is in near equilibrium with one or another of two possible modifications of calcium silicate hydrate, almost all the data are rationalized. Some important insights emerge for the understanding of the complex processes which occur during the hydration of tricalcium silicate.

710,810
PB88-157706 PC **A05**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Institute for Materials Science and Engineering, Ceramics: Technical Activities 1987.
Nov 87, 86p NBSIR-87/3612
See also report for 1985, PB86-196771.

Keywords: *Ceramics, Physical properties, Performance, Glass, Chemistry, Processing, Stability, Superconductivity, Optical materials, Mechanical properties, Powder(Particles), Tribology.

Current programs of the Ceramics Division are reviewed. Among the significant accomplishments by the Division in 1987 are: The phase diagram for the superconducting YBaCuO system was determined and published. A diamond film deposition apparatus was constructed and successful deposition of diamond films demonstrated. A theoretical model of the role of surface forces in subcritical crack growth was developed. A time-resolved micro-Raman test system to analyze reactions at tribological contacts was developed. The interrelationships between processing, microstructure, and properties of superconducting YBaCuO were determined. A novel technique for measurement of sintering stress in ceramics was invented. Low temperature 'sintering' through the application of high pressure was demonstrated, with the potential for enhanced toughness through pressure induced phase transformation. As part of the International Energy Agency (IEA) international powder characterization round-robin, 2000 silicon nitride reference powder samples were prepared, certified and distributed. Standard Reference Material 6406, silicon powder, was certified for calibration of x-ray line positions in x-ray powder diffraction. Techniques to predict the effect of filaments on crack growth retardation in ceramic matrix components were developed. The first data on the fracture behavior of superconducting ceramics as a function of sintering and annealing conditions were obtained. Volume 6 of Phase Diagrams for Ceramics was completed.

Coatings, Colorants, & Finishes

710,811
PATENT-4 233 107 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultra-Black Coating Due to Surface Morphology.
Patent.
C. E. Johnson. Filed 20 Apr 79, patented 11 Nov 80, 6p PB80-600032, PAT-APPL-6-031 706

Keywords: *Etchant bath, Light absorption, Microscopic pores, Nickel-phosphorus alloy, Solar collector, Surface morphology, Ultra-black surface coating.

The invention provides a method of producing an ultra-black surface coating, having an extremely high light absorption capacity, on a substrate, such as a metal, ceramic, glass, or plastic, the blackness being associated with a unique surface morphology consisting of a dense array of microscopic pores etched into the surface, as well as the resulting coated substrate. The method involves preparing the substrate for plating with a nickel-phosphorus alloy, as by cleaning and/or activating it, immersing the thus-prepared substrate in an electroless plating bath containing nickel and hypophosphite ions in solution until an electroless nickel-phosphorus alloy coating has been deposited on the substrate, and then removing the substrate, coated with the electroless nickel-phosphorus alloy, from the plating bath and washing and drying it. The dried substrate, coated with the electroless nickel-phosphorus alloy, is then immersed in an etchant bath consisting of an aqueous solution of nitric acid, wherein the nitric acid concentration ranges from a 1:5 ratio with distilled or de-ionized water to concentrated, until the coated surface of the substrate develops ultra-blackness, the blackness being associated with the surface morphology as described above. The resulting substrate, covered with the ultra-black coating is thereafter washed and dried. The ultra-black surface, which has a spectral reflectance on the order of about from 0.5 to 1.0% at wavelengths of light of about from 320 to 2140 nanometers, finds use as a solar collector in the field of solar energy.

710,812
PATENT-4 361 630 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Ultra-Black Coating Due to Surface Morphology.
Patent.
C. E. Johnson. Filed 18 Aug 81, patented 30 Nov 82, 7p PB82-600040, PAT-APPL-6-293 783

Keywords: *Electroless nickel plating, Nickel-phosphorus alloy, Ultra-black coating.

The invention provides a method of producing an ultra-black surface coating, having an extremely high light absorption capacity, on a substrate, such as a metal, ceramic, glass, or plastic, the blackness being associated with a unique surface morphology consisting of a dense array of microscopic pores etched into the surface, as well as the resulting coated substrate. The ultra-black surface, which has a spectral reflectance on the order of about from 0.5 to 1.0% at wavelengths of light of about from 320 to 2140 nanometers, finds use as a solar collector in the field of solar energy.

710,813
PB-275 159/2 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Applied Technology.
Graffiti-Resistant Coatings: Methods of Test and Preliminary Selection Criteria.
Final rept.,
M. Godette, M. Post, and P. G. Campbell. Nov 75, 41p NBSIR-75-789
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Energy, Building Technology, and Standards Div.

Keywords: *Protective coatings, *Buildings, *Cleaning, Construction materials, Performance evaluation, Bricks, Tiles, Markers, Spray painting, Criteria, *Vandalism.

The 'graffiti problem,' removal of common markings from building materials, exists in public, private, commercial and industrial buildings. Substantial savings could be made by the Department of Housing and Urban Development (HUD) if the exposed surfaces in public housing resisted defacement by graffiti. Therefore, HUD initiated a program to identify and evaluate coatings which resist defacement by marking devices. From preliminary test of 48 commercially-available coatings, 19 were selected for more detailed tests. The 19 coatings were evaluated for ability to release common markings and to resist ultraviolet radiation, high humidity, condensing moisture, abrasion and graffiti removers. The flexibility and water vapor permeance of the coatings were also determined. The substrates used were clay brick and a matte tile. Seven of the coatings were highly resistant to defacement by spray paint, and five were highly resistant to felt-tip pen, crayon and lipstick.

710,814
PB-275 452/1 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Electronic Technology Div.
Experimental Investigation of Means for Reducing the Response of Pressure Transducers to Thermal Transients.
Final rept.,
J. S. Hilten, C. F. Vezzetti, J. F. Mayo-Wells, and P. S. Lederer. Jan 78, 66p NBS-TN-961
Sponsored in part by Naval Air Systems Command, Washington, D.C. and Range Commanders Council, Albuquerque, N. Mex. Transducer Committee.

Keywords: *Pressure sensors, Protective coatings, Transient radiation effects, Reduction, Response, Thermal radiation.

Experimental efforts are described in the evaluation of protective diaphragm coatings as a means to reduce the effects produced by thermal radiant-energy transients on pressure-transducer response. A series of tests was carried out to investigate the effects of a variety of protective coatings on the amount and rate of thermal energy transmission through thin metal disks (used to simulate transducer diaphragms) as revealed by measurements of the disk back-side temperature. The temperature histories of both bare and protected disks were measured with thermocouples during and after exposure of the disks to thermal radiant-energy transients (of approximately 20mJ/sq mm at the disk) generated by No. 22 photographic flashbulbs. Protective coatings investigated include various tapes, greases, and room-temperature-vulcanizing rubbers (RTVs). Based on the results from these tests, the effectiveness of nine selected coatings in reducing thermally-induced zero shifts of four types of pressure transducers was investigated.

710,815
PB-278 935/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Anti-Graffiti Coatings.
Final rept.,
M. A. Post, M. Godette, and P. G. Campbell. Feb 78, 8p
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Energy, Building Technology, and Standards Div.
Pub. in Mod Paint Coat. 68, n2 p28-35 Feb 78.

Keywords: *Protective coatings, Cleaning, Performance evaluation, Buildings, Reprints, Graffiti.

Commercially available graffiti-resistant coatings were screened using a graffiti cleanability test. The most easily cleaned coatings were then subjected to additional graffiti removal tests and to other tests designed to measure performance characteristics. Differences in performance characteristics were tabulated. The test results formed the basis for proposed performance criteria for graffiti-resistant coatings. The results show that organic coatings are available which can be used to protect building substrates against defacement by graffiti.

710,816
PB-285 143/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Performance of Industrial-Type Cladding Materials.
Final rept.,
G. A. Sleater. 1977, 7p
Sponsored in part by Naval Facilities Engineering Command, Washington, D.C., Directorate of Civil Engineering (Air Force), Washington, D.C., and Office of the Chief of Engineers (Army), Washington, D.C.
Pub. in Proceedings RILEM/ASTM/CIB Symp. on Evaluation of Performance of External Vertical Surfaces of Buildings, Otaniemi, Espoo, Finland, Aug 28-Sep 2, 1977, v2 p302-308 (Technical Research Centre of Finland, Helsinki, Finland 1977).

Keywords: *Cladding, *Design criteria, Laboratory tests, Weathering, Abrasion, Impact tests, Color, Moisture, Salt spray tests, Field tests.

The development of performance criteria for the selection of industrial cladding materials is described. These criteria are based upon: (1) laboratory testing of commercial cladding materials, to determine limits of acceptable performance; (2) natural weathering exposure at NBS Exposure Stations, to study weathering effects; (3) field inspection of structures using industrial cladding, to obtain information about cladding durability under use. The performance criteria cover abrasion resistance, impact resistance, color and gloss changes, salt spray resistance, and moisture resistance.

710,817
PB-285 394/3 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Nontoxic Yellow Traffic Striping.
Final rept.
P. G. Campbell, and M. A. Post. Jan 78, 74p FHWA/RD-78-1

Keywords: *Paints, *Pigments, Vehicular traffic control, Substitutes, Colors, Markers, Formulations, Rubber coatings, Alkyd resins, Toxicity, *Traffic lane markings, Lead chromates.

A study was carried out to examine the performance characteristics of alternative pigments which might be used in yellow traffic paints if the use of lead chromate were curtailed. Thirty-six yellow traffic paints were prepared using lead chromate and alternative pigments as the yellow color source. Screening tests were used to evaluate the initial color stability and durability characteristics of the paint formulations. The thermal stabilities of selected yellow pigments for use in thermoplastic marking applications were evaluated. Also, outdoor exposures and a small scale field test were used to evaluate the performance of formulations containing lead chromate and alternative pigments. The performance of the alternative organic yellow pigments, as measured by color change under the various exposure conditions, was found to be at least as good as that of lead chromate.

710,818
PB-291 769/8 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Economics and Regulatory Technology Div.
Guidelines for Cost-Effective Lead Paint Abatement.
R. E. Chapman, and J. G. Kowalski. Jan 79, 93p NBS-TN-971
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Assistant Secretary for Policy Development and Research.

Keywords: *Lead(Metal), *Paints, *Cost analysis, *Guidelines, Abatement, Buildings, Mathematical models, Construction materials, *Lead paint poisoning, Boston(Massachusetts).

Public and private concern about the potential for lead poisoning in children due to the ingestion of lead-based paint chips has resulted in a Federally sponsored program to develop technologies by which the lead-based paint hazard may be eliminated from the nation's housing. Through this program lead-based paint abatement techniques were tested in field deleading operations conducted in Boston, Massachusetts. The major focus of the program was on the collection of data on the direct costs of labor, materials and special equipment associated with these abatement techniques. Data were also collected on contractors' bids so that markup ratios could be calculated. This report provides an overview of the statistical analysis of these direct cost data by abatement technique and building component (i.e., walls, doors and frames, windows and frames, and miscellaneous trim). An overview of the statistical analysis of the markup ratio is also included. Cost models are developed for each abatement technique which identify the key factors which affect direct cost and markup. Guidelines are given so that these models can be used by municipal officials and building owners to estimate deleading costs as well as provide input to policy evaluation and formulation.

710,819
PB-293 375-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Galvano-Thermal Production of Protective Copper-Nickel Alloys Coatings. (Gal'vanotermicheskoe Poluchenie Zashchitnekh Pokretii Mednonikelevemi Splavami).
P. P. Belyaev, and A. A. Sladkov. 1974, 17p DMDC-13667, TT-74-53230
Trans. of Vestnik Mashinostroeniya (USSR) v16 n9 p93-98 1936. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Protective coatings, Metal coatings, Diffusion coatings, Copper alloys, Nickel alloys, Electrodeposition, Iron alloys, Heat treatment, USSR, Translations.

This is an early paper on the formation of a protective coating of Cu-Ni alloy on ferrous-base materials. The Cu-Ni alloy was electrolytically deposited on a workpiece and followed by a high temperature (500 to 800C) heat treatment to cause interdiffusion between the metals. Good bonding was achieved and a core material with good mechanical properties and a corrosion-resistant surface was manufactured.

710,820
PB-298 841/8 PC **A99**/MF **A01**
Environmental Protection Agency, Washington, DC. Office of Toxic Substances.
Proceedings of the Workshop on Alternatives for Cadmium Electroplating in Metal Finishing Held at National Bureau of Standards, Gaithersburg, Maryland on October 4-6, 1977.
E. Dage, E. Dyckman, W. Isler, and F. Ogburn. Mar 79, 634p EPA/560/2-79/003
Sponsored in part by Consumer Product Safety Commission, Washington, DC., Department of Commerce, Washington, DC., Department of Defense, Washington, DC., and Department of Health, Education, and Welfare, Washington, DC.

Keywords: *Metal finishing, *Meetings, Electroplating, Substitutes, Plating, Cadmium, Zinc, Tin, Aluminum, Water pollution control, Waste treatment, Protective coatings.

The publication compiles the proceedings of the Workshop on Alternatives for Cadmium Electroplating in Metal Finishing held October 4-6, 1977 which was jointly sponsored by seven Federal agencies. The workshop was prompted by the concerns of government agencies for the potential environmental damage

resulting from current cadmium electroplating practices and the high rate of government use of electrodeposited cadmium. The workshop examined techniques and alternatives to minimize the environmental losses of cadmium from electroplating by (a) applying cadmium by mechanisms that reduce the loss of cadmium during plating and (b) developing suitable and cost-effective alternative materials, methods, and coatings. The workshop included presentations on the Federal and industrial concerns for the commercial significance, environmental effects, and health effects of cadmium. Panel discussions reviewed the topics 'Are specifications and standards barriers to change' and 'How essential is electrodeposited cadmium'.

710,821
PB81-126203 Not available NTIS
National Bureau of Standards, Washington, DC.
Thin Zinc Films on Aluminum.
D. Lashmore. Mar 80, 6p
Sponsored in part by Aluminum Association, Washington, DC.
Pub. in Jnl. Electrochem. Soc. 127, n3 p573-578 Mar 80.

Keywords: *Metal films, *Zinc coatings, Plating, Aluminum, Thin films, Substrates, Reprints.

The deposition of thin zinc films on aluminum substrates was investigated by transmission electron microscopy and by electron diffraction.

710,822
PB81-129157 Not available NTIS
National Bureau of Standards, Washington, DC.
Qualitative Ellipsometric-Electrochemical Approach to the Study of Film Growth Under Organic Coatings,
J. J. Ritter, and J. Kruger. 1980, 11p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Surface Science 96, p364-374 1980.

Keywords: *Protective coatings, *Metal coatings, *Polarimetry, Organic compounds, Paints, Corrosion inhibitors, Chromates, Additives, pH, Feasibility, Reprints.

A feasibility study was made to determine if qualitative ellipsometry can be used together with electrochemical pH and potential measurements as a technique for the study of metal substrates protected by transparent organic coatings. The objective of the work was to gain a deeper understanding of the mechanisms governing the corrosion protective actions of paints on metal surfaces. Computer modeling and experiments with transparent coatings on inert substrates indicated that changes in the ellipsometric parameter delta could, for the most part, be safely interpreted as thickness alterations in the substrate oxide film. Experiments with the Fe-collodion system in dilute chloride solutions exhibited three sequential stages of activity, two of which could be interpreted in terms of corrosion mechanisms using the optical and electrochemical measurements. The effect of CrO4(-2) as a corrosion inhibitor in coatings was studied using this technique. The presence of the CrO4(-2) was shown to have a profound effect upon the development of the sub-coating processes.

710,823
PB81-134629 Not available NTIS
National Bureau of Standards, Washington, DC.
Thickness of Gold Coating Measured with a Calibrated SEM (Scanning Electron Microscope).
F. Ogburn, and D. Ballard. Apr 80, 5p
Pub. in Plating and Surface Finishing 67, n4 p49-53 Apr 80.

Keywords: *Gold coatings, *Dimensional measurement, Thickness, Electron microscopy, Reprints.

The thickness of gold coatings can be measured in a metallographic cross section by examination with a scanning electron microscope (SEM). The SEM magnification is calibrated with a stage micrometer scale and measurements made on conventional photomicrographs or, for improved accuracy, measurements are made on photos of the SEM video waveform signal.

710,824
PB81-138752 Not available NTIS
National Bureau of Standards, Washington, DC.
Immersion Coatings on Aluminum.
D. Lashmore. Jan 80, 6p
Prepared in cooperation with Aluminum Association, Washington, DC., and American Electroplaters Society.
Pub. in Plating Surf. Finish. 67, pt1 p37-42 Jan 80.

Keywords: *Zinc coatings, *Tin coatings, *Electrodeposited coatings, Aluminum, Aluminum alloys, Morphology, Reprints.

No abstract available.

710,825
PB81-144206 Not available NTIS
National Bureau of Standards, Washington, DC.
Preparation of Calibration Standards for Coating Thickness Instruments.
F. Ogburn. 1978, 9p
Pub. in Proceedings of American Electroplaters Society Symposium on Thickness Testing of Surface Finishing (1st), New York, NY., February 28-March 1, 1978, p1-9.

Keywords: *Thickness gages, *Calibrating, *Standards, Coatings, Electrodeposited coatings, Electroplating.

Coating thickness gages can be calibrated with specimens having adherent coatings of known thickness, with foils, or with synthetic standards. To prepare calibration standards with adherent coatings, the coatings must be plated with uniform thickness distribution. This requires a cell geometry providing a uniform primary current distribution and careful control of solution agitation, current efficiency, and polarization.

710,826
PB82-123969 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Short-Term Evaluation Procedures for Coatings on Structural Steel.
Final rept.
P. G. Campbell, J. W. Martin, and M. E. McKnight. Sep 81, 46p NBS-TN-1149
Sponsored in part by Federal Highway Administration, Washington, DC.

Keywords: *Protective coatings, Structural steels, Evaluation, Accelerated tests.

The objectives of the study are to review existing short-term test procedures for selecting coatings, and to discuss analytical measurement techniques for characterizing coating systems and for monitoring coating degradation. In assessing current accelerated aging testing procedures several deficiencies became apparent. These included the reported lack of reproducibility in the rankings for different iterations of the same short-term test and the lack of correlatability between the rankings of short-term laboratory and long-term outdoor exposure tests.

710,827
PB82-177049 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Paint Solubility Testing.
J. I. Thornton, S. Kraus, B. Lerner, and B. Hendrickson. Jan 82, 24p NBS-SP-480-40
Sponsored in part by National Inst. of Justice, Washington, DC. Prepared in cooperation with California Univ., Berkeley. Dept. of Biomedical and Environmental Health Sciences. Library of Congress Catalog card no. 81-600176.

Keywords: *Paints, *Solubility, Tests, Law enforcement, Technology.

This report presents the results of a study to develop criteria for the characterization of paint through solubility testing. Experiments were conducted with common solvents to classify chemical reactivity with automobile and household paints. Seven categories of reactivity are defined, which form the basis for specifying the extent of solubility of paints in various reagents under controlled conditions of time and temperature. The report also describes a novel solubility test procedure by which acrylic lacquers, organic-dispersed enamels, and water-based enamels can be distinguished through sequential testing, a characterization not previously accomplished with solubility testing.

710,828
PB82-210162 Not available NTIS
National Bureau of Standards, Washington, DC.
Dissolution of Passive Films on Iron in Nearly Neutral Solutions.
Final rept.
J. Kruger. 1981, 11p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in in Corrosion and Corrosion Prot. 81-8, p66-76 1981.

Keywords: *Protective coatings, *Iron, Oxidation, Polarimetry, Corrosion.

A description is given of a study of the dissolution of passive films formed by potentiostatic anodic oxidation of iron in sodium borate-boric acid solutions. Using an ellipsometric-potentiostatic technique, four different potential regions were identified where different dissolution behavior could be observed. Two different dissolution modes were found at potentials in the passive region; one dissolution mode at potentials at or slightly below the Flade potential, and one mode at potentials where cathodic reduction becomes possible.

710,829
PB82-212036 Not available NTIS
National Bureau of Standards, Washington, DC.
Feasibility Study of High-Temperature Liquid Crystals in Wall-Coated Open-Tubular Columns.
Final rept.
W. L. Zielinski, R. A. Scanlon, and M. M. Miller. 1981, 4p
Pub. in Jnl. of Chromatography 209, p87-90 1981.

Keywords: *Liquid crystals, *Coatings, Feasibility, High temperature tests, Columns(Process engineering), Gas chromatography, Laboratory equipment, Reprints, Toludine/N-N-bis(butoxy-benzylidene)-bi.

High-temperature liquid crystals (mesophase transitions > 150C) were used as wall coating substrates in wall-coated open-tubular gas chromatographic columns. N,N-Bis(p-n-butoxy-benzylidene) alpha, alpha - bi-p-toludine (BBBT) liquid crystal was selected for this study due to its ready solubility in chloroform for preparation of coating solutions, and its desirable temperature transitions. The separation characteristics of the wall-coated BBBT wide-bore open tubular columns for 3-4-, and 5-ring polycyclic aromatic hydrocarbons are consistent with earlier findings for these isomers on packed gas chromatographic columns.

710,830
PB82-235078 Not available NTIS
National Bureau of Standards, Washington, DC.
Salt Spray Testing for Short-Term Evaluation of Coatings. Part 1: Reaction of Coatings in Salt Spray.
Final rept.
B. R. Appleman, and P. G. Campbell. Mar 82, 9p
Sponsored in part by Federal Highway Administration, Washington, DC. Office of Research and Development.
Pub. in Jnl. Coatings Technol. 54 n686 p17-25 Mar 82.

Keywords: *Coatings, *Salt spray tests, Steels, Reprints.

Various aspects of short-term testing of coatings for steel are examined, with particular emphasis on the salt spray test. The salt spray test is the most widely used and the most widely criticized of the accelerated test methods. The salt spray test continuously exposes a coating to a neutral salt solution at an elevated temperature. The test excludes ultraviolet light and atmospheric pollutants. The chemical and physical consequences of this artificial environment are reviewed. The coating's ability to protect against corrosion is examined in light of the principal mechanisms (i.e., barrier, inhibitive, sacrificial). In addition, the observed and expected effects of salt spray are discussed for specific coating binder types including oil and alkyd systems, vinyls and other thermoplastic polymers, catalyzed epoxies, latexes, and zinc-rich primers.

710,831
PB82-250010 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of a Test Apparatus and Method for Measuring Adhesion of Protective Coatings.
J. F. Seiler, M. E. McKnight, and L. W. Masters. Jul 82, 40p NBSIR-82-2535
Prepared in cooperation with Tri-Services Building Materials Investigation Program Committee.

Keywords: *Protective coatings, *Tests, Test equipment, Measurement, Adhesion, Pneumatic equipment.

A pneumatic test apparatus and associated test method for measuring the adhesion of coatings have been developed with particular emphasis on: (1) overcoming some of the shortcomings of existing tests; and (2) providing a method which can provide quantitative information for both laboratory and field applications. The test apparatus utilizes compressed air to lift a stainless steel loading fixture (button) which is bonded with an adhesive to the surface of the protective coating. The rate at which the loading fixture is loaded is controlled by a precision air pressure gauge and the tensile force required to lift the button from one coating is measured. Assuming the level of adhesion of the adhesive to the coating is greater than that of the coating to the substrate, the tensile force provides a measure of the coating adhesion. Laboratory studies with two coating materials have been performed to assess the method. This report describes the test apparatus and associated test method and presents test data obtained to date, proposed modifications to the initial test apparatus design, and additional research needs. An Instruction Manual for use of the test apparatus is included in the Appendix.

710,832
PB82-252024 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of Interim Performance Criteria for Restoration Coatings for Porcelain Enamel Surfaces.
J. F. Seiler, and P. G. Campbell. Jul 82, 54p NBSIR-82-2553
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Porcelain enamels, *Surface finishing, *Renovating, Criteria, Coatings.

A study was performed to develop interim performance criteria for restoration coatings for porcelain enamel surfaces. The laboratory study consisted of evaluating five restoration coatings which had been applied to porcelain enamel test panels with various surface conditions. Performance characteristics of the coatings examined included appearance, adhesion, impact resistance, stain resistance and fungal resistance. Existing test methods were used in the study if appropriate methods were available. However, the laboratory studies led to the development of a new cyclic exposure test and the use of a newly developed method for measuring adhesion. Adhesion of the coatings was the performance characteristic most sensitive to change with time of exposure to the newly developed cyclic exposure test. Interim performance criteria for restoration coatings for porcelain enamel surfaces were developed, based upon the results of the laboratory study. Additional studies are being conducted to assess the performance and durability of selected restoration coatings applied to bath tubs in public housing units. Since the field studies are not yet completed, they are not addressed in this report.

710,833
PB82-264367 Not available NTIS
National Bureau of Standards, Washington, DC.
Dry Sliding Wear Studies of Nickel-Phosphorus and Chromium Coatings on 0-2 Tool Steel.
Final rept.
A. W. Ruff, and D. S. Lashmore. 1982, 23p
Pub. in American Society for Testing and Materials Special Technical Publication 769, p134-156 1982.

Keywords: *Metal coatings, *Wear, Chromium coatings, Nickel alloys, Phosphorus containing alloys, Electrodeposited coatings, Tool steels, Wear tests, Reprints, Amorphous materials.

An investigation of the dry sliding wear behavior of electrodeposited nickel-phosphorous and chromium coatings on 0-2 tool steel has been carried out. Wear and friction measurements were made on the materials in an argon atmosphere under dry sliding conditions at 0.2 m/s sliding speed and a load of 10N. Among the materials studied, significant differences in wear rates were found which depended upon the nature of the coating. This work has determined the wear rates and has examined factors involved in the wear process for nickel alloy and chromium coatings produced using electroless, direct current and pulsed current plating techniques.

710,834
PB83-115550 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Mathematical Models for the Corrosion Protective Performance of Organic Coatings.
Technical note (Final).
J. M. Pommersheim, P. G. Campbell, and M. E. McKnight. Sep 82, 102p NBS-TN-1150
Prepared in cooperatrion with Bucknell Univ., Lewisburg, PA.

Keywords: *Mathematical models, *Corrosion prevention, *Protective coatings, Performance evaluation, Organic compounds, Polymers, Water, Oxygen.

Mathematical models were developed for conceptual models describing the principal phenomena that occur in the corrosion performance of polymeric coatings. These include models for water and oxygen permeability through organic coatings, models for the growth of blisters beneath coatings, and preliminary models for the polarization occurring at the electrode surfaces. Results predicted by the models are discussed in terms of the improvement of the protective function of the membrane.

710,835
PB83-252387 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Relationships between Mechanical Properties and Performance of Inks as the Basis for Quality Control Techniques.
Rept. for 1 Oct 81-30 Sep 82.
D. L. Hunston. Jul 83, 57p NBSIR-83-2691
Sponsored in part by Bureau of Engraving and Printing, Washington, DC.

Keywords: *Inks, *Mechanical properties, *Performance evaluation, *Quality control, Curing, Rheology, Viscosity, Printing, Shear rate.

Three different intaglio ink formulations have been examined to determine their mechanical properties. In all cases the properties share a strong shear rate and time dependence. In addition, the behaviors of the different formulations vary substantially at intermediate shear rates but are similar at the very high and very low shear rates that are seen on the printing press. Consequently, the shear behavior has importance for ink fabrication but does not explain the differences in printing performance that are seen for these formulations. The ink samples were then examined for the changes in mechanical properties that occur during drying (curing). Distinct differences in curing behavior are observed for the various formulations and it was determined that these differences can influence performance. It was also found that direct exposure to air (oxygen) will produce curing. The major implications of these results in terms of fabrication, quality control, and printing procedures are discussed.

710,836
PB84-141787 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Performance Criteria for Restoration Coatings for Porcelain Enamel Surfaces.
J. F. Seiler, and P. G. Campbell. Sep 83, 35p NBSIR-83-2781
See also PB82-252024. Sponsored in part by Department of Housing and Urban Development, Washington, DC. Div. of Energy, Building Technology and Standards.

Keywords: *Protective coatings, *Renovating, *Enamels, *Organic coatings, Field tests, Performance evaluation, Surfaces, Assessments.

In June 1982, the results of a laboratory-based study to develop interim performance criteria for restoration coatings for porcelain enamel surfaces were reported in NBSIR 82-2553, 'Development of Interim Performance Criteria for Restoration Coatings for Porcelain Enamel Surfaces'. Additional studies, consisting of a one-year field test of three of the five restoration coatings studied in the laboratory, were performed to assess the effectiveness of the interim performance criteria. The field test included periodic evaluation of the three restoration coatings applied to a total of nine bathtubs in public housing units in Alexandria, Virginia. The results of the field test were compared to the previous laboratory results and showed that the interim performance criteria were effective in selecting durable restoration coatings. This report presents the findings of the field test and includes the final performance criteria.

710,837
PB84-148758 PC **A03**/MF **A01**
Porcelain Enamel Inst., Inc., Washington, DC.
Adherence of Porcelain Enamel to Aluminum.
Building science series (Final).
M. A. Baker. Nov 74, 48p NBS-BSS-59
Library of Congress catalog card no. 74-23734.

Keywords: *Porcelain enamels, Aluminum, Adhesion, Aluminum alloy 6063.

Light and electron microscopy, electron microprobe, and X-ray diffraction techniques were used to determine the mechanisms of adherence of porcelain enamel to aluminum. A theory is presented that adherence depends upon diffusion of aluminum into the enamel and further, the diffusion zone should be relatively free of reaction products for the enamel-metal system to retain good adherence after exposure to chemical solutions or to weathering. Round-robin testing of 6063 aluminum alloy extrusions indicated that this alloy can be enameled if care is exercised in the selection of the enamel and the pretreatment.

710,838
PB84-153360 Not available NTIS
National Bureau of Standards, Washington, DC.
Cure of Intaglio Printing Inks.
Final rept.
D. L. Hunston, J. L. Rushford, W. R. Newitt, and B. A. Vaudreuil. 1983, 18p
Sponsored in part by Bureau of Engraving and Printing, Washington, DC. Research Div.
Pub. in Chemorheology of Thermosetting Polymers, Chapter 10, p149-167 1983.

Keywords: *Printing inks, *Rheology, Viscosity, Performance evaluation, Elasticity, Crosslinking, Drying, Reprints.

The intaglio inks used to print currency in the United States contain relatively little solvent and dry primarily by chain extension and cross-linking reactions in the vehicles. To obtain good performance, the initially fluid inks must change rheologically in the manner required to give proper transfer to the plate and then to the paper and to obtain sufficient hardness at the end of the process so that the printed sheets do not smear when stacked. To study these changes, the rheology of two ink formulations with very different press performances were examined, first in the uncured state and then during curing. The uncurred inks exhibited complex rheological properties including time dependence, yield behavior, elasticity, and non-linearity. Curing of the inks produced an increase in both viscosity and elasticity. The viscosity change could be roughly modelled with a first order type equation. Comparisons between these results and the performance of the inks on the press show that if the rate at which properties change during cure falls outside a certain range, acceptable print quality cannot be achieved.

710,839
PB84-203447 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Second-Surface Mirror Standards of Spectral Specular Reflectance (SRM's (Standard Reference Materials) 2023, 2024, 2025).
Special pub. (Final).
J. C. Richmond, J. J. Hsia, V. R. Weidner, and D. B. Wilmering. Oct 82, 45p NBS/SP-260-79
Also available from Supt. of Docs as SN003-003-02447-3. Library of Congress catalog card no. 82-600615. Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Optical materials, *Mirrors, *Aluminum, Vacuum deposited coatings, Solar energy, Optical reflectometers, Calibration, Specular reflection, Standards, Concentrating mirrors, Reflectance.

NBS was requested by the Department of Energy to prepare, calibrate and disseminate standards of spectral specular reflectance for use in calibrating reflectometers used to evaluate the solar specular reflectance of concentrating mirrors used in solar energy systems. The mirror chosen was a second-surface mirror of vacuum-deposited aluminum on optically polished vitreous quartz backed up with a second plate of ground and polished vitreous quartz cemented to the back of the mirror. Standards were prepared in two sizes, 51 x 51 mm, and 25 x 101 mm. The cost of developing and

calibrating the standards was included in a contract issued by the Solar Energy Research Institute of Golden, Colorado, which is financed by the Department of Energy.

710,840
PB85-104685 Not available NTIS
National Bureau of Standards, Washington, DC.
Pulsed Electrodeposition of Nickel Phosphorus Metallic Glass Alloys.
Final rept.
D. S. Lashmore, and J. Weinroth. 1982, 5p
Pub. in Plating and Surface Finishing 69, n8 p72-76 Aug 82.

Keywords: *Wear resistance, *Nickel coatings, *Plating, *Nuclear magnetic resonance, Electron microscopy, Alloys, *Nickel phosphorus, *Metallic glass.

It is shown, by using bright field and dark field electron microscopy, in combination with nuclear magnetic resonance techniques, that pulsed electrodeposited nickel phosphorus alloys are not only metallic glasses but that they also exhibit at least two distinct amorphous structures (configurations) which depend on the deposition parameters. Alloys with a phosphorus content up to 41 atomic percent phosphorus have been produced, and their corresponding microhardness values depend on the deposition conditions and can be higher than 750 VHN(50) as deposited. Dry sliding wear measurements reveal a wear rate for these alloys comparable to hard chromium. Following a heat treatment of 400 C for 30 minutes, the wear rate for the nickel phosphorus alloys is found to be an order of magnitude lower than that found for hard chromium measured under identical conditions. Distinct differences between direct and pulsed processes revealed themselves in the NMR data, the wear data, and the microhardness data.

710,841
PB85-142784 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optical-Properties of Black Chrome - A Model for Predicting the Effect of Exposure to Elevated Temperature.
Final rept.
S. T. Wu, and L. W. Masters. 1982, 5p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Coatings Technology 54, n691 p41-45 1982.

Keywords: Optical properties, Reprints, *Black chrome.

The paper summarizes the first phase of research to help meet the need for predictive models. The scope of this initial phase of research was to develop a model on predicting the effects of elevated temperature on the optical properties of black chrome. Oven aging tests were performed in the laboratory at temperatures of 150C, 200C, and 250C. The permanent change in optical properties was found to reach a maximum within only a few days after initiation of the exposure. The nature of the change in reflectance spectra was found to be a horizontal shift along the wavelength axis. The model was developed based on these findings. Reasonable numerical fits were made by applying the model to the test data.

710,842
PB85-144038 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Plating Standards and Specifications.
Final rept.
F. Ogburn, and E. T. Clegg. 1984, 22p
Pub. in Electroplating Engineering Handbook 4, p263-284 1984.

Keywords: *Electrodeposited coatings, *Metal coatings, Standards, Specifications, Electroplating, Reprints.

The electrodeposited coating standards of the ISO, ASTM, SAE, and U.S. Government are discussed in some detail. The requirements of the specifications are reviewed and the coating thickness requirements are tabulated.

710,843
PB85-151686 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Strategy for Selection of Tribological Coatings.
Final rept.
M. B. Peterson, and A. W. Ruff. 1984, 10p
Pub. in Proceedings of Meeting of the Mechanical Failures Group (37th), Gaithersburg, MD., May 10-12, 1983, p138-147 1984.

Keywords: *Coatings, Selection, Friction, Wear, Lubrication, *Tribology.

A strategy for the selection of a tribological coating is proposed. The important factor to consider is the tribological function of the coating. The most important functions are reduction of various modes of wear, retention of lubricant in the contact area, increase of lubricant load capacity, replacement or rebuilding of contact surfaces, and modification of the coefficient of friction. Once the required function needed in an application has been defined it is then possible to select compositions and properties which will accentuate each function. Specific laboratory tests can also be performed which rank the coatings as to their ability to perform each function. Examples are given here for important tribological functions. Over the past 10 years many new developments have been made in metallic coatings to improve their utilization for tribological purposes. These include composite and alloy coatings, new application techniques, simple cost effective application techniques, and precise composition and microstructure control. Examples are given here of advances in some of these areas.

710,844
PB85-172468 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radiation Curing of Coatings.
Final rept.
G. A. Senich, and R. E. Florin. 1984, 86p
Pub. in Jnl. of Macromolecular Science C24, n2 p239-324 1984.

Keywords: *Coatings, *Curing, *Radiation effects, Industrial plants, Polymerization, Thermosetting resins, Plastics, Reprints.

The science and technology of curing organic materials with radiation is reviewed. Electron beam, ultraviolet, infrared, microwave, and high frequency radiation sources and the resin systems suitable for use with these sources are considered. Equipment necessary to affect a radiation cure is discussed and some practical problems unique to each radiation method are indicated. The application of radiation curing to industrial processes which employ inks and coatings is covered, with particular emphasis given to printing with radiation curable formulations. Included are discussions of the advantages and disadvantages of radiation curing inks, some typical ink components and formulations, the specialized machinery required, and the influence of parameters unique to radiation curing methods on the printing process. Other nonprinting but related industrial operations utilizing radiations for treating thin films and coatings are also considered. Some costs, examples, and market statistics are given for these commercial procedures. New nonconventional, but also nonradiation, alternative curing methods are discussed briefly. A bibliography of recommended further reading and a list of over two hundred fifty references are included.

710,845
PB85-196962 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Method for Preparing Cross-Sections of Films on Wear Surfaces for Transmission Electron Microscopy Study.
Final rept.
L. K. Ives. 1983, 6p
Pub. in Wear 86, n1 p151-156, 1 Apr 83.

Keywords: *Protective coatings, Wear, Metal films, Coatings, Electron microscopy, Surfaces, Reprints.

A method for preparing cross sections for transmission electron microscopy study of surface layers which exist on bulk metal substrates is described. The surface layer or film is protected by a vacuum deposited or sputtered coating of a suitable metal. A mask is placed over the surface and non-masked areas are exposed to ion beam etching until the substrate is exposed. A subsequently applied thick electroplated layer adheres well to the ion etched substrate and seals the coated surface film against damage during slicing, grinding, etc. that are usual steps in preparation from bulk materials of thin foils for transmission electron microscopy study. The method was specifically developed for the analysis of boundary and extreme pressure lubrication films on wear surfaces. However, it is also applicable to the investigation of oxide, corrosion and other surface films.

710,846
PB85-205946 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Simple Model for the Numerical Simulation of Reflectance of Black Chrome Coating Systems.
Final rept.
S. T. Wu, and L. W. Masters. 1984, 4p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Coatings Technology 56, n711 p29-32 1984.

Keywords: *Coatings, Mathematical models, Reflectance, Reprints, *Black chrome, Solar collectors.

Black chrome has been used extensively as an absorptive coating in solar collector systems because of its high absorptance/emittance ratio as well as its general stable characteristics under various environmental conditions. This paper is to present a numerical simulation on the optical properties of black chrome coating systems. A simple model is developed based on the analytical studies as well as the experimental results. The black chrome coating is considered to be composed of three 'pseudo' layers. The dielectric constants of the material are determined with the mean field approach. Rouard's method is used for computing the reflectance spectra of the coating system. The model can be used to serve the engineering needs for correlating the optical performance with the properties of the material. A numerical example is provided to illustrate the approach.

710,847
PB86-102449 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Selection of a Spatial Sampling Procedure for Evaluating the Defect Area of a Coated Steel Panel.
Final rept.
D. P. Bentz, and J. W. Martin. Jul 85, 7p
Pub. in Jnl. of Coatings Technology 57, n726 p43-49 Jul 85.

Keywords: *Coatings, Evaluation, Defects, Sampling, Monte Carlo method, Reprints.

Various spatial sampling procedures for determining the defect area of a coated panel are assessed using Monte Carlo techniques. Spatial sampling procedures have many advantages over the comparative visual standards currently used in evaluating defect area. In a previous report, a full grid sampling procedure was employed; the primary disadvantage of this procedure was its long evaluation time. This procedure can be replaced by other sampling procedures with shorter sampling times as long as these other procedures are both accurate and easy to implement into actual practice. From the Monte Carlo simulations, systematic point sampling is found to be superior to both random point and stratified random point sampling in quickly estimating defect area proportion. Two other spatial sampling procedures may also find applications in coatings evaluation, linear sampling which effectively quantifies the corrosion area around a scribe mark and systematic area sampling which provides valuable information on the defect size distribution as well as the total defect area.

710,848
PB86-138526 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Mechanical Properties of Compliant Coating Materials.
Final rept.
D. L. Hunston, C. Yu, and G. W. Bullman. 1984, 5p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of Energy Sources Technology Conference - Laminar Turbulent Boundary Layer, New Orleans, Louisiana, February 12-16, 1984 p85-89.

Keywords: *Coatings, Mechanical properties, Viscoelasticity, Turbulent flow, Synthetic elastomers, Polyvinyl chloride, Acrylonitrile copolymers, Diene resins.

Analyzing and understanding the interactions that occur at the interface between a compliant surface coating and a fluid undergoing turbulent flow requires a detailed knowledge of the mechanical properties of

the coating material. The present work involves a comprehensive characterization of the shear viscoelastic properties of coating materials. A nitrile rubber is used to examine the general types of behavior expected for coatings.

710,849
PB86-143740 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Interlaboratory Comparison of Gold Thickness Measurements.
Final rept.
F. Ogburn, and J. Mandel. 1985, 4p
Pub. in Plating and Surface Finishing 72, n9 p48-51 Sep 85.

Keywords: *Gold coatings, *Thickness, Dimensional measurement, Reprints.

Several factors contributed to the variability of gold thickness measurements during a round robin of 44 participating laboratories. The influence of individual factors and suggestions for improving the reliability of measuring the thickness of gold deposits with beta backscatter are presented.

710,850
PB86-160983 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Quantitative Evaluation of Blistering and Corrosion in Organic Coating Systems.
Final rept.
M. E. McKnight, and J. W. Martin. 1984, 8p
Sponsored by Federal Highway Administration, Washington, DC.
Pub. in Proceedings of the Symposium on New Concepts for Coating Protection of Steel Structures, Lake Buena Vista, FL., January 26, 1983, ASTM (American Society for Testing and Materials) Special Technical Publication 841, p13-20, 1985.

Keywords: *Organic coatings, *Corrosion, Blistering, Degradation, Evaluation, Nondestructive testing, *Infrared thermography.

A nondestructive procedure using infrared thermography for detecting air and water filled blisters and localized corrosion at the coating/substrate interface is described. Deteriorated areas are observed in real time as varying gray levels on the cathode ray tube of an infrared thermographic camera or after digitization of the signal on a TV monitor. Digitization of the analog signal permits (1) image enhancement through signal averaging techniques, (2) association of gray levels with degraded areas, (3) quantitative analysis of the panel for amount, location, and type of degradation, (4) computerized storage of the digitized signal for dynamic analysis of the degraded coating and (5) graphic display of thermographic images.

710,851
PB86-165206 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Non-Electrical Measurement Techniques for Assessing the State of Coating Systems Deterioration.
M. E. McKnight, T. Nguyen, and J. W. Martin. Feb 86, 33p NBSIR-85/3293
Sponsored by Civil Engineering Lab. (Navy), Port Hueneme, CA.

Keywords: *Degradation, *Coatings, Protective coatings, Tests.

Nonelectrical methods used to characterize early degradation in coating systems were reviewed and critiqued with respect to their ability to provide predictive in-service performance data. The methods reviewed were classified into those that measure chemical changes, coating/substrate interfacial changes, and adhesion and mechanical properties. Although many methods are used to characterize coating system degradation, very limited research has been done to relate early property changes to in-service performance. It was concluded that because of the complexity of the degradation of coating systems, a combination of methods will be needed to characterize early degradation to the extent that service-life prediction of coating systems can be based on these measurements.

710,852
PB86-186772 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Prediction of the Service Life of Coatings on Steel, Part 1: Procedure for Quantitative-Evaluation of Coating Defects.
Final rept.
J. W. Martin, and M. E. McKnight. 1985, 8p
See also PB86-186780.
Pub. in Jnl. of Coatings Technology 57, n724 p31-38 1985.

Keywords: *Coatings, Evaluation, Degradation, Steels, Defects, Service life, Organic coatings, Reprints.

A new procedure, based on spatial statistical techniques, is proposed and demonstrated for quantitatively evaluating the degradation state of steel substrate panels protected by an organic coating. Representative output from this procedure is presented. This output includes changes in the number, size, area, and location of defects as function of time. The proposed procedure is fully compatible with existing visual procedures. The advantage of the proposed procedure is its increased precision. Attributes of the proposed evaluation procedure are discussed in terms of an ideal evaluation procedure. It was concluded that the proposed procedure (1) is simple to apply; (2) is systematic in its approach; (3) generates quantitative measures of the degradation state of a coated panel; and (4) outputs this raw data in a publishable format. Although not proven as yet, strong indications exist that the results of the proposed procedure should also be reproducible and repeatable. The major drawback of the current procedure is the long time needed for evaluating each panel. Alternatives to this procedure are discussed which could significantly reduce this time.

710,853
PB86-186780 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Prediction of the Service Life of Coatings on Steel, Part 2: Quantitative Prediction of the Service Life of a Coating System.
Final rept.
J. W. Martin, and M. E. McKnight. 1985, 10p
See also PB86-186772. Sponsored by Federal Highway Administration, Washington, DC.
Pub. in Jnl. of Coatings Technology 57, n724 p39-48 1985.

Keywords: *Coatings, Predictions, Steels, Service life, Degradation, Organic coatings, Reprints.

The applicability of a reliability and life testing procedure is demonstrated for quantitatively predicting the service life of two different coating systems. By subjecting an acrylic and an alkyd coating system to three temperatures and 95 percent relative humidity, it is experimentally demonstrated that the proposed procedure is capable of quantitatively estimating the maximum service life, at 95 percent relative humidity over a wide range of temperatures, beyond which a specified proportion, 1-, of the nominal coating populations will survive. An important result of this research is that the form of the Weibull parameter acceleration factors is the same for both coating systems, indicating that a range of organic coating systems may be governed by the same acceleration factors. It is concluded that the extension of this procedure to include other coating systems and other degradation factors is possible.

710,854
PB86-192432 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Ellipsometric Studies of Chelating Inhibitor Effects on the Cathodic Delamination of an Organic Coating on Iron.
Final rept.
J. J. Ritter. 1984, 6p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Coatings Technology 56, n714 p55-60 1984.

Keywords: *Acrylic coating, Chelating inhibitors, Anodization, Reprints, *Cathodic delamination, Ellipsometry.

Qualitative ellipsometry has been used to study the effects of chelating inhibitors on the cathodic delamination of an acrylic coating from an iron surface. Chelating inhibitors, such as 8-hydroxyquinoline and 2,5 dimercapto 1,3,4 thiadiazole, when dispersed in the coating, were observed to delay the onset of delamination. A similar beneficial effect was noted with a two-layer system employing a zinc chromate primer. However, when applied by an anodic pretreatment procedure, these chelating inhibitors were relatively ineffective. Catechol was found to be an ineffective inhibitor, whereas 4-methylcatechol exhibited impressive inhibition when applied in the two-step anodization pretreatment process.

710,855
PB86-201381 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Ex-situ and In-situ Sample-and-Detector Chambers for the Study of Passive Films Using Surface EXAFS.
Final rept.
G. G. Long, J. Kruger, and M. Kuriyama. 1983, 5p
Pub. in Proceedings of the International Symposium on Passivity of Metals and Semiconductors (5th), Bombannes, France, May 30-June 3, 1983, p139-143.

Keywords: *X-ray spectroscopy, *Films, Metals, Surface properties.

Two sample-and-detector chambers for the study of surface films on metals using x-ray absorption spectroscopy are described. Results have been obtained using both a high intensity rotating anode x-ray generator and using the Cornell High Energy Synchrotron Source (CHESS).

710,856
PB86-201761 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Plasma Arc Carbide Coatings on Titanium.
Final rept.
R. D. Shull, P. A. Boyer, L. K. Ives, and K. J. Bhansali. 1984, 5p
Pub. in Proceedings of the Plasma Processing and Synthesis of Materials, Boston, MA., November 15-17, 1983, v30 p297-301 1984.

Keywords: *Abrasion resistant coatings, *Protective coating, *Titanium, *Plasma spraying, Arc spraying, Chromium carbides, Titanium carbides, Tungsten carbides, Hard surfacing, Wear.

The plasma transferred arc process (PTA) has been traditionally used to deposit wear resistant coatings on iron base alloy substrates, but has not been employed to coat light weight alloys due to processing problems. In the current study, use of the PTA process to deposit TiC, WC, and Cr3C2 coatings on titanium substrates has been explored. The resistance of these coatings to dry abrasive wear has been measured and compared to that of the base metal. The variation in wear resistance of these coatings is discussed in terms of the carbide particle size and the microstructure of the deposit. A comparison is made between the coatings prepared by the present process and coatings prepared by a laser surface melting and carbide particle injection process.

710,857
PB87-118121 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Kinetics of Cure of Resins and Varnishes by Differential Scanning Calorimetry.
Final rept.
J. H. Flynn. 1985, 2p
Pub. in Polymer Preprints 26, n1 p6-7 1985.

Keywords: *Reaction kinetics, *Drying oils, *Varnishes, Polymerization, Curing, Coatings, Thermal analysis, Inks, Reprints, Differential scanning calorimetry, Itaglio inks.

The differential scanning calorimeter (DSC) is ideal for measuring the cure of the drying oils and varnishes in currency inks since it measures these oxidative catalyzed polymerization reactions with great sensitivity. However, the cure reaction takes place mainly at the oxygen-ink interface and deep curve depends on the permeation of oxygen through a highly crosslinked skin. These factors complicate the kinetics and make it difficult to measure to total heat and degree of cure. Special fused silica cells of constant surface area and constant depths of 5 to 80 micrometers have been constructed to circumvent these complications. Temperature jump techniques have been used for the first with the DSC. Equations are developed for direct cure fitting of rate-time data and tables are given of time

ratios for determining kinetic parameters. Examples of these techniques are applied to the cure of inks and their drying oil components.

710,858
PB87-128203 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Plating on Aluminum: A Review.
Final rept.
D. S. Lashmore. 1985, 4p
Pub. in Plating and Surface Finishing 72, n6 p36-39 1985.

Keywords: *Aluminum coatings, Electrodeposited coatings, Metal coatings, Reprints.

A review of the current technology used to electrodeposit metallic coatings on aluminum is presented. For many years the zincate process seemed to dominate the industry and this trend seems to be continuing with alloy coatings containing zinc, copper, iron, and nickel. Problems in alloy sensitivity continue with the zincate process and are even more severe in anodic processes. Even so, some alloys can be coated using a phosphoric acid anodizing process as a pretreatment to plating.

710,859
PB87-134243 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Surface Reactions in Discharge and CVD Deposition of Silane.
Final rept.
A. Gallagher. 1986, 8p
Pub. in Mat. Res. Soc. Symp. Proc. 70, p3-10 1986.

Keywords: Surface chemistry, Polymeric films, Substrates, Silanes, Discharge, *Amorphous silicon, *Chemical vapor deposition, *Surface reactions.

Glow discharge deposition of hydrogenated amorphous silicon films involves; (A) the electron collisions which produce the reactive species, (B) the gas reactions these species undergo while diffusing or drifting to the surfaces, and (C) the surface reactions involved in film growth and gas processing. The author will first describe our knowledge of the electron and gas reactions in these discharges, then of the surface reactions, and finally the author will offer some conjectures regarding the influence of these different surface reactions and bombardments upon film properties.

710,860
PB87-151528 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Laboratory Scale Electrodeposition.
Final rept.,
T. J. Bruno. 1986, 4p
Sponsored by Gas Research Inst., Chicago, IL., and Department of Energy, Washington, DC.
Pub. in Jnl. of Chemical Education 63, n10 p883-886 Oct 86.

Keywords: *Electrodeposition, Pilot plants, Electroplating, Reprints.

In the paper, some of the practical aspects of electrodeposition or electroplating are discussed. Special emphasis is given to the techniques required to make electrodeposition work reliably in the laboratory. The author will then discuss some of the problem-solving applications that have been of value in the author's laboratory.

710,861
PB87-224218 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Measurement of Residual Stresses in Coatings on Brittle Substrates by Indentation Fracture.
Final rept.,
M. F. Gruninger, B. R. Lawn, E. N. Farabaugh, and J. B. Wachtman. May 87, 5p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of the American Ceramic Society 70, n5 p344-348 May 87.

Keywords: *Coatings, *Cracking(Fracturing), Indentation, Substrates, Reprints.

A method for evaluating stresses in coatings on brittle substrates by indentation is described. The basis for evaluation is a fracture mechanics model of the radial crack system in the Vickers geometry, incorporating the effects of a thin surface stress layer. Experiments on coated glass substrates are used to demonstrate the methodology. The crack sizes on these coated specimens are found to be considerably smaller than those on uncoated controls, indicating substantial (about 50 MPa) in-plane stresses. Substrate tensile stresses, as reflected in the crack expansions observed after applying the coatings to already indented surfaces, are found to make an unexpectedly large contribution to the fracture susceptibility. The procedure offers a simple means for quantifying the mechanical integrity of coating configurations for ceramic components.

710,862
PB88-141304 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Microindentation Hardness Testing of Coatings: Techniques and Interpretation of Data.
Final rept.,
P. J. Blau. 1986, 21p
See also PB86-132644.
Pub. in AIP (American Institute of Physics) Conference Proceedings Phys. Chem. Prot. Coat. 149, p1-21 1986.

Keywords: *Coatings, *Hardness tests, Thin films, Indentation, Mechanical properties, Penetration tests, Reprints.

The paper addresses the problems and promises of microindentation testing of thin solid films. It has discussed basic penetration hardness testing philosophy, the peculiarities of low load-shallow penetration tests of uncoated metals, and it has compared coated with uncoated behavior so that some of the unique responses of coatings can be distinguished from typical hardness versus load behavior. As the uses of thin solid coatings with technological interest continue to proliferate, microindentation testing methodology will increasingly be challenged to provide useful tools for their characterization. The understanding of microindentation response must go hand-in-hand with machine design so that the capability of measurement precision does not outstrip the ability to interpret test results in a meaningful way.

Composite Materials

710,863
AD-A031 775/0 PC **A07**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Non-Metallic Antenna-Support Materials Pultruded Rods for Antenna Guys, Catenaries and Communications Structures.
Final technical rept. Oct 71-Oct 74.
N. Halsey, D. E. Marlowe, R. A. Mitchell, and L. Mordfin. May 76, 135p AFML-TR-76-42
Contract F33615-72-M-5000

Keywords: *Fiber reinforced composites, *Reinforced plastics, *Guy wires, *Catenaries, *Antenna components, Glass fibers, Glass, Composite materials, Rods, Polyester plastics, Weatherproofing, Stress testing, Corrosion resistance, E glass, Kevlar 49 resin, Aramid resin, Pultrusion process, Polyimide resins, Synthetic fibers.

Both E-glass and Kevlar 49 (aramid) fibers were used to reinforce an isophthalic polyester resin. These materials were used, in turn, to form pultruded antenna rod hardware for structural tests. The aramid material exhibited substantially improved strength-retention properties over the glass-reinforced material under prolonged exposure to heat and humidity. The aramid material offers the promise of superior weatherability in antenna-support applications although further testing is warranted. The stress-rupture properties of pultruded rod, under high humidity, possess unusual temperature and time dependencies. These are explained in terms of the mechanisms whereby moisture is transported from the environment to the fiber/matrix interface. The stress-rupture properties, as well as the tensile properties, may be improved by appropriately modifying the pultrusion process. Two new end fittings, generally capable of attaining the full tensile strength of glass fiber-reinforced pultruded rod, were developed. Several new test methods were developed, including and environmental stress-rupture test, two methods for investigating the quality of the fiber/matrix interface, and a method for examining the rate sensitivity of the tensile strength. A significant rate sensitivity was observed for glass fiber-reinforced rod but not for aramid fiber-reinforced rod. (Author)

710,864
PATENT-4 260 660 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Use of Sulphur as an Additive to Inhibit the Smoldering Combustion of Materials.
Patent.
R. J. McCarter. Filed 14 Mar 78, patented 7 Apr 81, 6p PB81-600038, PAT-APPL-886 384

Keywords: *Fibrous, Polyurethane foam materials, Smolder resistant upholstered furniture or matress assembly, Sulphur.

Disclosed is a smolder resistant upholstered furniture or mattress assembly and a method for rendering the composite materials of such assembly smolder resistant. Placement of a layer of sulphur immediately adjacent a normally smolder-prone material in the composite effectively prohibits the advances of smoldering combustion to a dangerous stage. The sulphur layer is advantageously applied by backcoating the fabric overlay, coating or impregnating the fibrous or polyurethane foam materials or separating layers of such materials with sulphur-containing films, fabrics and the like. An advantageously effective amount of sulphur is from about 25-30 g/m2 to about 250-300 g/m2 in a layer having a depth of about 1 to 3 mm.

710,865
PATENT-4 302 345 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Flame Retarding Cellulosic Materials with Sodium or Potassium Thiocyanate.
Patent.
R. J. McCarter. Filed 12 Sep 80, patented 24 Nov 81, 6p PB81-600046, PAT-APPL-6-186 871

Keywords: *Flame and smolder resistance, Flame resistant cellulosic insulation material, Thiocyanate compounds.

A flame resistant cellulosic insulation material, method of treating loosefill cellulosic material and compositions for imparting flame resistance and flame and smolder resistance to such materials are disclosed utilizing thiocyanate compounds intersitially distirbuted throughout the cellulosic insulation material as a flame retardant. Sodium and potassium thiocyanate are used in extremely small quantities in insulation materials and impart flame resistance due to the hygroscopic migration of the compounds into the insulation material. The effectiveness of such small quantities of thiocyanate make possible the addition and retention of effective amounts of powdered smolder inhibitors such as boric acid, and sulfur.

710,866
PATENT-4 499 770 Not available NTIS
Department of Commerce, Washington, DC.
Systems for Monitoring Changes in Elastic Stiffness in Composite Materials.
Patent.
R. D. Kriz. Filed 22 Jul 82, patented 19 Feb 85, 6p PB85-176550, PAT-APPL-6-400 571
Supersedes PB83-108779.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Patents, *Ultrasonic tests, *Fiber composites, Monitoring, Elastic properties, Stiffness, Degradation, PAT-CL-73-599.

Traversing energy flux transmitted into a fiber/matrix composite structure is propagated through the structure in directions which vary depending upon the elastic stiffness condition of the composite. Degradation in elastic stiffness of the composite, from any cause, will result in variations in the direction of travel of the flux through the composite. By determining the direction of flux propagation in the composite, or the portion of the composite structure from which the flux is detected as it exists the structure, the condition of the composite structure, independent of the source of degradation, can be determined. In preferred embodiments the energy flux is ultra-sound energy, while in preferred testing devices a single transmitting transducer is directed towards at least two receiving transducers, for example, one located at a position to receive some

flux in the total absence of stiffness degradation, and a second located at a position to receive some flux which would have traveled through a stiffness degraded structure.

710,867
PB-266 590/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Static Tensile Properties of Boron-Aluminum and Boron-Epoxy Composites at Cryogenic Temperatures.
R. E. Schramm, and M. B. Kasen. 1977, 9p
ARPA Order-2569
Pub. in Proceedings, International Cryogenic Materials Conference (1st), Kingston, Ontario, Canada 22-25 Jul 75; Paper C-2 in Advances in Cryogenic Engineering, v22 p205-213 1977.

Keywords: *Composite materials, *Reinforced plastics, *Boron, Tensile properties, Elastic properties, Shear properties, Yield strength, Poisson ratio, Cryogenics, Boron fibers, Boron reinforced composites, Aluminum matrix composites, Metal matrix composites, Epoxy matrix composites.

State-of-the-art boron-aluminum and boron-epoxy composites have been mechanically characterized at 295, 76, and 4 K. Static tensile properties include elastic and shear moduli, Poisson's ratio, yield and ultimate strengths, and elongation. The data are in a form useful in strength or stiffness limiting predictions of complex crossply components using macromechanical composite theory. Both composites performed well at cryogenic temperatures.

710,868
PB-271 572/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Elastic Properties of a Boron-Aluminum Composite at Low Temperatures.
Final rept.,
D. T. Read, and H. M. Ledbetter. 1977, 5p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in J. Appl. Phys., v48 n7 p2827-2831 Jul 77.

Keywords: *Fiber composites, Elastic properties, Modulus of elasticity, Low temperature research, Cryogenics, Boron reinforced composites, Aluminum matrix composites, Boron fibers.

Elastic properties of a boron-filament-reinforced, aluminum-matrix composite were studied experimentally. Assuming transverse-isotropic elastic symmetry, five independent elastic constants were measured using a piezoelectric composite-oscillator method. Two constants -- Young's modulus along the filament axis and the torsional modulus perpendicular to the filament axis -- were determined between 300 and 4K. The composite's elastic-constant values are between boron's and aluminum's, and closer to aluminum's. Along the filament axis, Young's modulus is 2.30 x 10 to the 11th power N/sq m. Cooling from 300 to 4K increases all the elastic stiffnesses by as much as eleven percent.

710,869
PB-275 614/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sorption of Water by Filled-Resin Composites.
Final rept.,
D. N. Misra, and R. L. Bowen. Jun 77, 10p
Grant PHS-DE-02494-06
Sponsored in part by American Dental Association Health Foundation, Chicago, Ill.
Pub. in Jnl. of Dental Research, v56 n6 p603-612 Jun 77.

Keywords: *Composite materials, *Reinforced plastics, *Sorption, *Water, Chemical reactions, Tin, Niobium, Titanium, Zinc, Cobalt alloys, Chromium alloys, Molybdenum alloys, Reaction kinetics, Reprints.

Water-sorption studies discriminate between passive (those containing Sn, Nb, and Ti) and reactive (those containing Zn and an alloy of CoCrMo) metal-resin composites. The reactive ones form hydrated oxides or hydroxides or both, in accord with a parabolic rate law. The nature of the chemical reaction is elucidated in two instances by analysis of the resultant gases.

710,870
PB-278 418/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cryogenic Mechanical Properties of Boron-, Graphite-, and Glass-Reinforced Composites.
Final rept.,
R. E. Schramm, and M. B. Kasen. 1977, 8p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in Materials Science and Engineering, v30 n3 p197-204 1977.

Keywords: *Composite materials, *Reinforced plastics, *Laminates, *Cryogenics, Laminated plastics, Boron, Epoxy resins, Carbon fibers, Fiberglass reinforced plastics, Graphite, Tensile properties, Compressive properties, Shear properties, Thermal expansion, Reprints, Carbon fiber reinforced plastics, Graphite reinforced composites, Epoxy matrix composites, Boron reinforced composites, Metal matrix composites, Aluminum matrix composites.

This paper presents key static tensile, compressive, and shear properties for uniaxial laminates of boron-epoxy, boron-aluminum, graphite-epoxy, and glass-epoxy composites at temperatures of 295, 76 and 4 K. The data also include tensile properties of plus or minus 45 degrees crossply layups and uniaxial thermal expansivity.

710,871
PB-280 385/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fatigue of Composites at Cryogenic Temperatures.
Final rept.,
M. B. Kasen, R. E. Schramm, and D. T. Read. 1977, 11p
ARPA Order-2569
Pub. in Proceedings of American Society for Testing and Materials Symposium on Fatigue of Filamentary Composite Materials, Denver, Colo., Nov 15-16, 1976, p141-151 1977.

Keywords: *Composite materials, *Reinforced plastics, *Fatigue(Materials), *Cryogenics, Boron epoxy resins, Aluminum, Boron reinforced composites, Metal matrix composites, Aluminum matrix composites, Epoxy matrix composites.

A comparison has been made between the wearout rates of (0/+ or -45/0) boron/epoxy and boron/aluminum composites in low-cycle fatigue at 295 and 76K. Using degradation of modulus as the wearout criterion, these preliminary data indicate that cryogenic temperatures have a negligible effect on either tensile or compressive fatigue performance of boron/epoxy. A similar indication was obtained for boron-aluminum in tensile fatigue. These conclusions are substantiated by high-cycle fatigue results on boron/epoxy.

710,872
PB-297 474/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Composite Laminate Applications in Magnetic Fusion Energy Superconducting Magnet Systems.
Final rept.
M. B. Kasen. 1978, 15p
Sponsored in part by Department of Energy, Washington, DC.
Proceedings of the International Conference on Composite Materials (2nd) Held at Toronto, Ontario, Canada on April, 16-20, 1978, p1493-1507.

Keywords: *Laminates, Cryogenics, Superconducting magnets, Superconductivity, Composite materials, Nuclear reactor materials.

Potential composite applications span the range from industrial laminates to advanced composites. Service conditions are unusually demanding, as materials must function predictably over a 20-year lifetime at 4.2 kelvin while subject to neutron and gamma radiation. Laminate components must also withstand occasional warming to room temperature. Presently, industrial laminates of the NEMA/ASTM G-10 or G-11 types are most frequently proposed for electrical and thermal insulation. This reflects the low cost, ready availability and successful use of such materials in existing small superconducting magnets. However, the more stringent demands of MFE systems requires the development of component-specified industrial laminates, thoroughly tested under radiation and cryogenic conditions. Present designs do not make structural use of advanced composite laminates. However, the combination of high modulus, low thermal and electrical conductivity make such materials attractive substitutes for stainless steel in some components of superconducting magnets. Advanced-composite metal-matrix technology has an important role to play in understanding the effects of cyclic stress on the current-carrying ability of the metallic superconducting composite.

710,873
PB-300 567/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamic Elastic Modulus and Internal Friction in Fibrous Composites.
Final rept.
H. M. Ledbetter. 1979, 15p
Pub. in Proc. ICMC Symp. on Nonmetallic Materials and Composites at Low Temperatures, W. Germany, July 10-11, 1978, Paper in Nonmetallic Materials and Composites at Low Temperatures, p267-281 1979.

Keywords: *Fiber composites, Internal friction, Modulus of elasticity, Boron, Aluminum, Epoxy resins, Fiberglass reinforced composites, Reinforced plastics, Carbon fibers, Polyimide resins, Low temperature research, Cryogenics, Boron reinforced composites, Aluminum matrix composites, Epoxy matrix composites, Carbon fiber reinforced plastics.

Longitudinal, transverse, and crossply Young's moduli determined dynamically in this study provide useful comparisons with previously determined static moduli. Dynamic internal friction tends to relate inversely to dynamic modulus in the studied materials, which include: boron-aluminum, boron-epoxy, glass-epoxy, graphite-epoxy, and aramid-epoxy. The experimental arrangement consisted of a Marx three-component oscillator at frequencies between 30 and 90 kHz. The graphite-epoxies show regular temperature behavior and a relatively small percentage change in Young's modulus between room temperature and 76 K.

710,874
PB-300 568/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Cryogenic Applications of Composite Technology.
Final rept.
M. B. Kasen. 1979, 21p
Pub. in Proc. ICMC Symp. on Nonmetallic Materials and Composites at Low Temperatures, Munich, W. Germany, July 10-11, 1978, Paper in Nonmetallic Materials and Composites at Low Temperatures, p317-337 1979.

Keywords: *Composite materials, Cryogenics, Technology assessment, Utilization, Aggregates, Laminates.

The present applications of composite materials in U.S. cryogenic technology is reviewed. Particular attention is paid to identifying the reasons for selecting a specific composite for a given application and to assessing performance. Future applications are discussed with emphasis on the technological progress required to implement composite materials use. The review includes concrete aggregates as well as laminates.

710,875
PB78-600055 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Structure of Slow Crack Interfaces in Silicon Nitride.
N. J. Tighe. 1978, 9p
Pub. in Jnl. Mater. Sci. 13, p1455-1463 1978.

Keywords: *Cracks, Electron microscopy, Fracture interfaces, Plastic deformation, Silicon nitride, Turbine materials.

Fracture interfaces formed in silicon nitride at high temperatures were studied using light and electron microscopy. The structure of the fracture interface depended on the type of silicon nitride fractured. High-purity, reaction-bonded silicon nitride always formed flat, relatively featureless, fracture surfaces. Fracture occurred by a brittle mode even at the highest temperature (1500C) studied. The critical stress intensity factor for reaction-bonded silicon nitride (approximately 2.2 MN m to the minus 3/2 power) is relatively low and is insensitive to temperature. By contrast, hot-pressed silicon nitride gave evidence of plastic flow during fracture at elevated temperatures. Crack growth in magnesia-doped, hot-pressed silicon nitride occurs by creep, caused by grain boundary sliding and grain separation in the vicinity of the crack tip. As a consequence of this behaviour, extensive crack branching was observed along the fracture path. The primary and secondary cracks followed intergranular paths; sometimes dislocation networks, generated by momentary

crack arrest, were found in grains bordering the crack interface. As a result of the high temperature, cracks were usually filled with both amorphous and crystalline oxides that formed during the fracture studies. Electron microscopy studies of the compressive surfaces of four-point bend specimens gave evidence of grain deformation at high temperatures by diffusion and dislocation motion.

710,876
PB78-600057 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ion Microprobe Analysis of 30Si Diffusion in Alpha-SiC.
J. D. Hong, R. F. Davis, and D. E. Newbury. 1978, 8p
Pub. in Proceedings 13th Annual Conf. Microbeam Analysis Society, Ann Arbor, MI, June 19-23, 1978, p30A-30H 1978.

Keywords: *Alpha-SiC, Ion microprobe analysis, Si-containing materials.

No abstract available.

710,877
PB80-104417 Not available NTIS
National Bureau of Standards, Washington, DC.
Storage Stability of Dental Composites.
Final rept.,
G. M. Brauer, N. Petrianyk, and D. J. Termini. Aug 79, 10p
Sponsored in part by Army Medical Research and Development Command, Washington, DC.
Pub. in Jnl. of Dental Research 58, n8, p1791-1800, Aug 79.

Keywords: *Dental materials, *Composites, *Storage, Temperatures, Life(Durability), Polyethylene, Stability, Reprints, Monomers, Xylidine/dimethyl.

The deterioration of composites based on Bis-GMA-diluent and cured by peroxide-amine systems was studied. Properties of composites, cured from components stored at various temperatures were determined. On storage at 60C, the catalyst containing component of a paste-paste system partially hardens within one day and the other paste within one month. Stored for 6 years at 5C the pastes do not cure. Components of powder-liquid formulations do not harden in their containers when stored at 60C or 45C, but after prolonged exposure a gradual increase in hardening time and reduction in tensile and compressive strength of the composite occurs. The shelf life of the peroxide-coated powder is shorter than the amine-containing monomer. Liquids stored at elevated temperatures for prolonged periods when mixed with ambient-aged powders yield resins with satisfactory properties. No improved shelf life is obtained by substituting (1) polyethylene for brown glass containers, (2) aerating the monomer prior to storage, (3) other diluents for TEGDMA, (4) equimolar concentration of dimethyl-p-toluidine, dimethylaminophenylacetic acid or its methyl ester for dimethyl-sym-xylidine. Because of the better shelf-life, powder-liquid formulations should be used when the composite may be subjected to temperatures above 45C.

710,878
PB80-104466 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Pressure Industrial Laminates for Cryogenic Applications.
Final rept.,
M. B. Kasen. 1979, 1p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Compos. Tech. Rev. Research Briefs, 1, n3, p17 1979.

Keywords: *Laminates, Cryogenics, Mechanical properties, Physical properties, Reprints, High pressure.

The research brief describes NBS/industry efforts to provide industry with a commercial source of high-pressure industrial laminates having predictable mechanical and physical properties at cryogenic temperatures.

710,879
PB80-105109 PC **A14**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
MFPG - Advanced Composites: Design and Applications. Proceedings of the Meeting of the Mechanical Failures Prevention Group (29th) Held at the National Bureau of Standards, Gaithersburg, Maryland on May 23-25, 1979.
Final rept.,
T. R. Shives, and W. A. Willard. Oct 79, 307p NBS/SP-563
Sponsored in part by Office of Naval Research, Arlington, VA., Naval Air Systems Command, Washington, DC., National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center, and Department of Energy, Washington, DC. Fossil Energy.
See also report dated Sep 77, PB-272 848.

Keywords: *Composite materials, *Meetings, Utilization, Design, Ultrasonic tests, Laminates, Failure, Fiber composites, Filament wound materials, Fiberglass reinforced plastics, Advanced composites, Carbon fiber reinforced plastics, Graphite reinforced composites, Epoxy matrix composites, Polyimide matrix composites.

These proceedings consist of a group of thirty one submitted entries (twenty one papers and ten abstracts) from the 29th meeting of the Mechanical Failures Prevention Group which was held at the National Bureau of Standards in Gaithersburg, Maryland, May 23-25, 1979. The subject of the symposium was the design and application of advanced composites. Special emphasis was directed to aerospace, aircraft, automotive, marine, and industrial applications and design. Failure modes in advanced composites were also discussed.

710,880
PB80-165731 Not available NTIS
National Bureau of Standards, Washington, DC.
Orthotropic Elastic Stiffnesses of a Boron-Aluminum Composite.
Final rept.,
H. M. Ledbetter. 12 Dec 79, 2p
Pub. in Journal of Applied Physcis 50, n12, p8247-8248, 12 Dec 79.

Keywords: *Fiber composites, Stiffness, Elastic properties, Reprints, Boron reinforced composites, Aluminum matrix composites.

Measuring 18 separate ultrasonic velocities in a uniaxial boron-fiber-reinforced aluminum-matrix composite by a 10-MHz pulse-echo technique reveals orthotropic symmetry and provides nine independent elastic-stiffness constants, which compare favorably with those measured previously by a resonance method at lower frequency.

710,881
PB81-197824 Not available NTIS
National Bureau of Standards, Washington, DC.
Specific Heat Capacity and Electrical Resistivity of a Carbon-Carbon Composite in the Range 1500-3000 K by a Pulse Heating Method.
Final rept.
A. Cezairliyan, and A. P. Miiller. 1980, 14p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in International Jnl. of Thermophysics 1, n3 p317-330 1980.

Keywords: *Composite materials, *Carbon, *Specific heat, *Electrical resistivity, Reprints, NTISCOMNBS, NTISDODAF.

Measurements are described of specific heat capacity and electrical resistivity of a 2-2-3 T-50 carbon-carbon composite in the temperature range 1500-3000 K by a subsecond duration pulse heating technique.

710,882
PB81-235327 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamic Elastic Modulus and Internal Friction in G-10CR and G-11CR Fiberglass-Cloth-Epoxy Composites.
Final rept.
H. M. Ledbetter. Nov 80, 4p
Pub. in Cryogenics 20, n11 p637-640 Nov 80.

Keywords: *Fiberglass reinforced plastics, Modulus of elasticity, Internal friction, Reprints, Epoxy matrix composites.

Young's moduli were determined dynamically for two fiberglass-cloth-epoxy composites in the warp, fill, and normal directions between room temperature and liquid-nitrogen temperature. Dynamic internal friction relates inversely to dynamic modulus in the studied materials. The experimental arrangement consisted of a Marx three-component oscillator at frequencies between 40 and 90 kHz.

710,883
PB81-245102 Not available NTIS
National Bureau of Standards, Washington, DC.
Silver Staining Technique for Investigating Wear of Restorative Dental Composites.
Final rept.
W. Wu, and E. N. Cobb. 1981, 6p
Pub. in Jnl. of Biomedical Materials Research, n15 p343-348 1981.

Keywords: *Dental materials, *Composite materials, *Wear, *Silver, Reprints.

A silver staining technique was developed to demonstrate microdefects in dental restorative composites. Fine silver particles were preferentially introduced into the damaged region to provide optical contrast between the damaged and the undamaged regions. The amount of silver deposition determined with an electron probe microanalyzer provided an indication of the extent of damage within the dental composites. Examples to demonstrate this technique were given with one clinically worn dental composite restoration and one in vitro worn composite sample.

710,884
PB82-118324 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical Properties of Plastic Composites Under Low Temperature Conditions.
Final rept.
M. B. Kasen. Apr 81, 1p
Pub. in Composites 12, n2 p107 Apr 81.

Keywords: *Fiber laminates, Mechanical properties, Cryogenics, Reprints, Epoxy matrix composites.

A publication by K. Kaotani, 'Mechanical Properties of Plastic Composites under Low Temperature Conditions', Composites, V 11, No. 2, April, 1980, pp. 87-94, is interpreted for composite laminates having substantially higher fiber contents than that studied in the reported work. It is shown that the conclusion of the author as to the superiority of highly flexibilized epoxy matrices cannot be extrapolated to the general class of commercial laminates.

710,885
PB82-133992 Not available NTIS
National Bureau of Standards, Washington, DC.
Cryogenic Properties of Filamentary-Reinforced Composites: An Update.
Final rept.
M. B. Kasen. Jun 81, 18p
Pub. in Cryogenics 21, p323-340 Jun 81.

Keywords: *Fiber composites, Cryogenics, Temperatures, Mechanical properties, Elastic properties, Electrical properties, Thermal properties, Laminates, Forecasting, Reprints.

Progress since 1975 in understanding the effect of cryogenic temperatures on the mechanical, elastic, thermal and electrical properties of fiber-reinforced structural composites is reviewed. The two categories considered are relatively inexpensive laminates reinforced with woven fabric or random mat and the more expensive uniaxial laminates often reinforced with high-performance, advanced fibers. The status of fundamental research and of test method development is reviewed and directions of effective future research are considered.

710,886
PB82-134016 Not available NTIS
National Bureau of Standards, Washington, DC.
Anisotropic Elastic Constants of a Fiber-Reinforced Boron-Aluminum Composite.
Final rept.
S. K. Datta, and H. M. Ledbetter. 1980, 6p
Pub. in Proceedings of Mechanics of Nondestructive Testing, Blacksburg, Virginia, September 10-12, 1980, p215-230.

Keywords: *Composite materials, *Fiber composites, *Elastic properties, *Aluminum, *Boron, Mathematical models.

Elastic constants, both the C(ij)'s and the S(ij)'s, were measured and calculated for a laminated, uniaxially fiber-reinforced boron-aluminum composite. Three theoretical models were considered: square-array, hexagonal-array, and random-distribution. By combining several existing theoretical studies on randomly distributed fibers, a full set of elastic constants can be predicted for this model. The random-distribution model agrees best with observation, especially for off-diagonal elastic constants. Considering all nine elastic constants, observation and theory differ on the average by six percent.

710,887
PB82-137456 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical, Electrical, and Thermal Characterization of G-10CR and G-11CR Glass-Cloth/Epoxy Laminates between Room Temperature and 4K.
Final rept.
M. B. Kasen, G. R. MacDonald, D. H. Beekman, and R. E. Schramm. 1980, 10p
Pub. in Advances in Cryogenic Engineering Materials, Paper D-1, 26, p235-244 1980.

Keywords: *Laminates, *Epoxy laminates, *Glass cloth, Mechanical properties, Electrical properties, Thermal properties, Cryogenics, Reprints.

The U.S. magnetic fusion energy program will require large-scale use of industrial glass-reinforced/epoxy laminates for structural supports and for electrical and thermal insulation in superconducting magnets. There is an immediate need for a commercial supply of such materials having predictable cryogenic performance. NBS has cooperated with the laminating industry and the National Electrical Manufacturers' Association to establish and make available specifications for cryogenic grades of G-10 and G-11 glass-cloth/epoxy laminates. These materials are designated G-10CR and G-11CR. This paper presents mechanical, electrical, and thermal property characterization of these two materials from room temperature to 4K. A variant of these laminates made with boron-free glass was also tested.

710,888
PB82-210212 Not available NTIS
National Bureau of Standards, Washington, DC.
Wave Propagation and Elastic Constants in Particulate and Fibrous Composites.
Final rept.
S. K. Datta, H. M. Ledbetter, and V. K. Kinra. 1981, 6p
Sponsored in part by National Science Foundation, Washington, DC., and Department of Defense, Washington, DC.
Pub. in Proceedings of Japan-U.S. Conference on Composite Materials, Tokyo, Japan, January 12-14, 1981, Paper in Composite Materials, p30-38 1981.

Keywords: *Fiber composites, *Particulate composites, Wave propagation, Elastic properties, Composite materials.

For two types of composites--particulate and fiber-reinforced--dynamic elastic properties were studied both theoretically and experimentally. The two composites contained, respectively, randomly distributed spherical inclusions and aligned continuous fibers, both in a homogeneous matrix. The theory describes aligned, identical ellipsoidal inclusions. As special cases, the theory comprises both spherical inclusions and short fibers. Bose and Mal presented previously a similar theory for continuous fibers. The theories estimate the effective propagation speed of a plane harmonic wave; the theories average the scattered field by the Waterman-Truell procedure and use the Lax quasi-crystalline approximation. Theory and observation agree quite well. Particulate composites were studied in a through-transmission water-immersion tank, while the fiber composite was studied by both pulse-echo-overlap and resonance methods.

710,889
PB82-210527 Not available NTIS
National Bureau of Standards, Washington, DC.
Elastic Constants and Internal Friction of Fiber-Reinforced Composites.
Final rept.
H. M. Ledbetter. 1981, 6p
Pub. in Proceedings of Japan-U.S. Conference on Composite Materials, Tokyo, Japan, January 12-14, 1981, Paper in Composite Materials, p65-70 1981.

Keywords: *Fiber composites, Elastic properties, Internal friction, Fiberglass reinforced plastics, Boron reinforced composites, Aluminum matrix composites, Epoxy matrix composites, Carbon fiber reinforced plastics, Graphite reinforced composites.

Experimental studies at NBS on the anisotropic elastic constants and internal friction of fiber-reinforced composites are reviewed. Materials that were studied include: boron-aluminum, boron-epoxy, graphite-epoxy, glass-epoxy, and aramid-epoxy. In all cases, elastic-constant direction dependence could be described by relationships developed for single crystals of homogeneous materials. Elastic stiffness and internal friction were found to vary inversely.

710,890
PB82-234899 Not available NTIS
National Bureau of Standards, Washington, DC.
Hardening Shrinkage and Hygroscopic Expansion of Composite Resins.
Final rept.
R. L. Bowen, J. E. Rapson, and G. Dickson. May 82, 5p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 61, n5 p654-658 May 82.

Keywords: *Composite materials, *Polymerization, Absorption, Shrinkage, Reprints, Hygroscopic expansion.

Polymerization shrinkages of various restorative resins were measured. The specimens stored in water expanded, but most did not recover sufficiently to countervail the losses from polymerization.

710,891
PB83-106096 Not available NTIS
National Bureau of Standards, Washington, DC.
Absorbed Moisture and Stress Wave Propagation in Graphite/Epoxy.
Final rept.
R. D. Kriz. 1981, 2p
Pub. in Compos. Technol. Rev. 3, n4 p154-155 1981.

Keywords: Elastic properties, Stress waves, Wave propagation, Moisture, *Carbon fiber reinforced plastics, Graphite reinforced composites, Epoxy matrix composites.

By diffusion, the epoxy component of many fiber-reinforced materials can absorb moisture, which is realized as an increase in weight and a decrease in elastic stiffness. This change in elastic stiffness is sufficient to shift the direction of stress-wave propagation in graphite/epoxy.

710,892
PB83-106104 Not available NTIS
National Bureau of Standards, Washington, DC.
Toward the Nondestructive Characterization of Fatigue Damage in Composite Materials.
Final rept.
L. Mordfin. 1982, 9p
Pub. in Proceedings of Damage in Composite Materials, Bal Harbor, Florida, November 13-14, 1980, Am. Soc. Test. Mater. Spec. Tech. Publ. 775, p7-15 1982.

Keywords: *Composite materials, *Nondestructive tests, Fatigue(Materials), Damage, Standards.

Experiences with an unusual form of damage in pultruded guys for antenna-support systems are described to show that the development of meaningful test methods for composites may benefit from unconventional approaches. It is suggested, furthermore, that the development of voluntary standards for the nondestructive characterization of composite materials will succeed only to the extent that individuals with the relevant competences are encouraged to contribute to this important activity.

710,893
PB83-143719 Not available NTIS
National Bureau of Standards, Washington, DC.
Standardizing Nonmetallic Composite Materials for Cryogenic Application.
Final rept.
M. B. Kasen. 1982, 11p
Sponsored in part by Department of Energy, Washington, DC. Office of Magnetic Fusion Energy.
Pub. in Proceedings of the Conf. on Nonmetallic Materials and Composites at Low Temperatures, Geneva, Switzerland, August 4-5, 1980, 2, p327-337, 1982.

Keywords: *Composite materials, Cryogenics, Standardization, Laminates.

The need for standardized nonmetallic composite laminates in the cryogenic industry is reviewed. A description is provided of current efforts underway in the U.S. to meet the immediate cryogenic needs and for establishing the basis for an orderly materials development program to meet long range needs. The advantages of a comprehensive coded composite materials designation system is discussed and an example pertinent to the cryogenic industry is given.

710,894
PB83-177501 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical Performance of Graphite- and Aramid-Reinforced Composites at Cryogenic Temperatures.
Final rept.
M. B. Kasen. 1982, 14p
Sponsored in part by Air Force Aero Propulsion Lab., Wright-Patterson AFB, OH.
Pub. in Proceedings of International Cryogenic Materials Conference (4th), San Diego, California, August 10-14, 1981, Paper in Advances in Crygenic Engineering 28, p165-178 1982.

Keywords: *Fiber composites, Cryogenics, Epoxy laminates, Mechanical properties, Laminates, Polyamide resins, Oriented fiber composites, Carbon fiber reinforced plastics, Graphite reinforced composites, Aramidyl.

The results of a program to determine the effect of cryogenic temperatures on the static mechanical properties of uniaxial and plus or minus 45 degree laminates reinforced with high and medium modulus graphite and with aramid fiber are presented and discussed. Properties include tensile, compression and in-plane shear. The same commercial epoxy prepreg system was used for all laminates. Results indicate that cryogenic temperatures are not deleterious to the material performance.

710,895
PB83-179259 Not available NTIS
National Bureau of Standards, Washington, DC.
Current Status of Standardized Nonmetallic Cryogenic Laminates.
Final rept.
M. B. Kasen, and R. E. Schramm. 1982, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the International Cryogenic Materials Conference (4th), San Diego, CA, Aug 10-14, 1981. Paper in Advances Cryogenic Engineering 28, p271-278 1982.

Keywords: *Laminates, Cryogenics, Standardization, Composite materials.

The MFE, MHD and rotating cryogenic machinery technologies are making increasingly severe demands on materials technology. This is particularly acute in nonmetallic structural and insulating materials required for superconducting magnet construction. Unlike metals technology, available nonmetallic materials have not been standardized, creating problems in reliability. The paper reviews efforts to meet current industrial needs for standardized nonmetallic laminates while laying the groundwork for systematic materials development to meet future needs.

710,896
PB83-236240 Not available NTIS
National Bureau of Standards, Washington, DC.
Sandwich Model of the Amorphous Material in Semicrystalline Polymers, Block Copolymers and Filled or Reinforced Elastomers.
Final rept.
R. J. Gaylord, D. J. Lohse, C. M. Guttman, and E. A. DiMarzio. 1980, 4p
Sponsored in part by Department of Energy, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Polymer Bulletin 3, p301-304 1980.

Keywords: *Elastomers, *Mathematical models, *Sandwich laminates, Copolymers, Filled composites, Reprints, *Amorphous materials, Block copolymers.

A theoretical model of the amorphous material in semicrystalline polymers, block copolymers and filled or reinforced elastomers is presented. The model consists of a dense system of bridges, loops, cilia and floating chains 'sandwiched' between a pair of parallel walls. A

prescription is given for determining the total free energy of the model.

710,897
PB84-133388 Not available NTIS
National Bureau of Standards, Washington, DC.
Predicted Elastic Constants of Transversely Isotropic Composites Containing Anisotropic Fibers.
Final rept.
S. K. Datta, H. M. Ledbetter, and R. D. Kriz. 1982, 7p
Pub. in Proceedings of Progress Science Engineering Composites, Tokyo, Japan, October 1982, p340-355.

Keywords: *Fiber composites, Bulk modulus, Elastic properties, Modulus of elasticity, Wave propagation, Carbon fiber reinforced plastics, Graphite reinforced composites, Epoxy matrix composites.

By a wave-scattering method, the authors derive dispersion relationships for waves propagation perpendicular to continuous fibers that are oriented unidirectionally. In the long-wavelength limit one obtains relationships that predict the composite's effective static elastic constants. The author compare these relationships with others derived by energy methods to obtain upper and lower bounds of the effective static moduli. The authors demonstrate this comparison graphically by plotting for graphite-epoxy the predicted composite constants over the full range of fiber volume fractions. The authors consider the fibers to be anisotropic but transversely isotropic. Under special conditions, the energy-method upper and lower bounds compare identically with the results of this study. The static properties are, of course, special cases of the more general dispersion relationships. Graphs are given for nine elastic constants: axial and transverse Young's and shear moduli, bulk and plane-strain-bulk moduli, and three Poisson's ratios.

710,898
PB84-133503 Not available NTIS
National Bureau of Standards, Washington, DC.
Variability in Mechanical Performance of G-10CR Cryogenic-Grade Insulating Laminates.
Final rept.
M. B. Kasen, and R. E. Schramm. May 83, 2p
Pub. in Cryogenics, p279-280 May 83.

Keywords: *Laminates, *Insulation, Cryogenics, Elastic properties, Assessments, Reprints.

An assessment is made of the variability in cryogenic mechanical performance of insulating laminates produced by five manufacturers to a common component and procedure specification. Results at 295K and 76K indicate that the specification is adequate to ensure the desired degree of product uniformity.

710,899
PB84-156728 Not available NTIS
National Bureau of Standards, Washington, DC.
Multifilamentary Nb-Nb3Sn Composite by Liquid Infiltration Method: Superconducting, Metallurgical, and Mechanical Properties.
Final rept.
M. Hong, G. W. Hull Jr., J. T. Holthuis, W. V. Hassenzahl, and J. W. Ekin. May 83, 5p
Pub. in IEEE Transactions on Magnetics, MAG-19, n3 p912-916 May 83.

Keywords: *Fiber composites, *Superconductors, Niobium, Niobium intermetallics, Tin intermetallics, Wire, Current density, Reprints, Liquid infiltration.

A rapid solid-liquid reaction mechanism has been used to form A15 Nb3Sn in the liquid-infiltration processed Nb-Sn wire. Small, equiaxed A15 grains across the fine reacted filaments of 0.2-1.0 micrometers thickness were revealed with the transmission electron microscopy studies. A uniform Sn concentration near the stoichiometry was found in the A15 region. High inductive T sub c's of 17.9 K with sharp transition widths (<0.3 K) and excellent overall J sub c's of 10,000 A/sq cm at 19 T and 4.2 K were achieved. Mechanical properties of the reacted wire are not worse than those of typical commercial bronze-process Nb3Sn conductors, and epsilon sub irrev is slightly higher.

710,900
PB84-219815 Not available NTIS
National Bureau of Standards, Washington, DC.
Adsorption of N,N-dimethyl-p-aminophenylacetic Acid on Hydroxyapatite.
Final rept.
D. N. Misra. 1984, 10p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Adsorption on and Surface Chemistry of Hydroxyapatite, p105-114 1984.

Keywords: *Dental materials, *Composite materials, Tensile strengths, Adsorption, Surfaces, Polymerization, Nitrogen organic compounds, Reprints, *Hydroxyapatite, *Acetic acid/N-N-dimethyl-aminophenyl.

The adsorptive properties of N,N-dimethyl-p-aminophenyl-acetic acid on hydroxyapatite have been investigated. It is a fast-acting amine polymerization accelerator, but tensile strengths of composites of resin filled with apatite show that it is not an effective coupling agent for a hydroxyapatite-dental resin composite.

710,901
PB84-222041 Not available NTIS
National Bureau of Standards, Washington, DC.
Cryogenic Properties of Filamentary-Reinforced Composites: An Update.
Final rept.
M. B. Kasen. Dec 82, 33p
Sponsored in part by Air Force Aero Propulsion Lab., Wright-Patterson AFB, OH. and Department of Energy, Washington, DC.
Pub. in Annales Des Composite 2, p33-65 Dec 82.

Keywords: *Cryogenics, *Composite materials, *Reinforcing materials, *Fibers, Mechanical properties, Thermal properties, Performance evaluation, Laminates, Reprints.

Progress since 1975 in understanding the effect of cryogenic temperatures on the mechanical, elastic, thermal and electrical properties of fiber-reinforced structural composites is reviewed. The two categories considered are relatively inexpensive laminates reinforced with woven fabric or random mat and the more expensive uniaxial laminates often reinforced with high-performance, advanced fibers. The status of fundamental research and of test method development is reviewed and directions of effective future research are considered.

710,902
PB84-223239 Not available NTIS
National Bureau of Standards, Washington, DC.
What Is Fatigue Damage.
Final rept.
J. T. Fong. 1982, 24p
Pub. in American Society for Testing and Materials Special Technical Publication 775, p243-266 1982.

Keywords: *Fatigue tests, *Fatigue(Materials), *Composite materials, Fatigue life, Microstructure, Holography, Nondestructive tests, Neutron scattering, X ray diffraction, Annihilation reactions, Positrons, Mathematical models, Reprints.

A conceptual definition of fatigue damage is proposed to assist in the selection of measurement techniques and parameters for correlating damage with fatigue life. To illustrate the concept, a critical review of some typical damage parameters for composite materials is given. A survey of some new techniques for damage monitoring including the small angle neutron scattering (SANS) method, is presented and discussed. Pitfalls in damage modeling are illustrated with examples drawn from the literature. A summary of an ASTM E9.01 panel study on fatigue damage and research opportunities in the 1980's is presented.

710,903
PB84-223304 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Cryogenic Temperatures on the Mechanical Performance of Glass-Fabric-Reinforced Epoxy and Polyimide Matrix Laminates.
Final rept.
M. B. Kasen, R. E. Schramm, and R. D. Kriz. Dec 82, 4p
Sponsored in part by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Proceedings of Int. Cryogenic Mater. Conf., Kobe, Japan, May 11-14, 1982, p269-272.

Keywords: *Composite materials, *Mechanical properties, *Epoxy laminates, *Polyimide resins, Insulation, Cryogenics, Reinforced plastics, Performance evaluation, Radiation shielding materials.

Radiation-resistant laminates are required for insulators and structural supports in the superconducting magnets of magnetic fusion energy systems. Glass-reinforced laminates fabricated with a polyimide matrix have a much higher tolerance to neutron and gamma radiation at 4 K than do laminates fabricated with an epoxy matrix. However, tests indicate that the mechanical performance of polyimide-matrix laminates is inferior to that of the epoxy type, while the elastic performance is superior. Fractographic studies show that the performance difference is due to a lower integrity of the polyimide-glass interface.

710,904
PB84-225523 Not available NTIS
National Bureau of Standards, Washington, DC.
Composites.
Final rept.
M. B. Kasen. 1983, 52p
Pub. in Materials at Low Temperatures, Chapter 12, p413-464 1983.

Keywords: *Composite materials, *Cryogenics, Laminates, Mechanical properties, Ionizing radiation, Reprints.

A tutorial presentation is given for the usage of composite materials at cryogenic temperatures. Advantages of composite construction is discussed, and the terminology of the industry is reviewed. Emphasis is placed on the effect of cryogenic temperatures on the mechanical properties of the most used materials. Consideration is given to the fabrication of efficient joints between nonmetallic laminates and metallic structural parts. The effect of ionizing radiation combined with cryogenic temperatures is discussed. Recommendations are given for test methods that provide accurate information on mechanical performance at cryogenic temperatures.

710,905
PB84-227255 Not available NTIS
National Bureau of Standards, Washington, DC.
Harmonic Waves in a Periodically Laminated Medium.
Final rept.
S. K. Datta, A. H. Shah, and H. M. Ledbetter. 1982, 10p
Sponsored in part by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Proceedings IUTAM Symp. Mechanics Composite Materials, Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, Aug 16-19, 1982. Paper in Mechanics of Composite Materials, Recent Advances, p207-216.

Keywords: *Laminates, *Harmonics, *Composite materials, *Wave propagation, Comparison, Fiber composites, Boron aluminum composites.

The authors present a stiffness method for studying harmonic-wave propagation in periodically laminated composite media. Together with Floquet's theory, they used the continuity of displacement and traction at the laminae interfaces. Deformation is assumed to be plane strain. Both isotropic and anisotropic (fiber-reinforced) laminates are considered. For comparison with observation, they considered a laminated boron-aluminum composite.

710,906
PB84-242924 Not available NTIS
National Bureau of Standards, Washington, DC.
Elastic Constants of Fiber-Reinforced Boron-Aluminum: Observation and Theory.
Final rept.
S. K. Datta, and H. M. Ledbetter. Feb 83, 10p
Pub. in International Jnl. of Solids and Structures, v19 n10 p885-894 Feb 83.

Keywords: *Fiber composites, *Elastic properties, Composite materials, Laminates, Mathematical models, Reprints, *Boron reinforced composites, *Aluminum matrix composites, *Boron fibers, Numerical solution, Metal matrix composites.

Elastic constants were measured and calculated for a laminated, uniaxially fiber-reinforced boron-aluminum composite. Three theoretical models were considered: square-array, hexagonal-array, and random-distribution. By combining several existing theoretical studies on randomly distributed fibers, the authors derived relationships for predicting the full set of elastic constants for this model. The random-distribution model agrees best with observation, especially for off-diagonal elastic constants. Considering all nine elastic constants, observation and theory differ on the average by 6%. These discrepancies arise from three sources: experimental error propagation, limited applicability of a

transverse-isotropic model to a laminated composite, and elastic anisotropy of boron fibers.

710,907
PB84-245828 Not available NTIS
National Bureau of Standards, Washington, DC.
Composites of Aluminum Alloys: Fabrication and Wear Behavior.
Final rept.
M. Hosking, F. F. Portillo, R. Wunderlin, and R. Mehrabian. Feb 82, 22p
Pub. in Jnl. of Materials Science 17, n2 p477-498 Feb 82.

Keywords: *Particulate composites, Fabrication, Wear resistance, Friction factor, Composite fabrication, Composite materials, Vacuum melting, Forging, Microstructure, Wear, Reprints, *Aluminum matrix composites.

This paper describes processes for fabrication of aluminum alloy composites containing particulate nonmetals, the net shape forming of these composites, their microstructure, their friction and wear behavior and mechanical properties. Composites to two wrought (2014 and 2024) and one cast (201) aluminum alloys containing 2 - 30 weight percent of Al2O3 and SiC particles in the size range of 1 micrometer to 142 micrometers were prepared. The compositing apparatus developed in this investigation consists of a vacuum induction melting system, a controlled mixing assembly and a special vibration system for addition of the non-metals. The non-metallic particles were added to a partially solid, vigorously agitated matrix alloy. The particles were then retained in the matrix until interface interaction, for example, the formation of MgAl2O4 spinel in the case of Al2O3 particles, was facilitated. These composites were solidified and subsequently reheated to above their liquidus temperature and formed into shape under high pressure in a closed die forging type of appartus.

710,908
PB85-141364 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calculated Elastic Constants of Composites Containing Anisotropic Fibers.
Final rept.
S. K. Datta, H. M. Ledbetter, and R. D. Kriz. 1984, 10p
Pub. in Int. Jnl. Solids Struct. 20, n5 p429-438 1984.

Keywords: *Fiber composites, Elastic properties, Computation, Reprints, Carbon fiber reinforced plastics, Graphite reinforced composites.

By a wave-scattering method, the authors derive dispersion relationships for wave propagation perpendicular to continuous fibers that are oriented unidirectionally. In the long-wavelength limit one obtains relationships that predict the composite's effective static elastic constants. The authors compare these relationships with others derived by energy methods to obtain upper and lower bounds of the effective static moduli. The authors demonstrate this comparison graphically by plotting for graphite-epoxy the predicted composite constants over the full range of fiber volume fractions. The authors consider the fibers to be anisotropic but transversely isotropic. Under special conditions, the energy-method upper and lower bounds compare identically with the results of this study. The static properties are, of course, special cases of the more general dispersion relationships. Graphs are given for nine elastic constants: axial and transverse Young's and shear moduli, bulk and plane-strain-bulk moduli, and three Poisson's ratios.

710,909
PB85-142438 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Young's Modulus and Internal Friction of an SiC-Particle-Reinforced Aluminum Composite.
Final rept.
H. M. Ledbetter, and S. K. Datta. 1984, 6p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Materials Science and Engineering 67, p25-30 1984.

Keywords: *Particulate composites, Silicon carbides, Aluminum alloys, Modulus of elasticity, Internal friction, Reprints, Aluminum matrix composites, Silicon carbide reinforced composites.

Using dynamic methods, the authors measured Young's modulus and the associated internal friction of a particle-reinforced composite in wrought plate form produced by powder metallurgy methods. The particles, 30% by volume, consisted of single crystals of alpha-SiC with sizes near 5 micrometers. The matrix consisted of aluminum alloy 6061 with original particle sizes near 20 micrometers.

710,910
PB85-142636 Not available NTIS
National Bureau of Standards, Boulder, CO.
Multiple Scattering of Elastic Waves and Effective Properties in Materials Containing Inclusions.
Final rept.
S. K. Datta, and H. M. Ledbetter. 1984, 17p
Prepared in cooperation with Colorado Univ. at Boulder.
Pub. in Proceedings of Conference on Wave Propagation in Homogeneous Media and Ultrasonic Nondestructive Evaluation, San Antonio, TX, June 17-21, 1984, p123-139.

Keywords: *Composite materials, *Elastic properties, *Elastic scattering, *Alloys, Physical properties, Aluminum silicon alloys, Acoustic velocity.

Theoretically and experimentally, the authors studied plane-wave propagation in materials containing inclusions. The theory applies to any elastic inclusion in a homogeneous elastic isotropic matrix. Particles can be distributed homogeneously or nonhomogeneously. They assumed ellipsoid-shaped particles, oriented either randomly or aligned. Mainly they considered an SiC-particle-reinforced aluminum-alloy composite. But the authors give results also for a porous rock, where they consider both prolate-spheroid and oblate-spheroid voids. For all nine elastic constants, measurement and (nonhomogeneous) model agree within a few percent.

710,911
PB85-145449 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Method for Fabrication of Aluminum/Alumina Composites.
Final rept.
B. F. Quigley, G. J. Abbaschian, R. Wunderlin, and R. Mehrabian. 1982, 8p
Pub. in Metallurgical Transactions, A: Physical Metallurgy and Materials 13A, n1 p93-100 Jan 82.

Keywords: *Fiber composites, Fabrication, Aluminum alloys, Aluminum oxide, Magnesium containing alloys, Solidification, Reprints, Metal matrix composites.

A new process was used to produce Al-Mg alloy composites containing discontinuous Al2O3 fibers. In the first step of the process, induced convection of the melt permits intimate contact between the fibers and the melt which invariably results in chemical interaction between the two. The presence of MgAl2O4 spinal on the fiber surface was confirmed. The composites produced contained randomly distributed fibers, and were further processed both to increase the volume fraction of fibers and to align them in two dimensions (planar random alignment). Examination of composite specimens fractured under tension indicated that the interfaces were strong enough to permit transfer of load from the matrix to the fiber. For example, modulus of elasticity and ultimate tensile strength of the alloy were improved approximately 50% and approximately 40% respectively by the addition of 23 v/o Al2O3 fibers.

710,912
PB85-182897 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Abrasive Wear of Aluminum Matrix Composites.
Final rept.
K. J. Bhansali, and R. Mehrabian. 1982, 5p
Pub. in Jnl. of Metals 34, n9 p30-34 1982.

Keywords: *Wear, Composite materials, Aluminum oxide, Silicon carbides, Abrasion, Reprints, *Aluminum matrix composites.

Abrasive wear resistance of aluminum matrix composites containing Al2O3 and SiC was investigated using a dry sand/rubber wheel abrasion tester. Composites containing Al2O3 were found to be superior to those containing SiC. This behavior was attributed to the formation of a brittle bond at the interface between aluminum matrix and SiC. Wear resistance of a composite containing large 142 micrometers Al2O3 was better than that of composites containing smaller Al2O3 particles, and was comparable to AISI 1345 steel heat treated to a hardness of 67 HRC.

710,913
PB85-205912 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Stiffness and Internal Stresses of Woven-Fabric Composites at Low Temperatures.
Final rept.
R. D. Kriz. 1984, 7p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Advances in Cryogenic Engineering Materials 30, p1-7 1984.

Keywords: *Woven fiber composites, Cryogenics, Stiffness, Residual stress, Reprints.

Woven-fabric composites are used in superconducting magnets and in containment of cryogenic liquids. Here, the mechanical response of a plain-weave laminated composite at cryogenic temperatures is studied by predicting the load-deformation response of a fundamental 'unit cell.' At present, only tensile loads are studied in the warp direction. Results show that stresses normal to the warp-fill interface increase with increasing warp angle; the largest effect occurs in the matrix region. Thermal loads increase these stresses in the matrix region and decrease these stresses in the fill region. Stiffness increases with decreasing warp angle.

710,914
PB85-205920 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Influence of Ply Cracks on Fracture Strength of Graphite/Epoxy Laminates at 76 K.
Final rept.
R. D. Kriz. 1984, 16p
Sponsored by National Research Council, Washington, DC and Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in American Society for Testing and Materials, Special Technical Publication 836, p250-265 1984.

Keywords: *Epoxy laminates, Fracture strength, Cryogenics, Oriented fiber composites, Reprints, Carbon fiber reinforced plastics, Epoxy matrix composites, Graphite reinforced composites, Cracks, Finite element analysis.

Quasi-isotropic laminates were fabricated from graphite/epoxy and quasi-statically loaded in tension at 76 K until fracture occurred. Fibers in 0-deg plies carry the largest portion of the tensile load; the weaker 90- and 45-deg plies crack at loads much lower than fracture strength. The effect of ply cracks on fracture of load-bearing 0-deg plies was examined to understand how defects affect laminate strength. A generalized plane-strain finite-element model was used to predict stress gradients in the 0-deg ply near the crack tip. Variations in residual stress caused by changes in temperature and absorbed moisture were included in the analysis.

710,915
PB85-207330 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Elastic Constants of an Anisotropic, Nonhomogeneous Particle-Reinforced Composite.
Final rept.
H. M. Ledbetter, S. K. Datta, and R. D. Kriz. 1984, 7p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Acta Metallurgica 32, n12 p2225-2231 1984.

Keywords: *Particulate composites, Single crystals, Silicon carbides, Elastic properties, Reprints, Aluminum matrix composites.

Experimentally and theoretically, we studied the elastic constants of a particle-reinforced-composite wrought plate produced by powder-metallurgy methods. The particles, 30% by volume, consisted of single crystals of alpha-SiC with sizes near 5 micrometers. The matrix consisted of 6061 Al alloy with original sizes up to 20 micrometers. By measuring ultrasonic-wave velocities using a pulse-echo method, we determined the complete nine-component elastic-constant tensor. Thermal-mechanical processing introduced orthotropic macroscopic elastic symmetry into the material. Besides the Voigt elastic constants, we report all the usual engineering elastic constants: Young moduli, shear moduli, Poisson ratios, and bulk modulus (reciprocal compressibility). The elastic stiffnesses show

large negative departures from a rule-of-mixture: up to 42%. Large elastic anisotropies also occur: 13% in Young's modulus, 12% in shear modulus, and 13% in Poisson's ratio. Explanation of these physical-property peculiarities lies in the microstructure. SiC particles are distributed nonhomogeneously. With Al, they form an enriched 'sea' that surrounds 'islands' of Al. These nonspherical islands are aligned and produce anisotropy. Using wave-scattering methods and ensemble averaging, we develop a theory that predicts all the observed physical-property phenomena.

710,916
PB85-207991 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Damping Metal-Matrix Composites: Measurement and Modeling.
Final rept.
H. M. Ledbetter, and S. K. Datta. Nov 84, 18p
Pub. in Proceedings of Vibration Damping Workshop, Long Beach, CA., February 27-29, 1984, pW-1-W-18.

Keywords: Composite materials, Damping, Elastic properties, Internal friction, Measurement Mathematical models, *Metal matrix composites.

Both experimentally and theoretically, the authors consider attenuation of elastic waves in a composite consisting of elastic reinforcing particles dispersed in an elastic matrix. The authors consider only geometrical attenuation caused by scattering from particles. The authors model contains the effects of particle volume fraction, particle shape, particle size, particle elastic constants, matrix elastic constants, measurement frequency, and elastic-wave polarization.

710,917
PB86-107430 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Materials.
Glass Fiberboard SRM (Standard Reference Materials) for Thermal Resistance.
Final rept.
J. G. Hust. Aug 85, 35p NBS/SP-260/98
Also available from Supt. of Docs as SN003-003-02674-3. Library of Congress catalog card no. 85-600566.

Keywords: *Thermal conductivity, *Fiberboards, *Heat resistant materials, *Glass particle composites, Standards, Temperature, Density(Mass/volume), Comparison, Insulation, *Standard reference materials, Certified reference materials.

The apparent thermal conductivity data that provided the basis for the certification of glass fiberboard as an SRM of thermal resistance are reported and analyzed. New data for the extension of the temperature range of this SRM to 100 K are included. Detailed analysis and intercomparisons of previously described NBS and other published data are given. These data are represented by an equation describing the dependencies of the data on temperature and density. Certified values of thermal resistance are given for temperatures from 100 to 300 K and densities from 113 to 145 kg/cu m.

710,918
PB86-111812 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Monitoring Elastic Stiffness Degradation in Graphite/Epoxy Composites.
Final rept.
R. D. Kriz. 1982, 5p
Sponsored by American Society for Nondestructive Testing, Columbus, OH.
Pub. in Proceedings of American Society for Nondestructive Testing Conference, Boston, MA., March 22-25 and Pittsburgh, PA., October 4-7, 1982,p160-164.

Keywords: *Graphite composites, *Epoxy resins, *Stiffness methods, Composite materials, Elastic analysis, Degradation, Moisture, Nondestructive testing.

Stiffness-critical design utilizes the high elastic moduli of graphite/epoxy composites. Elastic-stiffness degradation is therefore important. Here, we describe a nondestructive technique that measures the degree of degradation of the fiber or matrix stiffness. This technique monitors an acoustic beam's propagation direction, which depends on the composite's degree of elastic anisotropy. The epoxy-matrix used in this study is a commonly produced TGDDM-DDS epoxy resin that was saturated with absorbed moisture. The fiber experiment verified that the moisture degradation of the epoxy elastic stiffness altered the elastic anisotropy; the direction of the acoustic beam changed 5 degrees. The authors consider also the effect of fiber-stiffness degradation on the direction of propagation.

710,919
PB86-119476 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Influence of Damage on Mechanical Properties of Woven Composites at Low Temperatures.
Final rept.
R. D. Kriz. 1985, 4p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Jnl. of Composites Technology and Research 7, n2 p55-58 1985.

Keywords: *Mechanical properties, *Composite materials, *Woven fiber composites, *Damage, Low temperature tests, Stress strain diagrams, Laminates, Reinforced plastics, Modulus of rupture tests, Reprints.

Large quantities of nonmetallic woven composites will be used in magnetic fusion energy structures at low temperatures. The authors predicted and measured the influence of crack formation on the mechanical performance of standard glass/epoxy laminates (G-10CR, G-11CR) at low temperatures. From experiments with tension loads, the authors studied the formation of damage as a collection of fiber breaks, fiber bundle cracks, and delaminations between adjacent fiber bundles. The authors measured fiber bundle cracks in the laminate interior and individual fiber fracture at the laminate edges. They discovered that the sequence and type of damage control the discontinuities ('knee) in the load-deformation (stress-strain) diagrams. The authors found that G-11CR has two knees and three distinct moduli, whereas G-10CR has only two moduli and a single knee at a lower strain than G-11CR. Decrease in moduli measured near the knees compared well with predictions from the finite element model.

710,920
PB86-122769 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Physical-Property Modeling in Silicon-Carbide/Aluminum.
Final rept.
H. M. Ledbetter, S. K. Datta, R. D. Kriz, and M. W. Austin. 1984, 27p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings of Annual Discontinuous Reinforced Aluminum Composites Working Group Meeting (6th), Park City, Utah, January 4-6, 1984, p69-95.

Keywords: *Composite materials, *Physical properties, *Metal matrix composite, *Aluminum, *Silicon carbide, Elastic properties, Specific heat, Thermal expansion, Internal friction.

The authors review recent NBS studies, experimental, and theoretical, on physical properties of particle-reinforced metal-matrix composites. They focus on silicon-carbide/aluminum and consider four physical properties: elastic constants, thermal expansivity, specific heat, and internal friction.

710,921
PB86-138427 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Elastic Representation Surfaces of Unidirectional Graphite/Epoxy Composites.
Final rept.
R. D. Kriz, and H. M. Ledbetter. 1985, 15p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Recent Advances in Composites in the United States and Japan, Hampton, Virginia, June 1983, ASTM STP 864, p661-675 1985.

Keywords: *Oriented fiber composites, Elastic properties, Carbon fiber reinforced plastics, Epoxy matrix composites, Graphite reinforced composites.

Unidirectional graphite/epoxy composites exhibit high elastic anisotropy and unusual geometrical features in their elastic-property polar diagrams. From the five-component transverse-isotropic elastic-stiffness tensor we compute and display representation surfaces for Young's modulus, torsional modulus, linear compressibility, and Poisson's ratios. Based on Christoffel-equation solutions, we describe some unusual elastic-wave-surface topological features. Musgrave considered in detail the differences between phase-velocity and group-velocity surfaces arising from high elastic anisotropy. For these composites, we find effects similar to, but more dramatic than, Musgrave's. Some new, unexpected results for graphite/epoxy include: a shearwave velocity that exceeds a longitudinal-wave velocity in the plane transverse to the fiber; a wave that changes polarization character from longitudinal to transverse as the propagation direction sweeps from the fiber axis to the perpendicular axis.

710,922
PB86-138518 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Effects of Lay-up, Temperature, and Loading Rate in Double Cantilever Beam Tests of Interlaminar Crack Growth.
Final rept.
D. L. Hunston, and W. D. Bascom. 1983, 2p
Pub. in Composites Technology Review 5, n4 p118-119 1983.

Keywords: *Composite materials, *Delaminating, Crack propagation, Temperature, Loading rate, Cantilever beams, Tests, Reprints.

The problem of delamination in composites has led to an interest in techniques for studying interlaminar crack growth. The double cantilever beam specimen is a major tool in this area. In an effort to help establish this test as a more quantitative technique, the variables of ply orientation, test temperature, and loading rate were examined. In selecting the lay-up pattern for the specimen, it was found that control of the crack path, specimen symmetry, and specimen stiffness were important considerations. In performing such experiments, the test temperature and loading rate were found to have relatively little effect with brittle matrix resins.

710,923
PB86-231545 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Polymer Composites--Challenges and Research Trends.
Final rept.
D. Hunston, R. Dehl, and W. L. Wu. Mar 86, 5p
Pub. in Mechanical Engineering, p52-56 Mar 86.

Keywords: *Composite materials, Polymers, Research, Measurement, Plastics processing, Reprints.

The application and growth of polymer composites are hindered by problems associated with fabrication and performance prediction capabilities. A major source of these problems is the lack of basic knowledge concerning the relationships among processing, and properties. Research at the National Bureau of Standards is helping to address the need by developing test methods and by using these methods to generate scientific data on model materials. The program involves efforts in three areas. First, processing is being studied by developing measurements to monitor cure and by simultaneously applying these tests to study model systems. Second, measurement methods for the analysis of molecular structure, morphology, and defect content in composite materials are being investigated. Finally, performance properties are being measured and characterized. These studies are used to generate processing-structure-property relationships that will facilitate more rapid and reliable fabrication of composites.

710,924
PB86-238409 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Effective Wave Speeds in an SiC-Particle-Reinforced Al Composite.
Final rept.
H. M. Ledbetter, and S. K. Datta. 1986, 10p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Jnl. of Acoustical Society of America 79, n2 p239-248 Feb 86.

Keywords: *Particulate composites, Composite materials, Wave propagation, Plane waves, Elastic properties, Reprints, Aluminum matrix composites, Silicon carbide reinforced composites.

Plane-wave propagation in an SiC-particle-reinforced aluminum-alloy composite was studied. Considering the composite to possess orthotropic symmetry (nine independent elastic constants), by a pulse-echo method, nine independent ultrasonic velocities were measured. Measured elastic stiffnesses departed negatively up to 40% from a rule-of-mixture model. Using ensemble-average, scattered-plane-waves methods, the composite was modeled as SiC particles represented as prolate spheroids distributed randomly, both in position and in orientation. Wave speeds of plane waves, both longitudinal and shear, were calculated in the long-wavelength limit. These wave speeds lead to equations for the effective static bulk and shear moduli of the composite. Further, a nonhomogeneous particle distribution was considered. Wave-speed equations were derived for the case where the composite contains particle-free aluminum-alloy regions that were represented by oblate spheroids.

710,925
PB86-238417 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Internal Strain (Stress) in an SiC/Al Particle-Reinforced Composite.
Final rept.
H. M. Ledbetter, and M. W. Austin. 1986, 8p
Pub. in Advances in X-ray Analysis, v29 p71-78 1986.

Keywords: *Residual stress, *Particulate composites, Composite materials, Strains, Reprints, Aluminum matrix composites, Silicon carbide reinforced composites.

Silicon carbide and 6061 aluminum alloy possess very different thermal-expansion coefficients: 3.3 and 22.5x0.000001/K, respectively. Thus, one expects large internal strains and stresses in these composites because the two constituents form interfacial bonds at high temperatures and are cooled to ambient temperatures. From a simple elastic model, one expects a hydrostatic tensile stress in the aluminum matrix and a hydrostatic compressive stress in the silicon-carbide particles. Using conventional diffraction geometry, using Cu kalpha radiation, the authors studied three surfaces of a plate specimen. For both phases, the authors determined the unit-cell dimensions for two situations: unmixed and mixed in the final composite.

710,926
PB87-111662 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Elastic Constants and Internal Friction of Reinforced Composites.
Final rept.
H. M. Ledbetter. 1985, 6p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Jnl. de Physique 46, n12 pC10-573-C10-578 Dec 85.

Keywords: *Composite materials, Internal friction, Elastic properties, Fiber composites, Reprints.

The authors describe experimental studies on the anisotropic elastic constants and internal friction of reinforced composites. Reinforcement types include fiber and fabric. Studied materials include boron-aluminum, glass-epoxy, boron-epoxy, graphite-epoxy, and aramid-epoxy. The authors made most measurements with a Marx three-component oscillator at kilohertz frequencies. In all cases, elastic-constant direction dependence fit relationships derived for homogeneous monocrystals. Usually, elastic stiffness and internal friction show an inverse relationship. In no case did the inclusion-matrix interface appear to contribute significantly to internal friction.

710,927
PB87-111670 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Young Modulus and Internal Friction of a Fiber-Reinforced Composite.
Final rept.
H. M. Ledbetter, M. Lei, and M. W. Austin. 1986, 5p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Jnl. of Applied Physics 59, n6 p1972-1976, 15 Mar 86.

Keywords: *Fiber composites, Modulus of elasticity, Internal friction, Fiberglass reinforced plastics, Reprints, Epoxy matrix composites.

By a kilohertz-frequency resonance method the authors determined the Young modulus and internal friction of a uniaxially fiber-reinforced composite. The composite comprised glass fibers in an epoxy-resin matrix. The authors studied three fiber contents: 0, 41, and 49 vol %. The Young modulus fit a linear rule of mixture. The internal friction fit a classical free-damped-oscillator model where one assumes a linear rule of mixture for three quantities: mass; force constant; and mechanical-resistance constant.

710,928
PB87-112314 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Characteristics of Composite Materials - A Review of the Literature.
J. E. Brown, J. J. Loftus, and R. A. Dipert. Aug 86, 46p NBSIR-85/3226
Sponsored by Naval Sea Systems Command, Washington, DC.

Keywords: *Composite materials, *Shipboard fire control, Navy, Thermoplastic resins, Thermoset resins, Fires, Tests, Flammability.

A review is presented of the open literature concerning fire tests of composite materials which may be considered for use in U.S. Navy shipboard structures and installations. Results obtained for thermoplastic resins, thermoset resins, and composite structures are summarized from standard test methods. The methods include tests for limiting oxygen index, smoke production, flame spread, fire endurance, and also from measurements of polymer properties, including differential scanning calorimetry and thermogravimetric analysis. Typical criteria used by various investigators for ranking materials are discussed, and the material rankings based on test results are given. Data from non-standard tests designed to measure fire performance are also discussed. A detailed review of data and results of tests for selected references is given. Finally, recommendations are made for test developments and for the future direction of the U.S. Navy's fire evaluation program for composites and related materials intended for shipboard use.

710,929
PB87-118618 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Composite Interlaminar Fracture: Effect of Matrix Fracture Energy.
Final rept.
D. L. Hunston. 1984, 5p
Contract NASA-L-31134B
Sponsored by National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Pub. in Composites Technology Review 6, n4 p176-180 1984.

Keywords: *Fracture(Materials), *Composite materials, Crack propagation, Adhesion, Thermoplastic resins, Delaminating, Reprints, Interlaminar fracture.

The data analyzed in the paper show a definite correlation between resin mode-I fracture energy and composite interlaminar fracture energy as measured by the double cantilever beam specimen. With brittle polymers, the resin toughness is fully transferred to the composite while with tougher polymers the resin toughness is only partially transferred presumably because the fibers restrict the crack tip deformation zone in the polymer. Not surprisingly, resin toughness is not the only factor that is important in interlaminar fracture. Factors that tend to increase the interlaminar toughness are fiber nesting and bridging and fiber breakage and pull-out during crack growth. Factors that tend to lower the interlaminar fracture energy are resin porosity and weak fiber-matrix bonding.

710,930
PB87-122495 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Fracture Toughness of a Steel Matrix, Titanium Carbide Composite.
Final rept.
R. J. Fields, D. E. Harne, and B. A. Fields. 1985, 11p
Pub. in Proceedings of Meeting of the Mechanical Failures Prevention Group, Failure Mechanisms in High Performance Materials (39th), Gaithersburg, MD., May 1-3, 1984, p117-127 1985.

Keywords: *Fracture toughness, *Titanium carbides, *Composite materials, *Steels, Matrix materials, Fracture tests.

Steel matrix-TiC composites are used in the cutwater of prototype coal slurry pumps and valves. In this application, these materials must resist erosion and fracture. While they have proved to be adequately resistant to erosion, there have been some fractures in this application. The authors have measured the fracture toughness of a 45 v/o TiC in steel metal matrix composite according to ASTM standard test method E-399. Difficulties encountered in performing these tests will be discussed. The results of using a simple hardness indentation technique to determine K(sub IC) will be compared with the E-399 results. In addition, relevant micrographs and fractographs will be presented to indicate how crack propagation occurs in this composite.

710,931
PB87-128963 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Influence of Damage on Mechanical Performance of Woven Laminates at Low Temperatures.
Final rept.
R. D. Kriz, and W. J. Muster. 1986, 8p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Proceedings of International Cryogenic Material Conference (6th), Cambridge, MA., August 12-16, 1985, p137-144 1986.

Keywords: *Cracking(Fracturing), *Damage, Mechanical properties, Laminates, Low temperature tests, Woven fiber composites, Modulus of rupture tests, Stress strain diagrams, Fiber laminates, *Woven laminates, Glass epoxy laminates.

Large quantities of nonmetallic woven composites will be used in magnetic fusion energy structures at low temperatures. The authors predicted and measured the influence of crack formation on the mechanical performance of standard glass/epoxy laminates (G-10CR, G-11CR) at low temperatures. From experiments with tension loads, the authors studied the formation of damage as a collection of fiber breaks, fiber bundle cracks, and delaminations between adjacent fiber bundles. The authors measured fiber bundle cracks in the laminate interior and individual fiber fracture at the laminate edges. The authors discovered that the sequence and type of damage control the discontinuities ('knees') in the load-deformation (stress-strain) diagrams. The authors found that G-11CR has two knees and three distinct moduli, whereas G-10CR has only two moduli and a single knee at a lower strain than G-11CR. Decrease in moduli measured near the knees compared well with predictions from a finite element model.

710,932
PB87-131868 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Finite Element Analysis of Curved Composite Laminate.
Final rept.
J. D. Lee, and B. L. Wang. 1986, 6p
Pub. in Proceedings of International Symposium on Composite Materials and Structures, Beijing (China), June 10-13, 1986, p274-279.

Keywords: *Laminates, *Composite materials, *Finite element analysis, Tension, Stresses, Strain(Mechanics), Torsion, Three-dimensional calculations.

A general purpose three-dimensional finite element computer program has been developed for the analysis and optimal design of composite structure made of arbitrarily curved composite laminate. The applicability and validity of this program are demonstrated here by solving a few sample problems: a composite tube subjected to axial tension, radial expansion, and/or torsion.

710,933
PB87-132742 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Standardizing Nonmetallic Composite Materials for Cryogenic Applications.
Final rept.
M. B. Kasen. 1986, 6p
Sponsored by Department of Energy, Washington, DC. Div. of Magnetic Fusion Energy.

Pub. in Proceedings of Seminar on Property Evaluation and Standardization of Cryogenic Materials, Tokyo, Japan, September 2, 1986, p1-6.

Keywords: *Composite materials, Nonmetals, Standards, Cryogenics, Fracture strengths, Torsion tests.

The current status of standards for nonmetallic composite materials at cryogenic temperatures is reviewed and future needs are assessed. It is concluded that a generic system for categorizing composite materials according to their cryogenic performance would be of value to engineers. It is also concluded that standard test methods are needed for producing both component data bases and design data bases.

710,934

PB87-132759 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
High Quality Organic Matrix Composite Specimens for Research Purposes.
Final rept.
M. B. Kasen. 1986, 4p
Sponsored by Department of Energy, Washington, DC. Div. of Magnetic Fusion Energy.
Pub. in Jnl. of Composites Technology and Research 8, n3 p103-106 1986.

Keywords: Composite materials, Mechanical properties, Fracture properties, Shear properties, Mechanical tests, Reprints, *Organic matrix composites.

An efficient method for producing and testing organic-matrix composite specimens for research purposes is described. The production method is adaptable to in-house manufacturing and provides complete control over a large variety of material and processing variables. The rod-shaped, uniaxially reinforced or neat-resin specimens may be cut to length and tested without further machining. Conventional short-beam shear, flexural strength, and compression test methods may be used. Development of test methods for performing torsinal shear tests and for determining the fracture energy, Glc, are described. Test results at room temperature and at cryogenic temperature are presented.

710,935

PB87-134755 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Continuous Damage Mechanics (CDM) Model of Damage Accumulation in Laminated Composites.
Final rept.
M. P. Wnuk, and R. D. Kriz. 1985, 18p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in International Jnl. of Fracture 28, p121-138 1985.

Keywords: *Fractures(Materials), *Laminates, Cracking(Fracturing), Composite materials, Crack propagation, Combination laminates, Reprints, Epoxy graphite laminates.

A modified version of the Kachanov damage accumulation law is employed to study the damage kinetics in laminated composite materials such as epoxy/graphite laminates. The primary objective of the present work is to quantify the characteristic events involved in the final stages of the failure process in composite materials following occurrence of the CDS. The process of localization and spread of damage ahead of the dominant matrix crack is viewed as a sequence of nucleation and propagation phases both of which may be described by use of the internal damage parameter. This scalar quantity reflects the ratio of the current crack (or pore) density to its saturation, or critical level. It is shown that the Continuous Damage Mechanics (CDM) approach is useful in modeling a damage field consisting mainly of the fiber breaks generated ahead of the matrix crack and clustered around the plane of a prospective fracture, thus forming the so-called 'damage band' embedded within the stress field of the dominant crack. Description of this type of damage applies to the failure process which follows formation of the 'characteristic damage state' (CDS) observed in a number of multiphase materials.

710,936

PB87-150801 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Cure Monitoring for Polymer Matrix Composites.
Final rept.,
B. Fanconi, F. Wang, D. Hunston, and F. Mopsik. 1986, 17p
Pub. in Materials Characterization for Systems Performance and Reliability, p275-291 1986.

Keywords: *Curing, Reprints, *Polymer matrix composites, Process monitoring.

Polymer matrix composites are desirable materials owing to their high specific strength and modulus and corrosion resistance. Wider application of these materials is limited by product variability and the labor intensive, time consuming manufacturing processes. The development of suitable means of process monitoring and control is the key to improved processing. A central thrust of the polymer matrix composites program at the National Bureau of Standards is cure monitoring for the purpose of process control. Four techniques have been explored, or are currently under development for cure monitoring. Fourier transform infrared spectroscopy has been used to follow the extent of chemical reactions forming the three dimensional network. Molecular mobility and ionic transport has been measured by dielectric spectroscopy. The mechanical properties of a curing matrix resin has been monitored using an ultrasonics method, and the microviscosity of a resin has been examined by an optical waveguide-fluorescence microprobe technique. Results of measurements conducted by these techniques are presented and their potential is explored.

710,937

PB87-182937 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Effective Elastic Properties of Materials with Inclusions.
Final rept.,
H. M. Ledbetter, and S. K. Datta. 1986, 16p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings Rheology of Anisotropic Materials, Paris, France, November 28-30, 1984, p291-306 1986.

Keywords: *Elastic properties, *Composite materials, Anisotropy, Inclusions, Poisson ratio, Modulus of elasticity, Approximation, Aluminum alloys.

Theoretically and experimentally, the authors studied plane-wave propagation in materials containing inclusions. The theory applies to any elastic inclusion in a homogeneous elastic isotropic matrix. Particles can be distributed homogeneously or nonhomogeneously. They assumed ellipsoid-shaped particles, oriented either randomly or aligned. As a particular example, the authors consider an SIC-particle-reinforced aluminum-alloy composite. They give results also for a porous rock, where the authors consider both prolate-spheroid and oblate-spheriod voids. For SiC/Al the authors first consider the homogeneous-particle-distribution case where SiC particles represented as prolate spheroids (aspect ratio-3) are oriented randomly.

710,938

PB87-200309 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Process Monitoring of Polymer Matrix Composites Using Fluorescence Probes.
Final rept.,
B. Fanconi, F. Wang, and R. Lowry. 1987, 9p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v6B p1287-1295 1987.

Keywords: *Polymers, *Composite materials, Viscosity, Fluorescence, Spectroscopy, Reprints.

A fluorescence technique has been developed to monitor the viscosity of polymer resins. The technique has application to cure monitoring of polymer matrix composites. Optic fibers are used to bring the excitation light into the polymer, or composite specimen, as well as to collect fluorescence light for detection.

710,939

PB87-201547 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Microstructures of SiC and Si3N4 with Fibrous Inclusions.
Final rept.,
N. J. Tighe, J. Sun, and R. M. Hu. 1986, 2p
Sponsored by Department of Energy, Oak Ridge, TN., and United Nations Industrial Development Organization, Vienna (Austria).
Pub. in Proceedings of the Annual Meeting of the Electron Microscopy Society of America (44th), Albuquerque, NM, April 4-6, 1986, p492-493 1986.

Keywords: *Ceramic composites, Silicon nitrides, Silicon carbides, Boron nitrides, Microstructure, Silicon nitride matrix composites, Silicon carbide matrix composites, Boron nitride matrix composites.

The paper describes morphology, structure, and chemistry of a silicon nitride/boron nitride composite, and a silicon carbide/carbon composite ceramic.

710,940

PB87-208310 PC **A03**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Structural Reliability and Damage Tolerance of Ceramic Composites for High-Temperature Applications,
E. R. Fuller, T. W. Coyle, R. F. Krause, and T. J. Chuang. Jun 87, 31p NBSIR-87/3564
Sponsored by Department of Energy, Oak Ridge, TN. Advanced Research and Technology Fossil Energy Materials Program.

Keywords: *Ceramic composites, *Ceramics, Silicon carbides, Whisker composites, Heat recovery, *Heat engines.

The achievement of higher efficiency heat engines and heat recovery systems requires the availability of high temperature, high performance structural materials. Structural ceramics, and more recently, ceramic matrix composites have received particular attention for these applications due to their high strength, and corrosion and thermal shock resistance. Even with these positive attributes, improved reliability and extended lifetime under service conditions are necessary for structural ceramics to gain industrial acceptance. The problems with these materials are mechanical and chemical in nature and are enhanced by the fact that they are subjected to high temperatures, reactive environments and extreme thermal gradients. With an objective of improved performance for heat engine/heat recovery applications, the NBS program on structural ceramics and ceramic composites addresses these problems through the determination of the critical factors which influence mechanical and microstructural behavior. The activities of the program are grouped under two major subtasks, each designed to develop key data, associated test methods and companion predictive models. The status of the subtasks are detailed in the following sections.

710,941

PB87-231999 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Matrix Resin Effects in Composite Delamination: Mode I Fracture Aspects.
Final rept.,
D. L. Hunston, R. J. Moulton, N. J. Johnston, and W. D. Bascom. 1987, 21p
Sponsored by National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Pub. in ASTM (American Society for Testing and Materials) Special Technical Publication 937, p74-94 1987.

Keywords: *Polymers, *Composite materials, Polycarbonate resins, Polyamide resins, Delaminating, Thermoplastic resins, Fracture properties, Reprints, *Foreign technology.

A variety of thermoset, toughened-thermoset, and thermoplastic polymers were characterized for Mode I critical strain energy release rates, and their composites were tested for interlaminar strain energy release rates using the double-cantilever beam specimen. A clear correlation between the data from the two types of experiments was found. With brittle polymers, the composite strain energy release rates varied from slightly greater than to three times greater than the resin values. Although the resin toughness may represent the lower limit for the composite, the increased strain release rate value usually found in the composite was attributed to the fiber breakage and pullout that generally accompany composite crack growth.

Composite Materials

710,942

PB88-122189 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Ductility Improvement in Particle-Reinforced Aluminum Composites: A Ductile-Fracture Model Based on Void Nucleation and Growth.
Final rept.,
I. H. Lin. 1987, 4p
Pub. in Proceedings of the International Conference on Mechanical Behaviour of Materials (5th), Beijing, China, June 3-6, 1987, p1261-1264.

Keywords: *Aluminum, *Ductility, *Composite materials, Failure, Mathematical models, Tension tests, Strain, Fracture properties.

The authors studied theoretically the effect of SiC particles on the ductility of SiC/A1 composites. The authors developed a failure model with the assumptions that voids nucleate at the particle-matrix interface and grow to a critical size at fracture. One adjustable parameter, the critical void size, was fit to results of uniaxial tensile tests. The model predicts quantitatively the tensile strain at fracture as a function of the SiC volume fraction.

710,943

PB88-122197 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Elastic-Wave Surfaces in Anisotropic Media.
Final rept.,
R. D. Kriz, and H. M. Ledbetter. 1986, 13p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Proceedings of Annual Colloquium on Rheology of Anisotropic Materials, Paris, France, November 28-30, 1984, p79-91 1986.

Keywords: *Fiber composites, *Reinforcing materials, Acoustics, Surfaces, Sound transmission, Reprints.

Based on Christoffel-equation solutions, some interesting wave-surface topological features are described for anisotropic media. These features include crossovers of transverse-longitudinal surfaces and continuous transverse-longitudinal mode conversion over a single surface. For orthorhombic symmetry (mmm), crossovers of transverse-transverse surfaces occur for all known cases: the transverse surfaces interconnect and form a single surface. Beyond this, some orthorhombic crystals exhibit a longitudinal-transverse crossover that causes all three surfaces to interconnect into a single surface. The authors consider several real cases, including wood and reinforced composites.

710,944

PB88-122205 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Elastic Representation Surfaces of Unidirectional Graphite-Magnesium Composites.
Final rept.,
R. D. Kriz, and H. M. Ledbetter. 1987, 14p
Pub. in Proceedings of Nondestructive Testing and Evaluation of Advanced Materials and Composites Conference, Colorado Springs, CO., August 19-21, 1986, p63-76 1987.

Keywords: *Magnesium, *Composite materials, *Elasticity, Graphite, Stiffness, Mathematical models, Anisotropy, Modulus of elasticity, Reprints.

Unidirectional graphite-magnesium composites show high elastic anisotropy and unusual geometrical features in their elastic-property polar diagrams. From the five-component transverse-isotropic elastic-stiffness tensor the authors compute and display representation surfaces for Young's modulus, torsional modulus, linear compressibility, and Poisson's ratios. The authors emphasize the importance of obtaining the complete elastic-stiffness tensor. They give examples of errors resulting from popular elastic-constant approximations.

710,945

PB88-122221 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Determination of Whole-Field Strain in a Composite Panel Using Coherent Optical Processing.
Final rept.,
J. F. Cardenas-Garcia, J. C. Moulder, and R. D. Kriz. 1986, 10p
Pub. in Proceedings of SEM (Society for Experimental Mechanics) Fall Conference on Experimental Mechanics, 'Optical Methods in Composites', Keystone, CO., November 2-5, 1986, p48-57.

Keywords: *Stresses, *Composite materials, *Panels, Glass, Deformation, Epoxy compounds, Cracks, Mathematical models, Strains, Tension, Reprints, Finite element analysis.

A newly devised video-optical experimental technique allows for the automated determination of the in-plane, plane stress components of the infinitesimal deformation tensor at discrete locations over an area of interest in a loaded specimen. It was used to evaluate a square area enclosing the central crack in a G10CR woven glass epoxy panel loaded in tension. A finite element analysis was performed to model the strain tensor field surrounding the central crack. The experimental and FEM results show a equivalence and the localized effect of high strains close to the crack tip is observed.

710,946

PB88-152087 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Fractographic Analysis of Interlaminar Fracture.
Final rept.,
W. D. Bascom, D. J. Boll, D. L. Hunston, B. Fuller, and P. J. Phillips. 1987, 19p
Sponsored by National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Pub. in ASTM (American Society for Testing and Materials) Special Technical Publication 937, p131-149 1987.

Keywords: *Carbon fibre reinforced plastics, *Epoxy laminates, Polyphenyl compounds, Fractography, Failure, Yield strength, Thermoplastic resins, Electron microscopy, Reprints.

The failed surfaces of interlaminar fracture (Mode I) specimens were examined using scanning electron microscopy. The matrix resins were Hercules 3501-6 and 2502 epoxies and Phillips Petroleum polyphenylene sulfide (PPS) and the reinforcing carbon fibers were Hercules AS4 and AS6G. The epoxy matrix composites exhibited fiber pull-out, hackle markings and regions of smooth resin fracture. Considerable (up to 30-50%) relaxation of the deformed resin occurred when the epoxy matrix specimens were heated above the matrix Te. Some of the fractography features are discussed in terms of the tensile stresses acting at the surface of the fibers.

710,947

PB88-152525 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Effect of Interface Properties on Wave Propagation in a Medium with Inclusions.
Final rept.,
S. K. Datta, and H. M. Ledbetter. 1986, 11p
Pub. in Mechanics of Materials Interfaces, p131-141 1986.

Keywords: *Composite materials, Secondary waves, Longitudinal waves, Attenuation, Inclusions, Interfaces, Ultrasonic frequencies, Reprints.

The study considers propagation of effective plane longitudinal and shear waves through a medium with a random distribution of spherical inclusions. The authors assume that inclusions and matrix possess different elastic properties and that a thin layer of elastic material with still different properties separates the inclusions from the matrix. Also, the authors assume same-size inclusions same-thickness layers. The authors find that the layers substantially affect the phase velocities and attenuation of coherent plane waves propagating through the composite medium.

710,948

PB88-153937 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Monitoring Elastic Stiffness Degradation in Graphite/Epoxy Composites.
Final rept.,
R. D. Kriz. 1987, 7p
See also PB86-111812.
Pub. in Solid Mechanics Research for Quantitative Non-Destructive Evaluation, p389-395 1987.

Keywords: *Graphite composites, *Epoxy resins, *Stiffness methods, Nondestructive testing, Composite materials, Elastic analysis, Degradation, Moisture, Reprints.

Many stiffness-critical aerospace structures exploit the high specific stiffness of graphite/epoxy composites. Elastic-stiffness degradation of these materials is therefore important. Here a nondestructive technique is described that measures stiffness degradation of the graphite-fibers and epoxy-matrix. The technique monitors variations in the direction of stress-wave propagation (energy-flux) corresponding to a change in composite stiffness.

710,949

PB88-153978 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Fracture Mechanics Characterization of Crack/Fiber Interactions in Ceramic Matrix Composites.
Final rept.,
T. W. Coyle, E. R. Fuller, P. Swanson, and T. Palamides. 1987, 6p
Sponsored by Department of Energy, Washington, DC.
Pub. in Ceramic Engineering and Science Proceedings 8, n7/8 p630-635 Jul/Aug 87.

Keywords: *Ceramic matrix composites, *Fracture properties, Cracking(Fracturing), Ceramic fibers, Bonding, Stress waves, Delaminating, Fractography, Reprints.

A crucial factor in the structural performance of ceramic matrix composites is the influence of the fiber/matrix bond on the interaction of a matrix crack with the reinforcing fibers. To elucidate the character of this interaction under controlled fracture conditions, glass fracture mechanics specimens were fabricated in the double-cleavage, drilled compression (DCDC) configuration with simple arrays of fibers. Propagating cracks were observed in cross-polarized illumination to characterize delamination of the fiber ahead of the crack and bridging interactions behind the crack tip. Stress wave fractography was employed to analyze the shape and relative velocity of the crack front.

Corrosion & Corrosion Inhibition

710,950

AD-A034 723/7 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Role of Passive Film Growth Kinetics and Properties in Stress Corrosion and Crevice Corrosion Susceptibility.
Technical summary rept. no. 7, Oct 75-Nov 76,
J. Kruger, and J. R. Ambrose. Nov 76, 55p NBSIR-76-1170
Contract NAonr-18-69
See also report dated Oct 75, AD-A019 648.

Keywords: *Corrosion, *Stress corrosion, *Iron alloys, *Stainless steel, Molybdenum alloys, Electrochemistry, Test methods, Passivity, Chlorides, Polarimetry, Reaction kinetics, Concentration cell corrosion.

This report consists of four parts as follows: (1) A study of the influence of Mo in Fe-Mo alloys on crevice corrosion. It was found that >5% Mo is needed to affect repassivation in a crevice. (2) The description of a new technique for measuring repassivation rates in a crevice. (3) A description of alloys prepared to simulate the composition of metal near grain boundaries of sensitized austenitic stainless steel. These alloys are used for studies of the effect of sensitization on repassivation kinetics. (4) A review of new approaches in the study of localized corrosion.

710,951

AD-A055 366/9 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.

Role of Passive Film Growth Kinetics and Properties in Stress Corrosion and Crevice Corrosion Susceptibility.
Technical summary rept. no. 8, Dec 76-Dec 77,
J. Kruger, J. R. Ambrose, J. J. Carroll, and A. J. Melmed. Nov 77, 68p NBSIR-78-1429
Contract NA onr-18-69

Keywords: *Corrosion, *Stress corrosion, *Corrosion resistance, *Corrosion resistant alloys, Metals, Alloys, Hydrogen, Hydrogen embrittlement, Field ion microscopy, Films, Corrosion inhibition, Iron, Stainless steel, Chromium, Depletion, Iron alloys, Molybdenum alloys, Repassivation.

This report consists of the following four parts: Field Ion Microscopy Studies of the Interaction of Hydrogen with Selected Metals and Alloys; The Role of Noncrystalline Films in Passivation and Breakdown of Passivation; Effect of Chromium Depletion on the Repassivation Kinetics 18-10 Austenitic Stainless Steel in Sodium Chloride Solutions; and Composition of Surface Films Formed During the Repassivation of Iron and Iron-Molybdenum Alloys. (Author)

710,952
AD-A078 596/4 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Passive Films, Surface Structure and Stress Corrosion and Crevice Corrosion Susceptibility.
Annual rept. Nov 77-Nov 78.
J. Kruger, J. J. Carroll, A. J. Melmed, J. J. Ritter, and J. R. Ambrose. Nov 78, 37p Rept nos. NBSIR-79-1904, NBS-TSR-9
Contract NAonr-18-69

Keywords: *Films, *Passive systems, *Surface properties, Structures, *Stress corrosion, Coatings, Iron, Chromium alloys, Niobium, Stainless steel, Aluminum, Field ion microscopy, Passivity, Hydrogen, Cracks, Spectra, Cathodes, Crystallography, Ellipsometers, Surface structures, Repassivation, Steel 304, Triboellipsometry.

Field ion microscopy (FIM) is capable of imaging defects such as sub-critical crack formation and growth, and surface rearrangements, and of detecting new surface phase formations, and other disturbances. Thus, we have used the technique to characterize various modes of hydrogen reactions with metal surfaces. Previous work from this laboratory has revealed examples of one mode, the initial crack formation and growth in the hydrogen-titanium and hydrogen-zirconium systems. In each case there were indications of preferential crystallographic attack producing cracks within the metal matrix approximately 10-15 atomic layers deep in the case of titanium, and 2-5 layers deep in the case of zirconium. In the present phase of the work, FIM was used to examine microscopic details of the initial stages of hydrogen interactions with some additional pure metals and metal alloys, i.e., niobrium, aluminum, 304 stainless ssteel and iron-24 wt. & chronium steel. The hydrogen-metal interactions occurred during the FIM imaging process with hydrogen pressures between ten to the minus 4th power and ten to the minus 6th power torr at metal temperatures between 20 and 80 K, and while the metal was subjected to stresses brought about by the electric field necessary for imaging the multifacted, approximately hemispherical metal surface. The method used involved comparison of micrographs obtained during inert gas imaging (neon, helim) with micrographs obtained in pure hydrogen or mixtures of hydrogen and inert gases.

710,953
DE85017205 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Corrosion of Materials Used in Steam Generating Boiler Systems. Final Report.
E. Escalante, D. Mathews, and J. Fink. Oct 84, 50p NBSIR-84-2959
Contract AT01-79CS20528
Portions of this document are illegible in microfiche products.

Keywords: *Boilers, *Incinerators, *Refuse-Fueled Boilers, Chlorides, Coal, Materials Testing, Pitting Corrosion, Stainless Steel-304, Steam Generators, ERDA/360105, ERDA/421000.

Five alloys, SA178, SA192, SA213-T11, SA213-T22, and Type 304 Stainless Steel, were evaluated on their resistance to pitting in a coal burning boiler and in a residential refuse burning incinerator. The materials were introduced into the vicinity of the boiler tubes using a probe whose temperature was controlled and monitored to simulate conditions of the boiler tubes. After three to six months, the probes were withdrawn and the alloy specimens removed for evaluation. The data indicate that the environment of the refuse burning incinerator was considerably more aggressive than that of the coal burning boiler. Chloride was found in practically all the pits examined in the alloys from the refuse burning system, but no chloride was found in the pits examined on the materials exposed in the coal burning boiler. The data suggest that the moisture from lawn clippings increases the rate of attack which is further aggravated by large temperature fluctuations. Type 304 stainless steel was the most resistant to pitting in both environments, but the SA213-T11 and SA213-T22 were less resistant to pitting than the lower alloy SA178 and SA192 in the refuse burning incinerator. (ERA citation 10:046748)

710,954
PB-264 316/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Corrosion Behavior of Ductile Cast-Iron Pipe in Soil Environments.
Final rept. 1958-1972,
W. F. Gerhold. Dec 76, 5p
Pub. in Jnl. of American Water Works Association, v68 n12 p5506-5510 Dec 76.

Keywords: *Underground corrosion, *Pipes, Carbon steels, Nodular iron, Soils, Reprints.

Ductile cast-iron pipe was buried for up to fourteen years in a variety of soil environments. This final report, comparing its performance to that of carbon steel buried in the same soils, suggests the two substances corrode at nearly the same rates when encased in some soils. Different soils, however, alter the corrosion rates considerably for both materials.

710,955
PB-268 512/1 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
Corrosion and Protection of Steel Piles in a Natural Seawater Environment.
Final rept.,
E. Escalante, W. P. Iverson, W. F. Gerhold, B. T. Sanderson, and R. L. Alumbaugh. Jun 77, 46p NBS-Mono-158
Sponsored in part by American Iron and Steel Inst., Washington, D.C. Supersedes rept. NBSIR-76-1104. Library of Congress Catalog Card number LCCCN-76-608410.

Keywords: *Offshore structures, *Steel piles, *Cathodic protection, *Protective coatings, Performance evaluation, Corrosion tests, Sea water corrosion, Tables(Data).

This report describes the first eight years of a long term program in which twenty-three coating systems and five cathodic protection systems are evaluated on their ability to protect steel piles in offshore conditions. These systems are made up of nonmetallic coatings, metallic pigmented coatings, nonmetallic coatings on metal filled coatings, nonmetallic coatings on metallic coatings, metallic coatings, and cathodic protection on bare and coated piles. It includes a description of the annual on site electrochemical coating evaluation and a description of the final physical evaluation made on the piles after removal. The results of these electrochemical and physical evaluations are presented graphically and in tabular form.

710,956
PB-268 672/3 PC **A05**/MF **A01**
American Univ., Washington, DC. Dept. of Chemistry.
Stress Corrosion Cracking Control Measures.
Final rept.,
B. F. Brown. Jun 77, 82p NBS--Mono-156
Contract N00014-68-A-0245-0007, ARPA Order-2616
Library of Congress catalog card no. 76-608306. See also report dated 7 Jul 75, AD-A013 611.

Keywords: *Stress corrosion, *Corrosion prevention, Copper alloys, Aluminum alloys, Titanium alloys, Nickel alloys, High strength steels, Stainless steels, Stress corrosion tests.

Stress corrosion cracking is a failure mode which has occurred with increasing frequency in all sectors of technology. This publication attempts to diminish the incidence of stress corrosion failures by assembling the available practical measures to avoid or minimize the problem and present these measures in a form comprehensible to those persons responsible for the design, fabrication and maintenance of new structures. The alloys covered are copper, aluminum, titanium and nickel alloys and high strength and stainless steels.

710,957
PB-270 318/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Qualitative Use of Ellipsometry to Study Localized Corrosion Processes.
Final rept.,
J. Kruger, and J. R. Ambrose. 1976, 19p
Sponsored in part by Office of Naval Research, Arlington, Va.
Pub. in Proceedings of Int. Conf. on Ellipsometry (3rd), Lincoln, Nebraska, September 23-25, 1975, Surf. Sci., v56 p394-412 1976.

Keywords: *Corrosion, *Polarimetry, Qualitative analysis, Stress corrosion, Concentration cell corrosion, Pitting corrosion, Passivity.

Localized corrosion processes such as pitting, intergranular corrosion, crevice corrosion, and stress corrosion involve many aspects that are not amenable to a quantitative study by ellipsometry. This paper describes uses of ellipsometry that can, however, provide valuable insights into localized corrosion processes without having to determine the optical constants of absorbing films. The uses described are as follows: (1) the determination of induction times for pit initiation and the demonstration that changes occur in the pass film prior to pitting; (2) the measurement of the rate of repassivation, of importance to stress corrosion, of a metal surface whose protective film has been removed by abrasion (triboellipsometry); and (3) the identification of three stages leading to crevice corrosion by ellipsometric measurements made within a crevice.

710,958
PB-273 116/4 PC **A12**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Corrosion and Metal Artifacts: A Dialogue Between Conservators and Archaeologists and Corrosion Scientists.
Final rept.,
B. F. Brown, H. C. Burnett, W. T. Chase, M. Goodway, and J. Kruger. Jul 77, 257p NBS-SP-479
Prepared in cooperation with American Univ., Washington, D.C., Smithsonian Institution, Washington, D.C., Washington Conservation Guild, D.C., and Centre Belge d'Etude de la Corrosion, Brussels.

Keywords: *Archaeology, *Corrosion, *Meetings, Sculpture, Bronze, Copper, Coatings, Patina coatings, Iron, Gold, Cleaning, Surface finishing, Electrochemistry, Corrosion inhibition, Museums, Artifacts.

This book contains the tutorial lectures on the aspects of corrosion science and engineering of relevance to conservators and archaeologists and, background lectures which are addressed to corrosionists with activities and problems in the conservation of metallic artistic artifacts. The report also contains the full discussion (attendee) of the structured questions distributed before the meeting. The report is well documented with illustrations. (Color illustrations reproduced in black and white)

710,959
PB-273 132/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Corrosion-Fatigue Properties of the Ti-6Al-4V Alloy.
Final rept.,
M. A. Imam, C. M. Gilmore, and A. C. Fraker. 1977, 8p
Pub. in Proceedings of Conference Environmental Degradation of Engineering Materials, Blacksburg, Virginia, October 10-12, 1977, p783-790 1977.

Keywords: *Corrosion fatigue, *Titanium alloys, Aluminum containing alloys, Vanadium containing alloys, Heat treatment, Fatigue life, Titanium alloy 6Al 4V.

The high strain, low frequency corrosion-fatigue properties of the Ti-6Al-4V alloy in two different conditions were determined. One group of specimens was tested in the mill annealed condition and another group was solution treated at 900C and water quenched prior to testing. Tests were conducted in Hanks' buffered saline solution at a temperature of 37C and solution pH of 7.4. Specimens were subjected to fully reversed torsion fatigue in a flowing solution at a shear strain of

0.018 and a frequency of 1 Hz. The specimen electrode potential was monitored to follow the corrosion fatigue process. At the beginning of the corrosion-fatigue test, there is a drop in the electrode potential in the negative direction indicating the formation of many cracks. This is followed by a rise in the positive direction and a leveling off of the potential at a much more negative value than the material would exhibit if there were no mechanical action indicating repassivation of some cracks while others continue to propagate. The results showed that the corrosion-fatigue life of the material heat treated at 900C and water quenched is almost two times longer than that of the mill annealed material.

710,960
PB-277 074/1 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Reactor Radiation Div.
Macroscopic Detection of Corrosion in Aluminum Aircraft Structures with Thermal Neutron Beams and Film Imaging Methods,
D. A. Garrett. 7 Dec 77, 42p NBSIR-78-1434
Sponsored in part by Naval Air Systems Command, Washington, D.C.

Keywords: *Corrosion, *Aircraft, *Aluminum, *Neutron radiography, *Detectors, Measuring instruments, Photographic images, Nondestructive testing.

The primary objective of this investigation was to determine the feasibility of detecting corrosion in aluminum Naval aircraft components with neutron radiographic interrogation and the use of standard corrosion penetrameters. Secondary objectives included the determination of the effect of object thickness on image quality, the defining of minimum levels of detectability and a preliminary investigation of a means whereby the degree of corrosion could be quantified with neutron radiographic data.

710,961
PB-278 954/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Application of Ellipsometry to the Study of Corrosion Processes.
Final rept.,
J. Kruger. 1978, 10p
Pub. in Proceedings of International Colloq. on the Optical Properties of Solid-Liquid Interfaces, La Colle sur Loup, France, May 23-28, 1977, Jnl. Phys. Issue No. C5, pC5-129-C5138 1978.

Keywords: *Corrosion tests, *Polarimetry, Surface roughness, Qualitative analysis, Pitting corrosion, Stress corrosion, Concentration cell corrosion.

Because corrosion processes involve localized effects in thin passive layers and because these processes lead to surface roughening, it is virtually impossible to do quantitative ellipsometry at todays theoretical and experimental state of the art. This paper, therefore, describes qualitative apparatus that provide valuable insights into corrosion processes without attempting to determine optical constants or exact measures of film thickness. A description is given of measurements of the repassivation kinetics of bare surfaces, changes in the passive film prior to breakdown and changes in crevices that lead to crevice corrosion.

710,962
PB-279 430/3 PC **A99**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Economic Effects of Metallic Corrosion in the United States. Appendix C. Battelle Columbus Laboratories Input/Output Tables.
Final rept.,
J. H. Payer, D. G. Dippold, W. K. Boyd, W. E. Berry, E. W. Brooman, A. R. Buhr, and W. H. Fisher. May 78, 751p NBS-GCR-78-122
See also Part 2, PB-282 632. Prepared by Battelle Columbus Labs., Ohio, Contract NBS-7-35716.
Also available in set of 3 reports PC E15, PB-282 630-SET.

Keywords: *Corrosion, *Economic analysis, Metals, Capitalized costs, Maintenance, Industrial engineering, Cost engineering, Tables(Data).

These tables consist of numerical data in matrix form without text. Direct Technical Coefficients worlds I, II, and III, Direct and Indirect Effects I, Direct and Indirect Effects II, and Direct and Indirect Effects III. Capital/Output Coefficients world I and III, Capital/Output Coefficients world II, Corrosion Useful Life worlds I, II, and III. Dollar Value Interindustry and Final Transactions worlds I, II, and III. Dollar Value Interindustry Differences, I-II, Dollar Value Interindustry Differences, I-III, and Social Capital/Infrastructure. Average Annual Capital Replacement Rate worlds I, II, and III.

710,963
PB-282 509/9 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Center for Building Technology.
Corrosion of Metallic Pipes Transporting Potable Water - Laboratory Testing Methods.
Final rept.,
J. N. Andre, and J. R. Clifton. Jun 78, 38p NBS/TN-974
Prepared in cooperation with Centre Scientifique et Technique du Batiment, Paris (France).

Keywords: *Corrosion tests, *Water pipes, Corrosion, Potable water, Copper, Galvanized materials, Metal pipes, Steels, Measurement, Buildings, Test methods.

Many factors affect both the form of and the corrosion of pipes transporting potable water including the composition, temperature and flow rate of the water, type of metal and the physical condition of the pipe. A pipeline was constructed and experimental methods developed to determine the effects of the above factors on the corrosion of pipes. Components of the pipeline were carefully selected or designed to prevent the occurrence of extraneous corrosion. The rate of corrosion of galvanized steel and copper pipes were measured by direct weight losses measurements and by polarization resistance methods. It appears that the polarization resistance technique is a useful tool which may be used in a variety of corrosion studies of pipe in aqueous media.

710,964
PB-282 631/1 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Economic Effects of Metallic Corrosion in the United States. Part I. A Report to the Congress by the National Bureau of Standards,
L. H. Bennett, J. Kruger, R. L. Parker, E. Passaglia, C. Reimann, A. W. Ruff, H. Yakowitz, and E. B. Berman. May 78, 68p NBS-SP-511-1
See also Part 2, PB-282 632. Prepared in cooperation with Berman (Edward B.) Associates, Inc., Marblehead, Mass. Library of Congress Catalog Card no. 78-600033.
Also available in set of 3 reports PC E15, PB-282 630-SET.

Keywords: *Corrosion, *Economic analysis, Corrosion inhibition, Metals, Paints, Capitalized costs, Industrial plants, Automobiles.

In response to a Congressional directive, this study of the cost of metallic corrosion to the United States was undertaken by the National Bureau of Standards (NBS). The analysis required in this study was placed under contract to the Battelle Columbus Laboratories (BCL). In 1975, corrosion cost the United States an estimated $70 billion. This was 4.2 percent of the estimated Gross National Product for that year. Of this total, about 15 percent or $10 billion was avoidable. An uncertainty of about + or -30 percent for the total corrosion cost figure results from inadequate data in some areas and unsure technical and economic judgments. The uncertainty in the avoidable costs is considerably greater. This study used a modified version of the BCL National Input/Output Model. The model quantitatively identifies corrosion-related changes in resources (material, labor, energy, value added), changes in capital stock, and changes in replacement lives of capital stock for all sectors of the economy. The use of this model is well suited for estimating the total direct and indirect costs of corrosion.

710,965
PB-282 632/9 PC **A12**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Economic Effects of Metallic Corrosion in the United States--Appendix B. Part II. A Report to NBS by Battelle Columbus Laboratories.
Final rept.,
J. H. Payer, D. G. Dippold, W. K. Boyd, W. E. Berry, E. W. Brooman, A. R. Buhr, and W. H. Fisher. May 78, 252p NBS-SP-511-2
See also Part 1, PB-282 631, and PB-279 430. Library of Congress Catalog Card no. 78-600033. Prepared by Battelle Columbus Labs., Ohio, Contract NBS-7-35716.
Also available in set of 3 reports PC E15, PB-282 630-SET.

Keywords: *Corrosion, *Economic analysis, Corrosion inhibition, Capitalized costs, Replacing, Metals, Industrial plants, Data processing, Electric power plants, National government, Automobiles, Maintenance.

The purpose of this study was to determine the economic effect of corrosion in the United States. The results provide a basis for development of technological, legislative, and other initiatives to promote effective economic savings. The study was confined to corrosion of metals. Input/Output analysis, which provided the methodogical framework for this study, permitted detailed and comprehensive treatment of all elements of the costs of corrosion. Production costs, capital costs, changes in replacement lives, etc. were treated in a coordinated and systematic manner. The corrosion I/O Model can be used to assess proposed means to reduce costs.

710,966
PB-283 054-T PC **A24**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Gas Corrosion of Metals,
S. Mrowec, and T. Werber. 1978, 561p TT-76-54038
Trans. of mono. Korozja Gazowa Metali, Warsaw, 528p 1975. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Corrosion, *Gases, Metals, Corrosion resistant alloys, Protective coatings, Corrosion inhibition, Controlled atmospheres, Translations, Poland.

The present volume gives basic information relating to the theory of high-temperature corrosion of metallic materials, and presents the results of the most important experimental investigations, and practical achievements in the field of protection against such corrosion. It also describes methods for protection against gas corrosion by means of appropriate selected alloying additions, protective coatings and protective atmospheres. The process of gas corrosion of the basic metallic materials in the most frequent corrosive atmospheres is also presented.

710,967
PB-283 110/5 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C.
Corrosion.
Consumer information series,
J. Kruger, and S. Halpin. Mar 78, 12p NBS-CIS-9

Keywords: *Corrosion, *Protective coatings, *Corrosion inhibitors, Rust, Descaling, Consumers.

This document explains what corrosion is, how it affects certain metals, and, how to prevent it.

710,968
PB-292 198/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Protection of Steel Piles by Selected Coatings in a Natural Sea Water Environment.
Final rept.
E. Escalante, and W. P. Iverson. 1978, 8p
Sponsored in part by American Iron and Steel Inst., Washington, DC.
Pub. in Proceedings of the Annual Offshore Technology Conference (10th), Held at Houston, TX. on May 8-11, 1978, p1215-1222, 1978.

Keywords: *Protective coatings, *Corrosion prevention, *Steel piles, Sea water corrosion, Nonmetallic coatings, Epoxy coatings, Coal tar, Primers(Coatings), Vinyl coatings, Pigments, Silicates.

Six types of coatings are evaluated on their ability to protect steel piles in offshore conditions. These coatings, made up of a single system metal pigmented paint and 5 two system nonmetallic coatings on metal filled primers, are described in detail. They include aluminum pigmented coal tar epoxy, coal tar epoxy over zinc rich epoxy, vinyl over zinc rich silicate, coal tar epoxy over zinc rich silicate, and other combinations of coatings. These protective coatings have displayed good to excellent resistance to deterioration in the environment of this program. A brief discussion of the corrosion of bare steel piles serving as controls is included. The electrochemical techniques used to evaluate the coating deterioration in situ, and the physical measurements made on the piles after removal are briefly described. The results found on these systems in the first six years of a fifteen year program are presented.

710,969

PB-292 368/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Protection of Steel Piles by Nonmetallic Coatings in Sea Water.
Final rept.,
E. Escalante, and W. P. Iverson. Oct 78, 7p
Sponsored in part by American Iron and Steel Inst., Washington, DC.
Pub. in Materials Performance 17, n10, p9-15, Oct 78.

Keywords: *Nonmetallic coatings, *Protective coatings, *Corrosion prevention, *Steel piles, Sea water corrosion, Polyester resins, Mastics, Phenolic resins, Vinylidene chloride resins, Coal tar, Polyamide resins, Polyamines, Reprints.

Polyamide and polyamine cured coal tar epoxy systems, one with Al oxide armor, one polyvinylidene chloride, one phenolic mastic, and one glass flake filled polyester system were evaluated after 6 years on carbon steel H-pilings embedded in the ocean floor near shore. Data are given on the overall and extent of protection in atmospheric (above high water), splash, submerged, and buried zones. Thicknesses ranged from 5 mils of the polyvinylidene chloride to the 34 mils of the glass flake filled polyester. Ratings, based on a synthesis of polarization, pitting attack, and flange thickness data are as follows in a decreasing order of resistance: polyester glass flake, phenolic mastic, polyamide cured coal tar epoxy, polyamide cured coal tar epoxy with Al oxide, polyamine cured coal tar epoxy, and polyvinylidene chloride. These are interim results in a 15 year program involving 23 coating systems and cathodic protection.

710,970

PB-299 997/7 PC **A03**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Center for Materials Science.
Bibliography on the Corrosion and Protection of Steel in Concrete.
E. Escalante, and S. Ito. Aug 79, 29p NBS-SP-550
Sponsored in part by Federal Highway Administration, Washington, DC. Library of Congress catalog card no. 79-600082.

Keywords: *Corrosion, *Reinforcing steels, *Corrosion prevention, *Bibliographies, Reinforced concrete, Bridge decks, Steels.

This is a bibliographic list of references of published papers, reports, and talks about the corrosion of steel in concrete and related subjects. The references are presented in two forms: (1) a subject index divided into six major subheadings including reviews, factors affecting corrosion, measurement techniques, protection techniques, concrete design, and related fields, and (2) an author index in alphbetical form. A total of 394 references are listed covering the period from 1964 to November 1978.

710,971

PB-300 704/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Laboratory Corrosion Studies on Tinned Copper Concentric Neutral Wires.
Final rept.,
U. Bertocci, and J. L. Mullen. 1979, 8p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Materials Performance 18, n6 p24-31 Jun 79.

Keywords: *Corrosion, *Copper, Corrosion tests, Wire, Reprints.

Long term corrosion tests, potentiodynamic scans and current potential measurements have been carried out on copper concentric neutral (CCN) wires in various environments, simulating the conditions that could be encountered in the field. The effect of different ions in the electrolyte, including chloride, of the presence of oxygen and of the superposition of an a.c. signal were investigated. The influence of these conditions on causing pitting corrosion are examined and discussed.

710,972

PB80-104433 Not available NTIS
National Bureau of Standards, Washington, DC.
Corrosion Induced by an Alternating Voltage. A Comparison Between Theoretical Predictions and Experimental Results.
Final rept.,
U. Bertocci, and J. L. Mullen. 1979, 11p
Contract E(49-1)-3800
Pub. in Corrosion/79, Paper 242, p242/1-242/11 1979.

Keywords: *Corrosion, Alternating current, Copper, Electrodes, Charge transfer.

After summarizing the theoretical predictions for the current response to an alternating voltage of an electrode under charge-transfer control, the experimental results obtained for the hydrogen evolution reaction on a copper electrode are reported. The results show that the current-potential curves obtained for the d.c. component of the current as well as some of the harmonic components of the peridic current are in good agreement with the values calculated from the theoretical model. The predictions concerning the effect of varying the modulating signal amplitude and frequency are also verified experimentally. The experimental results begin to deviate from the predicted ones when the amplitude exceeds the potential range where only charge-transfer is significant, and when the ohmic drop resistance becomes large with respect to the other circuit elements.

710,973

PB80-114556 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Adherence of Cuprous Oxide Layer (O Prikontaktnom Sloe Zakisi Meeli),
A. I. Andrievskii, and M. T. Mishchenko. 1979, 14p
DMDC-17265, TT-79-58081
Trans. of Zhurnal Tekhnicheskoi Fiziki (USSR) v24 n5 p818-825 1954. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Scale(Corrosion), *Anodic coatings, *Copper oxides, Microstructure, Copper, Oxidation, Impurities, Copper alloys, Translations.

Bulk copper specimens and copper alloys (containing less than one percent Ni) were tested in air at 800 and 1000C. The resulting microstructures of the oxide scales were examined metallographically and the effect of nickel impurities on the oxidation process studied. The adherence of the oxide layer was followed as a function of the experimental variables.

710,974

PB80-122906 Not available NTIS
National Bureau of Standards, Washington, DC.
Fundamental Aspects of the Corrosion of Metallic Implants.
Final rept.,
J. Kruger. 1979, 21p
Pub. in Am. Soc. Test. Mater. Spec. Tech. Publ. 684, p107-127 1979.

Keywords: *Corrosion, Passivity, Galvanic corrosion, Reprints, *Implants.

The corrosion of metals in the aqueous environments of body fluids involves the setting up of electrochemical corrosion cells. The corrosion produced by these cells is controlled by thermodynamic and kinetic factors. The thermodynamic factors determine the corrosion tendencies; the kinetic factors determine the rate. Galvanic corrosion is affected by both thermodynamic and kinetic factors and occurs when two metals with widely differing potentials are placed in contact with each other. Other forms of corrosion depend more directly on factors controlling the rate of corrosion. For most alloys used in implants the corrosion rate is mainly dependent on the protective properties of the thin passive films that exist on the surfaces of these alloys. The quality of the protection afforded by passive films is related to their ability to resist chemical breakdown by damaging species and, once broken down, their ability to reform rapidly (repassivate). The interplay between breakdown and repassivation is important in determining the susceptibility of metallic implants to pitting, crevice corrosion, stress corrosion, corrosion fatigue, intergranular corrosion, and fretting corrosion.

710,975

PB81-135287 Not available NTIS
National Bureau of Standards, Washington, DC.
Detection and Analysis of Electrochemical Noise for Corrosion Studies.
U. Bertocci. 1979, 11p
Pub. in Proceedings of the International Conference on Metallic Corrosion (7th) Held at Rio de Janeiro, Brazil on Oct 4-11, 1978, p2010-2020 1979.

Keywords: *Corrosion, Iron, Aluminum, *Electrochemical noise.

This paper describes the work done at NBS for the study of the fluctuations in current and potential of electrochemical systems, commonly referred to as electrochemical noise.

710,976

PB81-141772 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of 'True' Polarization Curves for Corrosion Rate Measurements of Steel in NaCl Stagnant Solutions.
S. Wolynec, and E. Escalante. 1980, 7p
Pub. in Corrosion-NACE 36, n7 p327-334 1980.

Keywords: *Carbon steels, *Corrosion, Polarization, Reaction kinetics, Measurement, Reprints.

A new method for obtaining polarization data was derived from chronoamperemetric investigations. The data generated by this method is in good agreement with weight loss and corrosion potential measurements not only in terms of corrosion rate but also in terms of Tatel slopes.

710,977

PB81-155806 Not available NTIS
National Bureau of Standards, Washington, DC.
Soils and Underground Corrosion.
Final rept.
E. Escalante. 1979, 23p
Sponsored in part by American Iron and Steel Inst., Washington, DC.
Pub. in Proceedings of the Annual Liberty Bell Corrosion Course (17th), Philadelphia, PA., September 19-21, 1979.

Keywords: *Underground corrosion, *Soils, Electrical resistivity, pH, Electrode potentials.

The effect of the soil environment on underground corrosion is often not given sufficient consideration in engineering design. This may be a consequence of the lack of soil data necessary for a soil corrosivity evaluation. This paper will deal with measurements for soil characterization, galvanic currents, improper material selection and how these affect the corrosion of metals underground.

710,978

PB81-156341 Not available NTIS
National Bureau of Standards, Washington, DC.
Anodic Polarization Behavior of Ti-Ni and Ti-6Al-4V in Simulated Physiological Solutions.
Final rept.
K. M. Speck, and A. C. Fraker. Oct 80, 6p
Pub. in Jnl. of Dental Research 59, n10 p1590-1595 Oct 80.

Keywords: *Corrosion, *Titanium alloys, *Anodic polarization, Polarization(Charge separation), Stainless steel, Comparison, Reprints, Chromium cobalt molybdenum alloys, Chromium cobalt molybdenum nickel alloys, Hanks' solution.

The purpose of this paper is to report on the in vitro corrosion behavior of selected metals in physiological and amino acid solutions and to show how this behavior is affected by alloy composition. Anodic polarization measurements were made on the following metals: titanium, Ti-6Al-4V, Ti(.495)Ni(.490)Co(.015),MP35N (a Co-Ni-Cr-Mo alloy), Co-Cr-Mo alloy and 316L stainless steel. The tests were conducted in Hanks' solution which had a pH of 7.4 and was maintained at a temperature of 37C. These anodic polarization curves show the passivation of these metals in Hanks' solution and also the breakdown potentials. The measurements made in Hanks' solution were used as a basis for comparison with measurements made when the amino acid, cysteine or tryptophan was added to the Hanks' solution. It was found that there was a reduction in the breakdown potentials of some metals, especially those containing nickel when cysteine was added to the solution. The addition of tryptophan did not cause any significant changes in the corrosion properties of the materials.

710,979
PB81-168874 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Noncrystalline Films in Passivation and Breakdown of Passivation.
Final rept.
A. G. Revesz, and J. Kruger. 1979, 11p
Pub. in Proceedings of the International Conference on Metallic Corrosion (7th) Held at Rio de Janiero, Brazil on Oct 4-11, 1978, p330-340 1979.

Keywords: *Films, *Passivity, *Corrosion, Corrosion resistance.

Owing to the lack of grain boundaries, noncrystalline oxide film have better passivating properties than polycrystalline ones. Bond and/or structural flexibility is an important factor in determining the ability to form a noncrystalline structure and its stability: This point was demonstrated by the example of vitreous SiO2 and by ligand formation of transition metal ions. The flexibility of the noncrystalline structure ensures a good accommodation at the oxide/substrate interface without requiring an epitaxial relationship. Such an interface is less prone to chemical attack than an imperfect one. High degree of short range order in vitreous oxide films also contributes to their chemical resistance. The flexibility of the structure is responsible for the increased ductility of noncrystalline passivating films which is crucial from the viewpoint of pitting and stress corrosion.

710,980
PB81-168882 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrochemical Study of an Al-Zn-Mg Alloy.
Final rept.
G. M. Ugiansky, J. Kruger, and R. W. Staehle. 1979, 9p
Pub. in Proceedings of the International Conference on Metallic Corrosion (7th) Held at Rio de Janiero, Brazil on Oct 4-11, 1978, p605-613 1979.

Keywords: *Aluminum alloys, *Corrosion, Electrochemistry, Polarization, Zinc containing alloys, Magnesium containing alloys.

In the age hardened Al-Zn-Mg alloys, there are essentially three significant constituents that contribute to the various intergranular corrosion phenomena. These are: the equilibrium MgZn2 precipitate in the grain boundary, the precipitate free zone (PFZ) adjacent to the grain boundary, and the matrix. The technique used in this work is one of studying the localized corrosion of a multi-constituent alloys by examining the electrochemical polarization characteristics of separate electrodes that simulate these individual constituents in the grain boundary region.

710,981
PB81-168890 Not available NTIS
National Bureau of Standards, Washington, DC.
Stress Corrosion Testing at Elevated Temperatures in Simulated Coal Conversion Gases.
Final rept.
G. M. Ugiansky, and C. E. Johnson. 1979, 10p
Pub. in Proceedings of the International Conference on Metallic Corrosion (7th) Held at Rio de Janiero, Brazil on Oct 4-11, 1978, p915-924 1979.

Keywords: *Stress corrosion, *Coal gasification, *Nickel alloys, *Stainless steels, Stress corrosion tests, Strain rate, Steel 310, Steel 347, Steel 446, Nickel alloy 800, Nickel alloy 671.

A total of six different alloys -- stainless steels (SS) Types 310, 310S, 347, and 446, and nickel alloys 800 and 671 - were tested using the slow strain rate test technique in oxidizing/sulfidizing and in oxidizing/sulfidizing/carburizing simulated coal gasification environments, and in helium (and other inert environments) at both 450 and 600C at a strain rate of 0.000001/s.

710,982
PB81-178154 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Corrosion Behavior of Selected Stainless Steels in Soil Environments.
Final rept. 1970-78.
W. F. Gerhold, E. Escalante, and B. T. Sanderson. Feb 81, 106p NBSIR-81-2228
Sponsored in part by American Iron and Steel Inst., Washington, DC.

Keywords: *Stainless steels, *Underground corrosion, *Corrosion tests, Corrosion resistance, Soils, Data, Corrosion, Protective coatings.

In order to obtain more definitive information regarding the corrosion and stress corrosion of stainless steels in soil environments, NBS in cooperation with the Committee of Stainless Steel producers, AISI, initiated in 1970 a soil burial program in representative soil environments. Test materials included coated and uncoated sheet specimens in the annealed and sensitized condition, uncoated welded tubing specimens and galvanically coupled and uncoupled stressed and unstressed specimens. To date approximately 10,000 specimens have been buried at six soil test sites. This report contains the results obtained for specimens buried for up to approximately four years.

710,983
PB81-227571 Not available NTIS
National Bureau of Standards, Washington, DC.
New Ellipsometric-Electrochemical Approach to the Study of Corrosion Under Organic Coatings.
Final rept.
J. J. Ritter, and J. Kruger. 1980, 6p
Sponsored in part by the Office of Naval Research, Arlington, VA.
Pub. in Preprint Division of Polymer Chemistry, American Chemical Society 43, p575-580 1980.

Keywords: *Corrosion, *Protective coatings, *Polarimetry, Organic compounds, pH, Electrochemistry, Paints, Metals, Reprints.

Qualitative ellipsometry was used in conjunction with electrochemical pH and potential measurements as a technique for the study of corrosion processes occurring under organic coatings. The objective of the work was to gain a deeper understanding of the mechanisms governing the corrosion protective actions of paints on metal surfaces. Computer modeling and experiments with collodion coatings on iron substrates indicated that changes in the ellipsometric parameter delta could, for the most part, be safely interpreted as thickness alterations in the substrate oxide film and roughening of the substrate. Experiments with the Fe-collodion system in dilute chloride solutions exhibited three sequential stages of activity, two of which could be interpreted in terms of corrosion mechanisms using the optical and electrochemical measurements. Chromate ion as a corrosion inhibitor in coatings was also studied using this technique, and was shown to have significant effects upon the development of the subcoating processes.

710,984
PB81-240244 Not available NTIS
National Bureau of Standards, Washington, DC.
Corrosion. Its Character and Consequences.
Final rept.
J. Kruger. May 81, 3p
Pub. in American Society for Testing and Materials Stand. News 9, n5 p21-23, p48 May 81.

Keywords: *Corrosion, Economic impact, Corrosion prevention, Safety, Reprints.

The economic, health and safety, strategic, technological and cultural impacts of corrosion are described. A description is given of the causes of corrosion and ways that corrosion can be controlled.

710,985
PB81-240269 Not available NTIS.
National Bureau of Standards, Washington, DC.
Development of In Situ Techniques for the Detection of Corrosion of Copper Concentric Neutrals of Electric Cables in Underground Environments.
Final rept.
E. Escalante, U. Bertocci, J. Mullen, M. Cohen, and J. Kruger. 1981, 7p
Pub. in Proceedings of IEEE Power Engineering Society 1981 Transmission and Distribution Conference and Exposition, Minneapolis, MN. September 20-25, 1981, Paper No. 81 TD 623-8, p1-7 1981.

Keywords: *Corrosion, *Copper, Measurement, Detection, Underground corrosion.

The EPRI project described here is directed at the development of in situ techniques for measuring and detecting corrosion of copper concentric neutrals. Using a semi-automated experimental field site, measurements have been carried out on buried 50 m cables, that have demonstrated the utility of electrochemical polarization measurements in detecting and measuring the corrosion of buried CCN. The progress in the development of microprocessor instrumentation for carrying out such measurements in a simple manner is described.

710,986
PB82-165275 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Bibliography of Literature on Underground Corrosion of Metals and Alloys Considered for Use in the Construction of Containers for Nuclear Waste.
B. T. Sanderson, and J. Kruger. Jan 82, 47p NBSIR-81-2409
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Underground corrosion, *Bibliographies, Containers, Radioactive wastes, Radioactive waste disposal.

This bibliography consists of references pertaining to the corrosion of metallic container materials for nuclear waste disposal. Five kinds of corrosion data are presented - general underground corrosion data that may apply to metallic nuclear waste containers; corrosion considerations in package design; metallic corrosion in geothermal brines; internal corrosion of nuclear waste containers for underground use; and external corrosion of nuclear waste containers for underground environments. Abstracts are provided for most references, and key words are included when there is no abstract. One hundred and sixteen references are presented.

710,987
PB82-211103 Not available NTIS
National Bureau of Standards, Washington, DC.
Corrosion Principles and Surface Modification.
Final rept.
J. Kruger. 1982, 15p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Proceedings Sagamore Army Materials Research Conf. on Surface Modification, Lake George, NY, July 16-20, 1979, Chapter 6 in Surface Treatments for Improved Performance and Properties, p93-107 1982.

Keywords: *Corrosion, *Surface finishing, Corrosion prevention, Passivity, Electrochemistry.

The thermodynamic and kinetic principles governing corrosion are described. These are then used to develop thermodynamic and kinetic strategies whereby surface modification techniques can be applied to enhance the corrosion resistance of metals.

710,988
PB82-261892 Not available NTIS
National Bureau of Standards, Washington, DC.
Corrosion and Corrosion-Fatigue Behavior of Ti-4.5A1-5Mo-1.5Cr (Corona 5) and Ti-6A1-4V.
Final rept.
M. A. Imam, A. C. Fraker, K. M. Speck, and C. M. Gilmore. 1980, 10p
Pub. in Proceedings of International Conference on Titanium (4th), Kyoto, Japan, May 19-22, 1980, Titanium'80, p2595-2604.

Keywords: *Corrosion, *Titanium alloys, Corrosion fatigue, Microstructure, Salt water, Titanium alloy 4.5Al 1.5Cr 5Mo, Titanium alloy 6Al 4V.

This paper investigates the alloys, Ti-6Al-4V and Ti-4.5Al-5Mo-1.5Cr in terms of the microstructure and the corrosion-fatigue and general electrochemical behavior in saline solutions. Results show that the anodic polarization behavior in the passive range is quite similar for both alloys and both are highly corrosion resistant to saline solutions. Fatigue data show that at lower strain levels, the Ti-4.5Al-5Mo-1.5Cr alloy has a longer corrosion-fatigue life than the mill annealed Ti-6Al-4V while the opposite is true for higher strains.

710,989
PB83-127621 Not available NTIS
National Bureau of Standards, Washington, DC.
Overview of the Anaerobic Corrosion of Underground Metallic Structures, Evidence for a New Mechanism.
Final rept.
W. P. Iverson. 1981, 20p
Pub. in American Society for Testing and Materials Special Technical Publication 741, p33-52 1981.

Keywords: *Underground corrosion, Anaerobic processes, Corrosion, Sulfate reducing bacteria, Desulfovibrio.

Anaerobic corrosion of iron occurs throughout the world and from an economic standpoint, is quite costly. Sulfate-reducing bacteria, primarily of the genus Desulfovibria, are responsible for this type of corrosion. It has been postulated that corrosion by these bacteria is caused by their removal of hydrogen from the surface of iron causing it to go into solution. Evidence is presented which indicates that this mechanism may not be responsible for the main corrosive effect of these organisms. These bacteria appear to cause corrosion by producing extracellularly, under anaerobic conditions, a highly corrosive product in addition to hydrogen sulfide. The factors controlling the fate of iron in anaerobic environments, conducive to the growth of sulfate-reducing bacteria, may depend on whether iron sulfide film formation by hydrogen sulfide occurs first, thereby inhibiting corrosion, or whether the highly corrosive substance comes in contact with the iron before film formation has occurred, thereby accelerating corrosion. The antagonistic actions of these two compounds, hydrogen sulfide and the corrosive product, on corrosion produced by sulfate-reducing bacteria, could explain the conflicting observations on anaerobic corrosion noted by investigators in the field and laboratory.

710,990
PB83-143578 Not available NTIS
National Bureau of Standards, Washington, DC.
Factors Affecting the Corrosion of Metals in the Atmosphere.
Final rept.
P. Brown, and L. Masters. 1982, 19p
Pub. in Atmosphere Corrosion, p31-49 1982.

Keywords: *Atmospheric corrosion, Chlorides, Sulfates, Weathering, Reprints.

The durability of materials is dependent, to a large extent, on the in-service environment to which they are exposed; thus, the prediction of durability requires knowledge of the service environment. Weathering factors, which comprise one group of environmental factors, are the subject of this report. The effects of environmental factors on atmospheric corrosion are discussed with emphasis placed on weathering factors. Climatological data along with data on the abundance of pollutants are presented.

710,991
PB84-136175 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Passive Films Surface Structure and Stress Corrosion and Crevice Corrosion Susceptibility.
Final rept. Oct 82-Sep 83.
J. Kruger, J. J. Ritter, G. G. Long, M. Kuriyama, and A. I. Goldman. Nov 83, 47p NBSIR-83-2790
Sponsored in part by Office of Naval Research, Arlington, VA. Prepared in cooperation with State Univ. of New York at Stony Brook. Dept. of Physics. See also AD-A078 596.

Keywords: *Metal films, *Corrosion, X ray spectroscopy, Chelating agents, Inhibitors, Iron, Ellipsometry, Protective coatings, Absorption spectra, Electrochemistry, Iron oxides.

This document contains: Structural studies on passive films using surface EXAFS, EX-SITU and IN-SITU sample and detector chambers for the study of passive films using surface EXAFS, and Ellipsometric studies of chelating inhibitor effects on the cathodic delamination of an organic coating on iron.

710,992
PB84-136340 Not available NTIS
National Bureau of Standards, Washington, DC.
Current Understanding of Pitting and Crevice Corrosion and Its Application to Test Methods for Determining the Corrosion Susceptibility of Nuclear Waste Metallic Containers.
Final rept.
J. Kruger, and K. Rhyne. 1982, 23p
See also PB82-207507.
Pub. in paper on Nuclear and Chemical Waste Management 3, p205-277 1982.

Keywords: *Corrosion, *Containers, *Radioactive wastes, Tests, Pitting, Reprints.

A review of crevice and pitting corrosion mechanism and testing techniques is given to understand the fundamental problems involved in determining corrosion rates of alloys to be used as nuclear waste containers. The mechanisms are broken down into two sections, initiation and propagation of the crevice or pit. Theories of initiation include the absorbed ion displacement model, ion migration or penetration model and the breakdown-repair model. Experimental results concerning the initiation period include a discussion of the kinetics of initiation, the critical potential for breakdowns, and experimental factors affecting the initiation. The theories of pit and crevice corrosion propagation are mentioned as well as factors affecting propagation. Several experimental techniques are discussed that are useful in determining the probability of pitting and/or crevice corrosion of alloys. In assessing the lifetime of the metallic container, accelerated tests are required. With this in mind the testing techniques concentrate on electrochemical techniques and various modifications of these basic techniques. Although susceptibility of alloys to pitting and crevice corrosion can be determined readily, initiation time and propagation rates are not as straightforward particularly over 1000 years. Nevertheless several testing techniques exist that may be used to determine these important values.

710,993
PB84-225416 Not available NTIS
National Bureau of Standards, Washington, DC.
Nondestructive Corrosion Detection Under Organic Films Using Infrared Thermography.
Final rept.
M. E. McKnight, and J. W. Martin. 1982, 10p
Pub. in Proceedings of National SAMPE (Society for the Advancement of Material and Process Engineering) Tech. Conference (14th), Atlanta, GA., October 12-14, 1982, p349-358.

Keywords: *Nondestructive testing, *Protective coatings, *Corrosion, *Polymer films, *Infrared detectors, *Thermography, Organic coatings.

A rapid, nondestructive testing procedure, using infrared thermography, has been developed for detecting corroded and blistered areas under pigmented organic coatings on metallic substrates. Both invisible corroded areas under intact pigmented films, and corroded and blistered areas visible to the eye, can be detected, thus providing an early, accurate assessment of degradation. Software is being written to digitize the image and send the data to a computer for mathematical analysis, graphic display and storage. Modifications of the existing system are being considered to increase the resolution of the measurement.

710,994
PB85-100162 Not available NTIS
National Bureau of Standards, Washington, DC.
Corrosion Behavior of Some Stainless Steels in Underground Soil Environments.
Final rept.
W. F. Gerhold, and B. T. Sanderson. Apr 81, 21p
Sponsored in part by American Iron and Steel Inst., Washington, DC.
Pub. in Proceedings of Conference on Corrosion 1981, Toronto, Canada, April 6-10, 1981, 21p.

Keywords: *Stainless steels, *Corrosion, Corrosion tests, Soils, Steel 201, Steel 202, Steel 301, Steel 304, Steel 316, Steel 409, Steel 410, Steel 430, Steel 434.

A soil burial program utilizing nine stainless steels was initiated in 1970. Included were annealed and sensitized materials and materials with welds and crevices. After exposure for up to 8 years in the soils, the annealed AISI Types 201, 202, 301, 304 and 316 were relatively immune to corrosion in 3 of the 6 soils while AISI Types 409, 410, 430 and 434 were perforated by corrosion in 5 of the 6 soils. In the more corrosive soils, the AISI 200 and 300 series were susceptible to pitting and tunneling corrosion.

710,995
PB86-111010 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Basic Aspects of the Problems of Hydrogen in Steels.
Final rept.
C. G. Interrante. 1982, 15p
Pub. in Proceedings of International Conference on Current Solutions to Hydrogen Problems in Steels (1st), Washington, DC., November 1-5, 1982, p3-17.

Keywords: *Hydrogen embrittlement, *Steels, *Blistering, Diffusion, Transport properties, Surface chemistry, Solubility, Absorption.

The solubility, diffusion, and permeation of hydrogen in steels, the various proposed mechanisms of hydrogen embrittlement and attack, some of the prominent observed effects of hydrogen on the properties and behavior of steels, and some understanding of the ways in which hydrogen interacts with steels are described herein. Basic aspects of the problem involve the limited solubility of hydrogen, the adsorption of hydrogen on both internal and external steel surfaces, the absorption into the steel lattice, the transport of hydrogen by diffusion and by the motion of dislocations, and the localization of hydrogen at internal sites in the bulk metal. This localization may be as adsorbed hydrogen atoms on surfaces, as molecular hydrogen that exerts a gas pressure in void spaces, or as interstitial hydrogen in solution. While our overall understanding of the mechanisms that explain the harmful effects is incomplete, the proposed mechanisms furnish a context within which we can view the problem and classify the observed behavior and effects of hydrogen in steels.

710,996
PB86-111416 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
SEM (Scanning Electron Microscope) Analysis of Clad-Ceramic Coatings after Hot Corrosion Testing.
Final rept.
C. D. Olson. 1982, 2p
Sponsored by Electron Microscopy Society of America, Oak Ridge, TN.
Pub. in Proceedings of Annual Meeting of the Electron Microscopy Society of America (40th), Washington, DC., August 9-13, 1982, p522-523.

Keywords: *Protective coatings, *Metals, *Corrosion prevention, *Ceramic coatings, *Scanning electron microscopy, *Energy dispersive X ray analysis, AISI 1015 steel.

Scanning electron microscope (SEM) and energy dispersive x-ray analysis (EDX) have been used to study protective coatings on metals under a hot corrosive gas environment. Coatings were arc plasma sprayed on AISI 1015 steel and evaluated as to corrosive characteristic and protection to the steel under the exposed environment.

710,997
PB86-113990 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Materials Chemistry Div.
New Technique to Study Corrosion Mechanisms under Organic Coatings.
Final rept.
J. Kruger, and J. J. Ritter. 1982, 23p
Sponsored by American Chemical Society, Washington, DC.
Pub. in Proceedings of International Conference on Organic Coatings Science and Technology (8th), Athens, Greece, July 12-16, 1982 p383-405.

Keywords: *Polymer films, *Plastic coatings, *Corrosion prevention, *Iron, Electrochemistry, Ellipsometry, Protective coatings, pH, Procedures.

Transparent organic coatings on iron are used to simulate painted metal surfaces for simultaneous ellipsometric and electrochemical measurements. These studies show that significant changes occur both in the metal oxide film and in the subcoating environment during prolonged immersion in dilute Cl(-1) media. The relationship of these changes to aspects such as metal passivation, surface roughening, coating delamination, type of coatings, and inhibitor behavior are discussed.

710,998
PB86-128808 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Corrosion Processes in Building Insulation Systems.
Final rept.
J. M. Pommersheim, J. Lobo, and J. R. Clifton. 1981, 5p
Pub. in Proceedings of International Conference Durability of Building Materials and Components (2nd), Gaithersburg, MD., September 14-16, 1981, p274-278.

Keywords: *Corrosion, *Thermal insulation, Condensing, Buildings, Mathematical models.

The factors responsible for the corrosion of metal building service elements (such as electrical receptacle boxes and pipes) in contact with thermal insulation are discussed. The amount of corrosion and corrosion

rate depend on the amount of condensation, the rate of drying and the leaching rate of impurities from the insulation.

710,999
PB86-132594 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Modeling of Crack Chemistry in the Alpha Brass-Ammonia System.
Final rept.
U. Bertocci. 1984, 10p
Pub. in Proceedings of International Symposium Fall Meeting of Metallurgy Society, Embrittlement Localized Crack Environment, p49-58 1984.

Keywords: *Diffusion, Electromigration, *Stress corrosion, Brass, Ammonia, Hydrogen, Electric potential, Concentration(Composition).

Concentration and electrical potential profiles generated in a crack by anodic dissolution of alpha-brass in aqueous ammonia have been calculated for stationary conditions, taking into account both diffusion and electromigration. Hydrogen discharge following instantaneous crack advance, which exposes fresh brass surface to the solution, has also been considered. From the equivalent circuit, the values at the crack-tip have been obtained for a range of kinetic parameters and surface area ratios.

711,000
PB86-133543 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Properties and Performance of Candidate Structural Metals for the Production of Synthetic Gas from Coal.
Final rept.
B. W. Christ, H. Ondik, A. Perloff, and B. Beck. 1983, 15p
Sponsored by Department of Energy, Washington, DC. Office of Fossil Energy, and Department of Energy, Laramie, WY. Laramie Energy Technology Center.
Pub. in Proceedings of 1983 International Gas Research Conference, London, England, June 13-16, 1983, p456-470.

Keywords: *Coal gasification, *Construction materials, *Corrosion environment, *Materials tests, Structural analysis, Mechanical properties, Design criteria, Sites, Performance evaluation.

Data from several nationwide (U.S.) Department-of-Energy-sponsored programs have been collected and evaluated by the DoE-sponsored Materials Performance Center at the U.S. National Bureau of Standards. New and traditional alloys, about 60 of them, were evaluated. Laboratory measurements and in-plant measurements were made of the following properties: hot gas corrosion rates, aqueous corrosion rates, erosion-corrosion rates, aqueous corrosion rates, and mechanical properties in a coal gasification environment. Highlights of these data will be discussed in light of design needs at critical plant locations. Furthermore, test methodologies and opportunities for standardization will be discussed.

711,001
PB86-138583 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Problems Related to Sulfate-Reducing Bacteria in the Petroleum Industry.
Final rept.
W. P. Iverson, and G. J. Olson. 1984, 23p
Pub. in Petroleum Microbiology, p619-641 1984.

Keywords: *Petroleum industry, *Biodeterioration, *Sulfate reducing bacteria, Reviews, Corrosion, Microorganisms, Reprints.

The range of problems caused by sulfate reducing bacteria in the petroleum industry is discussed in the review containing over 100 references. Included in the discussion is a description of newly described species of sulfate reducing bacteria, the occurrence of sulfate reducing bacteria in subsurface environments, mechanisms of bacterial dissimilatory sulfate reduction, and the costly economic problems the petroleum industry faces as a result of the activity of these organisms. Some of the economic problems described are the corrosion of metals, plugging of oilfield reservoirs, and failure of tertiary oil recovery operations. Current and potential future control procedures are described.

711,002
PB86-142908 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Reflection/Absorption Fourier Transform Infrared Spectroscopy Studies of the Degradation of Organic Protective Coatings on Steel.
Final rept.
T. Nguyen, and W. E. Byrd. 1985, 6p
Pub. in Proceedings of the American Chemical Society, Polymeric Materials Science and Engineering, Chicago, Illinois, September 7-12, 1985, v53 p568-573.

Keywords: *Protective coatings, *Steels, *Corrosion, *Degradation, Absorption, Polybutadiene, Reflection, Complex compounds, Oxidation, Infrared spectroscopy, *Fourier transform spectroscopy.

The application of FTIR-RA for studying the degradation, resulting from exposure to a 40C and 82% RH environment, of two types of organic coatings on cold-rolled steel is presented in the paper. FTIR-RA results indicate bond weakening in the polymer, dehydration and bond scissions at the aryl-isopropylidene group of amine-cured epoxy coatings on cold-rolled steel. On the other hand, the polybutadiene coating on steel specimens show, not only bond weakening both within the coating and at the interface, but also extensive corrosive-related degradation which results in the formation of various highly oxidized products and losses in unsaturation. The characterization of fairly complex organic molecules formed during the oxidation and degradation by FTIR-RA offers a powerful means for studies of the degradation processes, both in the bulk and at the interface of protective coatings on steel subjected to corrosive environments.

711,003
PB86-142916 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Reflection/Absorption Fourier Transform Infrared Spectroscopy of the Degradation of Protective Coatings on Mild Steel.
Final rept.
T. Nguyen, and W. E. Byrd. 1985, 18p
Pub. in Proceedings of the International Conference on Organic Coatings Science and Technology (11th), Athens, Greece, July 8-12, 1985, p235-252.

Keywords: *Protective coatings, *Steels, *Corrosion, *Degradation, Absorption, Polybutadiene, Reflection, Complex compounds, Oxidation, Infrared spectroscopy, *Fourier transform spectroscopy.

The application of reflection/absorption Fourier transform infrared spectroscopy (FTIR-RA) for studying the degradation of two types of coating on steel after exposure to 40C/80% RH environments is presented in the paper. FTIR-RA results indicate the occurrence of (1) bond weakening in the polymer film, (2) dehydration and (3) bond scissions at the isopropylidene group of amine-cured after exposure to 40C and 80% RH environments for 7 months. On the other hand, the polybutadiene coating specimens show, not only bond weakening but also extensive degradation which results in the formation of various oxidized products and losses in unsaturation. The characterization of complex molecules that are formed during the oxidation and degradation by FTIR-RA offers a powerful means for studies of the degradation processes, both in the bulk and at the interface of protective coatings on steel.

711,004
PB86-193828 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Use of Load-Pulsing Technique to Determine Stress-Corrosion Crack Velocity.
Final rept.
P. W. Slattery, J. Smit, and E. N. Pugh. 1984, 13p
Pub. in ASTM (American Society for Testing and Materials) Special Technical Publication 821, p399-411 1984.

Keywords: *Stress corrosion, Cracking(Fracturing), Admiralty metal, Reprints.

A load-pulsing technique has been used to determine the velocity of transgranular stress-corrosion cracks in Admiralty Metal tested in a 15N aqueous ammoniacal solution. In this technique, small load pulses are periodically superimposed onto an otherwise constant tensile load during crack propagation, producing markings on the fracture surfaces which delineate the positions of the crack front.

711,005
PB86-238094 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Corrosion of Zinc.
Final rept.
J. Kruger. 1986, 1p
Pub. in Encyclopedia of Materials Science and Engineering, v2 p914 1986.

Keywords: *Corrosion, *Zinc, Reprints.

No abstract available.

711,006
PB86-238102 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Corrosion of Tin.
Final rept.
J. Kruger. 1986, 1p
Pub. in Encyclopedia of Materials Science and Engineering, v2 p912 1986.

Keywords: *Corrosion, *Tin, Reprints.

No abstract available.

711,007
PB86-238110 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Corrosion of Magnesium.
Final rept.
J. Kruger. 1986, 2p
Pub. in Encyclopedia of Materials Science and Engineering, v2 p904-905 1986.

Keywords: *Corrosion, *Magnesium, Reprints.

No abstract available.

711,008
PB86-238128 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Corrosion of Lead.
Final rept.
J. Kruger. 1986, 1p
Pub. in Encyclopedia of Materials Science and Engineering, v2 p904 1986.

Keywords: *Corrosion, *Lead(Metal), Reprints.

No abstract available.

711,009
PB86-238169 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Chemical and Electrochemical Aspects of SCC of Alpha-Brass in Aqueous Ammonia.
Final rept.
U. Bertocci, and E. N. Pugh. 1984, 9p
Pub. in Proceedings of International Congress on Metallic Corrosion (9th), Toronto (Canada), June 3-7, 1984, p144-152.

Keywords: *Brasses, *Stress corrosion, Ammonia, Electrochemistry.

The chemistry and electrochemistry of the brass-ammonia system have been reviewed and up-dated. It is concluded that the cupric ammonium complex whose presence is necessary for the occurrence of cracking under open-circuit conditions in conventional oxygenated solutions simply provides a cathodic reaction, permitting cracking either by the film-rupture model or by a mechanism involving dezincification. It is shown that cracking can also occur in deoxygenated solutions in the absence of significant concentration of the cupric ions provided that cuprous complexes are present, and it is suggested that the role of the cuprous complex is again to provide a cathodic reaction, in the case allowing dezincification to occur. These findings are consistent with the recognition that stress-corrosion failures of brass are not specific to ammonia.

711,010
PB86-238177 Not available NTIS

National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Electrochemical Principles of Corrosion.
Final rept.
U. Bertocci. 1986, 4p
Pub. in Encyclopedia of Materials Science and Engineering, v2 p1403-1406 1986.

Keywords: *Corrosion, *Electrochemistry, Reprints.

No abstract available.

711,011
PB86-238185 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Stress-Corrosion Cracking of Brass in Aqueous Ammonia in the Absence of Detectable Anodic-Dissolution.
Final rept.
U. Bertocci, F. I. Thomas, and E. N. Pugh. 1984, 2p
Pub. in Corrosion 40, n8 p439-440 1984.

Keywords: *Brasses, *Stress corrosion, Ammonia, Reprints, Copper alloy 30Zn.

Tensile tests on Cu-30Zn brass were carried out in aqueous ammonia solutions containing Cu+ ions and equilibrated with respect to copper so that no detectable dissolution of the specimens occurred. The specimens failed by transgranular stress corrosion cracking (SCC). Similar tests in deoxygenated aqueous ammonia did not show any brittle fracture. The results show that anodic dissolution of copper is not required for SCC to occur. The significance of these results in terms of various proposed mechanisms for SCC is discussed. Periodic Cu+ depletion at the crack tip is a possible cause for the experimentally observed discontinuous crack advance.

711,012
PB86-238334 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Underground Corrosion.
Final rept.
E. Escalante. 1986, 2p
Pub. in Encyclopedia of Materials Science and Engineering, v7 p5208-5209 1986.

Keywords: *Underground corrosion, Reprints.

No abstract available.

711,013
PB86-238375 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Corrosion of Metals: An Overview.
Final rept.
J. Kruger. 1986, 6p
Pub. in Encyclopedia of Materials Science and Engineering, v2 p905-910 1986.

Keywords: *Corrosion, Reviews, Reprints.

No abstract available.

711,014
PB86-238441 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Corrosion: Metallurgical Aspects.
Final rept.
E. N. Pugh. 1986, 2p
Pub. in Encyclopedia of Materials Science and Engineering, v2 p889-890, 1986.

Keywords: *Corrosion, Reprints.

No abstract available.

711,015
PB86-240751 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Stress-Corrosion Cracking.
Final rept.
E. N. Pugh. 1986, 2p
Pub. in Encyclopedia of Materials Science and Engineering, v6 p4669-4670 1986.

Keywords: *Stress corrosion, Reprints.

No abstract available.

711,016
PB86-241726 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Economic Effects of Corrosion and Other Degradative Processes.
Final rept.
E. Passaglia. 1986, 3p
Pub. in Encyclopedia of Materials Science and Engineering, v2 p1275-1277 1986.

Keywords: *Corrosion, Degradation, Economic analysis, Reprints.

No abstract available.

711,017
PB87-130522 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Anaerobic Corrosion Mechanisms.
Final rept.
W. P. Iverson. 1986, 10p
Pub. in Argentine-U.S.A. Workshop on Biodeterioration (Concet-NSF), p33-42 1986.

Keywords: *Corrosion, *Anaerobic bacteria, *Anaerobic processes, Iron compounds, Reduction(Chemistry), Hydrogen sulfide, Phosphine, Phosphorus, Biodeterioration, Reprints, Sulfate reducing bacteria.

Anaerobic corrosion, that is corrosion in the absence of oxygen at or near neutral pH values, has been postulated to be due to the removal of hydrogen from the surface of iron by sulfate-reducing bacteria. Evidence is presented to indicate that this type of corrosion is induced instead by a volatile, water soluble, corrosive, phosphorus-containing compound produced by these organisms in addition to hydrogen sulfide. Hydrogen sulfide produces a partially protective film on iron which has a tendency to break down. When this occurs, the phosphorus compound comes in contact with the bare iron and induces corrosion. Iron sulfide film formation may be presented by the addition of ferrous ions to the culture medium, allowing immediate contact of the corrosive phosphorus compound with the iron surface. Thus, sulfate-reducing bacteria can produce both an inhibitor and an inducer of anaerobic corrosion. The chemical formation of a similarly acting corrosive phosphorus compound by the action of hydrogen sulfide on certain phosphorus compounds is also described.

711,018
PB87-153615 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Therodynamic and Kinetic Corrosion Data: The NACE-NBS (National Association of Corrosion Engineers - National Bureau of Standards) Corrosion Data Program.
Final rept.,
M. J. Rodriguez, A. C. Van Orden, and G. M. Ugiansky. 1984, 9p
Pub. in Proceedings of Electrochem. Soc., n84-9 p325-333 1984.

Keywords: *Corrosion, Reaction kinetics, Thermodynamics, Alloy steels, Corrosion Data Center.

Corrosion costs can be reduced by improving known practices or implementing new practices through the use of kinetic and thermodynamic data. These corrosion data are not available now to designers and engineers, and are scattered throughout the literature. It is important to establish a central facility dedicated to data collection, evaluation and effective dissemination. Such a facility is being developed, the Corrosion Data Center. The Center is the core of a joint program between the National Association of Corrosion Engineers (NACE) and the National Bureau of Standards (NBS). Several projects have been initiated in the areas of kinetic and thermodynamic corrosion data. In the kinetic area, the projects include atmospheric corrosion of structural alloys, localized corrosion of austenitic stainless steels and uniform corrosion of steels. In the thermodynamic area, most of the efforts are directed toward the establishment of a facility of computer generated Pourbaix (E-pH) diagrams for multicomponent systems.

711,019
PB87-161592 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Computer Assisted Corrosion Data Evaluation and Dissemination.
Final rept.,
A. C. Van Orden, G. M. Ugiansky, M. J. Rodriguez, and E. Escalante. 1985, 10p
Pub. in Proceedings of Symposium on Computer Aided Acquisition and Analysis of Corrosion Data, New Orleans, LA., October 7-12, 1984, p180-189 1985.

Keywords: Corrosion, Data analysis, *Corrosion data center, Computer applications.

There is a great need to collect, evaluate, and disseminate the corrosion data which is presently scattered throughout the open literature and in the proprietary files of many companies and trade associations. The NBS facility, the Corrosion Data Center, will be dedicated to data collection, evaluation, and dissemination. The computer is an integral part and effective tool in this effort. The Corrosion Data Center has initiated several pilot projects in the areas of thermodynamic and kinetic data. These projects include atmospheric corrosion of structural alloys, localized corrosion of austenitic stainless steels, and the uniform corrosion of steels in acids, in the kinetic area. In the thermodynamic area, the efforts involve establishment of a facility for computer generated Pourbaix (E-pH) diagrams for multicomponent systems.

711,020
PB87-172763 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Role of Phosphorus and Hydrogen Sulfide in the Anaerobic Corrosion of Iron and the Possible Detection of This Corrosion by an Electrochemical Noise Technique.
Final rept.,
W. P. Iverson, G. J. Olson, and L. F. Heverly. 1986, 8p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Biologically Induced Corrosion, p154-161 1986.

Keywords: *Phosphorus, *Hydrogen sulfide, Iron, Microorganisms, Reprints, *Anaerobic corrosion, *Desulfovibrio, Electrochemical noise.

Anaerobic corrosion has been postulated as a process which results from the removal of hydrogen from the surface of iron by sulfate-reducing bacteria. Evidence is presented that this type of corrosion is induced instead by a volatile, water soluble, corrosive, phosphorus-containing compound produced by these organisms which also produce hydrogen sulfide. The chemical production of a similarly acting compound, by the action of hydrogen sulfide on certain inorganic phosphorus compounds, is also described. Anaerobic corrosion is stimulated both by the addition of ferrous ions to the anaerobic environment as well as the breakdown of the partially protective films of iron sulfide on the iron which permits the phosphorus compound to initiate the corrosion process in both cases.

711,021
PB88-129846 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Statistical Analysis of the Fluctuations of the Passive Current.
Final rept.,
U. Bertocci, M. Koike, S. Leigh, F. Qiu, and G. Yang. 1986, 5p
Pub. in Jnl. of the Electrochemical Society 133, n9 p1782-1786 Sep 86.

Keywords: *Iron containing alloys, *Corrosion, Pitting, Statistical analysis, Reprints, *Foreign technology.

From recordings of fluctuations in the passive current of Fe-Cr alloys in chloride-containing solutions, the statistical properties of sequences of intervals between current spikes and sequences of decay constants for the spikes were obtained. The intervent time sequences were examined for independence and stationarity, and decay constant sequences for time trends. The results show that the interevent times cannot be modeled by renewal processes or homogeneous Markov chains, but more complicated stochastic models have to be employed.

711,022
PB88-153788 PC **A06**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

MATERIALS SCIENCES

Corrosion & Corrosion Inhibition

Corrosion Evaluation of Underground Telephone Cable Shielding Materials,
J. L. Fink, D. Mathews, G. Hessler, and E. Speed.
Jan 88, 115p NBSIR-87/3546
Sponsored by Rural Electrification Administration, Washington, DC.

Keywords: *Telephone cables, *Coatings, *Underground corrosion, Plastics.

Corrosion data are given on the performance of base and plastic-coated metals intended for use as cable shields for buried telephone cable. The materials investigated on specially prepared specimens were buried for periods up to seven years in six different soil environments. Metals tested included homogeneous plastic-bonded and metallurgically bonded laminates. Some specimens were exposed bare (uncoated), while others had plastic coatings or other types of coatings on either one or both sides. Metals studied included aluminum, copper, low carbon steel, and stainless steel alloys.

711,023
PB88-153796 PC **A05**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Model for Molten Salt Corrosion of (Co,Cr)-Based Superalloys.
Final rept.,
L. P. Cook, and D. W. Bonnell. Dec 87, 94p NBSIR-87/3628
Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.

Keywords: *Heat resistant alloys, *Hot corrosion, Cobalt alloys, Chromium alloys, Fused salts, Hydrocarbons, Fuels, Impurities.

An integrated equilibrium kinetic model is described for treating the chemical solution component of corrosion of (Co, Cr)-based superalloys by the (Na, S, V)-molten salts originating from impurities present in hydrocarbon fuels. Gas phase chemistry and gas phase/condensed phase precipitate interactions are modeled using the NASA-Lewis multicomponent free energy minimization program (CEG).

Elastomers

711,024
PB-275 170/9 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Tests on Insulative Barriers as a Method of Protecting Neoprene Core Mattresses.
Final rept.,
J. N. Breese. Nov 77, 31p NBSIR-77-1295
Sponsored in part by Naval Sea Systems Command, Washington, D.C.

Keywords: *Chloroprene resins, *Bedding equipment, *Ships, *Fire tests, Ignition, Thermal insulation, Colorimetry.

Tests were performed to determine the value of noncombustible insulative barriers as a method of protecting neoprene (chloroprene) mattress cores from igniting and contributing to a shipboard fire. The mattress systems were tested in the heat release rate calorimeter and in a quarter scale model compartment. Thicknesses of up to 44 mm (1-3/4 in) of ceramic fiber and glass fiber insulation were used to protect the cores. Although the insulation reduced the rate of heating of the core, it also served to raise interior temperatures by the effect of heat 'trapping' to a point where the core could continue to decompose and smolder after all exterior heat supply had been removed.

711,025
PB-280 798/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of Hardness and Modulus of Rubber with Spherical Indentors.
Final rept.,
R. D. Stiehler, G. E. Decker, and G. W. Bullman. 1976, 11p
Pub. in Proceedings of International Rubber Conference, Kuala Lumpur, Malaysia, 20-25 Oct 74, v5 p277-287 1976.

Keywords: *Elastomers, *Hardness, Mechanical properties, Numerical analysis, Reprints.

The determination of the hardness of rubber in International Standard ISO 48 and related national standards is based on the modulus (M) calculated from the equation: F = 1.9 M r sq (d/r) 1.35, where F is the force applied to a spherical indentor of radius r that indents the rubber to a distance d; all values being expressed in SI units. This equation differs from the classical equation of Hertz in two respects: (1) the constant is 1.9 instead of 16/9 and (2) the exponent is 1.35 instead of 1.5. The empirical equation in ISO 48 is essentially correct for indentors about 2.5 mm in diameter, but it is not valid for other radii. Studies reported in this paper show that the exponent in the equation is related to the radius of the indentor. The Hertz equation is approached as the radius of the indentor increases. Other factors that affect the measurement are discussed. It is concluded that more reliable measurements of modulus and hardness could be made by measuring the force at a fixed indentation of a specified indentor.

711,026
PB77-600015 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Uniaxial Extension and Compression in Stress-Strain Relations of Rubber.
L. A. Wood. 1977, 7p
Included in Jnl. of Research of the National Bureau of Standards, v82 n1 p57-63 1977.

Keywords: Extension and compression in rubber, Martin-Roth-Stiehler equation, Modulus of rubber, Mooney-Rivlin equation, *Rubber, *Stress-strain relations, Stress-strain relations in rubber, Uniaxial extension and compression in rubber.

A survey of experimental data from the literature in cases where the deformation of a specimen is varied continuously from uniaxial compression to tensile deformation shows that Young's Modulus M, defined as the limit of stress to strain in the undeformed state, is independent of the direction of approach to the limit. The normalized stress-strain relation of Martin, Roth, and Stiehler (MRS, 1956) is F/M = (L to the minus 1 power - L to the minus 2 power) exp A(L - L to the minus 1 power) where F is the stress on the undeformed section, L is the extension ratio, and M and A are constants. Values of M and A are obtained from the intercept and slope of a graph of experim ental observations of log F/(L to the minus 1 power - L to the minus 2 power) against (L - L to the minus 1 power) including observations of uniaxial compression if available. They found the value of A to be about 0.38 for pure-gum vulcanizates of natural rubber and several synthetics. In later work several observers have now found that the equation is also valid for vulcanized containing a filler, but A is higher, reaching a value of about 1 for large amounts of filler. In extreme cases A is not constant at low deformations. The range of applicability in many cases now is found to extend from the compressive region where L = 0.5 up to the point of tensile rupture or to a point where A increases abruptly because of crystallization. Taking A as a constant parameter in the range 0.36 to 1, graphs are presented showing calculated values if (1) F/M as a function of L and (2) the normalized Mooney-Rivlin plot of F/(2M(L -L to the minus 2 power)) against L to the minus 1 power. Each of the latter graphs has only a limited region of linearity corresponding to constant values of the Mooney-Rivlin coefficients C sub 1 and C sub 2. Since this region does not include the undeformed state, where L = 1, or any of the compression region, the utility of the Mooney-Rivlin equation is extremely limited, since it can not be used at low elongations. The coefficients are dramatically altered for rubbers showing different values of the MRS constant A. For rubbers showing the higher values of A, the coefficients are radically altered and the region of approximate linearity is drastically reduced.

711,027
PB79-600002
(Order as PB80-103674, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Molecular Interpretations of Modulus and Swelling Relations in Natural Rubber Cross-Linked by Dicumyl Peroxide.
L. A. Wood. 1979, 6p
Included in Jnl. of Research of the National Bureau of Standards, v84 n5 p353-358 1979.

Keywords: *Cross-linking of rubber, Dicumyl peroxide, Elasticity theory, Modulus of rubber, Mooney-Rivlin constants, Rubber elasticity theory, *Rubber, Natural, Swelling of rubber network.

A survey of published experimental work on the modulus of natural rubber cross-linked by dicumyl peroxide permits a comparison with the results and molecular interpretations obtained in recent NBS work (J. Res. NBS 76A, No. 1, 51 (1972), 77A, No. 1, 171 (1973) and 80A, No. 3, 451 (1976)). Excellent agreement was found among values of the shear modulus G at the same cross-linking when the cross-linking is calculated from the amount of decomposed dicumyl peroxide. The types of deformation included torsion as well as uniaxial extension and compression. G increases kubeark with cross-linking (except at the lowest degrees) with a slope from 5 to 15 percent greater than that predicted by the simple statistical theory. Data of Mullins demonstrated that at each degree of cross-linking the value of G is intermediate between 2C1 and 2(C1+C2) where C1 and C2 are the Mooney Rivlin constants. Measurements of equilibrum swelling at a given degree of cross-linking are in reasonable agreement with each other. However the entropy components of the modulus and the sub-chain density calculated from swelling measurements are appreciably greater than those calculated from cross-linking of from direct mechanical measurements. They increase linearly with cross-linking. It is concluded that the number of sub-chains effective in limiting swelling is greater than that effective in direct mechanical measurements.

711,028
PB80-164650 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Physical Testing of Polymers for Use in Circulatory Assist Devices.
Annual rept. no. 2,
R. W. Penn, G. B. McKenna, and F. A. Khoury. Mar 80, 63p NBSIR-80-2008
Sponsored in part by National Heart, Lung, and Blood Inst., Bethesda, MD. Devices and Technology Branch.See also PB80-101546.

Keywords: *Elastomers, Polymers, Tests, Failure analysis, Medical equipment, Copolymers, Urethanes, Silicone resins, Polyurethane resins, Static loads, Dynamic tests, Durability, Mechanical properties, *Blood pumps.

The mechanical durability of an elastomer is a critical factor in its suitability for blood pump applications. In such applications, an elastomeric bladder is expected to undergo cyclic stress or strain histories at a frequency of approximately 1 Hz for periods of several years. Test methodologies for characterizing the mechanical durability of such materials do not exist. In this report, the authors describe a test methodology which we have developed for the characterization of the durability of elastomers which are candidate materials for blood pump applications. The cumulative damage framework suggests that the testing protocol be designed to examine four aspects of material failure: (1) failure under static loads, (2) failure under dynamic loads, (3) frequency dependence of dynamic failure, (4) statistics of failure. The authors report on the results to date on the uniaxial and equibiaxial failure of the blood pump elastomers using a testing protocol which includes the above four points.

711,029
PB80-225402 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Methods of Measurement of an Elastic Strain-Energy Function of the Valanis-Landel Type.
Final rept.,
E. A. Kearsley, and L. J. Zapas. 1980, 18p
Pub. in Jnl. of Rheology 24, n4 p483-500 1980.

Keywords: *Elastomers, Strains, Elasticity, Numerical analysis, Reprints.

For some pure elastomers, the strain-energy function can be expressed as the sum of three identical functions of the principal stretch ratios, that is, the strain energy is of the Valanis-Landel form. Methods of measuring this function are derived and demonstated. Examples are given of evaluation from extension and compression (biaxial extension) and from torsion of a cylinder. The character of the strain-energy function about the undeformed state is examined in detail.

711,030
PB81-106569

(Order as PB81-106536, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Representation of Long-Time Creep in a Pure-Gum Rubber Vulcanizate.
L. A. Wood. 30 Jan 80, 12p
Included in Jnl. of Research of the National Bureau of Standards, v85 n4 p283-293 Jul-Aug 80.

Keywords: *Creep properties, *Gums, *Vulcanized elastomers, Mechanical properties, Temperature, Stress relaxation, Aging tests(Materials).

Creep may be expressed as delta E/E(1) = A log t + B(t-1) where delta E is the increase of elongation above E(1) the one-minute value, during the time t. The initial slope of a plot of delta E/E(1) against log t is A, a measure of physical creep. The limit of the final slope of a plot of delta E/E(1) against (t-1) is B, a measure of chemical creep. The validity of the equation is determined by the linearity of a plot of (delta E/E(1) - A log t) against (t-1) after A has been determined by the first plot. B is obtained as the slope. With an activation energy of 84-125kJ(mol) (20-30 kcal(mol)) it probably reflects oxidative degradation of the network, often initiated by ozone. The appearance time at which the creep is first observed to exceed A log t can be taken as equal to 1/B. At high temperatures B is drastically increased with a corresponding strong reduction in appearance time. Creep in excess of that given by the equation is sometimes observed during a period immediately before rupture.

711,031
PB81-120552 Not available NTIS
National Bureau of Standards, Washington, DC.
Determining an Elastic Strain-Energy Function from Torsion and Simple Extension.
Final rept.
E. A. Kearsley. Aug 80, 2p
Pub. in Jnl. of Applied Physics 51, n8 p4541-4542 Aug 80.

Keywords: *Elastomers, *Strain energy methods, Reprints.

The elastic properties of rubbery materials can often be represented by a strain-energy function expressed as the sum over the three principal extension ratios of a function of a single extension ratio, the Valanis-Landel form. In that case, the strain-energy function can be completely determined from uniaxial extension data combined with data on the torque of a cylinder in torsion. The method is an improvement over other methods for determining the strain-energy function because the necessary experiments are particularly convenient.

711,032
PB81-121535 Not available NTIS
National Bureau of Standards, Washington, DC.
Kinetics of Hydrolytic Aging of Polyester Urethane Elastomers.
Final rept.
D. W. Brown, R. E. Lowry, and L. E. Smith. Apr 80, 5p
See also AD-D072855. Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Macromolecules 13, n2 p248-252 Mar-Apr 80.

Keywords: *Urethanes, *Reaction kinetics, *Degradation, Polyester resins, Elastomers, Hydrolysis, Reprints.

The hydrolytic degradation of polyester urethane elastomers is due to the acid catalyzed hydrolysis of the ester group.

711,033
PB81-134678 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystallization Phenomena.
A. Peterlin. 1979, 28p
Pub. in Proceedings of the Symposium on Flow-Induced Crystallization, Midland Macromolecular Institute, Midland, MI., August 22-26, 1977, Int. Jnl. Polymer Mater. 7, p1-28 1979.

Keywords: *Crystallization, *Nucleation, *Crystal growth, *Elastomers, Enthalpy, Temperatures, Melting points, Supercooling, Entropy, Polymers.

The minimum requirement of the free enthalpy increase for the formation of any type of critical size nucleus determines the probability for the nucleation from supercooled melt or solution and for the subsequent crystal growth. The minimum demand decreases as the inverse square of the supercooling. This yields a rapid increase of the nucleation and growth rate with decreasing temperature. On the other hand, the viscous resistance of the melt or solution to the chain transfer from the liquid to the crystalline phase increases with the temperature approaching that of the glass transition. Both effects together yield a maximum of the nucleation and growth rates at a finite supercooling with a subsequent drastic drop at a higher supercooling. The extension and alignment of the polymer chains in the liquid by applied mechanical forces lowers the entropy and to some extent also the enthalpy of the liquid state, thus raising the equilibrium melting temperature of the sustem and increasing the effective supercooling. As a consequence the rate of nucleation and crystal growth is drastically increased. Moreover, the shape of the primary nuclei becomes substantially linear with orientation in the main strain direction. Since these linear elements carry most of the applied load or stress the rest of the liquid can relax to such an extent that by epitaxial overgrowth the macromolecules are able to be deposited in more or less conventional lamellae perpendicular to the stress. This yields the shish-kebab structure in the stirred or sonicated solutions and the cylindritic structure in hard elastomers solidified from the extruded melt.

711,034
PB81-135303 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Effects of Pressure on Finite Elastic Shear,
B. Bernstein, and E. A. Kearsley. 1980, 7p
Pub. in Proceedings of the International Congress on Rheology (8th) Held at Naples, Italy on Sep 1-5, 1980, Paper in Rheology 1, p305-311 1980.

Keywords: *Shear tests, *Elastomers, *Pressure, Mechanical properties.

Often the theory of finite deformations of an elastic medium is used with the added restriction of incompressibility of the medium. This restriction makes possible the solution of several classes of problems in terms of an unspecified strain-energy potential, however, it excludes the possibility that the elastic material properties depend on pressure. In this paper, a general theory of materials whose mechanical properties depend on pressure will be derived from the unrestricted theory and the condition for incompressibility of the medium will be added as an approximation.

711,035
PB81-600059 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ferroelectric Polarization in Polymers.
M. G. Broadhurst, and G. T. Davis. 1981, 4p
Pub. in Ferroelectrics 32, p177-180 1981.

Keywords: *Cooperative model, Ferroelectric polarization, Molecular dipoles, Polarization, *Polyvinylidene fluoride, PVDF.

A cooperative model has been developed to describe ferroelectric polarization in polyvinylidene fluoride (PVDF). The molecular dipoles within the crystal are assumed to have two or more orientations available to them and the lattice energy of a given orientation site assumed to be proportional to the fraction of molecules having that orientation. An analytical solution for the 2-site model predicts polarization hysteresis typical of ferroelectrics. However, a more complex 6-site model, which can be analyzed numerically, is needed to account for observed infrared hysteresis data and electric-field-induced x-ray structural changes which have been reported for PVDF. Although the model is simple, rather complex behavior is observed including a gradual increase or decrease in the remnant polarization with number of cycles of electric field application. Though the agreements with various experimental data are good an obvious need to include kinetic effects in the model is indicated.

711,036
PB82-174202 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Solar Energy Systems - Standards for Rubber Hose Used with Liquids Above Their Boiling Points.
Final rept.
R. D. Stiehler. Jul 81, 30p NBSIR-81-2352
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Hoses, *Standards, Elastomers, Heat transfer, Boiling points, Coolants, Stability, Laboratory equipment, Tensile properties, Elongation, Swelling, Ethylene glycol, *Solar heating systems.

Class AT hose in ASTM Standard D 3952-80, Specification for rubber hose used in solar energy systems, is specified for use with aqueous liquids above 100C. The lining of this hose is subjected to immersion tests at 100C. The purpose of this study is to determine whether immersion tests in aqueous liquids above maximum service temperature are necessary in the hose standard. The results of an interlaboratory test indicate that Class AT hose should be subjected to immersion tests above maximum service temperature. By inference, Class N hose used with a volatile heat transfer liquid at a temperature above its boiling point should be similarly tested above maximum service temperature. The study also indicates that ASTM Reference Coolant (ethylene glycol base) is not stable at 150C. In addition to the hose lining, the stability of the heat transfer liquid above maximum service temperature must be determined to assure satisfactory performance of the system. A proposed revision of ASTM D 3952 is included in the report. It provides for immersion tests above maximum service temperature of Class AT and Class N hose linings used with heat transfer liquids above their boiling points.

711,037
PB83-239079 PC **A20**/MF **A01**
Akron Univ., OH. Inst. of Polymer Science.
Development of Processing Technology for the Extraction of Rubber and By-Products from Guayule Plants.
Final technical rept.
H. L. Stephens, and D. McIntyre. 1983, 453p
Grant NB80-NADA-1073

Keywords: *Elastomers, Technology, Laboratory equipment, Economic analysis, Chemical reactions, Pilot plants, Process charting, Moisture content, By-products, Utilization, Extraction, Storage, *Guayule.

Contents:
Administration and technical services (TASK 1);
Processing technology (TASK 2);
Goodyear subcontract on guayule resins (TASK 3) analysis and utilization of by-products extracted from parthenium argentatum (report for the period December 1, 1981 to February 28, 1982 prepared by the Goodyear tire and rubber company).

711,038
PB84-106129 Not available NTIS
National Bureau of Standards, Washington, DC.
Basis for Predicting Long-Time Behavior from Short-Time Tests of Geothermal Sealants.
Final rept.
E. A. Kearsley. Jul 83, 5p
Pub. in Jnl. of Testing and Evaluation, v11 n4 p299-303 Jul 83.

Keywords: *Sealers, *Elastomers, Lifetime(Durability), Forecasting, Performance evaluation, Reprints, *Geothermal wells.

New Elastomers are needed to serve as sealants in geothermal down-well atmospheres. Suitable materials are not now available. The basis for a testing program using short-time tests to predict long-time behavior is outlined in this paper. Measurements of rate of forming of cross-links and rate of breaking of cross-links are to be made to establish the dependence on parameters of the down-well atmophere. The methods of Tolosky using continuous and intermittant stress-relaxation measurements or permanent set measurements can be used for this purpose with materials in simple extension. The Valanis-Landel strain-energy is proposed to make possible the prediction of general deformations from simple extension or from other limited deformations. Maxwellian behavior of the rates with temperature is described. Biaxial permanent set experiments are analyzed.

711,039
PB84-135037 Not available NTIS
National Bureau of Standards, Washington, DC.
Deformation and Fracture Behavior of a Rubber-Toughened Epoxy. Part 1. Microstructure and Fracture Studies.
Final rept.
A. J. Kinloch, S. J. Shaw, D. A. Tod, and D. L. Hunston. Oct 83, 14p
Pub. in Polymer 24, p1341-1354 Oct 83.

Keywords: *Epoxy resins, *Elastomers, *Deformation, *Fracture tests, *Molecular structure, Crack propagation, Determination of stress, Reprints.

The microstructure and fracture behavior of an unmodified and a rubber-modified epoxy have been studied. Values of the stress-intensity factor at the onset of crack growth, K sub (Ic), the type of crack growth, and the detailed nature of the associated fracture surface have been ascertained. Both materials exhibit essentially the same types of crack growth, but the values of K sub (Ic) for the rubber-modified material were usually significantly higher and more loading rate dependent than those for the unmodified epoxy. The mechanisms for this increased toughness have been considered and a mechanism which accounts for all the observed characteristics has been proposed.

711,040
PB84-135045 Not available NTIS
National Bureau of Standards, Washington, DC.
Deformation and Fracture Behavior of a Rubber-Toughened Epoxy. Part 2. Failure Criteria.
Final rept.
A. J. Kinloch, S. J. Shaw, and D. L. Hunston. Oct 83, 9p
Pub. in Polymer 24, p1355-1363 Oct 1983.

Keywords: *Epoxy resins, *Elastomers, *Deformation, *Fracture tests, *Failure, Crack propagation, Temperature tests, Molecular structure, Reprints.

In Part I the microstructure and fracture characteristics of a rubber-modified epoxy, and for comparison those of the unmodified epoxy, were examined in detail. Based on this analysis a qualitative mechanism involving shear yielding and plastic flow was proposed. As an extension of this work, the present paper considers the yield behavior of the epoxy material and uses this data, together with the previously reported fracture results, to calculate values of the crack opening displacement.

711,041
PB84-225598 Not available NTIS
National Bureau of Standards, Washington, DC.
Equilibrium Acid Concentrations in Hydrolyzed Polyesters and Polyester-Polyurethane Elastomers.
Final rept.
D. W. Brown, R. E. Lowry, and L. E. Smith. 1983, 14p
Pub. in Jnl. of Applied Polymer Science 28, p3779-3792 1983.

Keywords: *Elastomers, *Polyurethane resins, *Polyester resins, Hydrolysis, Degradation, Chemical equilibrium, Humidity, Reprints, Poly(butylene adipate) diols, Poly(caprolactone diol).

Three polyester diols were aged at relative humidities (RH) of 25, 50, and 93%. Poly(butylene adipate) diols and a poly(caprolactone diol) reached equilibrium acid concentrations.

711,042
PB85-104750 Not available NTIS
National Bureau of Standards, Washington, DC.
Experiments on the Small Strain Behavior of Crosslinked Natural Rubber. 1. Torsion.
Final rept.
G. B. McKenna, and L. J. Zapas. 1983, 7p
Pub. in Polymer 24, n11 p1495-1501 Nov 83.

Keywords: *Natural rubber, *Crosslinking, *Strain tests, Elastomers, Elasticity, Torsion tests, Reprints.

Experiments in torsion were the torque and normal force were monitored continuously with time were carried out on samples of natural rubber crosslinked with, 1, 3 and 5 phr dicumyl peroxide. It was found that while the shear modulus increased as expected with amount of crosslinking agent, the individual derivatives of the strain energy function did not. Delta W/delta I2 increased only slightly with amount of peroxide, while delta W/delta I1 increased dramatically. Also the authors found that at small strains delta W/delta I2 did not become negative for any of the samples tested contrary to results which have been reported in the literature. This is in spite of the fact that our experiments were carried to smaller strains than had been reported previously.

711,043
PB85-189306 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Failure Behavior of Rubber-Toughened Epoxies in Bulk, Adhesive, and Composite Geometries.
Final rept.
D. L. Hunston, and W. D. Bascom. 1984, 17p
Prepared in cooperation with Naval Research Lab., Washington, DC. Chemistry Div.
Pub. in ACS (American Chemical Society) Advances in Chemistry Series, n208 p83-99 1984.

Keywords: *Rubber adhesives, *Composite materials, *Epoxy resins, *Failure, Temperature, Viscoelasticity, Reprints.

Rubber-modified epoxies were first developed empirically in the 1960's to improve the poor crack-growth resistance of epoxies with a minimum sacrifice in other desirable properties. In 1971 a major effort was launched to study the failure behavior of these materials as structural adhesives. Since then, this program has been expanded to include numerous laboratories and researchers, and the objectives have been broadened to include the failure behavior of bulk specimens and fiber-reinforced composites as well. The authors discuss the effects on failure behavior of rubber modification, test temperature, and loading rate for all three specimen types. For adhesive bonds, the effects of bond thickness are also discussed.

711,044
PB85-202588 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Experiments on the Small Strain Behavior of Crosslinked Natural Rubber. 2. Extension and Compression.
Final rept.
G. B. McKenna, and L. J. Zapas. 1983, 5p
See also PB85-104750.
Pub. in Polymer 24, n11 p1502-1506 Nov 83.

Keywords: *Natural rubber, *Strain tests, Experimental design, Crosslinking, Compressing, Modulus of elasticity, Extensions, Tension tests, Elastomers, Reprints.

Experiments were carried out to characterize the small strain tension and compression behavior of dicumyl peroxide crosslinked natural rubber. Strains which were smaller by an order of magnitude than any reported previously on natural rubber were achieved. The authors results support the contention that the compression and extension moduli of natural rubber are different. A new finding is reported. That is, the moduli in tension and compression do not become constant but rather they increase significantly as zero deformation is approached.

711,045
PB85-204717 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Structure and Properties of Polyethylene Films Used in Heavy Lift Balloons.
Rept. for Jan-May 84.
F. Khoury, J. M. Crissman, B. M. Fanconi, H. L. Wagner, and L. H. Bolz. Mar 85, 105p NBSIR-84/2989-NASA
Sponsored by National Aeronautics and Space Administration, Wallops Island, VA. Wallops Flight Center.

Keywords: *Polyethylene, *Polymeric films, *Mechanical properties, *Balloons, Molecular weight, Melting point, Density(Mass/volume), Surface properties, Birefringence, Graphs(Charts), Tensile properties, X ray diffraction, Crystal structure, Morphology, Strain rate, Infrared spectroscopy, Fine structure, Fourier transform spectroscopy, Polymer branching, Polymer chains.

The following features of five polyethylene films used by NASA in the construction of heavy lift balloons have been examined: molecular weight, molecular weight distribution, branching, melting behavior, density, surface texture, birefringence, orientation of crystalline regions, uniaxial deformation in the machine and transverse directions, and the effect of sample geometry and strain rate on deformation behavior. The goal of this exploratory study was to determine whether there are significant differences in any of the above mentioned features, or combination of features between the films. The acquisition of such information is a first step towards determining whether there are any specific correlations between film characteristics and the incidence of catastrophic failure of balloons during ascent through the troposphere. This exploratory study has resulted in the identification of similarities and differences between various features of the films. Close similarities have been found in methyl group content, crystallinity, and peak melting temperature. The preferred orientations in the crystalline regions appear to be qualitatively similar or related. Differences among the films have been revealed in two features, namely between their molecular weights, and in the balance of the strain to break behavior in the machine direction relative to that in the transverse direction.

711,046
PB86-142858 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Superposition of Small Deformations on Large Deformations: Measurements of the Incremental Relaxation Modulus for a Polyisobutylene Solution.
Final rept.
G. B. McKenna, and L. J. Zapas. 1985, 10p
Pub. in Jnl. of Polymer Science, Polymer Physics Edition 23, p1647-1656 1985.

Keywords: *Modulus of elasticity, *Molecular relaxation, *Deformation, Solutions, Viscoelasticity, Aging tests(Materials), Elastomers, Reprints, *Polyisobutylene, BKZ theory.

The incremental relaxation modulus deltaG(t) for a concentrated solution of polyisobutylene has been determined from step-shear experiments in which a small deformation delta/gamma was superimposed on a large deformation gamma(sub 1); deltaG(t) was found to decrease with increasing gamma (sub 1), and to increase with the t(sub e) after the imposition of the large deformation. It was aso observed that the 'apparent relaxation spectrum' associated with deltaG (t) narrows and shifts to shorter times when compared to the spectrum associated with the linear viscoelastic relaxation modulus G(t). The results are well described by the nonlinear constitutive equation of the BKZ elastic fluid theory.

711,047
PB86-214657 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Small Strain Behavior of Peroxide Crosslinked Natural Rubber.
Final rept.
G. B. McKenna, and L. J. Zapas. 1986, 8p
Pub. in Rubber Chemistry and Technology 59, nl p130-137 Mar/Apr 86.

Keywords: *Natural rubber, *Strains, Crosslinking, Mechanical properties, Strain tests, Stress analysis, Torsion, Reprints, *Peroxide/dicumyl.

The behavior of a Natural Rubber crosslinked with 5 phr dicumyl peroxide (149 deg C, 2 hrs) has been characterized in the region of small deformations in torsion. All experiments were carried out in stress relaxation at 23 + or - 10 deg C. Torque was measured at strains as low as gamma approx. equal 0.001 and the normal force was measured at strains of gamma approx. equal 0.0046. The derivatives of the strain energy density function, partial derivative of w with respect to I(sub 1) and partial derivative of w with respect to I(sub 2), were calculated from these measurements and the values reported are resultingly for values of strains which are smaller than any reported previously. Comparison is also made with reduced stress measurements in tension and compression which were reported in a prior study.

711,048
PB87-153292 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Strain-Energy Function for Rubber-Like Materials.
Final rept.,
L. J. Zapas. 1981, 11p
Pub. in IUTAM (International Union of Theoretical and Applied Mechanics) Symposium on Finite Elasticity, Lehigh University, August 10-15, 1980, P445-455 1981.

Keywords: *Elastomers, *Strains, Deformation, Mechanical tests.

Some results are presented on theories which attempt to describe the relation between force and deformation of rubbers where the linear laws of the classical theories of elasticity are not applicable. A few experimental results are presented in order to show the present status of the form of the strain-energy function of rubber-like materials.

711,049
PB88-110358 PC **A04**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
In-situ Characterization of the Interface of Glass Reinforced Composites.
Final rept.,
F. W. Wang, and B. M. Fanconi. Jun 87, 66p NBSIR-87/3581
Sponsored by Army Research Office, Research Triangle Park, NC.

Keywords: *Curing agents, *Viscosity, Epoxy compounds, Fluorescence, Composite materials, Remote sensing, Polyimide resins, Fiber optics.

A technique has been developed to monitor the viscosity of curing epoxies. Fluorescence spectroscopy of viscosity-sensitive organic dyes is used together with optic fibers as a means of delivering the probing light to the measurement site and retrieving the modulated light for detection. The technique is adaptable to remote sensing through the use of optic fibers: The evanescent wave of the guided radiation is used to excite probe molecules lying at the interface between the fiber and surrounding matrix. Therefore, the technique is adaptable to in-situ characterization of the interface of glass reinforced composites.

711,050
PB88-134622 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Non-Equilibrium Mechanical Response of a Cross-Linked Network.
Final rept.,
R. J. Gaylord, G. H. Weiss, and E. A. DiMarzio. 1986, 3p
Pub. in Macromolecules 19, n3 p927-929 1986.

Keywords: *Polymers, *Elastomers, Polymerization, Networks, Barriers, Crosslinking, Reprints, *Foreign technology.

The reptation and retracing mechanisms of chain relaxation in cross-linked polymer networks are viewed as multiple barrier passage processes and their properties are calculated in terms of the model of a continuous-time random walk with a pausing-time distribution having a long-time tail.

711,051
PB88-134648 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Continuous-Time Random Walk Description of the Non-Equilibrium Mechanical Response of Cross-Linked Elastomers.
Final rept.,
R. J. Gaylord, B. Joss, J. T. Bendler, and E. A. DiMarzio. 1985, 3p
Pub. in British Polymer Jnl. 17, n2 p126-128 Jun 85.

Keywords: *Natural rubber, *Elastomers, *Crosslinking, Networks, Stress relaxation, Polymers, Reprints, *Foreign technology, CTRW model.

The application of the continuous-time random walk model to the description non-equilibrium stress response of a cross-linked network is discussed. Different versions of the CTRW model lead to the prediction of a stress relaxation function having either a fractional-power law form or a fractional-exponential law form. Both forms are tested against experimental data on the stress relaxation and loss modulus behaviors of cross-linked natural rubber.

Fibers & Textiles

711,052
PB-257 767/4 PC **A05**/MF **A01**
Maryland Univ., College Park. Dept. of Textiles and Consumer Economics.
Basic Investigation of the Extinguishability of Various Fabrics.
Final rept.
L. B. Miles. 1976, 96p NBS-GCR-76-77
Contract NBS-4-9019

Keywords: *Fabrics, *Flammability testing, *Fire fighting, Hazards, Burning rate, Heat flux, Measurement, Heat sinks, Human factors engineering, Regression analysis, Curve fitting, Extinguishability.

In considering extinguishability hazards both the inherent qualities of a fabric as well as human reactions are important. This study concentrates on the former aspect. Linear burning rate and heat flux are measured for twelve fabrics within a TRI Flammability Analyzer cabinet. Initial work deals with ambient oxygen effects on the burning rate and heat flux of each fabric measured at four levels of oxygen. From the resulting data, a series of relationships were studied by regression techniques. The latter work investigates heat sink/interstitial effects on burning rate and heat flux. Two heat sink designs were evaluated using temperature and distance as variables. In studying cooling effects, each fabric was tested at three heat sink distances. Burning rate and heat flux were plotted as functions of inverse heat sink distance.

711,053
PB-257 836/7 PC **A06**/MF **A01**
Maryland Univ., College Park. Dept. of Textiles and Consumer Economics.
Investigation of Certain Design Parameters of the Mushroom Apparel Flammability Tester.
Final rept.
A. K. Stratton. Jul 76, 114p NBS-GCR-76-78
Contract NBS-4-9019

Keywords: *Flammability testing, *Apparel fabrics, *Test equipment, Design, Heat transfer, Rates(Per time), Methodology, Measurement, Flame propagation, Ignition, Reviews, Computation, Charring, Recommendations, Theses, Mushroom test(Flammability).

This paper describes the effect of variations in design parameters of the apparatus on the heat transfer rates measured by the 'Mushroom Apparel Flammability Tester'. In this instrument, cylindrical specimens of apparel fabrics are suspended from a circular top plate, and the rate of heat transfer to the top plate and a cylinder inside the specimen are measured. The paper describes the effect of changing the cylinder diameter, and of introducing rods between the specimen and the cylinder to prevent deposition of molten polymer on the cylinder. Heat transfer rates measured on the top plate and on the cylinder are compared. Design parameters for the present version of this instrument and the corresponding test method were chosen on the basis of this investigation. The paper is in the form of a Master of Science thesis; the experimental work was performed at NBS.

711,054
PB-265 784/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comments on 'Flammability Assessment of Apparel Fabrics'.
J. F. Krasny, and R. D. Peacock. Apr 77, 2p
Pub. in Textile Chemicals Colorists, v9 n4 p32-33 Apr 77.

Keywords: *Fabrics, *Flammability testing, Assessments, Comparison, Burning rate, Heat transfer, Textile industry, Reprints, Mushroom Apparel Flammability Testers.

The heat transfer rate from burning fabrics, measured on the Mushroom Apparel Flammability Tester, is compared with flammability assessments reported in a paper by Falil and Lomartire. Good agreement between the two methods was found for many but not all fabrics.

711,055
PB-269 489/1 PC **A09**/MF **A01**
Maryland Univ., College Park. Dept. of Textiles and Consumer Economics.
Extinguishability as a Component Measure of Flammability Hazard,
S. M. Spivak. Apr 77, 180p NBS-GCR-77-90
Grant NBS-4-9019

Keywords: *Apparel fabrics, *Fire hazards, *Extinguishing, Burning rate, Heat flux, Combustion control, Heat sinks, Textiles, Air flow, *Extinguishability.

Extinguishability of flammable fabrics has been investigated under two separate basic and applied phases. Twenty-two fabrics have been investigated. The basic phase focused on the influence of extinction mechanisms which control burning behavior during extinguishment, and thus extinguishability. Mechanisms studied include effects of ambient oxygen concentration and placement of a heat sink in proximity to the flame. A modified TRI Flammability Analyzer was used. Results show that burning rate and heat flux vary linearly with oxygen concentration, and the general behavior of fiber type can be ascertained. Further analyses show the influence of both sensitivity to, and lower limits of, oxygen concentration as these influence burning behavior. Heat sink effects cause reductions in flammability with increasing impingement of the heat sink device. The applied phase concentrated on laboratory simulations of extinguishment strategies, i.e., slapping out the flames and running to blow out the flames. In slapping, the test device consisted of two boards which could be closed onto a burning fabric. Numerous experimental variables influence these results. Thus, slapping is highly method dependent and may not be a good candidate as a simple test to assess extinguishability. A method of greater promise consisted of blowing air over burning fabric to simulate running. This utilized a controlled air flow directed at burning fabric mounted on an NBS Mushroom Apparel Flammability Tester (MAFT).

711,056
PB-273 093/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Burning Behavior of Borderline Fabrics.
Final rept.,
L. B.Miles. 1977, 33p
Sponsored in part by Cotton Foundation, Memphis, Tenn.
Pub. in Proceedings Symposium on Textile Flammability (5th), New Orleans, La., April 20-21, 1977, 33p 1977.

Keywords: *Fire resistant textiles, *Cotton fabrics, *Polyester fibers, Flammability, Blends, Cellulosic resins, Textile industry, Heat transfer, Reprints.

Under the proposed General Apparel Flammability Standard, the difference between class 1 fabrics, the 'safest' class of fabrics, and the other classes is a maximum heat transfer rate (MAFT value) of less than .40 J/sq cm/s at any time during the test. For the present study, as add-ons or phosphorus levels were increased on flame-retardant treated cottons and cotton blends, these fabrics exhibited bi-modal clustering of their MAFT values above and below the 0.40 value. Any fabric which generated MAFT values on both sides of the 0.40 J level was defined as a 'borderline' fabric. Heat data over time for several borderline fabrics were collected using the Mushroom Apparel Flammability Tester (MAFT) and one other flammability apparatus, the Apparel Flammability Modeling Apparatus (AFMA). Extinguishment by air flow was more successful for borderline synthetics than for borderline cellulosics. On the other hand, extinguishment by contact with a large copper body was considerably more successful for the borderline cellulosics than for the borderline synthetics.

711,057
PB-280 993/7 PC **A06**/MF **A01**
New York State Coll. of Human Ecology, Ithaca. Dept. of Design and Environmental Analysis.
Fabric and Dye Variations as Flammability Determinants: An Application of the Mushroom Apparel Flammability Tester.
Final rept.
D. L. Hopkins. Aug 77, 122p NBS/GCR-77/96
Grant NBS-4-9019
Master's thesis.

Keywords: *Flammability testing, *Textiles, *Dyes, Cotton fabrics, Heat transfer, Laboratory equipment, Data analysis, Theses, Mushroom apparel flammability testers, Procedures.

This study was aimed at investigating the flammability characteristics of a diverse collection of fabrics on the Mushroom Apparel Flammability Tester (MAFT) in order to determine the effects of fabric variables and Procion dyestuffs on burning behavior. Sixty-two fabrics, as part of the Cooperative Apparel Flammability Testing Program, were tested on the MAFT, evaluated and classified according to the NBS draft Proposed Standard for the Flammability of General Wearing Apparel. A market impact study of the Proposed Standard was also done. Selected cotton and cotton blend fabrics were dyed with two Procion dyes. Time to ignite, heat transfer rate and oxygen index were determined along with several physical properties. In conclusion, the specific dyes used seem to have little effect on flammability as tested but fabric characteristics have proved important in determining fabric flammability properties on the MAFT.

711,058
PB-281 451/5 PC **A11**/MF **A01**
Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
Effects of Ignition Sources and Fire Retardants on Material Ignition.
Final rept. Jan 77-Mar 78,
P. Durbetaki, W. C. Tincher, H. Chang, C. C. Ndubizu, M. L. Teague, and V. L. Wolfe. 31 Mar 78, 230p NBS-GCR-78-126
Grant NBS-G7-9003

Keywords: *Fire resistant textiles, *Ignition, Thermophysical properties, Fire resistant materials, Mathematical models, Fire prevention, Laboratory equipment, Tests.

The fire loss probability is composed of all sub-probabilities which are associated with the events and processes leading to the occurrence of the fire loss. The events and processes generally fall into two categories, the selection processes and the physico-chemical processes. The first important event of the physiochemical processes is ignition after given exposure to heat source. Measurements have been carried out to provide required data on thermophysical properties, constitutive description of processes, and ignition times. Description of the preignition processes and the prediction of ignition time was formulated and the results compared with measurements. Thermal radiative properties have been measured. Thermal conductance measurements were carried out. Ignition time and ignition frequency measurements under convective heating have been carried out with a microburner ignition source on fire retarded and untreated fabrics. Ignition time measurements on vertical fabric samples under radiative heating were conducted using large samples of fire retarded and untreated fabrics.

711,059
PB-295 039/2 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Studies of Flammability Test Procedures for Curtains and Drapes.
Final rept.
D. E. Hopkins, and J. F. Krasny. Mar 79, 25p NBSIR-79-1596
Sponsored in part by Coast Guard, Washington, DC.

Keywords: *Flammability testing, *Curtains, Fabrics, Tests, Comparison, Ignition, Ships, *Drapes, Procedures.

The Intergovernmental Maritime Consultative Organization (IMCO) is in need of a simple, relevant flammability test method for the curtain and drapery fabrics used aboard ships. Two methods for measuring self-extinguishment of fabrics upon removal of the flame were compared. One was proposed by the United States' representative to IMCO, the other was an adaptation of a recently proposed method of the International Standards Organization (ISO). The effects of variations of the proposed test methods (changes in the ignition flame characteristics, bottom edge or surface ignition, and in the specimen suspension) were also investigated. In general, the relative ranking of the fabrics was not changed, though the individual after-flame time and char length results were affected by some of these variables. The advantages and disadvantages of the two proposed test methods are discussed and an improved method is recommended.

711,060
PB-300 703/6 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS Activities in Apparel Flammability.
Final rept.
E. Braun, J. F. Krasny, R. D. Peacock, and A. Stratton. 1975, 9p
Sponsored in part by Consumer Product Safety Commission, Washington, DC.
Pub. in Proceedings of Annual Meeting of the Information Council on Fabric Flammability (9th), New York, NY., Dec 11, 1975, p263-271 Dec 75.

Keywords: *Flammability, *Textiles, Heat transfer, Extinguishing, Tests, Ignition.

This paper gives a brief overview of apparel flammability research activities of NBS and development of an apparel flammability test. Research consists of programs to explore: heat transfer during free burning and after contact is made between the burning fabric and a simulated body; ease of extinguishment; and optimization of fabric specimen configuration. Based on the results of this research and the general literature, a test concept was developed which strives for balance between simulation of real-life garment fires and test simplicity and reproducibility. A cylindrical specimen is suspended from a circular plate and ignited aboveits bottom edge. Time-to-ignite and heat transfer to the plate and a cylinder inside the specimen are measured. Typical results and possible criteria for dividing the fabrics into classes according to time-to-ignite and heat transfer are discussed. Fabrics which are hard to ignite and/or transfer little heat would be in a class which could be used in all garments. Fabrics which are easily ignited and/or transfer more heat could be used; e.g., in slacks and underwear, i.e., garments which cover only part of the body and ould be expected to fit tightly.

711,061
PB80-101918 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Assessment of the Quality of Pulp Fibers By Short Span Tensile Analysis.
Progress rept. 1 Oct 77-30 Sep 78,
E. L. Graminski, and K. Bonin. Oct 79, 22p NBSIR-79-1914
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Wood fibers, Wood pulp, Tensile strength, Tension tests, Assessments.

Fiber strength is an important factor in paper strength, but despite its importance fiber strength is rarely assessed as it involves the tedious and time consuming testing of single fibers. In the recycling of paper, especially of the abundant low grades of waste paper, the question of fiber quality always arises. The inability to monitor fiber quality of recycled pulp, especially from low grade waste paper has led to the practice of utilizing this pulp only for low grade papers regardless of the actual quality of the pulp fibers. Unfortunately, there is a limited demand for low grade papers. Increased utilization of low grade waste paper could be enhanced if the fiber quality of the recycled pulps could be monitored routinely. As the strength of fibers is affected by defects that are randomly distributed among and within fibers it appeared a short span tensile test might provide a means for assessing fiber quality. In short span tensile testing of fibrous webs the load at the break declines as the span increases. The rate of decline is partly controlled by the fiber length distribution. Since the probability of locating defects in fibers increases with increasing span lengths the rate of decline in web strength with increasing span lengths should be a function of fiber quality for a specific fiber length distribution, all things being equal. The results of this investigation indicate that the rate of decline in web strength with increasing span length is indeed a function of fiber quality. It appears that the test method could be used to monitor fiber quality routinely.

711,062
PB80-123243 Not available NTIS
National Bureau of Standards, Washington, DC.
Synthesis of a General Apparel Flammability Standard,
J. F. Krasny, E. Braun, and R. D. Peacock. 1976, 14p
Pub. in Proceedings of the Annual Information Council on Fabric Flammability (10th) Meeting Held at New York, NY on December 8-9, 1976, p171-184 1976.

Keywords: *Fabrics, *Flammability tests, *Standards, Safety, Textile industry, Consumer product safety act.

NBS has recently submitted a draft of a general apparel flammability standard to the Consumer Product Safety Commission. If accepted by the Commission, proposed in the Federal Register, and issued in final form, this standard would replace CS 191-53, the present general wearing apparel standard. It is based on the Mushroom Apparel Flammability Tester (MAFT) concept. The paper describes in some detail the work on which this apparatus and the standard are based: analysis of burn accidents collected in FFACTs, work under grant at the University of Maryland and MIT, and experimetal work at NBS in other laboratories.

711,063
PB80-144199 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of Fabrics for Thermal Protective Clothing.
Final rept.,
R. M. Perkins, J. F. Krasny, E. Braun, and R. D. Peacock. 1979, 19p
Pub. in Proc. Ann. Information Council on Fabric Flammability Conf. (12th), New York, Dec 6-7, 1978, p212-230 1979.

Keywords: *Protective clothing, *Fire resistant materials, Flammability testing, Heat flux, Heat transfer, Samples.

The thermal insulative properties of various fabrics under flaming and non-flaming exposure were studied. Fabrics tested had been made from natural fibers, man-made fibers, or from blend combinations. For studies of the insulative properties of fabrics under radiant heat flux, a modification of a method developed by the National Bureau of Standards was used. The influence of fabric weight, air permeability, thickness, chemical finish, and position of the sensor with relation to the fabric specimen was evaluated. Studies of the insulative properties of fabrics under convective heat flux were based on the proposed test method ASTM Designation: D 13-77-4. An attempt was made to quantify the protection afforded by charred fabrics.

711,064
PB80-144249 Not available NTIS
National Bureau of Standards, Washington, DC.
Exploratory Flammability Experiments with Fabrics Contaminated with Gasoline.
Final rept.,
B. B. Hibbard, and J. F. Krasny. 1979, 11p
Pub. in Proc. Ann. Information Council on Fabric Flammability Conf. (12th), New York, Dec. 6-7, 1978, p132-142 1979.

Keywords: *Flammability testing, *Fabrics, *Gasoline, Textiles, Evaporation, Ignition.

The rate of evaporation of gasoline from 18 fabrics varying widely in fiber composition and construction was measured and found to be inversely related to fabric weight, and directly related to the area wetted by the gasoline. For a given fabric weight, knitted fabrics tended to have a lower rate of evaporation than more compact, woven fabrics. The fiber composition seemed to have relatively little effect on rate of evaporation. Fabrics which did not ignite from exposure to a Tesla coil leak spot detector did ignite when there was as little as 0.1 cc of gasoline present. Additional experiments would be required to determine the relative safety of fabrics in various scenarios in which gasoline, garments, and fire are involved.

711,065
PB82-107996 Not available NTIS
National Bureau of Standards, Washington, DC.
Calorimetric Study of Flame-Retardant-Treated Cotton/Polyester Blends.
Final rept.
M. J. Manka, K. N. Yeh, and B. F. Smith. Aug 78, 16p
Pub. in Jnl. of Fire Retardant Chemistry 5, p144-159 Aug 78.

Keywords: *Fire resistant materials, *Textile processes, *Heat measurement, Blends, Cotton fabrics, Polyester fibers, Organic phosphates, Reprints, Phosphite/triphenyl, Phenyl phosphates, Phosphoric acid/tris(dibromo-(propyl-ester)).

The effectiveness of three flame retardants containing phosphorus or phosphorus and bromine has been evaluated for cotton/polyester blended fabrics. The effectiveness was based on reducing the heat released from a burning fabric. The flame retardants of interest are triphenyl phosphate ((phi O)3PO), triphenyl phosphite ((phi O)3P) and tris(2,3-dibromopropyl) phosphate (T-2,3-P). The results are also compared with those previously obtained for phosphoric acid treated blends and are interpretable in terms of existing mechanisms of flame-retardant action.

711,066
PB82-165267 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.

Airflow Extinguishment of Burning Apparel Fabrics.
Final rept.
B. B. Hibbard, J. F. Krasny, E. Braun, and R. D. Peacock. Dec 81, 41p NBSIR-81-2386
Prepared in cooperation with Man-Made Fiber Producers Association, Inc., Washington, DC.

Keywords: *Fabrics, *Flammability, *Air flow, Extinguishing, Burning rate, Velocity, Textiles, Polyester fibers, Cellulose, Heat transfer, Cotton fabrics, Apparel fire modeling apparatus.

The heat output of a burning fabric, subjected to a frontal airflow at various velocities, was measured behind the burning face of the fabric. Twelve different commercial fabrics were evaluated in this manner on the Apparel Fire Modeling Apparatus (AFMA). When the fabric burned to a given heat output, the selected level of airflow was applied to the face of the burning fabric in an attempt to extinguish the flame. Burn injury area, maximum total heat, and time to extinguishment were determined from AFMA data. The burning fabrics quickly extinguished with an airflow of 213 meters per minute (8 mph) or less in all but one of the fabrics studied. The one exception was an 85/15 cotton/polyester double faced, terry cloth fabric where this and higher airflows only increased the rate of burning. For the eight fabrics investigated which contained cellulose, the maximum total heat and burn injury area increased as fabric weight increased. For most of the fabric weight increased. For most of the fabrics studied, the total heat transferred to the simulated body generally decreased with increasing air velocity. Fabrics were classified into three groups based upon these airflow extinguishment parameters.

711,067
PB82-176082 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Modeling of NBS Mattress Tests with the Harvard Mark V Fire Simulation.
J. A. Rockett. Jan 82, 76p NBSIR-81-2440

Keywords: *Fire tests, *Bedding equipment, Mathematical models, Smoldering.

NBS burned eleven mattresses made up with bedding in two different rooms, typical of a residential bedroom and a nursing home patient room, respectively. Seven of the mattresses flamed and burned vigorously, the other four were of a construction or so heavily flame inhibited that they only smoldered. The burning behavior of the seven that flamed was modeled with the Harvard Mark V fire simulation. The experimental burn behavior for tests conducted in one room was well reproduced using only total weight of combustible, surface area and heat of combustion. Smoke production values were found to have little effect on the predicted behavior except for the smoke production itself. Fires in a second room, whose ventilation was intentionally restricted by the configuration of the adjoining space, could not be as well reproduced by the present, single room fire model. During this study several changes were made to the simulation. The most significant change was the inclusion of mixing of the hot, exiting fire gases with the cold incoming air. As a part of this, the inter-layer radiation exchange was reformulated to include the effect of smoke contamination of the lower layer. The reformation of the radiation model had a marked effect on the predicted upper layer gas temperatures, generally improving the quality of the simulation.

711,068
PB82-238346 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Low-Density Thermal Insulation Calibrated Transfer Samples--A Description and a Discussion of the Material Variability.
B. G. Rennex. Jun 82, 14p NBSIR-82-2538
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Thermal insulation, *Glass wool, *Calibration, Thermal conductivity, Thermal resistance, Samples, Density ratio, Probability theory, Thickness effect.

The National Bureau of Standards (NBS) has developed the capability to provide thick, low-density thermal insulation calibrated transfer samples to the thermal testing community. The calibrated transfer samples are described. The considerations that went into the selection and preparation of these low-density mineral-fiber samples are discussed. The contributions to the calibration uncertainty due to material variability are discussed and estimated to range between one percent and 2.5 percent.

711,069
PB82-264169 Not available NTIS
National Bureau of Standards, Washington, DC.
Cigarette Ignition Behavior of Commercial Upholstery Cover Fabrics.
Final rept.
G. H. Damant, S. S. Williams, and J. F. Krasny. Mar 82, 16p
Pub. in Jnl. of Consumer Product Flammability 9, n1 p31-46 Mar 82.

Keywords: *Flammability testing, *Ignition, *Upholstery, Cellulose, Fabrics, Fire resistant materials, Reprints, *Cigarettes, Smoldering.

The cigarette ignition of 70 primarily cellulosic upholstery cover fabrics was studied at the California Bureau of Home Furnishings (BHF) and the Center for Fire Research, National Bureau of Standards (NBS). BHF used the mini-mockup procedure, and classified the fabrics according to self-extinguishment or the time to reach 10 or 20 percent weight loss. Each of the fabrics was mounted over a variety of upholstery filling materials. NBS classified the fabrics according to self-extinguishment or ignition when the cigarettes were placed into crevices made up by a cushion and two types of filling materials in the vertical member, or on the flat surface of the cushion. Relatively cigarette ignition resistant fabrics, i.e., those which did not ignite in the NBS mock-ups also generally self-extinguished in the BHF polyester batting and foam mini-mockups. Certain fabric characteristics which tend to improve cigarette ignition resistance could be identified, such as low weight in cellulosic fabrics, blending of thermoplastic fibers with cellulosic fibers, certain backcoatings, and scouring of cellulosic fabrics to remove impurities present in raw cotton.

711,070
PB83-143099 Not available NTIS
National Bureau of Standards, Washington, DC.
Textile Flammability Testing: Appropriate Levels for Moisture Content of Specimens.
Final rept.
J. F. Krasny, and E. Braun. 1982, 4p
Pub. in Fire Mater. 6, n1 p38-41 1982.

Keywords: *Textiles, *Flammability testing, *Moisture content, Humidity, Temperature, Reprints.

This study was performed to establish the moisture level that would be appropriate for textile flammability test specimens (as determined by the temperature and relative humidity at which the specimens are preconditioned before testing and during the test). For this purpose, three investigations were carried out: the level of humidity in dwellings; the moisture content of garments worn at various distances from the body; and the effect of relatively short exposures to heat on the moisture level of fabrics, simulating the case of a person standing in front of an open fire. Moisture content of ambient air in dwellings was found to be primarily governed by the moisture content of the air outside (unless, of course, humidifying or dehumidifying equipment is used). The results of these studies indicate that oven-drying is a reasonable conditioning requirement for testing of the flammability of apparel and home furnishing fabrics.

711,071
PB83-179572 Not available NTIS.
National Bureau of Standards, Washington, DC.
Performance Evaluation of Fabrics Used in Fire Fighters' Turnout Coats.
Final rept.
J. F. Krasny, R. Singleton, and J. Pettengill. Nov 82, 10p
Pub. in Fire Technology 18, n4 p309-318 Nov 82.

Keywords: *Protective clothing, *Coats, Fire fighting, Performance evaluation, Fabrics, Abrasion tests, Flammability tests, Tensile strength, Reprints.

Several fabrics commonly used in the outer shells of structural fire fighter's turnout coats were subjected to a variety of laboratory tests. These included breaking and tearing strength tests as well as several kinds of abrasion tests. The flame exposure tests were also conducted on assemblies of outer shell fabric, vapor barrier and innerliner.

711,072
PB84-151703 Not available NTIS
National Bureau of Standards, Washington, DC.
Model of Apparent Thermal Conductivity for Glass-Fiber Insulations.
Final rept.
L. J. Van Poolen, J. G. Hust, and D. R. Smith. 1983, 12p
Pub. in Proc. Thermal Conductivity 17, Gaithersburg, MD., June 15-18, 1981, p777-788 1983.

Keywords: *Insulation, *Glass fibers, *Heat transfer, *Mathematical models, Thermal conductivity, Thermodynamics.

The heat transfer through glass-fiber insulations is modeled. The model is based primarily on parallel and independent components of heat transfer due to: (a) gas-fiber-gas and (b) fiber conduction, as well as, (c) radiation, and (d) convection. The mathematical model, containing six adjustable parameters, is derived from a physical model of sequential parallel layers of space (gas filled or evacuated) and fibers. The total heat transfer, from which one may derive an apparent thermal conductivity, is a function of the fill gas properties (thermal conductivity, collision diameter, and molecular weight), insulation properties (solid fiber conductivity, bulk density, fiber emittance, and fiber diameter), thermodynamic parameters (mean temperature and pressure), and boundary conditions (specimen thickness, temperature difference, and surface emittance). From data generated at the National Bureau of Standards, Boulder, Colorado, as well as published and unpublished data, the parameters in the model were determined. The functional character of the model using these parameters is presented and compared qualitatively to available data.

711,073
PB85-197549 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Flame Retardation of Cellulose By Thiocyanates. Preliminary Study.
Final rept.
R. J. McCarter. 1981, 12p
Pub. in Jnl. of Fire Retardant Chemistry 8, n3 p157-168 Aug 81.

Keywords: *Fire resistant materials, *Insulation, *Cellulose, *Combustion inhibitors, Sodium thiocyanates, Safety, Potassium thiocyanates, Newsprint, Fibers, Reprints.

Sodium and potassium thiocyanate were found effective flame retardants for cellulose at addition levels circa 1 1/2 weight percent. The properties of these deliquescent salts permit their interstitial deposition in newsprint fibers with a minimal amount of aqueous solvent and suggest their possible utility for retarding cellulosic loose-fill insulation. Samples of such insulation were prepared in laboratory-scale equipment, using the thiocyanates in combination with other required inhibitors of smoldering and corrosion. Combustion tests of these samples were found to approximate the requirements of federal safety standards for such insulation. Thermal analysis is reported of the effects of various retardants upon the pyrolysis of cellulose and newsprint fibers.

711,074
PB86-240074 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Apparel Flammability: Accident Simulations and Bench-Scale Tests.
Final rept.
J. F. Krasny. 1986, 17p
Pub. in Textile Research Jnl. 56, n5 p287-303 May 86.

Keywords: *Clothing, *Fire resistant textiles, Flammability, Ignition, Burning rate, Flammability testing, Apparel fabrics, Reprints.

Various apparel flammability characteristics of more than 60 fabrics were explored within the framework of the Cooperative Industry Program on General Apparel Flammability sponsored by the American Textile Manufacturers Institute. Testing consisted of apparel fire simulations on a full size mannequin and a device simulating a moving leg, as well as laboratory measurements of ignition time, heat release, weight loss, and linear and area flame spread.

Fibers & Textiles

711,075
PB87-107918 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Insulative Values of Double Layers of Fabrics Exposed to Radiative Heat.
Final rept.
R. M. Perkins, J. F. Krasny, and E. Braun. 1980, 9p
Pub. in Proceedings of the Annual Meeting Information Council on Flammable Fabrics (13th), Atlanta, GA., December 1979, p88-96 1980.

Keywords: *Fabrics, Apparel fabrics, Heat, Burns(Injuries), Layers.

Single and double layers of fabrics were exposed to a radiative heat flux for 2 minutes. The time to burn injury and the total heat transferred through the fabric to a heat sensor were measured.

711,076
PB87-153813 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Apparent Thermal Conductivity Characterization of Low-Density, Glass-Fiber Insulation Material.
Final rept.,
B. Rennex, and T. A. Somers. 1985, 23p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Thermal Insulation 8, p175-197 Jan 85.

Keywords: *Thermal insulation, Glass fibers, Thermal conductivity, Standards, Reprints, Standard reference materials.

The work describes the procedure, results, and error analysis of a study to characterize the apparent thermal conductivity values of a lot of low-density, glass-fiber insulation material. The uncertainty of these values of the 75 samples measured is estimated to be plus or minus 1.4 percent. The data was taken at a mean temperature of 24C, and the sample thickness was 25mm. It is recommended that this lot be made available as a Standard Reference Material from the Office of Standard Reference Materials of the National Bureau of Standards.

Iron & Iron Alloys

711,077
AD-A160 831/4 PC **A04**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Fracture and Deformation Div.
Effect of Heat Treatment on Mechanical Properties and Microstructure of Four Different Heats of ASTM A710 Steel.
Final rept.
G. E. Hicho, C. H. Brady, L. C. Smith, and R. J. Fields. Sep 85, 58p Rept no. DTNSRDC/SME-CR-05-85

Keywords: *Heat treatment, *Low alloy steels, Age hardening, Electrons, Metallography, Fracture(Mechanics), Heat, Steel, Microstructure, Fine grained materials, Grain size, Mechanical properties, Fractography, Tensile properties, Test and evaluation, Thermomechanics, High strength alloys, Chemical properties.

A710 is an high strength low alloy steel whose strength is a result of both a fine grained microstructure and a dispersion of copper precipitates. For these reasons, the tensile and impact properties of an A710 plate depend as much on the thermo-mechanical history of each plate as on the chemistry of each heat. Since plates shipped from steel suppliers are frequently heat treated under different conditions, it is difficult to attribute property differences to chemistry variations rather than to heat treatment variations or vice versa. Heat to heat property differences must be determined for a specific, known heat treatment. This report describes the variability in the mechanical properties of four plates (representing four heats of steel) that have received known, and carefully controlled, heat treatments at the National Bureau of Standards. The sensitivity of these properties to heat treatment variations within each heat of steel is also reported here. Optical and electron metallographic techniques were used to determine as-received and heat treated microstructures. Scanning electron fractography was used to ascertain the fracture mechanism in the tensile and impact tests. This report also contains two appendices in which splitting fracture and microchemistry observations in A710 are discussed.

711,078
AD-A176 497/6 PC **A02**/MF **A01**
Colorado School of Mines, Golden.
Model for the Silicon-Manganese Deoxidation of Steel Weld Metals,
O. Grong, T. A. Siewert, G. P. Martins, and D. L. Olson. Oct 86, 7p ARO-23474.7-MS
Contract DAAL03-86-K-0064
Pub. in Metallurgical Transactions A, v17A p1797-1807 Oct 86.

Keywords: *Welding, *Liquid metals, *Manganese, *Oxides, *Silicon, *Steel, *Weld metal, *Deoxidation(Metallurgy), Buoyancy, Flow fields, Fluid flow, High temperature, High velocity, Interactions, Low temperature, Models, Parameters, Particles, Rates, Separation, Surfaces, Reprints.

From an analytical and theoretical study of flat and out-of-position gas metal arc (GMA) C-Mn steel welds containing varying additions of silicon and manganese, it is concluded that the buoyancy effect (flotation obeying Stokes' law) does not play a significant role in the separation of oxide inclusions during weld metal deoxidation. The separation rate of the particles is controlled solely by the fluid flow pattern in the weld pool. A proposed two-step model for the weld metal deoxidation reactions suggests that inclusions formed in the hot, turbulent-flow region of the weld pool are rapidly brought to the upper surface behind the arc because of the high-velocity flow fields set up within the liquid metal. In contrast, those formed in the cooler, less-turbulent flow regions of the weld pool are to a large extent trapped in the weld metal as finely dispersed particles as a result of inadequate melt stirring. The boundary between 'hot' and 'cold' parts for possible inclusion removal is not well defined, but depends on the applied welding parameters, flux, and shielding gas composition. As a result of the intricate mechanism of inclusion separation, the final weld metal oxygen content depends on complex interactions among the following three main factors: 1) the operational conditions applied, 2) the total amount of silicon and manganese present, and 3) the resulting manganese-to-silicon ratio.

711,079
PB-251 097/2 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Analysis of Findings of Four Tank-Car Accident Reports.
Final rept.
C. G. Interrante, G. E. Hicho, and J. G. Early. Jan 75, 71p NBSIR-75-655, FRA/ORD-75/50
Contract DOT-AR-40008

Keywords: *Railroads, *Tank cars, *Metallurgical analysis, Chemical analysis, Tension tests, Ferrite, Grain size, Microstructure, Hardness tests, Mechanical properties, Bend tests, Impact tests, Specifications, Steels, Accident investigations, Hazardous materials, Railroad accidents.

A comprehensive overview of the findings and metallurgical analyses of tests conducted at the National Bureau of Standards on samples of tank-car materials submitted by the Federal Railroad Administration is presented. The submitted samples were taken from tank cars which had been involved in accidents during the period January 1970 to January 1971. The testing conducted during the metallurgical analyses included full chemical analyses, ambient temperature tensile tests on longitudinal and transverse specimens, quantitative metallography to determine ferrite grain size, peralite colony size, and inclusion content, size, and shape, hardness tests, bend tests on longitudinal and transverse specimens, and a very comprehensive program of impact testing, which is covered in a separate report on Impact Properties.

711,080
PB-261 012-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
X-Ray Diffraction Study of Diffusion in a Mixture of Copper and Nickel Powders Compressed at Various Pressures (Rentgenograficheskoe Issledovanie Difuzii v Smesi Poroshkov Medi i Nikelya, Spressovannykh pri Raznykh Davleniyakh),
S. D. Gertsriken, and M. G. Butsik. 1975, 10p DMDC-14112, TT-75-52132
Trans. of Fizichni Zapiski (URSR) v7 n2 p231-236 1938. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Copper alloys, *Nickel alloys, *Diffusion, X ray diffraction, Metal powder, Translations, USSR, Self diffusion.

Cu and Ni powders were sintered at temperatures of 600 and 650C under pressures of 3000 to 12000 atm. Powder size ranged from 1 to 3 micrometers. Alloy compositions were 73.5 at.% Cu and 26.5 at.% Ni and 73.5 at.% Ni and 26.5 at.% Cu. Interdiffusion between the two elemental powders was followed by x-ray diffraction.

711,081
PB-261 013-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion of Silver and Lead in Silver Bromide (Opete po Izucheniyu Diffuzii Ionov Serevra i Svintsa v Bromide Serebra),
A. Murin, and B. Lurie. 1974, 11p DMDC-8274, TT-74-53235
Trans. of Akademiya Nauk SSSR. Doklady, n99 p53-55 1954. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Silver, *Lead(Metal), *Silver bromide, *Diffusion, Isotopic labeling, Electrical conductivity, Translations, USSR, Self diffusion.

The diffusion of radioactive silver and lead in silver bromide is measured in the temperature range 150 to 350C using residual activity methods as the experimental technique. The results are compared to those obtained from electrical conductivity techniques.

711,082
PB-261 016-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion of Iron in Iron-Titanium Alloys (Diffuziya Zheleza v Splavakh Sistemee Fe-Ti),
A. Y. Shinyaev. 1974, 18p DMDC-11881, TT-74-53088
Trans. of Akademiya Nauk SSSR. Izvestiya, n4 p263-267 1971. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Iron alloys, *Titanium alloys, *Diffusion, Intermetallic compounds, Isotopic labeling, Iron isotopes, Phase transformations, Translations, USSR, Self diffusion.

Diffusion coefficients of Fe-59 in Fe-Ti alloys were measured at 864, 902, 929, 1054, and 1093C. Alloy compositions varied from 18 to 50 atomic percent Ti. Diffusion profiles were obtained from sectioning techniques. Multiphase diffusion takes place because of the formation of the intermetallic compound Fe2Ti.

711,083
PB-263 257/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Removal of Iron-Sulfide Deposits from Fracture Surfaces.
Final rept.,
C. G. Interrante, and G. E. Hicho. 1976, 17p
Pub. in Am. Soc. Test. Meter. Spec. Tech. Publ. 610, p349-365 1976.

Keywords: *Steels, *Fractures(Materials), *Iron sulfides, *Surface finishing, Crack propagation, Hydrogen sulfide, Fractography, Chemical cleaning, Steel 2.5Cr 1Mo.

Steels are most commonly used at moderate strength levels at which they have high ductility and resistance to subcritical crack growth due to hydrogen. Thus, in testing the susceptibility to hydrogen damage of these steels, severe charging conditions are commonly used, and hydrogen sulfide is often used in low-pH solutions to obtain the desired high fugacity for the test.

The fracture faces of specimens tested in this type of solution become covered with iron and other sulfides that are difficult to remove without affecting the underlying metal as well. The removal of these sulfide deposits from the fracture surfaces is a prerequisite to fractographic analysis of the failure mode, and it was attempted by various methods. Hydrogen reduction of the sulfides at elevated temperatures followed by ultrasonic cleaning in alcohol was found to be much more successful than the other methods studied. Evaluations of these methods for double-cantilever-beam and Charpy V-notch specimens of a 2 1/4Cr-1Mo steel provides information needed for studying the cracking mechanism under severe sulfide exposure conditions.

711,084
PB-264 434/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Atomistic View of Shock Wave Propagation in a Solid.
Final rept.,
D. H. Tsai, and R. A. MacDonald. 1976, 16p
Contract AT(49-13)3003
Sponsored in part by Army Research Office, Durham, N.C.
Pub. in Proceedings of European Conference on Thermophysical Properties of Solids at High Temperatures (5th), Moscow, USSR, 18-21 May 76, High Temp. High Pressures, v8 p403-418 1976.

Keywords: *Solids, *Shock waves, *Equation of state, Crystal structure, Iron, Mathematical analysis, Computerized simulation, Stress relaxation.

Molecular dynamical studies of the propagation of a strong one-dimensional shock wave in a perfect fcc or bcc monatomic lattice in one, two, and three dimensions are reported. Various two-body interatomic potentials ranging from a harmonic potential to one which simulates that in alpha-iron are used. The classical equations of motion for the atoms are solved numerically under appropriate initial and boundary conditions, and the properties of the lattice are obtained from averages of the atomic motion. With a realistic potential the shock wave velocity (mu sub s) increases approximately linearly with increasing particle velocity (mu sub p) in agreement with experiment. The results show the structure of the shock wave on an atomic scale, and give such details as the thickeness of the shock front and the equilibration of stresses and energies in the compressed region. Under certain conditions structural relaxation accompanied by stress relaxation is also observed. The implications of some of these details on the determination of equation of state data from shock wave experiments are examined.

711,085
PB-266 587/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Magnetothermal Conductivity of Selected Pure Metals and Alloys.
L. L. Sparks. 1977, 9p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in Proceedings, International Cryogenic Materials Conference (1st), Kingston, Ontario, Canada 22-25 Jul 75; Paper B-1 in Advances in Cryogenic Engineering, v22 p119-127 1977.

Keywords: *Nickel alloys, *Stainless steels, *Copper, *Thermal conductivity, *Magnetic fields, Chromium alloys, Iron alloys, Cryogenics, Steel 310.

The magnetothermal conductivity program was initiated to determine the effect of a magnetic field on the thermal resistance of technically important metals. The experiments are done in magnetic fields up to 8T and cover the temperature range from 4 to 20 K. The results of this study are presented for a Ni-Cr-Fe alloy, AISI 310 stainless steel, oxygen-free copper, and a high purity copper specimen.

711,086
PB-266 594/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fracture Toughness and Fatigue Crack Growth Rate of an Fe-Ni-Cr Super-alloy at 298, 76, and 4K,
R. P. Reed, R. L. Tobler, and R. P. Mikesell. 1977, 12p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in Proceedings, International Cryogenic Materials Conference (1st), Kingston, Ontario, Canada 22-25 Jul 75; Paper A-7 in Advances in Cryogenic Engineering v22 p68-79 1977.

Keywords: *Fatigue(Materials), *Fracture properties, *Iron alloys, Nickel alloys, Chromium alloys, Toughness, Crack propagation, Stresses, Cryogenics, Superalloys, J integrals, Stress intensity factor, Iron alloy A 453.

Fatigue crack growth rate and fracture toughness data at 298, 76, and 4 K are presented for a precipitation hardenable, Fe-Ni-Cr superalloy, ASTM A453. Plane strain, linear-elastic fracture mechanics and J-integral test techniques were applied using compact specimens. The crack growth rate was significantly lower at low temperatures than at room temperature. The toughness parameter K sub Q and the critical value of the J-integral, J sub IC, were determined. These results represent the first low temperature fatigue crack growth rate and toughness data for this alloy.

711,087
PB-271 573/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fracture Behavior of the Heat Affected Zone in 5% Ni Steel Weldments.
Final rept.,
H. McHenry, and R. P. Reed. Apr 77, 9p
Sponsored in part by Maritime Administration, Washington, D.C.
Pub. in Weld. J. Res. Suppl., 9p Apr 77.

Keywords: *Weldments, *Nickel steels, Fracture properties, Low temperature research, Cryogenics, Fatigue(Materials), Crack propagation, Toughness, Heat affected zone, Steel 5Ni.

The fracture properties of the base metal and the heat affected zone (HAZ) of 5% Ni steel weldments were determined at room temperature, 111k and 76K; emphasis was placed on tests at 111K, the minimum boiling point of liquefied natural gas (LNG). The 32 mm-thick test plates, which met the requirements of ASTM A645, were welded using the pulsed-power gas-metal-arc process at a heat input of 10.6 kJ/cm. The fatigue crack growth rates were determined for cracks growing through the thickness using four-point bend specimens. At 111K, the rates in the base metal were essentially the same as found by other investigators, however, the rates in the HAZ were up to 10 times faster than previously reported. Fracture toughness tests were conducted under load-controlled conditions using J-integral procedures. At 111K, the base metal and HAZ toughness values were 30 and 50 percent lower, respectively, than toughness values obtained previously for the same plate of test material under displacement-controlled conditions. Fracture mechanics analyses using the results reported herein indicate that 5% Ni steel is suitable for LNG applications, but more conservative estimates of fatigue life and critical crack size are necessary.

711,088
PB-271 594/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fracture of Structural Alloys at Temperatures Approaching Absolute Zero.
Final rept.,
R. L. Tobler. 1977, 8p
ARPA Order-2569
Pub. in Proc. Int. Conf. of Fractures (4th), Waterloo (Canada), June 19-24, 1977, Fracture 3, ICF4, p839-846 1977.

Keywords: *Structural steels, *Aluminum alloys, *Titanium alloys, *Nickel alloys, Fracture properties, Construction materials, Cryogenics, Low temperature research, High temperature tests, J-integrals.

The J-integral was used to evaluate and compare the low temperature fracture behavior of 14 commercial alloys, including ferritic steels, and aluminum-base, titanium-base and nickel-base alloys. The tests were performed at temperatures between 295 and 4 K. These data, which can be used in fracture mechanics evaluations, suggest several generalizations that should aid in predicting the behavior of untested alloys.

711,089
PB-274 325/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Elevated-Temperature Mechanical Behavior of a Carbon-Manganese Pressure Vessel Steel.
Final rept.,
J. G. Early. 1977, 7p
Sponsored in part by Federal Railroad Administration, Washington, D.C.
Pub. in Jnl. Eng. Mater. Technol. 99, n4 p359-365 Oct 77.

Keywords: *Carbon steels, Manganese containing alloys, Pressure vessels, Creep rupture strength, Creep rupture tests, Tension tests, Tensile properties, Fracture properties, Reprints.

The short-time effects of stress and temperature on the mechanical properties of a carbon-manganese pressure vessel steel were investigated using room- and elevated-temperature tensile tests and short-time creep-rupture tests. The tensile test results indicated that strain aging effects were not observed in the temperature range 1100 F to 1250 F. Analysis of the creep-rupture data, in the range 1150 F to 1250 F, by the Larson-Miller method using the procedures of Manson and Mendelson provided a value of 20.7 for the material constant, C. In the temperature and stress regime studied, a linear relationship was observed between log(stress) and log(time-to-rupture). Fractographic analyses revealed a common fracture mode in all specimens tested. The fracture mode is described as an intermediate type, containing features of both transgranular and intergranular fracture.

711,090
PB-275 118/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Anomalous Low-Temperature Elastic Behavior of a Nitrogen-Strengthened Chromium-Manganese Stainless Steel.
Final rept.,
H. M. Ledbetter. 1977, 6p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va. and Department of Defense, Washington, D.C.
Pub. in Materials Science and Engineering, v29 p255-260 1977.

Keywords: *Stainless steels, Elastic properties, Compressibility, Bulk modulus, Poisson ratio, Low temperature tests, Cryogenics, Modulus of elasticity, Chromium containing alloys, Manganese containing alloys, Nickel containing alloys, Steel 21Cr 9Mn 6Ni, Reprints.

Elastic constants of an Fe-21Cr-6Ni-9Mn stainless steel were studied experimentally by both pulse and resonance methods. The room-temperature elastic constants are similar to those of AISI 304. During cooling to liquid-nitrogen temperature (76 K), all the elastic constants behave anomalously below 130 K. As in Fe-Mn alloys, these anomalies are probably due to a Neel transition. A further anomaly in the compressibility at 190 K suggests a second transition of unknown nature.

711,091
PB-278 406/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Multi-Axial Fatigue and Creep at Elevated Temperatures and Mathematical Modeling.
Final rept.,
T. Fong, and W. Penn. 1977, 15p
Pub. in Proceedings of Int. Conf., Hong Kong, March 21-25, 1977, Paper in Fracture Mechanics and Technology, I, p145-159 1977.

Keywords: *Fatigue(Materials), *Creep, *Stainless steels, *Polymethyl methacrylate, Plastic properties, Latent heat, Deformation, High temperature tests, Steel 304.

An operational decomposition of the total mechanical energy that goes into a specimen undergoing low-cycle fatigue testing is reviewed and discussed with respect to multi-axial and elevated temperature design environment. This energy approach, when first applied by Fong (1975) to the analysis of uniaxial fatigue data for reannealed AISI type 304 stainless steel with and without hold time at 593C, contained an operational definition of a total latent heat for structural change. It is the exhaustion of that latent heat which Fong postulated as the cause for fatigue failure. To check this postulate which involves energy quantities hitherto defined only for uniaxial or torsional mode of deformation, tension-torsion fatigue data with variable hold times for polymethyl-methacrylate which simulates steel at elevated temperatures are analyzed. It was found that the postulate for the exhaustion of a total latent heat for structural change is reasonable for either uniaxial, torsional, or tension-torsion mode of deformation.

711,092
PB-278 410/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Low-Temperature Elastic Properties of a 300-grade Maraging Steel.
Final rept.,
H. M. Ledbetter, and D. T. Read. 1977, 4p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in Metall. Trans. 8A, n11 p1805-1808 Nov 77.

Keywords: *Maraging steels, *Elastic properties, Cryogenics, Shear properties, Modulus of elasticity, Bulk modulus, Poisson ratio, Nickel, Cobalt, Molybdenum, Reprints, Steel 9Co 5Mo 18Ni.

Elastic properties of an annealed 300-grade maraging steel (18 Ni, 9 Co, 5 Mo pct by weight) were studied between room temperature and liquid-helium temperature. Longitudinal and transverse ultrasonic velocities were determined by a pulse method. The reported elastic constants are: longitudinal modulus, shear modulus, Young's modulus, bulk modulus, and Poisson's ratio. Except for the bulk modulus, the room-temperature elastic constants are all lower than those of iron; and their temperature dependencies are regular in the studied temperature region.

711,093
PB-278 940/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Transmission and Scanning Electron Microscopy Studies of Deformation at Erosion Impact Sites.
Final rept.,
L. K. Ives, and A. W. Ruff. 1978, 14p
Pub. in Proceedings of International Conference on Wear of Materials, St. Louis, MO., April 26-28, 1977, Wear 46, p149-162 1978.

Keywords: *Erosion, *Impact properties, *Deformation, *Stainless steels, Electron microscopy, Aluminum oxide, Glass, Particles, Twinning, Steel 310, Scanning electron microscopy, Transmission electron microscopy.

Scanning and transmission electron microscopy methods have been employed to study topographic features and subsurface damage associated with erosive particle impact craters in annealed 310 stainless steel surfaces. Angular Al2O3 and spherical glass particles approximately 50 micrometers in diameter were projected at a velocity of 59 m/s to impact at attack angles of 90 degrees and 20 degrees. Under these conditions, material was found to be displaced but not removed from the surface at isolated impact sites. A comparison was made with damage produced at diamond pyramid hardness indentations. Substantial differences were not observed. In general, a high dislocation density zone a few micrometers wide was found to surround both impact craters and hardness indentations. The width of this zone varied according to the size and shape of the crater and the direction of particle motion. Deformation twinning occurred at some impact sites. An electron channelling pattern analysis of the strain field around impact craters in 310 stainless steel and copper was compared to the dislocation distribution observed directly by transmission electron microscopy.

711,094
PB-280 765-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Study of Interdiffusion Processes in Powder Metallurgical Bimetals (Isliedovania Protsessof Vzaimnoi Diffuzii v Metalokeramicheskikh Bimatallakh),
V. N. Antsiferov, T. G. Cherepanova, and S. N. Bobrova. 1976, 11p DMDC-14948, TT-76-59187
Trans. of Politekhnicheskii Inst., Perm. Sbornik Nauchnykh Trudov (USSR) n73 p94-99 1970. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Powder metallurgy, *Sintering, *Diffusion, Microscopy, Iron alloys, Molybdenum alloys, Phase diagrams, Carbon, Additives, Hardness, Steels, Translations, USSR.

The processes which take place during the sintering of iron-molybdenum and steel-molybdenum are followed with readings of microhardness and with the microscope. The observed changes are related to the phase diagrams at the appropriate binary systems. The introduction of carbon was found to lower the mobility of iron in molybdenum during sintering. The formation of carbides in the interdiffusion zone will tie up the diffusing elements.

711,095
PB-281 215-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion Welding Austentic Steel with Aluminium and Its Alloys (Diffuzıonnaya Svarka Austenitnoi Stali s Aluminiem i Ego Splavami),
V. V. Trutnev, M. X. Schorshorov, and A. A. Baikova. 1974, 17p DMDC-11389, TT-74-53222
Trans. of Svarochnoe Proizvodstvo (USSR) v37 n10 p11-13 1967. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Diffusion welding, *Steels, *Aluminum alloys, *Aluminum, Magnesium containing alloys, Copper containing alloys, Silicon containing alloys, Translations, USSR.

The physico-chemical phenomena taking place at the interface of metal-metal configuration during diffusion bonding is studied. Measured are those variables (temperature, alloy composition, etc.) needed to effect a strong bond between steel and aluminum as well as steel and alloys of AlMg, steel/Al-Si, and steel/Al-Cu.

711,096
PB-281 259-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Electron Microscopic Autoradiography (Electronmikroskopicheskaya Avtoradiografiya),
S. Z. Bokshtein, S. S. Ginzburg, S. T. Kishkin, L. M. Moroz, and E. P. Senchenko. 1976, 9p DMDC-15049, TT-76-59189
Trans. of Metody Ispty. Kontr. Issled. Mashinostroit. Mater (USSR) n1 p52-56 1971. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Autoradiography, *Electron microscopy, *Metals, *Diffusion, Nickel, Nickel isotopes, Tritium, Titanium, Isotopic labeling, Steels, Translations, USSR, Self diffusion.

This paper describes a technique used to observe and autoradiograph in an electron microscope. Sample preparation needed to accomplish this fact is detailed. Several examples are used to illustrate the practicality of the technique (self-diffusion of Ni-63 in a steel, diffusion of H3 in alpha-Ti).

711,097
PB-282 630-SET PC **E15**
National Bureau of Standards, Gaithersburg, MD.
Economic Effects of Metallic Corrosion in the United States.
May 78, 1071p-in 3v
Set includes PB-282 631, PB-282 632, and PB-279 430.

No abstract available.

711,098
PB-283 987/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Cryogenic Tensile, Fatigue, and Fracture Parameters for a Solution-Annealed 18% Nickel, 300-Grade Maraging Steel.
Final rept.,
R. L. Tobler, R. P. Reed, and R. E. Schram. Apr 78, 6p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in Jnl. of Eng. Mater. Technol 100, p189-194, Apr 78.

Keywords: *Maraging steels, *Cryogenics, Tensile properties, Fatigue(Materials), Fractures(Materials), Crack propagation, Fracture toughness, Reprints, Maraging steels 18Ni.

The mechanical properties of an eighteen percent nickel, solution-annealed 300-grade maraging steel were measured to assist in the evaluation of this material for low-temperature structural applications. Tensile, fatigue-crack growth rate, and fracture toughness tests were performed in ambient air (295 K), liquid nitrogen (76 K), and liquid helium (4 K).

711,099
PB-286 531/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison of the Threshold Stress Intensities and Fracture Characteristics for Temper Embrittled and Deembrittled 2 1/4 Cr-1 Mo Steel in a Hydrogen Charging Environment.
G. E. Hicho, and C. M. Gilmore. 1978, 12p
Pub. in American Society for Testing and Materials, Special Technical Publication 645, p351-362 1978.

Keywords: *Chromium molybdenum steels, Fracture properties, Hydrogen embrittlement, Tempering, Stresses, Embrittlement, Chromium containing alloys, Molybdenum containing alloys, Steels, Reprints, Steel 2.25Cr 1Mo.

Fracture toughness tests and fractographic examinations were conducted on temper embrittled and deembrittled 2 1/4 Cr-1 Mo steel using double cantilever-beam specimens. The tests were conducted in an aqueous/acetic acid solution containing hydrogen sulfide (H2S). The threshold stress intensity of the temper embrittled specimens tested in the H2S environment was lower than that of the deembrittled specimens tested in a similar environment. For the purpose of comparing fracture appearances, temper embrittled and deembrittled specimens were fractured in air. The fracture appearances of the temper embrittled and the deembrittled specimens tested in the H2S environment and the temper embrittled specimen fractured in air were predominantly intergranular. The fracture appearance of the deembrittled specimen fractured in air exhibited a transgranular ductile mode of failure. These results indicate that the embrittling effects due to temper embrittlement and to the H2S environment act cooperatively in reducing the threshold stress intensity of 2 1/4 Cr-1 Mo steel.

711,100
PB-291 486-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Study of the Diffusion of Radioactive Sulfur (Izutchemie Diffuzii Sery V Zeleze Metodom Radioaktiivniyh Isotopov).
P. L. Gruzin, I. F. Konoyuk, and M. M. Pavlyuchenko. 1976, 10p DMDC-17517, TT-76-59205
Trans. of Inzhenerno-Fizicheskii Zhurnal (USSR) v1 n1 p64-67 1958. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Iron, *Sulfur, Radioactive isotopes, Grain boundaries, Activation energy, Diffusion coefficient, Reaction kinetics, Translations, USSR.

The diffusion of radioactive sulfur in iron was measured in the temperature range 600C-1200C. The grain boundary diffusion of sulfur was also studied. Technical grade and Armco grade iron were used, with differing diffusion rates the result. An activation energy of approximately 30 kcal/gm. atom was calculated. Arrhenius equations were found for both grades of iron investigated. Because of grain boundaries, apparently no change in sulfur diffusion rates were found for the alpha, and gamma phases.

711,101
PB-291 582-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Wall Penetrability of Metal Tubes for Helium (Issledovanie Pronicaemosti Stenok Metallicaseskikh Tpub dlya Geliya).
I. S. Lupakev, and Y. S. Kuzmichev. 1974, 15p DMDC-14183, TT-74-53226
Trans. of Atomnaya Energiya (USSR) n17 p49-52 1964. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Steels, *Helium, *Metal pipe, Penetration, Stainless steel, High temperature tests, High pressure tests, Translations, USSR.

The ability of He to penetrate tube walls of a stainless steel, pearlitic steel, and a nickel-base steel was investigated in a temperature range up to 800C and He pressures up to 100 atmospheres. Using leak detectors and x-ray analysis, little or no He penetration thru the walls was found.

711,102
PB-298 756/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Elastic Constants at Low Temperatures: Recent Measurements on Technological Materials at NBS.
Final rept.
H. M. Ledbetter. 1978, 17p
Sponsored in part by Maritime Administration, Washington, DC., National Aeronautics and Space Administration, Washington, DC., and Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings Int. Cryogenic Materials Conf. (2nd), Held at Boulder, CO. on Aug 3-5, 1977. Paper in Advances in Cryogenic Engineering, v24 p103-119, 1978.

Keywords: *Aluminum alloys, *Copper alloys, *Titanium alloys, *Steels, *Composite materials, Cryogenics, Low temperature research, Niobium alloys, Fiberglass reinforced plastics, Elastic properties, Modulus of elasticity, Poisson ratio, *Elastic constants, Epoxy matrix composites, Metal matrix composites.

Low-temperature (4-300 K) elastic constants determined experimentally at NBS during the last four years are reviewed. Forty-seven technological materials were studied, including: aluminum alloys, cupro-nickels, titanium alloys, titanium-niobium superconducting alloys, copper-base precipitation-hardening alloys, invar, inconels, maraging steel, nickel steels, stainless steels, nitronics, and the composites -- fiberglass/epoxy, NbTi/Cu epoxy, NbTi/Cu, and B/Al. Elastic constants discussed primarily are: Young's modulus, the shear modulus, the bulk modulus, and Poisson's ratio.

711,103
PB-298 802/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fracture Mechanics Parameters for an Iron-13% Chromium-19% Manganese Stainless Steel and Its Welds at Cryogenic Temperatures.
Final rept.
R. L. Tobler, H. I. McHenry, and R. P. Reed. 1978, 13p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Proceedings of Int. Cryogenic Materials Conference (2nd), Boulder, CO., August 3-5, 1977, Paper K-7 in Advances in Cryogenic Engineering, 24, p560-572 1978.

Keywords: *Austenitic stainless steels, Fracture properties, Crack propagation, Fatigue(Materials), Cryogenics, Low temperature tests, Chromium containing alloys, Manganese containing alloys, Welded joints, Steel 13Cr 19Mn.

As part of the USA/USSR Science & Technology exchange program on the properties of LNG containment materials, fatigue crack growth rates and fracture toughness tests at selected temperatures between 295K and 4K were conducted on an Fe-13%Cr-19%Mn-0.2%N austenitic stainless steel from the USSR. Compact specimens (18.4 mm thick) and three-point bend specimens (12.5 mm thick) were used in testing the normalized base metal and submerged arc welds. The fatigue crack growth resistance decreases as temperature is decreased from 295 to 4K. Fracture toughness also decreases, with J sub Ic values ranging from 255 to 50 kJ(m to the minus 2 power) between 295K and 4K. The effects of welding are discussed, and specimen orientation is shown to be one of the most significant factors governing the fatigue crack growth resistance of the butt welds. For TS orientation, crack growth rates are higher in the HAZ and for TL orientations crack growth rates are lower in the HAZ, compared to the base metal.

711,104
PB-299 288/1 PC **A21**/MF **A01**
National Bureau of Standards, Washington, DC.
Materials Studies for Magnetic Fusion Energy Applications at Low Temperatures-II.
Technical rept.
F. R. Fickett, and R. P. Reed. Jun 79, 495p NBSIR-79-1609
Sponsored in part by Department of Energy, Washington, DC. See also report dated Apr 78, PB-282 444.

Keywords: *Stainless steels, Superconducting magnets, Aluminum alloys, Cryogenics, Physical properties, Welding, Nonmetals, Specific heat, Elastic properties, Magnetic permeability, Magnetization, Magnetic properties, *Thermonuclear reactor materials.

The reports presented here summarize the work of the low temperature materials research project for the second year of the program. The various projects are outlined and the research results are presented. The major thrust of the measurements has been the evaluation of the low temperature mechanical and physical properties of stainless steel base metal and welds, with particular emphasis on nitrogen strengthened stainless steels. Aluminum alloys have also received some consideration. Work has been done on the production of nonmetallics, primarily industrial laminates for low temperature applications and on the measurement of their properties at cryogenic temperatures. The second NBS/DOE Vail workshop was held in October 1978. A brief description is given of that program.

711,105
PB-299 988/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Fatigue Crack Growth Resistance of Structural Alloys at Cryogenic Temperatures.
Final rept.
R. L. Tobler, and R. P. Reed. 1978, 9p
Sponsored in part by Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings of International Cryogenic Materials Conference (2nd), Boulder, CO., August 3-5, 1977, Paper A-7 in Advances in Cryogenic Engineering, 24, p82-90 1978.

Keywords: *Titanium alloys, *Stainless steels, *Nickel steels, *Crack propagation, Fatigue(Materials), Cryogenics.

Fatigue crack growth rate data at selected temperatures including 295, 76, and 4 K are presented for a variety of titanium alloys, stainless steels, and FeNi alloys. The results correlate well with crystal structure. Compared to their behavior in room temperature air environment, stable austenitic face-centered cubic alloys exhibit improved fatigue crack growth resistance at low temperatures. Hexagonal close-packed titanium alloys show temperature-insensitive behavior. Temperature effects on the fatigue crack growth resistance of body-centered cubic Fe-Ni alloy steels are moderate, except below the fracture transition temperature range where fatigue crack growth rates are drastically accelerated.

711,106
PB-300 461/1 PC **A05**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.
Standard Reference Materials: Micro-Homogeneity Studies of NBS Standard Reference Materials, NBS Research Materials, and Other Related Samples.
Final rept.
R. B. Marinenko, K. F. J. Heinrich, and F. C. Ruegg. Sep 79, 88p NBS-SP-260-65
Library of Congress catalog card no. 79-600121.

Keywords: *Standards, *Alloys, Homogeneity, Steels, Gold alloys, Tungsten alloys, Brasses, Glass, Chemical analysis, Electron probes, Microanalysis, *Standard reference materials, Tungsten alloy 20Mo, Electron microprobe analysis.

A simple routine technique for studying homogeneity in the micrometer range with the electron microprobe has been developed. For graphic display, a digital periodic integrator is used. In conjunction with scalers and a stepping motor on the sample stage, traces similar to industrial control charts based on a comparison of the experiment with the expected (Poisson) counting statistics are quickly obtained. A computer program has been developed to numerically evaluate sample homogeneity. Several Standard Reference Materials (SRMs) have been tested. These include the iron and steels (SRMs 661-664, 461, and 463), the gold-copper and gold-silver alloys (SRMs 481 and 482), the tungsten-20 percent molybdenum alloy (SRM 480), cartridge brass (SRM 478), the iron-chromium-nickel alloy (SRM 479a). A Research Material, Glasses for Microanalysis (RM-30), has also been tested.

711,107
PB-300 712-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Mechanism of Internal Oxidation of an Fe-Al-Alloy(O Mekhanizme Vnutrannego O Kisleniyo Spleua Zhelezo - Alyuminii).
S. N. Abramishvili, L. L. Kunin, and V. A. Urazova. 1979, 13p DMDC-15806, TT-79-58079
Trans. of Tsentralnyi Nauchno-Issledovatelskii Institut Chernoi Metallurgii. Sbornik Trudov (USSR) n61 p65-71 1968. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Iron alloys, *Internal oxidation, Diffusion, Aluminum containing alloys, Reaction kinetics, Diffusion coefficient, Translations.

The obtained experimental data indicated that the diffusion of oxygen in iron with 0.84% Al is associated with the formation of oxidized compounds at points called 'traps'. Two different processes could be exactly identified either from microphotographs or kinetic curves. A typical diffusion process, in which both the total thickness and the thickness of the layer of finely dispersed inclusions are proportional to time, is observed in experiments at 1350C after 144 min. and at 1200C after 324 min. The starting period of diffusion is complicated with side processes related to the dissociation of the first oxidized layer. The formation of the layer is explained.

711,108
PB78-600018 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Transition Probabilities for Vanadium, Chromium, and Manganese (A Critical Data Compilation of Allowed Lines).
S. M. Younger, J. R. Fuhr, G. A. Martin, and W. L. Wiese. 1978, 136p
Included in Jnl. of Physical and Chemical Reference Data, v7 n2 p495-630 1978.

Keywords: *Allowed transitions, Chromium, F-values, Isoelectronic sequence, Line strengths, Manganese, Oscillator strengths, Systematic trends, Transition probabilities, Vanadium.

Atomic transition probabilities for about 2700 spectral lines of the elements vanadium, chromium, and manganese through all stages of ionization have been critically evaluated and compiled. All available literature sources have been utilized. Systematic trends along isoelectronic sequences have been extensively exploited to predict oscillator strengths (f-values) whenever no data were available in the literature. The data are presented in separate tables for each element and stage of ionization and are arranged according to multiples and, when appropriate, also to transition arrays and increasing quantum numbers. For each line, the transition probability for spontaneous emission, the absorption oscillator strength, and the line strength are given, along with the spectroscopic designation, the wavelength, the statistical weights, and the energy levels (when available) of the upper and lower atomic states. In addition, the estimated accuracy and the literature reference are indicated. In short introductions, which precede the tables for each spectrum, the main justifications for the choice of the adopted data and for the accuracy rating are discussed. A general introduction contains some more details on our evaluation procedure.

711,109
PB78-600049 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comments on the Paper 'Corrosion Behavior of Ductile Cast-Iron Pipe in Soil Environments'.
W. F. Gerhold. 1977, 1p
Pub. in Jnl. Am. Water Works Assoc. 69, n7 p404 1977.

Keywords: *Carbon steel, Corrosion, Ductile cast-iron, Statistical analysis, Underground.

No abstract available.

711,110
PB78-600053 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Elevated-Temperature Embrittlement of a Carbon-Manganese Steel under Impact Loading.
C. G. Interrante. 1976, 12p
Pub. in Proceedings Conf. on Dynamic Fracture Toughness, London, England, July 5-7, 1976, p327-338 1976.

Keywords: *Carbon-manganese steel, Dimpled rupture, Ductile failure, Embrittlement, Impact energy, Plastic failure, Secondary hardening, Strain aging, Temper embrittlement.

Dynamic tear impact specimens of two plates of a carbon-manganese tank-car steel tested over a broad range of temperatures from -46 to 690C indicate that the steel is embrittled moderately at temperatures near 200C and markedly at those near 580C. The embrittlement at the lower temperature appears to be caused by strain-ageing effects. That at the higher tempera-

ture is not understood, and the results indicate that it is not because of strain ageing, secondary hardening caused by vanadium, or temper embrittlement. Further study, using additional parameters pertinent to the elevated-temperature fracture process, is suggested for clarification of the phenomenon and its significance with respect to service performance.

711,111
PB79-600055 Not available NTIS
Production, Characterization, and Certification of NBS-SRM 64c, High-Carbon Ferrochromium.
J. E. Cumbo, and R. E. Michaelis. 1977, 5p
Pub. in Electr. Furn. Conf., Proc. 35, p52-56 1977.

Keywords: Composition, High-carbon ferrochromium, Homogeneity testing, Preparation, Processing, *Standard reference material.

No abstract available.

711,112
PB80-100753 Not available NTIS
National Bureau of Standards, Washington, DC.
Sound Velocity Anomalies Near the Spin Glass Transition in an Austenitic Stainless Steel Alloy.
Final rept.,
E. W. Collings, and H. M. Ledbetter. 11 Jun 79, 4p
Pub. in Physics Letter 72A, n1, p53-56, 11 Jun 79.

Keywords: *Austenitic stainless steels, *Acoustic velocity, Abnormalities, Magnetic permeability, Ultrasonic radiation, Reprints, Magnetic susceptibility.

A cusp in the magnetic susceptibility temperature dependence of a commercial manganese austenitic stainless steel alloy, attributable to spin-glass condensation, is accompanied by anomalies in the temperature dependences of both longitudinal and transverse ultrasonic wave velocities.

711,113
PB80-118060 Not available NTIS
National Bureau of Standards, Washington, DC.
Low Temperature US/USSR Material and Weld Properties for LNG Applications - Part 1.
Final rept.,
R. P. Reed, and K. A. Yushchenko. 1978, 13p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Proc. Int. Cryogenic Engineering Conf. (7th), London, England, July 4-7, 1978, p474-486 (IPC Science and Technology Press, Surrey, England, 1978).

Keywords: *Aluminum alloys, *Steels, Liquefied natural gas, Storage, Construction materials, Mechanical properties, Fracture properties.

Both the USA and the USSR have large material needs for liquefied natural gas (LNG) storage, sea transportation, and possibly, pipelines. Alloys currently considered for these applications are the aluminum alloys Al-4.Mg - USA designated 5083 and Al-6Mg USSR designated AMg-6 and the steels Fe-9Ni (USA - ASTM A-533), Fe-5Ni (USA - ASTM A-645) and Fe-13Cr-19Mn (USSR - 03X13AI19). A joint USA/USSR program to evaluate structural materials for LNG use has been conducted as a result of the mutual concerns of both countries for safe and economical LNG structures. This program consists of the exchange of the three USA and the two USSR alloys fracture and mechanical property measurements at low temperatures of the exchanged alloys in both countries and analysis of the data.

711,114
PB80-121346 Not available NTIS
National Bureau of Standards, Washington, DC.
Toughness, Fatigue Crack Growth, and Tensile Properties of Three Nitrogen-Strengthened Stainless Steels at Cryogenic Temperatures.
Final rept.,
D. T. Read, and R. P. Reed. 1979, 30p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proc. Symp. 107th AIME Ann. Meeting, Denver, CO, Mar 2, 1978. Paper in the Metal Science of Stainless Steels, p92-121, Metallurgical Society of the American Inst. of Mechanical Engineers, Warrendale, PA, 1979.

Keywords: *Stainless steels, Toughness, Crack propagation, Tensile properties, Cryogenics, Steel 18Cr 3Ni 13Mn, Steel 21Cr 12Ni 5Mn, Steel 19Cr 9Ni 2Mn.

Fracture toughness, fatigue crack growth rate, and tensile property data for three nitrogen-strengthened stainless steels at 295, 76, and 4 K have been obtained. These materials were tested to investigate their suitability as structural materials for cryogenic service. The materials tested were nitrogen-strengthened Fe-18Cr-3Ni-13Mn, Fe-21Cr-12Ni-5Mn, and Fe-19Cr-9Ni-2Mn. Toughness measurements employed J-integral, plane strain critical stress intensity, and crack-opening-displacement tests. It was found that the nitrogen-strengthened austenitic stainless steels generally exhibit lower toughness at 4 K than the widely used 300-series stainless steels. Of the nitrogen-strengthened steels tested to date, Fe-18Cr-3Ni-13Mn is the strongest and least tough, and Fe-19Cr-9Ni-2Mn is the toughest and least strong. Fatigue crack growth rates at 4 K in the nitrogen-strengthened stainless steels were found to be generally higher than or comparable to rates for previously tested stainless steels. Fe-18Cr-3Ni-13Mn had rates significantly above previously tested materials, especially at high stress intensity range levels. Four Kelvin crack growth rates for Fe-19Cr-9Ni-2Mn and Fe-21Cr-12Ni-5Mn fell approximately in the mid-range of previous data for austenitic stainless steels at 4 K. All studied materials exhibited high strengths at cryogenic temperatures. After being strained to failure at 4 and 76 K, Fe-18Cr-3Ni-13Mn and Fe-19Cr-9Ni-2Mn exhibited some ferromagnetism, indicating that martensitic transformations had occurred; Fe-21Cr-12Ni-5Mn exhibited no ferromagnetism.

711,115
PB80-122930 Not available NTIS
National Bureau of Standards, Washington, DC.
Tensile and Fracture Behavior of a Nitrogen-Strengthened, Chromium-Nickel-Manganese Stainless Steel at Cryogenic Temperatures.
Final rept.,
R. L. Tobler, and R. P. Reed. 1979, 16p
Pub. in Am. Soc. Test. Mater. Spec. Tech. Publ. 668, p537-552 1979.

Keywords: *Austenitic stainless steels, Cryogenics, Fracture properties, Tensile properties, Crack propagation, Phase transformations, Reprints, Steel 21Cr 6Ni 9Mn.

J-integral fracture and conventional tensile properties are reported for an electroslag remelted Fe-21Cr-6Ni-9Mn austenitic stainless steel that contains 0.28 percent nitrogen as an interstitial strengthening element. Results at room (295 K), liquid-nitrogen (76 K), and liquid-helium (4 K) temperatures demonstrated that the yield strength and fracture toughness of this alloy are inversely related and strongly temperature dependent. Over the investigated temperature range, the yield strength tripled to 1.24 GPa (180 ksi) at 4 K. The fracture toughness, as measured using 3.8-cm-thick (1.5 in.) compact specimens, decreased considerably between 295 and 4 K. During plastic deformation at 295 K the alloy undergoes slight martensitic transformation, but at 76 and 4 K it transforms extensively to martensites. The amount of body-centered cubic (bcc) martensite formed during tension tests was measured as a function of elongation.

711,116
PB80-141070 Not available NTIS
National Bureau of Standards, Washington, DC.
Corrosion Fatigue of 316L Stainless Steel, Co-Cr-Mo Alloy, and EL1 Ti-6Al-4V.
Final rept.,
M. A. Iman, A. C. Fraker, and C. M. Gilmore. 1979, 15p
Pub. in Proceedings American Society for Testing and Materials Symp. on Corrosion and Degradation of Implant Materials, Held at Kansas City, MO on May 22-23, 1978, Amer. Soc. Test. Mater. Spec. Tech. Publ 684, p129-143, 1979.

Keywords: *Austenitic stainless steels, *Titanium alloys, *Cobalt alloys, *Corrosion fatigue, Fatigue life, Implantation, Chromium containing alloys, Molybdenum containing alloys, Aluminum containing alloys, Vanadium containing alloys, Steel 316L, Titanium alloy GAl 4V.

The purpose of this paper is to compare corrosion-fatigue properties of selected implant alloys and to discuss the corrosion fatigue-life in terms of the corrosion behavior and the metal microstructure. The tests were conducted in fully reversed torsion in flowing Hank's solution at a temperature of 37 C and a pH of 7.4. Specimens were subjected to fatigue at shear strains ranging from 0.006 to 0.018 and at a frequency of 1 Hz. Surfaces of the 0.5-cm-diameter specimens were prepared by mechanically polishing through a 0.05 alumina powder and following this with steam sterilization.

711,117
PB80-164676 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Effect of Alloying Elements on the Diffusion Mobility of Molybdenum, Manganese and Silicon (Vliyanie Legiruyushchikh Elementov Na Diffuzionnuyu Podvizhnost' Molibdena, Margantsa i Kremniya),
M. A. Krishtal, and A. M. Mokrova. 1979, 12p DMDC-19337, TT-79-58082
Trans. of Tula. Gosudarstvennyi Pedagogicheskii. Fizikotekhnicheskie Nauki, n1 p93-100 1967. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Iron, *Iron alloys, *Diffusion, *Manganese, *Molybdenum, *Silicon, Alloying, Diffusion coefficient, Translations.

The aim of this work was to study the effect of alloying on the diffusion parameters in multi-component systems. The diffusion of manganese, molybdenum, and silicon in iron and iron alloys was studied. The composition of the diffused couple was selected so as to compare the diffusion parameters of manganese, molybdenum, and silicon in the nonalloyed iron (couples Fe-Fe + Mn; Fe-Fe + Mo; Fe + Si-Fe) with the diffusion parameters in alloyed iron (couples Fe + Cr + Mn-Fe + Cr; Fe + Cr + Mn + Ti-Fe + Cr + Mn + Ti + Mo; Fe + Cr + Mn + Ti + Mo + Si-Fe + Cr + Mn + Ti + Mo). The concentration of every alloying element in all alloys was about 2 at .%. Electrolytic iron was used as a base for all alloys.

711,118
PB80-168073 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion of Cobalt, Chromium, and Tungsten in Iron and Steel,
P. L. Gruzin. 1979, 17p TT-79-58095(A), DMDC-23001
Trans. of Problemy Metallovedeniya i Fiziki Metallov (USSR) n4 p475-485 n.d. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Cobalt, *Chromium, *Tungsten, *Iron, *Steels, Diffusion coefficient, Activation energy, Translations.

The temperature dependence of the diffusion coefficients of cobalt, chromium, and tungsten was studied in alpha and gamma phases of technical iron and in carbon steel of eutectoid composition. The chemical composition of the investigated alloys was varied. Measurements were carried out in the temperature range 700-1250C by means of the Gruzin technique, with the use of the radioactive isotopes of chromium (51Cr), tungsten (185W), and cobalt (60Co). It should be mentioned that the isotope (185W) radiates only beta particles. Consequently, the diffusion coefficients of tungsten were calculated by taking into consideration the absorption of beta-radiation in iron and steel. The validity of the absorption formula was checked during the measurement of the diffusion coefficients of cobalt, the radioactive isotope of which simultaneously radiates beta and gamma-rays. For this purpose, an alloy of cobalt, nickel, and chromium was used, with chromium and nickel contents of about 20%. The value of D was determined for the same sample - once for beta, and another time for gamma-radiation. The results of these measurements are given in the form of several mathematical parameters.

711,119
PB80-168081 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Influence of Carbon on the Self-Diffusion of Iron in the Iron-Nickel System,
P. L. Gruzin, and E. V. Kuznetsov. 1979, 10p TT-79-58095(B), DMDC-23002
Trans. of Problemy Metallovedeniya i Fiziki Metallov (USSR) n4 p498-502 n.d. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Iron alloys, *Iron, *Diffusion, Carbon, Nickel containing alloys, Activation energy, Microstructure, Diffusion coefficient, Translations, Self diffusion.

The influence of carbon on the self-diffusion in iron and iron-nickel alloys was measured in the temperature range 1050 to 1320C using the residual radioactivity technique. Diffusivities were calculated for 59Fe and Arrhenius plots were constructed from which the appropriate diffusion parameters were calculated. A composition dependence for carbon was noted. An influence of microstructures were also reported.

711,120

PB80-177702 PC **A02**/MF **A01**

National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.

Influence of Manganese on the Self-Diffusion of Iron,

P. L. Gruzin, B. M. Noskov, and V. I. Shirokov. 1979, 11p DMDC-23003, TT-79-58095(C)

Trans. of Problemy Metallovedeniya i Fiziki Metallov (USSR) n4 p503-508 n.d. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Iron, *Diffusion, Iron alloys, Manganese containing alloys, Diffusion coefficient, Activation energy, Translations, *Self-diffusion, Iron 59.

This is a study of the influence of the different elements on the parameters of self-diffusion of iron and is one of the most important problems connected with the self-diffusion of this element. The study of the influence of manganese additions on the self-diffusion of iron in austenite is of special importance, because manganese is an unavoidable impurity in almost all steel and iron-based alloys. Therefore, this study of the temperature dependence of the self-diffusion coefficients of iron in the gamma-phase of the iron-manganese alloys was carried out by the method of radioactive isotopes using radioactive iron isotope Fe59. The self-diffusion coefficients were calculated from the measurements of the integral radioactivity of the sample during successive removal of layers. Eight iron-manganese alloys were investigated in the temperature interval 950-1350C.

711,121

PB80-178031 Not available NTIS

National Bureau of Standards, Washington, DC.

Mossbauer Spectroscopy of Polycrystalline Steel Fibers.

Final rept.,

D. S. Lashmore, L. J. Swartzendruber, and L. H. Bennett. 1 Jan 80, 2p

Pub. in Journal of Applied Physics Letter 36 n1 p39-40, 1 Jan 80.

Keywords: *Metal fibers, Steels, Spectroscopy, Mossbauer effect, Reprints, Iron 57, Schladitz whiskers.

Polycrystalline steel fibers, commonly known as 'Schladitz whiskers,' produced by thermal decomposition of iron pentacarbonyl in the presence of a magnetic field, have been studied by means of the Fe 57 Mossbauer effect. Results show that the fibers are a two-phase alloy of alpha-Fe and Fe3C. Almost all the carbon present in the fibers is tied up as Fe3C. The magnetic polarization (in zero applied field) is random rather than being aligned along the fiber axis.

711,122

PB80-178403 Not available NTIS

National Bureau of Standards, Washington, DC.

Anomalous Low-Temperature Elastic-Constant Behavior in Fe-13 Cr-19 Mn.

Final rept.,

H. M. Ledbetter. Mar 80, 2p

Sponsored in part by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC.

Pub. in Metall. Trans. 11A, p543-544 Mar 80.

Keywords: *Stainless steels, *Elastic properties, Chromium containing alloys, Manganese containing alloys, Reprints, Steel 13Cr 19Mn, Magnetic ordering.

Elastic constants determined by sound-velocity measurements in an Fe-13Cr-19Mn steel show anomalous temperature behavior around 274 K, indicating a paramagnetic-antiferromagnetic transition.

711,123

PB80-178866 Not available NTIS

National Bureau of Standards, Washington, DC.

Elastic-Constant Variability in Stainless-Steel 304.

Final rept.,

H. M. Ledbetter, N. V. Frederick, and M. W. Austin. Jan 80, 5p

Sponsored in part by Department of Energy, Washington, DC.

Pub. in Jnl. Appl. Phys. 51, n1 p305-309 Jan 80.

Keywords: *Stainless steels, *Elastic properties, Modulus of elasticity, Shear modulus, Poisson ratio, Reprints, *Steel 304.

Variability of elastic constants in stainless-steel 304 was determined by measuring longitudinal and transverse ultrasonic velocities in 20 samples acquired randomly. Three kinds of variations--sample to sample, directional within a sample, and repeated measurements on a single sample--are reported for four elastic constants: the bulk modulus, Young's modulus, shear modulus, and Poisson's ratio. Because of surprisingly small variations, 1% or less, the principal problem became measurement sensitivity and reproducibility. To overcome this problem, a high-resolution measurement system was devised using general-purpose equipment augmented with a very simple impedance-transforming amplifier and an FET transmission gate. With this system the often-reported troublesome transit-time correction disappeared. Effects due to frequency and directionality were negligible.

711,124

PB80-179278 PC **A02**/MF **A01**

National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.

Study of alpha-Iron Self-Diffusion,

V. M. Golikov, and V. T. Borisov. 1979, 22p DMDC-23006, TT-79-58095(F)

Trans. of Problemy Metallovedeniya i Fiziki Metallov (USSR) n4 p528-542 n.d. See also PB80-168081. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Iron, *Diffusion, Diffusion coefficient, Determination, Translations, *Self-diffusion.

A method for the determination of small self-diffusion coefficients is given. For the determination of the diffusion coefficient, no preliminary determination of the absorption coefficient of beta-rays is required. In general, the absorption function does not seriously affect the ratio I(t)/I(t sub o). A method of calculation of the isotope composition of a compound is shown. The quantity K is introduced into the expression determining the diffusion coefficient (K accounts for the isotope composition) and is characteristic for the counting device. The temperature dependence of the self-diffusion coefficient of alpha-iron has been determined in the temperature interval 650-850C. The activation energy of the self-diffusion of alpha-iron is equal to 6.71 x 10,000 cal/mole.

711,125

PB80-180011 PC **A02**/MF **A01**

National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.

Influence of Chromium on the Self-Diffusion of Iron,

P. L. Gruzin. 1979, 10p DMDC-23005, TT-79-58095(E)

Trans. of Problemy Metallovedeniya i Fiziki Metallov (USSR) n4 p524-527 n.d. See also PB80-168081. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Iron, *Diffusion, Iron alloys, Chromium containing alloys, Diffusion coefficient, Activation energy, Translations, *Self-diffusion, Iron 59.

The self-diffusion of Fe59 in two iron-chromium alloys was measured in the temperature range 1100 to 1250C. Alloys contained 4 and 8wt.%Cr. The residual activity technique was employed as the experimental method. Measurements of diffusivities are described by Arrhenius equations. All measurements are made in the gamma phase.

711,126

PB80-180300 Not available NTIS

National Bureau of Standards, Washington, DC.

Determination of Content of Combustible Material in Ferrous Scrap Recovered from Refuse.

Final rept.,

Z. Khan, E. J. Duckett, and J. Early. 1979, 4p

Pub. in Resource Recov. Conserv. Short Commun. 4, p301-304 1979.

Keywords: *Metal scrap, Tests, Refuse, Contamination, Flammability, Reprints.

The results of combustion experiments on ferrous scrap recovered from refuse suggests that the test procedure contained in a proposed ASTM standard provides a generally reliable method of determining the combustibles content of the ferrous scrap. Although the number of tests conducted was limited, the absence of a significant variation in the results indicates a high degree of reproducibility in the data obtained.

711,127

PB80-180987 PC **A03**/MF **A01**

National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.

Theory of the Methods to Determine the Dependence of Diffusion Coefficients in Solid Solutions on Concentration,

B. Y. Lyubov, and B. E. Maksimov. 1979, 36p DMDC-23007, TT-79-58095(G)

Trans. of Problemy Metallovedeniya i Fiziki Metallov (USSR) n4 p543-569 n.d. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Iron, *Diffusion, *Iron alloys, Diffusion coefficient, Chromium containing alloys, Computation, Carbon, Translations.

A method is developed for the approximate estimation of the concentration dependence of diffusion coefficients according to experimental data. A set of certain simplified assumptions is employed in the method. The diffusion of C in gamma iron is shown in a typical calculation. The diffusion of radioactive Cr from an Fe-Cr alloy into another Fe-Cr alloy is used to illustrate the concentration dependence of an interdiffusion coefficient.

711,128

PB80-208077 PC **A05**/MF **A01**

National Bureau of Standards, Washington, DC. National Measurement Lab.

Studies of Microscopic Aspects of Wear Processes in Metals.

Annual rept. 1 Apr-31 Dec 79,

A. W. Ruff, and P. J. Blau. Jun 80, 78p NBSIR-80-2058

Contract N00014-79-F-0034

Keywords: *Wear, *Copper alloys, *Steels, Electron microscopy, Wear tests.

Wear experiments have been conducted in copper alloys and steels under dry sliding conditions in order to study the microscopic aspects of wear and the mechanism involved. Two experimental wear test systems have been developed: a linear sliding tester and a block-on-ring computer controlled tester. Preliminary findings have compared the wear rates of three different steels, one a high strength-low alloy 'dual phase' steel, and two copper-aluminum alloys. Worn surface and subsurface morphologies have been studied using optical and scanning electron microscopy. Wear debris particles have been recovered from the tests and compared in morphological characteristics between the materials. Mechanical properties measurements of two of the steels were carried out to determine strain hardening characteristics for comparison with wear behavior. Micro-hardness measurements have also been made. Initial wear rate and friction transients for tests in laboratory air and argon have been examined to study processes involved in the early stages of sliding.

711,129

PB80-212814 PC **A03**/MF **A01**

National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.

Diffusion Processes in Metal Welding,

L. N. Larikov, V. M. Falchenko, Y. Y. Greckii, and Y. A. Sterenbogan. 1972, 50p DMDC-16945A, TT-72-58030A

Trans. of Akademiya Nauk URSR, Kiev. Instytut Metallofizyky, v25 p5-37 1968. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Welding, *Diffusion, Reviews, Diffusion coefficient, Translations, *Foreign technology.

A broad review of diffusion processes taking place during a variety of welding techniques is presented.

Emphasis is given to solid state or diffusion welding processes although fusion joining techniques are also covered. A number of experiments are referred to in illustrating the various processes. Over 100 references are included. Also addressed are the roles of recovery, polygonization, and recrystallization processes as well as polymorphic transformation.

711,130
PB80-213952 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Influence of Deformation on Diffusion in the Iron-Nickel and Iron-Chromium Systems,
F. N. Tavadze, M. L. Bernshtein, K. I. Jugeli, and B. M. Surmava. 1980, 9p DMDC-19081, TT-80-58218
Trans. of Akademiya Nauk Gruzinskoi SSR, Tiflis. Soobshcheniya, v69 n2 p389-392 1973. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Iron alloys, *Nickel, *Chromium, Deformation, Diffusion coefficient, Computation, Translations, *Foreign technology.

The effect of deformation in interdiffusion in the Fe-Cr and Fe-Ni systems was investigated in the temperature range 750 to 1000C. Specimens were deformed in tension. Iron samples were coated with either Cr or Ni prior to deformation. Composition analysis was performed with an electron probe microanalyzer. Diffusion coefficients were calculated with the aid of the Matano Method and were found to both increase and decrease as a function of deformation. The results from undeformed samples were found to agree with the results of other authors. The results were complicated by the appearance of two-phase regions in the interdiffusion zone.

711,131
PB80-216567 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Investigation of Boundary and Volume Diffusion by the Method of Beta-Radiation Absorption,
V. T. Borisov, V. M. Golikov, and G. V. Shcherbedinskii. 1979, 42p DMDC-23388, TT-79-58096-B
Trans. of Problemy Metallovedeniya i Fiziki Metallov (USSR) n5 p383-396 1958. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Iron, Iron alloys, Silver containing alloys, Diffusion coefficient, Computation, Translations.

The diffusion of radioactive iron in iron and iron-3% Si alloys in the temperature range 700 to 890C is reported. An apparatus and technique is described and is based on absorption of the emitted Beta-radiation. Relative contributions of the grain boundaries is given much attention in the experiments. Diffusion parameters for both lattice and grain boundary diffusion are calculated and their dependence on grain size determined. Arrhenius expressions are given for both types of diffusion.

711,132
PB80-220460 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Self-Diffusion of Iron in Iron-Nickel and Iron-Nickel-Chromium Alloys,
E. V. Kuznetsov. 1980, 13p DMDC-22842, TT-80-58241
Trans. of Gorkovskii Gosudarstvennyi Universitat. Uchenye Zapiski (USSR) n148 p38-48 1972. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Iron, *Diffusion, Iron alloys, Nickel containing alloys, Chromium containing alloys, Diffusion coefficient, Activation energy, Translations.

The self-diffusion rate of Fe in ten Fe-Ni alloys. Nickel content of the alloys varied from 1.28 at.% to pure Ni. Four Fe-Ni-Cr alloys were also studied. Nickel content in the ternary alloys varied from 23.5 at.% to 24.9 at.% and Cr content varied from 0.77 at.% to 8.6 at.% with the balance Fe. The temperature range of the experiments was 1000 to 1330C. Gruzin's experimental technique was employed with the isotope Fe-58. Grain boundary diffusion measurements in the temperature range 800 to 1000C were inconclusive.

711,133
PB80-220676 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Effect of the Type of Lattice on the Diffusion of Atoms in Fe-Group Metals (Vliyanie tipa Kristallicheskoi Reshetki na Diffuzionnyu Podvizhnost' Atomov v Metallakh Gruppee Zheleza (Obzor)),
L. N. Larikov, V. M. Falchenko, and L. F. Chernaya. 1979, 22p DMDC-19674, TT-79-53188
Trans. of Akademiya Nauk URSR, Kiev. Instytut Metallofizyky, v31 p75-82 1970. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Iron, *Transition metals, Grain boundaries, Crystal lattices, Activation energy, Diffusion coefficient, Cobalt, Nickel, Reprints, *Foreign technology.

A review of diffusion data in BCC metals is presented and possible mechanisms and correlations are proposed. Lattice and grain boundary diffusivities are discussed. Results are compared with data in the HCP and FCC metals and/or phases. A unified point of view on diffusion processes is then put forth.

711,134
PB80-220718 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Influence of Alloying on the Diffusion of Elements in Chromium-Nickel Steels,
G. B. Fedorov, and A. N. Semenikhin. 1980, 14p DMDC-21738, TT-80-58230
Trans. of Metallurgiya i Metallovedenie Chistykh Metallov (USSR) n2 p252-258 1960. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Austenitic stainless steels, Silicon containing alloys, Molybdenum containing alloys, Activation energy, Diffusion coefficient, Translations, *Foreign technology.

The dependence of diffusion coefficients of iron, chromium, and nickel on temperature in austenitic chromium-nickel steels containing up to 4% silicon and and up to 2% molybdenum are measured. It is shown that alloying of steel with silicon leads to the increase of the activation energy of diffusion of iron, chromium, and nickel and to the decrease of the diffusion coefficients of the indicated elements in temperatures lower than 900C. The addition of up to 2% molybdenum to steel, which contains 2.5% silicon, also increases the activation energy of self-diffuson of iron and decreases the self-diffusion coefficients by the decrease of temperature. However alloying with molybdenum shows an opposite effect on the diffusion of chromium.

711,135
PB81-103368 Not available NTIS
Passive Films, Surface Structure and Stress Corrosion and Crevice Corrosion Susceptibility.
J. Kruger, J. J. Ritter, J. J. Carroll, and A. J. Melmed. Aug 80, 50p NBSIR-80-2101

Keywords: Chromate, *Electrochemistry, Ellipsometry, Field ion microscopy, Hydrogen, Inhibitors, Iron, *Organic coatings, Titanium-palladium alloys, *Vanadium.

A feasibility study has shown that qualitative-ellipsometry combined with electrochemical-pH and potential measurements comprise valuable techniques for the study of the corrosion of iron protected by an organic coating. A simulated painted metal system using cellulose nitrate over iron and immersed in dilute Cl-medium showed a concomitant rise of subcoating pH to high values (approximately equal to 14) and a thickening of the metal oxide film. Three titanium-palladium alloys, nominally containing 1, 2, and 3 at. % palladium were prepared and imaged in the field ion microscope at temperature less than 30 K. Although significant alloy inhomogeneities occurred in the wire preparations, the results indicated that the alloys offered no greater resistance to hydrogen/stress induced crack formation and development than unalloyed titanium under similar conditions.

711,136
PB81-112146 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermophysical Measurements on Low Carbon 304 Stainless Steel Above 1400 K by a Transient (Subsecond) Technique.
Final rept.
A. Cezairliyan, and A. P. Miiller. 27 Sep 79, 13p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Int. J. Thermophys. 1, n1 p83-95, 27 Sep 79.

Keywords: *Stainless steels, Measurement, Specific heat, Electrical resistivity, Emittance, Melting points, Reprints, Steel 304.

Simultaneous measurements, by a subsecond duration transient technique, to determine the specific heat capacity, the electrical resistivity, and the hemispherical total emittance in the temperature range 1400-1700K, and the melting point and the radiance temperature at the melting point, of AISI type 304L stainless steel are described.

711,137
PB81-112989 Not available NTIS
National Bureau of Standards, Washington, DC.
Cryogenic Effects on the Fracture Mechanics Parameters of Ferritic Nickel Alloy Steels.
Final rept.
R. L. Tobler, R. P. Mikesell, and R. P. Reed. 1979, 21p
Pub. in American Society for Testing and Materials, Special Technical Publication 677, p85-105 1979.

Keywords: *Steels, *Cryogenics, Nickel containing alloys, Fracture properties, Fatigue(Materials), Crack propagation, Transition temperature, Ductile brittle transition, Reprints.

Fracture toughness (K sub ic, J sub ic) and fatigue-crack growth (da/dN) data for quenched and tempered low-carbon ferritic 3.5Ni and 9Ni steels were measured at temperatures between 295 and 4K. The tests were performed using 25- and 31-mm-thick compact specimens having fracture planes parallel to the rolling direction (TL orientation). The fracture toughness results for both steels showed qualitatively similar trends: at decreasing temperatures below 295K, J sub ic increased by about 20 percent prior to the onset of classical ductile-to-brittle transitions involving cleavage. The transitions occurred between 172 and 100K for 3.5Ni steel, and between 76 and 4K for 9Ni steel. Transitional behavior also was evident in the fatigue crack growth behavior. The room-temperature fatigue crack growth rates for these nickel steels are typical of ferritic steels, but the rates at subtransition temperatures are accelerated drastically, in association with cleavage and other brittle cracking modes. Data comparisons between the 3.5Ni and 9Ni steels tested here and other nickel alloy steels are included.

711,138
PB81-118507 Not available NTIS
National Bureau of Standards, Washington, DC.
Room-Temperature Elastic Constants and Low-Temperature Sound Velocities for Six Nitrogen-Alloyed Austenitic Stainless Steels.
Final rept.
H. M. Ledbetter. Jun 80, 3p
Pub. in Metallurgical Transactions A 11A, p1067-1069 Jun 80.

Keywords: *Austenitic stainless steels, Elastic properties, Acoustic velocity, Low temperature research, Reprints.

Despite large composition differences, ultrasonic-velocity measurements in six nitrogen-strengthened stainless steels show that their elastic constants differ only slightly except as affected by low-temperature magnetic transitions.

711,139
PB81-118549 Not available NTIS
National Bureau of Standards, Washington, DC.
Low-Temperature Magnetic and Elastic-Constant Anomalies in Three Manganese Stainless Steels.
Final rept.
H. M. Ledbetter, and E. W. Collings. 1978, 19p
Sponsored in part by Advanced Research Projects Agency, Arlington, VA.
Pub. in Proc. Symp. AIME Annual Meeting (107th) held at Denver, CO, Mar 2, 1978). Paper in The Metal Science of Stainless Steels, p22-40 (The Metallurgical Soc. of AIME, Warrendale, PA, 1978).

Keywords: *Austenitic stainless steels, Elastic properties, Transition temperature, Low temperature research, Cryogenics, Steel 22Cr 5Mn 13Ni, Steel 21Cr 9Mn 6Ni, Steel 18Cr 13Mn 3Ni.

Elastic properties of three austenitic stainless steels -- Fe-22Cr-13Ni-5Mn, Fe-21Cr-6Ni-9Mn, and Fe-18Cr-3Ni-13Mn -- were studied between room temperature and either liquid-nitrogen or liquid-halium temperature. A dynamic (pulse-echo, 10 MHz) method was used to determine longitudinal and transverse sound-wave velocities, which were converted to elastic constants -- Young's modulus, shear modulus, bulk modulus, and Poisson's ratio. At low temperatures all the elastic contents are anomalous, correlating with what appear to be spin-glass-type magnetic transitions detected by magnetic susceptibility measurements. The transition temperatures depend strongly on Mn content. Higher Mn content results in a higher transition temperature and a larger elastic-content anomaly.

711,140
PB81-123648 Not available NTIS
National Bureau of Standards, Washington, DC.
Slow Strain-Rate Stress Corrosion Testing of Metals in Gaseous Atmospheres at Elevated Temperatures.
G. M. Ugiansky, and C. E. Johnson. 1980, 19p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Stress Corrosion Cracking - The Slow Strain Rate Technique, Toronto, Canada, May 2-4, 1977, American Society for Testing and Materials, Special Technical Publication 665, p113-131 1980.

Keywords: *Stainless steels, *Nickel alloys, *Corrosion tests, Stress corrosion, Environmental tests, Coal gasification, Strain rate, Steel 310, Steel 310-S, Steel 347, Steel 446, Nickel alloy 800, Nickel alloy 671.

A total of six different alloys--stainless steel (SS) Types 310, 310S, 347, and 446, and nickel alloys 800 and 671--were tested using the slow strain-rate test technique in oxidizing/sulfidizing and in oxidizing/sulfidizing/carborizing simulated coal gasification environments, and in helium (and other inert environments) at both 450 and 600C at a strain rate of 0.000001/s. Of the six alloys, four (Types 310 stainless steel and 310S stainless steel, nickel alloy 800, and nickel alloy 671) were found to be susceptible to cracking at 600C by possibly different mechanisms, however, all were detected by the slow strain-rate technique.

711,141
PB81-133340 Not available NTIS
National Bureau of Standards, Washington, DC.
Operating Experiences with Incoloy 800 in Coal-Conversion Process Plants.
J. H. Smith. 1978, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the International Conference Alloy 800, Petten, Netherlands, March 14-16, 1978, p231-233 1978.

Keywords: *Heat resistant alloys, Failure, Coal, Conversion, Iron alloys, *Iron alloy Incoloy 800.

Selected examples of the use of Incoloy 800 in coal conversion of Incoloy in coal conversion plants that has resulted in degradation of the material and failure of key components are described.

711,142
PB81-137887 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Metallurgical Structure in the Integrity of Sliding Solid Contacts,
P. J. Blau. 1980, 7p
Pub. in Proceedings of Solid Contact and Lubrication AMD 39, p185-191 1980.

Keywords: *Steels, *Copper alloys, Sliding, Friction, Wear.

Metallurgical studies of several steels and Cu alloys have been undertaken to examine the characteristics of plastically strained regions produced by sliding.

711,143
PB81-142853 Not available NTIS
National Bureau of Standards, Washington, DC.
Debris Analysis of Erosive and Abrasive Wear.
A. W. Ruff. 1980, 9p
Pub. in Proceedings of the International Conference on the Fundamentals of Tribology, Massaschusetts Institute of Technology, Cambridge, MA., June 19-22, 1978, p877-885 1980.

Keywords: *Steels, *Wear, *Erosion, Particles, Analyzing, Steel 1015.

Debris particles have been recovered from dry abrasion and erosion studies of AISI 1015 steel specimens. The size and morphology of the debris particles have been related to the worn surface topography.

711,144
PB81-179152 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Use of the Slow Strain Rate Technique for the Evaluation of Structural Materials for Application in High-Temperature Gaseous Environments.
Final rept.
C. E. Johnson, and G. M. Ugiansky. Jan 81, 93p NBSIR-81-2191
Contract DOE-EA-77-A-01-6010

Keywords: *Stainless steels, *Accelerated tests, *Dynamic structural analysis, Strain rate, Iron alloys, Inconel, Coal gasification, Construction materials, Structural steels, Steel 309, Steel 310, Steel 347, Steel 446, Iron alloy Incoloy 800, Nickel alloy Inconel 671.

The slow strain rate technique has been evaluated as an accelerated test for determining the performance of structural materials in simulated coal gasification environments. Seven alloys, namely Types 309, 310, 310S, 347 and 446 stainless steels; Incoloy 800; and Inconel 671, were tested at temperatures from 370C to 1040C at strain rates from 0.0001 to 10 the minus 7 power/s in H2S plus water, gaseous mixtures of CO, CO2, CH2, CH4, H2S, and H2O, and H20, and in nominally inert environments of He and Ar.

711,145
PB81-215501 PC **A05**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Laser-Initiated Combustion Studies of Selected Aluminum, Copper, Iron, and Nickel Alloys.
J. W. Bransford, and A. F. Clark. Apr 81, 90p NBSIR-81-1647
Contract NASA Order-H-43201B

Keywords: *Combustion, *Aluminum alloys, *Stainless steels, *Nickel alloys, Copper alloys, Beryllium copper, Bronzes, Ignition, Aluminum alloy 1100, Aluminum alloy 2219, Aluminum alloy 6061, Steel 304, Steel 347, Steel 21-6-9, Nickel alloy Inconel 600.

The results of combustion studies at atmospheric pressure on ten metal alloys are presented. The alloys studied were aluminum alloys 1100, 2219, 6061, and tensile-50; 304, 347 and 21-6-9 stainless steel; inconel 600; beryllium-copper and a bronze. It was found that once ignition was achieved all alloys would generally burn to completion. The overall combustion process appears to obey a first-order rate process. Preliminary conclusions are presented along with recommendations for future work.

711,146
PB81-215758 Not available NTIS
National Bureau of Standards, Washington, DC.
Nuclear Magnetic Resonance in Alloys.
Final rept.
L. H. Bennett. 1981, 16p
Proceedings of Materials Research Society Annual Meeting, held in Boston, MA. on November 17-20, 1980.
Pub. in Nuclear and Electron Resonance Spectroscopies Applied to Material Science, p3-18 1981.

Keywords: *Alloys, *Nuclear magnetic resonance, Phase diagram, Magnetic materials, Intermetallics, Liquid metals, NTISCOMNBS.

Many papers on NMR in alloys are addressed to NMR specialists rather than to metal or alloy specialists, and talk about the 'potential' of NMR for application to alloys. This presentation emphasizes a review of some useful results of NMR experiments in alloys, including applications in diffusion, phase diagrams, magnetic materials, ordering in intermetallic compounds, liquid alloys and amorphous alloys.

711,147
PB81-215766 Not available NTIS
National Bureau of Standards, Washington, DC.
Sliding Wear Behavior of Electron Beam Surface Melted 0-2 Tool Steel.
Final rept.
A. W. Ruff, and L. K. Ives. 1981, 9p
Proceedings of Int. Conf. Wear of Materials (3rd), held at San Francisco, CA. on March 30-April 2, 1981.
Pub. in the American Society of Mechanical Engineers, p326-34 1981.

Keywords: *Tool steels, *Wear, Sliding friction, Electron beam melting.

Studies were carried out on the dry sliding wear behavior of electron beam melted surface layers on a type 0-2 tool steel, and on annealed and conventionally hardened 0-2 steel specimens for comparison. Wear tests were conducted in a flowing argon atmosphere at a sliding speed of 20 cm/s, a load of 10 N, and against a 52100 bearing steel ring. Wear surface morphology was studied along with subsurface structure using optical and electron microscopy methods. The study concentrated on the wear of this steel after different processing treatments.

711,148
PB81-234650 Not available NTIS
National Bureau of Standards, Washington, DC.
Sound Velocities and Elastic Constants of Steels 304, 310, and 316.
Final rept.
H. M. Ledbetter. Dec 80, 2p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Metal Science Technical Note 14, n12 p595-596 Dec 80.

Keywords: *Stainless steels, Elastic properties, Acoustic velocity, Poisson ratio, Reprints, Steel 304, Steel 310, Steel 316.

Room temperature ultrasonic velocities, longitudinal and transverse, were measured in three AISI 300-series austenitic stainless steels. Elastic constants computed from these velocities show small but significant variations with composition.

711,149
PB81-600029 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Standard Reference Materials: Preparation and Characterization of an Iron-Chromium-Nickel Alloy for Microanalysis: SRM 479a.
R. B. Marinenko, F. Biancaniello, L. DeRoberts, P. A. Boyer, and A. W. Ruff. 1981, 36p NBS-SP-260-70

Keywords: *Austenitic stainless steel, Electron probe microanalysis, Fe-Cr-Ni alloy, Homogeneity testing, Standard reference material.

An alloy of weight fraction 0.710 iron, 0.181 chromium and 0.109 nickel was characterized at the micrometer level of spatial resolution by means of electron probe microanalysis. This alloy designated SRM 479a, is of suitable homogeneity for use as a standard in microanalytical techniques. There is no statistically significant variation in composition within specimens or from specimen to specimen. SRM 479a is supplied as a disk about 4.5 mm diameter by 0.8 mm thick.

711,150
PB82-124728 Not available NTIS
National Bureau of Standards, Washington, DC.
Fracture and Strength Properties of Selected Austenitic Stainless Steels at Cryogenic Temperatures.
Final rept.
D. T. Read, and R. P. Reed. Jul 81, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Cryogenics 21, n7 p415-418 Jul 81.

Keywords: *Austenitic stainless steels, Cryogenics, Fracture properties, Strength, Crack propagation, Tensile properties, Reprints.

Austenitic stainless steels have an excellent combination of mechanical and physical properties for load-bearing structures of large superconducting magnets for plasma containment in magnetic fusion experiments. To assess their relative suitability fracture toughness, fatigue crack growth, and tensile properties data for five austenitic steels at 295, 76, and 4K have been obtained. The steels were AISI 304, 316, 304LN, and 316LN, and an Fe-21cr-12Ni-5Mn alloy with a higher nitrogen content than the other four

grades. The two principal findings were the systematic variation of yield strength with nitrogen content and a systematic inverse correlation between fracture toughness and yield strength. Data from previous studies are reviewed which confirm the trends of the present data.

711,151
PB82-127739 Not available NTIS
National Bureau of Standards, Washington, DC.
Nitrogen-Strengthened Austenitic Stainless Steel for Cryogenic Magnet Structures.
Final rept.
F. N. Mazandarany, D. M. Parker, R. F. Koenig, and D. T. Read. 1980, 18p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Cryogenic Engineering Conference, Boulder, Colorado, August 2-5, 1977, 26, p158-170 1980.

Keywords: *Austenitic stainless steels, *Welded joints, Tests, Cryogenics, Mechanical properties.

This paper presents the results of the testing and evaluation of 25-mm-thick type 316LN plate, shielded metal-arc weld (SMAW) deposits selected for structural welds and gas tungsten-arc weld (GTAW) and gas metal-arc weld (GMAW) deposits selected for seal welds.

711,152
PB82-128083 Not available NTIS
National Bureau of Standards, Washington, DC.
Heating Effects during Tensile Tests of AISI 304L Stainless Steel at 4K.
Final rept.
D. T. Read, and R. P. Reed. Jun 80, 11p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Cryogenic Engineering Conference, Boulder, Colorado, August 2-5, 1977, Paper B-2 in Advances in Cryogenic Engineering, 26, p91-101 1980.

Keywords: *Stainless steels, Cryogenics, Tension tests, Adiabatic, Heating, Steel 304L.

In structural alloy tensile specimens undergoing mechanical work in a liquid-helium bath, internal temperature increases are favored by their low specific heat and thermal conductivity at this temperature (4K). The well-known phenomenon of discontinuous yielding is commonly attributed to adiabatic heating of the specimen. The possible occurrence of such heating must be considered in testing structural materials for liquid-helium-temperature applications. Therefore, temperatures of small tensile specimens of AISI 304L stainless steel were measured during straining at 4K at several strain rates. The number and magnitudes of the temperature rises and the number of load drops were used to calculate a specimen temperature profile during load drops. Examination of a specimen after one load drop occurred showed that only a small portion of the specimen deformed. The observed temperature rises and load drops were compared with calculated values. The possible effect of a latent heat of martensitic transformation on the specimen temperature was considered.

711,153
PB82-152679 Not available NTIS
National Bureau of Standards, Washington, DC.
Predicted Single-Crystal Elastic Constants of Stainless-Steel 316.
Final rept.
H. M. Ledbetter. Nov 81, 2p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in British Jnl. of Non-Destructive Testing 23, n6 p286-287 Nov 81.

Keywords: *Stainless steels, Single crystals, Elastic properties, Ultrasonic tests, Reprints.

For stainless steel 316, the author gives an improved prediction of the three C sub ij elastic-stiffness constants, which determine the optimum direction for acoustic beams used to locate and size flaws. The predictive method applies to all cubic-crystal-structure anisotropic materials.

711,154
PB82-152687 Not available NTIS
National Bureau of Standards, Washington, DC.
Strength and Toughness of USSR Fe-20Cr-16Ni-6Mn-0.2N Weldments at Cryogenic Temperatures.
Final rept.
R. P. Reed, R. L. Tobler, J. W. Elmer, H. I. McHenry, K. A. Yushchenko, and E. O. Paton. 1980, 5p
Sponsored in part by National Science Foundation, Washington, DC. Div. of Materials Research.
Pub. in Proceedings of the International Cryogenic Engineering Conference (8th), Genova, Italy, June 3-6, 1980, p797-801.

Keywords: *Austenitic stainless steels, Tensile properties, Toughness, Cryogenics, Weldments, Superconducting magnets, Steel 20Cr 6Mn 16Ni.

The structural reinforcement of large superconducting magnets normally requires the use of a very strong tough alloy at liquid helium temperature. The base and weldment material of a Soviet austenitic stainless steel, a nitrogen-strengthened Fe-20Cr-16Ni-6Mn alloy, is evaluated and compared with conventional AISI 300 series stainless steels (Fe-18Cr-8Ni). Tensile and fracture toughness measurements were made on base, heat-affected zone and weld material. Both tungsten inert gas and submerged arc weld processes, using 20 mm thick plate, were used. Magnetic measurements were made after deformation and tensile flow strengths were compared with the temperature dependence of stable austenitic stainless steels to assess the occurrence and influence of martensitic phase transformations on low temperature properties. J-integral fracture toughness was measured and the base and weldment properties compared.

711,155
PB82-153305 Not available NTIS
National Bureau of Standards, Washington, DC.
Investigation of the Unlubricated Friction and Wear Break-In Behavior of a Dual-Phase Steel,
P. J. Blau. 1981, 14p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Wear 72, p67-80 1981.

Keywords: *Steels, Friction, Wear, Reprints, Steel DP 80.

The friction and wear break-in behavior of a dual-phase steel (steel DP 80) was investigated using a stroke-by-stroke fixed ball-on-flat tribometer. The standard rider balls were steel 52100 ball bearings slid at a load of 4.9 N and a velocity of 0.5 cm/s. The atmospheres used were air at a relative humidity of (58 plus or minus 3)% and flowing argon gas at a relative humidity of 30% - 35%. Surface finishes obtained by 1 micrometer diamond lapping and by dry abrasion with 600 grit SiC cloth were tested.

711,156
PB82-155045 Not available NTIS
National Bureau of Standards, Washington, DC.
Fundamental Developments for Quantitative Acoustic Emission Measurements.
Final rept.
D. G. Eitzen, F. R. Breckenridge, R. B. Clough, E. R. Fuller, N. N. Hsu, and J. A. Simmons. Jun 81, 213p
Pub. in Electric Power Research Inst. Interim Report No. EPRI-NP-2089, Project 608-1, 213 p Jun 81.

Keywords: Standardization, Calibrating, Transducers, Measurement, Reprints, *Acoustic emissions, *Acoustic emission testing.

The work under Phase I of the program has focused on: improved test standardization through the development of a calibration capability for AE sensors; improved sensor concepts and techniques for field and laboratory calibration; an improved basis for understanding and predicting AE behavior through the development of a methematical framework for AE (transfer function formalism) through specific theoretical solutions to AE generation, transmission and inversion problems and the successful application of these theories to actual events in glass; an improved basis for assessing defect significance through the development of improved signal processing and inversion methods and through experimental results from AE in pressure vessel steels; the implementation of experiments to establish the feasibility of using casual methods, based on theoretical mechanics, to obtain source information in structural steels.

711,157
PB82-155128 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Dependence of Yielding in Austenitic Stainless Steels.
Final rept.
R. L. Tobler, R. P. Reed, and D. S. Burkhalter. 1980, 13p
Sponsored in part by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Proceedings of Cryogenic Engineering Conference Held at Madison, Wisconsin on August 21-24, 1979, B-4 in Advances in Cryogenic Engineering, n26 p107-119 1980.

Keywords: *Austenitic stainless steels, Yield strength, Cryogenics, Plastic deformation, Steel 316.

The temperature dependence of yielding is discussed with specific reference to austenitic stainless steels. Tensile yield stress measurements at 0.2% plastic strain, a strain rate of 0.02 mm/s, and temperatures between 4 and 295 K are reported for a heat of AISI 316 stainless steel.

711,158
PB82-210261 Not available NTIS
National Bureau of Standards, Washington, DC.
Strength Toughness Relationship for Interstitially Strengthened AISI 304 Stainless Steels at 4 K Temperature.
Final rept.
R. L. Tobler, D. T. Read, and R. P. Reed. 1982, 28p
Sponsored in part by Department of Energy, Washington, DC., and David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Proceedings of Fracture Mechanics: Conference (13th), Philadelphia, PA, 1981, ASTM STP 743, p250-268 1982.

Keywords: *Austenitic stainless steels, Fracture properties, Cryogenics, Toughness, Stainless steels, Tests, Test facilities, J integrals, Steel 304, Computer applications.

A study was conducted to determine the effects of carbon and nitrogen on the 4K fracture properties of an Fe-18Cr-10Ni austenitic stainless steel having a base composition corresponding to AISI 304. J-integral fracture toughness tests using 24.5 mm thick compact specimens (TL orientation) were performed in a liquid helium environment on nine steel heats having carbon plus nitrogen (C+N) contents between 0.067 and 0.325 weight percent. A computer-aided J-integral test facility was implemented to conduct this study. This new facility improves measurement accuracy, conserves material specimens and testing time, and systematizes test procedures.

711,159
PB82-238080 PC **A19**/MF **A01**
National Bureau of Standards, Boulder, CO.
Materials Studies for Magnetic Fusion Energy Applications at Low Temperatures - V.
Technical repts.
R. P. Reed, and N. J. Simon. May 82, 449p NBSIR-82-1667
See also Part 4, PB-282 444. Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Materials, *Cryogenics, *Superconducting magnetics, Stainless steels, Welded joints, Castings, Laminates, Composite materials, Mechanical properties.

The report contains results of a research program to produce material property data that will facilitate design and development of cryogenic structures for the superconducting magnets of magnetic fusion energy power plants and prototypes. The major portion of the program has been the evaluation of the low temperature mechanical and physical properties of stainless steel base metals, welds, and castings, with particular emphasis on the nitrogen-strengthened stainless steels. Stainless steels with manganese additions and other high manganese steels have also been investigated. Work has been done on the production and standardization of nonmetallics, primarily industrial laminates, for low temperature applications and on the measurement of their properties at cryogenic temperatures.

711,160
PB82-239070 Not available NTIS
National Bureau of Standards, Washington, DC.

Mechanical Testing in the 80's.
Final rept.
R. J. Fields, and J. H. Smith. Aug 80, 8p
Pub. in Metal Progress 118, n3 p38-45 Aug 80.

Keywords: *Mechanical tests, Automation, Crack propagation, Creep tests, Fatigue tests, Corrosion tests, Stress corosion, Reprints.

A forecast is made of the types of mechanical tests of materials that will be important in the next decade. This forecast is based on known, recent changes in technologies which use and rely on mechanical test data. There will be a strong emphasis on multiaxial tests in the 80's and on crack growth studies under combined conditions of stress, corrosion, and high temperature.

711,161
PB82-261496 Not available NTIS
National Bureau of Standards, Washington, DC.
Development of Some Analytical Fracture Mechanics Models for Surface Defects in Plates of Ductile Metals.
Final rept.
R. deWit, and J. H. Smith. Jun 80, 26p
Contract DOT-AS-800
Pub. in Proceedings of International Symposia on Continuum Models of Discrete Systems (3rd), Frendenstadt, Germany, June 24-30, 1980, p865-890.

Keywords: *Mathematical models, *Surface defects, *Weld defects, Welded joints, Pipelines, Failure, Fracture(Mechanics).

Fracture mechanics methods have been used to provide a basis for assessing the significance of defects in pipeline girth welds. Analytical models based on fracture mechanics technology are developed to establish predicted critical defect sizes for sharp defects in plates of ductile metal. The general problem considered here is that of a surface defect in a plate under tension. Both infinite and finite width plates are treated. Failure is considered to occur when the ligament ruptures. The fracture mechanics model used, called the collapsed ligament model, is based on the work of Erdogan and Bakioglu which is in turn based on the Dugdale model. The collapsed ligament model assumes plastic collapse in the depth direction, but any fracture mechanics model in the length direction. Curves are derived for the expected predicted critical defect sizes, in which the defect depth is plotted versus the defect length for a given set of material properties and applied stress. Given a particular defect, if the point falls below the curve, the defect is safe, but if the point falls above the curve, failure is predicted.

711,162
PB83-106070 Not available NTIS
National Bureau of Standards, Washington, DC.
Stainless-Steel Elastic Constants at Low Temperatures.
Final rept.
H. M. Ledbetter. Mar 81, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Applied Physics 52, n3 p1587-1589 Mar 81.

Keywords: *Stainless steels, Elastic properties, Cryogenics, Low temperature tests, Poisson ratio, Reprints, Steel 304, Steel 310, Steel 316.

For stainless steels 304, 310, and 316, longitudinal and transverse ultrasonic velocities were measured by a pulse-echo method between 295 and 4 K. From these velocities were computed five elastic constants: longitudinal modulus, shear modulus, Young's modulus, bulk modulus, and Poisson's ratio. All three steels show low-temperature elastic-constant anomalies, which arise from magnetic phase transitions.

711,163
PB83-115568 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Standard Reference Materials: A Standard Reference Material Containing Nominally Five Percent Austenite (SRM 485a).
Special pub. (Final).
G. E. Hicho, and E. E. Eaton. Aug 82, 28p NBS-SP-260-76
Library of Congress catalog card no. 82-600574.

Keywords: Standards, Austenite, Steels, Calibrating, X ray diffraction, *Standard reference materials.

This Standard Reference Material, SRM 485a, is a renewal of SRM 485, and is intended for the calibration of x-ray diffraction equipment used in determining the amount of retained austenite in hardened steels. 216 compacts were produced and subsequently examined for nickel content by x-ray fluorescence spectrometry. A calibration curve was established using 13 compacts randomly selected from the population of 216. The curve relates the weight percent nickel from x-ray fluorescence measurements to the volume percentage austenite as determined by quantitative microscopy measurements of area percent. The curve was then used to assign the certified values to the remaining compacts. This SRM may be used as an x-ray diffraction standard for retained austenite or in very special cases as an x-ray fluorescence standard for nickel content.

711,164
PB83-115576 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Standard Reference Materials: A Standard Reference Material Containing Nominally Thirty Percent Austenite (SRM 487).
Special pub. (Final).
G. E. Hicho, and E. E. Eaton. Sep 82, 28p NBS-SP-260-78
Library of Congress catalog card no. 82-600587.

Keywords: Standards, Austenite, Steels, Calibrating, X ray diffraction, *Standard reference materials.

This Standard Reference Material, SRM 487, is intended for the calibration of x-ray diffraction equipment used in determining the amount of retained austenite in hardened steels. 233 compacts were produced and subsequently examined for nickel content by x-ray fluorescence spectrometry. A calibration curve was established using 19 compacts randomly selected from the population of 233. The curve relates the weight percent nickel from x-ray fluorescence measurements to the volume percentage austenite as determined by quantitative microscopy measurements of area percent. The curve was then used to assign the certified values to the remaining compacts. This SRM may be used as an x-ray diffraction standard for retained austenite or in very special cases as an x-ray fluorescence standard for nickel content.

711,165
PB83-139105 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiance Temperature of Metals at Their Melting Points as Possible High Temperature Secondary Reference Points.
Final rept.
A. Cezairliyan, A. P. Miiller, F. Righini, and A. Rosso. 1982, 5p
Pub. in Proceedings of Symposium on Temperature (6th), Washington, DC., March 15-18, 1982, Paper in Temperature - Its Measurement and Control in Science and Industry, 5, p377-381 1982.

Keywords: *Melting points, Metals, Radiance, Temperature, Standards, Reference points, High temperature.

A summary is given of the measurements performed at the National Bureau of Standards and at the Istituto di Metrologia for the determination of the radiance temperature at two wavelengths (near 0.65 and 1 micrometers) of selected metals (Fe, Pd, Ti, Zr, V, Nb, Mo, Ta) at their melting point. The melting temperature of the metals studied ranged from about 1800 K to 3300 K. All the experiments were performed with a pulse-heating technique, in which the specimen was heated from room temperature to its melting point in less than one second by the passage of an electrical current pulse through it. Millisecond-resolution optical pyrometry was used for temperature measurements. The measurements show constancy and reproducibility of the radiance temperature at the melting point for a given metal, irrespective of the initial surface conditions of the specimen. The results suggest the possibility of the use of the radiance temperature of selected metals at their melting point as secondary reference points.

711,166
PB83-156968 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Recycling Municipal Ferrous Scrap.
J. G. Early. Sep 82, 37p NBSIR-82-2571

Keywords: *Metal scrap, Iron, Standards, Recycling, *Scrap recycling, *Municipal wastes.

Ferrous scrap recovered from municipal solid waste is one of the new sources of old scrap that may satisfy these increased demands. Systems for the recovery of the ferrous fraction from municipal solid waste have been developed, although increased usage of municipal ferrous scrap has been very slow due to institutional and technical barriers. The technical barriers posed by the physical and chemical characteristics of municipal ferrous scrap strongly inhibit the development of markets for this new material. The real and potential markets for increased consumption of municipal ferrous scrap are discussed in terms of these barriers together with the important role of standards for municipal ferrous scrap in improving communications between buyers and sellers.

711,167
PB83-164152 PC **A05**/MF **A01**
National Bureau of Standards, Boulder, CO. National Measurement Lab.
Fracture Toughness of Steel Weldments for Arctic Structures.
Interim progress rept.
T. L. Anderson, and H. I. McHenry. Dec 82, 86p
NBSIR-83-1680
Sponsored in part by Minerals Management Service, Reston, VA.

Keywords: *Weldments, *Structural steels, Cold weather construction, Welds, Toughness, Fracture properties, Arctic regions, J integrals.

The report summarizes the progress in the development of fracture criteria for steel weldments in arctic structures. Tensile, Charpy-impact, and fracture toughness properties have been measured as a function of temperature for a 25.4 mm (1 in) thick plate of normalized steel. Fracture toughness tests were performed on five geometries of single-edge notched bend (SENB) specimens. Critical values of the J-integral and the crack-tip opening displacement (CTOD) were computed and plotted versus temperature. The ductile-to-brittle transition temperature increased with increasing specimen thickness, and crack length. The effect of specimen geometry on fracture toughness is attributed to changes in crack-tip region constraint with geometry. Initial attempts to model this behavior have been moderately successful. Various aspects of the SENB fracture toughness test are being examined.

711,168
PB83-177410 Not available NTIS
National Bureau of Standards, Washington, DC.
Tensile and Fracture Properties of Manganese - Modified AISI 304 Type Stainless Steel.
Final rept.
R. L. Tobler, and R. P. Reed. 1982, 10p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of International Cryogenic Materials Conference (4th), San Diego, California, August 10-14, 1981, Paper in Advances in Cryogenic Engineering 28, p83-92 1982.

Keywords: *Austenitic stainless steels, Cryogenics, Tensile properties, Fracture properties, Toughness, Manganese containing alloys, Steel 304.

A series of ten low-carbon AISI-304-type austenitic stainless steels having 1 to 6 percent Mn (by weight) and 0.1 to 0.2 percent N were produced and tested to determine the effect of these elements on properties at 4 K. Tensile tests (at 295, 76, and 4 K) and J-integral fracture toughness tests (at 4 K) were conducted on developmental steels containing 18.25 to 19.50 percent Cr, 7.9 to 8.75 percent Ni, and 0.02 to 0.03 percent C. All steels were hot-rolled at 1450 K (2150F) from ingots to 25.4-mm (1-inch) plates. The 4-K yield strengths ranged from 620 MPa (90 ksi) to 1068 MPa (155 ksi), increasing strongly with nitrogen content. Unacceptably low toughness was observed in the low manganese compositions, but the fracture toughnesses of alloys containing 6 percent Mn were equivalent to those of conventional AISI 304 stainless steels.

711,169
PB83-177527 Not available NTIS
National Bureau of Standards, Washington, DC.

Deformation of Metastable Austenitic Steels at Low Temperatures.
Final rept.
R. P. Reed, and R. L. Tobler. 1982, 8p
Sponsored in part by Department of Energy, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Proceedings of International Cryogenic Materials Conference (4th), San Diego, California, August 10-14, 1981, Paper in Advances in Cryogenic Engineering 28, p49-56 1982.

Keywords: *Austenitic stainless steels, Plastic deformation, Cryogenics, Stress strain diagrams.

The stress-strain characteristics at low temperatures of commercial grades of polycrystalline austenitic stainless steels containing about 18 wt% chromium and 8 wt% nickel are not conventional. The anomalous behavior is thought to be caused by the martensitic transformation of face-centered-cubic austenite to body-centered-cubic and hexagonal close-packed phases. The paper suggests that the plastic deformation of metastable austenites is composed of three stages, and uses a series of Fe-18Cr-8Ni-1-6Mn, 0.1-0.2N alloys, tested at 4 K, to demonstrate the usefulness of this characterization.

711,170
PB83-177535 Not available NTIS
National Bureau of Standards, Washington, DC.
Indentation Loading Studies of Acoustic Emission from Temper and Hydrogen Embrittled A533B Steel.
Final rept.,
R. B. Clough, and H. N. G. Wadley. Nov 82, 11p
Sponsored in part by Electric Power Research Inst., Palo Alto, CA.
Pub. in Metallurgical Transactions A 13A, p1965-1975 Nov 82.

Keywords: *Structural steels, Hydrogen embrittlement, Embrittlement, Tempering, Inclusions, Fractures(Materials), Reprints, Steel A-533B, *Acoustic emission testing.

Isothermal tempering at 500C (within the region rendering low alloy steels susceptible to reversible temper embrittlement) induced acoustic emission (AE) activity in A533B steel during indentation loading. Samples, when sectioned, were found to contain small (approximately 10 micrometers long) MnS inclusions, some of which had debonded from the matrix material when they were near the indentations. Hydrogen charging prior to testing greatly enhanced the AE activity. It also resulted in the formation of small (approximately 20 to 200 micrometers) microcracks in samples tempered at 500C.

711,171
PB83-179267 Not available NTIS
National Bureau of Standards, Washington, DC.
Reliability Analysis of Steel Beam-Columns.
Final rept.
B. R. Ellingwood, and T. A. Reinhold. Dec 80, 5p
Pub. in Jnl. of The Structural Division, American Society of Civil Engineers Technical Notes 106, nST12 p2560-2564 Dec 80.

Keywords: *Steel structures, *Beams(Supports), *Reliability, Safety, Structural engineering, Probability theory, Building codes, Loads(Forces), Reprints.

Probabilistic analyses of the safety of structural members frequently have relied on a formulation of the ultimate limit state equation in which load carrying capacity (resistance) is measured by a single variable R, such as the fully plastic moment for a beam (1,3,5). Safety or reliability is defined by the condition where the effects of the applied loads do not exceed resistance R. However, there is a feeling that alternate formulations in terms of the basic variables that determine resistance, e.g., yield stress, section modulus, etc., may be more desirable in certain instances. This note compares measures of reliability calculated from the R-variable and basic variables formulations of the safety problem for hot-rolled steel beam-columns subjected to dead and live loads and considers some of the implications for reliability based design.

711,172
PB83-181685 Not available NTIS
National Bureau of Standards, Washington, DC.
Displacements and Rotational Factors in Single Edge Notched Bend Specimens.
Final rept.
I. H. Lin, T. L. Anderson, R. deWit, and M. G. Dawes. 1982, 5p
Sponsored in part by Department of Transportation, Washington, DC.
Pub. in International Jnl. of Fracture 20, pR3-R7 1982.

Keywords: *Test specimens, Displacement, Steels, Cracking(Fracturing), Reprints, J integrals, Plastic rotational factors.

This note reviews the definition and experimental measurement of the plastic rotational factors that are used with single edge notched bend specimens for estimates of crack tip opening displacements or, alternatively, for estimates of J contour integral values. Some new relationships are presented along with some experimental data for an API 5 LX-70 pipeline steel.

711,173
PB83-234351 Not available NTIS
National Bureau of Standards, Washington, DC.
Transitions and Phase Equilibria among Grain Boundary Structures.
Final rept.
J. W. Cahn. 1982, 5p
Pub. in Jnl. of Phys. 43, n12 pC6-199--C6-213 1982.

Keywords: *Grain boundaries, *Phase transformations, *Equilibrium, Microstructures, Grain structure, Reprints.

The characteristics of equilibrium first-order phase changes of the grain boundaries themselves are such that it leads to a definition of grain boundary phases in which smoothly curving boundaries are of the same phase. Different grain boundary phases coexist at facet edges and corners. The phase rule, phase diagrams, and some phase change mechanisms are developed. For a wide variety of problems orientation of the normal is shown to be analogous to composition in ordinary three-component systems. The role of symmetry in modifying the phase rule and in sectioning phase diagrams is explored. Reports of boundary phase changes are re-examined critically.

711,174
PB83-235408 Not available NTIS
National Bureau of Standards, Washington, DC.
Deformation and Fracture of Stainless Steel Castings and Weldments at 4 K.
Final rept.
T. A. Whipple, and E. L. Brown. 1982, 21p
Sponsored in part by Department f Energy, Washington, DC.
Pub. in Proceedings of Joining Division of American Society for Metals, New Orleans, LA. Nov 16-18 1981. Paper in Trends in Welding Research in the United States, p601-621 1982.

Keywords: *Stainless steels, *Castings, *Weldments, *Cryogenics, *Deformation, *Fractures(Materials), Microstructure, Solidification, Welded joints, Crack propagation.

A number of stainless steel weldments and castings that were deformed at 4 K have been examined with optical and electron microscopy. The purpose of this investigation was to assess the effects of residual delta-ferrite on the deformation and fracture mechanisms of these materials at cryogenic temperatures. Weldments and castings have very similar microstructures, but the delta-ferrite in castings is much coarser as a result of slower solidification and cooling rates. This wide variation in the scale of the structure provides a good opportunity for the study of structure and property relationships in these materials.

711,175
PB83-240598 PC **A07**/MF **A01**
National Bureau of Standards, Boulder, CO.
Applied J-Integral in HY130 Tensile Panels and Implications for Fitness for Service Assessment.
D. T. Read. Aug 82, 129p NBSIR-82-1670
Sponsored in part by David W. Taylor Ship Research and Development Center, Annapolis, MD.

Keywords: *Cracks, Defects, Assesments, Yield, Residual stress, Stress concentration, Strains, Panels, *J integrals, *Fracture(Mechanics), Steel HY-130.

An experimental technique for direct evaluation of the J contour integral is described. Results are reported and discussed. Some fifteen cracked HY130 tensile panels were tested, including center-cracked, single-edge-cracked, double-edge-cracked, face-cracked, and part-through-cracked configurations. As crack size increased, the post-yield deformation pattern changed from gross section yielding, for very small cracks, to net section yielding, for larger cracks. Net section yielding was associated with much larger J-integral values than gross section yielding.

711,176
PB83-241653 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Evaluation Criteria for Comparing Domestic and Foreign Material Specifications.
Final rept.
J. G. Early. May 83, 53p NBSIR-83-2692
Sponsored in part by Coast Guard, Washington, DC.

Keywords: *Specifications, *Metals, Comparison, Mechanical properties, Chemical composition, Standards, Evaluation.

Consistent decisions on the degree of equivalency between metal specifications of different national origins cannot be made only on the basis of chemical composition and direct comparison of mechanical property numbers. There are numerous additional factors, including metallurgical effects, product form effects, test acceptance criteria, and differences in specification philosophy, which if present, may influence the determination of equivalency because of their effect on property requirements. In order to remove the uncertainty in this decision-making process, these additional factors must be evaluated for each comparison.

711,177
PB83-259630 PC **A19**/MF **A01**
National Bureau of Standards, Boulder, CO.
Materials Studies for Magnetic Fusion Energy Applications at Low Temperatures - VI.
Technical repts.
R. P. Reed, and N. J. Simon. May 83, 434p NBSIR-83-1690
See also PB82-238080. Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Superconducting magnets, *Stainless steels, *Composite materials, *Cryogenics, Casting, Materials, Steels, Weldments, Laminates, Thermonuclear power plants, Technology transfer, *Magnetic fusion energy, Steel 304, Steel 310, Steel 316, Steel 18Cr 13Mn 3Ni, Steel 5Cr 26Mn.

The report contains results of a research program to produce material property data that will facilitate design and development of cryogenic structures for the superconducting magnets of magnetic fusion energy power plants and prototypes. The reports presented here summarize the sixth year of work on the low-temperature materials research program. Highlights of the results are presented first. Research results are given for the four main program areas: structural alloys, weldments and castings, nonmetallics, and technology transfer. Objectives, approaches, and achievements are summarized in an introduction to each program area. The major portion of the program has been the evaluation of the low-temperature mechanical and physical properties of stainless steel base metals, welds, and castings, with particular emphasis on the nitrogen-strengthened stainless steels. Developmental steels with manganese additions are also under investigation.

711,178
PB84-133487 Not available NTIS
National Bureau of Standards, Washington, DC.
Low-Temperature Elastic-Constant Anomalies in Fe-Cr-Ni-Mn Alloys.
Final rept.
H. M. Ledbetter. 1 Apr 83, 4p
Pub. in Physica 119 B+C n1 and 2 p115-118, 1 Apr 83.

Keywords: *Steels, Bulk modulus, Elastic properties, Shear modulus, Phase transformations, Poisson ratio, Transition temperature, Reprints, Steel 5Cr 26Mn.

By measuring velocities of longitudinal and shear waves we determined accurately the temperature variation of elastic constants--Young modulus, shear modulus, bulk modulus, Poisson ratio--of a polycrystalline austenitic steel: Fe-5Cr-26Mn. Versus temperature, near 335 K, this alloy exhibits an anomalous elastic-constant transition. In similar alloys, a magnetic-sus-

ceptibility cusp occurs at the transition temperature, T sub C. The bulk modulus shows a maximum at a higher temperature. Below T sub C, the Poisson ratio behaves anomalously, increasing with decreasing temperature.

711,179
PB84-151778 Not available NTIS
National Bureau of Standards, Washington, DC.
Fracture Properties of a 25Mn Austenitic Steel and Its Welds at 4 K.
Final rept.
H. I. McHenry, J. W. Elmer, and T. Inoue. Dec 82, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Int. Cryogenic Mater. Conf., Kobe, Japan, May 11-14, 1982, p413-416 Dec 82.

Keywords: *Austenitic steels, Welded joints, Fracture properties, Cryogenics, Tensile properties, Crack propagation, Metal plates, Steel 5Cr 25Mn 1Ni, Steel 6.5Cr 25Mn 2.8Ni, Fracture toughness.

Tensile properties, fracture toughness, and fatigue crack growth rates of 25Mn-5Cr-1Ni steel plates and 25Mn-6.5Cr-2.8Ni welds were measured in liquid helium at 4 K. The yield strengths were 894 MPa for the base metal and 961 MPa for the weld metal. The fracture toughness values measured by the J-integral method were 240 MPa/sqm for the base metal and 158 MPa/sqm for the weld. The fatigue crack growth rates of both the base metal and the weld were similar to those of 316 stainless steel plate over the stress intensity range evaluated, 29-80 MPa/sqm. The fracture surfaces of representative specimens were examined by scanning and transmission electron microscopy and magnetic measurements; they were ductile and contained no evidence of alpha prime martensite.

711,180
PB84-151786 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Dependence of Flow Strength of Fe-20Cr-16Ni-6Mn-0.2N and Fe-18Cr-10Ni-1.5Mn-0.1N (304LN) Austenitic Steels.
Final rept.
R. P. Reed, R. L. Tobler, and J. W. Elmer. Dec 82, 6p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Int. Cryogenic Mater. Conf., Kobe, Japan, May 11-14, 1982, p98-103 Dec 82.

Keywords: *Austenitic stainless steels, Tensile properties, Cryogenics, Low temperature research, Neel temperature, Steel 20Cr 6Mn 16Ni, Steel 18Cr 10Ni, Steel 304.

The tensile flow strength was investigated in the temperature range 4 to 295 K for two annealed polycrystalline alloys: Fe-20Cr-16Ni-6Mn-0.2N steel and Fe-18Cr-10Ni-0.1N steel (AISI 304LN). Major conclusions are: (1) The temperature dependence of the flow strength may be characterized by a linear dependence of log sigma versus T. (2) Temperature-change experiments below 200 K indicate that the same temperature dependence of the flow strength may be achieved by either straining single or multiple specimens. (3) The reported anomalous decreases of the flow strength associated with the Neel temperature and very low temperatures (<20 K) for austenitic steels were not confirmed by this study.

711,181
PB84-216464 PC **A03**/MF **A01**
National Bureau of Standards (NML), Washington, DC. Metallurgy Div.
Mechanical Properties of a Leaded, Resulfurized, Rephosphorized Steel in Various Thermo/Mechanical Conditions.
Final rept.
J. G. Early. Jan 84, 39p NBSIR-84-2839
Sponsored in part by Coast Guard, Washington, DC.

Keywords: *Steels, Mechanical properties, Cold working, Heat treatment, Steel 12214.

The results of the metallurgical evaluation of bar stock samples of AISI 12214 steel in two thermo/mechanical conditions, cold finished and hot rolled, illustrate the dominant role that the thermo/mechanical condition has on the resulting mechanical properties. The contributing effects of ferrite grain size and bar diameter on mechanical properties were small in comparison to the effects of cold work during the cold finishing operation. Cold finished bar stock samples subjected to a thermal brazing cycle (without the brazing alloy) develop mechanical properties that are very similar to those attained in hot rolled bars.

711,182
PB84-219930 Not available NTIS
National Bureau of Standards, Washington, DC.
Structural Alloys.
Final rept.
H. I. McHenry. 1983, 42p
Pub. in Materials at Low Temperatures, Chapter 11, p371-412 1983.

Keywords: *Austenitic stainless steels, *Nickel steels, *Aluminum alloys, Cryogenics, Copper alloys, Nickel alloys, Castings, Mechanical properties, Titanium alloys, Welding, Reprints, Superalloys.

The mechanical and physical properties of selected alloys for cryogenic service are reviewed with emphasis on austenitic stainless steels, nickel steels, and aluminum alloys. Welding, the properties of weldments, and other fabrication considerations are discussed. Copper and copper alloys, nickel-base superalloys, and titanium alloys are briefly discussed.

711,183
PB84-221316 Not available NTIS
National Bureau of Standards, Washington, DC.
Fracture Toughness of CF8 Stainless Steel Castings at 4 K.
Final rept.
E. L. Brown, T. A. Whipple, and R. L. Tobler. Jun 83, 5p
Sponsored in part by Brookhaven National Lab., Upton, NY., and Department of Energy, Washington, DC.
Pub. in Metallurgical Transactions A 14A, p1179-1183 Jun 83.

Keywords: *Steel castings, *Stainless steels, Toughness, Cryogenics, Reprints, *Fracture toughness, Steel CF8, J integrals.

The first fracture toughness measurements for CF8 stainless steel castings in liquid helium at 4 K are reported. Single-phase (austenite) and duplex (austenite + delta -ferrite) castings were tested.

711,184
PB84-221357 Not available NTIS
National Bureau of Standards, Washington, DC.
Fracture Properties of a 25mn Austenitic Steel and Its Welds at 4 K.
Final rept.
H. I. McHenry, J. W. Elmer, and T. Inoue. 1983, 12p
See also PB84-151778. Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of International Cryogenic Materials Conference held at Kobe, Japan on May 11-14, 1982, paper in Austentic Steels at Low Temperatures, p327-338 1983.

Keywords: *Austenitic steels, *Welded joints, Cryogenics, Fracture properties, Tensile properties, Crack propagation, Metal plates, Steel 5Cr 25Mn 1Ni, Steel 6.5Cr 25Mn 2.8Ni, Fracture toughness.

Tensile properties, fracture toughness, and fatigue crack growth rates of 25Mn-5Cr-1Ni steel plates and 25Mn-6.5Cr-2.8Ni welds were measured in liquid helium at 4 K. The yield strengths were 894 MPa for the base metal and 961 MPa for the weld metal. The fracture toughness values were measured by the J-integral method. The fatigue crack growth rates of both the base metal and the weld were similar to those of 316 stainless steel plate over the stress intensity range evaluated. The fracture surfaces of representative specimens were examined by scanning and transmission electron microscopy and magnetic measurements; they were ductile and contained no evidence of alpha martensite.

711,185
PB84-223247 Not available NTIS
National Bureau of Standards, Washington, DC.
Austenitic-Steel Elastic Constants.
Final rept.
H. M. Ledbetter. 1983, 21p
Sponsored in part by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Austenitic Steels at Low Temperatures, p83-103 1983.

Keywords: *Austenitic steels, *Elastic properties, Alloying, Interstitials, Magnetic fields, Texture, Polycrystalline, Phase transformations, Bulk modulus, Poisson ratio, Shear modulus, Modulus of elasticity, Nickel containing alloys, Chromium containing alloys, Manganese containing alloys, Reprints, Temperature dependence.

The author reviewed recent studies, experimental and theoretical, at NBS on the subject of austenitic-steel elastic constants, especially at low temperatures. The experimental variables include temperature, substitutional alloying (Cr, Ni, Mn), interstitial alloying (C,N), magnetic field, textures (castings, welds), and sample-to-sample variability. The principal theoretical problems include monocrystal-polycrystal relationships, texture, and lattice stability.

711,186
PB84-223353 Not available NTIS
National Bureau of Standards, Washington, DC.
Martensitic Phase Transformations.
Final rept.
R. P. Reed. 1983, 48p
Pub. in Materials at Low Temperatures, Chapter 9, p295-342 1983.

Keywords: *Phase transformations, *Cryogenics, Austenitic stainless steels, Nickel alloys, Iron alloys, Superconductors, Alkali metals, Solidified gases, Polymers, *Martensitic transformation.

This chapter concentrates on very low-temperature martensitic transformations, which are of great concern for cryogenic applications and research. The principal transformation characteristics are reviewed and then elaborated. The materials classes or alloy systems that exhibit martensitic transformations at very low temperatures are discussed in greater detail. In particular, the martensitic transformations and their effects in austenitic stainless steels, iron-nickel alloys, practical superconductors, alkali metals, solidified gases, and polymers are discussed.

711,187
PB84-224047 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical Properties of Stainless Steel Castings at 4 K.
Final rept.
T. A. Whipple, and H. I. McHenry. Dec 82, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Int. Cryogenic Materials Conference, Kobe, Japan, May 11-14, 1982, p104-107 Dec 82.

Keywords: *Nickel chromium molybdenum steels, *Stainless steels, *Steel castings, *Cryogenics, Fracture strength, Tensile properties, Ferrite, Nitrogen, Steel 19Cr 2Mo 9Ni.

The influences of delta-ferrite and interstitial nitrogen in the strength and toughness of stainless steel castings at 4K were evaluated using nine CF8M (nominally a 19Cr-9Ni-2Mo alloy) castings with controlled chemistries. The chromium and nickel contents were varied to obtain two series of alloys: one series of five alloys had 0.05 percent nitrogen and delta-ferrite contents ranging from 0 to 28.5 percent, and a series of five alloys had 9 + or - 1 percent ferrite and 0.02 to 0.20 percent nitrogen. The results indicate that an increase in either delta-ferrite or nitrogen content increases the yield strength at 4K. Fracture toughness decreases with increasing delta-ferrite up to a ferrite content of 17 percent and then remains constant. Fracture toughness decreases with increasing nitrogen content for nitrogen contents above 0.01 percent.

711,188
PB84-224054 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic Field Effects on Tensile Behavior of Alloys 304 and 310 at 4 K.
Final rept.
R. P. Reed, J. M. Arvidson, J. W. Ekin, and R. H. Schoon. Dec 82, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Int. Cryogenic Materials Conference, Kobe, Japan, May 11-14, 1982, p33-36 Dec 82.

Keywords: *Stainless steels, *Tensile properties, *Magnetic fields, Modulus of elasticity, Stresses, Strains, Yield strength, Cryogenics, Steel 304, Steel 310.

Experiments were conducted to assess the effects of a steady, transverse 7-T magnetic field on the austenite stress-strain characteristics of types 304 and 310 stainless steels at 4 K. Wire specimens of both a stable Fe-26Cr-20Ni (AISI 310) and metastable Fe-18Cr-9Ni (AISI 304) alloy were measured. No change in austenite flow strength of either alloy was observed from the application of a 7-T field. There was no detectable effect of a constant 7-T magnetic field on the yield strength of either alloy. Young's modulus at 4 K was found to decrease linearly with applied strain, but no effect of magnetic field was observed.

711,189
PB84-224161 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Dependence of Flow Strength of Selected Austenitic Stainless Steels.
Final rept.
R. P. Reed, R. L. Tobler, and J. W. Elmer. 1983, 12p
Pub. in Austenitic Steels at Low Temperatures, p105-116 1983.

Keywords: *Stainless steels, *Austenitic stainless steels, *Tensile strength, *Nickel chromium molybdenum steels, *Nickel chromium steels, Polycrystalline, Cryogenics, Martensite, Phase transformations, Reprints, Martensitic transformation, Temperature dependence.

It is important to characterize and to understand the temperature dependence of the tensile flow strength of austenitic steels for efficient design and material selection. Recent studies have suggested the possibility of three anomalies in the temperature dependence of the flow strength of Fe-Cr-Ni and Fe-Cr-Ni-Mn austenitic stainless steels. Reduction of flow strength at decreasing temperature may be associated with the onset of the austenite to martensite transformation (about 200 K), the magnetic transition at the Neel temperature (about 50 K) and low temperature dislocation dynamics ($<$20 K). The tensile flow strength was investigated in the temperature range 4 to 295 K for two annealed polycrystalline alloys: Fe-20Cr-16Ni-6Mn-0.2N steel (produced in the USSR and independently tested by two research laboratories) and Fe-18Cr-10Ni-0.1N steel (AISI 304LN). The former alloy is stable with respect to strain-induced martensitic transformations, the latter metastable.

711,190
PB84-226604 Not available NTIS
National Bureau of Standards, Washington, DC.
Ductile Fracture with Serrations in AISI 310S Stainless Steel at Liquid Helium Temperature.
Final rept.
R. L. Tobler, and R. P. Reed. 1983, 14p
Sponsored in part by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Proceedings of Elastic Plastic Fracture: Second Symposium, Philadelphia, PA, Oct 6-9 1983, American Society for Testing and Materials Special Technical Publication 803, pII-763-II-776.

Keywords: *Austenitic stainless steels, Cryogenics, Fracture properties, Fracture(Materials), Tests, J integrals, Fracture toughness, Steel 310-S.

Fracture toughness tests were performed on annealed austenitic stainless steel AISI 310S, immersed in liquid helium at 4 K, using 25 mm thick compact specimens. The Jlc results (360 to 380 kJ/sq m) from single- and multiple-specimen test techniques are compared and shown to be in close agreement. Attention is called to the remarkable failure process of this steel at 4 K: crack extension occurs by ductile tearing, while the test records exhibit serrations owing to repeated bursts of unstable plastic flow and arrests. The nature of this behavior is discussed, and the performance of stable austenitic AISI 310S is compared to that of related steels including those which transform from austenite to martensite during testing at 4 K.

711,191
PB84-226810 Not available NTIS
National Bureau of Standards, Washington, DC.
Structural Alloys for Cryogenic Service.
Final rept.
H. I. McHenry. Dec 82, 6p
Pub. in Proceedings of International Cryogenic Material Conference, Kobe, Japan, May 11-14, 1982, p313-318.

Keywords: *Austenitic stainless steels, *Nickel steels, *Aluminum alloys, *Cryogenics, Superconducting magnets, Liquefied natural gas, Rocket propulsion, Containers, Mechanical properties.

Many structural alloys are being successfully used in a wide variety of cryogenic systems. The author describes three important applications, identifies the alloys used and the design requirements that influence their selection, and discusses the properties of the single class of alloys most commonly used in each application. For large superconducting magnets, high strength in heavy sections is important; the austenitic stainless steels, particularly the nitrogen strengthened grades, are the preferred alloys. For land-based liquified natural gas tanks, economy consistent with safe performance is essential; nickel steels are commonly used. For rocket propulsion systems, strength-to-weight ratio is the prime concern; aluminum alloys are usually selected. Problem areas that warrant further research are discussed.

711,192
PB84-226869 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Thermal Processing Variation on the Mechanical Properties and Microstructure of a Precipitation Hardening HSLA Steel.
Final rept.
G. E. Hicho, S. Singhal, L. C. Smith, and R. J. Fields. Jun 84, 8p
Pub. in Jnl. of Heat Treating 3, n3 p205-212 Jun 84.

Keywords: *Steels, *Heat treatment, *Microstructure, Tensile properties, Impact strength, Hardness, Precipitation hardening, Fracture strength, Yield strength, Reprints, Steel A710.

Twenty-four variations in the heat treatment of ASTM A710 grade A, class 3 steel were performed to determine how sensitive this alloy is to deviations from the recommended heat treatment and to form a basis for understanding property variations in the heat affected zone of weldments. Tensile, impact, and hardness properties were measured for each heat treatment. Fractography and metallography were carried out to correlate microstructure with properties. It was found that small angle neutron scattering was extremely sensitive to small changes in the microstructure and also correlated extremely well with properties.

711,193
PB84-227073 Not available NTIS
National Bureau of Standards, Washington, DC.
Correlations of Fatigue Crack Growth Rate Parameters at Cryogenic Temperatures.
Final rept.
Y. W. Cheng, and R. L. Tobler. 1983, 6p
Sponsored in part by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Proceedings of ICF Symposium Fracture Mechanics, Beijing, China, November 22-25, 1983, p635-640.

Keywords: *Austenitic stainless steels, *Ferritic stainless steels, *Stainless steels, *Cryogenics, *Crack propagation, *Fatigue(Materials), Correlation.

Fatigue crack growth rate data of ferritic steels, AISI 300 series stainless steels, and austenitic steel welds at 295, 76, and 4 K were collected and analyzed in terms of the exponent in the Paris equation. The data considered pertain to constant amplitude fatigue loading and stress ratio equal to 0.1. It is observed that there is linear relation between log C and m, the parameters of Paris equation. The exponent, m, is insensitive to the variation of fracture toughness and yield strength of the material except in low fracture toughness materials. Temperature effects on m are observed for ferritic steels but not for austenitic steels.

711,194
PB84-227263 Not available NTIS
National Bureau of Standards, Washington, DC.
Applied J-Integral Values in Tensile Panels.
Final rept.
D. T. Read. Dec 82, 19p
Sponsored in part by Naval Sea Systems Command, Washington, DC., and David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Proceedings of Committee on Safety of Nuclear Installations (CSNI), Ductile Fracture Test Methods, Paris, France, Dec 1-3, 1982, p273-291.

Keywords: *Fracture properties, Structures, Nickel steels, *J integrals, Fracture(Mechanics), Fracture toughness.

The J contour integral has been applied widely in characterizing the fracture toughness of metals. In addition, the applied J-integral can be used to characterize the driving force for fracture in structures. This use of the J-integral requires knowledge of the dependences of the applied J integral on stress, strain, and crack size. Results from an experimental study of the applied J-integral as a function of strain in tensile panels are discussed in this paper.

711,195
PB84-227412 Not available NTIS
National Bureau of Standards, Washington, DC.
Martensitic Transformations in Fe-Cr-Ni Stainless Steels.
Final rept.
R. P. Reed. 1983, 17p
Sponsored in part by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Austenitic Steels at Low Temperatures, p41-67 1983.

Keywords: *Nickel chromium steels, *Austenitic stainless steels, *Phase transformations, *Stainless steels, Crystal structure, Stress strain diagrams, Cryogenics, Stability, Reprints, *Martensitic transformation, Temperature dependence.

Very low-temperature martensitic transformations are of great concern for cryogenic applications and research. The principal transformation characteristics are reviewed and then elaborated. The materials classes or alloy systems that exhibit martensitic transformations at very low temperatures are briefly discussed, and references to reviews and compilations are given. The austenite stability of Fe-Cr-Ni alloys with regard to cooling, elastic stress, and deformation is discussed in detail, and the empirical stability expressions that have been developed are summarized and reviewed. Structural relationships between the face-centered cubic austenite (gamma) and body-centered cubic (alpha) and hexagonal-close-packed (epsilon) martensite products are examined. Typical stress-strain curves of stable and metastable austenitic alloys are illustrated and analyzed as is the temperature dependence of the flow strength below room temperature. Finally, the influence of martensite transformation upon alloy performance in cryogenic applications is surveyed.

711,196
PB84-227420 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Magnetic Field on Tensile Behavior at 4 K of Alloys 304 and 310.
Final rept.
R. P. Reed, J. M. Arvidson, J. W. Ekin, and R. H. Schoon. 1983, 10p
Pub. in Austenitic Steels at Low Temperatures, p187-198 1983.

Keywords: *Stainless steels, *Tensile properties, *Magnetic fields, Modulus of elasticity, Stresses, Strains, Yield strength, Cryogenics, Steel 304, Steel 310.

Experiments were conducted to assess the effects of a steady, transverse 7-T magnetic field on the austenite stress-strain characteristics of types 304 and 310 stainless steels at 4 K. Wire specimens of both a stable Fe-26Cr-20Ni (AISI 310) and metastable Fe-18Cr-9Ni (AISI 304) alloy were measured. No change in austenite flow strength of either alloy was observed from the application of a 7-T field. There was no detectable effect of a constant 7-T magnetic field on the yield strength of either alloy. Young's modulus at 4 K was found to decrease linearly with applied strain, but no effect of magnetic field was observed.

711,197
PB84-227438 Not available NTIS
National Bureau of Standards, Washington, DC.
Properties of Austenitic Stainless Steel at Cryogenic Temperatures.
Final rept.
H. I. McHenry. 1983, 27p
Sponsored in part by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Austenitic Steels at Low Temperatures, p1-27 1983.

Keywords: *Austenitic stainless steels, *Cryogenics, *Stainless steels, Fatigue(Materials), Fracture

strength, Mechanical properties, Weldments, Welding, Nitrogen, Reprints.

The low temperature behavior of austenitic stainless steels is reviewed with emphasis on three general classes: (1) the AISI 300-series in the annealed condition; (2) the nitrogen-strengthened grades; and (3) high-strength cold-rolled sheet of the AISI 300-series. Mechanical and physical properties of selected alloys in these classes are presented. Welding, the properties of weldments, and other fabrication considerations are discussed. Recent results on the influence of ferrite content, nitrogen, and sensitization on castings of composition similar to the AISI 300 series are also reviewed.

711,198
PB84-227479 Not available NTIS
National Bureau of Standards, Washington, DC.
Experimental Method for Direct Evaluation of the J Contour Integral.
Final rept.
D. T. Read. 1983, 15p
Sponsored in part by Naval Sea Systems Command, Washington, DC., and David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in American Society for Testing and Materials Special Technical Publication 791, pII-199-II-213 1983.

Keywords: *High strength steels, Numerical integration, Strains, Stresses, Cracks, Reprints, *J integral, Contour integration.

A method for direct experimental evaluation of the J contour integral has been developed and used to measure J as a function of strain in tensile panels of high strength steel (sigma sub y = 900 MPa) under elastic-plastic loading conditions. The principle of the present method is to measure the integrand terms of J at suitable intervals along an appropriate contour and then to evaluate the integral. Because the resulting J values are based directly on the definition of J no assumptions about the crack size of stress/strain fields in the vicinity of the crack tip are necessary.

711,199
PB84-237395 PC **A10**/MF **A01**
National Bureau of Standards (NML), Boulder, CO. Fracture and Deformation Div.
Effect of Crack-Tip Region Constraint on Fracture in the Ductile-to-Brittle Transition.
T. L. Anderson. May 84, 213p NBSIR-84/3001
Sponsored in part by Minerals Management Service, Reston, VA.

Keywords: *Structural steels, Fracture properties, Mechanical properties, Fracture strength, Cracks, Toughness, Mathematical models, J integrals.

The effect of geometry on fracture toughness of steel in the ductile-to-brittle transition region has been studied. The critical crack-tip opening displacement (CTOD) and the critical J-integral have been measured as a function of temperature for ten fracture specimen configurations of ABS grade EH36 steel. A technique was developed to experimentally measure crack-tip constraint. Constraint decreased with crack blunting. This relaxation in constraint was modeled by a simple spring analog. The model was used to predict ductile-to-brittle transition curves for hypothetical structures. Some of the applications and limitations of the model are discussed.

711,200
PB84-239920 Not available NTIS
National Bureau of Standards, Washington, DC.
Factors Influencing the Low Temperature Dependence of Yielding in AISI 316 Stainless Steels.
Final rept.
R. L. Tobler, D. H. Beekman, and R. P. Reed. 1983, 23p
Sponsored in part by Department of Energy, Washington, DC. Div. of Magnetic Fusion Energy.
Pub. in Proceedings of International Cryogenic Materials Conference, Kobe, Japan, 11-14 May 1982, Paper in Austenitic Steels at Low Temperatures, p135-157 1983.

Keywords: *Stainless steels, Cryogenics, Plastic deformation, Yield strength.

Tensile tests at temperatures between 323 and 4K were performed on metastable austenitic AISI 316 stainless steel (FE-17Cr-12Ni-2MO). The yield and flow strengths at plastic strains up to 0.037 are analyzed and compared to existing data, noting metallurgical effects. The grain size effect on yield strength (sigma sub y) is weak at room temperature but substantial at cryogenic temperatures. No martensite is detected after tensile loading at low temperatures to 0.002 plastic strain. At higher strains (approximately 0.03), body-centered cubic (alpha') martensite forms in the parent austenite phase at test temperatures below 175K (the M sub d temperature). The initiation of alpha' transformation in this steel is associated with increased strain hardening below 175K, and not with a decrease of flow strength. Significant features of the temperature dependence of flow strength are: (1) a continuous rise of sigma sub y with decreasing temperature, in accord with thermally-activated plastic deformation, (2) an inflection in the thermal component of sigma sub y at about 150K, suggesting a change in deformation mechanism, and (3) absence of anomalies owing to martensitic transformations or to magnetic transition at the Neel temperature.

711,201
PB84-244003 Not available NTIS
National Bureau of Standards, Washington, DC.
PHAB - An Alloy Phase Diagram Bibliographic Database: A Part of the ASM/NBS Program for Alloy Phase Diagrams.
Final rept.
J. R. Cuthill, and H. Baker. 1983, 4p
Pub. in Proc. Materials Research Soc. Symp., Boston, MA, October 31-November 4, 1982, 19, p429-432 1983.

Keywords: *Phase diagrams, *Alloys, *Information systems, Chemical equilibrium, Crystal structure, Thermodynamics, High pressure tests.

PHAB is intended to be a complete bibliographic file of the phase diagram data papers pertaining to the experimental determination, evaluation, and calculation of phase diagrams of binary, ternary and higher-order alloy systems. Metastable as well as stable equilibrium data, crystal structure, thermodynamic and high pressure data are included. The database will provide a service to the scientific community as well as serving the ASM/NBS Data Program for Alloy Phase Diagrams. The PHAB Database will serve as a source of data to the other activities and outputs of the Program, including alloy system evaluations, the Bulletin of Alloy Phase Diagrams and bound volumes of evaluated phase diagrams, as well as other databases.

711,202
PB84-244532 PC **A05**/MF **A01**
National Bureau of Standards (NML), Washington, DC. Metallurgy Div.
Measuring the Corrosion Rate of Reinforcing Steel in Concrete.
E. Escalante, M. Cohen, and A. H. Kahn. Apr 84, 86p NBSIR-84/2853
Sponsored in part by Federal Highway Administration, Washington, DC.Portions of this document are not fully legible.

Keywords: *Corrosion, *Reinforcing steels, *Concrete, *Nondestructive testing, Bridge decks, Construction materials.

The progress on a research program directed at developing a nondestructive method for measuring the corrosion of steel in concrete as related to bridge deck deterioration is reported. This report summarizes the past work and describes the new developments on this project. The five phases described are: (1) a literature review, (2) preliminary studies, (3) measurements in concrete, (4) field measurements, and (5) development of a microprocessor system.

711,203
PB84-244607 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Behavior of Young's Moduli of Forty Engineering Alloys.
Final rept.
H. M. Ledbetter. Dec 82, 4p
Pub. in Cryogenics 22, p653-656 Dec 82.

Keywords: *Alloys, *Temperature, *Modulus of elasticity, Iron alloys, Nickel alloys, Copper alloys, Aluminum alloys, Reprints.

Young's modulus and temperature data are collected graphically and tabulated for forty alloys that have technological applications. Alloy base metals include: aluminum, copper, iron, and nickel. Sources of data are: handbooks, original research at NBS, and the scientific-engineering literature. The temperature range 0 to 590 K is covered.

711,204
PB84-246040 Not available NTIS
National Bureau of Standards, Washington, DC.
Automated Real-Time Analysis of Crack Growth Rates of Steels Tested in a Severe H2S Environment.
Final rept.
C. Interrante, and S. R. Low. 1981, 9p
Sponsored in part by Metallurgical Society of AIME, Warrendale, PA., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Proceedings of International Conference on Effect of Hydrogen on Behavior of Materials (3rd), Moran, WY, August 26-31, 1980, p713-721 1981.

Keywords: *Crack propagation, *Steels, *Hydrogen, *Stress analysis, *Data acquisition, Design criteria, Performance evaluation, Hydrogen sulfide, Corrosion.

Electrical impedance measurements of crack size are used in a data-acquisition system that takes data, checks for drift using a standard specimen, computes the stress-intensity factor (K), and the crack-growth rate (da/dt). This system is designed to operate in real time, with either d.c. or a.c. current, for tests of up to five specimens that are conducted simultaneously. An improved environmental chamber for fully instrumented tests of double-cantelever beam (DCB) specimens has been designed to prevent the environment from attacking test-specimens lead wires, which are used to measure the crack length. Using this improved design and the data-acquisition system, DCB specimens were tested in the NACE standard solution for evaluation of metals for resistance to sulfide stress cracking at ambient temperatures.

711,205
PB85-100238 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical Properties of CF8M Stainless Steel Castings at 4 K.
Final rept.
T. A. Whipple, and H. I. McHenry. 1983, 6p
Sponsored in part by Department of Energy, Washington, DC. Office of Magnetic Fusion Energy.
Pub. in Proceedings of International Cryogenic Materials Conference, Kobe, Japan, May 11-14, 1982 p243-248 1983.

Keywords: *Stainless steels, Cryogenics, Mechanical properties, Castings, Tensile properties, Toughness, Steel CF8M, Steel 19Cr 9Ni 2Mo, Fracture toughness.

The influences of delta-ferrite and interstitial nitrogen in the strength and toughness of stainless steel castings at 4K were evaluated using nine CF8M (nominally a 19Cr-9Ni-2Mo alloy) castings with controlled chemistries. The chromium and nickel contents were varied to obtain two series of alloys: one series of five alloys had 0.05 percent nitrogen and delta-ferrite contents ranging from 0 to 28.5 percent, and a series of five alloys had 9 plus or minus 1 percent ferrite and 0.02 to 0.20 percent nitrogen. The results indicate that an increase in either delta-ferrite or nitrogen content increases the yield strength at 4K. Fracture toughness decreases with increasing delta-ferrite up to a ferrite content of 17 percent and then remains constant. Fracture toughness decreases with increasing nitrogen content for nitrogen contents above 0.01 percent.

711,206
PB85-104867 Not available NTIS
National Bureau of Standards, Washington, DC.
Response of Carbon Black Filled Butyl Rubber to Cyclic Loading.
Final rept.
G. B. McKenna, and L. J. Zapas. 1981, 16p
Pub. in Rubber Chemistry and Technology 54, n4 p718-733 Sep-Oct 81.

Keywords: *Carbon black, *Butyl rubber, *Creep properties, Stress relaxation, Viscoelasticity, Failure, Loads(Forces), Reprints, BKZ theory.

Derham and Thomas recently reported on the creep behavior of a carbon black filled natural rubber under load-unload cycling. They found that, contrary to what would be expected for a linear viscoelastic material, the rate at which the material creeps is greater under cyclic loading than under static loading conditions. In order to further study this phenomenon of stress softening, the authors conducted stress relaxation and creep experiments under static and cyclic loading conditions. In order to analyze the data they used the BKZ

single integral nonlinear constitutive equation of Bernstein, Kearsley and Zapas. The results show that the softening effect in cyclic stress relaxation experiments is not very large but that under cyclic creep conditions (at similar levels of deformation) the softening is quite emphatic.

711,207
PB85-120723 Not available NTIS
National Bureau of Standards, Washington, DC.
Low-Temperature Magnetically Induced Elastic-Constant Anomalies in Three Manganese Stainless Steels.
Final rept.
H. M. Ledbetter, and E. W. Collings. 1979, 19p
Sponsored in part by Advanced Research Projects Agency, Arlington, VA.
Pub. in Proc. 107th AIME Annu. Meet., Denver, Colorado, March 2 1978, p22-40 1979.

Keywords: *Elastic properties, *Austenitic stainless steels, Iron alloys, Low temperature tests, Transition temperature, Manganese containing alloys, Neel temperature, Magnetic properties, Physical properties, Steel 18Cr 12Mn 3Ni, Steel 21Cr 9Mn 6Ni, Steel 22Cr 5Mn 13Ni.

Elastic properties of three austenitic stainless steels -- Fe-18Cr-3Ni-12Mn, Fe-21Cr-6Ni-9Mn, and Fe-22Cr-13Ni-5Mn--were studied between room temperature and either liquid-nitrogen or liquid-helium temperature. A dynamic (pulse-echo, 10 MHz) method was used to determine longitudinal and transverse sound-wave velocities, which were converted to elastic constants -- Young's modulus, shear modulus, bulk modulus, and Poisson's ratio. All the elastic constants are anomalous at low temperatures. These anomalies correlate with a paramagnetic-antiferromagnetic (Neel) transition detected by magnetic-susceptibility measurements. The transition temperature depends strongly on Mn content. Higher Mn content causes a higher transition temperature and a larger elastic-constant anomaly.

711,208
PB85-136216 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Magnetic Susceptibility and Strain-Induced Martensite Formation at 4 K in Type 304 Stainless Steel.
Final rept.
R. B. Goldfarb, R. P. Reed, J. W. Ekin, and J. M. Arvidson. Jul 84, 18p
Pub. in Advances in Cryogenic Engineering 30, p475-482 Jul 84.

Keywords: *Stainless steels, *Martensite, *Strain, *Phase transformations, Cryogenics, Magnetic fields, Reprints, *Magnetic susceptibility, *Steel 304.

Changes in magnetic susceptibility, chi, as a function of strain-induced structural transformations in AISI type 304 stainless steel at 4 K have been observed using a mutual inductance technique with simultaneous measurement of stress and strain. There is a small increase in chi coincident with plastic strain and a large increase in chi with the load drops that occur during serrated yielding. These are attributed to the formation of bcc martensite. The increases in chi are irreversible upon unloading. The application of a moderate 3-MA/m (37-kOe) dc field had no effect on the martensite formation.

711,209
PB85-139970 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Temperature Dependence of the Tensile Yield Strength of Selected Austenitic Steels.
Final rept.
R. P. Reed, and J. M. Arvidson. 1984, 8p
Pub. in Advances in Cryogenic Engineering 30, p263-270 1984.

Keywords: *Austenitic steels, Yield strength, Thermodynamic properties, Tensile strength, Reprints.

The trend toward the use of higher field superconducting magnets is creating the need for strong, tough structural materials to restrain the high magnetic forces. Austenitic and high-nitrogen-austenitic stainless steels are considered for such uses because of their high strength and good toughness, combined with high Young's modulus and low thermal conductivity. Study of the temperature dependence of tensile flow strength, including the 0.2 percent offset yield strength, leads to better understanding of deformation mechanisms in these face-centered cubic, polycrystalline alloys. The tensile properties of five austenitic Fe-Cr-Ni and Fe-Cr-Mn steels were measured. In these steels the Cr contents varied from 4.67 to 24.8 wt. percent; the nickel from 0.8 to 20.8 wt. percent; and the manganese from 1.7 to 21.79 wt. percent. Yet it is demonstrated that all steels primarily obtained their low temperature yield strength from carbon and nitrogen.

711,210
PB85-141976 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
J Integral Analysis of Surface Cracks in Pipeline Steel Plates.
Final rept.
R. B. King, Y. W. Cheng, D. T. Read, and H. I. McHenry. 1983, 14p
Pub. in American Society for Testing and Materials STP 803, pI-444--I-457 1983.

Keywords: *Steels, *Cracks, Surface defects, Reprints, Fracture(Mechanics), J integrals.

A capability for direct experimental evaluation of the J-integral in surface-cracked members under elastic-plastic deformation is useful for providing understanding of the driving force for fracture. In addition, such a capability makes it possible to evaluate analytical and numerical predictions of J. From a recent proof of path independence of the J contour integral evaluated around surface flaws, experimental procedures have been developed for direct evaluation of J at the root of surface cracks.

711,211
PB85-142511 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Low Temperature Strengthening of Austenitic Stainless Steels with Nitrogen and Carbon.
Final rept.
R. P. Reed, and N. J. Simon. 1984, 10p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Advances in Cryogenic Engineering 30, p127-136 1984.

Keywords: *Austenitic stainless steels, Yield strength, Nitrogen, Carbon, Shear modulus, Reprints, Steel 304.

The role of carbon and nitrogen in strengthening Fe-Cr-Ni austenitic stainless steels is reviewed. Discussion focuses on: (1) the relative contributions of carbon and nitrogen; (2) a dependence of concentration on strength; and (3) the shear modulus and volume change contributions in interstitial strengthening of austenitic stainless steels.

711,212
PB85-142826 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison of Four Microindentation Hardness Test Methods Using Copper, 52100-Steel, and an Amorphous Pd-Cu-Si Alloy.
Final rept.
P. J. Blau. 1983, 18p
Pub. in Metallography 16, n1 p1-18 1983.

Keywords: *Indentation hardness tests, Comparison, Copper, Steels, Palladium alloys, Microstructure, Reprints, Amorphous materials, Microhardness.

Microhardness numbers obtained with Knoop and Vickers diamond indenters can be greatly affected by the nature of indenter/test piece interactions. The values obtained by traditional methods of microhardness calculations, using optical measurement of impression dimensions, can be misleading unless these interactions are taken into account. Using microhardness data for large-grained Cu, fine grained bearing steel (SAE 52100), and an amorphous ('glassy') metal alloy of Pd-Cu-Si, the effects of microstructure on microhardness numbers at various loads are explored. Four methods of measurement are used: (1) standard Knoop number (long impression diagonal), (2) standard Vickers number (average of two impression diagonals), (3) a modified Knoop number (long and short impression diagonals), and (4) direct impression area measurement by an electronic image analyzing system.

711,213
PB85-197523 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
EXAFS Study of the Passive Film on Iron.
Final rept.
G. G. Long, J. Kruger, D. R. Black, and M. Kuriyama. 1983, 3p
Pub. in Jnl. of the Electrochemical Society 130, n1 p240-242 Jan 83.

Keywords: *Iron, *Corrosion, *Coatings, Solutions, Chromates, Nitrites, Crystalline structure, Vitreous state, Iron oxides, Reprints, *Extended X ray absorption fine structure.

A new surface EXAFS technique has been applied to the determination of the nature of the passive films formed on iron by chromate and nitrite passivating solutions. It found that the films formed that the EXAFS signatures of the passive films measured resemble those of the cubic spinel ferric oxides. The sharpness of the peaks, however, is significantly reduced from a crystalline structure, indicating that, at least the chromate-formed film is more vitreous than the model crystalline oxides.

711,214
PB85-207108 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Novel Double-Peaked Spin-Glass Susceptibility - Temperature Response in the Ternary Alloy Fe69Mn26Cr5.
Final rept.
T. Datta, D. Thornberry, E. R. Jones, and H. M. Ledbetter. 1984, 3p
Contract NSF-ISP80-11451
Sponsored by South Carolina Univ., Columbia, National Aeronautics and Space Administration, Washington, DC. and Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Solid State Communications 52, n5 p515-517 1984.

Keywords: *Austenitic stainless steels, Magnetic permeability, Phase transformations, Reprints.

The authors have studied the low-field (B< or = 10 to the minus 2 power T) d.c. susceptibility chi of the austenitic stainless-steel alloy Fe69Mn26Cr5 as a function of the magnetic field B and temperature T.chi(T) shows structure, strong B dependence, and typical irreversible effects. The range of temperatures studied comprises three distinct regions.

711,215
PB85-207132 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Thermal Expansion of Iron during the alpha yields gamma Phase Transformation by a Transient Interferometric Technique.
Final rept.
A. P. Miiller, and A. Cezairliyan. 1984, 14p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Thermal Expansion 8, p245-258 1984.

Keywords: *Iron, *Thermal expansion, Phase transformations, Measurement, Reprints.

Measurements of thermal expansion of iron in the vicinity of (and during) the alpha to gamma phase transformation have been performed by a transient (subsecond) interferometric technique. The basic method involves rapidly heating the specimen from room temperature up to about 1300 K in less than one second by the passage of an electrical current pulse through it, and simultaneously measuring the specimen expansion by the shift in the fringe pattern produced by a Michelson-type interferometer and the specimen temperature by means of a high-speed photoelectric pyrometer.

711,216
PB85-207967 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Anomalous Low-Temperature Elastic-Constant Behaviour of Fe-20Cr-16Ni-6Mn.
Final rept.
H. M. Ledbetter, and M. W. Austin. Nov 84, 4p
See also PB80-178403. Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy and National Science Foundation, Washington, DC.
Pub. in Metal Science 18, p539-542 Nov 84.

Keywords: *Austenitic stainless steels, Elastic properties, Bulk modulus, Cryogenics, Low temperature research, Phase transformations, Neel temperature, Shear modulus, Poisson ratio, Reprints, Steel 20Cr 6Mn 16Ni.

For the high nickel content austenitic stainless steel Fe-20Cr-16Ni-6Mn (wt-%), the complete set of polycrystalline elastic constants between 295 and 4 K were determined ultrasonically. A reversible magnetic transition occurs near 54 K. During cooling, the bulk modulus begins to soften at a much higher temperature, near 150 K. Local moments above the transition temperature may explain this peculiarity.

711,217
PB85-207975 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Predicted Monocrystal Elastic Constants of 304-Type Stainless Steel.
Final rept.
H. M. Ledbetter. 1985, 4p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Physica 128B, p1-4 1985.

Keywords: *Stainless steels, Elastic properties, Kroner method, Steel 304.

The three monocrystal elastic constants-C sub 11, C sub 12, C sub 44-of 304-type stainless steel are estimated from the polycrystalline bulk and shear moduli-together with an empirical C sub 12/C sub 11 value, which is discussed theoretically. The estimate involves a reverse Kroner method for relating monocrystal and polycrystal elastic constants.

711,218
PB85-207983 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Monocrystal-Polycrystal Elastic Constants of a Stainless Steel.
Final rept.
H. M. Ledbetter. 1984, 8p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Physica Status Solidi (a) 85, p89-96 1984.

Keywords: *Nickel chromium steels, *Stainless steels, Elastic properties, Reprints, Steel 19Cr 10Ni.

For a face-centered-cubic steel, new measurements of the monocrystal Voigt elastic-stiffness constants C sub 11, C sub 12, C sub 44 are given. The monocrystal steel, Fe-19Cr-10Ni, corresponds closely to the well-known AISI-304 austenitic stainless steel. Considering seven theories for the monocrystal-polycrystal elastic constants, it is found that the Hershey-Kroner-Eshelby theory agrees best with measurements. It predicts the shear modulus within 2% of observation, where the Voigt-Reuss first-order bounds differ by 49%. Ten sets of Fe-Cr-Ni C sub ij results are reviewed with the finding that both Zener's elastic anisotropy and the C sub 12/C sub 11 ratio are constant within 5%.

711,219
PB85-230647 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Effects of Carbon and Nitrogen on the Elastic Constants of AISI (American Iron and Steel Institute) Type 304 Stainless Steel.
Final rept.
H. M. Ledbetter, and M. W. Austin. 1985, 7p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Materials Science and Engineering 70, p143-149 1985.

Keywords: *Stainless steels, Elastic properties, Carbon, Nitrogen, Reprints, Steel 304.

Nine AISI type 304 stainless steel alloys were studied at room temperature. The carbon-plus-nitrogen contents of these alloys ranged from 0.067 to 0.325 wt.% (from 0.3 to 1.3 at. %). Five elastic constants (the longitudinal modulus, Young's modulus, the shear modulus, the bulk modulus and Poisson's ratio) were determined by a pulse echo ultrasonic method.

711,220
PB86-112869 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Environmental Testing under Conditions That Promote Crack Branch Formation in Side-Grooved, Double-Beam Specimens.
Final rept.
C. G. Interrante, and S. R. Low. 1982, 6p
Pub. in International Congress on Hydrogen in Metals (3rd), p557-562 1982.

Keywords: *Cracking(Fracturing), *Steels, Environmental tests, Crack propagation, Hardness, Inclusions, Hydrogen embrittlement.

Side-grooved, double-beam specimens of a 2 1/4 Cr - 1 Mo steel were tested under severe charging conditions that promoted the formation of branch cracks in test specimens of four orientations, which are designated S-T, S-L, T-L, and L-T. These branch cracks depart from the intended plane of cracking as they propagate into one of the beams of the specimen, and when this condition is severe it can preclude the development of meaningful data. The general tendency for branch crack formation was observed to increase with increasing hardness of the test specimen.

711,221
PB86-112877 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hydrogen Absorption by 2 1/4Cr-Mo Steel in Acidified H2S Environments.
Final rept.
J. A. Kargol, and C. G. Interrante. 1982, 9p
Pub. in Proceedings of International Conference (1st) on Current Solutions to Hydrogen Problems in Steels, Washington, DC., November 1-5, 1982, p438-446.

Keywords: *Steels, Hydrogen, Absorption, Cracking(Fracturing), Permeating, Hydrogen embrittlement, Hydrogen sulfide.

No abstract available.

711,222
PB86-119328 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Fatigue Crack Growth of a Ship Steel in Seawater under Spectrum Loading.
Final rept.
Y. W. Cheng. 1985, 6p
Sponsored by Minerals Management Service, Reston, VA.
Pub. in International Jnl. of Fatigue 7, n2 p95-100 1985.

Keywords: *Structural steels, *Fatigue(Materials), *Crack propagation, *Sea water corrosion, *Environmental tests, *Ship structural components, Offshore structures, Loads(Forces), North Sea, Mechanical properties, Reprints.

Fatigue crack growth of ABS EH36 steel under spectrum loading intended to simulate sea loading of offshore structures in the North Sea was studied using fracture mechanics. A digital simulation technique was used to generate samples of load/time histories from a power spectrum characteristic of the North Sea environment. The procedure is equivalent to applying Miner's summation rule in fatigue life calculations.

711,223
PB86-124138 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Isotope Dilution Spark Source Mass Spectrometric Determination of Sulfur in Selected NBS (National Bureau of Standards) Iron-Base Alloys.
Final rept.
P. J. Paulsen, R. W. Burke, E. J. Maienthal, and G. M. Lambert. 1981, 8p
Sponsored by American Society for Testing and Materials, Philadelphia, PA.
Pub. in American Society for Testing and Materials, Special Technical Publication 747, p113-120 1981.

Keywords: *Chemical analysis, *Isotopic labeling, *Sulfur, *Iron containing alloys, Sampling, Mass spectroscopy, Chemical equilibrium, Physical properties, Hydrogen sulfide, Silver sulfides, Metals, Concentration(Composition), Reprints, *Isotope dilution spark source mass spectroscopy.

A procedure has been developed at NBS utilizing spark source mass spectrometric (SSMS) isotope dilution for the determination of sulfur in iron-base alloys. With this technique a known amount of highly enriched (Sup 34)S isotope (spike) is added to the sample and, following physical and chemical equilibration between the spike sulfur and the natural sulfur in the sample, the equilibrated sulfur is isolated by reduction to H2S and precipitation as Ag2S. The altered isotopic ratio of the sulfur (Sup 34)S/(Sup 32)S is then measured with the SSMS. Sulfur concentrations are calculated from the sample weight, spike weight, measured altered isotope ratio, and known isotopic abundance of (Sup 34)S and (Sup 32)S in both natural and spike sulfur. The key step in obtaining a quantitative sulfur analysis is the dissolution of the sulfur-containing iron samples in a sealed tube. This dissolution procedure enables the sample sulfur and the spike sulfur to completely equilibrate without any possibility of loss of either species by volatilization.

711,224
PB86-128196 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Fatigue Crack Growth of Duplex Stainless Steel Castings at 4 K.
Final rept.
P. T. Purtscher, Y. W. Cheng, and P. N. Li. 1985, 5p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Jnl. of Engineering Materials and Technology 107, p161-165 Apr 85.

Keywords: *Stainless steels, *Crack propagation, Cryogenics, Fatigue(Materials), Reprints.

Constant-load-amplitude stage II fatigue crack growth rates at 4 K were measured for duplex stainless steel castings. The results show that at a delta K of 60 MPa(m to the 1/2 power), da/dN = 0.00076 mm/cycle for an alloy with 1 percent ferrite. For an alloy with 8 percent ferrite, da/dN is 35 percent, and for an alloy with 29 percent ferrite, da/dN is 260 percent greater than for the 1 percent ferrite alloy.

711,225
PB86-128253 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Rapid Solidification.
Final rept.
R. Mehrabian. 1982, 24p
Pub. in International Metals Reviews 27, n4 p185-208 1982.

Keywords: Solidification, Phase diagrams, Process control, Powder metallurgy, Nondestructive tests, Microstructure, Heat transmission, Reprints, *Rapid solidification.

Points of progress in current understanding of rapid liquid to solid transformation are reviewed. Emphasis is placed on those aspects of the emerging science that would permit development of guidelines and predictive models for alloy design and process control to achieve desired microstructures and properties.

711,226
PB86-128881 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Comment on 'The Elastic Stiffness Coefficients of Nickel-Iron Single-Crystal Alloys at Room Temperature'.
Final rept.
H. M. Ledbetter. 1985, 2p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Jnl. of Applied Physics 57, n11 p5069-5070, 1 Jun 85.

Keywords: *Iron alloys, *Nickel alloys, *Shear properties, Face centered cubic lattices, Elastic properties, Single crystals, Poisson ratio, Phase transformations, Magnetic properties, Reprints.

The author responds to the recent claim that in face-centered-cubic Fe-Ni alloys the two cubic elastic-shear coefficients, C44 and (C11-C12)/2, vary linearly with composition. Both theory and measurement support a nonlinear variation.

711,227
PB86-128899 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.

Manganese Contributions to the Elastic Constants of Face Centered Cubic Fe-Cr-Ni Stainless Steel.
Final rept.
H. M. Ledbetter. 1985, 7p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Jnl. of Materials Science 20, p2923-2929 1985.

Keywords: *Stainless steels, *Elastic properties, *Manganese containing alloys, Mechanical properties, Poisson ratio, Ultrasonic tests, Bulk modulus, Reprints.

The author determined experimentally the effect of manganese on the elastic constants of face centered cubic Fe-Cr-Ni alloys with chemical compositions near 304-type stainless steel. By a pulse-echo-overlap method, longitudinal and transverse soundwave velocities were determined in ten alloys containing up to 6% manganese. All the elastic stiffnesses decrease linearly with increasing manganese. The bulk modulus decreases most strongly. Poisson's ratio changes least. We consider what the elastic constants reveal concerning changes in chemical bonding, caused by manganese additions.

711,228
PB86-128907 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Elastic Constant Versus Temperature Behavior of Three Hardened Maraging Steels.
Final rept.
H. M. Ledbetter, and M. W. Austin. 1985, 5p
Sponsored by National Aeronautics and Space Administration, Langley Station, VA. Langley Research Center, and Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Materials Science and Engineering 72, p65-69 1985.

Keywords: *Elastic properties, *Maraging steels, Bulk modulus, Shear modulus, Poisson ratio, Reprints, *Temperature effects, Ultrasonic velocity.

Elastic constants of three maraging steels were determined by measuring ultrasonic velocities. Annealed steels show slightly lower bulk moduli and considerably lower shear moduli than hardened steels.

711,229
PB86-130119 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Interstitial Carbon and Nitrogen Effects on the Cryogenic Fatigue Crack Growth of AISI 304 Type Stainless Steels.
Final rept.
R. L. Tobler, and R. P. Reed. 1984, 7p
Pub. in Jnl. of Testing and Evaluation 12, n6 p364-370 Nov 84.

Keywords: *Crack propagation, *Stainless steels, Low temperature tests, Cryogenics, Carbon, Nitrogen, Mechanical properties, Fatigue(Materials), Reprints, Steel 304.

Constant-load-amplitude fatigue crack propagation (FCP) rate measurements are reported for AISI 304 (Unified Numbering System (UNS) S30400) type stainless steels having variable carbon-plus-nitrogen (C+N) contents. The improved cryogenic behavior at low C+N contents was associated with a transition in failure micromechanisms.

711,230
PB86-138096 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Computer Software Needs of Materials Property Data Bases for Selected Engineering Applications.
Final rept.
J. T. Fong. 1983, 31p
Pub. in Proceedings of Winter Annual Meeting of the American Society of Mechanical Engineers - On-Line Materials Property Data Base, Boston, MA., November 13-18, 1983, p75-105.

Keywords: *Engineering, *Computer graphics, *Materials, Properties, Economics, Stainless steels, Metal products, *Computer software, *Data bases, File management systems, User needs.

The technical opportunities and economic constraints in the development of materials property data bases and networks for engineering applications are examined. Factors that are likely to influence a typical engineer-user to supplement or supplant handbooks with data bases are discussed to support a proposition that engineering-oriented information systems need sophisticated softwares to ensure (a) credibility, (b) flexibility, and (c) faithful representation of the 'hard' and 'soft' texture of the data.

711,231
PB86-140035 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Midrange Fatigue Crack Growth Data Correlations for Structural Alloys at Room and Cryogenic Temperatures.
Final rept.
R. L. Tobler, and Y. W. Cheng. 1985, 26p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Fatigue at Low Temperatures, ASTM STP 857, p5-30 1985.

Keywords: *Structural steels, *Crack propagation, Cracking(Fracturing), Fatigue(Materials), Austenitic stainless steels, Cryogenics, Modulus of elasticity, Reprints.

Fatigue crack growth rate data for pure metals, structural alloys, and welds at temperatures from 295 to 4K are selectively reviewed. The data for more than 200 material and temperature combinations are discussed in terms of the parameters C and n for the midrange of the da/dN-versus-Delta K curve. Fatigue resistance varies greatly among the different alloy classes and crystal structure types, especially at extreme cryogenic temperatures, where alternative failure mechanisms emerge. Good general correlations were achieved on the basis of Young's modulus, fracture toughness, and empirical equations relating C and n for each alloy class.

711,232
PB86-140316 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Fracture Toughness and Microstructure of a Martensitic High Carbon Alloy Steel.
Final rept.
P. T. Purtscher, and G. Krauss. 1985, 16p
Sponsored by Bethlehem Steel Corp., PA.
Pub. in Proceedings of the Symposium on Fracture: Interactions of Microstructure, Mechanisms and Mechanics, Los Angeles, California, February 27-29, 1984, p179-194 1985.

Keywords: *Carbon steels, Fracture properties, Microstructure, High strength steels, Austentizing, Steel AISI 4485.

The toughness of AISI 4485 steel was evaluated as a function of austenitizing temperature between 800 and 950C. Increasing austenitizing temperature coarsened and reduced the volume fraction of spherical carbides retained after hardening. The shape of the curves is discussed relative to the changes in microstructure and fracture morphologies observed. An analysis technique based upon the energy required for crack growth is applied that describes the defect tolerance of the steel more completely than the ASTM E399 procedure.

711,233
PB86-165016 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Fracture and Deformation: Technical Activities 1985.
Rept. for Oct 84-Oct 85.
R. P. Reed, and H. I. McHenry. Nov 85, 70p NBSIR-85/3189

Keywords: *Deformation, Research projects, Metals, Composite materials, Ceramics, Polymers, Fractures(Materials), *Fracture(Mechanics).

The report summarized the technical program of the Fracture and Deformation Division of the Institute for Materials Science and Engineering, National Bureau of Standards for the fiscal year 1985. The division's two major program areas are: elastic-plasti fracture mechanics and fracture mechanisms and analysis. Elastic-plastic fracture mechanics includes contributions from stress analysis, material properties, nondestructure-, and temperature- dependent properties, composite mechanics, and material performance comprise the second area, fracture mechanisms and analysis. Significant technical programs relating to each of these are presented. Major accomplishments are highlighted, including very successful dynamic crack arrest measurements using 10-m-long specimens, development of the dynamic theory of crack tip-dislocation interactions, and continued development and application of finite-element analysis and scattering theory for prediction of composite properties.

711,234
PB86-165032 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Materials Science and Engineering.
Metallurgy Technical Activities, 1985.
E. N. Pugh, and J. G. Early. Nov 85, 116p NBSIR-85/3191

Keywords: *Metallurgy, Research projects, Microstructure, Mechanical properties, Wear, Corrosion, Electrodeposition, Nondestructive tests, Magnetic materials.

The report summarizes the FY1985 activities of the Metallurgy Division of the National Bureau of Standards. The research centers upon the structure-processing-properties relations of metals and alloys, and on the methods of their measurement. Task efforts comprise studies of synchrotron radiation research for materials characterization, metallurgical processing, wear and mechanical properties, chemical metallurgy, corrosion and protection of metals, electrodeposition, and nondestructive characterization. The work herein described includes three cooperative data programs with American professional socieities and industry: the American Society for Metals-NBS Alloy Phase Diagram Program, the National Association of Corrosion Engineers-NBS Corrosion Data Program, and the American Iron and Steel Institute-NBS Steel Sensor Program. The scientific publications, invited talks, committee participation, and other professional interactions of the 91 full-time and part-time members of the Metallurgy Division and its 33 guest researchers are identified.

711,235
PB86-189131 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Institute for Materials Science and Engineering.
Fundamentals of Fracture.
Final rept.
R. Thomson, and I. H. Lin. 1985, 58p
Pub. in Hydrogen Degradation of Ferrous Alloys, p454-511 1985.

Keywords: *Fracture(Materials), Dislocations(Materials), Cracks, Reprints, Fracture(Mechanics).

The fundamentals of fracture are presented with an emphasis on atomic models and dislocation interactions with cracks. The general fundamental principles are presented with some discussion of application to the hydrogen problem.

711,236
PB86-196623 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Application of Pulse-Echo Ultrasonics to Locate the Solid/Liquid Interface During Solidification and Melting of Steel and Other Metals.
Final rept.
R. L. Parker, J. R. Manning, and N. C. Peterson. Dec 85, 15p
Pub. in Jnl. of Applied Physics 58, n11 p4150-4164, 1 Dec 85.

Keywords: *Steels, *Ultrasonic tests, Solidification, Melting, Metallography, Interfaces, Reprints.

The velocity of sound and the density have values that are sufficiently different for liquid as compared to solid phases of metals and alloys to permit the use of pulse-echo ultrasonic techniques to locate the solid/liquid interface during solidification and melting. Experimental results are presented for pulse-echo observation of the melting and freezing of pure iron, 304 stainless steel, and tin, using Bridgman-type furnaces with unidirectional heat flow, at frequencies from 1 to 5 MHz. For both iron and steel, rapid grain growth in the solid phase at high temperatures can strongly attenuate the sound waves and can also produce backscattered waves which obscure the identification of the solid/liquid echo. Additionally, in alloys the presence of a 'mushy zone' rather than a sharp interface further reduces the reflected signal. These signal/noise problems were successfully overcome by the use of a

transducer spatial scanning technique with computer signal averaging that permits the interface to be located even in concentrated alloys.

711,237
PB86-196813 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
White-Beam Synchrotron Topography of Metals and Alloys.
Final rept.
W. J. Boettinger, H. E. Burdette, and M. Kuriyama. 1984, 11p
Pub. in Appl. X-ray Topogr. Methods Mater. Sci., p283-293 1984.

Keywords: *Topography, *Microstructure, Iron alloys, Aluminum containing alloys, Recrystallization(Metallurgy), Grain growth, Synchrotron radiation, X ray diffraction, Reprints.

Some applications of white beam synchrotron topography, performed at the Cornell High Energy Synchrotron Source (CHESS), to the microstructural characterization of metals and alloys will be described. The general quality of the x-ray topographs is shown with examples from Fe-24wt%Al samples. Topographs have also been obtained from 100 m diameter Sn powder samples. These powders were prepared by the Perepezko droplet-emulsion technique for obtaining large undercooling of liquid metal prior to solidification. Most of the powders are single crystals as determined from the topographs, but a small fraction are composed of two or three crystal grains. Multiphase alloy powders have also been examined. In situ recrystallization and subsequent grain coarsening of Al has been recorded on video tape using white beam synchrotron topography. The time evolution of the sizes of a number of crystal grains during heat treatment is determined. Simultaneous coarsening and recrystallization of a sample is seen to occur.

711,238
PB86-201746 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Ostwald Ripening of Rapidly Solidified Solid-Liquid Mixtures.
Final rept.
P. W. Voorhees, and M. E. Glicksman. 1983, 15p
Sponsored by Metallurgical Society of AIME, Warrendale, PA., and American Society for Metals, Metals Park, OH.
Pub. in Proceedings of the Fall Meeting of the Metallurgical Society of AIME (American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc.) Chemistry and Physics of Rapidly Solidified Materials, St. Louis, MO., October 26-27, 1982, p63-77.

Keywords: *Curing, Metallurgy, Mixtures, Solidification, Curvature, Morphology, Temperature measurement, *Foreign technology, *Rapid solidification.

A new theory of Ostwald ripening in two-phase mixtures has been developed which explicity accounts for the diffusional interactions between the dispersed coarsening second phase. The theory predicts the morphology of coarsening solid/liquid mixtures in terms of time invariant distributions of interfacial curvature. The theory also predicts a dependence of the curvature distributions and ripening kinetics on the volume fraction solidified. Experiments were performed to measure the response of an ultra-precise thermal probe immersed in the coarsening rapidly solidified solid/liquid mixture over a wide range of fraction solids. Through the theory it is now possible to interpret the experimental results to gain a deeper insight into the nature of Ostwald ripening following rapid solidification.

711,239
PB86-232717 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Stainless-Steel Elastic Constants at Low Temperatures: A Review.
Final rept.
H. M. Ledbetter. 1982, 4p
See also PB83-106070. Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Proceedings of International Cryogenic Materials Conference, Kobe, Japan, May 11-14, 1982, p112-115.

Keywords: *Stainless steels, Elastic properties, Poisson ratio, Modulus of elasticity, Reprints.

The authors review recent NBS studies on austenitic-stainless-steel elastic constants at low temperatures. By measuring velocities of longitudinal and shear waves, the authors determined accurately the usual engineering elastic constants: Young modulus, shear modulus, bulk modulus (reciprocal compressibility), and Poisson ratio.

711,240
PB87-108163 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Predicting the Toughness of SMA Austenitic Stainless Steel Welds at 77 K.
Final rept.
T. A. Siewert. Mar 86, 6p
Pub. in Welding Jnl. 65, n3 p23-28 Mar 86.

Keywords: *Austenitic stainless steels, *Welded joints, Cryogenics, Toughness, Welding, Stainless steels, Shielded metal arc welding, Statistical analysis, Reprints.

The austenitic stainless steels often provide the best combination of strength and toughness for cryogenic applications, however, the weld toughness is frequently much lower than that of the base metal. The study proposed a more accurate and simpler model for predicting improved filler metal compositions. Several previous studies of the weld toughness have been analyzed separately and in combination using a stepwise regression method and an expanded variable list.

711,241
PB87-108171 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Alternative View of Diffusion-Induced Grain Boundary Motion.
Final rept.
M. B. Kasen. 1986, 5p
Pub. in Philosophical Magazine A 54, n1 pL31-L35 1986.

Keywords: *Grain growth, *Grain boundaries, Diffusion, Transformations, Solutes, Motion, Migrations, Reprints, *Diffusion induced grain boundary motion.

Diffusion-induced grain boundary motion (DIGM) is interpreted as the manifestation of a solute-induced structural transformation within the boundary. The transformation results in a supersaturation of the daughter phase, which is alleviated by a reduction in excess solute by grain boundary migration. This produces the high concentration of solute observed in the wake of the boundary. A reversal of boundary motion upon reversal of the diffusion process is attributed to depletion of the boundary solute content to below the equilibrium level, causing the boundary to migrate through the high solute field to regain equilibrium. Inability to repeat the DIGM cycle is interpreted as evidence that the solute-induced transformation cannot be repeated. Evidence is provided that the solute-induced structural transformation giving rise to the DIGM process also occurs during conventional grain growth.

711,242
PB87-118543 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Cryogenic Steels for Superconducting Magnets: Developments in Japan.
Final rept.
H. I. McHenry. 1985, 21p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in ONRFE (Office of Naval Research Liaison Office) Scientific Bulletin 10, n2 p122-142 1985.

Keywords: *Steels, Cryogenics, Superconducting magnets, Stainless steels, Reprints.

The Japan Atomic Energy Research Institute initiated a program in 1982 to develop cryogenic steels for use in the large superconducting magnets planned for the Fusion Experimental Reactor. The target properties for the cryogenic steels are a yield strength of 1200 MPA at 4 K and a fracture toughness of 200 MPa/m at 4 K.

711,243
PB87-118592 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Mechanical and Swelling Behaviour of Well Characterized Polybutadiene Networks.
Final rept.
G. B. McKenna, and J. A. Hinkley. 1986, 9p
Pub. in Polymer 27, p1368-1376 Sep 86.

Keywords: *Polybutadiene, Synthetic elastomers, Swelling, Elastic properties, Reprints.

Endlinking of hydroxyl-terminated polybutadiene with the appropriate isocyanate has been used to prepare well characterized networks. Two networks have been studied with molecular weights of the prepolymers being 6100 and 2400 g/mole by g.p.c. Cylindrical specimens were prepared and the derivatives of the stored energy function with respect to the stretch invariants were determined by torque and normal force measurements in torsion. From these data the Valanis-Landel stored energy function derivatives w prime (lambda) were determined for both networks. The stored energy function for the junction constraint model of Flory, which is a special form of the Valanis-Landel function, has been fitted to that determined from the experiments. The contributions, Delta A sub ph and Delta A sub c to the stored energy function from the phantom network and from the junction constraints respectively do not agree with predictions from the topologies of the networks. In spite of this the form of w prime (lambda) for the junction constraint model gives an excellent 'curve fit' to the data. Comparison is also made with equilibrium swelling.

711,244
PB87-119111 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Strength-Toughness Relationship for Austenitic Stainless Steel Welds at 4 K.
Final rept.
R. L. Tobler, T. A. Siewert, and H. I. McHenry. 1986, 4p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Cryogenics 26, p392-395 Jul 86.

Keywords: *Austenitic steels, *Welded joints, Mechanical properties, Fractures(Materials), Toughness, Cryogenics, Reprints, Low temperature.

Cryogenic mechanical property data compiled at the National Bureau of Standards, USA, have been used to analyse the relationship between yield strength and fracture toughness for austenitic stainless steel welds at 4 K. The study demonstrates that there is an inverse linear correlation between yield strength and fracture toughness for the stainless steel welds at 4 K, and that the welds have significantly lower toughness than base materials of comparable strength.

711,245
PB87-119129 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Automatic Near-Threshold Fatigue Crack Growth Rate Measurements at Liquid Helium Temperature.
Final rept.
R. L. Tobler, and Y. W. Cheng. 1985, 7p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in International Jnl. of Fatigue 7, n4 p191-197 Oct 85.

Keywords: *Test equipment, *Crack propagation, *Austenitic steels, Fatigue(Materials), Liquid helium, Cryogenics, Reprints, Computer applications, Low temperature.

The development of a fully automated test apparatus for near-threshold fatigue crack growth rate measurements in a liquid helium environment is described, and some initial results for AISI 300 series stainless steels are presented. The experimental apparatus consists of a servohydraulic test machine and a cryostat, complete with a minicomputer, a programmable arbitrary waveform generator, a programmable digital oscilloscope and a fully automatic liquid helium refill system. The technique uses 6.4 mm thick compact specimens subjected to systematically decreasing loads, with 24 h operation at 40 Hz, the crack growth being continuously monitored by specimen compliance measurements.

711,246
PB87-119152 Not available NTIS

National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Low-Temperature Sound Velocities in 304-Type Stainless Steels: Effect of Interstitial C and N.
Final rept.
H. M. Ledbetter. 1986, 6p.
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Res. Mechanica 18, p245-250 1986.

Keywords: *Stainless steels, *Acoustic velocity, Interstitials, Cryogenics, Reprints, Low temperature, Steel 304.

Between T = 293 and 4 K, the longitudinal ultrasonic velocity of nine 304-type stainless steels with various C-plus-N contents (0.3-1.3 atomic per cent) was measured. All alloys showed similar behavior: a regular increase in velocity down to approximately 100 K; and below this, an anomalous decrease caused by a magnetic transition. The alloys varied in two ways: (1) contrary to some reports, increasing C + N decreases the Neel temperature strongly, by approximately 13 K per atomic per cent; (2) the magnitude of the low-temperature elastic softening associated with the Neel transition decreases slightly with increasing C + N content.

711,247
PB87-128948 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Fatigue Crack Initiation from Notches in Austenitic Stainless Steels.
Final rept.
R. L. Tobler, and O. S. Shu. 1986, 6p.
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Cryogenics 26, p396-401 Jul 86.

Keywords: *Austenitic stainless steels, *Cracking(Fracturing), *Fatigue(Materials), Austenitic steels, Cryogenics, Notch sensitivity, Mechanical properties, Reprints, Steel AISI 316, Steel AISI 304L.

Fatigue crack initiation from notches in austenitic stainless steels has been studied using compact specimens of two common cryogenic alloys: AISI 316 and AISI 304L. The procedure is based on a fracture mechanics technique whereby delta K rho(sub -1/2), a parameter proportional to the change in maximum elastic stress at the notch root, is correlated with the cycles to initiate a 0.254 mm crack. The effects of some experimental variables including notch radius, stress level, specimen size and test temperature (295, 76 and 4 K) are presented, and the fatigue crack initiation resistances of the AISI 316 and 304L austenitic steels are compared with martensitic and ferritic/pearlitic steel data at room temperature.

711,248
PB87-134763 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Tensile and Fracture Properties of an Fe-14Mn-8Ni-1Mo-0.7C Fully Austenitic Weld Metal at 4 K.
Final rept.
R. L. Tobler, R. E. Trevisan, and R. P. Reed. 1985, 5p.
Sponsored by Department of Energy, Washington, DC.
Pub. in Cryogenics 25, p447-451 Aug 85.

Keywords: *Austenitic steels, *Weld metals, Cryogenics, Weldments, Tensile properties, Fracture properties, Reprints, *Fracture toughness, Steel Fe-14Mn-8Ni-1Mo-0.7C.

A fully austenitic steel butt weld 21 mm thick was produced by submerged arc welding using an experimental filler metal composition: Fe-14Mn-8Ni-1Mo-0.7C. The tensile and fracture properties of the weld were measured in liquid helium to evaluate its candidacy for applications at 4 K. The yield strength (1115 MPa) and toughness, (k(sub Ic) approx 192 MPa m(sub 1/2)) combination of the material compares favorably with existing base metal properties for AISI 304 type alloys. A conventional ductile fracture consisting of void formation and coalescence was shown by both tensile and fracture toughness specimens.

711,249
PB87-151494 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Fracture and Deformation Div.
Statistical Observations of Creep Cavitation in AISI Type 304 Stainless Steel.
Final rept.,
T. S. Liu, R. J. Fields, D. G. Harlow, and T. J. Dolph. Mar 85, 6p.
Pub. in Scripta Metallurgica 19, n3 p299-304 Mar 85.

Keywords: *Stainless steels, *Creep properties, Reprints, *Steel 304, Computer applications.

It is well known from experimental observations that many of the characteristic features of intergranular creep cavitation are highly nonuniform. In specimens containing creep cavities, for example, the cavities are found more or less to be distributed randomly along the grain boundaries, preferentially along boundaries normal to the tensile axis. Moreover substantial variations in cavity sizes and shapes may be observed. Herein the authors report the results of statistical analysis of experimental creep cavitation data obtained through the use of an automatic image analyzing computer, a device which is capable of scanning large numbers of microscopic fields on polished metal surfaces and making individual creep cavity measurements in each field.

711,250
PB87-153631 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
X-ray Absorption Studies of the Role of Chromium and Hydrogen in the Structure of Oxide Films on Iron.
Final rept.,
G. G. Long, J. Kruger, M. Kuriyama, D. R. Black, I. Farabaugh, D. M. Sanders, and A. I. Goldman. 1984, 4p.
Pub. in Proceedings - Int. Congr. Met. Corros. 3, p419-422 1984.

Keywords: *Corrosion, *Iron, *Thin films, *X ray absorption, Chromium, Hydrogen, Iron oxides.

High resolution near edge x-ray absorption fine structure was measured for in-situ and ex-situ passive films on iron, where some of the films contained chromium as a glass former. Changes in the bonding are evaluated using the nearly free ion interpretation of known iron oxides.

711,251
PB87-162079 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Microindentation Hardness Measurements on Metal Powder Particles.
Final rept.,
T. R. Shives, and L. C. Smith. 1985, 14p.
Pub. in American Society for Testing and Materials Special Technical Publication 889, p243-256 1985.

Keywords: *Metal powder, *Indentation hardness tests, *Microhardness, *Powder(Particles), Atomizing, Measurement.

The National Bureau of Standards has undertaken a rather extensive metal processing program whereby metal powders will be produced by the inert gas atomization process. Powder particle sizes are expected to range form about 10 micrometer to 100 micrometers in diameter. Part of the overall program is the determination of the mechanical properties of the individual powder particles in the as-produced condition. Conventional microindentation hardness is one of the techniques that is planned to be employed for the mechanical properties characterization. In order to determine the applicability of this technique to very small particles, commercially available and experimental powders ranging in size from 3 to 65 micrometers have been mounted in various metallographic mounting media as well as in an electrodeposited metal mounting medium in order to evaluate the effects of the properties of the mounting materials on the measured hardness values. The effects of different applied loads and variations in particle size are also evaluated.

711,252
PB87-182903 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Carbon and Nitrogen Effects on the Elastic Constants of a Stainless Steel at 4 K.
Final rept.,
H. M. Ledbetter, M. W. Austin, and S. A. Kim. 1987, 5p.
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Materials Science and Engineering 85, p85-89 1987.

Keywords: *Elastic properties, *Carbon, *Stainless steels, *Temperature, Nitrogen, Modulus of elasticity, Poisson ratio, Stiffness, Shear modulus, Magnetic properties, Ultrasonics, Reprints.

Nine AISI type 304 stainless steel alloys were studied between ambient temperature and liquid helium temperature. The carbon plus-nitrogen contents of these alloys ranged from 0.080 to 0.359 wt.% (from 0.3 to 1.5 at.%). Five elastic constants (the longitudinal modulus, Young's modulus, the shear modulus, the bulk modulus and Poisson's ratio) were determined by a pulse-echo ultrasonic method. Except for the bulk modulus, all the elastic stiffnesses increase slightly with increasing interstitial content. Existing elastic theory predicts decreases in elastic stiffness caused by the volume increase.

711,253
PB87-182911 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Dilation of an fcc Fe-Cr-Ni Alloy by Interstitial Carbon and Nitrogen.
Final rept.,
H. M. Ledbetter, and M. W. Austin. Feb 87, 4p.
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Materials Science and Technology 3, p101-104 Feb 87.

Keywords: *Carbon, *Interstitials, *Iron alloys, Austenite, Nitrogen, Stainless steels, Alloying, Lattice parameters, Volume, Chromium, Nickel, Mathematical models, X ray diffraction, Face centered cubic lattices, Reprints, Dilation.

The volume change arising from introducing interstitial carbon and nitrogen into an fcc Fe-Cr-Ni alloy has been studied. The carbon plus nitrogen content varied from 0.3 to 1.3 at.-%. To complement these studies, alloys having a constant low-carbon content and a nitrogen content varying from 0.04 to 0.91 at.-% have also been studied. Volume was determined by X-ray diffraction using electropolished bulk polycrystalline specimens. An atom of carbon or nitrogen was found to increase volume by an amount approximately equal to three times its own volume or 70% of the atomic volume of the iron. In contrast with some studies, it was found that nitrogen exceeds carbon in dilating the fcc iron lattice. This occurs despite the atomic volume of carbon exceeding that of nitrogen. This is ascribed to electronic effects and to carbon-iron bonds stronger than nitrogen-iron bonds. A model calculation is given for the dilation.

711,254
PB87-197745 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Anaerobic Corrosion of Iron and Steel: A Novel Mechanism.
Final rept.,
W. P. Iverson, and G. J. Olson. 1984, 5p.
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of International Symposium on Current Perspectives on Microbial Ecology (3rd), p623-627 1984.

Keywords: *Corrosion, *Anaerobic corrosion, *Cathodic depolarization, Disulfide/dimethyl, Hydrogen sulfide.

The anaerobic corrosion of iron has been postulated to be caused by the removal of hydrogen (electrons) from the surface of iron by sulfate-reducing bacteria, by iron sulfide, or by bacterial removal of hydrogen from iron sulfide. Results indicate, however, that severe anaerobic corrosion takes place in the absence of both bacteria and iron sulfide. The agent causing corrosion is a volatile, highly reactive phosphorus-containing compound which reacts with iron to form iron phosphide as a corrosion product. A phosphorus-containing gas which also reacts with iron to form iron phosphide can be prepared by the action of hydrogen sulfide on hypophosphite. In addition to the formation of this phosphorus compound and hydrogen sulfide, the sulfate-reducing bacteria also produced methylmercaptan and dimethylsulfide which are relatively non-corrosive to iron under anaerobic conditions. Hydrogen sulfide produced by sulfate reducing bacteria normally produces a film of iron sulfide on iron at pH values near neutrality.

under anaerobic conditions. Corrosion can occur when the film of iron sulfide is disrupted, allowing the phosphorus-containing compound to come in contact with the iron surface.

711,255
PB87-199253 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Fracture Toughness of Weldments: Wide Plate Tests.
Final rept.,
D. T. Read. 1984, 17p
Sponsored by Metal Properties Council, Inc., New York.
Pub. in Proceedings of Pressure Vessels and Piping Conference and Exhibition, San Antonio, TX., June 17-21, 1984, p27-43.

Keywords: *Weldments, Plates(Structural members), Metal plates, Cracks, Steels, Impact tests, Toughness, Reprints.

A correlation was found between the failure loads of three as-welded, surface-cracked wide plates and the impact toughness of the welds. A fourth weldment, this one stress-relieved, failed at a higher load than expected from its impact toughness and the test results for the as-welded plates. The base metal was ASTM A537 Class 1 steel plate; the welds were made using the submerged arc process SAW using AWS Class EL12 electrode wire. The four wide plates tested were 0.59 m wide by 44 mm thick by 1.5 m long. The welds were all transverse to the specimen axis. Three plates were tested at -60 C, two as-welded, one stress-relieved. The remaining plate was tested, as-welded, at -30 C. All the cracks were on the weld centerlines, except in one plate tested as-welded at -60 C, in which the crack was in the heat-affected-zone, 1 mm from the fusion line. Impact toughness results were used to determine T20, the temperature at which the minimum observed Charpy-V notch impact energy was 27.1 J (20 ft lb).

711,256
PB87-219218 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Manganese and Nitrogen in Stainless Steel SMA (Shielded Metal Arc) Welds for Cryogenic Service.
Final rept.,
C. N. McCowan, T. A. Siewert, R. P. Reed, and F. B. Lake. 1987, 9p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Welding Research Supplement, p84-s-92-s Mar 87.

Keywords: *Shielded metal arc welding, Manganese, Nitrogen, Cryogenics, Weldments, Ferrite, Reprints, Stainless steel-308.

Evaluation of a shielded metal arc (SMA) weld test matrix in which manganese (1.5 to 10 wt-%) and nitrogen (0.04 to 0.26 wt-%) were varied independently has clarified the effect of these elements on cryogenic mechanical properties and predicted ferrite number (FN). Several molybdenum and boron additions were also made, but they had no observable effect on strength or Charpy V-notch (CVN) absorbed energy. The matrix was based on a type 308l stainless steel weld metal composition. Desired compositions and constant FN were attained through alloy additions to the electrode coating. For each weld, one all-weld metal 4-K tensile specimen and five 76-K CVN impact specimens were tested.

711,257
PB87-232583 PC **A06**/MF **A01**
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Strain Hardening and Stable Tearing Effects in Fitness-for-Service Assessment: Progress Report,
D. T. Read. May 87, 121p NBSIR-86/3045
Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.

Keywords: *Strain hardening, *Tearing, Toughness, Ductility, Graphs(Charts), Fracture tests, Aluminum alloy 5052, Steel-ASTM-A710, Steel A-710, J integrals.

The report describes studies done to provide information on how to account for material strain-hardening and tearing in fitness-for-service assessment. Included are a literature review, a study of the strength and ductility of cracked tensile panels under compliant loading, a report on applied J-integral measurements in an HSLA steel, a study of the relationship of the essential work of fracture to the J-integral, and a description of potential drop techniques for crack length measurement in double-edge-notched tensile panels.

711,258
PB87-233623 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Effect of Prior Deformation on the 76-K Fracture Toughness of AISI 304L and AWS 308L Stainless Steels.
Final rept.,
P. T. Purtscher, and D. T. Read. Apr 87, 6p
Pub. in Jnl. of Engineering Materials and Technology 109, p151-156 Apr 87.

Keywords: *Stainless steel-304, *Stainless steel-308, Cryogenics, Fracture strength, Toughness, Reprints, *Foreign technology.

In the study, the effect of service-induced deformation on the toughness of AISI 304L and its weld metal, AWS 308L was determined. Low temperature compressive loading in the laboratory produced larger deformations. Crack initiation toughness, and tearing resistance, at 76 K were evaluated as a function of martensite content, a measure of the deformation in these steels. The results showed that the toughness properties of the 304L decrease gradually as the martensite content increases from the 5 to 8 percent level found in the service condition to the 45 percent level obtained by compressive loading. The decrease was less than that expected on the basis of the increased flow stress. The toughness properties of the 308L weld metal decreased more sharply with increased martensite content than those of the 304L. The sharp decrease is associated with a degradation of the properties of the delta ferrite rather than that of the austenite.

711,259
PB87-233631 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Absence of Stretch Zones in Austenitic Stainless Steels Fractured at Cryogenic Temperatures.
Final rept.,
P. T. Purtscher. Sep 87, 3p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Testing and Evaluation 15, n5 p296-298 Sep 87.

Keywords: *Austenitic stainless steels, Cryogenics, Ductility tests, Fracture properties, Reprints, *Foreign technology.

Stretch zones are normally observed on the surface of fracture toughness specimens that break in a ductile manner. However, no stretch zones were observed in the scanning electron miscroscope on the ductile fracture surfaces of austenitic stainless steels broken in accordance with ASTM E 813 procedure at cryogenic temperatures.

711,260
PB88-110341 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Weldability of a Leaded Carbon Steel.
Final rept.,
J. G. Early, and J. H. Smith. Jun 87, 20p NBSIR-87/3598
Sponsored by Coast Guard, Washington, DC.

Keywords: *Carbon steels, *Leaded steels, Weldability, Bend tests, Hardness tests, Steel AISI 12L14.

Samples of A1S1 12L14, leaded free maching steel were welded using conventional metal-inert gas (MIG) welding procedures. The welds were evaluated for soundness and mechanical properties. Hardness, ductility and microstructure were evaluated to assess the integrity of the welds. Sound welds were produced but the overmatching strength of the weld metal resulted in failure in the HAZ.

711,261
PB88-117650 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Near-Threshold Fatigue Crack Growth Behavior of AISI 316 Stainless Steel.
Final rept.,
R. L. Tobler. 1985, 7p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Advances in Cryogenic Engineering Materials, v32 p321-327 1985.

Keywords: *Austenitic stainless steels, Fatigue(Materials), Cryogenics, Crack propagation, Test equipment, Reprints, *Foreign technology, Steel A-316.

The near-threshold fatigue behavior of an AISI 316 alloy was characterized using a newly developed, fully automatic fatigue test apparatus. Significant differences in the near-threshold behavior at temperatures of 295 and 4 K are observed. Results suggest that the near-threshold measurements of a 6.4-mm-thick specimen of this alloy are insensitive to cyclic test frequencies below 40 Hz.

711,262
PB88-122163 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Fracture, Acoustic Emission and Adiabatic Heating of Austenitic Stainless Steels at Liquid Helium Temperature.
Final rept.,
R. L. Tobler, T. Shoji, H. Takahashi, and K. Ohnishi. 1986, 9p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy, and Ministry of Education, Science and Culture, Tokyo (Japan).
Pub. in Progress in Acoustic Emission III, p453-461 1986.

Keywords: *Austenitic stainless steels, Fracture mechanics, Alloys, Toughness, Fracture properties, Heating, Acoustic measurement, Microstructure, Reprints.

Conventional fracture mechanics tests supplemented with acoustic emission (AE) and adiabatic heating (AH) measurements were conducted to characterize commercial austenitic stainless steels at 4 K. Three alloys representing low, medium, and high toughness behaviors were examined, and high levels of AE are reported in each case. The high AE activity of these austenitic steels at 4 K is attributed to low temperature strengthening effects in general, and to the peculiar failure mechanism involving discontinous deformation and adiabatic heating that occurs in ductile materials near absolute zero.

711,263
PB88-122171 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Elastic Plastic Models of Surface Cracks in Tensile Panels.
Final rept.,
D. T. Read, H. I. McHenry, and B. Petrovski. 1986, 6p
Pub. in Proceedings of SEM (Society for Experimental Mechanics) Fall Conference on Experimental Mechanics, 'Optical Methods in Composites', Keystone, CO., November 2-5, 1986, p210-215.

Keywords: *Tensile properties, *Panels, *Metal plates, Steels, Elasticity, Mathematical models, Cracks, Welded joints, Pipelines, Reprints.

The surface crack is a common flaw in structures and vessels, and its elastic characterization has been studied extensively as reviewed in (1) and its references. Elastic plastic fracture mechanics (EPFM) technology can be used to characterize surface cracks in tough materials. Two EPFM parameters are commonly used: the crack tip opening displacement (CTOD) and the three dimensional J-integral. The paper draws on a series of studies at the National Bureau of Standards related to the development and verification of analytical models for the calculation of EPFM parameters in surface cracked tensile panels. The models previously verified for pipeline steel plates, are used to calculate the crack mouth opening displacement (CMOD) and J for surface cracks in welded steel specimens.

711,264
PB88-129853 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Measurements and Interpretations of Sliding Wear Damage in Metals.
Final rept.,
P. J. Blau. 1985, 8p
Pub. in Jnl. of Tribology, Transactions of the ASME (American Society of Mechanical Engineers) 107, n4 p483-490 Oct 85.

Keywords: *Copper alloys, Wear, Friction, Deformation, Microstructure, Reprints, *Steel 1020, *Steel 4619.

Research on sliding friction and wear of metals has involved studies of subsurface microstructural deformation. The paper considers the difficulties of measuring deformation and analyzing the implications of such studies on several bases: (1) defining the physical extent of sliding-induced deformation, (2) making appropriate measurements of deformation for complex tribological conditions, and (3) correlating microstructural wear damage with the measureable friction forces on sliding contacts. Data for unlubricated block-on-ring tests of Cu and 1020 steel on 4619 steel is used to demonstrate limitations and correlations possible with metallographic studies in tribology.

711,265
PB88-141072 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Microstructural Characterization by Small Angle Neutron Scattering.
Final rept.,
R. J. Fields, R. C. Dobbyn, and C. I. Glinka. 1985, 9p
Sponsored by Army Materiel Command, Aberdeen Proving Ground, MD. Ballistic Research Lab., and David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Proceedings of NDE of Microstructure for Process Control Conference, Detroit, MI., September 18-19, 1984, p123-131 1985.

Keywords: Deformation, Steels, Copper, Nondestructive tests, *Small Angle Neutron Scattering Facility, Small angle scattering, Creep cavitation.

A brief review of the NBS SANS (Small Angle Neutron Scattering) facility is given, including applications of the technique to: (1) Precipitation of copper in steel; (2) Volume changes during deformation of precipitate strengthened alloys; and, (3) Creep cavitation. Some comments as to SANS use as a NDE nondestructive evaluation tool are made.

711,266
PB88-141320 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Acoustic Emission: An NDE Technique for Characterizing the Martensitic Transformation.
Final rept.,
Y. Berlinsky, M. Rosen, J. A. Simmons, and H. N. G. Wadley. 1986, 10p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v5 p1345-1354 1986.

Keywords: *Acoustic emission testing, *Nondestructive tests, *Martensitic stainless steels, Reprints.

Acoustic emission has been employed as a dynamic NDE characterization technique for the determination of kinetic and mechanistic parameters of the martensitic phase transformation in Fe-30wt.%Ni alloy. High-speed phenomena related to autocatalytic effect governing the transformation kinetics were observed. Using an energy calibration approach, it has been possible to estimate the elastic strain energy of the transformation. Values in accord with thermodynamic estimates have been obtained.

711,267
PB88-147509 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Ultrasonic Sensors to Measure Internal Temperature Distribution.
Final rept.,
B. E. Droney, F. A. Mauer, S. J. Norton, and H. N. G. Wadley. 1986, 8p
Sponsored by American Iron and Steel Inst., Washington, DC.
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v5A p643-650 1986.

Keywords: *Nondestructive tests, *Ultrasonic tests, Temperature measurement, Reprints, Steel 304, Steel 1018.

The in-process measurement of the internal temperature distribution is an important step toward improved processing of steels. A promising approach is the measurement of ultrasonic velocity, combined with a priori information on heat flow. Reference data on ultrasonic velocity versus temperature have been obtained for austenitic 304 stainless steel and for ferritic AISI 1018 steel. For stainless steel the longitudinal-wave velocity is nearly linear with temperature, with a proportionality constant of about -0.7 meters per second per degree Kelvin. In the paper the authors review the technical approach being used to ultrasonically determine internal temperature distribution.

711,268
PB88-147624 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Tensile and Fracture Properties of an Fe-18Cr-20Ni-5Mn-0.16N Fully Austenitic Weld Metal at 4 K.
Final rept.,
C. N. McCowan, T. A. Siewert, and R. L. Tobler. 1986, 4p
See also PB87-134763. Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Transactions of the ASME (American Society for Testing and Materials), Jnl. of Engineering Materials and Technology 108, p340-343 Oct 86.

Keywords: *Austenitic stainless steels, *Weld metals, Cryogenics, Weldments, Tensile properties, Fracture properties, Reprints, Steel 18Cr 5Mn 20Ni, Fracture toughness.

The 4-K tensile and fracture toughness properties of a fully austenitic stainless steel weld are reported. One tensile and two compact tension fracture specimens were tested. The weld was produced by gas metal arc welding using an Fe-18Cr-20Ni-5Mn-0.16N electrode and a 98 percent argon-2 percent oxygen shielding gas mixture. The suitability of this alloy for welding cryogenic structures is discussed.

711,269
PB88-152517 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Drop-Weight Testing of Non-Standard Geometries.
Final rept.,
S. R. Low, and J. G. Early. 1986, 21p
Pub. in ASTM (American Society for Testing and Materials) Special Technical Publication 919, p108-128 1986.

Keywords: *Impact tests, *Steels, Crack initiation, Fracture properties, Pipes(Tubes), Pressure vessels, Reprints, Steel 128, Steel 212.

The test requirements contained in the standard test method for drop weight testing ASTM (E208) generally limit its applicability to flat products or to products with at least one flat surface because of the shape of the standard test specimens and the need for the tension surface of the specimen to be an as-fabricated surface. Difficulties arise in the application of E207 to steel products whose fabricated shapes are not flat, e.g., piping and pressure vessels. For products with curved surfaces, some of the testing requirements must be violated, including: keeping the as-fabricated surfaces as the tension surface; uniform specimen thickness; flat compression surface; uniform stress on the tension surface. In the study, the nil-ductility transition temperature (NDT) was determined as function of test specimen geometry for two carbon/manganese structural steel grades.

Lubricants & Hydraulic Fluids

711,270
PB-271 562/1 PC **A07**/MF **A01**
National Bureau of Standards, Washington, D.C. Recycled Oil Program.
Measurements and Standards for Recycled Oil: Proceedings of a Workshop held at the National Bureau of Standards in Gaithersburg, Maryland on November 22 and 23, 1976.
Final rept.,
D. A. Becker. Aug 77, 145p NBS-SP-488
Library of Congress catalog card no. LCCCN-77-600032.

Keywords: *Oils, *Standards, *Oil wastes, *Meetings, Materials recovery, Fuels, Hydraulic fluids, Utilization, Fuel oil, Diesel engines, Gasoline oils, Petroleum products, Lubricating oils, Process charting, Performance evaluation, Quality assurance, Environmental surveys, Energy conservation, Additives, *Waste recycling, Liquid wastes.

Contents: The NBS workshop objectives and the NBS recycled oil program; Burning used oil at a military installation; Fuel oil and the Defense Supply Agency; Fuel oil specifications; Automotive crankcase drainings used for fuel; ASTM test methods for industrial oils; Industrial oil recycling at Chrysler; Industrial oils-descriptions, additives, and test methods; The use of recycled industrial and hydraulic oils at Ford; Industrial lubricants, reclaimed oils, and test methods; DOD experiences in testing lube oils; Waste oil recycling--an idea whose time has come; Comments on additive response to different base oils; Activities of the ASTM used oil task force; Activities of the API used oil task force; Chevron research's experiences with re-refined oils; Engine sequence tests for determination of lube oil quality; Screening tests on lube oils; Laboratory testing on re-refined motor oil; Diesel lube oil test methods; Recent used oil legislation; The lead problem associated with recycled oil; Factors affecting used oil recovery/utilization and effects of proposed policy alternatives; Energy conservation aspects of re-refined oil; Marketing barriers for recycled oil.

711,271
PB-299 951/4 PC **A10**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.
Measurements and Standards for Recycled Oil - II: Proceedings of a Conference.
Special pub.
D. A. Becker, and H. A. Hurd. Sep 79, 218p NBS-SP-556
See also report dated Aug 77, PB-271 562. Library of Congress catalog card no. 79-600126. Proceedings of a Conference Held at the National Bureau of Standards. Gaithersburg, Maryland on November 29 and 30, 1977.

Keywords: *Oils, *Meetings, Standards, Wastes, Utilization, Lubricating oils, Evaluation, Materials recovery, Environmental impacts, Fuel oils, *Recycled materials, *Waste oils, Waste recycling, Energy conservation, *Liquid wastes.

The publication is a formal report of the second Conference on Measurements and Standards for Recycled Oil, held at the National Bureau of Standards on November 29 and 30, 1977. There were seven sessions on specific subject areas, with a total of 32 presentations. The subject areas were as follows: (I) The Existing Situation, (II) Environmental Considerations, (III) Nonlubricating End Uses, (IV) Legislation and Studies, (V) Evaluation of Re-refined Engine Oils, (VI) Additional Recycled Oil Activities, and (VII) A panel discussion on the topic: 'What Data Base is Required to Establish the 'Substantial Equivalency' on Re-refined Motor Oils to Virgin Motor Oils.' Included in this report are invited talks given and a summary of the discussion following session VII.

711,272
PB78-600047 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Discussion on the Paper, 'Ferrographic Analysis of Wear Debris from Boundary Lubrication Experiments with a Five Ring Polyphenyl Ether'.
A. W. Ruff. 1975, 1p
Pub. in ASLE Trans. 18, n3 p162 1975.

Keywords: *Boundary lubrication, Ferrographic analysis, Wear debris.

No abstract available.

711,273
PB81-138307 Not available NTIS
National Bureau of Standards, Washington, DC.
Characterization of Lubricating Oils by Differential Scanning Calorimetry.
J. A. Walker, and W. Tsang. 1980, 9p
Pub. in Proceedings of the Conference on Fuels and Lubricants, Baltimore, MD., October 20-23, 1980, SAE Tech. Paper Series 801383, p1-8 1980.

Keywords: *Lubricating oils, *Heat measurement, Oxidation, High pressure tests.

The oxidative stability of formulated lubricating oils, and virgin and re-refined lubricating base stocks, have been determined by high pressure differential scanning calorimetry. The results of these studies indicate that the induction period measurements yield important information on the response of base stocks to ad-

ditive treatment which could be used in quality control for formulating lubricating oils. Further studies are, however, needed to obtain more definite conclusions.

711,274
PB81-214173 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Flammability Measurements on Fourteen Different Hydraulic Fluids Using a Temperature-Pressure Spray Ignition Test.
J. J. Loftus, N. Juarez, A. Maldonado, and J. A. Simenauer. May 81, 29p NBSIR-81-2247
Sponsored in part by Bureau of Mines, Pittsburgh, PA. Prepared in cooperation with Mine Safety and Health Administration, Triadelphia, WV.

Keywords: *Hydraulic fluids, *Flammability testing, Ignition, Coal mining, Viscosity, Spraying, NTISCOMNBS, NTISDIBM.

This report describes a spray ignition flammability test procedure which was developed and designed to be used as an alternative to the spray ignition test used by the Mine Safety and Health Administration (MSHA) to qualify hydraulic fluids for use in underground coal mines. The test procedure allows for quantitative measurement of heat and energy developed by fluids which may ignite in the test and provides for rank ordering of fluids according to their flammability. The testing program included currently used fluids such as invert emulsions, synthetics, and water glycols. Studies showed that the water glycol fluids were the only fluid type to resist ignition by spray testing. All other fluid types were ignited and in some cases produced considerable flaming.

711,275
PB82-131806 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Evaluation of the MSHA Temperature-Pressure Spray Ignition Test for Hydraulic Fluids.
Final rept.
J. J. Loftus, A. Maldonado-Rosado, and P. J. Allen. Sep 81, 45p NBSIR-81-2373
Sponsored in part by Mine Safety and Health Administration, Trialdelphia, WV., and Bureau of Mines, Pittsburgh, PA.

Keywords: *Hydraulic fluids, *Flammability tests, Safety, Ignition, Laboratory equipment, Temperature pressure spray ignition test, Mine safety and health administration.

The Mine Safety and Health Administration (MSHA) Temperature-Pressure Spray Ignition Test for determining the fire resistance of hydraulic fluids was evaluated in spray ignition tests on 14 different hydraulic fluids including water glycols, synthetics, and invert emulsions. Results of these and of other tests designed to evaluate the test method and its procedures are discussed in this report.

711,276
PB82-152729 Not available NTIS
National Bureau of Standards, Washington, DC.
Review of Antifriction Materials and Design for Cryogenic Environments,
R. L. Tobler. 1980, 12p
Sponsored in part by National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Pub. in Proceedings of Cryogenic Engineering Conference, Madison, Wisconsin, August 21-24, 1979, Paper A-5 in Advances in Cryogenic Engineering 26, p66-77 1980.

Keywords: *Low temperature lubricants, Cryogenics, Graphite, Molybdenum disulfide, Tetrafluoroethylene resins, Friction, Coefficients, Wear.

Friction must be considered in the design of any low temperature apparatus incorporating shafts, pistons, cams, gears, or other parts with sliding interfaces. Friction is usually more severe at cryogenic temperatures, causing problems of wear and heating. The latter factor is of special consequence to the design of superconducting devices since frictional heating would increase steady state cryogen consumption and operating costs, or possibly cause superconductors to go normal. This paper reviews the low temperature friction behavior of important structural materials and sliding couple combinations. Design methods and materials selection with regard to environment are discussed.

711,277
PB82-207515 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Introduction to Chemiluminescence Methods for Lubricant Oxidation Studies.
Interim rept. 19 Mar 81-31 Mar 82.
D. B. Clark, S. J. Weeks, and S. M. Hsu. Apr 82, 41p NBSIR-82-2490

Keywords: *Chemiluminescence, *Lubricants, *Oxidation, *Fuels, Hydrocarbons, Chemical reactions, Reaction kinetics, Activation energy, Stability, Catalysts, Additives.

An introductory review of chemiluminescence (CL) techniques describes applications for the study of oxidation of fuels and lubricants. Reviews of chemiluminescence and oxidation are briefly discussed. The mechanism of CL as it applies to complex hydrocarbon systems is discussed. Several steady state and nonsteady state kinetic methods are discussed with respect to the ability of each technique to give useful information about the kinetics and mechanisms of oxidation. Applications of CL techniques for fuels and lubricants, as well as simple hydrocarbon systems, are discussed. The unique properties of CL methods for materials testing (e.g. lubricant oxidation stability) as well as fundamental understanding of chemical oxidation reactions are emphasized. Studies which evaluate petroleum and synthoil products, oxidation inhibitors and metal catalysts are discussed. Instrumentation capabilities are reviewed and critical features of instrumental design are discussed.

711,278
PB82-258922 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Investigation of the Lubrication Mechanisms of the Complex Metal Sulfide, SbSbS4.
Annual rept. 1 Oct 80-30 Sep 81.
L. K. Ives, M. B. Peterson, J. S. Harris, P. A. Boyer, and A. W. Ruff. Jul 82, 75p NBSIR-82-2545
Contract N00014-80-F-0031

Keywords: *Solid lubricants, Metal complexes, Lubrication, Lubricant additives, Performance tests, Wear, Friction, *Antimony sulfides.

Studies have been carried out to determine certain basic properties of the complex metal sulfide, SbSbS4, that pertain to its use as a solid lubricant and lubricant additive material. The research verified the performance under EP conditions as an additive to a base grease. However the performance of SbSbS4 as a solid lubricant (in the form of a powder) was not found to be effective at temperatures below about 225C. It was noted though that, when used as a dry powder lubricant, the compound did produce a thick adherent film on steel surfaces in sliding contact. Six different types of wear and friction tests were carried out under various conditions of load, sliding speed, contact geometry, temperature, and time, in order to fully explore the potential of SbSbS4 as a lubricant on several different metals.

711,279
PB83-134932 Not available NTIS
National Bureau of Standards, Washington, DC.
Review of Laboratory Bench Tests in Assessing the Performance of Automotive Crankcase Oils.
Final rept.
S. M. Hsu. Dec 81, 10p
Pub. in Lubrication Engineering 37, n12 p722-731, Dec 81.

Keywords: *Lubricating oils, Crankcases, Laboratory equipment, Assessments, Performance evaluation, Reprints.

The basic mechanisms of how lubricant degrade in an engine are not well understood. Most of the bench tests are developed empirically based on engine test and product development experience. Very few test procedures are published in the literature and correlation between bench tests and engine tests are not available. A body of information, however, can be found in the patent literature in which the bench test results are used to substantiate claims. This review focuses on various test procedures in each area and summarizes the current state of the art.

711,280
PB83-232983 Not available NTIS
National Bureau of Standards, Washington, DC.
Relationship between Lubricating Basestock Composition and the Effects of Additives on Oxidation Stability.
Final rept.
S. M. Hsu, C. S. Ku, and R. S. Lin. 1982, 28p
Pub. in Base Oils for Automotive Lubricants SP-526, p29-56 1982.

Keywords: *Lubricating oils, *Additives, *Oxidation, Stability, Reprints.

Over fifty lubricating base oils from various crude sources and processing technologies, including ten refined base oils, were studied. These base oils were compounded with a SE/CC additive package and their response characteristics were measured by a thin film oxygen uptake test. This oxidation test has demonstrated correlation with ASTM engine sequence IIID test. Chemical compositon parameters such as sulfur, nitrogen, basic nitrogen, polar, saturate, and aromatic contents were systematically examined for correlation with the oxidation induction time data obtained from the oxidation test. Various combinations of these compositional parameters were also investigated. The additive response of these base oils was related to the saturate and sulfur contents of the base oils.

711,281
PB83-600031 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
ASTM/NBS Basestock Consistency Study Data.
S. J. Weeks, D. A. Becker, and S. M. Hsu. 1983, 482p NBS-SP-661

Keywords: *Additive response physical and chemical properties basestock, Consistency, Data, Lubricants, Oil, Petroleum, Rerefining.

ASTM and NBS co-sponsored a Basestock Consistency Study (BCS) to assess the quality consistency of lubricating base oils. This study, which is the first of its kind, will impact on developing basestock characterization methodology and on efficient utilization of energy resources as well as their conservation through recycling. The purpose of this publication is to present the ASTM/NBS BCS data for data analysis. Monthly production samples from six re-refiners and four refiners were analyzed by 14 laboratories for a 13 month period. The results of over 55 tests are divided according to six major categories: rheology, physical properties, chemical properties, hydrocarbon type analysis, general performance tests, and oxidation and wear bench tests. The data are presented in tabular and grphical form, which is quite amenable to further data analysis.

711,282
PB84-135003 Not available NTIS
National Bureau of Standards, Washington, DC.
Development of a Four-Ball Wear Test Procedure to Evaluate Automotive Lubricating Oils.
Final rept.
R. S. Gates, and S. M. Hsu. Sep 83, 9p
Pub. in Jnl. of the American Society of Lubrication Engineers 39, n9 p561-569 Sep 83.

Keywords: *Lubricating oils, *Test methods, Automobiles, Wear tests, Performance evaluation, Reprints.

Various techniques for evaluating wear performance of automotive crankcase oils were studied using four-ball wear testers. Wear test procedures at different speed/load combinations, load capacity tests and step loading test were examined. The techniques were evaluated using a set of six engine sequences IIID reference oils of known performance. Three test procedures were developed that correlated with engine sequence wear ratings.

711,283
PB84-136084 Not available NTIS
National Bureau of Standards, Washington, DC.
Electro-Optic Measurement of the Electric Field Distribution in Transformer Oil.
Final rept.
E. F. Kelley, and R. E. Hebner. Jul 83, 6p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems PAS-102, n7 p2082-2097 Jul 83.

Keywords: *Insulating oil, Electric fields, Measurement, Kerr electrooptical effect, Space charge, Nitrobenzenes, Reprints.

A system has been developed to measure the electric fields in transformer oil using the electro-optic Kerr effect. The system performance was verified by measuring the electric field and space charge in nitrobenzene. The field distributions were measured in clean oil, in oil which had been used as a wash for a radiator used in a power transformer, and in oil which was removed from a transformer that had failed. Measurements were made from room temperature to 100 C. Under the conditions studied, the electric field strengths were generally within 10% of the strengths that would be predicted assuming that space charge was negligible.

711,284
PB84-137017 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermogravimetric Analysis of Lubricants.
Final rept.
S. M. Hsu, and A. L. Cummings. 1983, 10p
Pub. in Jnl. Am. Soc. Automot. Eng., Tech. Paper 831682, p51-60 1983.

Keywords: *Thermogravimetry, *Lubricants, Oxidation, Chemical analysis, Quality control, Polymerization, Condensation reactions, Reprints.

A novel thermogravimetric analysis test method has been developed for the evaluation of lubricants. It involves superimposing the thermogravimetric traces of the sample in argon and oxygen atmospheres. The difference of the two traces indicates the oxidative influence on volatility as well as on the formation tendencies of high molecular weight products through condensation/polymerization reactions. The method was illustrated with a base oil with and without a catalyst package and an additive package. The test method is useful for lubricant screening, quality control, and composition of base oils.

711,285
PB84-167741 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Friction and Wear Characteristics of Molecular Compound Classes from Lubricating Base Oils. Part 1. Separation and Chemical Characterization.
S. M. Hsu, P. Pei, and R. S. Gates. Feb 84, 115p
NBSIR-84-2821
Sponsored in part by Oak Ridge National Lab., TN.

Keywords: *Lubricating oils, *Wear tests, *Friction factor, Separation, Chromatography, Molecular structure, Spectrochemical analysis, Chemical properties, Physical properties, Chemical analysis, Wear inhibitors, High performance liquid chromatography.

If the antiwear additives in oils provide antiwear performance, i.e, wear and friction control, as long as the additives remain in the system, then the natural polar structures in the base oil control the friction and wear failure. Identification of these polar fraction structures could provide a basis for model compounds selection. Therefore, the approach that we have chosen is to separate three lubricating base oils to provide basic structural information on the constituents in base oil that control friction and wear. After careful characterization of these compound classes, model compounds of various molecular structures will be used to measure their effects on friction and wear under different load/speed combinations.

711,286
PB84-226448 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of Automotive Crankcase Lubricants by Differential Scanning Calorimetry.
Final rept.
S. M. Hsu, A. L. Cummings, and D. B. Clark. Oct 82, 13p
Pub. in Base Oils for Automotive Lubricants, p127-139 Oct 82.

Keywords: *Lubricants, *Crankcases, *Oxidation, Automobiles, Stability, Performance evaluation, Reprints, *Differential scanning calorimetry.

A laboratory bench test has been developed to examine the oxidation stability of crankcase lubricants using a high pressure power-compensation differential scanning calorimeter (DSC). Oxidation induction time measured at 175 C and 3.62 MPa (525 psia) oxygen pressure was used to rank eight ASTM sequence IIID engine test reference oils. The DSC result correlated with the viscosity increase tendencies of the reference oils as determined by the engine tests. The new test method is rapid and requires only microliter sample size for testing with good precision. The method employs a mixture of soluble metal catalysts consisting of lead, iron, copper, maganese and tin (82%, 7%, 4%, 3.5%, 3.5%) together with a synthetic oxidized high boiling gasoline fraction. This combination was found necessary to simulate some of the engine conditions and chemistry.

711,287
PB84-227347 Not available NTIS
National Bureau of Standards, Washington, DC.
Thin-Film Oxygen Uptake Test for the Evaluation of Automotive Crankcase Lubricants.
Final rept.
C. S. Ku, and S. M. Hsu. Feb 84, 9p
Pub. in Jnl. of American Society of Lubrication Engineers 40, n2 p75-83 Feb 84.

Keywords: *Lubricants, *Crankcases, *Oxygen, Automobiles, Oxidation, Stability, Catalysts, Reprints.

A thin-film, oxygen absorption test has been developed for the evaluation of automotive lubricants using a standard Rotary Bomb Oxidation Test apparatus (RBOT) with simple modifications. The test measures the induction time of the lubricant under test conditions which simulate high temperature oxidation processes in automotive engines. Effects of oxidized fuel components and metal catalyses as well as the effect of hydrolysis on oil oxidation were considered. Test results on the ASTM engine sequence IIID reference oils suggested qualitative correlation with engine viscosity increase data. Additional commercial oils were also tested and the results fell within the reference oil ranges.

711,288
PB84-235969
(Order as PB84-235902, PC **A14**/MF **A01**)
California Dept. of Food and Agriculture, Sacramento.
Lube Oil Monitoring in the State of California.
J. N. Johnson. Jul 84, 3p
Included in Measurements and Standards for Recycled Oil-4, p43-45 1984.

Keywords: *Lubricating oils, *Regulations, California, Petroleum products, Labeling, Standards, Industrial plants, *Consumer products, Monitoring.

Lubricating oils are a unique commodity to the consumer. Few people, if any, can distinguish between grades or brands by touch, sight or smell. Unlike many other commodities, its sale and delivery into a vehicle is final in the sense that there is no practical way for the motorist to return or exchange the product if dissatisfied. The brand and labeling statements are principal factors in its presentation to the public. Therefore, the interests of the consumer are of primary importance in the assurance of stated quality. This is a vital factor in the monitoring and surveillance of lube oils. Of equal importance to consumer concerns, is the assurance that the lubricating oil industry competes in a marketplace where equity prevails and where unfair advantage is not gained through misleading and unfair business practices. The California Petroleum Products Program maintains a lubricating oil monitoring program to serve both the consumer and industry alike. State Petroleum Laboratories are located in Downey (Los Angeles) and Sacramento. Investigative staff work is conducted out of five regional offices that are strategically located throughout the State. Individual county weights and measures departments (56 counties) participate in joint enforcement of laws and regulations pertaining to petroleum in varying degrees.

711,289
PB84-235977
(Order as PB84-235902, PC **A14**/MF **A01**)
Army Mobility Equipment Research and Development Command, Fort Belvoir, VA.
Revision of the MIL-L-2104C Specification.
T. C. Bowen. Jul 84, 3p
Included in Measurements and Standards for Recycled Oil-4, p47-49 1984.

Keywords: *Lubricants, *Standards, Specifications, Refining, Performance evaluation, Military vehicles, Chemical properties, *Oil wastes, *Waste recycling, *MIL-L-2104C oils, Liquid wastes.

This paper will present the Army's activities in upgrading Military lubricant specifications to allow the use of re-refined materials. Although primary emphasis will be placed on the proposed revision to specification MIL-L-2104C, it also provides an update relative to actions taken with other automotive lubricant specifications.

711,290
PB84-235985
(Order as PB84-235902, PC **A14**/MF **A01**)
National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
Correlation Aspects of a Virgin and a Re-Refined Engine Oil Containing the Same Additives.
P. L. Stringer. Jul 84, 10p
Included in Measurements and Standards for Recycled Oil-4, p51-60 1984.

Keywords: *Lubricating oils, *Additives, Standards, Comparison, Petroleum products, Field tests, Viscosity, Physical properties, Oxidation, Refining, *Oil wastes, Engine tests, Liquid wastes.

Over a three year period commencing early in 1979, Environment Canada and the National Research Council of Canada carried out comprehensive comparative testing of a re-refined-base and a virgin-base automotive engine oil, both containing the same additive package, i.e., the only difference between the two being the base oil. Both oils were formulated to meet API service classification SE and SAE viscosity classification 20W-40 requirements. The virgin-base engine oil, being a commercial formulation, was regarded as the reference oil while the re-refined-base engine oil, being an 'experimental' formulation, was assessed for its potential use as a viable engine oil based on its comparative performance to the virgin-base engine oil. The ultimate objective of the exercise, supplemented by future testing of other formulations, was to determine the suitability of re-refined-base engine oils for use in government vehicles.

711,291
PB84-236017
(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Recycled Oil Program.
ASTM/NBS (American Society of Testing and Materials/National Bureau of Standards) Basestock Consistency Study.
D. A. Becker. Jul 84, 8p
Included in Measurements and Standards for Recycled Oil-4, p85-92 1984.

Keywords: *Lubricating oils, *Standards, Refining, Petroleum products, Sampling, Chemical analysis, Performance evaluation, Rheology, Physical properties, Chemical properties, Oxidation, Wear tests, *Oil wastes, *Waste recycling, Liquid wastes, Engine tests.

The ASTM/NBS Basestock Consistency Study was initiated in 1980 and completed in 1983. It's purpose was to help provide the technical data base required for the NBS Recycled Oil Program. In the study, six re-refined and four virgin lubricating oil basestocks were obtained monthly from different manufacturers. These oils, along with control samples, were characterized by 14 cooperating laboratories with over 50 different tests yielding over 65 different values per oil sample. The results and data analyses are compiled in a 500 page report, and are thought to be the most comprehensive ever obtained on lubricating oil basestocks.

711,292
PB84-236025
(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Chemical Stability and Tribology Group.
Multiple Regression Analysis: A Look Inside the ASTM/NBS (American Society of Testing and Materials/National Bureau of Standards) BCS (Basestock Consistency Study) Data.
S. J. Weeks, and S. M. Hsu. Jul 84, 2p
Included in Measurements and Standards for Recycled Oil-4, p93-94 1984.

Keywords: *Lubricating oils, *Regression analysis, Rheology, Physical properties, Chemical properties, Hydrocarbons, Performance evaluation, Sampling, Wear tests, Oxidation, *Oil wastes, *Waste recycling, Liquid wastes, Engine tests.

The ASTM/NBS Basestock Consistency Study was designed to assess the consistency of re-refined lubricating basestocks. Historically, the quality of a lubricant is defined by the ASTM engine sequence tests. For virgin base oils, the crude source and refining process are required to remain constant for quality control of the finished product. Concerns arose over the variability of the base oil when used oils were used as the feedstock for re-refining. These concerns necessitat-

ed a new evaluation of the consistency criteria for re-refined oils. The goal of the BCS work was to assess the consistency of re-refined base oils in comparison to corresponding characteristics of virgin base oils. The BCS compiled data of samples submitted monthly from four virgin and six re-refined base oil products. These samples were analyzed over a 13 month period by 14 cooperative laboratories. Over 55 tests were performed by more than one laboratory. The tests were grouped into six categories: (1) rheology; (2) physical properties; (3) chemical properties; (4) hydrocarbon type analyses; (5) general performance tests, and (6) oxidation and wear bench tests. Statistical methods were used to evaluate the significance of the BCS data.

711,293
PB84-236033
(Order as PB84-235902, PC **A14**/MF **A01**)
Amoco Chemicals Corp., Naperville, IL.
Consistency of Virgin Basestocks.
H. S. Golinkin. Jul 84, 14p
Included in Measurements and Standards for Recycled Oil-4, p95-108 1984.

Keywords: *Lubricating oils, *Viscosity, *Chemical analysis, Refining, Lubricants, Trends, Graphs(Charts), *Oil wastes, *Waste recycling, Liquid wastes.

The two main areas of concern in discerning the equivalency of re-refined and virgin lubricants are the establishment of criteria for evaluating re-refined and virgin basestocks, and the determination of variances that can be tolerated. As a supplier of additives to the lubricant industry, Amoco Chemicals Corporation receives many basestock samples each year. This paper will attempt to show the limits of variability observed for six broad viscosity grades of virgin basestocks over a seven-year period. Certain trends over this period are indicated. Single basestock variability from three suppliers will also be examined.

711,294
PB84-236041
(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Tribochemistry Group.
Evaluation of Test Methods for Physical Properties of Re-Refined Lubricating Base Oils.
S. J. Weeks, and S. M. Hsu. Jul 84, 15p
Included in Measurements and Standards for Recycled Oil-4, p109-123 1984.

Keywords: *Lubricating oils, *Physical properties, *Standards, Refining, Revisions, Gas chromatography, Petroleum products, Performance evaluation, Refractivity, Viscosity, Molecular weight, Boiling point, Density(Mass/volume).

ASTM standard test methods for determining physical characteristics of lubricating oil basestocks were selected, applied to re-refined base oils, and the results evaluated. The test methods evaluated were: color, viscosity, pour point, API gravity, density, flash point, boiling range distribution by gas chromatography, and refractive index. In addition, some properties derived from the above measurements were calculated. These included viscosity index, carbon distribution and structural group analysis by the n-d-M method, average molecular weight, and the viscosity-gravity constant. The evaluated test procedures were applied to most of the currently existing, commercially-available re-refined base oils. All of these standard test procedures except three were found to be acceptable when used with re-refined base oils. Modifications to the density, boiling range distribution and refractive index test methods were developed which made them acceptable for use with re-refined base oils. These modifications are described.

711,295
PB84-236058
(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Chemical Stability and Tribology Group.
Evaluation of Chemical Property Test Methods for Re-Refined Lubricating Base Oils.
A. L. Cummings, P. Pei, and S. M. Hsu. Jul 84, 14p
Included in Measurements and Standards for Recycled Oil-4, p125-138 1984.

Keywords: *Lubricating oils, *Standards, *Chemical properties, Revisions, Saponification, Refining, Petroleum products, *Oil wastes, Liquid wastes, Total acid number, Total base number, Total nitrogen.

Several standard test methods measuring chemical properties of lubricants were evaluated for use on re-refined lubricating basestocks. The methods evaluated included total acid number (TAN), total base number (TBN), total nitrogen, basic nitrogen, saponification number, and water. Except for the TAN and basic nitrogen test methods, some modifications were necessary for the test methods when applied to re-refined base oils. The evaluation and the modifications for each test method are described.

711,296
PB84-236066
(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Chemical Stability and Tribology Group.
Evaluation of Ashing Methods for the Determination of Total Metal Content of Lubricating Oil Basestocks.
J. J. Comeford, and S. M. Hsu. Jul 84, 16p
Included in Measurements and Standards for Recycled Oil-4, p139-154 1984.

Keywords: *Lubricating oils, *Metals, *Chemical analysis, *Ash content, Magnesium, Lead(Metal), Petroleum products, Revisions, Trace elements, *Oil wastes, *Waste recycling, Liquid wastes.

Ash from a petroleum oil is the residue, free of carbonaceous material, remaining after burning and ignition in air at a specified high temperature. Ash content of a re-refined oil provides a method for the determination of total metals resulting from wear or additive metals remaining after re-refining. Three ashing methods were evaluated for metal retention to ensure that the ash value reflects an oil's total metal content, including such metals as magnesium and lead which are volatile under the ashing conditions. The sulfated ash method (ASTM D874) was found to have good metal retention properties, and was modified to improve its precision in the low ash range.

711,297
PB84-236074
(Order as PB84-235902, PC **A14**/MF **A01**)
Pennsylvania State Univ., University Park. Dept. of Chemical Engineering.
Development and Use of the Microoxidation Test with Crankcase Oils.
E. E. Klaus, P. Shah, and V. Krishnamachar. Jul 84, 13p
Included in Measurements and Standards for Recycled Oil-4, p155-167 1984.

Keywords: *Lubricating oils, *Crankcases, *Oxidation, Comparison, Refining, Petroleum products, Molecular weight.

The Penn State microoxidation test has been used to evaluate a wide variety of mineral oil and synthetic lubricants. Techniques have been developed to use this test to study basestocks and finished formulations under bulk system and concentrated contact conditions. The microoxidation test also has been modified and adapted for use with re-refined and virgin base oils. This paper covers three specific projects. First, a modified microoxidation evaluation using steel and copper catalyst test cups has been used to provide a comparison of virgin and re-refined base oils. Second, conventional microoxidation tests have been used to evaluate fractions separated chromatographically from virgin and re-refined base oils. Some factions were produced by gravity percolation through a silica gel column and others by an HPLC separation on a column with packing similar to that from the gravity system. Third, a set of microoxidation test conditions have been developed to give good correlation with formulated mineral oil lubricants in the 3C and 3D engine sequence test.

711,298
PB84-236082
(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Metallurgy Div.
Evaluation of a Modified Timken Test for the Characterization of Motor Oils.
L. K. Ives, P. A. Boyer, and A. W. Ruff. Jul 84, 14p
Included in Measurements and Standards for Recycled Oil-4, p169-182 1984.

Keywords: *Lubricating oils, *Wear tests, Revisions, Refining, Loads(Forces), Performance evaluation, Laboratory equipment, *Timken test, *Oil wastes, *Waste recycling, Engine tests, Liquid wastes.

A modified version of the Timken method, ASTM D2782, for the determination of the load carrying capacity of lubricating fluids is described and evaluated. The modified method differs from the standard method primarily in that a very small volume of oil (0.2 ml) is used. The evaluation procedure consisted of applying the modified Timken method to a series of IIID engine sequence test reference oils having known performance characteristics. Good correlation was obtained between the modified Timken test results and documented IIID engine sequence test can plus lifter wear values. A similar correspondence was also found for VD engine sequence test reference oils. Good correlation with service data was obtained when the modified Timken method was applied to Royal Canadian Mounted Police Field Trial Oils. Results are also presented on the application of the method to commercial SF motor oils and to the determination of additive response of re-refined base oils.

711,299
PB84-236090
(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Chemical Stability and Tribology Group.
Development of a Step Loading Seizure Test for Engine Oil Additive Response.
R. S. Gates, and S. M. Hsu. Jul 84, 12p
Included in Measurements and Standards for Recycled Oil-4, p183-194 1984.

Keywords: *Lubricating oils, *Additives, *Wear inhibitors, Loads(Forces), Performance evaluation, Wear tests, Oxidation, Stability, Engine tests.

Additive response measures the effect of base oils on the performance of an additive or combination of additives. This study is concerned with measuring the effect of basestock composition on antiwear performance of oils with an SE/CC additive package. A step loading seizure that procedure using a four-ball wear tester was developed to measure the antiwear additive response of eighteen base oils. The procedures examined were: a step loading seizure test, and a thin film step loading seizure test with six microliters sample volume. The latter procedure combines oxidation and wear in a single test. Both test procedures have been shown to relate to engine wear experience. The conventional (10 ml) step loading seizure test procedure was found capable of measuring additive response only a very low additive concentrations. The microsample step loading seizure test procedure was able to measure differences in additive response among the base oils at the normal treat rate of 8.0 percent (wt.) additive package.

711,300
PB84-236108
(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Tribochemistry Group.
Differential Scanning Calorimetry Test Method for Oxidation Stability of Engine Oils.
S. M. Hsu, A. L. Cummings, and D. B. Clark. Jul 84, 14p
Included in Measurements and Standards for Recycled Oil-4, p195-208 1984.

Keywords: *Lubricating oils, *Crankcases, *Oxidation, Chemical stabilization, Performance evaluation, Degradation, Chemical reactions, Thermochemistry, Chemical reactions, *Differential scanning calorimetry, *Oil wastes, *Waste recycling, Chemical reaction mechanisms, Liquid wastes.

A laboratory bench test has been developed which measures oxidation stability of automotive crankcase lubricants under simulated engine conditions. The test employs a high-pressure, differential scanning calorimeter (DSC) to measure oxidation induction times in thin-film oil samples at 175C in 3.6 MPa oxygen. Engine chemistry is simulated by mixing the oil sample with oil-soluble metal naphthanates and oxidized nitrated gasoline. The DSC test ranks the relative oxidation stability of seven ASTM engine sequence IIID reference oils in the same order as the engine test does. The bench test requires less than an hour's time to perform, uses only 1 mg of sample, with an average 6 percent repeatability. Details of method development are discussed elsewhere. A copy of the paper is included as an appendix to this abstract.

711,301
PB84-236116

(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Chemical Kinetics Div.
Comparative Response of Re-Refined and Virgin Lube Oils to Additives by DSC (Differential Scanning Calorimetry).
J. A. Walker, W. Tsang, and L. Szegvary. Jul 84, 13p
Included in Measurements and Standards for Recycled Oil-4, p209-221 1984.

Keywords: *Lubricating oils, *Additives, *Antioxidants, Refining, Comparison, Petroleum products, Stability, Thermochemistry, *Differential scanning calorimetry, *Oil wastes, High pressure differential scanning calorimetry, Liquid wastes.

Earlier studies have demonstrated the capability of high pressure differential scanning calorimetry (HPDSC) for determining the propensity towards autoxidation of lubricating oils. This report is an extension of previous work and is focused on the following issues: (a) The consistency of basestocks produced over the course of a year, with special reference to the similarities and differences between re-refined and virgin basestocks. (b) The effect of the various components in the additive mixture on the intensity and time of response. (c) The response of various fractions of the basestocks to a particular additive. (d) The response of basestocks to different additive packages.

711,302
PB84-236124
(Order as PB84-235902, PC **A14**/MF **A01**)
Auburn Univ., AL. Dept. of Chemical Engineering.
Kinetic Studies for Waste Oil Demetallization.
A. R. Tarrer, R. Sachhathep, D. L. Vives, and L. J. Hirth. Jul 84, 17p
Included in Measurements and Standards for Recycled Oil-4, p223-239 1984.

Keywords: *Reaction kinetics, *Lubricating oils, Refining, Catalysts, Hydrogenation, Mathematical models, *Oil wastes, *Waste utilization, Liquid wastes, Ammonium phosphates, Numerical solution.

Research in waste oil re-refining was begun at Auburn University in January 1982. Major emphasis was placed on the development of kinetic parameters for demetallization using dibasic ammonium phosphate (DAP). In addition, studies were conducted in the area of hydrogenation accompanied be demetallization of waste oil using three types of guard catalysts. Thermal demetallization was also briefly investigated. The data obtained in the laboratory was used in the design fabrication and operation of a small re-refining unit recently started up in the Auburn area. Currently, the final product is a high quality fuel oil obtained at a capacity of 200,000 gallons/year. Future plans entail the addition of hydrotreating unit for the production of a high quality lube oil basestock. The experimental findings at Auburn will be of aid in the characterization of waste oils in terms of kinetic behavior and the prediction of operative parameters for their processing.

711,303
PB84-236132
(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Tribochemistry Group.
Re-Refined Lubricating Base Oil Characterization Using Liquid Chromatographic Techniques.
P. Pei, and S. M. Hsu. Jul 84, 15p
Included in Measurements and Standards for Recycled Oil-4, p241-255 1984.

Keywords: *Lubricating oils, *Chemical analysis, Refining, Separation, Chromatographic analysis, Petroleum products, Inpurities, Hydrocarbons, Infrared spectroscopy, Mass spectroscopy, Performance evaluation, *Oil wastes, *Waste recycling, Liquid wastes, Differential scanning calorimetry.

A separation scheme to characterize lubricating base oils in terms of molecular compound classes has been developed with the purpose of isolating and analyzing impurities in a re-refined base oil. The lubricating base oil is first separated into three major fractions--saturates, aromatics, and polars--using clay-gel liquid chromatography. The polars fraction is separated further into chemical compound classes having different polarities and functional structures. Analytical methods such as infrared and mass spectroscopy were used to elucidate the fundamental structures of the major fractions and compound classes in the polars subfractions. The saturate fraction consists mainly of paraffinic and cyclic paraffinic compounds. The aromatic fraction is composed of mono-, di-, and tri-aromatic compounds. Both poly-nuclear aromatic compounds and hydrocarbons with heteroatoms such as sulfur, halogen, and oxygen are present in the polar fraction.

711,304
PB84-236140
(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Chemical Stability and Tribology Group.
Evaluation of ASTM (American Society of Testing and Materials) D2007 Method for the Determination of Lubricating Oil Composition.
C. S. Ku, P. Pei, and S. M. Hsu. Jul 84, 13p
Included in Measurements and Standards for Recycled Oil-4, p257-269 1984.

Keywords: *Lubricating oils, *Chemical analysis, Hydrocarbons, Petroleum products, Refining, Viscosity, Separated, Solvent extraction, Infrared spectroscopy, Chromatographic analysis, *ASTM D2007 method, *Oil wastes, Liquid wastes, Procedures.

ASTM D2007, 'Characteristic Groups in Rubber Extender and Processing Oils by the Clay-Gel Adsorption Chromatographic Method,' and its variations are evaluated for lubricating base oils, both virgin and re-refined. The results are compared with the n-d-M method (refractive index, density, and molecular weight) and low resolution mass spectroscopy. ASTM D2007 is found to be acceptable for use with lubricating base oils, offering a rapid analytical procedure for classifying both virgin and re-refined base oils of various viscosity grades. Hydrocarbon types such as polar compounds, aromatics, and saturates are separated and characterized.

711,305
PB84-236157
(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Chemical Stability and Tribology Group.
Test Methods for Total Chlorine in Lubricating Base Oils.
P. Pei, R. Fleming, and S. M. Hsu. Jul 84, 15p
Included in Measurements and Standards for Recycled Oil-4, p271-285 1984.

Keywords: *Lubricating oils, *Chlorine, *Trace elements, *Chemical analysis, Refining, Petroleum products, Quality control, *Oil wastes, Liquid wastes.

Chlorine in trace quantities usually can be found in re-refined lubricating base oils. While the effects of chlorine on performance is not clear at this time, a method to measure chlorine accurately as a means of quality control is needed. Five analytical methods for the determination of chlorine in lubricating base oils were studied. They are: ASTM D-808, an oxygen bomb method; ASTM D-1317, a sodium alcoholate method; the Microcoulometric Titration method (MCT); X-ray Fluorescence (XRF); and Neutron Activation Analysis (NAA). The first three method (ASTM D808, D1317, and MCT) are not specific for chlorine but are generally used for chlorine measurement assuming that halogens other than chlorine are absent. The last two methods (XRF and NAA) are chlorine specific.

711,306
PB84-236165
(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Tribochemistry Group.
Thin-Film Oxygen Uptake Test for the Evaluation of Automotive Lubricants.
C. S. Ku, and S. M. Hsu. Jul 84, 10p
Included in Measurements and Standards for Recycled Oil-4, p287-296 1984.

Keywords: *Lubricating oils, *Automobiles, *Crankcases, Lubricants, High temperature tests, Revisions, Laboratory equipment, Viscosity, Oxidation, Catalysts, *Thin film oxygen absorption test, Rotary bomb oxidation test apparatus, Engine tests.

A thin-film, oxygen absorption test has been developed for the evaluation of automotive lubricants using a standard Rotary Bomb Oxidation Test apparatus (RBOT) with simple modifications. The test measures the induction time of the lubricant under test conditions which simulate high temperature oxidation process in automotive engines. Effects of oxidized fuel components and metal catalyses as well as the effect of hydrolysis on oil oxidation were considered. Test results on the ASTM engine sequence IIID reference oils suggested qualitative correlation with engine viscosity increase data. Additional commercial oils were also tested and the results fell within the reference oil ranges. The paper has been published elsewhere and a copy of the paper is included as an appendix to this abstract.

711,307
PB84-236173
(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Chemical Stability and Tribology Group.
Thin-Film Oxidation Test: Relationship between Composition and Additive Response for Re-Refined Oils.
C. S. Ku, and S. M. Hsu. Jul 84, 12p
Included in Measurements and Standards for Recycled Oil-4, p297-308 1984.

Keywords: *Lubricating oils, *Additives, *Chemical analysis, Refining, Oxidation, Stability, Chemical stabilization, Hydrocarbons, Performance evaluation, Specifications, Standards, *Oil wastes, *Thin film oxygen absorption test, Engine tests.

Sixteen re-refined lubricating base oils from various manufacturing processes were examined for oxidation stability using a NBS thin film oxygen uptake test. The oils were tested with a commercial SE/CC detergent-inhibitor additive package. Correlations among oxidation stability and chemical composition parameters such as saturates, aromatics, polars, sulfur, chlorine, and total nitrogen content were investigated. The key components that appear to affect oxidation stability of re-refined base oils were found to be sulfur, total polar constituents and percent of saturated hydrocarbons.

711,308
PB84-236181
(Order as PB84-235902, PC **A14**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Recycled Oil Program.
NBS (National Bureau of Standards) Provisional Tests for Re-Refined Engine Oil.
D. A. Becker, and S. Hsu. Jul 84, 9p
Included in Measurements and Standards for Recycled Oil-4, p309-317 1984.

Keywords: *Lubricating oils, *Standards, *Specifications, Refining, Additives, Crankcases, Performance evaluation, *Oil wastes, *Waste recycling, Engine tests, Liquid wastes, Waste utilization.

In Section 383(c) of the Energy Policy and Conservation Act of 1975 (42 U.S.C. 6363(c)), the Congress of the United States stated the following: 'As soon as practicable after the date of enactment of this Act, the National Bureau of Standards shall develop test procedures for the determination of substantial equivalency of re-refined or otherwise processed used oil or blend of oil, consisting of such re-refined or otherwise processed used oil and new oil or additives, with new oil for a particular end use.' The National Bureau of Standards (NBS) completed test procedures for recycled oil used as burner fuel in 1978. This present paper, together with other papers delivered at this conference and in other publications, summarizes NBS efforts to provide a coherent methodology for establishing the substantial equivalency between re-refined and virgin engine crackcase oils. Further, this paper describes a set of proposed provisional test procedures which can be used to establish the consistency of re-refined engine crankcase oil.

711,309
PB84-242916 Not available NTIS
National Bureau of Standards, Washington, DC.
Interactions of Additives and Lubricating Base Oils.
Final rept.
S. M. Hsu, and R. S. Lin. 1983, 9p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in SAE (Society of Automotive Engineers) Technology Paper 831683, p51-59 1983.

Keywords: *Lubricating oils, *Additives, *Crankcases, Dispersants, Detergents, Oxidation, Stability, Antioxidants, Temperature, Reprints.

Automotive lubricating oils consist of base oils and a variety of chemical additives. In this study, interactions among an antioxidant (ZDDP), a dispersant (succinimide), and a detergent (calcium sulfonate) are studied in terms of oxidation stability. Oxidation tests were conducted at 60C and 160C using the free radical titra-

tion test and the thin film oxygen uptake test respectively. Complex chemical interactions in terms of oxidation stability were found among the additives, as well as the additives with the polar species in the base oil. Optimum oxidation concentrations for some of the additives were observed. The effects of temperatures on the interaction were also described.

711,310
PB85-100360 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Aromatic Impurities on the Positive Streamer Growth in Marcol 70.
Final rept.
R. E. Hebner, E. F. Kelley, G. J. FitzPatrick, and E. O. Forster. Jun 84, 4p
Pub. in Proceedings of 1984 IEEE International Symposium on Electrical Insulation, Montreal, Canada, June 11-13, 1984, p284-287.

Keywords: *Insulation, *Impurities, *Electrical faults, Dielectric properties, Insulating oil, *Aniline/dimethyl, *Marcol 70 fluids.

The growth of positive streamers has been photographed in Marcol 70 in the presence and the absence of dimethylaniline (DMA). Marcol 70 is a fluid which is chemically similar to transformer oil but with the aromatic components removed. This combination has been studied previously by other authors, and was chosen for this work, because it should provide useful information on the contribution of aromatic components to the electrical properties of transformer oil. As in earlier studies, it was noted that the positive streamers initially propagate at or near sonic speed. After the streamer has propagated some distance across the inter-electrode gap, a supersonic secondary streamer develops that leads to breakdown. The initiation of this second event is significantly delayed by DMA. As in earlier studies in n-hexane, the reason for this behavior is assumed to be structural changes in the streamers because of the low ionization potential of DMA. These structural changes, in turn, lead to a modification of the electric field distribution between the positive streamer tips and the plane cathode. Information derived from the photographs suggests that the field distribution changes from a very nonuniform to a more uniform one, which would lead to the observed higher breakdown voltages. The data presented are not in complete agreement with those reported in the literature. This disagreement is believed to be attributable to experimental differences.

711,311
PB85-196103 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of an Oxidation-Wear Coupled Test for the Evaluation of Lubricants.
Final rept.
R. S. Gates, and S. M. Hsu. 1984, 7p
Pub. in Lubrication Engineering 40, n1 p27-33 Jan 84.

Keywords: *Wear tests, *Oxidation, *Lubricants, *Degradation, Separation, Reprints.

Lubrication usually involves complex interactions between lubricant and metal surfaces under oxidizing conditions. The effects of lubricant degradation/oxidation on friction and wear are not well understood. Normal simulation of actual engine or bearing conditions usually examine wear and oxidation separately. Sometimes misleading conclusions are drawn. A thin-film micro-sample wear test has been developed using a four-ball wear tester in which the lubricant is subjected to oxidizing conditions and the time to seizure is measured. This measures both the friction and wear characteristics as well as the oxidation resistance of the lubricant. The test has been found useful in simulating ASTM engine sequence IIID wear test.

711,312
PB85-196178 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Lubrication Mechanism of SbSbS4.
Final rept.
J. S. Harris, L. K. Ives, and M. B. Peterson. 1982, 2p
Sponsored by Electron Microscopy Society of America, Oak Ridge, TN.
Pub. in Proceedings of Annual Meeting of the Electron Microscopy Society of America (40th), Washington, DC, August 9-13, 1982, p530-531.

Keywords: *Solid lubricants, *Lubricant additives, *Wear tests, Blends, Electron microscopy, Experimental design, *Antimony thioantimonate.

Recent laboratory investigations have reported that SbSbS4 is a promising solid lubricant when blended with several fluid lubricants. A series of different wear tests were conducted to determine the conditions and limits within which SbSbS4 functions as a lubricant. Results of these tests together with scanning and transmission electron microscopy analyses of worn surfaces on AISI 52100 steel were used to investigate the mechanism of lubrication. It was determined that SbSbS4 does not function as a solid lubricant at temperatures below about 225C. As an additive in lithium grease the lubricating mechanism of SbSbS4 is complex involving the formation of a solid film of SbSbS4 as well as the release of sulfur and its reaction with the steel surface.

711,313
PB86-111028 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Evaluation of a New Wear Resistant Additive - SbSbS4.
Final rept.
L. K. Ives, J. S. Harris, and M. B. Peterson. 1983, 7p
Pub. in Proceedings of Wear of Materials, Reston, VA., April 11-14, 1983, p507-513.

Keywords: *Wear resistance, *Lubricant additives, *Greases, Electron microscopy, Performance evaluation, Lithium, *Antimony thioantimonate.

The addition of solid SbSbS4 powder to conventional lubricating base greases has been shown to result in reduced wear and a significant increase in load carrying capacity. In this investigation the antiwear behavior and response mechanisms of SbSbS4 when used as an additive to a lithium base grease are studied. Comparative block and ring tests were carried out on lithium base grease and on the base grease with separate additions of 5 wt% SbSbS4, and 0.43 wt% S. The tests were conducted under boundary lubrication conditions at a load of 267 N and a sliding speed of 5 cm/s utilizing 52100 steel specimen materials. Addition of 5 wt% SbSbS4 resulted in a reduction in wear rate by more than an order of magnitude compared to the base grease. The same effect, however, was achieved by the addition of 0.43 wt% S. This finding together with the identification of iron sulfide films on wear scar surfaces after lubrication with both SbSbS4 and S containing greases, indicated that the response of SbSbS4 was associated with the release of S and its reaction with the steel surface. The surface film studies described were carried out by means of analytical electron microscopy.

711,314
PB86-119344 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Role of Iron and Copper in the Oxidation Degradation of Lubricating Oils.
Final rept.
D. B. Clark, E. E. Klaus, and S. M. Hsu. 1985, 8p
Pub. in Lubrication Engineering 41, n5 p280-287 May 85.

Keywords: *Lubricating oils, *Oxidation, *Iron, *Copper, *Surface chemistry, Reaction kinetics, Metal containing organic compounds, Reprints, *Chemical reaction mechanisms.

In lubricant degradation, the role of metal surfaces in oxidation mechanisms has long been a subject of extensive study. In particular, copper and iron surfaces have been studied most frequently. However, data in the literature suggest both prooxidant and inhibiting characteristics for copper. A thin film microoxidation technique was used in this study to examine the role of copper and iron surfaces in the degradation process of lubricants. Metal analysis of the oxidized oil reveals that organometallic compounds are formed as a result of the lubricant-surface interactions. Different high-molecular-weight-reaction products from iron, copper, and glass result in varying effects on oxidation rates. This observation helps to explain the observed inhibiting effects and the prooxidant effects of copper in different systems. Iron has been found to promote oxidation much faster than copper.

711,315
PB86-138591 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Solid Lubrication of Steel by SbSbS4.
Final rept.
L. K. Ives, and M. B. Peterson. 1984, 12p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of Meeting of the Mechanical Failures Prevention Group (37th), Gaithersburg, Maryland, May 10-12, 1984, p208-219.

Keywords: *Solid lubricants, Steels, Antimony inorganic compounds, Antimonates, Friction, Wear, *Antimony thioantimonate.

The lubricating behavior of the amorphous solid, antimony thioantimonate (SbSbS4), in the form of a dry powder and as compressed pellets is investigated and compared to MoS2 and several other sulfides. The friction and wear response of the dry powders was determined by utilizing a three-pin-on-disk test configuration. Pins were of 52100 steel and disks were of 0-2 tool steel. Sliding experiments with compressed pellets of SbSbS4, MoS2, Sb2S3, FeS2, and Fe0,9S were used to study the friction, film forming, shear, and adhesion characteristics of the solid lubricant materials in the absence of metal to metal contact. A pin-on-ring configuration was employed with 52100 steel rings. The lubrication mechanism of SbSbS4 is discussed on the basis of the results of these experiments. Simple models of solid film lubrication are presented to assist in the analysis.

711,316
PB86-241742 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Lubricants.
Final rept.
S. M. Hsu. 1986, 8p
Pub. in Encyclopedia of Materials Science and Engineering, v4 p2584-2591 1986.

Keywords: *Lubricants, Lubricant additives, Reprints.

Lubricants can be defined as any material which reduces friction and/or controls wear between interacting surfaces in relative motion. A lubricant functions by preventing the collision of surface asperities on opposing surfaces and can be in the form of gas, liquid or solid. There are numerous lubricants, each is specifically designed to meet certain requirements in an application. These lubricants will be described from a material standpoint.

711,317
PB88-152699 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Effect of Solid Additives on Wear by Greases Containing Abrasive Particles.
Final rept.,
L. K. Ives, and M. B. Peterson. 1985, 9p
Pub. in Proceedings of International Conference on Wear of Materials, Vancouver, BC, Canada, April 14-18, 1985, p355-363.

Keywords: *Greases, *Additives, Lubricants, Abrasion, Wear, Particles, Molybdenum disulfide, Antimonates, Sulfur inorganic compounds, Reprints, Antimony thioantimonate.

The effect of additions of SbSbS4 and MoS2 on wear with greases containing abrasive particles (1 wt.% AC dust) has been investigated. Three greases were examined, a lithium 12-hydroxystearate thickened grease, and two clay thickened greases meeting Mil-G-24139 and Mil-G-81322C specifications. Wear tests were conducted with a machine utilizing a rotating pin on disk configuration.

Materials Degradation & Fouling

711,318
PB-267 228/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Particle Erosion Measurements on Metals,
J. P. Young, and A. W. Ruff. Apr 77, 5p
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Fossil Energy Program.
Pub. in Jnl. Eng. Mater. Technol., v99 p121-125 Apr 77.

Keywords: *Wear tests, *Erosion, *Metals, Particles, Measurement, Iron alloys, Nickel alloys, Test equipment, Reprints.

A method being used to measure the erosive wear of metals at different temperatures and under controlled environmental conditions is described. A commercial apparatus has been modified that can be used for tests at 500C and above and over a wide range of particle types, sizes, velocities and concentrations. Test results from several iron and nickel base alloys are presented. Particular interest has been placed in the role of the oxide scale, in the particle velocity dependence and the angular dependence of erosion rates, and in the effect of varying particle concentration in the beam. Reproducibility among the tests of about 10% can be realized if care is exercised with regard to several important experimental parameters.

711,319
PB-274 986/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Erosion Measurements on Metals at Elevated Temperatures.
Final rept.,
A. W. Ruff, J. P. Young, and L. K. Ives. 1976, 5p
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Fossil Energy Program.
Pub. in Proceedings of International Conference on Mechanical Behavior of Materials (2nd), Boston, Mass. 16-20 Aug 76.

Keywords: *Erosion, *Wear, *Stainless steels, *Nickel alloys, Erosion Corrosion, High temperature tests, Impingement, Metals.

Studies have been conducted on the erosive wear of metals resulting from solid particle impingement under various environmental conditions at elevated temperatures. Specimens of several stainless steel and nickel alloys were exposed to a particle-gas stream. The particle flux; angle of attack; particle velocity, size, and type; surface temperature and other variables were controlled.

711,320
PB-275 016/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Erosion of 310 Stainless Steel at 975 C in Combustion Gas Atmospheres.
Final rept.,
L. K. Ives. Apr 76, 7p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Jnl. of Eng. Mater. Technol., v99 p126-132 Apr 77.

Keywords: *Stainless steels, *Erosion corrosion, Combustion chamber gases, Impingement, High temperature tests, Wear, Reprints, Steel 310.

Erosion tests were conducted on 310 stainless steel in combustion gas atmospheres at 975C. SiC erosion particles of 100 mesh size were employed over a velocity range of 15 to 70 m/s at a 90 degree angle of impingement. A comparison is made with results obtained at 25C in air using the same test equipment. Scanning electron microscopy examination of the eroded surfaces revealed important information concerning the nature of the erosion-corrosion process. A multiple alloy component test specimen is described for application in intercomparing alloys under nearly identical test conditions.

711,321
PB-281 563/7 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Structures, Materials and Safety Div.
Effects of Herbicides on Masonry.
Final rept.,
J. E. Fearn. May 78, 24p NBSIR-78-1449
Sponsored in part by National Park Service, Washington, D.C.

Keywords: *Herbicides, Masonry, *Degradation, Corrosion, Construction materials, Plants(Botany), Chemical reactions.

In preserving historic structures, the control of obnoxious vegetation is a serious problem. To deal with this problem, a number of organic herbicides have been developed by industry. The efficacy of herbicides in the control of plant life has been studied to a great degree; but heretofore, very little has been reported about the possible effects of these chemical plant killers on the materials they are designed to protect. In this work, an exhaustive survey of pertinent literature has been undertaken. Obtaining very little specific information from literature, a correlation has been drawn between the effects of masonry of materials similar in chemistry to herbicides and the effects that would be expected from the herbicides themselves. Methods for checking the validity of conclusions are suggested.

711,322
PB-281 910/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Brittle Fracture in a Ductile Material with Application to Hydrogen Embrittlement.
Final rept.,
R. Thomson. 1978, 15p
Pub. in Jnl. of Materials Science 13, p128-142 1978.

Keywords: *Hydrogen embrittlement, *Fractures(Materials), Steels, Fracture properties, Toughness, Reprints.

A physical model of fracture in materials is developed which features a brittle crack imbedded in a plastically deformed medium. This model is presented as an alternative to fully ductile failure by hole growth, and general criteria for the two alternatives are discussed. One of these criteria for the existence of an atomically sharp crack is that the dislocation content near the crack tip be limited by the inhomogeneous character of dislocation slip in the crystal. With the dislocation distribution characteristic of Mode III fracture, we derive expressions for the fracture toughness as a function of material parameters. We have extended the theory to the case of hydrogen embrittlement in steels and compare our theoretical predictions with experimental work by others.

711,323
PB-291 988/4 PC **A06**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Center for Materials Science.
Erosion by Solid Particle Impact.
Interim rept.
A. W. Ruff, and S. M. Wiederhorn. Jan 79, 105p
NBSIR-78-1575
Sponsored in part by Office of Naval Research, Arlington, VA.

Keywords: *Erosion, *Metals, *Ceramics, Particles, Impact, Microstructure, Theory, Wear, Reviews.

A review of the methods and findings associated with solid particle impact erosion of metals and ceramics is presented. Modern theories of particle erosion and critically reviewed experimental observations are brought together and compared. Conclusions regarding the present state of understanding of erosion are given.

711,324
PB80-107360 Not available NTIS
National Bureau of Standards, Washington, DC.
Erosion by Solid Particle Impact.
Final rept.,
A. W. Ruff, and S. M. Wiederhorn. 1979, 58p
Pub. in Treatise Materials Science Technology 16, p69-126 1979.

Keywords: *Erosion, Impact, Particles, Metals, Ceramics, Reprints.

A review of the methods and findings associated with solid particle impact erosion of metals and ceramics is presented. Modern theories of particle erosion and critically reviewed experimental observations are brought together and compared. Conclusions regarding the present state of understanding of erosion are given.

711,325
PB81-142960 Not available NTIS
National Bureau of Standards, Washington, DC.
Sliding Wear of Metals.
P. J. Blau. Aug 80, 2p
Pub. in Materials Engineering 92, n2 p56-57 Aug 80.

Keywords: *Copper alloys, *Wear, Metals, Friction, Microstructure, Reprints.

This paper briefly reviews several recent models for sliding wear of metallic materials. These include a systems approach to wear, the delamination theory, a fracture mechanics approach, an oxidational wear model and a crystal plasticity model.

711,326
PB81-144222 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements and Standards for Dry Wear.
A. W. Ruff. 1979, 4p
Pub. in Proceedings of National Symposium on Wear and Corrosion, Washington, DC., June 1979, 4p.

Keywords: *Wear, Standards, Measurement, Metals.

The needs for improved capability in accurately determining the wear rates of materials will be discussed. Activities currently underway to develop and provide reference materials for wear testing, to improve wear measurement procedures and to obtain meaningful wear data will be described. A comparison will be attempted in the current state-of-the-art between wear and corrosion.

711,327
PB81-144321 Not available NTIS
National Bureau of Standards, Washington, DC.
Introductory Remarks on Erosion.
A. W. Ruff. 1979, 10p
Pub. in Proceedings of NACE Conference on Corrosion/Erosion of Coal Conversion System Materials, Berkeley, CA., January 24-26, 1979, p383-392.

Keywords: *Erosion, Particles, Deformation, Reviews, Metals.

The status of the science of solid particle erosion of materials is reviewed briefly. Examples of recent studies of single particle and also multiple particle exposures are given. Suggestions of critical needs in the field are presented.

711,328
PB81-211609 Not available NTIS
National Bureau of Standards, Washington, DC.
Observations on the Wear-In Process during the Sliding of Several Copper Alloys Against 52100 Steel.
Final rept.
P. J. Blau. 1981, 6p
Proceedings of the International Conference on Wear of Materials (3rd) held at San Francisco, CA., on March 30-April 2, 1981.
Pub. in Wear of Materials--1981, p69-74 1981.

Keywords: *Wear, Copper alloys, Steels, Friction, Copper, Copper alloy 7Al, Sliding contacts, Copper alloy 15Ag, Steel 52100, NTISCOMNBS.

The changes in the surface and subsurface microstructures which occur in early stages of metal sliding contact may set the stage for longer term friction and wear behavior. The current paper presents the results of a study of the friction and wear break-in behavior of Cu, Cu-7wt%Al, and Cu-15wt%Ag rubbing against fixed 52100 steel ball bearing sliders in a stroke-by-stroke linear wear test device. Friction was measured at 81 locations on each wear track and plotted by computer to reveal the frictional 'histories' of the given locations. The development of variations in the frictions traces was correlated with microstructure of the worn tracks to clarify the effects of previous sliding history on surface deterioration in the tested materials. Sliding behavior in air, flowing argon and distilled water was reported for Cu.

711,329
PB82-130022 Not available NTIS
National Bureau of Standards, Washington, DC.
Interpretations of the Friction and Wear Break-in Behavior of Metals in Sliding Contact.
Final rept.
P. J. Blau. 1981, 15p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Wear 71, p29-43 1981.

Keywords: *Metals, *Wear, *Sliding friction, Steels, Bronzes, Friction, Reprints.

Studies of wear and friction transient behavior during early periods in metal sliding can lead to useful insights. Such break-in studies may help to identify the relative roles of competing processes which reach a balance during longer term sliding situations. Interpretations may be facilitated by considerations which compare friction curve shapes, changes in friction during break-in and the relative durations of friction and wear break-in periods. Data for dry sliding of 1015

steel, a high strength low alloy steel, 0-2 tool steel and two Cu-Al alloys are presented in several formats to emphasize differences and similarities in break-in behavior.

711,330

PB84-223338 Not available NTIS
National Bureau of Standards, Washington, DC.
Fracture Mechanics.
Final rept.
R. L. Tobler, and H. I. McHenry. 1983, 26p
Pub. in Materials at Low Temperatures, Chapter 8, p269-294 1983.

Keywords: *Cryogenics, Fracture strength, Crack propagation, Fatigue(Materials), Alloys, *Fracture mechanics.

A tutorial review of fracture mechanics as it applies to cryogenics is presented. The fracture toughness and fatigue crack growth parameters of structural alloys and other materials are described at temperatures ranging from 300 to 4 K. Attention focuses on measurement methods, data trends, correlations and qualitative prediction. Fracture mechanics techniques and applications are also discussed.

711,331

PB84-223346 Not available NTIS
National Bureau of Standards, Washington, DC.
Elastic-Plastic Analysis of Surface Flaws Using a Simplified Line-Spring Model.
Final rept.
R. B. King. 1983, 15p
Sponsored in part by Department of Transporation, Washington, DC. Office of Pipeline Safety Regulation.
Pub. in Engineering Fracture Mechanics 18, n1 p217-231 1983.

Keywords: *Cracks, *Mathematical models, *Surfaces, Plates(Structural members), Shells(Structural forms), Pipes(Tubes), Steels, Elastic properties, Plastic properties, Reprints, *Fracture mechanics, J integral.

The line-spring model has proven to be an effective tool for evaluating fracture parameters in surface-cracked plates and shells. However, application of the model requires detailed numerical computations, necessitating the availability of a specialized computer code. For approximate engineering calculations a version of the model which is more convenient to implement computationally, would be useful. In this paper a simplified line-spring model is presented along with detailed illustration of its application. The simplification is accomplished by replacing the crack front with a crack of constant depth and treating the ligament 'spring' as elastic perfectly plastic. Despite its simplicity, the model gives reasonably accurate predictions of fracture parameters, such as the J-integral or crack opening displacement (COD) at the root of surface cracks. This will be demonstrated by comparing analytical results for J and COD with previously published experimental data for surface-cracked steel plates.

711,332

PB84-223783 Not available NTIS
National Bureau of Standards, Washington, DC.
Dislocation-Shielding Analysis of a Blunt-Notched Brittle Crack Embedded in a Ductile Material.
Final rept.
I. H. Lin. 1983, 4p
Pub. in Proceedings of ICF Int. Symposium Fracture Mechanics, Beijing, China, November 22-25, 1983, p951-956.

Keywords: *Fracture strength, Cracks, Dislocations(Materials), Models, Predictions, Fracture mechanics.

A fracture model of a blunt-notched brittle crack embedded in a plastically deformed ductile medium is developed. An elastic enclave separates the notched tip from the plastic zone that is generated by the dislocations created within this zone. Effects of the notch-root radius and material parameters on the fracture toughness are predicted. The predicted fracture toughness is consistent with experimental observations.

711,333

PB84-224013 Not available NTIS
National Bureau of Standards, Washington, DC.
Actual Versus Predicted Stresses during Particle Erosion: Observations on Dislocation Cells as a Tool for the Study of Sub-Surface Stresses Accompanying Erosion and Wear Damage.
Final rept.
D. Kuhlmann-Wilsdorf, L. K. Ives, and A. W. Ruff.
Sep 83, 7p
Pub. in Proceedings of Int. Conference on Erosion by Liquid and Solid Impact (6th), Cambridge, England, September 4, 1983, p42.1-42.7.

Keywords: *Dislocations(Materials), *Stresses, *Wear, *Copper, Erosion, Particles, Damage.

Studies of the dislocation structure underneath the surfaces of test samples can greatly aid in the understanding of the deformation processes accompanying damage due to erosion or wear. A little recognized aspect of this is the fact that a unique relationship exists between the average dislocation cell diameter and the flow stress which produced the deformation. Measurements of the cell diameter therefore reveal the sub-surface stresses during the damaging process, provided only that no subsequent recrystallization intervened. Application of this technique to earlier measurements of cell sizes in OFHC copper bombarded with irregular alumina particles of about 50 micrometer diameter and impact angles of 90 degrees and 20 degrees with velocities of 60 m/s and 20 m/s yielded a simple functional dependence of the sub-surface flow stress on those parameters and depth below the surface. This paper calculates an expected functional dependence which is then compared with the measurements; some significant differences are found. A number of further experiments are suggested to clear up this discrepancy.

711,334

PB84-225465 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Flat-On-Ring Sample Alignment on Sliding Friction Break-In Curves for Aluminum Bronze on 52100 Steel.
Final rept.
P. J. Blau, and E. P. Whittenton. 1984, 10p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Wear 94, p201-210 1984.

Keywords: *Aluminum bronzes, *Steels, *Sliding friction, *Wear, Reprints.

The effects of test sample fixturing on the interpretation of frictional break-in behavior are described for dry sliding flat-on-ring tests of CDA 688 bronze on 52100 steel. It is demonstrated that for otherwise similar test conditions (i.e. 10 N load, 20 cm/s velocity, 1 micrometer polished block surfaces, flowing Ar gas surroundings), tilt of the fixed flat block can affect the break-in duration for friction and for wear due to the rate at which a balance of steady state sliding surface contact conditions is achieved.

711,335

PB85-140689 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chemical Degradation of Castable Refractories in Coal Gasification Process Environments.
Final rept.
C. R. Robbins, and F. A. Mauer. 1981, 11p
Pub. in Jnl. of Materials for Energy Systems 3, n1 p32-42 Jun 81.

Keywords: *Coal gasification, *Castable refractories, *Degradation, X ray diffraction, Pilot plants, Laboratories, Reprints.

Reactions and transformations that result in chemical degradation of castable refractories used as liners for coal gasification reactors have been studied. In addition to phase analysis of laboratory and pilot plant specimens by conventional x-ray powder diffraction, a new test method was developed that permits changes in the phase composition to be observed without removing the specimen from the test atmosphere. Frequent changes in the bonding phases, and intervals in which a bonding phase was in transition were observed in the case of the high purity castable refractory. The silica-containing refractory, on the other hand, formed bonding phase which were stable in steam over a large range of temperatures and pressures.

711,336

PB85-184646 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Monitoring the Sliding Contact Conditions in Laboratory Wear Tests of Metals Using Time-Dependent Variations in Friction Coefficients.
Final rept.
P. J. Blau. 1982, 10p
Pub. in Proceedings of Conference on Time-Dependent Failure Mechanisms and Assessment Methodologies, Gaithersburg, MD, April 20-22, 1982, p145-154.

Keywords: *Wear, Friction, Metals, Monitoring, Wear tests, Reprints.

The concept of monitoring sliding conditions by observing changes in friction coefficient (i.e. friction forces) may lead to improved reproducibility in laboratory testing as well as to a better knowledge of basic sliding processes. This approach involves the identification and characterization of friction coefficient versus time (or cycles, or distance) curves. It also involves detailed microscopy of metal sliding contact surfaces which have been subjected to dry wear conditions. Systematic analysis of data for various metals and alloys sliding under similar controlled conditions has shown quite different running-in behavior. The balance of dominant wear processes was seen to influence the friction curve 'signatures'. Several examples of friction coefficient variation analysis for dry sliding of metals will be given.

711,337

PB85-195972 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characterization of Wear Surfaces and Wear Debris.
Final rept.
A. W. Ruff, L. K. Ives, and W. A. Glaeser. 1981, 55p
Sponsored by American Society for Metals, Metals Park, OH., and Metallurgical Society of AIME, Warrendale, PA.
Pub. in Fundamentals of Friction Wear of Materials, Pittsburgh, PA., October 4-5, 1981, Papers presented at the 1980 ASM Materials Science Seminar, p235-289.

Keywords: *Wear, Surface properties, Copper, Steels, Debris.

The paper describes the type of information that can be obtained from the characterization of worn specimens and the debris particles produced during wear. There are actually three potential sources for data and information - the worn surface, the subsurface volume, and the wear debris particles. The paper describes three different experiments carried out to develop an improved understanding of the wear of metals. In each case, the characterization methods applied were able to contribute necessary information to better understand the complete processes involved.

711,338

PB86-111994 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Analysis of Interlaboratory Test Results of Solid Particle Impingement Erosion.
Final rept.
A. W. Ruff. 1985, 7p
Pub. in Wear of Materials 1985, p654-660 1985.

Keywords: *Erosion, Impingement corrosion, Tests, Steels, Measurements, Test equipment, Particles.

During the development of a standard method for solid particle impingement erosion testing of materials, a number of interlaboratory test comparisons were conducted. The paper describes the results of four test series involving twelve laboratories in total. The measurements were carried out with considerable care using the gas jet type of erosion tester, involving nearly the same conditions and test parameters on two different materials, a low carbon steel and a stainless steel.

711,339

PB86-124781 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Understanding Materials Reliability - The Mechanisms of Fracture.
Final rept.
R. M. Thomson. 1980, 8p
Pub. in DARPA/AFML (Defense Advanced Research Projects Agency/Air Force Materials Lab.) Review of Progress in Quantitative Nondestructive Evaluation, La Jolla, CA., July 8-13, 1979, p159-166 1980.

Keywords: *Fractures(Materials), Fracture properties, Brittleness, Fatigue(Materials), Ductility, Plastic properties, *Fracture(Mechanics), Nondestructive evaluation.

For the benefit of the NDE community, a personal view will be given of the current status of our understanding of materials fracture. The discussion will include a general description of the physical and chemical processes which occur when a solid under load possesses a crack. A physical picture is presented of the role of plasticity. The basic question of ductile vs brittle response of the solid is addressed and recent ideas and progress is reviewed. Time dependence, and its manifestation in materials fatigue are briefly described. The implications for NDE are on two levels: (1) new insight generated by fundamental advances in the science of materials reliability will lead to new NDE tools; and (2) NDE techniques can and should be applied to further the fundamental understanding of reliability.

711,340
PB86-132628 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Wear Testing and Standardization.
Final rept.
P. J. Blau. 1985, 3p
Pub. in ASTM (American Society for Testing and Materials) Standardization News, p34-36 Oct 85.

Keywords: *Wear tests, Standardization, Wear, Friction.

Wear exacts a high cost in our economy. Its many forms affect most technological disciplines. To improve control and reduction of wear, research and development programs need to use wear testing methods of many kinds. Standardization to only a few basic tests may not be possible due to the diversity of wear modes. Use of simple, linear wear constants from laboratory tests may lead to unrealistic representations of actual component behavior. More advanced, multimode wear tests and analytical models for wear mechanisms need to be developed to improve relating laboratory testing data to field performance. ASTM can serve an important role by promoting multimode wear testing procedure development, improvements in standard terminology, and methods for reporting data.

711,341
PB86-189156 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Wear and Related Materials Degradation.
Final rept.
A. W. Ruff. 1984, 53p
Pub. in Industrial Materials Science and Engineering, p299-351 1984.

Keywords: *Wear, Ceramics, Erosion, Friction, Metals, Polymers, Reprints.

A review is presented of the principal considerations concerning wear and erosion of materials. Fundamental mechanisms of wear processes in different materials are described along with theoretical developments that attempt to predict wear rates. Three different research topics in wear of materials are also summarized, involving surface modification and microstructural effects on wear.

711,342
PB86-189701 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Interfacial Forces and the Fundamental Nature of Brittle Cracks.
Final rept.
B. R. Lawn. 1985, 3p
Pub. in Applied Physics Letters 47, n8 p809-811, 15 Oct 85.

Keywords: *Brittle fracturing, Crack propagation, Adhesion, Reprints.

A new conception of brittle fracture processes is presented. It is proposed that the crack-tip structure is immutably sharp at the atomic level, such that the attendant growth laws are uniquely determined by the stress intensity factor K of 'fracture mechanics' origin. Threshold features in the measured v(K) function for crack growth in interactive environments, previously put forward as evidence for fundamental changes in the tip structure by blunting, are shown to be more consistent with a negative K contribution from interfacial adhesive forces. These adhesive forces should be determinable from the crack velocity characteristics.

711,343
PB86-201373 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Study of the Friction and Wear Behavior of Titanium under Dry Sliding Conditions.
Final rept.
S. R. Nutt, and A. W. Ruff. 1983, 8p
Pub. in Proceedings of the International Conference on Wear of Materials, Reston, VA., April 11-14, 1983, p426-433.

Keywords: *Titanium, *Sliding friction, *Wear, Friction, Microscopy, Deformation.

The friction and wear behavior of commercial purity titanium has been studied under dry sliding conditions. Experiments were performed using both a ball-on-flat and a block-on-ring wear test apparatus. The type of counterface material and the applied load had significant effects on the measured values of friction and wear. Scanning electron microscopy showed that titanium transferred to the counterface very early in all of the wear tests. In extended tests, this material transfer eventually generated debris which then dominated the wear behavior for the duration of the test. Transmission electron microscopy of the highly deformed region immediately beneath the worn titanium surface revealed an elongated microstructure with a strongly preferred crystallographic orientation. This deformed region was typically 1-3 micrometers thick. Extensive deformation twinning also occurred, extending up to 50 micrometers below the worn surface.

711,344
PB86-237856 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Microbial Corrosion.
Final rept.
W. P. Iverson. 1986, 2p
Pub. in Encyclopedia of Materials Science and Engineering, v4 p3041-3042 1986.

Keywords: *Biodeterioration, Reprints.

No abstract available.

711,345
PB86-238136 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Degradation, Taxonomy of.
Final rept.
J. Kruger. 1986, 5p
Pub. in Encyclopedia of Materials Science and Engineering, v2 p1040-1044 1986.

Keywords: *Degradation, Taxonomy, Reprints.

No abstract available.

711,346
PB86-238144 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Application of Thermal Wave Microscopy to Research on the Sliding Wear Break-in Behavior of a Tarnished Cu-15 wt% Zn Alloy.
Final rept.
P. J. Blau, and C. D. Olson. 1985, 7p
Pub. in Proceedings of International Conference on Wear of Materials, Vancouver, British Columbia, April 14-18, 1985, p425-431.

Keywords: *Copper zinc alloys, *Wear, Sliding friction, Microscopy, Thermal wave microscopy.

Thermal wave microscopy (TWM) is a relatively new thermal acoustic imaging technique which can be used in a specially modified scanning electron microscope (SEM) to detect subsurface features in metals and ceramics. Contrast in TWM images can be produced by differences in thermal conductivity or by subsurface defects of many kinds including pores, voids, and delaminations of layered structures. These sources of contrast makes TWM a potentially valuable tool for wear research. The current paper describes how TWM was used in conjunction with optical microscopy and SEM studies to reveal wear process differences due to sliding direction reversal in a Cu-15 wt.% Zn alloy covered by an oxide film.

711,347
PB86-242583 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Wear: Modes, Behavior, and Applications.
Final rept.
A. W. Ruff, and K. C. Ludema. 1986, 6p
Pub. in Encyclopedia of Materials Science and Engineering, v7 p5273-5278 1986.

Keywords: *Wear, Materials, Ceramics, Reprints.

Wear is a common, costly and gradual degradative process involving loss of material and damage to which objects and machinery are generally subjected as a result of mechanical contact. While wear usually involves undesirable consequences, there are many processes of beneficial wear such as polishing, cutting and grinding. Wear, along with corrosion and obsolescence, are frequently the life-determining processes for consumer items and commercial machinery. Wear rarely involves sudden failure; hence, there is frequently acceptance of the situation that items wear out. The discussion will consider the prominent modes of wear, the different wear behavior found among different materials, and several examples of applications involving wear.

711,348
PB86-242591 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Erosion.
Final rept.
A. W. Ruff, and G. F. Schmitt. 1986, 6p
Pub. in Encyclopedia of Materials Science and Engineering, v2 p1573-1578 1986.

Keywords: *Erosion, Wear, Degradation, Materials, Reprints.

The term erosion or erosive wear is generally applied to material degradation through processes of solid, liquid and gas impact or flow that result in significant damage or removal of material. These processes may be either unwanted or perhaps intentionally applied as in cleaning or cutting operations. Several basic physical and chemical mechanisms have been identified in these erosion processes. It is necessary to consider the material type involved as well as the eroding media in order to establish the specific erosion mode taking place. The discussion of erosion will consider the prominent modes of erosion and the distinctions to be drawn involving different materials. It will conclude with examples of detrimental as well as beneficial erosion.

711,349
PB87-134748 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Essential Work of Fracture (w sub e) Versus Energy Dissipation Rate (J sub c) in Plane Stress Ductile Fracture.
Final rept.
M. P. Wnuk, and D. T. Read. 1986, 11p
Sponsored by Naval Sea Systems Command, Washington, DC.
Pub. in International Jnl. of Fracture 31, p161-171 1986.

Keywords: *Fracture strength, *Cracking(Fracturing), *Crack propagation, Aluminum, Reprints.

Two measures of fracture toughness have been investigated. The first is the Cotterell's essential work of fracture (w sub e) which reflects the energy absorbed in the process of localized necking and decohesion occurring within the crack up region. The second is the familiar critical energy dissipation rate associated with the onset of crack extension and commonly designated by J. Total of 48 fracture tests have been performed on thin aluminum double-edge-notched panels and thin compact tension specimens with varying crack size-to-ligament ratios. In a simple experimental procedure it has been established that both measures are equivalent, at least under the plane stress conditions, and that they both represent the fraction of energy which is transmitted through the plastic deformation field into the crack tip region. The ratio 'essential work of fracture/total work of fracture' has been suggested as a quantitative measure of the energy transmission process. Certain predictions are made concerning variations of the energy transmission factor during the stable phase of ductile fracture propagation.

711,350
PB87-171740 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Disfigurement of External Paint Films by Algae and Bacteria and Quantitative Detection by Epifluorescence Microscopy.
Final rept.,
G. J. Olson, W. P. Iverson, and F. E. Brinckman. 1986, 9p
Pub. in Biodeterioration 6, p622-630 1986.

Keywords: *Paint, *Films, Algae, Bacteria, Reprints, *Biodeterioration.

Several cases of non-fungal microbial disfigurement of exterior paint films on houses and test panels were investigated. The paint films were examined by epifluorescence microscopy techniques and algae and bacteria were cultured from paint film samples. The growth and distribution of algae on surfaces was quantified by measuring in vivo or extracted chlorophyll fluorescence at 680 nm using a computerized photometer-monochrometer system attached to the microscope. Methods for accelerated laboratory testing of algal and bacterial paint film disfigurement were investigated.

711,351
PB87-182929 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Stress Intensity Factors for Cracks in Panels with Uniformly Spaced Holes.
Final rept.,
R. H. Dodds, and D. T. Read. 1987, 11p
Sponsored by Naval Sea Systems Command, Washington, DC.
Pub. in Engineering Fracture Mechanics 26, n2 p267-277 1987.

Keywords: *Biaxial stresses, *Cracks, Panels, Cracking(Fracturing), Fatigue(Materials), Pressure vessels, Finite element analysis, Reprints, Stress intensity factors.

Stress intensity factors are presented for cracks at the edges of the central holes in a panel containing a uniformly spaced array of the circular holes. The finite element method is employed to obtain numerical values of the J-integral and the near-tip displacements from which the stress intensity factor K1, is inferred. Six representative ratios of hole spacing to hole radius are studied: 1.2, 1.25, 1.4, 1.6, 2.0 and 4.0. For each hole spacing, the stress intensity factor is computed for a number of crack lengths for each of two crack configurations. Uniaxial loading in two orthogonal directions is considered. Computed stress intensity factors are presented in graphical and functional form for all cases. The functional form should prove convenient for fatigue crack growth computation.

Miscellaneous Materials

711,352
DOE/NASA/CR-150704 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Applied Technology.
Solar Heat Transport Fluid: A Quarterly Report.
Jun 78, 12p
Contract EX-76-A-29-1037

Keywords: *Glycols, *Heat transfer fluids, Compatibility, Corrosive effects, Flat plate collectors, Glycerol, Performance testing, Pipes, Pumps, *Solar heating systems, Solar water heaters, Water, ERDA/140901, ERDA/140907, ERDA/360604.

The progress made in the development and delivery of noncorrosive fluid subsystems is covered. These subsystems are to be compatible with closed-loop solar heating or combined heating and hot water systems. They are also to be compatible with both metallic and non-metallic plumbing systems. At least 100 gallons of each type of fluid recommended by the contractor will be delivered under the contract. The performance testing of a number of fluids is described. (ERA citation 04:012947)

711,353
N78-11200/0 PC **A08**/MF **A01**
National Bureau of Standards, Boulder, Colo.
Cryogenic Foam Insulation: Abstracted Publications.
F. R. Williamson. Sep 77, 171p NASA-RP-1002
Subm-Sponsored by NASA.

Keywords: *Bibliographies, *Cryogenic equipment, *Foams, Abstracts, Cryogenics, *Thermal insulation.

A group of documents were chosen and abstracted which contain information on the properties of foam materials and on the use of foams as thermal insulation at cryogenic temperatures. The properties include thermal properties, mechanical properties, and compatibility properties with oxygen and other cryogenic fluids. Uses of foams include applications as thermal insulation for spacecraft propellant tanks, and for liquefied natural gas storage tanks and pipelines.

711,354
PB82-261710 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrical Conductivity Measurements on Mixed Ionic/Electronic Conducting Materials at High Temperatures.
Final rept.
W. R. Hosler. 1981, 6p
Pub. in Proceedings of Symposium on Thermophysical Properties (8th), National Bureau of Standards, Gaithersburg, MD, June 15-18, 1981, p138-143.

Keywords: *Conductivity, High temperature tests, Physical properties.

Measurements of the physical properties of materials at high temperatures are becoming increasingly important, particularly with respect to emerging energy technologies. A technique has been developed for the measurement of the electrical conductivity of some of the materials which are particularly difficult to handle. Contacts are made to the sample by using spongy platinum peened around the leads in holes drilled in the sample. For those samples that become liquid at some temperature during the course of the measurement, a leak-tight seal is made in the crucible using spongy platinum compressed around the leadout through the crucible. Measurements on coal slag are described. Four probe DC and AC (40Hz to 40KHz) measurements were made on the sample and the resulting conductivities are in good agreement. Additional voltage data were obtained on all probe sets. The differences between these AC and DC voltages developed on the various probe sets give an indication of the contribution of ionic conductivity.

711,355
PB84-107242 Not available NTIS
National Bureau of Standards, Washington, DC.
Diffusion Rate Data and Mass Transport Phenomena for Copper Systems. Part 2. INCRA Monograph VIII, the Metallurgy of Copper.
Final rept. 1 Mar 78-1 Jan 82.
D. B. Butrymowicz. 1982, 750p
Sponsored in part by International Copper Research Association, Inc., New York.
Pub. in Book of Diffusion Rate Data and Mass Transport Phenomena for Copper Systems, Part 2, 750p 1982.

Keywords: *Copper alloys, *Mass transfer, *Diffusion, Metallurgy, Metals, Kinetics.

A survey, comparison and critical analysis is presented of data compiled from the scientific literature concerning diffusion in copper alloy systems involving elements in Group IIB (Zn, Cd, Hg), Group IIIA (B, Al, Ga, In, T1), Group IVA (C, Si, Ge, Sn, Pb), Group VIA (0, S, Se, Te), Group VIIA (F, C1, Br, I), and Group VIIIA (Ge, Kr, Xe). Here the term 'copper alloy system' is interpreted in the broadest sense. For example, the review of diffusion in the Cu-M system reports all diffusion situations which involve both copper and element M, including diffusion of M in Cu or in any alloy containing Cu; and diffusion of any element in any alloy containing both Cu and M. Topics include volume diffusion, grain boundary diffusion, tracer diffusion, alloy inter-diffusion, electromigration, thermomigration, strain-enhanced diffusion and diffusion in molten metals. An extensive bibliography is presented along with figures, tabular presentation of data, and discussion of results.

711,356
PB87-104410 PC **A08**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Application of a Hard Sphere Equation of State to Refrigerants and Refrigerant Mixtures.
Final rept.
G. Morrison, and M. McLinden. Aug 86, 159p NBS/TN-1226
Also available from Supt. of Docs as SN003-003-02753-7. Sponsored by Electric Power Research Inst., Palo Alto, CA.

Keywords: *Refrigerants, Equations of state, Computer programs, Thermodynamic properties.

The note describes the application of the Carnahan-Starling-DeSantis equation of state to halogenated hydrocarbon refrigerants and their mixtures. A complete and consistent set of thermodynamic functions is derived from the p-V-T equation of state and the perfect (ideal) gas heat capacities. A thorough discussion of reference states is included for both pure materials and their mixtures. Although this model exhibits a critical point, it does not quantitatively represent properties in the critical region. Despite this limitation, this model can represent both liquid and gaseous mixtures away from their own critical points, even at conditions near to and above the critical points of their components.

711,357
PB88-154042 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Microstructural Analysis of Hardened Alite Paste. 1. Porosity.
Final rept.,
H. M. Jennings, and L. J. Parrott. 1986, 5p
Pub. in Jnl. of Materials Science 21, n11 p4048-4052 Nov 86.

Keywords: *Clinker, Calcium silicates, Hydrates, Porosity, Microstructure, Reprints, *Alite, Scanning electron microscopy.

New information about the pore structure of hydrating alite (impure tricalcium silicate) has been obtained with a scanning electron microscope. Specimens were taken at various intervals during hydration and impregnated with epoxy. Micrographs of polished surfaces, which were deeply etched to remove all material except the epoxy, were used to produce maps of the pore structure in a plane. Areas associated with pores were analyzed quantitatively and the results compared to measurements of porosity using volumetric techniques. The results suggest that pores < 50 nm diameter are an intimate part of calcium silicate hydrate. The structure of the large 'capillary pores' (i.e., pores > 50 nm diameter) changes with time from an open network of pores to an array of disconnected pores. Mature specimens contain regions, hundreds of micrometers across, which were relatively dense and were not observed in younger specimens.

711,358
PB88-154059 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Microstructural Analysis of Hydrated Alite Paste. 2. Microscopy and Reaction Products.
Final rept.,
H. M. Jennings, and L. J. Parrott. 1986, 7p
Pub. in Jnl. of Materials Science 21, n11 p4053-4059 Nov 86.

Keywords: *Clinker, Calcium silicates, Calcium hydroxides, Hydrates, Microstructure, Cements, Reprints, *Alite, Scanning electron microscopy.

The distribution and composition of the products of hydrating alite have been studied using a backscattered electron detector in a scanning electron microscope. Polished surfaces of specimens were examined and quantitatively analyzed. Calcium hydroxide forms in the available water filled space. Calcium silicate hydrate appears to have several distinct morphologies, and their formation can be associated with the different stages of the reaction. These observations are compared with observations obtained from fracture surfaces which are commonly studied.

Nonferrous Metals & Alloys

711,359
DE85000591 PC **A02**/MF **A01**
Brookhaven National Lab., Upton, NY.
Physical Modelling of Transition Metal Alloying: The Roles That Different Levels of Theory Play.
R. E. Watson, and L. H. Bennett. 1984, 15p BNL-35276, CONF-840417-8
Contract AC02-76CH00016
High-temperature alloys - theory and design conference, Bethesda, MD, USA, 8 Apr 1984.

Keywords: *Transition Element Alloys, *Band Theory, Electronic Structure, Enthalpy, Entropy, Thermodynamic Properties, ERDA/360104.

This paper is concerned with the properties of the ordered transition metal alloys, in particular, the prediction of the enthalpy of one system versus another. The current status of the results of the most detailed electron energy band machinery is reviewed as are cruder (and more economical) schemes. Evidence is presented indicating that electronic contributions are important to the relative entropy of one structure versus that of another and it is suggested that electronic (and phonon) contributions to a relative entropy should be a more severe test of detailed band theory than is the calculation of the relative enthalpy. The volume effects attending transition metal alloy formation are also considered. (ERA citation 10:000872)

711,360
DE85000592 PC **A02**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Patterns in the Occurrence of the Brittle Topologically Close-Packed Phases: Al.
L. H. Bennett, and R. E. Watson. 1984, 12p BNL-35275, CONF-840417-9
Contract AC02-76CH00016
High-temperature alloys - theory and design conference, Bethesda, MD, USA, 8 Apr 1984.
Portions are illegible in microfiche products.

Keywords: *Heat Resisting Alloys, Aluminium Alloys, D States, Design, Embrittlement, Phase Studies, Transition Element Alloys, ERDA/360102.

Precipitation of sigma and structurally related phases can weaken or embrittle superalloys and stainless steels. These phases, known generically as topologically close-packed (TCP) structures occur in many transition-metal alloys. Methods of predicting their appearances include examination of phase diagrams and the use of d-band electron-vacancy concentrations for the transition elements. The use of an effective set of such d-vacancy values for the transition elements is reviewed. An effective d-electron vacancy value between that of Rh and Ru is assigned to the important nontransition element Al. (ERA citation 10:000871)

711,361
DE86000031 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Systematics of Alloying Behavior of the Noble Metals.
L. H. Bennett, and R. E. Watson. 1985, 13p BNL-37029, CONF-850211-14
Contract AC02-76CH00016
114. AIME annual meeting (includes Society of Mining Engineers), New York, NY, USA, 24 Feb 1985.

Keywords: *Copper, *Gold, *Intermetallic Compounds, *Metallic Glasses, *Silver, Electronegativity, Energy Levels, Experimental Data, Hyperfine Structure, Knight Shift, Metallurgical Effects, Nuclear Magnetic Resonance, Volume, ERDA/360102, ERDA/360104.

The noble metals (Cu, Ag and Au) often behave as a class in alloying with simple metals, metalloids, or transition metals, whether as hosts, in intermetallic compounds, or as dilute impurities. Examples are given of this behavior, as well as noting important differences between the three elements. Hyperfine effects (Knight shifts and isomer shifts), intrinsic elemental effects (electronegativity, structural maps, atomic volumes) and metallic glasses are reviewed. 20 refs., 7 figs. (ERA citation 10:051712)

711,362
PATENT-4 538 671 Not available NTIS
Department of Commerce, Washington, DC.
Arc Furnace for the Production of Small Investment Castings of Reactive or Refractory Metals Such as Titanium.
Patent.
R. M. Waterstrat. Filed 7 Feb 84, patented 3 Sep 85, 8p PB86-137247, PAT-APPL-6-577 855
Sponsored by American Dental Association Health Foundation, Washington, DC.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Electric arc furnaces, *Patents, *Investment casting, Titanium, Chemical reactivity, Casting, PAT-CL-164-514.

An arc furnace and investment casting apparatus includes a copper base with an integrally formed crucible having a passage therethrough. A vacuum chamber is positioned on the top of the copper crucible with a non-consumable cathode projecting into the chamber to effect melting of metal placed in the crucible. A vacuum chamber is also suspended beneath the crucible for support of a mold to receive molten metal flowing through the passage.

711,363
PATENT-4 627 482 Not available NTIS
Department of Commerce, Washington, DC.
Arc-Furnace for the Production of Small Investment Castings of Reactive or Refractory Metals Such as Titanium.
Patent,
R. M. Waterstrat. Filed 5 Feb 85, patented 9 Dec 86, 5p PB87-150850, PAT-APPL-6-698 268
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Electric arc furnaces, *Patents, *Investment casting, *Refractory metals, Casting, Titanium, Chemical reactivity, PAT-CL-164-514.

An arc furnace and investment casting apperatus includes a copper base with an integrally formed crucible having a passage there through. A vacuum chamber is positioned on the top of the copper crucible with a non-consumable cathode projecting into the chamber to effect melting of metal placed in the crucible. A vacuum chamber is also suspended beneath the crucible for support of a mold to receive molten metal flowing through the passage.

711,364
PB-261 011-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Study of Low-Melting-Point Metals on the Surface of Copper (Izuchenie Rasprostraneniya Legkoplavkikh Metallov na Poverkhnosti Medi),
V. V. Gal, and P. L. Gruzin. 1974, 20p DMDC-11950, TT-74-53074
Trans. of Fizika i Khimiya Obrabotki Materialov (USSR) n5 p49-54 1970. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Copper, *Diffusion, *Mercury(Metal), *Gallium, Surfaces, Crystal structure, Orientation, Translations, USSR.

An experimental study of the spreading of Hg and Ga on the (110), (100), (111), and (210) surfaces of copper were measured on the temperature range of 5 to 80C. Surface diffusion rates for the two elements were nearly equal.

711,365
PB-263 267/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microstructural Influence of a 2 Wt Pct Mo Addition to a Ti-1.5 Wt Pct Ni Alloy.
Final rept.,
A. C. Fraker. Nov 76, 4p
Pub. in Metallurgical Transactions, A Commun. 7A, p1793-1796 Nov 76.

Keywords: *Titanium alloys, *Nickel containing alloys, *Molybdenum containing alloys, *Corrosion resistance, Microstructure, Microscopy, Electron microscopy, Phase transformations, Reprints, Transmission electron microscopy, Titanium alloy 2Mo 1.5Ni.

Microstructural changes resulting from adding 2 wt. % Mo to the crevice corrosion resistant Ti-1.5 wt. % Ni alloy have been studied. Light microscopy of bulk specimens and thin foil transmission electron microscopy show that the Mo addition produces a finer and more elongated grained microstructure and increases the martensitic reaction. The Mo addition also delays precipitation and growth of the intermetallic phase, Ti2Ni, and increases the hardness of the material.

711,366
PB-264 342/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Niobium-Osmium Constitution Diagram.
Final rept.,
R. M. Waterstrat, and R. C. Manuszewski. 1977, 13p
Grant PHS-DE-02455
Pub. in J. Less-Common Met., v51 p55-67 1977.

Keywords: *Niobium alloys, *Osmium alloys, *Phase diagrams, Microstructure, Electron probes, X ray diffraction, Order disorder transformations, Crystal structure, Reprints.

The Nb-Os alloy system has been investigated over the entire composition range using metallographic, x-ray diffraction and electron microprobe techniques. All of the intermediate phases possess highly ordered structures with the larger (Nb) atoms preferring the sites having high coordination while the smaller (Os) atoms prefer the sites of lowest coordination.

711,367
PB-265 055/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Temperature and Energy of alpha to beta Transformation in Hafnium-3w/0 Zirconium.
Final rept.,
A. Cezairliyan, and J. L. McClure. 1976, 7p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, D.C.
Pub. in High Temp. High Pressures 8, p461-467 1976.

Keywords: *Hafnium alloys, *Zirconium containing alloys, *Phase transformations, Pulse heating, Heat of transformation, Reprints.

Measurements of the temperature and energy of the alpha to beta transformation of hafnium containing 3.12w/0 zirconium using a millisecond-resolution pulse-heating technique are described. The results yield 2012K for the transformation temperature and 33.1 J/g for the transformation energy. The normal spectral emittance (at 0.65 micrometers at the transformation point is determined to be 0.42.

711,368
PB-265 539/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Low Temperature Effects on the Fracture Behaviour of a Nickel Base Superalloy,
R. L. Tobler. 1976, 6p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in Cryogenics, v16 n11 p669-674 Nov 76.

Keywords: *Heat resistant alloys, *Nickel alloys, Fracture properties, Cryogenics, Low temperature research, Fatigue(Materials), Crack propagation, Yield strength, Ultimate strength, Ductility, Iron containing alloys, Chromium containing alloys, *Superalloys, Nickel alloy 18Cr 18Fe, Nickel alloy Inconel 750, Reprints.

The mechanical properties of a solution treated and double aged nickel-18% iron-18% chromium alloy (Inconel 718) were studied to assess its utility at temperatures in the ambient-to-cryogenic range. Uniaxial tensile property measurements using unnotched specimens at decreasing temperatures between 295 and 4 K show that yield and ultimate strengths increase by 20% and 29%, respectively, while ductility remains virtually constant. Fracture mechanics tests using 2.54 cm thick compact specimens revealed that the fatigue crack growth resistance of this alloy improves slightly at extreme cryogenic temperatures. These results are compared with similar data for Inconel 750 alloys.

711,369
PB-266 033/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Vanadium-Rhodium Constitution Diagram,
R. M. Waterstrat, and R. C. Manuszewski. 1977, 13p
Grant PHS-DE-02455
Pub. in J. Less-Common Metals, v52 p293-305 1977.

Keywords: *Vanadium alloys, *Rhodium alloys, *Phase diagrams, Order disorder transformations, Electron probes, X ray diffraction, Differential thermal analysis, Reprints.

The V-Rh alloy system has been investigated over the entire composition range using metallographic, x-ray diffraction, electron microprobe and DTA measurements. There are six intermediate phases having structural similarities to phases which occur in the V-Ir and Nb-Rh alloy systems. A constitution diagram for the V-Rh system is presented.

711,370
PB-266 589/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Low-Temperature Elastic Properties of Invar,
H. M. Ledbetter, E. R. Naimon, and W. F. Weston. 1977, 8p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in Proceedings, International Cryogenic Materials Conference (1st), Kingston, Ontario, Canada, 22-25 Jul 75; Paper B-7 in Advances in Cryogenic Engineering, v22 p174-181 1977.

Keywords: *Elastic properties, *Nickel alloys, Measurement, Ultrasonic tests, Shear properties, Poisson ratio, Cryogenics, Magnetic fields, *Nickel alloy Invar.

The elastic properties of a polycrystalline invar alloy were determined between room temperature and liquid-helium temperature by two methods: measurement of ultrasonic (10 MHz) wave velocities with a pulse-echo technique, and measurement of resonance frequencies (60 kHz) of cylindrical specimens with a composite piezoelectric-oscillator technique. The shear moduli obtained by the two methods are essentially the same. However, the other elastic constants (all of which have a dilatational component) differ both in magnitude and in temperature dependence. The following elastic constants are reported: longitudinal modulus, Young's modulus, the shear modulus, the bulk modulus (reciprocal compressibility), and Poisson's ratio. The role of magnetic effects on invar's elastic properties is discussed briefly.

711,371
PB-266 591/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Research Program on the Properties of Structural Materials at 4 K,
R. P. Reed, A. F. Clark, and E. C. van Reuth. 1977, 8p
ARPA Order-2569
Pub. in Proceedings of International Cryogenic Materials Conference (1st), Kingston, Ontario, Canada 22-25 Jul 75; Paper A-1 in Advances in Cryogenic Engineering, v22 p1-8 1977.

Keywords: *Superconductors, *Materials, *Cryogenics, Mechanical properties.

A research program to obtain and evaluate the low temperature properties of materials applicable to large scale superconducting machinery is described. The properties and materials measured are summarized and representative results included. The effects of processing and fabricating on low temperature behavior is also being studied. Discussion is included on the problems of rapid and efficient distribution of properties information and the response of this program to that need.

711,372
PB-266 592/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermal and Electrical Measurements on Selected Materials for Low-Temperature Applications,
J. G. Hust, and P. J. Giarratano. 1977, 8p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in Proceedings, International Cryogenic Materials Conference (1st), Kingston, Ontario, Canada 22-25 Jul 75; v22 p128-135 1977.

Keywords: *Copper, *Stainless steels, *Nickel alloys, *Thermal conductivity, *Electrical resistivity, Cryogenics, Mechanical properties, Heat resistant alloys, Superalloys.

Thermal conductivity, electrical resistivity, thermopower, and Lorenz ratio data have been obtained with a variable-temperature, multiproperty apparatus for high conductivity copper, a nickel base superalloy, and a low expansion alloy. Values of these properties are presented in graphical form at temperatures from 4 to 300 K. The thermal conductivity data are accurate to 2%, which is well within material variability limits expected for production heats. Prediction techniques have been shown to yield conductivity values within 15 percent of experimental values for pure metals, such as high conductivity copper. In addition, thermal conductivity values have been obtained, using a fixed-point apparatus, for two stainless steels at 6, 79, 196, and 277 K. These values, accurate to 10%, are presented in graphical form. The above data are compared to existing literature data on similar alloys.

711,373
PB-268 490/0 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Heat Div.
Gallium Melting-Point Standard.
Special pub. (Final),
B. W. Mangum, and D. D. Thornton. Jun 77, 36p
NBS-SP-481
Library of Congress catalog card no. 77-600017.

Keywords: *Gallium, *Melting points, *Standards, Temperature measurement, Quality control, Temperature measuring instruments.

This Special Publication contains a series of papers published in Clinical Chemistry concerning the Bureau's temperature measurement system, the gallium melting-point as a thermometric fixed-point, how the gallium melting-point fits into the measurement system, and applications of the gallium melting-point standard.

711,374
PB-268 950/3 Not available NTIS
National Bureau of Standards, Washington, D.C.
Fatigue Crack Growth Rates of Structural Alloys at 4K,
R. L. Tobler, and R. P. Reed. 1977, 12p
Pub. in Proceedings International Cryogenic Materials Conference (1st), Held at Kingston, Ontario, Canada on July 22-25, 1975. Paper A-4 in Advances in Cryogenic Engineering, v22 p35-46 1977.

Keywords: *Fatigue(Materials), *Crack propagation, *Cryogenics, Titanium alloys, Aluminum alloys, Stainless steels, Nickel alloys, Crystal structure, Face centered cubic lattices, Body centered cubic lattices, Mathematical models, *Metal fatigue, Superalloys, Titanium alloy 5Al 2.5Sn, Titanium alloy 6Al 4V, Steel 304, Steel 316, Steel A-286, Nickel alloy Inconel 750, Steel 9Ni.

The fatigue crack growth rates (da/dN) of nine structural alloys tested in a liquid helium environment at a temperature of 4 K are presented and compared. Growth rates from 0.00007 to 0.002 mm/cycle were measured for compact specimens 2.54 to 3.81 cm thick. The materials tested include: Ti-5Al-2.5Sn, Ti-6Al-4V, AISI 304, 310, and 316 stainless steels, A-286, Inconel 750, 5083-0 aluminum and 9% nickel steel. Results showed that stable face-centered cubic alloys having high elastic moduli displayed superior crack growth resistance at 4K, whereas materials with body-centered cubic or martensitic phases exhibited relatively high growth rates at this temperature. When compared on the basis of the strain intensity factor, delta K/E, the growth rates of alloys having close-packed crystal structures were in close agreement. An equation describing the crack growth rates of four stable fcc alloys is suggested.

711,375
PB-270 129/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron Scattering Studies of the Diffusion of Hydrogen in Metals.
Final rept.,
J. M. Rowe. 1 Sep 76, 16p
Pub. in Proceedings of Conference on Neutron Scattering, Gatlinburg, Tenn. 6-10 Jun 76 p491-506.

Keywords: *Hydrogen, *Diffusion, *Metals, Crystal structure, Neutron scattering, Palladium.

Some results of neutron quasielastic scattering studies of hydrogen diffusion in metals are presented and discussed. The limitations of the models presently available to interpret these data are presented. Several experimental results indicate reasons for the failure of the simple model to explain diffusion in any of the bcc metals even though the model does work well for fcc palladium. The areas where further research is needed are discussed and some recent research in these areas is also presented.

711,376
PB-271 575/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Structural Materials for Cryogenic Applications.
Final rept.,
F. R. Fickett. 1976, 14p
Sponsored in part by International Copper Research Association, New York.
Pub. in Proc. of Int. Cryogenic Engineering Conf. (6th), Grenoble, France, May 11-14, 1976, p20-33 1976.

Keywords: *Construction materials, *Cryogenics, Alloys, Composite materials, Tests, Insulation, Crack propagation.

A general review of recent worldwide developments in the measurement of properties of materials used in structural applications at cryogenic temperatures is given. New alloy data and testing methods, particularly relating to crack growth, are discussed. The major emphasis is placed on the properties of a variety of composite materials now under consideration for various applications at low temperatures. Insulation materials and others which occasionally serve a structural purpose are also considered. An attempt is made to evaluate trends in these materials. Much of the literature in this field is contained in relatively obscure government reports and corporate publications. A brief bibliography is given as well as a guide to other sources this literature.

711,377
PB-271 593/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Temperature Dependences of the Elastic Constants of Precipitation-Hardened Aluminum Alloys 2014 and 2219.
Final rept.,
D. T. Read, and H. M. Ledbetter. 1977, 4p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in J. Eng. Mater. Technol., v99 p181-184 Apr 77.

Keywords: *Aluminum alloys, *Precipitation hardening alloys, Elastic properties, Ultrasonic tests, Poisson ratio, Modulus of elasticity, Cryogenics, Low temperature research, High temperature tests, Reprints, Aluminum alloy 2014, Aluminum alloy 2219.

Elastic properties of precipitation-hardened aluminum alloys 2014 and 2219 were studied between 4 and 300 K using ultrasonic pulse techniques. Both the longitudinal and transverse sound velocities were measured. Also reported are the Young's modulus, shear modulus, bulk modulus, and Poisson's ratio. For both alloys, the Young's moduli are about ten percent higher than for unalloyed aluminum, and they increase about ten percent on cooling from 300 to 4 K. All the elastic constants show regular temperature behaviors.

711,378
PB-271 627/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Anomalous Elastic Properties of a Precipitation-Hardened Copper Alloy.
Final rept.,
H. M. Ledbetter. 1977, 3p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in Met. Trans., v8A n6 p1006-1007 Jun 77.

Keywords: *Copper alloys, Elastic properties, Cadmium containing alloys, Chromium containing alloys, Precipitation hardening alloys, Poisson ratio, Modulus of elasticity, Reprints.

The room-temperature elastic constants of a polycrystalline precipitation-hardened copper-cadmium-chromium alloy were determined by a 10 MHz pulse-echo method. With respect to copper the alloy has a fifteen-percent-lower bulk modulus, a fifteen-percent-higher shear modulus, and a fourteen-percent-lower Poisson ratio. These changes, especially in the Poisson ratio, are much larger than those observed in the more familiar copper-beryllium precipitation-hardened alloy and compare to those usually obtained only by mechanical deformation or by phase transformation.

711,379
PB-275 135/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Low-Temperature Elastic Properties of a Precipitation-Hardened Copper Alloy.
Final rept.,
H. M. Ledbetter. Jul 77, 4p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va. and Department of Defense, Washington, D.C.
Pub. in Zeitschrift fuer Metallkunde, v68 n7 p506-509 Jul 77.

Keywords: *Copper alloys, *Cadmium containing alloys, *Chromium containing alloys, *Precipitation hardening alloys, Elastic properties, Bulk modulus, Shear modulus, Specific heat, Modulus of elasticity, Poisson ratio, Reprints.

Elastic constants of a copper-cadium-chromium precipitation-hardened alloy were measured between room temperature and liquid-helium temperature by ultrasonic-velocity methods. Compared to copper, the alloy has a much higher shear modulus, a much lower bulk modulus, and a seven-percent-higher Debye temperature. Despite different second-order elastic constants, the alloy's temperature derivatives are similar to copper's.

711,380
PB-277 172/3 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, Colo. Cryogenics Div.
Standard Reference Materials: Standard Thermocouple Material, Pt-67: SRM-1967.
Special pub.,
R. L. Powell, L. L. Sparks, and J. G. Hust. Feb 78, 52p NBS-SP-260-56
Library of Congress Catalog Card no. 77-29155. See also report dated Sep 77, PB-272 127.

Keywords: *Thermocouples, *Standards, *Platinum, *Thermoelectric materials, Wire, Thermoelectric properties, Standard reference materials.

Industry-wide standardization of thermocouple wire depends in part on thermoelectric comparisons of commercial wires to a standard. In this paper the authors describe a thermo-electric standard, designated Pt-67, which is available in wire form as a Standard Reference Material (SRM 1967). High purity platinum meets the requirements of a thermoelectric reference material for temperatures from 77K (-197C) up to 2040K (1767C). Thermoelectric voltages, residual resistance ratios, temperature coefficients of resistance, and chemical composition are reported for a high purity, highly characterized lot of platinum that has been developed as a thermoelectric standard, Pt-67. A review of the historical development of the material is followed by characterization data on the material and descriptions of the cryogenic and high temperature apparatus. The important effects of impurities are also described. Recommendations and precautions for usage of the reference material conclude the discussion.

711,381
PB-278 018-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Self-Diffusion of Cu in Cu2S(Samodiffuzija medi V Cu2S),
M. Pavlyuchenko, I. Pokrovskii, and A. Tikhonov. 1976, 8p TT-76-59201, DMDC-17494
Trans. of Akademiya Navuk BSSR, Minsk. Doklady, v9 p235-237 1965. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Copper, Copper inorganic compounds, Copper isotopes, Inorganic disulfides, Translations, USSR, *Copper sulfides, Copper 64.

The diffusion of 64Cu into Cu2S was investigated between 134-445C. The data fit the Arrhenius equation, D = 0.000246 exp (-4900 cal./RT) sq cm/s, with an accuracy of near 15%. The authors claim no dependency of the diffusion coefficient on composition between Cu:S rates of 1.77 to 1.99.

711,382
PB-278 409/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effects of Specimen Thickness on Fracture Toughness of an Aluminum Alloy.
Final rept.,
D. T. Read, and R. P. Reed. 1977, 13p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in Int. Jnl. Fract. 13, n2 p201-213 Apr 77.

Keywords: *Fracture toughness, *Aluminum alloys, Thickness, Cryogenics, Reprints, Stress intensity factor, J integrals, Aluminum alloy 2219.

J-integral resistance curves for three specimen thicknesses and valid (according to ASTM Method E 399) K sub i c values at 76K are reported for aluminum alloy 2219. The J-integral values were independent of thickness at small crack extensions, but at substantial crack extensions the values for the thin specimens were larger than those for the thick specimens. The measured J sub i c values were less than those calculated from the measured K sub i c values. The reason for this discrepancy was that crack extension occurred before the K sub i c measurement point was reached.

711,383
PB-278 417/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fracture Mechanics Parameters for a 5083-0 Aluminum Alloy at Low Temperatures.
Final rept.,
R. I. Tobler, and R. P. Reed. 1977, 7p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va., and Maritime Administration, Washington, D.C.
Pub. in Jnl. Eng. Mater. Technol. 99, n4 p306-312 Oct 77.

Keywords: *Aluminum alloys, *Fatigue(Materials), *Fractures(Materials), Fracture toughness, Crack propagation, Cryogenics, Reprints, Aluminum alloy 5083.

The fatigue crack growth and fracture resistance of a 5083-0 aluminum alloy plate were investigated at four temperatures in the ambient-to-cryogenic range -- 295, 111, 76, and 4 K. J-integral test methods were applied using compact specimens 3.17 cm thick, and the value of J required to initiate crack extension (J sub Ic) is reported as an index of fracture toughness. The fracture toughness was orientation dependent. In contrast, the fatigue crack growth rates (da/dN) are insensitive to specimen orientation. The fatigue crack growth rates at cryogenic temperatures are up to 10 times lower than in air at room temperature, but are virtually constant between 111 and 4 K.

711,384
PB-278 941/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quantitative Methods in Wear Debris Analysis.
Final rept.,
A. W. Ruff. 1978, 10p
Sponsored in part by Naval Air Engineering Center, Lakehurst, N.J.
Pub. in International Conference on Wear of Materials, St. Louis, MO, April 26-28, 1977, Wear 46, p263-272 1978.

Keywords: *Wear tests, *Particles, Particle size, Chemical analysis, X ray analysis, Electron microscopy, Microscopy, Iron, Nickel, Lubrication.

Wear debris has been recovered from a number of test systems and analyzed using different methods. Those methods produced specific information concerning the particulate size and composition. A magnetic debris recovery method was quantitatively evaluated using actual debris samples and also using collections of manufactured particulates having known sizes and compositions. Small 5 micrometer diameter SiO2 spheres, some containing nickel, were used to simulate debris. Other particulates of iron and nickel in different size ranges were also used in order to investigate such matters as size resolution, lubricant dilution techniques, particle overlap difficulties, and the general problem of calibration of debris recovery system. A comparison between chemical analysis and particulate analysis findings is presented. The application of optical and electron microscope methods and X-ray microanalysis in characterizing the wear particulates was carried out directly on the recovery substrate.

711,385
PB-278 943/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurements of Plastic Strain in Copper Due to Sliding Wear.
Final rept.,
A. W. Ruff. 1978, 11p
Sponsored in part by Office of Naval Research, Arlington, Va.
Pub. in Proceedings International Conference on Wear of Materials, St. Louis, MO., April 26-28, 1977, Wear 46, p251-261 1978.

Keywords: *Copper, *Plastic deformation, Wear tests, Sliding friction, Wear, Measurement, Scanning electron microscopy, Reprints.

Wear experiments have been conducted to determine the plastic strains that are introduced in the surface material near sliding wear tracks. Both oil lubricated and dry sliding experiments have been carried out at different sliding distances on surfaces of copper. The strain values were determined from selected area electron channeling patterns obtained using a scanning electron microscope from regions as small as 10 micrometers in size and 0.05 micrometer deep around the wear track. A deformed calibration specimen was used to relate electron channeling band contrast to deformation strain. Strain maps were obtained on the wear surface lateral to the wear track and also below the surface using electropolishing metal removal techniques. Particular attention was placed on the near-surface strain values. In all cases, the maximum strain was found at the wear surface located at the track center and the strains decreased uniformly with depth. Significant, large strains were also found outside the wear tracks. The results are compared with those previously reported for iron and with recent theoretical models.

711,386
PB-278 958/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heat Capacity and Electric Resistivity of Titanium in the Range 1500 to 1900 K by a Pulse Heating Method.
Final rept.,
A. Cezairliyan, and A. P. Miiller. 1977, 6p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, D.C.
Pub. in High Temp.-High Pressures 9, p319-324 1977.

Keywords: *Titanium, *Electrical resistivity, *Specific heat, Emittance, High temperature tests, Reprints.

The measurements of the heat capacity and electric resistivity of 99.9+% pure titanium in the temperature range 1500 to 1900 K by a subsecond duration pulse heating method are described. The hemispherical total emittance is 0.37 for the temperature range 1700 to 1900 K. Estimated maximum inaccuracies of the measured properties are: 3% for heat capacity, 2% for electric resistivity, and 5% for hemispherical total emittance.

711,387
PB-280 417/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Diffusion Rate Data and Mass Transport Phenomena for Copper Systems.
Final rept.,
D. B. Butrymowicz, J. R. Manning, and M. E. Read. Jul 77, 333p
Pub. in INCRA Monograph V. The Metallurgy of Copper, 333p Jul 77.

Keywords: *Copper alloys, *Diffusion, Bibliographies, Phase studies, Self diffusion.

A survey, comparison, and critical analysis is presented of data compiled from the scientific literature concerning diffusion in copper alloy systems involving elements in Group IA, IIA, IIIA, IVB, VB, VIB, VIIB, VIII, IB, and VA as well as self-diffusion of the pure metal Cu. Topics include volume diffusion, surface diffusion, grain boundary diffusion, tracer diffusion, alloy interdiffusion, electromigration, thermomigration, dislocation-pipe diffusion, and diffusion in molten metals. An extensive bibliography is presented along with figures, tabular presentation of data, and discussion of results.

711,388
PB-280 423/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Alloy Phase Diagram Activities of the Alloy Data Center.
Final rept.,
L. H. Bennett, G. C. Carter, and D. J. Kahan. 1977, 6p
Pub. in Proceedings of Biennial International Conference on CODATA (5th), Boulder, Colo. 28 Jun-1 Jul 76, p51-56 1977.

Keywords: *Alloys, *Phase diagrams, *Information centers, Information retrieval, Data processing.

The NBS Alloy Data Center has proposed a program concerned with coordination of alloy phase diagram data evaluation projects, centralization of bibliographic data, and distribution of this information to the scientific and technical community. The proposed program has been endorsed by a National Academy of Sciences - National Research Council ad hoc Advisory Panel on Phase Diagrams for Alloys which recommended, among other things, that the Alloy Data Center establish priorities on the basis of specific needs expressed by users, and that the Center maintain an indexed bibliographic file.

711,389
PB-280 764-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Alloying of Aluminum Under High-Speed Shock Conditions (Legirovanie Alumeniya Pri Skorostnom Soudarenii),
N. V. Kotov, B. N. Mukhin, V. Shaskova, A. A. Yavor, and V. A. Yakushev. 1976, 11p DMDC-13985, TT-76-59186
Trans. of Metallovedenie Proch. (USSR) n3 p244-251 1971. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Aluminum alloys, *Explosive forming, Microstructure, Ultimate strength, Hardness, Translations, USSR.

A simple explosive forming procedure is described for several aluminum alloys. The properties of the formed alloys are measured and related to microstructural changes.

711,390
PB-280 766-T PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Some Methods of Processing Experimental Data in the Determination of a Diffusion Coefficient (O Nekotorekh Sposobakh Obrabotki Eksperimental'nekh Dannekh po Opredeleniu Koeffitsienta Diffuzii),
S. Gertsriken, and V. Lozovik. 1976, 38p DMDC-16221, TT-76-53825
Trans. of Akademiya Nauk URSR, Kiev. Instytut Metallogizyky. Sbornik Nauchnykh Rabot, p78-96 1954. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Metals, *Diffusion theory, Boundary value problems, Tables(Data), Translations, USSR.

Several techniques are employed in solving the diffusion equation under a variety of boundary conditions for mass transport.

711,391
PB-280 767-T PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Electronic Microscopy (Elektronnaya Mikroskopia),
N. S. Gerichikova. 1976, 43p DMDC-17718, TT-76-59210
Trans. of Metody Ispty. Kontr. Issled. Mashinostroit. Mater (USSR) n1 p113-144 1971. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Electron microscopy, *Metals, Diffusion, Phase studies, Translations, USSR.

This review paper gives a Soviet worker's broad view of electron microscopy science. Some 120 references are used to provide the data discussed. Topics include replica techniques, preparation of specimen surfaces and electrolytes for a variety of ferrous and nonferrous metals. The interdiffusion of electron micrographs for a number of alloy systems is given. Dislocations, grain boundaries, phase growth, etc. are some of the topics receiving special attention in the paper.

711,392
PB-280 768-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Electron Diffraction-Structure Determination (Difrakcionnaya Elektronnaya Mikroskoniya),
M. L. Usikov. 1976, 25p DMDC-17719, TT-76-59211
Trans. of Metody Ispty. Kontr. Issled. Mashinostroit. Mater (USSR) n1 p144-159 1971. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Electron diffraction, *Alloys, Phase studies, Microstructure, Physical metallurgy, Translations, USSR.

This paper reviews the use of electron diffraction in Metallurgy. Half the papers referenced are to Soviet workers. Techniques of sample preparation and traditional applications of the instruments are described. A few examples where metallurgical phenomena (deformation, aging, phase transformations) are studied with this technique are given in the paper.

711,393
PB-280 769-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
High Temperature Microscopy-Methods of Investigating Metallic Thread-Like Crystals (Metody Issledovaniya Metallicheskikh Nitevidniky Kristallov),
M. R. Nazarova. 1976, 17p DMDC-17721, TT-76-59213
Trans. of Metody Ispty. Kontr. Issled. Mashinostroit. Mater (USSR) n1 p178-187 1971. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Metals, *Whiskers(Single crystals), Microscopy, Mechanical properties, Copper, Nickel, Cobalt, Aluminum oxide, Tensile strength, Stress strain diagrams, Metal fibers, Elastic properties, Deformation, High temperature tests, Translations, USSR.

Mechanical properties of whiskers of Cu, Ni, Co, and sapphire are investigated. Tensile strengths and character of the stress-strain curves are reported. Details of the testing machines used in this study are described. There is a discussion of extensive sample preparation.

711,394
PB-280 770-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Metallography of Metal Solidification - High-Temperature Metallography (Vysokotemperaturnaya Metallografiya),
M. G. Lozinskii. 1976, 23p DMDC-17722, TT-76-59214
Trans. of Metody Ispty. Kontr. Issled. Mashinostroit. Mater (USSR) n1 p186-202 1971. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Metallographs, Refractory metals, Heat resistant alloys, Microstructure, Translations, USSR.

The paper is devoted to the description of the capabilities of several Soviet-constructed, high temperature, optical metallographs. These instruments are used to study the behavior and microstructive features of metals at high temperatures or during cyclic annealing. Reference to experimental work is nearly all in relation to the author's own laboratory work. Mechanical testing is the thrust area of the work.

711,395
PB-280 771-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Electron Diffraction (Electronografiya),
S. A. Semiletov. 1976, 23p DMDC-17717, TT-76-59209
Trans. of Metody Ispty. Kontr. Issled. Mashinostroit. Mater (USSR) n1 p100-112 1971. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Electron diffraction, *Alloys, Diffusion, Phase studies, Crystal structure, Microstructure, Physical metallurgy, Translations, USSR.

A review is presented of the electron diffraction techniques used to study the structure of solids. An elementary treatment of theory and instruments is given by the author although extensive space is devoted to applications in metallurgy. The author draws heavily on the Soviet literature for this tutorial exposition.

711,396
PB-280 928-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
X-Ray Radiography of Alloys (Rentgenospectralnei Analiz),
I. B. Borovskii. 1976, 25p DMDC-17716, TT-76-59208
Trans. of Metody Ispty. Kontr. Issled. Mashinostroit. Mater (USSR) n1 p85-100 1971. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Metals, *Alloys, *X ray spectroscopy, Diffusion, Translations, USSR.

A good background in x-rays is given prior to getting into the instrumental analysis of the electron microprobe analyzer. Many metallurgical applications of the instrument are discussed.

711,397
PB-280 929-T PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Method of Studying Point Defects of a Crystal Lattice (Metody Izucheniya Tochechnykh Defektov Kristallicheskoi Reshetki),
Y. S. Nechaev. 1976, 29p DMDC-17720, TT-76-59212
Trans. of Metody Ispty. Kontr. Issled. Mashinostroit. Mater (USSR) n1 p159-178 1971. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Metals, *Point defects, Translations, USSR.

A review of the origin and behavior of point defects in metals is given. Parameters needed to measure defect formation, concentration, etc. are described and summed up for selected noble metals. The principal methods of experiment are reviewed along with their limitations. Both equilibrium and pseudo-equilibrium conditions are applied. Alloying, deformation, irradiation, etc. are examples of processes discussed by the author. Nearly half the references to research are of Soviet origin. Classic western papers are mentioned also.

711,398
PB-280 955-T PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Autoradiography (Avtoradiogrfiya),
S. Z. Bokshtein, S. T. Kishkin, and L. M. Moraz. 1976, 44p DMDC-17714, TT-76-59206
Trans. of Metody Ispty. Kontr. Issled. Mashinostroit. Mater (USSR) n1 p25-52 1971. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Autoradiography, *Metals, Surfaces, Diffusion, Phase studies, Crystallization, Translations, USSR.

The method of autoradiography is very effective in studying many specific problems of the physics of metals and physical metallurgy. It helps in studying the structure of metallic alloys and those processes taking place in them, the structure and properties of the surface parts of the metal (external surface, grain boundaries and phases), phase transformations, processes of crystallization and recrystallization, distribution and diffusion of components, several technological processes and others.

711,399
PB-280 956-T PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Fractography (Fractografiya),
T. A. Gordeeva. 1976, 48p DMDC-17723, TT-76-59215
Trans. of Metody Ispty. Kontr. Issled. Mashinostroit. Mater (USSR) n1 p212-231 1971. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Metals, *Fractures(Materials), *Diffusion, *Ceramics, Surfaces, Mechanical properties, Translations, USSR.

Mechanisms of failure in metals and ceramics and the testing techniques used to elucidate them are presented. The important influence of environment on failure is noted. Much is given about fatigue in materials. Those experimental techniques used to examine fractured surfaces are described. Many examples of fracture in variety of materials are used to illustrate those important aspects of fracture science.

711,400
PB-280 966-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center
Structure of Copper Oxide Copper Scales (O Tckstiure v Okaline Medi),
V. Arkharov, and Z. Kichigina. 1976, 10p DMDC-13951, TT-76-59218
Trans. of Zhurnal Tekhnicheskoi Fiziki (USSR) v18 n2 p215-218 1948. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Copper, *Oxidation, *Diffusion, Copper oxides, X ray diffraction, Metals, Translations, USSR.

Technical purity copper is oxidized in air at 700, 800, 900 and 1000C at times varying from 2 to 48 hours. The oxidized metal was subjected to x-ray diffraction investigation and the morphology of the scales examined. CuO and Cu2O were found in scales. Features of each oxide were noted, and probable underlying causes given. Relative rates and direction of diffusion of the metal and oxygen ions were deduced from the experimental results.

711,401
PB-280 967-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center
Interaction of Impurity Atom with Dislocations in Dilute Copper Solutions (Vzaimodestve Primesnykh Atomov s Dislokatsiyami v Razbavlennykh Rastvorakh Medi),
M. Krishtal, and M. Vyboishchik. 1976, 14p DMDC-15992, TT-76-59192
Trans. of Fizika i Khimiya Obrabotki Materialov (USSR) n3 p68-73 1973. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Copper, *Internal friction, *Metals, Additives, Lanthanum, Zirconium, Lithium, Nickel, Phosphorus, Boron, Binding, Translations, USSR.

Internal friction measurements were made in dilute solid solutions of copper with La, Zr, Li, Ni, P, and B. The dependence of amplitude, temperature, binding energy, and atomic radii, are reported.

711,402
PB-281 005-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Cu in Cu2 Se, Self-Diffusion (Samadiffuziya medi V Selenide medi),
S. Mamyko, M. Pavlyuchenko, and I. Pokrovskii. 1976, 12p DMDC-15768, TT-76-59190
Trans. of Akademiya Navuk BSSR, Minsk. Vesti, n3 p14-18 1973. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Copper, Metals, Selenides, Defects, Stoichiometry, Translations, USSR, *Copper selenides, Self diffusion.

The diffusion of 64Cu into Cu2Se and Cu(1.89)Se was measured in the temperature range 150-445 C by Gruzin's residual activity method. It was noted that the diffusion in the off-stoichiometric Cu(1.8)Se was 3-4 times that in stoichiometric Cu2Se and was ascribed to the increase in cation concentration. It was concluded that the vacancy mechanism was the most suitable for the copper-atom migration.

711,403
PB-281 214-T PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Calculating Conditions for Pressure Welding (K Voprosu Raschetnoi Otsenki Rezhimov Svarke Davleniem),
M. K. Shorshorov. 1974, 27p DMDC-11388, TT-74-53223
Trans. of Svarochnoe Proizvodstvo (USSR) v37 n7 p14-17 1967. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Pressure welding, *Metals, *Ceramics, Bonding strength, Phase transformations, Diffusion, Creep, Aluminum alloys, Silicon alloys, Nickel alloys, Copper alloys, Aluminum oxide, Chromium alloys, Zinc oxides, Titanium oxides, Niobium, Copper, Molybdenum, Titanium, Translations, USSR.

The physical-chemical phenomena taking place at the interface of metal-metal and metal-ceramic configurations is studied. Measured are those variables (temperature and pressure) needed to effect a strong bond between Al/Si, Ni/Al2O3, Cu/Al2O3, Ni-Cr alloys/ZnO-TIO2, Cu/Cu, Ni/Ni, Nb/Nb, Mo/Mo, and Ti/Cu. Welding takes place either in air or under a hydrogen atmosphere. Phases forming at the interface are identified.

711,404
PB-281 216-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion Vacuum Welding of Magnetic Alloys (Diffuzionnaya Svarka v Vakuume Magnitnekh Splavov),
N. F. Kazakov, A. N. Gererg, and N. A. Mashrova. 1974, 15p DMDC-11393, TT-74-53218
Trans. of Svarochnoe Proizvodstvo (USSR) v37 n12 p35-36 1967. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Diffusion welding, *Permanent magnets, *Steels, Nickel, Copper, Translations, USSR.

The diffusion bonding of several Soviet permanent cast magnet materials in vacuum to a low carbon steel is reported. Welding parameters were temperature & pressure. Surface preparation and interlayers of copper and nickel foils, nickel powder, and deposits of copper on the mating surfaces were found to affect bond integrity. Different geometries of construction were also considered.

711,405
PB-281 251-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Application of Artificial Radioactive Isotopes in the Study of Diffusion and Self-Diffusion in Alloys (Premenenia Iskustvenno-Padioaktivnickh Isotopov dlia Izutchenia Diffuzii i Samodiffuzii v Splavakh),
P. Gruzin. 1976, 18p DMDC-1255, TT-76-59185
Trans. of Akademiya Nauk SSSR. Otdelenie Tekhnicheskikh Nauk. Izvestiya, p383-392 1953. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Metals, *Isotopic labeling, Translations, USSR, Self diffusion.

This paper is often referred to as a classic in diffusion science. It describes the application of 'Gruzin's Technique' used to measure diffusion profiles. The method is described as well as the theory used in its evaluation. The experimental technique is also applied to the measurement of the self-diffusion coefficient of iron in the gamma phase at temperatures of 960, 1000, 1070, 1100, 1130, 1200, and 1250C. An Arrhenius expression is also arrived at to describe diffusional behavior.

711,406
PB-281 257-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Oxidation of Diffusion Coatings on a Niobium Alloy (Okislenie Diffuzionnykh Nokrytii na Splave Niobiya),
V. Lyk'yanov, G. Zemskov, R. Kogan, and V. Vidorman. 1976, 9p DMDC-16018, TT-76-59193
Trans. of Fazove Prevrashchonii Akad Nauk Ukr. SSR, p127-150 1970. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Metallizing, *Niobium alloys, *Oxidation resistance, Diffusion coatings, Chromium, Titanium, Silicon, Translations, USSR.

This work describes the oxidation of multi-component diffusion coatings, which are obtained by chrome-titanium plating with following siliconization. The three-components (Cr + Ti) Si, and also one-two-component coatings from these elements were tested in an atmosphere of air at 700-1200 C during a 10 hours period. The three-component coatings provide the highest heat-stability and were tested also at 1100C during a 100 hour period.

711,407
PB-281 519-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Morphology of Oxides on Copper (Prirode I Svoistvakh Melkristallicheskikh Prolock Zakici Medi),
A. Andrievskii, and M. Mishchenko. 1976, 14p DMDC-17266, TT-76-59196
Trans. of Zhurnal Tekhnicheskoi Fiziki (USSR) v24 n1 p34-40 1954. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Copper, *Oxidation, Copper oxides, Scale(Corrosion), Fractures(Materials), Diffusion, Translations, USSR.

Copper was oxidized in air at 1020C. The oxide scales which were formed were removed and tested at high temperatures (800 to 1020C) to failure. Fracture surfaces were examined with special attention given to grain boundaries and the probable reactions taking place in them.

711,408
PB-281 520-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Reaction and Formation of Copper Oxides at High Temperatures (O Mekhanizme Okisleniya Medi V Vozdushnoi Srede Pri Vysokoi Temperature),
A. Andrievskii, and M. Mishchenko. 1976, 12p DMDC-16607, TT-76-59195
Trans. of Zhurnal Tekhnicheskoi Fiziki (USSR) v25 n10 p1683-1688 1955. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Copper, *Oxidation, Copper oxides, Phase transformations, Diffusion, Translations, USSR.

Metallic copper is oxidized in air at temperatures between 1000 and 1060C. The oxides which form are examined metallographically. The role of grain boundaries, impurities, etc. are considered. The morphology and content of the resulting scales are correlated with the experimental variables and the phase diagram for the Cu-O system.

711,409
PB-281 521-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
High Temperature Oxidation of Some Silver-Copper Alloys (Issledovanie Serebyanyh Sulavov, Podvergnuthyh Vnutrennmu Okisleniyu),
E. Shpichinetskii, and G. Machulskaya. 1976, 12p TT-76-59198, DMDC-17342
Trans. of Metalloved. Obrab. Tsvetu. Meb. Splavov. (sic), v26 p77-82 1967. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Oxidation, *Silver alloys, Copper containing alloys, Magnesium, Nickel, Hardness, Electrical resistivity, Diffusion, Translations, USSR.

The microstructure of alloys of Ag, Mg, Cu, and Ni were examined after being internally oxidized in air or pure oxygen at temperatures in the range 650 to 700C. Electrical characteristics of the alloys were also measured. A sharp increase in hardness of the materials was noted.

711,410
PB-281 527-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Mechanism of Oxidation of Copper and the Structure of the Copper Oxide Layers (O Structure Mednoi Okaliny i Mekhanizme Okisleniya Medi),
N. P. Diev, and M. I. Kochnev. 1976, 9p DMDC-16388, TT-76-59194
Trans. of Akademiya Nauk SSSR. Doklady, v85 n3 p563-566 1952. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Oxidation, *Copper, Copper oxides, Crystal structure, Scale(Corrosion), Diffusion, Translations, USSR.

This review paper evaluates some of the early experiments on the oxidation of pure copper and proposes what the mechanism of degradation in air may be. Crystal structure data of the scales formed on the metal and their relative thickness are relied on heavily in making interpretations.

711,411
PB-281 911/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Simple Method for Producing High Conductivity Copper for Low Temperature Applications.
Final rept.,
S. S. Rosenblum, W. A. Steyert, and F. R. Fickett.
Nov 77, 3p
Sponsored in part by International Copper Research Association, New York.
Pub. in Cryogenics 17, n11 p645-647, Nov 77.

Keywords: *Copper, *Internal oxidation, Electrical properties, Reprints, Low temperature.

The note describes results obtained by internal oxidation of a variety of coppers. The importance of this technique in preparing copper for low temperature electrical applications is mentioned.

711,412
PB-282 190/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Importance of Temperature Standardization in Medicine.
Final rept.,
B. W. Mangum, and D. D. Thornton. Jan 78, 6p
Pub. in Lab. Manage., p32-37 Jan 78.

Keywords: *Temperature measurement, *Melting points, *Metals, *Standardization, Gallium, Melting, Freezing, Latent heat, Enzymes, Medical laboratories, Reprints, International Practical Temperature Scale.

After a brief discussion of the requirements and problems of thermometry in medicine, the authors describe a program to develop temperature fixed points in the range of biomedical interest, and have developed a point in the clinically important region near 30C. This fixed-point is a consequence of and is realized by the latent heat involved in the first-order phase transition exhibited by gallium metal at its liquid-solid equilibrium point. A general discussion is given of the melting and freezing behavior of pure metals. To check the suitability of the gallium system for use by the biomedical community, the authors have investigated the melting behavior of a few grams of pure gallium contained in a small Teflon container under an inert gas having a nominal pressure at one atmosphere. The melting point of gallium in such an environment is highly reproducible, easily realized, and has the value 29.7723 plus or minus 0.0007 on the International Practical Temperature Scale of 1968. It has been proposed that the melting-point of gallium, as realized in SRM 1968, provides a convenient fixed-point temperature suitable for use as the temperature for enzyme reference methods in clinical enzymology, as well as for use in accurate calibrations in general applications.

711,413
PB-283 086-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion of Cu in a Sulfide Scale on Cu(Diffuziya Midi V Sul'fidinoi Okaline na Medi),
I. Pokrovskii. 1976, 10p DMDC-17495, TT-76-59202
Trans. of Akademiya Navuk BSSR, Minsk. Doklady, n5 p499-502 1961. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Copper, *Scale(Corrosion), Sulfides, Isotopic labeling, Translations, USSR, *Copper sulfides, Copper 64.

The diffusion of 64Cu into a copper-sulfide scale was investigated. The data fit the Arrhenius equation D = .000255 exp(-4990 cal./RT) over the temperature range 127-445C. The activation energy for the formation of the copper scale was also determined, and found to be about 14 Kcal/mol, considerably higher than the tracer self-diffusion rates. Consequently, the authors concluded that self-diffusion is not the rate-limited process in the formation of a sulfide scale on copper.

711,414
PB-283 157-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Mechanism of Reactional Diffusion in the Interaction of Solid Copper with Some Gaseous Elements (K Voprosy o Mekhanizme Reaktsionnoi Diffyzii pri Vzaimodeistvii Tverdoi Medi s Nekotoremi Gazoobraznemi Elementami),
V. I. Arkharov, and S. Mardeshev. 1974, 17p DMDC-11547, TT-74-53072
Trans. of Akademiya Nauk SSSR. Doklady, n103 p273-276 1955. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Copper, *Gases, *Scale(Corrosion), Chlorine, Bromine, Iodine, Selenium, Tellurium, Phosphorus, Silicon, Zinc, Chemical reactions, Translations, USSR.

Copper metal is heated in vapors of C, Br, I, Se, Te, P, Si, and Zn at temperatures ranging between 215 and 1000C. Not all vapors are employed at the higher temperatures. The reaction products are studied in a qualitative manner (adhesion, recrystallization, etc.). Diffusional processes, particularly in scaling, are discussed.

711,415
PB-283 158-T PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Determination of the Diffusion Coefficient of Metals (Metodi Opredelenia Coeffitsienta Diffugi Mettalov),
B. S. Bokshtein. 1976, 35p DMDC-15047, TT-76-59188
Trans. of Metody Ispty. Kontr. Issled. Mashinostroit. Mater (USSR) n1 p5-25 1971. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Metals, Measurement, Tests, Isotopic labeling, Grain boundaries, Vacancies(Crystal defects), Translations, USSR.

A generalized review covering many theoretical aspects of diffusion in solids is presented. The calculation of the diffusion coefficient is described by various techniques, and is applied to various types of diffusion; e.g., tracer, surface, grain boundary, and interdiffusion. Relaxation methods, internal friction, correlation factors, isotopes effects, and mechanisms for diffusion are also discussed. Twelve references are listed.

711,416
PB-283 707/8 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
NBS: Properties of Electronic Materials.
Annual rept. 1 Apr 77-31 Mar 78,
J. R. Manning, and R. L. Parker. Jun 78, 117p
NBSIR-78-1483

Keywords: *Measurement, *Test facilities, Spacecraft environments, Surface tension, Gallium, Liquid metals, Experimental design, Alloys, Convection, Diffusion, Solidification, Lead alloys, Tin alloys, Phase transformations, Fluid flow, Crystal defects, Instrumentation, Cameras, Nickel, Iron oxides, Gravity, Corrosion, Chemical properties, Platinum, Flame propagation, *Space processing, X ray topography, Real time operation, Potassium ferrates.

This report describes NBS work for NASA in support of NASA's Materials Processing in Space Program covering the period April 1, 1977 to March 31, 1978. The NBS program has two main thrusts: (1) Carrying out precision measurements in space and investigating the feasibility of improved measurements when the space environment offers a unique opportunity for performing such measurements. These measurements would be useful for either space processing or processes on the ground. (2) Obtaining precision measurements on materials properties when these properties are important to the design and interpretation of space processing experiments. These measurements would be carried out either in space or on the ground. The NBS work is carried out in five tasks as follows: Surface tensions and their variations with temperature and impurities; Solutal convection and liquid diffusion coefficients; Determination of crystal perfection; A thermochemical study of corrosive reactions in oxide materials; Gravity effects on flame inhibition.

711,417
PB-285 235-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Phases Formed in the Interdiffusion Zone of the Ni-Sb System (Issledovanie Reaktsionnoi Diffuzii V Smesi Poroshkov Nikelya I Syur'mi),
N. Myuller, L. Sotnikova, A. Zaitsev, and V. Libkind. 1976, 16p DMDC-17352, TT-76-59199
Trans. of Metalloved. Obrab. Tsvetu. Met. Splavov. (sic) n20 p38-49 1967. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Nickel alloys, *Antimony containing alloys, *Diffusion, *Phase transformations, Hardness, X ray diffraction, Magnetic properties, Electrical conductivity, Crystal structure, Differential thermal analysis, Translations, USSR, Nickel antimonides.

Nickel and antimony powders form the intermetallide, NiSb, by interdiffusion at temperatures of 200-800C and pressures of 37 kg/sq cm. Phase identification was by microhardness and x-ray structural analysis methods. Electrical conductivity and qualitative magnetic property determinations were used to measure the completeness of the nickel-antimonide formation. Formation kinetics were studied by differential thermal analysis. The data on NiSb formation at various heat-treatment stages by microstructure analysis and microhardness confirmed the x-ray structural results. Extensive data on diffraction patterns are presented.

711,418
PB-285 299/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hydrogen Diffusion in Palladium by Galvanostatic Charging.
Final rept.,
J. G. Early. 1978, 9p
Pub. in Jnl. Acta. Met., v26 p1215-1223, 1978.

Keywords: *Palladium, *Hydrogen, *Diffusion, Reprints.

The diffusion of hydrogen in alpha-palladium at ambient temperature has been studied by a galvanostatic technique. Single transient and multiple transient hydrogen charging experiments were conducted on specimens over a range of charging currents and specimen thicknesses. The mathematical description of multiple transient charging is developed for the galvanostatic technique from the general solution for diffusion.

711,419
PB-285 300/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chemical Interdiffusion and Kirkendall Shifts in Silver-Cadmium Alloys.
Final rept.,
D. B. Butrymowicz, and J. R. Manning. Jul 78, 7p
Pub. in Jnl. Met. Trans., v9A p947-953, Jul 78.

Keywords: *Silver alloys, *Cadmium alloys, *Diffusion, Phase transformations, Reprints, *Kirkendall effect.

Chemical interdiffusion in alpha-phase silver-cadmium alloys was investigated in the temperature range 799 to 906C with solid-solid, single-crystal couples. Interdiffusion coefficients and Kirkendall shifts were experimentally determined. The Kirkendall shifts that were measured directly by traveling microscope measurements were compared to those shifts calculated from Matano analyses and those predicted by the theories of Manning and Darken. The experimentally-measured Kirkendall shifts were found in all cases to be greater than those predicted by Darken and equivalent to or slightly larger than those predicted by Manning. This difference from the results predicted by Darken is attributed to the vacancy wind effect. The experimentally-determined interdiffusion coefficients are in reasonable agreement with those predicted by theory.

711,420
PB-285 321/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microstructural Changes in 900 deg C Heat Treated Ti-6Al-4V after Deformation.
Final rept.,
M. A. Imam, A. C. Fraker, and C. M. Gilmore. 1977, 2p
Pub. in Proc. Annual Meeting of the Electron Microscopy Society of America (35th), Boston, Mass. Aug 22-26, 1977. Paper in Electron Microscopy, p254-255 (Claitor's Publishing Div., Baton Rouge, La., 1977).

Keywords: *Titanium alloys, *Deformation, Aluminum containing alloys, Vanadium containing alloys, Electron microscopy, Electron diffraction, Fatigue tests, Microstructure, Phase transformations, Transmission electron microscopy, Titanium alloy 6Al 4V.

Transmission electron microscopy (TEM) techniques have been used to show the microstructural relation to the degree of deformation. The martensite (alpha prime-Ti) size and density increase with increasing deformation and the amount of beta-Ti present decreases with increasing deformation. This is illustrated with TEM micrographs and associated electron diffraction patterns from Ti-6Al-4V material after fatigue testing to failure.

711,421
PB-286 785/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radiance Temperature of Titanium at Its Melting Point.
Final rept.
F. Righini, A. Rosso, L. Coslovi, A. Cezairliyan, and J. L. McClure. 1977, 7p
Sponsored in part by Air Force Office of Scientific Research, Arlington, VA.
Pub. in Proceedings of Symposium on Thermophysical Properties, held at Gaithersburg, MD on May 10-12, 1977, p312-318 (American Society of Mechanical Engineers, NY. 1977).

Keywords: *Titanium, *Radiance, *Melting points, High temperature tests, Spectral emittance, Pulse heating, Thermal radiation.

Radiance temperature (at two wavelengths, 653 and 997 nm) of titanium at its melting point was measured using a subsecond duration pulse heating technique. Specimens in the form of strips with initially different surface roughnesses were used. The results do not indicate any dependence of radiance temperature (at the melting point) on initial surface or system operational conditions. The average radiance temperature at the melting point of titanium is: 1800 K at 653 nm and 1711 K at 997 nm, with a standard deviation of 0.4 K at 653 nm and 0.8 K at 997 nm. The total inaccuracy in radiance temperature is estimated to be not more than + or - 6 K.

711,422
PB-288 102/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nuclear-Magnetic-Resonance Studies of Amorphous Ni-P Alloys.
Final rept.,
L. H. Bennett, H. E. Schone, and P. Gustafson. 1 Sep 78, 4p
Pub. in Physical Review, B. v18 n5 p2027-2030, 1 Sep 78.

Keywords: *Nickel alloys, *Phosphorus containing alloys, *Nuclear magnetic resonance, Frequency shift, Electroplated coatings, Electroless plating, Fabrication, *Amorphous alloys, Reprints.

Measurements of NMR line width, Knight shifts and relaxation time have been made on amorphous Ni-P alloys with phosphorous content between 15 and 25 percent. Alloys prepared by different techniques (electroplating and chemical deposition) give different Knight shifts, suggesting different local structures. Line width measurements support a binary DRPHS model in which phosphorous atoms have only nickel neighbors.

711,423
PB-289 010/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dynamics of Hydrogen in Metals.
Final rept.
J. M. Rowe, and J. J. Rush. 1978, 14p
Pub. in Paper IAEA-SM-219/131 in Neutron Inelastic Scattering 1977, II P303-316 (Internatl. Atomic Energy Agency, Vienna, Austria 1978).

Keywords: *Hydrogen, Dispersion relations, Alloys, Dynamics, Phonons.

The results of a series of measurements of the acoustic and optic modes of the phonon dispersion relation of high concentration metal-hydrogen alloys are presented. The data are correlated with other physical properties where possible, and points of similarity and difference for various types of alloy are brought out.

711,424
PB-289 567-T PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
X-Ray Radiography of Fine Structure (Rentgenograficheskoc Issledovanie Tonkoi Strucktury).
Y. S. Umanskii. 1976, 50p DMDC-17715, TT-76-59207
Trans. of Metody Ispty. Kontr. Issled. Mashinostroit. Mater (USSR) n1 p56-85 1971. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Radiography, *Crystal structure, Grain structure, Crystal defects, Lattice parameters, Microstructure, Line spectra, Metals, Texture, Alloys, Metallography, Deformation, X ray diffraction, Grain size, Translations, USSR, *Fine structure.

The use of a variety of x-ray techniques to study the fine structure of metals and alloys is reviewed. The degree of perfection of crystals and other microstructural changes brought about by chemical and mechanical treatments are investigated with x-ray procedures. Grain size, mosaic structure, rolling textures, etc. are some of the determinations made with a variety of x-ray techniques.

711,425
PB-289 570-T PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Identification of Phases by X-Ray Analysis (Fazovyi Rentgenostrukturnyi Analiz).
M. I. Ermolova. 1976, 30p DMDC-17725, TT-76-59217
Trans. of Metody Ispty. Kontr. Issled. Mashinostroit. Mater (USSR) n1 p291-307 1971. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *X ray analysis, *Crystal structure, *Phase, Metals, Alloys, Lattice parameters, Translations, USSR, Phase studies.

X-ray diffraction techniques used to determine metal structures and their pertinent parameters (interplanar spacing, lattice parameters, phase, etc.) are reviewed. Equipment needs are surveyed. A variety of materials are discussed in demonstrating applied techniques.

711,426
PB-289 601-T PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Physico-Chemical Analysis of Alloy Phases (Fazovyi Fiziko-Khemicheskii Analiz Splavov).
N. F. Lashko. 1976, 102p DMDC-17724, TT-76-59216
Trans. of Metody Ispty. Kontr. Issled. Mashinostroit. Mater (USSR) n1 p231-291 1971. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Alloys, *Chemical analysis, *Phase, X ray diffraction, Electron diffraction, Metals, Reviews, Translations, USSR, Phase studies.

A review is presented of nearly 200 papers dealing with the physico-chemical analysis of phases in alloys. The technique includes the separation of phases with a corrosive liquid into soluble and insoluble phases. The soluble phases are chemically analyzed. Insoluble phases are subjected to x-ray or electron diffraction examination. A wide variety of ferrous and nonferrous alloy systems are discussed, and the appropriate procedures are detailed for their analysis.

711,427
PB-291 482-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
X-Ray Study of Reaction Diffusion in the System Zn-Cu. (Rentgenograficeskoe Issledovanie Reakcionnoi Diffozii v Sisteme Medy-Cink).
V. I. Arkharov, and S. Mardeshev. 1974, 18p DMDC-1534, TT-74-53210
Trans. of Fizika Metallov i Metallovedenie (USSR) n1 p517-522 1955. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Copper, *Copper alloys, *Zinc, *Diffusion, Zinc alloys, X ray analysis, Metallography, Reaction kinetics, Phase transformations, Translations, USSR.

Pure copper and copper-zinc alloys were reacted with Zn vapors at temperatures ranging from 400 to 800C. The growth of new, multiphase layers on the solid alloys was followed metallographically and with x-ray analysis. The relative rates of mobility of copper and zinc were noted. Relative growth rates of phases were also measured.

711,428
PB-291 483-T PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
X-Ray Study of Reaction Diffusion in Binary Systems Composed of Cu with the Halides, with P, and with Si. (Rentgenograficheskoe Issledovanie Reaktsionnoi Diffuzii v Binarnikh Sistemah, Obrazovanikh Medbu s Galoidami, s Fosforom i Kremniem).
V. I. Arkharov, and S. Mardeshev. 1974, 31p DMDC-11506, TT-74-53208
Trans. of Fizika Metallov i Metallovedenie (USSR) n1 p510-516 1955. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Copper, *Halides, *Phosphorus, *Silicon, *Diffusion, *Brasses, Zinc, Iodine, AZZ, Chlorine, Bromine, Metallography, X ray analysis, Reaction kinetics, Translations, USSR.

Solid copper and brass are reacted with Si, P, I, Br, Cl, or Zn vapors at temperatures ranging from 20 to 825C. The formation of scale products which took place were examined metallographically and with x-ray patterns. The relative rates of mobility within the scales of the different atomic species were compared for each binary system.

711,429
PB-291 484-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Mutual Diffusion in the Fe-Cu Systems (Vzaimnaya Diffusiya v Sistemc Zhelezo-med).
M. A. Krishtal, A. P. Mokrov, Y. A. Belobragin, and K. V. Volkov. 1974, 12p DMDC-11635, TT-74-53082
Trans. of Fizika i Khimiya Obrabotki Materialov (USSR) n3 p109-112 1971. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Iron, *Copper, Diffusion coefficient, Solubility, Activation energy, Translations, USSR, Kirkendall effect.

Fe and Cu were interdiffused at 900, 950, 1000, and 1050C. Tungsten wire markers were found to shift towards the pure Cu side of the diffusion couple. Concentration profiles from interdiffusion were measured with an electron probe microanalyzer. A Matano analysis was performed on the data for the epsilon and gamma phases to calculate diffusion coefficients. Arrhenius plots of all of the data are given. Activation energies are determined.

711,430
PB-291 485-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Use of Radioactive Isotope to Study the Diffusion of Silver in Copper-Aluminum Alloys (Izsledvane Difuziyata na Srebro v Medno-Aluminievi Splavi s Promoshchta na Radioaktivni Izotopi).
A. V. Spasov, and G. Ivanov. 1974, 17p DMDC-12184, TT-74-53077
Trans. of Godishnik na Khimicheskiya Fakultet (sic), v63 p73-81 1968-69. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Silver, *Copper alloys, *Diffusion, Aluminum containing alloys, Radioactivation analysis, Activation energy, Diffusion coefficient, Translations, USSR.

The tracer diffusion coefficient of Ag-110 in Cu-Al alloys is measured over the temperature range 750 to 950C. The copper alloys contain from 1 to 5 wt.% Al and are all single phase alloys. Arrhenius plots are obtained for all compositions studied. A concentration dependence of the activation energy is noted, a minimum occurring at 3 wt.% Al. Experiments were performed with polycrystalline alloys.

711,431
PB-291 487-T PC **A02**/MF **A01**

National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Mutual Diffusion of Copper and Tin (Kbm Vbprosa za Vzaimnata Difusiya na Medta i Kalaya).
A. V. Spasov, and M. A. Spasova. 1974, 25p DMDC-14140, TT-74-53225
Trans. of Godishnik na Khimicheskiya Fakultet (sic), v50 p15-26 1958. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Information Program.

Keywords: *Copper, *Tin, *Diffusion, Phase transformations, Activation energy, X ray analysis, Metallography, Translations, USSR.

The interdiffusion of pure copper and pure tin is experimentally investigated at 200, 250, 300, and 350C. X-ray and metallographic examination were used to follow diffusion and the growth of new phases in the interdiffusion zone. Growth of the epsilon phase was found to be parabolic. Rates of the temperature and diffusion rates in the epsilon phase are calculated.

711,432
PB-291 488-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
About Diffusion in Solid Solutions with Varying Concentrations (O Diffuzii v Tverdyh Rastvorah s Peremennoi Koncentraciei).
A. S. Palatnik, and A. P. Lyubchenko. 1974, 13p DMDC-13727, TT-74-53071
Trans. of Akademiya Nauk USSR. Doklady, v117 p407-410 1957. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Solid solutions, *Iron, *Carbon, Equations, Vacancies(Crystal defects), Translations, USSR.

The diffusion of carbon and iron in solid solutions of varying concentrations at 910C is reported. A concentration dependence of the radioactive tracer diffusion coefficients is noted. Appropriate changes are made to the diffusion equations to account for the experimentally observed changes, and a physical picture is speculated to account for the observations.

711,433
PB-291 571-T PC **A14**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Structure and Properties of Heat Resistant Alloys (Struktura i Svoiestva Zaraoprochnie Splavov).
G. N. Dubinin. 1973, 322p DMDC-13356, TT-73-53050
Trans. of Aviatsionnyi Institut, Moscow. Trudy (USSR) n228 184p 1971. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Information Program. Portions of this document are not fully legible.

Keywords: *Heat resistant alloys, *Diffusion, Trends, Failure, Heat treatment, Aging(Metallurgy), Alkali metals, Powder metallurgy, Mechanical properties, Glow discharges, Microstructure, Aluminum coatings, Stainless steels, Translations, USSR.

This collection of papers deals with materials used in the aircraft industry. It includes many aspects dealing with the production and fabrication of these materials as well as with their behavior in high temperature service. The bulk of the work deals with surface treatments. Most of the research referred to is from the Soviet literature.

711,434
PB-291 572-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Determination of Diffusion Parameters in a Mixture of Two Phases (Opredelenie Parametrov Diffusii v Smesi Dvykh Faz).
S. D. Gertsriken, I. Y. Dekhtyar, L. M. Kumok, and E. G. Madatova. 1976, 10p DMDC-15455, TT-76-53826
Trans. of Akademiya Nauk URSR, Kiev. Instytut Metallofizyky. Sbornik Nauchnykh Rabot, n8 p105-108 1957. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Alloys, *Zinc, Phase, Mobility, Activation energy, Diffusion coefficient, Mathematical analysis, Translations, USSR, Self diffusion.

A mathematical treatment of diffusion in a two-phase system is considered. The results of the approach are applied to the self diffusion of zinc.

711,435
PB-291 574-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Dependence of Diffusion on the Grain Size (0 Zavisimosti Difuzii ot Razmera Zerna).
S. Gertsriken, and Z. Golubenko. 1975, 21p DMDC-12759, TT-75-53171
Trans. of Zhurnal Tekhnicheskoi Fiziki (USSR) n8 p1219-1225 1938. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Alloys, *Metals, Grain size, Copper, Nickel, Powder metals, Grain boundaries, Radiography, Coefficients, Translations, USSR.

Reported is one of the first experimental investigations into the relative rates of diffusion in grain boundaries vs. volume diffusion. Experiments with the copper-nickel binary system in the temperature range 700 to 900C showed fine-grained specimens experiencing large contributions from grain boundary diffusion to the total diffusion rate.

711,436
PB-291 575-T PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Determination of the Diffusion by the Technique of Change of Resistance in the System Copper-Nickel Pressed Powders (Vclidzhennya Vnurishn'oi Difuzii za Metodom Electrovidnosti v Sistemakh z Presovanikh Poroshkiv Mid'-Nikel).
S. D. Gertsriken, and A. A. Shatalov. 1975, 39p DMDC-14111, TT-75-53296
Trans. of Fizichni Zapiski (USSR) v7 p213-227 1938. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Copper, *Nickel, Powder metals, Hot pressing, Sintering, Electrical measurement, Electrical resistivity, Activation energy, Translations, USSR.

Pure copper and nickel powders were pressed at pressures ranging up to 12000 atmospheres and annealed at temperatures up to high as 800C for different lengths of time. Electrical resistivity measurements were recorded under the different variables in the experiment. Resistivity measurements were compared to x-ray studies. The amount of diffusion which took place was related to the resistivity measurements. An activation energy was calculated for the sintering process investigated.

711,437
PB-291 576-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion of Silver in Copper-Zinc by Using Radioactive Isotopes (Izsledvane Difuziyata na Srebro v Medno-Tsinkovi Silavi s Iomoshchta na Radioaktivni Izotopi).
A. L. Spasov, and G. Ivanov. 1974, 16p DMDC-14317, TT-74-53425
Trans. of Godishnik na Khimicheskiya Fakultet (sic), v64 p53-60 1969-70. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Silver, *Diffusion, *Copper alloys, Zinc containing alloys, Radioactive isotopes, Activation energy, Diffusion coefficient, Translations, Bulgaria, Silver 110.

The Arrhenius plots for the diffusion of radioactive Ag-110 in Cu-Zn alloys of single phase. Alloys contained 1.4% to 11.6 wt.% Zn. Diffusion anneals ranged from 750 to 950C. Activation energies ranged from 20.9 to 49.4 Kcal/mol.

711,438
PB-291 581-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
High Temperature Kinetics of Oxide Formation on Copper (Nckotopye Noprozy Kinetiki Protsessa Okis Leniya Meoli i Rosta Kristallov Zakici Medi).
A. Andrievskii, and M. Mishchenko. 1976, 12p DMDC-17267, TT-76-59197
Trans. of Zhurnal Teknicheskoi Fiziki (USSR) v22 n11 p1713-1717 1952. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Oxidation, *Copper oxides, *Reaction kinetics, *Diffusion, Surface chemistry, Copper, Layers, Impurities, Grain boundaries, Translations, USSR.

The heating of copper plates in air up to 900C in air is qualitatively investigated. The formation of CuO and Cu2O on the plate surface is followed metallographically and possible growth mechanisms of the oxides is put forward. The effect of various impurities present in the copper on the oxidation processes is noted. The role of grain boundaries in the growing layers of oxides is determined. Relative mobilities of the diffusing species are noted.

711,439
PB-291 583-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Method of Formation of Sulfides on Copper (O Mekhanizme Obrazovaniioi CuS Iz Sul'fidov Oduovalentnoe Medi (Cu(2-x)S) i Sery).
M. M. Pavlyuchenko, and I. I. Pokrovskii. 1976, 14p DMDC-17514, TT-76-59204
Trans. of Akademiya Navuk BSSR, Minsk. Vestsi. Seryya Khimichnykh Navuk, n3 p35-41 1967. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Copper, *Sulfur, *Diffusion, Diffusion coefficient, Reaction kinetics, Layers, Autoradiography, Translations, USSR, Copper sulfides, Self diffusion.

The formation of sulfides on the surface of copper is measured in the temperature range of 300 to 445C. Reaction products formed on the Cu surface were examined metallographically. Layer growth rates were measured. Self-diffusion coefficients were measured for Cu-64 and S-35 at 300, 350, 400, and 445C in the sulfide compounds using the residual activity technique. Autoradiography was employed as a supplementary technique to examine grain boundaries, porosity, and cracks in the sulfide scale.

711,440
PB-297 465/7 PC **A07**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
NBS: Properties of Electronic Materials.
Annual rept. 2 Apr 78-1 Apr 79.
J. R. Manning. Jun 79, 137p NBSIR-79-1767
See also report dated Jun 78, PB-283 707. Sponsored in part by National Aeronautics and Space Administration, Huntsville, AL. George C. Marshall Space Flight Center.

Keywords: Materials, Measurement, Physical properties, Liquid metals, Gallium, Interfacial tension, Convection, Diffusion, Solidification, Lead alloys, Tin alloys, Potassium oxides, Iron oxides, Corrosion, Thermodynamic properties, Specific heat, Refractory materials, Liquid flow, Spacecraft environments, *Space processing, Temperature dependence, Materials processing in space program.

The report describes NBS work for NASA in support of NASA's Materials Processing in Space Program covering the period April 2, 1978 to April 1, 1979. The results obtained are given in detailed summaries in the body of the report. Briefly, in Task I - Surface Tensions and their Variations with Temperature and Impurities - measurements of the surface tension of liquid gallium were made in vacuum by the sessile drop technique as a function of temperature T. In Task 2 - Solutal Convection and Liquid Diffusion Coefficients - samples of off-eutectic Pb-rich Pb-Sn were directionally solidified, and the macrosegregation and changes in microstructure along the length of the sample, attributed to solutal convection, were measured. In Task 3 - A Thermochemical Study of Corrosion Reactions in Oxide Materials - phase relationships in the K2O-Fe2O3 system were investigated up to 1600 degrees C. In Task 4 - Thermodynamic Properties of Refractory Inorganic Materials as Functions of Temperature - methods of determining heat capacities in reactive liquid samples

[illegible] at 0.6 temperature measured by use of [illegible] cooling [illegible] were analyzed.

PB 298 412/3 Not available NTIS
National Bureau of Standards, Gaithersburg MD
Metallurgical Effects in Niobium-Titanium Alloys
Final rept.
A. F. Clark and A. I. Braginski
Sponsored in part by National Research Council, Washington DC
Pub. in Cryogenics 19 no 9 p 535-543 Sep 79

Keywords: *Niobium alloys, *Titanium alloys, Metallography, Microstructure, Mechanical properties, Electron microscopy, Alloy systems, Temperature dependence, Cold working, Temperature, Low temperature, Reprints.

The microstructural and mechanical response of the ductile, commercial, low interstitial Nb-Ti alloy Nb-47.5 wt% Ti and Nb-46.5 wt% Ti-1.5 wt% Ta were studied by metallographic techniques and mechanical tests over the temperature range 4.2 to 300 K. The microstructure in these materials was controlled through the use of a cold work of 90% or more followed by a recrystallization anneal. The Nb-47.5 wt% Ti alloy was found to be a two-phase alloy in the as-annealed condition, while the Nb-46.5 wt% Ti-1.5 wt% Ta alloy was found to be a single-phase alloy. The mechanical properties of the two alloys were found to be very similar. [illegible]

PB 298 898/9 Not available NTIS
National Bureau of Standards, Washington DC
Low Temperature Fracture Properties of a Duplex Aluminum-6% Magnesium Alloy
[illegible]
J. A. McHenry, J. T. Vassilaros, P. J. Stein, and P. T. [illegible]
[illegible]
Pub. in Proceedings of the International Cryogenic Materials Conference (2nd) Held in Boulder, CO on August 1-4, 1977, p 487-498

Keywords: *Aluminum alloys, Magnesium containing alloys, *Fracture properties, Cryogenic properties, Tensile tests, Crack propagation, Fracture mechanics, Notch sensitivity, Aluminum alloy 5083, Aluminum alloy 5456, Aluminum alloy 5086.

Aluminum alloy 5083 (Al-4.6Mg-0.6Mn) was one of the first alloys considered for welded cryogenic applications. Although Al-Mg alloys are susceptible to hydrogen embrittlement, they have excellent cryogenic properties. In the present investigation, Alloy 5083 was compared with two other Al-Mg alloys, Alloy 5456 (Al-5Mg-0.8Mn-0.15Cr) and Alloy 5086 (Al-4Mg-0.5Mn-0.15Cr). All materials were tested in the H321 temper. Alloy 5456 was selected for the study because it is the strongest of the Al-Mg alloys available in the United States and is considered to be the most susceptible to hydrogen embrittlement. Alloy 5086 was selected because it is the weakest of the Al-Mg alloys and is considered to be the least susceptible to hydrogen embrittlement. The alloys were compared on the basis of tensile properties, notch sensitivity, and fracture toughness. [illegible]

PB 298 [illegible] Not available NTIS
National Bureau of Standards, Washington DC
Standard Reference Materials for Thermophysical Properties
Final rept.
[illegible]
Pub. in Proceedings of the International Cryogenic Materials Conference (2nd) Held in Boulder, CO on August 1-4, 1977, p 499-508

Keywords: *Thermal properties, *Standard reference materials, Specific heat, Thermal conductivity, Thermal expansion, Electrical resistivity, Enthalpy, Copper, Tungsten, Platinum, Sapphire, Synthetic polycrystalline materials, Aluminum oxide, Tungsten alloys, Aluminum alloys, Nickel base alloys, Stainless steels, Molybdenum, Reprints.

The National Bureau of Standards presently has in progress a program to develop Standard Reference Materials (SRM's) for thermophysical properties measurements. The program is divided into two parts: (1) the development of materials having extremely well characterized properties for use as primary standards, and (2) the development of materials having properties which are representative of those encountered in commercial practice. The first part of the program is concerned with the development of SRM's for the calibration of measurement systems in the laboratory. The second part is concerned with the development of SRM's for the routine measurement of properties in industrial practice. The significance of SRM's to the national measurement system is discussed along with desirable qualities of SRM's and their applications. The work in progress and future plans of the program are also presented.

PB 298 799/8 Not available NTIS
National Bureau of Standards, Gaithersburg MD
Microscopic Theory for Antiphase Boundary Motion and Its Application to Antiphase Domain Coarsening
Final rept.
S. M. Allen and J. W. Cahn
Sponsored in part by National Science Foundation, Washington DC
Pub. in Acta Met. [illegible] p 1085-1096 1979

Keywords: *Domains, Theory, Alloys, Domain walls, Kinetics, Reprints.

A microscopic theoretical theory for the motion of a curved antiphase boundary is presented. The mean velocity is found to be nearly proportional to the mean curvature of the boundary, but a phase factor, the constant of proportionality does not in general take the simple surface tree energy. Yet the driving force dependence of the energy is shown to be equal to the reduction in total boundary free energy. The theory is generalized for a model for antiphase domain coarsening. Experimental measurements of domain coarsening kinetics in Ni3Al alloys were made over a temperature range where the specific surface free energy was varied by more than two orders of magnitude. The results are consistent with the theory in general. The domain coarsening kinetics do not have the temperature dependence of the specific surface free energy.

PB 298 654/4 CSCL 11F, 20D, 20H, 20I, 20K, 20L, 20M, 20N, 20O, 20P, 20Q, 20R, 20S, 20T, 20U, 20V, 20W, 20X, 20Y, 20Z, 21A, 21B, 21C, 21D, 21E, 21F, 21G, 21H, 21I, 21J, 21K, 21L, 21M, 21N, 21O, 21P, 21Q, 21R, 21S, 21T, 21U, 21V, 21W, 21X, 21Y, 21Z, 22A, 22B, 22C, 22D, 22E, 22F, 22G, 22H, 22I, 22J, 22K, 22L, 22M, 22N, 22O, 22P, 22Q, 22R, 22S, 22T, 22U, 22V, 22W, 22X, 22Y, 22Z, 23A, 23B, 23C, 23D, 23E, 23F, 23G, 23H, 23I, 23J,

711,450
PB77-600002
(Order as PB-275 037, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Thermophysical Measurements on 90 Ti-6A1-4V Alloy Above 1450 K Using a Transient (Subsecond) Technique.
A. Cezairliyan, J. McClure, and R. Taylor. 1977, 5p
Included in Jnl. of Research of the National Bureau of Standards, v81A n2 and 3 p251-256 1977.

Keywords: Electrical resistivity, Heat capacity, High-speed measurements, High temperatures, Melting, Normal spectral emittance, Radiance temperature, *Specific heat capacity, Thermal radiation properties, Thermodynamics, *Titanium alloy.

Simultaneous measurements are described of specific heat capacity, electrical resistivity and hemispherical total emittance of the ternary allow 90Ti-6Al-4V in the temperature range 1450 to 1900 K, and the melting point and the radiance temperature at the melting point of the alloy by a subsecond duration transient technique.The results are expressed by the relations: cp = 1.3833 - 9.943 x 10(4)T + 3.745 x 10(7) doublet 7, p = 152.65 + .9304 x 10(2)T - 3.9548 x 10(6) doublet 7, where cp is in J.g(1).K(1), p is in Mu Omega.cm, and T is in K. The value of the hemispherical total emittance is 0.39 in the range 1700 to 1900 K. The melting point and the radiance temperature at the melting point are 1943 and 1796 K, respectively; the corresponding value for the normal spectral emittance at the melting point and at 653 nm is 0.395. Estimated inaccuracies of measured properties are:3 percent for specific heat capacity, 1 percent for electrical resistivity, 5 percent for hemispherial total emittance and 8 K for melting point and radiance temperature at the melting point.

711,451
PB77-600020
(Order as PB-276 556, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Melting Point Normal Spectral Emittance (at the Melting Point), and Electrical Resistivity (Above 1900 K) of Titanium by a Pulse Heating Method.
A. Cezairliyan, and A. P. Miiller. 1977, 4p
Included in Jnl. of Research of the National Bureau of Standards, v82 n2 p119-122 1977.

Keywords: *Electrical resistivity, Emittance, High-speed measurement, High temperature, *Melting point, Radiance temperature, *Titanium.

A subsecond duration pulse heating method was used to measure the melting point, the normal spectral emittance (at the melting point), and the electrical resistivity (above 1900 K) of 99.9 plus percent pure titanium. The results, based on the International Practical Temperature Scale of 1968, yield a value of 1945 K for the melting point. The normal spectral emittance (at 653 nm) at the melting point is 0.40. Estimated inaccuracies are: 5K in the melting point, 5 percent in the normal spectral emittance, and 3 percent in the electrical resistivity.

711,452
PB77-600030 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Diffusion in Copper and Copper Alloys. Part V. Diffusion in Systems Involving Elements of Group VA.
D. B. Butrymowicz, J. R. Manning, and M. E. Read. c1977, 50p
Included in Jnl. of Physical and Chemical Reference Data, v6 n1 p1-50 1977.

Keywords: Alloys, Antimony, Arsenic, Bismuth, *Copper, Diffusion, Electromigration, Liquid metals, Nitrogen, Phosphorus, Ternary diffusion, Thermomigration.

A survey, comparison, and critical analysis is presented of data compiled from the scientific literature concerning diffusion in copper alloy systems involving elements in Group Va (As, Bi, N, P, Sb). Here the term 'copper alloy system' is interpreted in the broadest sense. For example, the review of diffusion in the Cu-M system reports all diffusion situations which involve both copper and element M, including diffusion of Cu in M or in any binary, ternary, or multicomponent alloy containing M, diffusion of M in Cu or in any alloy containing Cu; and diffusion of any element in any alloy containing both Cu and M. Topics include volume diffusion, grain boundary diffusion, tracer diffusion, alloy-interdiffusion, electromigration, thermomigration, strain-enhanced diffusion and diffusion in molten metals. An extensive bibliography is presented along with figures, tabular presentation of data, and discussion of results.

711,453
PB77-600034 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Levels of Chromium, Cr I Through Cr XXIV.
J. Sugar, and C. Corliss. c1977, 68p
Included in Jnl. of Physical and Chemical Reference Data, v6 n2 p317-384 1977.

Keywords: *Atomic energy levels, Atomic spectra, *Chromium.

The energy levels of the chromium atom in all of its stages of ionization, as derived from the analyses of atomic spectra, have been completed. In cases where only line classifications are given in the literature, level values have been derived. The percentages for the two leading components of the calculated eigenvectors of the levels are given where available. Ionization energies and g-factors are also given.

711,454
PB77-600038 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Phase Diagrams and Thermodynamc Properties of Ternary Copper-Silver Systems.
Y. A. Chang, D. Goldberg, and J. P. Neumann. c1977, 54p
Included in Jnl. of Physical and Chemical Reference Data, v6 n3 p621-674 1977.

Keywords: Critically evaluated data, Phase diagrams, *Ternary copper-silver alloy systems, Thermodynamic properties.

Phase diagram and thermodynamic data for twenty ternary copper-silver-X alloy systems-where X represents Al, Au, Cd, Fe, Ge, In, Mg, Mn, Ni, P, Pb, Pd, Re, S, Sb, Se, Sn, Te, ti or Zn-were compiled and critically evaluated. Of the twenty ternary systems, thermodynamic data are available for only the seven systems containing Au, Pb, Pd, S, Sn, Te and Zn. The high-temperature phase relationships in the iron-rich region of the Cu-Fe binary system were also evaluated and a recommended phase diagram is presented.

711,455
PB77-600047 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Elastic Properties of Zinc: A Compilation and a Review.
H. M. Ledbetter. c1977, 24p
Included in Jnl. of Physical and Chemical Reference Data, v6 n4 p1181-1204 1977.

Keywords: Bulk modulus, Compressibility, Debye temperature, Elastic constants, Poisson's ratio, Shear modulus, Single-crystal elastic coefficients, Sound velocities, Young's modulus zinc, *Zinc.

The elastic constants of zinc are compiled and reviewed; one hundred references are cited. The included elastic constants are: Young's modulus, shear modulus, bulk modulus, compressibility, Poisson's ratio, second-order elastic stiffnesses. Temperatures and elastic-anisotropy effects are also reviewed. Other topics are: sound velocities, elastic Debye temperature, Cauchy relationships, elastic stability, pressure effects, and theoretical studies. New polycrystalline data are computed from single-crystal data by tensor-averaging methods.

711,456
PB78-600051 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Application of Proof Testing to Silicon Nitride.
S. M. Wiederhorn, and N. J. Tighe. 1977, 12p
Pub. in Proceedings ERDA Workshop on Ceramics for Advanced Heat Engines, Orlando, FL, Jan. 24-26, 1977, p247-258 1977.

Keywords: *Fracture, Nondestructive evaluation, Proof testing, Silicon nitride, Strength, Turbine materials.

Proof testing is being investigated as a method of insuring the reliability of silicon nitride in high temperature structural applications. In principle, proof testing ensures that the test survivors have a probability of failure that is acceptable for design purposes. A model program is being conducted at both room temperature and at 1200C to determine if the mechanical performance of hot-pressed silicon nitride can be enhanced by proof testing. It is observed that proof testing is useful for hot-pressed silicon nitride at service temperatures provided the effect of exposure time on strength is taken into account. Results are discussed with regard to flaw generation and oxidation in oxygen rich environments.

711,457
PB78-600054 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Solid State and Atomic Features in the Valence-Band Auger Spectra of Copper, Silver, and Gold.
C. J. Powell. 1978, 1p
Pub. in J. Vac. Sci. Tech. 15, n2 p652 1978.

Keywords: *Auger-electron spectra, Copper, Density of states, Electronic band structure, Gold, Silver.

A brief report is given of high-resolution measurements of selected Auger-electron transitions for copper, silver, and gold. These measurements are compared with a recent prediction by Sawatzky which provides a useful means for distinguishing the atomic-like Auger spectrum of copper from the bandlike spectrum of gold.

711,458
PB79-600035 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electrical Resistivity of Copper, Gold, Palladium, and Silver.
R. A. Matula. 1979, 152p
Included in Jnl. of Physical and Chemical Reference Data, v8, n4 p1147-1298 1979.

Keywords: *Copper, Critical evaluation, Data analysis, Data compilation, Data evaluation, Data extraction, Data synthesis, Electrical resistivity, Elements, Gold, Metals, Molten metals, Palladium, Precious metals, Reference data, Silver, Solid state physics, Transport properties.

In this work, recommended values for the electrical resistivity as a function of temperature from the cryogenic region to well beyond the melting point are given for bulk pure copper, gold, palladium, and silver. In addition to the total electrical resistivity values for the solid state, intrinsic electrical resistivity values are presented from cryogenic temperatures to the melting point. The values are corrected for the change in geometry due to thermal expansion. The recommendations are based on theoretical considerations and on the experimental data found in the open literature. That available experimental data together with information pertaining to the specimen characterization and measurement conditions are included in this work. The methods of data evaluation and other considerations used in arriving at the recommendations are described. For the solid state, an interpolation scheme is given to aid in the determination of values between those supplied in the tables; for the liquid state, equations are given.

711,459
PB80-104185 Not available NTIS
National Bureau of Standards, Washington, DC.
Diffusional Mass Transport in Polycrystals Containing Stationary or Migrating Grain Boundaries.
Final rept.,
J. W. Cahn, and R. W. Balluffi. 1979, 4p
Sponsored in part by Department of Energy, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Scripta Metallurgica 13, n6, p499-502 1979.

Keywords: *Grain boundaries, *Mass transfer, Diffusion, Polycrystals, Reprints.

Mass transport in polycrystalline materials is classified according to whether grain boundaries are stationary or not, whether there is time for lattice diffusion, and whether there is time for multiple interactions between diffusing species and grain boundaries.

711,460
PB80-104458 Not available NTIS
National Bureau of Standards, Washington, DC.
Diffusion Induced Grain Boundary Migration.
Final rept.,
J. W. Cahn, J. D. Pan, and R. W. Balluffi. 1979, 7p
Pub. in Scripta Metallurgica 13, n6, p503-509 1979.

Keywords: *Grain boundaries, *Diffusion, Migration, Reprints.

Diffusion induced grain boundary migration had been observed in three systems. The results in three addi-

tional systems are reported, suggesting that this may be a widespread phenomenon for low temperature diffusion. The theoretical problems posed by the observations are discussed.

711,461
PB80-117328 Not available NTIS
National Bureau of Standards, Washington, DC.
Discussion on the Paper 'A Mechanism of Intergranular Fracture During High-Temperature Fatigue' by B. Min and R. Raj.
Final rept.,
J. Early. 1979, 3p
Pub. in American Society for Testing and Materials, Special Technical Publication 675, p585-587 1979.

Keywords: *Fractures(Materials), Fatigue(Materials), Failure, Models.

The phenomenological model described in this paper is a further step in the process of separating the macroscopic failure mode categories of transgranular failure and intergranular failure from the qualitative description of mechanical behavior, such as ductile failure and brittle failure. By focusing on local deformation conditions, the model extrapolates discrete microscopic behavior to average macroscopic behavior which can be tested in the laboratory. Several questions are raised, however, concerning not only the particular model proposed in this paper but also the relationship of this model to other elevated temperature fracture models.

711,462
PB80-117807 Not available NTIS
National Bureau of Standards, Washington, DC.
Nondestructive Investigation of Texture by Neutron Diffraction.
Final rept.,
C. S. Choi, H. J. Prask, and S. F. Trevino. 1979, 5p
Pub. in Jnl. Appl. Cryst., v12 p327-331, 1979.

Keywords: *Texture, *Neutron diffraction, *Nondestructive tests, Grain structure, Copper, Reprints.

Texture measurement as a function of depth with a collimated thermal neutron beam is demonstrated for a 'two-layer plate' geometry sample with preliminary results for a copper cone.

711,463
PB80-119126 Not available NTIS
National Bureau of Standards, Washington, DC.
Positron Annihilation Study of Defects in Titanium.
Final rept.,
R. C. Reno, L. J. Swartzendruber, and L. H. Bennett. Oct 79, 4p
Pub. in NDT (Non-Destructive Testing) International, p224-227, Oct 79.

Keywords: *Titanium, *Defects, Annihilation reactions, Positrons, Measurement, Reprints, Positron annihilation.

Positron annihilation linewidth measurements have been used to study defect behavior in titanium samples which were first cold-worked and then annealed at temperatures ranging up to 850C. The line width for a highly deformed high purity (0.9998) sample showed a gradual increase with increasing annealing temperature up to the recrystallization temperature, above which there was a rapid increase. In contrast, a commercially pure (0.9984) sample deformed by 20% displayed a smooth increase in linewidth over the entire annealing range. Hardness measurements correlate reasonably well with the overall trend of the positron lineshape parameter, but the positron annihilation measurements reveal defect changes that occur at temperatures too low to give any observed changes in hardness.

711,464
PB80-124506 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Thermal Diffusion of Hydrogen in Titanium Alloy VT-15 (Termodiffuziya Vodoroda v Titane i Splave VT-15),
B. A. Kolachev, Q. P. Noozimov, and R. M. Gabidulin. 1979, 10p DMDC-18224, TT-79-58166
Trans. of Izvestiya Vysshikh Uchebnykh Zavedenii. Tsvetnaya Metallurgiya (USSR) v14 n2 p99-103 1971. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Titanium, *Titanium alloys, *Thermal diffusion, *Hydrogen, Activation energy, Aluminum containing alloys, Chromium containing alloys, Molybdenum containing alloys, Hydrogen embrittlement, Translations, Titanium alloy VT-15.

The thermotransport of hydrogen in technical grade Ti and a beta-alloy of Ti containing by weight 3.7% Al, 10.6% Cr, 7.35% Mo, 0.03% C, 0.11% Fe, 0.04% Si and 0.11% Oxygen. A temperature gradient of 2 degrees C/mm induced diffusion. Annealing times of 250 hrs. were employed. Hot and cold ends were 773 and 573K. Distribution of hydrogen in the specimens was measured. Activation energies were calculated. Experimental results were compared with theoretical predictions and discrepancies discussed. Comparisons with earlier data were also made. The possibility of hydrogen embrittlement occurring is speculated on by the authors.

711,465
PB80-138456 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion of Zirconium and Tin in a beta-Zirconium-Tin Alloy(Diffuziya Tsirkoniya i Olova V Olovyanistykh Splavakh beta-Tsirkoniya),
G. B. Fedorov, and V. D. Gulyakin. 1979, 11p TT-79-58097B, DMDC-40003B
Trans. of Metallurgiya i Metallovedenie Chistykh Metallov (USSR) n1 p170-177 1959, by V. S. Emelferov. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Zirconium, *Zirconium alloys, *Diffusion, Tin containing alloys, Tin, Activation energy, Diffusion coefficient, Translations, *Self diffusion, Zirconium alloy 3.25Sn, Zirconium alloy 5.6Sn, Zirconium alloy 0.7Sn.

The self-diffusion of radioactive Sn and Zr in pure Zr and Zr-Sn alloys (containing 0.7%Sn, 3.25%Sn, and 5.6%Sn, all by weight) were measured in the temperature range 900 to 1250C. The experimental technique employed was Gruzin's residual activity measurement method. Arrhenius plots were developed and Arrhenius relations determined. Results for these alloys were compared to similar measurements made in Ni, Fe, Co, Mo, and their alloys.

711,466
PB80-138795 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion in Heat-Resisting Alloys of Cobalt Base(Diffuziya v Zharoprochnykh Splavakh na Kobavakh na Kobal'tovoi Oshove),
P. L. Gruzin, and G. B. Fedorov. 1979, 9p TT-79-58097D, DMDC-40003D
Trans. of Metallurgiya i Metallovedenie Chistykh Metallov (USSR) n1 1959, by V. S. Emelferov. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Cobalt alloys, *Diffusion, Heat resistant alloys, Cobalt, Chromium, Tungsten, Nickel containing alloys, Chromium containing alloys, Tungsten containing alloys, Molybdenum containing alloys, Diffusion coefficient, Activation energy, Translations, Cobalt alloy VK-36.

The diffusion of radioactive Co, Cr, and W into a variety of alloys (containing principally Ni, Cr, Co, W, Mo, and minor amounts of C, Si, Mn, Fe, S, P, and Al) were measured in the temperature range of 850 to 1250C. Gruzin's method of measuring residual activity was the experimental technique used. Arrhenius plots are presented and the parameters of the diffusion equations listed. The role of carbide growth occurring in these alloys is discussed. The effect of various alloying elements (C and Mo) on the diffusion constants was also studied.

711,467
PB80-138803 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion of Zirconium and Tin in an alpha-Zirconium-Tin Alloy (Diffuziya Tsirkoniya i Olova V Olovyanistykh Splavakh alpha-Tsirkoniya),
G. B. Fedorov, and F. I. Zhomov. 1979, 10p TT-79-58097A, DMDC-40003A
Trans. of Metallurgiya Metallovedenie Chistykh Metallov (USSR) n1 p161-178 1959, by V. S. Emelferov. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Zirconium alloys, *Diffusion, *Zirconium, Tin containing alloys, Tin, Activation energy, Diffusion coefficient, Translations, *Self diffusion, Zirconium alloy 1Sn, Zirconium alloy 2Sn.

The self diffusion of radioactive Sn and Zr in pure Zr and Zr-Sn alloys (containing 0.41%Sn, 1.03%Sn, and 1.97%Sn all by weight) was measured in the temperature range 300 to 863C. The Gruzin method of residual activity measurements was the experimental technique employed. Arrhenius relations were obtained from plots of log D vs 1/T. Results were compared with diffusivities of the beta-phase alloys of this alloy system and alpha-Fe, gamma-Fe, as well as pure nickel.

711,468
PB80-157837 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Thermal Diffusion of Tl in Various Molten Metals,
P. P. Kuzmenko, and L. P. Golovinski. 1979, 13p DMDC-17828, TT-79-53192
Trans. of Akademiya Nauk URSR, Kiev. Instytut Metallofizyky. Sbornik Nauchnykh Rabot, n37 p65-69 1971. Sponsored in part with National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Thallium, *Thermal diffusion, Liquid metals, Gallium, Zinc, Indium, Tin, Lead(Metal), Bismuth, Antimony, Heat transfer, Translations.

The thermomigration of Tl in alloys of Ga, Zn, In, Sn, Pb, Bi, and Sb containing dilute additions of Tl were measured in temperature gradients of 40 to 100C/cm. The capillary technique was employed. Mean temperatures varied between 432 and 657C. The direction of Tl transfer toward hot or cold sides was noted and the heat of transport calculated. The role of phonon drag during migration is introduced.

711,469
PB80-157845 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Parameters of Diffusion in the Alpha and Beta Modifications of Titanium (Parametry Diffuzii Kislorods V Alpha-i Beta Modifikatsiyokh Titane),
D. V. Ignatov, M. S. Model, L. F. Sokiryanskii, and A. Y. Shinyev. 1979, 13p DMDC-14419, TT-79-58164
Trans. of Khim. Met. Splavov (USSR) n70 p208-213 1973. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Titanium, *Diffusion, Oxygen, Coefficients, Activation energy, Translations.

Iodide Ti was heated in pure oxygen and technically pure Ti was oxidized in air; both groups of specimens were examined in the temperature range 750 to 1150 C. The diffused specimens were then subjected to x-ray analysis and microhardness measurements for structure studies and oxygen concentration profiles. Diffusion parameters were determined for both the alpha- and beta-modifications of Ti. Mathematical expressions were developed for calculating diffusivities. Comparisons are made with the experimental results of a number of other researchers.

711,470
PB80-158546 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Formation of Secondary Porosity in Oxygen-Free Copper (Obrazovanie Vtorichioi Proistosti V Beskislorodnoi Medi),
K. T. Chernovsova, L. P. Fridman, and Y. P. Chernysheva. 1979, 10p DMDC-20882, TT-79-58156
Trans. of Akademiya Nauk Kazakhskoi SSR, Alma Ata. Institut Yadernoi Fiziki. Trudy, n10 p6-10 1969. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Copper, *Porosity, Porous metals, Microstructure, Heat treatment, Castings, Diffusion, Hydrogen, Translations.

The process of formation of secondary pores in continually-cast, oxygen-free copper of 99.98% purity was investigated. Microstructures were observed after the cast copper was rolled. Pore counts were made and the effects of subsequent heat treatments noted. Pore formation and growth velocities were tied to the specimens hydrogen content and diffusion of same.

711,471
PB80-164239 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Kinetics of Phase Transformations in the Copper-Zinc System (Kinetika Fazovykh Prevrashchenii V Sisteme Med'-Tsik),
Y. S. Logvinenko, Y. V. Piguzov, and K. M. Shtrokhman. 1979, 10p DMDC-20327, TT-79-58148
Trans. of Fizika i Khimiya Obrabotki Materialov (USSR) n4 p120-123 1970. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Copper, *Zinc, *Diffusion, *Phase transformations, Internal friction, Kinetics, Activation energy, Relaxation(Mechanics), Translations.

The kinetics of phase transformation during isothermal diffusion in the copper-zinc system was studied using the internal friction method. In the plots of the internal friction versus temperature, after homogenizing at different durations, three peaks were found at 260, 290, and 330C. Each peak is connected with the Zener relaxation in the phases. By computing the activation energy of the relaxation process in these phases, an equation for the dependence of relaxation times on temperature was established. For the peak, at 260C, a deviation, about half the width, at the same relaxation time was found. This deviation is connected with the degree of inhomogeneity in the alloy. It has been suggested that the variation in the temperature dependence of internal friction at different times, is due to the phase transformation kinetics during isothermal diffusion.

711,472
PB80-164668 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Structure of Hard-Surfacing Cu Alloys on Steel (Issledovanne Struktury Naplavok Mednykh Splavov na Stal'),
A. E. Vainerman, V. V. Obukhovskii, N. P. Kapitonova, N. M. Dobodeeva, and B. L. Belkin. 1979, 14p DMDC-20376, TT-79-58147
Trans. of Fizika i Khimiya Obrabotki Materialov (USSR) n5 p108-114 1971. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Hard surfacing, *Copper alloys, Steels, X ray analysis, Microstructure, Bronzes, Clad metals, Translations.

An x-ray analysis was made of a variety of hard-facing alloys applied to steels. The hard-facing alloys were copper, bronze, copper-nickel, and other copper base compositions. A variety of techniques were used to apply these alloys to the steel. Mechanical tests were also performed on the coated-specimens. A detailed microstructural analysis was correlated with results from the other testing procedures.

711,473
PB80-177710 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Influence of Doping on Self-Diffusion of Cobalt,
P. L. Gruzin, and B. M. Noskov. 1979, 14p DMDC-23004, TT-79-58095(D)
Trans. of Problemy Metallovedeniya i Fiziki Metallov (USSR) n4 p509-516 n.d. Sponsored in part by National Science Information, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Cobalt, *Diffusion, Cobalt alloys, Diffusion coefficient, Additives, Grain boundaries, Crystal lattices, Chromium containing alloys, Nickel containing alloys, Iron containing alloys, Titanium containing alloys, Activation energy, Cobalt 60, Translations, *Self-diffusion.

The self-diffusion of Co60 in pure Co & Co-Cr, Co-Ni, Co-Ni-Cr, Co-Fe, Co-Fe-Ti alloys was measured in the temperature range 110 to 1350C. The experimental technique employed was the residual activity method. Lattice diffusion coefficients and grain boundary diffusion coefficients were measured. Plots of the data and Arrhenius equations are presented. Composition dependence are also reported.

711,474
PB80-178411 Not available NTIS
National Bureau of Standards, Washington, DC.
Convective and Interfacial Instabilities during Unidirectional Solidification of a Binary Alloy.
Final rept.,
S. R. Coriell, M. R. Cordes, W. J. Boettinger, and R. F. Sekerka. May 80, 16p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Jnl. Cryst. Growth 49, n1 p13-28 May 80.

Keywords: *Solidification, Stability, Interfaces, Reprints, Binary alloys, Directional solification.

The onset of coupled convective and constitutional interfacial instabilities during the directional solidification of a single phase binary alloy at constant velocity vertically upwards (positive z-direction) is treated by a linear stability analysis. The authors consider a system for which the temperature gradient alone would cause a negative density gradient and the solute gradient alone would cause a positive density gradient. The temperature and concentration fields are coupled through the hydrodynamic equations. The solidification boundary conditions at the solid-liquid interface couple the hydrodynamic and interfacial stability phenomena. Specific calculations were made for physical properties appropriate to the solidification of lead containing tin. Results indicate that the stability-instability criterion differs substantially from the criterion of a net neutral density gradient.

711,475
PB80-192784 PC **A22**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion of Metals in Alloys,
M. A. Kristala. 1972, 519p DMDC-20414, TT-72-58028
Trans. of mono. Diffuziya v Metallah i Splavah, Tula, 448p 1968. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Meetings, *Metals, Alloys, Translations.

The volume is a collection of nearly 50 papers presented at the Third All-Union Conference on Diffusion in Metals and Alloys held at Tula, USSR. Many aspects of diffusion are covered, particularly as they relate to methods of research, theory, and mechanisms in pure metals as well as complex alloys. The role of crystal defects is also reported on. The role of various driving forces on diffusion are covered in a number of papers. A whole host of metals were studied in the papers presented.

711,476
PB80-194392 Not available NTIS
National Bureau of Standards, Washington, DC.
Niobium (Columbium)-Palladium Constitution Diagram.
Final rept.,
B. C. Giessen, N. J. Grant, D. P. Parker, R. C. Manuszewski, and R. M. Waterstrat. May 80, 5p
Contract SD-90, Grant PHS-DE-05031
Sponsored in part by Office of Naval Research, Arlington, VA. Contract N14-76-C-820.
Pub. in Jnl. Metall. Trans. A 11A, p709-713 May 80.

Keywords: *Niobium alloys, *Palladium alloys, Phase diagrams, X ray analysis, Phase transformations, Intermetallic compounds, Solubility, Reprints.

The Nb-Pd system was investigated over the entire composition range by metallography and X-ray diffraction analysis. The solubility limits of terminal and intermediate phases and solidus temperatures were determined. Alpha-Nb dissolves approximately 36 at. pct Pd at. 1520C and approximately 20 at. pct Pd at 800C; alpha-Pd dissolves approximately 31 at. pct Nb at 1610C and approximately 18 at. pct Nb at temperatures below 1500C. The presence of three intermediate phases NbPd2 (MoPt2-type), alpha-NbPd3 (TiAl3-type), and beta-NbPd3 (beta-NbPd3-type) was confirmed; NbPd2 melts at 1610C and one of the NbPd3 phases transforms at the same temperature into alpha-Pd solid solution which melts at 1625C. In addition, an approximately equiatomic high-temperature phase alpha-NbPd with a homogeneity range of approximately 11 at. pct was found which melts at 1520 to 1565C and probably is an extension of and isomorphous with the alpha-Pd solid solution. Five three-phase reactions are described, and crystal chemical relationships are discussed.

711,477
PB80-201262 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiance Temperature of Vanadium at its Melting Point.
Final rept.,
A. Cezairliyan, A. P. Miiller, F. Righini, and A. Rosso. 1979, 12p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in High Temperature Science. An International Jnl. 11, p223-232 1979.

Keywords: *Vanadium, Melting points, Emittance, Measurement, Radiance, Reprints.

The radiance temperature (at two wavelengths, 653 and 993 nm) of vanadium at its melting point was measured using a subsecond-duration pulse heating technique. Specimens in the form of strips with initially different surface roughnesses were used. The results do not indicate any dependence of radiance temperature (at the melting point) on initial surface or system operational conditions. The average radiance temperature at the melting point of vanadium is 1992 K at 653 nm and 1875 K at 993 nm, with a standard deviation of 1.2 K at 653 nm and 0.3 K at 993 nm. The total inaccuracy in radiance temperature is estimated to be not more than plus or minus 7 K.

711,478
PB80-213945 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Cyclic Annealing Device for the Study of the Diffusion Process at the Phase Transformation Point,
V. M. Fal'chenko. 1980, 9p DMDC-22841, TT-80-58240
Trans. of Gosudarstvennyi Komitet Standartov Soveta Ministrov SSSR, Moscow. Tekhnicheskaya Informatisiya, n1(29) 4p 1958-59. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Test equipment, Temperature control, Phase transformations, Iron, Titanium, Annealing, Translations.

A simple and inexpensive device used for cyclic heating and cooling described which allows for the accurate control of time and temperature. The apparatus wil operate with an atmosphere or vacuum. The instrument was used to study diffusion processes in Fe and Ti near phase transformation points.

711,479
PB80-214687 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Study of Diffusion in Microwires of Copper,
F. N. Tavadze, G. G. Surmava, and I. L. Svetlov. 1980, 10p DMDC-22155, TT-80-58223
Trans. of Akademiya Nauk Gruzinskoi SSR, Tiflis. Soobshcheniya, v42 n1 p45-49 1966. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Copper, *Zinc, Wire, Diffusion coefficient, Activation energy, Computation, Translations, *Foreign technology.

Experiments were carried out to measure the diffusion rate of Zn in very thin Cu wires at 600, 650, and 700C. Wire diameter was 6 to 20 micrometers and were either single or polycrystalline. The relative increment of wire diameter was measured at each temperature. From the kinetics of the diameter change, a diffusion coefficient is calculated. A linear temperature dependence was noted and an activation energy for the process was calculated for both thin and the more thicker wires employed. In both cases, the activation energy (approx. 25 kcal.mole) is about 1/2 that obtained in massive single crystals of Cu. The very low activation energy was attributed to thermal stresses in the wires-stresses introduced from growing the microwires in a glass sheath, thus, stress-enhanced diffusion of the Zn.

711,480
PB80-215387 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Effect of Irradiation on Diffusion Processes in Metals and Alloys,
L. N. Bystrov, L. I. Ivanov, and Y. M. Platov. 1980, 9p DMDC-20349, TT-80-58222
Trans. of Akademiya Nauk URSR, Kiev. Instytut Metallofizyky, n12 p250-254 1968. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Metals, *Alloys, *Irradiation, Diffusion coefficient, Activation energy, Brasses, Silver alloys, Zinc, Copper alloys, Aluminum, Computation, Translations, *Foreign technology.

The authors review the experimental results and theories of western researchers and develop their own conclusions, pointing out apparent inconsistencies. Various types of irradiation under a variety of experimental conditions are discussed including mechanisms, kinetics, and materials (i.g., alpha-brass, Ag-Zn alloys). Experimental results from the author's own laboratories are interspersed throughout the commentary.

711,481
PB80-216930 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion in Titanium and Titanium-Base Alloys,
P. L. Gruzin, and S. V. Zemskii. 1979, 24p DMDC-23387, TT-79-58096-A
Trans. of Problemy Metallovedeniya i Fiziki Metallov (USSR) n5 p365-382 1958. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Titanium, *Titanium alloys, Chromium containing alloys, Iron, Chromium, Tungsten, Diffusion coefficient, Activation energy, Translations, *Foreign technology.

Radioactive Fe, Cr, Ti, and W are diffused into Ti and titanium alloys containing 10 wt.% Cr. Also, the tracer diffusion coefficients of Cr and W in an alloy of Ti with 10 Wt.% W were measured. All experiments were performed in the temperature range 700 to 1250C using Gruzin's technique. Arrhenius expressions of the temperature dependence of the diffusion coefficient are given. Powder Metallurgy was used to prepare specimens. The authors speculate on the reasons for the observed mobilities and compare their results with other researchers and other metals.

711,482
PB80-218480 Not available NTIS
National Bureau of Standards, Washington, DC.
Addendum to 'Density Fluctuations in Liquid Rubidium'.
Final rept.,
S. W. Haan, R. D. Mountain, C. S. Hsu, and A. Rahman. Aug 80, 3p
Pub. in Physical Review, A. General Physics 22, n2 p767-769 Aug 80.

Keywords: *Rubidium, Liquid metals, Density(Number/volume), Reprints.

The authors performed molecular-dynamics simulations of liquid rubidium and the Lennard-Jones fluid at several densities and temperatures, and of a system whose pair potential is the repulsive core of the rubidium potential. In all cases, propagating density fluctuations occurred in the rubidiumlike systems at much shorter wavelength than in the Lennard-Jones system. This indicates that the repulsive part of the pair potential is the dominant factor in determining the relaxation of short-wavelength density fluctuation.

711,483
PB80-218712 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion Processes in Annealing Irradiated Metals,
L. N. Larikov, and N. P. Plotnikova. 1972, 27p DMDC-16945B, TT-72-58030B
Trans. of Akademiya Nauk URSR, Kiev. Instytut Metallofizyky, v25 p38-54 1968. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Metals, Annealing, Irradiation, Activation energy, Reviews, Translations, *Foreign technology.

A broad review paper on the diffusion processes occurring during the annealing of irradiated metals. Both electron and neutron radiation are involved. Mechanisms for both BCC and FCC metals are discussed. Of particular interest to the authors are the mechnical properties imparted to metals during the annealing process and the role atom transport plays. Dislocations and point defects and their relation to atom mobility are discussed. Theories and experiments are compared and their relative merits are presented. Over 70 references are used in the review of the subject matter.

711,484
PB80-220684 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Determination of the Diffusion Characteristics of Zinc in Copper According to the Initial Stage of Whiskers Thickening,
F. N. Tavadze, G. C. Surmava, and K. G. Svanidze. 1980, 8p DMDC-21426, TT-80-58229
Trans. of Akademiya Nauk Gruzinskoi SSR, Tiflis. Soobshcheniya, n60 p53-56 1970. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Copper, *Zinc, Whiskers(Single crystals), Activation energy, Diffusion coefficient, Computation, Translations, *Foreign technology.

Zinc diffusion characteristics in copper whiskers were determined. The value of the diffusion coefficient is 1-2 order lower than that of a massive monocrystal. The structural factor of the order of 6-7 and the energy of activation (2-3 times lower) are characterized by low values as well. Comparisons are made with copper microcrystals.

711,485
PB80-220692 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Thermal Diffusion and Oxidation of Copper Alloys,
N. A. Krotova, K. Z. Kutlin, L. G. Martynova, V. V. Panin, and M. I. Parshina. 1980, 10p DMDC-21934, TT-80-58232
Trans. of Vsesoyuznoe Soveshchenie po Zharostoikie Teplostoikie Pokrytiya. Trudy (USSR) n4 p181-186 1968. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Copper alloys, *Thermal diffusion, *Oxidation, Nickel containing alloys, Titanium containing alloys, Microstructure, Translations.

The oxidation of a copper alloy containing 1.8 wt.% Ni, 0.15 wt.% Ti, and 0.4 wt.% Be was investigated in the temperature range 800 to 1000C for 2, 9, 36 hours. The microstructure of the oxide scales was examined as a function of time and temperature. Microhardness measurements were also performed. Layer growth studies were part of the investigation. Electron diffraction patterns were also made of the oxide layers formed on the alloy.

711,486
PB80-220700 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Investigation of the Stationary Processes of Material Transfer in Copper Selenide (Cu2-xSE),
S. G. Mamyko, M. M. Pavlyuchenko, and I. I. Pokrovskii. 1980, 8p DMDC-14989, TT-80-58216
Trans. of Akademiya Navuk BSSR, Minsk. Doklady, v16 n6 p521-522 1972. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Copper, Wire, Selenium, Translations, *Foreign technology, *Copper selenides.

Copper wires are reacted with Se vapors in the temperature range of 350 to 520C. The growth of selenide layers on the wires is monitored by measurement of rate of material transfer. The relation between the velocity of movement of the copper selenide boundary with Se vapors and the reciprocal thickness of the selenide vapor is determined for different temperatures. The determining step of the process is the ambipolar diffusion of Cu in the form of cations and electrons thru the copper selenide layer.

711,487
PB80-220726 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Increase in the Mobility of Atoms in Metal Systems During Irradiation (Zbil'shennya Rukhomosti Atomiv u Metalevikh Sistemakh u Protsesi Oprominyuvannya),
I. Y. Dekhtyar, and A. M. Shalaev. 1979, 13p DMDC-19594, TT-79-53191
Trans. of Ukrainskii Fizicheskii Zhurnal (USSR) v15(1) p76-79 1970. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Metals, Radiation effects, Crystal defects, Interactions, Activation energy, Translations, *Foreign technology.

The processes of radiation-induced diffusion is examined from the point of view of interaction of defects, caused by irradiation among the bonding electrons, and the interaction of irradiation with free electrons and bonding electrons. A theory is proposed after the analysis of existing experimental data and theoretical considerations relevant to diffusion mechanisms.

711,488
PB80-222524 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Determination of the Diffusion Parameters of Chromium during the Vacuum Chromizing of Low-Carbon Steel,
A. P. Mokrov, and P. N. Zakharov. 1980, 10p DMDC-15120, TT-80-58238
Trans. of Izvestiya Vysshikh Uchebnykh Zavedenii. Chernaya Metallurgiya (USSR) n2 p22-26 1971. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Chromium, *Diffusion, Chromizing, Iron, Steels, Diffusion coefficient, Activation energy, Computation, Translations.

Armco iron was subjected to Cr vapor in a vacuum furnace in the temperature range 1100 to 1830C for 1 to 40 hours. Specimens were removed from the furnace and subjected to electron probe microanalysis to determine Cr distribution. The diffusion of Cr in the alpha and gamma phases of Fe was found to obey an Arrhenius relationship in the temperature region investigated. Parameters of the equations are tabulated in the results.

711,489
PB80-224959 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Study of the Kinetics of Segregation of Gaseous Impurities Along the Grain Boundaries of the Intermetallic Compounds,
D. P. Shashkov. 1980, 10p DMDC-20698, TT-80-58225
Trans. of Fizika i Khimiya Obrabotki Materialov (USSR) n6 p31-35 1970. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Intermetallic compounds, *Diffusion, *Copper silicon alloys, *Tin intermetallics, Gas analysis, Impurities, Grain boundaries, Brittleness, Translations, Nickel intermetallics.

Gas analyses were performed on the intermetallic compounds Cu4Si, Cu5Si, and Ni3Sn2 after they had been melted under various atmospheres. Specimens were either vacuum melted, air melted, or under an air atmosphere containing water vapor. Gas analyses were later performed to determine O2, H2, and N2 contents. In all cases, O and H segregated the grain boundaries of Cu3Si and in Cu5Si only O segregated to the boundaries. The segregation of N in Cu3Si and N and O in Cu5si proceeds considerably more slowly. Electron microscopy did not reveal the presence of an excessive number of brittle precipitates along the grain boundaries.

711,490
PB80-224967 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Elastic Diffusion of Two Pores in an Anisotropic Crystal,
M. E. Osinovskii. 1972, 20p TT-72-58030(C), DMDC-16945-C
Trans. of Akademiya Nauk URSR, Kiev. Instytut Metallofizyky, v25 p55-67 1968. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, Elastic theory, Crystals, Porosity, Translations.

The equations and boundary conditions for the elastic diffusion of two pores in an anisotropic crystal are formulated with an outline of the solution of these equations and presented in this paper. Also, the methods used in the solution of the equations of the elasticity theory applied to the problem are spelled out in detail.

711,491
PB80-225014 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Theory of the Method for Determining the Diffusion Coefficient at Grain Boundaries (K Teorii Metoda Opredeleneya Kozffitsienta Diffuzii po Granitsam Zeren Metallov),
V. T. Borisov, and B. Y. Lyubov. 1980, 17p DMDC-11504, TT-74-53213
Trans. of Fizika Metallov i Metallovedenie (USSR) n1 p298-302 1955. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion coefficient, Grain boundaries, Mathematical analysis, Theory, Translations.

A strictly mathematical basis for determining the grain boundary diffusion coefficient is developed. It is based on the model of Fisher (Jnl. of Appl. Physics 1951, 22, 74). An equation for the grain bdy. diff. coeff. is given along with the necessary boundary conditions for its application.

711,492
PB81-106775 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion Processes in Metals.
V. N. Svechnikov. 1979, 168p DMDC-169451, TT-79-52023
Trans. of Metallofizika (USSR) n25, pub. by Akademiya Nauk URSR, Kiev, 1968. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Metals, Welding, Annealing, Porosity, Iron, Tin intermetallics, Eutectics, Coalescing, Spheroidizing, Translations.

This book reviews the results of experimental and theoretical investigations on diffusion and diffusion processes occurring during the welding and irradiation of metals, the processes of spheroidization and coalescence of dispersed phases, and the behavior of pores in crystals at high temperatures. The volume emphasizes the work of Soviet researchers and each chapter is authored by a different group of Soviet writers. Materials mentioned include pure Ir, intermetallic compounds, eutectic structures, high speed steels, and cast irons.

711,493
PB81-118531 Not available NTIS
National Bureau of Standards, Washington, DC.
Parameters in Semi-Empirical Theories of Alloy Phase Formation.
Final rept.
L. H. Bennett, and R. E. Watson. Jun 80, 35p
Pub. in Proc. Symp. AIME Annual Meeting (108th), New Orleans, LA, Feb 19-20, 1979. Paper in Theory of Alloy Phase Formation, p390-424 (Metallurgical Soc. of AIME, Warrendale, PA, Jun 80.)

Keywords: *Alloys, *Phase transformations, Theories, Stability, Heat of formation, Intermetallic compounds.

Many theories of alloy solubility, structural stability of compounds, and heats of formation in alloying rely on parameters such as valence, size or electronegativity for their predictions. Nature, of course, requires only one parameter, the nuclear charge, to completely specify all the electronic properties of the elements. Thus, the atomic parameters are, of necessity, initimately connected with one another. It is our object in this presentation to review the physical origins of some of the more popular parameters used. The authors will emphasize the relationship of the different electronegativity scales to each other, and the relationship of electronegativity to other parameters such as atomic size. Structural stability maps employing electronegativity and some other parameters are shown for intermetallic compounds formed from different classes of elements: main group-main group, transition metal-main group, and transition metal-transition metal.

711,494
PB81-121501 Not available NTIS
National Bureau of Standards, Washington, DC.
Tantalum-Palladium Constitution Diagram.
Final rept.
R. M. Waterstrat, B. C. Giessen, R. Koch, and R. C. Manuszewski. May 78, 6p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD.
Pub. in Metallurgical Transactions, A. Physical Metallurgy and Materials Science 9A, p643-648 May 78.

Keywords: *Tantalum alloys, *Palladium alloys, *Phase diagrams, Phase transformations, Intermetallic compounds, Reprints.

The Ta-Pd alloy system has been investigated over the entire composition range using metallographic x-ray diffraction and quantitative electron microprobe methods. There are five intermediate phases and the crystal structures are known for all but one of these. A constitution diagram for the Ta-Pd system is presented.

711,495
PB81-121865 Not available NTIS
National Bureau of Standards, Washington, DC.
Slow Strain-Rate Stress Corrosion Testing of Aluminum Alloys.
G. M. Ugiansky, C. E. Johnson, D. S. Thompson, and E. H. Gillespie. 1980, 12p
Pub. in Proceedings of Stress Corrosion Cracking, The Slow Strain-Rate Technique, Toronto, Canada, May 2-4, 1977, American Society for Testing and Materials, Special Technical Publication 665, p254-265 1980.

Keywords: *Aluminum alloys, *Corrosion tests, Stress corrosion, Strain rate, Aluminum alloy 2124, Aluminum alloy 7075.

The use of the slow strain rate stress corrosion testing technique for testing aluminum alloys is discussed. This technique is compared to the more frequently used alternate immersion test technique used for evaluating the susceptibility of aluminum alloys to stress corrosion cracking. Aluminum alloys (2124 and 7075) each in three heat treatments with differing susceptibilities to stress corrosion cracking were tested by both the statically loaded alternate immersion test and by the slow strain rate technique. The results of the tests are compared, and the slow strain rate test is shown to be a viable, rapid technique for determining the SCC susceptibility of aluminum alloys.

711,496
PB81-137200 Not available NTIS
National Bureau of Standards, Washington, DC.
Interface Stability during Rapid Solidification.
S. R. Coriell, and R. F. Sekerka. 1980, 5p
Grant NSF-DMR78-22462
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings of the Rapid Solidification Processing; Principles and Technologies (2nd) Held at Reston, VA. on Mar 23-26, 1980, p35-49 Nov 80.

Keywords: *Solidification, Interfaces, Stability, Alloys, Supercooling.

The phenomenon of solid-liquid interface stability during directional solidification of a binary alloy is reexamined with special emphasis on very rapid solidification rates. For ordinary solidification rates, the predictions of the perturbation theory of morphological stability lead to results that are similar to those implied by constitutional supercooling; however, at very rapid solification rates, the perturbation theory predicts a vast increase in stabilization in comparison to constitutional supercooling.

711,497
PB81-140170 Not available NTIS
National Bureau of Standards, Washington, DC.
Antiphase Domain Growth in Cu3Au.
Final rept.
J. W. Cahn. Jan 80, 2p
Pub. in Scripta Metallurgica 14, n1 p93-94 Jan 80.

Keywords: Copper alloys, Gold containing alloys, *Domains, Diffusion, Reprints.

Data recently published on domain growth in Cu3Au fit my published theory better than one the authors try to put forth.

711,498
PB81-140402 Not available NTIS
National Bureau of Standards, Washington, DC.
Generation of Clean Liquid Gallium Surfaces by Ion Bombardment.
J. Fine, S. C. Hardy, and T. D. Andreadis. 1980, 4p
Pub. in Proceedings of the SPIG-80, Dubrovnik, Yugoslavia, Aug 25-29, 1980, Paper in the Physics of Ionized Gases p294-297 1980.

Keywords: *Gallium, *Liquid metals, Surface properties, Ion beams, Ion irradiation, Cleaning.

Ion beam bombardment has been used to prepare clean surfaces on bulk liquid gallium in vacuum. Observations are reported of a new type of phenomenon produced by ion bombardment: the rapid flow of impurity aggregates on a liquid metal surface.

711,499
PB81-142945 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Stress and the Chemical Equilibrium of Small Crystals. I. The Case of the Isotropic Surface.
J. W. Cahn. 1980, 5p
Pub. in Acta Metallurgica 28, n10 p1333-1338 1980.

Keywords: *Solid solutions, Interstitials, Melting, Crystals, Surfaces, Surface energy, Chemical equilibrium, Isotropy, Reprints.

The equilibria of small solid solution crystals with isotropic surfaces in contact with vapor or fluid solutions is considered when the surface stress differs numerically from the surface free energy.

711,500
PB81-143190 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of a Two-Diagonal Measurement Method for Reducing Scatter in Knoop Microhardness Testing.
P. J. Blau. 1980, 6p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Scripta Metallurgica 14, p719-724 1980.

Keywords: *Hardness tests, Knoop hardness, Copper, Copper alloys, Reprints.

Knoop indenter microhardness data for Cu and Cu-30 wt%Zn were used to demonstrate the usefulness of a two indentation diagonal measurement method for reducing data scatter.

711,501
PB81-143562 Not available NTIS
National Bureau of Standards, Washington, DC.
Eutectic Solidification and the Formation of Metallic Glasses.
W. J. Boettinger, F. S. Biancaniello, G. M. Kalonji, and J. W. Cahn. 1980, 6p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings of the International Conference on Rapid Solidification Processing: Principles and Technologies (2nd) Held at Reston, VA. on Mar 23-26, 1980, 6p 1980.

Keywords: *Solidification, *Palladium alloys, Copper containing alloys, Silicon containing alloys, Amorphous materials, *Amorphous alloys.

The relationship between eutectic solidification and the ease of formation of metallic glasses is investigated.

711,502
PB81-144289 Not available NTIS
National Bureau of Standards, Washington, DC.

Electron Microscopy Study of Erosion Damage in Copper.
L. K. Ives, and A. W. Ruff. 1979, 31p
Pub. in American Society for Testing and Materials Technical Pub. 664, p5-35 1979.

Keywords: *Copper, *Erosion, Electron microscopy, Reprints.

Surface and subsurface erosion damage in copper are investigated by transmission and scanning electron microscopy techniques.

711,503
PB81-145542 Not available NTIS
National Bureau of Standards, Washington, DC.
Microcreep of Instrument Grade Beryllium.
R. S. Polvani, and B. W. Christ. Jul 79, 5p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in SAMPE Quart. 10, n4 p37-41 Jul 79.

Keywords: *Beryllium, Creep properties, Stability, Gyroscopes, Mirrors, Reprints.

Elevated temperature uniaxial microcreep experiments show instrument grade beryllium deforms in excess of both design limitations. However, a microstrain hardening process was observed, leading to strain exhaustion, that seems a possibility for improving microcreep strength.

711,504
PB81-153298 Not available NTIS
National Bureau of Standards, Washington, DC.
Energy Dispersive XRF Composition Profiling Using Crystal Collimated Incident Radiation.
Final rept.
W. J. Boettinger, H. E. Burdette, and M. Kuriyama. 1980, 9p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Conference on Advances in X-ray Analysis, Denver, CO., July 30-August 3, 1979, Paper in Advances in X-ray Analysis 23, p209-217 1980.

Keywords: *X ray analysis, Chemical analysis, Alloys.

In order to measure changes in composition as a function of distance (macrosegregation) in directionally solidified two phase samples, a well collimated incident x-ray beam is required for XRF analysis. This is accomplished using Bragg diffraction of AgKalpha radiation from a highly perfect Si crystal. Because the incident beam is also monochromatic, additional advantages are realized: (a) the backgrounds caused by Compton and thermal diffuse scattering (TDS) of the incident beam are well localized in the energy spectrum and do not interfere with the fluorescent peaks, (b) the TDS can be used as a monitor of the incident photon flux and hence eliminates often substantial errors caused by incident beam intensity fluctuations.

711,505
PB81-155640 Not available NTIS
National Bureau of Standards, Washington, DC.
Microstructural Changes in Copper Due to Abrasive, Dry, and Lubricated Wear.
Final rept.
L. K. Ives. 1979, 3p
Pub. in International Conference on Wear of Materials, Dearborn, MI., April 16-18, 1979, p246-255 1979.

Keywords: *Copper, Wear, Microstructure, Electron microscopy, Reprints.

Copper was exposed to wear under conditions of abrasive, dry, and lubricated sliding contact in air. An examination of surface morphology and subsurface microstructure was conducted by scanning and transmission electron microscopy methods in order to study the detailed nature of the wear process on a microscopic level. Wear debris fragments were also examined and the results correlated with surface and subsurface observations.

711,506
PB81-155673 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Microscopy Studies of Wear in Copper.
Final rept.
L. K. Ives. 1979, 5p
Pub. in Proceedings of the Annual EMSA Meeting (37th), San Antonio, TX., August 13-17, 1979, p452-543 1979.

Keywords: *Copper, *Wear, Electron microscopy.

Electron microscopy studies were conducted on copper surfaces worn under conditions of lubricated and non-lubricated sliding against solid contacts, sliding against abrasive sand (SiO2) particles, and solid particle erosion by Al2O3 particles. Topographic and subsurface microstructural features associated with the various wear modes are described. In all cases, the high contact stresses and accompanying strains led to the development of a layer of fine polycrystalline grains at the surface. This layer extended to a depth of a few micrometers below the surface. At greater depths, a dislocation cell structure was observed. Deformation twins were found near the surface of specimens worn by solid particle erosion. Embedment of abrasive particle fragments in the surface was characteristic of both the abrasive and erosive types of wear.

711,507
PB81-155681 Not available NTIS
National Bureau of Standards, Washington, DC.
Discussion of the Paper 'The Study of Fatigue Mechanisms with Electron Channeling' by D. Davidson.
Final rept.
B. Ditchek, and A. W. Ruff. 1979, 7p
Pub. in American Society for Testing and Materials, Special Technical Publication 675, p269-275 1979.

Keywords: *Fatigue(Materials), Alloys, Deformation, Reprints, Electron channeling.

A publication by D. Davidson on fatigue of alloys is reviewed. Comments are made on the selected area electron channeling method applied in this study, along with suggestions for further improvement in the application.

711,508
PB81-167322 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Effect of the Concentration of Excess Vacancies on Diffusion Along Grain Boundaries.
L. N. Larikov, and O. A. Shmatko. 1980, 8p DMDC-19675, TT-80-58220
Trans. of Metallofizika (USSR) n25 p63-65 1971. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Grain boundaries, Cobalt alloys, Tungsten containing alloys, Vacancies(Crystal defects), Cooling rate, Aging(Metallurgy), Translations.

The effect of cooling rate on an alloy of Co-W (31.89 wt.%) and then the growth of eutectoid-like nuclei during subsequent ageing process is the subject of this experiment investigation. The nuclei form in the grain boundaries and grow with constant velocity. Specimens were annealed at 1200 C, quenched and aged at 700 C. The growth velocity was measured during ageing and the dependence constructed. The process of nuclei formation is related to the concentration of excess vacancies and precipitation from supersaturated solid solutions. Excess vacancies are believed to accelerate nuclei formation.

711,509
PB81-167348 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Internal Oxidation of Alloys.
A. A. Shmykov. 1980, 25p DMDC-14504, TT-79-53198
Trans. of Moskovskii Institut Elektronnogo Mashinostroeniya. Trudy (USSR) n8 p5-19 1970. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Internal oxidation, Alloys, Diffusion, Computation, Translations.

A review of the experiments data for the internal oxidation of alloys (without the formation of external scales) is made and then generalized laws are proposed to describe the process. The author relates the kinetics and thermodynamic approaches to the problem. Comparisons between theory and experiment are made.

711,510
PB81-171860 Not available NTIS
National Bureau of Standards, Washington, DC.

Interactive Computer Graphics for Storing Phase Diagrams.
Final rept.
J. L. Murray, and D. J. Orser. 1980, 4p
Pub. in Bull. Alloy Phase Diagrams 1, n1 p19-22 1980.

Keywords: *Computer graphics, *Phase diagrams, Alloys, Reprints, *Interactive graphics, Data base management.

Progress is described on an interactive graphics computer program needed for the creation of an automated phase diagram data base. Automation requires the ability to input literature data in various units and formats and to edit and update a phase diagram without unnecessary reentry of data. A relational data structure makes possible the necessary explicit representation of phase stability data. Examples of binary diagrams are given. Plans for global management of a large data base are described.

711,511
PB81-172348 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
NBS: Nondestructive Evaluation of Nonuniformities in 2219 Aluminum Alloy Plate - Relationship to Processing.
Technical rept. Aug 79-Sep 80.
L. Swartzendruber, W. Boettinger, L. Ives, S. Coriell, D. Ballard, D. Laughlin, R. Clough, F. Biancaniello, P. Blau, J. Cahn, R. Mehrabian, G. Free, H. Berger, and L. Mordfin. Dec 80, 246p NBSIR-80-2069
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.

Keywords: *Aluminum alloys, *Nondestructive tests, Metal plates, Abnormalities, Aluminum alloy 2219.

The compositional homogeneity, microstructure hardness, electrical conductivity and mechanical properties of 2219 aluminum alloy plates are influenced by the process variables during casting, forming and thermomechanical treatment.

711,512
PB81-187841 Not available NTIS
National Bureau of Standards, Washington, DC.
Solutal Convection Induced Macrosegregation and the Dendrite to Composite Transition in Off-Eutectic Alloys.
Final rept.
W. J. Boettinger, F. S. Biancaniello, and S. R. Coriell. Feb 81, 7p
Sponsored in part by National Aeronautics and Space Administration, Arlington, VA.
Pub. in Metall. Trans. A 12A, p321-327 Feb 81.

Keywords: *Solidification, Dendritic crystals, Eutectics, Lead alloys, Tin containing alloys, Structures, Reprints, Macrosegregation.

The effect of solute gradient induced convection during vertical solidification on the macrosegregation of Pb-rich Pb-Sn off-eutectic alloys is determined experimentally as a function of composition and growth rate.

711,513
PB81-215725 Not available NTIS
National Bureau of Standards, Washington, DC.
Simple Method for Cross-Sectional Examination of Wear Debris Flakes.
Final rept.
P. J. Blau. 1981, 1p
Pub. in Wear Short Commun. 66, p257-258 1981.

Keywords: *Wear tests, Brass, Metallography, Particle size, Reprints.

This brief note covers a precedure which can be used for mounting and cross-sectioning thin flakes of metallic wear debris (25-250 micrometers in size). The mounts can be used for metallographic studies of debris structure or for measurements of debris dimensions. The basic procedure involves the use of a glass coverslip sandwich mounted on edge in a standard, room temperature curing epoxy mount.

711,514
PB81-216756 Not available NTIS
National Bureau of Standards, Washington, DC.

Effect of Gravity on Coupled Convective and Interfacial Instabilities during Directional Solidification.
Final rept.
S. R. Coriell, M. R. Cordes, W. J. Boettinger, and R. F. Sekerka. 1981, 7p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC. Proceedings of the COSPAR Plenary Meeting (23rd) held at Budapest, Hungary on June 2-14, 1980.
Pub. in Advanced Space Research 1, p5-11 1981.

Keywords: *Solidification, *Lead alloys, Tin containing alloys, Stability, Interfaces, Gravity, Convection, Directional solidification.

The authors investigate the role of gravity in a linear stability analysis of the onset of coupled convective and morphological instabilities during directional solidification at constant velocity of a dilute alloy of tin in lead.

711,515
PB81-236226 Not available NTIS
National Bureau of Standards, Washington, DC.
Density of Autocatalytic Nickel-Phosphorus Deposits.
Final rept.
F. Ogburn, R. M. Schoonover, and C. E. Johnson. Mar 81, 1p
Pub. in Plating and Surface Finishing, 45p Mar 81.

Keywords: *Electroless plating, *Nickel alloys, Phosphorus containing alloys, Density(Mass/volume), Plating, Reprints.

The density and phosphorus content of 4 autocatalytic Ni-P deposits were determined.

711,516
PB81-239501 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Plating on Aluminum.
Final rept.
D. S. Lashmore. Nov 80, 66p NBSIR-80-2142
Sponsored in part by American Electroplater Society, Winter Park, FL., and Aluminum Association, Washington, DC.

Keywords: *Plating, *Aluminum, Dip coating, Anodic coatings, Anodizing, Metal coatings, Adhesion.

The program includes both anodizing and immersion pretreatments as well as a discussion of adhesion. In addition to the summary of results, some details of the last seven months of the project are presented including: (a) the morphology of the initial stages of anodic film formation; (b) the morphology of the interface of nickel coated anodized aluminum; and (c) a discussion of adhesion.

711,517
PB81-241127 Not available NTIS
National Bureau of Standards, Washington, DC.
Cryogenic Properties of Copper.
Final rept.
R. L. Powell, and F. R. Fickett. Dec 79, 1p
Sponsored in part by International Copper Research Association, New York.
Available from International Copper Research Association, 708 Third Ave., New York, NY. 10017, 1p Wall Chart, Dec 79.

Keywords: *Copper, *Copper alloys, Physical properties, Cryogenics.

This publication is a wall chart describing the physical and mechanical properties of copper and selected copper alloys between room temperature and liquid helium temperature. The data presented is extracted from numerous compilations and recent publications.

711,518
PB81-600017 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluated Activity and Osmotic Coefficients for Aqueous Solutions: Thirty-Six Uni-Bivalent Electrolytes.
R. N. Goldberg. 1981, 96p
Included in Jnl. of Physical and Chemical Reference Data, v10 n3 p671-766 1981.

Keywords: *Activity coefficient, Cesium, Critical evaluation, Electrolyte, Excess Gibbs energy, Lithium, Osmotic coefficient, Potassium, Rubidum, Sodium, Solutions, Thermodynamic properties.

A critical evaluation of the mean activity and osmotic coefficients in aqueous solutions of thirty-five uni-bivalent electrolytes at 298.15 K is presented. The systems which have been treated are ammonium orthophosphate, guanadinium carbonate, 1,2-ethane disulfonic acid, m-benzene disulfonic acid, ammonium decahydroborate, and the uni-bivalent compounds of lithium, sodium, potassium, rubidium, and cesium. Osmotic coefficients were calculated from direct vapor pressure measurements, from isopiestic measurements and from freezing-point depression measurements. Activity coefficients were calculated from electromotive force measurements on galvanic cells without transference and from diffusion measurements. Given are empirical coefficients for three different correlating equations, obtained by a weighted least squares fit to the experimental data, and tables consisting of the activity coefficients of the compounds, the osmotic coefficients and activity of water, and the excess Gibbs energy of the solution as functions of the molality for each electrolyte system. The literature coverage is through the computerized versior of Chemical Abstracts of September 1979.

711,519
PB81-600018 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Activity and Osmotic Coefficents of Aqueous Alkali Metal Nitrites.
B. R. Staples. c1981, 12p
Included in Jnl. of Physical and Chemical Reference Data, v10 n3 p767-778 1981.

Keywords: *Activity coefficients, Alkali metal nitrite salts, Aqueous, Critical evaluation, CsNO2, Electrolytes, Excess Gibbs energy, KNO2, LiNO2, NaNO2, Osmotic coefficients, RbNO2, Solutions, Standard reference data, Thermodynamic properties.

A critical evaluation of the mean activity gamma plus or minus, and osmotic coefficients, Phi, of aqueous alkali metal nitrites at 298.15 K is presented for the molality range from dilute to saturation. Osmotic coefficients were calculated from static vapor pressure measurements. A nonlinear least-squares program was used to fit Phi data as a function of molality. Several equations describe the osmotic coefficients, the mean activity coefficient, and the excess Gibbs energy as a function of the square-root of molality for each salt. The scientific literature was covered through March 1979.

711,520
PB82-100553 Not available NTIS
National Bureau of Standards, Washington, DC.
Lateral Solute Segregation During Unidirectional Solidification of a Binary Alloy with a Curved Solid-Liquid Interface II: Large Departures from Planarity.
Final rept.
S. R. Coriell, R. F. Boisvert, R. G. Rehm, and R. F. Sekerka. Aug 81, 9p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. of Crystal Growth 54, n2 p167-175 Aug 81.

Keywords: *Alloys, Binary systems(Materials), Diffusion, Solidification, Interfaces, Separation, Reprints.

The lateral solute segregation that results from a curved solid-liquid interface during steady state unidirectional solidification of a dilute binary alloy was previously calculated by perturbation theory for small departures of the interface shape from planarity. These calculations have been extended by other analytical and by numerical methods to the case where there are large departures of the interface from planarity. Numerical results are given for a sinusoidally shaped interface for various values of the distribution coefficient, k, and the parameter beta = VL/D where V is the velocity of solidification, L is the wavelength of the sinusoidal perturbation, and D is the diffusivity of solute in the liquid.

711,521
PB82-107988 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Selected Alloys in the Systems Cr-Pd, Cr-Ru, V-Pd and Ta-Pt.
Final rept.
R. M. Waterstrat. 1981, 6p
Contract PHS-DE-05031
Pub. in Jnl. of Less-Common Met. 80, pP31-P36 1981.

Keywords: *Chromium alloys, *Palladium alloys, *Tantalum alloys, *Vanadium alloys, Ruthenium alloys, Phase diagrams, Reprints, Phase studies.

Cr-Pd, Cr-Ru, V-Pd and Ta-Pt alloys were selected, appropriately annealed and subjected to electron microprobe analyses. The data enable a basis to be established for a more accurate location of phase boundaries which have not been accurately defined in previous studies.

711,522
PB82-112525 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Fatigue Crack Growth Rate Data from Different Laboratories.
Final rept.
J. T. Fong, and N. E. Dowling. 1979, 23p
Pub. in Proceedings of the ASTM Symposium Fatigue Crack Growth Measurement and Data Analysis held at Pittsburgh, PA., in October 1979, p171-193 1979.

Keywords: *Crack propagation, Data, Fatigue(Materials), Analyzing, Regression analysis.

A simple-minded yet quantitative approach to assessing interlaboratory fatigue crack growth rate data is proposed. Seven sets of da/dN versus Delta K data from six laboratories on nominally the same material and loading conditions in a cooperative test program sponsored by the Society of Automotive Engineers (SAE) are analyzed to illustrate this ad hoc approach.

711,523
PB82-137266 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC.
Proceedings, U.S. Department of Commerce Public Workshop on Critical Materials Needs in the Aerospace Industry, February 9-10, 1981.
J. B. Wachtman Jr. Jul 81, 700p NBSIR-81-2305

Keywords: *Aerospace industry, *Strategic materials, *Meetings, Chromium, Cobalt, Titanium, Tantalum, Technology assessment, Imports, Public law, *Critical materials, *Recycled materials.

On February 9 and 10, 1981, the Department of Commerce held a Public Workshop to obtain the views of the American Public on three questions directly pertinent to the Department's responsibilities under the Materials and Minerals Policy, Research and Development Act of 1980, Public Law 96-479. These questions were: What are the materials issues of primary concern to he American aerospace industry and its suppliers; What recommendations do the American aerospace industry and its suppliers have for Federal action to address these issues; Which specific materials should the Department of Commerce review in detail over the next few months in order to recommend the most urgently needed programs for Federal action. The Workshop addressed these questions within three distinct areas: critical raw materials, critical engineering materials, and substitution, conservation, specialized recycling, and higher performance. This report includes the formal views presented to the plenary workshop sessions, the reports of the Workshop Task Forces in each of the three above areas, and the written submissions invited in the Federal Register notice of the Workshop.

711,524
PB82-149121 Not available NTIS
National Bureau of Standards, Washington, DC.
Titanium-Aluminum Phase Diagram: alpha/alpha(2) Phase Boundary,
L. J. Swartzendruber, L. H. Bennett, L. K. Ives, and R. D. Shull. 1981, 9p
Contract N00014-72-F-0042
Pub. in Materials Science and Engineering 51, p1-9 1981.

Keywords: *Titanium alloys, *Phase diagrams, Aluminum alloys, Magnetic permeability, Measurement, Electron microscopy, Reprints, Phase boundaries.

Magnetic susceptibility measurements were used to determine the phase boundaries between the disordered hexagonal alpha and the ordered hexagonal alpha sub 2 phases in titanium-rich Ti-Al alloys.

711,525
PB82-152406 Not available NTIS
National Bureau of Standards, Washington, DC.
Binary Phase Diagrams of Transition Elements.
R. M. Waterstrat. Jun 81, 4p
Pub. in Bull. Alloy Phase Diagrams 2, n1 p35-38 Jun 81.

Keywords: *Transition metals, *Phase diagrams, Intermetallic compounds, Reprints.

A brief explanation is given for an accompanying chart of binary phase diagrams of the transition elements together with references and a commentary on the source of each reference.

711,526
PB82-153297 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanisms for Transitional Friction and Wear Behavior of Sliding Metals.
P. J. Blau. 1981, 12p
Sponsored in part by Office of Naval Research, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Wear 72, p55-66 1981.

Keywords: *Sliding friction, *Wear, Metals, Reprints.

Four processes which may cause transitions in the unlubricated sliding behavior of metals are described. These processes are (1) metal transfer, (2) film formation and removal, (3) debris generation and (4) cyclic surface deterioration.

711,527
PB82-155136 Not available NTIS
National Bureau of Standards, Washington, DC.
Processing Limits for Ultrafine-Multifilament Nb3Sn.
Final rept.
J. C. Ho, C. E. Oberly, H. J. Garrett, M. S. Walker, B. A. Zeitlin, and J. W. Ekin. 1980, 9p
Sponsored in part by Air Force Materials Lab., Wright-Patterson AFB, OH.
Pub. in Proceedings of Cryogenic Engineering Conference Held at Madison, Wisconsin on August 21-24, 1979, Paper E-7 in Advances in Cryogenic Engineering, n26 p358-366 1980.

Keywords: *Metal fibers, *Niobium intermetallics, Filaments, Processing, Niobium tin.

The high yield and fracture strengths of the ultrafine-filament bronze-process wire, combined with the demonstration of no fundamental processing limits in an extensive manufacturing methods evaluation effort, promise a bronze manufacturing process for high strength ultrafine-filament Nb3Sn conductors. These bronze-process conductors can be well controlled geometrically so that the losses experienced by randomly close-spaced filaments of in situ process Nb3Sn conductors can be tightly controlled.

711,528
PB82-199498 Not available NTIS
National Bureau of Standards, Washington, DC.
Bonding Effects in Dilute Transition-Metal Alloys.
Final rept.
R. E. Watson, L. J. Swartzendruber, and L. H. Bennett. Dec 81, 10p
Pub. in Physical Review B 24, n11 p6211-6220, 1 Dec 81.

Keywords: *Alloys, *Phase diagrams, Solubility, Mossbauer effect, Isomeric transitions, Impurities, Reprints.

The Mossbauer isomer-shift data of transition-metal nuclei as impurities in metals were considered in previous papers, where it was shown that, once volume effects were suitably accounted for, the data fell on a universal curve. In this paper, the deviations from universality are examined in more detail in an attempt to better understand the alloying behavior. It is found that atom A as an impurity in metal B does not sustain a shift of the same magnitude as atom B does when it is an impurity in metal A. The results are discussed in terms of hybridization and asymmetry in the solubility behavior in transition metal alloy phase diagrams.

711,529
PB82-232919 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Physical Properties Data Compilations Relevant to Energy Storage. V. Mechanical Properties Data on Alloys for Use in Flywheels.
H. M. Ledbetter. c1982, 38p NSRDS-NBS-61-PART-5
See also Part 4, PB81-244121. Library of Congress catalog card no. 81-14053.

Keywords: *Aluminum alloys, *Steels, *Titanium alloys, *Flywheels, Rotors, Mechanical properties, Elastic properties, Iron alloys, Data, Superalloys.

This report deals with the physical and mechanical properties of twenty-one commercial alloys that are candidates for flywheel rotors used as inertial-energy-storage systems. Base metals include aluminum, iron, and titanium. Alloys vary in complexity from simple carbon steels to superalloys. Properties include: mass density, Young's modulus, shear modulus, bulk modulus, Poisson's ratio, yield strength, ultimate strength, fatigue strength, fracture toughness, and creep strength. Property values were collected from many types of sources and were analyzed statistically to detect possible outlying values. For each alloy, the report contains typical chemical composition, typical heat treatment, metallurgical descriptions, and typical property values. The report also shows the variations of these properties and the relative abundances of experimental property values. (Copyright (c) 1982, by the Secretary of Commerce on Behalf of the United States Government.)

711,530
PB82-248147 Not available NTIS
National Bureau of Standards, Washington, DC.
Rapid Solidification Processing - An Outlook.
Final rept.
M. Cohen, B. H. Kear, and R. Mehrabian. 1980, 24p
Pub. in Rapid Solidification Processing: Principles and Technologies II, p1-24 1980.

Keywords: *Solidification, Powder metallurgy, Processing, Cooling rate, Microstructure, Melting, Reprints, Amorphous materials, *Rapid solidification.

Materials processing plays a central role in the general field of materials science and engineering; indeed, the recent surge of R&D activity in rapid solidification processing (RSP) provides a further example of how the advent of a processing method can catalyze new ideas across the wide spectrum of materials structure, properties, and performance. The major attention in RSP thusfar has been directed toward achieving fast cooling rates from the pre-alloyed liquid state, in the expectation that cost-beneficial properties in final shapes of technological importance can be obtained.

711,531
PB82-261652 Not available NTIS
National Bureau of Standards, Washington, DC.
Copper-Free Amalgams: Dimensional Change After Approximately Five Years at 60, 37, and 23 degrees C.
Final rept.
G. C. Paffenbarger, N. W. Rupp, and P. R. Patel. Jun 82, 3p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 61, n6 p811-813 Jun 82.

Keywords: *Dental materials, *Mercury amalgams, Expansion, Aging tests(Materials), Dimensional stability, Reprints.

Two copper-free amalgams expanded excessively after storage in air at 60C for about five years. One expanded significantly at 37C and slightly at 23C. High silver content, absence of copper, and presence of small amounts of zinc, or all three, seemed to promote very high expansions at 60C.

711,532
PB83-106153 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Alloy Constitution and Crystallization Kinetics on the Formation of Metallic Glass.
Final rept.
W. J. Boettinger. Aug 81, 4p
Pub. in Proceedings of International Conference on Rapidly Quenched Metals (4th), Sendai, Japan, August 24-28, 1981, 4p.

Keywords: Palladium alloys, Copper alloys, Silicon containing alloys, Intermetallics, Solidification, *Amorphous materials.

The relationship between alloy composition, solidification microstructure and ease of metallic glass formation is investigated in Pd-Cu-Si alloys. Esperiments are reported on three alloys, Pd78Cu4Si18, Pd77Cu6Si17 and Pd75Cu9Si15, which show the evolution of microstructure and formation of metallic glass as a function on interface velocity.

711,533
PB83-107854 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
NBS: Materials Measurements.
Annual rept. 1 Apr 81-31 Mar 82.
J. R. Manning. Jul 82, 105p NBSIR-82-2560
See also PB81-238537. Sponsored in part by National Aeronautics and Space Administration, Washington, DC.

Keywords: *Interfacial tension, *Measurement, *Convection, *Tungsten, Solidification, Gallium alloys, Tin containing alloys, Thermophysical properties, Space processing.

This work is directed toward measurement of materials properties important to the design and interpretation of space processing experiments and investigations of how the space environment may offer a unique opportunity for performing improved measurements and producing materials with improved properties. This work is being carried out in three independent tasks: (1) Surface tensions and their variations with temperature and impurities; (2) Convection during unidirectional solidification; and (3) Measurement of the high temperature thermophysical properties of tungsten group liquids and solids. Emphasis in Tasks 1 and 2 is on how the reduced gravity obtained in space flight can affect convection and solidification processes. Emphasis on Task 3 is toward development of techniques for thermodynamic measurements on reactive materials, requiring levitation and containerless processing.

711,534
PB83-134304 Not available NTIS
National Bureau of Standards, Washington, DC.
Controlled Rapid Solidification by Electron Beam Surface Melting.
Final rept.
R. J. Schaefer, W. J. Boettinger, F. S . Biancaniello, and S. R. Coriell. 1981, 10p
Sponsored in part by Defense Advanced Research Projects Agency.
Pub. in Proceedings Symposium 110th AIME Annual Meeting, Chicago, Illinois, Feb 22-26, 1981. Paper in Lasers in Metallurgy, p43-52.

Keywords: *Solidification, *Electron beam melting, Aluminum alloys, Silver alloys, Surfaces, *Rapid solidification.

The use of a modified electron beam welding apparatus to produce controlled rapid solidification is described. For research purposes, electron beam heating has several advantages over laser heating, most significantly that the absorbed power is known better and the beam can be deflected electronically at high speed. Experiments can thus be carried out in which local solidification velocities can be determined from the known thermal input by means of heat flow calculations. We report here several methods of utilizing electron beam heating, and some observations of cellular substructures in surface melted Al-Ag alloys.

711,535
PB83-134346 Not available NTIS
National Bureau of Standards, Washington, DC.
AES Research Project 41: Plating on Anodized Aluminum.
Final rept.
D. S. Lashmore. Apr 81, 7p
Pub. in Plating and Surface Finishing 68, n4 p48-54, Apr 81.

Keywords: *Nickel coatings, *Plating, Electrodeposition, Adhesion, Aluminum, Anodizing, Reprints.

The effect of anodizing voltage on adhesion of nickel electrodeposited onto anodized aluminum will be discussed and related to the morphology of the anodic film. It is shown that, in general, adhesion is a linear function of the applied anodizing voltage. The morphology of the anodic film is discussed and new data on the initial stages of pore formation presented. In particular, it is shown that the growth mechanism during the initial stage (<10 seconds) is different from subsequent growth, that there is no metallic bonding, and that electrodeposited nickel coatings typically fill the entire pore.

711,536
PB83-135152 Not available NTIS
National Bureau of Standards, Washington, DC.

Reflection X-Ray Topography of Hardness Indentations in Copper Single Crystals.
Final rept.
K. C. Yoo, B. Roessler, R. W. Armstrong, and M. Kuriyama. 1981, 6p
Pub. in Scripta Metallurgica 15, p1245-1250 1981.

Keywords: *Copper, *Nickel, *Plastic deformation, *Hardness, Single crystals, Work hardening, Reprints, X ray topography.

The plastic deformation zones surrounding microhardness identations put into the (110) surfaces of relatively soft copper and nickel single crystals have been studied by the asymmetrical crystal topography (ACT) method. The method gives valuable information about the importance of workhardening to determining the level of the microhardness pressure and to determining the magnitude of its anisotropy for different directions of the indenter axes for Knoop or diamond pyramid indentations. This is demonstrated especially for copper crystals by the very pronounced appearance of the strain patterns of diffraction contrast obtained at either type of hardness impression. Both the cumulative dislocation displacements (for extinction contrast) and their lattice rotations (for misorientation contrast) are employed in the analysis of the topographic strain patterns.

711,537
PB83-143115 Not available NTIS
National Bureau of Standards, Washington, DC.
Relationship Between Process Variables, Microstructure and NDE of a Precipitation-Hardened Aluminum Alloy.
Final rept.
L. J. Swartzendruber, W. J. Boettinger, L. K. Ives, S. R. Coriell, and R. Mehrabian. 1980, 19p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Nondestructive Evaluation: Microstructural Characterization and Reliability Strategies, Pittsburgh, PA., October 5-9, 1980, p253-271 1980.

Keywords: *Aluminum alloys, *Nondestructive tests, Heat treatment, Microstructure, Eddy current tests, Mechanical properties, Aluminum alloy 2219.

The relationship between process variables used during casting, working, and heat treatment of 2219 aluminum alloy and the resulting microstructures, mechanical properties, and NDE responses were investigated.

711,538
PB83-146522 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrical and Magnetic Properties of Internally Oxidized Copper and Dilute Copper-Iron Alloys.
Final rept.
F. R. Fickett. 1982, 17p
Pub. in Jnl. of Physics F: Metal Physics 12, p1753-1769 1982.

Keywords: *Copper, *Copper alloys, Oxidation, Iron, Magnetic properties, Electrical properties, Cryogenics, Reprints.

The results of several years of work devoted to developing an understanding of the process by which the resistive contribution of transition metal impurities, primarily iron, in copper is removed by internal oxidation are presented. The majority of the investigations were made on a CuFe alloy series of precisely determined composition from 1 to 100 atomic parts per million (at PPM) Fe. Electrical resistance and magnetic susceptibility measurements at room temperature and at 4 K on both unoxidized and oxidized samples are reported. These measurements, supported by scanning electron microscopy (SEM) and Curie temperature determinations, suggest a two-step internal oxidation process at even the lowest impurity levels.

711,539
PB83-156992 Not available NTIS
National Bureau of Standards, Washington, DC.
Growth Kinetic Limitations during Rapid Solidification.
Final rept.
W. J. Boettinger. 1982, 17p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings Materials Research Soc., Boston, MA., November 11-16, 1981, paper in Rapidly Solidified Amorphous and Crystalline Alloys, p15-31 1982.

Keywords: Solidification, Reaction kinetics, Growth, Microstructure, *Rapid solidification.

The importance of growth kinetics in the development of the microstructure of rapidly solidified alloys is described. Growth kinetics are conveniently divided into diffusion kinetics and interface attachment kinetics. The former, which are used extensively for the analysis of slow rate solidification, can be extended to high solidification rates to predict some microstructural features; e.g., the limitations on eutectic growth rate which can promote the formation of metallic glass, and the reduction of microsegregation. At the highest rates interface attachment kinetics must be included. Some microstructural effects of the velocity dependence of the partition coefficient will be described.

711,540
PB83-162198 Not available NTIS
National Bureau of Standards, Washington, DC.
Test of a Rule of Mixtures for Dry Sliding Friction of 52100 Steel on an Al-Si-Cu Alloy.
Final rept.
P. J. Blau. 1982, 6p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Wear 81, p187-192 1982.

Keywords: *Aluminum alloys, *Friction, Silicon containing alloys, Copper containing alloys, Tests, Reprints, Aluminum alloys C390-T5.

Friction coefficient date was obtained for dry sliding of a fixed 52100 steel ball on flats of Si, 2024-T4 Aluminum alloy, and C390-T5 Aluminum alloy using a computer controlled, linear, stroke-by-stroke tribometer. Two surface finishes on the C390-T5 alloy were compared: (1) polished, (2) deeply etched to allow the Si phase to stand above the matrix A1-phases. Friction results for the C390-T5 alloy were compared with those of Si and 2024-T4 alloy to see if a friction rule of mixtures would be obeyed.

711,541
PB83-177378 Not available NTIS
National Bureau of Standards, Washington, DC.
Volume Effects in Transition Metal Alloying.
Final rept.
R. E. Watson, and L. H. Bennett. 1982, 9p
Contract DE-AC02-76CH00016
Pub. in Acta Metallurgica 30, p1941-1955 1982.

Keywords: *Transition metals, *Alloying, Volume, Stability, Reprints.

The relatively modest volume contractions (or expansions) occurring on alloying of transition metals does not correlate well with the heats of formation. A useful correlation is obtained for equiatomic alloys with an atomic scale, phi, that has the character of a Gordy electronegativity. Manganese, due to its magnetism, and the light lanthanides, due to their chemical bonding, require separate treatment. Alloys off 50/50 display strikingly similar effects, though they must be discussed with a somewhat different phi scale. Structural trends are observed in a map of delta phi vs d-band electron vacancies.

711,542
PB83-179606 Not available NTIS
National Bureau of Standards, Washington, DC.
Relative Roles of Heat Transport and Interface Rearrangement Rates in the Rapid Growth of Crystals in Undercooled Melts.
Final rept.
S. R. Coriell, and D. Turnbull. 1982, 5p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Acta Metallurgica 30, p2135-2139 1982.

Keywords: *Crystal growth, Dendritic crystals, Nickel, Heat transmission, Kinetics, Interfaces, Reprints, Undercooling.

Perhaps, the highest measured crystal growth velocities (50 m/s) are those of Ni dendrites growing into pure undercooled melts as reported by Walker and Colligan and Bayles. Recent theoretical (Langer and Muller-Krumbhaar) and experimental (Glicksman et al.) advances in the understanding of dendritic growth allow accurate calculation of the heat transport limited rate of dendritic growth. The authors use previous results on the effect of interface kinetics on the morphological stability of a sphere to calculate the effect of interface kinetics on dendritic growth. An interface kinetic coefficient based on the estimated velocity of sound in molten nickel provides a good fit to the dendritic growth data at high velocities.

711,543
PB83-180984 PC **A21**/MF **A01**
National Bureau of Standards, Washington, DC.
Conservation and Substitution Technology for Critical Materials. Volume I.
A. G. Gray. Apr 82, 489p NBSIR-82-2495
See also Volume 2, PB83-180992. Sponsored in part by Bureau of Mines, Washington, DC. Prepared in cooperation with Vanderbilt Univ., Nashville, TN. Proceedings of a public workshop held at Nashville, TN., June 15-17, 1981.

Keywords: *Strategic materials, *Meetings, Conservation, Substitutes, Chromium, Cobalt, Titanium, Tantalum, Technology, *Critical materials.

The United States is highly vulnerable to problems in supply of critical and strategic materials and it is recognized that there is a whole spectrum of options for responding to such crises. While a number of supply oriented options are under study by various groups, the focus of this Workshop was on the technical options. The Workshop was held principally to develop information for the report required by the Department of Commerce, but should also be useful to the other agencies in their responsibilities. The DoC report is supposed to identify a materials needs case related to national security, economic well-being, and industrial productivity, to assess critical materials needs, and to recommend programs to meet these needs.

711,544
PB83-180992 PC **A25**/MF **A01**
National Bureau of Standards, Washington, DC.
Conservation and Substitution Technology for Critical Materials. Volume II.
A. G. Gray. Apr 82, 582p NBSIR-82-2495
See also Volume 1, PB83-180984. Sponsored in part by Bureau of Mines, Washington, DC. Prepared in cooperation with Vanderbilt Univ., Nashville, TN. Proceedings of a public workshop held at Nashville, TN., June 15-17, 1981.

Keywords: *Strategic materials, *Meetings, Conservation, Substitutes, Metal coatings, Utilization, Molybdenum, Nickel, Tungsten, Vanadium, Composite materials, Information systems, Technology, Materials recovery, *Critical materials, Rapid solidification.

The United States is highly vulnerable to problems in supply of critical and strategic materials and it is recognized that there is a whole spectrum of options for responding to such crises. While a number of supply oriented options are under study by various groups, the focus of this Workshop was on the technical options. The Workshop was held principally to develop information for the report required by the Department of Commerce, but should also be useful to the other agencies in their responsibilities. The DoC report is supposed to identify a materials needs case related to national security, economic well-being, and industrial productivity, to assess critical materials needs, and to recommend programs to meet these needs.

711,545
PB83-182568 Not available NTIS
National Bureau of Standards, Washington, DC.
Atomic Volumes in Transition Metal-Metalloid Crystalline and Glassy Alloys.
Final rept.
L. H. Bennett, and R. E. Watson. 1982, 4p
Pub. in Scripta Metallurgica 16, p1379-1382 1982.

Keywords: *Alloys, Transition metals, Metalloids, Atomic properties, Reprints, Amorphous materials, *Amorphous alloys.

The metalloid volume in transition metal rich-metalloid compounds is found to be roughly constant with a value close to that which can be inferred from the 12-fold bonding radii. This holds for proper-sized elements such as P and for the small interstitials B, C, and N. Volume contractions associated with charge transfer occur when elements from the Sc and Ti columns are involved and a break in bonding behavior, hence in volume effects, occur on going from the transition to the noble metals.

711,546
PB83-183533 Not available NTIS
National Bureau of Standards, Washington, DC.

Valency Effects and Relative Solubilities in Transition Metal Alloys.
Final rept.
D. A. Goodman, L. H. Bennett, and R. E. Watson. 1983, 5p
Pub. in Scripta Metallurgica 17, p91-96 1983.

Keywords: *Alloys, Transition metals, Phase diagrams, Solubility, Valance bands, Reprints.

The prediction of terminal solubilities for a given metal solute and solvent is a formidable problem, and it remains a major unsolved question in metallurgy. In the paper the authors attempt to describe the role of relative valency in the relative solubilities of the transition metals in one another. The authors discuss the problem of defining an appropriate measure of solubility for the transition metal alloys which have many intermediate phases, the authors present a map of relative solubilities for the transition metals, and the authors delineate the trend which occurs.

711,547
PB83-234484 Not available NTIS
National Bureau of Standards, Washington, DC.
Dimensional Changes of Four Amalgams After Five Years of Storage in Air at 60, 37, and 23C.
Final rept.
G. C. Paffenbarger, N. W. Rupp, and M. F. Coyne. Dec 82, 4p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 61, n12 p1427-1430 Dec 82.

Keywords: *Mercury amalgams, Alloys, Dimensional measurement, Expansion, Reprints.

Amalgam cylinders, 4 mm in diameter and 8 mm long, made from four alloys, expanded lengthwise from 204 to 220 at 60 C, 18 to 46 at 37 C, and 6 to 35 at 23 C, micrometers/cm, respectively, after storage in air at the indicated temperatures for five yr.

711,548
PB83-235614 Not available NTIS
National Bureau of Standards, Washington, DC.
Dimensional Changes of a High-tin Content Amalgam.
Final rept.
G. C. Paffenbarger, N. W. Rupp, and P. R. Patel. Dec 82, 4p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 61, n12 p1423-1426 Dec 82.

Keywords: *Mercury amalgams, *Dental materials, Silver alloys, Tin containing alloys, Copper containing alloys, Dimensional stability, Reprints, Silver alloy 5Cu 33Sn.

Amalgam made with Brewster Alloy (62% Ag, 33% Sn, 5% Cu, and 0.2% Zn) had little or no dimensional change during 24 h at 23C. Brewster amalgam stored for five yr in air expanded 186, 68, and 14 micrometers/cm at 60, 37, and 23C, respectively. Nearly 'stable' conditions were approached at about 50 mo.

711,549
PB83-236661 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Mechanisms in the Unlubricated Running-in Behaviour of an Al-Si-Cu Alloy Against 52100 Steel.
Final rept.
P. J. Blau, and E. P. Whitenton. Aug 82, 9p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Tribology International, p209-217 Aug 82.

Keywords: *Friction, *Aluminum copper silicon alloys, Wear, Microstructure, Reprints, *Steel 52100.

Friction coefficients of samples of an Al-Si-Cu alloy sliding against 52100 steel were determined on a tribometer. The alloy was chosen to represent a generic class of materials having wear resistant microstructures in which hard particles are contained within a softer metal matrix. These results together with microstructural observations from these samples and from comparative tests with silicon and 2024-T4 alloy led to a sliding running-in (break-in) model which takes account of the initial state of the surface, whether etched or polished.

711,550
PB83-600010 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Recommended Values for the Thermal Expansivity of Silicon from 0 to 1000K.
C. A. Swenson. c1983, 4p
Included in Jnl. of Physical and Chemical Reference Data, v12, n2 p179-182 1983.

Keywords: *High temperature expansivity, Silicon, Standard expansivities, Thermal expansivity.

Silicon, a high melting point, low expansivity, cubic material which can be obtained readily in high purity form, provides an excellent thermal expansion standard. Various absolute determinations of the thermal expansivity of both single crystal and polycrystalline silicon are used to establish a smooth relationship from 90 to 850 K which is believed to be reliable to roughly 10 to the minus 18th power K to the minus 1 power, and which is extrapolated to 1000 K. Values also are suggested for temperatures to absolute zero.

711,551
PB83-600011 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electrical Resistivity of Ten Selected Binary Alloy Systems.
C. Y. Ho, M. W. Ackerman, K. Y. Wu, T. N. Havill, R. H. Bogaard, R. A. Matula, S. G. Oh, and H. M. James. c1983, 139p
Included in Jnl. of Physical and Chemical Reference Data, v12, n2 p183-322 1983.

Keywords: *Alloy systems, Alloys, Conductivity, Critically evaluated data, Data analysis, Data compilation, Data synthesis, Electrical conductivity, Electrical resistivity, Metals, Recommended values, Resistivity.

This work compiles, reviews, and discusses the available data and information of the electrical resistivity of ten selected binary alloy systems and presents the recommended values resulting from critical evaluation, correlation, analysis, and synthesis of the available data and information. The ten binary alloy systems selected are the systems of aluminum-copper, aluminum-magnesium, copper-gold, copper-nickel, copper-palladium, copper-zinc, gold-palladium, gold-silver, iron-nickel, and silver-palladium. The recommended values for each of the ten binary alloy systems except three (aluminum-copper, aluminum-magnesium, and copper-zinc) are given for 27 compositions: (pure element), 0.5, 1,3,5,10(5)95,97,99,99.5, and 100% (pure element). For aluminum-copper, aluminum-magnesium, and copper-zinc alloy systems, the recommended values are given for 26, 12, and 11 compositions, respectively. For most of the alloy systems the recommended values cover the temperature range from 1 K to the solidus temperature of the alloys or to about 1200 K. For most of the nine elements constituting the alloy systems, the recommended values cover the temperature range from 1 K to above the melting point into the molten state. The estimated uncertainties in most of the recommended values are about plus or minus 3% to plus or minus 5%.

711,552
PB83-600012 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Levels of Silicon, Si I through Si XIV.
W. C. Martin, and R. Zalubas. c1983, 58p
Included in Jnl. of Physical and Chemical Reference Data, v12, n2 p323-380 1983.

Keywords: *Atomic energy levels, Atomic ions, Atomic spectra, Electron configurations, Ionization potentials, Silicon.

Energy level data are given for the atom and all positive ions of silicon (Z=14). These data have been critically compiled, mainly from published material on measurements and analyses of the optical spectra. We have derived or recalculated the levels for a number of the ions. In addition to the level value in cm to the minus first power and the parity, the J value and the configuration and term assignments are listed if known. Leading percentages from the calculated eigenvectors are tabulated or quoted wherever available. Ionization energies are given for all spectra.

711,553
PB84-106202 Not available NTIS
National Bureau of Standards, Washington, DC.
Relative Solubility Trends in Transition-Metal Alloys.
Final rept.
D. A. Goodman, L. H. Bennett, and R. E. Watson. 1983, 10p
Pub. in Proceedings of Materials Research Society Symposium, Boston, Massachusetts, October 31-November 4, 1982, 19, p43-52 1983.

Keywords: *Solubility, *Alloys, *Transition metals, Phase diagrams, Forecasting.

The prediction of terminal solubilities for a given metal solute and solvent is a formidable problem, and it remains a major unsolved question in metallurgy. In this paper we describe the relative solubilities of the transition metals in one another. After discussing the problem of defining an appropriate measure of solubility for the transition-metal alloys which have any intermediate phases, we present a map of relative solubilities for the transition metals. From this map, we delineate the trend which occurs. Both the Engel-Brewer theory and d-band transition-metal alloy theory are consistent with this trend.

711,554
PB84-106251 Not available NTIS
National Bureau of Standards, Washington, DC.
Metastable Phases in Rapidly Solidified Aluminum-Rich Al-Fe Alloys.
Final rept.
D. Shechtman, and L. J. Swartzendruber. 1983, 4p
Pub. in Proceedings of Materials Research Society Symposium, Boston, Massachusetts, October 31-November 4, 1982, p265-268 1983.

Keywords: *Aluminum alloys, Iron containing alloys, Metastable state, Heat treatment, Phase transformations, Solidification, Microstructure, Gamma ray spectra, Resonance, Transmission electron microscopy, Rapid solidification.

Aluminum-rich Al-Fe binary alloys up to and including Al3Fe were prepared by melt spinning in order to study the metastable phase structure and its transformation following heat treatment. Transmission electron microscopy and nuclear gamma-ray resonance were utilized in the study. The rapidly solidified structure was found to contain up to three metastable phases. One of the phases, with a composition and a gamma-ray resonance spectrum appropriate for Al6Fe, has either a globular or a cellular morphology upon quenching.

711,555
PB84-110493 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
NBS (National Bureau of Standards): Materials Measurements.
Annual rept. 1 Apr 82-31 Mar 83.
J. R. Manning. Aug 83, 135p NBSIR-83-2772
NASA Order-H-27954B
See also PB83-107854.

Keywords: *Interfacial tension, *Measurement, *Convection, *Tungsten, Solidification, Gallium alloys, Tin containing alloys, Thermophysical properties, Space processing.

The report describes NBS work for NASA in support of NASA's Materials Processing in Space Program under NASA Government Order H-27954B (Properties of Electronic Materials) covering the period April 1, 1982 to March 31, 1983. This work is directed toward measurement of materials properties important to the design and interpretation of space processing experiments and determinations of how the space environment may offer a unique opportunity for performing improved measurements and producing materials with improved properties. The work is being carried out in three independent tasks: Task (1) Surface Tensions and Their Variations with Temperature and Impurities; Task (2) Convection During Unidirectional Solidification; Task (3) Measurement of the High Temperature Thermophysical Properties of Tungsten Group Liquids and Solids. The results obtained for each task are given in detailed summaries in the body of the report.

711,556
PB84-133511 Not available NTIS
National Bureau of Standards, Washington, DC.
Solute Segregation and Boundary Structural Change During Grain Growth.
Final rept.
M. B. Kasen. 1983, 9p
Pub. in Acta Metallurgica 31, n4 p489-497 1983.

Keywords: *Aluminum, *Copper, Electrical resistivity, Grain growth, Grain boundaries, Separation, Reprints.

It is shown that the residual resistivity of dilute aluminum and copper alloys at liquid helium temperature systematically falls below that of the single crystal value during grain growth annealing. The resistivity undergoes a sudden upward perturbation at intermediate anneal times or temperatures, and again declines before finally returning to the single crystal value at very large grain sizes. Comparing the observed resistivity change with that attributable to the changing density of grain boundaries permits this electronic purification to be interpreted in terms of a redistribution of solute to and from migrating boundaries. Calculation of boundary solute content levels during the grain growth process suggests that the initial resistivity decline corresponds to an adsorption stage of segregation that terminates upon attainment of a common boundary solute density approximating that of full saturation.

711,557
PB84-135011 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Preparation and Corrosion Behavior of Titanium Alloys for Surgical Implants.
Final rept.
A. C. Fraker, A. W. Ruff, P. Sung, A. C. Van Orden, and K. M. Speck. 1983, 14p
Pub. in American Society for Testing and Materials Special Technical Publication 796, p206-219 1983.

Keywords: *Titanium alloys, *Titanium, *Surgical implants, Corrosion, Surface finishing, Passivity, Biocompatibility, Reprints, Titanium alloy 6Al 4V, Titanium alloy 4.5Al 1.5Cr 5Mo.

Surface preparation and corrosion behavior of titanium alloys were studied. Both topics deal with the formation of surface oxide films. When metals are prepared for surgical implant use, an effort is made to produce an optimum surface and various procedures are used. Titanium alloys are highly corrosion resistant to saline solutions and body fluids. Open circuit potential vs. time curves have been measured to show some electrochemical effects of various surface treatments. Results show that titanium alloys immersed in Hanks' physiological solution reach the same final open circuit potential after approximately two weeks' exposure regardless of prior surface treatment. Other work on the anodic polarization behavior of titanium alloys shows the effects of composition and testing solution on the passive region and breakdown potentials of these materials. In general, the differences are not great but the presence of nickel results in a significant shift of the breakdown potential. The materials studied were titantium, Ti-6A1-4V, Ti-Ni (memory alloy), and Ti-4.5A1-5Mo-1.5Cr.

711,558
PB84-137728 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamic and Physical Modelling of Alloy Phase Diagrams.
Final rept.
R. E. Watson, and L. H. Bennett. 1983, 48p
Pub. in Jnl. of Mater. Ed. 5, n4 p635-682 1983.

Keywords: *Phase diagrams, *Alloys, Mathematical models, Reprints.

This chapter constitutes a status report on current research in the understanding and prediction of alloy phase diagrams. It starts with thermodynamic predictions, emphasizing analytic models for the Gibbs free energies of the various phases. The use of metastable equilibrium phase diagrams which have such an important technological significance is illustrated. Approaches to equilibrium are treated combining equilibrium concepts with kinetics. First principle calculations and semi-empirical models are discussed.

711,559
PB84-137835 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanism for Diffusion Induced Grain Boundary Migration.
Final rept.
R. W. Balluffi, and J. W. Cahn. 1981, 8p
See also DOE-ER-0500213.
Pub. in Acta Metallurgica 29, p493-500 1981.

Keywords: *Alloys, *Diffusion, Grain boundaries, Diffusion coefficient, Crystal dislocations, Vacancies(Crystal defects), Reprints, Kirkendall effect.

Diffusion induced grain boundary migration (DIGM) has been found in six systems. The observed phenomena and empirical data is used to discard certain concepts about driving force and mechanisms. The authors propose a mechanism in which differences in diffusion coefficients of the diffusing species causes a self-sustaining climb of grain boundary dislocations (gbd's) and motion of their associated grain boundary steps.

711,560
PB84-138353 Not available NTIS
National Bureau of Standards, Washington, DC.
Compilations of Alloy Phase Diagram and Related Data.
Final rept.
D. J. Kahan, J. F. Harris, and L. H. Bennett. 1983, 9p
Pub. in Bulletin Alloy Phase Diagrams 3, n4 p417-435 1983.

Keywords: *Phase diagrams, *Alloys, Reprints.

This revised compilation of alloy phase diagram compilations and evaluations supersedes earlier versions. It lists most of the English language, and several Russian and other language, publications containing significant amounts of alloy phase diagram data. It is intended that coverage of the important evaluated data compilations from all over the world on this subject be comprehensive.

711,561
PB84-153394 Not available NTIS
National Bureau of Standards, Washington, DC.
Influence of Heat Treatment on the Fatigue Life of Ti-6A1-4V and Ti-4.5A1-5Mo-4.5Cr.
Final rept.
M. A. Imam, A. C. Fraker, J. S. Harris, and C. M. Gilmore. 1983, 15p
Pub. in American Society for Testing Materials Special Technical Publication 796, p105-119 1983.

Keywords: *Titanium alloys, Fatigue life, Heat treatment, Fatigue(Materials), Aluminum containing alloys, Vanadium containing alloys, Reprints, Titanium alloy 6Al 4V, Titanium alloy 4.5Al-5Mo-4.5Cr.

The paper reports on effects of heat treating on phase composition and fatigue behavior of the Ti-6Al-4V and the Ti-4.5Al-5Mo-4.5Cr alloys. Corrosion-fatigue experiments show that the Ti-6Al-4V alloy has the longest fatigue life when heat treated at 900C and quenched. The Ti-4.5Al-5Mo-4.5Cr alloy has increased fatigue life under low loading when heat treated at higher temperatures. The opposite trend in fatigue behavior appears to be true for specimens tested under high loads and heat treating at lower temperatures is more advantageous. Comparison of the fatigue life of the Ti-6Al-4V alloy and the Ti-4.5Al-5Mo-4.5Cr in the mill annealed condition shows that the Ti-4.5Al-5Mo-4.5Cr has improved fatigue behavior in the high cycle range but the Ti-6Al-4V is superior in the high cycle region.

711,562
PB84-191311 PC **A18**/MF **A01**
National Bureau of Standards, Washington, DC.
Phase Diagrams of Uranium Alloys.
O. S. Ivanov, T. A. Badaeva, R. M. Sofronova, V. B. Kishenevskii, and N. P. Kushnir. c1983, 418p TT-76-52046
Trans. from mono. Diagrammy Sostoyaniya i Fazovye Prevrashcheniya Splavov Urana, Moscow, 1972 by A. K. Dabir. Sponsored in part by National Science Foundation, Washington, DC.

Keywords: *Uranium alloys, *Phase diagrams, Phase transformations, Kinetics, Equilibrium, Translations, *Foreign technology.

This monograph presents a critical survey of the literature (through 1969) on the phase diagrams of binary, ternary and quaternary systems of uranium and the phase transformations of its alloys. It also reports original research by the author. The book examines the changes in the phase diagrams depending on the physico-chemical nature of the constituents. Data are presented on the crystallographic and chemical characteristics of the phases occurring in systems. Special attention is given to nonequilibrium states of uranium and its alloys, the kinetics and mechanism of transformations and the structure of metastable states of uranium alloys. There is a discussion of the general patterns of transformation of uranium alloys, which have an important role in developing the general theory of phase transformations.

711,563
PB84-217173 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Heat Treatment and Electron Beam Surface Melting on the Friction and Wear Behavior of a Cu-12wt.%Al Alloy.
Final rept.
P. J. Blau. 1984, 12p
Pub. in Wear 94, p1-12 1984.

Keywords: *Copper aluminum alloys, *Electron beams, *Heat treatment, *Eutectics, Surfaces, Wear, Microstructure, Hardness.

A Cu-12 wt% Al eutectoid composition binary alloy was wear and friction-tested in three heat-treated conditions designed to provide (1) a eutectoidal microstructure (E), (2) a martensitic microstructure (M) and (3) an electron beam-melted near surface microstructure (EB). Polished blocks of the alloy were worn dry against 52100 steel rings at 10 N load and 20 cm/s velocity in an argon gas environment. Both EB and M treatments had lower wear than the E heat treatment. All three showed transfer of material to the steel rings. Friction break-in characteristics varied with heat treatment. The martensitic microstructure, while lower in micro-indentation hardness had lower wear. Electron-beam melting of this alloy did not seem to improve performance any better than the quench to produce martensite.

711,564
PB84-217207 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Rapid Solidification Velocity on the Microstructure of Ag-Cu Alloys.
Final rept.
W. J. Boettinger, D. S. Shechtman, R. J. Schaefer, and F. S. Biancaniello. Jan 84, 12p
Pub. in Metallurgical Transactions (Section) A: Physical Metallurgy and Materials Science, v15A p55-66 Jan 84.

Keywords: *Silver alloys, *Microstructure, Copper containing alloys, Solidification, Eutectics, Reprints, Rapid solidification.

Electron beam solidification passes have been performed on a series of Ag-Cu alloys between 1 wt.% Cu and the eutectic composition (28.1 wt.% Cu) at speeds between 1.5 and 400 cm/s. At low growth rates conventional dendritic or eutectic structures are obtained. The maximum growth rate of eutectic structure is 2.5 cm/s. At high growth rates microsegregation-free single phase structures are obtained for all compositions. The velocity required to produce this structure increases with composition for dilute alloys and agrees with the theory of absolute stability of a planar liquid-solid interface with equilibrium partitioning. For alloys between 15 and 28 wt.% Cu, the velocity required to produce the microsegregation-free extended solid solution decreases with composition and is related to nonequilibrium trapping of solute at the liquid solid interface. At intermediate growth rates for alloys with 9 wt.% Cu or greater, a structure consisting of alternating bands of cellular and cell-free material is obtained. The bands form approximately parallel to the local interface.

711,565
PB84-217421 PC **A08**/MF **A01**
National Bureau of Standards, Wasnington, DC.
NBS (National Bureau of Standards): Materials Measurements (Annual Report for the Period 1 April 1983-31 March 1984).
J. R. Manning. Jun 84, 155p NBSIR-84-2882
NASA Order-H-27954B
See also PB83-107854. Sponsored in part by National Aeronautics and Space Administration, Washington, DC.

Keywords: *Interfacial tension, *Solidification, Measurement, Convection, Thermophysical properties, Silicon, Tungsten, Space processing.

This work is being carried out in three independent tasks: Surface Tensions and Their Variations with Temperature and Impurities; Convection During Unidirectional Solidification; Measurement of High Temperature Thermophysical Properties. Tasks 1 and 2 are directed toward determining how the reduced gravity obtained in space flight can affect convection and solidification processes. Emphasis in Task 3 is on development of levitation and containerless processing tech-

niques which can be applied in space flight to provide thermodynamic measurements of reactive materials.

711,566
PB84-220011 Not available NTIS
National Bureau of Standards, Washington, DC.
Dislocation Emission from Cracks in the Presence of Liquids.
Final rept.
I. H. Lin, and R. Thomson. 1983, 3p
Sponsored in part by Army Research Office, Arlington, VA.
Pub. in Scripta Metallurgica 17, p1035-1037 1983.

Keywords: *Embrittlement, *Cracking(Fracturing), Liquid metals, Dislocations(Materials), Emission, Reprints.

Lynch (1) and others have proposed that liquid metal embrittlement may be associated with enhanced rather than decreased dislocation activity in the vicinity of the crack tip. This proposal has been based on evidence for shallow dimples which are observed on the embrittled crack surfaces in large numbers. The reported difference relative to the untreated metal is that the dimples are shallower and more concentrated ahead of the crack, with a resulting lower CoD, in the embrittled case. Lynch (1) has speculated that the reason for this result is that dislocations are more easily emitted in a solid metal in contact with a second liquid metal. This suggestion is in contradiction with a lowered intrinsic surface energy caused by the wetting liquid which would tend to make dislocation emission less favored, and perhaps lead to cleavage (2). In this note, the authors will present a mechanism by which a wetting liquid can modify the emission criterion at the tip, and discuss the requirements for embrittlement.

711,567
PB84-221936 Not available NTIS
National Bureau of Standards, Washington, DC.
Microstructure and Phase Solubility Extension in Rapidly Solidified NiAl-Cr Quasibinary Eutectic.
Final rept.
D. Shechtman, W. J. Boettinger, T. Z. Kattamis, and F. S. Biancaniello. 1984, 8p
Pub. in Acta Metallurgica 32, n5 p749-756 1984.

Keywords: *Eutectics, Solidification, Microstructure, Free energy, Nickel alloys, Chromium containing alloys, Aluminum containing alloys, Reprints, Rapid solification, Phase solubility.

The microstructure of melt-spun ribbon of the NiAl-Cr quasibinary eutectic composition has been characterized by optical and transmission electron microscopies. The eutectic composition is Ni-38.5wt%Cr-19.4wt%Al and is of interest because of the similarity of crystal structures (CsCl for beta-NiAl and BCC for alpha-Cr) and lattice parameters of the two phases in the eutectic. The rapidly quenched microstructure consists of 0.5 micrometer diameter columnar grains of the beta-NiAl phase supersaturated with chromium to the eutectic composition. Between these grains a fine rod-type eutectic structure of the beta-NiAl and alpha-Cr phases is observed with eutectic spacings as fine as 12 nm. The composition of the phases in the eutectic portion of the microstructure were found to be close to the equilibrium solubilities for these phases. A rationale for the appearance of a supersaturated beta-NiAl phase at the eutectic composition, rather than a supersaturated alpha-Cr phase, will be presented based on the T sub o curves for this alloy system.

711,568
PB84-223254 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical Properties.
Final rept.
D. T. Read. 1983, 31p
Pub. in Materials at Low Temperatures, Chapter 7, p237-267 1983.

Keywords: *Mechanical properties, Yield strength, Fatigue(Materials), Creep properties, Dislocations(Materials), Crystal structure, Austenitic stainless steels, Copper, Aluminum, Titanium, Cryogenics, Alloys.

The mechanical properties of a material describe the relationships between the stresses acting on the material and its resulting deformations. Stresses capable of producing permanent deformations, which remain after the stresses are removed, are considered in this chapter. Yield strength, ultimate strength, elongation to fracture, and reduction of area are important mechanical properties. The temperature range considered here is 4-300 K, that is, from room temperature down to liquid helium temperature. Only macroscopically homogeneous materials are considered. The behavior of metals is considered. The fundamental mechanisms controlling temperature-dependent mechanical behavior, phenomena encountered in low-temperature testing, and the mechanical properties of some representative engineering metals and alloys are described. Modification of test procedures for low temperatures and sources of data are also included.

711,569
PB84-223957 Not available NTIS
National Bureau of Standards, Washington, DC.
Transition from an Emitting to a Cleaving Crack.
Final rept.
I. H. Lin, and R. Thomson. 1983, 4p
Pub. in Scripta Metallurgica 17, p1031-1034 1983.

Keywords: *Embrittlement, Liquid metals, Cracking(Fracturing), Dislocations, Emission, Reprints, Fracture(Mechanics).

Lynch (1) and others have proposed that liquid metal embrittlement may be associated with enhanced rather than decreased dislocation activity in the vicinity of the crack tip. This proposal has been based on evidence for shallow dimples which are observed on the embrittled crack surfaces in large numbers. The reported difference relative to the untreated metal is that the dimples are shallower and more concentrated ahead of the crack, with a resulting lower CoD, in the embrittled case. Lynch (1) has speculated that the reason for this result is that dislocations are more easily emitted in a solid metal in contact with a second liquid metal. This suggestion is in contradiction with a lowered intrinsic surface energy caused by the wetting liquid which would tend to make dislocation emission less favored, and perhaps lead to cleavage (2). In this note, the authors will present a mechanism by which a wetting liquid can modify the emission criterion at the tip, and discuss the requirements for embrittlement.

711,570
PB84-224781 Not available NTIS
National Bureau of Standards, Washington, DC.
Fracture.
Final rept.
R. Thomson. 1983, 64p
Pub. in Physical Metallurgy (3rd Edition), Chapter 23, p1488-1551 1983.

Keywords: *Cracks, *Dislocations(Materials), Fractures(Materials), Embrittlement, Fracture strength, *Fracture mechanics.

The fundamentals of fracture are reviewed from the perspective of the metallurgist. The importance of the sharp crack and its interaction with dislocations is emphasized. The concept of shielding of the crack by dislocations is explored, and expressions for fracture toughness developed. The importance of the structure of the underlying crack is realized, and the role of the stable atomically sharp crack is explained. These general ideas are applied to a number of the classic problem areas of metallurgical fracture.

711,571
PB84-225267 Not available NTIS
National Bureau of Standards, Washington, DC.
Abrasive Wear Studies of Laser Surface-Melted Aluminum and Titanium Alloys with Carbide Additions.
Final rept.
J. Ayers, L. K. Ives, F. Matanzo, and A. W. Ruff. 1983, 7p
Pub. in Wear of Materials, p265-271 1983.

Keywords: *Aluminum alloys, *Titanium alloys, *Wear resistance, *Abrasion resistance, *Carbides, Titanium carbide, Tungsten carbides, Vandium carbides, Melting, Reprints, Titanium alloy 6Al 4V, Aluminum alloy 6061, Aluminum alloy 5052, Aluminum alloy 2024, Laser applications.

A laser melting technique has been used to incorporate carbide particles into the surface region of several aluminum and titanium alloys thereby obtaining a significant improvement in abrasive wear properties. A multi-kilowatt CO2 laser was used to melt a shallow pool in the surface of each specimen that was passed under the beam. At the same time, powder particles were injected into the melt pool by a stream of helium gas from a small nozzle positioned nearby. The melted region subsequently solidified, incorporating the hard particles within the alloy matrix. Particles of TiC, WC, and VC in the size range 40 micrometers to 150 micrometers were used in order to study the effect of particle type and size on wear rate.

711,572
PB84-225606 Not available NTIS
National Bureau of Standards, Washington, DC.
Copper-TFE Friction at Cryogenic Temperatures.
Final rept.
R. S. Bell, C. K. Jones, and F. R. Fickett. Jan 84, 5p
Sponsored in part by International Copper Research Association, Inc., New York.
Pub. in Cryogenics, v24 n1 p31-35 Jan 84.

Keywords: *Copper, *Sliding friction, *Cryogenics, Fluorine organic compounds, Reprints, *Poly(ethylene/tetrafluoro), *Coefficient of friction, Temperature dependence.

Interfaces between metals and polytetrafluoroethylene (TFE) are common in cryogenic systems. In this paper the authors present results from measurements of the temperature dependence of the dynamic coefficient of friction between commercially pure copper and TFE. The effect of the copper surface finish was also determined. The effects of load and speed were evaluated over a small range, but nearly all data were taken at a surface speed of about 5.4 cm/s with a load of 1.63 N/sq cm. These parameters are typical of those encountered by the moving parts of cryogenic machinery.

711,573
PB84-235563
(Order as PB84-235530, PC **A07**/MF **A01**)
National Bureau of Standards, Washington, DC. Center for Materials Science.
Characterization of Creep Damage in Metals Using Small Angle Neutron Scattering.
E. R. Fuller, R. J. Fields, T. J. Chuang, and S. Singhal. 1 Dec 83, 11p
Included in Jnl. of Research of the National Bureau of Standards, v89 n1 p35-45 Jan-Feb 84.

Keywords: *Creep properties, *Neutron scattering, Materials tests, Metals, Failure.

Creep damage in polycrystalline metallic materials can be attributed to cavitation and cracking along the grain interfaces. Theories of creep cavitation that have been developed in recent years are reviewed. Further evaluation and/or refinement of these theories has been retarded by a lack of an experimental counterpart. Small angle neutron scattering studies (SANS) provide one experimental tool which is complementary to others. SANS done at NBS and elsewhere have shown that this tchnique is suitable for studying nucleation and early stage of growth of creep cavities. This would provide the impetus to further progress in this area.

711,574
PB84-235589
(Order as PB84-235530, PC **A07**/MF **A01**)
National Bureau of Standards, Washington, DC. Center for Materials Science.
Theory of Acoustic Emission from Phase Transformations.
J. A. Simmons, and H. N. G. Wadley. 1 Dec 83, 10p
Included in Jnl. of Research of the National Bureau of Standards, v89 n1 p55-64 Jan-Feb 84.

Keywords: *Phase transformations, Theories, *Acoustic emissions.

A theoretical framework is developed within which it is possible to predict the dynamic elastic displacement field (acoustic emission) for a phase transformation in which there is a change of both crystal structure (elastic constants) and shape (density). An integral equation is presented for the acoustic emission displacement field due to formation of inhomogeneous inclusions. This integral equation is solved by expressing the source in multipolar coefficients. Expressions for the source of elastic radiation are explicitly calculated for small isotropic spherical and ellipsoidal inclusions embedded in an isotropic matrix. These expressions are used for qualitative interpretation of recent experiments on martenistic transformations in steels and for identifying the information that may be deduced about transformation dynamics from quantitative measurements of acoustic emission.

711,575
PB84-235878 PC **A12**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Thermal Conductivity of Aluminum, Copper, Iron, and Tungsten for Temperatures from 1 K to the Melting Point.
J. G. Hust, and A. B. Lankford. Jun 84, 259p NBSIR-84/3007

Keywords: *Aluminum, *Copper, *Iron, *Tungsten, Thermal conductivity, Electrical resistivity, Thermophysical properties, Mathematical prediction, Cryogenics.

Data on the thermal conductivity of commercially pure aluminum, copper, iron, and tungsten specimens have been collected, coded, critically analyzed, and correlated with analytical techniques based on theoretical and empirical equations. The resulting functions are presented and used to generate tables and graphs of thermal conductivity as a function of temperature and residual resistivity ratio (RRR). An annotated bibliography of references is included. Discussions are included on the variations in thermal conductivity caused by chemical impurities, physical defects, size effects, and magnetic fields. Smoothed values are presented for temperatures from 1 K to near the melting point and for a large range of RRR values.

711,576
PB84-243898 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation Method for Comparing Domestic and Foreign Materials Specifications.
Final rept.
J. G. Early, and H. Hime. May 84, 8p
Sponsored in part by Coast Guard, Washington, DC.
Pub. in Jnl. of Testing and Evaluation 12, n3 p125-132 May 84.

Keywords: *Metals, *Chemical analysis, *Mechanical properties, *Specifications, *Guidelines, Tests, Comparisons, Reprints.

Consistent decisions on the degree of equivalence between metal specifications of different national origins cannot be made only on the basis of chemical composition and direct comparison of mechanical property numbers. There are numerous additional factors, which, if present, can influence the determination of equivalency because of their effect on property requirements. In order to remove the uncertainty in this decision-making process, these additional factors must be evaluated in each comparison. A generalized approach has been developed in which evaluation criteria have been identified and discussed in terms of their role in the determining of equivalence. These criteria are presented as part of a guideline for conducting material specification comparisons.

711,577
PB84-244326 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanism for Metalloid Strengthening of Udimet-700.
Final rept.
R. S. Polvani, A. W. Ruff, and P. R. Strutt. 1983, 4p
Pub. in Jnl. of Mater. Sci. Lett. 3, p287-290 1983.

Keywords: *High temperature tests, *Nickel containing alloys, *Heat resistant alloys, *Metalloids, Performance evaluation, Casting, Trace elements, Additives, Carbon, Boron, Silicon, Zirconium, Mechanical properties, *Udimet 700.

The deliberate use of metalloid (boron, carbon, silicon) and zirconium concentrations to improve the performance of nickel base superalloys has an interesting history. Initially small boron and zirconium additions were accidently added as crucible contaminants during casting. Their importance to the prevention of high temperature creep fracture became clear only after improved casting techniques eliminated these 'contaminants'. However, there is no appreciation of the important and different roles these trace additions play during high temperature creep. For this reason, a representative nickel base superalloy, namely Udimet-700, was selected and the effects of trace metalloid additions were studied in detail.

711,578
PB84-245810 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Thermally Generated Microstresses in Polycrystalline Beryllium Due to the Presence of Beryllium Oxide Inclusions.
Final rept.
T. A. Hahn, and R. W. Armstrong. 1982, 12p
Pub. in Proceedings of International Thermal Expansion Symposium (7th), p195-206 1982.

Keywords: *Beryllium, Thermal stresses, Inclusions, Beryllium oxides, Plastic flow, Dislocations(Materials).

In polycrystalline hexagonal beryllium (Be), the microstresses due to the relatively small thermal expansion anisotropy were previously estimated, on an ideal elastic basis, to be comparable to those stresses measured for the general yield and fracture strengths of bulk Be material. Commercial beryllium materials normally contain inclusions of (hexagonal) beryllium oxide (Be0), and the mismatch of expansivity between these materials is now shown to be capable of producing even larger elastic microstresses which should produce additional localized yielded and fracture zones within the material. Despite the fact that the Be0 inclusions are in compression, both compressive and tensile stresses are generated in the surrounding shell of Be material. The plastic zone size is estimated to be as much as ten times larger than an inclusion diameter so that an important parameter affecting the nature of plastic flow and cracking around an inclusion should be the polycrystal grain size. These several considerations are described on the basis of plasticity and dislocation models which are proposed for the material behavior.

711,579
PB84-245893 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamic Factors in the Extension of Solid Solubility in Al-Based Alloys.
Final rept.
J. L. Murray. 1983, 11p
Pub. in Proceedings of Materials Research Society Symposium, Boston, MA., October 31-November 4, 1982, p249-259 1983.

Keywords: *Aluminum alloys, Thermodynamic properties, Thermal analysis, Solidification points, Solubility, Chemical properties, Phase diagrams, Rapid solidification.

Stable and metastable equilibrium diagrams and T sub o curves are calculated for the Al-based binary systems Al-Ga, Al-Ge, Al-Fe, Al-Mg, and Al-Si. Extended solid solubilities and metastable phases have been produced by rapid solidification for each of these systems, and the calculations are compared to experimental observations.

711,580
PB84-245927 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical Properties of Welds in Aluminum Alloy 5083 at 4K.
Final rept.
R. A. Kelsey, L. N. Mueller, J. W. Elmer, and H. I. McHenry. Feb 82, 17p
Pub. in Proceedings of International Aluminum Welding Conference (1st), Cleveland, OH., April 7-8, 1981, p89-105 Feb 82.

Keywords: *Aluminum alloys, Mechanical properties, Cryogenics, Weldments, Aluminum alloy 5083.

A series of weldments were prepared by five cooperating companies in 51 mm thick 5083-0 aluminum plate using 5183 metal and gas metal arc welding (GMAW) processes. Tensile and notch-tensile properties measured at room temperature and at 4K are similar despite the fact that there were considerable variations in the welding procedures. Fracture toughness and fatigue crack growth rates of the weldments were measured at 4K and found to be similar to base metal properties. Strengths of the welds are appreciably higher at 4K than at room temperature, and notch yield ratios are high, indicating that the welds are tough. Data for each of the mechanical properties do not vary significantly from weld to weld; and it is concluded that the mechanical properties of 5183 welds at 4K do not depend significantly on GMAW parameters and procedures.

711,581
PB85-102184 Not available NTIS
National Bureau of Standards, Washington, DC.
Investigation of the Nature of Micro-Indentation Hardness Gradients Below Sliding Contacts in Five Copper Alloys Worn Against 52100 Steel.
Final rept.
P. J. Blau. 1984, 12p
Pub. in Jnl. of Materials Science 19, p1957-1968 1984.

Keywords: *Microhardness tests, *Indentation hardness tests, *Electric contacts, *Copper alloys, Copper aluminum alloys, Sliding friction, Abrasion resistant steels, Microstructure, Bronzes, Deformation, Metallography, Wear, Mechanical properties, 52100 steel.

This paper presents the results of a study of the differences in the variation of micro-indentation hardness with depth below sliding contact surfaces of OFHC Cu, Cu-3.5wt%Al, Cu-7.0wt%Al, and two commercial bronzes: CDA 638 and 688. All five metal alloys were worn dry against 52100 steel in a flat block (Cu alloy) on rotating cylinder (steel) configuration. The load was 10 N and sliding velocity was 20 cm/s in flowing argon environment. Metallography was performed using tapered cross-sections of the sliding surfaces of the Cu alloys. The variation of micro-indentation hardness with depth was found to be dependent upon the type of microstructural features below which each hardness profile was obtained. Therefore, micro-indentation hardness gradients sometimes varied more from location to location on a given sample than between similar microstructural features on one alloy and another. There was no obvious correlation between relative wear volumes of the alloys and the magnitude of their near surface micro-indentation hardness gradients. There did however seem to be a correlation between relative volumes and the thicknesses of their highly deformed near-surface layers.

711,582
PB85-107324 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Selenium and Tellurium in Stainless Steel, White Cast Iron, and Nickel Base Alloy Standard Reference Materials by Isotope Dilution Spark Source Mass Spectrometry.
Final rept.
H. M. Kingston, P. J. Paulsen, and G. Lambert. 1984, 5p
Pub. in Applied Spectroscopy 38, n3 p385-389 1984.

Keywords: *Chemical analysis, *Stainless steel, *Selenium, *Tellurium, *Nickel containing alloys, Standards, Reprints, *Standard reference materials, *Isotope dilution mass spectrometry, *White cast iron.

Procedures using stable isotope dilution spark source mass spectrometry were developed for the simultaneous determination of selenium and tellurium in stainless steels, white cast irons, and nickel based alloys. The selenium and tellurium were reduced using hypophosphorous acid except in the nickel based alloy where electro-deposition onto gold was also used for tellurium. A gold carrier was used to scavenge the selenium and tellurium efficiently during reduction. The samples were homogenized with gold and introduced into the mass spectrometer as electrodes. The concentrations calculated from the general isotope dilution equation ranged from 0.14 micrograms/g for selenium to 353 micrograms/g for tellurium. The materials tested were ten different Standard Reference Materials available from the NBS.

711,583
PB85-108579 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure of Rapidly Solidified Al-Fe-Cr Alloys.
Final rept.
R. Yearim, and D. Shechtman. Nov 82, 8p
Pub. in Metallurgical Transactions A 13A, p1891-1898 Nov 82.

Keywords: *Aluminum alloys, Microstructure, Reprints, *Rapid solidification.

Four aluminum alloys, designed for use at elevated temperatures, were studied. The alloys were supersaturated with iron and chromium, and one of them contained small amounts of Ti, V, and Zr. The starting materials were alloy powders made by the RSR (Rapid Solidification Rate) centrifugal atomization process. Extrusion bars were made from the four powders. The as-extruded microstructure and the microstructure of the alloys after annealing at 482 C were investigated by optical and transmission electron microscopy and by X-ray diffraction. The microstructure consists of equiaxed grains of aluminum matrix and two types of

precipitates, namely, Al3(Fe,Cr) and a metastable phase, Al6(Fe,Cr). The precipitates were different in their shape, size, distribution, and location within the grains.

711,584
PB85-108629 Not available NTIS
National Bureau of Standards, Washington, DC.
Phase Diagram Sample Preparation.
Final rept.
R. D. Shull. Jun 83, 11p
Pub. in Bulletin Alloy Phase Diagram 4, n1 p5-15 Jun 83.

Keywords: *Phase diagrams, Reprints, Sample preparation.

The procedures by which samples are prepared for phase diagram studies are examined and critically evaluated. The three key elements that require attention (alloy purity, homogeneity, and equilibrium) are separately addressed, and several examples of bad procedure are presented with information on their past and future consequences. The origin of commonly confronted problems are described and special procedures are suggested for their circumvention. Additionally, new methods for the early detection of some sample problems are presented, and the usefulness of rapidly solidified materials (as specimens) in phase diagram studies is illustrated.

711,585
PB85-128981 Not available NTIS
National Bureau of Standards, Washington, DC.
Zr-Rh System: A Case Study of Calculated and Experimental Phase Diagrams.
Final rept.
R. M. Waterstrat. 1984, 9p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of the Less-Common Metals 100, p347-355 1984.

Keywords: *Zirconium alloys, *Rhodium alloys, *Phase diagrams, Intermetallics, Reprints.

The current status of the Zr-Rh constitution diagram is reviewed. An outline of the procedures which may be used in calculating this phase diagram is presented beginning with Kaufman's predictive calculation in 1970. Kaufman's calculated phase diagram is compared with the currently accepted diagram determined from experimental data. The various types of experimental data which can be used to further improve the calculations are identified and some recent experimental results are also discussed. It is concluded that the most efficient strategy for obtaining a reliable phase diagram would involve both experiments and calculations since neither method achieves its maximum benefits when isolated from the other.

711,586
PB85-129427 Not available NTIS
National Bureau of Standards, Washington, DC.
Relationships between Phase Diagrams, the T. and Tn Temperatures, Cooling Rates and Glass Forming Ability.
Final rept.
T. B. Massalski, C. G. Woychik, and J. L. Murray. 1983, 7p
Pub. in Proceedings of Materials Research Symposium, Boston, MA, October 31-November 4, 1982, 19, p241-247 1983.

Keywords: Alloys, Phase diagrams, Glass transition temperature, Crystallization, Cooling, *Metallic glasses, Amorphous materials.

While the temperature concept has been of great use when comparing the glass forming ability of different alloys it would be desirable to broaden the GFA concept to include also the influence of the cooling rate and T sub n parameters, and perhaps also certain features of the specific techniques that are used to produce amorphous alloys.

711,587
PB85-135499 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Accuracy Conductivity Measurements in Non-Ferrous Metals.
Final rept.
G. M. Free. 1981, 8p
Pub. in Proceedings of Symposium on Eddy-Current Characterizing of Materials and Structures, Gaithersburg, MD, September 5-7, 1979, p121-128 1981.

Keywords: *Electrical resistivity, Electrical measurement, Metals, Electric measuring instruments, Eddy currents, Nonferrous metals.

An eddy current instrument has been built that measures electrical conductivity with a high degree of accuracy and precision. The instrument measures the electrical conductivity of non-ferrous metals at a constant skin depth. By keeping the product constant in all measurements, a linear relationship between conductivity and frequency can be established. Due to this linear relationship, only one conductivity standard is necessary to calibrate the instrument over the full range 1%-100% IACS.

711,588
PB85-136224 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Mill Temper on the Mechanical and Magnetoresistive Properties of Oxygen-Free Copper in Liquid Helium.
Final rept.
F. R. Fickett. Jul 84, 8p
Pub. in Advances in Cryogenic Engineering 30, p453-460 Jul 84.

Keywords: *Copper, Magnetoresistivity, Liquid oxygen, Mechanical properties, Cryogenics, Reprints.

Depending on the source of the ore and its subsequent processing, oxygen-free copper can show wide variations in low temperature mechanical and electrical properties. Further mechanical and thermal processing by the wire producer and final user will also affect the behavior of the copper as a stabilizer. Here we present data showing the effect of these processes on coppers from a variety of sources.

711,589
PB85-140002 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultrasonic Shear Wave Measurements of Known Residual Stress in Aluminum.
Final rept.
G. V. Blessing, N. N. Hsu, and T. M. Proctor. Sep 84, 5p
Pub. in Experimental Mechanics 24, n3 p218-222 Sep 84.

Keywords: *Aluminum alloys, *Stress analysis, *Ultrasonic tests, Residual stress, Secondary waves, Reprints, Electromagnetic-acoustic transducers.

Ultrasonic shear wave time-of-flight measurements were made at a nominal frequency of 4 MHz on a shrink-fit disk sample of 2024 aluminum alloy. The stress state of the sample was produced by shrink-fitting a plug and ring to produce a calculated 65 MPa region of uniform compression in the plug, and a concomitant non-uniform tension and compression in the ring. Time-of-flight measurement scans across sample diameters were made using a piezoelectric shear transducer with a viscous couplant, and repeated using a contactless electromagnetic acoustic transducer. The ultrasonic results were then compared with elasticity theory, assuming the acousto-elastic relationship between sound velocity and material strain.

711,590
PB85-142313 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Anodic Polarization Behavior of Unfired and Moderately Fired Nickel-Chromium Alloys.
Final rept.
H. Weber, and A. C. Fraker. 1980, 5p
Pub. in Deutsche Zahnaerztliche Zeitschrift 35, n10 p942-946 1980.

Keywords: *Dental materials, *Nickel chromium alloys, Anodic polarization, Reprints.

Due to the rapid increasing costs of gold alloys, attempts have been underway to develop other alloys which are suitable for dental crown and bridge work. This study deals with the effects of fire cycling on the anodic polarization behavior of three commercial nickel-chromium dental casting alloys. Measurements were made in modified Fusayama's solution at 37C.

711,591
PB85-142800 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Aging Process in Aluminum-Alloy 2024 Studied by Means of Eddy Currents.
Final rept.
M. Rosen, L. Swartzendruber, E. Horowitz, S. Fick, and R. Mehrabian. 1982, 8p
Pub. in Materials Science and Engineering 53, n2 p191-198 1982.

Keywords: *Aluminum alloys, *Aging(Metallurgy), Precipitation hardening, Hardness, Electrical resistivity, Reprints, Aluminum alloy 2024.

The influence of precipitation kinetics during aging of 2024 aluminum alloy on electrical conductivity, as measured by eddy currents, and on hardness was investigated. Aging temperatures between 21 and 190C were used and measurements were made on both unstretched and plastically deformed (3 percent permanent strain) samples. The two techniques, electrical conductivity and hardness, respond in a complementary manner to the varying microstructures that form during different phases of the aging process.

711,592
PB85-143428 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heat Flow during Surface Melting: Effect of Temperature-Dependent Absorptivity.
Final rept.
J. A. Sekhar, and R. Mehrabian. 1981, 3p
Pub. in Metallurgical Transactions, B: Process Metallurgy 12, n2 p411-413 1981.

Keywords: *Solidification, *Melting, *Heat transmission, Absorptivity, Reprints, Rapid solidification, Laser applications, Materials processing.

This paper discusses the effects of temperature dependent absorptivity on the heat flow in a semi-infinite substrate rapidly melted and solidified by the switching of an intense stationary laser beam.

711,593
PB85-143444 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Role of Water Vapor and Sulfur Compounds in Sodium Vaporization during Glass Melting.
Final rept.
D. M. Sanders, M. E. Wilke, S. Hurwitz, and W. K. Haller. 1981, 6p
Pub. in Jnl. of the American Ceramic Society 64, n7 p399-404 1981.

Keywords: *Glass, Melting, Sodium, Vaporization, Alkali glass, Silica glass, Sodium hydroxide, Sodium sulfates, Water vapor, Reprints.

The influence of sulfur compounds on the vaporization of sodium from soda-lime-silica glass was investigated using the newly developed stirrable transpiration apparatus (STA). With increasing sulfur concentration in either the melt or the atmosphere above it, the sodium vapor density was found to increase until attaining the value found over pure sodium sulfate liquid. At that point, the sodium vapor density was independent of sulfur concentration-presumably due to separation of sodium sulfate liquid from the glass.

711,594
PB85-143527 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heat Flow during Rapid Solidification of Undercooled Metal Droplets.
Final rept.
C. G. Levi, and R. Mehrabian. 1982, 14p
Pub. in Metallurgical Transactions, A: Physical Metallurgy and Materials Science 13, n2 p221-234 Feb 82.

Keywords: *Heat transmission, Aluminum, Mathematical models, Reprints, *Rapid solidification.

The solidification of undercooled spherical droplets with a discrete melting temperature is analyzed using both a Newtonian and a non-Newtonian (Enthalpy) model. Relationships are established between atomization parameters, the growth kinetics, the interface velocity and undercooling, and other important solidification variables. A new mathematical formulation and solution methodology is developed for non-Newtonian solidification of an undercooled droplet. An enthalpy model is used to model the solidification process in an undercooled droplet from a single nucleation event occurring at its surface. A superimposed bispherical (rotational bipolar) coordinate system is used. Numerical solutions for the solidification of pure aluminum drop-

lets based on the enthalpy model are developed, and their results are compared to the trends predicted from the Newtonian model.

711,595
PB85-143543 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microstructures of Rapidly Solidified Aluminum Alloy Submicron Powders.
Final rept.
C. G. Levi, and R. Mehrabian. 1982, 11p
Pub. in Metallurgical Transactions, A: Physical Metallurgy and Materials Science 13, n 1 p13-23 Jan 82.

Keywords: *Aluminum alloys, *Microstructure, Metal powder, Nucleation, Reprints, Rapid solidification.

The microstructures of electron transparent submicron aluminum alloy powders produced by an electrohydrodynamic process are described. The observations are coupled with thermodynamic, kinetic and heat flow concepts to deduce the thermal history and solidification mode of the powders. The range of microstructures observed include: homogeneous plane front solidified single crystals; cellular crystals; and powders containing blocky segregates, multiple grains and twins.

711,596
PB85-143600 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heat Flow Model for Surface Melting and Solidification of an Alloy.
Final rept.
J. A. Sekhar, S. Kou, and R. Mehrabian. 1983, 9p
Pub. in Metallurgical Transactions A 14, n6 p1169-1177 1983.

Keywords: *Heat transmission, Heat flux, Melting, Solidification, Aluminum alloys, Alloys, Numerical analysis, Enthalpy, Reprints.

The heat flow model previously developed for a pure metal is extended and applied to rapid surface melting and solidification of an alloy substrate over a range of temperatures. The substrate is subjected to a pulse of stationary high intensity heat flux over a circular region on its bounding surface. The finite difference form of the heat transfer equation is written in terms of dimensionless nodal temperature and enthalpy in an oblate spheroidal coordinate system. A numerical solution methodology is developed for an alloy which precipitates a eutectuc phase at the end of solidification. Generalized solutions are presented for an Al-4.5 wt% Cu alloy subjected to a uniform heat flux distribution over the circular region. Dimensionless temperature distributions, size and location of the 'mushy' zone and average cooling rate during solidification are calculated as a function of the product of absorbed heat flux, q, the radius of the circular region a and time.

711,597
PB85-143659 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystallization Kinetics Study of Amorphous Pd-Cu-Si by Ultrasonic Measurements.
Final rept.
M. Rosen, H. N. G. Wadley, and R. Mehrabian. 1981, 6p
Pub. in Scripta Metallurgica 15, n11 p1231-1236 1981.

Keywords: *Crystallization, Reaction kinetics, Ultrasonic tests, Nucleation, Palladium alloys, Copper containing alloys, Silicon containing alloys, Reprints, *Metallic glasses, Amorphous materials.

The objective of the investigation was to study the crystallization kinetics in Pd sub 0.775Cu sub 0.06Si sub 0.165 ribbons by means of laser-generated and piezoelectrically detected, ultrasonic waves whereby the extentional wave velocities, and consequently the Young moduli, could be determined with a high degree of accuracy. Corroborative evidence was obtained by means of optical metallography.

711,598
PB85-144400 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Passivation and Passivation Defects on Electromigration Failure in Aluminum Metallization.
Final rept.
H. A. Schafft, C. D. Younkins, T. C. Grant, C. Y. Kao, and A. N. Saxena. 1984, 6p
Pub. in Proceedings of 1984 Reliability Physics Symposium, Las Vegas, NV., April 3-5, 1984 p250-255.

Keywords: *Aluminum coatings, Passivity, Failure, Metallizing, Cracks, Reprints.

Metal line structures with intentional defects in the passivation, to simulate cracks or pin holes, were used in electromigration studies. Results show that the stress changes in the metallization caused by these defects are not as important as the restraining action of the passivation in affecting a metallization's resistance to electromigration failure. Also, the observed effects of restorative forces acting on the metallization suggests that continuous monitoring for open-circuit failure may be necessary to obtain an accurate measure of the mean-time-to-failure.

711,599
PB85-145233 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Review of Our Present Understanding of Macrosegregation in Axi-Symmetric Ingots.
Final rept.
S. D. Ridder, R. Mehrabian, and S. Kou. 1981, 24p
Pub. in Proceedings of Symposium Modeling of Casting and Welding Processes, Rindge, NH., August 3-8, 1980, p261-284 1981.

Keywords: *Ingots, *Separation, Castings, Nickel containing alloys, Tin containing alloys, Experimental data, Theories, Mathematical models, Fluid flow, Isotherms, Reprints.

Our present understanding of the mechanisms responsible for certain types of macrosegregation occurring in ESR, VAR and continuous cast ingots are reviewed. Experimental observations on both a high temperature alloy Ni-27 wt.% Mo and low temperature Sn-Pb alloys are compared to theoretical predictions. The mathematical models developed extend previous work by coupling the convective heat and fluid flow in the fully liquid metal pool above the liquidus isotherm to the interdendritic fluid flow responsible for macrosegregation.

711,600
PB85-172484 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermosolutal Convection during Directional Solidification.
Final rept.
G. B. McFadden, R. G. Rehm, S. R. Coriell, W. Chuck, and K. A. Morrish. Dec 84, 13p
Pub. in Metallurgical Transactions 15A, p2125-2137 Dec 84.

Keywords: *Convection, *Solidification, Prandtl number, Nonlinear differential equations, Diffusion, Temperature, Concentration(Composition), Fluid flow, Velocity, Schmidt number, Reprints, *Binary alloys.

During solidification of a binary alloy at constant velocity vertically upwards, thermosolutal convection can occur if the solute rejected at the crystal-melt decreases the density of the melt. The authors assume that the crystal-melt interface remains planar and that the flow field is periodic in the horizontal direction. The time-dependent nonlinear differential equations for fluid flow, concentration, and temperature are solved numerically in two spatial dimensions for small Prandtl numbers and moderately large Schmidt numbers. For slow solidification velocities, the thermal field has an important stabilizing influence: near the onset of instability the flow is confined to the vicinity of the crystal-melt interface. For fixed velocity as the concentration increases, the horizontal wavelength of the flow decreases rapidly; a phenomena also indicated by linear stability analysis. The lateral inhomogeneity in solute concentration due to convection is obtained from the calculations. For a narrow range of solutal Rayleigh numbers and wavelengths, the flow is periodic in time.

711,601
PB85-172492 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nonplanar Interface Morphologies during Unidirectional Solidification of a Binary Alloy.
Final rept.
G. B. McFadden, and S. R. Coriell. Jul 84, 9p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Physica 12D, n1-3 p253-261 Jul 84.

Keywords: *Solidification, Interfaces, Morphology, Reprints, *Binary alloys.

During directional solidification of a binary alloy, a planar solidification interface may become unstable and develop into a cellular nonplanar interface, exhibiting periodic structure transverse to the growth direction. Steady state two-dimensional temperature, solute concentration, and interface shapes are calculated numerically and the solute inhomogeneity (microsegregation) in the solidified material obtained. Specific results are presented for an aluminum alloy containing silver for solidification velocities of 0.01 and 1.0 cm/s, which corresponds to the constitutional supercooling and absolute stability regimes, respectively.

711,602
PB85-182822 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Phase Diagram Features Associated with Multicritical Points in Alloy Systems.
Final rept.
S. M. Allen, and J. W. Cahn. 1983, 16p
Grant NSF-DMR80-22277
Sponsored by American Society for Metals, Metals Park, OH., and Materials Research Society, University Park, PA.
Pub. in Proceedings of a Symposium on Alloy Phase Diagrams, Boston, MA, November 1982, Materials Research Society Symposia Proceedings, v19 p195-210 1983.

Keywords: *Phase diagrams, *Critical point, *Alloys, Binary systems(Materials).

Many features in the vicinity of critical points in phase diagrams can be illustrated using a Landau type free energy expansion as a power series in one or more order parameters and composition. This simple approach can be used with any solution model. It also predicts limits to metastability, and is useful for understanding mechanisms of phase change. The theory is applied to all the critical points that can occur in binary systems according to a Landau theory: critical consolute points order-disorder transition, tricritical points, critical end points, as well as to systems in which two transitions such as chemical and magnetic ordering occur.

711,603
PB85-183283 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Morphological Stability in the Presence of Fluid Flow in the Melt.
Final rept.
G. B. McFadden, S. R. Coriell, R. F. Boisvert, M. E. Glicksman, and Q. T. Fang. Dec 84, 8p
Pub. in Metallurgical Transactions A, 15A p2117-2124 Dec 84.

Keywords: *Melting, *Fluid flow, Stability, Morphology, Hydrodynamics, Reprints.

Recent experiments have shown that the presence of a vertical buoyancy-driven flow adjacent to an initially cylindrical crystal-melt interface may produce a time-dependent helical deformation of the interface, with a rotation period ranging from several minutes to many hours, depending upon the width of the melt. The temperature distribution is such that the interface is expected to be morphologically stable in the absence of fluid flow. A linear stability analysis reveals that the instability is due to a coupling between a basic hydrodynamic instability in the buoyant flow and the deformable boundary separating the two phases. The crystal-melt interface lowers the critical Grashof number of an analogous rigid-walled system by an order of magnitude for succinonitrile with a Prandtl number P=22.8; furthermore, the hydrodynamic mode that is actually destabilized by the interface is not the least stable mode in the rigid-walled system for P=22.8. The results show that the instability may be regarded either as a rather large alteration of a basic hydrodynamic instability by the crystal-melt interface, or as a significant modification of the morphological stability of the interface by the presence of the buoyant flow.

711,604
PB85-184539 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Diffusion-Induced Grain Boundary Migration.
Final rept.
D. B. Butrymowicz, J. W. Cahn, J. R. Manning, D. E. Newbury, and T. J. Piccone. 1983, 11p
Sponsored by American Ceramic Society, Columbus, OH.
Pub. in Proceedings of a Special Conference of the Annual Meeting of the American Ceramic Society

(84th), Cincinnati, OH., May 4-5, 1982, Advances in Ceramics, v6 p202-212 1983.

Keywords: *Grain boundaries, *Diffusion, Migration, Ceramics, Metals, Kirkendall effect.

The diffusion of a solute into or out of polycrystalline materials at temperatures at which only grain boundary diffusion is significant has been observed to induce grain boundaries to migrate in a large number of binary metal systems. This unexpected grain boundary migration leads to vastly enhanced mass transport and leaves altered concentrations of solute atoms in the regions traversed by the boundary. Recently suggested mechanisms for this effect depending on a grain boundary Kirkendall effect may explain why it has not yet been observed in ceramic systems.

711,605
PB85-187748 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Surface Melting of an Alloy Under Steady State Conditions.
Final rept.
J. A. Sekhar, R. Mehrabian, and H. L. Fraser. 1981, 13p
Sponsored by Metallurgical Society of AIME, Warrendale, PA.
Pub. in Proceedings of Symposium AIME Annu. Meet. Lasers in Metallurgy (110th), Chicago, IL, February 22-26, 1981, p207-219.

Keywords: *Melting, *Aluminum alloys, Steady state, Heat transmission, Aluminum alloy 4.5Cu, Rapid solidification.

A combined theoretical and experimental study is described for the surface melting of an Al-4.5 wt% Cu alloy substrate subjected to a high intensity stationary heat flux. Both the calculations and the experiments were done under steady state conditions. That is, the heat flux absorbed, through the circular region on the bounding surface of the substrate, is exactly balanced by conduction of heat into the substrate - thermal profiles remain the same after an initial transient. The heat flow model is based on a new formulation and solution methodology of the heat flow equation for the two free moving boundary problem at hand. The experiments were carried out on an electron beam welding apparatus especially modified for rapid solidification studies. Agreement between theory and experiment is shown to be reasonably good considering the limitations of the former due to a number of assumptions.

711,606
PB85-187755 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Morphological Stability of Electron Beam Melted Aluminum Alloys.
Final rept.
R. J. Schaefer, S. R. Coriell, R. Mehrabian, C. Fenimore, and F. S. Biancaniello. 1982, 11p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of Symposium on Rapidly Solidified Amorphous and Crystalline Alloys, Boston, MA, November 16-19, 1981, v8, p79-89 1982.

Keywords: *Aluminum alloys, Stability, Solidification, Melting, Rapid solidification.

For constant velocity solidification, morphological stability theory delineates the temperature gradients required for plane front solidification of a specific alloy. Using electron beams, surface heating of metals can be carried out with sufficiently well characterized thermal input to permit reliable use of computer models of melting and solidification. From numerical calculations, the growth velocity and temperature gradients as a function of position during resolidification can be obtained; combining these results with (constant velocity) morphological stability theory indicates the resolidification regimes for which the plane front is unstable. Presumably, completely planar solidification may be attained by selecting heating modes such that the region of instability is totally avoided, but the expected interface morphology is more difficult to predict if the interface passes briefly through an unstable region and then re-enters a region of stability. Aluminum-silver and aluminum-manganese alloys were melted under an electron beam with particular emphasis on attaining solidification sufficiently rapidly to satisfy the gradient-independent absolute stability condition.

711,607
PB85-196038 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quantitative Kinetic and Morphological Studies Using Model Systems.
Final rept.
R. J. Schaefer, and M. E. Glicksman. 1981, 9p
Sponsored by Metallurgical Society of AIME, Warrendale, PA., and American Society for Metals, Metals Park, OH.
Pub. in Proceedings of a Symposium on Modeling of Casting and Welding Processes, Rindge, NH., August 3-8, 1980, p375-383 1981.

Keywords: *Solidification, Morphology, Dendritic crystals, Stability, Supercooling.

The usefulness for metallurgists of solidification studies using transparent model systems depends to a large extent on quantitative correlation to detailed theories of specific solidification phenomena. By designing experiments in which the thermal and geometrical conditions considered by the theory can be attained as closely as possible, and by making detailed kinetic and morphological measurements of the resulting solidification behavior, one can carry out incisive tests of the theory. Thus detailed study of dendritic growth in pure succinonitrile, together with auxiliary experiments which measured relevant thermodynamic properties, led to the important conclusion that the maximum velocity hypothesis for dendrite growth was not correct. This result has stimulated further theoretical work, which now appears to relate dendrite growth velocities to morphological stability considerations. Moreover, additional experimental and theoretical work is now revealing the regimes in which convection and solute effects are significant.

711,608
PB85-196251 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calculations of Stable and Metastable Equilibrium Diagrams of the Ag-Cu and Cd-Zn Systems.
Final rept.
J. L. Murray. 1984, 8p
Pub. in Metallurgical Transactions, A: Physical Metallurgy and Materials Science 15, n2 p261-268 Feb 84.

Keywords: *Silver alloys, *Copper alloys, *Cadmium alloys, *Zinc alloys, Phase diagrams, Equilibrium, Thermodynamics, Reprints.

Thermodynamic functions have been modelled for the binary alloy systems Ag-Cu and Cd-Zn, simple eutectic systems of interest in the areas of rapid solidification. Parameters of the thermodynamic functions are derived primarily from phase diagram data and compared to measured excess functions. Stable and metastable phase equilibria have been calculated, as well as the chemical spinodals and the locus of compositions and temperatures where liquid and solid have equal free energies.

711,609
PB85-197630 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Polymorphism of Nickel-Phosphorus Metallic Glasses.
Final rept.
D. S. Lashmore, L. H. Bennett, H. E. Schone, P. Gustafson, and R. E. Watson. 1982, 4p
Pub. in Physical Review Letters 48, n25 p1760-1763, 21 Jun 82.

Keywords: *Nickel alloys, Phosphoruscontaining alloys, Polymorphism, Frequency shift, Reprints, *Metallic glass, Amorphous materials.

It is shown that nickel-phosphorus metallic glass alloys not only exhibit two distinct local structural configurations for a given composition, but also that the configuration can be selected by choosing the appropriate processing parameters. It is also shown that the structure exhibiting the greater Knight shift exhibits a discontinuous transformation to the structure with the lower Knight shift. Measurements have been extended to alloys containing up to 42 atomic percent phosphorus.

711,610
PB85-202034 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Fluid Flow on Macrosegregation in Axi-Symmetric Ingots.
Final rept.
S. D. Ridder, S. Kou, and R. Mehrabian. 1981, 13p
Pub. in Metallurgical Transactions B 12, n3 p435-447 Sep 81.

Keywords: *Ingots, *Continuous casting, Fluid flow, Mathematical models, Solidification, Separation, Heat transmission, Reprints.

A combined theoretical and experimental study of steady-state fluid flow, heat flow and segregation in axi-symmetric ingot production is presented, with specific applications in continuous casting and ESR. The fluid flow-segregation model involves the coupling of convective heat and fluid flow in the fully liquid metal pool ahead of the liquidus isotherm to the interdendritic fluid flow responsible for macrosegregation in the 'm ushy' zone of ingots solidifying under axi-symmetric conditions. Experiments on low-temperature Sn-Pb alloys verify the solidification model.

711,611
PB85-202059 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Diffusion-Induced Grain Boundary Migration in the Copper-Zinc System.
Final rept.
T. J. Piccone, D. B. Butrymowicz, D. E. Newbury, J. R. Manning, and J. W. Cahn. 1982, 5p
Pub. in Scripta Metallurgica 16, n7 p839-843 1982.

Keywords: *Copper alloys, *Diffusion, *Zinc, Grain boundaries, Microstructure, Metallography, Reprints.

Results are presented from an investigation of diffusion-induced grain boundary migration in the Cu-Zn system. Diffusion couples were prepared by annealing high-purity copper with brass powder. Zinc from the powder was diffused into the copper at temperatures at which grain boundary diffusion dominates and lattice diffusion is negligible. Boundary migration at or near the surface of the copper was examined through metallography, light microscopy, scanning electron microscopy, and the electron microprobe. Composition profiles across alloyed regions formed by boundary migration were determined with an electron microprobe and show unanticipated results.

711,612
PB85-205219 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Influence of a Multiple-Energy Ion Beam on the Equilibrium Profile of a Binary Alloy.
Final rept.
M. L. Roush, F. Davarya, T. D. Andreadis, and O. F. Goktepe. 1983, 3p
Pub. in Jnl. of Vacuum Science and Technology A 1, n2 p491-493 1983.

Keywords: *Ion irradiation, Reprints, *Binary alloys, Ion bombardment.

Ion-bombardment-induced sputtering of a multi-element solid results in the preferential movement of the constituents, producing a composition profile which is dependent upon the beam energy. Recent studies have demonstrated transient changes in surface composition of such samples when the bombarding energy is abruptly changed. It is important to be able to treat multiple-energy ion beams since most sputtering systems have a contaminant of multiply-charged ions with higher energy than the principal component. The authors have studied the various competing processes that result in the equilibrium profile in order to develop the capability to predict the equilibrium profile which will result, once the parameters of the bombardment have been specified. They found that the equilibrium profile produced by a beam containing two energies cannot be obtained simply by interpolating between the two profiles that would result from the ion components individually. Interpolation is possible only in the near surface region.

711,613
PB85-207181 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sub-Surface Hardening in Erosion-Damaged Copper As Inferred from the Dislocation Cell Structure, and Its Dependence on Particle Velocity and Angle of Impact.
Final rept.
D. Kuhlmann-Wilsdorf, and L. K. Ives. 1983, 13p
Pub. in Wear 85, n3 p361-373 1983.

Keywords: *Copper, Hardening(Materials), Erosion, Dislocations(Materials).

Previously published measurements of the cell diameters (d) of dislocation cells underneath copper surfaces exposed to particle erosion have been evaluated

in terms of the subsurface stresses to which they correspond. These were compared with the elastic stresses expected underneath spherical indentors impacting on the surface with different speeds. The inferred stresses differ markedly from theoretical prediction, not only in regard to dependence on speed and angle of impact, but even in regard to their decay along the z-axis, the direction normal to the surface.

711,614
PB85-227650 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Microanalytical Study of Secondary Precipitation in RSR 143 Using Atom Probe Field Ion Microscopy and Analytical Transmission Electron Microscopy.
Final rept.
M. E. Twigg, A. J. Melmed, R. Klein, M. J. Kaufman, and H. L. Fraser. 1984, 6p
Pub. in Proceedings of Int. Symp. Superalloys (5th), Champion, PA., October 7-11, 1984, p631-636 1984.

Keywords: *Precipitation(Chemistry), *Heat resistant alloys, *Heat treatment, *Chemical analysis, Nickel alloys, Phase transformations, Chemical composition, Stabilization, Tantalum, Aluminum, Solid solutions, Solids, Microanalysis, *Nickel alloy RSR 143, *Superalloys, Atom probe field ion microscopy, Transmission electron microscopy, Long range interactions.

For a given heat treatment, the Ni-base superalloy RSR 143 consists of three phases: the gamma matrix, gamma prime cuboids, and DO(22) platelets. Atom probe field ion microscopy and analytical transmission electron microscopy are used in determining the compositions of these three phases.

711,615
PB85-229375 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Convective Influence on the Stability of a Cylindrical Solid-Liquid Interface.
Final rept.
Q. T. Fang, M. E. Glicksman, S. R. Coriell, G. B. McFadden, and R. F. Boisvert. 1985, 20p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Fluid Mechanics 151, p121-140 1985.

Keywords: *Interfaces, Solids, Liquid metals, Fluid flow, Convection, Grashof number, Stability, Melts, Crystal growth, Reprints, Instability.

Experiments in which a long vertical, heated wire is surrounded by concentric annuli of a melt and its crystalline solid show that the convection state changes from a stable unicell surrounded by a stationary cylindrical solid-liquid interface, to a complex time-dependent flow surrounded by a rotating, helical solid-liquid interface. A linear stability analysis has been carried out for an infinitely tall vertical annulus. When the deformable nature of the crystal-melt interface is taken into account in the boundary conditions, two new modes of instability arise.

711,616
PB85-229425 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Effect of a Forced Couette Flow on Coupled Convective and Morphological Instabilities during Unidirectional Solidification.
Final rept.
S. R. Coriell, G. B. McFadden, R. F. Boisvert, and R. F. Sekerka. 1984, 8p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Crystal Growth 69, n1 p15-22 Nov 84.

Keywords: *Solidification, *Lead alloys, Couette flow, Tin containing alloys, Convection, Interfaces, Melts, Crystal growth, Reprints, Instability.

The effect of a forced Couette flow, parallel to a horizontal crystal-melt interface during directional solidification of an alloy of lead containing tin, on the onset of convective and morphological instabilities, is calculated numerically via a linear stability analysis. Such a flow does not affect perturbations with wave vectors perpendicular to the flow. For perturbations with wave vectors parallel to the flow, the onset of morphological instability is somewhat suppressed and thermosolutal convection is greatly suppressed. When instabilities occur, they are oscillatory and correspond to travelling waves. For values of the crystal growth velocity for which mixed morphological and convective modes occur, the presence of a forced flow produces sufficient decoupling to allow otherwise degenerate branches to be identified.

711,617
PB86-102399 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Cellular Growth During Directional Solidification.
Final rept.
S. R. Coriell, G. B. McFadden, and R. F. Sekerka. 1985, 27p
Grant NSF-DMR84-09397
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Annual Review of Materials Science 15, p119-145 1985.

Keywords: *Solidification, *Crystal growth, Binary systems(Materials), Alloys, Stability, Reprints.

During directional solidification of an alloy, a planar crystal-melt interface may become unstable and develop into a cellular or dendritic interface; the resulting crystal is then non-uniform in solute concentration with spatial inhomogeneities transverse to the growth direction. Linear morphological stability predicts the conditions and the wavelength at the onset of instability. The linear theory and recent extensions of it are reviewed. Recent theoretical advances in the non-linear aspects of the free boundary problem associated with directional solidification are discussed. Recent experimental tests of the linear theory and measurements of cellular wavelengths in binary alloys are described.

711,618
PB86-113602 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Basic Mechanisms of Atomic Redistribution in Alloys Undergoing Irradiation.
Final rept.
J. R. Manning. 1981, 19p
Pub. in Proceedings of Phase Stability During Irradiation, Pittsburgh, PA., October 5-9, 1980, p3-21 1981.

Keywords: *Point defects, *Crystal defects, *Diffusion theory, *Irradiation, *Segregation process, Alloys, *Physical radiation effects.

In alloys undergoing irradiation, vacancies and interstitials can be created in great numbers by radiation damage processes. These point defects then migrate and produce large defect fluxes directed from the interior of the alloy to grain boundaries, pores and the alloy surface. The resulting vacancy and interstitialcy fluxes can appreciably affect diffusion processes and cause significant solute redistribution, even in originally homogeneous alloys. In this paper, basic driving forces and diffusion equations governing this process are discussed. Two distinct forces which arise from the irradiation-rpduced defects can be identified: (1) steady state macroscopic defect concentration gradients affect the basic atom jump frequencies, and (2) defect fluxes, especially if the fluxes are non-uniform in character, change the local microscopic defect distributions around individual atoms and alter the effective atom jump frequencies. A general equation for the steady state segregation gradient in binary alloys is presented, and simple applications are made to dilute alloys.

711,619
PB86-123056 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Measurements and Standards Div.
Coin Silver as a Construction Material in Low-Temperature Experiments.
Final rept.
C. T. Van Degrift. 1981, 2p
Pub. in Physica B+C 107, n1-3 p605-606 Aug/Sep 81.

Keywords: *Coin silver, Construction materials, Low temperature tests, Physical properties, Reprints.

The utility of an alloy of 10% copper in silver (coin silver) as a construction material in certain low temperature experiments is discussed. While maintaining low-temperature thermal and electrical conductivities between copper and brass, this easily machined alloy has very little magneto-resistance, 10% of the magnetic specific heat of copper, and is highly resistant to creeping under mechanical stress. A table of the low-temperature properties of coin silver is presented which includes the results of direct measurements of its magneto-thermal conductivity below 500 mK.

711,620
PB86-124161 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Beryllium Microdeformation Mechanisms.
Final rept.
R. S. Polvani, B. W. Christ, and E. R. Fuller. 1981, 11p
See also AD-A111 499. Sponsored by Office of Naval Research, Boston, MA.
Pub. in Proceedings of International Conference on Creep and Fracture of Engineering Materials and Structures, Swansea, Wales, March 24-27, 1981, p85-95.

Keywords: *Beryllium, *Deformation, Dimensional measurement, Tensile strength, Creep properties.

Microtensile and microcreep behaviors of beryllium were studied using a capacitance type extensometer capable of resolving .1 um/m over long times. The nature of the dislocation processes responsible for microdeformation are not entirely clear; but surely, the primary difference between micro and conventional deformation is the extent to which the dislocations move and not the nature of the processes. Despite low temperatures, microcreep of Instrument Grade Beryllium appears to be diffusion limited.

711,621
PB86-124963 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Processing/Microstructure Relationships in Surface Melting.
Final rept.
R. J. Schaefer, and R. Mehrabian. 1983, 12p
Pub. in Proceedings of Laser-Solid Interactions and Transient Thermal Processing of Materials, Boston, MA., November 1-4, 1982, v13 p733-744 1983.

Keywords: Melting, Electron beam melting, Homogeneity, Aluminum, Interfaces, Stability, Solidification, Microstructure, Process control, *Surface melting, Rapid solification.

The development of predictive models for rapid surface melting and resolidification requires coupling of realistic heat flow models to emerging theories of rapid solification processing. An overview is given of the emerging guidelines for prediction and control of rapid solification conditions and microstructures. Homogenization of the liquid by convection and diffusion is also discussed. Electron beam surface melting of alloy substrates is used as an example of these processes.

711,622
PB86-129558 PC **A03**/MF **A01**
General Electric Co., Schenectady, NY. Materials Information Services.
Standards and Metadata Requirements for Computerization of Selected Mechanical Properties of Metallic Materials.
Final rept.
J. H. Westbrook. Aug 85, 50p NBS/SP-702
Library of Congress catalog card no. 85-600585. Also available from Supt. of Docs as SN003-003-02691-3. Sponsored by National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data, and Army Materiel Development and Readiness Command, Alexandria, VA.

Keywords: *Standards, *Metals, Mechanical properties, Tests, Computer applications.

To assist in building a computerized information system on the engineering properties of materials, the standards and metadata requirements for a representative group of mechanical property categories are considered. These categories include: tensile behavior, hardness numbers, notch-bar impact test parameters and fatigue properties. For each property group, definitions of terms, synonyms (and non-synonyms), standard test methods, standards for reporting data, precision and accuracy, and correlations of properties are addressed. The principal findings and recommendations are as follows. Existing test methods are generally adequate for the properties considered but better standards are needed for data reporting. Appraisal of materials variability and testing machine variability would be assisted by acess to standard reference materials, certified as to their mechanical properties.

711,623
PB86-130101 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Numerical and Experimental Verification of Compliance Functions for Compact Specimens.
Final rept.
R. L. Tobler, and W. C. Carpenter. 1985, 10p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Engineering Fracture Mechanics 21, n3 p547-556 1985.

Keywords: *Modulus of elasticity, Numerical analysis, Mechanical properties, Cracking(Fracturing), Reprints, Finite element analysis.

A two-dimensional finite element study of the compact specimen was performed in verification of its elastic compliance calibration functions. The results confirm Newman's boundary collocation solutions to within 2%. Empirical calibrations were also performed using alloys with well-known elastic moduli. The numerical and empirical agreement depends on the state of stress assumed in the model, with better agreement for plane stress than for plane strain.

711,624
PB86-132651 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Competition between Wear Processes during the Dry Sliding of Two Copper Alloys on 52100 Steel.
Final rept.
P. J. Blau. 1983, 8p
Pub. in Proceedings of Wear of Materials Conference, Reston, VA., April 11-14, 1983, p526-533.

Keywords: *Wear, *Copper alloys, Steels, Sliding, Tests, Friction, Microhardness.

More than one wear process may be operating simultaneously during the dry sliding of metals. Moreover, the relative contributions of these processes may change with time. Flat blocks of two commercial alloys of copper (CDA 638 and 688) were held against rotating rings of 52100 steel under a normal load of 10 N and 20 cm/s velocity for a series of tests in Ar gas environments. Microscopy revealed two different operating wear processes on the alloy 638 wear scars. Separate wear volumes were computed for the two mechanisms (metallic and dull-colored wear zones). Microhardness gradients were obtained below these zones.

711,625
PB86-139920 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Thermodynamic Properties of bcc Crystals at High Temperatures: The Transition Metals.
Final rept.
R. A. MacDonald, and R. C. Shukla. 1985, 8p
Pub. in Physical Review B 32, n8 p4961-4968, 15 Oct 85.

Keywords: *Vanadium, *Niobium, *Tantalum, *Molybdenum, *Tungsten, *Thermodynamic properties, Perturbation theory, Body centered cubic lattices, Electronic specific heat, Transition metals, Reprints.

The second-neighbor central-force model of a bcc crystal, previously used in lowest-order anharmonic perturbation theory to calculate the thermodynamic properties of the alkali metals, is here applied to the transition metals V, Nb, Ta, Mo, and W. The limitations of the model are apparent in the thermal-expansion results, which fall away from the experimental trend above about 1800 K. The specific heat similarly fails to exhibit the sharp rise that is observed at higher temperatures. A static treatment of vacancies cannot account for the difference between theory and experiment. The electrons have been taken into account by using a model that specifically includes d-band effects in the electron ground-state energy. The results thus obtained for the bulk moduli are quite satisfactory. In the light of these results, the authors discuss the prerquisites for a better treatment of metals when the electrons play an important role in determining the thermodynamic properties.

711,626
PB86-160595 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Ignition of Metals in High Pressure Oxygen.
Final rept.
J. W. Bransford. 1984, 15p
Sponsored by National Aeronautics and Space Administration, Huntsville, AL. George C. Marshall Space Flight Center.
Pub. in Proceedings of National Aeronautics and Space Administration Advanced High Pressure O2/H2 Technology, Huntsville, AL., p134-148 1984.

Keywords: *Ignition, *Combustion, Liquid oxygen, Aluminum, Nickel, Stainless steels.

A description of an experimental facility used to determine the ignition and combustion characteristics of metallic materials is described. The results obtained for aluminum 6061, 302 stainless steel, and the nickel alloy-N06625-are given.

711,627
PB86-189032 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Transition-Metal Alloy Formation. The Occurrence of Topologically Close-Packed Phases.
Final rept.
R. E. Watson, and L. H. Bennett. 1984, 13p
Pub. in Acta Metallurgica 32, n4 p477-489 1984.

Keywords: *Alloys, Transition metals, Phase, Chemical bonds, Reprints, Laves phases, Sigma phase.

The occurrence or non-occurrence of topologically close-packed (top) phases is discussed in terms of atomic volumes (V) and d-band hole counts (N sub h). The ranges of stoichiometries over which top phases occur are shown to be related to the relative sizes of the alloy constitutents. An effective N sub h is defined. It is necessary to consider the laves structures as distinct from the other top phases. The non-laves top phases have a range of favored A-to-B site volume ratios. Some suggestions are given of alloy systems in which top phases have not been reported but are expected, and vice versa.

711,628
PB86-189040 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Model Predictions of Volume Contractions in Transition-Metal Alloys and Implications for Laves Phase Formation. 2.
Final rept.
R. E. Watson, and L. H. Bennett. 1984, 12p
Pub. in Acta Metallurgica 32, n4 p491-502 1984.

Keywords: Transition metals, Alkali metals, Alkaline earth metals, Alloys, Reprints, *Laves phases.

A simple cellular model estimate of the site volume changes attending alloying of transition metals with each other, and with alkali and alkaline earth metals is made. Application is made to AB2 (MgCu2 and MgZn2) Laves phases as well as the related AB5(CaCu5 and AuBe5) structures. Size factors and electron factors are considered as measures controlling the occurrence of Laves phases.

711,629
PB86-190634 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Disorderly Crystal Structures in Transition Metal Rich-Metalloid Alloys: Implications for Glass Formation.
Final rept.
R. E. Watson, and L. H. Bennett. 1983, 6p
Pub. in Scripta Metallurgica 17, n7 p827-832 1983.

Keywords: *Metalloid alloys, Crystal structure, Transition metals, Reprints, Amorphous materials.

Easy glass formation usually occurs near eutectics where the glass forming temperature is close to the melting point. However, as Anderson observed(1), other factors also enter. Citing covalent systems such as SiO2 and GeS2, he noted that glass formation is favored when the crystal structure(s) of the compounds are complicated. The purpose of the present communication is to see what transition metal rich-metalloid compounds have complicated structures and what implications this might have for glass formation.

711,630
PB86-192515 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Precipitation in Rapidly Solidified Al-Mn Alloys.
Final rept.
D. Shechtman, R. J. Schaefer, and F. S. Biancaniello. 1984, 11p
See also AD-A136 128.
Pub. in Metallurgical Transactions A: Physical Metallurgy and Materials Science 15A, n11 p1987-1997 Nov 84.

Keywords: *Aluminum alloys, Manganese containing alloys, Precipitation(Chemistry), Microstructure, Reprints, Rapid solidification.

Precipitation at 450C was studied in melt-spun ribbons containing up to 15 wt.% Mn in solid solution in Al. The as-spun ribbons were microsegregation-free at compositions up to 5 wt.% Mn, but in more concentrated alloys a cellular microstructure was present. Upon annealing, four precipitate phases are observed, some of them being found preferentially on cell boundaries and others being found within the cells. Al6MN, G and G double prime phase can coexist for long times at 450 C, but the G phase appears to be slightly more stable. A less stable T phase was detected in Al-5 wt.% Mn foils following short annealing periods. The supersaturation of the Al matrix can persist for many hours in alloys containing up to 3 wt.% Mn, but is essentially gone after 1 hour in alloys with 5 wt.% Mn or more.

711,631
PB86-192960 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Diamond Anvil Cell Technology for P,T Studies of Ceramics: Zirconia (8 mol% yttria).
Final rept.
R. G. Munro, S. Block, G. J. Piermarini, and F. A. Mauer. 1984, 10p
Pub. in Mater. Sci. Res. 17, p783-792 1984.

Keywords: *Zirconium oxides, *Ceramics, *Aluminum oxide, Mechanical properties, X ray diffraction, Reprints.

The authors are undertaking a systematic study of the structural and bulk properties of zirconia and alumina-based materials as functions of pressure and temperature. This paper describes the experimental approach that is being taken and discusses some of the results already obtained for ZrO2 with 8 mol% Y2O3.

711,632
PB86-193240 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Small-Angle Neutron Scattering Study of Phase Decomposition in the Nickel-Rich Side of the Nickel/Nickel-Aluminum (Ni3Al) Miscibility Gap.
Final rept.
S. P. Singhal, F. S. Biancaniello, H. A. Alperin, and H. Herman. 1985, 6p
Pub. in Scripta Metallurgica 19, n2 p133-138 1985.

Keywords: *Nickel alloys, *Aluminum containing alloys, Phase transformations, Neutrons scattering, Reprints, *Aluminum nickel, Spinodal decomposition, Temperature dependence.

Small angle neutron scattering measurements on the isothermal phase decomposition of a Ni-14.4 at %-Al alloy is in qualitative agreement with a recent nucleation theory based on cluster dynamics. The data exhibits an apparent linear temperature dependence of the power law exponents for the peak intensity and position.

711,633
PB86-195005 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Phase Decomposition in Copper-Titanium Metallic Glass.
Final rept.
R. D. Shull, S. P. Singhal, B. Mozer, and A. Maeland. 1984, 6p
Pub. in Rapidly Solidified Metastable Mater. 28, p279-284 1984.

Keywords: *Titanium intermetallics, Phase transformations, Crystallization, Reprints, *Metallic glasses, Amorphous materials, Copper titanium.

A metallic glass ribbon of Cu55Ti45 prepared by melt spinning was examined by x-ray, neutron, and electron diffraction, by small angle neutron diffraction (SANS),

transmission electron microscopy (TEM), and by differential thermal analysis (DTA). In the liquid quenched condition large angle diffraction data (both x-ray and neutron) show the broad banded structure typical of the amorphous state. The SANS data, however, exhibit highly anisotropic patterns arising from phase decomposition during solidification. Ribbons annealed below the glass transition temperature (T sub g) produced neutron diffraction patterns of materials with the same amorphous structure combined with a new short range order; and the SANS patterns retained the assymetry of the as-quenched material. Ribbons annealed above the crystallization temperature (T sub c) show both isotropic and anisotropic contributions to the SANS patterns. Formation of the equilibrium TiCu phase occurs directly from the metallic glass at (T sub c). The equilibrium Ti4Cu3 phase, however, forms from the TiCu phase at a just slightly higher temperature.

711,634
PB86-196060 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Color Metallography of Diffusion-Induced Grain Boundary Migration in Copper-Zinc and Copper-Arsenic Alloys.
Final rept.
D. B. Butrymowicz, T. J. Piccone, J. R. Manning, and D. E. Newbury. 1983, 12p
Pub. in Metallography 16, n4 p349-360 1983.

Keywords: *Copper alloys, *Metallography, Arsenic containing alloys, Zinc containing alloys, Diffusion, Grain boundaries, Migrations, Reprints.

Diffusion-induced grain boundary migration is a recently recognized phenomenon which leads to unexpected motion of grain boundaries. Vastly enhanced mass transport characterizes the low temperature aspect of the phenomenon since the grain boundaries provide easy paths for diffusional redistribution of atoms in the regions traversed by the boundaries. Diffusion of a solute into or out of polycrystalline materials when only grain boundary diffusion is significant has been observed to induce grain boundaries to migrate in a number of alloys. Because the migrating boundaries sweep across grains, mixing in solute, and no compositional changes occur except in regions through which migrating boundaries pass, changes in the color of surface regions were used to detect, and to extract the extent of, the phenomenon.

711,635
PB86-196821 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Mechanisms of Microsegregation-Free Solidification.
Final rept.
W. J. Boettinger, S. R. Coriell, and R. F. Sekerka. 1984, 10p
Pub. in Materials Science and Engineering 65, n1 p27-36 Jul 84.

Keywords: *Solidification, Silver alloys, Kinetics, Reprints, Rapid solidification, Microsegregation.

Two solidification mechanisms can produce microsegregation-free crystalline alloys: planar growth and partitionless solidification. For growth at high velocity, but still with equilibrium partitioning of solute, capillarity can stabilize a planar liquid-solid interface. This type of stability, known as absolute stability, has been confirmed experimentally for Ag-Cu alloys and should apply only when the net heat flow is towards the solid. Another possibility for producing microsegregation-free alloys is partitionless solidification which can occur at high velocities and arises from the kinetics of interface motion. These kinetics involve the trapping of solute by the moving interface, causing the partition coefficient to be unity. A unified model for the variation of the interface temperature and partition coefficient with interface velocity is presented. This model spans the range from slow velocities, where local equilibrium is usually valid, to high velocities where partitionless solidification occurs. Considerations necessary to predict the conditions of microsegregation-free solidification for concentrated alloys are also discussed.

711,636
PB86-197373 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Radial Distribution Studies of Amorphous Fe-W and Ni-P at High Pressure.
Final rept.
R. G. Munro, F. A. Mauer, G. J. Piermarini, and S. Block. 1983, 7p
Pub. in Jnl. of Applied Physics 54, n10 p5698-5704 Oct 83.

Keywords: *Distribution functions, *Iron alloys, *Nickel alloys, Load cells, X ray diffraction, Tungston containing alloys, Phosphorous containing alloys, Reprints, *Amorphous materials, High pressure.

The determination of a radial distribution function of an amorphous material contained in a diamond anvil pressure cell is discussed. The details of the method of computation are presented, and the results for two amorphous metals, Fe-W (72 at.% Fe) and Ni-P (75 at.% Ni), are presented and critically discussed. For the reduced structure function and its Fourier transform, the differential radial distribution function, amplitudes are not well determined, and maxima and minima are located with an absolute accuracy not better than three percent. However, for a single experimental configuration and sample, the relative changes in the first neighbor distance as a function of pressure are readily detectable, even for variations on the order of 0.5 percent. Measurements at 0, 0.3, 3.6, 7.5, and 10.5 GPa and room temperature indicate that Fe-W (72 at.% Fe) has a bulk modulus of about 170 GPa. Measurements at 0.15, 2.80, and 5.50 GPa indicate that Ni-P (75 at.% Ni) has a bulk modulus of about 370 GPa at room temperature.

711,637
PB86-201415 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Heat Flow - Acoustic Emission - Microstructure Correlations in Rapid Surface Solidification.
Final rept.
R. B. Clough, H. N. G. Wadley, and R. Mehrabian. 1983, 10p
Sponsored by American Society for Metals, Metals Park, OH.
Pub. in Proceedings of the Lasers in Materials Processing Conference of the American Society for Metals, Los Angeles, CA., January 24-26, 1983, p37-46.

Keywords: *Solidification, Heat transmission, Microstructure, Acoustic emission testing, *Rapid solidification.

Heat flow models are now available for one- and two-dimensional melting and resolidification of metallic substrates subjected to high energy laser and electronbeam sources. The models can account for both stationary and moving heat sources. In the past, experimental observations have been limited to post-solidification examinations of the microstructures and have resulted in establishment of correlations between fineness of structure, interface stability and extent of altered microstructure (e.g. melt depth) with variables such as the heat flux distribution in space and time. Techniques are accordingly needed for in situ measurement of the dynamics of laser and electron beam material interactions, possibly leading to in-process control applications and the detection of defective conditions. Acoustic emission methods show promise for this. Acoustic emission accompanying absorption of 100 ms stationary electron beams of variable flux density have been measured from 1100 and 2219 aluminum alloys.

711,638
PB86-201779 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Use of Metastable Phase Diagrams in Rapid Solidification.
Final rept.
J. H. Perepezko, and W. J. Boettinger. 1983, 18p
Pub. in Proceedings of the Alloy Phase Diagrams Symposium, Boston, MA., November 1982, p223-240 1983.

Keywords: *Solidification, Phase diagrams, Metastable state, *Rapid solidification.

During rapid solidification, the nucleation and/or growth of a thermodynamically stable phase may be difficult. In this case the liquidus, solidus or other thermodynamic data for a metastable phase are important for the interpretation and prediction of the phases present in rapidly solidified materials. In this paper various techniques are described to obtain information about metastable equilibrium from measured stable equilibrium data. Extrapolations of phase boundaries as functions of temperature, pressure or composition (including a new component) into regions of metastability can often be constructed directly on the equilibrium diagram. These constructions can be performed more quantitatively with analytical methods using thermodynamic modelling of the free energy functions consistent with measured data. A number of examples are considered including a discussion of metastable liquid miscibility gaps, metastable eutectic and peritectic reactions, pressure diagrams and metastability in ternary alloys to indicate the possible product phase selection. A coupling of metastable phase diagrams with a solidification kinetics analysis can contribute towards effective alloy design and processing during rapid solidification.

711,639
PB86-208394 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Thermal Expansion of Molybdenum in the Range 1500-2800 K by a Transient Interferometric Technique.
Final rept.
A. P. Miiller, and A. Cezairliyan. 1985, 10p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in International Jnl. of Thermophysics 6, n6 p695-704 Nov 85.

Keywords: *Molybdenum, Thermal expansion, High temperature tests, Interferometers, Pulse heating, Reprints, Standard reference materials.

The linear thermal expansion of molybdenum has been measured in the temperature range 1500-2800 K by means of a transient (subsecond) interferometric technique. The molybdenum selected for these measurements was the Standard Reference Material SRM 781 (a high-temperature enthalpy and heat capacity standard).

711,640
PB86-208436 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Relationship between Anodic Film Microhardness and Metallic Coating Adhesion on Phosphoric Acid-Anodized Aluminum Alloys.
Final rept.
D. E. Thomas. 1983, 4p
Sponsored by Aluminum Association, Inc., Washington, DC.
Pub. in Plating and Surface Finishing 70, n7 p53-56 1983.

Keywords: *Aluminum alloys, *Coatings, Adhesion, Anodizing, Electrodeposition, Microhardness, Reprints.

One of the most difficult problems encountered in pretreating aluminum alloys for electrodeposition using the phosphoric acid anodizing process is the determination of the process parameters for maximum coating adhesion. The paper presents a simple method for determining the approximate coating adhesion without the financial and time consuming expense of adhesion testing. Investigations show that the coating adhesion is closely linked with the anodic film microhardness. The effect of anodizing potential, anolyte temperature, anodizing time, anolyte concentration, and post anodic treatments are examined with respect to both microhardness and coating adhesion. In each case an increase or decrease in the anodic film microhardness predicts a corresponding increase or decrease in the metal coating adhesion.

711,641
PB86-209293 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Chemical Principles Underlying Bioleaching of Metals from Ores and Solid Wastes, and Bioaccumulation of Metals from Solutions.
Final rept.
F. E. Brinckman, and G. J. Olson. 1986, 10p
Pub. in Biotechnology and Bioengineering Symposium, n16 p35-44 1986.

Keywords: *Hydrometallurgy, Metalliferous minerals, Solutions, Leaching, *Bioleaching, Biosynthesis.

A rapidly emerging though largely untapped component of biotechnology deals not only with a few light elements commonly viewed as the 'organic' part of the biosphere, but also with the remaining elements-especially the metals-that comprise the bulk of our planet and vitally influence our biosphere. Thus, current and projected research that deals with microbial interactions and processing of metals focuses on three major aspects that ties together their covalent chemistry and molecular biotransformations: (1) metabolic utilization of metal species, (2) toxic metal resistance mechanisms, and (3) indirect metals biotransformations by exocellular metabolites. Biooxidation of lean sulfide ores and wastes by microorganisms represent powerful new cost-beneficial chemistries, as does the parallel consideration of using microorganisms to accumulate or even synthesize metal compounds in selected forms of most value to further commercial processing.

711,642
PB86-209905 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Nature of Large Ti4Cu2O Particles Formed during Annealing of Cu55Ti45 Metallic Glass Ribbons.
Final rept.
M. J. Kaufman, and R. D. Shull. 1986, 7p
Pub. in Metallurgical Transactions A: Physical Metallurgy and Materials 17, p575-581 Apr 86.

Keywords: *Intermetallics, *Copper alloys, *Titanium containing alloys, Annealing, Crystallization, Electron diffraction, Spectroscopy, Reprints, Metallic glass.

Large particles observed in annealed Cu(sub 55)Ti(Sub 45) metallic glass ribbons have been identified using convergent beam electron diffraction and energy dispersive X-ray spectroscopy as Ti(sub 4)Cu(sub 2)O (diamond cubic, space group Fd3m), consistent with the structure derived earlier by Mueller and Knott (Trans. AIME, 1963, vol. 227, p. 674) using different experimental techniques. In addition, evidence is presented which suggests that these particles form prior to and independent of either of the two binary equilibrium phases, TiCu and Ti(sub 3) and Cu(Sub 4), which also form during the crystallization annealing treatment.

711,643
PB86-209913 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Constitution of an Al-37.5Ge Splat Quenched Foil: Implications on Nucleation Kinetics.
Final rept.
M. J. Kaufman, M. Ellner, and H. L. Fraser. 1986, 4p
Contract DE-AC02-76ER01198
Sponsored by Department of Energy, Washington, DC. Materials Sciences Div.
Pub. in Scripta Metallurgica 20, p125-128 1986.

Keywords: *Aluminum alloys, *Germanium containing alloys, Electron microscopy, X ray diffraction, Foils(Materials), Nucleation, Kinetics, Microstructure, Solidification, Quenching(Cooling), Cooling, Reprints, Undercooling, Rapid solidification, Splat quenching.

An Al-37.5Ge splat quenched foil has been analyzed using transmission electron microscopy and X-ray diffraction. The results are supportive of previously proposed nucleation kinetics and enforce the view that the microstructures which are produced using rapid solidification can and should be related directly to the undercoolings which are achieved prior to nucleation rather than the cooling rates characteristic of the specific process. These undercoolings frequently do depend on the cooling rates of the experimental techniques and may be depicted conveniently on time-temperature-transformation diagrams.

711,644
PB86-209921 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Determination of the Point Group of the Icosahedral Phase in an Al-Mn-Si Alloy Using Convergent-Beam Electron Diffraction.
Final rept.
L. A. Bendersky, and M. J. Kaufman. 1986, 6p
Pub. in Philosophical Magazine B: Electronic, Optical and Magnetic Properties 53, n3 pL75-L80 Mar 86.

Keywords: *Aluminum alloys, *Magnesium containing alloys, *Silicon containing alloys, Electron diffraction, Symmetry, Reprints, Point groups, Phase studies.

Convergent-beam electron diffraction has been used to determine conclusively the point group of the icosahedral phase in an Al-Mn-Si alloy. The patterns obtained clearly display the symmetries expected for the orientations of a quasicrystalline phase with the m35 point group.

711,645
PB86-209939 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Analytical Electron Microscopy Study of the Recently Reported 'Ti2Al Phase' in gamma-TiAl Alloys.
Final rept.
M. J. Kaufman, D. G. Konitzer, R. D. Shull, and H. L. Fraser. 1986, 6p
Contract DE-AC02-76ER01198
Sponsored by Department of Energy, Washington, DC. Materials Sciences Div.
Pub. in Scripta Metallurgica 20, p103-108 1986.

Keywords: *Titanium alloys, *Aluminum containing alloys, Electron microscopy, Electron diffraction, Phase, Creep properties, Analysis, Reprints.

A variety of experimental techniques has been utilized to establish that the phase reported previously to be a new stable Ti(sub2)Al phase is instead Ti(sub2)AlN. The space group of Ti(sub2)AlN has been determined to be P6(sub3)/mmc with lattice parameters, a=0.304 nm and c=1.369 nm, in agreement with the results of Jeitschko, et al. Also, since the phase is observed only in alloys which do not contain alpha sub 2-Ti(sub3)Al, it was suggested that the solubility of N in alpha sub 2 must be rather large, while that in the gamma(TiAl) phase is low. Finally, in light of the improved creep properties of gamma alloys containing Ti(sub2)AlN precipitates, it is suggested that an increase in the volume fraction of the phase, by increasing the N and/or C contents, in these alloys might be used to enhance the mechanical properties of the normally brittle compound.

711,646
PB86-229986 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Local Modes in Dilute Metal-Hydrogen Alloys.
Final rept.
A. Magerl, J. J. Rush, and J. M. Rowe. 15 Feb 86, 5p
Pub. in Physical Review B 33, n4 p2093 2097, 15 Feb 86.

Keywords: *Hydrogen, *Vanadium, *Niobium, *Tantalum, Intersititals, Defects, Reprints.

A report is made on measurements of the local modes of H in the transition metals V, Nb, and Ta with particular emphasis on low-concentration alloys. The excitations appear as very broad peaks in the neutron scattering spectrum even at a level of <1 at. % H, in contrast to the narrow density-of-states peaks normally expected for such interstitial defects. The lower vibration peak in NbH0.0055 reveals, within the alpha phase between 295 and 210 K, an unexpected continuous shift from 106 to 118 meV. Several possible mechanisms to explain these unusual observations are discussed and evaluated.

711,647
PB86-231537 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Hafnium-Rhodium Constitution Diagram.
Final rept.
R. M. Waterstrat, and A. A. Giuseppetti. 1986, 9p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of the Less-Common Metals 119, p327-335 1986.

Keywords: Hafnium alloys, *Rhodium alloys, *Phase diagrams, Intermetallic compounds, Reprints.

A constitution diagram is presented for the Hf-Rh system. The liquidus rises to a maximum near the equiatomic composition and then falls rapidly with increasing hafnium content to a deep eutectic minimum at about 73 at.% Hf. The congruently melting equiatomic phase delta apparently transforms martensitically during cooling to one of several unidentified structures depending on the composition. The rhodium-rich phase gamma 1, based on a Cu3Au-type structure, exists over a rather broad composition range at high temperatures, but the range narrows at lower temperatures and approaches a composition away from the ideal stoichiometry. The intermediate phases eta-Hf2Rh and epsilon-Hf3Rh5 are stable over small composition ranges and form via peritectic reactions at about 1520 C and 2040 C respectively.

711,648
PB86-238151 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Database Development under the ASM/NBS Program on Alloy Phase Diagrams.
Final rept.
K. J. Bhansali, D. F. Redmiles, J. L. Murray, and J. Sims. 1984, 15p
Proceedings of of National SAMPE Symposium and Exhibition, Reno, NV., April 3-5, 1984, v29 p1450-1464.

Keywords: *Phase diagrams, Alloys, *Data bases.

The ASM/NBS Phase Diagram Data Program addresses the need of the metals industry for up to date, critically assessed phase diagram data. Computerization is needed because of the sheer volume of phase diagram information currently being published. The scope of the computerization project goes beyond the treatment of text and digitization of figures, first because of the need for continuous update of critical assessments and second because of complex relationships among phase diagrams, crystallographic and thermodynamic data. Through a collaboration between the Metallurgy Division and the Center for Applied Mathematics, NBS is currently creating a prototype of the computerized phase diagram database. In the paper, evaluation of phase diagram data and the development of a prototype database are discussed.

711,649
PB86-238342 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Vegard's Law.
Final rept.
L. H. Bennett, and A. J. McAlister. 1986, 2p
Pub. in Encyclopedia of Materials Science and Engineering, v7 p5241-5242 1986.

Keywords: *Solid solutions, Lattice parameters, Reprints, Vegard law.

Vegard's Law is an empirical rule which states that the lattice constant of a solid solution varies linearly as a function of concentration between the lattice constants of the components. It is found that metallic systems seldom, if ever, obey Vegard's Law exactly.

711,650
PB86-238367 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Orientation Relationship between Precipitated Al9(Fe,Ni)2 Phase and Alpha-Aluminum.
Final rept.
L. Bendersky. Apr 85, 4p
Pub. in Metallurgical Transactions A 16A, n4 p683-686 Apr 85.

Keywords: *Aluminum alloys, Nickel containing alloys, Iron containing alloys, Phase, Orientation, Aluminum, Reprints, Rapid solidification.

The orientation relationship between Al9(Fe,Ni)2 precipitates and the FCC aluminum matrix in rapidly solidified Al-3.7, Ni-1.5 Fe (wt%) alloy has been determined. The precipitates are products of the supersaturated alpha-Al, decomposed by precipitation during continuous cooling immediately after solidification.

711,651
PB86-241999 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
New Magnetic Phase Diagram of the Amorphous Pd-Fe-Si Ferroglass Alloy System.
Final rept.
R. B. Goldfarb, K. V. Rao, and H. S. Chen. 1986, 2p
Pub. in Jnl. of Magnetism and Magnetic Materials 54-57, p111-112 1986.

Keywords: *Palladium alloys, Fron containing alloys, Silicon containing alloys, Phase diagrams, Reprints, Amorphous materials.

The magnetic phase diagram of amorphous Pd80-xFexSi20 is examined for 5 < or = x < or = 22. The authors use the peak in the imaginary component of ac susceptibility to determine the ferromagnetic-like to spin-glass transition temperatures T sub tg. It is found that the T sub tg curve is strongly field dependent and increases monotonically with increasing Fe concentration, even around x=22.

711,652
PB87-105227 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Diffusion-Induced Grain-Boundary Migration in the Au-Ag System.
Final rept.
D. B. Butrymowicz, D. E. Newbury, D. Turnbull, and J. W. Cahn. 1984, 6p
Pub. in Scripta Metallurgica 18, n9 p1005-1010 1984.

Keywords: *Gold alloys, Silver containing alloys, Diffusion, Grain boundaries, Mass transport, Reprints.

Diffusion-induced grain boundary migration (DIGM) is a recently recognized phenomenon that leads to unexpected motion of grain boundaries. Vastly enhanced mass transport characterizes the low-temperature aspect of the phenomenon, since the grain boundaries provide easy paths for diffusion redistribution of atoms in the regions traversed at temperatures at which only grain boundary diffusion is significant has been observed to induce grain boundaries to migrate in a number of binary metal systems. At relatively low temperatures (where lattice diffusion is frozen out and where grain boundary diffusion prevails), migrating boundaries sweep across grains mixing in (or removing) solute. At these temperatures, no compositional changes occur except in regions through which the migrating boundaries pass, resulting in a discontinuous concentration range across the moving boundary. The Ag-Au system is investigated here with the aid of optical metallography, electron microprobe, and SEM.

711,653
PB87-105235 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Cellular Microsegregation in Rapidly Solidified Silver-15 wt.% Copper Alloys.
Final rept.
L. A. Bendersky, and W. J. Boettinger. 1985, 4p
Pub. in Proceedings of the International Conference on Rapidly Quenched Metals (5th), p887-890 1985.

Keywords: *Silver alloys, Copper containing alloys, Microstructure, Silver alloy 15Cu, Rapid solidification.

Microstructural and microchemical analysis has been performed on Ag-15 wt% Cu alloys produced by electron beam melting with solidification velocities of 2.5, 12, and 18 cm/s. Cellular structures of the Ag-rich phase are produced with spacings of 0.8, 0.3, and 0.2 um, respectively. Intercellular regions contained fine eutectic at the lowest speed but only Cu-rich phase at the higher speeds. The composition within the cells was found to be nearly uniform and 12.5 plus or minus 1 wt% Cu. The uniformity and level of the Cu content within the cells are discussed.

711,654
PB87-105243 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Effect of Rapid Solidification Velocity on Microstructure and Phase Solubility Extension in Nickel-Aluminum-Chromium (NiAl-Cr) Quasibinary Eutectic.
Final rept.
W. J. Boettinger, D. Shechtman, T. Z. Kattamis, and R. J. Schaefer. 1985, 4p
Pub. in Proceedings of the International Conference on Rapidly Quenched Metals (5th), p871-874 1985.

Keywords: *Nickel alloys, Aluminum containing alloys, Chromium containing alloys, Eutectics, Microstructure, Solubility, *Rapid solidification.

The transition from a two-phase rod-type eutectic microstructure to a single-phase Cr-supersaturated NiAl microstructure for the NiAl-Cr quasibinary eutectic composition is determined as a function of growth rate by electron beam melting and solidification scans. At growth rates below 1 cm/s the alloy exhibits a two-phase eutectic structure. Above 2.5 cm/s the structure solidifies as single phase Cr-supersaturated NiAl which subsequently decomposes spinodally.

711,655
PB87-105250 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Environmental Effects on Titanium and Its Alloys.
Final rept.
H. B. Bomberger, D. A. Meyn, and A. C . Fraker. 1985, 20p
Pub. in Proceedings of the International Conference on Titanium (5th), p2435-2454 1985.

Keywords: *Titanium, *Titanium alloys, Corrosion, Hydrogen embrittlement, Crack propagation.

Titanium and its alloys are exceptionally resistant to corrosion in natural environments and in many media in which other structural alloys including stainless steels are subject to unacceptable deterioration. This resistance is a consequence of a very thin, tenacious and durable natural oxide surface layer which confers passivity to a metal which would otherwise be rapidly consumed by contact with oxygen or water. However, titanium and its alloys are susceptible to several kinds of attack by environmental agents, especially under conditions where the natural oxide surface layer is disrupted and can not be quickly repaired. Such conditions include moderately high temperatures, strongly reducing corrosive environments, oxide-fluxing environments, plastic straining during exposure, high anodic potentials and low pH, or high cathodic potentials and low pH. Both the fundamental and practical aspects of environmental effects on titanium and its alloys are discussed.

711,656
PB87-106365 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Neutron Powder Diffraction Studies of Two Uranium-0.75 wt. % Titanium Alloys.
Final rept.
C. S. Choi, and H. J. Prask. 1985, 4p
Pub. in Jnl. of Applied Crystallography 18, n3 p141-144 1985.

Keywords: *Uranium alloys, Tilanium containing alloys, Microstructure, Neutron diffraction, Line width, Particle size, Strains, Reprints.

The crystallographic and microstructural properties of depleted uranium alloys (0.75 wt.% Ti) with two different heat-treatments were studied by neutron powder diffraction methods. The crystal structures are essentially the same as that of pure alpha-uranium metal with somewhat different unit cell dimensions. The super saturated Ti impurity in the quenched sample is primarily substitutional. Diffraction lines of the quenched uranium alloy showed a clear strain broadening. The r.m.s. strain obtained from the broadening was 0.0019.

711,657
PB87-114658 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Center for Materials Science.
Elastically Induced Shape Bifurcations of Inclusions.
Final rept.
W. C. Johnson, and J. W. Cahn. 1984, 9p
Pub. in Acta Metallurgica 32, n11 p1925-1933 1984.

Keywords: *Inclusions, Shape, Reprints, Bifurcations.

Shape change transitions of elastically misfitting inclusions are predicted to occur when the inclusions are softer than the matrix. Below the size where the transition occurs, the shape is dictated by minimizing interfacial energy without regard to the elastic contribution. The transition is to a lower symmetry shape that is influenced by the elastic contribution. Transitions analogous to a second-order phase transition are predicted for an isotropic two-dimensional or plane-strain case, while transitions analogous to first-order phase transitions are predicted for an isotropic three-dimensional case.

711,658
PB87-118576 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Magnetic Excitations in Chromium II.
Final rept.
B. H. Grier, G. Shirane, and S. A. Werner. 1985, 10p
Pub. in Physical Review B: Condensed Matter 31, n5 p2892-2901 1985.

Keywords: *Chromium, Magnetic properties, Magnons, Neutron scattering, Reprints.

Neutron scattering measurements on pure chromium metal have been performed under various conditions of experimental resolution, energy transfer, temperature and magnetic field. The temperature and energy dependence of the commensurate-diffuse scattering surrounding the (001) point in reciprocal space has been followed from the spin flip temperature (T sub sf = 122 K) to temperatures as high as 700 K, well above the Neel point T sub N = 312 K). Magnetic correlations extending over 11 bcc unit cells persist to these high temperatures. The spectral width of the magnetic scattering is found to increase rapidly with temperature above T sub N. The importance of the commensurate-diffuse modes of excitation in the disappearance of the long-range ordered SDW state at T sub N is discussed. The magnetic field dependence of the excitations in the transversely polarized SDW Phase has been investigated and found to be absent.

711,659
PB87-119145 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Semi-Elliptical Surface Flaw EC (Eddy Current) Interaction and Inversion: Experiment.
Final rept.
J. C. Moulder, J. C. Gerlitz, B. A. Auld, and S. Jefferies. 1986, 8p
Sponsored by Ames Lab., IA.
Pub. in Review of Progress in Quantitative Nondestructive Evaluation 5A, p395-402 1986.

Keywords: *Cracks, *Aluminum alloys, *Titanium alloys, Eddy current tests, Nondestructive tests, Fatigue(Materials), Reprints, *Flaws, Notches.

Eddy current flaw signals were measured for a series of fatigue cracks and semi-elliptical, electrical-discharge machined notches in aluminum and titanium alloys. Absolute magnitude and phase of the change in eddy current probe impedance were determined by scanning the probe along the length of the flaw and measuring the probe impedance with a digital impedance analyzer. Both air-core and ferrite-core probes were used. Differences in the flaw signals from nominally identical air-core probes were traced to different magnetic field intensities of the probes. Experimental results are compared with flaw profiles calculated using a finite difference numerical model developed at Stanford University, which is described in a companion paper.

711,660
PB87-122487 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Automated Fatigue Crack Growth Rate Test System.
Final rept.
Y. W. Cheng, and D. T. Read. 1985, 11p
Sponsored by Minerals Management Service, Reston, VA., and Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in American Society of Testing and Materials Special Technical Publication 877, p213-223 1985.

Keywords: *Crack propagation, *Fatigue(Materials), Fatigue tests, Cracking(Fatigue), Nondestructive tests, Reprints.

An automated fatigue crack growth rate (FCGR) test system has been developed that can be used for tests of constant-load-amplitude FCGR above 10 to the -8th power m/cycle (ASTM Test Method for Constant-Load-Amplitude Fatigue Crack Growth Rates Above 10 to the -8th power m/Cycle(E647-83)) at normal (approx. 10 Hz) or low (approx. 0.1 Hz) cyclic frequencies and for tests of near-threshold and variable-load-amplitude FCGR. The test system consists of a minicomputer, a programmable arbitrary waveform generator, a servo-hydraulic test frame, and a programmable digital oscilloscope. The crack length is measured using the compliance technique; the FCGR and the stress-intensity factor range are calculated and plotted automatically during the test.

711,661
PB87-122503 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.

Nickel and Nitrogen Alloying Effects on the Strength and Toughness of Austenitic Stainless Steels at 4 K.
Final rept.
R. P. Reed, P. T. Purtscher, and K. A. Yushchenko. 1986, 8p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Advances in Cryogenic Engineering 31, p43-50 Sep 86.

Keywords: *Austenitic stainless steels, *Tensile strength, Low temperature tests, Tensile properties, Cryogenics, Nickel alloys, Reprints, *Fracture toughness, Nickel nitrogen alloys.

The tensile strength and fracture toughness at 4 K were studied as a function of Ni (6-15 wt.%) and N (0.90-0.28 wt.%) contents for eight austenitic stainless steels. Results indicate that Ni increases the tensile yield strength and decreases the fracture toughness, Klc(J), and Ni has little effect on tensile yield strength but increases the fracture toughness. The temperature dependence of the yield strength is given by sigma(sub y) = sigma(sub o) e(sup (-) AT), where sigma(sub o) is the yield strength at O K, and A is the slope of ln sigma(sub y) vs. T. The parameter A is proportional to the stacking fault energy. Lower Ni alloys exhibited brittle facets on fracture surfaces. The quality index, a new parameter = sigma(sub y) K(sub Ic) (J), relates to the capacity of the alloy to achieve greater strength or toughness, but not at the expense of the other parameter. Nickel alloying increases the quality factor; nitrogen has little effect.

711,662
PB87-122511 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Sizing Planar Flaws in Weldments Using Low-Frequency EMATs (Electromagnetic-Acoustic Transducers).
Final rept.
R. E. Schramm, and T. A. Siewert. 1986, 8p
Sponsored by David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.
Pub. in Second Half of the Proceedings of Annual Review of Progress in Quantitative Nondestructive Evaluation (12th), Williamsburg, VA., June 23-28, 1985, v5B p1705-1712 1986.

Keywords: *Weld defects, Weldments, Nondestructive tests, Ultrasonic tests, Transducers.

The report describes a significant improvement in flaw sizing capability using electromagnetic-acoustic transducers (EMATs) operating near 0.5 MHz. Previous work demonstrated the use of backscattered signals for determining flaw depths in the range of 0.5 to 3 mm; for deeper flaws the signal saturated. In the new procedure, a second receiver measures the forward-scattered signal transmitted through the weld. Using the backscattered to forward scattered ratio as a sizing parameter has extended the depth sizing range to at least 10 mm. Artificial flaws were used to generate a calibration curve used to size real lack-of-penetration weld flaws in 16-mm thick ferritic steel plates. True flaw depths, as determined by metallography, were in very good agreement with those determined by the ultrasonic measurements.

711,663
PB87-122560 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Roughening of Low-Angle Grain Boundaries.
Final rept.
C. Rottman. 1986, 5p
Pub. in Physical Review Letters 57, n6 p735-738, 11 Aug 86.

Keywords: *Grain boundaries, Crystal dislocations, Interfaces, Melting, Reprints.

The possibility of roughening in low-angle grain boundaries is investigated. By exhibiting an analogy between grain-boundary steps which do not have long-range strain and steps on solid surfaces, the author argues that a grain-boundary roughening transition, of the same type as for solid surfaces, is possible.

711,664
PB87-122842 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Influence of Thermal Processing on Fatigue Crack Initiation and Propagation of Ti-4.5Al-5Mo-1.5Cr.
Final rept.
C. M. Gilmore, M. A. Imam, A. C. Fracker, S. H. Yang, and A. C. Van Orden. 1985, 8p
Pub. in Proceedings of the International Conference on Titanium (5th), Washington, DC., v4 p2091-2098 1985.

Keywords: *Titanium alloys, Heat treatment, Cracking(Fracturing), Fatigue(Materials), Martensite, Crack propagation, Mechanical properties, Microstructures, Titanium alloy 4.5 Al 1.5 Cr 5 Mo.

The effects of thermal treatment on the microstructure and mechanical behavior of the Al-.Cr (-5Mo-1.5Cr (Corona 5) alloy were studied. The temperature range studied was 870C - 965C. Fatigue crack growth rates were not significantly affected by the presence of metastable beta Ti and its strain induced transformation to martensite. Fatigue crack initiation and fatigue life are affected by the presence of a metastable beta phase.

711,665
PB87-127940 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Optical Measurement of the Roughness of Sinusoidal Surfaces.
Final rept.
T. V. Vorburger, D. E. Gilsinn, F. E. Scire, M. J. McLay, C. H. W. Giauque, and E. C. Teague. 1986, 13p
Sponsored by National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Pub. in Wear 109, p15-27 1986.

Keywords: *Surface roughness, Roughness, Scattering, Metal working, Reprints.

Results are presented for optical scattering measurements of six sinusoidal surfaces with a roughness average R(sub a) ranging from 0.3 to 3 micrometers and wavelengths ranging from 40 to 800 micrometers. The probe was an He-Ne laser beam with a 0.6328 micrometers wavelength. The multipeaked scattering distributions were fitted by a straightforward phase screen integral to find the amplitude and spatial frequency parameters that then yielded results for R(sub a) and the spatial wavelength for each surface. The agreement with the comparable parameters as measured by a stylus instrument is excellent. This leads to the observation that optical scattering with visible light in conjunction with a straightforward optical theory can yield accurate measurements of roughness parameters provided that the surface roughness itself can be accurately modeled with appropriate a priori knowledge and provided that the surface slopes and heights are in the ranges represented by these sinusoidal surfaces.

711,666
PB87-127965 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Interaction of Line Singularities Near a Crack Tip and Their Application to Surface Stresses at Cracks.
Final rept.
R. Thomson, T. J. Chuang, and I. H. Lin. 1985, 8p
Pub. in Predictive Capabilities in Environmentally Assisted Cracking, p187-194 1985.

Keywords: *Crack propagation, Cracking(Fracturing), Dislocations(Materials), Ductility, Stresses, Reprints.

An elastic analysis of line singularities interacting with a crack is developed. The line singularities simulate the action of surface stresses which are present on all open surfaces, and which can be modified by adsorbtion of foreign chemical species on the cleavage surface near the crack tip. Results are presented showing that shielding k-fields at the crack are generated by anti-symmetric line dipoles. A symmetrical line dipole interacts only with other symmetrical line dipoles. When dislocations are included near the crack tip, it is found that under elastic conditions for a slit crack, dipoles of both kinds exert forces on the dislocation and can modify the ductility of materials.

711,667
PB87-128021 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Low Temperature Deformation of Copper and an Austenitic Stainless Steel.
Final rept.
R. P. Reed, and R. P. Walsh. 1986, 10p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Advances in Cryogenic Engineering 32, p303-312 1986.

Keywords: *Deformation, *Copper, *Austenitic stainless steels, Cryogenics, Low temperature tests, Tensile properties, Stress strain diagrams, Reprints, Steel AISI 310, Copper 10Z alloy.

The tensile-deformation characteristics and effect of strain rate were studied on relatively pure CDA 102 Cu and solid-solution-strengthened AISI 310. Tensile strain rate was varied between two orders of magnitude (0002 ;0.00005/s) at temperatures ranging from 4 to 295 K. Tensile stress-strain-hardening curves were determined for these temperatures. The effect of strain-rate changes on tensile flow strength was measured from strains near 0.002 (yield strength) to over 0.300. The data reflect three distinct ranges of face-centered cubic, polycrystalline plastic deformation, which have different characteristics depending on solute content.

711,668
PB87-128799 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Ultrasonic Determination of Principal-Stress Differences for a Slightly Anisotropic Residual Stress Specimen.
Final rept.
A. V. Clark, and J. C. Moulder. 1986, 11p
Pub. in Proceedings of Symposium on Nondestructive Evaluation (15th), San Antonio, TX., April 23-25, 1985, p260-270 1986.

Keywords: *Dynamic structural analysis, *Aluminum alloys, Nondestructive tests, Stresses, Structural analysis, Ultrasonic tests, Anisotropy, Texture, Acoustical birefringence.

The authors have used the acoustical birefringence technique to measure the difference of principal stresses in a specimen in a well-characterized state of residual stress. In this technique, the difference in aribal times of orthogonally polarized SH-waves (acoustical birefringence) is measured and then related to stress. Because the specimen is slightly anisotropic, it exhibits birefringence even in the unstressed state; in the specimen this initial birefringence, Bo, can be as large as (or larger than) that caused by stress. The authors used noncontacting EMATs, which allowed the measurements to be made quickly without introducing errors in arrival time due to couplant thickness variations. Experiments were first performed with the EMATs in the pitch-catch configuration, the authors found good agreement with theoretical predictions of the principal-stress differences for the shrink-fit aluminum alloy specimen.

711,669
PB87-128955 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Macrocrack-Dislocation Pile-up Interactions.
Final rept.
I. H. Lin. 1986, 11p
Pub. in Materials Science and Engineering 81, p325-335 1986.

Keywords: *Dislocations, *Loading(Mechanics), Stresses, Fracture toughness, Crack propagation, Reprints, *Microcracks.

In this paper the elastic interaction between a macrocrack and an excess double-ended pile-up under general loading is developed. The quantitative prediction of local stress intensity factors at the macrocrack tip and the blocked leading dislocations and the forces on each singularity are derived. These physical quantities are shown as functions of the dislocation-free zone, the pile-up size, the number and the sign of excess dislocations in the pile-up and the applied stress intensity factors. Results are presented which show that Newton's third law is satisfied between the macrocrack tip and blocked leading dislocations. It is found that a macrocrack tip is always antishielded by a pure double-ended pile-up. The elastic interaction developed in the paper is very general and four important pile-up limits are treated in the paper.

711,670
PB87-128989 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Elastic-Plastic Response of Tensile Panels Containing Short Center Cracks.
Final rept.
R. H. Dodds, and D. T. Read. 1984, 10p
Sponsored by Naval Sea Systems Command, Washington, DC.
Pub. in Proceedings of 1984 Pressure Vessel and Piping Conference and Exhibition, San Antonio, TX., June 17-21, 1984, p25-34.

Keywords: Cracking(Fracturing), Panels, Finite element analysis, Fracture properties, Deformation, *J integrals.

The finite element method (FEM) is used to predict applied J-integral values in highly strained tensile panels containing short center cracks. Experimental J-values are obtained by integrating strain and displacement quantities measured along an instrumented contour. FEM plane stress predictions for J-values and crack mouth opening displacements are much larger than experimentally measured values for short cracks ($a/W < 0.05$). Large geometry changes near the crack tip are demonstrated to have a negligible effect on the FEM J-values. The introduction of a small stiffened zone near the crack tip using an overlay of plane strain elements brings FEM J and CMOD values into close agreement with experimental values. For longer crack lengths, conventional plane stress FEM solutions are adequate to predict J and CMOD values.

711,671
PB87-132767 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Absolute Ultrasonic Determination of Stresses in Aluminum Alloys.
Final rept.
A. V. Clark, and J. C. Moulder. 1986, 11p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation 5B, p1449-1459 1986.

Keywords: *Stresses, *Aluminum alloys, Nondestructive tests, Reprints, Acoustic birefringence, Ultrasonics.

Ultrasonic methods are currently being investigated as a means of nondestructive stress measurement. The authors have considered various methods to obtain individual stress components using shear-horizontal (SH-) waves in slightly anisotropic (textured) structural components. For rolled aluminum alloy plates, there are typically three two-fold material symmetry axes. Referring stresses to these axes, the authors find that different methods of absolute stress determination must be used, depending upon whether or not the principal stress and material symmetry axes coincide. Furthermore, the presence of texture causes an initial birefringence; the birefringence is defined as the normalized difference in phase velocity of orthogonally polarized, pure-mode SH-waves.

711,672
PB87-132775 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Ultrasonic Techniques for Residual Stress Measurement in Thin Welded Aluminum Alloy Plates.
Final rept.
A. V. Clark, J. C. Moulder, R. E. Trevisan, T. A. Siewert, and R. B. Mignogna. 1986, 12p
Sponsored by Naval Research Lab., Washington, DC.
Pub. in Review of Progress in Quantitative Nondestructive Evaluation 5B, p1461-1472 1986.

Keywords: *Metal plates, *Aluminum alloys, *Stresses, Welding, Ultrasonic tests, Nondestructive tests, Reprints, Acoustic birefringence.

Thin aluminum alloy plates were single-pass butt-welded to produce a state of plane residual stress. Strain gages bonded to the plates prior to welding were used to measure the residual stresses. Residual stresses were also measured ultrasonically by three different methods. The acoustic birefringence technique was used to measure the principal stress difference, delta sigma, near the center of the welded plates. Noncontacting EMATs were used to measure arrival times of SH-waves before and after welding. Near the plate edges, a shear stress sigma (xy) exists. The gradient of sigma (xy) was measured with the acoustic birefringence technique and substituted into the stress-equilibrium equation to calculate the normal stress. Values obtained were within about 20 MPa of the strain gage data.

711,673
PB87-135216 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Extraction Replica Method for the Study of Surface Films.
Final rept.
L. K. Ives. 1985, 4p
Pub. in ASLE (American Society of Lubrication Engineers) Transactions 28, n1 p87-90 1985.

Keywords: *Surfaces, *Thin films, Wear, Surface chemistry, Substrates, Iron oxides, Iron sulfides, Reprints, *Extraction replica.

An extraction replica method is described by means of which thin solid films on worn surfaces may be removed from selected areas for examination in the transmission electron microscope. A scratch or several scratches are made on the worn surface with a pointed stylus. Displaced or loosened fragments of material are removed by means of a plastic extraction replica. After subsequent processing of the replica, sufficiently thin fragments can then be examined by transmission electron microscopy, electron diffraction and the allied methods of x-ray energy dispersive analysis and electron energy loss spectroscopy. The latter two methods permit the determination of chemical composition which can then be correlated with crystallographic and microstructural observations. Application of the scratch extraction replica method is illustrated with examples of films removed from worn steel specimens lubricated with paraffinic mineral oil, mineral oil with 1 wt.% ZDP, and with a formulated reference motor oil.

711,674
PB87-135224 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Equilibrium Solute Concentration Surrounding Elastically Interacting Precipitates.
Final rept.
W. C. Johnson, and P. W. Voorhees. 1985, 11p
Pub. in Metallurgical Transactions A-Physical Metallurgy and Materials Science 16, n3 p337-347 1985.

Keywords: *Precipitates, *Concentration(Composition), Thermodynamics, Elasticity, Metallurgy, Solutes, Stress analysis, Reprints.

Elastically induced equilibrium solute concentration profiles surrounding isolated and two elastically interacting precipitates are determined under the conditions of an applied shear and tensile stress, as well as an isotropic stress-free transformation strain. The self consistent open-system elastic constants approach is employed to account explicitly for the coupling between the stress and concentration fields. Substantial concentration changes are predicted near the surfaces of the particles which can easily exceed 50%. With self consistency to first-order in the concentration change, no net solute enhancement is observed surrounding isolated particles while net solute segregation is observed for elastically interacting particles.

711,675
PB87-136685 PC **A06**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Materials Science and Engineering.
Institute for Materials Science and Engineering, Metallurgy: Technical Activities 1986.
Annual rept.
Oct 86, 105p NBSIR-86/3438
See also PB86-196771.

Keywords: *Metallurgy, Processing, Metals, Alloys, Nondestructive tests, Chemical properties, Mechanical properties, Corrosion, Wear, Electrodeposition, Magnetic materials, Technical activities.

The report summarizes the FY 1986 activities of the Metallurgy Division of the National Bureau of Standards. The research centers upon the structure-processing-properties relations of metals and alloys, and on the methods of their measurement. Efforts comprise studies of synchrotron radiation research for materials characterization, metallurgical processing, wear and mechanical properties, chemical metallurgy, corrosion and protection of metals, electrodeposition, nondestructive characterization, and magnetic materials. The work herein described includes three cooperative data programs with American professional societies and industry: the American Society for Metals-NBS Alloy Phase Diagram Program, the National Association of Corrosion Engineers-NBS Corrosion Data Program, and the American Iron and Steel Institute-NBS Steel Sensor Program.

711,676
PB87-149811 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Aluminum-Copper System.
Final rept.,
J. L. Murray. 1985, 23p
Pub. in International Metals Reviews 30, n5 p211-233 1985.

Keywords: *Aluminum alloys, *Copper alloys, Thermodynamic properties, Phase diagrams, Reprints.

Data pertaining to stable and metastable phase equilibria, crystal structures, and thermodynamic properties of Al-Cu alloys have been compiled and critically assessed. The phase diagram has been calculated from optimized Gibbs energy functions. Estimates are provided for the contribution of elastic (coherency) energy to the Gibbs energy.

711,677
PB87-150728 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Complementary Use of Atom Probe Field-Ion Microscopy and Analytical Transmission Electron Microscopy for the Study of a Ni-Base Superalloy.
Final rept.,
A. J. Melmed, M. E. Twigg, R. Klein, M. J. Kaufman, and H. L. Fraser. 1984, 6p
Pub. in Jnl. de Physique 45, nC9 p373-378 1984.

Keywords: *Chemical analysis, *Nickel alloys, Metallurgy, Reprints, *Superalloys, Nickel alloy 6Al 18Mo, Nickel alloy 25Al 4Mo 4Ta, Nickel alloy 4Al 20Mo 3Ta.

Compositions of the gamma,gamma1 and DO22 phases in the nickel-base superalloy RSR143 (76Ni-13Al-9Mo-2Ta, at. %) have been determined via atom probe field-ion microscopy (APFIM) as 76Ni-6Al-18Mo, 76Ni-25Al-4Mo-4Ta and 73Ni-4Al-20Mo-3Ta respectively. Using energy dispersive x-ray spectroscopy in the analytical transmission electron microscopy (TEM), the composition of the gamma phase (69Ni-22Al-4Mo-5Ta) was found to be similar to that determined by APFIM. The deviation of the DO22 composition from Ni3Mo is in agreement with the prediction of a recent TEM study.

711,678
PB87-151643 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Compression Studies of a Nickel-Based Superalloy, MAR-M200, and of Ni3Al.
Final rept.,
F. A. Mauer, R. G. Munro, G. J. Piermarini, S. Block, and D. P. Dandekar. 15 Nov 85, 4p
Sponsored by Army Materials and Mechanics Research Center, Watertown, MA.
Pub. in Jnl. of Applied Physics 58, n10 p3727-3730, 15 Nov 85.

Keywords: *Nickel alloys, *Compression, Equations of state, Bulk modulus, Reprints, Superalloys, Nickel aluminide, Nickel alloy MAR-M200.

The lattice parameter of a cubic nickel-based alloy, MAR-M200, has been determined as a function of pressure for $O < P < 14$ GPa at room temperature. A similar study was made for Ni3Al in the range $O < P < 11$ GPa at room temperature. In both cases, the diamond anvil cell was used in conjunction with the energy dispersive method of x-ray diffraction. The data were analyzed in the context of model equations of state and in comparison with other results from ultrasonic studies.

711,679
PB87-151650 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Photons in LiC6 and in Heavy Alkali Metal Graphite Intercalation Compounds.
Final rept.,
A. Magerl, H. Zabel, and J. J. Rush. Dec 83, 7p
Pub. in Synthetic Metals (Switzerland) 7, n3-4 p339-345 Dec 83.

Keywords: Photons, Alkali metal compounds, Neutron scattering, Reprints, *Lithium carbides.

The authors have measured the longitudinal (ooq) and transverse (qoo) modes in LiC6 by inelastic neutron scattering, including the observation of a very-high-energy phonon branch, tentatively assigned to an optic mode. Analysis of the longitudinal (ooq) modes by a one dimensional shell model yields force constants which are considerably larger than those of the heavy alkali-metal stage 1 compounds. Also, the interlayer shear constant C44 is found to be distinctively larger than in the other stage 1 compounds. Yet, LiC6 still shows an omega - q (sub 2) dispersion of the transverse mode, characteristic for layered materials. Low temperature measurements on KC24 revealed a mode splitting in the longitudinal acoustic (ooq) branch, which persists at temperatures above the alkali order-disorder phase transition at 123 K. The splitting may be caused by an Einstein-like in-band mode, which seems also to hybridize the (qoo) transverse branch.

711,680
PB87-153607 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Correlation between Ultrasonic and Hardness Measurements in Aged 2024 Aluminum Alloy.
Final rept.,
M. Rosen, L. Ives, S. Ridder, F. Biancaniello, and R. Mehrabian. 1985, 10p
Pub. in Materials Science and Engineering 74, n1 p1-10 1985.

Keywords: Aging(Metallurgy), Nondestructive tests, Hardness, Reprints, *Aluminum alloy 2024.

Sound-wave velocity, ultrasonic attenuation, eddy currents and hardness measurements have been carried out on precipitation-hardening 2024 Al alloys subjected to a series of different preaging heat treatments prior to processing to T4, T351 and T851 tempers. For each temper the maximum hardness was found to correspond to a particular value of sound velocity. These results were correlated with electron microscopy observations of the microstructure. Ultrasonic attenuation was found to consistently decrease as hardness increased. Preaging at 350 C was found to induce most rapid initial reduction in hardness, and corresponding changes in sound velocity and ultrasonic attenuation. The investigation has demonstrated the feasibility of ultrasonic techniques for nondestructive evaluation and characterization of age hardened aluminum alloys.

711,681
PB87-161626 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Phase Equilibria in the Titanium-Aluminum System.
Final rept.,
R. D. Shull, A. J. McAlister, and R. C. Reno. 1985, 8p
Pub. in Titanium-Science and Technology 3, p1459-1466 1985.

Keywords: *Titanium alloys, *Aluminum alloys, Phase diagrams, Reprints, *Phase equilibria.

The Ti-rich end of the Titanium-Aluminum phase diagram has been determined on high purity (low interstitial content) alloys. The phase equilibria was determined both dynamically (by means of differential thermal analysis - DTA) as well as statically (by means of transmission electron microscopy, TEM, and large angle neutron diffraction), the latter being performed on well equilibrated and quenched samples. The consistency between these two types of data is evaluated for this system and explanations for confusion in the literature over the phase relationships in this alloy system are given. Chief among the results are a clarification of the order-disorder alpha-hexagonal phase boundaries.

711,682
PB87-161642 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Local Atomic Environments in Periodic and Aperiodic Al-Mn Alloys.
Final rept.,
L. H. Bennett, M. Kuriyama, G. G. Long, M. Melamud, R. E. Watson, and M. Weinert. 15 Dec 86, 3p
Pub. in Physical Review B 34, n12 p8270-8272, 15 Dec 86.

Keywords: *Aluminum alloys, *Manganese alloys, Molecular structure, Reprints.

The authors have applied Wigner-Seitz constructs to several known crystal phases of Al-Mn and to two independent descriptions of the Al-Mn icosahedral phase for which all the atomic positions are available. The resulting measures of local atomic environments for the icosahedral phase are in agreement with one another and with experiment: broad distributions in site metrics and volumes of both Mn and Al sites, none of which have local icosahedral point symmetry, and a similar radial distribution function.

711,683
PB87-163689 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD.
Dislocation - Crack Interactions.
Final rept.,
R. Thomson. 1986, 4p
Pub. in Scripta Metallurgica 20, n11 p1473-1476 1986.

Keywords: *Metallurgy, *Dislocations(Materials), Cracking(Fracturing), Reprints.

The paper gives a brief overview of the fundamental aspects of fracture in materials which rely on the interaction of cracks with dislocations.

711,684
PB87-164083 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Comparison of Several Path Independent Integrals Including Plasticity Effects.
Final rept.,
W. C. Carpenter, D. T. Read, and R. H. Dodds. 1986, 21p
Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD., and Naval Sea Systems Command, Washington, DC.
Pub. in International Jnl. of Fracture 31, p303-323 1986.

Keywords: *Fracture properties, Finite element analysis, Reprints, J integral.

Proceeding from the work of Eshelby, a path independent integral, J bar, is developed which is the negative of the rate of change of total energy for a material characterized by an incremental plasticity model. The integral is compared to several well known integrals to indicate that those integrals, for such a material, are deficient in certain terms with regard to the rate of change of total energy. The various integrals are compared on the three point bend specimen. The j integral was found to be very sensitive to the finite element idealization and limited studies indicate that under certain conditions that other more easily calculated integrals can be substituted for J bar.

711,685
PB87-165908 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Application of Pulse-Echo Ultrasonics to Locate the Solid/Liquid Interface During Solidification and Melting.
Final rept.,
R. L. Parker, and J. R. Manning. 1986, 13p
Pub. in Jnl. of Crystal Growth 79, p341-353 1986.

Keywords: *Solidification, *Metallurgy, Melting, Crystal growth, Reprints.

The velocity of sound and the density have values that are sufficiently different for liquid as compared to solid phases of metals, alloys, and semiconductors to permit the use of pulse-echo ultrasonic techniques to locate the solid/liquid interface during solidification and melting. Experimental results are presented for pulse-echo observation of the melting and freezing of pure iron, 304 stainless steel, tin and single-crystal (111) silicon using Bridgman-type furnaces with unidirectional heat flow, at frequencies from 1 to 5 MHz. Digital signal processing is applied to materials in which there is substantial Rayleigh grain scattering or for materials, such as concentrated alloys, that have solid/liquid interfaces that are not sharp. Recent experiments have shown that the technique is capable of locating, in real time, the solid/liquid interface with a sensitivity within one or two thousandths of an inch in favorable circumstances. It thus appears to have a number of potential applications to process control in the field of crystal growth from the melt, particularly for substances in which the solid/liquid interface cannot be conveniently located during growth since they are opaque to visible light (metals or semiconductor), as well as applications in metals processing and continuous casting. Additionally, information concerning the structure of the solid/liquid interface can be deduced from its ultrasonic reflectivity. The technique, since it provides information both on the location of the interface and on its characterization, may be regarded as real-time ultrasonic metallography.

711,686
PB87-167409 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Microanalytical Study of Secondary Precipitation in a Nickel-Base Superalloy with Use of Atom Probe Field Ion Microscopy and Analytical Transmission Electron Microscopy.
Final rept.,
M. E. Twigg, A. J. Melmed, R. Klein, M. J. Kaufman, and H. L. Fraser. 1984, 4p
Pub. in Anal. Electron Microsc., p185-188 1984.

Keywords: Nickel alloys, Phase transformations, Reprints, *Nickel alloy 13Al 9Mo 2Ta, Electron microscopy, Super alloys.

At temperatures below 800 deg C, RSR 143 (76Ni-13Al-9Mo-2Ta, at. %) exhibits a 20 % improvement in stress capability over directionally solidified Mar-M200. Pearson, et al. have ascribed this improvement to fine scale secondary precipitates and have recommended the stabilization of these precipitates through compositional modification of the alloy. Such an objective in alloy design would be more easily accomplished if the composition of the precipitates and the surrounding gamma matrix were known and if the kinetics for formation and dissolution of such precipitates were understood. The question of kinetics has been addressed in an extensive transmission electron microscopy (TEM) study by Martin, et al. The small size of these secondary precipitates hinders the determination of such compositions through current analytical TEM techniques. These compositions can, however, be determined using atom probe field ion microscopy (APFIM), the principal technique employed in the study.

711,687
PB87-179396 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Thermosolutal Convection during Directional Solidification. 2. Flow Transitions.
Final rept.,
G. B. McFadden, and S. R. Coriell. Mar 87, 13p
See also report dated Dec 84, PB85-172484.
Pub. in Physics of Fluids 30, n3 p659-671 Mar 87.

Keywords: *Convection, *Solidification, Concentration(Composition), Fluid flow, Prandte number, Nonlinear differential equations, *Binary alloys.

The effect of thermosolutal convection on the solute segregation in crystals grown by vertical directional solidification of binary metallic alloys or semiconductors is considered. Numerical results are obtained using finite differences in a two-dimensional, time-dependent model that assumes a planar crystal-melt interface. The configuration is assumed to be periodic in the horizontal direction with a given period, and the possibility of multiple flow states sharing the same period is examined. The results are summarized in bifurcation diagrams of the nonlinear states associated with the critical points of linear theory. The use of a time-dependent numerical scheme results in gaps in the bifurcation diagram where presumed unstable states exist that cannot be computed by this procedure. As the solutal Rayleigh number is varied, multiple steady states, time-periodic states, and quasiperiodic states may occur. The case is compared to the simpler case of thermosolutal convection with linear vertical gradients and stress-free boundaries, for which a rather complete numerical treatment is possible

through the use of a simple spectral representation of the nonlinear solution.

711,688
PB87-196366 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Surface Segregation in Liquid Ga-Sn Alloys by AES (Auger Electron Spectroscopy).
Final rept.,
S. C. Hardy, and J. Fine. 1983, 11p
Pub. in Surface Science 134, n1 p184-194 1983.

Keywords: *Gallium alloys, *Tin alloys, *Adsorption, Liquid phases, Surface properties, Separation, Reprints, Auger electron spectroscopy.

The surface segregation of Sn in liquid Ga-Sn alloys has been studied by Auger electron spectroscopy as a function of bulk composition at 350 degrees C. The tin was found to be strongly adsorbed at the surface. The surface concentrations of Sn and Ga were calculated from the Auger measurements using inelastic mean free paths and backscattering factors estimated in recent theoretical work. The values found for the surface concentrations are essentially in agreement with those deduced from surface tension measurements using Gibbs adsorption theory assuming a monolayer adsorption distribution.

711,689
PB87-197935 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Magnetism and the Observation of NMR Lines in Hexagonal Al4Mn and Icosahedral Al-Mn Alloys.
Final rept.,
L. H. Bennett, M. Rubinstein, G. Xiao, and C. L. Chien. 1987, 2p
Pub. in Jnl. of Applied Physics 61, n8 p4364-4365, 15 Apr 87.

Keywords: *Magnetism, *Aluminum, Manganese, Magnetic susceptibility, Reprints, *Nuclear magnetic resonance, Icosahedral alloys.

Previous measurements of the magnetic susceptibility and the intensity of the 55Mn NMR line in a number of periodic and quasiperiodic (i.e., icosahedral) Al-Mn and Al-Mn-Si alloys suggested some correlation, in that the 55Mn line intensity decreases as the magnetic susceptibility increases. The correlation had led to the tentative conclusion that the reduction of the 55Mn line intensity is due to the magnetism, and that the 'magnetic' Mn atoms are not seen in the NMR. The authors have found that the above correlation breaks down in a very substantial way for hexagonal Al4Mn which (i) shows a small magnetic susceptibility, and (ii) no observable 55Mn line. Thus the reduction in intensity in the 55Mn NMR line in the icosahedral phase is not necessarily due to its magnetism but may have its origin in another line broadening mechanism.

711,690
PB87-201398 PC **A04**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Evaluation of Cracking in Aluminum Cylinders.
Final rept.,
J. H. Smith. Mar 87, 52p NBSIR-86/3492
Sponsored by Department of Transportation, Washington, DC.

Keywords: *Gas cylinders, *Aluminum, Pressure vessels, Cracking(Fracturing), Threads, Aluminum alloy 6351.

Cracking was first observed in the threaded area of high pressure (4500 psi) fiberglass-wrapped composite-aluminum compressed gas cylinders and has resulted in the leaking and rupture of a few of these cylinders in the last three years. More recently, the neck and threaded area of some fiberglass-wrapped composite-aluminum and some seamless aluminum (type 3A1) cylinders have been visually inspected during the normal periodic retest. As a result of this visual inspection at the time of retesting, several aluminum cylinders were reported to show evidence of cracking in the neck and threaded area. A group of these cylinders was obtained for more detailed laboratory examination to determine the extent of the cracking and to attempt to assess the significance of the cracking. The report describes the results of the laboratory tests on this group of cylinders that were reported to have cracks.

711,691
PB87-201737 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Effects of Sliding Motion and Tarnish Films on the Break-in Behavior of Three Copper Alloys.
Final rept.,
P. J. Blau. 1987, 8p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Wear of Materials 1987, v1 p93-100 1987.

Keywords: *Copper alloys, *Sliding, *Tarnishing, Wear tests, Friction tests, Steels, Microstructure, Aluminum containing alloys, Tin containing alloys, Zinc containing alloys.

The effects of both sliding direction and tarnish films on the unlubricated break-in behavior of Cu-3.5 wt% Al, Cu 5 wt% Sn, and Cu 15 wt% Zn on AISI 52100 steel are compared. The tests were conducted on all three alloys using a hemispherically tipped pin-on-flat geometry. The present research compares the break-in friction curves and track widths of these materials as-polished, with a copper oxide tarnish coating, and with testing in both unidirectional and reciprocating sliding directions.

711,692
PB87-233995 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Temperature Dependence of Yield Stress and Fracture Toughness in Unstabilized Zirconia Crystals.
Final rept.,
T. W. Coyle, R. P. Ingel, and P. A. Willging. 1987, 7p
Pub. in Materials Research Society Symposium Proceedings, v78 p89-96 1987.

Keywords: *Zirconium oxides, Crystals, Fracture strength, High temperature tests, Toughness, Yield strength, Reprints, *Foreign technology.

The flexural strength and the single edge notch beam fracture toughness of undoped ZrO2 crystals, grown by the skull melting technique, were examined from room temperature to 1400 deg C. On heating the toughness increased with test temperature to a maximum of 4.0 MPa/m at 1225 deg C then gradually decreased to 2.6 MPa/m. Upon cooling after a 20 minute hold at 1250 deg C an increase in toughness to 5 MPa/m was observed at 1200 deg C; upon cooling to lower temperatures gradually diminished. The load-deflection curves for the flexural strength tests showed marked non-linearity before failure for samples tested on cooling. The temperature dependence of the apparent yield stress suggests that initial yielding occurs by slip above 1200 deg C but that from 1200 deg C to 1050 deg C the observed yielding is due to stress induced tetragonal to monoclinic transformation.

711,693
PB88-117320 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Neutron Diffraction Study of Age-Hardened U - 0.75wt% Ti Alloy.
Final rept.,
C. S. Choi, H. J. Prask, and G. M. Ludtka. 1987, 8p
Pub. in Jnl. of Nuclear Materials 150, p85-92 1987.

Keywords: Reprints, *Uranium alloy, *Lattice distortion, *Neutron diffraction, Particle size, Precipitation hardening.

Depleted uranium alloys containing 0.75 wt% titanium were prepared by gamma-quenching followed by aging with five different aging time and temperature conditions. The microstructural properties of the alloys were studied by using the neutron powder diffraction method and the small angle neutron scattering (SANS) method. The Rietveld refinement of the powder diffraction patterns for the uranium phase indicated two distinct aging stages for the alloy. In the first aging stage, the distortion of the b-axis length and the unit cell volume of the uranium phase increased with aging, and reached a peak value at an aging condition between 500 deg C/100 s and 550 C/1000 s. In the second aging stage, the above parameters decreased with increasing aging. The entire profiles of the diffraction patterns of the aged samples (two phases) were analyzed with multiphase Rietveld refinement to determine the amounts of U2Ti (sigma-phase) as a function of aging treatment. The particle size distributions of the sigma-phase precipitates were determined from the SANS data. The observed indentation hardness versus aging conditions closely paralleled the aging dependencies of the lattice distortion of the uranium phase and the number of the precipitates.

711,694
PB88-117429 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD.
Historical Perspective on the Utilization of Phase Diagrams for Precipitation Hardening.
Final rept.,
J. W. Cahn. 1983, 3p
Pub. in Bulletin of Alloy Phase Diagrams 4, n4 p349-351 1983.

Keywords: *Precipitation hardening, *Phase diagrams, Reprints, Historical aspects, Uses.

The suggestion in 1919 that precipitation would harden alloys had an immediate impact on the development of new alloys and led to a period of extremely active interest in careful phase diagram determinations. It also sparked a lively debate that had a lasting impact on physical metallurgy and led to a forerunner of dislocation theory.

711,695
PB88-117676 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Creep Cavities in Copper: An Ultrasonic-Velocity and Composite-Modeling Study.
Final rept.,
H. M. Ledbetter, R. J. Fields, and S. K. Datta. 1987, 6p
Pub. in Acta Metallurgica 35, n9 p2393-2398 1987.

Keywords: *Copper, *Creep properties, Cavaties, High temperature tests, Sound waves, Reprints, *Foreign technology.

The study considered cavities produced in polycrystalline copper by high-temperature tensile creep. Experimentally, the authors measured longitudinal sound-wave velocities, both parallel and perpendicular to the stress axis. Theoretically, the authors used a scattered-plane-wave ensemble-average model to predict the effects of voids on sound velocity.

711,696
PB88-121942 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Microstructural Studies on Supercooled Sub-Micrometer Powder Particles.
Final rept.,
D. Shechtman, S. D. Ridder, and R. Mehrabian. 1982, 9p
Pub. in Proceedings of Conference on Rapid Solidification Processing (3rd): Principles and Technologies III, Gaithersburg, MD., December 1982, p96-104.

Keywords: *Aluminum alloys, *Copper alloys, Microstructure, Powder(Particles), Transmission electron spectroscopy, Rapid solidification, Rapid quenching(Metallurgy).

Various Al-Cu alloy powders were made by the Microparticle Processor, and their microstructure was studied by transmission electron microscopy. The powder particles which sizes range from 3 nm to a few micrometers demonstrate different structural characteristics ranging from amorphous to ordered crystalline intermetallic, depending upon composition and particle size. Extended solid solubility was observed in all the alloys examined. Some of the results obtained from Al-Cu alloy powders will be shown and discussed. The cooling rates needed to suppress crystallization in some alloys will be calculated.

711,697
PB88-129861 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Analysis of the Microstructure of Rapidly Solidified Al-8 wt% Fe Powder.
Final rept.,
W. J. Boettinger, L. Bendersky, and J. G. Early. 1986, 10p
Pub. in Metallurgical Transactions A 17, n5 p781-790 May 86.

Keywords: *Aluminum alloys, *Solidification, *Powder metals, Eutectics, Microstructure, Reprints.

Rapidly solidified powders of Al-8 wt% Fe exhibit four distinct microstructures with increasing particle diameter in the size range of 5 micrometer to 45 microme-

ters; microcellular alpha-Al; cellular alpha-Al; and AlFe eutectic; and Al3Fe primary intermetallic structure. Small powder particles undercool significantly prior to solidification and typically exhibit a two-zone microcellular-cellular structure in individual powder particles. Larger particles experience little or no initial undercooling prior to solidification and do not exhibit the two-zone structure. The larger particles contain cellular, eutectic, or primary intermetallic structures that are consistent with growth rates controlled by heat extraction through the particle surface (external heat flow).

711,698
PB88-129879 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Microstructure Formation in Rapidly Solidified Alloys.
Final rept.,
W. J. Boettinger, and S. R. Coriell. 1986, 19p
Pub. in NATO ASI (Advanced Study Institute) Series E 114, p81-109 1986.

Keywords: *Solidification, *Powder alloys, Microstructure, Dendritic powder, Reprints.

In order to apply solidification theory to the interpretation of microstructures produced by rapid solidification, several modifications are required. A modification is presented here for alloy dendritic growth theory. For alloys solidifying dendritically into undercooled melts, solute redistribution dominates the relationship between growth rate and initial undercooling when the initial undercooling is smaller than the alloy freezing range (difference between liquidus and solidus temperatures). The fact has several important consequences for the eutectic coupled zone boundaries and for arrayed dendritic growth.

711,699
PB88-139159 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Residual Stress Determination in Aluminum Using Electromagnetic Acoustic Transducers.
Final rept.,
A. V. Clark, and J. C. Moulder. 1985, 7p
Pub. in Ultrasonics 23, n6 p253-259 Nov 85.

Keywords: *Ultrasonic tests, *Residual stress, Aluminum alloys, Texture, Reprints, EMAT(Electromagnetic Acoustic Transducer).

The residual stresses in a shrink-fit specimen were measured ultrasonically, using shear-horizontal (SH-) waves transmitted and received by noncontacting electromagnetic acoustic transducers. The presence of stress induces a small change in the velocity of the SH-waves. The difference in velocities of orthogonally polarized SH-waves is measured with a simple time-interval averaging system; the velocity difference can be related to the difference of principal stresses. The presence of material anisotropy (texture) also causes relative velocity changes comparable to stress-induced changes.

711,700
PB88-141312 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Fundamentals of Rapid Solidification.
Final rept.,
W. J. Boettinger, and J. H. Perepezko. 1985, 38p
Pub. in Proceedings of TMS-AIME Conference on Rapidly Solidified Crystalline Alloys, Morristown, NJ., May 1-3, 1985, p21-58.

Keywords: *Solidification, Phase transformations, Nucleation, Kinetics, Thermodynamics, Heat transfer, *Rapid quenching (Metallurgy).

General principles governing the liquid to solid transformation at high rates can provide a unified framework to understand the variety of processing approaches used in rapid solidification. These principles can be divided into four areas: heat flow, thermodynamics, nucleation, and growth kinetics. To a certain extent, heat flow determines the relationship between externally controllable processing parameters and the internal fundamental solidification parameters. The thermodynamics of metastable and non-equilibrium solidification sets the possible range of solidification product phases, while nucleation and growth kinetics determine the detailed microstructural evolution. Selected topics in these four areas are examined, including the role of melt subdivision, undercooling and liquid cooling rate on nucleation kinetics, and the role of solute redistribution on growth kinetics.

711,701
PB88-147467 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Icosahedral Al-Mn and Related Phases: Resemblance in Structure.
Final rept.,
L. Bendersky, R. J. Schaefer, F. S. Biancaniello, W. J. Boettinger, M. J. Kaufman, and D. Shechtman. 1985, 6p
Pub. in Scripta Metallurgica 19, n7 p909-914 1985.

Keywords: *Aluminum alloys, *Manganese containing alloys, *Crystal structure, Solidification, Reprints, *Icosahedral phase, *Aluminum intermetallics, *Manganese intermetallics, Rapid quenching (Metallurgy), Transmission electron microscopy, Aluminum manganese.

An icosahedral phase showing non-crystallographic point group symmetry (M-3-5) and at the same time sharp single crystal-like electron diffraction has recently been reported. In Al-Mn alloys, the phase is formed at alloy compositions between 15 and 35 wt% Mn. Several different techniques of rapid solidification provide sufficient melt undercooling to produce this phase. The icosahedral phase has been found to solidify in conjunction with other phases. One of these phases, called T phase, was previously reported as a product of solid state precipitation and is of interest due to the striking resemblance of electron diffraction patterns obtained from this phase and the icosahedral phase. In the present paper the authors report preliminary studies of the crystallographic relationship between these phases: icosahedral, T and Al4Mn. The study was performed using conventional and high-resolution transmission electron microscopy.

711,702
PB88-147491 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Rapidly Solidified Al-Cr Alloys: Structure and Decomposition Behavior.
Final rept.,
L. Bendersky, R. J. Schaefer, F. S. Biancaniello, and D. Shechtman. 1986, 8p
Pub. in Jnl. of Materials Science 21, n6 p1889-1896 Jun 86.

Keywords: *Aluminum alloys, *Chromium containing alloys, Solidification, Precipitation hardening, Supersaturation, Reprints.

Melt-spun ribbons of Al containing up to 15wt% Cr were examined in the as-spun condition and after annealing. The more concentrated alloys contained multi-phase spherulites embedded in an alpha-Al matrix: chemical microanalysis showed the average composition of the spherulite core to be + or - 2 wt% Cr. The kinetics of precipitation at grain boundaries and within the matrix were determined by TEM and x-ray diffraction. Three very similar Al-Cr intermetallic phases are present in the equilibrium phase diagram, but most of the precipitates in the melt-spun ribbons could be identified as Al7Cr.

711,703
PB88-147616 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Strength and Toughness of AISI 304 and 316 at 4 K.
Final rept.,
N. J. Simon, and R. P. Reed. 1986, 5p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Jnl. of Nuclear Materials 141-143, p44-48 1986.

Keywords: *Superconducting magnets, Nuclear fusion, Fracture strength, Grain size, Yield strength, Cryogenics, Reprints, *Steel 304, *Steel 316.

Structural design of superconducting magnets in fusion energy devices requires reliable property data at 4 K. Nitrogen-strengthened AISI 304 and 316 stainless steels are considered to be the best currently available low temperature structural alloys on the basis of their fabricability and their potential to meet the US fusion research goals of combined yield strength and fracture toughness at 4 K. The paper presents provisional equations for the yield strength of 304- and 316-type alloys at 4 K as a function of N content and grain size.

711,704
PB88-152137 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Unit Cell Structure of Rapidly Cooled Al-Mn Alloys with Icosahedral Symmetry.
Final rept.,
M. Kuriyama, G. G. Long, and L. Bendersky. 1985, 3p
Pub. in Physical Review Letters 55, n8 p849-851 1985.

Keywords: *Aluminum alloys, *Manganese containing alloys, *Crystal structure, Reprints, Icosahedral phase, Rapid quenching (Metallurgy).

The structure of rapidly cooled Al - 14 at. pct. Mn with icosahedral symmetry is shown to be a three dimensionally layered structure consisting of a periodic unit cell.

711,705
PB88-152707 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Single Crystal Structure of Rapidly Cooled Alloys with Icosahedral Symmetry: 2. Theoretical Analysis--Internal Modulations.
Final rept.,
M. Kuriyama, and G. Long. 1986, 9p
Pub. in Acta Crystallographica, Section A A42, pt3 p164-172, 1 May 86.

Keywords: *Aluminum alloys, *Manganese containing alloys, *Crystal structure, Electron diffraction, Single crystals, Reprints, *Icosahedral phase, Rapid quenching (Metallurgy).

Applying traditional crystallographic analysis to a set of electron diffraction patterns taken from a rapidly cooled Al - 14 at. pct. Mn alloy, the authors have reconstructed the reciprocal lattice patterns in complete agreement with the observed icosahedral patterns. The results lead to an atomic scale model which is derived from two sets of modulations, each of which has six independent modulation vectors. The resultant structure is completely regular, and is shown to possess a unit cell with all the required symmetry properties. The relationship of this unit cell to 3D nonperiodic Penrose tilings is shown.

711,706
PB88-157722 PC **A06**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD.
Institute for Materials Science and Engineering, Metallurgy: Technical Activities 1987.
Annual rept.
Oct 87, 106p NBSIR-87/3615
See also PB87-136685.

Keywords: *Metallurgy, Processing, Metals, Alloys, Nondestructive tests, Chemical properties, Mechanical properties, Corrosion, Wear, Electrodeposition, Magnetic materials, Radioactive waste, Technical activities.

The report summarizes the FY 1987 activities of the Metallurgy Division of the National Bureau of Standards. The research centers upon the structure-processing-properties relations of metals and includes alloys and on the methods of their measurement. The activities also include the generation and evaluation of critical materials data. Efforts comprise studies of metallurgical processing, corrosion and wear, chemical metallurgy, electrodeposition, nondestructive characterization and magnetic materials. The work described also includes three cooperative programs with American professional societies and industry: the American Society for Metals (ASM) - NBS Alloy Phase Diagram Program, the National Association of Corrosion Engineers (NACE) - NBS Corrosion Data Program, the American Iron and Steel Institute (AISI) - NBS Steel Sensor Program, and the Aluminum Association. Work in support of other government agencies includes a major program to assist the Nuclear Regulatory Commission in addressing the critical national problem of disposing of high level nuclear waste in geologic repositories.

Plastics

711,707
N87-11589/5 PC **A02**/MF **A01**
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
Effects of Backing Plates on the Electron Exposure of Thin Polymer Films.
C. K. Chang, S. M. Seltzer, and J. W. Wilson. Nov 86, 16p NAS 1.15:88995, L-16183, NASA-TM-88995
Grant NSG-1614

Keywords: Electron irradiation, *Polymeric films, *Radiation dosage, Substrates, Thin plates, Electron bombardment, Monte carlo method, Transport properties.

The effects of backing plates on the radiation dose received by thin nylon films were calculated using recently developed multilayer electron transport codes. The film dose increased with increasing atomic number of the backing plate. The estimated dose could be off by a factor of 2 or more if the backing plate were ignored in the calculations.

711,708
PB-265 089/3 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Reproducibility of the Radiant Panel Test Method (ASTM E 162-67) Using Polyurethane Foam, Neoprene, and Hardboard Specimens.
Final rept.,
T. G. Lee. Mar 77, 41p NBSIR-77-1222

Keywords: *Polyurethane resins, *Chloroprene resins, Flames, Tests, Calibrating, Temperature, Error analysis, Experimental design, Foams, Revisions, Statistical analysis, Variability, *Flame spread test methods, *Hardboards, Procedures.

Interlaboratory evaluation of the Radiant Panel Method (ASTM E 162-67) for flame spread testing of two flexible foam and one hardboard specimens was made. Results obtained by 13 laboratories based on 4 replicate tests, showed that the between-lab coefficient of variation on the flame-spread index (Is) was 21% for Hardboard A, 35% for Urethane B and 45% for Neoprene C. The within-lab coefficient of variation for the Hardboard was 9.9%. The higher variability of results for the foam materials was caused by the rapid melting of the Urethane B and unstable flame front of the Neoprene C specimens during the tests. An important source of error for some laboratories was in the determination of beta, the calibration constants, and the inappropriate use of base stack temperature correction. Statistics on the reproducibility of the flame-spread factor (Fs), heat evolution (Q) and Is are also given. A new pilot burner and other modifications of the method were found useful.

711,709
PB-265 782/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Conformation of PS-PMMA Diblock Copolymer in Toluene by Small Angle Neutron Scattering,
C. C. Han, and B. Mozer. Feb 77, 8p
Pub. in Macromolecules, v10 n1 p44-51 Jan/Feb 77.

Keywords: *Styrene copolymers, *Polymethyl methacrylate, Copolymers, Neutron scattering, Deuteration, Thermoplastic resins, *Molecular conformation, Reprints.

A deuterated polystyrene-poly(methyl methacrylate) (dPS-PMMA) diblock copolymer and its deuterated polystyrene homopolymer precursor were studied by small angle neutron scattering and light scattering experiments using toluene as the solvent. The radii of gyration of the deuterated PS homopolymer (M=88,000) measured by both methods and that of the PMMA block (M=203,000) in the diblock copolymer measured only by neutron scattering were determined as 210A and 85A respectively. In addition, the second virial coefficients and the chain excluded volume exponents were also obtained. The copolymer chain configuration in toluene at 23C is inferred from these measurements whereby the PMMA block forms the interior core from which the PS block exudes out as an expanded chain.

711,710
PB-270 290/0 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Performance of Plastic Packaging for Hazardous Materials Transportation. Part 1. Mechanical Properties.
Final rept. Jun 75-Jun 76,
J. M. Crissman, C. M. Guttman, and L. J. Zapas. Oct 76, 54p DOT/MTB/OHMO-76/4
Pub. in Report no. DOT/MTB/OHMO-76/4, 51p Oct 1976.

Keywords: *Hazardous materials, *Containers, *Plastics, Mechanical properties, Transportation, Polyethylene, Specifications, Standards, Performance tests, Loads(Forces), Viscoelasticity, Stress strain relations, Regulations, Government policies, Fractures(Materials), Design criteria, *Hazardous materials transportation.

This report contains background information useful in evaluating the performance of plastic packagings for hazardous materials transportation, insofar as mechanical properties are concerned. Current DoT regulations and test methods are reviewed, as well as testing procedures from other organizations and countries. Also included are recommendations to modify current DoT regulations to make test methods more quantitative. Finally, experimental data are presented which represent the initial stage of a study it is hoped will ultimately lead to the establishment of criteria upon which the long time behavior of plastic containers can be predicted based on short time tests.

711,711
PB-270 386/6 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Performance of Plastic Packaging for Hazardous Materials Transportation. Part II. Permeation.
Final rept. Jun 75-Jun 76.
J. D. Barnes, and G. M. Martin. Oct 76, 41p NBSIR-76-1163(R), DOT/MTB/OHMO-76/5
Contract DOT-AS-50074

Keywords: *Hazardous materials, *Containers, *Plastics, Polyethylene, Transportation, Permeability, Performance tests, Laboratory tests, Cargo transportation, Specifications, Government policies, Regulations, *Hazardous materials transportation, Polymer gas permeability.

Permeation as a mode of failure for plastics packagings is discussed. The materials properties which determine permeation performance are defined. Measurement methods aimed at determining values for the materials properties are surveyed. A 'matrix' scheme is introduced for evaluating the risks associated with the permeation failure of a package containing a hazardous materials lading. Permeation factors influencing reuse of plastic containers are described. Laboratory data from an evaluation of a simple method of test for estimating the intrinsic property of a lading to permeate polyethylene is presented.

711,712
PB-272 196/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Polymers in Dentistry.
Final rept.,
G. M. Brauer. 1977, 34p
Pub. in Proceedings of Anniversary Progress in Dental Materials (100th), Ann Arbor, Michigan on October 1, 1975, p78-111 1977.

Keywords: *Adhesives, *Plastics, *Dental materials, Polymers, Composites, Sealants.

Plastics are employed successfully in many dental applications. Their properties make them especially valuable in the construction of dentures, plastic teeth and impression materials. The composite filling materials have been quite successful in areas where esthetics is of prime importance. Perhaps the biggest improvement in filling materials would be the development of a liner that bonds to tooth structure. The evidence today suggests that continuing progress will lead to clinically acceptable adhesive restoratives that will substantially improve the quality of dental services.

711,713
PB-278 957/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Distribution of Energy Deposited in Plastic Tubing and Copperwire Insulation by Electron Beam Irradiation.
Final rept.,
W. L. McLaughlin, A. Miller, K. Pejtersen, and W. B. Pedersen. 1978, 14p
Pub. in Radiat. Phys. Chem. 11, p39-52 1978.

Keywords: *Electron irradiation, *Polymers, Electron beams, Radiation dosage, Dosimeters, Electrical insulation, Plastic pipes, Polyamide resins, Polyethylene, Polyvinyl chloride, Crosslinking, Reprints.

Scanned electron beam treatment is used to improve the physical properties of certain polymers, such as shrinkable plastic tubing and insulated wire and cable. Tubing or wires are passed at high speed under the beam scanner, and the material is irradiated to absorbed doses of several Mrad as uniformly as possible, usually by means of a multipass arrangement. In the present study, using irradiation by a scanned 0.4 MeV electron beam, measurements were made of high-resolution distributions of absorbed dose in polyethylene tubing and copper wire coated with polyethylene, nylon, or polyvinyl chloride insulation. Radiochromic dye films equivalent to the insulating materials were used as accurate dosimeters having a response independent of dose rate. Irradiations were in various geometries, wire and plastic thicknesses, positions along the beam scan, and with different backing materials near the wire as it passed through the electron beam.

711,714
PB-280 027/4 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.
Development of a Data Base for Assessing Plastics Fire Hazards,
J. A. Slater. Apr 78, 39p NBSIR-78-1422
Sponsored in part by Consumer Product Safety Commission, Washington, D.C.

Keywords: *Plastics, *Flammability testing, Tables(Data), Field tests, Buildings, Data bases, Residential buildings.

The growing use of plastics has, in recent years, produced an increased concern over the potential flammability of plastics materials and products. In order to assess some of the real-life hazards associated with fire incidents involving plastics, a data base of residential fire accidents is being developed. The data consist of detailed case history reports based on a questionnaire form developed at the National Bureau of Standards and laboratory tests of samples retrieved at the fire scene. The major criteria for a fire incident to be included in the data base are that (1) an identifiable plastic product played a significant role in the fire and (2) the sequence of events can be partially reconstructed. Information is collected about the building environment in which the fire occurred, the products and the persons involved in the incident, the fire development and extinguishment. The field data are being coded and computerized. Sample tabulations of field and laboratory data from the first 25 accident cases are shown.

711,715
PB-280 215/5 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Performance of Plastic Packaging for Hazardous Materials Transportation: Part III. Stress Cracking.
Final rept. Jun 76-Jun 77,
J. M. Crissman, and L. J. Zapas. Dec 77, 58p
NBSIR-77-1410, DOT/MTB/OHMO-77/4
Contract DOT-AS-50074
See also Part 2, PB-270 386.

Keywords: *Polymers, *Containers, *Stress corrosion tests, Hazardous materials, Cargo transportation, Fracturing(Cracking), Polyethylene, Density(Mass/volume), Specifications, Regulations, Government policies, *Hazardous materials transportation.

The emphasis of this work has been directed toward providing background information and laboratory studies on the subject of stress-cracking, the results of which will be pertinent to the establishment of performance criteria. The report is divided into four sections: Section 1 reviews the stress-cracking tests currently in common use; Section 2 provides background material taken from the technical literature and germane to the subject of stress-cracking in polyethylene; Section 3 summarizes laboratory studies carried out in the NBS Polymers Division in the areas of mechanical properties and stress-cracking; Section 4 contains recommendations for strengthening current DOT regulations in the areas of mechanical properties and stress-crack resistance.

711,716
PB-285 328/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Degradation Kinetics Applied to Lifetime Prediction of Polymer,
J. H. Flynn. 1978, 24p
Sponsored in part by Naval Air Systems Command, Arlington, Va. Office of Naval Research, Arlington, Va. Pub. in Proc. Eastern Analytical Symp. (17th), New York, N.Y. Nov 77. Paper in Thermal Methods in Polymer Analysis, p163-186 (The Franklin Inst. Press, Philadelphia, Pa. 1978).

Keywords: *Polymers, *Thermal stability, Thermal degradation, Aging tests(Materials), Predictions, Accelerated tests, Polyurethane resins, Reprints.

General problems in relating thermal properties of polymers to lifetime prediction are outlined and criteria for the application of thermal degradation data to predict failure at service conditions are discussed. Specific problems encountered in the attempt to apply these data to the prediction of aging characteristics of polymers involve the mode of kinetic coupling of the degradation kinetics to the aging process of interest. The authors are using three techniques of analysis in which the entire kinetic spectra are compared among experiments performed at different rates of heating in the range from 6 deg/min to 3.6 deg/hr. These techniques are: (1) Changes in mechanisms are diagnosed from plots of the logarithm of the heating rate vs reciprocal temperature. (2) The mode of kinetic coupling between competing processes is elucidated by comparison of experimental rates at slow and fast heating rates with calculated cases of model kinetics. (3) The initial degradation process at use conditions is predicted from a detailed analysis of the first five percent reaction kinetics.

711,717
PB-285 332/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Piezoelectricity and Pyroelectricity in a Polyvinylidenefluoride Copolymer.
Final rept.,
G. T. Davis, and M. G. Broadhurst. 1978, 8p
Pub. in Proc. Conf. on Electrical Insulation and Dielectric Phenomena, Gaithersburg, Md., Nov 3-6, 1975, Annual Report, p37-44 1975. (National Academy of Sciences, Washington, D.C. 1978).

Keywords: *Tetrafluoroethylene resins, *Copolymers, *Vinylidene resins, Piezoelectricity, Pyroelectricity, Fluorine aliphatic compounds, Electrets, Vinylidene fluoride polymers, Fluorinated polymers.

Piezoelectric d sub p and pyroelectric (p) coefficients of films of copolymer of vinylidenefluoride with 27% tetrafluoroethylene have been measured as a function of poling conditions and the results interpreted in terms of a model of aligned dipoles within the crystalline regions of the polymer. The experimental results are compared with the predictions of a dipole model and are shown to be easily accounted for by the model.

711,718
PB-287 429/5 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Center for Building Technology.
Evaluation of Plastic Wallcovering Materials.
Final rept.
E. J. Clark, and P. G. Campbell. Oct 78, 45p NBS-TN-984
Sponsored in part by Department of the Air Force, Washington, DC., Naval Facilities Engineering Command, Washington, DC., and Office of the Chief of Engineers (Army), Washington, DC.

Keywords: *Plastics, *Coverings, Walls, Performance evaluation, Fungus proofing, Surfaces, Abrasives, Washing, Stains, *Wall coverings.

The suitability of various test methods for measuring performance of plastic wallcovering materials was studied. This report contains the results of performance tests including abrasion resistance, surface texture, fungus resistance, washability and stain resistance. Based on the test results, tentative recommendations for the revision of Federal Specification CCC-W-408A, Wall Covering, Vinyl-Coated, have been developed. These recommendations are based upon the results of tests conducted on seventy-two wallcovering materials from seven manufacturers.

711,719
PB-296 115/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiation-Induced Copolymerization of Tetrafluoroethylene and Styrene at High Pressure.
Final rept.,
D. W. Brown, and R. E. Lowry. 1979, 10p
Pub. in Jnl. of Polymer Science 17, p759-768 1979.

Keywords: *Polymerization, *Tetrafluoroethylene resins, *Styrene resins, Copolymers, Synthesis(Chemistry), High pressure tests, Radiation, Monomers, Reprints.

The radiation-induced copolymerization of tetrafluoroethylene (A) and styrene (B) was studied in bulk and in perfluorotoluene at 22C at autogenous pressure and 260 and 510 MPa. The reactivity ratio for addition to A-ended radicals, r(A), is effectively zero at the two lower pressures and is in the range 0.002-0.008 at 510 MPa. The other reactivity ratio, r(B), is 6 at autogenous pressure and also at 260 and 510 MPa if the A content of the charge is less than 50%. If the A content is greater than 95%, r(B) appears to be 100 at pressures of 260 and 510 MPa. The apparent variation in r(B) cannot be explained by invoking a penultimate unit effect for B-ended radicals. Polymerization rates scatter somewhat, but all rates are quite small when the A content of the charge is in the range 95-99.8%. Polymers containing as much as 66% A appear to be inherently benzene soluble but frequently contain some gel because of radiation-induced crosslinking after their formation. No very high polymers were formed that contained more than a few percent A, even at high pressure. Features that complicated the study were immiscibility of the liquid monomers, extreme variation of the monomer-copolymer compatibility with charge composition, and freezing of B at high pressure.

711,720
PB-297 464/0 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Dental and Medical Materials Section.
Processing and Characterization of NBS Standard Polyethylene for Use as a Negative Control Material.
Final rept. 1 Sep 76-31 Aug 77.
A. J. Bur. Jan 78, 32p NBSIR-77-1401
Sponsored in part by Tennessee Univ. Center for the Health Sciences, Memphis. Materials Science Toxicology Labs.

Keywords: *Polyethylene, Physical properties, Plastics, Standards, Mass spectroscopy, Surfaces, Contamination, Infrared spectroscopy, Absorption spectra, Calorimetry, Density(Mass/volume), *Negative control materials, *Biomaterials, Secondary ion mass spectroscopy.

This work was initiated in order to fulfill a need for a polymer which can serve as a negative control material for biocompatibility studies involving new polymer implant materials. Two large batches of well-characterized polyethylene resin are the sources of the candidate negative control material. The original polyethylene resin, in pellet form, was processed into sheets and rods and examined for surface contaminants and uniformity. Surface observations consisted of measurements of contact angle, attenuated total reflectance infra-red absorption and secondary ion mass spectroscopy (SIMS). Bulk measurements consisted of density, differential scanning calorimetry, and transmission infra-red spectroscopy. The surfaces of the rod were found to contain metallic oxides and several other metals which were not present in the unprocessed polyethylene. It is concluded that close attention must be paid to the method of processing and that only a sensitive analytical tool such as SIMS can be used to detect surface contamination and the differences between these samples.

711,721
PB-297 671/0 PC **A06**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Polymer Science and Standards Div.
Models for the Migration of Paraffinic Additives in Polyethylene.
Annual rept. 1 Oct 77-30 Sep 78.
L. E. Smith, I. C. Sanchez, S. S. Chang, and F. L. McCrackin. Jan 79, 102p NBSIR-79-1598
Sponsored in part by Food and Drug Administration, Washington, DC. Bureau of Foods.

Keywords: *Polyethylene, *Additives, *Food packaging, Transport properties, Plastics, Polymeric films, Absorption, Diffusion, Samples, Radiation counters, Scintillation counters, Extraction, Laboratory equipment, Phosphorimetry, Fluorimetry, Numerical solution.

General physical models of the migration of low molecular weight species in polymer matrices are needed to provide a basis for the efficient regulation of plastics used in food contact applications. This report presents the first year's progress on a project containing both theoretical and experimental elements aimed at producing such models. Using a modified equation of state approach, models have been developed for estimating the equilibrium partitioning of a diffusant in a polymer at a temperature above its glass transition in contact with a finite volume of solvent. Some possible new approaches to a diffusion theory based on volume fluctuations were outlined. Model calculations using diffusion equations have been made for the extraction of additives from polymers with concomitant solvent absorption and for finding a constant extraction temperature equivalent to migration under varying temperature conditions. The migration of an oligomer, 14C-labeled octadecane, from high density linear polyethylene into various solvents at different temperatures was measured in order to elucidate the effects of thickness, temperature, concentration, and solvent. Deviations from ideal Fickean kinetics in the experimental results may be attributed to the strong influence of swelling of the polymer on the migration rates, and to the possible incorporation of a small portion of the oligomer in the crystalline phase of the polymer.

711,722
PB-297 793/2 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Structures and Materials Div.
Studies on the Photodegradation of Poly (Methyl Methacrylate).
Final rept.
M. Abouelezz, and P. F. Waters. Jun 79, 53p NBSIR-79-1766
See also report dated May 78, PB-281 828. Prepared in cooperation with American Univ., Washington, DC. Dept. of Chemistry.

Keywords: *Polymethyl methacrylate, *Photodegradation, Plastics, Ultraviolet radiation, Visible radiation, Polymers, Tables(Data), Graphs(Charts).

When poly (methyl methacrylate), PMMA, is exposed to sunlight, it gradually degrades and, after long-term exposures, may be unable to perform its intended functions. While the photodegradation of PMMA has been studied extensively using radiation sources below 300 nm, natural sunlight at the earth's surface does not extend below 292 nm. This study was performed in order to examine the effect of the radiation from the upper part of the ultraviolet, UV, and the visible regions on PMMA and to identify the mechanism(s) of degradation induced by the radiation. Thin films of PMMA were irradiated in air with upper UV, upper UV-visible, upper UV-visible-near infrared and 436 and 546 nm radiation. Exposure to either the upper UV or visible radiation caused degradation of the polymer. The data show that both random scission and unzipping of the polymer chain are operative in the degradation. Unzipping becomes increasingly important with incident radiation of increasing wavelength.

711,723
PB-298 047/2 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Performance of Plastic Packaging for Hazardous Materials Transportation. Part IV. Standardizing Permeation Measurements.
Final rept. Jun 76-Jun 77.
J. D. Barnes, G. M. Martin, and F. L. McCrackin. Jun 79, 48p NBSIR-79-1768, DOT/MTB/OHMO-77/5
See also Part 1, PB-270 290.

Keywords: *Hazardous materials, *Containers, *Polyethylene, Standards, Plastics, Permeability, Performance evaluation, Transportation, Surfaces, Laboratory equipment, Statistical analysis, Mathematical models, Mass, Diffusion, *Hazardous materials transportation, *Permachor method.

This report describes experiments which confirm the essential features of the 'permachor' method for estimating the permeability of polyethylene to various liquids. The variables controlled in these experiments were temperature, resin, and alkane chain length. A statistical analysis based on the Linear Model revealed that the data could be described by a function of the form: G(T,sigma,n) = exp(X(T,sigma) + B (T,sigma) x

H(n)), where G(T,sigma,n) is the transmission rate of lading n through resin sigma at temperature T and B, X, and H are empirically determined functions. The broader implications of this result with respect to possible standard artifacts for use in permeability testing are described. A concept we have called the 'effective carbon atom number' is introduced as a means of correlating data. Once the effective carbon atom number of a liquid is known from measurements on one kind of polyethylene, it should be possible to predict what its permeability performance will be in containers made from different polyethylenes. Procedures are presented for implementing a standard-based system for measuring effective carbon atom numbers of various liquids and using this information to make permeability performance predictions. The major advantage of such a system is that it minimizes the number of tests which must be made using full-scale containers.

711,724
PB-300 569/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Cryogenic Foam Insulations: Polyurethane and Polystyrene.
Final rept.
L. L. Sparks. 1979, 41p
Proc. ICMC Symp. on Nonmetallic Materials and Composites at Low Temperatures, Munich, W. Germany, July 10-11, 1978, Paper in Nonmetallic Materials and Composites at Low Temperatures, p165-205 1979.

Keywords: *Thermal insulation, *Cellular plastics, *Polystyrene, *Polyurethane resins, Cryogenics, Mechanical properties, Thermodynamic properties.

The need for and diverse use of low temperature thermal insulations has increased dramatically in the last 20 years. Widespread use of cryogenic temperatures in industry and aerospace endeavors and, more recently, the need to transport and store large volumes of (LNG) are primarily responsible. Two materials being used extensively in these applications are the expanded plastics polyurethane (PU) and polystyrene (PS). Expected behavior and experimentally determined data are discussed for the following properties: Tensile, compressive, and shear strengths and the associated moduli, thermal conductivity, linear thermal expansion, specific heat, and thermal diffusivity. Temperatures below 300 K are considered.

711,725
PB80-100738 Not available NTIS
National Bureau of Standards, Washington, DC.
Lifetime Behavior of Polyethylene Bars in Uniaxial Extension in Various Chemical Environments.
Final rept.,
J. M. Crissman, and L. J. Zapas. 1979, 11p
Pub. in ACS (American Chemical Society) Symposium, Series 95, Durability of Macromolecular Materials, Paper 20, p289-299 1979.

Keywords: *Polyethylene, Cracking(Fracturing), Solvents, Stress corrosion tests, Surfactants.

The uniaxial creep behavior of linear and branched polyethylene is examined in the presence of various environments. It is demonstrated that it is possible to use either a solvent or surface active type of stress-cracking agent as a means of accelerating fracture. In the case of a surface active stress-cracking agent a superposition principle has been applied in order to separate out one mechanism, that arising from bond rupture and crack formation. A proper description of this mechanism should be valuable as a means of predicting long time behavior under conditions where the applied load may be very small.

711,726
PB80-100746 Not available NTIS
National Bureau of Standards, Washington, DC.
Creep Failure and Fracture of Polyethylene in Uniaxial Extension.
Final rept.,
J. M. Crissman, and L. J. Zapas. Feb 79, 5p
Pub. in Polymer Engineering and Science 19, n2, p99-103, Feb 79.

Keywords: *Polyethylene, *Creep properties, *Fractures(Materials), Failure analysis, Cracking(Fracturing), Plastics, Reprints.

It is shown that under conditions of uniaxial creep the fracture of high density polyethylene can be categorized as one of three types, depending upon the magnitude of the applied load, molecular architecture, and environment. When subjected to relatively large loads, the specimens neck and then fracture almost immediately. At the other extreme of very small initial loadings, the specimens fracture in a brittle fashion through crack formation and growth. In the intermediate range of loadings the specimens neck and, depending upon the molecular weight and molecular weight distribution, may then elongate substantially before fracture. It is shown that the uniaxial creep behavior for the region where drawing occurs, when plotted in terms of isochrones, represents a type of phase diagram, one boundary of which describes the fracture envelope. In addition, experiments employing different constant rate of loading histories are described and an additivity of damage criterion used to predict the time to failure under constant load conditions, and vice versa.

711,727
PB80-104227 Not available NTIS
National Bureau of Standards, Washington, DC.
Stress-Strain-Time Diagrams, Including Failure Envelopes, for High-Density Polyethylenes of Different Molecular Weight.
Final rept.,
L. J. Zapas, and J. M. Crissman. 1979, 9p
Pub. in ACS (American Chemical Society) Symposium Durability of Macromolecular Materials (Series 95), Paper 21, p301-309 1979.

Keywords: *Stress strain diagrams, *Polyethylene, Samples, Molecular weight, Failure analysis, Viscoelasticity.

The behavior in uniaxial loading under creep for three samples of linear polyethylene of different molecular weight is examined. Stress-strain-time diagrams, including failure envelopes are presented and compared to a phenomenological description of the instability of viscoelastic bars.

711,728
PB80-107311 Not available NTIS
National Bureau of Standards, Washington, DC.
Specification Method for Ultra High Molecular Weight Polyethylene for Implant Use.
Final rept.,
H. L. Wagner, and J. G. Dillon. 1979, 4p
Pub. in Jnl. of Biomedical Materials Research 13, p821-824 1979.

Keywords: *Polyethylene, *Viscosity, Molecular weight, Shear tests, Reprints.

Several unusual difficulties which occur in the measurement of the viscosity number of ultra high molecular weight polyethylene (UHMWPE) are examined and a suggested procedure is outlined for its determination. Because of the dependence on shear rate, there is no simple way at present to relate this quantity to limiting viscosity number (or intrinsic viscosity) or to molecular weight. The authors recommend for routine purposes a single point measurement in a viscometer of standard dimensions, without any attempt to relate the results quantitatively to molecular weight.

711,729
PB80-163942 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Diffusivity, Specific Heat, and Thermal Conductivity of A-150 Plastic.
Final rept.,
S. R. Domen. Jan 80, 10p
Sponsored in part by National Cancer Inst., Bethesda, MD.
Pub. in Journal of Physics in Medicine and Biology 25, n1, p93-102, Jan 80.

Keywords: *Plastics, *Specific heat, *Thermal conductivity, *Thermal diffusion, Heat measurement, Thermal properties, Reprints.

Some thermal properties of A-150 tissue-equivalent plastic have been determined. The significance of the measurements for the design of a calorimeter core calibration heater is described briefly.

711,730
PB80-199870 Not available NTIS
National Bureau of Standards, Washington, DC.
Absorbed Dose Distributions in Irradiated Plastic Tubing and Wire Insulation.
Final rept.,
A. Miller, and W. L. McLaughlin. 1979, 9p
Pub. in Trans. International Meeting on Radiation Processing, Radiation Physics and Chemistry (2nd), Roskilde (Denmark), November 16-19, 1978, Radiat. Phys. Chem. 14, p525-533 1979.

Keywords: *Polyethylene, *Polyvinyl chloride, *Irradiation, *Plastics processing, *Curing, Plastic pipes, Electrical insulation, Simulation, Reprints.

Plastic tubing and wire insulation were simulated by radiochromic dye dosimeter films having electron absorbing properties similar to the materials of interest (polyethylene and PVC). A 400-keV electron accelerator was used to irradiate from 1, 2, 3, and 4 sides simulating possible industrial irradiation situations. The results indicate that in most cases it is necessary but also sufficient to irradiate from two opposite sides.

711,731
PB81-132573 Not available NTIS
National Bureau of Standards, Washington, DC.
Time-Dependent Failure in Poly(Methyl methacrylate) and Polyethylene.
G. B. McKenna, and R. W. Penn. Feb 80, 8p
Pub. in Polymer 21, p213-220 Feb 80.

Keywords: *Polymethyl methacrylate, *Polyethylene, *Failure analysis, *Stress analysis, Mathematical models, Mechanical properties, Time, Reprints.

Time dependent failure of PMMA and polyethylene are characterized within the framework of a cumulative damage model for failure. It is found that the mean failure times in constant rate of stress experiments can be successfully predicted from the model using a time to fail function determined from constant stress experiments. Experimental results show that the lifetime of PMMA decreases with increasing frequency, although less rapidly than if the fatigue process were cycle dependent. The lifetime of polyethylene increases with increasing test frequency.

711,732
PB81-132581 Not available NTIS
National Bureau of Standards, Washington, DC.
Drawing and Annealing of Fibrous Material.
A. Peterlin. Oct 77, 10p
Pub. in Jnl. of Applied Physics 48, n10 p4099-4108 Oct 77.

Keywords: *Polyethylene, *Annealing, Elasticity, Acetal resins, Polypropylene, Plastic deformation, X ray analysis, Infrared spectroscopy, Electron microscopy, Samples, Reprints.

The more-than-linear increase of elastic modulus with draw ratio, the gradual disappearance of meridional SAXS maximum, the drastic drop of elastic modulus after annealing and its recovery upon standing at room temperature if the sample was annealed with fixed ends so that it did not shrink, and the shape stability of such polyethylene samples and of superdrawn material (polyethylene, polypropylene, polyoxymethylene) during new annealing can be easily explained by the microfibrillar model of fibrous structure which was developed some years ago on the basis of electron microscopy and x-ray and IR investigation of plastically deformed linear polyethylene and isotactic polypropylene.

711,733
PB81-132623 Not available NTIS
National Bureau of Standards, Washington, DC.
Normal Stress Response in Nonlinear Viscoelastic Materials: Some Experimental Findings,
G. B. McKenna, and L. J. Zapas. 1980, 11p
Pub. in Jnl. of Rheology 24, n4 p367-377 1980.

Keywords: *Normal stress, *Viscoelasticity, *Polymethyl methacrylate, *Polyisobutylene, Reprints.

In a previous paper the authors presented the interesting theoretical result that in a two-step torsional or simple shearing deformation where the magnitude of the second step is one half the magnitude of the first step, the normal stress response is predicted to be independent of the duration of the first step and equal to the single step response to a deformation of the same magnitude as the second step. Experimental support for this prediction is presented based on tests run on two greatly different polymeric systems - a 19.3% solution of poly(isobutylene) in cetane and glassy poly(methyl methacrylate).

711,734
PB81-133282 Not available NTIS
National Bureau of Standards, Washington, DC.

Nonlinear Viscoelastic Behavior of Poly(Methyl methacrylate) in Torsion.
G. B. McKenna, and L. J. Zapas. 1980, 16p
Sponsored in part by National Research Council, Washington, DC.
Pub. in Jnl. Rheol. 23, n2 p151-166 1979.

Keywords: *Polymethyl methacrylate, *Viscoelasticity, Torsional strength, Shear stress, Reprints, *BKZ theory.

A modified form of the BKZ elastic fluid is presented. The specific form chosen is used to describe the normal stress and shear stress responses of PMMA in two-step torsion strain histories. The results show that the modified form of the BKZ theory does not account for mechanical aging effects in PMMA. However, the response of mechanically conditioned PMMA to the strain histories tested is described by the modified theory. An interesting result is that the normal stress response in a two-step strain history in which the second step strain is half the first step is predicted to be independent of the duration of the first step and identical to the response in a single-step history at the strain level of the second step. This response is observed experimentally.

711,735
PB81-135246 Not available NTIS
National Bureau of Standards, Washington, DC.
Impregnation and Void Filling of Porous Polymer Tapes with Dielectric Oil.
A. J. Bur. 1979, 7p
Pub. in Proceedings of the Conference on Electrical Insulation and Dielectric Phenomena Held at Pocono-Hershey, White Haven, PA. on Oct 21-25, 1979, Proceedings of the 1979 Annual Report, p382-388 1979.

Keywords: *Tapes, *Plastics, Impregnation, Dielectrics, Voids, Substitutes, Physical properties.

Porous polymer tapes are viewed as alternatives to paper tape presently used in the tape-oil insulation system of high-voltage transmission cables. The author have recently completed a study which defines the physical property criteria for porous polymer tapes and describes the experimental tests for measuring these properties. One of these tests, the degree of void filling test, was developed in the laboratory for the purpose of measuring the amount of void volume in a tape specimen which remains unfilled by the dielectric oil.

711,736
PB81-135485 Not available NTIS
National Bureau of Standards, Washington, DC.
Annealing Induced Changes in Orientation and Mobility in the Non-Crystalline Region of Drawn Linear Polyethylene: A (13)C NMR Study.
D. L. VanderHart. Dec 79, 4p
Pub. in Macromolecules 12, n6 p1232-1235 Nov-Dec 79.

Keywords: *Polyethylene, *Crystal structure, *Nuclear magnetic resonance, Transport properties, Reprints.

A cold drawn linear polyethylene (LPE) sample was subsequently annealed at consecutively higher temperatures between 120C and the melt. A definition based on differences of 13C NMR relaxation times was adopted in order to separate signals from the crystalline component (CC) and the non-crystalline component (NCC). Changes in crystallinity and mobility were noted as a function of the average orientation of chain segments. Annealing reduces the NCC from 0.33 to 0.19 with most of the NCC intensity change appearing in the spectral region of those NCC chain segments which are strongly oriented in the drawing direction.

711,737
PB81-135527 Not available NTIS
National Bureau of Standards, Washington, DC.
Instability Leading to Failure of Polyethylene in Uniaxial Creep,
L. J. Zapas, and J. M. Crissman. Feb 79, 4p
Pub. in Polymer Engineering and Science 19, n2 p104-107 Feb 79.

Keywords: *Polyethylene, *Creep tests, Instability, Molecular weight, Critical point, Mathematical models, Reprints.

Based on a continuum model, a point of instability is predicted for the uniaxial creep of high density polyethylene. From dead load experiments it has been found that the instability occurs for linear polyethylene at around 10-12 percent strain, depending upon molecular weight and molecular weight distribution. It is shown that in the range of applied stresses for which the specimens neck during uniaxial creep, the time required to reach the critical point is related by a constant factor to the time at which the neck appears. A synopsis of theoretical consideration, as well as experimental work in support of this idea, is given.

711,738
PB81-135568 Not available NTIS
National Bureau of Standards, Washington, DC.
Transport Phenomena and Polymer Morphology.
A. Peterlin. 1979, 18p
Pub. in Makromol. Chem., Chem., Suppl. 3, p215-232 1979.

Keywords: *Polymers, *Crystals, *Transport properties, *Mass, Diffusivity, Permeability, Sorption, Plastic deformation, Morphology, Reprints.

The presence of the crystals in the semicrystalline polymer reduces the mass fraction, determines the space distribution and modifies the transport properties of the amorphous component which is responsible for practically all the sorption, diffusion, and permeability. The conventional determination of the diffusion coefficient from the sorption or diffusion transient is strongly affected by the geometry of the sample. The anisotropy of a single amorphous layer of a thickness of less than 10 nm, however, cannot be detected by this method which measures the molecule displacement over about 300 nm.

711,739
PB81-138257 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Degradation and Oxidation of Polystyrene Studied by Factor-Jump Thermogravimetry.
B. Dickens. 1980, 20p
Pub. in Polymer Degradation Stability 2, p249-268 1980.

Keywords: *Polystyrene, *Oxidation, *Thermal degradation, Thermogravimetry, Activation energy, Pyrolysis, Reprints.

Factor-jump thermogravimetry has been used to study the activation energy of polystyrene degrading in a vacuum, in N2 flowing at 4 mm/s and in N2/O2 mixtures.

711,740
PB81-143588 Not available NTIS
National Bureau of Standards, Washington, DC.
Characterization of Polymers Under High Pressure Using Raman Spectroscopy,
J. F. Rabolt, S. Block, and G. J. Piermarini. 1979, 4p
Pub. in Proceedings of the AIRAPT Conference (6th) Held at the University of Colorado, Boulder, CO. on July 25-29, 1977, Paper in High-Pressure Science and Technology, Volume 1. Physical Properties and Material Synthesis, p478-481 1979.

Keywords: *Polymers, *Raman spectroscopy, High pressure tests, Phase transition, Copolymers, *Ethylene/tetrafluoro, *Propylene/hexafluoro, *Poly(ethylene/tetrafluoro).

The high pressure phase of nC20F42, polytetrafluoroethylene (PTFE) and a random copolymer of tetrafluoroethylene and hexafluoropropylene (TFE-HFP) has been investigated using Raman spectroscopy. All of these materials transform to the planar zig zag form (as evidenced by the appearance of the 625/cm band) in the 7-9 Kbar range. It was observed that the peak intensity ratio (PIR) of the 285 to 395/cm bands, taken as a qualitative measure of pressure induced deformation, increased significantly in PTFE in the 15-30 Kbar range. This behavior of the PIR with pressure was markedly different from that observed in nC20F42 and the TFE-HFP copolymer. This variation in PIR in PTFE has been correlated with a change in sample crystallinity. Morphological differences between the three materials studied suggest that the deformation mechanism at high pressures which results in an increase in PTFE crystallinity could be one of pressure induced nucleation or pressure driven crystal thickening.

711,741
PB81-144198 Not available NTIS
National Bureau of Standards, Washington, DC.

Nondestructive Evaluation Method Using Piezoelectric Polymer Transducers and Fourier Transform Vibrational Spectroscopy,
D. H. Reneker, S. Edelman, A. Dereggi, and D. L. Vanderhart. 1979, 13p
Pub. in Proceedings of International Conference on Polymer Processing, the Massachusetts Institute of Technology, Cambridge, MA., August 1977, Paper in Science and Technology of Polymer Processing, p844-856 1979.

Keywords: *Plastics, *Piezoelectricity, *Molecular vibration, Transducers, *Fourier transform spectroscopy.

The normal mode vibrational spectrum of a particular object contains a wealth of information about the mechanical integrity of the object. The nondestructive evaluation of objects by observation of such vibrational spectra is facilitated by the combination of recently developed low mass, high compliance piezoelectric polymer transducers, a synchronized method for exciting the sample, and a small computer capable of making digital Fourier transforms. The sensitivity of this method to mass defects, modulus changes, and mechanical flaws in plastic objects is examined.

711,742
PB81-158651 PC **A05**/MF **A01**
Factory Mutual Research Corp., Norwood, MA.
Physico-Chemical and Combustion/Pyrolysis Properties of Polymeric Materials.
Technical rept.
A. Tewarson. Dec 80, 83p NBS-GCR-80-295
Grant NB79-NADA-0014

Keywords: *Heat resistant plastics, *Flammability testing, Foam, Fire resistant materials, Combustion, Pyrolysis, Polymers, Aromatic compounds.

Data for the physico-chemical and combustion/pyrolysis properties of aromatic and nonaromatic granular and foamed polymeric materials are presented for use in fire modeling as well as for hazard evaluations and basic understanding of fires. The physico-chemical and combustion/pyrolysis properties include chemical formulae, stoichiometric air-to-fuel ratio, net heat of complete combustion, heat required to generate a unit mass of vapors, surface re-radiation loss, surface temperature, combustion efficiency including its convective and radiative components, product yields, light obscuration parameter, flame convective and radiative heat flux to the surface, Spalding's B-number modified for radiation and for combustion efficiency, normalized flame heights, ratio of CO2 concentration to gas temperature above ambient ratio of optical density per unit path length to gas temperature above ambient, and energy required to generate a combustible vapor-air mixture. The dependency of various fire properties such as heat release rate, product generation rates, light obscuration, etc., and fire detection, are analyzed in terms of the fire environment (thermal and over- or under-ventilated) and the properties of the materials.

711,743
PB81-163289 Not available NTIS
National Bureau of Standards, Washington, DC.
Acoustic Emission of Polymers under Tensile Load.
Final rept.
A. Peterlin. 1979, 8p
Pub. in Chapter 2 in Advances in Chemistry Series No. 174, Probing Polymer Structures, p15-23 1979.

Keywords: *Polymers, *Elastic waves, *Tensile strength, Plastic deformation, Acoustic measurement, Polystyrene, Polymethyl methacrylate, Crazing, Reprints, Poly(toluene/vinyl).

The observation of acoustic emission from a crazing polymer depends very much on the plastic deformability of the polymer. The crazes in ductile materials propagate so smoothly by relatively slow plastic deformation at the tip of the craze that the acoustical signal is not strong enough to be unambiguously separated from the high noise level. It is only in very brittle material that the jumpwise craze propagation yields acoustic bursts strong enough to be recorded easily. Such materials are polyvinyltoluene with a strain-to-break of less than 1%, low-molecular-weight polystyrene, and aged poly(methylmethacrylate). For brittle composite material it is better if the components differ greatly in their mechanical properties.

711,744
PB81-169955 Not available NTIS
National Bureau of Standards, Washington, DC.
Low-Temperature Properties of Expanded Polyurethane and Polystyrene.
Final rept.
L. L. Sparks. 1981, 22p
Pub. in Proceedings of the Symposium on Thermal Insulation Performance Held at Tampa, FL., on Oct 23-25, 1978, American Society for Testing and Materials, Special Technical Publication 718, p431-452 1981.

Keywords: *Thermal insulation, *Polystyrene, *Polyurethane resins, Cryogenics, Cellular plastics, Mechanical properties, Thermal properties.

Two materials being used extensively as cryogenic insulations are the expanded plastics polyurethane (PU) and polystyrene (PS). These cellular plastics are excellent thermal insulators with measured values of apparent thermal conductivity at a mean temperature of 112K being 0.013 to 0.016 W/m.K. The effect of aging and conditions of aging are critical factors in determining the ultimate conductivity. The major component of the overall conductivity, gas conductivity, is affected by permeation of gases through the cell walls. The reasonably high strength-to-density ratio for PU and PS at room temperature, 8 to 9 kPa/kg/cu m compared with about 50 for aluminum alloys and about 25 for stainless steels, allows these insulations to be self-supporting and to lend structural support to the system. The large variations found in existing data reflect these complex dependencies. Expected behavior and experimentally determined data are discussed for the following properties: tensile, compressive, and shear strengths and the associated moduli, thermal conductivity, linear thermal expansion, specific heat, and thermal diffusivity. Temperatures below 300 K are considered.

711,745
PB81-179756 Not available NTIS
National Bureau of Standards, Washington, DC.
Fatigue Effects in Poly (Methyl Methacrylate).
Final rept.
R. W. Penn, and G. B. McKenna. 1979, 9p
Pub. in Proceedings of the Meeting on ACS Symposium Series (176th) Held at Miami, FL., on Sep 11-14, 1978, Chapter 23 in Durability of Macromolecular Materials, p331-339 1979.

Keywords: *Polymethyl methacrylate, *Fatigue tests, Failure.

The fatigue failure of polymeric materials is a function of, not only the number of cycles to which the material is subjected, but also of the frequency of test and the waveform of the test (e.g., square wave, sinusoidal, etc.). In this work, the authors have examined the fatigue response of Poly(methyl methacrylate) (PMMA) in the framework of the concept of additive damage. That is, damage which the PMMA experiences as a result of a particular stress history is not recovered, but accumulates to some point in time at which material failure occurs. The applicability of the concept of additivity of damage to failure of PMMA is discussed.

711,746
PB81-187494 Not available NTIS
National Bureau of Standards, Washington, DC.
Viscoelastic Behavior of Poly (Methyl Methacrylate): Prediction of Extensional Response from Torsional Data.
Final rept.
G. B. McKenna, and L. J. Zapas. 1980, 9p
Pub. in Rheology, Applications 3, p299-307 1980.

Keywords: *Polymethyl methacrylate, *Viscoelasticity, Stress relaxation tests, Torsion tests, Reprints, Numerical solution.

Some years ago Rivlin showed that for certain deformations, one can treat isochronal data from single step stress relaxation experiments on viscoelastic materials in the same fashion as if the data were obtained for an elastic material. The authors have conducted single step relaxation experiments on cylinders of PMMA where we measured torque and normal force as functions of time and twist. Using a form for viscoelastic potential functions which is similar to the Valanis-Lande form of the strain energy function for elastic materials, they calculated the response in simple extenstion from our torsion-normal force determined values of W1 and W2. Although the authors obtained good agreement between the calculated and the observed behavior, they could not account fully for the observations of Sternstein and Ho.

711,747
PB81-187825 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Dependence of Young's Modulus and Internal Friction of G-10CR and G-11CR Epoxy Resins.
Final rept.
H. M. Ledbetter, and G. Maerz. Nov 80, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Cryogenics 20, n11 p655-658 Nov 80.

Keywords: *Epoxy resins, Composite materials, Modulus of elasticity, Internal friction, Low temperature tests, Cryogenics, Measurement, Reprints.

Young's moduli of the epoxy-resin matrix material used in NEMA-designation G-10CR and G-11CR fiberglass-cloth-reinforced composites were measured dynamically and semicontinuously between ambient and liquid-nitrogen temperatures. Both materials exhibit regular temperature behaviour, showing large Young's-modulus changes, about 125 and 50%, respectively. Internal friction decreased about 80% during cooling to liquid-nitrogen temperature (76 K). The different thermoelastic coefficients together with different internal friction reflect different internal structures in the two materials.

711,748
PB81-215287 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Polymer Science and Standards Division.
Annual rept. 80
R. K. Eby, M. G. Broadhurst, J. M. Cassel, B. M. Fanconi, I. C. Sanchez, and L. E. Smith. Apr 81, 91p NBSIR-81-2263

Keywords: *Polymers, *Standards, Plastics, Performance evaluation, Dielectric constants, Transport properties, Durability, Dental materials, Medical supplies.

This publication outlines the organization and programs of the Polymer Science and Standards Division of the National Bureau of Standards. It contains summaries of all technical projects in the Division for the 1980 fiscal year.

711,749
PB81-220378 Not available NTIS
National Bureau of Standards, Washington, DC.
Initiator-Accelerator System for Acrylic Resins and Composites.
Final rept.
G. M. Brauer. 1981, 15p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD. Proceedings of the Symposium on Application of Polymers in Dentistry held at Houston, TX., on March 23-28, 1980.
Pub. in Biomedical and Dental Application of Polymers, p395-409 1981.

Keywords: *Acrylic resins, *Composites, *Dental materials, Plastics.

Acrylic resins, because of their desirable esthetics, ease of processing, optical clarity that can duplicate in appearance the oral tissues it replaces, satisfactory mechanical properties and excellent biocompatibility, are the materials of choice wherever plastics have found applications in dental practice. The ready acceptability of these materials is the result of the ease with which they can be converted into their final state even under clinical conditions. In practically all dental applications a liquid monomer-solid mixture is cured by a free radical initiated polymerization that is generated by heat, light, an initiator, or a redox initiator-accelerator system adapted to the constraints imposed by the oral environment.

711,750
PB81-233686 Not available NTIS
National Bureau of Standards, Washington, DC.
Lifetime Behavior of Polyethylene Sheets Under Inflation in the Presence of Stress-Cracking Agent.
Final rept.
J. M. Crissman, and L. J. Zapas. 1979, 7p
Pub. in Proceedings of Symposium Meeting American Chemical Society (178th), Washington, DC., September 10-14, 1979, Org. Coat. Plast. Chem. 40, p475-481 1979.

Keywords: *Polyethylene, *Stress corrosion tests, Pressure, Performance evaluation.

Experiments on the failure of polyethylene sheets under inflation at a constant applied pressure are described. The behavior in air at two different temperatures is compared to that in stress-cracking agent at the same two temperatures for two types of commercial polyethylene having widely different stress-crack resistance. As in uniaxial creep it is found that failure occurs by one of two modes, one necking and cold-drawing or the other crack initiation and growth, depending upon the magnitude of the applied constant pressure. The primary difference between uniaxial creep and the inflation experiment is that in the presence of a stress-cracking agent the mechanism associated with cracking (long times to fail) becomes very much more emphatic under biaxial deformations. Again, as in uniaxial creep, the authors found that the mechanism of failure by cracking can be represented rather well by an empirical relation developed long ago to describe the fracture of inorganic glasses. One interesting result of this work is the observation that, when compared on a relative basis to the behavior in air, the reduction in lifetime resulting from the presence of stress-cracking agent is much greater for the polymer with superior stress-crack resistance, yet this polymer remains superior in overall performance because of its overwhelmingly better behavior in air.

711,751
PB81-236531 Not available NTIS
National Bureau of Standards, Washington, DC.
Static Fatigue of Polyethylene in Uniaxial Creep in the Presence of Stress-Cracking Agents and Solvent.
Final rept.
L. J. Zapas, and J. M. Crissman. 1979, 6p
Pub. in Proceedings of the Symposium Meeting of the American Chemical Socity (178th) held at Washington, DC., on September 10-14, 1979. Org. Coat. Plast. Chem. 40, p469-474 1979.

Keywords: *Polyethylene, *Stress corrosion tests, *Creep rupture strength, Solvents, Failure.

Experiments on the static fatigue in uniaxial creep are described for two commercial polyethylenes having widely different stress-crack resistance. The behavior in air at two different temperatures is compared to that in stress-cracking agent or solvent at the same two temperatures. It is shown that the fracture can be categorized as one of two types depending upon the magnitude of the applied load. At relatively large loads, the specimen experiences an instability which eventually leads to failure by necking and subsequent fracture. At small loads, on the other hand, failure occurs by cracking. The region of applied loads for which the transition takes place from the one failure mode to the other depends strongly upon the chemical structure of the polymer. In the presence of a surface active type of stress-cracking agent only the failure mechanism associated with cracking is influenced, whereas in a solvent which swells the polymer both failure mechanisms are greatly affected. For the mechanism associated with cracking it is found that the curve for time to fail versus applied stress can be represented rather well, both in air and in stress-cracking agent, by an empirical relation determined some three decades ago to describe the fracture of inorganic glasses.

711,752
PB81-239626 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Performance of Plastic Packaging for Hazardous Materials Transportation. Part VI: Mass Loss and Effective Carbon Atom Number Measurement.
Final rept.
J. C. Phillips. Apr 80, 32p NBSIR-80-2131, DOT/MTB/OHMO-80/3
See also PB-298 047.

Keywords: *Hazardous materials, *Polyethylene, *Containers, Plastics, Carbon, Atoms, Permeability, Density(Mass/volume), Mass, Performance evaluation, *Hazardous materials transportation.

This report describes the mass loss through polyethylene bottles of two n-alkyl series (n-alcohols and n-carboxylic esters) and a group of miscellaneous compounds. The experiments were performed at 50C using both low density and high density polyethylene bottles. The backbone chain length, NA, for each series of n-alkyl's was extended to 16 in order to char-

acterize more fully the dependence of loss rate from PE on chain length of permeant. The results suggest that the effective carbon atom number for a given permeant may be determined from a single density resin bottle using the n-alkane series as the standard lading. Once the effective carbon atom number has been determined under chosen conditions, the permeability performance of the permeant for another resin density may be predicted with reasonable accuracy. These results seem to complement the 'permachor' method to minimizing the number of tests required for the determination of the performance of full-scale containers.

711,753
PB82-100298 Not available NTIS
National Bureau of Standards, Washington, DC.
Apparatus for Infrared Measurement of Sorption/Desorption in Strained Polymeric Films.
Final rept.
J. C. Phillips, A. Peterlin, and P. F. Waters. 1981, 14p
Pub. in Jnl. of Polymer Science 19, p789-802 1981.

Keywords: *Polymeric films, *Infrared spectroscopy, *Laboratory equipment, Sorption, Desorption, Design criteria, Performance evaluation, Polyethylene, Reprints.

A new apparatus has been developed for optical measurement of sorption/desorption in transparent polymer films at a given strain or stress. The technique utilizes a chosen infrared absorption frequency of the diffusing vapor in a spectral region where the film has negligible absorption. From the time dependence of the IR absorption at this frequency the sorption/desorption behavior of the film may be determined at any strain or stress. The simultaneous measurement of mechanical relaxation as a function of the amount of sorbed vapor is also possible. The results presented here show the applicability of the apparatus for determining the transport and mechanical properties of a low-density polyethylene film in ethyl acetate vapor at 30C.

711,754
PB82-118381 Not available NTIS
National Bureau of Standards, Washington, DC.
Migration to and from Plastics.
Final rept.
G. A. Senich. Jun 81, 6p
Pub. in CHEMTECH 11, n6 p360-365 Jun 81.

Keywords: *Plastics, *Containers, *Transport properties, *Additives, Gas chromatography, Polyethylene, Packaging, Reprints.

The extent of migration of an impurity or additive from a polymer container into its contents can be estimated from data readily obtained by inverse phase gas chromatography (IGC) experiments. The specific retention volume is used to determine the polymer-migrant interaction parameter which when combined with the solubility of the migrant in the solvent allows calculation of the equilibrium partition coefficient, a direct measure of the fraction of the additive which can be expected to migrate from the container to the product. If the shelf life is short, an equilibrium prediction may greatly exaggerate the degree of migration expected. A value for the diffusion coefficient of the migrant in the polymer can then be obtained from IGC experiments and employed to estimate the degree of migration which will occur over the expected shelf life. Results are given for IGC studies on high density polyethylene with decane and octadecane migrants.

711,755
PB82-139072 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Relationship Between Morphology and Mechanical Properties of Ultra High Molecular Weight Polyethylene.
Annual rept. 9 Dec 79-30 Sep 80.
G. B. McKenna, F. A. Khoury, and J. M. Crissman.
Apr 81, 64p NBSIR-81-2209
Sponsored in part by Food and Drug Administration, Silver Spring, MD. Bureau of Medical Devices.

Keywords: *Polyethylene, *Mechanical properties, *Morphology, Plastics, Molecular weight, Melting points, Crystallinity, Creep tests, Stress relaxation tests, Failure analysis, Stress analysis, Scanning electron microscopy, High molecular weight polymers.

Aspects of the morphology of the constituent particles of the raw ultra high molecular weight polyethylene (UHMWPE) used in this study have been examined using scanning electron microscopy. In addition differential scanning calorimetry has been used to determine the melting point ('413K) and the crystallinity (78%) of the raw polymer. Protocols have been established for the preparation of compression molded sheets of UHMWPE having crystallinities of 50% and 602. A memory of the particulate nature of the raw polymer is retained in the sheets. The following aspects of the mechanical behavior of the molded sheets have been examined: Stress-strain behavior at constant rate of clamp separation, creep and single step stress relaxation in uniaxial extension and failure under both static and sinusoidal loading conditions. The relaxation modulus of the lower density material (quenched) was found to be smaller by a factor of two than that of the higher density material (slow cooled). The short time creep of the quenched UHMWPE was significantly greater than that of the slow cooled polymer; however, the limiting creep strain prior to failure was nearly the same for both materials. Low cycle fatigue data obtained on the slow cooled UHMWPE suggests that it may be possible to characterize the failure behavior of this polymer using a cumulative damage rule. The lifetime of the UHMWPE under zero-tension sinusoidal loading is 6-7 times longer than the lifetime in static (creep) tests in agreement with the cumulative damage rule.

711,756
PB82-160441 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Low Temperature Mechanical Properties of a Polyurethane Foam.
J. M. Arvidson, and L. L. Sparks. Nov 81, 18p
NBSIR-81-1654
Sponsored in part by Gas Research Inst., Chicago, IL.

Keywords: *Polyurethane resins, Mechanical properties, Foam, Low temperature tests, Laboratory equipment, Performance evaluation, Compression tests, Shear strength, Tensile strength.

Polyurethane foam, having a density of 32 kg/cu m, was tested at 295, 111, 76, and 45 K in helium gas. The material properties reported are Young's modulus, proportional limit, yield strength (at 0.2% offset), tensile, shear, and compressive strengths, and elongation (elastic and plastic). To perform these tests, a unique apparatus was developed. This apparatus permits tension, compression, and shear testing of materials at any temperature ranging from 295 to 4 K. Strain is measured with a concentric, overlapping-cylinder capacitance extensometer that is highly sensitive and linear in output.

711,757
PB82-205766 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Low Molecular Weight Leachables from Medical Grade Polymers.
Final rept.
B. F. Howell, S. Chesler, L. Hilpert, and D. J. Reeder.
Apr 82, 36p NBSIR-81-2436
Sponsored in part by Food and Drug Administration, Rockville, MD.

Keywords: *Silicone resins, *Polyurethane resins, *Polyethylene, *Polycarbonate resins, *Leaching, Prosthetic devices, Polymers, Medical equipment, Solvent extraction, Separation, Mammary gland, Chemical analysis, Gas chromatography, Mass spectroscopy, Enzymes, Purification, Hydroxylase/prolyl, Biomaterials.

Four medically important polymeric materials (silicone polymer from mammary prostheses, polyurethane, polyethylene, and polycarbonate) were placed in contact with water for time periods ranging from four hours to seven days. Substances leaching into water were separated by extraction with methylene chloride, or by evaporation of water, and identification of species in the leachate was attempted by a number of analytical techniques, with extensive use of combined gas chromatography/mass spectrometry (GC/MS). Low molecular weight fragments of dimethylsiloxane were identified from mammary prosthesis gel. Spectra are also included for leachate from the other three polymers; identification of these compounds is still in process. Prolyl hydroxylase and tritium-labeled protocollagen substrate were prepared from chick embryos, and an enzyme activity assay system was developed with use of Bio-Rad AG 50W-X8 cation exchange resin. No effect on enzyme activity was seen when silicone gel leachate was added to the assay mixture.

711,758
PB82-210469 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical and Transport Properties of Drawn Crosslinked Low-Density Polyethylene (LDPE).
Final rept.
F. de Candia, R. Russo, V. Vittoria, and A. Peterlin.
1982, 9p
Pub. in Jnl. of Polymer Science Polymer Physics Edition 20, n2 p269-277 1982.

Keywords: *Polyethylene, *Mechanical properties, *Transport properties, Density(Mass/volume), Plastic deformation, Reprints.

The values of drawing dependence of the density rho, axial elastic modulus E, and maximum draw ratio lambda of crosslinked low-density polyethylene (CLPE) rather similar to those obtained with uncrosslinked branched material of similarly low density. Very much the same applies to the equilibrium concentration of sorbed methylene chloride in the amorphous component and the zero-concentration diffusion coefficient D(o). The exponential concentration coefficient gamma(D) however, even at the maximum draw ratio, shows no indication of the rapid increase so characteristic of the completed transformation from the lamellar to the fibrous structure. On the basis of this finding, one can understand the small deviations in the dependence of the mechanical properties between the crosslinked and uncrosslinked branched material. The segments between the crosslinks, much shorter than the free molecules, favor the formation of the interfibrillar tie molecules that limit the drawability of the sample. But since they cannot be extended to the same length as the free molecules, they contribute less to the total fraction of tie molecules per amorphous layer and hence yield a smaller axial elastic modulus.

711,759
PB82-210832 Not available NTIS
National Bureau of Standards, Washington, DC.
Possible Use of Electron Spin Resonance of Polymer Films Containing Leucodyes for Dosimetry.
Final rept.
R. M. Uribe, W. L. McLaughlin, A. Miller, T. S. Dunn, and E. E. Williams. 1981, 6p
Prepared in cooperation with Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Fisica, and Beckton Dickinson Research Center, Research Triangle Park, NC.
Pub. in Proceedings International Meeting (3rd) on Radiation Processing, Tokyo, Japan, Oct 26-30, 1980, paper in Radiation Physics and Chemistry 18, n5-6 p1011-1016 1981.

Keywords: *Polymeric films, *Electron paramagnetic resonance, *Dosimetry, Gamma radiation, Plastics, *Leucodyes, Leucocyanides, Free radicals.

When plastic films containing leucocyanides of triphenylmethane dyes are irradiated with large doses of (60)Co gamma rays, free radicals are formed that are sufficiently stable for analysis at room temperature. It is shown that by separating the electron spin resonance spectrum due to free radicals produced in the polymeric host materials from that of the dye precursor, the number of spins associated with a free radical produced in the substituted triphenyl methyl radical can be determined as a means of dosimetry. Instabilities in the free radical populations are evaluated, and methods of preparing plastic films containing triphenylmethane leucodyanides are described. Not only can dosimetry be achieved at higher doses than are normally used with spectrophotometry of this films, but also information about the radiation chemistry of dye formation can be derived.

711,760
PB82-210964 Not available NTIS
National Bureau of Standards, Washington, DC.
Quality Control for Electron Beam Processing of Polymeric Materials by End-Point Analysis.
Final rept.
E. DeGraff, and W. L. McLaughlin. 1981, 11p
Prepared in cooperation with Columbia Research Corp., Gaithersburg, MD.
Pub. in Proceedings of International Meeting (3rd) on Radiation Processing, Tokyo, Japan, October 26-30, 1980, paper in Radiation Physics and Chemistry 18, n5-6, p975-985 1981.

Keywords: *Plastics, *Ionizing radiation, *Dosimetry, *Electron beams, Melting point, Calibrating, Polyethylene, Solubility, Stress corrosion tests, Mechanical properties, Copolymers, Reprints, Poly(ethylene/tetrafluoro), Ethylene vinyl acetate.

Properties of certain plastics, e.g. polytetrafluorethylene, polyethylene, ethylene vinyl acetate copolymer, can be modified selectively by ionizing radiation. One of the advantages of this treatment over chemical methods is better control of the process and the end-product properties. The most convenient method of dosimetry for monitoring quality control is post-irradiation evaluation of the plastic itself, e.g., melt index and melt point determination. It is shown that by proper calibration in terms of total dose and sufficiently reproducible radiation effects, such product test methods provide convenient and meaningful analyses. Other appropriate standardized analytical methods include stress-crack resistance, stress-strain-to-fracture testing and solubility determination. Standard routine dosimetry over the dose and dose rate ranges of interest confirm that measured product end points can be correlated with calibrated values of absorbed dose in the product within uncertainty limits of the measurements.

711,761
PB82-211426 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Relationship between Morphology and Mechanical Properties of Ultra High Molecular Weight Polyethylene.
Annual rept. 1 Oct 80-30 Sep 81.
J. M. Crissman, F. A. Khoury, and G. B. McKenna.
May 82, 62p NBSIR-82-2493-FDA
Sponsored in part by Food and Drug Administration, Silver Spring, MD. Bureau of Medical Devices.

Keywords: *Polyethylene, *Mechanical properties, *Morphology, Molecular weight, Polymers, Compression molding, Stress relaxation tests, Creep tests, Fatigue(Materials), Crack propagation.

This report describes work done durinf FY 1981 under task 80-81, NBS-FDA/BMD (Bureau of Medical Devices) Interagency Agreement. The report covers the second year of a four year project concerned with the relationship between morphology and mechanical properties of ultra high molecular weight polyethylene (UHMWPE). Various aspects of the UHMWPE being investigated include (1) the establishment of procedures for compression molding (under vacuum) sheets and cylinders of the polymer, (2) the influence of thermal history and molecular weight on the time dependent mechanical behavior such as creep and stress relaxation in both uniaxial extension and compression, (3) dynamic fatigue under conditions of zero-tension sinusoidal loading, (4) environmental stress-crack resistance, and (5) the optical and electron microscopy of sheets of the UHMWPE which have been deformed to varying degrees in uniaxial extension.

711,762
PB82-236068 Not available NTIS
National Bureau of Standards, Washington, DC.
Hydrolytic Degradation of Polyester Polyurethanes Containing Carbodiimides.
Final rept.
D. W. Brown, R. E. Lowry, and L. E. Smith. Apr 82, 6p
Pub. in Macromolecules v15 n2 p453-458 Mar/Apr 82.

Keywords: *Urethanes, *Aging tests(Materials), *Degradation, *Polyester resins, Humidity, Hydrolysis, Reaction kinetics, Acid treatment, Reprints, *Carbodiimides.

Polyester polyurethanes containing a mono-or polycarbodiimide were aged at 100% relative humidity at 85, 55, and 35C. Acid content, A, carbodiimide content, B, and the number average molecular weight, M, were measured at intervals. Results are consistent with the occurrence of three parallel processes: acid catalyzed hydrolysis, reaction of acid with carbodiimide, and uncatalyzed hydrolysis.

711,763
PB82-236753 Not available NTIS
National Bureau of Standards, Washington, DC.
Specific Heat of Thermosetting Resins: Study of Phenolic Resin by Automated Adiabatic Calorimetry and Differential Scanning Calorimetry.
Final rept.
S. S. Chang. 1981, 16p
Pub. in Proceedings of Thermal Analysis in Polymer Characterization, The Eastern Analytical Symposium, New York City, NY, Nov 80, p98-113 1981.

Keywords: *Specific heat, *Phenolic resins, Thermosetting resins, Heat measurement, Reprints.

Specific heat of a sample of resole-type phenolic resin was determined by a fully automated adiabatic calorimeter from 4 to 370 K.

711,764
PB82-242454 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Solar Energy Systems: Standards for Screening Plastic Containment Materials.
E. J. Clark, C. D. Kelly, and W. E. Roberts. Jun 82, 55p NBSIR-82-2533
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Plastics, *Solar energy, *Containers, *Standards, Plastic pipes, Performance evaluation, Storage, Heat transfer, *Energy systems.

Plastic materials are being chosen more frequently for various applications in solar energy systems. Problems with materials in solar systems have indicated a need for standards to assess the performance and durability of the materials. In this investigation laboratory studies have been performed to obtain data needed to develop standards to screen plastic containment materials for the effects of heat and for compatibility with heat transfer fluids. Five absorbers, three plastic pipe materials, and three plastics used in storage applications were included. They were evaluated to assess their durability after exposure to heat aging at 100C and 125C and to chemical compatibility with six heat transfer fluids at room temperature and at 70C. The results of the laboratory tests are presented and a draft standard to screen plastic containment materials is proposed.

711,765
PB83-110015 PC **A03**/MF **A01**
SRI International, Menlo Park, CA.
Polymer Degradation during Combustion.
Annual rept.(Revised).
S. K. Brauman, and I. J. Chen. Sep 82, 41p NBS-GCR-82-403
Contract NB80-NADA-1003

Keywords: *Polystyrene, *Degradation, *Combustion, Gasification, Kinetics, Plasma.

The steady-state degradation and gasification of polystyrene was examined by a driven-rod radiant pyrolysis technique. The impinging radiation flux (5.6 watts/sq cm) produced the same surface regression rate (0.06 cm/min) as was observed for the rods burning in air. The temperature profile in the regressing rod was measured by a fine thermocouple (0.13 mm junction) and the result used in conjunction with isothermal degradation kinetics to predict the rate of polystyrene gasification. The predicted rate is about 65% of the observed rate for the case of a nitrogen atmosphere. Other experiments include an examination of the effect of oxygen in the ambient gas and measurements of the molecular weight distribution in the degraded rods. It is concluded that the degradation mechanism for polystyrene is substantially unchanged in going from isothermal pyrolysis to combustion conditions.

711,766
PB83-134056 Not available NTIS
National Bureau of Standards, Washington, DC.
Review of the Migration of Food-Contact Organotin Stabilizers from Poly(vinyl chloride).
Final rept.
G. A. Senich. Aug 82, 3p
Sponsored in part by Food and Drug Administration, Rockville, MD.
Pub. in Polymer 23, p1385-1387 Aug 82.

Keywords: *Polyvinyl chloride, *Packaging materials, *Tin organic compounds, Stability, Food packaging, Additives, Heat resistant materials, Reprints.

The migration of di-n-octyltin-bis(2-ethylhexyl thioglycolate) and di-n-octyltin maleate polymer, two organotin heat-stabilizers approved by the US Food and Drug Administration, FDA, for poly(vinyl chloride) (PVC) used in food packaging, from PVC into foods and food simulants, is reviewed. The effects of other additives to PVC on organotin migration are considered. Methods of detecting organotins in foods and simulants are discussed. Two areas for further inquiry emerge from the review: (1) whether the intact organotin stabilizers or their degradation products migrate into simulating solvents: and (2) whether the bulk polymer or its surface is the more likely source of the stabilizer available for extraction. A bibliography of recent references is given.

711,767
PB83-200105 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Polymer Science and Standards Division Annual Report 1982.
R. K. Eby, M. G. Broadhurst, G. T. Davis, F. W. Wang, B. M. Fanconi, J. M. Cassel, and I. C. Sanchez. Mar 83, 102p NBSIR-82-2607
See also PB81-215287.

Keywords: *Polymers, *Standards, Plastics, Dental materials, Medical supplies, Performance evaluation, Dielectric constants, Transport properties, Durability, Composite materials, Elastomers, Polymerization.

Although synthetic polymers have been used as materials of technology for only 3 quarters of a century, they have left little of our economy, technology, industry, science & culture untouched. We have moved rapidly into an age in which an overgrowing number of humanity's needs are served by polymers. The volume currently produced exceeds that of steel & forms the basis of industries which add over $90 billion of value by manufacturer (a measure of the relative economic importance of manufacturing among industries) and provides 3.4 million jobs. Recent summaries show that polymers and polymer composite research already accounts for about 47% of the total industrial R&D expenditure for metals, polymers, & inorganic materials. Among these materials, polymers also constitute about 39% of the value added by manufacturer, 49% of the jobs, 45% of the number of scientific publications, and 39% of the ASTM standards.

711,768
PB83-204818 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO.
Tensile, Compressive, and Shear Properties of A 64-kg/m3 Polyurethane Foam at Low Temperatures.
J. M. Arvidson, L. L. Sparks, and C. Guobang. Feb 83, 34p NBSIR-83-1684
Sponsored in part by Gas Research Inst., Chicago, IL.

Keywords: *Polyurethane resins, *Cellular plastics, Compressive properties, Tensile properties, Shear properties, Cryogenics, Modulus of elasticity, Low temperature.

Polyurethane foam, having a density of 64-kg/cu m, was tested at 295, 111, 76, and 4 K. The material properties reported are Young's modulus, proportional limit, yield strength (at 0.2% offset), tensile, shear, and compressive strengths, and elongation (elastic and plastic). To perform these tests, a unique apparatus was developed. This apparatus permits tension, compression, and shear testing of materials at any temperature ranging from 295 to 1.8 K. Strain is measured with a concentric, overlapping-cylinder capacitance extensometer that is highly sensitive and linear in output.

711,769
PB83-216333 PC **A03**/MF **A01**
SRI International, Menlo Park, CA.
Polymer Degradation during Combustion.
Annual rept.
S. K. Brauman, D. P. Matzinger, and R. A. Berg. May 83, 40p NBS-GCR-83-428
Contract NB80-NADA-1003
See also PB83-110015.

Keywords: *Plastics, *Degradation, *Combustion, Polystyrene, Polypropylene, Kinetics, Isothermal treatment, Chemical reaction mechanisms.

This is an extension of previous work on the degradation of polymers in fire-like conditions. A polymer rod (13.5 mm dia.) is made to gasify linearly at rates equal to those in candle-like burning by replacing the flame with a radiant heat flux. It was previously demonstrated that, under these conditions, polystyrene degrades in the same manner as it does in isothermal heating. In the present work, the radiant flux was varied and the resulting steady-state regession rate measured; from the results an effective heat of gasification (472 cal/g) is inferred. Polypropylene was also examined in the present study. In nitrogen its degradation mechanism appears unchanged from that in isothermal heating but

in air the situation is less clear as oxygen is found to influence the rate of degradation substantially.

711,770
PB83-235853 Not available NTIS
National Bureau of Standards, Washington, DC.
Elevated Temperature and Humidity Effects on Urea-Formaldehyde Foam Insulations Observed by Scanning Electron Microscopy.
Final rept.
W. J. Rossiter, D. B. Ballard, and G. A. Sleater. Mar 83, 23p
Sponsored in part by Naval Facilties Engineering Command, Alexandria, VA. Air Force Office of Scientific Research, Bolling AFB, DC. and Office of the Chief of Engineers (Army) Washington, DC.
Pub. in Proceedings Conference Thermal Insulation Materials, and Systems for Energy Conservation in the 80's, Clearwater Beach, FL., Dec 8-11 1981, American Society for Testing and Materials, Special Technical Publication 789, p665-687 March 83.

Keywords: *Foam, *High temperature tests, *Humidity, *Urea formaldehyde resins, Porous materials, Exposure, Shrinkage, Insulation, *Scanning electron microscopy.

Exposure of urea-formaldehyde foam insulation to elevated temperature and relative humidities may result in its deterioration, as evidenced by shrinkage, mass loss, and under severe conditions, by disintegration. This paper describes the results of a scanning electron microscope (SEM) study undertaken to determine the effect on the cellular microstructure of urea-formaldehyde foam insulations from exposure to elevated temperature and relative humidity conditions. Recommendations for a temperature-humidity exposure test for these insulations are given.

711,771
PB83-236406 Not available NTIS
National Bureau of Standards, Washington, DC.
Polymer Science and Standards Division (of the National Bureau of Standards).
Final rept.
R. K. Eby. Nov 82, 4p
See also PB81-215287.
Pub. in Kobunshi/High Polym. Japan 31, p1026-1029 Nov 82.

Keywords: *Polymers, *Standards, *Research, Plastics, Elastomers, Performance evaluation, Utilization, Reprints.

There has been research on polymeric materials at the U.S. National Bureau of Standards since its early days. The background and function of the Polymer Science and Standards Division is reviewed. The present program is discussed in the context of the large, rapidly growing, and economically important U.S. synthetic polymer industry which contributes strongly to national productivity. The program develops concepts, measurements, standards, and data that can be used to insure the reliable performance and effective use of polymers in solving national problems including the growth of industrial productivity, improved national security, more efficient government, improved health, and better materials utilization.

711,772
PB83-240960 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Relationship between Morphology and Mechanical Properties of Ultra High Molecular Weight Polyethylene.
Annual rept. no. 3, 1 Oct 81-30 Sep 82.
J. M. Crissman, L. J. Zapas, and F. A. Khoury. May 83, 40p NBSIR-83-2696
See also PB82-211426.

Keywords: *Polyethylene, *Mechanical properties, *Morphology, Molecular weight, Creep tests, X ray diffraction, Molecular structure, Plastic deformation, Stress analysis.

This report describes work done during FY 1982 under task 80-01, NBS-FDA/BMD (Bureau of Medical Devices) Interagency agreement. The report covers the third year of a four year project concerned with the study of the morphology and mechanical properties of ultra high molecular weight polyethylene (UHMWPE). During FY 1982, the two principle areas of investigation were (1) the examination by x-ray diffraction of morphological changes occurring in UHMWPE while under strain, and (2) the creep and recovery behavior of UHMWPE at small deformations. A new one dimensional constitutive equation is presented which describes very well the creep and recovery behavior of this material at small deformations.

711,773
PB83-261891 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Prediction of the Long Term Stability of Polyester-Based Recording Media.
Annual rept. (2nd) 1 Jan 82-1 Jan 83.
D. W. Brown, R. E. Lowry, and L. E. Smith. Aug 83, 29p NBSIR-83-2750
Sponsored in part by National Archives and Record Service, Washington, DC.

Keywords: *Magnetic tapes, *Photographic films, *Aging tests(Materials), *Polyethylene terephthalate, *Degradation, Stability, Acidity, Mechanical properties, Molecular weight, Temperature, Humidity.

The stability of poly(ethylene terephthalate) is being studied in order to predict its long term behavior as the base for film and magnetic tape. This report contains results of the second year's work. Film base, photographic film, and electrographic film are being aged at several temperatures and relative humidities, RH. Acid contents, mechanical properties, and molecular weight have been measured at intervals. Two films have always failed before the others. The short lived films might well be stored with others, since failure of the former would warn of the approaching failure of the latter. Magnetic tapes are also being aged, primarily to study the binder that holds the magnetic oxide to the substrate.

711,774
PB84-125293 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 88, Number 5, September-October 1983.
Oct 83, 76p
See also PB84-125301 through PB84-125327 and PB83-226704. Library of Congress catalog card no. 63-37059.

Keywords: *Research projects, Polystyrene, Refractivity, Particle size, Fibers, Paper products, Nonwoven fabrics, Chemical bonds, Tensile properties, Atomic clocks, Frequency standards, Time standards, Refractive index.

Contents:
History of atomic clocks;
Size and refractive index determination of single polystyrene spheres;
The force-elongation curve of a thin fibrous network.

711,775
PB84-125319
(Order as PB84-125293, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC.
Size and Refractive Index Determination of Single Polystyrene Spheres.
E. Marx, and G. W. Mulholland. 7 Jun 83, 18p
Included in Jnl. of Research of the National Bureau of Standards, v88 n5 p321-338, Sep-Oct 83.

Keywords: *Polystyrene, *Particle size, Spheres, Light scattering, Mie scattering, Refractivity, *Refractive index.

The intensity of the light scattered from an individual dielectric spheres was measured as a function of the scattering plane. These sets of data were used to determine the radius and refractive index of the spheres by fitting the data to the scattering function obtained from Mie theory. The light was produced by a He-Cd laser (lambda=441.6 nm).

711,776
PB84-135458 PC **A06**/MF **A01**
Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
Transient Horizontal Flame Spread Tests on Cellular Plastics - Experimental Results: Volume 1.
S. Tan. Oct 83, 108p HOME FIRE PROJECT TR-53, NBS-GCR-83-445

Keywords: *Cellular plastics, *Flammability testing, Plastics, Foam, Polystyrene, Polyurethane resins, Combustion products, Heat measurement, Ignition, *Flame spread tests.

Experimental results from measurements of the characteristics of transient horizontal flame spread over cellular plastics under the influence of external radiation are presented. The measurements made include the radial spread of fire, mass pyrolysis rate, radiative and convective power released by fire and the production and consumption of gas species by fire. The efficiency of burning of various plastics is also presented. The plastics used are primarily cellular foams obtained from the PRC materials bank. Volume 1 contains the description and discussion of the experimental procedures and computations. Volumes 2 and 3 contain experimental data and summary of the empirical physical and chemical data reduced from the experimental data, respectively.

711,777
PB84-135946 Not available NTIS
National Bureau of Standards, Washington, DC.
New Test Method for Determining Environmental Stress-Crack Resistance of Ethylene Based Plastics.
Final rept.
J. M. Crissman. 1983, 6p
Pub. in American Society for Testing and Materials, Jnl. of Testing Evaluation 11, n4 p273-278 1983.

Keywords: *Polyethylene, *Stress corrosion tests, Plastics, Samples, Reprints.

A new test method is proposed for the determination of the environmental stress-crack resistance of ethylene based plastics. The method incorporates features of both ASTM D1693 and D2552. The specimen is constrained in a fixed geometry by bending it around a cylindrical metallic form and it is subjected to a constant applied stress. Data are presented which demonstrate that the method can be applied to polyethylenes having widely different molecular weights. Statistical data are presented which indicate that the coefficients of variation which can be expected from the new test are at least comparable to those reported earlier in round robin tests carried out using ASTM D2552. The principle advantage of the proposed new test over both D1693 and D2552 is a substantial savings in the time required to collect the data.

711,778
PB84-142272 PC **A14**/MF **A01**
Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
Transient Horizontal Flame Spread Tests on Cellular Plastics - Experimental Results: Volume 2 and Volume 3.
S. Tan. Oct 83, 312p HOME FIRE PROJECT TR-53, NBS-GCR-83-446
See also PB84-135458.

Keywords: *Cellular plastics, *Flammability testing, Plastics, Ignition, Tables(Data), Graphs(Charts), Pyrolysis, Polystyrene, Foam, Polyurethane resins, *Flame spread tests.

Experimental results from measurements of the characteristics of transient horizontal flame spread over cellular plastics under the influence of external radiation are presented. The experiments involve flame spread from point ignition to radii of about 0.3 m. A single wax match is sued for ignition. The measurements made include the radial spread of fire, mass pyrolysis rate, radiative and convective power released by fire and the production and consumption of gas species by fire. The efficiency of burning of various plastics is also presented. The plastics used are primarily cellular foams obtained from the PRC materials bank. The maximum external radiative flux used is 0.85 w/sq cm. Volume 1 contains the description and discussion of the experimental procedures and computations. Volumes 2 and 3 contain experimental data and summary of the empirical physical and chemical data reduced from the experimental data, respectively.

711,779
PB84-143643 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO.
Tensile, Compressive, and Shear Properties of a 96 kg cubic meter Polyurethane Foam at Low Temperatures.
J. M. Arvidson, R. S. Bell, L. L. Sparks, and C. Guobang. Dec 83, 31p NBSIR-83-1696
Sponsored in part by Gas Research Inst., Chicago, IL.

Keywords: *Polyurethane resins, *Shear properties, *Compressive properties, *Tensile properties, Foam, Elongation, Young's modulus, Procedure.

Polyurethane foam, having a density of 96 kg/cu m, was tested at 295, 111, 76, and 4 K. The material properties reported are Young's modulus, proportional limit, yield strength (at 0.2% offset), tensile, shear, and compressive strengths, and elongation (elastic and plastic). The test apparatus permits tension, compression, and shear testing of materials at any temperature ranging from 295 to 1.8 K.

711,780
PB84-152883 Not available NTIS
National Bureau of Standards, Washington, DC.
Cure Monitoring of Thermosetting Polymers by an Ultrasonic Technique.
Final rept.
D. L. Hunston. 1983, 19p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation 2B p1711-1729 1983.

Keywords: *Polymeric films, *Thermosetting resins, *Ultrasonic tests, *Reaction kinetics, *Curing, Nondestructive testing, Polyvinyl chloride, Wave propagation, Reprints, Monitoring.

An ultrasonic shear wave propagation technique for monitoring the cure of thin films of polymeric materials has been developed and demonstrated with several model polymer systems. The technique measures parameters that are related to the mechanical properties of the polymer film and changes in these parameters can be used to follow curing of the film. When the properties of the polymer are substantially different than those of the quartz or aluminum substrate that is employed in the test, the complex dynamic shear modulus of the film can be determined. Even for experiments where the modulus cannot at present be determined, however, the data can be used to examine cure rates and other important kinetic information. To extend the range of conditions where the shear modulus can be evaluated, initial experiments were performed to examine the relationship between the parameters measured by the technique and the properties of the film for conditions where this relationship is presently unknown. These test suggest that in some cases the relationship may be quite simple.

711,781
PB84-175538 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Mechanical Behavior of Ultra High Molecular Weight Polyethylene.
Annual rept. no. 4, 1 Oct 82-30 Sep 83.
J. M. Crissman. Jan 84, 44p NBSIR-84-2808(FDA)
Sponsored in part by Food and Drug Administration, Silver Spring, MD. Bureau of Medical Devices.

Keywords: *Polyethylene, *Mechanical properties, Molecular weight, Creep tests, Stress analysis, Gamma irradiation, Crack propagation, Plastic deformation.

This report describes work done during FY 1983 under task 80-01, NBS-FDA/BMD (Bureau of Medical Devices) Interagency Agreement. The report covers the fourth year of a four year project concerned with the study of the morphology and mechanical properties of ultra high molecular weight polyethylene (UHMWPE). The work done during FY 1983 dealt principally with the following aspects of the mechanical behavior of UHMWPE, (1) the temperature dependence of the creep and recovery behavior of uniaxial extension and compression at small deformations, (2) longer term (>1 day) creep and recovery behavior of uniaxial extension and compression at small deformations, (3) the effect of gamma-irradiation on the creep and recovery behavior, and (4) the effect of gamma-irradiation on the environmental stress-crack resistance of UHMWPE.

711,782
PB84-192954 PC **A02**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Thermal Conductivity of Glass Fiber/Epoxy Composite Support Bands for Cryogenic Dewards, Phase 2.
Final rept. Jan-Sep 83.
J. G. Hust. Mar 84, 24p NBSIR-84-3003
Contract NASA-S-12425-C

Keywords: *Fiberglass reinforced plastics, *Epoxy resins, *Composite materials, *Thermal conductivity, Dewar flasks, Cryogenics, Samples, Low temperature tests, Mechanical properties, *Support bands.

The thermal conductivities of three specimens of glass fiber/epoxy composites were measured and reported for the temperature range 4 to 300 K. These specimens were fabricated from two cryogenic dewar support bands. An average conductivity curve for the three specimens is presented. The data for the three specimens are within + or - 5% of this average curve. The average curve is compared to a similar curve obtained five years ago in Phase I of this continuing study of composite materials.

711,783
PB84-217280 Not available NTIS
National Bureau of Standards, Washington, DC.
Hydrolytic Degradation of Polyester Polyurethane Foams.
Final rept.
D. W. Brown, R. E. Lowry, and L. E. Smith. Mar 84, 2p
Pub. in Polymer Preprints, v22 n1 p223-224 Mar 81.

Keywords: *Degradation, *Polyurethane resins, *Foam, *Hydrolysis, Fuel tanks, Reaction kinetics, Reprints.

Urethane foams, some new and some from fuel tanks of military aircraft, were hydrolytically degraded until soluble. The acid contents were determined and extrapolated backward in time to get the value before aging. The foams from the fuel tanks were found to have much higher acid contents than the new materials. Since acid is a product of hydrolytic scission of esters, this reaction probably occurs during use, limiting the life of the foam. The condition of foam is existing tanks can be judged quickly by immersing a small piece of foam in dimethyl formamide.

711,784
PB84-218999 Not available NTIS
National Bureau of Standards, Washington, DC.
Migration of Low Molecular Weight Components from Polymers: 1. Methodology and Diffusion of Straight-Chain Ocatadecane in Polyolefins.
Final rept.
S. S. Chang. Feb 84, 8p
Pub. in Polymer 25, p209-217 Feb 84.

Keywords: *Polymers, *Molecular weight, *Transport properties, *Diffusion coefficients, *Olefin resins, *Alkanes, Plastics, Antioxidants, Radioactive isotopes, Reprints, *Tracer techniques, Monomers.

The migration kinetics of monomers, oligomers and antioxidants from several polymers into various solvents at different temperatures has been studied by radioactive tracer techniques. This paper describes in detail the methodology used for observing the migration and for reducing the data. Examples of the migration that follows strictly the Fickian diffusion behavior with a constant diffusion coefficient are shown. These examples were obtained by first saturating the polyolefin test plaques with a labelled oligomer and then extracting the labelled species from the polymer with identical, but unlabelled, oligomer as the solvent. The polyolefin test plaques were made from linear and branched polyethylene, as well as from isotactic polypropylene.

711,785
PB84-219005 Not available NTIS
National Bureau of Standards, Washington, DC.
Fat-Simulating and Accelerating Solvents for Polyolefins and MWD (Molecular Weight Distribution) of Solvent Extracts of Polyethylenes.
Final rept.
S. S. Chang, W. J. Pummer, and J. R. Maurey. Oct 83, 6p
Pub. in Polymer 24, p1267-1272 Oct 83.

Keywords: *Solvent extraction, *Reaction kinetics, *Diffusion coefficients, *Olefin resins, Food packaging, Molecular weight, Vegetable oils, Antioxidants, Reprints, *Tracer techniques.

Migration kinetics of straight-chain oligomers and antioxidants from several polyolefins at different temperatures into various solvents have been studied by radioactive tracer techniques. Anhydrous ethanol appears to be a well suited food-oil or liquid-fat simulant for extracting different types of migrants from polyolefins. Pure and mixed triglycerides are also good oil or fat simulants, but the triglycerides offer no simpler analytical procedures than the use of oil or fat themselves. n-Octanol may also be considered as a reasonable oil or fat simulant; however, its action depends somewhat on the choice of migrants. The molecular weight distributions (MWDs) of the n-heptane and ethanol extracts of polyolefins have been analysed. n-Heptane can not only accelerate the migration of the individual migrant but also remove oligomer species that are slightly soluble or present at low levels in the oil or simulant extracts.

711,786
PB84-219047 Not available NTIS
National Bureau of Standards, Washington, DC.
Thin Plastic Radiochromic Dye Films as Ionizing Radiation Dosimeters.
Final rept.
A. E. Buenfil-Burgos, R. M. Uribe, A. de la Piedad, W. L. McLaughlin, and A. Miller. Sep 83, 8p
Pub. in Radiation Physics and Chemistry, v22 n3-5 p325-332 Sep 83.

Keywords: *Polymeric films, *Dosimeters, *Dyes, *Radiation measuring instruments, Stability, Temperature, Humidity, Plastics, Curing, Storage, Nylon, Reprints, Poly(butyral/vinyl).

Radiochromic dye films were fabricated by casting polyvinyl butyral (PVB) in weakly acidic solution with the leucocyanide of pararosaniline. The effects of temperature, humidity, and period of storage on the response of these films were studied in the range from -5 to 60 C and from 11.8 to 96.6% r.h. for up to four months between irradiation and spectral analysis, and within nominal experimental uncertainty (about 10%), we found that all the radiochromic films studied can be stored for extended periods under steady-state conditions in the temperature range from -5 to 30 C and from 11.8-75.6% r.h. without correction factors for instability, but under extreme conditions of moisture at elevated temperatures the radiochromic image showed a fading effect on storage.

711,787
PB84-221373 Not available NTIS
National Bureau of Standards, Washington, DC.
Resistivity of Ultra-Drawn Polyvinylidene Fluoride.
Final rept.
A. J. Bur. 1982, 6p
Pub. in Proceedings of Electrical Insulation Dielectric Phenomena held at Amherst, Massachusetts on October 17-21, 1982, p156-161 1982.

Keywords: *Electric resistance, X ray analysis, Crystal structure, Drawing, *Vinylidene fluoride polymers.

Resistivity measurements have been carried out on polyvinylidene fluoride (PVDF) samples which were mechanically oriented beyond their natural 4:1 draw ratio up to 7:1. Drawing, which was done at 140 C, was done in two steps: first, a length of unoriented material was drawn until it necked to its natural draw ratio of 4:1; second, the 4:1 sample was reclamped in the testing machine and drawn to the desired draw ratio. For resistivity measurements, the samples were fitted with a guarded electrode in order to avoid the effects of surface and leakage currents. Upon application of a step voltage, current was observed as a function of time using an electrometer. The 10 minute current was used to calculate the sample resistance. The samples were also characterized by x-ray observations from which the proportionate amount of alpha and beta crystalline phases was calculated. The effects of poling on resistivity were also studied. The data showed that resistivity increased with increasing draw ratio, with increased beta phase and with poling.

711,788
PB84-221746 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Oxidation of Poly(Methyl Methacrylate).
Final rept.
T. Hirata, T. Kashiwagi, and J. E. Brown. 1984, 2p
Pub. in Proceedings of the American Chemical Society National Meeting (187th), St. Louis, MO., April 8-13, 1984, p176-177.

Keywords: *Oxidation, *Furniture, *Fire tests, *Pyrolysis, Residential buildings, Molecular weight, Fire resistance plastics, Reaction kinetics, Activation energy, Thermogravimetry, Plastics, *Polymethyl methacrylate, Gel chromatography.

A continual increase in the use of synthetic polymeric materials for interior furnishings significantly modifies fire initiation and growth in buildings. In order to predict an important aspect of these processes, the thermal oxidative stability of poly(methyl methacrylate), PMMA, was investigated by isothermal heating and thermogravimetry (TG) as a first step. The molecular weight and the molecular weight distribution were measured by

gel permeation chromatography for the isothermally degraded PMMA samples. The decrease in PMMA molecular weight as a function of weight loss was much more rapid in air than in nitrogen. The change in degree of polymerization with heating time indicates that PMMA initially decomposes by a first order random chain scission process in air.

711,789
PB84-236389 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Fire Research.
Modeling of Smoldering Combustion Propagation.
T. J. Ohlemiller. Jun 84, 112p NBSIR-84/2895

Keywords: *Combustion, *Flammability testing, *Plastics, Safety, Polyurethane resins, Foam, Chemical reactions, Mathematical models, Reaction kinetics, Cellulosic resins, *Smoldering, Numerical solution.

Smoldering combustion, which can pose a serious life safety hazard, is encountered most frequently in various cellulosic materials and in open-cell polyurethane foams. It is probable that the principal heat source driving this process is heterogeneous oxidation but gas phase reactions may also contribute at higher temperatures. The chemistry involved is best-defined for the case of pure cellulose but even here the details are limited and actual mechanisms poorly understood; simplified kinetic descriptions, typically derived from isothermal or theromoanalytical experiments, currently provide the only tractable inputs for smoldering combustion models. The general problem of smolder wave propagation through a permeable bed of fuel particles is posed; coupled to the chemistry, one must also consider the physical processes of heat and mass transfer on both the particle scale and on the smolder wave scale. The general equations can be somewhat simplified, after non-dimensionalization, for cases where certain dimensionless parameters are very large or very small compared to unity. Existing smolder propagation models are all greatly simplified compared to this general model, neglecting gradients on the particle scale and considering only one-dimensional gradients on the wave scale. These models are reviewed; their contributions and deficiencies are noted.

711,790
PB85-100949 PC **A08**/MF **A01**
National Bureau of Standards, Boulder, CO.
Thermal and Mechanical Properties of Polyurethane Foams and a Survey of Insulating Concretes at Cryogenic Temperatures.
Final rept. Jan 79-Feb 84.
L. L. Sparks, and J. M. Arvidson. Apr 84, 154p
NBSIR-84/3011, GRI-84/0086
Contract GRI-5081-352-0425

Keywords: *Polyurethane resins, *Foam, *Mechanical properties, *Insulation, *Cryogenics, *Thermodynamic properties, Portland cement, Low temperature tests, Liquefied natural gas, Storage.

Thermal and mechanical properties of expanded plastics, foams, are reported. The system studied was rigid, closed cell, CCl3F blown, polyether based polyurethane. The primary temperature range of study was 100 to 300 K; however, several properties were determined to 4 K. The nominal densities of the foams tested were 32, 64, and 96 kg/cu m. Properties reported are thermal conductivity, thermal expansion, strength and moduli in tension and in compression, proportional limit, yield strength, ultimate strength, and shear strength. Physical properties were determined both parallel and perpendicular to the orthogonal axes of the bulk supplies. The gas content of the specimens was determined using a gas chromatograph-mass spectrometer and with a gas displacement pycnometer. Empirical procedures for estimating the temperature dependent thermophysical properties were developed. These procedures are based on the experimental data and utilize the characterization parameters for molar gas concentration, gas pressure, and cell morphology. Regulations affecting vapor dispersion in the area around liquefied natural gas facilities make it attractive to construct dikes and impounding areas out of materials having low thermal conductivities. Several insulating concretes have the general properties required for such applications. Screening tests were done to determine the thermal conductivity, modulus of rupture, and the compressive strength of several polyester based materials with glass bead or perlite aggregate and of portland cement based materials with vermiculite or polystyrene aggregate. A bibliography resulting from an extensive literature survey of lightweight concretes is presented. Seven of the references which were particularly applicable are presented in annotated form.

711,791
PB85-104636 Not available NTIS
National Bureau of Standards, Washington, DC.
Technique for Determining the Polarization Distribution in Thin Polymer Electrets Using Periodic Heating.
Final rept.
S. B. Lang, and D. K. Das-Gupta. 1981, 4p
Pub. in Ferroelectrics 39, Nos. 1-4 p1249-1252 1981.

Keywords: *Electrets, *Polymeric films, *Polarization(Charge separation), Pyroelectricity, Least squares method, Ferroelectric materials, Plastics, Reprints, *Vinylidene fluoride polymers.

The variation in the polarization distribution through the thickness of a polymer electret is determined by heating each electrode of the sample with a laser beam which is modulated at various frequencies between 0.1 and 100 kHz. The periodic heating induces temperature waves which are attenuated exponentially as a function of both depth in the sample and frequency of modulation. The resulting 'thermal probe' heats regions having different polarizations and produces an AC pyroelectric current. A linear least-squares analysis of the experimental current-frequency data gives the polarization distribution.

711,792
PB85-107340 Not available NTIS
National Bureau of Standards, Washington, DC.
Blister Test for Adhesion of Polymer Films to SiO2.
Final rept.
J. A. Hinkley. 1983, 12p
Pub. in Jnl. of Adhesion 16, p115-126 1983.

Keywords: *Polymeric films, *Silicon dioxide, *Adhesion, Polystyrene, Polymethyl methacrylate, Substrates, Blistering, Reprints.

Films of polystyrene or polymethyl methacrylate were cast on oxidized silicon substrates, then detached by the application of gas or water pressure from the back side of the film through a hole in the substrate. Critical detachment pressures showed good repeatability and could be used to calculate the work of adhesion. For polystyrene on a hydrophilic silica in the presence of water, the apparent work of adhesion is 78 mJ/sq m. Other polymer/substrate combinations gave meaningful varisions in detachment pressure.

711,793
PB85-110179 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Thermal Analysis in the Lifetime Prediction of Polymers.
Final rept.
J. H. Flynn. 1981, 4p
Pub. in Proceedings of European Symposium Thermal Analysis (2nd), University of Aberdeen, United Kingdom, September 1-4, 1981, p223-226.

Keywords: *Polymers, *Thermal analysis, *Aging tests(Materials), *Life(Durability), Stability, Plastics, Polymethyl methacrylate, Degradation, Thermogravimetry.

The role of thermal analytical techniques in the development of accelerated aging methods for the prediction of service lifetime limits of polymeric materials is critically examined. The use of Arrhenius parameters for extrapolation over a wide temperature range in which the polymer may pass through phase changes, ceiling temperatures, and other changes in the mechanism of degradation warrants considerable skepticism. Techniques for obtaining high precision and testing for changes in mechanism are illustrated for several polymers.

711,794
PB85-140440 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mechanical Properties of Some Fiber Reinforced Polymer Composites After Implantation as Fracture Fixation Plates.
Final rept.
G. B. McKenna, G. W. Bradley, H. K. Dunn, and W. O. Statton. 1980, 4p
Pub. in Biomaterials 1, n4 p189-192 1980.

Keywords: *Composite materials, *Reinforced plastics, *Mechanical properties, Medical supplies, Fiberglass reinforced plastics, Polysulfone, Reprints, *Biomaterials.

Graphite/polysulfone and glass/epoxy composite materials were implanted on canine femora for 16 weeks and 12 months. The 16 week study used osteotomized femora, the 12 month study used intact femora. The plates were harvested and tested in four point bending. Strength and stiffnesses were compared with controls. It was found that neither the glass/epoxy nor the graphite/polysulfone showed loss of strength or stiffness after 16 weeks. In the 12 month study, however, both systems showed a loss of strength and the graphite/polysulfone showed a considerable loss in stiffness.

711,795
PB85-160133 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Prediction of the Long Term Stability of Polyester-Based Recording Media.
Progress rept. Aug 83-Dec 84.
D. W. Brown, R. E. Lowry, and L. E. Smith. Dec 84, 50p NBSIR-84/2988
See also PB83-172668. Sponsored by National Archives and Records Service, Washington, DC.

Keywords: *Aging tests(Materials), *Polymeric films, *Magnetic tapes, *Adhesives, *Binders(Materials), Humidity, Storage, Archives, Infrared spectroscopy, Polyethylene terephthalate, Hydrolysis, Stability.

Aging studies with poly(ethylene terephthalate) film base indicate the lifetime is equal to about 1000 years if the material is stored at 20-25C and 50% relative humidity. Concentration changes of acid and alcohol groups that occur as a result of aging have been measured by infrared analysis. Rate constants calculated by this method agree reasonably well with those calculated from acid contents determined by titration. Crosslinked polyester polyurethanes were prepared as models of the binder of magnetic tape. Aging studies with these materials indicate that they hydrolyze more slowly than ordinary polyester polyurethanes. Samples aged at 85C at 100, 50, and 25% relative humidity eventually deteriorated greatly in a physical sense. Magnetic tapes were aged and measurements made of the sol content of the binder and its adhesion to the polyester base. The latter quantity appears to be a more valuable indicator of tape condition than sol content. Values of binder adhesion of six brands of magnetic tape initially varied between 800 and 35 N/m(or g/cm). Binder adhesion in aged tapes was less the higher the temperature and humidity of aging. A tape transport had difficulty processing tape with values of binder adhesion as low as 10 N/m. There was no problem at 35 N/m. It is anticipated that the lifetime of magnetic tapes can be predicted by measurements of binder adhesion.

711,796
PB85-183200 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Performance of the Ohio State University Rate of Heat Release Apparatus Using Polymethylmethacrylate and Gaseous Fuels.
Final rept.
V. Babrauskas. 1982, 12p
Pub. in Fire Safety Jnl. 5, n1 p9-20 1982.

Keywords: *Polymethyl methacrylate, *Laboratory equipment, *Fire tests, *Calorimeters, Performance evaluation, Plastics, Burning rate, Heat of combustion, Reprints.

Tests with several gases and with horizontal specimens of polymethylmethacrylate (PMMA) plastic were performed in the Ohio State University (OSU) apparatus using two different techniques: (1) standard compensated thermopile measurement and (2) oxygen consumption. Results indicate that the combustion enthalpy is measured substantially completely with the oxygen consumption technique but that for the materials tested a varying 20 to 30 percent loss is seen with the standard method when the calibration is based on methane. Theoretical analysis and diagnostic irradiance and temperature measurements show this to be attributable to the fact that specimen flames impinge upon and heat up portions of the apparatus.

711,797
PB85-187367 Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Thermal and Mechanical Properties of Polyurethane Foams at Cryogenic Temperatures.
Final rept.
L. L. Sparks, and J. M. Arvidson. 1984, 14p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Proceedings of Society of the Plastics Industry (SPI) 28th Annual Technical/Marketing Conference, San Antonio, TX, November 5-7, 1984, p273-286.

Keywords: *Polyurethane resins, *Foam, *Thermal properties, *Mechanical properties, *Insulation, Cryogenics, Physical properties, Gas chromatography, Mass spectroscopy, Thermal expansion, *Expanded plastics.

Expanded plastics are used extensively for thermal insulation in cryogenic fuel facilities. Properties determined were thermal conductivity, thermal expansion, strength and moduli in compression and in tension, proportional limit, yield strength, ultimate strength, and shear strength. Physical properties were determined both parallel and perpendicular to the direction of foam rise. The gas content of the specimens was determined using a gas chromatograph-mass spectrometer, and the cell morphology was studied optically. Empirical procedures for estimating the temperature dependent thermophysical properties are discussed. These procedures utilize the characterization parameters for molar gas concentration and cell morphology.

711,799
PB85-205334 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Role of Interlaboratory Test Programs in Quality Assurance.
Final rept.
J. D. Barnes. 1985, 18p
Pub. in American Society for Testing and Materials Special Technical Publication 846, p31-48 1985.

Keywords: *Quality assurance, *Plastics, *Tests, Standards, Production methods, Reprints.

A program for assuring the quality of products made from plastics is only as valid as the test methodology that supports it. Test methods can be characterized as to their repeatability and reproducibility. Both of these measures describe the level of precision, or agreement among test results, obtained when a test method is used to characterize a product, be it raw material or a finished part. ASTM requires that each test method in the ASTM Book of Standards be provided with a statement of precision and accuracy. This paper describes some recent efforts within Committee D20 on Plastics to assess the precision of two test methods. The results are analyzed using ASTM Practice for Conducting an Interlaboratory Test Program to Determine the Precision of a Test Methods (E691). The implications of the measured precision of the test methods for their use in quality assurance activities are described.

711,799
PB85-222289 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Solar Type Photolytic and Thermal Degradation of Plates of Polymethyl Methacrylate.
Final rept.
B. Dickens, J. Martin, and D. Waksman. 1983, 2p
Pub. in Polymer Preprints, American Chemical Society, Division of Polymer Chemistry 24, n2 p84-85 1983.

Keywords: *Materials tests, *Polymethyl methacrylate, *Solar energy, *Thermal degradation, *Plates(Structural members), *Photolysis, Photochemical reactions, Oxidation, Polymerization, Temperature, Molecular structure, Photoplasticity, Plastics, Polymeric films, Reprints, Polymer chains, Chemical reaction mechanisms.

Specimens of 1.5 mm thick absorber-free PMMA containing about 1/2% monomer have been photolytically degraded in air at 50, 85 and 115C and thermally degraded in air at 115 and 125C. A simulated solar spectral range was used. Degradation was followed by GPC determinations of molecular weight as a function of depth in the specimen. The results show increased photo-degradation at the plate edges (back and front) over that occuring in the centers of the plates, and a rapidly attained constant amount of degradation for thermal degradation. The thermal degradation is ascribed to weak links, perhaps inchain peroxides introduced during polymerization. The products of photo-oxidation absorb the shorter (300-320 nm) radiation significantly and progressively screen the remainders of the plate as degradation proceeds. Degradation mechanisms are proposed.

711,800
PB85-222388 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Thermal and Oxidative Degradation of Poly(methyl methacrylate): Molecular Weight.
Final rept.
T. Kashiwagi, T. Hirata, and J. E. Brown. Feb 85, 8p
Pub. in Macromolecules 18, n2 p131-138 Feb 85.

Keywords: *Polymethyl methacrylate, *Molecular weight, *Thermal degradation, *Oxidation tests, *Thermal analysis, Polymerization, Reaction kinetics, Reprints, *Chemical reaction mechanisms, *Thermal oxidation.

The mechanisms of thermal degradation and thermal oxidation of polymethylmethacrylate (PMMA) were studied by measuring the molecular weight of rapidly quenched samples thermally degraded in nitrogen and air in the range of temperatures between 200C and 325C. Results show that thermal oxidation reduces the degree of polymerization much faster than does thermal degradation. Random scission is the initiation step for both thermal degradation and oxidative degradation.

711,801
PB85-230001 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Superposition of Small Strains on Large Deformations as a Probe of Nonlinear Response in Polymers.
Final rept.
G. B. McKenna, and L. J. Zapas. 1985, 4p
Pub. in Proceedings of the SPE Annual Technical Conference and Exhibition (43rd), ANTEC 85, Plastics 85, p582-585 1985.

Keywords: *Plastic deformation, *Polyisobutylene, *Polymethyl methacrylate, *Strain measurement, *Mechanical tests, *Aging tests(Materials), Viscoelasticity, Solutions, Glass, Polymers, Nonlinear systems, *BKZ fluids, BKZ theory.

The incremental moduli, delta G(+), for a concentrated solution of polyisobutylene (PIB) and for a PMMA glass have been determined from step shear experiments in which a small deformation, delta gamma, was superimposed upon a large deformation, gamma(sub 1). Delta G(+) for both systems was found to decrease with increasing gamma, and to increase with time, t(sub e), after the imposition of the large deformation. The results for the PIB are well described by the nonlinear constitutive equation of the BKZ elastic fluid theory. However, the polymer glass shows less nonlinearity than predicted by the BKZ theory. The results are used to show the ambiguity of molecular interpretations from these types of experiments.

711,802
PB85-230829 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Creep and Stress-Relaxation Behavior of Ultra High Molecular Weight Polyethylene in Uniaxial Extension and Compression.
Final rept.
J. M. Crissman, G. B. McKenna, and F. Khoury.
1982, 5p
Sponsored by Society of Plastic Engineers, Brookfield Center, CT.
Pub. in Proceedings of ANTEC/82, Annual Technical Conference and Exhibition of the Society of Plastics Engineers (40th): Plastics - Meeting Challenges of the Future, San Francisco, California, May 10-13, 1982, p55-58.

Keywords: *Molecular relaxation, *Creep tests, *Stress relaxation tests, *Polyethylene, *Compression tests, Molecular weight, Morphology, Mechanical properties, Plastics, Cold flow.

The manuscript represents the text of a paper which will be presented at the 40th Annual ANTEC sponsored by the Society of Plastics Engineers. The work described in the abstract is concerned with a study of the relationship of morphology to the mechanical behavior of ultra high molecular weight polyethylene (UHMWPE) used in the manufacture of orthopedic protheses, and it is being done under contract with the Food and Drug Administration, Bureau of Medical Devices. Both the morphology and mechanical behavior have been studied for samples of UHMWPE prepared under widely different processing conditions. Two results of significance are (1) that in uniaxial extension deformation of the material does not occur uniformly on a microscopic scale, rather it reflects the particulate nature of the raw polymer powder, and (2) that small changes in the crystallinity of the material can significantly alter the creep and stress-relaxation behavior. It is also shown that the environmental stress-crack resistance of UHMWPE is highly dependent upon the thermal history given compression molded samples.

711,803
PB86-111788 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD.
Study of Oxygen Effects on Nonflaming Transient Gasification of PMMA and PE during Thermal Irradiation.
Final rept.
T. Kashiwagi, and T. J. Ohlemiller. 1982, 9p
Sponsored by Combustion Inst., Pittsburgh, PA.
Pub. in Proceedings of Symposium on Combustion (19th), Haifa, Israel, August 8-13, 1982, p815-823.

Keywords: *Oxygen, *Polymethyl methacrylate, *Polyethylene, *Gasification, *Thermal degradation, *Surface chemistry, Pyrolysis, Oxidation, Nitrogen, Mixture, *Low density polyethylene.

The effects of gas phase oxygen on the rate of gasification and surface temperature history of large samples of PMMA and low density PE were investigated under transient, nonflaming heating by thermal radiation. Four different ambient gas mixtures, nitrogen, 10% O2/90% N2, 20% O2/80% N2, and 40% O2/60% N2, were used. Two different radiant fluxes, 1.7 and 4.0 W/sq cm, were used. For PMMA, large bubbles are formed in the hottest, near-surface layer in a nitrogen environment; these bubbles are smaller and more frequent in oxygen-containing environments. An increase in oxygen concentration significantly decreases the surface temperature of PMMA and even more significantly increases that with PE.

711,804
PB86-113644 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Deformation and Failure of Ultra High Molecular Weight Polyethylene.
Final rept.
G. B. McKenna, J. M. Crissman, and F. Khoury.
1981, 3p
Sponsored by Food and Drug Administration, Silver Spring, MD. Bureau of Medical Devices.
Pub. in Proceedings of the Society of Plastics Engineers Annual Technical Conference and Exhibition (39th) on Plastics - Creating Value Through Innovation, Boston, MA., May 4-7, 1981, p82-84.

Keywords: *Polyethylene, *Deformation, *Failure analysis, Molecular weight, Stress relaxation, Creep tests, Plastics.

In this paper the authors report results from a study of the effects of morphology/processing on the time dependent mechanical behavior of UHMWPE. To date, the creep and stress relaxation behaviors in uniaxial extension have been examined for compression molded sheets which have been either slowly cooled or quenched from the melt. In addition, results are reported for the failure behavior in constant load (creep), and sinusoidal loading (fatigue) conditions for the polymer which has been slowly cooled from the melt. At the same time the morphologies of both the raw polymer and compression molded sheets have been examined.

711,805
PB86-130150 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Small-Angle Neutron-Scattering of Partially Segregated Blends of Polyethylene and Deuteropolyethylene.
Final rept.
W. Wu, and G. D. Wignall. 1985, 6p
Pub. in Polymer 26, n5 p661-666 1985.

Keywords: *Polyethylene, *Deuterium compounds, Melting, Crystallization, Neutron scattering, Plastic de-

formation, Comparison, Sampling, Molecular weight, Substitutes, Neutron scattering, Temperature, Mathematical models, Reprints, *Small angle scattering, Chemical reaction mechanisms.

In previous paper, polyethylene (PEH) blended with 4.3 vol % deuterated polyethylene (PED) was annealed and plastically deformed at different temperatures. The most prominent change resulting from the deformation is a significant reduction in the apparent molecular weight measured from the extrapolated small-angle neutron scattering (SANS) data. The model adopted in the data interpretation was based on a heterogeneous distribution of the centers of mass of the labeled (PED) chains which form a two phase system of enriched and depleted regions described by a Debye like correlation function. A comparison between this model and alternative approaches based on the correlation network and random phase approximation will be delineated. The results from these models lead to the conclusion that for typical melt crystallized samples the centers of mass of the labeled chains are only slightly perturbed from a random distribution. Plastic deformation of the blends tends to lessen the degree of segregation of the PED molecules and the results suggest that a portion of the specimen must undergo a melting and recrystallization mechanism during deformation.

711,806
PB86-133501 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Thermodynamic Properties and Glass-Transition of Polystyrene.
Final rept.
S. S. Chang. 1984, 18p
Pub. in Jnl. of Polymer Science-Polymer Symposia Edition, n71 p59-76 1984.

Keywords: *Polystyrene, *Thermodynamic properties, *Glass transition temperature, Specific heat, Molecular weight, Heat capacity, Reprints, Standard reference material.

Heat capacity of a narrows molecular weight distribution polystyrene, National Bureau of Standards-Standard Reference Material 1478, has been determined by a fully automated adiabatic calorimeter from 5 to 380 k for the sample subjected to different thermal history. The number-average molecular weight of this sample is 35,800 and the dispersity in the molecular weights, M(sup w):(M sup n) is 1.045. The heat capacity of the glass and of the liquid of this material are found to be within 0.5% of other atactic polystyrenes over most of the temperature range studied.

711,807
PB86-136769 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Thermal and Photolytic Degradation of Plates of Poly(methyl methacrylate) Containing Monomer.
Final rept.
B. Dickens, J. W. Martin, and D. Waksman. 1984, 10p
Pub. in Polymer 25, n5 p706-715 1984.

Keywords: *Polymethyl methacrylate, *Degradation, *Thermal analysis, Oxidation, Photochemical reactions, Plates(Structural members), Temperature, Reprints, Monomers, Chemical reaction mechanisms.

Specimens of 1.5 mm thick absorber-free PMMA containing about 0.5 percent monomer have been photolytically degraded in air at 50, 85, and 115 C and thermally degraded in air at 115 and 125 C. Specimens were exposed to a simulated solar spectral range. Degradation was followed by GPC determinations of molecular weight as a function of depth in the specimens. The results show increased photo-degradation at the plate edges (back and front) over that occurring in the centers, and a rapidly attained constant amount of degradation for thermal degradation. The effect of temperature is mostly to decrease the importance of the cage effect and to allow the initial radicals formed to diffuse away from one another. The products of photo-oxidation absorb the shorter (300 to 330 micrometers radiation significantly and progressively screen the remainder of the plate as degradation proceeds. Degradation mechanisms are proposed.

711,808
PB86-160769 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Response of Radiochromic Film Dosimeters to Gamma Rays in Different Atmospheres.
Final rept.
W. L. McLaughlin, J. C. Humphreys, and C. Wenxiu. 1985, 13p
Pub. in Radiation Physics and Chemistry 25, n4-6 p793-805 1985.

Keywords: *Polymer films, *Plastics, *Dosimetry, *Radiation damage, *Gamma rays, Polystyrene, Polyvinyl chloride, Nylon, Irradiation, Stability, Reprints.

The high-dose gamma ray response (1000-500,000 Gy) of radiochromic film dosimeters, with ten kinds of plastic matrices (polychlorostyrene containing 1 or 25% Cl, polybromostyrene containing 2 or 43% Br, nylon, polyvinyl chloride, cellulose triacetate, and an aromatic polyamide) were investigated when irradiated under certain conditions in vacuum and in different atmospheres (air, oxygen, nitrogen, and nitrous oxide). In addition, the stability of the films was studied for storage periods up to one month after irradiation under these conditions. The responses and stabilities of the polyhalostyrene and nylon films were only slightly affected by the different atmospheres of irradiation, but there were marked differences of response for the other film types. Emphasis must be given to differences in atmospheric conditions encountered by dosimeters in practical industrial situations, which may cause marked differences in ultimate response factors.

711,809
PB86-160777 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Radiochromic Dye Dosimetry Using Triphenylmethane Leucocyanides in Nylon or Polyvinyl Butyral.
Final rept.
W. L. McLaughlin, and J. C. Humphreys. 1984, 28p
Pub. in Proceedings of High Dose Standardization and Intercomparison for Industrial Radiation Processing, Munich, Germany, November 8-11, 1983, p209-236 1984.

Keywords: *Polymer films, *Dosimetry, *Cobalt, *Nylon, Gamma radiation, Temperature, Vacuum environment, Stability, Humidity, Temperature, *Poly(butyral/vinyl), *Radiochromic dye dosimetry.

The use of commercially-available radiochromic plastic films (nylon or polyvinylbutyral) containing the leucocyanide of hexa (hydroxyethyl) pararosaniline is well established in radiation processing dosimetry (dose range: (10-100,000 Gy), especially for (60)Co gamma-ray applications. These thin-film systems when analyzed by spectrophotometry provide a convenient and routine means of dose assessment and dose-distribution mapping, as long as they are properly calibrated in standard gamma-ray fields and as long as suitable corrections are made for systematic error. In the present work, the following contributions to uncertainty in making absorbed dose evaluations with radiochromic film dosimeters were studied: variations in absorbed dose rate, photon energy, temperature, relative humidity, vacuum, and presence of gases other than air (oxygen, nitrogen, nitrous oxide) during irradiation and during storage. These influences on radiochromic dosimeter response and stability have been studied in detail experimentally, and suggestions are made for minimizing such uncertainties in practice.

711,810
PB86-160785 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Plastic Film Materials for Dosimetry of Very Large Absorbed Doses.
Final rept.
W. L. McLaughlin, A. Miller, F. Abdel-Rahim, and T. Preisinger. 1985, 20p
Pub. in Radiation Physics and Chemistry 25, n4-6 p729-748 1985.

Keywords: *Polymer films, *Plastics, *Radiation damage, *Dosimetry, Dosage, Absorption, Dyeing, Polyethylene terephthalate, Polyethylene, Polyvinyl chloride, Polystyrene, Reprints, Vinylidene fluoride resins.

Most plastic films have limited response ranges for dosimetry because of radiation-induced brittleness, degradation, or saturation of the signal used for analysis (e.g. spectrophotometry) at high doses. There are, however, a few types of thin plastic films showing linearity of response even up to doses as high as 2,000,000 Gy (200 Mrad) without severe loss of mechanical properties. Among many candidate film types tested, those showing such resistance to radiation damage and continued response at such high doses are polyethylene terephthalate, high-density polyethylene, dyed polyvinylchloride, polystyrene, dyed and undyed polyhalostyrenes, dyed aromatic polyamides, and polyvinylidene fluoride. Although most of these systems have fairly stable absorption spectra after irradiation, tests of dependence on dose rate and on temperature during irradiation show that only polystyrene and some of the polyhalostyrenes have essentially rate-indepent and moderately temperature-dependent responses to such large doses of ionizing radiation. While radiation-induced optical absorption in the ultraviolet for polystyrene is unstable following irradiation, thus leading to an intrinsic low-intensity rate dependence, the dyed polychlorostyrenes show essentially the same response to radiation-processing gamma-ray fields and to very high-intensity electron beams, and a relatively stable absorption spectrum at wavelengths for dosimetry analysis in the visible spectral region of about 430 nm.

711,811
PB86-183605 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Shielding Effectiveness Measurements of Plastics.
J. W. Adams, and E. J. Vanzura. Jan 86, 33p NBSIR-85/3035

Keywords: *Plastics, *Electromagnetic shielding, Effectiveness, Measurement.

Measurement of shielding effectiveness (SE) of plastic materials may give serious problems due to the insulating nature of many plastics. A method of making these measurements using a flanged coaxial holder overcomes these limitations.

711,812
PB86-186681 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Generation of Hydrogen Cyanide from Flexible Polyurethane Foam Decomposed Under Different Combustion Conditions.
Final rept.
B. C. Levin, M. Paabo, M. L. Fultz, and C. S. Bailey. 1985, 10p
Pub. in Fire and Materials 9, n3 p125-134 1985.

Keywords: *Polyurethane resins, *Hydrogen cyanide, *Combustion products, Flammability testing, Fire resistant materials, Ignition, Decomposition, Chemical analysis, Chars, Reprints.

Experimental thermal conditions conducive to the production of high levels of hydrogen cyanide (HCN) from flexible polyurethane foam were determined. In these experiments the material was exposed to relatively low-temperature non-flaming oxidative conditions for a short time period, during which a char was formed. Further heating of the char to temperatures above 500 deg C generated the increased HCN levels. Upon exposure to the same two-step decomposition process, a fire-retarded flexible polyurethane foam produced twice as much char and twice as much HCN.

711,813
PB86-190667 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Influence of Strain Deformation on the Solubility of Ethyl Acetate Vapor in Poly(vinylidene fluoride).
Final rept.
J. C. Phillips, A. Peterlin, and P. F. Waters. 1984, 7p
Pub. in Jnl. of Polymer Science, Polymer Physics Edition 22, n10 p1719-1725 1984.

Keywords: *Plastic deformation, *Solubility, *Ethyl acetate, *Vinylidene fluoride polymers, Deformation, Strains, Plastic flow, Transport properties, Vinyl plastics, Reprints.

The degree to which a polymer film develops plastic flow depends largely on the total strain epsilon and the elongation time t sub h. The magnitude and the time dependency of the elastic component epsilon sub e of the total deformation are controlling factors, respectively, in the solubility and diffusion processes. The plastic deformation epsilon sub p seems not to contribute to the transport properties. The non-linearity in sol-

ubility due to epsilon may be conveniently handled. In the study, the solubility of Ethyl Acetate vapor in Polyvinylidene Fluoride was determined as a function of pressure and total elongation at 30 deg C. These results tend to indicate that the strain magnitude and time dependency of the component deformations play an important role in transport behavior.

711,814
PB86-191426 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Creep and Recovery Behavior of Ultra-High Molecular Weight Polyethylene in the Region of Small Uniaxial Deformations.
Final rept.
L. J. Zapas, and J. M. Crissman. 1984, 6p
Pub. in Polymer 25, n1 p57-62 1984.

Keywords: *Polyethylene, *Creep properties, *Stress relaxation, *Viscoplasticity, Constitutive equations, Recovery, Reprints, Stress-strain relationships.

The creep and recovery behavior of an ultra high molecular weight polyethylene (UHMWPE) has been studied in the region of small uniaxial deformations. At deformations as small as .0005 the stress-strain behavior is non-linear and the recovery cannot be described by a theory of fading memory. A new one dimensional constitutive relation is presented which describes quantitatively the multistep creep and recovery behavior of the material in the case where the specimens were not mechanically preconditioned. The multistep in strain stress relaxation behavior of the UHMWPE has also been investigated for the case in which the second step in strain is approximately half the magnitude of the first step. Calculations of the strain necessary in order to give the observed stress in a two step stress-relaxation experiment have been made assuming that the stress-relaxation experiment can be represented by a series of multistep creep experiments where in each step the stress is adjusted so as to maintain a constant deformation.

711,815
PB86-191459 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Aspects of the Characterization of Ultra-High Molecular Weight Polyethylene.
Final rept.
H. L. Wagner, and J. G. Dillon. 1984, 5p
Pub. in Polym. Mater. Sci. Eng. 50, p53-57 1984.

Keywords: *Polyethylene, *Molecular weight, Chemical properties, Viscosity, Transport properties, Reprints, Characterization.

The measurement of molecular weight and molecular weight distribution of ultra high molecular weight polyethylene (UHMWPE) is essential for specification and control. However, there are many problems with conventional characterization techniques such as dilute solution viscosity, light scattering, and size exclusion chromatography (SEC or GPC). This is further complicated by its poor solubility and sensitivity to degradation. The viscosity is shear rate dependent, requiring that measurements be made in a low shear rate viscometer. The exclusion limit of presently available commercial SEC columns appears to be too low for UHMWPE, and in addition the polymer may undergo degradation during the run. Therefore, to determine the molecular weight distribution, a sample of commercial UHMWPE was subjected to a hydrodynamically induced crystallization to yield 10 fractions with limiting viscosity numbers ranging from 9 to 50 dL/g. Assuming that the Mark-Houwink relation for low molecular weight polyethylene holds for these higher molecular weight fractions, an integral distribution was obtained with molecular weights as high as 1 x 10 to the 7th power.

711,816
PB86-201035 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Necking of Semicrystalline Polymers in Tension.
Final rept.
L. J. Zapas, and J. M. Crissman. 1984, 18p
Pub. in Proceedings of Workshop Orienting Polymers, Minneapolis, MN., March 21-26, 1983, p46-63.

Keywords: *Necking, *Polypropylene, *Polyethylene, Tensile properties, Axial strain, Axial stress, Stability, Polymers, *Semicrystalline polymers.

The phenomenon of necking under various uniaxial stress and strain histories has been studied for several semicrystalline polymers. A rather detailed presentation is given on a quenched isotactic polypropylene and comparison of the experimental results is made to the Bernstein and Zapas theory on the instability of viscoelastic bars. Data are also presented for various polyethylenes under constant load uniaxial deformations, and diagrams showing the locus of points in strain and time at which necking occurs are given.

711,817
PB86-208477 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Differences in PMMA Degradation Characteristics and Their Effects on Its Fire Properties.
Final rept.
T. Kashiwagi, A. Inaba, and J. E. Brown. 1986, 11p
Pub. in Proceedings of International Symposium on Fire Safety (1st), Gaithersburg, MD., October 7-11, 1985, p483-493 1986.

Keywords: *Polymethyl methacrylate, Fire tests, Degradation, Fire studies.

Thermal degradation and thermal oxidative degradation characteristics of Plexiglas G and Lucite were determined using thermogravimetry. The results show that degradation rate of Plexiglas G is sensitive to gas phase oxygen but that of Lucite is much less so. Comparison of derivative thermogravimetry curves between the two samples indicates that at low temperatures Plexiglas G is more stable with respect to degradation in nitrogen. Lucite is initially more stable with respect to degradation in air than is Plexiglas G. A similar trend was observed in a nonflaming gasification study using external radiative heating. It appears that the chemical nature of the degradation processes of the two samples is the same for slow heating thermogravimetry and for more rapid heating (gasification study) simulating a fire environment.

711,818
PB86-209954 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Compatibility of Hydrogenated and Deuterated Polystyrene.
Final rept.
H. Yang, R. Stein, C. Han, B. Bauer, and E. Kramer. 1986, 4p
Sponsored by National Science Foundation, Washington, DC. Div. of Materials Research, and Massachusetts Univ., Amherst. Materials Research Lab.
Pub. in Polymer Communications 27, p132-135 May 86.

Keywords: *Compatibility, Hydrogenation, Reprints, *Polystyrene, Correlation length, Polymer blends, Neutron scattering.

A 50/50 blend of deuterated polystyrene (PSD,Mw =255 times 10 to the 3rd power) and polystyrene (PSH, Mw =233 times 10 to the 3rd power) was studied by small-angle neutron scattering (SANS) for its interaction parameter, x/vo, correlation length, and susceptibility, S(q=0) at various temperatures. The interaction parameter x/vo has a value of less than 10-6, which is within the error limit of being zero in the measurement temperature range. The error bound cannot exclude the possibility of an upper critical solution temperature (UCST). However, this UCST, if it exists, will be well below the glass transition temperature for any PSD/PSH blends with reasonable molecular weight. Phase separation of PSD/PSH blends does not occur under common experimental conditions and phase separation of isotopically labelled polymers is not a general phenomenon but a specific property of individual polymers.

711,819
PB86-230802 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Model Describing the Steady-State Gasification of Bubble-Forming Thermoplastics in Response to an Incident Heat Flux.
Final rept.
I. S. Wichman. Feb 86, 13p
Pub. in Combustion and Flame 63, nl-2 p229 Jan-Feb 86.

Keywords: *Thermoplastic resins, *Gasification, Bubbles, Heat flux, Reprints.

A theoretical model is developed to describe the in-depth effect of bubbles on the steady-state transport of volatile gases from the surface of a thermoplastic material subjected to an incident conductive heat flux. In the model the effect of the bubbles on the surrounding liquid is felt through the bubble number distribution function, n, which appears in the equations for conservation of mass, momentum, species, and energy in the melt. The equation describing the evolution of n includes the effects of bubble growth, convection, and nucleation.

711,820
PB86-232766 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tensile, Compressive, and Shear Properties of Polyurethane Foam at Low Temperatures.
Final rept.
J. M. Arvidson, and L. L. Sparks. 1982, 10p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Advances in Cryogenic Engineering 28, p289-298 1982.

Keywords: *Foam, *Polyurethane resins, Low temperature tests, Mechanical properties, Cryogenics, Tension, Compressive strengths, Elastic properties, Shear strength, Yield strength, Modulus of elasticity, Reprints.

Polyurethane foam, having a density of 32 kg/cu m, was tested at 295, 111, 76, and 45K in helium gas. The material properties reported are Young's modulus, proportional left, yield strength (at 0.2% offset), tensile and compressive strengths, and elongation (elastic and plastic). To perform these tests a new apparatus was developed. The apparatus permits tension, compression, and shear testing of materials at any temperature ranging from 295 to 4K. The system also incorporates a concentric, overlapping-cylinder capacitance extensometer which is highly sensitive and linear in output.

711,821
PB87-108114 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Effects of Weak Linkages on the Thermal and Oxidative Degradation of Poly(methyl methacrylates).
Final rept.
T. Kashiwagi, A. Inaba, J. E. Brown, K. Hatada, T. Kitayama, and E. Masuda. 1986, 9p
Pub. in Macromolecules 19, p2160-2168 1986.

Keywords: *Polymethyl methacrylate, Thermal degradation, Oxidation, Leakage, Nitrogen, Air, Thermogravimetry, Polymerization, Reprints.

The thermal and oxidative degradation mechanisms of poly(methyl methacrylate) (PMMA) were studied in atmospheres of nitrogen and air by thermogravimetry using various specially polymerized samples. Thermal degradation of PMMA polymerized with a free radical method proceeds in three steps of weight loss: the least stable step is initiated by scissions of head-to-head linkages, the second step by scissions at the chain-end initiation from vinylidene ends, and the most stable step by random scission within the polymer chain. There are no significant differences seen in the thermal or oxidative degradation of PMMA polymerized with the free radical method between azobis(isobutyronitrile) and benzoyl peroxide as the initiators. Gas-phase oxygen traps radicals resulting from chain scissions at head-to-head linkages. No weight loss observed from this step in air. Similarly, oxygen traps radicals generated by end initiation, but it is not as effective as for the case of head-to-head linkages. Possible mechanisms for end initiation and oxidative termination of radicals initiated from scission at the head-to-head linkages are discussed.

711,822
PB87-108130 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Workshop Proceedings: Morphology of Polyethylene and Cross-Linked Polyethylene.
Final rept.
M. G. Broadhurst, F. A. Khoury, A. J. Bur, and G. T. Davis. Nov 81, 33p
Sponsored by Electric Power Research Inst., Palo Alto, CA.
Pub. in Proceedings of Workshop on Morphology of Polyethylene and Cross-Linked Polyethylene, Gaithersburg, MD., March 31-April 1, 1981, 33p.

Keywords: *Polyethylene, *Meetings, *Electrical insulation, Morphology, Electron microscopy, Crosslinking, Power transmission lines, Aging.

The report summarizes the proceedings of a workshop on the morphology of extruded polyethylane power cable insulation. The purpose of the workshop was to review the state-of-the-art of morphological studies of cross-linked and uncross-linked polyethylene, to determine the potential relevance of the parameter in aging of these electrical insulation materials, and to arrive at suggestions for future work in the area. A major concern which developed during the workshop was that some of the features shown and reported in the literature might be artifacts resulting from the techniques used to prepare the surface of a specimen for examination via scanning electron microscopy. Suggestions were made for minimizing the possibility of creating such artifacts and for obtaining data for which the relationships between (1) bulk structural features and (2) defects related to aging and breakdown can be more reliably interpreted. Several corroborative experiments were also recommended to supplement the morphology studies.

711,823
PB87-108148 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Hydrolysis of Cross-Linked Polyester Polyurethanes.
Final rept.
D. W. Brown, R. E. Lowry, and L. E. Smith. 1984, 7p
Pub. in Polymer Material Science and Engineering 51, p155-161 1984.

Keywords: *Polyurethane resins, *Polyester resins, *Hydrolysis, Crosslinking, Polymers, Films, Degradation, Reprints.

Cross-linked polyester polyurethane films were made by reacting toluene diisocyanate with polyester polyurethane at 100 C for 5-7 days. Mol ratios of isocyanate to urethane were 0.14, 0.55, and 1.10. Sol fractions were 0.79, 0, and 0, respectively. These films and the original polymer were aged at various temperatures and relative humidities, RH. Samples were evaluated by measuring tensile strength, elongation, sol fraction, acid content, and the change in the concentration of alcohol groups. Dense cross-linking greatly extended the time before loss of strength and elongation became severe. Aging at 85 C and 100 and 50% RH eventually made all but the most densely cross-linked polymer completely soluble. A second infinite network probably existed in the latter, which was not hydrolyzed. The initial alcohol concentration was less in the more densely cross-linked films. Concentrations of alcohol and acid increased more slowly in these two films. The effect was especially marked at low RH.

711,824
PB87-113684 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Guest Editorial.
Final rept.
M. G. Broadhurst, F. Micheron, and Y. Wada. 1981, 1p
Pub. in Special Issue on PVDF (Polyvinylidene Fluoride) and Associated Piezoelectric Polymers, p3 Apr 81.

Keywords: *Ferroelectric materials, *Piezoelectric materials, Ferroelectricity, Polymers, Pyroelectricity, Vinylidene resins, *Vinylidene fluoride.

An introduction to a special issue of Ferroelectrics on Polyvinylidene Fluoride and related Piezoelectric polymers is given. The introduction includes a history of the field, an analysis of its progress, and a speculation about its future.

711,825
PB87-118964 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
FT-IR Studies of Molecular Organization in Polyethylene.
Final rept.
B. Fanconi, and D. Sarazin. 1984, 2p
Pub. in Polymer Preprints 25, n2 p173-174 1984.

Keywords: *Polyethylene, *Molecular structure, *Spectroscopic analysis, Infrared spectroscopy, Thermoplastic resins, Reprints, Fourier transform spectroscopy.

FT-IR studies of mixtures of perdeutero polyethylene and polyethylene have been carried out on single crystals suspended in cyclohexane. The spectra are compared to those obtained from dried and pressed single crystal mats to reveal substantial spectral changes caused by mechanical deformation of the crystallites. The impact of these spectral changes on the interpretation of the organization of polyethylene molecules in single crystal textured material is discussed. A method of analyzing the FT-IR spectra of mixed crystals that is based on lattice dynamical calculations and the electro-optical parameter approach for IR intensities is presented. The method has been successfully applied to n-alkane mixtures and an improved spectral measure of local concentration of deuterated molecules is derived. The method shows promise for characterizing the local concentrations of deuterated stems in melt-crystallized polyethylene mixtures.

711,826
PB87-122198 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Investigations in Array Sizing - 3. The Center Distance Finding Technique.
Final rept.
A. W. Hartman. 1986, 12p
See also PB86-196011.
Pub. in Powder Technology 46, n2-3 p109-120 1986.

Keywords: *Particle size distribution, Dimensional measurement, Arrays, Microscopy, Polystyrene, Optical measurement, Microphotographs, Reprints, *Microspheres.

The feasibility of measuring the size distribution of microspheres by optical microscopy is investigated for monosize 3 micrometers and 10 micrometers polystyrene material. A new technique for doing this is presented, based on the light-focusing properties of transparent and uniform microspheres that are arranged in a two-dimensional structure of spheres touching each other. When illuminated with parallel light, the spheres bring this light together into small focal spots which are then used as high-resolution markers of sphere position. The sphere center distances are measured with better than 0.5% resolution from scaled microphotographs. The obtained center distance distributions are used to find the diameter distributions of 3.0 micrometers and 10 micrometers polystyrene spheres.

711,827
PB87-122289 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Defect Motion and Relaxation Processes in Polyethylene.
Final rept.
D. H. Reneker, and J. Mazur. 1981, 4p
Pub. in International Symposium on Macromolecules, Abstracts of Communications (27th), Strasbourg, France, July 6-9, 1981, v2 p879-882.

Keywords: *Polyethylene, Defects, Relaxation(Mechanics).

The defect in polyethylene known as a point dislocation(1) or twist dispiration loop(2), which transports a chain along its axis through a crystal by a process appropriately called reptation. In the following, the word defect is used not in its general sense but as a short name for a point dislocation. Two sets of experimental data provide quantitative information on the rotation rate of the chain stems around their long axes. One set is from C-13 nuclear magnetic resonance experiments and the second is from dielectric loss measurements on lightly oxidized polyethylene which contains approximately one polar group per chain stem. Mechanical relaxation data can be interpreted as a consequence of the translation of a defect in a strain field.

711,828
PB87-128146 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Comparative Rates of Heat Release from Five Different Types of Test Apparatuses.
Final rept.
V. Babrauskas. 1986, 12p
Pub. in Jnl. of Fire Sciences 4, p148-159 Mar/Apr 86.

Keywords: *Test equipment, *Calorific value, Evaluation, Fire resistant materials, Construction materials, Fire tests, Ignition, Composite materials, Laminated plastics, Flashover, Aircraft cabins, Reprints.

Previously reported rates of heat release using five different bench-scale test methods are compared with each other and against a limited series of large-scale tests. The materials tested were low-flammability wall lining materials, of a construction similar as might be used for aircraft cabin walls. Based on the peak values at different irradiances, three of the methods gave similar results: the Cone Calorimeter, the FMRC Flammability Apparatus, and the Flame Height Apparatus. The other data, from the OSU calorimeter in the thermopile mode and the OSU calorimeter in the oxygen-consumption mode, gave results typically 1/2 of the first three methods. Simple techniques for predicting full-scale performance from bench-scale data are emerging. The preliminary application of these appears promising.

711,829
PB87-134813 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Up and Down Test Method - E-11 Members Respond.
Final rept.
E. H. Jebe, and M. G. Natrella. 1985, 2p
Pub. in ASTM Standardization News 13, n2 p40-41 1985.

Keywords: *Impact tests, *Plastic pipes, Structural plastics, Pipes(Tubes), Reprints, *Up and down method.

The brief note gives a summary of some characteristics of the Up-and-Down Test Method. It is a response by members of ASTM Committee E-11 to an article (previously published in ASTM Standardization News) that stressed some disadvantages of the Method as it was applied to the impact testing of plastic pipe.

711,830
PB87-136651 PC **A08**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Prediction of the Long Term Stability of Polyester-Based Recording Media.
L. E. Smith, D. W. Brown, and R. E. Lowry. Oct 86, 153p NBSIR-86/3474
See also PB85-160133.

Keywords: *Aging tests(Materials), *Polymeric films, *Magnetic tapes, *Adhesives, *Binders(Materials), Humidity, Storage, Archives, Infrared spectroscopy, Polyethylene terephthalate, Hydrolysis, Stability.

Magnetic data tapes have been aged at several temperatures and relative humidities. Data previously recorded on the tapes was read back after aging and the inability to read such data was used to make a preliminary estimate of tape lifetime. Based on the criterion the authors estimate a useful tape lifetime of 20 years at ambient conditions. The tape lifetime estimate should be considerably more certain by the time of the final report in the series which will be issued in November 1987. There are documented reports of tape failure after ten years of storage under normal room temperature and humidity. Reading failures with rapidly-aged tapes appear to be caused primarily by exudation of material from the binder layer. In order to test the condition of tapes before failure, three tests were devised that measure adhesion or extensibility of the binder layer. Water content and weight changes on aging were also measured. None of these five secondary quantities correlated quantitatively with the ability of a tape transport to read data previously written on the tapes, but some of them are useful indicators of risk.

711,831
PB87-152914 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Modeling of Chain Twist Boundaries in Polyvinylidene Fluoride as a Mechanism for Ferroelectric Polarization.
Final rept.,
D. H. Reneker, and J. Mazur. Jun 85, 6p
Pub. in Polymer 26, n6 p821-826 Jun 85.

Keywords: *Ferroelasticity, Polarization, Thermoplastic resins, Polymers, Reprints, *Polyvinylidene fluoride.

It is assumed that the process of ferroelectric polarization of the beta phase of polyvinylidene fluoride (PVF2) in response to the action of the external electric field in direction perpendicular to the molecular axis and to

the film, involves movement of the chain twist boundaries. These boundaries, at which every chain is twisted by 180 degrees, separate domains of opposite polarization. The energy barriers that are surmounted as the boundary was advanced one repeat unit were calculated and compared with the energy gained by reversing the polarization of an unfavorably oriented repeat unit in an electric field that produces polarization in PVF2. It is suggested that the movement of chain twist boundaries, in contradistinction to previously postulated models in which only one is twisted at a time, provides a model for the poling of PVF2 that is feasible energetically and kinetically. Theoretical modeling, analogous to that for Bloch wall that separates domains in magnetic materials, suggest that the process of polarization might be described either as a diffusion process or as the propagation of a soliton along the chains.

711,832
PB87-173035 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Reference Standard Polyethylene Resins and Piping Materials. Final Report October 1, 1985-September 30, 1986,
J. M. Crissman, F. W. Wang, C. M. Guttman, J. R. Maurey, and H. L. Wagner. Mar 87, 99p NBSIR-87/3506-GRI, GRI-86/0070-FR
Contract GRI-5084-260-1013
See also report for FY 85, PB86-203254. Sponsored by Gas Research Inst., Chicago, IL.

Keywords: *Plastic pipes, *Gas pipes, Standards, Polymers, Tensile tests, *Polyethylene resins, *Reference materials.

Polyethylene piping is currently in widespread use in gas distribution in the United States, and represents approximately 80% of new installation, Research that is currently being performed on gas pipes often employs many different polyethylenes selected from the large number of polyethylenes available for this use. The variation in materials makes it difficult to compare results from different research laboratories, or to compare measurements carried out in the same laboratory at different times. To avoid this difficulty Gas Research Institute and the National Bureau of Standards (NBS) have undertaken to provide a permanent store of one particular polyethylene resin as well as piping and fittings made from it which would provide a source of well characterized materials for research related to gas distribution systems. The report describes the choice of this resin and the types and quantities of the materials to be provided by NBS and the characterizations performed which include the determination of the branch content, melt flow rate, molecular weight and molecular weight distribution, density, and specific tensile properties.

711,833
PB87-197810 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
World of Polycarbonates.
Final rept.,
S. K. Sikdar. 1987, 7p
Pub. in Chemtech 17, p112-118 1987.

Keywords: *Polycarbonates, Thermoplastics, Reprints.

Polycarbonates, a member of a select group of engineering thermoplastics, have found applications to replace metals and glass where its strength and optical properties are important. More recently, because of intense competition from other thermoplastic formulations, blends and alloys of polycarbonates are being introduced. These blends and alloys optimally match performance for the cost justified for specific applications.

711,834
PB87-197950 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Thermal and Mechanical Properties of Polyurethane Foams at Cryogenic Temperatures.
Final rept.,
L. L. Sparks, and J. M. Arvidson. 1985, 35p
See also PB85-187367. Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Jnl. of Thermal Insulation 8, p198-232 Jan 85.

Keywords: *Polyurethane resins, *Foam, *Thermal properties, *Mechanical properties, *Insulation, Cryogenics, Physical properties, Gas chromatography, Mass spectroscopy, Thermal expansion, Reprints, *Expanded plastics.

Expanded plastics are used extensively for thermal insulation in cryogenic fuel facilities. Properties determined were thermal conductivity, thermal expansion, strength and moduli in compression and in tension, proportional limit, yield strength, ultimate strength, and shear strength. Physical properties were determined both parallel and perpendicular to the direction of foam rise. The gas content of the specimens was determined using a gas chromatograph-mass spectrometer, and the cell morphology was studied optically. Empirical procedures for estimating the temperature dependent thermophysical properties are discussed. These procedures utilize the characterization parameters for molar gas concentration and cell morphology.

711,835
PB87-224465 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Glass Temperature of Polymer Rings.
Final rept.,
E. A. DiMarzio, and C. M. Guttman. 1987, 5p
Pub. in Macromolecules 20, n6 p1403-1407 Jun 87.

Keywords: Temperature, Reprints, *Cyclic polymers, Entropy glass theory, *Glass transition, *Polymer rings.

The entropy theory of glass formation is used to predict the glass temperatures of a bulk polymer system consisting of noncatenated rings. It is found that the glass temperature of ring systems increases as the molecular weight is lowered, while the glass temperature of linear polymers decreases with decreasing molecular weight. Quantitative predictions for cyclic and linear poly(dimethylsiloxanes) and for cyclic and linear polystyrene are made and compared to experiment.

711,836
PB87-224473 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
WAXS (Wide-Angle X-ray Scattering) Study of the Deformation Behaviour of MDI/BDO Based Polyurethanes.
Final rept.,
R. M. Briber, and P. Sung. 1987, 5p
Pub. in Polymer Communications 28, n6 p162-166 Jun 87.

Keywords: Reprints, *Polyurethane, Wide angle x ray scattering, *Deformation, Segmented copolymer, WAXS.

The deformation of MDI/BDO based segmented polyurethanes has been studied by WAXS. The meridional portion of the MDI/BDO chain axis reflection moves to larger d-spacings with increasing deformation. The position of the reflection varies from 0.770 nm at 0 percent deformation to 0.877 nm at 700 percent stretch. At 700 percent stretch the reflection exhibits continuous diffuse scattering along the fourth layer line. This is evidence for a high degree of disorder between neighboring chains along the stretch direction. Upon annealing the stretched sample the disorder is lost and the polymer crystallizes in the type III crystal structure. The continuous change of d-spacing with stretch indicates a continuous change in length of the MDI/BDO repeated length with deformation. This leads to the conclusion that the conformational energy of the system is relatively insensitive to the butanediol conformation and may be dominated by effects such as hydrogen bonding and phenyl ring interactions.

711,837
PB88-110689 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Calculation of Thermal Degradation Initiated by Random Scission, Unsteady Radical Concentration.
Final rept.,
A. Inaba, and T. Kashiwagi. 1987, 11p
Pub. in European Polymer Jnl. 23, n11 p871-881 1987.

Keywords: *Polymers, Thermal degradation, Molecular weight, Cleavage, Computation, Reprints.

Changes in molecular weight distribution and in sample volume were calculated for thermal degradation of a polymer. The thermal degradation scheme consists of random scission initiation, depropagation and disproportionation termination reactions. An unsteady radical concentration was considered. There are two parameters, normalized zip length z/chi sub 0 and radical number per initial chain length z' chi sub 0, describing the thermal degradation scheme with an unsteady radical concentration.

711,838
PB88-134630 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Molecular Mechanism of Deformation in Epoxies--A Neutron Scattering Study.
Final rept.,
W. L. Wu. 1987, 7p
Pub. in Proceedings of the 1987 Materials Research Society Symposium, Boston, MA., December 1-4, 1986, p97-103 1987.

Keywords: *Epoxy resins, Deformation, Strain measurement, Neutron scattering, Crosslinking, Molecular structure.

Neutron scattering was used to investigate the molecular mechanism of large strain deformation in epoxies. Partially deuterated diglycidyl ether of bisphenol A (DGEBA) was cured with either tri- or di-amines of different molecular weights. The change of the average distance between crosslinks along the epoxy and the amine linkages could easily be determined from the shift in the positions of the scattering maxima.

711,839
PB88-147145 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Creep and Recovery Behavior of a Linear High Density Polyethylene and an Ethylene-Hexene Copolymer in the Region of Small Uniaxial Deformations.
Final rept.,
J. M. Crissman. 1986, 10p
Pub. in Polymer Engineering and Science 26, n15 p1050-1059 Aug 86.

Keywords: *Polyethylene, *Ethylene copolymers, *Creep tests, Molecular weight, Plasticity tests, Mechanical properties, Stress analysis, Recovery, Reprints, Ethylene hexene copolymer.

The results of creep and recovery experiments are reported for two types of polyethylene, one a linear high density homopolymer, and the other an ethylene-hexene copolymer. Data were obtained at temperatures in the range 23 degrees C to 57 degrees C and creep times of from 10 sec to 4.33 x 100000 sec. In order to approximate constant true stress conditions all of the experiments were carried out at the same value of applied stress (4 MPa) and the change in strain during creep was in all cases less than 2 percent. Comparison of these results with those from earlier work on an ultra high molecular weight polyethyene show that there is a great similarity in the behavior of all three materials, and the behavior of all three can be described quite well by a one-dimensional constitutive equation consisting of two terms, one a hereditary term and the other a plasticity term. It is further shown that to a very good approximation the idea of time-temperature superposition can be applied to the description of the hereditary term.

711,840
PB88-147152 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Energy Calculations for the Crystal Structure of the High Temperature Phases (I and IV) of Polytetrafluoroethylene.
Final rept.,
B. L. Farmer, and R. K. Eby. 1985, 9p
Pub. in Polymer 26, n13 p1944-1952 1985.

Keywords: *Polymers, Crystal structure, Conformal mapping, Crystal defects, Computation, Reprints, *Tetrafluoroethylene resins, Phase transformations, Order-disorder transformations, High temperature, Energy levels.

Energy analysis is used to determine the low energy crystal structure for polytetrafluoroethylene in the 15/7 conformation. It is also used to determine the energies of various conformational defects. The perfect structure has a motif of two left- and two right-handed molecular stems in a triclinic unit cell with parameters, a, b, and gamma of 1.102 nm, 1.142 nm, and 121 de-

grees, respectively. A variety of other perfect structures with higher energies exist. None of these corresponds to the experimentally observed metrically hexagonal cell containing one rotationally disordered stem. Excess energies were calculated for rotationally disordering defects such as molecules with the 15/7 conformation in a crystal of 54/25 molecules (and vice versa), rotated setting angle, reversed hand, and the 2/1 conformation.

711,841
PB88-147178 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Mechanical Preconditioning of Ultra High Molecular Weight Polyethylene at Small Uniaxial Deformations.
Final rept.,
J. M. Crissman, and L. J. Zapas. 1985, 12p
Pub. in Jnl. of Polymer Science, Polymer Physics Edition 23, n12 p2599-2610 Dec 85.

Keywords: *Polyethylene, *Creep strength, *Creep recovery, *Plasticity tests, Mechanical properties, Crystallization, Stress relaxation, Molecular weight, Time dependence, Temperature, Reprints.

The results of creep and recovery experiments are reported for a sample of UHMWPE at three different temperatures and creep times in the range from 10 sec to 1.47 x 100,000 sec. In order to approximate constant true stress conditions all of the experiments were carried out at the same value of applied stress (4MPa) and the change in strain during creep was never more than about 2%. Findings are cited.

Refractory Metals & Alloys

711,842
PB-266 493/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermal Conductivity and Electric Resistivity Standard Reference Materials: Tungsten (4 to 3000 K),
J. G. Hust. 1976, 4p
Pub. in Proceedings European Conference (5th) on Thermophysical Properties of Solids at High Temperatures, Held at Moscow, (USSR), on May 18-21, 1976, High Temp.-High Pressures, v8 p377-390 1976.

Keywords: *Tungsten, *Thermal conductivity, *Electrical resistivity, High temperature tests, Low temperature tests, Standard Reference Materials.

Thermal conductivity and electrical resistivity data for arc cast and sintered tungstens are compiled, analyzed, and correlated. Recommended values of thermal conductivity and electrical resistivity for particular lots of tungsten are presented for the range 4 to 3000 K. These values are based on low temperature NBS measurements and higher temperature measurements by participants of the AFML-AGARD project. The uncertainty of the thermal conductivity values below ambient is 2% and rises to 5% between ambient and 2000 K. Above 2000 K the uncertainty rises to a maximum of about 8%. The uncertainty of the electrical resistivity values is 2% over the entire temperature range.

711,843
PB-281 258-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Reaction of Tungsten and Molybdenum Metals with Gaseous Oxygen (Vzaimodistvie Resplavov Vol'frama i Molibdena s Gazoobraznym Kislorodom),
V. Kashin, A. Tsilosani, and E. Klibanov. 1976, 17p
DMDC-15861, TT-76-59191
Trans. of Fiziko Khimicheskie Osnovys Met Protsessov (USSR) p90-98 1973. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Oxidation, *Liquid metals, *Tungsten, *Molybdenum, Carbon, Arc melting, Diffusion, Translations, USSR.

A method was developed for the study of the interaction of liquid refractory metals with the gaseous phase under electric arc heating conditions. The kinetics of oxygen absorption and desorption from liquid molybdenum and tungsten, and the characteristics of interaction of the dissolved carbon in molybdenum with the gaseous oxygen was also studied.

711,844
PB-300 560/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Nb-Si Al5 Compounds Produced by Liquid Quenching.
Final rept.,
R. M. Waterstrat, F. Haenssler, and J. Muller. Jul 79, 4p
Sponsored in part by American Dental Association, Chicago, IL.
Pub. in Jnl. of Applied Physics 50, n7, p4763-4766, Jul 79.

Keywords: *Niobium alloys, *Superconductors, Silicon containing alloys, Cryogenics, Transition temperature, Quenching(Cooling), Niobium inorganic compounds, Tin inorganic compounds, Silicides, Reprints, Splat cooling, Niobium silicon tin.

A metastable A15-type structure has been obtained in binary Nb-Si alloys containing 18.8 plus or minus 0.5 at.% Si by very rapid quenching (splat cooling) from the liquid state. Superconducting onset temperatures (T sub c) of about 4 K were measured on these samples. The relatively low (T sub c) values can be a result of the nonstoichiometric (Nb-rich) composition, residual antisite disorder, or other types of defect structures. Ternary additions such as Sn, Pt, or Ir seem to improve the stoichiometry of the A15 phase, and a (T sub c) of 13 K was obtained for the analyzed composition Nb(75)Si(16)Sn(9).

711,845
PB80-138787 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Self-Diffusion of Molybdenum and Diffusion of Tungsten in Molybdenum (Samodiffuziya Molibdena i Diffuziya Vol'frama V Molibdene),
E. V. Borisov, P. L. Gruzin, L. V. Pavlinov, and G. B. Fedorov. 1979, 9p TT-79-58097C, DMDC-40003C
Trans. of Metallurgiya i Metallovedenie Chistykh Metallov (USSR) n1 p213-223 1959, by V. S. Emelferov. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Molybdenum, *Tungsten, *Diffusion, Activation energy, Diffusion coefficient, Translations, *Self diffusion.

These experiments were performed in the internal 1800 to 2175C. Radioactive isotopes of Mo and W were employed and Gruzin's method of measuring residual activity was the technique used. Arrhenius plots give the temperature dependence of diffusion and diffusion equations were determined. The results are compared with self-diffusion data for other high-melting point metals (eg., Co, Ni, etc.)

711,846
PB80-180979 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Self-Diffusion of Tantalum,
P. L. Gruzin, and V. I. Meshkov. 1979, 8p DMDC-23008, TT-79-58095(H)
Trans. of Problemy Metallovedeniya i Fiziki Metallov (USSR) n4 p570-573 n.d. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Tantalum, *Diffusion, Activation energy, Diffusion coefficient, Translations, Self-diffusion, Tantalum 182.

The self diffusion of radioactive Ta-182 in Ta was measured in the temperature range 1200 to 1300C using the residual activity experimental technique. An Arrhenius plot yielded the diffusion parameters for the diffusion equation.

711,847
PB80-215437 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion of Carbon in Some Alloys of Niobium with Tungsten and Molybdenum,
V. D. Lyubimov, V. A. Tskhai, and G. D. Bogomolov. 1980, 9p DMDC-15736, TT-80-58219
Trans. of Akademiya Nauk SSSR. Uralskii Filial, Sverdlovsk. Institut Fiziki Metallov. Trudy, n17 p48-51 1970. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Carbon, *Niobium alloys, Tungsten containing alloys, Molybdenum containing alloys, Activation energy, Diffusion coefficient, Translations, *Foreign technology.

Radioactive C-14 was diffused into polycrystalline Nb-W and Nb-Mo alloys in the temperature range 800 to 1250C. Alloys contained 5 to 30 wt.% W and 5 to 20 wt.% Mo. Specimens were sectioned after diffusion and the remaining activity measured. Arrhenius plots of the data allowed for the determination of activation energies and pre-exponential factors. Tracer diffusivities were determined within an error of plus or minus 10%. The change in concentration of the alloying element had little effect on the mobility of carbon. The diffusion of C-14 in the alloys was less than order of magnitude different from that in pure Nb. All the alloys are solid solutions.

711,848
PB81-167330 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion of Carbon in Alloys of Niobium with Titanium and Zirconium.
V. D. Lyubimov, V. A. Tskhai, and G. D. Bogomolov. 1980, 9p DMDC-15735, TT-80-58217
Trans. of Akademiya Nauk SSSR. Uralskii Filial, Sverdlovsk. Institut Khimii. Trudy, n17 p44-47 1970. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, *Carbon, *Niobium alloys, Titanium containing alloys, Zirconium containing alloys, Activation energy, Translations.

The diffusion of C-14 in Nb-Ti and Nb-Zr alloys was investigated in the temperature range 800 -1250C. The Nb-alloys contained 5.0, 15.1, 29.8, and 40.9 wt.% Ti and and 5.0 15.1, 24.2, and 36.1 wt.% Zr. Arrhenius plots of D* vs. 1/T yielded activation energies and pre-exponential factors for the diffusion equation. Relationships are developed between the parameters of carbon diffusion in the alloys. Composition dependencies of the diffusivity are given for the same alloys. The authors speculated on the theoretical mechanisms describing the basic carbon diffusion process.

711,849
PB83-182766 Not available NTIS
National Bureau of Standards, Washington, DC.
Transient Interferometric Technique for Measuring Thermal Expansion at High Temperatures: Thermal Expansion of Tantalum in the Range 1500 to 3200 K.
Final rept.
A. P. Miiller, and A. Cezairliyan. 1982, 30p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in International Jnl. of Theromphysics 3, n3 p259-288 1982.

Keywords: *Tantalum, *Thermal expansion, Measurement, Interferometers, Reprints, High temperature.

The design and operational characteristics of an interferometric technique for measuring thermal expansion of metals between room temperature and temperatures in the range 1500 K and their melting points are described. The basic method involves rapidly heating the specimen from room temperature to temperatures above 1500 K in less than one second by the passage of an electrical current pulse through it, and simultaneously measuring the specimen expansion by the shift in the fringe pattern produced by a Michelson-type polarized beam interferometer and the specimen temperature by means of a high-speed photoelectric pyrometer. Measurements of linear thermal expansion of tantalum in the temperature range 1500 to 3200 K are also described.

711,850
PB84-106574 Not available NTIS
National Bureau of Standards, Washington, DC.

Localized Modes and Hydrogen Trapping in Niobium with Substitutional Impurities.
Final rept.
D. Richter, J. J. Rush, and J. M. Rowe. May 83, 7p
Pub. in Physical Review B 27, n10 p6227-6233, 15 May 83.

Keywords: *Niobium, *Hydrogen, Impurities, Titanium, Niobium, Traps, Neutron scattering, Hydrides, Inelastic scattering, Vibrational spectra, Crystal defects, Phonons, Reprints, Temperature dependence.

The trapping of hydrogen by the substitutional impurities Ti and Cr in Nb has been investigated by neutron inelastic scattering measurements of hydrogen vibration spectra as a function of temperature. In the case of Ti, the hydrogen is in a trap which is deep enough to prevent precipitation into the hydride phase at low temperatures. In the case of Cr impurities the trap is shallower, and precipitation to the hydride phase is not inhibited at low temperatures. By studying the detailed behavior of the temperature dependence of the vibrational line shapes for dissolved, trapped, and precipitated H, a binding energy at the Cr trap of 105 plus or minus 10 meV has been derived.

711,851
PB85-229995 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Thermophysical Measurements on Tungsten-3 (Wt %) Rhenium Alloy in the Range 1500-3600 K by a Pulse Heating Technique.
Final rept.
A. Cezairliyan, and A. P. Miiller. 1985, 12p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in International Jnl. of Thermophysics 6, n2 p191-202, 27 Sep 85.

Keywords: *Tungsten alloys, Rhenium containing alloys, Specific heat, Electrical resistivity, Emittance, Thermal measurement, Reprints, Tungsten alloy 3Rh.

Simultaneous measurements of the specific heat capacity, electrical resistivity, and hemispherical total emittance of tungsten-3 (wt%) rhenium alloy in the temperature range 1500-3600K by a subsecond-duration pulse heating technique are described.

711,852
PB86-213030 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Nicrosil Versus Nisil Thermocouple: The Influence of Magnesium on the Thermoelectric Stability and Oxidation Resistance of the Alloys.
Final rept.
N. A. Burley, J. L. Cocking, G. W. Burns, and M. G. Scroger. 1982, 17p
Pub. in Temperature: Its Measurement and Control in Science and Industry, v5 pt2 p1129-1145 1982.

Keywords: *Thermocouples, *Heat resistance alloys, Thermoelectric properties, Nickel alloys, Silicon, Chromium, Magnesium, Oxidation resistance, Reprints.

The new nickel-base alloy thermocouple nicrosil (Ni-14.2 wt.%Cr-1.4 wt.%Si) versus nisil (Ni-4.4 wt.% Si-0.1 wt.%Mg) shows greatly enhanced thermoelectric stability relative to the ANSI standard base-metal thermocouples type E, J, K and T. This is primarily because the component solute levels of chromium and silicon in nicrosil and nisil are high enough to produce greatly enhanced oxidation resistance. The paper reports the effects of additions to the nominal compositions of up to 0.1 wt. % Mg upon the mechanisms of oxidation in air and upon the thermoelectric stability of both nicrosil and nisil at 1100 and 1200 C. The thermoelectric stability and oxidation resistance of nicrosil and nisil were found to be markedly superior to those of type KP and type KN thermoalloys tested for comparison under the same conditions.

711,853
PB87-104238 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Thermodynamic Properties of bcc Metals.
Final rept.
R. A. MacDonald, R. C. Shukla, and D. K. Kahaner. 1985, 6p
Pub. in High Temperatures-High Pressures 17, p665-670 1985.

Keywords: *Transition metals, *Thermodynamic properties, Specific heat, Free energy, Niobium, Tungsten, Reprints.

Lowest-order anharmonic perturbation theory has been used for calculating the Helmholtz free energy for a second-neighbour central-force model of a bee crystal in the high-temperature limit (T > the Debye temperature). The atomic interactions are represented by a modified Morse potential. The equilibrium lattice spacing, and thence the thermal expansion, are obtained. Results for the transition metals Nb and W are presented. Of the other thermodynamic properties, bulk moduli have been found to be very sensitive to the method used to treat the electrons. For the alkali metals, reasonable results were obtained when electron correlation was taken into account. A corresponding calculation for the transition metals is in progress. The results obtained for the thermal expansion and for the lattice contribution to the specific heat at constant volume are presented. The limitations of this model when electrons play a major role in stabilizing the crystal structure are discussed.

711,854
PB87-113585 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Niobium (Columbium)-Platinum Constitution Diagram.
Final rept.
R. M. Waterstrat, and B. C. Giessen. 1985, 7p
Grant PHS-DE-02455, Contract SD-90
See also PB80-194392. Sponsored by National Inst. of Dental Research, Bethesda, MD., and Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Metallurgical Transactions A 16A, p1943-1949 Nov 85.

Keywords: *Niobium alloys, *Platinum alloys, Phase diagrams, Intermetallic compounds, Solubility, Phase transformations, X-ray analysis, Reprints.

The Nb-Pt system was investigated over the entire composition range by metallography and X-ray diffraction analysis. The solubility limits of terminal and intermediate phases and solidus temperatures were determined. The presence of six intermediate phases was confirmed. Eight three-phase reactions are described, the mean atomic volumes are given, and crystal chemical relationships among the six homologous T(sub 5)-T(sub 10) systems (T(sub 5) = V, Nb, Ta; T(sub 6) = Pd, Pt) are discussed.

711,855
PB88-117478 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Microsecond-Resolution Transient Technique for Measuring the Heat of Fusion of Metals: Niobium.
Final rept.,
A. Cezairliyan, and J. L. McClure. 1987, 16p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in International Jnl. of Thermophysics 8, n5 p577-592 Sep 87.

Keywords: *Refractory metals, *Niobium, *Fusion(Melting), Electrical resistivity, Heat of fusion, Reprints.

A microsecond-resolution pulse-heating technique is described for the measurement of the heat of fusion of refractory metals. The method is based on rapid resistive self-heating of the specimen by a high-current pulse from a capacitor discharge system and measurement of the current through the specimen, the voltage across the specimen, and the radiance temperature of the specimen as a function of time. Melting of the specimen is manifested by a plateau in the temperature versus time function. The time integral of the power absorbed by the specimen during melting yields the heat of fusion. Electrical resistivity of solid and liquid niobium at its melting temperature was also measured.

711,856
PB88-147483 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Microstructural Characterization of Rapidly Solidified Nb-Si Alloys.
Final rept.,
L. Bendersky, F. S. Biancaniello, W. J. Boettinger, and J. H. Perepezko. 1987, 9p
Pub. in Materials Science and Engineering 89, p151-159 May 87.

Keywords: *Niobium alloys, Solidification, Microstructure, Metastable state, Grain size, Glass, Reprints.

Rapidly solidified alloys of Nb-Si containing between 12 and 25 at .% Si are examined by analytical electron microscopy to identify the phases present and the solidification path. The phase Nb3Si is absent either as the equilibrium tetragonal phase or the A15 phase. Glass formation is observed in high Si alloys but is difficult and observed only near the chill side of melt spun ribbons.

Solvents, Cleaners, & Abrasives

711,857
PB-275 158/4 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Applied Technology.
Graffiti Removers: Evaluation and Preliminary Selection Criteria.
Final rept.,
M. Godette, M. Post, and P. G. Campbell. Dec 75, 42p NBSIR-75-914
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Energy, Building Technology, and Standards Div.

Keywords: *Paint removers, *Buildings, *Cleaning, Performance evaluation, Spray painting, Markers, Construction materials, Concretes, Bricks, Solvents, Criteria, Compatibility, Spreading, Flammability, *Vandalism.

The vandalous use of spray paints and other marking materials to deface the surfaces of buildings has increased tremendously in the last decade. These markings, commonly known as 'graffiti', are unsightly and expensive to remove. A program was undertaken to determine the performance of graffiti removers so that performance criteria for selection of these types of materials could be recommended. The results of laboratory tests of removal efficiency, range of effectiveness, remover-substrate compatibility, migration (spreading), and flash point are presented. From the results obtained, tentative criteria for selection of graffiti removers are recommended. The marking materials (graffiti) used were spray paints of major generic types, crayon and felt-tip pen markers. The substrates used were clay brick, ceramic tile, limestone, sandstone, aluminum and wood. Ninety-nine commercial materials which are marketed for use as graffiti removers were used in the study. This report is on the removal of marking materials from brick. The results showed that all markings can be removed with a high degree of effectiveness. No single remover was effective on all markings, but a set of five selected removers used in sequence, was effective against all.

711,858
PB80-194418 Not available NTIS
National Bureau of Standards, Washington, DC.
Adhesive Bonding of Various Materials to Hard Tooth Tissues. XXII. The Effects of a Cleanser, Mordant, and PolySAC on Adhesion Between a Composite Resin and Dentin.
Final rept.,
R. L. Bowen. May 80, 6p
Grant PHS-DE-5129-01
See also report dated 1980, PB80-178825.
Pub. in Jnl. of Dental Research 59 n5 p809-814 May 80.

Keywords: *Dentin, *Cleaning agents, *Adhesives, *Composite materials, *Dental materials, Chemical bonds, Coupling agents, Iron chlorides, Reprints.

Preliminary evaluations on the effects of a cleanser, mordant, and polyfunctional surface-active comonomer on adhesion between a composite resin and dentin evinced that the ferric chloride mordant significantly improved bonding. The effects of the cleanser and coupling agent were also favorable, as were all of their interactions.

711,859
PB87-197737 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.

Solvents, Cleaners, & Abrasives

Performance Tests for Graffiti Removers.
Final rept.,
J. R. Clifton, and M. Godette. 1986, 11p
Pub. in ASTM STP (American Society for Testing and Materials Special Technical Publication) 935, p14-24 1986.

Keywords: *Paint removers, Paints, Performance criteria, Masonry, Cleaning, Reprints, *Crayon marks, *Graffiti.

The defacing of the surfaces of masonry buildings with graffiti has increased substantially during the past decade, with removal cost exceeding several hundred million dollars annually. An assortment of materials have been used to remove graffiti with varying success. The report discusses performance tests developed to form a technical basis for selecting effective graffiti removers. Important considerations in developing the tests and criteria for graffiti removers were effectiveness in removing marks and effects on the appearance of masonry substrates. In developing performance criteria, 'standard graffiti' were produced by applying aerosol paints, crayons, lipstick, and felt tip pens and markers to the surfaces of brick, sandstone, limestone, and aluminum specimens. The effectiveness of removers and their compatibility with masonry substrates was determined by comparing the color changes of unmarked, marked, and remover treated masonry surfaces. Test methods were also developed to determine the ability of removers to migrate into masonry.

Wood & Paper Products

711,860
PB-263 140/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Weibull Statistics and a Microscopic Degradation Model of Paper.
Rept. for 1 Jul-30 Nov 75,
J. T. Fong, R. G. Rehm, and E. L. Graminski. Jan 77, 4p
Sponsored in part by Bureau of Engraving and Printing.
Pub. in Tappi, v60 n1 p156-159 Jan 77.

Keywords: *Paper, *Tests, *Statistical analysis, Fatigue(Materials), Degradation, Weibull density functions, Mechanical properties, Electron microscopy, Mathematical models, Reprints, Scanning electron microscopy.

Motivated by scanning electron micrographs showing micro-structural degradation of several grades of paper under repetitive loadings, a crude statistical approach in defining two micro-variables, namely, an 'effective' fiber length and an 'equivalent' void diameter, is presented. The approach is based on the mathematical properties of a shape-sensitive statistical distribution originally derived by Weibull. Two micro-strength parameters, the fiber-breaking load and the fiber-to-fiber bond strength, are also given a Weibull statistical analysis. Two distinct mechanisms for explaining the loss of modulus due to repetitive flexing are presented for constructing a self-consistent microscopic degradation model of paper.

711,861
PB-264 689/1 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Characterizing the Inter-Fiber Bond Strengths of Paper Pulps in Terms of A Breaking Energy.
Progress rept. 1 Jan-30 Jun 76,
J. C. Smith, and E. L. Graminski. 15 Oct 76, 40p
NBSIR-76-1148
Prepared in cooperation with Energy Research and Development Administration, Washington, D.C.

Keywords: *Papers, *Pulps, *Fibers, *Strength, Bond stress, Mechanical tests, Tensile stress, Breaking load, Solid waste disposal, Materials recovery, Handsheets, Fiber strength, Paper recycling.

The inter-fiber bond strength of paper is an important but an arduous property to measure. In order to characterize a pulp completely, the quality of bondability must be known especially for pulps produced from a mixture of waste paper. It has been postulated that a measure of bond strength can be obtained by measuring 2.5 g/sq m handsheets to tensile failure, recording the number of bonds broken with a sensitive tensile tester and plotting a curve of number of bonds broken as a function of cumulative work done on the system. The value of the minimum slope of this curve is equal to the average energy dissipated per bond break. Results obtained on two different softwood kraft pulps indicate the proposed method may be useful in assessing bond strengths.

711,862
PB-274 355/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Image Analysis in Paper Manufacturing.
Final rept.,
E. L. Graminski, and R. A. Kirsch. 1977, 7p
Contract E(49-1)-3800
Pub. in Proceedings IEEE Computer Society Conference on Pattern Recognition and Image Processing, Troy, New York, June 6-8, 1977, p 137-143 1977.

Keywords: *Papermaking, *Automation, Images, Analyzing, Fibers, Papers, Pulps, Pattern recognition, Morphology, Algorithms, Energy conservation, Paper industry.

Significant energy savings in the paper industry can result from characterization of paper pulps by direct measurement of fiber morphology with automatic methods. The report discusses the various fiber properties for which automatic image analysis applied to microscope images of pulps can yield savings of materials and energy. Computational algorithms applied to actual fiber data are shown to yield useful measurements for fiber length, curl, and potentially other properties. A new fiber morphology measurement algorithm is shown to include curl and length as special cases. Potentials for collaboration between the paper industry and the image analysis instrument industry are explored.

711,863
PB-274 499/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Flexing on the Mechanical Properties of Paper.
Final rept.,
E. L. Graminski. 1973, 24p
Pub. in Proceedings of Symposium the Fundamental Properties of Paper Related to Its Uses, Cambridge, England, September 16-22, 1973, 24p 1973.

Keywords: *Paper, *Flexing, Mechanical properties, Deterioration, Materials handling, Durability.

Probable causes for the deterioration of the physical properties of paper as a result of repeated handling have been determined. A flexing test has been devised which evaluates the relative durability of paper. Investigations with the scanning electron microscope indicate that the fibrillar component of paper deteriorates during flexing and is probably responsible for the decline in stiffness as well as the modulus of paper. Because of the ever increasing use of automatic document handling equipment, stiffness retention with handling is essential since limp documents are difficult, if not impossible, to process automatically. Unfortunately, stiffness declines rapidly as paper is flexed or handled. The rates of deterioration for all other physical properties of paper during flexing are independent of each other and vary from one paper to another. The rate at which certain properties deteriorate is independent of the quality of the paper. No correlation has been found between any paper property and durability.

711,864
PB-276 473/6 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Polymers Div.
Characterizing the Interfiber Bond Strength of Paper Pulps in Terms of a Breaking Energy: Effect of Beating.
Progress rept. 1 Jul-30 Sep 76,
J. C. Smith, and E. L. Graminski. 15 Dec 76, 19p
NBSIR-77-1286
Sponsored in part by Energy Research and Development Administration, Washington, D.C. See also report dated 15 Oct 76, PB-264 689.

Keywords: *Papers, *Pulps, *Fibers, *Strength, Bond stress, Adhesion, Tensile stress, Breaking load, Mechanical properties, Beating.

Handsheets in the form of a thin web of basis weight 2.5 g/sq cm were prepared from Northern and Southern softwood kraft pulps. The pulps were unbeaten and beaten to 1,000, 2,000 and 5,000 revolutions in a laboratory beater. The relative density of bonding between fibers and the relative strength of the bonds were estimated from tensile test data. Bond strengths of the two unbeaten pulps were equal, but density of bonding was greater in the web made from the Northern pulp. Bond density and strength for both pulps increased with increases in the degree of beating to approximately the same value for pulps beaten 5,000 revolutions, but differences were observed in the rate of change of these quantities.

711,865
PB-278 622/6 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Algorithms for Image Analysis of Wood Pulp Fibers.
Final rept.,
R. A. Kirsch. Jan 78, 31p NBSIR-78-1442

Keywords: *Morphology, *Wood fibers, *Optical measurement, Optical scanners, Pulp, Paper industry, Softwoods, Quality, Defects, Process control, Specifications, Photomicrography, Pattern recognition, Computer graphics, Optical images, Image analysis.

Image analysis technology can be used to measure the visible morphology of pulp fibers. But before such measurements can be accepted, it is necessary to achieve precise definition of the necessary measurements in the form of suitable algorithms that have been experimentally tested on images of actual fiber data. The report presents such measurement results on both semiautomatically traced fiber data and on automatically scanned images. The author considered the variety of definitions possible for some simple well known properties of wood fiber morphology by applying suitable algorithms to fiber image data. Finally, he suggests that this exploratory approach to the specification of the precise image analysis measurements needed in paper manufacturing can facilitate the introduction of a technology for process control that will result in savings in paper manufacturing cost and in reduction of energy requirements.

711,866
PB-279 046/7 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Polymers Div.
Effects of Temperature and Moisture on the Accelerated Aging of Paper.
Progress rept. Jul 75-Dec 76,
E. L. Graminski, E. J. Parks, and E. E. Toth. Mar 78, 75p NBSIR-78-1443
Sponsored in part by National Archives and Records Service, Washington, D.C.

Keywords: *Papers, *Aging tests(Materials), High temperature tests, Degradation, Partial pressure, Humidity, Cellulose, Wet strength, Physical properties, Chemical properties.

The rate of paper degradation at elevated temperatures appears to be directly proportional to the partial pressure of atmospheric water up to 50% relative humidity. This linear relationship continues to exist at higher humidities at 60C but not at 80C. It is uncertain at this time whether the water in question is bound to cellulose or is atmospheric moisture. Additional degradation studies at relative humidities above 50% must be conducted in order to identify the type of water affecting the degradation rate. There is also an indication that either an optimum temperature exists for accelerated aging of paper or that the cellulose-water interaction at the higher temperatures and lower humidities differs significantly from that at ambient temperatures.

711,867
PB-280 275/9 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Paper Evaluation Section.
Evaluation of Archival Stability of Copies from Representative Office Copying Machines.
Interim rept.,
E. J. Parks, and W. K. Wilson. 30 Apr 74, 69p
NBSIR-74-498
Prepared in cooperation with National Archives and Records Service, Washington, D.C.

Keywords: *Paper products, *Aging(Materials), *Specifications, Stability, Reproduction(Copying), Physical properties, Durability, Tests, Archives, Records.

Information has been developed on the stability of papers used in preparing copy on office copying machines as well as stability of images formed by representative quick copy processes. Retention of physical

properties after accelerated aging according to ASTM Method D776 was used as one criterion of probable stability. Acidity as measured by ASTM Method D778 also was used as a criterion of potential stability. Abrasion resistance of the image after exposure to a xenon arc and after accelerated aging according to ASTM D776 was used as a criterion of stability of image. Representative papers made especially for specific copying machines, and representative copies from these machines, were used in the testing program. Suggested specifications for copies for permanent records, based on the data developed in this report, are presented.

711,868
PB-280 291/6 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Characterizing the Interfiber Bonding of Paper Pulps: Effect of Preparation Pressure on Tensile Test Specimens.
Progress rept. 1 Oct 76-31 Mar 77,
J. C. Smith, and E. L. Graminski. 15 Oct 76, 36p NBSIR-78-1459
See also report dated 30 Jun 76, PB-264 689.

Keywords: *Papers, *Pulps, *Tension tests, Bonding strength, Pressing, Softwoods, Laboratory tests, Handsheets.

Handsheets in the form of low-density open webs of grammage 2.5 g/sq m were prepared from Northern and Southern softwood kraft pulps. These handsheets, from pulps unbeaten and beaten for 5,000 revolutions in a laboratory beater, were pressed at 44, 350 and 660 kPa (6.4, 51.2 and 96 lb/sq in) during preparation. The relative density of bonding between fibers and the relative strength of the bonds were estimated from tensile strength data. It was found that the quality of bonding between fibers in the webs was not affected by preparation pressures between 44 kPa and 660 kPa, but webs prepared at the higher pressure tended to stick to the backing plate, thus incurring some damage upon removal.

711,869
PB-281 339/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characterizing the Interfiber Bond Strengths of Paper Pulps in Terms of a Breaking Energy.
Final rept.,
J. C. Smith, and E. L. Graminski. Feb 77, 7p
Pub. in Proceedings of 1977 Annual TAPPI Meeting, Atlanta, Ga. 14-16 Feb 77 p169-175 Feb 77. (Technical Association of Paper and Pulp Industry).

Keywords: *Paper products, *Chemical bonds, Fibers, Tensile strength, Mechanical properties.

If a very thin open web of pulp fibers is elongated to break in a sensitive tensile tester, a force-elongation curve containing numerous jags is obtained. Each jag is caused by the breakage of a bond between fibers comprising the paper network. From a plot of work of extension as a function of the number of bond breaks, the average energy stored in the fibers previously connected by a broken bond can be estimated. This energy parameter can be used as a means of characterizing the adhesion between two paper fibers. Paper samples of basis weight 2.5 g/sq m were made from Northern and Southern softwood kraft pulps subjected to various amounts of beating. The energy parameters for these papers were measured in order to characterize the bonding.

711,870
PB-289 872/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Trace Element Profiles and Ratios Determined by Instrumental Neutron Activation Analysis for Fine Paper Identification.
Final rept.,
D. B. Blanchard, and S. H. Harrison. 1978, 8p
Pub. in Jnl. of Forensic Sciences 23, n4, p679-686 1978.

Keywords: *Papers, *Neutron activation analysis, *Trace elements, Fines, Clay, Chemical analysis, Reprints.

The paper investigates the use of (INAA) instrumental neutron activation analysis for determination of trace element profiles and ratios of clay filled fine papers for forensic purposes. The first part of the investigation was directed toward determining if clays varied substantially in their trace-element profiles. The second part ascertained that resultant trace-element profiles and respective elemental ratios of clay filled papers could serve as a 'fingerprint' of a specific piece of paper for forensic purposes.

711,871
PB-295 789/2 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Mathematical Modeling and New Experiments on Durability of Paper: A Progress Report.
Rept. for 1 Feb 77-30 Sep 78.
J. T. Fong, I. K. Fong, E. E. Toth, and E. L. Graminski. 11 Apr 79, 83p NBSIR-79-1746
Sponsored in part by Bureau of Engraving and Printing, Washington, DC. Prepared in cooperation with Seneca Valley High School, Germantown, MD.

Keywords: *Papers, Durability, Pulps, Fibers, Data retrieval, BASIC programming language, Computer graphics, Manuals, Data bases, Data base management systems, PDP-10 computers, COLLIN system.

As a necessary step towards the modeling of the microstructural changes of paper due to environmental and mechanical loadings, a computer-aided data file for a collection of 47 NBS reports (1953-1976) is created. Using an in-house experimental database management system (COLLIN) as implemented on an NBS computer (DEC PDP-10), a mini-data bank for the 47 technical reports is set up with the following searchable parameters: (a) report number, (b) author's name, (c) keyword, (d) test sample label, and (e) primary test variable. Each search will yield a complete record containing all the searchable information as well as (f) title of report, (g) citation, (h) the abstract, and (i) the so-called secondary test variable. To obtain quantitative information from any specific report for some combinations of sample labels and test variables for which experimental data were reported, a data tape is prepared and implemented for retrieval on a leased mini-computer graphical system (Tektronix 4051 with printer 4641 and plotter 4662). The operating system using the computer language BASIC is general enough to assist any scientist or engineer to create a personal data file at a reasonable cost. It is clearly demonstrated that no prior training in the use of a computer is necessary for the implementation of this project. During this reporting period, experiments on relating the quantity of water in the cellulose walls of pulp fibers to the cross-sectional morphology of fibers in paper were in progress. A brief discussion of this aspect of work is included in this report.

711,872
PB80-117872 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of the Aging of Paper: Possible Reactions and Their Effects on Measurable Properties.
Final rept.,
W. K. Wilson, and E. J. Parks. 1979, 25p
Sponsored in part by National Archives and Records Service, Washington, DC.
Pub. in Restaurator, v3 p37-61, 1979.

Keywords: *Paper, *Aging tests(Materials), *Cellulose, Reprints.

Various reactions that cellulose can undergo are reviewed in relation to their bearing on the aging of paper. The principal reactions of cellulose are hydrolysis, oxidation, crosslinking, charge in lateral order in bonding area, and, during accelerated aging, thermal decomposition. The effects these various reactions might have on tests that are available for evaluating changes that occur during the aging of paper are reviewed. Some special examples of these reactions that occur during natural aging, because of special composition characterized of the paper, are discussed. Suggestions are made concerning most sensitive tests for use in detecting changes in paper and tests, regardless of sensitivity, available for determining what happens during aging. Some general guidelines regarding specifications for permanent record papers are discussed.

711,873
PB80-124589
(Order as PB80-124548, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Tensile Behavior of Some Mathematical Models of Paper Networks,
J. C. Smith. 20 Apr 79, 20p
Included in Jnl. of Research of the National Bureau of Standards, v84 n4 p299-318, Jul-Aug 79.

Keywords: *Papers, *Mathematical models, Tensile properties, Networks, Adhesion, Mechanical properties, Fibers.

The tensile behavior of a thin web-like paper network was imulated by two simple mathematical models. The mesh distortions, drop in tensile force and energy loss resulting from breakage of a network junction were calculated. These results were used to formulate two parameters for characterizing interfiber adhesion: a parameter averaging the network energy losses incurred in a series of bond breaks when the network is elongated and a parameter averaging the force drops. The effect of mesh size, local bond adhesive force, and size and shape of the specimen network were calculated. These results based on model studies were used to interpret behavior observed in an actual paper network.

711,874
PB80-150329 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Characterizing the Interfiber Bonding of Paper Pulps: Rationale for Bonding Parameters Derived From Tensile Test Data.
Progress rept. 1 Oct-31 Dec 78,
J. C. Smith. 15 Apr 79, 39p NBSIR-79-1722
Sponsored in part by Bureau of Engraving and Printing, Washington, DC.

Keywords: *Papers, *Pulps, *Tension tests, Bonding, Tensile strength, Elongation, Breaking load, Adhesion.

If low density open webs of paper pulp are tested in tension, the resulting force-elongation curves have numerous force drops caused by the breakage of interfiber bonds. Parameters characterizing the bonding are derived from these data. The relative number of bonds per unit area is characterized by the average elongation between bond breaks. The bond strength can be characterized by an average of the force drop magnitudes, by an average of the energy losses resulting from bond breaks, or by a characteristic elongation indicative of the stretch in the network needed to cause a break. Methods of obtaining these parameters are given in the report, and the rationale involved in their derivation is carefully explained.

711,875
PB80-189426 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS-TAPPI Collaborative Reference Program--Beginning Its Second Decade.
Final rept.,
T. W. Lashof. Apr 80, 3p
Pub. in TAPPI 63, n4 p61-63 Apr 80.

Keywords: *Paper, Tests, Paperboards, History, Reprints.

A brief history is given of the first ten years of the NBS-TAPPI collaborative reference program for paper, including a description of the program both past and present. This voluntary program provides participating laboratories with a means for checking the level and uniformity of tests for more than 20 paper and board properties.

711,876
PB81-187114 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Accelerated Aging of Book Papers in 1937 with 36 Years Natural Aging.
Final rept.
W. K. Wilson, and E. J. Parks. 1980, 55p
Pub. in Restaurator 4, n1 p1-55 1980.

Keywords: *Papers, *Aging test(Materials), Cellulose, Comparison, Solubility, pH, Tearing strength, Tensil strength, Reprints.

In 1937 a group of 72 book papers, made in the National Bureau of Standards experimental paper mill, was tested before and after accelerated aging for 72 hours at 100C in a circulating oven. The following tests appear to be useful in evaluating changes that occur in the aging of paper: alkali solubility, reducing power, pH, internal tearing strength, elongation, zero span tensile strength, and strength when wet as percentage of strength when dry.

711,877
PB81-220915

(Order as PB81-220899, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Effect of Calcium Carbonate on the Stability of Acid Treated Papers,
E. L. Graminski, and E. J. Parks. 17 Dec 80, 7p
Included in Jnl. of Research of the National Bureau of Standards, v86 n3 p309-315, May-Jun 81.

Keywords: *Papers, *Acid treatment, Stability, Calcium carbonates, Absorption, Sulfate pulping.

Exposure of kraft wood pulps to an acidic medium results in a destabilization of wood pulp. The degree of destabilization appears to depend on the concentration of acid the pulp is exposed to. The addition of calcium carbonate to acid destabilized pulp does not restore the pulp to its original stability. The absorption of alkali metals is pH dependent which could explain the destabilization of wood pulps when exposed to an acid medium. A number of questions arise about the merit of stabilizing degraded paper documents by deacidification with alkaline earth salts and the usefulness of an alkaline reserve in paper.

711,878
PB82-199365 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Life Data for Wood in the Bending Mode.
Final rept.
J. W. Martin. 1980, 20p
Pub. in Wood Science Technology 14, p187-206 1980.

Keywords: *Bending, *Wood, Statistical data, Bending stress, Durability, Service life, Loads(Forces), Estimating, Reprints.

The applicability of a proposed procedure based on accepted, reliable, statistics was evaluated for characterizing the duration of load properties of wood in bending. By subjecting small, clear, wood specimens to several constant stress levels, it was experimentally demonstrated that the proposed procedure is capable of estimating, at an acceptable level of confidence delta the maximum service life beyond which a specified proportion gamma of the nominal population will survive. The extension of this procedure to structural sized members seems plausible, since an estimate of the short term ultimate strength for each specimen is not required. Another attribute of the procedure is that parametric estimates can be computed without failing all of the specimens; thus this should significantly reduce the duration of load test time.

711,879
PB83-131532 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS-TAPPI Collaborative Reference Program - Beginning Its Second Decade.
Final rept.
T. W. Lashof. Apr 80, 3p
Prepared in cooperation with Collaborative Testing Services, Inc., Great Falls, VA.
Pub. in TAPPI 63, n4 p61-63 Apr 80.

Keywords: *Papers, Paper industry, Tests, Reprints, NBS-TAPPI Collaborative Reference Program.

A history of NBS-TAPPI Collaborative Reference Program and questions concerning its future direction are presented.

711,880
PB83-239590 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Preservation of the Constitution of Puerto Rico.
Final rept.
E. Passaglia, D. Brown, and B. Dickens. Jun 83, 53p
NBSIR-83-2743

Keywords: *Paper, *Preserving, *Controlled atmospheres, Ultraviolet radiation, Oxygen, Degradation, Leakage, *Constitution of Puerto Rico.

A general design for a display enclosure for the Constitution of Puerto Rico, and designs and methods of construction of hermetically sealed cases to contain the constitution documents are presented.

711,881
PB83-600033 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Smolder and Flame Resistant Insulation materials, Composition and Method.
R. J. McCarter. Filed 19 Oct 81, patented 15 Feb 83, 1p PAT-APPL-6-313 045, PATENT-4 374 171

Keywords: *Cellulosic insulation, Cellulosic material, Flame and smolder resistant.

A flame and smolder resistant cellulosic insulation material, method of treating loose-fill cellulosic material, and composition for imparting flame and smolder resistance to such materials are disclosed with the combination of from about 2 to 9% sulfur and from about 10 of 25% flame retardant uniformly distributed in the cellulosic insulation material based on the weight of cellulosic material.

711,882
PB84-122274 PC **A07**/MF **A01**
Michigan Univ., Ann Arbor. Coll. of Engineering.
Degradation of Mechanical Properties of Wood during Fire.
Final rept.
G. S. Springer, and M. H. Do. Oct 83, 133p NBS-GCR-83-433
Contract NB80-NADA-1054

Keywords: *Wood, *Fire tests, Wooden structures, Tensile properties, Compressive properties, Shear properties, Degradation, Pine wood, Douglas firwood, Computer programs.

The major objectives of this investigation were to evaluate the decrease in mechanical properties of wood exposed to fire, and to develop a method that can be used to predict the failure time of loaded wooden structural members during fire exposure. To achieve these objectives analytical models were developed which can be used to calculate the temperature distribution inside the wood, the mass loss, the changes in tensile, compressive, and shear strengths and moduli, the decrease in the safety factor and the time of failure. On the basis of these models, a user friendly computer code was written which is suitable for calculating these parameters for loaded wooden slabs exposed to elevated temperatures.

711,883
PB84-125327
(Order as PB84-125293, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC.
Force-Elongation Curve of a Thin Fibrous Network.
J. C. Smith. 13 May 83, 12p
Included in Jnl. of Research of the National Bureau of Standards, v88 n5 p339-350, Sep-Oct 83.

Keywords: *Paper products, *Nonwoven fabrics, Chemical bonds, Tensile properties, Force, Elongation, Sulfate pulping, Samples.

Specimens from low-density weblike handsheets were tested in a tensile tester. In a test the direction of extension was frequently reversed and the specimen reextended to obtain a series of force-elongation curves. For Kraft woodpulp specimens the force-elongation behavior was well represented by an exponential equation involving three parameters: a modulus of elasticity C2, a length parameter Xc related to average segment length between network bonds, and an elongation value X0 at which the curve starts. Some features of the tensile behavior can be modeled by a system of parallel filaments of equal length to which longer parallel filaments with an exponential length distribution have been added. Upon extension the filaments assume load successively, thus simulating the force-elongation behavior of a paper network. By thinking in terms of this model it is possible to anticipate intuitively much of the behavior of a paper network.

711,884
PB84-137736 Not available NTIS
National Bureau of Standards, Washington, DC.
Historical Survey of Research at the National Bureau of Standards on Materials for Archival Records 1,2.
Final rept.
W. K. Wilson, and E. J. Parks. 1983, 51p
Prepared in cooperation with National Archives and Records Service, Washington, DC.
Pub. in Restaurator 5, p191-241 1983.

Keywords: *Aging tests(Materials), *Archives, *Papers, *Films, Stability, Polyester resins, Polymeric films, Preservation, Reprints.

The history of research on conservation and stability of records materials at NBS spans more than half a century, and research on stability of materials related to records is still in progress. Most of the effort has been devoted to paper, but work also has been done on stability of microfilm, microfilm blemishes, requirements for a stable laminating film, and environmental requirements for proper storage of records. The current research program includes work on the stability of polyester films used as records substrates, and for encapsulation, and the development of statistical techniques for evaluation of the condition of holdings in archival institutions.

711,885
PB84-216449 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
NBS (National Bureau of Standards) Voluntary Product Standard: Construction and Industrial Plywood.
1984, 46p NBS/PS-1/83
Also available from Supt. of Docs as SN003-003-02570-4.

Keywords: *Standards, *Plywood, Requirements, Wood products, Veneers, Adhesive bonding, Durability, Construction, Exposure, Moisture, Defects, Maintenance, Performance evaluation.

The purpose of this Voluntary Product Standard is to establish nationally recognized requirements for the principal types and grades of construction and industrial plywood and to provide a basis for common understanding among producers, distributors, and users of the product.

711,886
PB87-118147 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
New Approach to the Measurement of Pulp Consistency.
Final rept.
A. K. Gaigalas. Jul 86, 1p
Contract DE-AI01-76PRO6010
Sponsored by Department of Energy, Washington, DC.
Pub. in Tappi Jnl. 69, n7 Jul 86.

Keywords: *Papers, *Pulps, Consistency, Dielectric properties, Wavelengths, Pipe flow, Gravimeters, Radio waves, Reprints, *Dielectric constants.

The effective dielectric constant of paper pulp flowing in a pipe with diameter equal to 6.25 inches was determined by measuring the wavelength, frequency, and attenuation of radio waves propagating inside the pipe. The solids percent was obtained from the effective dielectric constant by using a simple mixing model. Good agreement was obtained with values of percent solid obtained from grab sample measurement.

711,887
PB87-131819 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Prediction of the Heat Release Rate of Wood.
Final rept.
W. J. Parker. 1986, 10p
Sponsored by Federal Emergency Management Agency, Washington, DC.
Pub. in Proceedings of International Symposium on Fire Safety Science (1st), Gaithersburg, MD., October 7-11, 1985, p207-216 1986.

Keywords: *Wood, *Heat of combustion, Thermal conductivity, Pyrolysis, Thickness, Mathematical models, Moisture, Heat flux, Particle boards, Reprints, Douglas fir.

A method for predicting the heat release rate of wood for different thicknesses, moisture contents, and exposure conditions is described. A model has been set up and calculations have been made on a microcomputer. Heat release rates and effective heats of combustion were measured as a function of time and external radiant flux on 12.5 mm thick dry vertical specimens of Douglas fir particle board. The calculated and measured curves are similar in shape and amplitude but differ significantly in time scale. The initial results with the model are promising.

711,888
PB87-158564 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.

NBS (National Bureau of Standards) Voluntary Product Standard: American Softwood Lumber Standard (Amended 1986).
1 Jan 86, 30p NBS/PS-20/70
Also available from Supt. of Docs as SN003-003-02766-9.

Keywords: *Softwoods, *Lumber, *Standards, Size determination, Manufacturing, Surface roughness, Structural timber, Dimensional measurement, Thickness, Width, Inspection, Requirements.

The responsibility of the entire softwood lumber industry for maintaining, in the public interest, nationally recognized size, grade, and inspection standards is recognized. The purpose of this Product Standard is to establish voluntary standards for the size, grade, and inspection of softwood lumber. This Product Standard is intended to establish a common basis for uniform industrywide inspection and grade-marking practices for each piece of lumber which is produced and sold in accordance with the provisions hereof.

General

711,889
PATENT-4 297 394 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Piezoelectric Polymer Antifouling Coating and Method of Use and Application.
Patent.
S. Edelman. Filed 18 Mar 80, patented 27 Oct 81, 5p PB81-600045, PAT-APPL-6-132 607

Keywords: *Antifouling coating, Film, Marine structures, Piezoelectric polymer material, Vegetable and animal life.

An antifouling coating with method of use and method of application on marine structures in the form of a film containing piezoelectric polymer material, which, when electrically activated vibrates at a selected frequency to present a surface interfacing with water which is inhospitable for attachment of vegetable and animal life including free-swimming organisms thereby discouraging their attachment and their subsequent growth thereon to the macrofoulant adult stage.

711,890
PB-262 300/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theoretical Aspects of Acoustic Emission Spectral Measurements.
Final rept.,
J. A. Simmons, and R. B. Clough. 1976, 8p
Pub. in Proceedings of World Conference on Nondestructive Testing (8th), Held at Cannes, France on September 6-10, 1976, p1-8.

Keywords: *Nondestructive tests, *Acoustics, Defects, *Acoustic emission testing.

In this paper, the authors describe progress in developing the theory of acoustic emission. More specifically, they examine acoustic emission from planar, straight line dislocation segments moving in bursts. For simplicity, the ideal case of an infinite isotropic body is treated. This case should, however, provide an illustration of the general nature of the acoustic emission spectrum and how is it produced.

711,891
PB-282 444/9 PC **A16**/MF **A01**
National Bureau of Standards, Boulder, Colo. Thermophysical Properties Div.
Materials Studies for Magnetic Fusion Energy Applications at Low Temperatures - I.
Technical rept.
F. R. Fickett, and R. P. Reed. Apr 78, 367p NBSIR-78-884
Sponsored in part by Department of Energy, Washington, D.C. Div. of Magnetic Fusion Energy.

Keywords: *Materials, *Cryogenics, *Superconducting magnets, Stainless steels, Welds, Physical properties, Mechanical properties, Laminates, Fatigue(Materials), Fractures(Materials), Crack propagation, Elastic properties, Tables(Data), Metals, Nuclear fusion, Toughness, Tensile properties, Steel 304, Steel 316.

The reports presented here summarize the work of the low temperature materials research project for the first year of the program. The various projects are outlined and the research results are presented. The major thrust of the measurements has been the evaluation of the low temperature properties of stainless steel base metal and welds, with particular emphasis on the nitrogen strengthened stainless steels. Some initial work has also been done on the production and properties of nonmetallics, primarily industrial laminates, for low temperature applications. A handbook of material properties is also planned. A survey of low temperature materials needs and problems related to magnetic fusion energy, performed by NBS as groundwork for the program, is included as is a brief description of the first workshop held in October 1977.

711,892
PB77-600075 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurements on Insulating Materials at Cryogenic Temperatures.
W. E. Anderson, R. S. Davis, F. I. Mopsik, S. J. Kryder, F. Khoury, J. P. Colson, and L. H. Bolz. 1976, 135p
Pub. in Annual Report, Energy Research and Development Admin., Energy Conservation Report CONS/2062-1, 135 pages, 1976.

Keywords: Bridge measurements, Cryogenic, *Dielectric loss, Dissipation factor, *Epoxy insulation, High voltage, *Polymer tape insulation, Superconducting cable, Underground transmission.

This report details progress made to date on developing instrumentation and measurement methodology for studying high-voltage dielectric losses at cryogenic temperatures. The work described has been done in support of ERDA-funded ac superconducting transmission line projects at Brookhaven National Laboratory (BNL) and the Linde Division of the Union Carbide Corporation (UCC-Linde). Dissipation factor measurements have been made at a temperature of 4.2 K and at stresses up to 40 kV/mm. Care has been taken to insure that errors in dissipation factor measurements are less than + or - 1 x 10 to the minus 6 power. Sample dielectrics have included polymer tapes of interest to BNL and epoxy spacer material of interest to UCC-Linde. When dissipation factor measurements are made at high voltage, losses as sample interfaces become important. Flexible superconducting cables are designed to have many layers of coaxially wound plastic tape serving as the insulation. The spaces between tape layers will be impregnated with helium at pressures up to 1.5 MPa. Plans to investigate high-voltage dielectric losses under these conditions are discussed including a technique for measuring partial discharges using pulse-height analysis.

711,893
PB78-600024 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermal Conductivity of Ten Selected Binary Alloy Systems.
C. Y. Ho, M. W. Ackerman, K. Y. Wu, S. G. Oh, and T. N. Havill. 1978, 220p
Included in Jnl. of Physical and Chemical Reference Data, v7 n3 p959-1178 1978.

Keywords: *Conductivity, Critical evaluation, Data analysis, Data compilation, Data synthesis, Electrical resistivity, Metals, Recommended values, Thermal conductivity, Thermoelectric power.

This work reviews and discusses the available data and information on the thermal conductivity of ten selected binary alloy systems and presents the recommended values resulting from critical evaluation, analysis, and synthesis of the available data. The ten binary alloy systems selected are the systems of aluminum-copper, aluminum-magnesium, copper-gold, copper-nickel, copper-palladium, copper-zinc, gold-palladium, gold-silver, iron-nickel, and silver-palladium. The recommended values given include values of the total thermal conductivity, electronic thermal conductivity, and lattice thermal conductivity. The uncertainty of the values is generally of the order of plus or minus 10 percent. The values for each of the alloy systems except two are given for 25 alloy compositions: 0.5, 1, 3, 5, 10(5)95,97,99, and 99.5 percent. For most of the alloy compositions, the values cover the temperature range from 4 K to the solidus temperature or 1200 K. In addition, reliable methods for the estimation of the electronic and lattice thermal conductivities of alloys have been developed in this study.

711,894
PB80-107279 Not available NTIS
National Bureau of Standards, Washington, DC.
Materials Failure and Materials Research Policy.
Final rept.,
J. D. Hoffman. 1979, 10p
Pub. in Proceedings of the Symposium Meeting of the American Chemical Society (176th), Miami, Florida, September 11-14, 1978, ACS Symposium Series 95, Durability of Macromolecular Materials, Paper 1, p1-10 1979.

Keywords: *Materials tests, Service life, Failure, Durability, Life tests.

Several examples of failure in metals, ceramics, and polymeric materials are described to illustrate the need for increased understanding of the associated areas of lieftime prediction and materials durability. Examples of NBS studies of predictive testing are discussed in terms of the scientific problems which underlie such efforts. Recent national activities related to materials research policy are reviewed.

711,895
PB80-223159 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
NBS: Materials Measurements.
Annual rept. Apr 79-Mar 80,
J. R. Manning. Jul 80, 118p NBSIR-80-2082
Sponsored in part by National Aeronautics and Space Administration, Washington, DC. Materials Processing in Space Program.

Keywords: *Measurement, *Interfacial tension, *Convection, *Thermodynamic properties, Gallium, Refractory materials, Chemical reactivity, Oxides, Directional solidification.

The report describes NBS work for NASA in support of NASA's Materials Processing in Space Programs. In Task 1 - Surface Tensions and Their Variations with Temperature and Impurities - measurements in an Auger spectrometer of surface impurity concentrations on liquid gallium showed that the principle impurities were oxygen and carbon. The impurities showed a tendency to collect into plates or clumps. In Task 2 - Solutal Convection During Directional Solidification - in Pb-rich Pb-Sn off-eutectic alloys, macrosegration caused by solutal convection was not reduced by vertical or horizontal fields of 0.1T, but downward solidification (liquid below solid) virtually eliminated macrosegration in small (approximately 3 mm) diameter samples. In Task 3 - A Thermochemical Study of Corrosive Reactions in Oxide Materials - phase assemblages of selected compositions on the joints K(Fe0.5 Si 0.5) O2 -SiO2 and KFeO2 - SiO2 were determined over a large range of oxygen partial pressures and the temperature range 800C to 1400C. In Task 4 - Thermodynamic Properties of Refractory Materials at High Temperatures - use of pyroelectric detectors to determine the radiant heat loss from spherical samples as cooling occurs in free-cooling experiments is being investigated.

711,896
PB80-226632 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Flammability Testing of Solids Under the Federal Hazardous Substances Act.
Final rept. 1974-75,
R. D. Peacock, and M. P. Vaishnav. Apr 80, 93p NBSIR-78-1580
Supersedes PB80-179047. Sponsored in part by Consumer Product Safety Commission, Washington, DC.

Keywords: *Hazardous materials, *Flammability testing, Flame propagation, Fire tests, Fire safety, Powders(Particles), Fibers, Granular materials, Solids, Federal Hazardous Substances Act.

The objective of the Federal Hazardous Substances Act is to protect the consumer from hazards that arise from a large variety of products. The Act and its regulations have several provisions pertaining to the measurement of the flammability of substances. Some are detailed and explicity; others provide only general guidelines. This report presents the results of a program to provide improvements to particular provisions of the Act and includes test methods that may be used for the testing of various solid materials. An extensive review of the Federal Hazardous Substances Act, its predecessor, and the legislative history provides the basis for some specific recommendations for improvement or clarification. Experimental work performed for the improvement of test methods for shredded or slit

films, powders, pastes, and granular substances, and for extremely flammable solids is discussed. This report is based on work sponsored by the Consumer Product Safety Commission and performed from 1974 through 1976.

711,897
PB81-143570 Not available NTIS
National Bureau of Standards, Washington, DC.
Needed: A Fracture Mechanics Vocabulary.
C. G. Interrante. 1979, 3p
Pub. in Am. Soc. Test. Mater. Stand. News 7, n4 p22-24 1979.

Keywords: *Terminology, *Fracture tests, Fractures(Materials), Reprints.

Terminology for fracture testing is developed within Committee E-24 through the cooperative efforts of the entire membership of the Main Committee.

711,898
PB81-238537 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
NBS: Materials Measurements.
Annual rept. 1 Apr 80-31 Mar 81.
J. R. Manning. Jun 81, 149p NBSIR-81-2295
NASA Order-H-27954B
See also PB80-223159.

Keywords: *Interfacial tension, *Measurement, *Convection, *Thermodynamic properties, Tungsten, Refractory materials, Adsorption, Solidification.

The work emphasizes measurements of materials properties and thermophysical properties. The results obtained for each task are given in detailed summaries in the body of the report. The five tasks are Task 1 - Surface Tensions and Their Variations with Temperature and Impurities; Task 2 - Convection During Unidirectional Solidification; Task 3 - Measurement of High Temperature Thermophysical Properties of Tungsten Liquid and Solid; Task 4 - Thermodynamic Properties of Refractory Materials at High Temperatures; Task 5 - Experimental and Theoretical Studies in Wetting and Multilayer Adsorption.

711,899
PB81-245318 PC **A21**/MF **A01**
National Bureau of Standards, Washington, DC.
Technical Activities 1980: Center for Materials Science.
J. B. Wachtman, and D. H. Reneker. Oct 80, 480p
NBSIR-80-2108

Keywords: *Materials, Research projects.

The Center for Materials Science is part of the National Measurement Laboratory, one of the principal laboratories comprising the National Bureau of Standards. The Center is organized in six Divisions, each having responsibility in different areas of materials science appropriate to the major classes of materials -- metals, polymers, and ceramics and glass. These Divisions vary in their balance between theory and experiments, between direct standards work and research, and in their orientation toward industrial and Government needs and the needs of other components of the scientific and technical community. This volume summarizes the technical research activities and accomplishments of the six Divisions of the Center for Materials Science for Fiscal Year 1980.

711,900
PB82-142126 PC **A22**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
National Measurement Laboratory Center for Materials Science, Annual Report 1981.
J. D. Hoffman, and J. B. Wachtman. Nov 81, 522p
NBSIR-81-2408

Keywords: *Research, Metals, Polymers, Ceramics, Glass, Stability, Corrosion, High temperature tests, Standards, Plastics, Elastomers, Fractures(Materials), Deformation, Metallurgy, Neutron scattering, *Materials science, Standard reference materials.

The Center for Materials Science is part of the National Measurement Laboratory, one of two principal laboratories comprising the National Bureau of Standards. The Center is organized in six Divisions, each having responsibility in different areas of materials science appropriate to the major classes of materials--metals, polymers, ceramics, and glass. The Divisions vary in their balance between theory and experiment, between direct standards work and research, and in their orientation toward industrial and Government needs and the needs of other components of the scientific and technical community. This volume summaries the technical research activities and accomplishments of the six Divisions of the Center for Materials Science for fiscal year 1981.

711,901
PB82-600059 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Purity Materials, Standards, and Reference Materials.
D. A. Becker, H. L. Rook, and P. D. LaFleur. 1981, 22p
Pub. in Studies in Analytical Chemistry 3, Nondestructive Activation Analysis, p237-258 1981.

Keywords: *Accuracy, High purity materials, Instrumental neutron activation analysis, Precision, Reference materials, Standards, Trace analysis.

This is a chapter section which covers utilization of instrumental neutron activation analysis for the analysis of pure materials, and the proper use of standards and reference materials for trace element analyses with this technique. Also provided is an up-to-date listing of most of the readily available reference materials, including NBS SRM's.

711,902
PB83-177485 Not available NTIS
National Bureau of Standards, Washington, DC.
Low-Temperature Materials Research: A Historical Perspective.
Final rept.
F. R. Fickett. 1982, 16p
Pub. in Proceedings of International Cryogenic Materials Conference (4th), San Diego, California, August 10-14, 1981, Paper in Advances in Cryogenic Engineering 28, p1-16 1982.

Keywords: *Cryogenics, *Materials, Metals, Alloys, Superconductors, Reviews.

The evolution of materials research at cryogenic temperatures is traced from its earliest beginnings to the present day. The emphasis is on developments in the United States. Nonsuperconducting components of cryogenic systems are the main topic, but practical superconductors are not neglected. An assessment of the data base as it now exists is presented as well as some projections for the future. A few mild-mannered comments are made regarding the modern tendency to first build large devices and then do the materials research.

711,903
PB84-218940 Not available NTIS
National Bureau of Standards, Washington, DC.
Energy-Release Rate Associated with Diffusional Crack Growth.
Final rept.
T. J. Chuang. 1983, 14p
Sponsored in part by Department of Energy, Washington, DC. See also DE83-165076.
Pub. in International Jnl. of Fracture 23, p229-242 1983.

Keywords: *Crack propagation, Diffusion, Fracture(Materials), Reaction kinetics, Thermodynamics, Energy, Reprints, J integrals.

A general expression for the energy release rate (G) that arise during steady state crack propagation by diffusion is derived from the standpoint of irreversible thermodynamics. Three contributing components of G are identified: (1) the Griffith energy (GGr); (2) heat generated in the process of surface diffusion; and (3) grain-boundary diffusion. Further, the total G is shown to be directly related to the well-known J-integral if the strain energy effects can be ignored. This expression for G is valid in general even if the response of the material is not linear and the mass transport kinetics does not follow Fick's law. Quantitative evaluations of each component are made for the linear case where field solutions are available.

711,904
PB84-223221 Not available NTIS
National Bureau of Standards, Washington, DC.
Critical Issues in Materials and Mechanical Engineering.
Final rept.
J. T. Fong, R. C. Dobbyn, L. Mordfin, and B. M. Johnson. 1981, 286p
Pub. in Proceedings of Pressure Vessels Piping Conference, Centennial Celebration, American Society of Mechanical Engineers, San Francisco, CA., Aug 12-15, 1980, Paper in Critical Issues in Materials and Mechanical Engineering PVP-47, 286p 1981.

Keywords: Curve fitting, Mathematical models, Reliability, Nondestructive tests, Fatigue(Materials), Safety, Standards, Boiler codes, Pressure vessels, Pipes(Tubes), Pumps, Valves, Welding, *Materials science, Failure analysis, Fracture mechanics.

This book resulted from a three-year-effort by more than one hundred contributors under the leadership of the Materials and Fabrication Committee, Am. Soc. of Mech. Engrs. Beginning in April 1978 when the idea of planning a critical issue symposium was first conceived, a total of twelve issues were identified through a series of pre-symposium meetings and reviews. The twelve issues are: (1) The role of engineering judgment and the computer in the management of material property data. (2) Curve-fitting vs. modeling for formulating design rules. (3) New material property data: Terminal vs. incremental tests. (4) Variability of data: Standards for applications. (5) On-line monitoring of critical components to improve reliability. (6) Upgrading welders' skill and education level: How and why. (7) Reliability of nondestructive evaluation. (8) Characterization of the subjective component of inservice data. (9) Should there be a methodology for failure analysis. (10) Accelerated development of a more rational basis for nonlinear fracture mechanics. (11) Safety factors in fatigue design: Arbitrary or rational. (12) The ASME Code and Product Liability: Should compliance create a rebuttable presumption of proper design.

711,905
PB84-244722 Not available NTIS
National Bureau of Standards, Washington, DC.
Substituting Non-Metallic Materials for Vulnerable Minerals.
Final rept.
D. H. Reneker. 1984, 6p
Pub. in Materials and Society 8, n2 p195-200 1984.

Keywords: *Materials, Substitutes, Performance evaluation, Cost analysis, Design criteria, Polymers, Ceramics, Reprints.

Work, in cooperation with industry, in the Center for Materials Science of the National Bureau of Standards on the processing, microstructure, performance and properties of materials is described. Resulting information about materials allows designers and manufacturers to make informed choices about the use of advanced ceramics and polymers to minimize dependence on vulnerable minerals as well as to optimize cost and performance.

711,906
PB85-179059
(Order as PB85-179042, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD. Center for Materials Science.
Indentation Fractography: A Measure of Brittleness.
B. R. Lawn, and D. B. Marshall. 30 Aug 84, 17p
Sponsored by Office of Naval Research, Arlington, VA. Prepared in cooperation with Rockwell International, Thousand Oaks, CA. Science Center.
Included in Jnl. of Research of the National Bureau of Standards, v89 n6 p435-451 Nov-Dec 84.

Keywords: *Fractography, *Brittleness, Crack propagation, Mechanical properties.

Indentation constitutes one of the most powerful test techniques for the systematic investigation of deformation and fracture responses in brittle materials. Indentations can be used to evaluate critical mechanical parameters (toughness, hardness, elastic modulus) with great simplicity and high accuracy.

711,907
PB85-187250 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

National Materials Policy: Critical Materials and Opportunities.
Final rept.
J. B. Wachtman. 1982, 7p
Pub. in American Ceramics Society Bulletin 61, n2 p214-220 1982.

Keywords: Government policies, Reprints, *Critical materials, Advanced materials.

Materials technology is vital and central to high productivity in manufacturing, to efficient energy conversion, to maintaining a high level of health and safety, and to striking a good balance between our standard of living and environmental protection. Recent concern with the possibility of a 'resource war' waged in terms of price escalation or outright cutoff has brought the question of secure supply to the fore. Our advanced technological society requires many very special, high-performance materials. Some of these are almost unique in their ability to perform the required functions. The authors call these critical materials when the function that they perform is very important and when substitution of other materials significantly lowers performance or increases cost or does both.

711,908
PB85-208031 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optical Test Method for Measuring Biaxial Deformations.
Final rept.
R. S. Polvani, C. P. Reeve, and R. C. Veal. Jan 85, 5p
Contract N00014-82-F-0038
Pub. in Jnl. of Testing and Evaluation 13, n1 p69-73 Jan 85.

Keywords: *Deformation, *Optical measurement, Extensometers, Beryllium, Tests, Reprints.

A new and simple method is described for the measurement of biaxial deformation with a resolution of 0.025 micrometer (1 microinch). The basis for this technique is the use of an optical extensometer.

711,909
PB85-208064 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Some Remarks on the History and Development of the ASTM Committee E-37 Purity Method.
Final rept.
C. M. Guttman. 1984, 6p
Pub. in American Society for Testing and Materials, Special Technical Publication 838, p16-21 1984.

Keywords: *Purification, *Standards, *Materials tests, Sampling, Performance evaluation, Reprints.

The history and development of the ASTM Committee E-37 Purity Method are discussed. The early protocols and resulting round robin data are considered. The importance of the development of suitable sample materials to be used by the task group members in parallel with the methods development will also be discussed.

711,910
PB86-132644 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Microindentation Hardness Testing.
Final rept.
P. J. Blau, and T. R. Shives. 1985, 5p
Pub. in ASTM (American Society for Testing and Materials) Standardization News 13, n1 p47-51 Jan 85.

Keywords: *Hardness tests, Metals, Microhardness, Microstructure, Failure.

The paper briefly reviews two common micro-indentation hardness testing methods for metals, highlighting sources of measurement errors, the need to understand the significance of microhardness numbers, and both traditional and more unique applications of such testing. Examples of studies from several applied fields are used to illustrate the points in the discussion: failure analysis, microstructural characterization, fracture mechanism research, and tribology. The trend towards automating hardness test methods is discussed.

711,911
PB86-196011 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Investigations in Array Sizing - 2. The Kubitschek Effect.
Final rept.
A. W. Hartman. 1985, 4p
See also PB85-151637.
Pub. in Powder Technology 42, n3 p269-272 Jun 85.

Keywords: *Particle size, *Dimensional measurement, Optical measurement, Spheres, Reprints, *Microspheres, Kubitschek effect.

The Kubitschek array correction is detected and measured in microsphere material for the first time. Introduction of two new techniques permitted carrying out the needed dimensional measurements at the 0.01 micrometer level using optical microscopy.

711,912
PB87-162251 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Progress Towards a Computerized Materials Data System.
Final rept.,
J. R. Rumble. 1985, 10p
Pub. in Computerized Materials Data - A Workshop for Ground Vehicle Engineering, p25-34 1985.

Keywords: *Mechanical properties, Corrosion, *Computerized materials data, Computer applications.

A survey is given of progress towards developing a comprehensive computerized materials data system. The various supporting activities are identified.

711,913
PB88-110838 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Progress of the VAMAS (Versailles Project on Advanced Materials and Standards) Surface Chemical Analysis Working Party.
Final rept.,
C. J. Powell. 1987, 6p
Pub. in VAMAS (Versailles Project on Advanced Materials and Standards) Bulletin No. 6, p1-6 Jul 87.

Keywords: *Materials, *Surface chemistry, Standards, Workshops, Reprints.

A brief status report is presented on recent activities and current plans of the Surface Chemical Analysis Working Party of the Versailles Project on Advanced Materials and Standards (VAMAS).

711,914
PB88-152723 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Terminology Update - Fatigue and Fracture.
Final rept.,
C. G. Interrante. 1985, 2p
Pub. in ASTM (American Society for Testing and Materials) Standardization News, p28-29 Nov 85.

Keywords: *Standards, *Terminology, Documents, Fatigue(Materials), Fractures, Reprints, ASTM(American Society for Testing and Materials).

ASTM terminology standards are an essential part of the development and use of ASTM standard documents. Possibilities for expanding the applicability of terminology standards beyond the support of ASTM standards are explored as an invitation to all members of the Society to consider these wider uses. Approaches taken in ASTM Terminology Standards for fatigue and fracture are used as examples.

MATHEMATICAL SCIENCES

Algebra, Analysis, Geometry, & Mathematical Logic

711,915
AD-A052 205/2 PC **A02**/MF **A01**
California Univ., Santa Barbara. Inst. for the Interdisciplinary Applications of Algebra and Combinatorics.
Off-Diagonal Elements of Normal Matrices.
R. Grone. 4 Feb 77, 5p AFOSR-TR-78-0424
Grant AFOSR-77-3166
Availability: Pub. in Jnl. of Research of the National Bureau of Standards, B. Mathematical Sciences, v81B nos.1/2 p41-44 Jan-Jun 77.

Keywords: *Matrix theory, Complex variables, Numerical analysis, Eigenvalues, Eigenvectors, Hilbert space, Reprints.

Let A be an nxn complex matrix, and let W(A) denote the numerical range of A. In this paper, results of Parker and Mirsky are shown to be a consequence of the following fact. If A is normal, then the maximum value of (Ax,y) as x and y run over all ortho-normal pairs in C to the nth power coincides with the radius of the smallest closed disk in C which contains W(A). (Author)

711,916
AD-A101 792/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Extended-Range Arithmetic and Normalized Legendre Polynomials.
J. M. Smith, F. W. J. Olver, and D. W. Lozier. Mar 77, 14p ARO-14044.8-M
Grants DAAG29-77-G-0003, NSF-GP-32841
Pub. in ACM Transactions on Mathematical Software, v7 n1 p93-95 Mar 81 (No copies furnished by DTIC/NTIS).

Keywords: *Polynomials, *Arithmetic, Algorithms, Exponential functions, Floating point operation, Reprints, Legendre polynomials, Extended range arithmetic, NTISDODXR.

No abstract available.

711,917
AD-A123 592/8 Not available NTIS
Maryland Univ., College Park.
Further Developments of Rp and Ap Error Analysis.
F. W. J. Olver. 16 Apr 82, 26p ARO-16928.2-MA
Contract DAAG29-80-C-0032, Grant DAAG29-77-G-0003
Sponsored in part by Grant NSF-MCS78-02111.
Availability: Pub. in IMA Jnl. of Numerical Analysis, v2 p249-274 1982 (No copies furnished by DTIC/NTIS).

Keywords: *Floating point operation, *Error analysis, *Numerical analysis, Precision, Computations, Logarithm functions, Real numbers, Reprints, RP(Relative Precision), AP(Absolution Precision).

No abstract available.

711,918
AD-A131 521/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Error Analysis of Complex Arithmetic.
F. W. J. Olver. 1983, 15p ARO-16928.3-MA
Contract DAAG29-80-C-0032
Pub. in Computational Aspects of Complex Analysis, p279-292 1983 (No copies furnished by DTIC/NTIS).

Keywords: *Functions(Mathematics), *Error analysis, Algorithms, Precision, Computations, Floating point operation, Reprints.

The lecture begins with a brief account of recent work on unrestricted algorithms or computing mathematical functions, especially the development of error analysis based on a nontraditional definition of relative error. The main part of the talk describes the application of this analysis to real and complex arithmetic and concludes with some new extensions that have been made in complex arithmetic.

711,919
PB-247 477/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Continuous Solutions of a Homogeneous Functional Equation.
Final rept.
M. Newman, and M. Sheingorn. 1975, 13p
Pub. in Aequationes Math., v13 n1/2 p47-59 1975.

Keywords: *Functional analysis, Analytic functions, Computation, Theorems, Reprints.

It is shown that the functional equation f(x) + f(ax) + f(bx) = 0 , 1 < a < b, has a non-trivial solution which is continuous for all real x if and only if b not equal (a squared).

711,920
PB-262 615/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Asymptotic Formulas Related to Free Products of Cyclic Groups.
Final rept.,
M. Newman. Oct 76, 9p
Pub. in Math. Comp. 30, n136 p838-846 Oct 76.

Keywords: *Group theory, Asymptotic series, Reprints, Cyclic groups.

Asymptotic formulas for the number of subgroups of a given index of the free product of finitely many cyclic groups are given. The classical modular group Gamma is discussed in detail, and a table of the number of subgroups of Gamma of index n is given for 1 < or = n < or = 100.

711,921
PB-263 145/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Multiplicativity and Compatibility of Generalized Matrix Norms.
Final rept.,
C. R. Johnson. 1977, 13p
Pub. in Linear Algebra and Appl., v16 p25-37 1977.

Keywords: *Matrices(Mathematics), Computation, Reprints, *Matrix norms.

It is well known that if a generalized matrix norm is multiplicative, then it has a compatible vector norm associated with it. The converse, however, is invalid, and the precise relation between multiplicativity and compatibility is explored for a generalized matrix norm. In the process, certain methods for deriving one norm from another are mentioned.

711,922
PB-264 308/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Inertia of a Product of Two Hermitian Matrices.
Final rept.,
C. R. Johnson. Jan 77, 6p
Pub. in Jnl. of Mathematical Analysis and Applications, v57 n1 p85-90 Jan 77.

Keywords: *Matrices(Mathematics), Multiplication, Reprints, *Hermitian matrices.

Given the inertias of H and K, hermitian and nonsingular, the precise set of possible inertias of HK is determined. Several consequences are given.

711,923
PB-265 780/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Functional Characterizations of the Field of Values and the Convex Hull of the Spectrum,
C. R. Johnson. 1976, 4p
Pub. in Proc. Am. Math. Soc. 61, n2 p201-204 Dec 76.

Keywords: *Convex sets, *Matrices(Mathematics), Reprints.

The only compact, convex set-valued homogeneous and translatable function of square complex matrices which is an indicator function for the matrices with positive semidefinite real part is the classical field of values. An analogous characterization of the convex hull of the spectrum is given.

711,924
PB-265 869/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Connection Formulas for Second-Order Differential Equations with Multiple Turning Points,
F. W. J. Olver. 1977, 28p
Sponsored in part by Army Research Office, Durham, N.C.
Pub. in SIAM J. Math. Anal., v8 n1 p127-154 Feb 77.

Keywords: *Differential equations, *Approximation, Bessel functions, Asymptotic series, Reprints.

No abstract available.

711,925
PB-266 035/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Locally Compatible Generalized Matrix Norms,
C. R. Johnson. 1977, 4p
Pub. in Numer. Math., v27 p391-394 1977.

Keywords: *Matrices(Mathematics), Computation, *Matrix norms, Reprints.

No abstract available.

711,926
PB-266 471/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Moment-Theory Approximations for Non-Negative Spectral Densities,
C. T. Corcoran, and P. W. Langhoff. Apr 77, 7p
Pub. in Jnl. Math. Phys. v18 n4 p651-657 Apr 77.

Keywords: *Approximation(Mathematics), Power spectra, Integrals, *Method of moments, Stieltjes integral, Reprints.

Moment theory approximations constructed from finite numbers of spectral power moments are described for continuous, non-negative spectral densities and associated Stieltjes integrals. Derivatives of the mean (Stieltjes) values of the nth-order Tchebycheff bounds on nondecreasing distributions provide the appropriate approximations to the associated spectral densities. The nth-order Tchebycheff density so defined is shown to be real, non-negative, and continuous on the real axis, to have 2n-4 continuous derivatives there, and to support 2n-2 positive-integer power moments. Related approximations to the associated Stieltjes integral are obtained from the appropriate principal-value quadratures. The Tchebycheff densities are convergent in the limit of large numbers of spectral moments for determined moment problems, but they are not solutions of reduced moment problems of appropriate finite order. An illustrative application in the case of normal-mode lattice vibrations in a diatomic chain indicates that the Tchebycheff densities are suitably convergent, and provide faithful images of the forbidden band gap and Van Hove singularities present.

711,927
PB-267 034/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hadamard Product Involving M-Matrices,
C. R. Johnson. 1977, 4p
Pub. in Linear and Multilinear Algebra, v4 p261-264 1977.

Keywords: *Matrices(Mathematics), Computation, Reprints, Hadamard matrices.

It is shown that for any pair M,N of n by n M-matrices, the Hadamard (entry wide) product (M)(N sup-1) is again an M-matrix. For a single M-matrix M, the matrix (M)(M sup -1) is also considered.

711,928
PB-267 229/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Second-Order Differential Equations with Fractional Transition Points,
F. W. J. Olver. 1977, 15p
Sponsored in part by Army Research Office, Durham, N.C.
Pub. in Transactions of American Mathematical Society, v226 p227-241 1977.

Keywords: *Differential equations, Numerical analysis, Bessel functions, Complex variables, Reprints.

No abstract available.

711,929
PB-270 337/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Bifurcation of Solutions with Crystalline Symmetry.
Final rept.,
H. J. Raveche, and C. A. Stuart. 1976, 5p
Pub. in J. Math. Phys., v17 n10 p1949-1953 Nov 76.

Keywords: *Integral equations, Lattices(Mathematics), Nonlinear systems, Reprints, *Bifurcation theory.

The authors consider a nonlinear integral equation and the existence of solutions which have given lattice symmetries. Using fiburcation theory, the existence of branches of non-Euclidean invariant solutions is proven. The behavior of the bifurcation coefficients is calculated explicitly and stability is ascertained from a free energy functional.

711,930
PB-272 531/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Connection Formulas for Second-Order Differential Equations Having an Arbitrary Number of Turning Points of Arbitrary Multiplicities.
Final rept.,
F. W. J. Olver. 1977, 28p
Pub. in SIAM Jnl. Math. Anal., v8 n4 p673-700 Aug 77.

Keywords: *Differential equations, Approximation, Eigenvalues, Reprints, Liouville-Green approximation.

This paper solves the general problem of connecting the Liouville-Green approximations throughout an interval (a,b) for any number of turning points of arbitrary multiplicities. Several illustrative examples are given, including an arbitrary number of turning points of even multiplicity, an arbitrary number of turning points of odd multiplicity, an eigenvalue problem involving four turning points of multiplicities 1, 2, 3, and 4, and a problem solvable exactly in terms of Whittaker functions.

711,931
PB-272 544/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tanh Rule for Numerical Integration.
Final rept.,
S. Haber. 1977, 18p
Pub. in SIAM Jnl. Numer. Anal. 14, n4 p668-685 Sep 77.

Keywords: *Analytic functions, *Numerical integration, Rational functions, Approximation, Hyperbolictangent rule, Hardy space, Reprints.

The tanh rule for numerical integration is analyzed in the context of the Hardy space (H sup 2). The optimal parameter choice is determined, and it is shown that the norm of the error functional is asymptotic to C exp(-(Pi/2)(square root of (M)), where M is the number of points used and C is a certain constant. The result is related to recent theorems on the approximation of piecewise analytic functions by rational functions.

711,932
PB-280 406/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Functions Defined by Iterations of Each Other.
Final rept.,
J. D. Becker, and E. T. Ordman. 1972, 4p
Pub. in Aequationes Math., v8 n3 p238-241 1972.

Keywords: *Functions(Mathematics), Modules (Mathematics), Iteration, Reprints.

Let f and g be functions from and into the nonnegative integers, and denote iteration by superscripting (so (f sup 2)(n) = f(f(n))). The authors found all solutions of the functional equation (f sup n+1)(m) = (g sup m+1)(n) 0 = or < m, n < infinity and show in particular f(n) = g(n) for all n, for all solutions. The solution involves elementary modular arithmetic.

711,933
PB-280 591/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Multiplicative Maps of Matrix Semigroups Over Dedekind Rings.
Final rept.,
S. Pierce. 1973, 5p
Pub. in Arch. Math., v24 n1 p25-29 1973.

Keywords: *Matrices(Mathematics), Semigroup theory, Dedekind rings, Reprints.

No abstract available.

711,934
PB-281 985/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Note on an Equation Related to the Pell Equation.
Final rept.,
M. Newman. May 77, 2p
Pub. in American Mathematical Monthly, v84 n5 p365-366 May 77.

Keywords: *Diophantine equations, *Pell equation, Reprints.

It is shown that the diophantine equation (x squared) - d(y squared) = -1 has solutions, provided that d = p1p2...pr, where r is 2 or odd and p1,p2,...,pr are dis-

tinct primes congruent to 1 modulo 4 such that (p1/pj) = -1, i not equal to j.

711,935
PB-282 121/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sufficient Conditions for Ackerberg-O'Malley Resonance.
Final rept.,
F. W. J. Olver. Apr 78, 28p
Grants DA-ARO-D-31-124-73-G204, NSF-GP-32841
Pub. in SIAM Jnl., v9 n2 p328-355 Apr 78.

Keywords: *Boundary value problems, Viscous flow, Resonance, Weber equation, Reprints.

An investigation is made of the asymptotic nature of the solution of the boundary-value problem epsilon (y double prime) + 2xA(epsilon,x)y' - A(epsilon,x)B(epsilon,x)y = 0,y(a) = l, y(b) = m, as epsilon approaches 0, where A(epsilon,x) and B(epsilon,x) are continuous real functions of epsilon and x, a < 0, b > 0, and A(epsilon,x) is nonzero in the closed interval (a,b).

711,936
PB-282 123/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Asymptotic Behavior of Integrals of Bessel Functions of High Order.
Final rept.,
M. L. Glasser, and F. W. J. Olver. 1977, 15p
Grants DA-ARO-D-31-124-73-G204, NRC-9344
Sponsored in part by Grant NSF-GP-32841.
Pub. in Utilitas Math., v12 p224-239 1977.

Keywords: *Bessel functions, Gamma function, Airy function, Approximation, Contour integration, Asymptotic approximation, Stirling formula, Reprints.

Two methods are developed for the approximate evaluation of infinite integrals of products of Bessel functions when the order of these functions is large. The first method is to transform the integral into a contour integral of Barnes' type, and then approximate the resulting Gamma functions by Stirling's formula. The second method is to approximate the Bessel functions by their uniform asymptotic approximations in terms of elementary or Airy functions.

711,937
PB-282 148/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Approach to Error Arithmetic.
Final rept.,
F. W. J. Olver. Apr 78, 26p
Grants DA-ARO-D-31-124-73-G204, NSF-GP-32841
Pub. in SIAM Jnl. of Numerical Analysis, v15 n2 p368-393 Apr 78.

Keywords: *Error analysis, Computation, Floating point operation, Interval analysis, Round off errors, Reprints.

By modification of the standard definition of relative error, a form of error arithmetic is developed that is well suited to floating-point computations. Rules are given for conversion from interval analysis to the new approach, and vice versa, both for real and complex variables. Illustrative applications include accumulation of products, quotients, sums and inner products, and the evaluation of polynomials. The paper also includes some new error bounds for basic operations in floating-point arithmetic.

711,938
PB-282 916/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Accretive Matrix Products.
Final rept.,
C. S. Ballantine, and C. R. Johnson. 1975, 17p
Pub. in Linear and Multilinear Algebra, v3 p169-185 1975.

Keywords: *Matrices(Mathematics), Eigenvalues, Inequalities, Hermition matrices, Reprints.

No abstract available.

711,939
PB-284 620/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Multilinear Transformations on Matrices.
Final rept.,
H. A. Robinson. 1978, 14p
Pub. in Linear Algebra and Appl. 20 p205-218 1978.

Keywords: *Matrices(Mathematics), *Determinants, Transformations(Mathematics), Reprints.

No abstract available.

711,940
PB-284 621/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
R-Domination in Graphs.
Final rept.,
P. J. Slater. Jul 76, 5p
Pub. in Jnl. Assoc. Comput. Mach. 23 n3 p446-450 Jul 76.

Keywords: *Graph theory, Trees(Mathematics), Algorithms, Computational complexity, Reprints.

The problem of finding a minimum k-basis of graph G is that of selecting as small a set B of vertices as possible such that every vertex of G is at distance K or less from some vertex in B. Cockayne, Goodman, and Hedetniemi previously developed a linear algorithm to find a minimum 1-basis (a minimum dominating set) when G is a tree. In this paper the k-basis problem is placed in a more general setting, and a linear algorithm is presented that solves the problem for any forest.

711,941
PB-284 622/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fibonacci Numbers in the Count of Spanning Trees.
Final rept.,
P. J. Slater. Feb 77, 4p
Pub. in Fibonacci Quart. 15, n1 p11-14 Feb 77.

Keywords: *Trees(Mathematics), Number theory, Graph theory, *Fibonacci numbers, Lucas numbers, Reprints.

The occurrence of Fibonacci and Lucas numbers in the count of the number of spanning trees of a labelled graph, or multigraph, is examined. Formulas which give this number for several classes of graphs are presented.

711,942
PB-285 374/5
(Order as PB-281 311/1, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Vector-Valued Entire Functions of Bounded Index Satisfying a Differential Equation.
L. F. Heath. 27 Sep 77, 7p
Included in Jnl. of Research of the National Bureau of Standards, v83 n1, p75-80, Jan-Feb 78.

Keywords: *Entire functions, *Linear differential equations, Complex variables, Vectors(Mathematics), Theorems.

The concept of complex valued entire functions of bounded index is extended to C superscript n-valued entire functions by replacing the absolute value in the definition of an entire function of bounded index by the maximum of the absolute values of the components. If the components of a C supercript n-valued entire function are of bounded index, then the function is also of bounded index; however a C superscript n-valued function may be of bounded index without all of its components being of bounded index. Solutions of certain linear differential equations are related to C superscript n-valued functions of bounded index.

711,943
PB-286 541/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nonomnipotence of Regular Summability Methods.
Final rept.,
S. Haber, and O. Shisha. Jun 78, 2p
Pub. in Jnl. Adv. Math. v28 n3 p231-232 Jun 78.

Keywords: *Sequences(Mathematics), Divergence, Convergence, Divergent series, Series(Mathematics), Transformations(Mathematics), Reprints.

It is shown that for any regular summability method there exists a bounded divergent sequence whose transform by that summability method diverges just as badly as the original sequence; often the divergence of the transform is worse than that of the original sequence.

711,944
PB-286 787/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
General Connection Formulae for Liouville-Green Approximations in the Complex Plane.
Final rept.,
F. W. J. Olver. 27 Jul 78, 48p
Sponsored in part by Army Research Office, Durham, NC., and National Science Foundation, Washington, DC.
Pub. in Philosophical Transactions of the Royal Society of London, Series A: Math. Phys. Sci. v289, no. 1364, p501-548 (July 27, 1978).

Keywords: *Ordinary differential equations, Approximation, Complex variables, Bessel functions, Numerical analysis, Wave propagation, Holomorphic functions, Asymptotic solutions, Asymptotic approximation, Reprints.

No abstract available.

711,945
PB-288 100/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Asymptotic Approximations for Parabolic Cylinder Functions.
Final rept.,
C. Lozano, and F. W. J. Olver. 1978, 3p
Pub. in Jnl. of Physics, B: Atomic and Molecular Physics Letters, v11 n18 L531-L533 1978.

Keywords: Asymptotic series, Linear differential equations, Approximation, *Cylinder functions, *Parabolic cylinder functions, WKB approximation, Reprints.

Methods are discussed for the construction of uniform asymptotic expansions of parabolic cylinder functions of large order, based on integral representations and the theory of linear differential equations. Some previous errors in the literature are corrected.

711,946
PB-293 453/7
(Order as PB-293 447/9, PC **A05**/MF **A01**)
National Engineering Lab. (NBS), Washington, DC. Center for Applied Mathematics.
Partitioned and Hadamard Product Matrix Inequalities,
C. R. Johnson. 8 Aug 78, 7p
Prepared in cooperation with Maryland Univ., College Park.
Included in Jnl. of Research of the National Bureau of Standards, v83 n6 p585-591, Nov-Dec 78.

Keywords: *Matrices(Mathematics), *Inequalities, Matrix theory, Theorems, Hermitian matrices, Hadamard product matrices, Partitioned matrices.

This note is partly expository. Inequalities relating inversion with, respectively, extraction of principal submatrices and the Hadamard product in the two possible orders are developed in a simple and unified way for positive definite matrices. These inequalities are known, but we also characterize the cases of equality and strict inequality. A by-product is, for example, a pleasant proof of an inequality due to Fiedler. In addition, it is shown that the Hadamard product preserves inequalities in a generalization of Schur's observation. In the process, many tools for dealing with the positive semi-definite partial ordering are exhibited.

711,947
PB-293 454/5
(Order as PB-293 447/9, PC **A05**/MF **A01**)
National Engineering Lab. (NBS), Washington, DC. Center for Applied Mathematics.
Phase-Shifting Limit Cycles of the van der Pol Equation,
P. J. Melvin. 24 Aug 78, 9p
Included in Jnl. of Research of the National Bureau of Standards, v83 n6 p593-607, Nov-Dec 78.

Keywords: *Van der Pol differential equation, Nonlinear differential equations, Phase shift, Limit cycles, Computer programming, Fortran, Poisson series.

The van der Pol limit cycles are generated at small amplitudes by the computer implementation of the Poincare-Lindstedt method. The formal algebraic solution is accomplished by manipulations of Poisson series, and the Fortran programming of the inductive algorithm yields the phase-shifting limit cycles to graphical accuracy over the range 0 < or = lambda < or = 1.5. This improves upon the method of Deprit and Rom in two ways. First, because the formal solution is carried out by hand, an algebraic processor is not necessary.

Second, the standard solutions which they generated are only valid for 0 < or = lambda < or = 1.2 whereas the phase-shifting limit cycles are still valid at lambda = 1.5; that is, they do not exhibit the Gibbs phenomenon even at lambda = 1.5.

711,948
PB-295 740/5
(Order as PB-295 736/3, PC **A08**/MF **A01**)
National Engineering Lab. (NBS), Washington, DC. Center for Applied Mathematics.
Cutting the d-Cube,
J. Lawrence. 5 Oct 78, 3p
Included in Jnl. of Research of the National Bureau of Standards, v84 n1 p51-54, Jan-Feb 79.

Keywords: Cubes, Affine geometry, Vector spaces, Theorems, *Hypercubes, Hyperspaces, Hyperplanes, Mathematical space.

Some problems concerned with cutting faces of the cube with affine or linear spaces are considered. It is shown that through any d-3 points of R sup d there passes a hyperplane which cuts all the facets of the d-cube. Furthermore, it is shown that if m < d - 1 and d' < d - ((m + 1)/3), then no m-dimensional affine subspace of R sup d cuts all the d'-dimensional faces of the cube.

711,949
PB-296 339/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sign Patterns of Inverse-Positive Matrices.
Final rept.,
C. R. Johnson, F. T. Leighton, and H. A. Robinson. 1979, 9p
Pub. in Linear Algebra and Appl. 24, p75-83 1979.

Keywords: *Matrices(Mathematics), Matrix elements, Reprints.

The authors identify the sign patterns which occur among the real, nonsingular, entrywise nonzero matrices whose inverses are entrywise positive.

711,950
PB-296 442/7
(Order as PB-296 439/3, PC **A05**/MF **A01**)
California Univ., San Diego, La Jolla. Dept. of Mathematics.
Non-Free Groups Generated by Two Parabolic Matrices,
R. J. Evans. 11 Nov 78, 2p
Included in Jnl. of Research of the National Bureau of Standards, v84 n2 p179-180, Mar-Apr 79.

Keywords: *Group theory, *Matrices(Mathematics), Theorems, Nonfree groups.

A conjecture made by M. Newman (1974) is proved.

711,951
PB-297 935/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Right-Left Asymmetry in an Eigenvector Ranking Procedure.
Final rept.,
C. R. Johnson, W. B. Beine, and T. J. Wang. Feb 79, 4p
Pub. in Jnl. Math Psychol., v19 n1 p61-64 Feb 79.

Keywords: *Eigenvectors, *Asymmetry, Matrices(Mathematics), Comparison, Priorities, Reprints.

A suggestion for the priortization of alternatives using the Perron-Frobenius right eigenvector of a pairwise comparison matrix has recently been made by T. Saaty. The authors note that use of the left eigenvectors is equally justified (as long as order is reversed). The purpose of this note is to point out that the resultant prioritizations may disagree even when the comparisons are 'nearly consistent.'

711,952
PB77-600016 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Minimax Location Problems With Nonlinear Costs.
P. M. Dearing. 1977, 8p
Included in Jnl. of Research of the National Bureau of Standards, v82 n1 p65-72 1977.

Keywords: Facility location, *Location theory, Minimax, Networks.

Previous studies of one-facility minimax location problems are extended by permitting the cost of travel to be given by any (strictly) increasing, continuous function of travel distance. Previous solution procedures for the rectilinear distance problem in the plane and for the problem on a tree network are extended to these general cost functions.

711,953
PB77-600017 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Note on a Nonlinear Minimax Location Problem in Tree Networks.
R. L. Francis. 1977, 7p
Included in Jnl. of Research of the National bureau of Standards, v82 n1 p73-80 1977.

Keywords: Facility location, Location theory, Minimax, *Tree networks.

The authors present some new derivations of properties of a nonlinear version of a minimax tree network location problem. They provide necessary and sufficient conditioins for optimality, a means of computing the optimum ojective function value, and a means of constructing the unique optimum location.

711,954
PB77-600022
(Order as PB-276 556, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Minimum Polynomials and Control in Linear Systems.
J. Z. Hearon. 1977, 4p
Included in Jnl. of Research of the National Bureau of Standards, v82 n2 p129-132 1977.

Keywords: Control theory, Linear algebra, Matrix, *Minimum polynomials.

Given the constant coefficient system chi = A chi + B Mu, relationships are established among the minimum polynomial (with respect to A) of the range of B, the degree and null space of this polynomial, the rank of the controllability matrix and the degree of the minimum polynomial of A. These relations lead to a simple proof of a theorem on reduction of control.

711,955
PB77-600023
(Order as PB-276 556, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Eigenset Generalizations of the Eigenvalue Concept.
C. R. Johnson. 1977, 4p
Included in Jnl. of Research of the National Bureau of Standards, v82, n2 p133-136 1977.

Keywords: Boundset, Convex hull, *Eigenvalue-eigenvector equation, Root of unity.

For an n-by-n complex matrix A some generalizations of the eigenvalue-eigenvector equation A chi = lambda S of AS contained in lambda S where S is a subset of C to the nth power about which arious assumptions are made. For example, it is shown that there exists a finite set S contained in C to the nth power, the sum of whose elements is not O, such that AS = lambda S, if and only if lambda is an eigenvalue of A in the usual sense. The requirement that the sum of the elements of S is not O should be viewed as a natural analog of the requirement chi is not equal to O in the classical eigenvalue-eigenvector equation.

711,956
PB78-600009 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Comments on Shier's Paper for Inverting Sparse Matrices.
J. M. McNamee. 1978,3p
Included in Jnl. of Research of the National Bureau of Standards, v83 n5 p485-487 Sep-Oct 1978.

Keywords: *Sparse equations, Tree partitions.

A paper by Shier (J. Res. NBS 80B) shows how to partition the graph of a matrix into a tree so as to minimize the number of operations required to invert the matrix. The present paper shows how to economically solve a sparse system of linear equations after the application of Shier's method to the coefficient matrix.

711,957
PB80-103708 Not available NITS
National Bureau of Standards, Washington, DC.
Characterization of Incidence Algebras.
Final rept.,
R. B. Feinberg. 1977, 24p
Pub. in Discrete Math. 17, p47-70 1977.

Keywords: *Algebra, Homomorphisms, Modules(Mathematics), Set theory, Lattices(Mathematics), Classifications, Reprints, Incidence algebras, Incidence coalgebras.

An internal characterization of the incidence algebra of a lower finite quasi-ordered set is developed and dualized to obtain a characterization of the corresponding coalgebra. The algebra characterization consists of two axioms concerning the homomorphic images of the algebra and another axiom stipulating the existence of a faithful module over the algebra which has a distributive lattice of submodules.

711,958
PB80-103716 Not available NTIS
National Bureau of Standards, Washington, DC.
Faithful Distributive Modules Over Incidence Algebras.
Final rept.,
R. B. Feinberg. 1976, 11p
Pub. in Pacific Jnl. of Mathematics 65, n1, p35-45 1976.

Keywords: *Algebra, *Modules(Mathematics), Automorphisms, Group theory, Set theory, Ideal theory, Field theory(Algebra), Reprints, Incidence algebras, Incidence coalgebras.

Let Q be a lower finite quasi-ordered set and let I(Q) be the incidence algebra of Q over a field K. In this paper the author determines all faithful distributive modules over I(Q) and relates the result to the structure of the outer automorphism group of the algebra. In the case when Q is finite the author also determines all left ideals L of I(Q) such that sub (I(Q) I(Q)/L is a faithful distributive module over I(Q).

711,959
PB80-115868 Not available NTIS
National Bureau of Standards, Washington, DC.
Inclusion Region for the Field of Values of a Doubly Stochastic Matrix Based on Its Graph.
Final rept.,
C. R. Johnson. 1978, 6p
Pub. in Aequationes Math., v17 p305-310, 1978.

Keywords: *Stochastic matrices, *Eigenvalues, Matrices(Mathematics), Complex variables, Reprints.

It is known that an eigenvalue lambda = u+iv of a nonnegative, row stochastic n-by-n matrix A satisfies u + (absolute value of v) tan pi/n < or = 1, and it has been conjectured that n may be replaced by m < or = n where m is the length of the longest circuit (with no repeated nodes or edges) in the graph of A. It is shown that when A is doubly stochastic, this conjecture is correct not only for the eigenvalues of A, but also for all elements of the field of values of A.

711,960
PB80-117385 Not available NTIS
National Bureau of Standards, Washington, DC.
Hadamard Products of Matrices.
Final rept.,
C. R. Johnson. 1974, 13p
Pub. in Linear and Multilinear Algebra 1, p295-307 1974.

Keywords: *Matrices(Mathematics), Multiplication, Stability, Theorems, Reprints, Hadamard product matrices.

The entry-wise product of arbitrary n by n complex matrices is studied. The principal tools used include the Kronecker product, field of values, and diagonal multiplications. Inclusion theorems for the field of values and spectrum are developed in the general case and refined in special cases. These are employed to obtain inequalities involving the real parts of the characteristic roots and the numerical radius, and previously known results are found to be special cases of several of the theorems. In addition, the case of positive stable matrices is considered and a new class of nonnegative stable matrices is introduced, studied and related to D-stability.

711,961
PB80-124571
(Order as PB80-124548, PC **A05**/MF **A01**)
Cincinnati Univ., OH. Dept. of Mathematics.

Exact Coefficients of the Limit Cycle in Van der Pol's Equation,
A. Deprit, and D. S. Schmidt. 30 Mar 79, 6p
Included in Jnl. of Research of the National Bureau of Standards, v84 n4 p293-297, Jul-Aug 79.

Keywords: *Limit cycles, *Van der Pol differential equation, Nonlinear differential equations, Ordinary differential equations, Stability, Computer programming, PL/1 programming language, Algorithms, Recursion relations, Amdahl-470 computers, MAO system, POLYPAK system.

A program generator to manipulate automatically Poisson series over the field of rational numbers is applied to develop the limit cycle of Van der Pol's equation in the powers of the small parameter. The results indicate that the recurrence relations in what Melvin calls the algorithm of the shifted phase are stable.

711,962
PB80-131808
(Order as PB80-131766, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Graph Coloring Algorithm for Large Scheduling Problems,
F. T. Leighton. 6 Jun 79, 18p
Included in Jnl. of Research of the National Bureau of Standards, v84 n6 p489-506, Nov-Dec 79.

Keywords: *Graph theory, Combinatorial topology, Scheduling, Optimization, Algorithms, Mathematical programming, Computer programs, IBM-360/91 computers.

A new graph coloring algorithm is presented and compared to a wide variety of known algorithms. The algorithm is shown to exhibit O(n2) time behavior for most sparse graphs and thus is found to be particularly well suited for use with large-scale scheduling problems. In addition, a procedure for generating large random test graphs with known chromatic number is presented and is used to evaluate heuristically the capabilities of the algorithms discussed.

711,963
PB80-134885 Not available NTIS
National Bureau of Standards, Washington, DC.
Tests of Fourth-Order Difference Equations for Laplace's Equation in Cylindrical Coordinates.
Final rept.,
C. E. Kuyatt, and A. Galejs. 1978, 3p
Pub. in Proceedings of the International Conference on Electron and Ion Beam Science and Technology (8th) Held at Seattle, WA., on May 21-26, 1978, p655-657 1978.

Keywords: *Harmonic functions, *Finite difference theory, Computer programming, Accuracy, Coordinates, Cylinders, Spheres.

While most digital computer solutions of Laplace's equation have employed the second-order five-point difference equations, a few recent calculations used nine-point difference equations. In principle, nine-point equations should be capable of giving the potential to an accuracy which is fourth-order in the mesh size. However, only Durand's equations are derived in such a way that fourth-order accuracy is clearly obtained. To demonstrate the accuracy of Durand's equations, and to assess the accuracy of other equations, the authors have tested several difference equations for cylindrical coordinates on the analytic potential distribution between two spheres.

711,964
PB80-154008 Not available NTIS
National Bureau of Standards, Washington, DC.
Test Procedures and Test Problems for Least Squares Algorithms.
Final rept.,
R. H. Wampler. 1980, 19p
Pub. in Jnl. Economet. 12, p3-22 1980.

Keywords: *Least squares method, Tests, Algorithms, Iteration, Performance evaluation, Computer programming, Reprints, Computer program verification, Matrix inversion.

Numerous test problems have been introduced in the past twenty years for the purpose of studying and comparing least squares algorithms and computer programs. This paper discusses and classifies some of the useful test problems which have appeared in the literature. A recent large scale test procedure is briefly summarized. Several neat, mathematical examples are displayed. One of these, first introduced by Laeuchli, is modified so that it can be solved by the method of inverting a matrix of correlation coefficients. Comparative results from running two types of problems on several different algorithms are given which illustrate some of the factors affecting computational accuracy: choice of algorithm, scaling of the data, tolerance parameters, and iterative refinement.

711,965
PB80-154933 Not available NTIS
National Bureau of Standards, Washington, DC.
Algorithm 544 L2A and L2B, Weighted Least Squares Solutions by Modified Gram-Schmidt with Iterative Refinement (F4).
Final rept.,
R. H. Wampler. Dec 79, 6p
Pub. in Assoc. Comput. Mach. Trans. Math. Software 5, n4 p494-499 Dec 79.

Keywords: *Least squares method, Iteration, Weighting functions, Algorithms, Linear algebraic equations, Covariance, Curve fitting, Orthogonality, Fortran, Computer programming, Reprints, PFORT programming language, L2 subroutine, Covariance matrices.

The Fortran subroutine L2 calculates a least squares solution to an overdetermined system of n linear equations in m unknowns through the use of modified Gram-Schmidt orthogonalization with iterative refinement. The algorithm is one known to provide maximum accuracy in the case of ill-conditioned problems. Written in PFORT, a portable subset of ANSI Fortran, the subroutine has been tested extensively on several computers. The program accepts problems with weighted observations as well as problems where the solution is subject to linear equality constraints. The covariance matrix of the solution vector is computed.

711,966
PB80-154941 Not available NTIS
National Bureau of Standards, Washington, DC.
Solutions to Weighted Least Squares Problems by Modified Gram-Schmidt with Iterative Refinement.
Final rept.,
R. H. Wampler. Dec 79, 9p
Pub. in Assoc. Comput. Mach. Trans. Mat. Software 5, n4 p457-465 Dec 79.

Keywords: *Least squares method, Iteration, Weighting functions, Algorithms, Linear algebraic equations, Covariance, Curve fitting, Orthogonality, Fortran, Computer programming, Reprints, Covariance matrices.

A Fortran implementation of an algorithm for solving weighted least squares problems by modified Gram-Schmidt with iterative refinement is described. The algorithm is one known to provide maximum accuracy in the case of ill-conditioned problems. The types of problems which can be solved include overdetermined and underdetermined systems of linear equations, and problems where the solution is subject to linear equality constraints. The covariance matrix of the solution vector is computed.

711,967
PB80-169980 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Numerical Solution of Linear Difference Equations.
Final rept.,
D. W. Lozier. Mar 80, 170p NBSIR-80-1976

Keywords: *Finite difference theory, *Linear algebraic equations, Numerical analysis, Algorithms, Stability, Theorems, Computer programming, Fortran, Theses.

Consider a given inhomogeneous linear difference equation summation, s=0 to I (d sub s); (r)y(r+s) = g(r) where I = or > 2 and r = 0,1,2,... . Suppose y is a solution of this equation and u,v are solutions of the homogeneous form of this equation such that, as r approaches infinity, u(r)/v(r), y(r)/v(r), and u(r)/y(r) all approach 0. Under these circumstances algorithms for the computation of y based on forward or backward recurrence, such as the Miller algorithm, are numerically unstable. Stable algorithms, such as the method of Olver, have been based on approximating y(r) by the solutions of a certain sequence of boundary value problems. Boundary value problems of this type are shown to be equivalent to two initial value problems of order j and I-j by factorization of the difference operator. The solution of the problem of order j is obtained by forward recurrence; the solution of the other problem is obtained by backward recurrence. The algorithm is specified completely for a broad class of operators including, for example, every constant-coefficient operator. Convergence is proved and an expansion of the truncation error is derived. Numerical stability is demonstrated. The method is tested by numerical examples involving fourth-order equations with variable coefficients.

711,968
PB80-198187 Not available NTIS
National Bureau of Standards, Washington, DC.
Unrestricted Algorithm for the Exponential Function.
Final rept.,
C. W. Clenshaw, and F. W. J. Olver. Apr 80, 22p
Pub. in SIAM Jnl. on Numerical Analysis 17, n2 p310-331 Apr 80.

Keywords: *Exponential functions, Computation, Algorithms, Reprints.

An algorithm is presented for the computation of the exponential function of real argument. There are no restrictions on the range of the argument or on the precision that may be demanded in the results.

711,969
PB80-203409 Not available NTIS
National Bureau of Standards, Washington, DC.
Asymptotic Approximations and Error Bounds.
Final rept.,
F. W. J. Olver. 1980, 16p
Pub. in SIAM Review 22, n2 p188-203 Apr 80.

Keywords: *Approximation, Asymptotic series, Bessel functions, Reprints, *Asymptotic approximation.

The purpose of this paper is to demonstrate that well-constructed error bounds for asymptotic approximations can provide useful analytical insight into the nature and reliability of the approximations, enable somewhat unsatisfactory concepts such as multiple asymptotic expansions and generalized asymptotic expansions to be avoided, and lead to significant extensions of asymptotic results.

711,970
PB80-211949 Not available NTIS
National Bureau of Standards, Washington, DC.
Location of the Intermediate Point in Taylor's Theorem.
Final rept.,
S. Haber, and O. Shisha. 1980, 2p
Pub. in Proceedings of the International Conference on General Inequalities (2nd), Mathematical Research Institut, Oberwolfach, Black Forest, Germany, July 30-August 5, 1978, Paper in General Inequalities 2, p143-144 1980.

Keywords: Taylors series, Inequalities, Theorems, *Taylor theorem, Mean value theorems.

It is shown that, under suitable conditions, the intermediate point in Taylor's theorem must lie in the left half of the interval considered.

711,971
PB80-218431 Not available NTIS
National Bureau of Standards, Washington, DC.
Square Roots with Positive Definite Hermitian Part.
Final rept.,
C. R. Johnson, and M. Neumann. Jan 80, 3p
Pub. in Linear and Multilinear Algebra 8, p353-355 Jan 80.

Keywords: *Square roots, Reprints.

The question of when a square matrix has a square root whose hermitian part is positive definite is posed and discussed.

711,972
PB80-600039 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Accurate On-line Method for the Evaluation of Peak Areas in Pulse-Height-Analyzer Data.
F. J. Schima, D. D. Hoppes, and A. T. Hirshfeld. 1979, 8p
Pub. in Computers in Activation Analysis and Gamma-Ray Spectroscopy, DOE Symp. Series 49, p177-184 1979.

Keywords: *Least squares fitting, Normalized Gaussian function, Photo-peak area determination, Photo-peaks data, Data analysis, Summation method.

A simple and accurate method for obtaining areas of peaks in pulse-height-analyzer data resulting from the measurement of gamma-ray emission-rate standards with Ge or Ge(Li) spectrometer systems is described. Peaks can be located with a search procedure based on the method of second differences. For the peaks of interest, a linear background correction is made, after which a normalized Gaussian function is fitted to the counts in the near-Gaussian portion of the peak. The fitted values of the peak location and width are used to define a consistent summing interval for an accurate peak-area evaluation.

711,973
PB81-137176 Not available NTIS
National Bureau of Standards, Washington, DC.
Whittaker Functions with Both Parameters Large: Uniform Approximations in Terms of Parabolic Cylinder Functions.
F. W. J. Olver. 1980, 21p
Contract DAAG29-77-G-0003, Grant NSF-MCS78-02111
Pub. in Proceedings of the Royal Society of Edinburgh 86A, p213-234 1980.

Keywords: Asymptotic series, Hypergeometric functions, Approximation, *Whittaker functions.

Asymptotic approximations are derived for the Whittaker functions (W sub kappa, mu)(z), (M sub kappa, mu)(z), (W sub i(kappa), i(mu))(iz) and (M sub i(kappa), i(mu))(iz) for large positive values of the parameter mu that are uniform with respect to unrestricted values of the argument z in the open interval (0,infinity), and bounded real values of the ratio kappa/mu. The approximations are in terms of parabolic cylinder functions, and in most instances are accompanied by strict error bounds. The results are derived by application of a recently-developed asymptotic theory of second-order differential equations having coalescing turning points, and an extension of the general theory of equations of this kind is also included.

711,974
PB81-138380
(Order as PB81-138356, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC.
Univariate Extension of Jensen's Inequality,
C. H. Spiegelman. 23 May 80, 3p
Included in Jnl. of Research of the National Bureau of Standards, v85 n5 p363-366, Sep-Oct 80.

Keywords: *Inequalities, Random variables, Geometric mean, Theorems, Reprints, *Jensen inequality, Concave functions.

The result in this paper explains some of the qualitative nature of Jensen's inequality. It is shown that the more disperse the distribution of a random variable is, the smaller is the expectation of any concave function of it. This result can be used to show the inadequacy of some current methods of reporting environmental data by using geometric means, and it extends the result of I. Bilick, D. Shier, and C. H. Spiegelman, where symmetry of the error in environmental measurements is assumed.

711,975
PB81-138398
(Order as PB81-138356, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Numerical Solution of a Nonseparable Elliptic Partial Differential Equation by Preconditioned Conjugate Gradients,
J. G. Lewis, and R. G. Rehm. 16 Apr 80, 24p
Included in Jnl. of Research of the National Bureau of Standards, v85 n5 p367-390, Sep-Oct 80.

Keywords: *Elliptic differential equations, *Numerical integration, Partial differential equations, Matrices(Mathematics), Iteration, Convection, *Conjugate gradient method, Sparse matrix, Computer aided analysis.

In this report the combination of an iterative technique, the conjugate gradient algorithm, with a fast direct method, cyclic reduction, is used to solve the linear algebraic equations resulting from discretization of a nonseparable elliptic partial differential equation. An expository discussion of the conjugate gradient and preconditioned conjugate gradient algorithms and of their use in the solution of partial differential equations is presented. New results extending the use of the preconditioned conjugate gradients technique to singular linear equations which arise from discretized elliptic equations with Neumann boundary conditions are also given. The algorithms are applied to solve a specific elliptic equation which arises in the study of buoyant convection produced by a room fire. A code was developed to implement the algorithms for this application. Numerical results obtained through testing and the use of the code are discussed.

711,976
PB81-138703 Not available NTIS
National Bureau of Standards, Washington, DC.
Generalized Hiller-Sucher-Feinberg Identity.
J. Katriel. Mar 80, 2p
Pub. in Physical Review, A 21, n3 p1067-1068 Mar 80.

Keywords: *Delta function, *Identities, Wave functions, Reprints.

The identity recently derived by Hiller, Sucher and Feinberg between a delta function expectation value and the expectation value of a smoothly varying operator is generalized. A discussion of the relative accuracy of the two expressions for approximate wave functions is given.

711,977
PB81-144214 Not available NTIS
National Bureau of Standards, Washington, DC.
Comment on Explicit Integration Method for the Time-Dependent Schrodinger Equation.
R. J. Rubin. May 79, 1p
Pub. in Jnl. Chemical Physics 70, n10 p4811, 15 May 79.

Keywords: *Schrodinger equation, *Numerical integration, Stability, Reprints.

Recently, A. Askar and A. S. Cakmak outlined a numerical method for explicit integration of the time-dependent Schrodinger equation which they believed was new and unconditionally stable. In fact, it is neither. In 1957, their method was proposed and shown to be conditionally stable (in one space dimension) by H. F. Harmuth (H). In 1959, a slightly different explicit numerical integration method was analyzed for stability and used by J. Mazur and R. J. Rubin (MR) for the time-dependent Schrodinger equation in two dimensions. The MR algorithm is also conditionally stable. The stability condition is identical with that for the H algorithm.

711,978
PB81-168924 Not available NTIS
National Bureau of Standards, Washington, DC.
Number-Theoretic Problem in Numerical Approximation of Integrals.
Final rept.
S. Haber. 1980, 8p
Pub. in Proceedings of the Approximations Theory III Symposium Held at Austin, TX. on Feb 8-13, 1980, p473-480 1980.

Keywords: *Numerical integration, *Approximation, *Periodic functions, Lattices(Mathematics), Numerical quadrature, Number theory.

Some time ago two mathematicians and a scientist devised a generalization of the simple trapezoid rule, for numerical integration of periodic functions of more than one variable. The method has been successful in some practical applications, but its use has been limited by our ignorance of certain parameters needed for its implementation. This paper describes the method and some remarkable problems--in the theory of numbers and in geometry--connected with it. The problems involve trigonometrical sums, affine lattices, and the most nearly uniform distribution of a finite set of points inside a cube. Solution of the problems could provide improvements to the method, and clues for determining the essential parameters.

711,979
PB81-196206
(Order as PB81-196198, PC **A08**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Fitting Curves and Surfaces with Monotonic and Non-Monotonic Four Parameter Equations.
J. Mandel. 6 Aug 80, 25p
Included in Jnl. of Research of the National Bureau of Standards, v86 n1 p1-25 Jan-Feb 81.

Keywords: *Curve fitting, Statistical distributions, Monotone functions, Interpolation, Iteration, Computation, NTISCOMNBS.

This is a series of three papers in which methods are presented, with instructions on computational details, on the empirical fitting of tabulated data. Part I deals with fitting functions of a single argument; Part II with functions of two arguments; and Part III with functions of three or more arguments.

711,980
PB81-245920 Not available NTIS
National Bureau of Standards, Washington, DC.
Attainable Accuracy of Compact Discretizations of the Poisson Equation.
Final rept.
R. F. Boisvert. 1981, 5p
Pub. in Elliptic Problem Solvers, p219-223 1981.

Keywords: Finite difference theory, Truncation errors, Accuracy, Reprints, *Poisson equation.

Results are outlined on the maximum order of local truncation error attainable by compact as possible discretizations of Poisson's equation for a particular class of non-rectangular domains. It is shown, for instance, that although O(h6) accuracy is attainable for rectangular domains, one cannot always achieve this even in very simple non-rectangular cases. A numerical example indicating the effect of using less accurate formulas for irregular elements is also given.

711,981
PB81-600053 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
General Connection-Formula Problem for Linear Differential Equations of the Second Order.
F. W. J. Olver. 1980, 27p
Pub. in Proceedings Conf. on Singular Perturbations and Asymptotics, Madison, WI, May 28-30, 1980, p317-343 1980.

Keywords: *Asymptotic approximation, Connection formula, Fractional transition point, Irregular singularity, Liouville-Green approximation, Stokes line, Turning point.

In the neighborhood of an irregular singularity z sub 0 of the differential equation d(2)w/dz(2)=f(z)w asymptotic approximations to solutions are supplied by the Liouville-Green functions f(-1/4)(z)exp(+ or - integral f(1/2)(z)dz). These approximations are valid only in certain sectors of the neighborhood of z sub 0 and to obtain asymptotic approximations to the solutions elsewhere in the neighborhood connection formula are needed. In the case in which the differential equation is of the form d(2)w/dz(2)=(u(2)f(z)+g(z))w, in which u is a large parameter and f(z) and g(z) are independent of u, it is shown how asymptotic approximations may be constructed for the coefficients in the connection formula when u is large. The nature of these approximations depends on the nature of the other singularities of the differential equation in the complex plane, and also on the zeros of f(z).

711,982
PB82-100157 Not available NTIS
National Bureau of Standards, Washington, DC.
High Order Compact Difference Formulas for Elliptic Problems with Mixed Boundary Conditions.
Final rept.
R. F. Boisvert. 1981, 7p
Pub. in Proceedings of International Symposium on Computer Methods for Partial Differential Equations (4th), Bethlehem, PA., June 30-July 2, 1981, Advances in Computer for Partial Differential Equations IV, p193-199 1981.

Keywords: *Elliptic differential equations, Partial differential equations, Boundary value problems, Poisson equation, Helmholtz equation, HODIE method.

The author describes how compact finite difference discretizations of the HODIE type may be derived for elliptic problems with mixed boundary conditions. Explicit formulas are given for the case of the Helmholtz equation on a rectangle and a proof yielding O(h sup 4) convergence for this problem is outlined. In a second example compact difference formulas for the Poisson equation with normal derivative boundary conditions are presented for a class of non-rectangular domains with boundaries made up of straight lines. Numerical examples are also given.

711,983
PB82-103318 PC **A04**/MF **A01**
Boeing Computer Services Co., Seattle, WA.
Numerical Solution of a Nonseparable Elliptic Partial Differential Equation by Preconditioned Conjugate Gradients.
Final rept.
J. G. Lewis, and R. G. Rehm. 16 Apr 80, 66p NBSIR-80-2056
See also PB81-138398.

Keywords: *Elliptic differential equations, *Numerical integration, Partial differential equations, Matrices(Mathematics), Iteration, Subroutines, Fortran, Convection, *Conjugate gradient methods, Sparse matrices.

In this report the combination of an iterative technique, the conjugate gradient algorithm, with a fast direct method, cyclic reduction, is used to solve the linear algebraic equations resulting from discretization of a nonseparable elliptic partial differential equation. An expository discussion of the conjugate gradient and preconditioned conjugate gradient algorithms and of their use in the solution of partial differential equations is presented. New results extending the use of the preconditioned conjugate gradients technique to singular linear equations which arise from discretized elliptic equations with Neumann boundary conditions are also given. The algorithms are applied to solve a specific elliptic equation which arises in the study of buoyant convection produced by a room fire. A code was developed to implement the algorithms for this application. Numerical results obtained through testing and use of the code are discussed.

711,984
PB82-118027 Not available NTIS
National Bureau of Standards, Washington, DC.
Numerical Evaluation of Integrals Containing a Spherical Bessel Function by Product Integration.
Final rept.
D. R. Lehman, W. C. Parke, and L. C. Maximon. Jul 81, 15p
Pub. in Jnl. of Math. Phys. 22, n7 p1399-1413 Jul 1981.

Keywords: *Numerical integration, Bessel functions, Numerical quadrature, Convergence, Reprints.

A method is developed for numerical evaluation of integrals with k-integration range from 0 to infinity that contain a spherical Bessel function j sub l(kr) explicitly. The required quadrature weights are easily calculated and the rate of convergence is rapid--only a relatively small number of quadrature points is needed--for an accurate evaluation even when r is large. The quadrature rule is obtained by the method of product integration. With the abscissas chosen to be those of Clenshaw-Curtis and the Chebyshev polynomials as the interpolating polynomials, quadrature weights are obtained that depend on the spherical Bessel function. An inhomogenous recurrence relation is derived from which the weights can be calculated without accumulation of roundoff error. The procedure is summarized as an easily implementable algorithm. Questions of convergence are discussed and the rate of convergence demonstrated for several test integrals. Alternative procedures are given for generating the integration weights and an error analysis of the method is presented.

711,985
PB82-118373 Not available NTIS
National Bureau of Standards, Washington, DC.
Reply to Criticism on 'Electric Dyadic Green's Functions in the Source Region'.
Final rept.
A. D. Yaghjian. Feb 81, 4p
Pub. in Proceedings of IEEE 69, n2 p282-285 Feb 81.

Keywords: *Green's function, Delta function, Integral equations, Volume, Reprints.

A. D. Yaghjian wrote a paper, 'Electric Dyadic Green's Functions in the Source Region', which was published in the February 1980 Issue of the Proceedings of the IEEE. Professor C. T. Tai subsequently wrote a letter to the editor of the Proceedings, in which he criticized some technical points in Yaghjian's paper. This letter contains Yaghjian's response to the issues raised by Tai. Both letters will be published together in a future issue of the Proceedings.

711,986
PB82-127796 Not available NTIS
National Bureau of Standards, Washington, DC.
Intrinsic Variational Equations in Three Dimensions.
Final rept.
A. Deprit. 1981, 10p
Pub. in Celestial Mechanics 24, p185-193 1981.

Keywords: *Differential equations, Calculus of variations, Reprints, Hill equation, Three degrees of freedom.

The variational equations along an orbit in a conservative dynamic system with three degrees of freedom may be separated into (1) a linear system of order four involving only the normal and binormal displacements and (2) a quadrature to produce the tangential displacement.

711,987
PB82-144080 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of a Uniformly Accurate Difference Method for a Singular Perturbation Problem.
Final rept.
A. E. Berger, J. M. Solomon, and M. Ciment. Jul 81, 116p
Pub. in Mathematics of Computation 37, n155 p79-94 Jul 81.

Keywords: *Perturbation theory, Approximation, Convergence, Reprints, Variable mesh method.

It is proven that an exponential tridiagonal difference scheme, when applied with a uniform mesh of size h to: epsilon(u sub xx) + b(x)(u sub x) = f(x) for $0<x<1$,$b>0$,b and f smooth, epsilon in the interval greater than 0, equal or less than 1, and u(0) and u(1) given, is uniformly second-order accurate (i.e., the maximum of the errors at the grid points is bounded by C(h sup 2) with the constant C independent of h and epsilon). This scheme was derived by El-Mistikawy and Werle by a (C sup 1) patching of a pair of piecewise constant coefficient approximate differential equations across a common grid point. The behavior of the approximate solution in between the grid points is analyzed, and some numerical results are given.

711,988
PB82-226325
(Order as PB82-226226, PC **A08**/MF **A01**)
Johns Hopkins Univ., Baltimore, MD. Dept. of Mathematical Sciences.
Minimum-Loop Realization of Degree Sequences.
A. J. Goldman, and R. H. Byrd. 10 Jun 81, 80p
Included in Jnl. of Research of the National Bureau of Standards, v87 n1 p75-154 Jan-Feb 82.

Keywords: *Graph theory, Sequences(Mathematics), Theorems.

Given a finite sequence D of nonnegative intergers, let M(D) denote its maximum element and S(D) its sum. It is known that D is realizable as a degree sequence by some graph if and only if S(D) is even, and by a loopless graph if and only if the even integer S(D) - 2M(D) = or > 0. Here it is shown that if the even integer 2M(D) - S(D) is positive, then one-half this integer is the minimum number of loops in graphs realizing D, and that the minimum-loop realization is unique. These results are extended to a more general loop-cost minimization problem in which loops incident at different vertices can have different costs. The possible numbers of loops, in graphs realizing D, are also determined.

711,989
PB82-226416
(Order as PB82-226333, PC **A09**/MF **A01**)
National Bureau of Standards, Washington, DC.
Automatic Computing Methods for Special Functions. Part IV. Complex Error Function, Fresnel Integrals, and Other Related Functions.
I. A. Stegun, and R. Zucker. 15 Jul 81, 75p
Included in Jnl. of Research of the National Bureau of Standards, v86 n6 p661-686 3 Nov-Dec 81.

Acurate, efficient, automatic methods for computing the complex error functions to any presision are detailed and implemented in an american Standard FORTRAN subroutine. A six significant figure table of erfc z,e=2 erf z, and e=2 erfc(-z) is included for z in polar coordinate form with the modulus of z ranging from 0 to 9. The argand diagram is given for erf z.

711,990
PB82-236779 Not available NTIS
National Bureau of Standards, Washington, DC.
Fast Evaluation of Fourier Series.
Final rept.
S. Coffey, and A. Deprit. 1980, 6p
Pub. in Astronomy and Astrophysics 81, p310-315 1980.

Keywords: *Fourier series, Celestial mechanics, Algorithms, Reprints.

A theory in the sense of classical celestial mechanics was filed as a table of integer vectors for the multiples of its arguments and of numeric coefficients. A navigation table is attached to the file to allow applying the addition theorem for trigonometric functions in a recursive manner. This concept gives rise to an automated program which generates from the theory file a standalong program to evaluate the Fourier series offered by the theory.

711,991
PB82-263443 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Normal Form and Representation Theory.
Final rept.
R. Cushman, R. Mosak, and A. Deprit. Jun 82, 73p NBSIR-82-2541

Keywords: *Lie algebras, *Hamiltonian functions, Matrices(Mathematics), Perturbation theory, Vector spaces, Nonlinear systems, Polynomials, Oscillations, Conformal mapping, Theorems, Two degrees of freedom.

Representation theory of Lie algebras is called upon to develop a procedure for normalizing a dynamical system with two degrees of freedom in the neighborhood of an equilibrium when the Hamiltonian H(x, y, X, Y) in the coordinates (x, y) and their conjugate momenta (X, Y) is of the type H = ((X sup 2) + (Y sup 2))/2 + V(x, y, X, Y), the potential energy V being a sum of homogeneous polynomials in the phase variables of degree strictly greater than two. The fact that the resulting potential V' is a polynomial in the new coordinates (x', y') and the angular momentum G' = x' Y' - y' X' implies that the normalization is a rotation in the configuration space from a fixed frame to an ideal frame. The technique is intended for normalizing an Hamiltonian in equilibrium at the origin when the Lie derivative associated with the quadratic part is not semi-simple, e.g. the planar Restricted Problem of Three Bodies at the equilateral equilibrium L4 when the basic frequencies are equal (Routh's singular case).

711,992
PB82-600003
(Order as PB83-164533, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Curve Fitting with Clothoidal Splines.
J. Stoer. 1982, 30p
Included in Jnl. of Research of the National Bureau of Standards, v87 n4 p317-346 1982.

Keywords: *Approximation, Clothoids, Computer-aided design, Cornu-spirals, Curvature, Curve fitting, Fresnel-integrals, Interpolation, Splines.

Clothoids, i.e., curves Z(s) in R2 whose curvatures x(s) are linear fitting functions of arclength s, have been used for some time for curve fitting purposes in engineering applications. The first part of the paper deals with some basic interpolation problems for clothoids and studies the existence and uniqueness of their solutions. The second part discusses curve fitting problems for clothoidal splines, which are composed of finitely many clothoids. An iterative method is described for finding a clothoidal spline Z(s) passing through given points Z epsilon R2.i=0,1,..., n+1, which minimizes the integral zx(s)2ds. This algorithm is superlinearly convergent and needs only O(n) operations per iteration. A similar algorithm is given for a related problem of smoothing by clothoidal splines.

711,993
PB82-600043 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Families of High Order Accurate Discretizations of Some Elliptic Problems.
R. F. Boisvert. 1981, 17p
Pub. in SIAM Jnl. Sci. Stat. Comput. 2, n3 p268-284 Sep 1981.

Keywords: *Elliptic partial differential equations, Finite difference methods, High order accuracy, Poisson equation.

In this paper we construct and analyze high order finite difference discretizations of a class of elliptic partial differential equations. In particular, two one-parameter families of fourth order HODIE discretizations of the Helmholtz equation are derived and a discretization optimal with respect to a certain norm of the truncation error is identified. The use of compact nine-point formulas of positive type admits both fast direct methods and standard iterative methods for the solution of the resulting systems of linear equations. Extensions yielding sixth order accuracy for the Helmholtz equation and fourth order accuracy for a more general operator are given. Finally, numerical results demonstrating the effectiveness of the discretizations for a wide range of problems are presented.

711,994
PB83-143073 Not available NTIS
National Bureau of Standards, Washington, DC.
Integral Representations for the Regular and Irregular S-Wave Coulomb Wave Functions.
Final rept.
L. C. Maximon. 1982, 21p
Pub. in George Washington University, Department of Physics Technical Report, GWU/DP/TR-82/1, 21p 1982.

Keywords: *Wave functions, Integral equations, Nuclear physics, Reprints, Whittaker functions.

A number of new integral representations are derived for the bound and continuum s-wave Coulomb wave functions, written in terms of the Whittaker functions. The form of these representations makes them particularly well adapted to nuclear physics problems in which the Coulomb interaction is to be included in the final state of an amplitude already containing the strong-interaction pair rescattering. Each of these representations consists of two terms. The first is, apart from a constant factor, in the non-Coulomb function; the second term has the form of an integral over the momentum of the non-Coulomb function, and is manifestly zero when the Coulomb parameter is zero.

711,995
PB83-143313 Not available NTIS
National Bureau of Standards, Washington, DC.
Continuous and Discrete Fourier Transforms of Steplike Waveforms.
Final rept.
W. L. Gans, and N. S. Nahman. Jun 82, 5p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Instrumentation and Measurement IM-31, n2 p97-101 Jun 82.

Keywords: *Waveforms, Fourier transformation, Computation, Reprints, *Discrete Fourier transform.

A steplike waveform which has attained its final value is converted into a duration-limited one which preserves the spectrum of the original waveform and is suitable for discrete Fourier transform (DFT) computations. The method, which is based upon the response of a time-invariant linear system excited by a rectangular pulse of suitable duration, is first applied to continuous waveforms and then to discrete (sampled) waveforms. For completeness, the difference (error) between the spectra of a continuous waveform and a discrete representation of it are reviewed.

711,996
PB83-235820 Not available NTIS
National Bureau of Standards, Washington, DC.
Extrapolated Adaptive Quadrature.
Final rept.
D. Kahaner, and J. Stoer. Mar 83, 14p
Pub. in SIAM Jnl. Sci. Stat. Comput. 4, n1 p31-44 March 83.

Keywords: *Numerical quadrature, Extrapolation, Algorithms, Convergence, Reprints.

In this paper the authors consider algorithms for numerical quadrature in one dimension which combine global adaption and extrapolation. They analyze the convergence of one specific algorithm in terms of the amount of work as a function of the input accuracy request. The main result is that asymptotically the expected amount of work is unaffected by the adaption. This is illustrated by numerical examples. An alternative algorithm is also suggested.

711,997
PB83-236232 Not available NTIS
National Bureau of Standards, Washington, DC.
Bidiagonalization-Regularization Procedure for Large Scale Discretizations of Ill-Posed Problems.
Final rept.
D. P. O'Leary, and J. A. Simmons. Dec 81, 16p
Sponsored in part by Electric Power Research Inst., Palo Alto, CA.
Pub. in Soc. Ind. Appl. Math. J. Sci. Stat. Comput. 2, n4 p474-489 Dec 81.

Keywords: Least squares method, Matrices(Mathematics), Numerical analysis, Integral equations, Algorithms, Reprints, *Ill posed problems, Lanczos algorithm.

In this paper, the authors consider ill-posed problems which discretize to linear least squares problems with matrices K of high dimensions. The algorithm proposed uses K only as an operator and does not need to explicitly store or modify it. A method related to one of Lanczos is used to project the problem onto a subspace for which K is bidiagonal. It is then an easy matter to solve the projected problem by standard regularization techniques. These ideas are illustrated with some integral equations of the first kind with convolution kernels, and sample numerical results are given.

711,998
PB84-105675 Not available NTIS
National Bureau of Standards, Washington, DC.
Table Errata 592 - National Bureau of Standards Handbook of Mathematical Functions.
Final rept.
J. M. Smith. Apr 83, 2p
Pub. in Mathematics of Computation 40, n162 p723-724 Apr 83.

Keywords: *Legendre functions, Handbooks, Errors, Reprints.

Errors detected in Table 8.3, Legendre Functions - Second Kind (Q sub n)(x), of the NBS Handbook of Mathematical Functions are listed with their correct values.

711,999
PB84-105915 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of Floating-Point and Interval Arithmetic in the Computation of Error Bounds.
Final rept.
D. W. Lozier. Apr 83, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Computers C-32, n4 p411-417 Apr 83.

Keywords: *Computation, *Error analysis, Arithmetic, Algorithms, Precision, Reprints, *Interval arithmetic, *Floating point operation.

Three forms of interval arithmetic are defined in terms of absolute precision, relative precision, and combined absolute and relative precision. The ap form is related to conventional rounded-interval arithmetic. The three forms are compared on the basis of the floating-point operations needed to evaluate the error bounds.

712,000
PB84-105998 Not available NTIS
National Bureau of Standards, Washington, DC.
Posteriori Error Bounds for Gaussian Elimination.
Final rept.
F. W. J. Olver, and J. H. Wilkerson. 1982, 29p
Pub. in IMA Jnl. Numer. Anal. 2, p377-406 1982.

Keywords: *Linear algebraic equations, *Error analysis, Matrices(Mathematics), Computation, Reprints, Floating point arithmetic, Computer applications.

Explicit bounds are constructed for the error in the solution of a system of linear algebraic equations obtained by Gaussian elimination using floating-point arithmetic. The bounds take account of inherent errors in the data and all abbreviations (choppings or roundings) introduced during the process of solution. The bounds are strict and agree with the estimate for the maximum error obtained by linearized perturbation theory. The formulation of the bounds avoids the need for specially-directed rounding procedures in the hardware or software; in consequence the bounds are evaluable on most existing computers. The cost of computing the bounds is comparable with the cost of computing the original solution. The results are obtained by application of a recently-developed theory of relative and absolute precisions and use of forward error analysis.

712,001
PB84-136027 Not available NTIS
National Bureau of Standards, Washington, DC.
Generalized Exponential-Integral V(x,y) = the Integral from 1 to Infinity, of (exp(-xt)ln(t+y)dt/t) and Computer Algorithms for y = 0, 1.
Final rept.
D. G. Hummer. Sep 83, 7p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 30, n3 p281-287 Sep 83.

Keywords: *Integral equations, Exponential functions, Approximation, Algorithms, Reprints, *Radiative transfer, Computer applications.

The generalized exponential-integral function V(x,y) defined here includes as special cases the function (E sub 1) (x) = V(x,0) introduced by van de Hulst and the functions (M sub 0) (x) = V(x,1) and (N sub 0) (x) = V(x,-1) introduced by Kourganoff in connection with the integrals of the form which play an important role in the theory of monochromatic radiative transfer. Series and asymptotic expressions are derived, and for the most important special cases, y = 0 and y = 1, Chebyshev expansions and rational approximations are obtained that permit the function to be evaluated to at least 10 sf on 0 < x < infinity using 16 sf arithmetic.

712,002
PB84-139112 Not available NTIS
National Bureau of Standards, Washington, DC.
Complexity of Counting Cuts and of Computing the Probability That a Graph is Connected.
Final rept.
J. S. Provan, and M. O. Ball. Nov 83, 11p
Pub. in SIAM Jnl. of Comput. 12, n4 p777-788 Nov 83.

Keywords: *Graph theory, *Networks, Probability theory, Reliability, Computation, Approximation, Reprints.

Several enumeration and reliability problems are shown to be mesh P-complete, and hence, at least as hard as NP-complete problems. Included are important problems in network reliability analysis, namely, computing the probability that a graph is connected and counting the number of minimum cardinality (s,t)-cuts or network cuts. Also shown to be mesh P-complete are counting vertex covers in a bipartite graph, counting anti-chains in a partial order and approximating the probability that a graph is connected and the probability that a pair of vertices is connected.

712,003
PB84-152313 Not available NTIS
National Bureau of Standards, Washington, DC.
Parameters for Integrating Periodic Functions of Several Variables.
Final rept.
S. Haber. Jul 83, 15p
Pub. in Mathematics of Computation 41, n163 p115-129 Jul 83.

Keywords: *Periodic functions, *Numerical integration, Diophantine equations, Approximation, Fourier series, Integral equations, Numerical quadrature, Number theory, Reprints.

A number-theoretical method for numerical integration of periodic functions of several variables was developed some years ago. This paper presents lists of numerical parameters to be used in implementing that method. The parameters define quadrature formulas for functions of 2, 3 ..., 8 variables; error bounds for those formulas are also tabulated. The derivation of the parameters and error bounds is described.

712,004
PB84-154632 Not available NTIS
National Bureau of Standards, Washington, DC.
Multi-Dimensional Volumes, Super-Reflexivity and Normal Structure in Banach Spaces.
Final rept.
J. Bernal, and F. Sullivan. 1983, 13p
Sponsored in part by Catholic University of America, Washington, DC.
Pub. in Illinois Jnl. of Mathematics 27, n3, p501-513 1983.

Keywords: *Banach space, Riemannian manifolds, Reprints, Reflexivity.

A study is given of the relationship between super-reflexivity, normal structure and properties of higher dimensional volumes in Banach spaces. N-dimensional volumes enclosed by n+1 vectors in a Banach space are defined as to generalize the usual definition of volumes in three-dimensional Euclidean spaces.

712,005
PB84-154681 Not available NTIS
National Bureau of Standards, Washington, DC.
Associated Legendre Functions on the Cut.
Final rept.
F. W. J. Olver, and J. M. Smith. Sep 83, 17p
Pub. in Jnl. of Computer Physics 51, n3 p502-518 Sep 83.

Keywords: *Legendre functions, Polynomials, Difference equations, Power series, Computation, Arithmetic, Algorithms, Reprints.

Algorithms and a code are described for the computation of the associated Legendre functions (P sub nu, sup mu) (cos theta), (P sub nu, sup -mu) (cos theta), (Q sub nu, sup mu) (cos theta) and the normalized Legendre polynomial (P sub nu, sup -mu) (cos theta) in the ranges 0 < theta = or < pi/2, mu = 0,1,2,..., -1/2 = or < nu < infinity. The algorithms are based on power-series expansions and recurrence relations. They are executed in extended-range arithmetic, thereby admitting very extensive ranges of mu and nu without causing overflow or underflow.

712,006
PB84-154707 Not available NTIS
National Bureau of Standards, Washington, DC.
Laplace Transformation Methods for Some Heat Transfer Problems.
Final rept.
R. Buschman, and R. D. Noble. May 83, 6p
Pub. in Indian Jnl. of Pure and Applied Mathematics 14, n5 p575-580 May 83.

Keywords: *Heat transfer, *Laplace transformation, Boundary value problems, Rivers, Lakes, Temperature, Reprints.

The authors approach the problems in the spirit of Carslaw and Jaeger in their attempts to obtain exact or analytic solutions to some boundary value problems which have arisen. Their method of approach is to apply multidimensional Laplace transformations and to extend some of the ideas which Voelker and Doetsch have used on simpler problems. In this paper they develop the mathematics which is used in order to obtain the results which are stated elsewhere, and they show how related problems can be solved in which some of the boundary conditions are generalized. In Section 2 they discuss the 'river' problem of predicting temperatures downstream and at later times and in Section 3 they discuss the 'lake' problem of predicting vertical temperature profiles in stagnant large water bodies. In the Appendix they collect together some useful formulas which were derived in the course of their work and which do not appear directly in the tables. The definitions for the heat kernels, chi and psi, are also included.

712,007
PB84-160639
(Order as PB84-160605, PC **A04**/MF **A01**)
Massachusetts Inst. of Tech., Cambridge.
Circulants and the Characterization of Vertex-Transitive Graphs.
F. T. Leighton. 22 Sep 82, 8p
Included in Jnl. of Research of the National Bureau of Standards, v88 n6 p395-402, Nov-Dec 83.

Keywords: *Graph theory, Automorphisms, Polygons, Abelian groups, Theorems, Circulants.

In this paper, we extend the notion of a circulant to a broad class of vertex-transitive graphs, which we call multidimensional circulants. This new class of graphs is shown to consist precisely of these vertex-transitive graphs with an automorphism group containing a regular abelian subgroup. The result is proved using a theorem of Sabidussi which shows how to recover any vertex-transitive graph from any transitive subgroup of its automorphism group. The approach also allows a short proof of Turner's theorem that every vertex-transitive graph on a prime number of nodes is a circulant.

712,008
PB84-160647
(Order as PB84-160605, PC **A04**/MF **A01**)
Massachusetts Inst. of Tech., Cambridge.
Decomposition of Vertex-Transitive Graphs into Multicycles.
F. T. Leighton. 22 Sep 82, 8p
Included in Jnl. of Research of the National Bureau of Standards, v88 n6 p403-410, Nov-Dec 83.

Keywords: *Graph theory, Decomposition method, Theorems, Circulants.

In this paper, it is proven that every vertex-transitive graph can be expressed as the edge-disjoint union of symmetric graphs. We define a multicycle graph and conjecture that every vertex-transitive graph can be expressed as the edge-disjoint union of multicycles. We verify this conjecture for several subclasses of vertex-transitive graphs, including Cayley graphs, multidimensional circulants, and vertex-transitive graphs with a prime or twice a prime number of nodes. We conclude with some open questions of interest.

712,009
PB84-224773 Not available NTIS
National Bureau of Standards, Washington, DC.
Fourth Order Accurate Fast Direct Method for the Helmholtz Equation.
Final rept.
R. F. Boisvert. 1984, 10p
Pub. in Proceedings of Elliptic Problem Solvers II, Monterey, CA., January 10-12, 1983, p35-44 1984.

Keywords: Finite difference theory, Fourier transformation, Divichlet problem, *Helmholtz equation, Neumann problem, Poisson equation.

A fourth order accurate fast direct method for the Helmholtz equation with Dirichlet, Neumann, or periodic boundary conditions on rectangular domains in two or three dimensions is described. High accuracy is attained through the use of compact finite differences techniques, and the resulting algebraic equations are solved using Fourier transforms. The results of several computational examples are also presented.

712,010
PB84-245950 Not available NTIS
National Bureau of Standards, Washington, DC.
Lopsided Sets and Orthant-Intersection by Convex Sets.
Final rept.
J. F. Lawrence. 1983, 19p
Pub. in Pacific Jnl. of Mathematics 104, n1 p155-173 1983.

Keywords: *Set theory, *Convex sets, Inequalities, Reprints, Matroids.

Given a subset L of the (2 sup d) closed orthants in d-dimensional Euclidean space, is there a convex set K which intersects those closed orthants in L, while missing those not in L. A strong combinatorial condition on L, which is necessary for the existence of such a convex set, is exhibited. This condition is studied and its close connections with the theory of oriented matroids are examined. The sets L satisfying this condition - the 'lopsided' sets - have rich combinatorial structure which can be exploited in the study of convex sets and systems of linear inequalities.

712,011
PB85-108751 Not available NTIS
National Bureau of Standards, Washington, DC.
Control of Wave Processes with Distributed Controls Supported on a Subregion.
Final rept.
J. Lagnese. 1983, 18p
Pub. in SIAM (Society for Industrial and Applied Mathematics) Jnl. on Control and Optimization 21, n1 p68-85 Jan 83.

Keywords: *Wave equations, Reprints, One dimensional.

It is proved that solutions of one dimensional wave equations satisfying general boundary conditions at the ends of a bounded interval I can be exactly controlled to any finite energy state by means of distributed controls which vanish outside of any fixed nonempty subinterval I. An example is given which shows that no such general analogous result can hold in higher dimensions. In this case, for a spherical region, those states are characterized which can be exactly controlled to zero by means of controls supported in an annulus within the region. It is found that very strong controllability obtains when the controls are distributed near the boundary, but that only rather weak controllability is possible with controls supported in an interior annulus. Applications of these results to boundary control problems in annular regions are also discussed.

712,012
PB85-115699 Not available NTIS
National Bureau of Standards, Washington, DC.
High Order Generalized Method of Averaging.
Final rept.
D. E. Gilsinn. 1982, 22p
Pub. in SIAM (Society of Industrial and Applied Mathematics) Jnl. on Applied Mathematics, v42 n1 p113-134 1982.

Keywords: *Average, Van der Pol differential equation, Perturbation theory, Computation, Oscillation, Algorithms, Reprints, Asymptotic approximation.

A high order generalized perturbation technique is developed that extends the Krylov - Bogoliubov- Mitropolsky method of averaging to vector systems written in normal form with multiple angular components. An algorithm is presented that iteratively gives the terms in the asymptotic approximation. A nonresonance condition is assumed that guarantees the smoothness of the terms. The main result establishes that the absolute error between the unaveraged normal system and ite N-th power of the perturbation parameter. The high order algorithm is applied to a coupled van-der-Pol oscillator system. Some numerical results are given to show that the main result reflects actual computational experience.

712,013
PB85-115723 Not available NTIS
National Bureau of Standards, Washington, DC.
Mixed Finite Element Methods - Reduced and Selective Integration Techniques: A Unification of Concepts.
Final rept.
D. S. Malkus, and T. J. R. Hughes. 1978, 19p
Pub. in Computer Methods in Applied Mechanics and Engineering, v15 n1 p63-81 Jul 78.

Keywords: *Finite element analysis, Incompressible flow, Degrees of freedom, Euler-Lagrange equation, Plates(Structural members), Beams(Supports), Computation, Constraints, Reprints, *Integration, Lagrange multipliers.

The equivalence of certain classes of mixed finite element methods with displacement methods which employ reduced and selective integration techniques is established. This enables the accuracy of the mixed formulation to be obtained without incurring the additional computational expense engendered by the auxiliary field of the mixed method. Applications and numerical examples are presented for problems with constraints which can be difficult to enforce in finite element approximations and have often dictated the use of mixed principles. These include thin beams and plates, and linear and nonlinear incompressible and nearly-incompressible continuum problems in solid and fluid mechanics.

712,014
PB85-123594 Not available NTIS
National Bureau of Standards, Washington, DC.
Constructive Characterization of Trees with at Least K Disjoint Maximum Matchings.
Final rept.
P. J. Slater. 1978, 13p
Pub. in Jnl. of Combinatorial Theory Ser. B 25, n3 p326-338 1978.

Keywords: *Trees(Mathematics), Graph theory, Reprints.

Let H = F(v) + G(w) denote the graph obtained from F and G by identifying vertices v of F and w of G; H will be said to be obtained by surgery on F and G. A matching of a graph is a collection of edges, no two of which are incident with the same vertex. This paper presents a constructive characterization of the (S sub k),k = or > 2, of trees which have at least k disjoint maximum matchings. For each k = or > 2 there are three types of surgery such that T is in (S sub k) if and only if T can be obtained from a star (K sub 1,n)(n = or > k) by a finite sequence of the specified surgical operations. A constructive characterization is also given for trees with two disjoint maximum independent vertex sets.

712,015
PB85-123602 Not available NTIS
National Bureau of Standards, Washington, DC.
Note on Cospectral Graphs.
Final rept.
C. R. Johnson, and M. Newman. 1980, 8p
Pub. in Jnl. Combinatorial Theory Ser. B 28, n1 p96-103 1980.

Keywords: *Graph theory, Matrices(Mathematics), Polynomials, Eigenvalues, Congruences, Isomorphisms, Permutations, Reprints.

It is noted that many cospectral pairs of graphs are accidents due to the interpretation of 0,1 as real numbers. A 1,x adjacency matrix, together with a method for dealing with it, is suggested. Many cospectral pairs are simply distinguished, and those which are not have adjacency matrices similar via matrices very much like permutations.

712,016
PB85-128908 Not available NTIS
National Bureau of Standards, Washington, DC.
Alternative to the Plucker Relations.
Final rept.
H. A. Robinson. 1977, 4p
Pub. in Proceedings of the American Mathematical Society 66, n2 p237-240 1977.

Keywords: Algebraic varieties, Vector spaces, Polynomials, Tensors, Reprints, *Plucker relations, Grassmann space.

It is shown how to obtain a set of homogeneous, degree m polynomials in (sub m, sup n) indeterminates over a field F so that the associated algebraic variety is the set of decomposable elements in the m-th Grassmann space over an n-dimensional vector space over F. The same techniques are used to produce an analogous result for the tensor product of m finite dimensional vector spaces.

712,017
PB85-140416 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Positive Definite Matrices and Catalan Numbers.
Final rept.
F. T. Leighton, and M. Newman. 1980, 5p
Pub. in Proceedings of the American Mathematical Society 79, n2 p177-181 1980.

Keywords: *Matrices(Mathematics), Determinants, Reprints, Catalan numbers.

It is shown that the number of n x n integral triple diagonal matrices which are unimodular, positive definite and whose sub and super diagonal elements are all one, is the Catalan number ((superscript 2n)(subscript n))/(n+1). More generally, it is shown that if A is a fixed integral symmetric matrix and d is a fixed positive integer, then there are only finitely many integral diagonal matrices D such that A+D is positive definite and det(A+D) = d.

712,018
PB85-140481 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Criteria for Choosing a Linearized Least Squares Technique for the Exponential Model Exp ((A sub 1) and (A sub 2) x).
Final rept.
G. G. Munro. 1981, 9p
Pub. in Jnl. of Computer Physics 44, n1 p189-197 Nov 81.

Keywords: *Least squares method, Exponential functions, Estimates, Reprints, Covariance matrices, Parameter estimation.

A user-oriented discussion of the determination of the parameters ((A sub 1) and (A sub 2) x) in the exponential model exp ((A sub 1) and (A sub 2) x) is presented in the context of four commonly employed linear least squares techniques. The best method to use is found to be dependent on several criteria, of which the most important are: (1) the objective of fit; (2) the range of data; and (3) the type of error contained in the data. Selecting the best method according to these criteria, the benefit of extending either the range of data or the density of data is determined for the purpose of obtaining the best values of ((A sub 1) and (A sub 2) x). Further, in the important 'modified' least squares method, the effect of the modified weight factor on the evaluation of the covariance matrix is estimated.

712,019
PB85-142818 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Normal Form and Representation Theory.
Final rept.
R. Cushman, A. Deprit, and R. Mosak. 1983, 16p
See also PB82-263443.
Pub. in Jnl. of Mathematics and Physics 24, n8 p2102-2117 1983.

Keywords: *Lie algebras, *Hamiltonian functions, *Three body problem, Matrices(Mathematics), Perturbation theory, Vector spaces, Nonlinear systems, Polynomials, Oscillations, Conformal mapping, Dynamics, Reprints, *Representation(Mathematics), Two degrees of freedom.

Representation theory of Lie algebras is called upon to develop a procedure for normalizing a dynamical system with two degrees of freedom in the neighborhood of an equilibrium when the Hamiltonian H(x,y,X,Y) in the coordinates (x,y) and their conjugate momenta (X,Y) is of the type H = ((X squared) + (Y squared))/2 + V(x,y,X,Y), the potential energy V being a sum of homogeneous polynomials in the phase variables of degree strictly greater than two. The fact that the resulting potential V' is a polynomial in the new coordinates (x',y') and the angular momentum G' = x'Y' - y'X' implies that the normalization is a rotation in the configuration space from a fixed frame to an ideal frame. The technique is intended for normalizing an Hamiltonian in equilibrium at the origin when the Lie derivative associated with the quadratic part is not semi-simple e.g. the planar Restricted Problem of Three Bodies at the equilateral equilibrium L4 when the basic frequencies are equal (Routh's singular case).

712,020
PB85-144954 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stable Marching Scheme for an Ill-Posed Initial Value Problem.
Final rept.
A. S. Carasso. Jun 83, 25p
Grant DAAG29-78-G-0091
Pub. in International Series of Numer. Math. 63, p11-35 Jun 83.

Keywords: *Parabolic differential equations, *Partial differential equations, Numerical integration, Computation, Reprints, *Initial value problems, Ill posed problems, Evolution equations.

The author develops and analyzes a marching procedure for the numerical computation of backwards parabolic equations with variable coefficients and noisy initial data. The scheme is stable (but inconsistent) and leads to error bounds of logarithmic convexity type for t bounded away from the line t = T, where the solution is only of class (L sup 2). The scheme is a two step procedure where the solution is appropriately filtered in the frequency domain, at every alternate step. The procedure assumes a constraint on the class of solutions which is stronger than the usual (L sup 2) bound at t = T. This stronger constraint is equivalent to the usual constraint in the constant coefficient case.

712,021
PB85-182699 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ideal Resonance Problem at First Order.
Final rept.
A. Deprit. 1982, 6p
Sponsored by American Astronautical Society, Alexandria, VA., and American Inst. of Aeronautics and Astronautics, New York.
Pub. in Proceedings of AAS/AIAA Astrodynamics Conference, North Lake Tahoe, NV, August 3-5, 1981, Advances in the Astronautical Sciences, v46 p521-526 1982.

Keywords: *Resonance, *Oscillation, Elliptic functions, Perturbation theory, Pendulums, Nonlinear systems.

Perturbations of the first order are removed jointly by a canonical transformation representing the hunting effect, and by a change of the time to synchronize the perturbed pendulum. Both operations are expressed in elementary functions. The reduced system is a simple pendulum integrable by elliptic functions.

712,022
PB85-201937 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determinacy in Linear-Systems and Networks.
Final rept.
J. S. Provan. 1983, 17p
Pub. in SIAM (Society for Industrial and Applied Mathematics) Jnl. of Algebraic Discrete Meth. 4, n2 p262-278 1983.

Keywords: *Linear systems, *Networks, Correlations, Transportation, Reprints, Sensitivity analysis.

Interdependent and determinate behavior is studied between variables subject to a system of linear equalities. For each pair of variables in such a system, four definitions of 'correlation' are introduced which relate the behavior of the variables to a chosen set of 'basic' variables for the system. These definitions correspond directly to such terms as statistical correlation, rates of substitution in economics, sensitivity in linear programming, and sign-solvability in linear algebra. For each definition of correlation, there is a stronger property of determinacy between two variables, established by the consistency in sign of the correlation between the two variables over every set of basic variables. The authors show that the property of determinacy is independent of which definition of correlation is used. The author also examines correlation and determinacy in systems related to networks, and derive good characterizations of determinacy in terms of properties of the underlying networks.

712,023
PB85-205714 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Invariance of Perturbed Null Vectors under Column Scaling.
Final rept.
G. W. Stewart. 1984, 5p
Pub. in Numerische Mathematik 44, n1 p61-65 1984.

Keywords: *Matrices(Mathematics), Perturbation theory, Invariance, Reprints.

Let X be an nxp matrix of rank p-1, and let u be a null vector of X. If T is nonsingular and v' is a suitably scaled null vector of X = XT, then v = Tv'. Now let (X tilde) = X + E and (x tilde)' = (X tilde)T. It is shown that if (v tilde) and (v tilde)' are singular vectors of (X tilde) and (X tilde)' corresponding to their smallest singular values, then (v tilde) = T(v tilde)' + O(11E11 sup 2).

712,024
PB85-208148 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Inverse Gaussian Pulse in the Experimental Determination of Linear System Green's Functions.
S. Carasso, and N. Hsu. Feb 85, 16p
Sponsored by Army Research Office, Research Triangle Park, NC.
Pub. in Transactions of the Second Army Conference on Applied Mathematics and Computing, Troy, New York, May 1984, ARO Report 85-1, p389-404 Feb 1985.

Keywords: *Green's function, Linear systems, Time invariant systems, Acoustic emissions, Deconvolution, Impulse response.

A new time domain deconvolution method is presented for determining the 'impulse response' of linear time invariant systems. The method is based on the use of the one-sided, causal, inverse Gaussian pulse as an approximation to the Dirac delta-function. Deconvolution of that kernel is equivalent to an inverse heat conduction problem. The method is particularly useful in cases where the Green's function for the linear system has singularities such as jumps, cusps, spikes, and the like. Computational reconstructions of singularities, from smooth synthetic data, are presented in the context of Acoustic Emission Green's functions.

712,025
PB86-103587 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.

Probe Waveforms and Deconvolution in the Experimental Determination of Elastic Green's Functions.
Final rept.
A. S. Carasso, and N. N. Hsu. Jun 85, 14p
Contract ARO-63-82
Pub. in SIAM (Society for Industrial and Applied Mathematics) Jnl. on Applied Mathematics 45, n3 p369-382 Jun 85.

Keywords: *Signal processing, Greens function, Linear systems, Cauchy problem, Reprints, *Impulse response, Acoustic emissions, Initial value problems, Deconvolution.

The authors propose a new time domain method for the experimental determination of the 'impulse responsaveforms are particular (C sup infinity symbol) approximations to the Dirac delta-function and the Heaviside' of linear systems. The technique centers around the use of specifically designed probe waveforms. These w unit step function, and lead to a subsequent time domain deconvolution problem which can be implemented as a Cauchy initial value problem. This approach allows for continuous deconvolution, a powerful option in the presence of noise. The authors orient the discussion to the context of acoustic emission and elastic Green's functions, and present several numerical reconstructions of sharp signals from smooth synthetic data.

712,026
PB86-103645 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Statistical Engineering Div.
Computational Experience with Confidence Regions and Confidence Intervals for Nonlinear Least Squares.
Final rept.
J. R. Donaldson, and R. B. Schnabel. May 85, 30p
Pub. in University of Colorado Department of Computer Science Technical Report CU-CS-302-84, 30p May 85.

Keywords: *Least squares method, Monte Carlo method, Confidence limits, Computation, *Parameter estimation, Nonlinear analysis, Linearization.

The authors present the results of a Monte Carlo study of the most commonly discussed methods for constructing approximate confidence regions and confidence intervals for parameters estimated by nonlinear least squares. The methods examined are the three varianTs of the linearization method, the likelihood method, and the lack-of-fit method. The linearization method is the most frequently implemented method. It is computationally inexpensive and produces easily understandable results. The likelihood and lack-of-fit methods both are much more expensive and more difficult to report. Based on results, it is concluded that among the three variants of the linearization method, the variant based solely on the Jacobian appears preferable because it is simple, less expensive, more numerically stable, and at least as accurate as the other two variants which utilize the full Hessian.

712,027
PB86-112083 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Scientific Computing Div.
Successive Overrelaxation, Multigrid, and Preconditioned Conjugate Gradients Algorithms for Solving a Diffusion Problem on a Vector Computer.
Final rept.
J. Gary, S. McCormick, and R. Sweet. 1983, 25p
Pub. in Applied Mathematics and Computation 13, n3/4 p285-309 1983.

Keywords: *Diffusion theory, Elliptic differential equations, Matrices(Mathematics), Numerical integration, Algorithms, Reprints, *Successive overrelation method, *Multigrid methods, *Conjugate gradient method, Vector processors.

The purpose of the paper is the treatment of three numerical algorithms (successive overrelaxation (SOR), multigrid (MG) and conjugate gradients preconditioned by a fast Poisson solver (CG)) for solving large but mildly behaved diffusion problems on a vector computer with memory-to-memory architecture. The problem is a symmetric nonnegative definite matrix equation arising from a cell-centered finite difference approximation of a 3-d diffusion equation with full Neumann boundary conditions.

712,028
PB86-128956 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Decay of Solutions of Wave-Equations in a Bounded Region with Boundary Dissipation.
Final rept.
J. Lagnese. 1983, 20p
Pub. in Jnl. of Differential Equations 50, n2 p163-182 1983.

Keywords: *Wave equations, Energy dissipation, Reprints.

An energy decay rate is obtained for solutions of the wave equation in a bounded region in (R sup n) whose boundary consists partly of a nontrapping reflecting surface and partly of an energy absorbing surface.

712,029
PB86-132537 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Operations Research Div.
Banach-Spaces That Have Normal Structure and Are Isomorphic to a Hilbert-Space.
Final rept.
J. Bernal, and F. Sullivan. 1984, 5p
Pub. in Proceedings of American Mathematical Society 90, n4 p550-554 1984.

Keywords: *Banach space, Hilbert space, Reprints.

The authors prove that given a Hilbert space (E,//.//), and /./ a norm on E such that for all x epsilon E, 1/ beta/x/ = or <//x// = or </x/ for some beta, if 1 = or < beta < (square root of 2), then (E,/./) satisfies a convexity property from which normal structure follows.

712,030
PB86-195625 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Asymptotic Behavior of Scaled Singular Value and QR Decompositions.
Final rept.
G. W. Stewart. 1984, 7p
Pub. in Mathematics of Computation 43, n168 p483-489 1984.

Keywords: Asymptotic series, Least squares method, Approximation, Reprints, *Matrices, Singular value decomposition, Factorization.

Asymptotic expressions are derived for the singular value decomposition of a matrix, some of whose columns approach zero. Expressions are also derived for the QR factorization of a matrix, some of whose rows approach zero. The expressions give insight into the method of weights for approximating the solutions of constrained least squares problems.

712,031
PB86-214681 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Addition of Points to Gauss-Laguerre Quadrature Formulas.
Final rept.
D. K. Kahaner, J. Waldvogel, and L. W. Fullerton. Mar 84, 14p
Pub. in SIAM (Society for Industrial and Applied Mathematics) Jnl. of Scientific and Statistical Computing 5, n1 p42-55 Mar 84.

Keywords: *Gaussian quadrature, Numerical quadrature, Numerical integration, Error analysis, Reprints.

The Gauss-Laguerre quadrature formula is defined by If = the integral from 0 to infinity, of ((e sup -x)f(x)dx) approx. = Summation from (i-1) to n, of ((a sub i, sup (n)) f (zeta sub i, sup (n))), where the numbers a sub i, sup (n) and zeta sub i, sup (n) are weights and nodes. A common method of estimating the error of the rule is to evaluate the quadrature rule for two different values of n and to then compare the difference in the answers. Unfortunately, none of the nodes or weights are in common for the two different quadrature rules, and so the function must be evaluated at each separate node. The authors investigate in the paper the addition of points to the Gauss-Laguerre rule such that the new points are real, lie in the interval of integration, and the associated weights are positive. Such rules enable one to estimate economically the error of quadrature, because the function values at the Gauss-Laguerre abscissae are reused. A collection of suitable low-order formulae are given.

712,032
PB86-215175 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Evaluation of L sub 1 Codes Using Polynomial Approximation Problems.
P. D. Domich, K. L. Hoffman, R. H. F. Jackson, P. B. Saunders, and D. R. Shier. Jun 86, 48p NBSIR-86/3390

Keywords: *Approximation, *Polynomials, Mathematical programming, Nonlinear systems, Computation, Algorithms, Computer applications, UNIVAC - 1108 computers.

The paper presents the methodology and results of a computational experiment which compares the performance of four computer codes which determine the best discrete L sub 1 approximation to a continuous nonlinear function. The experiment uses 320 test problems created by a test problem generator. Several performance measures describe solution quality as well as computational effort.

712,033
PB86-215183 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Near-Optimal Starting Solution for Polynomial Approximation of a Continuous Function in the L sub 1 Norm.
P. D. Domich. Jun 86, 28p NBSIR-86/3389

Keywords: *Approximation, *Polynomials, Computation, Chebyshev functions.

The paper presents a method of selecting a near-optimal starting basis for a large class of polynomial approximation problems in the L sub 1 norm. While it is possible to prove the optimality of these advanced starting solutions for only a small class of problems, empirical evidence indicates the starting bases are nearly optimal for a much larger class of problems. The paper presents the method used to determine the starting basis and a heuristic justification backed by empirical results supporting its use.

712,034
PB86-229689 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
L (sup infinity symbol) Error Bounds in Partial Deconvolution of the Inverse Gaussian Pulse.
Final rept.
A. S. Carasso, and N. N. Hsu. Dec 85, 10p
Sponsored by Army Research Office, Research Triangle Park, NC.
Pub. in SIAM (Society for Industrial and Applied Mathematics) Jnl. of Applied Mathematics 45, n6 p1029-1038 Dec 85.

Keywords: Signal processing, Delta functions, Greens function, Linear systems, Approximation, Reprints, *Impulse response, Time invariant systems, Deconvolution.

When a C(sup infinity symbol) approximation to the Dirac delta-function, in the form of an inverse Gaussian pulse, is used as input into a linear time invariant system, the output waveform is an approximation to that system's Green's function, in which the singularities have been smoothed out. The ill-posed deconvolution problem for the output signal aims at reconstructing these singularities. By exploiting the smoothing properties of the inverse Gaussian kernel, the authors prove that partial deconvolution of the output waveform, given L(sup 2) a priori bounds on the data noise and the unknown Green's function, results in L(sup infinity symbol) error bounds for the regularized solution and its derivatives. Consequently, when the L2 norm of the output noise is sufficiently small, partial deconvolution is a pointwise reliable C(sup infinity symbol) function, which in turn approximates the desired Green's function in many applications.

712,035
PB87-128120 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Some Results on Generalized Elliptic-Type Integrals.
Final rept.
S. L. Kalla, S. Conde, and J. H. Hubbell. 1986, 15p
Pub. in Applicable Analysis 22, p273-287 1986.

Keywords: *Elliptic functions, Hypergeometric functions, Asymptotic series, Reprints, Numerical solution.

In the present paper, the authors study a family of integrals for which special cases occur in radiation field problems. They obtain a series expansion and establish its relationship with Gauss' hypergeometric function. Asymptotic expansions valid in a neighborhood, and some recurrence relations are given. Results obtained earlier by Epstein and Hubbell, Weiss, and Kalla follow as particular cases of the formulae established here. Some numerical values are computed.

712,036
PB87-140596 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
B2DE - A Program for Solving Systems of Partial Differential Equations in Two Dimensions.
J. L. Blue. Jun 86, 63p NBSIR-86/3411

Keywords: *Elliptic differential equations, *Partial differential equations, *Nonlinear differential equations, *Computer programs, B2DE computer program, Two-dimensional calculations, Laplace equation, Interactive graphics, Fortran 77 programming language.

B2DE is a program for solving systems of nonlinear elliptic partial differential equations (PDEs) in two dimensions. The program is a collection of modules with an interactive driver. Many types of interactive graphics plots are included. Users may modify the driver, and may be able to construct a 'black box' program for a restricted class of PDEs. B2DE is available from the author.

712,037
PB87-164117 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Generalized Exponential and Logarithmic Functions.
Final rept.,
C. W. Clenshaw, D. W. Lozier, F. W. J. Olver, and P. R. Turner. 1986, 11p
Pub. in Computers and Mathematics with Applications 12B, n5-6 p1091-1101 1986.

Keywords: *Generalized functions, *Exponential functions, *Logarithm functions, Reprints.

Generalizations of the exponential and logarithmic functions are defined and an investigation is made of two possible versions of these functions. Some applications are described, including computer arithmetic, properties of very large and very small numbers, and the determination of functional roots.

712,038
PB87-197836 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Polyadic Structure of Factorable Function Tensors with Applications to High-Order Minimization Techniques.
Final rept.,
R. H. F. Jackson, and G. P. McCormick. 1986, 32p
Pub. in Jnl. of Optimization Theory and Applications 51, n1 p63-94 1986.

Keywords: *Functions(Mathematics), Computation, Optimization, Tensors, Reprints, Matrices, Factorization, Halley method, Tangent hyperbolas method.

Factorable functions are shown to have arrays of Nth order derivatives (tensors) which are naturally computed as sums of generalized outer product matrices (polyads). The computational implications of this for high order minimization techniques (such as Halley's method of tangent hyperbolas) are investigated. A direct derivation of these high order techniques is also given.

712,039
PB87-225421 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Generalization of the Eckart-Young-Mirsky Matrix Approximation Theorem.
Final rept.,
G. W. Stewart. Apr 87, 11p
Sponsored by Maryland Univ., College Park. Dept. of Computer Science.
Pub. in Linear Algebra and Its Applications 88-9, p317-327 Apr 87.

Keywords: *Matrices(Mathematics), *Approximation, Reprints, Eckart-Young theorem, Singular value decomposition.

The Eckart-Young theorem solves the problem of approximating a matrix by one of lower rank. However, the approximation generally differs from the original in all its elements. In the paper it is shown how to obtain a best approximation of lower rank in which a specified set of columns of the matrix remains fixed. The paper concludes with some applications of the generalization.

712,040
PB87-233524 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Infinitely Divisible Pulses, Continuous Deconvolution, and the Characterization of Linear Time Invariant Systems.
Final rept.,
A. S. Carasso. Aug 87, 36p
Contract ARO-63-82
Sponsored by Army Research Office, Research Triangle Park, NC.
Pub. in SIAM (Society for Industrial and Applied Mathematics) Jnl. on Applied Mathematics 47, n4 p892-927 Aug 87.

Keywords: Reprints, *Impulse response, *Time invariant system, *Pulse probing, *Volterra equations.

The paper addresses the problem of determining the impulse response of a linear time invariant system, by probing the system with a causal, C infinity approximation to the Dirac delta-function. The authors analyze the ill-posed deconvolution problem which results from a wide choice of possibly multimodal, infinitely divisible, probe pulses. The notion of infinite divisibility is shown to play a key role when the system's response is suspected of having nondifferentiable singularities. The authors reformulate the Volterra integral equation as a Cauchy problem for a linear partial differential equation in two independent variables, and introduce the concepts of partial and continuous deconvolution. The authors then show that partial deconvolution of the output waveform results in infinity error bounds for the regularized solution and its derivatives under L2 a priori bounds on the data noise and the unknown system response. Using the Poisson summation formula and FFT algorithms, the authors construct an efficient computational algorithm for performing continuous deconvolution, given sufficiently long but finite records of the probe pulse, and the output waveform. The theory is illustrated with several examples of computational reconstructions of singular elastic Green's functions, from smooth synthetic noisy data.

712,041
PB88-141049 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Further Results on Generalized Elliptic-Type Integrals.
Final rept.,
S. L. Kalla, C. Leubner, and J. H. Hubbell. 1987, 6p
Pub. in Applicable Analysis 25, p269-274 1987.

Keywords: *Elliptic functions, Reprints, *Integrals, Asymptotic approximation.

Simple direct proofs of some recent results by Kalla. Conde, and Hubbell for a generalized elliptic type integral (Appl. Anal., 22 (1986), pp. 273-287) are presented. Furthermore, a new single term asymptotic approximation for the function is derived, which is superior to the two term approximation given by these authors.

712,042
PB88-152574 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Generalized Stirling Approximations to N Factorial.
Final rept.,
C. Leubner. 1985, 3p
Pub. in European Jnl. of Physics 6, n4 p299-301 1985.

Keywords: *Gamma function, Transcendental functions, Approximation, Reprints, *Stirling formula, Asymptotic methods.

Generalized asymptotic approximations to Gamma (x+1), which contain an arbitrary parameter, are derived both from the integral representation of the Gamma function without assuming the knowledge of the Stirling series, and through elementary rearrangements of the Stirling series. By optimizing the arbitrary parameter according to appropriate criteria, several known Stirling-like approximations are recovered in a unifying way. Furthermore, a new such asymptotic series emerges, with a leading term that is as compact as but numerically superior to the known Stirling approximations, meaningful on the entire interval -1 < x < infinity, reasonably accurate even for x close to -1, and has a singularity as x tends to -1. It is pointed out that these interesting results - arrived at by elementary but generally applicable asymptotic techniques - can be exploited in physics teaching to demonstrate the power and utility of asymptotic methods in the analysis of a variety of physics problems.

712,043
PB88-152582 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Note on the Uniform Asymptotic Expansion of Integrals with Coalescing End Point and Saddle Points.
Final rept.,
C. Leubner, and H. Ritsch. 1986, 7p
Pub. in Jnl. of Physics A 19, n3 p329-335, 21 Feb 86.

Keywords: Asymptotic series, Reprints, *Integrals, Contour integration.

For the uniform asymptotic expansion of certain types of contour integrals, one of whose critical points is an end-point of the interval of integration, a method alternative to Bleistein's is introduced and numerically tested by way of a non-trivial physical example.

712,044
PB88-153010 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Algorithm HFFT - High-Order Fast-Direct Solution of the Helmholtz Equation.
Final rept.,
R. F. Boisvert. 1987, 15p
Pub. in ACM (Association for Computing Machinery) Transactions on Mathematical Software 13, n3 p235-249 Sep 87.

Keywords: Elliptic differential equations, Partial differential equations, Boundary value problems, Finite difference theory, Fourier analysis, Algorithms, Reprints, *Helmholtz equation, Two-dimensional calculations, Three-dimensional calculations, Discretization(Mathematics), HFFT algorithm.

HFFT is a software package for solving the Helmholtz equation on bounded two- and three-dimensional rectangular domains with Dirichlet, Neumann, or periodic boundary conditions. The software is the result of combining new fourth-order accurate compact finite difference (HODIE) discretizations and a fast-direct solution technique (the Fourier method). In the paper the authors briefly describe the user interface to HFFT and present an example of its usage and several details of its implementation.

712,045
PB88-153028 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Fourth-Order-Accurate Fourier Method for the Helmholtz Equation in Three Dimensions.
Final rept.,
R. F. Boisvert. 1987, 14p
Pub. in ACM (Association for Computing Machinery) Transactions on Mathematical Software 13, n3 p221-234 Sep 87.

Keywords: Fourier analysis, Elliptic differential equations, Partial differential equations, Boundary value problems, Finite difference theory, Reprints, *Helmholtz equation, Discretization(Mathematics), Two-dimensional calculations, Three-dimensional calculations.

The author presents fourth-order-accurate compact discretizations of the Helmholtz equation on rectangular domains in two and three dimensions with any combination of Dirichlet, Neumann, or periodic boundary conditions. The resulting systems of linear algebraic equations have the same block-tridiagonal structure as traditional central differences and hence may be solved efficiently using the Fourier method. The performance of the method for a variety of test cases, including problems with nonsmooth solutions, is pre-

sented. The method is seen to be roughly twice as fast as deferred corrections and, in many cases, results in a smaller discretization error.

712,046
PB88-153044 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Status of the NBS (National Bureau of Standards) Guide to Available Mathematical Software.
Final rept.,
S. E. Howe. 1986, 6p
Pub. in Computer Sciences and Statistics, Proceedings of the Symposium on the Interface (17th), Lexington, KY., March 17-19, 1985, p307-312 1986.

Keywords: *Scientific data, *Statistics, *Mathematics, Data processing, *Classifications, *Cataloging, Computation, *Data bases, *Relational data bases, *Software libraries, National Bureau of Standards, GAMS system, Access, End use.

The Guide to Available Mathematical Software (GAMS) is a classification scheme, a data base system, and a printed catalog. GAMS provides a framework for both the end-user scientist and the software maintainer to handle large quantities of mathematical and statistical software. The extensive problem-oriented GAMS classification scheme provides a structure for organizing software for general purpose mathematical and statistical computations. The software currently cataloged in GAMS consists of approximately 2400 programs, sub-programs, and interactive systems in some two dozen libraries. These libraries are available on a variety of computers. Data about the software and about library availability are stored in a relational data base and are maintained using a variety of software tools. Users access the data via an on-line query system based on the classification scheme. The printed GAMS catalog organizes information about the software according to the classification scheme and in several other useful ways.

712,047
PB88-153648 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Expected O(N) and O(N sup 4/3) Algorithms for Constructing Voronoi Diagrams in Two and Three Dimensions,
J. Bernal. Nov 87, 44p NBSIR-87/3679

Keywords: Computation, Algorithms, Theorems, *Voronoi diagrams, Computational geometry, Computational complexity, Two dimensional, Three dimensional.

Bentley, Weide and Yao have proposed an expected O(N) cell technique for computing Voronoi diagrams in two dimensions that does not generalize readily to three. In this paper their work is further developed and generalized to produce expected O(N) and O(N sup 4/3) algorithms for constructing Voronoi diagrams in two and three dimensions, respectively. Computational experience is presented for the algorithm in two dimensions.

712,048
PB88-162490 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Stable and Efficient Algorithm for Nonlinear Orthogonal Distance Regression.
Final rept.,
P. T. Boggs, R. H. Byrd, and R. B. Schnabel. 1987, 17p
See also AD-A164 346.
Pub. in SIAM (Society for Industrial and Applied Mathematics) Jnl. on Scientific and Statistical Computing 8, n6 p1052-1078 Nov 87.

Keywords: *Curve fitting, Algorithms, Regression analysis, Equations, Errors, Nonlinear analysis, Reprints, Levenberg Marquardt algorithm, *Least squares method.

One of the most widely used methodologies in scientific and engineering research is the fitting of equations to data by least squares. In cases where significant observation errors exist in the independent variables as well as the dependent variables, however, the ordinary least squares (OLS) approach, where all errors are attributed to the dependent variable, is often inappropriate. An alternate approach, suggested by several researchers, involves minimizing the sum of squared orthogonal distances between each data point and the curve described by the model equation. The authors refer to this as orthogonal distance regression (ODR). The paper describes a method for solving the orthogonal distance regression problem that is a direct analog of the trust region Levenberg-Marquardt algorithm. The number of unknowns involved is the number of model parameters plus the number of data points, often a very large number. By exploiting sparsity, however, the authors algorithms has a computation effort per step which is of the same order as required for the Levenberg-Marquardt method for ordinary least squares. The authors prove their algorithm to be globally and locally convergent, and perform computational tests that illustrate some differences between ODR and OLS.

Operations Research

712,049
PB-281 360/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Min-Max Theorem for p-Center. Problems on a Tree.
Final rept.,
D. R. Shier. Aug 77, 10p
Pub. in Transp. Sci., v11 n3 p243-252 Aug 77.

Keywords: *Optimization, Network flows, Minimax technique, Trees(Mathematics), Theorems, *Location problems, Reprints.

This paper considers the problem of locating p facilities on a tree network in order to minimize the maximum distance from a point on the network to its nearest facility. Such a problem might arise, for example, in optimally locating a fixed number of fire hydrants along a street network. The present paper identifies an underlying min-max theorem that governs such a p-center problem. More specifically, this p-center problem is shown to be equivalent to the 'dual' problem of locating p+1 points on the network so as to maximize the minimum distance between pairs of points.

712,050
PB-281 914/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Policing the Market Place.
Final rept.,
M. H. Pearl, and A. J. Goldman. Sep 77, 7p
Pub. in Math. Mag. 50, n4 p179-185, Sep 77.

Keywords: *Game theory, *Inspection, Optimization, Zero sum two person games, Cheating, Reprints.

This paper, of an expository nature, presents a simple mathematical model dealing with an inspector-inspectee relationship. This model takes the form of a zero-sum two-person game. The inspectee always tries to maximize his net gain which is the amount he obtains by 'cheating' less the amount he is penalized when caught. Several simple examples are presented to show the relation between the level of cheating and the levels of inspection resources and penalty.

712,051
PB-281 982/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Average Distance, Problem 75-12.
Final rept.,
H. J. Oser. Jul 76, 5p
Pub. in SIAM (Society for Industrial and Applied Mathematics) Review, v18 n3 p497-501 Jul 76.

Keywords: *Distance, Transportation models, Integral equations, Integration, Reprints.

To determine the average distance between points in two adjacent unit squares, the given 4-fold integral has to be evaluated. This paper shows how the four integrations can be carried out explicitly. The value is 1.08814. This result should be of interest to workers in transportation modelling and similar fields.

712,052
PB-284 601/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Batch Scheduling from Short Lists.
Final rept.,
G. Lyon. 1978, 3p
Pub. in Proceedings of Conference on Information Science and Systems, Held at Johns Hopkins University, Baltimore, Maryland on March 29-31, 1978, p493-495.

Keywords: *Scheduling, Resource allocation.

Almost all of m appointment slots can be assigned nearly optimally in O(m) provided appointment preferences are sufficiently random. And while there may be hundreds of appointments, each client need only indicate a set of five or six preferred times. These results are in sharp contrast to the standard assignment solution that costs O(m**3) in the worst-case and demands that each client provide a preference order for all m slots.

712,053
PB-289 803/9 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC.
Mathematical Models for Selecting Catalogs of Standard-Sized Items.
D. R. Shier. Sep 78, 81p NBSIR-78-1539

Keywords: *Mathematical models, *Inventories, Components, Dimensions, Length, Width, Standards, Optimization, Cost engineering, *Size(Dimensions).

This report identifies and discusses various mathematical models for selecting a 'best' catalog of standard sizes. A survey of existing models for continuous and discrete versions of the catalog selection problem is presented. The advantages and disadvantages of such models are assessed with regard to both range of applicability and computational feasibility. This evaluation shows that a frequently-advocated iterative procedure may produce erroneous results and identifies another approach as the most promising. Various refinements and extensions are then proposed for this latter (discrete) model and its associated solution technique (dynamic programming). In particular, a multidimensional version of the catalog selection problem is formulated and analyzed. Areas for further investigation, and unresolved issues, are also discussed.

712,054
PB-290 011/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Considerations for Improving Federal Modeling.
Final rept.
P. F. Roth, S. I. Gass, and A. Lemoine. 1978, 5p
Pub. in Proceedings Winter Simulation Conf., 1978, Held at Miami Beach, FL. on 4-6 Dec 78, p213-217 (IEEE, NY, Dec 78).

Keywords: *Mathematical models, National government, Simulation, Systems analysis, Computerized simulation.

There is a growing awareness of the need for better communication and management techniques to improve the process of developing computerized models. Modeling is defined as the process of solving complex system problems and making decisions using experimental data generated by a computerized conception of the system. The process is subtle and sophisticated and often misunderstood. The Government is a large underwriter of models. The Government's modeling process has been criticized by several GAO Reports. Some critical issues involved in improving the Government modeling process are disclosed, evaluated by expert practitioners, and ranked according to importance: better communication between users and developers of models is important; special bureaucracies to address modeling is unimportant. The responsibility for sponsorship of research is addressed.

712,055
PB-296 255/3 PC **A10**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Applied Mathematics.
Utility and Use of Large-Scale Mathematical Models.
S. I. Gass. May 79, 219p NBS-SP-534
Library of Congress Catalog card no. 79-600045. Proceedings of a Workshop Held at Gaithersburg, MD. on April 28-29, 1977.

Keywords: *Mathematical models, *Meetings, National government, Military research, Government policies, Performance evaluation, Computer programming, Standards, Energy models.

The Workshop on the Utility and Use of Large-Scale Mathematical Models held at the National Bureau of Standards, Gaithersburg, Maryland (April 28-29, 1977), was a 'first' for its purpose to examine the problem of how to improve the use and utility of large-scale math-

ematical models in the Federal Government. The Workshop speakers addressed specific problem areas, including: the present status of model use in DOD and non-DOD applications, issues facing developers, problems of model implementation, transfer and development in the energy field, model assessment and evaluation, use in policy analysis, comparison of models, management of the modeling process, model software and documentation, and guidelines, standards and management improvement activities. This Proceedings volume presents the papers and much of the discussion that took place at the Workshop, along with a summary of directions for needed research.

712,056
PB80-170277 Not available NTIS
National Bureau of Standards, Washington, DC.
Batch Scheduling from Short Lists.
Final rept.,
G. Lyon. 1979, 3p
Pub. in Information Processing Letters 8, n2 p57-59, 15 Feb 79.

Keywords: *Scheduling, Batching, Optimization, Resource allocation, Time, Reprints.

Almost all of m appointment slots can be assigned nearly optimally in O(m) provided appointment preferences are sufficiently random. And while there may be hundreds of appointments, each client need only indicate a set of five or six preferred times. These results are in sharp contrast to the standard assignment solution that costs O(m(star)(star)3) in the worst-case and demands that each client provide a preference order for all m slots.

712,057
PB80-188790 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of Fault Trees to the Evaluation of Risk.
Final rept.,
B. C. Pierman. 1979, 4p
Pub. in Proceedings of Intl. System Safety Conf. (4th), San Francisco, CA. July 9-13, 1979, p167-170 1979.

Keywords: *Risk, Trees(Mathematics), Systems analysis, *Fault tree analysis, Risk assessment.

Advances in the state of technology result in benefits that are often accompanied by increased risks which require critical evaluation. Many parameters contribute to the general acceptability of societal risk. A preliminary framework is developed to classify and display parameters in a systematic manner. Called SART - Situational Analysis and Risk Tree, the framework utilized a fault tree approach and results in a density display of risk parameters that are overrepresented in a given situation. A Standard Test Question for each tree element reflects that an issue occurs 'more than average' in a situation. Completed SART trees for different risk situations can result in comparisons of the number of parameters affecting risk acceptability for those situations. The version presented requires detailed development, but serves to illustrate the concept.

712,058
PB81-138406
(Order as PB81-138356, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Player Aggregation in Noncooperative Games.
A. J. Goldman, and D. R. Shier. 29 Mar 78, 6p
Included in Jnl. of Research of the National Bureau of Standards, v85 n5 p391-396, Sep-Oct 80.

Keywords: *Game theory, Theorems, *Noncooperative games.

A condition is given, under which subsets of the players of a noncooperative game can be combined into 'aggregate players' without changing the set of equilibrium-point solutions of the game. The condition is that an individual player's payoff does not depend on the strategy choices of the other players forming the same aggregate player. 'Approximate' versions of this result are also formulated and proven.

712,059
PB81-164857 Not available NTIS
National Bureau of Standards, Washington, DC.
Arc Tolerances in Shortest Path and Network Flow Problems.
Final rept.
D. R. Shier, and C. Witzgall. 1980, 15p
Pub. in Jnl. Networks 10, p227-291 1980.

Keywords: *Network flows, Optimization, Reprints, Shortest path method, Sensitivity analysis, Directed graphs.

This paper studies one aspect of the 'robustness' of optimal solutions to shortest path and, more generally, network flow problems. Specifically, the authors characterize the maximum increase and the maximum decrease in an arc's cost that can be tolerated without changing optimality of the current solution. Calculation of these quantities is quite simple for nonbasic arcs, and somewhat more involved for basic arcs. When such tolerances are to be determined simultaneously for all arcs in the network, considerable duplication of effort can be avoided through the use of specialized algorithms. Several algorithms for calculating all arc tolerances are presented, one of which is shown to have complexity order (n sup 2) for general networks with n nodes.

712,060
PB81-164873 Not available NTIS
National Bureau of Standards, Washington, DC.
Algorithms for Finding the k Shortest Paths in a Network.
Final rept.
D. R. Shier. 1979, 10p
Pub. in Jnl. Networks 9, p195-214 1979.

Keywords: *Network flows, Transportation models, Optimization, Algorithms, Reprints, Shortest path method.

This paper presents, within a unified framework, several new algorithms for computing k shortest paths in a network. These algorithms use strategies which have proved to be efficient in solving shortest path problems. In addition, a computational study was conducted to assess the effects of the different 'arc processing' orders which are characteristic of each algorithm. Testing was performed using generated classes of moderately large grid, complete and random networks. Two particular algorithms emerge as the most promising among those evaluated.

712,061
PB81-207789
(Order as PB81-207748, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Game-Theoretic Model of Inspection-Resource Allocation,
M. H. Pearl, and A. J. Goldman. 2 Jul 80, 23p
Included in Jnl. of Research of the National Bureau of Standards, v86 n2 p193-215, Mar-Apr 81.

Keywords: *Game theory, *Inspection, Mathematical models, Optimization, Penalties, Theorems, Resource allocation, Zero sum games, NTISCOMNBS.

This paper presents a generalization of a game-theoretic model, first described in an earlier paper, of the relationship between an inspectee who may decide to 'cheat' or not, and an inspector whose task it is to minimize the expected gain that the inspectee achieves by cheating. When cheating is detected by the inspector, a penalty is assessed against the inspectee. The generalized model permits imposing a relationship between the level of the penalty to the inspectee when he/she is caught and the value of the inspectee of not being caught when he/she is cheating. The solution of the game takes on different forms depending on whether or not the inspector's resources are sufficient to make the detection of cheating likely.

712,062
PB82-140633
(Order as PB82-140575, PC **A05**/MF **A01**)
Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
'Uniformity Principle' for Evacuation Route Allocation,
R. L. Francis. 1 Apr 81, 5p
Included in Jnl. of Research of the National Bureau of Standards, v86 n5 p509-513, Sep-Oct 81.

Keywords: *Network flows, *Evacuating(Transportation), *Buildings, Optimization.

This paper establishes what might be called a 'uniformity principle' for building evacuation problems. The principle may be stated as follows: given a building for which each occupant has reasonable access to every evacuation route, if the building is evacuated in minimum time, then the allocation of evacuees to routes is such that the route evacuation times are all the same. That is, there is a uniformity of route evacuation times. Also, analytical expressions for the minimum time to evacuate a building, and for the corresponding allocation of evacuees to routes, are obtained.

712,063
PB83-236422 Not available NTIS
National Bureau of Standards, Washington, DC.
Random Walks: Theory and Selected Applications.
Final rept.
G. H. Weiss, and R. J. Rubin. 1983, 143p
Pub. in Advances in Chemical Physics 52, p363-505 1983.

Keywords: *Random walk, Solid state physics, Diffusion, Transport properties, Microorganisms, Adsorption, Reprints, Polymer chains.

The theory of discrete step random walks in discrete time and continuous time is outlined. The relation between continuous time random walks and a generalized master equation is developed. In the limit of long walks, various asymptotic properties are discussed. The effect of boundary conditions and traps on random walk behavior, maximum displacements and spans and the application of Wald's identity for first passage time problems is treated in a chapter devoted to boundary conditions. Applications of the general theory in four areas are discussed: (1) polymer physics, freely jointed chains, size and shape parameter of random flight chains, determination of distribution of end-to-end distance from moments, the wormlike chain, and polymer chain adsorption at a surface, (2) multistate random walks, (3) solid state physics, correlated diffusion models, trapping models, nonlattice models, transport in disordered structures, and random walk in ID with disordered rate constants, and (4) models of the motion of microorganisms.

712,064
PB84-166701 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Survey of Sensitivity Analysis Methodology.
R. G. Hendrickson. Feb 84, 89p NBSIR-84-2814

Keywords: Mathematical models, Computation, Statistical analysis, Sampling, Errors, Mathematical programming, Surveys, Reviews, *Sensitivity analysis.

This survey on the methodology of sensitivity analysis presents a general statement of the several broad categories of this discipline for the purpose of pulling together the various approaches and theory, to show the extent and sophistication of new techniques, special applications, and the relation of sensitivity analysis to model evaluation.

712,065
PB85-102275 Not available NTIS
National Bureau of Standards, Washington, DC.
Linearization in 0-1 Variables: A Correction.
Final rept.
A. J. Goldman. Oct 83, 2p
Pub. in Operations Research 31, n5 p946-947 Sep-Oct 83.

Keywords: *Nonlinear programming, Computation, Correction, Reprints, Integer programming, Linearization, Zero one programming.

A published method for linearizing nonlinear 0-1 programs is shown to be incomplete, but a simple modification restores its validity and retains most of its computational advantage.

712,066
PB85-116317 PC **A03**/MF **A01**
Harris (Carl M.) and Associates, Charlottesville, VA.
Issues in Sensitivity and Statistical Analysis of Large-Scale, Computer-Based Models.
Final rept.
C. M. Harris. Aug 84, 41p NBS/GCR-84/466
Sponsored in part by Federal Emergency Management Agency, Washington, DC.

Keywords: *Mathematical models, *Computerized simulation, Statistical analysis, Probability theory, Sensitivity analysis, Uncertainty, Response surface analysis, Energy models.

This report addresses both the theoretical and practical considerations associated with the use of sensitivity analysis in model evaluation. Special attention is paid to uses of sensitivity analysis to determine the

rates of output change with respect to changes in the inputs, importance ranking of the inputs from a sensitivity viewpoint, and assessment of output variability attributable to the inputs. One of the natural consequences of such statistical quantification of the variability of the model's outputs is the development of tools useful for the decision maker in employing the target model in the analysis of measures for dealing with an uncertain environment. Two analysis techniques, model sampling and response surface analysis, are described in the report. Illustrations are provided to demonstrate how one would apply each of the techniques as an integral part of a model evaluation.

712,067
PB85-142974 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
IFORS (International Federation of Operational Research Societies) in Retrospect, IFORS Twenty-Fifth Anniversary Banquet Speech.
Final rept.
J. H. Engel. 1984, 11p
Sponsored by International Federation of Operational Research Societies and Technical Univ. of Denmark, Lyngby.
Pub. in Operational Research '84, p55-65 1984.

Keywords: *Operations research, *Scientific societies, *Societies, Reviews, Reprints, *International Federation of Operational Research Societies.

The author reviews, in a non-technical way, what has happened to IFORS during its first twenty-five years, and shows that IFORS has succeeded in encouraging the creation of a world-wide community of scientists engaged in operational research.

712,068
PB85-183184 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calculating Bounds on Reachability and Connectedness in Stochastic Networks.
Final rept.
M. O. Ball, and J. S. Provan. 1983, 26p
Pub. in Networks 13, n2 p253-278 1983.

Keywords: Algorithms, Approximation, Graphics, Networks, Probability theory, Reliability, Reprints, *Stochastic networks.

The paper presents computational procedures for generating bounds on measures of network reliability. The two measures considered, reachability and connectedness, are the probability that there is an operating path from a node to all other nodes in a directed (respectively undirected) stochastic network. The bounds, which are given in terms of polynomials in p, the common arc failure probability, are based on recent bounding results the authors developed for the class of shellable independence systems. Two pairs of bounds are given weaker bounds whose computation time is bounded by a polynomial in the size of the network and tighter bounds whose computation time is bounded by a polynomial in the size of the network and the number of minimum cardinality network cuts. Computational results are also given that evaluate the quality of the bounds. The generation of the bounds involves several interesting path and cut counting problems.

712,069
PB85-201986 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Computing Network Reliability in Time Polynomial in the Number of Cuts.
Final rept.
J. S. Provan, and M. O. Ball. 1984, 11p
Pub. in Operations Research 32, n3 p516-526 1984.

Keywords: *Networks, Computation, Reliability, Polynomials, Algorithms, Reprints, *Stochastic networks, Probability.

In this paper, the authors present a new algorithm for computing the probability that there exists an operating path from a node s to a node t in a stochastic network. This algorithm has the special property thats computation time is bounded by a polynomial in the number of (s,t)-cuts in the network. They also investigate other connectedness reliability problems in terms of their complexity with respect to the number of cutsets and pathsets in the network. They indicate which problems do have algorithms which are polynomial in the number of such sets, and which ones will not have such algorithms unless P=NP.

712,070
PB86-105830 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Family of Descent Functions for Constrained Optimization.
Final rept.
P. T. Boggs, and J. W. Tolle. Dec 84, 16p
Grant DAAG29-77-G-0125
Sponsored by Army Research Office, Research Triangle Park, NC.
Pub. in SIAM (Society for Industrial and Applied Mathematics) Jnl. on Numerical Analysis 21, n6 p1146-1161 Dec 84.

Keywords: *Nonlinear programming, Convergence, Algorithms, Reprints, *Constrained optimization.

In order to achieve a robust implementation of methods for nonlinear programming problems, it is necessary to devise a procedure which can be used to test whether or not a prospective step would yield a 'better' approximation to the solution than the current iterate. In this paper, the authors present a family of descent or merit functions which are shown to be compatible with local Q-superlinear convergence of Newton and quasi-Newton methods. A simple algorithm is used to verify that good descent and convergence properties are possible using this merit function.

712,071
PB86-105988 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Global Solutions to Factorable Nonlinear Optimization Problems Using Separable Programming Techniques.
G. P. McCormick. Jul 85, 46p NBSIR-85/3206

Keywords: *Mathematical programming, Least squares method, Computation, Optimization, Algorithms, Nonconvex programming, Branch and bound method, Nonlinear analysis.

Many algorithms for obtaining global solutions to nonconvex optimization problems have been proposed in recent years. The methods farthest along computationally are those for separable problems. These use linear programming codes to solve sequences of LP problems formed from piece-wise linear approximations to the nonlinear functional forms. For a large class of optimization problems, called factorable programming problems, it is possible to create equivalent separable problems. This is done at a cost: additional variables and constraints. In this paper the procedure for creating the equivalent separable problems is outlined and a brief description is given of a global solution algorithm due to Falk. A small example is given illustrating the above techniques. The example is also solved using a more direct method. Application to the solution of nonlinear least squares is illustrated with another example. Discussion of areas of research for improving the efficiency of this approach concludes the paper.

712,072
PB86-119203 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Characterizing Supremum and l (sub p) Efficient Facility Designs.
Final rept.
L. G. Chalmet, R. L. Francis, and J. F. Lawrence. 1981, 13p
See also AD-A059040. Sponsored by Army Research Office, Research Triangle Park, NC., and National Research Council, Washington, DC.
Pub. in Jnl. of Optimization Theory and Applications 35, n1 p129-141 Sep 81.

Keywords: *Experimental design, *Facilities, Optimization, Reprints.

Define a design to be any planar set D of known area a, but of unknown shape and location; more generally, a design can be any set in (R sub d) of measure a. For example, a design might be one floor of a warehouse, or a sports arena of known seating capacity. Given mild assumptions about the disutility functions, and a slight refinement of the design definition to rule out certain pathologies, the authors present necessary and sufficient conditions for a design to be efficient, and study properties of efficient designs.

712,073
PB86-124831 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
One-Row Linear Programs.
Final rept.
C. Witzgall. 1980, 31p
Pub. in Proceedings of International Symposium Extremal Methods and Systems Analysis, Austin, TX., 1977, p384-414 1980.

Keywords: *Linear programming, *Simplex method, Algorithms, Pivot theory.

Motivated by the possibility of improving the efficiency of the dual simplex method, the paper discusses direct solution algorithms for linear programs with upper bounds and generalized upper bounds which apart from bound constraints consist of a single row representing a constraint equation. The close connection between 1-row linear programs with upper bounds and the problem of determining weighted medians is demonstrated. The latter problem is known to be of complexity O(n) where n is the number of variables. A solution algorithm of complexity O(n log n) + O(k(n-k)) is presented for the l-row k-mix linear program with generalized upper bounds. The algorithm is based on determining the lower boundary of the convex hull of points in the plane.

712,074
PB86-210069 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Operations Research Div.
Projections onto Order Simplexes.
Final rept.
S. J. Grotzinger, and C. Witzgall. 1984, 24p
Pub. in Applied Mathematics and Optimization 12, n3 p247-270 1984.

Keywords: Quadratic programming, Curve fitting, Reprints, *Isotone regression, Isotone regression, Kuhn-Tucker theory.

Isotone regression techniques are reinterpreted and extended to include upper and lower bounds on the ordered sequences in question. This amounts to solving the shortest distance problem for the order simplex in (S sup n) in (R sup n). An O(n) algorithm is presented for this problem, verified via the Kuhn-Tucker conditions, and explained geometrically in terms of the Lagrange multipliers. In the context, isotone regression techniques are interpreted in terms of orthogonal projections onto faces of the order simplex (S sup n). These projections provide a succinct characterization of the descent directions required for the design of gradient projection methods for minimizing differentiable functions on (S sup n).The latter problem arises in parameterized curve fitting. The authors conclude by considering generalizations of these techniques.

712,075
PB87-104436 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Polyadic Third-Order Lagrangian Tensor Structure and Second-Order Sensitivity Analysis with Factorable Functions.
R. H. F. Jackson, and G. P. McCormick. Aug 85, 68p NBSIR-85/3222
Prepared in cooperation with George Washington Univ., Washington, DC. Dept. of Operations Research.

Keywords: *Nonlinear programming, Perturbation theory, Tensors, Theorems, Constrained optimization, Sensitivity analysis, Matrices.

Second-order sensitivity analysis methods are developed for analyzing the behavior of a local solution to a constrained nonlinear optimization problem when the problem functions are perturbed slightly. Specifically, formulas involving third-order tensors are given to compute second derivatives of components of the local solution with respect to the problem parameters. When in addition, the problem functions are factorable, it is shown that the resulting tensors are polyadic in nature.

712,076
PB87-233573 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Scientific Computing Div.
Modular System of Algorithms for Unconstrained Minimization.
Final rept.,
R. B. Schnabel, J. E. Koontz, and B. E. Weiss. 1985, 22p
See also report dated Nov 82, AD-A123 204.

Pub. in ACM Transactions on Mathematical Software 11, n4 p419-440 Dec 85.

Keywords: *Mathematical programming, Finite difference theory, Approximation, Algorithms, Reprints, *Unconstrained minimization.

The authors describe a new package, UNCMIN, for finding a local minimizer of a real valued function of more than one variable. The novel feature of UNCMIN is that it is a modular system of algorithms, containing three different step selection strategies (line search, dogleg, and optimal step) that may be combined with either analytic or finite difference gradient evaluation and with either analytic, finite difference, or BFGS Hessian approximation. The authors present the results of a comparison of the three step selection strategies on the problems in More, Garbow, and Hillstrom in two separate cases: using finite difference gradients and Hessians, and using finite difference gradients with BFGS Hessian approximations. They also describe a second package, REVMIN, that uses optimization algorithms identical to UNCMIN but obtains values of user supplied functions by reverse communication.

712,077
PB88-129762 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Efficient Strategy for Utilizing a Merit Function in Nonlinear Programming Algorithms.
Final rept.,
P. T. Boggs, and J. W. Tolle. 1986, 11p
Pub. in Lecture Notes in Mathematics 1230, p127-137 1986.

Keywords: *Nonlinear programming, Sequential analysis, Optimization, Algorithms, Reprints, Quadratic programming, Merit functions, Newton method.

The problem considered is the equality constrained nonlinear programming problem. Many implementations of algorithms for solving such problems involve a merit function to assess the step, i.e., a procedure for deciding whether the next iterate is 'better' than the current iterate. In a previous paper, the authors introduced a merit function with desirable properties. The function is differentiable, an unconstrained minimum corresponds to a solution of the original problem, and its use will not interfere with q-superlinear convergence. The major drawback is that the merit function involves gradients of both the objective function and the constraint functions and hence it is expensive to use. In the paper, a related merit function which is cheap to evaluate and easy to implement is described. Some theoretical and numerical results are presented.

712,078
PB88-141346 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Numerical Optimization, 1984.
Final rept.,
P. T. Boggs, R. H. Byrd, and R. B. Schnabel. 1985, 287p
Pub. in Proceedings of SIAM (Society for Industrial and Applied Mathematics) Conference on Numerical Optimization, Boulder, CO., June 12-14, 1984, 287p 1985.

Keywords: *Mathematical programming, *Numerical analysis, *Optimization, *Meetings, Constrained optimization, Computer software, Nonlinear analysis, Global optimization.

The volume contains a selection of the papers presented at the SIAM Conference on Numerical Optimization held in Boulder, Colorado on June 12-14, 1984. The aim of the conference was to bring together researchers and practitioners of numerical optimization techniques to discuss the latest developments in the important area of numerical computation. Three topics were selected as the foci of the conference, namely nonlinearly constrained optimization, optimization software, and global optimization. Eight speakers were invited to give presentations on these topics. In addition, contributed papers on all topics pertinent to numerical optimization were solicited; approximately 90 papers covering the spectrum from research in new methods to novel applications were delivered. The conference was attended by 248 people widely distributed among government, industry, and academia.

712,079
PB88-153036 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
LP-Based Combinatorial Problem Solving.
Final rept.,
K. Hoffman, and M. Padberg. 1985, 69p
Pub. in NATO Adv. Sci. Inst. Ser. F: Comput. Systems Sci. 15, p55-123 1985.

Keywords: *Linear programming, *Combinatorial analysis, Computation, Optimization, Problem solving, Integer programming, Traveling salesman problem, Matrices.

A tutorial outline of the polyhedral theory that underlies linear-programming (LP)-based combinatorial problem solving is given. Design aspects of a combinatorial problem solver are discussed in general terms. Three computational studies in combinatorial problem solving using the polyhedral theory developed in the past fifteen years are surveyed: one addresses the symmetric traveling salesman problem, another the optimal triangulation of input/output matrices, and the third the optimization of large-scale zero-one linear programming problems.

Statistical Analysis

712,080
AD-A119 018/0 Not available NTIS
National Bureau of Standards, Washington, DC. National Engineering Lab.
Using Biweight M-Estimates in the Two-Sample Problem. 1. Symmetric Populations.
K. Kafadar. May 81, 18p ARO-16669.25-MA
Contract DAAG29-79-C-0205
Availability: Pub. in Communications in Statistics: Theory and Methods, v11 n17 p1883-1901 1982 (No copies furnished by DTIC/NTIS).

Keywords: *Population(Mathematics), *Estimates, *Confidence limits, Monte Carlo method, Statistical analysis, Replacement, Efficiency, Validation, Reprints, Symmetry, Sampling theory.

No abstract available.

712,081
AD-A142 580/0 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Errors-in-Variables for Binary Regression Models.
R. J. Carroll, C. H. Spiegelman, K. K. G. Lan, K. T. Bailey, and R. D. Abbott. 1984, 8p AFOSR-TR-84-0519
Contract F49620-82-C-0009
Pub. in Biometrika, v71 n1 p19-25 1984.

Keywords: *Mathematical models, Binary arithmetic, *Regression analysis, Errors, *Cardiovascular diseases, Variables, Mathematical prediction, Measurement, Estimates, Probability, Coronary disease, Risk, Blood pressure, Cholesterol, Reprints, Logistic regression, Probit regression.

The authors consider in detail probit and logistic regression models when some of the predictors are measured with error. For normal measurement errors, the functional and structural maximum likelihood estimates (MLE) are considered; in the functional case the MLE is not generally consistent. Non-normality in the structural case is also considered. By an example and a simulation, the authors show that if the measurement error is large, the usual estimate of the probability of the event in question can be substantially in error, especially for high risk groups.

712,082
AD-A159 104/9 PC **A02**/MF **A01**
North Carolina Univ. at Chapel Hill. Inst. of Statistics.
Note on the Effect of Ignoring Small Measurement Errors in Precision Instrument Calibration.
Technical rept. Sep 84-Sep 85,
R. J. Carroll, and C. H. Spiegelman. Jun 85, 17p
MIMEO SER-1580, AFOSR-TR-85-0701
Contract F49620-82-C-0009

Keywords: *Calibration, *Errors, Least squares method, Measurement, Variations, Models, Linear regression analysis, Mathematical models, Confidence limits, Intervals, Measurement, Instrumentation, Precision, Slope, Statistical processes, Variables, Standard deviation, Documents, Statistics, Confidence intervals, Precision instruments.

The authors' focus is the simple linear regression model with measurement errors in both variables. It is often stated that if the measurement error in x is small, then we can ignore this error and fit the model to data using ordinary least squares. There is some ambiguity in the statistical literature concerning the exact meaning of a small error. For example Draper and Smith (1981) state that if the measurement error variance in x is small relative to the variability of the true x's, then errors in the x's can be effectively ignored, see Montgomery & Peck (1983) for a similar statement. Scheffe (1983) and Mandel (1984) argue for a second criterion, which may be informally summarized that the error in x should be small relative to (the standard deviation of the observed Y about the line)/(slope of the line). We argue that for calibration experiments both criteria are useful and important, the former for estimation of x given Y and the latter for confidence intervals for x given Y. (Author)

712,083
PB-266 032/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Least Squares Algorithms,
R. H. Wampler. 1977, 2p
Pub. in Am. Stat. Letter to Ed., v31 n1 p52-53 Feb 77.

Keywords: *Least squares method, Algorithms, Reprints.

No abstract available.

712,084
PB-266 477/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis of Interlaboratory Test Data,
J. Mandel. Mar 77, 5p
Pub. in Stand. News v5 n3 p17-20 56 Mar 77.

Keywords: *Analysis of variance, *Tests, Laboratories, Mathematical models, Reprints.

Precision and accuracy, as parameters for the evaluation of test results, are discussed. The precision is shown to involve both within- and between-laboratory variability. Therefore a proper evaluation of a test method requires that a properly designed interlaboratory study be conducted. The paper deals with the design and analysis of the results of intelaboratory studies. It is shown that the conventional two-way analysis of variance can lead to erroneous values for the within- and between-laboratory components of variance. It is strongly recommended that the data be analyzed level by level, i.e., separately for each material or level, by means of a one-way analysis of variance (within-between analysis). This method leads to unbiased estimates for the precision components and allows the latter to be evaluated as functions of the level. A numerical example is included.

712,085
PB-271 188/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dynamic Model for a Population of Durable Goods.
Final rept.,
F. Gornick, and E. Passaglia. 1977, 17p
Pub. in Resource Recovery Conserva., v2 p193-209 1976/77.

Keywords: *Population(Statistics), Mathematical models, Reprints, Durable goods.

A dynamic model for a population of durable goods is presented. In the most general case the rate at which each individual member of the population delivers the service embodied in it is age-specific. If the total demand for services from goods of all ages is specified along with scrappage rates, the model predicts (1) the age distribution of a steady or stable-age distribution and (2) the time dependence of the approach to the steady state.

712,086
PB-275 024/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Contribution to Invited Discussion of 'Do Robust Estimators Work with Real Data' by Stephen M. Stigler.
Final rept.,
C. Eisenhart. Nov 77, 39p
Pub. in Ann. Stat., v5 n6 p1085-1087 Nov 77.

Keywords: *Estimates, Measurement, Reprints, *Robust procedures, Data sets.

Inasmuch as the actual causes and precise nature of the systematic errors affecting historic data sets, e.g.

A. A. Michelson's and S. Newcomb's measurement of the velocity of light, are not known today, it is impossible to bring such data sets 'into line' with modern measurements of the same quantity, or, alternatively, to work backwards from a currently accepted value of the quantity concerned (e.g. the velocity of light) to derive trustworthy determinations of the particular ('true') values that such historic data sets were striving to indicate. Consequently efforts, such as Stigler's, to compare the accuracies of alternative estimators of location applied to such historic data sets are dubious.

712,087
PB-275 151/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Boscovich and the Combination of Observations.
Final rept.,
C. Eisenhart. 1977, 13p
Pub. in Historical Studies in Probability and Statistics, ch2 p88-100 1977.

Keywords: *Statistical analysis, Algorithms, *Boscovich method, *Method of averages.

No abstract available.

712,088
PB-280 811/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement Evaluation.
Final rept.,
J. Mandel, and L. F. Nanni. 1978, 64p
Pub. in Quality Assurances Practices for Health Laboratories, ch4 p209-272 1978.

Keywords: *Biostatistics, *Statistical analysis, Confidence limits, Precision, Accuracy, Errors, Reprints.

This is a chapter written for inclusion in a book on 'Quality Assurance Practices for Health Laboratories,' to be published by the American Health Association. This chapter deals with basic statistical concepts and their application to the evaluation of measurements. It covers, among other topics, the evaluation of precision and accuracy, using point and interval estimates, statistical distribution functions, straight line fitting, the evaluation of diagnostic tests, and control chart techniques.

712,089
PB-280 822/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
t-Statistic for a Double Exponential Distribution.
Final rept.,
R. C. Sansing. Dec 76, 12p
Pub. in SIAM Jnl. of Applied Mathematics 31, n4 p634-645, Dec 76.

Keywords: *T test, Exponential density functions, Statistical samples, Analysis of variance, Mean, Robust procedures, Reprints.

Questions of robustness of the 'Student's t-statistic have been given attention for many years. The qualitative results produced thus far have led to consideration of new tests for routine use that depend less heavily on the model assumptions. In order to properly evaluate these new procedures, more quantitative results on the t-test are required. To this end the t-test with samples from a population with a double exponential density function are considered here in some detail. The joint density of the sample mean and variance is derived exactly in the region where the ratio is sufficiently large and the exact density of the t-statistic for the absolute value of $t > n-1$ is given for samples from this population. Upper and lower bounds are given for these density functions in the remaining regions. These bounding functions have the property that they coincide with the exact densities in the regions where the exact densities have been derived. Particular emphasis is placed on the evaluation of approximations of the t-density and attention is given to possible improvements in one of these approximations.

712,090
PB-295 162/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Contribution to Invited Discussion of 'Francis Ysidro Edgeworth, Statistician' by Stephen M. Stigler.
Final rept.,
C. Eisenhart. 1978, 2p
Pub. in Jnl. of Roy. Stat. Soc. Ser. A (General) 141, Part 3, p317-318 1978.

Keywords: *Statistical tests, Statistical analysis, Statistical distributions, Goodness of fit tests, Edgeworth test, Reprints.

It is pointed out that Sir Francis Beaufort (1774-1857), Hydrographer of the Admiralty and originator of the Beaufort Wind Scale, was both grand-uncle and uncle of F. Y. Edgeworth, and it would be interesting to know to what extent the former influenced the latter's development. It is noted also that the latter's test of goodness-of-fit to a particular hypothetical distribution, H0, can be arranged so as to be the best possible binomial test in small samples, or chi-squared test in large samples, relative to a single completely specified alternative distribution, H1, when H0 is also completely specified.

712,091
PB-296 942/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Transition from 'Student's' z to 'Student's' t.
Final rept.,
C. Eisenhart. Feb 79, 5p
Pub. in Am. Stat., v33 n1 p6-10, Feb 79.

Keywords: *T test, Statistical tests, Statistical analysis, Reprints.

The change from the z of 'Student's' 1908 paper to the t of present day statistical theory and practice is traced and documented. It is shown that the change was brought about by the extension of 'Student's' approach, by R. A. Fisher, to a broader class of problems, in response to a direct appeal from 'Student' for a solution to one of these problems.

712,092
PB80-117443 Not available NTIS
National Bureau of Standards, Washington, DC.
OMNITAB 78.
Final rept.,
D. Hogben. 1979, 12p
Pub. in Proceedings of the International Association for Statistical Computing Exhibition (41st) Held at New Delhi, India, 1977, Chapter 11, p197-208 1979.

Keywords: *Statistical analysis, Computer programming, Data processing, *OMNITAB 78 system, Computer program portability.

This document gives an overview of the OMNITAB 78 general-purpose statistical computing system. The basic design of OMNITAB is described. The main features and types of instructions are listed. The portability of OMNITAB is explained with a description of the types of computers on which OMNITAB can be installed. The ease of learning and using OMNITAB is explained with a discussion of the user's manual and training required. The reliability of OMNITAB is discussed with accuracy, maintenance and updating. The document concludes with a set of references and an example of a 'typical' set of instructions.

712,093
PB80-123250 Not available NTIS
National Bureau of Standards, Washington, DC.
Biography of 'Youden, W. J.',
H. H. Ku. 1978, 5p
Pub. in International Encyclopedia of Statistics, p1257-1261 1978.

Keywords: Biographies, *Youden William John.

This is a 2,000-word biography of Dr. W.J. Youden prepared for a volume of statistics and statistics-related articles and biographies. Dr. Youden was a member of the Applied Mathematics Division, National Bureau of Standards, from 1948-1965, and a guest worker until his death on March 31, 1971.

712,094
PB81-106577
(Order as PB81-106536, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Design Aspects of Scheffe's Calibration Theory Using Linear Splines.
C. H. Spiegelman, and W. J. Studden. 30 Jan 80, 11p
Prepared in cooperation with Purdue Univ., Lafayette, IN. Dept. of Statistics.
Included in Jnl. of Research of the National Bureau of Standards, v85 n4 p295-304 Jul Aug 80.

Keywords: *Calibrating, *Experimental design, Probability theory, Mathematical prediction, Curve fitting, Measurement, Estimates, Algorithms, Spline functions, Uncertainty.

The measurement process uncertainty is propagated through the use of a calibration curve. The magnitude and direction of this uncertainty depends on the choice of the controllable variable in producing the calibration curve; in other words, the design of the calibration experiment. In this paper this design is discussedin the context of Scheffe's approach to the uncertainties of a calibration curve and in particular for the case in which the calibration curve is a linear spline. A class of appropriate designs is given, which depend on the location of the knots and the slopes of the segments. One of these designs is quickly calculable and can be found without a computer. Based on these results, a design approach is suggested for the case in which the knots are not known exactly.

712,095
PB81-126179 Not available NTIS
National Bureau of Standards, Washington, DC.
Internal Configurations of Span-Constrained Random Walks.
G. H. Weiss, and R. J. Rubin. 1980, 13p
Pub. in Jnl. Statistical Physics 22, n1 p97-109 1980.

Keywords: *Random walk, Reprints.

The spans of a random walk on a simple cubic lattice are the sides of the smallest rectangular box with sides parallel to the coordinate axes that entirely contain the random walk. The authors consider the position, at dimensionless time tau, of a random walker constrained by a set of spans S. It is shown in one dimension that if S squared is much $>$ 4 tau, the random walker tends to be located at the extremities of the span, while in the contrary case the random walker is most likely to be found halfway between the extremities. This is true whether the single-step transition probabilities have a finite or an infinite variance, as is shown by example. In higher dimensions, the position of the random walker in the direction of the largest span tends to lie at the span extremities, while the position in the direction of the smallest span tends to be in the middle.

712,096
PB81-209322 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Bispectrum and Higher-Order Spectra: A Bibliography,
P. V. Tryon. Apr 81, 28p NBS-TN-1036

Keywords: *Time series analysis, *Bibliographies, Spectrum analysis, Fourier transformation, *Bispectral analysis, Bispectrum, Nonlinear analysis, NTIS-COMNBS.

The bispectrum or Fourier transform of the 3rd order moments of a time series is useful for the study of nonlinear or non-Gaussian phenomena. This bibliography cites 134 papers covering both theory and application. The entries are classified by content with special effort made to indicate papers that contain material on the computation, display and interpretation of the bispectrum.

712,097
PB82-152802 Not available NTIS
National Bureau of Standards, Washington, DC.
Dependence Concepts for Stochastic Processes.
Final rept.
D. S. Friday. 1981, 13p
Pub. in Statistical Distributions in Scientific Work, p349-361 1981.

Keywords: *Stochastic processes, Multivariate analysis, Distribution theory, Reprints, Brownian motion.

Dependence concepts are a relatively recent development in multivariate distribution theory. They allow dependence to be incorporated into a problem without requiring specific model assumptions, and define classes of multivariate distributions with useful properties. It is not apparent that related notions have also evolved in the theory and applications of stochastic processes. Multivariate concepts and stochastic process concepts, however, have had no influence on each other. In this paper, an overview is presented of the work in stochastic processes that is analogous to multivariate dependence concepts.

Statistical Analysis

712,098
PB82-199282 Not available NTIS
National Bureau of Standards, Washington, DC.
Discussion of: 'A Bayesian Analysis of the Linear Calibration Problem' by William G. Hunter and Warren F. Lamboy.
Final rept.
J. R. Rosenblatt, and C. H. Spiegelman. Nov 81, 5p
Pub. in Technometrics, v23 n4 p329-333 Nov 81.

Keywords: *Calibrating, Curve fitting, Statistics, Reprints, *Bayesian analysis, Uncertainty.

This contribution is part of an invited discussion of the statistical problems associated with the calibration of measurement instruments and procedures. It proposes five applications-oriented criteria for classifying statistical issues that arise in fitting and using calibration curves. Examples of nonlinear models and calibration experiments with correlated errors, and recalibration issues, illustrate the many statistical problems still to be investigated.

712,099
PB82-199381 Not available NTIS
National Bureau of Standards, Washington, DC.
Random Walks on Lattices: The Problem of Visits to a Set of Points Revisited.
Final rept.
R. J. Rubin, and G. H. Weiss. Feb 82, 3p
Sponsored in part by National Institutes of Health, Bethesda, MD.
Pub. in Jnl. Math. Phys. 23, n2 p250-253 Feb 82.

Keywords: *Random walk, Reprints.

A general method is outlined for calculating the statistical properties of the number of visits to a set of points in a random walk. In illustrative examples, known results and new results are easily derived.

712,100
PB82-226291
(Order as PB82-226226, PC **A08**/MF **A01**)
California Univ., San Diego, La Jolla. Dept. of Mathematics.
Approach to Peak Area Estimation,
J. Rice. 27 May 81, 13p
Sponsored in part by National Bureau of Standards, Washington, DC.
Included in Jnl. of Research of the National Bureau of Standards, v87 n1 p53-65 Jan-Feb 82.

Keywords: *Nuclear radiation spectroscopy, Mathematical prediction, Analysis of variance, Estimates, Bias, Sampling, Theorems, Smoothing(Mathematics).

Considered is the problem arising in nuclear spectroscopy, of estimating peak areas in the presence of a baseline of unknown shape. A procedure is considered that chooses the baseline to be as smooth as is consistent with the data. It is noted that the estimates have a certain minimax optimality. Expressions are developed for the systematic and random errors of the estimate, and some large sample approximations are derived. Procedures for choosing a smoothing parameter are developed and illustrated by simulations.

712,101
PB82-226309
(Order as PB82-226226, PC **A08**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Note on the Behavior of Least Squares Regression Estimates When Both Variables Are Subject to Error,
C. Spiegelman. 19 Apr 81, 4p
Included in Jnl. of Research of the National Bureau of Standards, v87 n1 p67-70 Jan-Feb 82.

Keywords: *Regression analysis, Least squares method, Linear regression, Random variables, Estimates, Theorems.

No abstract available.

712,102
PB82-226317
(Order as PB82-226226, PC **A08**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Univariate Inequality for Medians,
C. Spiegelman. 8 Sep 81, 4p
Included in Jnl. of Research of the National Bureau of Standards, v87 n1 p71-74 Jan-Feb 82.

Keywords: *Median(Statistics), *Inequalities, Average, Theorems.

An inequality is provided for medians which is an analog of a theorem due to Karamata, dealing with majorization.

712,103
PB82-600004
(Order as PB83-164541, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Consensus Values and Weighting Factors.
R. C. Paule, and J. Mandel. 1982, 9p
Included in Jnl. of Research of the National Bureau of Standards, v87 n5 p377-385 1982.

Keywords: *ANOVA (within-between), Components of variance, Consensus values, Design of experiments, Pooling of variance, Weighted average, Weighted least squares regression.

A method is presented for the statistical analysis of sets of data which are assembled from multiple experiments. The analysis recognizes the existence of both within group and between group variabilities, and calculates appropriate weighting factors based on the observed variability for each group. The weighting factors are used to calculate a 'best' consensus value from the overall experiment. The technique for obtaining the consensus value is applicable to either the determination of the weighted average value, or to the parameters associated with a weighted least squares regression problem. The calculations are made by using an iterative technique with a truncated Taylor series expansion. The calculations are straightforward, and are easily programmed on a desktop computer. An examination of the observed variabilities, both within groups and between groups, leads to considerable insight into the overall experiment and greatly aids in the design of future experiments.

712,104
PB83-143594 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of the Singular Value Decomposition in Regression Analysis.
Final rept.
J. Mandel. Feb 82, 10p
Pub. in American Stat. 36, n1 p15-24 Feb 82.

Keywords: *Regression analysis, *Linear regression, Reprints, Principal component analysis, Collinearity.

Principal component analysis, particularly in the form of singular value decomposition, is a useful technique for a number of applications, including the analysis of two-way tables, evaluation of experimental design, empirical fitting of functions, and regression. This paper is a discussion in expository form of the use of singular value decomposition in multiple linear regression, with special reference to the problems of collinearity and near collinearity.

712,105
PB83-226688
(Order as PB83-226670, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Acceptance Probabilities for a Sampling Procedure Based on the Mean and an Order Statistic.
M. C. Croarkin, and G. L. Yang. 13 Oct 82, 27p
Included in Jnl. of Research of the National Bureau of Standards, v87 n6 p485-511 Nov-Dec 82.

Keywords: *Sampling, *Probability theory, *Acceptability, Exponential density functions, Weibull density functions, Approximation, Mean, Order statistics.

A dual acceptance criterion based on the sample mean and an extreme order is used in many inspection procedures. Computation of the acceptance probability for such criterion is investigated. An approximation and a lower bound to the acceptance probability are derived and are applicable to any continuous distribution. In addition, the connection between this dual criterion and hypothesis testing of scale and location parameters is studied. In the case of the exponential distribution the exact evaluation of the accpetance probability yields the power of the test.

712,106
PB83-234534 Not available NTIS
National Bureau of Standards, Washington, DC.
One-Sided Trimming in Small Samples with Asymmetric Contamination.
Final rept.
K. Kafadar, J. Rice, and C. Spiegelman. 1983, 20p
Pub. in Commun. Statist. Theor. Meth. 12, n4 p477-496 1983.

Keywords: *Sampling theory, Statistical distributions, Mathematical prediction, Estimating, Reprints, Outliers.

An estimator for location, given a sample of only four or five observations, is proposed. The underlying distribution of the sample may (with probability p) be contaminated by an outlier from a rightly-skewed distribution. The estimator minimizes the maximum mean squared error over all values of p. In fact, an estimator which is unbiased in both the outlier-free and positive-outlier cases may be found. Mean squared errors for various underlying situations are calculated and compared with other location estimators such as the mean and the median.

712,107
PB83-237131 Not available NTIS
National Bureau of Standards, Washington, DC.
Documentation of Statistical Software in GAMS: The Guide to Available Mathematical Software.
Final rept.
S. E. Howe. 1983, 4p
Pub. in Proceedings of Symposium on Interface, Troy, NY, July 5-7, 1982, Paper in Computer Science and Statistics, p251-254 1983.

Keywords: *Statistical analysis, *Mathematics, *Directories, Classifications, Documentation, *Computer software, Scientific personnel.

This is the first phase of a project to organize and publicize the mathematical and statistical software available to scientists at the National Bureau of Standards. All of the software which this guide documents is available on the Univac 1100/82 computer at NBS in Gaithersburg, Maryland, and most is available on the CDC Cyber 750 at the Department of Commerce laboratories in Boulder, Colorado, where some NBS staff are located. GAMS is based on an extensive scheme for classifying both statistical software and software for mathematical computations of interest to statisticians--such as special functions, linear algebra, integrals, differential equations, and optimization. The current edition classifies and contains documentation for approximately 2300 subroutines in the IMSL, NAG, and PORT proprietary libraries and three dozen high-quality public-domain packages including LINPACK, FFTPACK, and QUADPACK. A future edition will include programs and interactive systems as well as more subroutines, and will take the form of a more easily maintained and searched on-line database.

712,108
PB84-115773
(Order as PB84-115757, PC **A04**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Efficiency of the Biweight as a Robust Estimator of Location.
K. Kafadar. 9 Nov 82, 12p
Included in Jnl. of Research of the National Bureau of Standards, v88 n2 p105-116, Mar-Apr 83.

Keywords: *Statistical analysis, Sampling, Efficiency, Estimating, *Biweight, Robustness(Mathematics).

The biweight is one member of the family of M-estimators used to estimate location. The variance of this estimator is calculated via Monte Carlo simulation for samples of sizes 5, 10, and 20. The scale factors and tuning constants used in the definition of the biweight are varied to determine their effects on the variance. A measure of efficiency for three distributional situations (Gaussian and two stretched-tailed distributions) is determined. Using a biweight scale and a tuning constant of $c = 6$, the biweight attains an efficiency of 98.2% for samples of size 20 from the Gaussian distribution. The minimum efficiency at $n = 20$ using the biweight scale and $c = 4$ is 84.7%, revealing that the biweight performs well even when the underlying distribution of the samples has abnormally stretched tails.

712,109
PB84-153386 Not available NTIS
National Bureau of Standards, Washington, DC.

Testing for Homogeneity of Two-Dimensional Surfaces.
Final rept.
J. J. Filliben, K. Kafadar, and D. R. Shier. 1983, 23p
Pub. in Math. Modelling 4, p167-189 1983.

Keywords: Surface properties, Statistics, Tests, Reprints, *Surface analysis, *Homogeneity, Two dimensional, Cluster analysis, Randomness.

This paper presents and develops three approaches for evaluating the degree of 'homogeneity' or 'randomness' present in a two-dimensional surface in which no distributional assumptions have been made. The first approach defines the concept of a 'cluster' and develops some associated test statistics. The second method divides the surface into subareas and performs a Kruskal-Wallis test for similarity of subareas. The third approach employs a graph-theoretical model, in which the total length of a certain minimal spanning tree is used as a measure of homogeneity. A motivating application involving a standard reference material illustrates all three methods; other technological, biological and geological applications are discussed.

712,110
PB84-244946 Not available NTIS
National Bureau of Standards, Washington, DC.
Fitting Straight Lines When Both Variables Are Subject to Error.
Final rept.
J. Mandel. Jan 84, 14p
Pub. in Jnl. of Quality Technology 16, n1 p1-14 Jan 84.

Keywords: *Linear regression, *Regression analysis, Least squares method, Errors, Reprints.

Least squares linear regression is one of the most widely used statistical techniques. Almost all textbooks or statistical methods provide the necessary formulas for the fitting process, based on the assumption that there is no error in the independent variable. How these formulas should be modified when both variables are subject to error, is dealt with in detail, using, as an example, an interlaboratory study.

712,111
PB85-107308 Not available NTIS
National Bureau of Standards, Washington, DC.
Discussion on Paper by Brewer and Sarndal. Reply to Comments by Brewer.
Final rept.
K. R. Eberhardt. 1983, 5p
Pub. in Incomplete Data in Sample Surveys 3, p369-371, p399-400 1983.

Keywords: *Sampling theory, Probability theory, Data reduction.

This paper is an invited discussion of the paper, Six Approaches to Enumerative Survey Sampling, by K.R.W. Brewer and C.E. Sarndal. The impact of labels on finite population sampling theory is discussed, leading to the conclusion that the formal role given to the labels is a critical component of any theory. In discussing the use of randomization in sample design, a maxmin property of simple random sampling is given.

712,112
PB85-107399 Not available NTIS
National Bureau of Standards, Washington, DC.
Laws of Error III: Later (Non-Gaussian) Distributions.
Final rept.
C. Eisenhart. 1983, 5p
See also PB85-107407.
Pub. in Encyclopedia of Statistical Sciences 4, p562-566 1983.

Keywords: *Statistical distributions, Reprints, *Laws of error.

J.D. Gergonne (1821), J. W. L. Glaisher (1873), E. J. Stone (1873), F. Y. Edgeworth (1883), S. Newcomb (1883), R. M. Stewart (1920), and H. Jeffreys (1932, 1939) propose methods of weighting based on mixtures of Gaussian laws of error (or, normal distributions) to reduce influence of discordant observations. N. Mantel (1956) shows Stone-Edgeworth solution to be fallacious. S. D. Poisson's invention (1824) of so-called 'Cauchy distribution' negates presumed universality of 'arithmetic mean rule' and the 'hypothesis of elementary errors' as bases for Gauss's law of error. Poisson's amendment (1829) to the Gaussian distribution to admit penultimate asymmetry of distributions of sums of independent random errors as their number increases without limit, and F. W. Bessel's amendments (1838) to admit flatter or sharper modes, as predecessors to the Gram-Charlier type A (c. 1860-1905) and Edgeworth (1896-1905) series expansions of probability distributions. Similarity of G. H. L. Hagen's derivation (1837) of the Gaussian law of error from the binomial distribution and K. Pearson's derivation (1895) of his system of frequency curves from the hypergeometric distribution.

712,113
PB85-107407 Not available NTIS
National Bureau of Standards, Washington, DC.
Laws of Error II: The Gaussian Distribution.
Final rept.
C. Eisenhart. 1983, 16p
See also PB85-107415.
Pub. in Encyclopedia of Statistical Sciences 4, p547-562 1983.

Keywords: *Statistical analysis, Normal density functions, Least squares method, Central limit theorem, Reprints, *Laws of error.

C. F. Gauss's derivation (1809) of his law of error based on axiomatic acceptance of the 'arithmetic mean rule' is outlined; J. Bertrand's (1888, 1889), P. Pizzetti's (1892), B. Meidell's (1908) and H. Poincare's (1912) criticisms of Gauss's derivation noted; and the support for Gauss's law provided by P. S. Laplace's (1810, 1811, 1812) proofs of the asymptotic normality as n approaches infinity of sums and linear functions of n independent random variables indicated. R. Adrain's (1809), Sir John Herschel's (1850), and W. F. Donkin's (1857) proofs of Gauss's law starting from quite different assumptions about the mathematics of errors are outlined as well as the proofs of G. H. L. Hagen (1837), F. W. Bessel (1838), M. W. Crofton (1870), and others, based on Thomas Young's (1819) 'hypothesis of elementary errors.' The efforts of Bessel (1818, 1838), C. S. Peirce (1873), Sir George Airy (1879), and others to provide empirical support for Gauss's law as the real-life law of error are mentioned and declared illusory.

712,114
PB85-107415 Not available NTIS
National Bureau of Standards, Washington, DC.
Laws of Error I: Development of the Concept.
Final rept.
C. Eisenhart. 1983, 18p
See also PB85-107407.
Pub. in Encyclopedia of Statistical Sciences 4, p530-547 1983.

Keywords: *Statistical analysis, Statistical distributions, Probability distribution functions, Reprints, *Laws of error.

The development of laws of error is traced in the text, and portrayed in a chart, from the inception of the concept in an April 1755 letter of Thomas Simpson through the contributions of J.H. Lambert (1760, 1765), P.S. Laplace (1774, 1781), J.L. Lagrange (1776) and Daniel Bernoulli (1778) to the publication (1809) of the law of C.F. Gauss, which became universally regarded in the 19th century as 'the law of error'.

712,115
PB85-163384 PC **A02**/MF **A01**
Harris (Carl M.) and Associates, Charlottesville, VA.
Computer Generation of Latin Hypercube Sampling Plans.
Final rept.
C. M. Harris. Nov 84, 18p NBS/GCR-84/476
Sponsored by Federal Emergency Management Agency, Washington, DC.

Keywords: Mathematical models, Simulation, Sampling, Algorithms, *Latin hypercube sampling, Sensitivity analysis, HYPCUBE computer program, FORTRAN 77 programming language, Cyber-855 computers.

A previous study examined the primary statistical methods for understanding possible randomness in large-scale model prediction. The major focus of that work was a discussion of the role of Latin hypercube sampling for the measurement of uncertainty in model output. This work documents the development of detailed software for selecting a hypercube sampling plan. This computer code generates Latin hypercubes of any user-applied dimension. The time necessary to run the program goes up with size, but this growth is slow and should not pose any unusual problem for the user.

712,116
PB85-197440 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Random Walk on a Random Channel with Absorbing Barriers.
Final rept.
D. A. Huckaby, and J. B. Hubbard. 1983, 9p
Pub. in Physica A 122, n3 p602-610 Dec 83.

Keywords: *Random walk, *Diffusion theory, *Membranes, Absorbers(Materials), Barriers, Reprints.

The authors investigate a random walk which takes place on a one dimensional random channel, where both walker and channel are confined by absorbing barriers. The authors are able to analytically follow the transition from diffusive to non-diffusive behavior as the minimum number of channel segments required to traverse the membrane increases.

712,117
PB85-197507 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Program to Simulate the Galton Quincunx.
Final rept.
J. Hilsenrath, and B. F. Field. 1983, 3p
Pub. in Math. Teacher 76, n8 p571-573 Nov 83.

Keywords: *Normal density functions, *Computer programs, BASIC programming language, Computerized simulation, Reprints, *Galton quincunx.

A BASIC program is presented and described which produces a normal distribution on the computer screen in the manner of a Galton Quincunx.

712,118
PB85-202810 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Statistic for Detecting Influential Observations in a Scheffe Type Calibration Curve.
Final rept.
C. H. Spiegelman. Dec 84, 8p
Pub. in Australian Jnl. of Statistics 26, Part 3 p290-297 Dec 84.

Keywords: *Calibrating, *Statistics, Reprints.

A statistic for identifying influential observations in calibration is given. The statistic is easy to interpret, and provides a useful measure of influence for Scheffe' type calibration curves.

712,119
PB86-138344 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Notched Box-and-Whisker Plot.
Final rept.
K. Kafadar. 1985, 4p
Pub. in Encyclopedia of Statistical Sciences, v6 p367-370 1985.

Keywords: *Statistical analysis, Statistical tests, Significance.

A statistical article is to be submitted to the Encyclopedia of Statistical Sciences. Definitions and applications are given for each entry.

712,120
PB86-142841 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
National Bureau of Standards.
Final rept.
J. R. Rosenblatt. 1985, 3p
Pub. in Encyclopedia of Statistical Sciences, v6 p148-150 1985.

Keywords: *Statistical analysis, Measurement, Test methods.

The article provides a brief description of statistical aspects of the work of the National Bureau of Standards.

712,121
PB86-165792
(Order as PB86-165776, PC **A08**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Jack Youden.
H. H. Ku, and J. R. DeVoe. Dec 85, 2p
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p393-394 Nov-Dec 85.

Statistical Analysis

Keywords: Chemist, Statistical analysis, Chemical analysis, *Youden Jack, Statisticians.

Jack Youden was a chemist and a communicator. The Chemical Division of the American Society for Quality Control in 1969 established a Jack Youden prize to be awarded yearly for the best expository paper in its journal, Technomerics. But it was Youden the statistician who furthered collaboration and helped to maximize the information content of experimentation, which is what the Chemometrics Conference was about. So it appropriate that these conference proceedings be dedicated to the memory of Dr. Youden.

712,122
PB86-165826
(Order as PB86-165776, PC **A08**/MF **A01**)
Washington State Univ., Pullman.
Adaptive Kalman Filtering.
S. D. Brown, and S. C. Rutan. 24 Jun 85, 5p
Prepared in cooperation with Virginia Commonwealth Univ., Richmond. Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p403-407 Nov-Dec 85.

Keywords: *Chemical analysis, Least squares method, Data reduction, Covariance, *Kalman filtering, Computer applications.

The increased power of small computers makes the use of parameter estimation methods attractive. Such methods have a number of uses in analytical chemistry. When valid models are available, many methods work well, but when models used in the estimation are in error, most methods fail. Methods based on the Kalman filter, a linear recursive estimator, may be modified to perform parameter estimation with erroneous models. Modifications to the filter involve allowing the filter to adapt the measurement model to the experimental data through matching the theoretical and observed covariance of the filter innovations sequence. The adaptive filtering methods that result have a number of applications in analytical chemistry.

712,123
PB86-165917
(Order as PB86-165776, PC **A08**/MF **A01**)
Wisconsin Univ.-Madison.
Some New Ideas in the Analysis of Screening Designs.
G. Box, and R. D. Meyer. 1 Jul 85, 8p
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p495-502 Nov-Dec 85.

Keywords: *Experimental design, Screenings, *Fractorial design.

Consideration of certain aspects of scientific method leads to discussion of recent research on the role of screening designs in the improvement of quality. A projective rationale for the use of these designs in the circumstances of factor sparsity is advanced. In this circumstance the possibility of identification of sparse dispersion effects as well as sparse location effect is considered. A new method for the analysis of fractional factorial designs is advanced.

712,124
PB86-165966
(Order as PB86-165776, PC **A08**/MF **A01**)
Columbia Univ., New York.
Regression Analysis of Compartmental Models.
T. L. Lai. 24 Jun 85, 6p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p525-530 Nov-Dec 85.

Keywords: *Regression analysis, *Mathematical models, *Compartment analysis, Least squares method, Decay, Kinetics, System identification.

Herein the authors study the problem of assessing, on the basis of noisy and incomplete observations, how much information there is in the data for model identification in compartmental systems. The underlying concept is that of and 'information distance' between competing models, and estimation of this distance on the basis of the given data is discussed. Useful reduction of the dimensionality of the corresponding least squares problem is accomplished by regarding the decay rate constant as primary parameters of interest and the other parameters of the model as nuisance parameters. Estimation of the decay rate function is also discussed.

712,125
PB87-152385 PC **A14**/MF **A01**
National Bureau of Standards, Boulder, CO.
STARPAC - The Standard Times Series and Regression Package,
J. R. Donaldson, and P. V. Tryon. Jan 87, 309p
NBSIR-86/3448

Keywords: *Time series analysis, *Statistical analysis, Analysis of variance, Least squares method, Correlation techniques, Regression analysis, Spectrum analysis, *STARPAC system, Subroutine libraries, Random number generators, Nonlinear analysis, Digital filtering.

STARPAC, the Standards Time Series and Regression Package, is a library of Fortran subroutines for statistical data analysis developed by the Statistical Engineering Division (SED) of the National Bureau of Standards (NBS), Boulder, Colorado. Earlier versions of this library were distributed by the SED under the name STATLIB (Tryon and Donaldson, 1978). STARPAC incorporates many changes to STATLIB, including additional statistical techniques, improved algorithms and enhanced portability. STARPAC emphasizes the statistical interpretation of results, and, for this reason, comprehensive printed reports of auxiliary statistical information, often in graphical form, are automatically provided to augment the basic statistical computations performed by each user-callable STARPAC subroutine. STARPAC thus provides the best features of many stand-alone statistical software programs within the flexible environment of a subroutine library.

712,126
PB87-162137 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Two Pitfalls of Using Standard Regression Diagnostics When Both X and Y Have Measurement Error.
Final rept.,
C. H. Spiegelman. 1986, 4p
Pub. in American Statistician 40, n3 p245-248 1986.

Keywords: *Regression analysis, Measurement, Errors, Reprints.

Modern data analysis produces models that are not based on physical theory, but rather on a model that is consistent with pictures of the data. When both X and Y have errors, this can be risky because important features are hidden. Two examples are given which show that systematic model departures and heteroscedasticity are not detectable in standard plots of the data.

712,127
PB87-162145 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Jensen's Inequality for General Location Parameter.
Final rept.,
C. H. Spiegelman. 1985, 1p
Pub. in Amer. Statist. 39, n1 p54 1985.

Keywords: *Inequalities, Convex functions, Reprints, *Location problems, *Jensen's inequality.

The purpose of the note is to show that a wide class of location parameters satisfy Jensen's inequality. When the expectation EX exists and I is a convex function, then Jensen's inequality states EI(x) less than or equal to I(EX). What the authors show is that for mu(a) location parameter appropriately defined, mu(I(x)) less than or equal to I(mu(x)).

712,128
PB87-165759 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Planning of Comparative Experiments.
Final rept.,
M. G. Natrella. 1985, 14p
Pub. in Metals Handbook (9th edition), Vol. 8--Mechanical Testing, p639-652 1985.

Keywords: *Experimental design, Block design, Latin squares, Factorial design, Response surface analysis, Youden squares.

The chapter outlines some general principles for planning good experiments, e.g. randomization, replication, and planned grouping (blocking). It describes some classes of statistical designs for experiments, including factorial and fractional factorial designs, complete and incomplete block designs, Latin and Youden squares, and response - surface designs. A selected set of specific plans is provided for each class.

712,129
PB87-213484
(Order as PB87-213476, PC **A05**/MF **A01**)
National Physical Lab., Teddington (England).
Two Theories of Experimental Error,
A. R. Colclough. 20 Jan 87, 19p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v92 n3 p167-185 May-Jun 87.

Keywords: *Error analysis, Experimentation, Uncertainty.

Two theories of error are identified, and their possible justifications assessed. They are the 'orthodox theory' based on the familiar distinction between random and systematic errors and the 'randomatic theory' which dispenses with the distinction and treats all errors as the orthodox theory treats random errors.

712,130
PB87-218335 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Confidence-Intervals for Inequality-Constrained Least-Squares Problems, with Applications to Ill-Posed Problems.
Final rept.,
D. P. O'Leary, and B. W. Rust. 1986, 17p
Pub. in SIAM (Society for Industrial and Applied Mathematics) Jnl. on Scientific and Statistical Computing 7, n2 p473-489 1986.

Keywords: *Confidence limits, *Multivariate analysis, Integral equations, Nonlinear programming, Algorithms, Estimating, Reprints, Ill posed problems, Quadratic programming.

Computing confidence intervals for functions phi(x) = (w sup T)x where Kx=y+e and e is a normally distributed error vector, is a standard problem in multivariate statistics. In this work, the authors develop an algorithm for solving this problem if additional information, x = or > 0, is given. Applications to estimating solutions to integral equations of the first kind are given.

712,131
PB87-225355 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Analysis of a Two-Way Table.
Final rept.,
J. Mandel. 1987, 15p
Pub. in Design, Data and Analysis, Chapter 11, p245-259 1987.

Keywords: Curve fitting, Surfaces, *Row linear model.

A set of data dealing with viscosity measurements of filled and plasticized elastomer compounds was originally analyzed using the Box-Cox Transformation. In the paper the data are reanalyzed by a different technique, the 'Row Linear Model'. The advantages of the approach are discussed in detail.

712,132
PB87-234043 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Testing Spatial Autocorrelation of Regression Residuals.
Final rept.,
S. E. Howe. 1982, 4p
Pub. in Proceedings of American Statistical Association, Statistical Computing Section (1982), p149-152.

Keywords: *Regression analysis, Autocorrelation, Paleoclimatology, Moran statistics, Voronoi diagrams, Residuals.

Regression data are on occasion obtained from a set of sites in a planar or geographical region. The residuals from the regression may be spatially autocorrelated if location information is not included in the regression. The spatial relationships among randomly distributed sites can be described by the dual of the Voronoi diagram, and the dual can be used to define a spatial weight matrix in the Moran statistic to test spatial autocorrelation of residuals from ordinary least squares re-

gression. Software for constructing the Voronoi diagram and its dual in a possibly non-convex bounded polygonal region, and for computing the Moran statistic, is described. The test is used in calibrating temperature using pollen data for paleoclimatic estimation.

712,133
PB88-147400 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Comparison of Least Squares and Errors-in-Variables Regression, with Special Reference to Randomized Analysis of Covariance.
Final rept.,
R. J. Carroll, P. Gallo, and L. J. Gleser. 1985, 4p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of the American Statistical Association 80, n392 p929-932 1985.

Keywords: *Regression analysis, Analysis of variance, Covariance, Errors, Least squares method, Comparison, Reprints.

In an errors-in-variables regression model, the least squares estimate is generally inconsistent for the complete regression parameter but can be consistent for certain linear combinations of this parameter. The authors explore the conjecture that, when least squares is consistent for a linear combination of the regression parameter, it will be preferred to an errors-in-variables estimate, at least asymptotically. The conjecture is false, in general, but it is true for important classes of problems. One such problem is a randomized two-group analysis of covariance, upon which they focus.

712,134
PB88-152335 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Fundamentals of Error Analysis.
Final rept.,
H. H. Ku, and R. M. Judish. 1986, 3p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) 74, n1 p25-27 Jan 86.

Keywords: *Error analysis, Measurement, Statistics, Reprints, Calibration, Uncertainty.

The paper discusses the process of assessing the uncertainty of measurement results through error analysis. The authors restrict the discussion to sources of errors, measurement errors, modelling errors, and calibration errors in the context of physical experiments.

712,135
PB88-162557 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Limiting Distribution of Least Squares in an Errors-in-Variables Linear Regression Model.
Final rept.,
R. J. Carroll, L. J. Gleser, and P. P. Gallo. 1987, 4p
See also AD-A160 190. Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Annals of Statistics 15, n1 p220-233 1987.

Keywords: *Linear regression analysis, *Least squares method, Attenuation, Calibration, Confidence limits, Intervals, Hypotheses, Errors, Reprints.

It is well-known that the ordinary least squares (OLS) estimator Beta of the slope and intercept parameters in a linear regression model with errors of measurement for some of the independent variables (predictors) is inconsistent. However, Gallo (1982) has shown that certain linear combinations of Beta are consistently estimated by the corresponding linear combinations of Beta. In the paper, it is shown that under reasonable regularity conditions such linear combinations are (jointly) asymptotically normally distributed. Some methodological consequences of the authors results are given in a companion paper (Carroll, Gallo and Gleser, 1985).

General

712,136
PB-268 499/1 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Designs for the Calibration of Standards of Mass.
Final rept.,
J. M. Cameron, M. C. Croarkin, and R. C. Raybold.
Jun 77, 68p NBS-TN-952

Keywords: *Standards, *Weight(Mass), *Experimental design, Calibrating, Tests, Least squares method, Design.

The report presents a collection of designs for the intercomparison of sets of weights for use in precision calibration of standards of mass. These include a number of previously unpublished designs which have an additional weight in each set to serve as the check standard for monitoring the performance of the weighing process. Also included are the classical designs of Benoit and Hayford. The complete least squares analysis is presented in integer form (i.e., with a common division) for the most widely used designs; and for the others, the standard deviations are given for various weight combinations when used as an ascending or as a descending series. Designs for sets of nominally equal objects, the 2 2 . . . 1 1 . . . series, the binary sequences, the 5 2 2 1 1 series, and the 5 3 2 1 1 and some miscellaneous series are given.

712,137
PB-272 187/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Planes, Cubes and Center-Representable Polytopes.
Final rept.,
L. S. Joel, D. R. Shier, and M. L. Stein. 1977, 4p
Pub. in American Mathematical Monthly 84, n5 p360-363 May 77.

Keywords: *Set theory, Convex sets, Reprints, Convex polytopes, *Polytopes.

Given an n-dimensional hypercube C(n), is there a hyperplane that meets the interior of every facet of C(n). Contrary to the impression given by the cases $n = 1$ and $n = 2$, the answer is 'yes' for all $n > 2$. Furthermore, for $n > 3$, the hyperplane can also be chosen to contain any prescribed point of C(n). Such results imply that the center of the smallest hyper-rectangle having sides parallel to the coordinate planes and enclosing a convex polytope K does not necessarily lie in K. A practical estimation problem motivating the inquiry is described.

712,138
PB-285 373/7
(Order as PB-281 311/1, PC **A06**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Norm Approximation Problems and Norm Statistics.
D. R. Shier, and C. J. Witzgall. 15 Sep 77, 5p
Included in Jnl. of Research of the National Bureau of Standards, v83 n1 p71-74, Jan-Feb 78.

Keywords: *Approximation, Curve fitting, Least squares method, Matrices(Mathematics), Theorems, Norms, Minimization, Residuals.

This paper explores a relation between various approximation problems (arising from fitting linear models to data) and corresponding statistical measures (norm statistics). It is established that for any optimal solution to an approximation problem defined with respect to a norm, the resulting residuals have zero as their norm statistic. This result holds whenever the underlying design matrix has a column of ones. An extension to the case of arbitrary design matrices is also considered.

712,139
PB77-600008 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tables of One- and Two-Dimensional Inverse Laplace Transforms of Complete Elliptic Integrals.
S. Okui. 1977, 35p
Included in Jnl. of Research of the National Bureau of Standards, v81B n1 and 2 p5-39 1977.

Keywords: *Complete elliptic integrals, *Inverse Laplace transforms.

This paper gives an extensive tabulation of one- and two-dimensional inverse Laplace transforms of complete elliptic integrals.

712,140
PB77-600010 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Distant Coordinates in Matrix Form.
K. Goldberg. 1977, 12p
Included in Jnl. of Research of the National Bureau of Standards, v81B n1 and 2 p61-72 1977.

Keywords: Barycentric coordinates, *Distance coordinates, Euclidean plane, Matrices of order three, Triangle of reference.

In the Euclidean plane: given three noncolinear points (vertices of the 'triangle of reference') any point is uniquely determined by its distances to those vertices. These are called the 'distance coordinates' of the point. The main result of our first paper was to determine which vectors of three nonnegative numbers could be distance coordinates for the given reference triangle. In this paper we put that result, and others, into matrix form. This leads to generalizations, and to the effect of a change of the reference triangle on the distance coordinates and the formulas in which they are involved.

712,141
PB77-600029
(Order as PB-276 557, PC **A06**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Enclaveless Sets and MK-Systems.
P. J. Slater. 1977, 6p
Included in Jnl. of Research of the National Bureau of Standards, v82 n3 p197-202 1977.

Keywords: Dominating set, *Enclaveless set, Graph, Hypergraph, Konig System, *MK-System, Menger System, MK-System.

A hypergraph H = (Chi, Epsilon) is called a Menger System if the maximum cardinality of a family of pairwise disjoint edges (upsilon sub 1(H)) is equal to the minimum cardinality of a subset of vertices which meets every edge (Tau sub 0(H)). A set S contained in Chi is defined to be enclaveless if each vertex in Chi - S. A parameter (pi sub 0) related to the formation of maximal enclaveless sets is defined, and it is shown that if H has no singleton edges then upsilon sub 1 (H) is equal to or less than pi sub 0 (H). MK-Systems are defined to be those hypergraphs H without singleton edges for which upsilon sub 1 (H) = pi sub 0 (H); simple graphs which are Menger Systems are shown also to be MK-Systems.

712,142
PB77-600080 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Section B. Mathematical Sciences, Volume 81B Numbers 1 and 2, January-June 1977.
1977, 72p
See also PB77-600007 through PB77-600010.

Keywords: *Mathematics.

No abstract available.

712,143
PB81-600003
(Order as PB81-220899, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Properties of Labeling Methods for Determining Shortest Path Trees.
D. R. Shier, and C. Witzgall. 1981,17p
Included in Jnl. of Research of the National Bureau of Standards, v86 n3 p317-330 1981.

Keywords: *Complexity, Labeling, Network, Sequence list, Shortest path, Tree.

A number of labeling procedures for determining shortest paths in a network employ a sequence list in order to carry out the required steps systematically. The paper studies certain formal properties of such sequence lists. It is shown that the desirable property of branching out from nodes whose labels represent actual in-tree distances is assured for certain ways of managing the sequence list, but not for others. The relationship of this property to the computational complexity of various labeling procedures is also investigated.

712,144
PB82-600042 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Delaunay Normalisations.
A. Deprit. 1982, 13p
Pub. in Celestial Mechanics 26, p9-21 1982.

MATHEMATICAL SCIENCES

General

Keywords: *Algebra by computer, Birkhoff normalisation, Celestial mechanics, Resonances, Satellite theory.

Too many terms are generated by a Delaunay normalisation when the perturbation is developed in powers of the eccentricity. Ways of bypassing the expansion are discussed. There are: (1) Brouwer's method of implicit variables; (2) the preparation by canonical tranformations; and (3) the application of representation theory for Lie algebras. Illustrations of the techniques are drawn from the main problem of satellite theory and from the (1-1) resonance at the triangular equilibrium in the restricted problem of three bodies.

MEDICINE & BIOLOGY

Biochemistry

712,145
PATENT-4 705 949 Not available NTIS
Department of Commerce, Washington, DC.
Method and Apparatus Relating to Specimen Cells for Scanning Electron Microscopes.
Patent,
J. W. Grimes, H. Jennings, and P. W. Brown. Filed 25 Nov 85, patented 10 Nov 87, 8p PB88-132535, PAT-APPL-6-802 091
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.50.

Keywords: *Patents, *Cells(Biology), *Laboratory equipment, *Chemical analysis, *Bioassays, Samples, Electron irradiation, Performance evaluation, Design criteria, *Scanning electron microscopes.

The invention discloses an improved specimen cell for maintaining a scanning electron microscope specimen under nearly physiological conditions during observation when said specimen includes liquids having a relatively high vapor pressure. A cavity in the specimen cell mounts an open or closed specimen module which is scanned by the electron beam through a small aperture. During preparation of the electron microscope for observation, the aperture is closed by a door so as to prevent evaporation of liquids from the specimen. The door is mechanically or electronically opened to facilitate observation thus minimizing the exposure of the specimen to the desiccation and/or destructive vacuum effects.

712,146
PB-270 329/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Liquid Radiochromic Dye Dosimetry for Continuous and Pulsed Radiation Fields Over a Wide Range of Energy Flux Densities.
Final rept.,
M. M. Kosanic, M. T. Nenadovic, B. B. Radak, V. M. Markovic, and W. L. McLaughlin. 1977, 9p
Sponsored in part by Institut za Nuclearne Nauke Boris Kidric, Vinca (Yugoslavia).
Pub. in Int. J. Appl. Radiat. Isot., v28 p313-321 1977.

Keywords: *Chemical dosimeters, *Calorimetry, Dyes, Gamma-rays, Radiolysis, Cobalt 60, Reprints.

New studies of radiochromic dye dosimeters in liquid phase have shown that these systems may be used over a very wide range of absorbed dose rates. These systems are suitable for applied dosimetry in either continuous gamma-ray fields or high-intensity pulsed accelerator beams, (e.g. radiation processing or pulse radiolysis). The accuracy of dose measurement is t or - 3%, as long as the dye yield of the dosimeter solution is properly calibrated against a chemical or calorimetric standard system and as long as the concentration of the radiochromic dye precursor is accurately specified. The calibration may easily be carried out at relatively low radiation flux densities, as with 60Co gamma radiation, and then the dosimeter may be used with the same G-value at extremely high dose rates.

712,147
PB-280 528/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Location of Catecholamines in the Brain Using the 17O(n,a)14C Reaction.
Final rept.,
I. Wassermann, D. Samuel, A. Yuwiler, and B. S. Carpenter. 1974, 1p
Pub. in Transactions American Nuclear Society 1974 Annual Meeting, Philadelphia, Pa., June 23-27, 1974, p1-401.

Keywords: *Catecholamines, Amines, Brain, Hypothalamus, Isotopic labeling, Oxygen isotopes, Biosynthesis, Rats, Laboratory animals, In vivo analysis, Pons, Neurotransmitters.

A study was made to map the distribution and turnover of biogenic amines (catecholamines), the neurotransmitting compounds, by the Nuclear Track Technique. The location of catecholamines that formed in the hypothalamus and pons regions of rat brains by inhaling air which was enriched in the stabled (17)O2 isotope were examined. The effect of inhibiting the formation of the catecholamines in the brain by the injection of alpha-methyl-p-tyrosine in the rat was also included in this study.

712,148
PB-290 983/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Area of Dental Enamel, Bone and Hydroxyapatite: Chemisorption from Solution.
Final rept.
D. N. Misra, R. L. Bowen, and G. J. Mattamal. 1978, 4p
Grant PHS-DE-02494-10
Sponsored in part by American Dietetic Association Health Foundation, Chicago, IL.
Pub. in Calcified Tissue Research 26, p139-142, 1978.

Keywords: *Bones, *Chemisorption, Area, Adsorption, Chloromethanes, *Dental enamel, *Hydroxyapatite.

The surface areas of three different samples of hydroxyapatite, samples of deproteinized bone, and samples of whole and deproteinized enamel were determined by adsorption of an adduct (the diglycidyl ether of bisphenol A with N-phenylglycine) from methylene chloride solution. In all cases, the surface areas of these samples agree well with those obtained by the BET (N2) method.

712,149
PB82-100249 Not available NTIS
National Bureau of Standards, Washington, DC.
Purified Reduced Nicotinamide Adenine Dinucleotide: Responses to Lactate Dehydrogenase Isozymes from Three Cell Sources.
Final rept.
A. E. Kaplan, E. R. Weiss, S. T. Byrne, N. M. El-Torkey, and S. A. Margolis. 1981, 3p
Pub. in Science 212, p553-555, 1 May 81.

Keywords: *Inhibitors, *Lactate dehydrogenase, Kinetics, Enzymes, Reprints, *Hepatoma, *Isoenzymes, NADH, Nicotinamide adenine dinucleotide.

Lactate dehydrogenase (LDH, E.C. 1.1.1.27) isozymes from three single-cell sources reacted differently with reduced nicotinamide adenine dinucleotide (NADH) purified to published chromatographic and spectrophotometric specification and free of inhibitors of LDH, when compared with a commercial preparation of NADH. The activity of LDH-1, purified from rabbit erythrocytes, increased the most with inhibitor-free NADH; the next most stimulated were the LDH isozymes from a control hepatocyte line; but hardly responsive at all were the same isozymes from chemically transformed cells. Thus isozyme composition alone did not account for the range of responses to purified NADH. The commercial preparation of NADH used in these-studies contains the Strandjoerd-Clayson inhibitors, the most potent group identified in NADH preparations relative to LDH activity. The results suggest that specific molecular differences in individual isozymes contribute to the differential response to the Strandjoerd-Clayson inhibitors.

712,150
PB82-210865 Not available NTIS
National Bureau of Standards, Washington, DC.
'Active' Conformation of an Inactive Semi-Synthetic Ribonuclease-S.
Final rept.
H. C. Taylor, D. C. Richardson, J. S. Richardson, A. Wlodawer, A. Komoriya, and I. M. Chacken. 1981, 5p
Grant PHS-GM-1500
Pub. in Jnl. Mol. Biol. 149, p313-317 1981.

Keywords: *Ribonuclease, Enzymes, Proteins, X ray analysis, Reprints, *Molecular conformation.

The authors have studied the integrity of folded structure of a fully active semi-synthetic ribonuclease-S which lacks amino acid residues 16 through 20, and an inactive one with the same residues deleted and 4-fluoro-L-histidine substituted for active site histidine 12. Using 'Y' form crystals, we obtained X-ray structural data to a resolution of 2-6 A and, incorporating phase information calculated from refined ribonuclease-S coordinates, prepared several types of electron density maps. These showed that the overall backbone structure and active site configuration of both analogues do not differ noticeably from those of the native protein.

712,151
PB83-262667 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Molecular Biophysics of Olfaction: Progress Report 2.
R. B. Murphy. Aug 83, 74p NBS-GCR-83-442
See also PB82-205782. Prepared in cooperation with New York Univ., NY. Dept. of Chemistry.

Keywords: *Smell, *Epithelium, Chemical analysis, Membranes(Biology), Electrical measurement, Odors, Electric fields, Concentration(Composition), Proteins, Separation, Ethyl sulfide, Numerical solution.

This report summarizes the progress of the Olfactory Research Program at the Department of Chemistry, New York University, under Prof. Randall B. Murphy. The report presents two technical sections: experimental procedures and results. The experimental procedures describe in detail the method of olfactory epithelial extract, membrane formation, the system used to measure the electrical parameters of the bilayer system, and the measurement procedures. The results include membrane response to diethyl sulfide and the dependence of conductance upon homogenate concentration, ion selectivity, and specificity, and electrical field dependence as well as response to other odorants. The artificial membranes evidence a chemosensitive response, measured in terms of current flow at constant voltage, to very low concentrations in the nanomolar region of the odorant diethyl sulfide. A model system is described for the initial chemosensory events in the mammalian olfactory epithelium, based upon the functional reconstitution of membrane proteins from olfactory bipolar receptor cell cilia into artificial lipid bimolecular membranes.

712,152
PB84-133461 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Performance Liquid Chromatographic Analysis of Diastereomers and Structural Analogs of Angiotensins 1 and 2.
Final rept.
S. A. Margolis, and P. L. Konash. 1983, 4p
Pub. in Analytical Chemistry 134, p163-169 1983.

Keywords: *Angiotensin, *Amino acids, Peptides, Chemical analysis, Standards, Stereochemistry, Biochemistry, Reprints, *High performance liquid chromatography.

Diastereomers, alpha- and beta-aspartic acid forms, and partial sequences of angiotensin I and II were resolved by reversed-phase high-performance liquid chromatography (HPLC). Nearly all of the peptides which were examined contained significant amounts of peptides whose amino acid composition differed from the designated peptide. This chromatographic procedure combined with amino acid analysis clearly offers the investigator a rapid method for analyzing and quantifying the purity of angiotensins which are intended for use as reference substances for radioimmunoassay and biological assay.

712,153
PB85-107332 Not available NTIS
National Bureau of Standards, Washington, DC.
Enzymatic Digestibility of Peptides Crosslinked by Ionizing Radiation.
Final rept.
M. Dizdaroglu, E. Gajewski, and M. G. Simic. 1984, 13p
Pub. in International Jnl. of Radiation Biology 45, n3 p283-295 1984.

Keywords: *Enzymes, *Peptides, *Ionizing radiation, *Digestion(Decomposition), Crosslinking, Reprints.

Digestibility by proteolytic enzymes of peptides crosslinked by ionization radiation was investigated. Small peptides of alanine and phenylalanine were chosen as model compounds and aminopeptidases and carboxypeptidases were used as proteolytic enzymes. Peptides exposed to gamma-radiation in aqueous solution were analyzed by high-performance liquid chromatography before and after hydrolysis by aminopeptidase M, Leucine aminopeptidase, carboxypeptidase A and carboxypeptidase Y. The results obtained clearly demonstrate the different actions of these enzymes on crosslinked aliphatic and aromatic peptides. Peptide bonds of crosslinked dipeptides of alanine were completely resistant to enzymatic hydrolysis whereas the enzymes except for carboxypeptidase Y cleaved all peptide bonds of crosslinked peptides of phenylalanine. The actions of the enzymes on these particular compounds were discussed in detail.

712,154
PB85-120814 Not available NTIS
National Bureau of Standards, Washington, DC.
Sensitivity of Trends in Geometric Mean Blood Levels to Random Measurement Errors.
Final rept.
I. H. Billick, D. R. Shier, and C. H. Spiegelman. 1982, 16p
Pub. in Jnl. of Science of the Total Environment 24, n3 p233-248 Aug 82.

Keywords: *Blood chemical analysis, *Lead(Metal), Poisoning, Sensitivity, Models.

A statistical model is investigated that expresses observations, such as blood lead levels, as an additive function of true levels and random measurement errors. Both empirical results (obtained by a series of simulation experiments) and theoretical results indicate how the various statistics such as means, standard deviations, geometric means and geometric standard deviations of the observations vary in response to measurement errors. In particular, it is shown that the geometric mean of blood lead levels varies inversely with laboratory precision.

712,155
PB85-145555 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Physicochemical Bench-Scale Caries Model.
Final rept.
L. C. Chow, and W. E. Brown. Jun 84, 6p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 63, n6 p868-873 Jun 84.

Keywords: *Biochemistry, *Membranes, Diffusion, Dental materials, Reprints, *Caries mechanism, Fluorapatite, Hydroxyapatite.

A diffusion cell comprising two compartments separated by a commercial membrane of known ion permselectivity was used as an experimental model to study factors which may affect caries formation. One compartment (the 'lesion') contained an excess of hydroxyapatite or fluorapatite crystals, and its solution was kept near saturation by stirring. An unsaturated acidic calcium phosphate solution flowed continuously through the other compartment (the 'Plague-saliva'), thus providing the driving force for dissolution of the crystals as modified by the permeability of the membrane and/or the presence of fluoride. Calcium, phosphate, fluoride, and chloride concentrations, pH, and membrane potential were measured at steady state.

712,156
PB85-184588 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Isolation and Characterization of Radiation Induced Aliphatic Peptide Dimers.
Final rept.
M. Dizdaroglu, and M. G. Simic. 1983, 9p
Pub. in International Jnl. of Radiation Biology and Related Studies in Physics, Chemistry and Medicine 44, n3 p231-239 1983.

Keywords: *Peptides, *Separation, *Radiation effects, Gas chromatography, Mass spectroscopy, Reprints, *Hydroxyl radicals, Dimers, High performance liquid chromatography, Succinic acid/diamino-dimethyl.

Alpha-Peptide radicals of L-Ala-L-Ala and tetra-L-Ala, which are formed from OH radical reactions, were shown to give peptide dimers. These peptide dimers were separated and isolated by HPLC. On acid hydrolysis, all of the studied peptide dimers yielded alanine and alpha-diamino dimethyls succinic acid (Ala-Ala dimer), which was characterized by gas chromatography-mass spectrometry as a TMS derivative. The described procedure is suggested as a suitable method for isolation and characterization of amino acid dimers.

712,157
PB85-205987 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Application of Joint Neutron and X-ray Refinement to the Investigation of the Structure of Ribonuclease A at 2.0 A Resolution.
Final rept.
A. Wlodawer, and L. Sjolin. 1984, 16p
Pub. in Neutrons in Biology, p349-364 1984.

Keywords: *Biochemistry, *Molecular structure, *Ribonuclease, *Neutron diffraction, *X ray analysis, Proteins, Organic phosphates, Algorithms, Mathematical models.

The structure of ribonuclease A has been refined jointly with the neutron and X-ray data extending to 2.0 A. The results of an earlier X-ray refinement provided the starting model (Wlodawer, A., Bott, R. and Sjolin, L. (1982) Biochemistry 257, 1325-1332). The final R-factors were 0.159 (X-ray) and 0.183 (neutron) for a model containing all of the atoms expected in the protein, 128 waters, and a phosphate molecule in the active site. The performance of the joint refinement algorithm has been evaluated.

712,158
PB86-185493 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Active Site of RNase: Neutron Diffraction Study of a Complex with Uridine Vanadate, a Transition-State Analog.
Final rept.
A. Wlodawer, M. Miller, and L. Sjolin. 1983, 4p
Pub. in Proceedings of the National Academy of Sciences 80, n12 p3628-3631 1983.

Keywords: *Ribonuclease, Enzymes, Catalysis, Neutron diffraction, X ray diffraction, Hydrogen bonds.

A complex of PNase A with a transition state analog, uridine vanadate, has been studied by a combination of neutron and X-ray diffraction. The vanadium atom occupies the center of a distorted trigonal bipyramid, with the ribose oxygen O2' at the apical position. Contrary to expectations based on the straightforward interpretation of the known in-line mechanism of action of RNase, NE2 of His 12 was found to form a hydrogen bond to the equatorial oxygen O8, while NZ of Lys 41 makes a clear hydrogen bond to the apical O2'. Nitrogen NDl of His 119 appears to be within a hydrogen bond distance of the other apical oxygen, O7. Two other hydrogen bonds between the vanadate and the protein are made by NE2 of Gln 11 and by the amide nitrogen of Phe 120. The observed geometry of the complex may necessitate reinterpretation of the mechanism of action of RNase.

712,159
PB86-189123 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Iron Electronic Structure in Oxyhemoglobin and Carboxypeptidase Digested Derivatives.
Final rept.
B. Balko, E. Bucci, R. L. Berger, L. J. Swartzendruber, and J. X. Montemarano. 1984, 10p
Pub. in Jnl. of Biochemical and Biophysical Methods 10, n1-2 p55-64 1984.

Keywords: *Hemoglobin, *Iron, *Magnetic fields, Reprints, *Electronic structure, Mossbauer effect.

Mossbauer experiments were performed on the oxy-derivatives of human hemoglobin and its products of digestion with carboxypeptidases. The hemoglobins were chemically enriched to 95% in 57Fe, and were free from hemochrome impurities. Spectra were taken at low temperatures in the presence and absence of a 5.0 T magnetic field. It was observed that the enzymatic digestions which remove residues at least 16 angstroms from the iron of the nearest heme appear to modify the electronic environment of the metal.

712,160
PB86-210028 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Separation of Peptides by High-Performance Ion-Exchange Chromatography.
Final rept.
M. Dizdaroglu. 1984, 21p
Pub. in CRC Handbook HPLC Separation of Amino Acids, Peptides, Proteins, v2 p23-43 1984.

Keywords: pH effect, Polymers, Silicia, Temperature, Reprints, *Ion exchange chromatography, *Peptide separations.

The use of high-performance ion-exchange chromatography in peptide separations has been reviewed. Separation profiles of peptides from various sources on silica-based or polymeric ion-exchangers are presented. A recently developed method using a weak anion-exchanger is discussed in detail.

712,161
PB86-229424 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Formation of Cytosine Glycol and 5,6-Dihydroxycytosine in Deoxyribonucleic Acid on Treatment with Osmium Tetroxide.
Final rept.
M. Dizdaroglu, E. Holwitt, M. P. Hagan, and W. F. Blakely. 1986, 6p
Sponsored by Armed Forces Radiobiology Research Inst., Bethesda, MD.
Pub. in Biochemical Jnl. 235, p531-536 1986.

Keywords: *Deoxyribonucleic acids, Gas chromatography, Mass spectroscopy, Reprints, *Repair enzymes, *Glycol/cytosine, *Cytosine/dihydroxy, *Oxide/osmium-tetra.

OsO4 selectively forms thymine glycol lesions in DNA. In the past, OsO4-treated DNA has been used as a substrate in studies of DNA repair utilizing base-excision repair enzymes such as DNA glycosylases. Using a methodology developed recently for characterization of oxidative base damage in DNA, the authors provide evidence for the formation of cytosine glycol and 5,6-dihydroxycytosine moieties, in addition to thymine glycol, in DNA on treatment with OsO4. The implications of these findings relative to studies of DNA repair are discussed.

712,162
PB86-239746 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Binding of Pt(NH3)3 (2+) to Nucleic Acid Bases.
Final rept.
H. Basch, M. Krauss, W. J. Stevens, and D. Cohen. 1986, 5p
Pub. in Inorganic Chemistry 25, n5 p684-688 1986.

Keywords: *Chemical bonds, *Deoxyribonucleic acids, Nucleic acids, Ligands, Reprints, *Platinum amine complex, Binding energy, Nucleotides, Effective potential.

The bonding of Pt-amine complexes to DNA is modeled by calculating the SCF binding energy of Pt(NH3)3(2+) to gaunine, adenine, cytosine, and thymine. A relativistic effective potential is used to represent the core electrons of Pt and compact effective potentials were also used to replace the core electrons in carbon, nitrogen, and oxygen to simplify the calculation of these large molecules. In order to analyze the bonding, SCF calculations were also done for H2O, NH3, imidazole, pyrimidine, and 2- and 4-pyrimidone. The binding is calculated to have a large electrostatic contribution but there is a significant contribution from polarization of the base. The valence all-electron energy can be reproduced by an SCF energy for a system where the Pt(NH3)3(2+) complex is replaced by an effective charge, (Z sub eff). The binding order for all the sites on the nucleic acid bases was calculated by the means.

712,163
PB87-100236
(Order as PB87-100186, PC **A08**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Inorganic Materials Biotechnology: A New Industrial Measurement Challenge.
G. J. Olson, and F. E. Brinckman. Jun 86, 9p
Sponsored by Office of Naval Research, Arlington, VA.

Included in Jnl. of Research of the National Bureau of Standards, v91 n3 p139-147 May-Jun 86.

Keywords: *Metals, *Metalloids, Microorganisms, Materials recovery, Organometallic compounds, Inorganic compounds, *Microbial processes, *Biotechnology, Heavy metals, Metabolites.

Biotechnological processing of inorganic, heavy elements has only begun to emerge as the authors start to understand microbial strategies and mechanisms of heavy element transformation. Chemical speciation of key, diagnostic intermediates and products of bioprocessing in gas liquid, and cellular phases, and on surfaces, is required to understand and optimize important reactions. Recent discoveries of microorganisms in metal-enriched thermal environments, and further investigations into production of exocellular metal transforming metabolites, offer exciting prospects for development of new technologies for strategic and precious materials recovery and processing.

712,164
PB87-106084 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Weak Anion-Exchange High-Performance Liquid Chromatography of Peptides.
Final rept.
M. Dizdaroglu. 1985, 21p
Pub. in Jnl. of Chromatography 334, n1 p49-69 1985.

Keywords: *Peptides, *Chromatographic analysis, Chemical analysis, Anion exchanging, Reprints, Liquid chromatography.

In the survey, the principles and applications of a method recently developed for peptide separations are given. This method uses a bonded weak anion-exchange column and mixtures of volatile triethylammonium acetate buffer and acetonitrile as eluent. Its applications to the separation of a large number of peptides including diastreomeric and other closely related peptides are discussed. Separation of the enzymatic digests of some proteins is also presented. The complementary use of this method to the reversed-phase methods is outlined and their combined use for separation of enzymatic digests of proteins and assessment of purity of synthesized peptides is demonstrated. The results reviewed show that the weak anion-exchange method is an excellent approach for peptide separations and could be an important partner of reversed-phase methods for achieving optimal results.

712,165
PB87-106092 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Separation of Sequence Isomeric Dipeptides by High-Resolution Gas Chromatography.
Final rept.
M. Dizdaroglu. 1985, 5p
Pub. in Jnl. of Chromatography 318, n2 p384-388 1985.

Keywords: *Chromatographic analysis, *Peptides, Gas chromatography, Reprints, Peptide sequencing.

Trimethylsilyl derivatives of some sequence isomeric dipeptides were separated by high-resolution gas chromatography on a fused silica capillary column. The nominal structures of the separated isomers were confirmed by gas chromatography-mass spectrometry. The relevance of this work to sequencing of polypeptides by using dipeptidyl peptidases and gas chromatography-mass spectrometry is discussed.

712,166
PB87-106696 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Characterization of Free Radical-Induced Base Damage in DNA at Biologically Relevant Levels.
Final rept.
M. Dizdaroglu, and D. S. Bergtold. 1986, 5p
Sponsored by Armed Forces Radiobiology Research Inst., Bethesda, MD.
Pub. in Analytical Biochemistry 156, p182-188 1986.

Keywords: *Deoxyribonucleic acid, *Free radicals, Chemical radicals, Chromatographic analysis, Reprints, *Biological radiation effects, DNA damage, DNA repair, Hydroxyl radicals, Carcinogenesis.

DNA damage induced by oxygen radicals, e.g., hydroxyl radicals generated in living cells either by cellular metabolism or external agents such as ionizing radiations, appears to play an important role in mutagenesis, carcinogenesis, and aging. Elucidation of the chemical nature of such DNA lesions at biologically significant quantities is required for the assessment of their biological consequences and repair. For this purpose, a sensitive method using gas chromatography-mass spectrometry with the selected-ion-monitoring technique (GC-MS/SIM) was developed in the present work. DNA was exposed to hydroxyl radicals and hydrogen atoms produced by ionizing radiation in N2O-saturated aqueous solution. This technique permitted the detection and characterization of a large number of free radical-induced based products of DNA. Because the GC-MS/SIM technique provides rapid and absolute characterization of a large number of free radical-induced base products simultaneously and does so with a high degree of sensitivity, it is suggested as an ideal analytical tool for the identification of such base lesions in cellular DNA, for their detection in biological fluids, and for the study of their repair and biological consequences.

712,167
PB87-117966 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Free-Radical-Induced Formation of an 8,5' - Cyclo-2' - Deoxyguanosine Moiety in Deoxyribonucleic Acid.
Final rept.
M. Dizdaroglu. 1986, 8p
Pub. in Biochemical Jnl. 238, p247-254 1986.

Keywords: Free radicals, Deoxyribonucleic acids, Chemical analysis, Gas chromatography, Mass spectroscopy, Reprints, *Cyclodeoxyguanosine, *Guanosine/deoxy, *DNA, Gamma radiation, Enzymatic hydrolysis.

Isolation and identification of a novel OH-induced product, namely an 8,5'-cyclo-2'-deoxyguanosine moiety, in DNA and 2'-deoxyguanosine are described. OH radicals were generated in dilute aqueous solutions by gamma-irradiation. Analyses of 2'-deoxyguanosine and enzymic hydrolysates of DNA by gas chromatography-mass spectrometry (g.c.-m.s.) after trimethylsilylation showed the presence of 8,5-cyclo-2'-deoxyguanosine on the basis of its fragment ions. The use of g.c.-m.s. with the selected-ion monitoring technique facilitated the detection of 8,5'-cyclo-2'-deoxyguanosine in DNA at radiation doses as low as 1 Gy. Its mechanism of formation probably involves hydrogen atom abstraction by OH radicals from the C-5' of the 2'-deoxyguanosine moiety followed by intramolecular cyclization with the formation of a covalent bond between the C-5' and C-8 and subsequent oxidation of the resulting N-7-centred radical.

712,168
PB87-118600 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Mathematical Models for Ligand-Receptor Binding: Real Sites, Ghost Sites.
Final rept.
I. M. Klotz, and D. L. Hunston. 1984, 3p
Pub. in Jnl. of Biological Chemistry 259, n16 p60-62 1984.

Keywords: *Ligands, Binding, Enzymes, Reaction kinetics, Mathematical models, Molecular structure, Reprints, *Asparate transcarbamylase.

In the basic life sciences the term 'model' implies a physical, chemical or molecular construct that provides a representation for the interpretation of experimental observations. To the mathematical statistician, however, a 'model' is a mathematical expression for correlating data, which may or may not have roots in a molecular picture. With regard to ligand-receptor interactions, the mathematical model used plays a crucial role in extrapolations of binding measurements. Regardless of the statistical goodness of fit of the data to an equation, the relationships of the parameters of a mathematical formalism to the molecular features of ligand-receptor complexes is generally very complex. Oversimplified interpretations of the molecular significances of the constants derived from binding measurements are unwarranted, unless one has independent information from molecular probes.

712,169
PB87-118691 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Molecular Dynamics Simulation Study of a Two-Dimensional Fluid Mixture System: A Model for Biological Membranes.
Final rept.
R. D. Mountain, R. M. Mazo, and J. J. Volwerk. 1986, 11p
Grants PHS-GM-25698, NSF-CHE82-14688
Sponsored by Public Health Service, Rockville, MD., and National Science Foundation, Washington, DC.
Pub. in Chemistry and Physics of Lipids 40, p35-45 1986.

Keywords: *Lipids, Membranes, Computerized simulation, Reprints, *Protein lipid ordering, Molecular dynamics.

The computer simulation technique of molecular dynamics was applied to a model two-dimensional fluid mixture system to examine the short-range ordering of lipid and protein molecules in biological membranes. The model system consists of small disks (lipids) and large disks (proteins) with a radius ratio of 6, constrained to move in a plane. The particles interact with pairwise additive repulsive short range potentials, so as to simulate hard disks. Periodic boundary conditions are assumed in order to minimize boundary effects. For values of the number density of the small disks and of the temperature appropriate for a lipid membrane, the fraction, f, if small disks 'next to' at least one large disk was computed by molecular dynamics. This was done as a function of concentration and for several definitions of 'next to'. The molecular dynamics results show that, at moderately low mole fractions of the large disks, the calculated values of f deviate noticeably from the linear relation which would be expected in the absence of protein-protein proximity effects. The results are discussed in terms of current models of lipid-protein ordering in biological membranes.

712,170
PB87-120218 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Oxidation of Ascorbate and a Tocopherol Analogue by the Sulfite Derived Radicals SO3(1-) and SO5(1-).
Final rept.
R. E. Huie, and P. Neta. 1985, 6p
Pub. in Chem.-Biol. Interact. 63, n1-2 p233-238 1985.

Keywords: *Free radicals, *Oxidation, *Sulfites, Chemical reactions, Chemical radicals, Tocopherol, Reprints, *Ascorbate, *Chemical reaction kinetics, Peroxysulfite radicals, Sulfite radicals.

The sulfite radical, SO3(1-), was produced by the pulse radiolytic oxidation of sulfite or bisulfite and its reactions followed by kinetic spectrophotometry. It was found to be a mild oxidant, reacting with ascorbate with $k = 9.2 \times 10$ to the 6th power/Ms at pH = 6.8 and with trolox (a water-soluable tocopheral analogue) with k approx. 1×10 to the 6th power/Ms at pH = 9. It also reacts rapidly with O2 ($k = 1.5 \times 10$ to the 9th power/Ms) to form the peroxysulfite radical SO5(1-), which reacts with ascorbate with $k = 1.4 \times 10$ to the 8th power/Ms at pH = 6.8 and with trolox with $k = 1.2 \times 10$ to the 7th power/Ms at pH = 9.

712,171
PB87-127973 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Thermodynamics of Carbohydrate Isomerization Reactions: The Conversion of Aqueous Allose to Psicose.
Final rept.
Y. B. Tewari, and R. N. Goldberg. 1986, 4p
Pub. in Biophysical Chemistry 24, p291-294 1986.

Keywords: *Carbohydrates, Thermodynamics, Chemical reactions, Chromatographic analysis, Hexoses, Pentoses, Enthalpy, Reprints, *Psicose, *Allose.

The thermodynamics of the conversion of aqueous d-psicose to d-allose has been investigated using high-pressure liquid chromatography. The reaction was carried out in phosphate buffer at pH 7.4 over the temperature range 317.25-349.25 K. The following results are obtained for the conversion process at 298.15 K: delta G = -1.41 + or - 0.09 kJ/mol, delta H = 7.42 + or - 1.7 kJ/mol, and delta C (sub p) = 67 + or - 50 J/mol K. An approximate equilibrium constant of 0.30 is obtained at 333.15 K for the conversion of aqueous D-psicose to D-altrose. Available thermodynamic data

for isomerization reactions involving aldohexoses and aldopentoses are summarized.

712,172

PB87-132072 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Thermodynamics of the Hydrolysis of Adenosine 5'-triphosphate to Adenosine 5'-diphosphate.
Final rept.
E. Gajewski, D. K. Steckler, and R. N. Goldberg. 1986, 5p
Pub. in Jnl. of Biological Chemistry 261, n27 p12733-12737, 25 Sep 86.

Keywords: *Enthalpy, Hydrolysis, Thermodynamic properties, Chemical reactions, Specific heat, Reprints, *ADP, *ATP, Heat capacity.

The enthalpy of hydrolysis of the enzyme-catalyzed (heavy meromyosin) conversion of adenosine 5'-triphosphate (ATP) to adenosine 5'-diphosphate (ADP) and inorganic phosphate has been investigated using heat-conduction microcalorimetry. Enthalpies of reaction were measured as a function of ionic strength (0.05-0.66 mol/kg), pH (6.4-8.8), and temperature (25-37 degC) in Tris/HCl buffer. The measured enthalpies were adjusted for the effects of proton ionization and metal ion binding, protonation and interaction with the Tris buffer, and ionic strength effects to obtain a value of delta H(sup 0) = -20.5 + or - 0.4 kJ/mol at 25 deg C for the process, ATP (4-)(aq) + H2O(l) = ADP(3-)(aq) + HPO 4(2-) (aq) + H(1+) (aq) where aq is aqueous and l is liquid.

712,173

PB87-134698 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Tryptophan Metabolites as Antioxidants.
Final rept.
S. V. Jovanovic, and M. G. Simic. 1985, 7p
Pub. in Life Chem. Rep. 3, n1-2 p124-130 1985.

Keywords: *Tryptophan, Amino acids, Free radicals, Reaction kinetics, Reprints, *Antioxidants, Metabolites, Pulse radiolysis.

Hydroxy-indole derivatives, metabolic products of tryptophan, were shown to be a new class of potent endogenous antioxidants. Kinetics and mechanisms of their reactions with free radicals in general and tryptophan radical in particular are presented.

712,174

PB87-149407 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Theoretical Model for the Binding of Cis-Pt(NH3)2(2+) to DNA.
Final rept.,
K. J. Miller, E. R. Taylor, H. Basch, M. Krauss, and W. J. Stevens. 1985, 15p
Pub. in Jnl. of Biomolecular Structure and Dynamics 2, n6 p1157-1171 1985.

Keywords: *Deoxyribonucleic acid, Stability, Reaction kinetics, Ligands, Reprints, *Binding energies.

The binding of cis-Pt(NH3) 2 B(sub 1) B(sub 2) to bases B(sub 1) and B(sub 2) of DNA is studied theoretically. The components of the binding are analyzed and a model structure is proposed for the intrastrand binding to the d B(sub VpdB(sub 2) sequence of a kinked double helical DNA. Quantum mechanical calculations of the liquid binding energy indicates that Pt+2 binds to N7(G), N3(C), 02(C), 06(G), N3(A), N7(A), 04(T) and 02(T) in order of decreasing binding energy. Conformational analysis provides structures of kinked DNA which yield a proper placement of base atoms involved in complex formation. Only bending toward the major groove allows the construction of acceptable square planar complexes. Examples are presented for kinks of -70 deg and -40 deg at the receptor site to orient the base pairs for ligand binding to B1 and B2 to form a nearly square planar complex.

712,175

PB87-161691 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Study of Proline Peptide Bond Conformation and Ring Dynamics in Crystalline Cyclic Peptides Using (13)C MAS NMR.
Final rept.,
S. K. Sarkar, D. A. Torchia, K. D. Kopple, and D. L. VanderHart. 1984, 4p
Pub. in Jnl. of American Chemistry Society 106, n11, p3328-3331 1984.

Keywords: *Peptides, Chemical bonds, Amino acids, Nuclear magnetic resonance, Relaxation, Reprints, *Proline, Carbon 13.

The authors have studied three cyclic peptides, cyclo(Val-Pro-Gly)2, cyclo(Phe-Pro-D-Ala)2 and cyclo(Gly-Pro-D-Ala)2, in the crystalline powder form using 13C MAS NMR. A comparison of chemical shift differences between the beta- and gamma-carbons of the proline ring suggests that the Val-Pro and Phe-Pro peptide bonds are cis and that the Gly-Pro bonds are trans. These results for crystalline samples agree with those obtained in solution and are verified by crystal structures of cyclo(Phe-Pro-D-Ala)2. Solid state relaxation data show that the disorder reported at one proline ring in the crystal structure of the latter peptide results from ring motion. A ring correlation time of 1.4x10-11 is obtained when the relaxation data are analyzed using the two site exchange model suggested by the crystal structure.

712,176

PB87-162160 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Thermodynamics of the Conversion of Aqueous Glucose to Fructose.
Final rept.,
Y. B. Tewari, and R. N. Goldberg. 1984, 25p
Pub. in Jnl. of Solution Chemistry 13, n8 p523-547 1984.

Keywords: *Thermodynamics, *Glucose, *Fructose, Carbohydrates, Calorimetry, Enthalpy, Specific heat, Reprints.

The thermodynamics of the conversion of aqueous glucose to fructose has been investigated using both heat-conduction microcalorimetry and high pressure liquid chromatography (HPLC). The reaction was carried out in both aqueous TRIS/HCl buffer and in aqueous phosphate buffer in the pH range 7 to 8 using the enzyme glucose isomerase and the co-factors CoCl2 and MgSO4. The temperature range over which this reaction was investigated was 298.15 to 358.15 K. The authors have found that the enthalpy of reaction is independent of pH over the range investigated. A combined analysis of both the HPLC and microcalorimetric data leads to the following results at 298.15 K: delta G = 349 + or - 53 J/mol, delta H = 2.78 + or - 0.20 kJ/mol, and delta C = 76 + or - 30 J/mol K. The stated uncertainties are based upon an analysis of both the random and systematic errors inherent in the measurements. Comparisons are made with literature data. The percent conversion of glucose to fructose has been calculated for the temperature range 300 to 373.15 K.

712,177

PB87-171765 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Predicted Structures of cAMP Binding Domains of Type I and II Regulatory Subunits of cAMP-Dependent Protein Kinase.
Final rept.,
I. T. Weber, T. A. Steitz, J. Bubis, and S. S. Taylor. 1987, 9p
Pub. in Biochemistry 26, n2 p343-351 1987.

Keywords: *Molecular structure, Binding, Enzymes, proteins, Reprints, *AMP, Cyclic adenosine monophosphate, Regulatory subunits, E coli.

The mammalian cAMP-dependent protein kinases have regulatory (R) subunits that show substantial homology in amino acid sequence with the catabolite gene activator protein (CAP), a cAMP-dependent gene regulatory protein from Escherichia coli. Each R subunit has two in-tandem cAMP binding domains, and the structure of each of these domains has been modeled by analogy with the crystal structure of CAP. Both the type I and II regulatory subunits have been considered, so that four cAMP binding domains have been modeled. The binding of cAMP in general is analogous in all the structures and has been correlated with previous results based on photolabeling and binding of cAMP analogues. The model predicts that the first cAMP binding domain correlates with the previously defined fast dissociation site, which preferentially binds N6-substituted analogues of cAMP. The second domain corresponds to the slow dissociation site, which has a preference for C8-substituted analogues. The model also is consistent with cAMP binding in the syn conformation in both sites. Finally, this model has targeted specific regions that are likely to be involved in interdomain contacts. This includes contacts between the two cAMP binding domains as well as contacts with the amino-terminal region of the R subunit and with the catalytic subunit.

712,178

PB87-231510 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Conformational Transitions of Synthetic DNA (Deoxyribonucleic Acid) Sequences with Inserted Bases, Related to the Dodecamer d(CGCGAATTCGCG).
Final rept.,
M. Miller, W. Kirchhoff, F. Schwarz, E. Appella, Y. Y. H. Chiu, J. S. Cohen, and J. L. Sussman. 1987, 14p
Pub. in Nucleic Acids Research 15, n9 p3877-3890 1987.

Keywords: *Deoxyribonucleic acids, Nucleic acids, Synthesis(Chemistry), Reprints, Dodecamer, Palindromes.

Conformational transitions for a series of imperfect palindromes related to the dodecamer d(CGCGAATTCGCG) have been investigated. These sequences are: two isomeric 13-mers-d(CGCAGAATTCGCG) (13-merl) and d(CGCGAATTACGCG) (13-merl), 17-mer d(CGCGCGAATTACGCGCG) and 15-mer d(CGCGAAATTTACGCG). Insertion of a single-adenine nucleotide prevents these sequences from being self-complementary. Analysis of thermodynamic parameters derived from the melting profiles together with other data at higher concentrations (NMR and calorimetry) indicates that the insertion of the additional nucleotide which lacks a complement in the opposite strand does not change the enthalpy of the duplex formation, but does alter the number of stable nucleation configurations. The relative position of the insertion within the self-complementary sequence determines the equilibrium between the duplex form and the single-stranded hairpin loop. C-G segments separated by the insertion from the rest of the molecule can undergo an independent conformational transition at high salt concentration, probably to the Z form.

712,179

PB88-129655 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Nuclear Magnetic Resonance and Neutron Diffraction Studies of the Complex of RNase A with Uridine Vanadate, a Transition-State Analog.
Final rept.,
B. Borah, C. W. Chen, W. Egan, M. Miller, A. Wlodawer, and J. S. Cohen. 1985, 10p
Pub. in Biochemistry 24, n8 p2058-2067 1985.

Keywords: *Enzymes, *Ribonuclease, Proteins, Spectroscopy, Nuclear magnetic resonance, Neutron diffraction, Reprints.

The complex of RNase A with uridine-vanadate (U-V), a transition-state analog, has been studied with (51)V and proton NMR spectroscopy in solution and by neutron diffraction in the crystalline state. Upon the addition of aliquots of U-V at pH 6.6, the ((C sup epsilon-H)) resonances of the two active site histidine residues 119 and 12 decrease in intensity while four new resonances appear. These four resonances are assigned to His-119 and His-12 in protonated and unprotonated forms in the RNase-(U-V) complex. The results of both proton NMR in solution and neutron diffraction in the crystal are compared and interpreted in terms of the mechanism of action of RNase.

712,180

PB88-134655 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Biochemistry

Calcium Phosphate Formation in Aqueous Suspensions of Anionic Liposomes.
Final rept.,
E. D. Eanes. 1986, 6p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in International Congress Series--Excerpta Medica 705, p187-192 1986.

Keywords: *Calcium phosphates, Ionophore, Liposomes, Matrix vesicles, Reprints, *Amorphous calcium phosphate, Apatite, Biomineralization, Calcification.

Artificial phospholipid vesicles (liposomes) have recently been investigated as possible models for membrane-bound biological calcification processes, such as those which occur in matrix vesicles. An effective way to induce mineral formation in liposomes is to prefill their aqueous interiors with buffered phosphate solutions and then, with the addition of cationophores, make the enclosing membranes permeable to Ca2+ion fluxes from physiological-like external solutions. Using the procedure, it was found that at pH 7.4 crystalline apatite readily formed in the microinteriors of the liposomes. If Mg2+ was encapsulated along with the phosphate, amorphous calcium phosphate was the initial product. The latter phase was unstable, however, and hydrolyzed to apatite. The accumulation of intraliposomal precipitate was also found to disrupt the membrane covering and induce precipitation in the external solution phase as well. These precipitation events parallel in many ways those which appear to occur in matrix vesicles and suggest that liposomes could be useful vehicles for investigating, in vitro, possible effects native membrane constituents may have on the calcification process. One such constiuent, phosphatidylserine, was found to retard extraliposomal precipitation.

712,181
PB88-137088 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Immunoreactor-Based Flow Injection Analysis System.
Final rept.,
L. L. Brown, A. L. Plant, R. M. Kannuck, and R. A. Durst. 1986, 19p
Pub. in Bioelectroanalytical Symposium (1st), p15-33 1986.

Keywords: Reprints, *Flow injection analysis, *Immunoreactors, Continuous flow method.

Flow injection analysis is a continuous-flow method based on the introduction of a sample aliquot into a moving, nonsegmented carrier stream. As the injected sample is transported through the system, it undergoes controlled dispersion and can be chemically and/or physically treated by the introduction of appropriate reagents or processing. The results of the sample treatment can then be quantitated using suitable flow-through detectors. A novel flow injection analysis system is being developed which utilizes an immunospecific reactor and incorporates many features over current solid-phase immunoassays. In the immunoreactor system, free antigen (the analyte) competes with antigen covalently coupled to the surface of marker-loaded liposomes for binding to antibodies immobilized in the reactor column.

712,182
PB88-138904 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Thermodynamics of the Conversion of Aqueous L-Aspartic Acid to Fumaric Acid and Ammonia.
Final rept.,
R. N. Goldberg, E. Gajewski, D. K. Steckler, and Y. B. Tewari. 1986, 11p
Pub. in Biophysical Chemistry 24, n1 p13-23 1986.

Keywords: *Enzymes, *Aspartic acid, *Fumaric acid, Thermodynamic properties, Chemical equilibrium, pH, Reprints, Conversion, Liquid chromatography.

The thermodynamics of the conversion of aqueous L-aspartic acid to fumaric acid have been investigated using both heat conduction microcalorimetry and high-pressure liquid chromatography. The reaction was carried out in aqueous phosphate buffer over the pH range 7.25 to 7.43, the temperature range 13 to 43 degrees C, and at ionic strengths varying from 0.066 to 0.366 mol/kg. Calculations have also been performed which give values of the apparent equilibrium constant for the conversion of L-aspartic acid to fumaric acid and ammonia as a function of temperature, pH, and ionic strength.

Botany

712,183
PB87-231981 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Further Carbon-13 NMR Evidence for the Coexistence of Two Crystalline Forms in Native Celluloses.
Final rept.,
D. L. VanderHart, and R. H. Atalla. 1987, 31p
Pub. in ACS (American Chemical Society) Symposium Series 340, Chapter 5 p88-118 1987.

Keywords: *Algae, *Celluloses, *Hydrolysis, Reprints, Carbon 13, *Nuclear magnetic resonance, Polymorphy, Spin exchange.

The hypothesis that all native celluloses are composites of two crystalline polymorphs, I alpha and I beta, is further explored using solid state (13)C NMR techniques. Spectra of several algal and higher plant celluloses and the effects of acid hydrolysis and mechanical heating are investigated. No significant alteration of the I alpha and I beta ratios is seen upon hydrolysis of a cellulose from cotton linters. However, both beating and hydrolysis are seen to enhance the I beta proportion in an algal cellulose obtained from Cladophora. Methods of enhancing the crystalline core resonances are used to verify that unit cell inequivalence rather than crystal surface chains determines the crystalline resonance profiles. These studies indicate that the C4 resonance region, from 88-92 ppm in all native celluloses is a faithful monitor of unit cell inequivalences. Also, the higher plant celluloses contain a much smaller fraction of the Ia crystalline form than originally proposed. The possibility even exists that the higher plant celluloses represent the pure I beta form. If so, the corresponding unit cell contains more than the usually accepted four non-equivalent anhdroglucose residues.

712,184
PB88-129820 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Dielectric Properties of Biological Tissue (Crassula portulacea) from 0.01 to 1 Billion Hz.
Final rept.,
M. G. Broadhurst, C. K. Chiang, K. J. Wahlstrand, R. M. Hill, L. A. Dissado, and J. Pugh. 1987, 9p
Sponsored by Food and Drug Administration, Rockville, MD.
Pub. in Jnl. of Molecular Liquids 36, p65-73 1987.

Keywords: Reprints, *Dielectric constant, Conductivity, Ion diffusion, *Biological tissue, Plant leaves, *Crassula portulacea.

Dielectric data from 0.01 Hz to 1 billion Hz are given for fresh leaves of Crassula portulacea (Jade plant), liquid extracted from such leaves and extracted liquid containing a synthetic polymer film. Features associated with the bulk electrolyte, the cell walls and the electrical double layer at the electrodes of the specimen holder are clearly delineated in the data. A synthetic film is shown to produce interfacial polarization that appears quite similar to that due to cell walls. Interpretation of the data is given in terms of ionic movement through the leaf structure. The data presented here are intended to be a prototype for live tissue data and used, for example, to design synthetic dielectric phantom materials.

Clinical Chemistry

712,185
PB-268 516/2 PC **A15**/MF **A01**
National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
Blood pH, Gases, and Electrolytes. Proceedings of the Workshop on pH and Blood Gases Held at Gaithersburg, Maryland on July 7-8, 1975.
Special pub. (Final),
R. A. Durst. Jun 77, 341p NBS-SP-450
Sponsored in part by American Association for Clinical Chemistry, Washington, D.C., American Society of Clinical Pathologists, Chicago, Ill., International Federation of Clinical Chemistry, and National Committee for Clinical Lab. Standards. Library of Congress catalog card no. 76-608179.

Keywords: *Meetings, *Blood gas analysis, *Blood chemical analysis, Electrolytes, pH, Acid-base equilibrium, Carbon dioxide, Standards, Sampling, Measurement, Laboratory equipment, Quality control, Calcium, Oxygen, Potassium, Sodium, Terminology, Storage, *Clinical chemistry.

A major goal of this workshop was the initiation of cooperative efforts on an international level toward the standardization of pH and blood gas measurements and the various quantities and terms used in this field. To this end, the first technical session was concerned with the acid-base status of blood and included the topics: Definitions of quantities and concepts; recommendations of nomenclature, physiological terminology and symbols; reference values; and the evaluation of nomograms and algorithms. The second session addressed itself to the more pratical aspects of this subject and included the topics: Blood sampling, handling, and storage; instrument specifications; quality control and standards; and the development of reference methods. Finally, a brief session on the newer topic of the electrometric measurement of blood electrolytes. This volume contains all of the papers invited for presentation at the workshop and a transcription of the extensive discussion sessions.

712,186
PB-282 870/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
o-Phthalaldehyde for the Fluorometric Assay of Non-Protein Amino Compounds.
Final rept.,
D. J. Reeder, L. T. Sniegoski, and R. Schaffer. 1978, 8p
Pub. in Analytical Biochemistry, v86 p490-497 1978.

Keywords: *Amino acids, *Chemical analysis, *Blood analysis, Serum albumin, Performance evaluation, Reprints, Procedures.

The authors describe a manual fluorometric method for the quantitation in serum, of total free amino compounds, expressed as norleucine. A trichloroacetic acid deproteinization step is employed, and o-phthalaldehyde, buffered with phosphate at pH 9.2, is used as the fluorogenic reagent. The method is linear, reproducible, and rapid. Recoveries of amino acid spikes from serum are quantitative. Sensitivity is in the picomole range. Results on unselected patient sera are discussed.

712,187
PB-286 533/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Enzyme Immunoassay Adapted for Use with a Digital Kinetic Analyzer.
Final rept.,
B. F. Howell, R. Schaffer, and E. A. Sasse. 1978, 1p
Pub. in Clinical Chemistry 24, n7 p1284 1978.

Keywords: *Drugs, *Anticonvulsants, Enzymes, Nitrogen heterocyclic compounds, Ketones, Imides, Pyrrolidines, Reprints, *Immunoassay, Hydantoin/diphenyl, Phenobarbital, Carbamazepine, Dibenzazepine carboxamide, Phenytoin, Imidazolidine dione/diphenyl, Ethosuximide, Pyrrolidine dione/ethyl-methyl, Primidone, Pyrimidine dione/ethyldihydro-phenyl.

The use of a digital kinetic analyzer is described for performing enzyme-linked immunoassays of antiepileptic drugs (carbamazepine diphenylhydantoin, ethosuximide, phenobarbital, and primadone in serum. The values obtained are in good agreement with the known concentrations of the drugs in prototype standards and in samples used for the Pippenger drug surveys.

712,188
PB-286 944/4 PC **A06**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.

Standard Reference Materials: A Reference Method for the Determination of Sodium in Serum.
R. A. Velapoldi, R. C. Paule, R. Schaffer, J. Mandel, and J. R. Moody. Aug 78, 109p NBS-SP-260-60
Library of Congress Catalog Card no. 78-606106.

Keywords: *Blood chemical analysis, *Sodium, Blood serum, Standards, Tests, Atomic spectroscopy, Bioinstrumentation, Concentration(Composition), Calibrating, Samples, Performance evaluation, Flame atomic emission spectroscopy, Analytical methods, Clinical chemistry, Standard reference materials.

Guided by a committee of experts in clinical chemistry, a reference method was established for the determination of serum sodium based on flame atomic emission spectroscopy (FAES). Its accuracy was evaluated by comparing the values obtained by use of the method in twelve laboratories against the results obtained by a definitive analytical method based on an ion-exchange sodium separation followed by gravimetry as Na2SO4. Seven serum pools with sodium concentrations in the range 113.2 to 158.6 mmol/L were analyzed. Manual and semiautomated pipetting alternatives were tested using sample sizes of 5.0 and 0.25 mL, respectively. The laboratories used several different FAES instruments. The results showed that the standard error for a single laboratory's performance of the procedure ranged from 0.46 to 0.86 mmol/L with a maximum bias of 1.0 mmol/L over the range of concentrations studied. These values were within the accuracy and precision goals that had been set by the committee. There were no significant differences in the results from the two pipetting techniques. The calibration curve data showed excellent linearity over the total concentration range, with 21 of 26 curves having standard deviations of fit of 0.5 mmol/L or less.

712,189
PB-287 026/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Statistical Evaluation of CAP Survey Results for Calcium, Potassium, and Blood Urea Nitrogen.
Final rept.,
R. C. Paule, and J. Mandel. 1978, 10p
Pub. in American Jnl. of Clinical Pathology 70, n3 p471-480 Sep 78.

Keywords: *Blood urea nitrogen, *Calcium, *Potassium, National government, Surveys, Comparison, Accuracy, Precision, Reprints, Analytical methods, National Bureau of Standards, Clinical laboratories, Pathologists.

Through the use of the statistical technic known as the linear model, a complete analysis has been made of data obtained in the College of American Pathologists Survey of 1975 for calcium, potassium, and blood urea nitrogen (BUN). The analysis allows a separation of laboratories into core and non-core categories. It also allows for determination of the reproducibility of each analytic technic involved in this survey. For Ca and K, the results obtained by each analytic method were compared with the results obtained by the National Bureau of Standards through use of the definitive method. For BUN, the comparison was made with the average of values for all laboratories and all methods.

712,190
PB-296 105/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement Compatibility in Clinical Chemistry.
Final rept.
J. P. Cali. Jun 78, 2p
Pub. in CAMLT (California Association for Medical Laboratory Technology)/Newsline 4, n6, p4-5, Jun 78.

Keywords: Measurement, Compatibility, Materials, *Clinical chemistry, National Bureau of Standards.

Measurement compatibility is assured when all laboratories in a network do accurate analysis, i.e., analyses free of systematic error and that are precise. To accomplish this agreement on measurement units, the use of reference materials and reference methods is required. Reference materials useful in clinical chemistry laboratories and available from the National Bureau of Standards are cited.

712,191
PB80-110117 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.

Standard Reference Materials: Reference Method for the Determination of Chloride in Serum.
Final rept.,
R. A. Velapoldi, R. C. Paule, R. Schaffer, J. Mandel, T. J. Murphy, and J. W. Gramlich. Nov 79, 101p NBS-SP-260-67
Library of Congress catalog card no. 79-600174.

Keywords: *Electrical measurement, *Chloride, *Blood serum, Concentration(Composition), Coulometers, Electrolytes, Analytical methods, Clinical chemistry.

Guided by a committee of experts in clinical chemistry, a reference method was established for the determination of serum chloride based on a coulometric titration-amperometric end-point determination (C-A). Its accuracy was evaluated by comparing the values obtained by use of the method in 14 laboratories against the results obtained by a definitive analytical method based on isotope dilution-mass spectrometry (IDMS). Seven serum pools with chloride concentrations in the range 79.2 to 116.8 mmol/L were analyzed. Micro- and macropipetting alternatives were tested using sample sizes of 0.010-0.100 and 5.0 mL, respectively. The laboratories used several different C-A instruments. The results showed that the standard error for a single laboratory's performance of the procedure was approximately 1.0 mmol/L with a maximum bias of 0.5 mmol/L over the range of concentrations studied. These values are within the accuracy and precision goals that had been set by the committee. The results from the micro- and macropipetting techniques were similar. The calibration curve data showed excellent linearity over the total concentration range, with 12 of 14 curves having standard deviation of fit of less than 0.80 mmol/L. With appropriate experimental design, the reference method may be used to establish the accuracy of field methods as well as to determine reference chloride values for pooled sera.

712,192
PB81-113136 Not available NTIS
National Bureau of Standards, Washington, DC.
Total Serum Cholesterol by Isotope Dilution/Mass Spectrometry: A Candidate Definitive Method.
Final rept.
A. Cohen, H. S. Hertz, J. Mandel, R. C. Paule, R. Schaffer, L. T. Sniegoski, T. Sun, M. J. Welch, and E. White. 1980, 7p
Sponsored in part by Food and Drug Administration, Washington, DC.
Pub. in Clinical Chemistry 26, n7 p854-860 1980.

Keywords: *Chemical analysis, *Clinical chemistry, Mass spectroscopy, Gas chromatography, Separation, Samples, Blood serum, Reprints, *Cholesterol, Vitamin D.

A highly accurate and precise method for the determination of serum cholesterol using isotope dilution mass spectrometry is described. The method was developed for a study group of the AACC Standards Committee for use in establishing the accuracy of a candidate reference method, and fulfills their criteria for a definitive method. Cholesterol-d7 is added to serum, keeping the ratio of it to the total cholesterol near to 1:1. The esters are hydrolyzed and the cholesterol is separated and converted into the trimethylsilyl ether derivative for GC/MS. The intensity ratio of the molecular ions at m/z 465 and 458 is measured for the derivative from each sample and two bracketing calibration mixtures, according to a prescribed protocol. The method was applied to 5 serum pools over several weeks. Statistical analysis shows excellent overall precision: the coefficient of variation for a single measurement is 0.36%. The absence of interferences in our method was demonstrated by measurements at several other masses.

712,193
PB81-118457 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Serum and Blood Densities.
Final rept.
L. T. Sniegoski, and J. R. Moody. Aug 79, 2p
Pub. in Anal. Chem. 51, n9 -1577-1578 Aug 79.

Keywords: *Blood analysis, *Blood serum, *Density(Mass/volume), Reprints.

A simple semi-micro method for the determination of blood and serum densities was developed. The density values were in good agreement with those obtained by the use of a 10-mL pycnometer.

712,194
PB81-220758 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Standard Reference Materials: SRM 900, Antiepilepsy Drug Level Assay Standard.
Final rept.
D. J. Reeder, B. Coxon, D. Enagonio, R. G. Christensen, B. F. Howell, R. C. Paule, J. Mandel, and R. Schaffer. Jun 81, 83p NBS/SP-260-72

Keywords: *Blood analysis, *Drugs, Standards, Concentration(Composition), Chemical analysis, Phenobarbital, Primidone, Mass spectroscopy, Nuclear magnetic resonance, Gas chromatography, *Standard reference materials, Phenytoin, Procedures, Ethosuximide.

Recognition of the efficacy of monitoring the concentrations of therapeutic drugs in the blood of patients has revealed many needs for standardization of the laboratory tests used for such monitoring. The National Bureau of Standards was asked to provide a Standard Reference Material (SRM) consisting of three serum samples, each to contain four antiepilepsy drugs at different concentrations. The four drugs are phenobarbital, phenytoin, primidone, and ethosuximide. The SRM would fill a basic role for achievement of accurate analysis to help ensure the reliability of analysis for these drugs. The needs that had to be fulfilled to produce the SRM included: (1) analytical criteria for purity of the drugs; (2) serum to be used as a matrix for the drugs; (3) techniques for achieving homogeneity and stability of the SRM; and (4) two independent, highly accurate analytical methods for the certification. This document describes development of methods and procedures used to produce and certify the SRM.

712,195
PB83-162131 Not available NTIS
National Bureau of Standards, Washington, DC.
Accurate Determination of Serum Glucose by Isotope Dilution Mass Spectrometry - Two Methods.
Final rept.
E. White, M. J. Welch, T. Sun, L. T. Sniegoski, R. Schaffer, H. S. Hertz, and A. Cohen. 1982, 13p
Pub. in Biomedical Mass Spectrometry 9, n9 p397-405 1982.

Keywords: *Blood analysis, *Glucose, Mass spectroscopy, Chemical analysis, Isotopic labeling, Gas chromatography, Reprints.

Two isotope dilution mass spectrometric methods have been developed for the determination of D-glucose in human serum. Each uses a uniformly labeled (13)C-glucose and the internal standard. The first method involves conversion of glucose into 1,2:5,6-di-O-iso-propylidene-alpha-D-glucofuranose and an extensive clean-up, followed by quantitation using packed column GC/MS. In the second method, glucose is converted into alpha-D-glucofuranose cyclic 1,2:3,5-bis(butylboronate)-6-acetate. The wet chemistry work-up is simpler, but analysis by capillary GC/MS is required. Both methods exhibit excellent precision (coefficients of variation $< 0.3\%$) and provided mean values that agree within 1% for all serum pools tested.

712,196
PB83-239509 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Standard Reference Materials: The Measurement of the Catalytic (Activity) Concentration of Seven Enzymes in NBS Human Serum SRM 909.
Final rept.
G. N. Bowers, R. Alvarez, J. P. Cali, K. R. Eberhardt, D. J. Reeder, R. Schaffer, G. A. Uriano, R. Elser, L. M. Ewen, R. B. McComb, R. Rej, and L. M. Shaw. Jun 83, 109p NBS-SP-260-83
Library of Congress catalog card no. 83-600543. Prepared in cooperation with Hartford Hospital, CT., York Hospital, PA., New York State Dept. of Health, Albany and Hospital of the Univ. of Pennsylvania, Philadelphia.

Keywords: *Enzymes, Clinical chemistry, Activity, Measurement, Blood serum, Humans, *Catalytic concentration, Standard Reference Material.

The authors determined the catalytic (activity) concentrations of seven enzymes (ACP, ALP, AlaAT, AspAT, CK, LDH and, gamma-GT) in the NBS lyophilized human serum Standard Reference Material (SRM 909). SRM 909 enzyme activity values should provide

the basis for compatibility among methods for determining enzyme values in serum. Separate teams of clinical chemistry experts selected and carried out the analyses for the individual enzymes. The methods used are primarily those recommended by the Standards Committees of the AACC and/or the IFCC, as candidate reference methods; however, a reaction temperature set-point of 29.77 C (the gallium melting point) was used. This monograph describes the serum reconstitution protocol, the specific enzyme methods, and the results of the third (and last) round of the interlaboratory test program, which were used to derive mean values for enzyme catalytic (activity) concentrations in SRM 909.

712,197

PB84-216894 PC **A04**/MF **A01**
National Bureau of Standards (NML), Washington, DC.
Evaluation by an ID/MS (Isotope Dilution/Mass Spectrometric) Method of the AACC (American Association for Clinical Chemistry) Reference Method for Serum Glucose.
Final rept.
R. Schaffer, J. Mandel, T. Sun, A. Cohen, and H. S. Hertz. Oct 82, 58p NBS/SP-260-80
Also available from Supt. of Docs as SN003-003-02443-1. Library of Congress catolog card no. 82-600618. Prepared in cooperation with Centers for Disease Control, Washington, DC.

Keywords: *Glucose, *Blood analysis, *Standards, Clinical chemistry, Chemical analysis, Performance evaluation, Statistical analysis, Laboratories, *Standard reference materials, *Isotope dilution mass spectrometry.

A study group of the Committee on Standards of the American Association for Clinical Chemistry was organized in 1972 for the purpose of establishing a reference method for serum glucose determinations. This required the study group to (a) consider the limits for bias and imprecision it judged would be acceptable in a glucose reference method for clinical chemistry, (b) identify the potential (i.e., candidate) reference method, from such evidence as low susceptibility to possible sources of interference and amenability to precise performance, (c) obtain several serum pools whose glucose leveis are determined by an essentially bias-free, highly precise (i.e., definitive) method, and (d) use the serum pools in a statistically designed, multilaboratory study to evaluate the candidate method as the reference method. Cali et al. (1) employed that approach in attempting to establish the reference method for total calcium, and it was subsequently used for the serum sodium (2), potassium (3), chloride (4), and lithium (5) reference methods.

712,198

PB84-216993 Not available NTIS
National Bureau of Standards, Washington, DC.
Study of Biological Samples Obtained from Victims of MGM Grand Hotel Fire.
Final rept.
M. Birky, D. Malek, and M. Paabo. Dec 83, 7p
Pub. in Jnl. of Analytical Toxicology 7, p265-271 Nov-Dec 83.

Keywords: *Blood chemical analysis, Death, Fire, Soot, Respiratory system, Inhalation, Reprints, *Carboxyhemoglobin.

Eighty blood samples and 17 respiratory-tract tissue samples containing fluid taken from victims of the MGM Grand Hotel fire were studied to assist in the determination of the cause of death. The blood and tissue-fluid samples were analyzed for carboxyhemoglobin, oxyhemoglobin, methemoglobin, and total hemoglobin. Outgassing studies were done on the tissue samples using gas chromatography/mass spectroscopy, and heavy metal analysis on inhaled soot was done by x-ray fluorescence. The carboxyhemoglobin values obtained on the samples were significantly higher than those reported by Clark County. However, the percentage of the victims with a carboxyhemoglobin saturation level of 50% or less is higher than that found in the Maryland fire fatality study, suggesting that other toxic factors may have contributed to the lethal nature of the fire.

712,199

PB84-239896 Not available NTIS
National Bureau of Standards, Washington, DC.
Candidate Reference Method for Determination of Bilirubin in Serum. Test for Transferability.
Final rept.
B. W. Perry, B. T. Doumas, D. D. Bayse, T. Butler, A. Cohen, W. Fellows, C. C. Garber, B. Howell, T. Koch, S. Krishnamurthy, A. Louderback, R. B. McComb, D. Miller, R. R. Miller, R. N. Rand, and R. Schaffer. 1983, 5p
Sponsored in part by American Association for Clinical Chemistry, Washington, DC. Study Group on Bilirubin.
Pub. in Clinical Chemistry 29, n2 p297-301 1983.

Keywords: *Bile pigments, *Standards, *Blood analysis, Solutions, Blood serium, Laboratories, Comparison, Chemical analysis, Reprints.

Each of 10 laboratories, using portions of a single crystalline bilirubin preparation, prepared bilirubin standards in solutions of bovine serum albumin. The standards were prepared on two days. The standards and two control sera were analyzed by a modified Jendrassik-Grof method, in duplicate, on the same day the standards were prepared. The mean molar absorptivity of the alkaline azobilirubin at 598 nm was 75080 L/mo1/cm-1 with a standard deviation of 760. Mean values for the two controls were 41.4 and 113.5 mg/L, with standard deviations of 0.9 and 1.4 mg/L, respectively.

712,200

PB85-196145 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Studies of Calcified Tissues by Raman Microprobe Analysis.
Final rept.
M. D. Grynpas, W. J. Landis, and E. S. Etz. 1982, 5p
Sponsored by Microbeam Analysis Society, Bethesda, MD.
Pub. in Proceedings of Annual Conference of the Microbeam Analysis Society (17th), Washington, DC., August 9-13, 1982, p333-337.

Keywords: *Raman spectroscopy, *Bioassay, *Bones, *Mineralization, *Calcium, Sampling, Chemical analysis, Laboratory animals, *Microprobe analysis.

Bone samples at various stages of mineralization have been investigated with the NBS developed Raman microprobe. This research parallels both chemical and other microanalytical studies aimed at elucidating the physico-chemical and structural changes of the bone matrix as a function of bone maturation. The samples studied consist of embryonic, young (5-week) and fully-matured (1-year) chicken leg bone for which vibrational Raman spectra have been obtained from microscopic bone particles and thin sections of chick leg bone. These spectra provide qualitative (and semiquantitative) molecular information on the progressive changes in the mineral and organic composition of these tissues heretofore not further exploitation of the micro-Raman technique as a unique tool for the microchemical study of biological mineralization.

712,201

PB86-242245
(Order as PB86-242179, PC **A04**/MF **A01**)
Veterans Administration Medical Center, Omaha, NE.
Storage and Pre-Neutron Activation Analysis Treatment for Trace Element Analysis in Urine.
A. J. Blotcky, and E. P. Rack. 29 Oct 85, 10p
Prepared in cooperation with Nebraska Univ.-Lincoln.
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v91 n2 p93-102 Mar-Apr 86.

Keywords: Storage, *Biomedical sampling, *Trace element analysis, *Neutron activation analysis, *Urinalysis.

The problems regarding storage and pre-neutron activation analysis treatment for the elements aluminum, calcium, vanadium, selenium, copper, iodine, zinc, manganese, and magnesium in a urine matrix are reviewed. The type of collection and storage procedure and pre-neutron activation analysis treatment of urine depend on the specific trace element; that is, its inherent physical and chemical properties. Specifically polyethylene in teflon containers are the most suitable for general determinations. Whether any preservative is added would depend upon the stability of the trace element and its tendency for surface adsorption. Preferably preservatives should contain no radioactivatable elements for maximum efficacy. Freeze drying or packing urine shipments under dry ice needs to be explored on an individual basis. Each pre- or post-neutron activation analysis treatment is specific and optimized for the trace element analyzed.

712,202

PB87-161709 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Calcium Phosphate Saturation Levels in Ultrafiltered Serum.
Final rept.,
N. Eidelman, L. C. Chow, and W. E. Brown. 1987, 8p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Calcified Tissue International 40, p71-78 1987.

Keywords: *Calcium phosphates, Serum(Blood), Tissues, Chemical analysis, Reprints.

Calcifications occurring in arteriosclerotic plaque and other pathological deposits are important health concerns, and the nature of these deposits and their mechanisms of formation warrant investigation. Crystals of the relevant calcium phosphates were equilibrated with the undiluted ultrafiltered human serum (u.f.s.) at 37 degrees C by constant stirring and periodically removing samples for calcium and phosphate analysis and for pH measurement. The ion activity products of DCPD and OCP in u.f.s. under CO2 indicate that the concentrations of calcium and phosphate complexing agents (except bicarbonate) are quite low.

712,203

PB87-219150 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Calcium Phosphate Phase Transformations in Serum.
Final rept.,
N. Eidelman, L. C. Chow, and W. E. Brown. 1987, 9p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Calcified Tissue International 41, p18-26 1987.

Keywords: Reprints, *Calcium phosphate phase transformations, *Dicalcium phosphate dihydrate, Hydroxyapatite, Octacalcium phosphate, Serum, Ultra filtered serum.

A better knowledge of the pathological calcification mechanisms should provide a rational basis for their control. In the present study, dicalcium phosphate dihydrate (DCPD, CaHPO4-2H2O) was used as a source of calcium and phosphate ions to investigate the mechanism of formation of more basic and more insoluble calcium phosphates in ultrafiltered serum (u.f.s.) DCPD crystals were suspended in u.f.s. at 37 C by constant stirring; samples were removed periodically for calcium and phosphate analysis and pH measurement. Occasionally, samples of solids were removed for X-ray diffraction. The experiments were carried out both with and without a 5.5% CO2 atmosphere. After initially becoming saturated with DCP, the u.f.s. composition changed and became saturated with respect to octacalcium phosphate (OCP, Ca8H2(PO4)6-5H2O). At this point OCP crystals were detected in the solid phase by X-ray diffraction.

712,204

PB87-233797 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Distribution-Free Tolerance Limits Using a Covariate with Clinical Chemistry Applications.
Final rept.,
K. R. Eberhardt, and R. W. Mee. 1986, 4p
Pub. in Proceedings of 1986 Biopharmaceutical Section of the American Statistical Association, Chicago, IL., August 15-18, 1986, p48-51.

Keywords: *Clinical chemistry, Regression, Statistical data, *Tolerance interval, Covariate, Order statistics, Standard Reference Material.

A solution is prepared by adding a fixed amount of water to a mass X of solute. Let Y denote the measured concentration of a particular analyte in the resulting solution. The relation between Y and X is modeled as linear regression through the origin, Y = thetaX + e, where e is random measurement error and X is observed without error. The problem consists of setting tolerance limits for the true analyte concentration thetaX with respect to a nonnormal population of masses, X. The available data consist of a small sample of (Xi,Yi) pairs (i = 1,...,n), plus a large sample of masses Xi (i = n+1,...,N). The limits for the distribu-

tion of concentration are based on order statistics of X and an estimate of theta. The problem arose in setting tolerance limits for a human serum standard reference material at the National Bureau of Standards. The authors solution has application to other tolerance limit problems where data on a covariate may be obtained inexpensively.

712,205
PB88-120928 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Determination of Retinol, alpha-Tocopherol, and beta-Carotene in Serum by Liquid Chromatography with Absorbance and Electrochemical Detection.
Final rept.,
W. A. MacCrehan, and E. Schonberger. 1987, 8p
Pub. in Clinical Chemistry 33, n9 p1585-1592 1987.

Keywords: *Blood serum, Electrochemical detection, Liquid chromatography, Provitamin A, Retinal, Vitamin A, Reprints, *Tocopherol.

The authors describe a method for the determination of retinol, a-tocopherol, and Beta-carotene in serum, using a liquid-chromatographic separation with wavelength-programmed ultraviolet/visible absorbance and amperometric electrochemical detection with a glassy carbon eletrode. After protein denaturation and addition of an internal standard, tocol, 250-microl samples are twice extracted with hexane. The reversed-phase, gradient-elution chromatographic separation provides baseline resolution of: the all-trans isomer of retinal from the cis isomers, alpha from gamma-tocopherol, and all-trans-Beta carotene from alpha-carotene and from cis Beta-carotene isomers. The linearity of response and the detection limits for the two detectors for the three analytes are measured. A comparison of the values obtained for serum extracts shows good agreement between the absorbance and electrochemical detectors.

712,206
PB88-137070 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Clinical Electrolyte Potentiometry: Sources of Error, Reference Methods and Materials.
Final rept.,
R. A. Durst. 1985, 15p
Sponsored by National Committee for Clinical Lab. Standards, Villanova, PA.
Pub. in Proceedings of Workshop on Direct Potentiometric Measurements in Blood, Gaithersburg, MD., May 18-20, 1983, p143-157 1985.

Keywords: *Blood analysis, *Electrolytes, *Potentiometric analysis, *Errors, Electrodes, Calibration, References(Standards), Materials, pH, Gases.

A general review of the sources of error associated with the use of reference and ion-selective electrodes is presented. In the case of indicator electrodes, topics considered include types of interferences, ionic distribution and speciation, fouling, water activity, and the effect of disease states and therapy. Detailed consideration is given to the reference electrodes and the factors which affect their performance. Of primary concern is the liquid junction which is the site of most of the reference electrode problems. Factors such as the electrolyte composition and structure of the salt bridge, streaming and tip potentials, and suspension effects are discussed with suggestions for minimizing their influence on the reference electrode. Problems associated with various types of electrode drift is also treated. Finally, no matter how perfect the measurement system and solution conditions, accurate results cannot be achieved if the electrode system is not calibrated properly. Sources of calibration errors, such as preparation and matrix effects, will be discussed. The general concept of reference materials and methods is presented, followed by a more detailed discussion of present and future reference materials for pH, gases, and electrolytes.

Clinical Medicine

712,207
PB-262 609/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Potential for Exposure Reduction in Diagnostic Radiology.
Final rept.,
J. W. Motz, and M. Danos. Jul 76, 1p
Pub. in Proceedings of Digest of the Int. Conf on Medical Physics (4th), Special Issue of Physics in Canada, Ottawa, Canada, July 25-30, 1976, n32 p13.3 Jul 76.

Keywords: *Radiology, *X rays, *Diagnostic agents, Radiography, Patients, Exposure, Health physics, Reduction, Image processing.

Based on considerations of the statistical noise generated by the detection of a given number of particles in a given resolution element, a method is developed for determining the quantitative dependence of the image information content on the patient exposure. Data are given which show: (1) the minimum exposures required for the detection of image signals from six sample structures encountered in diagnostic radiology, as a function of the spatial resolution and x-ray energy, (2) the number of gray levels attainable for a given patient exposure, body thickness, and x-ray energy, and (3) the quantitative effects of x-ray grids in increasing the image contrast and gray level number, and in reducing the exposure required for the detection of a given image signal. The implications of these results for reducing exposures and for detecting low contrast objects below the visibility threshold are discussed.

712,208
PB-278 401/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Image Information Content and Patient Exposure.
Final rept.,
J. W. Motz, and M. Danos. 1978, 15p
Pub. in Med. Phys. 5, n1 p8-22 Jan/Feb 78.

Keywords: *X rays, *Radiation hazards, *Irradiation, Health physics, Radiology, Patients, Exposure, Reprints, Image processing.

Presently, patient exposure and x-ray tube kilovoltage are determined by image visibility requirements on x-ray film. With the employment of image-processing techniques, image visibility may be manipulated and the exposure may be determined only by the desired information content, i.e., by the required degree of tissue-density discrimination and spatial resolution. This work gives quantitative relationships between the image information content and the patient exposure, give estimates of the minimum exposures required for the detection of image signals associated with particular radiological exams. Also, for subject thickness larger than approximately 5 cm, the results show that the maximum information content may be obtained at a single kilovoltage and filtration with the simultaneous employment of image-enhancement and antiscatter techniques. This optimization may be used either to reduce the patient exposure or to increase the retrieved information.

712,209
PB-284 576/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Model for Evaluating the Ocular Contusion Injury Potential of Propelled Objects.
Final rept.,
R. E. Berger. 1978, 14p
Pub. in Jnl. Bioeng. 2 p345-358 1978.

Keywords: *Eye(Anatomy), *Wounds and injuries, Mathematical models, Evaluation, Impact, Projectiles, Predictions, Hazards, Product safety, Reprints, Toys, *Ocular contusion.

The existing data on experimental ocular contusion was analyzed in terms of a simple mathematical model which predicts the maximum contact force between the eye and the impacting projectile. It was shown that this force was related to the injury producing mechanism, eyeball expansion, which was widely advocated in the literature. The effect of loading rate was also accounted for in the model. A dimensional analysis allowed previous experimental data to be used to generate tolerance curves for ocular injury. The agreement between the prediction of the model and previous subjective opinions of a panel of ophthalmologists was considered to be satisfactory. When the model was used to predict the hazard potential of projectile toys which presently exist in the marketplace, it was found that the contusive injury producing capability of these products covered the full range from safe to hazardous.

712,210
PB-295 738/9
(Order as PB-295 736/3, PC **A08**/MF **A01**)
National Bureau of Standards, Washington, DC. Center for Consumer Product Technology.
System for Assessing Eye Injury Potential of Propelled Objects,
R. E. Berger. 27 Sep 78, 8p
Included in Jnl. of Research of the National Bureau of Standards, v84 n1 p9-20, Jan-Feb 79.

Keywords: *Eye(Anatomy), *Wounds and injuries, Mathematical models, Tests, Assessments, Safety, Toys.

A test system is proposed to evaluate the ocular injury potential of propelled objects. The object in question is fired into a thin rubber pad, and the force of impact and the rise time are measured. For a set of test projectiles, the response of the system was shown to correlate with the likelihood of injury, as predicted by a mathematical model. The response was further related to ocular injury tolerance curves which were generated by the math model using data from impact injuries to real eyes.

712,211
PB-298 622/2 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Product Safety Technology Div.
Electrical Injuries - A Literature Review.
Y. C. Wu. Feb 79, 37p NBSIR-79-1710
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Injuries, *Electrical shock, *Burns(Injuries), Hospitals, Reviews, Humans, Physiological effects, Statistical data, Recommendations, Threshold(Physiology), Electrolytes, Health statistics, Literature surveys.

The report reviews and discusses the frequency, severity and mechanisms of the electrical injury as reported in the literature. Detailed national statistics on the frequency and severity of specific types of electrical injury are not available, however, limited data from the literature and from a survey of a few randomly selected hospitals are summarized and presented. The mechanisms of injury involve the physical and physiological parameters of the electrical source and the human body. These parameters are discussed according to known principles. Injury to the human body, initiated by the flow of electrical current, is the consequence of disturbance, change or destruction of physiological entities such as nerves, blood vessels, organs, muscles and bones. For interpreting the electrical injury phenomena two theories exist in the literature. One theory suggests that electrical injury is thermal in nature and is caused by the Joulean heat (I2R) resulting from current flow through the body. The other theory suggests that injury is caused by specific electrical effects such as electrolyte shifts that are induced by the current flow. Evidence to support or dispute both theories was found in the literature. Due to the lack of quantitative data, however, the validity of these theories can only be assessed qualitatively.

712,212
PB-300 449/6 PC **A08**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.
Proceedings of a Conference on Neutrons from Electron Medical Accelerators.
H. T. Heaton, and R. Jacobs. Sep 79, 175p NBS-SP-554
Sponsored in part by Bureau of Radiological Health, Rockville, MD., and American Association of Physicists in Medicine, Chevy Chase, MD. Library of Congress catalog card no. 79-600133. Held at Gaithersburg, Maryland on April 9-10, 1979.

Keywords: *Neutrons, *Radiotherapy, *Meetings, Medical equipment, Electron accelerators, Gamma rays, Regulations, Neutron flux, X rays, Radiation effects, Standards, Biological effects.

These proceedings are the compilation of 18 papers presented at the Conference on Neutrons from Electron Medical Accelerators held in Gaithersburg, MD on April 9 and 10, 1979. The topics addressed include properties of high energy beams for radiotherapy, regulations, biological interpretation, physical measurements and calculations, and neutron reduction techniques.

712,213
PB80-180318 Not available NTIS
National Bureau of Standards, Washington, DC.

Accuracy Requires Precision: A Comment on Understanding and Using Statistics in Nuclear Medicine.
Final rept.,
R. Colle. Mar 80, 3p
Pub. in J. Nucl. Med. 21, n3 p90-92 Mar 80.

Keywords: *Statistical data, *Accuracy, Clinical medicine, *Nuclear medicine.

This letter to the Editor is in regards to a recent article by Levin (J. Nucl. Med 20: 550-558, 1979) who reviewed some of the fundamental principles of statistics as they apply to the estimation of measurement uncertainties. Levin unfortunately, has reinforced a common misunderstanding of the meaning of 'accuracy'. He uses the extremely restrictive definition of accuracy as equivalent to the absence of bias, and contends that accuracy is independent of precision. This letter clarifies the distinction between precision and bias, and their relation to accuracy. It points out that accuracy requires precision, and that an understanding of this furthers the understanding of the measurement process and the requirements for obtaining accurate measurements.

712,214
PB81-126104 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanism for Incorporation of Carbonate into Apatite,
N. S. Chickerur, M. S. Tung, and W. E. Brown. 1980, 8p
Contract PHS-DE-05030
Pub. in Calcified Tissue International 32, p55-62 1980.

Keywords: *Calcium phosphates, *Hydrolysis, Impurities, Sodium, Enamels, Teeth.

Octacalcium phosphate (Ca8H2(PO4)6.5H2O) is considered to be a precursor in the formation of apatite in bones and teeth; a crucial step for incorporation of impurities appears to occur during its hydrolysis. The present study examines the role that octacalcium phosphate plays in the process of incorporation of carbonate into apatite. Chemical, X-ray diffraction, and infrared techniques were used. When octacalcium phosphate is hydrolyzed in the presence of sodium and carbonate ions in aqueous media, approximately one sodium and one carbonate ion seem to substitute for a calcium and phosphate ion, respectively, in forming apatite, and the a axis is shortened. The infrared spectrum of the product indicates that the carbonate is in the type B site, which is presumed to be a phosphate site. This mechanism is of particular importance since the presence of carbonate in human enamel appears to be related to caries susceptibility. A structural mechanism for the incorporation of impurities during hydrolysis of octacalcium phosphate is presented.

712,215
PB81-169963 Not available NTIS
National Bureau of Standards, Washington, DC.
Formalism for Calculation of Absorbed Dose to a Medium from Photon and Electron Beams.
Final rept.
R. Loevinger. Feb 81, 12p
Pub. in Medical Physics 8, n1 p1-12 Jan-Feb 81.

Keywords: *Ionization chambers, *Beams(Radiation), *Photons, *Electrons, Radiotherapy, Reprints.

A formalism is derived that relates the absorbed dose to a medium from photon and electron beams to the photon calibration factor of an ionization chamber. The formalism is applicable to the photon and electron beam energies that are currently of interest in radiation therapy. It is developed in terms of a cavity-gas calibration factor, a quantity characteristic of the chamber and independent of the energy of the calibration beam assuming the energy expended per ion pair is energy independent. The cavity-gas calibration factor can be obtained from a chamber calibration performed in terms of exposure, absorbed dose to water, or air kerma. The perturbation corrections due to replacement of the surrounding medium by the chamber wall and cavity are identified as ratios of the photon energy fluence, or the electron fluence, at the position of the chamber center. The unmanageable complexities of a theory that covers an ionization chamber made of several materials are avoided by limiting the development to a chamber made of a single material with the expectation that the inhomogeneities of real chambers can be treated as perturbations. Attention is called to certain theoretical aspects of this dosimetry development that do not appear to have been previously recognized.

712,216
PB81-179053 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC.
Implant Retrieval: Material and Biological Analysis.
Final rept.
A. Weinstein, D. Gibbons, S. Brown, and W. Ruff.
Jan 81, 790p NBS-SP-601
Library of Congress catalog card no. 80-600194. Prepared in cooperation with Tulane Univ., New Orleans, LA., Case Western Reserve Univ., Cleveland, OH., and California Univ., Davis, CA.
Proceedings of a conference Held at the National Bureau of Standards, Gaithersburg, maryland on May 1-3, 1980.

Keywords: *Meetings, *Implantation, *Medical equipment, Information systems, Orthopedic equipment, Cardiovascular system, Failure, Polymers, *Implant retrieval.

The book contains the proceedings of a conference on implant retrieval and analysis as well as a report on a workshop concerned with implant retrieval systems. Twenty-six invited papers that were presented at the conference are included. Four subject areas are specifically addressed: bulk phenomena, release phenomena, interface phenomena, and information utilization. Implants of both orthopaedic type and cardiovascular type were considered at the conference. Data on the failure modes of implants were presented. Specific consideration of biocompatibility problems was included. Several operating data/information systems were described in detail. Recommendations were made in the workshop concerned with uniformity and standardization of information systems dealing with implant retrieval data.

712,217
PB81-238503 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Heat Transfer Analysis of Scald Injury.
Final rept.
R. L. Palla. Jul 81, 69p NBSIR-81-2320

Keywords: *Burns(Injuries), *Heat transfer, Thresholds(Physiology), Sensitivity, Exposure, Tissues(Biology), Skin(Anatomy), Criteria, Fluids, Models.

Numerical solutions for skin tissue temperature during scald injury events are obtained and utilized in conjunction with a thermal injury criterion, to predict critical exposure levels for various heated fluids. A one-dimensional tissue model of the type used by Love is employed to determine the initial tissue temperature distribution. The bio-heat equation for tissue heat transfer is then solved via an implicit finite difference technique, subject to convective heating and cooling at the surface. The sensitivity of the critical exposure level to variations in tissue properties and convective heating coefficients is investigated. Thermal injury thresholds are presented for various fluids along with bounds to reflect uncertainty in assumed tissue properties. The results obtained are in good agreement with existing experimental scald injury data.

712,218
PB82-118340 Not available NTIS
National Bureau of Standards, Washington, DC.
Compilation and Evaluation of Radiation Depth Dose Data from Electron Accelerators Used for Radiotherapy: Experiences of a Pilot Data Project in a Hospital Environment.
Final rept.
S. P. Fivozinsky, and J. A. Purdy. Jul 81, 5p
Pub. in Proceedings of International CODATA Conference Data for Science and Technology (7th), Kyoto, Japan, October 8-11, 1980, p50-54 Jul 81.

Keywords: *Radiotherapy, *Radiation dosage, Linear accelerators, Electrons, Hospitals, National government, National Bureau of Standards.

The Office of Standard Reference Data of the U.S. National Bureau of Standards is supporting a pilot data project to provide evaluated compilations of central axis absorbed dose data for the use of the radiotherapy community. The project is presently concentrating on the compilation of measured photon and electron data from linear accelerators in the energy range 4 to 25 MeV. Data sets used in the study include published values and data obtained directly from over 100 participating institutions. This paper discusses the reasons for establishment of the project, methods of evaluation, formatting and dissemination, probable impact on the medical radiation physicist and radiation oncologist, and the unique aspects of a physics data center located in a clinical environment.

712,219
PB82-118415 Not available NTIS
National Bureau of Standards, Washington, DC.
Computer Based File of X-ray and Electron Beam Central Axis Depth Dose Data for Use in Radiation Therapy.
Final rept.
J. A. Purdy, W. B. Harms, and S. Fivozinsky. 1980, 10p
Pub. in Proceedings of Annual Symposium Computer Applications in Medical Care (4th), Washington, DC., November 2-5, 1980, p94-103 Nov 80.

Keywords: *Meetings, *Radiotherapy, *Dosimetry, Computers, X rays, *Medical computer applications.

The central axis absorbed dose data for x-ray and electron beams generated by linear accelerators in the energy range 4 thru 25 MV are being compiled. The compilation includes specific x-ray beam parameters (surface doses, output factors, percent depth doses, tissue-phantom ratios, and wedge factors) as well as electron beam parameters (percent depth doses and output factors). The compilation includes published data sets of these parameters and those obtained directly from over 100 institutions participating in the study. The data are grouped by accelerator model and input into computer files that provide a standard format suitable for intercomparisons. The software used to construct the computer files and to manipulate the data is discussed. Selected examples of the average values of parameters obtained to date with the standard deviations, the coefficients of variation, and the maximum and minimum values will be presented for several different linear accelerator models.

712,220
PB82-133968 Not available NTIS
National Bureau of Standards, Washington, DC.
Brain Destruction Alone Does Not Elevate Brain Aluminum.
Final rept.
R. D. Traub, T. C. Rains, R. M. Garruto, and D. C. Gajdusek. and C. J. Gibbs. Aug 81, 5p
Pub. in Neurology 31, n8 p986-990 Aug 81.

Keywords: *Aluminum, *Alzheimers disease, *Atomic spectroscopy, *Huntingtons chorea, Brain, Tissues(Biology), *Neurologic diseases.

Graphite furnace atomic-absorption spectroscopy was used to measure aluminum concentrations in brain samples from 33 patients dying from a variety of neurologic diseases. Four samples from patients dying of nonneurologic causes also were studied. Nine samples (one from each of nine patients) of Creutzfeldt-Jakob disease brain contained normal amounts of aluminum. Aluminum was increased in 9 of 18 brain specimens with seven different pathologic processes. This included three of seven Alzheimer disease, two of three Huntington disease, two of two Parkinson disease, one of one progressive supranuclear palsy, one of one acoustic neuroma, one of two cerebrovascular disease, and one of two Guamanian amyotrophic lateral sclerosis (ALS). Aluminum was normal in the remaining samples (four normal, two ALS, one multiple sclerosis, one Pick disease, and two Guamanian parkinsonism-dementia). The significance of high aluminum values is not clear, but the normal values from the Creutzfeldt-Jakob cases imply that neuronal destruction per se need not lead to accumulation of aluminum in the brain.

712,221
PB82-178278
(Order as PB82-178146, PC **A09**/MF **A01**)
Atomic Industrial Forum, Inc., Washington, DC.
Traceability Programs for Nuclear Medicine.
D. B. Golas. Feb 82, 12p
Sponsored in part by National Bureau of Standards, Washington, DC.
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p99-110 1982.

No abstract available.

712,222
PB83-134221 Not available NTIS
National Bureau of Standards, Washington, DC.

Role of the Standards Laboratory in Brachytherapy.
Final rept.
R. Loevinger. 1981, 10p
Pub. in Proceedings of Recent Advances in Brachtherapy Physics, Sturbridge, MA., October 5-6, 1979, p22-31 1981.

Keywords: Calibrating, Standards, Cesium 137, Dosimetry, Iodine isotopes, *Brachytherapy.

The role of the standards laboratory in the medical use of brachytherapy (interstitial) sources is to provide access to the International Measurement System by providing calibration against verified national dosimetry standards. It is proposed that in the United States clinical brachytherapy sources shall be calibrated by comparison with sources of the same kind that have been calibrated at the National Bureau of Standards in terms of exposure rate at one meter in air. It is argued that the quantities activity, exposure-rate constant, and equivalent mass of radium are unnecessary in brachytherapy dosimetry, and for reasons of accuracy and economy of effort should be eliminated in favor of exposure rate at one meter in air.

712,223

PB83-139055 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparative Measurements of Zinc-70 Enrichment in Human Plasma Samples with Neutron Activation and Mass Spectrometry.
Final rept.
M. Janghorbani, V. R. Young, J. W. Gramlich, and L. A. Machlan. 1981, 9p
Grant NSF-PFR79-19112
Pub. in Clinica Chimica Acta 114, p163- 171 1981.

Keywords: *Zinc, *Radioactive isotopes, *Blood plasma, Metals, Measurement, Humans, Metabolism, Neutron activation analysis, Mass spectroscopy, Reprints.

Radiochemical neutron activation analysis (RNAA) is compared with isotope ratio mass spectrometry (IRMS) for the measurement of 70ZN isotopic enrichment in human plasma following oral administration of the isotope. It is shown that both techniques are suitable for this purpose, although IRMS yields more precise data. Each method, with its advantages and limitations can be realistically employed to study kinetics of appearance of 70Zn in plasma obtained during conduct of human metabolic studies.

712,224

PB83-183517 Not available NTIS
National Bureau of Standards, Washington, DC.
System for Electron Therapy Dosimetry Surveys with Thermoluminescence Dosimeters.
Final rept.
C. G. Soares, M. Ehrlich, T. N. Padikal, and Z. C. Gromadzki. 1982, 7p
Pub. in International Jnl. of Applied Radiation and Isotopes 33, p1007-1013 1982.

Keywords: *Dosimetry, *Radiotherapy, Thermoluminescence, Responses, Accumulation, Reprints.

Radiation-therapy dosimetry surveys employing thermoluminescence dosimeters (TLDs) are now being considered for high-energy electron beams. Using a system of individually calibrated pressed LiF TLDs in a water and a polystyrene phantom, we established that the distortions of depth-dose distributions in non-conducting materials previously observed at high absorbed doses and high dose rates were not detectable in the present geometry at doses and dose rates as much as 40 times higher than those employed in radiation therapy. The system was then used to measure TLD response in water and in polystyrene in the nominal electron-energy range from 7 to 18 MeV. In the water phantom, the well-known trend for TLD response to decrease with increasing electron energy was observed. In the polystyrene phantom, TLD response was found to be independent of electron energy.

712,225

PB83-235416 Not available NTIS
National Bureau of Standards, Washington, DC.
Kerma Factors of Elements and Compounds for Neutron Energies Below 30 MeV.
Final rept.
R. S. Caswell, J. J. Coyne, and M. L. Randolph. 1982, 36p
Sponsored in part by Department of Energy, Washington, DC. Office of Health and Environmental Research. and National Cancer Inst. Bethesda, MD.
Pub. in International Jnl. of Applied Radiation and Isotopes 33, n11 p1227-1262 1982.

Keywords: *Dosage, *Neutrons, Therapy, Absorption, Reprints, Cancer, Kerma factors.

Based on recently calculated tables of neutron kerma factors for 19 elements, kerma factors for 44 compounds have been calculated. The neutron energy range covered extends from 8 eV to 30 MeV. Because of the increased uncertainty in the nuclear data used, care must be taken when the tables are applied above 15 MeV. The user must also be careful when applying these results at low neutron energies because of the difficulties in associating kerma values with molecular materials at low energies.

712,226

PB83-252429 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Pilot National Environmental Specimen Bank - Analysis of Human Liver Specimens.
Final rept.
R. Zeisler, S. H. Harrison, and S. A. Wise. Aug 83, 138p NBS-SP-656
Library of Congress catalog card no. 83-600561.
Sponsored in part by Health Effects Research Lab., Research Triangle Park, NC.

Keywords: *Liver, *Absorption spectra, Homogenizing, Gas chromatography, Humans, Neutron activation analysis, Trace elements, *Specimen banks.

The work was performed under a joint EPA/NBS research program to develop state-of-the-art protocols for the sampling, storage, and analysis of biological and environmental-type matrices as part of a Pilot National Environmental Specimen Bank program. The purpose of this report is to summarize the experience and results obtained for the first sample type, human liver. The sample collection protocol was evaluated with respect to costs and suitability of donor selection criteria. An analytical protocol was implemented for the determination of trace elements in the liver samples using the techniques of atomic absorption spectrometry, isotope dilution mass spectrometry, neutron activation analysis, and voltammetry. Individual sections of this report describe in detail the procedures used and the results obtained for each of these analytical techniques. The analytical results for the determination of 31 trace elements in 36 liver specimens are presented and discussed. Analytical methodology for the measurement of organochlorine compounds is also described.

712,227

PB84-104181 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Studies of Interface Bondings on Implant Alloys.
Rept. for Oct 81-Oct 82.
A. C. Fraker, A. W. Ruff, K. J. Bundy, J. D. Smith, R. W. Penn, and A. C. Van Orden. Sep 83, 98p NBSIR-83-2736
Sponsored in part by Food and Drug Administration, Silver Spring, MD. Bureau of Medical Devices.

Keywords: *Cements, *Bones, *Bonding strength, *Alloys, Implantation, Surgical transplantion, Torsional strength, Surfaces, Mechanical properties, Interfacial tension, Polymethyl methacrylate, Numerical solution, Steel 316L, Titanium alloy 6Al 4V, Biomaterials.

The work dealth primarily with testing metal/bone cement interface strength using the torsion test which was developed earlier in this project and described in NBSIR 82-2563. The test proved to be a good one and to be reasonably reproducible. The parameters studied to determine their influence on the metal/bone cement interface strength were material type, specimen surface roughness, sterilization and passivation treatments, cure time prior to testing and effects of ultra clean surfaces. Metals used were the alloys, Co-Cr-Mo, Ti-6Al-4V and 316L stainless steel. The bone cement used was Howmedica Surgical Simplex P which is a poly(methy1 methacrylate) type. Seventy-seven tests were conducted. The description of these tests, analysis of the results and a discussion of related studies in the technical literature are given in the technical report entitled 'An Experimental Investigation of the Torsional Strength of Metal/Bone Cement Interface'.

712,228

PB84-165083 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
Information on Polymeric Materials Used in Orthopedic Devices.
J. M. Crissman, and G. B. McKenna. Jan 84, 134p NBSIR-84-2820-FDA
Sponsored in part by Food and Drug Administration, Silver Spring, MD. Bureau of Medical Devices.

Keywords: *Orthopedic equipment, *Plastics, *Implantation, Mechanical properties, Acrylic resins, Polymethyl methacrylate, Specifications, Polyethylene, Wear, Bones.

This report provides information on the two polymeric materials most commonly used in the fabrication of orthopedic implants. The work was done as part of Task 80-01 NBS-FDA/BMD Interagency Agreement. The two materials described are ultra high molecular weight polyethylene UHMWPE and polymethylmethacrylate (PMMA) bone cement. The report contains information on such subjects as specifications (ASTM), raw materials characterization, processing, morphology, mechanical properties, and wear.

712,229

PB84-223965 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement Assurance Studies of High-Energy Electron and Photon Dosimetry in Radiation-Therapy Applications.
Final rept.
M. Ehrlich, and C. G. Soares. 1981, 8p
Pub. in Proceedings of Intercomparison Procedures in Dosimetry of High-Energy X-ray Electron Beams, Vienna, Austria, April 2-6, 1979, IAEA-TECDOC-249, p75-88 1981.

Keywords: *Radiology, *Dosimetry, Cobalt 60, Radiation dosage, Bremsstrahlung, Gamma rays, X rays, Thermoluminescent dosemeters.

This is a brief review of surveys on the dosimetry of radiation-therapy beams by the National Bureau of Standards (NBS). Covered are the NBS ferrous-sulfate (Fricke) dosimetry service, a recently completed survey carried out with thermoluminescence dosimeters (TLD) on the dosimetry in cobalt-60 teletherapy beams, and plans for a TLD survey of dosimetry in high-energy bremsstrahlung beams.

712,230

PB85-100212 Not available NTIS
National Bureau of Standards, Washington, DC.
U.S. National Bureau of Standards/Atomic Industrial Forum Radioactivity Measurements Assurance Program.
Final rept.
D. B. Golas, and J. M. Calhoun. 1983, 6p
Pub. in International Jnl. of Nuclear Medicine and Biology 10, n2/3 p163-168 1983.

Keywords: *Radioactivity, *Industrial plants, *Radiochemistry, Standards, Drugs, Samples, Reprints, *Standard reference materials, Nuclear medicine, NRC.

Beginning in the early 1970's, the U.S. National Bureau of Standards (NBS) and the Atomic Industrial Forum (AIF), representing several of the major bulk suppliers of radiochemicals and producers of radiopharmaceuticals, have cooperated in a measurements assurance program in the field of nuclear medicine. Approximately 10 different samples (Standard Reference Materials) of known but undisclosed value ('blinds') are distributed to each participating company each year. Participants then report their measured value to NBS and a report is issued showing how well their measurements agree with those of NBS. Consequences of this program are (i) each company's measurements are in better agreement with those of other participating companies, (ii) measurement uncertainties have been reduced, (iii) traceability to NBS demonstrates a participant's measuring abilities when submitting New Drug Applications to the U.S. Food and Drug Administration (FDA), and (iv) evidence of compliance with requirements of the U.S. Nuclear Regulatory Commission (NRC), the U.S. Pharmacopeia and other Federal and State agencies is provided.

712,231
PB85-102143 Not available NTIS
National Bureau of Standards, Washington, DC.
Programme of the United States Bureau of Standards in Dosimetry Standards for Neutron Radiation Therapy.
Final rept.
L. J. Goodman, J. J. Coyne, and R. S. Caswell. 1984, 11p
Pub. in Proceedings Advances in Dosimetry for Fast Neutrons and Heavy Charged Particles for Therapy Applications, Vienna, Austria, June 14-18, 1982, IAEA-AG-371/8, p217-227 1984.

Keywords: *Radiotherapy, *Dosimetry, *Standards, Gamma rays, Neutrons, Calibration.

This report discusses two aspects of the neutron dosimetry program at the United States National Bureau of Standards (NBS), namely the plans and progress towards establishing dosimetry standards for neutron radiation therapy, and an investigation of the neutron and gamma-ray tissue kerma rates from a 252Cf source. Neutron radiation therapy is being clinically tested at a number of centers in the world. To maximize the chances of success of this radiation therapy modality, good physical dosimetry is needed. To facilitate exchange of therapy experience between institutions, the United States dosimetry standards base must be accurate and consistent with the international standards system. The purpose of the NBS program is to improve the accuracy and consistency of measurements of absorbed dose for neutron radiation therapy by providing national dosimetry standards and improved data on neutron interactions with tissue and tissue-equivalent materials. A longer-term goal is to develop a calibration facility at NBS where neutron dosimeters can be calibrated and their energy dependence studied.

712,232
PB85-129609
(Order as PB85-129591, PC **A03**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Exposure Standardization of Iodine-125 Seeds Used for Brachytherapy.
T. P. Loftus. 1 May 84, 9p
Included in Jnl. of Research of the National Bureau of Standards, v89 n4 p295-303 Jul-Aug 84.

Keywords: *Calibration, *Radiotherapy, Exposure, Standards, X rays, *Iodine 125, Ionizing radiation.

A method for calibrating iodine-125 seeds in terms of exposure has been established. The standard free-air ionization chamber, used for measuring soft x rays, was chosen for the measurements. Arrays of four to six seeds were used to enhance the ionization-current-to-background-current ratio. Seeds from an array were measured individually in a re-entrant chamber. The quotient of the exposure rate for the array by the sum of the ionization currents in the re-entrant chamber is the calibration factor for the re-entrant chamber. Calibration factors were established for three types of iodine-125 seeds. The overall uncertainty for the seed exposure calibrations is less than 6%.

712,233
PB85-229847 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Energy Dependence of Radiochromic Dosimeter Response to X-rays and Gamma Rays.
Final rept.
W. L. McLaughlin, A. Miller, R. M. Uribe, S. Kronenberg, and C. R. Siebentritt. 1985, 28p
Sponsored by International Atomic Energy Agency, Vienna (Austria), and Federal Emergency Management Agency, Washington, DC.
Pub. in Proceedings of the International Symposium on High-Dose Dosimetry, Vienna, Austria, October 8-12, 1984, p397-424 1985.

Keywords: *Dosimetry, X rays, Gamma rays, Tissues(Biology), Films, Energy, *Radiochromic dosimeters.

Liquid, solid and liquid-core 'fibre-optics' radiochromic dosimeters were studied for their spectral sensitivity to ionizing photons in the energy range 10 keV to 100 MeV. By comparison of ratios of mass energy-absorption coefficients and mass collision stopping powers of water and biological tissues (fat, muscle and bone), approximate errors due to energy dependence for typical 60Co gamma-ray scattered spectra and to rough simulation of tissues by means of certain additives to radiochromic dosimeters could be estimated. Design of approximate tissue-simulating dosimeters is accomplished by comparing experimental and computational results for various radiochromic films, liquid solutions and liquid-core waveguides. Several experimental tests of energy dependence were made using X- and gamma-rays. For water-, fat-, muscle- or bone-simulation over the photon energy range, chlorides, bromides, triethyl phosphate or dimethyl sulphoxide or a combination of these are added in appropriate concentrations.

712,234
PB86-122991 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Effects of Sequential Calcium Phosphate-Fluoride Rinses on Dental Plaque, Staining, Fluoride Uptake, and Caries in Rats.
Final rept.
R. J. Shern, L. C. Chow, K. M. Couet, A. Kingman, and W. E. Brown. 1984, 5p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 63, n12 p1355-1359 Dec 84.

Keywords: *Fluorides, *Preventive dentistry, *Dentistry, Enamel, Plaque, Reprints, Dental cavies.

Oral rinses which included (1) an acidic calcium phosphate solution containing 0.7 M Ca, 1.9 M PO4, and saturated with respect to CaHPO4.2H2O, and with a pH of 2.0, followed by (2) a 0.52 M fluoride solution, from NaF or SnF2, were provided to rats once daily for seven days. The investigation consisted of two studies: In the first study, the amounts of dental plaque on the tooth surfaces and fluoride concentrations in the outer enamel were assessed seven days after the last treatment; in the second study, the extent of dental caries was evaluated seven weeks after the last treatment. All rinse sequences containing fluoride provided significant caries protection. The acidic calcium phosphate treatment markedly enhanced the ability of the enamel to acquire fluoride without change of surface morphology. Only the rinse sequences that included stannous fluoride showed significant plaque suppression.

712,235
PB86-142817 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Experimental Basis for Absorbed-Dose Calculations in Medical Uses of Radionuclides.
Final rept.
J. S. Robertson, M. J. Berger, J. P. Jones, K. A. Lathrop, J. W. Poston, K. N. Vanek, R. G. Zamenhof, and T. Fearon. 1985, 111p
Pub. in NCRP (National Council on Radiation Protection and Measurements) Report No. 83, 111p 1985.

Keywords: *Dosimetry, Reviews, Estimates, Absorbtion, Dosage, Reprints, *Radionuclides.

The report reviews the status of the methods used to estimate the radiation absorbed doses to humans from internally deposited radionuclides with the emphasis on medical applications.

712,236
PB86-200714 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Modification of Cements Containing Vanillate or Syringate Esters.
Final rept.
G. M. Brauer, J. W. Stansbury, and D. Flowers. 1986, 7p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Dental Materials 2, p21-27 1986.

Keywords: *Dental materials, Dental supplies, Toxicity, Zinc oxides, Esters, Fluorides, Reprints, *Vanillate/hexyl, *Syringate/ethyl-hexyl.

Addition of small concentrations of acid, metals or fluorides to vanillate or syringate dental cements was studied in order to improve their physical properties and anticariogenic behavior. Incorporation of acids into cement formulations lowers their setting time. Coating a portion of the zinc oxide powder ingredient with propionic acid offers a convenient way of adjusting the cure to a rate most suitable for clinical applications. The resulting cements are non-brittle, have high strength, low solubility and bond strongly to non-precious metals, porcelain or composites. Cements with zinc undecylate are flexible and may be useful as soft tissue packs. Metallic powders do not act as reinforcing agents for these cements. Hexyl vanillate or ethylhexyl vanillate or ethylhexyl syringate cements can be prepared by adding 0.1% to 1% fluoride salts such as NaF, ZrF4, ZnF2 or dimethylaminoethyl methacrylate hydrofluoride to the powder ingredient.

712,237
PB86-209657 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Materials.
Use of NBS (National Bureau of Standards) Standard Reference Materials in Validating Trace Element Determinations in Biological Materials.
Final rept.
R. Alvarez. 1985, 3p
Pub. in Proceedings of International Symposium on Trace Elements in Man and Animals (5th), Aberdeen (Scotland), June 29-July 4, 1984, p655-657 1985.

Keywords: Calibration, Metals, Metabolism, Bioassay, *Standard reference materials, *Biological materials, *Trace elements.

Analyses of biological materials for trace elements often disagree seriously. Yet, accurate analyses are indispensable to understand the role of trace elements in metabolic processes. One approach towards obtaining accurate trace element determinations is through the use of Certified Reference Materials such as the Standard Reference Materials issued by NBS. In general, SRM's are homogeneous stable materials with certified chemical or physical properties for use in calibrating instruments, validating laboratory data, developing methods of known accuracy, and referring data from different laboratories to a common base. Whenever possible SRM's are certified on the basis of accuracy rather than method-dependent analyses. Certified concentrations are based either on the results of a definitive method or on the concordant results of two or more independent analytical methods.

712,238
PB86-212065 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Inst. for Materials Science and Engineering.
Dielectric Phantoms for Electromagnetic Radiation.
M. G. Broadhurst, C. K. Chiang, and G. T. Davis. Mar 86, 64p NBSIR-86/3355
Sponsored by Food and Drug Administration, Rockville, MD. Center for Devices and Radiological Health.

Keywords: Electromagnetic radiation, Models(Simulation), Design, Performance, Muscles, Dielectric constant, *Health physics, *Phantoms, *Radiation effects.

The report describes the design and performance of a synthetic material that has the same dielectric heating characteristics as living muscle in the 1-1000 MHz frequency range. The dielectric phantom is a combination of four components: (1) a 50/50 solution of ethylene carbonate and propylene carbonate chosen to have the same dielectric constant as water, (2) an organic salt to provide the same conductivity as biological electrolytes, (3) flakes of polyethylene terephthalate to provide the interfacial polarization that occurs at cell walls in biological tissue and (4) an inorganic and a polymeric gelling agents to provide mechanical rigidity. The resulting composite material is more stable to biological attack and drying than are existing aqueous based phantom materials, and its dielectric properties are more closely matched to those of natural tissues over most of the frequency range of interest.

712,239
PB86-231503 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Water on Apatites.
Final rept.
D. N. Misra. 1986, 6p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Calcified Tissue International 38, p333-338 1986.

Keywords: *Calcium phosphates, *Water, *Adsorption, Bones, Area, Surfaces, Reprints, Tooth enamel.

Adsorption of water was studied gravimetrically at 23 deg C in an open system at several relative humidities on a variety of apatitic calcium phosphates including enamel, deproteinized enamel and bone mineral. The amount of adsorbed water increases linearly with the surface areas of the synthetic apatites and does not appear very sensitive to calcium to phosphorus ratio of the apatites. The adsorption results correlate very well up to about two monolayers with a conventionally determined isotherm. Higher uptake of water even by 'deproteinized' enamel or bone may be due to the presence of pore structure and imcompletely removed organic matter.

712,240
PB86-241890 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Determination of Serum Creatinine by Isotope Dilution Mass Spectrometry as a Candidate Definitive Method.
Final rept.
M. J. Welch, A. Cohen, H. S. Hertz, K. J. Ng, R. Schaffer, P. Van Der Lijn, and E. White. 1986, 5p
Pub. in Analytical Chemistry 58, n8 p1681-1685 Jul 86.

Keywords: *Chemical analysis, Chemical analysis, Mass spectroscopy, Reprints, *Creatinine, Isotope dilution, Standard reference materials, Carbon 13.

An Isotope dilution mass spectrometric (ID/MS) method for serum creatinine is described which uses creatinine-(13)C2 as the labeled internal standard. Creatinine is separated from creatine and converted to the ethyl ester of N-(4,6-dimethyl-2-pyrimidinyl)-N-methylglycine. Combined capiliary column gas chromatography and electron impact mass spectrometry are used to obtain the abundance ratio of the unlabeled and labeled (M-COOC2H5)(H) ions from the derivative. Quantitation is achieved by measurement of each sample between measurements of two standards whose unlabeled/labeled ratios bracket that of the sample. The high precision and absence of significant bias qualify the method as a candidate definitive method.

712,241
PB87-106001 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Theory of Polymer Composites.
Final rept.
R. L. Bowen, D. L. Menis, L. E. Setz, and K. A. Jennings. 1985, 13p
Sponsored by National Institutes of Health, Bethesda, MD., and American Dental Association Health Foundation, Chicago, IL.
Pub. in Posterior Composite Resin Dental Restorative Materials, p95-107 1985.

Keywords: *Dental materials, *Glass particle composites, Dentistry, Composite materials, Polymers, Reinforced plastics, Reprints.

Particulate reinforcing glass fillers are used to improve the physical properties of resins used to restore teeth. Certain aluminoborosilicate glass formulations can be phase-separated by appropriate heat treatment inducing a high-silica phase and a low-silica phase with interpenetrating, interconnected morphology of both vitreous phases. Particles of such glass can be acid-etched to produce microporosity in the surface. The depth of these interconnecting surface asperities can be controlled by the amount of strong acid used in the etching process. The amount of acid was found to correlate with the nitrogen B.E.T. (Brunauer, Emmett, Teller) surface area. When perfected, these materials are expected to yield improved dental composite resin restorative formulations having better strength, polishability, and durability under oral conditions.

712,242
PB87-181756 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Nature and Properties of Cardiovascular Deposits.
Final rept.,
B. B. Tomazic, E. S. Etz, and W. E. Brown. 1987, 11p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Scanning Microscopy 1, n1 p95-105 1987.

Keywords: Reprints, *Cardiovascular deposits, Scanning electron microscopy.

Mineral deposits from human aortas and bioprosthetic devices implanted in experimental animals show close similarities in chemical compositions, solubility and structural characteristics. Chemical analyses show compositions corresponding to a Na, Mg, CO3 substituted apatitic calcium phosphate. The data indicate that the deposits can be represented by a series of carbonate-substituted products, arising from OCP that has hydrolyzed to varying degrees. Dissolution of deposits can be described kinetically as a surface controlled rate process. The similarities in the two types of deposits suggest that they form by a common mechanism (e.g., OCP could be the precursor for both deposits).

712,243
PB88-134663 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Dielectric Phantoms for Electromagnetic Radiation.
Final rept.,
M. G. Broadhurst, C. K. Chiang, and G. T. Davis. 1987, 18p
See also PB86-212065. Sponsored by Food and Drug Administration, Rockville, MD. Center for Devices and Radiological Health.
Pub. in Jnl. of Molecular Liquids 36, p47-64 1987.

Keywords: Electromagnetic radiation, Models(Simulation), Design, Performance, Reprints, *Health physics, *Phantoms, *Radiation effects.

The report describes the design and performance of a synthetic material that has the same dielectric heating characteristics as living muscle in the 1-1000 MHz frequency range. This dielectric phantom is a combination of four components: (1) a 50/50 solution of ethylene carbonate and propylene carbonate chosen to have the same dielectric constant as water, (2) an organic salt to provide the same conductivity as biological electrolytes, (3) flakes of polyethylene terephthalate to provide the interfacial polarization that occurs at cell walls in biological tissue and (4) an inorganic and/or polymeric gelling agent to provide mechanical rigidity. The resulting composite material is more stable to biological attack and drying than are existing aqueous based phantom materials, and its dielectric properties are more closely matched to those of natural tissues over most of the frequency range from 1-1000 MHz.

Cytology, Genetics, & Molecular Biology

712,244
PB-276 205/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characterization of Crystals of L-Glutaminase-Asparaginase from Acinetobacter Glutaminasificans and Pseudomonas 7A.
Final rept.,
A. Wlodawer, J. Roberts, and J. S. Holcenberg. 1977, 4p
Pub. in Jnl. of Molecular Biology 112, p515-519 1977.

Keywords: *Glutaminase, *Pseudomonas, *Crystal structure, *Enzymes, Bacteria, Single crystals, *Acinetobacter glutaminasificans, *Asparaginase, Molecular biology, Reprints.

Single crystals of glutaminase-asparaginase from two sources have been grown. A new crystal form (III) of Acinetobacter enzyme belongs to the space group I222, a = 96.7 A, b = 112.4 A and c = 70.9 A, with one subunit in the asymmetric unit. Crystals of Pseudomonas 7A enzyme belong to the space group P2(1)2(1)2(1), a = 118.0 A, b = 131.2 A and c = 85.1 A, with a tetrameric molecule in the asymmetric unit. Both types of crystals are suitable for high resolution structure determination.

712,245
PB87-165775 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Structure of Bovine Pancreatic Trypsin Inhibitor: Results of Joint Neutron and X-ray Refinement of Crystal Form II.
Final rept.,
A. Wlodawer, J. Walter, R. Huber, and L. Sjolin. 1984, 29p
Pub. in Jnl. of Molecular Biology 180, n2 p301-329 1984.

Keywords: X ray diffraction, Molecular structure, Proteins, Reprints, *Trypsin inhibitor.

The structure of form II crystals of bovine pancreatic trypsin inhibitor has been investigated by joint refinement of x-ray and neutron data. Crystallographic R factors for the final model were 0.200 for the x-ray data extending to 1 Angstrom resolution and 0.197 for the 1.8 Angstrom neutron data. The model was strongly restrained, with 0.020 Angstrom r.m.s. departure of bond lengths from their ideal values and 0.019 Angstrom r.m.s. departure of planar groups from planarity. The resulting structure was very similar to that of crystal from I (r.m.s. deviation for main chain atoms was 0.40 Angstrom); nevertheless larger deviations were observed in particular regions of the chain. Twenty out of sixty three ordered water molecules occupy similar positions (deviation less than 1 Angstrom in both models. Eleven amide hydrogens were found to be protected from exchange after three months of soaking the crystals in deuterated mother liquor at pH 8.2. Their locations were in excellent agreement with the results obtained by two-dimensional NMR, but the rates of exchange are much lower in the crystalline state.

Dentistry

712,246
PATENT-4 243 763 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tertiary Aromatic Amine Accelerators in Acrylic Resin.
Patent.
H. Argentar. Filed 10 Mar 78, patented 6 Jan 81, 13p PB81-600035, PAT-APPL-855 275

Keywords: *Acrylates, Acrylic resins, Aminoglutethimide or paraaminophenylacetic acid, Cementing of bone, Fillings, Methacrylates, Tertiary aromatic amines, Unsaturated polyesters.

Tertiary aromatic amines derived from aminoglutethimide or paraaminophenylacetic acid act as accelerators for the peroxide catalyzed polymerization of acrylic resins, especially methacrylates, acrylates and unsaturated polyesters. The amines are characterized by good hardening, strength, color and toxicity characteristics, and are thereby particularly suited for use in the filling and restoration of human teeth and the cementing of bone.

712,247
PATENT-4 251 565 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Use of a Polyfunctional Surface-Active Comonomer and Other Agents to Improve Adhesion Between a Resin or Composite Material and a Substrate.
Patent.
R. L. Bowen. Filed 9 Feb 79, patented 17 Feb 81, 14p PB81-600037, PAT-APPL-6-010 803

Keywords: *Acrylate, Adhesion, Aminobenzoate, Composite material, Dentin, Methacrylate, Polyfunctional surface-active comonomers, Reconstructive dental work, Resin.

A family of polyfunctional surface-active comonomers which act to improve the adhesion between a resin or composite material and solid surfaces capable of binding polyvalent cations is described. These polyfunctional surface-active comonomers, or 'PolySACs', are preferably the reaction product of an epoxy acrylate or methacrylate and an aminobenzoate. The adhesion of the resin or composite material to certain solid surfaces is also improved by the preparatory treatment of these surfaces with a monobasic acid of intermediate strength followed by treatment with a mordant. In its most preferred form the invention is employed in reconstructive dental work to improve the adhesion between a resin or composite material and dentin. The

dentin is cleansed with isotomic formic acid, treated with an isotonic ferric chloride mordant and then treated with a PolySAC which is the reaction product of an oligomeric diglycidyl ether, acrylic acid and lithium orthoaminobenzoate. The resin or composite material is then applied.

712,248

PATENT-4 284 551 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tertiary Aromatic Amine Accelerators Derived from Para-aminophenethanol.
Patent.
H. Argentar. Filed 30 Nov 79, patented 18 Aug 81, 13p PB81-600043, PAT-APPL-6-098 886

Keywords: *Accelerators, Cementing of bone, High reactivity, Low toxicity, Peroxide catalyzed polymerization, Tertiary aromatic amines, Unsaturated polyesters, Vinyl monomers.

Tertiary aromatic amines derived from para-aminophenethanol act as accelerators for the peroxide catalyzed polymerization of vinyl monomers, especially methacrylates and acrylates, and for the curing of unsaturated polyesters. The amines are characterized by generally high reactivity and low toxicity, and by their yielding polymers of high strength and low color, and are thereby particularly suited for use in polymerizable or curable formulations employed in the filling and restoration of human teeth, in the preparation of colecuring denture base materials for fabricating or repairing dentures and in the cementing of bone.

712,249

PATENT-4 306 913 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Method for Preparing Microporous Glassy Filler Grains for Dental Resin Composites.
Patent.
C. Mabie, and D. Menis. Filed 6 Jun 80, patented 22 Dec 81, 36p PB81-600047, PAT-APPL-6-157 182

Keywords: *Dental composite resin restorations, Finishability, Microporous filler, System nontoxicity, X-ray opacification.

A microporous filler for dental composite resin restoration has been developed which gives greatly improved finishability, system non-toxicity and x-ray opacification. These fillers are prepared from frits obtained by the low temperature calcination of gelled inorganic 'polymers' followed by a pulsed high-heat treatment.

712,250

PATENT-4 616 073 Not available NTIS
Department of Health and Human Services, Washington, DC.
Hydrophobic Dental Composites Based on a Polyfluorinated Dental Resin.
Patent.
J. M. Antonucci. Filed 9 Aug 84, patented 7 Oct 86, 12p PB87-121232, PAT-APPL-6-639 673
Supersedes PB85-116440.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Patents, *Dental materials, *Composite materials, *Fluorine organic compounds, Polymers, Performance evaluation.

Dental resin systems prepared from polyfunctional or monofunctional highly-fluorinated methacrylate prepolymers are described. Preferred systems comprise (a) a major amount of a polyfluorinated aligomeric polyfunctional methacrylate such as (PFMA), preferably in combination with a diluent monomer such as 1,10-decamethylene dimethacrylate (DMDMA), methylmethacrylate (MMA), neopentyl dimethacrylate (NPDMA), 1,6-hexamethylene dimethacrylate (HMDMA), etc., or mixtures thereof; and (b) a minor amount of a polyfluorinated monofunctional methacrylate (PFMMA), such as 1,1-dihydropentadecafluorooctyl methacrylate (PDFOMA) as a minor or secondary diluent monomer in a non-hydroxylated bis-GMA resin system.

712,251

PB-264 343/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effects of Fluoride on Enamel Solubility and Cariostasis.
Final rept.,
W. E. Brown, T. M. Gregory, and L. C. Chow. 1977, 24p
Grant PHS-DE-02659
Pub. in Caries Res. 11, Suppl. 1, p118-141 1977.

Keywords: *Fluorides, *Enamels, *Dental caries, Solubility, Preventive dentistry, Physicochemical properties, Reprints.

The known caries-reducing effect of fluoride is frequently attributed to its ability to reduce the solubility of enamel. Solubility data are presented which show that under a caries-like condition, the difference in the amounts of enamel that would dissolve in the absence and in the presence of fluoride ions is not significant. A new theory for the physicochemical action of fluoride is proposed which is based on the view that fluoride increases the chemical potential of the component H3PO4 and decreases the chemical potential of the component Ca(OH)2 of the solution within the lesion, thereby lowering diffusion out of the enamel or hastening remineralization.

712,252

PB-265 403/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Characterization and Modification of Permselective Properties of Apatite Membranes,
M. S. Tung. 1976, 9p
Grants PHS-DE-02659, PHS-RR-05689
Pub. in J. Dental Res. 55, Spec. Issue D, pD77-D85 1976.

Keywords: *Calcium phosphates, *Dental materials, *Dental caries, Surface properties, Dentistry, Research, Reprints, Preventive dentistry, Tooth enamel.

Compressed apatite disks were used as models for tooth enamel. Their permselective properties were studied as functions of the pH of the gradient solutions, the composition of the apatites, and the pretreatments with anionic phosphate compounds and cationic proteins. The results are discussed in relation to the caries mechanisms.

712,253

PB-273 934/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Present State and Future of Macromolecules for Dental Applications.
Final rept.,
G. M. Brauer. 1977, 35p
Grant PHS-DE-40015
Pub. in Polymer-Plastic Technology (Eng), v9 n1 p87-121 1977.

Keywords: *Dental materials, *Dental prostheses, Composite materials, Adhesives, Polymers, Sealers, Dentistry, *Macromolecules, Reprints.

The oral region is subject to a small number of commonly occurring diseases, but a multitude of prosthetic devices involving macromolecular materials are required for the pertinent treatment. Plastics are especially valuable in the construction of dentures. Composite filling materials have been quite successful in areas where esthetics is of prime importance and have extended the useful life of the restoration. Adhesive liners that bond composites to tooth structure are greatly needed. New polymers will open vast horizons in maxillofacial prostheses and for implants. Additional preventive procedures will result chiefly from research. These will include sealants or lacquers that will reduce or even eliminate caries. Provided the battle against periodontal disease can also be won, it will be possible for future generations to carry the natural dentition from cradle to grave.

712,254

PB-275 392/9 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Dental and Medical Materials Section.
Properties and Interactions of Oral Structures and Restorative Materials.
Annual rept. 1 Jul 76-30 Sep 77,
J. M. Cassel. Dec 77, 96p NBSIR-77-1397
See also report dated Jul 76, PB-255 808. Sponsored in part by National Inst. of Dental Research, Bethesda, Md.

Keywords: *Dental materials, Physical properties, Surface properties, Assessments, Dentistry, Sealers, Bonding, Adhesives, Evaluation, Adhesion, Alloys, Composite materials, Preventive dentistry, *Biomaterials, Coupling agents, Restorative dentistry.

Previous encouraging results with titanium and silicone based coating agents for coupling dental resins to tooth surfaces have been reinforced with accelerated aging data. Accelerated aging data for bone bonded to bone specimens indicates that a viscous isoamyl cement may be worthy of clinical evaluation. Procedures for synthesis and purification of crystallizable aromatic aldehyde dimethacrylates are given. These highly purifiable materials offer promise as adhesion promoters through reaction with collagen and may have utility as diluent comonomers with Bis-GMA in composites or sealants. The feasibility of generating free radical induced polymerization of dental resins by using more thermally stable organic peresters or hydroperoxides and an ascorbic acid ester has been demonstrated. Design, assembly and debugging of a new multi-specimen wear instrument has been completed. Judging by their thermal expansion characteristics, high copper type amalgams show little or no evidence of phase changes at temperatures less than 90C.

712,255

PB-277 302/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Disciples of Eugene W. Skinner: Philander B. Taylor and George M. Hollenback.
Final rept.,
G. C. Paffenbarger. 1977, 6p
Sponsored in part by American Dental Association, Chicago, Ill.
Pub. in Operative Dentistry 2, n4 p148-153 1977.

Keywords: *Dental materials, Dentistry, Dental services, Research, Biographies, History, Dentists, Scientists, Reprints.

Eugene W. Skinner, Ph.D. (Physics) was pre-eminent in the science of dental materials having taught at Western Reserve and at Northwestern Universities for several decades. His textbook, 'The Science of Dental Materials' first published in 1934, has sold in excess of 100,000 copies. Two of his prominent disciples as well as students were Philander B. Taylor, A.M. (Physics) and George M. Hollenback, D.D.S., M.S.D. Taylor's researches involved denture bases, direct filling resins and the lost wax casting process. Hollenback designed a host of instruments for measuring pertinent physical properties of dental materials primarily used in restorative dentistry. The researches of all three men contributed substantially to the advancement of dental health service.

712,256

PB-280 402/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Surface Chemical Modification of Hard Tissues. I. Bone.
Final rept.,
G. M. Brauer, D. J. Termini, and S. M. Levy. Jun 77, 14p
Sponsored in part by National Inst. of Dental Research, Bethesda, Md.
Pub. in Jnl. of Dental Research, v56 n6 p646-659 Jun 77.

Keywords: *Bones, *Dentin, Graft polymerization, Surface chemistry, Revisions, Tissues(Biology), Reprints.

Surfaces of bone were modified in a controlled manner by grafting or by adding interpenetrating polymeric side chains to the bone substrate. The properties of the hard tissue surface attained varied widely. The surface alteration may improve the ability of hard tissues such as bone or dentin to adhere to restorative materials.

712,257

PB-281 801/1 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Product Safety Technology Div.
Evaluation of Children's Biting Strength for Toy Safety Criteria.
Y. C. Wu. Mar 78, 20p NBSIR-78-1452

Keywords: *Product safety, Humans, Children, Strength, Force, Teeth, Hardness, Safety, Criteria, *Bites, *Toys, Enamel(Teeth).

Children's biting strength (biting force over the occlusal area) is one of the major parameters in evaluating the bite induced broken-toy hazard. The estimation of biting strength includes the assessments of controlling

factors that influence the maximum biting force and the occlusal area. Values for biting strength are discusses accordingly. Since only the maximum biting forces (over a constant area of measuring device) of the deciduous molars or the first permanent molars are given in the literature, and since the biting strength of single opposing molars is approximately equal to that of two adjacent opposing molars, the maximum biting forces for single molars are evaluated. In the interest of child safety, the highest biting strength (biting force and area) of upper age group in a given age bracket is recommended. Other parameters, such as molar bite opening, time for sustaining maximum biting force, and the hardness of the enamel of teeth are also discussed.

712,258
PB-282 914/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Survey of the Use of Casting Alloys in Commercial Dental Laboratories. Part II. Ceramic Alloys.
Final rept.,
R. W. Bauer. Sep 77, 8p
Sponsored in part by National Association of Dental Labs., Alexandria, Va.
Pub. in Proceedings of National Association of Dental Labs. Annual Meeting, Seattle, Wash. Aug 77; Jnl. of National Association of Dental Labs. Special Issue p8-15 Sep 77.

Keywords: *Dental materials, *Casting, *Fabrication, Ceramic materials, Alloys, Precious metals, Porcelain enamals.

The current usage of various types of ceramic casting alloys in commercial dental laboratories was assessed by a comprehensive survey of 3,044 member laboratories of the National Association of Dental Laboratories. It was found that high noble, medium noble, low noble and non-precious alloys accounted for 33.3, 36.5, 5.2 and 25.0 percent respectively of the total production of ceramic units in 1975 and 1976. Data provided by NADL member laboratories indicates that there is a strong negative correlation between the total noble metal content and the degree of difficulties experienced during fabrication of porcelain fused to metal restorations.

712,259
PB-285 298/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microporous Glassy Fillers for Dental Composites.
Final rept.,
C. P. Mabie, and D. L. Menis. 1978, 38p
Grant PHS-DE-04058
Pub. in Jnl. Biomed. Mater. Res., v12 p435-472, 1978.

Keywords: *Dental materials, *Porous materials, *Fillers, Composite materials, Opacity, Frit, Reprints.

A microporous filler giving greatly improved finishability, systemic nontoxic X-ray opacification, low thermal expansion, and satisfactory translucencies has been developed for dental composite resin restorations. These fillers are prepared from frits obtained by the low-temperature calcination of gelled inorganic sols followed by a pulsed high-temperature treatment. Composites prepared from these fillers are within the range of commercial products with regard to strength and setting contraction.

712,260
PB-289 092/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Adhesive Bonding of Various Materials to Hard Tooth Tissues - Solubility of Dentinal Smear Layer in Dilute Acid Buffers.
Final rept.,
R. L. Bowen. 1978, 11p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in International Dental Jnl., v28 n2 p97-107 1978.

Keywords: *Dental materials, *Acid treatment, *Adhesion, Surface properties, pH, Buffers(Chemistry), Teeth, Dentin, Electron microscopy, Experimental data, Reprints.

Adhesion between composite restorative materials and dentin or cementum surfaces of teeth is severely limited by a smear layer (a disturbed surface region), which persists on the surface after it has been cut or mechanically disturbed. Clinically feasible means of removing this layer with acidic solutions were studied; the purpose was to find a solution of highest pH that would accomplish this removal, as evidenced by scanning electron microscopy. Buffer solutions were used, at concentrations isomotic with tissue fluids. Acids were selected on the basis of pK values, covering the range of 5.12 to 0.64. An attempt was made to avoid toxic compounds, those forming chelate complexes, and those that would precipitate solid phases due to the common ion effect. Freshly cut dentin surfaces were exposed to each solution for 30 seconds, rinsed, dried and examined with SEM. The results suggest that the smear layer on dentin can be removed by exposure to a 0.16 molar solution (isotonic with tissue fluids) of monobasic acids with pK values in the range of about 3.8 to about 2.5. Solutions having pH values of about 2.5 + or - 0.6 should be given further study.

712,261
PB-289 913/6 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. Dental and Medical Materials Section.
Properties and Interactions of Oral Structures and Restorative Materials.
Annual rept. 1 Oct 77-30 Sep 78.
J. M. Cassel. Dec 78, 96p NBSIR-78-1573
See also report dated Dec 77, PB-275 392. Sponsored in part by National Inst. of Dental Research, Bethesda, MD.

Keywords: *Dental materials, Resin cements, Catalysts, Storage, Interactions, Collagens, Bonding, Alloys, Metals, Physical properties, Mechanical properties, Dentistry, Sealers, Adhesives, Composite materials, Acrylic acid/cyano, Biomaterials, Coupling agents, *Restorative dentistry, Cyanoacrylates.

To improve the storage stability of dental composite resin systems, alternative catalyst systems to the commonly used benxoyl peroxide-tertiary amine are being developed. Increased storage stability is attainable with organic peresters or hydroperoxides but requires more efficient accelerators than the presently used amines. Ascorbic acid or ascorbyl palmitate offer promise as useful accelerators which give good biocompatibility. To develop more reactive amine accelerators with perhaps less toxicity than those currently in use, p-dimethylamino-phenylacetic acid (or ester derivatives) and dimethylaminoglutethimide were synthesized and shown to yield composite restorative specimens of good mechanical strength and color stability. A wide range of cyanoacrylates from the simplest, 2-ethyl cyanoacrylate, to the more complex type such as viscous isoamyl product have been examined for their capacity to achieve and retain bonding between acrylic resin and dentin. Very high initial bond strengths were achieved with isobutyl-2-cyanoacrylate on dentin pretreated with dilute acid but a one-month thermal cycling test in water indicated the bonding was not sufficiently stable. Initial pin on disc wear measurements with a synthetic hydroxyapatite pin have shown promise. A pattern modification to reduce variability in the alloy castability test has been developed. Variations in the number of firing cycles and amount of condensation of green porcelain have been shown to cause significant differences in dimensional characteristics on cooling of fused dental porcelain.

712,262
PB-295 145/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Contributions to Dental Science of Robert J. Nelson (Introductory Remarks).
Final rept.
G. C. Paffenbarger. Jan 79, 3p
Sponsored in part by American Dental Association, Chicago, IL.
Pub. in Jnl of Am. Coll. Dent. 46, n1, p57-59, Jan 79.

Keywords: *Dental equipment, Design, Dentistry, Awards, Research, Radiography, Benefit cost analysis, Reprints.

Dr. Robert J. Nelsen, the present Executive Officer of the American College of Dentists, was the recipient of the Callahan Memorial Award in 1978. The presentation of the Award included the benefit/cost ratio (27,000) of his invention of the turbine contra-angle dental handpiece in 1953 while he was a Research Associate of the American Dental Association at the National Bureau of Standards. The money saved by the use of the turbine contra-angle handpiece for the year 1978 would educate and set up in practice the equivalent of over 9,000 dentists. As it costs about $100,000 to educate a dentist beyond high school, and to set up a practice, approximately 1 billion dollars would be saved. Dr. Nelsen's research work in dental radiography and in dental materials, together with his administrative positions, are reflected in the introduction.

712,263
PB-298 008/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dimensional Change of Dental Amalgam and a Suggested Correlation between Marginal Integrity and Creep.
Final rept.,
G. C. Paffenbarger, N. W. Rupp, and P. R. Patel. Jul 79, 7p
Contract PHS-DE-05030
Pub. in Jnl. Amer. Dental Assoc., v99 p31-37 Jul 79.

Keywords: *Dental materials, *Mercury amalgams, Dimensional stability, Creep properties, Reprints.

Amalgams made from Micro Alloy, New True Dentalloy and Dispersalloy, on which there is adequate extant clinical testing, showed large expansion when stored in air at 60C and much less or no expansion at 37 and 23C. Zinc free amalgam had very small expansions or shrinkages at 60, 37 and 23C. Thus zinc appears to promote diffusion in hardened amalgam. Dimensional changes were usually less proportionally on the diameter than on the lengths of 8 x 4 mm unrestricted cylinders. Amalgam confined in cylindrical cavities extruded less than the unrestricted cylinders. The extrusion from the cavities was proportional to the creep values of the amalgams. Thus it is suggested that the apparent correlation of the marginal integrity of clinical amalgam restorations with creep of the amalgams, as demonstrated by Mahler et. al. in 1970 (J Dent Res 49:1452, 1970) may be caused by the relative resistance of the amalgams to deformation caused by expansion of the three foregoing amalgams.

712,264
PB-299 772/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Physical and Chemical Properties and Wear.
Final rept.
G. Dickson. 1979, 9p
Pub. in Proceedings of Composites in Dentistry Symposium Celebrating the 50th Anniversary of Cooperation between the ADA and NBS in Dental Research 1928-1978, held in conjunction with the General Session of the International Association for Dental Research (56th), Washington, DC., March 15, 1978, Jnl. Dental Research 58, n5 p1535-1543 May 79.

Keywords: *Meetings, *Dental materials, *Composite materials, *Wear tests, Chemical properties, Physical properties, Dimensional stability, Thermal stability, *Dental restorations.

Composite restorative materials undergo shrinkage on hardening which may be approximately compensated for by the expansion that occurs as the material absorbs water in the oral enviornment. Dimensional changes continue to occur with changes in temperature and with the mechanical forces applied by opposing teeth. The thermal expansions of composite materials are much larger than those of tooth structures and thus tend to produce mechanical stresses in a restoration which is confined in a cavity or is adhering to tooth structure. Clinical observations indicate that composites were more rapidly than do amalgams. The pattern of wear of a composite does not follow the contours of the opposing tooth surface but approaches more nearly the loss of a uniform thickness layer from the surface. It is thought that both stresses resulting from external forces applied to the restoration and stresses developed internally as a result of the large differences in the thermal expansions of the components of the material contribute to the wear of composites. Of the various types of wear test methods developed it appears that a method involving the sliding of enamel against the composite specimen, perhaps with accompanying tensile cycling, may offer the greatest possibility of providing a rapid procedure for predicting the clinical were resistence of composite materials.

712,265
PB-299 818/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Clinical Placement and Performance of Composite Resin Restorations.
Final rept.
N. W. Rupp. May 79, 7p
Contract DHEW-DE-04936
Pub. in Jnl. of Dental Research 58, n5, p1551-1557, May 79.

Keywords: *Dentistry, *Dental materials, *Polymers, Composite materials.

Composite resins should be used for esthetic restoration of Class III, IV and V cavities, and not for load bearing areas nor the distal of cuspids. Defects other than gradual wear and color shift in the material can be controlled by careful placement, finishing and glasing.

712,266

PB-299 825/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Fifty Years of Cooperative Research Between the American Dental Association and the National Bureau of Standards: A Historical Perspective 1928-1978.
Final rept.
G. C. Paffenbarger. May 79, 7p
Contract PHS-DE-04936
Pub. in Jnl. of Dental Research 58, n5, p1486-1492, May 1979.

Keywords: *Dental materials, Quality control, Research, Health related organizations, *National Bureau of Standards, *American Dental Association, Reprints.

In April 1928 there began a cooporative research program on dental materials and instruments between the National Bureau of Standards and the American Dental Association that continues in 1978. During this 50 years the research has invented new dental materials and instruments, has improved existing materials, has formulated specification and certification programs for dental materials, has developed quality control methods for manufacturers, and has trained many teachers and researchers in the science of dental materials for many institutions. The work has had a substantial effect in professional, educational and trade circles in dentistry. Its cost to benefit ratio is 1 to many thousands of dollars. In this 25 minute review the failures, the misjudgment and the false steps have not only been negelected they have been ignored.

712,267

PB-300 270/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Compatibility of Various Materials with Oral Tissues. I: The Components in Composite Restorations.
Final rept.
R. L. Bowen. 1979, 11p
Grant PHS-DE-05129-01
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Proceedings of Composites in Dentistry Symposium Celebrating the 50th Anniversary of Cooperation between the ADA and NBS in Dental Research 1928-1978 held in conjunction with the General Session of the International Association for Dental Research (56th), Washington, DC., March 15, 1978, Jnl. Dental Research 58, n5 p1493-1503 May 79.

Keywords: *Meetings, *Composite materials, *Toxicology, *Dental materials, Tissues(Biology), Inflammation, Protection, Teeth, Monkeys, Methacrylates, Laboratory animals.

The components used in formulating state-of-the-art composite restorative materials are discussed in qualitative terms. Brand names of contemporary composite are not given, and care has been taken to avoid the revealing of trade secrets or the favoring of one over another. There are at least eight categories of ingredients used in contemporary composites: a dimethacrylate monomer, a comonomer to adjust viscosity, a stabilizer to prevent premature polymerization, a stabilizer to diminish subsequent discoloration, a polymerization initiator, a polymerization accelerator, an inorganic reinforcing filler, and the resin. For some composite formulations, a photoinitiator is used in place of the polymerization accelerator and, perhaps, the polymerization initiator. For most of these categories, there are alternative compounds that can be used; proprietary composites contain various combinations. Certain widely-used compounds have been selected here to exemplify members of each category. The responses of dental pulps in the teeth of monkeys to eight typical compounds is currently being studied and will be reported in Part II.

712,268

PB-300 271/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Compatibility of Various Materials with Oral Tissues. II: Pulp Responses to Composite Ingredients.
Final rept.
H. R. Stanley, R. L. Bowen, and J. Folio. 1979, 11p
Grant PHS-DE-05129-01
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Proceedings of Composites in Dentistry Symposium Celebrating the 50th Anniversary of Cooperation between the ADA and NBS in Dental Research 1928-1978, held in conjunction with the General Session of the International Association for Dental Research (56th), Washington, DC., March 15, 1978, Jnl. Dental Research 58, n5 p1507-1517 May 79.

Keywords: *Dental materials, *Composite materials, *Toxicology, *Meetings, Tissues(Biology), Inflammation, Protection, Teeth, Monkeys, Laboratory anaimals, Macaca irus.

In their present commercial formulations, composite restorative materials cause significant inflammation of dental pulp tissues unless special protective measures are taken by the dentist. The literature lacks reports delineating the pulp-irritating potential of individual ingredients of composite restorative materials. Eight components, used in formulating dental composite restorative materials, were placed, individually, against the pulpal walls of Class V cavities in Macaca irus primate teeth, and covered with gold foil and the ZOE fillings. After 21 days, the teeth were prepared for histological appraisal of the dental pulps. Each ingredient, individually, was apparently innocuous, not producing an average degree of inflammation greater than 1 on a scale of 0 to 4. No abscesses or lesions predominating in leukocytes occurred. Inter action effects (especially benzoyl peroxide initiator and amine accelerators) should be studied next.

712,269

PB80-127970 Not available NTIS
National Bureau of Standards, Washington, DC.
Dental Materials.
Final rept.,
G. C. Paffenbarger, and N. W. Rupp. 1979, 61p
Sponsored in part by American Dental Association, Chicago, IL.
Pub. in Kirk-othmer: Encyclopedia of Chemical Technology, 7, Third edition, p461-521 1979.

Keywords: *Dental materials, Alloys, Gold alloys, Gypsum, Refractories, Specifications, Waxes.

Dental materials encompass organic, metallic and ceramic components and combinations of these. Many of these have unique therapeutic or prosthetic applications since much of dental therapy involves the replacement of hard and soft tissues lost through disease. The operative restorations and prostheses employ amalgam, chromium-based alloys, precious and noble metal alloys, special cements, synthetic polymers, and porcelain, all of which must serve in the mouth with mechanical efficiency, freedom from toxicity, and the ability to withstand the corrosive oral environment. Many accessory materials are needed in fabrication of dental appliances. These include synthetic polymers, gums, waxes, hydrocolloids, elastomers, gypsums and refractories. The employment, values for the pertinent physical and chemical properties, the compositions and specifications characterizing the foregoing materials are presented and documented along with adequate sources for additional information.

712,270

PB80-132020 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Properties and Interactions of Oral Structures and Restorative Materials.
Annual rept. 1 Oct 78-30 Sep 79,
J. M. Cassel, J. A. Tesk, G. M. Brauer, J. M. Antonucci, J. E. McKinney, R. P. Whitlock, and G. B. McKenna. Nov 79, 125p NBSIR-79-1943
Sponsored in part by National Inst. of Dental Research, Bethesda, MD. See also PB-289 913.

Keywords: *Dental materials, Polymers, Adhesives, Porcelain.

The objective of the research effort discussed briefly in the report is to effect improved dental health through development of new knowledge and better understanding of the mechanical, chemical and physical properties of materials used or potentially of use in restorative and preventive dental practices. The four major areas of research as approved in the interagency agreement are: Dental composite, resin and sealant chemistry and development; Development of adhesive bonding techniques; Wear resistance and mechanical properties of dental materials; and Dental alloy, ceramic and implant research. Promising new polymerization shrinkage-reducing dental resins that have been synthesized include prepolymer fluorinated polymethacrylate monomer; diurea dimethacrylate; and methacryloxyethyl-1-adamantylcarboxylate, a tri-cyclic saturated monofunctional monomer. Initial experiments to gain greater durability using a rubber toughening approach with BIS-GMA indicates a less brittle but tougher matrix can be achieved. Acetylthiourea and ascorbic acid have been shown to be promising non-amine type of accelerators for the BIS-GMA. Research to develop adhesive restorative materials indicates that urethane methacrylates with residual isocyanate groups yield less adhesion than is achievable with 2-cyanoacrylate esters. Dimensional change data that results from thermal cycling of different porcelains indicate considerable variation, some of which appears relatable to the crystalline forms that are present.

712,271

PB80-132798 Not available NTIS
National Bureau of Standards, Washington, DC.
New Initiator Systems for Dental Resins Based on Ascorbic Acid.
Final rept.,
J. M. Antonucci, C. L. Grams, and D. J. Termini. Sep 79, 13p
Contract PHS-Y01-DE-4001
Pub. in Jnl. of Dent. Res. 58, n9, p1887-1899, Sep 79.

Keywords: *Dental materials, *Ascorbic acid, Accelerating agents, Polymerization, Peroxy organic compounds, Oxidation reduction reactions.

Several promising initiator systems for the ambient polymerization of dental monomers were developed utilizing the oxidation-reduction reactions of certain organic peroxides and certain transition metal compounds with L(+) ascorbic acid and its derivatives.

712,272

PB80-151988 Not available NTIS
National Bureau of Standards, Washington, DC.
Fit of Porcelain Fused-to-Metal Crown and Bridge Castings.
Final rept.,
G. T. Eden, O. M. Franklin, J. M. Powell, Y. Ohta, and G. Dickson. Dec 79, 9p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD., and Naval Medical Research and Development Command, Bethesda, MD.
Pub. in Journal of Dental Research 58, n12, p2360-2368, Dec 79.

Keywords: *Dental materials, *Casting, Porcelain, Metals.

The dimensional accuracy of porcelain fused to metal crown and bridge castings was determined on truncated cone-shaped steel dies. Ni-Cr castings produced in manufactures' laboratories were consistently undersize, while precious metal castings were consistently oversize. Ni-Cr castings, produced in NBS laboratories using a modified investing technique, were routinely oversize.

712,273

PB80-184344 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Organizations Engaged in Preparing Standards for Dental Materials and Therapeutic Agents with a List of Standards.
Special pub.,
G. C. Paffenbarger, N. W. Rupp, and M. Malmstedt. Apr 80, 59p NBS-SP-571
Library of Congress catalog card no. 80-600041.

Keywords: *Dental materials, *Standards, *Drug therapy, Foreign countries, Specifications, Programs, Organizations, Indexes(Documentation), Agencies, Dental equipment.

The first specification for dental materials was prepared by Dr. Wilmer Souder, a physicist at the National Bureau of Standards, in 1927. From this stemmed the specification and certification programs of the American Dental Association (1930) and all of the similar national and international programs. The Federation Dentaire Internationale (FDI) was the first in the inter-

national field (1953). Today the International Organization for Standardization (ISO) through its Technical Committee 106-Dentistry, organized in 1963, is the prime international agency formulating specifications for dental materials and devices. The FDI role by agreement with ISO/TC106 is the preparation for standards on clinical evaluations, on biological test methodology, on the preparation of informative reports on dental materials and therapeutic agents and on the proper methods of using them. Today there are 15 international and national agencies that have prepared about 900 specifications for dental materials and devices. These agencies and their addresses are listed, with a brief history of each, together with a list of the specifications and standards that they have promulgated.

712,274
PB80-210826 Not available NTIS
National Bureau of Standards, Washington, DC.
Important Accomplishments in Dentistry, 1930-1980: A Personal Appraisal.
Final rept.,
G. C. Paffenbarger. May 80, 2p
Pub. in New York Jnl. of Dentistry 50, n5 p190-191 May 80.

Keywords: *Dentistry, Dental caries, Fluorides, Diagnosis, Therapy, Dental materials, History, Prevention, Diseases, Reprints.

The effect of fluoride in the reduction of dental caries was the single most important accomplishment in dental health service in the period between 1930-1980. Caries were found to be caused by micro-organisms and is a transmissible disease. The reduction in irradiation of patients in diagnostic procedures, the curtailment of periodontal disease by oral hygiene, the reduction of sugar in the diet, the use of new drugs, the improvement in anesthetics and in dental materials such as the invention of new cements, elastic impression materials, the turbine contra-angle handpiece, the composite restorative materials, and enamel etching techniques all contributed to the improvement of dental health service.

712,275
PB81-126088 Not available NTIS
National Bureau of Standards, Washington, DC.
Reactions of Powdered Human Enamel and Fluoride Solutions With and Without Intermediate CaHPO4.2H2O Formation.
L. C. Chow, M. K. Guo, C. C. Hsieh, and Y. C. Hong. Aug 80, 6p
Pub. in Jnl. Dental Research 59, n8 p1447-1452 Aug 80.

Keywords: *Acid treatment, *Enamels, Sodium fluorides, Humans, Fluoridation, Teeth, Tin fluorides.

Powdered human enamel treated for 3 minutes with an acidulated phosphate fluoride solution followed by suspension in synthetic saliva for a 72-hour period acquired a small but significant amount of apatitic fluoride. Similar treatments using 2% NaF and 8% SnF2 solutions produced no apatitic fluoride uptake. All three fluoride agents produced large amounts of apatitic fluoride when used in combination with a pretreatment with a solution saturated with CaHPO4.2H2O. The pretreatment enhanced the apatitic F formation by producing some CaHPO4.2H2O in the enamel, which could then react with the CaF2 formed by the fluoride treatment. The formation of this apatitic fluoride appears to occur after the topical treatment and before CaF2 is lost or removed.

712,276
PB81-207151 Not available NTIS
National Bureau of Standards, Washington, DC.
Adhesive Bonding of Various Materials to Hard Tooth Tissues: Tracer Study of Mordant Adsorption on Enamel.
Final rept.
T. E. Gills, and R. L. Bowen. 1981, 9p
Grants PHS-DE-02494-10, PHS-DE-02494-11
Pub. in Orthodontics: The State of the Art, p163-171 1981.

Keywords: *Dental materials, *Adhesive bonding, *Teeth, *Resins, Tissues(Biology), Adsorption, Enamel, Prevention, Dental caries, NTISCOMNBS, NTISNIHIDR.

For improving adhesion between resins and hard tooth tissues, a mechanism has been proposed which calls for chelate bonding of polyfunctional monomers with surface calcium ions or, preferably, with cations that have higher chelate stability constants. For clinical utility, the substitution (ion exchange) must be very rapid and relatively irreversible. The present study evaluated selected metal ions simultaneously for their sorption (adsorption or absorption) on enamel surfaces. The test solution contained 2M phosphoric acid and 1/6 M each of cupric, zinc, cobaltous, and ferric chloride, spiked with radioactive tracers. Eight noncarious premolar tooth crowns were cleaned, exposed to the solution for 60 seconds, rinsed with water, and then dried. The residual radioactivity was measured to quantify each element sorbed. The copper ion concentration was as high after a second, extensive washing as it was before, indicating irreversible adsorption. The copper was slightly higher than the zinc, and more than ten times higher than the retained cobalt ions. That these ions can be sorbed during an etching or 'conditioning' treatment from a phosphoric acid solution is very important to the development of practical therapeutic measures for both restorative and preventive dentistry.

712,277
PB81-216715 Not available NTIS
National Bureau of Standards, Washington, DC.
Adhesive Bonding of Various Materials to Hard Tooth Tissues: XXIII. Isotonic Monomer Formulations.
Final rept.
R. L. Bowen. May 81, 7p
Sponsored in part by National Inst. of Dental Research, Bethesda, MD. See also report dated May 80, PB80-194418.
Pub. in Jnl. of Dental Research 60, n5 p901-907 May 81.

Keywords: *Adhesive bonding, *Dental materials, *Teeth, Dentin, Polymers, Osmosis, Solubility, Biomaterials.

With regard to adhesion to dentin by chemical mechanisms, the vitality of odontoblasts and contiguous pulpal cells might require that materials influencing the dentinal tubules be maintained within certain limits of osmotic pressure. Resins for use in adhesive formulations can be made isotonic with vital tissues by adjusting the proportions of hydrophilic monomers and the water contents of the formulations.

712,278
PB81-216731 Not available NTIS
National Bureau of Standards, Washington, DC.
Amine Accelerator for Colorfree Curing of Cold-Curing Methyl Methacrylate Denture Systems.
Final rept.
H. Argentar, J. A. Tesk, and E. E. Parry. May 81, 2p
Contract PHS-DE-02159-02
Pub. in Jnl. of the American Dental Association 102, p664-665 May 81.

Keywords: *Dental materials, *Amines, Nitrogen organic compounds, Polymethyl methacrylate, Curing, Coloring, Ultraviolet radiation, Reprints, *Toluidine/N-N-dimethyl-butyl.

The various methacrylate denture systems used in dentistry employ differing amounts of amine accelerators for producing a cured denture. The most generally used amine is N,N-dimethyl-p-toluidine (DMPT). Upon curing, this imparts an undesirable yellow color to the resin, thereby rendering it impossible to obtain a satisfactory match of some shades between systems. A recently commercialized amine, N,N-dimethyl-p-t-butylaniline (DMBA), was tested and found to impart no color to specimens of denture resin as a result of the polymerization reaction. With the addition of a suitable quantity of a commercially available ultraviolet absorber, specimens containing DMBA exhibited satisfactory color stability when exposed to a sunlamp for 24 hours according to an American Dental Association specification for denture base resins. If used in a denture base formulation, DMBA has the potential of allowing consistent shading from one system to another. This is of value from economic as well as esthetic consideration.

712,279
PB81-220329 Not available NTIS
National Bureau of Standards, Washington, DC.
New Monomers for Use in Dentistry.
Final rept.
J. M. Antonucci. 1981, 15p
Proceedings of Symp. Application of Polymers in Dentistry, held at Houston, TX. on March 23-28, 1980. Pub. Biomedical and Dental Applications of Polymers, p357-371 1981.

Keywords: *Dental materials, *Composites, *Synthesis(Chemistry), *Sealants, Impurities, Polymerization, Sorption, Shrinkage, Chemical properties, Physical properties, Mechanical properties, Methacrylates, Fluorine organic compounds, *Monomers, *Methacrylate/benzaldehyde-di, *Methacrylate/diurea-di.

There is a need to further enhance the durability of dental composite restorative and sealant materials. Dimethacrylates such as BIS-GMA (the diadduct of bisphenol A and glycidyl methacrylate) are now widely used to formulate the resin component of these materials. Some of the deficiencies of dental composites and sealants are traceable to impurities and inherent structural imperfections in the monomer systems. Structure-property studies are needed to explore ways of achieving minimal shrinkage on polymerization, reducing water sorption, promoting adhesion, generally optimizing the chemical physical and mechanical stabilities of the resulting polymers. The synthesis of such an ideal dental monomer system is not an easy task. This paper describes the synthesis of several alternate types of monomers that address some of these problem areas and hopefully have utility as components of dental monomer systems. One novel type monomer system of high purity is derived from isomeric crystalline monomers that can form liquid eutectics. Other types include functional monomers such as benzaldehyde methacrylates, bicyclic diacetal benzaldehyde dimethacrylates, diurea dimethacrylates, and highly fluorinated thermosetting methacrylates including comb type prepolymer monomers. The latter monomers are designed to minimize water sorption and polymerization shrinkage and maximize the chemical, physical and mechanical properties of the resin binder.

712,280
PB81-221723 Not available NTIS
National Bureau of Standards, Washington, DC.
Consideration of Some Factors Influencing Compatibility of Dental Procelains and Alloys, Part I: Thermo-Physical Properties.
Final rept.
R. P. Whitlock, J. A. Tesk, G. E. O. Widera, A. Holmes, and E. E. Parry. Apr 81, 10p
Sponsored in part by Naval Medical Research and Development Command, Bethesda, MD., and National Institutes of Health, Bethesda, MD.
Pub. in Proceedings of the International Precious Metals Conference (4th) held at Toronto, Canada on June 2-5, 1980, p273-282 Apr 81.

Keywords: *Dental materials, *Thermal expansion, Porcelain, Alloys.

Preliminary results on the determination of thermal expansion of several brands of dental porcelain and veneering alloys are presented. The porcelain specimens were cooled rapidly, similar to processing of porcelain veneered alloy prostheses. Large differences in expansion of up to approximately equal to 30 percent were found to exist between some porcelains and alloys.

712,281
PB81-227548 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamics of Apatite Crystal Growth and Dissolution.
Final rept.
W. E. Brown, and L. C. Chow. 1981, 11p
Sponsored in part by the National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. of Crystal Growth 53, p31-41 1981.

Keywords: *Thermodynamics, *Crystal growth, *Dissolving, Density, Reprints, *Hydroxylapatites.

The rates of dissolution and crystal growth of hydroxyapatite, Ca5 (PO4) 3OH, are subjects of considerable interest because of their involvement in many biological and commercial processes. An important factor governing these rates can be the composition of the quasi-saturated solution immediately adjacent to the crystal surface which acts as a boundary condition for diffusion, especially in unstirred systems. The complications resulting from the presence of additional components, such as strong and weak acids and a swamping electrolyte, are discussed.

712,282
PB81-236895 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Properties and Interactions of Oral Structures and Restorative Materials.
Annual rept. 1 Oct 79-30 Sep 80.
J. M. Cassel, J. A. Tesk, G. M. Brauer, J. M. Antonucci, W. Wu, J. E. McKinney, R. P. Whitlock, and R. Hinmen. Nov 80, 107p NBSIR-80-2168
Sponsored in part by National Inst. of Dental Research, Bethesda, MD. See also PB80-132020.

Keywords: *Dental materials, Polymerization, Adhesives, Mechanical properties, Wear resistance, Ceramics, Alloys, Acetic acid/amino-diethyl-phenyl, Monomers.

Development of more efficient, less toxic polymerization accelerators indicates much promise for the generically biocompatible 4,4,N-diethylaminophenylacetic acid which is reactive at four fold reduced concentration relative to currently used amines. Raman, IR and 13C NMR spectroscopy and DSC are being compared for investigation of dental resin polymerization. Solvent carrier and amine catalysts have been shown to influence stability of silane-silica bonding in composites. A state-of-the-art report on radiopaque plastics in dentistry was prepared. A silver staining technique developed to assist investigation of mechanisms of degradation and wear in composite restorations yields useful information on subsurface microdefects in in vivo and in vitro worn specimens. In vitro wear with a pin-on-disc machine indicates increased wear of a composite is generated by going from a very hard (apatite) pin to a softer (stainless steel) pin. A wear test placing greater emphasis on shear forces generated via food particle interplay with teeth has been developed. With thermal expansion measurements, significant differences in the excess volume retained on cooling porcelains fired as per manufacturers' recommendations were noted. Gap and shape changes in a porcelain veneered to alloy split ring offer promise for determining compatibility of porcelains for alloys.

712,283
PB82-153263 Not available NTIS
National Bureau of Standards, Washington, DC.
Apatitic Fluoride Increase in Enamel from a Topical Treatment Involving Intermediate CaHPO4.2H2O Formation, an 'In vivo' Study.
L. C. Chow, M. K. Guo, C. C. Hsieh, and Y. C. Hong. 1981, 8p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Caries Res. 15, p369-376 1981.

Keywords: *Fluorides, *Enamels, Dental caries, In vivo analysis, Therapy, Dentistry, Reprints, Uptake.

Previous laboratory and animal studies have reported high levels of apatitic fluoride uptake from a topical fluoride procedure in which teeth were pretreated with an acidic solution saturated with respect to CaHPO4.2H2O (DCPD) prior to the fluoride treatment. A study was initiated to determine the fluoride uptake from this procedure under clinical conditions. A microbiopsy technique was used to measure enamel fluoride contents before, 1 month after, and 3 months after an application of an acidulated phosphate fluoride (APF) solution alone or in combination with a DCPD pretreatment on the maxillary incisors of 50 fourth-grade children in a non-fluoride area. One month after treatment, there was no significant difference in enamel fluoride concentration between APF and control groups. The DCPD/APF treatment produced mean fluoride uptakes of 1,011 plus or minus 134 ppm (n = 50) and 2,042 plus or minus 221 ppm (n = 47) in the outer 3.5 micrometers of enamel measured 1 and 3 months, respectively, after treatment. The results indicate that the DCPD pretreatment can substantially increase permanently bound fluoride uptake under clinical conditions.

712,284
PB82-153289 Not available NTIS
National Bureau of Standards, Washington, DC.
Marginal Adaptation of BIS-GMA-Based Composites Containing Various Diluents.
G. M. Brauer, D. M. Dulik, H. N. Hughes, K. Dermann, and N. W. Rupp. Dec 81, 6p
Sponsored in part by Army Medical Research and Development Command, Washington, DC.
Pub. in Jnl. of Dental Research 60, n12 p1966-1971 Dec 81.

Keywords: *Dental materials, *Composite materials, Shrinkage, Reprints, Dental restoration.

The objective of this study was to determine the gap formation and marginal leakage of dental restorative resins containing various diluents and diluent concentrations. Marginal adaptation of composites thermocycled for one week between 5 and 55C is dependent on the type and concentration of polymerizable monomer diluent present in the resin formulation. Curing shrinkage of the resin is a major contributor to breaking the marginal seal. Addition of dimethacrylate diluents containing (CH2)n recurring units generally yield composites with better marginal adaptation than those containing (CH2CH2O)n groups. Marginal leakage is reduced on lowering the diluent concentration. Optimum adaptation will be obtained for compositions containing a minimum percentage of diluent with clinically acceptable working properties. Volume changes on temperature cycling resulting from differences in thermal expansion coefficients of composites do not affect the marginal integrity as much as does curing shrinkage.

712,285
PB82-195223 Not available NTIS
National Bureau of Standards, Washington, DC.
Historical Development of Dental Composite Resins.
Final rept.
R. L. Bowen. 1981, 8p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Dent. Diamond (Japanese) 6, n13 p8-15 1981.

Keywords: *Dental materials, *Methacrylates, Composite materials, Sealants, Fillers, Reprints, *Bisphenol A, *Methacrylic acid/(glycidyl-ester), Monomers.

As requested, this essay (which will be translated by Professor Ikuo Ohmorie, Tsurumi University, before publication in the Japanese language in the dental journal, Dental Diamond) describes the origin and historical development of the dimethacrylate monomer, known in the dental literature as 'BIS-GMA'. The need for composite resins was based in the shortcomings of the two esthetic direct restorative materials available in 1953: silicate cements and direct filling resins based on methyl methacrylate. The first attempts to make an improved direct filling material using an epoxy resin together with fused quartz or porcelain reinforcing filler particles were unsuccessful. A hybrid monomer was synthesized from bisphenol A and glycidyl methacrylate; it was from this reaction that the acronym 'BIS-GMA' was derived. Since the first synthesis of BIS-GMA in October 1956 (at the National Bureau of Standards) this monomer has come into widespread use. Although its primary use is as a binder for reinforcing fillers to form composite restorative materials, it is also used without additional fillers as a fissure sealant resin to prevent decay in newly erupted teeth. New resins and techniques are being developed, and further improvements can be expected.

712,286
PB83-143776 Not available NTIS
National Bureau of Standards, Washington, DC.
Relationship Between Subsurface Damage and Wear of Dental Restorative Composites.
Final rept.
J. E. McKinney, and W. Wu. Sep 82, 6p
Grant PHS-DE-40015
Pub. in Jnl. of Dental Research 61, p1083-1088, Sep 82.

Keywords: *Dental materials, Composite materials, Damage, Wear, Reprints.

Pin and disc wear measurements were made on a commercial dental composite over a stress range from 2.5 to 20 MPa. The wear rates were found to increase suddenly during wear at times which tended to decrease with increasing stress. The results are interpreted in terms of wear mode conversion which results from the build-up of subsurface damage during wear. Micrographs showing damaged layers are compared with those from restorations worn in vivo.

712,287
PB83-147546 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
Properties and Interactions of Oral Structures and Restorative Materials.
Annual rept. 1 Oct 81-30 Sep 82.
J. M. Cassel, J. A. Tesk, G. M. Brauer, J. M. Antonucci, and W. Wu. Dec 82, 151p NBSIR-82-2623
Sponsored in part by National Inst. of Dental Research, Bethesda, MD. See also PB82-194887.

Keywords: *Dental materials, *Adhesives, Solubility, Composite materials, Infrared spectroscopy, Polymerization, Synthesis(Chemistry), Physical properties, Wear resistance, Ceramics.

Dental cements based on esters of vanillic acid display excellent long term solubility characteristics. Modification of formulations yield uniquely high strength properties and the potential for high strength intermediate restorative resins. Polymeric formulations designed to reduce curing shrinkage, residual unsaturation and hydrophilicity in composites have been developed. Initial four point bending results obtained in collaboration with dental manufacturers indicate the potential for a simple, reproducible, informative test. Alloy castability values generated in a new test method are strongly dependent on mold and alloy temperatures. Data variance can be used to optimize casting conditions.

712,288
PB83-176941 Not available NTIS
National Bureau of Standards, Washington, DC.
Influence of Chemicals on Wear of Dental Composites.
Final rept.
W. Wu, and J. E. McKinney. Oct 82, 4p
Pub. in Jnl. of Dental Research 61, n10 p1180-1183 Oct 82.

Keywords: *Dental materials, *Composite materials, Wear, Chemical compounds, Softening, Swelling, Reprints.

The wear resistance of a commercial dental restorative composite exposed to different chemicals was measured with a pin-disc apparatus. The initial wear rate increased dramatically once the composite had been immersed in chemicals known to soften the cross-linked matrix material, which is a copolymer derived from BIS-GMA and diluent monomer. The increase of wear rate in a chemically softened composite was found to persist over a depth beyond 160 micrometers for specimens immersed over two wk prior to wear testing.

712,289
PB83-177071 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Hydrophilic Diluents on the Properties of Cured Composites.
Final rept.
K. Dermann, N. W. Rupp, and G. M. Brauer. Nov 82, 5p
Sponsored in part by Army Medical Research and Development Command, Washington, DC., and Army Inst. of Dental Research, Washington, DC.
Pub. in Jnl. of Dental Research 61, n11 p1250-1254 Nov 82.

Keywords: *Composite materials, *Dental materials, Curing, Water, Reprints, *Hydrophilicity.

Hydrophilic diluents in composite formulations slightly increase water sorption of cured resin. This increased water uptake does not result in a significant improvement in the marginal adaptation, although other properties of the resulting composites are very satisfactory.

712,290
PB83-179432 Not available NTIS
National Bureau of Standards, Washington, DC.
Adhesive Bonding to Dentin and Enamel.
Final rept.
R. L. Bowen, E. N. Cobb, and L. E. Setz. Dec 82, 3p
Contract N01-DE-05129-04
Sponsored in part by American Dental Association Health Foundation, Chicago.
Pub. in Dentistry 82, p11-13 Dec 82.

Keywords: *Adhesive bonding, *Dentin, *Enamels, Tensile strength, Reprints.

A new method for preparing dentin and enamel surfaces to bond to hardening composite resins resulted in average tensile bond strengths of about one ton (2,000 pounds) per square inch. Fractures occurred

not only in the interfacial region but also in the composite material and occasionally in the dentin of the extracted tooth.

712,291
PB83-182675 Not available NTIS
National Bureau of Standards, Washington, DC.
Detecting Margin Leakage of Dental Composite Restorations.
Final rept.
W. Wu, E. Cobb, K. Dermann, and N. W. Rupp. 1983, 7p
Pub. in Jnl of Biomedical Materias Research 17, p37-43 1983.

Keywords: *Dentistry, *Dental materials, Leakage, Cavities, Silver, Staining, Composite materials, Reprints, Dental restorations.

The degree of microleakage between a restoration and the cavity wall is difficult to quantify objectively. A silver-staining method is used and compared to the radio-isotope method with results that indicate a superior definition and more accurate evaluation of microleakage. In addition to the accuracy, two advantages are presented: (1) scoring of the leakage can be refined and divided into more precise numbers, and (2) teeth can be observed directly in a microscope without resorting to the indirect interpretation of film or photograph.

712,292
PB83-234427 Not available NTIS
National Bureau of Standards, Washington, DC.
Adhesive Bonding of Various Materials to Hard Tooth Tissues: Forces Developing in Composite Materials during Hardening.
Final rept.
R. L. Bowen, K. Nemoto, and J. E. Rapson. Apr 83, 3p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of American Dental Association 106, p475-477 Apr 83.

Keywords: *Dental materials, *Hardening(Materials), Polymerization, Force, Shrinkage, Reprints, Composite resins.

The reported measurements show that significant tensile stresses develop during the hardening of composite resins if there is bonding to the cavity walls.

712,293
PB83-234856 Not available NTIS
National Bureau of Standards, Washington, DC.
Biological Assessments of Experimental Cavity Cleansers: Correlation between In vitro and In vivo Studies.
Final rept.
I. A. Mjor, A. Hensten-Pettersen, and R. L. Bowen. Aug 82, 6p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL., and Nordisk Inst. for Odontologisk Materialprovning, Oslo (Norway).
Pub. in Jnl. of Dental Research 61, n8 p967-972 Aug 82.

Keywords: *Polymers, *Cleaners, *Acid treatment, In vivo analysis, In vitro analysis, Assessments, Adhesion, Bioassay, Toxicity, Dentin, Reprints.

Adhesive bonding of resins to dentin surfaces requires the removal of the layer of debris caused by the cutting. Certain isotonic acidic solutions can do this rapidly. Five solutions were evaluated using cell cultures and pulp studies in monkeys. At concentrations above 10%, each solution caused the cultured human epithelial cells to respond unfavorably, probably due to the low pH of the culture medium. None of these experimental cleanser solutions caused significant pulpal irritation.

712,294
PB83-234872 Not available NTIS
National Bureau of Standards, Washington, DC.
Characterization and Modification of Electrochemical Properties of Teeth.
Final rept.
M. S. Tung, and W. E. Brown. Jan 83, 5p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 62, n1 p60-64 Jan 83.

Keywords: *Teeth, *Electrochemistry, Enamel, Revisions, Reprints, Calciumions, Hydrogen ions, Permselectivity.

Permselectivity of teeth was studied by membrane potential measurements. The enamel was found to have a preferential affinity for calcium and hydrogen ions. Its permselectivity could be modified by anionic compounds such as phytate and alginate, cationic compounds such as protamine, polyarginine and polylysine, or alternating coating of the above compounds.

712,295
PB83-600032 Not availabale NTIS
National Bureau of Standards, Gaithersburg, MD.
Cementitious Dental Compositions which do not Inhibit Polymerization.
G. M. Brauer, H. Argentar, and J. W. Stansbury. Filed 10 Dec 81, patented 7 Dec 82, 11p PAT-APPL-6-329 590, PATENT-4 362 510

Keywords: *Dental adhesive, Dental cement, Endodontic sealant, Impression paste, Insulating base, Luting agent, Pulp capping material, Sedative base, Tissue pack.

Cementitious dental compositions suitable for use as luting agents, sedative and insulating bases, temporary and long term restoratives, endodontic sealants, pulp capping materials, tissue packs, impression pastes and adhesives for dental composites and hard tissues comprising a solid phase which includes a metal oxide or hydroxide of tin or a Group II metal and a liquid phase which includes a chelating compound, the chelating compound being an ester of a vanillic acid moiety in which the ester is the product of a reaction of one of an alcohol, a polyhdric alcohol or a polyalkylene gylcol and at least one of either vanillic acid or its isomers or hololoynes. The compositions may additionally contain a second chelating compound, Al2O3, and hydrogenated rosin, polymeric materials and polymerizable monomeric materials.

712,296
PB84-135052 Not available NTIS
National Bureau of Standards, Washington, DC.
Status Report on Amalgamators.
Final rept.
N. W. Rupp. Oct 83, 5p
Pub. in Jnl. of the American Dental Association 107, p639-640 Oct 83.

Keywords: Equipment, Reprints, *Dental equipment, *Amalgamators.

Mechanical amalgamators are indispensable adjuncts to placing dental amalgam restorations. Their effectiveness would be improved if the manufacturers of alloy and those for amalgamators would define capsule and pestle characteristics to be used while using certain speed and amplitude amalgamators.

712,297
PB84-137165 Not available NTIS
National Bureau of Standards, Washington, DC.
Method for Bonding to Dentin and Enamel.
Final rept.
R. L. Bowen, and E. N. Cobb. Nov 83, 3p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of the American Dental Association 107, p734-736 Nov 83.

Keywords: *Bonding agents, *Dentin, *Enamel, Adhesion, Resins, Composites, Reprints.

An average tensile bond strength of about one ton (2,000 pounds) per square inch between composites and dentin and enamel was obtained in vitro by applying a 5.3% aqueous solution of ferric oxalate to the tooth surface, followed by water and air cleansing; by applying a 10% acetone solution of NTG-GMA the adduct of N(p-tolyl)glycine and glycidyl methacrylate, followed by cleansing with acetone and air; by applying a 5% acetone solution of PMDM (the addition reaction product of pyromellitic dianhydride and 2-hydroxyethylmethacrylate) followed by air to remove the solvent; and by placing the freshly mixed composite against the treated surface. Fractures occurred not only in the interfacial region, but also in the composites and in the dentin of the extracted teeth.

712,298
PB84-153147 Not available NTIS
National Bureau of Standards, Washington, DC.
Gel-Route Preparation of Low Fusing Dental Porcelain Frit.
Final rept.
C. P. Mabie, D. L. Menis, E. P. Whitenton, R. L. Trout, R. S. Metherate, and C. H. Ferry. 1983, 23p
Sponsored in part by the American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Biomedical Materials Research 17, p691-713 1983.

Keywords: *Ceramics, Metals, Porcelain, Gels, Reprints, *Dental materials.

Dental porcelain frits have been prepared by the gel route, a procedure involving solubilization of alkalies, boron, rare earth, and other compounds in an aluminasilica sol. Using this procedure, porcelain frits suitable for metal-ceramic application have been prepared that fire to maturity at temperatures lower than current commercial porcelains. Solubilities, translucencies, thermal expansion coefficients, dilatometric softening temperatures, and flexure strengths are within the ranges of current commercial porcelains. The high degree of dispersion of pigments and phosphors made possible by gel route technology and the technology's ability to disperse crystalline phases to strengthen porcelain offers many processing advantages. Gel route technology also offers a great degree of freedom in modifying porcelain properties.

712,299
PB84-153642 Not available NTIS
National Bureau of Standards, Washington, DC.
Advances in Dental Therapeutics and Materials: Experts Explore the Future.
Final rept.
R. L. Bowen, C. H. Boozer, R. L. Bowen, S. A. Cooper, J. C. Mitchem, E. A. Neidle, R. W. Phillips, A. Picozzi, and G. Ryge. Nov 83, 8p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of the American Dental Association 107, p719-725 Nov 83.

Keywords: *Dental materials, Forecasts, Reprints.

The paper is the response to the question 'What advances do you see in the near future (5-10 years) in the area of materials'.

712,300
PB84-217231 Not available NTIS
National Bureau of Standards, Washington, DC.
Cements Containing Syringic Acid Esters - o-Ethoxybenzoic Acid and Zinc Oxide.
Final rept.
G. M. Brauer, and J. W. Stansbury. Feb 84, 4p
Pub. in Jnl. of Dental Research, v63 n2 p137-140 Feb 84.

Keywords: *Dental materials, *Adhesives, Esters, Zinc oxides, Physical properties, Reprints, *Syringic acids, *Benzoic acid/ethoxy, Syringic acid/(hexyl-ester), Syringic acid/(ethylhexyl-ester).

Fissure caries is reduced when syringic acid is incorporated into a cariogenic diet of rats. It was therefore of interest to synthesize n-hexyl and 2-ethylhexyl syringate and to evaluate the properties of cements with these compounds as ingredients. Liquids containing the esters dissolved in o-ethoxybenzoic acid (EBA)-when mixed with powders made up from zinc oxide, aluminum oxide, and hydrogenated rosin-hardened in from four to nine min. Properties of the cements were determined, when possible, according to ANSI/ADA specification tests. Depending on the powder-liquid ratio employed, we obtained compositions with varying physical properties desirable for different dental applications.

712,301
PB84-217587 PC **A04**/MF **A01**
National Bureau of Standards (NML), Washington, DC. Polymers Div.
Properties and Interactions of Oral Structures and Restorative Materials. Annual Report for Period October 1, 1982 through September 30, 1983.
J. A. Tesk, G. M. Brauer, J. M. Antonucci, W. Wu, J. E. McKinney, and J. Stanbury. May 84, 59p NBSIR-84/2843
See also PB83-147546. Sponsored in part by National Inst. of Dental Research, Bethesda, MD.

Keywords: *Dental materials, *Adhesives, Solubility, Composite materials, Infrared spectroscopy, Polymeri-

zation, Synthesis(Chemistry), Physical properties, Wear resistance, Ceramics, Biomaterials.

High strength, eugenol-free cements based on esters of vanillic acid show good biocompatibility in some tests, do not inhibit polymerization and have low solubility. Additional potential applications include pulp capping, endodontic sealing and intermediate restoratives. Hydrophobic resin formulations have lower water sorption than Bis Phenol Glycidal Methacrylate (BIS-GMA) and reduce microleakage. Flexible backbone dimer and trimer acids produce hydrophobic materials with potential for use as cavity liners, endodontic sealers and impression materials. A 75% ethanol-25% water solution softens composites more than other ratios; resins with solubility parameters more different from this solution than BIS-GMA are under development. The newer resins are fluoromethacrylates and urethaneacrylates. A cumulative failure plot, based on Wiebul statistics was shown capable of representing data obtained from a four point bending composite beam (porcelain-fused-to-metal). Castabilities of six nickel based alloys were shown to be represented by a simple, two term equation with constants characteristic of each alloy.

712,302
PB84-227297 Not available NTIS
National Bureau of Standards, Washington, DC.
Subsurface Damage Layer of In vivo Worn Dental Composite Restorations.
Final rept.
W. Wu, E. E. Toth, J. F. Moffa, and J. A. Ellison. May 84, 6p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL., and National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. of Dental Research 63, n5 p675-680 May 84.

Keywords: *In vivo analysis, *Dental materials, Surfaces, Wear tests, Solubility, Reprints.

Dental composite restorations have been examined using a silver staining method to elucidate in vivo wear mechanisms. Emphasis was placed on examination of material immediately beneath the wearing surfaces. Several in vitro tests were also investigated for their ability to generate in vivo-like surface defects. For all the clinically worn composite restorations, a porous layer has been observed beneath those surfaces exposed to the oral environment. A laboratory test using certain substances to simulate the oral environmental effects can reproduce this porous layer. These results suggest that the in vivo wear process of dental composites is one accelerated by environmental softening of the composites.

712,303
PB84-239318 Not available NTIS
National Bureau of Standards, Washington, DC.
Approach to Remineralization via Saliva.
Final rept.
L. C. Chow, and W. E. Brown. 1982, 6p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Proceedings of Annual Conference on Foods, Nutrition and Dental Health (3rd), Chicago, IL., October 10-12, 1979, p217-222 1982.

Keywords: *Calcium phosphates, *Dental materials, In vitro analysis, In vivo analysis, Enamel, Concentration(Composition), Calcium, Phosphates, *Remineralization, Apatite/hydroxy.

From much evidence published previously, the authors can be certain that remineralization of teeth can and does occur to a very significant extent both in vitro and in vivo. Remineralization has the potential of being a very promising means of caries prevention. Several difficulties, however, block application of remineralization in practice. One such difficulty is the volume factor. Most remineralizing solutions that have been tried have low concentrations of calcium and phosphate. Typically, the calcium concentration is less than three mM. As tooth mineral contains about 40% calcium and has a density of 3, the calcium concentration in terms of molarity is about 30. Therefore, the calcium concentration in enamel is 10,000 x that of the calcifying solution. Furthermore, as only a fraction of the calcium in the solution can precipitate, one would need approximately 10 to the 5th power unit volumes of calcifying solution to produce one unit volume of the mineral. This is not a serious problem in in vitro experiments because a liter of such calcifying solution could precipitate 30 mg of the calcium phosphate, which is probably more than any given tooth specimen requires. However, to do this in the mouth is much more difficult. It may require rather elaborate devices and tedious procedures to place a large volume of the calcifying solution on the portion of the tooth where calcification must occur.

712,304
PB84-242460 Not available NTIS
National Bureau of Standards, Washington, DC.
Recently Developed Concepts in Adhesive Bonding of Composites to Dentin and Enamel.
Final rept.
R. L. Bowen, E. N. Cobb, and L. E. Setz. May 84, 3p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Buffalo Dent. Rev. 1, n1 p10-12 May 84.

Keywords: *Adhesive bonding, *Dentin, *Composite materials, *Enamels, Polymerization, Methacrylic acid, Surfaces, Reprints, Free radicals.

Strong in-vitro bonding between composites and dentin can now be obtained. Described are results of tests using variations from the method developed recently. To accomplish the strong bonding, it is currently concluded that two necessary features of the treatment are (1) the dissolution of the smeared surface layer and precipitation of insoluble reaction products, forming a strong, probably microporous, structure; and (2) the initiation of free radical polymerization of the methacrylate layers by redox interactions among the components complexed with this altered surface structure.

712,305
PB85-107449 Not available NTIS
National Bureau of Standards, Washington, DC.
Parallel Beam Microradiography of Dental Hard Tissue Using Synchrotron Radiation and X-Ray Image Magnification.
Final rept.
S. Takagi, L. C. Chow, W. E. Brown, R. C. Dobbyn, and M. Kuriyama. 1984, 3p
Grant PHS-DE-05030-05A2
Pub. in Nuclear Instruments and Methods in Physics Research 222, p256-258 1984.

Keywords: *Radiography, *Dentistry, Reprints.

A novel technique utilizing a highly parallel beam of monochromatic synchrotron radiation combined with x-ray image magnification has been used to obtain microradiographs of caries lesions in relatively thick tooth sections. Preliminary results reveal structural features not previously reported. This technique holds the promise of allowing one to follow the structural changes accompanying the formation, destruction and chemical repair of mineralized tissue in real time.

712,306
PB85-140937 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Internal Volumetric Expansion of Casting Investments.
Final rept.
F. A. Marsaw, W. G. de Rijk, R. Hesby, R. W. Hinman, and G. Pelleu. Sep 84, 6p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Prosthetic Dentistry 52, n3 p361-366 Sep 84.

Keywords: *Investment casting, *Dental materials, Expansion, Setting, Volumetric analysis, Elastomers, Plastics casting, Reprints.

Previous studies of setting expansion employed external measurements on a core of investment material; no determinations have been attempted in the center of the mold where the wax pattern is located. The purpose of this study was to develop a technique for evaluating setting expansion in the pattern area of an investment mold. The setting expansion of three commercially available phosphate-bonded investments was determined by measuring the change in volume of a cavity located in the center of the investment. A water-filled reservoir with a volume of 1.2 ml was connected to a 0.1 ml pipette (0.3 mm in diameter) and embedded in the center of the casting investment. Changes in the volume of the reservoir resulted in changes in the water level in the pipette. The internal temperature of the investment was monitored by a thermocouple. This experiment was performed with both nonyielding metal and yielding rubber casting rings. The results for the metal and rubber casting rings were indistinguishable. These findings indicate a need to re-evaluate the methods by which setting expansion is measured as well as the mechanism by which this expansion takes place.

712,307
PB85-183341 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effects of Ionic Organic Materials on Enamel Demineralization.
Final rept.
M. S. Tung, and W. E. Brown. 1985, 4p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Caries Research 19, p72-75 1985.

Keywords: *Organic coatings, *Enamels, *Demineralization, *Teeth, Cations, Anions, Dental materials, Reprints.

Effects of charged organic coatings, which changed the permselective properties of enamel, on tooth demineralization were studied. The alternating cationic and anionic coatings render remarkable protection to enamel exposed to an acid buffer.

712,308
PB85-183556 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Initiator-Accelerator Systems for Dental Resins.
Final rept.
G. M. Brauer, and H. Argentar. 1983, 13p
Grant PHS-DE-40015
Pub. in ACS (American Chemical Society) Symposium Series 212, p359-371 1983.

Keywords: *Dental materials, *Acrylic resins, Curing, Plastics, Polymerization, Free radicals, Stability, Sealants, Polymeric films, Reprints, Toluidine/bis(hydroxyethyl), Phenylacetic acid/(dimethylamino), Benzoyl peroxide, Polymerization initiators.

Acrylic resins, because of their excellent esthetic properties, ease of processing and satisfactory biocompatibility, are materials of choice for dental fillings, prosthetic devices and sealants. In practically all applications, a fluid monomer formulation (sometimes with solid fillers) is hardened by a free-radical-initiated polymerization that is effected by an initiator and/or heat, light or an initiator-accelerator system. Dentures are cured by a heating cycle during which the initiator, usually benzoyl peroxide (BP) is decomposed and releases sufficient radicals to yield a hard denture. Azo compounds such as 2,2-azo-bis-isobutyronitrile may also be used. To provide the cure at ambient or mouth temperature, redox initiator-accelerator systems, generally BP-tertiary aromatic amines, are employed. Many commercial chemical activated restorative resins employ the BP-bis (2-hydroxyethyl)-p-toluidine (DHEPT) system. More reactive amines which yield color stable products, are p-(dimethylamino) phenylacetic acid and its esters. Redox systems such as BP-sulfinic acids, peroxide-thiourea, hydroperoxide-ascorbic acid or trialkylborane-oxygen also cause rapid polymerization of acrylic resins. Their instability on prolonged storage or suspect biocompatibility limits their chemical applications. Cure systems activated by UV or visible light exposure use respectively an aliphatic ether of benzoin or an alpha-diketone such as camphoroquinone with a substituted morpholine reducing agent. Light-cure offers a great advantage since this allows the dentist as much working time as he requires.

712,309
PB85-186989 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Dental and Medical Materials Group.
Intermediate Restoratives from N-Hexyl Vanillate-EBA-ZnO-Glass Composites.
Final rept.
G. M. Brauer, and J. W. Stansbury. Nov 84, 6p
Contract PHS-DE-40015
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. of Dental Research 63, n11 p1315-1320 Nov 84.

Keywords: *Dental materials, *Composite materials, Chelates, Additives, Adhesives, Renovating, Glass particle composites, Reprints, *Vanillic acid/(hexyl-ester), Benzoic acid/(ethoxy-ester), Methyl methacrylates, Methacrylic acid/cyclohexyl, Methacrylic acid/dicyclopentadienyloxyethyl.

Vanillate esters such as n-hexyl vanillate (HV) dissolved in a suitable chelating agent - e.g., o-ethoxybenzoic acid (EBA) - react with zinc oxide, aluminum oxide, and hydrogenated rosin powder to yield non-eugenol-containing cements that do not inhibit polymerization and are compatible with acrylic monomers. These cements can be modified by adding methyl methacrylate, or the less-volatile, higher-molecular-weight dicyclopentenyloxyethyl, or cyclohexyl methacrylate to the HV-EBA liquid, and silanized glass to the powder. The cement composites adhere strongly to composites, non-precious metals, or porcelains. Rupture of the bond occurs cohesively within the cement. Because of their high strength, low solubility, and excellent adhesion, these cements, subject to their biocompatibility with dental tissues, show great promise as intermediate restorative resins and in the repair of fractured porcelain or porcelain-to-metal crowns and bridges.

712,310
PB85-189181 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Smear Layer: Removal and Bonding Considerations.
Final rept.
R. L. Bowen, J. D. Eick, D. A. Henderson, and D. W. Anderson. 1984, 5p
Prepared in cooperation with Oral Roberts Univ., Tulsa, OK. Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Operative Dentistry, Supplement 3, p30-34 1984.

Keywords: *Dentin, *Abrasives, *Surface chemistry, Adhesions, Chemical bonds, Reprints, Transmission electron microscopy.

A study of cut and abraded dentin surfaces using transmission electron microscopy revealed collagen denaturation to a depth of about one micrometer and loosening of microcracking of the calcified intertubular dentinal structure to a depth of about three micrometers below the surface.

712,311
PB85-207041 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Enamel Fluoride Profile Construction from Biopsy Data.
Final rept.
L. C. Chow, G. M. Beaudreau, and W. E. Brown. 1985, 10p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Caries Research 19, p103 -112 1985.

Keywords: *Enamels, *Fluoride, Biopsy, Reprints.

In fitting enamel biopsy data to a curve that describes the F profile in a subset of individuals subjected to a given treatment regimen, an implicit approximation is made that all individuals of a subset have the same F profile. In the present work the authors assume that the F profiles for the individuals can be best described by a single polynomial functional form, and that the coefficients of the polynomial can be calculated for each individual from multilayered biopsy data. The F content at a normalized depth can then be calculated for each individual and be used to compute the mean F content of the subset.

712,312
PB85-207264 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Enhanced Fluoride Uptake from Mouthrinses.
Final rept.
Y. C. Hong, L. C. Chow, and W. E. Brown. Feb 85, 3p
Sponsored by American Dental Association Health Foundation, Washington, DC.
Pub. in Jnl. of Dental Research 64, n2 p82-84 1985.

Keywords: *Fluoride, *Preventive dentistry, Reprints, *Mouthrinses.

It has been shown in laboratory and animal studies that tooth enamel becomes considerably more reactive toward low levels of fluoride after receiving pretreatment which forms dicalcium phosphate dihydrate (DCPD) in the enamel as an intermediate. This in vitro study was undertaken to determine the effect on human enamel fluoride uptake of incorporating DCPD-forming rinses into a conventional fluoride rinsing program.

712,313
PB85-210409 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Properties and Interactions of Oral Structures and Restorative Materials. Annual Report for Period October 1, 1983 through September 30, 1984.
J. A. Tesk, J. M. Antonucci, G. M. Brauer, J. E. McKinney, and R. W. Penn. Mar 85, 71p NBSIR-85/3119
See also PB84-217587. Sponsored by National Inst. of Dental Research, Bethesda, MD.

Keywords: *Dental materials, *Alloys, Composite materials, Wear resistance, Physical properties, Biomaterials.

The report presents the results of work involved with the development of basic generic science and engineering which is expected to be useful in the development or control of dental materials used for restorative or treatment purposes. Some of the developments involve investigations into new dental resin formulations (Part I) which might improve the performance of dental composites. Cements and adhesion to filler particles or tooth structure are also addressed in this part. Part II deals with examination of the basic parameters affecting the wear and durability of materials with particular emphasis on dental composites. The resultant information is used to help guide developments in Part I. Part III is concerned with dental casting alloys, and the strength of veneered dental systems, in particular, porcelain fused-to-metal.

712,314
PB86-102431 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Acidic Calcium Phosphate Precursors in Formation of Enamel Mineral.
Final rept.
W. E. Brown, L. C. Chow, C. Siew, and S. Gruninger. 1984, 6p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Proceedings of the Symposium on Tooth Enamel (4th), Odawara, Japan, May 24-28, 1984, p8-13.

Keywords: *Dental materials, *Calcium phosphates, *Enamels, In vitro analysis, In vivo analysis, Acids, *Chemical reaction mechanisms, Apatite/hydroxy.

It is slightly over a quarter of a century since octacalcium phosphate (OCP), Ca8H2(PO4)6.5H2O, was firmly established to be a member of the family of crystalline calcium phosphates and its relationship to hydroxyapatite (OHAp), Ca5(PO4)3OH, was correctly perceived. Yet, despite its involvement in many aspects of calcium phosphate chemistry in vitro, its role in enamel chemistry is frequently ignored. In this paper the authors briefly summarize the reported evidence for the involvement of OCP in enamel formation. They then describe the results of some in vivo experiments which provide close to incontrovertible proof that an acidic precursor is involved in the formation of enamel mineral. The authors then discuss the evidence showing that OCP rather than brushite, CaHPO4.2H2O, or monetite, CaHPO4, is the most probable acidic calcium phosphate to be involved in this way.

712,315
PB86-111945 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Internal Setting Expansion of a Dental Casting Investment Measured with Strain Gauges.
Final rept.
E. T. Meiser, W. G. de Rijk, J. A. Tesk, R. W. Hinman, R. A. Hesby, and G. B. Pelleu. Jun 85, 4p
Pub. in Jnl. Prosthetic Dentistry 53, n6 p870-873 Jun 85.

Keywords: *Dental materials, *Castings, Cements, Investments, Strain gages, Reprints, Prosthodontics.

Dental casting procedures rely in part on the setting expansion of the casting investment to compensate for the shrinkage of the casting alloy during the solidification and cool down process. The feasibility of monitoring the setting expansion of casting investments by means of strain gauges was investigated, with thestrain gauges located near the center of the investment. Two types of configurations were employed: I - strain gauges on a polymeric substrate embedded directly in the investment, II - an augmented retentive form (with plates perpendicular to the substrate) also embedded directly in the investment. Results show that the setting expansion as indicated by the strain gauges is significantly less than the values found by the traditional methods of external measurements and even less than those of the internal measurements previously developed by some of the authors. The addition of a retentive frame (wings) to the gauges reduced the variation in the data obtained and produced expansion values higher than those seen with strain gauges on a flat substrate only. Considering all methods, a very real question arises as to which (if any) of the techniques is valid.

712,316
PB86-124872 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Dental Research at the National Bureau of Standards: How It Changed the Practice of Dental Health Service.
Final rept.
G. C. Paffenbarger, J. A. Tesk, and W. E. Brown. 1985, 7p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of the American Dental Association 111, p83-89 Jul 85.

Keywords: History, Standards, Reprints, *Dental research, *National Bureau of Standards, *Amalgams.

A history of dental research at the National Bureau of Standards (NBS) since the inception in 1919 is presented. The initial thrust on dental amalgam by the U.S. Army Dental Corps, the assignment of Dr. Souder to the project and subsequent developments are traced. Difficulties in obtaining support for the early stages of the program following World War I are described. The involvement of the American Dental Association (ADA) in 1928, issuance of the first ADA specification on dental amalgam and the ultimate ramifications on dental (and medical) standards programs throughout the world are described. Patient, dentist and taxpayer benefits from support of the dental research program are shown to exceed the combined budgets of the currently supporting institutions, the NBS, ADA and National Institute of Dental Research.

712,317
PB86-129004 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Bonding of Restorative Materials to Dentine: The Present Status in the United States.
Final rept.
R. L. Bowen. 1985, 5p
Pub. in International Dental Jnl. 35, p155-159 1985.

Keywords: *Adhesion, *Bonding agents, *Dentine, Composites, Enamel, Resins, Reprints.

Adhesion of dental resins and composites to dentine and enamel is a research objective that has been pursued by many investigators for over a quarter of a century. The therapeutic possibilities that would derive from success in these endeavors have been exemplified by the numerous clinical applications that have resulted from bonding various resins to enamel by the acid etch bonding technique. Although etching with aqueous phosphoric acid solutions produces clinically useful bonding to enamel, it does not yield adequate bonding to dentine surfaces, and dentine usually comprises part of the surface to which the restorative material must adhere to successfully repair most dental lesions.

712,318
PB86-130093 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Application of an X-ray Image Magnifier to the Microradiography of Dental Specimens.
Final rept.
S. Takagi, L. C. Chow, W. E. Brown, R. C. Dobbyn, and M. Kuriyama. 1985, 4p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. of Dental Research 64, n6 p866-869 Jun 85.

Keywords: *Radiography, *Dentistry, X rays, Dentin, Enamel, Teeth, Reprints.

A highly parallel incident x-ray beam combined with x-ray image magnification was used to obtain high-resolution microradiographs of dental specimens. Preliminary results obtained using a rotating anode x-ray generator show that limitations associated with conventional contact microradiography regarding (1) spatial resolution; (2) sample thickness; and (3) sample orientation, relative to the film, were significantly reduced.

712,319
PB86-142692 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Divanillates and Polymerizable Vanillates as Ingredients of Dental Cements.
Final rept.
J. W. Stansbury, and G. M. Brauer. 1985, 11p
Pub. in Jnl. of Biomedical Materials Research 19, p715-725 1985.

Keywords: *Dental materials, *Polymerization, Chelating agents, Chemical properties, Physical properties, Performance evaluation, Reprints, *Vanillates, *Divanillates, *Metal oxides, Vanillic acid/(hexyl-ester), Benzoic acid/(ethoxy-ester), Vanillic acid/(methacryloylethyl-ester), Divanillic acid/(decamethylene-ester).

Vanillate esters with multifunctional groups that react with metal oxides to give chain-extended molecules have been synthesized. Divanillates were obtained from vanillic acid and the corresponding polymethylenediols. Methacryloylethyl vanillate (MEV) and vanillyl methacrylates were prepared respectively from hydroxyethyl vanillate or vanillyl alcohol and methacryloyl chloride. The properties of cements prepared with liquids incorporating these compounds were determined. These cements, subject to their biocompatibility to oral tissues, could be most useful for a number of dental applications.

712,320
PB86-160157 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Base Metal Alloys in Restorative Dentistry.
Final rept.
R. W. Hinman, and J. A. Tesk. 1984, 14p
Pub. in Advanced Restorative Dentistry, ch17 p281-294 1984.

Keywords: *Dental materials, *Alloys, *Metals, Reprints.

The use of base (nonprecious) metal alloys in dentistry is presented. Relevant physical and mechanical properties are described. Some pertinent comparisons of differences between gold and base metal alloys are cited. Attention is focused on processing of prosthetic dental devices with emphasis on casting, soldering, and porcelain veneering; these are primary operations requiring special attention.

712,321
PB86-160744 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Environmental Damage and Wear of Dental Composite Restoratives.
Final rept.
J. E. McKinney. 1985, 15p
Pub. in Proceedings of the International Symposium on Posterior Composite Resin Dental Restorative Materials, St. Martin, Caribbean, January 16-19, 1985, p331-347.

Keywords: *Dental materials, Corrosion, Polymers, Restoration, Solubility.

Microhardness and pin-disc wear measurements are used to determine in vivo degradation mechanisms for dental composite restorations. In order to simulate in vivo conditions, the wear test specimens are preconditioned in organic food simulating liquids, which have the potential to damage the polymer matrix; and intraoral acids and water, which have the potential to damage the inorganic filler. Subsequent wear and hardness may be influenced considerably by the chemical damage caused by preconditioning. The matrix damage is quantitized by using the solubility parameter as an independent variable. The filler damage is interpreted in terms of static and stress corrosion, the latter of which occurs during wear. Methods are suggested for improving both the matrix and filler to enhance durability of composite restorations by eliminating, or reducing, vulnerability to intraoral environmental attack.

712,322
PB86-160751 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Chemical Softening and Wear of Dental Composites.
Final rept.
J. E. McKinney, and W. Wu. Nov 85, 6p
Contract N01-DE-3-0001
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. of Dental Research 64, n11 p1326-1331 Nov 85.

Keywords: *Dental materials, *Composite materials, *Polymers, *Wear tests, *Softening, Solubility, Surfaces, Degradation, Solvents, Plastics, Reprints.

The purpose of the work was to determine the influence of chemical food-simulating liquids on the wear of various commercial dental composite restoratives. In many cases, pre-conditioning the restoratives in these liquids for one week produced swelling of the polymer matrix and considerable surface damage. The resulting degradation reduced the hardness and enhanced the wear as measured by a pin-and-disc apparatus. Four kinds of commercial composites were investigated: a conventional quartz-filled, a strontium-glass-filled, a visible-light-activated, and a microfilled composite.

712,323
PB86-191327 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Adsorption of Zirconyl Salts and Their Acids on Hydroxyapatite: Use of the Salts as Coupling Agents to Dental Polymer Composites.
Final rept.
D. N. Misra. 1985, 4p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 64, n12 p1405-1408 Dec 85.

Keywords: *Preventive dentistry, *Acids, *Dental enamel, Adsorption, Composite materials, Reprints, Hydroxyapatite, Zirconyl salts.

Zirconyl methacrylate (I) and zirconyl-2-ethylhexanoate (II) were synthesized, and their adsorption isotherms from solutions onto synthetic hydroxyapatite were studied. The isotherms of methacrylic and 2-ethylhexanoic acids were also determined from the same solvents. The adsorption of I was irreversible from methylene chloride, and that of II was irreversible from cyclohexane. The adsorption in both cases was constant from solutions above a certain concentration, and exhaustive below the threshold concentration. Both compounds rendered the dried apatite powder extremely hydrophobic; however, the adsorbate was slowly washed off by excess water.

712,324
PB86-193570 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Dental Applications.
Final rept.
G. M. Brauer, and J. M. Antonucci. 1986, 22p
Grant Y01-DE-30001
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Encyclopedia of Polymer Science and Engineering 4, p698-719 1986.

Keywords: *Dental materials, Resins, Composite materials, Adhesives, Polymers, Reprints.

Plastics have been edging into the dental market for the last fifty years. The consumption of resins for dental prosthetic devices, restorative, impression materials and sundries amounts to over 500 tons. Methacrylates are the most widely used resins for the construction of dentures, although many other polymers have been evaluated. Predominance of acrylics is not surprising since the monomer-polymer dough can be polymerized readily and has minimal curing shrinkage. The hardened materials are strong, lifelike, have good color and dimensional stability and are biocompatible with the oral tissues. Miscellaneous uses of these resins include tissue conditioners, crown and bridge resins, mouth protectors, splints, impression trays and patterns for metal castings. Over 13 million acrylic teeth are made annually in the U.S. They have a natural appearance, low breakage, bond to resin base and can be polished. Composites based on dimethacrylate have been very successful in non-stress bearing areas as anterior restoratives where esthetics is of prime importance.

712,325
PB86-200698 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
History of the International Association for Dental Research Wilmer Souder Award in Dental Materials with a Short Biography of Wilmer Souder.
Final rept.
G. C. Paffenbarger, and N. W. Rupp. 1986, 4p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Dental Materials 2, p49-52 1986.

Keywords: *Certification, *Dental materials, Specification, *Handwriting.

In the 39 years that Dr. Wilmer Souder was associated with the National Bureau of Standards, he accumulated many awards in several disciplines. The principal areas of his recognition, criminology and dental materials research, were founded in his interest in and capability of making precise length measurements. In 1919 the Army Dental Corps asked the Bureau to assist in formulating a specification for the purchase of alloys for dental amalgam. Dr. Souder agreed to take on the assignment. From that beginning the Dental Materials Section grew to encompass all dental materials and some equipment. His dedication to precision in all of his endeavors lead to Dr. Souder's being recognized as the 'Father of Dental Materials Research.' He became president of the International Association for Dental Research and an honorary member of the American College of Dentists and the American Dental Association. A short biography covers his early years and his education in physics at the University of Chicago. It also includes his many contributions to dental materials research and some of his many successes in criminology.

712,326
PB86-209947 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Basic Alloys and Compositions.
Final rept.
J. A. Tesk. 1986, 13p
Pub. in Proceedings of International Workshop on Biocompatibility, Toxicity and Hypersensitivity to Alloys Systems Used in Dentistry, Ann Arbor, MI., June 23-25, 1985, p3-15 1986.

Keywords: *Dental alloys, Composition, Structure, Gold, Nickel, Cobalt, Chromium.

There are today a great number of dental alloys covering a wide range of compositions (Classification System for Cast Alloys, 1984; Tuccillo, 1977; and Dentists Desk Reference, 1983). Even with the exclusion of amalgams, the variety in composition and application is almost unlimited as indicated in Table 1.1 (Classification System for Cast Alloys, 1984; Jelenko Alloys, Composition Chart, 1984; Dentists Desk Reference, 1983; Tuccillo, 1977; Moffa, 1977; Hodges, 1977; Coleman, 1928; and Phillips, 1973).

712,327
PB86-209970 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Adsorption of Benzoic Acid on Pure and Cupric Ion-Modified Hydroxyapatite: Implications for Design of a Coupling Agent to Dental Polymer Composites.
Final rept.
D. N. Misra. 1986, 6p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 65, n5 p706-711 May 86.

Keywords: *Adsorption, *Dental composites, Hydrogen bonding, Hydroxyapatite, Reprints, *Benzoic acid, Coupling agents.

The adsorption isotherms of benzoic acid on synthetic hydroxyapatite (containing about 1.5 monolayers of

physisorbed water) were studied from ethanol, dimethylsulfoxide, p-dioxane, methylene chloride, and benzene to discern the role of solvent in the process. The adsorption is reversible from the first three solvents and follows the Langmuir plots. It is irreversible from the last two, and a constant amount of absorbent is removed from solutions above a certain concentration. The isotherms of potassium benzoate on the apatite from ethanol and dimethyl sulfoxide were reversible. The isotherms of the acid on cupric ion-modified apatite surfaces from ethanol and benzene were identical with those obtained on the pure hydroxyapatite. This may demonstrate that any 'surface chelation' with the cation may not be a significant factor for adsorption to occur.

712,328
PB86-209988 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Recording Dilatometer for Measuring Polymerization Shrinkage.
Final rept.
R. W. Penn. 1986, 2p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Dental Materials 2, p78-79 1986.

Keywords: *Dental composites, Dental cements, Reprints, *Dilatometer, *Polymerization shrinkage, Recording dilatometer.

The volumetric changes which occur during curing of dental resins and cements is considered important to their clinical performance. To measure these changes a dilatometer device is required. A device is described in the literature (deGree and Davidson 1981) but its stability has been found to be worse (by a factor of ten) than conveniently acceptable. Using the same principles, a device with modified components and accessories and improved stability has been developed. It is constructed from the female part of a spherical glass joint which is ground flat and covered with a flat quartz plate. The stem of the joint is bent into a U-tube and filled with mercury. The height of the mercury in the U-tube is measured by a linear variable differential transformer which indicates volume changes in the sample which is placed in the joint on the bottom side of the quartz plate. The device is stable to 0.00001 cc over periods of several hours.

712,329
PB86-231529 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Complexes of Iron Cations with N-Phenylglycinate or Oxalic Acid.
Final rept.
R. L. Bowen, and D. N. Misra. Mar 86, 5p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 65, n3 p412-416 Mar 86.

Keywords: *Oxalic acid, *Iron, Dentistry, Teeth, Dentin, Adhesion, Metal complexes, Reprints, *Glycine/N-phenyl, Tooth enamel.

N-phenylglycine plays a very important role in obtaining adhesion of restorative composites to dentin and enamel (Bowen et al., 1982a). In a systematic investigation, ferric or ferrous N-phenylglycinate complexes formed when aqueous ferric nitrate or ferrous chloride was combined with solutions of potassium N-phenylglycinate in stoichiometric proportions. The molal ratios of iron ion to N-phenylglycinate ion in each complex were confirmed by osmolality measurements with a freezing-point osmometer. The reaction of aqueous solutions of oxalic acid with ferric nitrate indicated formation of ferric oxalate complexes with a stoichiometry of Fe2(oxalate)3 in solution, using Job's method of continuous variations (1925;1928).

712,330
PB87-122255 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Effects of Neutral Salts in a Bench-Scale Caries Model.
Final rept.
W. E. Brown, and L. C. Chow. 1986, 6p
Sponsored by American Dental Association Health Foundation, Chicago, IL., and Public Health Service, Rockville, MD.
Pub. in Jnl. of Dental Research 65, n9 p1115-1120 Sep 86.

Keywords: *Fluoride, Membranes, Sodium fluoride, Reprints, *Dental caries, Hydroxyapatite, Fluorapatite.

In an earlier paper on bench-scale simulation of the caries process, it was shown that the passage of ions through ion-permselective barriers could have profound effects on the composition of the solution within the 'lesion' at steady state. As indicated in earlier papers, these changes are produced by unequal rates of diffusion of Ca and PO4 ions prior to reaching steady state. Comparable effects are attributable to F ions when present. Here, the authors used the same two-compartment diffusion apparatus and membranes, as described in the earlier paper, to show that a neutral salt, such as NaCl, disproportionates under the influence of membrane potential. Thus, although the Na and Cl concentrations are nearly equal in the 'plaque-saliva' compartment, they become very different in the 'lesion' solution.

712,331
PB87-122271 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Composite Resin Chemistry: The Effects of Solvents on Surface Hardness.
Final rept.
W. Wu, J. Pestaner, and R. L. Bowen. 1984, 14p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Proceedings of the International Symposium on Posterior Composite Resins, Chapel Hill, NC., October 13-14, 1982, p7-20.

Keywords: *Sorption, *Dental materials, Surface properties, Solubility, Hardness, Softening, Swelling, Composite materials.

Nine liquid chemical compounds, with a solubility parameter range of 7.4 to 23.4 (Cal/cc)(sup 1/2), were used to study how sorption affects the properties of BIS-GMA co-polymers. One commercial dental restorative composite and one unfilled BIS-GMA resin were immersed in each of these chemicals. The changes in sample weight and surface hardness were monitored with time. No significant change in sample weight was observed over the test period of four weeks; however, a dramatic drop in hardness was found in both the composite and the unfilled resin after these materials were immersed in compounds with solubility parameters from 8.9 to 14.7 (Cal/cc)(sup 1/2).

712,332
PB87-150793 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Calcium Phosphate Precipitation in Aqueous Suspensions of Phosphatidylserine-Containing Anionic Liposomes.
Final rept.,
E. D. Eanes, and A. W. Hailer. 1987, 6p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Calified Tissue International 40, n1 p43-48 1987.

Keywords: *Calcium phosphate, Tissues, Bone, Reprints, Precipitation, Liposomes.

Liposomes prepared from 6.3:1.8:0.9:1.0 molar mixtures of phosphatidylcholine, dicetyl phosphate, cholesterol, and phosphatidylserine, respectively, (PS(+)liposomes) were compared with similarly prepared liposomes without the phosphatidylserine (PS(-)liposomes) for their effect on calcium phosphate precipitate formation in aqueous solutions at pH 7.4 and 22 degrees C. In the present study, Ca(2+) losses resulting from intraliposomally confined precipitation were found to be marginally greater in PS(+) liposomes due primarily to a larger volume of entrapped P1 available for reaction in these liposomes. However, with the addition of P1 to the external solution, the reverse was observed, i.e., considerably less Ca(2+) was lost in PS(+) than in PS(-) suspensions, a result of markedly less X-537A-induced precipitate forming outside PS(+)liposomes.

712,333
PB87-150819 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Research in Improved Composites.
Final rept.,
R. L. Bowen, and M. W. Chalkley. 1986, 12p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Anterior Restoratives p1-12 1986.

Keywords: *Dental materials, *Composite materials, Bonding, Dentin, Dentistry, Reprints.

Landmark advances in the history of restorative composites have been delineated in order to discuss improved composites effectively. The paper deals with the first author's experience in the area of developments in composite research beginning in the early 1950's when the shortcomings of silicate cements and methyl methacrylate unfilled resins stimulated research to improve esthetic direct restorative materials. This limited review includes the advances made possible through the development of composites that incorporated, separately or in combination, epoxy resins, spherical reinforcement particles, semiporous glass filler particles, x-ray opacity, etc. Also discussed is the effect, beneficial to dentistry, of the acid etch technique on the application of composites and the promise of further refinements in materials and techniques.

712,334
PB87-152823 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Callahan Award Lecture - Dental Composites: State-of-the-Art in Dentin Bonding.
Final rept.,
N. W. Rupp. Nov 84, 3p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Ohio Dental Jnl. 58, n11 p23-25 Nov 84.

Keywords: *Dental materials, *Composite materials, Bonding, Dentin, Dentistry, Reprints.

Dental composite restorative materials have been improved in their physical properties and manipulation characteristics. Further improvements are required before they can be used in load bearing areas. Also, dentin bonding adhesion needs strengthening.

712,335
PB87-161683 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Discoloration of Dental Cements and Composites in a Sulfide Solution.
Final rept.,
A. Sugawara, M. Ohashi, J. M. Antonucci, and G. C. Paffenbarger. 1984, 1p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 63, p232 1984.

Keywords: *Acid bonded reaction cements, *Dental materials, *Discoloration, Exposure, Composite materials, Reprints.

An aqueous solution of 0.1% Na2S (pH = 9) is an effective medium for inducing discoloration in esthetic dental restorative materials containing base metal contaminants. Glass ionomer cements exhibited greater discoloration due to base metal contaminants than did composite resin materials containing equivalent amounts of the same metal.

712,336
PB87-171732 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
In vitro Wear Rates of Three Types of Commercial Denture Tooth Materials.
Final rept.,
D. J. Whitman, J. E. McKinney, R. W. Hinman, R. A. Hesby, and G. B. Pelleu. Feb 87, 4p
Pub. in Jnl. of Prosthetic Dentistry 57, n2 p243-246 Feb 87.

Keywords: *Dental prostheses, *Acrylic resins, *Wear tests, Dentistry, Thermoplastic resins, Wear resistance, Reprints.

One disadvantage of acrylic resin teeth is that they abrade easily. Two new denture tooth materials are reported as more resistant than conventional materials to wear and chemical degradation. IPN (Dentsply) and Isosit were compared with conventional acrylic tooth, Bioform, for in vitro wear resistance. Specimen disks were processed exactly as denture teeth are. To simulate the long-term effects of foods, the disks were preconditioned for one week at 37 deg C in 75% ethanol or distilled water (control). Wear was generated with a stainless steel pin by the pin-and-disk apparatus de-

scribed by McKinney. The results suggest that IPN and Isosit denture teeth would wear much better under intraoral conditions than the conventional acrylic resin teeth.

712,337
PB87-182861 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Diametral Tensile Strength and Dental Composites.
Final rept.,
R. W. Penn, R. G. Craig, and J. A. Tesk. 1987, 3p
Pub. in Dent. Mater. 3, p46-48 1987.

Keywords: *Dental materials, Composite materials, Tensile strength, Reprints, Dental composites, Diametral tensile strength.

The diametral tensile strength (DTS) is a property described by ADA/ANSI Specification 27 for characterizing dental composite restoratives (DCR). Since the approval of Specification 27 in 1977, numerous new DCR's have been developed. These are often quite different in terms of filler and filler type, resin matrix and method of curing. A question naturally arises as to the applicability of the diametrical tensile test (DTT) to the newer systems DTT is suited only for truly brittle materials. Materials which plastically deform would produce erroneous DTS values and also would be expected to display strain rate sensitivity. Linear regressions of DTS vs log CS showed weak to moderate dependency for all materials tested as did the correlation coefficients which ranged from 0.10 to 0.50. Statistical analysis correlate composites behaved in sufficiently brittle manner to conclude that the DTT is valid for evaluation of the tensile strength of newer composites.

712,338
PB87-200291 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Resin Based Dental Composites. An Overview.
Final rept.,
J. M. Antonucci. 1986, 27p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Polymers in Medicine II, p277-303 1986.

Keywords: *Dental materials, *Composite materials, Fillers, Bonding, Resins, Polymerization, Reprints.

The quest for a durable, esthetic, adhesive and biocompatible material suitable for the restoration of lost tooth structure has long challenged dental materials researchers. A significant step toward the realization of this goal was the development of resin based dental composites which overcame many of the shortcomings of the silicate cements (a purely inorganic composite) and unfilled resin restoratives (a purely organic composite based on methyl methacrylate and its polymer). The synthesis of BIS-GMA (an offspring of the marriage of epoxy and acrylate chemistry) by Bowen, ushered in the modern era of resin based dental composite restorative materials and also dental sealants. Efforts to enhance the durability and range of applications (e.g. posterior as well as anterior fillings) of dental composites include optimization of the types, sizes, shapes and volume of the dispersed phase, reductions in residual vinyl unsaturation and polymerization shrinkage of the resin phase, and the development of more effective interfacial bonding phases.

712,339
PB87-200325 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Research Opportunities for American Industry at the National Bureau of Standards.
Final rept.,
J. A. Tesk. 1987, 1p
Pub. in UPDATE (Newsletter of the American Dental Trade Association), 1p Jan-Apr 87.

Keywords: *Dental materials, *Composite materials, Research, Castings, Restoratives, National Bureau of Standards.

The research associate program in dental materials at the NBS is briefly described. Opportunities for collaborative research are presented; specific programs are cited. This is an introductory article which will be followed by others in 'Update'.

712,340
PB87-219168 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Wear and Microhardness of Glass-Ionomer Cements.
Final rept.,
J. E. McKinney, J. M. Antonucci, and N. W. Rupp. 1987, 6p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Jnl. of Dental Research 66, n6 p1134-1139 Jun 87.

Keywords: *Cements, *Dental materials, *Composites, Hardness, Wear, Reprints, Glass ionomers.

Pin-and-disc wear and Knoop Hardness measurements were made on three commercial glass-ionomer cements having slightly different compositions. The specific objective was to determine whether these cements have potential for use in posterior teeth, and if not, what modifications in composition and structure would be appropriate to enhance their performance. The specimens were pre-conditioned in air, water, or lactic acid at 37 deg C for one week prior to being wear-tested. Although differences among the samples were noted, some common trends were observed. From changes in hardness, before and after storage, two opposing trends were observed. The trend involved continued cross-linking and possible dehydration, resulting in a substantial increase in hardness. The other trend involved softening from penetrant liquid absorption and a concomitant decrease in hardness.

712,341
PB87-219176 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Ultramicro Analysis of the Fluid in Human Enamel during In vitro Caries Attack by Hydrochloric Acid.
Final rept.,
G. L. Vogel, C. M. Carey, L. C. Chow, T. M. Gregory, and W. E. Brown. 1987, 16p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Caries Research 21, p310-325 1987.

Keywords: *Diffusion, *Enamel fluid, Reprints, *Dental caries.

An in vitro experimental caries model is described in which an ultramicro system of analysis was used during simulated decay to study the composition of fluid in micro wells drilled within human enamel. In this experiment, hydrochloric acid was used as the demineralizing agent because the results could be directly compared to recent bench-scale studies using a two-compartment diffusion cell. The two sets of results agree in principle and generally confirm an earlier 'diffusion-controlled' caries model. Furthermore, the results are contrary to caries models based on the assumption that the rate-controlling process is release of ions from the enamel crystal surfaces because: (1) The solutions at various points in the lesion remained satured during the attack, although a highly demineralized lesion was used in the experiment, and a high degree of undersaturation was used to drive the demineralization, (2) The Ca/P ratio in the lesion solution increased during the demineralization. (3) The calcium and phosphate concentrations increased during the demineralization above their initial values although there was no concentration gradient for hydrochloric acid in this system. (4) Small membrane potentials developed during the demineralization, indicating that the tooth surface was permselective. (5) The directions of the changes in the concentrations of all the ions in solution could be predicted from the permselectivity using the 'diffusion-controlled' model. These results have major implications relative to the design of theoretical physicochemical models employed to elucidate the mechanism of caries.

712,342
PB87-224481 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Dental Materials Research at the National Bureau of Standards, Opportunities for Industry.
Final rept.,
J. A. Tesk. 1987, 1p
Pub. in Trends and Techniques 4, n6 p5 Jul/Aug 87.

Keywords: Reprints, *Dental materials, *National Bureau of Standards, Dental alloys, Dental castings, Castability.

A brief description of the research program in dental materials is presented. The overview is a prelude to subsequent articles which will appear. Items of specific interest to dental laboratories are cited including research on dental investments and casting of dental alloys.

712,343
PB87-233813 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Wear Mechanisms of Dental Composite Restorations.
Final rept.,
W. L. Wu. 1982, 20p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Proceedings of International Symposium on Posterior Composite Resins, Chapel Hill, NC., October 13-14, 1982, p127-146.

Keywords: *Polymerization, Diffusion, *Dental composites, Solubility parameters, Swelling, Thermoset resins.

The in vivo wear process of dental composite restorations is believed to be accelerated by a chemical softening mechanism. The degree of polymerization can be increased by raising the curing temperature which, in turn, decreases the diffusion rate of foreign substances within the dental composites. Accordingly, the extent of chemical softening can be mitigated by improving the degree of polymerization.

712,344
PB88-117346 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Ultrastructural Study of Calcium Phosphate Formation in Multilamellar Liposome Suspensions.
Final rept.,
B. R. Heywood, and E. D. Eanes. 1987, 10p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Calcified Tissue International 41, p192-201 1987.

Keywords: *Liposomes, *Calcium phosphates, Reprints, *Apatite, Matrix vesicles, TEM.

Calcium phosphate precipitation can be induced within liposomes containing buffered inorganic phosphate by the ionophore-mediated loading of calcium ions. Negative staining, positive staining for thin sectioning, and freeze-fracture electron microscopy were used to characterize these synthetic vesicles and to evaluate the liposome-mineral interactions resulting from apatite formation. Suspensions of phosphate (0-50 mM KH_2PO_4)-encapsulated liposomes were prepared from mixtures of phosphatidylcholine, dicetyl phosphate, and cholesterol in the molar ratios of 7:2:1. Precipitation reactions were initiated by first suspending the liposomes in a buffered solution containing calcium (1.3-2.2 m $Ca(NO_3)_2$) and then adding the cationic ionophore X-537A. All experiments were carried out at 22 deg C, pH 7.4, and 240 mosm.

712,345
PB88-117353 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Rapid Determination of Extracellular Potassium Concentrations in Whole Human Dental Plaque and Plaque Fluid.
Final rept.,
C. M. Carey, A. Tatevossian, and G. L. Vogel. 1987, 1p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 66, n9 p1516 Sep 87,

Keywords: *Dentistry, Electrodes, Reprints, Dental plaque, Potassium.

Recently, Dibdin et al., (1986) found concentrations of potassium in plaque fluid lower than previously reported. These authors attributed the higher levels reported in other studies to prolonged sample storage. In the paper a rapid ion selective micro electrode technique was used to study the effect of sample storage and fluid separation procedures on potassium concentrations in fasting plaque. The potassium concentrations obtained, 64 plus or minus 8 mmol/L N=28 were similar to previous values and indicate that differences in sampling techniques may be responsible for the lower values obtained by Dibdin et al., (1986). The high levels of potassium and other ions in plaque fluid

appear to indicate a poor exchange between plaque fluid and saliva.

712,346
PB88-117361 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Dentin Adhesive Bonding.
Final rept.,
R. L. Bowen. 1987, 1p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Trends and Techniques 4, n8 Oct 87.

Keywords: *Adhesion, *Bonding, *Dental composites, Dental materials, Dentin, Enamel, Technology transfer, Reprints.

After decades of research, a combined dentin and enamel bonding method developed at the Paffenbarger Research Center, National Bureau of Standards, is beginning to address and minimize problems associated with the adhesion of dental composites to tooth surfaces. At the conclusion of a five-year clinical trial, it is hoped that new products based on these new adhesive materials will be introduced into U.S. and international dental materials markets.

712,347
PB88-120902 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Forces Fracturing Cements at Die Interfaces and Their Dependence on Film Thickness.
Final rept.,
H. Iizuka, G. M. Brauer, N. Rupp, M. Ohashi, and G. Paffenbarger. 1987, 7p
Sponsored by National Inst. of Dental Research, Bethesda, MD., and Nihon Univ., Tokyo.
Pub. in Dental Materials 3, p187-193 1987.

Keywords: *Dental materials, *Cements, Venting, Reprints, *Crown forms, Ionomers, Polycarboxylates, Zinc phosphate.

Film thickness (FT) and retention of zinc phosphate, polycarboxylate and ionomer cement as a function of powder-liquid (P/L) ratio were determined for both non-vented and vented crowns and using a standard ADA/ANSI test. The effect of P/L ratio on FT was more dependent on the composition of the brand than on the type of cement. FT values obtained from the specification test usually lay between those obtained from the vented crowns and from the non-vented crowns. Higher consistency (higher P/L ratio) of the mix increased the FT. The relationship between FT of P/L ratio and retention is complex and depended on the type of cement, brand, and on the technique used. Venting of the prepared crown lowered the FT and usually tended to increase retention.

712,348
PB88-120910 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Enhanced Enamel F Uptake by Monocalcium Phosphate Monohydrate Gels.
Final rept.,
S. Takagi, L. C. Chow, E. M. Yamada, and W. E. Brown. 1987, 4p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 66, n10 p1523-1526 Oct 87.

Keywords: *Teeth, *Dentistry, Reprints, Dicalcium phosphate dihydrate, Fluorapatite, Fluoride, Monocalcium phosphate monohydrate, Remineralization, *Enamel.

Application of DCPD-forming solutions has been shown to increase substantially the enamel reactivity toward F. The effectiveness of a variation of the treatment procedure, in which the DCPD-forming solution was replaced by a viscous carboxymethycellulose gel containing monocalcium phosphate monohydrate (MCPM), was evaluated by use of 12 extracted human molars. The MCPM gel was highly effective in enhancing the F uptake by enamel. The mean F uptakes by teeth treated with MCPM gel, followed by exposure to a F solution, were 3972 (plus or minus 565), 2383 (plus or minus 312), and 1751 (plus or minus 313) ppm, respectively, in the outer 5-, 10-, and 15-micrometer depths in enamel. These uptakes were 2374, 1273, and 852 ppm more than those of the control teeth. Because the F solution was undersaturated with respect to CaF2, the F incorporated into the enamel was believed to be in apatitic form and not as CaF2. The MCPM gel has advantages over the DCPD-forming solution because (1) much longer gel-tooth contact times can be achieved, and (2) the treatment agent can readily be delivered to specific sites where the tooth needs the protection most.

712,349
PB88-129812 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Adhesion to Dentin Mediated by Gluma: Effect of Pretreatment with Various Amino Acids.
Final rept.,
E. Asmussen, and R. L. Bowen. 1987, 5p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Scandinavian Jnl. of Dental Research 95, p521-525 1987.

Keywords: Reprints, *Adhesive dentistry, *Composite resins, *Dentin bonding agents, Operative dentistry.

Dentin surfaces were treated with various amino acids. The treatment caused an alteration of the dentin surface that influenced the tensile bond strength to a restorative resin obtained with the Gluma system. The bond strengths varied between 5.6 and 14.2 MPa. Among the amino acids tested, N-phenylglycine produced the strongest bonds.

712,350
PB88-134614 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Report on State of the Art in Titanium Castings.
Final rept.,
R. M. Waterstrat. 1987, 1p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Trends and Techniques 4, n7 p46 Sep 87.

Keywords: *Dental materials, Ceramics, Reprints, *Titanium castings, Castings, *Biocompatibility, Implant dentistry.

The paper presents a summary of the current state of dental titanium castings technology in the United States. The field is developing rapidly, and a variety of commercial applications can be anticipated shortly. Progress in the direction, both in the U.S. and in Japan, will bear continued surveillance.

712,351
PB88-140959 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Micro-Electrode Techniques for the Analysis of Oral Fluids.
Final rept.,
G. L. Vogel, C. M. Carey, L. C. Chow, and W. E. Brown. 1987, 7p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 66, n11 p1691-1697 Nov 87.

Keywords: *Dental plaque, Dental enamel, Microanalysis, Microvolumes, Reprints.

The paper describes the use of micro-electrodes for the analysis of small fluid volumes recovered from the oral environment. The analysis has several advantages: (1) It directly measures the activity of ions, a quantity more relevant to mineral saturation than the conventionally measured concentration; (2) minimum fluid volume for analysis is usually less than 0.005 micro L, small enough to avoid sample pooling in most analyses; (3) numerous ions can be measured simultaneously; (4) the analysis time is very short; and, (5) the use of mineral oil to isolate specimens provides a simple method for controlling the CO2 tension and humidity over the specimens.

712,352
PB88-147160 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Effect of Acidic Pretreatment on Adhesion to Dentin Mediated by Gluma.
Final rept.,
E. Asmussen, and R. L. Bowen. 1987, 3p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 66, n8 p1386-1388 Aug 87.

Keywords: *Dental materials, *Dentin, *Dentistry, *Acid bonded reaction cements, Bonding, Adhesives, Enamels, Tensile strength, Amino acids, Reprints, *Resin bonding.

Tensile bond strengths between dentin and a typical restorative resin were measured after the dentin was treated with Gluma. Solutions of phosphoric, pyruvic, nitric, or oxalic acid, also containing various amino acids, were used as pretreatments. Without amino acids in the solutions, the pretreatments conferred bonds of low strength. Use of acidic solutions containing glycine or N-phenylglycine was found to give bonds of high strength to both dentin and enamel.

712,353
PB88-152095 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Piezoelectric Polymer Transducers.
Final rept.,
G. T. Davis. 1987, 5p
Pub. in Adv. Dent. Res. 1, n1 p45-49 Oct 87.

Keywords: *Piezoelectric transducers, *Dental equipment, Piezoelectric materials, Polymers, Reprints, *Vinylidene fluoride polymers, Polyvinylidenes.

Poly(vinylidene fluoride) (CH2-CF2)n is a tough, flexible polymer readily available in the form of thin film which can be made piezoelectric by the temporary application of a high electric field. The areas of the film which become piezoelectric can be controlled to be the areas where metal electrodes are evaporated onto the film. The same electrodes and associated leads are subsequently used to detect the electric charge generated by the application of pressure to the active area. Such films may have applications in the measurement of occlusal forces. The physical properties of such polymer films and examples of their use in pressure transducers are reviewed with the intent of stimulating interest in development of a system useful for measuring occlusal forces.

Ecology

712,354
DOE/ET/6010-1 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Initial Psychoacoustic Experiments on the Human Response to Transmission Line Audible Noise.
J. A. Molino, G. A. Zerdy, N. D. Lerner, D. L. Harwood, and S. G. Tremaine. 1978, 82p
Contract EA-77-A-01-6010

Keywords: *Corona discharges, *Power transmission lines, Biological effects, Man, Noise, Noise pollution, ERDA/560400.

A project is underway to investigate human response to transmission line audible noise. This project is developing a psychoacoustic data-base to determine the extent to which present measurement scales and human response criteria are appropriate for evaluating the environmental impact of transmission line audible noise, and to suggest different scales and criteria if necessary. A realistic listening room was used for psychoacoustic experiments in which a listener was given choices between various acoustic environments, including corona sounds, while reading a book. In another experiment groups of participants rated various sounds for their annoyance level while watching television programs. Results indicate that despite its relatively low sound level, corona noise is equally aversive to certain other environmental sounds that are 8 dB higher in sound pressure level. All of the common frequency weighting scales underestimate the aversiveness of corona noise relative to other environmental sounds. From a limited sample of comparison sounds, corona noise was found to be roughly equal in aversiveness to the noise from a room air conditioner. Knowledge of the source of the noise did not affect the relative aversiveness of corona noise as presented in the laboratory. The high-frequency hissing and crackling components of corona noise are more aversive than the low-frequency humming and buzzing components. There are distinctly different kinds of corona

noise which differ both in frequency spectrum and relative aversiveness. Thus, in order to assess environmental impact, long-term sampling of corona noise from different lines may be needed. Similar results were obtained from experiments involving reading and television viewing as participant activities, indicating consistent and generalizable findings. (ERA citation 05:009369)

712,355
PB-277 682/1 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
National Environmental Specimen Bank,
H. L. Rook, and G. M. Goldstein. Feb 78, 62p NBS-SP-501
Proceedings of the Joint EPA/NBS Workshop on Recommendations and Conclusions on the National Environmental Specimen Bank Held at the National Bureau of Standards, Gaithersburg, Maryland on August 19-20, 1976. Sponsored in part by Health Effects Research Lab., Research Triangle Park, N.C. Library of Congress Catalog Card no. 78-682.

Keywords: *Meetings, *Ecology, Samples, Environments, Objectives, Research, Design, Planning, Data, Demography, Technology, *Specimen banks, Analytical methods.

The Workshop consisted of a review session where past considerations were discussed; a technical session where recent analytical research relevant to the sample bank was abstracted and discussed; and a planning session where planning and design of a prototype banking system was outlined. The workshop concluded that with the ever increasing influx of new man-made substances into our ecosystem, that a formalized, systematic approach is needed to assess the environmental impact of these substances on a national as well as an international level. The technology to initiate a pilot banking program is presently available and was formulated into a five-year pilot bank program. This program will be evaluated at each stage of development.

Electrophysiology

712,356
AD-A098 980/6 PC **A02**/MF **A01**
Colorado Univ. at Denver. EEG Lab.
Magnetic Auditory Evoked Fields: Interhemispheric Asymmetry.
M. Reite, J. T. Zimmerman, and J. E. Zimmerman. 4 Nov 80, 7p
Contract N00014-79-C-0383
Pub. in Electroencephalography and Clinical Neurophysiology, v51 p388-392 1981. Presented at the Annual Meeting of the Society for Neuroscience (1980).

Keywords: *Audiometry, *Electroencephalography, Magnetic fields, Biomagnetism, Encephalograms, Stimulation(Physiology), Response(Biology), Reprints, Auditory evoked fields, Auditory cortex, NTISDODXR.

No abstract available.

712,357
PB-291 949/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Human Magnetic Auditory Evoked Fields.
Final rept.
M. Reite, J. Edrich, J. T. Zimmerman, and J. E. Zimmerman. 1978, 4p
Sponsored in part by Denver Research Inst., CO., and Colorado Univ. Medical Center, Denver.
Pub. in Electroencephalography and Clinical Neurophysiology 45 p114-117 1978.

Keywords: Electrophysiology, Humans, Electroencephalography, *Evoked responses, Squid devices, Scalp.

Several laboratories have demonstrated that both visual and somatosensory magnetoencephalographic (MEG) averaged evoked fields (AEF) are more localized in their scalp distribution than are their more conventional EEG evoked potential counterparts (Brenner et al. 1975; Teyler et al. 1975; Brenner et al. 1978; Reite and Zimmerman 1978). In this report, the authors present the first evidence of MEG auditory evoked fields. The authors data indicate that they, too, are highly localized in their scalp distribution.

Immunology

712,358
PB-287 976/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Derivatized Silica Spheres as Immunospecific Markers for High Resolution Labeling in Electron Microscopy.
Final rept.,
K. R. Peters, G. Rutter, H. H. Gschwender, and W. Haller. 1978, 21p
Pub. in Jnl. Cell. Biol., v78 p309-318 1978.

Keywords: *Influenza virus, *Silicon dioxide, *Markers, *Antigens, Electron microscopy, Cells(Biology), Reprints, HeLa tissue culture cells.

For high resolution labeling of influenza virus cell surface antigens on HeLa cells, an immunospecific marker is used with silica sphere cores of 13-14 nm average diameter. These markers are formed using commercially available silica sphere sols. Two other size ranges are available, 7-8 nm and 22-25 nm. The steps for chemical derivatization are described in detail. Amino and aldehyde functions are covalently introduced onto the sphere surface. Sols of these derivatized silica spheres (DSS) are physicochemically stable and therefore usable for years. Coupling of IgG to DSS followed by permeation chromatography on controlled pore glass results in size-defined immunospecific silica sphere markers (DSS-markers). Saturation labeling of cell surface antigens on HeLa cells on cover slips is obtained with the final sphere concentration of 10(14) DSS-marker/cu cm within 20 min. With usual protective conditions, the marker stability and labeling ability are preserved for months. The visibility and the fine structure of the DSS-marker on cell surfaces are shown by using transmission electron microscopy (TEM) with stereo replicas and ultrathin sections.

712,359
PB82-152653 Not available NTIS
National Bureau of Standards, Washington, DC.
Detailed Intercomparison of Calculated and Measured Ionization Yield Spectra for 20 MeV Neutrons and the Implications for High Energy Neutron Dosimetry.
J. Coyne, J. C. McDonald, H. G. Menzel, and H. Schuhmacher. 1981, 11p
Grant PHS-CA-26313-02
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Symposium Neutron Dosimetry (4th), Munich-Neuherberg, Germany, June 1-5, 1981, Paper in Radiation Protection 1, p213-223 1981.

Keywords: Proportional counters, Alpha particles, Fast neutrons, Ionizing radiation, *Neutron dosimetry, Tissue-equivalent detectors.

Tissue-equivalent proportional counters have been used to measure ionization yield spectra for approximately 20 MeV neutrons at two different neutron facilities. The results of these measurements are compared with calculated ionization yield spectra which have been obtained by using the analytical method. The calculations have taken into account the variation of ionization yield with ion energy and ion type. The comparisons at 20 MeV indicate that fewer alpha particles are observed than are predicted by the calculations, and call into question the nuclear data used in these calculations. These facts could have important implications for neutron kerma factors and the measurement of neutron dose at high energies. Re-examination of results at 14.5 MeV indicate that there may already be problems at this energy. The need for better nuclear data in the energy region above 10 MeV is evident.

Microbiology

712,360
PB-295 737/1 (Order as PB-295 736/3, PC **A08**/MF **A01**)
National Measurement Lab. (NBS), Washington, DC. Center for Materials Science.
Diffusion Coefficients of the 45S and 50S States of the Large Ribosomal Subunit of E. coli by Quasielastic Light Scattering,
C. C. Har, I. N. Serdyuk, and H. Yu. 3 Oct 78, 8p
Prepared in cooperation with Wisconsin Univ., Madison. Dept. of Chemistry.
Included in Jnl. of Research of the National Bureau of Standards, v84 n1 p1-8, Jan-Feb 79.

Keywords: *Ribosomes, *Escherichia coli, *Light scattering, Bacteria.

The translational diffusion coefficients of the 45S and 50S states of the large ribosomal subunit of E. coli were determined from the spectral distribution of quasielastically scattered light with a 5 mW He-Ne laser as the source. The spectral analysis was performed by directly Fourier transforming the photocurrent and fitting to double-Lorentzian profile via a non-linear regression routine. A small amount (about 1%) of strongly scattering contaminants required the double-Lorentzian profile in order to extract the diffusion coefficients of the principal components.

712,361
PB80-108541 Not available NTIS
National Bureau of Standards, Washington, DC.
Microbial Metabolism of Heavy Metals.
Final rept.,
W. P. Iverson, and F. E. Brinckman. 1978, 32p
Sponsored in part by Environmental Protection Agency, Washington, DC. Office of Water Planning and Standards.
Pub. in Chapter 8 in Water Pollution Microbiology, 2, p201-232 1978.

Keywords: *Metals, *Microorganisms, *Metabolism, *Metalloids, Arsenic, Cadmium, Food chain, Lead(Metal), Mercury, Tin, *Heavy metals.

The current understanding of the transformations of metals and metalloids by, and the effects of metals and metalloids on, microorganisms is reviewed with 200 references. Microbial transformations of several technologically prominent toxic metal systems, including arsenic, mercury, cadmium, lead and tin are discussed, in greater detail with respect to inorganic and organometallic ions. The implications of these transformations to the general problem of metal pollution, particularly in aquatic environments, are described. The effect of metal stress, plasmid transfer, and metal tolerance on bacteria is considered.

712,362
PB84-136423 Not available NTIS
National Bureau of Standards, Washington, DC.
Anaerobic Corrosion by Sulfate-Reducing Bacteria Due to a Highly-Reactive Volatile Phosphorus Compound.
Final rept.
W. P. Iverson, and G. J. Olson. 1983, 8p
Pub. in Proceedings of Conference on Microbial Corrosion Held at Teddington (England) on March 8-10, 1983, p46-53 1983.

Keywords: *Sulfate reducing bacteria, *Anaerobic processes, *Corrosion, Phosphorus inorganic compounds, Hydrogen sulfide, Iron.

Anaerobic corrosion by sulfate-reducing bacteria appears to be caused by a highly active volatile phosphorus compound, which reacts with bulk iron to form iron phosphide. Preliminary evidence also indicates that the phosphorus compound may also be produced by the direct action of bacterially produced hydrogen sulfide on inorganic phosphorus compounds. Accordingly, any organism that produces hydrogen sulfide, under anaerobic conditions, in the presence of certain phosphorus compounds should stimulate the anaerobic corrosion of iron, providing the iron does not have a film of iron sulfide present. In addition to formation of the phosphorus compound and the metabolic production of hydrogen sulfide by sulfate-reducing organisms, methylmercaptan and dimethyldisulfide are produced. These compounds were relatively non-corrosive to iron.

712,363
PB85-117992 Not available NTIS
National Bureau of Standards, Washington, DC.

Volatilization of Mercury By Thiobacillus-Ferrooxidans.
Final rept.
G. J. Olson, W. P. Iverson, and F. E. Brinckman.
1981, 4p
Pub. in Current Microbiology 5, n2 p115-118 1981.

Keywords: *Mercury(Metal), *Thiobacillus, *Vaporizing, Microorganisms, Bacteria, Gas chromatography, Metals, Reprints, *Thiobacillus ferrooxidans, Heavy metals.

Thiobacillus ferrooxidans and an acidophilic iron-oxidizing bacterium resembling T. ferrooxidans became significantly more tolerant to mercury stress after culturing in media of increasing mercury (II) concentrations. When mercuric chloride was added to the growth medium and the headspace above the cultures was analyzed by a gas chromatography-atomic absorption system, the resistant organisms were found to volatilize elemental mercury (Hg). Mercury was not similarly volatilized from phenylmercuric acetate or methylmercuric chloride. T. ferrooxidans may be an important factor in the natural mercury cycle since the environments where T. ferrooxidans is found typically contain elevated levels of heavy metals, including mercury.

712,364
PB87-233557 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Use of Epifluorescence Microscopy for Characterizing the Activity of 'Thiobacillus ferrooxidans' on Iron Pyrite.
Final rept.,
T. Y. Yeh, J. R. Godshalk, G. J. Olson, and R. M. Kelly. 1987, 9p
Grant NSF-CBT85-07399
Sponsored by National Science Foundation, Washington, DC.
Pub. in Biotechnology and Bioengineering 30, p138-146 Jul 87.

Keywords: *Iron pyrite, *Bacteria, Oxidation, Reprints, Thiobacillus ferrooxidans, *Epifluorescence microscopy, Metal oxidation, Ore bioleaching.

The enumeration and characterization of microorganisms attached to solid surfaces have always presented significant difficulties. This is particularly true for microorganisms that are indigenous to coal mines and mineral deposits where metal sulfides are ubiquitous. The complications that arise are the result of the variety of inorganic compounds that are present in these environments, the harsh conditions under which the microorganisms profliferate, and the low cell densities to which they grow. The work presented here suggests that epifluorescence microscopy using acridine orange can be a useful probe to study acidophilic metal-leaching bacteria. Experiments involving the growth of Thiobacillus ferrooxidans on iron pyrite are described which indicate a relationship between cell fluorescence color and bacterial activity.

Nutrition

712,365
PB82-263450 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Reference Materials for Organic Nutrient Measurement.
Final rept.
S. A. Margolis. Aug 82, 54p NBS-SP-635
Proceedings of a Workshop held at the National Bureau of Standards, Gaithersburg, Maryland, October 23, 1980. Library of Congress catalog card no. 82-600575. Sponsored in part by Food and Drug Administration, Washington, DC., Department of Agriculture, washington, DC., and National Food Processors Association, Berkeley, CA.

Keywords: *Meetings, *Nutrients, Standards, Measurement, Food, Vitamins, Cholesterol, Fats, Sugars, Stability, *Reference materials, State of the art.

This publication contains seven formal presentations which provided the framework for three workshop sessions. Each workshop session focused on one of three groups of nutrients: (1) cholesterol, fat, and fat-soluble vitamins; (2) water-soluble vitamins; or (3) sugars. Each workshop session reported on the state-of-the-art in measurement techniques, suggested matrices which are appropriate for Standard Reference Materials (SRM's), and indicated areas where there were problems in measurement methodology. These recommendations are included in this publication.

712,366
PB87-197828 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Preparation of a Mixed Human Diet Material for the Determination of Nutrient Elements, Selected Toxic Elements and Organic Nutrients: A Preliminary Report.
Final rept.,
G. V. Iyengar, J. T. Tanner, W. R. Wolf, and R. Zeisler. 1987, 18p
Sponsored by Food and Drug Administration, Rockville, MD., and Department of Agriculture, Beltsville, MD.
Pub. in Science of the Total Environment 61, p235-252 1987.

Keywords: *Diets, *Nutrition, *Atomic absorption, Atomic emission, Elemental analysis, Neutron activation.

Using 201 foods from the United States Food and Drug Administration's Total Diet Study (FDA TDS), a mixed diet composite (USDIET-1) was prepared to represent the intake of 25-30-year-old males in the United States. Proximate analyses, phytate determination, and assays for nutrient elements and selected toxic elements, as well as organic nutrients were carried out on this composite. As part of a quality control exercise for a coordinated research program, atomic absorption spectrophotometry, inductively coupled atomic emission spectrometry, colorimetry and neutron activation analysis were used to determine up to 30 elements in the diet material. A comparison of the daily intakes of As, Ca, Cd, Cu, Fe, Hg, K, Mg, Mn, Na, P, Se and Zn from the composite USDIET-I shows excellent to good agreement with FDA TDS values calculated from results of single food analyses. These USDIET-I results demonstrate the feasibility of the mixed diet concept as a viable approach for a reliable assessment of daily intakes, especially for a number of elements such as Cd, Cr, Hg and Mo that occur at low concentrations in individual food products. Simultaneously, stability of some organic nutrients during storage was also investigated. Initial findings suggest that this program may also be useful in the development of reference materials for organic nutrients, for which there is a great need. These aspects are discussed.

Pathology

712,367
PB-296 356/9 PC **A15**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.
Ultrasonic Tissue Characterization II.
M. Linzer. Apr 79, 346p NBS-SP-525
Sponsored in part by National Science Foundation, Washington, DC. Research Applied to National Needs, and National Institutes of Health, Bethesda, MD. Diagnostic Radiology Dept. Library of Congress catalog card no. 79-600026. Presented at the International Symposium on Ultrasonic Tissue Characterization (2nd) Held at Gaithersburg, MD. on June 13-15, 1977.

Keywords: *Meetings, *Ultrasonic tests, *Tissues(Biology), Acoustic properties, Acoustic measurement, Nondestructive tests, Ultrasonic frequencies, Absorption, Acoustic velocity, Attenuation, Scattering, Acoustic impedance, Pattern recognition, Neoplasms, Diagnosis, Pathology, Microscopy, Noninvasive tests, Ultrasonic imaging, Acoustic holography.

The Second International Symposium on Ultrasonic Imaging and Tissue Characterization was held at the National Bureau of Standards on June 13-15, 1977. The meeting was cosponsored by the National Bureau of Standards, the National Science Foundation, and the National Institutes of Health. This volume contains extended and reviewed papers based on 43 of the 53 talks presented at the Symposium. Topics covered include techniques for measurement of ultrasonic tissue parameters, the dependence of tissue properties on physical and biological variables (e.g., ultrasonic frequency, temperature), mechanisms of ultrasonic tissue interactions, propagation through bone and skull, tumor Doppler signatures, computerized tomography, signal processing and pattern recognition, and tissue phantoms. A survey of velocity and attenuation data in mammalian tissue is included in an appendix.

712,368
PB85-140333 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultrasonic Tissue Characterization Seminar: An Assessment.
Final rept.
M. Linzer. 1976, 4p
Pub. in Jnl. of Clinical Ultrasound 4, n2 p97-100 Apr 76.

Keywords: *Diagnosis, *Tissues(Biology), *Ultrasonics, Characteristics, Reprints.

A review and assessment of the impact of the 1975 Ultrasonic Tissue Characterization Seminar is presented.

712,369
PB85-143477 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Amplitude Analysis of Pancreatic B-Scans: A Clinical Evaluation of Cystic Fibrosis.
Final rept.
T. A. Shawker, S. I. Parks, M. Linzer, B. Jones, L. A. Lester, and V. S. Hubbard. 1980, 12p
Pub. in Ultrason. Imaging 2, n1 p55-66 Jan 80.

Keywords: *Cystic fibrosis, *Pancreas, *Ultrasonic frequencies, Respiratory diseases, Reprints.

Ultrasonic B-scan images of the pancreatic parenchyma in normal and cystic fibrotic patients were numerically analyzed. Images of both the maximum and minimum echoes from the tissue were generated by a recently-developed digital ultrasound system. Complete segregation of the two groups was achieved by averaging the echo amplitude over a selected region in the image. The dependence of the numerical values on the B-scan imaging mode, transducer properties, dynamic range compression curve, and operator scanning technique is discussed in depth.

712,370
PB85-143618 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultrasonic Tissue Characterization.
Final rept.
M. Linzer, and S. J. Norton. 1982, 27p
See also PB-296 356.
Pub. in Annual Review of Biophysics and Bioengineering 11, p303-329 1982.

Keywords: *Ultrasonic tests, *Tissues(Biology), Acoustic properties, Reprints, Noninvasive tests.

A critical review of ultrasonic tissue characterization techniques is presented.

712,371
PB86-142478 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Role of Octacalcium Phosphate in Subcutaneous Heterotopic Calcification.
Final rept.
M. S. Tung, and W. E. Brown. 1985, 3p
Sponsored by National Inst. of Dental Research, Bethesda, MD.
Pub. in Calcif. Tissue Int. 37, p329-331 1985.

Keywords: *Tissue(Biology), *Calcification, *Scleroderma, Pathology, Reprints.

Comparison of lattice parameters and morphology of some of the microcrystallites in a subcutaneous heterotopic calcification reported by Daculsi et al. with those of heat-treated octacalcium phosphate (OCP) suggests that OCP is one of the mineral phases in dense globules and one of the precursors for the apatite.

712,372
PB86-241734 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

Accuracy of Participant Results Utilized as Target Values in the CAP Chemistry Survey Program.
Final rept.
A. E. Hartmann, H. K. Naito, R. W. Burnett, and M. J. Welch. Oct 85, 10p
Pub. in Archives of Pathology and Laboratory Medicine 109, p894-903 Oct 85.

Keywords: *Definitive methods, Surveys, Reprints, *Organic serum analytes.

Samples of lyophilized human serum were circulated to more than 7,000 participants in the College of American Pathologists chemistry survey program. The participants measured the concentrations of glucose, cholesterol, uric acid, and urea along with other constituents in the samples. Selected samples also were sent to the National Bureau of Standards (NBS) for analysis of these same analytes by definitive methods. Consensus mean values of participant results are used as target values.

712,373
PB86-242179 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 91, Number 2, March-April 1986.
Apr 86, 74p
See also PB86-242187 through PB86-242245, and PB86-206364. Also available from Supt. of Docs as SN703-027-0009-1.

Keywords: *Tissues(Biology), *Sampling, Humans, *Biomedical sampling, Trace elements, Urinalysis, Neutron activation analysis.

Contents: Representative sampling of human tissue; Technical considerations for sampling and sample preparation of biomedical samples for trace element analysis; Environmental specimen banking; Presampling factors; The sampling and analysis of human livers; The collection and preparation of human blood plasma or serum for trace elements analysis; Storage and pre-neutron ativation analysis treatment for trace element analysis in urine.

712,374
PB86-242187
(Order as PB86-242179, PC **A04**/MF **A01**)
Medical Coll. of Ohio at Toledo.
Representative Sampling of Human Tissue.
H. C. Hopps. 24 Oct 85, 4p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v91 n2 p47-50 Mar-Apr 86.

Keywords: *Tissues(Biology), *Sampling, Qualtiy control, Analysis, *Biomedical sampling, Trace elements.

In the chemical analyses of tissues for trace elements, quality control of the tissue sample for its anatomic composition is a critically important step that is frequently overlooked. This is because the analyst often assumes a degree of homogeneity that does not exist. The means of attaining a representative sample vary greatly depending on the organ or tissue involved, and also on the level of resolution chosen, i.e., the size of the sample.

712,375
PB86-242195
(Order as PB86-242179, PC **A04**/MF **A01**)
International Atomic Energy Agency, Vienna (Austria).
Technical Considerations for Sampling and Sample Preparation of Biomedical Samples for Trace Element Analysis.
R. M. Parr. 24 Oct 85, 7p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v91 n2 p51-57 Mar-Apr 86.

Keywords: *Tissues(Biology), *Sampling, Analysis, Contamination, Quality assurance, Handling, *Biomedical sampling, *Trace elements.

Sampling and sample preparation procedures are to a large extent determined by the analytical method used since different methods vary in the amount of material required for analysis and in how this is pre-treated before being introdued into the measuring instrument. Judging from imtercomparison studies conducted by the International Atomic Energy Agency (IAEA), the most widely applicable methods now in use are Neutron Activation Analysis, Atomic Absorption Spectrometry, and Inductively Coupled Plasma Atomic Emission Spectrometry, though the latter still seems to have insufficient sensitivity for many trace elements of biomedical interest. Common to all thses methods is the problem of contaminating the sample before or during analysis. For many elements sufficient control over contamination can only be achieved by the use of special tools and reagents, and by working in a controlled (dust-free) environment. Several important elements are subject to losses on drying or ashing, but can be recovered reliably if wet-ashed in a closed container such as a PTFE 'bomb'. For representative sampling it is almost always necessary to start with several grams of material, and to homogenize this, if the effects of sample heterogeneity are to be reduced to an acceptable level. Quality assurance procedures covering all these aspects are difficult both to define and to apply. However, much can be learned from the statistical evaluation of results for duplicate samples, and from a determination of the limit of quantitation of the analytical procedure.

712,376
PB86-242203
(Order as PB86-242179, PC **A04**/MF **A01**)
Muenster Univ. (Germany, F.R.).
Environmental Specimen Banking: The Selection, Collection, Transport, and Storage of Biomedical Samples.
F. H. Kemper, and N. P. Luepke. 24 Oct 85, 7p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v91 n2 p59-65 Mar-Apr 86.

Keywords: Humans, Exposure, *Specimen banking, *Biomonitoring, *Biomedical sampling.

In order to adequately ensure the protection of human health and the environment from the thousands of presently suspected hazardous substances and the new compounds added to those by new industrial processes, sophisticated approaches to hazard assessment and monitoring are being established. Environmental specimen banking (ESB) is necessary, useful, and important for environmental monitoring currently, and in the future for monitoring the past. ESB has already proved a good tool for recording inorganic and/or organic pollution trends over the years. Moreover, ESB offers the possibilities and potentials for retrospective analysis of authentic samples from the past by improved futhure analytical procedures, including the detection of presently unnoticed environmental chemicals of biological interest. Among the specimens representing the environment, specimens of human origin play a key role. The selection criteria for human specimens include ethical and legal considerations together with the appropriate scientific approaches and epidemiological criteria. Technical considerations for sampling, preparation, transportation, and storage of the specimens include the selection and development of specific materials and implements, cold storage, and clean room technology in order not to compromise the original composition of the sample.

712,377
PB86-242211
(Order as PB86-242179, PC **A04**/MF **A01**)
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.).
Presampling Factors.
G. V. Iyengar. 24 Oct 85, 8p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v91 n2 p67-74 Mar-Apr 86.

Keywords: *Tissues(Biology), *Sampling, Humans, *Biomedical sampling, *Trace elements.

Choosing the right kind of samples from human subjects for trace element studies poses many difficult problems. First of all, due to practical considerations, specimens with clinical relevance are restricted to a few such as whole blood, hair, nail, urine, and faeces. Although autopsies provide access to collect various organs, their usefulness is restricted to monitoring type of activities and not for clinical diagnosis. Besides these basic differences one is also confronted with procuring 'valid' samples for analysis. Validity refers to both analytical and biological aspects and the material collected should satisfy both the demands to make the specimen meaningful. In practice this is not a simple task because a number of presampling factors need to be taken into account. Significant situations among these are the biological variations, post mortem changes, intrinsic errors resulting from internal contaminations, etc. The impact of these factors alters the status of the sample and calls for adequate discription of the specimen. In the absence of a well defined sample protocol accurate characterization of the material will not be possible and renders the analytical effort worthless. Solutions to these problems should be sought at interdisciplinary level and effective team work is mandatory to make any meaningful progress in endeavors to answer public health questions.

712,378
PB86-242229
(Order as PB86-242179, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Sampling and Analysis of Human Livers.
R. Zeisler. 9 Jan 86, 11p
Included in Jnl. of Research of the National Bureau of Standards, v91 n2 p75-85 Mar-Apr 86.

Keywords: *Liver, *Tissue preservation, *Sampling, Humans, Low temperatures, *Biomedical sampling, Trace elements, Neutron activation analysis.

A comprehensive approach to the analysis of human livers has been developed in a pilot program for a National Environmental Specimen Bank (NESB). Since 1980, the pilot NESB program has examined the collection, processing, storage and analysis of human livers. Sampling protocols, handling procedures and analytical methods have been developed and implemented considering the requirements for valid analytical results. Sampling and handling included the use of cleanroom technology, specific clean implements and packing materials made from titanium and Teflon and flash-freezing and preservation at liquid nitrogen scheme combined up to four analytical techniques to determine the distribution of 29 trace elements in 66 human livers.

712,379
PB86-242237
(Order as PB86-242179, PC **A04**/MF **A01**)
Ghent Rijksuniversiteit (Belgium).
Collection and Preparation of Human Blood Plasma or Serum for Trace Element Analysis.
J. Versieck. 24 Oct 85, 6p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v91 n2 p87-92 Mar-Apr 86.

Keywords: *Blood collection, *Sampling, Reagents, Containers, Contaminiation, Humans, *Clean rooms.

Trace element concentrations in blood plasma or serum have been assayed by numerous investigators using a variety of analytial techniques. For serveral elements, figures obtained in different centers are widely disparate. Impressive evidence has accumulated that a great deal of the inconsistencies should be ascribed to unsuspected contamination of the samples with exogenous material during their collection and preparation. In the paper, a number of potential sources of extraneous additions are indicated. Methods for controlling contamination are also briefly discussed.

712,380
PB87-162095 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Evaluation of Biological Samples for Specimen Banking and Biomonitoring by Nuclear Methods.
Final rept.,
S. F. Stone, R. L. Zeisler, and J. R. Vogt. 1984, 12p
See also DE84-017348.
Pub. in Proceedings of International Conference on Nuclear Methods in Environmental and Energy Research (5th), Mayaguez, Puerto Rico, April 2, 1984, p801-812 1984.

Keywords: *Specimen banking, *Biomonitoring, Humans, Livers, Mussels, Neutron activation analysis, Trace elements, Mytilus edulis.

In a pilot program for environmental specimen banking, human livers and marine mussels (Mytilus edulis) were sampled, analyzed and banked. Nuclear methods played a major role in the evaluation of the samples, providing concentration data for up to 38 major, mineral and trace elements. Instrumental neutron activation analysis was complemented by neutron capture prompt gamma activation analysis, radiochemical separations and, for the mussels, by instrumental X-ray

fluorescence analysis. The cryogenic homogenization procedure was applied for sample preparation and was evaluated. Assessment of accuracy was made by analyzing Standard Reference Materials and by intercomparison of the techniques. Results are reported for 66 individual human liver specimens, collected at three locations in the United States, and for batches of 65 mussels from a collection made at Narragansett Bay, Rhode Island.

Pest Control

712,381
PB-263 275/0 PC **A05**/MF **A01**
Little (Arthur D.), Inc., Cambridge, MA.
Developing Incentives for Pest Control Methods: Proceedings of a Conference Held in Gaithersburg, Maryland on October 26-27, 1976.
Final rept.
Jan 77, 92p NBS-GCR-ETIP-76-34
Contract EPA-68-01-3133

Keywords: *Pesticides, *Pest control, *Meetings, Recommendations, Safety, Risk, Policies, Incentives.

The purpose of the conference was to assemble representatives of the parties at interest (government agencies, industry and public interest groups) in order to examine and evaluate the incentives that had been developed. The result is a consensus concerning the incentives and their implementation. The report contains summaries of the workshops, their recommendations for the parties at interest to follow, and the reactions of participants after the conference was held.

712,382
PB-300 846/3 PC **A09**/MF **A01**
Little (Arthur D.), Inc., Cambridge, MA.
Evaluation Design Concept for Regulatory Reform: The Waiver of Efficacy Data.
Final rept.
H. D. Ojha, T. V. Renda, J. E. Harrison, and J. H. Perwak. May 79, 177p NBS/GCR/ETIP-79/71
Contracts NBS-7-35829, EPA-68-01-4788

Keywords: *Pesticides, *Regulations, *Technology innovation, Government policies, Evaluation, Project management, National government, Effectiveness, Pest control, Legislation, Consumer affairs, Public health, *Environmental Protection Agency, Environment management, Waivers, Registration.

The report presents an evaluation design concept aimed at supporting the Office of Pesticide Programs of the U.S. Environmental Protection Agency in implementing one of its recently adopted regulatory reform efforts--the efficacy data waiver. It documents the policy and administrative settings as well as the evaluation problem associated with the waiver and its implementation. This report also marks the beginning of an experiment evaluation design phase of a larger joint project between EPA and the Experimental Technology Incentives Program of the National Bureau of Standards Center for Field Methods. The whole project is aimed at improving pesticide regulation so as to improve the environment for technological innovation. The purpose of this project, as an administrative experiment, has been to develop and evaluate a change in the policy or process of pesticide regulation which could improve the environment for technological innovation. It has proceeded through several stages involving background investigations of pesticide regulations, effects on industry, stakeholders' views, and administrative and regulatory processes. At the present stage, the project is focused on documenting an evaluation design concept which can be used in subsequent phases by OPP to evaluate the efficacy data waiver policy implementation.

Pharmacology & Pharmacological Chemistry

712,383
PB-263 273/5 PC **A03**/MF **A01**
Rochester Univ. Medical Center, N.Y. Center for the Study of Drug Development.
Post Marketing Surveillance of New Drugs: A Preliminary Review of the Current State-of-the-Art.
Draft no. 2,
W. M. Wardell, M. C. Tsianco, H. T. Davis, and S. N. Anavekar. Dec 76, 46p NBS-GCR-ETIP-76-35

Keywords: *Drugs, Evaluation, Pharmacology, Toxicology, Effectiveness, Benefit cost analysis, Surveillance, Regulations, Marketing, Surveys, Biostatistics, Data acquisition, Statistical analysis, *Prescription drugs.

The study had the aim of gathering information to (1) identify examples of post-marketing surveillance that have been carried out, (2) review the methodology available for PMS in relation to the aims of studies involved, using the actual examples upon which data could be obtained, (3) analyze the examples in technical terms, particularly experimental design and statistical power, (4) examine their costs and benefits where sufficient data exist. The case examples selected for this study were those upon which the data could be obtained in a limited time period and in some cases published data were used. Examples of controlled experiment studies, controlled cohort surveys, uncontrolled cohort surveys, case-control surveys, and spontaneous voluntary reporting are provided. These examples are not the products of a formal system of PMS but are studies which have been carried out to meet a variety of perceived needs. A main conclusion is that no single design approach for a PMS system will by itself be sufficient to carry out all that is needed from a PMS system.

712,384
PB-295 586/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Chemical Spot Test Kits for Preliminary Identification of Drugs of Abuse.
Final rept.
R. Mills, and R. A. Velapoldi. Dec 78, 19p
Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, DC.
Pub. in NILECJ-STD-0604.00, 19p, Dec 78.

Keywords: *Drugs, *Identifying, Tests, Performance standards, Sensitivity, Requirements, Methodology, Color, Labeling.

This is a performance standard for field testing kits that use chemical spot tests for the preliminary identification of drugs of abuse. Performance requirements and methods of test are given for such attributes as specificity, sensitivity, color development, and labeling.

712,385
PB80-218449 Not available NTIS
National Bureau of Standards, Washington, DC.
Non-Peptide Impurities in Angiotensin I and Other Commercial Peptides.
Final rept.,
S. A. Margolis, and P. J. Konash. Jun 80, 1p
Pub. in Jnl. of HRC and CC, Short Commun. 3, p317 Jun 80.

Keywords: *Peptides, *Purity, *Drugs, *Angiotensin, Impurities, Contamination, Reprints.

Knowledge of the purity of commercial samples of biologically active peptides is essential to the understanding and interpretation of pharmacological and physiological studies with these substances. However, studies in the laboratories show that these peptides are not pure. The origin and nature of these impurities has not been investigated. In this study the authors demonstrate that certain impurities found in angiotensin I might originate from the rubber stopper of the container and the container walls, and others might be introduced during the purification of the crude peptide.

712,386
PB80-218522 Not available NTIS
National Bureau of Standards, Washington, DC.
Traceability Program for Radiopharmaceuticals at the United States National Bureau of Standards.
Final rept., Jul-Oct 79.
L. M. Cavallo, D. B. Golas, and W. B. Mann. Oct 79, 1p
Pub. in Atomic Energy in Australia 22, n3-4 p55 Jul-Oct 79.

Keywords: *Radioactive isotopes, *Drugs, Management, Radioactivity, Reprints.

The regulation of the use of radiopharmaceuticals and the traceability of measurements of their activity to the National Radioactivity Measurements System in the United States are described.

712,387
PB81-179699 Not available NTIS
National Bureau of Standards, Washington, DC.
Place of Reference Materials and Reference Methods in the Evaluation of Drug Effects.
Final rept.
D. J. Reeder. 1980, 9p
Pub. in Proceedings of the Use of Laboratory Test Results, Variation Due to Drug Intake Held at Pont-a-Mousson, France on Dec 17-19, 1979, Paper in Drug Effects on Laboratory Test Results, Developments in Clinical Biochemistry 2, p49-57 1980.

Keywords: *Drugs, Evaluation, Accuracy, Variability, Precision, Tests, Analytical methods, *Reference materials.

The presence of analytical errors in clinical laboratory testing may be the result of many factors. Even though most clinical tests are becoming very precise, reliance on precise tests for accurate analytical values is not sufficient because of potential bias caused by drug effects. Proper analytical techniques can minimize the sources of inaccuracies caused by variabilities and interferences but a true understanding of drug effects can only be obtained when measurements are placed on an accuracy base. Assurance that measurements are accurate can best be accomplished by use of reference materials and reference methods that are free of interferences and that can establish the accuracy of an analytical value. Development of new reference materials and reference methods will become increasingly important for proper health care.

712,388
PB81-223232 PC **A10**/MF **A01**
Performance Development Inst., Washington, DC.
Evaluability Assessment of the Developing Experiment in Post-Marketing Surveillance of Prescription Drugs,
S. Clarren, P. Nalley, G. Gregory, W. Frederick, and R. Hausmann. Mar 81, 214p NBS-GCR-ETIP-81-96
Contract NBS-78-3603

Keywords: *Drugs, *National government, *Research projects, Design, Surveillance, Evaluation, Data acquisition.

The report describes the context within which a regulatory administrative experiment is being developed by the Experimental Technology Incentives Program (ETIP) and the Food and Drug Administration (FDA). The purpose of the experiment is to determine the impact on drug development approval of new methods of gathering and analyzing data after a drug is marketed. The report assesses the evaluability of the experiment, raising measurement considerations and proposing means for evaluation.

712,389
PB83-132332 PC **A09**/MF **A01**
Performance Development Inst., Washington, DC.
Experiment in Post-Marketing Surveillance of Prescription Drugs: An Initial Status Report.
Final rept.
S. Clarren, P. Nalley, and C. Zuiches. Nov 82, 183p NBS-GCR-ETIP-82-99
Contract NBS-78-3603

Keywords: *Drugs, *Product development, Pharmaceutical industry, Marketing, Surveillance, Innovation, Regulations, Safety, Drug industry, *Consumer protection, Baseline data, *Prescription drugs.

This study examines baseline information on the continuing administrative experiment in changes in the regulatory process for prescription drugs. The experiment deals with changes in post marketing surveillance and their impact on the drug approval process and on innovation in the drug industry and health care in general. The baseline information includes data and analysis covering effects on innovation, the Food and Drug Administration regulatory decisions and the pharmaceutical industry. The study also includes recommendations for continuing the experiment and measuring its effects.

712,390
PB87-128401 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.

Pharmacology & Pharmacological Chemistry

Clinical Evaluation of a Hydroxyapatite Precipitate for the Treatment of Dentinal Hypersensitivity.
Final rept.
W. G. de Rijk, W. E. Brown, and L. C. Chow. 1986, 4p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Biomedical Engineering V Recent Developments, p336-339 1986.

Keywords: Hypersensitivity, Dicalcium phosphate dihydrate, Sensitivity, Reprints, *Dentin tubule, *Hydroxyapatite, Tetracalcium phosphate.

A newly developed paste that precipitates hydroxyapatite has been clinically evaluated for the treatment of dentinal hypersensitivity. Both the experimental paste and the placebo (SnO2) produced a significant reduction in patient discomfort. Only a minor difference was observed in the paste over the placebo.

712,391
PB88-152970 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
One-Electron Redox Reactions of Pyrazolin-5-Ones. A Pulse Radiolysis Study of Antipyrine and Analogues.
Final rept.,
S. V. Jovanovic, P. Neta, and M. G. Simic. 1985, 4p
Pub. in Molecular Pharmacology 28, n4 p377-380 1985.

Keywords: *Pyrazolines, *Drugs, Electrode potentials, Oxidation, Reprints, *Antipyrine, Aqueous solutions.

One-electron oxidation of several derivatives of pyrazolin-5-one, including the drug antipyrine, were studied by pulse radiolysis of aqueous solutions.

Physiology

712,392
PB-265 024/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radiotracer Techniques for Protein Adsorption Measurements.
Final rept.,
W. H. Grant, L. E. Smith, and R. R. Stromberg. 1977, 6p
Pub. in Jnl. of Biomedical Materials Research, Symposium 8, p33-38 1977.

Keywords: *Proteins, *Tracer techniques, *Isotopic labeling, Radioactive isotopes, Adsorption, Measurement, Physiology, Reprints.

Factors which contribute to measurement errors associated with the use of radiotracers to measure protein adsorption are considered. Techniques for removal of excess adsorbent solution and for estimation of surface area are described. Artifacts induced by the incorporation of a radio-labeled both by specific adsorption of the labeling atom and by changes in the protein are discussed.

712,393
PB-283 828/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Magnetic Phenomena of the Central Nervous System.
Final rept.,
M. Reite, and J. Zimmerman. 1978, 22p
Pub. in Ann. Rev. Biophys. Bioeng. n7 p167-188, 1978.

Keywords: *Central nervous system, Magnetic properties, Medical equipment, Electroencephalography, Measurement, Detection, Brain, Sensitivity, Measuring instruments, Evoked responses, Reprints, Biomagnetism, *Magnetoencephalography.

Several laboratories have contributed significantly to the present state of experimental knowledge of magnetic phenomena of the central nervous system. This includes observations of magnetoencephalograms of normal and pathological subjects, magneto-oculograms, magnetic visual evoked responses, and extensive comparisons between magnetoencephalograms and electroencephalograms. A useful feature of magnetic detection is that sources in the brain can be localized more precisely, and more easily, than the surface electric potential measurements, because of the quite different way in which the skull and other electrical inhomogenieties affect the two types of measurements. Instrumental sensitivity and interference rejection and shielding techniques are currently adequate for measurements down to about 10 to the minus 14th power tesla. Considerably better sensitivity is possible in principle, and would be very desirable in order for the full potential of magnetic detection of neurological phenomena to be realized.

712,394
PB-284 044/5 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C.
Arousal from Sleep by Emergency Alarms: Implications from the Scientific Literature.
Final rept.,
V. J. Pezoldt, and H. P. Van Cott. Jun 78, 38p
NBSIR-78-1484 (HEW)
Report on HEW-NBS, Fire/Life Safety Program. Sponsored in part by Department of Health, Education, and Welfare, Washington, D.C.

Keywords: *Warning systems, *Sleep, *Arousal, Intensity, Thresholds(Perception), Stimulus(Psychophysiology), Safety, Fire alarm systems, Recommendations, Experimental data, Reviews, Audiometry, Drugs, Noise(Sound), Design, Performance(Human), Motivation, Characteristics, Age, Nursing homes.

A review of the sleep research and other scientific literature pertaining to the arousal of sleeping individuals by external stimuli is reported. This effort was undertaken to provide information about the characteristics of emergency alarms which will reliably awaken a sleeping population, especially nursing home residents, in the event of fire. The literature reviewed does not provide an adequate basis for specifying signal characteristics which will offer a high assurance of producing arousal. Among the factors that influence the intensity of a signal which will produce arousal are the age and physical/mental condition of the sleeper, drug use, sleep stage, time of night, and meaningfulness or personal significance of the signal. Data relevant to these variables are discussed as is the problem of performance following abrupt arousal. Recommendations regarding stimulus characteristics, measures of arousal and the experimental environment for future studies of arousal by emergency alarms are presented.

712,395
PB-288 526/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Luminance-Brightness Comparisons of LED Alpha-Numeric Sources at Suprathreshold Levels.
Final rept.,
R. L. Booker. Jul 78, 4p
Pub. in Jnl. of the Optical Society of America 68, n7 p949-952, Jul 78.

Keywords: *Brightness, *Luminance, Humans, Photometry, Spectroradiometers, Experimental data, Visual perception, Comparison, Reprints.

An experiment was conducted in which observers adjusted the luminance of a 2856 K white comparison source to appear equally as bright as a red, yellow, or yellowish-green LED alpha-numeric source. Although the present CIE photometric system predicts brightness-luminance ratios of 1.0, the ratios obtained in this experiment, for the mean observer, were 1.13 for the yellowish-green, 1.28 for the yellow, and 2.54 for the red. These results demonstrate that there can be substantial differences between photometric luminance based on the V wavelength function and brightness as perceived visually.

712,396
PB-295 161/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Reference Materials for pH and Blood Gases.
Final rept.
R. A. Durst. Mar 79, 7p
Pub. in Blood pH and Gases, Session III, p81-87, Mar 79. Proceedings of the Workshop on Blood pH and Gases, Held at Utrecht, The Netherlands on June 5-6, 1978.

Keywords: *Blood, pH, Gases, Carbon dioxide, Oxygen, Acid-base equilibrium.

The paper is an extended abstract of a talk presented at the Workshop on pH and Blood Gases in Utrecht, The Netherlands on June 6, 1978. The full publication will eventually appear as an IFCC Recommendation on Quantities related to pH and Blood Gases, Part 3. Reference Materials.

712,397
PB-300 565/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanisms of Planning and Problem Solving in the Brain.
Final rept.
J. S. Albus. 1979, 47p
Pub. in Math. Biosci. 45, p247-293 1979.

Keywords: *Brain, *Cognition, *Planning, *Problem solving, Perception, Motor reactions, Intelligence.

Classical and/or goal, or task, decomposition techniques are generalized to deal with the problem of sensory-interactive goal-directed behavior in biological organisms. a neurophysiological model is described which demonstrates the capacity to learn, to generalize, to compute multivariate mathematical functions, and to decompose input commands into sequences of output commands in a context-sensitive manner. Evidence is presented that clusters of neurons with such properties are arrange in hierarchical structures in the brain so as to produce and/or task compositions. At the lowest levels in the motor system these clusters transform coordinates and compute servo functions. At the moddle levels they decompose input commands into sequences of output commands which give rise to behavior patterns. Mechanisms by which feedback can alter these decomposition sequences to compensate for perturbations and uncertainties in the environment are described. At the highest levels of the hierarchy there are goal selecting and evaluating mechanisms. It is argued that in higher mammals these upper levels of the motor hierarchy are the mechanisms of planning and problem solving.

712,398
PB81-133316 Not available NTIS
National Bureau of Standards, Washington, DC.
Developing Definitive Methods for Human Serum Constituents--A Progress Report from the CAP (College of American Pathologists) NBS Research Associate.
M. J. Welch. Dec 79, 4p
Sponsored in part by Food and Drug Administration, Washington, DC., and College of American Pathologists, Skokie, IL.
Pub. in Pathologist XXXIII, n12 p673-676 Dec 79.

Keywords: *Cholesterol, Methodology, Glucose, Blood serum, Humans, Mass spectrometry, Urea, Uric acid.

The report covers the principal activities of Michael Welch, who is a Research Associate at NBS, sponsored by the CAP. These activities are part of the effort of the Organic Analytical Research Division to develop definitive methods for organic constituents of human serum. Isotope dilution mass spectrometry (IDMS) is the analytical technique chosen for these methods. Definitive methods and IDMS are described in the report. Work has been completed on a definitive method for cholesterol; a brief description of the method and a table listing representative results are included. The progress of work on glucose, uric acid, urea, and creatinine is also described.

712,399
PB82-100256 Not available NTIS
National Bureau of Standards, Washington, DC.
Adsorption of Human Serum Albumin and gamma-Globulin on Hydrophobic and Hydrophilic Surfaces.
Final rept.
W. H. Grant, and R. E. Dehl. 1980, 9p
Pub. in Proceedings of Joint ACS & CSJ Cong. Adhesion and Adsorption of Polymers, Honolulu, HI., April 2-6, 1979, Paper in Adhesion and Adsorption of Polymers Pt. B, p827-835 1980.

Keywords: *Desorption, *Gamma globulin, *Serum albumin, Humans, Polyethylene, Proteins, Adsorption.

When a foreign surface is placed in contact with the blood there is little doubt that the initial event is the adsorption of plasma proteins onto the surface. The nature of the adsorbed protein, the absolute and relative amounts, the number and types of binding sites and the spatial distribution of the protein across the surface potentially affect the later stages of the interaction of the formed elements with the foreign surface. Since the initially deposited protein layer serves as the substrate for deposition of platelets, the other blood elements which can lead to formation of a thrombus, it seems likely that the detailed characteristics of the

protein layer may determine the mechanism of platelets adhesion and aggregation. As an approach to the development of an understanding of this mechanism the authors are investigating the adsorption and desorption of an isolated blood protein on hydrophobic surfaces, since some of these surfaces have been accepted in relation to the amount of thrombus formation as good biomaterials and others as poor biomaterials. Thus, it has been shown that there is essentially no appreciable difference in the total adsorbance of human serum albumin (HSA) on a good or poor biomaterial but there is a tremendous difference in the amount of HSA retained on these surfaces after several days of prolonged desorption.

712,400
PB82-104985 Not available NTIS
National Bureau of Standards, Washington, DC.
Auditory Space Perception.
Final rept.
J. A. Molino. 1977, 6p
Pub. in International Encyclopedia of Psychiatry, Psychology, Psychoanalysis, and Neurology, p222-227 1977.

Keywords: *Auditory perception, *Acoustics, Psychology, *Hearing.

Scientific data on human auditory space perception is presented. History and theories related to physical measurements are reviewed. Current methods and empirical results in auditory localization are given. A section on physiological models and practical applications is included.

712,401
PB82-118100 Not available NTIS
National Bureau of Standards, Washington, DC.
Reference and Quality Control Materials for pH and Blood Gases.
Final rept.
R. A. Durst, O. Siggaard-Andersen, and A. H. J. Maas. 1981, 12p
Pub. in Proceedings of Meeting IFCC Expert Panel on pH and Blood Gases (5th), Copenhagen, Denmark, June 16-18, 1980, Paper in Blood pH, Carbon Dioxide, Oxygen, and Calcium-ion, p89-100 1981.

Keywords: *Meetings, *Quality control, *pH, *Blood gas analysis, Standards, Carbon dioxide, Oxygen, *Reference materials.

A review of clinical reference and quality control materials is presented. The hierarchical structure of the measurement chain from the basic measurement units of the SI via standards and measurement methods to the routine laboratory determinations is illustrated. The variety of reference materials available for blood pH and gases (carbon dioxide and oxygen) are discussed as well as future needs in this area. A brief description is given of the NBS pH certification procedures.

712,402
PB87-113726 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Effects of Time-Varying Noise on Human Response: What Is Known and What Is Not.
Final rept.
S. L. Yaniv, and J. W. Bauer. 1980, 11p
Pub. in Proceedings of International Congress on Noise as a Public Health Problem, Freiberg (Germany, F.R.), September 25-29, 1980, p511-521.

Keywords: *Noise, *Responses, Humans, Time varying noise.

No abstract available.

712,403
PB87-149852 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Dynamics of Calcium Metabolism in Infancy and Childhood. 1. Methodology and Quantification in the Infant.
Final rept.,
L. J. Moore, L. A. Machlan, M. O. Lim, A. L. Yergey, and J. W. Hansen. 1985, 6p
Pub. in Pediatric Research 19, n4 p329-334 1985.

Keywords: *Calcium, *Metabolism, *Calcium isotopes, *Infant nutrition, Pediatrics, Infants, Calcium metabolism disorders, Stable isotopes, Mass spectroscopy, Reprints, Calcium dynamics, Calcium disorders.

Stable isotopes of calcium, (46)Ca and (48)Ca were injected intravenously and administered orally, respectively, to newborn infants. Methodology was developed to chemically separate calcium from serum and excreta, and to measure the enriched calcium isotopes with thermal ionization mass spectrometry. These studies have demonstrated that the dynamics of calcium metabolism can be quantified in infants by fitting the data to a multicompartmental model that consists of three expanding, rapidly exchangeable calcium pools interacting with bone, the kidney, and the gastrointestinal tract. The data suggest that in the process of reaching adulthood, urinary calcium losses fail to show the large decrease observed in other kinetic parameters; relative to other parameters, the rate of urinary calcium excretion increases. Applications of the procedures are expected to be useful in studying the calcium dynamics in selected individuals during growth and development or with various calcium disorders.

712,404
PB87-233433 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Precipitation of Sodium Acid Urate from Electrolyte Solutions.
Final rept.,
H. Furedi-Milhofer, V. Babic-Ivancic, O. Milat, W. E. Brown, and T. M. Gregory. 1987, 9p
Sponsored by American Dental Association Health Foundation, Chicago, IL., and Public Health Service, Rockville, MD.
Pub. in Jnl. of Crystal Growth 83, p572-580 1987.

Keywords: *Renal stones, Reprints, *Phase diagrams, *Gouty stones, Precipitation boundaries, Precipitation diagrams, Sodium acid urate monohydrate, Urolithiasis.

The precipitation of sodium urate from solutions containing uric acid, sodium hydroxide, hydrochloric acid, sodium chloride and water was investigated at constant pH (7.5 + or - 0.1) and temperature (308 K). Precipitates were observed by light and electron microscopy and characterized by electron and X-ray diffraction. The results are represented in the form of 'precipitation' and 'chemical potential' diagrams, the latter giving the sodium-to-urate molar ratios of the precipitates. Two types of precipitation boundaries were observed, both of which had indicated sodium-to-urate molar ratios of 1:1. The ion activity product, (Na+)(HU-), associated with boundary I was API=(4.8 + or - 1.1) times 10 to the minus 5th power and with boundary II was APII=(6.5 + or - 0.4) times 10 to the minus 4th power. The supersaturation, S, at boundary II was S=APII/K(sp)=12.3, in which K(sp) is the solubility product of sodium acid urate monohydrate. The latter precipitated as well-formed crystals at supersaturations of 12.3 and above. The ion activity product associated with boundary I is approximately equal to the solubility product of sodium acid urate monohydrate. Small amounts of several morphologically different sodium urate crystals formed in the range of supersaturations (1 less than or equal to S less than or equal to 12.3). Crystals formed in this range may include the monohydrate of sodium acid urate and possibly a higher hydrate. The findings have relevance to pathological renal stone formation and gouty arthritis.

712,405
PB87-233441 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Computed Phase Diagrams for the System: Sodium Hydroxide - Uric Acid - Hydrochloric Acid - Water.
Final rept.,
W. E. Brown, T. M. Gregory, and H. Furedi-Milhofer. 1987, 11p
Sponsored by American Dental Association Health Foundation, Chicago, IL., and Public Health Service, Rockville, MD.
Pub. in Jnl. of Crystal Growth 83, p588-598 1987.

Keywords: Solubility, Uric acid, *Isotherms, *Phase diagrams, Renal stones, Sodium acid urate monohydrate, *Sodium hydroxide, Urolithiasis.

Renal stone formation is made complex by the variety of solid phases that are formed, by the number of components in the aqueous phase, and by the multiplicity of ionic dissociation and association processes that are involved. In the present work the authors apply phase diagrams calculated by the use of equilibrium constants from the ternary system sodium hydroxide-uric acid-water to simplify and make more rigorous the understanding of the factors governing dissolution and precipitation of uric acid (anhydrous and dihydrate) and sodium urate monohydrate. The system is then examined in terms of four components. Finally, procedures are described for fluids containing more than four components. The isotherms, singular points, and fields of supersaturation and undersaturation are shown in various forms of phase diagrams. The system has two notable features (1) in the coordinates -log(H2U) versus -log(NaOH), the solubility isotherms for anhydrous uric acid and uric acid dihydrate approximate straight lines with slopes equal to +1 over a wide range of concentrations. As a result, substantial quantities of sodium acid urate monohydrate can precipitate from solution or dissolve without changing the degree of saturation of uric acid significantly. (2) The solubility isotherm for NaHU-H2O has a deltoid shape with the low-pH branch having a slope of infinity. As a result of the vertical slope of this isotherm, substantial quantities of uric acid can dissolve or precipitate without changing the degree of saturation of sodium acid urate monohydrate significantly. The H2U-NaOH singular point has a pH of 6.87 at 310 K in the ternary system.

Public Health & Industrial Medicine

712,406
NUREG/CR-3400 PC **A04**/MF **A01**
National Bureau of Standards (NML), Washington, DC. Center for Radiation Research.
Analysis of Measurements with Personnel Dosimeters and Portable Instruments for Determining Neutron Dose Equivalent at Nuclear Power Plants.
Final technical rept. Aug 81-Jun 83.
C. M. Eisenhauer, and R. B. Schwartz. Aug 83, 75p

Keywords: *Nuclear power plants, *Radiation dosage, *Dosimetry, Proportional counters, Gamma rays, Calibrating, Nuclear reactor containment, Portable equipment, *Neutron dosimetry, *Dose equivalents, Remmeters, Tissue-equivalent detectors.

Published data from measurements made by Pacific Northwest Laboratory (PNL) and those made jointly by the Environmental Measurements Laboratory (EML) and by Rensselaer Polytechnic Institute (RPI) inside containment at nuclear power plants were examined for the purpose of determining the best method for estimating the neutron dose equivalent received by workers. These data included measurements with TLD albedo dosimeters, 9-inch spherical remmeters, Andersson-Braun remmeters, multisphere sets, 'Cutie Pie' gamma survey meters, 3He spectrometers, and tissue equivalent proportional counters. Results are presented.

712,407
PB-264 666/9 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C. Product Systems Analysis Div.
Risks Associated with Certain Sports Activities.
Final rept.,
W. B. Beine. Jan 77, 106p NBSIR-77-1218
Sponsored in part by Consumer Product Safety Commission, Bethesda, Md. Bureau of Engineering Sciences.

Keywords: *Injuries, *Accidents, *Recreation, Epidemiology, Equipment, Protective clothing, Recommendations, Risk, Tables(Data), Protectors, Product safety, Bibliographies, Mortality, Head(Anatomy), Neck(Anatomy), Face(Anatomy), Leg(Anatomy), Research and development, Consumers, Data sources, Baseball, *Sports participation, Appendices, Football, Skiing, Basketball, Gymnastics, Hockey, Priorities.

The study provides the Consumer Product Safety Commission with recommendations for assigning priorities to tasks associated with reducing the incidence and severity of sports related injuries. Recommendations were derived from an analysis of the published literature and the NEISS data. They emphasize the need for collecting additional data, improving surveillance capabilities, stimulating research, and developing and promulgating equipment safety standards.

712,408
PB-265 031/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Piezoelectric-Crystal Mercury Dosimeter.
Final rept.,
E. P. Scheide. 1977, 5p
Pub. in Phys. Teach., v15 n1 p47-51 Jan 77.

Keywords: *Dosimeters, *Industrial hygiene, *Mercury(Metal), Piezoelectric transducers, Industrial medicine, Vapors, Industrial atmospheres, Exposure, Personnel, Reprints, Toxic substances, Indoor atmospheres.

A personal dosimeter for mercury vapor in air based on the use of a piezoelectric sensor with a selective coating has been developed and evaluated. The philosophy behind the use of such devices is explained along with the basic physics concerning this scientific principle. The sensor is a gravimetric device which indicates an integrated total exposure to mercury vapor. Calibration curves are given in the industrial hygiene range of interest and the device was evaluated from an industrial hygiene point of view. Short summaries are given describing current research and new directions in this field.

712,409
PB-267 611/2 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Hazard of Benzidine to Criminal Justice Personnel.
Final rept.,
H. Steinberg. Feb 77, 20p NBS-SP-480-21

Keywords: *Hazardous materials, *Carcinogens, *Industrial medicine, Blood analysis, Recommendations, Law enforcement, Criminology, Industrial hygiene, Morbidity, Bladder neoplasms, Malignant neoplasms, Epidemiology, Materials handling, Recommendations, Fingerprints, Toxic substances, *Benzidines, Forensic science, Forensic chemistry, Cancer, Occupational safety and health, Reagents.

Benzidine is a hazardous material which can cause bladder cancer in man. Yet it is used by criminalists and by investigative personnel in the detection of blood and in the preparation for photography of fingerprints found on bloody substrates; significant benzidine uptake by these personnel is possible. The forensic techniques which utilize benzidine, and the most likely routes by which contamination of personnel may occur, are described. Recommendations regarding its handling and use are presented.

712,410
PB-280 394/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Lead Paint Poisoning: A Closer Look at the Costs.
Final rept.,
R. E. Chapman. Nov 76, 4p
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Office of the Assistant Secretary for Policy Development and Research.
Pub. in Jnl. of Housing, v33 n10 p489-492 Nov 76.

Keywords: *Lead poisoning, *Costs, *Economic analysis, Toxic diseases, Residential buildings, Housing, Abatement, Estimating, Procedures, Reprints, Lead based paints.

Indecision about how to deal with the lead paint poisoning problem in residential dwellings stems in part from a lack of knowledge about the costs of various abatement methods. This research, sponsored by HUD's Office of Policy Development and Research, provides a procedure for estimating the costs of the alternative abatement methods. Federal and local housing officials can use this procedure and cost information derived from its application to achieve more lead paint abatement per public dollar invested.

712,411
PB-292 246/6 PC **A08**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Building Economics and Regulatory Technology Div.
Lead Paint Abatement Costs: Some Technical and Theoretical Considerations.
Technical note.
R. E. Chapman, and J. G. Kowalski. Feb 79, 156p NBS-TN-979
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Assistant Secretary for Policy Development and Research.

Keywords: *Lead poisoning, *Paints, *Abatement, Residential buildings, Hazards, Economic analysis, Cost estimates, Elimination, Public health, Barriers, Removal, Computer programs, Economic models, Lead based paints, *Toxic substances.

Public and private concern about the potential for lead poisoning in children due to the ingestion of lead-based paint chips has resulted in a Federally sponsored program to develop technologies by which the lead-based paint hazard may be eliminated from the nation's housing. The nature and design of the Experimental Hazard Elimination Program (EHEP) is thought to be unique in that it permitted the costs of the alternative lead paint abatement techniques to be rigorously analyzed. The focus of this report is on the design, implementation and analysis of EHEP and the cost information it produced. Statistical analyses which permitted the development of econometric models capable of estimating abatement technique costs and expected contractor markup are described. Structural equations relating changes in the values of certain key factors to variations in direct cost and contractor markup are also presented. Guidelines, including a national deleading cost estimate, are given so that these econometric models can be used by municipal officials and building owners to estimate deleading costs as well as provide input to policy evaluation and formulation.

712,412
PB-295 411/3 PC **A04**/MF **A01**
Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
Human Fatalities from Unwanted Fires.
Final rept.
W. G. Berl, and B. M. Halpin. Apr 79, 64p APL/JHU/FPP/TR-37, NBS-GCR-79-168
Grant NBS-G7-9016

Keywords: *Death, *Mortality, *Maryland, *Fires, Accidents, Humans, Demography, Information, Reviews, Hazards, Alcohols, Smoking, Gases, Socioeconomic factors, Statistical data, Pathology, Sex, Responses, Fire safety, Toxic substances, Cigarette smoking, Alcohol consumption, Race.

World-wide demographic information on human fire fatalities is reviewed. Particular emphasis is given to the physical causes and medical consequences of fire fatalities in the State of Maryland, USA, during 1972-1977. The analysis and conclusions are based on investigations of 463 fire deaths. The importance of toxic gases as the cause of death, of cigarettes as one of the principal ignition sources and of alcohol as an important contributing factor is discussed. The widely differing fire fatality rates among the various States of the U.S. are correlated by means of Ignition and Potentiating Indices which are based, in turn, on a variety of physical social and economic factors that are responsible for the frequency of unwanted ignition and the likelihood of a fatal outcome.

712,413
PB-297 815/3 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Fire Accident Simulations with Apparel Fabrics.
Final rept.
A. W. Meierhoefer, E. Braun, J. F. Krasny, and R. D. Peacock. Jun 79, 32p NBSIR-79-1755

Keywords: *Flammability testing, *Burns(Injuries), Simulation, Injuries, Evaluation, Accidents, Fire safety, Experimental data, Data acquisition, Computation, Fabrics, Heat transfer, Fire tests.

The objective of the work described here was to continue earlier garment burn simulations and to establish further background for the estimation of the relative burn injury potential of flammable apparel fabrics. The apparatus used was the Apparel Fire Modeling Apparatus (AFMA). The AFMA is a semicylinder almost completely covered with heat sensors. It simulates part of a human leg or torso. Fabrics can be burned on the AFMA in the free-hanging mode or can be brought into contact with its surface after a small amount of heat is sensed by the AFMA. The burn injury potential of the fabrics can be evaluated by such heat transfer characteristics as the total heat transferred to the AFMA and the area of the AFMA which would be susceptible to a second-degree burn, as well as the rate of increase of this injury area. The results are related to fiber content, and weight and construction of the fabrics. The fabrics used were selected from a series used in the Cooperative Program on Apparel Flammability sponsored by the American Textile Manufacturers Institute.

712,414
PB78-600043 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Applications of Experimental Skin Injury Research to Product Safety.
B. M. Mahajan. 1975, 1p
Pub. in Proceedings 28th Annual Conf. on Engineering in Medicine and Biology, New Orleans, LA, Sept. 20-24, 1975, p182 1975.

Keywords: *Consumer Product Safety Commission, Mechanical factors, Skin injury research, Threshold values.

No abstract available.

712,415
PB80-117187 Not available NTIS
National Bureau of Standards, Washington, DC.
Numerical Aid to Reduce Construction Injury Losses.
Final rept.,
L. I. Knab. Dec 78, 9p
Pub. in Jnl. of the Construction Division, Proceedings of the American Society of Civil Engineers 104, nCO4, Proceedings Paper 14213, p437-445, Dec 78.

Keywords: *Industrial accidents, *Construction industry, *Injuries, Death, Risks, Safety, Prevention, Cost effectiveness, Hazards, *Occupational safety and health.

In the construction industry, the rate of work-related injuries and deaths is two or more times the national rate for all industries. Loss prevention techniques have been successfully used in many industries to efficiently reduce injuries, deaths, and property losses caused by accidents. In the construction industry, however, the development of loss prevention techniques is in its infancy. This paper explores current loss prevention techniques for their application to the construction industry. This paper develops a rational method which quantitatively rates construction risks, using risk scores. The scores, which are computed for each workmens' compensation classification, are based on insurance premiums and injury cause-cost analyses. In addition, the method numerically ranks the relative cost effectiveness of corrective actions which are taken to reduce the risks. The cost effectiveness ranking is determined from the risk score, the cost, and the degree of effectiveness of the corrective action. Use of the method can improve the efficiency of evaluating risks and allocating resources to minimize the risks. The method presented is considered only a first step. The uses, limitation, and further development of the method are presented.

712,416
PB80-123235 Not available NTIS
National Bureau of Standards, Washington, DC.
Criteria for Personnel Monitoring Performance,
M. Ehrlich. 1979, 2p
Pub. in Transactions of the American Nuclear Society 32, p657-658 1979.

Keywords: *Meetings, *Monitors, *Dosimetry, *Health physics, Criteria, Personnel, Standards, American National Standards Institute, Peer review, *Occupational safety and health.

In the summer of 1978, the Draft American National Standard, Criteria for Testing Personnel Dosimetry Performance was published for one year of trial use and comment. In as much as this standard is to form the basis for a mandatory testing program of the performance of all U.S. suppliers of personnel-dosimetry services, it is important that comments and suggestions be received by the work group of the Health Physics Society Standards Committee that developed the document prior to its final adoption as the basis for such a test program. A brief outline is given of the contents of the standard for the purpose of stimulating peer reaction.

712,417
PB80-161466 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Analysis of Scaffolding Accident Records and Related Employee Casualties,
S. G. Fattal, C. L. Mullen, B. J. Hunt, and H. S. Lew. Jan 80, 57p NBSIR-79-1955
Sponsored in part by National Inst. for Occupational Safety and Health, Rockville, MD.

Keywords: *Industrial accidents, *Scaffolds, Medical records, Safety, Human factors engineering, Statistical

data, Regulations, Construction, Casualties, Environmental factors, *Occupational safety and health.

The report analyzes the causes of scaffold accidents involving employee casualties based on existing records of such incidents. Where possible, the causes are identified with system failures, environmental factors or human factors. System failures are further subdivided into categories to pinpoint the exact nature of the event that triggered the accident. The study provides an insight into the major safety-related aspects of scaffolding practices and points out the types of remedial measures that should be instituted to mitigate the frequency and consequences of scaffolding incidents. Simultaneously, it identifies critical research needs to develop the technical basis for the improvement of the safety aspects of scaffolding practices.

712,418
PB80-170210 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS Conducts Study for OSHA, Requests Information from Public.
Final rept.,
H. L. Steinberg. Feb 76, 1p
Pub. in Occup. Saf. Health Rep. 5, n39 p1278 Feb 76.

Keywords: *Industrial accidents, Statistical data, Safety belts, Scaffolds, Reprints, *Occupational safety and health.

This article is, basically, a request for data on accidents in which the use, or misuse, of fall-restraint or fall-arrest equipment played a significant role. 'Fall-restraint/fall-arrest equipment' is taken to include: safety (body) belts, lanyards, drop lines, safety lines, life lines, linemen's belts, body and chest harnesses, rope-grabbing and shock absorbing devices and associated hardware. 'Accidents' are defined to include 'near misses' (i.e., mishaps where no losttime injury occurred). The motivation for this request is briefly explained for the purpose of enhancing response probability.

712,419
PB80-184369 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Review of Current Codes and Standards for Scaffolds,
S. G. Fattal, C. L. Mullen, H. S. Lew, and B. J. Hunt. Apr 80, 71p NBSIR-79-1937
Sponsored in part by National Inst. for Occupational Safety and Health, Rockville, MD.

Keywords: *Industrial accidents, *Scaffolds, Safety, Supports, Design, Reviews, Hazards, Construction, Maintenance, *Occupational safety and health.

This report presents a critical review of the provisions in existing codes and standards for the design, erection, operation and maintenance of scaffolds used in construction work and other applications. The requirements in these documents were examined from the standpoint of clarity, consistency and completeness. Ambiguities arising from conflicting requirements or from provisions that led to more than one interpretation, and lack of consideration of major safety-related structural, environmental and human factors are highlighted. In addition, the adequacy of, and the rationale behind, the prescribed provisions are examined. These are supplemented by a specific application appearing in Appendix B. Appendix A illustrates common types of scaffolding systems that have been addressed by at least one of the codes or standards examined. The findings of this study serve to identify principal areas of needed research to improve present scaffolding practices.

712,420
PB81-154395 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Assessment of Locomotive Crew In-Cab Occupational Noise Exposure.
Final rept.
R. D. Kilmer. Dec 80, 185p FRA/ORD-80/91

Keywords: *Locomotives, Industrial hygiene, Tests, Assessments, Exposure, Noise(Sound), Screenings, Environments, Safety, Regulations, *Noise pollution, *Occupational safety and health, Railroad industry.

The railroad industry, unlike most other U.S. industries, is not subject to the safety regulations of the Occupational Safety and Health Administration. Instead, railroad workers are covered by the safety regulations of the Federal Railroad Administration (FRA). This report documents an extensive study designed to assess the noise environment in locomotive cabs. Operational duty cycle and in-cab sound level data are presented for 18 test runs made on 16 different locomotives used in wide range of operational modes (e.g., through freight and local transfer freights), varies terrains (mountainous, undulating and flat) and varied trip lengths (6 to 12 hours). The general conclusion of this study is that there does not appear to be a widespread problem of overexposure to noise based on the same type of evaluation as currently used by OSHA (only 1 out of 18 test runs exceeded the criteria). The noise exposure is within acceptable limits because the operational duty cycle is such that the sources which generate high sound levels (horn and brake) are operating only for short periods of time and because the locomotive spends a great deal of time in idle (diesel engine sound levels below 90 dB). However, there was one test run for which an overexposure to noise was measured. To pinpoint such cases where overexposure to noise may occur, a simplified testing procedure is developed. This test consists of making in-cab sound level measurements of engine notch 8 (no load), horn sounding and brake application with the locomotive stationary. With these three sound level measurements and an estimate of the time that the locomotive is operating on-line, the in-service noise dose can be estimated and a pass/fail assessment made of whether the noise exposure might exceed acceptable limits.

712,421
PB81-207318 Not available NTIS
National Bureau of Standards, Washington, DC.
Health Physics Program at the National Bureau of Standards Linac.
Final rept.
T. G. Hobbs. Apr 81, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-28, n2 p1600-1602 Apr 81.

Keywords: *Health physics, National government, Safety, *National Bureau of Standards, Federal government, Monitoring, NTISCOMNBS.

A three-person Accelerator Health Physics team provides continuous radiation safety service for the National Bureau of Standards 150-MeV linear electron accelerator (Linac), which operates on a five days per week, 24 hours per day schedule, with one day per month downtime scheduled for maintenance. This team also serves the synchrotron ultraviolet light radiation facility (SURF), two Van de Graaffs, some other electrostatic accelerators, and several high-energy x-ray generators. Although the Linac is not licensed by a safety-regulating agency, as is the NBS Research Reactor, Health Physics makes no distinction between the two sources in providing coverage. Various regulations do impact on operations, e.g., the NRC dose totals and effluent releases and the OSHA requirements.

712,422
PB82-237850 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
Symbols for Industrial Safety.
Final rept.
B. L. Collins, N. D. Lerner, and B. C. Pierman. Apr 82, 158p NBSIR-82-2485
Sponsored in part by National Inst. for Occupational Safety and Health, Morgantown, WV.

Keywords: *Symbols, *Industrial hygiene, Coding, Comprehension, Safety, Perception, Visibility, Accuracy, Communicating, Standards, Visual perception, *Occupational safety and health.

A four phase evaluation of a set of selected industrial worksite symbols is described. The four phases involved identification of 33 key safety messages, selection of candidate symbols for each message, evaluation of the understandability of the candidate symbols, and determination of the preference for the 87 candidate images, using both industrial and nonindustrial (naive) personnel.

712,423
PB84-152263 Not available NTIS
National Bureau of Standards, Washington, DC.
National Quality Assurance Program for Personnel Dosimetry.
Final rept.
E. H. Eisenhower. Apr 83, 15p
Pub. in Proceedings of the Annual National Conference Radiation Control (14th) Portland, ME., May 24-27, 1982, Conference Publication 83-1, p225-239 Apr 1983.

Keywords: *Radiation dosimetry, *Dosimetry, *Health physics, *Quality assurance, *Occupational safety and health.

In 1973, a workshop of the Conference of Radiation Control Program Directors identified a need for improved reliability of personnel dosimetry services, and recommended that a federal agency such as the National Bureau of Standards direct a continuing performance testing program of those services. This paper describes actions taken since then to implement the recommendation by means of a national program under development.

712,424
PB85-221885 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reference Bases for Accurate Measurement.
Final rept.
H. T. Yolken. 1983, 10p
Sponsored by American Medical Association, Chicago, IL.
Pub. in American Society for Testing Materials SP-800, p13-21 1983.

Keywords: *Accuracy, Measurements, Standards, Communities, Health, Reprints, *Reference bases.

A rationale is presented to provide for an accuracy based measurement and standards system for use by the health community. The reference base presented relies on a consistent and compatible set of base and derived measurement units, reference measurement methods, standard reference materials and artifacts, evaluated reference data, and instrument calibration services. In addition, the system also includes field measurement methods and instruments, written procedural standards, and measurement assurance programs.

Radiobiology

712,425
PATENT-4 489 240 Not available NTIS
Department of Commerce, Washington, DC.
Radiochromic Leuko Dye Real Time Dosimeter, One Way Optical Waveguide.
Patent.
S. Kronenberg, W. L. McLaughlin, and C. R. Siebentritt. Filed 15 Nov 82, patented 18 Dec 84, 4p PB86-174513, PAT-APPL-6-441 718
Supersedes AD-D009 964.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensng. Copy of patent available Commissioner of Patent, Washington, DC 20231 $1.00.

Keywords: *Dosimeters, *Patents, *Dyes, *Optical waveguides, Real time operations, *Leuko dye dosimetry, *Radiochromic waveguide dosimeters, Radiochromic dyes, PAT-CL-250-474.

A radiochromic leuko dye dosimeter includes a plastic tube containing a solution of a radiochromic dye which is sensitive to ionizing radiation, one end of the tube being closed by a reflective surface, the opposite end of the tube being closed by a transparent plug to form a one-way optical waveguide. Light enters the tube through the transparent end thereof and is reflected back and exits through the transparent end. The intensity of the exiting light is measured to determine radiation induced absorption of the leuko dye.

712,426
PB-269 738/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radiochromic Plastic Films for Accurate Measurement of Radiation Absorbed Dose and Dose Distributions.
Final rept.,
W. L. McLaughlin, A. Miller, S. Fidan, K. Pejtersen, and W. B. Pedersen. 1977, 9p
Sponsored in part by Research Establishment Risoe, Roskilde (Denmark).
Pub. in Radiation Physical Chemistry, v10 p119-127 1977.

Keywords: *Chemical dosimeters, *Dyes, *Polymeric films, Plastics, Radiation measuring instruments, Dose rate, Gamma rays, X rays, Electrons, Reprints.

Thin radiochromic dye films are useful for measuring large radiation absorbed doses (10 to the 5th power - 10 to the 8th power) and for high-resolution imaging of dose patterns produced by penetrating radiation beams passing through non-homogeneous media. Certain types of amino-substituted triarylmethane cyanides dissolved in polymeric solutions can be cast into flexible free-standing thin films of uniform thickness and reproducible response to ultraviolet and ionizing radiation. Upon irradiation of the film, the profile of the radiation field is registered as a permanent colored image of the dose distribution. Unlike most other types of dyed plastic dose meters, the optical density produced by irradiation is in most cases stable for periods of at least one year. Methods have been developed for casting various types of thin radiochromic plastic films and combinations of plastics (cellulose acetate, polyvinyl butyral, polyvinyl acetate, polyvinyl pyrrolidone and polyvinyl chloride) having radiation absorption characteristics corresponding to those of many polymeric systems in industrial radiation processing. The result is that errors due to energy dependence of response of the radiation sensor are effectively reduced, since the spectral sensitivity of the dose meter matches that of the polymer of interest, over a wide range of photon and electron energies (0.01-10 MeV).

712,427
PB-270 197/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurements of Dose Distributions in Various Materials Irradiated by 10-MeV Electrons.
Final rept.,
J. C. Humphreys, S. E. Chappell, W. L. McLaughlin, and R. D. Jarrett. 1977, 13p
Pub. in Proceedings Int. Radiation Processing Conf., Puerto Rico, May 10-13, 1976, Radiat. Phys. Chem., v9 p749-761 1977.

Keywords: *Dosimeters, Dosage, Statistical analysis, Monte Carlo method.

Calibrated radiochromic dye films were used to measure depth-dose profiles and lateral absorbed dose distributions in several irradiated media. Measurements were made in carbon, aluminum, polystyrene, and beef muscle irradiated by incident electrons of about 10 MeV. The dye-film dosimeters were placed within the media in several geometrical configurations. In one arrangement, the dosimeters were used to integrate the dose distribution within the volume of irradiated beef packages. These measurements show a significant variation in dose near the lateral edges of the medium. The experimental depth-dose distributions are compared with Monte Carlo calculations and with reported experimental measurements. These data are of interest in radiation effects studies, radiation processing, and diagnostic and therapeutic radiology.

712,428
PB-273 085/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Recent Developments in the Characterization and Measurement of Hazardous Electromagnetic Fields.
Final rept.,
R. R. Bowman. 1973, 11p
Pub. in Proceedings of International Symposium Biologic Effects and Health Hazards of Microwave Radiation, October 15-18, 1973, Warsaw (Poland), P217-227 1973.

Keywords: *Radiation hazards, *Electromagnetic fields, *Radiation measuring instruments, Measurement.

Exposure to hazardous electromagnetic fields often occurs in situations where the field has reactive near-field components, multipath components, and arbitrary polarization. The accurate measurement of such fields has been notoriously difficult yet must be made easily to provide adequate safety. Recently, several instruments have been developed that will measure the Hermitian magnitude /E/ of the electric component of complicated electromagnetic fields with extreme ease. Within their operating limits, the response of these instruments is essentially independent of angular orientation. The physics of the field sensors of these instruments is briefly discussed and the basic capabilities and limitations of each type of sensor are indicated.

712,429
PB-275 129/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fundamentals of Dosimetry.
Final rept.,
W. L. McLaughlin. 1977, 34p
Pub. in Manual of Food Irradiation Dosimetry, ch1 Technical Reports Series 178, p1-34 (International Atomic Energy Agency, Vienna, Austria) 1977.

Keywords: *Food irradiation, *Dosimeters, *Calibrating, Dosimetry, Radiation dosage, Reprints.

For food irradiation applications, it is worthwhile to consider water as a reference material in which radiation absorbed can be measured by a reference dosimeter system, a water calorimeter or the more frequently used Fricke dosimeter, or by a calibrated routine dosimeter system that is also nearly water equivalent, such as ferrous cupric systems, acrylic (Perspex) or similar plastics, dyestuffs, or other organic systems. The correct calibration of the response of a dosimeter depends chiefly on the following observations: (1) If the absorbed dose is measured in a material whose radiation absorption characteristics (photon mass energy absorption cross sections or electron mass stopping powers) differ appreciably from those of water, appropriate corrections have to be made in order to convert the dose in one material to that in the other; (2) If the dose distribution is taken into account properly, that is, if the calibration of a dosimeter is carried out under electronic equilibrium conditions, the dosimeter system may be used at any given depth or position in an absorber in order to get a measurement of absorbed dose at that position.

712,430
PB-277 310/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Kerma Factors for Tissue Compositions, Compounds and Mixtures.
Final rept.,
R. S. Caswell, J. J. Coyne, and M. L. Randolph. 1976, 29p
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Div. of Biomedical and Environmental Research.
Pub. in Proceedings of Workshop on Physical Data for Neutron Dosimetry, Rijswijk, the Netherlands, May 19-21, 1976, Paper in Monograph on Basic Physical Data for Neutron Dosimetry EUR5629e, p69-76, p287-309 1976.

Keywords: *Radiation dosage, Neutrons, Elements, Nuclides, Dosimetry, Radiotherapy, Radiobiology, *Kerma.

The basis for the calculation of new tables of kerma factors (kerma per unit neutron fluence) for neutrons of energy below 30 MeV is discussed. Kerma factors are given for 19 elements or nuclides: H, 6Li, 7Li, B, C, N, O, F, Na, Mg, Al, Si, P, S, Cl, Ar, K, Ca, and Fe. Kerma factors are given for 15 tissue compositions, compounds and mixtures of interest for neutron dosimetry, neutron radiation therapy, and radiobiology. Nuclear data from the Evaluated Nuclear Data File ENDF/B-4 are used when available.

712,431
PB-278 398/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dissemination of the Unit of Absorbed Dose by Calorimetric and Ionometric Methods.
Final rept.,
R. Loevinger. 1977, 22p
Sponsored in part by National Cancer Inst., Bethesda, Md.
Pub. in Proceedings of Int. Course at Varenna, Italy, September-October, 1974, Paper D-3 in Ionizing Radiation Metrology, p141-162 1977.

Keywords: *Calorimeters, *Radiation dosage, *Ionizing radiation, Absorption(Biology), Tissues(Biology), Ionization chambers, Water, Exposure, Formulas(Mathematics), Standards.

Absorbed dose to water or to tissue can be determined by an ionization chamber of known volume, or can be derived from an ionization chamber calibrated in terms of exposure (against cavity chambers as standards), or in terms of absorbed dose (against calorimeters as standards). Formulae for relating absorbed dose to water to instrument response and calibration factor are developed and discussed, and the associated uncertainties are estimated. Portable absorbed-dose calorimeters are expected to play an important role in comparing national standards of absorbed dose, and in verifying the accuracy of any system for disseminating the unit of absorbed dose.

712,432
PB-278 419/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Uncertainty in the Delivery of Absorbed Dose.
Final rept.,
R. Loevinger, and T. P. Loftus. 1977, 15p
Pub. in Proceedings of Int. Course at Varenna, Italy, September-October, 1974, Paper G-6 in Ionizing Radiation Metrology, p459-473 1977.

Keywords: *Radiotherapy, *Radiation dosage, *Cobalt 60, Absorption(Biology), Patients, Standards, Tissues(Biology), Ionizing radiation, Measurement, Dosimetry, Probability theory, Estimates, Phantoms.

The magnitude of the absorbed dose delivered to a patient can in principle be traced back to a national primary measurement standard. Each step in the measurement chain contributes to the uncertainty in the magnitude of the final delivered dose. A method is described of taking into account estimated values of the many random and systematic uncertainties so as to arrive at a quasi-quantitative estimate of overall uncertainty. The method is applied to a simplified model, starting with the national primary standard for cobalt-60 gamma rays, and continuing to administration of absorbed dose to a soft-tissue phantom. This leads to an estimate for the overall uncertainty in the delivery of absorbed dose to a tissue phantom, of about 2 1/2% for optimum conditions, and about 5% for minimally acceptable conditions of measurement and instrumentation.

712,433
PB-278 422/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Realization of the Unit of Exposure: Cavity Chambers.
Final rept.,
R. Loevinger. 1977, 8p
Pub. in Proceedings of Int. Course at Varenna, Italy, September-October, 1974, Paper C-5 in Ionizing Radiation Metrology, p103-110 1977.

Keywords: *Cobalt 60, *Ionization chambers, *Radiation dosage, Gamma irradiation, Standards, Measurement, Exposure, *Bragg Gray chambers.

The relationship between the quantity exposure and the response of a cavity ionization chamber is derived from the Bragg-Gray equation and the definition of exposure. The gas in the cavity chamber used to realize the unit of exposure need not be air, but can be any gas whose properties are suitable and known. A comparison in a cobalt-60 gamma-ray beam of the national cavity chamber standards of exposure of the National Bureau of Standards (USA) and the Physikalisch-Technische Bundesanstalt (F.R.G.) with the standard of the Bureau International des Poids et Mesures (in Paris) has been published (Metrologia 11, 17-23, 1975). This comparison is summarized and discussed. It is concluded that existing cavity chamber standards are adequately accurate for present needs, but several challenging physical problems in cavity chamber theory remain unsolved.

712,434
PB-280 432/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Use of Graphite as a Health Physics Monitor for High Energy Neutrons.
Final rept.,
T. G. Hobbs. 1976, 6p
Pub. in Proceedings of Conference on Scientific and Industrial Applications of Small Accelerators, North Texas State Univ., Denton, Tex. 27-29 Oct 76, n76CH 1175-9 NPS p357-362 1976. (IEEE).

Keywords: *Health physics, *Monitoring, *Neutrons, *Graphite, Safety, Activation, Radiation protection.

Solid, nuclear-purity graphite, machined into cup shapes, is activated by neutrons with energies greater than 20.2 MeV by 12C(n,2n)11C. The resulting 20.3 minute half-life, positron-emitting 11C is measured with NaI(Tl) detectors. Comparison of the results of the solid monitor with results from simultaneously irradiated powder results, coupled with an efficiency for powder doped with a positron emitter, shows that neutron flux densities below 1 n/sq cm-s can be detected.

712,435
PB-280 564/6 PC **A07**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Radiation Research.
National Measurement System for Ionizing Radiations.
Final rept.,
R. S. Caswell. Apr 78, 133p NBSIR-75-946

Keywords: *Ionizing radiation, *Monitoring, Health physics, Measurement, Standards, Safety, Trends, Surveys, Tables(Data), National Bureau of Standards, Environmental impacts, Environmental health.

In this study the structure of the National Measurement System for Ionizing Radiation has been investigated for eight classes of radiation users: medical, nuclear power, industrial radiation processing, defense, environmental, science, chemical analysis, and miscellaneous radiation applications. In addition two fields of increasing importance to all radiation users were investigated: regulatory control of radiation and personnel monitoring. Needed major actions on the part of the National Bureau of Standards were identified particularly for nuclear power and its related environmental and safety impacts, medical applications of radiation, assistance to regulatory control of radiation and measurement assurance for personnel monitoring.

712,436
PB-281 353/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement and Quality Assurance of the Amount of Administered Tracer.
Final rept.,
W. Hauser, and L. Cavallo. 1977, 10p
Pub. in Proceedings, Symposium on Standardization, Performance and Quality Control in Nuclear Medicine, Gaithersburg, Md. 12-14 Jun 75, ch17 in Quality Control in Nuclear Medicine, Radiopharmaceuticals, Instrumentation and in Vitro Assays, p154-163 1977.

Keywords: *Radiation dosage, *Dosimetry, *Radioactive isotopes, Labeled substances, Terminology, Measurement, Quality assurance, Quality control, Patients, Radioactive materials, Laboratories, Calibration, *Radiopharmaceutical agents, *Nuclear medicine.

Problems encountered in the measurement of radioactivity by the producer and/or user of radioactive materials are many. This paper is concerned with terminology, techniques for minimizing dose-calibrator measurement errors within-laboratory, quality control and interlaboratory comparisons, and the importance of accuracy in the quantification of radioactive material to be administered to patients.

712,437
PB-282 500/8 PC **A02**/MF **A01**
American National Standards Inst., New York.
American National Standard N43.2; Radiation Safety for X-Ray Diffraction and Fluorescence Analysis Equipment.
Final rept.,
S. Block. May 78, 23p ANSI-N43.2-1977, NBS--HB-111
Supersedes COM-72-50698. Revision of Rept. no. N43.2-1971. Library of Congress Catalog Card no. 71-189153.

Keywords: *Ionizing radiation, X ray apparatus, *Health physics, Radiation injuries, Safety, Standards, Design, Criteria, Operations, Personnel, Monitors, Radiation dosage, Permissible dosage, Industrial hygiene, Installing, Definitions, Maximum permissible exposure level.

The standard reviews the types of injuries resulting from accidental exposure to ionizing radiation resulting from the operation of x-ray diffraction and fluorescence analysis equipment, establishes equipment design criteria, sets up requirements for approved operating procedures, and recommends the establishment of health surveillance, and personnel monitoring programs. The circumstances under which operation of equipment must be limited to specially designated areas equipped with radiation barriers and warning signs are set forth. Maximum permissible dose limits established by the National Council on Radiation Protection and Measurement are stated. A list of references to selected articles on various aspects of radiation safety is given and notes on the detection and measurement of radiation from x-ray diffraction and fluorescence analysis equipment are included in an appendix.

712,438
PB-287 805/6 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Center for Radiation Research.
Central-Axis 60CO Ionization Measurements in Graphite as a Function of Phantom Diameter, Depth, and Field Size.
S. R. Domen. Sep 78, 21p NBSIR-77-1203

Keywords: *Graphite, Radiation dosage, Calorimeters, Gamma rays, Tables(Data), Radiation dosage, Cobalt 60, Ionizing radiation, *Depth dose distributions, Phantoms, Biological models, Calorimetry.

Ionization measurements along the central axis were made in a graphite phantom irradiated with cobalt-60 gamma rays. The measurements were made under the following conditions: phantom diameters of 15, 20, and 30 cm; 15 depths from 1 to 39 g/sq cm; and square field sizes of 8.3, 10.5, 12.4, and 17.4 cm at a fixed detector position of 1 m from the source. Empirical fits to the data aid in correcting calorimeter comparisons to a common geometry.

712,439
PB-287 979/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Criteria for Testing Personnel Dosimetry Performance in the United States of America.
Final rept.
M. Ehrlich. 1978, 2p
Pub. in Proceedings Internatl. Symp. National and Internatl. Standardization of Radiation Dosimetry, Held at Atlanta, GA. on Dec 5-9, 1977. Paper in Natl. and Internatl. Standardization of Radiation Dosimetry, IAEA-SM-222/16, 1, p419-420.

Keywords: *Dosimetry, *Personnel dosimetry, *Health physics, United States, Criteria, Irradiation, Monitoring, Standards, Procedures, Performance evaluation, Tests, Industrial medicine, *Occupational safety and health.

Under the auspices of the Health Physics Society Standards Committee, a standard has been developed that specifies procedures for testing the performance of suppliers of personnel-dosimetry services in the United States.

712,440
PB-288 094/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Medical Dosimetry Standards Programme of the National Bureau of Standards.
Final rept.
R. Loevinger. 1978, 8p
Sponsored in part by Bureau of Radiological Health, Rockville, MD.
Pub. in Proceedings International Symp. National and International Standardization of Radiation Dosimetry, Atlanta, GA., Dec 5-9, 1977. Paper in National and International Standardization of Radiation Dosimetry, IAEA-SM-222/58,1,p159-174, 1978.

Keywords: *Radiation dosimetry, *Radiation protection, Standards, Calibrating, National government, Measurements, Measuring instruments, X ray irradiation, Gamma rays, National Bureau of Standards.

In the field of radiation dosimetry for medicine and radiation protection, the National Bureau of Standards has the responsibility to establish, verify, maintain and make available suitable measurement standards, and to carry out studies to assure that dosimetry measurements made in the United States of America are in adequate agreement with NBS standards. The physical quantities involved are exposure and absorbed dose, and the measurement standards are free-air chambers, graphite cavity chambers, calorimeters, extrapolation chambers, and radium standards. These NBS standards have been verified after construction, and periodically since that time, by comparison with each other, and with other national and international standards. Calibration services based on the NBS standards are offered for X-ray and gamma-ray measuring instruments, beta-particle and gamma-ray brachytherapy sources, and X-ray penetrameters; irradiation of passive dose meters is offered in photon beams with maximum energies from 10 keV to 1 MeV. Exposure-measuring and absorbed-dose-measuring instruments are subjected to a variety of pre-calibration tests.

712,441
PB-291 159/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Influence of Source Configuration on Spectral Composition of Gamma-Ray Beams from (super 60)Co Teletherapy Units.
Final rept.,
M. Ehrlich, C. G. Soares, B. Jackson, and P. Lanoue. 1978, 7p
Pub. in International Jnl. of Applied Radiation and Isotopes, v29 p741-747 1978.

Keywords: *Cobalt 60, *Gamma ray spectroscopy, Atomic number, Laboratory equipment, Encapsulating, Configuration, Teletherapy, Reprints.

Measurements were made of the photon spectra of simulated (60)Co teletherapy beams. Various source configurations and source environments of practical interest were employed for this purpose. The sources consisted of activated cobalt pellets packed into steel capsules. Several combinations of capsule diameters and heights of pellet layers were used. The spacer materials filling the remaining capsule volume were chosen to be of high, intermediate, or low atomic number. The capsules could be inserted, one at a time, into a compartment of either tungsten or brass, simulating the central section of popular commercial (60)Co teletherapy units. There also was some choice in the atomic number of the structural elements holding the capsules in place in the compartment. The largest contribution of scattered photons was found to occur when the materials close to the source pellets had atomic numbers in the vicinity of 30.

712,442
PB-291 718/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Traceability in Ionizing Radiation Measurements Systems.
Final rept.
L. M. Cavallo, M. Ehrlich, and J. M. R. Hutchinson. 1978, 23p
Pub. in Proc. Int. Symp. on National and International Standardization of Radiation Dosimetry, Atlanta, GA, Dec 5-9, 1977, IAWA-SM-222/181, p65-87 (International Atomic Energy Agency, Vienna, Austria, 1978).

Keywords: *Ionizing radiation, *Dosimetry, National government, Standards, Measurement, Tables(Data), Tests, Monitors, Surveillance, *National Bureau of Standards.

There are many demands for traceability to the national radiation measurements systems (NRMS): federal regulatory agencies; state health laboratories; commercial suppliers of radioactive materials and their customers; hospitals and their patients. The National Bureau of Standards supervises and administers technology assurance programs for radiation therapy departments, the radiopharmaceutical industry, federal agencies charged with radiation and radioactivity monitoring and surveillance, and for manufacturers and users of radioactivity standards, and administers to the radioactivity measurements assurance program of the College of American Pathologists. These efforts are described and the results are tabulated.

712,443
PB-292 111/2 PC **A03**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Center for Radiation Research.
Nationwide Survey of Cobalt-60 Teletherapy Dosimetry.
Technical note.
C. G. Soares, and M. Ehrlich. Aug 78, 45p NBS/TN-978
Sponsored in part by Bureau of Radiological Health, Rockville, MD. Radioactive Materials Branch.

Keywords: *Radiotherapy, *Radiation dosage, Cobalt 60, Dosimetry, Surveys, Phantoms.

Between September 1974 and December 1977 the National Bureau of Standards, in cooperation with the Bureau of Radiological Health, performed a study of the accuracy with which a prescribed absorbed dose of cobalt-60 gamma radiation is delivered to a specified point in a water phantom. Approximately two-thirds of the cobalt-60 teletherapy units in the U.S. were surveyed by mail, using a rugged thermoluminescence dosimetry system. The dose given by prticipants was evaluated from dosimeter response, and information supplied by participants was used to check their computations of the dose delivered. In this nationwide study, 83 percent of the units surveyed yielded dose interpretations within 5 percent of the requested dose,

13 percent yielded differences between 5 and 10 percent, and 4 percent of the dose interpretations differed by more than 10 percent from the dose requested. Sources of discrepancies are discussed, and the results of this survey are compared with those of other dosimetry surveys.

712,444
PB79-600056 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photofission Effects in Reactor Pressure Vessel Dosimetry.
C. D. Bowman, C. M. Eisenhauer, and D. M. Gilliam. 1978, 8p
Pub. in Proceedings Second ASTM-EURATOM Symp. on Reactor Dosimetry, Palo Alto, CA, Oct. 3-7, 1977, p575-582 1978.

Keywords: *Dosimetry, Fast neutrons, Photofission, Photoneutrons, Pressure vessel, Reactor, Threshold detectors.

Experiments and calculations both suggest that serious backgrounds from photofission are present when threshold fission foils are used as spectral indices for fast neutron intensity and spectrum measurements in pressure vessel dosimetry. The problem might be resolved by a measurement of the higher energy gamma-ray spectrum and intensity by means of induced activity from (gamma,n) reactions.

712,445
PB80-100852 Not available NTIS
National Bureau of Standards, Washington, DC.
Traceability Program for Radiopharmaceuticals at the United States National Bureau of Standards,
L. M. Cavallo, D. B. Golas, and W. B. Mann. 1979, 2p
Pub. in A.N.Z. Nuclear Medicine Newsletter, p15-16 1979.

Keywords: *Radioactivity, United States, Regulations, Measurements, National government, *Radiopharmaceuticals, *National Bureau of Standards.

The regulation of the use of radiopharmaceuticals and the traceability of measurements of their activity to the National Radioactivity Measurements System in the United States are described.

712,446
PB80-110125 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
American National Standard N538 Classification of Industrial Ionizing Radiation Gauging Devices.
Final rept.
E. H. Eisenhower. Oct 79, 31p NBS-HB-129, ANSI-N538-1979
Library of Congress catalog card no. 79-600113.

Keywords: *Radiation measuring instruments, *Radiation hazards, Ionizing radiation, Standards, Measuring instruments, Performance evaluation, Radiation dosage, Safety.

This American National Standard applies to the radiation safety aspects of gauging devices, commonly called gauges, which use sealed radioactive sources or x-ray tubes for the determination of control of thickness, density level, interface location, or qualitative or quantitative chemical composition. This standard establishes a system for classification of gauging devices based on performance specifications relating to radiation safety. In addition to specific tests for both use conditions and accident conditions, guidelines for other safety features and considerations are presented. This standard does not apply to the measurement performance of gauging devices.

712,447
PB80-123169 Not available NTIS
National Bureau of Standards, Washington, DC.
Dose Equivalent Unit.
Final rept.,
R. Loevinger. Oct 79, 2p
Pub. in Health Physics Letter to Ed. 37, p602-603, Oct 79.

Keywords: *Radiation dosage, Reprints, *Dose equivalents, Sievest unit.

In answer to a previous letter, it is explained that there is no logical conflict in using the name gray for the joule per kilogram for the physical quantity absorbed dose, and the name sievert for the joule per kilogram for the weighted physical quantity dose equivalent.

712,448
PB80-194376 Not available NTIS
National Bureau of Standards, Washington, DC.
Wn and Neutron Kerma for Methane-Based Tissue-Equivalent Gas.
Final rept.,
L. J. Goodman, and J. J. Coyne. 1980, 14p
Sponsored in part by Department of Energy, Washington, DC., and National Cancer Inst., Bethesda, MD.
Pub. in Jnl. Radiation Research 82, p13-26 1980.

Keywords: *Dosimetry, *Ionizing radiation, Neutrons, Gases, Charged particles, Kerma.

Homogeneous tissue-equivalent ionization chambers containing a methane-based gas mixture are widely used to determine the absorbed dose of neutrons employed in radiobiology and radiotherapy. Conversion of the measured ionization charge to the absorbed dose requires knowledge of Wn, the mean energy expended to form an ion pair in the gas by the initial spectra of secondary charged particles produced by the neutrons. This report discusses the computed charged particle spectra in the gas and the relative kermas contributed by the various types of charged particles. These spectra are combined with an evaluation of the available experimental data on W for the secondary particles to compute Wn as a function of neutron energy. Over the energy range of 0.1 to 20 MeV, Wn was found to vary from 32.8 to 31.0 eV, respectively, including sharp changes in Wn due to large resonances in the energy transferred to carbon and oxygen. It is recommended that the data presented be used to evaluate Wn for each neutron spectrum for which accurate dosimetry is required. A single value of 31.9 + or - 0.9 eV is recommended for less demanding applications or when neutron spectra are poorly known.

712,449
PB80-195712 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Radon in Buildings.
Final rept.,
R. Colle, and P. E. McNall. Jun 80, 88p NBS-SP-581
Proceedings of a Roundtable Discussion of Radon in Buildings Held at the National Bureau of Standards, Gaithersburg, Maryland on June 15, 1979. Library of Congress catalog card no. 80-6000069.

Keywords: *Radon, *Meetings, Radiation protection, Measurement, Buildings, Irradiation, Exposure, Ventilation, Environments, Strategies, Control, Biological effects, Environmental health.

This is the proceedings of a Roundtable Discussion of Radon in Buildings held June 15, 1979 at the National Bureau of Standards in Gaithersburg, Maryland. The meeting brought together a number of participants with diverse interdisciplinary interest in radiation protection, radiation measurement and building technology, provided a forum to exchange information, and drew attention to some of the problems and research needs associated with radiation exposure due to radon in buildings. Emphasis was placed on (1) the characterization of the sources and pathways of radon in buildings; (2) the biological and health effects; (3) measurement considerations; and (4) strategies and control technologies to minimize indoor radiation exposure.

712,450
PB80-199862 Not available NTIS
National Bureau of Standards, Washington, DC.
Dosimetry for the Commissioning of a Versatile Irradiation Plant.
Final rept.,
B. B. Radak, V. M. Markovic, and W. L. McLaughlin. 1979, 8p
Pub. in Trans. International Meeting in Radiation Processing, Radiation Physics and Chemistry (2nd), Miami, FL, November 16-19, 1978, Radiat. Phys. Chem. 14, p449-456 1979.

Keywords: *Meetings, *Dosimetry, *Radiation dosage, Sterilization, Quality control, Cobalt 60, Gamma rays.

The chief objective of dosimetry for commissioning of a radiation plant is the comparison of the real, i.e., measured absorbed doses, with the ones expected from the calculations of the designer or producer of the plant. This mainly comprises the values of minimum and maximum absorbed dose in a typical box of products to be treated in the plant. With a little more effort, however, the complete set of relevant parameters for a suitable running of the plant can be obtained from the commissioning measurements. In the present work the results of such measurements obtained with the Irradiation Plant for Industrial Sterilization of Disposable Medical Supplies at the Boris Kidric Institute - Vinca (1) are present.

712,451
PB80-199896 Not available NTIS
National Bureau of Standards, Washington, DC.
Response of Plastic Dosimeters to Gamma Rays and Electrons at High Absorbed Dose Rates.
Final rept.,
W. L. McLaughlin, J. C. Humphreys, B. B. Radak, A. Miller, and T. A. Olejnik. 1979, 16p
Pub. in Trans. International Meeting in Radiation Processing, Radiation Physics and Chemistry (2nd), Miami, FL, November 16-19, 1978, Radiat. Phys. Chem. 14, p535-550 1979.

Keywords: *Dosimeters, Plastics, Gamma rays, Electron irradiation, Performance evaluation.

Several clear plastics and dyed plastics are commercially available for dosimetry in intense radiation fields, particularly for radiation processing applications using gamma rays from intense cobalt-60 sources and electron beams from accelerators running at potentials from 0/1 to 10 MeV. For calibrations with gamma rays, only those plastics containing the radiochromic triphenylmethane cyanides or methoxides, i.e. nylon, polychlorostyrene, polyvinylbutyral, or polyvinylpyrrolidone, can correctly interpret dose determinations from electron beam irradiation. The other systems show a marked rate dependence of response. Of radiochromic dye systems, only polyvinylpyrrolidone as host matrix can be read with precision immediately after electron irradiation, since a slow build-up of the absorption band during the first hours after irradiation occurs in the other radiochromic plastic systems.

712,452
PB80-200512 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron and Gamma-Ray Dosimetry Using Radiation-Induced Color Centers in LiF.
Final rept.,
W. L. McLaughlin, A. C. Lucas, B. M. Kapsar, and A. Miller. 1979, 14p
Pub. in Radiat. Phys. Chem. 14, p467-480 1979.

Keywords: *Lithium fluorides, Dosimeters, Color centers, Ionizing radiation, Reprints, *Electron dosimetry, *Gamma dosimetry.

Ionizing radiation produces relatively stable color centers in lithium fluoride. The values of the optical absorbance at the maxima of the resulting absorption bands are measured at the following wavelingths: lambda = 247 nm (F-centers); 443 nm (M-centers); 315 nm (R1-centers); 374 nm (R2-centers); 517 nm (N1-centers); 547 nm (N2-centers). It is shown that the response expressed in terms of optical absorbance as a function of absorbed dose in LiF is approximately the same for electron beams at very high absorbed dose rates and for gamma radiation at intermediate does rates. Commercially available cleaved LiF crystals, 6 mm x 2 mm in size and containing only very low amounts of impurities, proved to have satisfactory optical properties for high-level dosimetry applications. Commercially available LiF discs, 25 mm in diameter and 1.5 mm in thickness, supplied as vacuum-ultraviolet-transmitting window material, are also useful for dosimetry. Both types are of optical quality and may be reused by thermally bleaching the radiation-induced color centers.

712,453
PB81-112971 Not available NTIS
National Bureau of Standards, Washington, DC.
Standardization: Where We Have Been and Where We Are Going.
Final rept.
E. H. Eisenhower. Apr 80, 12p
Pub. in Health Physics: A Backward Glance, p185-196 Apr 80.

Keywords: *Ionizing radiation, *Standards, Measurement, History, Hazards, Safety, United States, Reprints, *National Bureau of Standards.

This paper summarizes the history of efforts in the United States to place measurements of ionizing radiation on a common reference basis. The need for such actions was generally stated in the founding documents of the country. Some of the key actions taken in the area of radiation began in 1913, when a radium standard arrived at the National Bureau of Standards.

Early applications of radiation didn't include adequate recognition of associated health hazards. In the late 1920's, NBS began to develop x-ray and radium protection standards, as well as physical measurement standards. Although most of the radium concoctions were worthless, beneficial use of radiation for therapeutic purposes began during this period. As applications expanded, the need for increased NBS services was felt. Present services are summarized, and trends which will influence the nature of future NBS programs are described.

712,454
PB81-174138 Not available NTIS
National Bureau of Standards, Washington, DC.
Kerma Values by Particle Type.
Final rept.
J. J. Coyne. 1980, 13p
Pub. in Proceedings of the International Workshop on Ion Chambers for Neutron Dosimetry Held at Rijswijk, Netherlands on Sep 17-20, 1979, p195-207 1980.

Keywords: *Dosimetry, Tissues(Biology), *Kerma factors, Neutron dosimetry.

The kerma values that were published in the ICRU Report 26 are compared with the values which have been submitted for publishing in Radiation Research. The differences in nuclear data which have prompted these small changes are discussed. Comparisons with other calculations and experiments are given. For tissue and tissue-equivalent materials the percent of the total kerma due to various ions is also given.

712,455
PB81-207243 Not available NTIS
National Bureau of Standards, Washington, DC.
Dosimetry Standards for Industrial Radiation Processing.
Final rept.
W. L. McLaughlin. 1978, 18p
Pub. in Chapter in National and International Standardization of Radiation Dosimetry 1, p89-106 1978.

Keywords: *Heat measurement, *Dosimetry, Dose rate, Gamma radiation, Quality control, Sterilization, NTISCOMNBS.

The United States National Bureau of Standards (NBS) has recently made a series of calibration services available to the industrial radiation community and to users of large sources of gamma rays, X-rays and electrons. These calibrations contribute to standardizing the measurement of large absorbed doses of ionizing radiation (100-10 to the 6th power Gy), over the energy range of interest in radiation processing (0.1-10MeV). Since, in practice, a wide variety of dosimetry systems are used for the many industrial applications, special problems have been encountered in developing proper calibration procedures and selecting transfer instruments that supply traceability to primary radiation measurement standards, for example, absorbed dose measurements by calorimetry. Standardized measurement procedures involve the use of a large calibrated cobalt-60 gamma-ray source at NBS, for which the dose rate has been determined calorimetrically. This source is used to calibrate the response of a relatively accurate and reproducible dose meter, namely, a radiochromic dye film covering the dose ranges of interest in radiation processing. Because of the ruggedness and stability of this dose meter and the absence of dose-rate dependence of its response, it can be used as a routine transfer instrument for postal dose intercomparisons and to determine absorbed dose rates from industrial radiation sources, to measure dose distributions, and to calibrate other dosimetry systems for use on a production line or in commissioning a new radiation process.

712,456
PB81-207268 Not available NTIS
National Bureau of Standards, Washington, DC.
Dye Film Dosimetry for Radiation Processing.
Final rept.
J. C. Humphreys, and W. L. McLaughlin. Apr 81, 5p
Proceedings of the Conference on Application of Accelerators in Research and Industry (6th) Held at Denton, TX., on November 3-5, 1980.
Pub. in IEEE (Institute on Electrical and Electronics Engineers) Transactions on Nuclear Science NS-23, n2 p1797-1801 Apr 81.

Keywords: *Calibrating, *Dosimetry, *Films, *Radiation dosimetry, Dyes, Plastics, NTISCOMNBS.

Commercially available plastic films containing dyes or dye precursors are convenient dosimeters and imaging media for electron beams or photons used for industrial radiation processing. As 'grainless' imaging systems having thicknesses down to a few micrometers, they provide high spatial resolution for determining detailed absorbed dose distributions through microdensitometric analysis. The radiation absorption properties of these systems are adjusted by changing film composition so that the dosimeter materials can be made to simulate the material of interest undergoing irradiation (e.g., tissue, bone, various insulating materials, semiconductor devices, and a wide assortment of polymers). Other advantages include long-term stability, dose-rate independence, and ease of use and calibration. Radiochromic dye films with thicknesses varying from 0.005 to 1 mm are presently used to monitor electron-beam or gamma-ray doses from 10 to 100,000 Gy (1,000 to 10 to the 7th power rad), typical of those encountered in medical applications, radiation curing of polymeric composites, wire and cable insulation, shrinkable plastic tubing and film, as well as sterilization of medical supplies and treatment of municipal and industrial wastes. An NBS calibration service to industry involves the traceability of standard 60 Co gamma ray absorbed dose measurements by means of these films employed as transfer standards.

712,457
PB81-234890 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS Program for Electron Dosimetry.
Final rept.
R. Loevinger. Jun 81, 11p
Sponsored in part by Office of Naval Research, Arlington, VA., Department of Energy, Washington, DC., and National Institutes of Health, Bethesda, MD.
Pub. in Proceedings of the Symposium on Electron Beam Therapy held at the Memorial Sloan-Kettering Cancer Center, New York, NY., on September 25-27, 1979, p31-41 Jun 81.

Keywords: *Heat measurement, *Dosimetry, *Meetings, Radiotherapy, Standards, Electron beams.

NBS has the responsibility to provide access to reliable national dosimetry standards in order that absorbed dose to tissue in radiation therapy be traceable to dosimetry standards. For high-energy electron beams the traceability is established by calibrating the beam with an instrument that has been assigned an NBS-traceable calibration factor in a cobalt-60 beam, and then using a calculated correction to the instrument response. For this purpose NBS provides updated values of energy-absorption coefficients and stopping-power ratios. The NBS radiation transport program is used to calculate electron dose distributions in water, electron spectra in air and in water, the angular distribution of scattered electrons, bremsstrahlung contamination of electron beams, and other properties of electron therapy beams, all as functions of a variety of physical factors. The Fricke chemical dosimetry system has been used to provide measurement assurance for high-energy electron therapy since 1967, and a summary of the results to date shows a slow but definite improvement in the accuracy of electron beam calibration. A graphite calorimeter has been used for the experimental determination of electron stopping-power ratios at NBS, and has served as the NBS standard of absorbed dose. Work is underway at NBS to develop an absorbed-dose calorimeter that responds directly to temperature rise in water.

712,458
PB81-600030 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
X-ray Measurements and Protection 1913-1964: National Radiological Organizations.
L. S. Taylor. 1981, 386p

Keywords: *Dosage, Dosimetry, Health and safety, High voltage, Ionization chamber, Ionizing radiation, Ionometer, Radiation quantities and units, Radiation standards and protection, Radioactivity, Radiology, Radium, Roentgen ray, Tubes(X-ray), X-ray measurement, X-rays.

An account of the initial U.S. concerns with, and subsequent efforts to cope with, the safe use of ionizing radiation is given. National interest was focused in the National Bureau of Standards where radiation programs were established at the urging of, and with the close cooperation of, the radiological profession. The NBS ionizing radiation research programs, the first in the U.S. Government, were dedicated to establishing a sound scientific base for x-ray measurement and protection. Along with the support and constant efforts of the national and international radiological organizations, the Bureau played a critically important role in the Nation's ability to use radiation effectively and safely. Based on widely scattered files assembled from both Government and non-government sources, the document represents a single source record of significant committee papers, correspondence, and decisions during the period 1913 to 1964, along with the authors summary of NBS work, and the interrelated efforts of many others. A listing of papers that contributed significantly to the understanding of ionizing radiation, and provides a complete record of the published output of the NBS radiation staff, is included.

712,459
PB82-118001 Not available NTIS
National Bureau of Standards, Washington, DC.
Choice of Radiation Protection Quantities for a Personnel Dosimetry Performance Standard.
Final rept.
M. Ehrlich. 1981, 4p
Pub. in Proceedings of the European Seminar on Radiation Protection Quantities for External Exposure, Braunschweig, Federal Republic of Germany, Oct 13-15, 1980, p239-242 1981.

Keywords: *Meetings, *Radiation measuring instruments, *Performance standards, *Dosimetry, *Personnel dosimetry.

This is a discussion of the difficulties encountered in the development of a personnel radiation dosimetry performance standard that were related to the choice of a suitable quantity for reporting the results and to the derivation of conversion factors to this quantity from the quantities in which personnel dosimeters are usually calibrated.

712,460
PB82-152646 Not available NTIS
National Bureau of Standards, Washington, DC.
Difficulties in Calculating Spectrum-Averaged Values of Neutron Dose Equivalent.
C. Eisenhauer, and R. Schwartz. Nov 81, 4p
Sponsored in part by Nuclear Regulatory Commission, Washington, DC.
Pub. in Health Physics 41, n5 p774-777 Nov 81.

Keywords: *Heavy water, *Radiation dosage, Reprints, *Nuclear power plants.

The problem of inconsistencies in standard tabulations of the flux to dose rate conversion factor for neutrons is examined. It is shown that such inconsistencies can lead to uncertainties of 25% in the dose equivalent calculated for neutron spectra in maintenance areas of nuclear power reactors.

712,461
PB82-153313 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Experimental and Theoretical Ionization Yield Spectra for Neutrons.
R. S. Caswell, J. J. Coyne, and L. J. Goodman. 1981, 12p
Grant PHS-CA-26313-02
Sponsored in part by Department of Energy, Washington, DC. Office of Health and Environmental Research.
Pub. in Proceedings of Symposium on Neutron Dosimetry (4th), Held at Munich-Neuherberg, Germany on June 1-5, 1981, Paper in Radiation Protection, n1 p201-212 1981.

Keywords: Proportional counters, Spectrum analysis, Ionization, *Neutron dosimetry, Tissue-equivalent detectors.

Measurements with tissue-equivalent proportional counters are used in neutron dosimetry to indicate the quality of the radiation. What is effectively measured is the ionization yield spectrum. However, the energy deposition spectrum is usually desired. These two spectra will differ if the ionization yield (E/W) varies as a function of secondary ion type and energy. In the past the authors have calculated energy deposition spectra, and compared them to experimental ionization yield spectra. Our analytic energy deposition code has been modified to produce ionization yield spectra as well as energy deposition spectra. These newly-calculated ionization yield spectra are compared with both walled and wall-less tissue-equivalent proportional counter spectra. Calculated ionization yield spectra are also compared with calculated energy deposition spectra. This permits evaluation of the differences which are useful in interpretation of the experimental proportional counter spectra.

712,462
PB82-165036 PC **A17**/MF **A01**
National Bureau of Standards, Washington, DC.
X-Ray Measurements and Protection, 1913-1964: The Role of the National Bureau of Standards and the National Radiological Organizations.
Final rept.
L. S. Taylor. Dec 81, 390p NBS-SP-625
Library of Congress catalog card no. 81-600158.

Keywords: *Ionizing radiation, *Health physics, *Dosimetry, *Radiation protection, Safety, Standards, Protection, X rays, Measurements, National government, Dosage, High voltage, National Bureau of Standards.

An account of the initial U.S. concerns with, and subsequent efforts to cope with, the safe use of ionizing radiation is given. National interest was focused in the National Bureau of Standards where radiation programs were established at the urging of, and with the close cooperation of, the radiological profession. The National Bureau of Standards' ionizing radiation research programs, the first in the U.S. Government, were dedicated to establishing a sound scientific base for x-ray measurement and protection. Along with the support and constant efforts of the national and international radiological organizations, the Bureau played a critically important role in the Nation's ability to use radiation effectively and safely. Based on widely scattered files assembled from both Government and nongovernment sources, this document represents a single source record of significant committee papers, correspondence, and decisions during the period 1913 to 1964, along with the author's summary of National Bureau of Standards' work, and the interrelated efforts of many others in the scientific community. A complete listing of the published output of the National Bureau of Standards' radiation staff is also included in this document. These papers contribute significantly to our understanding of ionizing radiation.

712,463
PB82-178187
(Order as PB82-178146, PC **A09**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
National Standards for Radiation Dosimetry.
R. Loevinger. Feb 82, 2p
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p29-30 1982.

No abstract available.

712,464
PB82-178229
(Order as PB82-178146, PC **A09**/MF **A01**)
Bureau of Radiological Health, Rockville, MD.
Calibration Program of the Bureau of Radiological Health,
T. R. Ohlhaber. Feb 82, 7p
Sponsored in part by National Bureau of Standards, Washington, DC. National Measurement Lab.
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p59-65 1982.

No abstract available.

712,465
PB82-178252
(Order as PB82-178146, PC **A09**/MF **A01**)
Texas Univ. System Cancer Center, Houston.
American Association of Physicists in Medicine's Regional Calibration Laboratory System,
R. J. Shalek, L. J. Humphries, and W. F. Hanson. Feb 82, 8p
Sponsored in part by National Bureau of Standards, Washington, DC. National Measurement Lab.
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p81-88 1982.

No abstract available.

712,466
PB82-178260
(Order as PB82-178146, PC **A09**/MF **A01**)
National Bureau of Standards, Washington, DC.
NBS Traceability Programs for Radiation Therapy.
C. G. Soares, and M. Ehrlich. Feb 82, 9p
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p89-97 1982.

No abstract available.

712,467
PB82-178286
(Order as PB82-178146, PC **A09**/MF **A01**)
Texas Univ. Health Science Center at Houston. School of Public Health.
Role of Calibration Standards in Environmental Thermoluminescence Dosimetry,
T. F. Gesell, M. F. Jones, and G. de Planque. Feb 82, 6p
Sponsored in part by National Bureau of Standards, Washington, DC. National Measurement Lab. Prepared in cooperation with Department of Energy, New York. Environmental Measurements Lab.
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p111-116 1982.

No abstract available.

712,468
PB82-178328
(Order as PB82-178146, PC **A09**/MF **A01**)
Michigan Univ., Ann Arbor.
Performance Testing of Personnel Dosimetry Services.
P. A. Plato, and C. G. Hudson. Feb 82, 4p
Sponsored in part by National Bureau of Standards, Washington, DC. National Measurement Lab.
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p145-148 1982.

No abstract available.

712,469
PB82-178336
(Order as PB82-178146, PC **A09**/MF **A01**)
Nuclear Regulatory Commission, Washington, DC.
Occupational Exposure Measurements in NRC Regulatory Guides.
A. Brodsky. Feb 82, 21p
Sponsored in part by National Bureau of Standards, Washington, DC. National Measurement Lab.
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p149-169 1982.

No abstract available.

712,470
PB82-178344
(Order as PB82-178146, PC **A09**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Dosimetry for Industrial Radiation Processing.
W. L. McLaughlin, J. C. Humphreys, and A. Miller. Feb 82, 8p
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p171-178 1982.

No abstract available.

712,471
PB82-178716 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Tables of Energy-Deposition Distributions in Water Phantoms Irradiated by Point-Monodirectional Electron Beams with Energies from 1 to 60 MeV, and Applications to Broad Beams.
M. J. Berger, and S. M. Seltzer. Jan 82, 58p NBSIR-82-2451
Sponsored in part by Department of Energy, Washington, DC. Office of Health and Environmental Research, and Office of Naval Research, Arlington, VA.

Keywords: *Dosimetry, *Electron beams, Monte Carlo method, Superposition(Mathematics), Tables(Data), Graphs(Charts), Water, Phantoms.

This report presents tables of elementary three-dimensional absorbed-dose distributions in a water phantom irradiated by monoenergetic, point-monodirectional electron beams. Such distributions have been obtained by the Monte Carlo method for 14 beam energies from 1 MeV to 60 MeV. The tabulated results can be applied to the determination of absorbed-dose distributions from parallel beams of arbitrary finite cross section. The beam of interest is treated as a superposition of point-monodirectional beams, and the absorbed-dose distribution is obtained as a corresponding superposition of elementary absorbed-dose distributions. By way of example, the tabulated data are used to obtain (1) depth-dose curves and practical ranges in broad-beam geometry, and (2) central-axis depth-dose curves, radial distributions of absorbed dose, and isodose patterns for beams with finite circular cross section.

712,472
PB82-192477 Not available NTIS
National Bureau of Standards, Washington, DC.
Gamma-Ray Response of Radiochromic Dye Films at Different Absorbed Dose Rates.
Final rept.
W. L. McLaughlin, J. C. Humphreys, H. Levine, A. Miller, B. B. Radak, and N. Rativanich. 1981, 13p
Sponsored in part by Risoe National Lab., Roskilde (Denmark); Institut za Nuklearne Nauke Boris Kidric, Vinca (Yugoslavia); and Office of Atomic Energy for Peace, Bangkok (Thailand).
Pub. in Radiation Physics and Chemistry 18, n5-6 p987-999 1981.

Keywords: *Dosimetry, *Gamma rays, *Thin film polymers, Dyes, Plastics, Reprints.

In leucotriphenylmethane radiochromic dye systems, using polymeric host materials, low-intensity rate dependence of gamma-ray response at does greater than 10 kGy and at dose rates less than/Gy.s is observed in some dye plastic combinations. This effect is prevalent under dry or anoxid conditions, and accompanies a shift in the optical absorption band. Whether or not the net dye yield becomes sublinear with dose and diminishes with decreasing dose rate is determined by environmental effects (e.g. relative humidity) and expecially by the nature of the host material. Experiments at absorbed dose rates between 0.01 and 3/Gy.s show that the apparent low-intensity dose rate dependence is due mainly to a moisture-controlled decrease in efficiency of radiation-induced dye formation at relatively low radiation intensities. For several hydrophilic dosimeters, the thinner the film, the greater the dose rate effect. With the exception of polyvinyl pyrrolidone and the very thin films, there is only slight rate dependence at intermediate relative humidity.

712,473
PB82-199258 Not available NTIS
National Bureau of Standards, Washington, DC.
Broad-Range Dosimetry with Leuko Dye Optical Waveguides.
Final rept.
S. Kronenberg, W. L. McLaughlin, and C. R. Siebentritt. 1981, 4p
Sponsored in part by Army Electronics Research and Development Command, Fort Monmouth, NJ.*Federal Emergency Management Agency, Washington, DC.
Pub. in Nuclear Instruments and Methods 190, p365-368 1981.

Keywords: *Dosimeters, Ionizing radiation, Fiber optics, Methyl sulfoxide, Reprints, *Gamma dosimetry, *Neutron dosimetry, Optical waveguides.

Optical waveguides consisting of plastic tubing filled with a solution of leuko radiochromic dye are designed for use as ionizing radiation dosimeters. Anomalous dispersion near the radiation-induced absorption band of the dye solutions results in refractive index changes, permitting dosimetry with a dynamic range of abosrbed dose, or dose equivalent, of at least six order of magnitude.

712,474
PB82-199555 Not available NTIS
National Bureau of Standards, Washington, DC.
Choice of Conversion Factors to the Shallow and Deep Dose Equivalents for Use in a U.S. Personnel Dosimetry Performance Testing Programme.
Final rept.
M. Ehrlich. 1981, 5p
Pub. in Radiation Protection Dosim. 1, n4 p271-275 1981.

Keywords: *Radiation dosage, *Dosimetry, *Health physics, *Occupational safety and health.

In June 1981, the Health Physics Society Standards Committee adopted a standard that will be used in a future mandatory U.S. personnel dosimetry performance testing program. In this standard, a set of factors is specified for converting from quantities generally used to characterize the radiation fields in which radiation protection instruments are calibrated to the shallow and the deep dose equivalent specified for reporting the results of future performance tests. For photons, the choice of these conversion factors was the cause of considerable controversy. For this reason, it was decided to publish this relatively detailed discussion of the considerations which were the basis for the choice of all the factors used.

712,475
PB82-210253 Not available NTIS

National Bureau of Standards, Washington, DC.
Calculation of Absorbed Dose in High-Energy Photon and Electron Beams Using a Calibrated Ionization Chamber.
Final rept.
R. Loevinger. 1981, 13p
Sponsored in part by National Cancer Inst., Bethesda, MD.
Pub. in Proceedings of International Symposium on Biomedical Dosimetry: Physical Aspects, Instrumentation, Calibration, Paris, France, Oct 27-31, 1980, Invited paper IAEA-SM-249/93, p283-296 1981.

Keywords: *Meetings, *Calibrating, *Electron beams, Radiotherapy, *Radiation doses, Ionization chambers, High energy physics, Photon beams.

Conventional methods of obtaining absorbed dose for radiation therapy in a high-energy beam make use of ionization chambers calibrated in terms of exposure, and are generally described as the C lambda and CE methods. It is also well known that these methods contain at least small errors due to neglect of the individual properties of the ionization chambers. Calibration is now provided at various standards laboratories in terms of exposure, air kerma, and absorbed dose to water. A method of calculation is described that can start with a calibration in terms of any one of these three quantities, and that (at least in principle) accounts for properties of the ionization chamber, the surrounding medium, and the high-energy beam.

712,476

PB82-210279 Not available NTIS
National Bureau of Standards, Washington, DC.
Progress in High-Dose Radiation Dosimetry.
Final rept.
K. V. Ettinger, J. W. Nam, W. L. McLaughlin, and K. H. Chadwick. 1981, 28p
Sponsored in part by International Atomic Energy Agency, Vienna (Austria).
Pub. in Proceedings of International Symposium on Biomedical Dosimetry: Physical Aspects, Instrumentation, and Calibration, Paris, France, October 1980, p405-432 1981.

Keywords: *Dosimetry, *Clinical medicine, Calibrating, Performance evaluation, Heat measurement.

The last decade has witnessed a deluge of new high-dose dosimetry techniques and expended applications of methods developed earlier. Many of the principal systems are calibrated by means of calorimetry, although production of heat is not always the final radiation effect of interest. Requirements for a stable and reliable transfer dose meters have led to further developments of several important high-dose systems: thermoluminescent materials, radiochromic dyes, cericcerous solutions analyzed by high-frequency oscillometry. A number of other prospective dosimeters also treated in this review. In addition, an IAEA program of high-dose intercomparison and standardization for industrial radiation processing is described.

712,477

PB82-235045 Not available NTIS
National Bureau of Standards, Washington, DC.
Overview of United States Activities for Nonionizing Electromagnetic Radiation Safety.
Final rept.
H. E. Clark. Dec 80, 26p
Pub. in Proceedings of 'The Washington Impact: How It Affects Microwave Users', Washington, DC, November 13-14, 1980, p34-60.

Keywords: *Meetings, *Electromagnetic radiation control, Safety, United States, Standards, *Nonionizing radiation.

The speech provides a review of the overall U.S. Government Program of Nonionizing Electromagnetic Radiation (NER) Safety including: the goal and rationale of that program, the strategy for achieving it, identification of nearly all organizations (Federal or private) which have a role in assuring NER safety, and listing of all Federal and state exposure standards.

712,478

PB82-235961 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Procedures for Calibrating Neutron Personnel Dosimeters.
Final rept.
R. B. Schwartz, and C. M. Eisenhauer. May 82, 38p
NBS-SP-633
Library of Congress catalog card no. 82-600543.
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Dosimeters, *Calibrating, Neutron sources, *Neutron dosimetry, Californium 252.

Procedures are given for routine testing and calibration of neutron dosimeters and remmeters with radioactive neutron sources. The issues addressed include: the choice of neutron source; phantom construction; fluence to dose equivalent conversion; and the corrections for air scatter, room return, and anisotropic-neutron emission. Explicit, semi-empirical, analytic expresions are given for the room return correction, and calculated numerical values are given for air scatter.

712,479

PB83-139246 Not available NTIS
National Bureau of Standards, Washington, DC.
Radioactivity Standards Programme of the National Bureau of Standards.
Final rept.
W. B. Mann. 1978, 8p
Sponsored in part by International Atomic Energy Agency, Vienna (Austria).
Pub. in Proceedings of IAEA Symposium, National and International Standardization of Radiation Dosimetry, Atlanta, GA., Dec 77, II, p147-154 1978.

Keywords: *Radioactivity, Standards, Environments, Programs, *National Bureau of Standards.

From nuclear data tables, such as those compiled by the Oak Ridge Nuclear Data Project, the absorbed dose to a homogenous medium can be calculated from given values of the mean energy per radiation, expressed in gram rad per microcurie hour. To make any of these calculations the activities of the various components of radioactive effluents or of the administered radiopharmaceuticals must be known. For more than ten years the Radioactivity Section of the National Bureau of Standards has been devoting a very considerable part of its effort to the production of radioactivity standards that are needed in environmental and nuclear-medicine measurements. Such standards are also being produced in appropriate environmental matrices and the latest available nuclear-decay data, often produced in the Radioactivity Section, is also supplied. Traceability to the International and National Radioactivity Measurements Systems is discussed.

712,480

PB83-143743 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Neutron Room Return Effects.
Final rept.
C. M. Eisenhauer, and R. B. Schwartz. 1981, 10p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the DoE Workshop on Personnel Neutron Dosimetry (8th), Louisville, Kentucky, June 18-19, 1981, p171-180.

Keywords: *Neutron scattering, *Dosimeters, Calibrating, Walls, *Neutron dosimetry, *Albedo-neutron dosemeters, Californium 252.

An approach for measuring the effect of neutrons scattered from the walls of a calibration room on the response of neutron personnel monitors is discussed. Experimental results are presented for 9-inch and 3-inch polyethylene spheres and for albedo dosimeters irradiated with a (252)Cf neutron source. An analytical model for predicting the effects of scattered neutrons is reviewed and comparisons with experiments are made.

712,481

PB83-143768 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of a D20 Moderated (252) Cf Source for Dosimeter Testing and Calibrating.
Final rept.
R. B. Schwartz, and C. M. Eisenhauer. 1982, 7p
Sponsored in part by Nuclear Regulatory Commission, Washington, DC.
Pub. in Proceedings of DoE Workshop on Personnel Neutron Dosimetry (8th), Louisville. Kentucky, June 18-19, 1981, p153-162.

Keywords: *Dosimeters, *Calibrating, Performance evaluation, *Neutron dosimetry, *Albedo-neutron dosemeters, *Remmeters, Californium 252, Radiation doses, Dose equivalents.

The 15 cm radius D2O moderated (252)Cf source has been used to test and calibrate several types of neutron personnel dosimeters and remmeters. Measurements were made of the response of the devices to the moderated neutrons, relative to the response from a bare (252)Cf source. In general, the measured results are in good agreement with calculations, and dosimeters calibrated with the moderated source gave accurate results when used to measure the dose equivalent at power reactors.

712,482

PB83-234542 Not available NTIS
National Bureau of Standards, Washington, DC.
Calculation of the Energy Dependence of Dosimeter Response to Ionizing Photons.
Final rept.
A. Miller, and W. L. McLaughlin. 1982, 12p
Pub. in International Jnl. of Applied Radiation and Isotopes 33, p1299-1310 1982.

Keywords: *Dosimetry, *Dosimeters, Radiation dosage, Gamma rays, Basic programming language, Reprints, Energy dependence, Computer applications.

Using a program in BASIC applied to a desk-top calculator, simplified calculations provide approximate energy dependence correction factors of dosimeter readings of absorbed dose according to Bragg-Gray cavity theories. Burlin's general cavity theory is applied in the present calculations, and certain limitations of the theory are considered. Examples of the use of the program are given for (60)Co gamma-ray irradiation of a LiF dosimeter held in aluminum and for evaluation of the influence of changes in broad gamma-ray spectra on the response of several dosimeters. The BASIC program and typical data plots as given here are available for certain dosimeter probe materials and combinations used with intermediate energy photon spectra (0.01-100 MeV).

712,483

PB83-235598 Not available NTIS
National Bureau of Standards, Washington, DC.
Dosimetry.
Final rept.
W. L. McLaughlin, R. D. Jarrett, and T. A. Olejnik. 1982, 57p
Pub. in Preservation of Food by Ionizing Radiation (Chapter 8), 1, p189-245 1982.

Keywords: *Calorimetry, *Dosimetry, *Irradiated foods, Reprints.

This chapter deals with methods and systems for measuring radiation quantities, in particular the absorbed dose which can be released to each biological effect of interest in the irradiation of foods. Primary reference dosimetry techniques for calibrating routine dosimeters are described, as well as ways to apply these measurement devices in research, commissioning, and quality control of radiation process. An important consideration is the determination of dose distributions in food items and the use of these data to ascertain with suitable statistical controls the dose extremes and the dose uniformity ratio in a process run. A large number of dosimeter systems is included here. It must be emphasized that only systems that are well-established and proven under practical processing conditions should be accepted for routine use. The less familiar systems are those with possibilities for future applications, once they have proven 'tried and true'.

712,484

PB83-235861 Not available NTIS
National Bureau of Standards, Washington, DC.
Theoretical Aspects of Electron Dosimetry.
Final rept.
M. J. Berger, and S. M. Seltzer. 1982, 19p
Sponsored in part by Department of Energy, Washington, DC. and Office of Naval Research, Arlington, VA.
Pub. in Proceedings Symposium Electron Dosimetry and Arc Therapy, Wisconsin Univ., p1-19 September 10-11 1981.

Keywords: *Dosimetry, Radiation dosage, Electron beams, Monte Carlo method, *Electron dosimetry.

This paper deals with the application of the superposition method to the calculation of absorbed-dose distri-

butions in homogeneous water phantoms irradiated by electron beams. The first stage of the calculation consists of the evaluation, by the Monte Carlo method, of elementary three-dimensional absorbed-dose distributions from narrow-pencil beams. In the second stage, the beam of interest is treated as a superposition of narrow-pencil beams, and the absorbed-dose distribution from the beam is obtained as a corresponding superposition of elementary distributions. A data base has been generated consisting of 14 elementary absorbed-dose distributions from monoenergetic pencil beams with energies between 1 and 60 MeV. Examples of such elementary distributions are presented, as well as other results obtained by applying the data base to other beam geometries.

712,485

PB83-235937 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Room-Scattered Neutrons on the Calibration of Radiation Protection Instruments.
Final rept.
C. M. Eisenhauer, and R. B. Schwartz. 1981, 10p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Symposium on Neutron Dosimetry (4th), GSF, Munich-Neuherberg, Germany, June 1-5, 1981, p421-430.

Keywords: *Calibrating, *Dosimeters, Neutron sources, *Neutron dosimetry, Remmeters, Californium 252.

Measurements of the response of 9-inch spherical remmeters, 3-inch spheres, and albedo dosimeters to neutrons from a Cf fission neutron source are presented. Measurements as a function of source-detector distance in several different calibration facilities support the argument that the response of an instrument to neutrons reflected from the room surfaces is constant over the central volume of the room. Approximate expressions are given for understanding the response to reflected neutrons in terms of the energy spectrum of the neutron source, the type of detector, and the size of the calibration room.

712,486

PB83-263236 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Investigation of Lyoluminescence Techniques for Application in Radiation-Protection Dosimetry.
Final rept. Jan 80-Jan 82.
R. Hanig. Aug 83, 57p NBSIR-83-2734

Keywords: *Luminescent dosimeters, Chemiluminescence, Additives, Saccharides, Spectrochemical analysis, Reaction kinetics, Phosphors, Agents, Solvents, Fast neutrons, *Lyoluminescence dosimetry, *Neutron dosimetry, Lyoluminescence, Phthalazine dione/amino-dihydro, Liquid scintillation detectors, Free radicals.

The goal of this research is to improve the sensitivity and reproducibility of lyoluminescence by using different instrumentation, using purer reagents and sensitizing agents, and using new and doped phosphors. Also modeling for the light output vs time may help in evaluating future spectral and kinetic data.

712,487

PB83-600034 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optical Waveguide Dosimeter.
S. Kronenberg, H. Levine, W. L. McLaughlin, and C. R. Siebentritt. Filed 28 May 81, patented 22 May 83, 4p PAT-APPL-6-267 312, PATENT-4 377 751

Keywords: *Dosimetry, Leuko dye, Optical waveguide dosimeter.

An optical waveguide dosimeter for personnel dosimetry is provided including a liquid solution of leuko dye hermetically sealed in plastic tubing into clear epoxy, thus forming beads that serve as optical lenses. A layer of clear ultraviolet absorbing varnish coated on these beads and an opaque outer layer over the plastic tubing provides protection against ambient UV.

712,488

PB84-106269 Not available NTIS
National Bureau of Standards, Washington, DC.
Calculations of Quality Factors for Fast Neutrons in Materials Composed of H, C, N and O.
Final rept.
B. R. L. Siebert, R. S. Caswell, and J. J. Coyne. 1983, 10p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Symposium on Microdosimetry (8th), Julich, Germany, F.R., September 27-October 1, 1982, p1131-1140 1983.

Keywords: *Dosimetry, Hydrogen, Carbon, Nitrogen, Oxygen, *Microdosimetry, *Neutron dosimetry, *Quality factor, MeV range 10-100.

Microdosimetric measurements in neutron or mixed neutron-gamma fields allow the determination of the absorbed dose and the mean quality factor. Various methods for extracting the mean quality factor from measured dose distributions in LET have been proposed and the use of these techniques for radiation protection has been suggested. The aim of this paper is to show that the mean quality factor for neutrons in tissue can be calculated in a good approximation directly from initial recoil energy spectra. Tables are given which make it possible to compute quality factors for monoenergetic neutrons from 11 MeV to 20 MeV in any tissue-simulating material composed of H, C, N and O. The calculations are based on water as slowing down medium. The quality of this approximation is discussed.

712,489

PB84-106335 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS (National Bureau of Standards) Neutron Fields for Personnel Dosimetry Calibration.
Final rept.
R. B. Schwartz, C. M. Eisenhauer, D. M. Gilliam, V. Spiegel, and O. A. Wasson. 1980, 3p
Pub. in Proceedings of Transactions of the American Nuclear Society, Las Vegas, Nevada, June 8-12, 1980, p621-623.

Keywords: *Dosimeters, *Calibrating, Neutrons.

The National Bureau of Standards has established both monoenergetic and continuous-energy neutron fields for personnel dosimeter calibrations. These facilities have been used for a wide variety of dosimeter and instrument calibrations and tests, and this paper will largely be a discussion of the characteristics of these calibration fields.

712,490

PB84-106533 Not available NTIS
National Bureau of Standards, Washington, DC.
Dosimetry of a Lightly Encapsulated 252Cf Source.
Final rept.
L. J. Goodman, J. J. Coyne, J. Zoetelief, J. J. Broerse, and J. C. McDonald. 1983, 6p
Sponsored in part by National Cancer Inst., Bethesda, MD.
Pub. in Radiation Protection Dosimetry 4, n2 p91-96 1983.

Keywords: *Dosimetry, Neutrons, Gamma rays, Reprints, *Californium 252, Neutron detectors, Encapsulation.

For use in calibrating various neutron detectors, the National Bureau of Standards employs several strong (252)Cf sources specially fabricated in light encapsulation. Measurements of the neutron and gamma ray tissue kerma rates in free air produced by one of these source (about 2 mg) were performed with tissue-equivalent ionization chambers, a magnesium walled argon filled ionization chambers, and miniature Geiger-Muller gamma-ray dosimeters. The kerma rates were also calculated from accurate measurements of the neutron emission rate of the source.

712,491

PB84-107069 Not available NTIS
National Bureau of Standards, Washington, DC.
Dose Distribution Mapping in Intense Gamma-Ray Fields Using Dye Film Dosimetry.
Final rept.
A. Z. El-Behay, and W. L. McLaughlin. 1982, 4p
Pub. in International Jnl. of Applied Radiation and Isotopes 33, n8 p684-687 1982.

Keywords: *Cobalt 60, *Dosimetry, Radiation, Dyes, Films, Mapping, Reprints.

Thin radiochromic dye film dosimeters of 50 micro M thickness were used to map isodose curves inside products contained in aluminum boxes of wall thickness 1.5 mm, which are typically irradiated for sterilization of medical products in the large 60Co irradiation facility of Egypt. Reproducibility of the absorbed dose readings obtained using this dosimetry system was calculated to be less than 2.5 percent. The value of the uniformit ratio inside the product material contained in these boxes was measured to be 1.28 plus or minus 0.06, which is less than its value for the usual cardboard boxes used in radiation processing. The isodose curves obtained for the aluminum cases are also more widely spaced than those obtained for the cardboard boxes alone. It is therefore, recommended to use such large aluminum boxes as containers for cardboard boxes of products being processed in large gamma-radiation facilities.

712,492

PB84-107119 Not available NTIS
National Bureau of Standards, Washington, DC.
Spatial Correlation of Ionization Events in Water.
Final rept.
M. J. Berger. 1981, 11p
Pub. in Proceedings of Symposium on Microdosimetry (7th) held at Oxford (United Kingdom) on September 7-12, 1980, p521-531 1981.

Keywords: *Radiobiology, *Beta particles, *Gamma rays, Electrons, Dosimetry, Effectiveness, X rays.

The spatial correlation of ionizations in water from various low-LET radiations is discussed in terms of a restricted ionization yield. This quantity is defined as the number of ionizations per 100 eV which are preceded by another ionization on the track within a distance s or closer. For large values of s the restricted ionization yield goes over into the usual total ionization yield. Restricted ionization yields have been computed for various separation distances s, ranging from less than 1 nm to 1000 nm, for monoenergetic electrons with energies from up to 1 MeV. These results have in turn been used to obtain restricted yields for monoenergetic photons, x-ray spectra and tritium beta rays. Whereas the total ionization yield is almost the same for various low-LET radiations, the restricted yield depends markedly on the radiation quality. For small and moderate separation distances it can become almost 2 times larger for 1-keV than for 1-MeV electrons, and 1.5 times larger for low-energy x rays and tritium beta rays than for cobalt-60 gamma rays. These yield ratios may provide a partial explanation for observed differences in radiobiological effectiveness between various low-LET radiations.

712,493

PB84-152271 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiation Dosimetry for Quality Control of Food Preservation and Disinfestation.
Final rept.
W. L. McLaughlin, R. M. Uribe, and A. Miller. 1983, 10p
Pub. in Radiation Physics and Chemistry 22, n1-2 p21-29 1983.

Keywords: *Food preservation, *Disinfestation, *Radiation dosimetry, *Dosimetry, Insect control, Quality control, Reprints.

In the use of x and gamma rays and scanned electron beams to extend the shelf life of food by delay of sprouting and ripening, killing of microbes, and control of insect population, quality assurance is provided by standardized radiation dosimetry. By strategic placement of calibrated dosimeters that are sufficiently stable and reproducible, it is possible to monitor minimum and maximum radiation absorbed dose levels and dose uniformity for a given processed foodstuff. The dosimetery procedure is especially important in the commissioning of a process and in making adjustments of process parameters (e.g. conveyor speed) to meet changes that occur in product and source parameters (e.g. bulk density and radiation spectrum). Routine dosimetry methods and cavity-theory corrections of dosimetry data may be selected for the radiations used in typical food processes.

712,494

PB85-120640 Not available NTIS
National Bureau of Standards, Washington, DC.

NBS (National Bureau of Standards) Standard Reference Neutron Fields for Personnel Dosimetry Calibration.
Final rept.
R. B. Schwartz, and J. A. Grundl. 1978, 19p
Sponsored in part by International Atomic Energy Administration, Washington, DC.
Pub. in Proc. Natl. and Int. Conf. on Standardization of Radiation Dosimetry, Atlanta, Georgia, December 5-9 1977, p367-375.

Keywords: *Neutron sources, *Dosimetry, *Calibrating, Thermal column, Dosimeters, *Personnel dosimetry, *Neutron dosimetry, Californium 252.

The National Bureau of Standards (NBS) has established and characterized several neutron fields for dosimeter calibration. Two of these fields are continuous neutron spectra: the spontaneous fission neutron distribution from (252)Cf, and a thermal Maxwellian beam. The other three neutron fields are monoenergetic reactor beams with energies of 2, 24, and 144 keV.

712,495
PB85-137479 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Gamma Ray Response of 'Opti-chromic' Dosimeters.
Final rept.
B. B. Radak, and W. L. McLaughlin. 1984, 3p
Pub. in Radiation Physics and Chemistry 23, n6 p673-675 1984.

Keywords: *Dosimeters, Fiber optics, Food irradiation, Gamma rays, Performance, Cobalt 60, Reprints, *Gamma dosimetry, Methane/triphenyl, Radiochromic dyes.

Commercially available 'Opti-chromic' dosimetry systems, consisting of radiochromic dye solutions in plastic tubing, were tested in terms of their response to (60)Co gamma radiation at various doses, dose rates, and temperatures, representative of those that might be encountered in typical radiation processing environments. Results of the tests are presented.

712,496
PB85-141448 Not Available NTIS
National Bureau of Standards, Gaithersburg, MD.
Improvement of Radiochromic Film Dosimetry Precision by Individual Dosimeter Characterization.
Final rept.
R. M. Uribe, W. J. Chappas, and W. L. McLaughlin. 1984, 3p
Pub. in International Jnl. of Applied Radiation and Isotopes 35, n10 p995-997 1984.

Keywords: *Dosimeters, Radiation dosage, Precision, Gamma rays, Reprints, *Radiochromic dyes, Gamma dosimetry.

Dosimeters supplied in large batches generally have intrinsic non-uniform response characteristics that can be improved by a technique of individual dosimeter characterization. Pre-use irradiation of radiochromic dye film dosimeters provides a simple method for reducing the standard deviation and error in making absorbed dose assessments. Through a simple pre-use uniform irradiation of a selection of dosimeters to a dose of 1.0 kGy, variability in the dosimeters' optical absorbances at a given wavelength and film-to-film variation in thickness are automatically included in an interpretation of subsequent unknown doses in the range 1-20 kGy. This technique reduces by about a factor of four the nominal error associated with routine radiochromic dye film measurements.

712,497
PB85-222305 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Calibration Techniques for Neutron Personal Dosimetry.
Final rept.
C. M. Eisenhauer, J. B. Hunt, and R. B. Schwartz. 1985, 15p
Pub. in Radiation Protection Dosimetry 10, n1-4, p43-57 1985.

Keywords: *Dosimeters, *Calibrating, Reprints, *Neutron dosimetry, Dose equivalents.

Techniques for calibrating devices used to estimate neutron dose equivalent are discussed. Procedures are recommended for making such calibrations, and for correcting them for effects such as neutron scattering in air and in the walls of the calibration room. Appropriate neutron source and detector combinations, source anisotropy, and optimum source-detector distances for calibrations are discussed. Corrections for neutron scattering using measurements with shadow cones and fitting procedures for detector response as a function of distance are considered, as are corrections predicted by means of simple analytic expressions.

712,498
PB86-138559 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Natural Matrix Materials for Low-Level Radioactivity Measurements, Lung and Liver.
Final rept.
K. G. W. Inn, and J. F. McInroy. 1983, 4p
Pub. in Proceedings of World Congress of Nuclear Medicine and Biology (3rd), Paris, France, August 29, 1982, p2912-2915.

Keywords: *Radioactivity, Pathology, Lung, Liver.

No abstract available.

712,499
PB86-193836 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Enhanced Sensitivity of Chemical Dosimeters Using Liquid-Core Optical Waveguides.
Final rept.
B. B. Radak, W. L. McLaughlin, and M. G. Simic. 1986, 6p
Pub. in Nuclear Instruments and Methods in Physics Research A243, p201-206 1986.

Keywords: *Chemical dosimeters, Fiber optics, Spectrophotometers, Absorption spectra, Reprints, Optical waveguides.

The spectrophotometric sensitivity of chromophoric chemical dosimeters can be enhanced by increasing the optical path length through the light absorbing medium. The approach is used with optical waveguide (OWG) dosimeters, consisting of liquid-phase light-propagating media filling the core of a long, thin flexible polymer tubing. The liquid phase consists of dimethyl sulfoxide, N, N,-dimet hylformamide, or triethyl phosphate solutions of hexa (hydroxyethyl) pararosaniline cyanide, a wellknown radiochromic dye precursor, which on irradiation converts from the leucoform into a brightly colored dye chromophore. The experimental design is described as well as the influences of some experimental parameters: length of the OWG, curvature of the waveguide loops, cross section of the liquid light-guiding core, the temperature and the solvent. It is suggested that such long OWG assemblies can be used for enhancing the response of chemical dosimeters for medical and radiation protection applications, as well as in analytical chemistry and for chemical kinetics studies.

712,500
PB86-210085 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Use of Threshold Activation Detectors to Obtain Neutron Kerma for Biological Irradiations.
Final rept.
C. Eisenhauer, J. Grundl, C. Cassapakis, and V. Verbinski. 1985, 15p
Pub. in Reactor Dosimetry, p921-928 1985.

Keywords: *Neutron flux, Neutron spectra, Reprints, Benchmarks, Kerma, Activation detectors.

Fission and non-fission activation foils have been irradiated in experimental room at the Armed Forces Radiobiology Research Institute (AFRRI) in Bethesda, Maryland, in order to characterize the neutron field there. The field, which is generated by neutrons from a TRIGA MARK-F reactor adjacent to the room, is used for radiobiological experiments. Results from each of six activation detectors have been analyzed to estimate the absolute neutron kerma rate per unit power of the reactor. These kerma rates have been compared with those derived from tissue equivalent ionization chamber measurements, and with those calculated by the method of discrete ordinates. A few group neutron spectrum has been inferred from the activation measurements by means of a least-squares adjustment. An example is included of benchmark referencing to a fission neutron spectrum and consequent improvement in measurement confidence.

712,501
PB86-230752 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Neutron Kerma Values.
Final rept.
R. S. Caswell, and J. J. Coyne. 1985, 3p
Pub. in Physics in Medicine and Biology Encyclopedia, p521-523 1985.

Keywords: Neutron irradiation, Reprints, *Kerma.

Kerma, K, is defined by the International Commission on Radiation Units and Measurements (ICRU) as the quotient of dE(tr) by dm, where dE(tr) is the sum of the initial kinetic energies of all the charged ionizing particles liberated by uncharged ionizing particles (such as neutrons) in a material of mass dm, that is K=dE(tr)/dm.

712,502
PB86-242609 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Critical Evaluation of Neutron Kerma Factors Using Theoretical and Experimental Ionization Yield Spectra.
Final rept.
H. Schuhmacher, H. G. Menzel, and J. J. Coyne. 1984, 12p
Sponsored by Commission of the European Communities, Luxembourg, and Department of Energy, Washington, DC. Office of Health and Environmental Research.
Pub. in Symposium on Neutron Dosimetry (5th), Neuherberg, Germany, F.R., September 17-21, 1984, p213-224.

Keywords: Neutrons, Alpha particles, Proportional counters, *Neutron dosimetry, *Kerma, *Alpha dosimetry, Tissue-equivalent materials, MeV range 10-100, Carbon 12 target.

Ionization yield calculations were performed and compared to measurements for 13.9, 15.0, 17.0 and 19.0 MeV. The measured spectra were normalized to unit neutron fluence and the calculations take account of the neutron energy distributions at the detector positions. The computer code was tested by comparison with experimental data at 0.57, 2.07 and 5.25 MeV because physical data are well known at these energies. Total kerma for 19 MeV as well as kerma due to alpha-particles for 17.0 and 19.0 MeV are significantly lower for the measured data. There is clear evidence that the (12)C(n,n'3 alpha) cross section for 17 and 19 MeV used in the calculations and in kerma evaluations is too high.

712,503
PB87-109872
(Order as PB87-109864, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Calibration of Beta-Particle Ophthalmic Applicators at the National Bureau of Standards.
J. S. Pruitt. 27 Aug 86, 6p
Included in Jnl. of Research of the National Bureau of Standards, v91 n4 p165-170 Jul-Aug 86.

Keywords: *Ophthalmology, *Calibrating, Strontium 90, Water, *Radiation doses, *Electron dosimetry, Yttrium 90.

The method used at the National Bureau of Standards for the calibration of strontium-90 + yttrium-90 beta-particle ophthalmic applicators in terms of absorbed dose to water, is described. The method involves measurement of ionization density at the applicator surface with an extrapolation chamber, correction for the difference in backscatter between the collection electrode and water, and application of the Bragg-Gray equation. The calibration obtained is an average over the active surface of the applicator. The overall uncertainty of the surface calibration is about + or - 15 percent.

712,504
PB87-122552 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

Future of A-150 TE Plastic.
Final rept.
L. J. Goodman. 1985, 16p
Pub. in Proceedings of Symposium on Neutron Dosimetry (5th), Munich, Neuherberg, Germany, September 17-21, 1984, v2 p687-694 1985.

Keywords: *Dosimetry, Plastics, Ionization chambers, *Tissue-equivalent materials, A 150 TE plastics, Neutron dosimetry.

The United States National Bureau of Standards is now considering the desirability of supplying A-150 plastic as a research material with at least the homogeneity certified. The authors are, however, faced with a dilemma since the nylon used in A-150 has been discontinued by the manufacturer and the current stock of A-150 has been estimated to be adequate to supply the demand for only the next 2 or 3 years. Thus, it will be necessary to reformulate the plastic mixture that will be used in the future. This may be a blessing in disguise because it offers the opportunity to change the composition of tissue-equivalent plastic to better conform to present-day requirements. To elucidate just what these requirements are, a postal survey of the opinions of neutron dosimetrists was conducted.

712,505
PB87-130514 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
OH Radical-Induced Products of Tyrosine Peptides.
Final rept.
L. R. Karam, M. Dizdaroglu, and M. G. Simic. 1984, 10p
Pub. in International Jnl. of Radiation Biology 46, n6 p715-724 1984.

Keywords: *Tyrosine, *Peptides, Chemical reactions, Amino acids, Chemical radicals, Chromatographic analysis, Crosslinking, Chemical bonds, Reaction kinetics, Reprints, *Hydroxyl radicals, Phenoxy radicals.

Reactions of radiation-generated OH radicals with tyrosine and its homopeptides, i.e. L-Tyr-L-Tyr and L-Tyr-L-Tyr-L-Tyr, in N2O-saturated solutions were shown to give crosslinks between the peptide chains with high yields. High-performance liquid chromatography, capillary gas chromatography and mass spectrometry were used for isolation and identification of the monomeric and dimeric products. Evidence is presented for the crosslinking to occur through C - C and C - O - C bonds. Mechanisms of product formation are also discussed.

712,506
PB87-149548 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Measurement of Absorbed Dose and Dose Distribution.
Final rept.,
A. Miller, and W. L. McLaughlin. 1984, 10p
Sponsored by Risoe National Lab., Roskilde (Denmark).
Pub. in Proceedings of Conference on Radiation Processing for Plastics and Rubber II, Canterbury, England, March 28-30, 1984, p10.1-10.10.

Keywords: *Dosimeters, Electron accelerators, Electron beams, *Radiation doses, Gamma radiation.

Absorbed dose from electron accelerators and cobalt irradiators can be measured reproducibly, e.g. with thin film plastic dosimeters, which also are useful for dose distribution measurements. Corrections must be applied to obtain the dose in product from measurement of the dose in a dosimeter. New developments in absolute dosimetry by means of calorimetry are discussed, as well as new developments in relative dosimetry.

712,507
PB87-165593 PC **A07**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Approximate Procedures for Calculating Protection from Initial Nuclear Radiation from Weapons,
C. M. Eisenhauer, and L. V. Spencer. Feb 87, 131p NBSIR-87/3507
Sponsored by Federal Emergency Management Agency, Washington, DC.

Keywords: *Structures, *Radiation shielding, *Nuclear weapons, Radiation protection, Nuclear explosion effects, Nuclear radiation, Buildings, Radiation transport, Neutron transport, Gamma radiation, Dose rates.

In the report the authors discuss procedures for routine evaluation of the protection of complex structures against the initial radiations from nuclear detonations. They describe procedures for evaluating and combining dose reduction factors for four radiation components: early fission product gamma rays, air secondary gamma rays generated by neutron interactions in the air, neutrons, and wall capture gamma rays generated by neutrons through interactions with nuclei in structural materials. They describe computer codes developed to evaluate reduction factors for each of these components.

712,508
PB88-108535 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
NBS (National Bureau of Standards) Measurement Services: Calibration of Beta-Particle-Emitting Ophthalmic Applicators.
Final rept.,
J. S. Pruitt. Jul 87, 38p NBS/SP-250/9
Also available from Supt. of Docs. as SN003-003-02817-7. Library of Congress catalog card no. 87-619844.

Keywords: *Ophthalmology, *Strontium 90, Quality assurance, *Beta sources, *Yttrium 90, *Calibration, Radiation doses.

The service provides calibrations for (90)Sr + (90)Y beta particle ophthalmic applicators. The calibration determines the average surface absorbed-dose rate to water over the active area of the applicator. The technique used is to measure current per unit mass of air at the active surface with an extrapolation ionization chamber, and to convert this into absorbed-dose rate with Bragg-Gray cavity ionization theory. The extrapolation chamber measurements are made in three parts. Data book measurements and a calibration report are given for one particular applicator.

712,509
PB88-110374 PC **A04**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
NBS (National Bureau of Standards) Measurement Services: Fricke Dosimetry in High-Energy Electron Beams.
Final rept.,
C. G. Soares, E. L. Bright, and M. Ehrlich. Jul 87, 58p NBS/SP-250/4
Also available from Supt. of Docs. as SN003-003-02816-9. Library of Congress catalog card no. 87-619834.

Keywords: *Chemical dosimeters, Iron sulfate, Spectrophotometry, Quality assurance, Electron beams, *Electron dosimetry, Radiation doses, Fricke solution, High energy, US NBS.

The NBS Fricke-Dosimetry Service (advertised in NBS Special Publication 250, 1986-1988 and earlier editions) is described in detail. After a brief historical introduction and description of the service, the theoretical basis (including what quantities are measured, how, and why) and the philosophy of internal quality checks are discussed in some detail. This is followed by a description of the physical setup and of the step-by-step operating and reporting procedures. Throughout the section, there is reference to sample records of past performance, in order to facilitate continuity of operation in the case of personnel changes. The document concludes with a discussion of the uncertainties involved in the measurement quality assurance service, safety considerations, and an appendix containing samples of all form letters and of the final report mailed to the participants.

712,510
PB88-117700 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Tissue-Equivalent Radiochromic Waveguide Dosimeters for X-and Gamma Rays and Fast Neutrons.
Final rept.,
S. Kronenberg, W. L. McLaughlin, and C. R. Siebentritt. 1986, 4p
Sponsored by Army Communications-Electronics Command, Fort Monmouth, NJ., and Federal Emergency Management Agency, Washington, DC.
Pub. in Nuclear Tracks 12, n1-6 p561-564 1986.

Keywords: *Dosimeters, Fast neutrons, Real time operations, Reprints, *Tissue-equivalent detectors, *Neutron dosimetry, *Gamma dosimetry, *X-ray dosimetry, Radiochromotography, Optical waveguides.

Radiochromic waveguide dosimeters consist of small fluorinated ethylene propylene (FEP) tubing containing a radiation-sensitive organic liquid or gel, which, because of its higher refractive index, propagates light through the tubing as an optical waveguide. The measurement of dose is accomplished by reading radiation induced changes in the ratio of transmitances at two visible light wavelengths. These dosimeters read the gamma and neutron tissue doses. Real time dosimeters were built on this principle for use in radiation therapy.

712,511
PB88-141031 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Nuclear Data for Biomedical Applications.
Final rept.,
R. S. Caswell. 1986, 12p
Sponsored by Department of Energy, Washington, DC. Office of Health and Environmental Research.
Pub. in Radiation Effects 94, n1-4 p1-12 1986.

Keywords: *Decay schemes, Nuclear cross sections, Neutron cross sections, Neutron irradiation, Reprints, *Nuclear medicine, Radioisotopes, Radiopharmaceuticals, Radiation therapy.

Needs for better nuclear data for biomedical applications are chiefly of two kinds: decay-scheme and production data for radionuclides used in nuclear medicine, and cross sections and spectral information for high-LET radiations used in radiation therapy of cancer, especially high-energy neutrons. Radiopharmaceuticals are used primarily for diagnostic and physiological function studies. Decay scheme information is important to establish the internal radiation dose received by the patient. Radionuclides for which better decay scheme data are needed are identified. Protons, alphas, pions, neutrons, and heavy nuclei such as Si-28 and A-40 are all being studied or used for radiation therapy of cancer. Of these, the most widely used is neutron radiation therapy at about 8 centers in the United States, 22 worldwide. The nuclear data needed are total and partial neutron cross sections for the elements that compose tissue and for dosimeter materials up to about 60 MeV.

712,512
PB88-141056 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Effect of Air Scatter on Calibration of Instruments for Detecting Neutrons.
Final rept.,
C. M. Eisenhauer, R. B. Schwartz, and R. C. McCall. 1987, 8p
Sponsored by Defense Nuclear Agency, Washington, DC.
Pub. in Radiation Protection Dosimetry 19, n2 p77-84 1987.

Keywords: *Dosimeters, Neutron sources, Californium isotopes, Americium isotopes, Reprints, *Neutron dosimetry, Personnel dosimetry, Atmospheric correction, Calibration, Radiation doses.

Monte Carlo calculations of the effect of air scatter on neutron fluence from Cf, moderated Cf, Am-Be, and Am-B neutron sources are presented. Net scattered fluence ratios of 1.38 + or - 0.10%, 4.40 + or - 0.21%, 0.95 + or - 0.10%, and 0.99 + or - 0.10% per meter, respectively, are indicated. Application of these results to the calibration of neutron personnel protection instruments is discussed, and a method is given for estimating air scattering from other neutron sources.

712,513
PB88-147574 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Monte Carlo Studies of X-ray Scattering in Transmission Diagnostic Radiology.
Final rept.,
G. Barnea, and C. E. Dick. 1987, 6p
Pub. in Medical Physics 13, n4 p490-495 Jul/Aug 87.

Keywords: *Radiology, Monte Carlo method, Polystyrene, Water, Reprints, *X-ray scattering, Nuclear medicine, KeV range 10-100, KeV range 100-1000.

Monte Carlo methods have been used to simulate the scattering of x rays in polystyrene and water phantoms. In particular, the ratio of the scattered-to-total x-ray fluence (scatter fraction) has been calculated for monoenergetic x-ray beams in the energy region relevant to diagnostic radiology and nuclear medicine (300-660 keV). Simulations have been made for representative values of the pertinent geometrical factors: phantom thickness from 5 to 21 cm, x-ray beam diameters of 10 and 25 cm, and scatter-to-image-plane separations from 0 to 20cm. As a function of x-ray energy, the scatter fraction was found to vary slowly between 30 and 100 keV, and to decrease between 100 and 660 keV. The present results were generated with a special transport code which included the effects of special geometries and the response of the x-ray detector.

712,514
PB88-152665 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Effects of Varying Geometry on Dose Calibrator Response: Cobalt-57 and Technetium-99m.
Final rept.,
J. M. Calhoun, D. B. Golas, and S. Harris. 1987, 6p
Pub. in Jnl. of Nuclear Medicine 28, n9 p1478-1483 Sep 87.

Keywords: Ionization chambers, Standards, Geometry, Shape, Reprints, *Radiation doses, Technetium 99, Cobalt 57, Radiopharmaceuticals, Nuclear medicine, Calibration.

A joint project between the National Bureau of Standards (NBS) and Biomedical Products Department, E.I. du Pont de Nemours and Company, Inc. compared the indicated activity of (a) cobalt-57 samples in NBS 5-ml ampoules, plastic syringes, Du Pont 27-ml Vial E epoxy- and Solution-filled containers, and (b) technetium-99m solutions in NBS 5-ml ampoules, elution vials, and syringes. The measurements were made in ionization chambers from two manufacturers. The main objective was to examine the use of radionuclides in NBS ampoules and Du Pont Vial E containers as suitable reference sources for ionization chambers used to assay radiopharmaceuticals in elution vials and syringes. The exercise illustrated that regardless of the brand of dose calibrator used, a calibration factor for each geometry should be determined to ensure the highest accuracy. The data show that as much as a 9% difference from the correct activity can be observed for these radionuclides, even when the ampoule reference source gives the appropriate reading.

712,515
PB88-152673 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Energy Loss and Range of Electrons.
Final rept.,
M. J. Berger. 1987, 23p
Sponsored by Department of Energy, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Nuclear and Atomic Data for Radiotherapy and Related Radiobiology, p323-345 1987.

Keywords: *Electrons, Dosimetry, Distance, *Stopping power, Range, Energy losses, Radiation therapy, KeV range 01-10, KeV range 10-100.

The paper reviews the information available on electron stopping powers and ranges, both in the energy region above 10 keV, where the information is found to be adequate for dosimetry and radiation therapy planning, and in the region below 10 keV, where the information is fragmentary and should be improved to meet the needs of microdosimetry and track structure research. Attention is focused on the state of the art as represented by the compilation in ICRU Report 37, 1984.

712,516
PB88-152954 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Free Radical-Induced Cross-Linking of Polydeoxythymidylic Acid in Deoxygenated Aqueous Solution.
Final rept.,
L. R. Karam, M. G. Simic, and M. Dizdaroglu. 1986, 9p
Pub. in International Jnl. of Raiation Biology and Related Studies in Physics, Chemistry and Medicine 49, n1 p67-75 1986.

Keywords: *Deoxyribonucleic acids, Irradiation, Cross-linking, Spectrophometry, Hydrogen, Chromatic analysis, Reprints, *Polydeoxythymidylic acid, Aqueous solutions, Hydroxyl radicals.

Radiation-generated hydroxyl radicals and hydrogen atoms were shown to induce the cross-linking of polydeoxythymidylic acid in N2O-saturated aqueous solution. The irradiated samples were hydrolyzed with formic acid and then analyzed by high performance liquid chromatography. Products were isolated and subsequently characterized by capillary gas chromatography-mass spectrometry. The presence of previously described monomeric thymine products was also shown. Yields were determined and mechanisms of formation were described for the products.

712,517
PB88-154588 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Secondary Charged Particle Spectra and Kerma Calculations.
Final rept.,
J. J. Coyne, H. M. Gerstenberg, and L. A. Hennen. 1987, 16p
Pub. in Nuclear and Atomic Data for Radiotherapy and Related Radiobiology, p189-204 1987.

Keywords: *Alpha particles, Carbon, *Kerma, Particle production, Breakup reactions, Radiation therapy.

A detailed analysis had been made of the reaction mechanisms which could contribute to the (n,n')3 alpha reaction in carbon, and their contribution to kerma.

Stress Physiology

712,518
PB-292 743/2 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Product Safety Technology Div.
Impact Attenuation Performance of Surfaces Installed Under Playground Equipment.
B. M. Mahajan, and W. B. Beine. Feb 79, 53p NBSIR-79-1707
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Playgrounds, *Surface finishing, *Accidents, *Injuries, Stress(Physiology), Head(Anatomy), Tests, Criteria, Methodology, Tolerances(Physiology), Experimental data, Product safety, *Head injuries.

This report describes a test method and a suggested criterion for evaluating the impact attenuation performance of playground surfacing materials intended to protect against head injury due to falls. Several types of surfacing materials have been tested and the results are included. These results indicate that some surfacing materials impart peak accelerations below this criterion for fall distances up to 10 feet while others exceed the criterion for relatively short fall distances.

Toxicology

712,519
PB-267 233/5 PC **A14**/MF **A01**
Pittsburgh Univ., PA. Graduate School of Public Health.
Toxicity of Plastic Combustion Products. Toxicological Methodologies to Assess the Relative Hazards of Thermal Decomposition Products from Polymeric Materials.
Special rept.,
Y. Alarie, and C. S. Barrow. Feb 77, 313p NBS-GCR-77-85
Grant NBS-5-9005

Keywords: *Plastics, *Toxicity, *Hazardous materials, *Combustion products, Inhalation, Chlorine, Hydrogen chloride, Toxicology, Methodology, Mice, Laboratory animals, Experimental data, Pyrolysis, Exposure, Tables(Data), Polymers, Lethal dosage, Bioassay, Rabbits, Polyvinyl chloride, Polyurethane resins, Tetrafluoroethylene resins, Fiberglass reinforced plastics, Polyester resins, Carbon monoxide, Carbon dioxide, Oxygen, Acroleins, Douglas fir wood, Toxic substances, Animal models.

Sensory and pulmonary irritation effects of thermal degradation products from natural and synthetic materials were studied using mice. Mice were used to develop a sensory irritation stress index based on changes in respiratory rate. In addition, acute lethality was obtained. Dose-response curves were generated for decomposition products from Douglas Fir, PVC, flexible polyurethane, teflon, and fiberglas reinforced polyester. Similar data were obtained for CO, CO2, low O2, acrolein, HCl and Cl2. Preliminary studies on the pulmonary effects of combustion products using rabbits are also reported.

712,520
PB-267 828/2 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Hazard Characteristics of Combustion Products in Fires: The State-of-the-Art Review.
Final rept.,
M. M. Birky. May 77, 50p NBSIR-77-1234, NASA-CR-135088
NASA Order-C-97823B

Keywords: *Fire hazards, *Combustion products, *Toxicology, Toxicity, Smoke, Respiration, Mortality, Gases, Carbon monoxide, Polymers, Hydrogen cyanide, Chemical analysis, Organic phosphates, Building codes, Standards, Construction materials, Fire detection systems, Fire prevention, Bioassay, Laboratory animals, Reviews, Toxic substances, Synergism.

The report reviews what is known about the smoke inhalation hazard as related to human fatalities, the limitations of the fire fatality data and the methods that have been and are being used to assess the inhalation toxicity hazard. Fire statistics indicate that 70 to 80% of the fire fatalities are attributed to smoke inhalation. In depth autopsy studies of some of these fatalities show that carbon monoxide is the predominant toxicant produced from fires. The role of new synthetic polymers and other additives is unknown as is the role of hydrogen cyanide in fire fatalities. Chemical analysis of combustion products has been used extensively to assess the toxicological hazard in fire research. Recent combined biological and selected analytical measurements are critically reviewed. The mechanism of toxic action of a few well known combustion products is discussed. The role of building codes and standards and early detection and suppression of fire are discussed as a means of reducing human exposure to toxic combustion products.

712,521
PB-268 341/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Chronic Intra-Arterial Cannula and Rapid Micro-Technique for Carboxyhemoglobin Determination,
S. C. Packham, D. B. Frens, J. B. McCandless, J. H. Petajan, and M. M. Birky. Nov 76, 8p
Grant NSF-ATA72-03406-A03
Pub. in Jnl. of Combust. Toxicology, v3 p471-478 Nov 76.

Keywords: *Carbon monoxide poisoning, *Catheters, Blood vessels, Arteries, Implantation, Chemical analysis, Spectrophotometry, Microanalysis, Procedures, Rats, Laboratory animals, Hemoglobins, Experimental data, Reprints, *Carbonylhemoglobin, Femoral artery.

A procedure for chronic placement of a cannula in the femoral artery of the rat is described. A rapid spectrophotometric technique for COHb analysis is outlined.

712,522
PB80-167042 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Carbonaceous Aerosol Generator for Inhalation Studies.
Final rept. Feb 78-Apr 79,
T. G. K. Lee, and G. W. Mulholland. Feb 80, 53p EPA-600/1-80-014

Keywords: *Toxicology, Respiration, Concentration(Composition), Aerosols, Air pollution, Soot, Diffusion flame, *Diesel engine exhaust, Particulates.

A carbonaceous aerosol generator designed for inhalation experiments with animals is described. The aerosol produced from a modified diffusion flame has a concentration of 3-10 mg/cu. m. at a flow rate of 30 L/

min. The addition of a small amount of O2 to the acetylene fuel greatly increased the efficiency of fuel to particulate conversion, the maximum value was 2.5%. The aerosol size characteristics were: Dgn = 0.14 micro m., based on the electrical aerosol analyzer; approximately 0.08 micro m., based on a low pressure inertial impactor; mediam elementary particle approximately 0.023 micro m. and mediam agglomerate particle approximately 0.54 micro m., based on transmission electron microscopy. The size characteristics of the generated aerosol are compared with diesel exhaust based on available published data.

712,523
PB81-110884 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of Recommended Test Method for Toxicological Assessment of Inhaled Combustion Products.
Final rept.
M. M. Birky, M. Paabo, B. C. Levin, S. E. Womble, and D. Malek. Sep 80, 56p NBSIR-80-2077

Keywords: *Combustion products, *Toxicology, Development, Tests, Respiration, Hydrogen cyanide, Exposure, Animals, Evaluation, Characteristics, Measurement, Cyanides, Materials, Chemical analysis, Lethal dosage, *Toxic substances.

The objective of the project supported by PRC was to develop a test method for measuring the toxicity of combustion products from polymeric materials including cellular plastics. The development of such a test procedure was considered an essential first step to determine the hazard to life when cellular plastics are involved in fire. As result of this work, a test procedure was developed. It consists of 3 major elements; (1) combustion system, (2) chemical analysis system and (3) animal exposure system. Two biological endpoints obtained from the exposure are: (1) incapacitation in 30 minute exposure period, and (2) lethality in 30 minutes plus 14 days post exposure. The test apparatus has been evaluated to determine mixing rates and loss of reactive chemicals in the exposure chamber. In addition, a statistical evaluation of the experimental results demonstrated that order of incapacitation was independent of animal location. Evaluation of a limited number of different materials that produce different toxicological syndromes has demonstrated the utility of all 3 endpoints. Two natural polymers (wood and wool) and 2 synthetic materials (modacrylic and PTFE) have been studied in detail. In addition, preliminary data have been obtained on a flexible polyurethane foam (CM-21).

712,524
PB82-210345 Not available NTIS
National Bureau of Standards, Washington, DC.
Inhalation of Toxic Products from Fires.
Final rept.
M. M. Birky, and F. B. Clarke. Dec 81, 17p
Prepared in cooperation with New York Academy of Medicine, NY.
Pub. in Bulletin of the New York Academy of Medicine 57, n10 p997-1013 Dec 81.

Keywords: *Toxicology, *Fires, Death, Carbon monoxide, Respiration, Heart diseases, Hydrogen chloride, *Toxic substances, Cigarette smoking, Heavy metals.

A detailed fire fatality was carried out to determine the primary cause of death and the specific cause of fatality-producing fires. The study showed that: (1) the predominant cause of death is due to carbon monoxide, (2) a high percentage of the victims have elevated blood alcohol, (3) a significant number of fatalities had pre-existing cardiovascular disease, and (4) the predominant fatal fire scenario is the cigarette ignition of upholstered furniture or bedding with alcohol as a contributory factor. Issues raised by the study and left unanswered include: (1) the relative significance of hydrogen cyanide and carbon monoxide, (2) the significance of antimony and other heavy metal found in the respiratory tract of victims as it relates to death and injury, (3) the significance of heavy soot deposits in the respiratory tract, and (4) the significance of sensory and pulmonary irritants such as HCl from vinyl materials and aldehydes.

712,525
PB82-217886 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Further Development of a Test Method for the Assessment of the Acute Inhalation Toxicity of Combustion Products.
B. C. Levin, A. J. Fowell, M. M. Birky, M. Paabo, A. Stolte, and D. Malek. Jun 82, 146p NBSIR-82-2532

Keywords: *Combustion products, *Toxicity, *Fire tests, *Air pollution, *Materials tests, Exposure, Laboratory equipment, Laboratory animals, Respiration, Concentration(Composition), *Indoor air pollution.

This report describes the development of a test method for the assessment of acute inhalation toxicity of combustion products of materials. The procedure is primarily intended for research and screening purposes. It provides: (1) a method for determining, under flaming and non-flaming conditions, the LC(50) (the concentration of combustion products which causes 50% lethality in the test animals (rats) exposed for 30 minutes and observed for 14 days following exposure); (2) an optional procedure to examine materials which rapidly produce combustion products which cause death of test animals within a 10 minute exposure and a 14 day post-exposure observation period; and (3) a description of analytical and physiological measurements which can provide more detailed information on the nature of the toxic effects of combustion products. Limitations of the test method are identified and future work to address them is proposed. The participation through the direct exchange of technical information of organizations representing academia, industry, and other agencies of the United States Government is acknowledged.

712,526
PB83-157479 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Workshop on Combustion Product Toxicity. Summary of Presentations, September 10, 1982.
J. E. Snell, B. C. Levin, and A. J. Fowell. Jan 83, 68p NBSIR-82-2634

Keywords: *Combustion products, *Toxicology, Meetings, Building codes, Hazards, Respiration, Fire tests, Materials, Tests, Gases, Smoke, Regulations, Screening, *Air pollution effects(Humans), Toxic substances.

This publication is a summary of presentations given September 10, 1982, at a Workshop on Combustion Product Toxicity. Publicity on fire deaths caused by smoke and toxic gases has given impetus to a number of state legislatures to consider requiring material toxicity provisions in building codes and other regulations. The National Bureau of Standards recently published a technical report describing the development of a test method for the assessment of the acute inhalation toxicity of combustion products. This test method is intended primarily for research and for preliminary screening purposes by product researchers and material manufacturers in developing and evaluating materials. The test method is not intended to be used itself in evaluating the suitability of a material for specific application since additional factors must be considered. Therefore, the National Bureau of Standards sponsored a half-day workshop on combustion product toxicity, 9:00 a.m.-12:00 noon, Friday, September 10, 1982, at NBS in Gaithersburg, Maryland. The purpose of this meeting was to brief fire code and building officials and others on the NBS test method for assessing acute inhalation toxicity of combustion products and to provide an opportunity for discussion of its appropriate use.

712,527
PB83-174425 PC **A04**/MF **A01**
Utah Univ., Salt Lake City. Flammability Research Center.
Study on the Sensitivity of the Leg-Flexion Avoidance Response to the Sensory Irritant Component of Douglas Fir Combustion Products.
D. G. Farrar, F. D. Hileman, T. L. Blank, and D. L. Pope. Mar 82, 59p UTEC-79-143, NBS-GCR-82-381 Grant NBS-8-9012

Keywords: *Combustion products, *Irritants, *Toxicology, Contaminants, Responses, Sensitivity, Senses, Acrolein, Models, Detection, Rats, Laboratory animals, Wood, Thermal degradation, *Leg flexion avoidance, *Bioindicators, Toxic substances, *Air pollution effects(Animals).

Experiments which were conducted to determine the effect of experimental conditions on the sensitivity of the leg-flexion avoidance response of the rat to combustion products, particularly sensory irritants e.g., acrolein. The experiments showed that there were ill-defined relationships between the strength of the electrical stimulus given to rats to train them to perform the response, and the sensitivity of the response to environmental contaminants. The value of the leg-flexion avoidance response as a model for the detection of the potential incapacitation due to the presence of sensory irritants in the environment is discussed.

712,528
PB83-198093 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Interlaboratory Evaluation of the 1980 Version of the National Bureau of Standards Test Method for Assessing the Acute Inhalation Toxicity of Combustion Products.
Final rept.
B. C. Levin, M. Paabo, and M. M. Birky. Apr 83, 90p NBSIR-83-2678

Keywords: *Combustion products, *Toxicity, *Standards, Assessments, Tests, Laboratories, Laboratory animals, Air pollution.

Seven laboratories selected from academia, industry, and government evaluated the 1980 version of the NBS test method for assessing the toxicity of combustion products to determine the operability of the procedure and the reproducibility of results across laboratories. The experimental design specified that each laboratory was responsible for testing Douglas fir and three other materials from a total of twelve natural and synthetic materials.

712,529
PB84-136431 Not available NTIS
National Bureau of Standards, Washington, DC.
Accumulation and Fate of Tri-N-Butyltin Cation in Estuarine Bacteria.
Final rept.
W. R. Blair, G. J. Olson, F. E. Brinckman, and W. P. Iverson. 1982, 11p
Pub. in Microbial Ecology 8, p241-251 1982.

Keywords: *Bacteria, *Cations, Metabolism, Reprints, *Tributyltin cation, Bioaccumulation, *Water pollution effects(Animals).

The uptake and possible metabolic transformation of tri-n-butyltin cation by tin-resistant estuarine bacteria was studied. The bacterial isolates accumulated tributyltin to 3.7 to 7.7 mg tin per g dry weight of cells by a non-energy requiring process, probably by adsorption to the cell envelope. Chemical speciation of cell extracts and culture media by combined liquid chromatography-atomic absorption spectrophotometry and tin-selective purge and trap flame photometric gas chromatography for possible tributyltin degradation products revealed no significant biotransformations of tributyltin cation by the tributyltin-resistant isolates. Apparently the isolates accumulate, but do not metabolize, tributyltin. Research into the persistence of tributyltin cation in natural estuarine waters and sediments is needed.

712,530
PB84-140227 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Acute Inhalation Toxicological Evaluation of Combustion Products from Fire Retarded and Non-Fire Retarded Flexible Polyurethane Foam and Polyester.
Final rept.
B. C. Levin, M. Paabo, M. L. Fultz, C. Bailey, W. Yin, and S. Harris. Nov 83, 71p NBSIR-83-2791
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Polyurethane resins, *Polyester resins, *Combustion products, *Toxicology, Fire resistant plastics, Plastics, Foam, Hydrogen cyanide, X ray fluorescence, Exposure, Laboratory animals, Decomposition, Gas analysis, Ignition, Air pollution, Chemical analysis, Carbon dioxide, Carbon monoxide, Lethal dosage.

The acute inhalation toxicity of the combustion products from selected upholstered furniture filling materials with and without fire retardants was evaluated by the toxicity test method developed by the National Bureau of Standards. The five materials that were evaluated consisted of two different formulations of flexible polyurethane foam (each formulation was sup-

plied in both a fire retarded and non-fire retarded form) and a polyester fiberfill (not fire retarded). Atmospheric concentrations of carbon monoxide, carbon dioxide, oxygen, and hydrogen cyanide in the exposure chamber were monitored throughout the thermal decomposition of the materials. The LC50 (30 minute and 14 day) values did not distinguish any of the materials as being significantly more toxic than the others. Extensive weight loss and post-exposure deaths occurred after exposure to the combustion products from all the materials.

712,531
PB84-244284 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of the Pulmonary Toxicity of Plasticized Polyvinyl Chloride Thermal Decomposition Products in Guinea Pigs by Repeated CO2 Challenges.
Final rept.
K. L. Wong, M. F. Stock, and Y. C. Alarie. 1983, 13p
Pub. in Toxicology and Applied Pharmacology 70, p236-248 1983.

Keywords: *Toxicity, *Polyvinyl chloride, *Plastics, *Thermal decomposition, *Air pollution, Laboratory animals, Reprints, Guinea pigs.

Evaluation of the Pulmonary Toxicity of Plasticized Polyvinyl Chloride Thermal Decomposition Products in Guinea Pigs by Repeated CO2 Challenges. Wong, K. L., Stock, M. F., and Alarie, Y. C. (1983). Toxicol. Appl. Pharmacol. 70, 236-248. Male guinea pigs were exposed to thermal decomposition products of plasticized polyvinyl chloride (PVC-A) at different concentrations up to levels inducing acute lethality. Several groups exposed at sublethal levels were then evaluated for pulmonary performance for a period of 57 days following exposure. Pulmonary performance was evaluated by challenging each animal with a mixture containing 10% CO2, 20% O2, and 70% N2. In control animals, this mixture induced an increase in both tidal volume and respiratory frequency. This hyperventilatory response was greatly depressed during the first 3 days following exposure and gradually returned to normal during the following weeks with the exception of the highest exposure group which still showed a diminished response 57 days after exposure. The pulmonary toxicity induced by thermal decomposition products of PVC-A is probably related to the very large amount of HCl released during thermal decomposition. The CO2 response test, a nonintrusive and noninvasive method to evaluate pulmonary performance in guinea pigs, is easily performed and appears to be a very promising type of pulmonary function test for toxicological evaluations.

712,532
PB84-244292 Not available NTIS
National Bureau of Standards, Washington, DC.
Toxicity of Smoke during Chair Smoldering Tests and Small Scale Tests Using the Same Materials.
Final rept.
Y. C. Alarie, M. F. Stock, M. Matijak-Schaper, and M. M. Birky. 1983, 8p
Pub. in Fund. Appl. Toxicol. 3, p619-626 1983.

Keywords: *Toxicology, *Fire tests, *Materials tests, *Chairs, *Air pollution, Furniture, Polyester fibers, Cotton fabrics, Laboratory animals, Carbon monoxide, Hydrogen cyanide, Decomposition, Pyrolysis, Reprints, *Smoldering, *Indoor air pollution, *Air pollution effects(Animals).

Toxicological evaluation of smoke produced during smoldering chair tests was undertaken by exposing mice to smoke emitted prior to, as well as following, flaming ignition of the chairs. By exposing several groups of mice, using undiluted smoke from the room containing the chairs, as well as various dilutions of the smoke, different levels of acute lethality were obtained. From these experiments, chairs constructed with polyurethane foam were found to create higher toxic atmospheres than chairs constructed with polyester or cotton fiber cushions. The same materials (polyurethane foam, polyester and cotton fibers) were also thermally decomposed in a small scale system and mice were exposed to the smoke to evaluate acute toxicity. Again polyurethane foam was found to produce smoke more toxic than smoke produced by polyester and cotton fibers. Sensory irritation monitored in mice during the smoldering tests indicated that an intense level of irritation was present long before large amounts of smoke were generated and long before flaming ignition occurred. The phenomenon of eye, nose and throat irritation would therefore be the first effect impeding escape attempts of individuals in a fire situation. Sensory irritation was followed by asphyxiation as evolution of carbon monoxide or hydrogen cyanide, or both, occurred. The same pattern of responses was observed with smoke generated with the small scale decomposition system.

712,533
PB85-208080 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Combustion Conditions and Exposure Conditions for Combustion Product Toxicity Testing.
Final rept.
C. Huggett. Oct 84, 20p
Pub. in Jnl. of Fire Sciences 2, n5 p328-347 Sep/Oct 84.

Keywords: *Toxicity, *Materials tests, *Fire tests, *Combustion products, Air pollution control, Exposure, Laboratory animals, Dosage, Smoke, Comparison, Hazards, Reprints, *Air pollution effects(Animals), *Indoor air pollution, Air pollution effects(Humans).

A number of procedures have been described in the literature for investigation of the inhalation toxicity of combustion products. There is need for agreement on test methods and test conditions to facilitate communication, allow the exchange of data, and provide a basis for control of hazards due to combustion products in fires. Combustion systems and animal exposure systems which have been employed are classified according to their basic attributes. Simple considerations of limiting stoichiometry in the combustion module can guide the selection of conditions which simulate real fire environments. The dynamics of the exposure system will determine the procedural dose received by the test animal and can be related to real fire exposure. Many past investigations have failed to take adequate account of these fundamental principles.

712,534
PB86-141942 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Exploration of Combustion Limitations and Alternatives to the NBS (National Bureau of Standards) Toxicity Test Method.
B. C. Levin, V. Babrauskas, E. Braun, J. Gurman, and M. Paabo. Nov 85, 87p NBSIR-85/3274
Sponsored by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Toxicity, *Plastics, *Flammability testing, *Laboratory equipment, *Calorimeters, *Air pollution, Combustion products, Experimental design, Bioassay, Performance evaluation, Assessments, Substitutes, *NBS toxicity test method, *Indoor air pollution, Procedures.

Some limitations and potential limitations of the NBS toxicity screening test method had been identified in earlier work. These limitations have now been explored in greater detail. Also investigated was an alternative combustion system, consisting of a radiant cone heater, identical to the one in the recently developed Cone Calorimeter, an enclosed combustion chamber, and a slightly revised variant of the animal chamber. The new animal chamber was so constructed that, prior to the insertion of the animals, it could be evacuated and then back-filled with a desired sampling of the combustion products. The radiant combustion system showed a different mix of capabilities and limitations compared to the cup furnace combustor in the existing test method. In the present project, the more detailed assessment of the cup furnace operation leads to the recommendation that there is no single, universally preferable combustion environment, but that the cup furnace is adequate for the intended purpose of providing toxicity screening.

712,535
PB86-182284 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Polystyrenes: A Review of the Literature on the Products of Thermal Decomposition and Toxicity.
J. L. Gurman, L. Baier, and B. C. Levin. Mar 86, 88p NBSIR-85/3277
Sponsored by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Polystyrene, *Decomposition, *Toxicology, Pyrolysis, Combustion products, Test methods, Fire safety, Literature surveys.

The current English literature through 1984 on the products of pyrolysis and combustion from polystyrenes and the toxicity of those products is reviewed. Among 57 compounds detected by chemical analyses of the thermal decomposition products produced under various atmospheric conditions (vacuum, inert, and oxidative), the main volatile component is the styrene monomer. Evidence is provided that the mass fraction of styrene increases with furnace temperatures at least through 500 C. At 800 C and above, the concentration of styrene decreases. In oxidative atmospheres, carbon monoxide (CO), carbon dioxide (CO2) and oxidative hydrocarbons are formed. The concentrations of CO and CO2 are a function of temperature and combustion conditions, i.e., greater amounts are produced in the flaming than in the nonflaming mode. Eleven different test procedures were used to evaluate the toxicity of the pyrolysis and combustion atmospheres of polystyrenes.

712,536
PB86-193067 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Predicting Toxicity Using Computed Molecular Topologies: The Example of Triorganotin Compounds.
Final rept.
R. B. Laughlin, W. French, R. B. Johannesen, H. E. Guard, and F. E. Brinckman. 1984, 10p
Pub. in Chemosphere 13, n4 p575-584 1984.

Keywords: *Biocides, *Toxicology, Lethal dosage, Crabs, Organatins, Solubility, Molecular biology, Reprints, *Triorganotin, Computer applications, *Water pollution effects(Animals).

Thermodynamic properties of sparingly soluble organic molecules in water have been correlated with boiling points and toxicity, suggesting that appropriate physicochemical descriptions of molecular conformation or topology can provide similar predictors. The paper reports a novel alternative to previous applications of substituent structure-activity coefficients based on experimental kinetic or equilibrium data to predict solubility and toxicity. The authors have developed a combined computer program utilizing SAREA and PROPHET NET which, respectively, permit independent calculations of total available surface areas TSA of organometallic molecules based upon bond distances and angles, and expected conformations in aqueous media. Our first demonstration is applied to a comprehensive series of neurotoxic organotin compounds of commercial concern for which subacute LC50 toxicities toward crab larvae (Rhithropanopeus harrisii) in sea water were independently determined.

712,537
PB86-201621 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Toxicity of the Pyrolysis and Combustion Products of Poly(vinyl chlorides): A Literature Assessment.
C. Huggett, and B. C. Levin. Apr 86, 49p NBSIR-85/3286
Sponsored by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Polyvinyl chloride, *Combustion products, *Pyrolysis, *Toxicity, Plastics, Hazardous materials, Exposure, Lethal dosage, Air pollution, Hydrogen chloride, Carbon monoxide, Fire tests, Toxic substances, Inhalation, Indoor air pollution.

Poly(vinyl chlorides) (PVC) constitute a major class of synthetic plastics. Many surveys of the voluminous literature have been performed. The report reviews the literature published in English from 1969 through 1984 and endeavors to be more interpretive than comprehensive. PVC compounds, in general, are among the more fire resistant common organic polymers, natural or synthetic. The major products of thermal decomposition include hydrogen chloride, benzene and unsaturated hydrocarbons. In the presence of oxygen, carbon monoxide, carbon dioxide and water are included among the common combustion products. The main toxic products from PVC fires are hydrogen chloride (a sensory and pulmonary irritant) and carbon monoxide (an asphyxiant).

712,538
PB86-210713 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.

Toxicology

Quantitative Determination of Smoke Toxicity Hazard - A Practical Approach for Current Use.
Final rept.
R. W. Bukowski. 1986, 12p
Pub. in Fire Safety Science--Proceedings of the First International Symposium, Gaithersburg, MD., pp. 1089-1100 (1986).

Keywords: *Toxicology, Hazardous materials, Validation, Statistical analysis, *Fire tests, *Smoke layers.

The concepts of fire hazard assessment are discussed. The development of these concepts into the framework for a hazard assessment model is described. This model, which is actually a group of interacting models, is presented in terms of the component functions and the interactions necessary to accomplish a hazard analysis. The most critical research issues which must be resolved in order to use this hazard analysis model for practical problems are identified. Preliminary results of experiments to assess the predictive accuracy of the multi-compartment transport model used within the hazard model are presented. A simple, engineering approach to toxicity evaluation included in the current model is also discussed.

712,539
PB86-230679 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Summary of the NBS (National Bureau of Standards) Literature Reviews on the Chemical Nature and Toxicity of the Pyrolysis and Combustion Products from Seven Plastics: Acrylonitrile-Butadiene-Styrenes (ABS), Nylons, Polyesters, Polyethylenes, Polystyrenes, Poly(Vinyl Chlorides) and Rigid Polyurethane Foams.
B. C. Levin. Jun 86, 37p NBSIR-85/3267
Sponsored by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Toxicology, *Pyrolysis, *Combustion products, *Plastics, Nylon, Polyesters, Polyethylenes, Polystyrenes, PVC, Polyurethane foams, Literature surveys, ABS.

A series of literature reviews was undertaken by the National Bureau of Standards to examine the toxicity and chemistry of the effluents produced when seven plastics were decomposed under various thermal and atmospheric conditions. These plastics are: acrylonitrile-butadiene-styrenes, nylons, polyesters, polyethylenes, polystryrenes, poly(vinyl chlorides), and rigid polyurethane foams. The English language literature on each of these was reviewed and published as a separate report of the National Bureau of Standards. Over 400 different thermal decomposition products, many common to more than one plastic, were identified. The toxicity of most of these individual products is unknown and an assessment of the toxicity of the multitude of possible combinations is not feasible at this time. Therefore, a variety of bioassay toxicity protocols have been used to assess the toxicity of the gaseous atmospheres generated by the thermal decomposition of these plastics. In general, these seven plastics did not produce unusually or extremely toxic pyrolysis or combustion products when compared to those of other synthetic or natural materials. In a few cases involving additives, toxic products of concern were produced.

712,540
PB86-232303 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Toxicity of the Combustion Products from a Flexible Polyurethane Foam and a Polyester Fabric Evaluated Separately and Together by the NBS (National Bureau of Standards) Toxicity Test Method.
Final rept.
B. C. Levin, M. Paabo, C. S. Bailey, and S. E. Harris. 1986, 12p
Sponsored by Consumer Product Safety Commission, Bethesda, MD.
Pub. in Proceedings of International Symposium on Fire Science Safety (1st), Gaithersburg, MD., October 7-11, 1985, p1111-1122 1986.

Keywords: *Toxicity, *Polyurethane resins, *Combustion products, Exposure, Fabrics, Rats, Ignition, Carbon monoxide, Hydrogen cyanide, *Toxic substances, *Polyester textiles, Inhalation, Lethal doses.

Representative specimens of two materials, a flexible polyurethane foam and a polyester, were thermally decomposed separately and together in order to compare the toxicological effects of the combustion products from the combined materials with those from the single homogeneous materials. Gas concentrations (CO, CO2, O2 and HCN), blood carboxyhemoglobin, and LC(50) values (the concentration of material necessary to kill 50% of the test animals (Fischer 344 male rats) during a 30 minute exposure and a 14 day post-exposure observation period) were determined for the separate and combined materials under both flaming and non-flaming conditions. The results of the combined experiments indicated that under non-flaming conditions, both materials contributed in an additive manner to the concentration of the combustion products. However, under flaming conditions, the generation of HCN and CO is greater than that predicted from the addition of the maximum amounts produced by the materials separately.

712,541
PB87-140265 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Comparison of the Toxicity of the Combustion Products from a Flexible Polyurethane Foam and a Polyester Fabric Evaluated Separately and Together by the NBS (National Bureau of Standards) Toxicity Test Method and a Cone Radiant Heater Toxicity Test Apparatus.
B. C. Levin, E. Braun, J. L. Gurman, and M. Paabo. Nov 86, 71p NBSIR-86/3457
Sponsored by Consumer Product Safety Commission, Washington, DC.

Keywords: *Toxicity, *Combustion products, *Foam, *Polyurethane resins, Concentration(Composition), Hydrogen cyanide, Rats, *Polyester fabrics, Toxicity test methods.

Representative specimens of flexible polyurethane foam and polyester fabric were thermally decomposed separately and together in order to compare the toxicity of the combustion products from the combined materials with those from the single homogeneous materials and to compare the toxicological results obtained with the NBS Toxicity Test Method with those using a cone radiant heater toxicity test apparatus. Gas concentrations (CO, CO2, O2 and HCN), blood carboxyhemoglobin, and LC(sub 50) values in Fischer 344 rats were determined for the materials under both flaming and non-flaming conditions. With the NBS Toxicity Test Method, the results of the non-flaming combined experiments indicated that both materials contributed in an additive manner to the concentration of the combustion products. However, under flaming conditions, the generation of HCN is greater than that predicted from the addition of the maximum amounts produced by the materials separately.

712,542
PB88-138888 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Toxicological Interactions between Carbon Monoxide and Carbon Dioxide.
Final rept.,
B. C. Levin, M. Paabo, J. L. Gurman, S. E. Harris, and E. Braun. 1987, 30p
Sponsored by Harry G. Armstrong Aerospace Medical Research Lab., Wright-Patterson AFB, OH.
Pub. in Proceedings of Conference of Toxicology (16th), Dayton, OH., October 28-30, 1986, p1-30 1987.

Keywords: *Toxicology, *Carbon dioxide, *Carbon monoxide, Bioassay, Carboxyhemoglobin, Combustion products, Inhalation, Materials, Plastics, Rats, Laboratory animals, *Air pollution effects, Synergism.

Fischer 344 male rats were subjected to 30-min individual or combined exposures of carbon monoxide (CO) and carbon dioxide (CO2). All deaths from CO occurred during the exposures, and the LC50 values were 4600 and 5000 ppm, depending on experimental conditions. Animals exposed to CO2 concentrations ranging from 1.3 to 14.7% for 30 min were neither incapacitated nor fatally injured. The addition of nonlethal concentrations of CO2 (1.7 to 17.3%) to sublethal concentrations of CO (2500 to 4000 ppm) caused deaths of the exposed rats both during and following (up to 24 h) the 30-min exposures. The most toxic combination of these two gases (2500 ppm CO plus 5% CO2) increased the rate of carboxyhemoglobin (COHb) formation 1.5 times that found in rats exposed to 2500 ppm of CO alone. The COHb equilibrium levels were the same. Exposure to both CO and CO2 produced a greater degree of acidosis and a longer recovery time than that observed with either single gas. The results fit a mathematical model indicating a synergistic interaction. Combustion of 11 materials at their LC50 values indicated that CO was probably the primary toxicant in one case and that the combined CO plus CO2 was the cause of the deaths in three other cases. Additional fire gases need to be studied to explain deaths from the other materials.

712,543
PB88-141296 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Chronic Cadmium Intoxication: Tissue-Response in an Occupationally Exposed Patient.
Final rept.,
V. F. Garry, B. Pohlman, M. Wick, J. Garvey, and R. Zeisler. 1986, 9p
Pub. in American Jnl. of Industrial Medicine 10, n2 p153-161 1986.

Keywords: *Toxicology, *Tissues(Biology), *Cadmium, In vitro analysis, Reprints.

A report on a case of high level cadmium exposure is given. Investigations include morphologic studies of the patient's tissues, neutron activation analyses of kidney and liver samples, metallothionein analyses of the patient's liver, and comparison to human liver's from the Pilot National Environmental Specimen Bank.

General

712,544
PB77-600062 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Standard Reference Collections of Forensic Science Materials: Status and Needs.
H. L. Steinberg. 1977, 90p
Pub. in LESP-RPT-0601.00.

Keywords: Criminalistics, Evidential materials, Forensic reference collections, *Forensic science, Reference materials, Standard reference collections.

An overview of criminalistics is given, stressing the potential forms and uses of Standard Reference Collections (SRCs). A set of 34 classes of materials of Forensic Science import (FSM classes) is presented. A brief introduction to each FSM class is then given, along with a recommended action. Where a recommendation for SRC development or for further consideration is made, some elaboration of relevant factors is given. Fourteen FSM classes are so recommended. Fifteen classes were not recommended for further SRC consideration at this time. Five FSM classes were classified as 'indeterminate,' due to an insufficient data base. An extensive bibliography is included.

712,545
PB80-180326 Not available NTIS
National Bureau of Standards, Washington, DC.
Simultaneous Determination of Mercury and Cadmium in Biological Materials by Radiochemical Neutron Activation Analysis.
Final rept.,
R. R. Greenberg. Apr 80, 4p
Pub. in Anal. Chem. 52, n4 p676-679 Apr 80.

Keywords: *Neutron activation analysis, *Mercury(Metal), *Cadmium, Chemical analysis, Solvent extraction, Separation, Reprints, *Biological materials.

A radiochemical procedure has been developed for the simultaneous determination of Hg and Cd in biological matrices. The procedure is based upon bomb dissolution followed by solvent extraction using Ni and Zn diethyldithiocarbamates. Mercury is separated from Se allowing the use of the (203)Hg isotope as well as the (197)Hg isotope to quantify Hg.

712,546
PB81-154130 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.

Impact on Human Eyes by Propelled Objects.
R. E. Berger, and J. A. Huckeba. May 80, 15p NBSIR-80-2037
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Eye injuries, Projectiles, Safety, Impact, Accidents, Pressure measurement.

High speed motion pictures were employed to observe experimental impacts on enucleated human eyeballs by low speed missiles which are representative of toy projectiles. A procedure was devised to adjust the intraocular pressure prior to each impact. For similar impact conditions, the gross deformation of eyeballs with normal pressure was not as severe as had been previously reported for eyeballs with near zero pressure. The maximum displacement was measured for several eyeballs with normal pressure. These displacements were shown to correlate with the predictions of a mathematical model which had been used to develop a test method for toy projectiles.

712,547
PB82-133943 Not available NTIS
National Bureau of Standards, Washington, DC.
Pilot Program for the National Environmental Specimen Bank. Phase I.
Final rept.
S. H. Harrison, R. Zeisler, and S. A. Wise. May 81, 6p
Pub. in Environmental Protection Agency, Washington, DC. Rept. no. EPA/600/S1-81-025, 6p May 81.

Keywords: Feasibility studies, Sampling, Storage, Procedures, Protocols, *National Environmental Specimen Bank, *Specimen handling.

This work was performed under a joint NBS/EPA research program to develop state-of-the-art protocols for the sampling, storage, and analysis of biological and environmental-type matrices. This report summarizes the procedures used in the initial phase of a pilot program for determining the feasibility of the National Environmental Specimen Bank. A special clean-laboratory/storage facility has been designed and completed for use in this program. Detailed protocols for sampling, storage, and analysis of human liver samples have been designed for this study. The implementation of these protocols for human liver samples is described in this report.

712,548
PB82-217175 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Medical Physics Data Book.
T. N. Padikal, and S. P. Fivozinsky. Mar 82, 125p NBS-HB-138
Library of Congress catalog card no. 81-600102.
Sponsored in part by National Cancer Inst., Bethesda, MD. and American Association of Physicists in Medicine, Chicago, IL. Midwest Chapter.

Keywords: *Physics, *Handbooks, *Radiotherapy, Medicine, Radiography, Electromagnetic radiation, Data, *Nuclear medicine.

The Medical Physics Data Book is a collection of physical and chemical data useful in medical physics. The information has been extracted from other published sources. The handbook is divided into five sections: General Physics, Nuclear Medicine, Diagnostic Radiology, Radiation Therapy, and Non-ionizing Radiation. Carried out by the Medical Physics Data Group of the American Association of Physicists in Medicine, this compilation is meant to serve as a handy reference to the numerical data needed by the practicing medical physicist.

MILITARY SCIENCES

Logistics, Military Facilities, & Supplies

712,549
PB-264 211/4 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Building Environment Div.
Air Leakage and Thermal Performance of a Mark III Relocatable Lewis Building.
Final rept.,
C. W. Phillips, B. A. Peavy, and M.E. Kuklewicz. Dec 76, 43p NBSIR-76-1178
Sponsored in part by Naval Civil Engineering Lab., Port Hueneme, Calif.

Keywords: *Military facilities, *Portable equipment, *Buildings, *Gust loads, Honeycomb structures, Air flow, Heat transfer, Prefabrication, Naval research, *Naval shore establishments, Mark 3 relocatable buildings.

This report presents the findings of air leakage and heat transfer tests of a Mark 3 relocatable building at the National Bureau of Standards, Building Environment Division, for the U.S. Department of the Navy. Quantitative and qualitative (smoke trace) air leakage tests with the building pressurized, and the heat transfer test, were performed with the building erected in an environmental laboratory. The quantitative air leakage tests were performed in two phases. One was with the building racked to simulate a wind load and the other was without racking. The building was of prefabricated honeycomb panel construction using aluminum skins. Included are photographs of the building and test equipment and tables and charts showing the magnitude of air leaks at the windows and doors. Racking had negligible effect on the air leakage rate.

712,550
PB-269 354/7 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Transportation, Handling and Field Service Loads for Air Mobility Shelter Systems.
Final rept.,
C. W. C. Yancey. Jul 77, 75p NBSIR-77-1254

Keywords: *Portable shelters, *Airmobile operations, *Transportation, Trucks, Aircraft, Railroad cars, Fork trucks, Dynamic loads, Gust loads, Probability distribution functions.

To fulfill one of the prerequisites for establishing design criteria for military field shelters, transportation, handling and field service load data are presented. An extensive literature search was conducted to determine the magnitude and frequencies of shock and vibration responses produced by railroad, road and air cargo vehicles and by devices commonly used in handling field shelters. Summary data, extracted from field study reports, are presented in the form of acceleration versus frequency diagrams. The acceleration values can be used to compute an Equivalent Static Force input for the design and analysis of shelter models. The probabilities of occurrence of the acceleration amplitudes generated by the three transportation modes are indicated in cases where data reduction included statistical analyses. Sources of the dynamic load data included flatbed trucks, propeller and jet airplanes, helicopters, railroad flatcars and forklift trucks. Where possible, the shock and vibration data used in presenting the summary diagrams were restricted to that obtained from tests involving military vehicles commonly used to transport shelters. Recommendations are presented for the selection of static design loads to account for gravity, snow, ice and wind effects.

712,551
PB80-160427 PC **A05**/MF **A01**
Michigan State Univ., East Lansing. Dept. of Economics.
Investigation of Factors Affecting Geographic Cost Differentials on Military Construction Projects.
Final rept.,
J. M. Johannes, P. D. Koch, and R. H. Rasche. 28 Feb 79, 100p NBS-GCR-80-197
Grant NBS-8-9021

Keywords: *Construction costs, *Military facilities, *Cost estimates, Economic factors, Salaries, Econometrics, Labor estimates, Materials estimates, Capitalized costs, Economic models, Statistical analysis, Wages.

Three classes of cost functions are estimated based on an assumed Cobb-Douglas production technology. A base city is then chosen for use as a deflator. This approach permits area cost factors for each major geographical region to be calculated. Included in the report are annual estimates of the area cost factors for military construction projects in each major geographical region between the years of 1975 and 1978.

712,552
PB82-123746 PC **A20**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Sensor Handbook for Automatic Test, Monitoring, Diagnostic, and Control Systems Applications to Military Vehicles and Machinery.
Final rept.
P. S. Lederer. Oct 81, 467p NBS-SP-615
Sponsored in part by Army Communications Research and Development Command, Fort Monmouth, NJ. Library of Congress catalog card no. 81-600127.

Keywords: *Detectors, *Handbooks, Measurement, Calibrating, Data acquisition, Evaluation, *Automatic test equipment, Military equipment.

The Sensor Handbook is intended as a guide for those who design, specify, use, and test military automatic test equipment containing sensors. The handbook addresses measurands and principles of measurement, data acquisition, sensor calibration and testing, environmental considerations, stability, durability, reliability, and error assessment. Sensor manufacturers and sensor calibration and evaluation resources are included, as is an annotated bibliography. The handbook is based largely on the present, proved state-of-the-art. Possible future trends are briefly discussed. The handbook is addressed to the general engineer, system designer, or manager with an engineering background. It does not provide the highly detailed technical information needed by the measurement engineer, although ample references are included for further study.

712,553
PB87-118345 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Operations Research Div.
Analytical Techniques for Military Construction Projects.
Final rept.
R. E. Chapman. 1984, 13p
Pub. in Proceedings of Symposium Operations Analysis in Cost Analysis, pII-122-II-134 1984.

Keywords: *Cost analysis, *Military facilities, Operation research, Construction cost.

The paper focuses on the theoretical and empirical considerations associated with the derivation, estimation and use of cost functions to control for variations in construction cost due to changing location and structure type. Regional factoring is used to develop a specific type of cost estimating relationship capable of estimating area cost factors for military construction projects. Accurate estimates of area cost factors are of crucial importance to the military since these factors are used as deflators to control for regional cost differentials among planned projects.

712,554
PB88-110234 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Interim Survey of Selected Military Building Environments: A Research Approach.
Interim rept. Sep 86-Mar 87,
A. I. Rubin, and B. L. Collins. Aug 87, 98p NBSIR-87/3606
Sponsored by Army Intelligence and Security Command, Arlington Hall Station, VA.

Keywords: *Military facilities, *Workplace layout, *Work environment, Environmental engineering, Interior lighting, Air quality.

Because many military and civilian employees of the U.S. Army are required to work in environments unlike those experienced by most civilian workers, a project involving a comprehensive assessment of such workplaces was initiated. This assessment involves a two-phase effort in which the first phase consisted of a literature search, interviews with experts, site visits, and limited field environmental measurements. The second phase will include a comprehensive assessment of environmental conditions including lighting at selected military facilities. The present report documents findings from phase 1, including a detailed bibliography of target areas: lighting, stress, and shiftwork. It also includes preliminary results from a visit to two military field stations.

712,555
PB88-113394 PC **A23**/MF **A01**

National Bureau of Standards (ICST), Gaithersburg, MD. Center for Programming Science and Technology.
Final NBS (National Bureau of Standards) Report for CALS (Computer Aided Logistic Support), FY86,
S. J. Kemmerer. May 87, 547p NBSIR-87/3566
Sponsored by Assistant Secretary of Defense (Acquisition and Logistics), Washington, DC.

Keywords: *Weapon systems, *Manufacturing, *Logistics, *Contracts, *Digital systems, *Computer systems design, *Computer graphics, Product development, Program management, *Computer aided design, *Computer aided manufacturing, Data base management, Department of Defense, Computer Aided Logistic Support (CALS) program.

The overall objective of the DoD Computer Aided Logistic Support (CALS) Program is to integrate the design, manufacturing, and logistic functions through the efficient application of computer and communications technology. DoD requires functional and interface standards and procedures that will enable the digital interchange of data in weapon system and automated system contracts, that will be common to all Services and DLA. The FY86 Final Report provides NBS recommendations for standards usage to support the interchange of CALS digitized technical information in four major areas: product data, graphics, database management, and text.

Nuclear Warfare

712,556
PB80-197080 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Psychological Deterrents to Nuclear Theft: An Updated Literature Review and Bibliography,
G. W. Lapinsky, and C. Goodman. May 80, 47p NBSIR-80-2038
See also report dated Mar 76, PB-252 021.

Keywords: *Radioactive materials, *Nuclear weapons, *Crimes, *Human behavior, Psychological effects, Security, Perception, Senses, Cognition, Bibliographies, Reviews, *Crime prevention, *Theft, *Deterrence.

A review of the unclassified literature dealing with psychological deterrents was conducted for the Defense Nuclear Agency (DNA). The review indicates that while human psychological processes (sensory, perceptual, and cognitive) can be manipulated by various means, definitive empirical data are lacking which directly relate to deterring nuclear weapon theft. Behavioral impact research should be undertaken by DNA to ascertain the deterrence values of the many techniques identified.

Passive Defense Systems

712,557
AD-P002 925/6 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Washington, DC.
Psychological Deterrents to Nuclear Theft.
G. Lapinsky. 1 Jun 81, 5p
Pub. in Proceedings of the Symposium on the Role of Behavioral Science in Physical Security (5th Annual) Held at Gaithersburg, MD., June 11-12, 1980, AD-A138 882, p123-127.

Keywords: *Area security, *Deterrence, Management planning and control, Behavioral science, Social psychology, Threats, Crisis management, Component Reports, Physical security.

In 1975 the Defense Nuclear Agency (DNA) and the National Bureau of Standards jointly conceived the psychological deterrents project as an on-going review of the unclassified and the classified literature relating to psychological factors that may have impact on the design and development of DNA's Forced Entry Deterrent System (better known as FEDS). The classified and unclassified literature suggest that it may be possible to manipulate several human behavioral processes, but that there are few definitive data directly related to achieving deterrence by means of these psychological manipulations.

712,558
PB-274 998/4 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
Security Lighting for Nuclear Weapons Storage Sites: A Literature Review and Bibliography.
Final rept.,
P. G. Meguire, J. J. Kramer, and A. Stewart. Nov 77, 40p NBS-SP-480-27
Sponsored in part by Defense Nuclear Agency, Washington, D.C. Intelligence and Security Directorate. Library of Congress Catalog Card no. 77-600050. See also report dated Oct 77, PB-273 117.

Keywords: *Security, *Military facilities, *Illuminating, Human factors engineering, Nuclear weapons, Storage, Reviews, Bibliographies, Personnal detection, Identification, Visibility, Crime prevention, *Nuclear weapons storage sites.

The Defense Nuclear Agency (DNA) program to improve the security of nuclear weapons storage facilities includes consideration of requirements for not only physical barriers and alarm systems but security lighting to aid response force personnel as well. The report presents a literature review and bibliography dealing with optimization of Nuclear Weapons Storage Site (NWSS) security lighting systems design through the application of established principles of human psychological and behavioral functioning. Three distinct psychological/behavioral processes are relevant to the design of security lighting system design: (1) intruder psychological deterrence, (2) detection, and (3) incapacitation. General recommendations for NWSS security lighting system design are provided, based on the literature review and analysis.

712,559
PB-280 416/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
On-Site Data Communication in Security Systems.
Final rept.,
R. J. Carpenter. 1977, 15p
Sponsored in part by Army Mobility Equipment Research and Development Command, Fort Belvoir, Va. Pub. in Proceedings of Seminar on Sensor Technology for Battlefield and Physical Security Applications, Fort Belvoir, Va. 13-15 Jul 77 p266-280 1977.

Keywords: *Data transmission, *Warning systems, Pulse communication, Optical communication, Security, Packet communication systems.

Security systems for a single site, be it an office building or a weapons storage facility, require substantial communication from sensors to a central station and from that central station back to actuators. Even the simplest burglar alarm system has solved many of the same problems which face the designer of modern site security systems; just the level of performance is very different.

712,560
PB85-147973 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Fluid-Fiber Gradiometers: Their Promise for Tunnel Detection - A Status Report.
Final rept.
J. E. Faller, J. K. Hoskins, P. T. Keyser, and T. M. Niebauer. 1984, 19p
Pub. in Proceedings of Technical Symposium on Tunnel Detection (2nd), Golden, CO., September 26-28, 1984, p1-19.

Keywords: *Tunnel detection, Security, *Gravity gradiometers, *Gradiometers, *Intrusion detection.

At the Joint Institute for Laboratory Astrophysics, the authors are working on a new type of torsion pendulum gravity gradiometer. In this torsion pendulum apparatus, the traditional fiber is replaced with two surrogates in which the fiber's suspension role is provided entirely by a fluid while its restoring and centering functions are achieved by an appropriate electrode array with adjustable voltages. The authors have constructed -- for purposes of testing the concept -- two fluid gradiometers each 10 inches in diameter, a size such that their sensitivities would theoretically permit one to see the change in gravity gradient resulting from a tunnel at a distance of one kilometer. The authors have also under study one very large 50 inch diameter float whose intended purpose is to improve on the accuracy of the Eotvos experiment (equivalence of gravitational and inertial mass). This float is presently being used as a sensitive test bed to look at the effects of various noise terms on floats in general. At the July 21-23, 1981 Symposium on Tunnel Detection, the authors presented a paper, 'Tunnel Detection Utilizing Field-Stationary Gravity Gradiometry.' Since that time, an experimental program to study this idea has been under way. A number of unforeseen problems have been encountered, but in all cases satisfactory solutions have been found. The authors briefly review the idea and the present status of this work, and discuss their prognosis for this type of device as a field-practical instrument.

General

712,561
PB83-157016 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Convective Flow on Morphological Stability.
Final rept.
S. R. Coriell, and R. F. Sekerka. 1981, 13p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in PCH, PhysicoChemical Hydrodynamics 2, n4 p281-293 1981.

Keywords: *Solidification, Crystal growth, Convection, Stability, Fluid flow, Reprints, Morphology.

The theory of morphological stability pertains to the dynamics of the spontaneous change in shape of a two-phase interface during a phase transformation. For crystal growth from the melt, the parent phase is a liquid; therefore, the transport of heat and solute can take place by both diffusion and convection. For forced convection, the fluid flow is dominated by external forces and the solid-liquid interface is captive to this flow. This situation has been modeled by either a stagnant boundary layer or a boundary layer in which a parallel flow is perturbed by the solid-liquid interface shape. Forced convection sometimes gives rise to both modifications in the criterion for instability and in the dynamics of instability, the principal feature of the latter being the possibility that a perturbation can grow laterally because of the bias introduced by the forced flow. In the absence of forced convection, natural convection, driven by variations of density with temperature and solute content, can take place. Were it not for the solidification aspects, this natural convection would result from the classical Benard instability, including the possibility of thermosolutal convection. When solidification is admitted, the solidification boundary conditions at the solid-liquid interface serve to couple the classical hydrodynamic and interfacial stability phenomena.

712,562
PB83-179028 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Simulation of the Guard Control Station in a Computerized Site Security Monitor and Response System.
R. T. Moore, A. W. Holt, A. L. Koenig, A. Mink, and G. Nacht. Feb 83, 107p NBSIR-82-2656
Sponsored in part by Defense Nuclear Agency, Washington, DC.

Keywords: *Security, Military facilities, Microcomputers, Systems engineering, *Computer applications, Security personnel, Area security.

This report describes a mock-up of a Guard Control Station that was used in simulating the performance of this component of a Computerized Site Security Monitor and Response System. The mock-up was interconnected to three microcomputer systems in an arrangement that permitted simulation of physical security scenarios in an interactive mode.

712,563
PB88-122114 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.

NBS' (National Bureau of Standard's) Role in Calibration Support for Modern Defense Systems: Meeting the Challenge of Today's High Technology.
Final rept.,
B. C. Belanger. 1983, 13p
Pub. in Proceedings of the Worldwide Air Force PMEL Conference (2nd), Granville, OH., July 11-15, 1983, 13p.

Keywords: *Calibrating, *Weapon systems, Metrology, Reprints, *Foreign technology, US NBS.

The paper reviews the challenges faced by a modern calibration laboratory manager, describes the role of the National Bureau of Standards in providing traceability to national standards for Air Force and Air Force contractor calibration and metrology activities, and describes selected ongoing metrology research projects at NBS, many of which are jointly funded by the Air Force.

NATURAL RESOURCES & EARTH SCIENCES

Cartography

712,564
PATENT-4 193 115 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Method and Apparatus for Implementation of the CMAC Mapping Algorithm.
Patent.
J. S. Albus. Filed 15 Dec 77, patented 11 Mar 80, 12p PB80-600028, PAT-APPL-860 799

Keywords: *Adaptive control system, Intermediate mapping variables.

An adaptive control system is disclosed in which control functions involving many input variables are computed by referring to data stored in a memory. Each value of the control functions is distributed over a number of physical memory locations, such that the linear sum of the contents of these physical locations defines the value. An addressing algorithm is used in which the input variables are mapped into a set of intermediate mapping variables. Apparatus for accomplishing the intermediate mapping comprises first and second counters which are used to address a memory in which the intermediate variables are stored in a predetermined arrangement.

Forestry

712,565
PB86-234127 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
Solid-State 13C NMR (Nuclear Magnetic Resonance) Determination of the Syringyl/Guaiacyl Ratio in Hardwood.
W. F. Manders. May 86, 23p NBSIR-86/3380

Keywords: *Lignin, *Hardwoods, *Softwoods, Nuclear magnetic resonance, Carbon isotopes, Decomposition, Oak trees, Spectrum analysis, Comparison, Nitrobenzenes, Oxidation reduction reactions, Syringyl-guaiacyl ratio.

The unprotonated aromatic regions of the solid-state 13C NMR spectra of several hardwoods and softwoods are examined. Spectra are acquired with cross polarization, magic-angle spinning, and delayed proton decoupling. The hardwood spectra are decomposed into syringyl and guaiacyl components with the aid of a softwood spectrum, which is assumed to be the same as the guaiacyl component of the hardwood spectrum. The molar ratio of syringylpropanoid units to guaiacylpropanoid units (S/G) in hardwood is determined from the intensities of their respective component spectra. These results were comparable to literature values that were obtained by a combination of methoxyl and elemental analyses.

Geology & Geophysics

712,566
PB-266 865/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of the Positions of Points on the Earth's Surface Using an Absolute Gravimeter and a Multi-Wavelength Geodimeter as Complements to Extraterrestrial Techniques,
J. E. Faller, and J. Levine. 1977, 7p
Pub. in Proceedings SALUR Symp., Austin, Texas, June 1976, Paper in Scientific Applications of Lunar Laser Ranging, p277-283 1977.

Keywords: *Gravimetric geodesy, Tectonics, Laser range finding.

The usefulness of extraterrestrial techniques and in particular lunar laser ranging in obtaining the position of points on the earth's surface with an accuracy of several centimeters is now recognized. The positional information obtained in this way cannot be unambiguously interpreted without ancillary surface measurements. The use of a geodimeter with an accuracy of 5 parts in 10 to the 8th power (over a 50 km baseline) would permit all of the points within a radius of several hundred kilometers around a ranging station to be tied together with centimeter level accuracy, thereby eliminating any local phenomena that could be associated with single-point sites and at the same time extending the coverage of extraterrestrially determined measurements. The use of an absolute gravimeter with an accuracy of 3 parts in 10 to the 9th power (which corresponds to a height sensitivity of about 1 cm) would serve as a check on vertical motions and, in combination with extraterrestrially determined height data, yield information on internal mass motions. The implications of these ground-based measurement capabilities for extraterrestrially determined position measurements are discussed.

712,567
PB-267 936/3 CP **T02**
National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
Countries, Dependencies, and Areas of Special Sovereignty.
Data file,
H. E. McEwen. 1 Mar 77, mag tape NBS-FIPS-PUB-10-2, NBS/DF-77/005
Supersedes COM-74-11290 and NBS-FIPS-PUB-10-1-C. Also available in 232 punched cards. Price includes documentation, FIPS-PUB-10-2.
Source tape is in EBCDIC character set. Tape(s) can be prepared in most standard 7 or 9 track recording modes for one-half inch tape. Identify recording mode desired by specifying character set, track, density, and parity. Call NTIS Computer Products if you have questions.

Keywords: *Data file, *Geography, *Data processing, Standards, Magnetic tapes, *Countries, Federal information processing standards, Data elements.

This publication provides a list of geographical-political entities of the world and associated standard codes. These entities include independent states, dependent areas, areas of quasi-independence, noncontiguous territories, possessions without population, areas with special sovereignty associations, areas without sovereignty, political regimes not recognized by the United States, and outlying areas of the United States.

712,568
PB-273 928/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Earth Tide Strain Measurements in the Poorman Mine Near Boulder, Colorado.
Final rept.,
J. Levine, and J. C. Harrison. 10 May 76, 13p
Grant NSF-GA-36365
Pub. in Jnl. of Geophysical Research, v81 n14 p2543-2555, 10 May 76.

Keywords: Tides, *Strain measurement, Earth models, Colorado, Reprints, *Earth tides.

Earth tide strains at a particular site are affected by the internal structure of the solid earth, by ocean loads, local inhomogeneities in elastic constants due to geologic structure, topography near the observation site and the cavity in which the measuring instrument is situated. All of these influences have been estimated quantitatively for the Poorman site for a diurnal and a semidiurnal tide.

712,569
PB-273 932/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Distance-Measuring Techniques.
Final rept.,
J. Levine. 1977, 13p
Pub. in Annual Review of Earth and Planetary Science, v5 p357-369 1977.

Keywords: *Range finders, *Lasers, *Distance measuring equipment, Geodimeters, Strain measuring instruments, Surveying instruments, Astronomical instruments, Tides, Reprints, *Laser range finders.

This is a review of the field of laser distance measuring techniques. The discussion includes the results obtained using strainmeters, geodimeters, and various extraterrestrial techniques.

712,570
PB-274 348/2 Not available NTIS
National Bureau of Standards, Boulder, CO.
Spectrum of Earth Strain from 10-8 to 10 (sup 2) Hz.
Final rept.,
J. Berger, and J. Levine. 1974, 5p
Grant NSF-GA-36365
Pub. in Jnl. Geophysical Research 79, n8 p1210-1214, 10 Mar 74.

Keywords: *Strain measurement, *Earth crust, Power spectra, Geophysics, Reprints.

The power spectrum of the earth strain fluctuations over 10 decades in frequency from 0.00000001 Hz to 100 Hz was measured using data from three strain observatories. Although the strain meters were widely separated and of different design, they produced records whose power spectra are in close agreement with each other. It was found that the composite power spectrum shows an approximate inverse square dependence on frequency over the entire band investigated.

712,571
PB-274 354/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comments on the Review of 'Strainmeter Technology,' by P. H. Sydenham.
Final rept.,
J. Levine. 9 Oct 75, 1p
Pub. in Nature 257, n5526 p513, 9 Oct 75.

Keywords: *Strain measurement, *Earth crust, Strain gages, Lasers, Reprints.

Several of the conclusions of P. H. Sydenham re earth strain research are not acceptable. In particular, conventional strain meters (i.e., quartz) have very serious problems in temperature and humidity control when it comes to the measurement of long period earth strain. These problems are relieved by using a laser strain meter. Some of the advantages and disadvantages of both types are discussed.

712,572
PB-285 138/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analytical Methods in Determining Elemental Composition from the Apollo X-Ray and Gamma-Ray Spectrometer Data.
Final rept.,
J. I. Trombka, R. L. Schmadebeck, M. J. Bielefeld, L. G. Evans, A. E. Metzger, E. L. Haines, C. S. Dyer, S. M. Seltzer, R. C. Reedy, and J. R. Arnold. May 78, 2p
Pub. in Jnl. Trans. Am. Nucl. Soc., v28 suppl 1 p2-3 May 78.

Keywords: *Chemical analysis, *Lunar probes, *X ray spectrometers, *Gamma spectrometers, Lunar rock, Data processing, Manned spacecraft, Photons, Least squares method, Reprints, Apollo 15 spacecraft, Apollo 16 spacecraft.

Analytical methods are described which were used in the analysis of data obtained with the x-ray proportional-counter and gamma-ray NaI spectrometers flown on

the Apollo-15 and -16 missions for the purpose of mapping the elemental composition of the lunar surface. One method includes: (1) procedures for subtracting various background radiation components from the data; (2) a least-squares unfolding of the signal, based on knowledge of the detector response; and (3) the determination of elemental abundances from the photon emission characteristics of excited nuclei. Two simpler, more approximate methods for the analysis of the gamma-ray data are also described, which are useful in limited energy regions.

712,573

PB-286 792/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Raman Microprobe Spectra of Individual Microcrystals and Fibers of Talc, Tremolite and Related Silicate Minerals.
Final rept.,
J. J. Blaha, and G. J. Rosasco. Jun 78, 5p
Pub. in Analytic Chemistry, v50, no. 7, p892-896 (June 1978).

Keywords: *Raman spectroscopy, *Silicate minerals, *Natural fibers, Talc, Reprints, Tremolite, Anthophyllite, Actimolite.

With a recently developed Raman microprobe, vibrational spectra have been obtained from individual microcrystals and fibers of sheet and chain silicate minerals. Species such as talc, tremolite, low-iron anthophyllite, and actinolite give distinct spectra. No systematic differences exist between spectra of the fibrous and nonfibrous forms of a given mineral.

712,574

PB-295 155/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Possible High-Mobility LAGEOS Ranging Station.
Final rept.,
P. L. Bender, J. E. Faller, J. Levine, S. Moody, M. R. Pearlman, and E. C. Silverberg. 1979, 5p
Pub. in Tectonophysics, 52, p69-73 1979. Proceedings of the Symposium on Recent Crustal Movements (1977) Held at Trieste, Italy on June 20-24, 1977.

Keywords: Range finding, Range finders, Continental drift, Tectonics, Geophysics, Accuracy, *Laser range finders, LAGEOS satellite.

A relatively low-cost system for determining both the vertical and horizontal coordinates of several dozen points per year with an accuracy of about 2 cm appears feasible. One approach considered is to use a subnanosecond pulse length laser with a few millijoules per pulse output energy and to employ single photoelectron detection of the returned signal. The single photoelectron approach has been thoroughly tested in the Lunar Laser Ranging Experiment. With a laser average power of about 50 mW, a 30-cm diameter transmit-receive aperture, 10 arc sec pointing accuracy and a beam divergence of 20 arc sec, the expected returned signal level is about 70 pulses in a 3-min interval. If the differences between the observed ranges and those calculated from a reasonably good LAGEOS ephemeris over a 3-min interval are considered, the expected standard deviation of the mean is <0.7 cm. The calibration procedure used in lunar ranging appears capable of reducing any bias due to the photomultiplier or timing system to 0.5 cm. The other main error source we have considered for the measured optical transit time is a possible difference in arrival time in different parts of the far field pattern because of laser mode structure. This effect needs to be checked experimentally, but we expect it to be 0.5 cm or less for a laser pulse length of about 200 psec. Based on these error estimates, simulations for one week of observations from the high-mobility station have been carried out for us at the National Geodetic Survey. When a refraction model error of 0.15% was used, the uncertainty of the high-mobility station position with respect to a reference station 500 km away was found to be 2.4 cm or less in each coordinate. After the gravity-field uncertainties have been reduced, the station location accuracy will be improved further and the limitation of measuring with respect to a regional reference station can be relaxed.

712,575

PB-295 163/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Plans for the Development of a Portable Absolute Gravimeter with a Few Parts in (10 to the 9th power) Accuracy.
Final rept.
J. E. Faller, R. L. Rinker, and M. A. Zumberge. 1979, 10p
Pub. in Tectonophysics, 52, p107-116 1979. Proceedings of the Symposium on Recent Crustal Movements (1979) Held at Trieste, Italy on June 20-24, 1977.

Keywords: *Gravimeters, Portable equipment, Accuracy.

Successful development of a few parts in 10 to the 9th power portable g apparatus (which corresponds to a height sensitivity of about 1 cm) would have an impact on large areas of geodynamics as well as having possible application to earthquake prediction. Furthermore, the use of such an instrument in combination with classical leveling or extraterrestrially determined height data would yield information on internal mass motions. The plans for the development of such an instrument at JILA using the method of free fall will be given. The proposed interferometric method uses one element of an optical interferometer as the dropped object. Recent work has resulted in substantial progress towards the development of a new type of long-period ($T > 60$ sec) suspension for isolating the reference mirror (corner cube) in the interferometer. Improvements here over the isolation methods previously available, together with state-of-the-art timing and interferometric techniques, are expected to make it possible to achieve a few parts in 10 to the 9th power accuracy with a field-type instrument.

712,576

PB-298 007/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some U.S. Views on Scientific Opportunities in Ocean and Earth Dynamics.
P. L. Bender. 1978, 5p
Pub. in Proceedings European Space Agency Workshop, Held at Schloss Elmau (Germany, F.R.) on Jan 16-21, 1978 p19-23 1978.

Keywords: *Ocean currents, *Earth movements, Tectonics, Earth crust, Earthquakes, Polar wandering, Geodesy, Geodynamics, Earth rotation, Spacecraft tracking, SEASAT-A satellite, Plate tectonics.

Some of the areas of ocean dynamics and Earth dynamics in which ESA participation would be strongly welcomed by earth scientists in the U.S. are discussed in this paper. The topics covered are ocean currents, tectonic plate motions, crustal movements in seismic zones, earth rotation and polar motion, and mapping of the gravity field. Cooperative international efforts in applying space techniques to these fields are likely to yield highly valuable scientific results, which later can be applied to practical problems in many countries. Particular needs for increased European participation are apparent in the laser tracking of SEASAT A, in setting up an international geodynamic control network, in developing accurate but inexpensive methods for detecting crustal movements at many points in seismic zones, in monitoring UT 1 and polar motion by both laser ranging and long baseline radio interferometry, and in developing a new gravity field mapping mission.

712,577

PB-298 010/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Geodesy - Trends and Prospects.
Final rept.
P. L. Bender. 1978, 3p
Pub. in Proceedings IEEE Conf. on Precision and Control (17th), Including Symp. on Adaptive Processes, Held at San Diego, CA. on Jan 10-12, 1978, p455-457.

Keywords: *Geodesy, Earth movements, Earth crust, Spaceborne detectors, Measurement.

A report with the above title recently has been completed by the Committee on Geodesy of the National Research Council. An important part of the charge to the Committee was to review and make recommendations concerning scientific and technological advances in modern geodesy and related fields, and planning for spaceborne instrumentation pertinent to geodesy in the 1980's. Some of the recommendations of the Committee in the areas of crustal movement measurements and needs for the development of new geodetic instruments are discussed briefly.

712,578

PB-300 266/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Plans for the Development of a Portable Absolute Gravimeter: A Tool for Studying Non-Tidal Variations in Gravity.
Final rept.
J. E. Faller, R. L. Rinker, and M. A. Zumberge. 1978, 7p
Sponsored in part by Air Force Geophysics Lab., Hanscom AFB, MA.
Pub. in Proceedings of Non-Tidal Variations in Gravity and Methods of Their Study Conference, Trieste, Italy, June 20-24, 1977, Bollettino di Geofisica Teorica ed Applicata 20, n80 p355-361 Dec 78.

Keywords: *Gravimeters, Forecasting, Earthquakes, Measurement, Gravity.

The availability of a few parts in 10 to the 9th power absolute gravimeter would impact large areas of geodynamics as well as having possible application to earthquake prediction. The use of such an instrument in combination with classical leveling or extraterrestrially determined height data would also yield information on internal mass motions. The plans for the development of such an instrument at JILA using the method of free fall are discussed.

712,579

PB80-104524 Not available NTIS
National Bureau of Standards, Washington, DC.
Strain-Tide Spectroscopy.
Final rept.,
J. Levine. 1978, 15p
Pub. in Geophysical Jnl. of the Royal Astronomical Society 54, p27-41 1978.

Keywords: Atmospheric pressure, Tides, Earth(Planet), Ocean tides, Strains, Gravity, Diurnal variations, Anisotropy, General relativity, Reprints, *Earth tides, Postnewtonian approximation, Spacetime.

Two years of strain-tide data were used to study the response of the Earth to the diurnal and semidiurnal tidal excitations. The results show that there is significant structure in the response of the Earth to tidal excitations near one cycle/sidereal day. This structure agrees with the resonance behavior predicted from calculations of the forced elastic-gravitational response of an elliptical, rotating earth with a liquid outer core. The data can also be used to test for possible preferred frames and spatial anisotropies.

712,580

PB80-117336 Not available NTIS
National Bureau of Standards, Washington, DC.
Noise Reduction Techniques for Use in Determining Local Geomagnetic Field Changes.
Final rept.,
R. H. Ware, and P. L. Bender. 1978, 5p
Pub. in Jnl. of Geomagnetism and Geoelectricity 30, p533-537 1978.

Keywords: *Geomagnetism, *Noise reduction, Magnetic measurement, Magnetometers, Magnetic fields, Electrical resistivity, Abnormalities, Reprints.

Measurements of the difference in total field delta F(t) over a 16 km N-S path near Boulder have been made and the behavior has been found to be quite different from that observed for an E-W path. The present accuracy of the authors' narrow line rubidium magnetometers is about 0.01 gamma. The N-S variations appear to correlate mainly with variations in H rather than D, and may be associated with either gradients of external fields or current in shallow conductivity anomalies. More recently the authors have set up the three magnetometers on a straight E-W line so that the 'second difference' can be measured, and a transfer function from field component variation to the second difference can be determined. The authors plan to use a generalization of this approach for analyzing USGS tectonomagnetic data from California.

712,581

PB80-121353 Not available NTIS
National Bureau of Standards, Washington, DC.
Progress on the Development of a Portable Absolute Gravimeter.
J. E. Faller, R. L. Rinker, and M. A. Zumberge. 1979, 8p
Contract DI-14-08001-1680
Prepared in cooperation with Electronic Systems Div., Hanscom AFB, MA.

Pub. in Proc. Conf. Bureau Gravimetrique International, Paris, France, May 1979, Bull. d'Inf. 44, I-B-4 - I-B-11, 1979.

Keywords: *Gravimeters, Geodesy, Accuracy, Portable equipment.

An absolute gravimeter using the method of free fall is under development at the Joint Institute for Laboratory Astrophysics. The goal is to devise an easily portable apparatus that has a 1-3 microgal sensitivity and which requires less than half a day per measurement (including set up) to obtain that accuracy. Significant progress toward this goal has been made.

712,582
PB80-150527 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Ground Motions on Amplitude Interferometry.
Final rept.,
P. L. Bender. Jan 79, 9p
Pub. in Proceedings of the IAU Colloq, No. 50, University of Sydney, Australia, August 30-September 1, 1978, Paper in High Angular Resolution Stellar Interferometry, p5-1--5-9, Jan 79.

Keywords: *Earth movements, Stability, Interferometers, Amplitude, Microseisms, Errors, *Interferometry, Ground motion.

Some examples are given of types of ground motion which have been observed with seismic and geodetic instruments. In general, away from sources of manmade noise, the amplitudes of ground strains and tilts in the microseism band with periods of a few seconds normally are of the order of a few times 10 to the -10 power. Strain and tilt tides give amplitudes of a few times 10 to the -8 power, and long term average strain and tilt rates at relatively good sites may be roughly 10 to the -7 power/yr. Superposed on such relatively long wavelength motions can be larger local pier motions, which are likely to be irregular. However, very high ground stability has been demonstrated at a few sites. The limitations of ground motions on long term amplitude interferometer stability are serious if applications such as earth rotation and polar motion measurements are considered, but at shorter periods the environmental problems will be almost completely atmospheric.

712,583
PB80-151145 Not available NTIS
National Bureau of Standards, Washington, DC.
Report on the Development of a Portable Absolute Gravimeter.
Final rept.,
J. E. Faller, R. L. Rinker, and M. A. Zumberge. 1979, 4p
Contract DI-14-08-001-1680
Sponsored in part by Air Force Geophysics Lab., Hanscom AFB, MA.
Pub. in Proceedings of International Workshop on Monitoring Crustal Dynamics in Earthquake Zones, European Seismological Commission and the European Geophysical Society, Strausbourg, France, August 29-September 5, 1978, Paper in Terrestrial and Space Techniques in Earthquake Prediction Research, p359-362 1979.

Keywords: *Gravimeters, Portable equipment, Accuracy, Free fall.

The authors are in the process of developing an absolute gravimeter with an accuracy goal of 1-3 microgal and a set up and measurement time of only a few hours at any given site. They discuss the plans and progress to date on such an instrument which uses the method of free fall.

712,584
PB80-157498 Not available NTIS
National Bureau of Standards, Washington, DC.
Modelling of Solar Quiet Magnetic Field Variations near a Conductivity Anomaly.
Final rept.,
E. B. Aronson, R. H. Ware, and P. L. Bender. 1979, 14p
Pub. in Geophys. J:, v59 n1 p539-552, 1979.

Keywords: *Telluric currents, *Geomagnetism, Ionosphere, Electric current, Geoelectricity, Diurnal variations, Temperate regions, Northern Hemisphere, Rocky Mountains, Reprints.

A simplified model of the solar quiet-time ionospheric current system is used to calculate the induced currents in a model earth. The conductivity is assumed to be constant below a depth of about 400 km and zero above that depth. The current induced in the north-south conductivity anomaly under the Rocky Mountains is then estimated from the time-varying potential difference between points at 30 and 45 degrees latitude at the surface of the conducting sphere. The purpose of these calculations is to investigate whether variations in the latitude of the northern hemisphere current system vortex will substantially alter the relationship between the observed magnetic field components at the Earth's surface and the local magnetic field gradient caused by the conductivity anomaly.

712,585
PB81-116865 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Investigation of the Miyagi-ken-oki, Japan, Earthquake of June 12, 1978.
Final rept.
B. R. Ellingwood. Oct 80, 235p NBS-SP-592
Library of Congress catalog card no. 80-600116.

Keywords: *Buildings, *Bridges, *Earthquakes, Damage assessment, Earth movements, Landslides, Earthquake resistant structures, Japan, *Ground motion, *Liquefaction(Soils), Sendai City(Japan).

On June 12, 1978, a destructive earthquake with Richter magnitude of 7.4 occurred off the east coast of Miyagi Perfecture, Japan. Preliminary estimates by the National Land Agency of Japan indicated that the earthquake caused an equivalent of $800 million in total damage. There is a cooperative agreement between the Governments of the United States and Japan termed the U.S.-Japan Program in Natural Resources (UJNR). Following the earthquake, it was arranged through UJNR that teams of U.S. structural engineers and geologists would visit Miyagi Prefecture and inspect the damage caused by the earthquake. This report assembles the information and collective experiences of the investigation team so as to describe the earthquake and document its effects. Field investigations conducted by geologists and structural engineers are described in detail and some of the implications for seismic resistant design and construction of structures in the United States are also discussed.

712,586
PB81-133928 Not available NTIS
National Bureau of Standards, Washington, DC.
Probable LAGEOS Contributions to a Worldwide Geodynamics Control Network.
P. L. Bender, and C. C. Goad. 1979, 17p
Pub. in Proceedings of the Symposium on the Use of Artificial Satellites for Geodesy and Geodynamics and Laser Workshop, Lagonissi, Greece, May 1978, p145-161 1979.

Keywords: *Geodesy, *Geodetic satellites, LAGEOS(Satellite), Laser range finding.

The need to establish a worldwide reference system for use in geodynamics is clear. The authors have carried out simulations on the contributions which laser range measurements to LAGEOS can make in establishing such a system.

712,587
PB81-136822 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Gravity as a Reconnaissance Tool for Vertical Height Changes and for Studying Density Changes.
J. E. Faller, R. L. Rinker, and M. A. Zumberge. 1980, 13p
Sponsored in part by Air Force Geophysics Lab., Hanscom AFB, MA., and Geological Survey, Washington, DC.
Pub. in Proceedings of International Symposium on Problems Related to the Redefinition of North American Vertical Geodetic Networks (2nd), Ottawa, Canada, May 26-30, 1980, p919-931 1980.

Keywords: *Gravimeters, Portable equipment, Design.

A major effort is under way to develop a highly portable absolute gravimeter having an accuracy of 3 microgal or better. Significant progress toward this end has been made. The instrument uses the method of free fall and consists basically of four parts: a drag free dropping chamber, a long period isolation device, a stabilized laser, and the necessary timing electronics. The size and weight of these units is such that the apparatus can be easily handled and assembled by a single person. The expected measurement time required at any given site is about one hour. As the instrument's gravity measurements are based on secondary length and time standards, it is inherently drift free. The authors believe field use of it will significantly advance the study of tectonic processes, including vertical height changes.

712,588
PB81-140287 Not available NTIS
National Bureau of Standards, Washington, DC.
Algebraic Explanation of Closure Correlation Among the Coefficients of a Principal Component,
J. Rosenblatt, F. Chayes, and J. Trochimczyk. Dec 78, 2p
Pub. in Annual Report 1977-1978 to the Carnegie Institution of Washington Year Book 77, p901-902 Dec 78.

Keywords: *Petrology, Statistics, *Principal components analysis.

In chemical petrology, especially in the study of the distribution of essential constituents, the data matrix is a table of percentages resulting in (well-known) negative covariances among major constituents. Principal components analysis has been used for characterization of such arrays. This note considers a 'data' matrix consisting of a set of experimental estimates of the leading principal component obtained from a set of tables of percentages; there will be negative covariances among the elements of the estimates.

712,589
PB81-165607 PC **A13**/MF **A01**
National Bureau of Standards, Washington, DC.
Physical Properties Data for Rock Salt.
L. H. Gevantman. Jan 81, 293p NBS-MONO-167
Library of Congress catalog card no. 80-607096. Prepared in cooperation with Geological Survey, Reston, VA., New Jersey Inst. of Tech., Newark, Rensselaer Polytechnic Inst., Troy, NY. Molten Salts Data Center, and Purdue Univ., Lafayette, IN. Center for Information and Numerical Data Analysis and Synthesis. Sponsored in part by Battelle Memorial Inst., Columbus, OH.

Keywords: *Rock salt, *Sodium chloride, Rock salt deposits, Chemical properties, Mechanical properties, Electrical properties, Optical properties, Thermodynamic properties, Magnetic properties, Radiation damage, Reviews, *Radioactive waste storage.

Rock salt and pure sodium chloride properties data are assembled into a single source. The properties covered include geological, mechanical, optical, thermal, radiation damage, electrical, magnetic, chemical, and physical. A concerted attempt has been made to present the best data consistent with their availability in the literature. Recommended values for data are given where possible. A brief discussion of measurement techniques is included for each property. Although the principal reasons for assembling this Monograph are nuclear-waste-storage inspired, the data for most of the properties cited would also apply to the burial of other types of waste where long-term stable facilities are required. It is intended that the data will serve as a source of generalized information to the salt industry.

712,590
PB81-182800 Not available NTIS
National Bureau of Standards, Washington, DC.
Improved Methods for Measuring Present Crustal Movements.
Final rept.
P. L. Bender. 1980, 8p
Pub. in Dynamics of Plate Interiors, Geodynamics Series 1, p155-162 1980.

Keywords: *Earth crust, *Geodynamics, *Distance measuring equipment, *Geodesy, Gravity, Reprints, Plate tectonics.

Improvements in geodetic measurement techniques are likely to play an important role in a number of types of geodynamics studies during the next decade. Increased accuracy for horizontal distance and gravity measurements at many sites is expected using mutliple-wavelength measurements and falling-retroreflector gravimeters. An international program of worldwide position measurements with about 3 cm accuracy is planned, using both laser range measurements to the LAGEOS satellite and long baseline radio interferometry.

712,591
PB81-247280 Not available NTIS
National Bureau of Standards, Washington, DC.
Using the Global Positioning System (GPS) for Geodetic Positioning.
Final rept.
J. D. Bossler, C. D. Goad, and P. L. Bender. 1980, 11p
Pub. in Bulletin Geodesique 54, p553-563 1980.

Keywords: *Geodesy, Geodetic surveys, Reprints, Global Positioning System, Satellite observation.

The development of relatively inexpensive satellite receivers in the early 1970's has resulted in cost-effective applications of satellites for a variety of geodetic surveying needs. Currently achievable accuracies range from 10 to 20 centimeters. The NAVSTAR Global Positioning System, now under development by the Department of Defense, incorporates advanced technology which has the potential capability of revolutionizing satellite geodesy. Several concepts for utilizing GPS signals are briefly reviewed, and another concept, called the reconstructed carrier phase method, is described in some detail. This concept is being pursued by the Defense Mapping Agency, National Oceanic and Atmospheric Administration, and the U.S. Geological Survey. These agencies have numerous requirements for accurate positioning. Several prototype receivers are planned to be available for testing in mid-1982. These receivers should be highly portable, consume little power, and obtain base line accuracies of several centimeters in several hours of observation time. However, water vapor radiometers will be needed in order to achieve the full accuracy. Initial simulation results utilizing the reconstructed carrier phase method are included.

712,592
PB81-247793 Not available NTIS
National Bureau of Standards, Washington, DC.
Establishment of Terrestrial Reference Frames by New Observational Techniques.
Final rept.
P. L. Bender. 1981, 14p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of IAU Colloq. 56 held at Warsaw, Poland on September 8-12, 1980, Paper in Reference Coordinate Systems for Earth Dynamics, p23-36 1981.

Keywords: *Geodesy, Geodynamics, Plate tectonics, Satellite observation.

The use of space techniques for establishing transcontinental and intercontinental distances is progressing very rapidly. We can think of the set of station locations used in either LAGEOS ranging of VLBI measurements as forming the vertices of a polyhedron. After correcting for tectonic plate motions using an adopted model, we expect the geometry of the polyhedron to be fairly stable over periods of the order of a year. However, after some period of time, a new set of station coordinates will be requied because of improved data, unexpected station motions, etc. Methods for maintaining agreement with the previous set of station coordinates in some average sense are discussed in this paper. Some of the contributions expected from other new measurement methods also are described.

712,593
PB82-152075 Not available NTIS
National Bureau of Standards, Washington, DC.
Isotope Composition of Cd, Ca and Mg in the Brownfield Chondrite.
K. J. R. Rosman, I. L. Barnes, L. J. Moore, and J. W. Gramlich. 1980, 9p
Pub. in Geochemical Jnl. 14, p269-277 1980.

Keywords: *Meteorites, *Isotope availability, Cadmium isotopes, Calcium isotopes, Magnesium isotopes, Reprints.

The isotopic composition of cadmium, calcium and magnesium in the Brownfield chondrite have been measured. The measurements on cadmium show that this element is isotopically fractionated ith the heavier isotopes relatively enriched to the extent of 2.7% per mass unit. This confirms earlier reports by Rosman and DeLaeter (1976, 1978). Calcium and magnesium show no evidence of isotope fractionation, indicating that the process responsible for fractionating cadmium does not seem to have affected these more refractory elements.

712,594
PB82-153800 Not available NTIS
National Bureau of Standards, Washington, DC.
Statistics of Narrow Structures of the Gravity Field of the Earth. I. General Theory.
B. Bertotti. 10 Nov 81, 8p
Pub. in Jnl. of Geophysics Research 86, nB11 p10835-10842 1981.

Keywords: *Gravity, Statistical analysis, Correlation, Reprints.

With the increase in resolution and accuracy of gravity measurements it is becoming possible and increasingly important to concentrate attention on local analysis and on the role of elongated geophysical features. This paper deals with the statistical analysis of such features and develops for this purpose a new mathematical tool, the three- and four-point correlation function.

712,595
PB83-115311 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Physical Properties Data for Basalt.
Final rept.
L. H. Gevantman. Sep 82, 765p NBSIR-82-2587
Sponsored in part by Battelle Project Management Div., Columbus, OH. Office of Nuclear Waste Isolation.

Keywords: *Basalt, *Thermodynamic properties, Thermophysical properties, Rock properties, Chemical composition, Thermochemical properties, Volumetric analysis, Statistical data, Tables(Data).

This work provides compiled experimental data and associated information on the thermodynamic, mechanical, thermophysical, and electrical properties of basalts from various locations in the United States and abroad. The thermodynamic properties include the chemical characterization of basalts, heat capacity, relative enthalpy, entropy, Gibbs energy, and molar volume. A summing procedure for obtaining values of heat capacity and calorimetric entropy above 298K is introduced.

712,596
PB83-134171 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Absolute Gravity.
Final rept.
J. E. Faller, Y. G. Guo, and M. A. Zumberge. 1982, 11p
Pub. in Proceedings of American Society of Photogrammetry, American Congress on Surveying and Mapping, Denver, CO., March 14-20, 1982, p63-74.

Keywords: *Gravity, Gravimeters, Design, Accuracy, Portable equipment, *Gravimetry.

The status of absolute gravimetry is discussed. A new and easily portable apparatus which has been developed at JILA for the absolute determination of the acceleration of gravity is described. Laboratory tests of this new instrument indicate a measurement accuracy of 6 parts in 10 to the 9th power is achieved. This corresponds to an equivalent height sensitivity of about 2 cm.

712,597
PB83-145656 Not available NTIS
National Bureau of Standards, Washington, DC.
Scientific Goals of Laser Range Measurements.
Final rept.
P. L. Bender. 1982, 10p
Pub. in Proceedings of Int. Workshop on Laser Ranging Instrumentation (4th), Austin, Texas, October 12-16, 1981, p502-511 1982.

Keywords: *Geodesy, *Geodynamics, *Tectonics, *Range finding, Earth movements, Scientific satellites, *Laser range finders, *Plate tectonics.

Two of the most important areas of geodynamics to which laser ranging appears capable of making fundamental contributions are discussed. These are worldwide plate tectonic motion measurements and the monitoring of the longer wavelength crustal movements in seismic zones. In both areas, the accuracy and reliability of the results are of great importance, since a factor 2 improvement in accuracy can reduce the time necessary for detecting anomalous motions by the same factor. The capabilities of other techniques are discussed briefly, and it is argued that laser ranging to satellites is likely to make major and unique contributions to geodynamics if it succeeds in demonstrating higher measurement accuracy than radio techniques. A strong emphasis on improving the measurement accuracy thus appears to be needed during the next two years.

712,598
PB83-176834 Not available NTIS
National Bureau of Standards, Washington, DC.
Portable Apparatus for Absolute Measurements of the Earth's Gravity.
Final rept.
M. A. Zumberge, R. L. Rinker, and J. E. Faller. 1982, 8p
Sponsored in part by Air Force Geophysics Lab., Hanscom AFB, MA.
Pub. in Metrologia 18, p145-152 1982.

Keywords: *Gravity, *Measuring instruments, Portable equipment, Tectonics, Accuracy, Reprints.

The authors have developed a new and portable apparatus for making absolute measurements of the acceleration due to the Earth's gravity. They use the method of free fall, and interferometrically determine the acceleration of a freely falling corner cube. In the design and development of this instrument, particular attention was paid to those aspects which would affect its performance in the field. The resulting instrument, they believe, provides a viable new tool for the study of tectonic motions. The system is very small; it can be transported in a small van and requires only two hours for assembly. The results of extensive tests indicate that the achievable accuracy is about six parts in 10 to the 9th power of g. This instrument therefore provides a sensitivity to vertical motions (e.g. of the Earth's crust) as small as 2 cm.

712,599
PB83-233494 Not available NTIS
National Bureau of Standards, Washington, DC.
Earth Tides.
Final rept.
J. Levine. Dec 82, 8p
Pub. in Physics Teacher, p588-595 Dec 82.

Keywords: Gravimeters, Gravity, Reprints, *Earth tides, Gravitational fields.

For centuries, people living along coastlines have noticed the diurnal and semidiurnal fluctuations in the height of the sea. The connection between the moon and these tides was obvious, and, even before the formulation of any theory, quite satisfactory predictions of the ocean tides were published. Tidal tables were constructed by various undivulged methods, and these methods were often passed from father to son. It was less widely appreciated that the earth itself is subjected to tidal stresses and undergoes tidal deformations. It is the purpose of this paper to investigate these tidal stresses and to see how the deformations may be measured.

712,600
PB83-234609 Not available NTIS
National Bureau of Standards, Washington, DC.
Advanced Absolute Gravity Determination.
Final rept.
J. E. Faller, Y. G. Guo, R. L. Rinker, and M. A. Zumberge. 1983, 10p
Sponsored in part by Air Force Geophysics Lab., Hanscom AFB, MA.
Pub. in Jnl. of the Geodetic Society of Japan, Tokyo, p309-318 1983.

Keywords: *Gravity, Gravimeters, Reprints.

During the past twenty years, a number of absolute gravimeters based on laser interferometry have been developed. At the Joint Institute for Laboratory Astrophysics (JILA), the authors have recently designed and built a new and highly-portable absolute gravity apparatus based on these principles for the purpose of surveying tectonically interesting regions. The status of this new instrument and the future plans for it, as well as the general status of absolute gravity determinations, are discussed.

712,601
PB84-106400 Not available NTIS
National Bureau of Standards, Washington, DC.

JILA Absolute Gravimeter.
Final rept.
J. E. Faller, M. A. Zumberge, and R. L. Rinker. 1983, 10p
Sponsored in part by Air Force Geophysics Lab., Hanscom AFB, MA.
Pub. in Proceedings of International Conference on Earth Tides (9th), New York, New York, August 17-22, 1981, p465-474 1983.

Keywords: *Gravimeters, Rubidium frequency standards, Gravity, Accuracy, Laser interferometry, Retroreflectors, Earth tides.

The authors have developed a new absolute gravimeter based on high speed laser interferometry which measures the acceleration of a freely falling retroreflector using sub-nanosecond timing electronics. A rubidium frequency standard is used as the reference of time while an iodine-stabilized laser is used as the reference of length. The instrument is designed to measure g with an absolute accuracy of a few parts in 10 to the 9th power in a measurement time of one half hour or less. The status of the instrument and results obtained with it will be discussed.

712,602
PB84-138494 Not available NTIS
National Bureau of Standards, Washington, DC.
Promise and Plans for the JILA Gravimeter.
Final rept.
J. E. Faller, Y. G. Guo, T. M. Niebauer, and R. L. Rinker. Jun 83, 12p
Pub. in Proceedings of 1983 Int. School Symp. Precision Measurement Gravity Experiment, Taipei, Republic of China, Jan 24-Feb 2, 1983, p477-488 Jun 83.

Keywords: *Gravimeters, Portable equipment, Measurement, Precision, *Acceleration of gravity, Laser interferometry.

During the past several decades, scientific interest in gravity has continued to be strong. At the Joint Institute for Laboratory Astrophysics (JILA) the authors have recently designed and built a new and highly-portable absolute gravity apparatus based on laser interferometry. This instruments performance and their plans for its use are discussed.

712,603
PB84-138502 Not available NTIS
National Bureau of Standards, Washington, DC.
Little 'g': An Introduction to Dropping Things.
Final rept.
J. E. Faller. Jun 83, 13p
Pub. in Proceedings of 1983 Int. School Symp. Precision Measurement Gravity Experiment, Taipei, Republic of China, Jan 24-Feb 2, 1983, p465-476 Jun 83.

Keywords: *Gravity, Measurement, Experimental design, *Acceleration of gravity.

An introduction to the measurement of g, the acceleration of gravity, is given. In particular, the experimental details and problems are discussed in a pedagogical way.

712,604
PB84-154665 Not available NTIS
National Bureau of Standards, Washington, DC.
Results from an Absolute Gravity Survey in the United States.
Final rept.
M. A. Zumberge, J. E. Faller, and J. Gschwind. 10 Sep 83, 8p
Pub. in Jnl. of Geophysical Research 88, nB9 p7495-7502, 10 Sep 83.

Keywords: Gravity, United States, Reprints, *Gravity surveys.

Using the recently completed JILA absolute gravity meter, the authors made an absolute gravity survey which covered 12 sites in the United States. Over a period of 8 weeks, the instrument was driven a total distance of nearly 20,000 km to sites in California, New Mexico, Colorado, Wyoming, Maryland, and Massachusetts. The time spent in carrying out a measurement at a single location was typically 1 day. A measurement accuracy of around 1 x 10 to the -7th power m/(sec sq) (10 microGal) is believed to have been obtained at each of the sites.

712,605
PB84-218437 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibrating Pollen Data in Climatic Terms: Improving the Methods.
Final rept.
S. Howe, and T. Webb. 1983, 35p
Pub. in Quaternary Science Review 2, p17-51 1983.

Keywords: *Pollen, *Climate, *Paleoclimatology, Yield, Regression analysis, Periodic variations, Calibrating, Atmospheric temperature, Computer programming, Michigan, Reprints.

When properly calibrated, Holocene pollen data provide an important source of quantitative information about Holocene climates. Multiple linear regression of modern climate and pollen data allows the development of statistical calibration functions that transform percentages of certain pollen types into quantitative estimates of climatic variables, and these functions, when applied to Holocene pollen data, yield estimates of climatic variables for past times. Confidence intervals for the climatic variables provide estimates of the statistical errors. In order to illustrate the sequence of procedures, the authors used data from the lower peninsula of Michigan to develop a calibration function for July mean temperature and then used Holocene pollen data from central lower Michigan to estimate past temperatures.

712,606
PB84-226232 Not available NTIS
National Bureau of Standards, Washington, DC.
Design of a Deep Borehole Tiltmeter.
Final rept.
J. C. Harrison, J. Levine, and C. M. Meertens. 1983, 11p
Sponsored in part by Air Force Geophysics Lab., Hanscom AFB, MA.
Pub. in Proc. Ninth Int. Conf. Earth Tides, Stuttgart, West Germany, August 17-22 1981, p273-281 1983.

Keywords: *Boreholes, Design criteria, Performance evaluation, Tides, Deep depth, *Tiltmeters, *Earth tilt, Earth tides.

A deep borehole tiltmeter has been developed which can be operated below the near surface layers so as to reduce the influence of meteorological effects and which is relatively inexpensive to build and to install. A 15 cm diameter borehole is cased with steel irrigation pipe and has a stainless steel instrument compartment of 10 cm internal diameter at the bottom of the hole. The tiltmeter is contained in a 2 m stainless capsule held against the sides of the hole with flat springs. The tilt sensors are mounted on a platform which can be leveled by means of motors controlled from the surface, allowing for hole deviations of up to five degrees from the vertical. A number of different tilt sensors have been used on such platforms. Simple pendulums and horizontal pendulums have so far yielded the best results. A depth of 33 m is normally used although this is not a critical aspect of the design, as the electronics are inside the instrument capsule. The instruments are capable of operating unattended for long periods of time at tidal sensitivity; results of our tidal measurements will be presented in a companion paper at this symposium.

712,607
PB84-226257 Not available NTIS
National Bureau of Standards, Washington, DC.
Performance of a Deep Borehole Tiltmeter.
Final rept.
J. Levine, J. C. Harrison, and C. M. Meertens. 1983, 11p
Sponsored in part by Air Force Geophysics Lab., Hanscom AFB, MA.
Pub. in Proc. Ninth Int. Conf. Earth Tides, Stuttgart, West Germany, August 17-22 1981, p47-57 1983.

Keywords: *Boreholes, Deep depth, Design criteria, Performance evaluation, Tides, Sites, *Tiltmeters, *Earth tilt, Earth tides, Case studies.

Deep borehole tiltmeters described by Harrison, Levine and Meertens at this symposium have been installed at two sites near Boulder, Colorado. One site is at the edge of the foothills with closely spaced holes 6 m, 16 m, and 33 m deep. The other site is 24 km to the east in the flat plains where five holes, each 33 m deep have been drilled spaced from 30 m to 120 m apart. Using an observation time of 28 days, earth tides are observed with a signal to noise ratio of almost 40 dB and with an apparent secular tilt of about 0.1 microradian. Data from the instruments are used to construct the tidal admittance and to study the coherence among the instruments. The semi-diurnal tidal admittance shows very good agreement with theory. Consecutive monthly admittance show a standard deviation of approximately 6% and no secular trend. The instruments show no nonlinear behavior.

712,608
PB85-130821
(Order as PB85-130078, PC **A99**/MF **A01**)
Bureau International des Poids et Mesures, Sevres (France).
Gravitational Acceleration, Mass, and Electrical Quantities: Present Status of the Absolute Measurement of Gravitational Acceleration.
A. Sakuma. 1984, 8p
Included in Precision Measurement and Fundamental Constants II, p397-404 1984.

Keywords: *Gravity, Portable equipment, Gravimeters, Acceleration, Measurement, Reviews, *Gravimetry, Free fall.

The paper reviews the recent work on the absolute measurement of gravitational acceleration g, covering the last decade since PMFC-I in 1970. The single principle involved in the precise absolute measurement of g to better than 1 part in 10 to the 8th power is the observation of free fall in the gravity field: All the ten or so laboratories presently engaged in this measurement employ only this principle of free fall and no longer the traditional reversible pendulum. A large number of new absolute gravity stations (about 50 by the end of 1980) have been created in Europe, North America, Asia, and Oceania by transportable absolute gravity meters of several laboratories. These stations are aimed at improving the accuracy of the world gravity network, IGSN 1971, and also at monitoring in the future the secular variation of the network.

712,609
PB85-130839
(Order as PB85-130078, PC **A99**/MF **A01**)
Joint Inst. for Lab. Astrophysics, Boulder, CO.
New, Portable, Absolute Gravimeter.
M. A. Zumberge, J. E. Faller, and R. L. Rinker. 1984, 5p
Included in Precision Measurement and Fundamental Constants II, p405-409 1984.

Keywords: *Gravimeters, *Gravity, Optical interferometers, Portable equipment, Performance, Measurement, Accuracy, *Laser interferometry, Free fall.

The authors report on the performance of a new and easily portable apparatus for the absolute measurement of the acceleration of gravity. Rapid acquisition of data and high accuracy result from the use of a drag-free dropping chamber that descends with the falling object whose acceleration is measured interferometrically. Preliminary results indicate an absolute accuracy of 6 parts in 10 to the 9th power.

712,610
PB85-130854
(Order as PB85-130078, PC **A99**/MF **A01**)
National Inst. of Metrology, Beijing (China).
Transportable Gravimeter for the Absolute Determination of Gravity.
Y. G. Guo, D. L. Huang, D. X. Li, G. Y. Zhang, and J. L. Gao. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p419-421 1984.

Keywords: *Gravimeters, *Gravity, Optical interferometers, Helium neon lasers, Portable equipment, Rubidium frequency standards, Measurement, Free fall.

At the National Institute of Metrology in Beijing, a transportable gravimeter, using the method of free fall has been constructed. The instrument consists of an optical interferometer illuminated by light from a stabilized He-Ne laser, in which one of the mirrors, a corner-cube reflector, falls freely. The time standard is obtained from a highly stabilized rubidium clock. The methods of time and distance measurement are described. The effect of the verticality or collimation is discussed. A positive correction has to be included. Some recent (1979-1980) results are presented. The accuracy achieved with this apparatus is about two parts in 10 to the 8th power.

712,611
PB85-130862
(Order as PB85-130078, PC **A99**/MF **A01**)
Air Force Geophysics Lab., Hanscom AFB, MA.

New Techniques for Absolute Gravity Measurement.
J. A. Hammond, R. L. Iliff, and R. W. Sands. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p423-426 1984.

Keywords: *Gravity, Portable equipment, Measurement, Precision, Correction, Laser applications, Free fall.

In the 11 years since PMFC-1, a number of new techniques have been put into practice in the Air Force Geophysics Laboratory's transportable system for measuring the acceleration of gravity. The improved system in use at the present time incorporates an earlier vacuum chamber with some modifications and includes new electronics, data analysis, and optical subsystems. The electronics now produce time measurement at a large number (500) points during the free fall of the object. These time values are analyzed with a least-squares fit to a second-order polynomial to obtain the average acceleration. The correction for air resistance is now made by monitoring the pressure and making a correction based on extrapolation from high pressures to the low operating pressures. The use of an iodine-stabilized laser as a reference for the length measurement has significantly reduced the uncertainty due to the wavelength of the Lamb-dip stabilized laser.

712,612
PB85-143675 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mineralogical Characteristics of Asbestos.
Final rept.
E. B. Steel, and A. G. Wylie. 1981, 7p
Sponsored by Society of Mining Engineers of AIME, Littleton, CO.
Pub. in Geology of Asbestos Deposits, p93-99 1981.

Keywords: *Amphiboles, *Asbestos, *Serpentine, Crystal structure, Surface properties, Reprints.

The asbestiform habit is most commonly developed in certain amphiboles and chrysotile, but other minerals may also crystallize with this unusual habit. The habit may be characterized by (1) a fibril structure, single or twinned crystals of very small widths (generally less than 0.5 micrometer) which have grown with a common fiber axis direction but which are disoriented in the other crystallographic directions, (2) anomalous optical properties, primarily parallel extinction, (3) unusual tensile strength, (4) high aspect ratio, and (5) flexibility. In addition, there is evidence to indicate that some amphibole asbestos may have unusual surface properties.

712,613
PB85-187482 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
SQUID Applications to Geophysics.
Final rept.
J. E. Zimmerman, H. Weinstock, and W. C. Overton. 1981, 4p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of the SQUID Applications to Geophysics Workshop, Los Alamos, New Mexico, June 2-4, 1980, p81-84, 1981.

Keywords: *Magnetometers, Superconductors, Refrigerators, Cryogenics, *SQUID devices, *Cryocoolers.

No alternatives to liquid-helium cryostats for SQUID geomagnetic measurements are presently available, but micro-miniature Joule-Thomson and low-power non-magnetic Stirling cryocoolers are being developed for this and similar purposes. With increasing interest and experimental work on the subject during the past year or two, it is likely that demonstrations of feasibility will occur in the moderately near future, and perhaps even a suitable commercial cryocooler in the next few years.

712,614
PB85-202638 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Loudounite, a New Zirconium Silicate Mineral from Virginia.
Final rept.
D. E. Newbury, and P. J. Dunn. 1983, 4p
Pub. in Canadian Mineralogist 21, n1 p37-40 Feb 83.

Keywords: *Silicate minerals, Zirconium compounds, Reprints, *Loudounite, Actinolite, Chlorite, Ancylite.

Loudounite, NaCa5Zr4Si16O41(OH)11 . 8H2O, is a new mineral from the Goose Creek Quarry, Loudoun County, Virginia, where it occurs as green to colorless spherules associated with actinolite, chlorite and ancylite. The hardness is approximately 5 (Moh's); the density is 2.48(3) g/cc; and the streak is colorless. Loudounite is biaxial with wavy extinction, is length-slow, and has indices of refraction alpha = 1.536 and gamma = 1.550 (both + or - 0.004). Loudounite has also been found at the Fairfax Quarry, Centreville, Fairfax County, Virginia.

712,615
PB85-203438 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nuclear and Chemical Dating Techniques: Interpreting the Environmental Record.
Final rept.
L. A. Currie. 1982, 517p
Pub. in ACS (American Chemical Society) Symposium Series 176, p1-516 1982.

Keywords: *Geochemistry, *Archaeology, *Age estimation, *Radiocarbon dating, *Chemical analysis, Physicochemical properties, Meteorites, Trees(Plants), Ice formation, Sediments, Mass spectroscopy, Thermoluminescence, Isotope dating, Reprints, State of the art.

This volume is based on a symposium which took place at the March 1980 National ACS Meeting in Houston, Texas. The general objective of the Symposium was to review the latest developments and state-of-the-art of scientific (physicochemical) dating methods together with biogeochemical applications. In view of that objective the contents of this volume focus on advances in knowledge, testing of assumptions, and model validation which can be brought about through the use of complementary or multi-technique approaches--i.e., chemical vs nuclear chronometers, and dating with nuclides differing in decay characteristics and chemical behavior. Among the topics included are: advances in isotope mass spectrometry and low-level counting, resonance ion spectroscopy, direct atom counting with nuclear accelerators, amino acid racemization, thermoluminescence, and the extraction of isotopic and chemical records from meteorites, ice cores, sediment cores, and tree rings.

712,616
PB85-222859 CP **T02**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Countries, Dependencies, Areas of Special Sovereignty, and Their Principal Administrative Divisions (FIPS PUB 10-3).
Data file.
H. Tom, and J. Newton. 7 Jun 85, mag tape FIPS PUB 10-3, NBS/DF/MT-85/001
Supersedes PB-267 936.
Data file is available in the EBCDIC and ASCII character sets on 9-track one-half inch tape. Identify recording mode by specifying density and character set. Call NTIS Computer Products if you have questions.

Keywords: *Data file, *Geography, *Data processing, Standards, Magnetic tapes, Countries, Federal information processing standards, Data elements.

The file contains data from Table 1 of Federal Information Processing Standard Publication (FIPS PUB) 10-3 'Countries, Dependencies, Areas of Special Sovereignty, and Their Principal Administrative Divisions' including its change notices 1 and 2. The file includes the names and alphabetic two-character codes of each basic entity. In addition, it includes the name and four-character code of each principal division for those basic entities whose divisions are included in FIPS PUB 10-3. Records are sequenced in alphabetic order by basic entity. A typical entry consists of the country (basic entity) code and name and, if the basic entity is subdivided, the principal division codes and names. When printed out, each entry consists of the basic entity code and name on one line, followed by the principal division codes and names, one to each line. On lines with basic entity names, the last two characters of the code field are blank. Note that basic entity names are represented in UPPER CASE, while principal division names are in Mixed Case. Some principal divisions also have entries for conventional or former names. Conventional names are enclosed in (parentheses), while former names are enclosed in 'quotation marks'. Diacritics are not represented.

712,617
PB85-229391 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
JILA (Joint Institute for Laboratory Astrophysics) Portable Absolute Gravity Apparatus.
Final rept.
J. E. Faller, Y. G. Guo, J. Gschwind, T. M. Niebauer, R. L. Rinker, and J. Xue. 1983, 11p
Sponsored by Air Force Geophysics Lab., Hanscom AFB, MA.
Pub. in Proceedings of the International Union of Geodesy and Geophysics General Assembly (18th), Hamburg, Germany, August 15-27, 1983, p87-97.

Keywords: *Gravimeters, *Gravity, Portable equipment, Accuracy, Laser interferometry.

At the Joint Institute for Laboratory Astrophysics, the authors have developed a new and highly portable absolute gravity apparatus based on the principles of free-fall laser interferometry. A primary concern over the past several years has been the detection, understanding, and elimination of systematic errors. In the Spring of 1982, the authors used the instrument to carry out a survey at twelve sites in the United States. The time required to carry out a measurement at each location was typically one day. Over the next several years, the intention is to see absolute gravity measurements become both usable and used in the field. To this end, and in the context of cooperative research programs with a number of scientific institutes throughout the world, the authors are building additional instruments (incorporating further refinements) which are to be used for geodetic, geophysical, geological, and tectonic studies. With these new instruments, the authors expect to improve (perhaps by a factor of two) on the 6-10 microgal accuracy of their present instrument. Today one can make absolute gravity measurements as accurately as -- possibly even more accurately than -- one can make relative measurements.

712,618
PB86-102951 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
High Precision Gravity Measurements.
Final rept.
I. Marson, and J. E. Faller. 1985, 15p
Pub. in Proceedings of the Conference on High Precision Geodetics Measurements, University of Bologna, Bologna, Italy, October 16-17, 1984, p314-328 1985.

Keywords: *Gravity, Geodesy, Measurement.

The measurement of the gravity acceleration is of interest in a broad area of physical sciences: metrology, geophysics and geodesy. High precision gravity data are required to study gravity variation with time, the motion of the Earth's core, and mass redistribution in the mantle and crust. In this paper, measurement techniques employed in high precision gravity devices are discussed.

712,619
PB86-110160 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Physical Properties Data of Rock Salt for Use in Designing Nuclear Waste Repositories.
Final rept.
L. H. Gevantman. 1982, 7p
Pub. in Proceedings of Symposium of AIME Annual Meeting on Process Mineralogy 2: Applications in Metallurgy, Ceramics, and Geology, Dallas, TX., February 14-18, 1982, p401-407.

Keywords: *Rock salt, Physical properties, Chemical properties, *Radioactive waste storage, Salt deposits.

A program for the compilation of evaluated physical and chemical numerical properties data is being pursued at the National Bureau of Standards within the Office of Standard Reference Data. The intent is to assemble a reliable body of numerical properties data concerning candidate mineralogical materials in which high-level radioactive wastes are to be buried. The ready accessibility of the data to site designers and the credibility achieved through the evaluative process are designed to help assess and compare the feasibility of each candidate material for use as a disposal site. Both generic and site-specific data are to be assembled. To date, generic rock salt properties have been assembled and published by the NBS as NBS Monograph 167. Details of the effort to produce this book are discussed.

712,620
PB86-123098 Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Position Location Using Sequential GPS (Global Positioning System) Measurements.
Final rept.
M. Weiss. 1982, 4p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Plans 82 Position Location and Navigation Symposium, Atlantic City, NJ., December 6-9, 1982, p275-278.

Keywords: Position(Location), *Time measurement, *Global positioning system.

The paper reports the development of a program to derive a first order correction to initial estimates of local coordinates and local clock bias from GPS time using a single channel GPS receiver of the C/A code. The program measures sequentially the local minus GPS time via four different satellites based on an initial estimate of local coordinates. Then using these measurements along with known locations of the satellites the first order corrections to the X, Y, and Z coordinates and the local time bias from GPS time are obtained.

712,621
PB86-160991 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Sawtooth Segmentation and Deformation Processes on the Southern San Andreas Fault, California.
Final rept.
R. Bilham, and P. Williams. 1985, 4p
Sponsored by Geological Survey, Reston, VA., National Aeronautics and Space Administration, Washington, DC., and National Geophysical Data Center, Boulder, CO.
Pub. in Geophysical Research Letters 12, n9 p557-560 Sep 85.

Keywords: *San Andreas Fault, *Geological faults, Earthquakes, California, Reprints.

Five continuous 12-13 km fault segments form a sawtooth geometry on the southernmost San Andreas fault. The kinematic and morphologic properties of each segment depend on fault strike, despite differences of strike between segments of as little as 3 degrees. Oblique slip (transpression) of fault segments within the Indio Hills, Mecca Hills, and Durmid Hill results from an inferred 8:1 ratio of dextral slip to convergence across the fault zone. Triggered slip and creep are confined almost entirely to transpressive segments of the fault. Durmid Hill has been formed in the last 28 + or - 6 ka by uplift at an average rate of 3 + or - 1 mm/a.

712,622
PB86-193182 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
g -- The Acceleration of Gravity: Its Measurement and Its Importance.
Final rept.
I. Marson, and J. E. Faller. 1986, 11p
Pub. in Jnl. of Physics E: Scientific Instruments 19, p22-32 1986.

Keywords: *Gravitation, *Gravity, Measurement, Reprints.

The measurement of the acceleration of gravity (g) has long been a matter of scientific interest. Its value is of interest in a broad area of physical sciences, namely metrology, geophysics and geodesy. In the paper the authors discuss the various types of instrument, the methods of measurement, and the applications of g.

712,623
PB86-200458 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Characterization of Polycyclic Aromatic Hydrocarbon Minerals Curtisite, Idrialite and Pendletonite Using High-Performance Liquid Chromatography, Gas Chromatography, Mass Spectrometry and Nuclear Magnetic Resonance Spectroscopy.
Final rept.
S. A. Wise, R. M. Campbell, W. R. West, M. L. Lee, and K. D. Bartle. 1986, 19p
Pub. in Chemical Geology 54, p339-357 1986.

Keywords: *Aromatic polycyclic hydrocarbons, Chemical analysis, Minerals, Gas chromatography, Mass spectroscopy, Nuclear magnetic resonance, Reprints, *Curtisite, *Idrialite, Liquid column chromatography.

Two polycyclic aromatic hydrocarbon (PAH) minerals-curtisite and idrialite-have been characterized using high-resolution gas chromatography-mass spectrometry (GC-MS) and high-performance liquid chromatography (HPLC) with fluorescence detection. Using analytical techniques, the curtisite and idrialite were found to be unique complex PAH mixtures consisting of six specific PAH structural series with each member of a series differing from the previous member by addition of another aromatic ring. The curtisite and idrialite samples contained many of the same components but in considerably different relative amounts. The identification of these compounds supports the conclusions of M. Blumer that these minerals were formed by medium-temperature pyrolysis of organic compounds, followed by extended equilibration at elevated temperatures in the subsurface.

712,624
PB86-212842 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
GPS (Global Positioning System) Carrier Phase Ambiguity Resolution Over Long Baselines.
Final rept.
P. L. Bender, and D. R. Larden. May 85, 5p
Pub. in Proc. Int. Symp. on Precise Positioning with the Global Positioning System (1st), Rockville, MD., April 15-19, 1985, p357-361.

Keywords: *Geodesy, Navigation satellites, Carriers, Phase measurement, Resolution, Satellite orbits, *Global positioning systems.

As GPS satellite orbit determination accuracy improves, carrier phase ambiguity resolution over baselines 100 km to 1000 km or more in length will be desirable. With phase delay single differences for both the L1 and L2 frequencies from the j-th satellite, two particularly useful linear combinations can be formed. One is dj, a measure of the difference in geometric distance to the ground stations plus the clock correction. The other is gj, a measure of the difference in integrated electron content along the two paths. The information should make possible ambiguity resolution over long baselines if the orbits, phase measurements, and tropospheric corrections are sufficiently accurate.

712,625
PB86-228657 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Geophysical Reasons for Monitoring Contemporary Plate Motions and the Earth's Rotation.
Final rept.
P. L. Bender. 1983, 5p
Pub. in Proceedings of Workshop on Multiple Uses of the Very Long Baseline Array, Washington, DC., April 8-9, 1983, p39-43.

Keywords: Polar wandering, Earthquakes, *Plate tectonics, Earth rotation, Plates (Tectonics), Very long base interferometry.

A number of types of scientific information which can be expected from studies of present tectonic plate motions, distortions in seismic zones, polar motion, and changes in the Earth's rotation rate are described. Contributions which could be made by the Very Long Baseline Array through intensive observations after large earthquakes, and through regular monitoring during calibration periods, are emphasized.

712,626
PB87-106076 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Effect of Fluorine on Viscosities in the System Na2O-Al2O3-SiO2.
Final rept.
D. B. Dingwell, C. M. Scarfe, and D. J. Cronin. 1985, 8p
Sponsored by Alberta Univ., Edmonton. Dept. of Geology.
Pub. in American Mineralogist 70, n1-2 p80-87 1985.

Keywords: *Fluorine, *Viscosity, *Slags, Silicate minerals, Albite, Reprints, *Silicates, Jadeite, Nepheline.

The effect of fluorine on melt viscosities of five compositions in the system Na2O-Al2O3-SiO2 has been investigated at one atmosphere and 1000-1600 deg C by concentric-cylinder viscometry. The compositions chosen were albite, jadite and nepheline on the join NaAlO2-SiO2 and two others off the join at 75 mole percent SiO2, one peralkaline and one peraluminous. All melt viscosities were independent of shear rate over two orders of magnitude, indicating Newtonian behavior. All viscosity-temperature relationships were Arrhenian within error. Fluorine reduces the viscosities and activation energies of all melts investigated.

712,627
PB87-107116 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Theoretical Analysis of Chemical and Magnetic Ordering in the System Hematite-Ilmenite (Fe2O3-FeTiO3).
Final rept.
B. P. Burton. 1985, 9p
Pub. in American Mineralogist 70, n9-10 p1027-1035 1985.

Keywords: *Order disorder transformations, Phase diagrams, Phase transformations, Thermodynamic properties, Metaliferous minerals, Entropy, Enthalpy, Reprints, *Hematite, *Ilmenite, Magnetic ordering.

A theoretical model of equilibrium phase relations in the system Fe2O3 FeTiO3 is presented. This model is based on the single prism approximation in the cluster variation method and includes both chemical and magnetic contributions to the free energy of mixing. The inclusion of a magnetic degree of freedom, and magnetic interaction parameters, leads to a more realistic treatment of the configurational entropy of mixing, and therefore, to improved estimates of the oxidation-reduction and cation-ordering contributions to the enthalpy of stabilization of FeTiO3 (relative to mechanical mixing of Fe2O3 and Ti2O3). Two tricritical points are predicted to occur in the Fe2O3 - FeTiO3 phase diagram: one at which an Fe-Ti order-disorder transition pierces the peak of a two-phase field; and a second at which the two phase field is intersected by an essentially antiferromagnetic transition. Below this latter point, the two-phase field is predicted to bulge out (towards Fe2O3) and it is argued that this feature should be useful in geothermometry.

712,628
PB87-118584 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Absolute Gravity: A Reconnaissance Tool for Studying Vertical Crustal Motions.
Final rept.
T. M. Niebauer, J. K. Hoskins, and J. E. Faller. 1986, 5p
Sponsored by Air Force Geophysics Lab., Hanscom AFB, MA., and Defense Mapping Agency, Washington, DC.
Pub. in Jnl. of Geophysical Research 91, nB9 p9145-9149, 10 Aug 86.

Keywords: *Gravimeters, *Tectonics, Portable equipment, Gravity, Reprints.

A major effort is under way to develop highly portable absolute gravimeters having an ultimate accuracy of 3-5 microGal, an accuracy which translates into a height sensitivity of several centimeters. The authors are just finishing the construction of six such units. Measurements at the Joint Institute for Laboratory Astrophysics with one of these new instruments agree well with the earlier measurements made in 1981 and 1982 with a previous generation instrument. Recent measurements at the International Bureau of Weights and Measures in Sevres, France, as a part of an international intercomparison of absolute gravimeters, also show good agreement with the other instruments.

712,629
PB87-134219 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Densely Spaced Array of Sea Level Monitors for the Detection of Vertical Crustal Deformation in the Shumagin Seismic Gap, Alaska.
Final rept.
J. Beavan, K. Hurst, R. Bilham, and L. Shengold. 1986, 14p
Pub. in Jnl. of Geophysical Research 91, nB9 p9067-9080, 10 Aug 86.

Keywords: *Earthquakes, *Shumagin Island, Monitoring, Earth crust, Motion, Sea level, Pressure gages, Deformation, Alaska, Reprints, Tiltmeters.

The authors have installed a network of sea level gauges with approximately 40 km spacing in the Shumagin Islands in order to detect relative vertical motion, in particular, possible crustal motion precursory to an expected major earthquake. This required the development and deployment of a pressure sensor sea level gauge suitable for installation on remote and harsh coastlines. Data are collected in near-real-time via satellite, both in order to exploit fully any precursors that may be observed and to provide continuous information on the status of the instruments. Using Wiener filtering techniques, the authors have determined conservatively that no relative vertical crustal motion greater than 0.1 m between stations has occurred during 1981-1985. A short-baseline tiltmeter operating in a tunnel has demonstrated that suitably designed and located land-based tiltmeters have a lower noise level, and hence better precursor detection characteristics than the sea level gauges, at monthly and shorter periods.

712,630
PB87-135018 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Hydrostatic Levels in Precision Geodesy and Crustal Deformation Measurement.
Final rept.
K. Hurst, and R. Bilham. 1986, 15p
Grant NSF-EAR81-16369
Sponsored by National Science Foundation, Washington, DC., and National Geodetic Survey, Rockville, MD.
Pub. in Jnl. of Geophysical Research 91, nB9 p9202-9216, 10 Aug 86.

Keywords: *Geodesy, Precision, Reprints, *Hydrostatic leveling.

Previous attempts to apply the principles of hydrostatic leveling to precision geodesy have been limited by the uniformity of the fluid density attainable in field environments. This is largely due to the effects of temperature variations in the fluid tube. The authors have overcome this difficulty by using water maintained near its maximum density at 3.98 C inside a counterflow heat exchanger to limit the variations in density to less than 1 ppm. They have demonstrated the feasibility of this method with a 14-m prototype level and have used a computer model of the system to demonstrate the theoretical performance of instruments up to 1 km long. It appears possible, for example, to construct a fluid tube 200 m long, 12.5 cm in diameter, and weighing 3.8 kg/m that would provide uniform density to < 1 ppm in field environments between -40 and 50 C. In their attempt to use the 14-m prototype pressure-transfer level they were unable to exploit the density stability that they had achieved due to inadequacies in available pressure gauges.

712,631
PB87-157160 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Fracture Mechanics and Non-Destructive Evaluation Investigation of the Subcritical-Fracture Process in Rock.
Final rept.,
P. L. Swanson. 1986, 19p
Pub. in Fracture Mechanics of Ceramics 8, p299-317 1986.

Keywords: *Cracking(Fracturing), *Rocks, Nondestructive tests, Fracture properties, Reprints, *Rock fracture.

Results of subcritical-fracture experiments performed in air on five different rock types are presented. A nonunique relationship between calculated stress-intensity factor and crack velocity suggests violations of the assumptions made when using conventional fracture testing techniques. To obtain a better understanding of fracture propagation in rock without regard to single-parameter characterizations of the fracture process several non-destructive testing techniques were employed in conjunction with subcritical crack-growth experiments on Westerly granite. The size and shape of the fracture process zone is estimated from (1) 2-dimensional surface-deformation maps obtained using holographic interferometry, (2) the location of acoustic-emission events, and (3) the spatial distribution of ultrasonic-wave attenuation. By focusing attention in the areas shown to be of importance in the NDT experiments, in-situ microscope observations are used to identify several micromechanisms of fracture.

712,632
PB87-218301 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Theoretical Analysis of Cation Ordering in Binary Rhombohedral Carbonate Systems.
Final rept.,
B. P. Burton. 1987, 8p
Pub. in American Mineralogist 72, p329-336 1987.

Keywords: *Carbonate minerals, *Calcite, *Dolomite(Mineral), Thermodynamics, Trigonal lattices, Clustering, Cations, Reprints.

A three-parameter version of the tetrahedron approximation in the cluster-variation method is used to model cation ordering in rhombohedral carbonate systems. The model is sufficient to calculate theoretical phase diagrams that are in complete qualitative agreement with high-temperature phase-equilibrium data and with experimental composition and temperature dependence of the excess heats that are associated with cation ordering. In addition, the many-body interaction parameters that are required to obtain appropriate phase-diagram topologies at high temperature lead to the prediction of an ordered ground-state with stoichiometry Ca3Mg(CO3). Cation ordering in this 3:1 phase yields a trigonally distorted analogue of the Cu3Au or Al3Ti structure.

712,633
PB87-224085 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Liquid-Supported Torsion Balance as Gradiometer.
Final rept.,
P. T. Keyser, and J. E. Faller. 1987, 23p
Pub. in Proceedings of Gravity Gradiometer Conference (14th), Colorado Springs, CO, February 11-12, 1986.

Keywords: Variometers, Sensitivity, *Gradiometers, *Gravity gradiometers, Torsion balances.

The authors use a liquid-supported torsion balance as a fixed-site long-term curvature variometer. The traditional torsion fiber is replaced by liquid support and electrostatic positioning. Thus the torsion constant is adjustable by varying the voltage applied to the torque electrodes, while the centering voltage remains constant. The sensitivity of this type of gradiometer is discussed, along with critical parameters for success. Preliminary data is presented.

712,634
PB87-224093 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Results of the International Comparison of Absolute Gravimeters in Sevres (2nd), 1985.
Final rept.,
Y. Boulanger, J. Faller, and E. Groten. 1986, 15p
Pub. in Bureau Gravimetrique International, n59 p89-103 1986.

Keywords: *Gravimeters, Gravity, Comparison, Reprints.

The results of the second international comparison of absolute gravimeters in Sevres 1985 are discussed.

Hydrology & Limnology

712,635
FIPS PUB 103 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
Codes for the Identification of Hydrologic Units in the United States and the Caribbean Outlying Areas. Category: Data Standards and Guidelines. Subcategory: Representations and Codes; Earth Science Series.
Federal information processing standards (Final).
R. G. Saltman. 15 Nov 83, 129p
Three ring vinyl binder also available, North American Continent price $6.25; all others write for quote.

Keywords: *Hydrology, *Coding, *River basins, *Standards, *Information, Water resources, *Geographic codes, Federal information processing standards.

This standard adopts the set of codes used to identify hydrologic units published in Geological Survey Circular 878-A. These codes identify a hydrologic system that divides the United States and Caribbean outlying areas into 21 major regions. These regions are further subdivided into approximately 2150 units that delineate river basins having drainage areas usually greater than 700 square miles. The codes provide a standardized base for use by water-resources organizations. FIPS 103 was developed by the U.S. Geological Survey, U.S. Department of the Interior, for use in automated earth-science systems, and was adopted as a result of a Memorandum of Understanding signed in February 1980 between the National Bureau of Standards and the Geological Survey.

712,636
PB85-142594 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Vertical Temperature Distribution in Lakes.
Final rept.
R. D. Noble, N. J. Kemp, and R. G. Buschman. 1985, 13p
Pub. in Jnl. of Environmental Systems 14, n1 p63-75 1984-85.

Keywords: *Temperature distribution, *Lakes, Mathematical models, Water flow, Heat transfer, Adsorption, Radiation, Reprints.

Analytical solutions are presented for the vertical temperature distribution in lakes. The solutions are good for large water bodies where inflows and outflows are negligible. The solution is based on a linearization of the surface heat exchange term. Solutions are presented for both zero-order and first order linearizations. An analytical expression is used to describe the actual daily absorbed radiation at the air-water interface. The model contains no adjustable parameters. A comparison of model results with experimental data is presented.

Mineral Industries

712,637
PATENT-4 618 410 Not available NTIS
Department of Commerce, Washington, DC.
Shale Oil Dearsenation Process.
Patent.
F. E. Brinckman, T. F. Degnan, and C. S. Weiss.
Filed 4 Nov 85, patented 21 Oct 86, 5p PB87-113676, PAT-APPL-6-794 590
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Patents, *Shale oils, Coking, *Dearsenation process, PAT-CL-208-97.

An improved process for shale oil dearsenation comprises coking a retorted shale oil stream following by contacting the liquid coker product with water. Water washing is preferably carried out under ambient conditions to achieve a reduction to less than 3 ppm w soluble arsenic.

712,638
PB-272 700/6 PC **A10**/MF **A01**
Charles River Associates, Inc., Cambridge, MA.
Commodity Supply Policies.
Final rept.
Aug 77, 211p NBS-GCR-ETIP-77-38
Contract NGS-6-35783

Keywords: *Mineral economics, *Commodity management, *Resource conservation, *Meetings, Metal industry, Supply(Economics), Fossil fuels, Aluminum industry, Chromium, Manganese, Crude oil, Stockpiling, Government policies, National government, Bauxite, International trade, Supply(Economics), Demand(Economics), Chromite ore deposits, Cobalt, Copper, Platinum, Palladium, Taxes, Forecasting, Systems analysis, Contingency planning, Chromium industry, Manganese industry.

The general objectives of the conference were to acquaint private industry, academia, and government with the analytical framework and policy implications of a study on the policy implications of producer country supply interruptions. In workshops, participants discussed the nontechnological policy options such as tariffs and stockpiles, and assessed their merits relative to technological policy options in four of the markets considered: aluminum, chromium, energy and manganese. The study found that contingency risks from supply cutoffs by producer countries are concentrated in a few markets, notably, chromite, cobalt, platinum/palladium, and possibly manganese. Of the nontechnological policies considered, moderate contingency stockpiling -- on the order of one to twelve months of consumption, varying with the specific market -- was recommended as the most effective insurance against impacts of potential supply disruptions.

712,639
PB-273 090/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Noise Spectrum Measurement System Using the Fast Fourier Transform.
Final rept.,
W. D. Bensema. 1977, 7p
Contract H0111019
Pub. in IEEE Transactions on Electro-Magnetic Compatibility EMC-19, n2 p37-43 May 77.

Keywords: *Radiation measuring instruments, *Electromagnetic noise, *Spectrum analyzers, Portable equipment, Magnetic fields, Fourier analysis, Three dimensional display systems, Spectral energy distribution, Fast fourier transforms, Reprints.

A portable, multichannel battery-operated measurement system was developed to measure the rms magnetic-field noise spectrum in the frequency range from 100 Hz to 375 kHz. During each measurement, the entire spectrum is measured simultaneously through the use of time-domain recordings which are later analyzed by Fast Fourier Transform (FFT) processing. Dynamic ranges of 60 dB in a 125 Hz bandwidth are obtained for spectra covering the range from 100 Hz to 100 kHz. The method also allows a three-dimensional display of the way spectrum occupancy changes with time. Some advantages of the system are portability, rms measurement, 100% probability of signal intercept, data gathering times measured in seconds or milliseconds, simultaneous coverage of several decades of frequency, no 'picket fence' amplitude uncertainty with the associated potential 3 dB error, and increased frequency measurement resolution. Some examples of electromagnetic noise (measured in and above coal mines) are given, primarily to show the capability of the measuring system.

712,640
PB-273 092/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Amplitude, Time, and Frequency Statistics of Quasi-Impulsive Noise.
Final rept.,
W. D. Bensema. 1977, 6p
Contract H0111019
Pub. in Proceedings 1977 EMC Symposium, Montreux (Switzerland), June 18-30, 1977, p347-352 1977.

Keywords: *Electromagnetic noise, Coal mines, Spectrum analysis, Electromagnetic spectrum, Fourier analysis, Spectral energy distribution, Portable equipment, Radiation measuring instruments, Magnetic fields, Fast fourier transforms.

A portable, multichannel battery-operated measurement system was developed to measure the rms magnetic-field noise spectrum in the frequency range from 100 Hz to 375 kHz. During each measurement, the entire spectrum is measured simultaneously through the use of time-domain recordings which are later analyzed by Fast Fourier Transform (FFT) processing. Dynamic ranges of 60 dB in a 125 Hz bandwidth are obtained for spectra covering the range from 100 Hz to 100 kHz. The method also allows a three-dimensional display of the way spectrum occupancy changes with time. Some advantages of the system are portability, rms measurement, 100% probability of signal intercept, data gathering times measured in seconds or milliseconds, simultaneous coverage of several decades of frequency, no 'picket fence' amplitude uncertainty with the associated potential 3 dB error, and increased frequency measurement resolution. Some examples of electromagnetic noise (measured in and above coal mines) are given, primarily to show the capability of the measuring system.

712,641
PB-279 218/2 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of Developmental Automation and Control Technology.
Interface Standards for Automated Coal Mining Equipment.
Final rept.,
B. M. Smith, R. W. Markley, L. Costrell, G. E. Clark, I. W. Cotton, and J. M. Bakshi. Jul 77, 80p NBSIR-77-1301
Sponsored in part by Bureau of Mines, Pittsburgh, Pa. Pittsburgh Mining and Safety Research Center.

Keywords: *Mining equipment, *Automatic control equipment, Interfaces, Automation, Coal mining, Standards, Systems engineering, Automatic control, Computers, Microcomputers, Computer applications, Automated extraction system, Continuous miners.

The report describes interface standards applicable to the use of computer control systems with automated mining equipment. The report identifies, analyzes, and recommends interface standards applicable to the modular control system of an Automated Extraction System (AES) being built by the US Bureau of Mines (USBM). The work serves both as a technical guide and as a summary of existing and forthcoming standards applicable to computer control systems. Since the system configuration of the AES control system has not yet been defined, this report uses several alternative architectures to illustrate various interfaces that may be encountered. The benefits and limitations of the formal and de facto standards which apply to these interfaces are then discussed. In this context, standards are recommended for the supervisory computer - local control computer interfaces and the local control computer - sensor and actuator interfaces. The best use of these standards and important trade-offs are identified and explained.

712,642
PB-288 107/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electromagnetic Technique of Measuring Coal Layer Thickness.
Final rept.,
D. A. Ellerbruch, and D. R. Belsher. Apr 78, 8p
Contract J0155124
Pub. in IEEE Transactions on Geoscience Electronics, GE16 n2 p126-133 Apr 78.

Keywords: *Coal deposits, *Thickness gages, Microwave equipment, Dielectric properties, Electromagnetic testing, Thickness, Dimensional measurement, Reprints.

An FM-CW microwave system was investigated for measuring coal layer thickness. Measurements were made in three different mines near Pittsburgh, Pennsylvania, near Fairview, West Virginia, and Coffeen, Illinois. Microwave frequencies in the range 1-2 GHz were used to measure samples up to 55 cm thick. All samples were backed with a naturally occurring shale. Measurements were also made on coal and shale samples compounded in the laboratory at the Bureau of Mines Pittsburgh Mining and Safety Research Center near Bruceton, Pennsylvania. The results indicate that layer thickness can be determined in most cases, although large anomalies may, in some cases, produce misleading results. Many anomalies that were detected with the FM-CW system were verified visually by drilling into the coal layer. The dielectric constant of coal apparently varies significantly within a coal seam. It appears that this technique has the potential of measuring changes in the dielectric constant of a coal seam and providing an output that can be used for real-time corrections in layer thickness measurement.

712,643
PB-289 730/4 PC **A21**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.
Proceedings of Workshop on Asbestos: Definitions and Measurement Methods.
C. C. Gravatt, P. D. LaFleur, and K. F. J. Heinrich.
Nov 78, 494p NBS-SP-506
Held at National Bureau of Standards, Gaithersburg, Maryland on July 18-20, 1977. Library of Congress Catalog Card no. 78-600109. Sponsored in part by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Asbestos, *Meetings, Chemical properties, Physical properties, Public health, Chemical analysis, Regulations, Mineralogy, Environmental surveys.

This document contains invited papers which were given at a workshop on 'Asbestos: Definitions and Measurement Methods' which was jointly sponsored by the National Bureau of Standards of the U. S. Department of Commerce and the Occupational Safety and Health Administration of the U. S. Department of Labor. The discussion portions of the Workshop also have been included as has written material appropriate to the topics under consideration which was submitted to the editors at a later date. The Workshop covered four major topics: Mineralogical Aspects, the Relationship Between Chemical and Physical Properties and Health Effects, Analytical Methods, and Regulatory Positions and Criteria. Also included in these Proceedings is a summary of each of these topics. These summaries serve to define those factors for which there was general agreement at the Workshop, identify remaining points of controversy, and, in some cases, describe additional research required to resolve remaining problems.

712,644
PB-291 366/3 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Fluid Engineering Div.
Low Velocity Performance of a Bronze Bearing Vane Anemometer.
Task rept. for 1 Dec 76-28 Feb 77.
L. P. Purtell. Feb 78, 27p NBSIR-78-1433
Contract H0166198

Keywords: *Mine ventilation, *Anemometers, Air flow, Flow measurement, Sleeve bearings, Measuring instruments, Calibration, Low velocity, Bronze bearings.

Performance of a bronze bearing vane anemometer is evaluated over the speed range of 64 to 690 feet per minute including starting speed and stopping speed. The tests were performed in the NBS Low Velocity Airflow Facility which provides a uniform flow of low turbulence and uses a laser velocimeter as the velocity standard. The rotary vane anemometer tested for this report is a commercially available instrument used in the mining industry and elsewhere as a portable anemometer. It was supplied for test by the U.S. Mining Enforcement and Safety Administration (MESA) at the request of the U.S. Bureau of Mines.

712,645
PB-291 409/1 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Fluid Engineering Div.
Low Velocity Performance of a High Speed Vane Anemometer.
Rept. for 1 Jun-31 Jul 77.
L. P. Purtell. Sep 78, 24p NBSIR-78-1545
Contract H0166198

Keywords: *Mine ventilation, *Anemometers, Air flow, Flow measurement, Ball bearings, Vanes, Measuring instruments, Calibration, Low velocity.

Performance of a high speed vane anemometer is evaluated over the speed range of 43.4 to 741 feet per minute including starting speed and stopping speed. The tests were performed in the NBS Low Velocity Airflow Facility which provides a uniform flow of low turbulence and uses a laser velocimeter as the velocity standard. The rotary vane anemometer tested for this report is a commercially available instrument used in the mining industry and elsewhere as a portable anemometer. It was supplied for test by the U.S. Mining Enforcement and Safety Administration (MESA) at the request of the U.S. Bureau of Mines.

712,646
PB-291 410/9 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Fluid Engineering Div.
Low Velocity Performance of a Jewel Bearing Vane Anemometer.
Rept. for 1 Apr-31 May 77.
L. P. Purtell. Sep 78, 22p NBSIR-78-1524
Contract H0166098

Keywords: *Mine ventilation, *Anemometers, Air flow, Flow measurement, Jewel bearings, Measuring instruments, Calibration, Low velocity.

Performance of a jewel bearing vane anemometer is evaluated over the speed range of 60.6 to 752 feet per minute including starting and stopping speed. The tests were performed in the NBS Low Velocity Airflow Facility which provides a uniform flow of low turbulence and uses a laser velocimeter as the velocity

standard. The rotary vane anemometer tested for this report is a commercially available instrument used in the mining industry and elsewhere as a portable anemometer. It was supplied for test by the U.S. Mining Enforcement and Safety Administration (MESA) at the request of the U.S. Bureau of Mines.

712,647
PB-300 713-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion Phenomena and Newly Formed Minerals during the Interaction of Chalcopyrite with Iron Sulfides at 250-600C(Diffuzionnye Yavleniya i Novoo'razovanie Mineralov pri Vzaimodeistoii Khal'kopirita s Sul'fidami Zheleza v Oblasti Temperatur 250-600C).
M. S. Sakharova, N. A. Kalitkina, G. R. Kolonin, Y. G. Lavrent'ev, and L. N. Pospelova. 1979, 18p DMDC-17020, TT-79-58080
Trans. of Geologiya Rudnykh Mestorozhdenii (USSR) v14 n2 p101-109 1972. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Chalcopyrite, *Diffusion, *Iron sulfides, Copper, Sulfide minerals, Interactions, Translations.

Results of experiments of heating sulfide aggregates, containing chalcopyrite, pyrrhotite, pyrite, and arsenopyrite in ampules under temperatures of 250-600C, are discussed. Under these conditions, mutual diffusion of copper and iron takes place along the contact zone between chalcopyrite and sulfides of iron, which favours the formation of new mineral phases, the composition of which depends on diffusion. Also, the changes in the chalcopyrite itself have been studied; these changes accompany the interaction of chalcopyrite with the iron sulfides. According to the published and practical data of the present investigation, a conclusion could be made about the possibility of interaction of natural sulfide ores in the solid phase with the participation of copper under comparatively low temperatures (lower than 300C).

712,648
PB80-117864 Not available NTIS
National Bureau of Standards, Washington, DC.
Compressive, Tensile, Pipe-Bonding Strengths, and Permeability of Selected Cementing-Materials for Hot-Dry-Rock Wells.
Final rept.,
R. F. Krause, and E. R. Fuller. 1978, 9p
Pub. in Cementing of Geothermal Wells, Jul-Sep 1978, BNL 50943 UC-66c (Geothermal Energy, Drilling Technology, TID-4500), p139-147, Progress rept. no. 10. (Brookhaven National Lab., Upton, NY).

Keywords: *Wells, *Geothermy, *Bonding strength, Cementing, Tensile strength, Compressive strength, Permeability, *Hot-dry-rock systems.

Compressive and tensile strength data for five cementing-materials, which are candidates for cementing hot-dry-rock wells, were obtained after 40 and 176 hour exposure to water in an autoclave at 195 C (383 F) and 21 MPa (3000 psi). Additional tests will be conducted after extended exposure of four and eight weeks to similar conditions; these exposures are presently two weeks underway. In addition, an apparatus is under construction, and specimens are being prepared, to measure at ambient laboratory conditions the shear bond strength of the interface between a cementing-materials and a steel rod, and the permeability to water of a cementing-materials. The authors also plan to investigate the effect that thermal cycling between autoclave conditions and ambient laboratory conditions will have on these properties.

712,649
PB80-219785 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Testing Geothermal-Well Cements: Strength Measurements Following Hydrothermal Exposures.
Interim rept.,
R. F. Krause, and E. R. Fuller. Jul 80, 14p NBSIR-80-2099-1
Contract DOE-FA-77-A-01-6010

Keywords: *Geothermal prospecting, *Well casings, *Cements, Compressive strength, Tensile strength, Shear properties, High temperature tests, *Hot rock systems, *Geothermal wells.

Laboratory data were obtained for the compressive and tensile strength of some candidate cements for geothermal wells after they were exposed to water at a temperature of 195C and a pressure of 17 to 21 MPa for various periods. Some of these cements were being considered for use in the remedial cementing of a hot-dry-rock well at Los Alamos Scientific Laboratory. The shear-bond strength to steel of the prime candidate for this remedial cementing was also examined. The methods used are preliminary to a standard property verification program, now being developed at the National Bureau of Standards.

712,650
PB80-219793 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Testing Geothermal-Well Cements: High Temperature, High Pressure, and Fluid Handling Facility.
Interim rept.,
R. F. Krause, and E. R. Fuller. Jul 80, 13p NBSIR-80-2099-3
Contract DOE-FA-77-A-01-6010

Keywords: *Geothermal prospecting, *Well casings, *Cements, Pressure vessels, Compressive strength, Tensile strength, Shear properties, High temperature tests, *Hot dry rock systems, *Geothermal wells.

Construction of a high temperature, high pressure, and fluid handling facility, which includes four pressure vessels of Hastelloy alloy C, has been completed. The facility allows set cements to be exposed to simulated geothermal fluids at pressures up to 60 MPa (8700 psi) and at temperatures up to 400C. Two of these pressure vessels are equipped for measuring either the shear-bond strength of the cement-steel interface or the cement permeability to water at elevated temperatures and pressures. In addition, there is a fifth pressure vessel of stainless steel 316 which can be used for set-curing cements in molds under water at pressures up to 21 MPa (3000 psi) and at temperatures up to 340C.

712,651
PB80-219801 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Testing Geothermal-Well Cements: Standard Practice.
Interim rept.,
R. F. Krause, and E. R. Fuller. Jul 80, 24p NBSIR-80-2099-2
Contract DOE-FA-77-A-01-6010

Keywords: *Geothermal prospecting, *Well casings, *Cements, Compressive strength, Tensile strength, Shear properties, High temperature tests, *Hot dry rock systems, *Geothermal wells.

The National Bureau of Standards is under contract with the U.S. Department of Energy to verify certain properties of cementing materials which are submitted as candidates for use in the finishing operations of geothermal wells. Specimens will be set-cured in molds under water for two days at elevated temperature and pressure. Subsequently, specimens will be exposed demolded to light and heavy simulated geothermal fluids for periods of one week or one month. Following each of these treatments, the following properties will be measured at room temperature and pressure: compressive strength, splitting tensile strength, shear-bond strength of the cement-steel interface, and cement permeability to water. Upon the basis of this survey of properties at room temperature, a priority of cementing materials will be established for further testing of select physical properties while the specimens are at elevated temperature and pressure.

712,652
PB80-224843 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Explosion Containment for Underground Coal Mine Equipment: A Bibliography.
Interim rept.,
C. A. Wan, and E. Braun. Aug 80, 32p NBSIR-80-2112
Sponsored in part by Bureau of Mines, Pittsburgh, PA. and Mine Safety and Health Administration, Triadelphia, WV.

Keywords: *Coal mines, *Explosion proofing, *Bibliographies, Mining equipment, Electric equipment, Enclosures, Safety devices, Fire safety, *Mine safety.

This is a bibliography of publications concerning explosion-proof enclosures with the emphasis on underground coal mine applications. A survey of the literature primarily in English speaking countries through 1974 is compiled. The compilation includes over 200 citations. An author and key word index is included for cross reference.

712,653
PB81-116261 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of a New Raman Microprobe Spectrometer to Nondestructive Analysis of Sulfate and Other Ions in Individual Phases in Fluid Inclusions in Minerals.
G. J. Rosasco, and E. Roedder. 1979, 9p
Pub. in Geochimica et Cosmochimica Acta 43, p1907-1915 1979.

Keywords: *Raman spectroscopy, *Chemical analysis, *Minerals, *Microanalysis, Performance evaluation, Samples, Calibrating, Ores, Reprints, Laser induced fluorescence.

Rosasco et al. reported the first successful application of laser-excited Raman spectroscopy for the identification and nondestructive partial analysis of individual solid, liquid, and gaseous phases in selected fluid inclusions. The authors report here the results of the application of a new instrument, based on backscattering, that eliminates many of the previous stringent sample limitations and hence greatly expands the range of applicability of Raman spectroscopy to fluid inclusions. Fluid inclusions in many prophyry copper deposits contain 5-10 micrmeter 'daugther' crystals thought to be anhydrite but too small for identification by the previous Raman technique. Using the new instrument, they have verified that such daughter crystals in quartz from Bingham, UT, are anhydrite. They may form by leakage of hydrogen causing internal autooxidation of sulfide ion. Daughter crystals were also examined in apatite (Durango, Mexico) and emerald (Muzo, Columbia). Valid analyses of sulfur species in solution in small fluid inclusions from ore deposits would be valuable, but are generallyimpossible by conventional methods. They present a calibration procedure for analyses for SO4 = in such inclusions from Bingham, UT (12,000 + or - 4000 ppm) and Creede, CO (probably <500 ppm). A fetid Brazilian quartz, originally thought to contain liquid H2S, is shown to contain only HS(-) in major amounts.

712,654
PB81-119836 Not available NTIS
National Bureau of Standards, Washington, DC.
Raman Microprobe Spectra of Individual Microcrystals and Fibers of Talc, Tremolite, and Related Silicate Minerals.
Final rept.
J. J. Blaha, and G. J. Rosasco. Jun 78, 5p
Pub. in Analytical Chemistry 50, n7 p892-896 Jun 78.

Keywords: *Raman spectra, *Silicate minerals, Talc, Crystals, Reprints, *Microprobe analysis, Tremolite, Anthophyllite, Actinolite.

With a recently developed Raman microprobe, vibrational spectra have been obtained from individual microcrystals and fibers of sheet and chain silicate minerals. Species such as talc, tremolite, low-iron anthophyllite, and actinolite give distinct spectra. No systematic differences exist between spectra of the fibrous and nonfibrous forms of a given mineral.

712,655
PB81-119869 Not available NTIS
National Bureau of Standards, Washington, DC.
Raman Microprobe Spectra and Vibrational Mode Assignments of Talc.
G. J. Rosasco, and J. J. Blaha. 1980, 5p
Pub. in Applied Spectroscopy 34, n2 p140-144 1980.

Keywords: *Raman spectra, *Talc, Silicate minerals, Molecular vibrations, Dipole moments, Reprints, *Microprobe analysis.

The Raman spectra of talc microparticles have been obtained with the Raman microprobe over the frequency range 100 to 3800/cm. The vibrational modes are discussed in terms of an idealized unit cell (1-M polymorph of C(2h) symmetry). An electrostatic dipole-dipole interaction is used to compare the Raman and infrared active branches. Assignments of the Raman active stretching modes of the silicate sheet are found to support previous infrared assignments. Estimates of intrasheet dipole-dipole interactions are obtained.

712,656
PB81-172496 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Evaluation of Alternate Mounting Methods for the Evaluation of Brattice Cloth on ASTM E-162.
Final rept.
E. Braun, and R. Reyes-Virella. Jan 81, 28p NBSIR-81-2200
Sponsored in part by Bureau of Mines, Pittsburgh, PA., and Mine Safety and Health Adminstration, Triadelphia, WV.

Keywords: *Coal mines, *Mine ventilation, *Barriers, Mountings, Flame propagation, Mine fires, Fire resistant materials, Fire tests, *Brattice cloth, *Mine safety.

Twenty-two brattice cloth samples representing a cross-section of materials available to the coal mining industry were tested using ASTM E-162, Surface Flammability of Materials Using a Radiant Heat Energy Source. The tests were conducted to evaluate alternative mounting methods that would improve test repeatability. Five mounting methods were studied. The study showed that the flame spread index was dependent on the mounting methods. The foil/spacer/backing method produced the highest values, while the backing only method produced the lowest values. However, measurement dispersion was unaffected by mounting method.

712,657
PB81-214884 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Analysis of Fire Data, Large-Scale Tests, and Small-Scale Tests for Conveyor Belts Used in Underground Coal Mines.
Final rept.
E. Braun, R. E. Meade, and L. R. Smith. May 81, 106p NBSIR-81-2256
Sponsored in part by Bureau of Mines, Pittsburgh, PA. and Mine Safety and Health Administration, Triadelphia, WV.

Keywords: *Underground mining, *Coal mines, *Belt conveyors, *Fire safety, Mine haulage, Flame propagation, Mine fires, Fire tests, *Fire Spread, *Mine safety.

An investigation into the requirements and fire test performance of conveyor belts intended for use in underground coal mines was conduted. The aim of this study was to develop recommendations for the Mine Safety and Health Administration (MSHA) on a test method suitable for measuring the fire hazard potential of a conveyor belt in a coal mine environment. A review of incident data, large-scale tests, and small-scale tests was conducted to provide the necessary information. The incident data was analyzed with the goal of developing scenarios that could form the basis for a suitable test to evaluate the appropiateness of the existing test. Large-scale tests were reviewed to determine anticipated belt fire performance under 'realistic' end-use conditions. The tests showed how geometry, input energy, and ventilation controlled belt fire performance. Small-scale tests were used to provide information on specific fire properties such as ease of ignition, flame spread, and smoke generating potential.

712,658
PB81-227878 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Review of Fire Test Methods and Incident Data for Portable Electric Cables in Underground Coal Mines.
Final rept.
E. Braun. Jun 81, 23p NBSIR-81-2292
Sponsored in part by Bureau of Mines, Pittsburgh, PA., and Mine Safety and Health Administration, Trialdelphia, WV.

Keywords: *Fire tests, Coal mines, Transmission lines, Portable equipment, Power lines, Electric cables.

Electrically powered underground coal mining machinery is connected to a load center or distribution box by electric cables. The connecting cables used on mobile machines are required to meet fire performance requirements defined in the Code of Federal Regulations. This report reviews Mine Safety and Health Administration's (MSHA) current test method and compares it to British practices. Incident data for fires caused by trailing cable failures and splice failures were also reviewed. It was found that the MSHA test method is more severe than the British but that neither evaluated grouped cable fire performance. The incident data indicated that the grouped configuration of cables on a reel accounted for a majority of the fires since 1970.

712,659
PB81-238511 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
MSHA Wick Test for Hydraulic Fluids: A Preliminary Evaluation.
Final rept.
J. J. Loftus. Jul 81, 29p NBSIR-81-2312
Sponsored in part by Mine Safety and Health Administration, Trialdelphia, WV., and Bureau of Mines, Pittsburgh, PA.

Keywords: *Coal mines, *Hydraulic fluids, *Fire tests, Flammability testing, Reproducibility, Test equipment, Wick tests.

This report is an evaluation and analysis of 'The Test to Determine the Effect of Evaporation on the Flammability of Hydraulic Fluids (Wick Test).' The Wick Test is used by the Mine Safety and Health Administration (MSHA) to qualify hydraulic fluids for use in underground coal mines. This report includes a review of the test method's operating characteristics as well as a comparison of test results from the Wick Test with two alternative test procedures--a hot wire coil test and a substained flame contact test. The evaluation program included currently used fluids such as invert emulsions, synthetics, and water glycols. The Wick Test studies showed that the test method was not well defined and that reproducibility was poor.

712,660
PB82-142217 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Assessment of Three Different Fire Resistance Tests for Hydraulic Fluids.
Final rept.
J. J. Loftus. Oct 81, 54p NBSIR-81-2395
Sponsored in part by Bureau of Mines, Pittsburgh, PA, and Mine Safety and Health Administration, Triadelphia WV.

Keywords: *Mining equipment, *Hydraulic fluids, *Fire tests, Coal mines, Fire resistance, Flammability testing, Ignition temperature, Ignition time, *Mine safety, Ignition temperature tests, Spray ignition tests, Wick tests.

The Center for Fire Research (CFR) at the National Bureau of Standards (NBS) at the request of the Mine Safety and Health Administration (MSHA) and the Bureau of Mines (BOM) made an evaluation or assessment of the three different flammability tests used by MSHA for measuring the fire resistance of hydraulic fluids intended for use in underground coal mining operations. The methods described in the Code of Federal Regulations Schedule 30, Part 35, consist of the following: an Autogenous Ignition Temperature Test, a Temperature-Pressure Spray Ignition Test, and a Test to Determine the Effect of Evaporation on the Flammability of Hydraulic Fluids. This report summarizes the various studies conducted in the evaluation and provides recommendations for improvement of the three test procedures.

712,661
PB82-212077 Not available NTIS
National Bureau of Standards, Washington, DC.
SPT Hammer Energy Measurement.
Final rept.
W. D. Kovacs, and L. A. Salomone. Apr 82, 22p
Pub. in American Society of Civil Engineers Jnl. Geotech. Eng. Div. 108, nGT4, p599-620 Apr 82.

Keywords: *Percussion drilling rigs, *Energy transfer, Field tests, Penetration tests, Kinetic energy, Reprints.

A field measurement system and procedure which measures the energy delivered by a drill rig system was developed and successfully used to study the factors which affect delivered energy. Results are presented which indicate that the energy delivered by certain drill rig systems varies widely in engineering practice. The energy delivered to the drill stem varied with the number of turns of rope around the cathead, the fall height, drill rig type hammer type, and operator characteristics. The type of hammer had a strong influence on the energy transfer mechanism between the anvil and the drill stem. It appears that the safety (sleeve enclosed) hammer is more efficient in transmitting the available kinetic energy through the anvil to the drill stem than the donut hammer.

712,662
PB83-145581 Not available NTIS
National Bureau of Standards, Washington, DC.
Durability of Various Cements in a Well of the Cerro Prieto Geothermal Field.
Final rept.
R. F. Krause, and L. E. Kukacka. 1982, 9p
Prepared in cooperation with Brookhaven National Lab., Upton, NY. Sponsored in part by Department of Energy, Washington, DC. Div. of Geothermal Energy. Pub. in Proceedings of Geothermal Engineering and Materials (GEM) Program Conference, Sheraton Airport Inn, San Diego, CA., October 6-8, 1982, p97-105 1982.

Keywords: *Geothermy, *Well completion, *Cementing, Cements, Compressive properties, Permeability, *Geothermal fields.

The durability of each of 16 different cements was evaluated by both room temperature compressive strength and water permeability measurements, following various periods of treatment of the cements in flowing geothermal fluid of the Cerro Prieto field of Mexico. Some of these cements were selected through a Department of Energy program to develop improved cements for geothermal well completion while the others were contributed by several other institutions interested in the tests.

712,663
PB83-165001 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Improved Coal Interface Detector.
Final rept.
K. C. Roe, and R. C. Wittmann. May 82, 52p NBSIR-82-1663
Contract DE-ET-77-C-01-8881

Keywords: *Detectors, *Coal deposits, *Continuous wave radar, Coal mining, Interfaces, Shales, Frequency modulation, Electromagnetic radiation, Detection.

This report describes the theory, design, construction and testing of an electromagnetic coal interface detector. The purpose of this type detector is measuring the thickness of roof coal left during underground mining operations. An above ground test facility constructed to evaluate the coal interface detector is also described.

712,664
PB84-165877 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
Use of Hazard Pictorials/Symbols in the Minerals Industry.
Open file rept. 30 Jan 81-31 Jan 83 (Final).
B. L. Collins. Sep 83, 194p NBSIR-83-2732, BUMINE-OFR-44-84
Contract J01113020

Keywords: *Mining, *Safety engineering, *Symbols, Accident prevention, Hazards, Color codes, Responses, Human factors engineering, Guidelines, Handbooks, *Mine safety, *Mineral industries.

This report documents a multiphase research effort on the evaluation of the effectiveness of safety symbols and hazard pictorials for use in mining and milling operations. The first phase reviews applicable codes and standards, and documentation of typical mining hazards to determine relevant safety messages. In the second phase, visits were made to eight mine sites to document existing sign practice and common mining hazards. In the third phase, the effectiveness of 2 sets of symbols for 40 different safety messages was evaluated with 267 miners from 10 sites at disparate geographical locations. The evaluation included an assessment of the effectiveness of six different symbol surround shapes and colors. The most effective symbols depicted both the person and the hazard or protective gear; these were more representational than highly abstract. Based on this research, a set of 40 symbols are suggested for further graphic refinement, additional evaluation, and eventual use.

712,665
PB85-104123 PC **A04**/MF **A01**

National Bureau of Standards (NEL), Washington, DC. Center for Building Technology.
Field Evaluation of SPT (Standard Penetration Test) Energy, Equipment, and Methods in Japan Compared with the SPT in the United States.
W. D. Kovacs, and L. A. Salomone. Aug 84, 75p NBSIR-84/2910

Keywords: *Drilling, Penetration tests, Drilling rigs, Equipment, Production methods, Japan, Field tests, Energy consumption, Comparative evaluations.

Field energy measurements on Japanese drill rigs were made during the performance of the Standard Penetration Test to document the difference between Japanese and present U.S. Practice. A total of 78 Standard Penetration Tests were performed using 19 different testing conditions (equipment and operators). Over 2000 data points are reported.

712,666
PB85-128858 Not available NTIS
National Bureau of Standards, Washington, DC.
Control of Blowout Fires with Water Sprays.
Final rept.
D. D. Evans. 1984, 7p
Sponsored in part by Minerals Management Service, Reston, VA.
Pub. in Proceedings of Technology Assessment and Research Program for Offshore Minerals Operations, Reston, VA, March 28-29, 1984, p89-95.

Keywords: Blowouts, Fires, Fire extinguishing agents, Fire fighting, *Fire protection, Fire safety, *Hydrocarbons, Offshore drilling, Offshore structures, Water, Spraying.

An overview of the fire suppression research studies directed at understanding the effects of water spray on hydrocarbon fires is presented. Fire protection system design concepts for the protection of offshore oil and gas platforms in the event of a blowout fire are discussed.

712,667
PB85-128866 Not available NTIS
National Bureau of Standards, Washington, DC.
Dielectric Measurements of Oil Shale as Functions of Temperature and Frequency.
Final rept.
R. L. Jesch, and R. H. McLaughlin. Jan 83, 7p
Sponsored in part by Department of Energy, Laramie, WY. Laramie Energy Technology Center.
Pub. in Institute of Electrical and Electronics Engineers Transactions on Geoscience and Remote Sensing GE-22, n2 p99-105 Mar 84.

Keywords: *Oil shale, *Dielectric properties, Measurement, Samples, Holders, Temperature, Frequencies, Electromagnetic properties, Reprints.

A high-temperature sample holder designed by the National Bureau of Standards was used to determine the dielectric properties of approximately 40 oil shale samples as functions of temperature and frequency. A description of the sample holder characterization is given along with the measurement procedure and the sample preparation.

712,668
PB85-137669 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Microwave Detection of Lost Wells and Unknown Water-Filled Voids in Coal Mines.
Final rept. Jan 79-Mar 84.
D. R. Belsher, R. H. McLaughlin, A. G. Repjar, and H. E. Bussey. Sep 84, 87p NBSIR-84/3017
Contract H0272007

Keywords: *Coal mines, *Radar detection, Voids, Detection, Microwave equipment, Antennas, Detectors, Fluid infiltration, Safety, Hazards, Computer programs, Signal to noise ratio.

Work on contract H0272007 is summarized for the period of January 1979 through March 1984. The development of improved antennas useable with both a pulse system or an FM-CW system is described. The development of a field prototype pulse sampling system is described. Initial theoretical work on the problem of dielectric loading of antennas as well as a study of potential system range is included.

712,669
PB85-142222 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Jet Diffusion Flame Suppression Using Water Sprays - An Interim Report.
Final rept.
B. J. McCaffrey. 1984, 30p
See also PB84-159052.
Pub. in Combustion Science and Technology 40, p107-136 1984.

Keywords: *Fire fighting, *Blowouts, Fire extinguishing agents, Flames, Spraying, Water, Gas wells, Oil wells, Reprints.

The feasibility of using water sprays for the control of offshore oil/gas well blowout fires has been addressed. Considering the sheer scale of the problem, knowledge from a fundamental viewpoint is going to be required in order to extrapolate laboratory-sized flame studies up to full scale. Available data and appropriate literature concerned with the application of water sprays as a jet diffusion flame suppression/extinguishment agent have been reviewed. Small pneumatic atomizing nozzles using H2 gas, both as the flame source as well as the atomizing driver, have been used to scale high momentum jet flames and to study the effect of water on the flame. Thermodynamic equilibrium was shown to be an effective guide in interpretating the results. The effect of flame temperature reduction due to water sprays has been observed to correlate with a single spray parameter--the median drop diameter. Directions for further study have been indicated.

712,670
PB85-161305
(Order as PB85-161271, PC **A05**/MF **A01**)
National Bureau of Standards, Boulder, CO.
Radio Propagation in a Coal Seam and the Inverse Problem.
D. A. Hill. 17 Jul 84, 10p
Included in Jnl. of Research of the National Bureau of Standards, v89 n5 p385-394 Sep-Oct 84.

Keywords: *Coal deposits, *Radio transmission, Attenuation, Remote sensing, Inverse problems.

The longwall method of mining in underground coal seems very efficient in uniform seams, but coal seam anomalies can make the method unprofitable and unsafe. This paper describes the theoretical basis for detection of coal seam anomalies using medium frequency (MF) radio transmission over paths on the order of 200 m in length. The key to the method is the sensitivity of the attenuation rate of the coal seam mode of propagation to changes in the coal seam parameters, such as height or electrical conductivity. From a large number of transmission paths, the principles of tomography can be used to reconstruct an image of the seam.

712,671
PB85-178093 PC **A10**/MF **A01**
Energy Analysts, Inc., Norman, OK.
Blowout Fire Simulation Tests. Final Report.
D. B. Pfenning. Jan 85, 204p NBS/GCR-85/484

Keywords: *Blowouts, *Fire tests, Data, Oil wells, Gas wells, Fire fighting, Fire extinguishing agents, Water injection, Methane, Water spray.

The blowout of oil and gas wells during drilling, production, and workover presents a serious hazard to personnel, the environment, and equipment. The only practical method to control a well fire subsequent to a blowout is to shut in the hydrocarbon at the well. Although some individuals have effectively used water to mitigate well fire hazards, the quantitative effect of water sprayed into the fire zone is not known. To design effective oil and gas well blowout fire control systems, both the hazards associated with the fire and the efficiency of water to control fire hazards must be quantitatively understood. The Center for Fire Research (CFR) of the National Bureau of Standards has studied for the Department of the Interior the effectiveness of water spray to control and extinguish fires resulting from gas well blowouts. Laboratory scale tests have been performed by the CFR on 0.01-10 megawatt fires to study the effects of water injection on the combustion of high velocity methane jets. This report presents the results of two 100 megawatt and five 200 megawatt fire tests performed to measure the effects of water spray on fires from large velocity gas discharges characteristic of natural gas well blowouts.

712,672
PB85-232544 PC **A10**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Application of Risk Analysis to Offshore Oil and Gas Operations - Proceedings of an International Workshop Held at Gaithersburg, Maryland on March 27 and 28, 1984.
Final rept.
F. Y. Yokel, and E. Simiu. May 85, 213p NBS/SP-695
Also available from Supt. of Docs as SN003-003-02650-6. Library of Congress catalog card no. 85-600525.

Keywords: *Meetings, *Offshore drilling, Gas production, Oil recovery, Specifications, Reliability, Offshore structures, Logistics support, Research management, Safety, Marine engineering, Operations, Petroleum industry, Regulations, Standards, *Risk analysis.

The proceedings of an International Workshop held at the National Bureau of Standards on March 27 and 28, 1984, are presented. The purpose of the workshop was to examine the application of risk analysis in offshore oil and gas operations. The proceedings include: an executive summary, an introduction, and summary reports and recommendations of four Working Groups: Standards, Codes, and Certification; Concept Evaluation and Design; Operation and Maintenance; and Logistics and Support. Also included are theme presentations on current practice in the United States, Great Britain, and Norway, and on current risk assessment methodologies.

712,673
PB85-240901 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Jet Diffusion Flame Suppression Using Water Sprays, Final Report.
B. J. McCaffrey. Jul 85, 58p NBSIR-84/2812-1
Supersedes PB84-159052. Sponsored by Minerals Management Service, Washington, DC.

Keywords: *Offshore drilling, *Fire protection, *Blowouts, Water, Spraying, Gas wells, Oil wells, Fire extinguishing agents, Nozzles, Thermodynamic equilibrium, Diffusion flames, Temperature, Fires, Retarding, Water spray.

The feasibility of using water sprays for the control of offshore oil/gas well blowout fires has been addressed. Considering the sheer scale of the problem, knowledge from a fundamental viewpoint is going to be required in order to extrapolate laboratory-sized flame studies up to full scale. Available data and appropriate literature concerned with the application of water sprays as a jet diffusion flame suppression/extinguishment agent have been reviewed. Small pneumatic atomizing nozzles using H2 gas, both as the flame source as well as the atomizing driver, have been used to scale high momentum jet flames and to study the effect of water on the flame. Thermodynamic equilibrium was shown to be an effective guide in interpreting the results. The effect of flame temperature reduction due to water sprays has been observed to correlate with a single spray parameter - the median drop diameter.

712,674
PB87-103271 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Development of a Fire Evaluation System for Underground Coal Mines.
J. A. Shibe. Aug 86, 146p NBSIR-86/3425
Sponsored by Bureau of Mines, Pittsburgh, PA.

Keywords: *Coal mines, *Fire safety, Fire hazards, Fire protection, Underground mining, Evaluation.

A prototype Fire Safety Evaluation System has been developed and is ready to be evaluated by a Peer Consulting Panel and for performing field tests. The system can be used to determine combinations widely accepted fire safety equipment and underground coal mines features that provide a level of safety equivalent to those required by the Code of Federal Regulations-Title 30 for underground coal mines. In this evaluation, equivalent safety performance is gauged in terms of overall level of safety provided rather than by a component by component comparison.

712,675
PB87-117941 Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Water Sprays Suppress Gas-Well Blowout Fires.
Final rept.
D. Evans, and D. Pfenning. 1985, 7p
Pub. in Oil and Gas Jnl. 83, n17 p80-86 1985.

Keywords: *Blowouts, *Fire fighting, *Gas wells, Spraying, Oil wells, Fire extinguishing agents, Fires, Reprints, *Water sprays.

No abstract available.

712,676
PB87-127981 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Crystal Structures of Bobierrite and Synthetic Mg3(PO4)2 . 8H2O.
Final rept.
S. Takagi, M. Mathew, and W. E. Brown. 1986, 5p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in American Mineralogist 71, p1229-1233 1986.

Keywords: *Crystal structure, Hydrates, Minerals, Reprints, *Bobierrite, *Vivanite, *Magnesium phosphate octahydrate.

The crystal structures of two forms of Mg3(PO4)2.8H2O, bobierrite (I) and the synthetic polymorph (II), have been determined by single-crystal X-ray diffraction. Crystal data for polymorph I are space group C2/c, a=4.667(1), b=27.926(8), c=10.067(3) A, beta=105.01(2), Z=4, R=0.041 for 963 reflections. Crystal data for polymorph II are space group C2/m, a=10.034(1), b=13.407(2), c=4.657(1) A, beta=105.09(1), Z=2, R=0.025 for 510 reflections. The structure of polymorph I is closely related to that of the vivianite group, whereas polymorph II is isostructural with vivianite. Both structures consist of octahedral edge-sharing dimers Mg2O6(H2O)4 and independent MgO2(H2O)4 octahedra linked together by PO4 tetrahedra to form complex sheets parallel to (010). The arrangement of these sheets along b is different in the two structures.

712,677
PB87-134318 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Momentum Diffusion Flame Characteristics and the Effects of Water Spray.
B. J. McCaffrey. Nov 86, 72p NBSIR-86/3442
Sponsored by Minerals Management Service, Reston, VA.

Keywords: *Fire safety, *Blowouts, Diffusion flames, Extinguishing, Model tests, Spraying, Water, *Natural gas wells, Blow off.

For water spray suppression of gas well blowout fire applications, reasonably large scale (1-10 MW) methane diffusion flames have been investigated near the high Froude number limit. Flame blow-off has been observed with pipe sizes to 30 mm diameter. Flame and lift-off heights, centerline temperatures and incident radiative flux to nearby targets have been measured with and without water spray suppressant. Using the Dayan-Tien formulation for a cylindrical flame model an effective gray absorption coefficient approaching 0.2/m was determined at the blow-off limit. The derived shape of the functional dependence of decreasing radiative fraction with jet Froude number in the limit is consistent with small scale experiments. The effect of spraying water internal to the flame envelope at the base is to shift or raise the flame above its normal position and to lower peak flame temperature and radiation levels despite increased absorptivity due to the radiatively active steam. Extinguishment near blowoff is thought due to the former effect. Calculations of flame entrainment based on increased water vapor emission are consistent with literature estimates of entrainment when account of the effects of buoyancy due to the liquid spray is provided.

712,678
PB87-152344 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Qualitative Analysis of the Inherent Fire Safety/ Fire Risk in a Coal Mine,
H. E. Nelson. Dec 86, 83p NBSIR-86/3502
See also report dated Aug 86, PB87-103271. Sponsored by Bureau of Mines, Pittsburgh, PA.

Keywords: *Coal mines, *Fire safety, Fire hazards, Fire protection, Underground mining, Evaluation.

This is a quantitative description of a fire safety analysis system for a coal mine. An event-logic tree and a state transition model are presented. The report is also presented as Appendix D of NBSIR 86-3425, The Development of a Fire Evaluation System for Underground Coal Mines.

712,679
PB87-161477 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Electromagnetic Wave Propagation in an Asymmetrical Coal Seam.
Final rept.,
D. A. Hill. Feb 86, 4p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Antennas and Propagation AP-34, n2 p244-247 Feb 86.

Keywords: *Electromagnetic wave transmission, Medium frequencies, Coal mines, Remote sensing, Propagation, Radio communication, Reprints, *Coal seams.

Electromagnetic wave propagation in a coal seam is analyzed for the case where the surrounding floor and roof rocks have different electrical properties. Numerical results are presented for the attenuation rate and field distribution of the dominant mode. Even when the roof and floor conductivities are different, the vertical electric field and the horizontal magnetic field are the dominant components, and they are nearly constant within the coal seam. The results have application to mine communication and remote sensing of coal seams.

712,680
PB87-191185 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Experimental Determination and Modeling of the Heat Capacity of Coal in Various Atmospheres.
Final rept.,
J. E. Callanan, S. A. Sullivan, and R. A. MacDonald. Jan 87, 13p
Pub. in International Jnl. of Thermophysics 8, n1 p133-145 Jan 87.

Keywords: *Coal, *Specific heat, Helium, Argon, Carbon monoxide, Desorption, Models, Reprints.

During the development of transferable measurement techniques for the heat capacity of raw coal, it was observed that the atmosphere in sealed sample cells affected the thermal behavior, particularly during the initial measurements. The model which had been used to represent the specific heat of coal did reproduce the results in air but failed to reproduce the deep exotherm of the thermograms obtained in nitrogen. The specific heat of coal has been determined in helium, argon, and carbon monoxide to provide insight into possible modifications to the model. The results of initial and repeat runs in the five different atmospheres and the impact of these results on the modeling are presented and discussed. The agreement between the experimental heat capacity and that predicted by the model, up to 500K, is excellent and supports Merrick's predictions for the heat capacity of coal.

Natural Resource Management

712,681
PB81-197071 PC **A05**/MF **A01**
Energy Enterprises Northwest, Olympia, WA.
State of Washington: A Study of Procurement of Products Containing Recycled Materials.
Final rept.
Mar 81, 87p NBS-GCR-81-314
Contract NB80-NAAE-5150

Keywords: *Procurement, *Washington(State), Government policies, Purchasing, Materials recovery, Public law, Natural resources, Legislation, Commodities, Conservation, Regulations, *Recycled materials, Energy policy, Environmental protection, NTISCOMNBS.

The report examines the current State activities, regulations, statutes, and policies, as well as technical institutional and economic barriers relating to the public procurement of products containing recovered or recycled materials. The report also lists the top ten commodities procured by the State in dollars plus a listing of products that, in the opinion of the State, have a high potential for the use of recycled or recovered material. The report includes a list of recommendations or suggested actions that could be taken to potentially improve the manufacture, distribution, and procurement of products containing recovered or recycled materials.

712,682
PB81-198236 PC **A06**/MF **A01**
Colorado Dept. of Administration, Denver. Div. of Purchasing.
Procurement of Products Containing Recycled/ Recovered Materials in the State of Colorado.
Final rept.
Mar 81, 104p NBS-GCR-81-308
Contract NB80-NAAE-4037
Portions of this document are not fully legible.

Keywords: *Procurement, *Colorado, *Materials recovery, Government policies, Purchasing, Public law, Natural resources, Legislation, Commodities, Conservation, Regulations, *Recycled materials, Energy policy, Environmental protection, NTISCOMNBS.

The report examines the current State activities, regulations, statutes, and policies, as well as technical institutional and economic barriers relating to the public procurement of products containing recovered or recycled materials. The report also lists the top ten commodities procured by the State in dollars plus a listing of products that, in the opinion of the State, have a high potential for the use of recycled or recovered material. The report includes a list of recommendations or suggested actions that could be taken to potentially improve the manufacture, distribution, and procurement of products containing recovered or recycled materials.

712,683
PB81-202178 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Water Usage Characteristics of Household Appliances and the Potential for Water Savings.
R. L. Palla. Dec 80, 35p NBSIR-80-2173, HUD-0001985

Keywords: *Kitchen equipment and supplies, *Water conservation, Savings, Utilization, Dishwashers, Laundries, Washing machines, Design, Flow rate, *Water saving devices, NTISHUDPDR, NTISCOMNBS.

This study was part of a comprehensive water conservation program sponsored by HUD through the Center for Building Technology (CBT). The purpose of this study was to identify appliance parameters, usage techniques, and options available to manufacturers and consumers that offer the most substantial water savings. Appliances considered were clothes washers and dishwashers. Through a comparison of estimated water savings, the study indicates that the most significant means of saving water are those that are already commercially available -- front-loading machines and suds-saver options for clothes washers and short-cycle settings for dishwashers. Water savings of about 20 to 30 percent are estimated with these features, or aout 10 gallons for clothes washers and 3 gallons for dishwashers.

712,684
PB81-204448 PC **A05**/MF **A01**
Michigan Energy and Resource Research Association, Detroit.
Procurement of Products Containing Recovered Materials: A Study of State of Michigan Practices.
Final rept.
J. Kittel. Mar 81, 93p NBS/GCR-81-310
Contract NB80-NAEE-5151

Keywords: *Procurement, *Michigan, Government policies, Purchasing, Materials recovery, Public law, Natural resources, Legislation, Commodities, Conservation, Regulations, *Recycled materials, Energy policy, Environmental protection, NTISCOMNBS.

The report examines the current State activities, regulations, statutes, and policies, as well as technical institutional and economic barriers relating to the public procurement of products containing recovered or recycled materials. The report also lists the top ten com-

modities procured by the State in dollars plus a listing of products that, in the opinion of the State, have a high potential for the use of recycled or recovered material. The report includes a list of recommendations or suggested actions that could be taken to potentially improve the manufacture, distribution, and procurement of products containing recovered or recycled materials.

712,685
PB81-205445 PC **A09**/MF **A01**
Florida State Dept. of Environmental Regulation, Tallahassee.
State of Florida: The Procurement of Products Containing Recovered Materials.
Final rept.
May 81, 195p NBS-GCR-81-309
Contract NB80-NAAE-4667
Portions of this document are not fully legible.

Keywords: *Procurement, *Florida, Government policies, Purchasing, Materials recovery, Public law, Natural resources, Legislation, Commodities, Conservation, Regulations, *Recycled materials, Energy policy, Environmental protection, NTISCOMNBS.

The report examines the current State activities, regulations, statutes, and policies, as well as technical institutional and economic barriers relating to the public procurement of products containing recovered or recycled materials. The report also lists the top ten commodities procured by the State in dollars plus a listing of products that, in the opinion of the State, have a high potential for the use of recycled or recovered material. The report includes a list of recommendations or suggested actions that could be taken to potentially improve the manufacture, distribution, and procurement of products containing recovered or recycled materials.

712,686
PB81-223448 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Performance Aspects of Water Conservation Techniques for Appliances.
C. C. Gordon, and R. L. Palla. May 81, 41p NBSIR-81-2291
Sponsored in part by the Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research.

Keywords: *Washing machines, *Water conservation, Laundries, Kitchen equipment and supplies, Performance evaluation, Standards, Removal, Water consumption, Tests, Tables(Data), Graphs(Charts).

The performance of household clothes washers and dishwashers is evaluated assuming various water conservation methods. For clothes washers the effect of fill level setting on soil removal is presented. A guideline for setting fill level is suggested. For dishwashers the soil removal capabilities are evaluated at reduced fill volumes. An analysis of the percentage of soil removed for each wash/rinse subcycle shows the relative quantities of soil in the discharge for each subcycle.

712,687
PB81-240475 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Procurement of Products Containing Recovered Material: A Summary of Activities in Seven States.
J. G. Berke, and C. H. Hudson. Jul 81, 77p NBSIR-81-2316
See also PB81-204448.

Keywords: *Procurement, Government policies, Purchasing, Materials recovery, Natural resources, Legislation, Commodities, Conservation, Regulations, Florida, Colorado, Michigan, Minnesota, New Jersey, New York, Washington(State), *Recycled materials, Energy policy, Environmental protection.

The report summarizes the major study carried out in seven states dealing with the procurement of products containing recycled/recovered materials as specified in the Resource Conservation and Recovery Act (P.L. 94-580) and its amendments (P.L. 96-482). The report lists current state activities, regulations, statutes and policies, as well as technical, institutional and economic barriers to the public procurement of recycled products. A list of recommendations and suggested actions are also included.

712,688
PB81-246779 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Economic Framework for Cost-Effective Residential Water Conservation Decisions.
Final rept.
S. F. Weber, B. E. Thompson, and B. C. Lippiatt. Aug 81, 66p NBSIR-81-2304
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research.

Keywords: *Cost effectiveness, *Water conservation, *Residential buildings, Decision making, Public utilities, Savings, Benefit cost analysis, Prices, Market value, Rates(Costs), Water saving devices, Water rates.

This report presents an economic framework for utilities to use in recommending water-saving devices that are cost-effective for homeowners. A variety of devices designed to save water used in water closets, showers, and indoor faucets are described in terms of their costs and benefits. The cost components considered are acquisition, installation, maintenance, and replacement costs. Benefits considered are water savings, avoidance of wastewater treatment, and energy savings in the case of reduced hot water use.

712,689
PB82-234501 PC **A20**/MF **A01**
Dynamac Corp., Rockville, MD.
Proceedings of the National Water Conservation Conference on Publicly Supplied Potable Water.
Final rept.
Jun 82, 464p NBS/SP-624
Held in Denver, Colorado, April 14-15, 1981. Library of congress catalog card no. 82-600551. Sponsored in part by Environmental Protection Agency, Washington, DC., Department of the Interior, Washington, DC., Army Corps of Engineers, Washington, DC., Department of Housing and Urban Development, Washington, DC., and Water Resources Council, Washington, DC.

Keywords: *Potable water, *Water conservation, *Meetings, Waste water reuse, Water flow, Local government, Plumbing, Education, Benefit cost analysis, State government, Maintenance, Toilet facilities, Landscaping, Vegetation, Prices, *Water saving devices.

This 'Proceedings' is a complete compilation of the papers presented April 14 and 15, 1981, at the National Water Conservation Conference - Publicly Supplied Potable Water in Denver, CO. Techniques for, and analysis of, potable water conservation and wastewater flow reduction were presented. The topics addressed included: Water-saving technology; public education and motivation; economics; planning; and case studies.

712,690
PB82-264011 Not available NTIS
National Bureau of Standards, Washington, DC.
Water Rates and Residential Water Conservation.
Final rept.
B. C. Lippiatt, and S. F. Weber. Jun 82, 4p
Pub. in Jnl. AWWA 74, n6 p278-281 Jun 82.

Keywords: *Residential buildings, *Water conservation, Rates(Costs), Prices, Scheduling, Policies, Reprints, *Water rates.

Descriptions of the five major types of water rate schedules are presented. A national sample of rate schedules is analyzed to measure the effect of existing water pricing policies on the dollar value to homeowners of a unit of conserved water. This value is found to be significantly lower than the average price of water, which analysts often incorrectly use to evaluate water conservation investments.

712,691
PB83-180406 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development and Evaluation of a Test Method for Shower Heads.
P. Kopetka, and L. Galowin. Feb 83, 65p NBSIR-82-2630
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research.

Keywords: *Plumbing, *Water conservation, Tests, Flow rate, Temperature measurement, Pressure gages, Pipes(Tubes), Water distribution, *Water saving devices, Showerheads, Low flow.

A proposed test method for the evaluation of low-flow shower heads or flow-restrictor-modified shower heads was developed. The test method provides for the measurement of the principal operating characteristics, i.e., pressure-flow rate dependency and the shower spray distribution. The requirements for laboratory instrumentation suitable for application to the apparatus and the procedures for testing were established. A water collection device, 'sector rig,' was designed and constructed for the measurement of spray distribution patterns. Experiments were conducted with a small number of shower heads to determine the suitability of the proposed test method.

Snow, Ice, & Permafrost

712,692
PB-281 044/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Model for the Ice VII-Ice VII Transition.
Final rept.,
J. W. Haus, and T. Tanaka. 1 Sep 77, 6p
Pub. in Physical Review B 16, n5 p2148-2153, 1 Sep 77.

Keywords: *Ice, *Phase transformations, Order disorder transformations, Protons, Dielectric properties, Specific heat, Entropy, Models, Reprints.

A lattice model is proposed to describe the transition between the proton disordered ice VII phase and the proton order ice VIII phase. The model includes a ferroelectric four proton interaction which prefers to satisfy the ice rule. This model is solved in the mean field approximation, and the change in dielectric constant, entropy, specific heat are given. Generalizations of the model and higher order approximations are discussed.

712,693
PB-296 321/3 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Fields Div.
Comparison of Centrifuge and Freezing Calorimeter Methods for Measuring Free Water in Snow.
R. N. Jones. May 79, 44p NBSIR-79-1604
Sponsored in part by National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.

Keywords: *Snow, *Moisture content, Water, Measurement, Calorimeters, Centrifuges, Calorimetry, Freezing, Centrifuging, Comparison.

In using microwave measurements in hydrological studies of snowpack or avalanche prediction, the presence of free water in the snow has a strong influence on observed data because it affects the dielectric characteristics. Although several methods are in use for determining the percentage of free water in snow, there is very little information in the literature as to how well the various methods agree. This paper reports on a comparison of two popular methods; namely, the centrifuge and the freezing calorimeter. Results from measurements over a two-month period in the Colorado mountains in the winter of 1978 indicate serious disagreement between these two methods. Some reasons for the disagreement are presented and verified. This raises some important questions pertaining not only to what the two methods actually measure, but also which methods may be appropriate for particular applications.

712,694
PB-296 927/7 Not available NTIS
National Bureau of Standards, Boulder, CO.
Electromagnetic Scattering Properties of Soils and Snow.
Final rept.
D. A. Ellerbruch, R. L. Jesch, R. N. Jones, H. E. Bussey, and H. S. Boyne. 1978, 18p
Pub. in Proceedings Int. Symp. on Remote Sensing of Environment (12th), Held at Ann Arbor, MI on 20-26 Apr 78, v2 p957-974.

Keywords: *Snow, *Soils, *Electromagnetic scattering, Electromagnetic properties, Soil properties, Field tests, Remote sensing.

The electromagnetic scattering properties of soils and snow are being measured in situ under natural environmental conditions. A physical analysis is done at each

test site to determine the physical properties of the sample for correlation with its electromagnetic signature.

712,695
PB80-103849 Not available NTIS
National Bureau of Standards, Washington, DC.
Microwave Measurements of Snow Stratigraphy and Water Equivalence.
Final rept.,
H. S. Boyne, and D. A. Ellerbruch. 1979, 7p
Pub. in Proceedings of the Annual Western Snow Conference (47th) Held at Sparks, NV. on April 18-20, 1979, p20-26 1979.

Keywords: *Snow, *Electromagnetic scattering, Electromagnetic properties, Superhigh frequencies, Physical properties, Density(Mass/volume), Stratigraphy, Hardness, Moisture content, Surface properties, Dielectric properties, Microwaves.

This paper reports on a study of electromagnetic surface and subsurface scattering properties of snow using an FM-CW radar system operating in the frequency range 8-12 GHz. The scattering properties are interpreted and compared with the measured physical properties of snow such as density, stratigraphy, hardness, and equivalent moisture content. The electromagnetic scattering properties are measured in situ under natural environmental conditions, and the physical analysis is done at each test site to correlate the physical properties of the sample with its electromagnetic signature. Correlation between the electromagnetic and physical properties of snow are discussed. In particular, it is shown that there is a simple relationship between the optical depth of the snowpack and the snowpack-water equivalence, where the optical depth, is the product of the square root of the average dielectric constant and the physical depth of the snowpack.

Soil Sciences

712,696
PB-291 944/7 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Fields Div.
Dielectric Measurements of Five Different Soil Textural Types as Functions of Frequency and Moisture Content.
Final rept.
R. L. Jesch. Oct 78, 27p NBSIR-78-896
Sponsored in part by Army Mobility Equipment Research and Development Center, Fort Belvoir, VA.

Keywords: *Soils, *Dielectric properties, Electrical measurement, Attenuation, Sands, Loams, Clay soils, Moisture content, Ultrahigh frequencies, Superhigh frequencies.

Open-circuit coaxial transmission-line sample holders were used to determine the electromagnetic dielectric properties of five soil textural types as functions of moisture level content and frequency. A brief outline of the theoretical basis is given for the open-circuit method along with the measurement system and the sample preparation. Experimental results are given for the different soil textural types for moisture levels ranging from 0 to 48 percent and for test frequencies ranging from 300 to 9300 MHz.

712,697
PB85-137719 PC **A04**/MF **A01**
Maryland Univ., College Park. Dept. of Civil Engineering.
Size Effect in Simple Shear Testing.
M. I. Amer, M. S. Aggour, and W. D. Kovacs. Nov 84, 66p NBS/GCR-84/478
Prepared in cooperation with Rhode Island Univ., Kingston.

Keywords: *Soil mechanics, *Shear tests, Damping, Finite element analysis, Shear properties, Earthquake engineering.

Simple shear testing is considered to be one of the most appropriate ways of reproducing in the laboratory the stresses that would be experienced by an element of soil subjected to earthquake loading. The main drawback concerns the sample size, in that for a small sized sample, the test results are affected by the non-uniformity of the stress in the sample. To investigate the sample size effect on the primary dynamic soil properties, namely the shear modulus and damping, a large simple shear apparatus was constructed. A total of 144 tests were performed to study the size effect and to choose an ideal size for testing dry sand. The suggested size gave results of shear modulus and damping independent of the sample boundaries. Formulas and charts for correction factors were also developed to be used to correct the results from simple shear tests on samples having sizes other than the ideal size proposed herein.

NAVIGATION, GUIDANCE, & CONTROL

Control Devices & Equipment

712,698
PB-265 426/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Magnetic Torque on a Shielded Superconducting Gyroscope.
Final rept.,
L. B. Holdeman, and J. T. Holdeman. 1976, 8p
Pub. in J. Appl. Phys., v47 n11 p4936-4943 Nov 76.

Keywords: *Gyroscopes, Superconductivity, Electrodynamics, Magnetic properties, Torque, Reprints.

The torque on a superconducting sphere rotating in an arbitrary magnetic field is calculated. The result is expressed in terms of the coefficients of the expansion of the magnetic field in spherical harmonic functions, but in general a boundary-value problem must be solved to obtain these coefficients. The boundary-value problem is solved and the torque calculated for configurations pertinent to the gyroscope relativity experiment, a proposed satellite experiment which is to test various theories of gravitation. Typical numerical results for these torques are given and compared with the predicted relativistic effects.

Navigation & Guidance System Components

712,699
PB-299 807/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Composite Oscillator Systems for Meeting User Needs for Time and Frequency.
S. R. Stein, and F. L. Walls. 1978, 7p
Pub. in Proc. Annual Precise Time and Time Interval Applications and Planning Meeting (10th), Held at Washington, DC. on Nov 28, 1978, p22-28.

Keywords: *Frequency standards, Phased locked systems, Oscillators, Frequency stability.

Frequency standards are used in most navigation and position location systems to provide a long term memory of either frequency, phase, or time epoch. From a systems point of view, the performance aspects of the frequency standard can be weighed against other systems characteristics, such as overall performance, cost, size, and accessibility. A number of areas of navigation and position location are very briefly reviewed from this point of view. The theory of phase lock and frequency lock systems is outlined in sufficient detail that one can easily predict total oscillator system performance from measurements on the individual components. As an example, details of the performance of a high spectral purity oscillator phased locked to a long term-stable oscillator are given. Results for several systems, including the best system stability that can be obtained from present commercially available 5-MHz sources, is shown.

712,700
PB-300 268/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Special Purpose Ammonia Frequency Standard - A Feasibility Study.
Final rept.,
D. J. Wineland, D. A. Howe, M. B. Mohler, and H. Hellwig. Jun 79, 11p
ARPA Order 3140
Pub. in IEEE Transactions on Instrumentation and Measurement 28, n2 p122-132 Jun 79.

Keywords: *Frequency standards, Ammonia, Feasibility, Oscillators, Electromagnetic absorption, Microwave frequencies, Frequency stability, Reprints.

The authors investigated the feasibility of a special purpose frequency standard based on microwave absorption in ammonia gas (15)NH3. Such a device would potentially fill a need in certain communications and navigation applications for an oscillator which has medium stability, greater accuracy (approximately 10 to the minus 9 power) than that provided by crystal oscillators, but a cost significantly smaller than that of more sophisticated atomic frequency standards. A device was constructed using a stripline oscillator near 0.5 GHz whose multiplied output was frequency-locked to the absorption of the 3-3 line in (15)NH3 (approximately 22.8 GHz). Output between 5 and 10 MHz was provided by direct division from the 0.5-GHz oscillator. Observed stability was 2 x 10 to the minus 10 power from 10 to 6000 s, and reproducibility (accuracy) is estimated to be plus or minus 2 x 10 to the minus 9 power. The unique features of this device, which include (1) high-performance stripline oscillator, (2) digital servo techniques, (3) unique oscillator-cavity servo, (4) pressure shift compensation scheme, and (5) acceleration insensitivity, are discussed. Areas for further study are noted.

712,701
PB80-104508 Not available NTIS
National Bureau of Standards, Washington, DC.
Relationships Between the Performance of Time/Frequency Standards and Navigation/Communication Systems.
Final rept.,
H. Hellwig, S. R. Stein, F. L. Walls, and A. Kahan. 1979, 15p
Pub. in Proceedings of the Precision Time and Time Interval Planning Meeting (10th) Held at Washington, DC. on November 28, 1978, p37-51 1979.

Keywords: *Time standards, *Frequency standards, Systems analysis, Telecommunication, Navigation, Requirements, Clocks, Stability, Trade off analyses.

The paper discusses the relationship between system performance and clock or oscillator performance. Our approach will be basic, pointing out some tradeoffs such as short term stability versus bandwidth requirements; frequency accuracy versus signal acquisition time; flicker of frequency and drift versus resynchronization time; frequency precision versus communications traffic volume; spectral purity versus bit error rate, and frequency standard stability versus frequency selection and adjustability, Our aim is to give the system designer and manager a better grasp of the benefits and tradeoffs of using precise frequency and time signals at various levels of precision and accuracy.

712,702
PB80-117468 Not available NTIS
National Bureau of Standards, Washington, DC.
Time Deviation and Time Prediction Error for Clock Specification, Characterization, and Application.
Final rept.,
D. W. Allan, and H. Hellwig. 1978, 8p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Postion Location and Navigation Symposium (1978) Held at San Diego, CA. on November 6-9, 1978, p29-36 1978.

Keywords: *Clocks, *Time, Errors, Time measurement, Oscillators, Frequency stability.

The characterization of oscillators and clocks in terms of frequency fluctuations as a function of averaging time, sigma sub y(tau) is now well understood and documented. However, a need still exists to describe a time deviation measure x(t). The authors show the dependence of such a deviation measure and the error of prediction of this measure on practical measurement constraints, on systematic characteristics, as well as on sigma sub y(tau). Models are developed which allow clock characterization from insufficient data. For

example, when statistically significant data are constrained to the short term region it is still possible to extrapolate into the long term. Finally, the authors summarize the state-of-the-art of clocks and oscillators in terms of x, and show the obvious importance of these measures to properly choosing, measuring, specifying, or using clocks and oscillators for position location or navigation applications.

712,703
PB80-223464 Not available NTIS
National Bureau of Standards, Washington, DC.
Space Applications of Superconductivity: Instrumentation for Gravitational and Related Studies.
Final rept.,
R. L. Peterson. Jun 80, 8p
Contract NASA-A-437018(JM)
Pub. in Cryogenics 20, n6 p299-306 Jun 80.

Keywords: *Superconductivity, *Instruments, Accelerometers, Gyroscopes, Gravimeters, Utilization, Gravitation, Reprints.

This is the sixth of a seven part series on the potential applications of superconductivity in space. Superconductivity already appears to have a role in measurements related to gravitational effects (superconducting gryoscope, accelerometers, and levitation), and offers many potential advantages in other, related, studies of relevance to the space program. Superconducting devices of promise include magnetometers, cavity oscillators, gravimeters, and bearings. In addition to fundamental studies involving many types of tests of gravitational theories, deep space navigation and elucidation of the properties of planetary interiors are areas for potential applications.

712,704
PB85-228393 PC **A09**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
VOR (Very-High-Frequency Omnidirectional Range) Calibration Services.
N. T. Larsen, D. F. Vecchia, and G. R. Sugar. Apr 85, 179p NBS-TN-1069
Also available from Supt. of Docs as SN003-003-02652-2.

Keywords: *Radio beacons, *Calibrating, VOR(Very high frequency omnidirectional radio range).

The National Bureau of Standards has designed, constructed, and evaluated a standard for the support of very-high-frequency omnidirectional range (VOR) air navigation aids. The standard consists of two instruments: (1) a digital waveform signal generator for the composite VOR audio waveform, and (2) a standard phasemeter based on time series analysis of the waveform. Experimental results, a statistical analysis of them, and the principal software listings are included.

712,705
PB86-129046 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Simplified GPS C/A Receiver Front End with Low Noise Performance.
Final rept.
D. D. Davis, and A. D. Clements. 1985, 8p
Pub. in Proceedings of Annual Precise Time and Time Interval Applications and Planning Meeting (16th), Greenbelt, MD., November 27-29, 1984, p467-474 1985.

Keywords: *Receivers, Antennas, *Down-converters, *Multipliers, Low noise, Global positioning system.

A redesign of the antenna electronics package for the NBS/GPS C/A receiver has resulted in significantly reduced cost and improved performance. Major improvements include a simplified and more reliable multiplier/mixer, elimination of all twelve piston trimmer tuning capacitors in the original design, elimination of expensive bandpass filters, less expensive antenna and a simplified packaging scheme.

712,706
PB87-106779 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Naval Observatory Time Dissemination before the Wireless.
Final rept.
I. R. Bartky. 1983, 28p
Pub. in Proceedings of the Sesquicentennial Symposia of the U.S. Naval Observatory 'Sky with Ocean Joined', Washington, DC., December 5-8, 1980, p1-28 1983.

Keywords: *Time standards, Chronometers.

An historical outline of USNO time dissemination services prior to radio is presented. The various needs for accurate, such as for longitude determinations, for the general public, and for sea navigation are mentioned. The talk emphasizes the development and deployment of visual time signals, or time balls, for rating ship chronometers.

Navigation Systems

712,707
PB-281 158/6 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Statistical Model for Random Errors of Position Location Based on Lines of Position.
Final rept.,
J. R. Rosenblatt. Mar 78, 15p NBSIR-78-1457

Keywords: *Position(Location), Position finding, Statistical analysis, Random error, Confidence limits, Least squares method, Lines of position.

The U.S. Coast Guard's Aids to Navigation Positioning Project has proposed that procedures for routine determination of positions be revised to include redundant observations for assessing precision and accuracy of the results. This report provides a statistical model and a method for calculating a confidence region for the position location.

712,708
PB80-212269 Not available NTIS
National Bureau of Standards, Washington, DC.
Impact of Improved Clocks and Oscillators on Communications and Navigation Systems,
S. R. Stein. 1979, 6p
Pub. in Proceedings of the Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (11th), Greenbelt, MD., November 27-29, 1979, Conference Publications 2129, p31-36 1979.

Keywords: *Atomic clocks, *Oscillators, Telecommunication, Navigation, Impact.

This paper discusses the results of a Workshop which addressed the role of clocks and oscillators in large scale systems, particularly communications and navigation. The ultimate purpose of this Workshop was to do two things: first, to provide research and development people in government, at universities and in companies with adequate information to appropriately direct their activities towards the real needs for clock and oscillator improvements; second, to determine whether or not there are any ways in which existing oscillators and clocks could serve systems better than they are doing now.

712,709
PB81-104432 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Implications of Reciprocity for Two-Way Clock Synchronization.
Final rept.
J. L. Jespersen. 1979, 14p
Pub. in Proc. Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (11th), Goddard Space Flight Center, Greenbelt, MD., Nov 27-29, 1979 p171-184 1979.

Keywords: *Clocks, *Synchronism, Loran, Time, Loran C navigation systems.

Two common methods for synchronizing remote clocks are called one-way and two-way. Both of these methods, when operated in the traditional fashion are subject to a number of difficulties related to propagation perturbances. This paper points out however, that under certain circumstances, these difficulties can be circumvented for the two-way scheme. This possibility is explored theoretically, in some detail, with respect to the Loran-C navigation system.

712,710
PB84-133370 Not available NTIS
National Bureau of Standards, Washington, DC.
Remote Synchronization within a Few Nanoseconds by Simultaneous Viewing of the 1.575 GHz GPS Satellite Signals.
Final rept.
D. D. Davis, M. C. Weiss, A. Clements, and D. W. Alan. 1982, 3p
Pub. in Conference on Electromagnetic Measurements, Boulder, CO, June 28-July 1, 1982, CPEM 82 Digest, pN-15-N-17 1982.

Keywords: Synchronism, Frequency standards, Receivers, *Global positioning system, *Time comparison, Time transfer.

The NBS/GPS receiver has been designed around the concept of obtaining high accuracy, low cost, time and frequency comparisons between remote frequency standards and clocks with the intent to aid international time and frequency coordination. Simultaneous viewing with the USNO commercial GPS receiver at Washington D.C. and the NBS constructed receiver at Boulder, CO (approximetely equal to 3000 km baseline) yielded synchronization accuracies of less than 10 ns as compared with several portable click trips. The hardware and software of the NBS/GPS receiver will be outlined in the text. The receiver is fully automatic under microprocessor control with a built in 0.1 ns resolution time interval counter. The microprocessor also does data processing. Satellite signal stabilities are routinely at the 5 ns level for 15s averages, and the internal receiver stabilities are at the 1ns level. The receiver has a built-in CRT and parallel keyboard for operator interface. Serial RS232 is provided for local hard-copy (printer) and telephone modem use.

712,711
PB85-151710 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Separating the Variances of Noise Components in the Global Positioning System.
Final rept.
D. W. Allan, and M. Weiss. 1983, 16p
Pub. in Proceedings of the Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting, Washington, DC., December 6-8, 1983, p115-131.

Keywords: Frequency stability, Errors, Atomic clocks, *Global positioning system.

Central to the success of the GPS program is the ability to model the frequency stability characteristics of its various components. A persistent challenge in evaluating the Global Positioning System is the separation of the errors of the satellite clocks from those due to the satellite ephemeris errors and/or the signal propagation delay errors. This information is important when one tries to improve the performance of the Global Positioning System. It is necessary to know if a particular component of the system meets specification and which component(s) limits performance. Although one cannot separate the errors themselves, a method has been developed whereby the 'Allan Variances' of critical components to the GPS can be separated. Using a reference clock such as UTC(NBS) or UTC(USNO), for example, the fractional frequency stability of each of the following can be separated from each of the others: the reference clock, the space vehicle clock, the GPS clock, the clock upload correction, the ephemeris and the propagation delay. This technique has the potential to significantly assist in properly setting the parameters to obtain optimum performance from the Global Positioning System e.g. setting the Kalman filter parameters. Results will be given showing some interesting surprises in the characteristics of the system.

712,712
PB86-138617 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Global Positioning System for Accurate Time and Frequency Transfer and for Cost-Effective Civilian Navigation.
Final rept.
J. L. Jespersen, M. Weiss, D. D. Davis, and D. W. Allan. 1980, 1p
Pub. in Proceedings of IEEE Plans 80, Position Location and Navigation Symposium, Atlantic City, New Jersey, December 8-11 1980, p468.

Keywords: *Navigation, Position(Location), Time, Frequencies, Atomic clocks, *Global positioning system.

The paper described some alternative applications of Global Positioning System (GPS) including a method

for very accurate time transfer and for civilian position location much less expensively than the designed Department of Defense method. The first part of the paper discusses several time transfer techniques with emphasis on what we call the 'common-view' approach, and the second part considers the system for position location. Both applications depend on the fact that accurate ephemerides are available for GPS and that GPS time is based on atomic clocks.

712,713
PB87-111654 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Weighting and Smoothing of Data in GPS Common View Time Transfer.
Final rept.
M. A. Weiss. 1986, 16p
Pub. in Proceedings of Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (17th), Washington, DC., December 3-5, 1985, p261-276 1986.

Keywords: Data smoothing, *Global positioning systems, *Time transfer.

It is now possible to compare a clock with UTC(NBS) anywhere in common view of a GPS satellite with Boulder, Colorado at the full level of accuracy and stability of the NBS atomic time scale for integration times of about four days and longer via the NBS Global Time Service. The availability includes Japan, Europe, and the entire United States. The service includes a dial-up service for current estimates of the user's clock performance, and a monthly report with improved estimates after the fact. The authors discuss here the exact method by which the common view time transfer values in the monthly reports are computed.

712,714
PB87-161725 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Position Location with the NBS/GPS (National Bureau of Standards/Global Positioning System) Time Transfer System.
Final rept.,
M. Weiss. 1984, 5p
Pub. in Proceedings of Symposium on IEEE (Institute of Electrical and Electronics Engineers) PLANS (Position Location and Navigation System) '84, San Diego, CA, November 26-29, 1984, p175-179.

Keywords: *Position finding, Time standards, Frequency stability, Ephemerides, Precision, Global positioning system.

The NBS/GPS time transfer system is a low-cost receiver of the GPS C/A code for anyone with a high quality clock interested in referencing that local clock to UTC(NBS) at state-of-the-art time and frequency accuracies using the common-view technique. In particular it is used in comparing primary time standards around the world for generating the international UTC. In order to do these things the local user must know the coordinates of the receiver antenna within the GPS coordinate system. For this purpose the receiver has a position location program. The ability of the receiver to perform absolute and differential positioning was evaluated in experiments over three baselines: short (26m - 77m), medium (131 km), and long (240 km). Solutions from the receiver were compared with WGS-72 first order survey points. Absolute positioning error varied from 4.1 m to 10.2 m except during periods where the GPS was having trouble with the space vehicle clocks.

712,715
PB88-138979 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Position Location Using Sequential GPS Measurements.
Final rept.,
M. Weiss. 1982, 4p
Pub. in Proceedings of Symposium on IEEE (Institute of Electrical and Electronics Engineers) PLANS (Position Location and Navigation), Atlantic City, NJ., December 6-9, 1982, p275-278.

Keywords: *Correction, *Position(Location), *Coordinates, Global positioning system, Reprints, *Foreign technology.

The paper reports the development of a program to derive a first order correction to initial estimates of local coordinates and local clock bias from GPS time using a single channel GPS receiver of the C/A code. The program measures sequentially the local minus GPS time via four different satellites based on an initial estimate of local coordinates. Then using these measurements along with known locations of the satellites the first order corrections to the X, Y, and Z coordinates and the local time bias from GPS time are obtained.

NUCLEAR SCIENCE & TECHNOLOGY

Fusion Devices (Thermonuclear)

712,716
PB-272 210/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Controlled Thermonuclear Reactors: A Prospective Large-Scale Use of Pure Copper.
Final rept.,
F. R. Fickett. 1976, 44p
Sponsored in part by Internationl Copper Research Association, New York.
Pub. in INCRA Research Report, 44p 1976.

Keywords: *Thermonuclear power generation, *Superconducting magnets, *Copper, Plasma control, Pinch effect, Nuclear fusion, *Thermonuclear reactors.

The prospect of Controlled Thermonuclear Reactor (CTR) power plants operating before the turn of the century is a very real possibility. The magnetic confinement for the plasma in these systems will, most likely, be provided by superconducting magnets stabilized with pure copper. The paper provides an introduction to the principles of controlled fusion, followed by a discussion of various magnetic confinement schemes. The U.S. program in CTR is outlined in some detail and a tabular summary of the foreign effort is provided. The amounts and types of copper employed in the proposed power plant designs is given, as is a discussion of the data necessary for optimum design of the magnets.

712,717
PB-285 231/7 PC **A07**/MF **A01**
National Bureau of Standards, Boulder, Colo. Cryogenics Div.
Helium Heat Transfer and Refrigeration in Support of Magnetic Fusion Energy Systems,
V. Arp, J. A. Brennan, P. J. Giarratano, W. R. Parrish, W. G. Steward, T. R. Strobridge, and R. O. Voth. Feb 78, 140p NBSIR-78-877

Keywords: *Cryogenics, *Heat transfer, *Refrigerators, *Helium, Data, Assessments, Superconducting magnets, Efficiency, Reliability, Pressure measurement, Data bases, *Cryogenic refrigerators.

This is the first year-end report on a program of studies on cryogenic engineering data in support of magnetic fusion energy projects. The report is divided into four parts: (1) an assessment of the cryogenic engineering data base used in the MFE community, and recommendations for needed work for that base, (2) experimental progress on measurement of transient helium heat transfer; the data are of importance for magnet stability analysis, (3) presentation of a newly developed general technique for analyzing the efficiency of helium refrigerators of any configuration and thereby identifying sources of inefficiency, and (4) progress towards setting up a data bank on refrigeration system reliability. The technology assessment, item (1), is a revision of a preliminary version dated May 13, 1977, with inclusion of feedback received from both within and outside the MFE community. (Portions of this document are not fully legible)

712,718
PB-298 017/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Atomic Processes for Magnetic Fusion Research and Their Data Status.
Final rept.
W. L. Wiese. 1979, 36p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proc. IX Int. Symp. on Physics of Ionized Gases, Dubrovnik, Yugoslavia, Aug. 28-Sept. 2, 1978, R. K. Janey, Ed., p661-696 (Institute of Physics, Beograd, Yugoslavia, 1979).

Keywords: Nuclear fusion, Ions, Atomic properties, Ionization, *Atom collisions, *Ion collisions, Magnetic fusion research.

The role of atomic collision and radiation processes in magnetic fusion research is discussed, using the coronal plasma model as a guide. The data needs and priorities with respect to the type of atomic quantity, chemical element and stage of ionization are reviewed. The status of our knowledge for such atomic data is surveyed, and some of the problems in acquiring them are pointed out. It is shown that reliable atomic data for highly ionized species are very scarce. A few examples for the impact of atomic physics on fusion research are cited.

712,719
PB80-191497 PC **A17**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Materials Studies for Magnetic Fusion Energy Applications at Low Temperatures - III,
R. P. Reed. Jun 80, 392p NBSIR-80-1627
Sponsored in part by Department of Energy, Washington, DC. See also part 2, PB-299 288.

Keywords: *Stainless steels, Superconducting magnets, Aluminum alloys, Cryogenics, Welding, Laminates, Fiberglass reinforced composites, *Thermonuclear reactor materials, Epoxy matrix composites, Steel 304-L, Steel 316, Steel 304, Steel 310, Aluminum alloy 5083.

The reports presented here summarize the work of the low temperature materials research project for the third year of the program. The various projects are outlined and the research results are presented. The major thrust of the measurements has been the evaluation of the low temperature mechanical and physical properties of stainless steel base metal and welds, with particular emphasis on the nitrogen-strengthened stainless steels. Aluminum alloys have received some consideration also. Work has also been done on the production and standardization of nonmetallics, primarily industrial laminates, for low temperature applications and on the measurement of their properties at cryogenic temperatures. The third NBS/DOE Vail workshop was held in October 1979. A brief description is given of that program.

712,720
PB81-121840 Not available NTIS
National Bureau of Standards, Washington, DC.
Emittance Growth in High Current Beam Transport.
S. Penner. Feb 78, 4p
Pub. in Proceedings of the Heavy Ion Fusion Workshop Held at Brookhaven National Lab., Upton, NY. on Oct 17-21, 1977, p127-130 Feb 1978.

Keywords: *Ion beams, Nuclear fusion, Particle trajectories, Space charge, Mathematical models, Simulation, *Beam transport, Heavy ions.

The transport of heavy-ion particle beams in a symmetric FODO quadrupole focusing channel is calculated by a numerical simulation. For sufficiently high beam currents, a rapid initial growth rate of the beam emittance is found, for beams whose current density is similar to that of the Kapchinsky-Vladimirsky distribution. After the initial emittance growth, continued transport of the beam results in a much less rapid growth rate.

712,721
PB81-222507 PC **A99**/MF **A01**
National Bureau of Standards, Boulder, CO.
Materials Studies for Magnetic Fusion Energy Applications at Low Temperatures - V.
Technical rept.
R. P. Reed, and N. J. Simon. Apr 81, 659p NBSIR-81-1645
See also part 2, PB80-191497. Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Stainless steels, Superconducting magnets, Aluminum alloys, Cryogenics, Welding, Laminates, Castings, Fiberglass reinforced plastics, *Thermonuclear reactor materials, Carbon fiber reinforced plastics, Epoxy matrix composites, Steel 304, Steel 304-L, Steel 316-L, Aluminum alloy 5083, Steel 18Cr 8Ni.

The reports presented here summarize the fourth year of work on the low temperature materials research program. Highlights of the results are presented first. Research results are given for the four main program areas: structural alloys, weldings and castings, nonmetallics, and technology transfer. Objectives, approaches, and achievements are summarized in an introduction to each program area. The major portion of the program has been the evaluation of the low temperature mechanical and physical properties of stainless steel base metal and welds, with particular emphasis on the nitrogen-strengthened stainless steels. Aluminum alloys have received some consideration also. Work has been done on the production and standardization of nonmetallics, primarily industrial laminates, for low temperature applications and on the measurement of their properties at cryogenic temperatures. A brief description is given of the fourth NBS/DoE Vail workshop held in October 1980.

712,722
PB82-140906 Not available NTIS
National Bureau of Standards, Washington, DC.
Nondestructive Analysis of Laser Fusion Microsphere Targets Using Rotational Raman Spectroscopy.
Final rept.
M. C. Drake, G. J. Rosasco, R. Schneggenburger, and R. L. Nolen. Dec 79, 4p
Pub. in Jnl. of Applied Physics 50, n12 p7894-7897 Dec 79.

Keywords: *Nondestructive tests, *Hydrogen isotopes, Microanalysis, Reprints, Raman spectroscopy, Laser targets, Laser fusion, Microspheres.

The use of rotational Raman scattering for nondestructive analysis of laser fusion microsphere targets is reported. Typical hollow, glass microsphere sample characteristics are 100 micrometers diameter, 1.0 micrometer glass wall thickness, and 0.5 nl volume containing a mixture of hydrogen, deuterium, and tritium gases at pressures of 10-70 atms (total gas sample weights of 5 ng). Relative species mole fraction measurements for all hydrogen isotope species are determined from spectral peak height analysis from rotational Raman spectra. Accuracies of + or - 0.01 (mole fraction) are obtained from spectra requiring 20 minutes scan time. Individual species detectability limits are less than 100 pg. Absolute partial pressure measurements (accurate to + or - 20 percent) are obtained using calibration spheres of known diameter and pressure.

712,723
PB82-144023 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoelectric Quantum Efficiencies and Filter Window Absorption Coefficients from 20 eV to 10 KeV.
Final rept.
R. H. Day, P. Lee, E. B. Saloman, and D. J. Nagel. Nov 81, 9p
Pub. in Jnl. of Applied Physics 52, n11 p6965-6973 Nov 81.

Keywords: *Photocathodes, *Plasma diagnostics, Nuclear fusion, Quantum efficiency, Reprints, *X-ray detection.

Photodiodes with x-ray sensitive photocathodes are commonly used as broadband x-ray detectors in fusion plasma diagnostics. The authors have measured the photocathode quantum efficiency between 1-500 A of common photocathode materials including aluminum, copper, nickel, gold, three forms of carbon, chromium, and cesium iodide. The authors have also studied the effects of the experimental environment and long-term cathode aging on the measured quantum efficiencies. In addition, they have measured the x-ray mass-absorption coefficients of x-ray filter windows of Kimfoil, aluminum, polypropylene, and Formvar in energy regions where data were previously unavailable.

712,724
PB83-146431 Not available NTIS
National Bureau of Standards, Washington, DC.
Sensitivity of Commercial Ion Gage Tubes.
Final rept.
C. R. Tilford. 1981, 4p
Sponsored in part by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Proceedings of Symposium on Engineering Problems of Fusion Research (9th), Chicago, Illinois, October 26-29, 1981, p1924-1927 1981.

Keywords: *Ionization gages, *Vacuum gages, Performance evaluation, Sensitivity, Accuracy.

Fusion science and engineering requires an increasing number of accurate vacuum measurements. In order to determine what level of a performance can be expected from different ion gages a gage characterization program has been initiated. This program determines the uniformity, accuracy, and linearity for different gage tubes, and for the more promising candidates further characterizes the sensitivity for different gases and the effects of changing bias voltages and emission currents. Results to date show the best performance from conventional triode and tubulated Bayard/Alpert gages with tungsten filaments. Significantly poorer results are obtained from nude Bayard/Alpert gages and gages with thoriated iridium filaments.

712,725
PB84-217488 PC **A18**/MF **A01**
National Bureau of Standards (NML), Boulder, CO. Fracture and Deformation Div.
Materials Studies for Magnetic Fusion Energy Applications at Low Temperatures - VII.
Technical rept.
R. P. Reed, and N. J. Simon. May 84, 425p NBSIR-84/3000
See also PB83-259630. Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Superconducting magnets, *Stainless steels, *Composite materials, *Cryogenics, Mechanical properties, Weldments, Castings, Materials, Technology transfer, *Magnetic fusion energy, Steel 304, Steel 18Cr 13Mn 3Ni, Steel 19Cr 10Ni.

Work leading toward development of strong, tough structural alloys for use in superconducting magnets continued this year, with low temperature studies assessing the quantitative dependence of the yield strength, density, and elastic constants of AISI 304 stainless steels upon carbon and nitrogen concentration. Tensile property measurements of developmental austenitic steels from the U.S., Japan, and the U.S.S.R. confirmed a logarithmic dependence of yield strength upon temperature between 4 K and room temperature. Evidence is presented to show that the flow strength and austenite stability of stainless steels are not significantly affected by 8-T fields at 4 K. New instrumentation developed for low-temperature testing included a computer-assisted apparatus that was used to measure threshold fatigue. Low-temperature welding research involved an investigation of the weld reinforcement effect on the weld joint strength and measurements of the 4-K fracture toughness of 25MN - 5Cr steel weldments and 320LR electrodes. In the area of nonmetallics, a standardized test specimen was devised for a screening program to develop radiation-resistant composites for magnet insulation, and models to predict damage in woven glass/epoxy laminates were tested experimentally at low temperatures. Mechanical properties of concrete mortar and polyurethane foam at 4 K are reported.

712,726
PB85-115491 Not available NTIS
National Bureau of Standards, Washington, DC.
Structural Alloys for Superconducting Magnets in Fusion Energy Systems.
Final rept.
H. I. McHenry, and R. P. Reed. 1980, 18p
Sponsored in part by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Nuclear Engineering and Design, v58 n2 p219-236 May 80.

Keywords: *Superconducting magnets, Stainless steels, Aluminum alloys, Cryogenics, Mechanical properties, Reprints, Steel 304, Steel 310, Steel 316, Aluminum alloy 5083, Aluminum alloy 6061, Aluminum alloy 2219, Steel 21Cr 9Mn 6Ni.

The behavior of selected alloys for superconducting magnet structures in fusion energy systems is reviewed with emphasis on the following: austenitic stainless steels (AISI grades 304, 310S and 316), nitrogen-strengthened austenitic stainless steels (types 304LN, 316LN and 21Cr-6Ni-9Mn) and aluminum alloys (grades 5083, 6061 and 2219). The mechanical and physical properties of the selected alloys at 4 K are reviewed. Welding, the properties of weldments and other fabrication considerations are briefly discussed. The available information suggests that several commercial alloys have adequate properties at 4 K and sufficient fabrication characteristics for the large magnet structures needed for fusion energy systems.

712,727
PB85-120616 Not available NTIS
National Bureau of Standards, Washington, DC.
Low Temperature Materials Research Program for Magnetic Fusion Energy.
Final rept.
F. R. Fickett, M. B. Kasen, H. I. McHenry, and R. P. Reed. 1978, 11p
Pub. in Advances in Cryogenic Engineering 24, p52-62 1978.

Keywords: *Nuclear fusion, *Superconducting magnets, Alloys, Mechanical properties, Cryogenics, Reviews, Reprints, *Fusion reactors.

The Cryogenics Division of NBS is currently operating a program for ERDA to develop data on materials properties, both mechanical and physical, of solids which have application in superconducting magnets for magnetic fusion energy. The materials groups considered are: structural alloys; thermal insulators; electrical insulators, films and coatings; structural composites and bulk insulators; conductors; adhesives. The authors have recently completed a survey of materials needs and current choices for proposed MFE devices. The results of the survey will be presented. In addition, the research program and data handbook project, both now underway, will be described.

712,728
PB85-143006 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sensitivity of Commerical Ion Gage Tubes.
Final rept.
C. R. Tilford. 1981, 1p
Sponsored by Department of Energy, Washington, DC., Illinois Univ. at Urbana-Champaign, Argonne National Lab., IL., and Institute of Electrical and Electronics Engineers, Inc., New York.
Pub. in Proceedings of Symposium on Engineering Problems of Fusion Research (9th), Chicago, IL., October 26-29, 1981, p1924+, IEEE Catalog No. 81CH1715-2 NPS, p1924+ 1981.

Keywords: *Ionization gages, Measuring instruments, Vacuum gages, Performance, Sensitivity, Accuracy, Linearity, Variability.

Fusion science and engineering requires an increasing number of accurate vacuum measurements. In order to determine what level of a performance can be expected from different ion gages a gage characterization program has been initiated. This program determines the uniformity, accuracy, and linearity for different gage tubes, and for the more promising candidates further characterizes the sensitivity for different gases and the effects of changing bias voltages and emission currents. Results to date show the best performance from conventional triode and tubulated Bayard/Alpert gages with tungsten filaments. Significantly poorer results are obtained from nude Bayard/Alpert gages and gages with thoriated iridium filaments.

712,729
PB85-196129 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Perturbance of the Composition Depth Profile of a Material Due to Multi-Directional Ion Bombardment.
Final rept.
O. F. Goktepe, M. J. Roush, F. Davarya, and T. D. Andreadis. 1982, 2p
Sponsored by American Nuclear Society, LaGrange Park, IL.
Pub. in Transactions of the American Nuclear Society v43 p190-191, 1982.

Keywords: *Radiation damage, Ion beams, Monte Carlo method, Xenon, Reprints, *Ion bombardment, *First wall, *Fusion reactors, EVOLVE computer program.

The ion bombardment of multi-element solids, whether in alloy or oxide form, often leads to marked compositional changes at the surface as a consequence of ion

implantation, preferential sputtering, and atomic cascade mixing. For fixed energy ions, these mechanisms produce a composition profile which is dependent upon the incident angle of the ions. Research in the area of ion-bombardment-induced composition changes has almost exclusively dealt with mono-directional ion beams. Most applications of ion bombardment are concerned with well-collimated beams. In the case of the first wall of a fusion reactor, however, the impinging ions are not restricted to any particular angle. The Monte Carlo code EVOLVE, which models the ion bombardment of surfaces, has been used to correlate the composition changes due to a multidirectional ion beam to those of mono-directional beams. Calculations are presented for a multi-directional Xe beam of 1.5 keV containing equal portions of ions with incident angles of 0 degrees and 70 degrees.

712,730

PB85-236362 PC **A15**/MF **A01**
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Materials Studies for Magnetic Fusion Energy Applications at Low Temperatures - 8.
Technical rept.
R. P. Reed. May 85, 335p NBSIR-85/3025
See also PB84-217488. Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.

Keywords: *Superconducting magnets, *Stainless steels, *Composite materials, *Cryogenics, Mechanical properties, Weldments, Materials, Technology transfer, Magnetic fusion energy, Steel 304, Steel 14Mn 1Mo 8Ni, Carbon reinforced plastics, Steel 18 Cr 13Mn 3Ni.

The report contains results of a research program to produce material property data that will facilitate design and development of cryogenic structures for the superconducting magnets of magnetic fusion energy power plants and prototypes. The program was developed jointly by the staffs of the National Bureau of Standards and the Office of Fusion Energy of the Department of Energy; it is managed by NBS and sponsored by DOE. Research is conducted at NBS and at various other laboratories through subcontracts with NBS. Research results for 1984 are summarized in an initial 'Highlights of Results' section and reported in detail in the technical papers that form the main body of this report. The technical papers are presented under four headings reflecting the main program areas: Welding, Nonmetallics, Structural Alloys, and Technology Transfer. Objectives, approaches, and achievements are summarized in an introduction to each program area.

712,731

PB86-231099 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Development of Radiation-Resistant Organic Insulators for Magnetic Fusion Energy Applications.
Final rept.
M. B. Kasen. 1985, 4p
Sponsored by Department of Energy, Washington, DC. Div. of Magnetic Fusion Energy.
Pub. in Proceedings of International Conference on Nuclear Power Plant Aging, Availability Factor and Reliability Analysis, San Diego, CA., July 8-12, 1985, p265-268.

Keywords: *Electrical insulation, Superconducting magnets, Neutron irradiation, Cryogenics, *Physical radiation effects, Gamma radiation, Fusion reactors.

Current knowledge of cryogenic irradiation effects on organic-matrix electrical insulators required for the superconducting magnets in magnetically-confined, fusion energy systems is reviewed. It is concluded that the performance of presentiy available materials is marginal for such applications. Since the cost of substituting inorganic materials as insulators appears to be inordinately expensive, a program to develop organic insulators having improved performance is under way. The program will make use of the National Low Temperature Neutron Irradiation Facility currently being constructed at ORNL. The main features of the program are described.

712,732

PB86-243375 PC **A15**/MF **A01**
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Materials Studies for Magnetic Fusion Energy Applications at Low Temperatures - 9.
Technical rept.
R. P. Reed. May 86, 333p NBSIR-86/3050
See also PB85-236362. Sponsored by Department of Energy, Washington, DC. Office of Fossil Energy.

Keywords: *Superconducting magnets, *Stainless steels, Cryogenics, Copper, Aluminum, Weldments, Mechanical properties, Toughness, Fusion reactors, Steel 316, Steel 304, Steel 308, Fiber reinforced composites, Physical radiation effects.

The report contains results of a research program to produce material property data that will facilitate design and development of cryogenic structures for the superconducting magnets of magnetic fusion energy power plants and prototypes. Research results for 1985 are summarized in an initial 'Highlights of Results' section and reported in detail in the technical papers that form the main body of the report. The technical papers are presented under four headings reflecting the main program areas: Welding, Nonmetallics, Structural Alloys, and Technology Transfer. Objectives, approaches, and achievements are summarized in an introduction to each program area.

712,733

PB87-128971 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Strategy for the Data Base Construction on Radiation-Resistant Cryogenic Composite Insulators for Magnetic Fusion Energy Applications.
Final rept.
M. B. Kasen. 1986, 7p
Sponsored by Department of Energy, Washington, DC. Div. of Magnetic Fusion Energy.
Pub. in Proceedings of International Symposium on Fundamental Research Strategy in the Development of New Materials for Efficient Energy Conversion, Osaka (Japan), August 25-27, 1986, p112-118.

Keywords: *Superconducting magnets, *Electrical insulation, Fiber composites, Cryogenics, Fracture strength, Neutron irradiation, Fusion reactors, Data bases, Physical radiation effects, International cooperation.

A strategy is suggested for the development of fiber-reinforced, organic insulators to be used in superconducting magnets for magnetic fusion energy power systems. Two data bases are required. The first is a component data base providing information for basic materials selection. The second is an engineering data base generated on insulators fabricated from the selected components. Successful completion of these tasks requires multidisciplinary expertise. Cooperative research is presently under way among laboratories in the United States, Japan, and England.

712,734

PB87-232575 PC **A18**/MF **A01**
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Materials Studies for Magnetic Fusion Energy Applications at Low Temperatures--X,
R. P. Reed. May 87, 418p NBSIR-87/3067
See also report dated 1980, PB85-115491. Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.

Keywords: *Superconducting magnets, Stainless steels, Aluminum alloys, Cryogenics, Mechanical properties, *Thermonuclear reactor materials, Steel 304, Steel 310, Steel 316, Aluminum alloy 2090.

The report contains the results of a research program to determine the properties of materials that may be used in cryogenic structures for the superconducting magnets of magnetic fusion energy power plants and prototypes. Its purpose is to facilitate their design and development. The program was developed jointly by the staffs of the National Bureau of Standards and the Office of Fusion Energy of the Department of Energy; it is managed by NBS and sponsored by DOE. Research is conducted at NBS and at other laboratories through subcontracts with NBS. Research results for 1986 are presented in technical papers under five headings that reflect the main program areas: Structural Alloys, Welding, Nonmetallics, Technology Transfer, and United States-Japan Cooperative Program. Objectives and research highlights are summarized in the introduction to each program area.

Isotopes

712,735

PATENT-4 025 406 Not available NTIS
Department of Commerce, Washington, DC.
Photochemical Method for Chlorine Isotopic Enrichment.
Patent.
M. Lamotte, H. J. Dewey, R. A. Keller, and J. J. Ritter. Filed 28 Jan 76, patented 24 May 77, 5p PB-271 821/1, PAT-APPL-652 911
Supersedes PB-250 078.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, D.C. 20231 $0.50.

Keywords: *Patents, *Chlorine isotopes, *Photochemistry, *Isotope separation, Excitation, Chemical reactions, Molecular energy levels, Separation, Performance evaluation, Sulfur inorganic compounds, PAT-CL-204-157.1, *Laser induced reactions, *Chlorine 35, *Chlorine 37, Thiophosgene.

An isotopic starting material consisting of a mixture of chlorine-35 and chlorine-37 isotopic species of an isotopic compound having the formula CYCIX, wherein Y is O or S and X is Cl or F, such as thiophosgene, is selectively isotopically enriched by means of a laser-induced photochemical reaction between selected chlorine isotopic species in the starting material and a dialkoxyethlene, such as diethoxyethylene. The wavelength of the radiation is selected so as to selectively excite at least one but less than all of the chlorine isotopic species in the starting material, thereby causing the excited species to preferentially react with the dialkoxyethylene. The resulting reaction product is readily separable from the reaction mixture thereby leaving unreacted isotopic starting material selectively enriched in the unexcited chlorine isotopic species.

712,736

PB-264 312/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Activation Analysis with a Californium-252 Source.
Final rept.,
G. J. Lutz. 1976, 15p
Pub. in Proceedings of Education Seminar on Use of Californium-252 in Teaching and Research, Karlsruhe, Germany 14-18 Apr 75, IAEA-SR-3/3, Chapter in Some Physical, Dosimetry and Biomedical Aspects of Californium-252 p73-87 (International Atomic Energy Agency, Vienna, Austria 1976.)

Keywords: *Neutron activation analysis, Californium isotopes, Chemical analysis, Detection, Surface waters, Minerals, Oceanography, In vivo analysis, Radioactive analysis, Safety, *Californium 252.

Aside from the great disparity in fluxes, neutron activation analysis with a 252 Cf source differs in two ways from the more traditional methods with a reactor. Firstly, in situ analyses require that the bombarding source and detector conform to the requirements of the sample, e.g. material on a conveyor belt or minerals in a bore hole, and hence frequently use 252 Cf sources; secondly, prompt capture gamma rays, the photons produced virtually simultaneously with the capture of a neutron by the nucleus, are frequently used for detection in californium activation analysis. They are rarely used in activation analysis with a reactor. This review discusses the major 'field' applications of 252 Cf activation analysis--on-stream analysis, well logging, terrestrial mineral exploration, in vivo analysis, oceanography, studies of inland waters and sediments, and for nuclear safeguards. This is followed by a discussion of more conventional laboratory activation analysis with the isotope source.

712,737

PB-281 051/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radionuclidic Purity.
Final rept.,
D. D. Hoppes. 1977, 9p
Prepared in cooperation with Johns Hopkins Medical Institutions, Baltimore, Md., Food and Drug Administration, Rockville, Md., and Veterans Administration, Washington, D.C.
Pub. in Proceedings of Symposium on Standardization, Performance and Quality Control in Nuclear Medicine, Gaithersburg, Md., Jun 12-14, 1975, p164-172, 1977.

Keywords: *Radioactive isotopes, Purification, Gamma ray spectroscopy, Detectors, Chemical analysis, Reprints.

Radionuclidic impurity determinations are described, with the selection and use of germanium detectors for measuring gamma rays discussed in detail. Spectral artifacts and analysis methods are illustrated, and an example of an impurity determination is given.

712,738
PB-290 703/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Environmental Radiocarbon Measurements.
Final rept.
L. A. Currie. 1978, 19p
Sponsored in part by Environmental Protection Agency, Washington, DC.
Pub. in Proceedings of the Conference on Radiocarbon Dating with Accelerators (First), Held at Rochester, NY. on April 20-21, 1978, p372-390.

Keywords: *Radiocarbon dating, Carbon 14, Carbon 12, Fossil fuels, Low level counting.

Measurements of the 14C/12C ratio in environmental carbonaceous species can provide a unique indication of natural vs anthropogenic (fossil fuel) origin. Because of the low concentrations of atmospheric gases and particles which contain carbon, convenient sample sizes are limited to tens of milligrams of carbon. An assessment of the measurement feasibility, using 10 mg-C samples and Accelerator Mass Spectrometry and Low-Level Counting is given, together with the kinds of environmental problems which might be studied. Preliminary low-level gas-proportional counting results, are given for atmospheric particulate samples containing 5-10 mg-C.

712,739
PB79-600005
(Order as PB80-103674, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Isoionic Isotope Exchange with Hydroxylapatite and the Dilution Effect.
D. N. Misra. 1979, 11p
Included in Jnl. of Research of the National Bureau of Standards, v84 n5 p395-406 1979.

Keywords: *Dilution effect, At same pH and concentration, Hydration shell, Role of, Hydroxylapatite, At different pHs, Isotopic exchange, Isoionic, Recrystallization, Role of, Surface layer, Role of.

Isoionic isotope exchange date of (45)Ca(2plus) and (32)PO4(3minud) in a saturated solution with hydroxylapatite at 25 degree C, collected by Avnimelech, have been reinterpreted on the basis that the processes consisted of three pools: hydration shell, surface layer and 'recrystallization of crystallites,' These processes are regarded as strictly separable. This theoretically allows: (i) a quantitative evaluation of the constants involved in the processes; (ii) an estimation of the exchange capacities of hydration and surface layers (fast pools) which may be pH-dependent; and (iii) a determination of the isoionic exchange rate constants. The constants are essentially the same for Ca(2 plus) and PO4(3minus) at a given pH if the cross-sectional areas of the ions are taken as 23 Angstrom 2 and 33 Angstrom 2 respectively; they, perhaps, increase linearly with the hydrogen ion concentration of the solutions. The effects of three consecutive abrupt dilutions of the radioactive ions without changing the concentrations (or pH) of the nonradioactive components of the solution are predictable by a mathematical model based on the complete reversibility of the two fast pools and the kinetics of the irreversible third pool.

712,740
PB81-121873 Not available NTIS
National Bureau of Standards, Washington, DC.
Preparation and Calibration of the 1978 National Bureau of Standards Tritiated-Water Standards.
M. P. Unterweger, B. M. Coursey, F. J. Schima, and W. B. Mann. Mar 80, 4p
Pub. in International Jnl. of Applied Radiation and Isotopes 31, p611-614 Mar 80.

Keywords: *Tritium, *Standards, *Calibrating, Preparation, Reprints, Standard reference materials.

The National Bureau of Standards activity standards for tritiated water, SRM 4926 and SRM 4927, have been recalibrated by the method of internal gas-proportional counting, and a new batch of standards have been prepared. The agreement between the 1961 and 1978 gas counting measurements is 0.7%, assuming the adopted half life of 12.35 years. The results are in complete agreement if, instead, a half life of 12.44 years is used. A half life of 12.43 + or - 0.05 years, based on measurements of the NBS tritiated-water standards over a span of 18 years, is suggested.

712,741
PB81-145443 Not available NTIS
National Bureau of Standards, Washington, DC.
Mass Spectrometric Isotope Metrology of Uranium on Resin Beads.
Final rept.
J. D. Fassett, W. R. Kelly, L. A. Machlan, and L. J. Moore. 1980, 8p
Pub. in Proceedings of the ORNL Conference on Analytical Chemistry in Energy Technology, Gatlinburg, TN., October 8-12, 1979, Paper in Radioelement Analysis Progress and Problems, p357-364 1980.

Keywords: *Uranium, *Mass spectroscopy, *Isotope separation.

The potential for making high-precision, high-accuracy isotopic ratio measurements on submicrogram amounts of uranium absorbed on anion-exchange resin beads has been investigated utilizing a single stage thermal ionization mass spectrometer with pulse counting detection. The errors inherent in this measurement process has been evaluated.

712,742
PB81-149882 Not available NTIS
National Bureau of Standards, Washington, DC.
Liquid Scintillation Counting of Inorganic Radiochemicals in High-Efficiency Scintillators.
Final rept.
B. M. Coursey, and J. M. Calhoun. 1980, 11p
Pub. in Proceedings of the International Conference on Liquid Scintillation Counting, Recent Applications and Development, San Francisco, CA., August 21-24, 1979, Paper in Sample Preparation and Applications II, p19-29 1980.

Keywords: *Radioactive isotopes, *Scintillation counters, Performance evaluation, Samples.

Methods of incorporating inorganic radiochemicals into liquid and solgel scintillators that exhibit high scintillation yield are described. Liquid-scintillation measurements have been made at the National Bureau of Standards on 31 different radionuclides for a variety of applications in radionuclide metrology. Sample preparation techniques are described for a number of radionuclides that differ markedly in their chemical behavior as well as in their nuclear-decay characteristics. Particular emphasis given to radionuclides such as (55)Fe and (241)Pu which decay by emission of low-energy radiations.

712,743
PB82-265687 Not available NTIS
National Bureau of Standards, Washington, DC.
CO2 Laser Coincidences with nu(3) of SiF4 Near 9.7 Micrometer.
Final rept.
R. S. McDowell, C. W. Patterson, N. G. Nereson, F. R. Petersen, and J. S. Wells. Sep 81, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Optics Letters 6, n9 p422-424 Sep 81.

Keywords: *Silicon fluorides, Carbon dioxide lasers, Intermediate infrared radiation, Reprints, *Laser isotope separation, Tunable lasers.

Doppler-limited tunable-diode-laser spectra of the stretching fundamental (nu sub 3) of (28)SiF4 at 1031/cm have been analyzed and the spectroscopic constants determined. Explicit identifications have been made for transitions near CO2 laser lines of the 9.4 micrometer band; eight such transitions have been observed in sub-Doppler saturation spectra obtained with a waveguide CO2 laser. Implications for isotope enrichment experiments are discussed.

712,744
PB83-135202 Not available NTIS
National Bureau of Standards, Washington, DC.
Comments on the NBS Tritiated-Water Standards and Their Use.
Final rept.
W. B. Mann, M. P. Unterweger, and B. M. Coursey. 1982, 4p
Pub. in International Jnl. of Applied Radiation and Isotopes 33, p383-386 1982.

Keywords: *Tritium, *Water, *Standards, *Half life, Preparation, Reprints.

A panel of consultants of the International Atomic Energy Agency has recommended the adoption of the National Bureau of Standards tritiated-water standard and the half life of 12.43 years that resulted from a 1978 recalibration of the 1961 standard by NBS, and measurements of that standard by several other laboratories. Transformation factors are given to convert results obtained using a previous standard and half life to the newly recommended standard and half life. The preparation of a new low-level tritiated-water standard with an activity concentration of 1.312/s/g is described.

712,745
PB84-106830 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Transmission Measurements to Determine Isotopic Content of Spent Fuel.
Final rept.
J. W. Behrens, R. G. Johnson, and R. A. Schrack. 1983, 2p
Pub. in Proceedings of Transactions of the American Nuclear Society Annual Meeting, 1983, Detroit, MI, 44, p204-205.

Keywords: *Nuclear fuels, *Radioactive isotopes, *Chemical analysis, Radioactive wastes, Reprints, *Spent fuels, Neutron time of flight.

The NBS has completed neutron transmission measurements on spent nuclear fuel. The measurements were conducted using the NBS linac as a pulsed-neutron source and a (6)Li glass detector located 20 meters from the neutron-producing target. The energy range of interest was from 0.8 to 45 eV, determined using the time-of-flight technique. From our data we have identified resonances from 11 actinide isotopes and 5 fission products. Analysis of the resulting transmission dips gives a quantitative determination of the isotopic content.

712,746
PB84-135904 Not available NTIS
National Bureau of Standards, Washington, DC.
Standardization of (18)F for Use in Positron-Emission Tomography.
Final rept.
B. M. Coursey, D. D. Hoppes, M. P. Unterweger, A. G Malonda, R. A. Margolin, R. M. Kessler, and R. Manning. 1983, 9p
Pub. in International Jnl. of Applied Radiation and Isotopes 34, n8 p1181-1189 1983.

Keywords: *Standards, Standardization, Ionization chambers, Gamma spectrometers, Reprints, *Fluorine 18, *Positron emission tomography, Liquid scintillators, Li-drifted Ge detectors, Nuclear medicine.

Fluorine-18 has been standardized using three counting systems: (i) the NBS pressurized 4 pi gamma ioization chamber, (ii) a 4 pi beta liquid-scintillation counter, and (iii) a Ge(Li) gamma-ray spectrometer previously calibrated with sodium-22. The results of the three measurements agreed to within 1 percent. Solution standards of fluorine-18 were used at the NIH to calibrate counting systems used in position-emission tomography (PET) for nuclear medicine.

712,747
PB85-197606 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calibration for Measurements with Background Correction Applied to Uranium-235 Enrichment.
Final rept.
W. Liggett. 1983, 16p

Pub. in Nuclear Instruments and Methods in Physics Research 216, n3 p455-570 1 Nov 83.

Keywords: *Uranium 235, *Enrichment, *Calibrating, *Gamma ray spectroscopy, Reprints.

In enrichment measurement by gamma spectroscopy, two activity levels are observed: One is the sum of the response to the enrichment and a background level, and the second is another background level. Calibration consists of determining not only the relation between the response and the enrichment but also the relation between the two background levels. A calibration procedure with this property is developed under the assumption that the random errors have constant variance and the assumption that the two background

levels are proportional. This procedure provides a consistent estimator for the calibration curve and interval estimates for the unknowns measured after calibration. The calibration procedure is applied to enrichment measurements made with the SAM-2 enrichment meter. With these measurements as illustrations, techniques for judging the validity of the assumptions are presented.

712,748

PB85-222313 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Mass Spectrometric Analysis of Uranium and Plutonium Loaded Anion Exchange Resin Beads: An Interlaboratory Round Robin.
Final rept.
J. D. Fassett, and W. R. Kelly. 1982, 8p
Pub. in Proceedings of ORNL Conf. Analytical Chemistry in Energy Technology, Gatlinburg, TN., 1981, p131-138 1982.

Keywords: *Isotope separation, *Anion exchanging, *Laboratory equipment, *Chemical exchange isotope separation, *Uranium isotopes, *Plutonium isotopes, Polymers, Performance evaluation, Radioactive isotopes, Chemical analysis, Error analysis, Spectroscopic analysis, *Thermal ionization mass spectroscopy.

The resin bead sample loading technique in thermal ionization mass spectrometry has been evaluated for the accurate and precise measurement of uranium and plutonium isotopic ratios by means of an interlaboratory analysis program (round robin) sponsored by the National Bureau of Standards (NBS). Nanogram size samples, including both standards and unknowns, were loaded onto anion exchange resin beads and transported to participating laboratories for measurement. Six laboratories or 40 percent of the laboratories identified as having the requisite high sensitivity instrumentation have participated in all phases of the round robin to date. Isotopic fractionation is concluded to be a major source of imprecision and calibration of isotopic fractionation the major source of inaccuracy.

712,749

PB86-140274 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Occupational Health and Safety Div.
National Bureau of Standards Health Physics Radioactive Material Shipment Survey, Packaging, and Labelling Program Under ICAO/IATA and DOT Regulations.
Final rept.
D. R. Sharp, and L. A. Slaback. Feb 84, 5p
Pub. in Proceedings of the Health Physics Society Mid-year Topical Symposium (17th), Pasco, Washington, February 5-9, 1984, p7.87-7.91.

Keywords: *Packaging, *Marking, Regulations, Transportation, *Radioisotopes, BASIC computer program, US NBS.

NBS routinely ships, both domestically and internationally, many isotopes in small to moderate activities. These shipments are divided about evenly between Limited Quantity and Type-A shipments, with many containing mixtures of isotopes in a variety of combinations. The ICAO/IATA shipping regulations (and the new DoT regulations on their model) specify individual shipping parameters for every isotope, with limited quantity limits that are additionally a function of physical state. The resulting parametric permutations have become so complex that quality control in the shipment of these radioactive packages has become difficult to maintain. The authors have developed a computer program that will guide a person with minimal training in transportation regulations through package surveys and give exact packaging and labelling instructions. The program is a 27K-byte, user-friendly, BASIC program that runs on the Epson-HX20 notebook computer with microcassette drive and 16K memory expansion unit. This small computer is more manageable than the regulation books for which it will be substituted and will be used in our routine radioactive shipments.

712,750

PB87-105821 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Radiocarbon Dating of Microgram Samples: Accelerator Mass Spectrometry and Electromagnetic Isotope Separation.
Final rept.
L. A. Currie, G. A. Klouda, D. Elmore, and H. E. Gove. 1985, 6p
Pub. in Nuclear Instruments and Methods in Physics Research B12, n3 p396-401 1985.

Keywords: *Radiocarbon dating, Mass spectroscopy, Carbon 14, Electromagnetic isotope separation, Reprints, *Isotope dating, Standard reference materials.

An exploratory experiment was performed to investigate methods for extending the direct atom counting technique to natural radiocarbon samples containing only micrograms of carbon. A threefold approach was adopted for the study: direct measurement of a microgram-size sample, in the form of elemental carbon; dilution of a few micrograms of an environmental (atmospheric particulate) reference sample with inert ('dead') carbon; and implantation of carbon ions (as CO(1+)) into copper foil prior to placement in the tandem accelerator ion source. The last experiment, which linked work with the NBS variable-geometry electromagnetic isotope separator and the NSRL tandem Van de Graaff, automatically led to isotopic enrichment during the implantation step. All three phases of the experiment were unique (not previously attempted) and gave consistent results, indicating great promise for the future application of direct atom counting to individual trace chemical species of environmental or archaeological importance.

712,751

PB87-108544 PC **A06**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry.
Uranium-235 Isotope Abundance Standard Reference Materials for Gamma Spectrometry Measurements.
Final rept.
B. S. Carpenter, J. W. Gramlich, R. R. Greenberg, L. A. Machlan, and P. DeBievre. Sep 86, 101p NBS/SP-260/96
Also available from Supt. of Docs as SN003-003-02763-4. Library of Congress catalog card no. 86-600585. Prepared in cooperation with Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements, and Department of Energy, Argonne, IL. New Brunswick Lab.

Keywords: *Uranium 235, *Gamma ray spectroscopy, *Standards, Isotope availability, *Standard reference materials, Uranium oxides U308.

The accurate determination of isotope abundances by any method requires that the measuring systems be calibrated using well characterized isotope reference materials. The National Bureau of Standards (NBS) and the Central Bureau for Nuclear Measurements (CBNM) have jointly produced and certified U3O8 nondestructive assay (NDA) reference samples to be used for calibrating gamma measurements. Five different uranium abundances have been certified (0.31, 0.71, 1.95, 2.95, and 4.46 nominal mass percent, (235)U/U). In the 260 series publication, the material fabrication and certification are described and a discussion of the measurement results affecting the accuracy of gamma spectrometry is given. These certified standards represent the first example of an international effort that establishes traceability to NBS, CBNM, and the basic SI units.

712,752

PB88-141023 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Standardization of Carbon-14 by 4 pi beta Liquid Scintillation Efficiency Tracing with Hydrogen-3.
Final rept.,
B. M. Coursey, W. B. Mann, A. Grau Malonda, E. Garcia-Torano, J. M. Los Arcos, J. A. B. Gibson, and D. Reher. 1986, 6p
Pub. in Appl. Radiat. Isot. 37, n5 p403-408 1986.

Keywords: *Carbon 14, *Standards, Tritium, Reprints, Liquid scintillation detectors.

Carbon-14 in the form of (14)C-tartaric acid solution has been standardized by means of 4(pi)(beta) liquid-scintillation efficiency tracing using the NBS (3)H-water standard. The method of computing the detector efficiency for a two-phototube counting system using a standard of (3)H is described. The combined uncertainty in the (14)C radioactivity concentration, which may be treated as if it were one standard deviation, is 0.20%.

Nuclear Explosions & Devices

712,753

PB87-224507 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Statistical Engineering Div.
Continuous Time Series Models for Unequally Spaced Data Applied to Modeling Atomic Clocks.
Final rept.,
R. H. Jones, and P. V. Tryon. 1987, 11p
Pub. in SIAM Jnl. Sci. Stat. Comput. 8, n1 p71-81 Jan 87.

Keywords: Reprints, *Atomic clocks, Kalman filters, Missing observations, State space representations, Time series analysis, Unequally spaced data.

State space representations and Kalman filters used to calculate likelihoods have increased the ease and flexibility of fitting time series models to data. When data are unequally spaced with no underlying basic sampling interval, continuous time series models are more natural than discrete time series models. State space representations still provide the flexibility needed to include a large class of models. The paper gives a survey of state space methods for continuous time processes, discusses extensions to multivariate data at unequally spaced time points with missing data within the observation vector, and gives an example of estimating time and model parameters from an ensemble of atomic clocks.

Nuclear Instrumentation

712,754

DE85014352 PC **A02**/MF **A01**
British Columbia Univ., Vancouver. TRIUMF Facility.
FASTBUS for the Particle Accelerator Laboratories.
W. K. Dawson, L. Costrell, H. Ikeda, P. J. Ponting, and H. V. Walz. May 85, 3p SLAC-PUB-3697, CONF-850504-189
Contract AC03-76SF00515
Particle accelerator conference, Vancouver, Canada, 13 May 1985.
Also Pub. in IEEE Transactions on Nuclear Science NS-32, n5 p2089-2091 October 1985.

Keywords: *Accelerator Facilities, *Fastbus System, Data Acquisition Systems, Reviews, Specifications, ERDA/440104.

The FASTBUS modular high speed data acquisition and control system for high energy physics and other applications was described by Costrell and Dawson at the 1983 Particle Accelerator Conference. Both the specification and the implementation of this interlaboratory development have progressed considerably since that time. Because of its many attractive features, FASTBUS is currently in use in several major nuclear and high energy physics laboratories and is also finding application in other areas. 10 refs. (ERA citation 10:037526)

712,755

NUREG/CR-4266 PC **A05**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Standard Beta-Particle and Monoenergetic Electron Sources for the Calibration of Beta-Radiation Protection Instrumentation.
Technical rept. (Final) Sep 82-May 85.
M. Ehrlich, J. S. Pruitt, C. G. Soares, C. E. Dick, and H. T. Heaton. Aug 85, 85p NBSIR-85-3169
Sponsored by Nuclear Regulatory Commission, Washington, DC. Office of Nuclear Regulatory Research.

Keywords: *Standards, *Calibrating, Radiation protection, Ionization chambers, Dose rate, *Beta sources, *Beta dosimetry, Electron sources, Beta detection, KeV range 100-1000, MeV range 01-10, Calibration standards.

Nuclear Instrumentation

In a project funded jointly by the National Bureau of Standards (NBS) and the Nuclear Regulatory Commission (NRC), NBS has developed a calibration facility for beta-particle instruments and sources used in radiation-protection dosimetry. The facility consists of beta-particle and nearly monoenergetic electron beams characterized in terms of absorbed-dose rates to plastic and in terms of beta-particle spectra. A second phase of the project was concerned with establishing secondary calibration laboratories for radiation-protection instruments. The final report includes a detailed discussion of (1) the determination of absorbed-dose rates to plastic for each beta-particle and nearly monoenergetic electron beam, dose-rate dependence on altitude above sea level, and an estimate of the overall uncertainties in dose-rate measurements; (2) beta-particle and nearly monoenergetic electron spectra and their dependence on source configuration; and (3) degree of achievable uniformity of beam cross sections. Included also is a review of the results of a first attempt to predict instrument response to realistic beta-particle environments from their response to monoenergetic electrons and knowledge of the approximate beta-particle spectra. Attached to the report are proposed guidelines for establishing secondary calibration laboratories for radiation-protection instruments.

712,756
PB-262 608/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radiometry with Synchrotron Radiation.
Final rept.,
R. P. Madden, and L. R. Hughey. 1976, 27p
Pub. in the Proceedings of Synchrotron Radiation Facilities, Quebec Summer Workshop, Quebec, Canada, June 15-18, 1976, Chapter 10.4 p10-51--10-77 1976.

Keywords: *Synchrotron radiation, *Radiation measuring instruments, Ionization chambers, Meetings, Storage rings, Reprints.

Transfer standard detectors are calibrated at NBS by comparing their output with that of a double-ionization chamber. In this instance the synchrotron radiation from the NBS electron storage ring (SURF) is utilized as a convenient source of radiation in the wavelength range of 190A to 600A. Synchrotron radiation is also used as an absolute irradiance standard. Numerous experimental checks of Schwinger's theoretical predictions have demonstrated agreement within the limits of accuracy of the measurements. SURF is a well characterized storage ring. The magnetic field and electron radius are known to about .01%. The major source of uncertainty is the determination of the number of electrons in orbit (N sub e). (N sub e) is measured with a narrow band photodiode calibrated by the NBS Optical Radiation Section. This method provides (N sub e) to about 2.4% and an overall uncertainty of less than 5% for wavelengths in excess of 40A.

712,757
PB-269 341/4 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
Exposure Spectra from NBS Vertical-Beam 60Co Gamma-Ray Source.
Final rept.,
M. Ehrlich, and C. G. Soares. Nov 76, 12p NBSIR-76-1117

Keywords: *Gamma rays, *Cobalt 60, Spectrum analysis, Pulse height analyzers.

Exposure spectra at a distance of 1 meter from the NBS vertical-beam 60 Co gamma-ray source are presented in tabular form for field sizes of practical interest. Also tabulated are contributions to exposure arising from source housing and collimator, as well as from the source proper.

712,758
PB-270 124/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calibration of Ge(Li) Gamma-Ray Spectrometers for the Measurement of Radioactive Noble Gases.
Final rept.,
B. M. Coursey, J. M. R. Hutchinson, and M. P. Unterweger. 1977, 3p
Pub. in International Jnl. of Applied Radiation and Isotopes, v28 p551-553 1977.

Keywords: *Radiation measuring instruments, *Calibrating, Gamma ray spectroscopy, Reprints, *Li drifted Ge detectors, *Gamma spectrometers.

Assays of radioactive noble gases, in particular reactor gaseous effluents, are routinely made with Ge(Li) gamma-ray spectrometers. In the past, significant uncertainties in these assays have been associated with the calibration of the detector, that is, with the preparation of a full-energy-peak efficiency vs gamma-ray energy curve for the gas container. A method of preparing such a curve, based on measurements made with gamma-ray point-source standards, is given here. An expression is given which relates the full-energy-peak efficiency for a point source above a glass hemisphere to that of a gaseous source in a spherical ampoule, for a given gamma-ray energy. Measurements made with standards of krypton-85, xenon-127, xenon-131m, and xenon-133 demonstrate that the method is suitable for the intended purpose.

712,759
PB-270 198/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radiation Measurements and Quality Control.
Final rept.,
W. L. McLaughlin. 1977, 35p
Pub. in Proceedings Int. Radiation Processing Conf., Puerto Rico, May 10-13, 1976, Radiat. Phys. Chem., v9 p147-181 1977.

Keywords: *Radiation measuring instruments, *Quality control, Dose rate.

Accurate measurements are essential to research leading to a successful radiation process and to the commissioning of the process and the facility. On the other hand, once the process is in production, the importance to quality control of measuring radiation quantities (i.e., absorbed dose, dose rate, dose distribution) rather than various other parameters of the process (i.e., conveyor speed, dwell time, radiation field characteristics, product dimensions) is not clearly established. When the safety of the product is determined by the magnitude of the administered dose, as in radiation sterilization, waste control, or food preservation, accuracy and precision of the measurement of the effective dose are vital. Since physical dose measurements are usually simpler, more reliable and reproducible than biological testing of the project, there is a trend toward using standardized dosimetry for quality control of some processes. In many industrial products, however, such as vulcanized rubber, textiles, plastics, coatings, films, wire and cable, the effective dose can be controlled satisfactorily by controlling process variables or by product testing itself. In the measurement or radiation dose and dose profiles by dosimetry, it is necessary to have suitable dose meter calibrations, to account for sources of error and imprecision, and to use correct statistical procedures in specifying dwell times or conveyor speeds and source and product parameters to achieve minimum and maximum doses within specifications.

712,760
PB-270 199/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Absorbed Dose Calibration System of the National Bureau of Standards.
Final rept.,
R. Loevinger. 1976, 1p
Pub. in Proceedings Int. Conf. on Medical Physics (4th), Ottawa, Canada, July 25-30, 1976, Phys. Canada, v32 Paper 10.1 p2 Jul 76.

Keywords: *Ionization chambers, Calibrating, Cobalt 60, Dosage.

Ionization-chamber calibrations traceable to exposure standards have been provided for many years by the National Bureau of Standards (NBS). These calibrations have been limited to photon beams with energies up to that of cobalt-60. Since January 1976 NBS has offered calibration in a cobalt-60 beam in terms of absorbed dose to water. These calibrations are traceable to two graphite calorimeters, which are the NBS standards of absorbed dose.

712,761
PB-271 194/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fission Rate Measurements for Materials Neutron Dosimetry in Reactor Environments.
Final rept.,
J. Grundl, and C. Eisenhauer. 1977, 30p
Pub. in Proc. ASTM-EURATOM Symp. on Reactor Dosimetry (1st), Petten (Netherlands), September 22-26, 1975, EUR 5667 e/f, Part 1, p425-454 1977.

Keywords: *Nuclear fission, *Radiation measuring instruments, Neutron flux, Breeder reactors.

The use of fission detectors in materials neutron dosimetry in reactor environments offers unusual flexibility of application, a unique and useful variety of energy-dependent responses, and convenience of interpretation. In addition, because fission is the essential reaction rate of nuclear energy generation, fission cross sections are among the most accurate in existence. These characteristics of fission rate measurements will be described in the context of establishing neutron flux and fluence in reactor structures, beginning in-core and extending out to sensitive neutron environments at the reactor pressure vessel. An assessment of existing measurement methods and calibration schemes for characterizing neutron fluence spectra focuses on the interpretation of fission detector responses. Present day measurements practice and outlook in U. S. breeder reactor development programs and in the U.S. commercial power reactor industry are reviewed. Radiation effects testing of electronic components with degraded fission neutrons is included. Near-term and expected accuracy requirements will be underscored insofar as they can be ascertained.

712,762
PB-275 026/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Improved Beta Scintillation Counting.
Final rept.,
B. D. Stewart. Oct 77, 2p
Pub. in Health Physics, v33 n4 p343-344 Oct 77.

Keywords: *Beta particles, *Scintillation counters, Reprints.

An improved method of low-level beta scintillation counting using thin plastic phosphors is described. The improved method reduces the uncertainty associated with detector efficiency measurements, and it reduces the cost per sample.

712,763
PB-280 390/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron Measurement Intercomparisons.
Final rept.,
R. S. Caswell. 1977, 20p
Sponsored in part by Department of Energy, Washington, D.C. Div. of Biomedical and Environmental Research.
Pub. in Proceedings of International Course at Varenna, Italy Sep-Oct 74, Paper D1 in Ionizing Radiation Metrology, p113-132 1977.

Keywords: *Neutron flux, Fast neutrons, Thermal neutrons, Measurement, Comparison.

Neutron measurement intercomparisons are discussed from the standpoint of philosophy (reasons for carrying out intercomparisons), and methods for making intercomparisons. A method for carrying out the statitical analysis of intercomparisons is given. Examples of measurement intercomparisons are given for neutron source emission rate, thermal neutron flux density, fast neutron flux density, neutron-induced reaction rates, and for fast neutron kerma and absorbed dose.

712,764
PB-280 466/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Accuracy and Merit in Liquid Scintillation Counting,
Final rept.,
L. A. Currie. 1976, 24p
Pub. in Proceedings of Symposium on Liquid Scintillation Counting, Bath, England, Sep. 16-19, 1975 p219-242.

Keywords: *Scintillation counting, Precision, Accuracy, Errors, Helium 3, Beta spectrometers, Phosphorus isotopes, *Liquid scintillation counters, Phosphorus 32, Reprints.

Modern liquid scintillation spectrometry, while extremely convenient and broad in its applicability, presents the user with numerous opportunities for systematic and random error. Following a survey of the current state of the art with respect to accuracy, a detailed inquiry is made into the magnitude and nature of error sources. Special attention is paid to sampling errors, recovery errors (chemical and isotopic), quenching errors and blank (contamination errors). Control of blunders via monitoring techniques and redundancy is recommended. Figure of Merit (F) as a measure of method performance is examined in depth. Inconsist-

ent and equivocal measures for F are exposed, and a rational approach is developed. The resulting graphical technique permits immediate evaluation of relative merit among several alternative procedures as well as optimization of controllable variables for a given procedure. Illustrations are given for high and low-energy beta-emitters (32P, 3H) for liquid scintillation, Cerenkov and gas counting.

712,765
PB-282 017/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radial Efficiency Gradients in Ge(Li) Gamma Detectors.
Final rept.,
R. M. Lindstrom. 1977, 9p
Pub. in Jnl. of Radioanalytical Chemistry, v39 p153-161 1977.

Keywords: *Gamma detection, Precision, Accuracy, *Germanium(Li) detectors, Reprints.

Counting of radioactive sources in contact with the vacuum container of a Ge(Li) detector may lead to errors because of large efficiency gradients. In order to explore the radial dimension of this problem, several point sources were stepped across in contact with the cap of several detectors, and curves of absolute efficiency against radius were measured. The insensitive core of an open-end coaxial detector reduced the central point-source efficiency at 122 keV at the cap to 20% less than a comparable closed-end detector. In compensation, however, there was a reduction in the radial efficiency gradient. The radial efficiency gradient was approximately proportional to the radius, with the central flattening for the open-end detector superimposed on the trend.

712,766
PB-282 129/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Germanium Detector Efficiency Calibration with NBS Standards.
Final rept.,
A. T. Hirshfeld, D. D. Hoppes, and F. J. Schima. 1976, 4p
Pub. in Proceedings ERDA X-and Gamma-Ray Symp., Ann Arbor, Michigan, May 19-21, 1976 p90-93. Available as ERDA CONF. 760539 from the National Technical Information Service, Springfield, Va. 22161.

Keywords: *Gamma spectrometers, Germanium, Standards, Calibrating, Europium isotopes, Selenium isotopes, Silver isotopes, *Gamma detection, *Germanium(Li) detectors, Selenium 75, Silver 110, Europium 152.

The efficiency calibration of two complementary germanium detectors has provided a means of comparing the gamma-ray emission rates of all suitable radioactivity standards currently available at the National Bureau of Standards. This procedure has not only checked the activity calibrations and the accepted gamma-ray probability per decay for each gamma ray, but has served to illustrate precautions necessary for the use of the standards in accurate detector calibrations. Our approach has been initially to use rather idealized conditions (low rates, geometrical efficiencies of about 0.1% of 4 pi, well-separated peaks) to establish the characteristics of the detector systems, then to observe discrepancies as these conditions are relaxed. A constant-dead-time pulse-height-analysis system allows monitoring of the operating parameters during data collection and statistical evaluation from repeated measurements. An expansion of the logarithm of a detector efficiency in powers of the energy fits extensive energy regions with only small systematic deviations and provides an interpolation function. The calibration curve for a 30-cc coaxial Ge(Li) detector contains 24 points between 88 and 2754 keV, with an average deviation from a fitted function of about 1/2%. The detector systems have been used to measure directly a probability per decay for many gamma rays from standards of 75Se, (110m)Ag, and 152Eu whose activities had been determined by methods essentially independent of decay-scheme parameters.

712,767
PB-288 537/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison of BNM-LMRI and NBS Absorbed-Dose Standards for 60Co Gamma Rays.
Final rept.,
J.-P. Guiho, J.-P. Simoen, and S. R. Domen. 1978, 6p
Pub. in Metrologia v14 p63-68, 1978.

Keywords: *Standards, France, United States, Calorimeters, Cobalt 60, Radiation dosage, Gamma rays, Comparison, Radiation doses, Reprints.

The first comparison of national standards of absorbed dose has been carried out by the Laboratoire de Metrologie des Rayonnements Ionisants (LMRI) and the National Bureau of Standards (NBS). The graphite calorimters were compared in the LMRI 60 Co gamma-ray beam. The ratio of the response of the NBS calorimeter to the LMRI calorimeter was 1.003, with a 95% confidence limit of + or - 0.6%, and an estimated upper bound to the systematic uncertainties of + or - 0.3%.

712,768
PB-291 785/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Theoretical Aspects of Electron and Photon Dosimetry.
Final rept.
S. M. Seltzer, J. H. Hubbell, and M. J. Berger. 1978, 41p
Sponsored in part by Department of Energy, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of the National and International Standardization of Radiation Dosimetry, Held at Atlanta, GA. on December 5-9, 1977, p3-43 1977.

Keywords: *Dosimetry, Scattering cross sections, Electron beams, Photons, Bremsstrahlung, Attenuation, *Electron dosimetry, *Gamma dosimetry, Phantoms.

The dosimetry standardization program at the National Bureau of Standards has a number of theoretical components. These include the compilation of standard cross-section data sets, the theoretical analysis of detector response to various radiations, the spectral and directional characterization of radiation sources, and the determination of absorbed-dose distributions in irradiated media. The purpose of this talk is to describe recent results from these areas, with emphasis on photon and electron dosimetry. A discussion is given of some recent developments pertaining to photon attenuation coefficients and electron stopping powers. Response functions are presented for intrinsic germanium detectors (used to measure the output of diagnostic x-ray machines) and for sodium iodide detectors (used to measure the spectral characteristics of one of the NBS 60Co irradiation facilities). As examples of source characterization, calculations are described pertaining to the passage of high-energy electron beams through foils. Consideration is given to thin foils used to spread the electron beam, and to thick foils used as bremsstrahlung converters. The results include the energy spectra and angular distributions of the transmitted electrons and emergent bremsstrahlung photons. An example of the calculation of absorbed-dose distributions is given for irradiation of a carbon phantom by a 60Co gamma-ray beam.

712,769
PB-292 370/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectrometer of a 60Co Gamma-Ray Beam Used for Instrument Calibration.
Final rept.,
M. Ehrlich, S. M. Seltzer, M. J. Bielefeld, and J. I. Trombka. 1976, 11p
Pub. in Metrol. 12, p169-179 1976.

Keywords: *Cobalt 60, *Gamma ray spectroscopy, *Calibrating, Gamma ray spectra, Energy spectra, Calibration, Reprints.

Measurements were made of the spectrum of one of the collimated 60Co gamma-ray beams employed in the instrument-calibration program of the National Bureau of Standards. The high-activity calibration-source capsule was replaced by one of low activity and identical geometry. The contributions to the spectrum by the scatter from the low-activity replacement source, the housing, and the collimation system were isolated by means of supplementary measurements in free air on the replacement source and on a scatter-free source. Depending on collimator setting, the scatter contribution below 1 MeV was found to be between 13 and 19 percent of the total number of photons in the beam. A description is given of the measurements and of the technique for data reduction. Detailed spectral results are presented.

712,770
PB-293 451/1
(Order as PB-293 447/9, PC **A05**/MF **A01**)
National Measurement Lab. (NBS), Washington, DC. Center for Radiation Research.
Neutron Flux Intercomparison at NBS,
K. C. Duvall, M. M. Meier, O. A. Wasson, and V. D. Huynh. 8 Aug 78, 7p
Prepared in cooperation with Bureau International des Poids et Mesures, Sevres (France).
Included in Jnl. of Research of the National Bureau of Standards, v83 n6 p555-561, Nov-Dec 78.

Keywords: *Neutron counters, *Calibrating, Neutron flux, Efficiency, Statistics, Comparison, KeV range 100-1000.

National Bureau of Standards (NBS) participation in an International Bureau of Weights and Measures (BIPM) sponsored neutron flux intercomparison is described. The efficiencies of two transfer instruments, a gas-filled 3He proportional counter and a BF3 counter imbedded in a polyethylene sphere, were determined at neutron energies of 250 keV and 560 keV. The efficiency of the 3He detector was determined by placing it in the flux monitored by the NBS 'black' detector. Since the polyethylene sphere detector shadows the 'black' detector, a secondary BF3 counter was calibrated and it normalized the sphere and 'black' detector runs. The efficiencies are reported and compared to the quantities determined at other participating standards laboratories.

712,771
PB-298 019/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Resonance Neutron Radiography Using a Position-Sensitive Proportional Counter.
Final rept.,
J. W. Behrens, R. A. Schrack, and C. D. Bowman. 1979, 2p
Sponsored in part by Nuclear Regulatory Commission, Washington, DC.
Pub. in Proc. Am. Nuclear Society Annual Meeting, Atlanta, GA, June 3-7, 1979, Trans. Am. Nucl. Soc. 32, 207-208 (American Nuclear Society, Hinsdale, IL, 1979).

Keywords: *Neutron radiography, *Proportional counters, Nuclear materials management, Disks(Shapes), Brazing alloys, Silver, Performance evaluation, Time of flight method.

This paper describes progress at NBS in the development of resonance neutron radiography as a laboratory reference method for measurements for safeguarding nuclear fuel. To demonstrate and test the method a broad energy spectrum of neutrons and a linear position-sensitive proportional counter were used with time-of-flight techniques to determine the distribution of solder between two silver-brazed metal disks and to measure the thickness of the braze.

712,772
PB78-600042 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Utilization of the NBS Reactor.
R. S. Carter. 1977, 1p
Pub. in Trans. Amer. Nucl. Soc. 1977 Winter Meeting, San Francisco, CA, Nov. 29-Dec. 2, 1977, v27 p828 1977.

Keywords: *Materials characterization, Neutron, Neutron radiography, Neutron scattering, Neutron standards, Reactor, Trace analysis.

No abstract available.

712,773
PB78-600045 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of the National Bureau of Standards Low-Energy-Photon-Emission-Rate Radioactivity Standards.
J. M. R. Hutchinson, W. B. Mann, and P. A. Mullen. 1976, 3p
Pub. in Proceedings ERDA X- and Gamma-Ray Symp., Ann Arbor, MI, May 19-21, 1976 p25-28 1976.

Keywords: *Defined solid angle spectrometer, Standardization, 55Fe, 85Sr, 109Cd, 125I.

The National Bureau of Standards has recently developed point source low-energy-photon-emission-rate standards of 55Fe, 85Sr, 109Cd and 125I. The standardizations were performed using a defined solid angle. NaI(Tl) spectrometer that can be operated with

gas fillings at atmospheric and reduced pressure. The corrections applicable to such a spectrometer have been discussed by W. B. Bambynek.

712,774
PB80-103740 Not available NTIS
National Bureau of Standards, Washington, DC.
Report of the National Bureau of Standards' Survey of State Measurement Needs.
Final rept.,
E. H. Eisenhower. Apr 78, 10p
Pub. in HEW Publication (FDA) 78-8054, p117-126, Apr 78.

Keywords: *Radiation measuring instruments, *State government, Measurement, Surveys, User needs, Radiation monitoring.

This paper presents a summary of the results of an NBS survey of radiation measurement needs and capabilities in state radiation control programs. The survey was funded by Congress in fiscal year 1975. Survey mechanisms consisted of a questionnaire and on-site visits to 16 state programs. The questionnaire was distributed to all 58 members of the Conference of Radiation Control Program Directors, of which 38 responded. Some impressions received during the visits are presented. Responses to some of the more significant questions asked in the questionnaire are summarized. State needs as perceived by a task force of state personnel are also presented, in the form of recommendations for action. A limited NBS program which has been initiated in response to the discovered needs is described. Questions and problems which require further consideration are identified.

712,775
PB80-123268 Not available NTIS
National Bureau of Standards, Washington, DC.
Concerning Li2B4O7 Thermoluminescence Dosimeters,
C. G. Soares, and M. Ehrlich. 1979, 1p
Pub. in Med. Phys. Commun. 6, n4, p312, Jul/Aug 79.

Keywords: Luminescent dosimeters, Lithium inorganic compounds, Borates, Performance evaluation, Measurement, Reprints, *Thermoluminescent dosemeters, Lithium boran oxides, Lithium borates.

The authors have compared two commercially available types of lithium borate thermoluminescence dosimeters, one obtained from the Harshaw Chemical Company and the other from Studsvik, AB Atomenergi, Sweden. Differences between the samples of the two types were apparent mainly in their long-term storage characteristics. The Studsvik samples exhibited more fading under ambient laboratory conditions than the Harshaw samples, while the Harshaw samples were influenced more adversely by storage at high relative humidities. From these results one might conclude that a superior dosimeter could be obtained if the Harshaw powder were distributed in a matrix similar to that used by Studsvik.

712,776
PB80-134893 Not available NTIS
National Bureau of Standards, Washington, DC.
Catalogue of Artifacts Observed in Energy-Dispersive X-Ray Spectrometry and Their Influence on Analysis.
Final rept.,
C. E. Fiori, R. L. Myklebust, and D. E. Newbury. 1979, 38p
Pub. in Paper in Microbeam Analysis in Biology, p225-263 1979.

Keywords: *X ray spectroscopy, X ray spectra, Errors, X ray spectrometers, Error analysis, Li-drifted Si detectors.

Spectra recorded with the lithium-drifted silicon detector, a type of energy dispersive x-ray spectrometer frequently used in electron beam instruments, are subject to artifacts introduced during the processes of x-ray detection and signal amplification. The artifacts observed include x-ray absorption effects in the components of the spectrometer and accompanying fluorescence of the silicon of the detector, peak broadening, peak distortion, formation of parasitic peaks caused by escape of silicon x-rays from the detector, sum peaks due to pulse coincidence, and effects due to system deadtime. Other artifacts arise from interactions of the spectrometer with its environment, including microphonic effects and sensitivity to stray sources of radiation in the sample chamber. The artifacts influence the strategy for qualitative and quantitative analysis. Qualitative analysis proceeds through the identification of all members of the family of x-ray lines for each element. Artifacts in spectra are recognized by their particular characteristics and eliminated from consideration as possible elemental constituents of the sample. In quantitative analysis, peak overlaps resulting from broadening can be calculated with algorithms based on the Gaussian function which describes each peak. Peak distortions and silicon escape peaks can also be calculated with appropriate algorithms.

712,777
PB80-184336 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Thermoluminescence Dosimetry System for Use in a Survey of High-Energy Bremsstrahlung Dosimetry.
Final rept. for 1978 and 1979,
M. Ehrlich, and C. G. Soares. May 80, 50p NBS-TN-1119
Contract FDA-224-78-6002

Keywords: *Bremsstrahlung, Luminescent dosimeters, Dosimetry, Lithium fluorides, Calibrating, *Thermoluminescent dosemeters.

This is the final report covering the work performed under an interagency agreement between the National Bureau of Standards and the Bureau of Radiological Health during the fiscal years 1978 and 1979. A thermoluminescence dosimetry system suited for a survey of high-energy bremsstrahlung in U.S. radiation-therapy departments was selected and calibrated. The experiments leading to the choice of the recommended operational characteristics, including dosimeter handling, annealing and readout, dosimeter stability in the contemplated mode of operation, dosimeter response over the photon-energy range to be covered, irradiation geometry and irradiation level are treated in detail. Results are reported of a pilot study involving the shipment of a typical survey assembly (a plastic phantom loaded with a set of dosimeters) for irradiation in one U.S. therapy department and the overall uncertainty of the proposed survey procedure is discussed.

712,778
PB80-191406 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature and Humidity Effects on the Gamma-Ray Response and Stability of Plastic and Dyed Plastic Dosimeters.
Final rept.,
H. Levine, W. L. McLaughlin, and A. Miller. 1980, 24p
Pub. in Radiat. Phys. Chem. 14, p551-574 1980.

Keywords: *Dosimeters, *Gamma counters, Plastics, Temperature, Humidity, Performance, Cellulose acetate, Polycarbonate resins, Polyethylene terephthalate, Polyvinyl fluoride, Polymethyl methacrylate, Polyvinyl chloride, Vinyl acetal resins, Cellophane, Dyes, Nylon resins, Nitrogen organic compounds, Reprints, Poly(pyrrolidone/vinyl).

Several plastics and dyed plastics are widely used for routine dosimetry in radiation processing with gamma radiation. A study was made of the effects of different temperatures and relative humidities during and after irradiation on the dose interpretation of these dosimeters, which are normally calibrated under controlled laboratory conditions. Samples of dosimeter materials investigated were cellulose triacetate, polycarbonate, polyethylene terephthalate, polyvinyl fluoride, dyed polymethyl methacrylate ('red Perspex'), undyed polymethyl methacrylate (UVT Lucite), dyed Nylon, dyed polyvinyl pyrrolidone, dyed and undyed polyvinyl chloride, dyed polyvinyl butyral, and dyed Cellophane or Ultraphan. The results show that most of these dosimeters when used under extreme conditions of relative humidity and temperature may give erroneous readings unless suitable corrections are made. There is also indications that the environmental effects on dosimeter response are apt to differ somewhat from one supply of a given material to another.

712,779
PB80-205966 Not available NTIS
National Bureau of Standards, Washington, DC.
Pinhole Camera Imaging of Neutrons Using a Position-Sensitive Proportional Counter.
Final rept.,
J. W. Behrens, R. G. Johnson, and C. D. Bowman. 1980, 2p
Pub in. Transactions of the American Nuclear Society 34, p663-664 1980.

Keywords: *Neutrons, Neutron sources, Proportional counters, Reprints, *Imaging techniques, Pinhole cameras.

The authors describe progress at NBS in imaging eV neutrons produced by a spatially extended source using a position-sensitive proportional counter in a pinhole camera configuration. This work is being conducted (1) for a better understanding of the eV neutron source characterization from the neutron-producing target at the NBS linac, (2) for the development of resonance neutron radiography, and (3) for possible use in imaging high energy neutron sources.

712,780
PB80-210834 Not available NTIS
National Bureau of Standards, Washington, DC.
Low-energy Gamma-Ray Imaging Detector.
Final rept.,
L. I. Yin, J. I. Trombka, and S. M. Seltzer. 1979, 8p
Pub. in Space Science Instrumentation 4, p321-328 1979.

Keywords: Design, Reprints, *X-ray detection, *Gamma detection, X ray telescopes, Imaging techniques.

The authors describe a hard-X-ray/soft-gamma-ray imaging detector, incorporating a microchannelplate (MCP) electron multiplier, for possible use in future telescopes. In contrast to previous attempts using MCP's, this approach promises to achieve high quantum detection efficiencies in addition to high-spatial and temporal resolution. Preliminary results indicate not only the capability of simultaneous imaging and single-photon counting, but also coarse energy resolution.

712,781
PB80-210842 Not available NTIS
National Bureau of Standards, Washington, DC.
Portable X-Ray Imaging System for Small-Format Applications.
Final rept.,
L. I. Yin, J. I. Trombka, and S. M. Seltzer. 1979, 6p
Pub. in Nuclear Instruments and Methods 158, p175-180 1979.

Keywords: *X rays, Design, Performance evaluation, Reprints, *Lixiscope, *Imaging techniques, Iodine 125, X-ray sources.

A prototype low-intensity x-ray imaging system with the acronym LIXIscope was built to demonstrate the feasibility of a modular approach toward X-ray imaging in small-format applications. The prototype, including its own X-ray source, is shown to be fully portable, rugged and pocket-sized. Preliminary results and performance characteristics obtained with the prototype Lixiscope are presented.

712,782
PB80-211667 Not available NTIS
National Bureau of Standards, Washington, DC.
New Position-Sensitive Hard X-Ray Spectrometer.
Final rept.,
L. I. Yin, J. I. Trombka, and S. M. Seltzer. Jun 80, 2p
Pub. in Review of Scientific Instruments 51, n6 p844-845 Jun 80.

Keywords: *X ray spectrometers, Gamma spectrometers, Design, Reprints, *Lixiscope.

A new prototype Lixiscope (Low intensity x-ray imaging scope) is described. In addition to good spatial and temporal resolution in the 20 keV to 200 keV region, it is capable of single-photon counting, imaging, as well as good energy resolution. The new device is well-suited for future low-flux applications in astronomy, medicine, and industry.

712,783
PB80-211683 Not available NTIS
National Bureau of Standards, Washington, DC.
Germanium Semiconductor Detector Efficiency Determination Using a Standard Marinelli (Reentrant) Beaker Geometry.
Final rept.,
L. Costrell, D. E. Persyk, C. Sanderson, G. Walford, and F. J. Walter. Feb 80, 4p
Pub. in Health Physics 38, p229-232 Feb 80.

Keywords: Performance evaluation, Efficiency, Reprints, *Ge semiconductor detectors, *Semiconductor detectors, *Gamma detection.

A standard technique, using Marinelli (reentrant) beakers, has been defined for the determination of gamma-ray efficiency specification of detectors used in the measurement of large-volume, low-activity samples.

712,784
PB80-223456 Not available NTIS
National Bureau of Standards, Washington, DC.
Small Rugged Imaging X-Ray Spectrometer: A Lixiscope with Good Energy Resolution.
Final rept.,
L. I. Yin, J. I. Trombka, and S. M. Seltzer. 1980, 7p
Sponsored in part by National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
Pub. in Nucl. Instrum. Methods 172, p471-477 1980.

Keywords: *X ray spectrometers, *Gamma spectrometers, Design, Reprints, *Lixiscopes.

A new prototype Lixiscope (Low Intensity X-ray Imaging Scope) is described for operation in the 20-200 keV region. In addition to good spatial resolution, the new prototype is capable of providing simultaneous gamma-ray or X-ray single-photon counting, imaging, and energy resolution. The observed energy resolution determined from gamma-ray pulse-height spectra is only a factor of two poorer than that of a NaI(T1)-PMT (photomultipler tube) system. Taking into account the good spatial resolution, such a Lixiscope is thus equivalent to operating thousands of NaI(T1)-PMT systems in parallel with minimal degradation in overall energy resolution. These characteristics make the new prototype Lixiscope a compact and rugged device eminently suited for possible low-flux imaging applications.

712,785
PB81-120636 Not available NTIS
National Bureau of Standards, Washington, DC.
Angle Resolved Photoelectron Spectrometer for Atoms and Molecules.
Final rept.
A. C. Parr, R. S. Stockbauer, B. E. Cole, D. L. Ederer, and J. L. Dehmer. May 80, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Nuclear Instruments and Methods 172, n1-2 p357-361, 15 May 80.

Keywords: Photoelectrons, Synchrotron radiation, Reprints, *Electron spectrometers.

An angle resolved photoelectron spectrometer has been constructed and coupled to the high throughput 2 m in normal incidence monochromator now in operation at SURF-II. Two novel features are employed to make the system highly effective: one is a capillary which channels the monochromatized output photon beam to the gas photon-interaction zone and isolates the vacuum in the spectrometer chamber from the vacuum in the monochromator; the second feature is a high speed cryopump which permits a high density gas jet to interact with the photon beam while maintaining a high enough vacuum to minimize electron scattering and permit operation of the channeltron detector. These features combined with output fluxes permit vibrationally resolved photoelectron spectra of N2 and CO to be obtained in about 15 min.

712,786
PB81-137234 Not available NTIS
National Bureau of Standards, Washington, DC.
Calculation of Radioactivity Induced in Gamma-Ray Spectrometers during Spaceflight.
C. S. Dyer, J. I. Trombka, S. M. Seltzer, and L. G. Evans. 1980, 17p
Sponsored in part by National Aeronautics and Space Administration Greenbelt, MD. Goddard Space Flight Center and Office of Naval Research, Arlington, VA.
Pub. in Nuclear Instruments and Methods 173, p585-601 1980.

Keywords: *Gamma spectrometers, *Induced radioactivity, Cosmic rays, Germanium, Space flight, Reprints.

Radioactivity induced in detector materials by cosmic rays, trapped photons and secondary neutrons is a major background in gamma-ray astronomy and remote sensing spectroscopy of the moon and planets. A calculation scheme for assessing this component has been developed, based on semi-empirical cross sections and stochastic calculations of energy-loss spectra of radioactive nuclides. Preliminary estimates have been made of the important gamma-ray line features to be expected from cosmic-ray induced spallation products in germanium detectors.

712,787
PB81-177636 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Requirements for an Effective National Ionizing Radiation Measurements Program, A Report to the Congress by the National Bureau of Standards.
Final rept.
E. H. Eisenhower. Mar 81, 141p NBS-SP-603
Prepared in cooperation with Conference of Radiation Control Program Directors, Inc.

Keywords: *Radiation measuring instruments, *Ionizing radiation, Radiation hazards, X rays, Beta particles, Gamma rays, Neutrons, Measurement, Accuracy, Dosimetry, Standards, Calibrating, Public health, Health hazards, Radiation protection.

This report was prepared for the Senate Committee on Commerce, Science, and Transportation in response to its recommendation that the National Bureau of Standards review in cooperation with the Conference of Radiation Control Program Directors the need for intermediate calibration laboratories for ionizing and nonionizing radiation. Conclusions relevant to the measurement of nonionizing radiation are presented in a separate report. This report is a description of the elements of an effective support system for ionizing radiation measurements, an evaluation of current needs in this area, a description of necessary measurement accuracies for specific applications, and a discussion of possible options to improve the support system. The focus is on institutional and technical actions needed to assure the accuracy of ionizing radiation measurements for the protection of workers and the general public.

712,788
PB81-199630 Not available NTIS
National Bureau of Standards, Washington, DC.
Source Imaging for FMIT Using a Neutron Pin-Hole Camera.
Final rept.
R. G. Johnson, J. W. Behrens, and C. D. Bowman. Jul 80, 9p
Pub. in Proceedings of the Symposium on Neutron Cross-Sections from 10 to 50 MeV Held at Upton NY., on May 12-14, 1980, p629-637 Jul 80.

Keywords: Neutron sources, Proportional counters, *Neutron detectors, *Imaging techniques, Pinhole cameras, NTISCOMNBS.

A pin-hole camera technique has been used to measure the variation in neutron emission intensity over the area of the neutron-producing target of the NBS Electron Linac. The method uses a linear position-sensitive proportional counter (PSPC) with an intrinsic spatial resolution of 1.0 mm. The pin hole is made in a thick sheet of cadmium and neutron energy (<0.3 eV) selection is achieved by time-of-flight. Both one-dimensional and two-dimensional detectors are now available for this work. In a completely separate experiment the neutron cone obtained from the (d,t) reaction using the associated-particle technique was imaged by a two-dimensional PSPC. This second measurement demonstrated the use of the two-dimensional detector for imaging high energy (14 MeV) neutrons.

712,789
PB81-206401 PC **A05**/MF **A01**
Conference of Radiation Control Program Directors, Inc.
Directory of Commercial Calibration Services for Ionizing Radiation Survey Instruments.
Apr 81, 77p NBS-GCR-80-296
Contract NBS-8C-3607

Keywords: *Ionizing radiation, *Radiation measuring instruments, *Calibrating, *Directories, USA, NTISCOMNBS.

This directory lists information provided by commercial services that calibrate survey instruments used to measure ionizing radiation, and information on the availability of calibrated radioactive sources. Companies included in this directory are cross-referenced. The first listing is by state, subdivided into the instrument calibration and source manufacturer categories. This listing includes the types of radiation services offered, calibration method(s) used, estimated calibration accuracies, radiation energy and intensity ranges, and types of instruments and radioactive sources manufactured or calibrated. The second list summarizes the services offered by radiation type. In the final list, each company is shown with its address, telephone number, and a contact person. Included in the appendices is information on possible sources of inaccuracy in calibrating survey instruments and on the properties of common calibration sources.

712,790
PB81-207342 Not available NTIS
National Bureau of Standards, Washington, DC.
National Standardization Programme for High-Dose Measurements.
Final rept.
W. L. McLaughlin. 1981, 16p
Pub. in Technical Reports Series No. 205: High-Dose Measurements in Industrial Radiation Processing, p17-32 1981.

Keywords: *Radiation measuring instruments, *Dosimetry, *Calibrating, Ionizing radiation, Electron beams, Gamma rays, Standardization, Reprints, Calorimetric dosemeters, NTISCOMNBS.

A variety of dose meter calibration services is provided by NBS to industrial radiation users of intense radiation fields; in particular, large gamma-ray sources and electron accelerators at energies up to approximately 4 Me V. The services include the administering of known doses of ionizing photons and electrons to users' dose meters, supplying calibrated secondary-standard transfer dose meters and subsequent read-out and dose interpretation after irradiation, and special calibration services such as the determination of temperature dependence, rate dependence, or reproducibility of dose meter response and measurement of detailed dose distributions in specific irradiation geometries and in selected absorbing materials. The latter can, in fact, include dose profiles in heterogeneous absorbers and at surfaces and interfaces of different substances.

712,791
PB81-241143 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibration of a Gamma-Ray Telescope Using Tagged Positron Annihilation Photons.
Final rept.
D. L. Bertsch, and W. R. Dodge. 1981, 9p
Pub. in Nuclear Instruments and Methods 185, p439-448 1981.

Keywords: Calibrating, Positrons, Annihilation reactions, Reprints, *Gamma astronomy, *Gamma ray telescopes.

Measurements of detection efficiency, angular resolution, and energy resolution properties of a gamma-ray telescope used to study celestial gamma rays from balloon flight altitudes are described. Nearly monochromatic photons produced at the National Bureau of Standards tagged photon facility were used for the calibration. Details of the photon beam configuration and properties and results of the measurements made at photon energies of 15.1 and 31.1 MeV are presented. Finally, the data are compared with a Monte Carlo analysis of the instrument properties.

712,792
PB81-241200 Not available NTIS
National Bureau of Standards, Washington, DC.
Design of High-Efficiency Liquid-Scintillation Counting Systems.
Final rept.
B. M. Coursey, and W. B. Mann. 1980, 13p
Pub. in Part III, Monographie BIPM-3, 'The Application of Liquid-Scintillation Counting to Radionuclide Metrology,' p23-25 1980.

Keywords: Photoelectrons, Reprints, *Scintillation counting, Liquid scintillation detectors, Liquid scintillators, Beta detection.

In order to compare liquid-scintillation-counting systems the authors first refer to some figures of merit which have been used in this field. The most useful of these for design purposes is eta, which is the number of photoelectrons arriving at the first dynode per kiloelectronvolt of energy deposited in the scintillator. In the second part of this chapter, we consider methods of optimizing eta, and, finally, a review is given on the liquid-scintillation systems that have been used in radionuclide metrology. Seventy six references are given to the literature on design and construction of such systems. Several of the two-phototubes designs reported should give eta values, for 5-keV monoenergetic electrons, in excess of 1 photoelectron/keV for each phototube.

712,793
PB82-127804 Not available NTIS
National Bureau of Standards, Washington, DC.
Hard X-ray and Soft Gamma Ray Telescope Spectrometer.
Final rept.
L. I. Yin, J. I. Trombka, R. L. Schmadebeck, S. M. Seltzer, and M. J. Bielefeld. 1981, 6p
Pub. in Proceedings of the SPIE 268, p97-102 1981.

Keywords: *Gamma spectrometers, *X ray spectrometers, Design, Gamma ray telescopes, X ray telescopes, Lixiscopes.

The authors propose a new design of a hard X-ray and soft gamma-ray telescope spectrometer in the energy domain of 30 keV to 200 keV with reasonable spatial, temporal, and energy resolution for possible space flight missions. This design incorporates a Uniformly Redundant Array (URA) mask in the front end and the Low Intensity X-ray Imaging Scope (Lixiscope) developed in their laboratory as the imaging spectrometer. Using a newly acquired intensifier tube with a digitizing anode, preliminary results indicate that such a complete hard X-ray and soft gamma-ray telescope spectrometer system is indeed feasible.

712,794
PB82-137449 Not available NTIS
National Bureau of Standards, Washington, DC.
Calculated Response of Intrinsic Germanium Detectors to Narrow Beams of Photons with Energies Up to Approximately 300 keV.
Final rept.
S. M. Seltzer. 1981, 19p
Pub. in Nuclear Instruments and Methods 188, p133-151 1981.

Keywords: X rays, Performance evaluation, Reprints, *Ge semiconductor detectors, Gamma detection.

The response of small intrinsic Ge detectors has been calculated for photons incident with energies up to about 300 keV. The results include the effects of scattering and escape from the detector of the photons and of Ge characteristic X-rays produced in photoelectric absorption. Included also are the effects of the backscattering of photons from material behind the detector. The results, based on Monte Carol calculations for various photon energies and detector sizes, have been generalized on the basis of a single-scatter model and are given as a set of formulae that can be evaluated for any photon energy and detector size in the range of interest. The formulae are used to tabulate photopeak efficiencies for a large number of commercially available detectors, and to generate response functions for unfolding measured pulse-height distributions obtained for continuous incident spectra.

712,795
PB82-140617
(Order as PB82-140575, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Graphite Calorimeter as a Standard of Absorbed Dose for Cobalt-60 Gamma Radiation,
J. S. Pruitt, S. R. Domen, and R. Loevinger. 6 May 81, 8p
Included in Jnl. of Research of the National Bureau of Standards, v86 n5 p495-502, Sep-Oct 81.

Keywords: *Cobalt 60, *Calorimeters, *Gamma rays, *Radiation dosage, Standards, Absorption, Graphite, Comparison, Calibrating.

Absorbed dose to water in a cobalt-60 gamma-ray beam has been determined using a thick-walled graphite ionization chamber. The chamber was calibrated in a graphite phantom against a graphite calorimeter, and the graphite calibration factor was converted to a water calibration factor using published energy absorption coefficient ratios and a measured replacement factor. Comparisons between the graphite and water measurements were made at pairs of points that were scaled in position according to the ratio of electron densities, so that the photon spectra were the same for the two points in a given pair. Measurements performed in graphite over a wide range of phantom depths, field sizes, and source distances, showed that the calibration factor varies slowly with the phantom depth and field size, and probably has a negligible dependence on source distance. By comparison with the thick-walled chamber in a cobalt-60 gamma-ray beam, a secondary ionization chamber can be calibrated in terms of absorbed dose to water with an estimated uncertainty of about + or - 1 percent.

712,796
PB82-149808 Not available NTIS
National Bureau of Standards, Washington, DC.
Source Imaging Using Neutron Pinhole Cameras Based on Position-Sensitive Proportional Counters.
Final rept.
R. G. Johnson, J. W. Behrens, and C. D. Bowman. Dec 81, 4p
Pub. in Nuclear Technology 55, p724-727 Dec 81.

Keywords: *Linear accelerators, *Neutrons, Proportional counters, Reprints, *Imaging techniques.

A pinhole camera technique has been used to measure the variation in neutron emission intensity over the area of the neutron-producing target of the National Bureau of Standards Electron Linac. The method uses a one-dimensional position-sensitive proportional counter (PSPC) with an intrinsic spatial resolution of 1.0 mm. The pinhole is made in a thick sheet of cadmium, and neutron energy (<0.3-eV) selection is achieved by time-of-flight. In a completely separate experiment, the neutron cone obtained from the (d,t) reaction using the associated-particle technique was imaged by a two-dimensional PSPC. This second measurement demonstrated the use of the two-dimensional detector for imaging high-energy (14-MeV) neutrons.

712,797
PB82-163882 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
Nuclear Data for the Efficiency Calibration of Germanium Spectrometer Systems: Measurements from the Laboratories of the International Committee for Radionuclide Metrology alpha-, beta-, and gamma-ray Spectrometry Group.
Final rept.
D. D. Hoppes, and F. J. Schima. Jan 82, 155p NBS-SP-626
Library of Congress catalog card no. 81-600161.

Keywords: *Gamma spectrometers, *X ray spectrometers, *Half life, *Calibrating, Germanium, *Ge semiconductor detectors.

Members of the Alpha-, Beta-, and Gamma-Ray Spectrometry Group of the International Committee for Radionuclide Metrology agreed in 1979 to collect the nuclear data from any measurements in their laboratories that were pertinent to the calibration of the efficiency of germanium spectrometer systems. This report is composed of the contributions from 14 laboratories, as listed in part II. If a self-contained contribution was received, it has been incorporated without editing. Less formal communications, or references to published articles, are discussed in short comments prepared by the compilers. Part IV is a compilation of a selected portion of the data, arranged by radionuclide.

712,798
PB82-178146 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements.
Final rept.
H. T. Heaton. Feb 82, 190p NBS-SP-609
See also PB82-178153 thru PB82-178344. Library of Congress catalog card no. 81-600197. Held at National Bureau of Standards, Gaithersburg, MD, on May 8-9, 1980.

Keywords: *Radiation measuring instruments, *Ionizing radiation, *Dosimetry, *Health physics, *Meetings, Quality assurance, Calibrating, Standards, Industrial hygiene, Public health, Traceability, Environmental health, Occupational safety and health.

These proceedings are the compilation of 21 papers presented at a seminar on Traceability for Ionizing Radiation Measurements held at the National Bureau of Standards, Gaithersburg, MD, on May 8-9, 1980. General concepts for traceability were presented from several perspectives. The national standards for radiation dosimetry, radioactivity measurements, and neutron measurements were described. Specific programs for achieving traceability to the national standards for radiation measurements in medical, occupational, and environmental applications were summarized.

712,799
PB82-178153
(Order as PB82-178146, PC **A09**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Traceability - A View from the NBS Center for Radiation Research.
E. H. Eisenhower. Feb 82, 8p
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p3-10 1982.

No abstract available.

712,800
PB82-178161
(Order as PB82-178146, PC **A09**/MF **A01**)
Battelle Pacific Northwest Labs., Richland, WA.
Traceability of Radiation Measurements: Musings of a User.
R. L. Kathren. Feb 82, 7p
Sponsored in part by National Bureau of Standards, Washington, DC. National Measurement Lab.
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p11-17 1982.

No abstract available.

712,801
PB82-178179
(Order as PB82-178146, PC **A09**/MF **A01**)
National Physical Lab., Teddington (England).
Radiation Measurement Traceability in the United Kingdom.
W. A. Jennings. Feb 82, 9p
Sponsored in part by National Bureau of Standards, Washington, DC. National Measurement Lab.
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p19-27 1982.

No abstract available.

712,802
PB82-178195
(Order as PB82-178146, PC **A09**/MF **A01**)
National Bureau of Standards, Washington, DC.
National Standards for Radioactivity Measurements.
L. M. Cavallo. Feb 82, 7p
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p31-37 1982.

No abstract available.

712,803
PB82-178203
(Order as PB82-178146, PC **A09**/MF **A01**)
National Bureau of Standards, Washington, DC.
National Standards for Neutron Measurements.
J. A. Grundl. Feb 82, 5p
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p39-43 1982.

No abstract available.

712,804
PB82-178211
(Order as PB82-178146, PC **A09**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
NBS Services for Ionizing Radiation Measurements.
H. T. Heaton. Feb 82, 14p
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p45-58 1982.

No abstract available.

712,805
PB82-178237
(Order as PB82-178146, PC **A09**/MF **A01**)
California Univ., Livermore. Lawrence Livermore Lab.
LLL Calibration and Standards Facility,
G. W. Campbell, and J. H. Elliott. Feb 82, 9p
Sponsored in part by National Bureau of Standards, Washington, DC. National Measurement Lab.
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p67-75 1982.

No abstract available.

712,806
PB82-178245
(Order as PB82-178146, PC **A09**/MF **A01**)
Illinois State Dept. of Public Health, Springfield.

State of Illinois Regional Calibration Laboratory.
M. Neuweg. Feb 82, 3p
Sponsored in part by National Bureau of Standards, Washington, DC. National Measurement Lab.
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p77-79 1982.

No abstract available.

712,807
PB82-178294
(Order as PB82-178146, PC **A09**/MF **A01**)
National Bureau of Standards, Washington, DC.
National Bureau of Standards Low-Level Radioactivity-Measurements Program,
K. G. W. Inn, and J. R. Noyce. Feb 82, 11p
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p117-127 1982.

No abstract available.

712,808
PB82-178310
(Order as PB82-178146, PC **A09**/MF **A01**)
Department of Energy, New York. Environmental Measurements Lab.
Radon and Radon Daughter Field Measurements.
A. C. George. Feb 82, 9p
Sponsored in part by National Bureau of Standards, Washington, DC. National Measurement Lab.
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p135-143 1982.

No abstract available.

712,809
PB82-199225 Not available NTIS
National Bureau of Standards, Washington, DC.
Radon Measurements: National Needs and the Role of NBS.
Final rept.
R. Colle. 1981, 3p
Pub. in Proceedings Conference American Nuclear Society Winter Meeting, San Francisco, CA, Nov 29-Dec 3, 1981, Transactions of The American Nuclear Society 39, p84-86, American Nuclear Society, 555 N. Kensington, Avenue, LaGrange Park, IL.

Keywords: *Radon, *Radiation measuring instruments, *Calibrating, Alpha particle detectors, Quality assurance, Standards.

This summary briefly highlights the existing state of services required to support the measurement of radon and related quantities, and describes the need for readily available measurement standards, calibration services, and measurement assurance mechanisms.

712,810
PB82-210485 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of the Photon Emission Rates of the NBS Long-Lived Mixed-Radionuclide Standard.
Final rept.
B. M. Coursey, D. D. Hoppes, and F. J. Schima. 1982, 8p
Pub. in Nuclear Instruments and Methods 193, p1-8 1982.

Keywords: *Gamma rays, *Standards, *Gamma spectrometers, *Calibrating, Reprints, Gamma detection, Antimony 125, Europium 154, Europium 155.

A mixture of 125Sb, 154Eu, and 155Eu has been used to prepare gamma-ray emission-rate standards with a functional life of over 10 years and with useful photon emissions at over 18 energies between 25 and 1600 keV. The standards are useful for the calibration of the efficiency of germanium gamma-ray detectors in this energy range. The emission rates of selected X-rays and gamma-rays from the standards are specified with total uncertainties of from 0.6% to 1.3%, estimated to correspond to one standard deviation of the mean.

712,811
PB82-211079 Not available NTIS
National Bureau of Standards, Washington, DC.
Evaluation of Radiochromic Dye Films and Other Plastic Dose Meters under Radiation Processing Conditions.
Final rept.
A. Miller, and W. L. McLaughlin. 1981, 20p
Pub. in Proceedings of Conf. on High-Dose Measurements in Industrial Radiation Processing, Vienna, Austria, Sep 25-29, 1978, Tech. Rept. Ser. 205, p119-138 1981.

Keywords: *Dosimeters, *Dyes, *Polymeric films, Plastics, Gamma radiation.

Selection of dose meters for industrial irradiation purposes is mainly based on the specific dosimetry needs of the individual irradiation processes, weighed against knowledge of the well-documented behavior of the dose meters in question. These selection criteria are briefly discussed. A comprehensive study is made of radiochromic dye dose meters with respect to the data needed in making a meaningful evaluation of their merits and faults. Part of the program has been carried out for several types of radiochromic dye films, as well as red, amber and clear Perspex dose meters, and the results of these measurements are given.

712,812
PB82-211236 Not available NTIS
National Bureau of Standards, Washington, DC.
Dosimetry for Industrial Radiation Processing.
Final rept.
W. L. McLaughlin, J. C. Humphreys, and A. Miller. Feb 82, 8p
Pub. in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, Gaithersburg, Maryland, May 8-9, 1980, p171-178 Feb 82.

Keywords: *Dosimeters, *Calibrating, Electron beams, Gamma rays, Quality control, Sterilization, Nuclear industrial applications, Calorimetry.

In the dosimetry related to sterilization of goods by ionizing photons and electrons, and in other industrial radiation applications, i.e., modification of plastic and other materials, food preservation, and treatment of waste products, it is important to have traceability to standard absorbed dose measurements. The preferred primary methods of dosimetry for large radiation doses (>10 Gy) are considered. Using these techniques as primary reference methods, it is possible to calibrate the response characteristics of routine dosimeters, such as plastics, dyed plastics, and solid-state sensors in terms of a reproducible signal versus known values of absorbed dose. Dose levels and dose gradients within a sizable irradiated volume, e.g., product packages, are determined within specified values of uncertainty, which may be set in terms of statistical error and precision in making practical interpretation of dose and dose limits.

712,813
PB82-212291 Not available NTiS
National Bureau of Standards, Washington, DC.
Measurement of Neutrons Reflected from the Surfaces of a Calibration Room.
Final rept.
C. Eisenhauer, R. Schwartz, and T. Johnson. Apr 82, 7p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Health Physics 42, n4 p489-495 Apr 82.

Keywords: Neutron scattering, Californium isotopes, Fission neutrons, Calibrating, Reprints, *Neutron detectors.

Measurements of the response of 9-inch spherical remmeters and 3-inch Bonner spheres to neutrons from a Cf fission neutron source are presented. Measurements as a function of source-detector distance in two different calibration rooms show that the response of an instrument to neutrons reflected from the walls of a room is constant over the central volume of the room. Approximate expressions are given for understanding the response to reflected neutrons in terms of the energy of the neutron source, the type of detector, and the size of the calibration room.

712,814
PB83-134239 Not available NTIS
National Bureau of Standards, Washington, DC.
Source Imaging Using Neutron Pinhole Cameras Based on Position-Sensitive Proportional Counters.
Final rept.
R. G. Johnson, J. W. Behrens, and C. D. Bowman. 1981, 4p
Pub. in Nuclear Technology 55, p724-727 Dec 81.

Keywords: *Neutron flux, Proportional counters, Neutron sources, Measurement, Reprints, Pinhole cameras.

A pin-hole camera technique has been used to measure the variation in neutron emission intensity over the area of the neutron-producing target of the NBS Electron Linac. The method uses a linear position-sensitive proportional counter (PSPC) with an intrinsic spatial resolution of 1.0 mm. The pin hole is made in a thick sheet of cadmium and neutron energy (< 0.3 eV) selection is achieved by time-of-flight. Both one-dimensional and two-dimensional detectors are now available for this work. In a completely separate experiment the neutron cone obtained from the (d,t) reaction using the associated-particle technique was imaged by a two-dimensional PSPC. This second measurement demonstrated the use of the two-dimensional detector for imaging high energy (14 MeV) neutrons.

712,815
PB83-139139 Not available NTIS
National Bureau of Standards, Washington, DC.
Hard X-Ray and Soft Gamma-Ray Telescope Spectrometer.
Final rept.
L. I. Yin, J. I. Trombka, R. L. Schmadebeck, S. M. Seltzer, and M. J. Bielefeld. 1981, 6p
Sponsored in part by National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
Pub. in Proceedings of the Society of Photo-Optical Instrumentation Engineers 268, p97-102 1981.

Keywords: *X ray spectrometers, *Gamma spectrometers, Telescopes, Design.

The authors propose a new design of a hard X-ray and soft gamma-ray telescope spectrometer in the energy domain of 30 keV to 200 keV with reasonable spatial, temporal, and energy resolution for possible space flight missions. This design incorporates a Uniformly Redundant Array (URA) mask in the front end and the Low Intensity X-ray Imaging Scope (Lixiscope) as the imaging spectrometer. Using a newly acquired intensifier tube with a digitizing anode, preliminary results indicate that such a complete hard X-ray and soft gamma-ray telescope spectrometer system is indeed feasible.

712,816
PB83-177303 Not available NTIS
National Bureau of Standards, Washington, DC.
Improvement of the Quality of the Data Collected Using a Position-Sensitive Detector.
Final rept.
A. Wlodawer, and L. Sjolin. 1982, 6p
Pub. in Nuclear Instruments and Methods 201, p117-122 1982.

Keywords: *Detectors, X rays, Neutrons, Diffraction, Films, Reprints.

A procedure for integrating the intensities of diffraction peaks which optimizes the signal-to-noise ratios and minimizes the possibility of introducing systematic errors has been extended to the data collected using a position-sensitive area detector. This technique, called 'dynamic mask procedure', is capable of finding precise boundaries of the peaks on the basis of the variances in the signal. It can now be applied to X-ray and neutron data collected on films and using one- and two-dimensional position-sensitive detectors. A test using the neutron data collected with an area detector showed a significant decrease in the estimated standard deviations of the integrated peak intensities compared with the traditional techniques of peak summation.

712,817
PB83-234815 Not available NTIS
National Bureau of Standards, Washington, DC.
Nuclear Data for the Efficiency Calibration of Germanium Spectrometer Systems.
Final rept.
D. D. Hoppes, and F. J. Schima. 1983, 2p
Pub. in International Jnl. of Applied Radiation and Isotopes 34, n2 p491-492 1983.

Keywords: *Calibrating, *Gamma spectrometers, Half life, Efficiency, Measurement, Germanium, Reprints, *Ge semiconductor detectors, Gamma detection.

Members of the Alpha-, Beta- and Gamma-Ray Spectrometry Group of the International Committee for Radionuclide Metrology agreed in 1979 to collect the nuclear data from any measurements in their laboratories that were pertinent to the calibration of the efficiency of germanium spectrometry systems. The contributions from 14 laboratories are contained in the NBS Special Publication 626.

712,818
PB83-236455 Not available NTIS
National Bureau of Standards, Washington, DC.
Homogenizing the Field in a Picture-Frame Magnet.
Final rept.
P. Debenham. Sep 81, 14p
Pub. in Proceedings of Workshop on High-Resolution, Large-Acceptance Spectrometers, Argonne, IL, September 8-11, 1981, pIII.G-1--III.G-14.

Keywords: *Magnets, Design, *Electron spectrometers, *Magnetic spectrometers.

A picture-frame magnet with appropriate dimensions for a 1 GeV/c electron spectrometer is investigated. The magnetic field in the air gap is calculated and is found to contain a non-uniform, sextupole component of magnitude 0.0005 relative to the dipole component, B0. This value is intolerably large for many high-resolution spectrometers. A method is proposed to reduce the non-uniform component by incorporating auxillary air gaps (Purcell filters) in the picture-frame magnet. The sextupole field component is reduced to less than + or - 0.00002 B0 in the range 0.5 to 1.4 Tesla with the proposed design.

712,819
PB84-103662 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory, Performance, and Measured Results with an Improved Absorbed Dose Water Calorimeter.
Final rept.
S. Domen. 1982, 14p
Pub. in Proceedings of Symposium on Electron Dosimetry and ARC Therapy, Madison, WI. Sep 10-11, 1981, p89-102.

Keywords: *Calorimeters, *Radiation dosage, *Water, Performance, Convection, Thermistors, Gamma rays, Design criteria, Performance evaluation.

The feasibility of this calorimeter is mainly the result of the low thermal diffusivity of water that retards a temperature change at a point along a temperature profile. The temperature change is sensed by two calibrated thermistors sandwiched between two polyethylene films that electrically insulate the thermistors from water. The product of the temperature rise and the specific heat of water gives the combined effect of the absorbed dose and any heat defect. Temperature drifts are quickly controlled by making slight changes in electrical power dissipated in the water. Compared to solid-bodied calorimeters requiring vacuum systems, it was easy to construct, to get into operation, and to operate

712,820
PB84-103720 Not available NTIS
National Bureau of Standards, Washington, DC.
Polystyrene-Water Calorimeter.
Final rept.
S. R. Domen. 1983, 2p
Pub. in International Jnl. of Applied Radiation and Isotopes Technical Note 34, n3 p643-644 1983.

Keywords: *Calorimeters, *Radiation dosage, *Polystyrene, Water, Thermistors, Design criteria, Performance evaluation, Reprints.

A new type of calorimeter is described for the measurement of absorbed dose in polystyrene, which is reported (for some irradiation conditions) to have a heat defect of less than one percent. This calorimeter provides another investigative tool for comparison with absorbed dose measurements in water, which is the standard reference material.

712,821
PB84-107127 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiation on Processing Dosimetry.
Final rept.
W. L. McLaughlin. 1983, 8p
Pub. in Radiation Physics and Chemistry 21, n4 p359-366 1983.

Keywords: *Radiation dosage, *Dosimetry, *Quality control, Electron beams, Proton beams, Gamma rays, Reprints, Calorimetry.

Measurements of ionizing radiation quantities of .intense photon and electron radiations are used to establish quality control of industrial radiation processes. The most important quality is absorbed dose as determined through traceability of routing dosimetry to calorimetry or standard chemical dosimetry. Some crucial concerns of dosimetry are: (1) Calculations and measurements of radiation energy depositions (2) improved radiation interaction data in condensed media; (3) radiation scattering behavior for difference substances and spectral distribution; (4) secondary radiation phenomena at boundaries and in dielectrics; (5) environmental effects on dosimetry response and analysis.

712,822
PB84-107150 Not available NTIS
National Bureau of Standards, Washington, DC.
Photoelectron Spectrometer for High Resolution Angular Resolved Studies.
Final rept.
A. C. Parr, S. H. Southworth, J. L. Dehmer, and D. M. P. Holland. Apr 83, 4p
Pub. in Nuclear Instruments and Methods 208, n1-3 p767-770, 15 Apr 83.

Keywords: Spectrometers, Photoelectrons, Design, Reprints, *Electron spectrometers, *Photoelectron spectroscopy, High resolution.

The authors report on a new electron spectrometer system designed for use on storage ring light sources. The system features a large (76 cm dia. x 92 cm long) triply magnetically shielded vacuum chamber and two 10.2 cm mean radius hemispherical electron energy analyzers. One of the analyzers is fixed and the other is rotatable through about 150 degrees. The chamber is pumped by a cryopump and a turbomolecular pump combination so as to enable experiments with a variety of gases under different conditions. The light detection includes both a direct beam monitor and polarization analyzer. The electron detection is accomplished with either a continuous channel electron multiplier or with multichannel arrays used as area detectors.

712,823
PB84-138460 Not available NTIS
National Bureau of Standards, Washington, DC.
Megagray Dosimetry (Or Monitoring of Very Large Radiation Doses).
Final rept.
W. L. McLaughlin, R. M. Uribe, and A. Miller. Sep 83, 30p
Pub. in Radiation Physics and Chemistry 22, n3-5 p333-362 Sep 83.

Keywords: *Dosimetry, *Radiation dosage, *Polymeric films, Plastics, Absorbers(Materials), Dyes, Cellulose resins, Lithium fluorides, Polyethylene terephthalate, Polystyrenes, Reprints.

A number of suitably calibrated plastic and dyed films and solid-state systems can provide mapping of very intense radiation fields with high spatial resolution and reasonable limits of uncertainty of absorbed dose assessment. Although most systems of this type suffer from rate dependence and temperature dependence of response when irradiated with charged particle beams at high dose rates, a few are suitable, easily calibrated, and capable of faithful imaging of detailed dose profiles, even at doses up to 1,000,000 Gy and dose rates up to 10 to the 8th power Gy/s. Candidates include certain undyed plastic films (e.g., polyethylene terephthalate and polyhalostyrenes), some dyed cellulosics, radiochromic dye films (e.g., Nylon-base 'Trogamide' films) and pure LiF crystals.

712,824
PB84-221670 Not available NTIS
National Bureau of Standards, Washington, DC.
Gamma-Ray Component from a Cf Fission Source.
Final rept.
C. M. Eisenhauer, and R. B. Schwartz. Dec 82, 6p
Pub. in Proceedings of Department of Energy Workshop Personnel Neutron Dosimetry (9th) held at Las Vegas, Nevada on June 24-25, 1982, p28-34 Dec 82.

Keywords: *Dosimeters, *Ionization chambers, Californium isotopes, Nuclear fission, Comparison, Gamma rays, Measurement, *Gamma detection.

Measurements of the gamma ray components from bare and moderated Cf fission sources are described. The three types of detectors used were Hankins-type albedo dosimeters, Mg-Ar ionization chambers, and plastic pocket ionization chambers. Measurement of the gamma-ray component of the moderated Cf source are believed to be spuriously high due to capture gamma rays produced in the Cd of the Hankins dosimeters. Measurements of the gamma-rays from the bare NBS Cf source indicate a significant component of soft photons with energies about = or < 50 keV.

712,825
PB84-224179 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiation Detection and Measurement (Book Review).
Final rept.
L. Costrell. Jun 80, 72p
Pub. in Nuclear Science and Engineering, v74 n3 p163-234 Jun 80.

Keywords: *Radiation measuring instruments, Books, Reviews, Reprints, *Radiation detection.

A Book Review of 'Radiation Detection and Measurement' by Glenn F. Knoll, John Wiley and Sons (1979) is given.

712,826
PB84-224849 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Fission Chambers for High-Energy Neutron Fields.
Final rept.
D. M. Gilliam, and I. G. Schroder. Nov 82, 2p
Pub. in Proceedings of 1982 Winter Meeting, American Nuclear Society, Washington, DC., November 14-18, 1982, Transactions 43, p286-287.

Keywords: *Fission chambers, *Ionization chambers, *Neutron counters, Nuclear fusion, Fusion reactors, Tokamak type reactors.

The neutron diagnostics systems for both the Tokamak Fusion Test Reactor and the Joint European Torus will use fission ionization chambers for observing the time profiles of neutron production. These systems cover wide dynamic ranges (9 to 12 orders of magnitude) by a combination of the pulse-counting and current modes of operation. The present paper discusses the advantages and possibilities of extending the pulse-counting mode as high as possible into the dynamic range for neutron diagnostics in high-energy neutron fields. A limit of the order of 10 to the 12th power n/((sq cm)sec) is estimated from past fission chamber developments and the present calculations of charged particle emissions.

712,827
PB84-225424 Not available NTIS
National Bureau of Standards, Washington, DC.
Beam Current Monitor for Intense Electron Beams.
Final rept.
R. B. Fiorito, M. Raleigh, and S. M. Seltzer. Aug 83, 13p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA. and Office of Naval Research, Arlington, VA.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-30, n4 p2210-2212 Aug 83.

Keywords: *Electron beams, *Electron accelerators, Monitors, Reprints, *Beam currents, Electrostatic shielding.

The use of interceptive probes for measuring the current density profile of electron beams is a common technique in accelerators producing low currents (1 << 1 A). Severe requirements are imposed on interceptive devices when current densities of the order of kiloamperes per square centimeter are encountered. In this case, space charge effects, large secondary electron production, and probe heating are important considerations. This paper describes a simple, fast (tau (rise) about 0.4 ns) interceptive 'electric' probe which can be used in repetitively pulsed intense electron beam accelerators with high current densities. The device is sensitive only to beam charge present within the probe volume. To accomplish this, the probe uses a 'built in' electrostatic shield. By mechanically scanning the probe through the beam as a function of radius the beam current density can be determined.

712,828
PB84-227446 Not available NTIS
National Bureau of Standards, Washington, DC.

Procedural Standards for Radioactivity Measurements.
Final rept.
C. W. Seidel, and J. M. R. Hutchinson. Dec 80, 10p
Sponsored in part by New England Nuclear Corp., Boston, MA. Nuclides and Sources Div.
Pub. in Proceedings of the Health Soc. Winter Meet. 1980, Hyannis, MA, Dec 8-12, p345-354.

Keywords: *Radiation measuring instruments, *Radioactivity, *Standards, *Calibrating, *Radiation dosage, Ionization chambers, Sodium iodides, Measurement, Gamma detection, Liquid scintillation detectors.

The American National Standards Institute (ANSI) Committee-N42.2 has, since 1973, worked on developing procedural standards for the calibration and usage of: (a) 'dose calibrator' ionization chambers for the assay of radionuclides; (b) germanium detectors for the measurement of gamma-ray emission of radionuclides; (c) sodium iodide detector systems; (d) liquid scintillation counting systems. These procedures have become National Standards within the last 2 1/2 years. Other standards are currently being developed. The composition of the committee and writing groups, the objectives that were set in developing the procedural standards and the interactions with the appropriate regulatory groups, instrument manufacturers as well as the National Bureau of Standards are presented. The Standards included a section on precautions as well as one on the sources of error to minimize the potential of obtaining and using erroneous data and to give the user a better understanding of the measurement system.

712,829
PB84-244029 Not available NTIS
National Bureau of Standards, Washington, DC.
Three-Dimensional Imaging of X-Ray Objects.
Final rept.
L. I. Yin, S. M. Seltzer, M. J. Bielefeld, and J. I. Trombka. 1983, 2p
Pub. in Am. Nucl. Soc. Trans. 45, p256-257 1983.

Keywords: *X rays, *Gamma rays, Computerized simulation, Reprints, *Imaging techniques, Three dimensional, Tomography.

By means of computer-simulated results, the authors demonstrate in this paper the imaging of extended x-ray- and gamma-ray-emitting objects using a Non-Overlapping Redundant Array (NORA). The basic concept has been used by the authors previously in the development of a laboratory device for the real-time viewing of x-ray objects. Here they explore the feasibility of using NORA for the imaging of weak x-ray and gamma-ray objects in both analog and digital modes.

712,830
PB85-112043 Not available NTIS
National Bureau of Standards, Washington, DC.
National Bureau of Standards Small-Angle Neutron Scattering Spectrometer.
Final rept.
C. J. Glinka. 1982, 3p
Sponsored in part by Argonne National Lab., IL.
Pub. in Proceedings of Symposium of Neutron Scattering, Argonne, IL., August 12-14, 1981, n89 p395-397 1982.

Keywords: *Neutron spectrometers, *Neutron scattering, Performance, Design, *Research facilities, *Position sensitive detectors.

A new facility for small-angle neutron scattering is near completion at the NBS Research Reactor. The instrument uses a 65 x 65 sq cm position-sensitive detector, variable incident wavelength, and a novel converging beam collimation system. The instrument and its capabilities are discussed, along with measurements indicative of its performance.

712,831
PB85-113025 PC **A02**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD.
Calibrated Glass Standards for Fission Track Use (Supplement to NBS SP 260-49).
Final rept.
B. S. Carpenter. Sep 84, 25p NBS/SP-260/92
Library of Congress catalog card no. 84-601112. Also available from Supt. of Docs as SN003-003-02610-7.

Keywords: *Standards, Thermal neutrons, Neutron irradiation, Uranium, Glass, *Standard reference materials, *Fission tracks, *Neutron monitors.

Two glasses of different uranium concentrations were prepared and reissued for certification by the National Bureau of Standards as standards for use as neutron monitors to aid fission track studies. These Standard Reference Materials (SRM's) and their uranium concentrations are: SRM 962a (37.4 ppm) and SRM 963a (0.823 ppm). These glass wafers were irradiated in the National Bureau of Standards Research Reactor and the neutron fluence was monitored using copper and gold foils, as well as an iron-cobalt foil.

712,832
PB85-123461 Not available NTIS
National Bureau of Standards, Washington, DC.
Nuclear Track Determination of Lithium and Boron in Various Matrices.
Final rept.
L. J. Pilione, and B. S. Carpenter. 1981, 8p
Pub. in Nuclear Instruments and Methods in Physics Research 188, n3 p639-646 1981.

Keywords: *Alpha particle detectors, *Lithium, *Boron, *Tritons, Particle tracks, Thermal neutrons, Trace elements, Neutron reactions, Reprints.

In recent experiments it has been demonstrated that trace amounts of lithium and boron can be determined uniquely by recording their thermal neutron-induced reaction products in nuclear track detectors. In some samples it may be difficult to isolate the source of alpha particle emissions, induced by thermal neutrons, because these reactions are common to a number of elements. Lithium and boron will undergo a significantly larger number of alpha-producing nuclear reactions than equivalent amounts of these other elements, because of their large thermal neutron cross-sections and isotopic abundances. By careful chemical etching, the alpha particle tracks from neutron-induced boron reactions can be enlarged selectively to an easily discernible size. The boron distribution within the sample is determined by measuring these etched alpha particle tracks in the detector. The boron-alpha detector also serves the role of a particle absorber, stopping all alpha particles produced at the sample surface from reaching a second detector positioned behind it. Tritons, generated by neutron-induced lithium reactions, penetrate and produce etchable tracks within the second detector.

712,833
PB85-124345 Not available NTIS
National Bureau of Standards, Washington, DC.
Microchannel Plate Neutron Detector.
Final rept.
R. A. Schrack. 1984, 8p
Sponsored in part by Nuclear Regulatory Commission, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Nuclear Instruments and Methods in Physics Research 222, p499-506 1984.

Keywords: Neutron radiography, Lithium, Reprints, *Position sensitive detectors, *Neutron detectors, Microchannel electron multipliers, Two dimensional.

A two-dimensional, position-sensitive neutron detector using a microchannel plate electron multiplier with resistive anode has been developed for use in resonance neutron radiography. The resolution characteristics of the detector are determined for different scintillator arrangements. The best resolution obtained with a 0.5 mm thick scintillator with a black backing is 0.75 mm. The use of the detector is demonstrated in producing separated images of three elements in a complex matrix sample.

712,834
PB85-140663 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of the (235)U Mass in a Large Volume Multiplated Fission Ionization Chamber.
Final rept.
O. A. Wasson, and M. M. Meier. 1981, 12p
Pub. in Nuclear Instruments and Methods 190, n3 p571-582, 15 Dec 81.

Keywords: *Uranium 235, *Mass, Ionization chambers, Neutron beams, Nuclear fission, Reprints.

The mass of (235)U contained in a large-volume multideposit fission ionization chamber used for neutron cross section experiments was measured relative to the National Bureau of Standards reference deposit 25S-2-1. The mass ratio used the thermal neutron induced fission reaction in a uniform 25 cm diameter neutron beam from the thermal column of the NBS reactor. The mass was independent of the geometrical area and areal density variation of the deposits, absolute neutron flux, thermal neutron energy distribution, and neutron cross sections. The (235)U mass in the chamber is 0.1709 g with a one standard deviation uncertainty of 1.2%.

712,835
PB85-141372 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Design and Calibration of an Absolute Flux Detector for 1-15 MeV Neutrons.
Final rept.
M. S. Dias, R. G. Johnson, and O. A. Wasson. 1984, 14p
Pub. in Nuclear Instruments and Methods in Physics Research 224, p532-546 1984.

Keywords: *Calibrating, Neutron beams, Design, Performance, Reprints, *Neutron detectors, MeV range 01-10, MeV range 10-100.

An absolute neutron flux monitor having fast timing and a calculable response has been developed for use in a collimated beam of 1-15 MeV neutrons. The detector consists of dual thin plastic scintillators in which the proton recoil spectrum distortion caused by the escape of protons from the first scintillator is eliminated experimentally. The absolute detector efficiency was measured at 2.45 and 14.0 MeV neutron energies using the associated-particle technique at the NBS Positive-Ion Van de Graaff facility. The efficiency and pulse height distributions were calculated using a Monte Carlo based program in order to extend the efficiency throughout the 1-15 MeV interval. The uncertainty in the efficiency is 1-2% (1 standard deviation).

712,836
PB85-207058 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Design of the NBS (National Bureau of Standards) Magnetic Monopole Detectors.
Final rept.
A. F. Clark, M. W. Cromar, and F. R. Fickett. 1984, 4p
Pub. in Proceedings of Int. Cryogenic Engineering Conf. (10th), Helsinki, Finland, July 31-August 3, 1984, p365-368.

Keywords: Magnetometers, Superconductors, *Squid(Detectors), *Magnetic monopoles.

Several different configurations of magnetic monopole detectors have been built and operated at the National Bureau of Standards. These have been designed based on the following objectives: (1) Study of the noise characteristics; (2) Simplicity and ease of changing configurations; (3) Operation in relatively large magnetic fields; and (4) Optimum detector area. Satisfying these objectives has resulted in several compromises, but also a flexible and useful apparatus for studying the behavior of the SQUID-detector loop combination with particular emphasis on noise sources that can simulate a monopole signal. Several sources of noise and techniques for their elimination are discussed. Data from the spectral analysis of the noise signals are presented.

712,837
PB85-221984 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Dose Conversion Factors and W sub n Values for Infinitesimal Infinite Tissue-Equivalent Ion Chambers in Monoenergetic Neutron Fields from Thermal to 20 MeV.
Final rept.
B. R. L. Siebert, and J. J. Coyne. 1984, 4p
Pub. in Radiation Protection Dosimetry 9, n3 p215-218 1984.

Keywords: *Ionization chambers, *Dosimetry, Thermal neutrons, Fast neutrons, Reprints, *Neutron dosimetry, *Tissue-equivalent detectors, Tissue-equivalent materials.

In neutron dosimetry it is common practice to use tissue-equivalent (TE) plastic as a wall material and methane based TE filling gas in constructing ionization chambers and proportional counters. As the materials differ in their elemental composition, Fano's theorem cannot be applied, and therefore it is to be expected that the cavity size has an effect on the response of the instrument. In consequence, the dose conversion

factor (i.e. ratio of dose in wall to dose in gas) and the (W sub n) value (i.e. ratio of specific energy deposited in the gas to the specific number of ion pairs created) also depend on the size. The paper gives these ratios for infinitesimal and infinite cavities as a function of neutron energy from thermal to 20 MeV. The relevance of the results to microdosimetric measurements is discussed. Formulas are given which relate the quantities to the primary spectra of charged particles produced by neutrons in materials of interest.

712,838
PB85-222354 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Investigation of an Experimental Method for the Determination of Dose Equivalent in the ICRU Sphere.
Final rept.
G. H. Hartmann, J. J. Coyne, A. Morhart, H. Schuhmacher, and H. G. Menzel. 1984, 4p
Sponsored by Commission of the European Communities, Ispra (Italy).
Pub. in Radiation Protection Dosimetry 9, n3 p207-210 1984.

Keywords: Proportional counters, Calibrating, Standards, Dosimetry, Reprints, *Neutron dosimetry, *Dose equivalents, Tissue-equivalent detectors.

An idealized tissue-equivalent proportional counter of infinitesimal size was assumed for the measurement of dose equivalent in the ICRU sphere. The response of the counter to neutrons over a wide energy range in terms of dose equivalent and its sensitivity in mixed radiation fields have been studied by computer calculations. Results are discussed with respect to the applicability of tissue-equivalent proportional counters in establishing an experimental calibration standard for dose equivalent quantities.

712,839
PB85-229904 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Measurement of High Doses Near Metal and Ceramic Interfaces.
Final rept.
W. L. McLaughlin, J. C. Humphreys, M. Farahani, and A. Miller. 1985, 25p
Pub. in Proceedings of the International Symposium on High-Dose Dosimetry, Vienna, Austria, October 8-10, 1984, p109-133 1985.

Keywords: *Dosimetry, Calcium fluorides, Sodium chloride, Lithium fluorides, Polymeric films, Electron beams, Gamma rays, Alkali halides.

Radiochromic dosimeters consisting of leuco dyes dissolved and cast in very thin (5 to 100 micrometer) plastic films have been shown to be accurate and reproducible dosimeters for measuring absorbed doses in the range 1,000 to 1,000,000 Gy. There are also thin, optical-quality ceramic crystals (e.g. LiF, NaCl and CaF2) having thicknesses about 0.1 to 2 mm that can provide precise absorbed dose readings in the range 100 to 1 billion Gy by spectrophotometric readings of a series of radiation-induced color-center absorption bands. Besides their relatively broad response ranges, these dosimeters have the advantages of being useful in both photon and electron radiation fields, without great losses in accuracy due to rate or temperature dependence. The plastic films are particularly useful for mapping high-resolution dose distributions, such as depth-dose or isodose contours in thin layers, tubing and wire insulation. It has been shown that, by suitable selection of these plastic and crystalline systems, a fairly wide assortment of materials can be simulated in terms of radiation absorption properties over wide photon and electron spectral ranges (0.01 to 10 MeV).

712,840
PB85-230621 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Practical Guide to Ionization Chamber Dosimetry at the AFRRI (Armed Forces Radiobiology Research Institute) Reactor.
Final rept.
L. J. Goodman. Mar 85, 41p
Pub. in Armed Forces Radiobiology Research Institute, Contract Report 85-1, p1-41 1985.

Keywords: *Ionization chambers, *Dosimetry, *AFRRI reactor, TRIGA type reactors.

The report provides the dosimetrists at the Armed Forces Radiobiology Research Institute with practical guidance on the use of ionization chambers to perform mixed-field dosimetry at the TRIGA Reactor. Experimental techniques, calculational formulas, physical constants, and correction factors are discussed with the emphasis on practice rather than theory in order to provide consistency and long-term continuity to the reactor dosimetry program at AFRRI.

712,841
PB86-112802 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
NBS (National Bureau of Standards) Magnetic Monopole Detector.
Final rept.
M. W. Cromar, A. F. Clark, and F. R. Fickett. 1985, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics MAG-21, n2 p418-420 Mar 85.

Keywords: Reprints, *Magnetic monopoles, SQUID (Detectors), SQUID devices, Magnetic shielding.

The authors have built and operated several inductive type monopole detectors, the present one having three concentric, orthogonal loops operated in coincidence. The area of each loop is 200 sq cm and the cross sectional area of the superconducting shield is 700 sq cm. The detector loops are in a trapped magnetic field of approximately 3 milligauss. The system is mechanically stable and is relatively insensitive to external disturbances, both mechanical and electro-magnetic. The detector is quiet, having a signal-to-noise ratio for monopole detection of approximately 20. The authors have also investigated several sources of noise and spurious signals which might mimic a monopole event.

712,842
PB86-112851 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Book Review, Advances in Scintillation Counting.
Final rept.
B. M. Coursey. 1985, 1p
Pub. in International Jnl. of Applied Radiation and Isotopes 36, n4 p331-332 1985.

Keywords: Reprints, *Scintillation counting, Book reviews.

This book contains the edited papers presented at the International Conference on Advances in Scintillation Counting held in Banff in May of 1983. The organizers asked themselves before undertaking this conference whether a book entitled 'Advances in Scintillation Counting' could live up to its promise. It was well that they considered this question because the decade of the 1970s had seen perhaps too many such conferences. There were at least six international conferences on scintillation counting during this time and, as in many instances the same groups presented papers, it was questionable how much real advancement could occur in the diminishing intervals between meetings.

712,843
PB86-124070 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Radiation-Induced Color Centers in LiF for Dosimetry at High Absorbed Dose Rates.
Final rept.
W. L. McLaughlin, A. Miller, S. C. Ellis, A. C. Lucas, and B. M. Kapsar. 1980, 2p
Pub. in Proceedings of International Conference on Solid State Dosimetry (6th), Toulouse, France, April 1-4, 1980, Nuclear Instrumentation Methods 175, n1 p17-18 Sep 80.

Keywords: *Lithium fluorides, *Color centers, *Dosimetry, Reprints, *Beta dosimetry, Albedo-neutron dosemeters, Gamma dosimetry, Physical radiation effects.

Color centers formed by irradiation of optically clear crystals of pure LiF may be analyzed spectrophotometrically for dosimetry in the absorbed dose range from 100 to 10 to the 7th power grays. Routine monitoring of intense electron beams is an important application. Both (6)LiF and (7)LiF forms are commercially available, and when used with filters as albedo dosimeters in pairs, they provide discrimination of neutron and gamma-ray doses.

712,844
PB86-128220 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Calibration of the NBS (National Bureau of Standards) Black Neutron Detector at 2.3 MeV Using the Time-Correlated Associated-Particle Method.
Final rept.
K. C. Duvall, A. D. Carlson, and O. A. Wasson. 1985, 3p
Pub. in Nuclear Instruments and Methods in Physics Research B10/11, n9 p931-933 1985.

Keywords: *Calibrating, Neutron sources, Reprints, *Neutron detectors, MeV range 01-10.

A time-correlated associated-particle measurement capability using the D(d,n)(3)He source reaction has been developed at the National Bureau of Standards 3-MV positive-ion Van de Graaff Accelerator Laboratory. The facility has been used to measure the efficiency of the NBS Black Neutron Detector at a neutron energy of 2.3 MeV. The associated (3)He particles are detected at an angle of 45 degrees with respect to the beam axis which is a more forward angle than conventionally employed. The kinematically more energetic (3)He particles detected at the forward angle are readily separated from scattered deuterons at an incident beam energy of 250 keV. The time-correlated coincidence requirement on events detected in the Black Neutron and associated-particle detectors virtually eliminates the need for background corrections to the Black Neutron Detector rate. A result for the efficiency of the Black Neutron Detector at 2.3 MeV has been obtained with an accuracy of about + or - 1% and agrees well with a Monte Carlo calculated value. The measurement extends the usefulness of the Black Neutron Detector as an absolute neutron flux monitor to the higher energy region.

712,845
PB86-200748 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Quantum Metrology Group.
New Two-Dimensional Position Sensitive Proportional Counter.
Final rept.
P. L. Cowan. 1986, 3p
Pub. in Nuclear Instruments and Methods in Physics Research A242, p484-486 1986.

Keywords: *Proportional counters, Photodiodes, Reprints, Microchannel electron multipliers, X-ray detection, Two dimensional, Position sensitive detectors.

A new scheme for two-dimensional position encoding has been devised for position sensitive proportional counters (PSPC). The method involves charge division at the cathode of the detector, similar to the 'wedge and strip' approach. The intrinsic spacial resolution of the encoding scheme suggests the possibility of applying the scheme to other two-dimensional detectors, such as micro-channel plates or photodiodes.

712,846
PB86-210044 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Two-Dimensional PSD (Position Sensitive Detection) at the National Bureau of Standards' Small-Angle Neutron Scattering Facility.
Final rept.
C. J. Glinka, and N. F. Berk. 1983, 8p
Pub. in Proceedings of the Workshop on Position Sensitive Detection of Thermal Neutrons, Grenoble (France), October 11-12, 1982, p141-148 1983.

Keywords: Neutron scattering, Data acquisition, *Position sensitive detectors, *Neutron detectors, Two dimensional, Small angle scattering.

A new facility for small-angle neutron scattering (SANS) has been in operation at the NBS research reactor for about one year. The neutron detector at the NBS facility is the first commercial version of the Borkowski-Kopp type, 65 x 65 sq cm, PSD which was developed for use at the SANS facility at ORNL. The counter is based on RC-encoding and time-difference decoding of the positions of individual neutrons captured in the detector. In this article, measurements of the operating characteristics of the PSD, including linearity, spatial and energy resolution, uniformity, count rate capability, gamma ray sensitivity, and long-term stability, are presented. In addition, the position decod-

ing electronics, which minimize the use of analog signal processing circuitry, are described.

712,847
PB86-229697 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Measurement of the NBS (National Bureau of Standards) Black Neutron Detector Efficiency at 2.3 MeV.
Final rept.
K. C. Duvall, A. D. Carlson, and O. A. Wasson. 1985, 6p
Pub. in International Atomic Energy Agency (IAEA) Advisory Group Meeting on Nuclear Standard Reference Data, Geel, Belgium, November 12-16, 1984, p332-337 1985.

Keywords: Neutron flux, Efficiency, *Neutron detectors, MeV range 01-10.

The absolute efficiency of the National Bureau of Standards (NBS) Black Neutron Detector at 2.3 MeV has been measured using the time-correlated associated particle method. The measurement extends the usefulness of the Black Neutron Detector as an absolute neutron flux monitor to the higher energy region.

712,848
PB86-232725 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurements of Inelastic Neutron Scattering in the eV Range.
Final rept.
C. D. Bowman, and R. G. Johnson. 1983, 7p
See also PB83-143818.
Pub. in Proceedings of Workshop on Thermal Reactor Benchmark Calculations, Techniques, Results, Applications, Upton, NY., May 17-18, 1982, p7-1 - 7-7 1983.

Keywords: *Neutron scattering, Inelastic scattering, Molecular vibrations, Excitation, eV range, Time-of-flight method.

The increasing availability of pulsed spallation neutron sources such as WNR at Los Alamos National Laboratory and IPNS at Argonne National Laboratory, has spurred interest in studies using epithermal neutrons. Among these are measurements of inelastic neutron scattering in the eV energy range. Such research offers the possibility of studying high-lying molecular rotational-vibrational states, atomic and molecular electronic excitations, and measurements of scattering laws at higher energies. In this paper the emphasis will be primarily on the methods used in measuring inelastic neutron scattering (in the eV region), where at NBS the first measurements of this kind have recently been performed. Emphasis will also be placed on interpretation of these inelastic scattering spectra and the implications to the problems of neutron moderation.

712,849
PB86-239415 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
New Two Dimensional Position Sensitive Proportional Detectors Using Charge Division.
Final rept.
G. G. Luther, P. L. Cowan, A. Henins, and S. Brennan. 1986, 4p
Pub. in Nuclear Instruments and Methods in Physics Research A246, p537-540 1986.

Keywords: *Proportional counters, Reprints, *Position sensitive detectors, Two dimensional.

Several two dimensional position sensitive proportional counters have been built. The cathodes can encode the position of the event in one or two dimensions using capacitative charge division techniques; a backgammon configuration encodes in one dimension with anode encoding of the second dimension or a new cathode pattern can be used to encode in two dimensions. Details of the construction and performance are given.

712,850
PB87-109484 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Experiences in Calibration of Neutron Survey Instruments.
Final rept.
R. B. Schwartz. Nov 85, 9p
Pub. in Proceedings of Workshop on Radiation Survey Instruments and Calibrations, Gaithersburg, MD., July 10-12, 1984, pF35-F43 1985.

Keywords: *Calibrating, *Remmeters, *Neutron dosimetry, Linearity.

It is shown that the measured calibration factors for many neutron remmeters vary considerably for nominally identical instruments, and even from one scale to another for the same instrument.

712,851
PB87-117719 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Development of a 6 to 7 MeV Photon Field for Instrument Calibration.
Final rept.
K. C. Duvall, C. G. Soares, H. T. Heaton, and S. M. Seltzer. 1985, 4p
Pub. in Nuclear Instruments and Methods in Physics Research Section B-Beam Interactions WI 10-11, p942-945 May 85.

Keywords: Radiation protection, Calibrating, *Gamma sources, Thermoluminescent dosemeters, NaI detectors, MeV range 01-10, Response functions.

A photon source has been developed at the National Bureau of Standards to measure the response of radiological survey instruments to high-energy photons. The response of six commercial radiological survey instruments has been measured behind various thickness of plastic absorber. The results indicate that approximately 2.5 cm of plastic in front of these instruments is sufficient to discriminate against the associated high-energy electron contamination.

712,852
PB87-122230 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Neutron Fluence and Cross Section Measurements for Fast Neutron Dosimetry.
Final rept.
G. P. Lamaze, D. M. Gilliam, E. D. McGarry, and A. Fabry. 1985, 9p
Pub. in Proceedings of International Conference on Nuclear Methods in Environmental and Energy Research (5th), Mayaguez, Puerto Rico, April 2-6, 1984, p293-601 1985.

Keywords: *Fast neutrons, Neutron cross sections, Fission neutrons, *Neutron dosimetry, Neutron fluence.

The National Bureau of Standards maintains three standard fields for fast neutron dosimetry calibrations: a (252)Cf fission spectrum, a (235)U fission spectrum, and an Intermediate Energy Standard Neutron Field (ISNF). The paper describes the fields and techniques that maintain the traceability of their fluence rates to NBS-I, the international standard radium-beryllium photoneutron source.

712,853
PB87-122792 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
NBS (National Bureau of Standards) Facilities for the Study of Radiation-Protection Instruments.
Final rept.
M. Ehrlich, J. M. Selby, K. L. Swinth, E. J. Vallario, and B. L. Murphy. 1985, 22p
Pub. in Proceedings of Workshop on Radiation Survey Instruments and Calibration, Gaithersburg, MD., July 10, 1984, pF.13-F.34 Nov 85.

Keywords: *Radiation measuring instruments, *Radiation protection, Beta particles, Bremsstrahlung, Electron beams, Gamma rays, Radiation doses, US NBS.

An account is given of the NBS radiation facilities available for the study of radiation protection instruments. Covered are: The customary bremsstrahlung, cobalt-60, and cesium-137 beams; the new 6- to 7-MeV, essentially monoenergetic photon beam produced by (19)F(p, alpha gamma)(16)O reaction in the positive-ion Van de Graaff accelerator; the beta-particle beams (prometheum-137, thallium-204, and strontium-90+yttrium-90); the essentially monoenergetic electron beams covering the energy range from about 0.2 to 2.5 MeV, produced in the electrostatic accelerator and the electron Van de Graaff accelerator; and the facility simulating a semi-infinite cloud containing a noble-gas radionuclide. The characterization of the facilities in terms of exposure rate or absorbed-dose rate to water at the point of instrument calibration and in terms of spectral distributions are described. Finally, examples are given of the result of studies of instruments in these radiation facilities.

712,854
PB87-131835 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Accurate Determination of Gamma-Ray Energies for E < or = 2 MeV.
Final rept.
E. G. Kessler, G. L. Greene, R. D. Deslattes, and H. G. Borner. 1985, 4p
Pub. in AIP (American Institute of Physics) Conference Proceedings 125, p921-924 1985.

Keywords: Fundamental constants, Reprints, *Gamma radiation, MeV range 01-10, Neutron mass.

A flat crystal spectrometer facility has been established at the 57 MW reactor at the Institut Laue-Langevin (ILL). The high flux reactor with the associated source changing facilities produces the intense capture gamma-rays needed for the high-resolution low-efficiency spectrometer. Initial measurements of gamma-ray energies up to 2 MeV from the reaction (35)Cl(n, gamma) have clearly demonstrated that sub-ppm measurements of intense sources are possible in the 2 to 4 MeV region. Energy values for the 517, 786, 788, 1165, 1951, 1959 keV lines are available with uncertainties of about 1 ppm. Three of these lines (786 + 1165 = 1951) satisfy the sum rule to better than 1 ppm. Future prospects for high energy capture gamma-ray measurements which impact on the neutron mass and the fundamental constants are briefly discussed.

712,855
PB87-151585 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
A-150 Plastic Radiometric Calorimeter for Charged Particles and Other Radiations.
Final rept.,
J. C. McDonald, and S. R. Domen. 1986, 6p
Pub. in Nuclear Instruments and Methods in Physics Research A252, p35-40 1986.

Keywords: *Calorimeters, Calibrating, Reprints, *Tissue-equivalent materials, Radiation doses.

A local absorbed dose calorimeter with certain novel features has been designed and constructed of A-150 tissue-equivalent (TE) plastic. The radiation absorption properties of this material and the relative absence of core impurities make the calorimeter suitable for use in a wide variety of radiation beams. The low thermal diffusivity of A-150 plastic led to the development of a unique spiral electrical calibration heater that has a mass of only 0.1% that of the core. The calorimeter can be calibrated in the quasiadiabatic or the heat-loss-compensated mode to test for possible effects caused by temperature gradients. The details of construction and operation are described.

712,856
PB87-157061 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Effect of Altitude on Beta-Ray Source Calibrations.
Final rept.,
J. S. Pruitt. 1985, 7p
Pub. in Radiation Protection Dosimetry 11, n3 p151-157 1985.

Keywords: Strontium 90, Altitude, Dosimetry, Reprints, *Beta sources, *Calibration, Promethium 147, Thallium 204, Yittrium 90.

A study has been made of the effect of altitude on beta-ray source calibrations, using commercially available (147)Pm, (204)Tl, and (90)Sr+(9)OY sources. The measurements were made in a large environmental chamber, from which air was removed to simulate several altitudes between sea level and 3.7 km (12,000 feet). The results show that the calibration does vary with altitude, most drastically for (147)Pm, much less for both (204)Tl and (90)Sr + (90)Y. It is shown that the change in source calibration for a given change in air density is almost the same as the change produced by addition of a plastic filter with the same thickness in mass per unit area.

712,857
PB87-199410 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Advances in Calorimetry for Radiation Dosimetry.
Final rept.,
S. R. Domen. 1987, 76p
Pub. in Dosimetry of Ionizing Radiation, v2 p245-320 1987.

Keywords: *Dosimetry, Portable equipment, Reviews, *Calorimetry, Radiation doses.

The chapter describes and discusses recent advances in absorbed dose calorimetry. Presented are new design details, operational procedures, and methods for rapid reduction and control of troublesome signals caused by temperature drifts. A portable absorbed dose graphite calorimeter is discussed in detail. An A-150 plastic calorimeter is also described along with significant results. A homogeneous water calorimeter is described with its simplicity of construction and operation. A simple modification produces a polystyrene-water calorimeter for comparison with the water calorimeter. A brief discussion is given on total absorption calorimetry and two calibrated ionization chambers, the NBS P2 and the Wilson quantameter. Described is a transformer Wheatstone bridge which significantly improves the detection sensitivity. The chapter discusses the evolution of the absorbed dose calorimeter to the point of being a practical and portable field instrument of wide use. Numerous references are cited.

712,858
PB87-201414 PC **A02**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Calculated Response of A 5.5 x 5.5 cm High-Purity Ge Detector to Gamma Rays with Energies Up to 20 MeV,
S. M. Seltzer. Apr 87, 13p NBSIR-87/3548
Sponsored by Department of Energy, Washington, DC. Office of Health and Environmental Research.

Keywords: Gamma ray spectroscopy, Performance evaluation, Efficiency, *Ge semiconductor detectors, *Gamma detection, KeV range 100-1000, MeV range 1-10, MeV range 10-100, Response functions.

Monte Carlo calculations have been done of the energy and angular response of a 5.5 x 5.5 cm, high-purity Ge detector, for gamma rays incident with energies from 0.1 to 20 MeV. Results are given for the absolute probabilities of total energy absorption and of single and double annihilation escape, which relate the areas of the peaks in the measured pulse-height distribution to the intensities of incident gamma-ray lines.

712,859
PB87-227617 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
NBS (National Bureau of Standards) Measurement Services: Neutron Personnel Dosimetry.
Final rept.,
R. B. Schwartz. Jul 87, 47p NBS/SP-250/12
See also PB87-174041. Also available from Supt. of Docs as SN003-003-02811-8. Library of Congress catalog card no. 87-619842.

Keywords: *Neutron dosimeters, *Calibrating, Measurement, Standards, Services, Quality assurance, National Bureau of Standards.

Detailed procedures are given for calibration of neutron dosimeters and remmeters with californium neutron sources, both 'bare' and moderated. Corrections for scatter, room-return, anisotropic neutron emission, and deviation from the inverse square law are discussed, and specific examples given. The uncertainties in arriving at the final value for the calibration factor are also discussed.

712,860
PB88-123708 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
NBS (National Bureau of Standards) Measurement Services: Radioactivity Calibrations with the '4 pi' Gamma Ionization Chamber and Other Radioactivity Calibration Capabilities.
Special pub. (Final),
J. M. Calhoun. Oct 87, 45p NBS/SP-250/10
Also available from Supt. of Docs. as SN003-003-02824-0. See also PB88-123781, and PB88-123690. Library of Congress catalog card no. 87-619870.

Keywords: *Ionization chambers, *Radioactivity, Standards, *Calibration, *Gamma detection, Radioisotopes, US NBS, Uncertainty.

The paper describes the use of the NBS 4 pi' gamma ionization chamber - an instrument which provides an indirect method of comparing the activity (decays per second) of gamma-ray-emitting radionuclides with national standards for a routine calibration service by the National Bureau of Standards Radioactivity Group. A description of the chamber's construction and characteristics, the operational procedure, and the associated equipment is included. A description of NBS capabilities for direct radioactivity calibrations is also presented. Many of these capabilities are used to establish calibration factors for the '4 pc' gamma ionization chamber.

712,861
PB88-124425
(Order as PB88-124409, PC **A04**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
NBS (National Bureau of Standards) Large-Area Alpha-Particle Counting Systems,
J. M. R. Hutchinson, and S. J. Bright. 1987, 14p
Included in Jnl. of Research of the National Bureau of Standards, v92 n5 p311-324 Sep-Oct 87.

Keywords: *Alpha particle detectors, *Radiation counters, Proportional counters, Radioactivity, Standards, US NBS.

Two alpha-particle counting systems for the measurement of large-area sources have been developed at the National Bureau of Standards. The systems and their characteristics are described. One system uses an internal-source proportional counter and the other measures sources external to the counting volume through a thin aluminized mylar window. The 'internal' system is used to measure sources in the lower activity ranges. These calibrated sources are then used to establish the efficiency of the 'external' counter used to measure the higher-activity sources.

712,862
PB88-141064 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Development of the Dual Thin Scintillator (DTS) in the 1 + 2 Coincidence Configuration as a Neutron Spectrometer.
Final rept.,
K. C. Duvall, and R. G. Johnson. 1986, 1p
Pub. in Radiation Effects 95, n1-4 p319 1986.

Keywords: *Neutron spectrometers, Reprints, Neutron detectors, Proton recoil detectors, Response functions, Spectra unfolding.

The Dual Thin Scintillator (DTS) when operated in the 1 + 2 coincidence configuration, exhibits a peaked response centered at the incident neutron energy. This is a more favorable response to be used with spectrum unfolding techniques and should provide a significant improvement over spectral determinations with conventional proton recoil response functions.

Radiation Shielding, Protection, & Safety

712,863
DE85005518 PC **A02**/MF **A01**
National Bureau of Standards (NML), Washington, DC. Molecular Spectroscopy Div.
Monte Carlo Calculation of Energy Deposition and Ionization Yield for High Energy Protons.
W. E. Wilson, J. C. McDonald, J. J. Coyne, and H. G. Paretzke. Sep 84, 10p PNL-SA-12071, CONF-8409161-4
Contract AC06-76RL01830
Symposium on neutron dosimetry, Munich, F.R. Germany, 17 Sep 1984.

Keywords: *Neutron Transport, *Protons, *Tissue-Equivalent Materials, Charged-Particle Transport, Computer Calculations, Energy Losses, Ionization, MeV Range 01-10, MeV Range 10-100, Monte Carlo Method, Radiation Doses, Recoils, ERDA/654003, ERDA/654001.

Recent calculations of event size spectra for neutrons use a continuous slowing down approximation model for the energy losses experienced by secondary charged particles (protons and alphas) and thus do not allow for straggling effects. Discrepancies between the calculations and experimental measurements are thought to be, in part, due to the neglect of straggling. A tractable way of including stochastics in radiation transport calculations is via the Monte Carlo method and a number of efforts directed toward simulating positive ion track structure have been initiated employing this technique. Recent results obtained with our updated and extended MOCA code for charged particle track structure (3) are presented here. Major emphasis has been on calculating energy deposition and ionization yield spectra for recoil proton crossers since they are the most prevalent event type at high energies (>99% at 14 MeV) for small volumes. Neutron event-size spectra can be obtained from them by numerical summing and folding techniques. Data for ionization yield spectra are presented for simulated recoil protons up to 20 MeV in sites of diameters 2 to 1000 nm. 10 references. (ERA citation 10:011901)

712,864
LA-UR-79-2685 MF **A01**
Los Alamos Scientific Lab., NM.
Dosimetry Results for Big Ten and Related Benchmarks.
G. E. Hansen, D. M. Gilliam, and J. A. Grunde. 1979, 10p CONF-791051-5
Contract W-7405-ENG-36
Pub. in Proceedings ASTM-EURATOM symposium on reactor dosimetry (3rd), Ispra, Italy, 1 Oct 1979.
Microfiche copies only.

Keywords: *Big ten reactor, Boron 10, Cross sections, Dosimetry, Flux density, Inelastic scattering, Lithium 6, Neutron flux, Nuclear reactions, Plutonium 239, Reaction kinetics, Uranium 233, Uranium 235, ERDA/654003.

Measured average reaction cross sections for the Big Ten central flux spectrum are given together with calculated values based on the US Evaluated Nuclear Data File ENDF/B-IV. Central reactivity coefficients for exp 233 U, exp 235 U, exp 239 Pu, exp 6 Li, and exp 10 B are given to check consistency of bias between measured and calculated reaction cross sections for these isotopes. Spectral indexes for the Los Alamos exp 233 U, exp 235 U, and exp 239 Pu metal critical assemblies are updated, utilizing the Big Ten measurements and interassembly calibrations, and their implications for inelastic scattering are reiterated. (ERA citation 05:005123)

712,865
NUREG/CR-3628 PC **A05**/MF **A01**
Brookhaven National Lab., Upton, NY.
Probability Based Safety Checking of Nuclear Plant Structures.
B. Ellingwood. May 84, 85p BNL-NUREG-51737
Contract DE-AC02-76CH00016
Prepared in cooperation with National Bureau of Standards, Washington, DC. National Engineering Lab.

Keywords: *Nuclear power plants, *Structures, Design criteria, Safety, Loads(Forces), Reinforced concrete, Structural engineering, Probability.

This report describes the basis for the development of practical probability-based design criteria for nuclear plant structures. A brief critical review of existing criteria is provided to highlight desirable features of probability based-safety checking. A specific deterministic design criteria format is then recommended. Finally, the selection of a set of structures to test the validity of the probability-based checking equations is described. Statistical data on structural loads are summarized in an appendix.

712,866
NUREG/CR-3876 PC **A05**/MF **A01**
Brookhaven National Lab., Upton, NY.
Probability Based Load Combination Criteria for Design of Concrete Containment Structures.
H. Hwang, S. Kagami, M. Reich, B. Ellingwood, and M. Shinozuka. Aug 85, 99p BNL-NUREG-51795
Contract DE-AC02-76CH00016
Prepared in cooperation with National Bureau of Standards, Gaithersburg, MD., and Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.

Keywords: *Concrete structures, Design criteria, Reliability, Loads(Forces), *Containment buildings, *Earthquake engineering, Probability.

The report describes a research effort for the development of the probability-based load combination criteria for design of concrete containment structures. The proposed criteria are in a load and resistance factor design (LRFD) format. In order to test the performance objectives of the proposed criteria, four representative structures are selected using a Latin hypercube sampling technique. Next, the reliability analysis method developed by Brookhaven National Laboratory is employed to assess the reliability of these representative containments. The load factors for accident pressure due to the design basis accident and safe shutdown earthquake are derived for three target limit state probabilities. Other load factors are also discussed on the basis of prior experience with probability-based design criteria for ordinary building construction.

712,867
PB-270 970/7 PC **A02**/MF **A01**
American National Standards Inst., New York.
Radiological Safety Standard for the Design of Radiographic and Fluoroscopic Industrial X-Ray Equipment.
American National Standard.
E. H. Eisenhower. Aug 77, 19p ANSI-N537-1976, NBS-HB-123
Library of Congress catalog card no. 77-608121.

Keywords: *Radiation protection, *Standards, *Safety, *X ray apparatus, Design, Radiography, X ray tubes, Fluoroscopy, Industrial plants.

The standard provides guidelines specific to the radiation safety aspects of the design of industrial x-ray equipment operating at energies below 1 MeV for radiographic and fluoroscopic applications, wherein the x rays are generated by electronic means. The objective is to achieve safe design of industrial x ray equipment by establishing requirements for some of the components which are critical for radiation safety. These include controls, panel displays, warning indicators, tube assembly, and shielding. Other considerations which are generally the responsibility of the manufacturer are also included, such as instructions, provision of means for connecting interlocks, and labelling. This standard does not include safety considerations outside the realm of radiation safety, nor does it apply to safe operation of such equipment.

712,868
PB80-176860 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
SHIELDOSE: A Computer Code for Space-Shielding Radiation Dose Calculations.
Final rept.,
S. Seltzer. May 80, 75p NBS-TN-1116
Sponsored in part by Office of Naval Research, Arlington, VA., and National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.

Keywords: *Spacecraft shielding, *Radiation dosage, Aluminum, Water, Silicon, Silicon dioxide, Electron irradiation, Proton irradiation, Bremsstrahlung, Computer programs, Fortran, Tables(Data), *SHIELDOSE computer program.

A computer code, SHIELDOSE, has been developed for the calculation of absorbed dose as a function of depth in aluminum shielding material of spacecraft, given the electron and proton fluences encountered in orbit. Absorbed dose, for small volumes of the detector materials Al, H2O, Si, and SiO2, is evaluated in three geometries: (1) in a semi-infinite plane medium; (2) at the transmission surface of a finite-thickness slab; and (3) at the center of a solid sphere. Use of the code is described, and an extensive set of monoenergetic depth-dose data for the various detector materials and geometries is tabulated.

712,869
PB82-207507 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Current Understanding of Pitting and Crevice Corrosion and Its Application to Test Methods for Determining the Susceptibility to Such Corrosion of Nuclear Waste Metallic Containers.
J. Kruger, and V. K. Hardman. Apr 82, 72p NBSIR-82-2477
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Containers, *Corrosion, Accelerated tests, Pitting, Concentration cell corrosion, Electrochemistry, Reviews, *Radioactive waste storage, Spent fuel casks.

Localized corrosion is the most damaging and prevalent type of corrosion that can affect metallic containers used in nuclear waste repository sites. Mechanisms of pitting and crevice corrosion, and the techniques used in elucidating these mechanisms, are discussed in this review, which includes a literature survey.

712,870
PB84-221720 Not available NTIS
National Bureau of Standards, Washington, DC.
Physics and Mathematics of Beta-Particle Dosimetry for Radiation Protection.
Final rept.
R. Loevinger, S. M. Seltzer, and H. T. Heaton. Jan 84, 14p
Pub. in Proceedings of Int. Beta Dosimetry Symposium, Washington, DC., February 15-18, 1983, p1-14 Jan 84.

Keywords: *Radiation protection, *Beta particles, *Dosimetry, Point kernels, Transport theory.

Fast electrons interact with matter through many elastic and inelastic collisions with atomic electrons and nuclei. The effects of these interactions are often described in terms of collision stopping power, radiative stopping power, angular scattering, electron range, and range straggling. Electron transport theory combines these effects to provide a description of the penetration of the electrons, and the deposition of energy in materials of interest. Calculations of interest in radiation protection have been performed for mono-energetic electron sources and for beta-particle sources, and the results can be expressed in terms of point and plane kernels. The energy dependence of the results can often be greatly reduced by suitable scaling. The physical information and mathematical methods that constitute the basis of beta-particle dosimetry for radiation protection are surveyed.

712,871
PB84-242015 PC **A03**/MF **A01**
American National Standards Inst., New York.
American National Standard N43.10; Safe Design and Use of Panoramic, Wet Source Storage Gamma Irradiators (Category IV).
Final rept.
Jul 84, 36p ANSI-N43.10-1984, NBS/HB-142
Also available from Supt. of Docs as SN003-003-02598-4. Library of Congress catalog card no. 84-601091.

Keywords: *Gamma irradiation, *Radiation protection, *Standards, Gamma rays, *American national standards, Gamma sources.

This standard applies to panoramic, wet source storage irradiators (Category IV) that contain sealed gamma emitting sources for the irradiation of objects or materials. It establishes the criteria to be used in the proper design, fabrication, installation, use, and maintenance of these irradiators which will ensure a high degree of radiation safety at all times. The requirements of the standard are grouped as (1) general considerations, (2) manufacturer's responsibility, and (3) owner's responsibility. Included in the first group are general radiation protection criteria, sealed source performance requirements, and radiation survey needs. Among the manufacturer's responsibilities are criteria for maximum external radiation levels, integrity of shielding, and controls and indicators. The requirements for users include safety-related servicing, administrative procedures, operator qualifications, and routine safety tests.

712,872
PB85-126001 PC **A14**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Building Penetration Project.
J. C. Wyss, W. J. Anson, and R. D. Orr. Sep 84, 310p NBSIR-84/3009
Sponsored in part by Army Communications Command, Fort Huachuca, AZ.

Keywords: *Electromagnetic radiation, *Buildings, *Attenuation, Computer programs, Electromagnetic shielding, Construction materials, Penetration, Electrical properties, Dimensions, Design, Architecture, Shielding.

This report documents a computer program which calculates building attenuation of electromagnetic radiation over the frequency range 10 kHz - 10 GHz. Attenuation (in dB) is computed from building shape, dimensions, room layout, and the electrical properties of construction materials; no electromagnetic measurements are required. Details of the structure and use of the program are given.

712,873
PB85-136265 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Phantom Geometry on the Conversion Factor from Exposure to Absorbed Dose.
Final rept.
M. Ehrlich, and C. G. Soares. 5 Mar 84, 3p
Pub. in Radiation Protection Dosimetry 8, n4 p261-263, 5 Mar 84.

Keywords: *Radiation dosage, *Gamma rays, Reprints, Thermoluminescent dosimetry, Conversion factors, KeV range 10-100, KeV range 100-1000, MeV range 01-10, Phantoms.

The conversion factors from exposure to absorbed dose in water phantoms of slab and spherical geometries are deduced from TLD measurements in polymethylmethacrylate phantoms, for photon energies between about 20 keV and 1.25 MeV, and for shallow and deep depths in the phantoms. The conversion factors measured in the slab are found to exceed those measured in the sphere by at most 10 percent for the shallow depth and by somewhat less for the deep depth. The effect is most pronounced for photon energies between 80 and 140 keV. The results are compared with those deduced from calculations and measurements available in the literature.

712,874
PB85-143923 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reflection of 252Cf Fission Neutrons from a Concrete Floor.
Final rept.
L. Linpei. 1983, 5p
Pub. in Radiation Protection Dosimetry 5, n4 p227-231 1983.

Keywords: *Fission neutrons, *Neutron albedo, Reflection, Concretes, Floors, Reprints, *Californium 252.

The effect of (252)Cf fission neutrons reflected from a concrete floor, on the response of (235)U in a NBS fission chamber was measured. It was found that the reflected neutrons contribute 0.12% of the response at the usual source detector distance of 5 cm. By varying the source height above the floor, the author found that relative contributions of reflected neutrons were as high as 300%. It was found that the contribution from reflected neutrons varies as the inverse square of the distance of the detector from the image source created by regarding the floor as a mirror.

712,875
PB85-189231 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Evaluation of Dose Equivalent Per Unit Fluence for a D2O-Moderated 252Cf Neutron Source.
Final rept.
C. Eisenhauer. 1984, 2p
Pub. in Radiation Protection Dosimetry 9, n1 p63-64 1984.

Keywords: *Neutron sources, Fission neutrons, Dosimeters, Calibrating, Reprints, *Dose equivalents, Californium 252.

A correction is given to published values of the fluence-to-dose-equivalent conversion factor for a D2O-moderated Cf fission neutron source to account for neutrons between 0.41 eV and 1.0 eV. The corrected value of the conversion factor for all neutrons above 0.41 eV is 10 to the -6th power mrem-sq cm.

712,876
PB85-202125 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron Self-Shielding Factors for Simple Geometrics.
Final rept.
R. F. Fleming. 1982, 6p
Pub. in International Jnl. of Applied Radiation and Isotopes 33, n11 p1263-1268 Nov 83.

Keywords: *Radiation shielding, *Neutrons, Slabs, Spheres, Cylinders, Dosimetry, Reprints, *Self-shielding.

The neutron self-shielding factors are presented for slabs, spheres, and cylinders irradiated in both isotropic and beam neutron fields. Macroscopic cross-sections are tabulated for a number of dosimetry materials for thermal neutrons of 2200 m/s velocity.

712,877
PB86-195542 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Probability-Based Load Combinations for the Design of Concrete Containments.
Final rept.
H. Hwang, S. Kagami, M. Reich, B. Ellingwood, and M. Shinozuka. 1985, 13p
Sponsored by Brookhaven National Lab., Upton, NY.
Pub. in Nuclear Engineering and Design 86, n3 p327-339 1985.

Keywords: *Nuclear power plants, *Structural engineering, Loads(Forces), Reinforced concrete, Prestressed concrete, Probability theory, Reliability, Criteria, Reprints, Containment buildings.

The paper describes a procedure for developing probability-based load combinations for the design of concrete containments. The proposed criteria are in a load and resistance factor design (LRFD) format. The load factors and resistance factors are, in general, derived for use in limit states design and are based on target limit state probability. In the paper, the load factors for accident pressure due to the design basis accident and safe shutdown earthquake are derived for three target limit state probabilities. Other load factors are recommended on the basis of prior experience with probability-based design criteria for ordinary building construction.

712,878
PB86-195989 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Probabilistic Descriptions of Resistance of Safety-Related Structures in Nuclear-Plants.
Final rept.
B. Ellingwood, and H. Hwang. 1985, 10p
Sponsored by Brookhaven National Lab., Upton, NY.
Pub. in Nuclear Engineering and Design 88, n2 p169-178 1985.

Keywords: *Nuclear power plants, *Structural engineering, Design, Reliability, Steels, Reinforced concrete, Fragility, Probability theory, Probability distribution functions, Reprints, Containment.

Calculations of reliability of safety-related nuclear plant structures require a knowledge of the probability distributions that describe their resistance. The study considers the applicability of existing statistical data for describing the resistance of steel and reinforced concrete nuclear plant structures. Probability distributions are recommended which can be used in assessing the reliability of containments and Category I structures, developing fragilities, and selecting appropriate resistance criteria for probability-based structural design.

712,879
PB87-105268 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Recent Improvements in Neutron Energy Deposition Calculations.
Final rept.
R. S. Caswell, J. J. Coyne, and H. M. Gerstenberg. 1985, 9p
Pub. in Commission of the European Communities Report EUR 9762, Radiation Protection, v1 p255-263 1985.

Keywords: *Dosimetry, Monte Carlo method, Radiation protection, Reprints, *Neutron energy, *Neutron dosimetry, Computer applications.

At higher neutron energies calculations using the analytic method yield microdosimetric spectra in which the proton peak is narrower and shifted in peak energy when compared to experiment. The difference is usually attributed to the neglect of straggling in the calculation. In order to extend the calculational capability to this situation, the authors have written a Monte Carlo neutron energy deposition code which includes straggling of the energy depositions by charged particles in the sensitive volume. As a first consistency check, Monte Carlo calculations without straggling have been compared with the analytic method, and found to agree within the statistics of the Monte Carlo program. For 'thin' sensitive volumes for which the Landau distribution should be appropriate, the authors are using the Monte Carlo code to calculate lineal energy (y) distributions with proton straggling included for energies up to 15 MeV.

712,880
PB87-149787 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Evaluation and Compilation of DOE (Department of Energy) Waste Package Test Data.
Rept. for Dec 85-Jul 86,
C. Interrante, E. Escalante, A. Fraker, M. Kaufman, W. Liggett, and R. Shull. 30 Nov 86, 128p
Pub. in NUREG/CR-4735, v1 128p, 30 Nov 86.

Keywords: *Cans, Containment, Basalt, Borosilicate glass, Leaching, Corrosion, Alloys, *Radioactive waste facilities, *High-level radioactive wastes, Tuff, Salt caverns.

The report summarizes results to date of NBS evaluations of Department of Energy (DOE) activities in waste packages designed for containment of radioactive high-level nuclear waste (HLW). The waste package is a proposed engineered barrier that is part of a permanent repository for HLW. Candidate repository sites include three different media: tuff, basalt, and salt. Metal alloys are the principal barriers for the proposed canisters and overpacks. In addition, borosilicate glass and various packing materials have been proposed as components of the engineered system. Thus, the associated technical problems involve corrosion, leaching, dissolution and transport within the waste packages. The report gives status reports on waste package activities related to each of the three host media.

712,881
PB87-219143 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Nondestructive Evaluation of Monolithic Transportation Casks for Spent Nuclear Fuel.
Final rept.,
D. G. Eitzen, R. C. Placious, L. J. Swartzendruber, and L. Mordfin. 1987, 90p
Contract DE-AC04-76DP00789
Sponsored by Department of Energy, Washington, DC.
Pub. in Contractor Report SAND86-7158, p1-90 May 87.

Keywords: Nondestructive tests evaluations, *Spent fuel casks.

No abstract available.

712,882
PB88-122429 PC **A07**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Evaluation and Compilation of DOE (Department of Energy) Waste Package Test Data. Biannual Report: December 1985-July 1986.
C. Interrante, E. Escalante, A. Fraker, M. Kaufman, W. Liggett, and R. Shull. Mar 87, 128p
RE-ANNOUNCEMENT of PB87-149787 with new releasibility: Available from NTIS. See also PB88-122437. Sponsored by Nuclear Regulatory Commission, Washington, DC. Div. of Waste Management.
Pub. in NUREG/CR-4735, v1 128p, 30 Nov 86.

Keywords: *Cans, *Containers, *High-level radioactive wastes, *Radioactive waste facilities, Tuff, Basalt, Salt deposits, Alloys, Containment, Borosilicate glass, Corrosion, Leaching.

The report summarizes results to date of NBS evaluations of Department of Energy (DOE) activities in waste packages designed for containment of radioactive high-level nuclear waste (HLW). The waste packages is a proposed engineered barrier that is part of a permanent repository for HLW. Candidate repository sites include three different media: tuff, basalt, and salt. Metal alloys are the principal barriers for the proposed canisters and overpacks. In addition, borosilicate glass and various packing materials have been proposed as components of the engineered system. Thus, the associated technical problems involve corrosion, leaching, dissolution and transport within the waste packages. The report gives status reports on waste package activities related to each of the three host media.

Radioactive Wastes & Radioactivity

712,883
PB-284 599/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Needs in the Measurement of Environmental Radioactivity.
Final rept.,
J. M. R. Hutchinson, and W. B. Mann. 1978, 101p
Proceedings of Seminar on Metrology Needs in the Measurement of Environmental Radioactivity, Held at Paris, France on October 4-6, 1976, Environ. Int. 1, n1/2 101p 1978.

Keywords: *Radioactivity, Standards, Quality assurance, Monitoring, Concentration(Composition), Measurement.

Needs in the measurement of environmental radioactivity are described. Papers divide generally into two groups, those describing the needs for standards, for example, natural matrix standards, and those connected with monitoring and quality assurance programs in low-level radioactivity measurements. The conclusions drawn from the symposium are that there is a need for quality assurance programs, for an information exchange and a need for some particular radioactivity standards.

712,884
PB-285 117/8 PC **A02**/MF **A01**
American National Standards Inst., New York. Subcommittee N43-3.4.
American National Standard N433.1; Safe Design and Use of Self-Contained, Dry Source Storage Gamma Irradiators (Category I).
Final rept.,
E. H. Eisenhower. Jul 78, 25p ANSI-N433.1-1977, NBS-HB-127

Keywords: *Gamma irradiation, *Standards, Radiation protection, National standards.

This standard applies to self-contained, dry source storage irradiators (Category I) that contain sealed gamma emitting sources for the irradiation of objects or materials. It establishes the criteria to be used in the proper design, fabrication, installation, use, and maintenance of these irradiators which will ensure a high degree of radiation safety at all times. The requirements of the standard are grouped as (1) general considerations, (2) manufacturer's responsibility, and (3) owner's responsibility. Included in the first group are general radiation protection criteria, sealed source performance requirements, and radiation survey needs. Among the manufacturer's responsibilities are criteria for maximum external radiation levels, integrity of shielding, and controls and indicators. The requirements for users include safety-related servicing, administrative procedures, operator qualifications, and routine safety tests.

712,885
PB-290 521/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Radioactivity Standards for Environmental Monitoring.
Final rept.,
B. M. Coursey, J. M. R. Hutchinson, L. L. Lucas, W. B. Mann, T. Matsumura, and J. R. Noyce. 1978, 10p
Pub. in Jnl. of Radioanalytical Chemistry 43, p451-460 1978.

Keywords: *Radioactivity, Standards, Environmental surveys, Monitoring, *Low level radiation, Reprints.

The low-level radioactivity laboratory in the Radioactivity Section of the National Bureau of Standards, and its work in producing standards for monitoring in the environment, are described.

712,886
PB-291 714/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Planned Compilation of Stopping Power and Range Data.
Final rept.
M. J. Berger. 1978, 11p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Symposium on Microdosimetry (6th), Brussels, Belgium, May 22-26, 1978, p639-649 1978.

Keywords: Charged particles, Transport theory, Electrons, Protons, Alpha particles, Absorption, *Charged-particle transport, *Stopping power, *Range, Depth dose distribution, Heavy ions.

In recent years there has been a steady accumulation of new information about the penetration of charged particles through matter. The ICRU has appointed a committee that is charged with the task of digesting this new information and of preparing an up-to-date compilation of stopping-power and range data for electrons, protons and heavy ions, with emphasis on the needs of medical physics and radiobiology. The purpose of this talk is to discuss the plans, priorities and initial activities of the committee, and to point out some recent development in stopping-power research which will facilitate the committee's task.

712,887
PB-292 200/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Treatment of Counting Data.
Final rept.
H. H. Ku. 1 Nov 78, 28p
Pub. in a Handbook of Radioactivity Measurements Procedures (Chapter 7), National Council on Radiation Protection and Measurements Report No. 58, p271-298, 1 Nov 78.

Keywords: *Radioactivity, *Statistics, Counting, Statistical analysis, Errors, Precision, Probability theory, Statistical data, Mathematical models, Experimental design.

This section on statistics is prepared for the revision of NBS Handbook 80, A Manual of Radioactivity Procedures, to be issued as a report by the National Council on Radiation Protection and Measurements. The original section on the treatment of counting data has been retained with modifications. Four new subsections: (1) statistical models of a measurement process, (2) statistical terms and formulas, (3) statistical design of experiment, and (4) precision, systematic error, and uncertainty, have been added.

712,888
PB-299 778/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Energy Deposition Spectra for Neutrons Based on Recent Cross Section Evaluations.
Final rept.
R. S. Caswell, and J. J. Coyne. 1978, 13p
Pub. in Proceedings of Symposium on Microdosimetry (6th), Brussels, Belgium, May 22-26, 1978, II, p1159-1171 1978.

Keywords: *Nuclear cross sections, *Neutron cross sections, Radiobiology, Energy dissipation, Dosimetry, Carbon 12, Nuclear reactions.

Improved neutron cross section evaluations, such as ENDF/B-IV and the now-emerging ENDF/B-V, are making possible the calculation of improved microdosimetric energy deposition spectra for secondary particles resulting from neutron interactions in tissue, especially in the neutron energy range 10-20 MeV. Nuclear reactions with more than two particles in the final state are included, in addition to the 12C(n,n')3 alpha reaction previously considered. Examples of single-event energy deposition spectra are shown and compared with other calculations and experimental measurements. Microdosimetry parameters, such as y bar(D) and y* which are derived from the spectra are also presented. Some calculated spectra are presented for inhomogeneous Rossi spherical proportional counters (wall and gas of differing composition).

712,889
PB-299 780/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Average W sub n, Computed from Recent Nuclear Data and Average W Measurements.
Final rept.
J. J. Coyne. 1978, 8p
Pub. in Proceedings of Symposium on Microdosimetry (6th), Brussels, Belgium, May 22-26, 1978, II, p699-706 1978,

Keywords: *Nuclear cross sections, *Neutron cross sections, Carbon 12, Nuclear reactions, Hydrogen, Nitrogen, Carbon, Oxygen.

Initial spectra of secondary charged particles produced by neutrons with energies varying from 60 keV to 20 MeV have been calculated. The most recent nuclear data evaluations have been used: ENDF/B-IV for hydrogen, nitrogen and oxygen and a preliminary version of ENDF/B-V for carbon. Many reactions with more than two particles in the final state are now included. In addition to the 12C(n,n')3 alpha reaction, which was used in previous calculations, the reactions (n,n'p), (n,n' alpha), (n,2 alpha) and (n,2n) have been calculated. Recent measurements of the average energy per ion pair, w bar, for protons and other heavy ions have been combined with these initial spectra to derive a balue for w bar (n) as a function of neutron energy. Preliminary results of these calculations will be presented and comparisons with previous calculations of w bar (n) will be presented.

712,890
PB78-600044 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Joint ANSI-INMM 8.1--Nuclear Regulatory Commission Study of Uranium Hexafluoride Cylinder Material Accountability Bulk Measurements.
P. E. Pontius, and L. W. Doher. 1977, 7p
Pub. in Nucl. Mater. Management VI, n111 p480-487 1977.

Keywords: *Accountability bulk measurements, Nuclear material control, Nuclear Regulatory Commission, Reference mass standards, Uranium hexafluoride.

This paper reports the progress to date in a demonstration of the procedures in ANSI N15.18-1975 'Mass Calibration Techniques for Nuclear Material Control,' sponsored and funded by the Nuclear Regulatory Commission (NRC). The philosophy of mass measurement as a production process, as promulgated in ANSI N15.18-1975, is reviewed. Special emphasis is placed on the use of artifact Reference Mass Standards (RMS) as references for uranium hexafluoride (UF6) calibration and bulk measurement processes. The history of the creation of the artifact concept and its adoption by ANSI N15.18-1975 and the Nuclear Regulatory Commission is narrated. The program now under way is specifically described; including descriptions of the RMS, their calibration, and the assignment of uncertainties to them by the National Bureau of Standards (NBS). Instrument tests, in-house standards (IHS), and assignment of values relative to the RMS-NBS values at nuclear facilities which measure UF6 cylinders are described. Comparisons and the data base are detailed to provide realistic measurement process parameters associated with accountable transfer of UF6. The as yet uncompleted part of the demonstration is described, that is, to further close the measurement loop by verification both between and within facilities.

712,891
PB80-123300 Not available NTIS
National Bureau of Standards, Washington, DC.
International Committee for Radionuclide Metrology ICRM Newsletter: Report of the Woods Hole Conference on the Development of Naturally Contaminated Radioactivity Standards.
Final rept.,
J. M. R. Hutchinson. 1979, 2p
Pub. in Environment International 2, n1, p49-50 1979.

Keywords: *Natural radioactivity, Standards, Radioactivity, Reprints.

The recommendations of the Woods Hole Conference on the development of 'natural matrix' radioactivity standards are summarized.

712,892
PB80-146590
(Order as PB80-146566, PC **A04**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Standardization of Iridium-192 Gamma-Ray Sources in Terms of Exposure,
T. P. Loftus. 29 Sep 79, 9p
Included in Jnl. of Research of the National Bureau of Standards, v85 n1 p19-25, Jan-Feb 80.

Keywords: *Gamma flux density, Iridium isotopes, Standards, Gamma emission, Radiation dosage, *Iridium 192, Gamma sources.

Iridium-192, in the form of small platinum- or Stainless-steel-clad seeds, is used for radiation therapy. Standardization of this radionuclide, for the quantity exposure was carried out by measuring groups of seeds in an open-air geometry, using the NBS standard graphite cavity ionization chambers, and transferring the exposure data to a re-entrant ionization chamber. Tables are provided from which the corrections for the graphite chamber have been calculated along with corrections for room scattering. Radiographs of the source arrays are shown and details of the re-entrant chamber source measurements and construction are provided. As assessment of the errors involved in establishing this standard leads to a statement of 2 percent for the overall uncertainty in the calibration of an iridium seed for the quantity exposure.

712,893
PB80-183668 Not available NTIS
National Bureau of Standards, Washington, DC.
Photon Point Source Buildup Factors for Air, Water, and Iron.
Final rept.,
A. B. Chilton, C. M. Eisenhauer, and G. L. Simmons. 1980, 11p
Pub. in Jnl. Nucl. Sci. Eng., Tech. Note 73 p97-107 1980.

Keywords: *X ray absorption, *Gamma rays, Air, Water, Iron, Computerized simulation, Reprints, *Build-up, MeV range 01-10, KeV range.

Buildup factors for photons in infinite homogeneous samples of air, water, and iron have been calculated by a moments method code. The photons were assumed to be emitted from a point source. Comparisons of these results to values obtained earlier, both by experiment and by calculation, show reasonable agreement except in some instances of deep penetration. The parameters in the Berger empirical formula for buildup factors have been evaluated from the present work.

712,894
PB81-142770 Not available NTIS
National Bureau of Standards, Washington, DC.
Modeling of Radon and Its Daughter Concentrations in Ventilated Spaces.
T. Kusuda, S. Silberstein, and P. E. McNall. Nov 80, 7p
Pub. in Jnl. of Air Pollution Control Association 30, n11 p1201-1207 Nov 80.

Keywords: *Natural radioactivity, Buildings, Ventilation, Reprints, *Indoor air pollution, Energy conservation, Radon 222.

In order to predict indoor radiation levels due to radon daughters at low building ventilation and air leakage rates, differential equations governing the decay and venting of radon Rn-222 and its daughters were solved. A computer program based on the solutions was written to predict radon and daughter concentrations, total potential alpha energy and equilibrium factor. The program can account for time dependence of ventilation and emanation rates and is readily usable by building designers. Sample calculations using the program showed that tightened buildings can commonly have potential alpha energy levels near 0.01 working level (WL), a level more than twice as high as concentrations currently found in most houses.

712,895
PB81-163123 Not available NTIS
National Bureau of Standards, Washington, DC.
Traceability, Quality Assurance, and Standards.
Final rept.
J. M. R. Hutchinson. 1980, 2p
Pub. in Proceedings of Low-Level Measurement Techniques Group International Committee for Radionuclide Metrology, Braunschweig, West Germany, June 18-19, 1979, Paper in Environment International 3, n5 p363-364 1980.

Keywords: *Radioactivity, Metrology, Quality assurance, Standards.

The development of traceability in low-level radioactivity measurements is discussed. The role that the development of large quantities of natural matrix standards can play is also discussed.

712,896
PB81-171290 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.

National Measurement Laboratory Office of Measurements for Nuclear Technology Annual Report 1980.
Rept. for 1 Oct 79-30 Sep 80.
J. D. Hoffman, H. T. Yolken, W. P. Reed, and B. S. Carpenter. Jan 81, 56p NBSIR-81-2205

Keywords: Radioactive contaminants, Leaching, *Radioactive waste management, *Safeguards, Nuclear safeguards, Standard reference materials, MNT program.

This annual report is a summary of the National Bureau of Standards (NBS) Measurements for Nuclear Technology (MNT) Program for Fiscal Year 1980. The MNT activities at NBS are divided into two programs: Nuclear Safeguards and Nuclear Waste Management. The MNT Program is one of several matrix managed efforts at NBS. The programs provide a focus for the activity, both inside and outside NBS. The programs provide funds and directions for needed technical work that is done within NBS Centers. People remain attached to Centers but are funded for specific activities in a matrix management approach. A program provides central organization for outside inquiries and for distribution of results. Often programmatic focus can provide improved assistance to outside agencies with measurement problems. The MNT Program is operating in this manner.

712,897
PB82-178302
(Order as PB82-178146, PC **A09**/MF **A01**)
Nuclear Regulatory Commission, Washington, DC.
NRC Traceability Concerns in its Inspection and Enforcement Program.
L. K. Cohen. Feb 82, 5p
Sponsored in part by National Bureau of Standards, Washington, DC. National Measurement Lab.
Included in Proceedings of a Meeting on Traceability for Ionizing Radiation Measurements, p129-133 1982.

No abstract available.

712,898
PB82-210287 Not available NTIS
National Bureau of Standards, Washington, DC.
Reporting of Environmental Radiation Measurements Data.
R. Colle. 1981, 17p
Pub. in Proceedings of Annual Conference on Radiation Control (11th), Oklahoma City, OK, May 6-10, 1979, Paper in HHS Publication (FDA) 81-8054, Radiological Health, p342-358 1981.

Keywords: *Radioactivity, Recommendations, *Radiation monitoring, Radiation detection, Uncertainty.

Based on an interagency and multi-organizational project coordinated by NBS, recommendations for a uniform method of data reporting are presented and justified. Three primary requisites are considered: proper units, an appropriate number of significant figures, and an unambiguous statement of measurement uncertainty. Guidelines are given for estimating random and systematic uncertainties, and for propagating and combining them to form an overall uncertainty. It is recommended that each reported measurement result include the value, the total random uncertainty expressed as the standard deviation, and the combined overall uncertainty. To avoid possible biasses of data, all measurement results should be reported directly as obtained, including negative values. The lower limit of detection (LLD) should serve only as an a priori estimate of detection capability for the instrumentation, and not as an absolute level of activity that can or cannot be detected. The concept of a minimum detectable concentration (MDC) is introduced to serve as an a priori estimate of the capability for detecting an activity concentration by a given measurement instrument, procedure, and type of sample. Neither the LLD nor the MDC is intended to be an a posteriori criterion for the presence of activity.

712,899
PB82-258930 PC **A04**/MF **A01**
Conference of Radiation Control Program Directors, Inc.
Survey of Radon Measurement Needs and Activities in State Radiation Control Programs.
Jul 82, 54p NBS-GCR-82-394
Contract NB80-NAHA-1046

Keywords: *Radon isotopes, Radiation protection, Alpha particle detectors, Health hazards, Calibrating, Surveys, States(United States), *Radiation monitoring, Alpha detection, Radon 222, Radon 220.

This report summarizes the findings of a survey which was conducted in April-May, 1981 to determine radon measurement needs and present activities in state radiation control programs. The survey focuses on a wide variety of methods for measurements of radon and related quantities. This includes methods for measurement of radon (222Rn) concentration in air, potential alpha energy concentration, individual radon progeny concentrations, radon exhalation or flux density from surfaces, radon concentration in water, and thoron (220Rn) or thoron progeny concentrations in air. The report identifies the sources of radon and thoron which necessitate measurements in the states; the types of measurements and measurement methods that are performed routinely, or that the states would like to obtain or improve the capability of performing; existing calibration capabilities for these measurement methods; and the perceived needs for improving the quality of the measurements.

712,900
PB83-139071 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Considerations of Analytical Chemical Methodology Relevant to Testing of Leachates from Radioactive Solids.
Final rept.
J. R. Moody. 1982, 5p
Pub. in Nuclear and Chemical Waste Management 3, p29-33 1982.

Keywords: *Chemical analysis, *Radioactive wastes, Leaching, Soil analysis, Concentration(Composition), Reprints.

The analysis of leachate derived from simulated radioactive solids provides an interesting challenge from both an instrumental and a chemical point of view. Because of the low anticipated leach rates, the elemental concentrations of interest are also low. Consequently, contamination or analytical blank problems are significant. Both the analyte (analyzed leachate) and the blank measurements have a statistical precision and therefore the difference between the two should have calculable precision. Measurement accuracy, however, is not related to this calculated value. Without either knowing the absolute values in advance or having a sufficiently well characterized Standard Reference Material (SRM) it will not be possible to establish the absolute accuracy. Instrumental methods may produce a bias and extensive round robin tests alone do not establish the magnitude of these biases unless a suitable control or SRM material is used simultaneously. The largest anticipated chemical problem associated with trace and ultratrace element determinations in leach tests is that of sample contamination. Methods have been developed at the National Bureau of Standards (NBS) and other laboratories which can reduce or control contamination, however, it is important to realize that there are practical limits and contamination, per se, cannot be totally eliminated.

712,901
PB83-234310 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiation Protection and the International Commission on Radiation Units and Measurements (ICRU).
Final rept.
R. S. Caswell. 1981, 4p
Pub. in Radiation Protection Dosimetry 1, n4 p241-244 1981.

Keywords: *Radioactivity, *Dosimetry, Reprints, *Radiation dose units, *Radiation protection, *ICRU, SI units.

The principal objectives of the ICRU include the development of internationally acceptable recommendations concerning quantities and units of radiation and radioactivity and their measurement. Special concepts, quantities and units have been developed and practical guidance and advice is given in a series of publications the latest of which is currently in press.

712,902
PB83-235176 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibration of K-x-Ray Emission Rates in the Decay of Vanadium-49V.
Final rept.
J. M. R. Hutchinson, and P. A. Mullen. 1983, 4p
Pub. in International Jnl. of Applied Radiation and Isotopes 34, n2 p539-542 1983.

Keywords: *Calibrating, *Half life, Vanadium isotopes, X rays, Reprints, *Vanadium 49.

(49)V K-x-ray point sources with an average energy of 4.55-keV have been standardized for emission rate by two methods, namely by 2pi-proportional counting and by comparison with a calibrated (55)Fe point source. The two results agree to within 1%. The half-life of (49)V has been measured to be 338 + or - 5 days.

712,903
PB83-236653 Not available NTIS
National Bureau of Standards, Washington, DC.
Radioactivity Standardization of 99m Tc and 99 Mo.
Final rept.
R. L. Ayres, and A. T. Hirshfeld. 1982, 7p
Pub. in International Jnl. of Applied Radiation and Isotopes 33, p835-841 1982.

Keywords: *Radioactivity, *Standards, Half life, Technetium isotopes, Molybdenum isotopes, Reprints, *Technetium 99, *Molybdenum 99.

The 4pi(beta)-gamma coincidence calibration of (99m)Tc and (99)Mo at the National Bureau of Standards is described. The 4pi(beta)-gamma coincidence technique used is reviewed extensively. The results of our half-life measurements on (99m)Tc are reported, along with various other decay scheme parameter measurement results for both radionuclides.

712,904
PB84-102128 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Vaporization of Simulated Nuclear Waste Glass.
J. W. Hastie, E. R. Plante, and D. W. Bonnell. Jun 83, 71p NBSIR-83-2731

Keywords: *Radioactive waste processing, *Borosilicate glass, *Vaporizing, Thermodynamics, High temperature tests, Laboratory equipment, Mass spectroscopy, *Radioactive waste storage, Numerical solution.

Industrial development of nuclear waste glass processing requires basic data on glass vaporization thermodynamics. Detailed mass spectrometric experiments and thermodynamic estimates have been made for vaporization of a nonradioactive borosilicate glass containing representative nuclear waste isotopes. Alkali metaborates were observed to be the dominant vapor species and their partial pressures indicate significant vapor transport under likely process conditions. The results indicate the following order of significance for vapor transport of radionuclide species, CS about equal to Re (about equal to Tc) > Ru >> Sr.

712,905
PB84-107168 Not available NTIS
National Bureau of Standards, Washington, DC.
Standards, Traceability and Regulations.
Final rept.
W. B. Mann. 1981, 2p
Sponsored in part by American Nuclear Society, LaGrange Park, IL.
Pub. in Proceedings of American Nuclear Society Annual Meeting (1981) held at Miami, Florida on June 9, 1981, p1-2.

Keywords: *Radioactivity, Standards, Regulations, Health physics, *Occupational safety and health.

This paper reviews the development of measurements-assurance programs in the field of radioactivity to meet various regulatory and licensing requirements in the United States.

712,906
PB84-138429 Not available NTIS
National Bureau of Standards, Washington, DC.
Needs for Radioactivity Standards and Measurements.
Final rept.
W. B. Mann. 1983, 6p
Pub. in International Jnl. of Applied Radiation Isotopes 34, n8 p1041-1046 1983.

Keywords: *Radioactivity, *Standards, Alpha particles, Beta particles, Gamma rays, Lasers, Spectroscopy, Reprints.

At the summer school held in Herceg Novi in 1972, a paper was given on the then contemporary needs in the field of radionuclide metrology. The applications of radioactive materials to problems in so many scientific, technological and medical fields were then growing rapidly. In the intervening years many of the measurements needs have been met and, moreover, the inter-

est in nuclear power in some countries, and in its by-products, has waned. Some of the chief interests now lie in development of the more sensitive methods of measurement such as atom counting to the same level of accuracy as activity measurements, and also in the acquisition of needed and consistent decay data.

712,907
PB84-153998 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Nuclear Waste Management Program: Summary Report.
Final rept.
R. M. Chung. Dec 83, 231p NBS/SP-668
See also DOE-ET-0094. Sponsored in part by Department of Energy, Washington, DC. Library of Congress catalog card no. 83-600607.

Keywords: *Backfills, *Meetings, Basalt, Packaging, Containers, Cans, *Radioactive waste management, Radioactive waste disposal, *Radioactive waste storage, Geologic formations, *Underground disposal, Salt deposits, Radionuclide migration.

An international workshop on the backfill component of a multi-barrier under-ground isolation system for nuclear waste disposal/storage was conducted on April 13 and 14, 1981, at the National Bureau of Standards, Washington, DC. This report includes the papers presented and/or submitted to the workshop for publication. It also contains the surveyed results of a questionnaire distributed to the participants at the workshop. The workshop held a one-day informal indepth discussion on the subject and a summary of these discussions is included in this report, which states areas where further research and development needs are required to better understand the fundamental mechanisms of the backfill in the waste repository.

712,908
PB84-239342 Not available NTIS
National Bureau of Standards, Washington, DC.
Dedication, Wilfrid Basil Mann.
Final rept.
B. M. Coursey, and W. L. McLaughlin. 1983, 2p
Pub. in International Jnl. of Applied Radiation and Isotopes 34, n8 piii-iv 1983.

Keywords: *Radioactivity, *Metrology, *Scientists, Environmental surveys, Standards, Reprints, *Mann Wilfrid Basil.

Dr. Wilfrid Mann's peripatetic early career as diplomat and scientist is described in his recent book 'Was There a Fifth Mann, Quintessential Recollections'. Having read for his Doctorate in Physics at Imperial College, London in the 30's, interspersed with Fellowships for research with Niels Bohr and Martin Knudsen in Copenhagen and with Ernest Lawrence at Berkeley, Dr. Mann divided the war years between London and Washington in researching, teaching, and scientific liaison. For his war-time ordnance work at the British Central Scientific Office in Washington, he received the Medal of Freedom. Returning, in 1945, to Imperial College to lecture and to complete the assembly of the Van de Graaff accelerator, he was soon recruited for a new project on radioactive-tracer work at the Canadian National Research Council's laboratory, which under John Cockcroft's directorship had just moved from Montreal to Chalk River. There he set up the first radioactivity-standards laboratory. The Chalk River work was interrupted in 1948 by another Scientific Liaison mission at the British Embassy in Washington, but by this time Dr. Mann's sights were firmly set on a career in radionuclide metrology.

712,909
PB84-242981 PC **A03**/MF **A01**
American National Standards Inst., New York.
American National Standard N542; Sealed Radioactive Sources, Classification.
Final rept.
Jul 78, 30p ANSI-N542-1977, NBS/HB-126

Keywords: *Radioactivity, *Radiation protection, *Standards, Classifications, *American national standards, *Radiation sources.

This standard establishes a system of classification of sealed radioactive sources based on performance specifications related to radiation safety. It provides a manufacturer of sealed sources with a series of tests for evaluating the safety of his product under specified conditions, and also assists a user of such sources to select a type which suits the intended application insofar as maintenance of source integrity is concerned. Tests are prescribed for temperature, external pressure, impact, vibration, and puncture over a range of severity. Sealed source performance requirements are identified for a variety of source applications, in terms of a specific degree of severity of each test. Appendixes are included on the subjects of leak test methods, quality assurance and control, brachytherapy sources, self-luminous light sources, and special form radioactive material.

712,910
PB85-137446 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
National Bureau of Standards Rocky Flats Soil Standard Reference Material.
Final rept.
K. G. W. Inn, W. S. Liggett, and J. M. R. Hutchinson. 1984, 8p
Pub. in Nuclear Instruments and Methods in Physics Research 223, p443-450 1984.

Keywords: *Radioactive contaminants, *Soils, *Standards, Plutonium 239, Concentration(Composition), Sampling, Chemical analysis, Reprints, *Standard reference materials, Rocky Flats Plant, Plutonium 240, Natural emissions.

The National Bureau of Standards (NBS) in collaboration with a number of environmental laboratories of the ICRM has recently issued a soil standard certified for radionuclidic concentrations of activation and fission products and natural radionuclides. Initial disagreements between laboratories of measured concentrations have led to a careful examination of the characteristics of the sample and the radiochemical procedures employed by the participants. A number of assay problems were identified and are discussed. The sample was found to contain an average of approximately 1.8 'hot' (239 + 240)Pu) particles per bottle of 90 g of soil. A statistical analysis of over seventy measurements was used to determine that the homogeneity of the material excluding hot particles is satisfactory. A sampling method for using this material for quality control of plutonium measurements which minimizes the effect of hot particles is described.

712,911
PB85-137768 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of a Regenerative Radon-in-Water Radioactivity Standard.
Final rept.
J. M. R. Hutchinson, P. A. Mullen, and R. Colle. 1984, 7p
Pub. in Nuclear Instruments and Methods in Physics Research 223, p451-457 1984.

Keywords: *Radioactivity, *Standards, *Water analysis, Potable water, Water quality, Quality control, Water, Concentration(Composition), Reprints, *Radon 222, Radium 226.

NBS has developed a prototype standard that generates samples of radium-free (222)Rn gas dissolved in distilled water. This standard is intended to be used for quality control of the U.S. Environmental Protection Agency's program to survey drinking water. It consists of a generator and delivery system which can accurately dispense solutions of (222)Rn with known concentration into, for example, a liquid scintillation vial containing scintillation cocktail. The prototype consists of a source of (226)Ra which is deposited on an ion exchange filter and sandwiched between two layers of thin polyethylene tape and immersed in water in a specially constructed accumulation chamber. The chamber is then flushed and (222)Rn is allowed to accumulate for a measured time and flushed again into a large syringe from which the standard solution is dispensed. From the measurements made at NBS over the past two years, the (222)Rn in the ion exchange filter-polyethylene sandwich, and therefore, the concentration of radon dissolved in the water, can be predicted accurately. Other characteristics of the system will be reported.

712,912
PB85-148047 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Basic Radionuclide Measurements at the U.S. National Bureau of Standards.
Final rept.
D. D. Hoppes. 1984, 9p
Pub. in Environment International 10, p99-107 1984.

Keywords: *Radioactive isotopes, *Radioactivity, *Calibrating, Metrology, Reprints, Standard reference materials.

Methods presently used for the direct measurement of the activity of radionuclides are summarized. The application of these and other methods to the basic calibrations maintained in the Radioactivity Group at the U.S. National Bureau of Standards are then examined, with short descriptions of some of the available instruments. Calibration methods and uncertainties are given for 79 radionuclides.

712,913
PB85-148054 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Statistical Assessment of Subsampling Procedures.
Final rept.
W. S. Liggett, K. G. W. Inn, and J. M. R. Hutchinson. 1984, 9p
Pub. in Environment International 10, p143-151 1984.

Keywords: *Radioactivity, *Sampling, Environmental impacts, Plutonium 239, Normal density functions, Normality, Reprints, Standard reference materials, Plutonium 240, Hypothesis testing.

As shown by the examples in this paper, the concentrations in subsamples are not necessarily independently and normally distributed despite vigorous grinding and mixing of the original sample. Studies of the statistical properties of subsample concentrations should test for deviations from independence and normality and, if deviations are found, should model the observed distribution. The tests include an analysis of variance to check for less variation among nearby subsamples than among widely spaced subsamples, as well as the computation of the probability plot correlation coefficient to check for nonnormality. These tests are illustrated with (239)Pu + (240)Pu measurements on subsamples prepared for use as standard reference materials. These materials are used in quality assurance for environmental radioactivity measurements.

712,914
PB85-148096 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radioactivity Standards for Environmental Monitoring. 2.
Final rept.
K. G. W. Inn, P. A. Mullen, and J. M. R. Hutchinson. 1984, 7p
See also PB-290 521. Sponsored by Department of Energy, Washington, DC., Environmental Protection Agency, Washington, DC., and Nuclear Regulatory Commission, Washington, DC.
Pub. in Environment International 10, p91-97 1984.

Keywords: *Radioactivity, *Standards, Environmental surveys, Gamma rays, Reprints, Radiation monitoring, Radon 222.

The current environmental-monitoring-standards efforts of the low-level radioactivity laboratory in the Radioactivity Group of the National Bureau of Standards are described. The calibration efforts include traceability programs, natural-matrix Standard Reference Materials, alpha-particle-emitting standards, and international radioactivity intercomparisons. New radiometrology efforts under development include a prototype radon-222 in water standard, gamma-ray emission-rate measurement techniques in the 60-keV region, and atom-counting techniques for radioactivity measurements.

712,915
PB85-183333 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Uranium-235 Measurement in Waste Material by Resonance Neutron Radiography.
Final rept.
R. A. Schrack. Nov 84, 7p
Sponsored by Nuclear Regulatory Commission, Washington, DC.
Pub. in Nuclear Technology 67, p326-332 Nov 84.

Keywords: *Radioactive wastes, *Uranium 235, Neutron radiography, Measurement, Reprints.

The use of resonance neutron radiography as a means of monitoring the amount of (235)U in waste material is investigated. A matrix material simulating incinerator

ash is inoculated with (235)U in concentrations ranging from 0.00048 to 0.0046 g/cc. The observed uncertainty agrees well with an analytical model and ranges from 16% for the lowest concentration to 2.5% for the highest concentration. The effect of inhomogeneity of matrix and sample is determined and found to be in agreement with analytical models. The technique is demonstrated on sample sizes ranging from 2-l bottles to 55-gal drums.

712,916
PB85-189330 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of Nondestructive Evaluation.
Measurements and Standards for Nuclear Waste Management.
Final rept.
H. T. Yolken. 1980, 1p
Sponsored by American Nuclear Society, LaGrange Park, IL.
Pub. in Proceedings of Annu. Meeting American Nuclear Society, Las Vegas, NV, June 8, 1980, Transactions of the American Nuclear Society 34, p193.

Keywords: Measurement, Standards, *Radioactive waste management, *Radioactive waste disposal, US NBS.

In August 1979, the Department of Energy (DOE) invited the National Bureau of Standards (NBS) to consider establishment of a technical program that would contribute to the measurement standards foundation required for disposal of nuclear waste. A group of NBS scientists was asked by the management of NBS to examine the needs for measurement standards in nuclear waste management and, if desirable, to recommend a technical program. This talk is an interim report on the progress of their study and states their tentative conclusions and recommendations for an NBS technical program.

712,917
PB85-207363 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Thermal Expansion of U.S. and Australian Synroc B.
Final rept.
H. R. Kase, J. A. Tesk, and E. D. Case. Mar 85, 4p
Pub. in Nuclear Technology 68, p423-426 Mar 85.

Keywords: *Thermal expansion, Radioactive waste processing, Comparison, Reprints, *Radioactive waste disposal, *Synroc process.

For the safe disposal of nuclear waste, a synthetic rock (SYNROC) was developed. Continuing research in this field has led to U.S. and Australian versions of SYNROC B. For both materials, the thermal expansion and expansivity have been determined by the temperature range from 296 to 1100 K.

712,918
PB86-128949 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Reference Laboratory Testing for Backfill.
Final rept.
R. M. Chung, and F. Y. Yokel. 1982, 9p
Sponsored by Battelle Project Management Div., Columbus, OH. Office of Nuclear Waste Isolation.
Pub. in Proceedings of Annual Meeting of Materials Research Society, Boston, MA., November 1981, Scientific Basis for Nuclear Waste Management, v4 p379-387 1982.

Keywords: *Containers, Compaction, Requirements, Packaging materials, Swelling, Hydraulic conductivity, *Radioactive waste storage, *Backfilling.

Relatively high magnitude of swelling and low hydraulic conductivity are two of the performance requirements for the backfill placed around the radioactive waste package for the underground nuclear waste storage scheme. Some studies have been conducted in U.S. national laboratories and in other countries where the candidate backfill materials were tested under many different conditions to determine the expected range of these properties. This paper briefly examines the variables that were found to be significant in the evaluation of swelling and hydraulic conductivity and special emphasis is placed on the compaction method, compaction effort, and the moisture content at the time of compaction, which do not receive much consideration in ongoing test programs.

712,919
PB86-129541 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Chemical Engineering.
Review of Materials for pH Sensing for Nuclear Waste Containment.
T. Dietz, and K. G. Kreider. Sep 85, 62p NBSIR/85-3237
Sponsored by Nuclear Regulatory Commission, Washington, DC.

Keywords: *pH meters, *Radioactive wastes, Reviews, Corrosion, Design criteria, Performance evaluation, Electrochemistry, Electrodes, Glass, Thin films, Platinum oxides, Stability, Transition metals, Yttrium compounds, *Radioactive waste disposal, *Radioactive waste storage, NRC, Chemical reaction mechanisms, Metal oxides, Palladium hydride, Iridium oxide.

The report defines the performance criteria of the needed pH sensors and reviews the performance of a number of elevated temperature pH sensing technologies with respect to these criteria. The criteria of electrode performance were developed to predict the utility of various pH electrodes in these simulated environments. The classes of pH electrodes reviewed are the glass electrode, yttria stabilized zirconia, palladium hydride and a variety of metal oxides. The report focuses on a relatively new solid state electrode material, reactively sputter deposited iridium oxide. The performance of this thin film material is of particular interest because its low electrical resistivity and high corrosion resistance eliminate some of the shortcomings of the glass and ceramic materials. The reactive sputtering technology permits these films to be deposited and pattern defined on a wide variety of substrate materials. Low electrical resistivity, which simplifies electrical contacts, and a flexible deposition technology make this material a prime candidate for micro pH sensors.

712,920
PB86-133428 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Characterization of Elastic Properties and Microstructure of U.S. and Australian Synroc-B.
Final rept.
E. D. Case, and T. Negas. 1984, 7p
Sponsored by California Univ., Berkeley. Dept. of Materials Science and Engineering.
Pub. in Adv. Ceram. 8, p723-729 1984.

Keywords: Elastic properties, Microstructure, Australia, Comparison, Reprints, *Synroc process, *Radioactive waste disposal, USA.

The Young's modulus, shear modulus, and Poisson's ratio have been measured for U.S. and Australian versions of Synroc B. Despite some microstructural differences between the U.S. and Australian synroc, their elastic properties are quite similar. For the Australian synroc, thermal anneals in air, at temperatures up to 1285C, resulted in the appearance of numerous voids about 10 micrometers across and some additional voids > 100 micrometers across.

712,921
PB87-132718 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Investigation of a Precise Static Leach Test for the Testing of Simulated Nuclear Waste Materials.
Final rept.
H. M. Kingston, D. J. Cronin, and M. S. Epstein. 1984, 13p
Pub. in Nuclear and Chemical Waste Management 5, n1 p3-15 1984.

Keywords: *Radioactive wastes, Chemical analysis, Precision, Concentration(Composition), Zinc, Calcium, Barium, Cesium, Molybdenum, Sodium, Silicon, Strontium, Reprints, *Leach tests.

The overall precision of the static leach test is determined by the summation of random effects caused by; (1) variance in the experimental conditions of the leaching procedure, (2) in homogeneity of the material to be leached, (3) variance of the analytical techniques used to determine elemental concentrations in the leachate. In the study, strict control of key experimental parameters was employed to reduce the source of variance. In addition, special attention to preparation of glass samples to be tested assured a high degree of homogeneity. Described here are the details of the reduction of these two sources of variance to a point where the overall test precision is limited by that of the analysis step. Of the elements determined B, Ba, Ca, Cs, Mo, Na, Si, Sr, and Zn; only Ca and Zn exhibited replicate imprecision significantly greater than that observed in the analysis of the leachate solutions.

712,922
PB88-128160 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Vaporization of Simulated Nuclear Waste Glass.
Final rept.,
D. W. Bonnell, E. R. Plante, and J. W. Hastie. 1986, 8p
See also PB84-102128.
Pub. in Jnl. of Non-Crystalline Solids 84, n1-3 p268-275, 2 Jul 86.

Keywords: *Radioactive waste disposal, Borosilicate glass, Cesium, Spectrometry, Radioactive waste processing, Thermodynamics, Reprints.

Industrial development of nuclear waste glass processing requires basic data on glass vaporization thermodynamics. Detailed mass spectrometric experiments and thermodynamic estimates have been made for vaporization of a nonradioactive borosilicate glass containing representative nuclear waste isotopes. Alkali metaborates were observed to be dominant vapor species and their partial pressures indicate significant vapor transport under likely process conditions. The results indicate the following order of significance for vapor transport of radionuclide species, CS about equal to Re (about equal to TC)> Ru >> Sr.

Reactor Engineering & Nuclear Power Plants

712,923
PB-272 047/2 PC **A07**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
Index of U.S. Nuclear Standards.
Special pub. (Final),
W. J. Slattery. Aug 77, 130p NBS-SP-483

Keywords: *Nuclear engineering, *Nuclear reactors, *Nuclear reactor materials, *Standards, *Indexes(Documentation), Specifications, *Nuclear standards.

This Index contains the permuted titles of more than 1,200 nuclear and nuclear-related standards, specifications, test methods, codes and recommended practices published by 34 U.S. Government agencies, technical societies, professional organizations, and trade associations. Each title can be found under all the significant key words which it contains. These key words are arranged alphabetically down the center of each page together with their surrounding context. Each entry includes the date of publication or last revision, the standard number, an acronym designating the standards-issuing organization, any cross reference standard number, and price.

712,924
PB-294 343/9 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Computer Systems Engineering Div.
Computerized Site Security Monitor and Response System.
Final rept. on Phase 2.
R. T. Moore, R. J. Carpenter, A. W. Holt, A. L. Koenig, and R. B. J. Warnar. Mar 79, 119p NBSIR-79-1725
See also report dated 1 Jun 77, PB-269 346. Sponsored in part by Defense Nuclear Agency, Washington, DC.

Keywords: *Automation, *Nuclear materials management, *Monitors, Nuclear weapons, Radioactive materials, Security, Computer networks, Computer applications, CSSMRS system, Nuclear safeguards.

The Computerized Site Security Monitor and Response System (CSSMRS) was conceived as an integrated, state-of-the-art, computer based system to enhance and improve the overall physical security of storage sites for nuclear weapons and materials. This would result from the interconnection of all site securi-

ty systems including intrusion detection equipment, duress alarms, guard radio and telephone systems, guard activity sensors, access control equipments, meteorological and environmental sensors and deterrent systems to a distributed processing network of computers. These would be expected to provide timely, accurate and unambiguous information about the site security status or the progress of an attack or intrusion attempt. To the extent that is feasible, appropriate response initiatives would be preprogrammed into the system. Changes in site security status and the resulting response actions would be automatically reported upchannel to higher command levels and backup and reserve forces would be automatically called out in the event of certain identifiable threat situations, particularly those in which continued survival of local guard forces might be doubtful.

712,925
PB78-600046 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Paraxial Ray Analysis of a Cat's-Eye Retroreflector: Author's Reply to Comments.
J. J. Snyder. 1976, 1p
Pub. in Appl. Opt. 15, n7 p1691 1976.

Keywords: *Cat's-eye reflector, Paraxial ray analysis, Retroreflector, Cat's-eye.

No abstract available.

712,926
PB80-165756 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Laminagraphy for Inspection of Nuclear Fuel Subassemblies.
Final rept.,
H. Berger, N. P. Lapinski, and K. J. Reimann. 1980, 8p
Pub. in Proceedings of the International Symposium on New Methods of Non-Destructive Testing of Materials and Their Application Especially in Nuclear Engineering, Saarbrucken, West Germany, September 17-19, 1979, p275-282, Mar 80.

Keywords: *Neutron radiography, *Nuclear fuel rods, Nuclear fuel assemblies, Fast neutrons, Thermal neutrons, Resolution.

Multiple-film laminagraphy to display individual object planes within a complex, reactor fuel subassembly is described. Neutron radiography methods in the thermal, resonance, and fast energy ranges are shown to be capable of good laminagraphic results. Spatial resolution in individual object planes is 0.5 mm for thermal and resonance neutrons and is projected to be 1 to 2 mm for 14 MeV neutrons.

712,927
PB80-202104 PC **A08**/MF **A01**
Performance Development Inst., Washington, DC.
Assessment of an Experiment in Accelerating the Development of Nuclear Standards.
Final rept.,
J. P. Woodward, and S. D. Garrity. Jun 80, 154p NBSIR-80-2086
Contract NBS-7-35822

Keywords: *Regulations, Standards, Policies, Experimental design, Licenses, US NRC, *Nuclear facilities.

As part of its program on regulatory experimentation, the Experimental Technology Incentives Program conducted a project with the Nuclear Regulatory Commission on accelerating the standards development process. This report assesses the execution and outcomes of the project with a specific focus on whether further work is needed on the project and on how to improve future experimental designs. The report includes sections on agency and project background, project initiation, project plans, what actually happened, what was learned about the standards development process, and factors to consider in the design of other experiments.

712,928
PB81-120883 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Probabilistic Assessment of Tornado-Borne Missile Speeds.
Final rept.
E. Simiu, and M. R. Cordes. Sep 80, 88p NBSIR-80-2117
Sponsored in part by Nuclear Regulatory Commission, Washington, DC. Errata sheet inserted.

Keywords: *Nuclear power plants, *Tornadoes, Flow fields, Aerodynamic forces, Wind velocity, Ballistic trajectories, Probability theory, Computer programs, *Windborne debris.

A procedure was developed for estimating speeds with which postulated missiles hit any given set of targets in a nuclear power plant or similar installation. Hit speeds corresponding to probabilities of occurrence of .0000001 were calculated for a given nuclear power plant under various assumptions concerning the magnitude of the force opposing missile take-off, direction of tornado axis of translation, number and location of missiles, and size of target area. The results of the calculations are shown to depend upon the parameters: CDA/m, where CD = drag coefficient, A = projected area, m = mass of missiles, and the ratio, k, between the minimum aerodynamic force required to cause missile take-off, and the weight of the missile.

712,929
PB81-128423 CP **T08**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Probabilistic Assessment of Tornado-Borne Missile Speeds.
Software.
M. R. Cordes. Oct 80, mag tape NBS/DF-81/002
Source tape is in ASCII character set. Character set restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation, PB81-128431.

Keywords: *Software, *Nuclear power plants, *Tornadoes, Wind(Meteorology), Probability theory, *Windborne debris.

A procedure was developed for estimating speeds with which postulated missiles hit any given set or targets in a nuclear power plant or similar installation. Hit speeds corresponding to probabilities of occurrence of .0000001 were calculated for a given nuclear power plant under various assumptions concerning the magnitude of the force opposing missile take-off, direction of tornado axis of translation, number and location of missiles, and size of target area. The results of the calculations are shown to depend upon the parameters: CDA/m, where CD = drag coefficient, A = projected area, m = mass of missiles, and the ratio, k, between the minimum aerodynamic force required to cause missile take-off, and the weight of the missile.

712,930
PB81-128431 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Probabilistic Assessment of Tornado-Borne Missile Speeds.
Final rept.
E. Simiu, and M. R. Cordes. Sep 80, 88p NBSIR-80-2117, NBS/DF-81/002A
For system on magnetic tape, see PB81-128423. Errata sheet inserted.

Keywords: *Nuclear power plants, *Tornadoes, Wind(Meteorology), Probability theory, Computer programs, *Windborne debris.

Estimates of tornado-borne missile speeds for nuclear power plant design purposes were previously presented. One of the assumptions on which these estimates were based was that the missiles start their motion from a point located on the tornado translation axis, at a distance upwind of the tornado center equal to the radius of maximum circumferential wind speeds. In addition, it was assumed that the speed with which a missile hits a target is equal to the maximum speed, denoted by VH max, that the same missile would attain if its trajectory were unobstructed by the presence of any obstacle. Clearly, neither of these assumptions is realistic. The purpose of this report is to attempt an approach to the missile speed problem that takes into account the fact that the initial positions of the missiles with respect to the tornado center are not necessarily those assumed, and that the speeds with which the missiles hit the targets are not necessarily equal to VHmax.

712,931
PB84-220953 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultrasonic Weld Inspection for Nuclear Power Plant Structures.
Final rept.
L. Mordfin. Jan 84, 2p
Pub. in Materials Evaluation, n42 p30-31 Jan 84.

Keywords: *Ultrasonic tests, Structures, Nuclear power plants, Nondestructive tests, Welded joints, Reprints.

Book review of 'Advances in Non-Destructive Examination in Relation to Structural Integrity,' R.W. Nichols, editor, xvi = 447 pp, Applied Science Publishers, London, 1982. Distributed in the USA and Canada by Elsevier Science Publishing Co., New York, $90.25.

712,932
PB84-224856 Not available NTIS
National Bureau of Standards, Washington, DC.
Requirements for Referencing Reactor Pressure Vessel Surveillance Dosimetry to Benchmark Neutron Fields.
Final rept.
E. D. McGarry. 1982, 20p
Pub. in Proceedings of International Atomic Energy Agency Meeting, Vienna, Austria, Oct 12-16, 1981, p29-45, 1982.

Keywords: *Pressure vessels, Nuclear reactor safety, Calibrating, Accuracy, Neutron irradiation, *Neutron dosimetry, Benchmarks, Light water reactors.

The objective of benchmark field referencing is to guarantee measurement accuracy of dosimetry methods for LWR-PV Dosimetry Surveillance by carrying out various types of calibration irradiations in well-characterized neutron fields. The participation of the National Bureau of Standards in particular phases of benchmarking is discussed and the status of activities is given. Notable applications to date are given.

712,933
PB85-108611 Not available NTIS
National Bureau of Standards, Washington, DC.
Tornado-Borne Missile Speed Probabilities.
Final rept.
E. Simiu, and M. R. Cordes. Jan 83, 15p
Sponsored in part by Nuclear Regulatory Commission, Washington, DC.
Pub. in Jnl. of Structural Engineering 109, n1 p154-168 Jan 83.

Keywords: *Nuclear power plants, Velocity, Estimates, Tornadoes, Missiles, Probability theory, Reprints, Computer applications.

A procedure is developed for estimating speeds with which postulated missiles hit any given set of targets in a nuclear power plant or similar installation. Hit speeds corresponding to probabilities of occurrence are calculated for a given nuclear power plant under various assumptions concerning the magnitude of the force opposing missile takeoff, direction of tornado axis of translation, number and location of missiles, and size of target area.

712,934
PB85-242196 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Heat Release Rate Characteristics of Some Combustible Fuel Sources in Nuclear Power Plants.
B. T. Lee. Jul 85, 53p NBSIR-85/3195
Sponsored by Nuclear Regulatory Commission, Washington, DC.

Keywords: *Fire hazards, *Nuclear power plants, Fuels, Fire safety, Fires, Cables(Power lines), Trays, Flammability, Flammable liquids, Ignition, Wood, Fire tests, Refuse, *Heat release rate.

A major risk to a nuclear power plant is the possibility of serious fire. There is a need to know the heat release rate behavior of combustible fuels in the plant in order to help reduce the fire threat to the facilities. Heat release rate characteristics of cable tray fires and some of the associated potential external ignition sources are discussed. Existing correlations are given for determining the time to ignition and the subsequent heat release rate of spills and pools of flammable liquids. Approximate correlations are developed for heat release rate for trash fires as a function of fire size and for one particular cable tray array arrangement as a function of the type of cable. In addition, a scheme is given for calculating the heat release rate from wood fuel fires.

712,935
PB88-139134 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Reactor Engineering & Nuclear Power Plants

Wide Plate Crack Arrest Testing.
Final rept.,
R. deWit, and R. J. Fields. 1987, 7p
Sponsored by Department of Energy, Washington, DC. Pub. in Nuclear Engineering and Design 98, n2 p149-155 1987.

Keywords: *Pressure vessels, *Plates(Structural members), *Crack propagation, Thermal shock, Nuclear reactor materials, Steels, Tests, Reprints.

To predict the behavior of a nuclear pressure vessel undergoing pressurized thermal shock, certain information on dynamic crack propagation and arrest is required. The purpose of the work described here is to provide such data on wide plates fracturing at temperatures up to the upper shelf region. Four tests have been completed on the 26 MN Universal Testing Machine at NBS since the Twelfth Water Reactor Safety Information Meeting. The paper summarized the results of these most recent tests.

712,936
PB88-141379 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
National Bureau of Standards Reactor (NBSR).
Final rept.,
R. S. Carter, and T. M. Raby. 1984, 8p
Pub. in Use and Development of Low and Medium Flux Research Reactors, Chapter 2, Supplement 44, p180-187 1984.

Keywords: *NBSR reactor, US NBS.

The National Bureau of Standards Reactor (NBSR) is a heavy water moderated and cooled reactor operating at 10 MW. Reactor facilities and special features, experimental instrumentation, and reactor utilization are described.

712,937
PB88-147566 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Role of Reactor Characterization in NAA Quality Assurance.
Final rept.,
D. A. Becker. 1987, 9p
Pub. in Jnl. Radioanal. Nucl. Chem. 110, n2 p393-401 1987.

Keywords: Quality assurance, Neutron irradiation, Neutron flux, Radioactivation analysis, Reprints, *NBSR reactor, Irradiation reactors, Activation analysis.

As a result of the NBS reactor upgrade to 20 MW, an extensive program of recharacterization of the irradiation facilities was undertaken. These measurements were made to (1) evaluate the neutron flux density and its variability over the irradiation volume, which is important for assuring quality in neutron activation analysis using these facilities, and (2) help establish safe irradiation conditions for samples in the NBSR. Techniques used to measure various parameters are described.

Reactor Fuels & Fuel Processing

712,938
LA-UR-80-1817 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Measurement Trends for Future Safeguards Systems.
S. M. Baloga, and E. A. Hakkila. 1980, 23p CONF-800655-12
Contract W-7405-ENG-36
21. annual meeting of the Institute of Nuclear Materials Management, Palm Beach, FL, USA, 30 Jun 1980.

Keywords: *Nuclear facilities, *Safeguards, Accounting, Material balance area, Measuring methods, ERDA/055001.

Safeguards for future commercial-scale nuclear facilities may employ three materials control and accounting concepts: classical accounting, dynamic materials balancing, and independent verification of inventories and materials balances. Typical measurement needs associated with the implementation of these concepts at high-throughput facilities are discussed. Promising measurement methods for meeting these needs are described and recent experience is cited. General directions and considerations for meeting advanced safeguards systems needs through measurement technology development over the next decade are presented. (ERA citation 05:027022)

712,939
PB-269 346/3 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Computer Systems Engineering Div.
Computerized Site Security Monitor and Response System,
R. T. Moore, R. J. Carpenter, and A. L. Koenig. 1 Jun 77, 46p NBSIR-77-1262

Keywords: *Radioactive materials, *Nuclear weapons, *Security, Monitors, Microcomputers, Computer systems hardware, *Computer applications, CSSMRS system.

The Computerized Site Security Monitor and Response System (CSSMRS) was conceived as an integrated, state-of-the-art, computer-based system to enhance and improve the overall physical security of storage sites for special weapons or materials. This report is divided into three sections. Section 1 contains an overview summary of the findings or study results for each of the eight specific phase 1 tasks. These are set forth in varying degrees of detail as appropriate to both the nature of the task and the results. Section 2 is a description of the CSSMRS in its current (and incomplete) state of evolution. Here many of the attributes, capabilities, and features developed during the course of Phase I work are set forth. Some of the alternatives are identified as are areas where additional work will be necessary to reach clearly identifiable and attainable objectives necessary to complete the system definition. In section 3, a proposed phase 2 work plan is presented.

712,940
PB-289 112/5 PC **A13**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.
Analytical Methods for Safeguards and Accountability Measurements of Special Nuclear Materials.
Special pub.
H. T. Yolken, and J. E. Bullard. Nov 78, 297p NBS-SP-528
Prepared in cooperation with Babcock and Wilcox Co., Lynchburg, VA. Lynchburg Research Center. Sponsored in part by American Nuclear Society. Virginia Section. Library of Congress Catalog Card no. 78-600115. Proceddings from American Nuclear Society Topical Meeting Held in Williamsburg, Virginia on May 15-17, 1978.

Keywords: *Nuclear fuels, *Meetings, *Chemical analysis, Safety, Quality assurance, Isotopes, Uranium, Plutonium, Thorium, Forecasting, X ray analysis, Design criteria, Gamma ray spectroscopy, Laboratory equipment, Radioactive wastes, Volumetric analysis, X ray fluorescence, X ray diffraction, Actinide, Samples, Feasibility, *Nuclear materials management, Uranyl nitrates, Transuranium elements, Accountability.

This book contains proceedings of the American Nuclear Society's (co-sponsored by the National Bureau of Standards) topical meeting entitled, 'Analytical Methods for Safeguards and Accountability Measurements of Special Nuclear Materials.' The meeting was held in Williamsburg, Va. on May 15-17, 1978. The two objectives of the meeting were to discuss the latest techniques for chemical analysis of special nuclear materials and to strengthen lines of communication among scientists working in this field. The presentations deal with advanced analytical chemistry techniques such as x-ray spectrometry for elemental content, neutron interrogation and gamma ray techniques for isotopic content, mathematical correction models, and wet chemistry methods for elemental content. Examples of remote systems for handling highly radioactive samples for analysis are given. Progress is being made on the problems associated with obtaining high precision and accuracy for analysis of special nuclear materials while at the same time maintaining short turn around time and reduced possibility of diversion. Various approaches are described which emphasize computer-controlled operating systems with built-in safeguards and quality assurance programs. Current trends in the fuel cycle, along with future approaches to control and accountability of special nuclear materials, are discussed.

712,941
PB80-156300 Not available NTIS
National Bureau of Standards, Washington, DC.
In-tank Measurement of Solution Density.
Final rept.,
F. E. Jones, R. M. Schoonover, and J. F. Houser. 1979, 1p
Pub. in Proceedings of the Symposium on Measurement Technology for Safeguards and Materials Control, Kiawah Island, SC., November 26-30, 1979, p42 1979.

Keywords: *Nuclear materials management, Solutions, Density(Mass/volume), Measurement.

This paper presents the results of an experiment which established the feasibility of in-tank determination of the density of nuclear process solutions in the field with an accuracy competitive with the precision claimed for the best laboratory determinations. The work also provided a calibration factor, with a precision (estimate of the relative standard deviation of the mean) of 2.2 parts in 10,000 which can be used to infer density from differential pressure measurements in the particular accountability tank. The technique eliminates one error in the laboratory determination of density and minimizes another. It also can be used to indicate the homogeneity of the tank solution and thus determine when a sample should be taken for determination of the concentration of nuclear material in the solution.

712,942
PB80-203417 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Measurement Technology for Safeguards and Materials Control,
T. R. Canada, and B. S. Carpenter. Jun 80, 772p NBS-SP-582
Sponsored in part by American Nuclear Society, Washington, DC., and Institute of Nuclear Materials Management, Columbus, OH. Prepared in cooperation with Los Alamos Scientific Lab., NM. Library of Congress catalog card no. 80-600072. Proceedings from American Nuclear Society Topical Meeting held November 26-30, 1979, Kiawah Island, South Carolina.

Keywords: *Nuclear fuels, *Meetings, Nuclear fuel reprocessing, Standards, Technology, Chemical analysis, Inspection, Mass spectroscopy, Thorium, Uranium, Plutonium, Isotopes, X ray fluorescence, X ray analysis, Gamma ray spectroscopy, Trace elements, Separation, *Safeguards, Reference materials.

This publication contains the proceedings of the American Nuclear Society's Topical Conference entitled, Measurement Technology for Safeguards and Materials Control. The presentations were applications oriented and offered a good balance between chemical analysis, nondestructive assay techniques, bulk measurement techniques, inspection techniques, and integrated systems for material measurements and control. Reports discussing preparation and use of reference materials and measurement traceability were included. Examples of measurement requirements and techniques used for both national and international safeguards are given. Approaches to various analysis of materials throughout the fuel cycle from enrichment and fuel fabrication to spent fuel and reprocessing are considered.

712,943
PB81-187973 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Some Conservative Statistical Approaches for Presenting Interlaboratory N.D.A. Enrichment Measurements.
Final rept.
C. H. Spiegelman. Mar 81, 20p NBSIR-81-2222
Contract AT(49-25)-9009

Keywords: *Enrichment, *Standards, Measurement, Nondestructive tests, Statistical analysis, Multivariate analysis, Uranium oxides.

It is important to realistically evaluate interlaboratory measurements on prototype and primary standards. The emphasis in this paper is on nondestructive assay (NDA) measurements. These measurements are based on an estimate of the total number of counts from a target source. This estimate is called the peak area calculation. It is necessary to distinguish real differences between laboratory findings from artificial differences such as those caused by artifacts of individual peak area calculations. This report provides guid-

ance for assessing the magnitude of these peak area artifacts. A wide variety of statistical tests for homogeneity of the peak areas for these standards is considered. For these tests, algorithms are provided for finding linear peak area computations which either make the standards appear most or least homogeneous. These tests include the usual F statistics as well as the standardized range.

712,944
PB84-229533 Not available NTIS
National Bureau of Standards, Washington, DC.
Computerized Site Security Monitor and Response System.
Final rept.
R. T. Moore. 1 Jun 81, 9p
Sponsored in part by Defense Nuclear Agency, Washington, DC. See also PB84-294343.
Pub. in Proceedings of Annual Symposium Role of Behavioral Science in Physical Security (5th), Gaithersburg, MD., June 11-12, 1980, p9-17, 1 Jun 84.

Keywords: *Nuclear materials management, *Nuclear weapons, *Security, Monitors, Computer networks, Optical communication, Detectors, Reliability, Maintainability, *Safeguards, Computer applications, State of the art.

An integrated, state-of-the-art, computer-based system has been defined to enhance and improve the overall physical security of storage sites for nuclear weapons and materials. It would provide for the interconnection of a distributed network of computers with a survivable, fiber optics communications network. This distributed processing system would monitor and control the various physical security sub-systems on the site, including intrusion alarms and alarm assessment subsystems, access control equipments, deterrent systems. Sensors responsive to meteorological and environmental stimuli are provided to permit the use of correlation techniques to identify certain classes of nuisance alarms. The system is intended to provide timely, accurate and unambiguous information about the site security status or the progress of an attack or intrusion attempt and to provide local security forces with appropriate preprogrammed response initiatives.

712,945
PB84-242965 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Resonance Transmission Analysis of Reactor Spent Fuel Assemblies.
Final rept.
C. D. Bowman, R. A. Schrack, J. W. Behrens, and R. G. Johnson. 1983, 9p
Pub. in Proceedings of World Conference on Neutron Radiography (1st), San Diego, CA., December 7-10, 1981, p503-511 1983.

Keywords: *Nuclear fuel reprocessing, *Assaying, Uranium isotopes, Plutonium isotopes, Americium isotopes, Neutron beams, *Spent fuels, *Neutron resonance transmission analysis, Safeguards.

A method called Neutron Resonance Transmission Analysis (NRTA) is under study which would use a pulsed neutron beam for nondestructive isotopic assay of a complete spent fuel assembly. Neutrons removed from the collimated beam by absorption or scattering in the resonances of the various isotopes in the spent fuel appear as dips in the neutron transmission. The method is completely insensitive to matrix materials such as oxide, fuel cladding, and other structural members. Measurements on spent fuel buttons using the NBS linac as a pulsed neutron source demonstrate a high accuracy capability for the isotopes (234,235,236,238) U, (239,240,241,242) Pu, (241) Am, (243) Am, and several fission products. The NRTA method offers high speed and modest operational cost, and it can be implemented with commercially available medical or radiographic gamma-ray generators adapted for neutron production.

712,946
PB85-102770 Not available NTIS
National Bureau of Standards, Washington, DC.
Possibilities for International Cooperation in Standardizing Measurement Methods for Nuclear Safeguards.
Final rept.
H. T. Yolken. 1979, 7p
Sponsored in part by International Atomic Energy Agency, Vienna (Austria).
Pub. in Proceedings of IAEA (International Atomic Energy Agency) Symposium, Nuclear Materials Safeguards, Vienna, Austria, October 2, 1978, p243-249 1979.

Keywords: *Nuclear materials management, Measurement, Standards, *International cooperation, *Safeguards, Nuclear facilities.

The need to accurately determine the amount of fissionable materials in nuclear fuel cycle facilities is of clear importance to both international and domestic safeguards activities. A suggested international measurement and standards system is described. Finally, a number of recommendations for implementing and carrying forward an international cooperative effort in standardization of measurements for nuclear safeguards are presented.

712,947
PB85-144483 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron Resonance Transmission Analysis of Reactor Fuel Samples.
Final rept.
J. W. Behrens, R. G. Johnson, and R. A. Schrack. 1984, 7p
Pub. in Nuclear Technology 67, p162-168 Oct 84.

Keywords: *Nuclear fuels, Fission products, Isotope availability, Reprints, *Spent fuels, *Isotope ratio, Neutron resonance transmission analysis, Time-of-flight method.

Neutron resonance transmission analysis (NRTA) was used to measure the isotopic content of fresh and spent nuclear reactor fuel samples. Using the National Bureau of Standards 100-MeV electron Linac as a pulsed neutron source, neutron transmission spectra were measured for two samples of fresh reactor fuel and two samples of spent fuel. The transmission spectra were fit using the well-known and unique neutron cross sections for each isotope of interest. For the fresh fuel samples, the (235)U and (238)U contents were determined and compared to the results of a destructive analysis. Excellent agreement was obtained. For the spent fuel samples, the abundances of 11 actinides and 5 fission products were obtained. NRTA was shown to be a method for nondestructive analysis with high isotopic discrimination and high accuracy.

712,948
PB85-145365 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Improved Mass Measurement Accuracy Using the PNB (Preloaded Narrow-Band) Load Cell Scale.
Final rept.
S. Suda, P. Pontius, and R. Schoonover. 1981, 6p
Pub. in Nuclear Materials Management 10, p266-271, 15 Jul 81.

Keywords: *Nuclear materials management, *Mass, *Weight measurement, Measurement, Comparison, Load cells, Reprints, *Safeguards.

The PNB Load Cell Scale is a Preloaded, Narrow-Band calibration mass comparator. It consists of (1) a frame and servo-mechanism that maintains a preload tension on the load cell until the load an unknown mass is sensed, and (2) a null-balance digital instrument that suppresses the cell response associated with the preload thereby improving the precision, and accuracy of the measurements. Ideally, the objects used to set the preload should be replica mass standards that closely approximate the density and mass of the unknowns. The advantages of the PNB scale are an expanded output signal over the range of interest which increases both the sensitivity and resolution, and minimization of the transient effects associated with loading and unloading of load cells. An area of immediate and practical application of this technique to nuclear material safeguards is the weighing of UF6 cylinders where in-house mass standards are currently available and where the mass values are typically assigned on the basis of comparison weighings. Several prototypical versions of the PNB scale have been assembled at the U.S. National Bureau of Standards. A description of the instrumentation, principles of measurements, and applications are presented in this paper.

712,949
PB85-196186 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of Uranium Oxide Reference Materials for Gamma-Ray Measurements of the Enrichment.
Final rept.
R. J. S. Harry, and H. T. Yolken. 1979, 11p
Sponsored by Institute of Nuclear Materials Management, Inc., Piketon, OH.
Pub. in Proceedings of the Institute of Nuclear Material Management Annual Meeting (20th), Albuquerque, NM., July 16-18, 1979, v8 p54-64.

Keywords: *Uranium oxides, Nuclear materials management, Gamma ray spectroscopy, Nondestructive tests, *Reference materials, *Safeguards.

The application of gamma-ray measurements for uranium enrichment determinations is now a mature technique finding widespread use. These facts led the European Safeguards Research and Development Association (ESARDA) Working Group on Techniques and Standards for Non-destructive Analysis to conclude that the development of certified reference materials for low enriched uranium oxide was the next necessary step to enhance the usefulness of the technique. This paper describes the cooperative development of these certified reference materials in the European Community and the United States of America. The following organizations are taking part in the development: The ESARDA working group, the Commission of the European Communities Joint Research Centre - Geel Establishment - Central Bureau for Nuclear Measurements, the U.S. National Bureau of Standards, the New Brunswick Laboratory, and the Los Alamos Scientific Laboratory.

712,950
PB85-201903 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tank Volume Calibration Algorithm.
Final rept.
F. E. Jones. 1984, 12p
Pub. in Nuclear Materials Management 13, n1 p16-27 1984.

Keywords: *Nuclear materials management, *Tanks(Containers), *Volume, *Calibrating, Accountability, Water, Reprints, *Safeguards.

An algorithm has been developed to enable inference of the volume of process mixture in a tank, such as a nuclear materials accountability tank, at temperature T from measurements of differential pressure and temperature and values of other parameters. The differential pressure is converted to that corresponding to water at the reference temperature, 25C, by the use of a derived equation. This differential pressure is then used in a water calibration equation to calculate the volume of water at 25C. This volume is equal to the volume of process mixture at 25C at the same level in the tank, the desired result.

712,951
PB87-153300 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Office of Nondestructive Evaluation.
Recent Research at the U.S. National Bureau of Standards on Measurement Methodology for Nuclear Safeguards.
Final rept.,
H. T. Yolken. 1979, 4p
Sponsored by European Safeguards Research and Development Association, Rome (Italy).
Pub. in Proceedings of Annual Symposium on Safeguards and Nuclear Materials Management (1st), Brussels, Belguim, April 25-27, 1979, p352-355.

Keywords: *Nuclear materials management, Accounting, Measurement, Standardization, *Safeguards.

The U.S. National Bureau of Standards (NBS) has an ongoing program to provide for the standardization of measurement methods used for nuclear materials accountability. Current NBS activities are in five major areas: (1) nondestructive assay, (2) destructive chemical and isotopic assay, (3) bulk measurements, (4) statistical methods and sampling, and (5) systems studies. The NBS program will be described with emphasis on the first three areas.

712,952
PB87-156998 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Reactor Fuels & Fuel Processing

NDE (Nondestructive Evaluation) of Residual Stress in Uranium by Means of Neutron Diffraction.
Final rept.,
H. J. Prask, and C. S. Choi. 1984, 8p
Pub. in Jnl. of Nuclear Materials 126, n2 p124-131 1984.

Keywords: *Uranium, *Stresses, Nondestructive tests, Neutron diffraction, Reprints.

In the present work, a neutron diffraction technique for the nondestructive measurement of subsurface residual stress gradients in textured metallurgical samples is described. Results for three sample types are presented: aluminum cylinder and steel calibration samples; and two, depleted uranium-alloy cylinders of differing thermo-mechanical histories. The results in all cases confirm the accuracy of the technique. Furthermore, neutron diffraction, now appears to be the only technique by which nondestructive characterization of subsurface residual stress in uranium is possible.

712,953
PB87-203014 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Office of Nondestructive Evaluation.
Book Review of 'Nuclear Safeguards Analysis: Nondestructive and Analytical Chemical Techniques.'
Final rept.,
H. T. Yolken. 1981, 1p
Pub. in Medical Physics 8, n1 p127 Jan/Feb 81.

Keywords: Nondestructive tests, Chemical analysis, Reprints, *Nuclear materials management, *Safeguards.

The paper is a book review of the American Chemical Society Symposium Series, 79, 'Nuclear Safeguards Analysis Nondestructive and Analytical Chemical Techniques' for the journal Medical Physics.

Reactor Materials

712,954
PB86-185253 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Texture of Extruded Uranium Alloy by Neutron Diffraction.
Final rept.
C. S. Choi, and H. J. Prask. 1985, 6p
Pub. in Jnl. of Applied Crystallography 18, p413-418 1985.

Keywords: *Uranium alloys, *Nuclear reactor materials, Extrusions, Texture, Neutron diffraction, Tungsten, Fibers, Reprints.

The pole-density distributions of two hydrostatically extruded samples, a U-075 wt % Ti alloy and a U-075 wt % Ti/W composite alloy, were studied by neutron diffraction methods. Analysis of U 112, U 131 and U 111 pole figures revealed that the U phases of both samples posses a (010)/(340) duplex fiber texture with a probability ratio of approximately 2.8:1 in favor of the (010) direction. The W phase of the composite sample had a (110) fiber texture. The orientation distribution profiles of the fiber axes obtained from the rocking curves (as a function of the tilt angle) were represented best by a Gaussian-Lorentzian combination function. The full widths at half maximum of the distributions were approximately 21, 11, and 5 degs for the U (010), U(340) and W (110) fiber axes, rspectively.

Reactor Physics

712,955
HEDL-SA-1939-FP PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Double Fission Chamber for Absolute Fission Rate Measurements in Power Reactor Environments.
J. L. Fuller, D. M. Gilliam, and J. A. Grundl. Aug 79, 9p CONF-791051-15
Contract EY-76-C-14-2170
Pub. in Proceedings ASTM-EURATOM symposium on reactor dosimetry (3rd), Ispra, Italy, 1 Oct 1979.

Keywords: *Fission chambers, *Fission fragment detection, Design, Diagrams, Fabrication, Performance, Testing, ERDA/360101.

A prototype fission chamber was tested and several chambers were built. The design and performance characteristics are presented. (ERA citation 05:008832)

712,956
PB-299 816/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Chemical and Temperature Effects on Thermal 235U Fission.
Final rept.
R. A. Schrack, and C. D. Bowman. 1979, 4p
Sponsored in part by International Atomic Energy Agency, Vienna (Austria).
Pub. in Proceedings of the International Conference on Neutron Physics and Nuclear Data for Reactors and Other Applied Purposes Held at Harwell, (England), on September 25-29, 1978, p742-745 1979.

Keywords: *Uranium 235, *Nuclear fission, Uranium oxides, Chemical properties, Thermodynamic properties, Thermal neutrons, Phonons, Uranium dioxide, Uranium oxides U3O8, Temperature dependence.

Theoretical and experimental checks have been made to look for reported chemical dependence in the yield of delayed neutrons from thermal neutron induced fission in 235U. No significant chemical dependence arising from phonon transfer is predicted using an Einstein model of the lattice phonon distribution. Two types of experimental tests were made. In the first, the fission fragment yield was compared for thermal neutron induced fission in U3O8 and UO2. In the second experiment the delayed neutron yield from samples of U3O8 and UO2 irradiated in a thermal neutron field was compared. Neither experiment showed a difference in yield for the two chemical states of uranium.

712,957
PB81-197451 Not available NTIS
National Bureau of Standards, Washington, DC.
Benchmark Referencing of Neutron Dosimetry Measurements.
Final rept.
C. M. Eisenhauer, J. A. Grundl, D. M. Gilliam, E. D. McGarry, and V. Spiegel. 1980, 9p
Pub. in Proceedings of the ASTM (American Society for Testing and Materials)-Euratom Sypmosium on Reactor Dosimetry Held at Ispra, Italy on October 1-5, 1979, p919-927 1980.

Keywords: *Neutron flux, Power reactors(Nuclear), Pressure vessels, *Benchmarks, NTISCOMNBS.

The concept of benchmark referencing is illustrated by the determination of the neutron flux in the air cavity external to the pressure vessel of the Arkansas Power and Light Company. The value determined for this flux is traced by means of two flux transfer procedures and a source-strength intercomparison to the emission rate of the U.S. primary neutron source standard. Numerical results and estimates of uncertainty are included.

712,958
PB81-220345 Not available NTIS
National Bureau of Standards, Washington, DC.
Dosimetry Characterization of a Reactor Pressure Vessel Simulator by Fission Chamber and Foil Activation Measurements.
Final rept.
E. D. McGarry, and A. Fabry. 1980, 11p
Pub. in Proceedings of ASTM-Euratom Symp. Reactor in Dosimetry Methods for Fuels, Cladding and Structural Materials (3rd), EUR6813 EN-FR, II, p1031-1041 1980.

Keywords: *Pressure vessels, *Neutron flux, Simulators, Fission chambers, Light water reactors.

A summary is given of the significance and results of extensive dosimetry measurements in the low-power, Light-Water Reactor Pressure Vessel (RPV) Simulator at the Pool Critical Assembly. Calculated and measured neutron flux and spectral characteristics are compared for a RPV simulator that represents a clean-core calculational model with measured core-power distributions. The purpose of such a model is to validate transport theory computations needed to extrapolate into the pressure vessel dosimetry observations in the surveillance position. Also reported are investigations of the neutron field characteristics of other configurations, which were investigated to establish the design of a high-power RPV simulator to proof test the correlation of metallurgy and dosimetry results.

712,959
PB86-210036 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Observations of Spin Dependence in Superelastic Scattering of Polarized Electrons from Na(3P).
Final rept.
J. J. McClelland, M. H. Kelley, and R. J. Celotta. 1986, 6p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Electronic and Atomic Collisions, p239-244 1986.

Keywords: *Electron scattering, Reprints, *Atomic angular momentum, Superelastic scattering, *Exchange scattering.

Measurements are presented of spin asymmetries observed in the superelastic scattering of 10 eV electrons from laser excited Na(3P). Asymmetries as large as 16% are seen, despite the fact that the target is not spin-polarized. Data are presented both as a function of scattering angle and laser polarization angle. An interpretation of the effect is given in qualitative terms.

712,960
PB88-139126 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Examination of (10)B(n,He) and (6)Li(n,He) Cross Section Measurements in Reactor Physics Benchmarks.
Final rept.,
J. A. Grundl. 1986, 6p
Pub. in Radiation Effects 93, n1-4 p135-140 1986.

Keywords: *Nuclear cross sections, Helium, Reprints, Reactor physics, Boron 10, Lithium 6, Benchmarks.

Helium production cross sections measurements for (10)B and (6)Li in five reactor physics benchmarks are examined, with emphasis on neutron fluence scale and benchmark spectrum uncertainties.

General

712,961
PB-284 592/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Benchmark Neutron Fields for Reactor Dosimetry.
Final rept.,
J. Grundl, and C. Eisenhauer. 1978, 52p
Pub. in Proceedings Consultants' Meeting on Integral Cross-Section Measurements in Standard Neutron Fields for Reactor Dosimetry, Held at Vienna, Austria on November 15-19, 1976. Paper I. 1 in Neutron Cross Sections for Reactor Dosimetry 1, No. IAEA-208, p53-104 1978.

Keywords: *Dosimetry, Radiation measuring instruments, Reactor fuels, Nuclear reactor materials, Neutron reactions, Nuclear fission.

The necessity for benchmark neutron fields measurements to achieve reliable reactor dosimetry is widely recognized. An organized response to this recognition is the IAEA Program, 'Benchmark Neutron Fields Applications for Reactor Dosimetry.' This report presents one step in the IAEA Program: A first compendium of information on benchmark neutron fields employed for dosimetry data generation, detector calibration, and dosimetry methodology referencing. The information presented is based on results of an IAEA worldwide survey of neutron fields suitable as reactor dosimetry benchmarks. Neutron fields included cover the energy range from fission spectrum neutrons to Maxwellian thermal, and a neutron flux range from 10 to the 7th power to 10 to the 11th power n/sq cm sec. The summary includes a physical description of each system, features of the irradiation facility, and assigned spectra based on spectrometry and calculation.

712,962
PB79-600050 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Mapping and Detecting Elements Selectively by the Nuclear Trace Technique.
B. S. Carpenter. 1978, 8p
Pub. in Proceedings Int. Conf. on Nuclear Methods in Environmental and Energy Research, Columbia, MO, Oct. 10-13, 1977, p136-143 1978.

Keywords: *Alpha tracks, Biomedical, Boron, Fission tracks, Geochronology, Geology, Lithium, Nitrogen, Silicon devices, Trace analysis, Uranium.

The nuclear track technique (NTT) has been routinely used to determine trace concentrations of uranium, boron and lithium in a variety of matrices, as well as macro-concentrations (e.g. is greater than 500 microgram/gram) of nitrogen in steels and biological materials. In addition to the trace element determinations, the NTT has found sinificant applications in geology as a viable method for geochronology and geothermometry. Aside from the analytical and geological applications, the NTT is being used to micromap the location, distribution and behavior of dopants, such as boron, lithium, oxygen and uranium, in various materials. This is particularly the case in the semiconductor and biomedical areas, since no convenient long lived radioactive nuclides of these elements exist.

712,963
PB79-600065 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reaction Rate Measurements and Integral Cross Sections Using the NBS 252CF Fission Neutron Indoor Irradiation Facility.
V. Spiegel, C. M. Eisenhauer, J. A. Grundl, and G. C. Martin. 1977, 9p
Pub. in Proceedings 2d ASTM-EURATOM Symp. on Reactor Dosimetry: Dosimetry Methods for Fuels, Cladding, and Structural Materials, Palo Alto, CA, Oct. 3-7, 1977, p959-967 1977.

Keywords: *California dosimetry, Fission neurons, Iron cross section, Nickel cross section, Reaction rates.

A fission source of 252Cf has been developed especialy for integral cross section determinations and reaction rate calibrations at the National Bureau of Standards (NBS). An irradiation program has been successfully completed utilizing the NBS 252Cf standard fission spectrum indoor facility and the radioactivity counting laboratory at General Electric Company, Valecitos Nuclear Center (VNC). Certified fission neutron fluences for two irradiations of aluminum, iron, nickel, titanium, 235U, 238U, and 237Np dosimeters were 6.6 x10 to the 12th power and 1.6 x 10 to the 13th power n/cm sq. The cross sections reported are--58Ni(n,p)58Co, 27Al(n,alpha)24Na, 46Ti(n,p)46Sc, 47Ti(n,p)47Sc, 48Ti(n,p)48Sc, 54Fe(n,p)54Mn, 238UNn,f)140Ba, 235U(n,f)140Ba, and 237(Np(n,f)140Ba. This report describes the methods and results of this program. Reaction-rate cross sections inferred from the radioanalysis if the activation detectors include corrections for all nearby and remote scattering materials.

712,964
PB79-600069 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calculation of Radioactivity Induced in Scintillator Materials During Spaceflight.
C. S. Dyer, J. I. Trombka, and S. M. Seltzer. 1977, 2p
Pub. in Trans. Am. Nucl. Soc. 27, p195-196 1977.

Keywords: *Radioactivity, Scintilltor materials during spaceflight, Spaceflight.

No abstract availabale.

712,965
PB79-600074 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Workshop Chairmen's Report 'Utilization of Benchmark Neutron Fields'.
J. Grundl, and G. DeLeeuw-Gierts. 1977, 2p
Pub. in Proceedings 2d ASTM-EURATOM Symp. on Reactor Dosimetry: Dosimetry Methods for Fuels, Cladding, and Structural Materials, Palo Alto, CA, Oct. 3-7, 1977, p981-982 1977.

Keywords: *Benchmark fields, benchmark testing, Neutron fields, Nuclear data, Reactor dosimetry.

No abstract available.

712,966
PB80-127939 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of an Improved Volume Calibration System to the Calibration of Accountability Tanks.
Final rept.,
F. E. Jones. 1979, 7p
Pub. in Nuclear Safeguards Technology, II, p653-659 1978.

Keywords: *Nuclear materials management, Measurement, Volume, Liquids, Pressure measurement.

This paper describes a very significantly improved system for the volume calibration of nuclear materials accountability tanks. The system involves the transfer of the current technology of liquid volume measurement and differential pressure measurement to the field, enabling an improvement of tank volume calibration by one to two orders of magnitude, and a consequent improvement in process solution volume measurement, leading to significantly improved accountability of nuclear materials for nuclear safeguards purposes. The system has been used in a very successful calibration of an input accountability tank at the Savannah River Plant operated for the US Department of Energy.

712,967
PB80-194400 Not available NTIS
National Bureau of Standards, Washington, DC.
Assessing Errors Related to Characteristics of the Items Measured.
Final rept.,
W. Liggett. 1980, 5p
Sponsored in part by Nuclear Regulatory Commission, Washington, DC.
Pub. in Jnl. Inst. Nucl. Manage. IX n1 p78-82 1980.

Keywords: *Nuclear materials management, Measurement, Errors, Accuracy, Accounting, Reprints.

Errors that are related to some intrinsic property of the items measured are often encountered in nuclear material accounting. An example is the error in nondestructive assay (NDA) measurements caused by uncorrected matrix effects. Such errors cannot be assessed by remeasurement of the items, and they cannot be fully assessed by measuring standards, although standards that span the range of the item characteristics might give upper and lower bounds. Nuclear material accounting requires for each material type one measurement method for which bounds on these errors can be determined. If such a method is available, a second method might be used to reduce costs or to improve precision. If the second method is less expensive than the first, then cost might be reduced by substituting the second method for the first in the measurement of some items. If the measurement error for the first method is longer-tailed than Gaussian, then precision might be improved by measuring all items by both methods.

712,968
PB80-600057 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Use of Gas Discharges as Ultraviolet Radiometric Standards.
W. R. Ott, J. M. Bridges, and J. Z. Klose. 1979, 1p
Pub. in Jnl. Phys. 40, Suppl. 7, pC7-803 - C7-804 1979.

Keywords: *Calibrations, Irradiance, Radiance, Sources, Ultraviolet.

No abstract available.

712,969
PB81-163099 Not available NTIS
National Bureau of Standards, Washington, DC.
X-ray Source Characteristics and Detection Efficiencies of Prototype Lixiscopes.
Final rept.
S. M. Seltzer. Jul 78, 4p
Pub. in Proceedings of Lixiscope Conference, Greenbelt, MD. July 27-28, 1978, NASA Conference Publication 2112, p11-14 Jul 78.

Keywords: Screens(Displays), *Lixiscopes, *X-ray sources, *X-ray detection, Iodine 125, Gadolinium 153, Cesium iodides.

Important components used in the prototype Lixiscope (low-intensity x-ray-imaging scope) are the radioactive x-ray source and the scintillator screen. Calculated data are given pertinent to the spectra and intensity of x-rays emitted by the commercially available (125)I and (153)Gd finite, encapsulated sources used. Detection efficiencies for a rare-earth and a CsI scintillator screen are compared.

712,970
PB81-239519 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
New Method of Assigning Uncertainty in Volume Calibration,
J. A. Lechner, C. P. Reeve, and C. H. Spiegelman.
Dec 80, 108p NBSIR-80-2151

Keywords: *Nuclear materials management, *Volume, *Calibrating, *Computer programs, Statistical analysis, Pressure, Polynomials, Fortran 4 programming language, Safeguards, Spline functions, Uncertainty.

This paper presents a practical statistical overview of the pressure-volume calibration curve for large nuclear materials processing tanks. It explains the appropriateness of applying splines (piecewise polynomials) to this curve, and it presents an overview of the associated statistical uncertainties. In order to implement these procedures, a practical and portable FORTRAN IV program is provided along with its users' manual. Finally, the recommended procedure is demonstrated on actual tank data collected by NBS.

712,971
PB81-241259 Not available NTIS
National Bureau of Standards, Washington, DC.
Preparation of Counting Samples.
Final rept.
B. M. Coursey, and A. A. Moghissi. 1980, 16p
Pub. in Part II, Monographie BIPM-3, 'The Application of Liquid-Scintillation Counting to Radionuclide Metrology,' p7-22 1980.

Keywords: *Radioactive isotopes, Reprints, *Scintillation counting, *Sample preparation, *Radioisotopes.

The paper is intended as a guide to sample preparation for radionuclide metrology techniques employing liquid-scintillation (LS) counting. This material should also be useful to those engaged in applied-science studies, such as radioimmunoassay or environmental monitoring, which generally involve comparative rather than direct activity measurements. Examples are given for the preparation of samples for a number of radionuclides which differ in their chemical behavior as well as in their nuclear-decay schemes. A critical review of the literature in this field is also included (116 references). The results of this review are displayed in the form of a periodic chart, showing the 57 elements that have been incorporated into liquid-scintillation counting samples, and a table with literature references for 76 radionuclides which have been assayed by LS counting.

712,972
PB82-210204 Not available NTIS
National Bureau of Standards, Washington, DC.
National and International Traceability in Radioactivity Measurements: Methods of Low-Level Counting and Spectrometry.
Final rept.
W. B. Mann, J. M. R. Hutchinson, and D. E. Edgerly. 1981, 15p
Sponsored in part by International Atomic Energy Agency, Vienna (Austria).
Pub. in Proceedings of Symposium on Methods of Low-Level Counting and Spectrometry, Berlin, West Germany, June 10, 1981, p173-187 1981.

Keywords: Radioactive contaminants, Quality assurance, *Radiation measurement.

The quality of radioactivity measurements in this period of rapidly expanding production and use of radioactive materials and their transfer to the biosphere has come under increasing scrutiny from government regulatory agencies and the public alike. This paper reviews the history and present status of measurements assurance, or traceability, programmes developed in the USA to ensure the quality of such measurements. It also briefly describes intercomparative measurements carried out with other national laboratories either directly or through the BIPM and the IAEA for the purpose of establishing traceability in the international field. It is concluded that in the USA it is logistically impossible, except in a few special cases, for the NBS to provide other than programmes that will give implicit quality assurance for radioactivity measurements.

712,973
PB83-112300 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.

General

Accountability Tank Volume Calibration Data.
Technical note.
F. E. Jones, J. F. Houser, and R. M. Schoonover.
Aug 82, 16p NBS-TN-1158
Sponsored in part by Nuclear Regulatory Commission, Washington, DC.

Keywords: *Nuclear materials management, *Tanks(Containers), Calibration, Volumetric analysis, Pressure gages, Differential pressure, Water tanks, Temperature, *Nuclear safeguards.

This paper presents the very precise data from the volume calibration of a nuclear materials input accountability tank and briefly describes the treatment of the data. The calibration system involves the use of volumetric test measures for dispensing known increments of the calibration fluid (water) into the tank, and a null-operated quartz bourdon-type differential pressure gage for measuring the differential pressure between the bottom of the bubble on the tip of a bubbler tube near the bottom of the tank and a port in the top of the tank. The tank is essentially a right circular cylinder with a capacity of approximately 13,600 L (3,600 gal). The height is approximately 3.4 m (11 ft) and the diameter is approximately 2.4 m (8 ft). The water volume and the differential pressure were adjusted to correspond to the reference temperature, 25.00C.

712,974
PB84-107093 Not available NTIS
National Bureau of Standards, Washington, DC.
Small, Battery-Operated Fluoroscopic System: Lixiscope with X-ray Generator.
Final rept.
L. I. Yin, J. I. Trombka, A. P. Ruitberg, and S. M. Seltzer. Jun 83, 5p
Pub. in Materials Evaluation 41, n7 p844-848 Jun 83.

Keywords: *Fluoroscopes, *Medical equipment, Design, Utilization, Radiography, Reprints, *Lixiscopes, *X-ray sources.

A small, battery-operated x-ray generator has been developed to be used as part of a small-format fluoroscopic system, the Lixiscope (Low Intensity X-ray Imaging Scope). The x-ray generator consists of a grounded rod-anode x-ray tube with a 0.2 mm focal spot and a specially designed, battery-operated, 0 to -80 kV high-voltage supply. Total power consumption is about 10 W. The fine focal spot, in conjunction with the continuously variable x-ray intensity and spectral distribution, helps to extend both the versatility and the performance of the Lixiscope toward a much wider range of terrestrial and spacecraft applications. The complete fluoroscopic system is described, and some examples of possible applications are shown.

OCEAN TECHNOLOGY & ENGINEERING

Biological Oceanography

712,975
PB88-147657 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Mercury Transformation by Heterotrophic Bacteria Isolated from Cinnabar and Other Metal Sulfide Deposits in Italy.
Final rept.,
F. Baldi, G. J. Olson, and F. E. Brinckman. 1987, 16p
Pub. in Geomicrobiol. Jnl. 5, n1 p1-16 1987.

Keywords: *Mercury(Metal), *Sulfide minerals, *Bacteria, *Aquatic microbiology, *Resistance, *Geochemistry, Mercury organic compounds, Italy, Reprints, *Mediterranean sea.

Several mercury-resistant bacteria were isolated from sites in Italy surrounding natural mercury deposits. Bacterial strains resistant to 5 mg/L mercuric chloride reduced Hg(2+) to elemental mercury by an inducible process. One bacterial strain was resistant to methylmercuric chloride, and produced elemental mercury when incubated with several organomercurial compounds. No methylmercury was detected in bacterial cultures growing in the presence of 2 mg/L mercuric chloride. Mercury reduction is the major mercury transformation in mercury-resistant bacteria isolated from these environments.

Dynamic Oceanography

712,976
PB85-138592 PC **A04**/MF **A01**
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
Practical Approximations of Peak Wave Forces.
M. Grigoriu, and B. Alibe. Nov 84, 60p NBS/GCR-84/481
Sponsored in part by Minerals Management Service, Reston, VA.

Keywords: *Water waves, *Storms, Statistical analysis, Drag, Inertia, Force, Ocean waves, Approximation, Simulation, Peaks.

According to Morrison's equation, wave forces acting on cylindrical members have two components: drag forces, which depend nonlinearly on wave particle velocity, and inertia forces, which are proportional to wave particle acceleration. Wave forces are then non-Gaussian processes although fluid velocities are assumed to follow Gaussian distributions. This report develops approximations of the mean of the peak of wave forces during design storms. It shows that the square root of the sum of the squares (SRSS) rule can be applied to approximate the mean of the peak wave force from the average peaks of inertia and drag forces. The approximation is satisfactory for any ratio of drag to inertia forces and frequency content of the wave particle velocity process. The report also provides various descriptors of drag, inertia, and wave forces, including marginal distributions, mean crossing rates, and extreme value distributions.

Marine Engineering

712,977
PATENT-4 283 461 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Piezoelectric Polymer Antifouling Coating.
Patent.
T. Negas, and L. Domingues. Filed 31 May 79, patented 11 Aug 81, 6p PB81-600042, PAT-APPL-6-044 130

Keywords: *Antifouling coating, Film, Marine structures, Piezoelectric polymer material, Vegetable and animal life.

An antifouling coating for marine structures in the form of a film containing piezoelectric polymer material, which, when electrically activated vibrates at a selected frequency to present a surface interfacing with water which is inhospitable for attachment of vegetable and animal life including free-swimming organisms thereby discouraging their attachment and their subsequent growth thereon to the macrofoulant adult stage.

712,978
PB-295 941/9 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Applied Mathematics.
Custody Transfer Systems for LNG Ships: Tank Survey Techniques and Sounding Tables.
R. H. F. Jackson, R. S. Collier, S. Haber, and P. V. Tryon. May 79, 84p NBSIR-79/1751
Sponsored in part by Maritime Administration, Washington, DC.Portions of this document are not fully legible.

Keywords: *Tanker ships, *Liquefied natural gas, *Storage tanks, Volume, Gas analysis, Cryogenics, Calibrating, Mathematical models, Analytical photogrammetry, Tables(Data), Strapping measurement.

Static measurements of liquefied natural gas (LNG) for custody transfer purposes require an accurate and precise knowledge of the container volume and the volume-height relationship. The extremely low temperatures of LNG (less than 150K) preclude in situ surveys; however, the increasing value of the cargo requires more precise and accurate measurements than previously used for bulk marine cargoes. A description and assessment of the application of photogrammetric techniques to the ambient temperature survey of a 35-meter diameter spherical aluminum container are presented. Sample sounding tables (height-volume) are calculated, and an estimate of error is given.

712,979
PB-297 631/4 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Fire Buildup in Shipboard Compartments - Characterization of Some Vulnerable Spaces and the Status of Prediction Analysis.
Final rept.
B. T. Lee, and W. J. Parker. May 79, 46p NBSIR-79-1714
Sponsored in part by Naval Ship Engineering Center, Washington, DC.

Keywords: *Naval ships, *Fires, Ship structural components, Flame propagation, Fire tests, Materials, Flammability, Predictions, *Ship fires.

A review of shipboard fire incidents in the Navy over the past six years was made to determine the spaces of greatest vulnerability to fire and the most common sources of ignition in these areas. Some of these compartment spaces are characterized with regard to their furnishing and interior finish materials. Their fire loads are specified. The various factors which determine the extent and rate of fire buildup in a compartment are discussed in terms of a simplified prediction model. Although substantial progress has been made in developing a prediction model for room fire development, a satisfactory treatment of flame spread on combustible interior finish materials along with a better understanding of the effect of the fire environment on fire buildup are needed. Meanwhile, criteria for choosing fire safe materials must continue to rely on existing laboratory fire tests. The application of laboratory fire tests on ignition, flame spread, and heat release rate to control the use of interior finish materials aboard ship is explored. Test data on ignition, flame spread, and heat release rate of typical shipboard materials are provided.

712,980
PB-297 765/0 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Fire Performance Guidelines for Shipboard Interior Finish.
Final rept.
B. T. Lee, and W. J. Parker. Jun 79, 24p NBSIR-79-1700
Sponsored in part by Naval Ship Engineering Center, Washington, DC.

Keywords: *Ships, *Fire resistant materials, Hazards, Risk, Standards, Fire safety, Flame propagation, Fire tests, *Ship fires, Compartment fires.

The present Navy fire performance requirements given in Military Standard 1623B (SHIPS) for shipboard interior finish provide a means for selecting fire safe materials. However, a recent evaluation of the Navy fire safety requirements along with an experimental berthing compartment fire study have suggested more rational design rules. New guidelines are recommended to update this standard with improved fire risk criteria.

712,981
PB80-185671 PC **A10**/MF **A01**
SRI International, Menlo Park, CA.
Cost Effectiveness of Marine Fire Protection Programs.
Final rept.,
K. R. Oppenheimer, R. S. Alger, S. B. Martin, P. C. McNamee, and F. L. Offensend. Nov 78, 222p NBS-GCR-79-173

Keywords: *Marine safety, *Fire protection, *Cost effectiveness, Fire safety, Fire fighting, Fire departments, Coast Guard, Merchant ships, Benefit cost analysis, Technology assessment, *Shipboard fires, *Ship fires.

This report presents the results of a cost-effectiveness study of alternative marine fire protection programs. It includes an estimate of current and future marine fire losses and a comparison of the cost-effectiveness of programs designed to reduce these losses. The study,

sponsored by the U.S. Department of Commerce, evaluates proposed legislation that would establish regional marine firefighting teams in port cities throughout the country. In the analysis, a wide range of alternatives are compared with the regional team approach; these alternative approaches include fire prevention and fire suppression, and involve fire departments, the U.S. Coast Guard, merchant seamen, and fire protection equipment.

712,982
PB81-159907 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Estimated Accuracy of Calibration of Some Membrane-Type LNG Transport Tanks.
W. C. Haight, R. J. Hocken, B. R. Borchardt, C. L. Carroll, R. G. Hartsock, C. P. Reeve, F. F. Scire, and R. C. Veale. Jan 81, 79p NBSIR-80-2141

Keywords: *Tanker ships, *Liquefied natural gas, *Storage tanks, *Calibration, Measurement, Volumetric analysis, Dimensional measurement, El Paso Southern vessel, El Paso Arzew vessel, El Paso Howard Boyd vessel.

The National Bureau of Standards has completed a study on the calibration uncertainty of ship cargo tanks used to transport Liquid Natural Gas (LNG). The data from measurements made on 18 such tanks is presented, along with a comparison to measurement determined from an independent technique. Calibration reports for each tank measured by NBS are presented, including tables that relate tank volume to liquid level in the tank. The measurement technique used was accurate to plus or minus 0.05% of total volume and agreed with the independent measurement data to plus or minus 0.2%.

712,983
PB82-156985 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Surface Roughness Measurements of Circular Disks and Their Correlation with Hydrodynamic Drag.
Final rept.
T. V. Vorburger, F. E. Scire, and E. C. Teague. Jan 82, 66p NBS-TN-1151
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.

Keywords: *Shiphulls, *Surface roughness, *Measuring instruments, Drag, Hydrodynamics, Friction, Correlation techniques, Profilometers, *Hydrodynamic drag.

The problem of relating hull roughness to the drag of ships is a complex and important one in ship research. One of the complications is that there are three fairly distinct roughness regimes (microroughness, macroroughness, and structural roughness) which make up a ship's surface and their relative importance is not yet well understood. The present report focuses on stylus measurements of the microroughness of rotating disks and their significant correlation with drag measurements.

712,984
PB82-165192 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Smoke Movement and Smoke Control on Merchant Ships.
Final rept.
J. H. Klote, and R. H. Zile. Jan 82, 69p NBSIR-81-2433
Sponsored in part by Coast Guard, Washington, DC. Office of Merchant Marine Safety.

Keywords: *Merchant ships, *Fires, *Smoke, Air flow, Fire tests, Ventilation, Fire safety, *Ship fires, *Smoke spread.

In the past ten years considerable progress has been made in developing systems to control smoke movement in building fires. At present no such smoke control systems are in use on merchant ships. This paper discusses the basic concepts of smoke movement and smoke control with emphasis upon shipboard applicability. A report of simulated smoke movement tests performed on two merchant vessels is presented. Based upon these test results potential methods of smoke control for merchant vessels are discussed. Recommendations are made for future study.

712,985
PB82-188186 PC **A13**/MF **A01**
National Bureau of Standards, Washington, DC.
Estimated Uncertainty of Calibrations of Free-standing Prismatic Liquefied Natural Gas Cargo Tanks.
J. D. Siegwarth, and J. F. LaBrecque. Jan 82, 281p NBSIR-81-1655
Sponsored in part by Maritime Administration, Washington, DC. Prepared in cooperation with El Paso Marine Co., Houston, TX.

Keywords: *Tanker ships, *Liquefied natural gas, *Storage tanks, Calibrating, Photogrammetry, Volumetric analysis, Measurement, Cargo transportation, Laser applications.

The accuracy of the tank calibrated by the photogrammetric technique was examined during the calibration of fifteen freestanding prismatic LNG transport tanks. This examination indicated that the calibration accuracy of the tanks calibrated in the storage position was better than plus or minus 0.1%. Additional factors influencing the accuracy of the calibration of the tanks, such as the effects of installing the tanks into the ship and loading the ships with LNG, were examined in the course of this work and the results are reported here. The various measurements used by various NBS personnel to analyze the calibration accuracy are detailed in the eight Appendices included in this report.

712,986
PB82-244542 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Measurement Uncertainties of Level Gages for Liquefied Natural Gas.
J. D. Siegwarth. Jun 82, 52p NBSIR-82-1668
Sponsored in part by Maritime Administration, Washington, DC.

Keywords: *Liquefied natural gas, *Liquid level indicators, *Gas storage, *Cargo transportation, Tanker ships, Measuring instruments, Capacitance meters, Accuracy, Calibration, Hysteresis, Bubbler gages, Cable gages.

The measurement uncertainties of three types of gages commonly used in large liquefied natural gas storage and ship transport tanks have been studied and the results of this study are reported here. The types are bubbler, capacitance, and cable gages. Measurement uncertainties for various types can be determined but the test conditions must be carefully specified because many of the largest errors result from parameters external to the gaging device. The gage installation, the tank design, and the liquid properties all influence gaging accuracy. A modification of cable gage installations that should significantly improve gaging accuracy is presented. Intrinsic accuracies of some representative cable gages are reported from tests done at ambient temperature under nearly isothermal conditions.

712,987
PB83-134122 Not available NTIS
National Bureau of Standards, Washington, DC.
Multiple Redundancy in the Measurement of Large Structures.
Final rept.
R. J. Hocken, and W. C. Haight. 1978, 4p
Pub. in Ann. CIRP 27, n1 p357-360 1978.

Keywords: *Tanker ships, *Tanks(Containers), Measurement, Coordinates, Redundancy, Metrology.

The modern metrologist is increasingly being called upon to measure large structures with high accuracy. Commonly encountered are: airplane fuselage measurements, nuclear reactor component measurements, structural element measurements for prefabricated structures, and measurement of large irregularly shaped containers used in custody transfer. In this paper we will describe how the techniques of coordinate transformation and multiple redundancy, developed for small scale 3-D metrology, were used for the measurement of large Liquid Natural Gas (LNG) tanks aboard ships.

712,988
PB83-148494 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Analysis of Foreign and Domestic Material Specifications for Ships Components.
Final rept.
J. G. Early, and L. D. Ballard. Apr 82, 244p NBSIR-82-2481
Sponsored in part by Coast Guard, Washington, DC.

Keywords: *Ship building, *Materials specifications, Piping systems, Pressure vessels, Mechanical properties, Chemical properties, Metallurgy, Design criteria, Foreign technology.

Under United States law, United States flag vessels must satisfy applicable United States codes, and further, the materials of construction of these vessels must satisfy the material requirements specified in these codes. For vessels manufactured in foreign countries, a determination must be made as to whether materials of construction produced under foreign specifications for specific components such as piping and flanges, are acceptable in performance to materials produced under approved U.S. specifications. A program has been initiated at the National Bureau of Standards under the sponsorship of the United States Coast Guard to develop a manual of equivalent engineering standards which specifies those foreign specifications that are equivalent to acceptable domestic specifications, those foreign specifications that are not equivalent, and those that would be equivalent if certain additional criteria are met. Results are presented here of a detailed technical comparison between foreign specifications.

712,989
PB83-186189 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Measurement Lab.
Materials Selection Criteria for Crack Arrester Strakes in Naval Vessels (Interim Progress Report).
R. B. King. Jan 83, 38p NBSIR-83-1681
Prepared in cooperation with David W. Taylor Naval Ship Research and Development Center, Annapolis, MD. Sponsored in part by Naval Sea Systems Command, Washington, DC.

Keywords: *Ship hulls, *Crack propagation, Naval ships, Steels, Toughness, Metal plates, *Crack arrest, Fracture(Mechanics).

Research has been conducted on the problem of developing quantitative criteria for materials selection for crack arrester strakes in naval vessels. Quantitative analysis of material performance in service requires application of dynamic elastic-plastic fracture mechanics. Results of an extensive literature survey in the area of dynamic fracture mechanics with specific attention given to the crack arrest application are presented. The research program that has been developed is described in detail.

712,990
PB83-209338 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC.
Investigation of the Forced Ventilation in Containership Holds.
H. R. Baum, and J. A. Rockett. May 83, 177p NBSIR-83-2665
Sponsored in part by Coast Guard, Washington, DC.

Keywords: *Cargo ships, *Ventilation, Air flow, Mass transfer, Fire safety, Fire hazards, Computer programs, *Containerships, *Ship holds.

An analysis of the fluid flow and mass transfer induced by ventilation systems in containership holds was carried out. The work was performed in support of the U.S. position before a committee of the International Convention on Safety to Life at Sea. The analysis consists of a detailed calculation of the forced motion through an interconnected set of narrow, stably stratified vertical air passages which represent an idealized containership holds the results of this calculation are then used in a study of the concentration boundary layers formed by the pickup of spill material assumed to lie at the bottoms of the air passages. The result is a set of formulae which determine the rate of extraction of spill material as a function of hold geometry, ventilation parameters, and ambient stratification. The results are incorporated in a computer program which is described in detail.

712,991
PB85-109809 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.

Structural Reliability Fundamentals and Their Application to Offshore Structures.
E. Simiu, and C. E. Smith. Sep 84, 32p NBSIR-84/2921
Sponsored in part by Minerals Management Service, Reston, VA.

Keywords: *Offshore structures, Structural design, Structural engineering, Reliability, Service life, Safety factor, Design standards, Failure, Probability theory.

The objective of this report is to present an overview of fundamental topics in structural reliability as applied to individual members, which are potentially applicable to ocean engineering problems. These topics include: the estimation of failure probabilities; safety indices; and safety (or load and resistance) factors. Some of the theoretical and practical difficulties in the application of structural reliability tools are mentioned and/or discussed.

712,992
PB85-142883 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hydrodynamic Drag Versus Roughness for Rotating Disks.
Final rept.
T. V. Vorburger, F. E. Scire, and E. C. Teague. 1982, 11p
Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Wear 83, n1-2 p339-349 Dec 82.

Keywords: *Disks(Shapes), *Rotation, Drag, Roughness, Hydrodynamics, Surface roughness, Surface properties, Ships, Hulls(Structures), Reprints.

The present paper focuses on stylus measurements of the microroughness of rotating disks and their significant correlation with hydrodynamic drag measurements. The roughest disks were found to have drag coefficients that are about 30% greater than those of the smoothest disks. Other surface parameters and functions were measured, however, at the present state of understanding, it seems that knowledge of an amplitude sensitive parameter and a wavelength sensitive parameter is adequate for characterizing increases in the drag of rotating disks due to surface roughness.

712,993
PB85-159085 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Materials Selection Criteria for Crack Arrester Strakes in Naval Vessels: Second Interim Progress Report.
R. B. King, T. Teramoto, and D. T. Read. Oct 84, 64p NBSIR-84/3012
See also PB83-186189. Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.

Keywords: *Ship hulls, *Crack propagation, Naval ships, Steels, Toughness, Metal plates, *Crack arrest, Fracture(Mechanics).

Laboratory experiments have been conducted under conditions intended to simulate those in a structural situation. These experiments were designed to include two key features of ship structural behavior: (1) Crack arrest occurs specifically because a step in toughness is encountered; (2) the load on the specimen, simulating dead load in the structure, is transferred to the uncracked ligament after arrest, thus introducing the possibility of reinitiation. A spring-loaded double-cantilever-beam (DCB) specimen has been used in these experiments. An electron-beam weld is made along the crack propagation line, producing a brittle crack propagation path with a step in toughness at its end. The dynamic run-arrest portion of these experiments has been modeled using a modification of Kanninen's DCB model that includes the effect of the loading spring, and using a finite element model. The elastic-plastic reloading portion has been modeled quasistatically using J integral and tearing instability theory. In addition, a simplified dynamic viscoelastic-plastic model has been developed to analyze the reloading portion of the experiments.

712,994
PB85-184745 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Chemical Waste Incinerator Ships: The Interagency Program to Develop a Capability in the United States.
Final rept.
G. O. Chapman, D. W. Leubecker, L. A. Martinez, R. T. Matthews, D. A. Oberacker, and F. Wybenga. 1982, 16p
Sponsored by Society of Naval Architects and Marine Engineers, New York.
Pub. in Marine Technology 19, n4 p325-340 Oct 82.

Keywords: *Incinerators, *Ships, *Solid waste disposal, *Hazardous materials, Regulations, Design, Construction, Safety, Operations, Environmental impacts, Air pollution, Substitutes, Reprints, *Liquid waste disposal, *Chemical wastes, Waste management.

In February 1980, an interagency work group undertook a study of at-sea incineration and the alternatives available to the Federal Government for encouraging the design, construction, and operation of U.S.-flag incinerator ships. The group examined previous incineration operations, various federal assistance programs, safety and control measures, incinerator ship conceptual designs, environmental impacts, and waterfront facilities. This paper presents the findings of the work group and the work program which the Interagency Review Board has initiated. Important ship design factors, such as the regulatory requirements, incinerator technologies, and incinerator system research recommendations, are explained. Details of a conceptual dual-mission ship design, that can incinerate both liquid wastes and solid wastes, are given. Anticipated operating permits, environmental monitoring, and waterfront facilities are discussed.

712,995
PB86-103488 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Growth in Combat Ships.
J. G. Quintiere, H. R. Baum, and J. R. Lawson. Jun 85, 100p NBSIR-85/3159
Sponsored by David. W. Taylor Naval Ship Research and Development Center, Bethesda, MD.

Keywords: *Fires, *Combatant ships, Explosions, Computation, Fire damage, Mathematical models, Flame propagation, *Ship fires, *Fire growth.

A discussion of fire phenomenology pertaining to ships is presented. It draws on background from ship fires, combat ship construction characteristics and scientific knowledge developed for building fires. Its immediate goal is to assess the prospect of developing a deterministic (physics) model for ship fire growth as initiated by explosive weapon effects. A specific analysis of vented explosion flows is given as well as a procedure for computing fire growth phenomena from formulae.

712,996
PB86-130226 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Response of Compliant Offshore Platforms to Waves.
M. Grigoriu, and B. Alibe. Sep 85, 61p NBS/GCR-85/501
Prepared in cooperation with Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering. Sponsored by Minerals Management Service, Reston, VA.

Keywords: *Ocean waves, *Offshore structures, Stabilized platforms, Response, Mathematical models, Monte Carlo method, Random processes.

Probabilistic descriptors are developed for the response of structures of the Tension Leg Platform type to current and waves. These are obtained by Monte Carlo techniques by assuming the validity of the Morison equation. The results are compared to those obtained by using statistical linearization techniques. Also, for offshore platforms with higher natural periods of vibration, mean upcrossing rates for various levels of the structural response are estimated by simulation, by statistical linearization techniques, and by additional procedures developed in the report.

712,997
PB86-193398 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.

Ductile Tearing Stability Analysis of a Ship Structure Containing a Crack Arrester Strake.
Final rept. Sep 84-Sep 85.
A. V. Clark, and D. T. Read. Jan 86, 52p NBSIR-85/3038
Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.

Keywords: *Ships, Tearing, Tear strength, Ductility, *Crack arrest.

An analysis is presented for a structure made up of a crack arrester plate embedded in a ship structure. The crack arrester material is specified by its crack arrest temperature, its strength, and its tearing modulus T sub mat. The remainder of the structure is characterized as a set of springs and lumped masses. A stability condition is derived which states that the load-displacement curve of the structure as a whole must increase monotonically. An approximate quasistatic stability criterion sets a minimum material tearing modulus value that depends on the structural stiffness. Higher stiffness promotes effective crack arrest. A calculation including dynamic effects requires forward integration of a set of differential equations describing the fracture process and the motion of the structure.

712,998
PB87-114096 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Growth in Combat Ships.
J. A. Rockett. Sep 86, 38p NBSIR-86/3451
Sponsored by David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.

Keywords: *Naval ships, *Fire safety, Ventilation, Exhaust systems, Smoke, Mass transfer, FIRMOD computer program.

Several enrichments to FIRMOD, the Navy's ship battle damage estimation computer program, are considered. Enrichments recommended for immediate consideration are exponentially growing fires, ingestion by one ventilation system of smoke issuing from other ventilation system exhausts, and smoke transport between spaces served by the same ventilation system. Areas where further experimental work is recommended before FIRMOD enrichments are considered include fires ventilated primarily from above and buoyant smoke transport up shafts and ladderways.

712,999
PB87-171500 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Mat Foundations for Offshore Structures in Arctic Regions,
F. Y. Yokel, and R. G. Bea. Feb 87, 152p NBSIR-86/3419
Prepared in cooperation with PMB Systems Engineering, Inc., San Francisco, CA. Sponsored by Minerals Management Service, Reston, VA.

Keywords: *Offshore structures, *Mats, *Foundations, Offshore drilling, Platforms, Exploration, Oil recovery, Production, Chukchi Sea, Beaufort Sea.

Design limit states for offshore gravity structures in the Alaskan Beaufort and Eastern Chukchi continental shelves are discussed. The report contains a description of geological conditions, design loads, and type of structures used. Three foundation types are considered: foundations for artificial islands; foundations for caisson retained island with sand cores; and rigid foundations for various types of gravity structures which are positioned on the ocean floor with a minimum of preparation. Design limit states for these foundations are identified and the required reliability against the occurrence of these limit states is discussed. The authors ability to determine foundation resistance is assessed.

713,000
PB88-155759 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Analysis of the Pressure Rise in Sealed Magazine Fires,
H. R. Baum. Nov 87, 29p NBSIR-87/3557
Sponsored by Naval Weapons Center, China Lake, CA.

Keywords: *Ship fires, *Propellants, Mathematical models, Room fires.

A mathematical model for the pressure and temperature rise in sealed ship magazines caused by propellant fires is developed. The model is a simplified version of several existing zone fire models, modified to consider sealed compartments. The equations describing the model are solved exactly. Sample results are shown for a variety of magazine geometries.

Oceanographic Vessels, Instruments, & Platforms

713,001
PB85-140770 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pressure-Retaining Deep Ocean Sampler and Transfer System for Measurement of Microbial Activity in the Deep Sea.
Final rept.
P. S. Tabor, J. W. Deming, K. Ohwada, H. Davis, M. Waxman, and R. R. Colwell. 1981, 15p
Pub. in Microbial Ecology 7, n1 p51-65 1981.

Keywords: *Marine microorganisms, *Samplers, *Ocean environments, Deep water, Pressure, Temperature, Populations, Reprints, *Oceanographic equipment.

A Deep Ocean Sampler (DOS) has been developed for microbiological sampling and is capable of aseptically collecting 400 ml water samples from any depth in the world oceans. The instrument maintains samples under in situ pressure and temperature. A hyperbaric transfer system has also been developed, enabling transfer of sample volumes up to 150 ml, without decompression or dilution, to pressurized incubation chambers. Utilization of (14)C-glutamate (21 to 96 micrograms/l) and (14)C-acetate (4.6 micrograms/l) by microbial populations in undecompressed water samples from the N.W. Atlantic and the Cape and Angola Basins was recorded over incubation periods of 2 to 18 weeks.

713,002
PB88-100680 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Assessment of Uncertainties and Risks Associated with the Dynamic Behavior of Compliant Offshore Structures.
Final rept.,
E. Simiu. 1984, 9p
Sponsored by Minerals Management Service, Reston, VA.
Pub. in Technology Assessment and Research Program for Offshore Minerals Operations, Outer Continental Shelf Report MMS 84-0001, p211-219 1984.

Keywords: *Loads, *Ocean engineering, Structural engineering, Structural reliability, Waves, Wind engineering, Reprints.

The paper describes NBS activities within the framework of the project 'Dynamics and Reliability of Compliant Offshore Platforms' sponsored by the Minerals Management Service. The objective of these activities is to estimate uncertainties and errors in the modeling of compliant structure behavior with a view to developing techniques for the assessment of their structural reliability. A brief presentation is included of an NBS investigation into the dynamic effects of turbulent winds upon the surge response of tension leg platforms in the presence of current and waves.

Physical & Chemical Oceanography

713,003
PB-285 155/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Methods for Polynuclear Aromatic Hydrocarbon Analysis in the Marine Environment,
S. A. Wise, S. N. Chesler, H. S. Hertz, L. R. Hilpert, and W. E. May. 1978, 8p
Sponsored in part by Environmental Protection Agency, Washington, D.C. Office of Research and Development.
Pub. in Paper in Carcinogenesis, v3: Polynuclear Aromatic Hydrocarbons, p175-182 1978.

Keywords: *Aromatic polycyclic hydrocarbons, *Water analysis, Gas chromatography, Chemical analysis, Sediments, Ocean environments, Solvent extraction, Reprints, Liquid chromatography.

Procedures employed at the National Bureau of Standards for the analysis of PAH's in water, sediment, and marine biota are discussed in this paper. The more volatile PAH's are removed from the sample matrix by dynamic headspace sampling (i.e., naphthalenes, phenanthenes and pyrene) whereas the larger PAH's (4 rings and larger) are removed by coupled-column trace enrichment techniques or solvent extraction procedures. After removal from the matrix, PAH's are isolated according to the number of rings, using normal-phase HPLC on a chemically bonded aminosilane packing material. Individual PAH fractions are subsequently analyzed by GC-MS and/or reversed-phase HPLC with combined UV absorption/fluorescence emission detection. In addition, a novel procedure for the preparation of aqueous solutions of PAHs is reported. This procedure should lead to the development of the first trace organic standard reference material (SRM).

713,004
PB87-164109 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
High Nitrite Levels off Northern Peru: A Signal of Instability in the Marine Denitrification Rate.
Final rept.,
L. A. Codispoti, G. E. Friederich, T. T. Packard, H. E. Glover, P. J. Kelly, R. W. Spinrad, R. T. Barber, J. W. Elkins, B. B. Ward, F. Lipschultz, and N. Lostaunau. 12 Sep 86, 3p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Science 233, p1200-1202, 12 Sep 86.

Keywords: *Nitrification, *Nitrites, *Coasts, Accumulation, Cooling, Abnormalities, Sea water, Oxygen, Ocean temperature, South Pacific Ocean, *Denitrification, El Nino.

During February and March 1985, nitrite levels along the northern (approximately 7 to 10 degrees S) Peruvian coast were unusually high. These accumulations occurred in oxygen-deficient waters, suggesting intensified denitrification. In a shallow offshore nitrite maximum, concentrations were as high as 23 micromoles per liter (a record high). Causes for the unusal conditions may include a cold anomaly that followed the 1982-83 El Nino. The removal of combined nitrogen (approximately 3 to 10 trillion grams of nitrogen per year) within zones of new or enhanced denitrification observed between 7 to 16 degrees S suggests a significant increase in oceanic denitrification.

Underwater Construction & Habitats

713,005
PB87-225454 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Extraction of Topographic Features in Support of Autonomous Underwater Vehicle Navigation.
Final rept.,
D. J. Orser, and M. Roche. 1987, 13p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings of International Symposium on Unmanned Untethered Submersible Technology (5th), Merrimack, NH., June 22-24, 1987, p1-13.

Keywords: *Autonomous navigation, *Underwater vehicles, Topographic features, Bathymetry, Reprints.

The authors describe in an expository manner ongoing research concerned with the identification and extraction of topographic features relevant to automated navigation algorithms for an autonomous underwater vehicle. These features are presented within the framework of the external point topography network (EPTN), an idea going back to Arthur Cayley and J. Clerk Maxwell. The computational problems addressed here are the reconstruction of the surface terrain from irregular spaced bathymetric data and the subsequent extraction of the EPTN. While clearly no single best method exists for this latter step, the authors present here a description of several methods they have tried with some success. The data used for this research is that for a selected area of Lake Winnipesaukee, New Hampshire.

General

713,006
PB-298 264/3 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Submarine Compartment Fire Study - Performance Evaluation of Hull Insulation.
Final rept.
B. T. Lee, and J. N. Breese. May 79, 50p NBSIR-78-1584

Keywords: *Submarines, *Submarine hulls, *Insulation, *Fire tests, Flame propagation, Fire resistant coatings, Combustion products, Fire safety, Foam rubber, Compartment fires.

Certain foam rubber materials which are currently used to insulate the interior of submarines are shown to possess a serious fire risk potential. Flame spread tests often do not adequately reflect the fire hazard potential of these materials. It is shown that compartment fire testing is the only satisfactory method of of evaluating these kinds of materials at the present time. Fire barrier coatings for protecting these hull insulations are also investigated. Two candidate coatings are found to prevent full fire involvement of an insulated compartment following a moderately large flame exposure and at the same time meet the Navy's elasticity requirement for submarine application. The study includes comparisons of model and prototype compartment fire behavior and demonstrates the practicality of using quarter-scale fire tests for screening compartment finish materials.

713,007
PB83-207464 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Turbulent Wind Effects on Tension Leg Platform Surge.
Final rept.
E. Simiu, and S. D. Leigh. Mar 83, 49p NBS-BSS-151
Library of Congress catalog card no. 83-600507.
Sponsored in part by Minerals Management Service, Reston, VA.

Keywords: *Offshore structures, *Ocean waves, *Wind pressure, Aerodynamic forces, Hydrodynamics, Gust loads, Turbulence, Wind velocity, Mathematical models.

A procedure is presented for estimating surge response to turbulent wind in the presence of current and waves. The procedure accounts for the nonlinearity of the hydrodynamic forces with respect to surge and for the coupling of aerodynamic and hydrodynamic effects. It is shown that current wind spectra do not model correctly the wind speed fluctuations at very low frequencies and an alternative model of the wind spectrum, consistent with fundamental principles, is presented. The equation of surge motion under turbulent wind in the presence of current and waves is solved for typical tension leg platforms, and it is shown that under extreme wave conditions the damping provided by the hydrodynamic forces precludes the occurence of significant wind-induced resonant amplification effects even if the drag coefficient in the Morison equation is very small.

713,008
PB83-253005 PC **A07**/MF **A01**
Brown and Root Development, Inc., Houston, TX.
State-of-the-Art Report on Guyed Tower Platforms.
1983, 128p NBS-GCR-83-443
Sponsored in part by Minerals Management Service, Reston, VA.

Keywords: *Offshore structures, *Guy wires, Structural design, Dynamic loads, Static loads, Hydrodynamics, *Compliant structures.

This state-of-the-art report reviews general concepts, design considerations, the modeling of dynamic and fatigue behavior, methods of analysis, and problems of fabrication and installation, pertaining to offshore guyed tower platforms. In addition, a list of references

is provided, complemented by a bibliography on dynamic problems in platform design.

713,009
PB84-121904 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Proceedings of the International Workshop on the Performance of Offshore Concrete Structures in the Arctic Environment.
N. J. Carino. Jul 83, 77p NBSIR-83-2751
Held at Washington, D.C. on Mar 1-2, 1983. Summaries in English and French. Sponsored in part by Minerals Management Service, Reston, VA., and Canada Centre for Mineral and Energy Technology, Ottawa (Ontario).

Keywords: *Offshore structures, *Concrete structures, *Arctic regions, *Meetings, Sea ice, Maintenance, Inspection, Structural design, Technology assessment.

A workshop was held March 1 and 2, 1983 at the U.S. National Bureau of Standards. The objective was to bring together an international group of experts for the purpose of information exchange on the subject of the performance of Arctic offshore concrete structures. The workshop participants were divided into four working groups to discuss the following subjects related to Arctic offshore concrete structures: (1) design; (2) materials; (3) construction; and (4) inspection and repair. Each working group addressed the following topics within their subject: past experiences, current projects, and recommended research areas. The chairmen of each group prepared reports summarizing their group's deliberations. These reports are incorporated into this workshop summary.

713,010
PB84-159052 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Jet Diffusion Flame Suppression Using Water Sprays: An Interim Report.
B. J. McCaffrey. Jan 84, 58p NBSIR-84-2812
Sponsored in part by Minerals Management Service, Washington, DC.

Keywords: *Offshore structures, *Blowouts, *Fire fighting, Diffusion flames, Spray quenching, Fire extinguishing agents, *Water sprays.

The feasibility of using water sprays for the control of offshore oil/gas well blowout fires has been addressed. Considering the sheer scale of the problem, knowledge from a fundamental viewpoint is going to be required in order to extrapolate laboratory-sized flame studies up to full scale. Available data and appropriate literature concerned with the application of water sprays as a jet diffusion flame suppression/extinguishment agent have been reviewed. Small pneumatic atomizing nozzles using H2 gas, both as the flame source as well as the atomizing driver, have been used to scale high momentum jet flames and to study the effect of water on the flame.

713,011
PB84-216522 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Wind-Tunnel Study of Wind Loading on a Compliant Offshore Platform.
T. A. Morreale, P. Gergeley, and M. Grigoriu. Mar 84, 36p NBS-GCR-84-465
Prepared in cooperation with Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering. Sponsored in part by Minerals Management Service, Reston, VA.Color illustrations reproduced in black and white.

Keywords: *Offshore structures, *Platforms, Wind tunnel models, Wind direction, Static tests, Torsion, Loads(Forces), Structural engineering, *Wind loads.

Two models, with scales of 1/250 and 1/500, of an offshore oil platform were tested in a wind tunnel to obtain static forces for various wind directions. Two peak wind velocities were used: 54 fps and 108 fps. The measured shears and moments along wind were generally in reasonably good agreement with previous results obtained in a different wind tunnel using larger models. The agreement for transverse forces and moments and for torsion was not as satisfactory.

713,012
PB84-221944 Not available NTIS
National Bureau of Standards, Washington, DC.
Turbulent Wind Effects on Tension Leg Platform Surge.
Final rept.
E. Simiu, and S. D. Leigh. Apr 84, 18p
See also PB83-207464. Sponsored in part by Minerals Management Service, Reston, VA.
Pub. in Jnl. of Structural Eng. 110, n4 p785-802 Apr 84.

Keywords: *Offshore structures, *Platforms, Structural engineering, Wind(Meteorology), Turbulence, Aerodynamics, Hydrodynamics, Reprints, *Wind loads.

A procedure is presented for estimating surge response to turbulent wind in the presence of current and waves. The procedure accounts for the nonlinearity of the hydrodynamic forces and for the coupling of aerodynamic and hydrodynamic effects. It is shown that current wind spectra do not model correctly the wind speed fluctuations at very low frequencies and an alternative model of the wind spectrum, consistent with fundamental principles, is presented. The equation of surge motion under turbulent wind in the presence of current and waves is solved for a typical tension leg platform and it is shown that the damping provided by the hydrodynamic forces precludes the occurrence of significant wind-induced resonant amplification effects even if the drag coefficient in the Morison equation is very small.

713,013
PB84-226117 Not available NTIS
National Bureau of Standards, Washington, DC.
Tether Deformation and Tension Leg Platform Surge.
Final rept.
E. Simiu, A. Carasso, and C. Smith. Jun 84, 4p
Sponsored in part by Minerals Management Service, Reston, VA.
Pub. in Jnl. of Structural Engineers, v110 n6 p1419-1422 Jun 84.

Keywords: *Offshore structures, *Platforms, Loads(Forces), Hydrodynamics, Waves, Structural engineering, Dynamic structural analysis, Reprints.

A preliminary numerical investigation is conducted into the question whether tether deformation under the action of hydrodynamic loads can affect the surge response of tension leg platforms (TLP's). The motion of the tethers subjected to a forced oscillation at the platform level is represented by a nonlinear wave equation. The numerical solution of this equation showed that the lateral deformation of the tethers had no significant effect on the surge of deep water TLPs investigated in this note.

713,014
PB86-132933 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Fitness-for-Service Criteria for Assessing the Significance of Fatigue Cracks in Offshore Structures.
Y. W. Cheng. Aug 85, 74p NBS/TN-1088
Also available from Supt. of Docs as SN003-003-02698-1. Sponsored by Minerals Management Service, Reston, VA.

Keywords: *Cracking(Fracturing), *Fatigue(Materials), *Offshore structures, Crack propagation, Tests, Stresses, Power spectra, Steels.

Contents: An automated fatigue crack growth rate test system; The fatigue crack growth of a ship steel in saltwater under spectrum loading; Estimation of irregularity factor from a power spectrum; Fatigue crack growth in areas of stress concentration -- Plasticity and small-crack effects; and High/low stress amplitude effects on fatigue crack growth rates of a ship steel in air and in saltwater.

713,015
PB87-140141 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Fluid-Structure Interaction Effects for Offshore Structures.
Final rept.
A. S. Veletsos, A. M. Prasad, and G. Hahn. Dec 86, 56p NBS/GCR-86/519
Prepared in cooperation with Rice Univ., Houston, TX. Sponsored by Minerals Management Service, Reston, VA.

Keywords: *Offshore structures, Hydrodynamics, Structural engineering, Models, Dynamic response, Damping, Water waves, *Fluid-solid interactions, Morison equation.

Comprehensive analyses are made of the differences in the responses of simple models of offshore structures computed by the standard and extended versions of Morison's equation for the hydrodynamic forces, and of the effects and relative importance of the numerous parameters involved. The responses also are evaluated by the equivalent linearization technique and Penzien's decoupling technique, and the interrelationship and accuracy of these approaches are elucidated. The results are displayed graphically in the form of response spectra for absolute maximum displacement employing dimensionless parameters that are easy to interpret and use. In addition, the decoupling technique is generalized to include consideration of a current of constant velocity, and a simple modification is proposed which improves the accuracy of this approach. A particularly simple approximation is included for the hydrodynamic modal dampling values of multi-degree-of-freedom, stick-like systems.

713,016
PB87-150512 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Amplification of Wind Effects on Compliant Platforms.
Final rept.,
G. Cook, T. Kumarasena, and E. Simiu. 1986, 12p
Sponsored by Minerals Management Service, Reston, VA.
Pub. in Proceedings of Conference on Wind Effects on Compliant Offshore Structures, New Orleans, LA., September 15-18, 1986, p59-70.

Keywords: *Wind pressure, *Offshore structures, Turbulence, Water waves, Structural engineering, *Offshore platforms, Wind engineering.

A brief review is presented of recent information on the estimation of hydrodynamic damping. Results of simplified calculations are then presented, which indicate that typical tension leg platforms do not appear to experience significant amplification of wind-induced dynamic surge motions. This is the case not only for platforms in extreme environments, for which earlier investigations have been reported, but for non-extreme environments as well. It is noted that smaller values of the drag coefficient in the Morison equation result in increased amplifications of the fluctuating wind-induced response.

ORDNANCE

Ammunition, Explosives, & Pyrotechnics

713,017
PB-287 218/2 PC **A09**/MF **A01**
Purdue Univ., Lafayette, IN.
Control Systems Readiness for Munitions Plants: A First Pass.
Final rept.
T. J. Williams. Oct 78, 192p NBS/SP-522
Proceedings of a Workshop held at Purdue University, West Lafayette, Indiana on September 19-20, 1977. Sponsored in part by Army Armament Research and Development Command, Dover, NJ. Library of Congress Catalog Card no. 78-600075.

Keywords: *Munitions industry, *Industrial mobilizing, *Meetings, Industrial readiness, Operational readiness, Production engineering, Automatic control equipment, Government furnished equipment, Management planning, Shutdown, Government owned government operated facilities, Government owned contractor operator facilities, LAP facilities, Industrial plant shutdown.

Experts in the field of Industrial Process Control were asked to assist the U.S. Army and address a most challenging and unique problem. Large capacity munitions manufacturing production facilities are required only in times of national emergency. These production facilities are complex manufacturing processes normally operated by sophisticated industrial process control systems. Long periods of dormant storage may

occur between facility construction and required operation. Guidance is required for the Army to properly plan for appropriate technical activity which will assure the readiness of these industrial processes at the time of national emergency. The Workshop which is reported upon in this document was held to help provide some of the needed background to this problem. Contents: Past experience in the reactivation of Army ammunition plants, A. J. Zahatko; Current procedures and problems in the layaway and reactivation of process control systems, F. T. Beiwel; An overview of the performance characteristics of sensory transducers, P. S. Lederer; Production base response required to meet mobilization requirements, J. Nemanich; Layaway, standby and reactivation procedures for computer magnetic media, S. B. Geller; Environmental effects on electrical and electronic devices and equipment under long storage conditions, A. J. Graf and L. W. Doremus; A layaway program for control valves, J. Van Damme; The independent testing and proving of hardware and software elements of plant computer control systems on reactivation of munitions plants, D. Zobrist; The layaway and reactivation problems of beet sugar mills for their annual campaigns including management, manpower and training aspects, T. J. Williams and D. D. Lesser; High reliability design techniques for distributed digital systems, M. P. Lukas and J. J. Steinkirchner; Use of simulation and other related techniques for the training of startup crews for reactivation of laid-away plants, W. B. Field; Operating today's plant design tomorrow, M. C. Beaverstock.

713,018
PB81-188286 PC **A15**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Third Appraisal of Methods for Estimating Self-Reaction Hazards.
Interim rept. Jan 76-Aug 78.
K. L. Churney, and D. Garvin. Aug 80, 327p NBSIR-80-2018, DOT/RSPA/MTB-7816
Contract DOT-AS-40028

Keywords: *Cargo transportation, *Hazardous materials, *Thermal stability, Decomposition reactions, Cellulose nitrate, Nitrogen organic compounds, Azo compounds, Heat measurement, Explosives, Materials handling, Transportation safety, Thermal instability, Methane/azido-triphenyl, Benzoic acid/azido.

A study has been made of thermal explosion theory and thermal hazard tests. From this definitions have been developed, suitable for use in a transportation context, of thermally unstable materials-package configuration is one: (1) composed of substances that can decompose or react with the evolution of heat, (2) for which a thermal mechanism of initiation of a temperature rise is present, and (3) in which a resulting rapid, large increase in the temperature of the material can occur. A thermal instability hazard exists if decomposition of the material-package configuration results in destruction of the package or neighboring objects or poses a safety threat. Typical destructions are explosion, rupture of package, and fire. The properties of the material and package needed to predict the hazard are identified and methods for their measurement, using heat conduction and adiabatic calorimetry, are analyzed.

713,019
PB84-217454 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Law Enforcement Standards Lab.
Test Procedure for Armor-Piercing Handgun Ammunition.
Final rept.
D. E. Frank. May 84, 10p NBSIR-84/2884
Sponsored in part by National Inst. of Justice, Washington, DC.

Keywords: *Revolvers, *Armor piercing ammunition, *Firing tests(Ordnance), Test facilities, Targets, Metal plates, Aluminum alloys, Penetration tests.

A test method and test parameters are defined for discriminating between armor-piercing handgun ammunition and nonarmor-piercing handgun ammunition. A multi-plate aluminum test target is described where the number of plates perforated by the bullet, when fired at the test target out of an industry standard velocity gun, performs the discrimination between armor-piercing and nonarmor-piercing bullets.

713,020
PB87-145058 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Statistical Characterization of Electroexplosive Devices Relevant to Electromagnetic Compatibility Assessment.
Technical note.
D. S. Friday, and J. W. Adams. May 86, 57p NBS/TN-1094
Also available from Supt. of Docs as SN003-003-02744-8. Sponsored by Army Aviation Systems Command, St. Louis, MO.

Keywords: *Initiators(Explosives), Electromagnetic compatibility, Electromagnetic pulses, Thermodynamic properties, Firing tests(Ordnance), Firing likelihood plots.

Electroexplosive devices (EEDs) are electrically fired explosive initiators used in a wide variety of applications. The nature of most of these applications requires that the devices function with near certainty when required and remain inactive otherwise. Recent concern with pulsed electromagnetic interference (EMI) and nuclear electromagnetic pulse (EMP) made apparent the lack of methodology for assessing EED vulnerability. A new and rigorous approach for characterizing EED firing levels is developed in the context of statistical linear models and is demonstrated in the paper. The authors combine statistical theory and methodology with thermodynamic modeling to determine the probability that an EED, of a particular type, fires when excited by a pulse of a given width and amplitude. The results can be applied to any type of EED for which the hot-wire explosive binder does not melt below the firing temperature. Included are methods for assessing model validity and for obtaining probability plots, called 'Firing Likelihood Plots'. A method of measuring the thermal time constant of an EED is given. This parameter is necessary to evaluate the effect of a train of pulses.

Armor

713,021
PB-295 587/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Ballistic Resistance of Police Body Armor.
Final rept.
N. J. Calvano, S. Wakamiya, and R. C. Dobbyn. Dec 78, 17p
Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, DC.
Pub. in NILECJ-STD-0101.01, 17p, Dec 78.

Keywords: *Body armor, *Terminal ballistics, Protective clothing, Standards, Police, Penetration resistance.

This standard is for personnel armor intended to protect the torso against gunfire. It establishes methods of test for ballistic penetration and deformation of body armor. The standard provides for five levels of protection, designated as 22 LR-38 Spec., lower velocity 357 Mag.-9 mm, higher velocity 357 Mag.-9 mm, high velocity rifle, and armor-piercing rifle.

713,022
PB87-105524 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Law Enforcement Standards Lab.
Ballistic Tests of Used Soft Body Armor.
D. E. Frank. Sep 86, 44p NBSIR-86/3444
Sponsored by National Inst. of Justice, Washington, DC.

Keywords: *Body armor, Ballistics, Tests.

A sample of 24 ballistic resistant undergarments (soft body armor) from a production lot of 1500 originally distributed to 15 police departments throughout the United States in 1975 for issue to officers as part of a Law Enforcement Assistance Administration demonstration project, was tested for V50 ballistic limit. The program was a joint effort of the U.S. Department of Justice National Institute of Justice and the National Research Council of Canada Public Safety Project Office. Tests of ballistic limit were conducted on virgin armor that were never issued, and armor showing evidence of light, moderate, and heavy wear both dry and while wet. The results show that armor does not lose ballistic efficiency as a consequence of age.

Combat Vehicles

713,023
PB85-123420 Not available NTIS
National Bureau of Standards, Washington, DC.
Police Handgun Ammunition.
Final rept.
L. D. Shubin, and D. E. Frank. Aug 84, 3p
Sponsored in part by National Inst. of Justice, Washington, DC.
Pub. in Police Chief LI, n8 p23-25 Aug 84.

Keywords: *Guns(Ordnance), *Ammunition, Terminal ballistics, Weapons effects.

This is an article to announce the availability of National Institute of Justice Report 100-83, 'Police Handgun Ammunition: Incapacitation Effects. Volume I: Evaluation' and National Institute of Justice Report 101-83, 'Police Handgun Ammunition: Incapacitation Effects. Volume II: Experimental Data.'

Detonations, Explosion Effects, & Ballistics

713,024
PB82-210857 Not available NTIS
National Bureau of Standards, Washington, DC.
Ballistic Resistant Protective Materials.
Final rept.
N. J. Calvano. Dec 81, 7p
Sponsored in part by National Inst. of Justice, Washington, DC.
Pub. in NIJ Standard-0108.00, 7p Dec 81.

Keywords: *Protectors, *Terminal ballistics, *Materials specifications, Safety devices, Shielding, Body armor, Transparent armor, Composite armor.

This is a standards document; it establishes minimum performance requirements and methods of test for ballistic resistant protective materials. This standard supersedes NILECJ-STD-0103.00, Portable Ballistic Shields, dated May 1974, by expanding the applicability of the standard to all materials used to provide ballistic protection against gunfire, including portable ballistic shields. In addition, this standard establishes threat level classifications that are consistent with other NIJ standards for ballistic protection.

713,025
PB82-210931 Not available NTIS
National Bureau of Standards, Washington, DC.
Selection and Application Guide to Police Body Armor.
Final rept.
R. C. Dobbyn, and R. A. Gorden. Sep 81, 23p
Sponsored in part by National Inst. of Justice, Washington, DC.
Pub. in NILECJ Standard-0101.01, 23p 1981.

Keywords: *Police, *Protective clothing, *Body armor, Threat evaluation, Terminal ballistics, Performance evaluation, Performance standards.

The guide provides information to assist police in the selection of body armor to provide full time protection throughout a full shift of duty. Data are provided to demonstrate the effectiveness of body armor in protecting police. Specific weapon threats are related to ballistic protection and the classifications of the five threat levels included within the voluntary national performance standard for police body armor, NILECJ-STD-0101.01. Background information concerning the effort sponsored by the National Institute of Justice to develop an armor suitable for full time use is provided to acquaint the reader with the factors that are important to the performance and wearability of body armor. The use and maintenance of police body armor are discussed. The use of NILECJ-STD-0101.01 as a basis for procurement is described in detail.

Guns

713,026
AD-A130 809/7 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Nonlinear Inverse Heat Transfer Calculations in Gun Barrels.
Interim rept. 15 Jul 82-15 Jul 83.
A. S. Carasso. 15 Jul 83, 30p ARO-19643.1-MA
Contract MIPR-ARO-63-82
Pub. in Proceedings Trans. Army Applied Math Comp. Conference (First), Washington, DC. May 1983.

Keywords: *Nonlinear analysis, *Heat transfer, *Gun barrels, *Interior ballistics, Conduction(Heat transfer), Thermocouples, Temperature, Measurement, Diffusion, Partial differential equations, Algorithms, Numerical analysis, Boundary value problems, Problem solving, Frequency, Time intervals, Cannons.

We consider the problem of determining the temperature history inside a gun barrel from embedded thermocouple measurements at some distance away from the inside wall. This inverse problem leads to an improperly posed initial value problem for a nonlinear system of partial differential equations, whenever the thermal properties are temperature dependent. We discuss a step-by-step marching algorithm for the numerical computation of such problems. The scheme is stabilized by appropriately filtering in the frequency domain at each step. We illustrate this technique with a numerical experiment on a nonlinear problem whose exact solution is known. The basic ideas are applicable to other unstable evolution equations.

713,027
PB83-600042 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
38/357 Caliber Revolvers.
L. K. Eliason, N. J. Calvano, S. Wakamiya, and D. E. Frank. 1983, 10p
Pub. in NIJ-Std-0109.00 1983.

Keywords: *Handguns, Handgun safety, Handgun standard, Handgun testing, Protective equipment, Revolvers, 38 caliber revolvers.

This standard establishes performance requirements and test methods for revolvers to be used by law enforcement officers. It addresses only 38 caliber double action revolvers, including those known as 357 magnum. It also provides guidelines for assessing the acceptability of new or reissue revolvers. While revolver sights are not standardized, the factors to be considered in reference to the sighting system are discussed in an appendix.

General

713,028
PB-275 062/8 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
Reduction of Airborne Lead in Indoor Firing Ranges by Using Modified Ammunition,
A. A. Juhasz. Nov 77, 30p NBS-SP-480-26
Prepared by Ballistic Research Labs., Aberdeen Proving Ground, Md. Sponsored in part by Law Enforcement Assistance Administration, Washington, D.C.

Keywords: *Firing tests(Ordnance), *Air pollution, *Lead(Metal), Small arms ammunition, Primers(Explosives), Interior ballistics, *Firing ranges.

A study was conducted to evaluate the feasibility of decreasing or eliminating aerosol lead contamination at firing ranges by selectively modifying the ammunition fired. A 38 Special police revolver was used in the study and firings were conducted in a specially designed container which allowed trapping of particulate effluents from this weapon for subsequent analysis. Under the conditions of the experiment, conventional 38 Special ammunition yielded an average of 5,638 micrograms of lead per round at the position of the shooter. Under identical conditions, experimental ammunition, using jacketed soft point projectiles and a special non-lead-container primer composition yielded an average of 13 micrograms of lead per round. The data indicate a decrease of the particulate lead produced per round by a factor greater than four hundred. The ballistic characteristics of the ammunition were also examined. The manufacture of no-lead primers which will reproduce the interior ballistics of conventionally-primed ammunition appears to be well within the state of the art.

713,029
PB87-173712 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Metrology Challenges of the Strategic Defense Initiative.
Final rept.,
B. C. Belanger. 1987, 11p
Pub. in Proceedings of 1987 Measurement Science Conference, Irvine, CA., January 29-30, 1987, p1-11.

Keywords: *Metrology, *Measurement, Standards, Military strategy, Defense system, Microwaves, Strategic Defense Initiative.

As the nation's standards laboratory, the National Bureau of Standards (NBS) has a responsibility to monitor new technological developments in order to identify emerging requirements for national measurement reference standards and measurement services. During the past two years, NBS has been working with the Strategic Defense Initiative Office (SDIO), the Military Services, and industrial contractors to determine what new or improved measurement capabilities will be required to support the SDI. The paper provides an indication of the metrology challenges in selected technical areas by citing several specific examples.

PHOTOGRAPHY & RECORDING DEVICES

Photographic Techniques & Equipment

713,030
PB81-103301 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Law Enforcement Standards Lab.
Selection and Application Guide to Police Photographic Equipment.
C. C. Grover. Aug 80, 68p NBS-SP-480-23
Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, DC. Prepared in cooperation with Naval Surface Weapons Center White Oak Lab., Silver Spring, MD.

Keywords: *Photographic equipment, Police, Selection, Utilization.

This user guide provides a basis for the selection of photographic equipment that meets the needs of law enforcement. Typical police photographic assignments are discussed to identify those aspects of the tasks that influence equipment needs. Each of the available types of cameras is described, including operation, required operator skill, advantages and disadvantages. Lenses, film, lighting equipment, filters, exposure meters and other accessories are also discussed.

713,031
PB83-235945 Not available NTIS
National Bureau of Standards, Washington, DC.
Quantum Noise-Limited Images in Screen Film Systems.
Final rept.
J. W. Motz, and M. Danos. 1982, 5p
Pub. in Proceedings of Application Optical Instrumentation in Medicine (10th), New Orleans, Louisiana, May 9-12, 1982, SPIE 347, p62-66.

Keywords: *Screens(Displays), X rays, Resolution, Films, *X ray imagery, Quantum noise, Modulation transfer functions, Spatial resolution.

The limits imposed on the spatial resolution obtained with screen-film systems for low contrast images are determined primarily by x-ray quantum noise rather than by the spatial response(MTF curve) of the system. For 40 keV x rays incident on a HiPlus/XRP screen-film system, the x-ray quantum noise limits spatial resolution in the density region of unity from approximately 0.2 to 1 line pair per mm for film density differences respectively in the region from .02 to 0.1. By comparison, the MTF effect over most of this region of density differences, produces less than a 10 percent degradation of the spatial resolution.

713,032
PB87-151882 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Calibration of a Camera and Light Source by Fitting to a Physical Model.
Final rept.,
P. Mansbach. 1986, 20p
Pub. in Computer Vision, Graphics, and Image Processing 35, p200-219 1986.

Keywords: *Cameras, *Calibrating, *Graphic methods, *Robots, Images, Model, Distance, Data processing, *Light sources, Image processing, Computer vision, National Bureau of Standards.

The paper describes the calibration of a camera-and-plane-of-light ranging system. Equations are derived which relate the image coordinates in the camera to the external coordinate system. These equations contain coefficients which are functions of the geometrical parameters of the camera/light-source system (focal length, pixel spacing, camera-to-plane-of-light distance, etc.). Several pictures are taken of a test block at different distances, and the geometrical parameters in the equations are varied to achieve a best (least squares) fit to the data. The resulting equations have a remaining error of less than one pixel, and have been used successfully on a parts-acquisition robot.

713,033
PB87-210225 PC **A04**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Wear Due to Printing Inks.
Final rept. Oct 84-Sep 86,
L. K. Ives, M. Peterson, A. W. Ruff, J. S. Harris, and P. A. Boyer. Jun 87, 69p NBSIR-87/3574
Sponsored by Bureau of Engraving and Printing, Washington, DC.

Keywords: *Printing inks, *Wear, Inks, Abrasive, Electroplating, Polishing, Polyvinylchloride.

The principal modes of wear during currency and stamp printing by the intaglio method were identified. Three laboratory test methods were developed and applied to a study of different ink materials and different chromium platings. The importance of abrasive particles in the inks was established. Recommendations for continued research, both fundamental and applied, were made.

Recording Devices

713,034
PB-275 608/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microprocessor Data Logging System for Utilizing TV as a Time-Frequency Transfer Standard.
Final rept.,
D. D. Davis. 1976, 15p
Pub. in Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (8th), Greenbelt, Md. 30 Nov-2 Dec 76 p167-181 1976.

Keywords: *Data recorders, *Microcomputers, Time standards, Frequency standards, Carrier waves, Television transmission, Monitors, Microprocessors.

The TV network color subcarriers have been used for several years as frequency transfer standards. Additionally, a time transfer method using TV line-10 is presently used for maintaining clock synchronization at the microsecond level. This paper describes an NBS-developed microprocessor data logging system that automates both functions in a relatively inexpensive package. Three of these systems are in routine use to collect the color subcarrier and line-10 data published in the NBS Time and Frequency Services Bulletin. Two additional systems are used to monitor

the station clocks of WWV/WWVB and the GOES satellite clock at Wallops Island, VA.

713,035
PB82-242215 PC **A05**/MF **A01**
National Bureau of Standards, Boulder, CO.
Proceedings of the Waveform Recorder Seminar.
Final rept.
R. A. Lawton. Jun 82, 100p NBS-SP-634
Proceedings of the Seminar on Waveforn Recorder Mesurement Needs and Techniques for Evaluation/ Calibration, held in Boulder, CO. Oct 15, 1981. Library of Congress catalog card no. 82-600552.

Keywords: *Recording instruments, *Waveforms, *Meetings, Standards, Converters, Coders, Measurement.

In the past, for the most part, precision electromagnetic measurements were concerned with the measurement of parameters for sinusoidal (or steady state) excitation and response, e.g., magnitude, phase, and power. One reason for the popularity of frequency domain measurement was that in this domain only one complete data point need be recorded to constitute a useful measurement. Recording a thousand data points as required for precision time domain waveform measurements simply was not feasible. Today such frequency domain measurements are still important but now share their importance with transient pulse time domain measurements. With the emergence of integrated circuit components for (1) sampling or analog to digital conversion, (2) storage, and (3) control, real time digital waveform recording is now practical and widespread in usage. Furthermore, by coupling waveform recording components to minicomputers and microprocessors integrated circuitry it is now possible to record single events using compact systems (instruments) which acquire, record, process, and analyze transient signals. In fact, the incorporation of digital computation integrated circuitry appears to be a major driving force in expanding the role of waveform measurements in the academic, industrial and scientific communities.

713,036
PB83-172668 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Prediction of the Long Term Stability of Polyester-Based Recording Media.
Annual rept. no 1.
D. W. Brown, R. E. Lowry, and L. E. Smith. Jun 82, 47p NBSIR-82-2530
Sponsored in part by National Archives and Records Service, Washington, DC.

Keywords: *Polyethylene terephthalate, *Aging tests(Materials), Polyester resins, Stability, Tape recording, Films, Temperatures.

The stability of poly(ethylene terephthalate) is being studied in order to predict its long term behavior as the base of the film and tape used to record archival information. This report contains results of the first year's work.

713,037
PB83-600043 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Continuous-Recording Voice-Logging Tape Recorders.
L. K. Eliason, D. Brenner, and M. Treado. 1983, 13p
Pub. in NIJ-Std-0220.00 1983.

Keywords: *Continuous-recording, Law enforcement, Multichannel recorder, Performance standard, Tape recorder, Tape recorder test methods, Voice-logging recorder, Voluntary standard.

The purpose of this standard is to establish performance requirements and test methods for 24 hour continuous-recording, multichannel, reel-to-reel, voice-logging tape recorders used by law enforcement agencies. In addition to performance requirements and test methods, the standard includes the necessary definitions, the information to be supplied to the user or testing facility by the manufacturer or distributor and a listing of the principal items of test equipment needed. This standard is intended for voluntary use by agencies in the selection and procurement process.

713,038
PB86-134905
(Order as PB86-134871, PC **A09**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Characterization of Waveform Recorders.
D. R. Flach. Oct 85, 24p
Included in Proceedings of Seminar on Digital Methods in Waveform Metrology, p31-54 Oct 83.

Keywords: Tests, Recording instruments, *Waveform recorders.

Although transient waveform recorders have been in use for more than 15 years, no commonly accepted test procedures were in use for these instruments, particularly for the evaluation of errors associated with dynamic input signals. The tests described are essentially those in which the final output of the test is the result of digital signal processing on the waveform recorder's digital output.

713,039
PB86-209301 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Transient Response Characterization of Waveform Recorders.
Final rept.
T. M. Souders, D. R. Flach, and H. K. Schoenwetter. 1985, 4p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Pulsed Power Conference (5th), Arlington, VA., June 10-12, 1985, p352-355.

Keywords: *Waveforms, *Recording instruments, Transient response, Tests.

Test methods for characterizing the transient response of waveform recorders are presented, together with typical test results. The methods, based on the use of a precision, programmable step generator developed at NBS, are suitable for recorders having up to 10 bits of resolution and 100 MHz bandwidth.

PHYSICS

Acoustics

713,040
AD-A148 921/0 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Acoustic Emission Transducer Calibration by Means of the Seismic Surface Pulse.
Technical rept.
F. R. Breckenridge. Apr 82, 9p Rept no. TR-82-1
Contracts N00014-81-F-0009, N00014-82-F-0004
Also Pub. in Jnl. of Acoustic Emission, v1 n2 p87-94 Apr 82.

Keywords: *Transducers, *Calibration, *Acoustic emissions, Elastic waves, Voltage, Output, Error analysis, Naval research.

A system for calibrating transducers as receivers of elastic waves at the surface of a solid medium has been developed and is now in use at the National Bureau of Standards (NBS). The method provides the voltage output of the transducer when mounted on a surface whose motion is known. The measurement is made over the range of 100 kHz to 1 MHz and is designed with the calibration of acoustic emission (AE) transducers in mind. An error analysis is given.

713,041
PB-265 021/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laboratory Measurements in Acoustics.
Final rept.,
C. R. Voorhees, and D. S. Pallett. Oct 76, 5p
Pub. in Noise Control Eng., v7 n2 p52-56 Sep-Oct 76.

Keywords: *Acoustic measurement, Test facilities, Reprints.

A detailed questionnaire on the topic of Laboratory Measurements of Noise Emission and of Acoustical Properties of Building Elements and Materials was initiated by the Board of Directors of the Institute of Noise Control Engineering in September 1974. Topics dealt with cover the use of facilities for sound power, acoustical absorption, transmission loss, and impact noise measurements, and the use of reference sound sources and anechoic chambers. Results of the survey, which are presented and briefly discussed, indicate the extent and type of activity in these areas. They also reveal a general feeling among respondents that acoustic measurements could be made more accurate with the implementation or improvement of existing facility qualification (performance) criteria, calibration data, measurement standards, and measurement methodology.

713,042
PB-265 022/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Recent Reverberation Room Qualification Studies at the National Bureau of Standards.
Final rept.,
D. S. Pallett, T. W. Bartel, and C. R. Voorhees. Oct 76, 10p
Pub. in Noise Control Eng., v7 n2 p71-80 Sep-Oct 76.

Keywords: *Test facilities, *Acoustic measurement, Automation, Power measurement, Reprints, Reverberation rooms.

A computer-controlled instrumentation system has been implemented to ascertain room 'qualification' (per ANS S1.21-1972) for sound power measurements, to measure radiated sound power, and to measure acoustic absorption in the NBS reverberation room. Preliminary studies performed with this system indicate the effectiveness of rotating diffuser elements and the use of a 12-microphone array in achieving a qualified condition. Initial sound power measurements made under qualified conditions appear to show a measurement repeatability that is generally consistent with and within the bounds of the uncertainties indicated in Table 1 of S1.21.

713,043
PB-265 035/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Qualification of an Acoustic Research Facility for Sound Power Determination.
Final rept.,
C. I. Holmer. 1976, 5p
Pub. in Noise Control Eng., v7 n2 p87-92 Sep-Oct 76.

Keywords: *Test facilities, Acoustic measurement, Power measurement, Reprints.

Modifications to a test facility that were required in order to bring the facility to within the qualification requirements of American National Standard S1.21 for sound power measurement of sources emitting pure tones are described. The facility is unique in that two nearly identical rooms, of substantially smaller volume than recommended (i.e. 90 cu m), were found to be 'qualifiable' with suitable modifications. The modifications included the use of an eight microphone array, fixed and rotating diffusers, low frequency absorption and multiple source locations. The modifications, and some of their objective effects on the qualification measurements are discussed.

713,044
PB-273 957/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
National Measurement System for Acoustics.
Final rept.,
D. Pallett, and M. A. Cadoff. Oct 77, 12p
Pub. in Sound Vibration, v11 n10 p20-31 Oct 77.

Keywords: *Acoustic measurement, Noise(Sound), Reprints, National Measurement System.

Many recent acoustical measurement processes have been motivated by societal concern over noise and have broad relevance to our contemporary technological society. The emphasis of the study of the National Measurement for Acoustics has been to determine the adequacy of these important physical measurements and to promote improvements within the measurement system. The relevant physical quantities are indicated, and the interactions occurring between participants as well as the roles of acoustical standardization institutions are specified. Finally, the status and trends of the system and the NBS role in adapting to changing technology are discussed.

713,045
PB-273 958/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Approach to Acoustic Emission Signal Analysis - Theory and Experiment.
Final rept.,
N. N. Hsu, J. A. Simmons, and S. C. Hardy. Oct 77, 7p
Sponsored in part by Electric Power Research Inst., Palo Alto, Calif.
Pub. in Materials Evaluation, v35 n10 p100-106 Oct 77.

Keywords: *Elastic waves, Acoustic signals, Analyzing, Simulation, Theory, *Acoustic emissions, Reprints, Acoustic emission testing.

Acoustic Emission (AE) signals are notorious for their complexity and irreproducibility. Because AE source characteristics are virtually unknown and because the detected AE signals are colored by the propagation media, the sensor response and the instrumentation settings, interpretations of test results such as spectral analysis or correlation studies are mostly qualitative and sometimes controversial; theories either are empirically derived or cannot be verified by experiments. The paper, sketches an approach to the AE signal analysis problem. It first reports the development of a theory which allows the computation of the displacement as a function of time at an arbitrary point on an infinite plate due to an arbitrary point source force function. The theory is based on a new Fourier inversion technique which yields exact formulas similar to those developed for seismological 'ray' theories. It then reports experimental results obtained on a 2.52 cm thick aluminum plate using a reproducible step function stress release pulse as a simulated AE signal and a wide band displacement capacitive transducer as a sensor. The measurements are in quantitative agreement with the predictions of theory. It also discusses applications wherein the simulated signal, capacitive transducer and plate are used for AE source signature analysis, and sensor calibration problems.

713,046

PB-274 361/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Arbitrary Temperature and Flow Profiles on the Speed of Sound in a Pipe.
Final rept.,
B. Robertson. Oct 77, 6p
Pub. in Jnl. of Acoust. Soc. Am. 62, n4 p813-818, Oct 77.

Keywords: *Acoustic velocity, *Fluid flow, *Piping systems, Numerical analysis, Temperature, Reprints.

An expression for the wavenumber of the fundamental mode in a uniform pipe of arbitrary cross section is obtained correct to first order in V/c and in (c sub 0), where V is the velocity of the fluid in the pipe and c = (c sub 0) + (c sub 1) is the local sound speed with (c sub 0) = constant. Correction terms are also obtained. The calculation applies to a fluid with the equation of state of an ideal gas or to a liquid and is valid for frequencies well below cutoff. The speed c and velocity V can be arbitrary functions of position across the cross section given only dell dot V identically equal to 0. For the gas, the wavenumber can be expressed in terms of the average density and the total mass flow rate.

713,047

PB-274 503/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reply to 'Comments on (Environmental Effects on Microphones of Various Constructions)'.
Final rept.,
G. R. Hruska, E. B. Magrab, and W. B. Penzes. 1977, 1p
Pub. in Jnl. Acoustical Society of America 62, n5 p1314 Nov 77.

Keywords: *Microphones, Humidity, Sensitivity, Calibrating, Tests, Reprints.

To answer the question as to whether or not the microphones were given sufficient time to recover from a particular humidity, the authors elaborate further on the experimental procedure.

713,048

PB-275 574/2 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.

Interactive Computer Program for the Determination of Reverberation Time.
Final rept.,
T. W. Bartel. Dec 77, 128p NBSIR-77-1383

Keywords: *Reverberation, *Computer programs, *Acoustic absorption, Computation, Acoustic velocity, Acoustic measurement, Real time operations, Microphones, Random noise, Fortran 5 programming language.

A description of the computer program used to measure the reverberation time in a reverberation room is presented. The program controls the operation of a real-time analyzer, a random noise generator, and a microphone multiplexer. The reverberation time for each digitally recorded decay curve is determined from a straight line least-squares fit. The program is written in Fortran 5 and requires approximately 35,000 eight-bit bytes of core memory. Flow charts, source listings, and sample printouts are included.

713,049

PB-280 434/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Exact Fractions Interferometer.
Final rept.,
P. L. M. Heydemann. 1976, 4p
Pub. in Proceedings of 1976 Ultrasonics Symposium, Annapolis, Md. 29 Sep-1 Oct 76 p649-652 IEEE Transactions on Sonics and Ultrasonics 1976.

Keywords: *Interferometers, Ultrasonic frequencies, Distance measuring equipment, Velocity measurement, Algorithms, Exact fractions method, Reprints.

A mathematical algorithm is described which provides an algebraid solution to the problem of measuring distance or signal velocity with the exact fractions method using phase information from several reflected waves with different wave lengths. This algorithm makes the exact fractions method attractive for length and velocity measurements with ultrasonic interferometers. These measurements are virtually instantaneous, non-accumulating and they retain the resolution of the best conventional interferometer methods. The method is illustrated with numerical examples, and the necessary electronic circuitry is indicated.

713,050

PB-281 342/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
History of American Acoustics: Introductory Comments.
Final rept.
R. K. Cook. Feb 77, 1p
Pub. in Jnl. of the Acoustical Society of America, v61 n2 p249 Feb 77.

Keywords: *Acoustics, Research projects, Scientific societies, History, United States, Meetings.

This paper introduces six papers on the history of American acoustics. All of the papers were presented at the 91st Meeting of the Acoustical Society of America, held in Washington, D.C. in April 1976. Publication is planned for the Journal of the Acoustical Society of America.

713,051

PB-282 003/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison of Microphone Traverse and Microphone Array for Determining Space Average Sound Pressure Level in a Reverberation Room.
Final rept.,
C. I. Holmer, and D. Lubman. Oct 76, 7p
Pub. in Noise Control Engineering, v7 n2 p64-70 Sep/Oct 76.

Keywords: *Sound pressure, Acoustic measurement, Microphones, Tests, Errors, Noise(Sound), Test chambers, Reverberation, Reprints.

A feasibility study of a particular reverberation room design is described in which the effectiveness of different systems for finding the space average sound level of the sound field in that reverberation room is studied. The specific systems include a fixed microphone array, a single circular microphone traverse, and a single linear microphone traverse. The relative effectiveness of each system is evaluated using the limited measurement volume which is permitted when measurements are performed in accordance with American National Standard S1.21, 'Methods for the determination of sound power output of small sources in reverberation rooms.' Comparisons with the objectives for measurement precision established in this standard are made. It is concluded that none of the systems meets the precision objectives without additional reduction of the spatial variations of a pure tone sound field such as is provided by a rotating diffuser. Alternatively, with an 'effective' rotating diffuser, it is found that the circular traverse and array systems are nearly adequate for the precision objectives. The choice between the systems may thus be based on other factors such as cost, ease of implementation or operational flexibility.

713,052

PB-284 575/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultrasonic Transducer Power Output by Modulated Radiation Pressure.
Final rept.,
M. Greenspan, F. R. Breckenridge, and C. E. Tschiegg. Apr 78, 8p
Sponsored in part by Office of Naval Research, Arlington, Va.
Pub. in Jnl. of the Acoustical Society of America 63, n4 p1031-1038, Apr 78.

Keywords: *Acoustic measurement, *Power measurement, *Piezoelectric transducers, Ultrasonic radiation, Calibrating, Sound pressure, Reprints.

The article relates to an apparatus for the measurement of total sound power output of a piezoelectric transducer radiating into water. The apparatus combines the better features of previously used methods which depend on radiation pressure. The input is modulated at a low frequency and the output power is intercepted by a target which experiences a force at the modulation frequency. The target is mounted on the armature of an electromagnetic receiver provided with an independent coil through which a current at the modulation frequency is adjusted in amplitude and phase, either manually or automatically by feedback, to arrest the motion of the armature. When the armature is stationary the force depends only on the current, and the apparatus can be calibrated using direct current and dead weights. It is thus absolute. In practice, the carrier frequency is swept over any part of the range 0.1 - 15 MHz while a recording of power output versus frequency is made. The results of comparisons made with those of other methods are encouraging. Examples of curves from normal and defective transducers are shown.

713,053

PB-285 302/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Studies on the Spatial Variation of Decaying Sound Fields.
Final rept.,
T. W. Bartel, and E. B. Magrab. Jun 78, 10p
Pub. in Jnl. Acoust. Soc. Am., v63 n6 p1841-1850, Jun 78.

Keywords: *Acoustic fields, *Loudspeakers, *Spatial distribution, *Acoustic measurement, Reverberation, Analysis of variance, Acoustic absorption, Standard deviation.

The spatial variation of the reverberation time was measured in the NBS reverberation room in the 1/3-octave bands from 80 to 10 000 Hz to determine the following: (1) the effects on the precision of the spatially averaged reverberation time due to (a) vane speed and vane orientation, (b) loudspeaker location, and (c) the area and location of an absorbing panel and its absorption coefficient; (2) the selection of the parameters in (1) above such that the measurement uncertainty of the reverberation time is minimized; and (3) the overall measurement uncertainty for this optimum configuration as a function of the number of microphone locations and the number of decay curves recorded at each microphone location. For an 11-Square meters panel with relatively little low frequency absorption and with the vanes oriented at 22.5 degrees from the vertical and rotating at 7.5 rpm, an analysis of variance indicated that the total uncertainty of the measured average reverberation time (one standard deviation from the mean) was less than 0.5% from 160 to 4000 Hz and less than 1.5% from 80 to 10 000 Hz when 20 decays at each of six microphone locations were used.

713,054

PB-286 536/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Acoustical Properties of the National Bureau of Standards Anechoic Chamber.
Final rept.,
W. Koidan, and G. R. Hruska. Aug 78, 9p
Pub. in Jnl. Acoust. Soc. Am., v64 n2 p508-516, Aug 78.

Keywords: *Anechoic chambers, *Acoustic properties, Acoustic environments, Sound pressure, Curve fitting, Least squares method, Reprints.

The acoustical properties of the large anechoic chamber at the National Bureau of Standards were investigated by two methods over the frequency range 40-63 000 Hz. In the firt method described, deviations of mean-square sound pressure from an assumed inverse square law were measured as a sound source and microphone were moved apart. Over most of the frequency range, the deviations were found from a least-squares curve-fitting procedure by means of digital-computer processing of the data. The effective acoustic centers of the sources were obtained as a by-product of the procedure. In the second method, the source and microphone were kept at a fixed separation as they were moved together across the chamber, and deviations from the mean value of the sound pressure level were estimated from recordings. The significances of the two methods are discussed with a view towards their application.

713,055
PB-287 311/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultrasonic Calorimeter for Beam Power Measurements from 1 to 15 Megahertz.
Final rept.
T. L. Zapf, M. E. Harvey, N. T. Larsen, and R. E. Stoltenberg. 1977, 4p
Sponsored in part by Bureau of Radiological Health, Rockville, MD. Div. of Electronic Products.
Pub. in Proceedings of Ultrasonics Symposium (1976), Annapolis, MD. 29 Sep-1 Oct 76, IEEE Cat76 CH1120-5SU p573-576 1977.

Keywords: *Power meters, Ultrasonic radiation, Beams(Radiation), Power measurement, Medium frequencies, High frequencies, Transducers.

A twin, series flow, ultrasonic comparator has been constructed at the National Bureau of Standards for the measurement of beam power from ultrasonic transducers in the 1 to 15 MHz frequency range. Uncertainties are believed to be less than plus or minus (7% + 0.2 mW). An ultrasonic sound beam absorbed in one vessel can be compared rapidly with accurately-measured dc electrical power in the other vessel. Absorbing liquid enters each vessel near the ultrasonic input port. The temperatures of the absorbing liquid at the input ports are equalized by a heat exchanger, and the mass-flow rates are the same in both vessels. Twin temperature sensors, connected in the output flow from the vessels, are connected in an electrical bridge circuit. In automatic operation the bridge is connected to a feedback circuit. With ultrasonic power introduced into one vessel, the feedback circuit promptly applies power to an electrical heater in the other vessel to regain bridge balance. The ultrasonic power then equals the measured dc power corrected for known errors.

713,056
PB-294 117/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultrasonic Transducer Characterization at the NBS.
Final rept.,
E. B. Miller, and D. G. Eitzen. Jan 79, 12p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Sonics and Ultrasonics. SU-26, n1, p28-37, and p63-64, Jan 79.

Keywords: *Underwater acoustics, Ultrasonic radiation, Performance evaluation, Errors, *Ultrasonic wave transducers, MHz range 01-100, Nonlinear acoustics, Reprints.

Four methods for characterizing ultrasonic transducers are reviewed. These methods have been or are being developed at the National Bureau of Standards (NBS) for characterizing the performance of ultrasonic devices operating into a water load. The nominal frequency range for the methods considered here is 0.5 to 30 MHz, which corresponds to devices used in nondestructive testing, medicine, and animal science. It is helpful to thoroughly understand the physical theory which applies to each measurement method so that appropriate methods can be developed and analyzed for errors or uncertainties. Studies of errors and their basis constitute an important interest of the National Bureau of Standards. Consistent with this interest, and to provide continuity among the measured quantities, linear and second-order acoustic relationships are tabulated in terms of the pressure and particle-velocity variables for lossless fluids. This provides an outline which interrelates measured quantities and suggests other derived quantities, or measurements, that may also be of interest. A formally economical method for obtaining such nonlinear acoustic relationships is outlined briefly in the Appendix. This provides the basis for the brief analyses which pertain to the radiation force method and to the scanning technique in the body of the paper. Aspects of the treatment of radiation force appear to be novel.

713,057
PB-295 170/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Piston Radiator: Some Extensions of the Theory.
Final rept.,
M. Greenspan. Mar 79, 24p
Pub. in Jnl. of the Acoustical Society of America 65, n3, p608-621, Mar 79.

Keywords: *Sound transducers, Baffles, Pistons, Pressure, Boundary value problems, Reprints.

Those results of the theory of the baffled, uniform-piston radiator that can be calculated exactly are extended to some other cases, especially the simplest case of a simply supported radiator, the simplest case of a clamped-edge radiator and a Gaussian radiator. It is also shown that from the solution to a problem with boundary conditions framed in terms of velocity, the solution to a corresponding problem, having boundary conditions framed in terms of pressure, can be obtained very easily.

713,058
PB-300 557/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Standing-Wave Tube as an Absolutely Known Source of Sound Power.
Final rept.,
R. K. Cook, and T. M. Proctor. Jun 79, 14p
Pub. in Jnl. of Acoustical Society of America 65, n6, p1542-1555, Jun 79.

Keywords: *Sound generators, *Standing waves, Standards, Acoustic measurement, Power measurement, Power, Acoustic fields, Calibrating, Acoustic absorption, Tubes, Reprints.

An open ended standing-wave tube has been examined as an absolute sound power (ASP) source, having an absolutely known radiated sound power. The ASP source can serve as an acoustical instrument, principally in reverberation chambers, for three purposes. The first is for calibration of the presently used arrays of microphones for measurement of total radiated sound power by steady sources. The second is for measurement of the influence of acoustical diffusion devices, such as moving vanes, on the radiated power of a source. A third application is to the steady-state measurement of the total cross section for sound absorption. The power measurement scheme makes use of concurrent measuemens of sound pressure, both amplitude and phase, at two separate points inside the tube and on its axis. From these, the time-averaged produce (Umov vector) of the particle velocity and pressure can be obtained. The product gives accurately both the sound intensity within the tube and the radiated power from the open end. Optimum accuracy for measuement of intensity is achieved by large microphone separations (one-quarter wavelength). Comparison of indicated sound power radiated from the tube with the usual sound power measuements done in both an anechoic and a reverberant environment are mde.

713,059
PB79-600046 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Piezoelectric Polymer Membrane Stress Gage.
A. S. DeReggi, and S. Edelman. Filed 23 Feb 78, patented 28 Aug 79, 5p PAT-APPL-880 406, PATENT-4 166 229

Keywords: *Acoustic waves, Piezoelectric polymer, Preset tensile stress, Pressure variations.

Apparatus and method for detecting pressure variations because of acoustic waves by modulating a preset tensile stress in a stretched thin sheet of a piezoelectric polymer. The modulation is provided by the changing stress caused by an impinging acoustic signal or the like. The piezoelectric polymer sheet under a preset tension acts effectively as a membrane resulting in a high output combined with a high resonance frequency and a wide operating frequency range.

713,060
PB80-107287 Not available NTIS
National Bureau of Standards, Washington, DC.
Interpretation of Elastic-Wave Scattering Theory for Analysis and Design of Flaw-Characterization Experiments: The Long-Wavelength Limit.
Final rept.,
J. E. Gubernatis, J. A. Krumhansl, and R. M. Thomson. May 79, 8p
Pub. in Journal of Applied Physics 50, n5, p3338-3345, May 79.

Keywords: *Acoustic scattering, *Nondestructive tests, Cracks, Scattering cross sections, Defects, Polarization(Waves), Angles(Geometry), Reprints, Born approximation.

Recently, the results of a general theory of the scattering of elastic waves from a flaw embedded in an isotropic medium were shown in the far-field limit to be compactly represented by a single vector, the f vector. Studying the f vector is thus a way to investigate systematically the dependence of the scattering on the polarization of the incident mode, scattering angle, changes in material parameters, and shape. In the long-wavelength limit the f vector is exactly determinable and exhibits significant features of the flaw. Long-wavelength scattering results for volume flaws and idealized cracks are discussed, and some of the results are compared with those of the Born approximation, which has already been calibrated by comparison to exact calculations and experiment.

713,061
PB80-117278 Not available NTIS
National Bureau of Standards, Washington, DC.
Experiments in Acoustic Emission Waveform Analysis for Characterization of AE Sources, Sensors and Structures.
Final rept.,
N. N. Hsu, and S. C. Hardy. 1978, 22p
Pub. in Elastic Waves and Non-Destructive Testing of Materials, Proceedings of the American Society of Mechanical Engineers Held at San Francisco, California on December 10-15, 1978, AMD-29, p85-106 1978.

Keywords: Elastic waves, Acoustic signals, Signal processing, Analyzing, Transfer functions, Transducers, Spectrum analysis, *Acoustic emissions, Time domain analysis.

While industrial acoustic emission (AE) applications and instrumentation developments have progressed well in recent years, the precise interpretation of AE signals remains a problem. In this paper, the authors review various signal processing techniques which have been used to characterize the detected signals, and report a simple experimental system consisting of a large plate, a mechanical step-impulse simulator, and a capacitive transducer. The transfer function of the plate can be theoretically computed; thus it provides a basis for detailed analysis. The transfer function of the capacitive transducer is shown to be true displacement measurements. The system is used to determine unknown sources in terms of force-time functions explicitly through a time-domain deconvolution algorithm. The system also provides means to characterize sensors and structures. The spectral and direct time-domain analysis are compared, and their limitations are discussed.

713,062
PB80-117435 Not available NTIS
National Bureau of Standards, Washington, DC.
Acoustooptic Modulator Intensity Servo.
Final rept.,
H. P. Layer. 1 Sep 79, 3p
Pub. in Applied Optics 18, n17, p2947-2949, 1 Sep 79.

Keywords: *Noise reduction, Bragg angle, Reprints, *Acoustooptic modulators, Acoustooptics, Bragg reflection.

A device has been constructed that combines optical isolation and amplitude noise reduction by the use of a servo controlled acoustooptic intensity modulator. The

isolation can, in principle, be perfect while the noise reduction can be significant up to about 100 kHz and as large as 80 dB at low frequency. This performance is accomplished by applying negative feedback around an acoustooptic modulator, servoing the intensity of the Bragg diffracted beam to a constant value.

713,063
PB80-131089 Not available NTIS
National Bureau of Standards, Washington, DC.
Simple Technique for Visualizing Transmitted or Reflected Sound Fields.
Final rept.,
D. J. Chwirut. Dec 79, 4p
Pub. in Mater. Eval. 37, n13, p29-32, Dec 79.

Keywords: *Acoustic fields, *Recording instruments, Ultrasonic radiation, Reprints.

A simple apparatus for recording transmitted or reflected ultrasonic fields, in longitudinal or transverse section, is described. The equipment required, in addition to the flaw detector and immersion lab scanner, consists only of two position sensors with power supplies and an analog dc X-Y plotter. This system has been used at the National Bureau of Standards (NBS) for ultrasonic transducer characterization, material evaluation, and defect detection. Examples of usage and output are presented.

713,064
PB81-207136 Not available NTIS
National Bureau of Standards, Washington, DC.
Piezoelectric Polymer Probe for Ultrasonic Applications.
Final rept.
S. Edelman, A. S. DeReggi, S. C. Roth, J. M. Kenney, and G. R. Harris. Mar 81, 7p
Pub. in Jnl. of the Acoustical Society of America 69, n3 p853-859 Mar 81.

Keywords: *Hydrophones, *Piezoelectric transducers, Hydrophone arrays, Probes, Ultrasonic frequencies, Broadband, Vinylidene resins, Reprints, Vinylidene fluoride polymers, NTISCOMNBS.

Miniature piezoelectric polymer hydrophones for ultrasonic field characterization in the low megahertz region have been developed and tested. The principal advantages of these devices over conventional hydrophones are their uniform frequency response and minimal perturbation of the field. These characteristics are achieved by rendering a small central region of a thin sheet of the polymer polyvinylidene fluoride locally piezoelectric, and then supporting the sheet in the field by holding it taut in a metal hoop having dimensions larger than the field being probed. Both single elements having diameters less than 1 mm and multielement arrays have been formed on the polymer. Methods of construction, signal amplification, and, in one design, rf shielding are discussed, and data are presented on insertion loss, sensitivity, frequency response, and immunity to rf interference.

713,065
PB81-211617 Not available NTIS
National Bureau of Standards, Washington, DC.
Characterization and Calibration of Acoustic Emission Sensors.
Final rept.
N. N. Hsu, and F. R. Breckenridge. Jan 81, 9p
Proceedings of the International Conference of Acoustic Emission held at Anaheim, CA., on September 10-13, 1979.
Pub. in Materials Evaluation 39, n1 p60-68 Jan 81.

Keywords: *Detectors, Calibrating, *Acoustic emissions, NTISCOMNBS.

It is generally agreed that AE sensor calibration is necessary to the quantification of AE technology. However, how a sensor should be calibrated remains a question subject to argument. In this paper, the authors first discuss conceptually how a sensor can be characterized, and what assumptions must be made to facilitate the actual calibration. The selection of a specific calibration technique depends on the particular application. A criterion for the selection is also discussed. Then various suggested calibration techniques are compared in terms of underlying principles and assumptions, specific methods and procedures, and limitations and advantages. The helium gas jet technique and the reciprocity technique are reviewed. The stepforce calibration technique is described in detail. Sample calibration results of a commercial sensor are shown.

713,066
PB82-112681 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface-Wave Displacement: Absolute Measurements Using a Capacitive Transducer.
Final rept.
F. R. Breckenridge, and M. Greenspan. Apr 81, 9p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Jnl. of the Acoustical Society of America 69, n4 p1177-1185 Apr 81.

Keywords: *Surface waves, Measurement, Reprints.

The authors have constructed a capacitive transducer for the absolute measurement of the normal component of surface-wave motion on a flat solid, the direction of travel of the wave being known.

713,067
PB82-229345 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Ultrasonic Research Summary Report and Literature Guide to the National Bureau of Standards/ Office of Naval Research Program.
M. Greenspan, and D. G. Eitzen. Jun 82, 11p NBSIR-82-2529
Sponsored in part by Office of Naval Research, Arlington, VA.

Keywords: *Acoustics, *Sound transmission, Underwater sound, Transducers, Bibliographies, Reviews, National Bureau of Standards.

This brief report summarizes research efforts in physical acoustics at the National Bureau of Standards (NBS) which were partially supported by the Office of Naval Research (ONR). It summarizes what is thought to be many of the major accomplishments at NBS in the area of physical acoustics from 1948 to 1981. The published literature documenting these accomplishments is listed.

713,068
PB83-142844 Not available NTIS
National Bureau of Standards, Washington, DC.
Inhomogeniety Size and Shape Determination from Scattering of Low-Frequency Sound Waves.
Final rept.
R. D. Mountain, and G. Birnbaum. May 82, 4p
Pub. in Jnl. of Applied Physics 53, n5 p3581-3584 May 82.

Keywords: *Acoustic scattering, Sound waves, Scattering cross sections, Nondestructive tests, Reprints, Born approximation.

The scattering of sound waves by isolated inhomogenities in a solid is examined using the Born approximation. A procedure is developed to extract information about the size and shape of the scatterer. The procedure uses data from the long wavelength region where this approximation is valid. The size and shape information is in the form of special moments of the volume of the scatterer which depend on the orientation of the scatterer relative to the direction of the difference in the incoming and outgoing wavevectors. A scheme is described which permits the characterization of the scatterer in terms of an equivalent ellipsoid. The scheme provides a second-moment solution of the inverse scattering problem.

713,069
PB84-216985 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of 'Corner Microphones' for Sound Power Measurements in a Reverberation Chamber.
Final rept.
T. W. Bartel, S. L. Yaniv, and D. R. Flynn. Dec 83, 7p
Pub. in Jnl. of the Acoustical Society of America, v74 n 6 p1794-1800 Dec 83.

Keywords: *Acoustic measurement, Reverberation, Test chambers, Microphones, Power measurement, Reprints.

A comparison was made between acoustic measurements conducted with microphones mounted in the trihedral corners of the 425-m3 NBS reverberation chamber and similar measurements using microphones located in the room interior, away from the room boundaries. Measurements of broad-band and discrete-frequency sound pressure and of reverberation time were included.

713,070
PB84-227040 Not available NTIS
National Bureau of Standards, Washington, DC.
Line Source and Site Characterizations for Defining the Sound Transmission Loss of Building Facades.
Final rept.
F. F. Rudder. Mar 83, 22p
Pub. in Jnl. of Sound and Vibration, v91 n3 p403-424 Mar 83.

Keywords: *Buildings, *Sound transmission, Noise(Sound), Reprints, *Acoustic attenuation.

An analytical model is presented for defining the sound transmission loss of building facades exposed to noise from line sources. The model describes the non-diffuse sound field incident upon the facade in terms of both source and site parameters. The effects of facade orientation relative to the line source and the sound propagation with distance are introduced as a single term in the definition of the facade sound transmission loss. This term defines a mean angle of incidence for the exterior sound field that is equivalent to a point source location relative to a point on the facade. Numerical results are presented estimating the magnitude of these effects and it is shown that alternate methods for conducting field measurements of building facade sound transmission loss may be related using this model.

713,071
PB85-120699 Not available NTIS
National Bureau of Standards, Washington, DC.
Further Development and Clinical Evaluation of the Expanding Aperture Annular Array System.
Final rept.
S. I. Parks, M. Linzer, and T. H. Shawker. 1979, 6p
Pub. in Jnl. of Ultrason. Imag. 2, n4 p378-383 1979.

Keywords: *Ultrasonic radiation, Focusing, Sensitivity, Reprints, *Imaging techniques.

This paper describes a more sensitive version of the expanding aperture annular array system reported recently. A preliminary clinical evaluation is presented.

713,072
PB85-134062 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Acoustical Holography with an Annular Aperture.
Final rept.
S. J. Norton. 1982, 10p
Pub. in Jnl. of the Acoustical Society of America 71, n5 p1169-1178, 5 May 82.

Keywords: *Holography, Apertures, Resolution, Reprints, *Acoustic holography, Imaging techniques, Ultrasonic holography, Synthetic apertures.

A synthetic-aperture imaging system using an annular array of transducer elements is analyzed. The aperture is assumed to consist of N elements, where each element serves both as a source and receiver of sound, giving rise to (N squared) amplitude and phase measurements around the annular circumference. Because of source-receiver reciprocity, however, (N/2)(N-1) of these measurements (where (N/2(N-1) is the number of element pairs on the annulus) are redundant, giving a total of (N squared)-(N/2)(N-1) = (N/2)(N+1) independent pulse-echo measurements. It is shown how suitable processing of these measurements can yield a high-resolution image of a reflecting object in a plane parallel to the annulus and located within its Fresnel region. Moreover, the resultant resolution is shown to be equivalent to that of a full circular aperture twice the diameter of the annulus. This approach differs from the (J squared)-synthesis of Wild in that the annular array acts as a source as well as a receiver and that no assumptions regarding the spatial coherence of the reflecting object are required. Numerical reconstructions based on simulated data are presented. Possible areas of application of the annular imaging system include medical ultrasonic imaging, underwater acoustic imaging, and microwave imaging.

713,073
PB85-141547 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Analog Measurement Intensity for Band-Limited Noise in a Standing-Wave Tube.
Final rept.
T. W. Bartel, S. L. Yaniv, and R. K. Cook. Nov 84, 4p
Pub. in Jnl. of Acoustical Society of America 76, n5 p1573-1576 Nov 84.

Keywords: Sound waves, Standing waves, Acoustic measurement, Analog systems, Computation, Bandwidth, Reprints, *Sound intensity, Standing wave tubes.

The analog computation of acoustic intensity to determine the sound power radiated from an open ended standing-wave tube (R.K. Cook and T.M. Proctor, J. Acoust. Soc. Soc. 65, 1542-1555 (1979)) was extended to sound waves composed of band-limited random noise. The bandwidth extension was achieved through the use of a two-channel wideband pi/2 phase shifting network. Comparison with the free-field method for determining sound power yielded agreement within 0.25 dB for bandwidths of 1/3-octave.

713,074
PB85-145381 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Choosing Among Intense Acoustic Background Stimuli - Acoustic Menu.
Final rept.
G. A. Zerdy, and J. A. Molino. 1974, 1p
Pub. in Jnl. of the Acoustical Society of America 56, n8 64p 1974.

Keywords: *Noise(Sound), *Acoustics, *Stimulus(Psychophysiology), Loudness, Noise pollution, Responses, Frequencies, Human behavior, Reprints, Preferences.

Preferential relations among acoustic stimuli were determined for human subjects by a procedure that employed no verbal descriptions of the stimuli. Stimuli were presented in pairs to subjects as they studied Russian on a teaching machine. Thirteen different subjects were employed in each of two experiments. They were instructed that they could 'change the sounds that you hear' by pressing a telegraph key. Each key press switched the acoustic background from the current to the alternate member of a stimulus pair. The pair member presented was alternated periodically independently of the subjects' responses. The stimuli were four pure tones (125, 1000, 4000, and 8000 Hz at A-weighted sound levels ranging from 90 - 112 dB) and a low-level white noise. The proportion of time which subjects spent in the acoustic background stimuli varied significantly as a function of frequency even though equivalent A-weighted sound levels were presented. This finding suggests that A-weighting the sound levels does not accurately describe the preference (indifference) relationships among the stimuli employed.

713,075
PB85-151694 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Acoustical Laboratory Accreditation Program of the United States.
Final rept.
R. J. Peppin, and D. B. Thomas. 1984, 4p
Pub. in Proceedings of Federation of Acoustical Societies of Europe, Sandefjord, Norway, August 21-24, 1984, p139-142.

Keywords: *Test facilities, *Laboratories, *Acoustic measurement, *Accreditation, National Voluntary Laboratory Accreditation Program.

Laboratory accreditation is the determination and recognition that a laboratory has the competence to carry out specific tests or calibrations. In the field of acoustical testing, the United States currently has a program to accredit laboratories. It is the National Voluntary Laboratory Accreditation Program (NVLAP) which is operated by the National Bureau of Standards. The purpose of the NVLAP is to provide a testing laboratory examination service over a broad range of product areas wherever a need is identified. The Acoustics Laboratory Accreditation Program (Acoustics LAP) of NVLAP was implemented in September, 1982, at the request of an acoustical insulation manufacturer. Laboratories can request NVLAP accreditation for one or more of 50 national and international test methods. These methods involve the measurement of the acoustical properties of materials and the sound power and sound pressure levels of products such as industrial machinery, office machines, and motor vehicles. Laboratories interested in applying for accreditation of their acoustical testing services will receive an application package which includes a list of test methods in the product area of interest, a statement of fees for participation, and a handbook which describes the technical requirements for accreditation.

713,076
PB85-170660 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analytical Approach to Acoustic Emission Signal Processing: Problems and Progress.
Final rept.
N. N. Hsu, and D. G. Eitzen. Oct 84, 9p
Pub. in Proceedings of Int. Acoustic Emission Symposium (7th), Progress in Acoustic Emission 2, Zao, Japan, October 23-26, 1984, p326-334.

Keywords: *Signal processing, Greens function, *Acoustic emissions.

The detected AE voltage waveform is considered as the convolution of (1) the source waveform, (2) the Green's function of the structure and (3) the transduction function of the detector. The authors have demonstrated, both in concept and in controlled experiment, that knowing two of the three functions the remaining unknown function can be determined. However, to solve any of the three the other two must be precisely determined. Many problems remain to be solved. The authors have made some progress in the understanding of these problems. Specifically they will report on the: 1. Design and characterization of simulated transient AE sources. 2. Development of techniques for experimental determination of Green's functions. 3. Development of a new test configuration for AE source characterization for material studies. Finally the authors make some remarks on the comparison of the various approaches to AE waveform analysis.

713,077
PB85-172476 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Appendix to 'A New Method of Acoustic Emission Transducer Calibration' by Masayasu Ohtsu and Kanjo Ono.
Final rept.
F. R. Breckenridge, and T. Watanabe. Jun 84, 10p
See also AD-A149 837. Sponsored by Army Research Office, Research Triangle Park, NC.
Pub. in Jnl. of Acoustic Emission 3, n2 p59-68 Jun 84.

Keywords: *Transducers, *Calibration, Voltage, Greens function, Frequencies, Emission, Reprints, *Acoustic measurement.

A new method of acoustic emission transducer calibration is developed using numerical solutions of Green's functions in a half space. This method allows transducer calibration without employing elaborate equipment. The calibration curves obtained for six transducers by the present method agree with results obtained by the Nippon Steel Corporation and the National Bureau of Standards.

713,078
PB85-202653 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Correcting for Ray Refraction in Velocity and Attenuation Tomography: A Perturbation Approach.
Final rept.
S. J. Norton, and M. Linzer. 1982, 33p
Pub. in Ultrason. Imag. 4, n3 p201-233 1982.

Keywords: *Ultrasonic radiation, *Refraction, *Acoustic refraction, Acoustic velocity, Perturbation theory, Correction, Reprints, *Tomography, Acoustic attenuation.

In velocity and attenuation tomography, ray refraction leads to errors in time-of-arrival, as well as to errors in attenuation due to phase cancellation and lateral beam displacement. Some authors have proposed iterative techniques based on ray tracing to correct for these effects. In this paper, the authors consider an alternative approach using a perturbation analysis of refraction. This approach requires neither iteration nor ray tracing. In both two and three dimensions, the perturbation approach is much simpler computationally than ray tracing methods. Computer simulated reconstructions are presented which clearly show the improvement that can be achieved with the second-order time delay correction.

713,079
PB85-202901 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Scattering of Sound Waves by Inhomogeneities: Time Domain Analysis.
Final rept.
R. D. Mountain, and G. Birnbaum. 1984, 7p
Pub. in Nondestructive Testing Communications 1, p219-225 1984.

Keywords: *Acoustic scattering, *Nondestructive tests, Acoustic measurement, Ultrasonic tests, Solids, Reprints, Born approximation.

The scattering of sound waves by isolated inhomogeneities in an otherwise uniform solid is analyzed using the Born approximation in the time domain. The volume and shape of the scatterer is related to time moments of the amplitude of the scattered signal. The matching of the incident pulse shape to the size of the scatterer is found to be essential if this type of measurement is to yield useful results.

713,080
PB85-242162 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Product Standards Policy.
Acoustics LAP (Laboratory Accreditation Program) Handbook. Operational and Technical Requirements of the Laboratory Accreditation Program for Acoustical Testing Services.
R. L. Gladhill, W. A. Hall, J. Horlick, and H. W. Berger. Jul 85, 32p NBSIR-85/3199

Keywords: *Laboratories, Acoustics, Requirements, Accreditation.

The document explains the operational and technical requirements of the Laboratory Accreditation Program (LAP) for Acoustics (Acoustics LAP). All of the steps leading to accreditation are discussed. Technical requirements are explained indicating how the NVLAP criteria are applied. It is intended for use by staff of accredited laboratories, those seeking accreditation, other laboratory accreditation systems, and others needing information on the requirements for NVLAP accreditation under this LAP.

713,081
PB86-119252 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD.
Acoustical Research in the Physical Sciences - Properties of Gases, Liquids, and Solids.
Final rept.
M. Greenspan. 1980, 7p
Pub. in Jnl. of the Acoustical Society of America 68, n1 p29-35 1980.

Keywords: *Acoustics, Ultrasonic radiation, Acoustic absorption, Reprints, Dispersion.

In June, 1979 the Acoustical Society of America celebrated its 50th anniversary at its 97th meeting in Cambridge, Mass. As a special feature there was held each day a plenary session, attended by about 1000 people, at which the history, from 1929 until the present, of the several branches of acoustics was treated by about a dozen speakers. The present author was chosen to speak for one-half hour on physical acoustics as it relates to other branches of physics. The paper is a nearly verbatim rendering of this talk. It is intended to be intelligible to the non-specialist and has only one equation. The major emphasis is on relaxation phenomena in fluids.

713,082
PB86-124104 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Traceability of Acoustical Instrument Calibration to the National Bureau of Standards.
Final rept.
V. Nedzelnitsky. 1980, 4p
Pub. in Proceedings of International Conference on Noise Control Eng. Noise Control for the 80's, Miami, FL., December 8-10, 1980, Inter-Noise 80, v2 p1043-1046.

Keywords: *Acoustic measurement, *Calibrating, *Microphones, Electroacoustic transducers, Metrology.

The necessity for the National Bureau of Standards (NBS) to provide absolute, reciprocity-based pressure and free-field calibrations of measuring microphones sufficiently accurate for the most critical needs creates

a hierarchy of instrument calibration establishing direct or implied chains of 'traceability' to the NBS. Different users have differing needs so that 'traceability' is not the same concept for all users. In analyzing various definitions of traceability, Belanger ('Traceability: An Evolving Concept,' ASTM Standardization News, Jan. 1980, pp. 22-27) described two contrasting views. Each of these views is shown in the present paper to represent the primary concern of a group of users of the NBS acoustic calibration services. Whichever view is employed, the value of a given system for realizing traceability depends on that system's capacity to ensure measurements of adequate accuracy.

713,083
PB86-185303 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Gas-Filled Spherical Resonators: Theory and Experiment.
Final rept.
M. R. Moldover, J. B. Mehl, and M. Greenspan. Feb 86, 18p
Pub. in Jnl. of the Acoustical Society of America 79, n2 p253-270 Feb 86.

Keywords: *Acoustic resonators, Acoustic velocity, Argon, Thermodynamic properties, Reprints.

Gas-filled spherical resonators are excellent tools for routine measurement of thermophysical properties. The radially symmetric gas resonances are nondegenerate and have high Q's (typically 2000-10,000). Thus they can be used with very simple instrumentation to measure the speed of sound in a gas with an accuracy of 0.02%. The authors have made a detailed study of a prototype resonator filled with argon (0.1-1.0 MPa) at 300 K, with the objective of discovering those phenomena which must be understood to use gas-filled spherical resonators to measure the thermodynamic temperature and the universal gas constant R. The resonance frequencies f(N) and half-widths g(N) were measured for nine radially symmetric modes and nine triply-degenerate nonradial modes with a precision near 10 to the -7th power f(N). The data were used to develop and test theoretical models for the geometrically simple oscillating system.

713,084
PB86-188471 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.
Transient Waves in an Elastic Plate: Theory and Experiment Compared.
Final rept.
T. M. Proctor, F. R. Breckenridge, and Y. H. Pao. 1983, 3p
Pub. in Jnl. of the Acoustical Society of America 74, n6 p1905-1907 1983.

Keywords: *Waveforms, Detectors, Transducers, Reprints, *Acoustic emissions.

Waveforms calculated by generalized ray theory for a thick plate driven by a step-function point force are compared with experimental waveforms obtained on a glass plate using an improved piezoelectric displacement-sensing transducer.

713,085
PB86-239969 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Electrical Performance Tests for Audio Distortion Analyzers.
Final rept.
O. B. Laug, G. N. Stenbakken, and T. F. Leedy. Jan 86, 161p NBS/TN-1219
Sponsored by Army Communications-Electronics Command, Fort Monmouth, NJ.

Keywords: *Sound analyzers, Performance tests, Distortion, Computer programs.

Electrical performance test procedures for audio distortion analyzers were developed by the National Bureau of Standards for the U.S. Army Communications-Electronics Command. The report provides detailed, step-by-step test procedures that are based on specifications supplied by the Army for purposes of evaluating audio distortion analyzer bid samples. Examples of data sheets and tables are also provided for recording interim and final results. The report discusses the philosophy of each measurement procedure with a view toward providing an understanding of the basic metrology required to perform the measurements. In addition, the sources of measurement error are discussed. The primary applications and basic principles of modern audio distortion analyzers are also presented.

713,086
PB87-110086 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Uncertainties in the Cross-Spectral Method for Acoustic Intensity under Semireverberant Conditions.
Final rept.
M. Villot, T. W. Bartel, and S. L. Yaniv. 1986, 11p
Pub. in Jnl. of the Acoustical Society of America 79, n3 p691-701 Mar 86.

Keywords: *Acoustic measurement, Intensity, Reprints.

Measurements were performed, under semireverberant conditions, to examine uncertainties in the two-microphone cross-spectral method for determining acoustic intensity. Calculations of the pressure gradient error, the error associated with the correction for phase mismatch, and the cross-spectrum random error are discussed. The results of preliminary tests performed under free-field and plane-wave conditions are also presented. The influence of semireverberant conditions on the accuracy of the intensity measurement was studied through the use of a standing-wave tube as a reference sound source. With the tube source placed in a 112-cu m room having reverberation times of about 0.5 s, the radiated power was determined both from the intensity measured inside the tube and from the intensity integrated over a spherical surface enclosing the source.

713,087
PB87-134276 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Practical Sound-Reducing Enclosure for Laboratory Use.
Final rept.
D. Hils, J. E. Faller, and J. L. Hall. 1986, 3p
Pub. in Review of Scientific Instruments 57, n10 p2532-2534 Oct 86.

Keywords: *Acoustic absorption, *Enclosures, Laboratory equipment, Noise reduction, Design, Reprints, Acoustic attenuation.

The authors describe the design of a sound-reducing laboratory enclosure. The unit fits directly over the experiment and is hoisted to the ceiling during setup and adjustment stages. The advantages of the design are its modest cost, saving of space, and the fact that no door is required. The average sound isolation achieved is 30 dB, typical for a wall mass per unit area of 35 kg/sq m.

713,088
PB87-134482 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Institute of Electrical and Electronics Engineers (IEEE) Ultrasonics Symposium.
Final rept.
G. V. Blessing. 1986, 3p
Pub. in Ultrasonics 24, n6 3p Nov 86.

Keywords: *Meetings, Reprints, *Ultrasonics.

The IEE 1985 Ultrasonics Symposium, a three-day international conference held in San Francisco 16-18 October of 1985, is reviewed here. The Conference covers the theory, development, and application of ultrasonic techniques and tools. Over one-third of the papers presented were from outside the United States. Symposium proceedings have been published and are available from the IEEE publishing headquarters in New Jersey.

713,089
PB87-149803 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Reconstructing Spatially Incoherent Random Sources in the Near Field: Exact Inversion Formulas for Circular and Spherical Arrays.
Final rept.,
S. J. Norton, and M. Linzer. 1984, 7p
Pub. in Jnl. of the Acoustical Society of America 76, n6 p1731-1737 1984.

Keywords: *Ultrasonic radiation, Reprints, Inverse problems, Near field.

The authors consider the inverse problem for a 2-dimensional, spatially-incoherent random source. Under these assumptions, the authors show that an exact inversion formula can be derived for recovering the source spectral intensity, as a function of position, from near-field measurements of the emitted radiation recorded on the circumference of a circle enclosing the source region. Although solutions to the inverse random source problem have been reported in the past, these results have almost employed far-field approximations. After deriving the inversion formula in two dimensions. The authors discuss an efficient method for numerically evaluating this formula using the fast Fourier transform algorithm. Finally, a generalization of the inverse problem to a 3-D source enclosed by a spherical recording surface is given.

713,090
PB87-233334 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Measurement of RF Signal Generator Phase Noise Using a One-Generator Delay-Line Method.
Final rept.,
R. T. Adair, R. L. Ehret, and E. M. Livingston. 1986, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-35, n4 p496-502 Dec 86.

Keywords: Reprints, *Delay line, *Frequency stability, Phase modulation, Phase noise, RF signal generators, Spectral density.

A technique is described which utilizes a single generator and a delay line for the measurement of frequency-domain phase noise in synthesized signal generators. Terms are defined and equations developed for theory and calculations of normalized phase-noise sideband power in a 1-Hz bandwidth offset 20 kHz from signal frequencies of interest. The system described covers the range from 0.45 to 2000 MHz. The function and contribution of each component in the measurement system is presented. Advantages of the method are discussed and a brief error analysis is given.

713,091
PB87-233649 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Comments on 'Speed of Sound in Standard Air' (Journal of the Acoustical Society of America 79, p1359-1366 1986).
Final rept.,
M. Greenspan. Jul 87, 3p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of the Acoustical Society of America 82, n1 p370-372 Jul 87.

Keywords: *Acoustic velocity, Equations of state, Air, Correction, Reprints.

In the subject paper, Wong recommended that the commonly used value for the speed of sound in air at STP be revised. The method he used to allow for gas imperfection, which is the only question at issue, is incorrect; the correct method, which has been described in many papers, texts, and reference books, is here briefly summarized. Wong's problem is used as an example. The 'old' value (C sub 0, sup 1) = 331.44 m/s, is correct.

Fluid Mechanics

713,092
PB-266 944/8 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, Colo. Cryogenics Div.
Cryogenic Design and Safety Review, NASA-Langley Research Center 0.3 Meter Transonic Cryogenic Tunnel,
R. O. Voth, and T. R. Strobridge. Apr 77, 28p
NBSIR-77-857
Sponsored in part by National Aeronautics and Space Administration, Langley Station, Va. Langley Research Center.

Keywords: *Test facilities, *Transonic flow, Liquid nitrogen, Cryogenics, Hazards, Safety engineering, Cost analysis, Recommendations, Systems engineering, Structural design, *Liquefied gas tunnels, *Cryogenic tunnels.

The findings of a Cryogenic Design and Safety Review of the NASA-Langley 0.3 m Transonic Cryogenic Tunnel are presented in this report. The tunnel working fluid and coolant is nitrogen. The nitrogen, supplied as liquid, is exhausted as a low temperature gas. The use and storage of liquid nitrogen at the facility presents several potential hazards to personnel and equipment. An appropriate cryogenic design minimizes these risks, and provides for convenient tunnel operation and for the economical use of the liquid nitrogen. The tunnel and ancilliary systems are generally well designed but several recommendations to improve the cryogenic systems are made. The cost of recovering the cold vent gas is compared to the cost of producing the required liquid nitrogen using a captive air separation plant. Although the economic analysis is preliminary, it shows that because of the periodic operation of the tunnel, a captive air separation plant has a lower annual operating cost than the vent gas recovery systems considered.

713,093
PB-273 094/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Progress Report on Cryogenic Flowmetering at the National Bureau of Standards.
Final rept.,
J. A. Brennan, J. F. LaBrecque, and C. H. Kneebone. 1976, 16p
Sponsored in part by American Gas Association, Inc., Arlington, Va., and Compressed Gas Association, Inc., New York, N.Y.
Pub. in Proceedings Biennial Symposium Instrumentation in the Cryogenic Industry (1st), Houston, Texas, October 11-14, 1976, 1, p621-1-621-16 1976.

Keywords: *Cryogenics, *Flowmeters, Liquefied gases, Argon, Liquid oxygen, Flow measurement, Liquid argon.

Three years experience with cryogenic flowmeter transfer standards is reviewed with emphasis on their long term stability. Some statistically significant trends are identified and analyzed. Results of some brief flowmeter tests in liquid argon and liquid oxygen are also presented. Some early results from an LNG flowmetering program are also included.

713,094
PB-273 535/5 PC **E14**/MF **A01**
National Bureau of Standards, Washington, D.C. Mechanics Div.
Flow Measurement in Open Channels and Closed Conduits.
Final rept.,
L. K. Irwin. Oct 77, 982p NBS-SP-484-Vols-1/2
Proceedings of the Symposium Held at the National Bureau of Standards in Gaithersburg, Maryland on February 23-25, 1977. Volumes 1 and 2. Library of Congress Catalog Card no. 77-14243.

Keywords: *Open channel flow, *Pipe flow, *Flow measurement, *Meetings, Water flow, Waste water, Flue gases, Petroleum products, Natural gas, Flowmeters, Stream gages, Anemometers, Mathematical models.

The wide range and complexity of problems and potential solutions that must be considered for useful flow measurements are emphasized by the papers contained in these proceedings. Fifty-three presentations cover: characteristics of new and improved instruments; applications of traditional and new measuring devices in field environments; procedures for identifying and analyzing errors or uncertainties in data under specific conditions; uses of physical and numerical models; politico-economic changes that affect international standards for flow measurement; and philosophical bases for making measurements. The fluids of most interest are water and waste water, petroleum and related refined products, air, natural gas and stack gas. Experimental and analytical investigations on instrument performance and interpretation of results include innovative applications of traditional and new flow measurement techniques to fluid flows in open channels and closed conduits. The traditional devices or techniques include weirs, flumes, current meters, orifice plates, turbines, hot-wires, pitot-static tubes, velocity traverses, dye-dilution, and others. More recent instrumentation developments and procedures such as laser doppler anemometry, acoustic and thermal imaging, acoustic pulse velocity and doppler anemometry, numerical modeling, vortex shedding and digital computation are covered for particular measurement purposes. The most significant trend reflected in these presentations is the general awareness that uncertainties in measured quantities at the lowest point in the measurement chain, i.e., in the field or plant, are more important than accuracy statements derived from controlled laboratory studies. Other trends in evidence are the rising importance of turbine meters for use as transfer standards and in-line measurements of liquids and gases in filled pipes and the increasing number of applications for acoustics and laser technology for flow measurements in both open channels and closed conduits.

713,095
PB-274 650/1 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Fluid Meters Section.
Computer Code for the Simulation of Turbulent Swirling Flow Through Closed-Conduit Flow Meters.
Final rept.,
R. W. Davis, and E. F. Moore. Dec 77, 13p NBSIR-77-1394

Keywords: *Flowmeters, *Turbulent flow, Computerized simulation, Fluid flow, Swirling, Pipe flow, Closed conduits, TEACH computer code.

A computer code is presented for the simulation of turbulent swirling flow through closed-conduit flow meters. The code is reasonably fast and accurate. The response of a flow meter to changes in its operating environment is easily assessed. Through the use of computer plotting routines, a complete picture of the flowfield through a meter can be obtained. An example flowfield for a target meter is presented.

713,096
PB-281 049/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Experimental Tests of Some Integral Rheological Relations.
Final rept.,
E. A. Kearsley, and L. J. Zapas. 1976, 5p
Pub. in Trans. Soc. Rheol 20, n4 p623-637 1976.

Keywords: *Rheological properties, *Shear flow, *Polymers, Solutions(Chemistry), Stress analysis, Tests, Polyisobutylene, Reprints, *BKZ fluid.

Some new rheological relations are derived for the BKZ fluid in shear. These relations all involve integrals rather than derivatives of stress measurements. For suddenly applied constant rate of shear, several relations are found connecting a) time-dependent normal-stress at one shear rate to integrals of time-dependent shear-stress over shear-rate and time, b) time-dependent shear-stress to integrals of time-dependent normal-stess over shear-rate and time, c) an integral over time of normal-stress to an integral over shear rate of steady-state shear-stress and d) an integral over time of shear-stress to an integral over shear-rate of normal-stress. For sudden cessation of steady shear a rheological relation is found connecting an integral over time of shear-stress to an integral over shear-rate of normal-stress. These relations are tested with data from measurements on PIB solutions. The results suggest that time-dependent normal-stress data are not reliable. Within this limitation, the results are consistent with the requirements of a BKZ fluid. A rheological relation appropriate to single-integral rate-type constitutive equations is examined also and found to be inconsistent with the data, as is the van Es and Christensen test.

713,097
PB-281 050/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some New Integral Rheological Relations.
Final rept.,
E. A. Kearsley. 1976, 2p
Pub. in Proceedings of Int. Congress on Rheology (7th), Gothenburg, Sweden, Aug 23-27, 1976, p576-577.

Keywords: *Rheological properties, *Shear flow, *Polymers, Stress analysis, Solutions(Chemistry), *BKZ fluid, Reprints.

Some new rheological relations are derived for the BKZ fluid in shear. These relations all involve integrals rather than derivatives of stress measurements. For suddenly applied constant rate of shear, relations are found connecting a) normal-stress to integrals of shear-stress over shear-rate and time, b) shear-stress to integrals of normal-stress over shear-rate and time, c) an integral over time of normal-stress to an integral over shear-rate of steady-state shear-stress and d) an integral over time of shear-stress to an integral over shear-rate of normal-stress. For sudden cessation of steady shear a rheological relation is found connecting an integral over time of shear-stress to an integral over shear-rate of normal-stress.

713,098
PB-281 501/7 PC **A17**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Hydraulic Research in the United States and Canada, 1976.
Special pub.,
P. H. Gurewitz. Apr 78, 378p NBS-SP-497
Library of Congress Catalog Card no. 73-60019. See also report dated Jun 76, PB-254 464.

Keywords: *Hydraulics, *Hydrodynamics, Research projects, United States, Canada, Universities, Industries, Hydraulic laboratories, State government, National government, Abstracts, Model tests, Announcement bulletins.

Current and recently concluded research projects in hydraulics and hydrodynamics for the years 1975-1976 are summarized. Projects from more than 200 university, industrial, state and federal government laboratories in the United States and Canada are reported.

713,099
PB-283 055/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Critical Phenomena in a Low Gravity Environment.
Final rept.,
J. V. Sengers, and M. R. Moldover. 1978, 12p
Prepared in cooperation with Maryland Univ., College Park. Center of Materials Research, and National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.
Pub. in COSPAR: Space Research, v18 p495-506 1978.

Keywords: *Criticality, *Fluids, *Space processing, Gravity.

The study of critical phenomena in fluids is related to some very general issues in materials science. Earth-bound experiments near the critical point of fluids are severely affected by the presence of the earth's gravitational field. If critical phenomena experiments in fluids were conducted in a low gravity environment, the results might be of interest to materials science in general.

713,100
PB-284 731/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Extensions of the Lax-Wendroff Method.
Final rept.,
C. Hunter. Jun 78, 6p
Sponsored in part by National Science Foundation, Washington, D.C.
Pub. in Jnl. of Computational Physics Note 27, n3 p447-452, Jun 78.

Keywords: *Fluid dynamics, *Hydrodynamics, Numerical analysis, *Lax-Wendroff method, Reprints.

The Taylor series expansion in time that Lax and Wendroff used to derive their algorithm can clearly be applied to equations that are not in conservation law form. This note considers certain specific applications in fluid dynamics, and shows that such expansions can lead to unstable difference schemes. Fortunately, the difference schemes can also be recast in stable forms. The instabilities that may occur are not primarily due to the fact that we deal with equations that are not of conservation form, but can also arise with equations of conservation form when staggered grids are used.

713,101
PB-288 105/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Transfer Standards in Cryogenic Flow Measurement.
Final rept.
J. A. Brennan, C. H. Kneebone, and E. Jenkins.
1978, 10p
Pub. in Proceedings of Conference, Flow Measurement of Fluids, Groningen, Netherlands, 11-15 Sep 78 p503-512 1978. (North-Holland Publ. Co., New York, NY.)

Keywords: *Cryogenics, *Flowmeters, Flow measurement, Flow rate, Temperature, Liquefied gases, Fluid flow, Nitrogen, Argon, Oxygen.

The use of transfer or secondary standards for testing custody transfer flowmeters is described. Test procedures and recommended practices developed during five years experience are included where appropriate. Test results showing the effect of fluid temperature, flow rate, flowmeter interchangeability and transfer standard stability during tests in liquid nitrogen are shown. Results of some comparative testing using liquid nitrogen, liquid argon and liquid oxygen are also included. Apparent flowmeter fluid dependencies are discussed relative to the fluid PVT and flow facility uncertainties.

713,102
PB-290 982/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Numerical Solutions for Turbulent Swirling Flow Through Target Flowmeters.
Final rept.
R. W. Davis, E. F. Moore, G. E. Mattingly, and R. W. Miller. 1978, 11p
Pub. in Proceedings of the American Society of Mechanical Engineers 1978 Winter Annual Meeting Held at San Francisco, CA. on December 10-15, 1978, 78-WA/FM-4, p1-11, 1978.

Keywords: *Turbulent flow, *Flowmeters, Fluid dynamics, Reynolds number, Flow measurement, Mathematical models.

The turbulent incompressible flow through axisymmetric target flowmeters is modeled using the two-equation K epsilon-turbulence model developed at Imperial College, London. A variety of target disk diameters are examined through a range of Reynolds numbers for different inlet axial velocity profiles. The effects of swirling inlet flow are also tested, as are the effects of different target disk thicknesses. The results indicate that target flowmeter performance can be markedly affected by variations in inlet axial velocity profile and swirl distribution. A comparison between computed and experimental flow coefficients is made.

713,103
PB-291 784/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Several Relations for Comparison of a General Rate Fluid and the BKZ Fluid.
Final rept.,
S. J. Chang, and L. J. Zapas. 1976, 2p
Sponsored in part by Energy Research and Development Administration, Oak Ridge, TN. Oak Ridge Operations Office.
Pub. in Proceedings of the International Congress on Rheology (7th), Gothenburg, Sweden, August 23-27, 1976, p566-567, 1976.

Keywords: *Fluid flow, Viscoelasticity, Rheology, Shear flow, Shear stresses, Shear rate, Reprints, BKZ fluid, Rate fluid.

In the framework of a general rate fluid and a BKZ fluid the stress components for a shearing flow history can be obtained from a knowledge of the behavior in other flow histories. In some cases the two fluids are indistinguishable. To avoid specialized forms of either fluid we obtained a set of rheological relations (relations which are independent of the material properties) for two flow histories, stress relaxation after shear and suddenly applied steady shear. It is found that the relations are identical for the two fluids only in shear rates in the range of a second order fluid.

713,104
PB-295 172/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Motion of Bubbles in a Vertical Temperature Gradient.
Final rept.,
S. C. Hardy. 15 Mar 79, 6p
Pub. in Jnl. of Colloid and Interface Science 69, n1, p157-162, 15 Mar 79.

Keywords: *Bubbles, *Temperature gradients, Silicones, Oils, Buoyancy, Interfacial tension, Bubble dynamics, Marangoni forces, Reprints.

The motions of air bubbles in a viscous silicone oil in response to buoyancy and Marangoni forces have been studied. The Marangoni forces are produced by establishing a temperature gradient in the oil which generates a surface tension gradient over the bubbles. From the thermal gradients required to balance the buoyancy and Marangoni forces, the temperature dependence of the surface tension gamma prime, is found to be -0.055 mJ/Sq m. This is in agreement with an independent measurement of gamma prime using the pendant drop technique.

713,105
PB-296 441/9
(Order as PB-296 439/3, PC **A05**/MF **A01**)
National Measurement Lab., Chippendale (Australia).
Psychrometric Wet Elements as a Basis for Precise Physico-Chemical Measurements,
R. G. Wylie. 30 Oct 78, 17p
Included in Jnl. of Research of the National Bureau of Standards, v84 n2 p161-178, Mar-Apr 79.

Keywords: *Psychrometers, Air flow, Fluid flow, Flow measurement, Temperature, Boundary layer flow, Laminar flow, Moisture content, Accuracy.

Under appropriate conditions, psychrometric wet elements of simple design can be highly reproducible in behavior. A temperature depression of 10K can be reproducible from element to element within 2 mK. The properties of a wet element can be determined very accurately by direct comparisons with other wet elements in a common airstream. Comparisons with one specially developed type show the effects of practical water-retaining coverings. Comparisons with another type, which simulates the fully calculable flat-plate system, then give the behavior in absolute terms. A cotton-yarn covering increases the psychrometer coefficient A by only 0.2 percent. The departure of the flow around a cylinder from laminar boundary-layer flow increases it by 0.7 percent. The background and theory are outlined. The detailed behavior of cotton-yarn covered cylinders is deduced from element comparisons; and their absolute value of A obtained as a function of diamter, airspeed, and the temperature, pressure and water content of the airstream. The dependence of A on these parameters is essentially simple. The work leads to a large increase in the accuracy of water vapor measurements and to new methods of measuring some other physico-chemical quantities.

713,106
PB-296 945/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Experimental Study of Thermally-Induced Flow Oscillations in Supercritical Helium.
Final rept.,
D. E. Daney, P. R. Ludtke, and M. C. Jones. Feb 79, 6p
Pub. in Jnl. Heat. Transfer 101, n1 p9-14, Feb 79.

Keywords: *Liquid helium, *Supercritical flow, Density(Mass/volume), Oscillations, Aspect ratio, Pressure reduction, Enthalpy, Temperature gradients, Reprints.

The density wave stability boundary has been experimentally determined for supercritical helium flowing in a long (L = 185 m), heated channel of high aspect ratio (L/d = 46000). A pressure drop ratio and the fluid expansion ratio correlate the oscillation inception point data. The growth of enthalpy (temperature) perturbations in a heated channel has been experimentally verified. During the density wave oscillation, the channel exit temperature and inlet mass flow were observed to be in phase, and the oscillation period was close to twice the fluid transit times. All three observations agree with a simple incompressible flow model. Oscillation amplitudes as great as 11 K and 100 percent of inlet flow were observed.

713,107
PB77-600009 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laminar Flow Induced by a Point Source of Heat.
H. R. Baum. 1977, 15p
Included in Jnl. of Research of the National Bureau of Standards, v81B n1 and 2 p45-60 1977.

Keywords: Analysis, Buoyancy, *Laminar flow, Plume, Pressure distribution, Streamlines, Temperature distribution.

An asymptotic description of the laminar flow pattern generated by a point source of heat is derived. Existing solutions of the boundary layer equations are shown to be valid in a limited domain where buoyancy forces are dominant. These solutions are supplemented by new results for the buoyant plume and are matched asymptotically to solutions valid everywhere outside the plume. Composite analytical formulae for the pressure, enthalpy and velocity fields are obtained and applied to the computation of the streamline pattern, pressure, and enthalpy distribution for Prandtl numbers 0.7 and 1.0.

713,108
PB78-600002 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Direct Determination of Air Density in a Balance Through Artifacts Characterized in an Evacuated Weighing Chamber.
W. F. Koch, R. S. Davis, and V. E. Bower. 1978, 7p
Included in Jnl. of Research of the National Bureau of Standards, v83 n5 p407-413 Sep-Oct 1978.

Keywords: *Buoyancy of air, Density, Mass comparisons in vacuo, Precise weighing, Vacuum, Vacuum weighing.

This paper describes a simple device which permits mass comparisons in air without appeal to the correction for air buoyancy. The device consists of a canister which is evacuated and weighed on a laboratory balance with a mass inside. A second weighing of another mass in the evacuated canister provides the desired mass comparison. The method was used to determine the mass difference between two stainless steel weights of widely differing densities. With knowledge of this mass difference and of the volume difference one may, by a simple air weighing of the two objects, determine directly the density of the air in the balance case. Densities of air determined by this method were compared with those calculated from the barometric pressure, the temperature, and the relative humidity of the laboratory air. The experimental and calculated values agree throughout to within 1.0 microgram/cu cm (where the normal air density is about 1.2 mg/cu cm). The calculated and experimental values of day-to-day fluctuations in air density agree to within 0.5 microgram/cu cm.

713,109
PB78-600003 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Density of Ultra-pure Air at 298.15 K for Mass Transfer Buoyancy Corrections.
M. Waxman, and H. Davis. 1978,4p
Included in Jnl. of Research of the National Bureau of Standards, v83 n5 p415-418 Sep-Oct 1978.

Keywords: *Burnett method, Low pressures, PVT, Ultra-pure air, 298 15 K.

Within the context of the general problem to attain improved accuracy for the transfer of apparent mass values, the PVT properties of ultrapure air at 298.15 K for low pressures have been determined. At 0.1 MPa, the accuracy of the molar density is estimated to be 0.001 percent. Our application of the isothermal Burnett method to obtain the 'PVT' measurements, the analysis of these measurements, and the effects of systematic Burnett errors on the PVT results are discussed.

713,110
PB79-600021 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Correlation of the Viscosity and Thermal Conductivity Data of Gaseous and Liquid Propane.
P. M. Holland, and H. J. M. Hanley. 1979, 18p
Included in Jnl. of Physical and Chemical Reference Data, v8 n2 p559-576 1979.

Keywords: *Correlated data, Critical point enhancement. Data evaluation, Propane, Thermal conductivity, Viscosity.

Data for the viscosity and thermal conductivity of gaseous and liquid propane have been evaluated and represented by empirical functions developed in previous work. Tables of values are presented for the range 140-500 K for pressures to 50 MPa (approximately 500 atm). The viscosities are estimated to have uncertainties of about plus or minus 5%, with corresponding uncertainties of the thermal conductivities of about plus or minus 8%. It is stressed that the data base should be improved. As in our work with other fluids, the

anomalous contribution to the thermal conductivity in the vicinity of the critical point is included.

713,111
PB79-600059 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Viscosity Measurements in the Diamond-Anvil Pressure Cell.
G. J. Piermarini, R. A. Forman, and S. Block. 1979, 5p
Pub. in Proceedings 6th AIRAPT Int. High Pressure Conf., Boulder, CO, July 25-29, 1977, p860-864 1979.

Keywords: *Diamond-anvil, Glass transition, High pressure, Hydrostacity, Liquids, Pressure cell, Viscosity.

The viscosity of liquids can be measured in the diamond-anvil pressure cell utilizing a falling-ball method and the ruby technique for pressure measurement. The pressure dependence of the viscosity of a 4:1 mixture (by volume) of methanol:ethanol has been determined. The accuracy of the technique has been estimated from measurements made on a fluid of known viscosity.

713,112
PB80-103831 Not available NTIS
National Bureau of Standards, Washington, DC.
Grid Turbulence in Air and Water.
Final rept.,
F. N. Frenkiel, P. S. Klebanoff, and T. T. Huang. Sep 79, 12p
Pub. in Physics of Fluids 22, n9, p1606-1617, Sep 79.

Keywords: *Water tunnels, *Wind tunnels, *Turbulence, Hot wire anemometers, Fluid flow, Probability distribution functions, Velocity measurement, Reprints, Grid turbulence.

An experimental comparison of grid turbulence performed in a wind tunnel and in a water tunnel is described. The measurements were made in the initial stage of decay with mesh Reynolds numbers ranging from 12800 to 81000. Hot-wire and hot-film instrumentation combining analog and digital computing methods were used to measure higher-order correlations of the longitudinal component of turbulent velocity and higher-order moments of longitudinal turbulent velocity gradients. A comparison of the latter is obtained for an increase in Reynolds number without having to alter the flow geometry. Apart from the intrinsic interest of such measurements in water, the results show the non-Gaussian character of the turbulent fluctuation and compare the behavior of higher-order moments of turbulent velocity gradients to theoretical considerations for the small scale turbulent structure.

713,113
PB80-123144 Not available NTIS
National Bureau of Standards, Washington, DC.
Equivalence of Integral Equations in the Molecular Theory of Fluids.
Final rept.,
R. F. Kayser, and H. J. Raveche. 1979, 11p
Pub. in Physica 97A, p399-409 1979.

Keywords: *Fluid dynamics, *Integral equations, Molecular theory, Kinetic theory, Intermolecular forces, Reprints, BBGKY equation, Kirkwood-Salsburg equation, Mayer-Montroll equation.

It is proven that, under physically reasonable conditions, the correlation functions satisfying the BBGKY equations for an infinite system are also solutions of the Mayer-Montroll and Kirkwood-Salsburg equations. The relation between these correlation functions and the probability distributions for finding a fixed number of particles in a given finite region of an infinite system is investigated. The Gibbsian nature of these probability distributions is shown to depend on the range of the intermolecular forces.

713,114
PB80-124563
(Order as PB80-124548, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Preliminary Study of the Fluid Mechanics of Liquid Penetrant Testing,
S. Deutsch. 28 Feb 79, 6p
Included in Jnl. of Research of the National Bureau of Standards, v84 n4 p287-292, Jul-Aug 79.

Keywords: *Fluid infiltration, *Mathematical models, Penetration, Liquids, Surface defects, Nondestructive tests.

Some aspects of the fluid mechanics of liquid penetrant testing are considered. Penetration is represented by surface tension driven flow into defects of small defect width to depth ratio. Defect width is chosen so that both gravitational and non-continuum effects may be ignored. Penetration time is found to follow a Rideal-Washburn relation, in which t is proportional to (l squared mu)/(gamma R cosine theta) where t is time, l defect depth, mu the dynamic viscosity, gamma the surface tension, R the defect width and theta the contact angle. The proportionality constant, however, is shown to be strongly dependent on defect geometry and penetrant application procedure. The effect of slight fluid elasticity is shown to be negligible.

713,115
PB80-221500 Not available NTIS
National Bureau of Standards, Washington, DC.
Generalized OCI Schemes for Boundary Layer Problems.
Final rept.,
A. E. Berger, J. M. Solomon, M. Ciment, S. H. Leventhal, and B. C. Weinberg. Jul 80, 37p
Sponsored in part by Naval Surface Weapons Center, Silver Spring, MD.
Pub. in Mathematics of Computation 35, n151 p695-731 Jul 80.

Keywords: *Boundary layer, Perturbation, Diffusion, Reynolds number, Reprints.

A family of tridiagonal formally fourth-order difference schemes is developed for a class of singular perturbation problems. These schemes have no cell Reynolds number limitation and satisfy a discrete maximum principle. Error estimates and numerical results for this family of methods are given, and are compared with those for several other schemes.

713,116
PB80-600021 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Improved Representative Equation for the Dynamic Viscosity of Water Substance.
J. T. R. Watson, R. S. Basu, and J. V. Sengers. c1980,36p
Included in Jnl. of Physical and Chemical Reference Data, v9, n4, p1255-1290.

Keywords: *Correlation length, Critical region equation of state, Critical viscosity enhancement, Steam, viscosity, Water, Water vapor.

Experimental evidence for steam and other fluids has demonstrated the existence of an anomalous enhancement of the dynamic viscosity in the close vicinity of the critical point. A reanalysis of the experimental evidence for the viscosity of steam indicates that the observed behavior of the critical viscosity enhancement is consistent with current theoretical predictions. An interpolating equation for the dynamic viscosity of water substance is presented which is in good agreement with the experimental viscosity data in a large range of temperatures and pressures. The equation contains a smaller number of coefficients than the current international equation for the viscosity of water substance and incorporates the enhancement of the viscosity in the close vicinity of the critical point.

713,117
PB80-600043 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Influence of the Space Environment on Some Materials Processing Phenomena.
R. F. Sekerka, and S. R. Coriell. 1979, 11p
Pub. in Proceedings 3d European Symp. on Material Science in Space, Grenoble, France, Apr. 24-27, 1979, ESA SP-142, p55-65 Jun 1979.

Keywords: *Crystal, Double-diffusive convection, Floating zone, Materials processing, Microgravity, Morphological stability, Similarity principle.

The influence of the space environment on some materials processing phenomena is studied by applying the principles of physical similarity to a system E on earth and a system S in the microgravity environment of space. If these systems can be characterized by a set of dimensionless groups N1...Nq, then they are similar if corresponding members of the set are equal for E and S. Similarity is often impractical or impossible if Q is larger than a few. For example, there is a simple law of similarity for an isothermal lizuid zone floating between inert solids; however, similarity is lost if the zone becomes nonisothrmal. A molten zone during crystal growth is so complex that a complete set of N1 cannot be identified with certainty. A second example is double-diffusive convection during unidirectional solidification of a binary alloy. Buoyancy driven fluid dynamical instabilities couple with constitutionally related instabilities quite differently in E and S.

713,118
PB81-115131 PC **A18**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Hydraulic Research in the United States and Canada, 1978.
Final rept.
P. H. Gurewitz. Oct 80, 401p NBS-SP-583
Library of Congress catalog card no. 80-600124. See also PB-281 501.

Keywords: *Hydraulics, *Hydrodynamics, Research projects, Universities, Industries, Hydraulic laboratories, State government, National government, Abstracts.

Current and recently concluded research projects in hydraulics and hydrodynamics for the years 1977-1978 are summarized. Projects from more than 200 university, industrial, state and federal government laboratories in the United States and Canada are reported.

713,119
PB81-155731 Not available NTIS
National Bureau of Standards, Washington, DC.
Numerical Modeling of Swirling Laminar Orifice Flow.
Final rept.
R. W. Davis, and E. F. Moore. 1980, 6p
Pub. in Proceedings of the IMEKO Symposium on Flow Measurement and Control in Industry, Tokyo, Japan, November 13-16, 1979, p81-86 1980.

Keywords: *Orifice meters, *Flow measurement, Swirling, Laminar flow, Vortices, Flow fields, Mathematical models, TEACH computer program.

The objective of this study is to investigate the effects of axisymmetric swirl on the performance of concentric orifice meters operating in the laminar flow regime. A computer code, TEACH, developed at Imperial College, London and modified at the National Bureau of Standards is used to predict the performance of a variety of these orifice meters under laminar flow conditions with inlet swirl numbers up to 50. The parameters investigated are inlet swirl and axial velocity distributions, Reynolds number, and orifice plate thickness and hole diameter. It is seen that increasing swirl number results in decreasing values for the various orifice meter discharge coefficients. At the higher values of swirl number, a vortex breakdown zone forms at the inlet to the computational test section and, at the greatest swirl numbers, extends through the orifice meter itself. Salient features of the flowfield, such as the extent of the recirculation zone behind the orifice plate, are tabulated. In order to demonstrate the accuracy of the program under at least the simplest of circumstances, numerical predictions for swirl decay down a straight pipe are shown to compare well with an analytical solution. It is concluded that swirl effects on orifice meters can be substantial and that an investigation such as this for the more realistic situation of non-axisymmetric swirl at high Reynolds numbers would be very useful.

713,120
PB81-155749 Not available NTIS
National Bureau of Standards, Washington, DC.
Numerical-Experimental Study of Parshall Flumes.
Final rept.
R. W. Davis, and S. Deutsch. 1980, 18p
Pub. in Jnl. Hydraulic Research 18, n2 p135-152 1980.

Keywords: *Open channel flow, *Parshall flumes, *Flow measurement, Hydraulic models, Flow fields, Finite difference theory, Reprints.

Parshall flumes are commonly used devices for the measurement of flow rates in open channels such as sewers and irrigation ditches. The operation of these flumes in 'nonstandard' situations, such as when faced with distorted upstream velocity profiles or when placed in sloping channel beds, is poorly understood. This paper presents numerical solutions for the flow through Parshall flumes utilizing a three-dimensional, free-surface finite difference code. The effects on flume operation of channel slope, upstream velocity profile distortions, and flume geometry changes are

assessed. Experimental results are obtained for a Parshall flume with a 15.2 cm (6 in.) throat width. Experimental and numerical data on important features of the flume flowfield are seen to compare well.

713,121
PB81-174146 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamics of Steady Homogeneous Shear Flow.
Final rept.
D. J. Evans, and H. J. M. Hanley. 24 Nov 80, 3p
Pub. in Physical Letters 80A, n2-3 p175-177, 24 Nov 80.

Keywords: *Thermodynamics, *Shear flow, Reprints.

Simulation data from model systems subjected to a shear can be described consistently by a thermodynamic formalism that includes the dependence of pressure and energy on the shear rate. Stability criteria are suggested which are examined specifically for a system of soft spheres.

713,122
PB81-197840 Not available NTIS
National Bureau of Standards, Washington, DC.
Water Depth and Solid Velocity Measurements in Unsteady Partially-Filled Horizontal Pipe Flow.
Final rept.
B. M. Mahajan, and L. S. Galowin. Mar 81, 23p
Sponsored in part by Department of Housing and Urban Development, Washington, DC.
Pub. in Proceedings of the Symposium Flow: Its Measurement and Control in Science and Industry (2nd) Held at St. Louis, MO., on March 23-26, 1981, p649-671 Mar 81.

Keywords: *Solids flow, *Pipe flow, Wastes, Velocity measurement, Sewer pipes, Drainage, NTISCOMNBS, NTISHUDG.

Few investigations have been reported on the transport mechanisms of finite solids in time-dependent partially-filled pipe flows. Due to increased concern for water conservation, the effects of reduced water usage on maintaining adequate transport and sweeping velocities for waterborne solids in pitched horizontal drains of gravity drainage plumbing systems has become the subject of current research. Open channel flow analogues are not applicable since they are based upon steady flow conditions. Determination of the flow characteristics for the non-uniform, transient water flow with varying depth-time history and the waterborne solids requires experimental measurement methods which do not produce any interference with the transport mechanisms. The experimental apparatus, instrumentation, and procedures are described. Typical results obtained from the tests are presented to illustrate the results derived from the tests. The ability of the methods adopted are shown to be suitable to derive the empirical data base required to develop mathematical correlations applicable to pipe sizes for effective low water drainage system performance.

713,123
PB81-220337 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Diffusion in Oscillating Laminar Flow in a Pipe.
Final rept.
L. P. Purtell. May 81, 5p
Pub. in Phys. Fluids 24, n5 p789-793 May 81.

Keywords: *Pipe flow, Laminar flow, Diffusion, Perturbation, Mass transfer, Oscillating flow.

The effect of flow oscillations on the axial diffusion of a solute in a pipe is analyzed theoretically by a perturbation method for small oscillation Reynolds numbers. The specific case of an initial step distribution in concentration is solved to second order. Numerical results of diffusion enhancement are given for several values of the parameters involved and are found to be conveniently summarized in terms of an equivalent diffusion parameter.

713,124
PB81-220352 Not available NTIS.
National Bureau of Standards, Washington, DC.
Turbulent Boundary Layer at Low Reynolds Number.
Final rept.
L. P. Purtell, P. S. Klebanoff, and F. T. Buckley. May 81, 10p
Pub. in Phys. Fluids 24, n5 p802-811 May 81.

Keywords: *Turbulent boundary layer, Skin friction, Pressure gradients, Reynolds number, Boundary layer.

The results of an experimental investigation of a turbulent boundary layer with zero-pressure gradient directed toward extending the data base at low Reynolds numbers are presented. The data obtained are concerned primarily with mean-velocity distributions, skin-friction coefficients, and distributions of intensity of the longitudinal-component of the turbulent-velocity fluctuations for Reynolds numbers based on momentum thickness as low as 465. The validity, at low Reynolds numbers, of the semiempirical laws characterizing the inner and outer regions of the boundary layer is examined.

713,125
PB81-227639 Not available NTIS
National Bureau of Standards, Washington, DC.
Nonlinear Viscous Flow in Two-Dimensional Systems.
Final rept.
D. J. Evans. Jul 80, 5p
Pub. in Physical Review A 22, n1 p290-294 Jul 80.

Keywords: *Viscous flow, Two dimensional flow, Nonlinear systems, Reprints.

Nonequilibrium molecular dynamics calculations have been performed for soft disks. It was found that the strain-rate dependence gamma of shear viscosity eta and hydrostatic pressure p could be described by functional forms. These functional forms are the same as ones that have been predicted using asymptotic 'long-time-tail' theories. The numerical values of the coefficients as determined from the simulations are several orders of magnitude greater than theory predicts. If the equation for the effective shear viscosity is valid in the limit of small strain rates, then Navier-Stokes hydrodynamics does not exist in two-dimensional fluids.

713,126
PB81-240228 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamic Traceability of Flow Measurements.
Final rept.
G. E. Mattingly. 1979, 11p
Pub. in Proceedings of IMEKO Symposium Flow Measurement and Control in Industry, Tokyo, Japan, 13-16 November, 1979, p0-4-1--0-4-11 1979.

Keywords: *Fluid flow, *Flow measurement, Engineering standards, Quality assurance, Calibration.

Given the present growth rate of the world's population and given the finite availability of the world's known material resources, it is obvious that custody transfer and equity in trade are becoming, and will continue to become, increasingly important concepts in affecting flow measurements in man's future. Consequently, the measurement systems that form the bases of such transactions are destined to become correspondingly crucial. Individual measurements will have to be made satisfactorily at all levels - in the 'field,' in the laboratories operated by the vendors of measurement instrumentation, in the independent measurement laboratories, and in the national laboratories in each and every country. Furthermore, it will become increasingly important that the quality of these measurements be satisfactorily assured to be as good as they are specified to be. Measurements, measurement standards, and their respective traceability networks will be required to 'stand-up' to legal scrutiny and cross-examination in court. To realistically assure that resource measurements - particularly fluid flow measurements are as good as specified, traceability systems which incorporate the dynamic nature of fluid flow measurements will have to be established and maintained. It is the purpose of this paper to put forth some ideas that are intended to describe how dynamic-traceability of flow measurements might be established and maintained.

713,127
PB82-140948 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamic Fluctuation Theory for Shear Flow.
Final rept.
D. J. Evans, and H. J. M. Hanley. 1981, 8p
Pub. in Physica 108A, p567-574 1981.

Keywords: *Couette flow, *Shear flow, Thermodynamic equilibrium, Strain rate, Reprints, Shear dilation effect.

A generalization of the Einstein relation for thermodynamic fluctuations is applied to a fluid undergoing Couette flow. It is shown that if the strain rate fluctuations are to reduce to the known equilibrium results, then the shear dilation effect, that is the variation of the pressure with shear at constant temperature and density, must be a nonanalytic function of strain rate. This conclusion is consistent with computer results obtained previously.

713,128
PB82-155185 Not available NTIS
National Bureau of Standards, Washington, DC.
Gas Mass Flow Reference System - A Progress Report.
Final rept.
D. B. Mann, J. A. Brennan, and C. H. Kneebone. 1980, 3p
Pub. in Proceedings of American Gas Association 1980 Operating Section Distribution and Transmission Conference; Distribution Conference Held at Detroit, Michigan on March 19-21, 1980; Transmission Conference Held in Salt Lake City, Utah on May 5-7, 1980, pT-366-T-368 1980.

Keywords: *Gas flow, *Mass flow, Flow measurement, Flow rate, Standards, Fluid flow, Closed loop systems.

A new type of gas flow reference system under development at the National Bureau of Standards results in direct, accurate and precise mass flow rate measurements. The closed loop system allows continuous flow of nitrogen gas at line pressures of 4.1 MPaa (600 psia) and at ambient temperatures. The gas flow is then cooled to liquid nitrogen temperature, and weighed at low nitrogen temperature, and weighed at low pressures and at a density of up to 17 times the density in the gas phase.

713,129
PB82-175068 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Entry Transition Water Surface Profile Prediction in Supercritical Partially Filled Pipe Flow.
J. A. Swaffield. Jun 81, 107p NBSIR-81/2290, HUD-0002121
Prepared in cooperation with Brunel Univ., Uxbridge (England), Drainage Research Group.

Keywords: *Pipe flow, Supercritical flow, Flow rate, Pressure gradients, Great Britain, *Foreign technology.

The criteria governing the development of steady partially filled supercritical pipe flow are presented together with the necessary techniques to determine the water surface profile in the pipe entry transition length. The establishment of full bore flow is predicted for a range of flow rates and pipe design parameters. Based on the water surface profile calculation technique, the report presents pipe length predictions to avoid the air pressure fluctuations in the drainage system that result from full bore flow establishment. Findings allow design decisions to be made that link pipe slope, diameter, and roughness to the need to avoid full bore flow. A graphical technique is also presented that removes the necessity to interpolate from the tabular data. The effect of entry geometry loss coefficients is included in the techniques presented. Four references and equations are provided. (Author abstract modified).

713,130
PB82-198797 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Computation of Two-Dimensional Time-Dependent Natural Convection of Compressible Fluid in a Rectangular Enclosure.
H. Yamashita, and V. D. Arp. Mar 82, 46p NBSIR-82-1660

Keywords: *Compressible flow, *Convection, Heat transfer, Finite difference theory, Pressure gradients, Transient response, Time dependence, Computer applications.

Studies of natural convection processes generally assume an incompressible fluid wherein the density is a function of temperature only (the Boussinesq approximation). However, local pressure gradients caused by rapid variations in the heated wall temperature cannot be described within this approximation. These time-varying gradients cause fluid motions which perturb the quasi-static natural convection process. In this study, we describe a numerical analysis procedure which includes compressibility effects and

allows computation of transient fluid motions during onset of natural convection. Details of the computational procedure and preliminary results for one geometry are given.

713,131

PB82-211277 Not available NTIS
National Bureau of Standards, Washington, DC.
Non-Newtonian Viscosity and Normal Pressure Differences of Simple Liquids.
Final rept.
S. Hess. Jan 82, 3p
Prepared in cooperation with Erlangen-Nuremberg Univ. (Germany, F.R.). Inst. fuer Theoretische Physik.
Pub. in Physical Review A 25, n1 p614-616 Jan 82.

Keywords: *Non-Newtonian fluids, *Non-Newtonian systems, Viscosity, Pressure gradients, Shear rate, Couette flow, Fluid friction, Tensors, Reprints.

An equation governing the friction pressure tensor is derived from the Kirkwood-Smoluchowski equation where terms non-linear in the shear rate are taken into account. The ensuing non-Newtonian viscosity and normal pressure differences are presented for a (stationary) plane Couette flow.

713,132

PB82-234816 Not available NTIS
National Bureau of Standards, Washington, DC.
Numerical Study of Vortex-Shedding from Rectangles.
Final rept.
R. W. Davis, and E. F. Moore. 1982, 32p
Pub. in Jnl. of Fluid Mechanics 116, p475-506 1982.

Keywords: *Rectangular bodies, *Two phase flow, Vortices, Lift, Drag, Reynolds number, Mathematical models, Reprints, *Vortex shedding.

The purpose of this paper is to present numerical solutions for two-dimensional flow about rectangles in infinite domains. The numerical method that is employed utilizes third-order upwind differencing for convection, and a Leith-type of temporal differencing. An attempted use of a lower-order scheme for this modeling effort is described. The Reynolds number regime investigated is from 100 to 2800. Other parameters that are varied are upstream velocity profile, angle of attack, and rectangle dimensions. The initiation and subsequent development of the vortex-shedding phenomenon is investigated.

713,133

PB82-237405 PC **A06**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Application of Method of Characteristics to Model the Transport of Discrete Solids in Partially-Filled Pipe Flow.
Final rept.
J. A. Swaffield. Feb 82, 122p NBS-BSS-139
Library of Congress catalog card no. 81-600198. Prepared in cooperation with Department of Housing and Urban Development, Washington, DC.Portions of this document are not fully legible.

Keywords: *Pipe flow, *Solids flow, Unsteady flow, Supercritical flow, Mathematical models, Fortran, Computer program, *Solids transport, Method of characteristics, TRANSCD computer program.

The flow depth and velocity changes across a moving solid in partially-filled pipe flow are predicted by means of the application of the method of characteristics to solve the unsteady flow equations. Simplified force models are presented which, when used in conjunction with empirical relationships linking leakage flow past the solid to upstream specific energy, are sufficient to provide the required moving solid boundary conditions that allow solid velocity prediction. A wide range of simulated transport conditions are presented that confirms the applicability of this technique as a basis for the future evaluation of more complex body force models.

713,134

PB82-247321 Not available NTIS
National Bureau of Standards, Washington, DC.
Computational Method for Unsteady Partially Filled Pipe Flow and Finite Solid Velocity Transport.
Final rept.
L. S. Galowin, J. A. Swaffield, and S. A. Bridge. Jun 82, 8p
Pub. in Proceedings of AIAA/ASME Joint Thermophysics, Fluids, Plasma and Heat Transfer Conference (3rd), St. Louis, MO, June 7-11, 1982, p1-8.

Keywords: *Pipe flow, *Unsteady flow, Solids flow, Fluid mechanics, *Solids transport, Method of characteristics.

The unsteady flow equations defining partially filled unsteady pipe flow were developed and shown to be capable of numerical solution by the method of characteristics. Comparisons between predicted and observed flow attenuation in pitched pipes confirmed the solution technique. Predictive models for solid transport, based upon the use of force and leakage flow relationships, provide the moving boundary conditions about the solid for coupling with the method of characteristics solution for the transient analysis. Agreement between solid transport measurements with predicted results for solid velocities with input time dependent surge flow and for initiation of solid motion from rest with steady inflow was shown.

713,135

PB83-134924 Not available NTIS
National Bureau of Standards, Washington, DC.
Further Measurements on the Small-Scale Turbulence Structure.
Final rept.
P. S. Klebanoff, and F. S. Frenkiel. 1978, 4p
Pub. in Proceedings of the Bat-Sheva International Seminar (2nd) on MHD Flows and Turbulence, Beersheva, Israel, Mar 28-31 1978 p325-328.

Keywords: *Turbulent flow, Flow measurement, Hot wire anemometers, Velocity measurement.

An experimental investigation of the small-scale turbulence structure is described under conditions which permit an extended Reynolds number range to be obtained without altering the flow configuration. Measurements of higher-order moments of temporal gradients of the longitudinal and transverse components of the turbulent velocity are presented, and the adequacy of the lognormal representation is evaluated.

713,136

PB83-179424 Not available NTIS
National Bureau of Standards, Washington, DC.
LDV Measurements Near a Vortex Shedding Strut Mounted in a Pipe.
Final rept.
T. T. Yeh, B. Robertson, and W. M. Mattar. Nov 82, 4p
Pub. in Proceedings of Winter Annual Meeting of the American Society of Mechanical Engineers, Phoenix, Arizona, November 14-19, 1982. Paper in Engineering Applications of Laser Velocimetry, p193-202 1982.

Keywords: *Vortices, Fluid flow, Flow distribution, Flow measurement, Velocity measurement, Struts, *Vortex shedding, *Flow fields, Laser Doppler velocimeters.

The velocity field around a vortex shedding strut mounted in a circular pipe has been measured in detail with a laser Doppler velocimeter (LDV) at a Reynolds number equal to 90,000. The instantaneous velocity is decomposed into mean, periodic, and random components. Only the first two harmonics are large enough to be detected; the large-scale structure can be characterized by just these two terms and the mean. Profiles of the different velocity terms are given upstream of, downstream of, and close to the strut. The two-dimensional velocity vector field of the mean flow on the transvers diametral plane of symmetry is presented along with its streamlines. Finally, profiles of the ratio of the energy of a periodic component to the total kinetic energy in a narrow frequency band are given.

713,137

PB83-179655 Not available NTIS
National Bureau of Standards, Washington, DC.
Numerical Computation of Large-Scale Fire-Induced Flows.
Final rept.
H. R. Baum, and R. G. Rehm. 1982, 15p
Pub. in Proceedings of International Conference of Numerical Methods in Fluid Dynamics (8th), Aachen, West Germany, June 28-July 2, 1982, 14p 1982.

Keywords: *Fires, Fluid flow, Plumes, Convection, Heat transfer, Finite difference theory, *Buoyant convection.

Large-scale fire-induced flows are calculated using a filtered set of inviscid equations driven by a volumetric heat source prescribed as a function of space and time. All phenomena with length and time scales too small to be resolved by direct computation are removed by the assumptions of the model: rapid time scales associated with acoustic and shock waves are removed by analytical filtering; combustion phenomena are replaced by a grid-resolvable heat source; and Grashof number limitations and boundary layers are removed by the inviscid approximation. No turbulence model is used. The finite difference method used for the computation is second order accurate in space and time, and is dispersive rather than diffusive to avoid numerical viscosity damping. Evolution equations for density and two velocity components (in the two-dimensional case reported here) are integrated on a staggered grid, and a nonseparable elliptic equation for pressure is solved at each time step. Results of a sample computation are presented and shown to be able to predict the two dimensional buoyant plume front velocity in experiments performed by releasing dyed salt water into a fresh water tank.

713,138

PB83-183442 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Application of Laser-Induced Rayleigh Light Scattering to the Study of Turbulent Mixing.
W. Pitts, and T. Kashiwagi. Feb 83, 123p NBSIR-83-2641

Keywords: *Light scattering, *Turbulent flow, *Rayleigh scattering, Binary systems(Materials), Methane, Pollution, Natural resources, Mathematical models, Numerical solution, Laser applications.

This work describes the development and characterization of an experimental system employing laser-induced Rayleigh light scattering with digital data acquisition as a time-resolved, quantitative concentration probe in the turbulent flow field of a binary gas mixture.

713,139

PB83-183541 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of Thermocapillary Migration in a Controllable Heat Valve.
Final rept.
L. A. Schmid. Dec 82, 4p
Pub. in Jnl. of Applied Physics 53, n12 p9204-9207 Dec 82.

Keywords: *Capillary flow, Capillary pressure, Condensates, Heat flux, Valves, Reprints, *Heat pipes.

In accordance with the Marangoni effect, immiscible droplets in a host fluid in which a temperature gradient exists move in the direction of increasing temperature. This thermocapillary migration can be used to construct a 'liquid wick' that will return the condensed vapor at the condenser end of a heat pipe back to the evaporator, thus completing the fluid circuit. The droplets are formed when capillary pressure generated at the evaporator wick forces the condensate through a perforated diaphragm whose temperature controls the droplet flux, and hence the heat flux between the two ends of the heat pipe, which thus becomes a controllable heat valve.

713,140

PB83-224071 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Numerical Procedure for an Inviscid Stability Analysis of an Axisymmetric Jet.
Final rept.
E. F. Moore. May 83, 13p NBSIR-83-2686

Keywords: *Jet mixing flow, Inviscid flow, Axisymmetric flow, Incompressible flow, Boundary value problems, Jet flow, Eigenvalues, Euler-Lagrange equation, Computer applications.

Inviscid stability analysis has been applied to the mixing layer profile of an axisymmetric jet and a coflowing stream. A collection of computer subprograms has been developed to solve the resulting eigenvalue problem. The effect of changing the velocity profile and its parameters can be easily assessed. Results for Gaussian profiles are included.

713,141
PB83-234252 Not available NTIS
National Bureau of Standards, Washington, DC.
Unsteady Flow in Long Drainage Systems.
Final rept.
J. A. Swaffield, S. Bridge, and L. S. Galowin. Feb 83, 12p
Pub. in Building Research and Practice 11, n1 p48-59 Jan/Feb 83.

Keywords: *Drains, *Pipe flow, Solids flow, Unsteady flow, Piping systems, Drainage, Reprints.

The effect of flow attenuation on drainage design is identified and is shown to be modelled by the partially filled unsteady pipe flow equations. Numerical solutions to these equations are presented and validated against laboratory testing at flow rates appropriate to installed drainage systems. Application of the method to both steep fronted waves and solids moving through the pipe system are also presented.

713,142
PB84-101187 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Gas Orifice Meter Discharge Coefficients as Determined by Mass Flow Measurements.
D. B. Mann, J. A. Brennan, C. F. Sindt, J. F. LaBrecque, S. E. McManus, and C. H. Kneebone.
Aug 83, 139p NBSIR-83-1685
Sponsored in part by Gas Research Inst., Chicago, IL.

Keywords: *Gas flow, *Orifice flow, Flow measurement, Orifice meters, Mass flow, Flow rate.

Performance data of gas orifice meter runs and plates have been generated under a U.S. gas industry supported program. The data have been developed using nitrogen gas and a unique NBS gas flow measurement facility capable of directly measuring the mass of gas metered by the orifice device. Direct comparison of predictions from empirical equations can now be made at orifice bore Reynolds Numbers near four million. Two meter runs for each of four nominal line sizes and two sets of orifice plates with up to six beta ratios per set were interchanged in order to develop full meter performance characteristics. Orifice meter and flow reference system data are used to calculate discharge and expansion coefficients which in turn are compared to those derived from existing equations. Orifice meter performance data and system descriptions are provided.

713,143
PB84-115872
(Order as PB84-115849, PC **A04**/MF **A01**)
National Bureau of Standards, Washington, DC.
Analysis of Liquid Flow-Induced Motion of a Discrete Solid in a Partially Filled Pipe.
B. M. Mahajan. 20 Apr 83, 28p
Included in Jnl. of Research of the National Bureau of Standards, v88 n4 p261-288, Jul-Aug 83.

Keywords: *Pipe flow, *Solids flow, Channel flow, Equations of motion, Flow rate, Transport properties.

An analysis is presented for the liquid flow-induced motion of a solid in partially filled pipes. A general equation of the flow-induced motion of a solid is developed. Two alternate force models, one based on free stream velocity and another based on free stream momentum flux, are formulated to simplify the general equation.

713,144
PB84-134592 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
High-Speed Data Acquisition System for Fluid Mechanics Measurements.
Technical note (Final).
L. P. Purtell. Nov 83, 34p NBS-TN-1181

Keywords: *Fluid mechanics, *Data acquisition, Measuring instruments, Hot wire anemometers, Turbulent flow, Unsteady flow, Time interval counters, Minicomputers, Computer applications.

The requirements, characteristics, and performance of a minicomputer-based data acquisition and analysis system suitable for research in fluid mechanics processes are presented. The particularly stringent requirements imposed by unsteady and turbulent flows are discussed including estimates of the required data acquisition rates and durations.

713,145
PB84-137025 Not available NTIS
National Bureau of Standards, Washington, DC.
Long-Wave Acoustic Flowmeter.
Final rept.
J. E. Potzick, and B. Robertson. 1983, 7p
Pub. in Instrum. Soc. Am. 22, n3 p9-15 1983.

Keywords: *Flowmeters, *Acoustic measurement, Flow rate, Gas flow, Pipe flow, Single phase flow, Acoustic waves, Reprints.

An acoustic flowmeter has been developed for measuring the flow of an arbitrary single phase fluid in a pipe. Sound waves are induced in the fluid at two frequencies, one twice the other. The phases and amplitudes of the waves are detected by two microphones located in the wall of the pipe, one downstream from the other a distance of six diameters or more. The frequencies of the sound are automatically adjusted so that the shorter wavelength is equal to the distance between microphones. The instrument then measures in real time the volume flowrate of, and the sound speed in, the fluid, independent of fluid composition or temperature. If the fluid is a gas and its molecular weight and specific heat ratio are given, the instrument calculates the temperature. Also, given an independent measurement of the pressure in the pipe, the instrument calculates gas density and mass flowrate.

713,146
PB84-137892 Not available NTIS
National Bureau of Standards, Washington, DC.
Fluid Property Effects on Flow-Generated Waves on a Compliant Surface.
Final rept.
R. J. Hansen, and D. L. Hunston. 1983, 16p
Pub. in Jnl. of Fluid Mechanics 133, p161-177 Dec 83.

Keywords: *Viscoelasticity, *Viscosity, *Non-Newtonian fluids, Polymers, Rheology, Turbulent flow, Reprints, *Drag reducing fluids.

An experimental study of the influence of liquid viscosity and viscoelasticity on flow-generated waves on a compliant surface has been conducted in a rotating disk geometry. Over the entire range of liquid properties studied, each test gave a well-defined critical onset flow velocity above which waves were present and below which no waves were observed. This onset velocity increased with increasing fluid viscosity, and for sufficiently high viscosities the onset occured when the flow on the disk was laminar rather than turbulent. The effects of liquid viscoelasticity were examined in the turbulent flow using dilute solutions of high molecular weight polymers. This type of viscoelasticity had little influence on the onset flow velocity in these circumstances but did make the wave structure on the surface more regular in appearance than when the liquid was Newtonian. In all cases the wave structure produced a dramatic increase in drag similar to that expected for a rough surface. For the viscoelastic fluid, however, the increase in drag was much less than for a viscous fluid of the same viscosity.

713,147
PB84-138510 Not available NTIS
National Bureau of Standards, Washington, DC.
Data and Thermal Design: The Role of Fluid Property Data and Their Significance in Design Calculations.
Final rept.
H. J. M. Hanley, and M. E. Baltatu. Jun 83, 5p
Pub. in Mechanical Engineering 105, n6 p68-72 Jun 83.

Keywords: *Heat exchangers, *Fluid mechanics, Data acquisition, Thermal analysis, Reprints.

The role of fluid property data, and the significance of data in design calculations, is discussed. Some difficulties are pointed out with partially characterized fluids, with mixtures of diverse species, and with fluids under difficult operating conditions, such as near a critical point or subject to a high shear rate and transient temperature. A practical example is presented to illustrate how problems with a partially characterized fluid could affect the design of a heat exchanger.

713,148
PB84-154699 Not available NTIS
National Bureau of Standards, Washington, DC.
Solvable Weak-Potential Model of a Non-Newtonian Fluid.
Final rept.
J. C. Rainwater, and S. Hess. 1983, 12p
Pub. in Physica 118A, p371-382 1983.

Keywords: *Non-Newtonian fluids, Couette flow, Pressure gradients, Tensors, Dilatancy, Reprints.

A theoretical model is developed for a non-Newtonian fluid of spherical molecules interacting with a weak potential. The Kirkwood-Smoluchowski equation for planar Couette flow reduces in leading order in potential strength to a shear-diffusion equation with an inhomogeneous source term. The pressure tensor elements are calculated and, for a Gaussian potential, reduce to one-dimensional integrals which are evaluated numerically. The model reproduces several qualitative features of non-Newtonian liquids and the computer simulations of Evans and Hanley. These features include shear thinning, shear dilatancy, normal pressure differences, and dependence on shear rate to a half-integer power.

713,149
PB84-160621
(Order as PB84-160605, PC **A04**/MF **A01**)
Brunel Univ., Uxbridge (England).
Applicability of the Colebrook-White Formula to Represent Frictional Losses in Partially Filled Unsteady Pipeflow.
J. A. Swaffield, and S. Bridge. 19 Jul 83, 5p
Included in Jnl. of Research of the National Bureau of Standards, v88 n6 p389-393, Nov-Dec 83.

Keywords: *Pipe flow, Friction factor, Unsteady flow, Channel flow, Surface roughness, Computer applications, Methods of characteristics.

The use of Manning's n as a friction factor is shown to be unsuitable in the case of small bore (less than about one meter diameter) partially filled pipeflow, particularly for relatively smooth materials such as glass and cast-iron. The Colebrook-White equation with the roughness coefficient k is presented in a form suitable for inclusion in a computer program to solve the partially filled unsteady pipeflow equations by means of the method of characteristics. Results are presented which show that the Colebrook-White equation provides substantially improved predictions of the wave velocity along the pipe. It provides slightly improved predictons for the maximum depth of flow along the pipe.

713,150
PB84-223189 Not available NTIS
National Bureau of Standards, Washington, DC.
Asymmetric Instabilities in Buoyancy-Driven Flow in a Tall Vertical Annulus.
Final rept.
G. B. McFadden, S. R. Coriell, and R. F. Boisvert.
Jun 84, 3p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Physics of Fluids 27, n6 p1359-1361 Jun 84.

Keywords: *One dimensional flow, Buoyancy, Cylindrical bodies, Stability, Heat transfer, Reprints, Coaxial cylinders, Instability.

Linear stability of the one-dimensional flow between infinite vertical coaxial cylinders induced by heating the inner cylinder is considered for various radius ratios kappa $<$ 1 and for Prandtl numbers P appropriate to air and water. For air with P = .71 the least stable disturbance is non-axisymmetric for kappa $<$ .44 and is axisymmetric for kappa $<$ .44, and in either case the instability is due to the action of the shear forces. For water with P = 3.5, the situation is similar, except that the asymmetric shear mode is superceded by an axisymmetric instability driven by buoyancy forces for .03 $<$kappa$<$.18. Wave speeds, wave numbers, and critical Grashof numbers for these cases and for the case of zero Prandtl number are given.

713,151
PB84-225275 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibration Facility for Static Pressure Transducers and Differential Pressure Transducers at High Base Pressure.
Final rept.
C. F. Sindt, and J. F. LaBrecque. 1982, 3p
Sponsored in part by American Gas Association, Inc., Arlington, VA. and Gas Research Inst., Chicago, IL.

Pub. in Proceedings of American Gas Association Operating Section Distribution Conference, Washington, DC., May 3-5, 1982, pT-400-T-402.

Keywords: *Pressure sensors, *Calibrating, *Standards, *Manometers.

A facility has been developed to calibrate pressure transducers that are used in the NBS Gas Mass Flow Facility. Both static and differential pressure transducers can be calibrated. An air dead weight tester is the standard for static transducers in the range from 3.8 to 4.5 MPa. An air dead weight tester is also the standard for the differential pressure transducers in the range of 2.5 kPa to 50 kPa; a cistern manometer provides the transfer for the standard to a base operating pressure of 4.1 MPa.

713,152

PB84-227222 Not available NTIS
National Bureau of Standards, Washington, DC.
Stokes-Maxwell Relations for the Distorted Fluid Microstructure.
Final rept.
S. Hess, and H. J. M. Hanley. 1983, 4p
Pub. in Physics Letters 98A, n1-2 p35-38, 3 Oct 83.

Keywords: *Fluids, Kinetic theory, Microstructure, Relaxation time, Reprints, Stokes-Maxwell relations.

Relationships between the coefficients of the expansion of the pair correlation function for a fluid subjected to a shear are derived from a model kinetic equation. They equate a relaxation time with the viscosity and shear modulus of the fluid. Nonlinear phenomena are considered. The results are tested using nonequilibrium molecular dynamic simulation data for a soft sphere system close to freezing. Agreement between the theory and the simulations is satisfactory.

713,153

PB84-245752 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Chemical Engineering.
Numerical Solutions for Steady Natural Convection in a Square Cavity.
Final rept.
E. F. Moore, and R. W. Davis. Mar 84, 34p NBSIR-84/2830

Keywords: *Fluid dynamics, *Convection, Numerical analysis, Analysis(Mathematics), Fluid flow, Viscous flow, Cavity flow.

Numerical solutions have been obtained for steady natural convection in a square cavity. The numerical method used was developed for unsteady, incompressible, viscous fluid flow. The similarity parameters were chosen to match those of an international comparison exercise. Results are presented and compared with those obtained by other researchers using different methods.

713,154

PB85-104065 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Applied Mathematics.
Finite Difference Calculations of Buoyant Convection in an Enclosure. Part 2. Verification of the Nonlinear Algorithm.
Final rept.
R. G. Rehm, H. Baum, P. D. Barnett, and D. M. Corley. Sep 84, 36p NBSIR-84/2932
See also PB84-137801.

Keywords: *Convection, Fluid dynamics, Mathematical models, Fires, Enclosures, Combustion, Smoke.

Earlier, a novel mathematical model of buoyant convection in an enclosure was developed. The nonlinear equations constituting this model have recently been solved by finite difference methods in two dimensions. In this paper two solutions, obtained in special cases, to the model equations are presented. For both cases the solutions to the partial differential equations and to the finite difference equations used to approximate the differential equations are obtained by combinations of analytical and numerical techniques.

713,155

PB85-104875 Not available NTIS
National Bureau of Standards, Washington, DC.
Air-Flows Induced by Sparse Clouds of Droplets.
Final rept.
D. S. Bright, R. A. Fletcher, and H. R. Baum. 1984, 7p
Pub. in Aerosol Science and Technology 3, n2 p187-193 1984.

Keywords: *Air flow, Drops(Liquids), Velocity measurement, Interactions, Fluid flow, Navier-Stokes equations, Reprints.

Very slow air flows induced by a column of 5-20 micrometer diameter droplets settling in a 9 mm diameter chamber were measured with a laser light velocimeter apparatus. The air flow velocity was measured as the difference between the Doppler-measured Stokes settling velocity of individual droplets and the settling velocity calculated from simultaneous measurements of droplet optical diameter. Experimental conditions included a wide range of droplet sizes, relatively slow air motion, and many droplets being in the laser beam at the same time.

713,156

PB85-129229 Not available NTIS
National Bureau of Standards, Washington, DC.
Diffusion in a Laminar Flow: Shear Rate Dependence of Correlation Functions and of Effective Transport Coefficients.
Final rept.
S. Hess, and J. C. Rainwater. 1 Feb 84, 9p
Pub. in Jnl. of Chemical Physics 80, n3 p1295-1303, 1 Feb 84.

Keywords: *Laminar flow, *Diffusion theory, *Couette flow, Shear flow, Transport theory, Normal density functions, Tensors, Reprints.

The diffusion equation for independent Browian particles suspended in a fluid undergoing plane Couette shear flow is solved in Fourier space by means of the Campbell-Baker-Hausdorff expansion for the product of exponentials of noncommuting operators. Explicit solutions are derived and numerically evaluated for an initial Gaussian distribution with no source and for a continuous stationary source with a Gaussian spatial distribution. For the latter problem, the tensor describing the curvature of the steady-state distribution at the origin is analyzed in some detail and is shown to possess a dependence on shear rate very similar to that of the pressure tensor obtained in computer simulations of simple liquids under shear by Hanley and Evans.

713,157

PB85-135523 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Numerical Solutions for Laminar Orifice Flow.
Final rept.
G. E. Mattingly, and R. W. Davis. 1977, 8p
Pub. in American Society of Mechanical Engineers Paper 77-WA/FE-13, 8p 1977.

Keywords: *Orifice flow, *Laminar flow, *Flow measurement, Incompressible flow, Axisymmetric flow, Orifice meters, Reynolds number, Pressure, Numerical analysis, Discharge coefficient, Flow velocity.

Numerical solutions have been obtained for laminar, axisymmetric, incompressible flow through a variety of concentric orifice meters for different Reynolds numbers. Flow fields are presented using velocity and pressure variables, and streak patterns are used to exhibit salient dynamic features. Good agreement is found between the computed discharge coefficients and corresponding experimental data.

713,158

PB85-142065 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pressure Tensor and Viscosity Coefficients of a Soft Sphere Liquid under Shear.
Final rept.
S. Hess, and H. J. M. Hanley. 1983, 8p
Pub. in International Jnl. of Thermophysics 4, n2 p97-114 1983.

Keywords: *Liquids, *Shear flow, Viscosity, Pressure, Distortion, Properties, Particles, Nonequilibrium flow, Molecular flow, Rheological properties, Spheres, Non-Newtonian fluids, Reprints.

General properties and consequences of the distortion of the structure of a simple liquid subjected to a planar shear flow are reported. In particular, the orientational distribution of particles in the first coordination shell around a given particle is analyzed and the effect of this distribution on the pressure tensor is discussed. The distorted distribution gives rise to a set of non-Newtonian viscosity coefficients reflecting the occurrence of normal pressure differences in the liquid. Numerical values of these viscosities are given for a soft sphere fluid at 7/8 of the freezing density using the technique of nonequilibrium molecular dynamics. A wide range of shear rates is considered and all viscosity coefficients are found to be functions of the shear rate.

713,159

PB85-145456 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Asymptotic Behavior of Three Particle Correlations.
Final rept.
H. J. Raveche, and R. F. Kayser. Feb 84, 3p
Pub. in Physical Review A: General Physics 29, n2 p1003-1005 Feb 84.

Keywords: *Fluids, Compressibility, Correlations, Reprints.

The three particle correlation function, (G sub 3) (r sub 12, r sub 13, r sub 23), for a fluid with a longrange pair potential is computed in two limits: (a) all (r sub ij) approaches infinity, and (b) one distance, say (r sub 12), fixed and (r sub 13), (r sub 23) approaches infinity. In both cases, the pair potential times the square of the isothermal compressibility appears.

713,160

PB85-151645 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Asymptotic Density Correlations and Corrections to Scaling for Fluids with Non-Finite-Range Interactions.
Final rept.
R. F. Kayser, and H. J. Raveche. Feb 84, 3p
Pub. in Physical Review A: General Physics 29, n2 p1013-1015 Feb 84.

Keywords: *Fluids, Density(Mass/volume), Correlations, Correction, Interactions, Reprints, Correlation functions, Scaling laws.

The asymptotic behavior of the pair-correlation function in fluids with realistic long-range pair potentials is shown to give rise to a correction to scaling that has not been previously taken into account.

713,161

PB85-170629 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Flow and Temperature Profile Independence of Flow Measurements Using Long Acoustic Waves.
Final rept.
B. Robertson. Mar 84, 3p
Pub. in Jnl. of Fluids Engineering 106, p18-20 Mar 84.

Keywords: *Flow measurement, *Elastic waves, Sound transmission, Velocity, Pipes(Tubes), Temperature, Frequencies, Reprints.

An expansion in powers of V/c is derived for the wave number of the fundamental sound mode in a flow conduit, where V is the velocity of fluid in the conduit and c is the local sound speed. Both V and c are assumed to be independent of the longitudinal coordinates and of the time, but may have arbitrary profiles. The calculation applies to frequencies well below the cutoff frequency of the conduit, which may have an arbitrary cross-sectional shape. To lowest order, the wave number depends only on the average of the longitudinal component of V and is independent of its profile.

713,162

PB85-184661 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Numerical-Experimental Study of Confined Flow Around Rectangular Cylinders.
Final rept.
R. W. Davis, E. F. Moore, and L. P. Purtell. 1984, 14p
Pub. in Physics of Fluids 27, n1 p46-59 Jan 84.

Keywords: *Fluid flow, *Cylinders, Experimentation, Numerical analysis, Aspect ratio, Blocking, Velocity, Pressure, Reynolds number, Mathematical models, Wind tunnels, Tests, Vortices, Computerized simulation, Unsteady flow, Containment, Reprints, *Vortex shedding, Strouhal number, Numerical flow visualization.

A previous numerical study by Davis and Moore of vortex shedding from rectangles in infinite domains is extended to include the effects of confining walls. The major changes to the numerical modeling are the addition of a direct solver for the pressure equation and the use of an infinite-to-finite mapping downstream from the rectangle. The parameters in the problem are now Reynolds number, rectangle aspect ratio, blockage ratio, and upstream velocity profile. As each of these is varied, the effects upon the forces acting on the rectangle and the structure of the wake are discussed. Streakline plots composed of multishaped passive marker particles provide a clear visualization of the vortices. These plots are compared with smoke-wire photographs taken from a wind tunnel test. Strouhal numbers obtained both computationally and experimentally are compared for two values of the blockage ratio. Moving recirculation zones which appear between the wake and the walls are discussed.

713,163

PB85-197457 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Numerical Solutions for a Moving Shear Layer in a Swirling Axisymmetric Flow.
Final rept.
H. Baum, M. Ciment, R. W. Davis, and E. F. Moore. 1981, 485p
Pub. in Proceedings of International Conference on Numerical Methods in Fluid Dynamics (7th), Lecture Notes in Physics Series 141, 485p 1981.

Keywords: *Axisymmetric flow, Viscous flow, Unsteady flow, Incompressible flow, Reynolds number, Swirling, Mathematical models, Numerical analysis, Fluid dynamics, *Shear layers, Cylindrical coordinates.

This paper presents both a new model problem for unsteady, incompressible viscous flow and a new numerical method for modeling flows in cylindrical geometries. The model problem is an exact solution to the fully three-dimensional axisymmetric Navier-Stokes equations and is shown to represent a moving shear layer of rotating fluid whose thickness depends on Reynolds number. An asymptotic steady-state is reached which consists of a potential vortex with a viscous core. The new numerical method is a fundamental solution technique for cylindrical coordinates similar in derivation to the El-Mistikawy-Werle scheme (AIAA J., 16, p. 749, 1978) for cartesian coordinates. This method is implemented in the context of the operator compact implicit (OCI) format. The new scheme and several others are tested on the model problem over a range of Reynolds numbers.

713,164

PB85-205235 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Finite Difference Solutions for Internal Waves in Enclosures.
Final rept.
H. R. Baum, and R. G. Rehm. Dec 84, 20p
Pub. in SIAM (Society for Industrial and Applied Mathematics) Jnl. on Scientific and Statistical Computing 5, n4 p958-977 Dec 84.

Keywords: *Finite difference theory, *Fluid flow, *Internal waves, *Enclosures, Partial differential equations, Buoyancy, Computation, Fires, Stratification, Stability, Reprints.

Finite difference approximations to the set of partial differential equations governing internal waves are investigated. Analytical solutions describing waves in an enclosure in two and three dimensions are obtained. The schemes considered are second order accurate in space and include first order explicit and second order time differencing. The solutions are used to investigate the temporal stability and long term accuracy of all schemes. The mode frequencies and wave shapes obtained from each difference scheme are compared with the solutions both to the corresponding partial differential equations and to equations obtained by discretizing in space only. The solutions have been used by the authors to help develop a finite difference code designed to compute non-linear buoyancy-driven flows of the type that arise in enclosure fires.

713,165

PB85-230761 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Numerical Simulation of Flow Around Squares.
Final rept.
R. W. Davis, and E. F. Moore. 1981, 13p
Pub. in Proceedings of the International Conference on Numerical Methods in Laminar and Turbulent Flow (2nd), Venice, Italy, July 13-16, 1981, p279-290.

Keywords: *Computerized simulation, *Two dimensional flow, *Unsteady flow, Reynolds number, Velocity, Lift, Drag, Aerodynamic configurations, Finite differency theory, Numerical analysis, Fluid mechanics, Aerodynamics, Mathematical models, Convection, *Square configuration, Strouhal number, Vortex shedding.

The paper presents a numerical simulation of two-dimensional unsteady flow around squares in infinite domains with uniform upstream velocity profiles. Variations in the behavior of lift and drag with Reynolds number are discussed. Passive marker particles are used to visualize the onset and subsequent development of vortex shedding at a Reynolds number of 1000. The finite difference scheme employed in this simulation utilizes third-order accurate upwind differencing for convection and a Leith-type of temporal differencing. Variations in convective differencing near the corners of the square and at the out-flow boundary of the mesh are described.

713,166

PB86-103454 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Response Behavior of Hot-Wires and Films to Flows of Different Gases.
W. M. Pitts, and B. J. McCaffrey. Jul 85, 124p
NBSIR-85/3203
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.

Keywords: *Flow measurement, Hot wire anemometers, Gas flow, Velocity measurement, Reynolds number, Nusselt number, Heat transfer, Correlations, Cylindrical bodies, Convection, Vortices, Calibrating, Hot-film anemometers, Accommodation coefficient.

Measurements of the voltage output for hot-wire and film anemometers placed in flows of nine different gases have been made as a function of flow velocity. In order to obtain these correlations it has been necessary to consider and correct for the effects of probe end conduction losses, temperature dependencies of gas molecular properties, flow slip at the probe surfaces, and gas accommodation. The importance of the nature of the flow over the cylindrical devices to the heat transfer behavior is described. A previously unreported hysteresis in the heat transfer behavior for RE 44 has been characterized and attributed to the presence or absence of eddy shedding from the heated cylinder.

713,167

PB86-128238 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fluid Engineering Div.
Drag on a Sphere Moving Horizontally Through a Stratified Liquid.
Final rept.
K. E. B. Lofquist, and L. P. Purtell. 1984, 14p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Fluid Mechanics 148, p271-284 Nov 84.

Keywords: *Drag, *Spheres, Salt water, Wakes, Reprints, Stratified flow, Stratified fluids.

The drag on a sphere moving horizontally through stably stratified salt water is measured in laboratory experiments. The increment in drag coefficient due to the stratification, delta (C sub D), is obtained as function of a stratification parameter, kappa (eq. 5) and, in principle, the usual Reynolds number, R. In these experiments, where R ranges from 150 to 5,000, delta (C sub D) is insensitive to R. But as function of kappa, delta (C sub D) has both positive and negative values. A positive peak in delta (C sub D)(kappa), about as large as the unstratified (C sub D), is identified as a resonance maximum in the lee-wave drag. Negative values of delta (C sub D)(kappa), as large as 15% of (C sub D), are interpreted as a reduced rate of generation of heat within the wake due to inhibition of vertical turbulent motions and vertical spreading of the wake by the stable stratification.

713,168

PB86-136728 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Numerical Modeling of Unsteady Gas-Particle Flows Around Rectangles Inside Channels.
Final rept.
R. W. Davis, E. F. Moore, and C. T. Crowe. 1983, 10p
Pub. in Proceedings of International Conference on Numerical Methods in Laminar and Turbulent Flow (3rd), Seattle, WA., August 8-11, 1983, p1037-1046.

Keywords: *Gas flow, Mathematical models.

The paper presents numerical solutions for gas-particle flows around rectangles inside two-dimensional channels. Vortex shedding frequencies are seen to compare well with the results of a wind tunnel experiment. Trajectories of individual physical particles through this highly unsteady flow are presented for varying combinations of Stokes number and gravitational force. The numerical scheme utilizes an explicit Leith-type of temporal differencing and quadratic upwind differencing for convection.

713,169

PB86-136736 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Finite Difference Methods for Fluid Flow.
Final rept.
R. W. Davis. 1984, 19p
Pub. in Proceedings of 1983 International Conference on Computational Techniques and Applications: CTAC-83, University of Sydney, Australia, August 28-31, 1983, p51-69 1984.

Keywords: *Navier-Stokes equations, *Finite difference theory, Unsteady flow, Computerized simulation, *Computational fluid dynamics, Separated flow.

The purpose of the paper is to describe how finite difference methods can be employed to solve the incompressible Navier-Stokes and continuity equations of fluid flow. The differencing of the various terms in these equations is considered in detail, and a solution procedure is presented which gives reasonable results for two complex flow problems. These problems involve unsteady viscous separated flows in the wake of a rectangular obstacle inside a two-dimensional channel and in an axisymmetric mixing layer. The importance of a priori testing of the numerical methods on appropriate simple model problems is stressed and a useful example is given. Also stressed is the importance of computational flow visualization and data analysis in order to make sense of a flow calculation.

713,170

PB86-154036 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Chemical Engineering.
Experimental/Computational Investigation of Organized Motions in Axisymmetric Coflowing Streams.
Final rept.
R. W. Davis. Dec 85, 40p NBSIR-85/3287
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.

Keywords: *Entrainment, Jet flow, Axisymmetric flow.

A joint experimental/computational investigation of the entrainment process in the turbulent mixing of a round jet with a coflowing stream has been carried out. The overall objectives of this work were to identify and characterize coherent motions in the mixing region, investigate the dynamical role these motions play in the entrainment process, and determine the extent to which entrainment is affected by such factors as initial conditions and forcing.

713,171

PB86-160793 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysical Properties Div.
Decay of Swirling Gas Flow in Long Pipes.
Final rept.
S. E. McManus, B. R. Bateman, J. A. Brennan, I. Vasquez, and D. Mann. 1985, 5p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Proceedings of the American Gas Association Operating Section (1985), Boston, MA., May 20-22, 1985, p629-633.

Keywords: *Gas flow, *Flow measurement, Swirling, Decay, Pipe flow.

A characterization of swirling flow of nitrogen gas at ambient temperature, pressure of 4 MPa (600 psi), and Reynolds numbers of 800,000 to 1,400,000 is presented. Possible flowmeter measurement errors in a pipe of circular cross-section are given. An instrumented test section containing a hot wire anemometer and a directional pilot tube for the measurement of swirl angles and velocities are described. Results suggest that large values of swirl are possible in gaseous flow, that the decay of the swirl is very slow at high Reynolds numbers, and that reliance on long lengths of pipe to reduce swirl to acceptable levels may not be a practical solution to eliminating potential flow measurement errors attributable to swirl.

713,172
PB86-187267 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Double-Diffusive Convection with Sidewalls.
Final rept.
G. B. McFadden, S. R. Coriell, and R. F. Boisvert. Sep 85, 7p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Physics of Fluids 28, n9 p2716-2722 Sep 85.

Keywords: *Diffusivity, *Fluid flow, Convection, Stability, Reprints, Sidewalls.

The effect of rigid vertical boundaries on the onset of convective instability is calculated for the salt finger regime of double-diffusive convection. The unperturbed state is a quiescent fluid with constant vertical gradients of temperature and solute, which are stabilizing and destabilizing, respectively. The horizontal boundaries are taken to be stress-free and perfectly conducting. The lateral boundaries are perfectly insulating for solute. Changing from thermally insulating to thermally conducting sidewalls results in a strong destabilization of the flow for large thermal Rayleigh numbers even in the limit that the separation between the sidewalls approaches infinity. Further, for thermally conducting sidewalls, a decrease in the separation of the sidewalls may destabilize the system.

713,173
PB86-187697 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Tagged Particle Fluctuations in Uniform Shear Flow.
Final rept.
M. C. Marchetti, and J. W. Dufty. 1983, 23p
Pub. in Jnl. of Statistical Physics 32, n2 p255-277 1983.

Keywords: *Boltzmann equation, *Shear flow, Kinetic theory, Nonequilibrium flow, Velocity, Reprints.

The nonlinear Boltzmann and Boltzmann-Lorentz equations are used to describe the dynamics of a tagged particle in an nonequilibrium gas. For the special case of Maxwell molecules with uniform shear flow, an exact set of equations for the average position and velocity, and their fluctuations, is obtained. The results apply for arbitrary magnitude of the shear rate and include the effects of viscous heating. A generalization of Onsager's assumption of the regression of fluctuations is found to apply for the relationship between the equations for the average dynamics and those for the time correlation functions. The connection between fluctuations and dissipation is described by the equations for the equal-time correlation function.

713,174
PB86-196722 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Chemically Reacting Turbulent Flow.
Final rept. 1 Oct 82-30 Sep 85.
W. M. Pitts, and T. Kashiwagi. Mar 86, 43p NBSIR-85/3299
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.

Keywords: *Turbulent flow, *Chemical reactions, Rayleigh scattering, Light scattering, Reynolds number, Flow visualization.

The report summarizes the results of the first three years of a study on chemically reacting turbulent flow. The development of new diagnostics for variable density flows are described. These include Rayleigh light scattering for real-time, spatially-resolved concentration measurements, combined Rayleigh light scattering and hot-wire anemometry for simultaneous concentration and velocity measurements, and the development of a digital line camera which has allowed the concentration measurements to be made along a line. A study of heat transfer from heated cylinders is discussed which has generated a much improved correlation of experimental results. These studies have also included a limited investigation of Reynolds number effects. The observed dependence of the mixing behavior on the density ratio and Re have led us to make new hypotheses concerning the nature of turbulent mixing.

713,175
PB86-200375 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
New Diagnostic Technique for Simultaneous, Time-Resolved Measurements of Concentration and Velocity in Simple Turbulent Flow Systems.
Final rept.
W. M. Pitts, B. J. McCaffrey, and T. Kashiwagi. 1983, 6p
Contract AFOSR-MIPR-83-00012
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Proceedings of the Symposium on Turbulent Shear Flows (4th), Karlsruhe, West Germany, September 12-14, 1983, p15.22-15.27.

Keywords: *Flow measurement, *Turbulent flow, Rayleigh scattering, Hot wire anemometers, Velocity measurement, Cross correlation.

A new experimental method is described which allows the simultaneous real-time measurement of concentration and velocity in simple flow fields of binary gas mixtures. This method combines the use of Rayleigh light scattering for concentration measurements and hot-wire (or hot-film) anemometry. Calibration methods and representative results are discussed.

713,176
PB86-210234 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Measurement of Air Velocity Components of Natural Convective Interzonal Air Flow.
Final rept.
B. M. Mahajan. 1986, 9p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Air Movement and Distribution Conference, Lafayette, IN., May 27-29, 1986, p95-103 May 86.

Keywords: *Air flow, Flow visualization, Convection, Doors.

Recent flow visualization tests performed at the National Bureau of Standards Passive Solar Test Facility, indicated that the natural convective interzonal flow through a doorway is three dimensional with the velocity components perpendicular to the plane of the opening and the plane of the floor appearing dominant. In order to further investigate the velocity components of the interzonal airflow through a doorway an experimental study was undertaken.

713,177
PB86-210242 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Inter-room Air Flow by Natural Convection via a Doorway Opening.
Final rept.
B. M. Mahajan. 1986, 9p
Sponsored by Department of Energy, Washington, DC.
Pub. in ASME (American Society of Mechanical Engineers) Solar Energy Conference (SED 8th Annual), Anaheim, CA., April 13-16, 1986, p473-481.

Keywords: *Air flow, Doors, Convection, Temperature, Velocity.

The objectives of the study were to measure the temperature and velocity profiles of the air moving by natural convection through a doorway opening; and compare the measured data with the values predicted by the simple existing algorithms. Two types of experiments were carried out in two sets of full-size adjoining rooms of the NBS passive solar test facility.

713,178
PB87-100244
(Order as PB87-100186, PC **A08**/MF **A01**)
Brunel Univ., Uxbridge (England).
Improvements in the Application of the Numerical Method of Characteristics to Predict Attenuation in Unsteady Partially Filled Pipe Flow.
J. A. Swaffield, and K. Maxwell-Standing. Jun 86, 8p
Grant NANB-D-0510
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v91 n3 p149-156 May-Jun 86.

Keywords: *Pipe flow, *Unsteady flow, Pipes(Tubes), Interpolation, Attenuation, Iteration, Numerical solution, Method of chracteristics.

The use of linear interpolation and simplified iteration procedures are shown to introduce inaccuracies to the rectangular grid method of characteristics, particularly when applied to subcritical flows. Comparisons of experimental and computational results are presented illustrating the use of Everett and Newton-Gregory interpolation, in addition to a more complex iteration procedure, to substantially improve the method's ability to maintain both steady uniform flows under subcritical conditions, and retain wave steepness during propagation along the drainage pipe. The results presented will be directly applicable to the building drainage network model previously developed at Brunel University with the support of NBS CBT grant aid.

713,179
PB87-106035 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Numerical Modeling of Vortex Merging in Axisymmetric Mixing Layers.
Final rept.
R. W. Davis, and E. F. Moore. 1985, 6p
Pub. in Lecture Notes in Physics 218, p180-185 1985.

Keywords: Two dimensional flow, Vortices, Stability, Jets, *Computational fluid dynamics, *Mixing layers.

The paper presents numerical solutions for spatially-developing axisymmetrix mixing layers. The vortex merging inside these mixing layers is driven by small perturbations derived from linear inviscid stability theory. It is found that, as seen experimentally in the two-dimensional case, the merging process is controlled by the frequency content of the forcing function. Thus it is possible to manipulate the downstream behavior of the mixing layer by altering the applied perturbation. Although the forced temporally-developing mixing layer with its simpler boundary conditions has been studied computationally, this is not as desirable as studying the spatially-developing case which occurs in most physical situations.

713,180
PB87-106043 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Numerical Study of Vortex Merging in Mixing Layers.
Final rept.
R. W. Davis, and E. F. Moore. 1985, 10p
Pub. in Physics of Fluids 28, n6 p1626-1635 1985.

Keywords: Two dimensional flow, Unsteady flow, Vortices, Mixing, Reprints, *Computational fluid dynamics, *Mixing layers.

Numerical solutions are presented for forced spatially-developing axisymmetric and two-dimensional mixing layers. The numerical scheme employs quadratic upwind differencing for convection and a Leith-type of temporal differencing in order to solve the incompressible Navier-Stokes and continuity equations. The applied forcing function is derived from linear inviscid stability theory. The resulting large-scale vortex dynamics is visualized by means of streakline and isovorticity contour plots. It is seen that the vortex merging behavior in both types of mixing layers is determined by the subharmonics present in the forcing function. Manipulation of the vortex dynamics in a predictable fashion is possible through alterations in the frequency content of this applied forcing. Reynolds number is shown to be of only minor importance.

713,181
PB87-109682 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.

Non-Newtonian Flow between Concentric Cylinders and the Effects of Finite Compressibility.
Final rept.
J. C. Rainwater, and H. J. M. Hanley. Nov 85, 11p
Sponsored by Department of Energy, Washington, DC.
Pub. in International Jnl. of Thermophysics 6, n6 p595-605 Nov 85.

Keywords: *Compressibility, Thermophysical properties, Compressible flow, Reprints, *Non-Newtonian flow, Concentric cylinders, Weissenberg effect.

Previous studies of the flow of a model soft-sphere liquid between rotating vertical concentric cylinders have predicted an enhanced depression of the free surface at the inner cylinder and the necessity and importance of accounting for finite compressibility. In those studies the rheological properties of the liquids were taken directly from computer simulations, whereas in the present work the liquid properties are altered in a controlled manner and the fluid dynamics problems is again solved numerically and self-consistently with the original boundary conditions. Specific alterations include the removal of all non-Newtonian properties, the change in sign of a generalized viscosity to create a rodclimbing or Weissenberg effect, and the removal of shear dilatancy or increase in pressure with shear. The conclusion is that nonzero compressibility needs to be taken into account only in the presence of shear dilatancy.

713,182
PB87-117735 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Note on Flow Rate and Leak Rate Units.
Final rept.
C. D. Ehrlich. 1986, 2p
Pub. in Jnl. of Vacuum Science and Technology A 4, n5 p2384-2385 Sep/Oct 86.

Keywords: *Gas flow, *Leakage, Calibrating, Vacuum, Reprints.

The confusion in the literature and in the laboratory surrounding the terminology and units of gas flow rates, particularly as applied to calibrated leak artifacts, has prompted this discussion of leak rate units. Special attention is paid to conflicting usages of the term 'throughput,' and how this frequently leads to the loss of crucial information about the gas temperature and hence the true gas flow rate. The advantages of expressing leak rates in 'mol/s,' avoiding the complications of both the explicit mention of temperature in the unit and the need for agreement on 'standard' temperature and pressure, are also discussed.

713,183
PB87-128328 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Thermometer for Fast Response in Cryogenic Flow.
Final rept.
B. Louie, R. Radebaugh, and S. R. Early. 1986, 12p
Sponsored by Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH.
Pub. in Advances in Cryogenic Engineering 31, p1235-1246 1986.

Keywords: *Temperature measuring instruments, *Resistance thermometers, Silicon, Thin films, Sapphires, Substrates, Reprints, *Cryogenic fluids, Acoustic waves, Transients.

The measurement of transient temperatures in cryogenic fluid flow requires a highly sensitive, intrinsically fast sensor that is in good thermal contact with the fluid but in poor thermal contact with the solid walls confining the fluid. A resistance thermometer made from a 1 micrometer thick silicon layer on a 125 micrometers thick sapphire substrate has a calculated intrinsic response time of about 10 ns at 4 K, and its sensitivity is comparable to germanium or carbon thermometers in the range of 1 - 80 K. The paper describes a novel construction method to mount the small silicon-on-sapphire thermometer in an oscillating fluid flow.

713,184
PB87-134383 PC **A16**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Investigation of Horizontal Flow Boiling of Pure and Mixed Refrigerants.
H. D. Ross. Nov 86, 359p NBSIR-86/3450
Portions of this document are not fully legible. Sponsored by Department of Energy, Washington, DC.

Keywords: *Heat transfer, *Refrigerants, Two phase flow, Boiling, Fluid flow, Mixtures.

The research involved determining experimental heat transfer coefficients (HTC), examining the phenomena involved in the physical process, and analyzing the predictive ability of available models and correlations. This work was done for pure R152a and R13B1 and for mixtures of these refrigerants. The mixtures yielded sharply lower heat transfer coefficients than either pure refrigerant. With pure refrigerants full suppression of nucleate boiling (FSNB) occurs only at rather low pressures. Correlative evidence suggests that suppression is easier to achieve with mixtures than pure fluids. In the evaporation-dominated heat transfer regime, Chen's correlation was successfully applied to the refrigerants with and without the occurrence of FSNB conditions. In the nucleate boiling dominated regime, the Stephan and Abdelsalam method was validated for pure fluids, and used successfully with Thome's method for mixtures. Pressure drop correlations for pure fluids were also extended to mixtures without modification.

713,185
PB87-153656 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Early Applications of Vacuum, from Aristotle to Langmuir.
Final rept.,
T. E. Madey. 1984, 8p
Pub. in Jnl. of Vacuum Science and Technology A-Vacuum Surfaces and Films 2, n2 p110-117 1984.

Keywords: *Vacuum, Vacuum apparatus, Vacuum pumps, History, Reprints.

Highlights of the development of vacuum science and technology from ancient times to the early twentieth century are reviewed. The view of the Greek philosophers that vacuum was an impossibility hampered understanding of the basic principles of vacuum until the mid 17th century. Verifiable vacua were first produced in Italy by Berti and Toricelli; von Guericke's dramatic experiments vividly demonstrated atmospheric pressure. Serious scientific developments of the 19th century which necessitated vacuum included Crooke's and Faraday's gaseous discharge measurements, the first sputtering experiments by Grove, the isolation of the rare gases by Ramsey, the standards work of Miller, the discovery of the electron by Thomson and of X-rays by Rontgen. The development of the incandescent light by Edison provided a background for the remarkable achievements of Langmuir in vacuum and surface science at the dawn of the 20th century. An appendix is included which lists museums containing vacuum-related exhibits.

713,186
PB87-153854 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Fluid Metering Research at NBS (National Bureau of Standards): New Research Tools and New Opportunities.
Final rept.,
G. E. Mattingly. 1984, 25p
Pub. in Advances in Instrumentation 39, Part 2 p1145-1169 1984.

Keywords: *Fluid flow, *Metrology, Measurements, Flow rate, Reprints, Laser doppler velocimeters.

As the value of the scarce fluid resources increases in today's market places and process industries so does the need for improved fluid quantity and flowrate measurements. Both buyers and sellers of fluid products are increasingly concerned about accurate custody transfer. Designers and operators of industrial processes are increasingly concerned about the repeatability of their fluid measurements to optimize the performance of their continuous production technologies. To satisfy these expressed needs for improved fluid measurements, in the wide range of fluids and conditions required, is a considerable task. Currently desired levels of fluid measurement generally exceed existing metering capabilities. Anticipated future measurement requirements will be even more demanding. To meet these levels using existing metering techniques or to establish new metering technologies to meet them will require full use of the fluid research tools and capabilities now available for these purposes. A description of several of the new fluid metering research tools and capabilities established at NBS will be given. Several examples of how these capabilities have been (and are) being used will also be shown.

713,187
PB87-157004 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Performance Evaluation of the Longwave Acoustic Flowmeter.
Final rept.,
J. Potzick. 1984, 1p
Pub. in Review of Scientific Instruments 55, n7 p1173 1984.

Keywords: *Flowmeters, Gas flow, Acoustics, Reprints.

The NBS Longwave Acoustic Flowmeter has been tested on room-temperature airflow in a closed pipe to 1.4 kg/s and found to have a sensitivity error of -0.8% and an offset of 2.3 g/s.

713,188
PB87-157129 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Numerical Computation of 3-D Fire-Induced Flows and Smoke Coagulation.
Final rept.,
R. G. Rehm, and H. R. Baum. 1985, 6p
Pub. in Proceedings of International Conference on Numerical Methods in Fluid Dynamics (9th), Saclay, France, June 25-29, 1984, p453-458 1985.

Keywords: *Smoke, Fire tests, Convection, Buoyancy, Finite difference theory, Computational fluid dynamics.

In the previous conference the authors proposed a convective model which eliminates all small-scale phenomena and concentrates on predicting the large-scale buoyant convection without empirical parameters (such as occur in turbulence models). The numerical scheme, computational results and comparison of the large-scale features with experiments were presented for a thermally expandable fluid in the two-dimensional case. In the present paper, the numerical scheme is generalized to three-dimensional, time-dependent flows and specialized to a Boussinesq fluid. It is also shown how the small-scale phenomenon of smoke coagulation can be imbedded in the large-scale flow field. The authors suggest that this simple model, coupling a small-scale phenomenon to large-scale convective features, can be regarded as a prototype for more general and more complicated couplings which occur during combustion, heat transfer along walls and other physical phenomena, including turbulence.

713,189
PB87-201836 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Effects of Global Density and Reynolds Number Variations on Mixing in Turbulent, Axisymmetric Jets.
Internal rept.,
W. M. Pitts. Mar 86, 173p NBSIR-86/3340
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.

Keywords: *Turbulent flow, *Jet mixing flow, Flow visualization, Density measurement, Shadowgraph photography, Axisymmetric flow, Reynolds number, Rayleigh scattering, Light scattering, Quantity ratio.

Shadowgraphy and laser-induced Rayleigh light scattering measurements of centerline concentration have been utilized to investigate the effects of global density and Reynolds number variations on the mixing behavior of a turbulent, axisymmetric jet. The shadowgraph measurements give a qualitative indication of the variations in average mixing behavior and turbulent structure which occur when the jet/coflow density ratio and the Re are varied. These trends are quantified by the Rayleigh scattering concentration measurements which give measurements of average centerline concentration fluctuations. The results of the study have led to the proposal of a simple, qualitative theory based on reasonable assumptions concerning the flow

behavior which gives predictions which are in agreement with the experimental findings.

713,190
PB87-225413 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Effects of Global Density and Reynolds Number Variations on Mixing in Turbulent, Axisymmetric Jets - Implications for Turbulent Jet Diffusion Flames.
Final rept.,
W. M. Pitts. 1987, 13p
See also PB87-201836. Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Proceedings of American Society of Mechanical Engineers/JSME Thermal Engineering Joint Conference (1987), Honolulu, HI., March 22-26, 1987, v1 p123-135.

Keywords: *Turbulent flow, *Jet mixing flow, Axisymmetric flow, Density measurement, Isotherms, Mixing, Fluid dynamics, Reynolds number, Diffusion flames, Jets, Reprints.

Recent experiments by Pitts have characterized the effects of global density ratio and Reynolds number on mixing in isothermal, turbulent, axisymmetric jets. The results are summarized and implications for turbulent jet diffusion flames are discussed. The findings of the isothermal study are directly applicable to flame lift-off and blow out for which it is shown that these properties can be predicted based on the known isothermal mixing behavior. This analysis requires that these processes be dependent only on mixing in large scale eddies. Conditions are identified for which the isothermal results can be extended to turbulent mixing within the combustion regions of jet flames. Magnitudes of local Reynolds numbers in either isothermal or combusting jets are shown to have a negligible effect on time-averaged jet fluid concentration or unmixedness as long as they are large enough to insure the development of large scale turbulent structures.

713,191
PB88-122056 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Measurement of Solids Fraction in Two-Component Slurries.
Final rept.,
W. G. Cleveland, and A. K. Gaigalas. 1987, 8p
Contract DE-AI01-85CE40748
Sponsored by Department of Energy, Washington, DC. Office of Industrial Programs.
Pub. in Sensors Expo Proceedings 1987, Detroit, MI., September 15-19, 1987, p41-48.

Keywords: *Slurries, *Two phase flow, Solids, Pipe flow, Dielectric properties, Reprints, *Foreign technology.

An important parameter in many industrial processes involving slurries is the mass fraction of solids being carried by the liquid phase. A technique is described to measure the solids fraction in a two-component slurry, such as cellulose-water, sand-water, or coal-water. The method determines the effective dielectric constant of the slurry and then utilizes a mixture rule and the dielectric constants of the two individual components to extract the solids fraction. The greatest sensitivity is attained when there is a large difference in the dielectric properties of the two components, which is the case for most slurries with water as the carrier liquid.

713,192
PB88-138896 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.
Analysis of a Laminar Vortex Shedding Behind a Circular Cylinder by Computer-Aided Flow Visualization.
Final rept.,
B. E. Eaton. 1987, 29p
Pub. in Jnl. of Fluid Mechanics 180, p117-145 Jul 87.

Keywords: *Flow visualization, Navier-Stokes equations, Numerical analysis, Vortices.

Streamline, streakline, and material line flow visualization techniques have been numerically simulated in the vortex shedding flow field from a finite element simulation of the 2-D Navier-Stokes equations at Reynolds number 110. The results have been used (1) to characterize the wake in terms of its critical point trajectories, and (2) to verify that the 2-D Navier-Stokes model predicts the mechanism of vortex shedding experimentally observed by Gerrard (1978). A technique for determining vorticity balances in the flow field is also presented.

713,193
PB88-138912 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Viscous Flow in the Stress Ensemble.
Final rept.,
D. J. Evans, and J. F. Ely. 1986, 6p
Pub. in Molecular Physics 59, n5 p1043-1048, 10 Dec 86.

Keywords: *Fluid flow, *Viscous flow, *Shear stress, Simulation, Constraints, Reprints.

The stress ensemble has advantages for studying shear flow in highly viscous media. The authors derive a simple method for performing NEMD simulations in the ensemble. The authors also derive the associated equilibrium fluctuation expressions for the zero frequency shear viscosity. These expressions relate the reciprocal of the shear viscosity to strain rate fluctuations in the zero stress equilibrium ensemble. The authors analysis is based upon the Nose-Hoover method of treating non-holonomic constraints. They show that for generating the stress ensemble, the Nose-Hoover method is much simpler to implement than the corresponding Gaussian approach.

713,194
PB88-152210 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Algorithm for Ascertaining Linear Range of Turbine Flow Meters.
Final rept.,
F. E. Jones. 1985, 2p
Pub. in Review of Scientific Instruments 56, n9 p1829-1830 Sep 85.

Keywords: *Flowmeters, *Turbine instruments, Fluid flow, Algorithms, Range(Extremes), Calibrating, Reprints.

The conventional practice of expressing the relationship between volume flow rate, Q, and frequency, f, (or pulse rate) for turbine flow meters by the 'K factor' is examined. Curvature in plots of K against f due to the existence of a non-zero intercept in the linear equation relating f to Q is illustrated using calibration (water and Type II hydrocarbon) data. An algorithm which enables the actual linear range of turbine flow meters to be simple and easily ascertained is presented. The very significant improvement in linearity accomplished by the use of the algorithm is illustrated for the calibration data.

713,195
PB88-152418 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Transfer Leak Studies and Comparisons of Primary Leak Standards at the National Bureau of Standards and Sandia National Laboratory.
Final rept.,
R. W. Hyland, C. D. Ehrlich, C. R. Tilford, and S. Thornberg. 1986, 4p
Pub. in Jnl. of Vacuum Science and Technolgy A 4, n3 pt1 p334-337 May/Jun 86.

Keywords: *Leakage, *Standards, Calibrating, Helium, Temperature coefficient, Nitrogen, Argon, Flow rate, Sintering, Transferring, Reprints.

Primary leak standards are being developed at the National Bureau of Standards (NBS), and a cooperative NBS - Sandia National Laboratory (SNL) program is underway to compare their different primary standards and investigate the properties of transfer leaks. Initial results of comparisons of the primary standards at the two laboratories, accomplished via sintered metal transfer leaks in the range 5e-12 to 5e-9 moles/sec, show that the calibration methods used in the two laboratories agree to within a few percent for nitrogen, argon, and helium. Significant instabilities with time have been observed for one of the two leaks used in the comparison. Temperature coefficient data for helium diffusion leaks are presented which illustrate the possibility of significant errors when a linear temperature dependence is assumed over too wide a temperature range.

Optics & Lasers

713,196
AD-A037 525/3 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Optical Materials Characterization.
Semi-annual technical rept. 1 Aug 76-31 Jan 77.
A. Feldman, D. Horowitz, R. M. Waxier, M. J. Dodge, and W. K. Gladden. Mar 77, 37p Rept no. NBSIR-77-1219
ARPA Order-2620

Keywords: *Optical materials, Prisms(Optics), Single crystals, Refractive index, Thermal properties, Optical coatings, Vapor deposition, Interferometry, Zinc sulfides, Calcium fluorides, Doping, Erbium, Radiation absorption, Windows, Thermal stresses, Alkali metal compounds, Alkaline earth compounds, Halides, Zinc selenides, Chemical vapor deposition, Visible spectra, Infrared optical materials, Infrared windows, Sodium fluoride, Laser materials, Reactive atmosphere process, Barium fluoride, Strontium fluoride, Potassium chloride, Potassium bromide, Potassium iodide.

The refractive indices of three prisms of chemical vapor deposited ZnS were measured at room temperature over the wavelength range 540 nm to 1.083 micrometers. The refractive indices of eight specimens of CaF2 doped with Er were measured from 404.7 nm to 1.083 micrometers. The doping range was 0.001% to 3% Er. Interferometric measurements of dn/dT were made over the temperature range -180 to 200 C at the wavelengths 632.8 nm and 3.39 micrometers on single crystal specimens of BaF2, CaF2, reactive atmosphere processed (RAP) KBr, RAP KCl, KCl, doped with KI, LiF, NaF and SrF2, and on chemical vapor deposited (CVD) ZnSe and hot forged CaF2. (Author)

713,197
AD-A038 725/8 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Proposed Standards for Ladar Signatures.
Final rept.
B. L. Danielson. Apr 77, 39p Rept no. NBSIR-77-856

Keywords: *Optical radar, *Lasers, *Optical signatures, Standardization, Calibration, Cross sections, Diffusers, Polarization, Radar cross sections, Doppler effect, Bibliographies, Laser targets, Standards.

The laser radar (LR) signatures program sponsored by the Ballistic Missile Defense Advanced Technology Center is directed towards employing LR target scattering for the identification and discrimination of threatening objects. The scattered target radiation is usually expressed in terms of various types of laser radar cross sections (LRCS). Unfortunately, in the past there has not been universal agreement on the precise definitions of the LRCS's of interest, nor has there been a common traceable method for calibrating the diverse systems used in measuring experimental values of LRC's. For example, cross section definitions based on radar use can differ by a factor of 4 from definitions based on the optical use of diffuse plates. Polarization is another factor that is not consistently taken into account. This report represents an effort by the National Bureau of Standards (NBS) to encourage the adoption of a common basis for LRCS measurements.

713,198
AD-A045 095/7 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Optical Materials Characterization.
Semi-annual technical rept. 1 Feb-31 Jul 77,
A. Feldman, D. Horowitz, R. M. Waxler, M. J. Dodge, and W. K. Gladden. Aug 77, 43p NBSIR-77-1304
ARPA Order-2620

Keywords: *Laser materials, *Infrared windows, *Refractive index, Optical materials, Coefficients, Thermal properties, Infrared optical materials, Tables(Data), Strontium compounds, Calcium fluorides, Lithium fluorides, Potassium chloride, Zinc selenides, Potassium compounds, Sodium compounds, Barium compounds, Chlorides, Bromides, Fluorides, Plexiglas, Polycarbonates, Polycarbonate resins, *Crystal growth, Fabrication, Barium fluoride, Strontium fluoride, Potassium bromide, Sodium fluoride, Zinc sulfides, Reactive atmosphere processing, Chemical vapor deposition, Forging, Thermal expansion.

The refractive index of fusion cast CaF2 was measured at room temperature over the wavelength range

0.2144 micrometers to 8.662 micrometers and the data were fitted to a Selmeier type equation. Measurements of refractive index of hot forged CaF2 were extended to the wavelength range 0.2024 micrometers to 0.2483 micrometers. Data are presented for dn/dT of single crystal specimens of CaF2, BaF2, reactive atmosphere processed (RAP) KC1 and KBr, LiF, NaF, and 2SrF2, and polycrystalline chemical vapor deposited (CVD) ZnSe and ZnS. The measurements were done by the method of Fizeau interferometry over the temperature range -180 deg to 200 deg C at the wavelengths 0.6328 micrometers, 1.15 micrometers, 3.39 micrometers and 10.6 micrometers. Data are presented for the refractive indices, the linear thermal expansion and dn/dT of Lexan and Plexiglas 55. (Author)

713,199
AD-A056 197/7 PC **A02**/MF **A01**
National Bureau of Standards Washington DC Ceramics Glass and Solid State Science Div
Optical Materials Characterization.
Technical rept. 1 Aug 77-31 Jan 78,
A. Feldman, D. Horowitz, R. M. Waxler , and M. J. Dodge. May 78, 23p NBSIR-78-1473
ARPA Order-2620

Keywords: *Laser materials, *Infrared windows, *Infrared optical materials, Calcium fluorides, Barium compounds, Fluorides, Strontium compounds, Refractive index, Interferometry, Thermal expansion, Piezoelectric materials, Photoelasticity, Infrared lasers, Stress optical coefficient, Sodium chloride, Cadmium fluorides, Barium fluorides, Strontium fluorides.

The piezo-optic constants of CaF2, BaF2, and SrF2 have been measured at 0.6328 micrometers and 1.15 micrometers. The temperature dependence of the refractive indices of CdF2, MgF2, and NaCl have been measured at several wavelengths in the infrared by the method of Fizeau interferometry. The linear thermal expansion coefficients of NaCl and CdF2 as a function of temperature have also been measured. (Author)

713,200
AD-A125 809/4 Not available NTIS
Rochester Univ., NY. Dept. of Physics and Astronomy.
Elimination of Distortions by Phase Conjugation without Losses or Gains.
G. S. Agarwal, A. T. Friberg, and E. Wolf. 3 Aug 82, 7p ARO-16814.19-PH
Contract DAAG29-80-C-0020
Pub. in Optics Communications, v43 n6 p446-450, 15 Nov 82.

Keywords: *Distortion, *Scalers, *Phase control, *Gain, *Losses, *Mirrors, Greens function, Approximation(Mathematics), Reprints, Phase conjugations, Mirrors(Phase conjugated), Distortion cancellation, PCM(Phase Conjugate Mirrors), Lossless mirrors.

No abstract available.

713,201
PATENT-4 184 127 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Frequency Stabilized Laser.
Patent.
R. B. Green, R. A. Keller, G. G. Luther, P. K. Schenck, and J. C. Travis. Filed 13 Nov 78, patented 15 Jan 80, 6p PB80-600027, PAT-APPL-960 193

Keywords: *Analytical flame, Discharge tube, Laser, Optogalvanic effect, Transition frequency.

An apparatus and method for utilizing the opto-galvanic effect to perform spectroscopic or analytic investigations of atomic or molecular species. A sample of the substance to be analyzed is vaporized in an analytical flame, gas discharge tube, high temperature furnance or the like and the vapor is irradiated with chopped or pulsed variable wavelength monochromatic light. The electrical resistance of the vapor is monitored as the frequency of the radiation is tuned through one or more electronic transition frequencies of the substance. The resistance spectrum resembles the optical absorption spectrum of the species in the vapor. The optogalvanic effect may also be used to frequency lock a laser to a transition frequency of a substance in a gas discharge cell.

713,202
PATENT-4 590 597 Not available NTIS
Department of Commerce, Washington, DC.
Modulation Transfer Spectroscopy for Stabilizing Lasers.
Patent.
M. Long-sheng, L. Hollberg, J. H. Shirley, and J. L. Hall. Filed 21 May 84, patented 20 May 86, 6p PB86-201985, PAT-APPL-6-612 291
Supersedes PB84-224641.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.00.

Keywords: *Lasers, *Frequency stability, *Stabilization, *Patents, Gases, *Modulation transfer spectroscopy, Optical resonators, PAT-CL-372-32.

A method and apparatus are disclosed for precisely stabilizing a laser to a sub-Doppler resonance of an absorbing gas contained in a cell located external to the laser resonator. Stabilization is based on the detection of modulation transferred onto a previously unmodulated probe beam by the non-linear interactions of the absorbing gas located in a cell which is subject to a counter-running, frequency-modulated saturation beam. Alternatively, the further modulation of the saturation beam can be detected.

713,203
PATENT-4 700 150 Not available NTIS
Department of Commerce, Washington, DC.
External Laser Frequency Stabilizer.
Patent,
J. L. Hall, and T. W. Hansch. Filed 14 Jun 85, patented 13 Oct 87, 6p PB88-146816, PAT-APPL-6-745 309
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 $1.50.

Keywords: *Laser beams, *Frequency stability, *Patents, Frequency control, Stabilization, Electrooptics, Phase modulation, Frequency shift, Transducers, Tunable lasers, Dye lasers, Acoustooptics, PAT-CL-332-751.

An external laser frequency stabilizer combines an acousto-optic frequency shifter and a fast electro-optic phase modulator. A compensating electronic delay line in a crossover network provides a near-ideal transducer response while keeping the voltage across the electrooptic crystal away from the amplifier limits.

713,204
PB-262 581/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electrical Strobing of a Photoconductor Cuts Sampling Oscilloscope's Risetime.
Final rept.,
R. A. Lawton, and J. R. Andrews. 1976, 4p
Pub. in Laser Focus Mag., p62-65 Nov 76.

Keywords: *Oscilloscopes, Waveforms, Sampling, Optical equipment, Gallium arsenides, Photoconductors, Reprints.

An oscilloscope capable of directly sampling optical waveforms has been developed at NBS. It uses a GaAs photoconductor strobed by an electrical impulse. The transition time of the oscilloscope is 100 ps.

713,205
PB-263 138/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theory of Optical Wedges as Flux Modulators.
Final rept.,
C. S. McCamy. Dec 76, 6p
Pub. in J. Opt. Soc. Am. 66, n12 p1350-1355 Dec 76.

Keywords: *Densitometers, *Photographic images, Optical measurement, Modulation, Reflectance, Light transmission, Apertures, Calibrating, Wedges, Reprints, Microdensitometers, Optical modulators, *Optical wedges.

Many optical experiments and applications require the use of devices called optical wedges which are thin-sheet optical modulators having a continuous, usually linear, change in optical density with either distance or angle. The optical density of a sample area on an optical wedge depends on the size and shape of the aperture and the characteristics of the wedge. The relationship of the effective density of the whole sample to the density at the center of the sample has been derived for wedges of rectilinear and circular form and sampling apertures in the form of rectangles, circles, and circular sectors. The theory has applications in the microdensitometry of photographic edges.

713,206
PB-263 141/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Range Measurements Using Non-Gaussian Pulse Shapes.
Final rept.,
F. D. Ghigo, P. J. Shelus, E. C. Silverberg, and J. E. Faller. Nov 76, 3p
Pub. in Appl. Opt., v15 n11 p2621-2623 Nov 76.

Keywords: *Range finders, *Laser beams, Accuracy, *Laser range finders, Reprints.

Many optical ranging systems currently use lasers with approximately Gaussian shape of a few nanoseconds or less. In those cases where the number of photoelectrons in the return signal is small, either on a single shot basis or where a number of shots are combined to build up an 'equivalent' single shot, the accuracy of the range measurement is proportional to W/(square root of N), where W is the width of the laser pulse and N the number of photoelectrons received. The authors show that a considerable improvement in accuracy can be obtained if the unbounded, Gaussian pulse shape is modified so that it can be considered a bounded distribution of finite duration.

713,207
PB-264 136/3 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C.
Measurement of Energy Irradiance from Single Pulse Sources.
Final rept.,
A. R. Schaefer, and E. F. Zalewski. Feb 77, 35p
NBS-TN-935

Keywords: *Flash lamps, *Xenon lamps, *Luminous intensity, Radiometry, Standards, Optical measurement, Photometry.

A method of measuring the energy irradiance from a single pulsed source, such as a xenon flashtube, is presented. Details of the approach used in this particular measurement are given, along with a discussion of the data analysis. In particular, the authors consider some of the inherent problems encountered in curve fitting which are also common to other radiometric and photometric measurements.

713,208
PB-264 318/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Inclusions in Cadmium Telluride: Estimates for Damage Thresholds.
Final rept.,
H. S. Bennett, and C. D. Cantrell. 1977, 8p
Pub. in J. Appl. Phys., v48 n2 p522-529 Feb 77.

Keywords: *Cadmium tellurides, *Inclusions, *Laser materials, Infrared optical materials, Radiation effects, Elastic properties, Stresses, Impurities, Defects, Reprints.

One problem frequently encountered in high-power laser systems is the thermal extrinsic damage to the laser materials, which arises from absorbing inclusions. Absorbing inclusions are impurities with physical and optical properties which differ substantially from those of the host material. Such inclusions may absorb sufficient radiation from the incident laser beam to produce major stresses within the host. In this paper, estimates of the maximum tensile stress as a function of inclusion size, laser pulse width, and laser power are computed for the common precipitates in CdTe.

713,209
PB-264 325/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Absolute Spin-Flip Raman Laser Frequency Measurements with Metal-Insulator-Metal Diodes.
Final rept.,
J. S. Wells, G. E. Streit, and F. R. Petersen. 1976, 5p
Pub. in Opt. Commun., v19 n2 p248-252 Nov 76.

Keywords: *Frequency measurement, *Infrared spectrometers, *Tunable lasers, Raman spectroscopy, Optical pumping, Metals, Frequency synthesizers, Diodes, Infrared lasers, Reprints, Metal insulator metal junctions, Raman lasers, Spin flip raman lasers.

Infrared frequency synthesis techniques with metal-insulator-metal (MIM) diodes have been extended to in-

clude absolute frequency measurement of a spin-flip Raman Laser (SFRL). As a result of this extension, spectroscopy in the 5.3 micrometer region more readily can be put on a frequency rather than a wavelength metrology basis. Additional observations with the diode are in qualitative agreement with recent work relating to non-linear tuning over axial SFRL modes.

713,210
PB-264 338/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Precision Interferometer for Measuring Photoelastic Constants.
Final rept.,
R. M. Waxler, D. Horowitz, and A. Feldman. 1977, 3p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in Appl. Opt., v16 n1 p20-22 Jan 77.

Keywords: *Silica glass, *Photoelasticity, *Interferometers, Optical measuring instruments, Reprints.

A stable polarizing interferometer has been adapted for measuring small changes in optic path induced by small stresses in optical materials. With this instrument the authors measured the piezo-optic constants of fused silica at 0.6328 micrometers by applying stresses up to 13,400,000 N/sq.m and found good agreement with previous workers who employed much higher stresses. This technique is valuable for measuring the piezo-optic constants of materials that cannot withstand large stresses.

713,211
PB-265 225/3 PC **A09**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Color: Universal Language and Dictionary of Names,
K. L. Kelly, and D. B. Judd. Dec 76, 192p NBS-SP-440

Keywords: *Color, *Standards, *Dictionaries, Munsell Color System, Visual perception, Accuracy, Graphs(Charts), Tables(Data), Comparison, Colorimetry.

The Universal Color Language (UCL) has been revised and will be published together with the 7th printing of the Color Names Dictionary. It serves as the means of updating the Dictionary. The UCL brings together all the well known color-order systems and methods of designating color. It interrelates them in six correlated levels of fineness of color designation, each higher level indicating a finer division of the color solid. It follows closely the original requirements for the ISCC-NBS Method of Designating Colors stated in the Color Names Dictionary. They were: (a) accurate enough to satisfy a scientist, (b) usable enough to satisfy a manufacturer, and (c) simple enough to be understood by the average person on the street. The UCL is being increasingly used by science, art and industry. Instructions are included for the application of the UCL at each level. (Color illustration reproduced in black and white.)

713,212
PB-265 783/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Relative Dominance of Bulk or Surface Absorption in Highly Transparent Materials by Transient Methods,
H. S. Bennett, and R. A. Forman. Mar 77, 6p
Pub. in Jnl. of Applied Physics, v48 n3 p1217-1222 Mar 77.

Keywords: *Laser beams, *Infrared optical materials, *Absorptivity, Gases, Measurement, Pressure, Test equipment, Transparence, Reprints, Barothermal method.

For the case in which a pulsed laser beam passes through the weakly absorbing windows of a gas cell containing a nonabsorbing gas, the time rate of change of the relative pressure rise immediately after the cessation of the laser beam correlates directly with the relative dominance of bulk and surface absorption in highly transparent materials. Whenever bulk absorption dominates, the time derivative of the pressure rise in the gas for times shortly after cessation of the pulse is positive; when surface absorption dominates, it is negative; and when bulk and surface absorption are comparable, it is very close to zero. This, suggests then, a relatively simple experimental procedure by which one may determine nondestructively the relative dominance of bulk or surface absorption in highly transparent materials.

713,213
PB-266 040/5 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Optical Physics Div.
Optical Radiation Measurements: The 1973 NBS Scale of Spectral Irradiance.
Final rept.,
R. D. Saunders, and J. B. Shumaker. Apr 77, 40p NBS-TN-594-13
See also report dated Oct 76, PB-259 639.

Keywords: *Radiant flux density, *Irradiance, *Optical measuring instruments, Optical measurement, Calibrating, Monochrometers, Standards, Mathematical analysis, Lamps.

This note describes the measurement apparatus and techniques used in deriving the 1973 scale of spectral irradiance. The uncertainty of this scale is believed to be less than 2% in the spectral region 250 nm-500 nm and less than 1% in the spectral region 500 nm-1600 nm. This uncertainty represents a threefold improvement over the previous NBS scale of spectral irradiance. The complete derivation of the projected solid angle, which is crucial when transferring from radiance to irradiance, is given. Also described in this note is a model for interpolating the spectral irradiance at wavelengths between the wavelengths measured. Measurement details are presented and sources of error are discussed.

713,214
PB-266 472/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heterodyne Measurements of Submillimeter Laser Spectrometer Frequencies,
H. E. Radford, F. R. Peterson, D. A. Jennings, and J. A. Mucha. Mar 77, 3p
Pub. in IEEE Jnl. Quant. Electron. Notes and Lines QE-13 n3 p92-94 Mar 77.

Keywords: *Gas lasers, *Infrared lasers, *Submillimeter waves, Optical pumping, Carbon dioxide lasers, Infrared spectroscopy, Frequency measurement, Far infrared radiation, Reprints, Laser spectroscopy.

The frequencies of 46 cw laser lines commonly used for submillimeter spectroscopy, with wavelengths between 0.1 mm and 0.7 mm have been measured by heterodyne methods. All the lines are optically pumped by a CO2 laser, with threshold pump powers of 3 w or less. The precision of measurement, limited by the laser line width, is typically plus or minus one part per million.

713,215
PB-266 475/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Frequency Dependence of Photoacoustic Spectroscopy: Surface- and Bulk-Absorption Coefficients,
H. S. Bennett, and R. A. Forman. Apr 77, 5p
Pub. in Jnl. Appl. Phys. v48 n4 p1432-1432-1436 Apr 77.

Keywords: *Optical materials, *Absorptivity, *Laser beams, Measurement, Test equipment, Transparence, Laser materials, Gases, Pressure, Nitrogen, Optical glass, Mathematical models, *Photoacoustic spectroscopy, Reprints.

Researchers seek improved ways to measure separately the surface- and bulk-absorption coefficients of highly transparent materials. The case in which a laser beam modulated at angular frequency omega passes through the weakly absorbing windows of a gas cell which contains a nonabsorbing gas is investigated in this paper. In particular, the frequency dependences of the acoustic stresses in the gas which arise from the surface and bulk absorption are derived. Expressions for the acoustic stress and phase shift which are valid for all frequencies are given. These expressions enable one to develop numerical procedures by which the surface- and bulk-absorption coefficients may be determined separately. Numerical examples for a representative laser glass and air (nitrogen) are given.

713,216
PB-266 479/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Implementation of a System of Optical Calibration Based on Pyroelectric Radiometry,
W. M. Doyle, B. C. McIntosh, and J. Geist. Dec 76, 8p
Pub. in Opt. Eng. v15 n6 p541-548 Nov/Dec 76.

Keywords: *Radiometry, *Optical measurement, *Reviews, Calibrating, Standards, Detectors, Pyroelectricity, Reprints, Pyroelectric detectors.

This paper is a status report covering the development of detector-based standards for optical calibration. It briefly treats, in historical perspective, the philosophy and technology underlying the use of detectors as standards and assesses the impact of recent technological developments. Next, the development and operation of the Electrically Calibrated Pyroelectric Radiometer (ECPR) are described, and the methods used to characterize this instrument are outlined. Finally, the authors review the present capabilities of the ECPR and summarize some of the measurements to which it has been applied.

713,217
PB-266 480/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Trends in the Development of Radiometry,
J. Geist. Dec 76, 4p
Pub. in Opt. Eng. v15 n6 p537-540 Nov/Dec 76.

Keywords: *Radiometry, *Reviews, Lasers, Standards, Detectors, Reprints.

The presentation of the history of radiometry is divided into two periods separated by 1959, the year that the first laser was reported. In contrast to the coverage of the second period which relies heavily on the original sources, the coverage of the first period relies mostly on review material. The presentation is slanted toward work reported in the English language. This is particularly true of the second period. The presentation also tends to emphasize radiometric standards.

713,218
PB-268 502/2 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Optical Physics Div.
Self-Study Manual on Optical Radiation Measurements. Part I. Concepts, Chapter 6. Distribution of Optical Radiation with Respect to Polarization.
Final rept.,
F. E. Nicodemus. Jun 77, 66p NBS-TN-910-3
See also Rept. no. NBS-TN-910-1 dated Mar 76, PB-251 331.

Keywords: *Optical measurement, *Spectral emittance, *Radiometry, *Polarization(Waves), Optical measuring instruments, Instrumentation, Mathematical analysis, Calibrating, Manuals.

This is Chapter 6 of a SELF-STUDY MANUAL ON OPTICAL RADIATION MEASUREMENTS. It develops and illustrates the concepts necessary to include polarization rigorously in classical radiometry. The treatment is based upon the Stokes polarization vector of spectral radiance and Mueller transmittance matrices. The Mueller matrices of many common polarizing optical components are discussed. Considerable attention is paid to the measurement of the Stokes spectral radiance vector components and to the measurement of the Mueller transmittance matrix elements. The concepts and techniques are illustrated by discussions of such subjects as radiometer calibrations, three-polarizer attenuators, depolarizers, and the characterization of Polaroid-type polarizers. Also included are an appendix on matrix multiplication and an appendix showing one way by which, in principle, any Mueller transmittance matrix may be measured.

713,219
PB-269 612/8 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Optical Physics Div.
Spectral Radiometry: A New Approach Based on Electro-Optics.
Final rept.,
J. Geist, M. A. Lind, A. R. Schaefer, and E. F. Zalewski. Jul 77, 27p NBS-TN-954

Keywords: *Radiometers, *Electrooptics, Photodetectors, Silicon, Luminous intensity, Optical measurement, Pyroelectricity, Calibrating, Standards, Lasers, Circuits, Experimental design, Pyroelectric detectors.

Progress in developing a new approach to radiometry based on electro-optical technology is discussed. A feasibility experiment that demonstrates and motivates the new approach is described. The laser-based, characterization facility that plays a central role in the new approach is described. This consists of the electrically calibrated pyroelectric radiometer that provides the

absolute radiant power measurements, and the silicon photovoltaic detectors. Alternatives for extending the wavelength range of the new approach are also discussed.

713,220
PB-269 777/9 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
System for Calibrating Laser Power Meters for the Range 5-1000 W,
E. D. West, and L. B. Schmidt. May 77, 31p NBS-TN-685

Keywords: *Laser beams, *Power meters, *Calorimeters, *Calibrating, Measuring instruments, Standards, Test equipment, Performance evaluation, Experimental design, Beam splitting, Laser calorimetry.

This technical note describes the National Bureau of Standards measurement system for calibration and test of laser power and energy devices at power levels up to 1 kW and total energies of several kJ. The main parts of the system are two electrically calibrated calorimeters and several beam splitters of different materials. The two calorimeters have the same precision, and the standard deviation of an electrical calibration is the same as the standard deviation of a laser energy measurement, indicating that the laser beam does not affect the precision of the measurement. The standard deviation of an energy measurement depends on the total energy to the calorimeter and is about 0.8 percent at 1 kJ.

713,221
PB-269 778/7 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
NBS Detector Response Transfer and Intercomparison Package: The Instrumentation.
Final rept.,
M. A. Lind, E. F. Zalewski, and J. B. Fowler. Jul 77, 27p NBS-TN-950

Keywords: *Radiometers, *Photodetectors, *Radiant flux density, Instrumentation, Electrooptics, Test equipment, Calibrating, Optical measurement, Design, Laboratory equipment, Silicon, Ultraviolet radiation, Light(Visible radiation), Infrared radiation, Standards, Optical filters, Errors, Reproducibility, Circuits, Technology transfer.

A system has been designed to transfer the NBS absolute radiant power base in the 250 to 1150 nm wavelength range. The silicon detector based radiometer and its accompanying test materials can be used to measure the absolute spectral response of detectors and to provide a diagnosis of some common measurement problems. The instrumentation and accompanying components are described in this publication.

713,222
PB-270 334/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interpretation of the Drop Ball Test in Terms of a Statistical Model for Fracture.
Final rept.,
R. E. Berger. 1976, 12p
Sponsored in part by Optical Manufacturers Association, Arlington, Va.
Pub. in Am. J. Optom. Physiolog. Opt., v53 n8 p396-407 Aug 76.

Keywords: *Impact strength, *Lenses, Eyeglasses, Statistical data, Nondestructive tests, Impact tests, Defects, Reprints.

Some well known statistical models for fracture were applied to the problem of impact of glass ophthalmic lenses. Parameters for a flaw distribution function were chosen to fit some previously published results of drop ball testing. The concept of an impact-resistant lens was reformulated in terms of minimizing the most severe flaws. It was shown that the fracture of such lenses identified by the drop ball test is very small. As a side note, it was found that it is not significantly more difficult to expose 'bad' lenses when they are tested in plastic bags. A method of obtaining useful information from the results of drop ball testing was outlined.

713,223
PB-270 576/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Considerations and Standards for Visual Inspection Techniques.
Final rept.,
G. T. Yonemura. 1977, 11p
Pub. in Proceedings of Symp. on Nondestructive Testing Standards, Gaithersburg, Maryland, May 19-21, 1976, Am. Soc. Test. Mater. Spec. Tech. Pul. 624: Nondestructive Testing Standards - A Review, p220-230 Jun 77.

Keywords: *Visual acuity, *Nondestructive testing, *Optical measurement, Standards, Images, Modulation transfer functions.

The human visual system has many capacities depending on the circumstances under which it is used. The sensory data show that man can adjust to a wide variety of operating conditions. But, unless there is detailed information of the conditions for which these processes are to be optimized and quantitative descriptions of the tasks to be performed, the advantages to be obtained by visual science applications cannot be optimally used. Physical correlates of the response should be quantified, followed by a systematic scaling of the physical correlates for application to nondestructive testing. The Modulation Transfer Function widely used in optical imaging assessments would be an evaluation technique applicable to hardware, processing and image description.

713,224
PB-270 585/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Survey of Sources Used for the Accurate Measurement of Visible, Near-Infrared, and Near Ultraviolet Radiation.
Final rept.,
B. Steiner. 1976, 7p
Pub. in Proceedings of Int. Commission on Illumination (18th Session), London (England), September 13, 1975, p-75-07, p139-145 1976.

Keywords: *Optical measurement, *Photometry, *Radiometry, *Light sources, Standards, Light(Visible radiation), Infrared radiation, Ultraviolet radiation, Photons, Lasers.

A survey of photon sources used for accurate measurement throughout the world includes data on over one hundred sources. Principal characteristics of the source emission, its sensitivity to environment, and physical characteristics are covered. Incandescent sources stable to better than 0.1% have been identified. The best discharge sources are about three times less stable. Although development of entirely new sources appears unnecessary, the incorporation of bases that would permit precise alignment would improve many measurements. The most suitable sources for one type of measurement may prove more widely useful. A few lasers stable to 1% are identified.

713,225
PB-270 725/5 PC **A08**/MF **A01**
National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
Proceedings of the Workshop Seminar on Standardization in Spectrophotometry and Luminescence Measurements held at National Bureau of Standards, Gaithersburg, Maryland on November 19-20, 1975.
Final rept.,
K. D. Mielenz, R. A. Velapoldi, and R. Mavrodineanu. May 77, 154p NBS-SP-466
Library of Congress catalog card no. 77-4739. See also Volume 80A, PB-254 239.

Keywords: *Meetings, *Optical measurement, *Standards, *Photometry, Spectrophotometry, Spectroscopy, Luminescence, Luminous intensity, Optical measuring instruments, Instrumentation, Quantum efficiency, Reflectance, Fluorescence, Dyes, Laser materials, Excitation, Absorption spectra, Calorimetry, Calibrating, Ultraviolet spectroscopy, Visible spectra, Metal films, Standard Reference Materials, Immunochemistry.

Contents: Fluorescence quantum yield measurements. (J.B. Birks); Some methods of luminescence efficiency measurements. (Alfred Bril and A. Willy de Jager-Veenis); On the actinometric measurement of absolute luminescence quantum yields. (J.N. Demas and B.H. Blumenthal); The calorimetric detection of excited states. (James B. Callis); Fluorescence efficiency of laser dyes. (K.H. Drexhage); Diffuse reflectance spectroscopy; applications, standards, and calibration (with special reference to chromatography). (R.W. Frei); The interpretation of diffuse reflectance spectra. (Harry G. Hecht); Calibration of reflectance spectra. (W. Budde); Understanding bidirectional reflectance and transmission for space applications. (John B. Schutt); Standardization of light scattering measurement in conjunction with immunochemical analysis. (Gregory J. Buffone); Errors in spectrophotometry and calibration procedures to avoid them. (A.G. Reule); Standardization in transmission spectrophotometry in the visible and ultraviolet spectral regions. (A.R. Robertson); Acidic potassium dichromate solutions as ultraviolet absorbance standards. (R.W. Burke and R. Mavrodineanu); Considerations for the use of semitransparent metallic thin films as potential transmittance standards in spectrophotometry. (R. Mavrodineanu); Structure-related optical characteristics of thin metallic films in the visible and ultraviolet. (H.E. Bennett and J.L. Stanford).

713,226
PB-271 164/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analytical Procedure for Determining Lengths from Fractional Fringes.
Final rept.,
C. R. Tilford. 1977, 4p
Pub. in Appl. Opt., v16 n7 p1857-1860 Jul 77.

Keywords: *Lasers, *Interferometers, *Length, Optical measuring instruments, Metrology, Mathematical analysis, Reprints.

The development of stabilized multifrequency lasers makes fractional fringes an increasingly attractive technique for length measurement. Determination of an unknown length from the measured fractional fringes is aided by the development of analytical equations for the length and its uncertainty, and criteria are given for selecting the wavelengths.

713,227
PB-271 576/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optically Pumped FIR Lasers: Frequency and Power Measurements and Laser Magnetic Resonance Spectroscopy.
Final rept.,
K. M. Evenson, D. A. Jennings, F. R. Petersen, J. A. Mucha, and C. J. Howard. Jun 77, 3p
Pub. in IEEE J. Quantum Electron. QE-13, n6 p442-444 Jun 77.

Keywords: *Infrared lasers, *Optical pumping, *Frequency meters, *Power meters, Methyl alcohol, Optical measuring instruments, Reprints, Laser spectroscopy, Waveguide lasers, Methyl alcohol lasers.

Optically pumped FIR lasers are currently in use in both frequency metrology and laser magnetic resonance spectroscopy programs in the NBS Boulder labs. The laser for use in frequency metrology is a cw 71 micrometer methyl alcohol waveguide laser with over 100 mw output for frequency synthesis. Another laser with an intracavity absorption cell for laser spectroscopy has been constructed and is nearly transversely pumped. The metrology technique used to measure the frequency of these lasers is briefly reviewed and a unique power meter is described.

713,228
PB-271 596/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison of Some Optical Microscope Measurements of Photomask Linewidths.
Final rept.,
D. A. Swyt, and F. W. Rosberry. 1977, 6p
DARPA Order-2397
Pub. in Solid State Technol., p70-75 Aug 77.

Keywords: *Optical microscopes, Masking, Standards, Calibrating, Measurement, Photomasking, Photomasks, Reprints.

Results of photomask linewidth measurements which depend systematically on the type or linespacing-calibrated optical microscopes used for the measurements have been observed during National Bureau of Standards work on developing calibrated photomask linewidth standards. Depending on the combination of microscope, measuring device, illumination type and object polarity present, repeatably regular differences in the apparent width of the same line, most often in the range from +0.25 micrometer to -0.25 micrometer, were seen. Opaque lines and clear spaces from 1 to 10 micrometers in width on chromium-on-glass photomask-like targets were measured. For the most part, a

filar eyepiece microscope and an image-shearing eyepiece microscope were used. Some data for an automatic TV/microscope system and a second type of image-shearing microscope were obtained. Results support the contention that proper calibration of measuring instruments for photomask linewidth measurements requires true linewidth standards rather than line-spacing standards.

713,229
PB-272 183/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tunable Visible and Ultraviolet Laser on S2 (B triplet Sigma(-)(u)-x triplet Sigma(-)(g)).
Final rept.,
S. R. Leone, and K. G. Kosnik. 1977, 3p
Contract N00014-76-6-0451
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in Appl. Phys. Lett. 30, n7 p346-348, 1 Apr 77.

Keywords: *Sulfur, *Gas lasers, Optical pumping, Ultraviolet lasers, Molecular energy levels, Reprints, Tunable lasers.

Laser action has been achieved on the B triplet sigma (-) (u) - X triplet sigma (-) (g) transition of S2 by optical pumping with a frequency doubled dye laser and a nitrogen laser. The observed lasing is line tunable from 365 nm to 570 nm. The S2 molecule is a promising candidate for an efficient, scalable ultraviolet laser system.

713,230
PB-272 358/3 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Measurement Procedures for the Optical Beam Splitter Attenuation Device BA-1.
Final rept.,
B. L. Danielson. May 77, 24p NBSIR-77-858
Sponsored in part by Aerospace Guidance and Metrology Center, Newark Air Force Station, Ohio.

Keywords: *Laser beams, *Optical prisms, Attenuation, Optical glass, Optical measurement, Power meters, Luminous intensity, Light(Visible radiation), Infrared radiation, Optical filters, Power meters, Calorimeters, *Beam splitting, Optical modulators.

Measurement procedures are described for the step attenuation of laser beams up to 44 dB using a specially constructed attenuator box (BA-1). With the use of an additional preattenuator beam splitter, the attenuation range can be extended to over 70 dB. The BA-1 system is designed for use at .6328 micrometer, .5145 micrometer, and 1.06 micrometer. The attenuation ratios of these wavelengths are calculated values. An analysis of the estimated uncertainties is also given.

713,231
PB-273 079/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Time-Dependent Physical Spectrum of Light.
Final rept.,
J. H. Eberly, and K. Wodkiewicz. 1977, 9p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Jnl. of the Optical Society of America 67, n9 p1252-1260 Sep 77.

Keywords: *Light(Visible radiation), *Spectrum analysis, Optical measurement, Instrumentation, Photodetectors, Reprints.

The authors investigate the time-dependent spectrum of light from an observational point of view and define a time-dependent 'physical spectrum' of light based on the counting rate of a photodetector. The tunable element, the filter, that allows observation of different spectral components of the light is shown to play an essential role in the time-dependent spectrum. Its bandwidth cannot be taken arbitrarily narrow. The authors establish the connection between their physical spectrum and other time-dependent spectra associated with Page, Lampard, Silverman, and Kolmogorov, as well as with the Wiener-Khintchine power spectrum. They also show the conditions under which these earlier definitions can be used as the first approximations to the complete physical spectrum, and give an expression for the correction terms.

713,232
PB-273 087/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Discharge Studies of the Ne-Cu Laser.
Final rept.,
F. J. deHoog, J. R. McNeil, and G. J. Collins. 1977, 4p
Sponsored in part by Energy Research and Development Administration, Washington, D.C., and Office of Naval Research, Arlington, Va.
Pub. in Jnl. of Applied Physics 48, n9 p3701-3704 Sep 77.

Keywords: *Metal vapor lasers, Gas discharge tubes, Absorption, Cathode sputtering, Electric discharges, *Copper neon lasers, Reprints.

Spontaneous emission and absorption studies of the Ne-Cu hollow cathode discharge are summarized. Emphasis is placed on cathode sputtering as a source of copper atoms and the qualitative aspects of a proposed model of the Ne-Cu laser are discussed. The major discharge processes operative in the Ne-Cu laser are outlined.

713,233
PB-273 125/5 Not available NTIS
National Bureau of Standards, Boulder, CO.
Frequency Stabilization of a cw Dye Laser.
Final rept.,
R. L. Barger. 1973, 7p
Pub. in Laser Spectrosc., p273-279 Jun 73.

Keywords: *Lasers, *Frequency stabilization, Absorption spectra, Iodine, Reprints, *Dye lasers, Laser spectroscopy.

A cw dye laser has been frequency stabilized to a high finesse optical cavity with residual rms fluctuations less than 50 kHz for short times (20 microsec) and 100 Hz for long times (10 sec.). Drift in the unstabilized optical cavity produced about 1 1/2 MHz/min drift in the laser frequency. The servo system is briefly described, and a representative saturated absorption spectrum of I2 is shown.

713,234
PB-273 439/0 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Geometrical Considerations and Nomenclature for Reflectance.
Final rept.,
F. E. Nicodemus, J. C. Richmond, J. J. Hsia, I. W. Ginsberg, and T. Limperis. Oct 77, 70p NBS-MONO-160
Prepared in cooperation with EG and G, Inc., Las Vegas, Nev., and Agro Sciences, Inc., Ann Arbor, Mich. Library of Congress catalog card no. 77-22966.

Keywords: *Reflectance, *Optical measurement, Mathematical models, Specifications, Geometry.

A unified approach to the specification of reflectance, in terms of both incident- and reflected- beam geometry, is presented. Nomenclature to facilitate this approach is proposed.

713,235
PB-273 931/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Spectral Radiance Calibrations Between 165-300 nm: An Interlaboratory Comparison.
Final rept.,
J. M. Bridges, W. R. Ott, A. Pitz, D. Einfeld, and D. Stuck. Jul 77, 3p
Sponsored in part by National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
Pub. in Applied Optics, v16 n7 p1788-1790, Jul 77.

Keywords: *Ultraviolet lamps, *Calibrating, Standards, Deuterium, Radiance, Reprints, *Deuterium lamps.

The spectral radiance of deuterium lamps calibrated by the Max Planck Institute fur Astronomie, the Physikalisch Technische Bundesanstalt, and the U.S. National Bureau of Standards are compared. The wavelength dependence of the measured spectral radiance, based upon independent and different primary standards, agrees to within a plus or minus 3% error over the wavelength range from 165 nm to 300 nm.

713,236
PB-273 936/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Speed Frequency Modulation of Far Infrared Lasers Using the Stark Effect.
Final rept.,
S. R. Stein, A. S. Risley, H. Van de Stadt, and F. Strumia. Jul 77, 4p
Pub. in Applied Optics, v16 n7 p1893-1896 Jul 77.

Keywords: *Infrared lasers, *Far-infrared radiation, Frequency modulation, Stark effect, Reprints, *Tuning devices.

Electronic frequency tuning of an optically pumped far-infrared waveguide laser has been achieved by using the Stark effect. Frequency modulation with a 50 kHz modulation frequency and an index greater than 1 has been observed as well as a maximum modulation frequency of 300 kHz.

713,237
PB-273 939/9 Not available NTIS
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Eight Techniques for the Optical Measurement of Surface Roughness.
Interim rept.,
R. D. Young. 25 May 73, 40p NBSIR-73-219
Paper copy available from National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.

Keywords: *Surface roughness, *Optical measurement, *Nondestructive tests, Performance evaluation, Comparison, Calibrating, Standards, Lasers, Spectrometers, Metals, Light scattering, Speckle patterns, Interferometric holography.

The need for a fast, on line, non-destructive technique for measuring surface roughness has recently accelerated the decade long development of optical methods. It is anticipated that these new techniques will add a new dimension to the surface roughness measurement system which may require an appropriate NBS response. In order to formulate this response, the eight optical techniques which have been identified are briefly described and are summarized and compared.

713,238
PB-273 947/2 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Survey of the Stability of Optical Flats.
Final rept.,
C. P. Reeve, and R. C. Veale. 25 Jun 73, 27p NBSIR-73-232

Keywords: *Optical equipment, *Flatness, *Calibrating, Sampling, Performance evaluation, Standards, Graphs(Charts), *Optical flats.

Some optical flat owners are concerned about the long term stability of their optical flats. To examine this problem, a survey was made of several optical flats which were calibrated by the National Bureau of Standards at least three times during the period from 1959 to 1972. The measured profiles of these flats are presented graphically so that the different calibrations can be compared. The conclusion of this survey is that optical flats are quite stable over a period of several years, but since the individual requirements for precision may vary greatly, it should be left up to the owner to weigh the appropriate factors in determining how frequently he needs his optical flat calibrated.

713,239
PB-274 515/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Remeasurement of NBS Spectrophotometer-Integrator Filters - 1976.
Final rept.,
K. L. Eckerle, and W. H. Venable. 1977, 5p
Pub. in Color Res. Application, v2 n3 p137-141 Fall 77.

Keywords: *Spectrophotometers, *Standards, Color, Chromaticity, Optical filters, Reprints, Standard Reference Materials.

Sets of five colored glass filters, identified as Standard Reference Materials 2101 through 2105 and intended for checking the performance of spectrophotometer-integrator systems, have been issued by NBS for many years. High-accuracy transmittance measurements were performed on a set of the colored filters designated 'Master Set No. 3' by using a reference spectrophotometer constructed at NBS. A comparison of the new values with the original data obtained in 1962 for

Master Set No. 3 shows agreement to within the experimental uncertainties of the 1962 measurements.

713,240
PB-274 643/6 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
National Measurement System for Radiometry and Photometry.
Final rept.,
H. J. Kostkowski. Nov 77, 33p NBSIR-75-939

Keywords: *Radiometry, *Photometry, *Standards, *Optical measurement, Ultraviolet radiation, Light(Visible radiation), Infrared radiation, Economic analysis, Radiance, Optical measuring instruments, Industries, Regulations, Government policies, Sociology.

The National Measurement System Study is concerned with the measurement of the energy or power in ultraviolet, visible and infrared radiation. This study has shown that radiometry and photometry are having a significant economic and social impact in the U.S. today and this impact is expected to increase. The capability of this portion of the measurement system is inadequate for today's needs. An accuracy of a few percent is frequently needed; 10-50 percent is commonplace. The reason is that radiometric and photometric measurements are very difficult to make, and there is too little expertise to make these difficult measurements. NBS' program is designed to improve the situation by (1) making the measurements easier through simpler, inexpensive standards and techniques and (2) increasing the expertise through a Self-Study Manual on the subject.

713,241
PB-274 712/9 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Optics and Micrometrology Section.
Improved Photographic Edge-Artifact.
Final rept.,
W. R. Smallwood, and R. E. Swing. Aug 76, 49p NBSIR-76-1129

Keywords: *Photographic acutance, *Edges, *Densitometers, Calibrating, Optical measurement, Standards, X rays, Tests, Tantalum, Photographic images, Computer programs, BASIC programming language, Microdensitometry, DOODAH computer program.

The history of edge-objects for use in optical and photographic testing is briefly reviewed. A summary is presented of the techniques developed at NBS in 1965 for producing photographic edges by x-ray exposures of High Resolution Plates with a tantalum strip to generate the discontinuity. The report then covers the development of an improved method for producing these edge-artifacts. It is shown that with x-ray exposure, the relation of density to exposure is linear up to densities of approximately 2.0. This linear relation is then exploited to produce two kinds of edge-artifacts. Both artifacts contain ten (10) values of density and three edge-discontinuities. The edges on one artifact have the same value of contrast, with different mean densities, while the edges on the other have different values of contrast. The use of each type is discussed. Techniques for determining exposures, for determining the transmittances of the aluminum step tablets used to modulate x-ray exposure and for determining the linear relation between density and exposure are presented in mathematical detail and exemplified in subsequent illustrative experiments.

713,242
PB-274 973/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Direct Calibration of Laser Wavelength and Bandwidth Using the Opto-Galvanic Effect in Hollow Cathode Lamps.
Final rept.,
D. S. King, P. K. Schenck, K. C. Smyth, and J. C. Travis. Oct 77, 3p
Pub. in Applied Optics, v16 p2617-2619 Oct 77.

Keywords: *Lasers, *Wavelengths, *Bandwidth, *Laser beams, Measurement, Discharge lamps, Reprints.

A convenient and inexpensive new technique for the calibration of laser spectral wavelengths and linewidths is described. Electrical signals from commercial hollow cathode lamps resulting from the illumination of the discharge region with continuous-wave or pulsed laser sources in resonance with an electronic transition (opto-galvanic effect) were used for wavelength (plus or minus 0.0001 nm in the range 260 nm to 655 nm) and bandwidth calibrations (to plus or minus 0.005 nm). Extension of this technique to provide simultaneous calibration spectra while scanning laser wavelength is discussed.

713,243
PB-275 137/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Traveling Michelson Interferometer with Phase-Locked Fringe Interpolation.
Final rept.,
S. A. Lee, and J. L. Hall. 1977, 2p
Grant NSF-PHY76-04761
Pub. in Proceedings of International Conference on Laser Spectroscopy (3rd), Jackson, Wyo. 3-6 Jul 77, Paper in Springer Series in Optical Sciences, v7: Laser Spectroscopy 3, p421-422 1977.

Keywords: *Interferometers, Lasers, Real time, Continuous radiation, Michelson interferometers, Laser interferometers.

The authors describe an automatic scanning Michelson interferometer with a resolution extension scheme which uses a phase-locked oscillator in the fringe interpolation algorithm. The interferometer provides real-time wavelength display of single mode cw lasers with a demonstrated absolute accuracy of 0.0000002.

713,244
PB-275 139/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pulsed and cw Optically Pumped Lasers for Novel Applications in Spectroscopy and Kinetics.
Final rept.,
J. B. Koffend, R. W. Field, D. R. Guyer, and S. R. Leone. 1977, 12p
Contract ONR-2411(66), Grant NSF-PHY76-04761
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, D.C.
Pub. in Proceedings of International Conference on Laser Spectroscopy (3rd), Jackson, Wyo. 3-6 Jul 77, Paper in Springer Series in Optical Sciences, v7: Laser Spectroscopy 3, p382-393 1977.

Keywords: *Lasers, *Optical pumping, Dimerization, Gas lasers, Electron transitions, Reaction kinetics, Electrical lasers, Laser spectroscopy.

The subject of optically pumped diatomic lasers is rapidly developing into an important new field of research. There are three general, significant areas of exploration: spectroscopy, kinetics, and new laser devices. Optically pumped lasers provide new and unique methods to measure fundamental spectroscopic and kinetic details of molecular systems.

713,245
PB-275 148/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Frequency Measurements: A Review, Limitations, Extension to 197 THz (1.5 micrometers).
Final rept.,
K. M. Evenson, D. A. Jennings, F. R. Petersen, and J. S. Wells. 1977, 13p
Pub. in Proceedings of International Conference on Laser Spectroscopy (3rd), Jackson, Wyo. 3-6 Jul 77, Paper in Springer Series in Optical Sciences, V7: Laser Spectroscopy 3, p56-68 1977.

Keywords: *Frequency measurement, *Frequency standards, *Gas lasers, Carbon dioxide lasers, Infrared lasers, Frequency stabilization, Methane, Accuracy, Optical measurement, Near infrared radiation, Light speed, Helium neon lasers.

The CO2 and He-Ne lasers stabilized respectively with CO2 and CH4 are now accepted as frequency and wavelength standards at 9 to 12, and 3.39 micrometers. This is due to their excellent frequency stability and accuracy, and the direct measurement of their frequencies. The measurement of both the frequency and wavelength of the CH4 device yielded a hundred fold increase in the accuracy of the speed of light. This paper reports the extension of direct frequency measurements to the 197 THz (1.5 micrometers) cw line of a He-Ne laser and reviews the current status of laser stabilization and speed of light measurements.

713,246
PB-275 149/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Absorbing Precipitates in Cadmium Telluride: Estimates for Catastrophic Laser-Damage Thresholds.
Final rept.,
H. S. Bennett, and C. D. Cantrell. Nov 77, 3p
Pub. in Applied Optics, v16 n11 p2931-2933 Nov 77.

Keywords: *Cadmium tellurides, *Laser materials, *Radiation effects, Thermal properties, Infrared optical materials, Tensile stress, Elastic properties, Inclusions, Absorptivity, Reprints.

One problem frequently encountered in high-power laser systems is thermal extrinsic damage to the laser materials, which arises from absorbing inclusions. In this paper the maximum tensile stresses as a function of inclusion size, laser pulse width, and laser power are estimated for the common precipitates in CdTe.

713,247
PB-275 150/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photoacoustic Spectroscopy: A Measurement Technique for Low Absorption Coefficients.
Final rept.,
H. S. Bennett, and R. A. Forman. Nov 77, 3p
Pub. in Applied Optics, v6 n11 p2834-2836 Nov 77.

Keywords: *Laser beams, *Absorptivity, *Optical glass, Measurement, Test equipment, Gases, Pressure, Nitrogen, Laser materials, *Photoacoustic spectroscopy, Optical modulation.

The case in which a laser beam modulated at angular frequency omega passes through the weakly absorbing windows of a gas cell which contains a nonabsorbing gas is investigated in this paper. In particular, the frequency dependences of the acoustic stresses in the gas which arise from the surface and bulk absorption are derived. An intermediate range of frequencies exists for which the acoustic stress due to surface absorption varies approximately as 1/omega and has an approximate 90 degree phase shift relative to the modulated laser beam and for which the acoustic stress due to bulk absorption varies approximately as omega to the (-3/2) power and has an approximate 45 degree phase shift. Numerical examples for a representative laser glass and air (nitrogen) are given.

713,248
PB-275 616/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photoelastic Constants of Potassium Chloride at 10.6 micrometers.
Final rept.,
A. Feldman, D. Horowitz, and R. M. Waxler. Nov 77, 6p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, Va.
Pub. in Applied Optics, v16 n11 p2925-2930 Nov 77.

Keywords: *Potassium chloride, Optical properties, Electrooptics, Photoelasticity, Potassium iodides, Refractivity, Infrared spectra, Visible spectra, Reprints, Piezobirefringence, Stress optical effect.

The piezooptic constants of pure KCl and KCl doped with KI have been measured in the visible and at 10.6 micrometers by interferometric and polarimetric techniques. The dispersion of the elastooptic constants, computed from the piezooptic constants, differs from the dispersion calculated from a theory based on a two-oscillator model of the refractive index.

713,249
PB-277 176/4 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C. Optical Physics Div.
Self-Study Manual on Optical Radiation Measurements: Part 1 - Concepts, Chapters 4 and 5.
Final rept.,
F. E. Nicodemus, and H. J. Kostkowski. Feb 78, 121p NBS-TN-910-2
See also part 1, PB-251 331.

Keywords: *Radiometry, *Optical measurement, *Spectral emittance, Photometry, Photons, Luminous intensity, Geometry, Mathematical analysis, Spatial distribution, Manuals.

This is the second in a series of Technical Notes (910-) entitled 'Self-Study Manual on Optical Radiation Measurements.' It contains the fourth and fifth chapters of this Manual. The Manual is a comprehensive tutorial treatment of the measurement of incoherent radiation that is complete enough for self instruction. Detailed

chapter summaries make it also a convenient authoritative reference source. The following radiometric quantities are defined and discussed in Chapter 4: radiant energy, radiant exposure, radiant fluence, radiant density, radiant intensity, radiant flux (surface) density, irradiance, radiant exitance, radiant fluence rate, radiant sterisent, as well as spectral radiant energy, and the other corresponding spectral quantities. In particular, each quantity is related to the quantities previously introduced in Chapters 1-3. The measurement equation, central to our approach to all of radiometry, is introduced in Chapter 5 through three illustrative measurement problems: a spectral-radiance-comparison measurement; a spectral-irradiance measurement near a large source; and an irradiance measurement with a wide-band radiometer. Normalization of spectrally broad-band measurements is briefly discussed. A general discussion of the measurement equation summarizes and enlarges on the points brought out by the examples. A set of orderly steps for solving the measurement equation is presented and the limitations of the measurement equation developed in this chapter are summarized.

713,250
PB-278 951/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theoretical Basis of a New Optical Method for the Accurate Measurement of Small Line-Widths.
Final rept.,
R. E. Swing. 1976, 13p
ARPA Order-2397
Pub. in Proceedings SPIE Conference on Developments in Semiconductor Microlithography, San Jose, CA, June 1-3, 1976, Semicond. Microlithography 80, p65-77 1976.

Keywords: *Line width, *Optical measurement, Microscopes.

As part of the effort conducted at NBS to solve some of the fundamental problems associated with width measurement of very small (1-5-micrometers) lines and spaces, the performance of an optical microscope with coherent illumination is investigated. From these studies, the theoretical basis for a new method of accurate width measurements is developed and explored. The new method, in effect, produces an optical transformation in which the image no longer resembles the original line but in which the location of the line-edges is marked by two narrow, dark lines within a bright surround. The correct line-width is then given by the distance between these two lines, a measurement that eliminates the orientation problems normally associated with filar eyepieces and sidesteps the coherence problem that affects shearing eyepieces. Suggestions are made about implementing the technique. Available microscope objectives are not suitable for such a system, and a redesign is recommended.

713,251
PB-278 952/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microdensitometer Optical Performance: Scalar Theory and Experiment.
Final rept.,
R. E. Swing. 1976, 19p
Pub. in Opt. Eng. 15, n6 p559-577 Nov-Dec 76.

Keywords: *Densitometers, *Performance evaluation, Calibrating, Apertures, Coherent radiation, Optical measurement, Measuring instruments, Instrumentation, Optical density, Reprints, Microdensitometers.

The scalar theory of microdensitometer performance developed in previous papers is revised and expanded to include coherent illumination. The central ideas of scalar microdensitometry are combined from several basic sources and summarized; this paper serves as a convenient single source of microdensitometer theory. Eight distinct variations of instrument configuration and operation are identified, and the image characteristics and conditions for linear microdensitometry are developed for each. The concept of effective incoherence is summarized and discussed. Further consideration of the problems associated with aperture sizes, determination of the sampling aperture size and image vs sample scanning are presented. An experimental test program, carried out with the Mann-Data Microanalyzer, by experienced operators, under closely controlled conditions to test the theory, is reported.

713,252
PB-279 938/5 PC **A24**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Laser Induced Damage in Optical Materials: 1977.
Final rept.,
A. J. Glass, and A. H. Guenther. Dec 77, 561p NBS-SP-509
Proc of Annual Symp on Optical Materials for High Power Lasers (9th) Held at Boulder, CO on Oct 4-6, 1977. See also rept dated Dec 76, PB-262 553. Also pub as American Society for Testing and Materials, Phil, PA, Special Tech Pub 655. Spons. in part by Office of Naval Research, Arl, VA. Prep in coop with California Univ, Livermore. Lawrence Livermore Lab, and AF Weapons Lab, Kirtland AFB, NM.

Keywords: *Laser materials, *Radiation damage, *Meetings, Optical materials, Infrared optical materials, Laser beams, Infrared windows, Metals, Mirrors, Halides Radiation effects, Refractivity, Fabrication, Thin films, Defects, Dielectric films, Infrared lasers, Semiconducting films, Dielectric films, Deposition, Ultraviolet optical materials.

The Symposium was divided into sessions concerning Laser Windows and Materials, Mirrors and Surfaces, Thin Films, Laser Glass and Glass Lasers, and Fundamental Mechanisms. Particular emphasis was given to materials for use from 10.6 micrometer to the UV region. Highlights included surface characterization, thin film-substrate boundaries, and advances in fundamental laser-matter threshold interactions and mechanisms. The scaling of damage thresholds with pulse duration, focal area, and wavelength were also discussed.

713,253
PB-280 382/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analytic Recurrence Procedure for Computing the Cross-Multiplication Coefficients in an Analytic OTF Method.
Final rept.,
E. C. Kintner. 1977, 10p
Pub. in Optica Acta. 24, n12 p1237-1246 1977.

Keywords: *Optical transfer function, Transfer functions, Computation, Optical images, Reprints.

The cross-multiplication coefficients required in an analytic method for calculating the Optical Transfer Function may be computed analytically through the use of a recurrence relation. The new recurrence procedure is both faster and more accurate than numerical integration, and the results obtained from it suggest that the analytic OTF method will be more accurate and more versatile than suggested earlier.

713,254
PB-280 436/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optical Properties of Infrared Laser Windows.
Final rept.,
A. Feldman. 1976, 8p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, Va.
Pub. in Proceedings of Electro-Optical Systems Design Conf. 76 and International Laser Exposition, New York, Sept. 14-16, 1975, P499-506.

Keywords: *Infrared windows, *Laser materials, Refractivity, Infrared optical materials, Thermal expansion, Photoelasticity, Stresses, Interferometry, Infrared lasers, Optical properties, Stress optical coefficient.

The refractive index, n, the change of index with temperature, dn/dT, the piezo-optic constants, q sub ij, and the thermal expansion coefficient, alpha, of infrared laser window materials are being measured. These parameters are needed for determining the performance of these materials as windows in high-power laser systems as well as in other optical systems. Precision spectrometers are used to measure n from 0.2 micrometer in the ultraviolet to 50 micrometers in the infrared. Measurements of n at two temperatures, 20C and 30C, permit us to calculate dn/dT over a wide wavelength range. The piezo-optic constants, which determine the effect of stress on refractive index, are measured by several interferometric techniques. Measurements are made at the wavelengths of the helium-neon laser, .6328 micrometer, 1.15 micrometers and 3.39 micrometers, and at the wavelength of the carbon-dioxide laser, 10.6 micrometers.

713,255
PB-280 449/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electronic Aspects of the NBS Detector Response and Inter-Comparison Package and Laser Stabilization Facility.
Final rept.,
J. Fowler. 1977, 3p
Pub. in Proceedings of Electro-Optics/Laser 77 Conference and Exposition, Anaheim, Calif. 25-27 Oct 77, p689-695 1977.

Keywords: *Photodetectors, *Optical measuring instruments, Silicon, Radiometers, Electrooptics, Amplifiers, Optical filters, Design, Calibrating, Photoconductivity, Laser beams, Stabilization, Ultraviolet spectra, Visible spectra, Infrared spectra, Optical modulators, Readout.

The paper describes two silicon detector based instruments designed to fill the needs of the NBS program of calibration and transfer of detector responsivity. The first instrument to be described is a self-contained high accuracy radiometer employing a temperature controlled silicon cell, amplifier, filter and digital readout. The second instrument is a device employing an electro-optic modulator which stabilizes the power in a laser beam to 0.05% from DC to 100 KHZ in the 350 to 1200 nm range.

713,256
PB-280 457/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Use of an Opto-Galvanic Effect to Frequency-Lock a Continuous Wave Dye Laser.
Final rept.,
R. B. Green, R. A. Keller, G. G. Luther, P. K. Schenck, and J. C. Travis. Feb 77, 2p
Pub. in IEEE Jnl. Quantum Electron. QE-13, n2 p63-64, Feb 77.

Keywords: *Dye lasers, Electric discharges, Frequency stabilization, Gas discharges, Mode locked lasers, Reprints.

An electrical signal, derived from a gas discharge irradiated by a CW dye laser, is used to lock the laser to characteristic transition frequencies of species in the discharge. The technique may be used with commercial hollow cathode lamps to lock to both resonance and excited state transitions in a wide variety of elements.

713,257
PB-280 462/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Frontiers in Optical Radiation Measurements.
Final rept.,
J. Geist. 1976, 4p
Pub. in Proceedings of Electro-Optical Systems Design Conf. 76 and International Laser Exposition, New York, Sept. 14-16, 1976, p281-284.

Keywords: *Optical measurement, *Optical measuring instruments, *Optical detectors, Radiation, Coherent radiation, Light(Visible radiation).

Recent progress in optial radiation measurements is reviewed with emphasis on very recent progress in areas currently undergoing significant development. By its nature the paper must rely on some extent on unpublished material.

713,258
PB-280 523/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Improving the Accuracy of Radiant Power Measurements Based on Photodetector Instrumentation.
Final rept.,
E. F. Zalewski, and M. A. Lind. 1977, 11p
Pub. in Proceedings of Symposium on Biological Effects and Measurement of Light Sources, Rockville, Md., Mar 25-26, 1976, p117-127.

Keywords: *Photodetectors, *Optical measurement, *Radiometry, Lasers, Power measurement, Luminous intensity, Optical detectors, Instrumentation, Silicon, Ultraviolet radiation, Performance tests.

A model of the radiometric measurement system for detector based instrumentation is described. Four areas of research at NBS affecting this measurement system are briefly discussed. They are: (1) evaluation of the absolute (electrical) base measurements of radiant power; (2) instrumentation for detector characterization and absolute spectral response measurements; (3) ultraviolet radiation effects on silicon photo-

detectors; and (4) an interlaboratory comparison to test the state-of-the-art in detector responsivity transfer measurement.

713,259
PB-280 534/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Coupling to the Detector Measurement Base at NBS.
Final rept.,
E. F. Zalewski. 1976, 5p
Pub. in Proceedings of Electro-Optical Systems Design Conference 76 and International Laser Exposition, New York, Sep 14-16, 1976, p285-289 1976.

Keywords: *Photodetectors, *Radiometry, *Photometry, Optical measurement, Instrumentation, Coupling circuits.

The structure of the measurement chain for the determination of the absolute response of photodetectors and other radiometric instrumentation is described. There are three possible models of coupling to this chain. These are discussed, along with the various advantages and limitations.

713,260
PB-280 821/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS Laser Measurement Assurance Program (MAP).
Final rept.,
A. A. Sanders, and A. R. Cook. 1976, 3p
Pub. in Proceedings of Electro-Optical Systems Design Conference 76 and International Laser Exposition, New York, Sep 14-16, 1976, p277-280.

Keywords: *Lasers, *Optical measurement, *Quality assurance, *Standards, Management planning, Test equipment, Power measurement, Luminous intensity, Helium neon lasers, Visible lasers, Laser measurement assurance program.

A review is given of the NBS Laser MAP for the measurement of 1 mW, HeNe (632.8 nm) laser radiation. The review describes pertinent qualities necessary for an NBS transfer standard including the measurement accuracies and precision assigned by NBS. Moreover, typical accuracies and precision that a MAP participant can expect to achieve in his laboratory by intercomparison with a transfer standard are explored. Important considerations for making laser measurements are presented. The information presented should be of interest to those individuals and organizations who want to establish a documented laser measurements capability for the purpose of regulatory compliance.

713,261
PB-280 824/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Spectral Irradiance Standard for the Ultraviolet: The Deuterium Lamp.
Final rept.,
R. D. Saunders, W. R. Ott, and J. M. Bridges. 15 Feb 78, 8p
Pub. in Applied Optics 17, n4 p593-600, 15 Feb 78.

Keywords: *Radiant flux density, *Irradiance, *Optical measurement, *Ultraviolet radiation, Standards, Calibrating, Near ultraviolet radiation, Radiometry, *Deuterium lamps, Reprints.

A set of deuterium lamps is calibrated as spectral irradiance standards in the 200-350-nm spectral region using both a high accuracy tungsten spectral irradiance standard and a newly developed argon mini-arc spectral radiance standard. The method which enables a transfer from a spectral radiance to a spectral irradiance standard is described. The following characteristics of the deuterium lamp irradiance standard are determined: sensitivity to alignment; dependence on input power and solid angle; reproducibility; and stability. The absolute spectral radiance is also measured in the 167-330-nm region. Based upon these measurements, values of the spectral irradiance below 200 nm are obtained through extrapolation.

713,262
PB-280 826/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Silicon Detector Physics on Radiometric Applications.
Final rept.,
A. R. Schaefer. 1976, 5p
Pub. in Proceedings of Electro-Optical Systems Design Conference 76 and International Laser Exposition, New York, Sep 14-16, 1976, p75-79.

Keywords: *Photodetectors, *Radiometry, Silicon, Photoconductivity, Ultraviolet radiation, Infrared radiation, Thermal properties, Performance evaluation.

Recent radiometric applications of silicon photodetectors are placing stringent demands on them. Several factors have been reported which severely degrade their performance, such as spatial non-uniformity of spectral responsivity in the ultraviolet and infrared, changes in detector responsivity due to exposure to ultraviolet radiation, thermal effects, etc. These effects, and approaches to alleviate the resulting problems are discussed in some detail.

713,263
PB-280 827/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultraviolet Enhanced Responsivity of Silicon Photodiodes: An Investigation.
Final rept.,
A. R. Schaefer. Jun 77, 4p
Pub. in Optics 16, n6 p1539-1542, Jun 77.

Keywords: *Photodiodes, *Ultraviolet radiation, *Radiation effects, Photodetectors, Silicon, Reprints.

An enhancement of the responsivity of certain types of silicon photodetectors after exposure to ultraviolet radiation has been recently reported. Several possible mechanisms were investigated experimentally and ruled out on the basis of the results.

713,264
PB-280 828/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Linearity Studies on Silicon Photodiodes.
Final rept.,
A. R. Schaefer, E. F. Zalewski, M. A. Lind, and J. Geist. 1977, 5p
Pub. in Proceedings of Electro-Optics/Laser 77 Conference and Exposition, Anaheim, Calif. Oct. 25-27, 1977, p459-463.

Keywords: *Photodiodes, Photoconductivity, Linearity, Photodetectors, Light sources, Laser beams, Silicon, Krypton lasers.

A technique described earlier by Lind has been used to study extensively the linearity of spectral response of the silicon photodiodes contained in the NBS Detector Response Transfer and Intercomparison Package. An amplitude stabilized CW krypton-ion laser was used to provide both the AC and DC light beams necessary for the application of this technique. This study was performed at a number of the available krypton lines from the near ultraviolet to the near infrared, in order to look for wavelength dependence of the onset of non-linearities. This provides more insight into the physics of the detector.

713,265
PB-281 045/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Double-Group Theory on the Half-Shell and the Two-Level System. II. Optical Polarization.
Final rept.,
W. G. Harter, and N. dos Santos. Mar 78, 10p
Pub. in American Jnl. of Physics 45, n3 p264-273 n.d.

Keywords: *Molecular energy levels, *Polarization, Birefringence, Optics, Reprints.

Relations are derived between several different descriptions of optical polarization by analogy to the theory of spin 1/2. The rotational slide rule developed in a preceding article is used to (a) compute the final polarization state and phase of an optical beam given the optical wave matrix, initial state, and phase, (b) make conversions between various types of polarization parameters, and (c) find the output intensity for perfect polarizers. Other polarization problems and methods are discussed briefly.

713,266
PB-281 356/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fizeau Wavelength Meter.
Final rept.,
J. J. Snyder. Aug 77, 2p
Pub. in Proceedings, International Conference on Laser Spectroscopy (3rd), Jackson, Wyo. 4-8 Jul 77 p419-420 Aug 77.

Keywords: *Laser beams, *Interferometers, *Wavelengths, *Optical measurement, Monochromatic radiation, Optical measuring instruments, Instrumentation, Meters, Fizeau interferometers, Computer applications.

This Wavelength Meter is a self-contained instrument that measures the wavelength of radiation produced by lasers or other pulsed or cw sources of monochromatic light. The instrument is based on a Fizeau or 'optical wedge' interferometer. The fringe pattern produced by the interferometer is digitized and stored in a small computer which converts the fringe pattern into the wavelength (in the desired units) of the interfering light.

713,267
PB-281 542/1 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Laser Far-Field Beam-Profile Measurements by the Focal Plane Technique.
G. W. Day, and C. F. Stubenrauch. Mar 78, 52p
NBS-TN-1001

Keywords: *Laser beams, *Far field, *Optical measurement, Test equipment, Focusing, Beam splitting, Luminous intensity, Infrared lasers, Mirrors, Performance evaluation, Quality control, Optical lenses.

An analysis of laser far-field beam-profile measurements by the focal plane technique is given. Particular attention is paid to systems at about 1 micrometer wavelength and having apertures up to 10 cm. The basic mathematics is reviewed and approximations are evaluated. Using geometrical optics techniques, it is shown that an f/20 plano-convex lens is an appropriate choice for the focusing element. For two arbitrarily chosen laser beam profiles the errors associated with the choice of this lens are discussed through the use of computed far-field and focal-plane irradiance distributions. Experimental procedures including methods of testing the optical elements are given.

713,268
PB-281 907/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Resonances in the Efficiency Factors for Absorption: Mie Scattering Theory.
Final rept.,
H. S. Bennett, and G. J. Rosasco. 15 Feb 78, 3p
Pub. in Applied Optics, v17 n4 p491-493, 15 Feb 78.

Keywords: *Laser beams, *Mie scattering, Refractivity, Thorium dioxide, Particles, Atmospheric attenuation, Radiation absorption, Reprints.

The nature and implications of the very sharp resonances which exist in the efficiency factors for absorption by weakly absorbing spheres are discussed in this letter. Numerical examples are given for thoria microparticles in air.

713,269
PB-281 984/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optical Linewidth Measurements on Silicon and Iron-Oxide Photomasks.
Final rept.,
D. Nyyssonen. 1977, 8p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) Conference on Developments in Semiconductor Microlithography II, San Jose, Calif. 4-5 Apr 77. SPIE Jnl., v100 p127-134 1977.

Keywords: *Line width, *Optical measurement, Integrated circuits, Masking, Silicon, Iron oxides, Photolithography, Microscopy.

Measurements of linewidths on silicon and iron-oxide photomasks is hampered by the dark banding which occurs along the edges. It is shown that this banding arises from the combination of low contrast and optical path difference introduced by the silicon or iron-oxide in conjunction with the partial coherence of the illumination. As previously shown in work with chromium-oxide photomasks, when the condenser numerical aperture is sufficiently less than that of the objective, an expression can be derived for the proper transmittance threshold for determining edge location. An expression is also derived for the linewidth error which would result from locating the edge at the center of the dark band. Theoretical and experimental results are compared.

713,270
PB-282 011/6 Not available NTIS

National Bureau of Standards, Gaithersburg, MD.
Accurate Linewidth Measurements at the National Bureau of Standards.
Final rept.,
J. M. Jerke, A. W. Hartman, D. Nyyssonen, F. W. Rosberry, R. E. Swing, D. A. Swyt, and R. D. Young. 1977, 9p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, Va.
Pub. in Proceedings of Kodak Microelectronics Seminar, Monterey, Calif. 3-5 Oct 76, Kodak pub nG47, 1977.

Keywords: *Line width, *Optical measuring instruments, Calibrating, Integrated circuits, Masking, Optical measurement, Microscopes, Microelectronics.

The current progress of the NBS program to develop primary measurement calibration of 1 to 10 micrometer linewidths on integrated-circuit photomasks, to develop improved theory for accurate linewidth measurements with optical microscopes, and to provide calibrated measurement artifacts and measurement procedures is discussed. Calculated linewidth image profiles for known conditions of partial coherence, defocus, and spherical aberration in an optical microscope are given. These calculated image profiles are compared with photometric image profiles obtained from an optical-microscope measurement system. A polarization interferometer located in a scanning electron microscope has been developed to make the primary linewidth calibrations. The measurement assurance program used to transfer linewidth measurements from NBS to the microelectronics industry is described.

713,271
PB-282 127/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Line-Width Measurement with an Optical Microscope: The Effect of Operating Conditions on the Image Profile.
Final rept.,
D. Nyyssonen. Aug 77, 8p
ARPA Order-2397
Pub. in Appl. Opt., v16 n8 p2223-2230 Aug 77.

Keywords: *Line width, *Optical measuring instruments, Masking, Microscopes, Calibrating, Optical images, Reprints.

A theoretical model of the optical microscope based on the theory of partial coherence is used to predict the image profiles of lines on IC photomasks and assess measurement errors for different conditions of microscope operation. A comparison of experimental and theoretical image profiles is given, showing good agreement with theory for a 0.9 N.A. and linewidths as small as 0.5 micrometer. The primary sources of differences appear to be edge quality and accuracy of focus.

713,272
PB-282 874/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calibration of Optical Microscopes for Photomask Linewidth Measurements.
Final rept.,
D. A. Swyt, F. W. Rosberry, and D. Nyyssonen. 1978, 14p
DARPA Order-2397
Pub. in Proceedings of Kodak Microelectronics Seminar (1977), Monterey. Calif. 5-7 Oct 77, Kodak Pub-G48, p131-144 1978.

Keywords: *Optical microscopes, Calibrating, Masking, Line width, Standards.

An on-going program at the National Bureau of Standards has produced a method for the use of optical microscopes for photomask linewidth measurements in the general 1 to 10 micrometers range which can significantly reduce certain types of troublesome systematic errors. Proposed as a means to improve accuracy of industrial photomask linewidth measurements made with optical microscopes, the method involves the use of an NBS calibrated linewidth artifact and a recommended measurement procedure. To be discussed are relevant aspects of: laboratory and field testing of the overall method; a comparison of measurements made with filar, TV and image-shearing eyepiece microscopes; the NBS prototype linewidth artifact and the manner of calibration of such artifacts at NBS.

713,273
PB-283 534/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fast Frequency Stabilization of cw Dye Laser.
Final rept.,
R. L. Barger, J. B. West, and T. C. English. 1 Jul 75, 3p
Pub. in Applied Physics Letters, v27 n1 p31-33, 1 Jul 75.

Keywords: *Dye lasers, Frequency stability, Reprints, Continuous wave lasers, *Frequency stabilizers, Helium neon lasers, Laser cavities, Potassium phosphates.

A system is described for stabilizing a cw dye laser frequency to a high-finesse optical cavity. The length of this optical cavity is locked to a CH4-stabilizer He-Ne laser with a tunable frequency-offset technique. A very fast servo system (using an intracavity KDP crystal), a long dye laser cavity, and the stabilized optical cavity result in an absolute frequency stability of 1 kHz for an integration time of 0.0001 sec and 300 Hz for 300 sec. Intensity is stabilized to one part in 10,000.

713,274
PB-283 537/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Refractive Index of Nitrogen, Water Vapor and Their Mixtures at Submillimeter Wavelengths.
Final rept.,
C. C. Bradley, and H. A. Gebbie. Apr 71, 4p
Pub. in Applied Optics, v10 n4 p755-758 Apr 71.

Keywords: *Nitrogen, *Water vapor, Refractivity, Submillimeter waves, Interferometers, Masers, Optical measurement, Far infrared radiation, Reprints, *Refractive index.

Molecular masers have been used to measure the refractive index of nitrogen, water vapor, and their mixtures at wavelengths of 337 micrometers, 311 micrometers, and 28 micrometers. A discrepancy between the new measurement and microwave values for pure nitrogen is at present unexplained.

713,275
PB-283 840/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Polarization Phenomena in X-Ray Scattering.
Final rept.,
G. G. Cohen, and M. Kuriyama. 3 Apr 78, 4p
Pub. in Phys. Rev. Lett., v40 n14 p957-960, 3 Apr 78.

Keywords: *X ray absorption, *Polarization, Silicon, Single crystals, Reprints, *X ray scattering.

Rotation of the plane of polarization of a linearly polarized x-ray beam by simple transmission through a (110) silicon crystal has been observed. Both the amount of rotation and the amount of absorption of x-rays depend on the orientation of the crystal in the incident beam. Contemporary scattering theory calculations have been used to explain this effect, including the x-ray analog to optical activity, for a suitable crystal sample.

713,276
PB-283 852/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Three-Body Ion-Ion Recombination in Mercury-Halide Lasers.
Final rept.,
M. R. Flannery. 15 May 78, 5p
Pub. in Chemical Physics Letters, v56 n1 p143-147, 15 May 78.

Keywords: *Gas lasers, Mercury halides, Recombination reactions, Reprints, Metal vapor lasers, *Mercury lasers, Ion ion interactions.

The role of ion-ion recombination in the formation of excited-states in mercury-halide laser is outlined. A generalization of Natanson's treatment to unequal-mass constituents and general mean-free-paths is proposed.

713,277
PB-284 594/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Xenon-Ion Pumped Blue Dye Laser.
Final rept.,
D. W. Fahey, and L. D. Schearer. Apr 78, 2p
Pub. in IEEE Jnl. Quant. Electron QE-14 n4 p220-221, Apr 78.

Keywords: *Dye lasers, *Tuning, Optical filters, Reprints, *Laser pumping, Visible lasers.

A pulsed xenon ion laser with an output power of 5kW at 364.5 nm has been used as a pump source for several blue dyes. Broadband conversion efficiencies exceed 20 percent. The use of a birefringent filter provides tunable output in the blue region of the spectrum with a bandwidth of 0.08 nm and a pulsewidth of 120 ns.

713,278
PB-285 147/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser-Mode Beating Used for Detector Frequency-Response Measurements.
Final rept.,
R. A. Lawton, and M. Young. Oct 77, 3p
Pub. in Jnl. Appl. Opt., v16 n10 p2703-2705 Oct 77.

Keywords: *Photodetectors, *Frequency response, Optical measurement, *Helium neon lasers, *Mode locked lasers, Reprints.

Low-power He-Ne lasers generally oscillate in two spectral cavity modes. The authors have found that the amplitude of the beat note between the two modes is nearly constant, even though the powers of the two modes may be changing considerably with time. They use this fact to measure the frequency response of an optical detector at the intermode-beat frequency. Many photodetectors have impulse responses that decay approximately exponentially with time. Therefore, one may further show that it is possible to estimate the frequency response of such detectors at all frequencies from the results of a simple measurement at a single frequency.

713,279
PB-285 150/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Temperature and Pressure Variation of the Refractive Index of Diamond.
Final rept.,
J. Fontanella, R. L. Johnston, J. H. Colwell, and C. Andeen. Nov 77, 3p
Sponsored in part by Naval Academy, Annapolis, Md. and Army Research Office, Washington, D.C.
Pub. in Jnl. Appl. Opt., v16 p2949-2951 Nov 77.

Keywords: *Diamonds, *Refractivity, Pressure, Temperature, Measurement, Reprints.

The temperature and pressure variations of the refractive index for a Type IIa diamond have been measured at audio frequencies using capacitance techniques. Measurements have been made at zero pressure over the 5.5-340-K temperature range and at pressures up to 1.4x 10 to the 8th power Pa (1.4 kbar) at room temperature. At room temperature, $(1/n)\ (dn/dT)p = +0.00000404/K$ and $(1/n)(dn/dp)T = -0.35 \times 10$ to the -12th power/Pa. In addition, the curvature in the refractive index with temperature has been determined. The first-order derivatives are compared with previous experimental data and the recent theoretical calculations of Van Vechten and Yu and Cardona.

713,280
PB-285 316/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Redefining the Meter.
Final rept.,
K. M. Evenson. Nov 73, 1p
Pub. in Jnl. Lett. to Editor, Laser Focus 9 n11, 8 Nov 73.

Keywords: *Laser beams, *Optical measurement, *Standards, Optical measuring instruments, Instrumentation, Meters, Length, Reprints.

This letter corrects a statement made in Laser Focus pertaining to the possible redefinition of the meter using lasers.

713,281
PB-285 319/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Improvements in a Calorimeter for High-Power CW Lasers.
Final rept.,
G. E. Chamberlain, P. A. Simpson, and R. L. Smith. Mar 78, 6p
Sponsored in part by National Aeronautics and Space Administration, Washington, D.C. and Department of Defense, Washington, D.C.
Pub. in Jnl. IEEE Trans. Instrum. Meas., vIM-27 n1 p81-86, Mar 78.

Keywords: *Calorimeters, *Lasers, Design, Backscattering, Calibrating, Performance evaluation, Reprints, Laser calorimeters.

Measurement certainty with the BB series of electrically calibrated calorimeters for high-energy lasers has been enhanced by the addition of monitors for energy backscattered from the meter and for energy missing the entrance aperture (overspill). The performance and design features of the recently constructed BB2 meter are compared with the previously described BB1 meter. Direct intercomparison shows the agreement between meters to be 1 percent.

713,282
PB-285 326/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Absolute Reference Calorimeter for Measuring High Power Laser Pulses.
Final rept.,
D. L. Franzen, and L. B. Schmidt. Dec 76, 8p
Sponsored in part by Bureau of Radiological Health, Rockville, Md. and Aerospace Guidance and Metrology Center, Newark Air Force Station, Ohio.
Pub. in Jnl. Appl. Opt., v15 n12 p3115-3122, Dec 76.

Keywords: *Lasers, *Calorimeters, Calibrating, Standards, Carbon dioxide lasers, Performance evaluation, Error analysis, *Laser calorimeters, Reprints.

A calorimeter for making absolute energy measurements of high power laser pulses is described. The calorimeter, based on volume absorption in a solid, is electrically calibrateable and requires no window or vacuum environment. An error analysis is included giving the systematic and random errors of the instrument. Most of the volume absorber documentation is applicable for 1.06 micrometers; however, the calorimeter should be useful from the near infrared through the visible. Absorbers for use with CO2 lasers in the 9-11 micrometer range are also discussed.

713,283
PB-285 339/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Frequency Stability and Stabilization of a Chemical Laser,
J. Munch, M. A. Kolpin, and J. Levine. Jan 78, 6p
Pub. in IEEE Jnl. Quantum Electron. vQE-14 n1 p17-22, Jan 78.

Keywords: *Chemical lasers, *Frequency stability, Hydrogen fluoride, Deuterium compounds, Fluorides, Reprints, Hydrogen fluoride deuterium fluoride lasers, Mode locked lasers.

The authors have built a low-power CW HF/DF chemical laser, designed to achieve high-frequency stability. Measurements are reported which characterize the instantaneous spectral width of the laser output to less than one part in 10 to the 11th power (delta nu<1kHz) and the variations in absolute frequency of this emission with time to four parts in 10 to the 10th power (delta nu equals + or -20kHz) per 0.1 ms. Two experiments to actively stabilize the laser frequency are reported. In one experiment the laser was locked to a high-finesse Fabry-Perot to five parts in 10 to the 9th power (delta nu = + or -250 kHz) for many minutes. In the other experiment one laser was locked to another using heterodyne beat spectroscopy to 1.7 parts in 10 to the 9th power (delta nu = + or -85 kHz). The stabilization experiments were limited by the feedback loops used.

713,284
PB-285 349/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Power and Energy.
Final rept.,
R. L. Smith. Oct 76, 6p
Pub. in Proc. Symp. on Biological Effects and Measurement of Light Sources, Rockville, Md., Mar 25-26, 1976 p81-86 (Dept. of Health, Education, and Welfare, Public Health Service, Food and Drug Administration, Bureau of Radiological Health, Rockville, Md., Oct 1976).

Keywords: *Lasers, *Optical measurement, *Quality assurance, *Standards, Safety, Hazards, Reviews, Measurement Assurance Program, Helium neon lasers.

The National Bureau of Standards Laser MAP program as it relates to measurements for safety are reviewed. The concept of MAP is reviewed and the results of a 1 mW HeNe round robin are given.

713,285
PB-285 350/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Improving Beam Measurement.
Final rept..
R. L. Smith, and A. A. Sanders. Apr 75, 2p
Pub. in Jnl. Laser Focus Mag. Circle n155 p70-71, Apr 1975.

Keywords: *Lasers, *Optical measurement, *Quality assurance, *Standards, Test equipment, Power measurement, Luminous intensity, Reprints, Measurement Assurance Program.

The National Bureau of Standards is in the early stages of developing a measurement assurance program, MAP, for the measurement of laser power and energy. The main features of a MAP are discussed and compared to the more familiar calibration service. A brief status report is presented on the MAP for laser power and energy measurements. The goal of a MAP is to assure that those who need a given measurement capability have it with proof that they have it.

713,286
PB-285 352/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optical Collisions in an Intense Laser Field.
Final rept.,
A. Szoke. Feb 78, 3p
Contract N00014-67-A-0405-008, Grant NSF-MPS72-05169
Pub. in Jnl. Opt. Lett., v2 n2 p36-38, Feb 78.

Keywords: *Laser beams, *Collisions, Energy levels, Argon, Strontium, Reprints.

The collisionally broadened optical absorption cross section that is constant at low intensities is predicted to decrease at high intensities. The prediction is based on a nonlinear change of the effective interaction of the atom with the strong incident electromagnetic field and a distortion of the atomic interaction potential by it. An experiment is analyzed here that observes this fall-off on the 'wing' of the 460.73-nm strontium resonance line, collision broadened by an argon buffer gas. Qualitative agreement is reached between theory and experiment when the degeneracy of the levels is taken into account.

713,287
PB-286 543/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High-Power Discharge in Na-Xe Vapor.
Final rept.,
H. L. Rothwell, D. Leep, and A. Gallagher. Aug 78, 5p
Contract N00014-76-C-0123
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Jnl. Appl. Phys., v49 n8 p4396-4400 Aug 78.

Keywords: *Gas lasers, Sodium, Xenon, Electric discharges, Reprints, *Metal vapor lasers, *Sodium xenon lasers, *Excimer lasers.

High-power (10-100 MW/l) pulsed discharges in Na-doped Xe vapor have been studied at Na densities of 10 to the 15th power - 10 to the 16th power per cc, and Xe densities of 10 to the 19th power - 10 to the 20th power per cc, as appropriate for excimer laser use. Stable, steady-state discharges are obtained for a number of microseconds in a small volume cell, without use of preionization or sustainers. This stability is attributed to the observed positive V-I characteristic. Measured spectra are interpreted to yield Na excited-state densities, and the implications for a potential excimer laser are discussed.

713,288
PB-287 312/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
1 W Operation of Singly Ionized Silver and Copper Lasers.
Final rept.,
B. E. Warner, D. C. Gerstenberger, R. D. Reid, J. R. McNeil, R. Solanki, K. B. Persson, and G. J. Collins. Aug 78, 3p
Sponsored in part by Office of Naval Research, and Department of Energy, Washington, DC. Arlington, VA.
IEEE Jnl. of Quantum Electronics QE14 n8 p585-570 Aug 78.

Keywords: *Gas lasers, Electric discharges, Electron transitions, Cathodes, Infrared lasers, Design, Reprints, *Metal vapor lasers, *Copper lasers, *Silver lasers.

The authors report a multi-line output power of one watt from the 800.4, 825.5, and 840.4 nm Ag II transitions and 350 mW from the 408.6 nm Ag II transition resulting from pulsed operation of a silver hollow cathode laser. Continuous output of 1w was obtained in a copper hollow cathode from the 780.8 nm Cu II transition. Design considerations for continuous high power operation of the hollow cathode discharge are also discussed.

713,289
PB-287 451/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Progress in Far-Infrared Frequency Synthesis.
Final rept.
S. R. Stein, and A. S. Risley. 1978, 2p
Pub. in Proceedings Conf. on Precision Electromagnetic Measurements, Held at Ottawa, Canada on June 26-29, 1978, IEEE Cat. No. 78CH 1320-1 IM, CPEM Digest, p68-69, 1978.

Keywords: *Frequency synthesizers, *Infrared lasers, Far infrared radiation, Phased locked systems, Stark effect, Optical pumping, Tunable lasers.

Experiments are being performed to synthesize far-infrared frequencies with a precision of 10 to the -13th power. An electric (Stark) field tuning technique has been developed for optically pumped lasers operating in the 500 micrometer to 70 micrometer wavelength region. Using this technique, a tunable laser has been phase-locked to a reference laser.

713,290
PB-287 453/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Method for the Calculation of Partially Coherent Imagery.
Final rept.,
E. C. Kintner. 1 Sep 78, 7p
Pub. in Jnl. Appl. Opt., v17 n17 p2747-2753, 1 Sep 78.

Keywords: *Optical images, Computation, Fourier transformation, Reprints, Optical transfer functions.

The tedious numerical computations associated with the calculation of partially coherent imagery are alleviated by a method which uses dimensionless co-ordinates and takes advantage of the properties of the Fourier transform. A one-dimensional periodic object function can model many objects of practical interest, including non-periodic objects. The properties of a given optical system are described in terms of the transmission cross-coefficient. For aberration-free systems with circular pupils, including annular sources (dark-field illumination), the cross-coefficient can be calculated analytically. For aberrated or apodized systems, a one-dimensional approximation can be used. The effect of a convolving slit in the image plane of a scanning microscope can also be included.

713,291
PB-287 459/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluating the Inequivalence and a Computational Simplification for the NBS Laser Energy Standards.
Final rept.,
E. G. Johnson. Aug 77, 7p
Pub. in Appl. Opt., v16 p2315-2321 Aug 77.

Keywords: *Calorimeters, *Test equipment, *Optical measurement, *Lasers, Standards, Power measurement, Luminous intensity, Temperature measurement, Reprints.

A model with two time constants is used to estimate the inequivalence in response between a laser energy pulse and an electrical energy pulse put into a calorimeter of the C Series type. The results are as follows: the calorimeter labeled C41 showed a 0.15% inequivalence and the calorimeter labeled C46 showed none. The author also found that the complicated model currently used to get the corrected temperature rise of a measurement can be replaced by a simpler four-data-point method with no significant loss in accuracy. This simplification means one can substitute a microprocessor for the large computer to get the correct temperature rise in an electrical calibration or laser energy measurement.

713,292
PB-288 090/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Picosecond-Domain Waveform Measurements.
Final rept.
N. S. Nahman. Apr 78, 14p
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronics Engineers), n4, p441-454, Apr 78.

Keywords: *Waveforms, Measurement, Reviews, Pulsation, Time domain, Picoseconds, Pulse rise time, State of the art.

A review of the state-of-the-art of picosecond time-domain measurements is presented which draws together techniques from the electrical and optical regions of the electromagnetic spectrum. Measurement methods are listed in categories which exhibit the commonality between electrical and optical methods. State-of-the-art values for temporal resolution are presented with reference citations to specific methods and related technical topics.

713,293
PB-288 106/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fiber Optics Metrology at NBS.
Final rept.
B. Danielson, G. Day, and D. Franzen. Dec 77, 2p
Pub. in Proceedings of Union Radio Scientifique Internationale Comm. A Symp., Lannien, France, 3-7 Oct 77 p430-431 Dec 77. (International Union of Radio Science, France.)

Keywords: *Fiber optics, *Optical measurement, *Tests, Atmospheric attenuation, Bandwidth, Optical properties, Light transmission, Optical waveguides, Optical couplers, Atmospheric transmissivity.

Recently a fiber optics program was initiated in the Electromagnetics Division, Guided Wave Metrology Section of the National Bureau of Standards. The purpose of the program is to develop standards and measurement methodology as needed by fiber optics technology. The activities are concerned with the following fiber measurements: attenuation, bandwidth, power, and coupling.

713,294
PB-288 541/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS Self-Study Manual on Optical Radiation Measurements.
Final rept.
F. E. Nicodemus. 1978, 2p
Pub. in Proceedings Seminar Testing Solar Materials Systems, Gaithersburg, MD., 22-24 May 78 p256-257. (Inst. of Env. Sci., Mt. Prospect, IL. 1978).

Keywords: *Optical measurement, *Manuals, Photometry, Radiometry, Optical measuring instruments, Instrumentation.

A background discussion of the need for the NBS Self-Study Manual on Optical Radiation Measurements is followed by the general plan and objectives for preparation of the Manual. The content and level of presentation are reviewed, followed by a list of chapters already published in NBS Tech Notes, a list of chapters currently in preparation, and a list of topics for future chapters through 1981. Ordering information is provided, particularly stock numbers and prices, for obtaining copies of published NBS Tech Notes with Manual chapters from the Superintendent of Documents at the U.S. Government Printing Office. Availability is described for routine notification by both GPO and NBS of the publication of additional Manual chapters in the future.

713,295
PB-289 095/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of the Photoelastic Constants of Optical Materials.
Final rept.,
A. Feldman. Oct 78, 10p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Opt. Eng., v17 n5 p453-462 Sep/Oct 78.

Keywords: *Photoelasticity, *Optical materials, Stresses, Strains, Refractivity, Static loads, Lasers, Figure of merit, Interferometers, Optical measurement, Optical properties, Optical interferometers, Birefringence, Distortion, Light scattering, Acoustooptics, Elastooptic effect, Brillouin scattering, Reprints.

The photoelastic constants describe the effect of stress or strain on the refractive indices of materials. These coefficients are important in several applications. They are required for the computation of stress-induced optical distortion in optical systems such as high-power laser systems, and they are needed for computing figures of merit for materials to be used in acousto-optic devices. Interferometric and polarimetric techniques are described for measuring piezo-optic coefficients under static loading conditions. Acousto-optic and Brillouin scattering techniques are described for measuring elasto-optic constants.

713,296
PB-289 096/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ultralinear Bistable Electro-Optic Polarization Modulator.
Final rept.,
A. Feldman. 1 Aug 78, 3p
Pub. in Applied Physics Letters, v33 n3 p243-245, 1 Aug 78.

Keywords: Linear systems, Electrooptics, Modulators, Birefringence, Optical equipment, Polarization(Waves), Feedback, *Optical modulators, *Optical polarization, Power limiters, Bistability, Pockels cells, Reprints.

An optical device using optical feedback has been constructed with a Pockels cell and polarizing components. Two modes of operation of the device are demonstrated. Both modes exhibit optical bistability. It is demonstrated that, in one mode of operation, the nonlinear dependence of the output intensity as a function of an input optical or electrical signal can be made arbitrarily small compared to the linear dependence.

713,297
PB-289 097/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Internal Field Resonance Structure: Implications for Optical Absorption and Scattering by Microscopic Particles.
Final rept.,
G. J. Rosasco, and H. S. Bennett. Sep 78, 9p
Pub. in Jnl. of the Optical Society of America, v68 n9 p1242-1250 Sep 78.

Keywords: *Mie scattering, Dielectrics, Resonance, Electric moments, Magnetic moments, Particle size distribution, Absorption, Absorptivity, Spheres, Extinction, Fluorescence, Efficiency, Refractivity, *Raman scattering, Microparticles, Reprints.

Mie scattering theory is used to calculate the efficiency factors for absorption by microscopic dielectric spheres. Resonances in the efficiency factors for absorption and resonances in the amplitudes of the electric and magnetic multipoles which occur in an expansion of the fields inside the dielectric sphere are discussed. Several trends in the strengths and width of the various resonances as functions of the absorption coefficient of the sphere, size, parameter, multipole order, and multipole resonance number are given. A formal solution for elastic (Mie) and inelastic (Raman) scattering by microscopic particles is derived from the extinction theorem. With this background, some implications of the resonances in the interpretation of absorption, fluorescence, and Raman scattering by microscopic particles are discussed.

713,298
PB-289 897/1 PC **A02**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.
Detector Spectral Response From 350 to 1200 nm Using a Monochromator Based Spectral Comparator.
Technical note.
A. Corrons, and E. F. Zalewski. Dec 78, 24p NBS-TN-988
Prepared in cooperation with Consejo Superior de Investigaciones Cientificas, Madrid (Spain). Inst. de Optica.

Keywords: *Photodetectors, Detectors, Photoconductivity, Infrared detectors, Measurement, Comparators, Monochromators, Photometers, Radiometers, *Optical detectors.

The method of relative spectral detector response measurement based on filters of known transmittance and a spectral irradiance standard lamp was used to measure the responsivity of a thermopile. The thermopile was then used in conjunction with a monochromator based spectral comparator to measure the relative spectral response from 350 to 1200 nm of several other detectors. Several auxiliary experiments to evaluate the accuracy of these techniques are described. The estimated accuracy of relative spectral response measurements using these techniques and this particular instrumentation was found to range from 3 to 7% depending upon the type of detector being measured and the spectral region under study. Finally, the effective transmittance of several filters was measured to evaluate the accuracy of the relative spectral detector response measurements. It was concluded that the effective transmittance test is not a reliable way to judge the accuracy of detector response measurements.

713,299
PB-290 013/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stabilized Lasers and Precision Measurements.
Final rept.,
J. L. Hall. 1978, 10p
Pub. in Science, v202 p147-156, 13 Oct 78.

Keywords: *Lasers, *Frequency stability, Helium neon lasers, Carbon dioxide lasers, Measurement, Spectroscopy, Metrology, Special relativity, *Laser applications, Continuous wave lasers, Dye lasers, Light speed, Reprints.

This article traces the development of stabilized lasers from the Massachusetts Institute of Technology passive-stabilization experiments of the early 1960's up through the current epoch of highly stabilized helium-neon and carbon dioxide and continuous wave dye lasers. The utility, present performance, and limitations of stabilized lasers as standards of length or frequency for precision measurements are discussed. Examples considered of laser applications to physical measurements of outstanding scientific interest include determination of the speed of light, redefinition of the meter, resolution of the photon recoil-induced spectral doubling, use of optical 'Ramsey' interference fringes from ultrahigh-resolution spectroscopy, and two improved tests of special relativity.

713,300
PB-290 018/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Action in Sputtered Metal Vapors.
Final rept.
J. R. McNeil, W. L. Johnson, G. J. Collins, K. B. Persson, and D. L. Franzen. 1976, 2p
Pub. in Proceedings of the International Conference on Quantum Electronics (9th) Held at Amsterdam, The Netherlands on June 14-18, 1976, p162-163 1976.

Keywords: Ultraviolet lasers, Infrared lasers, *Continuous wave lasers, *Metal vapor lasers, Silver lasers, Copper lasers, Visible lasers.

Continuous wave laser action has been obtained on twenty-eight transitions of Cu II spanning the wavelength region from 2486 A to 7988 A and on four transitions of Ag II in the visible region. Threshold currents for the 2500 A transitions of Cu II are typically 6 A and 10 mW of cw output power was obtained at 10 A, the limit of our d.c. power supply.

713,301
PB-292 199/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Far-Infrared CH3F Stark Laser.
Final rept.,
M. Inguscio, F. Strumia, K. M. Evenson, D. A. Jennings, A. Scalabrin, and S. R. Stein. Jan 79, 3p
Pub. in Opt. Lett. 4, n1, p9-11, Jan 79.

Keywords: *Infrared lasers, *Far infrared radiation, Stark effect, *Methyl fluoride lasers, Waveguide lasers, Stark components, Reprints.

A rectangular metal-dielectric FIR waveguide laser has been operated on the individual Stark components of CH3F by the application of an electric field across the laser medium. The results agree well with theoretical predictions.

713,302
PB-292 245/8 PC **A04**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Center for Materials Science.

Optical Materials Characterization - Final Technical Report February 1, 1978-September 30, 1978.
Technical note.
A. Feldman, D. Horowitz, R. M. Waxler, and M. J. Dodge. Feb 79, 74p NBS/TN-993
See also AD-A056 197. Sponsored in part by Advanced Research Projects Agency, Arlington, VA.

Keywords: *Infrared optical materials, *Infrared windows, *Laser materials, Alkali metal compounds, Alkaline earth compounds, Aluminum oxide, Silicon dioxide, Zinc selenides, Zinc sulfides, Germanium, Halides, Thermophysical properties, Photoelastic analysis, Piezoelectric materials, Refractivity, Optical properties, Optical materials characterization program.

Data obtained as part of the Optical Materials Characterization Program are summarized in this report. Room temperature values of refractive index as a function of wavelength are presented for the following materials: commercially grown KCl, reactive atmosphere processed (RAP) KCl, KCl nominally doped with 1.5% KI, hot forged CaF2, fusion cast CaF2, CaF2 doped with Er (0.001% to 3% Er), SrF2, chemical vapor deposited (CVD) ZnSe (2 specimens), and ZnS (CVD, 2 specimens). Data for the thermo-optic constant (dn/dT) and the linear thermal expansion coefficient are given for the following materials over the temperature range -180 degrees C to 200 degrees C: Al2O3, BaF2, CaF2, CdF2, KBr, KCl, LiF, MgF2, NaCl, NaF, SrF2, ZnS (CVD), and ZnSe (CVD). The piezo-optic constants of the following materials are presented: As2S3 glass, CaF2, BaF2, Ge, KCl, fused SiO2, SrF2, a chalcogenide glass (Ge 33%, As 12%, Se 55%) and ZnSe (CVD).

713,303
PB-293 491/7 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Technology Div.
Laser Beam Profile Measurements Using Spatial Sampling, Fourier Optics, and Holography.
E. G. Johnson. Jan 79, 96p NBS-TN-1009

Keywords: *Laser beams, Profiles, Holography, Spatial distribution, Lenses, Mirrors, Electric fields, Measurement, Interferometric holography.

A technique for beam profile measurements at a preselected observation plane was demonstrated, using appropriate holography, lenses, mirrors, and two-dimensional array of small holes to sample the electric field of a laser pulse. This method can measure the amplitude and phase of a laser pulse at each preselected sampling point on a transverse observation plane. Subject to constraints, these measurements can provide separated visual images of the temporal pulse shapes for the amplitude and phase at each of the sampled electric fields. This paper describes the basic concepts for beam profile measurements via holography and uses pictures generated by a prototype system for illustration.

713,304
PB-294 049/2 PC **A03**/MF **A01**
Aerospace Guidance and Metrology Center, Newark AFS, OH.
Measurement of Pulsed-Laser Power.
M. Young, and R. A. Lawton. Feb 79, 42p NBS-TN-1010
Sponsored in part by Aerospace Guidance and Metrology Center, Newark Air Force Station, OH.

Keywords: *Power meters, *Q switched lasers, Laser beams, Accuracy, Calibrating, Optical measurement, Neodymium lasers, Speckle patterns, Laser outputs.

The calibration of several optical-pulse power meters to an accuracy of about 8% or better are described. The meters are designed for Q-switched neodymium lasers with peak powers in excess of a few megawatts and pulses longer than five or ten nanoseconds. Combined with a fast oscilloscope or a transient digitizer, the meters display the time-domain waveform of the laser emission and thereby allow determination of parameters such as transition duration (risetime, falltime), duration and peak power. The calibration of the meters by both pulsed and cw methods are described, and it is shown why each method is useful as a check on the other. The effect of speckle on the use of diffusers as attenuators in power meters is treated in some detail.

713,305
PB-295 015/2 PC **A02**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Center for Radiation Research.
Servo Controlled Electro-Optic Modulator for cw Laser Power Stabilization and Control.
Technical note.
J. B. Fowler, M. A. Lind, and E. F. Zalewski. Apr 79, 21p NBS/TN-987

Keywords: *Lasers, *Modulators, Electrooptics, Stabilization, Control, Continuous radiation, Sevomechanisms, Power, *Laser modulators.

Two simple designs for a low cost laser stabilization system are presented. The systems described are capable of stabilizing the power output of a cw laser line to better than .05% from DC to 100 kHz in the 350 to 1150 nm spectral range.

713,306
PB-295 042/6 PC **A16**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Laser Induced Damage in Optical Materials: 1978.
A. J. Glass, and A. H. Guenther. Dec 78, 364p NBS-SP-541
See also report dated Dec 77, PB-279 938. Also pub. as American Society for Testing and Materials, Philadelphia, PA., Special Technical Pub. 689. Sponsored in part by Office of Naval Research, Arlington, VA. Prepared in cooperation with California Univ., Livermore. Lawrence Livermore Lab., and Air Force Weapons Lab., Kirtland AFB, NM. Library of Congress catalog card no. 79-600050.
Proceedings of Annual Symposium on Optical Materials for High Power Lasers (10th) Held at Boulder Colorado on September 12-14, 1978.

Keywords: *Radiation damage, *Optical materials, *Meetings, Absorptivity, Optical measurement, Optical properties, Mirrors, Surfaces, Thin films, Optical coatings, Laser materials, Dielectric breakdown, Reviews, *Laser damage.

The Tenth Annual Symposium on Optical Materials for High Power Lasers (Boulder Damage Symposium) was held at the National Bureau of Standards in Boulder, Colorado, from 12-14 September 1978. The Symposium was held under the auspices of ASTM Committee F-1, Subcommittee on Laser Standards, with the joint sponsorship of NBS, the Defense Advanced Research Project Agency, the Department of Energy, and the Office of Naval Research. About 175 scientists attended the Symposium, including representatives of the United Kingdom, France, Canada, Japan, West Germany, and the Soviet Union. The Symposium was divided into sessions concerning the Measurement of Absorption Characteristics, Bulk Material Properties, Mirrors and Surfaces, Thin Film Damage, Coating Materials and Design, and Breakdown Phenomena. As in previous years, the emphasis of the papers presented at the Symposium was directed toward new frontiers and new developments. Particular emphasis was given to materials for use from 10.6 micrometers to the UV region. Highlights included surface characterization, thin film-substrate boundaries, and advances in fundamental laser-matter threshold interactions and mechanisms. The scaling of damage thresholds with pulse duration, focal area, and wavelength were also discussed. In commemoration of the Tenth Symposium in this series, a number of comprehensive review papers were presented to assess the state of the art in the various facets of laser induced damage in optical materials.

713,307
PB-295 168/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Quantum Efficiency of the p-n Junction in Silicon as an Absolute Radiometric Standard.
Final rept.,
J. Geist. 15 Mar 79, 3p
Pub. in Applied Optics 18, n6,p760-762, 15 Mar 79.

Keywords: *Silicon, *Detectors, *Optical detection, Mathematical models, Radiometry, Standards, Laboratory equipment, Reprints.

An investigation has been performed which shows that the absolute external quantum efficiency of a silicon detector can be accurately predicted by a simple model over a broad region of the spectrum. In the visible beyond 600 nm the accuracy of this calculation exceeds that of direct radiometric measurement of the external quantum efficiency, hence it should be possible to use silicon as an absolute detector in this spectral region. Using a good thermal detector, one can then 'bootstrap' a silicon based calibration down into the blue or ultraviolet region of the spectrum.

713,308
PB-296 047/4 PC **A07**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Center for Radiation Research.
Self-Study Manual on Optical Radiation Measurements: Part I. Concepts. Chapter 7. The Relative Spectral Responsivity and Slit-Scattering Function of a Spectroradiometer. Chapter 8. Deconvolution. Chapter 9. Physically Defining Measurement-Beam Geometry by Using Opaque Barriers.
F. E. Nicodemus. Jun 79, 137p NBS-TN-910-4
See also Chapter 6, Part 1, PB-268 502.

Keywords: *Optical measurement, Photoconductivity, Spectroradiometers, Monochromators, Wavelength, Spectral energy distribution, Measurement, Beams(Radiation), Manuals, Deconvolution.

This is the fourth in a series of Technical Notes (910-) entitled 'Self-Study Manual on Optical Radiation Measurements'. It contains Chapters 7, 8, and 9 of this Manual. Additional chapters will continue to be published, similarly, as they are completed. The Manual is a comprehensive tutorial treatment of the measurement of incoherent radiation that is complete enough for self instruction. Detailed chapter summaries make it also a convenient authoritative reference source. The manner in which the spectral responsivity of a spectroradiometer containing a monochromator varies with wavelength is treated in Chapter 7. Deconvolution, discussed in Chapter 8, is the numerical process of recovering an improved spectral distribution from spectroradiometric measurements inevitably smeared spectrally by the spectral-responsivity function of the radiometer. The physical definition of measurement beams, including the integration limits in the measurement equation, is treated in Chapter 9 in terms of geometrical-optics quantities and concepts.

713,309
PB-296 926/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Frequency Measurement of the 260-THz (1.15-micrometers) He-Ne Laser.
Final rept.,
D. A. Jennings, F. R. Petersen, and K. M. Evenson. May 79, 2p
Pub. in Optics Lett. 4, p129-130 May 79.

Keywords: *Helium neon lasers, *Frequency measurement, Near infrared radiation, Neon isotopes, Cadmium inorganic compounds, Germanium inorganic compounds, Arsenic inorganic compounds, Silver inorganic compounds, Sulfur inorganic compounds, Carbon dioxide, *Laser radiation, Neon 20, Cadmium germanium arsenides, Silver arsenide sulfides, Nonlinear optics, Reprints.

Absolute infrared frequency measurement has been extended to 260 THz with the measurement of the strong 1.15 micrometer laser line in 20Ne. The frequency was synthesized in nonlinear crystals of CdGeAs2 and Ag3AsS3 from stabilized CO2 lasers and the 1.5 micrometer laser line in 20Ne. The measured frequency is nu sub(20Ne,1.15 micrometers) = 260.103 284(30) THz.

713,310
PB-296 939/2 Not available NTIS
National Bureau of Standards, Boulder, CO.
Optical Fiber Phase Discriminator.
Final rept.,
B. L. Danielson. 15 Nov 78, 4p
Pub. in Jnl. Appl. Opt., v17 n22 p3665-3668, 15 Nov 78.

Keywords: *Phase discriminators, *Fiber optics, Delay time, Delay circuits, Light(Visible radiation), Feedback control, Frequency control, Demodulation, Angles(Geometry), Reprints.

Phase discriminators are devices widely used at rf and microwave frequencies to convert phase, or frequency, changes to amplitude changes. They find widespread use in generating audio feedback signals for frequency stabilization of oscillators, and in angle demodulation applications. This paper demonstrates that similar devices, with similar functions, can be constructed in the visible region using optical fibers as delay-line elements. The operating principles of an optical-fiber delay-line phase discriminator are discussed. The sensitivity is shown to be proportional to the fiber propagation-delay time. A device working at

.6328 micrometers is described and compared with predictions.

713,311
PB-296 951/7 PC A03/MF A01
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Technology Div.
Attenuation Measurements on Optical Fiber Waveguides: An Interlaboratory Comparison Among Manufacturers.
G. W. Day, and G. E. Chamberlain. May 79, 36p
NBSIR-79-1608

Keywords: *Fiber optics, Near infrared radiation, Electromagnetic absorption, Transmission loss, Power loss, Infrared optical materials, Performance evaluation, Comparison, Waveguides, *Optical waveguides, Comparative evaluations.

In late 1978, the National Bureau of Standards invited U.S. manufacturers of optical fiber waveguide to participate in an interlaboratory comparison of attenuation measurements. Seven manufacturers performed four different measurements on each of two fibers. The range of results was typically 1 to 1.5 dB/km for fibers with 3 to 7 dB/km nominal attenuation. This report contains the results and an analysis based on additional data taken by NBS.

713,312
PB-297 908/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS Reference Hazemeter: Its Development and Testing.
Final rept.,
V. R. Weidner, and J. J. Hsia. 1979, 8p
Pub. in Applied Optics 18, n10 p1619-1626, 15 May 79.

Keywords: *Haze, *Optical measuring instruments, Optical measurement, Optical materials, Light scattering, Photodiodes, Silicon, Performance evaluation, Hazemeters, Reprints.

A research hazemeter has been developed for quantitative analysis of light scattering by optical materials. The instrument is designed to measure percentage haze as set forth in the prescribed conditions recommended in ASTM Test Method D 1003. The hazemeter has several special features which make it possible to vary the geometrical conditions of the collimated light beam and the integrating sphere detector system for detailed studies of light scattering. The over-all uncertainty in percentage haze has been reduced to + or - 0.2%, and light scattering of less than 0.5% can readily be measured.

713,313
PB-299 763/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Versatile, Isotopically Specific Hydrogen Halide TEA Pin Laser.
Final rept.,
A. B. Horwitz, and S. R. Leone. 1979, 6p
Sponsored in part by Petroleum Research Fund, Washington, DC.
Pub. in Review of Scientific Instruments 50, n7 p811-816 Jul 79.

Keywords: *Isotope effects, Gas lasers, Chemical lasers, Chlorine isotopes, Bromine isotopes, Deuterium compounds, Hydrogen chloride, Hydrogen bromide, Reprints, *TEA lasers, Hydrogen chloride lasers, Hydrogen bromide lasers, Deuterium chloride lasers, Deuterium bromide lasers, Chlorine 35, Chlorine 37, Bromine 79, Bromine 81.

A practical easily constructed design for a laboratory hydrogen/deuterium halide chemical TEA laser is presented. Typical output energies in excess of 50 mJ/pulse broadband and 5 mJ/pulse on single lines are easily obtained. Isotopically specific oscillation on the nu = 1 yields 0 band ofsingle isotopes of H(35)Cl-H(37)Cl, D(35)Cl-D(37)Cl, H(79)Br-H(81)Br, and D(79)Br-D(81)Br is demonstrated. The ease of conversion from one laser species to the next and the flexible design provide a highly versatile device for laboratory problems in chemical and physical dynamics. Major advances in the development of laboratory HCl and HBr chemical TEA lasers are also reviewed.

713,314
PB-299 770/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Propagation Measurements in Multimode Optical Waveguides.
Final rept.
B. L. Danielson, G. W. Day, and D. L. Franzen. 1978, 3p
Pub. in Proceedings Fiber Optics and Communications Exposition (1st), Chicago, IL., Sep 6-8, 1978, p205-207 1978.

Keywords: *Fiber optics, *Optical measurement, Wave propagation, Reviews.

This talk provides an overview of the difficulties associated with adequate propagation measurements. Work at NBS and other laboratories is reviewed.

713,315
PB-299 771/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement Problems in Multimode Optical Waveguides.
Final rept.
G. W. Day. 1978, 1p
Pub. in Proceedings of International Conference on Communications (1978), Toronto, Canada, June 4-7, 1978, 1, p6.6.1 1978.

Keywords: *Fiber optics, *Optical measurement, Optical communication, Wave propagation, Optical waveguides.

This paper is primarily a review of problems associated with propagation measurements in multimode optical waveguides. Emphasis is placed on techniques which are of maximum use to the communication system designer.

713,316
PB-299 782/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Simple First Positive System Nitrogen Laser for Use in Optical Fiber Measurements.
Final rept.,
D. L. Franzen, B. L. Danielson, and G. W. Day. 1978, 3p
Pub. in IEEE Jnl. Quantum Electronics QE-14, n6 p402-404 Jun 78.

Keywords: *Infrared lasers, Near infrared radiation, Optical measurement, Fiber optics, Nitrogen, Reprints, *Nitrogen lasers.

A near infrared laser operating on several transitions of the first positive system of N2 was developed for measurements associated with optical fibers. The laser features a simple, longitudinal, segmented design giving pulsewidths of 60 to 80 ns full width at half maximum (FWHM) and peak powers of over 600 W in the 0.86 to 0.89 micrometers region in addition to significant output near 1.04 and 1.23 micrometers. Backscatter-reflection returns from optical fibers have been obtained using the laser.

713,317
PB-299 817/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Generation of Enhanced Coherent Anti-Stokes Raman Spectroscopy Signals in Liquid-Filled Waveguides.
Final rept.,
J. C. Schaefer, and I. Chabay. Aug 79, 3p
Pub. in Optics Letters 4, n8, p227-229, Aug 79.

Keywords: *Benzene, *Raman spectra, Coherent electromagnetic radiation, Dielectrics, Waveguides, Wave phases, Amplification, Reprints, Antistokes emission.

The authors have demonstrated enhancement of coherent anti-Stokes Raman spectroscopy signals in liquid benzene contained in dielectric waveguide capillaries with angular phase-matching conditions. Enhancement factors as high as 130 were observed relative to a single crossing. These were measured for capillaries of various cross sections as a function of length. The maximum enhancement observed was in a 50-micrometer by 50-micrometer by 292-mm capillary with a sample volume of 0.75 microliters. Signals increased steadily with capillary length and showed the same dependence on pump-beam crossing angle (phase-matching conditions) as in bulk samples.

713,318
PB-299 986/0 Not available NTIS
National Bureau of Standards, Washington, DC.
New Possibilities for Frequency Standards Using Laser Cooling and Detection of Stored Ions.
Final rept.
F. L. Walls, D. J. Wineland, and R. E. Drullinger. 1978, 7p
Pub. in Proceedings of Annual Symposium on Frequency Control (32nd), Atlantic City, NJ., May 31-June 2, 1978, p453-459 1978.

Keywords: *Frequency standards, *Ion traps(Instrumentation), Frequency stability, Cryogenics, Doppler effect, Ions, Ion temperature, Ultralow temperature.

Techniques for storing approximately 10000 to 100000 ions for periods of hours to days are described in detail. Ion dynamics and detection techniques are also covered. Experimental data is presented demonstrating that ions stored in a room temperature Penning style ion trap using dc electric and magnetic fields can be cooled to near zero Kelvin using a suitable laser. This cooling technique, which is appliciable to very many atomic and molecular ions, can reduce fractional frequency shifts due to the second order Doppler effect to smaller than 10 to the minus 15th power. This cooling, coupled with the other attractive features of ion storage, promises to make possible frequency standards with stabilities in the 10 to the minus 16th power to 10 to the minus 18th power range with accuracies of order 10 to the minus 15th power or better. One possible candidate for a microwave frequency standard is described. The projected fractional frequency stability is sibma sub y (tau) = 4 times 10 to the minus 15th power tau to the minus 1/2 power for 16 s < tau < 10,000 s.

713,319
PB-300 561/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Generalized Low-Frequency Approximation for Scattering in a Laser Field. II.
Final rept.,
L. Rosenberg. Jul 79, 6p
Pub. in Physical Review A 20, n1 p275-280 Jul 79.

Keywords: *Laser beams, *Scattering, Quantum theory, Bremsstrahlung, Potential theory, Reprints.

A time-independent formulation of the problem of scattering in an intense radiation field is used as the basis for a derivation of a low-frequency approximation in which field-free scattering amplitudes enter into the determination of transition amplitudes in the presence of the field. A single-mode field of arbitrary polarization is assumed and the scatterer is represented by a local, short-range potential. In the present derivation the dipole approximation for the field is not assumed. As a result, recoil corrections to earlier versions of the low-frequency approximation are obtained in explicit form. The low-frequency approximation for bremsstrahlung in the absence of a background field, derived some time ago by Low and others, appears as a limiting case of the result obtained here.

713,320
PB-300 571/7 Not available NTIS
National Bureau of Standards, Washington, DC.
New Measurement of the Proton Gyromagnetic Ratio and a Derived Value of the Fine-Structure Constant Accurate to a Part in 10(7).
Final rept.,
E. R. Williams, and P. T. Olsen. 1979, 5p
Pub. in Physical Review Letters 42, n24 p1575-1579, 11 Jun 79.

Keywords: *Protons, Measurement, Magnetic properties, Quantum electrodynamics, Reprints, *Gyromagnetic ratio, *Sommerfeld constant.

A new value for the fine-structure constant has been obtained from a new measurement of the gyromagnetic ratio of the proton. This value of 1/alpha is (0.33 + or - 0.14) ppm less than the value of 1/alpha derived from measurements of the anomalous magnetic moment of the electron, a sub e, and its current best quantum electrodynamics theoretical estimate.

713,321
PB-300 575/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Coulomb Scattering in a Laser Field.
Final rept.,
L. Rosenberg. 1979, 8p
Pub. in Physical Review A 20, n2 p457-464 Aug 79.

Keywords: *Laser beams, Quantum theory, Scattering, Reprints, *Coulomb scattering.

The problem of scattering by a local potential in the presence of an intense radiation field is studied for the case where the potential is Coulombic at great distances. The effect of the Coulomb tail on the asymptotic dynamics is accounted for here through a modification of the form of the wave functions which describe the time evolution of the system in initial and final states. This is in analogy with previous treatments of field-free Coulomb scattering. Starting from the time-dependent pictue, the author obtains a time-independent formulation of the problem and then applies it to the derivation of a low-frequency approximation. In the simplest version of this approximation the transition amplitude is represented as the product of a known field-dependent factor (a Bessel function) and the physical field-free scattering amplitude, thus generalizing an earlier result of this type derived for the case of a short-range potential.

713,322
PB77-600059 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
National Electromagnetic Measurement System.
R. A. Kamper. 1977, 42p NBSIR-75/936

Keywords: *Electromagnetic quantities, Laser, Microwave, National Measurement System, Radio measurements.

This report reviews the scientific, commercial, civil, and military activities that use electromagnetic measurements, and the measurement techniques and standards, and the institutions developing and using them, that have evolved to satisfy their needs. Through the early influence of the Department of Defense, this part of the National Measurement System is well coordinated, with NBS established as the central reference point. The measurement needs of lasers are included in the discussion.

713,323
PB79-600036 PC **A03**/MF **A01**
Dimensions/NBS. Volume 63, Number 9, September, 1979.
Monthly rept.
Sep 79, 32p NBS/DIM-63/9
See also report dated Jul/Aug 79, PB-298372.

Keywords: *Calibrations, *Energy, Fluid mixtures, *Light, Liquefied natural gas, Measurements, Microwaves, Super spring, Ultraviolet radiation.

Happy Anniversary, NBS/Boulder; Radar to the Rescue, F. P. McGehan; Accurate Measurement of Ultraviolet Radiation, J. L. Linsky; Liquefied Natural Gas: An Energy Alternative, G. Porter and K. Higgins; Assessing LNG Tank Volume Calibrations, K. Higgins and M. Baum; First Direct Frequency Measurement of Visible Light Reported, K. M. Evenson, D. A. Jennings and F. R. Petersen; Generic Technique for Accurately Predicting the Thermophysical Properties of Fluid Mixtures, N. Olien; Super Spring, J. E. Faller and R. L. Rinker; Conferences; Publications; News Briefs.

713,324
PB80-101256 PC **A06**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Design of a Reflection Apparatus for Laser Beam Profile Measurements,
E. G. Johnson. Jul 79, 122p NBS-TN-1015
Contract CCG-78-109

Keywords: *Optical measuring instruments, *Laser beams, *Mathematical models, Mirrors, Near infrared radiation, Intermediate infrared radiation, Design, Holography, Optical measurement, Computer programs, Beam profiles, BEAM computer program, BASIC programming language, Interdata computers.

Measurement of both the irradiance and phase front (the beam profile) in real time from the output of a laser has interest for control of that beam and for efficient energy and economic design of the source and the resulting optical systems. The National Bureau of Standards has begun a program to build a unit that can measure, at numerous wavelengths from 1.06 micrometers to 10.6 micrometers, a selected spatial sample of the beam profile. The design analysis reported here includes: the theory which uses Fourier optics concepts with off-axis reflections and rough surfaces to provide the basis for accurate computer simulation of laser beams; the program, BEAM, which generates the expected behavior of the apparatus under variation of laser wavelength, physical dimensions for curvatures, hologram structure, and changes in positions of the various components; the simulation results which demonstrate the expected characteristics for the apparatus; and the key element in the apparatus, namely the reflection hologram, which requires discussion of the design, construction, and testing of this element. The Hartmann plate method is described briefly so that a comparison between it and the holographic method can be made. The comparison shows why the holographic method is best for a standard for irradiance and phase-front measurements.

713,325
PB80-104219 Not available NTIS
National Bureau of Standards, Washington, DC.
Frontiers in Optical Radiation Measurements.
Final rept.,
J. Geist. 1976, 4p
Pub. in Proceedings of Electro-Optical Systems Design Conference - 1976 International Laser Exposition Held at New York, NY. on September 14-16, 1976, p281-284 1976.

Keywords: *Optical measurement, Technology assessment, Reviews.

Recent progress in optical radiation measurements is reviewed with emphasis on very recent progress in areas currently undergoing significant development. By its nature, the paper must rely on some extent on unpublished material.

713,326
PB80-104292 Not available NTIS
National Bureau of Standards, Washington, DC.
Time-Resolved Measurements of the Far UV Output of a BRV Source.
Final rept.,
T. B. Lucatorto, T. J. McIlrath, and G. Mehlman. 1 Sep 79, 2p
Pub. in Applied Optics 18, n17, p2916-2917, 1 Sep 79.

Keywords: *Far ultraviolet radiation, Vacuum apparatus, Ultraviolet sources, Discharge lamps, Reprints.

The temporal behavior of the BRV-type vacuum spark source was studied at two wavelengths (300 and 600 A). The position of the peak output was measured relative to the maximum spark current and values for the pulse width obtained.

713,327
PB80-104300 Not available NTIS
National Bureau of Standards, Washington, DC.
Capillary Array: A New Type of Window for the Vacuum Ultraviolet.
Final rept.,
T. B. Lucatorto, T. J. McIlrath, and J. R. Roberts. 15 Jul 79, 5p
Pub. in Applied Optics 18, n14, p2505-2509, 15 Jul 79.

Keywords: *Ultraviolet optical materials, *Capillary tubes, Glass, Far ultraviolet radiation, Pressure gradients, Reprints.

Experiments with optical radiation often require separation of a region of relatively high pressure from a lower pressure region while allowing transmission of radiation between regions. When working with vacuum ultraviolet radiation (VUV) the problem is made more difficult by the small number of transparent materials, there being no bulk materials which transmit at shorter wavelengths than the 1050A cut-off of LiF. In this paper the authors report the successful use of glass capillary arrays combined with differential pumping to sustain large pressure differences with excellent transmission of radiation throughout the VUV region.

713,328
PB80-104961 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Standard Reference Materials: Didymium Glass Filters for Calibrating the Wavelength Scale of Spectrophotometers - SRM 2009, 2010, 2013, and 2014,
W. H. Venable, and K. L. Eckerle. Oct 79, 89p NBS-SP-260-66
Library of Congress catalog card no. 79-600122.

Keywords: *Optical filters, *Transmittance, Spectrophotometers, Calibrating, Rare earth compounds, Oxides, Light transmission, Optical glass, *Standard reference materials, Data analysis.

This publication presents the use of didymium glass filters as Standard Reference Materials (SRM). The standard reference materials are labeled 2009, 2010, 2013, and 2014 depending on size and method of calibration. The certification and uncertainties are also discussed. An appendix with background material and terminology is included. Wavelengths of minimum transmittance and inflection points in the transmittance curve are certified to be at specified wavelength and provide a convenient method of calibrating the passband centroid of spectrophotometers with bandwidths between 1.5 and 10.5 nm.

713,329
PB80-107394 Not available NTIS
National Bureau of Standards, Washington, DC.
Modelling Ultraviolet Radiation Sources and the Upper Atmosphere - Critical Data Needs.
Final rept.,
L. Hagan. 1979, 4p
Pub. in Proceedings International Conf. on CODATA (6th), Held at Santa Flavia (Italy) on May 22-25, 1978, p73-76.

Keywords: *Ultraviolet radiation, *Stratosphere, Plasmas(Physics), Ozone, Atomic energy levels, Molecular energy levels, Air pollution, Mathematical models.

Ultraviolet (UV) radiation is important in the fields of controlled thermonuclear fusion research, the development of short wavelength lasers, the study of inadvertent modification of the upper atmosphere by pollutants, and in the study of the safety of UV radiation sources used in industry and medicine. Theoretical models are needed for many UV sources. The mostly non-thermal nature of high temperature plasmas requires consideration of detailed atomic and ionic processes governing the ionization and excitation. Reactions in the stratosphere between atmospheric pollutants and ozone reduce the ozone concentration and allow increased UV radiation from the sun to reach the earth. References to compilations of atomic and molecular data needed to model UV sources and reactions are summarized. Future needs for critical data and compilations are discussed.

713,330
PB80-115520 Not available NTIS
National Bureau of Standards, Washington, DC.
Refractometry of Fluids in Microscopic Tubes.
Final rept.,
C. P. Saylor. 1979, 7p
Pub. in Applied Optics 18, n6 p802-808, 15 Mar 79.

Keywords: *Fluids, *Refractivity, Optical measurement, Tubes, Optical properties, Focal length, Accuracy, Reprints.

Fluid filling a tube immersed in a medium that matches the index of the tube acts as a cylindrical lens. Because of geometrical aberrations, the focal length cannot be used directly for an accurate determination of refractive index. By observing the focal position with a microscope that has an aperture regulating diaphragm in the back focal plane, the ambiguity can be removed. The diaphragm restricts the observing light to two beams of equal and opposite obliquity. With unpolished tubes accuracy is about as good as with an Abbe refractometer, a few units in the fourth decimal place.

713,331
PB80-115629 Not available NTIS
National Bureau of Standards, Washington, DC.
National Standards of a Powerful Sort.
Final rept.,
A. A. Sanders. Aug 79, 5p
Pub. in Optical Spectra, p45-49 Aug 79.

Keywords: *Calorimeters, Laser beams, Measurement, Standards, Reprints, *Laser calorimetry.

Some basic principles of laser calorimeters are discussed. The calorimeter measurement system maintained by NBS as National standards for laser power and energy measurements is presented. Measurement services provided by these systems are outlined and techniques are discussed for performing documented traceable laser power measurements. The importance of linearity and spatial responsivity uniformity of transfer standards is shown.

713,332
PB80-115637 Not available NTIS
National Bureau of Standards, Washington, DC.
Fiber Measurements: Quality and Cost.
Final rept.,
G. W. Day. 1979, 3p
Pub. in ICC Conference (1979) Record 1, p10.4.1-10.4.3 1979.

Keywords: *Fiber optics, Waveguides, Measurement, Standards, Optical measurement, *Optical waveguides.

Several points which should be considered by groups writing standard measurement procedures for optical fiber waveguides are discussed. These include the quality of measurements now attainable, the factors limiting that quality, the prospect for improvement, and the cost of measurements. Some of the points are illustrated with data from measurement comparisons.

713,333
PB80-117450 Not available NTIS
National Bureau of Standards, Washington, DC.
Spatial Uniformity of Quantum Efficiency of a Silicon Photovoltaic Detector.
Final rept.,
A. R. Schaefer, and J. Geist. 15 Jun 79, 4p
Pub. in Applied Optics 18, n12, p1933-1936, 15 Jun 79.

Keywords: *Photodetectors, *Photovoltaic cells, Silicon, Quantum efficiency, Responses, Reprints.

In the course of investigating the spatial uniformity of response of a silicon detector, an extensive experiment was conducted to examine the correlation between changes in reflectance, internal and external quantum efficiency as a function of position and wavelength on the detector. The sensitivity of the technique was tested and demonstrated in several ways. The examined detector was found to be suitably uniform for absolute radiometric purposes, and the small changes observed in external quantum efficiency can be easily accounted for by the dead layer model.

713,334
PB80-117856 Not available NTIS
National Bureau of Standards, Washington, DC.
Continuous-Wave (Mode-Locked) Dye Laser with Unfolded Cavity.
Final rept.,
M. Young. 1 Oct 79, 1p
Pub. in Appl. Opt., v18 n19 p3212, 1 Oct 79.

Keywords: Catadioptic systems, Lasers, Pulse width, Reprints, *Continuous wave lasers, *Dye lasers, *Mode locked lasers, Rhodamine 6G, Xanthene dyes, Laser cavities.

A catadioptic cavity (rather than a folded cavity) has been used to produce 5 ps pulses with a passively mode locked, R6G dye laser.

713,335
PB80-118508 PC **A06**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Quality Assurance Program for the NBS C, K, and Q Laser Calibration Systems,
W. E. Case. Aug 79, 102p NBSIR-79/1619
Sponsored in part by Aerospace Guidance and Metrology Center, Newark Air Force Station, OH.

Keywords: *Laser beams, *Power measurement, Measurement, Energy, Calibrating, Quality assurance, Statistical analysis, Computer programs, Laser outputs.

This report contains a detailed procedure of how to set up and operate a Measurement Assurance Program for a laser power and energy calibration facility. Items such as traceability, methods of self-checking measurement consistency, computer documentation, and statistical analysis are discussed.

713,336
PB80-120066 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Time Domain Pulse Measurements and Computed Frequency Responses of Optical Communications Components,
J. R. Andrews, and M. Young. Sep 79, 36p NBSIR-79-1620

Keywords: *Optical measurement, *Optical communication, Optical equipment, Gallium arsenide lasers, Fiber optics, Fourier transformation, Avalanche diodes, Photodiodes, Neodymium YAG lasers.

The purpose of this report is to demonstrate the application of the NBS Automatic Pulse Measurement System to measuring the pulse responses of optical communications components and to computing their impulse and frequency responses. For example, measurements of the properties of two glass fibers and an avalanche photodiode using both a pulsed GaAs laser dioxide wavelength = 0.9 micrometer and a mode locked, Nd:YAG laser wavelength = 1.06 micrometers. All measurements were performed in the time domain; frequency domain data were obtained from the time domain data by using the Fast Fourier Transform. The impulse response was obtained by deconvolution.

713,337
PB80-121304 Not available NTIS
National Bureau of Standards, Washington, DC.
Metal-Vapor Production by Sputtering in a Hollow-Cathode Discharge: Theory and Experiment.
Final rept.,
B. E. Warner, K. B. Persson, and G. J. Collins. Sep 79, 10p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Appl. Phys. 50, n9 p5694-5703 Sep 79.

Keywords: Metal vapors, Density(Mass/volume), Cathode sputtering, Vaporizing, Reprints, *Metal vapor lasers, Charge-exchange reactions.

Laser action in singly ionized metal atoms has been obtained when a rare gas is excited in a metal hollow cathode. The required metal-vapor density is produced by discharge sputtering from the cathode and the excitation of upper levels occurs via a charge-transfer reaction. A unified discharge-sputtering theory is presented which describes the metal density created in the hollow cathode, including both the current and spatial dependence. The predictions of this model are then compared to the measured dependence of metal-vapor density with current, spatial position, and buffer-gas pressure.

713,338
PB80-122922 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser-Excited Galvanic Spectroscopy.
Final rept.,
D. S. King, and P. K. Schenck. Mar 78, 5p
Pub. in Laser Focus, p50, 52, 54, 56, and 57, Mar 78.

Keywords: Calibrating, Wavelengths, Frequency stability, Spectroscopic analysis, Solutions, Metals, Reprints, *Laser spectroscopy, Galvanic effect, Tunable lasers, Continuous wave lasers, Trace amounts, Laser applications.

The new spectroscopic and analytical technique, laser excited galvanic spectroscopy, is presented. Applications of this technique to wavelength calibration and bandwidth determination of tunable lasers, frequency stabilization of cw dye lasers, and analytical determinations of trace metals in aqueous solution are described.

713,339
PB80-123193 Not available NTIS
National Bureau of Standards, Washington, DC.
Conference on Optical Scattering Standards.
Final rept.,
M. Young. 1979, 2p
Pub. in SPIE Jnl. 181, p133-134 1979.

Keywords: *Light scattering, *Standards, Optical materials, Surfaces, Meetings, Measurements, Optical measurement, Calibrating.

This paper is a report on a conference, Standards for Scattering from Optical Surfaces, that was held February 6 and 7, 1979, at the National Bureau of Standards in Boulder, Colorado. Approximately 50 scientists attended and heard a dozen invited papers and a panel discussion. The visitors agreed, among other things, that national physical standards are needed. There was also general agreement that NBS should consider providing measurement services (such as well characterized surfaces) based on a state-of-the-art facility for precision scattering measurements and calibrations.

713,340
PB80-124597
(Order as PB80-124548, PC **A05**/MF **A01**)
Wayne State Univ., Detroit, MI. Dept. of Physics.
Class of Double Integrals Involving Gaussian and Trigonometric Factors,
D. M. Fradkin. 16 Apr 79, 8p
Included in Jnl. of Research of the National Bureau of Standards, v84 n4 p319-326, Jul-Aug 79.

Keywords: *Electric fields, *Fourier transformation, *Integral calculus, Charged particles, Electromagnetic radiation, Laser beams, Scattering, Error functions, Exponential functions.

The five-parameter double integral (integral from 0 to infinity of exp(-(py)squared)sine(beta y + theta)dy)(integral from 0 to y of exp(-x squared)cosine(epsilon beta x + phi)dx) is evaluated in terms of Fourier transforms of exp(-x squared)erfc(alpha x). Some new expressions for these transforms are obtained. The five parameter definite double integral considered in this paper is a generalization of that encountered in describing the radiation reaction effects on a charged particle swept over by a single plane laser pulse.

713,341
PB80-165590 PC **A03**/MF **A01**
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Chemistry.
Colorimetry of Fluorescent Specimens: A State-of-the-Art Report.
Final rept.,
F. W. Billmeyer. Oct 79, 49p NBS-GCR-79-185
Sponsored in part by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Fluorescence, *Colorimetry, Optical materials, Color, Radiance, Spectral emittance, Optical measurement, Optical measuring instruments, State of the art.

Accurate measurement of the color of fluorescent specimens, independent of instrument parameters, is very difficult because such materials absorb radiant power in one wavelenght region (the excitation region) and emit power in a region of longer wavelengths (the emission region). There is a complicating overlapping wavelength region in which both excitation and emission take place. Conformance to better color specifications requires irradiation by a source identical to CIE standard daylight illuminant D65, but existing instrument daylight simulators provide a widely discrepant range of results. Calculation methods are described allowing these results to be converted to those for D65 by computation. Instrument modifications and accompanying material standards are proposed for direct measurements corresponding to D65 irradiation. A proposed field test method and instrument are described. Recommendations for implementing these techniques are made for both short-term and long-term time frames.

713,342
PB80-165723 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Low Level Laser Pulses at 1.064 Micrometers.
Final rept.,
A. L. Rasmussen, and A. A. Sanders. 1979, 8p
Pub. in Proceedings of the SPIE Conference, San Diego, California, August 29, 1979, SPIE Measurment Optical Radiation 196, p96-103 1979.

Keywords: *Laser beams, *Optical measuring instruments, Pulse amplitude, Infrared lasers, Infrared radiation, Photodiodes, Avalanche diodes, Optical measurement, Pulsed lasers, Acoustooptics, Continuous wave lasers.

A system has been developed for measuring 1.064 micrometer laser pulses of about 10 to the -15th power J. The overall uncertainty of the system has been evaluated and is less than + or - 15%. The details of the measurement system, its documentation relative to the NBS absolute reference calorimeters, and the associated uncertainties of measurements are discussed. Several silicon avalanche and PIN photodiodes have been evaluated. Measurements have been performed using cw lasers, and laser pulses of about 30 and 200 ns. These measurements have demonstrated the feasibility of characterizing transfer standards for these low level energies by means of cw laser measurements and acousto-optic modulators. Such a system is discussed. The results of these eval-

uations and work towards realizing well documented transfer standards are also discussed.

713,343
PB80-170533 PC **A05**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Assessment of the Backscatter Technique as a Means for Estimating Loss in Optical Waveguides,
B. L. Danielson. Feb 80, 88p NBS-TN-1018
Sponsored in part by Aerospace Guidance and Metrology Center, Newark Air Force Station, OH., and Army Communications Command, Fort Monmouth, NJ. Communications Systems Center.

Keywords: *Backscattering, *Light transmission, *Fiber optics, Electromagnetic absorption, Light scattering, Optical measurement, Optical properties, Transmission loss, Errors, Accuracy, Optical waveguides.

This technical note addresses some of the problems associated with determining the accuracy of the backscatter technique as it is applied to the estimation of attenuation in optical waveguides. The basic theoretical assumptions involved in optical time domain reflectometry are reviewed. The effect on calculated loss values resulting from a departure from these assumptions is then examined. The approach taken is to employ computer modeling of the various scattering and other loss mechanisms using the bulk material properties of optical fibers. Computer responses permit a numerical comparison between the direct (insertion) method of measuring attenuation and several methods of estimating attenuation from analysis of backscatter data. Numerous examples are given of physical effects which can produce discrepancies in attenuation values calculated from backscatter signals. Also, some experimental comparisons are made between backscatter-derived and directly measured attenuation values in step and graded-index optical waveguides. Finally, the conditions necessary for good agreement between the direct and backscatter methods are discussed and suggestions for minimizing these errors are made.

713,344
PB80-174568 PC **E06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Contributions to Color Science.
Final rept.,
D. B. Judd, and D. L. MacAdam. Sep 79, 765p NBS-SP-545
Prepared in cooperation with Rochester Univ., NY. Inst. of Optics. Library of Congress catalog card no. 76-600132.Color illustrations reproduced in black and white.

Keywords: *Colorimetry, Color, Spectrophotometry, Colors(Materials), Visual perception.

This book is a collection of fifty-seven papers written by Deane B. Judd, a staff member of the National Bureau of Standards from 1926 to 1969, and an internationally recognized authority on color. The contents of this collection include some of the major contributions of Dr. Judd to such areas as the measurement and specification of color, spectrophotometry, color appearance and spacing, and color vision. Each paper is preceded by an introduction which provides general commentary on the article and explains the terminology used. Some introductions also direct the reader to related articles in the collection and point out significant developments, such as international agreements, which were based on Judd's work. A list of the more than 200 articles written by Dr. Judd is included in an appendix.

713,345
PB80-177421 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Measurement of Optical Fiber Bandwidth in the Time Domain.
Technical note,
D. L. Franzen, and G. W. Day. Feb 80, 72p NBS-TN-1019
Sponsored in part by Department of Defense, Washington, DC.

Keywords: *Fiber optics, *Bandwidth, Optical measurement, Optical properties, Time dependence, Transfer functions.

A system is described for determining optical fiber bandwidth from time domain information. A measurement gives the optical fiber transfer function (or frequency response) relating the output waveform to the input. An analysis is given of the variables affecting the measurement. This includes a discussion of such input related topics as launching conditions, mode scramblers, and laser diode sources; output related topics include a discussion of optical detectors. Laser diodes are evaluated with respect to short pulse performance, near field emission, material dispersion limits, and other spectral behavior like chirping; detectors are evaluated with respect to time response, linearity, and uniformity. Overall system architecture, precision, and dynamic range are discussed. A number of bandwidth related topics are briefly presented and typical experimental results given. This includes examples of: mode mixing via microbending, profile compensation, profile dispersion, intramodal broadening, materials dispersion constants, relative magnitude-phase behavior, and Gaussian predictions of frequency response.

713,346
PB80-177991 Not available NTIS
National Bureau of Standards, Washington, DC.
Properties of Crystalline Materials for Optics.
Final rept.,
A. Feldman, and R. M. Waxler. 1980, 9p
Pub. in Proceedings of the SPIE Conference on Recent and Future Developments in Medical Imaging II, San Diego, California, August 27-29, 1979, SPIE Journal 204 p68-76 1980.

Keywords: *Optical materials, *Crystals, Optical properties, Crystal structure, Refractivity, Absorptivity, Birefringence, Photoelasticity, Symmetry, Reprints, Electrooptics.

A tutorial review of refractive index, absorption, birefringence, the electro-optic effect and the photoelastic effect in crystalline materials is presented. Tensorial relationships are presented and related to the symmetry classes of crystals.

713,347
PB80-178114 Not available NTIS
National Bureau of Standards, Washington, DC.
Narrow-Band Pulsed Dye Laser System for Precision Nonlinear Spectroscopy.
Final rept.,
G. L. Eesley, M. D. Levenson, D. E. Nitz, and A. V. Smith. Feb 80, 3p
Pub. in IEEE Jnl. Quant. Electron., vGE-16 n2 p113-115 Feb 80.

Keywords: Reprints, *Dye lasers, *Pulsed lasers, Neodymium YAG lasers, Laser spectroscopy.

A CW oscillator/pulsed amplifier dye laser system that produces 20 kW of diffraction limited radiation with a linewidth of 17 + or - 4 MHz is reported. The key component is a unique long pulse Nd:YAG pump laser.

713,348
PB80-182280 Not available NTIS
National Bureau of Standards, Washington, DC.
Survey of Refractive Data on Materials for High-Power Ultraviolet Laser Applications.
Final rept.,
A. Feldman, R. M. Waxler, and I. H. Malitson. 1979, 7p
Sponsored in part by Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings Conference on Physical Properties of Optical Materials, Held at San Diego, CA on Aug 27-29, 1980, and Jnl. Soc. of Photo-optical Instrumentation Engineers, v204 p95-101, 1979.

Keywords: *Laser materials, *Refractivity, *Ultraviolet optical materials, Optical materials, Glass, Ultraviolet lasers, Ultraviolet radiation, Alkali metal compounds, Halides, Thermodynamic properties, Photoelasticity, Band structure of solids, Laser crystals, Xenon fluoride lasers, Alkali halides.

A literature survey of refractive indices, thermo-optic constants, and photoelastic constants has been conducted for materials of potential use in high-power ultraviolet applications. The limiting ultraviolet wavelength for which data exist is given for twenty alkali-halides, sixteen other crystalline solids, and three glasses. The bulk of the materials selected for the survey have band gaps that exceed 7 eV which is twice the photon energy of the XeF laser. There are large gaps in the available data for most of the materials.

713,349
PB80-183601 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Frequency Optically Heterodyned Saturation Spectroscopy via Resonant Degenerate Four-Wave Mixing.
Final rept.,
R. K. Raj, D. Bloch, J. J. Snyder, G. Camy, and M. Ducloy. 12 May 80, 4p
Pub. in Jnl. Phys. Rev. Lett., v44 n19 p1251-1254, 12 May 80.

Keywords: *Spectroscopy, Iodine, Molecular spectroscopy, Heterodyning, Saturation, Spectrum analysis, Spectral lines, Molecular relaxation, Reprints, Nonlinear optics.

Resonant degenerate four-wave mixing with two close optical frequencies (omega, omega + delta) is used to perform high-frequency optically heterodyned saturation spectroscopy. Doppler-free spectra of I2 (lambda = 514.5 nm) are obtained in this way for 20 kHz < delta < 20 MHz. Lock-in detection for delta < 1 MHz allows relaxation studies and line assignments. At higher frequencies, rf-power detection yields Doppler-free doublets split by 3 delta/2.

713,350
PB80-188592 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibrating a Spectroradiometer with CW Laser Lines and a Calibrated Detector.
Final rept.,
E. F. Zalewski. 1978, 6p
Pub. in Proceedings of Electro-Optics/Laser 78 Conf. and Exposition, Sept. 19-21, 1978, p271-276 1978.

Keywords: *Spectroradiometers, *Calibrating, Laser beams, Measurement, Accuracy, Detectors, Continuous wave lasers.

Presently the most widely used procedure to calibrate a spectroradiometer is based on using a known source of spectral irradiance as the reference standard. This calibration procedure works well in substitution type measurements where the unknown source also has a continuous emission spectra and a similar level of irradiance. If the unknown source has a considerably different spectral power output and/or emits a highly structured spectrum, then several auxilliary measurements have to be performed to adequately characterize the spectroradiometer's response. The accuracy of these auxilliary measurements can be significantly improved through the use of amplitude stabilized cw laser sources and silicon detectors characterized for linearity of response. In addition, the high levels of accuracy now attainable in electrical substitution radiometry can be utilized in conjunction with the stable cw laser sources to measure the absolute response of the spectroradiometer.

713,351
PB80-191141 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Measuring Features of the Fluence at the Far Field of a CO2 Pulsed Laser--An Issue Study with Suggestions on How to Do It,
E. G. Johnson, R. J. Phelan, and D. R. Boyle. Apr 80, 56p NBSIR-80-1628

Keywords: *Laser beams, *Luminous intensity, *Optical measurement, Carbon dioxide lasers, Plasmas(Physics), Sulfur hexafluoride, Sulfur fluorides, Pulsed lasers.

This study examines the problems for measuring the energy density incident on targets where the energy is from a pulse of high energy at CO2 wavelengths and where the targets are located at the far field. The analysis considers two targets--first, a ground-based target for testing and calibration of the measurement systems and second, a drone towed behind an airplane from which the energy distribution information is telemetered to the ground station. Although certain design limits are assumed, the results are general and therefore specific data about the laser sources is not supplied. This study traces each stage of the measurement system from the reception of the incident laser pulse on the drone to the pulse-coded transmission of the sampled data to a ground-based computer.

713,352
PB80-191422 Not available NTIS
National Bureau of Standards, Washington, DC.

NBS Specular Reflectometer-Spectrophotometer.
Final rept.,
V. R. Weidner, and J. J. Hsia. 15 Apr 80, 6p
Pub. in Appl. Opt. 19, n8 p1268-1273, 15 Apr 80.

Keywords: *Reflectometers, Specular reflection, Spectrophotometers, Mirrors, Reprints.

A specular reflectometer has been constructed and tested for calibrating the reflectance of mirror standards over the 250-2500-nm spectral range. This instrument is a measurement accessory to a reference spectrophotometer. The specular reflectometer is designed to measure mirror reflectances at angles of incidence between 5 and 80 degrees, using both vertically and horizontally polarized radiation. Absolute reflectance measurements are obtained by an optical system, which provides for direct measurement of the incident beam and for the sample mirror reflectance using the same beam. This is accomplished by means of a beam tracking system through which the beam is directed into a signal averaging sphere. The sphere rotates with the beam tracking optics, and the stationary detector views the interior of the sphere. Control of the beam tracking optical system is accomplished by a computer-controlled stepping-motor-driven precision turntable. Uncertainties of the reflectance measurements obtained with this system are estimated to be + or - 0.2% of the measured value.

713,353

PB80-194384 Not available NTIS
National Bureau of Standards, Washington, DC.
Models of High-Power Discharges for Metal-Xe Excimer Lasers.
Final rept.,
R. Shuker, A. Gallagher, and A. V. Phelps. Mar 80, 15p
Contracts N00014-76-C-0123, DOE-EA-77-A-01-6010
Pub. in Jnl. of Applied Physics 51 n3 p1306-1320 Mar 80.

Keywords: *Mathematical models, Gas lasers, Metals, Electron density, Ionization, Excitation, Reprints, *Xenon lasers, Electron ion interactions.

High-power (about 10 to the 8th power W/l) discharges in metal-doped Xe are modeled for typical metal atom densities of 10 to the 15th power-10 to the 17th power/cc and Xe densities of about 10 to the 20th power/cc, and electron densities of 10 to the 14th power-10 to the 17th power/cc as appropriate for proposed excimer lasers. Na is used as a prototype species, while its properties are varied to indicate some of the changes that could result from the use of different metals. The model includes sixteen excited levels of Na, three ionic species, the excimer levels of NaXe, and Na2. The degree of ionization is determined by collisional multistep excitation and ionization of excited atoms versus dissociative recombination of electrons with Na2(+). Steady-state conditions in the positive column are calculated for typical gas temperatures of about 0.06 eV and electron temperatures T(e) of 0.3-0.5 eV.

713,354

PB80-200538 Not available NTIS
National Bureau of Standards, Washington, DC.
Silicon Photodiode Absolute Spectral Response Self-Calibration.
Final rept.,
E. F. Zalewski, and J. Geist. 15 Apr 80, 3p
Pub. in Applied Optics 19, n8 p1214-1216, 15 Apr 80.

Keywords: *Photodiodes, *Photoconductivity, Calibrating, Lasers, Measurement, Silicon, Reprints.

A new technique is demonstrated for the determination of the absolute spectral response of a uv enhanced silicon photodiode. This technique is completely independent of the traditional approaches to absolute radiometry based on the thermal physics of blackbodies or electrically caibrated radiometers and surpasses them in accuracy and simplicity. For the photodiodes used in this study the radiant power in a 1 mW laser beam at 0.63299 micrometers was measured to within an uncertainty of + or - 0.04%.

713,355

PB80-201783 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Photometry and Colorimetry of Retroreflection: State-of-Measurement-Accuracy Report.
Final rept.,
K. L. Eckerle. Jul 80, 47p NBS-TN-1125

Keywords: *Reflection, Photometry, Colorimetry, Reflectors, Accuracy, *Retroreflection, Retroreflectors, Optical retroreflection.

A survey of the literature on retroflection has been conducted and information from this survey necessary for the understanding of the phenomenon of retroreflection is summarized. Items included are materials, measurement geometry, quantities to be measured, instrumentation, and methods of calibration. Recommendations are given to evaluate or to write specifications by discussing important parameters. A partial list of test methods and specifications is presented in tabular form. Some prior research and intercomparisons are summarized including the results. The state-of-measurement-accuracy is inferred from the information presented. A bibliography is included for those who would like to obtain more details.

713,356

PB80-202914 PC **A12**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Basic Optical Properties of Materials: Summaries of Papers,
A. Feldman. May 80, 256p NBS-SP-574
Sponsored in part by Optical Society of America, Washington, DC. Presented at the Topical Conference on Basic Optical Properties of Materials Held at Gaithersburg, Maryland, May 5-7, 1980. Library of Congress catalog card no. 80-600038.

Keywords: *Optical properties, *Meetings, Fiber optics, Magneto-optics, Thin films, Laser materials, Nonlinear optics, Optical waveguides.

This Special Publication contains summaries of papers presented at the Topical Conference on Basic Optical Properties of Materials on May 5-7, 1980. This publication contains summaries of 62 papers which include 14 invited papers. The principal topical areas are: Nonlinear Optical Properties; Ultraviolet Properties; Infrared Properties; Graded Index Materials; Inhomogeneous Materials; Properties of Thin Films; Optical Fibers, Planar Optical Waveguides; External Influences - Piezo-optics, Thermo-optics, Magneto-optics. The purpose of the conference is to discuss the state of the art in the measurement of the optical properties of optical materials. The emphasis is primarily on materials properties rather than on optical devices. The primary focus of the conference is on the measurement and theory of basic optical properties of materials in bulk, thin film and fiber form.

713,357

PB80-208267 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS (National Bureau of Standards) Reference Retroreflectometer.
Final rept.,
K. L. Eckerle, J. J. Hsia, V. R. Weidner, and W. H. Venable. 1980, 7p
Pub. in Applied Optics 19, n8 p1253-1259, 15 Apr 80.

Keywords: *Optical reflectometers, Reprints, *Retroreflectors.

A long-range retroreflectance instrument has been built in the photometric range of the radiometric Physics Division of the NBS. It is designed to measure photometric properties of retroreflectors for different geometries. It satisfies many needs of the measurement community, and it is planned to use this instrument as the basis for a Measurement Assurance Program (MAP) and for Standard Reference Materials (SRM). This paper describes the design and testing of the instrument. Some estimated uncertainties for typical samples are given.

713,358

PB80-215841 Not available NTIS
National Bureau of Standards, Washington, DC.
Results of a Recent Attenuation Measurement Comparison among U.S. Optical Waveguide Manufacturers.
Final rept.,
G. W. Day, and G. E. Chamberlain. 1979, 4p
Pub. in Proceedings of the European Conference on Optical Communication (5th), Amsterdam, Netherlands, September 17-19, 1979, p19.4-1--19.4-4 1979.

Keywords: *Fiber optics, *Attenuation, Measurement, Comparison, *Fiber optics transmission lines.

In this paper we report the results of a fiber attenuation measurement comparison among U.S. manufacturers in which each laboratory used methods close to those it normally uses in quality control. The data suggest the uncertainties that would presently be applied when similar products of different manufacturers are compared. The study also demonstrates clearly the need for standard measurement procedures and provides a reference from which they can be judged.

713,359

PB80-215858 Not available NTIS
National Bureau of Standards, Washington, DC.
Optically Pumped cw CH2DOH FIR Laser: New Lines and Frequency Measurements.
Final rept.,
A. Scalabrin, F. R. Petersen, K. M. Evenson, and D. A. Jennings. 1980, 10p
Pub. in International Jnl. of Infrared Millimeter Waves 1, n1 p117-126 1980.

Keywords: *Methyl alcohol, *Infrared lasers, Deuterium compounds, Far infrared radiation, Reprints.

The authors have measured the output powers and relative polarizations of 66 cw FIR laser lines from CH2DOH (including 50 not previously reported), which were optically pumped by a CO2 laser. The frequencies of 43 of these lines were measured relative to stabilized CO2 lasers.

713,360

PB80-215866 Not available NTIS
National Bureau of Standards, Washington, DC.
Limitations Imposed by Material Dispersion on the Measurement of Optical Fiber Bandwidth with Laser Diode Sources.
Final rept.,
D. L. Franzen, and G. W. Day. 1979, 1p
Pub. in Jnl. of the Optical Society of America 69, n10 p1448, 11 Oct 79.

Keywords: *Fiber optics, *Bandwidth, Dispersions, Measurement, Reprints, *Laser diodes.

Several single heterojunction (SHJ) laser diodes commonly used for the time domain measurement of optical fiber bandwidth (0.8 - 0.9 micrometers) were evaluated to determine the material dispersion contribution to measured bandwidth.

713,361

PB80-216476 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Propagation Constants Related to Material Properties in High-Bandwidth Optical Fibers.
Final rept.,
D. L. Franzen, and G. W. Day. Dec 79, 6p
Pub. in IEEE Jnl. Quantum Electron. QE-15, n12 p1409-1414 Dec 79.

Keywords: *Fiber optics, Wave propagation, Measurement, Light transmission, Infrared radiation, Reprints.

The material contribution to group index and material dispersion were measured in high-bandwidth graded-index optical fibers. A shuttle-pulse technique provided measurements of group index with precisions and accuracies of 0.1 and 0.2 percent using 5 m lengths of optical fiber. Material dispersion in fibers was measured over the 0.8-0.9 mm wavelength region using different wavelength, short-pulse laser diodes. The influence of material dispersion on fiber bandwidth measurements was evaluated for laser diode sources. Limitations arising from source linewidth, were experimentally determined from measurements on a fiber with high microbending enhanced bandwidth.

713,362

PB80-221278 PC **A23**/MF **A01**
National Bureau of Standards, Washington, DC.
Laser Induced Damage in Optical Materials: 1979. Proceedings of a Symposium Held at Boulder, Colorado on October 30-31, 1979,
H. E. Bennett, A. J. Glass, A. H. Guenther, and B. E. Newnam. Jul 80, 542p NBS-SP-568
Library of Congress catalog card no. 80-600100. Pub. as American Society for Testing and Materials, Philadelphia, PA., Special Technical Pub. 726. Sponsored in part by Office of Naval Research, Washington, DC.,

Department of Energy, Washington, DC., and Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Optical materials, *Laser materials, *Meetings, Laser beams, Optical coatings, Thin films, Damage, *Laser damage.

The Symposium was divided into sessions concerning Transparent Optical Materials and the Measurement of Their Properties, Mirrors and Surfaces, Thin Film Characteristics, Thin Film Damage, Considerations for High Power Systems, and finally Theory and Breakdown. Particular emphasis was given to materials for high power apparatus. The wavelength range of prime interest was from 10.6 micrometers to the uv region. Highlights surface characterization, thin film substrate boundaries, and advances in fundamental laser-matter threshold interactions and mechanisms. The scaling of damage thresholds with pulse duration, focal area, and wavelength was discussed in detail.

713,363
PB80-221542 Not available NTIS
National Bureau of Standards, Washington, DC.
Vacuum-Ultraviolet Spectral-Irradiance Calibrations: Method and Applications.
Final rept.,
W. R. Ott, J. M. Bridges, and J. Z. Klose. Jun 80, 3p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Optics Letters 5, n6 p225-227 Jun 80.

Keywords: *Far ultraviolet radiation, *Radiance, Sources, Standards, Ultraviolet radiation, Reprints.

A method to determine the spectral irradiance of a radiation source in the vacuum ultraviolet through the use of recently developed spectral-radiance standards is described. The method has been applied between 138 and 310 nm, and the spectral irradiances of several different light sources have been measured on an absolute scale with estimated uncertainties less than 10%.

713,364
PB80-225428 Not available NTIS
National Bureau of Standards, Washington, DC.
Ellipsometry Data Analysis Aided by Derivative Plots in N, K-Space.
Final rept.,
A. J. Melmed, and J. J. Carroll. 1 Jun 80, 2p
Pub. in Applied Optics 19, n11 p1735-1736, 1 Jun 80.

Keywords: *Refractivity, Polarimetry, Reprints, *Ellipsometry.

A technique involving the use of computer generated d Delta/dd, d Psi/dd plots as an aid in the analysis of ellipsometry data is described.

713,365
PB80-600020 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tables of Molecular Vibrational Frequencies-Part 10.
T. Shimanouchi, H. Matsuura, Y. Ogawa, and I. Harada. c1980,106p
Included in Jnl. of Physical and Chemical Reference Data, v9, n4 p1149-1254.

Keywords: *Force constants, Fundamental frequencies, Infrared spectra, Normal vibrations, Polyatomic-molecules, Raman spectra, Vibrational frequencies.

Fundamental vibrational frequencies of 94 molecular forms of 23 polyatomic chain molecules of halogenoalkanes and halogenoalkyl ethers consisting of the CH3, CH2, O, F, Cl, Br, and I groups are given as an extension of tables of molecular vibrational frequencies published in the NSRDS-NBS publication series and in this journal. On preparing the tables in this part, an approach, similar to that in Part 9 but different from that in earlier parts, based on the calculations of normal vibration frequencies was adopted. A set of force constants which explains all the frequencies of small molecules for which the assignments had been established was obtained and then the frequencies of larger molecules were calculated and compared with the frequencies observed in the infrared and Raman spectra. The tables provide a convenient source of information for those who require vibrational energy levels and related properties in molecular spectroscopy, thermodynamics, analytical chemistry, and other fields of physics and chemistry.

713,366
PB80-600036 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Resolution of Spectral Peaks: Use of Empirical Peak Shape.
G. L. Ritter, and L. A. Currie. 1979, 18p
Pub. in Computers in Activation Analysis and Gamma-Ray Spectroscopy, DOE Symp. Series 49, p39-56 1979.

Keywords: *Empirical peak shape, Gamma-ray spectrum fitting, Intercomparison of computational methods, International Atomic Energy Agency, Longrange interpolation, Non-linear least squares, Peak resolution, PICO.

A semiempirical method of gamma-spectrum peak resolution (PICO), which uses experimentally determined singlet peak shapes, has been devised to minimize sensitivity to systematic deviations from assumed analytic shape functions. The resolving power and accuracy of the method have been demonstrated through the use of International Atomic Energy Agency test spectra having Poisson measurement precision of about 0.5% and peak separations ranging from approximately 0.3 to 1.3 full width at half maximum.

713,367
PB80-600044 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron, Electron-Bremsstrahlung and Photon Depth-Dose Data for Space-Shielding Applications.
S. M. Seltzer. 1979, 9p
Pub. in IEEE Trans. Nucl. Sci. NS-25, n6 p4896-4904 Dec 1979.

Keywords: *Bremsstrahlung, Dose, Electrons, Proton, Shielding, Spacecraft.

A data set has been developed, consisting of depth-dose distributions for omni-directional electron and proton fluxes incident on aluminum shields. The principal new feature of this work is the accurate treatment, based on detailed Monte Carlo calculations, of the electron-produced bremsstrahlung component. Results covering the energy region of interest in space-shielding calculations have been obtained for the absorbed dose (a) as a function of depth in a semi-infinite medium, (b) at the edge of slab shields, and (c) at the center of a solid sphere. The dose to a thin tissue-equivalent detector was obtained as well as that in aluminum various results and comparisons with other work are given.

713,368
PB80-600056 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Infrared Spectroscopy.
R. S. Tipson, and F. S. Parker. 1980, 43p
Pub. in The Carbohydrates: Chemistry and Biochemistry, 2d Edition, p1394-1436 1980.

Keywords: *Attenuated total reflection, Determination of structure of carbohydrates, Infrared spectra of carbohydrates, Interpretation of infrared spectra, Plane-polarized radiation, Raman spectra.

A survey has been made of the literature on the infrared spectroscopy of carbohydrates, in which all of the important work in this field has been collected and systematized. This was needed because previous articles in the literature were either out of date or not sufficiently comprehensive, and certain statements that had been made were subject to misinterpretation. The present article discusses principles and instrumentation, sampling techniques, comparison of samples, interpretation of spectra, functional groups of carbohydrates and their derivatives, correlations for the fingerprint region and beyone, and conformational studies. In addition, examples are discussed of the use of infrared spectra for quantitative and qualitative purpose and in the determination of structure. Special techniques are briefly described, including use of plane-polarized radiation, and technique of attenuated total reflection, and Raman spectra.

713,369
PB81-102832 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Technical Digest - Symposium on Optical Fiber Measurements, 1980.
Final rept.
G. W. Day, and D. L. Franzen. Oct 80, 152p NBS-SP-597
Digest of a Symposium sponsored by the National Bureau of Standards in cooperation with IEEE Transmission Systems Sub-Committee on Fiber Optics (COMMSOC), and the Optical Society of America, October 28-29, 1980, Boulder, Colorado. Library of Congress catalog card no. 80-600141.

Keywords: *Fiber optics, *Meetings, Measurement, Attenuation, Bandwidth, Joints(Junctions), Defects, Distortion.

This volume contains summaries of 29 papers presented at the Symposium on Optical Fiber Measurements held October 28-29, 1980, at the National Bureau of Standards in Boulder, Colo. Subjects included are the measurement of attenuation, bandwidth/distortion, and index profile, joint/defect characterizaton, measurements on single mode fibers, applied measurements, and measurement standards.

713,370
PB81-104358 Not available NTIS
National Bureau of Standards, Washington, DC.
Small, Passively Operated Hydrogen Maser.
Final rept.
D. A. Howe, F. L. Walls, H. E. Bell, and H. A. Hellwig. 1979, 14p
Pub. in Proc. Annual Frequency Control Symposium (32nd), Atlantic City, NJ., May 3-June 1, 1979 p554-568 1979.

Keywords: *Gas masers, Hydrogen, Frequency standards, Frequency stability, Passive systems.

A compact passive hydrogen maser with many unique features, including a significant reduction in size over previous hydrogen masers, is described. It uses the passive mode of operation, thereby permitting use of a small microwave cavity which is dielectrically loaded by a low-loss alumina(Al2O3). The cavity is 14.6cm O.D. and 13.7cm high, weighing only 4.4kg. The unloaded cavity Q factor is about 6000. The teflon coated quartz bulb which is common in other masers has been replaced by a teflon coating on the inside wall of the cavity. This has yielded a simpler design and more rugged H-maser package.

713,371
PB81-115487 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
System for Measuring the Characteristics of High Peak Power Detectors of Pulsed CO2 Radiation,
P. A. Simpson. Sep 80, 48p NBS-TN-1023
Sponsored in part by Department of Defense, Calibration Coord Group, Air Force Avionics Lab., Wright-Patterson AFB, OH., and Office of Naval Research, Arlington, VA.

Keywords: *Carbon dioxide lasers, *Laser beams, *Power measurement, *Light pulses, Infrared detectors, Pyroelectricity, TEA lasers.

A system is described for determining the responsivity of detectors for high peak power CO2 laser pulses. The insertion loss of feed-through detectors can also be measured. The basic approach involves a measurement of the excitation energy and detector output waveform, and is applicable only for pulse amplitudes where the detector output voltage is a linear function of the optical power. However, a method is described for extending measurements to power levels where the responsivity becomes nonlinear. The time response of the detectors is checked using short duration (10 ns) rectangular pulses to simulate an impulse. A method for measuring beam diameter is also detailed. An error analysis of the system is given.

713,372
PB81-116279 Not available NTIS
National Bureau of Standards, Washington, DC.
Bistable Optical System Based on a Pockels Cell.
A. Feldman. Apr 79, 3p
Pub. in Optics Letters 4, p115-117 Apr 79.

Keywords: Modulators, Performance, Reprints, *Pockels cell, Bistable devices.

The performance of a bistable intensity modulator, based on a Pockels cell, can be optimized if a voltage proportional to a linear combination of the imput and output intensities is applied to the Pockels cell. The bistable response more closely approximates a step function. The output optical power regulation can be improved at levels close to the input power level. The operating point of an ultralinear modulator can be

maintained at the most linear portion of the response curve.

713,373
PB81-120453 Not available NTIS
National Bureau of Standards, Washington, DC.
Intercomparison of Radiometric Irradiance Scales in the 90-250-nm Wavelength Range.
Final rept.
H. Kaase, K. H. Stephan, W. M. Burton, A. T. Hatter, A. Ridgeley, L. R. Canfield, and R. P. Madden. Aug 80, 4p
Pub. in Applied Optics 19, n15 p2529-2532, 1 Aug 80.

Keywords: *Irradiance, *Calibrating, *Radiometry, Standards, Comparison, Reprints.

The work described in this report covers an intercomparison of absolute irradiance calibration methods applied at the National Bureau of Standards (NBS), the SRC Appleton Laboratory, Astrophysics Research Division (ARD), the Max-Planck-Institut fur Extraterrestrische Physik (MPE), and the Physikalisch-Technische Bundesanstalt (PTB). This was done by determining the MPE and PTB quantum efficiencies of two different calibrated transfer standards developed by the NBS and ARD. The comparison shows that the calibrations agreed within the estimated bounds of uncertainty, and also suggests that the uncertainty in the measured electron temperature required in argon arc source technique may be less than was estimated.

713,374
PB81-120495 Not available NTIS
National Bureau of Standards, Washington, DC.
Time-Resolved Measurements of the Far UV Output of a BRV Source.
Final rept.
T. B. Lucatorto, T. J. McIlrath, and G. Mehlman. Sep 79, 2p
Pub. in Applied Optics 18, n17 p2916-2917, 1 Sep 79.

Keywords: *Light pulses, *Far ultraviolet radiation, Pulse width, Electric sparks, Reprints.

The temporal behavior of the BRV-type vacuum spark source was studied at two wavelengths (300 and 600 A). The position of the peak output was measured relative to the maximum spark current, and values for the pulse width were obtained.

713,375
PB81-126310 Not available NTIS
National Bureau of Standards, Washington, DC.
Mirror Reflectivities from 50-150eV.
J. Rife, and J. Osantowski. 1980, 5p
Pub. in Nuclear Instruments and Methods 172, p297-310 1980.

Keywords: *Optical reflectometers, *Far ultraviolet radiation, Reflectometers, Reflectivity, Synchrotron radiation, Mirrors, Glass, Ultraviolet spectroscopy, Reprints.

An accurate reflectometer has been set up on the 2.2 meter monochromator at the NBS SURF-2 synchrotron radiation facility to determine optical constants of materials from 50 to 150 eV. Properties of the monochromator, reflectometer, and NBS windowless photodiode detector are discussed. Reflectivity data from 70 to 300 A for two low expansion glasses, a recrystallized glass and a high silica glass are reported, and preliminary optical constants for one glass are presented.

713,376
PB81-136848 Not available NTIS
National Bureau of Standards, Washington, DC.
New Frequency Stabilization Algorithm for a 0.633 micrometers HeNe Longitudinal Zeeman Laser.
T. Baer, F. V. Kowalski, and J. L. Hall. Sep 80, 5p
Contract N00014-77-0656, Grant NSF-PHY79-04928
Pub. in Applied Optics 19, n18 p3173-3177, 15 Sep 80.

Keywords: *Helium neon lasers, Frequency stability, Magnetic fields, Reprints, Zeeman lasers.

A new method was developed for stabilizing the output frequency of a HeNe laser in a longitudinal magnetic field. With simple modifications to a standard HeNe laser tube, the authors obtained a frequency stability of better than one megahertz (<10 to the -9th power) for an averaging time of 1 second and a long term (5 months) frequency reproducibility of about + or - MHz.

713,377
PB81-137895 Not available NTIS
National Bureau of Standards, Washington, DC.
Direct Frequency Measurement of the 260 THz (1.15 Micrometers) (20)Ne Laser: and Beyond.
D. A. Jennings, F. R. Petersen, and K. M. Evenson. 1979, 8p
Pub. in Proceedings of the International Conference on Laser Spectroscopy (4th) Held at Rottach-Egern, Federal Republic of Germany on Jun 11-15, 1979, Paper in Laser Spectroscopy IV, p41-48 1979.

Keywords: *Laser beams, *Frequency measurement, Near infrared radiation, Helium neon lasers, Neon 20, Iodine 127, Nonlinear optics.

Absolute frequency measurement has been extended to the visible spectrum with the measurement of the strong 1.15 micrometers laser line in (20)Ne at 260 THz and lines in iodine at twice this frequency. The 260 THz frequency was synthesized in nonlinear crystals of CdGeAs2 and AgAsS3 from stabilized CO2 lasers and the 1.5 micrometers laser line in (20)Ne. The visible frequencies were synthesized by generating the second harmonic of the 260 THz radiation with a LiNbO3 crystal. The absolute frequencies of ten hyperfine components of (127)I2 near 520 THz were measured.

713,378
PB81-138620 Not available NTIS
National Bureau of Standards, Washington, DC.
New Frequency Measurements and Laser Lines of Optically Pumped (12)CH3OH.
F. R. Petersen, K. M. Evenson, and D. A. Jennings. Mar 80, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Jnl. of Quantum Electronics QE-16, n3 p319-323 Mar 80.

Keywords: *Laser beams, *Frequency measurement, Carbon dioxide lasers, Power measurement, Infrared lasers, *Methyl alcohol lasers.

The frequencies of 70 optically pumped cw FIR (12)CH3OH laser lines have been measured relative to stabilized CO2 lasers. Fifteen new laser lines together with the relative output powers and polarizations for most of the 104 known lines pumped by laser lines in the normal 9 and 10 micrometer bands of (12)C(16)O2 are also reported.

713,379
PB81-140188 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of Deuterium Lamps as Radiometric Standards between 115 nm and 350 nm,
J. Z. Klose, J. M. Bridges, and W. R. Ott. 1980, 3p
Pub. in Proceedings of the International Conference on Vacuum Ultraviolet Radiation Physics (6th), University of Virginia, Charlottesville, VA., June 2-6, 1980, Paper III-52 in VUV Lasers, Synchrotron Radiation, Atmospheric and Space, Instrumentation, and Applications III, p1-3 1980.

Keywords: *Radiometry, *Standards, Far ultraviolet radiation, Deuterium, *Deuterium lamps.

The spectrum of a deuterium lamp has been investigated at wavelengths shorter than 165 nm for use as a radiometric standard. Applications are discussed.

713,380
PB81-143257 Not available NTIS
National Bureau of Standards, Washington, DC.
Piezo-Optic Coefficients of Four Neodymium-Doped Laser Glasses.
R. M. Waxler, and A. Feldman. Aug 80, 12p
Sponsored in part by California Univ., Livermore. Lawrence Livermore Lab.
Pub. in Applied Optics 19, n15 p2481 Aug 80.

Keywords: *Laser materials, Phosphate glass, Photoelasticity, Refractivity, Reprints, *Neodymium lasers, Refractive index.

The results of measurements of the piezo-optic coefficients of four new laser glasses, one neodymium-doped phosphate glass and three neodymium-doped fluorophosphate glasses, are reported. The measurements were made at 0.6328 micrometers and 1.15 micrometers and, in general, the values are slightly smaller at the longer wavelength. The small values of the coefficients at both wavelengths for certain glasses indicate that these glasses are to be preferred for laser use.

713,381
PB81-144339 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Synchrotron Radiation from the NBS SURF II Using a Silicon Radiometer.
A. R. Schaefer. 1979, 6p
Pub. in Proceedings of Annual International Tech. Symposium of the SPIE (23rd), San Diego, CA., August 27-30, 1979, Paper in Measurements of Optical Radiations 197, p84-89 1979.

Keywords: *Synchrotron radiation, *Radiometry, Photodetectors, Silicon, Storage rings.

A project is described in which the synchrotron radiation output from the NBS storage ring known as SURF II, will be measured using a well characterized silicon based radiometer. The radiometer consists of a silicon photodiode coupled with two interference filters to restrict the spectral response to a finite and convenient spectral region for the measurement. Considerations required for the characterization of the radiometer are discussed. The absolute radiant flux from the storage ring is also calculable from various machine parameters. A measurement of the number of circulating electrons will be derived from electron counting techniques at low levels. This will yield an important intercomparison between two entirely different determinations of the synchrotron radiant flux.

713,382
PB81-149445 Not available NTIS
National Bureau of Standards, Washington, DC.
Preliminary Results of the Interlaboratory Comparison of Detector Spectral Response Transfer Capabilities.
E. F. Zalewski. 1979, 3p
Pub. in Proceedings of Electro-Optics/Laser 79 Conference and Exposition, Anaheim, CA., October 23-25, 1979, p414-419 1979.

Keywords: *Detectors, *Calibrating, Comparison, Photometry, Radiometry, Photodetectors, Spectral response.

As part of the NBS detector spectral response calibration program, participating laboratories were asked to report the results of several diagnostic and response transfer simulation experiments. The diagnostic tests probed for wavelength inaccuracies and stray light problems. In the response transfer simulation experiments the participants measured, on the basis of the absolute spectral responsivity supplied with the detector, alternative spectral response functions generated by absorbing glass filters placed in front of the detector. The results of these measurements are an assessment of the state of the art of detector spectral response calibrations among the laboratories participating in this program. This paper describes the results of the diagnostic and intercomparison measurements in the visible spectral region.

713,383
PB81-155814 Not available NTIS
National Bureau of Standards, Washington, DC.
Kerr Effect, Electro-Optical.
Final rept.
R. E. Hebner. 1981, 1p
Pub. in Encyclopedia of Physics, p483 1981.

Keywords: *Kerr magnetooptical effect, Polarized electromagnetic radiation, Electric fields, Reviews, Reprints.

This paper is an introduction to the electro-optic Kerr effect for students, intelligent laymen, and scientists other than physicists. It contains a brief, phenomenological description of the effect, and typical applications are mentioned.

713,384
PB81-172470 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Use of LEDs (Light-Emitting Diode) to Simulate Weak YAG-Laser Beams,
M. Young. Jan 81, 50p NBS-TN-1031

Keywords: *Laser beams, Simulation, *Light emitting diodes, *YAG lasers.

The purpose of this report is to determine whether and under what conditions a light-emitting diode may be used to simulate a weak YAG-laser beam that has been scattered by a distant reflecting object. By examining the differences between laser radiation and LED radiation, the author concludes that there is no theo-

retical reason that a LED may not be used in place of the laser beam.

713,385
PB81-174401 Not available NTIS
National Bureau of Standards, Washington, DC.
Time-Resolved Subnatural-Width Spectroscopy.
Final rept.
H. Metcalf, and W. Phillips. Dec 80, 3p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Optics Letters 5, n12 p540-542 Dec 80.

Keywords: *Spectroscopy, *Line width, Spectral lines, Reprints, High resolution.

Spectra that are narrower than the natural width of decaying states can be achieved by beginning the observation of signals at a fixed delay time after excitation rather than immediately afterward. These signals are weaker (and noisier) than the full, time-unresolved signals. Applications of this line-narrowing technique to precision spectroscopy are discussed, and the properties of the resulting signals are studied. Numerical simulations demonstrate that time-resolved line narrowing is highly desirable in a large number of cases.

713,386
PB81-179707 Not available NTIS
National Bureau of Standards, Washington, DC.
Portable Iodine Stabilized Helium-Neon Laser.
Final rept.
H. P. Layer. 4 Dec 80, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-29, n4 p358-361, 4 Dec 80.

Keywords: *Helium neon lasers, Iodine, Stabilizers(Agents), Stabilization, Reprints.

A newly designed iodine stabilized helium-neon (He-Ne) laser is described which is stable to 3 x 10 to the 13th power (1000-s sample time) but which exhibits an intensity dependent shift of about 8 kHz/W sq. cm. Closer agreement between dissimilar lasers is attained when the internal power densities are approximately equal.

713,387
PB81-199622 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Stability Coaxial Flashlamp-Pumped Dye Laser.
Final rept.
T. B. Lucatorto, T. J. McIlrath, S. Mayo, and H. W. Furumoto. 15 Sep 80, 3p
Pub. in Applied Optics 19, n18 p3178-3180, 15 Sep 80.

Keywords: Flash lamps, Optical pumping, Stability, Reprints, *Dye lasers, Tunable lasers, Coaxial configurations, NTISCOMNBS.

Measurements on the stability of a coaxial flashlamp-pumped dye laser demonstrated that the quality of the output can be dramatically improved by isolating the dye cell thermally from the flashlamp and ensuring uniform axially symmetric flow of the dye throughout the cell. A quadraxial laser tube in which the dye cell is surrounded by an evacuated annulus to provide thermal isolation and is terminated by specially designed end caps to provide uniform injection and removal of the dye solution was tested in a standard cavity with a 1200-line/mm grating in Littrow configuration as the dispersive element. The performance characteristics were 1-mrad divergence, 0.5-A bandwidth of the spectral distribution, and 0.04-A jitter of wavelength at maximum intensity.

713,388
PB81-205544 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Measurement of Far-Field and Near-Field Radiation Patterns from Optical Fibers.
Technical note.
E. M. Kim, and D. L. Franzen. Feb 81, 47p NBS-TN-1032
Sponsored in part by Department of Defense, Washington, DC.

Keywords: *Fiber optics, Far field, Measurement, *Radiation patterns, Near field, NTISCOMNBS, NTISDODSD.

Systems are described for measuring the far- and near-field radiation patterns from optical fibers. Parameters which affect measurement precision, accuracy, resolution, and signal-to-noise ratio are discussed. Measurements using radiation patterns are covered; this includes radiation angle (numerical aperture), attenuation using mode filters, index profile, core diameter, and mode volume transfer function. Experimental examples are given in many instances.

713,389
PB81-205791 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Backscatter Measurements on Optical Fibers.
B. L. Danielson. Feb 81, 55p NBS-TN-1034
Sponsored in part by Army Communications Command, Fort Monmouth, NJ. Communications Systems Center.

Keywords: *Optical reflectometers, *Fiber optics, *Backscattering, Rayleigh scattering, Performance evaluation, Design, NTISCOMNBS, NTISDODA.

An optical time domain reflectometer (OTDR) and its components are described in detail. The system performance for this device is examined. Experimental methods are described for the measurement of several parameters of interest in the characterization of optical fibers using the OTDR. These parameters include scattering loss and capture fractions for unperturbed fibers. Experimental capture-fraction values are reported for several step and graded-index fibers and these results are compared with theoretical predictions. Rayleigh backscatter signatures are also presented for several fibers from different manufacturers. Fault signatures are shown for some intrinsic and extrinsic fiber perturbations.

713,390
PB81-215691 Not avalable NTIS
National Bureau of Standards, Washington, DC.
In situ Preparation of Thin Sodium Films as an Expendable Filter in the Vacuum Ultraviolet.
Final rept.
D. L. Ederer, T. A. Callcott, and E. T. Arakawa. Dec 79, 4p
Pub. in Rev. Sci. Instrum 50, n12 p1618-1621 Dec 79.

Keywords: *Ultraviolet filters, *Optical filters, Metal films, Sodium, X rays, Reprints, NTISCOMNBS.

The use of a sodium film as a filter for wavelengths between 40 and 80 nm is discussed, and a technique to prepare these films is described. Sodium films of 230 nm thickness were demonstrated to have a transmission of 55% at 100 K at a wavelength 41 nm. The transmission decreased to 40% after 18 h in a vacuum of 5 x 10 to the -8th power Torr. Films of this thickness were shown to attenuate 20.5-nm radiation appearing in second order at 41 nm by at least a factor of 50.

713,391
PB81-220436 Not available NTIS
National Bureau of Standards, Washington, DC.
Analytic Solutions for Three- and Four-Wave Mixing Via Generalized Bose Operators.
Final rept.
J. Katriel, and D. G. Hummer. 1981, 14p
Pub. in Jnl. of Physics, A, Mathematical and General 14, p1211-1224 1981.

Keywords: Reprints, *Wave interaction, Nonlinear optics, Second harmonic generation.

New types of generalized Bose operators are constructed. They are applied to the linearization of the equations of motion describing three- and four-wave mixing, resulting in integral equations for the temporal behaviour of the various fields. Some mathematical properties of these integral equations are studied, thus establishing the equivalence between approahes differing in the manner in which the linearization is carried out. The integral equations are solved analytically in terms of Jacobian elliptic functions.

713,392
PB81-221699 Not available NTIS
National Bureau of Standards, Washington, DC.
National Physical Laboratory-National Bureau of Standards Iodine-Stabilized Helium-Neon Laser Intercomparison.
Final rept.
H. P. Layer, W. R. C. Rowley, and B. R. Marx. Apr 81, 3p
Pub. in Optical Letters 6, n4 p188-190 Apr 81.

Keywords: *Helium neon lasers, Frequency shift, Comparison, Standards, Reprints, Intercomparison, Iodine 127.

The frequencies of two helium-neon lasers stabilized by intracavity saturated absorption of iodine (127I2) built at the National Bureau of Standards (NBS) and the National Physical Laboratory have been compared by beat-frequency measurement. The NBS laser exhibited a power-dependent frequency shift that was reproducible and significant in size (2x10 to the -10th power) over the working range of the power output. The orgin of the power shift has not been established, but several possible sources of the shift have been eliminated by our investigations. Specifically, the effect is not electronic in origin. No similar shift was observed in two lasers built at the National Physical Laboratory.

713,393
PB81-224610 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Refracted-Ray Scanning (Refracted Near-Field Scanning) for Measuring Index Profiles of Optical Fibers.
Technical note.
M. Young. May 81, 61p NBS-TN-1038

Keywords: *Fiber optics, Refractivity, Measurement, *Refractive index, Optical waveguides.

The purpose of this work is twofold. First, it provides an elementary description and tutorial overview of the new refracted-ray method of measuring fiber-index profiles. Second, it presents new results concerning the theoretical foundation, the linearity and precision, resolution limit and edge response, and other aspects of the method. In particular it was found that index differences may be measured to 5 percent or better and spatial resolution is diffraction limited. The author concludes by showing about 3 percent agreement with another laboratory, and good agreement with numerical-aperture measurements performed by participants in a round-robin experiment.

713,394
PB81-227621 Not available NTIS
National Bureau of Standards, Washington, DC.
Simple Interferometric Technique for Alignment of Segmented Retroreflectors.
Final rept.
R. L. Barger. Jul 80, 2p
Pub. in Applied Optics 19, p2088-2089 Jul 80.

Keywords: Laser beams, Optical interferometers, Reprints, *Interferometry, Retroreflectors.

Optical systems are described for (1) obtaining multiple laser beams with wavefronts parallel to interferometric accuracy and with large separations, and (2) retro-reflecting laser beams with the same accuracy.

713,395
PB81-227654 Not available NTIS
National Bureau of Standards, Washington, DC.
Lasers and Analytical Polarimetry.
Final rept.
A. L. Cummings, H. P. Layer, and R. J. Hocken. 1981, 12p
Pub. in Lasers in Chemical Analysis (Chapter 15), p291-302 1981.

Keywords: *Polarimetry, Gas lasers, Polarized electromagnetic radiation, Reprints, Tunable lasers, Dye lasers, Laser applications.

Gas lasers and a tunable dye laser have been used to facilitate rapid and accurate optical rotation measurements with 0.000003 rad resolution. With the aid of the optogalvanic effect, a single frequency dye laser provided wavelength tunability with reproducibility to better than 0.000003 micrometer (<3 GHz). The lasers have been shown to be superior to conventional light sources for precise polarimetry because of greater signal amplitude, higher signal to noise ratio, monochromacity, and wavelength reproducibility. This has resulted in shorter measurement time, better reproducibility of results, and less sensitivity to sample dispersion. Furthermore, greater flexibility in polarimeter design is permissible. With lasers, the polarimeter can become a much more selective analytical tool than is presently the case.

713,396
PB81-236192 Not available NTIS
National Bureau of Standards, Washington, DC.
System for Characterizing Detectors for Measurement of Power of CO2 TEA Laser Pulses.
Final rept.
P. A. Simpson. 1979, 9p
Pub. in Proceedings of the Electro-Optics/Laser 79 Conference and Exposition (11th) held at Anaheim, CA., on October 23-24, 1979, p399-407 1979.

Keywords: *Infrared detectors, *Laser beams, *Power measurement, Carbon dioxide lasers, TEA lasers.

A system for characterizing detectors for the measurement of power of CO2 laser pulses in the range of 10 kW up to 1 to 2 MW with a time resolution of several nanoseconds has been developed at the Boulder Laboratories of the National Bureau of Standards. This system measures the responsivity of the detectors. The dependence of responsivity on power density and optical signal risetime is studied. The basic principles involved are discussed, and the results of measurements on some detectors are presented.

713,397
PB81-236291 Not available NTIS
National Bureau of Standards, Washington, DC.
Subnanosecond Electrical Modulation of Light with Hydrogenated Amorphous Silicon.
Final rept.
R. J. Phelan, D. R. Larson, and P. E. Werner. 15 Apr 81, 3p
Sponsored in part by Rome Air Development Center, Hanscom AFB, MA.
Pub. in Applied Physics Letters 38, n8 p596-598, 15 Apr 81.

Keywords: *Electrooptics, Silicon, Thin films, Reprints, *Light modulators, *Optical modulators, Amorphous materials, Refractive index.

A silicon thin-film interferometer structure is used to demonstrate subnanosecond electrical modulation of light. Both thermally and electrically induced modulations are reported. An electrically induced change in the refractive index of 0.00047 is observed.

713,398
PB81-240277 Not available NTIS
National Bureau of Standards, Washington, DC.
Progress in Fiber Measurement. An LF (Laser Focus) Meeting Report from Boulder, CO.
Final rept.
G. W. Day, and D. L. Franzen. Feb 81, 5p
Pub. in Laser Focus Magazine p52-56 Feb 81.

Keywords: *Optical fibers, Measurement, Attenuation, Bandwidth, Meetings, Reprints.

This report summarizes the present status of optical fiber measurement technology based on papers and workshops at the Symposium on Optical Fiber Measurements held October 28-29, 1980 in Boulder, CO. Thirty-one papers covering the topics of attenuation, bandwidth, index profile and geometry, joint/defect characterization, single-mode fibers, applied measurements, and standards were presented.

713,399
PB81-241184 Not available NTIS
National Bureau of Standards, Washington, DC.
Results of an Interlaboratory Measurement Comparison Among Fiber Manufacturers to Determine Attenuation, Bandwidth, and N.A. of Graded-Index Optical Fibers.
Final rept.
D. L. Franzen, G. W. Day, B. L. Danielson, E. M. Kim, and G. E. Chamberlain. 1981, 3p
Pub. in Proceedings of International Conference Integrated Optics and Optical Fiber Communication (3rd), San Francisco, CA., April 27-29, 1981, p74-76 1981.

Keywords: *Optical fibers, *Numerical aperture.

A procedure for determining the radiation angle (numerical aperture) of graded index optical fibers was tested by an interlaboratory measurement comparison among six fiber manufacturers and the National Bureau of Standards (NBS). Radiation Angle was determined using the five percent intensity points of an exit far-field radiation pattern. Measurements on five fibers representing low to high numerical aperature values show standard deviations of 2.9, 2.4, 2.0, 1.5 and 0.9 percent. The overall average, 2.0 percent, is close to the one standard deviation measurement precision reported by most participants.

713,400
PB81-243446 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Characterization of Optical Fiber Waveguides: A Bibliography with Abstracts, 1970-1980,
G. W. Day. Jun 81, 71p NBS-TN-1043

Keywords: *Optical fibers, *Optical communication, *Bibliographies, *Optical waveguides.

This bibliography contains approximately 450 citations of papers concerning the characterization of optical fiber waveguides. Papers from scientific journals, trade journals, and conferences are included, along with book chapters. The citations are organized by parameter measured and measurement method. Where published abstracts are available, they are included.

713,401
PB81-247306 Not available NTIS
National Bureau of Standards, Washington, DC.
Interlaboratory Measurement Comparison to Determine the Radiation Angle (N.A.) of Graded-Index Optical Fibers.
Final rept.
D. L. Franzen, and E. M. Kim. 1 Apr 81, 3p
Pub. in Applied Optics 20, n7 p1218-1220, 1 Apr 81.

Keywords: *Fiber optics, Reprints, *Numerical aperture.

A procedure for determining the radiation angle (N.A.) of graded-index optical fibers was tested by an interlaboratory measurement comparison among six fiber manufacturers and the National Bureau of Standards (NBS). Radiation angle was determined using the 5% intensity points on an exit far-field radiation pattern. Measurements on five fibers representing low-to-high N.A. values show standard deviations of 2.9, 2.4, 2.0, 1.5, and 0.9%. The overall average, 2.0%, is close to the one standard deviation measurement precision reported by most participants.

713,402
PB81-247389 Not available NTIS
National Bureau of Standards, Washington, DC.
Luminance-Brightness Comparisons of Separated Circular Stimuli.
Final rept.
R. L. Booker. Feb 81, 6p
Pub. in Jnl. of the Optical Society of America 71, n2, p139-144 Feb 81.

Keywords: *Brightness, *Luminance, Color, Comparison, White light, Photometry, Reprints.

An experiment was conducted in which observers adjusted the luminance of a 2856 K white comparison source to appear equally as bright as a chromatic source of known luminance. Twenty different chromatic sources were used, each subtending a visual angle of one degree. The results show that, for sources having the same dominant wavelength, the amount of white light required to make a brightness match increases as saturation increases. Additional observations were made using four of the chromatic sources at viewing subtenses of 20' and 6'. These results show that the amount of white light required to make a brightness match decreased as the source size decreased. The rate of decrease was most rapid for the red source.

713,403
PB81-600024 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Tables of N2O Absorption Lines for the Calibration of Tunable Infrared Lasers From 522 cm-1 to 657 cm-1 and From 1115 cm-1 to 1340 cm-1.
W. B. Olson, A. G. Maki, and W. J. Lafferty. c1981, 20p
Included in Jnl. of Physical and Chemical Reference Data, v10 n4 p1065-1084 1981.

Keywords: *Infrared lasers, Infrared wavelength calibration, N2O, *Nitrous oxide, Spectroscopic constants of N2O.

Tables of N2O absorption lines are given for use as wavelength calibration standards in two regions in the infrared. The absorption lines are calculated from spectroscopic constants which have been determined by fitting of selected data in the literature to appropriate equations. Hot band lines and lines of N2O containing less abundant isotopes of N and O are also given, along with relative intensities of all lines in order to provide patterns for correct identification of lines to be used as wavelength standards.

713,404
PB82-108002 Not available NTIS
National Bureau of Standards, Washington, DC.
Diffraction from a Shallow Rectangular Groove.
Final rept.
G. S. White, and A. Feldman. 15 Jul 81, 5p
Pub. in Applied Optics 20, n14 p2585-2589, 15 Jul 81.

Keywords: *Infrared radiation, *Diffraction, Nondestructive tests, Surface properties, Reprints.

Infrared radiation scattered from a shallow groove is found to exhibit the same diffraction pattern as a single slit. A model based on a beam with a Gaussian intensity profile was found which explains the observed scattering patterns and which also describes the scattering pattern occurring when certain alignment errors are present in the system. The large scattering intensity from the shallow (depth about lambda/20) groove has implications in the use of optical scattering as a tool for nondestructive evaluation of surface flaws.

713,405
PB82-112921 PC **A21**/MF **A01**
National Bureau of Standards, Washington, DC.
Laser Induced Damage in Optical Materials: 1980.
Final rept.
H. E. Bennett, A. J. Glass, A. H. Guenther, and B. E. Newnam. Oct 81, 486p NBS-SP-620
Proceedings of a Symposium Held at Boulder, CO on Sep 30-Oct 1, 1980. Also pub. as American Society for Testing and Materials, Phil., PA. Special Technical Pub. 759.Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC., DOE, Washington, DC., and Office of Naval Research, Arl., VA. Library of Congress catalog card no. 81-600110. See also PB80-221278, and AD-A088 560.

Keywords: *Optical materials, *Laser materials, *Meetings, Laser beams, Optical coatings, Radiation damage, Mirrors, Thin films, *Laser damage.

Particular emphasis of the papers presented at the Symposium was given to materials for high power systems. The wavelength range of prime interest was from 10.6 micrometer to the uv region. Highlights included surface characterization, thin film-substrate boundaries, and advances in fundamental laser-matter threshold interactions and mechanisms. The scaling of damage thresholds with pulse duration, focal area, and wavelength was discussed in detail.

713,406
PB82-135179 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Measurement of Optical Fiber Bandwidth in the Frequency Domain.
Technical note.
G. W. Day. Sep 81, 48p NBS-TN-1046
Sponsored in part by Army Electronic Proving Ground, Fort Huachuca, AZ., and Department of Defense Calibration Coordination Group, Redstone Arsenal, AL.

Keywords: *Fiber optics, *Bandwidth, Optical communication, Measurement.

The design, evaluation, and performance of a system for determining the magnitude of the transfer function(hence, bandwidth) of a multimode optical fiber are presented. The system operates to about 1450 MHz using a tracking generator/spectrum analyzer combination for narrowband detection. It is constructed, almost entirely, from commercially available components. The system is less complex and easier to use than an equivalent time domain system and the measurement precision is comparable. Background information on time and frequency domain specifications, fiber bandwidth limitations, and alternate frequency domain techniques is also presented.

713,407
PB82-137431 Not available NTIS
National Bureau of Standards, Washington, DC.
Lyman-beta Lamp with Cooled LiF Window.
Final rept.
K. C. Harvey. Sep 81, 3p
Pub. in Applied Optics 20, p2883-2885, 1 Sep 81.

Keywords: *Ultraviolet lamps, *Far ultraviolet radiation, Lithium fluorides, Atomic beams, Optical pumping, Reprints, Hydrogen atoms.

The metastable state of atomic hydrogen has long been the object of precision measurements and many methods for its preparation in atomic beams have been developed. For some applications a slow dense beam of atomic hydrogen prepared in the metastable state by optical pumping with Lyman-beta radiation offers many advantages. Such a scheme is currently prohibited by the absence of an appropriate source of resonance radiation. The characteristics of this 1026A lamp would include high intensity, narrow spectral width to match the beams absorption and low self-reversal of the line. No appropriate laser sources exist at this wavelength and, although resonance lamps exist in the visible and ultraviolet, no solid window material transmits at room temperature at 1026A. Studies by Hunter and Malo of the transmission of various crystals as a function of temperature has shown that cooled LiF is a good transmitter at 1026A. Indeed, a combination of a cooled crystal and a thin film of indium produced a filter for Lyman-beta. An RF excited lamp cooled by liquid nitrogen with a LiF window is described here which provides an intense source of Lyman-beta with narrowed Doppler width.

713,408
PB82-149899 Not available NTIS
National Bureau of Standards, Washington, DC.
Real-Time Vibration Controller,
M. R. Serbyn, and W. B. Penzes. 1981, 5p
Pub. in Proceedings of International Instrumentation Symposium (27th), Indianapolis, Indiana, April 1981, Paper in Instrumentation in the Aerospace Industry 27, p489-494 1981.

Keywords: *Interferometers, Vibration isolators, *Michelson interferometers, Real time.

The Michelson interferometer is viewed as a noisy system whose noise input consists of unwanted changes in its optical path length, and whose desired output is a constant optical path-length difference. A technique for maintaining this quantity at a value equal to a multiple of quarter wavelengths of the light it described. This is accomplished by periodically comparing the phase difference between the fundamental and the second-harmonic components of the photodetector output. Using this information, a logic unit causes positive or negative-going ramp signals to be generated and applied to the 'fixed' mirror as a path-length correction.

713,409
PB82-152083 Not available NTIS
National Bureau of Standards, Washington, DC.
Unified Approach to Multiphoton Lasers and Multiphoton Bistability.
M. Reid, K. J. McNeil, and D. F. Walls. Oct 81, 15p
Pub. in Physical Review A 24, n4 p2029-2043 Oct 81.

Keywords: *Lasers, Photons, Theories, Reprints.

This paper presents a unified theory of nonequilibrium transitions which occur in radiation interacting via an n-photon transition with atomic systems inside optical cavities. Incoherent pumping of the atoms and coherent driving of the cavity are included. Examples of such systems are the n-photon laser, the n-photon laser with injected signal, and n-photon optical bistability. The state equation and stability conditions for these phenomena are derived. Fluctuations are included via a Fokker-Planck equation in the constant diffusion approximation for which potential solutions may be obtained in the steady state. Using these solutions, moments of the photon distribution are calculated for the above system in the specific cases of one-photon and two photon transitions.

713,410
PB82-152760 Not available NTIS
National Bureau of Standards, Washington, DC.
Sizing of Individual Optically Levitated Evaporating Droplets by Measurement of Resonances in the Polarization Ratio.
T. R. Lettieri, W. D. Jenkins, and D. A. Swyt. Aug 81, 7p
Pub. in Applied Optics 20, p2799-2805, 15 Aug 81.

Keywords: *Drops(Liquids), *Particle size, *Evaporation, Light scattering, Mie scattering, Glycerol, Measurement, Reprints, Polarized light, Levitation.

Resonances observed in the polarization ratio of light scattered at 90 degrees from single optically levitated evaporating droplets are shown to provide a means for continuous, high-resolution monitoring of droplet size. Due to the distinctive character of the individual features in the polarization ratio, each experimentally measured feature could be clearly identified with a specific calculated one. For evaporating droplets of glycerol from 6.6 to 11.5 micrometers in diameter, the sharp features which appeared in the calculations at approximately 0.03 micrometer intervals allowed measurement of droplet diameter to a resolution of 0.003 micrometers.

713,411
PB82-152794 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination and Correction of Quadrature Fringe Measurement Errors in Interferometers.
Final rept.
P. L. M. Heydemann. Oct 81, 3p
Pub. in Applied Optics 20, p3382-3384, 1 Oct 81.

Keywords: *Interferometers, Errors, Correction, Accuracy, Reprints.

The precision and accuracy of interferometers using quadrature fringe detection is often limited not by the interferometer itself, but by the detector system. There are three typical errors: unequal gain in the two channels, quadrature phase shift error, and zero offsets. This paper describes a simple method for determining the quadrature errors from experimental data obtained in the interferometer and correcting for them. A numerical example demonstrating the significant improvement in the precision of interferometer data is given.

713,412
PB82-155300 Not available NTIS
National Bureau of Standards, Washington, DC.
Frequencies and Wavelengths from a New, Efficient FIR Lasing Gas: CD2F2.
Final rept.
E. C. C. Vasconcellos, F. R. Petersen, and K. M. Evenson. 1981, 7p
Pub. in Int. Jnl. Infrared Millimeter Waves 2, n4 p705-711 1981.

Keywords: *Far infrared radiation, *Infrared lasers, *Deuterium compounds, Optical pumping, Carbon dioxide lasers, Frequency measurement, Polarization(Waves), Fluorine organic compounds, Reprints, *Methane/difluoro.

The authors report for the first time wavelength, relative polarization, and frequency measurements for 47 new cw FIR laser lines in the wavelength region from 120 to 1714 micrometers, all obtained by optically pumping CD2F2 with a CO2 laser. Relative output powers were also measured. For comparison, the 189.8 micrometer line pumped by RI(34) is nearly five times as efficient as the strong 118.8 micrometer methyl alcohol line.

713,413
PB82-174186 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Backscatter Signature Simulations.
Final rept. 1 Oct 80-1 Oct 81.
B. L. Danielson. Dec 81, 102p NBS-TN-1050
Sponsored in part by Army Communications Research and Development Command, Fort Monmouth, NJ.

Keywords: *Fiber optics, *Backscattering, Reflectometers, Graphs(Charts), Simulation, *Optical signatures, OTDR systems.

This report presents a collection of computer-generated backscatter signatures which represent realistic replicas of signals that can be encountered in optical time-domain reflectometer (OTDR) systems. Emphasis is placed on illustrating the appearance of backscatter signatures originating from localized and distributed imperfections which are superimposed on an otherwise uniform optical fiber. The details of these signatures are shown to be a function of the particular type of fiber perturbation, experimental parameters, and data reduction methods. This compilation of simulated responses is intended to facilitate the correct interpretation of OTDR signals as well as to point out sources of error which can arise in the characterization of optical fibers using backscatter techniques.

713,414
PB82-178096 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Integral Equations for Transient Electromagnetic Fields.
Final rept.
E. Marx. Feb 82, 72p NBS-TN-1157

Keywords: *Electromagnetic scattering, *Light scattering, *Integral equations, Partial differential equations, Greens function, Maxwells equations, Wave equations, Electric fields, Magnetic fields, Transients.

Integral equations for the electric and magnetic fields in free space are derived from Maxwell's equations. The fields are expressed in terms of their initial values, boundary values, and sources with the help of a retarded Green function for the scalar wave equation. These equations are then used to derive integral equations for the surface charge and current densities induced by the scattering of a transient electromagnetic field by perfect conductors. An alternative solution of Maxwell's equations with the help of dyadic Green functions is also presented.

713,415
PB82-198615 Not available NTIS
National Bureau of Standards, Washington, DC.
Rapid Frequency Scanning of Ring Dye Lasers.
Final rept.
W. D. Phillips. 15 Nov 81, 2p
Sponsored in cooperation with Department of the Navy, Arlington, VA.
Pub. in Applied Optical Jnl. 20, n22 p3826-3827, 15 Nov 81.

Keywords: Scanning, Continuous radiation, Reprints, *Ring lasers, *Dye lasers, Tunable lasers.

A technique has been developed for rapid frequency scanning of single frequency CW ring dye lasers. Scan rates over 60 THz/s with a range of more than 7 GHz have been achieved. Straightforward modifications of the technique should yield even larger rates and ranges.

713,416
PB82-208620 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Characterization of a Concentric-Core Fiber.
Final rept. 1 Oct 80-1 Oct 81.
B. L. Danielson, D. L. Franzen, R. L. Gallawa, E. M. Kim, and M. Young. Apr 82, 29p NBSIR-82-1661
Sponsored in part by Army Communications Research and Development Command, Fort Monmouth, NJ.

Keywords: *Fiber optics, Transmission loss, Attenuation, Backscattering, Refractive index, Concentric cylinders, Radiation patterns.

Several optical properties of a concentric-core fiber are examined. These include attenuation, radiation patterns, pulse broadening, index profile, backscatter signatures, and capture fraction. Experimental techniques are briefly described and the significance of the measured parameters is discussed.

713,417
PB82-210386 Not available NTIS
National Bureau of Standards, Washington, DC.
Fizeau Wavemeter.
Final rept.
J. J. Snyder. 1981, 5p
Pub. in Proceedings of Los Alamos Conference on Optics, Los Alamos, NM., April 7-10, 1981, SPIE 288, p258-262 1981.

Keywords: *Wavemeters, *Laser beams, *Wavelengths, Real time operations, Interferometers, Measurement, Computer applications.

The Fizeau Wavemeter is a real-time laser-wavelength measuring instrument intended for use with either pulsed or cw lasers. The instrument contains a static Fizeau interferometer which is illuminated by the laser. The fringe pattern of the interferometer is sampled by a 1024 element photodiode array and analyzed by a small computer to determine the wavelength of the illuminating laser.

713,418
PB82-210568 Not available NTIS
National Bureau of Standards, Washington, DC.

Bistable Systems in Nonlinear Optics.
Final rept.
D. F. Walls, P. D. Drummond, and K. J. McNeil.
1981, 33p
Prepared in cooperation with Waikato Univ., Hamilton (New Zealand). Dept. of Physics.
Pub. in Proceedings Int. Conf. and Workshop on Optical Bistability, Asheville, NC, Jun 3-5, 1980, Paper in Optical Bistability, p51-83 1981.

Keywords: Interferometers, *Nonlinear optics, Bistable devices, Second harmonic generation, Fabry Perot interferometer, Bistability.

A review of intracavity nonlinear optical systems exhibiting bistability is presented. A coherently driven Fabry Perot interferometer, enclosing an intracavity medium with a nonlinear polarizability, is considered. As an example of a system with a second-order nonlinear susceptibility X Chi, they consider sub/second harmonic generation; and, for a system with a third-order nonlinear susceptibility X Chi, they consider a nonlinear dispersive medium such as a Kerr liquid. The conditions under which these systems display bistability are derived. A quantum mechanical analysis enables a calculation of the spectrum and photon statistics of the transmitted light as well as the lifetime of the metastable states to be calculated.

713,419
PB82-221367 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Standard Reference Materials: Preparation and Calibration of First-Surface Aluminum Mirror Specular Reflectance Standards.
Final rept.
V. R. Weidner, and J. J. Hsia. May 82, 29p NBS-SP-260-75
Library of Congress catalog card no. 82-600542. See also PB82-138140.

Keywords: *Reflectance, *Standards, *Mirrors, *Calibrating, Aluminum, Preparation, *Standard reference materials.

A number of first-surface aluminum mirrors of high optical quality have been prepared and calibrated for use as specular reflectance standards over the wavelength range 250 to 2500 nm. The specular reflectance calibrations are provided at 25 selected wavelengths, including the laser wavelengths of 632.8 nm and 1060 nm. These mirrors are approximately 50 mm in diameter. The aluminum coating is vacuum deposited on a 9.5 mm thick glass substrate. The mirrors were aged for two years before calibrating. The absolute reflectances of these mirrors were determined by direct comparison to the master first-surface aluminum mirror. The calibration of the master mirror was accomplished by extensive measurements, using the NBS Reference Specular Reflectometer-Spectrophotometer. The absolute techniques for measuring specular reflectance by means of this instrument include analysis of the reflectance of the mirror as a function of wavelength, polarization, and angle of incidence.

713,420
PB82-234758 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectral Irradiance Calibration of Continuum Emitted from Rare-Earth Plasmas.
Final rept.
G. O'Sullivan, J. R. Roberts, W. R. Ott, J. M. Bridges, T. L. Pittman, and M. Ginter. Jan 82, 3p
Prepared in cooperation with University Coll., Dublin (Ireland), and Maryland Univ., College Park. Inst. for Physical Science and Technology.
Pub. in Optics Letters 7, n1 p31-33 Jan 82.

Keywords: *Radiometry, *Standards, Irradiance, Calibrating, Intensity, Reprints, *Laser-produced plasma, *Gadolinium plasma, *Ytterbium plasma.

The absolute spectral irradiance of laser produced plasmas of gadolinium and ytterbium have been determined in the 115-220 nm range for an incident 2.2J, 30 ns, Ruby laser pulse. The effects of target geometry and variation of laser energy on the radiation intensity were also studied. The potential of the source as a radiometric standard is discussed.

713,421
PB82-234915 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser-Based Resonant Scattering System for Size Measurement of Individual Droplets and Microspheres.
Final rept.
T. R. Lettieri, W. D. Jenkins, and D. A. Swyt. 1982, 5p
Pub. in Proceedings of Laser 1981 Opto-Elektronik, Munich, West Germany, June 1-4, 1981, p171-175 1982.

Keywords: *Particle size, Laser beams, Light scattering, Drops(Liquids), Mie scattering, Radiation pressure, Polarization(Waves), *Microspheres, Levitation.

A laser-based system for high-resolution sizing of individual microspheres is described. By making use of the sharp resonances which appear in the elastic scattering cross-sections of optically levitated particles, changes in diameter as small as 1 part in 10,000 can be detected. Experimental and theoretical results are given for two light scattering parameters, namely polarization ratio and radiation pressure. The implications of these results for high-resolution sizing is discussed for three different cases involving evaporating liquid droplets and solid microspheres.

713,422
PB82-236126 Not available NTIS
National Bureau of Standards, Washington, DC.
Specular Ultraviolet Reflectance Measurements for Cavity Radiometer Design.
Final rept.
R. L. Booker. 1 Jan 82, 5p
Pub. in Applied Optics 21 n1 p153-157, 1 Jan 82.

Keywords: *Radiometers, *Reflectance, Ultraviolet radiation, Reprints, Black.

Specular reflectance measurements were made on a black paint used in a solar constant monitoring cavity radiometer. Interference filters peaking at 180, 200, and 220 nm were used in conjunction with a deuterium lamp source and a silicon photodiode detector. Results showed that the black paint was specular for light incident 60 degrees from normal and reflected about 8% of the light at these wavelengths. It is concluded that the high absorptance of the radiometer calculated for visible wavelengths should remain valid down to ultraviolet wavelengths lambda = approximately 190 nm.

713,423
PB82-236167 Not available NTIS
National Bureau of Standards, Washington, DC.
Progress Toward Phase-Stable Optical Frequency Standards.
Final rept.
J. L. Hall, L. Hollberg, M. Long-sheng, T. Baer, and H. G. Robinson. Dec 81, 13p
Sponsored in part by National Science Foundation, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Jnl. Phys. Colloq. C8 n12 pC8-59-C8-71 Dec 81.

Keywords: *Frequency standards, Noise reduction, Sensitivity, Reprints, *Laser spectroscopy.

The sensitivity of laser spectroscopy is usually limited by laser amplitude noise of a technical nature. We describe a new and very sensitive detection technique which basically eliminates this source of noise by encoding the resonance information into RF frequencies using FM modulation followed by optical heterodyne and RF phase-sensitive detection. The method is applied to laser stabilization and sub-Doppler spectroscopy. Calculation shows the method provides an available sensitivity within 3.4 db of the theoretical limit for ideal absorption spectroscopy.

713,424
PB82-243114 Not available NTIS
National Bureau of Standards, Washington, DC.
Dye Laser Spectrometer for Ultrahigh Spectral Resolution: Design and Performance.
Final rept.
J. Helmcke, S. A. Lee, and J. L. Hall. May 82, 9p
Contract N00014-77-C-0656, Grant NSF-PHY79-04928
Pub. in Applied Optics 21, n9 p1686-1694, 1 May 82.

Keywords: *Spectrometers, Stabilization, Performance, Design, Reprints, *Laser spectrometers, Dye lasers.

A dye laser spectrometer for ultrahigh spectral resolution is described. A drift rate of less than 1 kHz/min was obtained while using this dye-laser spectrometer to investigate two-photon optical Ramsey fringes. A fringe width of the Ramsey features of 17 kHz has been observed, confirming for the first time the high resolution capability of two-photon optical Ramsey resonances.

713,425
PB82-261488 Not available NTIS
National Bureau of Standards, Washington, DC.
Precision Spectroscopy and Laser Frequency Control Using FM Sideband Optical Heterodyne Techniques.
Final rept.
J. L. Hall, T. Baer, L. Hollberg, and H. G. Robinson. 1981, 10p
Grant NSF-PHY79-04928
Pub. in Proceedings of International Conference on Laser Spectroscopy (5th), Jasper, Alberta, Canada, 29 June-3 July, 1981, p15-24.

Keywords: *Laser beams, *Frequency control, Frequency modulation, *Laser stability, Laser spectroscopy, Optical heterodyne spectroscopy.

The new hybrid rf/optical technique of FM sideband optical heterodyne spectroscopy is considered. A simple theory is given for the expected line shapes and compare with precise experimental data taken in I2 and in HF. Use of the technique for laser stabilization is also reported.

713,426
PB82-261702 Not available NTIS
National Bureau of Standards, Washington, DC.
Optical Constants of (001) Niobium in the Visible Region.
Final rept.
J. J. Carroll, S. T. Ceyer, and A. J. Melmed. May 82, 3p
Pub. in Jnl. Optical Society of America 72, n5 p668-670 May 82.

Keywords: *Niobium, Polarimetry, Reflectance, Dielectric properties, Light(Visible radiation), Reprints, Refractive index.

Optical constants, measured ellipsometrically at wavelengths between 400.0 and 632.8 nm, are reported for atomically clean (00) niobium. The results are compared to literature values.

713,427
PB83-111609 PC **A10**/MF **A01**
National Bureau of Standards, Boulder, CO.
Optical Fiber Characterization: Backscatter, Time Domain Bandwidth, Refracted Near Field, and Interlaboratory Comparisons (Volume 1).
Special pub.
B. L. Danielson, G. W. Day, D. L. Franzen, E. M. Kim, and M. Young. Jul 82, 208p NBS-SP-637-VOL-1
Library of Congress catalog card no. 82-600563.
Sponsored in part by Department of Defense, Washington, DC., and Army Communications Research and Development Command, Fort Monmouth, NJ.

Keywords: *Fiber optics, Backscattering, Attenuation, Bandwidth, Diameters, Comparison, *Optical waveguides, Refractive index, Numerical aperture, Near field, State of the art.

Optical fiber waveguide measurements are described. Systems to determine the backscatter, bandwidth, and index profile are covered in detail. Measurement comparisons between laboratories are given for fiber attenuation, bandwidth, numerical aperture, and core diameter.

713,428
PB83-125633 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Documentation of the NBS C, K, and Q Laser Calibration Systems.
W. E. Case. Sep 82, 74p NBSIR-82-1676

Keywords: *Laser beams, *Calibrating, Lasers, Power, Energy, Computer applications.

This report provides a complete guide for the documentation of the NBS laser power and energy calibration systems. The report also describes a detailed procedure for operating the three (C, K, and Q) calibration systems under computer control.

713,429
PB83-128611
(Order as PB83-129148, PC **A08**/MF **A01**)
Philips Gloeilampenfabrieken N.V., Eindhoven (Netherlands).
Prototype System for Automated Measurements of Transmission Properties of Graded Index Fibres.
J. W. Versluis, H. P. de Wert, and N. V. Philips. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p47-50 1982.

The accepted philosophy to measure all manufactured fibres requires increased measuring speed to keep in step with the expanding production. For this reason we have developed automated equipment in which we have combined all transmission measurements. Besides man-independent measurement conditions have been effected. The system measures attenuation at three and bandwidth at two wavelengths, length and numerical aperture in 7 minutes including the fibre cutback to 2 metres.

713,430
PB83-129148 PC **A08**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Technical Digest - Symposium on Optical Fiber Measurements, 1982.
D. L. Franzen, G. W. Day, and R. L. Gallawa.Oct 82, 153p NBS-SP-641
See also PB83-129155 through PB83-129445 and PB81-102832. Library of Congress catalog card no. 82-600594.

Keywords: *Fiber optics, *Meetings, Measurement, Attenvation, Bandwidth, Joints(Junctions), Defects, Standards, Fiber optics transmission lines.

This volume contains summaries of papers presented at the Symposium on Optical Fiber Measurements held October 13-14, 1982, at the National Bureau of Standards in Boulder, Colorado. Subjects include the measurement of attenuation, bandwidth, index profile/geometry, joint/defect, and single mode fibers. Also included are applied/field measurements and standards.

713,431
PB83-129155
(Order as PB83-129148, PC **A08**/MF **A01**)
Corning Glass Works, NY.
Prediction of Length Performance of Multimode Graded-Index Fiber.
P. R. Reitz. Oct 82, 7p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p1-7 1982.

The accurate prediction of the performance of concatenated lengths of graded-index multimode optical fibers is a basic requirement to meet the industry's need for reliable installations while simultaneously avoiding the over-design for which early fiber systems were noted. This paper provides a review of the progress toward this goal over the last several years, and highlights present directions.

713,432
PB83-129163
(Order as PB83-129148, PC **A08**/PC **A01**)
British Telecom Research Labs., Ipswich (England).
Bandwidth Studies of Concatenated Multimode Fibre Links.
J. V. Wright, and B. P. Nelson. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p9-12 1982.

A difficult problem facing the designer of high bit-rate multimode systems is that of fibre bandwidth specification. For economic reasons, he must reject only those fibres from a jointed link which would otherwise prevent the necessary system bandwidth being achieved. The factors which are important in determining the resultant bandwidth include mode coupling, differential mode attenuation and the equalisation of modal delays between adjacent fibres. The first two effects may operate throughout the length of the fibre (due to microbending for instane) or be localised at the joints. Further complications arise because the bandwidth of a fibre is sensitive to the exact launch conditions and also to its environment, if this introduces significant micro-bending. These problems have been studied at BTRL over a number of years using a variety of dispersion and differential mode delay measurements on a number of different fibre links. The results of our most recent studies will be compared to our earlier work.

713,433
PB83-129171
(Order as PB83-129148, PC **A08**/MF **A01**)
Plessey Telecommunications Research Ltd., Taplow (England).
Determining the Concatenated Dispersion of Multimode Fibres.
R. W. Blackmore, and N. G. Batty. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p13-16 1982.

Most multimode fibres have discrete defect introduces a small shift in the mean group velocity of a small number of modes from the mean velocity of the main group. This results in the modes travelling as two separate groups, so that a small pulse is produced in the impulse response of a single length of fibre. Experience has shown that when lengths of such fibres are spliced together the overall impulse is of the form in which there is a series of side pulses of decending order. J. Wright et al suggested that this could be explained by assuming 50% of mode mixing at each splice, so that there is a continual interchange of energy between the two modal groups. As it is not possible to accumulate enough fibres to explore experimentally the effect of variations in the magnitude and displacement of the minor group on the concatenated bandwidth, a computer simulation based on this relatively simple concept, was established to determine the variation.

713,434
PB83-129189
(Order as PB83-129148, PC **A08**/MF **A01**)
Centre National d'Etudes des Telecommunications, Lannion (France).
Is the -6 dB Bandwidth Fiber Selection Criterion Still Valid.
R. Bouillie, and J. C. Bizeul. Oct 82, 3p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p17-19 1982.

The commercial availiability of graded index multimode fibers with a very low attenuation (O,7 dB/km) at 1,3 micrometer, allows for a near feature the installation of high speed systems (= or > 140 Mb/s on long repeater sections (25 km, for the French experimental line LE MANS-ANGERS). The optical power budget indicate that the limitative factor, for these systems, is the baseband response of the concatenated link. The precise knowledge of the attenuation/frequency characteristic for each fiber is therefore, of paramount importance. The authors proposed in this paper a new criterion for the selection of fibers to be used for long repeater section systems, which is independant from the classical -6 dB cut-off frequency.

713,435
PB83-129197
(Order as PB83-129148, PC **A08**/MF **A01**)
Sumitomo Electric Industries Ltd., Yokohama (Japan).
Investigation on Launching Conditions in the Bandwidth Measurement of Graded-Index Fibers.
M. Nishimura, and S. Suzuki. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p21-24 1982.

Accurate measurements of the baseband frequency response of graded-index fibers are required both for quality assurance of fiber cables and for design of fiber transmission systems. As is well known, the measured bandwidth is strongly affected by the launching conditions, that is, how the launched optical power is distributed among the propagating modes. This paper describes the experiments showing the dependence of the bandwidth upon the launching spot size and numerical aperture. It is also reported that theoretical analysis can explain the experimental results especially for MCVD fibers.

713,436
PB83-129205
(Order as PB83-129148, PC **A04**/MF **A01**)
Bell Labs., Norcross, GA.
Results of a Bell System Bandwidth Measurement Round Robin.
F. T. Stone. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p25-28 1980.

Recently a multimode-fiber bandwidth-measurement round robin was conducted among several locations of Bell Laboratories and Western Electric. Analysis of the results has clarified some of the problems in obtaining agreement between test sets.

713,437
PB83-129213
(Order as PB83-129148, PC **A08**/MF **A**)
Ando Electric Co. Ltd., Tokyo (Japan).
Wavelength Dispersion Measuring Equipment.
J. Saito, T. Oki, and H. Yamamoto. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p29-32 1982.

In this paper, equipment designed to measure the wavelength dependent dispersion of multimode fibers is described.

713,438
PB83-129221
(Order as PB83-129148, PC **A08**/MF **A01**)
Bell Labs., Norcross, GA.
Measurement of Bandwidth Versus Impulse Response Width in Multimode Fibers.
M. J. Buckler. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p33-36 1982.

An empirically based relationship, which is simple yet highly correlated, has been found to exist between optical 3dB bandwidth and impulse response RMS pulse width in multimode graded index optical fibers. Experimentation has shown this relationship to be independent of the degree of externally induced mode coupling. Propagation of error analysis was used to find the total + or -3 sigma limits, and theoretical comparisons are made for three ideal pulse shapes - cosine, raised cosine and gaussian.

713,439
PB83-129239
(Order as PB83-129148, PC **A08**/MF **A01**)
Siecor Optical Cable, Hickory, NC.
Field Measurements of Fiber Optic Cable Systems.
O. I. Szentesi. Oct 82, 6p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p37-42 1982.

Field testing of fiber optic cable systems is usually performed in order to monitor the fiber splicing process, to ensure that end-to-end transmission specifications (attenuation and bandwidth) are met, and to provide baseline data for cable plant maintenance. This paper discusses the field measurements associated with the optical cable portion of the system. Typical results obtained on over 1200 jointed fiber strings will be discussed.

713,440
PB83-129247
(Order as PB83-129148, PC **A08**/MF **A01**)
Bell Labs., Norcross, GA.
Improved Automated Loss Set for Optical Cables.
L. S. Short, and R. B. Kummer. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p43-46 1982.

An automated loss set for optical cables (ALSOC) has been descried previously. A new version (ALSOC III) has been in use in the Western Electric lightguide manufacturing plant since August 1981. The new set has several advantages; it eliminates uncertainty due to connector loss, creates a steady state launch distribution as would occur in the field, measures loss at two wavelengths, and detects crossovers in a fiber ribbon automatically. The set also contains an optical time domain reflectometer (OTDR) and visible HeNe laser for diagnosing high loss or broken fibers. The loss of a 12-fiber ribbon can be measured at 2 wave-lengths in 3 minutes with an accuracy of better than 0.1 dB. A laboratory version which includes a time-domain bandwidth measurement will also be described. A loss concatenation experiment indicates that the set can be used to predict accurately system loss.

713,441
PB83-129254
(Order as PB83-129148, PC **A08**/MF **A01**)
Sumitomo Electric Industries Ltd., Yokohama (Japan).
Precise Measurement of Optical Fiber Breaking Elongation.
K. Matsui, S. Tanaka, and M. Hoshikawa. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p51-54 1982.

The authors propose a utilization of modulation phase of optical signals for the direct and precise detection of the fiber elongation during tensile tests and at fracture.

713,442
PB83-129262
(Order as PB83-129148, PC **A08**/MF **A01**)
Bell Northern Research Ltd., Ottawa (Ontario).
Precise Measurement of Steady-State Fiber Attenuation.
P. J. Vella, K. Abe, and F. P. Kapron. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p55-58 1982.

Various light launching techniques have been employed to measure fiber attenuation accurately and reproducibly. One of the reasons behind such efforts stems from the need for accurate prediction of fiber link attenuation (as well as fiber bandwidth). In this paper, the 'steady-state' attenuation is recognized as a unique fiber parameter and problems associated with its exact measurement are addressed. Furthermore, link attenuation predictability is evaluated based upon the steady-state measurements of individual fiber sections.

713,443
PB83-129270
(Order as PB83-129148, PC **A08**/MF **A01**)
Technische Univ., Brunswick (Germany, F.R.). Inst. fuer Hochfrequenztechnik.
Modal Behaviour of Various Mode Mixers and Mode Filters for Optical Fiber Measurements.
A. K. Agarwal, H. Karstensen, and U. Unrau. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p59-62 1982.

A bearing-ball-bed mode mixer is compared with mandrel wrap, 70% excitation and newly developed taper mode filters in the approximation of the stationary mode group power distribution of different fibers. The mode group power is computed from the near-field intensity pattern and compared with results from differential mode delay measurements.

713,444
PB83-129288
(Order as PB83-129148, PC **A08**/MF **A01**)
Norges Tekniske Hoegskole, Trondheim. Electronics Research Lab.
Influence of Differential Mode Attenuation on Backscattering Attenuation Measurements.
M. Eriksrud, A. R. Mickelson, S. Lauritzen, and N. Ryen. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p63-66 1982.

Although there have been laboratory tests of the repeatability of backscattering attenuation measurements, there has yet been no careful assessment of the sensitivity of the backscattering technique to launching conditions. It has been shown that a mode-filtering technique can be used to eliminate power fluctuations due to slowly varying fiber parameters. The resulting power decay function then represents a measure of the actual fiber loss. However, graded index multimode fibers can also exhibit rapid parameter variations and differential scattering and absorption effects which cause excess loss. The present work applies some simple modelling of the differential mode attenuation process to interpret the results of backscattering and cut-back measurements fo the variation of attenuation of telecommunication grade fibers with launching conditions.

713,445
PB83-129296
(Order as PB83-129148, PC **A08**/MF **A01**)
British Telecom Research Labs., Ipswich (England).
Measurement of Optical Fibre Absorption Loss: A Novel Technique.
R. Kashyap, and P. Pantelis. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p67-70 1982.

There is increasing evidence that absorption loss between 1 and 1.6 micrometers is not negligible on OH free single mode fibres. However, the absorption loss contribution to total attenuation in optical fibres has become difficult to assess with the achievemet of lower losses. There are a number of reports on methods of measurement, with one achieving a loss of less than one dB/km using a pyroelectric method. The authors present a novel calorimetric technique, using a pyroelectric sensor material, polyvinylidene fluoride (PVF2), which has the advantage of having a large pyroelectric coefficient and can be shaped to ideally suit this application. Using this material it is possible to measure sub-dB/km absorption losses with increased sensitivity with a few hundred milliwatts of laser power.

713,446
PB83-129304
(Order as PB83-129148, PC **A08**/MF **A01**)
Yokosuka Electrical Communication Lab. (Japan).
Single-Mode Fiber Measurement in Japan.
K. Nosu. Oct 82, 7p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p71-77 1982.

In recent years, single-mode fiber manufacturing technique has made a remarkable progress in producing low-loss fibers. The mass production of low-loss single-mode fibers stimulated the progress in peripheral techniques surrounding single-mode fiber transmission. The establishment of low-loss light coupling into a single-mode fiber, low-loss connecting, and splicing supports the large-capacity transmission through a single-mode fiber for the longer repeater spacing. In Japan, a 400Mb/s fiber transmission system is now on a field trial conducted since 1980 by NTT. On the system design of single-mode fiber transmission, it is essential to establish the measurement techniques for fiber transmission characteristics and device performances. This paper reports the measurement techniques for single-mode fibers in Japan.

713,447
PB83-129312
(Order as PB83-129148, PC **A08**/MF **A01**)
British Telecom Research Labs., Ipswich (England).
Characterization of Monomode Fibre Links Installed in Operational Duct.
J. R. Stern, D. B. Payne, T. D. S. Wood, and C. J. Todd. Oct 82, 6p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p79-84 1982.

During the past year a number of experimental monomode optical fibre links have been assembled at British Telecom Research Laboratories in order to aid transmission performance studies and to provide test bed links for system trials. The planning and assembly of these links has posed problems in fibre characterization, both in the laboratory and field, and the purpose of this paper is to outline the approaches we have adopted. Emphasis here is on data taken from the 31.5 km field installation although preliminary data is presented for the 61.3 km installation.

713,448
PB83-129320
(Order as PB83-129148, PC **A08**/MF **A01**)
Bell Labs., Norcross, GA.
Single Mode Fiber Loss Round Robin.
W. B. Gardner. Oct 82, 3p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p85-87 1982.

Obtaining good agreement between multimode fiber loss sets has proven difficult. The standard deviation between locations (i.e., test sets) is limited to about 0.2 dB/km by the problem of reproducing test set launch conditions. This particular problem shhould not exist with single mode fibers, since only one mode can propagate. Consequently, one would expect the interlocation standard deviation to be less than 0.2 dB/km when measuring single mode fiber attenuation. Indeed, because the loss of single mode fibers is frequently only a few tenths of a dB/km, a loss measurement accuracy of a few hundredths of a dB/km will be necessary. We have recently completed a loss measurement round robin involving seven Bell System test sets. The results indicate that this level of accuracy is attainable with single mode fibers.

713,449
PB83-129338
(Order as PB83-129148, PC **A08**/MF **A01**)
Bell Labs., Norcross, GA.
Characterization of the Bend Sensitivity of Single-Mode Fibers Using the Basket-Weave Test.
A. Tomita, P. F. Glodis, D. Kalish, and P. Kaiser. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p89-92 1982.

The basket-weave test provides rapid and valuable information concerning the macro- and microbend sensitivity of different types of SM fibers. Because of the wavelength dependence of the bending losses, BW tests should generally be performed in conjuction with spectral loss measurements.

713,450
PB83-129346
(Order as PB83-129148, PC **A08**/MF **A01**)
BICC Research and Engineering Ltd., London (England).
Calculation of Equivalent Step-Index Parameters for Single-Mode Fibres.
M. Fox. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p93-96 1982.

It is desirable to represent the propagation behavior of a single-mode fibre by a few key parameters. A method currently in favor is to define an 'equivalent-step-index' fibre, whose core radius a and relative refractive index difference delta should lead to reasonably accurate calculation of cut-off wavelength, spot size (and hence of losses at joints or due to microbending) and waveguide dispersiion, using standard formulae. The approaches used are either to calculate suitable average values of a and delta from the refractive index profile, or to find the values from the cut-off wavelength and the relation between spot size and wavelength in the single-mode region. The data used would usually be experimental. In the present paper, however, they are calculated from an assumed parabolic profile, for which a spot size formula has been published by Marcuse.

713,451
PB83-129353
(Order as PB83-129148, PC **A08**/MF **A01**)
Naval Research Lab., Washington, DC.
Comparison of Cutoff Wavelength Measurements for Single Mode Waveguides.
C. C. Wang, C. A. Villarruel, and W. K. Burns. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p97-100 1982.

The determination of a single mode fiber's cutoff wavelength, characteristic of the fiber's index profile, is an important consideration both to verify fiber design and to avoid modal noise in applications such as communication systems and sensors. The use of an effective cutoff wavelength which is characteristic of a particular fiber length, or condition of curvature, can be in error by hundreds of nanometers and can lead to system design errors. After considerable research and experimentation, three types of experiments have evolved to measure the cutoff wavelength of the LP11 mode on a single mode fiber: the far-field measurement of Gambling, et al., the near-field transmission measurement of Murakami, et al., and the refracted power measurement of Bhagavatula, et al.

713,452
PB83-129361
(Order as PB83-129148, PC **A08**/MF **A01**)
Southampton Univ. (England). Dept. of Electronics.
Measurements of Fibre Polarisation Properties Using a Photo-Elastic Modulator.
A. J. Barlow, and D. N. Payne. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p101-104 1982.

The authors have implemented a sensitive technique for birefringence measurement which uses a photo-elastic modulator. A range of measurements of fibres with extremes of birefringence have been conducted.

713,453
PB83-129379
(Order as PB83-129148, PC **A08**/MF **A01**)
British Telecom Research Labs., Ipswich (England).
Measurements of Strain in Cabled Monomode Fibre.
S. Hornung, and M. H. Reeve. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p105-108 1982.

Previous work has shown that fibre proof tested at 0.6% has a high probability of surviving a strain of 0.2% for 20 years. Our measurements have shown that monomode cable can be installed in long lengths using conventional techniques with considerably lower residual strains, giving a large safety margin on fibre life.

713,454
PB83-129387
(Order as PB83-129148, PC **A08**/MF **A01**)
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Field and Laboratory Transmission and OTDR Splice Loss Measurements of Multimode Optical Fibers.
R. B. Kummer, A. F. Judy, and A. H. Cherin. Oct 82, 13p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p109-121 1982.

All practical optical fiber systems require the use of interconnection devices such as splices and connectors. Their losses can be a very significant factor in the desing of fiber optic systems, particularly multi-kilometer telecommunication links. This paper descries the fundamental parameters affecting splice loss measurements. The relationships between transmission and OTDR (optical time domain reflectometry) splice loss measurements are developed and laboratory data is presented to illustrate how intrinsic and extrinsic splice loss parameters influence these relationships. In addition, recent field data, obtained with an OTDR, is included to show both the utility and limitations of OTDR splice loss testing of installed fiber optic systems.

713,455
PB83-129395
(Order as PB83-129148, PC **A08**/MF **A01**)
Bell Labs., Holmdel, NJ.
Optical Connector Measurement Aspects, Including Single Mode Connectors.
P. Kaiser, W. C. Young, and L. Curtis. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p123-126 1982.

Optical and mechanical precision measurements required to achieve insertion losses below 0.4 dB with biconic multi and single-mode connectors are described. Connector losses depend on the measurement procedure, and in case of multimode connectors, may also depend on the direction of propagation and the modal power distribution existing at the connection point.

713,456
PB83-129403
(Order as PB83-129148, PC **A08**/MF **A01**)
Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
Effects of Mode Filter Insertion on Connection Loss between Commercial Single-Fibre Cables.
C. Marchesi, and U. Rossi. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p127-130 1982.

Measurements of mode power distribution on connectorized single-fibre cables stress the strong influence of launching and propagation conditions on connection loss. The large dispersion in coupling loss values (from 0.43 to 1.13 dB) produced in different conditions by the same connector can be explained on the basis of such measurements.

713,457
PB83-129411
(Order as PB83-129148, PC **A08**/MF **A01**)
Western Australia Univ., Nedlands. Dept. of Electrical and Electronic Engineering.
New Approach to Joint Loss Measurement,
R. D. Jeffery, and J. L. Hullett. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p131-134 1982.

The authors report on a new display format for the accurate measurement of joint loss made possible by two-point processing of a back-scatter signal. This display is clearly superior to the more usual log plot because it presents the results in a form that allows the direct interpretation of joint loss and a comparison of all joint losses within a regenerator span. Furthermore, a threshold level can be displayed as an aid to the acceptance or rejection of joints, a feature which simplifies the field testing of fiber splices.

713,458
PB83-129429
(Order as PB83-129148, PC **A08**/MF **A01**)
Allen Clark Research Centre, Towcester (England).
Index Profile Measurements.
W. J. Stewart. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p135-138 1982.

Index profiling is an essential measurement for optical fibres and preforms, since the index profile vitally affects system performance. Methods for determining diameter and NA that do not involve profile measurement are inevitably open to equestion, and similar difficulties arise with such parameters as eccentricity. With the increasing importance of monomode fibres in systems, the need for high resolution in fibre profiling is growing. Its significance and the growing technical needs of users are tending to keep up pressure for better and more convenient profiling methods.

713,459
PB83-129437
(Order as PB83-129148, PC **A08**/MF **A01**)
Bell Labs., Norcross, GA.
Simple Technique for High Accuracy Core-Cladding Concentricity Measurement of Single Mode Fibers,
D. N. Ridgway, and L. J. Freeman. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p139-142 1982.

Core-cladding concentricity has been measured, to an accuracy of approximately + or - 0.1 micrometer using a simple technique that incorporates a vacuum chuck and a rotational stage. A butt-joint splice is assembled in the vacuum chuck and one fiber rotated 360 degrees. Transmission loss from maximum to minimum is directly related to core-cladding concentricity for circularly symmetric fibers.

713,460
PB83-129445
(Order as PB83-129148, PC **A08**/MF **A01**)
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Interlaboratory Measurement Comparison Core Diameter on Graded-Index Optical Fibers,
E. M. Kim, and D. L. Franzen. Oct 82, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p143-147 1982.

This paper describes a transmitted near-field (TNF) comparison on core diameter; participants include the National Bureau of Standards and three manufacturing members of the Electronic Industries Association (EIA).

713,461
PB83-134155 Not available NTIS
National Bureau of Standards, Washington, DC.
Dipole Radiation in the Presence of a Phase Conjugate Mirror.
Final rept.
G. S. Agarwal. 1 Jul 82, 3p
Pub. in Optics Communications 42, n3 p205-207, 1 Jul 82.

Keywords: Dipoles, Mirrors, Reprints, *Dipole radiation.

The decay rate of a dipole in the presence of a phase conjugate mirror is shown to be independent of the distance of the dipole from the mirror and equal to (1-mu) times the decay rate in the absence of a mirror. Since reflection amplitude mu could be equal to unity, the theoretical possibility exists that a dipole in front of a phase conjugate mirror does not radiate.

713,462
PB83-135053 Not available NTIS
National Bureau of Standards, Washington, DC.
Real-Time Vibration Controller.
Final rept.
M. R. Serbyn, and W. B. Penzes. 1982, 5p
Pub. in Instrument Society of America Transactions 21, n3 p55-59 1982.

Keywords: *Interferometers, Real time, Vibration, Control, Reprints, *Michelson interferometer.

The Michelson interferometer is viewed as a noisy system whose noise input results from unwanted changes in the optical path lengths of its beams, and whose desired output is a constant optical path-length difference. A technique for maintaining this quality at a value equal to a multiple of quarter wavelengths of the light is described.

713,463
PB83-138982 Not aavailable NTIS
National Bureau of Standards, Washington, DC.
Streak Camera Observations of the Pulse Emission from a Synchronously Pumped cw Mode-Locked Dye Laser.
Final rept.
S. L. Shapiro, R. R. Cavanagh, and J. C. Stephenson. Oct 81, 3p
Pub. in Optics Letters 6, n10 p470-472 Oct 81.

Keywords: Light pulses, Streak photography, Reprints, *Dye lasers, Mode locked lasers.

Pulse emission from a synchronously pumped cw mode-locked dye laser is investigated with a streak camera. Prominent satellite pulses with nonrepetitive temporal spacing can be detected that are difficult to observe with an autocorrelator.

713,464
PB83-139048 Not available NTIS
National Bureau of Standards, Washington, DC.
Extra cavity Laser Bandshape and Bandwidth Modification.
Final rept.
D. S. Elliott, R. Roy, and S. J. Smith. Jul 82, 7p
Contract DOE-EA-77-A01-6010
Pub. in Physical Review A 26, n1 p12-18 Jul 82.

Keywords: *Laser beams, *Power spectra, Bandwidth, Modulation, Frequency modulation, Reprints, Acoustooptics.

A technique for modifying the laser power spectrum by use of an acoustooptic modulator is described. The theory of the power spectrum resulting from frequency modulation by Gaussian noise is reviewed, and several examples of broadened laser power spectra are presented.

713,465
PB83-143503 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface-Enhanced Second-Harmonic Generation at a Metallic Grating.
Final rept.
G. S. Agarwal, and S. S. Jha. 15 Jul 82, 15p
Pub. in Physical Review B 26, n2 p482-496, 15 Jul 82.

Keywords: Gratings(Spectra), Plane waves, Plasmons, Surfaces, Reprints, *Second harmonic generation.

Theory of surface enhanced second harmonic generation at a rough metallic surface is developed. Using the form of the nonlinear source polarization given by Bloembergen et al., we solve Maxwell equations to obtain the fields at the second harmonic frequency. The calculations are done up to second order in the surface roughness parameter. These perturbation expressions are used to evaluate numerically the second harmonic intensity, in various directions, produced by a plane wave incident on a metallic grating. The resonant enhancement in the second harmonic intensity due to surface plasmon excitation at fundamental frequency , omega is discussed and the results compared with some recent experimental observations. The second harmonic fields are also shown to get enhanced due to excitation of surface plasmons at 2 omega these however correspond to local field enhancements at 2 omega and are evanascent in nature.

713,466
PB83-143644 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Back-Scattering in Phase Conjugation with Weak Scatterers.
Final rept.
G. S. Agarwal, A. T. Friberg, and E. Wolf. Jul 82, 3p
Sponsored in part by Army Research Office, Research Triangle Park, NC.
Pub. in Jnl. of The Optical Society of America 72, n7 p861-863, Jul 82.

Keywords: *Backscattering, Wave propagation, Distortion, Reprints, *Phase conjugation.

An extension is presented of a recently developed theory (based on the first Born approximation) of cancellation of distortions by phase conjugation. The influence of back-scattering of both the incident and the conjugate wave is considered. It is shown that when back-scattering is taken into account, distortions are

not eliminated by phase conjugation, except when the conjugate wave is generated without a loss or a gain.

713,467
PB83-145649 Not available NTIS
National Bureau of Standards, Washington, DC.
Proposed Standards for the NBS Retroreflection MAP.
Final rept.
K. L. Eckerle, and J. J. Hsia. 1982, 7p
Pub. in Color 7, n3 p235-241 1982.

Keywords: *Standards, Reprints, *Retroreflection, Retroreflectors, Measurement Assurance Program.

A proposed Measurement Assurance Program (MAP) service for retroreflectance is under development. A package for the MAP consists of high and low intensity bead sheeting retroreflectors, a prismatic retroreflector, and seven colored glass filters. The retroreflectors are being measured using the NBS reference retroreflectometer. The glass filter measurements are based on spectral data obtained using a high accuracy reference spectrophotometer. The luminous transmittances are calculated from the spectral transmittances using CIE Illuminant A and CIE V(lambda), and can be used to check the combined spectral distribution of source and responsivity of the receiver. Computations are mentioned which show that if a color correction filter is not carefully chosen, large errors may result.

713,468
PB83-164996 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Beam-Profile Measurement of Laser Pulses Using a Spatial Filter to Sample the Hermite Modes for a String of Pulses.
Technical note.
E. G. Johnson. Sep 82, 47p NBS-TN-1057

Keywords: *Laser beams, *Light pulses, Computerized simulation, Computer programs, Measurement.

As a first step in the development of a beam-profile measuring instrument for laser sources that is capable of determining the distribution of low-order (less than 25) Hermitian modes in a series of laser pulses, the author designed and evaluated the three key parts of such an instrument. First, there is the telescope system which allows the incident laser beam to be phase, beamwidth, and beam center matched to the optical spatial filter. Second, there is a brief error analysis of the structure of the mismatch function between the beam out of the telescope and that expected by the filter. Finally, there is the detailed analysis and design of the computer-generated spatial filter that will cause the incident-laser beam to be cross correlated with the low-order Hermite modes and will create an array of light spots in the detector (Fourier transform) plane each of which can be uniquely related to a particular Hermite mode of the original laser pulse. The principal conclusion is that the Hermite mode analysis can be done with better than 99 percent separation between modes, provided the phase between modes is uncorrelated from pulse to pulse when the filter has been fabricated with a two-level, gray-scale structure which samples the profile with either 0 percent, or 100 percent transmission.

713,469
PB83-165027 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
System for Measuring Energy and Peak Power of Low-Level 1.064 Micrometer Laser Pulses.
Technical note.
A. A. Sanders, and A. L. Rasmussen. Oct 82, 46p NBS-TN-1058

Keywords: *Laser beams, *Light pulses, *Energy, *Power, Near infrared radiation, Infrared lasers, Measurement, Calibrating, Neodymium lasers, YAG lasers.

For the first time, transfer standards have been developed for measuring 1.064 micrometer laser pulses of duration about 10-100 ns, peak irradiance of about 10 to the -8th power - 10 to the -4th power W/sq cm, and fluences of about 10 to the -16th power - 10 to the -11th power J/sq cm. These energy and power measurement devices use PIN and APD silicon detectors, respectively, and can be used as stable transfer standards with total uncertainties (random errors computed at the 95 percent confidence level) of 10 to 15 percent. The system for calibrating these transfer standards is also described and consists of a cw Nd:YAG laser beam acousto-optically modulated to provide low-level laser pulses of known peak power and energy. A detailed evaluation of systematic and random errors is also shown.

713,470
PB83-177287 Not available NTIS
National Bureau of Standards, Washington, DC.
Principal Angle Spectroscopic Ellipsometry Utilizing a Rotating Analyzer.
Final rept.
D. Chandler-Horowitz, and G. A. Candela. Aug 82, 6p
Pub. in Applied Optics 21, n16 p2972-2977, 15 Aug 82.

Keywords: *Polarimetry, *Thickness, Silicon dioxide, Silicon nitrides, Silicon, Films, Reprints.

The variations of the intensity of the reflected light near null as a function of the angle of incidence are compared for three ellipsometric techniques. For films of either SiO2 or Si3N4 on silicon, the highest accuracy of the film thickness measurement is always obtained when the angle of incidence is either equal or nearly equal to the principal angle for all thicknesses of the film layer. Based on these results, it is shown that a variable angle of incidence spectroscopic ellipsometer operated at the principal angle of incidence and using a rotating analyzer combines the advantage of versatility with near maximum accuracy and sensitivity.

713,471
PB83-177337 Not available NTIS
National Bureau of Standards, Washington, DC.
Development of Far UV Spectrometers for Synchrotron Radiation Facilities.
Final rept.
D. L. Ederer. 1982, 16p
Pub. in Nuclear Instruments and Methods 195, p191-206 1982.

Keywords: *Ultraviolet spectrometers, *Far ultraviolet radiation, *Synchrotron radiation, *Monochromators, *X rays, Reprints, State of the art.

Since the last conference on Synchrotron Radiation Instrumentation instruments have been proposed, designed, and constructed for the synchrotron radiation facilities throughout the world, and in particular, in the United States at existing facilities and at the new laboratories under construction. Monochromators that yield 10 to the 11th power photons/s - 100 mA - 0.1 eV at a photon energy of 100 eV with 0.03 eV resolution are in operation. Monochromators have also been constructed that yield 10 to the 12th power photons/s - 100 mA - 0.01 eV at photon energy of 10 eV. Designs that exploit the wavelength region below 100 A with planned resolution of 0.02 A and with expected throughputs of about 10 to the 11th power photons/s - 100 mA - 0.1 eV are under construction.

713,472
PB83-179416 Not available NTIS
National Bureau of Standards, Washington, DC.
Increased Gain through Identification and Alleviation of Dye Self Absorption in Laser Pumped Dye Lasers.
Final rept.
R. E. Drullinger. 15 Oct 81, 2p
Sponsored in part by Max-Planck-Inst. fuer Quantenoptik, Garching (Germany, F.R.).
Pub. in Optics Communications 39, n4 p263-264 15 Oct 81.

Keywords: Lasers, Optical pumping, Dyes, Reprints, *Dye lasers.

The effect of overlapping absorption and emission spectra is to shift the gain curve of a dye to the red side of its fluorescence curve and reduce its gain. It is shown how simple binary mixtures of 'adjacent' dyes can be used to produce a new gain maximum in the regions between the gain maximum of the single dyes.

713,473
PB83-187419 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Electromagnetic Formulation for Treating Optical Reflections from Graded-Material Surfaces.
Final rept.
A. G. Lieberman. Dec 82, 40p NBS-TN-1171

Keywords: *Light transmission, *Reflection, Electromagnetic wave transmission, Surfaces, Plane waves, Polarized electromagnetic radiation, Ricatti equation, Theory.

The reflection of a monochromatic plane wave falling obliquely upon the surface of an arbitrary, flat, depth-dependent material is investigated theoretically. The complex reflection coefficient for either principal (s or p) polarization of the field is shown to satisfy a nonlinear differential equation of the Ricatti type. An alternate formulation based on the wave immittance (i.e., impedance or admittance) functions is also presented. The immittance functions are shown to satisfy Ricatti differential equations of their own. The reflection coefficient formulation and the wave immittance formulations are related via a bilinear algebraic transformation. Singularities appearing in the reflection coefficient formulation may be suppressed in the immittance formulation, and vice-versa. The advantage of either formulation is that the reflection coefficients for an arbitrary, depth-dependent medium can be obtained directly without having to solve Maxwell's equations for the internal field configurations.

713,474
PB83-192633 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Self-Study Manual on Optical Radiation Measurements: Part I. Concepts, Chapter 10. Introduction to Coherence in Radiometry.
Technical note (Final).
F. E. Nicodemus. Mar 83, 73p NBS-TN-910-6
See also PB-296 047.

Keywords: *Optical measurement, *Radiometry, Monochromators, Coherent radiation, Laser beams, Measurement, Spectroradiometry.

This is the sixth in a series of Technical Notes (910-6) entitled 'Self-Study Manual on Optical Radiation Measurements'. It contains Chapter 10 of Part I of this Manual. In this chapter we introduce the reader to the basic field quantity of the theory of partial coherence, the cross-spectral density function, and show how it is used to describe radiation fields. We discuss the propagation of cross-spectral density along a beam and illustrate this propagation with calculations of diffraction effects in a number of simple aperturing and imaging examples. For instance, we treat in considerable detail one of the most common radiometric situations in which coherence effects can manifest themselves, the measurement of the slit-scattering function of a monochromator. Among other things, this treatment shows that laser illumination of a monochromator entrance slit must be nearly on-axis to avoid serious slit-scattering function distortions. Finally, we present the relationships between the cross-spectral density function and the classical radiometric quantities, such as spectral radiance.

713,475
PB83-207084 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Extension of a Reference Spectrophotometer into the Near Infrared.
Final rept.
K. L. Eckerle, V. R. Weidner, J. J. Hsia, and Z. W. Chao. Apr 83, 36p NBS-TN-1175

Keywords: *Spectrophotometers, *Near infrared radiation, Performance, Accuracy.

The purpose of this paper is to document adaptation of an existing reference spectrophotometer to the near infrared. Its previous wavelength range was from approximately 200 to 800 nm. The present adaptation increases its wavelength range to 2500 nm. The hardware and software necessary to achieve this were implemented along with tests necessary to characterize the instrument when it is operated in the near infrared (800 to 2500 nm). The accuracy of the transmittance measurements ranges from approximately 0.0002 to 0.012 transmittance units depending on instrument configuration, wavelength, and the sample itself. Incidental to the success of this work was conversion to a dedicated microcomputer with interface boards. Many of the latter were designed at NBS.

713,476
PB83-220723 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Standard Reference Materials: White Opal Glass Diffuse Spectral Reflectance Standards for the Visible Spectrum (SRM's 2015 and 2016).
Final rept.
V. R. Weidner. Apr 83, 36p NBS-SP-260-82
See also PB82-138140. Library of Congress catalog number 83-600516.

Keywords: *Standards, *Reflectance, *Spectrophotometry, Opal glass, Translucence, *Vitrolite, *Standard reference materials.

Vitrolite white opal glass has been calibrated for use as diffuse spectral reflectance standards since 1944. Its uniformity and long-term durability make it useful as an everyday working standard for spectrophotometric measurements in the visible spectral range. However, its translucency can introduce some errors in such measurements if improperly used. Prior to 1965 the Vitrolite reflectance standards were issued with diffuse reflectance values relative to freshly smoked magnesium oxide. Since that date the calibration of these standards is reported on an absolute reflectance scale or one which is relative to a perfect diffuser. Since the completion of the NBS Reference Spectrophotometer for diffuse reflectance measurements in 1975, work on the perfection of techniques for determining a more accurate absolute reflectance scale has made it possible to further improve these measurements. As a result of this effort, the Vitrolite reflectance standards are now more accurately characterized and are being issued as a Standard Reference Material.

713,477
PB83-226738
(Order as PB83-226704, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC.
Measurement Assurance Program Transmittance Standards for Spectrophotometric Linearity Testing: Preparation and Calibration.
K. L. Eckerle, V. R. Weidner, J. J. Hsia, and K. Kafadar. 26 Aug 82, 12p
Included in Jnl. of Research of the National Bureau of Standards, v88 n1 p25-36 Jan-Feb 82.

Keywords: *Spectrophotometry, *Standards, *Transmittance, *Optical filters, Calibrating, Glass, Measurement assurance program.

A Measurement Assurance Program for spectrophotometry is being established in order to assist laboratories involved in spectrophotometric calibrations. This paper deals with the preparation and calibration of neutral density glass filters for checking the linearity of photometric response, as applied to spectral transmittances of 92, 70, 50, 25, 10, 1, and 0.1% at a wavelength of 548.5 nm. These filter sets will be available in three sizes: these are, 38 mm diameter aperture in 51 x 51 mm holder, 25 mm diameter aperture in 51 x 28 mm holder, and 30 x 8 mm aperture in a cuvette holder. The filters were calibrated for spectral transmittance on the NBS Reference Spectrophotometer for high accuracy transmittance measurements.

713,478
PB83-234195 Not available NTIS
National Bureau of Standards, Washington, DC.
Direct Frequency Measurement of the I2-1/Stabilized He-Ne 473 THz (633nm) Laser.
Final rept.
D. A. Jennings, C. R. Pollock, F. R. Petersen, R. E. Drullinger, K. M. Evenson, J. S. Wells, J. L. Hall, and H. P. Layer. Mar 83, 3p
Pub. in Optics Letters 8, n3 p136-138 Mar 83.

Keywords: *Frequency measurement, *Helium neon lasers, Iodine, Standards, Reprints, Iodine 127.

The absolute frequency of the 473 THz He-Ne laser (633 nm), stabilized on the g and i hyperfine components of the (127)I211-5 R(127) transition, was measured by comparing its frequency with a known frequency synthesized by summing the radiation from three lasers in a He-Ne plasma.

713,479
PB83-234203 Not available NTIS
National Bureau of Standards, Washington, DC.
Generation of Continuous-Wave 194-nm Radiation by Sum-Frequency Mixing in an External Ring Cavity.
Final rept.
H. Hemmati, J. C. Bergquist, and W. M. Itano. Feb 83, 3p
Sponsored in part by Air Force Office of Scientific Research, Arlington, VA., and Office of Naval Research, Arlington, VA.
Pub. in Optics Letters 8, n2 p73-75 Feb 83.

Keywords: *Ultraviolet radiation, Ultraviolet lasers, Argon lasers, Continuous radiation, Potassium inorganic compounds, Borates, Mercury isotopes, Reprints, Mercury 202, Ring lasers, Dye lasers, Potassium borates, Sum frequency mixing.

Several microwatts of tunable cw radiation near 194 nm in a linewidth of less than 2 MHz have been generated by sum-frequency mixing the radiation from a frequency-doubled argon-ion laser and from a ring dye laser in a crystal of potassium pentaborate. An external ring cavity resonant with the dye laser gives an enhancement factor of about 14 in the sum frequency generated radiation power. The Doppler-limited absorption spectrum of the 6 doublet s S(sub1/2)- 6 doublet p P(sub1/2) first resonance line of natural HgII has been resolved and the vacuum wave number for the mass 202 isotope has been measured to be 51485.904(20)/cm.

713,480
PB83-234518 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectral Analysis of the Finish of Diamond-Turned Mirror Surfaces.
Final rept.
E. L. Church, M. R. Howells, and T. V. Vorburger. 1981, 16p
Pub. in Proceedings of the Society of Photo-Optical Instrumentation Engineers 315, p202-217 1981.

Keywords: *Mirrors, *Light scattering, *Surface roughness, Spectrum analysis, Precision finishing, Diamonds.

This paper discusses the effects of surface topographic scattering on the performance of optical elements and illustrates the results in terms of the focussing mirrors of the Brookhaven plane-grating monochromator.

713,481
PB83-235192 Not available NTIS
National Bureau of Standards, Washington, DC.
Streak-Camera Analysis of XeCl-and N2-Pumped Dye-Laser Outputs.
Final rept.
D. S. King, and R. R. Cavanagh. Jan 83, 3p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Optics Letters 8, n1 p18-20 Jan 83.

Keywords: Optical pumping, Streak cameras, Pulse width, Reprints, *Dye lasers, Xenon chloride lasers, Nitrogen lasers, Excimers.

The temporal and spectral content of modified Hansch type organic dye lasers pumped by either XeCl or N2 lasers has been studied. Two extreme cases of amplitude-squared detector mode beating and modelocked laser output are examined. Experimental consequences are briefly discussed.

713,482
PB83-235879 Not available NTIS
National Bureau of Standards, Washington, DC.
High Power Second Harmonic Generation of 257 nm Radiation in an External Ring Cavity.
Final rept.
J. C. Bergquist, H. Hemmati, and W. M. Itano. 15 Nov 82, 6p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC. and Office of Naval Research, Arlington, VA.
Pub. in Optics Communications 43, n6 p437-442 November 15, 1982.

Keywords: *Ultraviolet radiation, Frequency multipliers, Continuous radiation, Argon lasers, Laser beams, Reprints, *Second harmonic generation.

Continuous wave high power frequency doubling of a stabilized, single mode argon ion laser in a resonant external ring cavity is discussed and experimental results are presented. The second harmonic is generated in Brewster angled cut ADP crystal which is 90 degree temperature phase matched. Greater than 80 milliwatts of stable, useable UV is generated. Successful operation of the ring cavity with an internal harmonic beamsplitter to extract the UV radiation is reported.

713,483
PB83-235986 Not available NTIS
National Bureau of Standards, Washington, DC.
Four-Wave Mixing in Stochastic Fields: Fluctuation-Induced Resonances.
Final rept.
G. S. Agarwal, and C. V. Kunasz. Feb 83, 17p
Pub. in Physical Review A27, n2 p996-1012 Feb 83.

Keywords: Coherent radiation, Reprints, *Four wave mixing, Hanle effect.

The effect of pump fluctuations on various coherent processes that arise in three-level systems interacting with two external fields is examined. Such coherent processes include the forward Hanle effect and various four-wave mixing effects such as the generation of phase-conjugate signals. A general formulation that enables one to calculate the influence of laser linewidth on the coherent signals produced in various directions is presented. Ensemble averages, over laser temporal fluctuations, of various physical quantities, such as atomic polarization, are calculated.

713,484
PB83-251207 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Measurement of Multimode Optical Fiber Attenuation.
Technical note.
R. L. Gallawa, G. E. Chamberlain, G. W. Day, D. L. Franzen, and M. Young. Jun 83, 54p NBS-TN-1060

Keywords: *Fiber optics, *Attenuation, Measurement, Fiber optics transmission lines, Optical waveguides.

This document is one of a series which describes optical fiber measurement capabilities at the National Bureau of Standards. We concentrate here on the measurement of attenuation of multimode, telecommunication-grade fibers for the wavelength range of 850 nm to 1300 nm. The document begins by discussing the need for restricted launch conditions, the most fundamental and crucial aspect of precise attenuation measurements. The limited phase space launch (also called the beam optics launch) and the mode filter launch are discussed. Attention then turns to the practical matter of ensuring that the conditions of the restricted launch are met. Discussions of system noise and system linearity are also included. The document describes measurement procedure and results obtained in the laboratory using three typical fibers. Results are presented for the two wavelengths of current interest: 850 nm and 1300 nm. The procedures are applicable to any wavelength, however. The document touches briefly on the matter of monomode fibers. Finally, a summary of the results from an interlaboratory comparison are presented to give perspective to the stability of a fiber subjected to handling and shipping.

713,485
PB83-600037 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Frequency Stabilization for Two-Mode Laser.
J. L. Hall, T. M. Baer, and F. V. Kowalski. Filed 8 Sep 81, patented 9 Aug 83, 7p PAT-APPL-6-300 363, PATENT-4 398 293

Keywords: *Correction control, Error-correction signal, Laser frequency, Mode-pulling effect, Two mode laser.

Frequency stabilization is disclosed for a two-mode laser, such as a Zeeman laser. The emission frequency of the laser is servo-stabilized to the center of the atomic gain curve to provide a stable laser reference frequency that is independent of time and environmental operating conditions. Stabilization in a longitudinal-field Zeeman laser is achieved by utilizing the mode-pulling effect which makes the frequency difference between the two circular polarization components have a parabolic dependence on the optical frequency of the laser. The detected intermode beat frequency from the laser is subjected to digital phase-sensitive, drift-free integration, utilizing a reversible counter, to provide a cumulative count with a rate of increase corresponding to the displacement of the average wavelength from the atomic center wavelength and an analog error-correction signal is generated therefrom which is coupled to the laser. The error-correction signal is processed and coupled to the piezoelectric crystal which controls the emission frequency of the laser for fast laser frequency correction control, and may be also processed and coupled to the heater coil on the laser for thermally providing slow frequency correctional control.

713,486
PB83-600038 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Optogalvanic Intracavity Quantitative Detector and Method for its Use.
E. F. Zalewski, R. A. Keller, and C. T. Apel. Filed 25 Feb 81, patented 6 Sep 83, 11p PAT-APPL-6-238 236, PATENT-4 402 606

Keywords: *Atoms, Ions, Light, Molecules, Optogalvanic intracavity detector.

The disclosure relates to an optogalvanic intracavity detector and method for its use. Measurement is made of the amount of light absorbed by atoms, small molecules and ions in a laser cavity utilizing laser-produced changes in plasmas containing the same atoms, molecules, or ions.

713,487
PB83-600040 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calibration of Optical Systems for Linewidth Measurements on Wafers.
D. Nyyssonen. 1982, 6p
Pub. in Opt. Eng. 21, n5 p882-887 Sep/Oct 1982.

Keywords: *Critical dimensions, Linewidth, Metrology, Micrometrology, Microscopy, Optical imaging.

In contrast to earlier work with nearly opaque photomasks, optical linewidth measurements on wafers encompass materials with a much wider variation in optical parameters and material profiles. Accurate optical edge detection requires corrections for both the relative reflectance and phase at the line edge because of the partial coherence present in optical microscopes. However, measurement systems which cannot provide the appropriate corrections and cannot detect edge location accurately can be calibrated. Since the correction curve is material dependent, calibrated standards are theoretically required for each step in the wafer fabrication process where linewidths are measured. In the proposed approach for thin layers (less than 200 nm), a small number of etched silicon-dioxide-on-silicon wafers can be used for calibration of a large class of wafer meterials. Examples of water calibration data for filar, image-splitting, and image-scanning systems are given. The problems associated with accurate linewidth measurement and calibration for thick layers are also discussed.

713,488
PB84-103464 Not available NTIS
National Bureau of Standards, Washington, DC.
Glassy Optical Coatings by Multisource Evaporation.
Final rept.
D. M. Sanders, E. N. Farabaugh, and W. K. Haller. 1982, 18p
Pub. in Proceedings of SPIE Technical Symposium East '82 Thin Film Technologies and Special Applications, Arlington, Virginia, May 4-7 1982, Society of Photo-Optical Instrumentation Engineers 346, p31-48 1982.

Keywords: *Optical coatings, *Ceramic coatings, Magnesium oxides, Silicon dioxide, Zirconium oxides, Thin films, Evaporation, Amorphous materials.

The concepts of bulk glass formation are discussed in light of their possible application to the production of glassy thin films for optical applications. Specifically, the systems ZrO2-SiO2 and ZrO2-MgO were explored using electron beam coevaporation for the film production. The films so produced were characterized using x-ray diffraction and scanning electron microscopy. It was found that while coevaporation of a traditional bulk glass former (SiO2) to ZrO2 was more effective in producing an amorphous mixture coating, other dopants (MgO) could also achieve the same end if used in higher concentrations.

713,489
PB84-103605 Not available NTIS
National Bureau of Standards, Washington, DC.
Vacuum Ultraviolet and Extreme Ultraviolet Radiometry Using Synchrotron Radiation at the National Bureau of Standards.
Final rept.
E. B. Saloman, S. C. Ebner, and L. R. Hughey. Oct 82, 6p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Optical Engineering 21 n5, p951-956, Sep-Oct 1982.

Keywords: *Synchrotron radiation, *Radiometry, *Far ultraviolet radiation, *Standards, Calibrating, Spectrometers, Photodiodes, Reprints.

Synchrotron radiation is a source of continuum radiation ranging from the x-ray or soft x-ray region (depending on machine energy) to beyond the visible region. The amount of radiation emitted is a calculable function of machine operating parameters. This makes it possible to use synchrotron radiation from electron synchrotrons and electron storage rings as an absolute source particularly in the vacuum ultraviolet (VUV) and soft x-ray regions where other standards are difficult to find. At the National Bureau of Standards (NBS), an electron storage ring (SURF-II) has been used to calibrate spectrometers and photometers used in solar and aeronomy research and in fusion plasma diagnostics. A large chamber has recently been completed to facilitate such calibrations. The radiation incident on these spectrometers can be calculated to uncertainties of 3 percent. A technique to exactly determine the number of electrons orbiting in the ring is currently being developed to reduce this uncertainty. Detector calibrations between 5 to 55 nm (50 to 550 A) are routinely carried out at SURF-II, and transfer standard detectors with 6 to 10 percent uncertainties over the range of 5 to 254 nm (50 to 2540 A) are supplied. Special studies of 'practical', high efficiency, and disposable photodiodes have been made by NBS in collaboration with other groups.

713,490
PB84-106848 Not available NTIS
National Bureau of Standards, Washington, DC.
Phase Conjugate Optics.
Final rept.
G. S. Agarwal. 5 Mar 83, 6p
Pub. in Current Science (Golden Jubilee Issue) 52, n5, p193-198 1983.

Keywords: Scattering, Reprints, *Phase conjugate optics, Phase conjugation.

A brief review of some of the important developments in the relatively new field of phase conjugate optics is presented.

713,491
PB84-106863 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Phase and Frequency Stabilization Using an Optical Resonator.
Final rept.
R. W. P. Drever, J. L. Hall, F. V. Kowalski, J. Hough, G. M. Ford, A. J. Munley, and H. Ward. 1983, 9p
Sponsored in part by the Office of Naval Research, Arlington, VA. and the National Science Foundation, Washington, DC.
Pub. in Applied Physics B 31, p97-105 1983.

Keywords: Frequency stability, Interferometers, Frequency discriminators, Reprints, *Laser stability, Optical resonators, Laser spectroscopy, Fabry Perot interferometer, Phase stability.

The authors describe a new and highly effective optical frequency discriminator and laser stabilization system based on signals reflected from a stable Fabry-Perot reference interferometer. High sensitivity for detection of resonance information is achieved by optical heterodyne detection with sidebands produced by rf phase modulation. Physical, optical, and electronic aspects of this discriminator/laser frequency stabilization system are considered in detail. Applications of this system of laser stabilization include precision laser spectroscopy and interferometric gravity-wave detectors.

713,492
PB84-110964 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Optical Time-Domain Reflectometer Performance and Calibration Studies.
Technical note.
B. L. Danielson. Jun 83, 35p NBS-TN-1065
Sponsored in part by Army Communications Research and Development Command, Fort Monmouth, NJ.

Keywords: *Reflectometers, *Optical reflectometers, *Fiber optics, Photodiodes, Avalanche diodes, Backscattering, Attenuation, Performance, Calibrating, Optical tests, *Optical time domain reflectometers.

The measurement accuracy of the optical time-domain reflectometer (OTDR) is restricted in some applications by a limited operational dynamic range and by a lack of standardized test procedures. In an effort to better understand these restrictions, we have measured the range of linearity of some avalanche photodiodes used as backscatter detectors. Also, the effect of input launch conditions is examined and a possible standardized OTDR test procedure is proposed. Using these suggestions, we have made comparisons between attenuation values determined by cutback and backscatter Methods and found that good agreement is possible. Finally, some methods are described for checking the response linearity of OTDR systems.

713,493
PB84-127869 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC.
Laser Induced Damage in Optical Materials: 1981.
Special pub. (Final).
H. E. Bennett, A. H. Guenther, D. Milam, and B. E. Newnam. Sep 83, 654p NBS/SP-638
Proceedings of a Symposium Held at Boulder, CO on Nov 17-18, 1981. See also PB82-112921. Library of Congress catalog no. 83-600570. Sponsored in part by American Society for Testing and Materials, Philadelphia, PA., Office of Naval Research, Arlington, VA., DOE Washington, DC., DARP Agency, Arl., VA., and Air Force Office of Scientific Research, Bolling AFB, DC. Pub. as ASTM.

Keywords: *Optical materials, *Laser materials, *Radiation damage, *Meetings, Laser beams, Optical coatings, Mirrors, Intermediate infrared radiation, Near infrared radiation, Ultraviolet radiation, Infrared lasers, Thin films, *Laser damage.

The Symposium was divided into sessions concerning Materials and Measurements, Mirrors and Surfaces, Thin Films, and finally Fundamental Mechanisms. As in previous years, the emphasis of the papers presented at the Symposium was directed toward new frontiers and new developments. Particular emphasis was given to materials for high power apparatus. The wavelength range of prime interest was from 10.6 micrometers to the uv region. Highlights included surface characterization, thin film-substrate boundaries, and advances in fundamental laser-matter threshold interactions and mechanisms. The scaling of damage thresholds with pulse duration, focal area, and wavelength was discussed in detail.

713,494
PB84-133396 Not available NTIS
National Bureau of Standards, Washington, DC.
2.5 THz Frequency Difference Measurements in the Visible Using MIM (Metal-Insulator-Metal) Diodes.
Final rept.
R. E. Drullinger, K. M. Evenson, D. A. Jennings, F. R. Petersen, J. C. Bergquist, L. Burkins, and H. U. Daniel. 15 Jan 83, 2p
Pub. in Applied Physics Letters 42, n2 p137-138, 15 Jan 83.

Keywords: *Heterodyning, Light(Visible radiation), Infrared lasers, Far infrared radiation, Measurement, Reprints, *Frequency difference, MIM diodes, Laser radiation.

Using point-contact metal-insulator-metal (MIM) diodes, the authors have demonstrated heterodyne detection of visible laser radiation at frequency differences up to 2.5 THz (generated by a 119 micrometer laser). The signal to noise on the observed rf beat falls off at 2.3 dB/octave of laser frequency difference and would seem to indicate that 30 THz difference beats will be observable with improved laser stability or signal averaging. While the detector 'bandwidth' per se has not been evaluated, these measurements demonstrate an increase in the frequency difference which can be measured in the visible by more than an order of magnitude over that previously reported.

713,495
PB84-133412 Not available NTIS
National Bureau of Standards, Washington, DC.
Optical Properties and Stable, Broadly Tunable cw Laser Operation of New F(A)-Type Centers in Tl(+1)-Doped Alkali Halides.
Final rept.
W. Gellermann, F. Luty, and C. R. Pollock. 15 Nov 81, 5p
Pub. in Optics Communications 39, n6 p391-395, 15 Nov 81.

Keywords: *Infrared lasers, *Color centers, Thallium, Sodium chloride, Potassium chloride, Potassium bromide, Rubidium halides, Reprints, *Tunable lasers, F centers, Rubidium bromide, Rubidium chloride, Rubidium iodides, *Continuous wave lasers, Doped crystals.

A new group of complex color centers with FA-type properties, involving simple center production and high thermal and optical stabilities, has been found in six Tl(+)-doped alkali halides: NaCl, KCl, RbCl, KBr, RbBr and RbI. In its first tested examples, KCl and KBr, broadly tunable cw laser operation over the 1.4 to 1.7 micrometer range has been obtained, with output powers in the 100 mW range. In contrast to already existing F2(+) and F2(+)-like centers, operating in the same wavelenth range, the new F sub A (Tl(+)) lasers are optically stable and do not show any bleaching effects under laser operation.

713,496
PB84-133537 Not available NTIS
National Bureau of Standards, Washington, DC.
Long Optical Fiber Fabry Perot Interferometers.
Final rept.
D. L. Franzen, and E. M. Kim. 1 Dec 81, 2p
Pub. in Applied Optics 20, n23 p3991-3992, 1 Dec 81.

Keywords: *Interferometers, Fiber optics, Design, Reprints, *Fabry Perot interferometer.

A Fabry Perot interferometer using single mode optical fibers is described. A finesse of 14 was obtained for fiber lengths of a few meters.

713,497
PB84-134980 Not available NTIS
National Bureau of Standards, Washington, DC.
Silicon Photodiode with 100% Device External Quantum Efficiency.
Final rept.
E. F. Zalewski, and C. R. Duda. 15 Sep 83, 7p
Pub. in Applied Optics 22, n18 p2867-2873, 15 Sep 83.

Keywords: *Photodetectors, Photodiodes, Silicon, Quantum efficiency, Radiometers, Reprints.

A device using four inversion layer silicon photodiodes in a light-trapping arrangement was constructed and tested. The device was found to have a photon-to-electron conversion efficiency of 0.999 for short wavelength and low power (about 300 (mu)W) visible radiation. It was found that applying a reverse bias voltage extended its 100% quantum efficient response over the entire visible spectrum and up to the highest radiant power level we studied (several milliwatts). Several effects on the quantum efficiency were studied and the results are presented: reflectance variations; dark current versus reverse bias; and quantum efficiency versus wavelength, reverse bias, and radiant power level.

713,498
PB84-135029 Not available NTIS
National Bureau of Standards, Washington, DC.
Graphical Representation of Prism Coupling into Thin Films.
Final rept.
A. Feldman. 1983, 3p
Pub. in Applied Optics 22, n15 p2380-2382 1983.

Keywords: *Couplers, Optical prisms, Thin films, Reprints, Integrated optics.

A natural framework for evaluating prism-coupler performance is provided by a recently developed geometrical construction in which refraction through a prism for an arbitrary angle of incidence is represented by an ellipse. The useful operating range of a prism coupler is represented by the portion of the representational ellipse that appears within a window determined by the mode propagation conditions of a thin-film-substrate system.

713,499
PB84-136464 Not available NTIS
National Bureau of Standards, Washington, DC.
Comment: Authors' Reply to Comment of Skowronek.
Final rept.
T. A. Nee, and J. R. Roberts. 1983, 4p
Pub. in Physical Review A 27, n6 p3351-3354 1983.

Keywords: *Rayleigh scattering, *Laser beams, *Light pulses, Scattering cross sections, Reprints, Pulse duration.

Skowronek has commented on a Rayleigh-scattering cross-section measurement for various pulse durations made by us. His comments are discussed, and his questions on our experimental methods are answered.

713,500
PB84-137116 Not available NTIS
National Bureau of Standards, Washington, DC.
Extreme Ultraviolet Optical Properties of Two SiO2 Based Low Expansion Materials.
Final rept.
J. Rife, and J. Osantowski. Dec 83, 6p
Sponsored in part by National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
Pub. in Jnl. of the Optical Society of America 70, n12 p1513-1518 Dec 80.

Keywords: *Silica glass, *Devitrified glass, *Far ultraviolet radiation, *Reflectivity, Optical properties, Synchrotron radiation, Ultraviolet spectroscopy, Reprints.

Reflectances of two low expansion materials, a recrystallized glass ceramic and a high silica glass, have been measured at five angles of incidence from 15 to 85 degrees in the wavelength region from 80 to 310A and in some cases up to 1050A. Optical constants are derived, and silicon core level transitions analyzed.

713,501
PB84-138569 Not available NTIS
National Bureau of Standards, Washington, DC.
Telescopes and Forces that Mold Them: An Introduction to Optics and Mechanical Design.
Final rept.
J. E. Faller. Jun 83, 14p
Pub. in Proceedings of 1983 Int. School Symp. Precision Measurement Gravity Experiment, Taipei, Republic of China, Jan 24-Feb 2, 1983, p21-34 Jun 83.

Keywords: *Telescopes, Astronomical telescopes, Design.

This is designed to serve as an introduction to optics and mechanical design. It does this by discussing the how and the whys of telescope design. In particular, it emphasizes the fact that as telescopes evolve from small to big, structural considerations have prove to be of great importance and have often been of primary considerations in dictating the final design.

713,502
PB84-139104 Not available NTIS
National Bureau of Standards, Washington, DC.
Definition of Fiber Numerical Aperture.
Final rept.
R. L. Gallawa. Apr 82, 7p
Pub. in Electro-Optical Systems Design, p48-54 Apr 82.

Keywords: *Fiber optics, Reprints, *Numerical aperture, Definition.

This paper addresses the definition of a fundamental fiber optics term: fiber numerical aperture. The popular definition of the term in not adequate as a measure of light-gathering ability, because of leaky rays. Nevertheless, it is recommended that the term be accepted because of its utility for most fibers in use today.

713,503
PB84-139146 Not available NTIS
National Bureau of Standards, Washington, DC.
Generation of Continuous-Wave 243nm Radiation by Sum-Frequency Mixing.
Final rept.
H. Hemmati, and J. C. Bergquist. 15 Aug 83, 4p
Pub. in Optics Communications 47, n2 p157-160, 15 Aug 83.

Keywords: Ultraviolet radiation, Continuous radiation, Argon lasers, Inorganic phosphates, Hydrogen inorganic compounds, Reprints, *Sum frequency mixing, Nonlinear optics, Ring lasers, Dye lasers, Thermal lens effect, Ammonium phosphates.

The authors have generated tunable cw radiation near 243 nm with a linewidth of less than 4 MHz by sum-frequency mixing the 351 nm radiation from an argon-ion laser with the 789 nm radiation from a ring dye laser in a crystal of ammonium dihydrogen phosphate held at moderate temperature. An external ring cavity, resonant with the dye laser, gives a power enhancement of about 12 in the sum-frequency generated radiation. Thermal lensing due to laser heating of the nonlinear crystal, distorted the 351 nm mode structure. This effect could limit the efficiency of the sum frequency mixing process.

713,504
PB84-139211 Not available NTIS
National Bureau of Standards, Washington, DC.
Progress in Fiber Test Standards.
Final rept.
R. L. Gallawa, and D. L. Franzen. Apr 83, 14p
Pub. in Jnl. of Photonics Spectra, 17 n4 p55-68 Apr 83.

Keywords: *Fiber optics, Measurement, Metrology, Standards, Attenuation, Bandwidth, Reprints, *Optical waveguides, Test methods, Refractive index.

This paper reviews optical waveguide test procedures and techniques that are approved by, or in review for, the Electronics Industries Association (EIA). The authors concentrate on those procedures and documents to which they have been a party, either directly or indirectly. In particular, they discuss a glossary of terms, fiber attenuation, fiber bandwidth, and refractive index profile, the last of which leads to a determination of core diameter.

713,505
PB84-141324 Not available NTIS
National Bureau of Standards, Washington, DC.
Scattering from a V-Shaped Groove in the Resonance Domain.
Final rept.
G. S. White, and J. F. Marchiando. 1 Aug 83, 5p
Pub. in Applied Optics 22, n15 p2308-2312, 1 Aug 82.

Keywords: *Light scattering, Surface roughness, Measurement, Reprints, Grooves.

Radiation scattered from a v-shaped groove was measured and compared to predictions from a rigorous vector theory. The calculated scattering accurately predicted the number of peaks and general shape of the observed scattering. Small variations in groove shape were found to alter peak heights noticeably and peak positions slightly. Finite beam size caused unavoidable discrepancies between calculated and measured scattering.

713,506
PB84-141639 Not available NTIS
National Bureau of Standards, Washington, DC.
Principles of Optical Fiber Measurements: Book Review.
Final rept.
M. Young. Jan 82, 2p
Pub. in Laser Focus, p118-119 Jan 82.

Keywords: *Fiber optics, Optical communication, Measurement, Reprints, *Book reviews, Optical waveguides.

A review of the book, Principles of Optical Fiber Measurements, by Dietrich Marcuse, is given.

713,507
PB84-141647 Not available NTIS
National Bureau of Standards, Washington, DC.
Optical Fiber Index Profiles by the Refracted-Ray Method (Refracted Near-Field Scanning).
Final rept.
M. Young. 1981, 8p
Sponsored in part by Department of Defense, Washington, DC.
Pub. in Applied Optics 20, n19 p3415-3422, 1 Oct 81.

Keywords: *Fiber optics, Resolution, Comparison, Refraction, Reprints, Optical waveguides, Near field.

This paper has two primary purposes. First, it provides an elementary description and tutorial overview of the refracted-ray method of measuring fiber index profiles. Second, it presents new results concerning the theoretical foundation, the linearity and precision, and other aspects of the method. In particular, we find that index differences may be measured to 5% or better and conclude by showing about 3% agreement with another laboratory and good agreement with numerical aperture measurements performed by participants in an interlaboratory comparison.

713,508
PB84-141654 Not available NTIS
National Bureau of Standards, Washington, DC.

Quantum Noise Limits the Pinspeck Camera to Simple Objects.
Final rept.
M. Young. Mar 82, 2p
Pub. in Jnl. of the Optical Society of America 72, n3 p402-403 Mar 82.

Keywords: *Cameras, Performance, Images, Reprints, *Pinspeck cameras, Pinhole cameras, Quantum noise.

The pinspeck camera projects a low-contrast image with a great deal of veiling glare. Quantum noise determines that the camera can image only simple objects that contain no more than a few hundred picture elements.

713,509
PB84-151810 Not available NTIS
National Bureau of Standards, Washington, DC.
Frequency Measurements of Far Infrared cw Lasing Lines in Optically Pumped CHCl2F.
Final rept.
E. C. C. Vasconcellos, J. C. Wyss, F. R. Petersen, and K. M. Evenson. 1983, 6p
Pub. in Int. Jnl. Infrared Millimeter Waves 4, n3 p401-406 1983.

Keywords: *Infrared lasers, *Far infrared radiation, Continuous radiation, Carbon dioxide lasers, Optical pumping, Polarization(Waves), Frequency measurement, Wavelengths, Chlorine organic compounds, Reprints, *Methane/fluoro-trichloro, Continuous wave lasers.

The wavelengths, frequencies, and relative polarizations of 15 FIR cw lasing lines obtained by optically pumping CHCl2F with a cw CO2 laser have been measured. The lines in the wavelength range from 340.3 to 905.4 micrometers and were pumped by P- and R- branch laser lines in the 9 micrometer band of CO2.

713,510
PB84-152297 Not available NTIS
National Bureau of Standards, Washington, DC.
Picosecond-Domain Waveform Measurement: Status and Future Directions.
Final rept.
N. S. Nahman. Mar 83, 8p
Pub. in IEEE Transactions on Instrumentation and Measurement IM-32, n1 p117-124 Mar 83.

Keywords: *Electromagnetic pulses, *Waveforms, Electromagnetic radiation, Light transmission, Reviews, Reprints, *Picosecond pulses, State of the art, Time domain.

A review of the state-of-the-art of picosecond time-domain waveform measurements is presented which includes measurements in both the electrical and optical regions of the electromagnetic spectrum. This review is the latest edition of a series of reviews on high speed pulse measurements compiled by the author commencing in 1967; specifically this review up-dates the 1978 review. The significance of the IEEE Pulse Standards 181 and 194 (or the identical IEC Standards 469-1 and 469-2) are discussed briefly. The classification of time domain measurements from the 1978 review is summarized and augmented with basic instrumentation block diagrams. The advances in the present day capabilities from those in 1978 are presented via temporal resolution state-of-the-art charts using the 1978 format; however, the only entries in the charts are those that have changed since 1978. Also, presented are some opinions as to the future directions of electrical and optical picosecond domain measurements. Fifty-six references are cited.

713,511
PB84-152305 Not available NTIS
National Bureau of Standards, Washington, DC.
Availability of NBS (National Bureau of Standards) Radiometric Standards for Solar Irradiance Studies.
Final rept.
R. P. Madden. 1980, 8p
Pub. in Proceedings of Workshop Solar UV Irradiance Monitors, Boulder, CO., 31 Jul-1 Aug 80, p79-86.

Keywords: *Radiometry, *Irradiance, *Standards, Radiance, Synchrotron radiation, Photodiodes, Far ultraviolet radiation, Solar ultraviolet radiation.

The development of primary and secondary radiometric standards at the National Bureau of Standards is a responsibility of the Center for Radiation Research, in the National Measurement Laboratory. Three different standards available from NBS are given.

713,512
PB84-152891 Not available NTIS
National Bureau of Standards, Washington, DC.
Two-Dimensional Near-Field Contouring of Optical Fiber Cores.
Final rept.
E. M. Kim, and D. L. Franzen. 1982, 8p
Pub. in Society of Photo-Optical Instrumentation Engineers 355, p76-83 1982.

Keywords: *Fiber optics, Microcomputers, Measurement, Telecommunication, Cores, Contours, Reprints, *Radiation patterns, Computerized control systems, Two dimensional, Near field.

A microcomputer controlled system is described for measuring the two dimensional near-field radiation pattern from optical fibers. Because radiation measurements may be made in two dimensions, a novel method has been devised whereby a constant intensity contour of the core is mapped. A modified Left-Most-Looking (LML) digital image encoding algorithm is used to map the contour of the fiber core. The iso-intensity map provides information about the tolerance field, in which all of the measured iso-intensity points lie, and core noncircularity. Such information is useful in determining coupling efficiency at splices, connector joints, and terminal points. This paper will discuss the measurement apparatus, accuracy, precision, stability, and method of analysis of the NBS system. In addition, results will be presented on measurements of core diameters, the length dependence of such measurements, wavelength dependence of the radiation patterns, power law fits the patterns, calibration apparatus, and iso-intensity contours of telecommunications-grade fibers.

713,513
PB84-152909 Not available NTIS
National Bureau of Standards, Washington, DC.
Refraction through a Prism.
Final rept.
A. Feldman. Oct 83, 3p
Pub. in American Jnl. of Physics 51, n/o p929-931 Oct 1983.

Keywords: *Optical prisms, *Refraction, Reprints, Refractive index.

A simple formula is derived which describes the refraction of light through a prism for an arbitrary angle of incidence. This formula can be represented by an ellipse whereby the minimum deviation condition and the transmission cutoff due to total internal reflection have a simple geometrical interpretation.

713,514
PB84-153113 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of the Core Diameter of Graded-Index Optical Fibers, an Interlaboratory Comparison.
Final rept.
E. M. Kim, and D. L. Franzen. 1 Oct 82, 8p
Pub. in Applied Optics 21, n19 p3443-3450, 1 Oct 82.

Keywords: *Fiber optics, Measurement, Comparison, Cores, Diameters, Reprints.

An interlaboratory measurement comparison of optical fiber-core diameter was conducted by the National Bureau of Standards (NBS) in cooperation with the Electronic Industries Association. Participants include NBS and three fiber manufacturers. Six graded-index fibers were measured by all participants using the transmitted near-field method. Results are discussed.

713,515
PB84-154624 Not available NTIS
National Bureau of Standards, Washington, DC.
Compact Hydrogen Maser with Exceptional Long-Term Stability.
Final rept.
D. A. Howe, and F. L. Walls. 1982, 6p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Instrumentation and Measurement IM-32, n1 p218-223 Mar 82.

Keywords: *Masers, *Frequency stability, *Frequency standards, Reprints, *Hydrogen masers.

A compact passive hydrogen maser with many unique features, including a significant reduction in size over previous hydrogen masers, is described.

713,516
PB84-156751 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibration Reticle for Optical Fiber Near-Field Core Diameter Measurements.
Final rept.
E. M. Kim, and D. L. Franzen. 1982, 3p
Pub. in Proceedings of CPEM 82 Digest, Conference on Precision Electromagnetic Measurements, Boulder, CO, 18 Jun-1 Jul 82, IEEE Catalog No. 82CH1737-6, pL-17 - L-19 1982.

Keywords: *Fiber optics, *Calibrating, *Reticles, Diameters, Cores, Resolution, Near field.

A device is described for calibrating near-field core diameter measurement systems. It consists of a reticle fabricated by photolithographic techniques and illuminated by diffuse light from an optical fiber. Absolute calibration performance in the NBS system, and interlaboratory measurements are discussed.

713,517
PB84-158914 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC.
Optical Fiber Characterization: Attenuation, Frequency Domain Bandwidth, and Radiation Patterns. Volume 2.
Special pub.
G. E. Chamberlain, G. W. Day, D. L. Franzen, R. L. Gallawa, E. M. Kim, and M. Young. Oct 83, 243p NBS-SP-637-VOL-2
See also Volume 1, PB83-111609. Library of Congress catalog card no. 82-600563. Sponsored in part by Department of Defense, Washington, DC.

Keywords: *Fiber optics, Attenuation, Bandwidth, Dictionaries, Optical communication, Far field, Diameters, *Optical waveguides, Near field, Radiation patterns.

This is the second volume of a series intended to describe optical fiber measurement systems developed at the National Bureau of Standards. The topics covered in this volume are attenuation, bandwidth (frequency domain), and far-field near-field radiation patterns. Each chapter includes a tutorial section and a detailed description of the apparatus. The volume concludes with a glossary of optical communications terms.

713,518
PB84-164938 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Retroreflectance MAP (Measurement Assurance Program) Service for Coefficient of Luminous Intensity.
Final rept.
K. L. Eckerle, and J. J. Hsia. Feb 84, 59p NBS-SP-671
Also available from Supt. of Docs. as SN003-003-02554-7. Library of Congress catalog card no. 84-601001.

Keywords: *Luminous intensity, Coefficients, Errors, Accuracy, Experimental design, Tables(Data), *Retroreflection, *Retroreflectors, Uncertainty, Measurement assurance program.

This publication is written for those participating in the retroreflectance measurement assurance program (MAP) service provided by the National Bureau of Standards. This service is to verify the accuracy of measurement of coefficient of luminous intensity (R). This paper presents the techniques and procedures that are pertinent to participating in the MAP service, as well as a detailed explanation of the error analyses. Uncertainties for both retroreflectance and luminous transmittance were determined from two pilot studies carried out with the assistance of two industrial laboratories and by research performed on the elements of the MAP package.

713,519
PB84-175124 PC **A22**/MF **A01**
National Bureau of Standards, Washington, DC.
Laser Induced Damage in Optical Materials: 1982.
Final rept.
H. E. Bennett, A. H. Guenther, D. Milan, and B. E. Newnam. Jan 84, 502p NBS-SP-669
Also available from Supt. of Docs. as SN003-003-02563-1. Sponsored in part by American Society for Testing and Materials, Philadelphia, PA., Office of Naval Research, Arlington, VA.,Department of Energy,

Washington, DC., and Defense Advanced Research Projects Agency, Arlington, VA. Library of Congress catalog card no. 83-600625. See also PB84-127869.

Keywords: *Optical materials, *Radiation damage, *Laser materials, *Meetings, Laser beams, Mirrors, Surfaces, Thin films, Optical coatings, Ultraviolet lasers, Infrared lasers, *Laser damage.

The proceedings contain papers presented at the Fourteenth Annual Symposium on Optical Materials for High Power Lasers held at the National Bureau of Standards in Boulder, Colorado, November 16-17, 1982. The Symposium was held under the auspices of ASTM Committee F-1, Subcommittee on Laser Standards, with the joint sponsorship of NBS, the Defense Advanced Research Project Agency, the Department of Energy, the Office of Naval Research, and the Air Force Office of Scientific Research. Approximately 200 scientists attended the Symposium, including representatives of the United Kingdom, France, Japan, West Germany, and the USSR. The Symposium was divided into sessions concerning Materials and Measurements, Mirrors and Surfaces, Thin Films and finally Fundamental Mechanisms. As in previous years, the emphasis of the papers presented at the Symposium was directed toward new frontiers and new developments. Particular emphasis was given to materials for high power apparatus. The wavelength range of prime interest was from 10.6 micrograms to the uv region. Highlights included surface characterization, thin film-substrate boundaries, and advances in fundamental laser-matter threshold interactions and damage mechanisms.

713,520
PB84-192202 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO.
Measurement of Multimode Optical Fiber Attenuation: An NBS (National Bureau of Standards) Special Test Service.
R. L. Gallawa, G. E. Chamberlain, G. W. Day, D. L. Franzen, and M. Young. Feb 84, 30p NBSIR-83-1691 See also PB83-251207.

Keywords: *Fiber optics, *Attenuation, *Optical communication, Near infrared radiation, Telecommunication, Measurement, Tests, Fiber optics transmission lines, Optical waveguides, National Bureau of Standards.

This document is one of a series that describes optical fiber measurement procedures and capabilities at the National Bureau of Standards (NBS). The authors concentrate here on the measurement of attenuation of multimode, telecommunication-grade fibers for the wavelength range of 850 nm to 1300 nm. The document gives details on the measurement procedure, which is based on the Electronics Industries Association Recommended Standard as published in RS 455. The procedure is based on two restricted launch conditions, either of which may be used to control the modal power distribution at launch. The intent is to approximate the conditions that exist in a long link, to the end that the reported attenuation coefficient is indicative of what can be expected in long, concatenated links.

713,521
PB84-216936 Not available NTIS
National Bureau of Standards, Washington, DC.
Scattering Theory of Distortion/Correction by Phase Conjugation.
Final rept.
G. S. Agarwal, A. T. Friberg, and E. Wolf. Apr 83, 12p
Pub. in Jnl. of the Optical Society of America, v73 n5 p529-538 Apr 83.

Keywords: *Electromagnetic scattering, *Light scattering, Monochromatic radiation, Integral equations, Reprints, *Phase conjugation, Iterative methods.

The correction of wave distortions by the technique of optical phase conjugation is examined first on the basis of a newly derived integral equation for scattering of monochromatic scalar waves in the presence of a phase-conjugate mirror. The solution is developed in an iterative series, and the first- and second-order terms are analyzed and illustrated diagrammatically. A generalization of the integral equation is then presented, which takes into account the electromagnetic nature of light. It is also shown that if the conjugated wave is generated without losses or gains and with a complete reversal of polarization, a total elimination of distortions may be achieved by this technique under circumstances that frequently occur in practice.

713,522
PB84-216969 Not available NTIS
National Bureau of Standards, Washington, DC.
Optical Properties of Small Metal Spheres: Surface Effects.
Final rept.
P. Apell, and D. R. Penn. Apr 83, 4p
Pub. in Physical Review Letters, v50 n17 p1316-1319, 15 Apr 83.

Keywords: *Particles, *Light scattering, Optical properties, Metals, Spheres, Surfaces, Reprints.

For many years it has been assumed that the optical properties of small spheres can be understood by means of a Drude form for the dielectric function that incorporates a boundary scattering rate 1/(tau sub s) approximately = (v sub f)/R where (v sub f)/R is the Fermi velocity and R is the sphere radius. We calculate an effective scattering rate of the form 1/(tau sub s) = f dot (v sub f)/R and evaluate f as a function of photon frequency and electron density. It is pointed out that the largest contribution to f is due to the profile of the electron density of the sphere surface rather than the classical boundary scattering that is reduced an order of magnitude by electron screening.

713,523
PB84-217108 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Mfg. Engineering.
Free-Space Propagation of Light Pulses.
E. Marx. May 84, 54p NBSIR-84-2835

Keywords: *Light pulses, *Light transmission, *Computer programs, Electromagnetic fields, Plane waves, Greens function, Wave equations, Transients.

A transient electromagnetic field in free space is completely specified when the initial values of the electric and magnetic fields are given. Green's function for the scalar wave equation can then be used to find the field at later times. A group of computer programs that implement these equations and process the output are presented in this report.

713,524
PB84-218346 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Self-Study Manual on Optical Radiation Measurements: Part 1. Concepts. Chapter 11. Linearity Considerations and Calibrations.
Final rept.
J. B. Shumaker. Apr 84, 45p NBS/TN-910-7
Also available from Supt. of Docs as SN003-003-02577-1. See also PB83-192633.

Keywords: *Optical measurement, *Radiometry, Calibrating, Attenuation, Nonlinearity, Linearity.

This is the seventh in a series of Technical Notes (910-) entitled 'Self-Study Manual on Optical Radiation Measurements'. In this chapter the author reviews the radiometric treatment of a non-linear radiometer. The emphasis is on the underlying radiometric principles and the experimental evaluation of a true response function so that such 'real' radiometer-output signals can be used in the idealized equations appropriate for linear radiometers. Several common techniques are discussed: beam addition, beam attenuation, the inverse-square law, and a number of other techniques in which non-radiometric measurements provide some or all of the basis for the response-function calibration. Many references are given; they should permit the reader to pursue the experimental details of any of the techniques in greater depth.

713,525
PB84-221290 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Optical Edge Detection and Imaging of Thick Layers.
Final rept.
D. Nyyssonen. Oct 82, 12p
Pub. in Jnl. of the Optical Society of America 72, n10 p1425-1436 Oct 82.

Keywords: *Optical microscopes, Line width, Coherence, Measurement, Lithography, Microscopy, Reprints, *Edge detection, Microlithography.

The optical microscope measurement of small objects, 0.5 to 10 micrometers in diameter, is complicated by the apparent change in the dimension of the object with a change in the spatial coherence of the illumination. Coherent edge-detection methods have been developed for the measurement of line objects on integrated-circuit photo masks and wafers. A generalization is presented of the coherent threshold equation that permits the extension to any state of partial coherence of the illumination as well as extension to the measurement of nonplanar objects. In the latter case, a waveguide model is developed for imaging of lines patterned in thick layers and is compared with experimental data.

713,526
PB84-221324 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Frequency Measurements and the Redefinition of the Meter.
Final rept.
K. M. Evenson. Nov 81, 3p
Pub. in Laser Focus 17, n11 p61-63 Nov 81.

Keywords: *Frequency measurement, *Standards, *Length, Light(Visible radiation), Measurement, Iodine, Accuracy, Reprints, *Meter, Laser radiation.

Scientists at the U.S. National Bureau of Standards (NBS), Boulder, CO, and the Canadian National Research Council (NRC) in Ottawa, have accomplished the highest direct frequency measurement ever made on an electromagnetic wave. The joint experiment involved the direct frequency measurement of the frequency of a particular transition of the iodine molecule near 520 terahertz. The group demonstrated that it is possible to measure the very high frequencies of visible light in terms of the fundamental standards for frequency and time. Such frequency-based measurements are potentially a thousand times more accurate than measurements of wavelengths. The measured visible frequency is some 57,000 times the primary standard frequency near 9.2 x 10 to the 9th power Hertz. Thus the way is paved for extremely accurate spectroscopic investigations in the visible spectral region and an eventual new definition of the meter. This new definition would not immediately have any effect on the consumer, but it has a far-reaching impact on the science of measurement.

713,527
PB84-222983 PC **A03**/MF **A01**
National Bureau of Standards (NML), Washington, DC. Radiometric Physics Div.
NBS (National Bureau of Standards) Response to the Fourth CORM (Council for Optical Radiation Measurements) Report on Pressing Problems and Projected National Needs in Optical Radiation Measurements.
K. D. Mielenz. Jun 84, 49p NBSIR-84/2889

Keywords: *Optical measurement, *Radiometry, *Spectrophotometry, Calibrating, Standards, Infrared detectors, Council for Optical Radiation Measurements.

This publication constitutes the NBS Response to the Fourth CORM Report. It describes NBS policies for radiometry and spectrophotometry, the current status of projects suggested by CORM, and future plans. It also contains specific proposals for collaborative CORM/NBS efforts to provide needed standards and measurement services. With permission by CORM, the Fourth CORM Report itself is included as an appendix.

713,528
PB84-223270 Not available NTIS
National Bureau of Standards, Washington, DC.
Long Wave Infrared Testing at NBS (National Bureau of Standards).
Final rept.
C. R. Yokley. 1983, 7p
Pub. in Society of Photo-Optical Instrumentation Engineers 416, p2-8 1983.

Keywords: *Optical tests, *Far infrared radiation, *Calibrating, Blackbody radiation, Sensitivity, Cryogenics, Infrared detectors, Test facilities, Reprints.

At present, National Bureau of Standards (NBS) work in the Long Wave Infrared (LWIR) spectral region is performed using three calibration facilities. Two recent calibrations for the LWIR community will be described to illustrate the features and limitations of the present NBS facilities. Future plans to enlarge and upgrade the cryogenic facility to provide increased sensitivity will be described. Systematic studies of the errors due to diffraction, polarization, and attenuation are also planned for the upgraded facility. Future work to explore the

possibility of basing calibrations on self-calibration techniques with LWIR detectors will also be described.

713,529
PB84-223395 Not available NTIS
National Bureau of Standards, Washington, DC.
Present NBS (National Bureau of Standards) Capability in Optical Fiber Measurements.
Final rept.
G. W. Day, and D. L. Franzen. 1981, 5p
Pub. in Proceedings of Int. DoD/Industry Fiber Optics Standards Conf. (1st), Washington, DC., April 21-23, 1981, p132-136.

Keywords: *Fiber optics, Measurement, Attenuation, Bandwidth.

The design and performance of three systems now in use at the National Bureau of Standards for the measurement of attenuation and bandwidth of multimode optical fibers are reviewed. A brief discussion of measurement conditions, particularly launching conditions, is included.

713,530
PB84-223577 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Mfg. Engineering.
Metrological Consequences of the Hard Optical Boundary Assumption.
Final rept.
A. G. Lieberman. Jul 84, 31p NBS-TN-1198
Also available from Supt. of Docs as SN003-003-02594-1.

Keywords: *Reflection, Metrology, Vacuum, Interfaces, Sodium, Surface properties, Plane waves, Laser beams, Phase shift, Errors, *Polarized light, *Metal surfaces, Lang-Kohn model, Ricatti equation, Jellium.

The reflection of s-polarized light propagating in vacuum by a metal surface is examined for two descriptions of the vacuum-metal interface: the exponential surface transition and the Lang-Kohn transition. Both models treat the metal as a lossless, non-magnetic jellium material, but differ in the spatial distributions of their constituent charges. The displacement of the optical surface relative to the mechanical surface caused by the transition is evaluated for each model. Computerized results are presented for the optical displacement and phase change upon reflection from a sodium surface for the theoretically superior Lang-Kohn model. The measurement errors which result from ignoring the vacuum-metal transition become more significant as the angle of incidence is increased.

713,531
PB84-223833 Not available NTIS
National Bureau of Standards, Washington, DC.
Demonstration of Broadband Schottky Barrier Mixers for Visible Laser Light and Application to High Resolution Spectroscopy.
Final rept.
H. U. Daniel, B. Maurer, M. Steiner, H. Walther, and J. C. Bergquist. 1983, 3p
Prepared in cooperation with Max-Planck-Inst. fuer Quantenoptik, Garching (Germany, F.R.) and Munich Univ. (Germany, F.R.). Fachbereich Physik.
Pub. in Proceedings of Int. Conference Laser Spectroscopy (6th), Interlaken, Switzerland, June 27-July 1, 1983, p432-434.

Keywords: *Mixers, Microwave frequencies, Light(Visible radiation), Spectrometers, Broadband, Resolution, *Laser spectrometers, Schottky barrier devices, Dye lasers, Laser radiation.

Visible lasers, frequency separated by as much as 1 THz, are mixed on Schottky Barrier Mixers with a suitable microwave frequency, or its harmonic, to give a difference frequency near DC. Schottky Barrier Mixers exhibit vast improvement in sensitivity, in stability, and in nonlinear microwave generation as compared to the metal-insulator-metal point contact diodes. A broadly tunable frequency-offset-locked dye laser spectrometer, which uses a Schottky Barrier Mixer, demonstrates for the first time the broadband, but high resolution capability of such a device.

713,532
PB84-223858 Not available NTIS
National Bureau of Standards, Washington, DC.
Birefringence Measurements in Single Mode Optical Fiber.
Final rept.
G. W. Day. 1983, 8p
Sponsored in part by Department of Defense Calibration Coordination Group, Redstone Arsenal, AL.
Pub. in Proceedings of SPIE International Society for Optical Engineering, San Diego, CA., August 23-24, 1983, p72-79.

Keywords: *Fiber optics, *Birefringence, Polarization, Detectors.

Because their cores are not perfectly circular or because of stress, inherent to the structure or externally applied, practical single mode fibers are birefringent. These sources of birefringence are reviewed briefly. A simple model for the fiber consists of a combination of one linearly birefringent element and one circularly birefringent element. Depending on the magnitude of the birefringence, different techniques of evaluating the parameters of the model may be suitable. Several methods appropriate for low and high birefringence fiber are described and some of their advantages and disadvantages outlined.

713,533
PB84-225218 Not available NTIS
National Bureau of Standards, Washington, DC.
Geometrical Alignment Errors in the Measurement of Prismatic Retroreflectors.
Final rept.
K. L. Eckerle, J. J. Hsia, and W. S. Liggett. 1984, 6p
Pub. in Color, v9 n1 p23-28 1984.

Keywords: Measurement, Alignment, Errors, Reprints, *Retroreflectors, Retroreflection.

Measurements of the coefficient of luminous intensity (C.I.L.) for prismatic retroreflectors contain errors due to misalignment of the photometric range and samples. A procedure for assessing these errors has been developed for the two-orientation hexagon cube clear prismatic retroreflector that is included in the NBS Measurement Assurance Program (MAP) for retroreflection. this procedure involves experiments in which the geometrical setting of the range is deliberately varied so that the dependence of the C.I.L. on small variations in the geometry can be estimated. Results of this experiment are reported along with some repeated measurements of C.I.L. for an internal NBS MAP. Similar coefficients have previously been reported for retroreflective bead sheeting, and their implication is discussed in an appendix.

713,534
PB84-225374 Not available NTIS
National Bureau of Standards, Washington, DC.
Sum Frequency Generation of cw 194 nm Radiation in Potassium Pentaborate.
Final rept.
H. Hemmati, J. Bergquist, and W. Itano. 1982, 6p
Pub. in Laser Techniques for Extreme Ultraviolet Spectroscopy, v90 n2 p485-490 1982.

Keywords: *Far ultraviolet radiation, Continuous radiation, Argon lasers, Frequency multipliers, Reprints, *Sum frequency mixing, *Potassium borates, Tunable lasers, Dye lasers, Nonlinear optics, Second harmonic generation, Ammonium phosphates, Ammonium dihydrogen phosphate.

Narrowband, tunable cw radiation in the 194 nm region has been produced by sum frequency mixing in a potassium pentaborate (KB5) crystal. The input wavelengths required for 90 degree phase-matched sum frequency mixing (SFM) are approximately 257 nm and 792 nm. The tunable 792 nm radiation was obtained from a cw dye laser. The 257 nm radiation was obtained by frequency doubling the output of a cw argon ion laser in an ammonium dihydrogen phosphate (ADP) crystal. It is estimated that several microwatts of 194 nm radiation in a bandwidth of less than 10 MHz can be produced when all operating conditions are optimized.

713,535
PB84-225507 Not available NTIS
National Bureau of Standards, Washington, DC.
Role of Backscatter Signatures in Optical Fiber Characterization.
Final rept.
B. L. Danielson. 1981, 5p
Pub. in Proceedings of International DoD/Industry Fiber Optics Standards Conference (1st), Washington, DC., April 21-23, 1981, 1, p137-141.

Keywords: *Fiber optics, *Reflectometers, *Backscattering, Measurement, Optical waveguides.

The optical time domain reflectometer is a versatile instrument which can be used to measure several important physical, dimensional, and transmission properties of optical fibers. The author discusses some of these areas, some problems involved in the interpretation of backscatter signatures, and some possible military applications area in which it may be desirable to base specifications and tolerances on signature features.

713,536
PB84-226398 Not available NTIS
National Bureau of Standards, Washington, DC.
Sulfur Dioxide Submillimeter Wave Lasers.
Final rept.
J. P. Sattler, and W. J. Lafferty. 1984, 23p
Pub. in Reviews of Infrared and Millimeter Waves 2, p359-381 1984.

Keywords: *Gas lasers, *Submillimeter waves, Optical pumping, *Sulfur dioxide lasers, Laser radiation.

A review of current work on SO2 submillimeter lasers is given, including both optically pumped as well as discharge systems. The optically pumped laser emissions result from pumping the far P-branch of the (nu sub 1) band with a CO2 laser. After assignment of the (nu sub 1) band, all laser transitions have been very satisfactorily assigned. The assignment of the discharged laser lines has occupied several laboratories for sometime and is still not completely satisfactory. The lines, however, appear to originate in the (nu sub 1) + (nu sub 2) and 3(nu sub 2) band systems which have a weak Fermi resonance crossing at high K levels. As in the case of the H2O and HCN discharge laser systems, the laser transitions appear to orginate in the energy levels with the greatest amount of resonance mixing.

713,537
PB84-227065 Not available NTIS
National Bureau of Standards, Washington, DC.
Estimating Index Profiles of 1.3 Micrometer Single Mode Fibers by Near-Field Measurements at Blue Wavelengths.
Final rept.
E. M. Kim, D. L. Franzen, M. Young, and P. M. Rodhe. Dec 83, 5p
Pub. in Jnl. of Lightwave Technology LT-1, n4 p562-566 Dec 83.

Keywords: *Fiber optics, Light(Visible radiation), Reprints, Near field, Refractive index, Blue(Color).

Near-field intensity measurements are obtained at the wavelength of 0.45 micrometer for fibers designed to operate in a single mode at 1.3 micrometers. At blue wavelengths, the fibers are sufficiently multimode so the near-field scan gives an approximation to the index profile. Near-field scans from six fibers are compared to actual index profiles as determined by the refracted ray method. Experimental near-field scans are also compared to theoretical predictions from a model using numerical solutions to the scalar wave equation.

713,538
PB84-227388 Not available NTIS
National Bureau of Standards, Washington, DC.
High Pressure Polycrystalline Sodium Chloride Window and Mounting Arrangement for CO2 Laser Transmission.
Final rept.
J. W. Bransford. Jan 84, 2p
NASA Order-H-43201B
Pub. in Review of Scientific Instruments 55, n1 p125-126 Jan 84.

Keywords: *Infrared windows, *Sodium chloride, Carbon dioxide lasers, Laser beams, Polycrystalline, Mountings, Reprints.

A design for an unclamped high pressure window made from polycrystalline sodium chloride is presented. The window is used to pass a CO2 laser beam into a pressure chamber operating at pressures from 1.034 x 10 to the 5th power Pa to 13.8 MPa.

713,539
PB84-239904 Not available NTIS
National Bureau of Standards, Washington, DC.

Tunable Laser Stabilization Techniques for Ultra-high Resolution Spectroscopy.
Final rept.
J. L. Hall. 1983, 19p
Contract N00014-77-C-0656, Grant NSF-PHY79-04928
Pub. in Proceedings of Beijing/Shanghai International Conference on Lasers, Beijing, China, June 1980, p15-33 1983.

Keywords: *Spectroscopy, Resolution, Light(Visible radiation), Near infrared radiation, *Laser spectroscopy, *Laser stability, *Tunable lasers, Continuous wave lasers, *Dye lasers, Laser radiation.

The rapid development of tunable cw laser techniques gives us the possibility at present to match a single-frequency dye laser to an interesting quantum transition basically located anywhere within the visible or near infrared portions of the spectrum. However, a number of technical problems need to be overcome before one can enter the domain of high resolution spectroscopy and precision measurement. We discuss here generic dye laser problems and several of the laser control techniques that have proven useful. To conclude, and to show the power of these techniques, we present a rather high resolution illustration of the two-photon Ramsey fringe technique. For convenience in presentation, we will usually assume the laser to be a cw dye laser operating in the visible range. However, in view of the rapid development of broadly-tunable lasers using color centers as the active medium, we may be quite sure that ultrahigh stability laser radiation will be available from the visible up to about 3.3 micrometers in the near future.

713,540
PB84-239987 Not available NTIS
National Bureau of Standards, Washington, DC.
Frequency Measurement of Visible Light.
Final rept.
K. M. Evenson, D. A. Jennings, and F. R. Petersen. Dec 81, 11p
Pub. in J. de Phys. Colloq. C8, 42, n12 pC8-473-C8-483 Dec 81.

Keywords: *Frequency measurement, *Light(Visible radiation), Reprints, MIM diodes.

A discussion of the extension of absolute frequency measurements to the visible is given along with some new measurements of visible frequency differences using the MIM diode. Future frequency measurements and the redefinition of the meter are discussed.

713,541
PB84-242502 Not available NTIS
National Bureau of Standards, Washington, DC.
Submicrometer Interdigital Silicon Detectors for the Measurement of Picosecond Optical Pulses.
Final rept.
R. J. Phelan, D. R. Larson, N. V. Frederick, and D. L. Franzem. 1983, 5p
Pub. in Proceedings of SPIE, Int. Soc. Optical Engineering, San Diego, CA, Aug 24-26 1983, p207-211.

Keywords: *Infrared detectors, *Optical detection, *Optical measurement, Semiconductor diodes, Silicon, Light pulses, Schottky barrier devices, Amorphous materials, Amorphous silicon, Picosecond pulses.

Interdigital silicon Schottky barrier diodes have been evaluated for picosecond pulse measurements. Structures with clearly defined receiving apertures and submicrometer contact spacings were created with electron beam lithography. The detectors exhibit saturation currents corresponding to the absorbed optical power. Impulse response widths were less than 50 ps, and response maps yielded uniform patterns. A peak quantum efficiency of over 30 percent was obtained, and the usable spectral responsivity extends beyond 2 micrometers.

713,542
PB84-242957 Not available NTIS
National Bureau of Standards, Washington, DC.
Apparatus for Convenient Cover Lifting on a Nicolet Vacuum FT-IR System.
Final rept.
R. A. Forman, and A. Baghdadi. 1983, 1p
Pub. in FT-IR Spectral Lines 5, n1 p20 1983.

Keywords: *Optical spectrometers, *Mirrors, Adjusting, Reprints, *Beam splitters.

The large cover for the vacuum bench of the Nicolet 8000 is somewhat unwieldy to remove on a regular basis. Because of constraints set by the special nature of the experiments in place in our sample chamber, we have found it a bit inconvenient to routinely change the beamsplitter through the normal sample hole. We have devised a relatively simple and inexpensive method of raising and lowering the cover, which makes the use of the spectrometer much more convenient.

713,543
PB85-100352 Not available NTIS
National Bureau of Standards, Washington, DC.
Effective Two-Level Description of Pressure Induced Extra Resonances in Four-Wave Mixing.
Final rept.
G. S. Agarwal. Nov 82, 7p
Pub. in Physical Review A 26, n5 p2761-2767 Nov 82.

Keywords: Pressure, Reprints, *Four wave mixing, Bloch equations.

The possibility of formulating a treatment of pressure induced extra resonances (PIER) in four wave mixing, in terms of effective two-level equations, is examined. Using the method of time averaging, effective two-level equations, which are valid for arbitrary slowlying varying field envelopes, are obtained. Such equations are found to have a structure that is very different from that of Bloch equations. In the new structure, important inhomogeneous terms appear that are crucial for PIER. The present description is then used to study the effect of laser fluctuations on PIER.

713,544
PB85-111813 Not available NTIS
National Bureau of Standards, Washington, DC.
Need for Standard Launch Conditions in Fiber Measurements.
Final rept.
R. L. Gallawa, D. L. Franzen, and G. W. Day. 1981, 1p
Pub. in Proceedings of Fiber Optics and Comm. Proceedings, San Francisco, CA., September 1-3, 1981, p114.

Keywords: *Fiber optics, *Optical communication, Attenuation, Bandwidth, Measurement, Standards, Comparison.

Measurement of fiber attenuation and bandwidth is influenced by source characteristics, launch conditions, and modal excitation efficiency. This talk will concentrate on the reasons behind proposed standard launch conditions and will discuss results of a recent interlaboratory measurement comparison.

713,545
PB85-111847 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS (National Bureau of Standards) 45 Deg/Normal Reflectometer for Absolute Reflectance Factors.
Final rept.
J. J. Hsia, and V. R. Weidner. 1981, 6p
Pub. in Metrologia 17, n3 p97-102 Oct 81.

Keywords: *Reflectometers, *Reflectance, *Calibrating, Spectrophotometers, Measurement, Reprints, Polarized light.

A 45 deg/normal reflectometer has been constructed and tested for calibrating the absolute reflectance factor of diffuse samples over the 380-770 nm spectral range using polarized radiation. The measurement equations have been derived for the method used. The method using a step-down technique and view factor calls for the measurements of the ratio of two fluxes and, in addition, some linear dimensions. The uniformity of the receiver system is achieved by means of a double-sphere signal averager. Uncertainties of the absolute-reflectance-factor measurements obtained with this system are estimated to be + or - 0.3% of the measured value. For all the samples that have been tested, the 45 deg/normal reflectance factor was found to be higher than the 6 deg/hemispherical reflectance factor. The higher reflectance values for 45 deg/normal geometry were confirmed by additional gonioreflectometer measurements.

713,546
PB85-114700 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Technical Digest - Symposium on Optical Fiber Measurements, 1984.
Oct 84, 150p NBS/SP-683
See also PB85-114718 through PB85-115004 and PB83-129148. Also available from Supt. of Docs as SN003-003-02604-2. Library of Congress catalog card no. 84-601092. Prepared in cooperation with Optical Society of America, Washington, DC. and Institute of Electrical and Electronics Engineers, Inc., New York. Optical Waveguide Communications Committee.

Keywords: *Fiber optics, *Optical communication, *Meetings, Optical measurement, Optical dispersion, *Optical fibers, Multimode.

This volume contains summaries of 31 papers presented at the Symposium on Optical Fiber Measurements held October 2-3, 1984, at the National Bureau of Standards, Boulder, Colorado. Subjects include measurements on singlemode fiber, multimode fiber, fiber designed for sensing applications, instrumentation, field measurements, and standards.

713,547
PB85-114726
(Order as PB85-114700, PC **E07**/MF **E01**)
Bell Communications Research, Inc., Holmdel, NJ.
Effective Cut-Off Wavelength for Single-Mode Fibers: The Combined Effect of Curvature and Index Profile.
V. S. Shah. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p7-10 1984.

Keywords: *Fiber optics, Optical measurement, *Optical fibers, Cutoff wavelength.

In single mode transmission systems, the effective cut-off wavelength is an important design parameter separating the single-modal and bi-modal regime in an optical fiber. In light of the importance of the effective cut-off wavelength in system design and the need to standardize its range, a study program is in progress in our Laboratory to gain further understanding of the dependence of the effective cut-off wavelength (with the bend diameter as a parameter) on three fibers are reported here.

713,548
PB85-114734
(Order as PB85-114700, PC **E07**/MF **E01**)
Doctor Neher Lab., Leidschendam (Netherlands).
Length and Curvature Dependence of Effective Cutoff Wavelength and LP11-Mode Attenuation in Single-Mode Fibers.
H. T. Nijnuis, and K. A. H. van Leeuwen. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p11-14 1984.

Keywords: *Fiber optics, Optical measurement, *Optical fibers, *Cutoff wavelengths.

The authors report on measurements of the length and curvature dependence of the effective cutoff wavelength in a number of single-mode fibers with various types of index-profile, aimed at establishing such empirical rules. The results indicate approximately linear relations between the cutoff wavelength and the logarithm of the fiber length, and between cutoff wavelength and the inverse of the radius of curvature to which the fiber is bent.

713,549
PB85-114742
(Order as PB85-114700, PC **E07**/MF **E01**)
Bell Communications Research, Inc., Holmdel, NJ.
Cutoff Wavelength and Modal Noise in Single-Mode Fiber Systems.
N. K. Cheung, and P. Kaiser. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p15-18 1984.

Keywords: *Fiber optics, *Optical communication, Near infrared radiation, *Optical fibers, *Cutoff wavelength.

In practical single-mode fiber communication systems one generally distinguishes between the theoretical cutoff wavelength lambda sub (th) of the first higher order mode, and the effective cutoff wavelength which may be substantially shorter than lambda sub (th) by as much as 100 to 200 nm. In this paper the authors report on the observation of modal noise effects for different fiber interconnection schemes containing intentionally overmoded fiber sections.

713,550
PB85-114767

(Order as PB85-114700, PC **E07**/MF **E01**)
Laboratoires de Marcoussis - Centre de Recherches (France).
Bending and Microbending Loss Sensitivity of Step Index Single Mode Fibers.
J. Auge, P. Dupont, and L. B. Jeunhomme. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p25-28 1984.

Keywords: *Fiber optics, Bending, Losses, Attenuation, Sensitivity, *Optical fibers, Fiber optics transmission lines.

Single-mode optical fibers with step index core and matched index or depressed index claddings are finding an increasingly large variety of applications, in long range transmission, signal processing, and sensing devices. These applications involve very different bending and microbending conditions, and it is therefore necessary to get an in-depth knowledge of bend and microbend losses as a function of fiber parameters. The authors have used the basket-weave test to experimentally determine the losses in various matched cladding and depressed cladding fibers. The results are found to agree reasonably well with simple loss models, and the behavior of both fiber types is discussed in some details.

713,551
PB85-114775
(Order as PB85-114700, PC **E07**/MF **E01**)
Karlsruhe Univ. (Germany, F.R.).
Refractive-Index Profile and Modal Dispersion Prediction for a Single-Mode Optical Waveguide from Its Far-Field Radiation Pattern.
W. Freude, and A. Sharma. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p29-32 1984.

Keywords: *Fiber optics, Optical dispersion, Far field, Laguerre functions, *Optical waveguides, Optical fibers, Refractive index, Near fields.

The authors expanded measured far-fields in M Gau(beta)-Laguerre functions, the coefficients of which are determined with a least relative-error squares fit by matrix inversion. Thereby the near-field is given, from which the refractive-index profile can be calculated. Using wavelength dependent far-field data measured with an incoherent source, the waveguide dispersion may be deduced. Besides the general benefits of far-field measurements (uncritical methanical and optical setup), the advantage of the method lies in its inherent insensitivity against noise, so that the practical resolution limit is only given by the amount to which cladding modes and stray light can be reduced.

713,552
PB85-114783
(Order as PB85-114700, PC **E07**/MF **E01**)
British Telecommunications Research Labs., Martlesham Heath (England).
Simple Near-Field Scanning System for Refractive Index Profiles and Mode Spot Shape.
C. A. Millar. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p33-36 1984.

Keywords: *Optical scanners, *Fiber optics, Optical measurement, Resolution, *Optical fibers, *Refractive index, Near field.

Measurements of refractive index profile and mode spot intensity distribution are fundamentally important for singlemode fiber characterization. Using the Transmitted Near Field technique, the two measurements are essentially the same, but with different sources and detectors in place. This paper describes a straightforward apparatus which, when appropriate sources and detectors are used, permits high-resolution, real-time near field scanning.

713,553
PB85-114791
(Order as PB85-114700, PC **E07**/MF **E01**)
Centro Studi e Laboratori Telecomunicazioni, Turin (Italy).
Spot-Size Measurements in Single-Mode Fibres.
R. Caponi, G. Coppa, P. Di Vita, and U. Rossi. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p37-40 1984.

Keywords: *Fiber optics, Dimensional measurement, *Optical fibers.

It is known that the dimensional specification of single-mode fibers is performed on the basis of the so-called mode field diameter. It has not been possible, up to now, to agree (e.g., in the CCITT) an acceptable definition of such a parameter, and the matter is presently strongly debated. In order to clarify the situation, it seems convenient firstly to review some definitions of parameters related to the mode field diameter and successively to discuss various techniques proposed recently for its measurement. It is not our aim to penetrate the measurement problems of each proposed method, but we want to analyze them critically in order to understand what actually is being measured and how useful that quantity can be. Finally we expose a novel and very promising technique that permits a direct measurement of the mode field diameter making use of suitable masks.

713,554
PB85-114809
(Order as PB85-114700, PC **E07**/MF **E01**)
Corning Glass Works, NY.
Compatibility of National and International Standards for Optical Fiber.
P. R. Reitz. Oct 84, 7p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p41-47 1984.

Keywords: *Fiber optics, *Standards, Optical measurement, Compatibility, Comparison, Tests, *Optical communication, *Optical fibers.

In the last several years we have witnessed the rapid growth and acceptance of optical fiber communications; this has been accompanied by a noticeable maturation of standards activities. In large measure the existing measurement standards are very similar, particularly considering the diverse frames of reference from which they have been created. There remains, however, a significant number of important detail differences that must yet be resolved. This resolution will require great consideration to fairly weigh the requirements for simplicity and flexibility with the desire for uniformity and technical correctness. This is the ongoing challenge of standardization.

713,555
PB85-114817
(Order as PB85-114700, PC **E07**/MF **E01**)
Naval Research Lab., Washington, DC.
Optical Fiber Sensors.
A. Dandridge, J. H. Cole, and G. H. Sigel. Oct 84, 6p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p49-54 1984.

Keywords: *Fiber optics, *Detectors, Interferometers, *Optical fibers.

Recently, many types of sensors using optical fibers, either as the transduction element or as a communication link to an optical sensor, have been developed. These devices range from simple on/off types of device to highly sensitive interferometric designs. The wide range of these devices means there is no one type of fiber to fill the requirements of fiber sensors. In this paper, the authors describe the various types of fiber optic sensors, however, the emphasis will be on the properties of the fiber used in the snesors, rather than the source, demodulation or systems aspects.

713,556
PB85-114825
(Order as PB85-114700, PC **E07**/MF **E01**)
Rhode Island Univ., Kingston. Dept. of Physics.
Phase Velocity and Loss Coefficient of Optical Fibers Viewed as Stiff Strings.
F. W. Cuomo. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p55-58 1984.

Keywords: *Fiber optics, *Phase velocity, Modulus of elasticity, Vibration, Losses, *Optical fibers.

The standing wave method has been widely used in the determinatin of the damping properties of viscoelastic solids in the 100-10,000 Hz range, and loss coefficients have been obtained either by the experimental observation of the decay modulus or the half-power bandwidth of each resonant peak. This paper investigates by this method the behavior of optical fibers to mechanical vibrations. It is found that for plastic clad fibers the phase velocities are largely dependent on the tension and mass density while for other fibers tested the system behaves as a stiff string whereby the modulus of elasticity takes on a more pronounced role. Experimental data are presented to illustrate the differences in loss factors and phase velocities for several optical fiber configurations.

713,557
PB85-114833
(Order as PB85-114700, PC **E07**/MF **E01**)
Bell Labs., Norcross, GA.
Polarization Shuttle Pulse Technique.
C. S. Brown, and F. T. Stone. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p59-62 1984.

Keywords: *Fiber optics, *Birefringence, Polarization(Waves), Optical measurement, *Polarization shuttle pulse technique, *Optical fibers.

To satisfy the many applications of single-mode fibers, both high-and low-briefringence fibers are being developed, and the need for practical and repeatable measurement techniques to characterize the polarization properties of such fibers is increasing. Several briefringence-measurement techniques are currently in use; however, only a few can measure low briefringence. The most popular, the cut-back method, is destructive and exhibits poor repeatability. In this paper, the authors report on a new technique, the polarization shuttle pulse (PSP) method, for measuring briefringence and related polarization effects in low briefringence (i.e., delta beta = 3.6 degree/m to 360 degree/m) single-mode fibers of short lengths (20 to 100 cm).

713,558
PB85-114841
(Order as PB85-114700, PC **E07**/MF **E01**)
Southampton Univ. (England). Dept. of Electronics.
New Technique for the Measurement of Axial-Stress in Optical-Fibre Preforms.
M. P. Varnham, S. B. Poole, and D. N. Payne. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p63-66 1984.

Keywords: *Fiber optics, *Stresses, Thermal stresses, Measurement, *Optical fibers.

The ability to measure the axial stress in optical-fiber preforms is essential for the development of highly-birefringent and other specialist fibers, in which high levels of thermal stress are deliberately introduced to modify the fiber propagation characteristics. In this paper the authors present a new method for measuring the axial stress profile which should see widespread adoption as a result of its simplicity and convenience. The method has the advantage that it uses the same hardware and software that are commonly used in transverse refractive-index profiling and it is therefore readily incorporated into existing equipment. The technique can also in principle be applied to two-dimensional stress profiling of asymmetric preforms. In addition, the work provides a new insight into how thermal stresses affect fibre refractive-index profiling techniques.

713,559
PB85-114866
(Order as PB85-114700, PC **E07**/MF **E01**)
Bell Labs., Norcross, GA.
Systematic Approach to Specifying Multimode Fiber Manufacturing Tolerances.
D. W. Peckham, S. C. Mettler, and R. B. Kummer. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p73-76 1984.

Keywords: *Fiber optics, *Splices, Manufacturing, Losses, Tolerances(Mechanics), *Optical fibers, Intrinsic quality factors.

A systematic approach to fiber parameter specification which includes the effects on splice loss of parameter deviations has been presented. An example has been presented which illustrates the possible improvements in splice loss performance and yield obtainable with this approach.

713,560
PB85-114882
(Order as PB85-114700, PC **E07**/MF **E01**)
Siecor Optical Cable, Hickory, NC.

Automated Differential Fiber Strain Measurement System for Single and Multimode Fiber.
K. H. Hafemeister, T. A. Clarke, and E. J. Buonopane. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p81-84 1984.

Keywords: *Fiber optics, *Strain measurement, Loads(Forces), Optical measurement, *Optical fibers, Fiber optics transmission lines, Multimode.

This paper describes a fiber strain measurement system that can, as one option, measure the load level at which the fibers in the cable first see strain, thus ensuring the parameters of the cable design are met. This system also determines the amount of strain seen on a fiber at any stress situation and can evaluate the amount of residual strain cabled fibers see after tensile load is released.

713,561
PB85-114908
(Order as PB85-114700, PC **E07**/MF **E01**)
York Technology Ltd., Chandler's Ford (England).
Advances in Optical Time-Domain Reflectometry.
A. H. Hartog. Oct 84, 6p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p89-94 1984.

Keywords: *Fiber optics, Optical communication, Attenuation, Losses, Near infrared radiation, *Optical time domain reflectometry, *Optical fibers.

The following topics are discussed: Performance criteria in OTDR; Operation at long wavelength and with single-mode fibers; Long-range single mode OTDR at 1300 nm.

713,562
PB85-114916
(Order as PB85-114700, PC **E07**/MF **E01**)
Laboratoires de Marcoussis - Centre de Recherches (France).
1.3 Micrometer Portable Reflectometer for the Field Test of Single-Mode Fiber Cables.
J. J. Bernard, E. Depresles, L . Jeunhomme, J. L. Moncelet, and M. Carratt. Oct 84, 4p
Prepared in cooperation with Compagnie Lyonnaise de Transmissions Optiques (France).
Included in Technical Digest - Symposium on Optical Fiber Measurements, p95-98 1984.

Keywords: *Reflectometers, *Fiber optics, Optical measurement, Near infrared radiation, Portable equipment, Backscattering, Attenuation, *Optical time domain reflectometers, *Optical fibers.

The growth of single-mode optical fiber transmission systems at 1.3 micrometers requires test instruments for field use, specially designed for attenuation measurements, splices control, detection and localization of possible breaks. The authors describe in this paper a new portable optical time-domain reflectometer using the correlation technique designed for the field test of single-mode fiber codes. This device, presently being developed, shows a 15 dB one-way dyanamic range together with a 10 m ultimate spatial resolution.

713,563
PB85-114940
(Order as PB85-114700, PC **E07**/MF **E01**)
Helsinki Univ. of Technology, Espoo (Finland).
Elimination of the Influence of Q-Switched-Mode-Locked Laser Jitter in Sampled Time-Domain Measurements.
E. J. R. Hubach, A. B. Sharma, and S. J. Halme. Oct 84, 4p
Prepared in cooperation with Tampere Univ. of Technology (Finland). Lab. of Electronics.
Included in Technical Digest - Symposium on Optical Fiber Measurements, p107-110 1984.

Keywords: *Fiber optics, Crystal oscillators, Vibration, *Optical fibers, Mode locked lasers, YAG lasers.

In this paper, the authors draw attention to the influence of the sub-harmonic content of crystal oscillators upon the jitter performance of an important source for fiber measurements. It is shown that the effect is predominantly systematic and can be easily eliminated by judicial choice of the division ratio between mode-lock and Q-switch frequencies. The validity of the arguments is apparent from the jitter value of 5 ps RMS in their system, in contrast to their previous effective value of 100 ps.

713,564
PB85-114957
(Order as PB85-114700, PC **E07**/MF **E01**)
ITT Electro-Optics Div., Roanoke, VA.
Accurate Specification of Single-Mode Dispersion Measurements.
F. P. Kapron, and T. C. Olson. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p111-114 1984.

Keywords: *Fiber optics, *Optical dispersion, Near infrared radiation, Measurement, *Optical fibers.

Fiber chromatic dispersion is usually specified in terms of a maximum absolute value over a particular wavelength range. However, a maximum + or - 3.5 ps/km-nm between 1280 and 1340 nm, for example, is a worst-case estimate that ignores the better fiber performance attainable over much of the wavelength window. High bitrate single-mode systems will require a more flexible and precise specification, such as proposed in this paper, that does not stress manufacturing measurement time or yield.

713,565
PB85-114965
(Order as PB85-114700, PC **E07**/MF **E01**)
Corning Glass Works, NY.
Multiple-Wavelength System for Characterizing Dispersion in Single-Mode Optical Fibers.
R. A. Modavis, and W. F. Love. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p115-118 1984.

Keywords: *Fiber optics, *Optical dispersion, Near infrared radiation, Optical measurement, *Optical fibers.

It is important to be able to characterize chromatic dispersion in single-mode fibers for purposes of quality control and process feedback. The measurement system should be simple to use and maintain, yet contain sufficient accuracy and precision to satisfy transmission system design considerations. This paper discusses such a system which uses a 5-wavelength method and compares the measurement results with those obtained using a fiber Raman laser. Algorithms have been developed which extend the capability from step-index profile fiber designs previously considered to newer and more complex designs which sift and flatten the chromatic dispersion.

713,566
PB85-114981
(Order as PB85-114700, PC **E07**/MF **E01**)
Bell Labs., Norcross, GA.
Precision Interferometric Measurement of Dispersion in Short Single Mode Fibers.
M. J. Saunders, and W. B. Gardner. Oct 84, 4p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p123-126 1984.

Keywords: *Fiber optics, *Optical dispersion, Near infrared radiation, Optical measurement, Interferometers, Precision, *Optical fibers.

Disadvantages of the conventional pulse delay method for measuring single mode fiber dispersion are the high cost of the equipment, the requirement for long (about km) lengths of fiber, and the eye hazard due to the high laser power levels. To overcome these disadvantages, interferometric methods for measuring dispersion in fibers using both the Michelson and Mach-Zehnder arrangements have been devised. The authors have used a 100 watt quartz halogen source, a monochromator, and a Mach-Zehnder intererometer with a motor-driven delay line to measure dispersion in fibers as short as 8.6 cm. This test set produces high visibility interference fringes at wavelengths up to 1.7 micrometers without the use of a reference fiber.

713,567
PB85-114999
(Order as PB85-114700, PC **E07**/MF **E01**)
Helsinki Univ. of Technology, Espoo (Finland).
Interferometric Dispersion Measurement in Single-Mode Fibers with a Numerical Method to Extract the Group Delays from the Measured Visibility Curves.
L. Oksanen, and S. J. Halme. Oct 84, 8p
Included in Technical Digest - Symposium on Optical Fiber Measurements, p127-134 1984.

Keywords: *Fiber optics, *Optical dispersion, Optical measurement, Interferometers, Automation, *Optical fibers.

In research and manufacture it is often desirable to be able to measure dispersion from a short piece, say a few meters, of the fiber. This can be done conveniently with the interferometric group delay measurement method, which gives the total dispersion of the fiber. The authors report on a simple numerical method to extract the group delays from the measured visibility curves. This method eliminates human bias and error inherent in visual inspection of the curves, enhances resolution, and facilitates automation of the measurement procedure.

713,568
PB85-115509 Not available NTIS
National Bureau of Standards, Washington, DC.
Current Status of NBS (National Bureau of Standards) Low-Power Laser Energy Measurement.
Final rept.
E. D. West, and W. E. Case. 1974, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement, v23 n4 p422-425 Dec 74.

Keywords: *Power measurement, Laser beams, Heat measurement, Calorimeters, Calibrating, Radiometry, Reprints, *Laser radiation, *Calorimetry.

A set of four electrically calibrated calorimeters is used at the Boulder Laboratories of the National Bureau of Standards to test and calibrate devices for measuring laser powers in the range 100 W to 1 W and energies in the range 0.03 to 10 J. Each of these calorimeters is separately subjected to an analysis of errors. For each experiment time-temperature data are analyzed by a conventional calorimetric method based on the first law of thermodynamics. This method evaluates the energy stored in the calorimeter and the heat exchanged with the surroundings in order to arrive at the energy from the laser. The four calorimeters have been intercompared using an argon laser beam at 514.5 nm wavelength. The intercomparison will reveal systematic differences between calorimeters and serves as a check on the estimates of the limits of systematic error.

713,569
PB85-115673 Not available NTIS
National Bureau of Standards, Washington, DC.
Inverse-Fourth Apparatus for Photometric Calibrations.
Final rept.
D. A. Swyt, and J. G. LaRock. 1978, 7p
Pub. in Review of Scientific Instruments 49, n8 p1083-1089 Aug 78.

Keywords: *Photometry, *Calibrating, Photometers, Performance, Optical measurement, Light transmission, Reprints.

A new photometric device is described which can perform direct, as opposed to comparison, measurements of optical transmittance, without bootstrapping, over a range of nearly six orders of magnitude. Operated with a 1000 W tungsten-halogen lamp as a source, a photomultiplier as a detector, and either an integrating sphere or opal glass for diffuse collection at the detection plane, the system is designed to attain an overall accuracy of + or - 0.5% for ANSI PH2.19 diffuse transmission densities up to 6.0 density units, corresponding to + or - 0.1% for transmittances above 0.5000 transmittance units and to + or - 3% for transmittances between 0.000001 and 0.0001 transmittance units.

713,570
PB85-118297 Not available NTIS
National Bureau of Standards, Washington, DC.
Vacuum Ultraviolet Spectral-Irradiance Calibrations: Method and Applications.
Final rept.
W. R. Ott, J. M. Bridges, and J. Z. Klose. 1980, 3p
Pub. in Optics Letters 5, n6 p225-227 1980.

Keywords: *Far ultraviolet radiation, *Irradiance, *Standards, *Calibrating, Reprints, Light sources.

A method to determine the spectral irradiance of a radiation source in the vacuum ultraviolet through the use of a spectral radiance standard is described. The method has been applied, and the spectral irradiances of several different light sources have been measured on an absolute scale. Evidence for the reliability of the method is obtained by comparing the spectral irradiance calibrations in the near ultraviolet with those

based upon a straightforward calibration using a tungsten quartz-halogen spectral irradiance standard.

713,571
PB85-118438 Not available NTIS
National Bureau of Standards, Washington, DC.
Compact Static Wavelength Meter for Both Pulsed and CW Lasers.
Final rept.
J. J. Snyder. 1978, 5p
Pub. in Soviet Jnl. of Quantum Electronics 8, n8 p959-960 Aug 78.

Keywords: *Wavelengths, *Optical interferometers, Optical measurement, Reprints, *Laser radiation, Laser interferometry, Computer applications.

The author's Wavelength Meter is a self-contained instrument that measures the wavelength of radiation produced by lasers or other pulsed or cw sources of monochromatic light. The instrument is based on a Fizeau or 'optical wedge' interferometer. The fringe pattern produced by the interferometer is digitized and stored in a small computer which converts the fringe pattern into the wavelength (in the desired units) of the interfering light.

713,572
PB85-118446 Not available NTIS
National Bureau of Standards, Washington, DC.
Tomographic and Analog 3-D Simulations Using NORA (Non-Overlapping Redundant Array).
Final rept.
L. I. Yin, M. J. Bielefeld, S. M. Seltzer, and J. I. Trombka. 15 Jul 84, 3p
Pub. in Applied Optics 23, n14 p2239-2241, 15 Jul 84.

Keywords: Computerized simulation, X rays, Analog systems, Reprints, *Tomography, Image reconstruction, Imaging techniques, Three dimensional.

The authors have demonstrated, with computer simulation, that it is possible to use NORA to reconstruct and view extended x-ray objects with low photon statistics in 3-D, using spherical lenses, as well as to obtain complete tomographic information free of out-of-focus artifacts. The added capability of analog 3-D viewing may prove invaluable in the interpretation and selection of tomographic reconstructions.

713,573
PB85-124089 Not available NTIS
National Bureau of Standards, Washington, DC.
Dye Laser Frequency Stabilization Using Optical Resonators.
Final rept.
J. Hough, D. Hils, M. D. Rayman, M. Long-sheng, L. Hollberg, and J. I. Hall. 1984, 7p
Sponsored in part by Office of Naval Research, Arlington, VA., and National Science Foundation, Washington, DC.
Pub. in Applied Physics B 33, p179-185 1984.

Keywords: *Frequency stability, Line width, Heterodyning, Reprints, *Dye lasers, Optical resonators.

The authors describe a study, performed using heterodyne techniques, of the frequency fluctuations of two completely independent ring dye lasers locked to independent reference cavities. Single laser linewidths of less than 750 Hz were achieved, the principal limitation being residual vibrations from the noisy laboratory environment. With future design and environmental improvements, ultranarrow linewidths are expected, thus providing a useful tool for a great variety of high precision experiments.

713,574
PB85-128809 Not available NTIS
National Bureau of Standards, Washington, DC.
Critique of Tunable Infrared Lasers.
Final rept.
A. S. Pine. 1982, 9p
Pub. in Philosophical Transactions of the Royal Society of London, Series A: Mathematical and Physical Sciences 307, p481-489 1982.

Keywords: *Infrared lasers, Semiconductor lasers, Near infrared lasers, Reprints, *Tunable lasers, Raman lasers, Color center lasers, Nonlinear optics, Raman scattering.

The operating characteristics of tunable infrared semiconductor, spin-flip Raman, difference-frequency, color center and vibronic lasers are reviewed for application to spectroscopy at ultra-high resolution. Emphasis is placed on sub-Doppler molecular studies with these lasers.

713,575
PB85-130144
(Order as PB85-130078, PC **A99**/MF **A01**)
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Optical Frequency Standards: Progress and Applications.
J. L. Hall. 1984, 2p
Included in Precision Measurement and Fundamental Constants II, p43-44 1984.

Keywords: *Frequency standards, Reviews, *Visible radiation, Tunable lasers, Color center lasers, Dye lasers, Laser applications.

To reach spectral transitions of particular physical interest (e.g., H) or of special promise as standards (e.g., Ca at 657 nm) in general will require use of a broadly tuneable laser, typically using color center crystals or a flowing dye solution as the active medium. Comparable stabilization results with such tuneable lasers--especially dye lasers--is vastly more difficult than with gas lasers, although kilohertz linewidth dye lasers have just been reported. A technique suggested by Drever recently allowed achievement of sub-100 Hz dye laser linewidth.

713,576
PB85-130151
(Order as PB85-130078, PC **A99**/MF **A01**)
Max-Planck-Inst. fuer Quantenoptik, Garching (Germany, F.R.).
Measurement of Frequency Differences of Up to 170 GHz between Visible Laser Lines Using Metal-Insulator-Metal Point Contact Diodes.
H. U. Daniel, M. Steiner, and H. Walther. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p45-47 1984.

Keywords: *Frequency measurement, Microwave frequencies, Heterodyning, Laser radiation, MIM diodes, Krypton lasers, Dye lasers, Frequency difference.

Frequency differences of up to 170 GHz between the lines of a cw dye laser and a krypton laser at 568 nm were measured by mixing laser and microwave radiation in a metal-insulator-metal point contact diode. The beat signals exhibit good signal-to-noise ratio and no frequency 'roll-off' is observed when increasing the laser frequency difference from a few hundred MHz to 170 GHz. It follows that the point contact diode could be used at still much higher difference frequencies. Furthermore, these investigations show a diode response which is different at microwave and visible laser frequencies. Video detection experiments performed in the visible show the influence of thermal phenomena in the diode junction having a roll-off frequency of a few megahertz.

713,577
PB85-130169
(Order as PB85-130078, PC **A99**/MF **A01**)
Bonn Univ. (Germany, F.R.).
Precision Frequency Metrology for Lasers in the Visible and Application to Atomic Hydrogen.
B. Burghardt, H. Hoeffgen, G. Meisel, W. Reinert, and B. Vowinkel. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p49-51 1984.

Keywords: *Frequency measurement, Microwave frequencies, Photodiodes, *Laser radiation, Visible radiation, Frequency difference, Hydrogen atoms.

A multi-step method is discussed that permits the determination of frequency differences between lasers in the visible in cases where the beat frequency is too large for direct detection. A step width of 80 GHz is used; the beat signal is picked up with millimeter-wave GaAs photodiodes. The resulting beat signals can be measured without further smoothing using a frequency counter. The authors report on experiments with atomic hydrogen, applying the method to measure transition frequencies aiming to determine the Rydberg frequency and the electron/proton mass ratio with increased precision.

713,578
PB85-130177
(Order as PB85-130078, PC **A99**/MF **A01**)
National Research Lab. of Metrology, Sakura (Japan).
System for Light Velocity Measurement at NRLM (National Research Laboratory of Metrology).
K. Tanaka, T. Sakurai, N. Ito, T. Kurosawa, and A. Morinaga. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p53-56 1984.

Keywords: *Carbon dioxide lasers, *Frequency measurement, *Wavelengths, Frequency standards, Intermediate infrared radiation, *Light speed, Frequency difference, Infrared upconversion, Proustite, Water vapor lasers, Alcohol lasers.

A system for making an absolute measurement of the wavelength and frequency of a stabilized carbon-dioxide laser is under construction. The wavelength has been measured by an up-conversion technique using Proustite with reference to an iodine stabilized laser. For the frequency measurement, a water vapor laser and an optically pumped alcohol laser have been constructed. Tungsten-nickel and tungsten-cobalt point contact diodes with precision mounts as harmonic generators and mixers have been developed and used for evaluating the stability of the carbon-dioxide laser by beat frequency counting.

713,579
PB85-130185
(Order as PB85-130078, PC **A99**/MF **A01**)
National Physical Lab., Teddington (England). Div. of Mechanical and Optical Metrology.
Laser Wavelength Measurements and Standards for the Determination of Length.
W. R. C. Rowley. 1984, 8p
Included in Precision Measurement and Fundamental Constants II, p57-64 1984.

Keywords: *Wavelengths, *Length, *Standards, Optical interferometers, Laser radiation.

The light emitted by portable stabilized lasers used as wavelength standards for length and spectroscopic measurements is reproducible to at least three parts in 10 to the 11th power, and different wavelengths can be intercompared to this level of uncertainty by interferometry. Their absolute wavelength accuracy, limited at present to four parts in 10 to the 9th power by the (86)Kr standard of the meter, will be improved at least tenfold by a redefinition of the meter, based on the fixed value 299 792 458 m/s for the speed of light. Length measurements, however, are seldom more accurate than one part in 10 to the 7th power, except in lunar and interplanetary ranging; although changes in length can be measured to better than one part in 10 to the 14th power.

713,580
PB85-130193
(Order as PB85-130078, PC **A99**/MF **A01**)
Fizicheskii Inst., Moscow (USSR).
Double-Mode Method of Sub-Doppler Spectroscopy and Its Application in Laser Frequency Stabilization.
N. G. Basov, M. A. Gubin, V. V. Nikitin, A. V. Nikulchin, and V. N. Petrovskii. 1984, 4p
Prepared in cooperation with Institute of Physical Engineering, Moscow (USSR).
Included in Precision Measurement and Fundamental Constants II, p65-68 1984.

Keywords: *Frequency stability, Frequency standards, Helium neon lasers, Methane.

The authors present some results of the investigation of the proposed high sensitivity method of sub-Doppler spectroscopy and laser frequency stabilization which is based on the parameters of a double-mode (DM) gas laser containing an internal absorption cell. A short DM He-Ne/CH4 laser was constructed which has relative frequency stability better than 10 to the -14 power and radiation spectral width approx = or < 10 Hz. When a telescopic beam expander was used inside the cavity of the short DM He-Ne/CH4 laser, supernarrow reference spectral lines of about 3 kHz in width were obtained, and the magnetic hyperfine structure (hfs) of the (F sub 2, sup 2) methane line was resolved.

713,581
PB85-130201
(Order as PB85-130078, PC **A99**/MF **A01**)
Istituto di Metrologia Gustavo Colonnetti, Turin (Italy).

He-Ne ((127)I2) Lasers at 0.633 micrometer (and at 0.604 micrometer).
F. Bertinetto, B. I. Rebaglia, P. Cordiale, S. Fontana, and G. B. Picotto. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p69-72 1984.

Keywords: *Helium neon lasers, *Frequency standards, Frequency stability, Wavelengths, Visible radiation, Iodine 127.

Although iodine stabilized, 0.633 micrometer lasers are used as practical wavelength standards, no common agreement exists as to the operating conditions. It is shown that on the basis of such an agreement, reproducibility of + or - 20 kHz or (+ or - 4 x 10 to the -11th power) nu can be attained. This study proposes such conditions and shows that for reproducibility to exceed (10 to the -10th power) nu, certain cavity configurations must be discarded. Preliminary observations of strong absorption lines of iodine at the emission wavelength of 0.604 micrometer are also reported.

713,582
PB85-130219
(Order as PB85-130078, PC **A99**/MF **A01**)
Paris-11 Univ., Orsay (France).
Recent Work on 612 nm He-Ne Stabilized Lasers.
A. Brillet, P. Cerez, and C. N. Man-Pichot. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p73-76 1984.

Keywords: *Helium neon lasers, *Frequency standards, Absorption spectra, Visible radiation, Iodine 127.

The authors report on the metrological properties of 612 nm He-Ne lasers frequency stabilized on (127)I2 saturated absorption lines. They describe the new results of spectroscopic and metrological interest, obtained both with conventional internal cell devices and with the new technique using an external cell inside a Fabry-Peot resonator. A reproducibility of 6 x (10 to the -13th power) is obtained with this last technique.

713,583
PB85-130227
(Order as PB85-130078, PC **A99**/MF **A01**)
National Inst. of Metrology, Beijing (China).
Iodine and Methane Stabilized He-Ne Lasers as Wavelength Standards.
N. C. Shen, Y. X. Wu, Y. M. Sun, C. Y. Li, and X. B. Zhang. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p77-79 1984.

Keywords: *Frequency standards, *Helium neon lasers, Frequency stability, Wavelengths, Standards, Iodine, Methane, Reproducibility, Iodine 127.

The iodine and methane stabilized lasers designed by NIM and Peking University can be used as wavelength standards. The authors have compared the frequency differences of the lasers between NIM and BIPM in Paris in April 1980. The relative frequency differences are 2.9 x 10 to the -11th power for iodine and 6.3 x 10 to the -12th power for methane, respectively. When the laser power is given a fixed value, the frequency variation of the iodine stabilized laser can be very small. The power shift and standard power value are discussed in this paper.

713,584
PB85-130235
(Order as PB85-130078, PC **A99**/MF **A01**)
Conservatoire National des Arts et Metiers, Paris (France).
Spatial Coherence and Optical Wavelength Metrology.
P. Bouchareine. 1984, 2p
Included in Precision Measurement and Fundamental Constants II, p81-82 1984.

Keywords: *Optical interferometers, *Diffraction, Laser beams, Coherent radiation, Wavelengths, Length, Metrology, Correction, Visible radiation.

The influence on precise measurements of optical wavelengths of spatial coherence of laser beams, or of classical sources when the 'etendue' of the interferometer is reduced by isolating the central fringe at high path differences is discussed. The interferometric observation of the phase angle at a fixed path difference is currently made with an uncertainty less than 0.001 of a fringe. With spatially coherent illumination, phase shifts of this order can be given by scratches or dust particles, or by mirror aberrations, and cannot be compensated by subtracting two phase angles at two path differences. If the spatial coherence of a laser beam is destroyed, these errors vanish, but only if the etendue of the interferometer is large enough. At very high path differences allowed by the good temporal coherence of lasers, compensated field interferometers may be useful to eliminate these spurious shifts and the uncertainty in diffraction corrections.

713,585
PB85-140655 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Minimization of Volume and Astigmatism in White Cells for Use with Circular Sources and Apertures.
Final rept.
W. B. Olson. May 84, 6p
Pub. in Applied Optics 23, n10 p1580-1585, 15 May 84.

Keywords: Astigmatism, Apertures, Volume, Optimization, Reprints, *Imaging techniques.

Conditions are derived for minimum volume and astigmatism of White-type multiple reflection absorption cells, with multiple row and column image arrays, for the case of circular images and apertures.

713,586
PB85-140762 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Three Phase Excitation of a Hollow Cathode Laser.
Final rept.
R. D. Reid, G. J. Collins, and K. B. Persson. 1980, 2p
Pub. in Institute of Electrical and Electronics Engineers Jnl. of Quantum Electronics 16, n1 p3-4 Jan 80.

Keywords: *Lasers, Excitation, Direct current, Reprints, Helium copper lasers, Hollow cathodes, Three phase, Laser outputs.

A new hollow cathode discharge scheme using three phase electrical power at 60 Hz to generate excitation in a sputtered He-Cu laser has been demonstrated. The authors' results indicate that time independent laser output can be obtained from an ac power supply using overlapping excitation regions, each excited with a different electric phase. Two distinct hollow cathode designs are presented. One of these achieved a time independent or quasi-dc output power of 350 mW.

713,587
PB85-140994 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heterodyne Frequency Measurements and Frequency Calibration Standards for Tunable Diode Lasers.
Final rept.
J. S. Wells, F. R. Petersen, and A. G. Maki. 1983, 9p
Pub. in SPIE 438, p110-118 1983,

Keywords: *Frequency measurement, *Frequency standards, *Calibrating, Infrared radiation, Hydrogen bromide, Deuterium compounds, Reprints, *Tunable lasers.

New frequency calibration tables are required to keep abreast of the resolution attainable by currently available tunable lasers. One key to the generation of table with requisite accuracy involves accurate heterodyne frequency measurements, another key consists of reliable fitting and analysis. Coordinated activity in NBS involves selection of suitable molecular calibration candidates, their frequency measurement and analysis, and dissemination of the results in the form of frequency calibration tables. Current status of these efforts is described.

713,588
PB85-141026 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Wideband Frequency-Offset-Locked Dye Laser Spectrometer Using a Schottky Barrier Mixer.
Final rept.
J. C. Bergquist, and H. U. Daniel. 1 Jan 84, 7p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA. Prepared in cooperation with Max-Planck-Inst. fuer Quantenoptik, Garching, (Germany, F.R.).
Pub. in Optics Communications 48, n5 p327-333, 1 Jan 84.

Keywords: *Spectrometers, Crystal mixers, Broadband, Microwave frequencies, Reprints, *Laser spectrometers, Ring lasers, Dye lasers, Schottky diodes, Neon 20.

Precise frequency-controlled operation of a single mode ring dye laser with respect to another is reported at a frequency difference of 234 GHz. This extension of the technique of Laser frequency offset locking into the microwave range has been achieved by mixing the two laser lines with the harmonics of a suitable microwave frequency on a Schottky Barrier Mixer. The capability of this spectrometer was demonstrated by a frequency measurement of the transition singlet s (5) to doublet p (8) in (20)Ne with an uncertainty of 10 to the -9th power.

713,589
PB85-141034 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Simple, High Power, Nanosecond Pulse Nd:YAG Laser.
Final rept.
A. Charlton, and P. Ewart. Jun 84, 4p
Pub. in Optics Communications 50, n4 p241-244, 15 Jun 84.

Keywords: *Solid state lasers, *Lasers, Light pulses, Reprints, *YAG lasers, Neodymium lasers, Nanosecond pulses.

A relatively simple, Q-switched and self-injected oscillator is described which employs a passive forming network to produce single, one nanosecond duration laser pulses with nanosecond jitter times. Peak powers of 50 MW were obtained from the Nd:YAG system with 5% amplitude stability at 10 Hz repetition rates.

713,590
PB85-141562 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Standardizing Test Conditions for Characterizing Fibers.
Final rept.
D. L. Franzen, G. W. Day, and R. L. Gallawa. Aug 81, 3p
Pub. in Laser Focus, p103-105 Aug 81.

Keywords: *Fiber optics, Attenuation, Bandwidth, Tests, Reprints, *Optical fibers, Numerical aperture.

Standard launching conditions for the measurement of optical fiber attenuation, bandwidth, and numerical aperture are described. Usefulness of the launching conditions is demonstrated in an interlaboratory measurement comparison.

713,591
PB85-142180 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Linewidth Measurement by High-Pass Filtering - A New Look.
Final rept.
M. Young. 1 Jul 83, 4p
Pub. in Applied Optics 22, n13 p2022-2025, 1 Jul 83.

Keywords: *Line width, Measurement, Diffraction, Fourier transformation, Microscopy, Reprints, Optical processing, Spatial filtering.

Earlier workers have noticed that high-pass filtering produces a sharp dark line in precisely the location of the geometrical image of an edge. They proposed using this fact as an aid in measuring linewidth in microscopy but found that the other edge of the line caused significant error. In this paper, the author examines that error as a function of normalized linewidth and normalized spatial-filter width and finds that it may be limited to + or - 5% or so, provided that the spatial filter subtends between 0.25 and 0.3X the numerical aperture of the objective and that the linewidth exceeds about twice the resolution limit.

713,592
PB85-142198 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interlaboratory Measurement Comparison to Determine the Attenuation and Bandwidth of Graded-Index Optical Fibers.
Final rept.
D. L. Franzen, G. W. Day, B. L. Danielson, G. E. Chamberlain, and E. M. Kim. 15 Jul 81, 8p
Pub in Applied Optics 20, n4 p2412-2419, 15 Jul 1981.

Keywords: *Fiber optics, Attenuation, Bandwidth, Measurement, Comparison, Reprints, *Optical fibers.

An interlaboratory measurement comparison was conducted by the National Bureau of Standards in cooperation with the Electronic Industries Association. Par-

ticipants included NBS and nine optical fiber and cable manufacturers. Four graded-index fibers having lengths of 2,2,2, and 0.9 km were used. Measurements of attenuation at 850 nm, using both beam optics and mode filter approaches to achieve a restricted launch, gave one standard deviation spreads for an overall average of 0.23 dB/km. Best measurement agreement was obtained for a fiber having little differential mode attenuation. Measurements of -3-dB bandwidth from time domain acquired data at 90 nm gave an average one standard deviation spread of 12% with poorer agreement on the higher frequency portion of the frequency response.

713,593
PB85-142271 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Simulating the Scratch Standards for Optical Surfaces - Theory.
Final rept.
E. G. Johnson. Dec 83, 13p
Pub. in Jnl. of Applied Optics 22, n24 p4056-4068 Dec 83.

Keywords: *Optical equipment, *Surfaces, *Standards, Optical lenses, Light scattering, Simulation, Far field, Reprints, *Scratch standards.

The author shows how to simulate the scattering generated by a scratch on the surface of high-quality optics and their elements. This is accomplished by first describing how the present cosmetic scratch standards tend to be used in the optics industry. Second, the author derives from first principles, using the scalar model for electromagnetic radiation, the first-order scattering coefficients for the far-field radiation due to a particular scratch pattern. There are approximations made to get these coefficients. The results allow construction of a set of secondary scratch standards. These are a pattern of rectangular grooves that can be made precisely reproducible during the manufacturing phase. Appropriate selection from this set can provide the same range of scattering power and character as is present in the current scratch standards, which are not easily reproducible. Because the method for construction of these new secondary standards is nonrandom, to guarantee the reproducible construction between these standards it is necessary to restrict the observation range 5-10 degrees from the direct beam.

713,594
PB85-143667 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Water-Cooled 2 kW Calorimeter for Laser Power Measurement.
Final rept.
P. A. Simpson, and R. W. Zimmerer. 1981, 3p
Pub. in Proceedings of the Technical Program - Electro-Optics/Laser 81, Conference and Exposition, Anaheim, CA., November 17-19, 1981, p237-239.

Keywords: *Calorimeters, *Power measurement, *Carbon dioxide lasers, Calibrating, *Laser radiation, *High power lasers.

To meet the growing need for reliable monitoring of industrial high power CO2 lasers, a calorimeter was designed to be both easily used, reliable, and accurate. A maximum continuous power input of 2 kilowatts was specified in order to handle commonly used CO2 lasers. Two different measurement methods are discussed. First results indicate a sensitivity of 7.8 W/mV. The 1/e response time is approximately 6 seconds.

713,595
PB85-144392 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Single Axis Photoelectronic Autocollimator.
Final rept.
G. G. Luther, R. D. Deslattes, and W. R. Towler. May 84, 4p
Prepared in cooperation with Virginia Univ., Charlottesville. Dept. of Nuclear Engineering and Engineering Physics.
Pub. in Review of Scientific Instruments 55, n5 p747-750 May 84.

Keywords: *Collimators, Resolution, Performance, Design, Reprints.

Several single axis, diffraction limited, monolithic autocollimators, capable of resolving less than 0.001 arc s have been designed and built. Their features include small size, lightweight, ruggedness, and ease of operation. Construction features and performance levels are given.

713,596
PB85-144467 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Refractive Properties of Magnesium Fluoride.
Final rept.
M. J. Dodge. 15 Jun 84, 6p
Pub. in Applied Optics 23, n12 p1980-1985, 15 Jun 84.

Keywords: *Magnesium fluorides, Optical materials, Single crystals, Optical measurement, Polarization(Waves), Birefringence, Infrared radiation, Ultraviolet radiation, Reprints, *Refractive index, Dispersion, Visible radiation.

The refractive indexes of a commercially available specimen of single crystal MgF2 were determined for both the ordinary and extraordinary rays at selected wavelengths from 0.2026 to 7.04 micrometers. Measurements were made by means of the minimum-deviation method on a precision spectrometer near 19C. The experimentally determined index values for each polarization were fitted to a three-term Sellmeier-type dispersion equation. The birefringence was computed as a function of wavelength from the calculated index values obtained for the two polarizations. The dispersion coefficients were also determined for the O-ray and for the birefringence. The results of this study are compared with previously reported work on the refractive properties of MgF2.

713,597
PB85-144921 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Intercomparison between Silicon and Blackbody Based Radiometry Using a Silicon Photodiode/Filter Radiometer.
Final rept.
A. R. Schaefer, and R. D. Saunders. 15 Jun 84, 3p
Sponsored by National Research Council of Canada, Ottawa (Ontario).
Pub. in Applied Optics 23, n14 p2224-2226, 15 Jul 84.

Keywords: *Radiometry, *Radiometers, Blackbody radiation, Calibrating, Irradiance, Comparison, Silicon, Reprints, Storage rings, Intercomparison.

A radiometer composed of a silicon photodiode, interference filter, and integrating sphere was characterized and calibrated against an absolute silicon detector standard at 600 nm using a CW dye laser. This radiometer was then used to measure the irradiance at 600 nm from spectral irradiance lamps calibrated against a gold point blackbody, and also the irradiance from the NBS electron storage ring, SURF II. These results were intercompared with those independently derived from the other two sources, with overall agreement of better than one percent. Various aspects of the measurements are discussed.

713,598
PB85-145415 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Frequency Stability and Stabilization of a Chemical Laser.
Final rept.
J. Munch, M. A. Kolpin, and J. Levine. 1978, 6p
Pub. in IEEE Jnl. of Quantum Electronics 14, n1 p17-22 Jan 78.

Keywords: *Chemical lasers, *Frequency stability, Stabilization, Reprints, *Hydrogen fluoride lasers, *Deuterium fluoride lasers.

The authors have built a low-power CW HF/DF chemical laser, designed to achieve high-frequency stability. Measurements are reported which characterize the instantaneous spectral width of the laser output to less than one part in 10 to the 11th power (delta nu < 1 kHz) and the variations in absolute frequency of this emission with time to four parts in 10 to the 10th power (delta nu + or - 20 kHz) per 0.1 ms. Two experiments to actively stabilize the laser frequency are reported. In one experiment the laser was locked to a high-finesse Fabry-Perot to five parts in 10 to the 9th power (delta nu = + or - 250 kHz) for many minutes. In the other experiment, one laser was locked to another using heterodyne beat spectroscopy to 1.7 parts in 10 to the 9th power (delta nu = + or - 85 kHz). The stabilization experiments were limited by the feedback loops used.

713,599
PB85-145472 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Two-Photon Absorption from a Phase Diffusing Laser Field.
Final rept.
D. S. Elliott, M. W. Hamilton, K. Arnett, and S. J. Smith. Jul 84, 3p
Pub. in Physical Review Letters 53, n5 p439-441 Jul 84.

Keywords: Line width, Reprints, *Two photon absorption, Nonlinear optics, Laser radiation.

The authors report on the first quantitative measurements of the effect of a phase diffusing laser field on a nonlinear optical interaction. Using a nearly Lorentzian laser power spectrum, they have measured the spectral line width of an unsaturated two-photon absorption process. They found that the measured width scales as four times the laser width, in agreement with the theoretical predictions of Mollow.

713,600
PB85-148518 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Computer-Controlled System for Calibrating Detectors of TEA Laser Pulses.
Final rept.
P. A. Simpson. May 84, 11p
Pub. in Proceedings of Automatic RF Techniques Group (ARFTG) Fall 1983 Digest (22nd), Albuquerque, NM., November 3-4, 1983, p25-36 May 84.

Keywords: *Infrared detectors, *Optical detection, *Calibrating, Automation, *TEA lasers, Pulsed lasers, Computerized control systems, Laser radiation.

A computer-controlled system for calibrating detectors of TEA laser pulses is described. The types of detectors calibrated can be either energy detectors or waveform detectors. The operator inputs to the computer certain information pertinent to the measurements and the computer controls the run thereafter. Results are displayed on the screen, printed as hardcopy, and stored on cassette tape.

713,601
PB85-170611 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Absolute Spectral Irradiance Measurements Based on the Predicted Quantum Efficiency of a Silicon Photodiode.
Final rept.
E. F. Zalewski, and W. K. Gladden. 1984, 8p
Pub. in Optica Pura Y Aplicada 17, n2 p133-140 1984.

Keywords: *Irradiance, Optical measurement, Spectroradiometers, Photodiodes, Quantum efficiency, Silicon, Helium neon lasers, Reprints, Laser applications.

The spectral irradiance of an incandescent lamp was measured with a grating spectroradiometer that was calibrated at 632.8 nm with a HeNe laser and an absolute detector. The absolute detector was a silicon photodiode whose response was determined by the predictable quantum efficiency (also known as self-calibration technique). These results were compared to the spectral irradiance values obtained by calibrating the lamp relative to a black-body source traceable to the freezing point of gold. The ratio of the black-body based irradiance to detector based irradiance was found to be 1.0075 within a combined uncertainty of + or - 1.12%.

713,602
PB85-183507 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photodiode Quantum Efficiency Enhancement at 365 nm: Optical and Electrical.
Final rept.
R. L. Booker, and J. Geist. 1982, 3p
Pub. in Applied Optics 21, n22 p3987-3989 1982.

Keywords: *Photodiodes, *Quantum efficiency, Near ultraviolet radiation, Oxides, Silicon, Reprints.

Prolonged exposure of oxide-p(+)-n-n(+) silicon photodiodes to ultraviolet radiation increases their quantum efficiency. The cause of this effect is shown to be the storage of photogenerated negative charge at the front surface of the oxide.

713,603
PB85-184828 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Comment on Representation of Vector Electromagnetic Beams.
Final rept.
L. W. Davis, and G. Patsakos. 1982, 2p
Pub. in Physical Review A 26, n6 p3702-3703 Dec 82.

Keywords: *Laser beams, Reprints, Whittaker potentials.

The omission of a class of beam modes by Pattanayak and Agrawal is rectified, and the relationship of the representation of electromagnetic beams used by them to that used by the present authors is clarified.

713,604
PB85-187557 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Modulation Transfer Function for Two-Point and Periodic Objects Using Gaussian and Lorentzian Resolution Functions.
Interim rept.
R. A. Schrack. Jun 84, 35p NBSIR-84/2893
Sponsored by Department of Energy, Washington, DC.

Keywords: *Resolution, Neutron radiography, Normal density functions, *Modulation transfer functions, Imaging techniques, One dimensional.

This paper presents an analytical study of the effect of Gaussian- and Lorentzian-shaped line spread functions in non-coherent noise-free imaging systems. A mathematic development is given for the calculation of the Modulation Transfer Function (MTF). This technique is used to calculate the MTF for two-point and periodic objects using Gaussian and Lorentzian resolution functions. Figures and graphs are used to illustrate the comparison of the results. Relationships between the results obtained are developed that are useful in the interpretation of experiments used to determine the resolution of experimental systems. The development covers only noise-free, incoherent, one-dimensional systems.

713,605
PB85-189355 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Configuration Interaction in Multiphoton Ionization.
Final rept.
P. Zoller, E. Matthias, and S. J. Smith. 1984, 9p
Grants NSF-PHY82-00805, NSF-INT81-20128
Pub. in Proceedings of NATO Summer School in Quantum Electrodynamics and Quantum Optics, Boulder, CO, May 26-June 8, 1983, p313-321 1984.

Keywords: *Photoelectrons, Angular distribution, Ionization, *Barium atoms, *Configuration interaction, *Multiphoton ionization.

The application of multichannel quantum-defect theory (MQDT) to interpretation of recent photoelectron angular distribution measurements obtained in this laboratory by resonant multiphoton excitation and ionization of atomic barium, is discussed. The pronounced effect of a doubly excited (5d7d) state acting to perturb the singly excited 6snd Rydberg series makes these angular distributions and their interpretation particularly significant.

713,606
PB85-194736 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Redefining the Scratch Standards.
M. Young, and E. G. Johnson. Feb 85, 28p NBS/TN-1080
Sponsored by Army Armament Research and Development Command, Dover, NJ. Also available from Supt. of Docs as SN003-003-02635-2.

Keywords: *Optical measurement, *Standards, *Surfaces, Diffraction, Gratings(Spectra), Surface properties, *Scratch standards, MIL standards.

The scratch standard (MIL-0-13830A) is a cosmetic standard that is effected by a visual comparison with a set of submasters that are in turn evaluated by comparison with a set of master standards. Both manufacture and certification of the submasters are somewhat unreliable. In this paper, the authors show that the submasters can be classified according to the relative power scattered at a relatively small angle. They have designed etched gratings with which to replace the submasters; these gratings have the appearance of scratches but diffract a broad peak between 5 and 10 degrees off the axis of the incident beam. The authors have classified some prototypes both by comparison with the master standards and by a photoelectric measurement; agreement between the two methods is good. The authors suggest that such gratings be used as the submasters and possibly that they be classified by a photoelectric rather than visual measurement.

713,607
PB85-195303 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Self-Study Manual on Optical Radiation Measurements. Part 1. Concepts. Chapter 12. Blackbodies, Blackbody Radiation, and Temperature Scales.
Technical rept.
J. C. Richmond, and F. E. Nicodemus. Apr 85, 49p NBS/TN-910-8
See also PB84-218346. Also available from Supt. of Docs as SN003-003-02647-6.

Keywords: *Optical measurement, *Radiometry, *Blackbody radiation, *Temperature, *Thermal radiation, Temperature measurement, Manuals, Fundamental constants, Thermodynamics, Plancks constants, Stefan-Boltzmann equation.

This is the eighth in a series of Technical Notes (910-) entitled 'Self-Study Manual on Optical Radiation Measurements'. It contains Chapter 12 of Part I of this Manual. Additional chapters will continue to be published, similarly, as they are completed. The Manual is a comprehensive tutorial treatment of the measurement of optical radiation that is complete enough for self-instruction. Detailed chapter summaries make it also a convenient authoritative reference source. In this chapter, the authors review the radiometric treatment, and the significance for radiometric measurements, of blackbodies, blackbody radiation, and temperature scales. Many important and interesting aspects are not treated because the authors primary interest is in radiometry and radiometric measurements. The emphasis is on ideal blackbodies and laboratory simulators; thermal radiation from other real sources will be treated in a chapter on Thermal Radiation Properties of Materials.

713,608
PB85-195923 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
What is Dynamic Dispersion.
Final rept.
J. Reader. 1981, 2p
Pub. in Applied Optics 20, n13 p2171-2172, 1 Jul 81.

Keywords: *Optical dispersion, Gratings(Spectra), Reprints, *Dynamic dispersion, *Dispersion.

It is shown that the quantity dynamic dispersion, introduced by Lockwood in 1973, does not differ from ordinary dispersion.

713,609
PB85-195980 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radiometry Using Synchrotron Radiation.
Final rept.
E. B. Saloman, S. C. Ebner, and L. R. Hughey. 1981, 8p
Sponsored by SPIE-The International Society for Optical Engineering, Bellingham, WA.
Pub. in Proceedings of the SPIE 279, Ultraviolet Vacuum Ultraviolet Systems, Washington, DC., April 21-22, 1981, p76-83.

Keywords: *Synchrotron radiation, *Ultraviolet radiation, *Radiometry, *Calibrating, X rays, Storage rings, Uncertainty.

Synchrotron radiation is a source of continuum radiation ranging from the x-ray or soft x-ray region (depending on machine energy) to beyond the visible region. The amount of radiation emitted is a calculable function of machine operating parameters. This makes it possible to use synchrotron radiation from electron synchrotrons and electron storage rings as an absolute source particularly in the VUV and soft x-ray regions where other standards are difficult to find. At the National Bureau of Standards (NBS) an electron storage ring (SURF-II) has been used to calibrate spectrometers and photometers used in solar and aeronomy research and in fusion plasma diagnostics. A large chamber has recently been completed to facilitate such calibrations. The radiation incident on these spectrometers can be calculated to uncertainties of 3%. A technique to exactly determine the number of electrons orbiting in the ring is currently being developed to reduce this uncertainty.

713,610
PB85-196012 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optical Bistability Experiments and Mean Field Theories.
Final rept.
W. J. Sandle, R. J. Ballagh, and A. Gallagher. 1981, 16p
Pub. in Proceedings of International Conference on Optical Bistability, Ashville, NC., June 3-5, 1980, p93-108 1981.

Keywords: Optics, *Optical bistability, Laser radiation.

Theories of optical bistability have largely been concerned with idealized two-state absorbers in optical cavities, but experiments must contend with the properties of real atoms. The main purpose of this paper is to present experimental evidence for optical bistability taken under conditions where real atomic behavior can be closely represented by the two-state model, so that tests of mean field theories of OB are possible. An important feature of the work is the use of high optical intensities obtained with a near-concentric focussing cavity.

713,611
PB85-200186 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Transient Analysis of Electromagnetic Reflection from Dispersive Materials.
A. G. Lieberman. Mar 85, 73p NBS/TN-1202
Also available from Supt. of Docs as SN003-003-02651-4.

Keywords: *Light pulses, Plane waves, Polarization(Waves), Greens function, Surfaces, *Electromagnetic wave reflections, Laser radiation, Drude model, Transients, Dispersion, Femtosecond pulses.

Theoretical expressions are presented describing the transient and steady-state temporal evolution of an impulsive, TE-polarized, plane wave reflected into vacuum from any of a variety of frequency-dispersive material surfaces. Polar dielectrics, non-polar dielectrics, metals and plasmas are treated using, respectively, the Debye, Lorentz, and Drude material models to investigate the effects of dispersion upon dimensional measurements performed with optical pulses of extremely short duration. The more general problem, concerning the reflection of an optical pulse of any specified waveform, is resolved by performing a convolution of the incident wave at the material surface with the previously determined reflection of an impulsive wave.

713,612
PB85-201507 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Heterochromatic Stray Light in UV Absorption Spectrometry: A New Test Method.
Final rept.
K. D. Mielenz, V. R. Weidner, and R. W. Burke. 1982, 3p
Pub. in Applied Optics 21, n18 p3354-3356, 15 Sep 82.

Keywords: *Spectrophotometers, *Ultraviolet spectrophotometers, Estimating, Reprints, Stray light, Test methods.

A new method of estimating the amount of heterochromatic stray light in UV spectrophotometers is described. The method uses the same solution filters with sharp UV absorption edges as ASTM Test Method E387, but one measures the apparent absorbance of a 10-mm pathlength cell in the sample beam relative to a 5-mm cell in the reference beam. Scanning towards shorter wavelengths, one records an apparent absorbance maximum which is a direct measure of the stray light. This method was found to be in satisfactory agreement with the ASTM method in comparative tests of several spectrophotometers at different wavelengths between 200 and 390 nm, using KCl, KI, NaI, acetone, and $NaNO_2$ solution filters. The new method proved to be simpler, the main advantage being that the apparent absorbance maximum occurs at considerably lower scale values than the corresponding absorbance plateau measured by the ASTM method. This reduces the need for successive attenuations of the reference beam every time the spectrophotometer runs off scale. In many instances the new method required no attenuation at all.

713,613
PB85-201820 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Single-Shot Spectral Measurements and Mode Correlations in a Multimode Pulsed Dye Laser.
Final rept.
W. A. Westling, M. G. Raymer, and J. J. Snyder. Apr 84, 5p
Contract DE-AC02-ER10797
Pub. in Jnl. of the Optical Society of America B 1, n2 p150-154 Apr 84.

Keywords: *Light pulses, Correlations, Intensity, Reprints, Dye lasers, Pulsed lasers, Hole burning, Multimode.

Statistical cross correlations between mode intensities in individual pulses from a multimode dye laser have been studied using a Fizeau interferometer and a high resolution linear photodiode array. It was found that positive intensity cross correlations develop between modes separated by certain characteristic frequencies. This appears to be a result of spatial hole burning in the standing-wave cavity. The gain competition between certain modes is minimized due to the spatial inhomogeneity of the mode intensity distributions in the gain medium.

713,614
PB85-202802 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Calorimeter for Measuring 1-15 kJ Laser Pulses.
Final rept.
P. A. Simpson, and E. G. Johnson. 1984, 4p
Pub. in Proceedings of SPIE - Optical Radiation Measurements, San Diego, CA., August 21-22 1984, p121-124.

Keywords: *Calorimeters, *Power measurement, Laser beams, *Laser radiation, Pulsed lasers.

Two calorimeters for measuring high peak power laser pulses have been constructed by the NBS and delivered to the Newark Air Force Station, Newark, Ohio. These calorimeters are designed to measure pulses having intensities great enough to damage the volume absorbing material in normal calorimeters. In these new calorimeters, the volume absorbing material is already fragmented and flowing dry N2 gas is used to extract the temperature rise information. Pulse energy can be in the range 1 to 15 kJ. Wavelength range is from the ir to uv by employing various volume absorbing materials.

713,615
PB85-205284 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Detectors for Picosecond Optical Power Measurements.
Final rept.
R. J. Phelan, D. R. Larson, N. V. Frederick, and D. L. Franzen. 1984, 4p
Pub. in Proceedings of SPIE, Optical Radiation Measurements, San Diego, CA., August 21-22, 1984, v499 p34-37.

Keywords: *Light pulses, *Power measurement, *Optical measuring instruments, Photodiodes, Silicon, *Picosecond pulses, Schottky barrier devices, Silicon on sapphire, Laser radiation.

There are many features in addition to time resolution that are desirable for a picosecond optical power measurement system. An interdigitated contact, Schottky barrier silicon photodiode coupled to an electro-optic sampler exhibits a rise time better than 22 picoseconds, a quantum efficiency greater than 30%, a uniform responsivity over its receiving aperture, and a usable spectral response to beyond 2 micrometers.

713,616
PB85-205623 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Atmospheric Attenuation on Temperature Measurements Made Using Infrared Scanning Systems.
Final rept.
T. P. Sheahen. 1983, 8p
Pub. in Applied Optics 22, n7 p1070-1077, 1 Apr 83.

Keywords: *Atmospheric attenuation, *Infrared radiation, *Temperature measurement, Carbon dioxide, Water vapor, Reprints, *Atmospheric transmissivity, *Thermography, Remote sensing.

The atmosphere attenuates infrared radiation in the frequency range 3 - 5 micrometers even at distances as short as one meter. In order to do precise quantitative infrared thermography, it is necessary to correct the received signal for this attenuation. This paper develops a simple model and presents numerical calculations of the attenuation expected at a few meters distance, for one typical thermographic imaging system. (The extension to other equipment could easily be done by substituting different numerical data for the detector response.) The attenuation factors due to CO2 and due to H2O are 6% and 8%, respectively, at 10 meters range. A wide variety of target temperatures and ambient humidity conditions were examined; representative curves selected from this output are presented. Because of the importance of precise infrared measurements for industrial applications, the effect of varying CO2 concentration was also studied.

713,617
PB85-206050 PC **A04**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Transmittance MAP (Measurement Assurance Program) Service.
Final rept.
K. L. Eckerle, J. J. Hsia, and V. R. Weidner. Mar 85, 54p NBS/SP-692
Also available from Supt. of Docs as SN003-003-02655-7. Library of Congress catalog card no. 85-600513.

Keywords: *Transmittance, Accuracy, Filters, Wavelengths, Calibrating, Measurement, Spectrophotometers, Measurement Assurance program, Neutral density filters, Didymium filters, US NBS.

An introduction to the Transmittance Measurement Assurance Program (MAP) service is given. Documentation for the service is provided through a comprehensive list of references. The results of a pilot run for the MAP service are given in a sample calibration report.

713,618
PB85-206324 PC **A13**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
OM85: Basic Properties of Optical Materials. Summaries of Papers.
Final rept.
A. Feldman. Apr 85, 297p NBS/SP-697
See also PB85-206332 through PB85-207025. Also available from Supt. of Docs as SN003-003-02648-4. Library of Congress catalog card no. 85-600534. Presented at the Topical Conference on Basic Properties of Optical Materials, National Bureau of Standards, Gaithersburg, Maryland, May 7-9, 1985. Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC. and American Physical Society, Ne

Keywords: *Optical materials, *Meetings, Infrared optical materials, Ultraviolet optical materials, Optical glass, Polymers, Metals, Thin films, Fiber optics, Optical waveguides, Refractive index, Nonlinear optics, Photofractive effect, Semiconductors.

This Special Publication contains summaries of papers to be presented at the Topical Conference on Basic Properties of Optical Materials to be held at the National Bureau of Standards in Gaithersburg, Maryland on May 7-9, 1985. The conference is sponsored by the National Bureau of Standards, the Air Force Office of Scientific Research, and the American Physical Society in cooperation with the Optical Society of America and SPIE-The International Society for Optical Engineering. This publication contains summaries of 70 papers which include 17 invited papers. The purpose of the conference is to bring together researchers from industry, academia, and government to discuss the physical and structural properties of optical materials as they affect optical performance. The scope of the conference includes the measurement and theory of basic properties of optical materials in bulk and in thin film form and the dependence of these properties on atomic structure, morphological structure, impurity content, and inhomogeneity.

713,619
PB85-206332
(Order as PB85-206324, PC **A13**/MF **A01**)
Bell Labs., Holmdel, NJ.
Progress in Optical Materials Research (Keynote Talk).
I. P. Kaminow. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p1-4 Apr 85.

Keywords: *Optical materials, Fiber optics, Semiconductor lasers, Electrooptics, Reviews, Optical fibers, Nonlinear optics.

Topics discussed include optical fibers, semiconductor lasers, electrooptics and non-linear optics, and photonic structures.

713,620
PB85-206340
(Order as PB85-206324, PC **A13**/MF **A01**)
Bell Communications Research, Inc., Murray Hill, NJ.
Determination of Microstructure from Spectrophotometry and Spectroellipsometry.
D. E. Aspnes. Apr 85, 6p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p5-10 Apr 85.

Keywords: *Microstructure, *Spectrophotometry, Optical properties, Spectroellipsometry.

That microstructure can profoundly influence optical properties of materials has been known essentially from the first investigations of the electromagnetic response of macroscopic media. 'Microstructure' is used here in the standard materials science sense, referring to spatial inhomogeneities on the scale of about 1 to 25 nm. These are inhomogeneities large enough so that the separate regions possess their own dielectric identity, yet small compared to the wavelength of light. The present summary deals primarily with the modeling problem, and will cover topics that, in the opinion of the author, have not been adequately discussed elsewhere.

713,621
PB85-206357
(Order as PB85-206324, PC **A13**/MF **A01**)
Yale Univ., New Haven, CT.
Light Scattering from Dielectric and Metallic Microstructures.
R. K. Chang, and P. W. Barber. Apr 85, 6p
Prepared in cooperation with Clarkson Coll. of Technology, Potsdam, NY. Dept. of Electrical and Computer Engineering.
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p11-16 Apr 85.

Keywords: *Light scattering, *Optical measurement.

The generalized Lorenz/Mie formalism can be used to calculate the elastic scattering (e.g., extinction and scattering cross sections) and the internal electromagnetic field distributions of axisymmetric micro-objects (e.g., cylinders, spheres, and spheroids) with complex refractive index (n tilde = n + ik) and characteristic size a. The electromagnetic fields inside and on the surface of the microparticles can be enhanced at specific values of the size parameter x = 2(pi)/lambda (where lambda is the optical wavelength). For dielectric microparticles, even with x < 1, localized surface plasmon resonances can occur at several wavelengths with vastly different electromagnetic field enhancement factors and spectral linewidths. Recent experimental interests have been directed toward the exploitation of the enhanced electromagnetic field intensity of these resonances. For dielectric microparticles in particular, morphology-dependent resonances have been applied to the determination of the following properties of individual droplets flowing in a linear stream: (a) evaporation and condensation rates; (b) interfacial surface tension and bulk viscosity; and (c) nonlinear optical properties such as lasing and coherent Raman processes. For metallic microparticles, localized surface plasmon resonances have been applied to the species determination of molecular adsorbates via the surface enhanced Raman scattering. In this presentation, research results from collaboratorive work at Yale, Cornell, and Clarkson Universities will be briefly reviewed.

713,622
PB85-206365
(Order as PB85-206324, PC **A13**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.

Characterization of Optical Materials and Surfaces Using Time-Domain Reflectometry.
A. G. Lieberman. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p17-20 Apr 85.

Keywords: *Optical materials, Optical measurement, Light pulses, Surfaces, *Time domain reflectometry, Laser radiation, Femtosecond pulses.

The generation of femtosecond duration laser pulses containing only a few oscillations of coherent light has recently been achieved using pulse compression techniques. Such ultrashort pulses have broad spectral bandwidths which may encompass the material and structural resonances of a reflecting medium. The effects of these resonances of a reflecting medium. The effects of these resonances upon the reflected waveform could provide a novel method for characterizing the optical properties of a material or evaluating the surface finish of a manufactured object. The purpose of this paper is to explore the features of time-dependent optical pulse scattering from dispersive materials having smooth surfaces, from perfect conductors having randomly rough surfaces, and from materials exhibiting both dispersion and surface roughness.

713,623
PB85-206373
(Order as PB85-206324, PC **A13**/MF **A01**)
Naval Weapons Center, China Lake, CA.
Theory of Light Scattering from a Rough Surface with a Nonlocal Inhomogeneous Dielectric Permittivity.
J. M. Elson. Apr 85, 3p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p21-23 Apr 85.

Keywords: *Light scattering, *Surface roughness, Perturbation theory.

First-order perturbation theory can be used to predict the combined effect of surface roughness and dielectric inhomogeneities on the scattering of light from optical surfaces. Problems that arise, are discussed.

713,624
PB85-206381
(Order as PB85-206324, PC **A13**/MF **A01**)
Iowa State Univ., Ames.
Optical Properties of Metals in the Infrared - The Drude Model, Problems with It, and Non-Local Optics.
D. W. Lynch. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p24-27 Apr 85.

Keywords: *Optical properties, *Infrared radiation, *Metals, Electron gas, *Drude model.

The infrared optical properties of metals are frequently described by a free-electron gas model, the Drude model. The author discusses several situations for which the Drude model is known not to be valid, despite its use in the literature.

713,625
PB85-206399
(Order as PB85-206324, PC **A13**/MF **A01**)
Argonne National Lab., IL.
Separation of Drude and Band-to-Band Spectra in Polyvalent Metals.
D. Y. Smith, and B. Segall. Apr 85, 4p
Prepared in cooperation with Case Western Reserve Univ., Cleveland, OH.
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p28-31 Apr 85.

Keywords: *Optical properties, *Metals, Aluminum, Drude model.

The problem of separating intra- and interband contributions to optical properties has been reexamined with the goal of minimizing the dependence of the separation on specific models. This was prompted by a desire to compare the recently published theoretical interband spectrum of aluminum with reflectance measurements. Unfortunately, such a comparison is complicated because intra- and interband effects are almost inextricably intermeshed in the data. Several prior analyses have been involved restrictive assumptions regarding the interband component. However, the authors present here an approach that uses general qualitative features of the theory combined with experimental data over a wide energy range that reduces the assumptions required and yields a more reliable separation.

713,626
PB85-206407
(Order as PB85-206324, PC **A13**/MF **A01**)
Naval Weapons Center, China Lake, CA.
Status of Materials for Transmissive and Reflective Infrared Components.
H. E. Bennett. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p32-35 Apr 85.

Keywords: *Infrared optical materials, Absorption spectra, Zinc sulfides, Zinc selenides, Potassium chloride, Yttrium oxides, Reviews, Calcium lanthanum sulfides.

In addition to optical absorption, various other parameters must be considered in selecting an infrared transmittting material for a given application. In many cases, fracture toughness, resistance to thermal shock, and insensitivity to environmental agents such as water are of great importance.

713,627
PB85-206415
(Order as PB85-206324, PC **A13**/MF **A01**)
Wolfe Loeb and Co., Hinsdalew, IL.
Dimensional Stability.
W. Primak. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p36-39 Apr 85.

Keywords: *Optical materials, *Optical equipment, *Dimensional stability.

No abstract available.

713,628
PB85-206423
(Order as PB85-206324, PC **A13**/MF **A01**)
GTE Labs., Inc., Waltham, MA.
Nonlinear Optical Properties of Organic Polymer Materials.
G. M. Carter, Y. J. Chen, M. F. Rubner, M. K. Thakur, and S. K. Tripathy. Apr 85, 6p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p40-45 Apr 85.

Keywords: *Optical materials, *Polymers, Thin films, Molecular structure, Excitation, Roman spectroscopy, Molecular energy levels, *Polydiacetylenes, *Nonlinear optics.

Research into the nonlinear optical properties of organic polymers including such phemonena, as harmonic generation, Raman scattering, difference frequency generation, and the Kerr effect as well as including a wide variety of materials (available through organic synthesis) in various forms (e.g. solution, liquid crystal, and solid). The polydiacetylenes are an interesting nonlinear optical materials system, and current research is addressing the interrelation between their structural and the time dependent excited state properties to provide a knowledge base for potential applications. Yet the polydiacetylenes are just one interesting class of organic nonlinear optical materials. The present investigation of the nonlinearities in the PDA's can cleary set the broad direction for the investigation of other molecularly engineered organic systems for practical exploitation.

713,629
PB85-206431
(Order as PB85-206324, PC **A13**/MF **A01**)
IBM Research Lab., San Jose, CA.
Preparation of Organic Nonlinear Optical Materials for Second Harmonic Generation.
C. W. Dirk, R. J. Twieg, and G. Wagniere. Apr 85, 4p
Prepared in cooperation with Zurich Univ. (Switzerland). Inst. of Physical Chemistry.
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p46-49 Apr 85.

Keywords: *Polymers, *Organic compounds, *Crystal structure, *Nonlinear optics, *Second harmonic generation.

No abstract available.

713,630
PB85-206449
(Order as PB85-206324, PC **A13**/MF **A01**)
Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.

Optical Phase Transitions in Organo-Metallic Compounds.
T. O. Poehler, and R. S. Potember. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p50-53 Apr 85.

Keywords: *Electrooptics, *Semiconducting films, *Metal containing organic compounds, Thin films, Phase transformations, Raman spectra, Complex compounds, *Optical switches, Cyclohexadiene diylidene dimalononitriless.

The authors have recently reported optical and optoelectronic switching between two states in polycrystalline organo-metallic semiconductor films using the 488.0 and 457.9 nm lines of an argon ion laser. They have now demonstrated that defocused laser radiation can be used as a source of thermal energy to reverse or erase switched regions of the film. The wavelength dependence of the optical switching threshold for CuTCNQ and AgTCNQ was studied to obtain information about the switching mechanism. Work in progress has also involved a variety of thin films of semiconducting charge-transfer complexes different from the typical AgTCNQ and CuTCNQ for which many of the previous results have been reported. Other salts which are members of the class are those formed of metal donor atoms and the organic acceptor molecule such as TCNE, TCNQ, methyl TCNQ, and TNAP.

713,631
PB85-206472
(Order as PB85-206324, PC **A13**/MF **A01**)
Toledo Univ., OH.
Optical Constants and Harmonic Generation by Surface Plasmons.
H. J. Simon. Apr 85, 5p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p60-64 Apr 85.

Keywords: *Optical properties, Metal films, Metals, Dielectrics, Interfaces, *Second harmonic generation, *Plasmons.

The recent prediction of the properties of a new long range surface plasmon (LRSP) mode on the two surfaces of a thin metal film bounded by index-matched dielectrics has stimulated theoretical and experimental interest in this new mode. When the fundamental mode of this plasmon is excited on both surfaces of a thin silver film bounded by a nonlinear quartz crystal and an index-matched liquid, the second harmonic generation is over two orders of magnitude larger than that due to the single-boundary surface plasmon. In conclusion, the highly resonant and localized nature of the LRSP mode will make this mode a useful new probe for studying linear and nonlinear optical properties of metal-dielectric interfaces.

713,632
PB85-206480
(Order as PB85-206324, PC **A13**/MF **A01**)
Cincinnati Univ., OH. Dept. of Electrical and Computer Engineering.
Low Loss Thin Film Materials for Integrated Optics.
H. E. Jackson, and J. T. Boyd. Apr 85, 6p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, 65-70 Apr 85.

Keywords: Thin films, Glass, Zinc oxides, Silicon nitrides, Niobium oxides, Tantalum oxides, *Integrated optics, *Optical waveguides, Laser annealing.

The authors have reviewed their recent efforts to obtain low loss planar waveguides for potential use in integrated optics. Employing both novel fabrication and laser annealing techniques, they have achieved values of waveguide attenuation substantially below 1 dB/cm for a variety of waveguide materials. In several cases, values below 0.1 dB/cm were achieved, with efforts to achieve even lower values of waveguides attenuation continuing.

713,633
PB85-206506
(Order as PB85-206324, PC **A13**/MF **A01**)
Arizona Univ., Tucson. Optical Sciences Center.
Relationship of Microstructure to Optical Properties of Thin Films.
H. A. Macleod. Apr 85, 6p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p74-79 Apr 85.

Keywords: *Dielectric films, *Optical properties, *Microstructure, *Thin films, Titanium oxides, Zirconium oxides.

Although the properties of materials in thin-film form are broadly similar to those of bulk materials, there are often significant differences. Frequently the level of performance that can be achieved with thin films is inferior to that predicted from simple bulk properties. Great progress has been made in closing the gap between real thin-film properties and bulk properties but a gap still remains and much of it is a direct consequence of the effects of microstructure on the optical, mechanical and chemical properties of thin films. Here we are concerned solely with the optical properties and we limit the discussion to dielectric films.

713,634
PB85-206514
(Order as PB85-206324, PC **A13**/MF **A01**)
Royal Signals and Radar Establishment, Malvern (England).
Microstructure and Optical Properties of Thin Films Prepared by Molecular Beam Techniques.
K. L. Lewis, A. M. Pitt, J. A. Savage, A. G. Cullis, and N. G. Chew. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p80-83 Apr 85.

Keywords: *Thin films, *Optical coatings, *Microstructure, Radiation damage, Optical properties, *Molecular beam epitaxy, Laser radiation.

The present work assesses the potential of molecular beam techniques for the deposition of improved optical coatings. This growth technique allows a high degree of control over the deposition process and in situ assessment techniques such as Auger and XPS allow the characterization of the surfaces produced. By combining Knudsen evaporation with RF sputtering processes in a dedicated UHV facility, it is possible to fabricate coating structures containing a wide range of different materials including sulphides, selenides, tellurides, arsenides, phosphides, fluorides, chlorides, oxides and nitrides without necessarily having to break vacuum and risk the creation of contaminated interfaces.

713,635
PB85-206522
(Order as PB85-206324, PC **A13**/MF **A01**)
Centre National de la Recherche Scientifique, Marseille (France).
Simple Model of Inhomogeneity in Optical Thin Films.
G. Deniau, F. Flory, and E. Pelletier. Apr 85, 2p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p84-85 Apr 85.

Keywords: *Optical coatings, *Thin films, Titanium dioxides, Homogeneity, Models, Inhomogeneity.

Most materials used in thin-film optical coatings exhibit optical inhomogeneity that is frequently so large that it cannot be neglected. The inhomogeneity is directly related to the layer microstructure that can be observed in electron micrographs. This leads directly to the consideration of a layer model that can be used to represent this homogeneity and can be used in calculations. Its usefulness decreases with its complexity and it should therefore be as simple as possible but nevertheless it should also reflect the real behavior of the films. The unprecedented precision with which multilayer deposition can now be controlled coupled with the possibility of accurate in situ property measurement makes the time ripe for a reexamination of this problem.

713,636
PB85-206530
(Order as PB85-206324, PC **A13**/MF **A01**)
Optical Properties of Diamondlike Carbon Films on Semiconductors.
G. B. Bu-Abbud, J. D. Lamb, J. E. Oh, and J. A. Woollam. Apr 85, 3p
Prepared in cooperation with Universal Energy Systems, Dayton, OH.
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p86-88 Apr 85.

Keywords: *Optical coatings, *Carbon, Optical properties, Semiconductors(Materials), Substrates, Films, Diamonds, Ellipsometry, Refractive index, Extinction coefficients.

Diamondlike carbon (DLC) films have been described by various authors as being hard, resistant to various chemicals, highly insulating, and adherent to a wide variety of materials. The authors have recently been investigating the usefulness of these materials in various applications including dielectrics for integrated circuits and coatings for optical (especially infrared) materials. The purpose of the present paper is to describe the optical properties of DLC films deposited on several technologically important semiconductors. Specifically, the authors have used spectroscopic ellipsometry and absorption spectroscopy to determine the index of refraction and extinction coefficient over the wavelength range from 220 nm to 3.39 micrometers. Substrate materials include flat, polished, oriented single crystals of silicon, indium phosphide, cadmium telluride, mercury cadmium telluride, germanium, and quartz.

713,637
PB85-206548
(Order as PB85-206324, PC **A13**/MF **A01**)
IIT Research Inst., Chicago, IL.
Temperature Dependent Optical Properties of Silver Sulfide Thin Films.
R. L. Burton, H. Buhay, M. Nisar, J. L. Grieser, and N. P. Murarka. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p89-92 Apr 85.

Keywords: *Silver sulfides, *Infrared optical materials, Thin films, Refractive index, Extinction coefficients.

Flash evaporation techniques for synthesizing Ag2S thin films have been reported elsewhere. In this work, results are presented for films prepared by a triode D.C. sputtering process which has been found to provide greater control and produced superior films. Optical transmittance and reflectance measurements were made using a Perkin-Elmer Model 580B spectrophotometer. From the optical data, the frequency dependence of the refractive index n and extinction coefficient k were computed.

713,638
PB85-206555
(Order as PB85-206324, PC **A13**/MF **A01**)
Colorado State Univ., Fort Collins. Dept. of Physics.
Molecular Bonding in Optical Films Deposited by Ion-Beam Sputtering.
C. Y. She. Apr 85, 6p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p93-98 Apr 85.

Keywords: *Optical coatings, *Titanium dioxide, *Molecular structure, Crystal structure, Raman spectroscopy, Sputtering, Films, Laser annealing.

Using Raman spectroscopy, we have studied the microscopic structure and molecular bonding of ion-beam sputtered optical films by the method of thermal and laser annealing. Transformation of amorphous titania coatings to crystalline anatase and/or rutile structures has been observed. We report these results and discuss their implications in this paper.

713,639
PB85-206563
(Order as PB85-206324, PC **A13**/MF **A01**)
Bell Communications Research, Inc., Murray Hill, NJ.
Highly Transparent Metal Films: Pt ON InP.
D. E. Aspnes, A. Heller, J. D. Porter, T. T. Sheng, and R. G. Vadimsky. Apr 85, 4p
Prepared in cooperation with Bell Labs., Murray Hill, NJ.
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p99-102 Apr 85.

Keywords: *Metal films, *Platinum, *Optical coatings, *Transparence, Indium phosphides.

Highly transparent metal films are of potential interest in a number of areas of science and technology including light detection, photovoltaic energy conversion, catalysis, and photoelectrochemistry. In studies of light-activated hydrogen evolution on platinized semiconducting photocathodes, it was discovered that the quantum yield of hydrogen-evolving semiconducting electrodes did not decline significantly with increasing platinum coverages, even for metric thicknesses as much as 50 nm where 99.9% of the transmitted light should have been absorbed. The observation of this anomalous transparency stimulated further investigation, and in a recent preliminary report the authors described the preparation and characterization of the first substantially transparent supported metal films of significant thicknesses. They found that the essential characteristics giving rise to substantial transparency in metal films were porosity and microstructure, and that by controlling these properties, absorption and reflection losses could almost be eliminated. Here, the authors discuss in more detail the physical principles involved and present further results on Pt film/p-InP system.

713,640
PB85-206571
(Order as PB85-206324, PC **A13**/MF **A01**)
Pennsylvania Univ., Philadelphia.
Calculation of the Electronic Structure of As4S4 and As4Se4 Molecules.
D. Babic, and S. Rabii. Apr 85, 3p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p103-105 Apr 85.

Keywords: *Molecular structure, Molecular energy levels, Ionization potentials, *Arsenic sulfides, *Arsenic selenides, *Electronic structure, Integrated optics, Amorphous materials.

The recent developments in preparation of thin amorphous films of the arsenic chalcogenides by spin-coating from solution have led to renewed interest in these materials for applications in the field of integrated optics as waveguides, couplers, or storage media. As part of our theoretical investigation of the electronic structure of these materials, we have undertaken to calculate the molecular structure for some of their existing molecules, namely As4S4, As4Se4, As4S6 and As4Se6. In the present paper we report on our calculations for the first two molecules.

713,641
PB85-206589
(Order as PB85-206324, PC **A13**/MF **A01**)
IIT Research Inst., Chicago, IL.
Free-Carrier Absorption in a Thin Film Silver Sulfide Galvanic Cell.
R. L. Burton, H. Buhay, J. L. Grieser, and N. P. Murarka. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p106-109 Apr 85.

Keywords: Silver sulfides, *Infrared optical materials, *Electrolytic cells, Thin films, Transmittance, Reflectance, Refractive index, Extinction coefficients.

Ag2S undergoes a crystallographic phase transition at a temperature Tc=180C. The electrical conductivity of the high temperature phase, alpha-Ag2S, is three orders of magnitude greater than the low temperature phase, beta-Ag2S. As a result, beta-Ag2S transmits through much of the mid-infrared region, whereas alpha-Ag2S exhibits a distinct plasma absorption edge. Studies of the influence of the electron concentration on the electrical and optical properties of bulk Ag2S have been reported. Investigations of these properties were achieved by incorporating an AgS sample in a galvanic cell structure. The structure of these bulk material galvanic cells is given by: Ag electrode/AgI/Ag2S/Pt electrode. In a similar manner a thin film galvanic cell, with a design analogous to the bulk cell, has been made and used to vary the electron concentration in the silver sulfide film of the cell. Several thin film silver sulfide galvanic cells were prepared. The transmittance and reflectance data are shown. The corresponding refractive index and extinction coefficient computed from the best fit parameters are shown. Also given is a plot of electron concentration as a function of cell potential.

713,642
PB85-206597
(Order as PB85-206324, PC **A13**/MF **A01**)
Naval Weapons Center, China Lake, CA.
Synthesis and Characterization of Stoichiometric CdPS3.
J. Covino, P. Dragovich, and C. Lowe-Ma. Apr 85, 5p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p110-114 Apr 85.

Keywords: *Infrared optical materials, *Synthesis(Chemistry), X ray diffraction, Selenides, Sulfides, *Cadmium phosphide sulfides, Cadmium phosphide selenide sulfides.

CdPS3 is optically transparent from 4000/cm to 500/cm (2.5-20 micrometers) with a fundamental absorption edge close to 454/cm (22 micrometers). Initial studies of CdPS3 suggested that the material could be useful as an infrared transmitting material provided that the material strength could be increased. CdPS3 has been synthesized with stoichiometry much closer

to the theoretical value previously reported. The present X-ray data for the CdPS3 system, although reproducible from sample to sample, is not consistent with the C2/m structure assigned to this compound by Brec et al. However, the presently reported data are consistent with a layer structure in which cadmium might be in a different environment or in more than one environment. If cadmium is in a second environment then it must be, as the (113)Cd NMR shows, only one Cd(II) site. Furthermore, as seen by the EPR data of Mn-doped CdPS3 this cadmium site whether it be interstitial or defect cannot be substituted by Mn(II). Such structural differences could also explain the different intercalation chemistries of the cadmium and nickel MPS3 compounds.

713,643
PB85-206605
(Order as PB85-206324, PC **A13**/MF **A01**)
Energy Conversion Devices, Inc., Troy, MI.
Characterization of Thin Semiconducting Films on Transparent Substrates.
B. Edgerton, and D. Shortt. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p115-118 Apr 85.

Keywords: *Semiconducting films, Thin films, Glass, Transparence, Substrates, Amorphous silicon, Refractive index, Extinction coefficients.

Uniform homogenous layers of material deposited on a substrate can be described optically by a thickness and a complex index of refraction, n(lambda) - ik(lambda). Alternately one can describe the absorption coefficient, alpha(E), as a function of the photon energy. If the complex index of refraction and the thickness are known for both the film and the substrate, then electromagnetic theory provides a basis for calculating the reflectance and transmittance spectra of the film. The challenge is to work this problem backwards. Given the two spectra, can one find a unique description of the dispersion in the optical properties as well as a thickness which satisfy the data. The first step in our process is to choose a parameterized model to describe the optical properties. The second part of the process determines the values of the optical properties without recourse to a particular choice of parameterized model for describing the shape of the dispersion. The film used to illustrate this technique is a glow discharge deposition of amorphous silicon hydrogen alloy on Corning 7059 glass. The measured spectra appear in Fig. 1.

713,644
PB85-206613
(Order as PB85-206324, PC **A13**/MF **A01**)
Alexandria Univ. (Egypt). Faculty of Engineering.
Laser Propagation through Fibers with Biquadratic Refractive Index (Closed Form Solution).
F. Z. El-Halafawy, A. Y. Rezk, and E. A. Al-Badawy. Apr 85, 3p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p119-121 Apr 85.

Keywords: *Laser beams, *Light transmission, *Fiber optics, *Mathematical models, Intensity, *Optical fibers.

In this paper, closed form equations for both trajectories and intensity profiles of a light beam traveling in a continuous media of biquadratic graded refractive index are derived avoiding the approximations made by other authors. In conclusion, biquadratic-index media yields self-trapping if its parameters and the launch conditions are adjusted.

713,645
PB85-206621
(Order as PB85-206324, PC **A13**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Densification of Zirconia Films by Coevaporation with Silica.
A. Feldman, and E. N. Farabaugh. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p122-125 Apr 85.

Keywords: *Optical coatings, *Zirconium oxides, *Silicon dioxide, Electron beams, Substrates, Films, Coevaporation, Refractive index.

Optical films of zirconia have been receiving considerable attention because of their potential use as the high-index layer in multilayer optical coatings for the ultraviolet portion of the spectrum. Several problems are associated with electron-beam deposited zirconia films and these include index instability and index inhomogeneity. The index instability is caused by the adsorption and the desorption of water in the porous columnar structure of the zirconia films. Index inhomogeneity is due to the inhomogeneous structure in the films. Recent work has shown that the first several tens of nonometers of a film possess a cubic structure whereas the outmost layers possess a monoclinic structure. One approach for producing bulk-like zirzonia films that is receiving considerable attention at present is ion-assisted electron-beam deposition. This is because the method has successfully produced zirconia films having bulk-like densities and refractive indices that show insignificant sensitivity to water adsorption. In this paper we demonstrate a similar effect when mixed zirconia:silica films are produced by coevaporation from independent electron-beam sources, and, in particular, we show that the admixture of a small amount of silica with the zirconia produces a film possessing a higher refractive index than a pure zirconia film.

713,646
PB85-206639
(Order as PB85-206324, PC **A13**/MF **A01**)
Massachusetts Inst. of Tech., Cambridge.
Temperature Dependence of the VUV (Vacuum Ultraviolet) Optical Spectra and Band Structure of Al2O3.
R. H. French, and R. L. Coble. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p126-129 Apr 85.

Keywords: *Aluminum oxide, *Band structure of solids, *Energy bands, Far ultraviolet radiation, Ultraviolet spectra, Single crystals, Reflectivity, High temperature tests, *Electronic structure, Temperature dependence.

A high temperature vacuum ultraviolet (VUV) spectrophotometer has been built that is capable of measuring the reflectance and transmittance of samples from 6 eV to 15 eV (210 nm to 85 nm) in the VUV on samples heated without contamination from room temperature up to 1100C. The precision (reproducibility) of the measurements is 0.01 eV, the resolution of the monochromator is 0.1 eV while the spectrophotometer can resolve 0.3 eV wide spectral features of the sample. The temperature dependence of the electronic structure of single crystal Al2O3 has been studied with this facility.

713,647
PB85-206647
(Order as PB85-206324, PC **A13**/MF **A01**)
Academia Sinica, Shanghai (China). Shanghai Inst. of Optics and Fine Mechanics.
Raman Spectra of LiYF4 Crystal.
F. Y. Gan, and H. Y. Chen. Apr 85, 3p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p130-132 Apr 85.

Keywords: *Laser materials, *Raman spectra, Infrared lasers, Neodymium, *Lithium yttrium fluorides, Doped materials, Tunable lasers, Optical phonons, Polarization.

Rare earth ion doped LiYF4 crystals are well-known laser active materials; they produce the laser emissions in the range of 0.8-2.1 micrometer wavelength. LiYF4 host structure, a scheelite model, is a body-centre tetragonal with a = 5.175A and c = 10.74A. The polarized fluorescence and absorption, excitation spectra, life-time, etc. of the crystal doped with Nd(3+) have been studied in detail and the crystal-field parameters have also been reported, but only a few works about its vibrational properties have been presented so far. The optical phonon spectra are rather important for development of tunable solid state lasers; for this reason the authors carried out the study of Raman spectra of this material, analyzed its optical mode vibrations, and finally compared with that of the sample doped with Nd(3+).

713,648
PB85-206654
(Order as PB85-206324, PC **A13**/MF **A01**)
Naval Weapons Center, China Lake, CA.
EPR (Electron Paramagnetic Resonance) Studies of Infrared-Transmitting Sulfide Ceramics.
D. C. Harris, M. E. Hills, J. Covino, C. K. Lowe-Ma, and R. W. Schwartz. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p133-136 Apr 85.

Keywords: *Infrared optical materials, Optical properties, Crystal defects, Impurities, *Calcium lanthanum sulfides, *Aluminum zinc sulfides, Electron spin resonance.

Calcium lanthanum sulfide (nominally CaLa2S4) and zinc aluminum sulfide (ZnAl2S4) are potentially useful as infrared-transmitting ceramics. In an attempt to correlate optical properties with the presence of impurities and defects, the authors have been studying the electron paramagnetic resonance (EPR) spectra of powdered samples. EPR spectroscopy has established that CaS is an impurity phase in CaLa2S4 and has been used to identify transition metal impurities, paramagnetic defects and photochemical processes in these materials. Both Mn(2+) and a paramagnetic center with coupling to several (27)Al nuclei were observed in preparation of ZnAl2S4. These spectra may be useful in evaluating the quality of ZnAl2S4 preparations and in the identification of impurity phases that are present.

713,649
PB85-206662
(Order as PB85-206324, PC **A13**/MF **A01**)
Raytheon Co., Lexington, MA. Research Div.
Elastic Properties of Chemically Vapor-Deposited ZnS and ZnSe.
C. A. Klein, and C. B. Willingham. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p137-140 Apr 85.

Keywords: *Zinc selenides, *Zinc sulfides, *Elastic properties, Waveguide windows, Infrared windows, Chemical vapor deposition.

Material characteristics such as Young's modules and Poisson's ratio play an important role in designing optical windows or assessing their performance from the point of view of thermally--induced distortion as well as pressure--induced fracture. The elastic properties of interest in the study include Young's modulus, the shear modulus, the bulk modulus, Poisson's ratio, the velocity of compressional waves, and the velocity of shear waves.

713,650
PB85-206670
(Order as PB85-206324, PC **A13**/MF **A01**)
Litton Systems, Inc., Woodland Hills, CA. Guidance and Control Systems Div.
Radiation Effects in a Glass-Ceramic (Zerodur).
N. Koumvakalis, M. G. Jani, and L. E. Halliburton. Apr 85, 4p
Prepared in cooperation with Oklahoma State Univ., Stillwater. Dept. of Physics.
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p141-144 Apr 85.

Keywords: *Optical materials, *Radiation effects, *Ceramic composites, Gyroscopes, Quartz, Ionizing radiation, *Zerodur, Laser gyroscopes.

Zerodur is a low-expansion glass-ceramic with important applications in laser-gyro guidance systems. The material contains by weight 70-75% crystalline quartz in the form of crystallites approximately 50 nm in diameter which are embedded in a glass matrix. The glass-crystal ratio is adjusted so that the resultant expansion coefficient at room temperature is near zero. Ionizing radiation causes numerous effects in Zerodur. The most obvious is a change in the optical absorption, and this will have possible consequences in the thermal expansion behavior. Thus, characterization of radiation--induced defects will help solve problems affecting Zerodur's performance in guidance systems and will provide an understanding of the basic properties of this unique class of materials.

713,651
PB85-206704
(Order as PB85-206324, PC **A13**/MF **A01**)
Rockwell International, Thousand Oaks, CA. Science Center.
Diffuse Multilayer Analysis Using a Multiflux Method.
S. O. Sari. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p154-157 Apr 85.

Keywords: *Optical materials, *Optical coatings, *Coatings, Light scattering, Maxwells eauations.

The use of uniform material layers to form multilayer films forms the basis for an extensive coating technology. The transmissive and reflective properties of such structures are dominated by optical interference oc-

curring among the layers. Comparatively less attention seems to have been given to treating stratified media consisting of random rather than uniform material layers. Within such structures, the optical scattering properties of each sublayer dominate the optical properties. Some previous work on diffuse coatings has been concerned with investigations of surface-roughened layers and the form of diffuse scattering from one or more roughened interfaces. Such analytical investigations have been based on lowest-order solutions to Maxwell's equations at a perturbed roughened interface, a calculational procedure which has been carried out by several different authors in recent years. The present objective is to point toward a possible alternative method for treating diffuse scattering. Examples would include aggregate suspensions, artificial dielectrics, solids containing scattering defects, paint layers or inhomogeneous recording materials. This analysis may have applications to optical material studies such as ensemble microparticle drop sizing or other related topics of current interest. It may serve as an adjunct to scattering models based on direct solutions to Maxwell's equations for various scattering geometries.

713,652
PB85-206720
(Order as PB85-206324, PC **A13**/MF **A01**)
Concordia Univ., Sir George Williams Campus, Montreal (Quebec). Dept. of Electrical Engineering.
Properties of Guided Modes in Bidirectional Anisotropic Media.
O. Schwelb. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p160-163 Apr 85.

Keywords: *Light transmission, Matrices(Mathematics), Transfer functions, Optical waveguides.

Explicit expression have been presented for the layer transfer matrix, for the characteristic impedance and for the bounds of the effective guide index for uniaxial media in polar and longitudinal orientation. Some properties distinguishing the equatorial orientation have also been mentioned.

713,653
PB85-206738
(Order as PB85-206324, PC **A13**/MF **A01**)
University of Southern California, Los Angeles. Center for Laser Studies.
Calorimetric Measurement of Optical Absorption in Sapphire at Visible, near IR, and near UV Wavelengths.
A. B. Villaverde, R. T. Swimm, and M. Bass. Apr 85, 3p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p164-166 Apr 85.

Keywords: *Sapphire, Near infrared radiation, Near ultraviolet radiation, Single crystals, *Absorption coefficients, Laser radiation.

The optical absorption of sapphire was measured calorimetrically in the wavelength interval from 1.32 micrometer to 0.35 micrometer. The data show reasonably linear behavior in a plot of the natural logarithm of the absorption due to residual chromium ions.

713,654
PB85-206746
(Order as PB85-206324, PC **A13**/MF **A01**)
Nebraska Univ., Lincoln. Dept. of Electrical Engineering.
Optical Properties of Ion Beam Irradiated Molybdenum Laser Mirrors as Studied by Ellipsometry.
J. A. Woollam, G. H. Bu-Abbud, D. L. Mathine, D. Poker, and D. Ingram. Apr 85, 2p
Prepared in cooperation with Oak Ridge National Lab., TN., and Universal Energy Systems, Dayton, OH.
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p167-168 Apr 85.

Keywords: *Mirrors, *Molybdenum, Surface roughness, Polarimetry, Reflectivity, *Laser mirrors, Ellipsometry, Ion implantation, Refractive index, Extinction coefficients.

In this paper the authors report on implantation of Mo ions into polished molybdenum surfaces to investigate the effects of implantation on surface roughness, and optical reflectivity. The motivation is to develop ion beam techniques for improving the reflectivity and (surface smoothness) over a wide spectral range. Information on the index of refraction and extinction coefficient as functions of wavelength are also obtained.

713,655
PB85-206753
(Order as PB85-206324, PC **A13**/MF **A01**)
Anhui Inst. of Optics and Fine Mechanics (China).
Crystal Field Energy Levels and Optical Absorption Intensities of Ni(+2):MgF2.
B. Zhang, J. K. Zhu, and S. H. Liu. Apr 85, 2p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p169-170 Apr 85.

Keywords: *Laser materials, *Magnesium fluorides, *Energy bands, Nickel, Atomic energy levels, Magnetic dipoles, Absorptance, *Crystal field, Oscillator strengths, Nickel ions.

One-electron energy levels and wave functions of laser crystal Ni(2+):MgF2 with lower symmetric crystal fields (D sub (2 sup h)) are calculated by use of the spin-unrestricted MS-X(alpha) method.

713,656
PB85-206761
(Order as PB85-206324, PC **A13**/MF **A01**)
Naval Research Lab., Washington, DC.
Status of Optical Constants of Solids from X-ray to MM-Wave Region.
E. D. Palik. Apr 85, 6p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p171-176 Apr 85.

Keywords: X rays, Ultraviolet radiation, Light(Visible radiation), Infrared radiation, Millimeter waves, Thin films, *Refractive index, *Extinction coefficients.

As editor of the Handbook of Optical Constants of Solids (1) the author has obtained a bird's-eye view of th quantity and quality of optical constants for 37 solids of technological and physics interest. These include 11 metals - Al, Cu, Au, Ir, Mo, Ni, Os, Pt, Rh, Ag, W; 14 semiconductors - CdTe, GaAs, GaP, Ge, InAs, InSb, InP, PbSe, PbS, PbTe, Si, a-Si, ZnS; 12 insulators - As2Se3, As2S3 C(diamond), LiF, LiNbO3, KCl, SiO2, SiO, Si3N4, NaCl, TiO2. Twenty one critiquers have examined the existing literature for these materials and have tabulated a single set of refractive index n and extinction coefficient k for as wide a spectral region as possible. Examples of a metal Ag, a semiconductor Si and an insulator a-SiO2 (silica) are given in Fig. 1. Some effort is made to discuss the measurement techniques and the quality of the data. The problems encountered here with measurements and data are representative. The problems encountered here with measurements and data are representative of all the solids studied. The Handbook also contains 11 chapters on how to determine n and k in various spectral regions.

713,657
PB85-206779
(Order as PB85-206324, PC **A13**/MF **A01**)
Argonne National Lab., IL.
Optical Constants at X-ray Wavelengths.
D. Y. Smith, A. E. Williamson, and T. I. Morrison. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p177-180 Apr 85.

Keywords: *X ray absorption, Absorption spectra, Synchrotron radiation.

The present paper is a preliminary report on optical properties of selected elements at x-ray wavelengths as derived from measured absorption spectra. Need for such data is an outgrowth of the world-wide development of synchrotron radiation sources: the reflectance is of interest for designing grazing-incidence mirrors, and knowledge of optical constants is required to calculate the properties of multilayer elements, as well as to analyze differential absorption and anomalous scattering experiments.

713,658
PB85-206787
(Order as PB85-206324, PC **A13**/MF **A01**)
Bell Labs., Holmdel, NJ.
Vacuum Ultraviolet Loss in Magnesium Fluoride Films.
O. R. Wood, P. J. Maloney, H. G. Craighead, and J. E. Sweeney. Apr 85, 3p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p181-183 Apr 85.

Keywords: *Optical costs, *Magnesium fluoride, *Far ultraviolet radiation, *Ultraviolet optical materials, Light scattering, Losses, Thin films.

Because MgF2 is transparent to wavelengths as short as 1100 A in the VUV, it finds extensive use for lenses and windows in this region. Major applications can be found in UV lasers, spectroscopy and space astronomy. Another important use of MgF2 is as an evaporated coating onto aluminum, where it greatly increases the VUV reflectance and also retards oxidation. The authors have investigated the excess loss in evaporated films and found that it is due to scattering from inhomogeneities and absorption from the low energy tail of an excitation band. Both of these mechanisms were found to be strongly dependent on the degree of crystallinity of the film, which is largely determined by the substrate temperature during deposition. The study has allowed the authors to produce films with extinction coefficients as low as 0.005, several times better than previously reported.

713,659
PB85-206795
(Order as PB85-206324, PC **A13**/MF **A01**)
Vanderbilt Univ., Nashville, TN. Dept. of Physics and Astronomy.
Surface Erosion Induced by Electronic Transitions.
R. F. Haglund, and N. H. Tolk. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p184-187 Apr 85.

Keywords: *Ultraviolet optical materials, *Radiation damage, Synchrotron radiation, Electron inrradiation, Surfaces, Erosion, Sodium chloride, Lithium fluorides.

The problem of damage to ultraviolet optical materials has been and continues to be a major source of concern in the design and operation of high-power lasers. Little fundamental understanding exists of the atomic-level mechanisms which operate to produce this damage. However, recent experiments have shown that irradiation of optical materials by electrons and photons at energies characteristic of high-power and high-energy laser systems is an efficient cause of surface erosion. The experiments described here are intended to illuminate the basic mechanisms associated with energy absorption, distribution and localization leading to electronically induced desorption, and to determine the role of defects in these processes.

713,660
PB85-206829
(Order as PB85-206324, PC **A13**/MF **A01**)
Princeton Univ., NJ.
Micro-Raman Study of Laser-Induced Damage.
P. M. Fauchet, I. H. Campbell, and F. Adar. Apr 85, 4p
Prepared in cooperation with Instruments S.A., Inc., Metuchen, NJ.
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p198-201 Apr 85.

Keywords: *Radiation damage, *Raman spectroscopy, Optical materials, *Laser radiation, Neodymium lasers.

In most laser systems, damage to optical components is the major factor that limits scaling towards higher energy density. Although laser-induced damage in solids has been an active field of research for many years the authors do not have a satisfactory understanding of the physics involved in these processes. This situation is in part due to the lack of nondestructive, quantitative probes that can be used in situ. In this paper, the authors show that Raman scattering is such a probe and can be used successfully in a wide range of practical situations.

713,661
PB85-206837
(Order as PB85-206324, PC **A13**/MF **A01**)
Bell Labs., Holmdel, NJ.
Optical Effects in Quantum Well Structures and Superlattices.
D. S. Chemla. Apr 85, 12p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p202-213 Apr 85.

Keywords: Gallium arsenides, *Quantum wells, Superlattices, Aluminum gallium arsenides, Nonlinear optics.

The author has presented some recent progress made in the investigation and the utilization of the excitonic resonances observed at room temperature in GaAs/AlGaAs multiple quantum well structures. Novel nonlinear optical and electro-optical effects are observed which result from the lowered dimensionality of the

electrons in ultra-thin semiconductor layers. Room temperature excitonic peak are not only interesting for the applications, they also exhibit the most unusual properties owing to their extremely short life time and their transformation into free e-h pairs.

713,662
PB85-206845
(Order as PB85-206324, PC **A13**/MF **A01**)
Naval Research Lab., Washington, DC.
Photoreflectance in GaAs/AlGaAs Multiple Quantum Wells.
O. J. Glembocki, B. V. Shanabrook, N. Bottka, W. T. Beard, and J. Comas. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p214-217 Apr 85.

Keywords: Gallium arsenides, *Quantum wells, *Photoreflectance, Aluminum gallium arsenides, Heterojunctions.

Recently, the authors demonstrated that photoreflectance is a sensitive probe of interband transitions in GaAs/Al(x)Ga(1-x)As multiple quantrum wells (MQW) and modulation doped heterojunctions exhibiting a two dimensional electron gas. In this paper, the authors describe the photoreflectance technique and review the results of the MQW work found in another paper.

713,663
PB85-206860
(Order as PB85-206324, PC **A13**/MF **A01**)
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
Photorefractive and Nonlinear-Optical Properties of New Electrooptic Materials.
P. Guenter. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p222-225 Apr 85.

Keywords: *Electrooptics, Optical materials, Signal processing, Organic compounds, Reviews, Photorefractive effect, Nonlinear optics.

In this paper, the author presents a review of both photorefractive and nonlinear-optical materials for optoelectronic applications. The materials requirements for nonlinear optical laser frequency conversion using the electronic hyper-polarizabilities and optical signal processing using the photorefractive and nonlinear optical materials, its properties and applications are described.

713,664
PB85-206878
(Order as PB85-206324, PC **A13**/MF **A01**)
Hughes Research Labs., Malibu, CA.
Measurement of Defect and Transport Properties of Electro-Optic Materials Using the Photorefractive Effect.
M. B. Klein, and G. C. Valley. Apr 85, 3p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p226-228 Apr 85.

Keywords: *Electrooptics, Optical materials, Optical measurement, Transport properties, Barium titanates, *Photorefractive effect, Sodium barium niobates, Barium strontium niobates.

In this paper, the authors use steady state beam coupling as a function of grating period at 442 nm to obtain data on the sign of the dominant photocarrier, the concentration of empty traps and the effective electrooptic coefficient for several samples of BaTiO3, Ba2NaNb5O15 (BNN) and Sr(1-x)Ba(x)Nb2O6 (SBN). The authors assume an energy level model in which a single species X, in two valence states XX and X(+), is responsible for the photoactive energy states in the bandgap of each sample. The authors denote the concentration of X as N, and that of X(+) as N(+). The authors allow for the photo-generation of both electrons and holes, through the ionization of X or X(+), respectively.

713,665
PB85-206886
(Order as PB85-206324, PC **A13**/MF **A01**)
Oklahoma State Univ., Stillwater.
Analysis of Scattering Patterns and Decay Dynamics of Photorefractive Gratings in LiNbO3 Crystals.
J. K. Tyminski, R. C. Powell, H. C. Chow, and M. J. Kleiwer. Apr 85, 3p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p229-231 Apr 85.

Keywords: *Gratings(Spectra), Laser beams, Single crystals, Holography, Crystal defects, Light scattering, *Lithium niobates, *Photorefractive effect.

One technique for studying the photorefractive effect (PRE) in crystals is to establish and probe holographic gratings with crossed laser beams. Generally the gratings are assumed to have a sinusoidal shape and the measurement which is made is the scattering efficiency of the probe beam at the Bragg condition. The authors repoort the development of a new technique for studying the PRE based on the analysis of small angle scattering patterns. This technique allows for the inclusion of multiple fourier components in the geometric shape of the grating in analysis to LiNbO3 crystals with several different types of defect properties show that the measured scattering patterns are extremely sensitive to the microscopic properties of the grating.

713,666
PB85-206894
(Order as PB85-206324, PC **A13**/MF **A01**)
University of Southern California, Los Angeles.
Use of Optical Phase Conjugation for Understanding Basic Material Properties.
R. W. Hellwarth. Apr 85, 2p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p232-233 Apr 85.

Keywords: Barium titanates, *Phase conjugation, Four wave mixing, Photorefractive effect, Bismuth silicates, Semiconductors.

In the simplest class of phase--conjunction experiments the two beams E and G interfere to create intensity variations (moving or stationary) which in turn cause a variation in the refractive index seen by beam H. This variation is often called an index 'grating'. The H beam scatters from this grating to generate the F beam. This may be called the (tensor) volume holographic process for phase-conjugation. The beams can be on simultaneously or in various time sequences. The authors will describe how this single-grating process has been used to obtain the most accurate measurements of impurity density, conduction band diffusion lengths, and trap excitation cross-sections in photorefractive bismuth silicate and barium titante. Results for electron-hole pairs in semiconductors will also be described. This process gives often the simplest and most accurate method of measuring thermal conductivities of slightly absorbing transparent media. It is also the basis for another coherent Raman spectroscopic technique (Raman-induced phase conjugation) which has advantages and disadvantages relative to coherent anti-Stokes Raman spectroscopy and other well-known laser spectroscopic techniques.

713,667
PB85-206910
(Order as PB85-206324, PC **A13**/MF **A01**)
Hughes Research Labs., Malibu, CA.
Refractive Indices and Thermo-Optic Coefficients of Nonlinear Crystals Isomorphic to KH2PO4.
K. W. Kirby, C. S. Hoefer, and L. G. DeShazer. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p238-241 Apr 85.

Keywords: Light(Visible radiation), Near infrared radiation, Ammonium compounds, Cesium inorganic compounds, Rubidium compounds, Potassium inorganic compounds, Deuterium compounds, Arsenates, Thermal properties, Electrooptics, *Potassium hydrogen phosphates, *Refractive index, Phosphates, Nonlinear optics.

Crystals of the potassium dihydrogen phosphate (KDP) group are widely used in laser technology. These tetragonal isomorphs have the composition MH2XO4, where M may be K, Rb, Cs or NH4; X may be P or As; and H may be replaced by deuterium D, fully or partly. They encompass sixteen crystals potentially useful in state-of-the-art optical devices. These devices are second harmonic generators, sum and difference frequency mixers, electro-optical switches, and phase modulators. The refractive indices and their thermal behavior were measured for eleven of these nonlinear crystals (table 1). These parameters are needed to establish the phase matching geometry and thermal behavior of a nonlinear crystal in the frequency upconversion operation in high-power laser systems.

713,668
PB85-206928
(Order as PB85-206324, PC **A13**/MF **A01**)
San Jose State Univ., CA.
Bismuth Silicon Oxide: Sample Variability Studied with Thermally Stimulated Conductivity and Thermoluminescence.
B. W. Holmes, and J. E. Ludman. Apr 85, 4p
Prepared in cooperation with Rome Air Development Center, Hanscom AFB, MA.
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p242-245 Apr 85.

Keywords: *Thermoluminescence, Variability, Electron traps, Holography, *Bismuth silicon oxides, Photorefractive effect, Phase conjugation.

Bismuth silicon oxide (BSO) is widely used in optical data processing, reversible, real-time holography, and optical phase conjugation. The optical characteristics (such as wavefront reflectivity) vary significantly, even for identically prepared crystals. The manufacture of uniform and improved BSO crystals may well depend on a better understanding of the fundamental processes responsible for its photosensitivity. The authors studied electron trapping in BSO using thermally stimulated conductivity (TSC) and thermoluminescence (TL). In this study, the authors surveyed at a number of different BSO crystals, in order to assess sample variability as revealed in TSC and TL.

713,669
PB85-206936
(Order as PB85-206324, PC **A13**/MF **A01**)
Arizona Univ., Tucson. Optical Sciences Center.
Materials Requirements for Optical Logic and Bistable Devices.
N. Peyghambarian, and H. M. Gibbs. Apr 85, 3p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p246-248 Apr 85.

Keywords: Gates(Circuits), Zinc sulfides, Zinc selenides, Gallium arsenides, *Optical bistability, *Logic devices, Nonlinear optics, Refractive index, Aluminum gallium arsenides, Copper chlorides, Semiconductors.

Optical bistability, which is referred to as the existence of two stable output intensities for the same input intensity, has been realized in many semiconductors. Examples include the GaAs and GaAs-AlGaAs multiple-quantum-well superlattices, CuCl, and ZnSe. In this talk, the authors focus their attention on these materials because of their greater potential to be used as practical devices.

713,670
PB85-206944
(Order as PB85-206324, PC **A13**/MF **A01**)
Rensselaer Polytechnic Inst., Troy, NY.
Mirrorless Optical Bistability in CdS.
J. W. Haus, C. C. Sung, C. M. Bowden, and J. M. Cook. Apr 85, 2p
Prepared in cooperation with Alabama Univ. in Huntsville. Dept. of Physics, Army Missile Command, Redstone Arsenal, AL., and Middle Tennessee State Univ., Murfreesboro.
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p249-250 Apr 85.

Keywords: *Cadmium sulfides, *Optical bistability, Logic devices.

Recently, Dagenais and Sharfin have reported whole-beam optically bistable behavior in uncoated platelets of CdS. This phenomenon was observed at milliwatt power levels when the incident laser frequency was tuned just below the resonance of the I(2) bound-exciton. Using a qualitative model, the authors successfully correlated the temperature dependence of the absorption with the observed bistable behavior. The authors research extends their qualitative model by eliminating several unncesessary assumptions. It is shown how such devices can be used as multiplexers and as composite optical logic elements and for use in optical computing and optical communications. The role of the temperature-induced absorption in CdS which leads to bistable output intensities is explained.

713,671
PB85-206951
(Order as PB85-206324, PC **A13**/MF **A01**)
Lockheed Missiles and Space Co., Inc., Palo Alto, CA.
Nonlinear Optical Effects in Liquid Crystals.
D. Armitage, and S. M. Delwart. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p251-254 Apr 85.

Keywords: *Liquid crystals, Birefringence, Nonlinear optics.

Liquid crystals are birefringent materials with fluidity comparable to water. Device potential arises from the influence of electric, magnetic or optic fields on the optic axis oreintation. The response time is viscous limited. However, the more viscous smetic phases have storage properties. The birefringence is directly related to the order parameter of the fluid and its therefore sensitive to temperature, particularly near a phase ttransition. As the nematic to isotropic phase transition, the refractive index (n) discontinuity approximates 0.1. This is a weak first order transition with latent heat approximately 1 J/cc. These properties make the nematic phase an interesting solvent in a thermal dye cell. The thermal response is not viscous limited. It can be shown that when submillisecond response is demanded the thermal process is more efficient than the viscous limited orientation response. Experiments were performed with 5CB doped with L-dye D81 (EM Chemicals).

713,672
PB85-206969
(Order as PB85-206324, PC **A13**/MF **A01**)
Anhui Inst. of Optics and Fine Mechanics (China).
Study of Second Harmonic Generation Coefficients and Ultraviolet Absorption Edge of Barium Borate Crystal.
J. K. Zhu, B. Zhang, and S. H. Liu. Apr 85, 1p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p255 Apr 85.

Keywords: Ultraviolet radiation, Wave functions, *Barium borates, *Second harmonic generation, Nonlinear optics.

Barium borate (beta-BaB2O4) is a new type of nonlinear optical crystal. In this paper the authors report one-electron energies and wave functions of barium borate by use of EHMO theory. Both the calculated values of SHG coefficient and ultraviolet absorption edge for barium borate crystal are in quantitative agreement with the experimental results. The comparison between EHMO, CNDO/S and experimental values is shown.

713,673
PB85-206977
(Order as PB85-206324, PC **A13**/MF **A01**)
Alexandria Univ. (Egypt).
Soliton Transmission in Inhomogeneous Media with W-Tailored Refractive Index.
F. A. El-Halafawy, E. A. El-Badawy, M. A. El-Gammal, and M. H. Aly. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p256-259 Apr 85.

Keywords: *Fiber optics, *Optical fibers, *Solitons, Refractive index.

In this paper, a method for soliton transmission in inhomogeneous media with W-tailored refractive index is modeled and parametrically analyzed. Two kinds of inhomogeneities are simultaneously considered: (a) Biquadratic variation of the refractive index (W-tailored radial profile), and (b) Boundary conditions of the cladded fiber.

713,674
PB85-206985
(Order as PB85-206324, PC **A13**/MF **A01**)
BDM Corp., Albuquerque, NM.
Comparison of Vibrational Spectra of Heavy Metal Fluoride Glasses with Those of 'Common' Glasses.
B. Bendow. Apr 85, 6p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p260-265 Apr 85.

Keywords: *Vibrational spectra, *Glasses, *Optical glass, *Fluorides, *Infrared optical materials, Infrared spectra, Raman spectra, Chemical bonds, Molecular structure, Devitrified glass, Comparison, Heavy metals.

Vibrational spectroscopy, including polarized Raman scattering and fundamental IR reflectivity (Reststrahlen spectra), has been used to study the structure and bonding of many glasses, and to determine the origins of observed IR edge characteristics. In this paper, the authors reviews the spectra obtained to date for heavy metal fluoride glasses, and compares them with the spectra of simple halide, oxide and chalcogenide glasses.

713,675
PB85-206993
(Order as PB85-206324, PC **A13**/MF **A01**)
Schott Glaswerke, Mainz (Germany, F.R.).
Verdet Constant of Optical Glasses.
H. J. Hoffmann, W. W. Jochs, and G. Przybilla. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p266-269 Apr 85.

Keywords: *Optical glass, *Glass, *Faraday effect, *Magnetooptics, *Verdet constants, Polarized light.

A relation for the Verdet constant as a function of wavelength was first derived by Becquerel. Unfortunately Becquerel's equation cannot generally be justified on the basis of quantum mechanics. L. Rosenfeld calculated a quantum mechanical expression of the Faraday rotation angle for the monoatomic case. A thorough discussion of the limitations is given by Van Vleck. In order to avoid these difficulties, the authors developed recently a simple new dispersion formula. To test this equation, they determined experimentally the Verdet constant of different glasses in the visible spectral region by measuring the rotation angle induced by a magnetic field.

713,676
PB85-207009
(Order as PB85-206324, PC **A13**/MF **A01**)
National Defense Academy, Yokosuka (Japan).
Temperature Dependence of Magnetooptic Effects in Mid-Infrared Fibers.
H. Sato, Y. Azumai, and M. Saito. Apr 85, 4p
Prepared in cooperation with Horiba Ltd., Kyoto (Japan). Research and Development Dept.
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p270-273 Apr 85.

Keywords: *Infrared optical materials, *Magnetooptics, *Faraday effect, *Fiber optics, Intermediate infrared radiation, *Optical fibers, Temperature dependence, Verdet constants, Arsenic sulfides.

In the present paper, low temperature properties of KRS-5 and As2S3 fibers are described about their magnetooptic effects such as the Faraday- and Voigt effects at CO2 10.6 micrometer and He-Ne 3.39 micrometer laser radiation.

713,677
PB85-207017
(Order as PB85-206324, PC **A13**/MF **A01**)
GTE Labs., Inc., Waltham, MA.
Optical Characterization of Devitrification for Cr(+3)-Doped Zr-Ba-La-Al Fluoride Glass.
W. J. Miniscalco, L. J. Andrews, B. T. Hall, and D. E. Guenther. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p274-277 Apr 85.

Keywords: *Devitrified glass, *Optical glass, *Fluorides, Infrared optical materials, Atomic energy levels, Emission spectroscopy, Photoluminescence, Chromium, Stability, Crystal field, Doped materials, Heavy metals.

The past decade has seen an enormous increase in activity in the area of heavy metal fluoride glasses. These glasses contain no oxygen and are distinguished from the fluoroberyllates by the absence of beryllium. In addition to their scientific interest as a largely unexplored glass-forming system, heavy metal fluoride glasses are of technological interest because they have high optical transmission from the UV to the mid-IR (= or > 7 micrometers). One potential application is as optical fiber for both communications and energy transmission in the mid-IR. Since these glasses can be doped with transition metal and rare earth ions, other promising applications are as solid state laser hosts and magneto-optic devices. An important consideration in all applications is the relatively poor stability of these glasses compared to oxide glasses as indicated by their extremely narrow working ranges. Even for the best compositions the crystallization temperature is seldom more than 100 degrees C hier than the glass transition temperature. To further understand the stability of heavy metal fluoride glasses, the authors have undertaken an investigation of crystallization using primarily optical techniques. The work has concentrated on a Zr-Ba-La-Al fluorozirconate glass (ZBLA) which has been doped with probe ions whose optical spectra are sensitive to their local environment.

713,678
PB85-207025
(Order as PB85-206324, PC **A13**/MF **A01**)
Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center.
Optical Study of Ge-P-Te and Ge-Se-Te Chalcogenide Glasses.
L. Bohm, A. Bornstein, and S. Arie. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p278-281 Apr 85.

Keywords: *Infrared optical materials, *Fiber optics, Group 6A compounds, Chemical analysis, X ray analysis, Chemical composition, Optical properties, *Germanium phosphoride tellurides, *Germanium selenide tellurides, *Optical fibers.

Chalcogenide glasses have been thoroughly investigated, especially in connection with their electronic properties and their promise as IR windows in the 8-12 micrometers region. For the purpose of the present study, the major attraction of chalcogenides lies in their promise as IR materials for infrared optical fibers. Such fibers are needed in applications using high-power CO2 laser for surgery as well as in cutting and heat treatment of metals. These fibers will also play an important role in the development of many infrared devices in the field of image relaying and remote sensing. In this study, the authors present the preparation and optical characterization of two glass systems containing relatively high amounts of Te. Such glasses are expected to be transparent up to 20 micrometer and may serve as preforms for drawing IR fibers.

713,679
PB85-207231 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
External Dye-Laser Frequency Stabilizer.
Final rept.
J. L. Hall, and T. W. Hansch. Nov 84, 3p
Contract NSF-PHY82-00805
Pub. in Optics Letters 9, n11 p502-504 Nov 84.

Keywords: *Frequency stability, Phase modulation, Electrooptics, Reprints, *Dye lasers, Acoustooptics.

The authors describe an external dye laser frequency stabilizer, that combines an acoustooptic frequency shifter with a fast electro-optic phase modulator. A compensating electronic delay line in the crossover network provides a near-ideal transducer response, while keeping the voltage across the electro-optic crystal away from the amplifier limits.

713,680
PB85-207256 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Precision Measurements by Optical Heterodyne Techniques.
Final rept.
L. Hollberg, M. Long-Sheng, M. Hohenstatt, and J. L. Hall. 1984, 8p
Contract NSF-PHY82-00805
Pub. in Proceedings of SPIE - The International Society for Optical Engineering, San Diego, CA., August 23-24, 1983, p91-98 1984.

Keywords: *Optical measurement, *Heterodyning, Iodine, Line spectra, Erbium, Absorption spectra, Spectroscopy, Four wave mixing.

Optical heterodyne techniques are described that are generally applicable to spectroscopy and precision measurements. Phase modulation is used at high frequencies in order to suppress laser amplitude noise which is dominantly at low frequencies. The high sensitivity of these techniques is demonstrated in the detection of non-linear optical resonances in molecular iodine. Optical heterodyne saturated absorption and four-wave-mixing spectra taken with a dye laser are shown of the 612 nm I2 line which is of importance for optical frequency standards. Also shown are optical heterodyne detected saturated absorption spectra of Erbium taken in a hollow cathode discharge. An improvement in signal-to-noise ratio of 1000 is found for the optical heterodyne method relative to optogalvanic signals detected in the same discharge. Advantages and disadvantages of the various methods are discussed as are some ideas for improvement. A list of thirty references is given.

713,681
PB85-207355 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Using Optical Processing to Find the Beam Profile of a Laser Pulse (Theory).
Final rept.
E. G. Johnson. 1984, 14p
Pub. in Proceedings of SPIE--Optical Radiation Measurements 499, p75-88 1984.

Keywords: *Laser beams, Light pulses, Cross correlation, Reprints, *Beam profiles, Optical processing.

The paper looks at a particular form of optical processing, namely a form of cross-correlation, and demonstrates how the method measures certain beam profile features of a laser pulse. Beam profile is defined to mean a description of the electromagnetic field of a laser pulse in space and time.

713,682
PB85-208114 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Optical Frequency Synthesis Spectroscopy.
Final rept.
K. M. Evenson, D. A. Jennings, F. R. Petersen, J. S. Wells, and R. E. Drullinger. 1984, 9p
Pub. in Progress in Quantum Electronics 8, p143-151 1984.

Keywords: *Frequency measurement, *Electron transitions, Iodine, Reprints, Visible radiation, State of the art.

In order to measure the super narrow spectral features of cooled atoms and ions, in the optical region, optical frequency synthesis (OFS) techniques rather than wavelength techniques must be used. It is anticipated that many of these resonances will be in the optical region of the spectrum, and this paper addresses the state-of-the-art of the measurements of frequencies in that region. Two recent optical frequency measurements of iodine transitions in the visible are described, as well as recent improvements in fabricating the point-contact diode used in these measurements.

713,683
PB85-208122 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Attenuation of Multimode Fused Silica Optical Fibers Cooled to Liquid Helium Temperature.
Final rept.
A. Engelsrath, D. R. Larson, D. L. Franzen, and R. J. Phelan. 1984, 7p
Pub. in Proceedings of SPIE -- Fiber Optics: Short-Haul and Long-Haul Measurements and Applications II, n500 p124-130 1984.

Keywords: Fiber optics, Attenuation, Near infrared radiation, Detectors, Silicon dioxide, Cryogenics, *Optical fibers, Visible radiation, Multimode.

The feasibility of bringing an optical signal through an optical fiber to a detection and processing system at liquid helium temperature was examined. The attenuation of three multimode optical fibers, from two different manufacturers with different buffer coatings, was measured under different cooling conditions. It was found that the attenuation depends on the cooling condition and has hysteresis effects. Independent of the wavelength tested (0.4 - 1.65 micrometers) the attenuation stayed below 0.1 dB/m under controlled slow cooling and under 0.5 dB/m with very fast cooling. Therefore, optical fibers can be used to bring optical signals into a liquid helium cooled Dewar for detection and processing.

713,684
PB85-222008 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Wavelength Meters.
Final rept.
J. J. Snyder. 1982, 7p
Pub. in Laser Focus 18, n5 p55-61 1982.

Keywords: *Wavelengths, Measuring instruments, Optical interferometers, Reviews, Measurement, Metrology, Reprints, *Laser radiation.

A review of devices that may provide routine and rapid measurements with high accuracy and resolution.

713,685
PB85-227569 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Discrete 4D Photoabsorption Spectrum of Ba(+2).
Final rept.
C. W. Clark. Aug 84, 5p
Sponsored by National Research Council, Washington, DC., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of the Optical Society of America B 1, n4 p626-630 Aug 84.

Keywords: *Absorption spectra, Far ultraviolet radiation, Ultraviolet spectra, Reprints, *Barium ions.

The role of true collective effects in the 4d photoabsorption spectrum of Ba(+2) is shown to be minor. The most significant departures from independent particle behavior are in fact due to correlations involving the 5p, not the 4d, shell; their importance is magnified by the delicate balance of opposing single-particle forces. Reevaluation of the ionization limit reveals the presence of Beutler-Fano structures in the experimental data, the first that have been observed for excitations underneath closed shells.

713,686
PB85-229268 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Theory of Resonant Degenerate Four-Wave Mixing with Broad-Bandwidth Lasers.
Final rept.
G. Alber, J. Cooper, and P. Ewart. 1985, 9p
Grant NSF-PHY82-00805
Pub. in Physical Review A 31, n4 p2344-2352 Apr 85.

Keywords: Laser beams, Band width, Reprints, *Four wave mixing, *Degenerate four wave mixing, Nonlinear optics.

The effects of finite laser bandwidth on resonant degenerate four-wave mixing (DFWM) are calculated with use of a model in which the intense, counterpropagating pump beams are characterized by a chaotic field, the probe beam is weak and monochromatic, and the medium consists of a gas of two-level atoms. The authors present a steady-state solution in the limit where the pump-laser bandwidth exceeds all other atomic relaxation rates. Although the mean intensity due to the fluctuating fields is spatially independent (no steady-state standing-wave pattern is established), the analytic results indicate that, for intensities above the saturation intensity I(sat), spatially periodic saturation effects are important. Increasing bandwidth is shown to lead to an increase in the effective saturation intensity resulting in lower phase-conjugate reflectivity for $I < I(sat)$ than for coherent pump fields, in contrast to the results for narrow-bandwidth chaotic fields. The resonant DFWM line shape is also calculated and compared to the coherent result. The authors comment on the application of the model to other four-wave-mixing processes employing broad-bandwidth lasers.

713,687
PB86-103017 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Efficient Single Mode Operation of a CW Ring Dye Laser with a Mach-Zehnder Interferometer.
Final rept.
J. C. Bergquist, and L. Burkins. Jul 84, 7p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Optics Communications 50, n6 p379-385, 15 Jul 84.

Keywords: Reprints, *Dye lasers, *Ring lasers, Continuous wave lasers, Mach-Zehnder interferometers.

Stable single mode operation of a ring dye laser is obtained with the combination of a Mach-Zehnder interferometer (MZI), three plate birefringent filter, a single thin etalon, and a undirectional diode. The MZI eliminates the fractional insertion loss due to beam walk-off and distortion which an intracavity etalon must introduce in order to select single frequency operation. The authors experimentally demonstrate the low insertion loss, single mode stability, and frequency tuning of a ring dye laser using a specially designed, compact MZI. Finally, the authors propose MZIs with no coatings, which should permit extremely low loss broadband operation.

713,688
PB86-122785 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Coherent Raman Spectroscopy.
Final rept.
M. D. Levenson, and J. J. Song. 1980, 80p
Pub. in Coherent Nonlinear Optics Recent Advances, p293-372 1980.

Keywords: *Raman spectroscopy, Reviews, *Coherent antistokes raman spectroscopy, Four wave mixing, Nonlinear optics.

A comprehensive review is given of work on coherent Raman spectroscopy including sections on history, theory, experimental techniques, and applications. An extensive bibliography of more than 200 entries is included.

713,689
PB86-124054 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Grazing-Incidence High-Resolution Stigmatic Spectrograph with Two Optical Elements.
Final rept.
A. M. Malvezzi, L. Garifo, and G. Tondello. 1981, 6p
Pub. in Applied Optics 20, n14 p2560-2565, 15 Jul 81.

Keywords: *Ultraviolet spectrometers, *Spectrographs, Reprints, *Ultraviolet telescopes, *Solar spectrometers.

Using two optical toroidal elements, a mirror and a grating, both working at grazing incidence, a spectrometer can be built that is stigmatic in the XUV region at one wavelength. Good compensation of the aberrations is achieved when the intermediate sagittal image is nearly at infinity. By varying the angle of incidence on the grating with simple movements, a given couple of optical elements could cover stigmatically a rather extended spectral range. If coupled with bidimensional array detectors, such a spectrograph could find applications in planned solar XUV telescopes.

713,690
PB86-128246 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Detailed Look at Aspects of Optical Pumping in Sodium.
Final rept.
J. J. McClelland, and M. H. Kelley. 1985, 7p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in Physical Review A: General Physics 31, n6 p3704-3710 Jun 85.

Keywords: *Optical pumping, *Sodium, Ground state, Electron spin, Polarization(Spin alignment), Reprints, Bloch equations, Laser radiation.

Calculations and measurements are presented of the increase in (F bar)=1 ground-state population as a function of incident laser intensity in optically pumped sodium. The calculations involve numerical integration of a multilevel version of the optical Bloch equations. Agreement between experiment and theory is good when proper account is taken of the residual Doppler width in the atomic beam, which causes a larger increase in the (F bar)=1 population. The (F bar)=1 population increases by 3.5% at 35 mW/sq cm, the highest laser intensity investigated.

713,691
PB86-132743 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Direct Measurement of the Electric Field of a Laser Pulse - Theory.
Technical note.
E. G. Johnson. Aug 85, 60p NBS/TN-1084
Also available from Supt. of Docs as SN003-003-02697-2.

Keywords: *Laser beams, *Electric fields, Light pulses, Measurement, Fiber optics, Optical filters, Beam profiles.

The author considers realizing an electric field measuring apparatus by using optical processing, tapered optical fibers, and a pair of detectors at the end of each optical fiber. Using an appropriate computer-generated optical filter, the author shows it is possible to discriminate among a set of orthonormal modes used to represent the spatial features of the electric field with a signal-to-noise ratio of at least 100 to 1. If the positioning accuracies for various parts of the apparatus are

properly set up, it is expected that the signal-to-noise ratio could be about 1000. The purpose of the tapered and graded-index fiber is to select the fundamental propagating mode in a fiber and to attenuate the other modes. The existence of this fiber allows the precise determination of the strength of each of the orthonormal modes being used as the spatial basis of the electric field before the optical processing. The paper presents the conflicts in the design and gives a solution. The complete evaluation requires assembly of the proposed apparatus to assess final accuracy.

713,692
PB86-133600 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
High-Resolution VUV Spectrometer with Multichannel Detector for Absorption Studies of Transient Species.
Final rept.
C. L. Cromer, J. M. Bridges, J. R. Roberts, and T. B. Lucatorto. 1985, 16p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Applied Optics 24, n18 p2996-3001, 15 Sep 85.

Keywords: *Ultraviolet spectrometers, Far ultraviolet radiation, Resolution, Image intensifiers, Reprints.

A new high-resolution VUV spectrometer is demonstrated for applications in the 40-900-A wavelength range. The instrument is comprised of a laser-plasma VUV source, which provides continuum background illumination, 1.5-m grazing incidence spectrometer, and a 1024-channel VUV optical multichannel analyzer (VUV-OMA). The VUV-OMA is of new design, featuring a special resolution enhanced channel electron multiplier array in an overall configuration chosen to optimize the spatial resolution of the detector while maintaining single-photoelectron sensitivity.

713,693
PB86-137932 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Correlation Effects of a Phase-Diffusing Field on Two-Photon Absorption.
Final rept.
D. S. Elliott, M. W. Hamilton, K. Arnett, and S. J. Smith. 1985, 9p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A: General Physics 32, n2 p887-895 Aug 85.

Keywords: Reprints, *Two photon absorption, *Sodium atoms, Laser radiation.

Experimental evidence of field-correlation effects on weak-field two-photon absorption in atomic sodium is presented. In the case of a nearly Lorentzian laser power spectrum, the absorption profile has four times the spectral width of the exciting field, in agreement with predictions by Mollow. The measurement is carried out with counterpropagating laser beams to cancel Doppler broadening. The width of the two-photon absorption spectrum is decreased by partially decorrelating the counterpropagating laser beams. Increasing the correlation time of the frequency fluctuations, resulting in a nearly Gaussian laser power spectrum, has also been observed to decrease the width of the absorption spectrum. An extension of the time-dependent second-order perturbation theory to these additional cases yields good agreement.

713,694
PB86-138013 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Determination of Fringe Order in the Channel Spectra of Thin-Films.
Final rept.
A. Feldman. 1984, 4p
Pub. in Applied Optics 23, n8 p1193-1196 1984.

Keywords: *Optical interference, *Thin films, Optical coatings, Thickness, Reprints, Refractive index, Dispersion.

The fringe orders in the channel spectrum of a thin film can be determined unambiguously provided it is known that the film thickness is less than a critical value. The value is equal to minus one half the reciprocal dispersion of the material at the wavelength of minimum dispersion within the wavelength range of measurement. Values of critical thickness are given, as a function of wavelength, for 33 optical materials. The data indicate that the critical thickness is at least 10 micrometers in all of the materials at wavelengths within the operating range of commercial spectrophotometers.

713,695
PB86-139805 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Some Issues in Optical Fiber Bandwidth Measurements.
Final rept.
S. Yang, and R. L. Gallawa. 1985, 1p
Pub. in IEEE Instrumentation and Measurement Technology Conference, Tampa, FL., March 20-22, 1985, p228.

Keywords: *Fiber optics, *Bandwidth, Measurement, *Optical fibers.

This is a one-page summary of a talk given at the IEEE Instrumentation and Measurement Technology Conference. The talk discusses the measurement of optical fiber bandwidth, using methods in common use in the fiber community. Difficulties and variabilities are discussed.

713,696
PB86-140225 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
New Miniaturized Passive Hydrogen Maser.
Final rept.
F. L. Walls, and K. B. Persson. 1984, 4p
Sponsored by Naval Research Lab., Washington, DC.
Pub. in Proceedings of the Frequency Control Symposium (38th), Philadelphia, Pennsylvania, May 29-June 1, 1984, p416-419.

Keywords: *Masers, Frequency stability, Cesium frequency standards, Time standards, *Hydrogen masers.

The small passive hydrogen maser design developed at NBS has been further refined to produce a much smaller device with enhanced performance. This new miniaturized passive hydrogen maser is rack mounted, measuring 26 1/2 cm high exclusive of its external power supply. The weight is about 30 kgm with a steady state power consumption of about 54W at 25C. The reduction in the size and power has been achieved primarily by major changes in the beam optics, offset frequency synthesizer, and hydrogen supply. The present size is small enough to fit in the NBS environmental chamber used to house commercial cesium frequency standards.

713,697
PB86-140308 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Some Trends in Optical Electronic Metrology.
Final rept.
A. A. Sanders. 1984, 7p
Pub. in Proceedings of the Measurement Science Conference (1984), Long Beach, California, January 19-20, 1984, p27-33.

Keywords: *Fiber optics, *Electrooptics, *Metrology, *Optical fibers, Integrated optics, Laser applications, US NBS.

The use of optical related devices in high technology is expanding at a dramatic rate. Applications include the expanding use of optical fibers in telecommunications and sensors, lasers in industrial processing and medicine, optical storage devices, directed energy weapons for defensive purposes, non-destructive testing, etc. The Optical Electronics Metrology Group of the National Bureau of Standards has the responsibility for developing the standards, measurement data and methodology infrastructure for supporting much of this expanding technology. The paper reviews some of the ongoing research currently conducted by this group, and some of the perceived important technological applications in this area for the next few years. It discusses Group plans for developing the measurement infrastructure to support these innovations.

713,698
PB86-142387 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Visual Clarity with a Black-and-White Scene.
Final rept.
J. A. Worthey. 1985, 5p
See also AD-A141 498.
Pub. in Jnl. of the Illuminating Engineering Society 14, n2 p634-647 Apr 85.

Keywords: *Visual perception, Color vision, Experiments, Recognition, Resolution, Visual acuity, Reprints.

Visual clarity experiments are usually done with colorful test objects, and it is generally concluded that the results of such experiments are related to the color-rendering properties of the illuminants involved. Nonetheless, it has been observed that a clarity difference between illuminants may be seen, even with black-and-white objects. An experiment was performed to measure differences of perceived clarity using only black-and-white fabric and black yarn as test objects. (The word 'clarity' was not used in the instructions to subjects. They were asked questions concerning 'preferences' and 'blackness'.) The differences measured seem to indicate a role for color in black-and-white vision, but not a pure clarity effect independent of illuminant color.

713,699
PB86-142395 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Limitations of Color Constancy.
Final rept.
J. A. Worthey. 1985, 13p
Pub. in Jnl. of the Optical Society of America A2, n7 p1014-1026 Jul 85.

Keywords: *Color, *Adaptation, Visual perception, Chroma, Illuminance, Reprints.

Theories of adaptation, such as those based on the proportionality law of von Kries, provide detailed predictions concerning perception of object colors when illuminant spectral power distribution is changed. Since these predictions depart from the simple ideal of color constancy, a question arises of the relationships among data, theories, and the ideal of constancy. Projecting the data of a constancy experiment into an opponent-color system indicates that constancy tends to hold well for illuminant shifts in the blue-yellow direction but less well for shifts in the red-green direction. This observation is consistent with a theory based on von Kries adaptation.

713,700
PB86-142825 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Bandwidth of a Multimode Fiber Chain.
Final rept.
P. M. Rodhe. Feb 85, 10p
Pub. in Jnl. of Lightwave Technology LT-3, n1 p145-154, 1 Feb 85.

Keywords: *Fiber optics, *Bandwidth, Transfer functions, Optical measurement, Reprints, *Optical fibers, Multimode.

The author proposes a new method for evaluating the baseband transmission in a multimode fiber chain. Carnevale and Paek stated that errors in the tiber manufacturing process will randomly distort a desired index profile, presumably of power-law type. The author extends their discussion to the band-widths of concatenated fibers, by considering Gaussian approximations to actual transfer functions. The bandwidth can thus be separated into two parts, one of which is due to the over- and undercompensation of individual, idealized power-law profiles, and the other of which refers to random profile distortions as well as possible mode coupling within mode groups.

713,701
PB86-142833 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Intramodal Part of the Transfer Function for an Optical Fiber.
Final rept.
P. M. Rodhe. Feb 85, 5p
Pub. in Jnl. of Lightwave Technology LT-3, n1 p154-158, 1 Feb 85.

Keywords: *Fiber optics, *Transfer functions, *Bandwidth, Optical measurement, Reprints, *Optical fibers.

Intramodal contributions in measurements of optical-fiber bandwidth are investigated theoretically and experimentally in the quasimonochromatic case. A rela-

tion is established between the intramodal transfer function and a possibly non-Gaussian source spectrum, which may also vary with modulation frequency. By considering the latter variation in particular, we are able to predict the intramodal length dependence and show how it may deviate from that of a conventional approach.

713,702
PB86-160132 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Non-Resonant Laser-Driven Ionization of Condensing Vapors: A Mechanism Based on Cluster Fragmentation.
Final rept.
W. T. Hill. Jul 85, 6p
Sponsored by Research Corp., New York, and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Optics Communications 54, n5 p283-288, 1 Jul 85.

Keywords: *Barium, *Ionization, Argon, Vapors, Condensing, Reprints, Laser radiation.

Anomalous ionization has been observed following broad-band, nonresonant irradiation of an atomic barium vapor at high Ar buffer gas pressures. Time resolved hook measurements involving several neutral and ion states of Ba show that excited neutral and ion densities between 10 to the 14th power-10 to the 15th power/cc can be generated. The dependence of the densities on Ar pressure, time and Ba vapor density is suggestive of an ionization mechanism based on laser vaporization of barium droplets.

713,703
PB86-160629 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Monochromatic Source of Lyman-alpha Radiation.
Final rept.
J. Z. Klose, J. M. Bridges, and W. R. Ott. 1985, 4p
Contract NA80RA-G-03527
Sponsored by National Oceanic and Atmospheric Administration, Rockville, MD.
Pub. in Applied Optics 24, n14 p2263-2266, 15 Jul 85.

Keywords: *Lyman alpha radiation, Far ultraviolet radiation, Monochromatic radiation, Standards, Radiometry, Reprints, *Light sources, Hydrogen atoms.

A source has been developed which produces a pure spectrum of Lyman-alpha radiation (1215.7A). The source incorporates a wavelength selective filter and an rf-excited helium-filled lamp containing a mixture of uranium and uranium hydride in a sidearm. The uranium serves as a getter to eliminate atmospheric contaminants, and the uranium hydride, when heated, supplies H2 in a reproducible manner. The filter consists of a flowing-oxygen cell and a narrowband interference filter. The distinctive advantage of the devices is that radiation in the VUV at a well-defined wavelength is obtained without the use of a monochromator. Characteristics of the source and measurements of the irradiance of the spectral line are given for a typical lamp. The irradiance and spectral purity are seen to be not strongly dependent on oxygen flow.

713,704
PB86-161023 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.
Free-Space Propagation of Ultrashort Light Pulses.
Final rept.
J. Cooper, and E. Marx. 1985, 10p
Pub. in Jnl. of the Optical Society of America A 2, n10 p1711-1720 Oct 85.

Keywords: *Light pulses, Maxwells equations, Boundary value problems, Reprints.

A boundary-value problem for Maxwell's equations is formulated whose solutions represent ultrashort pulses of electromagnetic energy that travel along an axis. A paraxial approximation to the solution is introduced that in the case of Gaussian boundary data, is expressed as a single integral over frequency. Calculations are presented for a pulse of Gaussian cross section and Gaussian time profile. A careful study is made of the error introduced by the paraxial approximation, and an error bound is derived.

713,705
PB86-163490 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Characterization of Aircraft-Collected Particles Present in the Arctic Aerosol: Alaskan Arctic, Spring 1983.
Final rept.
P. J. Sheridan, and I. H. Musselman. 1985, 8p
Sponsored by National Oceanic and Atmospheric Administration, Washington, DC., National Aeronautics and Space Administration, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Atmospheric Environment 19, n12 p2159-2166 1985.

Keywords: *Electron microscopy, Particles, Reprints, *Arctic aerosols, *Laser microprobe analysis.

Eight hundred submicrometer and 516 large and giant (> 1 micrometer) particles collected by cascade impactor from Arctic haze aerosol were characterized using analytical electron microscopy. Selected particles were also analyzed using laser microprobe mass analysis. Over 97 percent of the analyzed submicrometer particles showed high sulfate concentrations, and a large majority (96 percent) of these appeared to have been collected directly as H2SO4 droplets. Anthropogenic particles, including graphitic carbon (soot), coal and oil fly ash, and Cu-Ni smelter emissions were observed in the coarser particle fraction. Air trajectories indicate much of the aerosol passed over industrialized regions in the U.S.S.R.

713,706
PB86-164456 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Servo Control of Amplitude Modulation in FM Spectroscopy: Shot-Noise Limited Measurement of Water Vapor Pressure-Broadening.
Final rept.
N. C. Wong, and J. L. Hall. 1985, 2p
Grant NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Proceedings of International Conference on Laser Spectroscopy (7th), Maui, HI., June 24-28, 1985, p393-394.

Keywords: Amplitude modulation, Phase modulation, Laser beams, Sensitivity, Servomechanisms, Water vapor, *Frequency modulation spectroscopy, *Laser spectroscopy.

The authors have developed and demonstrated an active servo system to suppress the AM noise of a phase modulated laser beam to achieve shot-noise limited detection in a linear absorption experiment.

713,707
PB86-164464 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Servo Control of Amplitude Modulation in Frequency-Modulation Spectroscopy: Demonstration of Shot-Noise-Limited Detection.
Final rept.
N. C. Wong, and J. L. Hall. 1985, 7p
Contract N00014-77-C-0656, Grant NSF-PHY82-00805
Sponsored by Office of Naval Research, Arlington, VA., and National Science Foundation, Washington, DC.
Pub. in Jnl. of the Optical Society of America B2, n9 p1527-1533 Sep 85.

Keywords: Laser beams, Amplitude modulation, Phase modulation, Sensitivity, Iodine, Electrooptics, Servomechanisms, Reprints, *Frequency modulation spectroscopy, *Laser spectroscopy.

The authors describe and demonstrate a new method to reduce actively the amplitude modulation of a phase-modulated laser to the shot-noise limit. This theoretical limit of ultrahigh sensitivity of FM spectroscopy is achieved in a linear absorption experiment with iodine.

713,708
PB86-168259 PC **A25**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Laser Induced Damage in Optical Materials: 1983.
Final rept.
H. E. Bennett, A. H. Guenther, D. Milam, and B. E. Newnam. Nov 85, 583p NBS/SP-688
See also PB84-175124. Proceedings of a symposium held at Boulder, Colorado, November 14-16, 1983. Also available from Supt. of Docs as SN003-003-02706-5. Library of Congress catalog card no. 85-600630. Sponsored by American Society for Testing and Materials, Philadelphia, PA., Office of Naval Research, Arlington, VA., Department of Energy, Washington, DC., and Defense Advanced Research Projects

Keywords: *Optical materials, *Meetings, Laser materials, Lasers, Damage, Thin films, Surfaces, Mirrors.

The Symposium was divided into sessions concerning Materials and Measurements, Mirrors and Surfaces, Thin Films, and finally Fundamental Mechanisms. As in previous years, the emphasis of the papers presented at the Symposium was directed toward new frontiers and new developments. Particular emphasis was given to materials for high power apparatus. The wavelength range of prime interest was from 0.6 micrometers to the uv region. Highlights included surface characterization, thin film-substrate boundaries, and advances in fundamental laser-matter threshold interactions and mechanisms. The scaling of damage thresholds with pulse duration, focal area, and wavelength was discussed in detail.

713,709
PB86-182367 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Documentation of the NBS APD (National Bureau of Standards Avalanche) and PIN Calibration Systems for Measuring Peak Power and Energy of Low-Level 1.064 Micrometer Laser Pulses.
A. L. Rasmussen, and A. A. Sanders. Dec 85, 75p
NBSIR-85/3032
Errata sheet inserted. Sponsored by Aerospace Guidance and Metrology Center, Newark AFS, OH., and Naval Plant Representative, Pomona, CA. Metrology Engineering Center.

Keywords: *Power measurement, *Photodiodes, *Standards, Light pulses, Near infrared radiation, Infrared lasers, Maintenance, Energy, Continuous radiation, *Transfer standards, *Laser radiation, *Calibration, PIN diodes, Beam splitters.

National Bureau of Standards APD (avalanche) and PIN silicon photodiode transfer standards are documented for a calibration service to measure 1.064 micrometer laser pulses from about 10 to the -8th power to about 10 to the -4th power W peak power and about 10 to the -16th power to about 10 to the -11th power J energy. A modulated cw measurement system generating known low-level pulses is described. Calibration support equipment, systematic and random errors, and computer programs and calibration data are also described.

713,710
PB86-185329 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Strength and Fatigue Properties of Optical Glass Fibers Containing Microindentation Flaws.
Final rept.
T. P. Dabbs, and B. R. Lawn. Nov 85, 7p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of the American Ceramic Society 68, n11 p563-569 Nov 85.

Keywords: *Fiber optics, Fatigue(Materials), Strength, Reprints, *Optical fibers, Lifetime.

The inert strength and dynamic fatigue properties of fused-silica optical fibers are studied using subthreshold indentation flaws, i.e., flaws without radial cracks. Direct observations of the indentation sites up to the point of failure indicate that the property differences can be interpreted in terms of a transition from propagation-controlled to initiation-controlled fracture instabilities at reduced contact loads. The subthreshold instability condition is modeled qualitatively as a two-step, deformation-fracture process, with strong emphasis on the importance of residual stress fields in parametric evaluations. The relevance of the results to the practical issue of fiber reliability, most notably in connection with the potential dangers of using macroscopic crack velocity data to predict long-lifetime characteristics, is addressed.

713,711
PB86-186673 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

New Far Infrared Laser Lines Obtained by Optically Pumping (13)CD3OD.
Final rept.
E. C. C. Vasconcellos, and K. M. Evenson. 1985, 11p
Grant NSF-INT80-19014
Sponsored by National Science Foundation, Washington, DC., and Conselho Nacional de Pesquisas, Rio de Janeiro (Brazil).
Pub. in International Jnl. of Infrared and Millimeter Waves 6, n11 p1157-1167 1985.

Keywords: *Infrared lasers, Far infrared radiation, Carbon dioxide lasers, Reprints, *Methyl alcohol lasers, Carbon 13.

Laser action was obtained in 34 far infrared lines for the first time in fully deuterated methyl alcohol with the (13)C isotope (13)CD3OD). The frequency of 13 lines was measured. The molecule was pumped by cw CO2 laser. The wavelength, the relative polarization, the relative intensity of most lines, the frequency, and the CO2 pump frequency offset of the strongest lines were measured. The new lines are distributed in the wavelength region from 75.27 micrometers to 464.7 micrometers.

713,712
PB86-187143 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Absolute Physical Quantities.
Longitudinal Ramsey Fringe Spectroscopy in an Atomic Beam.
Final rept.
J. J. Snyder, J. Helmcke, D. Zevgolis, and M. Glaeser. 1983, 5p
Pub. in Springer Series in Optical Sciences 40, n6 p108-112 1983.

Keywords: *Frequency standards, Atomic spectroscopy, Calcium, Reprints, Laser spectroscopy, Line broadening.

For ultra-high resolution spectroscopy such as optical frequency standards, the value of thermal sources such as atomic beams is currently limited by second-order Doppler broadening. The use of a longitudinal interaction geometry in which an atomic beam crosses the counter-propagating laser fields at a shallow angle is able to reduce second-order Doppler broadening to an insignificant level as well as to provide long interaction times without the necessity of large diameter optical beams. The authors have analyzed the geometry for the case of the long-lived calcium intercombination line, and conclude that when combined with pulsed (Ramsey) excitation, the longitudinal interaction geometry could be used with a thermal calcium beam to create an optical frequency standard with a reproducibility of the order of 10 to the -14th power for a few seconds of averaging time. Their initial experimental results have demonstrated the first use of the longitudinal geometry.

713,713
PB86-193919 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Spectrophotometric Tests Using a Dye-Laser-Based Radiometric Characterization Facility.
Final rept.
A. R. Schaefer, and K. L. Eckerle. 1984, 7p
Pub. in Applied Optics 23, n2 p250-256 1984.

Keywords: *Spectrophotometry, *Radiometry, Optical filters, Optical detection, Reprints, Laser applications, Dye lasers, Spectral response.

A new high accuracy dye laser based system useful for measuring the spectral transmittance of filters or the spectral response of optical detectors has recently been developed at NBS. The paper describes the system and discusses the results of measurements made for purposes of comparison with a high accuracy spectrophotometer, also developed at NBS.

713,714
PB86-202405 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Noise and Fluctuations in Multiphoton Processes.
Final rept.
P. Zoller. 1984, 11p
Pub. in Proceedings of the Rochester Conference on Coherence and Quantum Optics (5th), Rochester, NY., June 13-15, 1983, p383-393 1984.

Keywords: Light transmission, Stark effect, Stochastic processes, Noise, *Multi-photon processes, Laser radiation.

Aspects of how to formulate and solve the problem of resonant multiphoton processes in stochastic fields are summerized, emphasizing the connection with the (quantum) theory of laser coherence. Some recent results are discussed including Stark shifts in incoherent fields, laser fluctuation-induced line splitting, and ac-Stark splitting in stochastic fields with non-Gaussian statistics. A theory is developed which considers the change of classical light statistics during propagation in a nonlinear medium.

713,715
PB86-210739 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Precise Wavelength Measurements and Optical Phase Shifts. 1. General Theory.
Final rept.
W. Lichten. 1985, 8p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of the Optical Society of America A2, n11 p1869-1876 Nov 85.

Keywords: *Wavelengths, Phase shift, Optical measurement, Mirrors, Length, Standards, Reprints.

The measurement of wavelengths is subject to systematic errors caused by phase shifts on reflection. The paper gives methods for calculating these phase shifts for metallic and dielectric mirrors from knowledge of the easily obtained reflectivity or transmission spectrum. The Kramers-Kronig relations, as originated by H. W. Bode (Network Analysis and Feedback Amplifier Design (Van Nostrand, Princeton, N.J., 1945)), apply to dielectric and metallic mirrors in many cases. The success of metallic surfaces for interferometry is a direct consequence of the Kramers-Kronig relations. A specific example of a phase-shift calculation for a multilayer-dielectric-coated mirror is given.

713,716
PB86-212909 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Optical Bistability Experiments Using Samarium Vapor.
Final rept.
W. J. Sandle, and C. Parigger. 1986, 4p
Pub. in Proceedings of the Topical Meetings on Optical Bistability II, Tucson, AZ., December 2-4, 1985, p231-234 1986.

Keywords: *Samarium, Zeeman effect, Sodium, *Optical bistability, Optical switching.

Experimental investigations of optical bistability (OB) and generalized optical switching for atomic systems with degenerate lower states have up to now relied principally on atomic sodium. Many nonlinear mechanisms have been involved. Except in the simplest cases, the complicated level structure of sodium renders exact theoretical descriptions of these mechanisms beyond effective reach. Furthermore, the number of mechanisms simultaneously involved in the experiments frequently exceeds one. Consequently, one would like to study optical switching in a system for which the number of mechanisms is limited, and for which comparison with exact theoretical description is possible.

713,717
PB86-229804 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Transfer Standards for Energy and Peak Power of Low-Level 1.064 Micrometer Laser Pulses and Continuous Wave Laser Power.
Final rept.
A. L. Rasmussen, and A. A. Sanders. 1986, 9p
Pub. in Optical Engineering 25, n2 p277-285 Feb 86.

Keywords: *Standards, Near infrared radiation, Light pulses, Optical measurement, Photodiodes, Continuous radiation, Reprints, *Laser radiation, PIN diodes, Acoustooptics, Optical modulators, Neodymium lasers, YAG lasers.

For the first time, traceable transfer standards have been developed for measuring 1.064 micrometer laser pulses with duration of about 10 to 100 ns, peak power density of about 10 to the -8th power to 10 to the -4th power W/sq cm, and energy density of about 10 to the -16th power to 10 to the -11th power J/sq cm. These power and energy transfer standards use avalanche (APD) and PIN silicon photodiode detectors, respectively. They are stable and have total uncertainties of about 10%. The system for calibrating them and other devices consists of a cw Nd:YAG laser beam acousto-optically modulated to provide low-level laser pulses of known peak power and energy.

713,718
PB86-229937 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Index of Refraction of Sapphire between 24 and 1060C for Wavelengths of 633 and 799 nm.
Final rept.
J. Tapping, and M. L. Reilly. May 86, 7p
Pub. in Jnl. of the Optical Society of America A 3, n5 p610-616 May 86.

Keywords: *Sapphire, Single crystals, Near infrared radiation, Reprints, *Refractive index.

The index of refraction of the ordinary ray in sapphire for temperatures from 24 to 1060 C and for wavelengths of 633 and 799 nm was found to be expressed to 0.02% (99% confidence level). These expressions were calculated from measurements of the relative change with temperature in the reflectance for a plane surface normal to the c axis of single-crystal sapphire.

713,719
PB86-231594 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Determining the Mode-Field Diameter of Single-Mode Optical Fiber: An Interlaboratory Comparison.
Final rept.
D. L. Franzen, and R. Srivastava. Oct 85, 5p
Pub. in Jnl. of Lightwave Technology LT-3, n5 p1073-1077 Oct 85.

Keywords: *Fiber optics, Near infrared radiation, Optical measurement, Diameters, Reprints, *Optical fibers, Intercomparison.

The National Bureau of Standards, in cooperation with the Electronic Industries Association, conducted an interlaboratory measurement comparison among fiber manufacturers. Evaluated were transverse splice offset, near-field, far-field, and variable aperture far-field methods for determining mode-field diameter. Measurements were performed on five single-mode fibers at both 1300- and 1550-nm wavelengths. At 1300 nm, agreement was fairly good with the average one standard deviation being 0.15 micrometer for mode-field diameters in the 8-11 micrometer range. Distinct systematic differences among various techniques were observed at 1550 nm where mode distributions are not as Gaussian.

713,720
PB86-231602 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Determining the Effective Cutoff Wavelength of Single-Mode Fibers: An Interlaboratory Comparison.
Final rept.
D. L. Franzen. Feb 85, 7p
Pub. in Jnl. of Lightwave Technology LT-3, n1 p128-134 Feb 85.

Keywords: *Fiber optics, Near infrared radiation, Optical measurement, Reprints, *Cutoff wavelength, *Optical fibers, Intercomparison, Cut-off.

The National Bureau of Standards (NBS), in cooperation with the Electronic Industries Association, conducted an interlaboratory measurement comparison among six fiber manufacturers to determine the effective cutoff wavelength of single-mode fibers. Measurement techniques based on transmitted power were used to determine cutoff wavelength on four fibers designed for single-mode operation at 1300 nm. NBS also contributed results using a spectral near-field technique. One standard deviation measurement spreads for the various techniques range from 6 to 12 nm. With the appropriate data analysis, single bend attenuation and power step methods give the same results. Both techniques are easily implemented as extensions to the usual spectral attenuation measurement.

713,721
PB86-231628 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Optical Time-domain Reflectometer Specifications and Performance Testing.
Final rept.
B. L. Danielson. 1985, 10p
Pub. in Applied Optics 24, n15 p2313-2322, 1 Aug 85.

Keywords: *Reflectometers, Backscattering, Fiber optics, Performance, Reprints.

From a researcher's as well as a user's point of view, it is highly desirable to adopt a common basis for specifying optical time-domain reflectometer performance parameters. The paper proposes some procedures and test methods which permit these devices to be characterized in a consistent way. Passive test fixtures are also described which may facilitate measurements of dynamic range and other reflectometer properties.

713,722
PB86-241981 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Interlaboratory Measurement Comparison among Fiber Manufacturers to Determine the Effective Cutoff Wavelength and Mode Field Diameter of Single-Mode Fiber.
Final rept.
D. L. Franzen. 1985, 1p
Pub. in OFC/OFS '85 - Technical Digest, San Diego, CA., February 11-14, 1985, p36.

Keywords: *Fiber optics, Wavelengths, Diameters, Reprints, *Optical fibers, Intercomparison, Cutoff wavelength.

An interlaboratory measurement comparison to determine an effective cutoff wavelength and mode field diameter of a single-mode fiber was conducted by the National Bureau of Standards in cooperation with the Electronic Industries Association (EIA). Participants include NBS, several U.S. manufacturers, and some foreign laboratories. The purpose of the comparisons is to gather information on interlaboratory agreement when the same measurement techniques are used and to determine systematic offsets between different techniques. The various procedures tested are currently pending before the EIA and represent current practice for manufacturers.

713,723
PB86-242013 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Scratch Standard Is Only a Cosmetic Standard.
Final rept.
M. Young. Nov 85, 3p
Pub. in Laser Focus/Electro-Optics, p138-140 Nov 85.

Keywords: *Optical measurement, *Standards, *Surfaces, Reprints, *Scratch and dig standards.

The report presents a history of the scratch and dig standard, describing its application and pointing out that it may not be used for quantitative assessments such as width measurement.

713,724
PB86-245727 PC **A04**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD.
Holmium Oxide Solution Wavelength Standard from 240 to 640 nm - SRM 2034.
V. R. Weidner, R. Mavrodineanu, K. D. Mielenz, R. A. Velapoldi, and K. L. Eckerle. Jul 86, 73p NBS/SP-260/102
See also PB86-227592. Also available from Supt. of Docs as SN003-003-02751-1. Library of Congress catalog card no. 86-600560.

Keywords: *Wavelengths, *Standards, Spectrophotometers, Calibrating, Bandwidth, Transmittance, Perchloric acid, Solutions, *Holmium oxides, *Standard reference materials.

The work describes the methods and procedures used to determine the wavelengths of minimum transmittance of holmium oxide in perchloric acid solution. Measurements of spectral transmittance of the solutions were made by means of a high precision spectrophotometer over the wavelength range 200 nm to 680 nm. The wavelength scale accuracy of this instrument was verified by extensive measurements of mercury and deuterium emission lines. The measurements of spectral transmittance of the holmium oxide solutions were made as a function of temperature, purity, concentration, and spectral bandwidth. Analysis of the uncertainties associated with these parameters and the uncertainties associated with the calibration of the instrument wavelength scale and the data analysis have resulted in an estimated uncertainty of + or -0.1 nm for the determination of the wavelengths of minimum transmittance of the holmium oxide solution.

713,725
PB87-103289 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Attenuation Measurements on Deformed Optical Fibers.
A. Engelsrath, B. L. Danielson, and D. L. Franzen. Jul 86, 33p NBSIR-86/3052

Keywords: *Fiber optics, Optical measurement, Attenuation, Losses, Bending, Tension, Twisting, *Optical fibers, Multimode, Overlap.

Attenuation measurements were made on several different optical fibers subjected to bending, tension, twisting, and overlapping. The measurements were performed with an optical time-domain reflectometer which gives a partial separation between the various contributions to the measured deformation loss. The graded and step-index multimode fibers had a variety of different dimensions and coatings. The results of bending attenuation are compared with models and other reported experimental loss data. Based on the results of the present experiments, an empirical model has been derived which permits a prediction of the smallest bend radius consistent with a given allowed attenuation.

713,726
PB87-104055 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
High-Resolution VUV Spectrometer with Electronic Parallel Spectral Detector.
Final rept.
C. Cromer, J. M. Bridges, T. B. Lucatorto, and J. R. Roberts. 1984, 13p
Pub. in American Institute of Physics Conference Proceedings 119, p180-192 1984.

Keywords: *Ultraviolet spectrometers, *Far ultraviolet radiation, Reprints, Laser-produced plasma, Laser applications.

A new high resolution VUV spectrometer is described for applications in the range 40 to 900. The instrument is comprised of a laser-plasma VUV source, which provides continuum background illumination, a 1.5m grazing incidence spectrometer, and a 1024-channel VUV optical multichannel analyzer (VUV-OMA). The VUV-OMA is of new design, featuring a special resolution enhanced channel electron multiplier array in an overall configuration chosen to optimize the spatial resolution of the detector while maintaining single-photoelectron sensitivity. The characteristics of the source and detector along with various applications of the instrument to atomic physics is discussed.

713,727
PB87-104956 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Scratch-and-Dig Standard Revisited.
Final rept.
M. Young. 15 Jun 86, 8p
Sponsored by Army Armament Research and Development Command, Dover, NJ., and Department of Defense Calibration Coordination Group, Redstone Arsenal, AL.
Pub. in Applied Optics 25, n12 p1922-1929, 15 Jun 86.

Keywords: *Surfaces, *Standards, *Optical measurement, Diffraction, Reprints, *Scratch and Dig standards.

The scratch standard (MIL-O-13830A) is a cosmetic standard effected by a visual comparison with a set of secondary standards that are in turn evaluated by comparison with a set of master standards. Both manufacture and certification of the secondary standards are somewhat unreliable. The paper shows that they can be classified according to the relative power scattered at a relatively small angle and describes experiments with etched gratings that have the appearance of scratches but diffract light into a broad peak between 5 and 10 degrees off the axis of the incident beam. Some prototypes have been classified both by comparison to the master standards and by a photoelectric measurement; agreement between the two methods is good. Such gratings, used as the secondary standards, should display less intersample variation than scribed or other artifacts. The paper concludes by presenting evidence that the original primary standards have been stable over a long time.

713,728
PB87-105193 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
High-Resolution Spectra of Laser Plasma Light Sources in the Grazing Incidence Region.
Final rept.
P. Gohil, V. Kaufman, and T. J. McIlrath. 1986, 2p
Contract F496201-83-C-0130
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Applied Optics 25, n13 p2039-2040, 1 Jul 86.

Keywords: Far ultraviolet radiation, Reprints, *Laser-produced plasma, *Copper plasma, *Ytterbium plasma, *Tungsten plasma, *Light sources.

A Nd:YAG laser has been used to produce plasmas of Cu, Yb, and W. These plasmas were observed with high resolution using the NBS 10.7 m grazing incidence spectrograph. The Yb and W emissions are shown to be excellent sources of continua with very few emission lines.

713,729
PB87-106761 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Investigation of a Laser-Produced Plasma VUV Light Source.
Final rept.
J. M. Bridges, C. L. Cromer, and T. J. McIlrath. 1986, 7p
Contract F49620-83-C-0130
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Applied Optics 25, n13 p2208-2214, 1 Jul 86.

Keywords: *Far ultraviolet radiation, Radiometry, Reprints, *Laser-produced plasma, *Light sources, YAG lasers.

An investigation was conducted on the VUV radiation from laser-produced plasmas using a channel electron multiplier detector and a 1.5-m grazing incidence spectrometer. High-resolution quantitative spectra from 8 to 40 nm were obtained from the plasmas generated by a 0.5-J Nd:YAG laser focused on nine different target materials. The effects on the plasma emission of laser energy and focus were measured.

713,730
PB87-107314 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Stabilized Lasers.
Final rept.
T. Baer, and J. L. Hall. 1981, 8p
Pub. in Proceedings of Workshop on Precision Doppler Velocity Measurements in Astronomy, Solar Instrumentation - What's Next, Sunspot, NM., October 14-17, 1980, p142-149 1981.

Keywords: *Helium neon lasers, Stabilization.

Two methods of stabilizing He-Ne lasers are described, which provide a wavelength reference with a stability of better than 10 to the -9th power.

713,731
PB87-108684 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Pulse Spectrum Analysis Method of Measuring Fiber Bandwidth.
Final rept.
Y. Shao, R. Alvarez, C. Weimer, and R. L. Gallawa. 1985, 4p
Pub. in SPIE Fiber Optics: Short-Haul and Long-Haul Measurements and Applications II 559, p207-210 1985.

Keywords: *Fiber optics, *Bandwidth, Spectrum analysis, Signal to noise ratio, Optical communication, Reprints, *Optical fibers, Multimode.

A system for measuring optical fiber bandwidth using the Pulse Spectrum Analysis method (PSA) has been established. The paper discusses problems inherent to that system such as signal-to-noise ratio and off-peak error. Included are the results of bandwidth measurements on multimode telecommunication grade fibers. Finally, the PSA method is compared to other bandwidth measurement methods: the frequency domain (FD) method, and the time domain (TD) method.

713,732
PB87-108692 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Comparison of Three Bandwidth Measurement Techniques for Multimode Optical Fibers.
Final rept.
Y. Shao, and R. L. Gallawa. Jun 86, 8p
Pub. in IEEE Transactions on Instrumentation and Measurement IM-35, n2 p187-194 Jun 86.

Keywords: *Fiber optics, *Bandwidth, Comparison, Reprints, *Optical fibers, Multimode.

The paper presents the results of an experiment intended to compare three distinct methods of measuring the bandwidth of a telecommunication grade, multimode optical fiber. The three methods are: (1) the time-domain method; (2) the frequency-domain method; and (3) the pulse-spectrum analysis method. Good agreement was found between the frequency-domain method and the pulse-spectrum analysis method, but the time-domain method yields results that are lower than the other two for the cases considered.

713,733
PB87-111092 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Precise Wavelength Measurements and Optical Phase Shifts. 2. Applications.
Final rept.
W. Lichten. 1986, 7p
Grants NSF-PHY82-17458, NSF-PHY84-19105
See also PB86-210739. Sponsored by National Science Foundation, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Jnl. of the Optical Society of America A 3, n7 p909-915 Jul 86.

Keywords: *Wavelengths, Phase shift, Optical measurement, Mirrors, Reflection, Length, Standards, Reprints.

The paper calculates the optical phase shifts on reflection from dielectric coated mirrors. The technique consists of measuring the transmission spectrum of the mirrors. These data are fitted with a theoretical expression based on an equivalent, quarter-wave stack. This expression then gives the phase-shift corrections for the mirrors. A fast algorithm, based on a series representation for Chebyshev polynomials, calculates the reflectivity and phase shift for a single wavelength in 3 sec in BASIC on an inexpensive home computer. An application is to measure absolute wavelengths with equipment commonly present in laser laboratories, namely, scanning Fabry-Perot interferometers with dielectric coated mirrors. The method is that of exact fractions, which requires one primary wavelength standard, with a less accurate, secondary standard (or wavemeter). The accuracy of the technique is equal to that of the primary standard. The precision is that of reading the interferometer and can be many times that of the secondary standard.

713,734
PB87-117727 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Calibration in 1976 and 1983 of Didymium Glass Filters Issued as NBS (National Bureau of Standards) Standard Reference Materials.
Final rept.
K. L. Eckerle, S. Chang, and J. J. Hsia. 1985, 6p
Pub. in Color Research and Application 10, n1 p32-37 1985.

Keywords: *Optical filters, *Standards, *Spectrophotometers, *Calibrating, Wavelengths, Reprints, *Standard reference materials, Uncertainty.

In 1983, a new supply of didymium glass filters was prepared, as the stock calibrated in 1976 have been very useful and the inventory has been depleted. Results for representative samples of the new filters are presented. The new supply of glass has been calibrated by the batch mode and will be designated Standard Reference Materials (SRM) 2009A and 2010A. During the latter part of 1976, research was begun to characterize didymium glass filters for use with spectrophotometers with bandwidth in the range 1.5 to 10.5 nm. These filters were to have a smaller uncertainty than previously issued filters. Also, it was found that points of inflection in the transmittance curve could be used to supplement the data for transmittance minima. The results of that research were SRM 2009, 2010, 2013, and 2014. The same techniques were applied in 1983. Also, the results from 1983 and 1976 for one of the Master filters are compared.

713,735
PB87-118329 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Scanning Tunneling Microscopy Applied to Optical Surfaces.
Final rept.
R. A. Dragoset, R. D. Young, H. P. Layer, S. R. Mielczarek, E. C. Teague, and R. J. Celotta. 1986, 3p
Pub. in Optics Letter 11, n9 p560-562 Sep 86.

Keywords: *Optical measurement, *Surface roughness, Gratings(Spectra), Mirrors, Reprints, *Scanning tunneling microscopy, Diamond turning.

The technique of scanning tunneling microscopy has been applied to topographic mapping of two optical surfaces: a ruled grating replica and a diamond-turned gold mirror. The authors have demonstrated the ability of the scanning tunneling microscope to measure surface topography of a ruled-grating replica over an area of 2 micrometers X 2 micrometers. Furthermore, surface structure on a diamond-turned gold mirror was observed that could not be detected by any other type of surface-sensitive microscope. These measurements yield information necessary for gaining a complete understanding of the diamond-turning process.

713,736
PB87-121323
(Order as PB87-121315, PC **A04**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Wavelength Standard for the Near Infrared Based on the Reflectance of Rare-Earth Oxides.
V. R. Weidner, P. Y. Barnes, and K. L. Eckerle. 29 Feb 85, 11p
Included in Jnl. of Research of the National Bureau of Standards, v91 n5 p243-253 Sep-Oct 86.

Keywords: *Near infrared radiation, *Standards, Reflectance, Erbium oxides, Bandwidth, *Wavelength standards, Dysprosium oxides, Holmium oxides.

The work describes the techniques used to prepare and analyze a reflectance wavelength standard composed of three rare-earth oxides. A mixture of dysprosium oxide (Dy_2O_3), erbium oxide (Er_2O_3), and holmium oxide (Ho_2O_3) provides a pressed powder specimen exhibiting a near infrared reflectance spectrum charactrerized by many discrete absorption minima in the wavelength range 700 to 2000 nm. The object of this activity was to develop a wavelength standard for improving the accuracy of reflectance measurements in the near infrared.

713,737
PB87-122453 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Fiber Bandwidth Measurement Using Pulse Spectrum Analysis.
Final rept.
Y. Shao, and R. L. Gallawa. 1986, 3p
Pub. in Applied Optics 25, n7 p1069-1071, 1 Apr 86.

Keywords: *Fiber optics, *Bandwidth, Spectrum analysis, Comparison, Reprints, *Optical fibers, Time domain, Frequency domain.

The pulse spectrum analysis (PSA) method of measuring fiber bandwidth has been suggested as an alternative to the frequency and time domain methods, but there is a paucity of information on the technique and very little data. In fact, we know of no measurement comparisons between the PSA method and the frequency and time domain methods. The PSA method has the advantage of being very simple and gives results that are consistent with the time domain and frequency domain methods. The International Electrotechnical Commission (IEC) recommends the PSA method, but the Electronics Industries Association (EIA) of the U.S.A. takes no position in this regard. The paper gives results of an experiment which compared the three methods.

713,738
PB87-122628 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Single-Mode Fiber Dispersion Measurements Using Optical Sampling with a Mode-Locked Laser Diode.
Final rept.
T. Kanada, and D. L. Franzen. 1986, 3p
Pub. in Optics Letters 11, n5 p330-332 May 86.

Keywords: *Laser beams, *Optical dispersion, Light pulses, Fiber optics, Reprints, Mode locked lasers, Optical fibers.

Pulses from a wavelength-tunable, mode-locked laser diode were measured after 21 km of single-mode fiber propagation by optical sampling with another mode-locked laser diode; a resolution of 0.1 psec/(nm km) is achieved in the chromatic dispersion measurement. In another related experiment, 78-psec-duration pulses from an oedinary, multilongitudinal-mode laser diode are clearly displayed by optical sampling after 36 km of fiber propagation. System bandwidth increases to approximately 500 GHz km as the laser-diode wavelength is temperature tuned through the zero-dispersion region.

713,739
PB87-122636 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Optical Waveform Measurement by Optical Sampling with a Mode-Locked Laser Diode.
Final rept.
T. Kanada, and D. L. Franzen. 1986, 3p
Pub. in Optics Letters 11, n1 p4-6 Jan 86.

Keywords: *Laser beams, *Waveforms, *Optical measurement, Reprints, Aluminum gallium arsenide lasers, Gallium indium arsenide phosphide lasers, Optical fibers, Lithium iodates, Mode locked lasers.

Optical pulses from a GaAlAs laser diode directly modulated at a frequency fo (971 MHz) are mixed in a $LiIO_3$ crystal with optical sampling pulses at a frequency of fo - 10 Hz from a mode-locked GaAlAs laser diode. The optical signal obtained by sum-frequency mixing in the crystal is observed with a photomultiplier and an oscilloscope. The original pulse waveform is reproduced clearly with a temporal resolution equal to the mode-locked laser-diode pulse width and at a repetition frequency of 10 Hz. Similar results are obtained with InGaAsP laser diodes at a wavelength of 1.3 micrometers.

713,740
PB87-122644 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Direct Measurement of the Spatial Modes of a Laser Pulse: Theory.
Final rept.
E. G. Johnson. 1986, 9p
Sponsored by Department of Defense Calibration Coordination Group, Redstone Arsenal, AL.
Pub. in Applied Optics 25, n17 p2967-2975, 1 Sep 86.

Keywords: *Laser beams, *Electric fields, Light pulses, Fiber optics, Reprints, Beam profiles, Optical fibers.

An electric-field measuring apparatus was made by using optical processing, tapered optical fibers, and a pair of detectors at the end of each optical fiber. Using an appropriate computer-generated hologram (CGH), the author shows it is possible to discriminate among a set of orthonormal modes used to represent the spatial features of the electric field with a SNR of at least 100 to 1. The tapered fiber is a mode filter that is used in the transform plane of the CGH. The fiber allows precise determination of the strength of each of the orthonormal modes being used as the spatial basis of the electric field before the optical processing.

713,741
PB87-122677 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Linearity Study of a Diode-Array Radiometer.
Final rept.
A. T. Hattenburg, and J. B. Shumaker. 1984, 2p
Pub. in Applied Optics 23, n19 p3257-3258 1984.

Keywords: *Radiometers, Arrays, Photodiodes, Linearity, Silicon, Detectors, Spectroradiometers, Reprints.

No abstract available.

713,742
PB87-122685 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Comparison of the NBS SURF (National Bureau of Standards Synchrotron Ultraviolet Radiation Facility) and Tungsten Ultraviolet Irradiance Standards.
Final rept.
H. J. Kostkowski, J. L. Lean, R. D. Saunders, and L. R. Hughey. 1986, 10p
Pub. in Applied Optics 25, n18 p3297-3306, 15 Sep 86.

Keywords: *Irradiance, *Standards, Near ultraviolet radiation, Comparison, Reprints, Synchrotron Ultraviolet Radiation Facility.

Detailed comparisons of the spectral irradiance of the NBS Synchrotron Ultraviolet Radiation Facility II and tungsten FEL Scale of Spectral Irradiance at 297 and 254 nm with an uncertainty of about 1% show that these irradiance standards are consistent at both wavelengths to within the uncertainties assigned to them by NBS.

713,743
PB87-125738 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Metrology for Electromagnetic Technology: A Bibliography of NBS (National Bureau of Standards) Publications.
K. E. Kline, and M. E. DeWeese. Jun 86, 57p NBSIR-86/3048
Supersedes PB86-130234.

Keywords: *Electromagnets, *Metrology, *Fiber optics, *Bibliographies, Lasers, Optical communication, Superconductors, Standards, *Cryoelectronics, National Bureau of Standards.

The Electromagnetic Technology Division was formed during the reorganization of NBS in April 1978 by combining parts of the former Electromagnetics and Cryogenics Divisions. It develops measurement methods and standards and provides metrological support for: laser systems; optical communication equipment; cryoelectronics; superconductors; and other unusual electrical engineering materials.

713,744
PB87-128054 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Optical Frequency Measurements.
Final rept.
D. A. Jennings, K. M. Evenson, and D. J. E. Knight. 1986, 12p
Pub. in Proceedings of the Institute of Electrical and Electronics Engineers 74, n1 p168-179 Jan 86.

Keywords: *Frequency measurement, Dimensional measurement, Length, Standards, Reprints, *Laser radiation, Light speed.

The paper is a review of the history of the measurement of coherent optical frequencies. As coherent optical frequency implies a laser device, this is therefore a review of laser frequency measurement. The development of frequency measurement from the Cs frequency standard to the visible is traced. Two related aspects of optical frequency measurements, the speed of light and the redefinition of the meter, are also discussed.

713,745
PB87-128112 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Angular Momentum of Trapped Atomic Particles.
Final rept.
D. J. Wineland, J. J. Bollinger, W. M. Itano, and J. D. Prestage. 1985, 10p
Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of the Optical Society of America B 2, n11 p1721-1730 Nov 85.

Keywords: Angular momentum, Radiation pressure, Reprints, *Ion traps, *Atom traps, Ion storage, Laser spectroscopy, Laser cooling.

In axially symmetric atomic-particle traps, the angular momentum of the particles about the symmetry axis is conserved in the absence of external torques. Changes in this angular momentum owing to laser scattering are discussed.

713,746
PB87-128997 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Intercomparison between Independent Irradiance Scales Based on Silicon Photodiode Physics, Gold-Point Blackbody Radiation, and Synchrotron Radiation.
Final rept.
A. R. Schaefer, R. D. Saunders, and L. R. Hughey. 1986, 5p
Pub. in Optical Engineering 25, n7 p892-896 Jul 86.

Keywords: *Irradiance, *Radiometry, Synchrotron radiation, Photodiodes, Reprints, Intercomparison.

An intercomparison has been conducted among three independent scales of spectral irradiance: two source-based and one detector-based. Specifically, a radiometer composed of a silicon photodiode, an interference filter, and an integrating sphere was characterized and calibrated against an absolute silicon detector standard at 600 nm using a cw dye laser. The radiometer was then used to measure the spectral irradiance at 600 nm from spectral irradiance lamps calibrated against a gold-point blackbody, and the spectral irradiance at the same wavelength from the NBS electron storage ring, SURF-II. Intercomparisons of this type are an important check of the agreement between these independent radiometric techniques. It was found that the detector scale indicated a spectral irradiance at 600 nm that was 0.76% lower than predicted by the gold-point blackbody scale and 0.25% higher than predicted by the electron storage ring scale. This result implies agreement within the overall quadrature uncertainties of plus of minus 0.25% for the detector scale, plus or minus 0.84% for the gold-point blackbody scale, and plus or minus 0.60% for the electron storage ring scale.

713,747
PB87-133294 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Technical Digest - Symposium on Optical Fiber Measurements, 1986.
G. W. Day, and D. L. Franzen. Sep 86, 159p NBS/SP-720
See also PB85-114700. Also available from Supt. of Docs as SN003-003-02772-3. Library of Congress catalog card no. 86-600563. Prepared in cooperation with Institute of Electrical and Electronics Engineers, Inc., New York, and Optical Society of America, Washington, DC.

Keywords: *Fiber optics, *Meetings, Optical measurement, Dimensional measurement, Diameters, Electrooptics, Optical communication, *Optical fibers, Multimode.

The digest contains summaries of 34 papers presented at the Symposium on Optical Fiber Measurements, held September 9-10, 1986, at the National Bureau of Standards, Boulder, Colorado.

713,748
PB87-134193 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Excited-State Stability and X-ray Lasers.
Final rept.
J. N. Bardsley. 1986, 2p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Optics Letters 11, n10 p612-613 Oct 86.

Keywords: Stability, Reprints, *X ray lasers, Multiphoton processes.

Based on the results of recent studies of microwave ionization of Rydberg states, estimates are obtained for the stability of excited states of highly charged ions under irradiation from a powerful excimer laser. The short lifetimes and associated line broadening suggest caution in the design of x-ray lasers using selective multiphoton excitation as a pumping mechanism.

713,749
PB87-134920 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Pressure Effects on the Frequency of Continuous-Wave Optically Pumped Far-Infrared Lasers.
Final rept.
M. Inguscio, and K. M. Evenson. 1984, 2p
Pub. in Optics Letters 9, n10 p443-444 1984.

Keywords: *Infrared lasers, Far infrared lasers, Frequencies, Reprints, Pressure dependence.

The frequency of the 170.6 micrometer cw CH(3)OH optically pumped laser emission has been remeasured at different pressures without observing the pressure shift observed by Lawandy and Koepf. The FIR frequency was synthesized with two stabilized CO2 lasers. No measurable pressure shift over the operating pressure range of the laser was observed, and the frequency was confirmed to be 1757526.3 MHz. However, competing lasing lines were found to produce spurious effects on the frequency. These may explain their apparent shifts.

713,750
PB87-136644 PC **A19**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Laser Induced Damage in Optical Materials: 1984.
Special pub. (Final).
H. E. Bennett, A. H. Guenther, D. Milam, and B. E. Newnam. Oct 86, 448p NBS/SP-727
See also PB82-112921. Also available from Supt. of Docs as SN003-003-02761-8. Library of Congress catalog card no. 86-600587. Sponsored by American Society for Testing and Materials, Philadelphia, PA., Office of Naval Research, Arlington, VA., Department of Energy, Washington, DC., and Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Optical materials, *Laser materials, *Meetings, *Radiation damage, Mirrors, Surfaces, Thin films, Infrared radiation, Ultraviolet radiation, Optical coatings, *Physical radiation effects, Laser damage, Picosecond pulses.

The Symposium was divided into sessions concerning Materials and Measurements, Mirrors and Surfaces, Thin Films, and Fundamental Mechanisms. As in previous years, the emphasis of the papers presented at the Symposium was directed toward new frontiers and new developments. Particular emphasis was given to materials for high power apparatus. The wavelength range of prime interest was from 10.6 micrometers to the uv region. Highlights included surface characterization, thin film-substrate boundaries, and advances in fundamental laser-matter threshold interactions and damage mechanisms.

713,751
PB87-149878 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Fizeau Wavemeter for Pulsed Laser Wavelength Measurement.
Final rept.,
M. B. Morris, T. J. McIlrath, and J. J. Snyder. 1984, 7p
Pub. in Applied Optics 23, n21 p3862-3868 1984.

Keywords: *Wavemeters, *Wavelengths, Optical measurement, Light pulses, Laser beams, Reprints, *Laser radiation, *Pulsed lasers.

The authors have developed and characterized a Fizeau wavelength meter, optimized for use with pulsed laser sources, which demonstrates a CW resolution of a few parts in 10 and a pulsed resolution within 1 part in 10. The static optical design is based on a Fizeau wedge interferometer, which together with spatial filtering and collimating optics is used to produce a pattern of parallel fringes which are imaged on a linear photodiode array and analyzed by a minicomputer. The authors describe a series of CW and pulsed measurements of various narrow-band laser sources and examine the particular difficulties involved in pulsed laser measurements with the wavemeter.

713,752
PB87-152294 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Safety Color Appearance under Selected Light Sources,
B. L. Collins, B. Y. Kuo, S. E. Mayerson, J. A. Worthey, and G. L. Howett. Jan 87, 140p NBSIR-86/3493
Sponsored by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Colors, *Illumination, *Safety, Fluorescent lamps, Mercury lamps, Incandescent lamps, Sodium lamps, Specifications, Chromaticity coordinates, Luminance, *ANSI standard safety colors.

The present report provides data on the color appearance and physical measurements of 58 safety color samples viewed under each of seven light sources. The seven light sources included incandescent, cool white fluorescent, clear mercury, metal halide, metal halide-high pressure sodium mix, high pressure sodium, and low pressure sodium. Color samples included ones for safety red, orange, yellow, green, blue, purple (magenta), brown, white, gray, and black of several different types including ordinary, fluorescent, retroreflective, and retroreflective fluorescent. Analysis of the data indicated that the standard ANSI (American National Standards Institute) samples were often not identified accurately under many of the sources studied, with particularly poor performance for the two sodium sources and clear mercury. Specifications are given for a new set of samples that were identified more accurately under all seven sources and which showed a greater gamut of coloration in a uniform color space for all sources. Chromaticity and luminance coordinates for all 58 color samples are presented for both CIE x,y,Y and CIE L*a*b* values. In addition, the psychophysical data are compared with the CIELAB data.

713,753
PB87-153623 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Perturbation Correction for Refraction in Ultrasonic and Optical Tomography.
Final rept.,
S. J. Norton. 1983, 7p
Pub. in Proceedings of Conference on Inverse Optics, Arlington, Virginia, April 6-8, 1983, p25-31 1983.

Keywords: *Refraction, Ultrasonic frequencies, Optical tests, Perturbation, Correction, *Tomography, Refractive index.

Tomographic algorithms have been used to generate cross-sectional images of sound velocity in the human body from time-of-flight measurements of ultrasonic pulses. Similar algorithms have been employed to reconstruct optical refractive index fields, in which optical path lengths are measured interferometrically rather than transit times. Using a ray propagation model, an ultrasonic transit time or optical path length measurement is proportional to the line integral of the ultrasonic (or optical) refractive index over the ray path. Under the assumption that the propagation paths are straight, conventional computerized tomography (CT) algorithms have been used to perform the reconstructions. In real media, ray refraction introduces a time-of-arrival (or optical path length) error in the measurement, leading to image degradation. To date, only iterative techniques based on numerical ray tracing have been proposed to correct for the effects of refraction. In the paper, the authors present a perturbation approach to this problem which, for relatively small refractive-index fluctuations, requires neither iteration nor ray tracing.

713,754
PB87-153714 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Optical Bistability and Polarization Switching Utilizing Two-Level Atoms with Lower-Level Degeneracy.
Final rept.,
W. J. Sandle, C. Parigger, and R. J. Ballagh. 1986, 6p
Pub. in Society of Photo-Optical Instrumentation Engineers 667, p62-67 1986.

Keywords: Optical pumping, Atoms, Reprints, *Optical bistability, *Polarization switching.

The physics behind magnetically-induced polarization switching for atoms undergoing a J(lower)=1 - J(upper)=0 transition in a polarization degenerate cavity is discussed. The authors present preliminary theoretical results for self-pulsing between sigma (+) and sigma (-) modes.

713,755
PB87-161733 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Frequency Measurement of the Solitary Ethyl Alcohol Laser Line.
Final rept.,
E. C. C. Vasconcellos, D. A. Jennings, and K. M. Evenson. 1986, 2p
Sponsored by National Science Foundation, Washington, DC., and Conselho Nacional de Pesquisas, Rio de Janeiro (Brazil).
Pub. in International Jnl. of Infrared and Millimeter Waves 7, n2 p291-292 1986.

Keywords: *Frequency measurement, Carbon dioxide lasers, Far infrared radiation, Infrared lasers, Optical pumping, Reprints, *Ethyl alcohol lasers.

The authors measured the frequency, the relative polarization, and the pump frequency offset of the single FIR laser line obtained by optically pumping ethyl alcohol C2H5OH with a cw CO2 laser.

713,756
PB87-162277 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Automated Radiometric Linearity Tester.
Final rept.,
R. D. Saunders, and J. B. Shumaker. 15 Oct 84, 3p
Pub. in Applied Optics 23, n20 p3504-3506, 15 Oct 84.

Keywords: *Radiometers, Test equipment, Near infrared radiation, Near ultraviolet radiation, Automation, Linearity, Reprints, Visible radiation, Response functions.

A description is given of an automated beam conjoiner which is suitable for use in the near UV, visible, and near IR. The instrument uses filters to permit rapid, repeatable flux-level changes. The operation and data reduction techniques are outlined, and the results of the application of the instrument to the measurement of the response function of a radiometer are shown.

713,757
PB87-165676 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Line Shapes of Laser Intracavity Absorption.
Final rept.,
H. Schroder, K. Schultz, and P. E. Toschek. 1 Nov 86, 7p
Pub. in Optics Communications 60, n3 p159-165, 1 Nov 86.

Keywords: *Spectral lines, Lasers, Absorption, Spectroscopy, Reprints, Multimode.

Laser intracavity absorption has been afflicted by the appearance of highly complex lineshapes, which seriously limit the applicability of this sensitive spectroscopic technique. The authors demonstrate these lineshapes to emerge from the interplay of linear absorber dispersion and resonator diffraction. They can be avoided by tuning the resonator to a relative minimum of its diffraction loss.

713,758
PB87-167656 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Laboratory Intercomparison Study of Pressed Polytetrafluoroethylene Powder Reflectance Standards.
Final rept.,
V. R. Weidner, J. J. Hsia, and B. Adams. 1985, 6p
Pub. in Applied Optics 24, n14 p2225-2230 1985.

Keywords: *Reflectance, *Standards, Reprints, *Poly(ethylene/tetrafluoro), Interlaboratory comparisons, Intercomparison.

The object of the paper is to present the results of several experiments relating to the preparation and use of pressed polytetrafluoroethylene (PTFE) powder as a diffuse reflectance standard for the spectral range 200 to 2500 nm. These experiments include two round-robin intercomparisons envolving nine laboratories. These round-robin experiments provided data on the variability of the reflectance of pressed PTFE reflectance standards prepared in different laboratories. The results of these measurements provided insight into the problems associated with the PTFE standards and helped to establish what practices needed to be standardized in order to improve interlaboratory agreement for diffuse reflectance measurements.

713,759
PB87-167664 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Intensity Fluctuations in Multimode Pulsed Dye Lasers.
Final rept.,
L. A. Westling, M. G. Raymer, and J. J. Snyder. 1984, 1p
Pub. in Jnl. of the Optical Society of America A-Optics and Image Science 1, n12 p1319 1984.

Keywords: Spectrum analyzers, Intensity, Reprints, *Dye lasers, Multimode, Pulsed lasers.

Statistical properties of a multimode pulsed dye laser have been studied by measuring the cross correlation coefficients between mode intensities in individual pulses and the intensity autocorrelation function of the total output intensity.

713,760
PB87-173753 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Film Thickness and Refractive Index Standard Reference Material Calibrated by Ellipsometry and Profilometry.
Final rept.,
G. A. Candela, D. Chandler-Horowitz, D. B. Novotny, T. V. Vorburger, and C. H. W. Giauque. 1986, 6p
Pub. in Proceedings of SPIE - The International Society for Optical Engineering, Quebec City, Canada, June 3-6, 1986, p402-407.

Keywords: *Dimensional measurement, *Thickness, Silicon, Silicon dioxide, Polarimetry, Calibrating, *Standard reference materials, *Refractive index, Ellipsometry.

A Standard Reference Material (SRM) has been designed and fabricated and will be certified for thickness and refractive index using a highly accurate ellipsometer. The SRM consists of a three-inch diameter silicon wafer with a silicon dioxide film of uniform thickness. The design and preparation of the SRM are discussed and the ellipsometric measurement results and their comparisons with stylus profilometry are presented, along with the precision of the measurements. The ellipsometric accuracy depends upon the wafer oxide film, the model that represents the film-interface-substrate system, and the methods used to make the measurements. When the optical thickness, as determined by the ellipsometer, is compared with the mechanical thickness, as determined by the stylus profilometer, both the correct sample preparation and correct model are important in order to obtain high accuracy. The SRM will be available initially in three nominal oxide film thicknesses of 50, 100, and 200 nm. The SRM can be used to calibrate many different optical and mechanical thickness monitoring instruments as well as ellipsometers for which it was specifically designed.

713,761
PB87-174314 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.
Geometry and Amplitude of Veiling Reflections,
J. A. Worthey. Mar 87, 38p NBSIR-87/3525

Keywords: *Illuminating, *Visual perception, *Reflection, Color, Surface properties, *Veiling reflection.

The problem of veiling reflections in flat reading matter is examined in three theoretical analyses. These assumptions are made: (1) The surface is shiny, so that surface reflections can be treated as creating a mirror image; (2) The light source has a non-zero area; (3) Insofar as it matters, the reading material has non-zero area also. The first analysis assumes that the reader can tilt the reading material. The extent to which a larger luminaire forces him to tilt farther from his line of sight and from the incident light is then computed. The second analysis assumes that the luminaire image is

not avoided. Then, the smaller the luminaire is, the brighter its image will be, relative to a diffuse white surface; this effect is expressed in a formula and in graphs. The overall implication of the first two analyses is that while veiling reflections are not negligible with spherical illumination, the worst light sources are those of intermediate size, whose image is hard to avoid, yet brighter than in the spherical case. The final analysis shows that when veiling reflections cannot be avoided, they desaturate colored objects. For instance, spherical illumination reduces the accessible volume in the CIELAB uniform color space by 37%.

713,762

PB87-179438 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Standard Measurement Procedures for Characterizing Single-Mode Fibers.
Final rept.,
D. L. Franzen. 1986, 8p
Pub. in Test and Measurement World, p70-77 Oct 86.

Keywords: *Fiber optics, Optical dispersion, Attenuation, Wavelengths, Diameters, Reprints, *Optical fibers, Cut-off.

Parameters that describe single-mode optical fibers include attenuation, cut-off wavelength, mode-field diameter, and dispersion. Some measurement results depend on test -fiber condition and testing methods.

713,763

PB87-179883 PC **A04**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
NBS (National Bureau of Standards) Measurement Services: Spectral Radiance Calibrations.
Final rept.,
J. H. Walker, R. D. Saunders, and A. T. Hattenburg. Jan 87, 74p NBS/SP-250/1
See also PB87-174041. Also available from Supt. of Docs as SN003-003-02792-8. Library of Congress catalog card no. 87-619800.

Keywords: *Radiance, *Standards, Spectroradiometers, Blackbody radiation, Optical measurement, Errors, *Calibration, US NBS.

The report describes the measurement methods and instrumentation used in the realization and transfer of the NBS scale of spectral radiance. The application of the basic measurement equation to both blackbody and tungsten strip lamp sources is discussed. The determinations of the spectral responsivity function, response linearity, polarizance and 'size-of-source effect' of the spectroradiometer are described. The analysis of sources of error and estimates of uncertainty are presented. The assigned uncertainties in spectral radiance range from about 1.75% at 225 nm to 0.25% at 2400 nm.

713,764

PB87-191078 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Measurement Technique for Determining the Temperature Distribution in a Transparent Solid Using Holographic Interferometry.
Final rept.,
A. Ito, and T. Kashiwagi. Mar 87, 5p
Pub. in Applied Optics 26, n5 p954-958, 1 Mar 87.

Keywords: *Polymethyl methacrylate, *Silicon dioxide, Refractive index, Holography, Interferometers, Reprints.

Temperature distributions in transparent solids have been determined by measurements of changes in the refractive index of the sample using a holographic interferometry technique. The steady-state temperature distributions within two samples, fused silica and polymethyl methacrylate (PMMA), were measured to demonstrate the technique. Various errors in the measured temperature distribution caused by refraction and heat losses from the sample are discussed and estimated.

713,765

PB87-193587 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Laser Power and Energy Measurements and the NBS (National Bureau of Standards) Laser Measurement Assurance Program (MAP).
Final rept.,
W. E. Case, and A. A. Sanders. 1985, 5p
Pub. in Proceedings of IMTC/85 held at Tampa, FL., March 20-22, 1985, IEEE (Institute of Electrical and Electronics Engineers) Catalog No. 85CH2159-2, p281-285.

Keywords: *Power measurement, *Standards, Laser beams, Energy, *Laser radiation, US NBS, Instrumentation, Measurement assurance programs.

The paper describes the national standards for laser power and energy measurements maintained by the National Bureau of Standards, and how the measurement services based on these standards are disseminated. Particular emphasis is devoted to the procedures and instrumentation used in these measurements. The Laser Measurement Assurance Program (MAP) is discussed in detail. The paper also presents a detailed procedure for the user to choose proper instrumentation and procedures to implement a measurements program in the laboratory.

713,766

PB87-198024 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Intracavity Frequency Doubling for the Generation of Squeezed States of Light.
Final rept.,
H. J. Kimble, and J. L. Hall. 1986, 12p
Sponsored by National Science Foundation, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of International Symposium on Quantum Optics (4th), Hamilton, New Zealand, February 1986, p58-69.

Keywords: Frequency multipliers, Compressing, *Second harmonic generation, Nonlinear optics.

The authors experiments attempt to produce squeezed states of light by second harmonic generation within an optical cavity resonant at both fundamental and harmonic frequencies. They begin in Section II with an overview of the relevant theoretical predictions before turning in Section III to the actual experiment.

713,767

PB87-198032 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Floquet-Liouville Supermatrix Approach: Time Development of Density-Matrix Operator and Multiphoton Resonance Fluorescence Spectra in Intense Laser Fields.
Final rept.,
T. S. Ho, K. Wang, and S. I. Chu. 1986, 19p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 33, n3 p1798-1816 Mar 86.

Keywords: Fluorescence, Reprints, *Multi-photon processes, Floquet function, Matrices, Laser radiation.

A Floquet-Liouville supermatrix (FLSM) approach is presented for nonperturbative treatment of the time development of the density-matrix operator of atoms and molecules exposed to intense polychromatic fields. By extending the many-mode Floquet theory (MMFT) recently developed, the time-dependent Liouville equation for the density matrix of quantum systems undergoing relaxations (due to radiative decays and collisional dampings, etc.) can be transformed into an equivalent time-independent non-Hermitian FLSM eigenvalue problem. This yields a numerically stable and computationally efficient approach for the unified treatment of nonresonant and resonant, one- and multiple-photon, steady-state and transient phenomena in nonlinear optical processes, much beyond the conventional rotating-wave-approximation (RWA) method. Connections of the FLSM approach to the MMFT in the limit of zero relaxations are also made, providing the understanding of the physical significance of FLSM supereigenvalues and eigenvectors.

713,768

PB87-198040 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Stabilizing Lasers for Applications in Quantum Optics.
Final rept.,
J. L. Hall. 1986, 12p
Sponsored by Office of Naval Research, Arlington, VA., and National Science Foundation, Washington, DC.
Pub. in Proceedings of International Symposium on Quantum Optics (4th), Hamilton, New Zealand, February 1986, p273-284.

Keywords: *Lasers, *Frequency stability, Stabilization, Laser outputs.

Servo stabilization of laser output parameters, such as intensity and frequency, are considered. The intrinsic noise of the laser may be strongly reduced by such techniques, in principle to negligible values. However, noise of the measurement process and noise and drift of the discriminator are directly imposed onto the laser's output by the servo process. Results and problems are discussed for both intensity and frequency stabilization systems.

713,769

PB87-202958 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Optical Sampling with Gain-Switched, Pulse-Compressed, Distributed Feedback Laser Diodes.
Final rept.,
D. L. Franzen, Y. Yamabayashi, and T. Kanada. 1987, 2p
Pub. in Electronics Letters 23, n6 p289-290, 12 Mar 87.

Keywords: *Waveforms, Optical measurement, Sampling, Infrared lasers, Near infrared radiation, Reprints, Distributed feedback lasers, Picosecond pulses.

Chirped pulses from gain-switched, distributed feedback laser diodes at a wavelength of 1.3 micrometers are compressed to 8.7 ps FWHM by the linear dispersion properties of single-mode fibre. These pulses are used to optically sample fast waveforms from other 1.3 micrometers laser diodes. The high time resolution sampling system uses a fibre coupler to combine beams; this eliminates critical alignment and results in a practical design.

713,770

PB87-219069 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Efficient Electro-Optic Modulator for Optical Pumping of Na Beams.
Final rept.,
J. F. Kelly, and A. Gallagher. 1987, 4p
Sponsored by Department of Energy, Washington, DC.
Pub. in Review of Scientific Instruments 58, n4 p563-566 Apr 87.

Keywords: *Optical pumping, *Sodium, Electrooptics, Reprints, *Optical modulators, Lithium tantalates.

An electro-optic modulator using LiTaO3 is described which yields 34% of the carrier intensity in each of the first-order sidebands with rf phase modulation frequencies fm about 1.0 GHz and about or $<$ 1.0 W input power. The modulator makes use of a lumped resonator with Q about 200 to obtain efficient production of the sidebands. It is shown that the device can be scaled for operation at about 2 GHz. Applications of this modulator include optical pumping of the lighter alkali atoms, FM sideband spectroscopy, and laser phase/frequency stabilization using rf modulation techniques.

713,771

PB87-219127 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Spectral Irradiance Scales Based on Filtered Absolute Silicon Photodetectors.
Final rept.,
R. J. Bruening. 1987, 7p
Pub. in Applied Optics 26, n6 p1051-1057, 15 Mar 87.

Keywords: *Irradiance, *Radiometry, Photodetectors, Silicon, Reprints, Visible radiation.

A scale of spectral irradiance has been realized for the 400-700-nm wavelength range based on absolute silicon photodetectors, with the wavelength selected by interference filters. From these data, a photometric

scale of luminous intensity has been realized. The results were compared to scales based on blackbodies.

713,772
PB87-220521 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Quantum-Mechanical Noise in an Interferometer: Intrinsic Uncertainty versus Measurement Uncertainty.
Final rept.,
W. T. Ni. 15 May 87, 6p
Pub. in Physical Review D 35, n10 p3002-3007, 15 May 87.

Keywords: *Optical interferometers, Measurement, Reprints, *Michelson interferometers, Quantum mechanics, Uncertainty.

In many quantum-mechanical measurements, the total uncertainties (sigma) are greater than or equal to the intrinsic uncertainties (sigma 1) of the quantities to be measured; the differences are due to the particular measurement processes chosen. In each of these situations, a measurement uncertainty (sigma M) can be defined as (sigma M)=square root of (sigma squared - (sigma 1) squared). A question to ask is whether (sigma M) is independent of the initial quantum state of the system to be measured, i.e., whether (sigma M) is only dependent on the measurement process chosen. For a Michelson interferometer, the authors extend Loudon's model to show that in the model (sigma M) is only dependent on the measurement process chosen for the case with small radiation-pressure fluctuation. When the intensity and radiation-pressure fluctuation are high, there are cross-correlated terms. Some of these terms are negative and give hope to the possibility of uncertainty reductions for appropriate schemes.

713,773
PB87-224549 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Method for First-Order Design of a Transfer Optics System to Throughput Match a Fourier Transform Spectrometer to a Sample Cell Without Use of a Field Lens at the Cell Input.
Final rept.,
W. B. Olson. 1987, 5p
Pub. in Applied Optics 26, n12 p2441-2445, 15 Jun 87.

Keywords: Reprints, *Fourier transform spectrometers, *Throughput matching, *FTIR, Ray transfer matrices, Absorption cells, White cells.

The realization that the usual optical geometry of an absorption cell is the frustrum of a cone and that a requirement can be put on any transfer optics system that eliminates the need for a field lens at the cell input leads to a powerful method of first-order optical system design through (1) determination of a required ray transfer matrix, unique except for sign, which requires a single concave spherical mirror (or lens) to implement and (2) getting additional degrees of freedom to make the system more practical at the expense of additional spherical mirrors (or lenses). Two successful applications of the method are described.

713,774
PB87-233326 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Waveform Standards for Electrooptics: A Pulse Duration Comparison.
Final rept.,
R. A. Lawton, and K. Meyer. 1987, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques MTT-35, n4 p450-453 Apr 87.

Keywords: *Waveforms, Standards, Measurements, Reprints, *Electrooptic samplers, *Pulse measurement system.

A transfer standard has been developed for use in comparing the measurement capability of the Automatic Pulse Measurement System (APMS) at the National Bureau of Standards to that of the recently developed electrooptic samplers. The transfer standard is a comb generator driven by a 90-MHz sine wave. Using the standard, measurements were made of the pulse waveform of a comb generator output with both the APMS and an electrooptic sampler. A comparison was then made of the pulse duration (full width at half maximum) obtained in the two waveform measurements. The result was a duration of 102 ps as measured by the APMS and 112 ps as measured by the electrooptic sampler. The signal-to-noise ratio at the comb generator input was improved over that of previous measurements, and a correction for pulse broadening was made to achieve the result. The pulse broadening was caused by the impedance mismatch between the sampler and the transmission system (50 omega).

713,775
PB87-233359 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Optically Pumped (13)CH2F2 Laser: Wavelength and Frequency Measurements.
Final rept.,
A. Scalabrin, J. Tomaselli, D. Pereira, E. C. C. Vasconcellos, K. M. Evenson, F. R. Petersen, L. Zink, and D. A. Jennings. 1985, 7p
Sponsored by Conselho Nacional de Pesquisas, Rio de Janeiro (Brazil), and National Science Foundation, Washington, DC.
Pub. in International Jnl. of Infrared and Millimeter Waves 6, 10 p973-979 1985.

Keywords: *Far infrared radiation, *Millimeter waves, *Infrared lasers, Optical pumping, Polarization(Waves), Wavelenghts, Reprints, Carbon 13, Phosphonic difluoride/methyl.

The authors have obtained laser action in carbon 13 difluormethane, (13)CH2F2, pumping with CO2 cw laser lines from 10R4 to 9R44. They have found 65 lines ranging from 106 to 1220 micrometers. They have performed wavelength, polarization, and intensity measurements. The frequencies of 57 of these lines were measured by the synthesis of two frequency stabilized CO2 lasers in a MIM diode. Most of these lines have intensities comparable to those of the well known (12)CH2F2 laser.

713,776
PB87-233367 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Measurements of New FIR Laser Lines in CD3OD.
Final rept.,
D. Pereira, E. C. C. Vasconcellos, A. Scalabrin, K. M. Evenson, F. R. Petersen, and D. A. Jennings. 1985, 6p
Sponsored by Conselho Nacional de Pesquisas, Rio de Janeiro (Brazil), and National Science Foundation, Washington, DC.
Pub. in International Jnl. of Infrared and Millimeter Waves 6, n9 p877-882 1985.

Keywords: *Far infrared radiation, *Millimeter waves, *Infrared lasers, Carbon dioxide lasers, Optical pumping, Deuterium compounds, Masers, Reprints, *Methyl alcohol lasers.

The authors report the measurement of 80 new FIR laser lines in CD3OD optically pumped by a regular continuous wave CO2 laser. These lines are in the spectral range of 79 micrometers to 2.9 mm.

713,777
PB87-233656 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Microscope Objectives, Cover Slips, and Spherical Aberration.
Final rept.,
C. W. Oates, and M. Young. 1987, 1p
Pub. in Applied Optics 26, n11 p2043, 1 Jun 87.

Keywords: *Fiber optics, Microscopes, Reprints, *Optical fibers, *Microscope objectives, Spherical aberration, Numerical aperture.

Microscope objectives, with powers of 20X and higher, will display significant spherical aberration when used to examine an optical fiber without a cover slip.

713,778
PB87-233730 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Depolarization of Near-Resonance Rayleigh Scattering by Barium Ions.
Final rept.,
G. Chen, and T. J. A. Nee. 1987, 3p
Pub. in Jnl. of the Optical Society of America B4, n8 p1303-1305 Aug 87.

Keywords: *Barium, *Depolarization, Plasma, Rayleigh, Scattering, Reprints.

The polarization ratio of near-resonance Rayleigh scattering (NRRS) from barium ions in a resonant laser-driven plasma has been measured. The Ba+ resonance transition involved in the NRRS originates from a state with angular momentum J = 0. It has been deduced from the experimental results that the resonance scattering is completely depolarized, which is in good agreement with theory.

713,779
PB87-234019 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Simple Stray-Light Test for Spectrophotometers.
Final rept.,
K. D. Mielenz, V. R. Weidner, and R. W. Burke. Jan 82, 9p
Pub. in Optical Radiation News, n38 p1-9 Jan 82.

Keywords: *Spectrophotometers, Tests, Reprints.

The Newsletter contains descriptions of technical procedures and results of the NBS program in radiometry, photometry, and spectrophotometry, and reports of significant meetings in the field.

713,780
PB87-234027 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Absolute Spectral Response Intercomparison.
Final rept.,
E. F. Zalewski. Apr 82, 3p
Pub. in Optical Radiation News, n39 p1-3 Apr 82.

Keywords: Reprints, *Spectral response.

The Newsletter contains descriptions of technical procedures and results of the NBS program in radiometry, photometry, and spectrophotometry, and reports of significant meetings in the field.

713,781
PB88-108550 PC A04/MF A01
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
NBS (National Bureau of Standards) Measurement Services: Regular Spectral Transmittance.
Final rept.,
K. L. Eckerle, J. J. Hsia, K. D. Mielenz, and V. R. Weidner. Jul 87, 65p NBS/SP-250/6
Also available from Supt. of Docs. as SN003-003-02805-3. Library of Congress catalog card no. 87-619840.

Keywords: *Transmittance, Optical measurement, Spectrophotometers, Near ultraviolet radiation, Near infrared radiation, Wavelengths, Accuracy, Visible radiation, Calibration, US NBS, Uncertainty.

The documentation describes measurement services, instrumentation, standards, and measurement techniques for regular spectral transmittance over the spectral range of 200 to 2500 nm. It is divided into three parts. Part I describes the services and standards that are available and the guiding philosophy behind the efforts to provide a primary laboratory for spectral transmittance measurements. Part II describes the high accuracy reference spectrophotometer. Part III describes the high precision transfer spectrophotometer. The transfer instrument relies on master standards that are periodically calibrated using the reference spectrophotometer.

713,782
PB88-109905 PC A07/MF A01
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
NBS (National Bureau of Standards) Measurement Services: Spectral Reflectance.
Special pub. (Final),
V. R. Weidner, and J. J. Hsia. Jul 87, 146p NBS/SP-250/8
Also available from Supt. of Docs as SN003-003-02812-6. Library of Congress catalog card no. 87-619843.

Keywords: *Spectrophotometers, *Reflectance, Spectrophotometry, Ultraviolet radiation, Near infrared radiation, Standards, Optical measurement, *Spectral reflectance, Visible radiation, US NBS.

The report describes the instrumentation, standards, and techniques used in the measurement of spectral reflectance over the ultraviolet, visible, and near infra-

red spectral ranges. The report is divided into three parts. Part I describes the guiding philosophy for maintaining reference and transfer spectrophotometers for spectral reflectance measurements, and standards and services that are available. Part II describes the NBS high accuracy reference spectrophotometer including specially developed accessory reflectometers. The instrument provides the basis for the development of absolute NBS standards of diffuse and specular reflectance. Part III describes the NBS transfer spectrophotometer, a high precision commercial spectrophotometer used for calibrating Standard Reference Materials (SRMs) such as diffuse reflectance and specular reflectance standards.

713,783
PB88-111158 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Piezooptic and Elastic Constants.
Final rept.,
A. Feldman. 1986, 13p
Pub. in CRC (Chemical Rubber Company) Handbook of Laser Science and Technology, Chapter 1.1.1.4, v4 pt2 p55-67 1986.

Keywords: *Laser materials, Elastic properties, *Laser windows, Piezooptic effect.

Piezo-optic and elastic constants of window materials have been tabulated.

713,784
PB88-117460 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
New Far UV Detector Calibration Facility at the National Bureau of Standards.
Final rept.,
L. R. Canfield. 1987, 7p
Pub. in Applied Optics 26, n18 p3831-3837, 15 Sep 87.

Keywords: *Ultraviolet detectors, *Standards, Far ultraviolet radiation, Synchrotron radiation, Monochromators, Photodiodes, Reprints, *Calibration, SURF II storage ring, US NBS.

A description is given of a new facility, located at the NBS (Gaithersburg) Synchrotron Ultraviolet Radiation Facility (SURF-II), in which the absolute calibration of working standard detectors for the 5-50-nm spectral region, and the subsequent calibration of outgoing transfer standard detectors is performed. A dual toroidal grating monochromator, with diffraction gratings optimized for 3-13 and 12-52 nm, disperses synchrotron radiation from the electron storage ring into tandem experimental chambers in which a rare gas ionization chamber determines the absolute magnitude of the incident radiant flux and hence the efficiency of the photoemissive photodiodes.

713,785
PB88-117601 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Guided-Wave Reflectometry with Micrometer Resolution.
Final rept.,
B. L. Danielson, and C. D. Whittenberg. 1987, 7p
Pub. in Applied Optics 26, n14 p2836-2842, 15 Jul 87.

Keywords: *Reflectometers, Reprints, Optical time domain reflectometry, Michelson interferometers.

The authors describe a new type of optical reflectometry which is useful in testing single-mode lightguide systems. The technique uses a scanning Michelson interferometer in conjunction with a broadband illuminating source and cross-correlation detection. High resolution is achieved through the limited coherence of the backscattered radiation. With this approach it is possible to distinguish scattering centers separated by only a few micrometers. In some cases loss may be estimated for components in the transmission path of a test lightguide. The basic principles of the diagnostic technique, along with some performance characteristics, are illustrated for an all-fiber reflectometer. They also discuss several laboratory applications which serve to demonstrate the resolution capabilities of the measurement concept.

713,786
PB88-120985 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Population Inversions in C IV in a Recombing Theta-Pinch Plasma.
Final rept.,
R. U. Datla, J. R. Roberts, W. T. Silfvast, and O. R. Wood. 1987, 3p
Pub. in Optics Letters 12, n9 p675-677 Sep 87.

Keywords: *Plasmas(Physics), Electron transitions, Line spectra, Far ultraviolet radiation, Carbon, Lasers, Ultraviolet spectra, Reprints, *Population inversion, Theta pinch.

Population inversions on the 5g-4f and 4f-3d transitions of C IV at 253.0 and 116.9 nm have been observed in the recombination phase of a theta-pinch plasma initially containing 14 m Torr of acetylene and 0.5 m Torr of hydrogen gas. Population ratios of 17:11:1 for the 5g, 4f, and 3d levels were deduced from measured absolute line intensities of the 5g-4f and 4f-3d, and 3d-2p transitions at 253.0, 116.9, and 38.4 nm. The resulting gain-length product for a single pass through the 23-cm-long plasma column, based on the measured Doppler-broadened linewidth, is 2.3% at 116.9 nm and 5.8% at 253.0 nm.

713,787
PB88-121025 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Review of Frequency Measurements of Optically Pumped Lasers from 0.1 to 8 THZ.
Final rept.,
M. Inguscio, G. Moruzzi, K. M. Evenson, and D. A. Jennings. 1986, 32p
Pub. in Jnl. of Applied Physics 60, n12 pR161-R192, 15 Dec 86.

Keywords: *Infrared lasers, *Frequency measurement, *Far infrared radiation, Line spectra, Optical pumping, Reviews, Reprints.

A list is presented of more than 800 far-infrared laser lines emitted by optically pumped molecular lasers whose frequencies have been measured. For each line, frequency, wavelength, wave number, lasing molecule, CO2 pump line, and, if available, the assignment of the lasing transition, are given. The list is accompanied by a survey of the techniques of frequency measurement in the far infrared. Accuracies and limitations of the various techniques are also discussed.

713,788
PB88-121108 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Response of a Fabry-Perot Cavity to Phase Modulated Light.
Final rept.,
D. Hils, and J. L. Hall. 1987, 7p
Contract NGL-06-003-057
Sponsored by National Science Foundation, Washington, DC., and National Aeronautics and Space Administration, Washington, DC.
Pub. in Review of Scientific Instruments 58, n8 p1406-1412 Aug 87.

Keywords: Optical measurement, Light(Visible radiation), Phase modulation, Responses, Reprints, *Fabry-Perot cavities.

A solution is given to the lock-in detection method, which is valid for arbitrary values of the modulation frequency. The solutions agree with the results of the quasistatic theory, in the limit of small modulation frequency compared to the resonance linewidth.

713,789
PB88-123674 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
NBS (National Bureau of Standards) Measurement Services: Radiance Temperature Calibrations.
Special pub. (Final),
W. R. Waters, J. H. Walker, and A. T. Hattenburg. Oct 87, 46p NBS/SP-250/7
Also available from Supt. of Docs. as SN003-003-02827-4. See also PB88-123781. Library of Congress catalog card no. 87-619850.

Keywords: *Temperature measurement, *Radiance, Optical measurement, Blackbody radiation, *Calibration, Pyrometers, US NBS, Uncertainty, High temperature.

The report describes the measurement methods and instrumentation used in the realization and transfer of the International Practical Temperature Scale (IPTS-68) above the temperature of melting gold. The determination of the ratios of spectral radiance of tungsten-strip lamps to a gold-point blackbody at a wavelength of 654.6 nm is detailed. The response linearity, spectral responsivity, scattering error, and polarization properties of the instrumentation are described. The analysis of sources of error and estimates of uncertainty are presented. The assigned uncertainties (three standard deviations) in radiance temperature range from plus or minus 2 deg K at 2573 deg K to plus or minus 0.5 deg K at 1073 K. K.

713,790
PB88-123682 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Metrology for Electromagnetic Technology: A Bibliography of NBS (National Bureau of Standards) Publications, January 1970-December 1986,
K. E. Kline, and M. E. DeWeese-Bishop. Jun 87, 62p NBSIR-87/3074
Supersedes PB87-125738.

Keywords: *Metrology, *Fiber optics, *Superconductors, *Josephson junctions, *Bibliographies, Lasers, Magnetic measurement, Optical communication, *Cryoelectronics, Optical fibers, SQUID devices, SQUID (Detectors), Laser radiation.

This bibliography lists the publications of the personnel of the Electromagnetic Technology Division of NBS in the period from January 1970 through December 1986. A few earlier references that are directly related to the present work of the Division are included. Fields covered include the following: Optical electronic metrology, Cryoelectronic metrology, Superconductor and magnetic measurement.

713,791
PB88-123781 PC **A06**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
NBS (National Bureau of Standards) Measurement Services: Spectral Irradiance Calibrations.
Special pub. (Final),
J. H. Walker, R. D. Saunders, J. K. Jackson, and D. A. McSparron. Sep 87, 106p NBS/SP-250/20
Also available from Supt. of Docs. as SN003-003-02829-1. See also PB88-123674, and PB88-123708. Library of Congress catalog card no. 87-619862.

Keywords: *Irradiance, *Radiometry, Optical measurement, Spectroradiometers, Blackbody radiation, Standards, *Calibration, Spectral sensitivity, US NBS, Uncertainty.

The report describes the measurement methods and instrumentation used in realization and transfer of the NBS scale of spectral irradiance. The basic measurement equation for the irradiance realization is derived. The spectral responsivity function, linearity of response, and 'size of source effect' of the spectroradiometer are described. The analysis of sources of error and estimates of uncertainty are described. The analysis of sources of error and estimates of uncertainty are described. The assigned uncertainties (3-sigma level) in spectral irradiance range from 2.2% at 250 nm to 1.0% at 654.6 nm to 6.5% at 2400 nm.

713,792
PB88-124441
(Order as PB88-124409, PC **A04**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
International Intercomparisons of Photometric Base Units,
K. D. Mielenz. 1987, 3p
Included in Jnl. of Research of the National Bureau of Standards, v92 n5 p335-337 Sep-Oct 87.

Keywords: *Photometry, *Luminous intensity, *Candela, Interlaboratory comparisons.

In order to evaluate the worldwide consistency of practical implementations of 1979 redifinition of the candela, the Consultative Committee for Photometry and Radiometry (CCPR) has conducted an international intercomparison of photometric base units. The intercomparison showed 0.8% agreement (one standard deviation) of independent luminous-intensity scale realizations by 15 national laboratories, and 0.6% agreement of luminous-flux scale realizations by 11 laboratories. The NBS candela and lumen agreed with the world

mean within quoted uncertainty limits, and were shown to be consistent with one another within 0.5%.

713,793
PB88-129838 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Principles of Optical Phase-Locking: Application to Internal Mirror He-Ne Lasers Phase-Locked via Fast Control of the Discharge Current.
Final rept.,
J. L. Hall, M. Long-Sheng, and G. Kramer. 1987, 11p
Contracts NSF-PHY86-04504, N00014-85-0816
Sponsored by National Science Foundation, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Jnl. of Quantum Electronics QE-23, n4 p427-437 Apr 87.

Keywords: *Frequency control, *Phase locked systems, Helium neon lasers, Reprints, *Laser radiation, Visible radiation.

While phase-locking techniques have long been in routine use in the microwave frequency domain, the ten-thousand-fold increase of the carrier frequency in the visible domain brings new problems for effective optical phase control. Particularly robust locks can be based on combining phase-locking under quiescent conditions with an outer frequency-control loop which takes control when phase lock is lost. Electronic strategies for implementing the process are discussed. Diagnostic techniques to allow characterization of phase-lock performance of optical oscillators are presented and discussed, using, as an example, the phase-locking of a low-cost internal mirror He-Ne laser tube. Effectively complete phase lock was possible, using small variations of the discharge current to provide fast frequency control.

713,794
PB88-140926 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Doppler-Free Lineshapes.
Final rept.,
A. Gallagher. 1987, 20p
Grant NSF-PHY82-00805
Sponsored by National Science Foundation, Washington, DC.
Pub. in Proceedings of the International Conference on Spectral Line Shapes (8th), Hampton, VA., July 1986, p215-234 1987.

Keywords: *Spectral lines, *Sodium, Line width, Line broadening.

An experiment on two-wavelength excitation of Na in the presence of inert gas perturbers is described and analyzed in terms of spectral redistribution line-broadening theory and velocity-changing kernels. It is noted that the results yield velocity dependent line-broadening coefficients for various pairs of the three atomic states, and that new issues in line-shape theory are raised by such Doppler-free experiments.

713,795
PB88-141395 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
XUV Radiometric Standards at NBS (National Bureau of Standards).
Final rept.,
W. R. Ott, L. R. Canfield, S. C. Ebner, L. R. Hughey, and R. P. Madden. 1986, 10p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in X-ray Calibration: Techniques, Sources, and Detectors, v689 p178-187 1986.

Keywords: *Far ultraviolet radiation, *Radiometry, *Standards, Ionization chambers, Photodiodes, X ray spectrometers, Ultraviolet spectrometers, Synchrotron radiation, Reprints, *Soft x radiation, Calibration, Surf II storage ring.

The National Bureau of Standards supports a research and development program in the vacuum ultraviolet and soft x-ray region of the spectrum with the goal of providing radiometric source and detector standards for measurement applications. The report will review the instrument and detector calibration services, and also will describe several soft x-ray measurement-related research projects where NBS staff and visiting scientists have been active.

713,796
PB88-147376 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Characteristics and Performance of Miniature NBS (National Bureau of Standards) Passive Hydrogen Masers.
Final rept.,
F. L. Walls. 1987, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n2 p596-603 Jun 87.

Keywords: *Masers, Frequency stability, Sensitivity, Time measurement, Reprints, *Hydrogen masers.

Recent data on the minature (30 kg) passive hydrogen masers developed at the National Bureau of Standards (NBS) in cooperation with the Naval Research Laboratory (NRL) indicate a frequency stability of (sigma sub v)squared (tau) = or < (1.5 x 10 to the -12th power/(tau to the 1/2 power))squared + (5 x 10 to the -15th power)squared, 1 s < tau < 500,000 s. These masers also have extremely low sensitivity to changes in the external magnetic field or temperature. The sensitivity to barometric pressure and or humidity, although very small, does dominate the residuals in one of the minature masers for times beyond about a week. Frequency drift is so small as to be hidden in the present measurement precision. The fractional reproducibility under all changes, excluding the storage bulb, appears to be better than 5 x 10 to the -13th power. The concepts behind the physics and the electronics that made these advances possible as well as present limitations are explained in some detail.

713,797
PB88-152053 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Refractive Index.
Final rept.,
M. J. Dodge. 1986, 27p
Pub. in CRC Handbook of Laser Science and Technology, v4 pt2 p21-47 1986.

Keywords: *Laser materials, Infrared radiation, Ultraviolet radiation, Tables(Data), *Refractive index.

The section defines refractive index, gives the general form of the Cauchy, Sellmeier, and Hertzberger dispersion equations, and discusses the environmental factors that must be considered in the determination and use of refractive index values for a particular Material. Tables are included that give the refractive index and the temperature coefficient of refractive index for crystals that are of particular interest for the fabrication of optical components to be used in laser systems. Dispersion equations and equation parameters are also given for some of the materials.

713,798
PB88-152129 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Amplitude-Modulated Heterodyne Polarization Spectroscopy.
Final rept.,
M. Raab, and A. Weber. 1985, 4p
Pub. in Jnl. of the Optical Society of America B 2, n9 p1476-1479 Sep 85.

Keywords: *Spectroscopy, Amplitude modulation, Sodium, Polarization(Waves), Transition probabilities, Reprints, Forbidden transitions, Two photon absorption, Multi-photon processes, High sensitivity.

Amplitude-modulated heterodyne polarization spectroscopy was applied for detecting spectral features with small transition probabilities. The intrinsic sensitivity of Doppler-free polarization spectroscopy can be enhanced toward the shot-noise limit, using a frequency-offset saturating beam together with high-frequency chopping. Heterodyne detection of weak transitions with absorption in the one millionth range was achieved. Examples are given of spin-forbidden transitions in Na2 and of two-photon transitions in Na2 and Na.

713,799
PB88-153747 PC **A05**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
NBS (National Bureau of Standards) Measurement Services: Photometric Calibrations.
Final rept.,
R. L. Booker, and D. A. McSparron. Oct 87, 88p
NBS/SP-250/15
Also available from Supt. of Docs. as SN003-003-02835-5. Library of Congress catalog card no. 87-619878.

Keywords: *Photometry, *Luminous intensity, *Color temperature, *Standards, *Calibration, Procedures, US NBS.

The National Bureau of Standards supplies calibrated standards of luminous intensity, luminous flux, and color temperature on a routine basis. The procedures, equipment, and techniques used to perform these calibrations as of July 1986 are described. Details of the uncertainty information currently available, including estimates and procedures for determining uncertainties of the reported values, are also presented.

713,800
PB88-154596 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Possibilities for Achieving X-ray Lasing Action by Use of High-Order Multiphoton Processes.
Final rept.,
C. W. Clark, M. G. Littman, T. J. McIlrath, R. Miles, C. H. Skinner, S. Suckewer, and E. Valeo. 1986, 8p
See also DE86005034.
Pub. in Jnl. of the Optical Society of America B 3, n3 p371-378 Mar 86.

Keywords: Optical pumping, Excitation, Reprints, *X ray lasers, Multi-photon processes, Krypton fluoride lasers, Multicharged ions, Population inversion, Isoelectronic sequence.

The authors consider some possible mechanisms for producing gain in the 10 nm spectral region. They involve the creation of a population inversion in a confined plasma column by selective excitation of multicharged ions via absorption of many (>10) ultraviolet photons. Specific treatment is made of Kr-like ions pumped by a KrF excimer laser.

713,801
PB88-154612 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Band Structure and Density of States Changes in Heavily Doped Silicon.
Final rept.,
H. S. Bennett. 1986, 8p
See also PB85-206324.
Pub. in Jnl. of Applied Physics 59, n8 p2837-2844, 15 Apr 86.

Keywords: *Silicon, Interactions, Reprints, *Band structure, *Correlation energy, Density of states, Exchange energy.

The Klauder self-energy method is applied to calculating the effects of the one-body interactions among the dopant ions and the carriers in heavily doped silicon at 300 K. The many-body interactions of exchange energy for majority carriers and of the correlation energy for minority carriers are estimated by interpreting optical absorption measurements and by calculations based on degenerate theory. When densities exceed 5 times 10 to the 19 power per cubic centimeter, one-body and many-body terms become of the same order of magnitude and should be included in calculations of band structure changes and of properties such as carrier transport which depend on the density of states.

Plasma Physics

713,802
DE85007605 PC **A04**/MF **A01**
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Survey of Experimental and Theoretical Electron-Impact Ionization Cross Sections for Transition Metal Ions in Low Stages of Ionization.
M. S. Pindzola, D. C. Griffin, C. Bottcher, D. C. Gregory, and A. M. Howald. Mar 85, 64p ORNL/TM-9436
Contract AC05-84OR21400

Keywords: *Copper Ions, *Iron Ions, *Nickel Ions, *Titanium Ions, Cross Sections, *Electron-Ion Collisions, Experimental Data, *Ionization, Theoretical Data, ERDA/700103.

Electron-ion crossed beams measurements and distorted-wave theory have been employed to make a study of electron-impact ionization for transition metal ions in low stages of ionization. The atomic ions Ti+, Ti exp 2 +, Ti exp 3 +, Fe+, Fe exp 2 +, Fe exp 3 +, Fe exp 4 +, Ni+, Ni exp 2 +, Ni exp 3 +, Cu+, Cu exp 2 +, and Cu exp 3 + are examined. (ERA citation 10:017597)

713,803
PB-265 777/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
MHD Pipe Flow.
Interim rept.,
P. S. Klebanoff, and J. M. McMichael. 1976, 8p
Pub. in Proc. Bat-Sheva Int. Seminar, Ben-Gurion Univ. of Negev, Beersheva, Israel, March 17-20, 1975, Paper in MHD-Flows and Turbulence, p73-80 1976.

Keywords: *Magnetohydrodynamics, *Pipe flow, *Liquid metal MHD generators, Reynolds number.

A description of the liquid metal flow facility at NBS is presented. Data demonstrating the operation of the facility, including wall pressure measurements over a range of Hartmann numbers and Reynolds numbers extending up to 1350 and 340,000, respectively, are discussed.

713,804
PB80-127954 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetohydrodynamic Pipe Flow in Nonuniform, Axisymmetric Fields.
Final rept.,
J. M. McMichael, and S. Deutsch. Nov 79, 6p
Pub. in Physics Fluids 22, n11, p2087-2092, Nov 79.

Keywords: *Magnetohydrodynamics, *Pipe flow, Magnetic fields, Solenoids, Reynolds number, Perturbation, Reprints, Hartman number.

The perturbation of Poiseuille pipe flow by nonuniform, axisymmetric magnetic fields with weak axial gradients is treated theoretically for small magnetic Reynolds numbers and finite Hartmann and Reynolds numbers. Numerical examples for pipe flow through a finite length magnet solenoid are given. The results indicate that separated flow may develop in the fringing magnetic fields accompanied by appreciable local static pressure gradients and high local current densities.

713,805
PB80-165806 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron-ion Collisions: Experimental.
Final rept.,
G. H. Dunn. 1979, 9p
Pub. in Proceedings of the Nagoya Seminar on Atomic Processes in Fusion Plasma, Nagoya, Japan, September 5-7, 1979, Y. Itikawa, T. Kato, Eds., p57-65 1979.

Keywords: *Plasmas(Physics), Electron scattering, Ions, Scattering cross sections, Experimental data, Electron-ion collisions, Electron collisions, Ion collisions, Hot plasma, Atomic ions.

Electron-ion collisions have long been of interest because of the application to non-local thermodynamic equilibrium modeling of astrophysical phenomena. Significant further impetus has arisen in the past several years as the understanding of such collisions has been recognized as necessary in the development of controlled thermonuclear fusion. Despite the long interest and the importance, the experimental study of these processes is recent. The purpose of this brief paper will not be to repeat or try to improve upon recent reviews, but rather to look at work done since they were published and, where possible, to make unifying or speculative comments about the data. Because of the focus on very hot plasmas (fusion), attention will be limited to atomic ions; though there is a significant literature for electron-molecular ion collisions, especially for dissociative recombination.

713,806
PB80-221534 Not available NTIS
National Bureau of Standards, Washington, DC.
Tokamak-Generated Tungsten Radiation Identified in Ag I Isoelectronic Sequence (W XXVIII).
Final rept.,
J. Sugar, and V. Kaufman. Jun 80, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review, A. General Physics 21, n6 p2096-2098 Jun 80.

Keywords: *Tungsten, Atomic spectra, Plasmas(Physics), Thermonuclear reactions, Electron transitions, Reprints.

A new interpretation of the tungsten spectrum observed in 1.5-keV tokamak plasmas at Oak Ridge (the ORMAK) and Princeton (the PLT) is given. An isoelectronic extrapolation of the AgI sequence from newly observed data through Ho XXI strongly suggests that the tokamak radiation belongs to the transition array 4d104f-4d94f2 of W XXVIII. This is well supported by comparison with a calculation of the spectrum. An earlier interpretation incorrectly attributed the radiation to a superposition of complex transition arrays from mugh higher ionization stages. n identical pattern was seen for zymosan, a known C3 activator. Nylon induced conversion was Ca++ dependent, suggesting involvement of C1, and was highly temperature dependent. Nylon and zymosan particles also aggregated canine platelets in vitro as monitored by standard aggregometry. Cell adhesion to surfaces was studied after profound reduction of C3 levels in vivo with cobra venom factor (CVF)(Naja Haje). CVF had little effect on cell counts, coagulation times, or ADP levels required to induce platelet aggregation in vitro. Both platelet and leukocyte adhesion was sharply reduced in experiments involving CVF treated dogs relative to that seen in identical experiments carried out with normal dogs. The results suggest the involvement of complement activation in mediating leukocyte and platelet adhesion to polymers in the early phases of the blood/surface interaction in the context of the canine model.

713,807
PB81-143521 Not available NTIS
National Bureau of Standards, Washington, DC.
Piezoelectric and Pyroelectric Applications of Plastics.
M. G. Broadhurst, S. Edelman, and G. T. Davis. 1980, 5p
Pub. in Proceedings of the Division of Organic Coatings and Plastics Chemistry, American Chemical Society National Meeting (179th) Held at Houston, TX. on Mar 23-28, 1980, Paper in Organic Coatings and Plastics Chemistry 42, p241-245 1980.

Keywords: *Plastics, *Pyroelectricity, *Piezoelectric materials, Transducers, Polymers.

Synthetic polymeric materials can have large and durable electric dipole polarization. This polarization varies linearly with small applied stresses such as electric fields, mechanical stress and temperature change, and this sensitivity renders them useful as piezoelectric and pyroelectric transducers.

713,808
PB81-234734 Not available NTIS
National Bureau of Standards, Washington, DC.
Training of Epoxy-Impregnated Superconductor Windings.
Final rept.
J. W. Ekin, R. E. Schramm, and M. J. Superczynski. 1980, 7p
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Proceedings of International Cryogenic Materials Conference, Madison, WI., August 24-29, 1979, Paper J-5 in Advances in Cryogenic Engineering Materials, 26, p677-683 1980.

Keywords: *Superconducting magnets, Composite materials, Training, Fiberglass reinforced plastics.

A series of NbTi composite rings were constructed in which both the impregnant material and construction technique were varied. Preliminary results indicate that the training of potted superconducting magnets is associated with a process involving relief of stress concentration within epoxy impregnants. The degree of training is correlated with: (1) level of operating current (2) presence of fiberglass in the coil structure (3) prestraining the superconductor prior to winding.

713,809
PB82-118357 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Ion Current in the Collisionless Theory of Floating AC Probe Measurements.
E. R. Mosburg. 1981, 1p
Pub. in Review of Scientific Instruments 52, n8 p1182-1186 Aug 81.

Keywords: *Langmuir probes, Electron energy, Plasma diagnostics, Reprints, *Electron temperature.

Previous treatment of the theory of floating ac probes has considered only the electron current voltage dependence. In this paper, the effect of including the voltage dependence of the ion current is examined, and equations are derived which allow the use of the calculations by Laframboise of the ion current to cylindrical probes having arbitrary ratios of probe diameter to Debye length. The errors in electron temperature measurements introduced by neglecting the ion current variation, and the range of usefulness of the technique, are discussed. For example, in the normally expected range of floating potential, a measurement of the electron temperature could be in error by as much as about 13% if the voltage dependence of ion current is ignored.

713,810
PB82-234832 Not available NTIS
National Bureau of Standards, Washington, DC.
Time-Resolving Extreme Ultraviolet Spectrograph for Fusion Diagnostics.
Final rept.
R. E. Bell, M. Finkenthal, and H. W. Moos. Dec 81, 8p
Contract DE-AS02-76ET53006
Pub. in Review of Scientific Instruments 52, n12 p1806-1813 Dec 81.

Keywords: *Ultraviolet spectrometers, *Nuclear fusion, *Plasma diagnostics, *Far ultraviolet radiation, Design, Reprints.

A time-resolving spectrograph for the simultaneous measurement of emissions at extreme ultraviolet wavelengths (300 A - 2200 A) is described. The spectrograph is a 400 mm normal incidence f/30 system with seven gratings. Together two of the gratings cover the entire wavelength range at low resolution. The other five gratings have higher dispersion and cover adjacent intervals of the spectrum. The spectral resolution varies between 0.7 A and 4 A. The detector consists of a windowless microchannel plate/phosphor screen image intensifier coupled by fiber optics to a 1024 element self-scanning integrated photodiode array. The output from the array is digitized and stored by a small desktop computer which has sufficient memory to record up to 80 spectra during a single plasma discharge.

713,811
PB83-143669 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetohydrodynamic Electrical Power Generation.
Final rept.
D. W. Norcross. 1982, 17p
Pub. in Appl. At. Collis. Phys. 5, p69-85 1982.

Keywords: *Magnetohydrodynamics, *Plasmas(Physics), Magnetohydrodynamic generators, Thermodynamic properties, Composition(Property), Reprints, Electrical conductivity.

Applications of collision physics to the development of magnetohydrodynamic electrical power generating systems are reviewed. The technical areas in which collision physics relates most directly involve the characterization and modeling of the bulk plasma. Some of these are the gas-phase chemistry that determines the plasma composition and its thermodynamic properties, and the collision process that determines the electrical conductivity.

713,812
PB85-102804 Not available NTIS
National Bureau of Standards, Washington, DC.

Stark Broadening of Visible Neutral Helium Lines in a Plasma.
Final rept.
D. E. Kelleher. 1981, 30p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 25, n3 p191-220 Mar 81.

Keywords: *Stark effect, *Plasmas(Physics), Optical spectra, Line spectra, Line width, Reprints, *Helium plasma.

Side-on observations of the visible spectrum emitted by a helium plasma generated in a wall-stabilized arc are reported.

713,813
PB85-142040 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Discussion of the Conditional Probability Function for Electric Fields in a Plasma.
Final rept.
R. Stamm, and E. Smith. Jul 84, 14p
Pub. in Physical Review A 30, n1 p454-467 Jul 84.

Keywords: *Plasmas(Physics), *Electric fields, Plasma dynamics, Autocorrelation, Reprints, Conditional probability functions.

The conditional-probability function plays a centrai role in the development of stochastic models for spectral line shapes in plasmas. The authors discuss some of the physical properties of this function, using various analytic models as well as the results of a computer simulation.

713,814
PB85-142156 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Computer Simulation Technique for Plasmas.
Final rept.
E. W. Smith, and R. Stamm. Jul 84, 4p
Pub. in Physical Review A 30, n1 p450-453 Jul 84.

Keywords: *Plasmas(Physics), *Computerized simulation, Electric fields, Autocorrelation, Reprints.

A computerized simulation, based on statistically independent, noninteracting, shielded ions, is developed. This simulation procedure differs from the usual molecular-dynamics approach in several respects and, for some problems, provides less-time-consuming and more-accurate results. Simulation results are compared with analytically known plasma functions, and the basic limitations of the method are discussed.

713,815
PB85-197531 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Magnetohydrodynamics of Laminar Flow in Slowly Varying Tubes in an Axial Magnetic Field.
Final rept.
J. M. McMichael, and S. Deutsch. 1984, 9p
Pub. in Physics of Fluids 27, n1 p110-118 Jan 84.

Keywords: *Magnetohydrodynamics, *Laminar flow, *Pipe flow, Reprints.

Laminar flow of a conducting fluid in round, straight tubes with axially varying radius, with a uniform magnetic field applied parallel to the tube axis, is treated theoretically as a regular perturbation problem at finite hydrodynamic Reynolds number, finite magnetic Reynolds number, and Hartmann numbers as large as 0(alpha sup -1/2), where alpha is a small parameter characteristic of the slope of the tube wall. The first order solution is examined numerically for local tube dilations and for local constrictions. Flow separation along both converging and diverging sections of the tube is explored in detail. Pressure, current density, and induced magnetic field distributions are also presented.

713,816
PB85-207413 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Ionization in Gas Discharges: Experiment and Modeling.
Final rept.
A. V. Phelps. 1985, 9p
Pub. in Electron Impact Ionization, p335-343 1985.

Keywords: *Gas discharges, *Gas ionization, Electron beams, Interactions.

The report is a brief review of electron impact ionization in gas discharges. First, the various methods of measuring ionization coefficients in gases are reviewed, with emphasis on the differences expected at high electric field E to gas density ratios. Next, theoretical calculations or models of the ionization coefficients are summarized. Finally, the role of electron impact ionization in various discharge forms are reviewed.

713,817
PB85-222040 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Redistribution of Radiation in a Low Density Plasma.
Final rept.
G. G. Lombardi, and D. E. Kelleher. 1983, 11p
Pub. in Proceedings of Int. Conf. Spectral Line Shapes (6th), Boulder, CO., July 12-16, 1982, v2 p835-845.

Keywords: *Hydrogen, *Fluorescence, Light scattering, Spectral lines, *Plasma, Laser radiation, Balmer lines.

The redistribution of radiation was observed in (H sub alpha), the first Balmer line of hydrogen. A dye laser was tuned to the far wing of (H sub alpha), and the fluorescent radiation was observed in the core as a function of laser detuning. The profile, which was found to be Lorentzian, is principally determined by the natural and resonance broadening of the lower level. The polarization of the fluorescent radiation was measured relative to the incident linear polarization. The polarization of the fluorescence in the absence of collisions was calculated and compared to the measured value. It provides information concerning the rate of depolarizing collisions.

713,818
PB85-229417 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Measurement of the Ti x ion Density in a Theta-Pinch Plasma by a Laser Heterodyne Quadrature Interferometer.
Final rept.
R. U. Datla. 1985, 4p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Physical Review A 31, n4 p2764-2767 Apr 85.

Keywords: Interferometers, Impurities, Measurement, Reprints, *Plasma, *Titanium ions, *Ion density, *Electron density, Theta pinch.

The increase in the radial line integral of the electron density in the National Bureau of Standards theta-pinch plasma due to the ionization of the titanium impurity has been measured with the use of a He-Ne laser heterodyne quadrature interferometer. Titanium is injected as an impurity into the base gas of hydrogen with the use of a coaxial gun discharge between titanium electrodes. The Ti x ion density at its peak abundance in the plasma is deduced in each discharge from the measured increase in electron density by knowing the temporal charge-state distribution of Ti ions with the use of spectroscopy and assuming charge neutrality.

713,819
PB86-111952 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Near-Resonance-Rayleigh Scattering Measurement on a Resonant Laser-Driven Barium Plasma.
Final rept.
T. J. A. Nee. Jun 85, 5p
Pub. in Jnl. of Applied Physics 57, n11 p4968-4972, 1 Jun 85.

Keywords: *Rayleigh scattering, *Plasma density, Reprints, *Barium plasma, *Ion density.

Near-resonance-Rayleigh scattering is used as a space-time-resolved density probe on a resonant laser-driven barium plasma. Feasibility of this technique was investigated. Comparison to other methods such as absorption technique is made and found to be consistent.

713,820
PB86-128774 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.

Effect of Ion Current in the Collisionless Theory of Floating AC Probe Measurements.
Final Report.
E. R. Mosburg. 1981, 5p
See also PB82-118357.
Pub. in Review of Scientific Instruments 52, n8 p1182-1186 Aug 81.

Keywords: *Langmuir probes, Electron energy, Plasma diagnostics, Reprints, *Electron temperature.

Previous treatment of the theory of floating ac probes has considered only the electron current voltage dependence. In the paper the effect of including the voltage dependence of the ion current is examined, and equations are derived which allow the use of the calculations by Laframboise of the ion current to cylindrical probes having arbitrary ratios of probe diameter to Debye length. The error in electron temperature measurements introduced by neglecting the ion current variation, and the range of usefulness of the technique, is discussed. For example, in the normally expected range of floating potential, a measurement of the electron temperature could be in error by as much as about 13% if the voltage dependence of ion current is ignored.

713,821
PB86-192424 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Fokker-Planck and Langevin Descriptions of Fluctuations in Uniform Shear Flow.
Final rept.
R. F. Rodriguez, E. Salinas-Rodriguez, and J. W. Dufty. 1983, 20p
Pub. in J. Stat. Phys. 32, n2 p279-298 Aug 83.

Keywords: *Diffusion, Kinetic theory, Langevin equation, Shear flow, Reprints, Fokker-Planck equation.

The Boltzmann description of the preceeding paper for tagged particle fluctuations in a nonequilibrium gas is further analysed in the limit of small mass ratio between the gas and tagged particles. For a large class of nonequilibrium states the Boltzmann-Lorentz collision operator for the tagged particle distribution is expanded to leading order in the mass ratio, resulting in a Fokker-Planck operator. The drift vector and diffusion tensor are calculated exactly for Maxwell molecules. The Fokker-Planck operator depends on the nonequilibrium state only through the hydrodynamic variables for the fluid. The diffusion tensor is a measure of the 'noise' amplitude and is not simply determined from the nonequilibrium temperature; instead, it depends on the fluid stress tensor components as well. For the special case of uniform shear flow, the Fokker-Planck equation is of the linear type and may be solved exactly. The associated set of Langevin equations is also identified and used to describe spatial diffusion in the Langrangian corrdinates of the fluid. The effect of viscous heating on diffusion is discussed and the dependence of the diffusion coefficient on the shear rate is calculated.

713,822
PB86-193844 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Plasma Shifts of the He II (H sub alpha) and (P sub alpha) Lines.
Final rept.
T. L. Pittman, and C. Fleurier. 1986, 6p
Pub. in Physical Review A: General Physics 33, n2 p1291-1296 Feb 86.

Keywords: Emission spectra, Stark effect, Reprints, *Helium plasma, Line broadening.

Shift measurements for the H(alpha)(1640 A) and (P alpha) (4686 A) hydrogenic ion lines of He II have been done over an electron density range 2 x 10 to the 22nd power to 2 x 10 to the 23rd power/cu m and for an electron temperature of 4 eV. The plasma was produced in a linear Z discharge. Systematic red shifts linear in density are observed. The experimental data are compared with combined theoretical estimates for electron-impact and ion quadrupole effects. The experimental results are in agreement with their earlier results for Pa.

713,823
PB86-195591 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Plasma Physics

Study of Hydrogen Stark Profiles by Means of Computer Simulation.
Final rept.
R. Stamm, E. W. Smith, and B. Talin. Oct 84, 8p
Pub. in Physical Review A 30, n4 p2039-2046 Oct 84.

Keywords: Computerized simulation, Line spectra, Reprints, *Hydrogen plasma, Lyman lines.

A computerized simulation technique is used to calculate hydrogen spectral lines emitted by a plasma. These calculations are used to study ion dynamic effects on the line profiles. Results are obtained for Lyman alpha, Lyman beta and Lyman gamma lines, and comparisons are made with experimental results and with other theoretical methods.

713,824
PB87-130530 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Shifts of Ion Lines in Plasmas.
Final rept.
D. E. Kelleher, and J. Cooper. 1985, 36p
Pub. in Spectral Line Shapes, p85-120 1985.

Keywords: *Plasma(Physics), Polarization, Reprints, Shift.

A review of the experimental and theoretical aspects of the topic is presented. The authors begin with a brief summary of the subject's history. An overview of the current experimental situation for hydrogenic and 'isolated' ion lines will preceed an informal discussion of a recent formal theoretical approach to the problem. An important conclusion of the theory is that the 'plasma polarization' shift does not exist in the following sense: If one properly includes the effects of ion fields and of electron collisions in their nearly hyperbolic paths, then all the relevant physics is accounted for. The main difficulty in making accurate calculations of the shift is to properly account for strong collisions. A close coupling calculation should address many of the unanswered questions, such as the importance of low l partial waves and exchange. Current efforts being made in the direction are described.

713,825
PB87-153870 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Excitation Rate Coefficient Measurements of Cu XIII and Cu XVII Ions.
Final rept.,
R. U. Datla, J. R. Roberts, W. L. Rowan, and J. B. Mann. 1986, 6p
Contracts DOE-EA-77-A-01-6010, DE-AC05-78ET53043
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 34, n6 p4751-4756 Dec 86.

Keywords: *Electron transitions, *Excitation, Ultraviolet spectra, Reprints, *Copper ions, Plasma, Tokamak devices.

The absolute excitation rate coefficients for Cu XIII and Cu XVII optically allowed transitions have been measured using the Texas Experimental Tokamak (TEXT) tokamak. Cu is injected by the laser-ablation method at a time when the plasma has attained steady-state temperature and density profiles. The absolute intensities of the magnetic-dipole-forbidden transitions within the Cu XIII 3s(2) 3p(5) and the CuXVII 3s(2) 3p ground configurations are measured.

713,826
PB87-180824 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Overview of Electron-Ion Collisions.
Final rept.,
G. H. Dunn. 1986, 4p
Pub. in Dynamic Processes of Highly Charged Ions, p20-23 1986.

Keywords: Reviews, Reprints, *Electron-ion collisions.

The consequential roles of electron-ion collisions in a variety of plasmas - astrophysical, fusion, laser, etc. - have been responsible in substantial measure for a keen interest in these kinds of collisions in the past two decades. Elastic scattering, excitation, ionization, and recombination are all conceptually simple processes that have been studied and considered in electron-atom collisions for more than 70 years. Yet, these same processes, when pertaining to electron-ion collisions, continue to challenge the creative efforts of many to gain a detailed understanding.

713,827
PB87-180881 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Experiments on Dielectronic Recombination. A Review.
Final rept.,
G. H. Dunn. 1986, 13p
Contract DOE-EA-01-77-6010
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Atomic Processes in Electron-Ion and Ion-Ion Collisions, p93-115 1986.

Keywords: Reviews, *Dielectronic recombination, Beam-plasma systems, Colliding beams.

Experimental results and methods of study are reviewed for investigation of dielectronic recombination (DR). Implications of experimental findings to understanding DR phenomena are discussed. Experiments discussed include: coincidence measurements using crossed beams, Rydberg product observations using crossed beams, beam-gas experiments observing resonance transfer and excitation, photon observations using beam-plasma interactions, measurements on satellite line intensities, in plasmas, and analysis of temporal evolution of charge species in a plasma. Extrinsic fields and other environmental effects have a large impact on DR.

713,828
PB87-203824 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Local Measurement of Ba(1+) Density Temporal Evolution.
Final rept.,
G. Chen, and T. J. A. Nee. 1987, 4p
Pub. in Jnl. of Applied Physics 61, n9 p4707-4710, 1 May 87.

Keywords: Density(Number/volume), Rayleigh scattering, Reprints, *Barium ions, *Barium plasma, Laser applications.

The local temporal evolution of the Ba(1+) number density in a resonant laser-driven barium plasma has been measured for the first time by using near-resonance Rayleigh scattering. This local temporal evolution is quite different from other measurements, where spatially integrated absorption methods were employed.

713,829
PB87-224572 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Ne-Like CaXI-MnXVI 2p(5)3l-2p(5)4l Transition Arrays and Energy Levels.
Final rept.,
C. Jupen, U. Litzen, V. Kaufman, and J. Sugar. 1987, 15p
Sponsored by Department of Energy, Washington, DC. Office of Magnetic Fusion Energy.
Pub. in Physical Review A 35, n1 p116-130, 1 Jan 87.

Keywords: *Atomic energy levels, Spectra, Reprints, *Laser-produced plasma, *Calcium plasma, *Scandium plasma, *Titanium plasma, *Vanadium plasma, *Chromium plasma, *Manganese plasma.

Spectra from laser-produced plasmas of Ca, Sc, Ti, V, Cr and Mn have been recorded in the grazing-incidence region, and the transition arrays 3s-4p, 3p-4s, 3p-4d, and 3d-4f of the neonlike ions have been identified. The measured wavelengths together with the previously observed 3-3 transitions have been used for deriving energy levels of the 2s(2) 2p(5) 3l and 2s(2) 2p(5) 4l configurations. The term structure has been analyzed by means of ab initio and parametric calculations and isoelectronic relations. Coupling conditions have been studied and eigenvectors have been derived. Significant perturbations caused by the 2s2p(6)nl configurations have been investigated.

713,830
PB87-233375 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
High Gamma Strongly-Coupled, Non-Neutral Ion Plasma.
Final rept.,
L. R. Brewer, J. D. Prestage, J. J. Bollinger, and D. J. Wineland. 1987, 12p
Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Strongly Coupled Plasma Physics, p53-64 1987.

Keywords: *Plasmas(Physics), Reprints, *Beryllium ions, *Penning ion sources, Beryllium 9, Laser cooling.

The authors have produced a strong coupled non-neutral (9)Be(1+) ion plasma with a coupling parameter of approximately 100 or greater. The ions were spatially confined by a Penning trap and cooled and compressed using laser cooling. Measurements were made of the plasma shape, rotation frequency, density and temperature. In the paper the authors describe the experimental confinement geometry, the laser cooling of ions and the experimental data which are compared with theoretical predictions. Future experiments to measure the plasma static structure function, measure ion diffusion, and improve the temperature measurement are discussed.

713,831
PB88-138953 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Calculation of Helium Plasma Satellites in Turbulent Plasmas.
Final rept.,
T. J. A. Nee. 1987, 12p
Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 38, n3 p213-224 1987.

Keywords: Spectral lines, Turbulence, Reprints, *Helium plasma.

Neutral helium line profiles (2P-4D), under the influence of suprathermal electric field fluctuations, are calculated with the use of a relaxation line-broadening theory. First-order plasma satellites at the nearby forbidden component (2P-4F) are investigated for various turbulent plasma conditions. The spectral energy densities of the suprathermal electric field fluctuations are analytically modeled to infer quantitative relations between the plasma satellites and the enhanced electric field. It is found that the far satellite can grow stronger than the near satellite and both satellites will split into doublets as the turbulent electric field increases. The theory is generalized to higher order to describe the second harmonic plasma satellites near the allowed transition.

Radiofrequency Waves

713,832
PB-263 124/0 PC **A02**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Electromagnetic Remote Sensing of Inhomogeneous Media,
W. A. Bereuter, and D. C. Chang. Jan 77, 21p
NBSIR-76-851
Prepared by Colorado Univ., Boulder.

Keywords: *Microwaves, *Remote sensing, Dielectric properties, Wave equations, Hypergeometric functions, Mathematical models, Boundary value problems, Inverse scattering, Inverse problems.

This report deals with the electromagnetic response of inhomogeneous dielectrics, i.e., media whose permittivity is a function of depth. The resulting boundary value problem is solved for a large number of permittivity functions which can model almost any medium of interest. Since those permittivity profiles are characterized by only a few parameters, they are particularly useful for the inverse problem; i.e., the retrieval of profiles from the measured electromagnetic response. It is shown how the non-uniformity of the permittivity changes the response and how the change is related to the profile characteristics.

713,833
PB-266 486/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Advances in the Use of SQUIDS for RF Attenuation Measurement,
N. V. Frederick, D. B. Sullivan, and R. T. Adair. Jan 77, 4p
Pub. in Proceedings IEEE Conf. Applied Superconductivity, Held at Sanford, California, on August 18-20, 1976. IEEE Trans. Magm. MAG-13, n1 p361-364 Jan 77.

Keywords: *Attenuation, *Measuring instruments, Radio frequencies, Superconductivity, Josephson junctions, *SQUID devices, Josephson effect, Quantum interference, L band.

The SQUID system for rf attenuation measurement has been advanced by a number of significant changes. A redesign of the L-band SQUID has resulted in a significantly simpler geometry which provides an adjustable coupling for precise matching to the electronics. The redesigned SQUID contains a permanently adjusted point contact in a replaceable cartridge. Attenuation measurement with this system relies heavily on proper signal processing in the room temperature components and a careful study of these conditions indicates a series of areas where error can be generated. These signal handling problems and appropriate solutions are discussed in detail.

713,834
PB-274 944/8 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Spectrum Amplitude--Definition, Generation and Measurement.
Final rept. FY 75,
J. R. Andrews, and M. G. Arthur. Oct 77, 100p NBS-TN-699
Contract CCG-75-97

Keywords: *Spectral energy distribution, *Electromagnetic interference, Fourier transformation, Pulsation, Pulse generators, Spectrum amplitude.

The technical note is a detailed discussion of the electromagnetic quantity, spectrum amplitude, which is used to characterize broadband signals and noise. The definition of spectrum amplitude is presented in detail. Several practical means of generating electrical signals with broadband spectrum amplitudes are included. Various techniques for the measurement of spectrum amplitude are described along with experimental comparisons. The NBS measurement service for the calibration of impulse generator spectrum amplitude is described along with an error analysis.

713,835
PB-275 119/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Use of Three Term Recursion Relations for Numerical Computations as Applied to Near-Field Spherical Scanning.
Final rept.,
R. L. Lewis. 1977, 3p
Sponsored in part by Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
Pub. in Proceedings of International Union of Radio Science (URSI) International Symposium, Stanford, Calif. 20-24 Jun 77 p224-226 1977.

Keywords: *Antenna radiation patterns, Recursive functions, Algorithms, Computation, Near field, Computer calculations.

The near-field spherical scanning algorithms developed by Wacker require the computation of a large number of Fourier coefficients of the spherical point group's representation coefficients. Accurate and fast computations can be performed by three term recursion relations, as discussed by Gautschi. However, attempting to use Fano and Racah's recursion relation for these quantities without applying the constraints of Gautschi's theory results in numerical instability. This problem is solved, resulting in a self-convergent recursive process which is accurate to within round off error limits of the computer.

713,836
PB-283 845/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
RF Instrumentation Based on Superconducting Quantum Interference.
Final rept.,
D. B. Sullivan, R. T. Adair, and N. V. Frederick. Apr 78, 10p
Pub. in Proc. IEEE v66 n4 p454-463 Apr 78.

Keywords: *Radio transmission, Instrumentation, Attenuation, Radiofrequency power, Measurement, Superconductivity, Standards, *SQUID devices, Reprints.

The application of the Superconducting QUantum Interference Device (SQUID) to RF measurements is reviewed. The SQUID can be adapted as a broadband standard of RF current, power and attenuation and may be used as the sensor for an extremely good regulator of RF current. Bandwidths of dc to 100 MHz and dc to 1 GHz have been demonstrated with a power sensitivity of approximately -100 dBm (100-MHz bandwidth, 0.1-dB resolution). In the measurement of attenuation 0.002 dB uncertainty can be achieved with similar bandwidths.

713,837
PB-285 317/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microwave Characteristics of Snow.
Final rept.,
D. A. Ellerbruch, W. E. Little, H. S. Boyne, and D. D. Bachman. 1977, 7p
Pub. in Proc. Western Snow Conf., Albuquerque, N. Mex., Apr 18-21, 1977.

Keywords: *Electromagnetic scattering, *Snow, Microwaves, Measurement, Ultrahigh frequencies, Superhigh frequencies.

A program is underway at NBS to measure the microwave scattering characteristics of snow. Microwave signals nondestructively penetrate snow, but they are modified by the material properties of snow (density, free moisture content, resistance, temperature). There is a distinct possibility of developing miniaturized microwave instrumentation to remotely sense and measure those undisturbed snow properties as a function of time and depth. A portable FM-CW system was developed to measure electromagnetic profiles of snow packs down to ground level. This system was used to monitor changes in snow stratigraphy as a function of time of day. An Automated Network Analyzer system was used to measure the electromagnetic scattering properties of snow at discrete frequencies over the range 250 MHz - 18 GHz. The snow was physically analyzed in terms of resistance, temperature, and density profiles, and by visual characterization. Some experiments included measurement of global radiation and liquid water at the snow surface.

713,838
PB-290 019/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Millimeter Wave Metrology Capabilities at NBS.
Final rept.
C. K. S. Miller. 1974, 11p
Pub. in Proceedings of the 1974 Millimeter Waves Techniques Conference Held at San Diego, CA. on March 26-28, 1974, 11p 1974.

Keywords: *Millimeter waves, *Metrology, Standards, National Bureau of Standards.

This paper is a brief survey paper of the millimeter wave metrology capabilities of the Electromagnetics Division of the National Bureau of Standards, Boulder, Colorado. The measured quantities covered include power, attenuation, impedance, noise, and antenna gain. The basis for the metrology capabilities are briefly sketched to identify the reference standards used, the transfer system, measurement techniques, and accuracy of the final measurement process. Calibration services offered are identified. A few comments are made about millimeter wave flanges and the precise measurement of amplifier noise. This paper gives an overview of the state of precise millimeter wave measurement capabilities at NBS and refers liberally to recent publications that detail these capabilities.

713,839
PB-298 648/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser-to-Microwave Frequency Division Using Synchrotron Radiation.
Final rept.,
D. J. Wineland. Apr 79, 5p
Pub. in Jnl. of Applied Physics 50, n4, p2528-2532, Apr 79.

Keywords: *Frequency dividers, Microwave frequencies, Frequency synthesizers, Infrared lasers, Laser beams, Reprints.

Calculations are made to demonstrate the feasibility of obtaining one-step frequency division from optical or infrared laser frequencies to a subharmonic in the microwave spectral region. The cyclotron orbit of a single relativistic electron in a Penning trap is driven with a Gaussian laser beam focused to a spot diameter approximately wavelength; the laser subharmonic frequency is measured from the electron synchrotron radiation. The uncertainty in orbit dimensions is limited to wavelength/2 by radiative cooling and the technique of motional sideband excitation.

713,840
PB-298 675/0 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Fields Div.
Proceedings of the 1978 Electromagnetic Interference Workshop.
Special pub. (Final).
M. G. Arthur. Jul 79, 61p NBS-SP-551
Library of Congress catalog card no. 79-600091. Proceedings of a Workshop held November 2-3, 1978 at the National Bureau of Standards, Gaithersburg, Maryland.

Keywords: *Electromagnetic interference, *Meetings, Electromagnetic compatibility, Radiation effects, Standards, Radiation hazards, Frequency allocations, Spectrum management.

This report is a summary of the overview talks and session discussions at the 1978 Electromagnetic Interference Workshop. These discussions addressed the following questions: What are the significant Electromagnetic Interference (EMI) problems. How serious are they. Which should be tackled first. What solutions are practical. Who is responsible for solutions. What new standards or changes in present voluntary standards are needed. What is needed for progress. Impacted areas featured at the workshop included communications, transportation, consumer products, industrial, and medical. Workshop speakers and attendees represented a broad segment of decision-makers in both industry and government.

713,841
PB79-600048 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Apparatus and Method for Determination of Wavelength.
J. J. Snyder. Filed 27 May 77, patented 6 Nov 79, 14p PAT-APPL-801 272, PATENT-4 173 442

Keywords: *Fizeau-type interferometer, Fringe pattern, Spatial period, Wavelength of light.

An apparatus and method for determining the wavelength of light such as monochromatic radiation from a laser source. The apparatus comprises a Fizeau-type interferometer, photoelectric means for receiving the interference fringe pattern produced in the interferometer, means for determing the spatial period and phase of the fringe pattern, and means for calculating from the spatial period and phase the wavelength of the radiation.

713,842
PB80-117724 Not available NTIS
National Bureau of Standards, Washington, DC.
Characterization of a CISPR/VDE Far-Field EMI Test Site with Ground Screen.
Final rept.,
W. S. Bennett, and H. E. Taggart. 1979, 7p
Pub. in Proceedings of Electromagnetic Compatibility Symposium, Rotterdam, the Netherlands, May 1979, p507-513 1979.

Keywords: *Electromagnetic interference, Measurement, Far field, Tests.

The complex problem of measuring radiated EMI in the far-field is further complicated when measuring in close proximity of the earth. Because of reflections from the earth's surface, measured radiation from a system under test is a combination of both direct and reflected electromagnetic waves. If the ground plane is a highly conductive ground screen, and the reflection coefficients approximate those values associated with a perfect conductor, the incident and reflected signals should be predictable and agree with theoretical values. A test site at the National Bureau of Standards which meets all criteria specified by CISPR and VDE was used to perform a series of measurements whereby measured data were compared to theoretical data with the following conclusions. The presence and composition of a ground plane significantly affect far-field EMI measurements at frequencies from 30 to

1000 MHz. Range correction factors vary significantly over a highly conductive ground screen from those of free space; however, they are stable and well-defined. Measured responses to horizontally-polarized signals over a conductive ground screen are repeatable, and the measured results agree well with theoretical results. Measured responses to vertically-polarized signals over a conductive ground screen are erratic and often are not repeatable to within 10 dB.

713,843
PB80-117732 Not available NTIS
National Bureau of Standards, Washington, DC.
Broadband, Isotropic, Real-Time, Electric-Field Sensor (BIRES) Using Resistively Loaded Dipoles for EMI Measurements.
Final rept.,
M. Kanda. 1979, 6p
Pub. in Proceedings of IEEE International Symposium on Electromagnetic Compatibility (1979), San Diego, CA., October 9-11, 1979, p423-428 1979.

Keywords: *Detectors, Electric fields, Broadband, Electromagnetic interference, Measurement.

A broadband, isotropic, real-time, electric-field sensor (BIRES) developed by the National Bureau of Standards (NBS) consists of three resistively loaded dipoles mounted orthogonally to each other. It has the capability of measuring frequency, polarization, magnitude, and phase information of the incident electromagnetic (EM) field. The typical tangential sensitivity of the BIRES is 13 to 16 micro v/m with a typical usable dynamic range of 125 to 144 dB for various bandwidths in the frequency range of 10 MHz to 1 GHz. The isotropic response of the BIRES is obtained by arithmetically calculating the Hermitian magnitude of the incident electric field, and its variation is found to be less than plus or minus 1 dB.

713,844
PB80-211733 Not available NTIS
National Bureau of Standards, Washington, DC.
Applications of Time-Domain Methods to Microwave Measurements.
Final rept.,
N. S. Nahman, J. R. Andrews, W. L. Gans, M. E. Guillaume, R. A. Lawton, A. R. Ondrejka, and M. Young. Apr 80, 7p
Pub. in IEE (Institute of Electrical Engineers) Proceedings on Microwaves, Optics and Antennas 127, n2 ptH p99-105 Apr 80.

Keywords: *Microwaves, *Measurement, Utilization, Pulse generators, Transmission lines, Reprints, Time domain.

Microwave applications of a computer-controlled time-domain measurement system are presented. Examples of actual measurements are given showing the acquired time-domain waveforms and their corresponding Fourier transforms. Measurement results are presented for (a) impulse-generator spectrum-amplitude calibration, (b) transmission-line impulse response, (c) picosecond-domain photoconductor response, and (d) pulsed electromagnetic fields.

713,845
PB81-143158 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Bibliography of Publications in the NBS Electromagnetic Fields Division,
C. K. S. Miller. Nov 80, 36p NBSIR-80-1635

Keywords: *Electromagnetic fields, *Bibliographies, Electromagnetic intereference, Electromagnetic properties, Antenna radiation patterns, Radiation hazards, Measurement, National Bureau of Standards.

This bibliography lists the publications of the present personnel of the Electromagnetic Fields Division of NBS in the period from January 1970 through September 1979. A few earlier references that are directly related to the present work of the division are included.

713,846
PB81-166902 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Semiconductor Technology for the Non-Technologist.
R. I. Scace. Jan 81, 28p NBSIR-81-2197

Keywords: *Semiconductors, *Semiconductor devices, Integrated circuits, Processing.

The properties of semiconductor materials, the methods of processing them, and the solid-state products made from them are described in terms intended to be understandable by the lay person. The semiconductor industry has grown at a rate of 21 percent per year compounded for the last twenty years, and its products have declined in unit cost by a factor of five in current dollars (a factor of ten in constant dollars) in the same period. This very satisfactory but anomalous behavior has attracted the interest of many who are not familiar with the technology of the industry, yet who need to have some understanding of it. This report is intended to help meet that need.

713,847
PB83-214205 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Electric and Magnetic Field Sensor for Simultaneous Electromagnetic Near-Field Measurements--Theory.
Technical note.
M. Kanda. Apr 83, 37p NBS-TN-1062

Keywords: Electric fields, Magnetic fields, Loop antennas, Measurement, *Near fields, *Field strength meters.

The paper describes the theory of a single sensor to perform simultaneous electric and magnetic near-field measurements. The theory indicates that it is possible to obtain the magnetic-loop and electric-dipole currents using a loop terminated with identical loads at diametrically opposite points. The theory also indicates that it is possible to obtain an ideal load impedance for achieving equal electric and magnetic field responses of the loop. Preliminary experiments have been performed using plane waves to verify these results.

713,848
PB84-225515 Not available NTIS
National Bureau of Standards, Washington, DC.
Millimeter Wave Standards at the National Bureau of Standards (NBS).
Final rept.
R. A. Kamper, and C. A. Hoer. Nov 83, 3p
Pub. in Proceedings of SPIE Int. Soc. Opt. Eng. Millimeter Wave Technology II, San Diego, California, August 23-24, 1983, 423, p144-146 Nov 83.

Keywords: *Millimeter waves, *Standards, *Calibrating, Microwave frequencies, Measurement, Attenuation, Electrical impedance, Thermal noise.

This paper describes briefly the standards and measurement systems that are maintained at NBS to provide calibration service in the ranges 26 to 40 GHz, 55 to 60 GHz, and at 95 GHz. The measurement systems range in degree of automation from manually tuned reflectometer and attenuation measurement systems to semi-automated single and dual six-ports. Plans to complete the coverage in the range from 26 GHz to 75 GHz and to extend the range beyond 100 GHz are discussed.

713,849
PB84-226323 Not available NTIS
National Bureau of Standards, Washington, DC.
Integral Equation for Scattering by a Dielectric.
Final rept.
E. Marx. Feb 84, 7p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Antennas and Propagation AP-32, n2 p166-172 Feb 84.

Keywords: *Electromagnetic wave transmission, *Electromagnetic scattering, *Integral equations, *Dielectrics, Wave equations, Greens function, Monochromatic radiation, Reprints, Vector fields, Transients.

The determination of the scattered and transmitted transient electromagnetic waves produced by a uniform dielectric body is reduced to the solution of a singular integral equation of the first kind for one tangential vector field defined on the surface. All derivations are carried out within the heuristic approach to Green functions and delta functions. The electric and magnetic fields are expressed in terms of the sources, initial values, and the boundary values by means of the Green function for the scalar wave equation. The appropriate integral equation is derived, and the integrals for the scattered and transmitted fields are given. The simpler problem of scattering of scalar waves is developed first. Formulas for the scattering of monochromatic fields are also given in the scalar and electromagnetic cases when transmitted fields do not vanish.

713,850
PB85-102721 Not available NTIS
National Bureau of Standards, Washington, DC.
Broadband, Isotropic, Real-Time, Electric-Field Sensor (BIRES) Using Resistively Loaded Dipoles.
Final rept.
M. Kanda. 1981, 11p
See also PB80-117732.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electromagnetic Compatibility 23, n3 p122-132 1981.

Keywords: *Detectors, Electric fields, Broadband, Electromagnetic interference, Measurement, Reprints.

A broadband, isotropic, real-time, electric-field sensor (BIRES) developed by the National Bureau of Standards (NBS) consists of three resistively loaded dipoles mounted orthogonally to each other. It has the capability of measuring a complete description of frequency, polarization, magnitude, and phase information of the incident electromagnetic (EM) field. The typical tangential sensitivity of the BIRES is 13 to 16 uv/m with a usable dynamic range of 125 to 144 db for various bandwidths in the frequency range of 10 MHz to 1 GHz. The isotropic response, isotropy, of the BIRES is obtained by calculating the Hermitian magnitude of the incident electric field, and its variation is found to be less than plus or minus 1 dB.

713,851
PB86-197191 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
SCAT: A Vector Program to Solve a Transient MFIE (Magnetic Field Integral Equation).
E. Marx. Apr 86, 105p NBSIR-86/3362

Keywords: *Computer programs, *Electromagnetic scattering, Magnetic fields, Integral equations, Mie scattering, SCAT computer program.

The FORTRAN program SCAT is used to solve the magnetic field integral equation (MFIE) to determine the fields scattered by a perfectly conducting sphere. The incident field is a plane-wave pulse, and a stepping-in-time procedure is used to determine the surface current density induced on the sphere. The program does not take advantage of the special symmetry of the scatterer because it is intended to serve as a verified starting point for more general programs. The output is compared to that of the program PERF, which computes the same fields via a Fourier transform of the monochromatic fields obtained from the Mie formulas. The contributions of the self-patch and neighboring patches to the singular integral are optionally computed by using their expansions in the linear size of the patches. The self-patch term is important for the solution of other integral equations that may be of the first kind. For the MFIE, these corrections are small but not negligible. The program takes advantage of the vector programming features of the CYBER 205.

713,852
PB87-134359 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Lattice Approach to Volumes Irradiated by Unknown Sources.
J. Randa, and M. Kanda. Oct 86, 64p NBS/TN-1303
Also available from Supt. of Docs as SN003-003-02778-2.

Keywords: *Electromagnetic environments, Electromagnetic fields, Action principle, Ill posed problems, Successive overrelaxation method, Numerical solution.

The authors suggest an approach to the characterization of electromagnetic environments irradiated by unknown sources. The approach is based on the numerical solution of Maxwell's equations subject to the constraints imposed by the measured values of the field at a small number of measurement points and by boundary conditions. A thorough examination of two methods for the numerical solution is presented. The examples attempted demonstrate the approach but reveal that neither technique is fully successful. Possible future directions are suggested.

713,853
PB87-152849 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Neighboring-Patch Integrals in Transient Electromagnetic Scattering.
Final rept.,
E. Marx. 1985, 6p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Antennas and Propagation AP-33, n7 p768-773 Jul 85.

Keywords: *Electromagnetic scattering, *Integral equations, Reprints, Transients.

The integrals over patches that are close to the self-patch are calculated by expanding the factors in the integrand in power series. The values are computed analytically to first order in the linear size of the patch. This procedure applies to patches for which the distance between the centers is of the same order of magnitude as the size of the patch. The same formulas apply to monochromatic waves.

713,854
PB87-152880 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Self-Patch Integrals in Transient Electromagnetic Scattering.
Final rept.,
E. Marx. 1985, 5p
Pub. in Institute of Electrical and Electronics Engineers Transactions on Antennas and Propagation AP-33, n7 p763-767 Jul 85.

Keywords: *Electromagnetic scattering, *Integral equations, Reprints, Transients.

The self-patch integrals that arise in the integral equations of electromagnetic scattering are evaluated analytically for general orthogonal coordinate systems to first order in the linear size of the patch. There are terms that contain spatial derivatives of the surface fields, and these terms may not be negligible. Although the formulas are derived for transient waves, the same integrals appear for monochromatic waves.

713,855
PB87-172029 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Radio-Wave Propagation from a Forest to a Clearing.
Final rept.,
D. A. Hill. 1986, 12p
Pub. in Electromagnetics 6, p217-228 1986.

Keywords: *Radio waves, Wave propagation, High frequencies, Integral equations, Reprints, Forests.

Kirchhoff integration over a vertical aperture is used to obtain a simple expression for radio-wave propagation from a forest to a clearing. Numerical results are presented for a frequency of 10 MHz, and the classical recovery effect is observed. Numerical comparisons are made with a previous integral equation solution, and the agreement is good.

Solid State Physics

713,856
AD-A036 919/9 PC **A24**/MF **A01**
National Bureau of Standards Boulder Colo Cryogenics Div
Materials Research in Support of Superconducting Machinery - VI.
Semi-annual technical rept. 1 Mar-1 Sep 76.
R. P. Reed, H. M. Ledbetter, and E. C. Van Reuth. 1 Sep 76, 574p
ARPA Order-2569
Prepared in cooperation with Battelle Columbus Labs., Ohio and Westinghouse Electric Research and Development Center.

Keywords: *Superconductors, *Cryogenics, Research management, Reviews, Handbooks, Bibliographies, Machines, Nickel alloys, Chromium alloys, Cobalt alloys, Magnesium alloys, Copper alloys, Iron alloys, Steel, Stainless steel, Aluminum alloys, Fiber reinforced composites, Superalloys, Composite materials, Mechanical properties, Thermal properties, Elastic properties, Electrical properties, Magnetic properties, Structural properties, Processing, Fabrication.

The sixth semi-annual technical reports are collected from three subcontractors of an ARPA-sponsored program to study the very low-temperature properties of structural materials in support of the development of superconducting machinery. The program is outlined and new research results are reported. Low-temperature results are given for the following properties: elastic, tensile, fatigue and fracture, thermal expansion, specific heat, thermal and magnetothermal conductivity, electrical and magnetic. Effects of processing and fabrication are also considered for some properties; weld and braze-joint properties are included. Tensile and compressive properties at 4 K of selected composite materials are presented.

713,857
AD-A037 413/2 PC **A09**/MF **A01**
National Bureau of Standards Boulder Colo Cryogenics Div
Electrocaloric Refrigeration for Superconductors.
Final rept. May 73-Jun 75.
R. Radebaugh, J. D. Siegwarth, W. N. Lawless, and A. J. Morrow. Feb 77, 192p Rept no. NBSIR-76-847
Contract NAonr-1-75, ARPA Order-2535

Keywords: *Superconductors, *Refrigeration systems, Superconductivity, Cryogenics, Refrigerants, Electrets, Entropy, Beryllium, Dielectric properties, Single crystals, Ferroelectric materials, Ceramic materials, Glass, Specific heat, Polarization, Heat switches, Magnetothermal conductivity, Strontium titanates, Potassium tantalates.

A solid state type of refrigeration, which utilizes the electrocaloric effect in certain dielectric materials, has been investigated. Such a refrigerator would operate with a load at 4 K and reject heat to a reservoir at 15 K. Heat switches for such a refrigerator were studied. One type was a multiple leaf contract switch. The other type was a magnetothermal switch utilizing single crystal beryllium. Based upon earlier preliminary work, the refrigeration material was to be a SrTiO3 glass-ceramic. It was found here that such a material has no useful electrocaloric effect at 4 K. Many other materials were studied but none were found with sufficiently high electrocaloric effects for a practical refrigerator. The largest effects were seen in SrTiO3 ceramics, followed by KTaO3 single crystal. Temperature reductions of about 0.5 K at 10 K were observed during depolarization. A theoretical model, based on the electret behavior of impurity-vacancy dipoles, was developed to explain the observed dielectric behavior in the materials investigated. Another theoretical model, based on the lattice dynamics of displacive dielectrics, was used to explain the observed entropy and temperature changes seen in such materials. The model points out that displacive type materials have too low entropies at 4 K for practical refrigeration. An investigation of certain order-disorder dielectrics is suggested.

713,858
AD-A040 011/9 MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Semiconductor Measurement Technology.
Progress rept. 1 Jan-30 Jun 76.
W. M. Bullis. Apr 77, 122p Rept no. NBS-SP-400-29
ARPA Order-2397, Grant E(49-1)-3300

Keywords: *Semiconductors, Measurement, Technology, Materials, Electrical properties, Test methods, *Test equipment, Processing, Packaging, Wafers, Photolithography, Semiconductor devices, Silicon, Silicon dioxide, Sapphire, Microelectronics, Integrated circuits, Carrier mobility, Doping, *Quality control, Nondestructive testing, Manufacturing, Fabrication, Metal oxide semiconductors, Acoustic emissions, National Bureau of Standards.

This progress report describes NBS activities directed toward the development of methods of measurement for semiconductor materials, process control, and devices. Both in-house and contract efforts are included. The emphasis is on silicon device technologies. Principal accomplishments during this reporting period included (1) development of theoretical expressions for electron mobility in silicon based on combinations of scattering mechanisms; (2) successful low-temperature processing of MOS capacitors to permit measurement of thermally stimulated current and capacitance without subjecting the specimens to potentially degrading heat treatments; (3) completion of a study of the thermodynamics of reactions in an oxidation furnace tube which provides a basis for models of the effect of water vapor, chlorine, and tube wall conditions on sodium contamination levels; (4) development of a rapid, nondestructive method for reverse decoration of defects in passivation overcoats; (5) development of the theoretical basis for accurate measurement of small line widths by analysis of a spatially filtered image of the line; (6) extension of the acoustic emission technique to the nondestructive testing of tape-bonded chips and hybrid components; and (7) analysis of the results of a first exploratory interlaboratory evaluation of the radioisotope method for testing hermeticity of semiconductor devices.

713,859
AD-A047 425/4 PC **A03**/MF **A01**
National Bureau of Standards Washington D C Electronic Technology Div
Some Aspects of Using a Scanning Electron Microscope for Total Dose Testing.
Final rept.,
K. F. Galloway, and P. Roitman. Sep 77, 33p NBSIR-77-1235
Grant DNA-IACRO-77-809

Keywords: Radiation simulation tests, *Radiation damage, *Semiconductor devices, Electron microscopy, Electronic scanners, Ionizing radiation, Electron irradiation, Energy transfer, Estimates, *Dosimetry, Gamma rays, Penetration, Damage assessment, Scanning electron microscopy.

This report addresses a number of aspects involved in using a Scanning Electron Microscope (SEM) for radiation testing of semiconductor devices. Problems associated with using the low energy electron beam to simulate 60Co exposure and a method for estimating the total absorbed dose in critical device oxides are discussed. The method is based on the experimentally determined expression for electron energy dissipation versus penetration depth in solid materials of Everhart and Hoff. An appendix giving the method of estimating the total absorbed dose in a form sutiable for ASTM deliberations is included.

713,860
AD-A049 631/5 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Applied Technology.
Control of Mobile-Ion Contamination in Oxidation Ambients for MOS Device Processing.
Final rept. Oct 76-Oct 77,
S. Mayo, R. Y. Koyama, and T. F. Leedy. Jan 78, 33p NBSIR-77-1404
Contract DNA-IACRO-77-809

Keywords: *Metal oxide semiconductors, *Silicon dioxide, *Contamination, Ions, *Oxidation, Films, Substrates, Chlorine, Sodium hydroxide, Impurities.

An alternative method for controlling the mobile-ion contamination in the oxidation ambients for MOS device processing is explored. Mobile-ion contamination in silicon dioxide films thermally grown in dry oxygen at 1000 C on silicon substrates has been studied by use of a double-wall fused-silica oxidation tube. The space between the tubes were alternatively filled with chlorine, room air, or sodium hydroxide gas to determine if a correlation exists between the presence of these substances in the jacket and the mobile-ion density in the oxide films. MOS capacitors were prepared on these films and mobile-ion densities were measured using conventional c-v techniques. The ion densities ranged from 10 to the 13th power to 10 to the 10th power/sq cm as a function of the jacket atmosphere. These preliminary results suggest that there is a correlation between the presence of cleaning or contaminating agents in the jacket and the mobile-ion density in the oxide films. Both cleaning and contaminating actions occur through the tube wall.

713,861
PB-260 859/4 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
X-ray Topographic Observations of Magnetic Domains in Czochralski-grown Nickel Single Crystals in Anomalous Transmission Geometry,
M. Kuriyama, W. J. Boettinger, and H. E. Burdette. 26 Apr 76, 7p
Contract W-13475
Pub. in Jnl. of Applied Physics, v47 n11 p5064-5068 Nov 76.

Keywords: *Nickel, *Crystal growth, *Magnetic domains, X ray diffraction, Czochralski process, Single crystals, X ray topography, Reprints.

Ferromagnetic domain walls are observed in large Czochralski-grown nickel single crystals by x-ray double crystal diffraction topography in the surface reflection geometry as well as in the transmission geometry. The images of magnetic domain walls in surface reflection topographs possess almost as good contrast as those in the transmission topographs, and even reveal fine detailed structures distinctly. Based on a preliminary arguments, the images observed in the surface reflection topographs are attributed to 180 degrees walls intersecting with the crystal surface obliquely, while the transmission topographs easily image 71 degrees and 109 degrees walls in the interior of the crystals.

713,862
PB-261 015-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Diffusion of Impurities Along Electron Beam-Induced Defects (O Diffuzii Primesei po Elektronnoluchevm Defektam),
G. V. Dudko, M. A. Kolegaev, and D. I. Cherelinichenco. 1974, 14p DMDC-11059, TT-74-53216
Trans. of Elektronnaya Obrabotka Materialov (USSR) n6 p58-60 1967. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Silicon, *Impurities, *Diffusion, Crystal defects, Electron irradiation, Electron beams, Aluminum, Copper, Zinc, Boron, Phosphorus, Semiconductor junctions, Translations, USSR.

The diffusion of A, Cu, Zn, B, and P impurities was followed along dislocations induced by electron beams in silicon single crystals. Diffusion was noted from the depth of the p-n junction. Temperatures of the experiments ranged from 800 to 1200C and diffusion times varied from 60 to 120 minutes.

713,863
PB-261 172-T PC **A07**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Investigating the Electronic Properties of Metals and Alloys,
V. N. Svechnikov. 1976, 130p TT-74-52042
Trans. of mono. Issledovanie Elektronnykh Svoistv Metallov i Splavov, Kiev, 1967, by S. K. Paranjape. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Band structure of solids, Alloys, Electrical properties, X ray spectra, Translations, USSR, Magnetic properties, Thermal properties.

The present book is a collection of articles under the series 'Metal Physics.' It deals with various aspects of investigating the electronic properties of metals and alloys. The subject matter of this collection may be divided into three broad classes: (a) studies of X-ray spectra, (b) studies of magnetic properties, and (c) studies of electrical and thermal properties.

713,864
PB-264 121/5 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Electronic Technology Div.
Semiconductor Measurement Technology: The Dopant Density and Temperature Dependence of Electron Mobility and Resistivity in N-Type Silicon.
Special publication,
S. S. Li. Mar 77, 37p NBS-SP-400-33
ARPA Order-2397
Library of Congress catalog card no. 76-608381.

Keywords: *Semiconductor doping, *Silicon, Electron mobility, Electrical resistivity, Crystal structure, Lattice parameters, Electron scattering, Impurities, Ionization, Phosphorus, Composition(Property), Density(Mass/volume), Temperature, Graphs(Charts).

Traditional analysis of electron mobility in n-type silicon neglects the effects of electron-electron scattering and scattering anisotropy in the mobility calculations. As a result, theory fails to conform with experiment when dopant density exceeds 2 x 10 to the 18th power/cc. In this work, an improved theoretical model for computing mobility and resistivity as functions of dopant density and temperature has been formulated for n-type silicon. The model has been applied to phosphorus-doped silicon for dopant densities from 10 to the 13th power to 10 to the 19th power/cc, and temperatures between 100 and 500 K. Resistivity measurements on seven phosphorus-doped silicon slices with dopant densities from 1.2 x 10 to the 14th power to 2.5 x 10 to the 18th power/cc were carried out for temperatures between 100 and 500 K. Agreement between theory and experiment for both electron mobility and resistivity of phosphorus-doped silicon was within plus or minus 7% in the range of dopant densities and temperatures studied.

713,865
PB-264 258/5 PC **A05**/MF **A01**
National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
National Measurement System for Surface Properties.
Final rept.,
C. J. Powell. Dec 76, 80p NBSIR-75-945

Keywords: *Surface properties, *Spectroscopic analysis, *Measurement, *Quality control, Metals, Semiconductors, Microstructure, Composition(Property), Instrumentation, Crystal structure, Electron diffraction, Regulations, Cost estimates, Government policies, Standards, Auger electron spectroscopy, X ray photoelectron spectroscopy, Secondary ion mass spectroscopy, *National Measurement System for Surface Properties.

An analysis is given of the National Measurement System for Surface Properties. Emphasis is placed on the properties needed to characterize a solid surface, particularly surface composition, surface atomic structure and surface electronic structure; these characteristics directly affect many important surface properties or processes that occur on surfaces (e.g., electrical and optical properties, adhesion, bonding, catalytic activity, plating, durability, corrosion, decoration, segregation, lubrication and reactivity). The above three forms of surface characterization are widely used in surface-science experiments while measurements of surface composition are routinely made to solve a wide variety of problems in the semiconductor, chemical, petroleum and metallurgical industries for applications ranging from process and device development, process control, process evaluation to failure analysis. Recommendations for NBS action are given to improve and extend the measurement services required to promote surface science and surface technology and thereby to establish a satisfactory system for the measurement of surface properties.

713,866
PB-264 286/6 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
NBS Space Processing Research.
Annual rept. 1 Jan 76-31 Dec 76,
E. Passaglia, and R. L. Parker. Feb 77, 116p NBSIR-77-1208
NASA Order-H-19333B
See also PB-250 849.

Keywords: *Aerospace environments, *Crystal growth, *Purification, *Fabrication, Crystal defects, Czochralski process, Nickel, Single crystals, X ray diffraction, Aluminum oxide, Experimental design, Laboratory tests, Reduced gravity, Evaporation, Vacuum, Drops, Convection, Transport properties, Molybdenum alloys, Niobium alloys, Zirconium alloys, Chlorides, Mercury inorganic compounds, *Space processing, Space manufacturing, Bridgman growth technique, Mercury chlorides.

The results obtained for each task are given in detailed summaries in the body of the report. Briefly, in Task 1 - Crystal Perfection in Czochralski Growth - large nickel single crystals have been grown having dislocation densities as low as 400 lines/sq cm as assessed by x-ray dynamical diffraction techniques. In Task 2 - Evaporative Purification of Ultra-High Purity Materials - Part A - it was determined that the use of sessile drops as a means of support for the study of molten alumina places severe restrictions on the type and validity of the data that can be obtained in view of temperature measurement and control problems encountered. In Part B, rates of evaporative purification were determined for Nb-Mo and for Mo-Zr alloys at elevated temperatures using R.F. levitation of molten drops. In Task 3 - Vapor Transport Synthesis and Crystal Growth - the growth of 1.5 cm diameter crystals of mercurous chloride crystals by a vapor Bridgman technique is described. In Task 4 - Melt Shape in Weightless Crystal Growth, thermocapillary forces on air bubbles in a viscous oil were measured, and the shape of axisymmetric liquid zones and their stability with respect to perturbations has been investigated numerically.

713,867
PB-264 313/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystal Structure of Stannous Hydroxide Phosphate, a Reaction Product of Stannous Fluoride and Apatite.
Final rept.,
T. H. Jordan, L. W. Schroeder, B. Dickens, and W. E. Brown. 1976, 5p
Grants PHS-DE-00572, PHS-DE-53209
Sponsored in part by American Dental Association Health Foundation, Chicago, Ill.
Pub. in Inorganic Chemistry, v15 n8 p1810-1814 1976.

Keywords: *Crystal structure, *Tin inorganic compounds, Lattice parameters, Bonding, Phosphates, Hydroxides, Reprints, *Tin phosphates.

Stannous hydroxide phosphate, Sn2(OH)PO4, crystallizes in the monoclinic unit cell, a=7.176(4)A,b=7.051(1)A,c=10.453(4)A, and beta=103.96(3) degrees, with space group P21/n and Z=4. Refinement of the structure concluded with Rw=0.035 and R=0.053. A total of 1332 x-ray data of measurable intensity were collected from a single crystal using Mo radiation and theta-2 theta scans. The data were not corrected for absorption, and the refinements allowed for anomalous dispersion but not for secondary extinction.

713,868
PB-264 319/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Mean Free Paths for Free-Electron-Like Materials.
Final rept.,
D. R. Penn. 1976, 7p
Pub. in Phys. Rev. B, v13 n12 p5248-5254, 15 Jun 76.

Keywords: *Mean free path, *Electrons, Aluminum, Beryllium, Silicon, Silicon dioxide, Aluminum oxide, Electron mean free path.

Mean free paths for electrons in bulk jellium are calculated for electrons with energies from a few hundred to a few thousand eV and for values of (r sub s) for 1.5 to 5 where (r sub s) is the average distance between valence electrons measured in units of the Bohr radius. Account is taken of exchange and correlation effects in an approximate way. The present theory is compared to previous theories and to experiments on Al, Be, Si, SiO2, and Al2O3, and in most cases the agreement between theory and experiment is quite good.

713,869
PB-264 339/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Transmission Measurements of Electron Mean Free Path in Supported Thin Films from 1-5 keV.
Final rept.,
R. J. Stein. 1976, 9p
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Div. of Biomedical and Environmental Research.
Pub. in Surf. Sci., v60 p436-444 1976.

Keywords: *Mean free paths, *Electrons, *Metal films, Inelastic scattering, Chemical analysis, Spectroscopy, Aluminum, Germanium, Gold, Carbon, Substrates, Reprints, Auger electron spectroscopy, Electron mean free path.

Measurements are made of the transmission of medium energy electrons through in vacuo deposited films in order to determine the inelastic electron mean free path as a function of energy. Films of Al, Ge and Au are deposited in small increments on 20-30 A carbon substrates supported by 'holey' carbon films. The no-loss electron current is measured for each thickness as a continuous function of incident energy in the range of 1-5 keV. Although this preliminary experiment does not result in a precise separation of elastic and inelastic scattering effects, the attenuation lengths estimated are in reasonable agreement with measured and calculated inelastic mean free paths. Elastic scattering cross sections appear to be smaller than estimated by simple theory.

713,870
PB-265 536/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Polarization and Dielectric Constant of SrTiO3 Glass Ceramics at Low Temperatures,
J. D. Siegwarth. 1977, 4p
Contract NAonr-1-75
Pub. in J. Appl. Phys., v48 n1 p1-4 Jan 77.

Keywords: *Strontium titanates, *Dielectric properties, *Polarization(Charge separation), Vitreous state, Pyroceram, Electrets, Reprints.

Peaks observed in the temperature dependence of the dielectric constant of SrTiO3 glass ceramics do not appear in the dc polarization. A remanent polarization is observed between 4 and 77 K. The dielectric properties at low temperature are attributed to the relaxation of permanent dipoles to an electret state rather than to antiferroelectric ordering.

713,871
PB-265 867/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Strain on the Critical Current of Nb3Sn and NbTi Multifilamentary Composite Wires,
J. W. Ekin, and A. F. Clark. 1976, 3p
Sponsored in part by Naval Ship Research and Development Center, Annapolis, Md.
Pub. in Proc. Joint MMM-Intermag Conf., Pittsburgh, Pa., June 15-18, 1976, AIP Conf. Proc. n34, Magnetism and Magnetic Materials, p81-83 1976.

Keywords: *Niobium alloys, *Tin alloys, *Titanium alloys, *Superconductors, *Strain, Critical current, Intermetallic compounds, Superconducting wires, Niobium intermetallics, Tin intermetallics, Titanium intermetallics.

The critical currents of flexible Nb3Sn and NbTi composite wires have been observed to decrease as a function of strain. Characteristic samples of the data are presented along with a brief summary and intercomparison of the results for each wire type.

713,872
PB-266 031/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ternary A15-Phase Regions in the Nb-Sn-Si and Nb-Sn-As Systems,
R. M. Waterstrat, and J. Muller. 1977, 7p
Sponsored in part by American Dental Association, Chicago, Ill.
Pub. in J. Less-Common Metals, v52 p271-277 1977.

Keywords: *Niobium alloys, *Phase transformations, *Superconductivity, Tin containing alloys, Silicon containing alloys, Arsenic containing alloys, Electron probes, Intermetallic compounds, Reprints, Niobium intermetallics, Tin intermetallics.

The A15-phase regions in the Nb-Sn-Si and Nb-Sn-As systems have been delineated by quantitative electron microprobe analyses. In contrast to previous reports, both systems exhibit a rather limited solubility in the binary Nb3Sn compound. The addition of Si to Nb3Sn produces a strong deviation from the 'ideal' stoichiometry. The present results are in serious disagreement with previous reports concerning the solubility of As and Si in Nb3Sn. This may be attributed to a failure of the previous investigators to recognize fully the extent of inhomogeneities in their samples and the effect of this failure on the interpretation of X-ray diffraction data.

713,873
PB-266 034/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Amorphous Magnetism in Bulk Samples of Terbium Iron Alloys,
H. A. Alperin, J. R. Cullen, A. E. Clark, and E. Callen. 1977, 3p
Sponsored in part by Naval Surface Weapons Center, White Oak Lab., Silver Spring, Md.
Pub. in Physica, v86-88B p767-769 1977.

Keywords: *Iron alloys, *Terbium containing alloys, *Magnetization, Vitreous state, Magnetic moments, Coercive force, Curie temperature, Amorphous materials, Reprints.

Magnetization measurements made on compositions x = 0.45 and 0.75 in the series Tb(x)Fe(1-x) show a decreasing average terbium moment with increasing x. Spontaneous moments, coercive forces and Curie temperatures for samples in the range 0.018=or< x=or<0.75 are described in terms of a cluster model.

713,874
PB-266 134/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Bibliography on the Observation of Crystalline Materials by Use of Diffraction Effects in the Scanning Electron Microscope,
D. C. Joy, and D. E. Newbury. 1977, 10p
Pub. in Proceedings of Workshop on Analytical Electron Microscopy, Chicago, Ill. 28 Mar-1 Apr 77. Paper in Scanning Electron Microscopy I, p445-454 (IIT Research Inst., Chicago, Ill.) 1977.

Keywords: *Crystal structure, *Electron microscopy, *Bibliographies, Electron diffraction, Microstructure, Orientation, *Scanning electron microscopy.

A bibliography of references pertaining to the observation of crystalline materials by use of diffraction effects in the scanning electron microscope has been prepared. One hundred and eighty-three references have been collected covering the following topics: (1) theory of electron channeling contrast; (2) instrumental techniques; (3) tests of performance; (4) maps and quantitative procedures; (5) applications; (6) miscellaneous related techniques; and (7) review papers. Following the list of literature citations, the papers have been classified within these seven topics to facilitate recovery of particular information.

713,875
PB-266 473/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fracture Mechanics and its Application to Cryogenic Structures,
H. I. McHenry. 1977, 18p
Pub. in Proceedings Int. Cryogenic Materials Conf. (1st), Held at Kingston, Ontario, Canada, on July 22-25, 1975, Paper A-2 in Advances in Cryogenic Engineering, v22 p9-26 1977.

Keywords: *Fractures(Materials), *Cryogenics, Crack propagation, Low temperature tests, Reviews.

A tutorial review of fracture mechanics is presented with emphasis on the application of this technology to cryogenic structures. The concepts of linear-elastic and elastic-plastic fracture mechanics are briefly reviewed. Test methods and representative data for fatigue crack growth and fracture toughness of structural alloys at cryogenic temperatures are summarized. The elements of a fracture control plan are presented and applications of fracture mechanics to cryogenic structures are described.

713,876
PB-266 487/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Poisson's Ratio for Central-Force Polycrystals,
H. M. Ledbetter. Dec 76, 4p
Pub. in Z. Naturforsch. Teil A 31, n12 p1539-1542 Dec 76.

Keywords: *Poisson ratio, *Polycrystals, *Crystal structure, Face centered cubic lattices, Body centered cubic lattices, Elastic properties, Reprints.

The Poisson ratio nu of a polycrystalline aggregate was calculated for both the face-centered cubic and the body-centered cubic cases. A general two-body central-force interatomic potential was used. Deviations of nu from 0.25 were verified. A lower value of nu is predicted for the f.c.c. case than for the b.c.c. case. Observed values of nu for twenty-three cubic elements are discussed in terms of the predicted values. Effects of including volume-dependent electron-energy terms in the interatomic potential are discussed.

713,877
PB-266 585/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Picosecond Pulses from Josephson Junctions: Phenomenological and Microscopic Analyses,
R. L. Peterson, and D. G. McDonald. Jan 77, 4p
Sponsored in part by Office of Naval Research, Arlington, Va.
Pub. in Proceedings of IEEE Conference, Applied Superconductivity, Stanford, Calif., IEEE Transactions on Magnetics, MAG13 n1 p887-890 Jan 77.

Keywords: *Josephson junctions, Superconductivity, Voltage controlled oscillators, Pulse generators.

A Josephson junction modeled by the phenomenological current relation together with internal resistance can exhibit pulses in the voltage across the junction when driven by an oscillating current source. These pulses occur singly, in pairs, triplets, etc. with a repetition rate equal to twice the driving frequency. The inclusion of capacitance and inductance generally degrades the pulse characteristics, but typical values for tunnel junctions are tolerable. With realizable parameter values, the pulses have picosecond widths. It is concluded that well developed ps voltage pulses can be created in physical Josephson junctions.

713,878
PB-266 586/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Planar Test Structures for Characterizing Impurities in Silicon (Extended Abstract),
M. G. Buehler, J. M. David, R. L. Mattis, W. E. Phillips, and W. R. Thurber. May 75, 2p
ARPA Order-2397
Sponsored in part by Defense Nuclear Agency, Washington, D.C. and Department of the Navy, Washington, D.C.
Pub. in Proceedings, Electrochemical Society Spring Meeting, Toronto, Canada 11-16 May 75, v75-1 Abstract 171, p403-404 May 75.

Keywords: *Silicon, *Semiconductors, *Defects, *Quality control, Impurities, Electrical resistivity, Tests, Capacitors, Metal oxide semiconductors.

Various test structures such as sheet resistors, pn junctions, and MOS capacitors and their associated physical models have been developed to characterize dopants and defects in silicon. These structures address various needs within the semiconductor industry for (a) standardized and miniaturized test structures, (b) updated values for the dopant density versus resistivity relation, and (c) improved defect detection methods. Examples of their use include (a) an update of the dopant density-resistivity relation where a significant change from commonly used values has been found in p-silicon and (b) the detection of minute amounts of lifetime killing defects determined from thermally stimulated current measurements.

713,879
PB-266 588/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mechanisms for Critical-Current Degradation in NbTi and Nb3Sn Multifilamentary Wires,
J. W. Ekin. Jan 77, 4p
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, Md.
Pub. in Proceedings of IEEE Conference on Applied Superconductivity, Stanford, Calif. 18-20 Aug 76, IEEE Transactions on Magnetics, MAG13 n1 p127-130 Jan 77.

Keywords: *Superconductivity, Niobium alloys, Titanium alloys, Tin alloys, Intermetallic compounds, Stresses, Strains, Magnetic fields, Cryogenics, Superconducting wires, Niobium intermetallics, Titanium intermetallics, Tin intermetallics, Microcracks, *Critical current.

Critical currents of NbTi and Nb3Sn multifilamentary wires have been studied in magnetic fields to 9 T as a function of mechanical load applied at 4 K. Degradation of the critical current in NbTi is limited to about 30%, with the effect becoming large only at strains above approximately 1%. The change in critical current with strain is much larger in Nb3Sn, commencing at strains of 0.1 to 0.3%. For both NbTi and Nb3Sn the first 20 to 30% decrease in critical current is almost totally reversible. A number of possible explanations of the observed degradation are considered, including filament breakage, heat generation by mechanical creep, degradation of the stabilizing matrix, and defect formation in the superconductor itself. Results of experiments to test the source of degradation are reported.

713,880
PB-266 593/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Stress on the Critical Current of NbTi Multifilamentary Composite Wire,
J. W. Ekin, F. R. Fickett, and A. F. Clark. 1977, 4p
Sponsored in part by National Research Council, Washington, D.C. and David W. Taylor Naval Ship Research and Development Center, Annapolis, Md.

Pub. in Proceedings, International Cryogenic Materials Conference (1st), Kingston, Ontario Canada 22-25 Jul 75; Paper I-1 in Advances in Cryogenic Engineering v22 p449-452 1977.

Keywords: *Superconductors, Copper, Niobium alloys, Titanium alloys, Critical field, Stresses, Measurement, Cryogenics, Superconducting wires, *Critical current.

Measurements of the effect of stress on the critical current-magnetic field characteristics of a NbTi:Cu (1:1.8) composite wire containing 180 filaments are described. The experimental apparatus employs a design allowing transverse field measurements in a simple solenoidal magnet. A series of measurements are reported at 4 K in fields to 8 Tesla which show a definite degradation of I sub c with applied stress, starting at about 1/3 the breaking stress. The effect amounts to a 15-20% decrease in I sub c at 3/4 of the breaking stress, and rapidly increases at still larger stress levels. At each stress level, a substantial recovery toward the initial-unstressed I sub c value is observed after the stress is relieved.

713,881
PB-266 610/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Low Temperature Tensile Behavior of Copper - Stabilized Niobium-Titanium Superconducting Wire,
R. P. Reed, R. P. Mikesell, and A. F. Clark. 1977, 9p
Pub. in Proceedings of Cryogenic Materials Conference (1st), Kingston, Ontario, Canada 22-25 Jul 75; Paper I-3 in Advances in Cryogenic Engineering, v22 p463-471 1977.

Keywords: *Niobium alloys, *Titanium alloys, *Tensile properties, Copper, Additives, Superconductors, Stress strain relations, Yield strength, Modulus of elasticity, Cryogenics, Superconducting wires.

The tensile properties of multi-filamentary superconducting wire and its base components, Cu and Nb-Ti, were measured at 298, 76 and 4 K. Conventional tensile properties, yield strength, tensile strength, elongation and Young's modulus were obtained. Additionally, the influence of strain rate on tensile behavior and the stress-strain hysteresis effects of the superconducting wire were studied. The Young's moduli of the wires were found to be lower than the bulk values. The tensile and yield strengths were well behaved; no discontinuous yielding was observed.

713,882
PB-266 856/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Semiconductor Electronics at the National Bureau of Standards: Programs and Opportunities,
W. M. Bullis, and K. F. Galloway. 1977, 11p
Pub. in Proceedings IEEE (G-PHP)/ISHM University/Industry/Government Microelectronics Symposium (2nd), University of New Mexico, Albuquerque, New Mexico, Jan 3-5, 1977, Session IX, 11p 1977.

Keywords: *Semiconductors, *Semiconductor devices, Electronics, Microelectronics, National Bureau of Standards.

The National Bureau of Standards (NBS) has had a long history in the fields of electricity and electronics. Many groups at NBS have made contributions which have enhanced the growth of the electronics community. The Semiconductor Technology Program, a part of the Electronic Technology Division, is specifically directed toward the development of measurement technology needed in the semiconductor electronics field. This paper discusses the nature of the research and development work involved and the avenues of interaction with industry, universities, and other government agencies.

713,883
PB-268 631/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of Sodium Contamination in Semiconductor Oxidation Atmospheres at 1000C,
S. Mayo, and W. H. Evans. May 77, 6p
Prepared in cooperation with Defense Nuclear Agency, Washington, D.C.
Pub. in Jnl. of Electrochem. Soc. 124, n5 p780-785 May 77.

Keywords: *Semiconductors, *Sodium, *Impurities, Oxidation, Chemical reactors, Silica glass, Thermodynamics, Capacitance, Chemical-cleaning, Chlorine, Hydrogen chloride, Iodine, Hydrogen iodide, Reprints, Metal oxide semiconductors.

The thermodynamic equilibria established in fused silica oxidation tubes operated at 1000C are analyzed. Transparent fused silica tubes used for thermal oxidation of silicon contain about 10 ppm sodium impurity. At oxidation temperatures sodium diffuses in fused silica, evaporates into the oxidation ambient, and reacts with residual water contaminating the oxidation atmosphere. During the oxidation cycle enough sodium is incorporated into the growing oxide film to be detected later by capacitance measurements in metal-oxide-semiconductor (MOS) structures. Reactions taking place during currently used in situ furnace cleaning procedures are analyzed. Calculations indicate that the amount of sodium removed from the fused silica tube wall through chlorine or hydrogen chloride cleaning is substantial. The reaction rate is regulated by diffusion of sodium in the fused silica. The use of iodine and hydrogen iodide as cleaning agents is discussed.

713,884
PB-268 634/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Shape Stability in Float Zoning of Silicon Crystals,
T. Surek, and S. R. Coriell. Mar 77, 19p
Pub. in Jnl. of Cryst. Growth 37, n2 p253-271 Mar 77.

Keywords: *Silicon, *Crystal growth, *Zone melting, Perturbations, Mathematical analysis, Dimensional stability, Menisci, Reprints.

The time-dependent evolution and stability of the resolidifying crystal dimensions is examined in the usual floating zone geometries. The stability criterion is based on the finding that the steady-state cross-sectional growth of crystals in a meniscus-controlled process requires that the angle phi between the meniscus and the growth axis equal (phi sub 0) (a constant; for silicon, (phi sub 0) = 11 degrees). Analyses are carried out of float zoning of a thin sheet in a horizontal plane and of a cylindrical crystal in the vertical direction; these systems are shown to usually exhibit an inherent tendency toward shape stabilization. A linear perturbation analysis is carried out for the general case where the resolidified and original crystal dimensions can be different at steady state, and necessary and sufficient conditions are derived for crystal shape stability in float zoning. For a stable system, perturbations are shown to lead to an exponentially decaying oscillation about steady state. Application of the analysis is made, throughout the paper, to float zoning of silicon crystals; special cases where the crystal shape is expected to be unstable are described.

713,885
PB-268 945/3 Not available NTIS
National Bureau of Standards, Washington, D.C.
Measurement of the Resistivity of a Thin Square Sample with a Square Four-Probe Array,
M. G. Buehler, and W. R. Thurber. 1977, 4p
ARPA Order-2397
Pub in Solid-State Electron, v20 No. 5-B p403-406 1977.

Keywords: *Resistivity, *Measurement, *Electrical resistivity, Probes, Semiconductors, Silicon, Computation, Samples, Reprints.

Geometrical correction factors are evaluated for the measurement of the resistivity of a square conducting sample whose thickness is small compared to the probe spacing of a four-probe square array. The correction factors allow the computation of the resistivity when the probes are not on the periphery of the square sample. The solution is based on the method of images and is written in a compact, easily-evaluated form. The resistivity measurement error encountered with the square sample is presented in graphical form for use in test structure design.

713,886
PB-269 734/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Experimental and Calculated Standards for Quantitative Analysis by Powder Diffraction.
Final rept.,
C. R. Hubbard, and D. K. Smith. 1977, 13p
Pub. in Advances in X-Ray Analysis, v20 p27-39 1977.

Keywords: *X ray analysis, *X ray diffraction, *Quantitative analysis, Standards, Automatic control, Powder patterns, Reprints.

Quantitative analysis by x-ray powder diffraction methods has become increasingly important in recent years with the availability of computer-controlled automatic powder diffractometers. All data gathering techniques require suitable reference standards to scale the measured data properly. One means of achieving this scaling is through the reference intensity ratio which is defined as the intensity ratio of the strongest diffraction maximum of a substance to the strongest maximum of a reference material in a 1:1 mixture by weight. These ratios may be measured or they may be calculated if the crystal structures of the materials are accurately known.

713,887
PB-269 776/1 PC **A03**/MF **A01**
Hughes Research Labs., Malibu, CA.
Semiconductor Measurement Technology: Some Aspects of Dose Measurement for Accurate Ion Implantation,
D. M. Jamba. Jul 77, 48p NBS-SP-400-39
Contracts NBS-5-35891, ARPA Order-2397
Library of Congress Catalog card no. 77-24724. See also PB-264 929.

Keywords: *Semiconductor doping, *Ion implantation, *Dosimetry, Radiation measuring instruments, Dosage, Quality control, Calibrating, Semiconductor devices, Silicon, Circuits, Electrodes, Electron emission, Secondary emission, Electric current meters.

An investigation of various phases of semiconductor ion implantation dose measurement was carried out, covering in detail ion beam scanning, secondary particle suppression, and current measurement instruments. Problems are discussed and preferred techniques, electrode structures, and measurement circuitry are presented. Five current integrators were tested and are compared, especially in regard to pulsed current measurement.

713,888
PB-269 954/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Frequency Properties of Stable Nb-Nb Oxide-Pb Josephson Tunnel Junctions.
Final rept.,
T. F. Finnegan, J. Wilson, and J. Toots. 1977, 14p
Sponsored in part by Office of Naval Research, Arlington, Va.
Pub. in Proceedings of IC-SQUID Conference, West Berlin, Germany 4-8 Oct 76. Paper in Superconducting Quantum Interference Devices and Their Applications, p381-394 1977.

Keywords: *Microwave equipment, *Josephson junctions, Superconductivity, Lead(Metal), Niobium, Niobium oxides, Electron tunneling, Dielectric properties, Squid devices.

Thin film Nb-Nb Oxide-Pb Josephson junctions have been fabricated at the National Bureau of Standards in device configurations well suited for microwave-integrated-circuit applications. The device fabrication procedures are described in detail. DC and microwave measurements have been used to characterize and monitor devices. Simple microwave measurements are shown to be a useful probe of the Nb-Nb oxide junction interface and confirm the existence of a thin layer of metallic NbO which can be a serious device limitation for many appliations.

713,889
PB-270 122/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Topographic Observations of the Effects of Dynamical Diffraction in Imperfect Metal Crystals.
Final rept.,
W. J. Boettinger, H. E. Burdette, E. N. Farabaugh, and M. Kuriyama. 1977, 13p
Pub. in Advances in X-ray Analysis, v20 p207-219 1977.

Keywords: *Crystal defects, *X ray diffraction, Nickel, Copper, Surfaces, Diffraction topography.

X-ray diffraction topographs obtained in the anomalous transmission geometry contain images which are quite different from those obtained from thin crystals (mu L > 1). In this paper various topographic images which are unique to thick crystals (mu L < 1) are presented and discussed in terms of dynamical diffraction in imperfect crystals. It is observed in topographs that images of crystal imperfections caused by disruption of the anomalous transmission effect are slightly broader or more diffuse in the H-diffracted (Bragg-diffracted) beam than in the O-diffracted (transmitted

beam). These observations have been made in both copper and nickel crystals.

713,890
PB-270 125/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystal Imperfections and Magnetic Domain Walls in Thick Czochralski-Grown Nickel Single Crystals.
Final rept.,
M. Kuriyama, W. J. Boettinger, and H. E. Burdette. 1977, 13p
Pub. in Advances in X-ray Analysis, p245-257 1977.

Keywords: *Nickel, *Crystal growth, *X ray diffraction, Crystal structure, Czochralski process, Single crystals, Crystal defects, Surfaces, Magnetic domains, Domain walls, Diffraction topography.

To study the relationship between crystal growth conditions and resultant crystalline perfection, large nickel single crystals more than 12 cm long and 2 to 3 cm in diameter have been grown from the melt by the Czochralski method. Unlike semiconducting materials, one cannot easily thin metal crystals, without straining them. This situation with metal crystals necessitates the use of dynamical diffraction effects in imperfect crystals to permit sample crystals to be thick enough to demonstrate their imperfections as in the bulk. The crystal perfection in as-grown nickel single crystals has, therefore, been assessed by x-ray dynamical diffraction topography with an asymmetrical (double) crystal topographic (ACT) camera. The crystals grown under favorable conditions have shown strong anomalous transmission. The O-diffracted (transmitted) and the H-diffracted (Bragg-diffracted) beams display almost identical disruption images of crystal imperfections in the interior of the crystals. The types of imperfection and the degree of crystal perfection will be sorted by a set of crystal growth parameters, such as seed orientation and rotation rate.

713,891
PB-270 127/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron Diffraction Study of the Structure and Phase Transitions of Alkali Cyanide Crystals.
Final rept.,
J. M. Rowe, J. J. Rush, and E. Prince. 1 Jun 77, 3p
Pub. in Jnl. of Chemical Physics, v66 n11 p5147-5149, 1 Jun 77.

Keywords: *Antiferroelectricity, *Potassium cyanides, *Sodium cyanide, *Crystal structure, Phase transformations, Neutron diffraction, Order disorder transformations, Temperature, Reprints, Superlattices, Order parameters.

The structures of sodium and potasium cyanide have been determined by neutron powder diffraction as a function of temperature between 6 and 300K. The structure of the lowest temperature phase has been clearly established, and the nature of the order-disorder phase transitions has been elucidated by a careful study of a superlattice line intensity in KCN.

713,892
PB-270 288/4 PC **A03**/MF **A01**
Pennsylvania Univ., Philadelphia. Graduate School of Medicine.
Semiconductor Measurement Technology: Suppression of Premature Dielectric Breakdown for High-Voltage Capacitance Measurements.
Interim rept.,
A. M. Goodman. Jul 77, 28p NBS-SP-400-37
Contracts NBS-5-35912, ARPA Order-2397
Library of Congress Catalog card no. 77-608129.

Keywords: *Semiconductors, *Dielectric breakdown, Tests, Retarding, Capacitance, Measurement, Semiconductor devices, Capacitors, Metal insulator semiconductors.

Surface-initiated premature dielectric breakdown is encountered in extended-range MIS C(V) measurements at applied-bias voltages above some sample-dependent threshold value, e.g., 3 to 5 kV across a 150-micrometer-thick wafer of sapphire. It is necessary to suppress this premature breakdown in order that a much larger applied-bias voltage may be used without damaging the sample. This may be accomplished by eliminating the air space adjacent to the sample surface at the junction of the dielectric and the electrode edge. A simple, easy-to-use apparatus (sample holder and probe assembly) which allows this to be done conveniently and quickly by using a silicone rubber washer to cover the edge of the electrode and the adjacent area is described. Construction details of the apparatus and a test chamber which have been tested to 30 kV are provided in an appendix.

713,893
PB-270 331/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Scattering Studies of Low-Lying Collective States of Even Zn Isotopes.
Final rept.,
R. Neuhausen, J. W. Lightbody, S. P. Fivozinsky, and S. Penner. 1976, 12p
Pub. in Nucl. Phys., vA263 p249-260 1976.

Keywords: *Electron scattering, *Zinc isotopes, Phonons, Nuclear models, Zinc 64, Zinc 66, Zinc 68, Zinc 70, Reprints.

The inelastic electron scattering cross sections for the excitation of the low-lying collective states in the even Zn isotopes 64Zn, 66Zn, 68Zn, and 70Zn have been measured in the momentum transfer region q = 0.3 - 1.1 (fm sup (-1)). Strong transitions to the first 2(+) and 3(-) states have been observed and the modified Tassie model with a two parameter Fermi charge distribution for the ground state was used to extract the values for the reduced transition probability B (E lambda). Besides the investigation of these states, which in the framework of the vibrational model are considered as one-phonon states, special effort was made to measure the transition to the 2(+) two-phonon states in 64Zn (epsilon = 1.80 MeV) and 70Zn (epsilon = 1.76 MeV). We have applied the anharmonic vibrator model to these two nuclei and have extracted values for the static quadrupole moment to the first excited state.

713,894
PB-270 338/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hyperfine Fields in the Absence of Magnetic Order in Dy-SC Alloys
Final rept.,
R. Abbundi, R. Segnan, J. J. Rhyne, and D. M. Sweger. 1976, 3p
Pub. in Proceedings Annual AIP Conf. on Magnetism and Magnetic Materials (21st), Philadelphia, Pennsylvania, December 9-12, 1975. Paper in Magnetism and Magnetic Materials-1975, n29 p352-353 1976.

Keywords: *Dysprosium alloys, *Scandium alloys, *Magnetization, *Hyperfine structure, Transition temperature, Neutron scattering.

The authors have investigated the Dy hyperfine fields in a series of Dy(x)Sc(1-x) alloys in a range in which no T sub N is found (above 4 K). Although no long-range order is present, the alloys do show a well-defined hyperfine splitting corresponding to a field approximately equal to that in pure Dy metal and independent of Dy concentration. This is present even in a 2% Dy alloy which is the lowest concentration measured. This surprising result suggests a spin-relaxation mechanism is operative which produces the observed hyperfine fields, but which is not accompanied by static long-range magnetic order.

713,895
PB-270 340/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Inelastic Neutron Scattering Lineshapes in PdD0.63.
Final rept.,
C. J. Glinka, J. M. Rowe, J. J. Rush, A. Rahman, S. K. Sinha, and H. E. Flotow. 1976, 7p
Pub. in Proceedings Conf. on Neutron Scattering, Gatlinburg, Tennessee, June 6-10, 1976, p536-542, 1 Sep 76.

Keywords: *Palladium compounds, *Deuterium compounds, *Neutron scattering, Crystal structure, Crystal defects, Phonons, Single crystals, Palladium hydrides.

Previous measurements of the phonon dispersion curves in a single crystal of PdD(0.63) have been augmented by detailed inelastic neutron scattering measurements of the phonon lineshapes at 80 K. The lineshapes observed at this temperature show substantial broadening and subsidiary structure. The data have been compared to calculated lineshapes based on a model in which the absence of translational symmetry inherent in the structure is approximately taken into account. The calculations indicate that the complexities of the observed lineshapes are intrinsic features of the 'one phonon' response in this highly defected structure. In addition, the deuterium Debye-Waller factor has been obtained from the variation of the phonon intensity with scattering vector.

713,896
PB-270 341/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Spin Waves in Ferrimagnetic ErFe2.
Final rept.,
J. J. Rhyne, N. C. Koon, J. B. Milstein, and H. A. Alperin. 1976, 5p
Pub. in Proceedings Conf. on Neutron Scattering, Gatlinburg, Tennessee, June 6-10, 1976, p873-877, 1 Sep 76.

Keywords: *Magnons, *Erbium alloys, *Iron alloys, *Ferrimagnetism, Rare earth compounds, Magnetization, Neutron scattering, Curie temperature, Erbium intermetallics, Iron intermetallics.

Spin excitations in a single crystal of the rare earth Laves phase compound ErFe2 have been studied using inelastic neutron scattering. Measurements were made in the ordered state at room temperature (Curie temperature = 574 K) and revealed one acoustic and two optic modes. The lower optic mode is non-dispersive with energy of 5 meV, and is nearly degenerate with the acoustic mode at the zone boundary. Dispersion in this mode is controlled by the rare earth-rare earth exchange interaction which was found to be nearly zero for this compound. The upper optic mode exhibits a gap of 8.75 meV at the zone center and has a wave-vector dependence defined by the Fe-Fe exchange and which is approximately equal to that in Fe metal. A nearest neighbor spin wave model has been developed for which the calculated spin wave energies are in excellent agreement with those observed for all three modes. The model also predicts three additional optic modes (two are degenerate) at energies above 100 meV which are not significantly populated.

713,897
PB-270 348/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Lattice Vibrations of CeD2.12.
Final rept.,
C. J. Glinka, J. M. Rowe, J. J. Rush, G. G. Libowitz, and A. Maeland. 1977, 4p
Pub. in Solid State Commun., v22 p541-544 1977.

Keywords: *Cerium compounds, *Deuterium compounds, *Neutron scattering, Single crystals, Phonons, Crystal structure, Lattice vibrations, Dispersion relations, Cerium hydrides, Reprints.

The complete phonon dispersion relation including both optic and acoustic modes has been measured along the major symmetry axes of a single crystal of CeD(2.12) at 300 K by coherent neutron scattering. The results show the inadequacy of simple models previously used for the analysis of neutron incoherent scattering studies of rare earth dihydrides. The interstitial mode of vibration due to the excess deuterium (above CeD2) in octahedral sites has also been observed.

713,898
PB-270 583/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Emission of Polarized Electrons from Solids.
Final rept.,
M. Campagna, D. T. Pierce, F. Meier, K. Sattler, and H. C. Siegmann. 1976, 53p
Sponsored in part by Schweizerischer Nationalfonds zur Forderung der Wissenschaftlichen Forschung, Bern (Switzerland).
Pub. in Advances in Electronics and Electron Physics, v41 p113-165 1976.

Keywords: *Photoelectric emission, *Polarization, Magnetic properties, Semiconductors, Europium compounds, Nickel, Ferrates, Catalysts, Ferromagnetic materials, Gallium arsenides, Electron diffraction, Manganese inorganic compounds, Reprints, Lanthanum lead manganates, Spin polarization.

A review is presented of the emission of spin-polarized electrons from solids with emphasis on ultraviolet photoemission. The experimental techniques for spin-polarized photoemission and field emission are described in detail, including the detection of polarization by Mott scattering. A survey of results is given for 4f semiconductors and insulators such as the Europium chalcogenides, 3d semiconductors and semimetals like magnetite and other simple ferrites and the catalyst La(1-x) Pb(x) MnO3, 3d ferromagnets, and optical-

ly magnetized materials like GaAs. Preliminary spin polarized field emission results from Ni are also presented.

713,899
PB-271 179/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Single Crystal versus the Powder Method for Identification of Crystalline Materials.
Final rept.
A. D. Mighell. 1977, 10p
Pub. in Advances in X-Ray Analysis, v20 p53-62 1977.

Keywords: *X ray analysis, *Crystal structure, *Single crystals, X ray diffraction, Automatic control, Lattice parameters.

Single crystal X-ray diffraction methods have been mainly confined to the academic laboratory because of the rather lengthy and complex procedure necessary to determine the unit cell and the space group. Several recent developments give the single-crystal method considerable potential for routine industrial use. These include growth of the data base, advances in lattice theory, and automation of the single crystal X-ray diffractometer. To identify an unknown, one can start with a single crystal, mount it on the diffractometer, determine a refined primitive cell, reduce the cell, and check against a file of known reduced cells. The entire procedure can be automated. The single crystal X-ray diffraction method can now complement the powder method for the routine analysis of crystalline materials.

713,900
PB-271 183/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystal Structure of alpha-Ca3(PO4) 2.
Final rept.,
M. Mathew, L. W. Schroeder, B. Dickens, and W. E. Brown. 1977, 9p
Grant PHS-DE-00572
Pub. in Acta Cryst. B33, p1325-1333 1977.

Keywords: *Crystal structure, *Calcium phosphates, Lattice parameters, Reprints.

Alpha-Ca3(PO4)2 crystallizes in the monoclinic space group. The structure was solved by direct methods of phase determination and refined to R=0.051 and Rw=0.049 with 7002 reflections collected from a single crystal by counter methods. The calcium ions in alpha-Ca3(PO4)2 exhibit a wide range of coordination numbers and geometries.

713,901
PB-271 522/5 PC **A04**/MF **A01**
RCA Labs., Princeton, NJ.
Semiconductor Measurement Technology: A 25-kV Bias-Isolation Unit for 1-MHz Capacitance and Conductance Measurements.
Special pub.,
A. M. Goodman. Sep 77, 61p NBS-/SP--400-40
Contract NBS-5-35912, ARPA Order-2397
Library of Congress catalog card no. 77-608178.

Keywords: *Measurement, *Semiconductors Electric measuring instruments, Capacitance, Electrical resistance, Semiconductor devices, Capacitors, Bias, Silicon on sapphire.

The report describes a technique for using a commercially available C/G-meter with a Bias-Isolation Unit (BIU) for C and G measurements at bias-voltage magnitudes up to 25 kV without damage to the measurement equipment. The basic principles of operation and the details of the electrical design of a BIU are presented. The use of the BIU imposes certain limitations on the range of sample capacitance and conductance that may be measured without introducting excessive error. The theory of these limitations is presented and compared with experimental results obtained from the use of the BIU. The measurement capability demonstrated by these results is adequate for the intended silicon-on-sapphire measurement application and may be described in terms of a measurement range for a maximum added error due to the use of the BIU. For less than plus or minus 1% added error in the indicated (measured) capacitance, the measurable range of the sample capacitance is found to be from 0 to about 100 pF. In this application, it is also important to be able to accurately measure small changes in the sample capacitance; for less than plus or minus 1% added error in the indicated (measured) value of a small change in the sample capacitance, the measurable range of the sample capacitance is found to be from 0 to about 38 pF. Conductance measurements may be made with less than about 2% added error for samples whose capacitance is in the range 0 to 50 pF.

713,902
PB-271 582/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Orthorhombic Elastic Constants of an NbTi/Cu Composite Superconductor.
Final rept.,
H. M. Ledbetter, and D. T. Read. 1977, 6p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va.
Pub. in J. Appl. Phys., v48 n5 p1874-1879 May 77.

Keywords: *Superconductors, *Fiber composites, Elastic properties, Modulus of elasticity, Niobium intermetallics, Titanium intermetallics, Copper, Poisson ratio, Copper matrix composites, Reprints.

Elastic properties of a niobium-titanium-filament, copper-matrix composite superconductor were studied experimentally. Ultrasonic pulse and resonance measurements showed the material has orthorhombic symmetry and, therefore, nine independent elastic constants. With respect to copper, C11, C22, and C33 are about seven percent lower; C44, C55, and C66 are about fifteen percent lower; the off-diagonal elastic constants are unchanged; and the bulk modulus is about five percent lower. Deviations from isotropic elastic behavior are small.

713,903
PB-271 628/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystal Structure of Anhydrous Stannous Phosphate, Sn3(PO4)2.
Final rept.,
M. Mathew, L. W. Schroeder, and T. H. Jordan. 1977, 3p
Grants PHS-DE-00572, PHS-DE-04192
Pub. in Acta Cryst., vB33 p1812-1816 1977.

Keywords: *Crystal structure, Tin compounds, Inorganic phosphates, Least squares method, Reprints, *Tin phosphates.

Anhydrous stannous phosphate, Sn3(PO4)2, crystallizes in the monoclinic space group P2(1)/c with Z = 4. The structure was solved by the heavy-atom method and refined by full-matrix least-squares techniques to R(w)(F) = 0.034 and R(F) = 0.047 with 1813 reflections. The structure consists of alternating layers of Sn(II) and PO4 ions parallel to the ac plane. Two open channels parallel to (010) are formed by Sn(II) ions arranged in a helical fashion. Each Sn(II) ion is at the apex of a trigonal pyramid with the three nearest O atoms, each from a different PO4 group, forming the base. In one case, two Sn(II) ions enter into a dimeric configuration by sharing an O--O edge of the pyramid.

713,904
PB-272 211/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Preliminary Investigation of the Behavior of High Purity Copper in High Magnetic Fields.
Final rept.,
F. R. Fickett. 1974, 55p
Sponsored in part by International Copper Research Association, New York.
Pub. in Annual Report INCRA No. 186B, 55p Aug 74.

Keywords: *Copper, Magnetic fields, Electrical resistivity, Additives, Iron, Magnetic permeability, Cryogenics, Magnetic susceptibility, Magnetic impurities.

Measurements are reported on dilute copper iron alloys. The concentrations range from 1-1000 atomic parts per million. The electrical resistivity and magnetic susceptibility of the specimens were measured at 4K. Also reported is an attempt at magnetic separation of iron impurities from molten copper.

713,905
PB-272 372/4 PC **A07**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
Standard X-Ray Diffraction Powder Patterns. Section 14--Data for 68 Substances.
Interim rept.,
M. C. Morris, H. F. McMurdie, E. H. Evans, B. Paretzkin, J. H. de Groot, and R. Newberry. Sep 77, 147p NBS-Mono-25-Sect-14
Errata sheet inserted. Sponsored in part by Joint Committee on Powder Diffraction Standards, Swarthmore, Pa. Library of Congress catalog card no. 53-61386.
See also PB-254 073.

Keywords: *Crystal structure, *X ray diffraction, Standards, Lattice parameters, Refractivity, Inorganic compounds, Intermetallic compounds, Organic compounds, Tables(Data), *Powder patterns.

Standard x-ray diffraction patterns are presented for 68 substances. Twenty-seven of these patterns represent experimental data and 41 are calculated. The experimental x-ray powder diffraction patterns were obtained with an x-ray diffractometer. All d-values were assigned Miller indices determined by comparison with computed interplanar spacings consistent with space group extinctions. The densities and lattice constants were calculated, and the refractive indices were measured whenever possible. The calculated x-ray powder diffraction patterns were computed from published crystal structure data. Both peak height and integrated intensities are reported for the calculated patterns.

713,906
PB-272 529/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Current Trends in Silicon Characterization Techniques.
Final rept.,
W. M. Bullis, and F. G. Vieweg-Gutberlet. 1977, 7p
Pub. in Proceedings Int. Symp. on Silicon Materials Science and Technology (3rd), Philadelphia, Pennsylvania, May 9-13, 1977, Paper in Semiconductor Silicon 1977, v77-2 p360-266 1977.

Keywords: *Silicon, *Semiconductors, *Tests, Measuring instruments, Test equipment, Metrology, Chemical analysis, Electrical properties, Trace elements.

Good metrology is a critical factor both in the understanding of silicon material properties and in the design and production of silicon devices. Consequently, the semiconductor electronics field is at the forefront of a number of metrological areas, and advanced measurement techniques have been developed along with materials, processing, and device improvements. This introductory review provides a brief overview of recent developments in the multiplicity of electrical and physical analysis techniques available for characterizing silicon.

713,907
PB-272 543/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ion Imaging in Secondary Ion Mass Spectrometry.
Final rept.,
D. E. Newbury. 1977, 5p
Pub. in Proceedings of Society of Photo-Optical Instrumentation Engineers, Reston, Virginia, April 18-21, 1977, Paper in Multidisciplinary Microscopy, SPIE 104, p85-89 1977.

Keywords: *Surface properties, Mass spectroscopy, Beryllium alloys, Petrology, Rocks, Spectroscopic analysis, Copper alloys, *Secondary ion mass spectroscopy.

Secondary ion mass spectrometry (SIMS) is a surface analysis technique involving ion induced sputtering of a sample followed by mass spectrometry of the charged fraction of the emitted atoms. All elements and isotopes can be detected. Detectability limits range down to the parts per million level and quantitative analysis is possible by either empirical techniques or techniques based on physical models of secondary ion emission. Both surface and microanalysis can be carried out by SIMS. Ion images can be prepared by either the ion microscope (direct imaging) or the ion microprobe (scanning and image mapping). Ion images showing the distribution of intensities of elements and certain molecules can be obtained. Applications of ion imaging to the study of a copper beryllium alloy, a geological sample, and electronic materials are considered.

713,908
PB-272 546/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dopant Density and Temperature Dependence of Electron Mobility and Resistivity in n-Type Silicon.
Final rept.,
S. S. Li, and W. R. Thurber. 1977, 8p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, Va.
Pub. in Solid-State Electronics 20, p609-616 1977.

Keywords: *Silicon, *Electron mobility, *Electrical resistivity, Impurities, Semiconductor doping, Electron scattering, Phosphorus, Temperature, Reprints.

Traditional analysis of electron mobility in n-type silicon neglects the effect of electron-electron scattering in the mobility calculations. As a result, theory fails to conform with experiment when dopant density exceeds 2 x 10 to the 16th power/cc. In this work, an improved theoretical model for computing mobility and resistivity as functions of dopant density and temperature has been developed for n-type silicon. The model has been applied to phosphorus-doped silicon for dopant densities from 10 to the 13th power to 10 to the 19th power/cc, and temperatures between 100 and 500 K. Resistivity measurements on five phosphorus-doped silicon wafers with dopant densities from 1.1 x 10 to the 18th power/cc were carried out for temperatures from 100 to 500 K. Electron mobility at 300 K was deduced from resistivity and junction C-V measurements for dopant densities from 3 x 10 to the 14th power to 10 to the 18th power/cc. Agreement between theoretical calculations and experimental data for both electron mobility and resistivity of phosphorus-doped silicon was within plus or minus 7 % in the range of dopant densities and temperatures studied.

713,909

PB-273 941/5 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Surface Finish, Friction and Wear; The Need for More Than One Parameter.
Final rept.,
D. A. Swyt. 3 May 73, 29p NBSIR-73-196

Keywords: *Surface roughness, *Friction, *Wear, Finishes, Loads(Forces), Mathematical models, Power spectra, Autocorrelation.

Surface finish is most commonly described by an arithmetic average (AA) value, often coupled with a description of the process by which the surface is finally formed. Since the insensitivity of the AA parameter to the periodic nature of surface structure is well known, many supplemental 'second' parameters have been suggested. This short paper gives an indication of the basis for the insensitivity of the AA parameter to periodic structure and considers briefly some 'wavelength-conscious' parameters (e.g., average wavelength and correlation lengths) which may be useful in supplementing the basic AA value for a more complete description of surface finish. (Portions of this document are not fully legible)

713,910

PB-274 506/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Attenuation Lengths of Low-Energy Electrons in Solids Derived from the Yield of Proton-Excited Auger Electrons: Beryllium and Aluminum.
Final rept.,
C. J. Powell, R. J. Stein, P. B. Needham, and T. J. Driscoll. 1977, 10p
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Div. of Biomedical and Environmental Research.
Pub. in Physical Review B 16, n4 p1370-1379, 15 Aug 77.

Keywords: *Beryllium, *Aluminum, *Electron emission, Proton irradiation, *Auger electron spectroscopy, X ray photoelectron spectroscopy.

Values are reported for the absolute yields of KVV Auger electrons from beryllium and L23VV Auger electrons from aluminum excited by 60 to 220 keV proton bombardment. The measurements were made using semi-infinite, evaporated samples, and the results were used to derive effective values of the inelastic attenuation lengths for low-energy Auger electrons in the surface regions of the samples. The attenuation lengths determined using this technique are 5.1 A for 105 eV electrons in Be and 2.0 A for 67 eV electrons in Al. These values have estimated probable errors of + or - 17%, but the systematic errors could be as high as -50 to -60% due to factors which could not be determined in this preliminary investigation. These effective attenuation lengths are appropriate for use in Auger-electron spectroscopy and x-ray photoelectron spectroscopy.

713,911

PB-274 939/8 PC **A04**/MF **A01**
RCA Labs., Princeton, NJ.
Semiconductor Measurement Technology: A Versatile High-Voltage Bias Supply for Extended Range MIS C(V) and G(V) Measurements.
Special rept.,
P. Kuczer, H. O. Hook, and A. M. Goodman. Dec 77, 72p NBS/SP-400-41
Contracts NBS-5-35912, ARPA Order-2397
Library of Congress Catalog Card no. 77-25245. See also report dated Sep 77, PB-271 522.

Keywords: *Semiconductors, *Measurement, *Power supplies, High voltage, Bias, Capacitance, Electrical resistance, Function generators, Semiconductor devices, Sweep circuits, Electric measuring instruments, Metal insulator semiconductors, Silicon on sapphire.

Recently developed technology has enabled the measurement of MIS C(V) and G(V) at bias-voltage magnitudes as large as 25 kV. This report describes a versatile high-voltage power supply intended for use as a bias source in carrying out such measurements. The design allows the user a wide variety of options in the selection of the sweep function (waveform), sweep time, initial bias voltage, and the amplitude of the bias sweep. There are six possible sweep functions: (1) increasing ramp, (2) decreasing ramp, (3) positive polarity half-wave sawtooth (increasing ramp followed by decreasing ramp), (4) negative polarity half-wave sawtooth (decreasing ramp followed by increasing ramp), (5) full-wave sawtooth starting with increasing ramp, and (6) full-wave sawtooth starting with decreasing ramp. Either single or repetitive sweeps may be selected. The sweep time from the initial value to the end of the first ramp segment may be varied from 1 to 2000 s. Operator convenience is enhanced by certain features of the design; among these are light-emitting diodes which display the state of the sweep and automatic pen control if the sweep is used with an x-y recorder.

713,912

PB-275 012/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Results of Crystal Growth in Skylab (and ASTP).
Final rept.
R. L. Parker. 1977, 36p
Pub. in Proceedings of European Conference on Crystal Growth (1st), ETH, Zurich, Switzerland, 12-18 Sep 76, ch3.6 in 1976 Crystal Growth and Materials, p851-886 1977.

Keywords: *Crystal growth, Germanium alloys, Selenium alloys, Tellurium alloys, Indium antimonides, Gallium antimonides, Boron, Additives, Gallium, Antimony, Calcium carbonates, Experimental design, Netherlands, *Space processing, Skylab, Lead sulfates, Calcium tartrates.

A survey is presented of crystal growth experiments in microgravity, with an emphasis on Skylab experiments (1973-1974) but also with some discussion of Apollo-Soyuz Test Project experiments (1975). On Skylab the experiments include vapor growth of IV-VI compounds including GeSe and GeTe; directional solidification of a containerless melt of InSb; melt growth and segregation of Te-doped InSb; melt growth of InSb-GaSb alloys of several compositions; melt growth and microsegregation in Ge doped with Ga, Sb, or B; and model liquid floating zone studies. On ASTP the experiments include melt growth and interface marking in Ge doped with Ga or Sb; vapor growth of GeSe(0.99)Te(0.01),GeS(0.98)Se(0.02) and related compositions; and growth of calcium tartrate, calcium carbonate and lead sulphate crystals by reactions in aqueous solutions.

713,913

PB-275 031/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Observations of Oblique Magnetic Domain Walls in Nickel Single Crystals by X-Ray Topography.
Final rept.,
W. J. Boettinger, H. E. Burdette, and M. Kuriyama. 1977, 14p
Pub. in the Philosophical Magazine, v36 n4 p763-776 1977.

Keywords: *Domain walls, *Nickel, Single crystals, Magnetic domains, X ray diffraction, Reprints, X ray topography.

Unusual band images observed by dynamical diffraction x-ray topography in externally unmagnetized nickel single crystals are elucidated by a model of very thin magnetic domains which extend obliquely through the thickness of the crystal. In this model, image contrast is produced by the domain walls rather than by the domains themselves. These thin domains have a magnetization direction which would cause free-pole formation on the crystal surface. In order to avoid these free poles, it is assumed that local rotation of the magnetization away from (111) is possible. This rotation would cause curvature of the magnetic domain walls near the crystal surface. In this work such curvature is detected in the topographs by differences in the atomic displacement associated with the domain wall near the crystal surfaces and in the interior.

713,914

PB-275 125/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Method for Calculating Background Dopant Density from p-n Junction Capacitance-Voltage Measurements.
Interim rept. Jul 74-Jul 76,
R. L. Mattis, and M. G. Buehler. Dec 77, 6p
ARPA Order-2397
Pub. in Jnl. of Electrochemical Society, v124 n12 p1918-1923 Dec 77.

Keywords: *Semiconductor doping, Semiconductor junctions, Computation, Density(Number/volume), Electrical measurement, Reprints.

A new method is presented for calculating the average background dopant density within the depletion layer of a planar diffused p-n junction using capacitance-voltage (C-V) measurements. The method has been successfully applied to specimens having a background dopant density as high as 10 to the 18th power/cc, and ideal data studies indicate that the method may be applicable to specimens having a background dopant density up to about 10 to the 19th power/cc. The average background dopant density is calculated by finding the Gaussian diffused layer as characterized by an effective surface dopant density, background dopant density, and junction depth which can best be fitted to all the C-V data. It is not necessary to know the actual surface dopant density. The method is illustrated by calculations on both real and idealized C-V data.

713,915

PB-275 132/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ammonium Perchlorate: Reinvestigation of the Crystal Structure at 298 K.
Final rept.,
C. S. Choi, H. J. Prask, and E. Prince. Oct 76, 2p
Pub. in Acta Crystallographica B32 pt10 p2919-2920 Oct 76.

Keywords: *Ammonium perchlorate, *Crystal structure, X ray diffraction, Reprints.

The structure of ammonium perchlorate at 298 K has been refined with the x-ray diffraction data of Peyronel & Pignedoli (Acta Cryst. (1975), B31, 2052-2056). A satisfactory refinement was achieved in space group Pnma, in agreement with earlier observations at low temperatures.

713,916

PB-275 134/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Green Function Theory of Curie and Order-Order Transitions in Ferromagnetic Systems.
Final rept.,
R. G. Munro. 1977, 7p
Pub. in Jnl. Magnet. Magnetic Mater., v5 p177-183 1977.

Keywords: *Ferromagnetic materials, Curie temperature, Transition temperature, Phase transformations, Magnetic properties, Green's function, Reprints, Magnetic ordering.

Dipolar critical temperatures in ferromagnetic systems with isotropic bilinear and biquadratic exchange are investigated by means of the Green function technique. Expressions are found for both the familiar Curie temperature, (T sub c), and the less well known order-order transition temperature, (T sub 0), at which, under appropriate conditions, the magnetic ordering undergoes a change between fully aligned and canted ferromagnetism. The temperature dependence of the magnetic ordering is investigated by means of the double-time temperature-dependent Green function formalism. A new decoupling scheme is derived and used to reduce higher order Green functions to lowest order.

713,917
PB-275 582/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystal Structure of Calcium Ammonium Hydrogen-Pyrophosphate CaNH4HP2O7.
Final rept.,
M. Mathew, and L. W. Schroeder. 1977, 4p
Grant PHS-DE-00572
Pub. in Acta Cryst. B33, p3025-3028 1977.

Keywords: *Crystal structure, *Inorganic phosphates, Calcium phosphates, Ammonium compounds, X ray diffraction, Hydrogen bonds, Reprints, Calcium ammonium phosphates, Powder patterns.

CaNH4HP2O is monoclinic, space group P21/n, with a = 10.523 (2), b = 17.672(6), c = 7.266 (3) A, beta = 90.47 (2) degrees, Z = 8 (25 C). The structure was refined to R sub w(F) = 0.044, R(F) = 0.039 for 2895 observed reflections. The structure consists of layers of Ca2+ and HP2O7(3-) ions alternating with layers of NH+4 and HP2O7(3-) ions. The two independent Ca2+ ions are each coordinated to seven O atoms whose arrangement forms a distorted pentagonal bipyramid. A short, probably symmetric (O...O = 2.473(4) A), hydrogen bond links HP2O7(3-) ions as dimers. Two additional HP2O7(3-) ions act as donors to form two hydrogen bonds with the HP2O7(3-) dimers. The NH4+ ions participate in strong hydrogen bonds.

713,918
PB-275 623/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Space Processing/Program of the National Bureau of Standards,
Annual rept. Nov 74-Dec 75,
R. L. Parker. 1977, 13p
Contract W-13475
Pub. in Materials Sciences in Space with Application to Space Processing, v52. Progress in Astronautics and Aeronautics, p423-435 1977.

Keywords: *Crystal growth, *Purification, *Synthesis(Chemistry), *Composite materials, Fabrication, Experimental design, Gravity, Laboratory tests, Space environments, *Space processing.

This report describes NBS work for NASA in support of NASA's Space Processing Program covering the period November 1, 1974 to December 31, 1975. The objectives of the NBS program are to perform ground-based studies (and, where appropriate, space-based studies) of those aspects of space that could possibly provide a unique environment for making materials more perfect or more pure. The approach taken deals primarily with experimental and theoretical studies of the possible effects of the absence of gravitational forces on those materials preparation processes where the presence of gravity may be important in reducing perfection or purity. The materials preparation processes studied comprise six tasks in the areas of crystal growth, purification and chemical processing, and the preparation of composites.

713,919
PB-276 223/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron Scattering Studies of Crystal Dynamics and Order-Disorder Phase Transitions in Alkali Cyanides.
Final rept.,
J. M. Rowe, J. J. Rush, E. Prince, and N. J. Chesser. 1977, 3p
Pub. in Ferroelectrics, v16 p107-109 1977.

Keywords: *Sodium cyanide, *Potassium cyanides, *Neutron diffraction, *Order disorder transformations, Crystal structure, Phase transformations, Antiferroelectricity, Inelastic scattering, Reprints.

The structure, phase transitions and crystal dynamics of KCN and NaCN have been studied by a series of neutron diffraction and inelastic scattering measurements. High resolution powder diffraction results on the three phases of both salts show that the ordered low temperature phase has an 'antiferroelectric' orthorhombic structure, based on a primitive orthorhombic unit cell with essentially the same dimensions as the body-centered orthorhombic cell of the intermediate phase. The characteristic superlattice diffraction peak vanishes as the phase transition temperature is approached from below in the manner expected for a continuous order-disorder phase transition. In accord with other workers, the authors found no evidence of second-order behavior below the orthorhombic-cubic phase transition. Neutron inelastic scattering results are presented for the cubic phase of KCN, including a careful study of the behavior of a soft shear mode down to the cubic-orthorhombic phase transition.

713,920
PB-276 229/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
FEM-FIM Study of Fowler-Nordheim Slope Variation with Crystal Plane Size.
Final rept.,
A. J. Melmed, J. J. Carroll, and J. Smit. 1977, 7p
Pub. in Proceedings of Seminar on Surface Physics (1st), Lagow, Poland, 7-11 Jun 76, Acta Univ. Wratislav. Mat. Fiz. Astronom. n380 p29-35 (Wyda WNICTwa Universytetu, Wroclawskiego, Wroclaw, Poland 1977).

Keywords: *Field emission microscopes, *Surfaces, Ion microscopes, Tungsten, Ruthenium, *Field ion microscopy.

Field-electron microscope determinations of Fowler-Nordheim slope variations with plane size are reported for crystal planes characterized by field-ion microscopy. Experimental results are compared to theoretical computations.

713,921
PB-277 306/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Low-Temperature Lattice Properties of PdD Alloys.
Final rept.,
J. M. Rowe. 1978, 2p
Pub. in Jnl. Phys. F: Metal Phys. Lett. 8, n1 pL7-L8 1978.

Keywords: *Palladium inorganic compounds, *Deuterium compounds, Hydrides, Elastic properties, Specific heat, Thermal expansion, Crystal structure, Phonons, Dispersion relations, Reprints, Palladium deuterides, Palladium hydrides.

The measured phonon dispersion relations for PdD(0.63) at 150 K are used to estimate the elastic constants and low-temperature Debye (symbol - theta) for this compound. The results explain the observations that the low-temperature lattice properties (e.g. specific heat, thermal expansion) of PdH(x) alloys for x approximately = 0.6 are very similar to those for pure Pd.

713,922
PB-277 309/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Lattice Dynamics of NaNO3.
Final rept.,
K. W. Logan, S. F. Trevino, R. C. Casella, W. M. Shaw, L. D. Muhlestein, and R. D Nical. 1971, 5p
Pub. in Proceedings of International Conference on Phonons, Rennes, France, July 26-29, 1971, Paper in Phonons, p104-109 1971.

Keywords: *Sodium nitrates, *Phonons, Neutron scattering, Inelastic scattering, Lattice vibrations, *Lattice dynamics.

The lattice dynamics of NaNO3 have been studied by inelastic neutron scattering. The dispersion relations of phonons along the high symmetry C direction and along two directions of lower symmetry have been measured. The identification of the modes to appropriate irreducible representation has been accomplished with the aid of a new group theoretical procedure. Most of the previously measured optically active modes have been detected and the three inactive modes have now been identified.

713,923
PB-277 311/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Advances in Cryogenic Engineering (Book).
Final rept.,
K. D. Timmerhaus, R. P. Reed, and A. F. Clark. 1977, 570p
Pub. in Proceedings of International Cryogenic Materials Conf. (1st), Kingston, Ontario, July 22-25, 1975, 22, 570p 1977.

Keywords: *Cryogenics, Superconductors, Materials, Liquefied natural gas, Superconductivity.

The volume presents the latest advances in low-temperature materials research, consolidating the most recent findings of materials investigators with current reports from the designers of cryogenic systems. Responding to the two greatest stimuli for cryogenic materials research - applied superconductivity and the storage and transportation of LNG - eminent international investigators offer discussions on the properties of a wide variety of low-temperature materials, including: (1) Fatigue and fracture behavior of structural alloys used in superconducting machinery and LNG ships; (2) Thermal properties of epoxies used in composites; (3) Critical current and AC losses in new developmental superconductors. Numerous applications of low-temperature materials research in controlled thermonuclear fusion, in energy transmission, generation, and storage, and in the oxygen and liquefied gas industries are described. The use of low-temperature materials for insulators, seals, and structural supports for low-temperature areas such as storage tanks, power lines, bubble chambers, and magnets is discussed as well. The book includes discussions of efficient alloy selection, alternate materials choices, and degradation properties, all leading to safer design of cryogenics systems.

713,924
PB-277 313/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Magnetic Thermometry Between 1K and 20K Using Neodymium Ethylsulfate.
Final rept.,
B. W. Mangum, and W. J. Bowers. 1976, 3p
Pub. in Proceedings Session Comite Consultatif de Thermometrie (11th), Comite Int. des Poids et Mesures, Sevres, France, June 15-16, 1976, Paper T 10 in Comite Consultatif de Thermometrie, pT89-T91 1976.

Keywords: *Neodymium compounds, *Temperature measuring instruments, Cryogenics, Magnetic permeability, Mathematical analysis, Organic sulfates, Magnetic hyperfine structure, Spin lattice interactions, *Sulfuric acid/(ethyl-ester)-(neodymium salt), Magnetic susceptibility, *Cryogenic thermometers.

The authors have measured the ac magnetic susceptibility of neodymium ethylsulfate (NES) in the temperature range 1-20K. It was found to be a good magnetic thermometer for this range. Its susceptibility is well described by an equation in which the coefficients were calculated assuming dipolar interactions and hyperfine effects only.

713,925
PB-278 411/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Disclination Kinematics.
Final rept.,
E. Kossecka, and R. de Wit. 1977, 19p
Pub. in Arch. Mech. 29, n5 p633-651 1977.

Keywords: *Defects(Materials), Elastic properties, Materials, Mathematical analysis, Reprints, Dislocations.

A Mathematical theory of moving disclinations is developed. Kinematics is derived for a continuous distribution of disclinations and dislocations as well as for moving discrete disclination and dislocation lines. The concept of the plastic velocity is used to give the theory a symmetrical form. The new concepts of disclination and dislocation loop currents are introduced. The relation between the disclination theory and the incompatibility theory is given.

713,926
PB-278 414/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Refinement of alpha-Lead Azide by Neutron Diffraction.
Final rept.,
C. S. Choi, E. Prince, and W. L. Garrett. 1977, 2p
Pub. in Acta Crystallographica, Section B33, p3536-3537 1977.

Keywords: *Lead azides, *Crystal structure, Neutron diffraction, Chemical bonds, Reprints.

Pb(N3)2, is orthorhombic, Pnma; a = 6.63, b = 16.25, c = 11.31 A, Z = 12 (Azaroff (1956), Z. Kristallogr. 107, 362-369). The four independent azide groups in the structure are all asymmetric, with N-N bond distances, corrected by the riding model, ranging from 1.164 to 1.196 A, and N-N-N bond angles as small as 177.9 degrees.

713,927
PB-278 421/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
System K2O-Al2O3-SiO2. Part 1. Phases on the KAlSiO4-KAlO2 Join.
Final rept.,
L. P. Cook, R. S. Roth, H. S. Parker, and T. Negas. 1977, 11p
Pub. in American Mineralogist 62, p1180-1190 1977.

Keywords: *Potassium oxides, *Aluminum oxide, *Silicon dioxide, *Phase diagrams, Crystal structure, Phase transformations, Lattice parameters, Reprints, Kaliophilite, Potassium aluminosilicates, Potassium aluminates.

High temperature experiments have yielded information about the part of the tectosilicate join between KAlSiO4 and KAlO2. Orthorhombic KAlSiO4 synthesized at 950 C (a = 9.057(2), b = 15.642(2), c = 8.582(2)A), space group P2(sub 1) 2(sub 1) 2 transforms upon heating above 1450-1485 C to another orthorhombic phase having a larger unit cell (a = 18.110(3), b = 15.600(3), c = 8.560(2)A). The space group of the latter is shown from single-crystal precession photographs to be one of three possibilities: P2(sub 1)am, Pma2, or Pmam. A body-centered tetragonal phase, K(1+x) Al(1+x) Si(1-x)O4 (X=0.1), with unit-cell dimensions a = 8.943(1), c = 5.221(1)A is stable at the expense of orthorhombic KAlSiO4 and silica-saturated KAlO2 solid solution in the range 1400-1600 C. The compound previously reported to be K2Al2SiO6 is most likely a member of the f.c.c. solid solution K(1-x)Al(1-x)Si(x)O2. The SiO2-rich endmember of this solid solution has a composition with X=0.25 at 1600 C, and apparently belongs to Laue group m3m.

713,928
PB-278 956/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Inelastic-Neutron-Scattering Line Shapes in PdD0.63.
Final rept.,
C. J. Glinka, J. M. Rowe, J. J. Rush, A. Rahman, S. K. Sinha, and H. E. Flotow. 1978, 6p
Pub. in Physical Review B 17, n2 p488-493, 15 Jan 78.

Keywords: *Palladium inorganic compounds, *Neutron scattering, *Deuterium compounds, Molecular structure, Phonons, Inelastic scattering, Reprints, Palladium hydrides, Palladium deuterides, *Lattice dynamics.

Previous measurements of the phonon-dispersion curves in a single crystal of PdD(0.63) have been augmented by detailed inelastic-neutron-scattering measurements of the optical-phonon line shapes at 80 K. The line shapes observed at this temperature show substantial broadening and subsidiary structure. The data have been compared to line shapes calculated from a Born-von Karman type model in which the nonstoichiometric structure of the crystal is explicitly taken into account. Although the model results cannot reproduce all details of the observed line shapes, the observed line shapes, the observed and calculated linewidths agree reasonably well, which demonstrates that the broadening is primarily an effect of nonstoichiometry and not, for example, due to anharmonicity. The Pd-D force constants derived from the nonstoichiometric model agree closely with those obtained from an earlier analysis of the dispersion curves based on a conventional Born-von Karman approach in which the crystal was treated as stoichiometric PdD. The near-neighbor D-D force constants obtained in the present analysis, however, are some 50% larger than those deduced with a stoichiometric model.

713,929
PB-279 538/3 PC A09/MF A01
National Bureau of Standards, Washington, D.C. Reactor Radiation Div.
NBS Reactor: Summary of Activities July 1976 to June 1977,
F. J. Shorten. Apr 78, 192p NBS-TN-969
See also report dated Jan 76, PB-248 982.

Keywords: *Research projects, *Nuclear research and test reactors, Neutron scattering, Neutron activation analysis, Crystal structure, Isotopes, Solid state physics, Neutron radiography, Health physics, Industrial medicine, Nondestructive testing, Radiation effects.

This report summarizes all those programs which depend on the NBS reactor. It covers the period from July 1976 through June 1977. The programs range from the use of neutron beams to study the structure and dynamics of materials through nuclear physics and neutron standards to sample irradiations for activation analysis, isotope production, radiation effects studies, neutron radiography and nondestructive evaluations.

713,930
PB-280 446/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Nonlinear Lattice Theory of Fracture.
Final rept.,
E. R. Fuller, and R. Thomson. 1977, 8p
Pub. in Proceedings of International Conference on Fracture (4th), Waterloo, Canada, 19-24 Jun 77, Fract3 nICF4 p387-394 1977.

Keywords: *Fractures(Materials), *Crack propagation, Brittleness, Nonlinear systems, Surface energy, Mathematical models.

A nonlinear lattice theory of fracture is developed for a quasi-one-dimensional lattice model of a crack, where nonlinear cohesive force laws are introduced for the interaction of the 'crack-tip' atoms. Similar to previous developments, the crack is found to be stable over a range of applied forces, or 'lattice trapped.' Within this lattice trapping regime, conditions of stability give not only equilibrium configurations but also a saddle point configuration, thus enabling the calculation of forward and backward energy barriers for thermally activated subcritical crack propagation, or crack healing. As in the three-dimensional development by Esterling, the microscopic surface energy density, as defined by one-half the area under the cohesive force versus displacement curve, is found to lie outside the lattice trapping regime for certain cohesive force laws. However, the present model is not self-consistent for these atomic forces laws, and requires the consideration of additional nonlinear 'crack-tip' interactions to reduce this inconsistency.

713,931
PB-280 454/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Producing Visual Two-Dimensional Images of Ion Beams.
Final rept.,
J. Fine, and R. Gorden. Sep 77, 4p
Pub. in Proceedings of International Vacuum Congress (7th) and International Conference on Solid Surfaces (3rd), Vienna, Austria 12-16 Sep 77, vIII p2561-2564 Sep 77.

Keywords: *Sufaces, *Images, *Ion beams, Electron beams, Electric charge, Surface resistivity, Surface properties, Insulation.

Two-dimensional images of 1-5 keV argon ion beams incident on solid surfaces have been obtained by the coincident interaction of a rastered electron beam. Various target materials have been examined but only insulators were found effective in producing ion beam images. Those processes that seem basic to understanding this imaging effect are enhanced surface conductivity and charge storage and neutralization. The use of coincident ion and electron beams presents a new technique that is potentially useful for studying surface interactions.

713,932
PB-280 455/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electronic and Superconducting Properties of the Ti3P-Type Compounds Nb3As and Nb3Si.
Final rept.,
D. U. Gubser, R. A. Hein, R. M. Waterstrat, and A. Junod. 1 Nov 76, 6p
Grant PHS-DE-02455
Pub. in Phys. Rev. B14, n9 p3856-3861, 1 Nov 76.

Keywords: *Superconductivity, *Niobium inorganic compounds, Silicides, Arsenides, Electrical resistivity, Specific heat, Bond structure of solids, Transition temperature, Magnetic fields, Electron phonon interactions, Reprints, Niobium arsenides, Niobium silicides.

Superconductivity has been observed below temperatures of about 0.3K in the tetragonal Ti3P-type compounds Nb3Si and Nb3As. Measurements of the electrical resistivity, heat capacity, superconducting transition temperature, and the critical magnetic field curve are reported. From these measurements, values of the electronic specific heat coefficient gamma, the Debye temperature theta, the electron-phonon coupling constant lambda, and the Ginzburg-Landau parameter K, are deduced. A comparison of their electronic and superconducting properties with those of A3B compounds of the Al5-type suggests that the electron-phonon interaction is quite large in these Ti3P type materials.

713,933
PB-280 529/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New High-Pressure Phases of Nb3Si Produced by Recrystallization of Metastable Sputter Deposits.
Final rept.,
R. M. Waterstrat, F. Haenssler, J. Muller, S. D. Dahlgren, and J. O. Willis. Mar 78, 6p
Prepared in cooperation with American Dental Association Health Foundation, Chicago, Ill.
Pub. in Jnl. of Applied Physics 49, n3 p1143-1148, Mar 78.

Keywords: *Niobium alloys, *Silicon alloys, *Phase transformations, Sputtering, Crystallization, Superconductivity, Pressure, Transition temperature, Crystal structure, Reprints, Niobium silicides.

Three new phases of the alloy Nb3Si have been produced by a relatively low-temperature (about 800C) recrystallization anneal under pressures of up to 100 kbars. The new phases are apparently formed only when the Nb3Si starting material has a metastable body-centered cubic structure which is prepared by sputtering. They are not formed when the Nb3Si starting material has the Ti3P-type structure. One of the new high-pressure phases has a superconducting transition temperature (Tc) of 5.45 K but its crystal structure has not yet been identified. The phase formed at 60 and 100 kbars has a tetragonal Ni3P-type structure but the structure of the 80 kbar phase is not known.

713,934
PB-280 533/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dependence of Lifetime Predictions on the Form of the Crack Propagation Equation.
Final rept.,
S. M. Wiederhorn. 1977, 9p
Pub. in Proceedings of International Conference on Fracture (4th), Waterloo, Canada, Jun 19-24, 1977, p893-901 1977.

Keywords: *Crack propagation, Glass, Fractures(Materials), Failure, Mathematical prediction.

The importance of crack propagation equations to failure predictions is discussed. It is noted that for failure predictions purposes the most conservative predictions should be used.

713,935
PB-281 053/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron Powder Diffraction Study of the Intermediate-Temperature Form of Lithium Tantalate.
Final rept.,
A. Santoro, R. S. Roth, and D. Minor. 1977, 3p
Pub. in Acta Crystallographica B33, p3945-3947 1977.

Keywords: *Crystal structure, Neutron diffraction, Lithium compounds, Tantalates, *Lithium tantalates, Reprints.

M-LiTa3O8, monoclinic, C2/c, a=9.410(1), b=11.521(1), c=5.0506(5) A, beta=91.108(5) degrees, Z=4. The location of the lithium ion in the structure has been determined by profile analysis of powder diffraction data.

713,936
PB-281 350/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Detection of Multiplet Structure in Cu Kalpha(1,2) by Means of a Monolithic Double Crystal Spectrometer.
Final rept.,
W. C. Sauder, J. R. Huddle, and J. D. Wilson. 14 Nov 77, 3p
Sponsored in part by National Science Foundation, Washington, D.C.
Pub. in Physc. Letters, v63A n3 p313-315, 14 Nov 77.

Keywords: *Copper, Crystal structure, Crystal defects, X ray spectra, Reprints.

A monolithic double crystal spectrometer has been employed to produce a highly dispersed, well-resolved

Cu K alpha(1,2) spectrum. The observed spectrum contains structure that can be attributed to spectator vacancies accompanying the single vacancy transition.

713,937
PB-281 352/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Curie Temperatures of Amorphous RFe(2) Alloys.
Final rept.,
J. J. Rhyne. 1975, 2p
Pub. in Proceedings of Annual AIP Conference on Magnetism and Magnetic Materials (21st), Philadelphia, Pa. 9-12 Dec 75, Paper in Magnetism and Magnetic Materials 1975, n29 p182-183 1975.

Keywords: *Iron alloys, *Rare earth alloys, *Curie temperature, Magnetic properties, Gadolinium alloys, Erbium alloys, Yttrium alloys, Order disorder transformations, Terbium alloys, Dysprosium alloys, Holmium alloys, Phase transformations, Crystal structure, Amorphous materials, Magnetic ordering, Exchange interactions.

Curie temperatures of the series of amorphous rare earth-iron alloys RFe2 (where R=Gd, Tb, Dy, Ho, Er, and Y) have been determined from Belov-Goryaga plots of the magnetization isotherms. The Curie Temperature of GdFe2 is 500 K, and drops sharply (e.g. ErFe2T sub c = 105K) as one proceeds to the right in the above series (decreasing R spin). The observed Curie temperatures exhibit a smooth variation with the DeGennes factor of the rare earth ion, with the zero spin limit YFe2 exhibiting no long-range order. A molecular field model describing these interactions has been used to calculate the expected Curie temperature for both the amorphous and crystalline series. Overall agreement with the observed T sub c's was less satisfactory for the amorphous than for the crystalline materials.

713,938
PB-281 593/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamic Considerations in the Use of Polysilicon Oxidation Tubes for Clean Si02 Film Preparation.
Final rept.,
S. Mayo, and W. H. Evans. Jan 78, 5p
Sponsored in part by Defense Nuclear Agency, Washington, D.C.
Pub. in Jnl. of the Electrochemical Society, v125 n1 p106-110 Jan 78.

Keywords: *Silicon dioxide, *Oxidation, *Contamination, Vapor deposition, Sodium, Impurities, Polycrystals, Metal oxide semiconductors, Semiconductor devices, Fabrication, Cleaning, Dielectric films, Reprints, Chemical vapor deposition, High temperature, Silane/trichloro.

The thermodynamic equilibria established in oxidation atmospheres in polycrystalline silicon tubes operated at 1000C are analyzed. Silicon oxidation tubes made by chemical vapor deposition through hydrogen reduction of pure trichlorosilane have very low sodium content (about 10 ppb or 1000 times less sodium than in transparent fused silica oxidation tubes). Due to the low sodium content in new oxidation tubes, clean (low alkali content) thermal oxide films can be grown on silicon wafers. However, tube contamination developed during semiconductor processing operations imposes the need for appropriate periodic tube cleaning to maintain sodium contamination in the oxidation atmosphere within acceptable levels. Tube cleaning reactions taking place at oxidation temperature are discussed showing that the quality of thermal oxide films is influenced by tube cleaning efficiency.

713,939
PB-281 909/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Boron Determination in Silicon by the Nuclear Track Technique.
Final rept.,
W. R. Thurber, and B. S. Carpenter. Apr 78, 4p
ARPA Order-2397
Pub. in Jnl. of the Electrochemical Society 125, n4 p654-657, Apr 78.

Keywords: *Silicon, *Boron, *Chemical analysis, Electrical resistivity, Reprints, Nuclear track technique.

The nuclear track technique was used for the determination of the boron dopant density in silicon. It was found that boron in the range of 10 to the 15th power - 10 to the 20th power atoms/cc could be detected. The resistivity of the silicon specimens as a function of the boron density determined by the nuclear track technique compares well with the work of Wagner relating resistivity to boron density. The results obtained by the nuclear track technique show some scatter, but in general agree with those determined by the junction capacitance-voltage method.

713,940
PB-281 912/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Behavior of the Pyroelectric Coefficient at Low Temperatures.
Final rept.,
R. Radebaugh. 27 Feb 78, 3p
Pub. in Physical Review Letters 40, n9 p572-574, 27 Feb 78.

Keywords: *Pyroelectricity, *Cryogenics, Specific heat, Lithium inorganic compounds, Sulfates, Entropy, Thermodynamics, Reprints, *Lithium sulfates.

The third law of thermodynamics is used to show that the primary pyroelectric coefficient as T approaches 0 K cannot have a linear temperature dependence when the specific heat is proportional to T cubed. The argument is consistent with previous microscopic theories that predict a cubic temperature dependence for the pyroelectric coefficient but not with those that predict a linear temperature dependence. Electrocaloric cooling effects in lithium sulfate monohydrate below 1 K must then be smaller than predicted earlier.

713,941
PB-281 913/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Definitions of Terms for Practical Superconductors 2. Critical Parameters.
Final rept.,
R. L. Powell, and A. F. Clark. Mar 78, 5p
Pub. in Cryogenics 18, n3 p137-141, Mar 78.

Keywords: *Superconductors, *Definitions, Terminology, Measurement, Cryogenics, Critical point, Theory, Fabrication, Stabilization, Josephson junctions, Reprints.

The definitions of terms used in describing the phenomenology and measurement practices of practical superconductive materials are proposed. The definitions cover the subject categories of: (1) fundamental states and flux phenomena, (2) critical parameters, (3) fabrication, stabilization, transient losses, and (4) Josephson phenomena. It is intended that these terms will become the basis for the development of standard measurement practices, and responses are invited.

713,942
PB-281 978/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Spin Waves in ErFe2.
Final rept.,
J. J. Rhyne, N. C. Koon, J. B. Milstein, and H. A. Alperin. 1977, 3p
Pub. in Phys., 86-88B p149-151 1977.

Keywords: *Iron alloys, *Erbium containing alloys, *Magnons, Intermetallic compounds, Rare earth compounds, Neutron scattering, Inelastic scattering, Single crystals, Erbium compounds, Iron inorganic compounds, Cryogenics, Reprints, Exchange interactions.

Spin excitations in a single crystal of the rare earth Laves phase compound ErFe2 have been studied using inelastic neutron scattering at room temperature and at 4K (T sub c = 574K). A nearest neighbor spin wave model was used to derive the three exchange parameters from the observed dispersion relations.

713,943
PB-282 006/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystal Perfection in Czochralski Grown Nickel Single Crystals.
Final rept.,
M. Kuriyama, W. J. Boettinger, and H. E. Burdette. 1978, 4p
Pub. in Jnl. of Crystal Growth, v43 p287-300 1978.

Keywords: *Nickel, *Crystal growth, *Czochralski method, Crystal defects, Single crystals, X ray diffraction, Reprints.

To study the relationship between crystal growth conditions and resultant crystalline perfection, large nickel single crystals more than 12 cm long and 2 to 3 cm in diameter have been grown from the melt by the Czochralski method. The crystal perfection of as-grown nickel single crystals has been assessed by X-ray dynamical diffraction topography with an asymmetrical (double) crystal topographic (ACT) camera. In this work it has been found that nickel single crystals with perfections between 400 and 1000 dislocation lines/sq cm can be produced by controlling practical process parameters, such as the rotations of the seed and the melt, and the growth directions. However, more crucial factors influencing the ultimate level of crystal perfection are governed by some crystallographic effects closely related to the behavior of dislocations in grown crystals.

713,944
PB-282 018/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Transport in a Crystalline Solid Subjected to Intense Excitation.
Final rept.,
R. A. MacDonald, and D. H. Tsai. 1978, 4p
Pub. in Proceedings of International Conference on Lattice Dynamics, Paris, France, 5-9 Sep 77 p156-159 (Flammarion Science, Paris, France, 1978).

Keywords: *Thermal diffusivity, *Heat transfer, *Thermal shock, Body centered cubic lattices, Second sound, High pressure, High temperature.

The authors used the method of molecular dynamics to study thermal relaxation processes in a solid at high pressures and high temperatures. Thermal diffusion, heat pulse propagation and shock wave propagation were studied in a perfect, monatomic bcc lattice. The details obtained are helpful to understanding the phenomenon of second sound and in the interpretation of shock wave data. The importance of thermal relaxation processes in a strongly coupled system is clearly demonstrated.

713,945
PB-282 128/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electrical Resistance of Epitaxially-Grown Films of (SN)x.
Final rept.,
R. J. Soulen, and D. B. Utton. 1977, 4p
Grant N00014-76-F-001
Pub. in Solid State Commun., v21 n1 p105-108 1977.

Keywords: *Electrical resistance, *Sulfur inorganic compounds, Epitaxy, Crystal growth, Thin films, Superconductivity, Electron tunneling, Electron transitions, Temperature, Cryogenics, Reprints, *Sulfur nitrides.

The dc electrical resistance of three epitaxially-grown thin films of (SN) x was measured from 0.020 K to 8.9 K in a low ambient magnetic field. Above 0.25 K the data for all samples are best fit by an equation representing transport of electrons by tunneling between metallic particles of (SN)x. A change in the temperature dependence of resistance below 0.25 K is interpreted as suggestive, but not conclusive, evidence of superconductivity.

713,946
PB-282 132/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photoelastic Constants of Germanium.
Final rept.,
A. Feldman, R. M. Waxler, and D. Horowitz. Apr 78, 2p
Pub. in Jnl. Appl. Phys. Commun. v49 n4 p2589-2590 Apr 78.

Keywords: *Germanium, *Photoelasticity, Figure of merit, Pressure, Reprints, Stress optical coefficients, Acoustooptics.

The photoelastic constants of Ge have been measured at 3.39 and at 10.6 micrometers. The stress-birefringence data join smoothly to earlier stress-birefringence data at other wavelengths. The acousto-optic figure of merit Msub2, computed from our data, agrees well with Msub2 determined for commercial acousto-optic devices. However, the author's data disagree with some earlier measurements of Msub2, the elasto-optic constants Pij, and the change of refractive index with hydrostatic pressure dn/dP.

713,947
PB-282 134/6 Not available NTIS

National Bureau of Standards, Gaithersburg, MD.
Small-Angle Magnetic Scattering from a Dilute Amorphous Fe(Tb) Alloy.
Final rept.,
S. J. Pickart, H. A. Alperin, and J. J. Rhyne. 26 Dec 77, 3p
Grant NSF-DMR75-22379
Pub. in Phys. Lett., v64A n3 p337-339 26 Dec 77.

Keywords: *Iron alloys, *Rare earth containing alloys, Magnetic properties, Terbium containing alloys, Holmium containing alloys, Neutron scattering, Reprints, Amorphous materials.

Low temperature neutron scattering measurements on an amorphous alloy of composition Tb0.018 Fe0.982 reveal anomalous small-angle magnetic scattering similar to that observed in the more rare-earth-rich compounds TbFe2 and HoFe2. Inferences are drawn from the angular dependence of the scattering concerning cluster size and magnetic structure.

713,948
PB-282 135/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Superconductivity in Ti3P-Type Compounds.
Final rept.,
J. O. Willis, R. A. Hein, and R. M. Waterstrat. 1 Jan 78, 7p
Pub. in Phys. Rev. vB17 n1 p184-190 1 Jan 78.

Keywords: *Superconductors, Tetragonal lattices, Transition temperature, Zirconium inorganic compounds, Vanadium inorganic compounds, Niobium inorganic compounds, Critical field, Magnetic properties, Crystal structure, Specific heat, Tantalum inorganic compounds, Germanides, Silicides, Phosphides, Antimonides, Cryogenics, Reprints, Electron phonon interactions, Niobium germanides, Zirconium silicides, Zirconium germanides, Zirconium phosphides, Vanadium phosphides, Zirconium antimonides, Tantalum germanides, Zirconium phosphides.

A study of 12 intermetallic A3B compounds which crystallize in the tetragonal Ti3P-type structure has revealed 5 new superconductors with transition temperatures below 1Kappa: Zr3Ge; Zr3P; V3P; and Nb3Ge (extrapolated from the alloy series NbGeAs). In addition, two compounds, Zr3Sb and Ta3Ge, having the Ni3P structure type were found to be superconducting below 1 Kappa. Within the Ti3P-type compounds, those with the lighter 'B' elements in a given column of the periodic table have the higher transition temperatures. Critical magnetic field and electrical resistivity data are reported for the superconducting Ti3P-type compound which permit one to estimate the Ginsburg-Landau Kappa parameter and the electronic specific heat coefficient gamma.

713,949
PB-282 140/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Deuterium-Site Occupancy in the alpha and beta Phases of TiD(x).
Final rept.,
H. A. Alperin, H. Flotow, J. J. Rush, and J. J. Rhyne. 1 Sep 76, 5p
Sponsored in part by Naval Air Systems Command, Washington, D.C.
Pub. in Proceedings of Conference on Neutron Scattering, Gatlinburg, Tenn. 6-10 Jun 76 p517-521, 1 Sep 76. (Oak Ridge National Lab., Tenn.)

Keywords: *Neutron diffraction, Titanium inorganic compounds, Crystal structure, *Titanium deuterides, Titanium hydrides.

Neutron diffraction patterns were taken of TiD(0.075) at 375 C and TiD(0.67) at 400 C in the alpha (hcp) and beta (bcc) phases respectively. A mixed octahedral (y)--tetrahedral (1-y) site occupancy was found. The results are for the alpha-phase: $y = 0.68 +$ or - .02, while for the beta-phase: $0.15 < y < 0.30$.

713,950
PB-282 147/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
NBS Semiconductor Technology Program.
Final rept.,
W. M. Bullis. Oct 77, 6p
Sponsored in part by Advanced Research Projects Agency, Arlington, Va., Defense Nuclear Agency, Washington, D.C., National Aeronautics and Space Agency, Greenbelt, Md., and Strategic Systems Project Office (Navy), Washington, D.C.
Pub. in Proceedings of Symposium on Utilization of Large Scale Integrated Circuits in Military Systems, Arlington, Va. 9-11 Aug 77, IDA Paper P-1296, Pt2 pIII-89-III-94 Oct 77. (Institute for Defense Analyses, Arlington, Va. Science and Technology Div.).

Keywords: *Semiconductors, Measurement, Semiconductor devices, Integrated circuits, Quality control, Large scale integrated circuits.

The NBS Semiconductor Technology Program is a laboratory-based research effort directed toward development of practical, well documented measurement methods and associated data and instrumentation for use by the semiconductor electronics community. Use of improved measurement technology enables the integrated circuit (IC) manufacturer to exert more effective control over his manufacturing processes. The user benefits because his ICs have greater uniformity, improved quality and reliability, and more predictable performance. Examples are given in which the results of the work have led to cost savings and reliability improvements. Various current technical activities of importance to production of large scale integrated circuits (LSICs) are described briefly, and ways in which the results of the work are transferred to the industry are discussed.

713,951
PB-282 193/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Monte Carlo Study of the Maier-Saupe Model on Square and Triangle Lattices.
Final rept.,
R. D. Mountain, and T. W. Ruijgrok. 1977, 17p
Contract AT(49-16)3003
Pub. in Physica, v89A p522-538 1977.

Keywords: *Phase transformations, *Crystal structure, Monte Carlo method, Reprints, Order parameters.

The Monte Carlo method is used to investigate the statistical physics of the Maier-Saupe model on square and triangle lattices. These systems are found to exhibit higher than first order phase transitions except for the negative coupling square lattice case. The transition is signaled by a pronounced maximum in the specific heat as a function of temperature. The mechanism of the transition is shown to be associated with the onset of partial ordering of the vectors in individual members of the ensemble. A temperature dependent internal order parameter is introduced to characterize the degree of internal order in the system, as the ordering process does not break the rotational symmetry of the Hamiltonian and no macroscopic order parameter exists.

713,952
PB-282 196/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reduced Cell: Its Use in Classification, Evaluation, and Identification of Crystalline Materials.
Final rept.,
A. D. Mighell. Dec 76, 8p
Pub. in Jnl. of Applied Crystallography, v9 pt6 p491-498 Dec 76.

Keywords: *Crystal structure, *Lattice parameters, Classification, Identifying, Reprints.

A rapid-identification file for crystalline materials is being prepared from the Crystal Data file. In this new file, each cell is represented in its reduced form, which is unique, primitive, and based on the three shortest noncoplanar vectors of the lattice. Unknown materials can be rapidly matched with the same or related crystals in the file. To identify an unknown crystalline material, a primitive cell is first determined experimentally, then it is reduced and checked against the file for a match. Even if the cell of the unknown lattice is not primitive, identification is still possible by calculating appropriate derivative lattices, reducing them, and then checking the file.

713,953
PB-282 197/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Phase Diagram and Critical Points for a Metamagnetic Ising Model Using Constant Coupling Approximation.
Final rept.,
P. H. E. Meijer, and W. C. Stamm. 1978, 20p
Pub. in Physica, v90A p77-96 1978.

Keywords: *Ferromagnetism, *Phase transformations, *Critical point, Iron inorganic compounds, Bromides, Curie temperature, Reprints, Ising model, Iron bromides, Molecular field theory, Random phase approximation.

The authors computed the isotherms and phase diagram in the Constant-Coupling approximation for an Ising metamagnet with various values for the ratio of the ferromagnetic to the antiferromagnetic coupling parameters. The constant coupling method is set up entirely with the internal fields as a variation parameter. Search for the tricritical point, both directly and indirectly via the Hessian of the internal fields led to the conclusion that this model has no tricritical point, but a critical end point. Comparing the authors' computation with the experimental result for FeBr2, it was found that the value for the CE lies closer to the experiment than both the molecular field theory and the random phase approximation.

713,954
PB-282 199/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Re-analysis of Dysprosium Magnetostriction.
Final rept.,
D. J. Martin, and J. J. Rhyne. 1977, 4p
Pub. in Jnl. of Physics, vC10 p4123-4126 1977.

Keywords: *Magnetostriction, *Dysprosium, Domains, Rare earth elements, Magnetic anisotropy, Reprints.

A re-analysis of earlier magnetostriction measurements on dysprosium is presented. Domain effects have been corrected for using the phase theory. The re-analyzed results for the temperature dependence of the magnetostriction constants and of the magnetocrystalline anisotropy energy are in reasonable agreement with theoretical predictions and the results of other experimental workers.

713,955
PB-282 881/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Numerical Evaluation of the Response of a Josephson Tunnel Junction in an Arbitrary Circuit.
Final rept.,
R. E. Harris. Dec 77, 3p
Sponsored in part by Office of Naval Research, Arlington, Va.
Pub. in Jnl. of Applied Physics, v48 n12 p5188-5190 Dec 77.

Keywords: *Josephson junctions, Electron tunneling, Superconductivity, Computation, Response, Reprints.

A numerical technique is presented for calculating the response of a Josephson tunnel junction when connected to an arbitrary circuit. The approach includes all of the details of the microscopic theory including sine and cosine terms as well as the quasiparticle current together with its reactive part. An example is given, and techniques for reducing computation time are discussed.

713,956
PB-282 917/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Shock Wave Profile in a Crystalline Solid.
Final rept.,
D. H. Tsai, and R. A. MacDonald. 1978, 7p
Sponsored in part by Army Research Office, Washington, D.C.
Pub. in Jnl. of Physics C: Solid State Physics, v11 pL365-L371 1978.

Keywords: *Shock waves, *Solids, *Molecular vibration, Shock(Mechanics), Pressure, Dynamic tests, Kinetic energy, Reprints.

The authors analyse the results of Paskin et al (1977) obtained from their molecular dynamical simulation of shock wave propagation in a solid. The authors found that their kinetic 'temperature' profiles T sub 1 and T sub 3 behind the shock front are in error, because these are defined with respect to a reference frame that experiences acceleration, instead of one that moves at a uniform velocity with the compressed lattice as a whole. The basic difficulty with their definition is that with respect to non-Galilean transformation the Newtonian equations of motion are not invariant and the kinetic energy is not conserved. The error incurred is precisely equal to the kinetic energy associated with the oscillatory motion of the atomic planes relative to the compressed lattice. This error is very large in the region immediately behind the shock front, and it is not zero even in the tail region of the shock profile, where the interplanar oscillations are expected to disappear. When this kinetic energy is properly accounted for, as in their temperature profile T sub 2, their results are in

qualitative agreement with those which the authors obtained previously.

713,957
PB-283 482/8 PC **A05**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Electron Devices Div.
Semiconductor Measurement Technology: Progress Report, July 1 to September 30, 1976,
W. M. Bullis, and J. F. Mayo-Wells. Jul 78, 82p NBS-SP-400/36
Contract E(49-1)-3300, N00164-76-MP-04511
Prepared in cooperation with Space and Missile Systems Organization, Los Angeles, Calif. See also AD-A040 011.

Keywords: *Semiconductors, *Measurement, *Tests, Test equipment, Electrical properties, Silicon, Semiconductor devices, Chemical analysis, Optical measurement, Electron spectroscopy, Sapphire, Substrates, Photolithography, Packaging, Transistors, Thermal properties, Integrated circuits, Fabrication, Semiconductor doping, Acoustic measurement, Hole mobility, National Bureau of Standards, Secondary ion mass spectroscopy.

Contents: Materials characterization by electrical methods; Materials characterization by physical analysis methods; Materials and procedures for wafer processing; Photolithography; Test patterns; Assembly and packaging; Device inspection and test; References; Semiconductor technology program staff; Semiconductor technology program publications; Solid-state technology and fabrication services.

713,958
PB-283 729/2 PC **A08**/MF **A01**
National Bureau of Standards, Boulder, CO.
Role of Superconductivity in the Space Program: An Assessment of Present Capabilities and Future Potential,
D. B. Sullivan. May 78, 163p NBSIR-78-885
Contract NASA-A-437018(JM)

Keywords: *Superconductivity, Space exploration, Spaceborne detectors, Computers, Electronics, Magnets, Assessments.

The report describes the results of a study designed to assess the role which superconductivity might play in the U.S. Space Program. The study was performed by members of the staff of the Boulder Laboratories of the National Bureau of Standards. Six technical subject areas were considered; high field magnets, magnetometers, digital electronics, high-frequency detectors, instruments related to gravitational studies and ultra high-Q cavities. The study identifies a number of applications of superconductivity which are of potential interest to NASA. Wherever possible, the devices are related to specific types of space missions.

713,959
PB-283 829/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Role of Intrinsic Plasmons in Conduction Band X-Ray Photoemission from Solids.
Final rept.,
D. R. Penn. 27 Feb 78, 4p
Pub. in Phys. Rev. Lett., v40 n9 p568-571, 27 Feb 78.

Keywords: *Plasmons, Metals, Sodium, Magnesium, Conduction bands, X ray spectroscopy, Photoelectric emission, Reprints, *X ray photoelectron spectroscopy.

The author shows that intrinsic plasmons are created in x-ray photoemission experiments on the conduction bands of simple metals and that the plasmon creation probability is comparable to that found in core level x-ray photoemission experiments. Unlike the core case, the plasmons are produced by many body effects and are a direct consequence of electron correlation. A theory of the intrinsic plasmon production is given and a calculation of the electron loss spectra in conduction band x-ray photoemission from Mg and Na is presented. The calculation takes into account both intrinsic and extrinsic plasmon production, and agreement with experiment is good.

713,960
PB-283 832/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analog Computer Studies of Frequency Multiplication and Mixing with the Josephson Junction.
Final rept.,
A. S. Risley, E. G. Johnson, and C. A. Hamilton. Jan 77, 4p
Pub. in Proceedings 1976 Applied Superconductivity Conf., Stanford, Calif., Aug 18-20, 1976, IEEE Trans. Mag. MAG-13 n1 p381-384 Jan 77.

Keywords: *Josephson junctions, *Frequency multipliers, *Computerized simulation, Analog simulation, Phased locked systems, Laser beams, Far infrared radiation, Mixers(Electronics).

Using a point-contact Josephson junction (JJ), direct frequency measurement of far-IR laser lines can be performed by mixing the Nth harmonic of a microwave frequency nu sub 2 with the laser frequency nu sub 1 to produce a beat signal nu sub IF such that nu sub IF = nu sub 1 - nu sub 2. Analog computer simulation of the JJ has revealed an efficient mode of frequency multiplication and mixing. This is a condition wherein the self-oscillation, nu sub J, is phase locked to a frequency nu sub J = + or -l nu sub 2 + or - k nu sub 1 + or - m nu sub IF where l, k, and m are integers. The analog studies show that this phase locking can occur at very low as well as at high levels of the external drives. The result of the phase lock is an efficient transfer of energy into the nu sub IF output signal. At least one experimental result has verified the occurrence of phase locking to difference frequencies. It is also well known that the optimum bias points in mixing experiments lie between the nu sub 2 steps. The interpretation of these results and the direct role played by nu sub J in mixing experiments has not, however, been generally recognized.

713,961
PB-283 980/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Existence of an Isotope Shift for the Sulfur Deep Level in Silicon.
Final rept.,
D. R. Myers, and W. E. Phillips. 1 Jun 78, 3p
ARPA Order-2397
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Applied Physics Letters, v32 n11 p756-758, 1 Jun 78.

Keywords: *Silicon, *Ion implantation, *Sulfur isotopes, Semiconductor diodes, Band structure of solids, Capacitance, Isotope effect, Reprints.

The deep energy level of the isotope 34S in the upper half of the energy gap of silicon is examined by the isothermal transient capacitance measurements on ion-implantation-predeposited diode structures. The resulting energy level at Ec-0.512 eV is found to be 0.014 eV closer to the conduction band edge than the corresponding deep level for the isotope 32S in similarly prepared samples. The existence of an isotope shift for the deep sulfur level is interpreted as implying vibronic coupling between the electronic states of the sulfur center and the silicon lattice.

713,962
PB-283 982/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radiation Dose at the Silicon-Sapphire Interface Due to Electron-Beam Aluminization.
Final rept.,
K. F. Galloway, and S. Mayo. Apr 78, 8p
Sponsored in part by Defense Nuclear Agency, Washington, D.C. and Advanced Research Projects Agency, Arlington, Va.
Pub. in Jnl. of Applied Physics, v49 n4 p2586-2588 Apr 78.

Keywords: *Metallizing, *Aluminum coatings, Interfaces, Electron beams, Vapor deposition, Radiation effects, Reprints, *Silicon on sapphire technology.

Recently, the process of metallization in an electron-beam evaporator has been shown to result in a buildup of trapped positive charge at the silicon-sapphire interface during the fabrication of silicon-on-sapphire devices. This charge buildup can be attributed to radiation damage produced by x-rays generated by electron impact on the aluminum to be evaporated. This paper gives the results of calculations of the radiation dose in the sapphire near the silicon-sapphire interface due to the electron-beam-metallization process.

713,963
PB-283 988/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Polarized LEED Using a GaAs Spin Polarized Electron Source.
Final rept.,
W. B. Unertl, R. J. Celotta, and D. T. Pierce. 1978, 8p
Sponsored in part by Office of Naval Research, Arlington, Va., and Air Force Office of Scientific Research, Bolling AFB, D.C. Proceedings of Conference to Mark Anniversary of Discovery of Electron Diffraction, London, England, Sept. 19-22, 1977.
Pub. in Inst. Phys. Conf., n41 p287-294 1978.

Keywords: *Polarization, *Gallium arsenides, Electron diffraction, Electrons, Sources, Photoelectric emission, *Low energy electron diffraction.

Two years after their discovery of low energy electron diffraction, Davisson and Germer (1929) reported the absence of electron spin polarization effects in LEED. However, it is now known that an unpolarized electron beam is polarized by diffraction from a W(100) surface as found by O'Neill et al. (1975) using a Mott detector to measure the polarization of the reflected beam. Polarized LEED (PLEED) measurements can also be made using a polarized incident beam and recording the dependence of the intensity of the diffracted beam on the polarization of the incident beam. An ideal source of spin polarized electrons for PLEED measurements is provided by photoemission from negative electron affinity GaAs (Pierce and Meier, 1976). The intense, electron-optically bright beam has a spin polarization which can be modulated from -50% to +50%. The spin dependence of LEED can then be measured by synchronously detecting the modulation of the diffracted intensity. We describe an apparatus for making PLEED measurements with a GaAs source. The theoretical basis for PLEED measurements is reviewed and the effects of multiple scattering and phonon scattering on the spin dependence are discussed. The application of PLEED to the development of a new low energy, high efficiency polarization detector and to surface structure determination is explored.

713,964
PB-284 478/5 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Electron Devices Div.
Semiconductor Technology Program--Program Briefs,
W. M. Bullis. Jul 78, 13p NBSIR-78-1444-2
ARPA Order-2397

Keywords: *Semiconductors, *Measurement, *Tests, Semiconductor devices, Integrated circuits, Quality control, Defects, Optical scanners, Silicon.

Contents: Profiling the Si-SiO2 Interface; Detection of Cracks in Solar Cells; Gated Diodes and CCD Dark Current; Silicon Resistivity SRMs; Unintentional Ion Channeling Effects; Deep Level Measurements; Transferability of SOA Test Circuit; Acoustic Material Signatures; Availability of Test Pattern NBS-4; Moisture Measurement Workshop; SPV-FCD Lifetime Comparison; New Projects; Work in Progress; Recent Publications; Publications in Press.

713,965
PB-284 579/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Study of Point-Contact Josephson Junctions for Use in Frequency Synthesis.
Final rept.,
A. S. Risley. 1977, 7p
Pub. in Proceedings Annual Symposium on Frequency Control (31st), Fort Monmouth, New Jersey, 1-3 Jun 77, p583-589.

Keywords: *Josephson junctions, *Frequency synthesizers, Frequency multipliers, Mixing circuits.

A carefully controlled microwave experiment using point-contact Josephson junctions (PCJJ) is reported. The experiment measures the IF power, P sub IF generated in low-order frequency multiplication and mixing. Also measured is the number of induced steps produced by the microwave source. Four characteristics possessed by PCJJ's which gave the largest P sub IF are described. These criteria are compared to those which were obtained in studies previously reported. There is good agreement with three of these criteria and the discrepancy with the fourth is discussed in detail. An operational procedure for fabricating a good PCJJ is described. The four most important potential high frequency limitations of a PCJJ are discussed with

respect to the experimental results. The paper reports the use of a non-superconducting whisker plated with a superconductor.

713,966
PB-284 598/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Microscopic and Atomic Aspects of Fracture.
Final rept.,
R. Thomson. 1976, 21p
Pub. in Proceedings ASME Winter Meeting, New York, N.Y. December 5-10, 1976. Paper in The Mechanics of Fracture, AMD-19 p1-21 1976.

Keywords: *Fractures(Materials), Crack propagation, Crystal structure, Physical properties, Brittleness, Ductility.

This paper addresses some underlying ideas and issues in brittle and ductile fracture, and in the physics and chemistry of processes at a crack tip. The physical bases for ductile vs brittle fracture are explored and some new ideas regarding brittle fracture in ductile materials are presented. The lack of physical understanding for the ductile-brittle competition is emphasized. The physical consequences of cracks in lattices are discussed, and the underlying processes defining slow crack growth in materials are explored. Recent success in developing a physical basis for chemical infractions between external atmospheres and cracks in brittle materials is presented. The situation in more ductile materials is much more complex and in a more unsatisfactory state.

713,967
PB-284 603/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Sublattice Magnetization of ErFe2-H.
Final rept.,
J. J. Rhyne, S. G. Sankar, and W. E. Wallace. 1978, 6p
Pub. in Paper in Rare Earths in Modern Science and Technology, 1978 p63-68.

Keywords: *Erbium containing alloys, *Iron alloys, *Hydrides, *Magnetization, Hydrogen, Curie temperature, Phase transformations, Rare earth alloys, Crystal structure, Erbium iron hydrides.

ErFe2 has been found to absorb hydrogen readily and to exhibit a stable phase with composition near ErFeeH4. In this study the authors have examined ErFe2H3.5 which exhibits a Curie temperature of 450K significantly depressed from the 574K found for pure ErFe2. At low temperature the magnetization does not saturate even in fields as large as 120 k0e. Neutron scattering results show that at 10K the Er sublattice moment is 5.5 mu sub B which is sharply lower than the free ion value of 9 mu sub B found in pure ErFe2. The Er moment decreases rapidly as the temperature is raised and is essentially zero at 300K, well below the overall Curie temperature of 450K. The iron moment on the other hand is 1.6 mu sub B at low temperatures in agreement with that found in pure ErFe2 and remains essentially constant up to 350K before dropping rapidly to zero at the bulk Curie temperature. These results suggest a significant reduction in the Er-Er and Er-Fe exchange interactions on hydriding leading to a structure in which the rare earth is very loosely coupled.

713,968
PB-284 625/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Alkali Ion Exchange Reactions with RbAlSiO4: A New Metastable Polymorph of KAlSiO4.
Final rept.,
D. B. Minor, R. S. Roth, W. S. Brower, and C. L. McDaniel. 1978, 7p
Pub. in Mat. Res. Bull., v13 p575-581 1978.

Keywords: *Crystal structure, Ion exchange, X ray diffraction, Lattice parameters, Reprints, Potassium aluminosilicates, Rubidium aluminosilicates.

A new metastable polymorph of KAlSiO4 has been prepared by K(+) ion exchange of orthorhombic RbAlSiO4 (a = 9.215 + or - .001, b = 5.329 + or - .001, c = 8.742 + or - .001A). The new phase is pseudo-orthorhombic with a = 18.151 + or - .003, b = 10.551 + or - .002, c = 8.490 + or - .001A with apparent Cc** symmetry but may be monoclinic. This new polymorph is metastable at temperatures up to approximately 1100C where it transforms to normal 'low' orthorhombic KAlSiO4.

713,969
PB-284 629/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analysis of Layered Materials with the Ion Microprobe.
Final rept.,
K. F. J. Heinrich, R. L. Myklebust, and D. E. Newbury. 1976, 3p
Pub. in Intern. Conf. on X-Ray Optics and Microanalysis (8th), Held at Moscow, U.S.S.R. on July 7-16, 1974 p266-268 1976.

Keywords: *Microanalysis, Calibrating, Quantitative analysis, Semiconductors(Materials), Ion implantation, *Ion microprobes, Secondary ion mass spectroscopy.

The ion microprobe mass analyzer has unique capabilities for the characterization of compositional changes in depth on a microscopic scale. The technique is particularly useful for the study of elements implanted or diffused into semiconductor materials. Quantitation is achievable with calibration procedures with known standards.

713,970
PB-284 809/1 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, D.C. Electron Devices Div.
Semiconductor Technology Program - Progress Briefs.
Interim rept. Oct-Dec 77,
W. M. Bullis. Mar 78, 12p NBSIR-78-1444
Sponsored in part by National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center, Defense Advanced Research Projects Agency, Arlington, Va., Defense Nuclear Agency, Washington, D.C. and Department of Energy, Washington, D.C.

Keywords: *Semiconductors, *Research projects, Measurement, Semiconductor devices, Silicon, Integrated circuits, Microelectronics, Process control, Nondestructive tests.

The report provides information on the current status of NBS work in measurement technology for semiconductor materials, process control, and devices. Results of both in-house and contract research are covered. Highlighted activities include: analysis of x-levels in indium-doped silicon; evaluation of an electrical alignment test structure; correlations of gold density with leakage current in silicon; initial application of resonance ionization spectroscopy; calibration of second-generation line-width measurement artifacts; dopant profiling by dc measurements on MOSFETs; observation of an isotope shift in the sulfur deep level in silicon; development of a nondestructive test for second breakdown; analysis of scanning acoustic microscopy; and the third pacemaker workshop. In addition, brief descriptions of new and selected on-going projects are given. The report is not meant to be exhaustive; contacts for obtaining further information are listed. Compilations of current publications, publications in preparation, and scheduled talks are also included.

713,971
PB-285 224/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photolithographic Fabrication of Lead Alloy Josephson Junctions.
Final rept.,
R. H. Havemann, C. A. Hamilton, and R. E. Harris. Apr 78, 4p
Sponsored in part by Office of Naval Research, Arlington, Va.
Pub. in Jnl. Vac. Sci. Technol., v15 n2 p392-395, Mar/Apr 78.

Keywords: *Josephson junctions, Lead alloys, Fabrication, Photolithography, Thin films, Reprints.

Techniques for the photolithographic fabrication of thin film Josephson junctions are presented in detail, including metal liftoff processes, lead alloy composition and formation of tunneling junction barriers using plasma oxidation in an rf discharge. A comparison with earlier rf plasma oxidation studies on Pb (In) -oxide-Pb junctions shows the tunneling resistance of Pb (In,Au) -oxide-Pb (Au) junctions to be nearly two decades lower for a given oxygen pressure in the rf discharge; this difference was attributed to the use of different alloys and sputtering parameter measurement techniques in the respective studies. Typically, tunneling resistance decreased by only 2% after ten thermal cycles, but decreased at an accelerated rate with subsequent cycling Room-temperature storage often induced downward resistance changes on the order of 30% per month. Junctions stored at -15C generally showed little change after a period of three months.

713,972
PB-285 284-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Question of Copper Ion Mobility in Germanium (K Voprocy Ob Izuchenii Podvizhnosti Ionov Medi V Germanii),
A. Y. Potemkin, V. I. Potapov, and D. A. Peterov. 1976, 9p DMDC-17513, TT-76-59023
Trans. of Akademiya Nauk SSSR. Doklady, n127(6) p1256-58 1959. Sponsored in part by National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.

Keywords: *Copper, *Diffusion, *Germanium, Single crystals, Electric fields, Activation energy, Translations, USSR.

Mobility measurements (electromigration) of copper ions in single crystal n-type germanium in the temperature 500-680C are reported. An electrolytically-coated, 10 micrometer, layer of Cu was plated on the Ge samples. A direct current of 4-10 A and electric field intensity of 0.5-1.0 V/cm was used. Copper was found to migrate towards the positive electrode, and thus must have been negatively ionized.

713,973
PB-285 329/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Review of the NBS-ERDA Workshop on Materials at Low Temperatures.
Final rept.,
F. R. Fickett, and R. P. Reed. 1977, 4p
Pub. in Proc. Symp. on Engineering Problems of Fusion Research (7th), Knoxville, Tenn., Oct 25-28, 1977, p1506-1509 (Institute of Electrical and Electronics Engineers, Inc., New York, N.Y. 1977).

Keywords: *Superconducting magnets, *Materials, *Cryogenics, Meetings, Composite materials, Metals.

A workshop treating problems related to low temperature materials applications in superconducting magnet systems was held at Vail, Colorado, October 12-14, 1977. The major topics considered by the participants were: the recently completed NBS survey of low temperature materials for MFE applications and the production of an appropriate data handbook; materials choices of recent device designs; nonmetallic materials applications; high strength stainless steels for cryogenic service; thick section welding; and physical properties of magnet materials. A summary of the presentations and the ensuing discussions is given along with our assessment of the more pressing of the many low temperature materials research problems considered by the workshop participants.

713,974
PB-285 333/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Picosecond Pulses on Superconducting Striplines.
Final rept.,
R. L. Kautz. Jan 78, 7p
Contract N00014-77-F-0048
Pub. in Jnl. Appl. Phys., v49 n1 p308-314, Jan 78.

Keywords: *Superconductivity, Strip transmission lines, Pulse transmitters, Thin films, Propagation, Picoseconds, Reprints.

The attenuation and phase velocity of a superconducting thin-film stripline are calculated at high frequencies using the theory of Mattis and Bardeen. These results are used to study the propagation of picosecond pulses which have frequency components approaching the superconducting energy-gap frequency.

713,975
PB-285 342/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Definitions of Terms for Practical Superconductors. 1. Fundamental States and Flux Phenomena.
Final rept.,
R. L. Powell, and A. F. Clark. Dec 77, 6p
Pub. in Jnl. Cryogenics, v17 n12 p697-702, Dec 77.

Keywords: *Superconductors, Definitions, Critical temperature, Superconductivity, Losses, Reprints.

The definitions of terms used in describing the phenomenology and measurement practices of practical superconductive materials are proposed. The definitions cover the subject categories of: (1) fundamental states and flux phenomena, (2) critical parameters, (3) fabrication, stabilization, and transient losses, and (4) Josephson phenomena. It is intended that these terms will become the basis for the development of standard measurement practices. Responses are invited.

713,976
PB-285 343/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Heat Treatment and Impurities on the Kapitza Resistance of Copper Below 0.2 K.
Final rept.,
R. Radebaugh, and J. D. Siegwarth. 1978, 3p
Pub. in Proc. Hakone Int. Symp. on Physics at Ultralow Temperatures, Hakone, Japan, Sept. 5-9, 1977, p303-305 (Physical Society of Japan, Tokyo, Japan, 1978).

Keywords: *Copper, *Surface finishing, Cryogenics, Liquid helium, Helium 3, Helium 4, Impurities, Chromium, Beryllium, Hardening, *Kapitza resistance.

Measurements by Anderson showed that sandblasting the surface of commercial purity copper significantly reduced the Kapitza resistance to pure He3. He and others attribute this to the interaction of phonons with dislocations near the metal surface. The authors report here extensive Kapitza resistance measurements made on 99.999+% copper in He3 - He4 solutions with various surface conditions and heat treatments. The authors found an increase in Kapitza resistance as the sample was annealed at progressively higher temperatures. In addition, the authors report measurements on OFHC copper, Cu - 0.18 wt % Cr, and Cu - 1.86 wt % Be. These measurements show that impurities in these samples cause a large reduction in Kapitza resistance which dominates any effect due to hardening.

713,977
PB-285 345/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Temperature Dependence of the Elastic Constants of an NbTi/Cu Superconducting Composite.
Final rept.,
D. T. Read, and H. M. Ledbetter. Apr 78, 5p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, Va.
Pub. in Jnl. Composites, v9 n2 p100-104, Apr 78.

Keywords: *Superconductors, *Fiber composites, Elastic properties, Cryogenics, Niobium intermetallics, Titanium intermetallics, Modulus of elasticity, Temperature, Shear modulus, Copper, Copper matrix composites, Reprints.

Low-temperature elastic properties are reported for a commercial superconducting composite consisting of niobium-titanium filaments in a copper matrix. Both an ultrasonic (10 MHz) pulse-superposition technique and a composite-oscillator (100 kHz) technique were used. Seven of the composite's nine independent elastic constants were determined between 76 and 300K; Young's modulus along the filament axis and a shear modulus perpendicular to that axis were determined between 4 and 300K; all showed irregular temperature behavior.

713,978
PB-285 346/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Magnetic Excitations in HoFe2.
Final rept.,
J. J. Rhyne, and N. C. Koon. Mar 78, 3p
Pub. in Jnl. Appl. Phys., v49 n3 p2133-2135, Mar 78.

Keywords: *Iron alloys, *Holmium containing alloys, Neutron scattering, Inelastic scattering, Magnetization, Magnons, Anisotropy, Reprints, Crystal fields.

Spin wave and crystal field excitations in single crystal HoFe2 have been studied using inelastic neutron scattering. At 10 K (100) is the easy magnetic direction and at this temperature the acoustic spin wave mode exhibits a 0.60 meV gap due to anisotropy. The acoustic mode is degenerate at the zone boundary with a flat optic mode of energy 8.3 meV. The lack of dispersion in this mode is a consequence of the small (.01 meV) Ho-Ho exchange energy. A third mode is a highly dispersive optic mode which represents excitations of the iron sublattice spins and has a stiffness parameter almost identical to iron metal. A nearest neighbor linear spin wave model has been applied which represents the data of the three lowest modes well. This model predicts the remaining three allowed modes to be at energies above 200 meV. There is no measurable anisotropy in the spin wave modes with varying propagation directions. At room temperature, higher states of the Ho crystal field multiplet become populated and weaker dispersionless excitations are broadened beyond instrumental resolution because of contributions from several levels close together in energy. Crystal field calculations including exchange have been performed and are compared to the energies of the observed optic mode transitions.

713,979
PB-285 347/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Magnetic Neutron Scattering from Amorphous TmFe2.
Final rept.,
J. Rhyne, S. Pickart, and H. Alperin. Mar 78, 2p
Pub. in Jnl. Appl. Phys., v49 n3 p1691-1692, Mar 78.

Keywords: *Iron alloys, *Thulium containing alloys, Vitreous state, Magnetization, Neutron scattering, Transition temperature, Inelastic scattering, Elastic scattering, Reprints, Amorphous materials, Crystal fields.

Elastic and inelastic neutron scattering was observed from the sputtered amorphous composition TmFe2, which on the basis of magnetization measurements exhibits a transition T sub 0 45 K. Total scattering isotherms taken over a range of temperatures bracketing this value show a magnetic component similar to YF2, but not nearly as large as in TbFe2 and HoFe2. Energy scans suggest that the spin diffusion does not change greatly on going through the transition.

713,980
PB-285 401/6
(Order as PB-285 398/4, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Applied Technology.
Photovoltaic Technique for Measuring Resistivity Variations of High Resistivity Silicon Slices.
D. L. Blackburn. 13 Jan 78, 7p
Included in Jnl. of Research of the National Bureau of Standards, v83 n3 p265-272, May-Jun 78.

Keywords: *Silicon, *Electrical measurement, Electrical resistivity, Variations, Photovoltaic effect, Automation, Electric measuring instruments, Semiconductors, Wafers.

A description of an automated, photovoltaic system for measuring the resistivity variation of high resistivity, large diameter silicon wafers is given. The photovoltaic technique uses a scanning light spot to induce a bulk photovoltage and a change in resistance from which is calculated the local variation in resistivity. This nondestructive technique requires no contacts to the useful fabrication area of the wafer, and measured results have good correlation with the results of the four-probe technique. Specific examples of measured resistivity gradients are presented along with a discussion of the theory, measurement conditions and limitations, and description of a calculator-based automated system to perform the measurements.

713,981
PB-285 402/4
(Order as PB-285 398/4, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Applied Technology.
Detection of Deep Levels in High Power Semiconductor Materials and Devices.
R. Y. Koyama. 13 Jan 78, 9p
Included in Jnl. of Research of the National Bureau of Standards, v83 n3 p273-282, May-Jun 78.

Keywords: *Semiconductors(Materials), *Semiconductor devices, *Impurities, *Defects, *Quality control, Measurement, Fabrication, Tests, Thyristors, Semiconductor doping, Thermally stimulated current, Metal oxide semiconductors.

Thermally stimulated measurements (TSM) and other deep level measurement techniques are used to detect, characterize, and identify deep level defects which control lifetime and leakage in semiconductor devices. These measurements are performed on an apparatus which is capable of handling full-sized wafers as well as die-sized devices. Measurements of 'wafer maps' of the gold acceptor defect density in silicon reveal inhomogeneity in the defect distribution which is directly reflected in the leakage current distribution. The wafer handling capabilities make this apparatus a useful extension of routine fabrication-line diagnostic tools.

713,982
PB-285 403/2
(Order as PB-285 398/4, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Thermodynamics of the Glassy State. I. The Heat Capacity of One-Dimensional Disordered Harmonic Systems from Moments.
F. I. Mopsik, and C. M. Guttman. 26 Sep 76, 13p
Included in Jnl. of Research of the National Bureau of Standards, v83 n3 p283-296, May-Jun 78.

Keywords: *Vitreous state, *Specific heat, Order disorder transformations, Thermodynamics, Mathematical models, Glass, Amorphous materials.

Upper and lower bounds on the thermodynamic quantities of disordered one-dimensional systems are computed using the spectral moments of Domb et al. and a modification of a computational technique of Wheeler and Gordon. The heat capacity so produced is defined to better than 0.01 percent for all temperatures. Models for glasses in one dimension are presented. The difference in the heat capacity between glasses and crystals is seen. From models for glasses in one dimension it is argued that when the measured heat capacity of a glass exceeds that of its crystal, the glass must have regimes of higher density than that of the crystal. Various approximation schemes and bounds for the heat capacity of glasses in one and higher dimensions are also proposed.

713,983
PB-286 725/7 Not Available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effects of Stress on Practical Superconductors.
Final rept.
A. F. Clark. 1978, 7p
Pub. in Proceedings of International Conference on Magnet Technology (MT-6), held at Bratislava, Czechoslovakia, on August 29-September 2, 1977, v2, p612-618 (ALFA, Bratislava, Czechoslovakia, 1978).

Keywords: *Superconductors, Stresses, Stress analysis, Degradation, Superconducting magnets, Design, Electric wire, Critical current.

The effects of stresses and the resultant strains on practical superconductors is reviewed with respect to magnet design. The mechanical and electrical behavior of superconductors subject to both static and dynamic stresses is discussed. Emphasis is on the mechanical properties of superconducting wires, the degradation of critical current in wires under stress, and their correlation with superconducting coil composite behavior.

713,984
PB-286 784/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Solid-State and Atomic Features in the Valence-Band Auger Spectra of Copper, Silver, and Gold.
Final rept.,
C. J. Powell. 1978, 6p
Pub. in Solid State Communications, v26, no. 9, p557-562 (1978).

Keywords: *Copper, *Silver, *Gold, *Energy levels, Excitation, Band structure of solids, Valence bands, Reprints, Auger electron spectroscopy, Density of states.

High-resolution measurements of the L3VV, M45VV, and N67VV Auger spectra are reported for copper, silver, and gold, respectively. Qualitative trends in the spectra and experimentally determined values of U(eff)/2W (U(eff) is the effective energy required to excite two holes on the same atom; W is the d-electron bandwidth) are shown to be consistent with recent predictions by Sawatzky and Cini concerning the relative importance of atomiclike and bandlike features in Auger spectra.

713,985
PB-286 957/6 PC **A07**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Center for Materials Science.

Applications of Space Flight in Materials Science and Technology.
Special pub.
S. Silverman, and E. Passaglia. Sep 78, 132p NBS-SP-520
Proceedings of a Conference Held at the National Bureau of Standards, Gaithersburg, Maryland on Apr 20-21, 1977. Library of Congress Catalog Card no. 78-600074.

Keywords: *Materials, *Weightlessness, Crystal growth, Fluid flow, Metals, Melting, Solidification, Lead alloys, Antimony alloys, Ceramics, Glass, Thermodynamics, Purification, Transport properties, Combustion, Research management, Scientific satellites, Beryllium, Semiconductors, Critical point, Convection, *Space processing, Low gravity manufacturing, Reduced gravity, Skylab, Biomaterials.

This conference was held to review the materials science experiments carried out in space, and to assess the possible future applications of space in materials science and technology with the advent of the space shuttle. Experiments carried out on Skylab, the Apollo-Soyuz Test Project, and recent sounding rocket experiments were reviewed. Specific discussions were directed at possible future applications in metals and alloys, ceramics, semiconductor materials, biological materials, crystal growth, transport properties, critical phenomena, thermodynamic data, containerless processing, combustion, and convection effects.

713,986
PB-287 013/7 PC **A06**/MF **A01**
General Electric Co., Schenectady, NY. Superconductive Materials Data Center.
Properties of Selected Superconductive Materials, 1978 Supplement.
Technical note.
B. W. Roberts. Oct 78, 103p NBS-TN-983
Supersedes Rept. no. NBS-TN-825, COM-74-50460.

Keywords: *Superconductors, Physical properties, Tables(Data), Bibliographies, Chemical composition, Critical temperature, Critical field, Magnetic fields, Crystal structure, Organic compounds, Pressure, Cryogenics, Superconducting films.

This report includes data on additional superconductive materials extracted from the world literature up to fall 1977 and is an addendum to the data set published in J. Phys. Chem. Ref. Data 5, no. 3, 581-821 (1976) (Reprint no. 84). The data presented are new values and have not been selected or compared to values (except for selected values of the elements) previously assembled by the Superconductive Materials Data Center. The properties included are composition, critical temperature, critical magnetic field, crystal structure and the results of negative experiments. Special tabulations of high magnetic field materials with Type II behavior and materials with organic components are included. All entries are keyed to the literature. A list of recent reviews centered on superconductive materials is included.

713,987
PB-287 182/0 PC **A10**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.
Standard X-Ray Diffraction Powder Patterns, Section 15 - Data for 112 Substances.
M. C. Morris, H. F. McMurdie, E. H. Evans, B. Paretzkin, J. H. de Groot, B. S. Weeks, R. J. Newberry, C. R. Hubbard, and S. J. Carmel. Oct 78, 208p NBS-MONO-25-SECT-15
Errata sheet inserted. See also report dated Sep 77, PB-272 372. Sponsored in part by Joint Committee on Powder Diffraction Standards, Swarthmore, PA. Library of Congress Catalog Card no. 53-61386.

Keywords: *Crystal structure, *X ray diffraction, Standards, Lattice parameters, Refractivity, Inorganic compounds, Intermetallic compounds, Alloys, Tables(Data), *Powder patterns.

Standard x-ray diffraction patterns are presented for 112 substances. Fifty-four of these patterns represent experimental data and 58 are calculated. The experimental x-ray powder diffraction patterns were obtained with an x-ray diffractometer. All d-values were assigned Miller indices determined by comparison with computed interplanar spacings consistent with space group extinctions. The densities and lattice constants were calculated and the refractive indices were measured whenever possible. The calculated x-ray powder diffraction patterns were computed from published crystal structure data. Both peak height and integrated intensities are reported for the calculated patterns.

713,988
PB-288 763/6 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Theory and Application of a Two-Layer Hall Technique.
Final rept. 3 Apr 78-30 Sep 78.
R. D. Larrabee, and W. R. Thurber. Oct 78, 29p NBSIR-78-1553
Sponsored in part by Army Night Vision Lab., Fort Belvoir. VA.

Keywords: *Silicon, *Electrical measurement, Hall effect, Electrical resistivity, Epitaxy, Semiconductor doping, Indium, Semiconductor junctions, Substrates, Epitaxial growth, P type semiconductors, N type semiconductors.

The electrical characterization of epitaxial layers of silicon on substrates of the opposite conductivity type presents serious problems if the p-n junction at the interface has significant leakage current such that it cannot be used to effectively isolate the two regions. In order to meet the need for nondestructively characterizing such structures, a modification of the conventional Hall technique was developed in which the Hall measurements are made simultaneously on both the epitaxial layer and its substrate; the interface impedance is measured; and the interaction between the two regions is modeled and taken into account. This technique can be used not only to measure the unperturbed resistivity and Hall coefficient of each layer separately, but also to verify those cases in which the perturbing effects of a high resistivity substrate are negligible, thus justifying conventional measurements on the epitaxial layer. This technique was used to measure the parameters of an n-type indium-doped silicon epitaxial layer on a bulk-grown p-type indium-doped substrate. The results suggest that the major n-type dopant in this specimen has a density of about 1 x 10 to the 17th power/cc and an apparent activation energy of about 45 meV. Similar data were obtained on a second epitaxial layer grown on a high resistivity undoped substrate. These results argue strongly for the presence of one or more undesired sources of shallow donor contamination in the epitaxial growth system used to produce these specimens.

713,989
PB-289 004/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ammonium Azide.
Final rept.,
E. Prince, and C. S. Choi. 1978, 3p
Pub. in Acta. Cryst. B34 p2606-2608 1978.

Keywords: *Crystal structure, Ammonium compounds, Inorganic azides, Neutron diffraction, *Ammonium azide, Reprints.

NH4N3, orthorhombic, (Pmna) bar, Z = 4, a bar = 8.948(3) A, b bar = 3.808(2) A, c bar = 8.659(3) A, D sub C = 1.352 and D sub m = 1.352 gm/cc. Final R was 0.054 for 233 observed neutron reflections and a constrained model in which two independent azide groups were treated as rigid bodies. The corrected N-N distance is 1.186(4) A in both azide groups. There are two strong N-H...N hydrogen bonds, with N-N distances of 2.975(4) A and 2.967(3) A.

713,990
PB-289 029/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
'X'-Levels in Indium-Doped Silicon.
Final rept.
R. D. Larrabee. Aug 78, 9p
ARPA Order-2397
Pub. in Proceedings Joint Meeting IRIS Speciality Groups on Infrared Detectors and Imaging, Held at Annapolis, MD. on Jun 13-15, 1978, p253-261 (Infrared Information and Analysis Center, Arlington, VA. Aug 78).

Keywords: *Silicon, *Energy levels, Acceptor materials, Indium, Infrared detectors, Electrical measurement, Optical measurement, Hall effect, Semiconductor doping, Semiconductors(Materials).

Evidence for the existence of a new acceptor level in indium-doped silicon was reported at last year's IRIS Detector Specialty Meeting and subsequently reported in the literature. Since the apparent activation energy of this level does not correspond to any known elemental dopant or dopant complex, its nature is somewhat obscure; thus, it has been called the 'X'-level. One of the major applications of indium-doped silicon is for monolithic infrared imaging arrays, and such arrays can be seriously degraded by the presence of 'X'-levels. Therefore, a project was initiated to independently reproduce the evidence for 'X'-levels, to re-examine that evidence, and to determine if this evidence necessarily implies the existence of a new acceptor level or represents some artifact of the measurement or analysis techniques used. A donor addition experiment was performed with Hall and detector samples of indium-doped silicon that clearly demonstrated the validity of the 'X'-level interpretation of the original Hall data. These results show that, in spite of the assumptions inherent in the analysis of Hall data, this technique forms the basis of a definitive method for measuring 'X'-level concentrations in silicon heavily doped with indium.

713,991
PB-289 134/9 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Semiconductor Measurement Technology: Angular Sensitivity of Controlled Implanted Doping Profiles.
Final rept.
R. G. Wilson, H. L. Dunlap, D. M. Jamba, and D. R. Myers. Nov 78, 64p NBS-SP-400-49
ARPA Order-2397
Library of Congress Catalog Card no. 78-10624. Prepared in cooperation with Hughes Research Labs., Malibu, CA.

Keywords: *Semiconductor doping, Ion beams, Control, Angle of incidence, Crystal structure, Orientation, Profiles, Carrier density, Scanning, Silicon, *Ion implantation.

Ion implantation can be used to produce accurately controlled doping profiles for silicon devices and integrated circuits. The work reported here determines the angle at which the ion beam must strike the substrate in order to maintain control over the channeled and random equivalent depth distributions of carriers as measured by 1-MHz differential capacitance-voltage (C-V) profiling. A method to calculate the classical critical angle for channeling is presented. Data are presented that characterize the variation in the depth distribution of carriers with substrate orientation, incident ion species, and incident ion energy, for a range of critical angles. This study establishes the degree of control of the angle between the ion beam and the crystallographic orientation needed to produce the limiting cases of either optimal channeling or maximum randomization of ion trajectory in the substrate.

713,992
PB-289 136/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Multiple Magnetic Flux Entry into SQUIDS: A General Way of Examining the Cos(phi) Conductance.
Final rept.,
R. L. Peterson, and R. I. Gayley. 1 Aug 78, 9p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Phys. Rev. B 18, n3 p1198-1206, 1 Aug 78.

Keywords: *Josephson junctions, *Superconductivity, Flux(Rate), SQUID devices.

A new type of experiment is proposed for obtaining information about the cos phi conductance of the Josephson effect. Based on measurement of fluxoid entry into a superconducting ring broken by a Josephson junction, the technique is to operate in the low-damping regime for which the voltage excursions associated with fluxoid entry are small, thus validating the constant-voltage expression containing the cos phi conductance. It is shown that the erraticity associated with the low-damping regime has a predictable statistical pattern, which is rather insensitive to noise but quite sensitive to the cos phi term. A shunt resistance can be used to vary the average voltage. Statistics can be accumulated over a number of similar loops, or by very small variation of bath temperature. Thus, the technique would appear to be capable of estimating the controversial coefficient of the cos phi term as a function of voltage and temperature, and for any type of junction for which low damping can be achieved.

713,993
PB-289 141/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Theory of the Pressure Dependence of a Prototype Exchange Integral.
Final rept.,
R. G. Munro. 15 Jun 78, 6p
Sponsored in part by National Research Council, Washington, DC.
Pub. in Phys. Rev., vB17 n12 p4660-4665, 15 Jun 78.

Keywords: Solids, Hydrostatic pressure, Crystals, Ruby, Chromium, *Exchange interactions, Exchange integrals, Magnetic susceptibility, Reprints.

The variation of electron exchange integrals in solids subjected to hydrostatic pressures P is considered by examining a prototype exchange integral J. The quantity (1/J)(dJ/dP) is determined within the context of a theory of solids under hydrostatic pressures in which the application of pressure is represented in terms of the crystal compressibility and two parameters which are associated with electronic screening and wavefunction-distortion effects. Pressure variations of magnetic-phase boundaries, exchange-enhanced susceptibilities, and exchange interactions of pairs of Cr(+3) ions in ruby are considered as examples of the applications of the results.

713,994
PB-289 566-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Deformation Properties of Some Semiconductors (Tensometricheskie Svoistva Nekotorykh Poluprovodnikov).
A. N. Arsen'eva-Geil. 1976, 11p DMDC-17361, TT-76-59200
Trans. of Zhurnal Tekhnicheskoi Fiziki (USSR) v17 n8 p903-906 1947. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Semiconductors(Materials), Electrical properties, Copper inorganic compounds, Cadmium inorganic compounds, Cobalt inorganic compounds, Tin inorganic compounds, Bismuth inorganic compounds, Copper oxides, Lead sulfides, Selenides, Tungsten oxides, Tin tellurides, Tellurides, Inorganic sulfides, Oxides, Strains, Electrical resistivity, Conductivity, Translations, USSR, Cuprous oxide, Copper sulfides, Cadmium oxides, Tin selenides, Bismuth selenides, Cobalt tellurides.

Electrical properties of Cu2O, CdS, CuO, Se, Cu2S, SnTe, CdO, WO2, CoTe, CuS, Bi2Se3, SnSe, and PbS were measured while under compressive load or in extension. The change in resistivity as a function of load is plotted in graphs.

713,995
PB-290 015/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron Powder Diffraction Study of Titanium Copper Deuteride, TiCuD0.90.
Final rept.,
A. Santoro, A. Maeland, and J. J. Rush. 1978, 4p
Pub. in Acta Cryst., vB34 p3059-3062, 1978.

Keywords: Neutron diffraction, Crystal structure, Deuterium compounds, Titanium inorganic compounds, Copper inorganic compounds, Chemical bonds, *Copper titanium hydrides, Reprints.

TiCuD(0.90), tetragonal, P4/nmm, a = 3.020(1), c = 6.837(3) A (parameters determined by X-ray powder diffraction), Z = 2. The structure has been refined by the method of total profile analysis of a neutron diffraction powder pattern. The D atoms are located at the center of distorted tetrahedra of Ti atoms, with a Ti-D distance of 1.927(4) A.

713,996
PB-290 081/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Magnetic Relaxation Phenomena in Dy-Sc Alloys.
Final rept.,
R. Abbundi, J. J. Rhyne, D. M. Sweger, and R. Segnan. 1 Oct 78, 5p
Pub. in Physical Review, B. Solid State 7, p3313-3317, 1 Oct 78.

Keywords: Scandium alloys, Dysprosium containing alloys, Hyperfine structure, Mossbauer effect, Neutron scattering, Cryogenics, *Magnetic ordering, Reprints.

Neutron-scattering and magnetization experiments on R(x)Sc(1-x) (R = Gd, Tb, Ho, and Er) alloys have given anomalous results for the concentration dependence of the magnetic-ordering temperature. In contrast to conventional theoretical arguments and to data on other rare-earth alloys, these systems require large rare-earth concentrations (15% = or < X = or < 39%) for the onset of long-range magnetic order to occur. The work which is reported here deals with the investigation of the Dy(x)Sc(1-x) system in the concentration range 0.02 = or < X = or < 0.75. The Mossbauer effect was used to examine the magnetic hyperfine interaction at the (161)Dy nuclei both as a function of temperature and concentration. Neutron scattering on the samples containing <35-at.% Dy indicated no long-range magnetic order at T = 4.2 K. However, each of the alloys investigated, including the 2-at.% Dy alloy which was the lowest concentration measured, exhibits a well-defined magnetic hyperfine splitting at this temperature.

713,997
PB-290 087/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystal Subgrain Misorientations via X-Ray Diffraction Microscopy.
Final rept.,
R. W. Armstrong, C. C. Wu, and E. N. Farabaugh. 1977, 6p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Advances in X-Ray Analysis 20, p201-206 1977.

Keywords: *Grain structure, *X ray diffraction, Crystal structure, Orientation, Zinc, Aluminum oxide, Misalignment, Reprints.

The 'misorientation contrast,' which occurs at boundaries marking the relative displacement of adjacent subgrain reflections in x-ray diffraction images, is shown by a stereographic projection method of analysis to be useful for deciphering x-ray images obtained by the Berg-Barrett and Lang techniques. Experimental results are given for subgrain structures observed in Zn and Al2O3 crystals.

713,998
PB-291 711/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Small-Angle Neutron Scattering from Rare-Earth Iron Alloys.
Final rept.,
H. A. Alperin, S. J. Pickart, and J. J. Rhyne. 1978, 2p
Sponsored in part by Naval Surface Weapons Center, White Oak Lab., Silver Spring, MD., and National Science Foundation, Washington, DC.
Pub. in Jnl. of Applied Crystallography 11, p648-649 1978.

Keywords: *Rare earth alloys, Iron containing alloys, Neutron scattering, Magnetic properties, *Magnetic ordering, Amorphous materials, Reprints.

Small angle neutron scattering (SANS) has been used to investigate the onset of magnetic order and some aspects of the magnetic microstructure in a series of bulk amorphous rare-earth iron alloys prepared by dc rapid sputtering.

713,999
PB-291 715/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microscopic Theory for Domain Wall Motion and Its Experimental Verification in FeAl Alloy Domain Growth Kinetics.
Final rept.,
J. W. Cahn, and S. M. Allen. Dec 77, 4p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. de Physique (Paris), Colloque, Ch7, 38, n12 p51-54, Dec 77.

Keywords: *Domain walls, Iron alloys, Aluminum alloys, Free energy, Critical temperature, Reprints.

A microscopic theory for curved antiphase domain wall motion in ordered structures leads to a prediction that velocity is proportional to mean curvature. Unlike previous models, the velocity is not proportional to domain wall free energy. Experimental results on domain growth in ordered FeAl alloys over a range of temperatures, times and compositions, are consistent with the theory. In the vicinity of the critical temperature where domain wall free energy tends to zero, domain growth is not slowed.

714,000
PB-291 721/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Factors in the Occurrence of Sigma and Structurally Related Transition Metal Alloy Phases.
Final rept.,
R. E. Watson, and L. H. Bennett. 1978, 6p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Scr. Metall., v12 p1165-1170, 1978.

Keywords: *Sigma phase, Intermediate phases, Transition metals, Alloys, Embrittlement, Electrons, *Transition element alloys, *Electron factors, Reprints.

The sigma phase, a complex structure occurring in many transition metal systems, is of considerable practical and theoretical interest. Its presence can cause a normally ductile high performance steel or superalloy to embrittle and fail in service. There are a number of structurally related phases, some of which have properties which are of interest for other reasons. The stability of the sigma phase has generally been discussed in terms of electron and size factors. This note concentrates on the role of electron factors, and uses a pair of electronic coordinates for a structural map of these alloy systems.

714,001
PB-291 972/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystal Structure Study of a New Compound Li5B4.
Final rept.,
F. E. Wang, M. A. Mitchell, R. A. Sutula, J. R. Holden, and L. H. Bennett. 1978, 15p
Pub. in Jnl. of the Less-Common Metals, v61 p237-251, 1978.

Keywords: *Crystal structure, Lithium inorganic compounds, Borides, X ray diffraction, Neutron diffraction, Nuclear magnetic resonance, Electron transfer, *Lithium borides, Reprints.

A study has been made of the crystal structure of Li5B4 by x-ray, neutron powder diffraction techniques, and NMR (nuclear magnetic resonance) measurements. The crystal structure thus determined is rhombohedral (R3) in its short-range ordered state and bcc(123) in its statistically disordered (long-range) state. The boron atomic arrangement consists of a coplanar triangular cluster of four boron atoms which are situated at the vertices and the center of the triangle. This boron atomic arrangement has no precedent either in metal-borides or boron-hydrides. There is a strong indication that: (1) electrons on the boron atoms at the vertices are partially transferred (approx. 1.3 electrons) to the boron atom at the center of the triangle in Li5B4, (2) the amount of electron transfer increases with temperature rise. Lithium atoms, on the other hand, cluster in a bitetrahedral form (two tetrahedrons sharing a common face) with five lithium atoms occupying the vertices. This lithium atomic arrangement is in part similar to the hexagonal structure of lithium at low temperature.

714,002
PB-292 366/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Low Temperature Specific Heat of Two Stainless Steels.
Final rept.,
J. C. Ho, G. B. King, and F. R. Fickett. May 78, 3p
Sponsored in part by Department of Energy, Washington, DC. Div. of Magnetic Fusion Energy.
Pub. in Cryogenics 18, n5, p296-298, May 78.

Keywords: *Stainless steels, *Specific heat, Cryogenics, Steel 304, Steel 304L, Reprints.

Specific heat values between 2 and 20 K are reported for the two stainless steels AISI 304 and AISI 304L. Measurements were made by standard adiabatic calorimetry. The results suggest that the thermal properties are roughly comparable to AISI 310S, but the absence of magnetic clusters implies that they are more appropriate for low temperature work.

714,003
PB-292 369/6 Not available NTIS
National Bureau of Standards, Washington, DC.
ESCA Studies of the Clean Si(111) Surface.
Final rept.,
N. E. Erickson. 1977, 4p
Pub. in Physica Scripta 16, p462-465 1977.

Keywords: *Silicon, *Electron scattering, Valence bands, Elastic scattering, X rays, Angular distribution, Impurities, Gold, Nickel, Surface defects, Crystal structure, Binding energy, Electron Spectroscopy for Chemical Analysis, Reprints.

The angular variation of elastically scattered electrons excited by X-rays from various electron levels of silicon and surface or near surface impurity atoms of nickel and gold are reported. The valence band profile of the Si(111) surface is presented as a function of electron take-off angle. Evidence is presented that the Si(2p) binding energy is dependent on the crystal surface geometrical ordering. A discussion of some of the implications of these studies is presented.

714,004
PB-292 806/7 PC **A04**/MF **A01**
Texas Instruments, Inc., Dallas.
Techniques for the Preparation and Analysis of Standard Silicon Semiconductor Specimens for the Ion Microprobe Mass Analyzer.
Final rept.
G. Larrabee, and R. Dobrott. Jan 79, 62p TI-08-77-49, NBS/GCR-79/158
Contracts NBS-5-35917, ARPA Order-2397
Sponsored in part by Advanced Research Projects Agency, Arlington, VA.

Keywords: *Microanalysis, Calibrating, Semiconductor doping, Silicon, Silicon dioxide, Ion microprobe mass analyzers, Ion implantation.

A technique was developed to prepare sodium-, phosphorus-, arsenic-, antimony-, and gold-doped silicon and silicon dioxide reference specimens using ion-implantation techniques. The implants were done in small islands or microdots of various sizes to simulate geometries encountered in semiconductor integrated circuits. The number of dopant atoms per unit area was determined by neutron activation analysis. The reference specimens were applied to methods development and calibration of the ion microprobe mass analyzer (IMMA). IMMA detection limits were experimentally determined. A model for experimentally determining the parameters governing detection limits was developed.

714,005
PB-293 293/7 PC **A07**/MF **A01**
National Engineering Lab. (NBS), Washington, DC.
Semiconductor Measurement Technology: DISTRIB I, An Impurity Redistribution Computer Program.
Final rept. Jul 73-Dec 75.
D. Gilsinn, and R. Kraft. Feb 79, 132p NBS-SP-400-57
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA. Library of Congress catalog card no. 79-600002.

Keywords: *Silicon, *Impurities, Oxidation, Semiconductors(Materials), Mathematical models, Flow charts, Computer programs, Fortran, DISTRIB 1 computer program.

This report provides documentation of a computer program which calculates the redistribution of impurities in silicon during a single oxidation step. The documentation provides: (1) a physical and mathematical description of the redistribution process, (2) a detailed description of the discretization of the appropriate partial differential equations, and, (3) a complete description of the Fortran program for computing the solution.

714,006
PB-293 298/6 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Semiconductor Measurement Technology: A Wafer Chuck for Use Between -196 and 350 C.
Interim rept.
R. Y. Koyama, and M. G. Buehler. Jan 79, 26p NBS-SP-400/55
ARPA Order-2397
Library of Congress catalog card no. 78-600155. Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Chucks, *Wafers, Silicon, Semiconductor devices, Defects, Temperature measurement, Semiconductors, Band structure of solids.

This report describes the design and characterization of a variable-temperature wafer apparatus for use in the detection of electrically active defects which produce deep levels in the band gap of silicon. In its present form, the wafer chuck can heat and cool wafers as large as 51 mm in diameter over the temperature range from -196 to 350C; heating rates as high as 7 degrees C/s have been achieved. The uniformity of the temperature across the chuck under static conditions is estimated to be better than + or - 4C. Construction details of the chuck are given in an appendix. The use of this apparatus is illustrated by wafer mapping the gold defect density in diodes fabricated across a silicon wafer.

714,007
PB-293 556/7 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Development of Hydrogen and Hydroxyl Contamination in Thin Silicon Dioxide Thermal Films.
Final rept.
S. Mayo, and W. H. Evans. Mar 79, 29p NBSIR-78-1558
Sponsored in part by Defense Nuclear Agency, Washington, DC.

Keywords: *Silicon dioxide, Thin films, Hydrogen, Contamination, Oxidation, Hydroxyl ions.

Hydrogen and hydroxyl incorporation into thin silicon dioxide films thermally grown on silicon in dry oxygen atmospheres contained in resistance-heated fused silica or polycrystalline silicon tubes is analyzed. The mechanisms leading to incorporation of these impurities in the film are discussed in terms of trace water and hydrocarbon contamination in the oxygen used, room ambient humidity permeation through the fused silica tube, the silicon wafer preparation prior to oxidation, and other environment factors. The most significant reactions occurring the water-silica-silicon system during wafer oxidation at temperatures in the range from 800C to 1200C are discussed. It is shown that, during the oxidation period required to grow a 100-nm thick silicon dioxide film on a <100> silicon wafer in nominally dry oxygen containing water contamination in the ppm range, the introduction of hydrogen and hydroxyl contamination into the oxide film can be explained in terms of the water-silica interaction. The use of polycrystalline silicon oxidation tubes is discussed with reference to the inherent water gettering action of silicon at oxidation temperatures.

714,008
PB-294 158/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Energy Levels and the Defect Signature of Sulfur-Implanted Silicon by Thermally Stimulated Measurements.
Final rept.,
R. Y. Koyama, W. E. Phillips, D. R. Myers, Y. M. Liu, and H. B. Dietrich. Jul 78, 3p
ARPA Order-2397
Sponsored in part by Energy Research and Development Administration, Washington, DC.
Pub. in Solid-State Electronics. An International Journal. 21, n7, p953-955, Jul 78.

Keywords: *Silicon, *Energy levels, Semiconductor doping, Sulfur, Energy gap, Band structure of solids, Reprints.

Two energy levels of sulfur in the upper half of the energy gap of silicon were obtained by isothermal transient capacitance and thermally stimulated current measurements on samples prepared by sulfur implantation and high-temperature annealing. The measured energy levels are in good agreement with two levels for sulfur introduced by a closed-tube diffusion but disagree with one of two levels measured for implanted sulfur after low-temperature annealing.

714,009
PB-294 245/6 PC **A04**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Center for Absolute Physical Quantities.
Standard Reference Materials: SRM 768: Temperature Reference Standard for Use Below 0.5 K.
R. J. Soulen, and R. B. Dove. Apr 79, 52p NBS-SP-260-62
See also rept. dated Dec 78, PB-289 899. Library of Congress catalog card no. 79-600014.

Keywords: *Standards, *Temperature measurement, *Cryogenics, Transition temperature, Superconductivity, Reference standards.

Cryogenic temperature scales are now available (viz., the newly created EPT-76) which are quite accurate and which extend deep into the cryogenic region (as low as 0.5 K). It is the region below 0.5 K where no formal scale exists which is of concern here. By developing a compact device which provides five reference temperatures from 0.015 K to 0.21 K, the authors hope to provide a lingua franca by which experimental results of different laboratories involving the parameter temperature may be meaningfully compared. Such a device, designated SRM 768, is now available and consists of a self-contained assembly of coils and five samples which can be used to provide in situ temperature calibration. Simple room temperature electronics readily permit the observation of the five narrow and highly reproducible superconducting phase transitions. These phase transitions have been assigned temperature values by means of fundamental thermometers used at the National Bureau of Standards. Provided that care is exercised in reducing the magnetic field acting upon the device, the user can confidently expect to achieve a temperature reproducibility and traceability to the NBS temperature scale of plus or minus 0.3 mK.

714,010
PB-295 141/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystal Structure of a Struvite Analogue, MgKPO(4).6H(2)O.
Final rept.,
M. Mathew, and L. W. Schroeder. 1978, 3p
Grant PHS-DE-00572
Pub. in Acta Crystallographica, Section B. Structural Crystallography and Crystal Chemistry 35, p11-13 1979.

Keywords: *Magnesium oxides, *Potassium oxides, *Phosphorus oxides, *Crystal structure, Orthorhombic lattices, Struvite, Reprints.

The struvite analogue, MgKPO(4)6H(2)O, crystallizes in the orthorhombic space group Pmn2(1) with Z=2. The cell of a=6.873(2), b=6.160(2) and c=11.087(3) A, obtained in this study by a least-squares fit of thirty + or - 2 theta values, is in good agreement with that reported on JCPDS powder diffraction file card 20-685. Our structure determination shows that MgKPO(4).6H(2)O is isostructural with struvite, MgNH(4)PO(4).6H(2)O, and that the substitution of NH(4) sup(+) by the smaller K sup(+) produces only minor structural changes. The K sup(+) ion is loosely coordinated to four water molec ules at the base and more tightly to a PO(4) oxygen at the apex of a tetragonal pyramid. The packing of the Mg sup(2+), K sup(+) and PO sup(3-) sub 4 ions occurs in planes approximately parallel to the (101) and (011) planes, which provides a structural basis for the observation that crystals grown in aqueous solutions occur as irregular tetrahedra bounded by the (101), (101), (011) and (011) planes.

714,011
PB-296 122/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Examination of Five Preferred Orientation Functions.
Final rept.,
W. S. Horton. 1979, 3p
Pub. in Carbon 17, p153-155 1979.

Keywords: *Graphite, *Orientation, Functions(Mathematics), Least squares method, Pyrolitic graphite, X ray analysis, Bragg function, Bacon function, Ergun function, Lorentz function, Ruland function, Nonlinear problems, Reprints.

Five functions for describing the preferred orientation of graphite-like materials were examined. Their relative behavior for various degrees of orientation were compared, particularly with respect to the ease of discriminating among them experimentally. The results obtained when data were fitted by a non-linear least squares method were used for a practical comparison. It was found that a constant term is required to allow for base line effects and some unoriented material. For careful evaluation of functions it is necessary to assume that the angle for maximum X-ray reflection intensity was set with some error. Among the five functions compared, the Bragg function fitted the comparison data best. However, if zero slope is required 90 degrees away from the reference axis, this function is ineligible. In that case the Bacon and Ergun functions were equally good. Systematic trends in some of the data were related to sample preparation. The standard deviation for measuring the orientation parameter by fitting a function in this manner was from 0.4 to 3%.

714,012
PB-296 166/2 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Detection of Phosphorus in Epitaxial Silicon by EPR (Electron Paramagnetic Resonance).
T. T. Chang. May 79, 17p NBSIR-79-1748

Keywords: *Phosphorus, *Semiconductor doping, *Electron paramagnetic resonance, Microanalysis, Silicon, Semiconductors(Materials), Impurities, Concentration(Composition), Epitaxy.

Electron paramagnetic resonance (EPR) spectroscopy has been used to identify phosphorus in an epitaxial layer of silicon. The concentration of phosphorus atoms was estimated using a ruby standard sample (NBS SRM 2601) to establish a calibration for the spectrometer. The concentration obtained with EPR is in satisfactory agreement with the concentration obtained from Hall-effect data on the same specimen.

714,013
PB-296 265/2 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Electron Devices Div.
Semiconductor Measurement Technology: Spreading Resistance Analysis for Silicon Layers with Nonuniform Resistivity.
Final rept. 1 Oct 75-30 Sep 76.
D. H. Dickey, and J. R. Ehrstein. May 79, 75p NBS-SP-400/48
ARPA Order-2397
Prepared in cooperation with Solecon Labs., Costa Mesa, CA.

Keywords: *Semiconductor doping, *Electrical resistivity, Electrical resistance, Electrical measurement, Silicon, Semiconductor devices, Accuracy, Algorithms, Computer programs, Mathematical models, Microcomputers, Impurity profiles(Semiconductors), Spreading resistance, Electrical resistance, Electrical resistivity method, Electrical resistivity probes, One dimensional calculations, Two dimensional calculations, HP-9830A programmable calculators.

A simple mathematical algorithm is developed for the calculation of resistivity depth profiles from spreading resistance measurements on sectioned silicon device structures. It is applicable to structures consisting of one or more layers of the same or differing conductivity types. The algorithm accounts for modification of the sampling volume of the spreading resistance probes arising from nearby variations, in depth, of specimen resistivity whether resulting from graded dopant distribution or electrical boundaries, either insulating or conducting. Compared with the traditional spreading resistance analysis algorithm, the present work offers greatly reduced execution times even with a microcomputer, making real time analysis for process control possible. An experiment to test the accuracy of one of the limiting models used is described. In addition, computer experiments are used for simple layer models to compare results based on this algorithm with results from the Schumann-Gardner approach.

714,014
PB-296 267/8 PC **A07**/MF **A01**
National Measurement Lab. (NBS), Washington, DC.
NBS Reactor: Summary of Activities July 1977 to June 1978.
Technical note 1 Jul 77-30 Jun 78.
F. J. Shorten. May 79, 149p NBS-TN-995
See also report dated Apr 78, PB-279 538.

Keywords: *Neutron beams, *Research projects, Nuclear research and test reactors, Neutron irradiation, Neutron activation analysis, Materials tests, Isotopes, Radiation effects, Neutron radiography, Nondestructive tests, Isotope production.

This report summarizes all those programs which depend on the NBS reactor. It covers the period from July 1977 through June 1978. The programs range from the use of neutron beams to study the structure and dynamics of materials through nuclear physics and neutron standards to sample irradiations for activation analysis, isotope production, radiation effects studies, neutron radiography, and nondestructive evaluations.

714,015
PB-296 922/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Two Practical Magnetic Thermometers for Use Below 30K.
Final rept.,
B. W. Mangum, and W. J. Bowers. Aug 78, 2p
Pub. in Proceedings Int. Conf. on Low Temperature Physics (15th), Held at Grenoble, France on 23-29 Aug 78, Jnl. Phys., v6 sup8 n39 pC6/1175-C6/1176, Aug 78.

Keywords: *Temperature measuring instruments, Cryogenics, Magnetic permeability, Magnetic measurement, Temperature measurement, Gadolinium compounds, Phosphorus inorganic compounds, Neodymium compounds, Organic sulfates, *Cryogenic thermometers, Neodymium ethylsulfates, Gadolinium phosphates, Ultralow temperature, Very low temperature, Magnetic thermometers.

The authors have measured the magnetic susceptibility of Gd(PO3)3 (GP) and of Nd(C2H5SO4)3.9H2O (NES) over the range 2 to 27 K and found these salts to be good magnetic thermometers, although NES is less suitable for accurate work over this entire range. By fitting the magnetic data to recently calculated temperatures (T(ac)) determined acoustically by Plumb and Catalan, a magnetic temperature scale is developed and it is compared to other scales.

714,016
PB-296 932/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Superconducting Properties of Iridium Thin Films.
Final rept.,
L. B. Holdeman, R. J. Soulen, T. F. Finnegan, and P. N. Peters. Aug 78, 2p
Pub. in Jnl. Phys. Colloq., vC6 sup8 pt39 pC6/608-C6/609, Aug 78.

Keywords: *Iridium, *Superconductivity, Superconductors, Thin films, Tunnel diodes, Junction diodes, Aluminum, Aluminum oxide, Energy gap, Reprints.

Superconducting thin films of iridium were prepared, from which Dayem-type microbridges and Al-Al2O3-Ir tunnel junctions were fabricated that have I-V characteristics typical of these types of Josephson devices. Using the Al-Al2O3-Ir tunnel junctions, the authors have measured the temperature dependence of the superconducting energy gap of thin-film iridium.

714,017
PB-296 937/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Superconductive Device to Provide Reference Temperatures Below 0.5K.
Final rept.
R. J. Soulen. Aug 78, 3p
Pub. in Proceedings Int. Conf. on Low Temperature Physics (15th), Held at Grenoble, France on 23-29 Aug 1978, Jnl. Phys., v6 sup8 n39 pC6/1166-C6/1168, Aug 1978.

Keywords: *Superconductivity, Cryogenics, Standards, Tungsten, Beryllium, Iridium, Aluminum alloys, Gold alloys, Indium alloys, Intermetallics, Superconductors, Temperature, measurement, *Temperature scales, Ultralow temperature, Aluminum intermetallics, Gold intermetallics, Indium intermetallics.

A device was developed which contains five superconductive materials--W, Be, Ir, AuAl2 and AuIn2, which provides reference temperatures at 0.015 K, 0.024 K, 0.0975 K, 0.159 K, and 0.204 K, respectively. The reproducibility of three devices each containing these five superconductors was found to vary from 0.1 to 0.4 mK, except for Be where it was 1 mK.

714,018
PB-297 193/5 PC **A02**/MF **A01**
South Carolina Univ., Columbia. Coll. of Engineering.
Investigations of Surface Flashover Mechanisms.
Rept. for 1 Oct 77-31 May 79.
J. E. Thompson. Jun 79, 21p NBS/GCR-79/177
Grant NBS-G8-9009

Keywords: *Flashover, Electric discharges, Surfaces, Birefringence, Electrooptics, Potassium phosphates, Hydrogen inorganic compounds, Polymethyl methacrylate, Lithium oxides, Niobium oxides.

This report describes the following activities: (1) analysis of the transverse Pockels effect relevant to the measurements to be made; (2) construction of the test cell and power supplies for vacum/solid interface measurements; (3) construction of the polarization analyzer; (4) preliminary Pockels effect measurements in KDP; (5) measurement of the special electric field distribution in KDP for dc and pulsed excitation; (6) electrical flashover tests of KDP, LiNbO3, and Plexiglas; and (7) estimation of the surface electric fields for pulsed excitation.

714,019
PB-297 847/6 PC **A02**/MF **A01**
National Standard Reference Data System.
Physical Properties Data Compilations Relevant to Energy Storage. III. Engineering Properties of Single and Polycrystalline Sodium Beta and Beta"-Alumina.
G. R. Miller, and D. G. Paquette. cJun 79, 22p
NSRDS-NBS-61-PT-3
See also report dated Apr 79, PB-295 406. Prepared by Utah Univ., Salt Lake City. Dept. of Materials Science and Engineering. Library of Congress catalog card no. 77-10824.

Keywords: *Sodium oxides, *Aluminum oxide, *Solid electrolytes, Hexagonal lattices, Mechanical properties, Thermodynamic properties, Electrical properties, Density(Mass/volume), Lattice parameters, Thermal expansion, Ion currents, Electrical resistivity, *Sodium aluminum oxides, Sodium beta alumina, Temperature dependence.

A review of the properties of the two dimensional superionic conductors of the sodium beta alumina family is presented, with emphasis on the variability of properties with composition and processing. Processing methods, including methods of distributing additives, may strongly influence engineering properties of these substances through changes in microstructures. Described are common methods of measurement of properties with generally accepted ranges of property values. The need to compromise in the design of devices requiring several coincident optimal properties is, at this time, a necessary ingredient in the use of these materials as device components. (Copyright (c) 1979 by the Secretary of Commerce on behalf of the United States Government.)

714,020
PB-297 907/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Lowest Triplet State of the Biexciton May Be Bound.
Final rept.,
K. Murat, and J. Katriel. 1979, 3p
Pub. in Physics Letters 71A, n1 p143-145, 16 Apr 79.

Keywords: Crystals, Energy bands, Stability, *Excitons, Triplets, Reprints.

Using Haken's Hamiltonian and a simple variational wavefunction, the (1 sigma sub g, 1 sigma sub u) triplet Sigma sub u state of the biexciton in a polar crystal is found to be stable with respect to dissociation into two ground-state excitons, for a certain range of (realistic) material parameters, unlike the corresponding state in the H2 molecule.

714,021
PB-297 912/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Exact Solutions for Infinite-Range Spin Hamiltonians.
Final rept.,
G. F. Kventsel, and J. Katriel. 1979, 2p
Pub. in Jnl. of Applied Physics 50, n3 p1820-1821 Mar 79.

Keywords: *Magnetization, *Ferromagnetism, Phonons, Crystal lattices, Phase transformations, Critical temperature, Spin, Hamiltonians, Interaction range, Reprints.

The closed form magnetization equation for s is shown to be valid for any infinite range spin Hamiltonian H = N(dot)H(s), where N is the number of particles, each with elementary spin sigma, and s = S/N, S being the total spin. This equation is used to investigate the following problems: (1) determination of the class of Hamiltonians with a spinodal point at 0K; (2) spin-phonon coupling, quadratic in the lattice displacements. Magnetostriction of this form may lead to shift of the critical temperature, change of the order of the phase transition, decrease of the paramagnetic spinodal temperature up to 0K and renormalization of the phonon spectrum; (3) singlet-ground-state ferromagnetism, exhibiting various types of phase-transitions, including heat magnetization.

714,022
PB-298 012/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microanalysis in the Scanning Electron Microscope: Progress and Prospects.
Final rept.
D. E. Newbury. 1979, 20p
Pub. in Proceedings Annual Int. Scanning Electron Microscopy Conf., Held at Washington, DC. on Apr 16-20, 1979, Scanning Electron Microsc., v11 p1-20 1979.

Keywords: *Microanalysis, *Electron microscopes, Electron microscopy, Scanning, X ray analysis, Auger electrons, Cathodoluminesce, Mass spectroscopy, Ions, Spectroscopy, Raman spectroscopy, Spectrometers, *Scanning electron microscopy, Electron scanning.

Many techniques of analysis are available for the characterization of a sample on the micrometer scale in the scanning electron microscope. Directly available as a result of the electron bombardment are x-rays, Auger electrons, and visible light (cathodoluminescence). Auxiliary excitation sources which can be added to the SEM for analysis include ions for secondary ion mass spectrometry and ion scattering spectrometry, x-rays for x-ray induced characteristic x-ray emission (x-ray fluorescence), and monochromatic photons from laser sources for Raman spectroscopy and mass spectrometry. The information available from these techniques includes elemental and molecular composition, structural information from crystals, and a variety of semiconductor properties. The information can be obtained from regions with lateral dimensions of the order of 1um and with depth resolutions ranging from one atom layer to several micrometers. Qualitative and quantitative analysis can be carried out for all chemical elements, with relative errors in the best cases being less than 5 percent, and with limits of detection in the range 1-100 ppm. No one technique provides all of the information required for total characterization of a sample, and combinations of techniques are required.

714,023
PB-298 662/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Bound Hole Pairs on the d-band Photoemission Spectrum of Ni.
Final rept.,
D. R. Penn. 2 Apr 79, 5p
Pub. in Physical Review Letters 42, n14, p921-925, 2 Apr 79.

Keywords: *Nickel, *Holes(Electron deficiencies), Band structure of solids, Emission spectra, Photoelectric emission, Reprints.

It is shown that the spectral density of the Ni d electrons contains a peak due to excitations of bound hole pairs. The spectral density is observed directly in photoemission experiments which show a satellite peak below the bottom of the d bands. The observed peak exhibits a strong resonance as a function of photon energy and this behavior is also explained by the present theory.

714,024
PB-298 755/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electrical Characterization of Low-Dose Ion-Implanted Silicon Annealed with Microsecond Laser Pulses.
Final rept.
D. R. Myers, P. Roitman, and S. Mayo. 1979, 6p
Sponsored in part by Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings American Inst. of Physics Conf. (50th), Held at Boston, MA. on Nov 27-Dec 1, 1978. Paper in Laser-Solid Interactions and Laser Processing, p563-568, 1978.

Keywords: *Silicon, Annealing, Laser beams, Semiconductor doping, Boron, Phosphorus, Electrical properties, Dye lasers, Ion implantation, Boron ions, Phosphorus ions.

Silicon wafers implanted with low doses (about 10 to the 12th power/sq cm) of either boron or phosphorous ions were annealed with a dye laser and the results compared to those obtained from identically implanted, thermally annealed wafers. The laser was tuned to a wavelength of 600 nm and had a pulse duration of 1 microsecond with a roughly triangular waveform peaked at approximately 230 ns. Energy densities of the laser pulse were varied from 0.7 J/sq cm to 2.8 J/sq cm in five stages. The thermal anneals were performed at 700C or 800C for 30 min in dry nitrogen. Examination of electrical activation of the annealed areas using capacitance-voltage (C-V) profiling on Schottky barrier structures indicated significant boron activation for the laser-annealed areas, with peak dopant concentrations 25 to 100% of those obtained from thermal annealing alone.

714,025
PB-298 798/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fatigue and Stress Effects in NbTi and Nb3Sn Multifilamentary Superconductors.
Final rept.
J. W. Ekin. 1978, 11p
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Proceedings of Int. Cryogenic Materials Conference (2nd), Boulder, CO., August 3-5, 1977, Paper F-1 in Advances in Cryogenic Engineering, 24, p306-316 1978.

Keywords: *Superconductors, *Niobium intermetallics, Titanium intermetallics, Tin intermetallics, Fatigue(Materials), Stresses, Wire, Composition materials, Niobium titanium, Niobium tin.

In situ 4K measurements of the effects of fatigue and static stress are reported on multifilamentary NbTi and Nb3Sn wire conductors. A hydraulic-feedback loading system permitted measurement of (J sub c)(H, epsilon, N) while the specimen was under cyclic tensile stress. As many as 2,500,000 load cycles have been obtained at frequencies ranging from 1 to 15 Hz. The results show that in NbTi:Cu composites fatigue degradation of the matrix is the primary effect. The residual resistance ratio of the copper starts to rapidly degrade at peak-to-peak cyclic strain amplitudes greater than 0.4%. In Nb3Sn composites, on the other hand, static stress degradation of the critical current is the primary effect. It is shown that the widely varying results previously reported for this effect may be accounted for by different amounts of residual compressive prestress in the individual specimens from the thermal contraction of the bronze matrix. When normalized, the results show the critical current starts degrading when the Nb3Sn reaction layer experiences about 0.2% to 0.3% tensile strain. Thus, zero stress in an energized magnet could be accomplished by balancing the tensile hoop stress of the Lorentz force against the compressive prestress of the bronze matrix.

714,026
PB-298 800/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Magnetic Field Effect on Thermal Conductivity of Selected Metals.
Final rept.
L. L. Sparks. 1978, 7p
Sponsored in part by Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings of Int. Cryogenic Materials Conference (2nd), Boulder, CO., August 3-5, 1977, Paper D-2 in Advances in Cryogenic Engineering, 24, p224-231 1978.

Keywords: *Alloys, *Metals, *Thermal conductivity, Magnetic fields, Copper, Aluminum containing alloys, Iron alloys, Nickel alloys, Stainless steels, Titanium alloys, Vanadium containing alloys, Ferronickel, Temperature dependence, Ultralow temperature, Very low temperature, Titanium alloy 6Al 4V, Steel 310, Steel 304.

The behavior of thermal conductivity in the presence of magnetic fields has been experimentally determined for eight alloys and for two copper specimens (RRR = 107 and 1520). The data were taken for 0 = or < H = or < 6366 kA/m (80 k0e) and 5 = or < T = or < 20K. A summary of results is presented which indicates that (1) the decrease in conductivity is large (up to 80%) for the copper specimens and somewhat smaller (up to 50%) for aluminum alloy, (2) the Fe-Ni alloys are only slightly affected (up to 8%), (3) the effect on stainless steel S31000 (AISI 310) is approximately twice that of S30400 (AISI 304), and (4) the Ti-6Al-4V alloy shows a reasonably small percentage effect, but the largest difference with temperature of all of the materials tested. The relative importance of the magnetothermal effect compared to that of thermal history and material variability is discussed.

714,027
PB-298 801/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ground State of f.c.c. Alloys with Multiatom Interactions.
Final rept.,
J. W. Cahn, and R. Kikuchi. 1979, 8p
Sponsored in part by Army Research Office, Washington, DC.
Pub. in Acta Met. 27, p1329-1336 1979.

Keywords: *Face centered cubic lattices, Ground state, Atoms, Interactions, Free energy, *Binary alloy systems, Interaction range, Chemical potential, Reprints.

The ground state of a binary f.c.c. alloy with nearest neighbor interactions and tetrahedral multiatom interactions (characterized by two parameters alpha and beta) is derived and presented in a chart which shows classification of phases in the space of alpha and beta. Where non-stoichiometric phases can occur, the phase boundaries at T = 0 are computed using the tetrahedron approximation of the cluster variation method. Duality of the composition and the chemical potential is emphasized and results are presented and/or interpreted in the dual approaches.

714,028
PB-299 761/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Investigation of a Practical Superconductor with a Copper Matrix.
Final rept.,
F. R. Fickett. 1978, 44p
Sponsored in part by Internationsl Copper Research Association, New York.
Pub. in INCRA Project No. 255 Annual Report, 44p Jan 78.

Keywords: *Superconductors, Wire, Composite materials, Niobium intermetallics, Tin intermetallics, Copper, Reprints, Copper matrix composites.

The production of superconducting wires by a variety of in-situ techniques is described and referenced to an extensive bibliography. Alloy methods involving copper, niobium, and tin appear to be the most promising for the production of inexpensive, high-field superconductors of commercial interest.

714,029
PB-299 762/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Investigation of a Practical Superconductor with a Copper Matrix.
Final rept.,
F. R. Fickett. 1978, 64p
Sponsored in part by International Copper Research Association, New York.
Pub. in INCRA Project No. 255A Annual Report, 64p Dec 78.

Keywords: *Superconductors, Composite materials, Copper, Niobium intermetallics, Tin intermetallics, Wire, Reprints, Copper matrix composites.

In-situ preparation of complete Nb3Sn superconducting composite materials may offer a new and relatively inexpensive solution to the problems associated with production of high field superconductors. Several approaches were studied to the production of wires from a single melt. The alloying techniques and the electrical and magnetic properties of the resulting wires are given. A number of the wires show promise but are not yet competitive with commercial superconductors.

714,030
PB-299 769/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Characterization of Modulated Structures in AB04+x Phases.
Final rept.
R. J. Cava, and R. S. Roth. 1979, 3p
Pub. in AIP Conference Proceedings no. 53, Symposium on Modulated Structures, Kailua Kona, HI., Mar 26-30, 1979, Paper in Modulated Structures-1979, Sec 7, p361-363 1979.

Keywords: *Crystal structure, Phase transformations, Oxygen, Crystal lattices, *Fergusonite.

The fergusonite structure type has been shown to alter to a phase with a modulated structure with addition of excess oxygen. The reciprocal lattice must be characterized by 5 indices. The characteristics of the modulation vary dramatically with oxygen excess.

714,031

PB-299 779/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Hydrogen on Sublattice Magnetization of Laves-Phase Rare Earth Iron Compounds.
Final rept.,
G. E. Fish, J. J. Rhyne, S. G. Sankar, and W. E. Wallace. 1979, 3p
Pub. in Proceedings of Conference on Magnetism and Magnetic Materials (24th), Cleveland, OH., November 14-17, 1978, Jnl. Applied Physics 50, n3 p2003-2005 Mar 79.

Keywords: *Magnetization, *Hydrogenation, *Deuteration, Magnetic moments, Curie temperature, Magnetic anisotropy, *Erbium iron hydrides, *Holmium iron hydrides, Laves phases, Erbium ferrides, Holmium ferrides.

The authors have used elastic neutron scattering to examine the effect of hydriding on the sublattice magnetization of the Laves-phase compounds RFe2 for R = Ho and Er. On addition of hydrogen or deuterium a stable phase of composition about RFe2D3.5 is formed. The pure compounds RFe2 are ferrimagnetic, with the R moment equal to the free ion value and Fe moment of approximately 1.6 Bohr magnetons. The bulk Curie temperatures T sub c of the hydrides and deuterides are considerably lower than the corresponding RFe2 values (e.g., 440 K for RFe2D3.5 versus 574 K for ErFe2). The 10 K R moment is also significantly reduced in the deuterides (4.4 and 5.2 Bohr magnetons versus 9 and 10 Bohr magnetons for Er and Ho in RFe2) and drops steadily with increased temperature, reaching zero below T sub c in the case of Er. The Fe moment remains nearly constant with temperature until just below T sub c where it drops rapidly to zero; in ErFe2D3.5 and HoFe2D3.5 its magnitude is 1.6 Bohr magnetons and 1.9 Bohr magnetons, respectively. These results indicate that the exchange interactions involving the R atoms are markedly weakened in the hydrides. The distortion of the local anisotropy field due to random site occupancy of H and the weak exchange coupling of R produces a fanning of the R moment which reduces the spatially averaged moment measured in the neutron experiment.

714,032

PB-299 811/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Feasibility of Electrocaloric Refrigeration for the 4-15 K Temperature Range.
Final rept.,
R. Radebaugh, W. N. Lawless, J. D. Siegwarth, and A. J. Morrow. Apr 79, 22p
Sponsored in part by Advanced Research Projects Agency, Arlington, VA.
Pub. in Cryogenics 19, n4, p187-208, Apr 79.

Keywords: *Refrigerants, Solids, Refrigerating, Cryogenics, Beryllium, Entropy, Reprints, Strontium titanium oxides, Potassium tantalum oxides.

The feasibility of solid state type of refrigeration, which utilizes the electrocaloric effect in certain dielectric materials, has been investigated. The study was limited to the temperature range where the refrigerator would absorb heat from a load at about 4 K and reject heat to a reservoir at about 15 K. Heat switches would be required for such a refrigerator and two types were studied. One type was a multiple-leaf contact switch, the other a magnetothermal switch of single crystal beryllium. Many electrocaloric materials were studied but none was found with a sufficiently large reversible electrocaloric effect for a practical refrigerator. The largest effects were seen in a SrTiO3 ceramic, followed by a KTaO3 single crystal. Temperature reductions of about 0.3 K at 10 K were observed during depolarization from fields of 20 kV/cm. A theoretical model, based on the electret behaviour of impurity-vacancy dipoles is postulated to interpret the anomalous dielectric behaviour of the materials investigated. Another theoretical model, based on the lattice dynamics of displacive dielectrics, is postulated to explain the observed temperature changes seen in such materials. The model points out that at 4 K the entropies of displacive type materials are probably too low for practical refrigeration. An investigation of certain order-disorder dielectrics is suggested.

714,033

PB-299 819/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Quasiparticle Heterodyne Mixing in SIS Tunnel Junctions.
Final rept.,
P. L. Richards, T. M. Shen, R. E. Harris, and F. L. Lloyd. 1 Mar 79, 3p
Pub. in Applied Physics Letters 34, n5, p345-347, 1 Mar 79.

Keywords: *Josephson junctions, Heterodyning, Superconductivity, Cryogenics, Electron tunneling, Elementary excitations, Reprints.

The rapid onset of quasiparticle tunneling current in superconductor-insulator-superconductor (Josephson) junctions at voltages above 2 Delta/e is being used for millimeter-wave heterodyne mixing. Junctions with a 2 micrometers diameter and R(n) = 50 Ohms have little capacitive shunting at the signal frequency of 36 GHz. Because there is no series resistance, residual capacitance can be tuned out. Double sideband conversion efficiencies of 0.32 and mixer noise temperatures as low as T(M) < or = 7K = 4hf/K have been observed. The results are compared with shot-noise-limited mixer theory. Photon-assisted tunneling effects are seen which indicate the approach to photon-noise-limited operation.

714,034

PB-299 820/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Definitions of Terms for Practical Superconductors. 3. Fabrication, Stabilization, and Transient Losses.
Final rept.,
D. T. Read, J. W. Ekin, R. L. Powell, and A. F. Clark. Jun 79, 6p
Pub. in Cryogenics 19, n6, p327-332, Jun 79.

Keywords: *Superconductivity, Superconductors, Josephson junctions, Critical point, Definitions, Reprints.

The definition of terms used in describing the phenomenology and measurement practices of practical superconductive materials are proposed. The definitions cover the subject categories of: (1) fundamental states and flux phenomena; (2) critical parameters; (3) fabrication, stabilization, and transient losses; and (4) Josephson phenomena. It is intended that these terms will become the basis for the development of standard measurement practices and responses are invited.

714,035

PB-299 821/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic Properties of Laves-Phase Rare Earth Hydrides.
Final rept.,
J. J. Rhyne, G. E. Fish, S. G. Sankar, and W. E. Wallace. May 79, 2p
Pub. in Jnl. of Physics 40, nC-5, pC5-209-C5-210, May 79.

Keywords: *Erbium compounds, Holmium compounds, Thulium compounds, Hydrogenation, Iron inorganic compounds, Rare earth compounds, Magnetic moments, Magnetic properties, Neutron scattering, Curie temperature, Reprints, *Erbium iron hydrides, *Holmium iron hydrides, *Thulium iron hydrides, Laves phases, Erbium ferrides, Holmium ferrides, Thulium ferrides.

Neutron scattering results show that the introduction of hydrogen into RFe2 compounds (R = Tm, Ho, and Er) significantly lowers the overall Curie temperature and produces a reduced 0 K moment on the rare earth site. The rare earth spins disorder at a temperature lower than the bulk T sub c in ErFe2H3.5. The 0 K iron sublattice moment in ErFe2H3.5 is essentially the same as that found in the non-hydride compounds and remains nearly constant to approximately 0.8 T sub c.

714,036

PB-299 827/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Model Study of Fluctuations and Switching in Amorphous Semiconductors.
Final rept.,
R. D. Mountain. 1979, 9p
Pub. in Jnl. of Non-Crystalline Solids 33, p149-157 1979.

Keywords: *Semiconductors, Switching, Power spectra, Charge carriers, Variations, Reprints, *Amorphous semiconductors.

The model developed by Ma for the initiation of threshold switching is used as the basis for a master equation description of the fluctuation spectrum of the number of carriers. The system size expansion is used to derive explicit expressions for the fluctuation spectrum in terms of the parameters of the model. It is shown that the study of the power spectra of current fluctuations about stationary states is a useful way of investigating the physical mechanisms responsible for switching.

714,037

PB-299 829/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Superconducting Devices.
Final rept.,
J. E. Zimmerman, and D. B. Sullivan. 1979, 3p
Pub. in McGraw-Hill Yearbook of Science and Technology, p378-380 1979.

Keywords: *Superconductors, Magnetometers, Reviews, Reprints, *Squid devices, Superconducting quantum interference devices.

The history of the SQUID is reviewed with emphasis on recent developments.

714,038

PB-299 987/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Low Frequency Impedance and Noise Properties of an RF Biased Resistive SQUID.
Final rept.
R. P. Giffard, P. F. Michelson, and R. J. Soulen. 1979, 4p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of 1978 Applied Superconductivity Conference, Pittsburgh, PA., September 25-28, 1978, IEEE Trans. Mag. 15, n1 p276-279 Jan 79.

Keywords: *Josephson junctions, Thermal noise, Electron tunneling, Measurement, SQUID devices, Noise thermometers.

A noise thermometer consisting of a non-hysteretic resistive SQUID has been used for unusually precise measurements of the low frequency Josephson linewidth of a heavily shunted point-contact. The results agree with theories appropriate for weak links, and support the contention that the pair fluctuation noise calculated for tunnel junctions is not present in point contacts.

714,039

PB-300 572/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Silicon Irradiation Facilities at the NBS Reactor.
Final rept.
N. A. Bickford, and R. F. Fleming. 1979, 6p
Pub. in Proceedings of Neutron Transmutation Conference, Columbia, MO., Apr 23-26, 1978, Paper in Neutron Transmutation Doping in Semiconductors, p165-170 1979.

Keywords: *Neutron irradiation, *Silicon, Neutron flux, Cadmium, Neutron reactions, NBSR reactor.

A program of silicon irradiation is being carried out at the National Bureau of Standards 10 MW heavy water moderated reactor. The facility, which operates on a 40 day round-the-clock cycle, can provide a wide range of neutron fluxes with an equally wide range of cadmium ratios.

714,040

PB-300 707/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Study of Hydrogen Diffusion in Vanadium and Tantalum Hydride by Quasielastic Thermal Neutron Scattering.
Final rept.
L. A. deGraaf, J. J. Rush, R. C. Livingston, H. E. Flotow, and J. M. Rowe. 1972, 12p
Sponsored in part by Atomic Energy Commission, Washington, DC.
Pub. in Proceedings of International Meeting on Hydrogen in Metals, Kernforschungsanlage Juelich, Germany, F.R., Mar 20-24, 1972, p301-312 Mar 72.

Keywords: Hydrogen, Vanadium, Tantalum, Diffusion, Transport properties, Neutron scattering, Elastic scattering, *Vanadium hydrides, *Tantalum hydrides, Temperature dependence, High temperature, Medium temperature.

The diffusion of hydrogen in vanadium and tantalum has been studied by quasielastic thermal neutron scattering. Neutron line widths associated with diffusion broadening have been determined at 485 K for VH(0.198) and VH(0.570) and at several temperatures between 295 and 613 K for TaH(0.15). These measurements cover a range of momentum transfers (Q) for elastic scattering up to 4.1 A. The line widths results for alpha-VH(0.57) are compared with these models and with a model allowing occupation of multiple sites. Differences in the line width behaviour for VH(0.20) and VH(0.57), and the fact that the measured widths at large Q increased rapidly with Q rather than approaching an asymptotic value as predicted by the theory, are discussed. The tantalum hydride width curves are compared to the VH(x) results and to the same models.

714,041
PB-300 714-T PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Doping of Cadmium Sulfide Single Crystals with Lithium during the Production of Diffusion Piezoelectrical Transducers(O Legirovanii Monokristallov Sul'fida Kadmiya Litiem Pri Izgotovlenii Diffuzionnykh Akustoelektricheskikh Preo'razovatelei).
M. S. Fainer, L. A. Sysoev, L. V. Atroshchenko, and Y. A. Obukhovskii. 1979, 9p DMDC-19004, TT-79-58075
Trans. of Monokristalli i Tekhnika (USSR) v4 p144-148 1971. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Cadmium sulfides, *Semiconductor doping, Lithium, Single crystals, Indium, Piezoelectricity, Acoustic properties, Piezoelectric crystals, Translations, Piezoelectric transducers.

Single crystals of CdS were prepared, and In contacts deposited on the same crystals. Lithium was introduced into the specimens by diffusion. A study was made of the piezoelectrical properties revealed a dispersion of the CdS acoustical properties. A correlation was made between the changes in Li concentration with the variation in acoustical properties.

714,042
PB-300 786/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Method for Determining the Region of Superparamagnetism.
Final rept.,
G. A. Candela, and R. A. Haines. 15 Jun 79, 3p
Pub. in Applied Physics Letters 34, n12, p868-870, 15 Jun 79.

Keywords: *Coercive force, Magnetic materials, Magnetic properties, Temperatures, Particle size distribution, Reprints, *Superparamagnetism, Temperature dependence.

A simple procedure which determines the coercive force as a function of temperature has been developed for superparamagnetic materials having a particle-size distribution. This procedure accurately determines the region where superparamagnetism occurs, and it has been used to obtain the first experimental verification of the Bean-Livingston coercive-force temperature relation.

714,043
PB77-600039 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crystal Data Space-Group Tables.
A. D. Mighell, H. M. Ondik, and B. B. Molino. c1977, 156p
Included in Jnl. of Physical and Chemical Reference Data, v6 n3 p675-830 1977.

Keywords: Crystal, Isostructural materials, Lattice, Point group, Polymorphism, Space group, Symmetry, *Crystal Data Space-Group Tables.

Crystal Data Space-Group Tables lists over 17,000 materials whose space groups and symmetry have been determined mainly by x-ray diffraction. These tables comprise a companion publication to Crystal Data Determinative Tables. The space groups are listed in the same order and orientation as in International Tables for X-Ray Crystallograp h y. Within each space group, the materials' are arranged in increasing order of the ratios of the cell parameters. The space-group tables enable the user to find crystals of any specified symmetry, to locate isostructural molecules, and to compare the population frequencies of the various space groups.

714,044
PB77-600079 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement Techniques for High Power Semiconductor Materials and Devices: Annual Report for the Period January 1, 1976-December 31, 1976.
D. L. Blackburn, R. Y. Koyama, F. F. Oettinger, and G. J. Rogers. 1977, 92p
Pub. in Energy Conservation CONS/3800-2, 92p 1977.

Keywords: d-c transmission, *Energy conservation, Measurement methods, Photovoltaic method, Power-device grade silicon, Resistivity variations, Silicon, Thermally stimulated capacitance, Thermally stimulated current, Thermally stimulated measurements, *Thyristor materials measurements, Thyristor measurements.

This annual report describes NBS activities directed toward the development of measurement methods for semiconductor materials and devices which will lead to more effective use of high power semiconductor devices in applications for energy generation, transmission, conversion, and conservation. It responds to national needs arising from rapidly increasing demands for electricity and the present crisis in meeting long-term energy demands. Emphasis is on the development of measurement methods for thyristors and rectifier diodes. The major tasks under this project are (1) to evaluate the feasibility of the photo-voltaic method as a rapid, nondestructive technique for characterizing the resistivity uniformity of high-resistivity, large-diameter silicon wafers and (2) to evaluate the use of thermally stimulated current and capacitance measurements as a means for characterizing lifetime controlling or leakage source defects in power device grade silicon wafers.

714,045
PB80-103757 Not available NTIS
National Bureau of Standards, Washington, DC.
Strain Dependence of the Critical Current and Critical Field in Multifilamentary Nb3Sn Composites.
Final rept.,
J. W. Ekin. Jan 79, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics 15, n1, p197-200, Jan 79.

Keywords: *Superconductors, *Critical field, Fiber composites, Niobium intermetallics, Tin intermetallics, Strains, Reprints, *Niobium tin, *Critical current.

High-J sub C multifilamentary Nb3Sn superconductors with widely varying amounts of prestrain and critical field values can be characterized fairly accurately by a single normalized critical field-strain relationship. Such a relationship permits first order prediction of critical-current degradation at arbitrary magnetic field magnitudes knowing only two parameters for any conductor, the prestrain and the maximum critical field. Some of the conductor-fabrication factors affecting the parameters are considered.

714,046
PB80-103765 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Strain on the Critical Current of Nb3Ge.
Final rept.,
J. W. Ekin, and A. I. Braginski. Jan 79, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics 15, n1, p509-511, Jan 79.

Keywords: *Superconductors, Niobium inorganic compounds, Germanides, Strains, Reprints, *Niobium germanides, *Critical current.

The strain dependence of the critical-current density has been determined for composite tapes of Nb3Ge prepared by chemical vapor deposition. For Nb3Ge layers 3-4 micrometers thick deposited on a nickel-molybdenum-iron alloy substrate, the critical current monotonically increases when uniaxially strained to about 0.6 percent. This strain corresponds almost exactly to the compressive strain that would be introduced into the Nb3Ge by the substrate due to thermal contraction during cooldown after reaction. The increase in critical current was relatively small, about 6 1/2 percent at 7T and 5 1/2 percent at 4T. At higher strain, the critical current decreased rapidly, falling by more than 50 percent at a strain of 0.9 percent, for example. For Nb3Ge deposited on a tantalum substrate, however, the critical current monotonically decreased, falling by more than 50 percent at a strain of 0.4 percent. The results indicate that Nb3Ge can withstand considerable compressive strain (at least 0.6 percent), but fractures at tensile strains of only 0.1 to 0.2 percent.

714,047
PB80-104474 Not available NTIS
National Bureau of Standards, Washington, DC.
Development of Standards for Practical Superconductors.
Final rept.,
A. F. Clark, J. W. Ekin, R. Radebaugh, and D. T. Read. Jan 79, 4p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics 15, n1, p224-227, Jan 79.

Keywords: *Superconductors, Standards, Measurement, Terminology, Reprints, Critical current.

The program to develop standard measurement practices for practical superconductors includes the generation of uniform definitions of terms, the development of standard measurement techniques, and comparisons of these measurements using standard reference materials. The initial sets of definitions have been published and their development will be described. Responses will be solicited on terms whose definitions are still in development or are controversial. The progress in the development of standard measurement techniques for critical current, transient losses and critical temperature will be discussed. The different techniques will be compared and the experimental parameters which must be carefully controlled will be enumerated.

714,048
PB80-107329 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetization and Neutron Scattering Measurements on Amorphous NdFe2.
Final rept.,
H. A. Alperin, W. R. Gillmor, S. J. Pickart, and J. J. Rhyne. Mar 79, 3p
Pub. in Jnl. of Applied Physics 50, n3, p1958-1960, Mar 79.

Keywords: *Iron intermetallics, Neodymium compounds, Neutron scattering, Magnetization, Magnetic properties, Magnetic moments, Intermetallics, Reprints, *Neodymium intermetallics, Amorphous state, Temperature dependence, Magnetic ordering.

A bulk sputtered sample of NdFe2 was investigated by magnetization and neutron scattering measurements and compared to similar previous measurements for heavy rare-earth alloys. The amorphous structure was found here to be more open but in all other respects the results were found to agree quantitatively with the results for TbFe2 and HoFe2. Magnetic ordering from the neutron measurements was observed below T sub c = 305 K with a net moment of 1.3 Bohr magnetons/atom at T = 0. The coercive force increased to 11.4 kOe at 5 K.

714,049
PB80-107378 Not available NTIS
National Bureau of Standards, Washington, DC.
Preliminary Report on the Design and Results of the Second Round Robin to Evaluate Search/Match Methods for Qualitative Powder Diffractometry.
Final rept.,
R. Jenkins, and C. R. Hubbard. 1979, 10p
Pub. in Proceedings Annual Conf. on Applications of X-Ray Analysis (27th), Held at Denver, CO. on Aug 1-4,1978. Paper in Advances in X-Ray Analysis, v22 p133-142, 1979.

Keywords: *Diffraction, *Information retrieval, X ray analysis, Data retrieval, Powder(Particles), Qualitative analysis.

Six computer synthesized data sets, each representing a mixture, and one physical mixture were prepared and widely distributed in order to study the various search/match methods and factors which affect their success. A total of 67 returns were received representing eight countries and three search methods. The participants were primarily from industrial laboratories. The average score exceeded 90%. The Hanawalt search

method yielded the test overall score. Use of the Frequently Encountered Phases subfile decreased the search time by about 40% and marginally increased the success rate. For the physical mixture the delta d/d and delta I/I values were measured to about 2/1000 and 40% respectively. Use of an internal standard improved the d-values by a factor of 2 and resulted in better search/match performance.

714,050
PB80-107428 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Scattering Studies of Crystal Field Excitations in (RE)Mo6Se8.
Final rept.,
J. W. Lynn, and R. N. Shelton. Mar 79, 3p
Pub. in Jnl. Appl. Phys. v50 n3 p1984-86, Mar 79.

Keywords: *Superconductors, Terbium, Holmium, Erbium, Solid solutions, Ternary systems, Neutron scattering, Inelastic scattering, Molybdenum inorganic compounds, Selenides, Electric fields, Crystal symmetry, Magnetic moments, Reprints, *Molybdenum selenides, Crystal field.

Neutron inelastic scattering measurements have been made to determine the crystal field levels of the rare earth ions in the ternary superconductors Tb(1.2)Mo6Se8, Ho(1.2)Mo6Se8, and ErMo6Se8. The results show that the lifting of the free-ion angular momentum degeneracies can be adequately understood on the basis of a crystalline electric field with cubic symmetry. In each case the determined ground state possesses a magnetic moment. The situation found in these selenide materials contrasts with the sulfide materials in which no crystal field excitations have been observed over a wide range of energies.

714,051
PB80-108517 Not available NTIS
National Bureau of Standards, Washington, DC.
Direct Measurement of Pyroelectric Figures of Merit of Proper and Improper Ferroelectrics.
Final rept.,
A. Shaulov, M. I. Bell, and W. A. Smith. Jul 79, 7p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Jnl. of Applied Physics 50, n7, p4913-4919, Jul 79.

Keywords: *Ferroelectric materials, *Pyroelectricity, Figure of merit, Molybdates, Terbium compounds, Rare earth compounds, Organic sulfates, Infrared optical materials, Reprints, Glycine/sulfate.

A direct method is described for measuring the figures of merit which characterize the performance of pyroelectric materials as infrared vidicon targets or point detectors. The results of experiments carried out as a function of temperature on a proper ferroelectric, triglycine sulfate, and an improper ferroelectric, terbium molybdate, are compared with the predictions of the appropriate thermodynamic theories. It is shown that within the family of rare-earth molybdates isomorphic to terbium molybdate there exists an optimum value for the figure of merit relevant to pyroelectric vidicon performance.

714,052
PB80-110364 PC **A09**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Standard X-Ray Diffraction Powder Patterns. Section 16 - Data for 86 Substances.
Final rept.,
M. C. Morris, H. F. McMurdie, E. H. Evans, B. Paretzkin, J. H. de Groot, C. R. Hubbard, and S. J. Carmel. Oct 79, 190p NBS-MONO-25-SECT-16
See also report dated Oct 78, PB-287 182. Prepared in cooperation with Joint Committee on Powder Diffraction Standards, Swarthmore, PA. Library of Congress catalog card no. 53-61386.

Keywords: *Crystal structure, *X ray diffraction, Lattice parameters, Density(Mass/volume), Refractivity, Organic compounds, Inorganic compounds, Standards, Tables(Data), *Powder patterns.

Standard x-ray diffraction patterns are presented for 87 substances. Fifty-nine of these patterns represent experimental data and 28 are calculated. The experimental x-ray powder diffraction patterns were obtained with an x-ray diffractometer. All d-values were assigned Miller indices determined by comparison with computed interplanar spacings consistent with space group extinctions. The densities and lattice constants were calculated and the refractive indices were measured whenever possible. The calculated x-ray powder diffraction patterns were computed from published crystal structure data. Both peak height and integrated intensities are reported for the calculated patterns.

714,053
PB80-117252 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic Properties of Laves-Phase Rare Earth Hydrides.
Final rept.,
J. J. Rhyne, G. E. Fish, S. G. Sankar, and W. E. Wallace. May 79, 2p
Pub. in Jnl. of Physics C5, n40, Supplement 5, pC5-209-C5-210, May 79.

Keywords: Rare earth compounds, Iron inorganic compounds, Hydrides, Magnetic properties, Curie temperature, Neutron scattering, Reprints, *Laves phases, *Iron thulium hydrides, *Holmium iron hydrides, *Erbium iron hydrides, Temperature dependence, Magnetic ordering.

Neutron scattering results show that the introduction of hydrogen into RFe2 compounds (R = Tm, Ho, and Er) significantly lowers the overall Curie temperature and produces a reduced 0 K moment on the rare earth site. The rare earth spins disorder at a temperature lower than the bulk T(c) in ErFe2H(3.5). The 0 K iron sublattice moment in ErFe2H(3.5) is essentially the same as found in the non-hydride compounds and remains nearly constant to approximately 0.8 T(c).

714,054
PB80-117302 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin Excitations in Amorphous Transition-Metal Boron Glasses.
Final rept.,
J. J. Rhyne, J. W. Lynn, F. E. Luborsky, and J. L. Walter. Mar 79, 3p
Pub. in Jnl. of Applied Physics 50, n3, p1583-1585, Mar 79.

Keywords: *Magnons, Curie temperature, Magnetization, Neutron scattering, Inelastic scattering, Reprints, *Iron boride silicides, *Iron nickel boride phosphides, Amorphous state, Ribbons.

Magnetic inelastic neutron scattering studies have been performed on ribbon specimens of amorphous Fe83B(16.5)Si(0.5) and Fe20Ni60B19P. The samples were prepared from isotopically enriched B to reduce the neutron absorption. The Curie temperatures for the two materials are 613 K and 410 K respectively, and the room temperature saturation magnetizations 4 pi (M sub s) are 16.0 kG and 5.1 kG. In the Fe20Ni60B19P specimen, well-defined spin waves were observed at room temperature for neutron wavevector transfers in the range q = 0.06/A to q = 0.20/A. After correcting for instrumental resolution, the data obeyed a quadratic dispersion law with spin stiffness D = 80 meV sq A. Spin waves in the Fe83B(16.5)Si(0.5) amorphous alloy exhibited a D = 125 meV sq A consistent with the higher T sub c of this alloy.

714,055
PB80-117310 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin-Glass and Magnetic Blocking Transitions in Amorphous YFe2.
Final rept.,
D. W. Forester, N. C. Koon, J. H. Schelleng, and J. J. Rhyne. 1979, 4p
Pub. in Solid State Communications 30, n4, p177-180 1979.

Keywords: *Iron intermetallics, Intermetallics, Yttrium compounds, Magnetic permeability, Cryogenics, Critical temperature, Magnetic properties, Reprints, *Yttrium intermetallics, Amorphous state, Spin glass state, Magnetic susceptibility.

Low field dc magnetic susceptibility measurements on amorphous YFe2 show a distinct cusp-like peak at T(S.G.) = 58 K. This result, together with earlier Moessbauer and neutron scattering measurements, indicates that a true thermodynamic spin-glass transition occurs at T(S.G.). In addition, susceptibility and coercive field data are presented which strongly suggest a magnetic freezing or blocking temperature near T = 20 K. This is the first time these two magnetic phenomena have been observed in the same magnetic system.

714,056
PB80-117690 Not available NTIS
National Bureau of Standards, Washington, DC.
Excited State Spin Waves in ErFe2.
Final rept.,
N. C. Koon, and J. J. Rhyne. 1978, 4p
Pub. in Solid State Communications 26, p537-540 1978.

Keywords: *Iron intermetallics, *Magnons, Intermetallics, Erbium compounds, Neutron scattering, Inelastic scattering, Reprints, *Erbium intermetallics, Erbium ions, Crystal field, Temperature dependence.

Neutron inelastic scattering measurements on ErFe2 reveal an unusual doubling of the two lowest energy spin wave branches over a wide temperature range. Crystal field calculations suggest that one member of each doublet is associated with transitions from the ground state of Er(+3) to the first excited state, while the other is associated with transitions between excited states. The gapless acoustic mode appearing at high temperatures is identified as a propagating excited state spin wave.

714,057
PB80-117757 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Scattering Study of the Dynamics of (KCN)0.5(KBr)0.5.
Final rept.,
J. M. Rowe, J. J. Rush, D. G. Hinks, and S. Susman. 1979, 4p
Pub. in Physical Review Letters 43, n16 p1158-1161, 15 Oct 79.

Keywords: *Potassium cyanides, *Potassium bromide, Mixtures, Crystals, Glass, Cryogenics, Reprints.

Our earlier measurements on pure KCN and (KCN)(0.25)(KBr)(0.75) have been extended to mixed crystals of (KCN)(0.5)(KBr)(0.5). From a comparison of the observed neutron scattering line shapes to those predicted by a simple extension of the theory used to describe pure KCN, it is concluded that this theory does not describe the mixed systems correctly. This Letter suggests that the current results may be indicative of the formation of a 'glass' phase at low temperatures in these mixed systems.

714,058
PB80-117765 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Powder Diffraction Study of Tantalum Tungstate, Ta2WO8.
Final rept.,
A. Santoro, R. S. Roth, and D. Minor. 1979, 4p
Pub. in Acta Crystallographica, Section B35, p1202-1205 1979.

Keywords: Crystal structure, Orthorhombic lattices, Tantalum oxides, Tungstates, Neutron diffraction, Cyrstal symmetry, Reprints, *Tantalum tungstates.

Ta2WO8 crystals have the following structures: orthorhombie, Pbem, a = 3.8762(2), b = 17.716 (1),c = 16,684 (1) A. The structure was studied by profile analysis. Contrary to previous conclusions based on X-ray diffraction data, it was found that the compound crystallizes with the symmetry of space group Pbem and is isostructural with Nb2WO8.

714,059
PB80-117781 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Crystal-Field Spectroscopy of CeD2.12.
Final rept.,
C. J. Glinka, J. M. Rowe, G. G. Libowitz, and A. Maeland. 1979, 8p
Pub. in Jnl. Phys., vC12 p4229-4236, 1979.

Keywords: Deuterium compounds, Energy levels, Magnetic fields, Neutron scattering, Inelastic scattering, Reprints, *Cerium hydrides, *Crystal field, Cerium ions.

The crystal-field splitting of the doublet F(5/2) ground state of Ce(+3) in CeD(2.12) has been studied by inelastic neutron scattering. A single crystal-field transition, consistent with a cubic environment for the Ce ion, is observed at an energy of 20 meV. Low-temperature measurements of the quasielastic scattering in a magnetic field, however, cannot be explained in terms of crystal-field effects alone.

714,060
PB80-117815 Not available NTIS
National Bureau of Standards, Washington, DC.
Quasielastic Neutron Scattering and High Resolution Spectroscopy.
Final rept.,
J. J. Rush. 1979, 5p
Pub. in National Science Foundation Workshop Present Needs and Future Trends in Neutron Crystallography and Spectroscopy, Argonne National Lab., IL, Nov 15-17, 1978, Paper 14, p71-75, 1979.

Keywords: *Neutron scattering, *Inelastic scattering, Diffusion, Rotation, Energy levels, Electron tunneling, Spectroscopy, Resolution.

A brief introduction is given to the application of high-resolution neutron inelastic scattering to study of diffusive and rotational behavior in condensed phases and for studies of ultra-low energy transitions (e.g. tunnel splittings) in solids. Illustrative examples of such applications are discussed.

714,061
PB80-119050 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic Properties and Hyperfine Interactions in the Beta prime prime prime Phase of Potassium Ferrite.
Final rept.,
V. P. Romanov, G. A. Candela, R. S. Roth, and L. J. Swartzendruber. Oct 79, 4p
Pub. in Jnl. of Applied Physics 50, n10, p6455-6458, Oct 79.

Keywords: *Antiferromagnetism, Phase, Potassium inorganic compounds, Ferrites, Magnetic permeability, Magnetic properties, Hyperfine structure, Magnetite, Barium inorganic compounds, Reprints, *Potassium ferrites, *Magnetic ordering, Magnetic susceptibility, Barium ferrites, Exchange interactions.

The hyperfine field structure and magnetic susceptibility in the temperature range 5--295 K was measured for the beta prime prime prime phase of potassium ferrite. Results show that this new phase has an antiferromagnetic ordering similar to the beta phase. The hyperfine interaction parameters have been determined and are compared with those found in magnetite, beta(-) phase potassium ferrite, and barium hexaferrite.

714,062
PB80-119118 Not available NTIS
National Bureau of Standards, Washington, DC.
Stabilities of Germanium Thermometers at 20 K and Below.
Final rept.,
H. H. Plumb, and L. M. Besley. 1978, 7p
Pub. in Proceedings of ISA-78 (Instrument Society of America) National Conference and Exhibit Held at Philadelphia, PA. on October 15-19, 1978, p19-25 1978.

Keywords: *Temperature measuring instruments, Germanium, Cryogenics, Stability.

Germanium thermometers have been widely used in the last fifteen years both for engineering application and in precision thermometry measurements that have led to the development of and comparison of international temperature scales. For the most precise investigations it has been necessary that the experimentalists carefully select thermometers and continue intercomparisons to ensure that the thermometers' calibrations are maintained. This paper describes such selection and monitoring processes within the authors' laboratories.

714,063
PB80-119209 Not available NTIS
National Bureau of Standards, Washington, DC.
Note on the Dependence of AC Magnetic Susceptibility on the Magnitude of the Measuring Field.
Final rept.,
R. P. Hudson. 1979, 9p
Pub. in Jnl. of Low Temperature Physics 36, n5/6, p511-519 1979.

Keywords: *Magnetic measurement, Magnetic permeability, Magnesium inorganic compounds, Alternating current, Spin lattice relaxation, Frequencies, Field strength, Electromagnetic fields, Cerium compounds, Inorganic nitrates, Temperature measurement, Cryogenics, Reprints, *Magnetic susceptibility, Magnesium cerium nitrates.

Ac measurements of susceptibility are analyzed to investigate the effect of a finite measuring field, the effect arising from the interplay of the spin-lattice relaxation time, and the measuring frequency. The analysis constitutes an attempt at rather more rigor than that of a recent discussion by Dawber, Finn, and Kiymac. The consequences for precision magnetic thermometry with cerous magnesium nitrate are summarized.

714,064
PB80-120041 PC **A04**/MF **A01**
Florida Univ., Gainesville. Dept. of Electrical Engineering.
Semiconductor Measurement Technology: Theoretical and Experimental Study of the Temperature and Dopant Density Dependence of Hole Mobility, Effective Mass, and Resistivity in Boron-Doped Silicon.
Final rept.,
S. S. Li. Nov 79, 54p NBS/SP-400-47
Grant NSF-ENG76-81828, ARPA Order-2397

Keywords: *Silicon, Boron, Holes(Electron deficiencies), Electrical resistivity, Density(Number/volume), Semiconductor doping, Effective mass, Hole mobility, Temperature dependence, Low temperature, Medium temperature.

Theoretical expressions for resistivity and conductivity mobility of holes a functions of dopant density and temperature have been derived for boron-doped silicon. The model is applicable for dopant densities from 10 to the 13th power/cc to 3 times 10 to the 18th power/cc and temperatures between 100K and 400K. Resistivity measurements on nine boron-doped silicon slices with dopant densities from 4.5 times 10 to the 14th power/cc to 3.2 times 10 to the 18th power/cc were performed for 100K < or = T < or = 400K, using a planar four-probe square-array test structure. Finally, formulations for the density-of-states effective mass, conductivity effective mass, and Hall effective mass are described, and the results are applied to the calculations of hole masses in boron-doped silicon for 10 to the 14th power/cc < or = N sub A < or = 10 to the 18th power/cc and 50K < or = T < or = 500K.

714,065
PB80-120058 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Measurement Technology: An Automated Photovoltaic System for the Measurement of Resistivity Variations in High-Resistivity Circular Silicon Slices.
Final rept. Dec 75-Oct 77,
D. L. Blackburn. Nov 79, 35p NBS-SP-400-52
Sponsored in part by Department of Energy, Washington, DC. Library of Congress catalog card no. 79-600178.

Keywords: *Silicon, *Nondestructive tests, Electrical resistance, Photovoltaic effect, Wafers, Test equipment, Automation, Computer programs, Measurement.

This report describes an automated photovoltaic system for nondestructive measurement of resistivity variations of high-resistivity circular silicon slices. The computer-based system for making the measurements is described, detailed construction diagrams are given to facilitate reproduction of the system, and a listing of the computer program for controlling the system is given. Comparisons between resistivity profiles determined using the automated photovoltaic system and the four-probe technique indicate that the photovoltaic system is adequate for production screening and incoming inspection of high-resistivity float-zoned silicon slices.

714,066
PB80-120231 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Measurement Technology: Progress Report, October 1, 1976 to March 31, 1977.
Interim progress rept. 1 Oct 76-31 Mar 77,
W. M. Bullis. Nov 79, 99p NBS-SP-400-38
ARPA Order-2397
See also report dated Apr 76, PB-251 844. Sponsored in part by Defense Nuclear Agency, Washington, DC., Defense Advanced Research Project Agency, Arlington, VA., and Department of Energy, Washington, DC.

Keywords: *Semiconductors, *Semiconductor devices, *Quality control, *Tests, Nondestructive tests, Electrical resistance, Photolithography, Semiconductor doping, Measurement, Wafers, Silicon, Inspection.

This progress report describes NBS activities directed toward the development of methods of measurement for semiconductor materials, process control, and devices. Both in-house and contract efforts are included. The emphasis is on silicon device technologies. Principal accomplishments during this reporting period included (1) refinement and extension of the analysis of the nondestructive, photovoltaic method for measuring radial resistivity variation of silicon slices; (2) development of a donor-addition technique for testing for the presence of X-levels in indium-doped silicon; (3) development of a precision, wet chemical etching procedure for use in conjunction with x-ray photoelectron spectroscopy for profiling silicon dioxide-silicon interfaces; (4) completion of thermodynamic calculations of equilibrium sodium density in oxidation atmospheres contained in polycrystalline silicon tubes; (5) initial extensions of the line-width measurement procedure to partially transparent and reflecting specimens and to submicrometer dimensions; and (6) completion of the development of a test pattern for characterizing a large-scale-integration, silicon-on-sapphire process. Also reported is other ongoing work on materials characterization by electrical and physical analysis methods, materials and procedures for wafer processing, photolithography, test patterns, and device inspection and test procedures. Supplementary data concerning staff and publications are included as appendices.

714,067
PB80-126428 Not available NTIS
National Bureau of Standards, Washington, DC.
Space Applications of Superconductivity.
Final rept.,
D. B. Sullivan, and J. W. Vorreiter. Nov 79, 5p
Contract NASA-A-437018(JM)
Pub. in Cryogenics, p627-631, Nov 79.

Keywords: *Superconductivity, *Spacecraft instruments, Utilization, Digital systems, Superconducting magnets, Detectors, Cavity resonators, Reprints.

This is the first of a seven part series on the potential applications of superconductivity in space. The series considers six classes of superconducting instrumentation for space applications; high field magnets, low frequency sensors, digital electronics, microwave and infrared detectors, instruments for gravitational studies, and high-Q cavities. This introductory article provides background information for the study and briefly summarizes the contents of the articles which follow. This series is derived from a study supported by NASA and, as such, contains some speculation about ultimate instrument performance levels and future space missions.

714,068
PB80-132756 Not available NTIS
National Bureau of Standards, Washington, DC.
Face Dependence of the Spin Polarization of Photoelectrons from NEA GaAs (100) and (110).
Final rept.,
D. T. Pierce, G. C. Wang, and R. J. Celotta. 1 Aug 79, 3p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Appl. Phys. Lett. 35, n3, p220-222, 1 Aug 79.

Keywords: *Photoelectrons, *Polarization(Spin alignment), *Gallium arsenides, Photoelectric emission, Surface properties, Crystal structure, Reprints, EV range 01-10, Affinity.

Measurements of the spin polarization P of photoelectrons from negative electron affinity (NEA)GaAs(100) are presented. It is found that P = 43% at a photon energy of 1.57 eV. This contrasts with a maximum P = 21% measured by Erbudak and Reihl for NEA GaAs(110), which led them to conclude that NEA and high P exclude each other. This difference in P is important for sources of polarized electrons employing photoemission from GaAs. It is suggested that the origin of this difference may be connected with differences in the photoelectron emission process at the two faces, as calculated by Burt and Inkson.

714,069
PB80-135015 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.

Diffusion and Self-Diffusion Process in CdTe.HgTe,
F. A. Zaitov, L. A. Bovina, and V. A. Stofeev. 1979, 9p TT-79-58160, DMDC-18652
Trans. of Vsesoniznoe Soveshchanie Prob. Fiz. Soedinenie, Vilnius (USSR) v6 p165-169 1972. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Diffusion, Cadmium tellurides, Mercury tellurides, Semiconductor doping, Gold, Indium, Tin, Mercury, Diffusion coefficient, Translations, *Self diffusion, *Cadmium mercury tellurides, N-type conductors, P-type conductors, Temperature dependence, Pressure dependence.

The diffusion of Au, In, and Sn isotopes in CdTe-HgTe is measured in specimens of n- and p-type conductivity in the temperature range 200 to 450C for 24 to 100 hours. The self-diffusion of Hg was also measured. Diffusion coefficients were determined as a function of partial pressures and homogenizing heat treatments. Sectioning of the specimens was through mechanical grinding. Mathematical expressions were arrived at from the experimental data.

714,070
PB80-138662 Not available NTIS
National Bureau of Standards, Washington, DC.
Statistical Aspects of Fatigue at Microscopic, Specimen, and Component Levels.
Final rept.,
J. T. Fong. 1979, 30p
Pub. in Proceedings of the ASTM-NBS-NSF Fatigue Mechanisms Symposium, Kansas City, Missouri, May 1978, American Society for Testing and Materials, Special Technical Publication 675, p729-758 1979.

Keywords: *Fatigue(Materials), Mathematical models, Microstructure, Corrosion fatigue, Statistical analysis, Stress analysis.

The study of fatigue mechanisms at the microscopic level is examined. The complexity of the microstructure and the availability of quantitative microscopy concepts created a need to introduce statistical tools to the fundamental aspcts of fatigue research. Examples of the corrosion fatigue of high-strength steel, the bending fatigue of currency paper, and the swelling of nuclear fuel elements are used to illustrate this new viewpoint. The statistical concept of stress in a medium with distributed voids or other geometric imperfections is introduced to permit the use of models different from the conventional continuum viewpoint. The concept of a nested model and the incorporation of a size effect in the study of fatigue at three microscopic levels and three macroscopic (specimen, component, structure) levels are discussed.

714,071
PB80-140924 Not available NTIS
National Bureau of Standards, Washington, DC.
Superconductive Fixed Points for Temperatures Above 0.5 K.
Final rept.,
J. F. Schooley. 1979, 3p
Pub. in Proceedings Comite Consultatif de Thermometrie Meeting (12th), Held at Sevres, France on May 9-10, 1978, Annexe T8, pT86-T88 (Bureau International des Poids et Mesures, Pavillon de Breteuil, Sevres, France, 1979).

Keywords: *Critical temperature, *Temperature measurement, Superconductivity, Niobium, Intermetallics, Niobium intermetallics, Tin intermetallics, Vanadium intermetallics, Gallium intermetallics, Superconductors, Transition temperature, Cryogenics, Metrology, Ultralow temperature.

This paper is a progress report on the National Bureau of Standards study of superconductive temperature reference points above 0.5K. Reproducibility of critical temperatures for Nb, Nb3Sn, and V3Ga has been studied.

714,072
PB80-141096 Not available NTIS
National Bureau of Standards, Washington, DC.
Two-Probe (Spreading Resistance) Measurements for Evaluation of Semiconductor Materials and Devices.
Final rept.,
J. R. Ehrstein. 1979, 66p
Pub. in Proceedings of the Conference on NATO Advanced Study Institute on Nondestructive Evaluation of Semiconductor Materials and Devices, Villa Tuscolano, Italy, September 19-29, 1978, Chapter 1 in Nondestructive Evaluation of Semiconductor Materials and Devices, J. N. Zemel, Ed., p1-66 1979.

Keywords: *Silicon, *Electrical resistivity, Measurement, Semiconductors(Materials), Semiconductor devices, Semiconductor doping.

This paper, based on a survey of the literature, presents an overview of the spreading resistance technique for measuring resistivity variations in silicon. It begins with the simple model of ohmic constriction resistance and deviations from this model which are typically experienced. It then extensively covers the state of empirical knowledge regarding specimen and instrument conditions which affect the reliability of the measurement. A description of the formal physical models of the spreading resistance contact ensues. It is noted that when depth profiles of resistivity are required, it is usually necessary to deconvolute data to account for the sampling volume of the spreading resistance probe being larger than the desired data resolution scale. The development of several mathematical schemes to effect this deconvolution is outlined. Finally, borrowing heavily from the literature, numerous examples of applied spreading resistance measurements are given, with emphasis on comparison of resistivity or doping profiles by spreading resistance with those by other profiling techniques common to the semiconductor industry.

714,073
PB80-141690 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Magnetization of Ferromagnetic Ni(110): A Polarized Low-Energy Electron Diffraction.
Final rept.,
R. J. Celotta, D. T. Pierce, G. C. Wang, S. D. Bader, and G. P. Felcher. 3 Sep 79, 4p
Prepared in cooperation with Department of Energy, Washington, DC. and Office of Naval Research, Washington, DC.
Pub. in Phys. Rev. Lett., v43 n10 p728-731, 3 Sep 79.

Keywords: *Nickel, *Magnetization, Ferromagnetic materials, Surface properties, Critical temperature, Electron diffraction, Reprints, Temperature dependence.

The magnetic field dependence (hysteresis curve) and the temperature dependence of the magnetization ata NI(110) surface was measured by polarized low-energy electron diffraction. The diffracted intensities are spin dependent by a few percent. The temperature dependence of the surface magnetization measured in the range $0.5<T/T(c)<0.8$, is significantly different from that of the bulk.

714,074
PB80-144231 Not available NTIS
National Bureau of Standards, Washington, DC.
Amorphous Magnetic Rare Earth Alloys.
Final rept.,
J. J. Rhyne. 1979, 36p
Pub. in Chapter 16 in Handbook on the Physics and Chemistry of Rare Earths, p259-294 1979.

Keywords: *Rare earth alloys, *Magnetic materials, Magnetic properties, Phase transformations, Atomic structure, Amorphous state.

This article reviews experimental and theoretical aspects of amorphous rare earth alloys. Special emphasis is placed on atomic structure determination and models, magnetic behavior, and the magnetic phase transition in these alloys.

714,075
PB80-147101 Not available NTIS
National Bureau of Standards, Washington, DC.
Bistability Effects in Cooperative Multiphoton Ionisation.
Final rept.,
L. Armstrong. 1979, 5p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Journal of Physics B Letters to Ed. 12, n23, pL719-L723 1979.

Keywords: *Ionization, Photons, Rates(Per time), Reprints, *Photoionization, Bistability.

Using the Bonifacio-Lugiato model of bistability, it is shown that bistability in a collective atomic system will greatly affect the multiphoton ionisation rate of that system. Results are shown corresponding to two possible experimental measurements.

714,076
PB80-150550 Not available NTIS
National Bureau of Standards, Washington, DC.
Radiation from Charged Particles Passing Through Crystals.
Final rept.,
H. Mendlowitz, and S. J. Glass. 1 Oct 79, 3p
Pub. in Journal of Physical Letter 73A, n4, p363-365, 1 Oct 79.

Keywords: Charged particles, Electromagnetic radiation, Crystals, *Channeling, Recoils.

Expressions are presented for the radiation from charged particles passing through a crystal. Two cases are considered: (1) where there is no crystal recoil; (2) where the particle is initially moving parallel to the planes perpendicular to the crystal recoil.

714,077
PB80-154925 Not available NTIS
National Bureau of Standards, Washington, DC.
Stability of Rods with Anisotropic Surface Free Energy.
Final rept.,
J. W. Cahn. Sep 79, 3p
Pub. in Scr. Metall. 13, n11 p1069-1071 Sep 79.

Keywords: *Single crystals, Stability, Rods, Surface energy, Anisotropy, Reprints.

The stability of a long single crystal rod with respect to thickness variations by diffusional redistribution of matter is strongly affected by surface free energy anisotropy. The implications for composite stability and for measurement of surface energy anisotropy is briefly discussed.

714,078
PB80-157571 Not available NTIS
National Bureau of Standards, Washington, DC.
Quantum Scattering Theory of Electron-Stimulated Desorption: Ion Angular Distributions.
Final rept.,
W. L. Clinton. 10 Oct 77, 4p
Pub. in Phys. Rev. Lett., v39 n15 p965-968, 10 Oct 77.

Keywords: *Desorption, Electron scattering, Ions, Angular distribution, Scattering cross sections, Anisotropy, Reprints.

This Letter presents a quantum scattering theory of electron stimulated desorption and applies it to recent observations of ion angular distributions. The Franck-Condon desorption cross section is calculated in a three-dimensional reflection approximation. It is shown that the adsorption models suggested by Madey, Czyzewski, and Yates, which attribute anisotropy in the angular distributions to initial-state effects, are consistent with the theory and the data.

714,079
PB80-157852 Not available NTIS
National Bureau of Standards, Washington, DC.
Observation of Unequal Densities for Sulfur Defects in Silicon Predeposited by Low Fluence Ion Implantation.
Final rept.,
D. R. Myers, and W. E. Phillips. 1979, 8p
Sponsored in part by Department of Energy, Washington, DC. and Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Jnl. Electron. Mater., v8 n6 p781-788, 1979.

Keywords: *Silicon, *Crystal defects, Sulfur isotopes, Ion implantation, Density(Number/volume), Depth, Isotope effect, Capacitance, Thermal conductivity, Reprints, Sulfur 32, Sulfur 34.

The dynathermal current and capacitance responses of two isotopes of sulfur, 32S and 34S, predeposited by low fluence ion implantation into silicon pn junction diodes are presented. As opposed to all previous studies, in this work unequal densities are seen for the shallow and deep sulfur defects, for both the 32S- and 34S-related defects. Additionally, the dynathermal response of the deep 34S center is seen to exhibit a shift of 3 K from that of 32S at a fixed heating rate of 9.5 + or - 0.1 K/s, consistent with the isotope dependence of the thermal emission process observed earlier for these centers by isothermal capacitance measurements.

714,080
PB80-159130 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Spectroscopy and Surface Chemical Bonding.
Final rept.,
T. N. Rhodin, and J. W. Gadzuk. 1979, 160p
Sponsored in part by National Science Foundation, Washington, DC., and Cornell Materials Science Center, Ithaca, NY.
Pub. in Chapter 3 in The Nature of the Surface Chemical Bond, p113-273 1979.

Keywords: *Surface chemistry, Adsorption, Chemical bonds, Photoelectron emission, Ultraviolet radiation, X rays, Auger electrons, Electron energy, *Electron spectroscopy.

The theory of four electron spectroscopies, widely used in the study of chemical bonding of adsorbates to solid surfaces, is outlined. Both single electron (matrix element) and many-body aspects of ultraviolet and x-ray photoemission, Auger electron, and electron energy loss spectroscopies are discussed.

714,081
PB80-159148 Not available NTIS
National Bureau of Standards, Washington, DC.
Does Chemisorbed Carbon Monoxide Dissociate on Rhodium.
Final rept.,
J. T. Yates, E. D. Williams, and W. H. Weinberg. 1980, 9p
Sponsored in part by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Surface Science 91, p562-570 1980.

Keywords: *Carbon monoxide, *Rhodium, *Dissociation, Surface chemistry, Chemisorption, Desorption, Reprints.

Isotopic exchange measurements have shown that at surface temperatures below 800K, the upper limit on the probability of dissociation/recombination of CO on Rh(111) is approximately .001. Related Auger spectroscopic measurements, monitoring the accumulation of atomic carbon on the surface, have shown that the maximum probability of dissociation of CO per collision with the Rh surface in a temperature range between 300 and 870K is .0001. Hence, it has been demonstrated that the probability of dissociation of CO on Rh(111) is negligible compared to the probability of molecular desorption, in contrast to recent reports in the literature concerning both polycrystalline Rh and stepped surfaces of Rh.

714,082
PB80-163967 Not available NTIS
National Bureau of Standards, Washington, DC.
Space Applications of Superconductivity: Low Frequency Superconducting Sensors.
Final rept.,
J. E. Zimmerman. Jan 80, 8p
Contract NASA-A-437018(JM)
See also report dated Nov 79, PB80-126428.
Pub. in Journal of Cryogenics 20, n1, p3-10, Jan 80.

Keywords: *Superconductivity, *Spacecraft instruments, Utilization, Detectors, Magnetometers, Magnetic measurement, Magnetic instruments, Reprints, *SQUID devices.

This is the third of a seven part series on the potential applications of superconductivity in space. Superconducting quantum interference devices (SQUIDs) are used in highly-sensitive magnetometers and gradiometers. They are superior to all other magnetic sensors in sensitivity, frequency response, range, and linearity. They are potentially useful for measuring low-level magnetic field variations in space, such as fluctuations in the solar wind and small- or large-scale spacial anomalies of planetary fields. They are useful also as galvanometers and amplifiers, particularly for applications requiring extreme voltage sensitivity such as, for example, low-impedance bolometer amplifiers. In connection with low-frequency sensors, superconductivity provides some adjunct devices, namely perfect magnetic shields and flux transformers, the latter being used for a number of purposes including construction of fairly elaborate gradiometer pickup-loop arrays.

714,083
PB80-171119 Not available NTIS
National Bureau of Standards, Washington, DC.
Acoustic Matching of Superconducting Films to Substrates.
Final rept.,
S. B. Kaplan. 1979, 23p
Sponsored in part by National Research Council, Washington, DC., and Office of Naval Research, Washington, DC.
Pub. in Journal of Low Temperature Physics 37, nos. 3/4, p343-365 1979.

Keywords: *Superconductors, Substrates, Matching, Coefficients, Films, Reprints.

Acoustic mismatch theory is used to estimate phonon transmission coefficients for various superconductor/substrate interfaces. It is shown that the conventionally employed substrates offer the largest acoustic mismatch to many of the commonly studied superconductors, thereby leading to unnecessarily large phonon-trapping and other nonequilibrium effects. Most available experimental results are shown to be in reasonable agreement with the theoretical estimates.

714,084
PB80-171127 Not available NTIS
National Bureau of Standards, Washington, DC.
Alignment Effects on Implantation Profiles in Silicon.
Final rept.,
D. R. Myers, and R. G. Wilson. 1979, 9p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings of a Conference on Ion Beam Modification of Materials, Budapest, Hungary, September 4-8, 1978, p103-111 1979.

Keywords: *Silicon, Semiconductor doping, Alignment, Profiles, *Ion implantation.

Ion implantation is commonly used for the fabrication of fine geometry semiconductor devices. The need for shallower active layers in these devices requires that the extent of ion channeling be minimized to reduce the formation of deeply penetrating tails in the dopant distribution. In this paper, ion channeling in silicon is experimentally examined for a range of ion atomic numbers and implant energies characteristic of semiconductor device fabrication.

714,085
PB80-171143 Not available NTIS
National Bureau of Standards, Washington, DC.
Atomic Model of Strain Induced Martensitic Transformations.
Final rept.,
D. E. MacDonald. Mar 80, 6p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Proceedings of the International Conference on Martensitic Transformations ICOMAT 1979, Cambridge, Massachusetts, June 24-29, 1979, p325-330, Massachusetts Institute of Technology, Cambridge, Mar 80.

Keywords: *Alkali metals, Deformation, Phase transformations, Face centered cubic lattices, Body centered cubic lattices, Solid phases, Stability, Strains, *Martensitic transformation.

A jellium model of the alkali metals applicable to finite deformation is employed in the determination of the uniaxial extensions and contractions which trigger the martensitic transformation (bcc yields fcc) and the reverse transformation. A Born stability criteria based on infinitesimal elasticity is used to detect the onset of the transformation during a homogeneous deformation along (001). The symmetry and lack of it between the (bcc yields fcc) transformation and its reverse is explained in terms of the effect of the deformation on the volume and structure dependent terms in the expressions for the effective elastic coefficients. The finite values found for the uniaxial strains necessary for the transformations substantiates the need for a model which can sustain such deformations.

714,086
PB80-171150 Not available NTIS
National Bureau of Standards, Washington, DC.
Implantation Predeposition Technique for the Introduction of Deep-Level Chemical Impurities.
Final rept.,
D. R. Myers, R. Y. Koyama, and W. E. Phillips. 1979, 10p
Sponsored in part by Department of Energy, Washington, DC., and Defense Advanced Research Project Agency, Arlington, VA.
Pub. in Proceedings of a Conference on Ion Beam Modification of Materials, Budapest, Hungary, September 4-8, 1978, p439-448 1979.

Keywords: *Semiconductor doping, Semiconductors(Materials), Impurities, Silicon, Sulfur, Crystal defects, *Ion implantation, Sulfur additions.

The characterization of deep-level chemical impurity centers in semiconductors requires the controlled introduction of known impurities. A technique is described which employs ion implantation as a predeposition step for the introduction of deep-level chemical impurities into silicon, yet prevents implantation-related damage from interfering with the measured deep-level response of the implanted species. The utility and versatility of this method are demonstrated by its application to the characterization of sulfur defect centers in silicon.

714,087
PB80-174048 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
NBS Reactor: Summary of Activities July 1978 to June 1979.
Final rept.,
F. J. Shorten. Apr 80, 238p NBS-TN-1117

Keywords: *Neutron beams, *Research projects, Nuclear research and test reactors, Neutron irradiation, Neutron activation analysis, Materials tests, Isotopes, Radiation effects, Neutron radiography, Nondestructive tests, NBSR reactor, Isotope production.

This report summarizes all those programs which depend on the NBS reactor. It covers the period from July 1978 through June 1979. The programs range from the use of neutron beams to study the structure and dynamics of materials through nuclear physics and neutron standards to sample irradiations for activation analysis, isotope production, radiation effects studies, neutron radiography, and nondestructive evaluations.

714,088
PB80-175417 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Development of Standards for Superconductors.
Annual rept. for FY 1979,
F. R. Fickett, and A. F. Clark. Dec 79, 46p NBSIR-80-1629
Contracts DE-PR01-79ET52052, DE-PR02-79ET26603
Sponsored in part by Massachusetts Inst. of Tech., Cambridge.

Keywords: *Superconductors, *Standards, Losses, Critical temperature, Critical current.

Practical superconductors are complex materials and the determination of the parameters required for designing with them is a difficult task. Many approaches are possible for determining a given parameter and the results depend critically on which one is chosen. The goal of this program is to arrive at a set of useful voluntary standards for measurements on modern practical superconductors that will be acceptable to both manufacturers and users. Agreement on a set of standard definitions for the various parameters is also necessary. This report describes the status of the program and includes a brief historical introduction. The need for standards in this area is described in detail with particular attention paid to the need for consensus among all interested parties and the techniques for achieving it. Results from the experimental research by NBS and a review of the wire manufacturers' programs are presented.

714,089
PB80-178007 Not available NTIS
National Bureau of Standards, Washington, DC.
Ground State Excitations in $HoCo_2$.
Final rept.,
J. J. Rhyne, N. C. Koon, and B. N. Das. 1979, 2p
Pub. in Journal of Mag. Magn. Mater. 14 p273-174 1979.

Keywords: *Cobalt intermetallics, Excitation, Ground state, Intermetallic compounds, Holmium compounds, Single crystals, Cryogenics, Greens function, Neutron scattering, Inelastic scattering, Reprints, *Holmium intermetallics, *Spin, Laves phases, Crystal field.

Spin excitations in a single crystal of the Laves phase compound HoCo2 have been studied using inelastic neutron scattering. At 4K three modes are observable: an in-phase spin precision acoustic mode and two out-of-phase optic modes involving the rare earth spins. A self-consistent Green's function RPA theory has been used to analyze the data and obtain exchange and crystal field parameters.

714,090
PB80-178015 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic Properties of the Superconducting Alloy System (Ce(1-c)Ho(c))Ru2--A Neutron Scattering Study.
Final rept.,
J. W. Lynn, and C. J. Glinka. 1979, 2p
Pub. in Journal of Mag. Magn. Mater. 14 p179-180 1979.

Keywords: *Superconductors, *Rare earth alloys, Cerium alloys, Holmium alloys, Ruthenium alloys, Magnetic properties, Cryogenics, Ferromagnetism, Neutron scattering, Reprints, Holmium ions, Temperature dependence, Crystal field.

Neutron scattering measurements have been carried out on the superconducting alloy system (Ce(1-c)Ho(c))Ru2 for c=0.10, 0.32 and 0.38 as a function of temperature and magnetic field. The observed crystal-field transitions for all concentrations are found to be very similar and can be understood on the basis of a cubic crystal field acting on the Ho(3+) (J=8), with W=+0.03 meV and x=-0.3. The Ho ground state is thus established to be the magnetic Gamma(5) triplet over the entire composition range of interest. Small-angle scattering data taken on an alloy with 38% Ho, in which a conventional ferromagnetic transition was anticipated, show that indeed ferromagnetic correlations develop at low temperatures. However, no characteristic peak in the intensity vs. temperature was observed; rather the intensity at small wavevectors Q continues to increase slowly down to the lowest temperatures attained (1.05K), while little intensity change is observed below about T=2K at larger Q (0.05 yields 0.15/A).

714,091
PB80-178098 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultraviolet Photoelectron Spectroscopy of Pd-Si Glasses.
Final rept.,
B. J. Waclawski, and D. S. Boudreaux. 1980, 3p
Pub. in Solid State Commun., v33 p589-591 1980.

Keywords: Photoelectric emission, Ultraviolet spectroscopy, Glass, Reprints, *Palladium silicides, *Copper palladium silicides, Amorphous state.

In order to determine systematic changes in the density of states with alloy composition, photoelectron spectra at h nu = 21.2 eV were measured for several amorphous alloys based on the well-known Pd-Si glass system. Three binary alloys with 15, 20, and 25 at. % Si, two ternaries, Pd80 Si17 Cu3 and Pd 80 Si14 Cu6, and polycrystalline Pd were analyzed. Compared to Pd, both the density of states at the Fermi energy and the d-band width are reduced in the glasses. The d-bands display an overall shift of 0.4 eV over the range of alloy compositions studied. Partial agreement with recent density of state calculations was obtained.

714,092
PB80-178122 Not available NTIS
National Bureau of Standards, Washington, DC.
Bound Hole Pairs in Ni: Evidence from Photoemission.
Final rept.,
D. R. Penn. Nov 79, 3p
Pub. in Jnl. Appl. Phys., v50 n11 p7480-7482 Nov 79.

Keywords: *Nickel, *Holes(Electron deficiencies), Photoelectric emission, Band structure of solids, Reprints.

It is shown that the Ni d-band density of states contains a peak due to excitations of bound hole pairs. The density of states is observed directly in photoemission experiments which show a satellite peak below the bottom of the d bands.

714,093
PB80-178841 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic Correlations and Crystal-Field Levels in the Superconductor (Ce(0.73)Ho(0.27))Ru2.
Final rept.,
J. W. Lynn, D. E. Moncton, L. Passell, and W. Thomlinson. Jan 80, 3p
Sponsored in part by Department of Energy, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Phys. Rev. B 21, n1 p70-78, 1 Jan 80.

Keywords: Superconductors, Magnetic properties, Intermetallics, Neutron scattering, Ferromagnetism, Reprints, *Ruthenium intermetallics, *Cerium intermetallics, *Holmium intermetallics, Temperature dependence.

Neutron scattering studies have been carried out to investigate the atomic magnetic properties of the magnetic superconductor Ce(0.73)Ho(0.27)Ru2. At low temperatures the appearance of elastic or quasielastic magnetic scattering at small momentum transfers is observed, indicating the development of ferromagnetic correlations. The temperature and wave-vector dependence of this scattering can be described to a good approximation by an Ornstein-Zernike correlation function over the entire range of wave vectors (0.035-0.20/A) and temperatures (0.05-4.2K) explored.

714,094
PB80-183874 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Measurement Technology: Technical Impediments to a More Effective Utilization of Neutron Transmutation Doped Silicon for High-Power Device Fabrication.
Final rept.,
D. R. Myers. May 80, 38p NBS-SP-400-60
Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems. Library of Congress Catalog card no. 80-600047.

Keywords: *Semiconductor doping, *Neutron irradiation, Silicon, Thyristors, Radiation damage, Semiconductor devices, Fabrication, *Neutron transmutation doping.

Neutron transmutation doping (NTD) is a promising technique for the production of uniformly doped silicon needed to optimize power device performance. This report summarizes the problems involved in the neutron transmutation doping process and elaborates the concerns related to damage in transmutation doped silicon resulting from the neutron irradiation. Suggestions for future research are presented.

714,095
PB80-185531 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
NBS Semiconductor Technology Program and VLSI (Very Large Scale Integration),
W. M. Bullis, and R. I. Scace. Jun 80, 11p NBSIR-80-2057

Keywords: *Integrated circuits, *Semiconductors, Technology, Metrology, Very large scale integration, National Bureau of Standards.

The Semiconductor Technology Program at NBS is described briefly; several examples of past successful programs and their significance are given. The work is planned to be expanded significantly beginning in FY 1981. An outline of the present plans for this expansion to cover the problems of very large scale integration (VLSI) is presented.

714,096
PB80-188501 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Diffuse-Scattering Intensities in Niobium.
Final rept.,
J. M. Rowe, and A. Magerl. 15 Feb 80, 2p
Pub. in Phys. Rev. B, 21, n4 p1706-1707, 15 Feb 80.

Keywords: *Niobium, *Neutron scattering, Oxygen, Nitrogen, Impurities, Reprints, Doped materials.

New neutron diffuse-scattering data on pure Nb and on Nb doped with N impurities are presented and compared to the results shown previously by Chang and Colella. The new data show that the effects previously observed in nominally pure Nb can be explained as arising from small concentrations of O or N impurities.

714,097
PB80-188519 Not available NTIS
National Bureau of Standards, Washington, DC.
Recent Advances in Polarized Electron Sources.
Final rept.,
D. T. Pierce, and R. J. Celotta. 27 Mar 80, 1p
Pub. in Nature 284, p308, 27 Mar 80.

Keywords: *Electron emitters, *Polarization(Spin alignment), Tungsten, Ferromagnetic materials, Europium compounds, Sulfur inorganic compounds, Gallium arsenides, Photoelectric emission, Electron beams, Reprints, Europium sulfides.

A recent Nature article discussed atomic physics based sources of polarized electrons and the fact that beams of electrons become polarized as they circulate in a storage ring. The discussion is now extended to include recent advances in solid state sources of polarized electrons. Field emission from tungsten covered with a ferromagnetic Europium sulfide film provides a very bright source of polarized electrons. Photoemission from negative electron affinity GaAs provides the most intense source and the polarization can be easily modulated. The GaAs polarized electron source is very versatile and has been applied in areas as diverse as high energy physics and surface physics.

714,098
PB80-188527 Not available NTIS
National Bureau of Standards, Washington, DC.
Ising Models for Order-Disorder Transition in an Adsorbed Overlayer.
Final rept.,
T.-M Lu. 1980, 6p
Pub. in Surf. Sci. 93 pL111-L116 1980.

Keywords: Antiferromagnetism, Phase transformations, Spin spin interactions, Reprints, *Antiferromagnetic materials, *Order-disorder transformations, Ising model.

Based on a 2D zero field anti-ferromagnetic Ising model, a relation is obtained between the angular distribution of intensity of a LEED superlattice beam from an adsorbed lattice gas with nearest-neighbor repulsive interaction and the spin--spin correlation functions in the Ising model.

714,099
PB80-188550 Not available NTIS
National Bureau of Standards, Washington, DC.
Measuring Trace Elements in Semiconductors: Methods and Pitfalls.
Final rept.,
R. M. Lindstrom. 1980, 6p
Pub. in Proceedings of Photovoltaic Material and Device Measurement Workshop, Focus on Polycrystalline Thin Film Cells, Arlington, VA. June 11-13, 1979, Sol. Cells 1, n2 p117-122 1979/80.

Keywords: *Quantitative analysis, *Semiconductors(Materials), Impurities, Accuracy, Concentration(Composition), Microanalysis, Trace amounts.

A quantitative understanding of the electrical behavior of semiconductors requires quantitative knowledge of impurities at concentrations as small as one part per billion. Methods available for trace measurements at this level are few in number; for many constituents there are no routine, inexpensive, and reliably accurate methods. If the sample of interest is a thin film on a substrate, the mass of sample is small and the difficulties of microanalysis are added to those of trace analysis. Nearly all methods available for approaching this problem rely on physical rather than chemical reactions. The sample is probed with an external stimulus and the response to this stimulus is then detected. Desirable properties of a method are high sensitivity to the signal from the component sought, insensitivity to the presence of uninteresting factors such as the matrix, and a response related to the stimulus by a known factor of proportionality.

714,100
PB80-190671 Not available NTIS
National Bureau of Standards, Washington, DC.
GaAs Spin Polarized Electron Source.
Final rept.,
D. T. Pierce, R. J. Celotta, G.-C. Wang, W. N. Unertl, A. Galejs, C. E. Kuyatt,, and S. R. Mielczarek. Apr 80, 22p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Rev. Sci. Instrum. 51, n4 p478-499 Apr 80.

Keywords: *Electron emitters, *Polarization(Spin alignment), *Gallium arsenides, Electron optics, Photoelectrons, Photoelectric emission, Electron diffraction, Tungsten, Nickel, Ferromagnetic materials, Reprints.

The design, construction, operation, and performance of a spin polarized electron source utilizing photoemission from negative electron affinity (NEA) GaAs are presented in detail. A polarization of 43 + or - 2% is produced using NEA GaAs (100). The polarization can be easily modulated without affecting other characteristics of the electron beam. The light optics, electron optics, and cathode preparation including the GaAs cleaning and activation to NEA are discussed in depth. The origin of the spin polarization in the photoexcitation process is reviewed and new equations describing the depolarization of photoelectrons in the emission process are derived. Quantum yield and polarization measurements for both NEA and positive electron affinity surfaces are reported. The important considerations for interfacing the polarized electron source to an experiment are illustrated by its application to polarized low energy electron diffraction (PLEED). The advantages of this spin polarization modulated electron gun for PLEED are clearly demonstrated by sample PLEED results for W(100) and ferromagnetic Ni(110). A comparison with other polarized electron sources shows that the GaAs spin polarized electron source offers many advantages for a wide range of applications.

714,101

PB80-191521 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Technology Program, Progress Briefs,
W. M. Bullis. Apr 80, 17p NBSIR-80-2006

Keywords: *Semiconductors, Technology, Semiconductor doping, Diffusion, Semiconductor devices, Silicon, Infrared detectors.

This report provides information on the current status of NBS work on measurement technology for semiconductor materials, process control, and devices. Results of both in-house and contract research are covered. Highlighted activities include: modeling of diffusion processes, analysis of spreading resistance measurements, and studies of resonance ionization spectroscopy, resistivity-dopant density relationships in p-type silicon, infrared detector materials, photoresist sensitometry, power transistor switching characteristics, and gross leak testing and application of an electrical alignment test structure. Brief descriptions of selected on-going projects are included, and recent publications and publications in press are listed. The report is not meant to be exhaustive; contacts for obtaining further information are listed.

714,102

PB80-199516 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
User Evaluation of Crystal Data Products and Services: Questionnaire Analysis and Impact.
Final rept.,
J. K. Stalick, A. D. Mighell, and R. J. Boreni. Jun 80, 44p NBS-TN-1112

Keywords: *Crystal structure, Information retrieval, Performance evaluation, Questionnaires, *Crystal Data Center, National Bureau of Standards.

A survey was made of the needs of the users of Crystal Data Determinative Tables and related products and services of the NBS Crystal Data Center. The results indicate a high frequency of use of Crystal Data, with particular application materials analysis and design. The survey suggests a need for the development of a rapid and inexpensive method of unit-cell determination as well as education of the scientific community in the use of the single-crystal method for identification of unknown materials. More complete coverage and consolidation of entries are also suggested. The necessity for computer-based methods of data base dissemination is indicated, with particular importance for research applications.

714,103

PB80-199904 Not available NTIS
National Bureau of Standards, Washington, DC.
High Temperature Crystals: Limitations on the Phonon Description.
Final rept.,
R. A. MacDonald, and R. D. Mountain. 1980, 4p
Pub. in Proceedings of International Conference on Phonon Scattering in Condensed Matter (3rd), Brown University, Providence, RI, August 28-31, 1979, Paper in Phonon Scattering in Condensed Matter, p137-140 1980.

Keywords: *Rubidium, *Specific heat, Monte Carlo method, Phonons, High temperature.

The Monte Carlo method has been used to calculate the energy, pressure, and specific heat at constant volume, (C sub v), for model of rubidium. This calculation for a fully anharmonic perfect crystal, is a necessary step in understanding the anomalous behavior of the specific heat at high temperatures. The results may point to an explanation for the breakdown of the phonon description.

714,104

PB80-200389 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin and Energy Analyzed Photoemission: A Feasibility Analysis.
Final rept.
D. T. Pierce, C. E. Kuyatt, and R. J. Celotta. Nov 79, 7p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Review of Scientific Instruments 50, n11 p1467-1473 Nov 79.

Keywords: *Photoelectric emission, *Polarization(Spin alignment), Electron optics, Photoelectrons, Electron spin, Experimental design, Feasibility, Magnetic properties, Reprints, Magnetism.

New scientific opportunities, particularly for investigation of surface magnetism, will be provided by spin and energy analyzed photoemission. Electron-optical conservation laws and phase space concepts are summarized and applied to determine the feasibility of an experiment consisting of a photoemitter in a magnetic field, a photoelectron energy analyzer and an electron spin analyzer. For the example of photoemission from a Ni crystal using He resonance radiation and typical parameters for the energy and spin analyzers, a final signal count rate of approximately 220 counts/s is calculated. Ways to increase the count rate by orders of magnitude are described. In particular, a new experimental configuration is suggested which may avoid the large reduction in count rate caused by the magnetic field.

714,105

PB80-200397 Not available NTIS
National Bureau of Standards, Washington, DC.
Polarized LEED Study of Surface Magnetism.
Final rept.,
D. T. Pierce, R. J. Celotta, G.-C. Wang, G. P. Felcher, S. D. Bader, and K. Miyano. 1980, 5p
Sponsored in part by Office of Naval Research, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Jnl. Magnetism and Magnetic Materials 15, n18 p1583-1584 1980 (Proc. Int. Conf. on Magnetism, Held at Munich, Germany, F. R. on Sep 3-7, 1979).

Keywords: *Nickel, Surface properties, Ferromagnetic materials, Electron beams, Polarization(Spin alignment), Electron spin, Magnetic fields, *Magnetism.

The surface magnetization of ferromagnetic Ni(110) has been observed via the use of a spin polarized electron beam. The spin dependence of the scattered electron intensity was measured as a function of external magnetic field strength and temperature.

714,106

PB80-200488 PC **A24**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Accuracy in Powder Diffraction.
Final rept.,
S. Block, and C. R. Hubbard. Feb 80, 557p NBS-SP-567
Proceedings of a Symposium Held at the National Bureau of Standards, Gaithersburg, Maryland on June 11-15, 1979. Sponsored in part by International Union of Crystallography, and National Research Council of Canada, Ottawa (Ontarario). Library of Congress catalog no. 80-600010.

Keywords: *Lattice parameters, *Meetings, X ray diffraction, Neutron diffraction, Accuracy, Automation, *Powder patterns, *Powder diffraction.

The symposium was jointly sponsored by the NBS, the National Research Council of Canada, and the International Union of Crystallography. These proceedings contain a total of 24 invited and contributed abstracts. Many papers are followed by an edited discussion. The proceedings are divided into the following topics: Total Pattern, Instrumentation and Automation, Profile Fitting, Analysis of Peak Shape, Lattice Parameters and Indexing, Applications, and Future Opportunities in Powder Diffraction.

714,107

PB80-212376 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory and Application of a Two-Layer Hall Technique,
R. D. Larrabee, and W. R. Thurber. Jan 80, 8p
See also report dated Oct 78, PB-288 763.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices ED-27, n1 p32-36 Jan 80.

Keywords: *Silicon, *Hall effect, Electrical measurement, Electrical resistivity, Epitaxy, Semiconductor doping, Indium, Semiconductor junction, Substrates, Reprints.

The electrical characterization of epitaxial layers on substrates of the opposite conductivity type presents serious problems if the p-n junction at the interface has significant leakage current such that it cannot be used to effectively electrically isolate the two regions. In order to meet the need for nondestructively characterizing such structures, a modification of the conventional Hall technique was developed in which the Hall measurements are made simultaneously on both the epitaxial layer and its substrate, the interface impedance is measured, and the interaction between the two regions is modeled and taken into account. This can be used to verify those cases in which the perturbing effects of a high resistivity substrate are negligible, thus justifying conventional measurements on the epitaxial layer. In principle, it can be used to measure the resistivity and Hall coefficient of each layer separately if the assumptions of the model are realized in practice. The use of this technique is discussed and applied to the case of a thin n-type silicon epitaxial layer on: (1) a conducting substrate of indium-doped silicon that had a significant amount of leakage at the interface p-n junction and (2) a high resistivity silicon substrate that had negligible influence on the measurement of the Hall coefficient of the epitaxial layer.

714,108

PB80-212384 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Measurement Techniques for Determining Phosphorus Concentrations in Semiconductor Silicon,
W. R. Thurber. Mar 80, 10p
Pub. in Jnl. of Electronic Materials 9, n3 p551-560 Mar 80.

Keywords: *Silicon, Semiconductors(Materials), Phosphorus, Concentration(Composition), Density(Mass/volume), Measurement, Hall effect, Neutron activation analysis, Reprints.

Phosphorus densities in semiconductor silicon slices cut from 14 single crystal ingots have been determined by both electrical and analytical techniques. Hall effect measurements were made on specimens from all ingots, and junction capacitance-voltage measurements were made on specimens with densities up to about 5 x 10 to the 17th power/cu cm. Neutron activation analysis was used to measure phosphorus densities from 5 x 10 to the 15th power to 5 x 10 to the 19th power/cu cm and the photometric technique was used for densities greater than 10 to the 17th power/cu cm. A systematic discrepancy of about 15% between the photometric and neutron activation data is indicative of the interlaboratory agreement that might be realized in practice with these techniques.

714,109

PB80-212400 Not available NTIS
National Bureau of Standards, Washington, DC.

Interpretation of Hall Measurements,
R. D. Larrabee. Jul 80, 4p
Pub. in Jnl. of the Electrochemical Society 127, n7 p1640-1643 Jul 80.

Keywords: *Semiconductors(Materials), *Electrical measurement, *Hall effect, *Energy levels, *Silicon, Semiconductor doping, Indium, Reprints.

The temperature dependence of the Hall coefficient is the usual parameter measured to determine dopant energy levels and densities in semiconductors. However, this interpretation of Hall measurements is not necessarily unique. An example of current interest is indium-doped silicon, where a new acceptor level has been reported. It was found that the Hall data for an indium-doped silicon sample could be interpreted in two ways: one including, and the other without, the new level. A donor addition experiment was performed that clearly distinguished between these alternative explanations by supporting the new level interpretation and denying the alternative. It is suggested that donor addition is one example of a variety of techniques that can be used to supplement Hall measurements in order to resolve ambiguities of interpretation.

714,110
PB80-212418 Not available NTIS
National Bureau of Standards, Washington, DC.
Spreading Resistance Calibration for Gallium- or Aluminum-Doped Silicon,
J. R. Ehrstein. Jun 80, 2p
Contract DOE-EA-77-A-01-6010
Pub. in Jnl. of the Electrochemical Society 127, n6 p1403-1404 Jun 80.

Keywords: *Silicon, *Electrical resistivity, Calibrating, Semiconductor doping, Aluminum, Gallium, Boron, Thyristors, Measurement, Reprints.

The spreading resistance probes must be calibrated on specimens of known resistivity. The calibration response is known to depend on silicon crystallographic orientation, specimen conductivity type, and surface preparation. It has generally been assumed that there is no additional dependence upon the dopant atom species for either conductivity type, but the validity of the assumption has not previously been demonstrated. This paper reports a test of the assumption for the p-type dopants gallium, aluminum, and boron in the concentration range typical of their use in silicon thyristors. It is concluded that in this concentration range, no additional effect exists due to dopant atom species. Hence, calibration done only on boron doped silicon should be valid for analyzing measurements on aluminum or gallium doped silicon layers.

714,111
PB80-212426 Not available NTIS
National Bureau of Standards, Washington, DC.
Simple-Heating-Induced Josephson Effects in Quasiparticle-Injected Superconducting Weak Links,
S. B. Kaplan. Mar 80, 4p
Pub. in Jnl. of Applied Physics 51, n4 p1682-1685 Mar 80.

Keywords: Superconductivity, Elementary excitations, Tunneling(Electronics), Reprints, *Superconducting weak links, Quasi particles, Josephson effect.

The characteristics of quasiparticle-injected superconducting weak links containing films with short electron mean free paths have been studied. The behavior of these devices at $T = 4K$ is shown to be consistent with a spatially localized nonequilibrium state in which the electrons and the crystal lattice are at an elevated temperature $T^* > T$.

714,112
PB80-212830 PC **A05**/MF **A01**
RCA Labs., Princeton, NJ.
Semiconductor Measurement Technology: Method to Determine the Quality of Sapphire.
Final rept.,
M. T. Duffy, P. J. Zanzucchi, W. E. Ham, J. F. Corboy, and G. W. Cullen. Aug 80, 77p PRRL-79-CR-33, NBS/SP-400-62
Contract NBS-5-35915, ARPA Order-2397
Library of Congress catalog card no. 80-600103.

Keywords: *Sapphire, Reflectance, Surface properties, Measurement, Polishing, Surface defects, Silicon on sapphire.

Specular reflectance measurements were used in the quantitative characterization of sapphire and silicon surfaces. Residual polishing damage in sapphire surfaces can be easily detected by infrared miltiple reflectance measurements in the lattice-band region of sapphire, nominally 300 to 900/cm. Specular reflectance measurements in the ultraviolet, at a photon energy of 4.3 eV (corresponding to the X sub 4 - X sub 1 silicon transition), have been used for the surface characterization of bulk silicon surfaces and silicon films on sapphire. This measurement is sensitive to crystalline quality, polishing damage, and surface texture which cause light-scattering effects. The reflectance methods are fast, nondestructive, and can be used for quality control and research purposes. The reflectance methods were applied to the characterization of variously polished sapphire surfaces and to the characterization of heteroepitaxial silicon films grown on the substrates. The results of these measurements were correlated with various parameters of silicon-on-sapphire (SOS) devices fabricated in the silicon films. Measured device parameters include drain current, extrapolated threshold voltage, leakage current, and drain breakdown voltage. Most device data were automatically recorded using a special device test pattern and simple statistical data were computed for the various device parameters.

714,113
PB80-216484 Not available NTIS
National Bureau of Standards, Washington, DC.
Grain-Boundary Melting Transition in a Two-Dimensional Lattice-Gas Model.
Final rept.,
R. Kikuchi, and J. W. Cahn. 1980, 5p
Pub. in Phys. Rev. B 21, n5 p1893-1897, 1 Mar 80.

Keywords: *Grain boundaries, Phase transformations, Melting, Models, Reprints.

A two-dimensional lattice-gas model that is capable of producing gas, liquid, and two orientations of a solid phase is adopted to study properties of a boundary between two crystalline grains by use of a mine-site cluster approximation of the cluster-variation methods. At a temperature far below the melting temperature T sub m, a gradual but well-defined transition is discovered between the low- and high-temperature structures of the boundary; this transition signals the onset of a liquidlike phase inside the boundary. The thickness of the boundary increases with T; the excess entropy due to the boundary diverges as -ln(T sub m-T) near T sub m; and the grain boundary is completely wet with liquid at T sub m.

714,114
PB80-218472 Not available NTIS
National Bureau of Standards, Washington, DC.
Preparation and Calibration of the NBS (National Bureau of Standards) SRM767 (Standard Reference Materials): A Superconductive Temperature Fixed Point Device.
Final rept.,
J. F. Schooley, G. A. Evans, and R. J. Soulen. Apr 80, 7p
Pub. in Cryogenic 20, n4 p193-199 Apr 80.

Keywords: *Cryogenics, *Temperature measurement, Standards, Calibrating, Superconductivity, Transition temperature, Reprints.

More than 100 cryogenic-temperature reference-point devices based upon the reproducible superconductive transition temperatures of five elements have been distributed through the NBS Office of Standard Reference Materials as SRM 767. The fixed-point temperatures of the device have been noted as reference temperatures of the Provisional Temperature Scale 0.5 K to 30 K. The methods of preparation of the device, the procedures for its calibration, and summary of the results of the calibration experiments are briefly presented. Suggestions are offered for verification of the device temperatures and for improvements in the device performance.

714,115
PB80-219835 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Calculation of Fluorescent Efficiency from Experimental Data by the Huygens Principle,
Y. Beers. May 80, 36p NBS-TN-1020

Keywords: *Semiconductors(Materials), *Fluorescence, Silicon, Huygens principle, Plane waves, Refractivity, Amorphous semiconductors, Refractive index.

This paper is concerned with the calculation of internal fluorescent efficiencies of semiconductors, especially amorphous silicon, from appropriate experimental data. The principal topic which is discussed is the theory of the Huygens Principle method which gives the intensity of the emitted light in terms of the power of an array of point sources in the semiconductor. The method used is a direct application of Huygens Principle to the individual waves that are multiply reflected by the boundary surfaces. The results are given in terms of the constants of the materials, the dimensions, and three quantum numbers, (1) P, the number of two-way trips in the semiconductor, (2) Q, the number of round trips in the substrate, and (3) S, the number of two-way penetrations of the boundary between them. Because of approximations used, the method is mainly useful for radiation emerging nearly normal to the surfaces. For light with 10 degrees to the normal the errors are not more than a few percent.

714,116
PB80-223423 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Measurement Technology: April 1, 1977 to September 30, 1977
Interim progress rept.
W. M. Bullis. Aug 80, 47p NBS-SP-400-45
ARPA Order-2397
See also report dated Nov 79, PB80-120231. Sponsored in part by Defense Nuclear Agency, Washington, DC., Strategic Systems Project Office (Navy), Washington, DC., and Department of Energy, Washington, DC.

Keywords: *Semiconductors, *Semiconductor devices, *Quality control, *Tests, Nondestructive tests, Silicon, Electrical resistance, Hole mobility, Photolithography, Inspection, Wafers, Measurement.

This progress report describes NBS activities directed toward the development of methods of measurement for semiconductor materials, process control, and devices. Both in-house and contact efforts are included. The emphasis is on silicon device technologies. Principal accomplishments during this reporting period included (1) development of theoretical expressions for computing resistivity and hole mobility for boron-doped silicon; (2) completion of a study of problems associated with use of a scanning electron microscope for total dose testing of semiconductor devices; (3) completion of a pilot study to evaluate procedures for measuring 1- to 10-micrometers wide clear and opaque lines viewed with transmitted illumination; (4) completion of a preliminary study of test structures for estimating densities of process-induced random faults in device wafers; and (5) completion of an interlaboratory evaluation of the destructive wire bond pull test. Also reported is other ongoing work on materials characterization by electrical and physical analysis methods, materials and procedures for wafer processing, photolithography, test patterns, and device inspection and test procedures.

714,117
PB80-227655 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Scattering Studies of Magnetic Superconductors.
Final rept.,
J. W. Lynn, and R. N. Shelton. 1980, 2p
Sponsored in part by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Jnl. of Magn. Magn. Mater. 15-18, p1577-1578 1980.

Keywords: *Superconductors, *Selenides, Erbium compounds, Molybdenum inorganic compounds, Reprints, Erbium molybdenum selenides, Crystal fields.

Measurements have been carried out on a series of rare earth Chevrel-phase superconductors. In the selenide materials well defined crystal field transitions have been observed, which can be understood to a first approximation on the basis of a cubic crystal field with a magnetic ground state. In HoMo6S8, on the other hand, no crystal field excitations have been observed over a wide range of energies. Diffraction data show that essentially the full free-ion moment is readily induced in HoMo6S8, but that in ErMo6Se8 less than half the free-ion moment is induced. The induced-moment data on HoMo6S8 can be readily interpreted on the basis of one Ho atom per unit cell, whereas for ErMo6Se8 this appears not to be the case. These data

also demonstrate that the only significant magnetic impurity phases in these samples are (RE)2O2Se, and these are typically a few percent or less in volume.

714,118
PB80-600048 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Alignment Effects on Implantation Profiles in Silicon.
D. R. Myers, and R. G. Wilson. 1980, 4p
Pub. in Rad. Effects 47, p91-94 1980.

Keywords: *Capacitance-voltage profiling, Controlled doping profile, Critical channeling angle, Crystallographic orientation effects, Ion channeling, Random equivalent implants.

Ion implantation is commonly used for the fabrication of fine geometry semiconductor devices. The need for shallower active layers in these devices requires that the extent of ion channeling be minimized to reduce the formation of deeply penetrating tails in the dopant distribution. In this paper, ion channeling in silicon is experimentally examined for a range of ion atomic numbers and implant energies charactristic of semiconductor device fabrication. Implantation profiles were obtained by 1 MHz differential. capacitance-voltage (C-V) profiling for silicon substrates implanted at angles from accurately channeled alignment to 'random equivalent' orientation. The critical angle for channeling, as calculated from an existing computer fit to the Moliere continuum potential, was used to scale the angular dependence of the implantation profiles. The results of this study indicate that to minimize the extent of unintentional channeling, alignment of the ion beam to the nearest low-index crystallographic direction must be at angles exceeding twice the critical angle.

714,119
PB81-103269 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Standard X-ray Diffraction Powder Patterns. Section 17 - Data for 54 Substances.
M. C. Morris, H. F. McMurdie, E. H. Evans, B. S. Paretzkin, C. R. Hubbard, and S. J. Carmel. Oct 80, 119p NBS-MONO-25-SECT-17
See also report dated Oct 79, PB80-110364. Prepared in cooperation with Joint Committee on Powder Diffraction Standards, Swarthmore, PA. Library of Congress catalog card no. 53-61386.

Keywords: *Crystal structure, *X ray diffraction, Lattice parameters, Density(Mass/volume), Refractivity, Organic compounds, Inorganic compounds, Standards, Tables(Data), *Powder patterns.

Standard x-ray diffraction patterns are presented for 54 substances. The experimental x-ray powder diffraction patterns were obtained with an x-ray diffractometer. All d-values were assigned Miller indices determined by comparison with computed interplanar spacings consistent with space group extinctions. The densities and lattice constants were calculated and the refractive indices were measured in some cases.

714,120
PB81-112369 Not available NTIS
National Bureau of Standards, Washington, DC.
Definitions of Terms for Practical Superconductors: 4. Josephson Phenomena.
Final rept.
F. R. Fickett, S. B. Kaplan, R. L. Powell, R. Radebaugh, and A. F. Clark. Jun 80, 7p
See also PB-299 820.
Pub. in Cryogenics 20, n6 p319-325 Jun 80.

Keywords: *Superconductivity, *Superconductors, *Josephson junctions, Critical point, Definitions, Reprints.

The definitions of terms used in describing the phenomenology and measurement practices of practical superconductive materials are proposed. The definitions cover the subject categories of: (1) fundamental states and flux phenomena, (2) critical parameters, (3) fabrication, stabilization, and transient losses, and (4) Josephson. It is intended that these terms will become the basis for development of standard measurement practices and responses are invited.

714,121
PB81-112385 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrocaloric Refrigeration at Cryogenic Temperatures.
Final rept.
R. Radebaugh, W. N. Lawless, J. D. Siegwarth, and A. J. Morrow. 1980, 7p
Sponsored in part by Department of Defense, Washington, DC.
Pub. in Ferroelectrics 27, p205-211 1980.

Keywords: *Refrigerants, Ferroelectric crystals, Strontium tantalates, Cryogenics, *Electrocaloric effect, Strontium titanium oxides, Potassium tantalum oxides.

Refrigeration using the electrocaloric effect can be produced with no moving parts and thus promises to be highly reliable. This paper reviews the principles and experimental results on electrocaloric refrigeration, particularly in the 4-15K temperature range. Many electrocaloric materials were studied but none was found with a sufficiently large reversible electrocaloric effect for a practical refrigerator. The largest effects were seen in a SrTi03 ceramic, followed by a KTa03 single crystal. Temperature reductions of about 0.3K at 10K were observed during depolarization from fields of 20 kV/cm. A theoretical model based on the lattice dynamics of displacive dielectrics is postulated to explain the observed temperature change in such materials.

714,122
PB81-115495 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Measurement Technology: A FORTRAN Program for Calculating the Electrical Parameters of Extrinsic Silicon.
Final rept.
R. D. Larrabee, W. R. Thurber, and W. M. Bullis. Oct 80, 57p NBS-SP-400-63

Keywords: *Semiconductor(Materials), *Silicon, *Electrical properties, *Computer programs, Semiconductor doping, Carrier mobility, Hall effect, Electrical resistivity, Univac-1108 computers, Fortran 4 programming language.

Many electrical properties of silicon are strongly dependent upon the specific nature and density of the active impurities present. Calculation of these electrical properties hinges on the solution of the charge balance equation to determine the position of the Fermi level for each specific case of interest. A Fortran program is presented that performs this determination and then calculates some of the often-used electrical parameters of silicon as a function of temperature. Results obtained from this program have proven useful in interpreting Hall effect data, determining the degree of ionization of the separate dopant states as a function of temperature, predicting the behavior of specimens when the dopant picture is intentionally (or conceptually) changed, and understanding the variations in the relative roles of the different scattering mechanisms on carrier mobility as the temperature is changed.

714,123
PB81-116931 Not available NTIS
National Bureau of Standards, Washington, DC.
Strain-Induced Splitting and Oscillator-Strength Anisotropy of the Infrared Transverse-Optic Phonon in Calcium Fluoride, Strontium Fluoride, and Barium Fluoride.
A. Feldman, and R. M. Waxler. Jul 80, 4p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Physical Review Letters 45, n2 p126-129 Jul 80.

Keywords: *Phonons, *Calcium fluorides, Anisotropy, Strains, Reprints, *Barium fluorides, *Strontium fluorides, *Oscillator strengths.

Photoelastic data that show a large infrared dispersion due to lattice absorption, have been used to calculate the strain-induced splitting and strain-induced oscillator strength anisotropy of the TO phonon in CaF2, SrF2 and BaF2. The stain-induced oscillator strength anisotropy is found to be negligible for all strain directions; hence, the dispersion observed is attributed almost entirely to the strain-induced TO mode splitting. Thus the Szigeti effective charge (e sub s) remains a scalar. The results are based on a least-squares fit of the experimental data to a single oscillator model for lattice absorption.

714,124
PB81-119406 Not available NTIS
National Bureau of Standards, Washington, DC.
Effects of Stress on the Raman-Active Modes in Semiconductors.
M. I. Bell. Aug 80, 2p
Pub. in Proceedings of the International Conference on Raman Spectroscopy (7th) Held at Ottawa, Canada on August 4-9, 1980, p76-77 Aug 1980.

Keywords: *Semiconductors(Materials), *Raman spectra, Gallium arsenides, Indium antimonides, Stresses.

Previous calculations of the stress dependence of the Raman frequencies of covalent (diamond-structure) semiconductors are extended to include the effects of electrostatic interactions in partially ionic (zinc-blende structure) crystals. Results are obtained for GaAs and InSb which agree as well with experiment as those obtained previously for silicon, germanium, and diamond.

714,125
PB81-120479 Not available NTIS
National Bureau of Standards, Washington, DC.
Coherent Neutron Scattering Study of the Vibrations of Interstitial Deuterium in alpha-VD(0.7).
J. J. Rush, J. M. Rowe, C. J. Glinka, N. Vagelatos, and H. E. Flotow. Jun 80, 4p
Pub. in Physical Review B 21, n12 p5613-5616, 15 Jun 80.

Keywords: *Lattice vibrations, *Phonons, Single crystals, Deuterium compounds, Interstitials, Neutron scattering, Coherent scattering, Reprints, *Vanadium hydrides.

The lattice dynamics of a single crystal of alpha (bcc) VD(0.7) have been investigated by coherent inelastic neutron scattering measurements at 295K. As the scattering cross section of vanadium is almost entirely incoherent, this study offers a unique opportunity to directly measure the 'band' modes associated with vibrational displacements of the light atom interstitials as a function of wave vector and omega.

714,126
PB81-120511 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Scattering Study of Hydrogen Vibrations in Polycrystal and Glassy TiCuH.
Final rept.
J. J. Rush, J. M. Rowe, and A. J. Maeland. 1980, 3p
Pub. in Jnl. of Physics F, Letters to the Ed. 10, pL283-L285 1980.

Keywords: *Hydrides, *Neutron scattering, Interstitials, Reprints, *Copper hydrides, *Titanium hydrides, Amorphous materials.

Neutron vibrational spectra have been measured for both crystalline and amorphous titanium copper hydride from 40-200 meV. A rather narrow distribution of optical (hydrogen) vibrations is observed for the crystalline alloy TiCuH(0.93) with maxima at 142 and 157 meV, very close to previous results for gamma-TiH2. Amorphous TiCuH(1.3), however, exhibits a very broad band of hydrogen vibrations (about 75 meV FWHM) peaked at about 145 meV. This density of states provides a probe of the local environments of the hydrogen atoms residing in holes in the metallic glass structure and suggests an 'average' occupation of tetrahedral holes, but considerable fluctuations in local symmetry around these sites.

714,127
PB81-120529 Not available NTIS
National Bureau of Standards, Washington, DC.
RPA Theory of Magnetic Excitation in Rare Earth-Transition Metal Compounds: Application to ErCo2 and ErFe2.
Final rept.
N. C. Koon, and J. J. Rhyne. 1980, 2p
Pub. in Jnl. of Magn. Magn. Mater. 15-18, p349-350 1980.

Keywords: *Cobalt intermetallics, *Iron intermetallics, Neutron scattering, Intermetallics, Magnetic properties, Rare earth compounds, Reprints, *Erbium intermetallics, Random phase approximation, Exchange interactions.

The magnetic excitation spectrum and neutron scattering intensities appropriate to the Laves phase compounds ErCo2 and ErFe2 were calculated, using standard basis operator Greens functions in the random phase approximation. The results are in excel-

lent agreement with recent neutron inelastic scattering data.

714,128
PB81-121022 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Scattering Studies of (CN)- Defects in KBr.
J. M. Rowe, J. J. Rush, S. M. Shapiro, D. G. Hinks, and S. Susman. May 80, 6p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review B 21, n10 p4863-4868, 15 May 80.

Keywords: *Potassium bromide, *Potassium cyanides, *Neutron scattering, Excitation, Crystal defects, Phonons, Reprints.

The authors studied both the librational and the tunneling excitations of (CN)(-) ions in a KBr matrix through the interaction of these modes with the acoustic phonons of the KBr host. Measurements were made on a sample containing 0.00034 mole fraction of KCN in KBr. Results are discussed.

714,129
PB81-121246 Not available NTIS
National Bureau of Standards, Washington, DC.
Exchange and Crystal Field Excitations in Rare-Earth Iron and Rare-Earth Cobalt Laves-Phase Compounds.
N. C. Koon, and J. J. Rhyne. 1980, 16p
Pub. in Proceedings of Crystal Fields and Structure in 4f Electroon Systems, Philadelphia, PA., Nov 12-15, 1979, Paper in Crystalline Electric Field and Structural Effects in f-Electron Systems, p125-140 1980.

Keywords: *Cobalt intermetallics, *Iron intermetallics, *Rare earth compounds, *Magnetism, Magnons, Neutron scattering, Magnetic ordering, Exchange interactions, Crystal field.

The magnetic excitations in several rare earth iron (RFe2) and cobalt (RCo2) cubic Laves phase compounds are examined using inelastic neutron scattering. Both ground state excitations at low temperatures and excited state transitions at elevated temperatures have been observed, and the results correlated with a Greens function RPA theory for a ferrimagnet including crystal field interactions. By appropriate choice of crystal reflections, structure factor considerations as calculated from the model allow one to resolve separately modes involving in-phase and out-of-phase spin precessions of both rare earth and transition metal spins.

714,130
PB81-121485 Not available NTIS
National Bureau of Standards, Washington, DC.
Existence of an Orientational Glass State in (KCN)x(KBr)1-x Mixed Crystals.
K. H. Michel, and J. M. Rowe. Aug 80, 12p
Sponsored in part by Universitat des Saarlandes, Belgium. Sonderforschungsbereich Ferroelektrika.
Pub. in Physical Review, B 22, n3 p1417-1428, 1 Aug 80.

Keywords: *Potassium bromide, *Potassium cyanides, Neutron scattering, Order parameters, Amorphous materials.

Recent neutron scattering experiments by Rowe et al. on mixed crystals of (KCN)x(KBr)1-x cannot be explained by a previous dynamic theory by Michel et al. The appearance of a narrow central line in the scattering spectrum suggests the onset of an orientational glass state characterized by a freezing in the CN orientations. Starting from a microscopic lattice dynamical description of the coupling of orientational impurities with acoustic lattice modes, the present authors demonstrate that an orientational freezing in produces a freezing in of lattice strains. They introduce an orientational glass state parameter and a corresponding susceptibility. The neutron scattering law is formulated, taking into account interference between translations and orientations.

714,131
PB81-121816 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystal Field Effects in Magnetic Superconductors.
J. W. Lynn. 1980, 4p
Pub. in Proceedings of Crystal Fields and Structure in 4f Electron Systems, Philadelphia, PA., Nov 12-15, 1979, Paper in Crystalline Electric Field and Structural Effects in f-Electron Systems, p547-560 1980.

Keywords: *Superconductors, Rare earth compounds, Neutron scattering, Magnetic fields, *Magnetic superconductors, *Ligand fields, *Crystal field, Temperature dependence.

Neutron scattering experiments have been carried out as a function of temperature and magnetic field on a series of superconducting materials containing rare earth ions. Temperature dependent intrinsic linewidths have been observed in these systems, but no correlation with the superconducting transition temperatures has been found.

714,132
PB81-121832 Not available NTIS
National Bureau of Standards, Washington, DC.
Correlation between Superconducting Transition Temperature and the Cauchy Discrepancy in Body-Centered-Cubic Transition Metals.
H. M. Ledbetter. Jun 80, 3p
Pub. in Physical Letters 77A, n5 p359-361, 9 Jun 80.

Keywords: *Superconductors, *Transition temperature, Body centered cubic lattices, Transition metals, Reprints, Cauchy discrepancy.

For body-centered-cubic transition metals, an empirical relationship exists between the superconducting-transition temperature and the Cauchy discrepancy. This correlation may arise from many-atom effects.

714,133
PB81-121915 Not avaliable NTIS
National Bureau of Standards, Washington, DC.
Magnetic Excitations in TbFe2.
J. J. Rhyne, N. C. Koon, and H. A. Alperin. 1980, 2p
Pub. in Proceedings of the Rare Earth Research Conference (14th) Held at North Dakota State Univ., Fargo., ND. on June 25-28, 1979, Paper in The Rare Earths in Modern Science and Technology 2, p313-314 1980.

Keywords: *Iron intermetallics, *Magnetism, Rare earth compounds, Neutron scattering, Magnons, Anisotropy, *Terbium intermetallics, Exchange interactions.

Magnetic excitations in TbFe2 have been studied by inelastic neutron scattering and the results correlated with calculations based on a linear spin wave theory. Exchange and anisotropy parameters have been obtained and compared with other similar systems.

714,134
PB81-123630 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Scattering Studies of Hydrides of the Laves Phase Rare Earth Compounds RFe2.
G. E. Fish, J. J. Rhyne, T. Brun, P. J. Viccaro, D. Niarchos, B. D. Dunlap, G. K. Shenoy, S. G. Sankar, and W. E. Wallace. 1980, 2p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the Rare Earth Research Conference (14th) Held at North Dakota State Univ., Fargo, ND. on June 25-28, 1979, Paper in The Rare Earth in Modern Science and Technology 2, p569-570 1980.

Keywords: Iron intermetallics, *Rare earth compounds, *Hydrides, *Neutron scattering, Crystal structure, Magnetization, *Magnetic ordering, Exchange interactions.

Neutron scattering was used to study the effect of hydrogen on the structure and magnetic ordering of the laves-phase rare earth-iron compounds RFe2. Depending on temperature and pressure, stable hydrides can be formed with nominally 2, 3.5, and 4 H(D) per formula unit. The RFe2H2 and RFe2H3.5 phases retain the cubic C15 structure with a substantial increase in lattice parameter. The parent RFe2's order ferri-magnetically at T(c) about 600 K.

714,135
PB81-132706 PC **A20**/MF **A01**
National Bureau of Standards, Washington, DC.
Ruby and Sapphire.
Revised and enlarged.
L. M. Belyaev. 1980, 467p TT-76-52020
Trans. of mono. Rubin i Sapfir, Moscow, 1974. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Ruby, *Sapphire, Crystal growth, Single crystals, Aluminum oxide, Acoustic properties, Optical properties, Mechanical properties, Translations.

This monograph describes techniques for growing synthetic single crystals of pure corundum (leucosapphire) and corundum with additives (ruby), including large single crystals of corundum (boules, rods, and plates) and their properties. It also describes techniques and apparatus for studying some of these properties (optical, acoustic and mechanical). It includes information on the mechanical properties of corumdum at normal and high temperatures and on the electrical properties. The instruments and the techniques recommended could be employed for the study of crystals of other substances used in scientific and technological apparatus and in scientific research in general.

714,136
PB81-133274 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron-Microscope Study of the Crystal Structures of Mixed Oxides in the Systems Rb2O-Ta2O5,Rb2O-Nb2O5 and K2O-Ta2O5 with Composition Ratios Near 1:3. 1. Stacking characteristics of MO6 Layers.
K. Yagi, and R. S. Roth. 1978, 9p
Grant NSF-DMR76-06108
Sponsored in part by Ministry of Education of Japan.
Pub. in Acta Cryst. A34, p765-773 1978.

Keywords: *Crystal structure, Potassium oxides, Rubidium compounds, Niobates, Tantalates, Electron microscopy, Reprints, Rubidium oxides.

Crystal structures of phases previously designated as 11 L, 9 L and 16 L which were commonly found in the title systems are suggested from their high resolution two dimensional lattice images. Two types of blocks are found which are composed of 5 and 6 pentavalent metal oxide octahedron layers and are closely related to the pyrochlore structure. The 11 L structure is of rhombohedral ABCABC stacking of the former type blocks and the 9 L structure is of hexagonal BoA'BoA' stacking of the latter type blocks. The 16 L structure is found to be alternative stacking of the two types of blocks. The method of stacking of the blocks is the same for the three structures and is found to be favorable from the point of local charge balance.

714,137
PB81-133324 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystal Subgrain Misorientations Observed by X-Ray Topography in Reflection.
R. W. Armstrong, W. J. Boettinger, and M. Kuriyama. 1980, 8p
Grant NSF-DMR73-07619
Pub. in Jnl. Appl. Cryst. 13, p417-424 1980.

Keywords: *Grain boundaries, *X ray diffraction, Grain structure, Single crystals, Nickel, Orientation, Reprints.

Based on the principles of conservation of momentum and energy for x-ray diffraction, a vector description is obtained for the displacement of adjacent subgrain images. The analysis includes, in addition to those crystals parameters defining the misorientation at a subgrain boundary, the combined effects of (horizontal and vertical) divergence in the incident x-ray beam and of the position where the x-ray images are recorded. Also, the vector description is matched with a stereographic projection method of analysis for describing subgrain misorientations via x-ray topography. These total considerations are applied to the characterization of the nature of subgrain boundaries grown into a nickel single crystal solidified along (010), including specification of the dislocation structure within the boundaries.

714,138
PB81-133332 Not available NTIS
National Bureau of Standards, Washington, DC.
Atomically Sharp Cracks in Brittle Solids: An Electron Microscopy Study.
B. R. Lawn, B. J. Hockey, and S. M. Wiederhorn. 1980, 17p
Sponsored in part by Office of Naval Research, Washington, DC., and Australian Research Grants Committee.
Pub. in Jnl. of Materials Science 15, p1207-1223 1980.

Keywords: *Brittleness, Solids, Crack propagation, Aluminum oxide, Silicon, Silicon carbides, Germanium,

Fractures(Materials), Electron microscopy, Plastic deformation, Dislocations(Materials), Reprints.

The issue of bond rupture vs. microplasticity as well as essential mechanism of crack propagation in brittle solids is addressed. A detailed survey of existing theoretical and experimental evidence relating to this issue highlights the need for direct observations of events within the crack-tip process zone, at a level approaching 10 nm. Transmission electron microscopy is accordingly used to study arrested cracks about sharp-contact (Vickers indentation and particle impact) sites in Si, Ge, SiC and Al2O3.

714,139
PB81-133977 Not available NTIS
National Bureau of Standards, Washington, DC.
Resistivity-Dopant Density Relationship for Boron-Doped Silicon.
W. R. Thurber, R. L. Mattis, Y. M. Liu, and J. J. Filliben. Oct 80, 4p
Pub. in Jnl. of Electrochemical Society 127, n10 p2291-2294 Oct 80.

Keywords: *Silicon, *Semiconductor doping, Semiconductors(Materials), Electrical resistivity, Density(Number/volume), Boron, Reprints.

New data for the resistivity-dopant density relationship for boron-doped silicon have been obtained for dopant densities between 10 to the 14th power and 10 to the 20th power/cu cm and temperatures of 296 K (23C) and 300 K.

714,140
PB81-133993 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of the Relationship Between Derivative Lattices,
A. Santoro, A. D. Mighell, and J. R. Rodgers. 1980, 5p
Pub. in Acta Cryst. A36, p796-800 1980.

Keywords: *Crystal lattices, Twinning, Reprints, *Derivative lattices.

Derivative lattices are related to one another by transformation matrices having rational elements. A simple algorithm for finding these matrices consists in testing if the scalar products of the vectors defining two arbitrary primitive cells of two lattices can be exactly or approximately related by equations with rational coefficients. A rational relationship indicates that two or more lattices have a number of geometrical features in common such as common superlattices, sublattices, etc. The algorithm can, therefore, be applied to a variety of crystallographic problems such as the study of twinning, the indexing of powder patterns, single-crystal diffractometry and the critical evaluation of crystal data. Five examples are discussed in detail.

714,141
PB81-134611 Not available NTIS
National Bureau of Standards, Washington, DC.
Mean Free Paths of Very-Low-Energy Electrons; the Effects of Exchange and Correlation.
D. R. Penn. Sep 80, 6p
Pub. in Physical Review B 22, n6 p2677-2682, 15 Sep 80.

Keywords: *Mean free path, *Electrons, Reprints.

The mean free path of low-energy electrons in a free-electron-like material are calculated using a screened electron-electron interaction which is antisymmetrized for the case of parallel-spin electrons. Calculations are carried out for several different approximations of the screening function: Fermi-Thomas, Lindhard, Singwi, and Kukkonen-Overhauser. The first three yield mean free paths that agree to within 10%, while the Kukkonen-Overhauser screening yields mean free paths that are roughly half those given by the other approximations. The effect of the Pauli principal in all cases is that the scattering between anti-parallel-spin electrons is roughly three to ten times stronger than between parallel-spin electrons.

714,142
PB81-135477 Not avialable NTIS
National Bureau of Standards, Washington, DC.
Optical Microscopic, X-Ray Diffraction, and Electrical Resistance Studies of CuCl at High Pressure.
G. J. Piermarini, F. A. Mauer, S. Block, A. Jayaraman, T. H. Geballe, and G. W. Hull. 1979, 15p
Pub. in Solid State Communications 32, p275-289 1979.

Keywords: *Copper chlorides, *Phase transformations, X ray diffraction, Electrical resistivity, Solid phases, Reprints, *Pressure dependence, *High pressure, Optical microscopy.

Electrical resistance and x-ray diffraction measurements and also optical observations under a polarizing microscope were made on CuCl to pressures in excess of 12.5 GPa at room temperature using a diamond anvil cell. Optical observations and x-ray diffraction measurements indicate the existence of four phases in the pressure range studied, including a nonconducting black opaque phase which grows with time when CuCl is left for several days at the highest pressures.

714,143
PB81-135493 Not available NTIS
National Bureau of Standards, Washington, DC.
Establishment of a Temperature Scale from 0.01 K to 0.05 K Using Noise and (60)Co Gamma-Ray Anisotropy Thermometers,
R. J. Soulen, and H. Marshak. Jul 80, 5p
Pub. in Cryogenics 22, n7 p408-412 Jul 80.

Keywords: *Temperature measuring instruments, *Cryogenics, Josephson junctions, Cobalt 60, Gamma rays, Anisotropy, Reprints, Noise thermometers.

The authors describe their latest intercomparison of the Josephson junction noise thermometer and (60)Co gamma-ray anisotropy thermometer from 0.01 to 0.05 K. These results show that both thermometers are in agreement to better than 0.5%. This is an improvement over the authors' previous data and is due mainly to better temperature control and advances in instrumentation.

714,144
PB81-136798 Not available NTIS
National Bureau of Standards, Washington, DC.
Preferential Ordering of Mn and Fe Atoms in Y6(Fe1-xMnx)23.
K. Hardman, W. J. James, and W. B. Yelon. 1980, 5p
Grant NSF-INT78-16549
Pub. in Jnl. of Physics and Chemistry of Solids 41, p1105-1109 1980.

Keywords: *Crystal lattices, Iron alloys, Manganese alloys, Neutron diffraction, Reprints, Yttrium alloys.

Neutron diffraction studies of the nonmagnetic compositional range of the Y6(Fe(1-x)Mnx)23 system reveal the presence of preferential ordering of Fe and Mn atoms on the four transition metal crystallographic sites. Throughout the entire compositional range of the ternary system, Mn atoms prefer to occupy the f2 site and Fe atoms the f1 site. Refinements of the data were carried out using the Rietveld profile method.

714,145
PB81-136830 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory and Application of a Nondestructive Photovoltaic Technique for the Measurement of Resistivity Variations in Circular Semiconductor Slices.
R. D. Larrabee, and D. L. Blackburn. 1980, 10p
Sponsored in part by Department of Energy, Washington, DC., and Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Solid State Electronics 23, n10 p1059-1068 1980.

Keywords: *Wafers, *Semiconductors(Materials), Photoconductivity, Electrical resistivity, Electrical measurement, Reprints.

A nondestructive photovoltaic technique for measuring resistivity variations in high-resistivity semiconductor slices is described.

714,146
PB81-137218 Not available NTIS
National Bureau of Standards, Washington, DC.
Heat Capacity and Electrical Resistivity of Palladium in the Range 1400 to 1800 K by a Pulse Heating Method.
A. P. Miiller, and A. Cezairliyan. 1980, 7p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Int. J. Thermophys. 1, n2 p217-223 1980.

Keywords: *Palladium, *Specific heat, *Electrical resistivity, High temperature, Reprints.

No abstract available.

714,147
PB81-137879 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Spreading Resistance Correction Factor Algorithms Using Model Data.
J. Albers. 1980, 9p
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Solid-State Electronics 23, p1197-1205 1980.

Keywords: Electrical resistivity, Comparison, Correction, Reprints, *Spreading resistance, Laplace equation.

Model spreading resistance data generated from the Schumann-Gardner multilayer solution of Laplace's equation are employed to compare two recently published spreading resistance correction factor algorithms. Specifically, depth-dependent resistivities corresponding to diffusions and implants are used to generate the appropriate depth-dependent model spreading resistance data. These data are then analyzed according to the two algorithms and the resulting interpreted resistivities are compared with the original input resistivities.

714,148
PB81-138331 Not available NTIS
National Bureau of Standards, Washington, DC.
Resistivity-Dopant Density Relationship for Phosphorus-Doped Silicon.
W. R. Thurber, R. L. Mattis, Y. M. Liu, and J. J. Filliben. Aug 80, 6p
Pub. in Jnl. of the Electrochemical Society 127, n8 p1807-1812 Aug 80.

Keywords: *Silicon, *Semiconductor doping, Electrical resistivity, Density(Number/volume), Phosphorus, Semiconductors(Materials), Reprints.

New data for the resistivity-dopant density relationship of phosphorus-doped silicon have been obtained for dopant densities between 10 to the 13th power and 10 to the 20th power/cu cm and temperatures of 23 C and 300 K.

714,149
PB81-138372
(Order as PB81-138356, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Investigation of Epitaxy Relationships between Ca5(PO4)3OH and Other Calcium Ortho-Phosphates.
B. Dickens, and L. W. Schroeder. 16 Apr 80, 16p
Grant PHS-DE-05030
Included in Jnl. of Research of the National Bureau of Standards, v85 n5 p347-362, Sep-Oct 80.

Keywords: *Calcium phosphates, *Crystal structure, *Epitaxy, Twinning.

A procedure for generating and examining possible cases of epitaxy and twinning has provided a general and quantitative estimate of the relative probabilities of occurrence. The present procedure filters out unlikely candidates leaving the more probable cases for detailed examination. Such examination should include an assessment of the compatibility of the complete crystal structures in the vicinity of the contact plane.

714,150
PB81-138539 Not available NTIS
National Bureau of Standards, Washington, DC.
Random Strain Amplitude Cycling of Copper Single Crystals.
B. Ditchek, and R. W. Penn. 1980, 4p
Pub. in Scripta Metallurgica 13, p877-880 1979.

Keywords: *Single crystals, *Copper, Fatigue(Materials), Plastic deformation, Reprints.

The similarity in extent and appearance of PSBs on random and conventially cycled copper single crystals suggests that the saturation behavior is determined by the maximum allowable strain amplitude in a test and not the average.

714,151
PB81-138554 Not available NTIS
National Bureau of Standards, Washington, DC.

Sound Velocities and Elastic-Constant Averaging for Polycrystalline Copper.
H. M. Ledbetter. 1980, 6p
Pub. in Jnl. of Physics D: Applied Physics 13, p1879-1884 1980.

Keywords: *Copper, *Acoustic velocity, Elastic properties, Specific heat, Polycrystalline, Reprints, Debye temperature.

The study deals with the tensor-averaging problem, with the relationship between single-crystal and polycrystalline elastic constants. For polycrystalline copper, sound velocities were measured within a 0.1% inaccuracy at T = 295 K. Comparison with average values from twelve previous studies shows agreement within 0.2% in vt, 0.1% in ve, and 0.1% in vl. Among eight elastic-constant averaging methods, the Hershey-Kroner-Eshelby method works best for copper. This averaging method predicts that copper's polycrystalline and single-crystalline Debye temperatures differ by about 9 K.

714,152
PB81-138570 Not available NTIS
National Bureau of Standards, Washington, DC.
Electronic Properties of Ion-Implanted Silicon Annealed with Microsecond Dye-Laser Pulses.
D. R. Myers, P. Roitman, S. Mayo, and D. Harowitz. 1980, 6p
Pub. in Proceedings of the Symposium of the Materials Research Society on Laser and Electron Beam Pulses Held at Cambridge, MA. on Nov 27-30, 1979, p285-290 1980.

Keywords: *Silicon, *Annealing, Lasers, Radiation damage, Activation, Semiconductor doping, Laser annealing, Ion implantation.

The effects of laser irradiation in annealing ion-implanted silicon are examined for the case of a flash-lamp-excited, tunable dye laser operating at a wavelength near 600 nm with a baseline-to-baseline pulse duration of 1 microsec.

714,153
PB81-138638 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Expansion.
R. K. Kirby. Nov 80, 2p
Pub. in Article in Encyclopedia of Physics, p1023-1024 Nov 80.

Keywords: *Thermal expansion, Reviews, Reprints.

This is a short article (about 600 words) on thermal expansion that will be published in the AIP Encyclopedia of Physics. A descriptive study and comparison of the thermal expansion of gases, liquids, and solids are given. Examples are given in the text and 3 tables. The bibliography includes references to theory, measurement techniques, and data compilations.

714,154
PB81-138687 Not available NTIS
National Bureau of Standards, Washington, DC.
Use of Fick's Law in Modeling Diffusion Processes.
J. R. Lowney, and R. D. Larrabee. Sep 80,4p
Pub. in IEEE Transactions on Electron Devices ED-27, n9 p1795-1798 Sep 80.

Keywords: *Diffusion, Mathematical models, Semiconductors(Materials), Silicon, Impurities, Reprints, *Fick's law.

Fick's Law treats the diffusion coefficient as the factor of proportionality between the flux and the spatial gradient of a diffusion species. A recent theory for impurity diffusion in semiconductors computes the flux in a different way by taking the spatial gradient of the product of the diffusion coefficient and the density of diffusing species. The results of these two approaches are different for spatially dependent diffusion coefficients. The nature and significance of this difference is explored in terms of the random walk and thermodynamic derivations of the diffusion equation. It is concluded that Fick's Law is the more fundamental and straightforward way to model diffusion processes.

714,155
PB81-140329 Not available NTIS
National Bureau of Standards, Washington, DC.
Field Ion Transmission Microscopy.
A. J. Melmed, and J. Smit. 1979, 2p
Pub. in Jnl. Physics, E. Scientific Instruments 12, p355-356 1979.

Keywords: *Ion microscopes, Reprints, *Field ion microscopy, Ion microscopy.

A microscope has been constructed to image, by projection of positive ions or electrons from a point field-emitter, a remote specimen in a transmission mode. Direct magnification up to 350,000 and resolution of 2.5nm has been obtained for opaque specimens.

714,156
PB81-140386 Not available NTIS
National Bureau of Standards, Washington, DC.
Dynamical Electron-Phonon Interaction and Conductivity in Strongly Disordered Metal Alloys.
S. M. Girvin, and M. Jonson. 15 Oct 80, 15p
Pub. in Physical Review B, 22, n8 p3583-3597, 15 Oct 80.

Keywords: *Electron phonon interactions, Electrical resistivity, Alloys, Reprints.

A theory of transport in random metal alloys is presented which focuses on certain model-independent features of the electron-phonon dynamics which have been previously neglected. It is found that in the low resistivity limit the adiabatic phonon approximation is valid and the disorder associated with phonons increases the resistivity. In the high resistivity limit where the weak scattering approximation breaks down due to incipient Anderson localization, the adiabatic phonon assumption also fails and phonons actually assist the mobility producing an anomolous negative temperature coefficient of resistivity. Model analytical and numerical calculations suggest that this mechanism could be the source of the Mooij correlation between the resistivity and its temperature coefficient. The connection between these results and recent scaling theories of localization is discussed.

714,157
PB81-142929 Not available NTIS
National Bureau of Standards, Washington, DC.
Lattice Symmetry Determination.
A. D. Mighell, and J. R. Rodgers. 1980, 6p
Pub. in Acta Crystallographica A36, p321-326 1980.

Keywords: *Crystal symmetry, Reprints, Bravais crystals, Space groups.

Transformation matrices required to obtain a conventional cell (Crystal data cell) from the reduced cell have been applied to 47,000 materials in the Crystal-Data file. For 97 percent of the materials, the calculations from the reduced cell yield conventional cells (lattice parameters, lattice type, and crystal system) that are entirely consistent with those reported in the original literature. In a few instances in which the reduced cell matrix indicated a higher symmetry, the author had usually noted that the crystal was unusual in some way or that there was an error in the reported symmetry. Some implications of the results of this survey are given.

714,158
PB81-142952 Not available NTIS
National Bureau of Standards, Washington, DC.
Hole Recoil, Vibrational Shakeup and Photoelectron Lineshapes.
J. W. Gadzuk. 1980, 6p
Pub. in Proceedings of the Nobel Symposium on Many Body Theory of Atomic Systems (46), Gothenburg, Sweden, June 11-16, 1979, Phys. Scrip 21, p570-575 1980.

Keywords: *Holes(Electron deficiencies), Photoelectrons, Bosons, *Photoelectron spectroscopy.

The general problem of boson renormalization of a quasi-localized hole state created in a photo-ejection process from a molecule or solid is considered. A quasi-localized hole can hop from the initial site of creation and this introduces the possibility of recoil when the hole interacts with the boson field. As an illustrative example, the problem of the photo-ionization spectrum for a molecule adsorbed on a metal surface is the delocalization mechanism and intro-molecular vibrational modes are the bosons. Recoil induced interferences between the two processes lead to a more narrow lineshape than would be inferred from a straightforward convolution-of-independent-events line.

714,159
PB81-143612 Not available NTIS
National Bureau of Standards, Washington, DC.
Phase Transitions in Ammonium Nitrate.
C. S. Choi, H. J. Prask, and E. Prince. 1980, 7p
Pub. in Jnl. Appl. Cryst. 13, p403-409 1980.

Keywords: *Ammonium nitrate, *Phase transformations, *Crystal structure, Neutron diffraction, X ray diffraction, Hydrogen bonds, Reprints.

The phases of ammonium nitrate, NH4NO3, doped with small amounts of NiO or CuO, have been studied by X-ray and neutron diffraction at various temperatures from 80 to 423 K. Results are given.

714,160
PB81-144255 Not available NTIS
National Bureau of Standards, Washington, DC.
Growth of Shaped Crystals from the Melt.
T. Surek, S. R. Coriell, and B. Chalmers. 1980, 12p
Pub. in Jnl. of Crystal Growth 50, p21-32 1980.

Keywords: *Crystal growth, *Silicon, Germanium, Czochralski method, Shape, Stability, Reprints.

A general theory is presented for the time evolution and stability of the crystal shape in meniscus-controlled growth of crystals from the melt. In a meniscus-controlled process, the relationship of the crystal shape to that of the liquid-vapor interface shows up in the observed constancy of the relative angle (phi sub 0) between the crystal and liquid free-surfaces at the crystal-liquid-vapor junction. An experimental technique is described for determining the characteristic values of (phi sub 0) for silicon and germanium. A linear perturbation analysis of the dynamic crystal growth equations is carried out to derive the necessary and sufficient conditions for crystal shape stability in meniscus-controlled growth processes. Application of the analysis is made to Czochralski and floating zone growth, and to techniques which utilize a die shaper (such as the Stepanov and Edge-defined Film-fed Growth (EFG) methods). Specific numerical examples deal with the growth of silicon crystals by the various methods.

714,161
PB81-144297 Not available NTIS
National Bureau of Standards, Washington, DC.
Evidence for Reconstructed (001) Tungsten Obtained by Field-Ion Microscopy.
A. J. Melmed, R. T. Tung, W. R. Graham, and G. D. W. Smith. Nov 79, 4p
Pub. in Physical Review Letters 43, n20 p1521-1524, 12 Nov 79.

Keywords: *Tungsten, *Surfaces, Reprints, *Field ion microscopy.

New results have been obtained, by field-ion microscopy, relating to the atomic structure of clean (001) W. The evidence supports a reconstruction model with periodic displacements of atoms having vertical components. The reconstructed atomic configuration prevails over the entire temperature range of this investigation (about 15-460 K), suggesting that no phase transition may be needed to account for the structural features of (001) W.

714,162
PB81-145476 Not available NTIS
National Bureau of Standards, Washington, DC.
Powder Neutron Diffraction Study of Chemically Prepared beta-Lead Dioxide.
P. D'Antonio, and A. Santoro. 1980, 4p
Pub. in Acta Crystallographica B36, p2394-2397 1980.

Keywords: *Lead oxides, *Crystal structure, Neutron diffraction, Dioxides, Reprints.

Beta-PbO2, tetragonal, P4(2)/mnm, a = 4.9578, c = 3.3878 A,Z = 2, with the Pb atoms located in positions 2(a) and the O atoms in positions 4(f). The structure was refined with the Rietveld method using powder neutron diffraction data collected with a multiple-channel detector up to sin theta/lambda = 0.6/A. Anisotropic thermal parameters were included in the refinement. The O positional parameter was found to be x = 0.3067. The Pb atoms are coordinated by six O atoms, forming an irregular octahedron in which the four equatorial Pb-O distances are 2.1689(7) A and the two axial distances 2.150(1)A.

714,163
PB81-145518 Not available NTIS
National Bureau of Standards, Washington, DC.

Possibility of an Absolute Radiometric Standard Based on the Quantum Efficiency of a Silicon Photodiode,
J. Geist. 1979, 9p
Pub. in Proceedings of the Annual International Tech. Symposium of the SPIE (23rd), San Diego, CA., August 27-30, 1979, Paper in Measurements of Optical Radiations 197, p75-83 1979

Keywords: *Radiometry, Semiconductor junctions, Photovoltaic cells, Standards, Silicon.

The physical mechanisms governing the behavior of silicon photovoltaic p-n junctions are reviewed from the point of view of using the internal quantum efficiency of such devices as absolute radiometric standards.

714,164
PB81-149296 Not available NTIS
National Bureau of Standards, Washington, DC.
Field Ion Microscopy of Polycrystalline Iron Whiskers.
D. S. Lashmore, and A. J. Melmed. Aug 78, 2p
Pub. in Jnl. of Applied Physics 49, n8 p4586-4587 Aug 78.

Keywords: *Iron, Iron carbides, Polycrystalline, Microstructure, Crystal defects, *Whiskers, *Field ion microscopy.

Field ion micrographs of polycrystalline iron whiskers have been obtained for the first time. They indicate that the whiskers possess a two phase structure with one phase most probably alpha-iron with the other being Fe3C. A high defect density along with the presence of twins seems to be a whisker characteristic.

714,165
PB81-149379 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Expansion of Single Crystal Sapphire from 293 to 2000 K - Standard Reference Material 732.
T. A. Hahn. Aug 77, 11p
Pub. inProceedings of the International Symposium on Thermal Expansion, Hecla Island, Manitoba, Canada, August 29-31, 1977, n6 11p.

Keywords: *Sapphire, *Thermal expansion, Standards, *Standard reference materials, High temperature.

This single crystal sapphire rod is the fourth Standard Reference Material (SRM) to be certified for thermal expansion by the National Bureau of Standards. Expansion measurements to 1000 K on three samples indicate that the stock of material is of consistant quality suitable for certification. In the temperature range from 293 to 1000 K measurements were made using an interferometer apparatus. Above 1000 K length measurements were made using twin telemicroscope with the sample heated in a tungsten mesh furnace. Measurements were made parallel to the rod axis which is oriented 59 degrees from the c-axis of the crystal. Smoothed values of the expansion and coefficients of expansion were obtained by fitting the expansion with a variation of Gruneisen's equation. Final values of the four parameters were obtained by minimizing the standard deviation in a least-squares analysis. The results of this study are generally in good agreement with expansion values found in the literature. A comparison of the results of this study with data found in the literature will be presented.

714,166
PB81-154106 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Technology Program: Progress Briefs.
Interim rept. Apr-Jun 80.
W. M. Bullis. Oct 80, 13p NBSIR-80-2006-3
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA., Department of Energy, Washington, DC., Defense Nuclear Agency, Washington, DC., Charles Stark Draper Lab., Inc., Cambridge, MA.

Keywords: *Measurement, Semiconductors(Materials), Semiconductor devices, Semiconductor doping, Integrated circuits, Technology, Microelectronics, Process control, Silicon, Research.

This report provides information on the current status of NBS work on measurement technology for semiconductor materials, process control, and devices. Results of both in-house and contract research are covered. Highlighted activities include: optical linewidth and thermal resistance measurements, device modeling, dopant density profiles, resonance ionization spectroscopy, and deep-level measurements. Brief descriptions of selected on-going projects are included, and recent publications and publications in press are listed. Standardized oxide charge terminology developed by a joint IEEE-ECS committee is also described. The report is not meant to be exhaustive, contacts for obtaining further information are listed.

714,167
PB81-154114 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Technology Program: Progress Briefs.
Interim rept. Apr-Jun 79.
W. M. Bullis. Aug 79, 12p NBSIR-79-1591-4
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA., Department of Energy, Washington, DC., Defense Nuclear Agency, Wshington, DC., and Charles Stark Draper Lab., Inc., Cambridge, MA.

Keywords: *Measurement, Semiconductors(Materials), Semiconductor devices, Semiconductor doping, Integrated circuits, Microelectronics, Technology, Silicon, Research.

This report provides information on the current status of NBS work on measurement technology for semiconductor materials, process control, and devices. Results of both in-house and contract research are covered. Highlighted activities include studies of: laser annealing of silicon, dopant density profiles, silicon dioxide film thickness standards, intrachip linewidth variation, photoresist sensitometry, optical linewidth measurements, optical imagery calculations, and moisture measurement by mass spectroscopy. In addition, brief descriptions of new and selected on-going projects are given. The report is not meant to be exhaustive; contacts for obtaining further information are listed. Compilations of recent publications and publications in press are also included.

714,168
PB81-154122 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Technology Program: Progress Briefs.
Interim rept. Jul-Sep 79.
W. M. Bullis. Dec 79, 16p NBSIR-79-1591-5
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA., Department of Energy, Washington, DC., Defense Nuclear Agency, Washington, DC., and Charles Stark Draper Lab., Inc., Cambridge, MA.

Keywords: *Measurement, Semiconductors(Materials), Semiconductor devices, Semiconductor doping, Integrated circuits, Microelectronics, Technology, Diffusion, Silicon, Research.

This report provides information on the current status of NBS work on measurement technology for semiconductor materials, process control, and devices. Results of both in-house and contract research are covered. Highlighted activities include, modeling of diffusion processes, analysis of model spreading resistance data, and studies of resonance ionization spectroscopy, resistivity-dopant density relationships in p-type silicon, deep level measurements, photoresist sensitometry, random fault measurements, power MOSFET thermal characteristics, power transistor swithcing characteristics, and gross leak testing. In addition, brief descriptions of new and selected on-going projects are given. The report is not meant to be exhaustive; contacts for obtaining further information are listed. Compilations of recent publications and publications in press are also included.

714,169
PB81-155707 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic State at the Surface of Ferromagnet by Polarized Electron Diffraction.
Final rept.
G. P. Felcher, S. D. Bader, R. J. Celotta, D. T. Pierce, and G. C. Wang. 1980, 5p
Pub. in Proceedings of the International Conference, Lake Geneva, WI., May 28-30, 1980, p107-111 1980.

Keywords: *Nickel, *Magnetic properties, Surface properties, Ferromagnetism, Electron diffraction, Polarized electron diffraction.

The results of the first experiment by polarized electron diffraction (PLEED) on a (110) surface of magnetized nickel are presented and discussed. The conclusion is that nickel is magnetically active at the surface; and further, that this new technique might become a powerful analytical tool for the study of surface magnetism.

714,170
PB81-155756 Not available NTIS
National Technical Information Service, Springfield, VA.
Surface Magnetization in Ni(110) as Studied by Polarized Electron Scattering.
Final rept.
R. J. Celotta, D. T. Pierce, G. C. Wang, and S. D. Bader. and G. P. Felcher. 1980, 4p
Pub. in Proceedings of the International Conference on Solid Surfaces (4th) and European Conference on Surface Science (3rd), Cannes, France, September 22-26, 1980, p1045-1048 1980.

Keywords: *Nickel, *Magnetic properties, Surface properties, Ferromagnetism, Single crystals, Electron scattering, Polarized electron diffraction.

A new technique, capable of observing the surface magnetization of ferromagnetic single crystals, is described. Illustrative data is presented, giving the dependence of the magnetization of the Ni(110) surface on applied field, incident energy, absorbate and coverage.

714,171
PB81-156374 Not available NTIS
National Bureau of Standards, Washington, DC.
Anomalous Field Evaporation of Silicon.
Final rept.
T. Sakurai, R. J. Culbertson, and A. J. Melmed. 1978, 6p
Pub. in Surface Science 78, pL221-L226 1978.

Keywords: *Silicon, *Ion emission, *Desorption, Electric fields, Surfaces, Reprints, Field ion microscopy.

When a sufficiently high electric field is applied to a metal surface, metal atoms desorb orderly as single ions from surface kink sites (field evaporation). The authors report here an anomaly found in the case of field evaporation of semiconductor emitters. When Si whiskers were fieid-evaporated in vacuum at 78 K, it was found that surface Si atoms evaporate randomly as clusters of Si atoms instead of single atoms. Field evaporation at room temperature proceeded in the normal fashion.

714,172
PB81-157968 Not available NTIS
National Bureau of Standards, Washington, DC.
Standards Program for Ac Losses in Superconductors.
Final rept.
R. Radebaugh, G. Fujii, D. T. Read, and A. F. Clark. 1980, 4p
Pub. in Proceedings on International Congress of Refrigeration (15th), Venice, Italy, September 23-29, 1979, Session A 1/2, Paper 10 in Progress in Refrigeration Science and Technology, 4p 1980.

Keywords: *Superconductors, Standards, Measurement, Losses, Calorimeters, Alternating current.

The final goal of the program is to establish standard measurement practices and a standard reference material for calibration of apparatus. In this paper the authors discuss a comparison of several techniques for measuring ac losses in superconductors. The techniques are divided into either a calorimetric or electronic type.

714,173
PB81-158602 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Technology Program: Progress Briefs.
Interim rept. Jul-Sep 80.
W. M. Bullis. Dec 80, 11p NBSIR-80-2006-4
Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA., Department of

Energy, Washington, DC., Defense Nuclear Agency, Washington, DC., and Charles Stark Draper Lab., Inc., Cambridge, MA. See also PB80-207038.

Keywords: *Semiconductors, *Semiconductor devices, Measurement, Technology, Silicon, Integrated circuits, Microelectronics, Raman spectroscopy.

Highlighted activities include: studies of the Raman spectra of boron-doped silicon, spreading resistance measurements on gallium arsenide, the annealing behavior of optical absorption of sulfur-doped silicon, aluminum-silica interlayers, and the time dependence of acoustic emission from seal cracks. Brief descriptions of the newly announced optical microscope linewidth measurement standard and a metallization step coverage random fault test structure are given.

714,174
PB81-160905 Not available NTIS
National Bureau of Standards, Washington, DC.
Microwave Enhancement of Superconductivity in Aluminum Tunnel Junctions.
Final rept.
J. T. Hall, L. B. Holdeman, and R. J. Soulen. 22 Sep 80, 4p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Physical Review Letters 45, n12 p1011-1014, 22 Sep 80.

Keywords: *Superconductivity, *Aluminum, Metal films, Microwaves, Cryogenics, Junctions, Electron tunneling, Transition temperature, Reprints.

Microwave radiation (0.1 to 12 GHz) was propagated in a microstrip transmission line formed by a superconducting Al film on a BaF2 substrate. Cross strips formed Al-Al oxide-Al tunnel junctions that were used to study the effect of microwaves on the superconducting properties of the Al films. Large increases in the energy gap and transition temperature were observed for frequencies near 3.7 GHz. The enhancements were negligible below 1 GHz. Anomalous behavior of the features in the tunneling characteristics was observed above 5 GHz.

714,175
PB81-171498 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Powder Diffraction Study of the Structures of CeTaO4, CeNbO4, and NdTaO4.
Final rept.
A. Santoro, M. Marezio, R. S. Roth, and D. Minor. 1980, 9p
Pub. in Jnl. of Solid State Chemistry 35, p167-175 1980.

Keywords: *Crystal structure, Neutron diffraction, Cerium compounds, Neodymium compounds, Niobates, Tantalates, Reprints, *Cerium tantalates, *Cerium niobates, *Neodymium tantalates.

The crystal structures of CeTaO4, CeNbO4, and NdTaO4 have been refined with the Rietveld method using neudron powder diffraction data collected at room temperature. The results of these refinements show that the coordination of the Ce and Nd cations is 8 with an average Ce-O distance of 2.520 A in CeTaO4 and 2.480 A in CeNbO4, and an average Nd-O distance of 2.451 A in NdTaO4. The Nb and Ta cations in CeNbO4 and NdTaO4 are surrounded by six oxygen ions with Nb-O distances varying between 1.851 and 2.482 A, and Ta-O distances varying between 1.861 and 2.353 A. The structural arrangement of CeTaO4 can be regarded as that of an oxidized ABO3 perovskite. The difference in structure of CeTaO4 and NdTaO4 is most likely due to the difference in size of the rare-earth cations.

714,176
PB81-171936 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic Properties and Hyperfine Interactions in the B''' Phase of Potassium Ferrite.
Final rept.
V. P. Romanov, G. A. Candela, R. S. Roth, and L. J. Swartzendruber. Oct 79, 4p
Pub. in Jnl. of Applied Physics 50, n10 p6455-6458 Oct 79.

Keywords: *Antiferromagnetism, Potassium inorganic compounds, Ferrates, Hyperfine structure, Magnetic properties, Phase diagrams, Ferrites, Reprints, *Potassium ferrites, Magnetic susceptibility, Exchange interactions, Magnetic ordering.

The hyperfine field structure and magnetic susceptibility in the temperature range 5-295 K was measured for the (beta triple prime) phase of potassium ferrite. Results show that this new phase has an antiferromagnetic ordering similar to the beta phase. The hyperfine-interaction parameters have been determined and are compared with those found in magnetite, B-phase potassium ferrite, and barium hexaferrite.

714,177
PB81-171944 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystal Growth.
Final rept.
R. L. Parker. 1981, 2p
Pub. in Encyclopedia of Physics, p175-176 1981.

Keywords: *Crystal growth, Surveys, Reviews, Reprints.

A brief survey of the field of crystal growth is presented.

714,178
PB81-172082 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Expansion of Cubic Crystals.
Final rept.
R. C. Shukla, and R. A. MacDonald. 1980, 6p
Sponsored in part by Natural Sciences and Engineering Research, Canada.
Pub. in High Temperature High Pressures 12, p291-296 1980.

Keywords: *Face centered cubic lattices, *Thermal expansion, Brillouin zones, Free energy, Lead(Metal), Aluminum, Silver, Nickel, Copper, Calcium, Strontium, Reprints, High temperature.

A method for an exact calculation of the thermal expansion (epsilon) of cubic crystals in the high-temperature limit is presented. The calculation is carried out for a nearest-neighbor central force (nncf) model of a monatomic fcc crystal by minimizing the Helmholtz free energy of the crystal as a function of temperature and volume. The vibrational part of the Helmholtz free energy is obtained from the harmonic and the two lowest-order (cubic and quartic) anharmonic terms of the perturbation theory. A parameter (alpha 1) depending on the first and second derivatives of the pair potential phi(r) is introduced, and epsilon is calculated from the knowledge of phi(r) and of ten dimensionless Brillouin zone sums which are functions of alpha 1 alone. The numerical results for a number of materials (Pb, Al, Ag, Ni, Cu, Ca, and Sr) are compared with their experimental values, and the validity of the nncf model is discussed in the context of thermal expansion.

714,179
PB81-174294 Not available NTIS
National Bureau of Standards, Washington, DC.
Substitution in Barium-Fluoride Apatite: The Crystal Structures of Ba10(PO4)6F2, Ba6La2Na2(PO4)6F2 and Ba4Nd3Na3(PO4)6F2.
Final rept.
M. Mathew, I. Mayer, B. Dickens, and L. W. Schroeder. 1979, 17p
Sponsored in part by American Dental Association, Chicago, IL.
Pub. in Jnl. of Solid State Chemistry 28, p79-95 1979.

Keywords: *Crystal structure, Barium halides, Phosphates, Reprints, *Barium fluorides, *Apatites.

The crystal structures of the apatites Ba10(PO4)6F2(I), Ba6La2Na2(PO4)6F2(II) and Ba4Nd3Na3(PO4)6F2(III) have been determined by single-crystal X-ray diffraction. All three compounds crystallize in a hexagonal apatite-like structure. The structures were refined by normal full-matrix crystallographic least squares techniques. The final values of the refinement indicators R(w) and R are: I, R(w)=0.026, R=0.027,613 observed reflections; II, R(w)=0.081, R=0.074, 579 observed reflections; III, R(w)=0.062, R=0.044,1262 observerved reflections. In I, the Ba(1) atoms located in columns on threefold axes, are coordinated to nine oxygen atoms; the Ba(2) sites form triangles about the F site and are coordinated to six oxygen atoms and one fluoride ion. The structures of II and III contain disordered cations. In II there is disorder between La and Na in the column cation sites as well as triangle sites.

714,180
PB81-174302 Not available NTIS
National Bureau of Standards, Washington, DC.
Strain Scaling Law for Flux Pinning in Practical Superconductors. Part 1: Basic Relationship and Application to Nb3Sn Conductors.
Final rept.
J. W. Ekin. Nov 80, 14p
Sponsored in part by Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Cryogenics 20, n12 p611-624 Nov 80.

Keywords: *Superconductors, *Niobium intermetallics, Cryogenics, Magnetic fields, Gallium intermetallics, Titanium intermetallics, Vanadium intermetallics, Reprints, *Flux pinning, *Critical current, Niobium tin, Niobium germanium, Niobium titanium, Vanadium gallium.

Critical current and flux pinning densities have been determined for a series of Nb3Sn, V3Ga, Nb3Ge, and NbTi conductors as a function of uniaxial tensile strain in magnetic fields ranging from 4 to 19 T. An empirical relationship has been found at 4.2 K that describes these data over the entire range of field under both compressive and tensile strain.

714,181
PB81-174344 Not available NTIS
National Bureau of Standards, Washington, DC.
Development of Standards for Superconductors.
Final rept.
F. R. Fickett, and A. F. Clark. 1980, 5p
Sponsored in part by Department of Energy, Washington, DC. See also report dated Dec 79, PB80-175417.
Pub. in Proceedings of the International Cryogenic Engineering Conference (8th) Held at Genoa, Italy on June 3-6, 1980, p494-498 1980.

Keywords: *Superconductors, Standards, Critical temperature, Measurement, Critical current.

The U.S. National Bureau of Standards is now working in conjunction with the manufacturers and users of superconducting wires to arrive at a set of voluntary standards for making and reporting measurements on these materials. The program involves the preparation of standard definitions, investigation of measurement practices, experimental determination of the effect of various apparatus parameters, and development of standard test methods.

714,182
PB81-174377 Not available NTIS
National Bureau of Standards, Washington, DC.
Picosecond Applications of Josephson Junctions.
Final rept.
D. G. McDonald, R. L. Peterson, C. A . Hamilton, R. E. Harris, and R. L. Kautz. Oct 80, 21p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices ED-27, n10 p1945-1965 Oct 80.

Keywords: *Josephson junctions, Superconductivity, Strip transmission lines, Reprints, Time domain.

The behavior of simple superconducting circuits in the picosecond regime is described in a comprehensive way, with primary emphasis being given to the step function and pulse responses of these circuits. Topics receiving detailed discussion include Josephson-junction modeling with both the microsopic and shunted-junction models.

714,183
PB81-176141 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Development of Standards for Superconductors, Annual Report, FY 80.
F. R. Fickett, L. F. Goodrich, and A. F. Clark. Dec 80, 216p NBSIR-80-1642
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Superconductors, *Standards, *Critical current.

The work in FY 80 has concentrated nearly exclusively on the critical current standard. Experimental determinations of the effect of various parameters on the measurement have been made by NBS and by the wire manufacturers. Significant progress has been made in the preparation of the actual critical current measurement standard and the definition standard. Draft copies of both are now ready for comment.

714,184
PB81-182875 Not available NTIS
National Bureau of Standards, Washington, DC.
Strain Scaling Law and the Prediction of Uniaxial and Bending Strain Effects in Multifilamentary Superconductors.
Final rept.
J. W. Ekin. 1980, 17p
Sponsored in part by Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Proceedings of the Topical Conference Held at Upton, NY., on May 28-29, 1980, Paper in Filamentary A15 Superconductors, p187-203 1980.

Keywords: *Superconductors, Niobium intermetallics, Tin intermetallics, Strains, Filaments, Critical current.

The strain-scaling law has been used to determine uniaxial-strain characteristics which describe the critical-current degradation in commercial multifilamentary Nb3Sn conductors from 4 T to 16 T. Bending-strain degradation has then been calculated from the uniaxial-strain characteristics by taking an average appropriate for the twist-pitch to current-transfer-length ratio of the conductor.

714,185
PB81-187510 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin Dependence of the Electron Mean Free Path in Fe, Co, and Ni.
Final rept.
R. W. Rendell, and D. R. Penn. 22 Dec 80, 4p
Pub. in Physical Review Letters 45, n25 p2057-2060, 22 Dec 80.

Keywords: *Electrons, *Mean free path, Iron, Nickel, Cobalt, Electron spin, Ferromagnetic materials, Reprints, Hot electrons, Exchange interactions.

Spin-dependent electron mean free paths as a function of the hot electron energy are calculated for Fe, Co, and Ni. The difference in mean free paths of electrons for spin parallel and antiparallel to the majority spin direction of the ferromagnet is found to change sign and decrease rapidly in magnitude with increasing electron energy. Results for the mean free path with and without exchange included are also presented.

714,186
PB81-188120 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Technology Program:Progress Briefs.
Interim rept. Oct-Dec 80.
W. M. Bullis. Mar 81, 12p NBSIR-81-2230
See also report dated Dec 80, PB81-158602. Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems, Defense Nuclear Agency, Washington, DC., and Charles Stark Draper Lab., Inc., Cambridge, MA.

Keywords: *Semiconductors, *Semiconductor devices, Measurement, Technology, Integrated circuits, Microelectronics, Silicon.

This report provides information on the current status of NBS work on measurement technology for semiconductor materials, process control, and devices. Emphasis is placed on silicon and silicon based devices. Highlighted activities include an analysis of the cross-bridge sheet resistance test structure, observations of laser-induced patterns on semiconductor surfaces, a technique for analysis of data from test structures on process validation wafers, and advances in optical measurements of line-width on wafers.

714,187
PB81-197527 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic Inelastic Neutron Scattering Studies of Rare Earth Metals and Laves-Phase Compounds.
Final rept.
J. J. Rhyne. 1980, 30p
Pub. in Chapter 13 in Science and Technology of Rare Earth Materials, p261-290 1980.

Keywords: *Rare earth elements, Neutron scattering, Thermal neutrons, Aluminum inorganic compounds, Cobalt inorganic compounds, Iron inorganic compounds, Magnons, Reprints, Laves phases, Exchange interactions, Crystal field theory, Random phase approximation, NTISCOMNBS.

An introduction is given to the use of the inelastic thermal neutron scattering as a probe of the magnetic interactions in rare earth materials. As examples, the rare earth metals and cubic Laves-phase compounds are emphasized. For the rare earth metals, magnon dispersion is discussed in terms of current theories which include effects of both q-dependent exchange and single and multi ion magnetic anisotropies. The details of the generalized susceptibility function obtained for the different heavy rare earth elements is discussed in relation to their magnetic structure and electronic states. The magnetic field dependence of the q = 0 anisotropy gap is related to the magnetic-elastic properties of the elements. The Laves-phase compounds with Al, Fe, and Co have recently been explored in some detail. The Fe and Co compounds are prototypical systems for the study of magnetic excitations involving two magnetic atoms and two sites. In contrast to the Al compounds, the Fe and Co materials show negligible rare earth - rare earth exchange interaction.

714,188
PB81-197816 Not available NTIS
National Bureau of Standards, Washington, DC.
Polarized Low-Energy-Electron Diffraction from W(100).
Final rept.
G. C. Wang, R. J. Celotta, and D. T. Pierce. 15 Feb 81, 10p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Physical Review B 23, n4 p1761-1770, 15 Feb 81.

Keywords: *Tungsten, Surface properties, Reprints, *Polarized electron diffraction, *Low energy electron diffraction, NTISCOMNBS, NTISDODN.

A set of polarized low-energy-electron diffraction (PLEED) data from a W(100) surface measured using a polarized electron beam is presented. The data include conventional LEED profiles I(E,theta) as well as S(E,theta) profiles which measure the spin dependence of the scattering. These profiles are obtained for specular beams at angles of incidence from 9 degrees -24 degrees and for five nonspecular beams at normal incidence. The potential usefulness of S(E,theta) profiles for structure determination is discussed and the use of PLEED for spin analysis is assessed.

714,189
PB81-199655 Not available NTIS
National Bureau of Standards, Washington, DC.
Observation of Low-Energy Excitations in NbD: A Simple Lattice-Dynamical Model.
Final rept.
A. Magerl, J. M. Rowe, and D. Richter. 15 Feb 81, 4p
Pub. in Physical Review B 23, n4 p1605-1608, 15 Feb 81.

Keywords: Niobium inorganic compounds, Deuterium compounds, Phonons, Reprints, *Niobium hydrides, NTISCOMNBS.

A tentative explanation of the 18-19 meV peaks recently observed in NbD(0.85) is presented. These peaks are attributed to the presence of flat optical modes in the lattice dynamics of beta-phase NbD. These modes have significant structure factors over the whole pseudocubic zone in a multidomain crystal, mainly as a result of a large deuterium amplitude. Similar peaks in the alpha prime phase of NbD(0.85) can also be explained as a 'resonant interaction' where the broadening is due to the increased disorder.

714,190
PB81-205437 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
NBS*AIDS80: A FORTRAN Program for Crystallographic Data Evaluation.
Final rept.
A. D. Mighell, C. R. Hubbard, and J. K. Stalick. Apr 81, 58p NBS-TN-1141

Keywords: *Crystal structure, X ray diffraction, Data processing, Fortran, NBS AIDS80 computer program, UNIVAC-1100 computers, NTISCOMNBS.

Techniques for the computer-assisted evaluation of crystallographic data have been developed to improve the data compilations of the NBS Crystal Data Center and the JCPDS--International Centre for Diffraction Data. The resulting computer program, NBS*AIDS80, can be used for the analysis of unit-cell and powder diffraction data by the general scientific community as well. Research and analysis components include calculation of standard cells and space groups, determination of metric symmetry, checking the data for consistency, generation of d-spacings and indices, and analysis of powder patterns with calculation of figures of merit. Detailed input and output specifications are given.

714,191
PB81-209876 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
NBS Reactor: Summary of Activities, July 1979 to June 1980.
F. J. Shorten. May 81, 215p NBS-TN-1142

Keywords: *Neutron beams, *Research projects, Nuclear research and test reactors, Neutron irradiation, Neutron activation analysis, Materials tests, Neutron diffraction, Neutron radiography, Crystal structure, NTISCOMNBS.

This report summarizes all those programs which depend on the NBS reactor. It covers the period from July 1979 through June 1980. The programs range from the use of neutron beams to study the structure and dynamics of materials through nuclear physics and neutron standards to sample irradiations for activation analysis, isotope, radiation effects studies, neutron radiography, and nondestructive evaluation.

714,192
PB81-211625 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Band-Gap Narrowing on the Built-In Electric Field in N-Type Silicon.
Final rept.
J. Geist, and J. R. Lowney. Feb 81, 3p
Pub. in Jnl. of Applied Physics 52, n2 p1121-1123 Feb 81.

Keywords: *Semiconductors(Materials), *Silicon, *Energy gap, *Electric fields, Band structure of solids, Reprints, N type semiconductors, NTISCOMNBS.

A relation is derived to describe the change in the built-in electric field in an n-type semiconductor due to band tailing and carrier freeze-out, as well as band-gap narrowing. Recent numerical models of these various phenomena were used to illustrate the effect on heavily doped n-type silicon. While neither band-gap narrowing, band tailing, nor deionization alone is sufficient to explain the large decrease in the built-in electric field that has been inferred from experimental measurements, the combination of all three effects may be sufficient.

714,193
PB81-211633 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrical Resistivity of Molybdenum in the Temperature Range 1500 to 2650 K.
Final rept.
A. Cezairliyan. 1980, 11p
Pub. in International Jnl. of Thermophysics 1, n4 p417-427 1980.

Keywords: *Molybdenum, *Electrical resistivity, Reprints, Standard reference materials, NTISCOMNBS.

Measurement of the electrical resistivity of molybdenum in the temperature range 1500 to 2650 K by a subsecond-duration pulse-heating technique is described. The specimens were of the National Bureau of Standards Molybdenum Standard Reference Material 781 for Enthalpy and Heat Capacity. The estimated inaccuracy in the electrical resistivity data does not exceed 1%.

714,194
PB81-215733 Not available NTIS
National Bureau of Standards, Washington, DC.
Ground-State Spin Dynamics of ErCo2.
Final rept.
N. C. Koon, and J. J. Rhyne. 1 Jan 81, 8p
Pub. in Phys. Rev. B 23, n1 p207-214, 1 Jan 81.

Keywords: *Cobalt intermetallics, *Magnons, Ground state, Neutron scattering, Reprints, *Erbium intermetallics, Random phase approximation, NTISCOMNBS.

The ground-state magnetic excitation spectrum of ErCo2 was examined at 4.2 K, using neutron inelastic scattering. Four modes were observed, two which are nondispersive and two which are weakly dispersive.

Each of the weakly dispersive modes is degenerate with one of the nondispersive modes at the zone boundary, but falls lower in energy at the zone center. From the dynamic structure factor of the excitations, it is concluded that the nondispersive modes correspond to out-of-phase precession of the two rare-earth spins in the primitive cell, while the weakly dispersive modes correspond to in-phase precession.

714,195
PB81-221327 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Measurement Technology: The Relationship between Resistivity and Dopant Density for Phosphorus- and Boron-Doped Silicon.
Final rept.
W. R. Thurber, R. L. Mattis, Y. M. Liu, and J. J. Filliben. May 81, 58p NBS-SP-400-64
Library of Congress catalog card no. 81-600052. Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Semiconductors, *Silicon, *Semiconductor doping, Phosphorus, Boron, Electrical resistance, Density(Number/volume), Electron mobility, Hall effect.

New data have been obtained for the resistivity-dopant density relationship for silicon doped with phosphorus or boron for dopant densities in the range 10 to the 13th power to 10 to the 20th power/cu cm. For dopant densities less than 10 to the 18 power/cu cm, results were calculated from resistivity and junction capacitance-voltage measurements on processed wafers. For more heavily doped material, data were obtained from Hall effect and resistivity measurements on specimens cut from bulk silicon slices.

714,196
PB81-227530 Not available NTIS
National Bureau of Standards, Washington, DC.
Structural Phase Transitions in Nickel at the Curie Temperature.
Final rept.
J. C. Hamilton, and T. Jach. 16 Mar 81, 4p
Sponsored in part by the Department of Energy, Washington, DC.
Pub. in Physical Review Letters 46, n11 p745-748, 16 Mar 81.

Keywords: *Nickel, *Phase transformations, Single crystals, Curie temperature, Ferromagnetic materials, Surface properties, Reprints.

It is observed that a reversible step period rearrangement on clean nickel single-crystal surfaces occurs in the immediate vicinity of the Curie temperature. Reversible carbon segregation is observed on the same crystal surfaces below the Curie point. The segregated carbon is carbidic, not graphitic, and indicates a change in the nickel surface electronic structure occurring at the ferromagnetic transition. Measured carbon coverages indicate a change greater than 0.2 eV per carbon atom in the heat of segregation at the Curie point.

714,197
PB81-227563 Not available NTIS
National Bureau of Standards, Washington, DC.
Pressure Variation of the Low-Frequency Dielectric Constants of Some Anisotropic Crystals.
Final rept.
J. Link, M. C. Wintersgill, J. J. Fontanella, V. E. Bean, and C. G. Andeen. Feb 81, 4p
Sponsored in part by the Naval Academy Research Council, Washington, DC.
Pub. in Jnl. of Applied Physics 52, n2 p936-939 Feb 81.

Keywords: *Dielectric properties, *Quartz, *Sapphire, *Calcite, *Magnesium fluorides, Low frequencies, Anisotropy, Reprints, Pressure dependence.

The low-frequency dielectric constant for quartz, sapphire, calcite, and magnesium fluoride has been measured both parallel and perpendicular to the optic axis at several temperatures over the pressure range 0-0.3GPa. The results, when compared with the reported values for the effect of pressure on the high-frequency dielectric constant, indicate that pressure decreases the infrared contribution to the dielectric constant for all materials except calcite. Consequently, the infrared polarizability decreases with pressure for all but calcite.

714,198
PB81-227605 Not available NTIS
National Bureau of Standards, Washington, DC.
Strain Scaling Law for Flux Pinning in NbTi, Nb3Sn, Nb-Hf/Cu-Sn-Ga, V3Ga and Nb3Ge.
Final rept.
J. W. Ekin. 1 Jan 81, 4p
Sponsored in part by the David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in IEEE Transactions on Magnetics MAG-17, n1 p658-661, 1 Jan 81.

Keywords: *Superconductors, Gallium intermetallics, Niobium intermetallics, Tin intermetallics, Titanium intermetallics, Vanadium intermetallics, Cryogenics, Reprints, *Flux pinning, *Critical current, *Scaling laws, Niobium germanium, Niobium tin, Niobium titanium, Vanadium gallium, Germanium intermetallics.

Critical current and flux pinning densities have been determined for a series of practical conductors as a function of uniaxial tensile strain in magnetic fields ranging from 4 T to 19 T. An empirical relation has been found at 4.2 K that accurately describes these data over the entire range of field under both compressive and tensile strain.

714,199
PB81-234668 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic Susceptibility Studies of Amorphous Ni-Mn-P-B-Al Alloys.
Final rept.
R. B. Goldfarb, K. V. Rao, F. R. Fickett, and H. S. Chen. Mar 81, 3p
Pub. in Jnl. of Applied Physics 52, n3 p1744-1746 Mar 81.

Keywords: Nickel alloys, Manganese containing alloys, Phosphorus containing alloys, Aluminum containing alloys, Reprints, *Magnetic susceptibility, Amorphous materials, Boron additions.

Magnetic susceptibility studies have been made on amorphous (Ni(1-x)Mn(x)75P16B6Al3 alloys in the temperature range 4 - 300 K. Results are discussed.

714,200
PB81-235343 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin Glass-Ferromagnetic Phase Transition in Amorphous (Fe(x)Ni(1-x))0.75 P(0.16) B(0.06) Al(0.03).
Final rept.
J. W. Lynn, R. W. Erwin, J. J. Rhyne, and H. S. Chen. Mar 81, 3p
Pub. in Jnl. of Applied Physics 52, n3 p1738-1740 Mar 81.

Keywords: *Ferromagnetic materials, Iron alloys, Nickel alloys, Neutron scattering, Magnons, Reprints, Amorphous materials.

Inelastic neutron scattering studies have been carried out on the magnetically isotropic amorphous system in the concentration range ($x>0.17$) where both ferromagnetic and spin-glass behavior are observed. For $x=0.4$, well defined spin waves which obey the customary quadratic dispersion relation $E=D(Q^2)$ are observed below the Curie temperature ($T(c)=365K$) and D is found to increase with decreasing temperature as usual. Below about 80K, however, D begins to decrease with decreasing temperature as the spin-glass state is approached. Accompanied by this decrease in D is an increase in the spin wave linewidths. Preliminary results for $x=0.3$ and $x=0.2$ show qualitatively similar behavior.

714,201
PB81-235350 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Scattering Studies of the Magnetic Superconductor (Ce1-xTbx) Ru2.
Final rept.
J. A. Fernandez-Baca, and J. W. Lynn. Mar 81, 3p
Pub. in Jnl. of Applied Physics 52, n3 p2183-2185 Mar 81.

Keywords: Cerium compounds, Terbium compounds, Ruthenium compounds, Neutron scattering, Superconductors, Cryogenics, Reprints, *Magnetic superconductors, *Magnetic ordering.

Neutron scattering measurements have been carried out on polycrystalline specimens of (Ce(1-x)Tb(x))Ru2, for $x=0.07$, 0.18, 0.44, in order to study the inelastic magnetic scattering as well as the development of magnetic correlations at low temperatures. At small wavevectors the intensity in each sample increases with decreasing temperature indicating the development of ferromagnetic correlations at low temperatures, but the intensity saturates at low temperature with no peak in its temperature dependence. There is also no evidence of any magnetic Bragg peaks, which indicates that there is no long range ferromagnetic order.

714,202
PB81-235368 Not available NTIS
National Bureau of Standards, Washington, DC.
Superconducting Electronics.
Final rept.
D. G. McDonald. Feb 81, 11p
Pub. in Physics Today 34, n2 p37-47 Feb 81.

Keywords: *Electronics, *Superconductivity, Cryogenics, Reprints.

Scientific measurements using superconducting electronics are approaching fundamental limits, limits which no technology can surpass in some cases. Circuits with the same basic components have important advantages for large-scale integrated electronics. This combination of extraordinary performance and suitability for large scale integration presages the emergence of a broad new electronic technology.

714,203
PB81-236341 Not available NTIS
National Bureau of Standards, Washington, DC.
Young's Modulus of a Copper-Stabilized Niobium-Titanium Superconductive Wire.
Final rept.
H. M. Ledbetter, J. C. Moulder, and M. W. Austin. Jan 81, 3p
Sponsored in part by Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Wire, 3p Jan 81.

Keywords: Superconductors, Modulus of elasticity, Copper, Reprints, *Superconducting wires, *Young modulus, *Niobium titanium.

Young's modulus was determined for an Nb-Ti superconductive wire. Two methods were used: continuous-wave-resonance and laser-pulse-excitation. Young's moduli were also determined for the components copper and Nb-Ti - in both wire and bulk forms. Some mechanical deformation effects on Young's modulus were also measured. From the components' elastic moduli, that of the composite was predicted accurately by a simple rule-of-mixtures relationship.

714,204
PB81-236523 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Thermal Contraction of Sample-Holder Material on Critical Current.
Final rept.
G. Fujii, J. W. Ekin, R. Radebaugh, and A. F. Clark. 1980, 9p
Pub. in Proceedings of the International Cryogenic Materials Conference held at Madison, WI., on August 24-29, 1979, Paper I-1 in Advances in Cryogenic Engineering Materials 26, p589-598 1980.

Keywords: *Superconductors, Measurement, *Critical current.

As part of a program to develop standard practices for measuring critical current (I sub c), the I sub c characteristics of commercial multifilamentary Nb3Sn and V3Ga wires have been measured using phenolic, copper, and fiberglass epoxy (NEMA G-10) sample holders. For each of these materials, I sub c was measured with the sample in a hair-pin geometry supported in two different ways to prevent movement from Lorentz forces: first with the sample freely suspended in a slot machined in the support material, and second, with the sample frozen in place with vacuum grease.

714,205
PB81-236580 Not available NTIS
National Bureau of Standards, Washington, DC.
Cryogenics for SQUIDs.
Final rept.
J. E. Zimmerman. 1980, 21p
Pub. in Proceedings of International Conference Superconducting Quantum Devices (2nd), Berlin, Germany, F.R., May 6-9, 1980, Paper in Squid '80, p423-443 1980.

Keywords: *Cryogenics, SQUID devices, *Cryogenic refrigeration, Cryocoolers.

While not much work on SQUID cryocoolers as such has been done yet, a large amount of work on higher temperature refrigerators for infrared sensors and for use in spacecraft provides a sophisticated technical base upon which to build. A low-power five-stage Stirling cryocooler with a single-component SQUID gradiometer has begun operation in the author's laboratory. Although this machine requires only 20 W of mechanical power input to maintain a temperature of 7 K, a large reduction of input power is theoretically possible.

714,206
PB81-238529 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Technology Program: Progress Briefs.
W. M. Bullis. Jul 81, 17p NBSIR-81-2230-2
ARPA Order-3882, Contract N00030-78-C-0100
Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems Contract DOE-EG-77-C-01-4042. See also AD-A098 029.

Keywords: *Silicon, *Semiconductors(Materials), Measurement, Integrated circuits, Microelectronics, Semiconductor devices.

This report provides information on the current status of NBS work on measurement technology for semiconductor materials, process control, and devices.

714,207
PB81-241218 Not available NTIS
National Bureau of Standards, Washington, DC.
Characterizing Semiconducting Materials.
Final rept.
W. M. Bullis. Oct 80, 13p
Pub. in Semicond. Int., p79-91 Oct 1980.

Keywords: *Semiconductors(Materials), Characteristics, Reprints.

Materials characterization is needed to interpret device and circuit characteristics. Ancillary techniques associated with the analysis of process chemicals, control of process steps and characterizing packages will also assist in this.

714,208
PB81-245987 Not available NTIS
National Bureau of Standards, Washington, DC.
Isotopic Shifts in Complex Crystals.
Final rept.
R. C. Casella. 1978, 6p
Pub. in Physical Review B 17, n8 p3381-3386, 15 Apr 78.

Keywords: *Phonons, *Lattice vibrations, Reprints, Isotopic exchange.

Relations are given between the phonon frequencies of crystals related by isotopic substitution when several ion types are involved in the mode being probed. Also, when the rigid molecular-ion approximation applies to extended subunits of the basic lattice cell, the author considers the effects of substitution on combined translational and librational modes, involving more than one type of extended ion. The Teller-Redlich product rule is obtained for an arbitrary wave vector.

714,209
PB81-246027 Not available NTIS
National Bureau of Standards, Washington, DC.
Resonant Satellites in Photoemission and Auger Spectra of d-band Metals.
Final rept.
S. M. Girvin, and D. R. Penn. Mar 81, 4p
Pub. in Jnl. of Applied Physics 52, n3 p1650-1653 Mar 81.

Keywords: Auger electrons, Photoelectron emission, Reprints, *Auger electron spectroscopy, *Photoelectron emission.

Photoemission and Auger electron spectroscopy are powerful tools in the study of the electronic and magnetic properties of d band metals. In certain instances experimental spectra can be directly interpreted as a measure of some one body density of states. In other cases one must consider the many body dynamics of the measurement process in detail. Striking examples of the latter are the resonant satellites in several d band materials which have been observed in photoemission near the photon energy threshold for core hole production. An elementary introduction to the physics of this satellite phenomenon will be presented. A model recently introduced by Davis and Feldkamp to explain resonant satellites in filled d band materials will be discussed in some detail and the predictions of this model will be used to illustrate some general properties of resonant photoemission satellites.

714,210
PB81-248908 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Scattering from Coherent Admixtures of Phonons with Libronic Excitations of Diatomic Impurities.
Final rept.
R. C. Casella. 1979, 8p
Pub. in Physical Review B 20, n12 p5318-5325, 15 Dec 79.

Keywords: *Phonons, Neutron scattering, S matrix theory, Impurities, Reprints.

The coherent mixed-mode states are represented in an S-matrix formalism. In the small (q vector) quasi-continuum region, the phonon field is expanded in terms of vector cubic harmonics, analogues of vector spherical harmonics. Tunneling states of the diatoms in a cubic crystal field are analyzed via group-theoretically projected tight-binding local oscillator states developed by Dick. Plausible level schemes are constructed by joining the strong-coupling spectrum they describe to the weak-coupling (free-rotator) spectrum. This semiphenomenological approach does not depend upon details of the generalized Devonshire hindering potential. It is found that the T-matrix elements connecting the phonons with the libronic or hindered-rotator excitations vanish in lowest nontrivial order unless the latter are of E(g) or T(2g) symmetry. Expressions for estimating the relative strengths of these allowed T-matrix elements are derived. Results are applied to neutron scattering experiments on dilute-impurity KC CN(-) and KBr CN(-) and comparisons made with optical experiments on these systems.

714,211
PB81-248924 Not available NTIS
National Bureau of Standards, Washington, DC.
Lap Joint Resistance and Intrinsic Critical Current Measurements on a NbTi Superconducting Wire.
Final rept.
L. F. Goodrich, and J. W. Ekin. Jan 81, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Applied Superconductivity Conference (1980) Santa Fe, NM, September 29-October 2, 1980, IEEE Trans. Mag-17, n1 p1-4, Jan 81.

Keywords: *Superconductivity, Electrical resistance, Niobium alloys, Titanium alloys, *Critical current.

The lap joint resistance between two Cu:Nb-Ti wires (rectangular cross section, 0.53 x 0.68 mm) was measured at 4 K as a function of current, magnetic field, and joint area (0.5 to 7 mm squared). A simple model, using the magnetoresistance and current dependence, allowed the joint interface resistance and the current transfer resistance to be separated. The critical current of the wire was also measured adjacent to the joint. These critical current data were compared with data taken on the control sample (no lap joint). From these comparisons, operational checks were deduced for an intrinsic measurement of the critical current adjacent to a joint. The operational checks were on the reversibility of the V-I curves and on their current ramp-rate dependence. When these operational checks were applied to the critical current data of all the joints tested, the results agreed to + or - 2%.

714,212
PB82-101288 Not available NTIS
National Bureau of Standards, Washington, DC.
Hall Voltage Dependence on Inversion-Layer Geometry in the Quantum Hall-Effect Regime.
Final rept.
R. W. Rendell, and S. M. Girvin. 1981, 5p
Pub. in Physical Review B 23, n12 p6610-6614, 15 Jun 81.

Keywords: *Hall effect, *Semiconductors(Materials), Electric potential, Reprints, Inversion layers.

A calculation of the Hall voltage is presented within a model of a finite two-dimensional inversion layer. An explicit form for the electric field is obtained and this is found to have a power-law singularity in the corners of the inversion layer.

714,213
PB82-117805 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Standard X-ray Diffraction Power Patterns. Section 18 - Data for 58 Substances.
Final rept.
M. C. Morris, H. F. McMurdie, E. H. Evans, B. Paretzkin, H. S. Parker, N. C. Panagiotopoulos, and C. R. Hubbard. Oct 81, 113p NBS-MONO-25-SECT-18
See also report dated Oct 79, PB80-110364, and report dated Oct 80, PB81-103269. Prepared in cooperation with Joint Committee on Powder Diffraction Standards, Swarthmore, PA. Library of Congress catalog card no. 53-61386.

Keywords: *Crystal structure, *X ray diffraction, Lattice parameters, Inorganic compounds, Standards, Tables(Data), *Powder patterns.

Standard x-ray powder diffraction patterns are presented for 58 substances. These experimental patterns, useful for identification, were obtained by diffractometer methods. The lattice constants were refined by least-squares methods, and reflections were assigned Miller indices consistent with space group extinctions. Relative intensities, calculated densities, literature references, and other relevant data are included.

714,214
PB82-118043 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic Structure Determined by Nuclear Orientation.
Final rept.
B. G. Turrell, and H. Marshak. 1981, 6p
Pub. in Hyperfine Interactions 10, p1231-1236 1981.

Keywords: Antiferromagnetism, Holmium, Gamma rays, Anisotropy, Reprints, *Magnetic ordering.

In the last few years there has been an increased use of the nuclear orientation technique to study ordered magnetic structures. For ordered atomic magnets the spin structure can be inferred from measurements of the spatial distribution of nuclear radiations because the atomic spins define the nuclear quantization axes through the hyperfine interaction. In nuclear magnets the order is determined directly from the radiation pattern. Expressions for the spatial distributions of gamma-radiation from conical ordered structures are given, and applications to antiferromagnets and the rare-earth magnet holmium are discussed.

714,215
PB82-119835 Not available NTIS
National Bureau of Standards, Washington, DC.
Complete Collection of Minority Carriers From the Inversion Layer in Induced Junction Diodes.
Final rept.
J. Geist, E. Liang, and A. R. Schaefer. Jul 81, 3p
Pub. in Jnl. of Applied Physics 52, n7 p4879-4881 Jul 81.

Keywords: *Photodiodes, *Quantum efficiency, Silicon, Reprints, Minority carriers.

Mechanisms limiting the internal quantum efficiency in various types of oxide-passivated silicon photodiodes are discussed. It is argued that unit internal quantum efficiency is achievable in metallurgical junction, oxide-n(+)-p-p(+) photodiodes, if it is achievable in the inversion layer of induced junction diodes of the same type. Measurements of the variation in response of the latter type of photodiode under both oxide bias and reverse bias are described. The results indicate that 100% collection of the minority carriers generated in the inversion layer is achieved for sufficient low flux levels. Implantation in the oxide of Na(+) ions to augment the trapped positive charge increases maximum flux level at which 100% collection is observed.

714,216
PB82-119850 Not available NTIS
National Bureau of Standards, Washington, DC.

Localized Vibrational Modes in Fermi Liquids: General Theory.
Final rept.
J. W. Gadzuk. 15 Aug 81, 13p
Pub. in Physical Review B 23, n4 p1651-1663, 15 Aug 81.

Keywords: *Electron phonon interactions, Reprints, *Fermi liquids.

There exist an abundance of physically realized situations in atomic, chemical, molecular, nuclear, and solid-state physics which are modeled as a discrete state interacting with a continuum. One of these situations, a localized oscillator coupled to be the particle-hole excitation continuum of a Fermi liquid, forms the area of inquiry here. Special emphasis is placed on the electron-hole pair excitations of a metal although the results are more general. In particular, an exactly soluble model, in which a localized harmonic oscillator is coupled to the pair-density fluctuations of a random-phase-approximation Fermi liquid by an interaction linear in both oscillator displacements and density operators, is considered. The general results presented here have direct bearing in areas such as surface vibrational spectroscopy of adsorbed molecules, metal-hydride spectroscopy, and surface chemical-reactivity theory.

714,217
PB82-120122 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Semiconductor Measurement Technology: The Capabilities and Limitations of Auger Sputter Profiling for Studies of Semiconductors.
Final rept.
S. A. Schwarz, C. R. Helms, W. E. Spicer, and N. J. Taylor. Sep 81, 58p NBS-SP-400-67
Prepared in cooperation with Stanford Univ., Stanford, CA., and Varian Associates, Palo Alto, CA. Sponsored in part by Defense Advanced Research Projects Agency, Arlington, VA. Library of Congress catalog card no. 81-600003.

Keywords: *Integrated circuits, *Silicon dioxide, *Silicon, Surface properties, Interfaces, *Metal oxide semiconductor, *Auger electron spectroscopy, X ray photoelectron spectroscopy, Secondary ion mass spectroscopy.

Materials characterization is a critical area in current silicon integrated circuit technology. Those techniques that are commonly used include Auger sputter profiling, X-ray photoelectron spectroscopy, secondary ion mass spectrometry, and Rutherford backscattering. All of these techniques have unique capabilities and limitations for studies of silicon device structures. In this paper, the authors describe the capabilities and limitations of Auger sputter profiling especially with regard to sensitivity, spatial resolution, depth resolution, and chemical state determination. Although much of the discussion centers on Auger sputter profiling, the results are also applicable to X-ray photoelectron spectroscopy and secondary ion mass spectrometry.

714,218
PB82-127747 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin Dependent Attenuation Lengths in Ferromagnets.
Final rept.
R. W. Rendell, and D. R. Penn. Mar 81, 2p
Pub. in Jnl. of Applied Physics 52, n3 1620-1621 Mar 81.

Keywords: *Ferromagnetism, *Electron spin, Iron, Nickel, Cobalt, Reprints, Hot electrons.

Spin dependent attenuation lengths (AL) as a function of the hot electron energy are calculated for Fe, Co, and Ni.

714,219
PB82-133935 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Profile and Integrated-Intensity Methods in Powder Refinement.
Final rept.
E. Prince. 1981, 3p
Pub. in Jnl. of Applied Crystallography 14, p157-159 1981.

Keywords: Neutron diffraction, Statistical analysis, Linear regression, Reprints, *Powder patterns.

If a powder pattern consists of well resolved peaks, and if it is adequately described by a crystallographic model, as determined by statistical tests, the estimates of the parameters and their standard deviations will not be significantly different, in a statistical sense, whether the method of refinement uses peak profiles or integrated intensities. If the model does not fit adequately, the standard deviations cannot be calculated by statistical methods. If peaks overlap, there are correlations between the intensities of the individual peaks that are handled automatically in the profile method, but must be included explicitly in the integrated-intensity method. A background function should be included in the model, and its parameters refined. The background parameters have correlations with other parameters that become important if the pattern is complex, and therefore poorly resolved.

714,220
PB82-135864 PC **A02**/MF **A01**
Florida Univ., Gainesville. Dept. of Electrical Engineering.
Conductivity Mobility, Hall Mobility, and Resistivity in p-Type Silicon.
Final rept. 11 Mar 77-10 Jun 80.
S. S. Li. Sep 81, 9p NBS-GCR-81-334
Contract NB79-SBCA-0168, ARPA Order-2397

Keywords: *Semiconductors(Materials), *Silicon, *Electrical resistivity, Semiconductor doping, Hall effect, Holes(Electron deficiencies), Band structure of solids, Boron, Gallium, Indium, P type semiconductors, Density of states, Effective mass.

Detailed theoretical and experimental studies of the dopant density, hole density, hole mobility, and resistivity in p-type silicon were carried out over a wide range of dopant density (10 to the 14th power to 3 x 10 to the 18th power/cc) and temperature (100 to 400K). Good agreement between theory and experiment was obtained, and the theoretical models appear to be adequate for interpreting the temperature and dopant density dependence of resistivity of boron-, gallium-, and indium-doped silicon over the ranges studied.

714,221
PB82-135898 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Technology Program - Progress Briefs.
Interim rept. 1 Apr-30 Jun 81.
K. F. Galloway, R. I. Scace, and E. J. Walters. Nov 81, 13p NBSIR-81-2230-3
Contract N00030-79-C-0096, ARPA Order-3882
See also report for Jan-Mar 81, AD-A102 895. Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems, Defense Nuclear Agency, Washington, DC., and National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.

Keywords: *Microelectronics, *Silicon, Semiconductor doping, Band theory of solids, Gallium arsenides, Integrated circuits, Process control, Measurement, Technology, Semiconductors.

This report provides information on the current status of NBS work on measurement technology for semiconductor materials, process control, and devices. Emphasis is placed on silicon and silicon-based devices. Highlighted activities include semi-insulating GaAs characterization, an automatic scanning spectroscopic ellipsometer, linewidth measurement and coherence, bandgap narrowing effects in silicon, the evaluation of electrical linewidth uniformity, and arsenic-implanted profiles in silicon. In addition, recent publications and publications in press are listed. The report is not meant to be exhaustive; contacts for obtaining further information are listed.

714,222
PB82-137365 Not available NTIS
National Bureau of Standards, Washington, DC.
New Generating Functions and Results for the Density Polynomials of the Lattice Gas.
Final rept.
P. Esfandiari, P. H. E. Meijer, R. A. Farrell, and S. Favin. Aug 81, 14p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Physical Review B 24, n3 p1298-1311, 1 Aug 81.

Keywords: *Generating functions, *Helmholtz free energy, Simple cubic lattices, Body centered cubic lattices, Face centered cubic lattices, Reprints, *Lattice gases, Ising model.

This paper determines the density weight factors needed to evaluate the Helmholtz free energy for the Ising model of the lattice gas through tenth order in the coupling constants for arbitrary density and interactions. This is accomplished by developing new generating functions for the evaluation of the density factors that are associated with the articulated vertices which result from summing over the 'hard-core' part of the interaction potential. Application to the nearest neighbor model reproduces known results for the simple cubic (s.c.) and body-centered cubic (b.c.c.) lattices, and extends the known face-centered cubic (f.c.c.) results by two orders.

714,223
PB82-140872 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Neutron Scattering from Hydrogen in Metals Involving Transitions to Excited Tunnel-Split States.
Final rept.
R. C. Casella. Sep 81, 8p
Pub. in Physical Review B 24, n6 p2913-2920, 15 Sep 81.

Keywords: Neutron scattering, Protons, Hydrogen, Impurities, Metals, Niobium, Reprints, *Excited states, Tight binding theory.

A theory is developed for neutron-induced transitions to excited states of a proton trapped at a two-well potential near an interstitial impurity in a metal. The proton wave function is written as a linear combination of the states in each well (tight-binding approximation). Hence, in the main, the theory is limited to the low-lying excitations which lie below the central barrier. Otherwise, the theory is quite general and independent of the details of the potential. General expressions are derived for the differential cross section for transitions from the ground-state doublet to the excited states in terms of the transition form factor.

714,224
PB82-143967 Not available NTIS
National Bureau of Standards, Washington, DC.
New Field Theory Formulation of Localised States in Disordered Systems.
Final rept.
S. M. Girvin, R. W. Rendell, and G. W. Bryant. 1981, 6p
Pub. in Jnl. Phys. C: Solid State Phys. Lett. Ed. 14, pL881-L886 1981.

Keywords: Reprints, *Amorphous materials, Density of states, Quantum field theory.

A new field theoretic formulation of the quantum mechanics of disordered systems is given. The problem is converted to an explicit field theory by changing variables in the functional integral over all random potentials to an integral over all possible wave functions. Unlike previous formulations this field theory has the novel feature of having the 'right' sign for the coefficient of the (phi sup 4) term. Thus the important excitations are kinks rather than instantons. In addition, it exhibits singular solutions with finite action. The method is illustrated with an exact calculation of the asymptotic density of states in a one dimensional gaussian white noise potential.

714,225
PB82-144130 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Strain on the Critical Current of Nb-Hf/Cu-Sn-Ga.
Final rept.
J. W. Ekin, H. Sekine, and T. Tachikawa. Oct 81, 5p
Sponsored in part by Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Jnl. of Applied Physics 52, n10 p6252-6256 Oct 81.

Keywords: *Superconductors, *Strains, Niobium, Hafnium, Copper, Tin, Gallium, Cryogenics, Superconducting magnets, Reprints, *Critical current, Niobium tin, Flux pinning.

The critical current of multifilamentary Nb-Hf/Cu-Sn-Ga has been determined as a function of both field and strain at fields from 4 to 19 T. The strain dependence of the critical current is significantly decreased compared with that of commercial multifilamentary Nb3Sn superconductors. This reduced strain sensitivity, coupled with an enhanced critical-current density above

12 T, make this a candidate material for economic high-field magnet construction.

714,226
PB82-144148 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanical Properties and Strain Effects in Superconductors.
Final rept.
J. W. Ekin. 1981, 6p
Sponsored in part by Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Proceedings of 1980 NATO Advanced Study Inst., Sintra (Portugal), Aug 80, Chapter 7 in Superconductor Materials Science, p455-510 1981.

Keywords: *Superconductors, Mechanical properties, Strains.

An introduction is given to the field of mechanical studies of practical superconductors. The literature is surveyed, and the most important advances are described. A treatment of current research efforts is presented, along with an outline of future study areas.

714,227
PB82-144155 Not available NTIS
National Bureau of Standards, Washington, DC.
Chaotic States of rf-Biased Josephson Junctions.
Final rept.
R. L. Kautz. Oct 81, 6p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Jnl. of Applied Physics 52, n10 p6241-6246 Oct 81.

Keywords: *Josephson junctions, Reprints.

The existence of chaotic solutions to the rf-driven Stewart-McCumber model of Josephson junction has been demonstrated by Huberman et al. The present paper describes more fully the range of junction parameters and frequencies for which chaotic solutions occur, details the connection between chaotic states and instabilities in phase lock, and shows that chaotic noise can be much larger than the thermal noise of a junction.

714,228
PB82-144205 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin Dependence of Electronic Surface Resonance Scattering from W(100).
Final rept.
D. T. Pierce, R. J. Celotta, G. C. Wang, and E. G. McRae. 1981, 3p
Sponsored in part by Office of Naval Research, Washington, DC.
Pub. in Solid State Commun. 39, p1053-1055 1981.

Keywords: *Tungsten, Polarization(Spin alignment), Reprints, *Resonance scattering, Polarized electron diffraction, Low energy electron diffraction, Surface potential.

In polarized low energy electron diffraction (PLEED) from W(100) at energies of 2-9 eV and incident angles 15 degrees < theta < 45 degrees, the authors observe a spin-splitting of the resonance sequence of peaks which converge on the (01) beam threshold. For theta > 26 degrees the peak splitting to peak width ratio is approximately constant while for decreasing theta = or < 26 degrees, it increases. An anomalous spin-up-only peak appears at small theta. The nature of the spin dependent splitting is discussed within the four-beam layer multiple scattering approximation.

714,229
PB82-149105 Not available NTIS
National Bureau of Standards, Washington, DC.
Gap Enhancement in Aluminum Tunnel Junctions Coupled to Microstrip Resonators.
Final rept.
L. B. Holdeman, J. T. Hall, D. Van Vechten, and R. J. Soulen. 1981, 11p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Physica 108B, p827-828 1981.

Keywords: *Energy gap, Aluminum, Electron tunneling, Superconductivity, Metal films, Reprints, Radiation effects.

Irradiated (9.7 GHz) Al films show gap enhancement that agrees with Eliashberg's theory.

714,230
PB82-149170 Not available NTIS
National Bureau of Standards, Washington, DC.
Dielectric Function for Ultraviolet Plasmons in the Short-Lifetime Limit.
Final rept.
H. A. Fowler, and J. J. Filliben. Nov 81, 3p
Pub. in Jnl. Applied Physics 52, n11 p6701-6703 1981.

Keywords: *Plasmons, *Electron gas, Free electron theory, Energy dissipation, Reprints.

The 'inverted' Drude-Sellmeier formula, for a two-parameter free-electron-gas spectrum of plasmon excitations, is evaluated for very large values of the line breadth. These function values for 1/epsilon(omega) characterize a solid dominated by a free-electron plasma with short 'damping time', over the ultraviolet range. A rounded energy-loss distribution is suggested at the critical damping limit.

714,231
PB82-149824 Not available NTIS
National Bureau of Standards, Washington, DC.
Elastic Constants of Polycrystalline Copper at Low Temperatures.
Final rept.
H. M. Ledbetter. 1981, 8p
Sponsored in part by Stiftung Volkswagenwerk,, Hanover (Germany, F.R.).
Pub. in Physica Status Solidi A 66, p477-484 1981.

Keywords: *Copper, *Elastic properties, Polycrystals, Cryogenics, Specific heat, Reprints, Debye temperature.

Elastic constants of polycrystalline copper are determined between 4 and 295 K by measuring ultrasonic velocities, longitudinal and transverse. Five elastic constants are given: longitudinal modulus, shear modulus, Young's modulus, bulk modulus (reciprocal compressibility), and Poisson's ratio. Considering eight theories of single-crystal:polycrystal elastic constants, the Hershey-Kroner-Eshelby theory agrees best with observation, within 1% for the shear modulus. A problem exists concerning the calculation of the Debye temperature of polycrystalline aggregates.

714,232
PB82-152117 Not available NTIS
National Bureau of Standards, Washington, DC.
Modelling the Impedance of a Josephson-Junction Noise Thermometer.
R. L. Peterson, and D. Van Vechten. Sep 81, 4p
Pub. in Physical Review B 24, n6 p3588-3591, 15 Sep 81.

Keywords: Josephson junctions, Superconductivity, Mathematical models, Electrical impedance, Reprints, *Noise thermometers, *SQUID devices.

Recent experiments on noise thermometers made with Josephson junctions (rf SQUID's (superconducting quantum interference devices) shunted by a small resistance R) have shown that the SQUID impedance has an envelope which generally rises to the value of R as the rf power is increased, although the envelope can be distorted when the frequency is just above the rf circuit resonance. The authors summarize the results of a mathematical analysis which shows that in the absence of noise, and with no reactive feedback of the SQUID upon the rf circuit, the SQUID impedance will have a uniformly rising envelope because of the SQUID inductance. The calculated curves have the characteristics of the experimental observations in the rising-envelope cases.

714,233
PB82-152448 Not available NTIS
National Bureau of Standards, Washington, DC.
Reflection X-Ray Topography Hardness Indentations in Copper Single Crystals.
K. C. Yoo, B. Roessler, R. W. Armstrong, and M. Kuriyama. 1981, 6p
Pub. in Scr. Met. 15, p1245-1250 1981.

Keywords: *Copper, *Plastic deformation, Microhardness, Single crystals, Anisotropy, Nickel, Reprints.

The plastic deformation zones surrounding microhardness indentations put into the (110) surfaces of relatively soft copper and nickel single crystals have been studied by the asymmetrical crystal topography (ACT) method. The method gives valuable information about the importance of workhardening to determining the level of the microhardness pressure and to determining the magnitude of its anisotropy for different directions of the indenter axes for Knoop or diamond pyramid indentations. This is demonstrated especially for copper crystals by the very pronounced appearance of the strain patterns of diffraction contrast obtained at either type of hardness impression. Both the cumulative dislocation displacements (for extinction contrast) and their lattice rotations (for misorientation contrast) are employed in the analysis of the topographic strain patterns.

714,234
PB82-152562 Not available NTIS
National Bureau of Standards, Washington, DC.
Absorbed Current Electron Spin Polarization Detector.
D. T . Pierce, S. M. Girvin, J. Unguris, and R. J. Celotta. Oct 81, 8p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Review of Scientific Instruments 52, n10 p1437-1444 Oct 81.

Keywords: *Electron spin, *Polarization(Spin alignment), *Detectors, Metal films, Gold, Reprints.

The principle of spin analysis by means of measurement of the spin dependent absorption of a polarized electron beam is presented. The spin dependent signal is enhanced relative to the spin average signal at an energy near which the secondary yield is unity. Both the collected charge method and the zero-crossing method are described for situations where the polarization can and cannot be reversed. A statistical analysis of the uncertainty in the polarization determination by each method is given. Annealed, evaporated Au films are shown to be suitable for the detecting surface of this spin detector. The figure of merit is derived and found for Au films to be comparable to the very best Mott detectors, but the electron optical acceptance is smaller. The applications for which this simple compact spin detector are especially suited are discussed.

714,235
PB82-152570 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin Polarization in Electron Scattering from Surfaces.
D. T. Pierce, and R. J. Celotta. 1981, 71p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Advances in Electronics and Electron Physics 56, p219-289 1981.

Keywords: *Electron spin, *Polarization(Spin alignment), *Electron scattering, Magnetic properties, Surfaces, Solids, Reprints, Polarized electron diffraction.

A summary is presented of modern experimental and theoretical treatments of electron spin polarization phenomena in low energy electron scattering from solids. Relativistic and exchange interactions are treated separately. The use of polarization measurements for surface structure determinations and the investigation of surface magnetism is emphasized. A total of 105 references are given.

714,236
PB82-152612 Not available NTIS
National Bureau of Standards, Washington, DC.
LEED Inquiry into the Question of Reconstruction of (001)Nb,
A. J. Melmed, S. T. Ceyer, R. T. Tung, and W. R. Graham. 1981, 4p
Grant NSF-DMR80-0905
Pub. in Surface Science Lett. 111, pL701-L704 1981.

Keywords: *Niobium, *Crystal structure, *Surfaces, Cryogenics, Reprints, Low energy electron diffraction.

The authors have examined the structure of the (001) surface of Nb by LEED and have found that a (1X1) diffraction pattern prevails over the entire range of temperature investigated, that is about 15 - 500K. This is the first observation of an unreconstructed (001) surface of a BCC metal over such a temperature range.

714,237
PB82-152737 Not available NTIS
National Bureau of Standards, Washington, DC.

Superconductive Energy Gap of AuAl(2),
R. J. Soulen, D. Van Vechten, G. Costabile, T. Jach, and L. B. Holdeman. 1981, 2p
NASA Order-H-27908B
Pub. in Physica 108B, p823-824 1981.

Keywords: *Superconductors, *Energy gap, *Gold intermetallics, Metal films, Transition temperature, BCS theory, Reprints, *Aluminum intermetallics.

Two hundred nm films of AuA2 were prepared. The superconductive transition determined by resistive measurements were found to vary from film to film, from 177 to 184 mK, and the transition widths varied between 6 and 15 mK. Film surfaces were oxidized by the Greiner process and Al counter electrodes were deposited in order to produce tunnel junctions. The temperature dependence of the energy gap of AuAl2 was measured and found to agree well with BCS theory.

714,238
PB82-153271 Not available NTIS
National Bureau of Standards, Washington, DC.
High-Resolution X-Ray Facility,
H. Chen, and M. Kuriyama. 1981, 1p
Pub. in Jnl. of Applied Cryst. Lab. Note 14, p280 1981.

Keywords: *X ray diffraction, Angular resolution, Reprints.

An x-ray diffraction system capable of producing and detecting x-rays with an angular resolution better than two seconds of arc has been developed.

714,239
PB82-154451 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Investigation of the Two-Dimensional Shape of Ion-Implanted Regions.
Final rept.
P. Roitman, J. Albers, J. R. Ehrstein, and D. R. Myers. Dec 81, 72p NBSIR-81-2398
Contract DE-AC04-76DP00789
Sponsored in part by Naval Ocean Systems Center, San Diego, CA.

Keywords: *Silicon, Arsenic, Single crystals, Integrated circuits, Profiles, Etching, Electron microscopy, *Ion implantation.

The two-dimensional shape of arsenic ion-implanted regions in single-crystal silicon was investigated both experimentally and theoretically. Experimentally, two techniques were shown to have the necessary submicron resolution: a junction etch process and an SEM-induced current collection method. A comparison of junction depths determined by the etch technique, the EBIC technique, and spreading resistance with the depths calculated using several amorphous target codes was made.

714,240
PB82-177981 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Measurement Method for Determining the Optical and Electro-Optical Properties of a Thin Film,
D. R. Larson. Dec 81, 65p NBSIR-81-1652

Keywords: *Thin films, *Electrooptics, Amorphous materials, Sapphire, Silicon, Transmittance, Computer programs, Fortran, *Refractive index, Silicon or sapphire.

A method of determining the complex refractive index of a thin film on a nonabsorbing substrate is developed. The optical transmittance spectrum of the structure is measured and the index is determined by matching this spectrum numerically. An iterative procedure for finding the magnitude of an induced change in refractive index is also presented. In nonabsorbing spectral regions, the index and film thickness are determined directly. The optical transmittance of sapphire and thin films of gold and epitaxial silicon, both on sapphire, is examined. The refractive index of epitaxial silicon on sapphire, SOS, is determined and compares favorably with the results of other investigators. The measurement method is applied to a thin film of hydrogenated amorphous silicon, a-Si:H, deposited by a capacitively coupled rf glow discharge. The index is tabulated for various wavelengths and a field induced change in index comparable to GaAs is measured.

714,241
PB82-178690 PC **A02**/MF **A01**
Xerox Corp., Palo Alto, CA. Palo Alto Research Center.
DLTS Analysis of Residual Damage in Low-Dose Ion-Implanted Silicon.
Final rept.
N. M. Johnson. Feb 82, 25p NBS-GCR-81-364
Grant ARPA Order-2397

Keywords: *Silicon, *Ion implantation, *Radiation damage, Energy levels, Annealing, Arsenic, Semiconductor doping, Deep level transient spectroscopy.

Transient capacitance spectroscopy was used to measure the energy levels and spatial distributions of residual damage in low-dose ion-implanted silicon. The results indicate that a 800C 30-min anneal in flowing nitrogen successfully reduces arsenic ion-implantation damage to levels not expected to significantly influence C-V measurements of dopant profiles.

714,242
PB82-192469 Not available NTIS
National Bureau of Standards, Washington, DC.
Processing Effects on the Electrical and Optical Properties of Sulfur-Related Defect Centers in Silicon and Similarities to the Oxygen Donor.
Final rept.
R. A. Forman, R. D. Larrabee, D. R. Myers, W. E. Phillips, and W. R. Thurber. 1981, 6p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the 1980 Annual Meeting of the Materials Research Society Held at Boston, Massachusetts on Nov. 16-20, 1980, Paper in Defects in Semiconductors, p79-84 1981.

Keywords: *Silicon, Crystal defects, Electrical properties, Optical properties, Impurities, Sulfur, Density of states, Effective mass.

The properties of sulfur-related defects in silicon are shown to differ dramatically from those that would have been expected on the basis of effective mass theory for a simple substitutional double donor. The ratio of the densities of the sulfur states as measured by capacitance-voltage techniques has been observed to vary in specimens fabricated from the same starting resistivity. Optical absorption studies have shown that the deepest sulfur level has a manifold of ground states which anneal at unequal rates at 550C. Deep-level measurements show that the thermal emission rate at a given temperature and the variety of effects provided depends on annealing history and total sulfur density. The variability of properties of samples of sulfur-doped silicon is similar to those found for the oxygen donors in silicon, thus suggesting a chemical trend for the column VI impurities in silicon.

714,243
PB82-195165 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Donor Impurities on the Density of States Near the Band Edge in Silicon.
Final rept.
H. S. Bennett, and J. R. Lowney. Sep 81, 20p
Pub. in Jnl. of Applied Physics 52, n9 p5633-5642 Sep 81.

Keywords: *Silicon, *Band structure of solids, Semiconductor doping, Valence bands, Conduction bands, Energy gap, Impurities, Reprints, *Density of states, Effective mass.

Using the effective mass approximation and assuming that the scattering events for the electrons and holes by the assembly of donors are independent, the authors have calculated the effects of heavy doping on the conduction and valence states in silicon. When no bound-electron states associated with donors exist, the results show that: (1) the electron-donor interaction lowers the energy of the conduction and valence states, (2) band distortions occur, and (3) appreciable band-gap narrowing occurs. The numerical results tend to support the band-gap estimates interpreted from optical measurements.

714,244
PB82-195199 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Impurity Pairs on the Disappearance of Impurity Levels in Silicon.
Final rept.
A. H. Kahn, and J. R. Lowney. Jan 82, 3p
Pub. in Jnl. of Applied Physics 53, n1 p454-456 Jan 82.

Keywords: *Semiconductor doping, *Band structure of solids, *Silicon, Finite element analysis, Conduction bands, Ground state, Impurities, Reprints, Density of states, Effective mass.

Calculations of the binding energy of an electron to a pair of charged donor ions in the presence of screening by free carriers, are reported. The effective mass approximation was assumed. The results support the conclusion that at doping levels of 2 x 10 to the 19th power/cc or higher, the density of electronic states in silicon contains no conbribution from localized bound impurity levels.

714,245
PB82-199456 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of the Interlayer between Aluminum and Silicon Dioxide Using Ellipsometric Capacitance-Voltage and Auger Electron Spectroscopy Techniques.
Final rept.
G. A. Candela, K. F. Galloway, Y. M. Liu, and J. Fine. 1981, 11p
Pub. in Thin Solid Films 82, p183-193 1981.

Keywords: *Films, Measurement, Integrated circuits, Aluminum, Silicon dioxide, Electron microscopy, Reprints, *Interlayers.

Ellipsometric and capacitance-voltage measurements were combined to detect both the Al-SiO2 interlayer and the Si-SiO2 interlayer for the Si/SiO2/Al system. The Al-SiO2 interlayer was characterized by Auger electron spectroscopy (AES), combined with argon ion sputter profiling, of the Al/SiO2/Si structure and also of the remaining SiO2/Si structure after the aluminum had been chemically removed. An effective interlayer thickness is defined as the product of the interlayer thickness and the fractional change in the dielectric SiO2 constant. The results of these experiments indicate that the Al-SiO2 effective interlayer thickness has a range of 0.1-0.5 nm. The AES data can be readily interpreted if it is assumed that collision cascade mixing and recoil implantation occur as a consequence of sputter depth profiling through the aluminum.

714,246
PB82-199514 Not available NTIS
National Bureau of Standards, Washington, DC.
Propagation Errors in Elastic-Constant Inversion.
Final rept.
H. M. Ledbetter, J. F. LaBrecque, and J. L. Dahnke. 1981, 5p
Pub. in Physica Status Solidi A: Applied Research 67, p643-647 1981.

Keywords: *Elastic properties, Errors, Propagation, Reprints, Matrix inversion.

Physical-property tensors obtained through matrix inversion may inherit large errors, which may be asymmetric. Analysis of the cubic-symmetry elastic-constant case where stiffnesses are converted to compliances and vice versa, shows dramatic error-propagation, depending on the C sub 12/C sub 11 ratio.

714,247
PB82-210139 Not available NTIS
National Bureau of Standards, Washington, DC.
Detection of Impurity Tunneling in Solids via Coherent Phonon Coupling and Direct Neutron Scattering.
Final rept.
R. C. Casella. Dec 81, 3p
Pub. in Jnl. of Physique Colloque C6, 42, n12 pC6-923 - C6-925 Dec 81.

Keywords: Neutron scattering, Inelastic scattering, Potassium bromide, Potassium chloride, Hydrogen, Oxygen, Niobium, Cyanides, Impurities, Reprints, *Molecular tunneling, *Impurity tunneling.

A theoretical treatment is given of the observation of molecular tunneling in solids by the coherent interaction of the tunnel-split excitations with acoustic phonons and by direct neutron inelastic scattering. Results are applied to the case of rotation tunneling of CN(-) dumbbells in KBr and KCl, annd to the motion of H atoms in two-well traps associated with oxygen impurities in niobium. Comparison is made with experiment.

714,248
PB82-210303 Not available NTIS
National Bureau of Standards, Washington, DC.

Polarized Electrons.
Final rept.
R. J. Celotta, D. T. Pierce, M. H. Kelley, and W. T. Rogers. 1982, 11p
Pub. in Proceedings of Conference on the Physics of Electronic and Atomic Collisions (12th), Gatlinburg, TN, July 15-21, 1981, paper in Physics of Electronic and Atomic Collisions, p545-555 1982.

Keywords: *Electron beams, *Polarization(Spin alignment), *Polarized beams.

Previous papers on this topic at ICPEAC and ICAP have described clever techniques for producing polarized electron beams, novel experiments that could be performed if sufficient beam intensity were available, and a number of promising experiments skillfully completed with the huge effort necessary to overcome the inefficient processes of producing and detecting electron spin polarization.

714,249
PB82-210360 Not available NTIS
National Bureau of Standards, Washington, DC.
Incident-Energy Dependence of 3p Electron Energy-Loss Spectra of Nickel.
Final rept.
T. Jach, and C. J. Powell. 1981, 3p
Pub. in Solid State Communications 40, p967-969 1981.

Keywords: *Nickel, *Electron energy, *Excitation, Energy dissipation, Electron beams, Electron irradiation, Reprints.

The intensities of two features in the 3p electron energy-loss spectrum of nickel, a dip prior to the threshold and a satellite about 12 eV above the threshold, are observed to systematically decrease as the incident electron energy is lowered from 1000 to 150 eV. These intensity changes indicate a dependence of the matrix elements for each excitation on momentum transfer as the incident energy is decreased, in part through changes in the strength of Fano interference near threshold.

714,250
PB82-210410 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic Structures of Y6(Fe(1-x)Mn(x))23 Compounds.
Final rept.
K. Hardman, J. J. Rhyne, and W. J. James. Mar 81, 3p
Pub. in Jnl. of Applied Physics 52, n3 p2049-2051 Mar 81.

Keywords: *Yttrium alloys, *Iron alloys, *Manganese alloys, Crystal structure, Neutron diffraction, Reprints, *Magnetic ordering, Exchange interactions.

Neutron diffraction studies of eleven compounds across the compositional range of the Y6(Fe(1-x)Mn(x))23 system reveal the presence of substantial preferential atomic ordering of Fe and Mn atoms on the four transition metal crystallographic sites. Throughout the entire compositional range, Mn atoms prefer to occupy the f2 site, and Fe atoms the f1 site. Neutron diffraction profile refinements show no long range magnetic ordering occurring in the compositional range from x=0.4 to 0.75 as a consequence of the sharply reduced exchange interactions in the ternary compounds. The average Fe moments on each of the sites are reduced in the Fe-rich ternaries. The manganese atoms are nonmagnetic. In the Mn-rich ternaries the Fe atoms have no spontaneous moments and the Mn moments are decreased dramatically from Y6Mn23.

714,251
PB82-210493 Not available NTIS
National Bureau of Standards, Washington, DC.
Water-Rich Hydrates: The Structures of Dimasnesium Potassium Hydrogenbis(arsenate) 15-Hydrate and Dimagnesium Pottassium Hydrogenbis(phosphate) 15-Hydrate.
Final rept.
S. Takagi, M. Mathew, and W. E. Brown. 1982, 7p
Sponsored in part by American Dental Association Health Foundatiion, Chicago, IL.
Pub. in Acta Crystallographica B38, p44-50 1982.

Keywords: *Crystal structure, Magnesium inorganic compounds, Potassium inorganic compounds, Hydrogen inorganic compounds, Arsenates, Hydrates, Reprints, *Magnesium arsenates, *Magnesium phosphates, Phosphates.

The crystal structures of two isomorphous salts of the type Mg2KH(XO4)2.15H2O, where X = As (I) and X = P (II), have been determined by single crystal X-ray diffraction. Results are discussed.

714,252
PB82-210576 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Donor Impurities on the Conduction and Valence Bands of Silicon.
Final rept.
J. R. Lowney, and H. S. Bennett. Jan 82, 6p
Pub. in Jnl. of Applied Physics 53, n1 p433-438 Jan 82.

Keywords: *Silicon, *Band structure of solids, *Conduction bands, *Valence bands, Donor materials, Impurities, Reprints.

The energy shifts of valence and conduction band states in silicon, due to the interaction of electrons and holes with ionized donors, have been calculated by performing a partial wave analysis. The potential is modeled by the Yukawa form with the screening radius determined self-consistently by the Friedel sum rule. The results show that this effect is an important part of the optically measured band-gap narrowing. The variation of the Fermi energy due to this phenomenon is also calculated.

714,253
PB82-210980 Not available NTIS
National Bureau of Standards, Washington, DC.
Improved Technique for Peak Integration for Crystallographic Data Collected with Position-Sensitive Detectors: A Dynamic Mask Procedure.
Final rept.
L. Sjoelin, and A. Wlodawer. 1981, 11p
Sponsored in part by National Institutes of Health, Bethesda, MD.
Pub. in Acta. Crystallographica A37, p594-604 1981.

Keywords: *Neutron diffraction, *X ray diffraction, Crystal structure, Reprints, *Diffraction methods.

A technique for improving the precision of crystal data collected on films or with electronic position-sensitive detectors is proposed. The extent of each medium or strong reflection is computed independently, after smoothing and filtering the individual intensities, producing a variable 'dynamic mask'. A method of calculating universal background profiles, which preserves the data and limits the necessary storage, is introduced. The method was applied to data collected with X-ray precession and oscillation techniques and to neutron data collected with a flat-cone diffractometer equipped with a linear detector. In all cases, substantial improvement in the precision of weaker reflections was observed. The overall quality of the data was particularly enhanced in the neutron diffraction case.

714,254
PB82-211038 Not available NTIS
National Bureau of Standards, Washington, DC.
Hydrogen (H2) System.
Final rept.
H. M. Roder. 1981, 4p
Pub. in Bull. Alloy Phase Diagrams 2, n3 p363-366 1981.

Keywords: *Hydrogen, *Solidified gases, *Phase diagrams, *Crystal structure, Mechanical properties, Thermodynamic properties, Reprints, *Solid hydrogen, High pressure.

A brief description of the phase diagram of the crystal structure of solid hydrogen is given at both moderate and extreme pressures. Physical, mechanical, and thermal properties of the solid which are of immediate interest to the metallurgist are included.

714,255
PB82-211061 Not available NTIS
National Bureau of Standards, Washington, DC.
Polarized-Low-Energy-Electron-Diffraction Study of the Mechanism of Electron Reflection from W(001) at Low Energies.
E. G. McRae, D. T. Pierce, G. C. Wang, and R. J. Celotta. 15 Oct 81, 10p
Sponsored in part by Bell Labs., Murry Hill, NJ.
Pub. in Physical Review B 24, n8 p4230-4239, 15 Oct 81.

Keywords: *Tungsten, *Electron diffraction, Polarization(Spin alignment), Spin orbit interactions, Reprints, *Polarized electron diffraction, Low energy electron diffraction.

Polarized-low-energy-electron-diffraction (PLEED) measurements on W(001) are reported for incidence conditions close to the (01) beam threshold (energies 2<E<9 eV, polar angles 15 degrees < theta < 45 degrees, (01) azimuth).

714,256
PB82-211244 Not available NTIS
National Bureau of Standards, Washington, DC.
Comments on Non-Spherical and Spherical Defect and Screw Dislocation Interaction.
Final rept.
R. J. Arsenault, and R. deWit. 1981, 3p
Pub. in Scripta Metallurgica 15, p615-617 1981.

Keywords: *Screw dislocations, Crystal defects, Interstitals, Reprints, Defects(Materials).

With reference to a recent paper by Sato, Nakamura and Mori it is pointed out that there is a significant difference between the effects of a spherical and nonspherical defect on a screw dislocation. A couple force will always aid in the formation of a double kink irrespective of the spatial relationship of the interstitial and the screw dislocation line, whereas, a unidirectional force can aid or oppose the formation of a double kink depending upon the spatial relationship of the interstitial atom and the screw dislocation line. This couple force can lead to interstitial weakening, but unidirectional forces cannot.

714,257
PB82-212101 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin Waves in Amorphous FE(1-x)B(x) Alloys.
Final rept.
J. J. Rhyne, G. E. Fish, and J. W. Lynn. Mar 82, 3p
Pub. in Jnl. of Applied Physics 53, n3 p2316-2318 Mar 82.

Keywords: *Magnons, *Iron alloys, *Boron containing alloys, Neutron diffraction, Magnetization, Reprints, *Amorphous materials, Temperature dependence.

The temperature dependence of spin excitations has been studied in amorphous Fe(1-x)B(x) (x=0.18 and 0.14) by inelastic neutron scattering. The spin-wave stiffness constant D was determined directly from the magnon dispersion curves over the temperature range from below room temperature (T/Tc=0.48 and 0.36, respectively, for x=0.18 and 0.14 alloys) up to 548 K (T/Tc=0.75 and 0.99), which is just below the crystallization temperature.

714,258
PB82-212119 Not available NTIS
National Bureau of Standards, Washington, DC.
Site Magnetization of Cubic and Hexagonal HoMn2.
Final rept.
K. Hardman, J. J. Rhyne, S. Malik, and W. E. Wallace. Mar 82, 3p
Prepared in cooperation with Pittsburgh Univ., PA. Dept. of Chemistry.
Pub. in Jnl. of Applied Physics 53, n3 p1944-1946 Mar 82.

Keywords: *Magnetization, Neutron diffraction, Cryogenics, Hexagonal lattices, Reprints, *Holmium intermetallics, *Manganese intermetallics, Crystal field, Cubic lattices.

Magnetic neutron diffraction profile refinement methods have been used to determine the Ho and Mn site magnetizations in both the cubic C15 and hexagonal C14 Laves phases of HoMn2. The results are correlated with measurements of the temperature dependence of the bulk magnetization, which gave a (T sub C) for both phases of 26K and overall saturation magnetizations of 6.4 (mu sub B) for the cubic phase and 6.7 (mu sub B) for the hexagonal phase, as extrapolated from field data up to 20 kOe at 4 K.

714,259
PB82-212176 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron-Spectroscopic Evidence for Hydrogen Tunneling States in Niobium.
Final rept.
H. Wipf, A. Magerl, S. M. Shapiro, S. K. Satija, and W. Thomlinson. Apr 81, 4p
Contract DE-AC02-76CH00016
Pub. in Physical Review Letters 46, n14 p947-950, 6 Apr 81.

Keywords: *Niobium, *Hydrogen, Neutron scattering, Inelastic scattering, Impurities, Reprints, *Impurity tunneling.

Inelastic neutron scattering measurements demonstrating H tunneling states for O-H pairs in NbO(0.13)H(0.016) are presented. The tunneling matrix element found is 0.19 + or - 0.04 meV.

714,260
PB82-212192 Not available NTIS
National Bureau of Standards, Washington, DC.
Tritium Vibrations in Niobium by Neutron Spectroscopy.
Final rept.
J. J. Rush, A. Magerl, J. M. Rowe, J. M. Harris, and J. L. Provo. Oct 81, 3p
Contracts DE-AC04-76DP00789, DE-AC04-76DP00656
Prepared in cooperation with General Electric Co., St. Petersberg, FL. Neutron Devices Dept.
Pub. in Physical Review B 24, n8 p4903-4905, 15 Oct 81.

Keywords: *Tritium, *Niobium, Niobium inorganic compounds, Hydrides, Neutron spectroscopy, Phonons, Reprints, Niobium hydrides.

The first measurement of tritium vibrations in a metal is reported. Neutron spectra for tritium in niobium are compared with results for niobium deuteride and hydride in the same beta crystal phase to reveal deviations from a (square root of M) dependence, reflecting the anharmonicity of the potential. Vibration peaks are also observed for dilute H and O impurities in the niobium sample.

714,261
PB82-227877 PC **A05**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.
Electrical Properties of Materials and Their Measurement at Low Temperatures.
F. R. Fickett. Mar 82, 78p NBS-TN-1053
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Electrical resistivity, *Metals, *Alloys, *Cryogenics, Measurement, Impurities, Crystal defects, Reviews.

A review is given of the electrical resistivity of materials at cryogenic temperatures. Measurement techniques, the data base, and uses of the data are presented. The emphasis is on metals and alloys of technological importance, a topic which covers a large range of materials. There is no discussion of superconductors, semiconductors, or most insulators. Theory and experiment relating to single crystals or thin films are mentioned only when the information leads to a better understanding of the technologically important metals. The treatment of theory and of measurement techniques is primarily for the user interested in the more practical aspects of the subject. In every instance, however, references are given which allow the reader to pursue the subject at any level.

714,262
PB82-234717 Not available NTIS
National Bureau of Standards, Washington, DC.
Electronic Structure Evolution of Au, Ag, and Cu Deposited on A1(100).
Final rept.
W. F. Egelhoff. Mar 82, 3p
Pub. in Jnl. of Vacuum Science and Technology 20, n3 p668-670 Mar 82.

Keywords: *Band structure of solids, *Metal films, *Crystal growth, Thin films, Single crystal, Aluminum, Gold, Silver, Copper, Reprints, Low energy electron diffraction.

The evolution of the electronic structure of Au, Ag, and Cu from submonolayer coverages up to bulk metal has been studied by XPS on an Al(100) substrate. The ordering of the overlayers was monitored by LEED. All three elements share the common feature that the electronic structure, as determined by the core level binding energies and the shape of the valence band, do not converge on their bulk values until a thickness of about 10 to 20 monolayers. As this is drastically different from theoretical calculations indicating convergence around 4 layers thickness, it is clear that the overlayer growth mode is drastically different from a layer by layer structure. Analysis of the data is given.

714,263
PB82-234733 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS Superconductor Standardization Program.
Final rept.
F. R. Fickett, and L. F. Goodrich. Oct 81, 3p
Pub. in Proceedings 1980 Superconducting MHD Magnet Design Conference, Cambridge, MA., March 26-27, 1980, p87-89 Oct 81.

Keywords: *Superconductors, Standards, Critical temperature, Measurement, Critical current.

Modern practical superconductors are complex composites. The determination of their parameters is often difficult, and the results subject to various interpretations. The NBS program is attempting to create a number of consensus standards for the characterization of these materials. The major areas of concern this year are definitions of the parameters, development of standard critical current measurement techniques, and a first look at problems related to critical temperature measurement. To this end, experimental work is being carried out both at NBS and by the wire manufacturers. Also, an ASTM committee has been formed and is actively engaged in the preparation of several draft standards. This paper describes our progress in each of the areas.

714,264
PB82-234741 Not available NTIS
National Bureau of Standards, Washington, DC.
Electric and Magnetic Properties of CuSn and CuNi Alloys at 4 K.
Final rept.
F. R. Fickett. Mar 82, 3p
Pub. in Cryogenics 22, p135-137 Mar 82.

Keywords: *Superconductors, *Tin intermetallics, Electrical resistivity, Magnetoresistivity, Cryogenics, Reprints, *Copper intermetallics, *Nickel intermetallics, Magnetic susceptibility.

Results of low temperature resistivity, magnetoresistivity, and magnetic susceptibility measurements of CuSn and CuNi alloys of compositions commonly used in practical superconductors are presented and discussed.

714,265
PB82-234865 Not available NTIS
National Bureau of Standards, Washington, DC.
Mathematical Modelling of the Impedance of a Josephson Junction Noise Thermometer.
Final rept.
R. L. Peterson. Dec 81, 6p
Pub. in Jnl. of Applied Physics 52, n12 p7321-7326 Dec 81.

Keywords: *Josephson junctions, *Electrical impedance, Nonlinear differential equations, Mathematical models, Reprints, *SQUID devices, Noise thermometers.

Recent work on noise thermometers consisting of a resistively shunted superconducting loop containing a Josephson junction (a resistive SQUID), has shown some novel behavior of the SQUID dc impedance as a function of rf power. A mathematical analysis is given of the intrinsic behavior of a resistive SQUID in the limit of negligible noise and negligible feedback to the rf circuit. A nonlinear, first-order differential equation is thought to reasonably describe this system.

714,266
PB82-236092 Not available NTIS
National Bureau of Standards, Washington, DC.
Accurate Determination of the Energies of Auger Electrons and Photoelectrons for Nickel, Copper, and Gold (Summary Abstract).
Final rept.
C. J. Powell, N. E. Erickson, and T. J. Jach. Mar 82, 1p
Pub. in Vacuum of Science and Technology v20 n3 p625 Mar 82.

Keywords: *Auger electrons, *Photoelectrons, *Nickel, *Copper, *Gold, Kinetic energy, Surfaces, Reprints.

A summary is given of new measurements of absolute kinetic energies of Auger electrons and photoelectrons from nickel, copper, and gold.

714,267
PB82-236852 Not available NTIS
National Bureau of Standards, Washington, DC.
Field Ion Microscopy of Alpha Uranium.
J. J. Carroll, and A. J. Melmed. 1982, 15p
Contract NAonr-18-69
Pub. in Surface Science 116, p225-239 1982.

Keywords: *Uranium, *Surfaces, Orthorhombic lattices, Hydrides, Reprints, Field ion microscopy.

Field ion micrographs of alpha uranium show atomic details of many orthorhombic crystal planes. Images of the (010) and (001) plane edges are examined and discussed in particular. Micrographs indicate that a surface hydride phase is formed readily under hydrogen imaging conditions. Some micrographs indicate possible hydride particle precipitation at a major crystal defect boundary. No evidence was found, however, of hydrogen/stress induced surface cracks. Procedures used to prepare alpha uranium for field ion microscopy are described.

714,268
PB82-236902 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Magnetic Structures Using Low Temperature Nuclear Orientation: (166m)Ho-Ho.
Final rept.
B. G. Turrell, and H. Marshak. Dec 81, 18p
Pub. in Hyperfine Interaction 11, n3 p205-222 Nov/Dec 81.

Keywords: *Hyperfine structure, *Nuclear spin, Low temperature research, Gamma rays, Antiferromagnetism, Single crystals, Holmium, Orientation, Reprints, Magnetic ordering, Holmium 166.

It is demonstrated that the low temperature nuclear orientation technique can be used to determine the axes of quantization in a multiaxial ordered ensemble of nuclear spins. Expressions for the anisotropic gamma-ray intensity for particular geometries are derived. The determination of the atomic magnetic structure in antiferromagnets is discussed, and the results of recent experiments on helically ordered (166) Ho-Ho are presented. In these experiments, the angular variation of the intensities of some of the more intense gamma-rays were measured and compared to theory. A value of 80 degrees, not including systematic errors, was obtained for the semi-cone angle of the helix formed by the atomic magnets.

714,269
PB82-239138 Not available NTIS
National Bureau of Standards, Washington, DC.
Debye-Waller Factor of BCC Metals: A Comparison of the Lattice Dynamics and Molecular Dynamics Results for Li and Rb.
Final rept.
R. C. Shukla, and R. D. Mountain. Mar 82, 9p
Pub. in Physical Review B 25, n6 p3649-3657, 15 Mar 82.

Keywords: *Lattice vibrations, *Lithium, *Rubidium, *Body centered cubic lattices, Comparison, Reprints, *Debye-Waller factor.

A method is given for the numerical calculation of the anharmonic contributions to the Debye-Waller factor (DWF) for metals involving long range interactions. The numerical results of DWF obtained by the above method are compared with those of a molecular dynamics calculation for a sixth neighbour interaction model Li and Rb. It is shown that an excellent agreement is achieved between the results calculated by the two methods for the same model of the crystal potential.

714,270
PB82-239179 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin-Dependence of the Electron Inelastic Mean Free Path and the Elastic Scattering Cross Section - A High Energy Atomic Approximation.
Final rept.
J. A. D. Matthew. Mar 82, 7p
Pub. in Physical Review B 25, n5 p3326-3332, 1 Mar 82.

Keywords: *Electron scattering, *Scattering cross sections, Ferromagnetic materials, Elastic scattering, Inelastic scattering, Electron spin, Polarization(Spin alignment), Reprints.

The spin dependence of the inelastic scattering cross section (inverse mean free path) and the elastic scat-

tering cross section are calculated for polarized electrons scattered from oriented atoms in the Born-Ockhur approximation with a view to understanding spin dependent scattering in ferromagnets. In the medium to high energy range (about = or > 100 eV)the elastic scattering for parallel spins is greater than for anti-parallel spins, while the inelastic cross section for parallel spins is less than for anti-parallel. Elastic spin dependence appears to be greater than inelastic, and the exchange effects fall off rapidly with increasing energy. The relation of this atomistic scattering approach to solid state models is discussed.

714,271
PB82-240698 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
NBS Reactor: Summary of Activities July 1980 through June 1981.
F. J. Shorten. Jun 82, 205p NBS-TN-1160
See also PB81-209876.

Keywords: *Neutron beams, *Research projects, Nuclear research and test reactors, Neutron irradiation, Neutron activation analysis, Neutron diffraction, Neutron radiography, Materials tests, Crystal structure.

This report summarizes all those programs which depend on the NBS reactor. It covers the period from July 1980 through June 1981. The programs range from the use of neutron beams to study the structure and dynamics of materials, through nuclear physics and neutron standards to sample irradiations for activation analysis, isotope production, radiation effects studies, neutron radiography, and nondestructive evaluation.

714,272
PB82-247339 Not available NTIS
National Bureau of Standards, Washington, DC.
Continuous-Spin Ising Model g(0):phi sup 4:d Field Theory, and the Renormalization Group.
Final rept.
G. A. Baker, and J. M. Kincaid. 1981, 15p
Pub. in Jnl. of Statistical Physics 24, n3 p469-483 1981.

Keywords: Field theory(Physics), Statistical mechanics, Magnetization, Reprints, *Ising ferromagnets, Ising model, Magnetic susceptibility, Pade approximants.

The authors have computed, through tenth order, the high temperature series expansion for the magnetization, susceptibility, second derivative of the susceptibility, and the second moment of the spin-spin correlation function on eight different lattices. The analysis of these series is made using integral and Pade approximants. Results are discussed.

714,273
PB82-248089 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Spin Polarization Detector: Spin-Dependent Absorption of a Polarized Electron Beam.
Final rept.
R. J. Celotta, D. T. Pierce, H. C. Siegmann, and J. Unguris. Apr 81, 3p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Applied Physics Letters 38, n7 p577-579, 1 Apr 81.

Keywords: *Electron spin, *Polarization(Spin alignment), Spin orbit interactions, Ferromagnetic materials, Electron beams, Tungsten, Detectors, Reprints, Exchange interactions, Amorphous materials.

The exchange interaction and the spin-orbit interaction are observed to cause a spin dependence of the absorption of a polarized electron beam in the amorphous ferromagnet Ni(40)Fe(40)B(20) and a W(100) single crystal respectively. The enhancement of the spin dependence, near the energy where the secondary electron yield is unity, is shown to provide a simple efficient detector of spin polarization.

714,274
PB82-248097 Not available NTIS
National Bureau of Standards, Washington, DC.
Dispersion of the Piezobirefringence of GaAs Due to Strain-Dependent Lattice Effects.
Final rept.
A. Feldman, and R. M. Waxler. Mar 82, 7p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Applied Physics 53, n3 p1477-1483 Mar 82.

Keywords: *Gallium arsenides, Intermediate infrared radiation, Reprints, *Piezobirefringence, Dispersion.

The piezobirefringence of GaAs has been measured over the wavelength range 3.5-10.6 micrometers. A small yet significant dispersion is found which is attributed to the strain dependence of the transverse optic phonon. The main contribution to the dispersion appears to be due to the strain-induced anisotropy of the transverse effective charge. The data are in reasonably good agreement with the theory of Humphreys and Maradudin. The strain-induced relative anisotropies of the transverse effective-charge and the high-frequency photoelastic constants have been calculated on the basis of a two-parameter fit to the photoelastic dispersion.

714,275
PB82-248139 Not available NTIS
National Bureau of Standards, Washington, DC.
Comments on 'Raman Scattering from Boron-Implanted Laser-Annealed Silicon' by H. Engstrom and J. B. Bates.
Final rept.
R. A. Forman, M. I. Bell, and D. R. Myers. Jun 81, 3p
Pub. in Jnl. of Applied Physics 52, n6 p4337-4339 Jun 81.

Keywords: *Silicon, *Raman spectra, Ion implantation, Boron isotopes, Annealing, Reprints, Laser annealing, Boron 10, Boron 11.

Measurements have been made of the Raman spectra of silicon implanted with either 11B or 10B and subsequently thermally annealed. These measurements, taken with an argon-ion laser operating at 514.5 nm and at room temperature, revealed the presence of an intrinsic two-phonon combination band underlying the 11B local mode. The coincidence of these two spectral features complicates the analysis of the annealing process as diagnosed on the basis of the Raman spectrum. The use of the 10B isotope, and its spectra, minimizes ambiguities in interpretation of the spectra of ion-implanted silicon. A reexamination of the earlier annealing studies of Engstrom and Bates is suggested on the basis of the present results.

714,276
PB82-248170 Not available NTIS
National Bureau of Standards, Washington, DC.
Precision Gamma- and X-ray Energies.
Final rept.
R. D. Deslattes, and E. G. Kessler. 1980, 16p
Pub. in Proceedings of Conference Atomic Masses and Fundamental Constants 6 (1980), Ann Arbor, MI, September 18-20, 1979, p203-218 1980.

Keywords: *Gamma rays, *X rays, *Standards, X ray diffraction, Crystal structure.

At this time, it has been possible to redetermine a small but significant group of gamma-ray reference energies (0.6 less than E less than 1.1 MeV) in terms of the Rydberg constant, R (infinity). This work has made use of an I2 molecularly stabilized laser to link Doppler-free spectroscopy of hydrogen with achromatic procedures for crystal spacing determination. Crystals calibrated in this way (after suitable transfer measurements) have been used to determine X-ray and gamma-ray transition energies using flat-crystal instruments whose angular scales were established to high accuracy from first principles. The authors main aim is to summarize applications thus far, and to examine the technical problems and potential interest which may follow from extension of these techniques to higher energies.

714,277
PB82-261645 Not available NTIS
National Bureau of Standards, Washington, DC.
Powder Neutron Diffraction Study of the Nonstoichiometric Solid Solution of Lithium Tantalate 9LiTaO3:Ta2O5.
Final rept.
A. Santoro, R. S. Roth, and M. Austin. 1982, 5p
Pub. in Acta Crystallographica B38, p1094-1098 1982.

Keywords: *Solid solutions, *Neutron diffraction, Lithium inorganic compounds, Tantalates, Tantalum oxides, Reprints, *Lithium tantalates.

The nonstoichiometric solid solution 9LiTaO3:Ta2O5 has been studied with the powder neutron diffraction technique, and the intensity data have been used to refine several structural models with the Rietveld method. The results of these calculations show that the best fit to the experimental observations is obtained with the model for the defective structure proposed by Nassau & Lines. Data have also been collected from stoichiometric LiTaO3, and the results of the refinement of this structure agree well with those obtained with single-crystal diffraction techniques.

714,278
PB82-261843 Not available NTIS
National Bureau of Standards, Washington, DC.
Structure of Sodium Strontium Phosphate Nonahydrate.
Final rept.
S. Takagi, M. Mathew, and W. E. Brown. 1982, 7p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Acta Crystallographica B38, p1408-1413 1982/

Keywords: *Crystal structure, Single crystals, X ray diffraction, Sodium phosphates, Strontium compounds, Hydrates, Reprints, *Sodium strontium phosphates, Phosphated, Cubic lattices.

The crystal structure of SrNaPO4.9H2O has been determined by single-crystal X-ray diffraction. Results are discussed.

714,279
PB82-263971 Not available NTIS
National Bureau of Standards, Washington, DC.
Vibronic Spectrum of the U2 Isoelectronic Center in Si:In.
Final rept.
R. E. Stahlbush, and R. A. Forman. 1982, 6p
Pub. in Jnl. of Luminescence 26, p227-232 1982.

Keywords: *Silicon, *Photoluminescence, Indium, Additives, Cryogenics, Excitons, Reprints, Density of states.

The photoluminescence spectrum of Si:In measured at 2 K and 4 K using samples from several suppliers has been found to be preparation sensitive. In particular, intensity variations allow us to distinguish a sharp no-phonon line at 1.118 eV, variously referred to as U2 or P, and its associated vibronic spectrum from the In(NP) lines and their phonon replicas. Whereas the intensity of the latter did not show preparation sensitivity, the former has been observed to change by three orders of magnitude.

714,280
PB82-263997 Not available NTIS
National Bureau of Standards, Washington, DC.
Improved Thermometry for Deep-Level Measurements.
Final rept.
W. E. Phillips. 1982, 3p
Pub. in Jnl. of Physics E: Scientific Instruments 15, p499-501 1982.

Keywords: *Semiconductors(Materials), *Temperature measurement, Band structure of solids, Precision, Reprints.

The various semiconductor deep-level measurement techniques are often limited in their precision by thermometry. A temperature-measurement procedure is described which uses a statistical calibration of forward-biased temperature-sensing diodes to achieve a two-sigma precision of + or - mK. Several applications are discussed to illustrate where the improved thermometry can significantly affect the quality of the results.

714,281
PB82-264136 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Scattering Studies of Ternary Magnetic Superconductors.
Final rept.
J. W. Lynn. 1981, 7p
Pub. in Proceedings of Conference Ternary Superconductors, Lake Geneva, WI, September 24-26, 1980, p51-57 1981.

Keywords: *Superconductors, Neutron scattering, Erbium compounds, Holmium compounds, Rhodium inorganic compounds, Molybdenum inorganic compounds, Borides, Sulfides, Ferromagnetism, Cryogenics, *Magnetic superconductors, Magnetic ordering,

Erbium rhodium borides, Holmium molybdenum sulfides.

The rare-earth (RE) ternary superconductors belonging to the REMo6X8 (X=S,Se) and RERh4B4 classes of materials have provided the first unambiguous realizations in nature of the coexistence of superconductivity and long range magnetic order. The competitive nature of these two cooperative phenomena is illustrated by the ferromagnetic compounds HoMo6S8 and ErRh4B4, which first become superconducting and then order magnetically at lower temperatures. At first the superconductivity is able to prevent ferromagnetic alignment and a compromise long-wavelength oscillatory magnetization is established at intermediate temperatures. At sufficiently low temperatures, however, the superconductivity is destroyed as ferromagnetism sets in. Antiferromagnetic order, on the other hand, is found to be much less detrimental to superconductivity and there are now a rather large number of ternary materials where antiferromagnetism coexists with superconductivity. Inelastic scattering studies have shown that the crystal field splittings of the rare-earth ions in these materials are generally large in comparison with the magnetic energies.

714,282
PB82-264151 Not available NTIS
National Bureau of Standards, Washington, DC.
Bulk Magnetization of Dysprosium-Scandium Alloys.
Final rept.
J. H. Ferrick, J. J. Rhyne, and R. Segnan. Mar 82, 3p
Pub. in Jnl. of Applied Physics 53, n3 p2232-2234 Mar 82.

Keywords: *Magnetization, Ferromagnetism, Antiferromagnetism, Cryogenics, Reprints, *Dysprosium intermetallics, *Scandium intermetallics, Magnetic ordering.

Bulk magnetization measurements were made on Dy(0.25)Sc(0.75) and Dy(0.75)Sc(0.25) alloys. Results are discussed.

714,283
PB82-265646 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of the Quantized Hall Steps in Si at the ppm Level.
Final rept.
R. J. Wagner, C. F. Levine, M. E. Cage, R. F. Dziuba, and B. F. Field. 1982, 8p
Sponsored in part by Naval Research Lab., Washington, DC.
Pub. in Surface Science 113, p10-15 1982.

Keywords: *Field effect transistors, *Silicon, *Hall effect, Reprints, Metal oxide semiconductors.

Hall voltages of n-channel (100) Si MOSFETs have been studied with a high sensitivity potentiometric method. These experiments reveal Hall steps flat to within at least 1 ppm at a temperature of 1.5 K and magnetic field of 13 T. In addition, unanticipated features have been observed near the edges of the Hall steps. Possible explanations for these effects will be discussed.

714,284
PB82-265661 Not available NTIS
National Bureau of Standards, Washington, DC.
Critical Current Measurements: A Compendium of Experimental Effects.
Final rept.
L. F. Goodrich, and F. R. Fickett. May 82, 19p
Pub. in Cryogenics 28, p225-241 May 82.

Keywords: *Superconductors, Measurement, Copper, Niobium, Cryogenics, Tin, Titanium, Reprints, *Critical current.

The results of a program to evaluate the measurement of the critical current of relatively small (less than 600 A) practical superconductors are presented. Experimental data showing the effect of various parameters on the measurement are given. Specific areas covered are: experiment design and sample mounting; electric field and resistivity criteria; temporal and spatial field and current variation; and temperature and strain effects. The goal of the presentation is to describe the critical current measurement process and its pitfalls in sufficient detail to serve as a guide for those relatively new to the field of practical superconductors.

714,285
PB83-106120 Not available NTIS
National Bureau of Standards, Washington, DC.
Brittle Crack Advance by Double Kink Nucleation.
Final rept.
I. H. Lin, and J. P. Hirth. 1982, 14p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. of Materials Science 17, p447-460 1982.

Keywords: *Crack propagation, Edge dislocations, Brittleness, Nucleation, Reprints.

A Mode 1 brittle crack is simulated by a pile-up of edge dislocations. The leading dislocation is a perfect lattice dislocation and the remaining dislocations are sub-dislocations with fractional Burgers vectors. A double kink at the crack-tip is represented by a set of double jogs on the dislocations. The equilibrium jog array is determined for several examples. The calculations give results for the activation energy for double-kink formation and for the elastic field of double kinks. The results are applicable to theoretical estimates of crack-growth rates and in providing boundary conditions for atomic simulations.

714,286
PB83-110296 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Development of Standards for Superconductors.
Interim rept. Oct 80-Jan 82.
A. F. Clark, L. F. Goodrich, F. R. Fickett, and J. V. Minervini. Jul 82, 120p NBSIR-82-1678
Contract DE-AI01-76PR06010
See also PB81-176141. Sponsored in part by Massachusetts Inst. of Tech, Cambridge.

Keywords: *Superconductors, *Standards, *Critical current.

A cooperative program with the Department of Energy, the National Bureau of Standards, and private industry is in progress to develop standard measurement practices for use in large scale applications of superconductivity. The goal is the adoption of voluntary standards for the critical parameters and other characterizations of practical superconductors. Progress for the period October 1980 through January 1982 is reported. The major effort was the development of a standard test method for critical current, the necessary back-up research, and the coordination of the adoption of the test method and a standard terminology through the subcommittee level in ASTM.

714,287
PB83-112128 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Status of Electron Transport Cross Sections.
S. M. Seltzer, and M. J. Berger. Sep 82, 33p NBSIR-82-2572
Sponsored in part by National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center, Department of Energy, Washington, DC. Office of Health and Environmental Research, and Office of Naval Research, Arlington, VA.

Keywords: *Electron irradiation, *Cross sections, *Bremsstrahlung, Elastic scattering, Excitation, Electron-atom collisions, Stopping power.

This report describes recent developments and improvements pertaining to cross sections for electron-photon transport calculations. The topics discussed include: (1) electron stopping power (mean excitation energies, density-effect correction); (2) bremsstrahlung production by electrons (radiative stopping power, spectrum of emitted photons); (3) elastic scattering of electrons by atoms; (4) electron-impact ionization of atoms.

714,288
PB83-131649 Not available NTIS
National Bureau of Standards, Washington, DC.
Synchrotron Radiation Topography.
Final rept.
M. Kuriyama, W. J. Boettinger, and G. G. Cohen. 1982, 8p
Pub. in Annual Review of Materials Science 12, p23-50 1982.

Keywords: *Synchrotron radiation, X rays, Crystal defects, Crystal structure, Microstructure, Reprints.

Synchrotron x-ray topography has its roots in classical laboratory x-ray work performed between 1930 and 1960. The ability of the x-ray topographic technique to image microstructural details related to crystalline imperfection, has long given it a position of importance in materials science.

714,289
PB83-131656 Not available NTIS
National Bureau of Standards, Washington, DC.
X-Ray Extinction Theory in the Bragg Geometry.
Final rept.
M. Kuriyama, and G. G. Cohen. 1982, 9p
Pub. in Zeitschrift fuer Naturforschung 37a, p465-473 1982.

Keywords: X ray diffraction, Reprints, *X ray topography, *X ray extinction, X ray scattering.

In view of the renewed interest in surface reflection x-ray topography, a unified theory for the Bragg geometry has been laid out to explain the different types of image formation from the scattering point of view. The means by which the photons 'infiltrate' into a real crystal has been studied. The theory suggests, for example, a mechanism for image contrast inversion in the Bragg geometry, and will also be found to be important in other topics of high current interest, such as x-ray standing wave surface analysis and x-ray inelastic scattering at the Bragg angle.

714,290
PB83-134205 Not available NTIS
National Bureau of Standards, Washington, DC.
Josephson Effect.
Final rept.
L. B. Holdeman. 1982, 4p
Pub. in McGraw-Hill Encyclopedia Science Technology, 5th Edition, p438-441 1982.

Keywords: *Josephson junctions, Superconductivity, Reprints, *Josephson effect.

This article presents a brief, semitechnical description of the Josephson effect for inclusion in the new edition of the McGraw-Hill Encyclopedia of Science and Technology.

714,291
PB83-134262 Not available NTIS
National Bureau of Standards, Washington, DC.
Real Time Topography with X-Ray Image Magnification.
Final rept.
W. J. Boettinger, R. C. Dobbyn, H. E. Burdette, and M. Kuriyama. 1982, 7p
Pub. in Nuclear Instruments and Methods 195, p355-361 1982.

Keywords: *X ray analysis, Synchrotron radiation, Real time, Magnetic domains, Nickel, Single crystals, Domain walls, Reprints.

An x-ray optical configuration for real time synchrotron radiation topography is described. Asymmetric diffraction from perfect Si crystals is used to control the beam size, wavelength, and collimation before the sample, and to magnify the x-ray image after the sample. Preliminary results using this system are reported. Video images of moving magnetic domain walls under a varying magnetic field were obtained from Ni single crystals in the anomolous transmission geometry.

714,292
PB83-134361 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS*AIDS80: A Fortran Program to Evaluate Crystallographic Data.
Final rept.
C. R. Hubbard, J. K. Stalick, and A. D. Mighell. 1981, 11p
Pub. in Advances in X-Ray Analysis 24, p99-109 1981.

Keywords: *Crystallography, *Computer programming, Single crystals, Fortran, X ray diffraction, Reprints, Powder patterns.

The computer program NBS*AIDS80 has been developed for the computer-assisted evaluation of crystallographic data by the NBS Crystal Data Center and the JCDPS--International Centre for Diffraction Data. The program has been devised for the analysis of single-crystal data and powder patterns, with the following goals: (1) a single format to permit the concurrent evaluation of entries for the NBS Crystal Data File and the JCPDS Powder Diffraction File; (2) a single master data base from which all data base products (printed and computer files) will be derived; (3) improved evaluation of the data; and (4) the analysis of crystallographic data by the general scientific community.

NBS*AIDS80 is written in FORTRAN to permit implementation on a wide variety of computers, and input may be from cards or from a terminal.

714,293
PB83-134387 Not available NTIS
National Bureau of Standards, Washington, DC.
PDF Workbook: Use of the X-Ray Powder Diffraction File.
Final rept.
C. R. Hubbard, G. J. McCarthy, and C. M. Foris. 1980, 48p
Sponsored in part by JCPDS - International Centre for Diffraction Data, Swarthmore, PA.
Pub. in Book JCPDS p1-48 1980.

Keywords: *Crystallography, *X ray diffraction.

The workbook is intended as a handout at JCPDS-International Centre for Diffraction Data sponsored Workshops on how to use the Powder Diffraction File. The workbook contains rules of nomenclatures, schematics of search procedures, examples and problems. The examples and problems of the workbook are coordinated with the book Powder Diffraction Data from the JCPDS Associateship at the National Bureau of Standards.

714,294
PB83-135343 Not available NTIS
National Bureau of Standards, Washington, DC.
Superconductive Energy Gap of AuAl2.
Final rept.
R. J. Soulen, D. Van Vechten, G. Costabile, T. Jach, and L. B. Holdeman. 1981, 2p
NASA-Order-H-27908B
Pub. in Physica 108B, p823-824 1981.

Keywords: *Superconductors, *Energy gap, *Gold intermetallics, *Aluminum alloys, Metal films, Transition temperature, BCS theory, Reprints.

The authors have prepared 200 nm films of AuAl2. The superconductive transition determined by resistive measurements was found to vary from film to film, from 177 to 184 mK, and the transition widths varied between 6 and 15 mK. Film surfaces were oxidized by the Greiner process and Al counter electrodes were deposited in order to produce tunnel junctions. The temperature dependence of the energy gap of AuAl2 was measured and found to agree well with BCS theory.

714,295
PB83-139196 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin and Energy Analyzed Secondary Electron Emission from a Ferromagnet.
Final rept.
J. Unguris, D. T. Pierce, A. Galejs, and R. J. Celotta. 5 Jul 82, 5p
Pub. in Physical Review Letters 49, n1 p72-76, 5 Jul 82.

Keywords: *Ferromagnetic materials, *Electron spin, *Polarization(Spin alignment), *Secondary emission, Magnetic properties, Surfaces, Reprints, Scanning electron microscopy.

Measurements are presented of the energy dependence of the spin polarization of low-energy (0.5-25 eV) secondary electrons when a 500-eV primary beam is incident on an iron-based ferromagnetic glass. The polarization of the lowest-energy electrons is found to correspond to the net valence-band spin density. Possible causes for the observed decrease in polarization with increasing secondary energy are discussed. The results demonstrate a mechanism for measuring surface magnetic structure with the very high spatial resolution of scanning electron microscopy.

714,296
PB83-141945 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Gallium Arsenide Materials Characterization: Annual Report, October 12, 1978 to October 12, 1979.
Final rept.
J. R. Ehrstein, and A. C. Seabaugh. Dec 81, 40p
NBSIR-81-2403
Sponsored in part by Army Electronics Technology and Devices Lab., Fort Monmouth, NJ.

Keywords: *Gallium arsenides, *Electric contacts, *Ohmic contacts, Spreading resistance, Electrical conductivity.

Ohmic and Schottky barrier contacts for use in electrical characterization were examined both conceptually and experimentally with particular focus on the problems associated with ohmic contacts to semi-insulating GaAs. The conductivity type of the semi-insulating material, which can be either n- or p-type, was investigated by means of a potential profiling technique. In addition, the feasibility of spreading resistance measurements was examined and applied to both low resistivity bulk GaAs and ion-implanted semi-insulating substrate material.

714,297
PB83-143107 Not available NTIS
National Bureau of Standards, Washington, DC.
Phase Diagram of Simple Metamagnets as Determined by the Cluster Variation Method.
Final rept.
P. H. E. Meijer, and S. Ekmekci. 1982, 15p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Physica 113A, p351-366 1982.

Keywords: *Magnetic materials, *Phase diagrams, Ferromagnetism, Antiferromagnetism, Reprints, Ising model.

In order to explore the global properties of a simple Ising metamagnet, the authors computed the values of the coupling parameters for which the tricritical behavior is replaced by bicritical end points (Lifshitz point). The transition points are determined by means of the cluster variation method. The metamagnets studied have an antiferromagnetic coupling between the spins on two chosen sublattices and a ferromagnetic coupling between spins on the same sublattice. The following lattices and sublattices were considered: two dimensional square, simple cubic and two different subdivisions of the fcc and bcc lattices each. The method used is based on the coincidence of two roots for the bicritical end points and of three roots for the tricritical point. In contrast to the molecular field and the pair approximation results the presence or absence of the Lifshitz point depends on the lattice structure considered. The authors discuss the comparison of their results with the results from the renormalization theories.

714,298
PB83-143339 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of the Fits of Two Models to the Same Data Set.
Final rept.
E. Prince. 1982, 2p
Pub. in Acta Crystallographica B38, p1099-1100 1982.

Keywords: *Neutron diffraction, *Crystal defects, Mathematical models, Comparison, Correlations, Linear regression, Reprints, Lithium tantalates.

A frequently encountered problem is the determination of whether one model gives a significantly better fit to a set of data than another. This may be studied by examining the correlation between the differences in the predictions of the models and the corresponding differences between the observed data and the arithmetic means of the predictions. The existence and precision of such correlations may be determined using the techniques of linear regression. The analysis has been applied to a neutron powder diffraction study of the defect structure of nonstoichiometric lithium tantalate.

714,299
PB83-145565 Not available NTIS
National Bureau of Standards, Washington, DC.
Further Evidence for a Spin-Glass Phase Transition in Amorphous Fe-Mn-P-B-Al Alloys.
Final rept.
R. B. Goldfarb, K. V. Rao, H. S. Chen, and C. E. Patton. Mar 82, 3p
Pub. in Jnl. of Applied Physics 53, n3 p2217-2219 Mar 82.

Keywords: *Magnetic alloys, *Phase transformations, Magnetic hysteresis, Reprints, Magnetic susceptibility, Amorphous materials, Magnetic phase diagrams, Magnetic ordering.

Low field dc susceptibility, thermoremanent magnetization, and hysteresis studies are presented for two amorphous Fe-Mn-P-B-Al alloys of concentrations close to, and on either side of, the multicritical point in the magnetic phase diagram. They exhibit spin-glass, and para-ferro-spin-glass transitions respectively. For the spin-glass alloy, the Edwards-Anderson-type order parameter deduced from the dc susceptibility is found to yield a mean-field-valued critical exponent. In the alloy with two magnetic transitions, the temperature dependence of the thermoremanence and hysteresis indicate a ferro-spin-glass transition temperature consistent with that deduced from a scaling approach for the same alloy system.

714,300
PB83-146456 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Spatial Dispersion on the Classical Field Enhancement Factors Near a Rough Surface.
Final rept.
K. V. Sobha, and G. S. Agarwal. 1982, 5p
Pub. in Solid State Communications 43, n2 p99-103 1982.

Keywords: *Electromagnetic scattering, *Surface roughness, Reprints, Effective mass approximation.

Effect of spatial dispersion on the classical field enhancement factors near a rough surface is studied in detail for two different types of the material medium -- (i) metallic medium in hydrodynamic approximation, (ii) excitonic medium in the effective mass approximation. A general perturbation approach based on Ewald-Oseen extinction theorem is used to obtain fields to different orders in the surface roughness parameter. Numerical results indicate that spatial dispersion could have significant effect on the resonant enhancement of local fields.

714,301
PB83-146563 Not available NTIS
National Bureau of Standards, Washington, DC.
Contribution of Nuclear Magnetism to the Isochoric Pressure of BCC Solid 3He.
Final rept.
C. T. Van Degrift, W. J. Bowers, P. B. Pipes, and D. F. McQueeney. 12 Jul 82, 5p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Physical Review Letters 49, n2 p149-153, 12 Jul 82.

Keywords: *Helium 3, *Solidified gases, *Magnetostriction, Cryogenics, Magnetic fields, Pressure, Reprints.

Isochoric pressure measurements have been made in BCC solid 3He from the melting point down to 29 mK in magnetic fields up to 8.0 T and for molar volumes of 23.833, 24.161 and 24.353 ml/mole. The data have been fitted using an expansion consistent with the high temperature limit derived from an effective spin Hamiltonian. Our measurements indicate conclusively that the pressure at high magnetic fields cannot be made consistent with the nuclear magnetic susceptibility in the context of this type of theory, thus corroborating the original indication of the results of Kirk and Adams.

714,302
PB83-157008 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Self-Stress on Diffusion in Solids.
Final rept.
F. C. Larche, and J. W. Cahn. 1981, 11p
Pub. in Acta Metallurgica 30, p1835-1845 1982.

Keywords: *Diffusion, Stresses, Solids, Reprints, Ficks law.

The authors demonstrate that there is a failure of Fick's first law because of long-ranged elastic interaction of flux with the composition field and the shape of the specimen, even in the absence of applied stresses. This is because the diffusional flux is affected by the local stress field which is influenced by compositional inhomogeneity everywhere in the specimen. From an equation relating stress and composition field, the authors can find special cases in which a diffusion law resembling Fick's law occurs, but the anisotropy of the apparent diffusion coefficient reveals that non-local factors are still present. The authors also examine the case of diffusion through a thin plate for the functional dependence of diffusion on the composition field and predict much deeper diffusional penetration and accumulation on the far side.

714,303
PB83-164962 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.

Standard X-ray Diffraction Power Patterns. Section 19 - Data for 51 Substances.
Final monograph.
M. C. Morris, H. F. McMurdie, E. H. Evans, B. Paretzkin, H. S. Parker, N. P. Pyrros, and C. R. Hubbard. Dec 82, 122p NBS-MONO-25-SECT-19
See also PB82-117805. Prepared in cooperation with JCPDS-International Centre for Diffraction Data, Swarthmore, PA. Library of Congress catalog card no. 53-61386.

Keywords: *Crystal structure, *X ray diffraction, Lattice parameters, Inorganic compounds, Standards, Tables(Data), *Powder patterns.

Standard x-ray powder diffraction patterns are presented for 51 substances. These patterns, useful for identification, were obtained by manual or automated diffractometer methods, or were calculated from published crystal structure data. The lattice constants from the experimental work were refined by least-squares methods, and reflections were assigned Miller indices consistent with space group extinctions. Relative intensities, calculated densities, literature references, and other relevant data are included.

714,304
PB83-165043 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Semiconductor Technology Program Progress Briefs.
Interim rept. 1 Jul 81-30 Sep 82.
E. J. Walters. Jan 83, 21p NBSIR-82-2636
See also PB81-154122. Sponsored in part by Dept. of Energy, Washington, DC. Div. of Electric Energy Systems, Defense Advanced Research Projects Agency, Arlington, VA., Def. Nuclear Agency, Washington, DC., Naval Weapons Support Cntr, Crane, IN., Solar Energy Research Inst., Golden, CO., Dept. of the Army, Washington, DC., Dept. of the Air Force, Washington, DC., and Harry Diamond Labs.

Keywords: *Semiconductors(Materials), *Measurement, Semiconductor devices, Integrated circuits, Microelectronics, Radiation damage, Gallium arsenides, Silicon, Impurities, Research.

This report provides abstracts of recent publications of NBS work on measurement technology for semiconductor materials, process control, and devices. Emphasis is placed on silicon and silicon-based devices. Topics include: defects and impurities, IC test structures, micrometrology, packaging, physical analysis, power devices, process and device modeling, and radiation effects. In addition, publications in press and conference presentations are listed. Information is also given on recent seminars, workshops, and symposia and those scheduled for the near future.

714,305
PB83-176818 Not available NTIS
National Bureau of Standards, Washington, DC.
Inversion Layer Thermopower in High Magnetic Fields.
Final rept.
S. M. Girvin, and M. Jonson. 1982, 5p
Pub. in Jnl. of Physics C: Solid State Physics 15, pL1147-L1151 1982

Keywords: *Thermoelectricity, Electron gas, Magnetic fields, Hall effect, Reprints.

The authors calculate the thermopower of an ideal two-dimensional electron gas (inversion layer) in a quantizing magnetic field. They find that the thermopower is a universal function of the reduced temperature which has a novel dependence on the chemical potential.

714,306
PB83-176891 Not available NTIS
National Bureau of Standards, Washington, DC.
Novel Method to Detect Nonexponential Transients in DLTS.
Final rept.
W. R. Thurber, R. A. Forman, and W. E. Phillips. Nov 82, 4p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Jnl. of Applied Physics 53, n11 p7397-7400 Nov 82.

Keywords: *Spectroscopy, Semiconductors(Materials), Silicon, Defects, Impurities, Electrical properties, Reprints, *Deep level transient spectroscopy.

In conventional DLTS (Deep Level Transient Spectroscopy) measurements, the analysis of the results is based upon the assumption of an exponential current or capacitance transient. The authors present experimental and computational results on a novel experimental method for determining when the assumption of exponentiality is not satisfied by the sample under study. The measurement may be performed without any changes in the conventional double-boxcar DLTS system.

714,307
PB83-176933 Not available NTIS
National Bureau of Standards, Washington, DC.
Structural Ordering in Amorphous TbFe2 and YFe2.
Final rept.
P. D'Antonio, J. H. Konnert, J. J. Rhyne, and C. R. Hubbard. 1982, 9p
Pub. in Jnl. of Applied Crystallography 15, p452-460 1982.

Keywords: *Iron intermetallics, Crystal structure, Neutron scattering, Reprints, *Terbium intermetallics, *Yttrium intermetallics, Amorphous materials, Magnetic ordering.

Total neutron scattering data were collected on sputtered YFe2 at 298K and TbFe2 at 423K with a wavelength of 0.7 A. The TbFe2 data were collected above the magnetic ordering temperature of 383K. In addition, the elastic neutron scattering of TbFe2 was measured with the use of a pyrolytic graphite analyzer at a wavelength of 1.5 A, and its total X-ray scattering was measured with Mo radiation and a silicon-lithium drifted detector. Experimental radial distribution functions, with statistical error limits, were calculated.

714,308
PB83-177006 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin-Dependent Elastic Scattering of Electrons from a Ferromagnetic Glass, Ni40Fe40B20.
Final rept.
D. T. Pierce, R. J. Celotta, J. Unguris, and H. C. Siegmann. Sep 82, 9p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Physical Review B 26, n5 p2566-2574, 1 Sep 82.

Keywords: *Electron scattering, Nickel alloys, Iron alloys, Boron containing alloys, Elastic scattering, Electron spin, Surfaces, Reprints, *Ferromagnetic glass.

The dependence of the elastic scattering of electrons on the relative direction of the spin of the incident electron with respect to the magnetization of the ferromagnetic glass Ni40Fe40B20 was measured at various energies, angles and temperatures. The authors show that this scattering is liquid-like, i.e., effects of crystal diffraction are negligible. Also, multiple scattering of electrons contributes less than 30% to the intensity in the backward scattering direction. Under these conditions, and with correction for electron attenuation, the scattering is atom-like. This yields a first insight into the spin dependence of electron scattering from single magnetic atoms in a metallic environment. The surface magnetization was found to decrease with temperature with the same power law as the bulk magnetization at low temperature in agreement with theoretical predictions by Mills and Maradudin.

714,309
PB83-177311 Not available NTIS
National Bureau of Standards, Washington, DC.
Electronically Adjustable Delay for Josephson Technology.
Final rept.
R. E. Harris, P. Wolf, and D. F. Moore. Sep 82, 3p
Pub. in IEEE Electron Device Letter EDL-3, n9 p261-263 Sep 82.

Keywords: *Josephson junctions, Measurement, Delay circuits, Superconductivity, Sampling, Waveforms, Reprints.

An electronically adjustable time delay circuit for superconducting technology is reported. In conjunction with a superconducting sampler on the same chip, the delay circuit has allowed measurement of waveforms with an apparent resolution of 8.5 ps. The delay circuit permits flicker-free oscilloscope displays of fast waveforms, and provides the circuitry needed for further speed advances in superconducting sampling and other ultra-fast measurement techniques.

714,310
PB83-177444 Not available NTIS
National Bureau of Standards, Washington, DC.
Constant Momentum Transfer Average Study of PLEED Data from W(100).
Final rept.
G. C. Wang, R. J. Celotta, and D. T. Pierce. 1982, 9p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Surface Science 119, p479-487 1982.

Keywords: *Momentum transfer, Tungsten, Surfaces, Polarization(Spin alignment), Electron scattering, Reprints, *Polarized electron diffraction, Low energy electron diffraction.

The authors performed a constant momentum transfer averaging (CMTA) data reduction of PLEED data obtained from a W(100) surface. The results of averaging (00) beam intensity profiles, I(E, theta), and strength of spin dependent scattering profiles, S(E, theta), are presented and discussed.

714,311
PB83-177493 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Twist Pitch on Short-Sample V-I Characteristics of Multifilamentary Superconductors.
Final rept.
L. F. Goodrich, J. W. Ekin, and F. R. Fickett. 1982, 10p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of International Cryogenic Materials Conference (4th), San Diego, California, August 10-14, 1981, Paper in Advances in Cryogenic Engineering 28, p571-580 1982.

Keywords: *Superconductors, Twisting, Electrical properties, Critical current.

The voltage tap location on short samples of twisted multifilamentary superconductors can result in anomalous V-I characteristics and significantly affect the determination of critical current. A phenomenological model of the effect has been developed based on the twist pitch of the wire and current-transfer theory. Extensive experimental data has ruled out other potential explanations for the observed behavior.

714,312
PB83-181602 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin-Freezing Below the Ferromagnetic Transition Determined by the Imaginary Component of ac Magnetic Susceptibility.
Final rept.
R. B. Goldfarb, F. R. Fickett, K. V. Rao, and H. S. Chen. Nov 82, 3p
Pub. in Jnl. of Applied Physics 53, n11 p7687-7689 Nov 82.

Keywords: *Ferromagnetism, *Paramagnetism, Alternating current, Iron alloys, Nickel alloys, Manganese alloys, Phase transformations, Reprints, *Magnetic susceptibility, Amorphous materials, Spin glasses.

The temperature dependences of the real and imaginary components of an magnetic susceptibility have been measured for a number of amorphous Fe-Mn and Fe-Ni alloys. The alloys have paramagnetic, ferromagnetic, and spin-glass intervals as a function of decreasing temperature.

714,313
PB83-181677 Not available NTIS
National Bureau of Standards, Washington, DC.
Resonant Tunneling.
Final rept.
J. Halbritter. 1982, 19p
Pub. in Surface Science 122, p80-98 1982.

Keywords: *Electron tunneling, Niobium, Niobium oxides, Tantalum oxides, Tantalum, Reprints, *Resonance tunneling.

Localized electron states in oxides adjacent to metals hybridize with conduction electrons forming interface states, which at the localized state have a long decay time and amplitude resonantly enhanced over the amplitude of the conduction electrons. Resonant tunneling via these interface states corresponds to slow, but band like, diffusion which is much faster than activated diffusion, where the latter diminishes for correlation

(Coulomb) energies or for phonon energies much larger than the band width. These energies hinder the resonant tunneling yielding a strongly time, voltage and temperature dependent tunnel current. This transition from resonant tunneling to activated intermediate state tunneling corresponds to the metal-insulator-transition. In Ta2O5 and Nb2O5 the correlation energy is small and the band width is large and thus resonant tunneling can account for various tunnel anomalies of Ta- Ta2O5- metal or Nb - Nb2O5 - metal diodes.

714,314
PB83-181719 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Strain on the Critical Current and Critical Field of B1 Structure NbN Superconductors.
Final rept.
J. W. Ekin, J. R. Gavaler, and J. Gregg. 15 Nov 82, 3p
Pub. in Applied Physics Letters 41, n10 p996-998, 15 Nov 82.

Keywords: *Superconductors, Strains, Magnetic fields, Cryogenics, Reprints, *Niobium nitrides, *Critical current, *Critical field.

The effect of uniaxial strain on the critical current of NbN superconductors has been measured at 4.2 K in magnetic fields from 6 to 22 T. Results are discussed.

714,315
PB83-182618 Not available NTIS
National Bureau of Standards, Washington, DC.
Ground State Spin Excitations in HoAl2.
Final rept.
J. J. Rhyne, and N. C. Koon. Nov 82, 3p
Pub. in Jnl. of Applied Physics 53, n11 p8354-8356 Nov 82.

Keywords: *Magnons, Ground state, Cryogenics, Neutron scattering, Inelastic scattering, Single crystals, Reprints, *Holmium intermetallics, *Aluminum intermetallics.

Inelastic neutron scattering has been used to examine the spin waves in a single crystal of the cubic Laves-phase compound HoAl2, which orders at a Tc = 28 K.

714,316
PB83-182642 Not available NTIS
National Bureau of Standards, Washington, DC.
Search for Superconductivity in Pd-Ag Alloys.
Final rept.
I. K. Schuller, D. Hinks, and R. J. Soulen. 1 Feb 82, 2p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review B 25, n3 p1981-1982, 1 Feb 82.

Keywords: *Palladium alloys, *Silver alloys, *Superconductivity, Cryogenics, Reprints.

Pd(c)Ag(1-c) alloys (C=0.59-0.81) are found not to be superconducting down to a temperature of 10 mK. This is in contradiction to recent theoretical predictions.

714,317
PB83-214221 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Three Guises of Generation-Recombination Noise.
Technical note (Final).
J. Cohen. Apr 83, 16p NBS-TN-1173

Keywords: *Semiconductor junctions, *Electromagnetic noise, Noise, Charge carriers, Mathematical models.

It is shown that the noise in a zero-biased junction may be just a manifestation of the normally-occurring generation-recombination process, rather than shot noise, as is usually presumed. In addition, an attempt is made to clarify some noise mechanisms in semiconductors by addressing mathematical interpretation and terminology. In particular, for a biased homogeneous material at low frequencies, where the relevant transport mechanism is drift, a shot-like expression of the g-r noise equation is derived. For a zero-biased junction at low frequencies, where the relevant transport mechanism is diffusion, a pure shot-like expression of the g-r noise equation and an equivalent thermal (Nyquist) expression is derived. In both the homogeneous and the junction cases, however, the true noise remains generation-recombination noise, i.e., the origin of the noise is the fluctuations in the rates of generation and recombination of free carriers.

714,318
PB83-218636 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC.
NBS Reactor: Summary of Activities July 1981 through June 1982.
Technical note. Jul 81-Jun 82.
F. J. Shorten. Jun 83, 235p NBS-TN-1178
See also PB82-240698.

Keywords: *Neutron beams, *Research projects, Nuclear research and test reactors, Neutron irradiation, Neutron activation analysis, Neutron diffraction, Neutron radiography, Materials tests, Crystal structure.

This report summarizes all those programs which depend on the NBS reactor. It covers the period from July 1981 through June 1982. The programs range from the use of neutron beams to study the structure and dynamics of materials through nucelar physics and neutron standards to sample irradiations for activation analysis, isotope production, radiation effects studies, neutron radiography, and nondestructive evaluation.

714,319
PB83-234260 Not available NTIS
National Bureau of Standards, Washington, DC.
Superconductive Energy Gaps of Thin-Film AuAl2 and AuIn2.
Final rept.
D. Van Vechten, L. B. Holdeman, R. J. Soulen, and J. Toots. May 83, 18p
Pub. in Jnl. of Low Temperature Physics 51, n3/4 p329-346 May 83.

Keywords: *Gold intermetallics, *Energy gap, *Superconductivity, Electron tunneling, BCS theory, Thin films, Reprints, *Aluminum intermetallics, *Indium intermetallics, Temperature dependence.

Thin films of the intermetallic compounds AuAl2 and AuIn2 were prepared and used as electrodes in AuAl2/oxide/Al,Al/oxide/AuIn2, or AuAl2/oxide/AuIn2 tunnel junctions. The tunnel barriers were produced by rf sputter oxidation. The temperature dependence of the energy gaps of the AuAl2 and AuIn2 films was measured and found to agree well with BCS theory.

714,320
PB83-234443 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Magnetic Properties of Amorphous Ferromagnets Studied Using Electron Spin Polarization.
Final rept.
D. T. Pierce, R. J. Celotta, J. Unguris, and H. C. Siegmann. 1983, 3p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Magnetism and Magnetic Materials 35, p28-30 1983.

Keywords: *Ferromagnetic materials, *Magnetization, Electron spin, Polarization(Spin alignment), Surface properties, Magnons, Nickel containing alloys, Iron alloys, Reprints, Nickel iron boron alloy, Iron boron silicon alloy, Temperature dependence.

The temperature dependence of the surface magnetization of Ni(40)Fe(40)B(20) was determined by measurement of the intensity asymmetry after scattering a spin modulated incident electron beam. The energy dependence of the spin polarization of secondary electrons from Fe(81.5)B(14.5)Si(4) was measured and illustrates a new way to investigate surface magnetic microstructures.

714,321
PB83-234575 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Ionized Donors on the Electron and Hole Densitites of States in Silicon.
Final rept.
J. R. Lowney, and H. S. Bennett. Mar 83, 6p
Pub. in Jnl. of Applied Physics 54, n3 p1369-1374 Mar 83.

Keywords: *Silicon, Holes(Electron deficiencies), Electrons, Impurities, Reprints, *Density of states, Born approximation.

A self-consistent second Born approximation has been used to calculate the change in the electron and hole densities of states due to ionized donors in silicon. The results are compared with a previous partial-wave technique and found to be in good agreement for a case of common applicability, i.e., a donor density of 10 to the 20th power/cc at room temperature.

714,322
PB83-235051 Not available NTIS
National Bureau of Standards, Washington, DC.
Mechanics of Cracks Screened By Dislocations.
Final rept.
R. M. Thomson, and J. E. Sinclair. 1982, 10p
Sponsored in part by Army Research Office, Durham, NC.
Pub. in Acta Metallurgica 30, p1325-1334 1982.

Keywords: *Cracks, Dislocation(Materials), Force, Stresses, Reprints, *Fracture(Mechanics).

Authors develop a general theorem for the force on singularities in an elastic two-dimensional medium in terms of the residues of the stress at the singularities. This theorem is then applied to a sharp crack screened by a cloud of dislocations. A total fracture criterion can then be derived in principle by specifying the local cleavage condition at the crack and the lattice resistance of the dislocations. The COD of the crack is shown to be given by the total screening Burgers vector of the dislocation cloud, and the wake of a moving crack is discussed in terms of the resistance to moving the screening cloud. Finally, limitations of the model are discussed in terms of the geometrical effects on the cleavage plane caused by blunting the crack.

714,323
PB83-235150 Not available NTIS
National Bureau of Standards, Washington, DC.
Reply to Comment on 'A LEED Inquiry into the Question of Reconstruction of (001)Nb'.
Final rept.
A. J. Melmed, S. T. Ceyer, and W. R. Graham. 1983, 1p
Pub. in Surface Science 124, pL11 1983.

Keywords: *Niobium, Surface properties, Reprints, *Low energy electron diffraction.

This is a reply to a comment on the authors' publication 'A LEED Inquiry into the Question of Reconstruction of (001) Nb'.

714,324
PB83-235382 Not available NTIS
National Bureau of Standards, Washington, DC.
Thin Ag Films on Al(100).
Final rept.
W. F. Egelhoff. 1982, 7p
Pub. in Applications of Surface Science 11/12, p761-767 1982.

Keywords: *Silver, Thin films, Copper, Gold, Aluminum, Reprints, *Epitaxial growth, X ray photoelectron spectroscopy.

X-ray photoelectron spectra of thin (up to all A) Ag films deposited on Al(100) under ultrahigh vacuum conditions indicate that the Ag electronic structure does not converge on bulk Ag character until a thickness of around 40A or about 20 monolayers. This is surprising since theoretical calculations suggest convergence around 3 or 4 monolayers if the growth mode is layer by layer. This suggests the film is highly granular (at least, below about 20 monolayers). Strikingly similar data for Cu and Au films together with known properties of Au suggest that all three metals grow initially with a morphology that may roughly be described as tightly packed overlapping clusters whose diameter approximately equals the average film thickness.

714,325
PB83-235960 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin-Polarized Inverse Photoelectron Spectroscopy of Solid Surfaces: Ni(110).
Final rept.
J. Unguris, A. Seiler, R. J. Celotta, D. T. Pierce, P. D. Johnson, and N. V. Smith. 4 Oct 82, 4p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Physical Review Letters 49, n14 p1047-1050, 4 Oct 82.

Keywords: *Nickel, *Surfaces, Electron spin, Polarization(Spin alignment),Band structure of solids, Magnetism, Reprints, *Photoelectron spectroscopy.

Inverse photoemission spectra have been measured on Ni(110) at 9.7-eV photon energy with a spin-polarized electron source. Consistent with band theory, a d-band-derived peak is observed just above the Fermi level that corresponds to transitions to minority-spin states only, and which increases in intensity and displays a slight (0.1-eV) energy dispersion as the angle of electron incidence is increased. The inelastic background displays an unexpected nonzero (about -5%) polarization.

714,326
PB83-235894 Not available NTIS
National Bureau of Standards, Washington, DC.
Summary of Fracture Mechanics Concepts.
Final rept.
G. R. Irwin, and R. de Wit. Jan 83, 10p
Pub. in J. Test. Eval., Am. Soc. Test. Mater. 11, n1 p56-65 Jan 83.

Keywords: Toughness, Cracks, Corrosion, Deformation, Strains, Stresses, Crack propagation, Fatigue, Reprints, *Fracture(Mechanics).

The basic concepts of fracture mechanics are presented in a logical sequence. Each concept is given in a concise, definition-like paragraph. The concepts of toughness, process zone, crack, and linear-elastic fracture mechanics are first introduced. The crack-tip characterizations, i.e. stress-intensity factor, crack-extension force, J-integral, and crack (tip) opening displacement, are then discussed. The constraints in plane-stress, plane-strain, and three dimensions are pointed out. Various methods of evaluating the crack-tip characterizations are explained. The concept of fracture toughness is presented in relation to resistance curves, dynamics, constraints, and fast-stable crack growth. Some practical empirical fracture toughness relations are given. Then slow-stable crack growth is discussed, i.e. stress corrosion cracking, fatigue cracking, corrosion-fatigue, and viscous (creep) cracking. The summary concludes with the concept of fracture control plans.

714,327
PB83-236265 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Channeling Patterns in the Scanning Electron Microscope.
Final rept.
D. C. Joy, D. E. Newbury, and D. L. Davidson. Aug 82, 42p
Pub. in Jnl. of Applied Physics 53, n8 pR81-R122 Aug 82.

Keywords: *Crystallography, Crystal structure, Reprints, *Scanning electron microscopy.

The majority of contrast effects observed in the scanning electron microscope (SEM) are concerned with effects such as its surface topography or bulk chemical composition which are independent of the crystallography of the specimen. But in this paper we shall discuss a contrast mechanism in which visible effects are derived directly from the crystal structure of the specimen. Electron channeling patterns (ECP) are caused by a variation in the signal resulting from changes in the angle between the incident beam and the crystal lattice of the specimen. This effect is independent of, but may be superimposed on, the usual variation of the secondary and backscattered signals with the incident angle to the local surface normal. It will be shown that these make it possible to determine the crystalline orientation and symmetry of the sample, and that such features of the lattice as tilt and grain boundaries, and in some cases even individual defects, have been imaged and identified.

714,328
PB84-103456 Not available NTIS
National Bureau of Standards, Washington, DC.
Ferromagnetic and Spin Glass Behavior Near the Critical Concentration in Amorphous (Fe(x)Ni(100-x))(75)Gl(25).
Final rept.
J. W. Lynn, R. W. Erwin, J. J. Rhyne, and H. S. Chen. 1983, 2p
Pub. in Jnl. of Magnetism and Magnetic Materials 31-34, p1397-1398 1983.

Keywords: *Ferromagnetic materials, *Nickel alloys, *Iron alloys, Magnetic properties, Neutron scattering, Magnons, Reprints, Amorphous materials, Magnetic ordering, Spin waves.

The magnetic properties of amorphous (Fe(x)Ni(100-x))(75)P16B6Al3 have been investigated above the critical concentration (x=17) for long range order via neutron scattering. For x=30 the spin wave stiffness parameter D first increases with decreasing temperature, but then decreases at lower temperatures as the spin glass state is approached. Accompanied by the decrease in D is an increase in the spin wave linewidths.

714,329
PB84-103571 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin Polarized Electron Scattering Studies of Surface Magnetism.
Final rept.
D. T. Pierce, R. J. Celotta, and J. Unguris. 1983, 5p
Pub. in Jnl. of Magn. Magn. Mater. 31-34, p869-873, 1983.

Keywords: *Surface properties, *Electron scattering, *Electron spin, *Polarization(Spin alignment), Magnons, Reprints, *Magnetism, Polarized beams.

The asymmetry in the scattered intensity of an electron beam with spins polarized parallel or antiparallel to the target magnetization provides a sensitive measure of the magnetization of the outer few atomic layers of the target surface. The authors discuss the spin dependent scattering process itself as well as results, such as surface hysteresis curves, the temperature dependence of the magnetization, and data for magnetic structure determination, which illustrate the kind of information that can be obtained about the magnetic properties of ferromagnetic surfaces.

714,330
PB84-105261 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Dependence of the Spin Waves in ErFe2.
Final rept.
K. Clausen, J. J. Rhyne, B. Lebech, and N. C. Koon. 1982, 12p
Pub. in Jnl. of Physics C: Solid State Physics 15, p3587-3596 1982.

Keywords: *Iron intermetallics, *Magnons, Iron alloys, Reprints, *Erbium intermetallics, *Spin waves, Temperature dependence, Magnetism, Erbium alloys.

The temperature renormalisation of the energies of the optic modes in ErFe2 has been determined from room temperature up to close to the Curie temperature (574 K). It is found that the two modes, a dispersive transition-metal mode and a localised crystal-field-dominated mode, cross over at about 420 K. The experimental results have been interpreted and are well accounted for by a linear spin wave model, where the level scheme of the lowest J multiplet of the Er(+3) site has been assumed to consist of pure Jz states with an equidistant energy spacing between the levels.

714,331
PB84-105642 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic Properties of Cubic and Hexagonal HoMn2.
Final rept.
J. Rhyne, K. Hardman, S. Malik, and W. Wallace. 1982, 2p
Pub. in Rare Earths in Modern Science and Technology 3, p391-392 1982.

Keywords: *Ferrimagnetic materials, Holmium alloys, Manganese alloys, Hexagonal lattices, Neutron scattering, *Holmium intermetallics, *Manganese intermetallics, Cubic lattices, Laves phases, Magnetic ordering.

HoMn2 forms the C-15 (cubic Laves phase) structure. Upon heat treatment HoMn2 can also be stablized in the C-14 (hexagonal Laves phase) structure. Both HoMn2 samples magnetically order below 25 K. It is generally believed that the RMn2 compounds with the C-14 structure (e.g., ErMn2 and TmMn2) are ferromagnetic compounds in which the rare earth atoms magnetically order and the Mn atoms do not. However, the RMn2 compounds with C-15 structure are ferrimagnetic with the magnetic moments of the rare earth atoms coupled antiparallel to the Mn moments. In both HoMn2 (C-14 and C-15) compounds, the magnetically ordered structure is ferrimagnetic. The crystallographic parameters and magnetic moments in both of these compounds have been determined by neutron scattering profile refinement techniques.

714,332
PB84-105899 Not available NTIS
National Bureau of Standards, Washington, DC.
Robust/Resistant Technique for Crystal-Structure Refinement.
Final rept.
W. L. Nicholson, E. Prince, J. Buchanan, and P. Tucker. 1982, 35p
Pub. in Crystallographic Statistics -- Progress and Problems p229-263 1982.

Keywords: *Crystal structure, Single crystals, Least squares method, Reprints, Robustness(Mathematics), Parameter estimation.

A refinement technique is 'robust' if it works well over a broad class of error distributions in the data, and 'resistant' if it is not strongly influenced by any small subset of the data. Least squares possesses neither property. A more robust/resistant procedure is considered. The modified procedure has been used in a reanalysis of the D(+)–tartaric acid data collected by the Single Crystal Intensity Project of the International Union of Crystallography. The results show that the technique provides an efficient means for automatic screening of a data set for discrepant data points. It gives results in agreement with the least-squares results for good data sets. If the results do not agree with least squares it suggests systematic effects.

714,333
PB84-105907 Not available NTIS
National Bureau of Standards, Washington, DC.
Evolution from Ferromagnetism to Spin-Glass Behavior.
Final rept.
J. W. Lynn, R. W. Erwin, H. S. Chen, and J. J. Rhyne. 1983, 4p
Pub. in Solid State Communications 46, n4 p317-320 1983.

Keywords: *Nickel alloys, *Ferromagnetic materials, Neutron scattering, Magnetic properties, Reprints, *Spin glass state, Amorphous materials.

The magnetic properties of amorphous ((Fe(x)Ni(100-x))sub75)(Psub16)(Bsub6)(Alsub3) have been investigated in the critical concentration region (x sub c equals about 17) via neutron scattering. For x>(xsubc) a transition to ferromagnetism is first observed followed at lower temperatures by an evolution to spin-glass behavior. Associated with this low temperature state are two distinct time scales corresponding to a resolution-limited elastic peak and to excitations. The temperature dependence of the elastic component is directly related to the spin-glass order parameter and indicates that there is a region of temperature where ferromagnetism and spin-glass order coexist.

714,334
PB84-105931 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic and Structural Properties of TH6Mn23D(x) and Y6Mn23D(x).
Final rept.
K. Hardman, J. J. Rhyne, E. Prince, H. K. Smith, S. K. Malik, and W. E. Wallace. 1982, 2p
Pub. in Rare Earth in Modern Science and Technology 3, p477-478 1982.

Keywords: *Magnetic properties, *Molecular structure, Hydrides, Absorption, Neutron diffraction, Actinide series compounds, Antiferromagnetism, Deuterium compounds, Reprints, *Yttrium manganese, *Thorium manganese, Magnetic ordering.

The magnetic behavior of Y6Mn23 and Th6Mn23 is greatly affected by the absorption of hydrogen or deuterium. Y6Mn23 is a ferrimagnetic compound with T(c) = 486 K and a magnetic moment of 13 micrometer sub beta/f.u. In contrast to previous bulk magnetization studies which concluded that Y6Mn23 became paramagnetic upon hydrogen absorption, these results conclusively demonstrate that Y6Mn23D21 is antiferromagnetic in the ac plane. Th6Mn23 is a Pauli paramagnet but Th6Mn23H30 exhibits long-range magnetic ordering with T(c) = 329 K and a bulk magnetization value of 18.5 micrometer sub beta/f.u.

714,335
PB84-106079 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin Dynamics of HoAl2.
Final rept.
J. J. Rhyne, and N. C. Koon. 1983, 3p
Pub. in Jnl. of Magnetism and Magnetic Materials, p31-34 p608-610 1983.

Keywords: *Magnons, Aluminum alloys, Single crystals, Neutron scattering, Inelastic scattering, Brillouin zones, Reprints, *Holmium intermetallics, *Aluminum intermetallics, *Spin waves, Laves phases, Magnetism, Crystal field, Holmium alloys.

Inelastic neutron scattering has been used to examine the spin excitations at 4 K in a single crystal of the cubic Laves-phase compound HoAl2 along (q,q,O), (q,O,O), (q,q,q) propagation directions. Three pair of acoustic and optic modes are observed in Brillouin zones centered at (220) and (002). Crystal field and exchange parameters consistent with those found for other RAl2 compounds were determined by an RPA pseudo-boson analysis.

714,336
PB84-106087 Not available NTIS
National Bureau of Standards, Washington, DC.
New Insights from Electron Spin Polarization Studies of Surfaces.
Final rept.
D. T. Pierce, and R. J. Celotta. Jun 83, 6p
Pub. in Jnl. of Vacuum Science and Technology A 1, n2 p1119-1124, Apr-Jun 83.

Keywords: *Electron spin, *Polarization(Spin alignment), *Surface properties, Electron scattering, Magnons, Nickel, Chromium, Photoelectric emission, Reprints, Magnetism, Polarized beams, Photoelectron spectroscopy.

Examples of recent investigations in several laboratories where measurement of effects due to electron spin polarization provided new insight into surface phenomena will be reviewed. The results to be discussed include the use of spin dependent electron scattering to determine the surface potential barrier, the magnetic critical behavior of a semi-infinite solid, and the surface magnon contribution to low temperature surface magnetization. Examples from spin polarized photoemission include studies of the nature of the resonant 6 eV satellite in Ni and of oxygen induced magnetism in a Cr(100) surface. The use of angle resolved spin polarized inverse photoelectron spectroscopy to obtain information on spin dependent band structure of unoccupied states will also be described.

714,337
PB84-106301 Not available NTIS
National Bureau of Standards, Washington, DC.
Multiple Scattering Theory of the Density of States in Semiconductors.
Final rept.
A. H. Kahn, and J. R. Lowney. 1983, 5p
Pub. in Solid State Communications 46, n3 p229-233 1983.

Keywords: *Semiconductors(Materials), *Band structure of solids, Impurities, Silicon, Computation, Reprints, *Density of states.

A method for calculating the electronic density of states of a semi-conductor in the presence of impurity scattering is given. The approach is based on a low density multiple scattering expansion, due to Weiss and Abrahams, for the effects of the assemblage of impurity ions. The calculation treats the density of states of the conduction band, shifts of the band edge, the formation of impurity bands, and the profiles of the impurity bands. The calculations are performed for a simple model, using a square well potential for the individual impurity centers, but could be extended to any scattering potential.

714,338
PB84-106350 Not available NTIS
National Bureau of Standards, Washington, DC.
Interaction of a Dislocation with a Misfitting Precipitate.
Final rept.
W. C. Johnson. Dec 82, 13p
Pub. in Jnl. of Applied Physics 53, n12 p8620-8632 Dec 82.

Keywords: *Dislocations(Materials), *Precipitates, Mathematical models, Elastic properties, Interactions, Stresses, Strains, Screw dislocations, Edge dislocations, Reprints.

By formulating the appropriate differential equations and boundary conditions in terms of an integral equation, an expression is derived for the displacement associated with an interacting dislocation and precipitate in an infinite matrix. The technique is applicable to anisotropic systems in which the precipitate possesses a stress-free transformation strain and elastic constants different from those of the matrix phase. Approximate solutions to the integral equation are made and stress strain and interaction energy calculated for straight screw and edge dislocations situated near ellipsoidal and rectangular parallelepiped elastic inhomogeneities in an isotropic matrix.

714,339
PB84-106558 Not available NTIS
National Bureau of Standards, Washington, DC.
Transition Rate for Impact Ionization in the Approximation of a Parabolic Band Structure.
Final rept.
J. Geist, and W. K. Gladden. 15 Apr 83, 8p
Pub. in Physical Review B 27, n8 p4833-4840, 15 Apr 83.

Keywords: *Semiconductors(Materials), *Band structure of solids, *Silicon, Ionization, Impact, Approximation, Reprints.

The random k approximation to the transition rate for impact ionization is tested on a highly symmetric band structure model for which most of the dimensions of the twelve dimensional transition-rate integral can be treated analytically. The difference near threshold between the random k approximation and the rigorous result can be much larger than indicated by Kane's Monte Carlo integration for the silicon band structure, but this difference seems to be unimportant in practical problems where impact ionization competes with phonon emission.

714,340
PB84-106566 Not available NTIS
National Bureau of Standards, Washington, DC.
New Calculations of the Quantum Yield of Silicon in the Near Ultraviolet.
Final rept.
J. Geist, and C. S. Wang. Apr 83, 7p
Pub. in Physical Review B 27, n8 p4841-4847, 15 Apr 83.

Keywords: *Silicon, *Quantum efficiency, Ionization, Impact, Approximation, Near ultraviolet radiation, Holes(Electron deficiencies), Electrons, Reprints.

The rigorous expression for the quantum yield for electron-hole pair production was simplified using assumptions inspired by Kane's random-k approximation and by recent results of Alig, Bloom, and Struck. The resulting approximation was intuitively satisfying. It required integration with respect to kinetic energy of the joint distribution of the photogenerated electrons and holes over kinetic energy times the average number of electron-hole pairs created by the cascade of impact ionizations initiated by a carrier with a given kinetic energy. The first quantity in the integrand was calculated from a self-consistent, first principles band structure for silicon; the second was obtained from Alig, Bloom, and Struck. The results agreed reasonably well with recent experimental measurements of the quantum yield of silicon in the ultraviolet.

714,341
PB84-106921 Not available NTIS
National Bureau of Standards, Washington, DC.
Theory of Excitation Bands of Hydrogen in b.c.c. Metals and of their Observation by Neutron Scattering.
Final rept.
R. C. Casella. 15 May 83, 12p
Pub. in Physical Review B 27, n10, p5943-5954 1983.

Keywords: *Band structure of solids, *Hydrogen, *Metals, Body centered cubic lattice, Energy bands, Wave functions, Neutron scattering, Impurities, Bandwidth, Vanadium, Niobium, Tantalum, Muons, Cryogenics, Reprints.

The author considers the possibility that the excited-state oscillator wave functions of dilute hydrogen in b.c.c. metals overlap sufficiently with nearest-neighbor occupancy sites so as to produce hydrogenic energy bands, analogous to electronic energy bands in narrow-band semiconductors. The theory is motivated by the experiments of Magerl et al. as well as the earlier observation of ground-state tunnel splitting by Wipf et al., demonstrating quantum coherence in the motion of the hydrogen, despite the necessity of correlated motion by the surrounding metal atoms. Because of the latter complication, the relevant overlap integrals are not calculated from first principles.

714,342
PB84-106939 Not available NTIS
National Bureau of Standards, Washington, DC.
International Standards for Semiconductor Materials.
Final rept.
W. A. Baylies, R. I. Scace, and F. Vieweg-Gutberlet. May 83, 3p
Pub. in Am. Soc. Test. Mater. Standard. News, p.21-23 May 83.

Keywords: *Semiconductors(Materials), *Silicon, *Standards, International trade, Tests, Reprints.

Semiconductor silicon is an internationally traded commodity which requires sophisticated characterization procedures for producer's quality control and purchaser's incoming inspection tests. International coordination at the technical committee level, being pursued by ASTM Committee F-1 on Electronics, to create a technically consistent set of test methods throughout the world is described. Some further topics for international collaboration in test method development are also mentioned.

714,343
PB84-107077 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of Nonexponential Transient Capacitance in Silicon Diodes Heavily Doped with Platinum.
Final rept.
W. E. Phillips, and J. R. Lowney. May 83, 6p
Pub. in Jnl. of Applied Physics 54, n5 p2786-2791 May 83.

Keywords: *Semiconductors(Materials), *Capacitance, *Semiconductor diodes, Semiconductor doping, Silicon, Platinum, Space change, Reprints, Transients.

An analysis having improved rigor has been made of the capacitance transient in a space charge layer due to thermal emission from charged defect centers in a semiconductor depletion region. This analysis extends the range of applicability of capacitance-transient defect characterization techniques to nonexponential transient conditions such as found in heavily doped diodes or when defect centers are charges in only a part of the depletion region. An example of the improvement is shown for a silicon diode heavily doped with platinum.

714,344
PB84-133362 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibration Technique for Refracted Near-Field Scanning of Optical Fibers.
Final rept.
M. Young. 1 Aug 80, 3p
Pub. in Applied Optics 19, n15 p2479-2480, 1 Aug 80.

Keywords: *Calibrating, *Fiber optics, Refractivity, Scanning, Reprints, *Optical waveguides, Near field, Refractive index.

This paper describes a method for calibrating and determining the linearity of the refracted near-field scanning technique for measuring the index profile of optical waveguides. The method relies on a quartz fiber and several fluids whose indices are known at the measurement wavelength of 633 nm. The results show that near-field scanning is linear and that index profile may be measured to a precision of plus or minus 0.0005 or better.

714,345
PB84-133420 Not available NTIS
National Bureau of Standards, Washington, DC.
Four-Dimensional J-B-T-epsilon Critical Surface for Superconductors.
Final rept.
J. W. Ekin. Jan 83, 4p
Pub. in Jnl. of Applied Physics 54, n1 p303-306 Jan 83.

Keywords: *Superconductivity, Tin intermetallics, Niobium intermetallics, Vanadium intermetallics, Gallium

intermetallics, Strains, Reprints, *Critical surfaces, Temperature dependence, Three dimensional, Niobium tin, Gallium vanadium, Gallium intermetallics.

The concept of a superconducting critical surface in a four-dimensional J-B-T-epsilon space is introduced and from this a critical strain parameter epsilon sub c is defined in analogy to the usual three superconducting critical parameters: (J sub c), (B sub c2), and (T sub c). Examples of a subset of this surface in a three-dimensional J-B-epsilon space are presented as a function of temperature for the A15 superconductors, Nb3Sn and V3Ga, utilizing the recently discovered strain scaling law. The usefulness of the J-B-T-epsilon critical surface in characterizing the interaction of strain with the other three critical parameters and in setting strain limits for the mechanical design of superconducting devices is illustrated.

714,346
PB84-133438 Not available NTIS
National Bureau of Standards, Washington, DC.
Barrier Energy for the Bcc-Fcc Martensitic Transition in Sodium.
Final rept.
T. Suzuki, and H. M. Ledbetter. 1983, 12p
Pub. in Philosophical Magazine A48, n1 p83-94 1983.

Keywords: *Sodium, Body centered cubic lattices, Face centered cubic lattices, Reprints, *Martensitic transformation, Binding energy, Pseudopotential theory.

Using an Ashcroft empty-core model pseudopotential, the authors calculated the binding energy of the intermediate structures between body-centered-cubic and face-centered-cubic sodium at zero temperature for two homogeneous-deformation reaction-path models: Bain's and Zener's. Bain's model gives a lower barrier energy than Zener's: 9.2 K per atom, much lower than a previous estimate based on the second-order elastic constants.

714,347
PB84-135078 Not available NTIS
National Bureau of Standards, Washington, DC.
Deuterium Site Occupation and Magnetism in Ho(6)Fe(23)D(x) Compounds.
Final rept.
J. J. Rhyne, K. Hardman-Rhyne, H. K. Smith, and W. E. Wallace. 1983, 11p
Pub. in Jnl. of the Less-Common Metals 94, p95-105 1983.

Keywords: *Crystal structure, *Hydrides, Iron intermetallics, Neutron diffraction, Cryogenics, Rare earth compounds, Deuterium compounds, Reprints, *Holmium iron hydrides, *Magnetism, Holmium intermetallics.

High resolution neutron diffraction techniques were used to establish the hydrogen (deuterium) site occupation and sublattice magnetization of a series of Ho6Fe23Dx compounds (x = 1.5, 8.2, 12.1 and 15.7).

714,348
PB84-135938 Not available NTIS
National Bureau of Standards, Washington, DC.
Influence of Short-Channel Effects on Dopant Profiles Obtained from the dc MOSFET Profile Method.
Final rept.
G. P. Carver. Aug 83, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices ED-30, n8 p948-954 Aug 83.

Keywords: *Semiconductor doping, Profiles, Reprints, Charge conservation models.

Distortions in the dopant density profile obtained from dc MOSFET measurements due to short-channel effects are not properly predicted by present two-dimensional charge sharing or charge conservation models. The comparison of dopant profile data with predictions based on charge conservation models is a powerful technique for evaluating the accuracy of these models.

714,349
PB84-137033 Not available NTIS
National Bureau of Standards, Washington, DC.
Anomalous Electron Energy Loss in Small Spheres.
Final rept.
D. R. Penn, and P. Apell. 1983, 16p
Pub. in Jnl. of Physics C: Solid State Physics 16, n29 p5729-5743 1983.

Keywords: *Electron scattering, *Energy dissipation, Spheres, Reprints, *Energy losses.

In analogy to the case of optical absorption it is shown that inclusion of non-local surface effects results in a very large contribution to the energy loss of fast electrons scattered by a sphere. The scattering is found to be predominantly in the forward direction and is an order of magnitude larger than that calculated classically.

714,350
PB84-137074 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Finite Detector Slit Height on Peak Positions and Shapes in Powder Diffraction.
Final rept.
E. Prince. 1983, 4p
Pub. in Jnl. of Applied Crystallography 16, p508-511 1983.

Keywords: *Diffractometers, *X ray diffraction, Powder(Particles), Reprints, Slits.

The finite height of the detector slit of a powder diffractometer has three observable effects: (1) the peak is shifted; (2) the peak is broadened; (3) an asymmetry is introduced into the peak shape. If the underlying instrumental resolution function has a Gaussian shape, the slit height effects can be approximated, over a rather board range of shapes for the vertical resolution function, by an Edgeworth series making use of on adjustable parameter. This peak shape function is compared with experimental observations and with other shape functions that have been proposed. A well characterized peak shape is at least as important as resolution when the data are to be used for structure refinement by the Rietveld technique, and diffractometers should be designed so as to keep the slit height within the range that leads to shapes that can be described mathematically. Diffractometers with multiple detectors can usefully have different vertical divergences for detectors that cover different angular ranges.

714,351
PB84-137082 Not available NTIS
National Bureau of Standards, Washington, DC.
New Standard Reference Materials for X-ray Powder Diffraction.
Final rept.
C. R. Hubbard. 1983, 7p
Pub. in Advances in X-ray Analysis 26, p45-61 1983.

Keywords: *X ray diffraction, *Standards, *Calibrating, Lattice parameters, Silicon, Quartz, Mica, Reprints, *Standard reference materials, Fluorophlogopite.

Certification methods and results are presented for several new x-ray powder diffraction standard reference materials. SRM640a silicon powder was certified for lattice parameter and is to be used as a 2(theta) calibration standard. SRM675 fluorophlogopite was certified as a low 2(theta) standard to complement SRM640a. A set of five phases are being certified as intensity standards. Preliminary relative intensities and reference intensity ratios are given. A respirable quartz powder is currently being certified for percent amorphous content by a modified spiking analysis method.

714,352
PB84-137108 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Powder Diffraction Study of Phase Transitions and Structures of (KCN) sub x(KBR) sub (1-x) Mixed Crystals.
Final rept.
J. M. Rowe, J. J. Rush, and S. Susman. 15 Sep 83, 6p
Pub. in Physical Review B 28, n6 p3506-3511, 15 Sep 83.

Keywords: *Potassium bromide, *Potassium cyanides, *Crystal structure, Neutron diffraction, Monoclinic lattics, Orthorhombic lattices, Cryogenics, Reprints, *Mixed crystals, Cubic lattices.

The structures of 9kcn) (KBr) (1-x) mixed crystals for x = 0.95, 0.90, and 0.80 have been determined as a function of temperature. As the temperature is decreased from 295 K, where all of the samples are cubic (as are pure KCN and KBr), all samples measured transform to a monoclinic structure (space group C (c)). For x = 0.95 and 0.90, at a lower temperature there is a further transition to an orthorhombic structure similar to that found for pure KCN below 168 K. However, the samples do not transform completely, and the monoclinic and orthorhombic structures coexist down to 6K.

714,353
PB84-137140 Not available NTIS
National Bureau of Standards, Washington, DC.
Quantum Hall Effect I.
Final rept.
M. E. Cage, and S. M. Girvin. 1983, 16p
See also PB84-137157.
Pub. in Comments Solid State Physics 11, n1 p1-16 1983.

Keywords: *Hall effect, *Fundamental constants, *Quantum theory, *Standards, Quantum electrodynamics, Electrical resistance, Reprints, *Fine structure constant.

The recent surprising observation of a quantization of the Hall resistance in units of h(e squared) in quasi-two dimensional conductors presents the possibility of obtaining an improved value of the fine structure constant and development of a quantum standard of resistance using a solid state device.

714,354
PB84-137157 Not available NTIS
National Bureau of Standards, Washington, DC.
Quantum Hall Effect II.
Final rept.
S. M. Girvin, and M. E. Cage. 1983, 11p
See also PB82-212127, and PB84-137140.
Pub. in Comments Solid State Physics 11, n2 p47-58 1983.

Keywords: *Hall effect, *Fundamental constants, *Quantum theory, *Standards, Quantum electrodynamics, Electrical resistance, Reprints, *Fine structure constant.

The recent surprising observation of a quantization of the Hall resistance in units of h/(e squared) in quasi-two-dimensional conductors has necessitated a major rethinking of our theoretical picture of transport in these systems. The central problem is understanding why ideal behavior persists even in the presence of strong disorder.

714,355
PB84-137751 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin-Dependent Absorption of Electrons in a Ferromagnetic Metal.
Final rept.
H. C. Siegmann, D. T. Pierce, and R. J. Celotta. 9 Feb 81, 4p
Pub. in Physical Review Letters 46, p452-455, 9 Feb 81.

Keywords: *Ferromagnetic materials, *Electron beams, *Electron spin, Elastic scattering, Inelastic scattering, Metals, Dependence, Reprints.

It is found that the current collected by a ferromagnet placed in an electron beam depends on the orientation of the incident electron spin. At certain energies, only electrons with spins parallel or antiparallel to the net surface spin density cause a net target current. The spin dependence is caused by the influence of the exchange interaction on the elastic scattering. Inelastic scattering measurements show that the spin dependence of the production of secondary electrons is small.

714,356
PB84-138288 Not available NTIS
National Bureau of Standards, Washington, DC.
Test of a Robust/Resistant Refinement Procedure on Synthetic Data Sets.
Final rept.
E. Prince, and W. L. Nicholson. 1983, 4p
Acta Crystallographica A 39, p407-410 1983.

Keywords: *Crystal structure, Least squares method, Comparison, Errors, Tests, Reprints.

The conventional, crystallographic least-squares procedure has been compared with a robust/resistant modification in which the weight of each reflection is multiplied by a function of the ratio of its residual to a resistant measure of the width of the residual distribution on the previous cycle. Three synthetic data sets were created by adding random errors, according to various probability distributions, to the calculated structure factors for a known crystal structure.

714,357
PB84-138395 Not available NTIS
National Bureau of Standards, Washington, DC.
Investigation of the Magnetic and Superconducting Properties of (Er1-xHox)Rh4B4.
Final rept.
J. W. Lynn, R. N. Shelton, H. E. Horng, and C. J. Glinka. 1983, 3p
Pub. in Physica 120B, p224-226 1983.

Keywords: *Ferromagnetic materials, *Superconductivity, Neutron scattering, Erbium compounds, Holmium compounds, Rhodium inorganic compounds, Borides, Reprints, *Magnetic superconductors, *Erbium holmium rhodium borides, Magnetic susceptibility, Magnetic ordering, Order parameters, Small angle scattering.

Neutron scattering, susceptibility and resistivity measurements have been carried out for the system (Er(1-x)Ho(x))Rh4B4 near the multicritical point where the magnetic and superconducting phase boundaries converge (x about equal to 0.9).

714,358
PB84-138437 Not available NTIS
National Bureau of Standards, Washington, DC.
Rate of Ice Formation in Supercooled Water.
Final rept.
P. H. E. Meijer, and D. Clausse. 1983, 6p
Pub. in Physica 119B, p243-248 1983.

Keywords: *Crystallization, *Ice formation, *Water, *Benzene, *Supercooling, Rates(Per time), Reprints.

In this paper the author argues that the form of the crystallization curves obtained for supercooled water and benzene can be explained by assuming a two step process. This hypothesis can also give a phenomenological explanation as the rate dependence on the crystallization. The author predicts how the onset time will depend on the duration of the precooling. He gives a number of arguments to support the idea of an intermediate phase. The description does not rely on small fluctuations in order to trigger the crytallization process.

714,359
PB84-139179 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Strain on the Critical Parameters of V2(Hf,Zr) Laves Phase Composite Superconductors.
Final rept.
H. Wada, K. Inoue, K. Tachikawa, and J. W. Ekin. May 82, 3p
Pub. in Applied Physical Letters 40, n9 p844-846 May 82.

Keywords: *Superconductors, Critical temperature, Vanadium alloys, Zirconium containing alloys, Hafnium containing alloys, Magnetic fields, Strains, Reprints, *Critical parameters, Critical current, Laves phases.

Strain effects on the critical parameters of composite-processed V2(Hf,Zr) Laves phase superconductors have been examined. The critical temperature is found to be insensitive to the strain induced by the thermal differential contraction between the composite components. Critical current versus uniaxial strain curves obtained are completely flat at magnetic fields up to 19 tesla. It also turns out that the bulk upper critical field shows essentially no sensitivity to uniaxial strain.

714,360
PB84-139203 Not available NTIS
National Bureau of Standards, Washington, DC.
Properties of NbN Films Crystallized from the Amorphous State.
Final rept.
J. R. Gavaler, J. Greggi, R. Wilmer, and J. W. Ekin. May 83, 4p
Pub. in IEEE Transactions on Magnetics MAG-19, n3 p418-421 May 83.

Keywords: *Niobium nitrides, *Crystal structure, *Superconductivity, Mechanical properties, Sapphire, Substrates, Films, Cryogenics, Reprints, Amorphous materials, Cubic lattices, Critical properties.

Cubic B1 structure NbN was prepared by annealing amorphous Nb-N films made by sputtering niobium in an argon-nitrogen atmosphere onto low temperature (about, or < 350C) substrates. Crystallized films on sapphire substrates have equiaxed grains while films on niobium are columnar. Grain sizes vary from 12.5 nm to > 100 nm. The highest superconducting critical properties measured in these films are given. Data on the effect of uniaxial tensile strain on (J sub c) show that there is not measurable elastic (reversible) strain effect. Irreversible (J sub c) degradation begins at an intrinsic tensile strain of 1.3% in the best case.

714,361
PB84-151711 Not available NTIS
National Bureau of Standards, Washington, DC.
Specific Heat.
Final rept.
L. L. Sparks. 1983, 27p
Pub. in Chapter 2 in Materials at Low Temperatures, p47-73 1983.

Keywords: *Specific heat, Lattice vibrations, Superconductivity, Approximation, Reviews, Debye temperature.

Specific heat is defined as the amount of heat needed to raise the temperature of a unit mass a unit of temperature, i.e. C sub x = (dQ/dT)x where the constraint, x, is generally either pressure or volume. C sub p for a given material may change by six orders of magnitude in the temperature range $1<T<300$ K. Both conduction electrons and lattice vibrations contribute to the specific heat, with the lattice component being dominate at all but very low and very high temperatures. The Debye model of lattice specific heat along with Sommerfeld's quantum approach to the electronic contribution results in the well known representation of the total specific heat, C = beta(T cubed) + alpha(T). Cooperative phenomena such as magnetic spin alignment and superconductivity require additional temperature dependent terms to describe the observed specific heats. While the existing models can be used to predict the specific heats of some materials quite well, caution must be exercised since this is not true for all materials.

714,362
PB84-151729 Not available NTIS
National Bureau of Standards, Washington, DC.
Elastic-Wave Surfaces in Solids.
Final rept.
H. M. Ledbetter, and R. D. Kriz. 1982, 6p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physica Status Solidi 114, p475-480 1982.

Keywords: *Elastic waves, Elastic properties, Orthorhombic lattices, Reprints, *Wave surfaces, Christoffel equations.

Based on Christoffel-equation solutions, the authors describe some interesting wave-surface topological features for anisotropic media. These features include crossovers of transverse-longitudinal mode conversion over a single surface. For orthorhombic symmetry (mmm), crossovers of transverse-transverse surfaces occur for all crystals: the transverse surfaces interconnect and form a single surface. Beyond this, some orthorhombic crystals exhibit a longitudinal-transverse crossover that causes all three surfaces to interconnect into a single surface. Crossover of longitudinal and transverse surfaces means that a tranverse wave velocity will exceed a longitudinal wave velocity. A longitudinal-transverse mode conversion means that both longtudinal and transverse modes exist on the same wave surface.

714,363
PB84-151760 Not available NTIS
National Bureau of Standards, Washington, DC.
Elastic Properties.
Final rept.
H. M. Ledbetter. 1983, 45p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Chapter 1 in Materials at Low Temperatures, p1-45 1983.

Keywords: *Elastic properties, Polycrystalline, Poisson ratio, Shear modulus, Modulus of elasticity, Bulk modulus, Reviews, Temperature dependence, Low temperature.

In this review the author tried to convey several basic concepts concerning polycrystalline elastic properties and their temperature dependence.

714,364
PB84-151802 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Conductivity and Thermal Diffusivity.
Final rept.
J. G. Hust. 1983, 29p
Pub. in Materials at Low Temperatures Chapter 4, p133-161 1983.

Keywords: *Thermal conductivity, *Thermal diffusivity, *Heat transfer, Measurement, Solids, Low temperature.

This discussion of thermal conductivity and diffusivity in solids is intended to give the uninitiated an intuitive grasp of a complex and difficult subject. It is based on an empirical-theoretical approach with a minimum of in-depth theoretical rigor. This work includes a discussion of various heat flow mechanisms, a description of common measurement methods, and finally, various sets of illustrative data. Also included is a description of empirical correlations for use as predictive techniques. The temperature range below 300 K is of primary interest.

714,365
PB84-151828 Not available NTIS
National Bureau of Standards, Washington, DC.
Superconductors.
Final rept.
J. W. Ekin. Jun 83, 49p
Pub. in Materials at Low Temperatures Chapter 13, p465-513 Jun 1983.

Keywords: *Superconductors, Critical temperature, Magnetic fields, Fabrication, Stability, Mechanical properties, Alternating current, Transmission loss, Reviews, *Critical properties, Critical current.

An introduction to practical superconductors is presented. Topics covered are critical temperature, critical magnetic field, critical current, conductor fabrication, stability, ac losses, and mechanical properties. An introduction to each property is presented along with typical data on practical materials and a brief treatment of the experimental methods used to measure the property. For quick reference, the chapter contains an overall summary and reference guide to the principal parameters affecting superconductor material selection and multifilamentary composite design.

714,366
PB84-151836 Not available NTIS
National Bureau of Standards, Washington, DC.
J-B-T-(Epsilon) Interaction and Strain Limits in A15, B1, and C15 Crystal Structure Superconductors.
Final rept.
J. W. Ekin. May 83, 3p
Pub. in IEEE Transactions on Magnetics MAG-19, n3 p900-902 May 1983.

Keywords: *Superconductors, *Crystal structure, *Strains, Magnetic fields, Niobium intermetallics, Tin intermetallics, Gallium intermetallics, Vanadium intermetallics, Aluminum containing alloys, Copper alloys, Hafnium alloys, Reprints, Critical current, Germanium alloys.

Experimental evidence is presented which indicates that the elastic strain effect on the critical current of high-field compound superconductors correlates strongly with the type of superconductor crystal structure. Large strain effects are observed in all practical A15 superconductors examined to date, including Nb3Sn, Nb-Hf/Cu-Sn-Ga, Nb3Ge, Nb3A1, and V3Ga. Strain is observed to have no measurable effect, however, on either the critical current or the critical field of superconductors having the B1 crystal structure (NbN) or the C15 crystal structure (V2(Hf,Zr)). Strain limits placed on the mechanical design of superconducting devices are evaluated as a function of magnetic field for several A15 superconductors (Nb3Sn, Nb-Hf/Sn-Ga, and V3Ga) and compared with the strain limits imposed by B1 and C15 superconductors. It is shown that the latter materials have mechanical design advantage in applications where the superconductor is subjected to strain (either compressive or tensile) in excess of 0.2%.

714,367
PB84-152255 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutron Scattering Studies of Magnetic Phase Transitions in Superconductors.
Final rept.
J. W. Lynn. 1983, 9p
Pub. in Jnl. of Less-Common Metals 94, p75-83 1983.

Keywords: *Superconductors, *Phase transformations, *Antiferromagnetism, Rare earth compounds, Sulfides, Selenides, Neuron scattering, Reprints, *Magnetic ordering, Magnetic superconductors, Molybdenum compounds, Rhodium compounds.

The rare earth (R) ternary superconductors belonging to the RM06X8 (X=S,Se) and RRh4B4 classes of materials have provided the first unambiguous examples of the coexistence of superconductivity and long-range magnetic order. For systems in which the interactions between rare earth moments are antiferromagnetic in nature, the magnetic order only weakly perturbs the superconductivity as there is no macroscopic magnetization associated with the magnetic state. There are now a rather large number of ternary materials which exhibit long-range antiferromagnetic order coexisting with superconductivity over a wide range of temperature.

714,368
PB84-153659 Not available NTIS
National Bureau of Standards, Washington, DC.
Hole and Electron Mobilities in Heavily Doped Silicon: Comparison of Theory and Experiment.
Final rept.
H. S. Bennett. 1983, 10p
Pub. in Solid-State Electronics 26, n12 p1157-1166 1983.

Keywords: *Carrier mobility, *Silicon, Semiconductor doping, Hole mobility, Electron mobility, Field effect transistors, Mathematical models, Inequalities, Reprints, Bipolar transistors.

Most device models for npn or pnp transistors assume that hole (electron) mobilities in n-type and p-type silicon are equal. Partial-wave phase shift calculations for the contributions of carrier-dopant ion scattering to the carrier mobilities lead to inequalities between minority hole (electron) and majority hole (electron) mobilities at the same doping density. These calculations are valid over the doping range of 2 x 10 to the 19th power/cc to 8 x 10 to the 19th power/cc in n-type and p-type silicon and contain the assumptions that the holes and electrons move in isotropic, parabolic energy bands and are scattered by the screened Coulomb potentials of the dopant ions. The results of this work, particularly the inequality of minority and majority carrier mobilities, have implications for the modeling of both bipolar and field effect transistors and for process modeling.

714,369
PB84-155191 PC **A08**/MF **A01**
JCPDS-International Centre for Diffraction Data, Swarthmore, PA.
Standard X-ray Diffraction Power Patterns: Section 20 - Data for 71 Substances.
Final rept.
M. C. Morris, H. F. McMurdie, E. H. Evans, B. Paretzkin, and H. S. Parker. Jan 84, 153p NBS-MONO-25-SECT-20
Also available from Supt. of Docs. as SN003-003-02548-8. See also PB82-117805. Library of Congress catalog card no. 53-61386.

Keywords: *Crystal structure, *X ray diffraction, *Standards, Lattice parameters, Inorganic compounds, Tables(Data), *Powder patterns.

Standard x-ray powder diffraction patterns are presented for 71 substances. These patterns, useful for identification, were obtained by manual or automated diffractometer methods or were calculated from published crystal structure data. The lattice constants from the experimental work were refined by least-squares methods, and reflections were assigned Miller indices consistent with space group extinctions. Relative intensities, calculated densities, literature references, and other relevant data are included.

714,370
PB84-155902 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Measurement Techniques for High-Resistivity Detector-Grade Silicon: Progress Report, July 1, 1982 to June 30, 1983.
R. D. Larrabee, and J. R. Lowney. Dec 83, 22p NBSIR-83-2792
Sponsored in part by Army Electronics Research and Development Command, Fort Monmouth, NJ. Electronics Technology and Devices Lab.

Keywords: *Silicon, *Nondestructive tests, *Electrical resistivity, Helium neon lasers, Near infrared radiation, Measurement, *Carrier lifetime, Carrier recombination, Laser applications.

Techniques for nondestructively characterizing the resistivity and excess-carrier recombination lifetime in ingots of high-resistivity, long-lifetime detector-grade silicon are being evaluated. In particular, three interrelated techniques for nondestructively: (1) measuring an average resistivity, (2) profiling the low-level excess-carrier lifetime, and (3) profiling the resistivity of cylindrical ingot specimens are proposed and are in the process of being evaluated. All three techniques treat the ingot under test as a large van der Pauw specimen and require removable silver-paste contacts or pressed-on capacitive contacts. The profiling measurements use a highly penetrating 1.15 micrometer He-Ne laser beam as an optical probe. The conceptual and theoretical background for these measurements and the results of feasibility experiments obtained to date are presented.

714,371
PB84-156710 Not available NTIS
National Bureau of Standards, Washington, DC.
Oxygen-Free Copper at 4 K: Resistance and Magnetoresistance.
Final rept.
F. R. Fickett. May 83, 4p
Pub. in IEEE Transactions on Magnetics, MAG-19, n3 p228-231 May 83.

Keywords: *Copper, *Electrical resistance, *Magnetoresistivity, Superconductors, Oxygen, Cryogenics, Stabilization, Reprints.

Oxygen-free copper is the most common material used for stabilizing practical superconductors. This type of copper may show residual resistance ratios (RRR) that vary from 50 to 700 in the full soft condition. Knowledge of the exact RRR value is often essential for optimum system design. The author has investigated the effect of stress, temper, and reanneal on the RRR and magnetoresistance of several hundred samples of oxygen-free copper from many sources. In this paper, he describes the program and presents a sampling of the results obtained to date.

714,372
PB84-156736 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Field Orientation on Current Transfer in Multifilamentary Superconductors.
Final rept.
L. F. Goodrich. May 83, 4p
Pub. in IEEE Transactions on Magnetics, MAG-19, n3 p244-247 May 83.

Keywords: *Electric current, Superconducting magnets, Magnetic fields, Reprints, *Superconducting wires, Critical current, Transfer.

Experimental data and discussion are presented on the current distribution along the length of a superconducting wire when subjected to multiple parallel and perpendicular magnetic fields. The experimental data were taken on a rectangular pancake coil with the applied magnetic field in the plane of the coil. These data indicate that significant current transfer occurs in the first and last perpendicular magnetic field sections and little transfer occurs between the two sections. The implication for superconducting magnet design will also be discussed.

714,373
PB84-157387 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic Properties.
Final rept.
F. R. Fickett, and R. B. Goldfarb. Jul 83, 34p
Pub. in Materials at Low Temperatures, Chapter 6, p203-236 Jul 83.

Keywords: *Magnetic properties, *Magnetic measurement, Magnetization, Metals, Alloys, Cryogenics, Reviews, Magnetic susceptibility.

The magnetic properties of materials at low temperatures and techniques for their measurement are described. The low temperature literature is reviewed. The emphasis of the review is on metals and alloys of technological importance. Similarly, the treatment of theory and of measurement techniques is aimed toward the user interested in the more practical aspects of the subject. In every instance, however, references are given which allow the reader to pursue the subject at any level he may desire.

714,374
PB84-179282 PC **A10**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
NBS (National Bureau of Standards) Reactor: Summary of Activities July 1982 through June 1983.
F. J. Shorten. Apr 84, 206p NBS-TN-1190
Also available from Supt. of Docs. as SN003-003-02566-6. See also PB83-218636.

Keywords: *Neutron beams, *Nuclear research and test reactors, Neutron irradiation, Neutron activation analysis, Neutron diffraction, Neutron radiography, Materials tests, Crystal structure, Nondestructive tests.

This report summarizes all those programs which depend on the NBS reactor. It covers the period from July 1982 through June 1983. The programs range from the use of neutron beams to study the structure and dynamics of materials through nuclear physics and neutron standards to sample irradiations for activation analysis, isotope production, radiation effects studies, neutron radiography, and nondestructive evaluation.

714,375
PB84-216498 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Semiconductor Materials and Processes Div.
Measurement Techniques for High-Power Semiconductor Materials and Devices: Annual Report, January 1, 1982 to March 31, 1983.
Final rept.
W. R. Thurber, J. R. Lowney, and W. E. Phillips. Apr 84, 52p NBSIR-84-2838
See also DE-82-021026. Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Silicon, *Semiconductor devices, *Measurement, Defects, Computer programs, Charge carriers.

This annual report is the final one in a series which describes NBS research to develop procedures for the effective utilization of deep-level measurements to detect and characterize defects which reduce lifetime or contribute to leakage current in power-device-grade silicon. During this reporting period the previously written computer program for predicting excess-carrier lifetime was revised to calculate more accurately lifetimes for high or low injection conditions and in space-charge regions. Comparisons were made between lifetime measurements on platinum-doped silicon diodes and the predictions of the computer model. As part of the effort to extend the procedures to analyze data from nonexponential transient capacitance measurements, the time dependence of the capacitance-voltage relationship of a heavily platinum-doped silicon diode was measured as a function of bias voltage. Included as appendices are three recent publications resulting from the work. A listing of the lifetime-predicting computer program is also an appendix.

714,376
PB84-218023 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermoelectric Effect in a Weakly Disordered Inversion Layer Subject to a Quantizing Magnetic Field.
Final rept.
M. Johnson, and S. M. Girvin. 15 Feb 84, 8p
Pub. in Physical Review B 29, n4 p1939-1946, 15 Feb 84.

Keywords: *Thermoelectricity, Magnetic fields, Electron gas, Correction, Reprints, Two dimensional, Inversions.

The authors demonstrate that the usual Kubo formula for thermal response functions is invalid if a magnetic field is present. There exists a fundamental correction due to lack of time reversal symmetry. In addition to being of general importance in the theory of transport, the authors show in particular that this leads to a novel thermoelectric effect in a weakly disordered two-dimensional electron gas subject to a strong magnetic field. The thermopower tensor is calculated within the self-consistent Born approximation using a generalized Mott formula which is derived.

714,377
PB84-218429 Not available NTIS

National Bureau of Standards, Washington, DC.
XRD Quantitative Phase Analysis Using the NBS QUANT82 System.
Final rept.
C. R. Hubbard, C. R. Robbins, and R. S. Snyder. 1983, 8p
Pub. in Advances in X-Ray Analysis 26, p149-156 1983.

Keywords: *X ray diffraction, *Phase measurement, Fortran, Reprints, *Computer applications.

The NBS*QUANT82 system of Fortran 77 programs permit x-ray powder diffraction quantitative phase analysis by the spiking, intensity ratio, and internal standard methods. The programs can use multiple lines and multiple data sets as input. Output includes error estimates based on propagation of counting statistics and the root means square deviation from the average. For the internal standard method, line overlap, elemental chemical data, and weight fraction constraints can be used.

714,378

PB84-218478 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic and Crystallographic Structure of Y6Mn23D23.
Final rept.
K. Hardman-Rhyne, J. J. Rhyne, E. Prince, C. Crowder, and W. J. James. 1 Jan 84, 7p
Sponsored in part by Department of the Army, Washington, DC.
Pub. in Physical Review B 29, n1 p416-422, 1 Jan 84.

Keywords: *Crystal structure, *Antiferromagnetism, Yttrium compounds, Deuterium compounds, Face centered cubic lattices, Tetragonal lattices, Neutron diffraction, Cryogenics, Reprints, *Manganese yttrium hydrides, Manganese compounds, Magnetic ordering.

The magnetic behavior of Y6Mn23 is dramatically altered upon hydrogenation (or deuteration). In this study, it has been found by means of high resolution powder diffraction and Rietveld refinement techniques, that the crystallographic structure is distorted from face-centered cubic (Fm3m) at 295K to a primitive tetragonal structure at 4K in which deuterium atoms are automatically ordered. Y6Mn23 is a ferrimagnetic compound with T sub c - 486K, and bulk magnetization of 13.2 (mu sub B)/f.u. (formula unit). After deuteration of Y6Mn23 to the composition of Y6Mn23D23 low temperature scattering data (T<175K) show that the b and (f sub 2) sites are antiferromagnetic and the d and (f sub 1) sites have no spontaneous magnetic moment.

714,379

PB84-218700 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic and Crystallographic Structure of Th6Mn23D(x).
Final rept.
K. Hardman-Rhyne, H. K. Smith, and W. E. Wallace. 1984, 11p
Pub. in Jnl. of the Less-Common Metals 96, p201-211 1984.

Keywords: *Crystal structure, Deuterium compounds, Face centered cubic lattices, Tetragonal lattices, Neutron diffraction, Magnetic moments, Cryogenics, Reprints, *Manganese thorium hydrides, *Magnetic ordering, Manganese compounds, Thorium compounds.

Th6Mn23D16 and Th6Mn23D30 were studied by neutron diffraction profile refinement methods. At low temperatures, below 78 K, Th6Mn23D16 undergoes a crystallographic change from face centered cubic, Fm3m, to primitive tetragonal, P4/mmm. This compound has no long range magnetic ordering down to temperatures of 4 K. Th6Mn23D30 retains face centered cubic symmetry even at 4 K but exhibits ferromagnetism with a Curie temperature of 329 K. All moments are coupled parallel except the b site which has one Mn moment and is coupled antiparallel to the other 22 Mn moments in the d, (f sub 1) and (f sub 2) sites. The Mn magnetic moments are much less than those of Y6Mn23.

714,380

PB84-218726 Not available NTIS
National Bureau of Standards, Washington, DC.
Interacting Electrons in Two-Dimensional Landau Levels. Results for Small Clusters.
Final rept.
S. M. Girvin, and T. Jach. 15 Oct 83, 4p
Pub. in Physical Review B: Solid State, v28 n8 p4506-4509, 15 Oct 83.

Keywords: *Electron gas, Magnetic fields, Wave functions, Interactions, Hall effect, Quantum theory, Reprints, *Landau levels, Two dimensional.

The authors study the two-dimensional electron gas in a quantizing magnetic field for the cases of Coulomb and harmonic interactions among the electrons. Numerical solutions for the quantum states of clusters of up to five electrons show that the strength of the excitation gap is a strongly oscillating function of the density not unlike what is observed in the anomalous quantum Hall effect. The authors present analytic results for the case of harmonic interactions and show that the variational wave function recently proposed by Laughlin for the Coulomb problem is in fact an exact eigenstate of the harmonic problem.

714,381

PB84-218742 Not available NTIS
National Bureau of Standards, Washington, DC.
Short and Long-Range Magnetic Ordering of Y6(Fe(1-x)Mn(x))23 Compounds Using Neutron Scattering Techniques.
Final rept.
K. Hardman-Rhyne, and J. J. Rhyne. 1983, 14p
Pub. in Jnl. of the Less-Common Metals 94, p23-36 1983.

Keywords: Antiferromagnetism, Yttrium alloys, Iron alloys, Manganese alloys, Neutron diffraction, Magnetic moments, Crystal lattices, Reprints, *Magnetic ordering.

Neutron diffraction studies of the Y6(Fe(1-x)Mn(x))23 system reveal the presence of substantial preferential atomic ordering of Fe and Mn atoms on the four transition metal crystallographic sites. Throughout the entire compositional range, Mn atoms prefer to occupy the (f sub 2) site and Fe atoms the (f sub 1) site. Neutron diffraction profile refinements show no long range magnetic ordering occurring in the compositional range from x = 0.35 to 0.75. The average Fe moments on each of the sites are reduced in the Fe-rich ternaries and remain ferromagnetically coupled. The manganese atoms are nonmagnetic.

714,382

PB84-218833 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrical Properties.
Final rept.
F. R. Fickett. Jul 83, 39p
Pub. in Materials at Low Temperatures, p163-201 Jul 83.

Keywords: *Electrical properties, *Metals, *Alloys, *Cryogenics, Materials, Polymers, Electrical resistance, Electrical resistivity, Electrical conductivity.

This chapter gives a review of the electrical properties of materials at cryogenic temperatures. Measurement techniques, the data base, and uses of the data are presented. The emphasis is on metals and alloys of technological importance; a topic which covers a large range of materials. The treatment of theory and of measurement techniques is primarily for the user interested in the more practical aspects. In every instance, however, extensive references are given that allow the reader to pursue the subject further. The text is essentially that of NBS TN 1053 with minor modifications.

714,383

PB84-218866 Not available NTIS
National Bureau of Standards, Washington, DC.
Microstructure of Dielectric Thin Films Formed by E-Beam Coevaporation.
Final rept.
E. N. Farabaugh, and D. M. Sanders. 1983, 4p
Pub. in Jnl. of Vacuum Science and Technology A., v1 n2 p356-359 1983.

Keywords: *Dielectric films, *Zirconium oxides, *Magnesium oxides, *Silicon dioxide, *Microstructure, X ray diffraction, Thin films, Glass, Coatings, Optical properties, Reprints, *Coevaporation, Amorphous materials.

X-ray diffraction measurements were made on a series of mixed films in the ZrO2-MgO and ZrO2-SiO2 systems as part of a larger study to investigate the relationship between processing parameters and morphology of dielectric thin films produced by coevaporation. The primary interest was to determine if amorphous coatings produced by coevaporation would have optical properties superior to their polycrystalline counterparts as is the case in the bulk. The first experiments involved determining the importance of both quantity and composition of dopants which could be used to achieve amorphous films. While using x-ray diffraction to evaluate the extent of film crystallinity in doped ZrO2 films, it was observed that first the lattice spacing normal to the film-substrate interface progressively decreased as either MgO or SiO2 were added and that upon reaching 46 and 21 mol%, respectively, the crystallinity disappeared completely. The intent of this work is to present these results and discuss their possible significance.

714,384

PB84-218932 Not available NTIS
National Bureau of Standards, Washington, DC.
Low Energy Excitations in (KBr)1-x(KCN)x in the Orientational Glass State.
Final rept.
J. J. DeYoreo, M. Meissner, R. O. Pohl, J. M. Rowe, J. J. Rush, and S. Susman. 19 Sep 83, 4p
Pub. in Physical Review Letters, v51 n12 p1050-1053, 19 Sep 83.

Keywords: *Thermal conductivity, *Potassium bromide, *Potassium cyanides, *Excitation, Specific heat, Cryogenics, Reprints, Amorphous materials, Spin glasses.

The thermal conductivity of single crystal (KBr) (1-x)(KCN)(x), 0.05 = or < x = or < 0.5, in the temperature range 0.08 - 100 K shows behavior characteristic of amorphous solids. Furthermore, for x = 0.25, an abrupt change in the conductivity is seen in the vicinity of 70 K. The low temperature specific heats (T< 2.5 K), measured on long (about 50s) and on short (about = or < 0.2 ms) time scales also are identical to those found in amorphous solids. The authors propose that the KBr-KCN system provides a connecting link between the low energy excitations in amorphous solids and in spin glasses.

714,385

PB84-219039 Not available NTIS
National Bureau of Standards, Washington, DC.
Dissipation and Dynamic Non-Linear Behavior in the Quantum Hall Regime.
Final rept.
M. E. Cage, R. F. Dziuba, B. F. Field, E. R. Williams, S. M. Girvin, A. C. Gossard, D. C. Tsui, and R. J. Wagner. 10 Oct 84, 4p
Pub. in Physical Review Letters, v51 n15 p1374-1377, 10 Oct 84.

Keywords: *Hall effect, Nonlinear systems, Gallium arsenides, Quantum theory, Reprints, Heterostructures, Critical current, Transients.

Dynamic nonlinear behavior is reported at high currents in the Quantum Hall regime of GaAs heterostructures, resulting from breakdown of the dissipationless current flow. It is demonstrated that this breakdown is spatially localized and transient switching is observed on microsecond time scales among a set of distinct dissipative states. A simple macroscopic picture is proposed to account for these novel phenomena.

714,386

PB84-219997 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature-Dependent Sinusoidal Magnetic Order in the Superconductor HoMo6Se8.
Final rept.
J. W. Lynn, J. A. Gotaas, R. W. Erwin, R. A. Ferrell, J. K. Bhattacharjee, R. N. Shelton, and P. Klavins. 9 Jan 84, 4p
Pub. in Physical Review Letters 52, n2 p133-136, 9 Jan 84.

Keywords: *Superconductors, *Phase transformations, Holmium compounds, Selenides, Cryogenics, Neutron scattering, Reprints, *Holmium molybdenum selenides, *Magnetic ordering, Temperature dependence, Molybdenum compounds, Order parameters.

A magnetic phase transition (TM = 0.53 K) to a long-period (about 100A) magnetic state has been observed via neutron scattering in the superconductor (T sub c) = 5.6 K) HoMo6Se8. The characteristic wave vector (q sub c) is strongly temperature dependent

even though no higher-order satellites are observed. With use of a Ginzburg-Landau model it is found that the temperature dependence of (q sub c) can be explained as due to a renormalization of the superconducting order parameter caused by the coupling to the local magnetization density.

714,387
PB84-221076 Not available NTIS
National Bureau of Standards, Washington, DC.
Diffuse Neutron Scattering in Sodium and Potassium Cyanide.
Final rept.
J. M. Rowe, and S. Susman. 15 Apr 84, 6p
Pub. in Physical Review B 29, n8 p4727-4732, 15 Apr 84.

Keywords: *Sodium cyanide, *Potassium cyanides, Neutron scattering, Crystal structure, Reprints.

Diffuse neutron scattering has been measured in NaCN at 295 K and KCN at 175 and 295 K. In both samples, strong scattering from the soft shear mode (related to the translation-rotation coupling which leads to the phase transition from the high temperature cubic NaCl phase to the low temperature-orthorhombic phase) is observed. The asymmetry of this scattering about certain reciprocal lattice points is direct evidence both of the bilinear nature of the coupling, and of its sign (and hence of the relative importance of overlap and quadrupolar interactions). In NaCN, additional structured diffuse scattering is observed which is absent in KDN at both measured temperatures. This scattering is assumed to arise from short range order in CN orientations, but the data are not consistent with simple models of steric hindrance that have been proposed for the short range correlations in NaCN.

714,388
PB84-221084 Not available NTIS
National Bureau of Standards, Washington, DC.
Crystal Structure of Rubidium Cyanide at 4 K Determined by Neutron Powder Diffraction.
Final rept.
J. M. Rowe, J. J. Rush, and F. Luty. Feb 84, 3p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Physical Review B 29, n4 p2168-2170, 15 Feb 84.

Keywords: *Crystal structure, Neutron diffraction, Rubidium compounds, Cyanides, Monoclinic lattices, Cryogenics, Reprints, *Rubidium cyanides.

The crystal structure of RbCN at 4 K has been determined by neutron powder diffraction. The structure is monoclinic, space group (C sub c) , and is very similar to that determined recently for (KCN) (x) (KBr) (1-x). No evidence for ordering of the (CN)(-1) ion dipoles is found at 4 K.

714,389
PB84-222611 Not available NTIS
National Bureau of Standards, Washington, DC.
Spin-Polarized Electron Scattering Studies of the Ferromagnetic Glass Fe81.5B14.5Si4.
Final rept.
J. Unguris, D. T. Pierce, and R. J. Celotta. 1 Feb 84, 6p
Sponsored in part by Office of Naval Research, Arlington, VA
Pub. in Physical Review B29, n3 p1381-1386, 1 Feb 84.

Keywords: *Ferromagnetic materials, Electron beams, Polarization(Spin alignment), Silicides, Electron scattering, Elastic scattering, Inelastic scattering, Surface properties, Magnetic hysteresis, Glass, Reprints, *Electron spin polarization, *Boron iron silicides, Polarized beams, Boron compounds, Iron compounds, Low energy electron diffraction.

Low-energy (20-500)-eV spin-polarized electrons were used to probe the magnetic surface properties of the ferromagnetic metallic glass Fe(81.5)B(14.5)Si4. The spin-independent intensity and the spin-dependent asymmetry of the elastic scattering were measured as a function of applied magnetic field, electron energy, scattering angle, and angle of incidence. The scattering is liquidlike with no crystalline diffraction effects. Comparisons are made with scattering from the magnetic glass Fe(40)Ni(40)B(20) and an iron single crystal. Surface hysteresis curves as measured by the spin-dependent elastic scattering are very sensitive to ion-sputtering damage and to subsequent annealing. The asymmetry of the inelastic scattering was also measured for various primary energies and was found to closely resemble the elastic scattering asymmetry.

714,390
PB84-223163 Not available NTIS
National Bureau of Standards, Washington, DC.
Investigation of the Two-Dimensional Shape of Ion-Implanted Regions.
Final rept.
P. Roitman, J. Albers, and D. R. Myers. 15 Jun 84, 8p
Contract DE-AC04-76DP00789
See also DE82-011546. Sponsored in part by Naval Ocean Systems Center, San Diego, CA.
Pub. in Jnl. of Applied Physics 55, n12 p4436-4443, 15 Jun 84.

Keywords: *Silicon, Arsenic, Single crystals, Shape, Reprints, *Ion implantation, Two dimensional.

The two-dimensional shape of arsenic ion-implanted regions in single-crystal silicon were investigated both experimentally and theoretically. Experimentally, two techniques were shown to have the necessary submicron resolution: a junction etch process and a SEM-induced current collection method. A comparison of junction depths determined by the etch technique, the EBIC techniques with the depths calculated using several amorphous target codes was made.

714,391
PB84-223791 Not available NTIS
National Bureau of Standards, Washington, DC.
Intrinsic Brittle/Ductile Criterion.
Final rept.
I. H. Lin. 1983, 1p
Pub. in Jnl. of Materials Science Letters 2, p295 1983.

Keywords: *Brittle fracturing, *Fracture properties, *Ductility, Fractures(Materials), Dislocations, Cracks, Reprints.

This note reviews two intrinsic brittle/ductile criteria developed by Kelly, Tyson, and Cotrell (KTC), and Rice and Thomson (RT). The KTC criterion in terms of theoretical strengths is shown to be physically equivalent to the dislocation emission approach of RT.

714,392
PB84-224872 Not available NTIS
National Bureau of Standards, Washington, DC.
Certification of Si Powder Standard Reference Material SRM 640a.
Final rept.
C. R. Hubbard. 1983, 4p
Pub. in Jnl. of Applied Crystallography 16, p285-288 1983.

Keywords: *Silicon, *X ray diffraction, *Standards, Calibrating, Lattice parameters, Powder(Particles), Reprints, *Standard reference materials.

A new lot of high purity silicon powder with mean crystallite size of about 2 micrometers has been certified as Standard Reference Material 640a. This SRM can be used as both an external and an internal 2 theta calibration standard. The lattice parameter, uncorrected for refraction, is a = 5.430825(11) for lambda (Cu(K sub (alpha sub 1))) = 1.5405981 A at 25C. Comparison with the lattice parameter of silicon powder from the same boule with a larger mean crystallite size shows a small decrease in lattice parameter, possibly due to surface tension effects.

714,393
PB84-225366 Not available NTIS
National Bureau of Standards, Washington, DC.
Pearson Symbol.
Final rept.
C. R. Hubbard, and L. D. Calvert. 1981, 16p
Pub. in Bulletin Alloy Phase Diagram, v2 n2 p153-157 1981.

Keywords: *Crystal structure, Symbols, Reprints, *Pearson symbols.

The Pearson Symbol is readily used for classifying crystal structures. Rules for assigning this symbol are reviewed and notes concerning unusual cases are given. Several examples of the use of the Pearson Symbol are presented. Tables for conversion between the Strukturbericht structure designations and the Pearson Symbols are appended.

714,394
PB84-226273 Not available NTIS
National Bureau of Standards, Washington, DC.
Evidence of Band-Gap Narrowing in the Space-Charge Layer of Heavily Doped Silicon Diodes.
Final rept.
J. R. Lowney, and W. R. Thurber. 2 Feb 84, 2p
Pub. in Electronics Letters 20, p142-143, 2 Feb 84.

Keywords: *Semiconductor diodes, *Energy gap, *Silicon, Semiconductor doping, Space charge, Capacitance, Reprints.

The gradient voltage has been measured for seven heavily doped, graded-junction silicon diodes at 300 K. Experimental values up to nearly 0.5 V lower than conventional theoretical predictions have been observed. The lowering is attributed to bandgap-narrowing in the space-charge region. This narrowing is expected to be much larger than in neutral material of the same doping density because of the absence of free-carrier screening.

714,395
PB84-226299 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Models of the Built-In Electric Field in Silicon at High Donor Densities.
Final rept.
J. R. Lowney, and J. C. Geist. May 84, 4p
Pub. in Jnl. of Applied Physics 55, n10 p3624-3627 May 84.

Keywords: *Semiconductors(Materials), *Silicon, *Electric fields, *Photodiodes, *Energy gap, Holes(Electron deficiencies), Semiconductor doping, Quantum efficiency, Reprints.

The built-in electric field for holes due to donor-density gradients in n-type silicon is calculated at 300 K for donor densities between 1 x 10 to the 18th power and 1 x 10 to the 20th power/cc. The calculation is based upon a recent model of band-gap narrowing that includes the effects of ionized impurities, many-body interactions, and an estimate of spatial fluctuations of the band-gap edge caused by the random distribution of donor atoms in the silicon crystal. This model of band-gap narrowing differs significantly from a number of other band-gap narrowing models currently in use in that it agrees with the band-gap narrowing measured optically at 35 and 300 K rather than that inferred from electrical measurements. The built-in electric field based on this model, which also differs significantly from the results of most previous models, decreases significantly above a donor density of 1 x 10 to the 19th power/cc with a reversal of the field above 7 x 10 to the 19th power/cc. The implications of this work for photodiodes are discussed.

714,396
PB84-226307 Not available NTIS
National Bureau of Standards, Washington, DC.
Accuracy of Ellipsometric Thickness Determinations for Very Thin Films.
Final rept.
D. Chandler-Horowitz, and G. A. Candela. Dec 83, 4p
Pub. in Jnl. de Physique Colloque 10, n2 pC10-23-C10-26 Dec 83.

Keywords: *Thin films, *Thickness, *Polarimetry, Silicon dioxide, Silicon, Accuracy, Reprints, *Ellipsometry, Refractive index, Uncertainty.

The uncertainty in the ellipsometric determination of the thickness of a film on a substrate can be found quantitatively. The authors have used the solution of the differentials of film thickness and refractive index. Results of calculations for the air-SiO2-Si system are presented. This theory has been used to calculate the uncertainty in the value of the thickness as a function of wavelength. The authors have also calculated this uncertainty for known uncertainty in the film's refractive index. They show which uncertainties contribute the most to the overall accuracy of a thickness measurement.

714,397
PB84-226315 Not available NTIS
National Bureau of Standards, Washington, DC.

Statistical Comparisons of Data on Band-Gap Narrowing in Heavily Doped Silicon: Electrical and Optical Measurements.
Final rept.
H. S. Bennett, and C. L. Wilson. 15 May 84, 6p
Pub. in Jnl. of Applied Physics 55, n10 p3582-3587, 15 May 84.

Keywords: *Semiconductors(Materials), *Energy gap, *Silicon, Semiconductor doping, Photoluminescence, Cryogenics, Comparison, Reprints, Computer applications.

A system of subroutines for iteratively reweighted least squares (IRLS) computations has been applied to the published measured and theoretical data on band-gap narrowing in heavily doped silicon. The data include electrical and optical measurements at room temperature, photoluminescence and optical measurements for temperatures below 35 K, and theoretical calculations at 300 and 0 K. The IRLS procedure allows a clear graphical comparison of the various experimental and theoretical data in band-gap narrowing to be made. The results are (1) band-gap changes determined by the optical absorption are consistent at both 300 K and at temperatures below 35 K with recent theoretical calculations, (2) the electrical and optical measurements are not consistent with each other, and (3) the low temperature optical absorption data and the photoluminescence data are not consistent with each other.

714,398
PB84-226851 Not available NTIS
National Bureau of Standards, Washington, DC.
Intense Source of Monochromatic Electrons: Photoemission from GaAs.
Final rept.
C. S. Feigerle, D. T. Pierce, A. Seiler, and R. J. Celotta. May 84, 3p
Pub. in Applied Physics Letters 44, n9 p866-868, 1 May 84.

Keywords: *Gallium arsenides, Monochromatic radiation, Photoelectric emission, Reprints, *Electron sources, *Photoemission.

Measurements have been performed on the cathode currents and width of the energy distribution of photoemission from negative electron affinity (NEA) - GaAs. Distributions as narrow as 31 meV (FWHM) have been obtained. The measured currents are compared to those which are currently available by coupling thermionic cathodes with electron monochromators and found to be at least 10 times as intense for distributions of equivalent width.

714,399
PB84-227081 Not available NTIS
National Bureau of Standards, Washington, DC.
Experience in Standardizing Superconductor Measurements.
Final rept.
A. F. Clark, L. F. Goodrich, and F. R. Fickett. Jan 84, 4p
Pub. in Jnl. de Physique Colloque C1, n1 pC1-379-C1-382 Jan 84.

Keywords: *Superconductors, Measurement, Standards, Reprints, *Critical current.

The research leading to standard measurement techniques for characterizing practical superconductors is described. Special attention is given to measuring critical current.

714,400
PB84-239938 Not available NTIS
National Bureau of Standards, Washington, DC.
Inelastic Scattering of Electrons in Solids.
Final rept.
C. J. Powell. 1983, 23p
Pub. in Electron Beam Interactions With Solids, p19-31 1983.

Keywords: *Electron scattering, Inelastic scattering, Ionization, Mean free path, Radiation damage, Cross sections, Microanalysis, Photoelectrons, Auger electrons, Solids, Reviews, Reprints, Auger electron spectroscopy, Electron probe microanalysis, X ray photoelectron spectroscopy, Electron energy loss spectroscopy.

The principal mechanisms and available data for the inelastic scattering of electrons in solids are reviewed. The processes relevant for electron-probe microanalysis, electron energy-loss spectroscopy, Auger-electron spectroscopy, and x-ray photoelectron spectroscopy are described, and examples of relevant electron energy-loss data are shown. The discussion is based on the dielectric description of inelastic scattering and treats processes important in the excitation of both core electrons and valence electrons. Information is given on the cross sections for excitations of valence electrons, cross sections for ionization of core levels, inelastic mean free paths of Auger electrons and photoelectrons in solids, and radiation damage.

714,401
PB84-244235 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Electronic Structure and Screening of 3d-Band Holes in Cu(100).
Final rept.
W. F. Egelhoff. 15 Apr 84, 3p
Pub. in Phys. Rev. B 29, n8 p4769-4771, 15 Apr 84.

Keywords: *Copper, Band structure of solids, Surfaces, Reprints, *Electronic structure.

Analysis of the Cu(100) surface electronic structure demonstrates that in Cu holes in the 3d-band are screened by 4s and 4p electrons as effectively as deep core holes. It is concluded that although 3d holes are mobile, the 4s-4p screening charge is even more mobile so that in photoemission the final state should be viewed as a 3d hole and its screening charge propagating through the lattice together.

714,402
PB84-244789 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermodynamic Properties of BCC Crystals at High Temperatures. 1. The Alkali Metals.
Final rept.
R. A. MacDonald, R. C. Shukla, and D. K. Kahaner. 15 Jun 84, 11p
Pub. in Physical Review B 29, n12 p6489-6499, 15 Jun 84.

Keywords: *Alkali metals, *Lithium, *Sodium, *Potassium, *Rubidium, *Cesium, *Thermodynamic properties, Body centered cubic lattices, Bulk modulus, Thermal expansion, Helmholtz free energy, Specific heat, Reprints.

The authors have calculated the thermodynamic properties of monatomic bcc crystals at high temperatures from the Helmholtz free energy, F(V,T), for a second-neighbor, central-force model of the bcc lattice. F(V,T) includes cubic and quartic anharmonic terms in perturbation theory evaluated in the high temperature limit. Numerical results have been obtained for the alkali metals, Li, Na, K, Rb and Cs.

714,403
PB84-244797 Not available NTIS
National Bureau of Standards, Washington, DC.
Bond-Deformation Model for Rocksalt-Structure Compounds.
Final rept.
A. L. Dragoo. 15 Mar 84, 17p
Pub. in Physical Review B 29, n6 p3533-3549, 15 Mar 84.

Keywords: *Alkaline earth oxides, *Chemical bonds, Elastic properties, Strains, Electrostatics, Reprints, *Alkali halides, Cubic lattices.

The bond-deformation model is developed for compounds having the rocksalt structure--namely, the alkali halides and the alkaline-earth oxides. The full set of nearest-neighbor bond-deformation parameters is presented, and the parameters are related to the Lagrangian and internal strains and to the atomic displacements. The next-nearest-neighbor bond-stretching parameters are shown to be reducible to the nearest-neighbor parameters. A variety of central-force and non-central-force interactions is identified in the expansion of the short-range portion of the strain energy. By a transformation of variables the short-range contributions to the dynamical matrix are obtained. Expressions are derived for the elastic constants and for the force constant associated with the homogeneous polarization of the lattice.

714,404
PB84-244805 Not available NTIS
National Bureau of Standards, Washington, DC.
Coupled Convective Instabilities at Crystal-Melt Interfaces.
Final rept.
S. R. Coriell, G. B. McFadden, R. F. Boisvert, M. E. Glicksman, and Q. T. Fang. May 84, 11p
Pub. in Jnl. of Crystal Growth 66, n3 p514-524 May 84.

Keywords: Buoyancy, Stability, Prandtl number, Interfaces, Convection, Lead(Metal), Reprints, *Crystal melt, Instability, Succinonitrile.

The stability of the parallel flow between a vertical crystal-melt interface and a vertical wall held at a temperature above the melting point of the crystal is analyzed for Prandtl numbers, P, ranging from 0.01 to 100. Three modes of instability occur: (1) a buoyant mode, (2) a shear mode, and (3) a coupled crystal-melt mode. The buoyant and shear modes are similar to those that occur for flow between two vertical rigid walls held at different temperatures. For Prandtl numbers greater than approximately two, the coupled crystal-melt mode occurs at a lower Grashof number than the other two modes. Specific results are given for succinonitrile (P = 22.8) and lead (P = 0.0225). These calculations and similar calculations for a cylindrical geometry were motivated by, and are in general agreement with, recent experiments on succinonitrile.

714,405
PB84-244888 Not available NTIS
National Bureau of Standards, Washington, DC.
Particle-Hole Symmetry in the Anomalous Quantum Hall Effect.
Final rept.
S. M. Girvin. 15 May 84, 3p
Pub. in Physical Review B 29, n10 p6012-6014, 15 May 84.

Keywords: *Hall effect, Gallium arsenides, Quantum theory, Abnormalities, Holes(Electron deficiencies), Reprints, *Quantum Hall effect.

This paper explores the uses of particle-hole symmetry in the study of the anomalous quantum Hall effect. A rigorous algorithm is presented for generating the particle-hole dual of any state. This is used to derive Laughlin's quasi-hole state from first principles and to show that this state is exact in the limit nu approaches 1, where nu is the Landau level filling. It is also rigorously demonstrated that the creation of m quasi-holes in Laughlin's state with nu = 1/m is precisely equivalent to creation of one true hole. The charge-conjugation procedure is also generalized to obtain an algorithm for the generation of a hierarchy of states of arbitrary rational filling factor.

714,406
PB84-244904 Not available NTIS
National Bureau of Standards, Washington, DC.
Formalism for the Quantum Hall Effect: Hilbert Space of Analytic Functions.
Final rept.
S. M. Girvin, and T. Jach. 15 May 84, 9p
Pub. in Physical Review B 29, n10 p5617-5625, 15 May 84.

Keywords: *Hall effect, Quantum theory, Hilbert space, Analytic functions, Electron gas, Reprints, *Quantum Hall effect, Two dimensional.

The authors develop a general formulation of quantum mechanics within the lowest Landau level in two dimensions. Making use of Bargmann's Hilbert space of analytic functions, they obtain a simple algorithm for the projection of any quantum operator onto the subspace of the lowest Landau level. With this scheme, they obtain the Schroedinger equation in both real space and coherent state representations. A Gaussian interaction among the particles leads to a particularly simple form in which the eigenvalue condition reduces to a purely algebraic property of the polynomial wave function. Finally, the authors formulate path integration within the lowest Landau level using the coherent state representation. The techniques developed here should prove convenient for the study of the anomalous quantum Hall effect and other phenomena involving electron-electron interactions.

714,407
PB84-245844 Not available NTIS
National Bureau of Standards, Washington, DC.

Matrix Method for Lattice Symmetry Determination.
Final rept.
V. L. Himes, and A. D. Mighell. 1982, 2p
Pub. in Acta Crystallogr. Section A 38, p748-749 Sep 82.

Keywords: *Crystal symmetry, Matrices(Mathematics), Crystal structure, Reprints.

A new general approach for the determination of metric lattice symmetry has been devised. The central focus of the method is on the determination of matrices relating any primitive cell of the lattice to itself rather than on determining reduced cells or conventional cells. The method can conveniently be used in routine structure work as it readily detects the highest possible metric symmetry within any specified range of cell parameter errors.

714,408
PB84-246081 Not available NTIS
National Bureau of Standards, Washington, DC.
Order-Disorder Phenomena.
Final rept.
S. C. Greer. 1981, 33p
Pub. in Encyclopedia of Physics, p720-722 1981.

Keywords: *Order disorder transformations, *Phase transformations, Critical phenomena, Ising model, Superlattices.

The terminology of order-disorder phenomena is described, examples are given, and the theories of such phenomena are briefly presented.

714,409
PB85-102796 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of the Fine-Structure Constant Using GaAs-Al(x)Ga(1-x)As Heterostructures.
Final rept.
B. F. Field, M. E. Cage, R. F. Dziuba, D. C. Tsui, and A. C. Gossard. 1982, 4p
Prepared in cooperation with Bell Labs., Murray Hill, NJ. Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Physical Review Letters 48, n1 p3-6 1982.

Keywords: *Fundamental constants, Hall effect, Gallium arsenides, Electron gas, Reprints, *Fine structure constant, Aluminum gallium arsenides, Heterostructures.

The fine-structure constant alpha has been determined from precision measurements of quantized Hall resistances (R sub H) of three different GaAs-Al(x)Ga(1-x)As heterostructure samples. The result, 1/alpha = 137.035 968(23) (0.17 ppm), is in excellent agreement with the 0.11 ppm value obtained from the gyromagnetic ratio of the proton, gamma prime sub p, and 2e/h via the Josephson effect. Our (R sub H) value can be combined with gamma prime sub p and 2e/h to yield a more accurate value of 1/alpha independent of the ohm: 1/alpha = 137.035 965(12) (0.089 ppm).

714,410
PB85-104644 Not available NTIS
National Bureau of Standards, Washington, DC.
Decay of Pair Correlations in Three Dimensional Crystals.
Final rept.
R. F. Kayser, J. B. Hubbard, and H. J. Raveche. 1981, 8p
Pub. in Physical Review B 24, n1 p51-58, 1 Jul 81.

Keywords: *Crystals, Statistical mechanics, Elastic properties, Reprints, Three dimensional, Landau model.

The long range behavior of spatial correlations in three dimensional crystals is analyzed in the context of the Landau model.

714,411
PB85-104768 Not available NTIS
National Bureau of Standards, Washington, DC.
Impedance Spectrum of a Single Grain-Boundary in Yttrium Stabilized Zirconia.
Final rept.
A. L. Dragoo, C. K. Chiang, A. D. Franklin, and J. Bethin. 1982, 7p
Pub. in Solid State Ionics 7, n3 p249-255 1982.

Keywords: *Zirconium oxides, *Grain boundaries, *Electrical impedance, Single crystals, Alternating current, Yttrium, Bicrystals, Reprints, Temperature dependence.

Impedance measurements are reported for a bicrystal and single crystals of yttrium-stabilized ZrO2 (YSZ) over the frequency range from 100 to 10 to the 7th power Hz, and for temperatures from 200 to 500C in air. The grain boundary introduces an additional somewhat depressed arc when the impedance is plotted in the complex-plane. These data and an examination by both optical and scanning electron microscopy reveal the 'grain boundary' to be a gap between the adjacent crystals, with occasional bridges of YSZ. These results illustrate the potential of the method of impedance spectroscopy for studying internal boundaries in solid conductors.

714,412
PB85-104818 Not available NTIS
National Bureau of Standards, Washington, DC.
Single Crystal Neutron Diffraction Study of Ammonium Nitrate Phase III.
Final rept.
C. S. Choi, and H. J. Prask. 1982, 5p
Pub. in Acta Crystallographica Section B 38, p2324-2328 Sep 82.

Keywords: *Ammonium nitrate, *Crystal structure, *Neutron diffraction, Single crystals, Hydrogen bonds, Solid solutions, Potassium nitrate, Reprints.

The crystal structure of ammonium nitrate phase III has been studied at room temperature by neutron diffraction, using a single crystal containing 5% KNO3 in solid solution form. The ammonium ions are thermally disordered into two orientations, displaced by an angle of approximately 42 degrees about an axis parallel to the c-axis.

714,413
PB85-104826 Not available NTIS
National Bureau of Standards, Washington, DC.
Interaction of Intense Picosecond Pulses of 2.7 Micrometer Photons with Germanium.
Final rept.
G. W. Bryant, P. Kelley, D. Ritchie, P. Braunlich, and A. Schmid. 1982, 16p
Pub. in Physical Review B 25, n4 p2587-2602, 15 Feb 82.

Keywords: *Germanium, *Charge carriers, Laser beams, Light pulses, Near infrared radiation, Reprints, Picosecond pulses, Solid state plasmas.

Computer simulations of the propagation of intense picosecond laser pulses of 2.7 micrometer photons through germanium have been performed to determine the extent of carrier creation and carrier heating that occurs for a variety of pulse widths and intensities.

714,414
PB85-107365 Not available NTIS
National Bureau of Standards, Washington, DC.
Phonons in LiC6.
Final rept.
H. Zabel, A. Magerl, and J. J. Rush. 1983, 4p
Pub. in Physical Review B 27, n6 p3930-3933 1983.

Keywords: *Phonons, Lattice vibrations, Neutron scattering, Layers, Reprints, *Lithium carbides.

The authors have measured the longitudinal (001) and the out-of-plane transverse (100) phonon modes of LiC sub 6 by inelastic neutron scattering, including the observation of very-high-energy phonon groups, tentatively assigned to optic modes. The phonon branches yield interlayer force constants and elastic moduli C sub 33 and C sub 44 which are considerably larger than those of the heavy alkali-metal stage-1 compounds. Yet, LiC sub 6 still shows an omega approximately equal to q squared dispersion of the transverse basal-plane mode, characteristic for layered materials.

714,415
PB85-110195 Not available NTIS
National Bureau of Standards, Washington, DC.
Relaxation Modes of Point Defect Pairs in Ionic Crystals: Approximate Solutions for the Three-Shell Model.
Final rept.
A. D. Franklin, and K. F. Young. 1982, 9p
Pub. in Jnl. of Physics and Chemistry of Solids 43, n4 p357-365 1982.

Keywords: *Ionic crystals, *Point defects, Face centered cubic lattices, Alkaline earth compounds, Sodium chloride, Potassium chloride, Fluorides, Reprints.

A perturbation technique is used to obtain first-order expressions for the relaxation frequencies for the relaxation modes of the three-shell model of pairs of coupled defects moving on the same fcc lattice (e.g., divalent cation-cation vacancy in the rocksalt structure) or on interpenetrating fcc lattices (vacancy pairs in the rocksalt structure, or interstitial anion - excess valency cation in the fluorite structure). For the dielectrically-active T(1u) modes, expressions are given for the relaxation intensities in the zero-order approximation. These results are then used to discuss experimental data for NaCl and KCl containing divalent cations and for alkaline earth fluorides containing trivalent rare earth ions.

714,416
PB85-111797 Not available NTIS
National Bureau of Standards, Washington, DC.
Editors' Preface of 'Crystal Growth 1980' Proceedings of the International Conference on Crystal Growth (6th), Held at Moscow, USSR on September 10-16, 1980.
Final rept.
E. I. Givargizov, D. Elwell, R. Ghez, F. A. Kuznetsov, and H. S. Peiser. 1981, 492p
Sponsored in part by International Union of Crystallography.
Pub. in Jnl. on Crystal Growth, v52 pt1 492p 1981.

Keywords: *Crystal growth, *Meetings, Crystallography, United Soviet Socialist Republic.

Some details of the International Conference on Crystal Growth are given and organizational assistance is acknowledged.

714,417
PB85-115574 Not available NTIS
National Bureau of Standards, Washington, DC.
View of the Relation between the Continuum Theory of Lattice Defects and Non-Euclidean Geometry in the Linear Approximation.
Final rept.
R. DeWit. 1981, 32p
Pub. in International Jnl. of Energy Science 19, n12 p1475-1506 1981.

Keywords: *Crystal defects, Dislocations(Materials), Deformation, Plastic properties, Differential geometry, Reprints.

A view is presented of the relation between the continuum theory of defects in crystals and the mathematical theory of non-metric, non-Riemanman geometry. Both theories are treated in the linear approximation. The lattice defects consist of disclinations, dislocations, and extra-matter, which are identified with the following three important tensors from non-Euclidean geometry: the Riemann-Christoffel curvature tensor, the Cartan torsion tensor, and the nonmetric Q-tensor. Two examples are given to illustrate the concepts of the paper. One example is related to the deformations associated with constant dislocation distribution and the other to the deformations of a constant disclination distribution.

714,418
PB85-115590 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Exact Results for a Two-Dimensional Crystal Growth Problem.
Final rept.
E. A. DiMarzio, and C. M. Guttman. 1982, 9p
Pub. in Jnl. of Crystal Growth 57, n2 p403-411 1982.

Keywords: *Crystal growth, Surface roughness, Reprints, Two dimensional.

The growth rate G(alpha 1, beta 1; alpha 2, beta 2; L) for growth perpendicular to an edge L units long is calculated as a function of the rate constants alpha 1 (attachment) and beta 1 (detachment) for nucleation along the edge and of the rate constants alpha 2 and beta 2 for lateral filling in of nucleated regions along the edge. The bistrip problem (L=2) shows 4 distinct regions of growth. The first two of these are not realizable thermodynamically but may be realizable at large supercoolings. G for arbitrary L is also obtained for certain special choices of the rate constants. Various measures of surface roughness are defined.

714,419
PB85-118404 Not available NTIS
National Bureau of Standards, Washington, DC.
Analysis of High Resistivity Semiconductor Specimens in an Energy-Compensated Time-of-Flight Atom Probe.
Final rept.
A. J. Melmed, M. Martinka, T. Sakurai, Y. Kuk, and S. M. Girvin. 1981, 2p
Pub. in Applied Physics Letters 39, n5 p416-417, 1 Sep 81.

Keywords: *Semiconductors(Materials), *Silicon, Reprints, Atom probe field ion microscopy, Time-of-flight method, High resistivity, Field ion microscopy.

It is shown that high resistivity semiconductor specimens (at least up to 8600, and probably up to 24000 ohm cm) can be analyzed in a conventional energy-compensated ToF atom probe by using pulses of longer than usual duration, and that the necessary pulse width increases, with specimen resistance.

714,420
PB85-118461 Not available NTIS
National Bureau of Standards, Washington, DC.
Superconducting Tunnel-Junction Refrigerator.
Final rept.
R. G. Melton, J. L. Paterson, and S. B. Kaplan. 1980, 10p
Pub. in Physical Review B 21, n5 p1858-1867, 1 Mar 80.

Keywords: *Refrigerators, *Electron tunneling, *Superconductors, Elementary excitations, Phonons, Electrons, Cryogenics, Aluminum, Lead(Metal), Tin, Aluminum oxide, Reprints, *Cryogenic refrigerators.

The dc current through an S(1)-S(2) tunnel junction, with delta (2) greater than delta (1), when biased with eV < delta (1) + delta (2) will lower the energy in S(1). This energy reduction will be shared by the phonons and electrons. This device is shown to be analogous to a thermoelectric refrigerator with an effective Peltier coefficient pi approximately = delta (1)/e. Tunneling calculations yield the cooling power, the electrical power supplied by the bias supply, and the cooling efficiency.

714,421
PB85-120681 Not available NTIS
National Bureau of Standards, Washington, DC.
Polarized LEED Study of Surface Magnetism.
Final rept.
D. T. Pierce, R. J. Celotta, G. C. Wang, G. P. Felcher, S. D. Bader, and K. Miyano. 1980, 2p
See also CONF79-090915.
Pub. in Jnl. of Magnetism and Magnetic Materials 15, n8 p1583-1584 Jan 80.

Keywords: *Magnetization, *Nickel, Ferromagnetic materials, Surface properties, Electron beams, Electron spin, Magnetic fields, Reprints, Low energy electron diffraction, Polarized beams, Temperature dependence.

The surface magnetization of ferromagnetic Ni(110) has been observed via the use of a spin polarized electron beam. The spin dependence of the scattered electron intensity was measured as a function of external magnetic field strength and temperature.

714,422
PB85-120806 Not available NTIS
National Bureau of Standards, Washington, DC.
FeNb3Se10: A New Structure Type Related to NbSe3.
Final rept.
R. J. Cava, V. L. Himes, A. D. Mighell, and R. S. Roth. 1981, 4p
Pub. in Jnl. of Physical Review B 24, n6 p3634-3637 1981.

Keywords: *Crystal structure, *X ray diffraction, Physical properties, Reprints, *Iron niobium selenide.

The crystal structure of FeNb3Se10 consists of two NbSe6 trigonal prismatic chains of the type found in NbSe3 and a double chain of edge shared MSe6 octahedra, both running parallel to the monoclinic b axis. The metal atom disorder, critical to the interpretation of previously observed electronic properties, is confined to the octahedral chains.

714,423
PB85-120822 Not available NTIS
National Bureau of Standards, Washington, DC.
Superconducting Devices, 1979.
Final rept.
J. E. Zimmerman, and D. B. Sullivan. 1979, 3p
See also AD-A140050.
Pub. in McGraw-Hill Encycl. Sci. Technol., p378-380 1979.

Keywords: Josephson functions, Superconductivity, Magnetometers, Cryogenics, Reprints, *SQUID devices.

The history of the SQUID is reviewed with emphasis on recent developments.

714,424
PB85-123354 Not available NTIS
National Bureau of Standards, Washington, DC.
Novel Variable-Temperature Chuck for Use in the Detection of Deep Levels in Processed Semiconductor Wafers.
Final rept.
R. Y. Koyama, and M. G. Buehler. 1979, 5p
Sponsored in part by Advanced Research Projects Agency, Arlington, VA.
Pub. in Review of Scientific Instruments 50, n8 p983-987 Aug 79.

Keywords: *Silicon, *Crystal defects, *Chucks, Semiconductor diodes, Wafers, Band structure of solids, Design, Fabrication, Gold, Reprints, Deep levels.

This paper describes the design, construction, and characterization of a temperature-controllable wafer apparatus for use in the detection of electrically active defects which produce deep levels in the band gap of silicon. In its present form, the wafer chuck can heat and cool wafers as large as 51-mm in diameter over the temperature range from -196 to 350C. Heating rates as high as 7 deg C/s have been achieved. The use of this apparatus is illustrated by wafer mapping the gold defect density in diodes fabricated across a silicon wafer.

714,425
PB85-130656
(Order as PB85-130078, PC **A99**/MF **A01**)
Physikalisch-Technische Bundesanstalt, Brunswick (Germany, F.R.).
Work Related to the Determination of the Avogadro Constant in the PTB (Physikalisch-Technische Bundesanstalt).
P. Seyfried. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p313-316 1984.

Keywords: *Fundamental constants, *Density(Mass/volume), *Lattice parameters, *Silicon, Density measurement, Crystal lattices, *Avogadro constant.

The d(220)-lattice spacing in a highly pure nearly perfect silicon crystal was measured and found to be d(220) = 192 015.560 fm with an uncertainty of + or - 6 X (10 to the -8th power) d(220) in vacuum at 22.50C. Thus for this crystal the first of the three quantities, d(220), density rho, and molar mass M, from which the Avogadro constant N(A) can be derived, is known with sufficient accuracy. The d(220)-value given is -1.8 X (10 to the -6th power) d(220) smaller than that reported by Deslattes et al. and used in his determination of N(A). Carbon and oxygen impurities in our crystal cannot explain this large difference. A possible change in N(A) of +5.4 X (10 to the -6th power) of its value should be taken into account. Density standards in the form of cubes made of a ceramic material with trade name Zerodur have been prepared. These standards will be used for density measurements of silicon samples found to be uniform by high resolution double crystal and Moire-topography.

714,426
PB85-130664
(Order as PB85-130078, PC **A99**/MF **A01**)
Physikalisch-Technische Bundesanstalt, Brunswick (Germany, F.R.).
Absolute Determination of the (220)-Lattice Spacing in Silicon.
P. Becker, and H. Siegert. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p317-320 1984.

Keywords: *Lattice parameters, *Silicon, Optical interferometers, Crystal lattices, Measurement, X ray interferometry.

The (220)-lattice plane spacing in a silicon crystal was measured using a combined x-ray and optical interferometer. The experimental set-up and important characteristic features of the interferometer crystals and the translation device are described in detail. The results of several individual measurements are discussed to explain the evaluation method applied. The results of 170 measurements are characterized by a standard deviation I sigma = 6 X 10 to the -8th power.

714,427
PB85-130672
(Order as PB85-130078, PC **A99**/MF **A01**)
Physikalisch-Technische Bundesanstalt, Brunswick (Germany, F.R.).
Systematic Uncertainties in the Determination of the Lattice Spacing d(220) in Silicon.
H. Siegert, and P. Becker. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p321-324 1984.

Keywords: *Lattice parameters, *Silicon, Length, Precision, Correction, Uncertainty.

The origin and magnitude of corrections and uncertainties connected with the absolute determination of the d(220) lattice plane spacing in a silicon crystal are discussed. Contributions of crystal material, temperature, optical wavelength, alignment parameters, and guiding errors are estimated. A total correction of the mean value n/m = (lambda/2d) is calculated. The total uncertainty, comprising random and systematic uncertainties, amounts to + or - 6 X 10 to the -8th power d(220). The uncertainty of the mean contributes by less than one percent to this value, while the main part results from the uncertainties of the crystal temperature and the Abbe error.

714,428
PB85-131068
(Order as PB85-130078, PC **A99**/MF **A01**)
Technische Univ. Muenchen, Garching (Germany, F.R.). Physik-Dept.
Quantized Hall Resistance in Two-Dimensional Systems.
K. von Klitzing, H. Obloh, G. Ebert, J. Knecht, and K. Ploog. 1984, 10p
Prepared in cooperation with Max-Planck-Inst. fuer Festkoerperforschung, Stuttgart (Germany, F.R.).
Included in Precision Measurement and Fundamental Constants II, p519-528 1984.

Keywords: *Fundamental constants, *Hall effect, Metal oxide transistors, Electron gas, Gallium arsenides, Field effect transistors, *Quantum Hall effect, Fine structure constant, Heterostructures, Two dimensional, Metal oxide semiconductors, Aluminium gallium arsenides.

After the Josephson effect, a second solid state quantum effect--the quantized Hall resistance--seems to be useful to determine fundamental constants. The authors will demonstrate that electrons at the interface between two semiconductors or at a semi-conductor-insulator interface may form at low temperatures a degenerate two-dimensional electron gas with discrete energy levels (Landau levels), if a strong magnetic field is applied perpendicular to the interface. Under experimental conditions where an integer number i of Landau levels is fully occupied with electrons, the value of the Hall resistance R(H) (ratio between Hall voltage and current through the sample) becomes quantized with values which depend only on fundamental constants: R(H) = h(e squared)i (h = Planck constant, e = elementary charge). The authors experiments on (100) silicon MOSFETs (Metal-Oxide-Semiconductor Field-Effect-Transistors) and GaAs-Al(x)Ga(l-x) As heterostructures show that the measured value of the quantized Hall resistance is independent of device parameters.

714,429
PB85-131076
(Order as PB85-130078, PC **A99**/MF **A01**)
Electrotechnical Lab., Sakura (Japan).
Hall Effect in Silicon MOS Inversion Layers for h/(e squared) Determination.
C. Yamanouchi, K. Yoshihiro, J. Kinoshita, K. Inagaki, and J. Moriyama. 1984, 6p
Prepared in cooperation with Gakushuin Univ., Tokyo (Japan).
Included in Precision Measurement and Fundamental Constants II, p529-534 1984.

Keywords: *Hall effect, Metal oxide transistors, Field effect transistors, Measurement, Silicon, Cryogenics,

Precision, *Quantum Hall effect, High magnetic field research, Metal oxide semiconductors.

The quantized Hall conductivity has been measured in n-channel inversion layers of silicon metal-oxide-semiconductor field effect transistor devices at temperatures below 1.4 K using magnetic fields up to 15 T with improved accuracy and resolution. This work aimed to reexamine a new method for h/(e squared) determination proposed by von Klitzing, Dorda, and Pepper. The result, which corresponds to h/4(e squared), and its one standard deviation uncertainty are -1/(sigma sub xy) = (6453.1969 + or - 0.0046) Omega(ETL) or (6453.1969 + or - 0.0045) Omega(ABS). This results agrees with that obtained by other methods to 1 ppm.

714,430
PB85-131084
(Order as PB85-130078, PC **A99**/MF **A01**)
Physikalisch-Technische Bundesanstalt, Brunswick (Germany, F.R.).
Cryogenic Method for the Determination of the Fine-Structure Constant by the Quantized Hall Resistance.
E. Braun, P. Gutmann, G. Hein, F. Melchert, and P. Warnecke. 1984, 3p
Prepared in cooperation with Technische Univ. Muenchen, Garching (Germany, F.R.). Physik-Dept.
Included in Precision Measurement and Fundamental Constants II, p535-537 1984.

Keywords: *Fundamental constants, *Hall effect, Cryogenics, *Quantum Hall effect, *Fine structure constant, SQUID devices.

Recently a determination of the fine-structure constant with a relative uncertainty of 1.3 parts in one million has been carried out. Since then attempts have been made to construct an experimental setup based on a potentiometric method using modern cryogenic measurement techniques, which should lead to a significant decrease of the uncertainty.

714,431
PB85-131092
(Order as PB85-130078, PC **A99**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Electrical Measurements and Standards Div.
Status of the NBS-NRL (National Bureau of Standards-National Research Lab.) Determination of the Fine-Structure Constant Using the Quantized Hall Resistance Effect.
M. E. Cage, R. F. Dziuba, B. F. Field, C. F. Lavine, and R. J. Wagner. 1984, 3p
Prepared in cooperation with Naval Research Lab., Washington, DC. Electronics Technology Div.
Included in Precision Measurement and Fundamental Constants II, p539-541 1984.

Keywords: *Fundamental constants, *Hall effect, Metal oxide transistors, Field effect transistors, Silicon, Measurement, Precision, Superconducting magnets, *Quantum Hall effect, High magnetic field research.

Measurements of quantized Hall steps have been made on (100) Si MOSFET devices using a potentiometric method. In this approach, the quantized Hall resistance at a step is compared to a nominally equal room temperature reference resistor. The standard deviation of a single observation is 2 parts in 10 million at 10 microamps source-drain current. The measurement system is described, along with a report on some of the problems encountered.

714,432
PB85-131100
(Order as PB85-130078, PC **A99**/MF **A01**)
National Physical Lab., Teddington (England). Div. of Electrical Science.
Use of a Cryogenic Current Comparator to Determine the Quantized Hall Resistance in a Silicon MOSFET.
A. Hartland. 1984, 6p
Included in Precision Measurement and Fundamental Constants II, p543-548 1984.

Keywords: *Hall effect, Metal oxide transistors, Field effect transistors, Comparators, Electric bridges, Measurement, Cryogenics, Silicon, *Quantum Hall effect, SQUID devices.

A measurement system based on a cryogenic current comparator bridge is described. The system has the capability of being able to determine the ratio of a 6.453 kiloohm and 100 ohm resistors, at 295 K, with an uncertainty (1 sigma) of 2 parts in 10 million when the larger resistor is energized with a current of 10 microamps. The suggested application of this technique to the determination of the quantized Hall resistance in silicon MOSFETs is described, and sources of possible error are assessed.

714,433
PB85-131118
(Order as PB85-130078, PC **A99**/MF **A01**)
Bell Labs., Murray Hill, NJ.
Resistance Standard Using the Quantized Hall Resistance of GaAs-Al(x)Ga(1-x)As Heterostructures.
A. C. Gossard, and D. C. Tsui. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p549-551 1984.

Keywords: *Electrical resistance, *Hall effect, *Standards, Superconducting magnets, Gallium arsenides, Electron gas, Cryogenics, *Resistance standards, *Quantum Hall effect, Aluminum gallium arsenides, Heterostructures, Two dimensional, High magnetic field research, Fine structure constant.

The authors have observed quantization of the Hall resistance of the two-dimensional electron gas in GaAs-Al(x)Ga(1-x) As heterostructures. The quantized Hall resistance is given by rho(xy) = h(2(e squared)(N + 1)) where N is the quantum number of the Landau level immediately below E(F). The authors results show that the quantized p(xy) as given by this relation does not depend on temperature T, magnetic field B, and the electron mobility mu of the sample, which in this experiment is varied from mu = 1.8 (m squared)/V.s to 6.9 (m squared)/V.s. In other words, B, T, and mu must suffice to reach the quantum regime, which is evidenced by the vanishing of the parallel resistance p(xx), but the value of quantized p(xy) is independent of them. In the authors samples, this quantum regime is reached for B approx = or > 3 T at T = 1.2 K and for B approx = or > 4 T at T = 4.2 K. This modestly low magnetic field requirement makes this system a practical primary resistance standard.

714,434
PB85-131126
(Order as PB85-130078, PC **A99**/MF **A01**)
Physikalisch-Technische Bundesanstalt, Brunswick (Germany, F.R.).
Quantitative Theory for the Determination of h/(e squared) from the Hall Effect in Two-Dimensional Conductors.
L. Bliek, and G. Hein. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p553-556 1984.

Keywords: *Fundamental constants, *Hall effect, Magnetoresistivity, *Fine structure constant, *Quantum Hall effect, Two dimensional.

In experiments on two-dimensional conductors, steps proportional to (e squared)/h have been observed in the quotient of the electric current and the Hall voltage. They can be explained on the basis of the well-established theory of the Shubnikov-De Haas effect, provided the dependence of the scattering lifetime on the density of states is consistently taken into account. Results of numerical calculations of the Hall voltage and of the electrical resistance agree closely with published experimental data.

714,435
PB85-131134
(Order as PB85-130078, PC **A99**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Quantum Hall Effect: Role of Inversion Layer Geometry and Random Impurity Potential.
R. W. Rendell, and S. M. Girvin. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p557-560 1984.

Keywords: *Hall effect, Fundamental constants, Electrical resistance, Standards, Impurities, Measurement, Scattering, Errors, *Quantum Hall effect, Fine structure constant, Resistance standards, Density of states.

The recently discovered quantum Hall effect offers the potential for a new precision determination of the fine-structure constant and establishment of a quantum standard of resistance. The authors present here a discussion of possible sources of error associated with finite sample size. In addition, they present a preliminary report on an investigation of the density of states between Landau levels in the presence of a model impurity potential which is based on a non-perturbative variational calculation using recently developed field theoretic techniques.

714,436
PB85-134021 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Principles of Superconductive Devices and Circuits.
Final rept.
D. G. McDonald, and A. F. Clark. 1982, 1p
Pub. in Physics Today 35, n2 p80 Feb 82.

Keywords: *Superconductors, *Josephson junctions, Reviews, Reprints, High magnetic field research.

The book is a good introductory text for superconducting electronics.

714,437
PB85-135424 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Monte Carlo Calculation of Order on the Triangular Ising Lattice with Next-Nearest-Neighbour Interactions.
Final rept.
P. H. E. Meijer, and G. W. Cunningham. 1977, 6p
Pub. in Physical Review B 15, n7 p3436-3441, 1 Apr 77.

Keywords: *Ferromagnetism, *Antiferromagnetism, *Phase transformations, Magnetic moments, Monte Carlo method, Interactions, Reprints, *Ising model, *Magnetic ordering, Two dimensional.

This paper deals with a Monte Carlo calculation of a two-dimensional spin system on a triangular lattice. The interactions considered are: (1) Ferromagnetic nearest neighbor, (2) Antiferromagnetic nearest neighbor and (3) Antiferromagnetic nearest neighbor coupling with ferromagnetic next nearest neighbor coupling. The results of 1 and 2 are compared with the Onsager calculations of Houtappel and Wannier. The authors found minor discrepancies in both calculations. For the third model they found a new low temperature transition, not predicted by the Bethe-Peierls calculations. The new phase is displayed. The authors propose a modification of the Monte Carlo procedure, using the conditional probability and found faster convergence with this method. The results described above were obtained using either method.

714,438
PB85-135556 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Structure of Ammonium Calcium Phosphate Heptahydrate, Ca(NH4)PO4:7H2O.
Final rept.
S. Takagi, M. Mathew, and W. E. Brown. 1984, 3p
Sponsored in part by American Dental Association Health Foundation, Chicago, IL.
Pub. in Acta Crystallographica C40, p1111-1113 1984.

Keywords: *Crystal structure, Calcium phosphates, Hydrates, Reprints, *Ammonium calcium phosphate heptahydrate, Struvite.

M(r)= 279.19, monoclinic, P2(1), a = 6.300 (1), b = 11.929 (2), c = 7.176 (2) A, beta = 91.62 (2) degrees, V = 539.08 cubic A, Z = 2, D(m) = 1.71, D(x) = 1.720 Mg/(m cubed), T = 298 K, Mo K alpha, lambda = 0.7107 A, mu = 0.76/mm, F(000) = 296, R = 0.021 for the 453 reflections used in the refinement. The structure consists of Ca(H2O)7 polyhedra and PO4 groups linked together by hydrogen bonds forming an interpenetrating layer-type structure, similar to struvite, Mg(NH4)PO4.6H2O. All seven water molecules are coordinated to the Ca(2+) ion, forming a distorted pentagonal bipyramid.

714,439
PB85-136257 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Strain Effects in Superconducting Compounds - An Overview and Synthesis.
Final rept.
J. W. Ekin. Jul 84, 14p
Pub. in Advances in Cryogenic Engineering 30, p823-836 Jul 84.

Keywords: *Superconductors, *Strain, *Intermetallics, Critical field, Sensitivity, Crystal structure, Reviews, Niobium inorganic compounds, Vanadium inorganic compounds, Niobium intermetallics, Tin intermetallics, Gallium intermetallics, Vanadium intermetallics, Cyanides, Nitrides, Silicides, Cryogenics, Reprints, Critical current, Critical temperature, Niobium cyanides, Niobi-

um nitrides, Niobium aluminum, Niobium germanium, Niobium tin, Gallium vanadium, Vanadium silicides.

An overview of the effect of strain on the critical current, critical field, and critical temperature of A15, B1, and C15 superconductors is presented. Reversible elastic strain effects in many A15 superconductors have been measured, analyzed, and compared in terms of simple strain scaling parameters. In addition, a new critical parameter -- critical strain (epsilon sub c) -- is described and used to characterize the strain sensitivity of these materials. The elastic strain effect is shown to be strongly dependent on crystal structure; it is nonexistent in all superconductors with the B1 and C15 crystal structure tested thus far. Possible mechanisms for explaining the elastic strain effect are briefly described.

714,440
PB85-140986 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Lessons from the I.U.Cr. (International Union of Crystallography) X-ray Attenuation Project.
Final rept.
D. C. Creagh, and J. H. Hubbell. Aug 84, 1p
Grant NSF-EAR82-06256
Sponsored by Department of Energy, Washington, DC.
Pub. in Acta Crystallographica, Section A: Crystal Physics, Diffraction, Theoretical and General Crystallography 40 (Supplement), p C-175 1984.

Keywords: *Crystallography, Absorption, Attenuation, Silicon, Photons, X rays, Reprints, *X Ray Attenuation Project.

The I.U.Cr. X ray Attenuation Project, which was inaugurated in 1978 under the auspices of the Commission for Crystallographic Apparatus, is now almost finished. Some laboratories have yet to report their results and we are still receiving inquiries by laboratories wishing to join the project. It is our intention to provide specimen materials to these laboratories and to produce, at a later stage, addenda to the project reports which are now in the final stages of preparation.

714,441
PB85-141471 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Strongly Coupled Non-Neutral Ion Plasma.
Final rept.
J. J. Bollinger, and D. J. Wineland. 23 Jul 84, 4p
Pub. in Physical Review Letters 53, n4 p348-351, 23 Jul 84.

Keywords: *Ions, Radiation pressure, Plasmas(Physics), Reprints, Laser cooling, Beryllium 9, Ion traps.

Radiation pressure from a laser has been used to cool and compress small non-neutral plasmas of (9)Be(+) ions confined by static electric and magnetic fields. A second laser has been used as a probe to measure ion densities of 20 million/cc and ion temperatures below 100 mK. A coupling, gamma, as large as 10 has been obtained indicating that the plasma is strongly coupled. In the future, couplings large enough to observe a liquid-solid phase transition should be accessible.

714,442
PB85-142412 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Surface-Residual-Stress Evaluation Using Horizontally Polarized Shear Waves.
Final rept.
R. B. King, and C. M. Fortunko. 1 Jun 84, 7p
Pub. in Jnl. of Applied Physics 55, n11 p3978-3983, 1 Jun 84.

Keywords: *Residual stress, *Stresses, *Surfaces, Elastic waves, Anisotropy, Nondestructive tests, Polarization, Reprints, Secondary waves, S waves.

In this paper a new theory and experimental method are described for evaluation of surface residual stresses in inhomogeneous, anisotropic materials. The method is based on the use of horizontally polarized shear waves (SH-waves) that propagate at a grazing angle with respect to the surface of a sample. In addition, a new theory is presented for grazing SH-waves propagating through a body in which the stress distribution varies with depth. It is shown that, to first order, the average velocity of the grazing SH-waves is dependent only on the surface values of residual stress. Based on the use of electromagnetic-acoustic transducers (EMATs) to generate and detect grazing SH-waves, preliminary experimental verification of the theory is presented.

714,443
PB85-142495 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of Nb3Sn Cabled Conductor by External Diffusion Process and Effect of Strain on the Critical Current.
Final rept.
G. Pasztor, and J. W. Ekin. 1984, 9p
Pub. in Advances in Cryogenic Engineering 30, p787-795 1984.

Keywords: *Superconductors, Niobium intermetallics, Tin intermetallics, Transmission lines, Strains, Reprints, Critical current, Niobium tin.

Two prototype primary cables to be used in the 12 T extension of the test facility SULTAN have been developed and evaluated. The fabrication route adopted for the Nb3Sn basic strand was an external diffusion technique. The strand was found to have a maximum (strain-free) overall critical-current density significantly higher than in commercial bronze processed Nb3Sn conductors, equal to about 60,000 A/sq cm at 12 T, for example. The elastic strain sensitivity of the critical current was comparable to bronze processed Nb3Sn, while the irreversible strain limit of 1.5% was significantly higher. The large resistance between strands in the cable results in a long current transfer length.

714,444
PB85-142537 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Applications of Polarized Electron Sources Utilizing Optical Orientation in Solids.
Final rept.
D. T. Pierce, and R. J. Celotta. 1984, 6p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Optical Orientation, p259-264 1984.

Keywords: *Electron scattering, *Polarization(Spin alignment), Optical pumping, Parity, Surfaces, Gallium arsenides, Semiconductors, Band structure of solids, Sources, Reprints, *Electron spin polarization, *Magnetism, Electron-atom collisions, Exchange interactions.

The optical orientation of electron spin in semiconductors provides the basis for the most intense and well controlled source of spin polarized electrons. The method of polarized electron production, the characteristics of the source, and possible ways to increase the polarization are reviewed. Polarized electron sources using optical orientation in GaAs have been applied to a variety of experiments in atomic, condensed matter, and particle physics and a few illustrative examples are presented. A 'perfect' polarized electron-atom scattering experiment is discussed in which the quantum amplitudes and phases which are spin dependent owing to the spin-orbit interaction are determined. Surface magnetism of ferromagnetic solids is investigated by polarized electron scattering, where the spin dependence is due to the exchange interaction; surface hysteresis curves, the deviations of the surface magnetization from the bulk at low temperatures, the critical exponent of the surface magnetization, and spin dependent electronic band structure can be determined. Finally in elementary particle physics, high energy deep inelastic scattering of polarized electrons has given evidence of parity violation attributable to weak neutral currents as predicted in the Weinberg-Salam unified gauge theory.

714,445
PB85-142842 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Solid-Solid Phase Transformations. Where Do We Go from Here.
J. W. Cahn. 1982, 5p
Sponsored by American Society for Metals, Metals Park, OH., Carnegie-Mellon Univ., Pittsburgh, PA., National Science Foundation, Washington, DC., and Metallurgical Society of AIME, Warrendale, PA.
Pub. in Proceedings of International Conference Solid-Solid Phase Transformations, Carnegie-Mellon University, Pittsburgh, PA., August 10-14, 1981, p1586-1590 1982.

Keywords: *Phase transformations, *Elastic properties, *Plastic properties, Solids, Reviews.

The last session of a week-long international conference on phase transformation at Carnegie-Mellon University August 10-14, 1981 was to be a panel discussion entitled 'Where do we go from here.' The panel discussion did not take place, but became six separate discussions. The reports of these sessions together with a summary are published in the conference proceedings. The summary, prepared by J. W. Cahn, discusses the current issues, and the expected impact of new techniques and theoretical developments on the field. The report of one of the discussion sessions, chaired by William C. Johnson, concerns elasticity and plasticity in solid to solid phase transformations.

714,446
PB85-143485 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Crack as a Crystal Defect with Implications for the Fracture Resistance.
Final rept.
R. M. Thomson, and E. R. Fuller. 1983, 24p
Sponsored by Army Research Office, Arlington, VA., National Science Foundation, Washington, DC., and Office of Naval Research, Washington, DC.
Pub. in Proceedings of International Symposium (3rd) on Fracture Mechanics of Ceramics, University Park, PA, July 15-17, 1981. Paper in Fracture Mechanics of Ceramics, V5, p253-276 1983.

Keywords: *Crack propagation, *Crystal defects, *Fracture properties, Activation energy, Greens function, Stress intensity factor.

In previous work on a one-dimensional lattice model of a crack, the authors have shown how the discrete nature of bond rupture exhibits energy barriers to brittle crack propagation, and how these barriers resisting thermally activated crack propagation are related to idealized interatomic force laws for a material. The authors have now generalized results to two-dimensional, and to some extent three-dimensional crack configurations. In the paper they demonstrate this generalization, and draw a number of conclusions regarding how real cracks should behave. The authors also are able from their general results, to answer in the negative way an intriguing question, which has appeared at several points in the previous literature, as to whether force laws exist which allow the discrete atomistic barriers to subcritical crack propagation to vanish altogether. Finally, the authors discuss how their general formalism applies to chemically assisted bond rupture at the crack tip.

714,447
PB85-143998 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Liquid-Solid Transition and the Fractional Quantum Hall Effect.
Final rept.
P. K. Lam, and S. M. Girvin. 1 Jul 84, 3p
Pub. in Physical Review B: Condensed Matter 30, n1 p473-475, 1 Jul 84.

Keywords: Phase transformations, Solids, Liquids, Reprints, *Fractional quantum Hall effect, *Quantum Hall effect, Wigner crystals.

The critical Landau level filling factor (nu sub c) for the transition from Laughlin's liquid state to a Wigner crystal is determined by comparing the energies of these states. The Wigner crystal energy is substantially improved over the Hartree-Fock result by using a variational wave function which includes particle correlations. The liquid state energy is obtained from the Monte Carlo calculation of Levesque, et al. The authors found (nu sub c) to be slightly larger than 1/7 which is consistent with the experimental observation by Mendez, et al. that the fractional quantum Hall effect does not occur for $nu = or < 1/7$. The improvement in the crystal energy by correlation is essential to this agreement since without correlations, (nu sub c) is about 1/10. In addition, the crystal correlation energy explains the very low temperatures required to see the $nu = 1/5$ liquid state.

714,448
PB85-144012 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Anomalous Quantum Hall Effect and Two-Dimensional Plasmas: Analytic Approximations for Correlation Functions and Ground State Energies.
Final rept.
S. M. Girvin. 15 Jul 84, 3p
Pub. in Physical Review B: Condensed Matter 30, n2 p558-560, 15 Jul 84.

Keywords: *Hall effect, Wave functions, Ground state, Plasmas(Physics), Electron gas, Reprints, *Quantum

Hall effect, Two dimensional, High magnetic field research, Correlation functions.

A simple analytic scheme is presented for the estimation of the two-point correlation function and the ground state energy of a class of variational wave functions of interest in the study of the anomalous quantum Hall effect. The technique is illustrated by application to the wave function recently proposed by Laughlin and to a generalization of this wave function developed by Chui and Ma. The technique also yields information about the classical two-dimensional plasma problems associated with these wave functions.

714,449
PB85-144418 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Improved Device Physics for Calculating the Gain of Bipolar Structures in Silicon.
Final rept.
H. S. Bennett. 1984, 5p
Pub. in The Physics of Submicron Structures, p307-311 1984.

Keywords: *Transistors, Carrier mobility, Semiconductor doping, Gain, Silicon, Energy gap, Reprints, *Bipolar transistors, Carrier lifetime.

A model which is more physically correct than the extension of the empirical procedures of Slotboom and de Graaff for donor densities above 2.5 x 10 to the 19th power/cc has been developed for the effective intrinsic carrier concentration in n-type silicon. This new approach, which is based upon quantum mechanics and optical measurements for the bandgap, has been applied to an npn transistor with a 1 micrometer emitter-base junction depth and with donor densities greater than 10 to the 20th power/cc. Conventional device physics with even unrealistic carrier lifetimes does not predict the measured dc common emitter gain. The approach described here with carrier lifetimes comparable to those expected in processed silicon (about 0.1 microsecond) does predict the gain correctly.

714,450
PB85-144442 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fast Ion Transport in the NASICON Analog Na3Sc2(PO4)3: Structure and Conductivity.
Final rept.
S. Susman, C. J. Delbecq, T. O. Brun, and E. Prince. Dec 83, 6p
Pub. in Solid State Ionics, v9-10 pt2 p839-844 Dec 83.

Keywords: *Phase transformations, Sodium phosphates, Hexagonal lattices, Reprints, *Sodium scandium phosphates, *Electrical conductivity, *Ionic conductivity, Superionic conductors, Temperature dependence.

The room temperature modification of stoichiometric NASICON(Sc) is monoclinic Cc. At 64C there is a first order transition to a normal-conducting rhombohedral form R(bar 3)c. Na(1) sites are fully occupied whereas Na(2) sites are partially occupied. At 167C there is a transition to a superionic phase, but the structure remains rhombohedral R(bar 3)c. Vacancies are now shared equally by Na(1) and Na(2) sites. Fast Na-ion motion in stoichiometric Na3Sc2(PO4)3 arises from vacancy motion in a 'dogleg' path between Na(1) and Na(2) sites.

714,451
PB85-144517 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Calibration Methods and the Reference Materials in ESR Spectroscopy.
Final rept.
T. T. Chang. May 84, 60p
Pub. in Magnetic Resonance Review 9, n1-3 p65-124 May 84.

Keywords: *Electron parametric resonance, *Calibrating, Frequency measurement, Magnetic measurement, Magnetic fields, Reprints, *Electron spin resonance, Reference materials.

This paper reviews the calibration methods and the reference materials that have been recommended or have been in use in EPR spectroscopy. The methods for the measurement of microwave frequencies and magnetic fields are briefly mentioned. The methods to measure the Q-factor of a microwave cavity are described. The calculation and the measurement of the microwave magnetic field in an EPR resonance cavity are described in detail. Methods for the determination of the concentration of the paramagnetic centers in a sample are described after a discussion of the theoretical background. Precautions and factors that affect the accuracy of this determination are discussed. Reference materials, in 16 groups, are listed. Recipes for preparation of some of these standard samples are also given.

714,452
PB85-144889 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Emission and Ion Desorption Spectroscopy of Clean and Oxidized Ti(0001).
Final rept.
E. Bertel, R. Stockbauer, and T. E. Madey. 1984, 33p
See also AD-A141 319.
Pub. in Surface Science 141, p355-387 1984.

Keywords: *Titanium, *Surfaces, Hexagonal lattices, Synchrotron radiation, Oxidation, Reprints, *Electronic structure, Photoemission, Electron energy loss spectroscopy, Auger electron spectroscopy, Electron stimulated desorption.

The electronic structure of Ti(0001) has been investigated using energy loss spectroscopy (ELS), Auger electron spectroscopy (AES), UPS (ultraviolet photoemission spectroscopy) and electron stimulated desorption (ESD). Resonant electron emission due to a direct recombination process involving an atomic 3p - 3d interaction has been observed. Surface oxidation results in the formation of a thin protective TiO2 layer which is stable to 250C. In the oxide, the direct recombination process following 3p excitation gives rise to resonantly enhanced emission from the oxide valence band. The cross section for electron stimulated O(+) desorption is shown to be dominated by these atomic resonance effects as well.

714,453
PB85-144970 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Temperature Dependence of the Quantum Hall Resistance.
Final rept.
M. E. Cage, B. F. Field, R. F. Dziuba, S. M. Girvin, A. C. Gossard, and D. C. Tsui. 15 Aug 84, 3p
Pub. in Physical Review B 30, n4 p2286-2288, 15 Aug 84.

Keywords: *Hall effect, Gallium arsenides, Magnetic fields, Precision, Electron gas, Reprints, *Quantum Hall effect, Fine structure constant, Resistance standards, Temperature dependence, Two dimensional, Heterostructures.

The authors report high precision measurements of the temperature dependence of the quantum Hall resistance for two GaAs heterostructures. The Hall resistivity (rho sub xy)(T) is found to vary linearly with the minimum resistivity along the device (rho sub xx, sup min)(T) and to depend upon the sample, Hall probe set, and magnetic field direction, but to approach a sample-independent value as T approaches 0. The temperature dependent shift of (rho sub xy)(T) from (rho sub xy)(0) can be significant even for very flat Hall steps and is inconsistent with standard mechanisms.

714,454
PB85-145175 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Second Generation Automated Powder Diffractometer Control System.
Final rept.
R. L. Snyder, C. R. Hubbard, and N. C. Panagiotopoulos. 1982, 16p
Pub. in Advances in X-Ray Analysis 25, p245-260 1982.

Keywords: *X ray diffraction, *Diffractometers, Real time operations, Automation, Reprints, Powder patterns, AUTO system, Control systems.

The real-time x-ray powder diffractometer control system AUTO incorporates several advances in data collection and analysis. Counting procedures for selected data collection are optimized to achieve either a preselected statistical error in minimum time or a minimum error in fixed total time. Run files are employed to greatly simplify quantitative analysis procedures and for controlling repetitive runs. External calibration curves for 2 theta are used to eliminate all but sample dependent aberrations to peak positions. A generalized data file structure is used to document the instrumental variables and sample parameters.

714,455
PB85-145332 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Atomic Structure of (001)W.
Final rept.
R. T. Tung, W. R. Graham, and A. J. Melmed. 1982, 23p
Pub. in Surface Science 115, n3 p576-598 1982.

Keywords: *Tungsten, *Surfaces, Reprints, *Field ion microscopy.

Results of a field-ion microscope study of the clean surface structure of the (001) surface plane of tungsten are presented. The major conclusions are that (001) W is reconstructed over the temperature range 15-580K, and that the reconstructed surface contains an alternating vertical component to the displacements of the W surface. Details of this newly developed experimental approach for the study of surface reconstruction are reported, along with a number of control experiments which exclude the possibility that these results are artifacts due to the experimental technique. The discussion includes a comparison of the present results with those drawn from other experimental techniques, primarily low energy electron diffraction.

714,456
PB85-145530 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron Diffraction Structure Determination of the High-Temperature Form of Lithium Tritantalate, H-LiTa3O8.
Final rept.
J. L. Hodeau, M. Marezio, A. Santoro, and R. S. Roth. 1984, 18p
Pub. in Jnl. Solid State Chemistry 51, p275-292 1984.

Keywords: *Crystal structure, X ray diffraction, Electron diffraction, Neutron diffraction, Single crystals, Lattice parameters, Reprints, *Lithium tantalates, High temperature.

The crystal structure of H-LiTa3O8 has been reexamined by electron and neutron diffraction techniques. Neutron Weissenberg and electron diffraction photographs show that the space group of the compound is Pmmn and not Pmma as determined previously by X-ray diffraction techniques. There are eight molecules in the unit cell of lattice parameters a = 16.718(2) A, b = 7.696(1) A, c = 8.931(1) A. These values show that the b axis of the new cell is doubled with respect to the parameter measured by X-rays. The structural refinement was based on 1074 independent reflections measured on a single crystal with a four-circle neutron diffractometer. The large thermal vibrations found for the lithium atoms and the ionic conductivity of H-LiTa3O8 at high temperatures are consistent with weak Li-O bonding.

714,457
PB85-147916 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Determination of the Superconductive Transition Temperatures of Cd, Zn, and Al Using a Josephson Junction Noise Thermometer.
Final rept.
W. E. Fogle, J. H. Colwell, and R. J. Soulen. 1984, 2p
Pub. in Proceedings of International Conference on Low Temperature Physics (17th), Karlsruhe, Germany, August 15-22, 1984, p1149-1150.

Keywords: *Superconductors, *Transition temperature, *Temperature measurement, Aluminum, Cadmium, Zinc, Josephson junctions, Cryogenics, Noise thermometers, Ultralow temperature.

In order to evaluate the accuracy of the EPT-76 temperature scale, the authors measured three fixed points defined on that scale (the superconductive transition temperatures of Cd, Zn, and Al) using a Josephson junction noise thermometer.

714,458
PB85-151579 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Approach to Realism in Field Ion Microscopy via Zone Electropolishing.
Final rept.
A. J. Melmed, and J. J. Carroll. 1984, 2p
Pub. in Jnl. of Vacuum Science and Technology A2, n3 p1388-1389 Jul/Sep 84.

Keywords: *Electropolishing, Preparation, Microanalysis, Reprints, *Field ion microscopy, *Atom probe field ion microscopy.

A method of specimen preparation for field ion microscopy and atom probe analysis is presented which allows the preparation of specimens from a wide variety of initial morphologies.

714,459
PB85-151595 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron-Phonon Interactions and the Breakdown of the Dissipationless Quantum Hall Effect.
Final rept.
O. Heinonen, P. L. Taylor, and S. M. Girvin. 15 Sep 84, 4p
Pub. in Physical Review B: Condensed Matter 30, n6 p3016-3019, 15 Sep 84.

Keywords: *Hall effect, *Electron phonon interactions, Electron gas, Magnetic fields, Reprints, *Quantum Hall effect, Two dimensional, Electrical conductivity.

The Quantum Hall Effect is manifested by plateaus in the Hall conductivity at which the current flows without loss. Recently it has been observed that as the current is increased to a critical value, corresponding to a carrier drift velocity of the order of the speed of sound, there is a dramatic onset of dissipation. The authors investigated the role in the breakdown of phonon-assisted transitions between Landau levels and calculated the steady-state power absorption. As the drift velocity of the carriers is increased there is asudden onset of dissipation, and an upper limit for the critical current is obtained.

714,460
PB85-151629 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Atomic Structure and Optical Constants of (001) Tantalum.
Final rept.
S. T. Ceyer, A. J. Melmed, J. J. Carroll, and W. R. Graham. 1984, 5p
Pub. in Surface Science 144, pL444-L448 1984.

Keywords: *Tantalum, Polarimetry, Surfaces, Optical properties, Reprints, Low energy electron diffraction, Ellipsometry.

Low-energy-electron diffraction evidence is presented to show that the clean (001)Ta surface is not reconstructed, that is it has the normal (1x1) symmetry, at temperatures from about 650-15 K. Optical constants, determined by ellipsometry, are given for clean (001)Ta measured in the visible spectrum. The results are put into context with previous work.

714,461
PB85-177921 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Preparation and Certification of SRM's (Standard Reference Materials) for Calibration of Spreading Resistance Probes.
Final rept.
J. R. Ehrstein. Jan 85, 43p NBS/SP-260/93
Also available from Supt. of Docs as SN003-003-02633-6. Library of Congress catalog card no. 84-601158.

Keywords: *Silicon, *Calibrating, Electrical resistivity, Single crystals, Electrical measurement, *Standard reference materials, *Spreading resistance, *Semiconductors, Chips(Electronics), Uncertainty.

This Special Publication describes the material selection, characterization, data analysis, and measurement process control procedures for four types of Standard Reference Materials (SRMs), available from the National Bureau of Standards, for calibration of spreading resistance measurements on semiconductor silicon. Each of the four comprises a single combination of silicon conductivity-type and crystallographic orientation and contains 16 rectangular silicon chips which are certified for resistivity value based on four-probe resistivity measurements on the slices from which they were cut. The resistivity values of the chips in each set range from about 0.001 ohm-cms to about 100 ohm-cms. The uncertainty of the certified resistivity, as it applies to any individual chip, depends both on the uniformity of the starting slice and on the inherent measurement process uncertainty. The procedure for determining this uncertainty, which is specifically evaluated and tabulated on the certificate for each SRM set, is described.

714,462
PB85-183325 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Transport in a Disordered One-Dimensional System: A Fractal View.
Final rept.
R. J. Rubin. Sep 84, 10p
Pub. in Jnl. of Statistical Physics 36, n5/6 p615-624 Sep 84.

Keywords: *Crystal defects, Transport properties, Reprints, One dimensional, Fractals.

The author reexamines the calculation of the transmission coefficient of a random array of N isotopic defects in an otherwise perfect, harmonic, one-dimensional crystal lattice. The thermal conductivity of this model system has been studied under steady-state conditions in which there is a kinetic temperature difference across, and an associated energy flux through, the array of defects. An exact expression for the transmission coefficient is obtained in terms of the magnitude of an N th order determinant. Rubin reduced the evaluation of the determinant to the evaluation of a sequence of N-1 nonlinear transformations drawn from a set of transformations parametrized by the nearest-neighbor spacing of the isotopic defects. These transformations are self-inverse and provide an example of what Mandelbrot has termed a self-inverse fractal. The variety of limiting distributions of values obtained under these transformations will be illustrated.

714,463
PB85-184554 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison of Methods for Reducing Preferred Orientation.
Final rept.
L. D. Calvert, A. F. Sirianni, G. J. Gainsford, and C. R. Hubbard. 1982, 6p
Sponsored by Denver Research Inst., CO.
Pub. in Advances in X-Ray Analysis, v26 p105-110 1982.

Keywords: *Molybdenum oxides, *Phlogopite, *Mica, Orientation, X ray diffraction, Comparison, Reprints, *Fluorophlogopites.

Spray drying and liquid phase spherical agglomeration methods to orientation free prepare spherical agglomerates were tested for MoO3 and fluorophlogopite mica. Reflection geometry with CuK(alpha) radiation, Debye-Scherrer geometry with MoK(alpha) radiation and theoretical calculations are compared. Both methods of preparation of spherical agglomerates gave excellent results with the Debye-Scherrer geometry. Spray dried spheres gave good agreement for reflection geometry. Only spray dried spheres could be used with reflection geometry.

714,464
PB85-184802 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Oscillatory Morphological Instabilities Due to Non-Equilibrium Segregation.
Final rept.
S. R. Coriell, and R. F. Sekerka. 1983, 10p
Pub. in Jnl. of Crystal Growth 61, n3 p499-508 1983.

Keywords: *Crystal growth, *Solidification, Perturbation theory, Alloys, Reprints, Instability.

Linear perturbation theory is used to study morphological instability for rapid directional solidification at constant velocity under conditions where there is significant departure from local equilibrium at an initially planar solid-liquid interface. When present, oscillatory instabilities lead to a three dimensional segregation pattern in which periodic solute variations in the two transverse directions are modulated by a periodic variation in the direction of growth.

714,465
PB85-184836 PC **A08**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
NBS (National Bureau of Standards) Reactor: Summary of Activities July 1983 through June 1984.
Technical note.
F. J. Shorten. Feb 85, 163p NBS/TN-1207
Also available from Supt. of Docs as SN003-003-02643-3. See also PB83-218636.

Keywords: *Neutron beams, *Research reactors, Nuclear research and test reactors, Neutron irradiation, Neutron activation analysis, Neutron diffraction, Neutron radiography, Materials tests, Crystal structure.

This report summarizes all those programs which depend on the NBS reactor. It covers the period from July 1983 through June 1984. The programs range from the use of neutron beams to study the structure and dynamics of materials through nuclear physics and neutron standards to sample irradiations for activation analysis, isotope production, radiation effects studies, neutron radiography, and nondestructive evaluation.

714,466
PB85-186997 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Comparison of Theoretical and Empirical Lifetimes for Minority Carriers in Heavily Doped Silicon.
Final rept.
H. S. Bennett. 1984, 5p
Pub. in Solid-State Electronics 27, n10 p893-897 1984.

Keywords: *Silicon, Field effect transistors, Semiconductor doping, Reprints, *Minority carriers, *Carrier lifetime, *Semiconductors, Bipolar transistors.

The minority carriers determine essential electrical characteristics of bipolar devices and bipolar-like parasitic paths in field effect devices. The electrical behavior of such devices is frequently described by detailed device models. Compared to the other input parameters for detailed device models, the minority carrier lifetimes due to traps or defects as functions of doping density have great uncertainty. A major finding in this paper is that the commonly used empirical expressions for the lifetime due to defects may not give correct results when included in detailed models of shallow, heavily doped silicon emitters.

714,467
PB85-187375 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Changes in Stress Intensity with Dislocation Emission from a Crack.
Final rept.
I. H. Lin, and J. P. Hirth. 1984, 4p
Pub. in Philosophical Magazine A, 50, n6 pL43-L46 1984.

Keywords: *Stresses, Intensity, Dislocations(Materials), Crack propagation, Reprints.

Dislocation emission from a sharp crack changes it to a mixed defect with both crack and superdislocation character. The dislocation component can either enhance or retard the tendency for crack propagation.

714,468
PB85-187383 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Elastic-Constant Anomalies at the Neel Transition in Fe-18Cr-3Ni-12Mn.
Final rept.
H. M. Ledbetter, and E. W. Collings. 1985, 5p
Sponsored by Defense Department, Canberra (Australia).
Pub. in Materials Science and Engineering 68, p233-237 1985.

Keywords: *Elastic properties, Austenitic stainless steels, Neel temperature, Ultrasonic tests, Cryogenics, Reprints, *Steel 18Cr 12Mn 3Ni, Magnetic susceptibility.

The elastic constants of an 18Cr-3Ni-12Mn austenitic stainless steel (where the steel composition is given in approximate weight per cent) were measured ultrasonically between room temperature and liquid helium temperature. All the elastic constants change anomalously and reversibly near 191 K, which magnetic susceptibility measurements show to be the Neel (paramagnetic-to-antiferromagnetic) transition temperature.

714,469
PB85-189215 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Epitaxial Crystal Growth in Gadolinium on Tungsten.
Final rept.
A. Ciszewski, and A. J. Melmed. 1984, 4p
Pub. in Surface Science 145, pL471-474 1984.

Keywords: *Gadolinium, *Diffusion, *Surfaces, Tungsten, Epitaxy, Substrates, Crystal growth, Reprints, Field ion microscopy.

Field electron microscopy is used to measure activation energies for multilayer diffusion of gadolinium over several different surfaces of tungsten and to prepare crystal layers of gadolinium by epitaxy on tungsten substrates. Nucleation, crystal growth, and epitaxial relations are described.

714,470
PB85-189223 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Surface Self-Diffusion of Dysprosium and Gadolinium.
Final rept.
A. Ciszewski, and A. J. Melmed. 1984, 4p
Pub. in Surface Science 145, pL509-L512 1984.

Keywords: *Dysprosium, *Gadolinium, *Diffusion, *Surfaces, Epitaxy, Substrates, Tungsten, Reprints, *Self diffusion, Field electron microscopy.

Measurements of activation energy for surface self-diffusion are reported for dysprosium and gadolinium. The specimens were prepared by epitaxial crystal growth on clean tungsten substrates in an ultrahigh vacuum field electron microscope. Results are compared to earlier data for other metals.

714,471
PB85-189397 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
High-Frequency Transient-Resistance Spectroscopy of Deep Levels in SI GaAs.
Final rept.
A. C. Seabaugh, M. I. Bell, R. D. Larrabee, and J. D. Oliver. 1984, 9p
Pub. in Semi-Insulating 3-5 Materials: Kah-nee-ta 1984, p437-445 1984.

Keywords: *Gallium arsenides, Chromium, *Deep level transient spectroscopy, *Photoresistance deep level transient spectroscopy, Doped materials.

A new photoinduced transient-resistance technique is used to characterize deep levels in semi-insulating GaAs. In this technique, termed photoresistance deep-level transient spectroscopy (PR-DLTS), an optical pulse is used to generate excess carriers which are trapped by deep levels in the material. The ac resistance of the specimen is monitored, and the resistance transient which occurs after the illumination ends is signal processed in the same way as the capacitance transient in conventional DLTS. Comparison of this technique with the dc current-transient measurement, photoinduced transient spectroscopy (PITS), shows that it is sensitive to the same trapping/detrapping phenomena. PR-DLTS data for the Cr-related deep level is consistent with published DLTS results. Results are reported for materials grown by the horizontal Bridgman method and by the liquid-encapsulated Czochralski technique, both with and without chromium doping. Nineteen specimens from ten different manufacturers are compared.

714,472
PB85-189405 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Ellipsometry System for High Accuracy Metrology of Thin Films.
Final rept.
G. A. Candela, and D. Chandler-Horowitz. 1984, 7p
Pub. in SPIE 480--Integrated Circuit Metrology 2, p2-8 1984.

Keywords: *Ellipsometers, *Polarimetry, *Thin films, Metrology, Design, Performance, Calibrating, Dimensional measurement, Thickness, Reprints, Reference standards, Refractive index, Computer applications, Semiconductors, Laser applications.

A computer-controlled spectroscopic ellipsometer of high accuracy has been designed and constructed. A theta-two-theta goniometer unit and optical rail system allows various ellipsometric methods to be used to measure the parameters delta and psi. Three important methods under study for accuracy, precision, and speed of measurement are the conventional null method, the rotating analyzer method, and the principal angle method. All the goniometer angles, including the angle of incidence, can be measured to an accuracy of 0.001 deg. The present light sources are two lasers with fixed wavelengths, 632.8 nm and 441.6 nm, in addition to a monochromator that can be used to scan the wavelength range from 190 to 2600 nm. A unique sample alignment system which uses two quadrant detectors has been developed and a simple but very effective nulling scheme is used. This instrument is primarily used for the metrology of semiconductor materials and for the calibration of reference standards for thin film thickness and refractive index.

714,473
PB85-189470 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Investigation of a Practical Superconductor with a Copper Matrix.
Final rept.
F. R. Fickett. Sep 84, 57p
Sponsored by International Copper Research Association, Inc., New York. See also PB-299762.
Pub. in International Copper Research Association Annual Report, 57p 1984.

Keywords: *Superconductors, Copper, Composite materials, Niobium intermetallics, Tin intermetallics, Wire, Copper matrix composites.

The report summarized the work performed on four INCRA projects covering a span of about six years. The main goal of the work was to investigate the in-situ superconductors, those produced by the relatively rapid cooling of a melt containing essentially non-miscible components. The component with the higher melting point precipitates out as small particles during the cooling. Subsequent drawing of the resulting boule results in fine filaments of this material (the superconductor) in the lower-melting matrix (usually oxygen-free copper or a copper-tin alloy).

714,474
PB85-196004 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Advanced Multi-Chamber System for Preparation of Amorphous Thin Films by Coevaporation and Their Subsequent Characterization by AES (Auger Electron Spectroscopy), ESCA (Electron Spectroscopy for Chemical Analysis), SIMS (Secondary Ion Mass Spectroscopy), and ISS (Ion Scattering Spectroscopy) Methods.
Final rept.
D. M. Sanders, E. N. Farabaugh, W. S. Hurst, and W. K. Haller. 1981, 3p
Pub. in Jnl. of Vacuum Science and Technology 18, n3 p1308-1310 Apr 81.

Keywords: *Thin films, Electron beams, Silicon dioxide, Magnesium oxides, Preparation, Reprints, *Amorphous materials, *Coevaporation.

Vacuum deposition is one means of producing amorphous structures from compositions which do not normally form glasses. Aluminum oxide, for instance, is always polycrystalline when solidified from the melt, but frequently has highly disordered structures when produced by vacuum evaporation. Preparation of complex multicomponent thin films by single source vacuum evaporation is normally limited by the large differences in vapor pressures of the components. One approach which overcomes this difficulty involves codeposition from multiple sources operated at appropriate temperatures to produce the desired individual deposition rates. In this paper, the authors describe a facility which has been designed and constructed for the production of thin films by multiple source evaporation and subsequent analysis by Auger Electron Spectroscopy (AES), Electron Spectroscopy for Chemical Analysis (ESCA), Secondary Ion Mass Spectroscopy (SIMS) and Ion Scattering Spectroscopy (ISS). The authors then present initial results obtained on the system MgO-SiO2 showing the functional relationship between the concentration of the second component (in this case SiO2) and the crystallinity of the film.

714,475
PB85-196020 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Use of the Pearson Type VII Distribution in the Neutron Profile Refinement of the Structures of LiReO3 and Li2ReO3.
Final rept.
A. Santoro, R. J. Cava, D. W. Murphy, and R. S. Roth. 1982, 4p
Sponsored by Argonne National Lab., IL., and Argonne Universities Association, IL.
Pub. in AIP Conference Proceedings of Symposium on Neutron Scattering, Argonne, IL., August 12-14, 1981, n89 p162-165 1982.

Keywords: *Crystal structure, Neutron diffraction, *Lithium renates.

The crystal structures of the compounds LiReO3 and Li2ReO3 have been refined with the Rietveld method. Neutron powder diffraction data collected at room temperature were used in these calculations. Since the shapes of the diffraction lines for both materials could not be approximated by Gaussians with sufficient accuracy, the Pearson type VII function was used in all refinements. The value of m was assumed to be 2 theta -independent in these calculations. The best fits to the experimental observations were obtained with m = 1.5 for LiReO3 and m = 3 for Li2ReO3. Both compounds crystallize with the symmetry of space group R3c, and the lattice parameters (hexagonal axes) are a = 5.0918(3), c = 13.403(1) A for LiReO3 and a = 4.9711(4), c = 14.788(1) A for Li2ReO3.

714,476
PB85-196079 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Striations on the Compositional Analysis of Silicon Crystals.
Final rept.
R. A. Forman, M. I. Bell, A. Baghdadi, and S. Mayo. 1983, 10p
Sponsored by Electrochemical Society, Inc., Pennington, NJ. Electronics Div.
Pub. in Proceedings of the Electrochemical Society Symposium on Defects in Silicon, San Francisco, CA., May 8-13, 1983, v83 n9 p303-312.

Keywords: *Silicon, *Chemical analysis, Composition(Property), Crystal growth, Periodic variations, Striations, Impurities, Carbon, Oxygen, Crystal defects, Semiconductors, Gettering.

Periodic variations of composition along the growth direction in semiconductor crystals commonly arise from fluctuations in the local growth rate. These striations of impurity content can lead to systematic errors in compositional analysis by optical transmission or surface analysis techniques. A model appropriate for the analysis of such measurements is presented, and estimates of probable errors are given. The model is applied to earlier published measurements on the carbon and oxygen content of silicon. The implications of these results for studies of intrinsic gettering are discussed.

714,477
PB85-196111 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interaction Effects in Disordered Landau-Level Systems in Two Dimensions.
Final rept.
S. M. Girvin, M. Jonson, and P. A. Lee. 1982, 9p
Pub. in Physical Review B: Condensed Matter 26, n4 p1651-1659, 1 Aug 82.

Keywords: *Electron gas, *Coulomb interactions, Magnetic fields, Reprints, Density of states, Two dimensional.

Interaction effects in the disordered two dimensional electron gas are considered in the regime of high magnetic field and low temperature. Logarithmic temperature corrections to the density of states and the conductivity are obtained. When Hartree corrections are included, good agreement with the experimental results of Paalanen, et al. is obtained.

714,478
PB85-196228 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reversible Step Rearrangement and Segregation on Nickel Surface at the Curie Temperature.
Final rept.
T. Jach, and J. C. Hamilton. 1982, 8p
Pub. in Physical Review B: Condensed Matter 26, n7 p3766-3773, 1 Oct 82.

Keywords: *Ferromagnetic materials, *Nickel, *Surfaces, Phase transformations, Single crystals, Curie temperature, Carbon, Separation, Reprints.

Reversible step period rearrangement and carbon segregation have been observed on clean nickel single-crystal surfaces whose bulk is also relatively free of impurities. The temperature of these transitions which are 35K wide, appears to be the nickel Curie temperature, as determined by simultaneous LEED, Auger, and permeability measurements on nickel stepped and flat (111) surfaces. The observation of segregated carbon in carbidic form (isolated carbon atoms) indicates an unusual bonding state of C to the surface below the Curie temperature. Measured carbon coverages indicate a change greater than 0.2eV per carbon atom in the heat of segregation at the Curie point.

714,479
PB85-196236 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Integral Equation Approach to the Inclusion Problem of Elasto-Plasticity.
Final rept.
W. C. Johnson, and J. K. Lee. 1982, 7p
Pub. in Jnl. of Applied Mechanics 49, n2 p312-318 Jun 82.

Keywords: *Elastic properties, *Plastic properties, *Integral equations, Deformation, Strains, Stresses, Reprints, Pearson density functions.

An integral equation approach is derived for the calculation of the elasto-plastic strain field associated with a transformed inclusion of constant stress-free transformation strain and for an inhomogeneity when the far stress field remains elastic. The assumptions of a coherent precipitate and the deformation theory of plasticity are employed although any yield condition and flow rule can be chosen. The complexity of the integral equation is such as to necessitate an iterative solution scheme. The technique is applied to a spherical precipitate in a uniform elastic stress field where associated stress and strain fields and plastic zone are calculated. The nature of the plastic relaxation process compares qualitatively with two dimensional plane stress behavior. Extension of this technique to the nonaxisymmetric problem is also examined.

714,480
PB85-196277 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Radial Distribution Studies in A Diamond Anvil Pressure Cell (Amorphous Fe-W).
Final rept.
R. G. Munro, S. Block, F. A. Mauer, and G. J. Piermarini. 1982, 2p
Pub. in Jnl. of Applied Physics 53, n10 p7080-7081 Oct 82.

Keywords: X ray diffraction, Load cells, Iron alloys, Tungsten alloys, Reprints, *Radial distribution functions, Amorphous materials, High pressure.

High pressure radial distribution studies using energy dispersive x-ray diffraction have been performed for the first time in a diamond anvil pressure cell (DAPC). The differential radial distribution function (RDF) and the associated reduced structure factor (SF) have been determined for the amorphous metal Fe-W (56 wt.% W) at room temperature and at pressures of 0, 0.3, 3.6, 7.3, and 10.5 GPa.

714,481
PB85-197572 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Observation of Spin Waves in Pd(1.5% Fe).
Final rept.
J. W. Lynn, J. J. Rhyne, and J. I. Budnick. 1982, 3p
Sponsored by American Inst. of Physics, New York and Institute of Electrical and Electronics Engineers, Inc., New York.
Pub. in Jnl. of Applied Physics 53, n3 pt2, p1982-1984 Mar 84.

Keywords: *Ferromagnetic materials, *Palladium alloys, *Iron containing alloys, *Magnons, Neutron scattering, Magnetic moments, Cryogenics, Reprints, *Spin waves.

Inelastic neutron scattering measurements have been carried out on the 'giant-moment' alloy system Pd(1.5% Fe), which is in the dilute ferromagnetic regime. Below the Curie temperature of 67K relatively well defined spin wave excitations have been observed in the small wavevector region (Q < 0.14/A). The dispersion of these excitations is consistent with the quadratic relation E = D(Q sup 2) expected for an isotropic ferromagnet, with D = 40 meV-(A sup 2) at a temperature of the 40K. With increasing temperature, the spin waves are found to renormalize in energy, and broaden rapidly both with increasing Q and increasing temperature.

714,482
PB85-197580 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effects of Inhomogeneous Strain in Ferroelectric Crystals Near Their Phase Transitions.
Final rept.
G. M. Loicono, M. Delfino, A. Shaulov, W. A. Smith, and M. I. Bell. 1980, 4p
Pub. in Ferroelectrics 29, n3-4 p181-184 1980.

Keywords: *Ferroelectric crystals, *Specific heat, *Strains, Phase transformations, Pyroelectricity, Reprints, *Ammonium lithium sulfates, *Gadolinium molybdates, *Terbium molybdates, *Nickel borate bromides, Temperature dependence.

Measurements of the temperature dependence of the heat capacity in LiNH4SO4, Gd2(MoO4)3, Tb2(MoO4)3 and Ni3B7O13Br, near their ferroelectric phase transitions, exhibit multiple peaking. An explanation of this behavior, based on strains induced during crystal growth and/or sample fabrication, is described.

714,483
PB85-201929 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reply to 'Comment on 'On the Atomic Structure of (001) Tungsten''.
Final rept.
A. J. Melmed, and W. R. Graham. 1982, 3p
Pub. in Surface Science 123, n1 pL706-L708 1982.

Keywords: *Tungsten, *Atomic structure, *Surfaces, Phase transformations, Reprints, Field ion microscopy, Low energy electron diffraction.

A reply to comment by P. J. Estrup, L. D. Roelofs, and S. C. Ying is given.

714,484
PB85-202000 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Powder-Pattern: A System of Programs for Processing and Interpreting Powder Diffraction Data.
Final rept.
N. P. Pyrros, and C. R. Hubbard. 1983, 10p
Sponsored by JCPDS-International Centre for Diffraction Data, Swarthmore, PA.
Pub. in Advances in X-Ray Analysis 26, p63-72 1983.

Keywords: *X ray diffraction, *Crystal structure, Data processing, Spectrum analysis, Fortran, Reprints, *Powder patterns, POWDER-PATTERN system, Computer applications.

POWDER-PATTERN is a general system for processing powder diffraction data. The system has been designed and developed specifically for the processing of high quality standard x-ray diffraction powder patterns. POWDER-PATTERN is an interactive system that consists of a number of independent modules (programs) that have been designed so that they allow recycling in the execution of the modules. The modules are linked through the use of a common file named PKS that serves as an input to the modules and as a depository of the data generated by the different modules and by the user. An editing program allows for the manipulation of the PKS file. Modules locate the peaks, refine the parameters with profile refinement, correct the observed peak positions for external and internal calibration, and perform a least squares cell refinement. Interactive plotting programs allow the user to intervene at various stages of the processing, or to simply check the results. The profile refinement module using flexible rational profiles with a relatively small number of parameters can give accurate peak positions and can help in the interpretation of complicated bands with overlapping profiles.

714,485
PB85-205862 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Structure of LaTaO4 at 300C by Neutron Powder Profile Analysis.
Final rept.
R. J. Cava, and R. S. Roth. 1981, 9p
Pub. in Jnl. of Solid State Chemistry 36, n2 p139-147 1981.

Keywords: *Crystal structure, Neutron diffraction, Reprints, *Lanthanum tantalates.

LaTaO4 above 175C is orthorhombic, space group A2(1)am, with a = 5.6643(1), b = 14.6411(3), c = 3.9457(1), and z = 4(1). Orthorhombic LaTaO4 is isostructural with the room temperature BaMnF4. Orthorhombic CeTaO4 and PrTaO4 are isostructural.

714,486
PB85-206712
(Order as PB85-206324, PC **A13**/MF **A01**)
University of Southern California, Los Angeles. Center for Laser Studies.
Optical Absorption in the Band Gap in High Purity Silicon.
R. T. Swimm. Apr 85, 2p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p158-159 Apr 85.

Keywords: *Silicon, *Energy bands, Band structure of solids, Energy gap, Single crystals, Near infrared radiation, Laser radiation, Absorption coefficients, Calorimetry.

Calorimetric measurement of weak optical absorption of laser illumination by solid samples is a well established method. The possibility of applying such methods to the study of deep level impurities has been discussed in the literature (1,2), but little data has been published. In this paper, some of the many difficulties and constraints in applying calorimetry to the study of deep level impurities are discussed. The goal of the present study was to determine the energy of a deep level with respect to either the valence or conduction band edge. In order to do this it is necessary to measure the photoionization or photoneutralization cross section as a function of photon energy.

714,487
PB85-206803
(Order as PB85-206324, PC **A13**/MF **A01**)
Max-Planck-Inst. fuer Festkoerperforschung, Stuttgart (Germany, F.R.).
Dielectric Function and Interband Transitions in Semiconductors.
M. Cardona. Apr 85, 6p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p188-193 Apr 85.

Keywords: *Semiconductors(Materials), *Energy bands, Optical properties, Silicon, Germanium, Tin, Ellipsometry, Cadmium manganese tellurides, Cadmium mercury tellurides, Germanium sulfides.

No abstract available.

714,488
PB85-206811
(Order as PB85-206324, PC **A13**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Band Structure and Density of States Changes for Doped Gallium Arsenide.
H. S. Bennett. Apr 85, 4p
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p194-197 Apr 85.

Keywords: *Gallium arsenide, *Energy bands, Band structure of solids, Absorption, Density of states, Doped materials.

The paper contains calculations of the changes in the band structure and density of states for both n-type and p-type doped GaAs. These band structure changes may be applied to optical properties such as absorption, luminescence, and refractive index. The application to absorption is given here.

714,489
PB85-206852
(Order as PB85-206324, PC **A13**/MF **A01**)
Ohio State Univ., Columbus.
Picosecond Carrier Dynamics in alpha-S1.
A. I. D'Souza, M. G. Roe, and P. E. Wigen. Apr 85, 4p
Prepared in cooperation with Pennsylvania State Univ., University Park. Materials Research Lab.

Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p218-221 Apr 85.

Keywords: *Silicon, *Charge carriers, Carrier mobility, Energy bands, Dynamics, Picosecond pulses, Density of states.

The observations suggest that the large density of states in the gap in a-Si provides a fast and easy nonradiative channel for the decay of charge carriers out of the conduction band. This conclusion is derived from the exponential decay in the reflectance which is interpreted as indicating the dominance of monomolecular non-radiative recombination, with bimolecular radiative recombination relatively unimportant in sputtered a-Si at T = 300 K up to 900 ps.

714,490
PB85-208902
(Order as PB85-206324, PC **A13**/MF **A01**)
Hughes Research Labs., Malibu, CA.
Measurement of Dielectric Properties of KTa(1-x)Nb(x)O3 at Millimeter Wavelengths.
D. Rytz, M. B. Klein, B. Bobbs, M. Matloubian, and H. Fetterman. Apr 85, 4p
Prepared in cooperation with California Univ., Los Angeles. Dept. of Electrical Engineering.
Included in OM85: Basic Properties of Optical Materials. Summaries of Papers, p234-237 Apr 85.

Keywords: *Ferroelectric crystals, *Dielectric properties, Millimeter waves, Measurement, *Potassium tantalate niobates.

Mixed crystals of KTa(1-x)Nb(x)O3 or KTN are well known ferroelectrics whose transition temperatures T(c) can be adjusted between -273 and 430 degrees C by varying the Nb concentration x. In the present work, the authors report on dielectric measurements in the 60-95 GHz range for crystals with x = 0.20, 0.09, 0.025, 0 and T(c) = -103, -183, -238 degrees C respectively (for x = 0, i.e. pure KTaO3(c), there is no transition).

714,491
PB85-207033 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Characterization of a Standard Reference Superconductor for Critical Current and a Summary of Other Standard Research at NBS (National Bureau of Standards).
Final rept.
A. F. Clark, and L. F. Goodrich. 1984, 5p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Proceedings of Int. Cryogenic Engineering Conf. (10th), Helsinki, Finland, July 31-August 3, 1984, p433-437.

Keywords: *Calibrating, *Standards, *Standard reference materials, *Critical current, Niobium tin.

A standard reference material can be useful for the calibration of measurement apparatus and interlaboratory comparison of research results. The authors have carefully characterized the first practical superconductor SRM for critical current and it is now available from NBS as 'Standard Reference Material 1457 Superconducting Critical Current - NbTi Wire.' The selection, characterization, and statistical analysis of this material are described. The progress in other standards research will also be discussed for large conductor critical current, ac losses, stability, and critical field.

714,492
PB85-207090 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Interferometric High Pressure Gauge for the Diamond Anvil Cell Useful at High Temperatures.
Final rept.
J. A. H. da Jornada, S. Block, and G. J. Piermarini. 15 Sep 84, 3p
Sponsored by Conselho Nacional de Pesquisas, Rio de Janeiro (Brazil) and Universidade Federal do Rio Grande do Sul, Porto Alegre (Brazil). Inst. de Fisica.
Pub. in Applied Physics Letters 45, n6 p700-702, 15 Sep 84.

Keywords: *Pressure gages, High temperature tests, Optical interferometers, Pressure measurement, Reprints, *Anvil cells, Zinc tungstates, Refractive index.

A new method of precise pressure measurement in the diamond anvil cell, especially useful at high temperatures, is presented. It is based on the measurement of the channeled spectrum of a miniature Fabry-Perot etalon interferometer placed inside the cell. The validity of the method has been verified with an interferometric gauge of ZnWO4.

714,493
PB85-207389 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Survey of Chaos in the Rf-Biased Josephson Junction.
Final rept.
R. L. Kautz, and R. Monaco. 1 Feb 85, 15p
Pub. in Jnl. of Applied Physics 57, n3 p875-889, 1 Feb 85.

Keywords: *Josephson junctions, Superconductivity, Reprints, *Chaos, Voltage standards.

Chaotic behavior in the rf-biased Josephson junction is studied through digital simulations of the Stewart-McCumber model. Chaotic states are characterized by Poincare sections, Liapunov exponents, and power spectra. Models are presented which explain some features of the chaotic spectra. The parameter range over which chaotic behavior occurs is determined empirically for a broad range of dc bias, rf bias, and the hysteresis parameter for a fixed rf frequency. It is shown that chaos does not occur if either the dc bias or the rf bias is very large. An attempt is made to explain the boundaries of the chaotic region in terms of simple models for chaotic behavior.

714,494
PB85-219855 Not available NTIS
Purdue Univ., Lafayette, IN.
Electrical Resistivity of Selected Elements.
P. D. Desai, T. K. Chu, H. M. James, and C. Y. Ho. c1984, 28p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v13 n4 p1069-1096 1984. Available from American Chemical Society, 1155 Sixteenth St., N.W., Washington, DC 20036.

Keywords: *Electrical resistivity, *Hafnium, *Molybdenum, *Tantalum, *Tungsten, *Zinc, Graphs(Charts), Melting point, Metals, Experimental design, Cryogenics, Temperature dependence.

The work compiles, reviews, and discusses the available data and information on the electrical resistivity of hafnium, molybdenum, tantalum, tungsten, and zinc, and presents the recommended values resulting from critical evaluation, correlation, analysis, and synthesis of the available data and information. The recommended values presented are both uncorrected and also corrected for the thermal expansion of the material and cover the temperature range from 1 K to above the melting point into the molten state. The estimated uncertainties in most of the recommended values are about + or - 2% to + or - 10%.

714,495
PB85-219863 Not available NTIS
Purdue Univ., Lafayette, IN.
Electrical Resistivity of Vanadium and Zirconium.
P. D. Desai, H. M. James, and C. Y. Ho. c1984, 34p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v13 n4 p1097-1130 1984. Available from American Chemical Society, 1155 Sixteenth St., N.W., Washington, DC 20036.

Keywords: *Electrical resistivity, *Vanadium, *Zirconium, Graphs(Charts), Tables(Data), Experimental design, Melting point, Metals, Thermal expansion, Purity, Cryogenics, Temperature dependence.

The work compiles, reviews, and discusses the available data and information on the electrical resistivity of vanadium and zirconium and presents the recommended values resulting from critical evaluation, correlation, analysis, and synthesis of the available data and information. The recommended values presented are uncorrected and also corrected for the thermal expansion of the material and cover the temperature range from 1 K to above the melting point into the molten state. The estimated uncertainties in most of the recommended values are about + or - 2% to + or - 5%.

714,496
PB85-219871 Not available NTIS
Purdue Univ., Lafayette, IN.
Electrical Resistivity of Aluminum and Manganese.
P. D. Desai, H. M. James, and C. Y. Ho. c1984, 42p
Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v13 n4 p1131-1172 1984. Available from American Chemical Society, 1155 Sixteenth St., N.W., Washington, DC 20036.

Keywords: *Electrical resistivity, *Aluminum, *Manganese, Thermal expansion, Melting point, Metals, Graphs(Charts), Tables(Data), Purity, Cryogenics, Temperature dependence.

The work compiles, reviews, and discusses the available data and information on the electrical resistivity of aluminum and manganese and presents the recommended values resulting from critical evaluation, correlation, analysis, and synthesis of the available and information. The recommended values presented are uncorrected and also corrected for the thermal expansion of the material and cover the temperature range from 1 K to above the melting point into the molten state for aluminum and to 700 K for manganese. The estimated uncertainties in most of the recommended values are about + or - 2% to + or - 5%.

714,497
PB85-222115 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Symmetry in Solid State Transformation Morphologies.
Final rept.
J. W. Cahn, and G. Kalonji. 1982, 12p
Sponsored by Carnegie-Mellon Univ., Pittsburgh, PA, American Society for Metals, Metals Park, OH, and National Science Foundation, Washington, DC.
Pub. in Proceedings of Int. Conf. Solid to Solid Phase Transformations, Pittsburgh, PA., August 10-14, 1981, p3-14 1982.

Keywords: *Bicrystals, Crystal symmetry, Phase transformations, Interfaces, Crystal morphology.

Crystallographic symmetry is an important factor in determining the morphologies of crystals grown from (or embedded in) crystalline matrixes. The rules for obtaining the appropriate bicrystal morphologies (forms and variants) from symmetries of the individual crystals and their relative orientation are examined and applied to specific examples. The role of symmetry dictated extrema in specifying orientation relationships resulting from certain physical processes such as homogeneous nucleation, is discussed.

714,498
PB85-222255 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Structural Aspects of Lithium Insertion in Oxides: LixReO3 and Li2FeV3O8.
Final rept.
R. J. Cava, A. Santoro, D. W. Murphy, S. Zahurak, and R. S. Roth. Oct 81, 4p
Sponsored by Oak Ridge National Lab., TN, General Electric Co., Washington, DC, National Science Foundation, Washington, DC, and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of Int. Conf. Fast Ionic Transport in Solids, Gatlinburg, TN., May 18-22, 1981, Solid State Ionics 5, p323-326 Oct 81.

Keywords: *Crystal structure, Neutron diffraction, *Lithium rhenates, *Lithium iron vanadates.

The authors have determined the crystal structures of LiReO3, Li2ReO3 and Li2FeV3O8, obtained by Li insertion of ReO3 and FeV3O8, by neutron diffraction powder profile analysis. The ReO3 host lattice is exclusively corner shared and undergoes significant twisting on Li insertion. The FeV3O8 host lattice is extensively edge shared and changes little on Li insertion. The Li is accommodated in 6 coordinate sites in the rhenates and 5 coordinate sites in the iron vanadate.

714,499
PB85-227643 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Connection between Surface Magnetism and Electronic Structure of Oxygen on Ni(110) (Invited).
Final rept.
A. Seiler, C. S. Feigerle, J. L. Pena, R. J. Celotta, and D. T. Pierce. 15 Apr 85, 3p
Sponsored by National Science Foundation, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Applied Physics 57, n1 p3638-3640, 15 Apr 85.

Keywords: *Nickel, *Magnetism, *Surfaces, Chemisorption, Oxidation, Reprints, *Electronic structure, Photoelectron spectroscopy.

The d-band holes which give rise to ferromagnetism in Ni can be directly observed by spinpolarized inverse photoelectron spectroscopy (SPIPES). Only incident electrons polarized in the minority spin direction can fall into unfilled minority spin states and radiate a detected photon. On dissociative chemisorption of O2 one observes a reduction in the number of minority spin d holes. It is this change in electronic structure which gives rise to a decrease in magnetization. A background of minority and majority spin states remains essentially unchanged. Further exposure to oxygen causes formation of NiO; the surface magnetization goes to zero, and a completely different SPIPES spectrum is observed. The relative importance of d electrons and s, p electrons in chemisorptive bonding on Ni has been much discussed. These data suggest that the d states interact strongly with the oxygen and that this interaction has a profound influence on the surface magnetism.

714,500
PB85-229300 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Effect of Anisotropic Crystal-Melt Surface Tension on Grain Boundary Groove Morphology.
Final rept.
P. W. Voorhees, S. R. Coriell, G. B. McFadden, and R. F. Sekerka. 1984, 16p
Pub. in Jnl. of Crystal Growth 67, n3 p425-440 Aug 84.

Keywords: *Interfacial tension, *Grain boundaries, Crystal growth, Interfaces, Anisotropy, Reprints.

The shape of a stationary solid-liquid interface in a temperature gradient near a grain boundary in a pure material is calculated for anisotropic crystal-melt surface tension and equal thermal conductivities of crystal and melt. Results are compared with those for the well-known problem of the two-dimensional equilibrium shape of a crystal. For small anisotropy, the resulting interface shapes have continuously turning tangents but differ in detail from the grain boundary groove shapes that have been calculated for isotropic surface tension. For larger anisotropy, the interface shapes have discontinuities in slope as a result of missing orientations; these missing orientations are the same as those that would be missing on the corresponding equilibrium interface shape. In cases where a normal to the grain boundary or to the macroscopic interface is in the range of missing orientations on the corresponding equilibrium shape, the groove shape may contain some of these orientations as well as having varifold surfaces. Detailed numerical results are presented for a surface tension with fourfold symmetry.

714,501
PB85-229359 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
In situ Alignment Procedure for X-ray Topography.
Final rept.
R. A. Forman, and S. Mayo. 1985, 4p
Pub. in Jnl. of Applied Crystallography 18, p106-109 1985.

Keywords: *Alignment, X ray diffraction, Gallium arsenides, Silicon, Reprints, *X ray topography, Semiconductors.

A simple method for in situ alignment of samples in a double crystal x-ray topography system is described. The method permits a specific crystallographic axis to be made conincident with the sample rotation axis used to set the Bragg angle. Surface reflections from approximately orthogonal crystallographic planes are required, and tables of such planes suitable for alignment of cubic crystals are given. The procedure allows rapid setup for the other accessible surface reflection or transmission topographs.

714,502
PB85-229979 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Phase Transition and Compression of LiNbO3 Under Static High Pressure.
Final rept.
J. A. H. da Jornada, S. Block, F. A. Mauer, and G. J. Piermarini. 1985, 3p
Sponsored by Conselho Nacional de Pesquisas, Rio de Janeiro (Brazil), and Universidade Federal do Rio Grande do Sul, Porto Alegre (Brazil). Inst. de Fisica.
Pub. in Jnl. of Applied Physics 57, n3 p842-844, 1 Feb 85.

Keywords: *Lattice parameters, X ray diffraction, Phase transformations, Compressive properties, Reprints, *Lithium niobates, High pressure, Pressure dependence, Cubic lattices.

Lattice parameters of LiNbO3 were measured at room temperature over the pressure range 0-35 GPa by x-ray diffraction using the diamond anvil cell. In the region below 13 GPa (where a hydrostatic pressure was maintained) the pressure dependence of the volume can be well described by the Birch-Murnaghan equation of state, yielding B(o)=134 + or - 3 GPa for the zero-pressure bulk modulus and B'(0)=2.9 + or - 0.5 for its pressure derivative. A phase transformation was detected at 30 + or - 3 GPa both by x-ray diffraction and by optical observation of the change from a transparent to an opaque state. The pattern of the high-pressure phase was tentatively indexed on the basis of a cubic cell with a=6.78 A.

714,503
PB85-230712 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Electromechanical and Metallurgical Properties of Liquid-Infiltration Nb-Ta/Sn Multifilamentary Superconductor.
Final rept.
J. W. Ekin, and M. Hong. Aug 84, 3p
Sponsored by David W. Taylor Naval Ship Research and Development Center, Bethesda, MD.
Pub. in Applied Physics Letters 45, n3 p297-299, 1 Aug 84.

Keywords: *Superconductors, Critical field, Niobium, Tantalum, Tin, Reprints, Critical current.

Data are presented on the strain dependence of the critical current and critical field of Nb-Ta/Sn superconductors fabricated by the liquid Sn infiltration process. The results show that liquid infiltrated Nb-Ta/Sn superconductors have several significant advantages over bronze-process Nb/Sn super conductors: an overall (J sub c) that is 3-10 times higher for magnetic fields in the range 13-20 T, an irreversible (damage) strain limit twice as large, and a (J sub c) elastic-strain sensitivity less than half as large at fields above about 16 T. These improved properties are attributed to several unique characteristics of the liquid infiltration process: a tough Nb-Ta matrix, fine equiaxial A15 grains, and a uniform stoichiometric Sn concentration.

714,504
PB85-230746 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Heavy Doping Effects on Bandgaps, Effective Intrinsic Carrier Concentrations and Carrier Mobilities and Lifetimes.
Final rept.
H. S. Bennett. 1985, 8p
Pub. in Solid-State Electronics 28, n1/2 p193-200 1985.

Keywords: *Semiconductor doping, Mathematical models, Computerized simulation, Donor materials, Energy gap, Carrier mobility, Transistors, Reprints, Carrier lifetime.

Conventional device physics in most computer models of transistors may not predict correctly the measured electrical performance for shallow, heavily doped transistors. This paper presents improved concepts for numerical simulations of solid-state devices with donor densities up to 3 x 10 to the 20th power/cc and junction depths as small as 1 micrometer. These improved concepts pertain to bandgap narrowing, effective intrinsic carrier concentrations, and carrier mobilities and lifetimes.

714,505
PB85-230852 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Conductivity Mechanisms in the Superionic Phases of AgI and Ag2S as Determined by Neutron Diffraction.
Final rept.
R. J. Cava, F. Reidinger, and B. J. Wuensch. 1979, 4p
Pub. in Proceedings of the International Conference on Fast Ion Transport in Solids - Electrolytes and Electrodes, Lake Geneva, Wisconsin, May 19-27, 1979, p217-220.

Keywords: *Silver iodide, *Silver sulfides, Neutron diffraction, *Superionic conductivity, *Ionic conductivity.

Both alpha AgI and beta Ag2S have a BCC anion array. Neutron diffraction experiments indicate that silver ion transport in alpha AgI is characterized by continuous independent ion motion between nearest neighbor tetrahedral sites, whereas that in beta Ag2S is dominated by silver-silver interaction. The differences are attributed to mobile ion concentration and cation-anion bonding characteristics.

714,506
PB86-103611 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Epitaxial Crystal Growth of hcp Metals on bcc Metals: Dysprosium on Tungsten.
Final rept.
A. Ciszewski, and A. J. Melmed. 1984, 7p
Pub. in Jnl. of Crystal Growth 69, p253-259 1984.

Keywords: *Dysprosium, *Tungsten, *Epitaxy, *Crystal growth, Body centered cubic lattices, Hexagonal close packed lattices, Surfaces, Diffusion, Nucleation, Reprints, Field emission microscopy.

Surface diffusion of dysprosium on tungsten is discussed and activation energies for multilayer diffusion over various substrate planes are measured. Nucleation and epitaxial crystal growth are investigated and it is shown that single crystal or polycrystal layers can be grown under controlled conditions in the field emission microscope. The epitaxial relationships are given.

714,507
PB86-105822 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Analysis of Angular Dependent XPS (X-ray Photoelectron) Peak Intensities.
Final rept.
R. A. Armstrong, and W. F. Egelhoff. 1985, 8p
Pub. in Surface Science 154, pL225-L232 1985.

Keywords: *Epitaxy, Nickel, Copper, Cobalt, Metal films, Substrates, Surfaces, Reprints, *X-ray photoelectron spectroscopy.

Angle resolved X-ray photoelectron (XPS) studies of clean Ni(100) and of epitaxial Cu and Co films on Ni(100) have been interpreted with the aid of single scattering cluster calculations. It is found that for atoms in the top few atomic layers, photoelectron forward scattering by overlying atoms in the lattice causes XPS peak intensities to be enhanced at angles corresponding to nearest neighbor and next-nearest neighbor internuclear axes. Angle resolved XPS should thus be an excellent approach for gaining structural information on, for example, epitaxial overlayers or surface reconstructions.

714,508
PB86-111374 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Characteristics of Backscattered Electron Detectors for Scanning Electron Microscopy.
Final rept.
D. E. Newbury. 1981, 8p
Pub. in Proceedings of Annual Conference of the Microbeam Analysis Society (16th), Vail, CO., July 13-17, 1981, p1-8.

Keywords: Electron scattering, Backscattering, Scintillation counters, Solid state counters, *Scanning electron microscopy, *Electron detection, *Electron counters.

The backscattered electron signal in the scanning electron microscope carries useful contrast information on atomic number differences, topography, crystallography, and magnetism in a sample. Detectors for backscattered electrons fall into four categories (1) scintillators; (2) backscattered to secondary conversion with detection with a scintillator; (3) solid state diodes; and (4) specimen current. Important detector properties include: (1) solid angle of collection; (2) take-off (emergence) angle; (3) energy-response; (4) frequency response; and (5) sensitivity to electron trajectory effects. These properties are compared for the various detectors.

714,509
PB86-111879 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effect of Bandgap Narrowing on Diffusion Processes in Silicon.
Final rept.
J. R. Lowney. 1982, 7p
Sponsored by Electrochemical Society, Inc., Pennington, NJ. Electronics Div.
Pub. in Proceedings of the Very Large Scale Integration Science and Technology International Symposium (1st), Detroit, MI., October 18-21, 1982, v82-87, p123-129.

Keywords: *Silicon, *Energy gap, Integrated circuits, Energy bands, *Very large scale integration, Density of states.

As the dimensions of devices become smaller, the effect of bandgap narrowing, which occurs in silicon as a result of heavy doping, becomes increasingly more important. The diffusion coefficients of dopant ions depend strongly on the ratio of the majority carrier density to the intrinsic carrier density, which increases with decreasing energy gap. The authors have previously developed a model, restricted to donors, which accounts for the bandgap narrowing observed optically at 35 and 300 K. These results have been extended to the case of a donor density of 1.0 x 10 to the 20th power/cc at 1100C, for which our model predicts a bandgap reduction of 123 meV. However, the intrinsic carrier density is increased by only 15 percent because the perturbed bands are nonparabolic. The authors conclude that bandgap narrowing resulting from heavy doping has a much smaller effect on diffusion coefficients than predicted by prior models based on impurity bands.

714,510
PB86-112117 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Low-Temperature Spin Correlations and Spin Dynamics in Diluted Magnetic Semiconductors.
Final rept.
T. M. Giebultowicz, J. J. Rhyne, W. Y. Ching, and D. L. Huber. Apr 85, 3p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Applied Physics 57, n1 p3415-3417, 15 Apr 85.

Keywords: Neutron scattering, Magnons, Reprints, *Magnetic semiconductors, *Cadmium manganese tellurides, *Semiconductors, Heisenberg antiferromagnets.

Neutron scattering measurements of static and dynamic spin correlations in the semimagnetic semiconductor Cd(0.35)Mn(0.65)Te are reported and compared to computer simulations for a dilute Heisenberg fcc antiferromagnet that is the model analog of Cd(1-x)Mn(x)Te.

714,511
PB86-112125 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Collective-Excitation Gap in the Fractional Quantum Hall Effect.
Final rept.
S. M. Girvin, A. H. MacDonald, and P. M. Platzman. Feb 85, 3p
Pub. in Physical Review Letters 54, n6 p581-583, 11 Feb 85.

Keywords: *Hall effect, Excitation, Reprints, *Fractional quantum Hall effect, *Quantum Hall effect.

The authors present a theory of the collective excitation spectrum in the fractional quantum Hall-effect regimes, in analogy with Feynman's theory for helium. The spectrum is in excellent quantitative agreement with the numerical results of Haldane. Within this approximation the authors prove that a finite gap is generic to any liquid state in the extreme quantum limit and that in this single-mode approximation gapless excitations can arise only as Goldstone modes for ground states with broken translation symmetry.

714,512
PB86-112778 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Further Investigations of the Solid-Liquid Reaction and High-Field Critical Current Density in Liquid-Infiltrated Nb-Sn Superconductors.
Final rept.
M. Hong, D. M. Maher, M. B. Ellington, F. Hellman, T. H. Geballe, J. W. Ekin, and J. T. Holthuis. 1985, 4p
Sponsored by David W. Taylor Naval Ship Research and Development Center, Bethesda, MD., and Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions of Magnetics MAG-21, n2 p771-774 Mar 85.

Keywords: *Superconductors, Niobium intermetallics, Tin intermetallics, Reprints, *Niobium tin, Critical current.

Superior superconducting properties, such as high J(c)'s and T(c)'s, have been obtained from reacted liquid-infiltrated Nb-Sn composite wires. These excellent properties are attributed to the chemistry and structure of the material, which is prepared by a unique solid (Nb) - liquid (Sn) reaction. From heat capacity measurements, sharp bulk superconducting transitions of the A15 phase occur at 17.2-18 K and the weight fraction of A15 in the composite wire is about 23%. Analytical electron microscopy techniques have shown that: the microstructure of these conductors consists of alternating large-grain and small-grain filaments.

714,513
PB86-114030 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Raman and X-ray Investigations of Ice VII.
Final rept.
F. A. Mauer, S. Block, G. J. Piermarini, and R. Munro. 1982, 3p
See also AD-A116 900.
Pub. in AIRAPT Conference on High Pressure in Research and Industry (8th), Uppsala, Sweden, August 17-22, 1981, Assoc. Int. pour l'Avancement de la Recherche et de la Technologie aux Hautes Pressions 2, p537-539 1982.

Keywords: *Ice, *Crystal structure, Raman spectroscopy, X ray diffraction, High pressure.

Ice VII has been studied in a diamond anvil cell at room temperature by Raman spectroscopy to 30.0 GPa and energy dispersive x-ray diffraction to 36.0 GPa. Both the O-O distance and the Raman O-H frequency decrease with pressure and they are linear relative to each other within experimental error. The decrease in the Raman frequency is related to the increase in length of the O-H bond towards a symmetrical O..H..O hydrogen bond. Generally the lattice parameter at each pressure is based on the (110), (200), and (211) reflections. The largest portion of the error is due to the uncertainty of the pressure in the highest ranges arising from the nonhydrostatic character. The pressure range measured by the ruby fluorescence method in a sample approximately 0.2 mm in diameter by 0.1 mm thick ranged from 23.7 GPa to 26.2 GPa. In addition to the ice results, the advantages of the double-slit energy dispersive x-ray diffraction system is briefly described.

714,514
PB86-115540 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Effect of Uniaxial Strain on the Critical Current and Critical Field of Chevrel Phase PbMo6S8 Superconductors.
Final rept.
J. W. Ekin, T. Yamashita, and K. Hamasaki. 1985, 4p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics MAG-21, n2 p474-477 Mar 85.

Keywords: *Superconductors, *Critical field, Strains, Reprints, *Critical current, *Lead molybdenum sulfides.

The first measurements of the effect of uniaxial strain on the critical current of a Chevrel phase superconductor, PbMo6S8, have been obtained at 4.2 K in magnetic fields from 2 T to 24 T. The data show there is a very significant reversible effect of elastic strain on the critical current of PbMo6S8, comparable in magnitude to that observed in Nb3Sn. This is because both the peak pinning force and upper critical field are very sensitive to elastic strain. A correlation is noted between the elastic strain effect, radiation sensitivity, and crystal phase.

714,515
PB86-115664 PC **A07**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD.
Standard X-ray Diffraction Powder Patterns: Section 21 - Data for 92 Substances.
Final rept.
M. C. Morris, H. F. McMurdie, E. H. Evans, B. Paretzkin, and H. S. Parker. Sep 85, 146p NBS-MONO-25-SECT-21
See also PB84-155191. Also available from Supt. of Docs as SN003-003-02690-5. Prepared in cooperation with JCPDS-International Centre for Diffraction Data, Swarthmore, PA.

Keywords: *Crystal structure, *X ray diffraction, *Standards, Lattice parameters, Inorganic compounds, Tables(Data), *Powder patterns.

Standard x-ray powder diffraction patterns are presented for 92 substances. These patterns, useful for identification, were obtained by automated diffractometer methods. The lattice constants from the experimental work were refined by least-squares methods, and reflections were assigned hkl indices consistent with space group extinctions. Relative intensities, calculated densities, literature references, and other relevant data are included.

714,516
PB86-119286 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Quantum Metrology Group.
Two-Dimensional X-ray Scattering.
Final rept.
S. Brennan. 1985, 9p
Sponsored by Department of Energy, Washington, DC., National Science Foundation, Washington, DC., and National Institutes of Health, Bethesda, MD.
Pub. in Surface Science 152/153, p1-9 1985.

Keywords: *Surfaces, X ray diffraction, Metal films, Lead(Metal), Copper, Epitaxy, Substrates, Reprints, *X ray scattering, *Grazing incidence scattering, Two dimensional.

A discussion of Grazing Incidence Scattering (GIS) is presented, with an emphasis on applications of the technique. This paper is an overview of what can and has been done in this new area of surface structural science. The method is contrasted to some of the currently available techniques to show why it offers unique advantages for certain classes of problems such as the crystallography of ordered overlayers, clean reconstructed surfaces and the thermodynamics of two-dimensional melting. Some recent data for Pb layers on Cu(110) are presented to indicate the type of information that this new method can obtain. Also discussed is the application of the technique to the interfacial structure of epitaxial layers focusing on in-plane strain, lattice mismatch and the abruptness of the substrate-epitaxial interface.

714,517
PB86-119419 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Differences between Spin Glasses and Ferroglasses: Pd-Fe-Si.
Final rept.
R. B. Goldfarb, K. V. Rao, and H. S. Chen. 1985, 3p
Pub. in Solid State Communications 54, n9 p799-801 1985.

Keywords: Phase transformations, Ferromagnetism, Paramagnetism, Palladium, Iron, Silicon, Reprints, *Spin glass state, Magnetic susceptibility.

Near the multicritical point in the magnetic phase diagram, some alloys that appear to be simple spin g lasses actually have an intermediate ferro-magnetic-like state between the high-temperature paramagnetic and low-temperature spin-glass states. The temperature dependences of the imaginary component of a.c. susceptibility and d.c. magnetization are presented to illustrate the subtle experimental differences between spin glasses and these ferroglasses.

714,518
PB86-119435 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Magnetic Hysteresis and Complex Susceptibility as Measures of AC Losses in a Multifilamentary NbTi Superconductor.
Final rept.
R. B. Goldfarb, and A. F. Clark. 1985, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics MAG-21, n2 p332-335 Mar 85.

Keywords: *Superconductors, *Magnetic hysteresis, Alternating current, Magnetic permeability, Niobium, Titanium, Losses, Reprints, *Magnetic susceptibility, Critical current.

Magnetization and ac susceptibility of a standard NbTi superconductor were measured as a function of longitudinal dc magnetic field. The ac-field-amplitude and frequency dependences of the complex susceptibility are examined. The magnetization is related to the susceptibility by means of a theoretical derivation based on the field dependence of the critical current density. Hysteresis losses, obtained directly from dc hysteresis loops and derived theoretically from ac susceptibility and critical current density, were in reasonable agreement.

714,519
PB86-122942 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Operations Research Div.
Generalized Theory of Neutron Scattering from Hydrogen in Metals.
Final rept.
R. C. Casella. 1983, 10p
Pub. in Physical Review B: Condensed Matter 28, n6 p2927-2936, 15 Sep 83.

Keywords: *Neutron scattering, *Hydrogen, Metals, Energy bands, Reprints.

A recent analysis by the author of inelastic scattering of neutrons from dilute hydrogen in terms of coherent itinerant-proton energy bands is generalized to include incoherent processes such as the spontaneous decay of the proton from excited-oscillator states to the ground state, as well as incoherent hopping among excited local-oscillator states centered at neighboring interstitial occupancy sites. Similarly, the analysis of Chudley and Elliott of quasielastic neutron scattering and its extension by Rowe, Skold, Flowtow, and Rush are generalized to include coherent hopping (band transport) in the self-correlation function describing motion of the proton among neighboring oscillator ground states (and, when applicable, among excited states). The general formalism developed here encompasses quasielastic and inelastic scattering and allows for the coexistence of coherent and incoherent processes. At each level of complexity, the expressions obtained for the cross sections are shown to reduce to earlier results in the limits when either the coherent or the incoherent contributions to the neutron bandwidths can be ignored.

714,520
PB86-124096 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymer Science and Standards Div.
Numerical Analysis of the Thermal Pulse Experiment (Dielectric Polarization Distributions Measurement).
Final rept.
F. I. Mopsik, and A. S. DeReggi. 1980, 9p
Pub. in Proceedings of 1980 Annual Report Conference on Electrical Insulation and Dielectric Phenomena, Boston, MA., October 26-29, 1980, p251-259.

Keywords: *Polarization(Charge separation), Thermal radiation, Electrets, Fourier analysis, Computer applications, Transients.

The thermal pulse experiment has been presented as a way of investigating polarization distributions in poled materials. The method involves measuring the electrical response to a thermal pulse applied to one surface of a sample by a light flash. The Fourier analysis that the authors developed for the thermal pulse experiment has been used for the development of a computer program to analyze experimental data. The development of this program has led to a better understanding of the actual experiment, both as to experimental requirements and the results that are obtainable for the desired polarization distribution. The authors present the requirements on the sample cell, the effect of finite light pulses, and the optimum time sampling. They also show what the best possible result can be for the spatial distribution of polarization and how close one can come to it. Both actual and calculated data will be presented to illustrate their results.

714,521
PB86-128154 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Band-Gap Narrowing in the Space-Charge Region of Heavily Doped Silicon Diodes.
Final rept.
J. R. Lowney. 1985, 5p
Pub. in Solid-State Electronics 28, n1/2 p187-191 1985.

Keywords: *Energy gap, *Silicon, Semiconductor diodes, Space charge, Semiconductor doping, Reprints, Density of states.

The densities of states of the valence and conduction bands have been calculated in the space-charge region of a heavily doped linearly graded p-n junction silicon diode. Both the donor and acceptor densities were chosen to be equal to 6.2 x 10 to the 18th power/cc. The results showed the emergence of band tails which penetrated deeply into the energy gap and accounted for the band-gap narrowing observed in such a diode by analysis of capacitance vs voltage measurements of the built-in voltage.

714,522
PB86-128733 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Development of Standards for Superconductors, Interim Report January 1982-December 1983.
L. F. Goodrich, J. V. Minervini, A. F. Clark, F. R. Fickett, and J. W. Ekin. Jan 85, 168p NBSIR-85/3027
Contract DE-AI01-76PR06010
See also PB83-110296. Sponsored by Department of Energy, Washington, DC.

Keywords: *Superconductors, *Standards, Measurement, Losses, Critical current, Superconducting wires.

A cooperative program with the Department of Energy, the National Bureau of Standards, and private industry is in progress to develop standard measurement practices for use in large scale applications of superconductivity. The goal is the adoption of voluntary standards for the critical parameters and other characterizations of practical superconductors. Progress for the period January 1982 through December 1983 is reported. The major effort was the procurement, selection, and certification of the first superconducting wire for critical current measurements as a Standard Reference Material (SRM 1457). Other work reported here includes: effect of geometry on current transfer; lap-joint resistance; and ac losses.

714,523
PB86-129079 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Displacement Field of a Dislocation Distribution.
Final rept.
R. deWit. 1981, 6p
Pub. in Proceedings of International Conference on Dislocation Modelling of Physical Systems, Gainesville, FL., June 22-27, 1980, p304-309 1981.

Keywords: Elastic properties, Anisotropy, Displacement, *Dislocations, Burgers vector.

Burgers' formula gives the displacement field due to a discrete dislocation line of arbitrary shape in an isotropic, linearly-elastic, infinitely extended, homogeneous body. The paper derives the analogous expression for a continuous distribution of dislocations in an anisotropic body. Special cases give the displacement due to a discrete dislocation line in anisotropic elasticity and due to a continuous dislocation distribution in isotropic elasticity. These expressions all represent generalization of Burgers' original formula.

714,524
PB86-129509 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Interaction of Water Vapor with Tin Oxide.
Final rept.
D. F. Cox, S. Semancik, and P. D. Szuromi. 1985, 4p
Pub. in Proceedings of International Conference on Solid-State Sensors and Actuators-Transducers '85, Philadelphia, PA., June 11-14, 1985, p385-388.

Keywords: *Tin oxides, *Water vapor, Interactions, Adsorption, Surfaces, Valence bands, Auger electron spectroscopy, Photoelectron spectroscopy.

The interactions of low coverages of water vapor with tin oxide have been studied at temperatures below 200K. Auger electron spectroscopy (AES) and ultraviolet photoelectron spectroscopy (UPS) were used to characterize the clean tin oxide surface, and UPS was used to monitor the water adsorption process. Changes in the valence band UPS spectra induced by the molecular water overlayers are discussed.

714,525
PB86-129590 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Relative Stability of Dense Crystalline Packings.
Final rept.
H. J. Raveche, and R. D. Mountain. 1985, 3p
Pub. in Physical Review B: Condensed Matter 31, n11 p7446-7448, 1 Jun 85.

Keywords: *Crystal structure, Hexagonal lattices, Free energy, Stability, Reprints.

Close-packed crystalline arrangements of spherical particles interacting via the inverse-twelfth-power intermolecular potential are studied by molecular-dynamics simulations. For systems of 576 and 4608 particles under the condition of constant total energy, the different structures exhibit the same pressure and temperature at high densities, within the accuracy of the computations. The consequences of this apparent degeneracy in determining the relative stability of stackings of hexagonally packed layers are discussed.

714,526
PB86-129632 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Dynamics of Dilute H in Beta-Phase Palladium Deuteride: A Novel Mass Defect.
Final rept.
J. J. Rush, J. M. Rowe, and D. Richter. 1985, 2p
Pub. in Physical Review B: Condensed Matter 31, n9 p6102-6103, 1 May 85.

Keywords: *Crystal defects, Deuterium compounds, Lattice vibrations, Reprints, *Palladium hydrides.

The authors present a neutron scattering study of the bivrations of a light-atom defect which, in contrast with earlier studies, is both chemically identical to and half the mass of its heavy-atom host, namely, 3.7 at % H in beta-palladium deuteride. They observe a large shift in hydrogen vibration modes from those in beta-PdH, which is in close agreement with the local-mode frequency predicted for an isolated mass defect and provides a prototype example for such a system.

714,527
PB86-129764 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Dislocation Concepts Applied to Material Modelling.
Final rept.
R. deWit. 1985, 16p
Sponsored by American Society for Metals, Metals Park, OH., and Army Research Office, Arlington, VA.
Pub. in Proceedings of International Symposium on Mechanics of Dislocation, Houghton, MI., August 28-30, 1983, p111-126 1985.

Keywords: Plastic deformation, Microstructure, Work hardening, Homotrapy theory, Differential geometry,

Liquid crystals, Reviews, *Dislocations, Amorphous materials.

A selective survey is given of several research areas where dislocation concepts have made useful contributions to our understanding of the physical world. The value of dislocation theory for interpreting plastic deformation and work hardening is discussed. Dislocation concepts have led to elegant continuum theories which are closely related to differential geometry and have analogies in electrodynamics and relativity. Dislocation concepts are also useful in fields other than solid crystals, surface crystals, liquid crystals, magnetism, amorphous materilas, and waves. Finally, some speculations are given for the application of dislocations in solid state technology.

714,528
PB86-132214 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Inorganic Materials Div.
Electrolytic Coloration and Electrical Breakdown in MgO Single-Crystals.
Final rept.
M. M. Abraham, L. A. Boatner, W. H. Christie, F. A. Modine, T. Negas, R. M. Bunch, and W. P. Unruh. 1984, 16p
Sponsored by Oak Ridge National Lab., TN.
Pub. in Jnl. of Solid State Chemistry 51, n1 p1-16 1984.

Keywords: *Magnesium oxides, Electrical faults, Dielectric breakdown, Single crystals, Impurities, Reprints, *Breakdown(Electronic threshold), Doped materials.

A series of investigations of electrolytic coloration effects product in MgO single crystals containing iron-group impurities has been carried out. The purpose of these investigations was to determine the identity and production mechanism of localized coloration or dark streaks that are frequently observed following the electrical breakdown of MgO crystals at temperatures in the range of 1000 C.

714,529
PB86-133535 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Structure of ND4NO3 Phase-V by Neutron Powder Diffraction.
Final rept.
C. S. Choi, and H. J. Prask. 1983, 7p
Pub. in Acta Crystallographica Section B-Structural Science 39, p414-420 1983.

Keywords: *Ammonium nitrate, *Crystal structure, Deuterium compounds, Neutron diffraction, Phase transformations, Twinning, Thermal expansion, Reprints.

The crystal structure of ND4NO3 phase V was determined by the Rietveld refinement method for a series of neutron powder diffraction data measured at temperatures ranging from 10K to 250K using a 90% deuterated sample. The structure was found to be orthorhombic Pccn, a = 7.8850(2), b = 7.9202(2), c = 9.7953(2), and Z = 8. The final R-indices were R(integ) = .036, R(prof) = .024 for the 78K structure. The cations and anions are packed with a distorted CsCl-type arrangement and are linked together by two sets of three-dimensional hydrogen bond chains. There are no other polymorphic phases (i.e. phase VII) down to 10K. The thermal expansions of phases V, IV, III, and II were also measured in the study.

714,530
PB86-133576 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Quantum Metrology Group.
Diffraction of Evanescent X-rays: Results from a Dynamical Theory.
Final rept.
P. L. Cowan. 1985, 3p
Pub. in Physical Review B: Condensed Matter 32, n8 p5437-5439, 15 Oct 85.

Keywords: *X ray diffraction, Surfaces, Interfaces, Crystal structure, Reprints.

Evanescent x rays can be made to diffract from periodic structures parallel to a surface or interface. A dynamical theory of diffraction yields several novel predictions which may be experimentally important. First, x-ray standing-wave fields are generated and can be controlled. This suggests a new technique for unambiguous determination of surface structure. Secondly, evanescent x-ray wave fields may be produced in the incident medium as well as the substrate. Finally, the rocking curve of the diffracted beam is narrow and asymmetric.

714,531
PB86-136785 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Observation of Dislocation Images in Surface Reflection by Synchrotron Radiation Topography.
Final rept.
R. C. Dobbyn, and K. C. Yoo. 1984, 10p
Pub. in Applied X-ray Topography Methods Mater. Sci., p241-250 1984.

Keywords: *Diffraction, Single crystals, Copper, Zinc, Synchrotron radiation, X rays, Surfaces, Reflection, Reprints, *Dislocations.

Dislocation images from copper and zinc single crystals have been obtained by monchromatic synchrotron topography for the purpose of documenting the changes in diffraction contrast as a function of deviations of the incident radiation from the exact Bragg condition and deviations in the observation directions about the Bragg angle. The observed diffraction contrast changes are analyzed and compared with the predictions of the dynamical theory for diffraction in real (imperfect) crystals. Observations were made in real time and recorded on video tape and film at the Cornell High Energy Synchrotron Source (CHESS).

714,532
PB86-136884 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Surface Electronic-Structure Changes Induced by Chemisorption. Summary Abstract.
Final rept.
W. F. Egelhoff. 1984, 2p
Pub. in Jnl. of Vacuum Science and Technology A-Vacuum Surfaces and Films 2, n2 p932-933 1984.

Keywords: *Nickel, *Chemisorption, *Surfaces, Carbon monoxide, Adsorption, Reprints, *Electronic structure, X ray photoelectron spectroscopy.

X-ray photoelectron spectroscopy has been used to study the changes in the electronic structure of Ni(100) surface Ni atoms when carbon monoxide is adsorbed. The basic trends are for the d-shell to fill up and for the s-shell to empty. This produces a Ni configuration of approximately 3(d sup 10) 4(s sup 0).

714,533
PB86-136918 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
X-ray Photoelectron and Auger-Electron Forward Scattering: A New Tool for Studying Epitaxial Growth and Core-Level Binding-Energy Shifts.
Final rept.
W. F. Egelhoff. 1984, 4p
Pub. in Physical Review B 30, n2 p1052-1055, 15 Jul 84.

Keywords: Copper, Nickel, Surfaces, Reprints, *Auger electron spectroscopy, *X ray photoelectron spectroscopy, *Epitaxial growth, Binding energy.

Above a few hundred eV kinetic energy, Auger electrons and photoelectrons exhibit strong forward scattering by overlying atoms, and this produces intensity peaks at polar and azimuthal angles corresponding to internuclear axes. This provides a new structural probe which is especially useful for studying epitaxy, surface alloying, and surface segregation. It also provides a new approach to measuring core-level binding-energy shifts by permitting selective enhancement of bulk versus surface signals.

714,534
PB86-136926 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
New Tool for Studying Epitaxy and Interfaces: The XPS (X-ray Photoelectron Spectroscopy) Searchlight Effect.
Final rept.
W. F. Egelhoff. 1985, 3p
Pub. in Jnl. of Vacuum Science and Technology A3, n3 p1511-1513 May/Jun 85.

Keywords: Copper, Nickel, Substrates, Interfaces, Reprints, *X ray photoelectron spectroscopy, Epitaxial growth.

Very recently, a phenomenon long known in angle-resolved x-ray photoelectron spectroscopy (XPS) has been reinterpreted. The new interpretation is that XPS peak intensities are enhanced at angles corresponding to axes connecting the photoemitting atom to its immediate neighboring atoms. These enhanced intensities thus identify the bond axes present near the surface. In the paper, examples are presented of the great power of this 'XPS searchlight' effect as a new tool for studying epitaxy and interfaces.

714,535
PB86-136934 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Growth Morphology Determination in the Initial-Stages of Epitaxy by XPS (X-ray Photoelectron Spectroscopy).
Final rept.
W. F. Egelhoff. 1984, 3p
Pub. in Jnl. of Vacuum Science and Technology A-Vacuum Surfaces and Films 2, n2 p350-353 1984.

Keywords: *Copper, Nickel, Substrates, Reprints, *Epitaxial growth, *X ray photoelectron spectroscopy, *Auger electron spectroscopy.

It is found that for Cu(100) and Ni(100) x-ray photoelectrons and Auger electrons with energies of about 1000 eV exhibit intensity variations versus polar angle which are dominated by forward scattering off neighboring atoms. In monitoring the epitaxial growth of Cu on Ni(100) this phenomenon is shown to yield clear and easily available structural information about the arrangement of atoms in the Cu adlayers.

714,536
PB86-138021 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Spin Dynamics of the Amorphous Invar Alloy Fe(0.86)B(0.14).
Final rept.
J. A. Fernandez-Baca, J. W. Lynn, J. J. Rhyne, and G. E. Fish. 1985, 3p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Applied Physics 57, n1 p3545-3547, 15 Apr 85.

Keywords: Iron alloys, Boron containing alloys, Neutron scattering, Invar, Reprints, *Spin waves, Amorphous materials, Heisenberg ferromagnets.

High-resolution neutron scattering studies have been made of the long wavelength spin excitations in a ribbon sample of amorphous Fe(0.86)B(0.14), which exhibits Invar properties. Spin waves were observed. The spin wave energies are well described by a dispersion relation. There are no anomalies in the spin-wave lifetimes at long wavelengths which appear to relate to the Invar effect seen in the Fe(x)B(1-x) system.

714,537
PB86-138062 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Measurement of Time-Dependent Sputter-Induced Silver Segregation at the Surface of a Ni-Ag Ion Beam Mixed Solid.
Final rept.
J. Fine, T. D. Andreadis, and F. Davarya. 1983, 10p
Pub. in Proceedings of International Conference on Ion Beam Modification of Materials (3rd), Grenoble, France, September 6-10, 1982, Nuclear Instruments and Methods in Physics Research, v209-210, pt 1 p521-530 1983.

Keywords: Ion beams, Diffusion, Separation, Nickel, Silver, Interfaces, Surfaces, Reprints, *Ion bombardment, *Physical radiation effects, Argon ions.

Sputter depth profiling of alloys and interfaces using low energy ion beams can cause in-depth compositional changes to occur. One possible mechanism responsible for such changes is enhanced diffusion occuring along point defects generated by the ion bombardment in the near surface region. Sputter profiling of a Ni/Ag interface produces a mixed Ni-Ag surface region and the authors have found that in such a region, bombarded with 1 to 4 keV argon ions at 20C, that the Ag will segregate to the surface. The segregation can be observed to occur in real time after the ion bombardment has been stopped. Auger spectroscopy was used to obtain a unique set of measurements of

the kinetics of surface segregation due to bombardment enhanced near-surface diffusion. The kinetics of the segregation is examined and its influence on sputter depth profiling demonstrated.

714,538
PB86-138575 Not available NTIS
National Bureau of Standards (NEL), Washington, DC. Semiconductor Materials and Processes Div.
Hot Photoluminescence in Beryllium-Doped Gallium Arsenide.
Final rept.
E. A. Imhoff, M. I. Bell, and R. A. Forman. 1985, 4p
Pub. in Solid State Communications 54, n10 p845-848 1985.

Keywords: *Gallium arsenides, *Photoluminescence, Energy gap, Beryllium, Phonons, Reprints, Doped materials, Hot electrons, Molecular beam epitaxy.

Hot photoluminescence in GaAs:Be is reported for the first time. The emission from a sample with p=6.5 x 10 to the 16th power/cc at 10 K consists of a shoulder at 1.803 eV followed by a series of broad peaks at 1.781, 1.742, 1.704, 1.666, and 1.628 eV. Analysis of the results supports a decay model involving hot electron-acceptor recombination and implies an L - Gamma splitting of 320 + or - 4meV in the conduction band at 0 K.

714,539
PB86-139938 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Evidence of Lattice Relaxation in Platinum-Doped Silicon.
Final rept.
S. Mayo, J. R. Lowney, and M. I. Bell. 1985, 10p
Pub. in Proceedings of Materials Research Society Symposium Microscopic Identification of Electronic Defects in Semiconductors, San Francisco, CA., April 15-18, 1985, v46 p297-306 1985.

Keywords: *Silicon, Acceptor materials, Platinum, Cross sections, Cryogenics, *Photoionization, Crystal defects, Deep levels.

The photoionization cross section of the platinum-acceptor level in silicon was measured (in relative units) as a function of photon energy. Capacitance transients due to electron emission from this level were studied in a p(+)n gated photodiode at temperatures of 40, 60, and 80 K. The results provide the first clear experimental evidence of lattice relaxation associated with a deep level in silicon.

714,540
PB86-140241 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Microscopic Evidence for Quasi-Periodicity in a Solid with Long-Range Icosahedral Order.
Final rept.
D. Shechtman, D. Gratias, and J. W. Cahn. 1985, 6p
Pub. in C. R. Acad. Sc. Paris 11, n18 p909-914, 14 May 85.

Keywords: *Aluminum manganese alloys, *Crystal structure, Electron microscopy, Twinning, Reprints, Penrose tiling.

The authors demonstrate with high resolution electron microscopy that the icosahedral phase in aluminum manganese alloys has many of the topological features of a three-dimensional Penrose tiling. They rule out twinning and conventional modulated structures as alternate explanations for the structure, and suggest a classification scheme based on hyperspace crystallography.

714,541
PB86-140324 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
What Can Polarized LEED Contribute to Surface Structure Determination.
Final rept.
D. T. Pierce, R. J. Celotta, and G. C. Wang. 1984, 18p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of the Conference on Determination of Surface Structure by LEED, Yorktown Heights, New York, June 19-20, 1980, p339-356 1984.

Keywords: *Surfaces, Tungsten, *Low energy electron diffraction, *Electron spin polarization, Polarized beams.

Polarized LEED (PLEED) has come of age in the sense data can now be measured along with spin averaged LEED data without requiring any extra time due to the availability of electron guns which produce intense beams of spin polarized electrons. The authors have measured a large set of data, including five non-specular beams and many specular beams, for the W(100) 1x1 unreconstructed surface. They also report PLEED measurements of the temperature and hydrogen induced phase changes in W(100). They hope availability of the data will stimulate more dynamical PLEED calculations, the comparison to which will definitively test the usefulness of PLEED in surface structure determination.

714,542
PB86-142650 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electroreflectance of PZT Ceramics.
Final rept.
S. H. Shin, F. H. Pollak, and M. J. Bell. 1980, 1p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Ferroelectrics 27, n1-4 p147 1980.

Keywords: Ceramics, Reprints, *Lead zirconate titanates, *Electroreflectance, Aging(Materials), Optical modulation.

Application of the technique of surface barrier electroreflectance to opaque, insulating PZT ceramics is reported. The results constitute the first observation of hysteresis in these materials by optical means and demonstrate the potential value of this method in studies of the switching and aging of ceramics. Asymmetric hysteresis and switching behavior is described, which is apparently related to the growth of space charge fields during aging. The time dependence of the polarization during low-field switching is shown to resemble closely that of the dielectric and piezoelectric properties during aging.

714,543
PB86-142767 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Energy and Material Dependence of the Inelastic Mean Free Path of Low-Energy Electrons in Solids.
Final rept.
C. J. Powell. 1985, 5p
Pub. in Jnl. of Vacuum Science and Technology A3, n3 p1338-1342 May/Jun 85.

Keywords: *Electron scattering, *Mean free path, Carbon, Magnesium, Aluminum, Aluminum oxide, Copper, Silver, Gold, Bismuth, Inelastic scattering, Reprints, EV range 100-1000, KeV range 01-10, Energy dependence.

Calculations have been made of the inelastic mean free paths (IMFP's) of 100-2000-eV electrons in C, Mg, Al, Al2O3, Cu, Ag, Au, and Bi. These calculations have been based on experimental optical data and on theory. The optical data gives the dependence of the differential inelastic scattering cross section at zero momentum transfer on electron energy loss; the data used here satisfy optical sum rules closely. Theory is needed to specify the dependence of the differential inelastic scattering cross section on momentum transfer; results for free-electron-like solids were assumed to be applicable to the present materials. The calculated IMFP's show significant deviations from the dependencies on electron energy and material expected from the formulas of Seah and Dench, Szajman et al., and Ashley.

714,544
PB86-160728 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Electron Tunneling into Superconducting Filaments Using Mechanically Adjustable Barriers.
Final rept.
J. Moreland, and J. W. Ekin. Jul 85, 3p
Contract DE-AI01-84ER52113
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Applied Physics Letters 47, n2 p175-177, 15 Jul 85.

Keywords: *Superconductors, *Electron tunneling, Niobium, Energy gap, Filaments, Reprints.

A new type of squeezable tunneling (SET) junction has been developed for tunneling into superconducting filaments. Stable, mechanically adjustable tunneling barriers between the native surfaces of sputtered Nb films and 30-micrometers-diam Nb filaments were established in liquid helium at 4 K. The current versus voltage characteristics of these SET junctions were used to determine the superconducting energy gap at the surface of the filaments. Since the filaments were etched from commercial superconducting magnet wire, the type of tunnel junction shows promise as a diagnostic probe of superconducting materials for high-field magnets.

714,545
PB86-162120 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Electron Tunneling Experiments Using Nb-Sn 'Break' Junctions.
Final rept.
J. Moreland, and J. W. Ekin. 15 Nov 85, 8p
Contract DE-AI01-84ER52113
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy, and National Research Council, Washington, DC.
Pub. in Jnl. of Applied Physics 58, n10 p3888-3895, 15 Nov 85.

Keywords: *Superconductors, *Electron tunneling, Energy gap, Reprints, Niobium tin.

An Nb-Sn filament mounted on a flexible glass beam can be broken to form an electron tunneling junction between the fracture elements. Breaking the filament in liquid helium prevents oxidation of the freshly exposed fracture surfaces. A sharp superconducting energy gap in the I-V characteristics measured at 4 K indicates the formation of a high-quality tunneling barrier between the fracture elements. The resistance of the junction can be continuously adjusted by varying the surface bending strain of the beam. An estimated 0.1 nm change in the barrier thickness produces about an order of magnitude change in the resistance over the range from 100,000 to 100 million ohms. The exponential character of the dependence shows that the tunnel junction is freely adjustable without intimate contact of the junction elements. 'Break' junctions made in this way offer a new class of tunneling experiments on freshly exposed surfaces of a fractured sample without the oxide barrier previously required for junction stability. Such experiments provide a simple technique for tunneling to new materials and may eliminate complications that can be encountered during interpretation of data obtained using oxide barriers.

714,546
PB86-163532 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Precision and Accuracy in Structure Refinement by the Rietveld Method.
Final rept.
E. Prince. 1985, 9p
Pub. in Structure and Statistics in Crystallography, p95-103 1985.

Keywords: *Crystal structure, Standard deviation, Least squares method, Precision, Accuracy, Bias, Reprints, *Rietveld method, Parameter estimation.

Whenever the values of a set of experimental observations can be predicted by a model containing adjustable parameters, the values of those parameters can be estimated by the method of least squares. Statistical methods may be used to test whether the fitted model is consistent with the data and, on the assumption that the model is the correct one, to estimate the standard deviations of the parameters. Standard deviations, however, are measures of precision rather than of accuracy. Various workers have attempted to assess the accuracy of the method, by defining a number greater than one by which the standard deviations may be multiplied, or by using alternative procedures, such as the separate estimation of integrated intensities or the use of non-diagonal weight matrices. All of these attempts are hampered by the absence in the data, of any information concerning the correlations between systematic errors, and other sources of bias, and the parameters being estimated.

714,547
PB86-164530 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

High Resolution Magnetic Microstructure Imaging Using Secondary Electron Spin Polarization Analysis in a Scanning Electron Microscope.
Final rept.
J. Unguris, G. G. Hembree, R. J. Celotta, and D. T. Pierce. Aug 85, 2p
Pub. in Jnl. of Microscopy 139, pt2 pRP1-RP2 Aug 85.

Keywords: Ferromagnetism, Microstructure, Reprints, *Electron spin polarization, Scanning electron microscopy, Imaging techniques, Magnetism.

In recent measurements it was shown that the low energy secondary electrons generated when an electron beam is incident on a ferromagnetic material are spin polarized, reflecting the net spin density of the valance electrons of the ferromagnet (Unguris, et al., 1982). Additionally, it was predicted that the electron spin polarization should provide an efficient contrast mechanism that can be measured simultaneously with but independently of topographical contrast (Unguris, et al., 1982). The prediction was first tested by Koike and Hayakawa (1984, 1985) who used a scanning 10 micrometer diameter electron beam in conjunction with a 100 keV Mott spin analyzer to show that indeed the polarization contrast was large and could be obtained independently of the topographical contrast.

714,548
PB86-165933
(Order as PB86-165776, PC **A08**/MF **A01**)
National Institutes of Health, Bethesda, MD.
Fourier Representations of Pdf's Arising in Crystallography.
G. H. Weiss, and U. Shmueli. 24 Jun 85, 9p
Prepared in cooperation with Tel-Aviv Univ. (Israel). Sponsored by National Bureau of Standards, Gaithersburg, MD.
Included in Jnl. of Research of the National Bureau of Standards, v90 n6 p507-515 Nov-Dec 85.

Keywords: *Crystallography, *Fourier series, *Probability density functions, Crystal structure, Central limit theorem.

A survey is given of some recent calculations of univariate and multivariate probability density functions (pdf's) of structure factors used to interpret crystallographic data. The authors have found that in the presence of sufficient atomic heterogeneity the frequently used approximations derived from the central limit theorem in the form of Edgeworth or Gram-Charlier series can be quite unreliable, and in these cases the more exact, but lengthier, Fourier calculations must be made.

714,549
PB86-166774 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
NBS*LATTICE - A Program to Analyze Lattice Relationships. Version of Summer, 1985.
Final rept.
V. L. Himes, and A. D. Mighell. Dec 85, 84p NBS/TN-1214
Also available from Supt. of Docs as SN003-003-02713-8.

Keywords: *Crystal structure, *Crystal lattices, Computer programming, Crystal symmetry, Fortran, NBS star LATTICE computer program, Matrix inversion.

A FORTRAN program to analyze lattice relationships has been written and is available for distribution by the NBS Crystal Data Center. The present version of NBS *LATTICE performs several functions including: (1) the characterization and identification of unknown materials using lattice-formula matching techniques; (2) the calculation of the reduced cell of the lattice, and the calculation and reduction of specified derivative supercells and/or subcells (i.e., this program function calculates the standard cells which are useful in the determination of metric lattice symmetry, in finding a matrix relating two unit cells, etc.); (3) unit cell transformations; and (4) matrix inversions. It is planned to incorporate additional functions in forthcoming versions of this program. Among others, these functions will include a matrix method to determine metric lattice symmetry and a technique to find a transformation matrix relating any two unit cells.

714,550
PB86-167863 PC **A09**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
NBS (National Bureau of Standards) Reactor: Summary of Activities July 1984 through June 1985.
F. J. Shorten. Dec 85, 178p NBS/TN-1217
See also PB83-218636.

Keywords: *Neutron beams, *Research projects, Nuclear research and test reactors, Neutron irradiation, Neutron activation analysis, Neutron diffraction, Neutron radiography, Materials tests, Crystal structure, Nondestructive tests, Molecular dynamics.

The report summarizes all those programs which depend on the NBS reactor. It covers the period from July 1984 through June 1985. The programs range from the use of neutron beams to study the structure and dynamics of materials through nuclear physics and neutron standards to sample irradiations for activation analysis, isotope production, radiation effects studies, neutron radiography, and nondestructive evaluation.

714,551
PB86-185337 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Raman Spectrum of Carbon in Silicon.
Final rept.
R. A. Forman, M. I. Bell, D. R. Myers, and D. Chandler-Horowitz. Oct 85, 3p
Contract DE-AC04-76DP00789
Sponsored by Department of Energy, Washington, DC.
Pub. in Japanese Jnl. of Applied Physics 24, n10 pL848-L850 Oct 85.

Keywords: *Silicon, *Carbon, *Raman spectra, Impurities, Infrared spectra, Reprints, Semiconductors.

Raman spectroscopy is used to characterize carbon-doped silicon samples prepared by ion implantation and pulsed laser annealing. Sharp lines are observed in the Raman spectra due to the (12) C local mode at 604 + or - 1/cm and the (13) C local mode at 586 + or -1/cm. Identical spectra are obtained from a given carbon implant whether it is annealed using a 10 ns pulsed ruby laser or the significantly longer pulse of an R6G dye laser. It is shown that Raman spectroscopy has sufficient sensitivity to detect striated carbon distributions in as-grown commercial silicon. Finally, at high carbon density, where the local modes begin to broaden in the implanted and laser-annealed samples, a disorder-induced first-order Raman spectrum is observed produced by the mass defect of the substitutional carbon.

714,552
PB86-185451 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Magnetoplasmon Excitations from Partially Filled Landau Levels in Two Dimensions.
Final rept.
A. H. MacDonald, H. C. A. Oji, and S. M. Girvin. Nov 85, 4p
Pub. in Physical Review Letters 55, n20 p2208-2211, 11 Nov 85.

Keywords: Electron gas, Magnetic fields, Excitation, Reprints, *Magnetoplasmons, Heterostructures, Quantum Hall effect.

For a noninteracting two-dimensional electron gas in a strong perpendicular magnetic field, the excitation energies are multiples of (h bar)(omega sub c). These excitation energies are shifted in an interacting system. Because of the singular nature of the noninteracting-system energy spectrum it has previously been possible to evaluate the excitation energies of the interacting system only when all Landau levels are either completely empty or completely full. In the article they suggest a nonperturbative approach which overcomes this difficulty but recovers existing results in the appropriate limits.

714,553
PB86-185865 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Monte Carlo Calculation of One- and Two-Dimensional Particle and Damage Distributions for Ion-Implanted Dopants in Silicon.
Final rept.
J. Albers. Oct 85, 10p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in IEEE (Institute of Electrical and Electronic Engineers) Transactions on Electron Devices ED-32, n10 p1930-1939 Oct 85.

Keywords: *Silicon, *Crystal defects, *Radiation damage, Semiconductor doping, Vacancies(Crystal defects), Interstitials, Monte Carlo method, Reprints, *Ion implantation, Physical radiation effects.

The two-dimensional distributions of particles, primary damage, and electronic and nuclear energy loss were calculated for implantation of a line source into silicon targets by using the TRIM Monte Carlo code. In addition, the Kinchin-Pease equation was used to calculate approximate two-dimensional distributions of the Frenkel pairs (vacancy-interstitial) created by the primary displacement damage of the target atoms. These distributions allowed for the calculation of the one-dimensional distributions of these quantities for implantation into unmasked targets. The two-dimensional particle and approximate Frenkel pairs distributions for implantation past a mask edge were constructed by means of superposition. The results are important for understanding the mass, energy, and dose dependence of implantation and the associated displacement damage.

714,554
PB86-186061 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Near Ultraviolet Quantum Yield of Silicon.
Final rept.
F. J. Wilkinson, A. J. D. Farmer, and J. Geist. Feb 83, 3p
Pub. in Jnl. of Applied Physics 54, n2 p1172-1174 Feb 83.

Keywords: *Silicon, *Quantum efficiency, *Photodiodes, Near ultraviolet radiation, Reprints, Band theory.

New values for the quantum yield of silicon in the 3 to 5 eV spectral region are derived from reflectance and photo-response measurements on oxide/p+/n/n+ photodiode structures. The new values fall between high and low estimates derived from a recent model of impact ionization phenomena due to Alig, Bloom and Struck. A prominent peak in the new spectrum near 4.5 eV is attributed to the way the photon energy in excess of the band gap energy is distributed between the photo-generated electrons and holes at different photon energies due to the band structure.

714,555
PB86-187739 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Fractional Quantum Hall Effect: Superfluidity, Magneto-Rotons and Fractionally Charged Vortices.
Final rept.
S. M. Girvin, A. H. MacDonald, and P. M. Platzman. 1986, 5p
Pub. in Jnl. of Magnetism and Magnetic Materials 54-57, p1428-1432 1986.

Keywords: *Hall effect, Electron gas, Superfluidity, Reprints, *Fractional Quantum Hall effect, *Quantum Hall effect.

The fractional quantum Hall effect is a remarkable macroscopic quantum phenomenon in which the Hall resitivity of a two-dimensional electron gas is accurately quantized in units of h/(e squared). This nearly dissipationless state is analogous to superfluidity with the collective excitations being phonons, magneto-rotons, and fractionally charged vortices.

714,556
PB86-187747 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Magneto-Roton Theory of Collective Excitations in the Fractional Quantum Hall Effect.
Final rept.
S. M. Girvin, A. H. MacDonald, and P. M. Platzman. 15 Feb 86, 14p
Pub. in Physical Review B 33, n4 p2481-2494, 15 Feb 86.

Keywords: *Hall effect, Superfluidity, Reprints, *Fractional Quantum Hall effect, *Quantum Hall effect, Rotons.

The authors present a theory of the collective excitation spectrum in the fractional quantum Hall effect which is closely analogous to Feynman's theory of superfluid helium. The predicted spectrum has a large gap at k=0 and a deep magneto-roton minimum at

finite wave vector, in excellent quantitative agreement with recent numerical calculations. They demonstrate that the magneto-roton minimum is a precursor to the gap collapse associated with the Wigner crystal instability occurring near nu=1/7. In addition to providing a simple physical picture of the collective excitation modes, the theory allows one to compute rather easily and accurately experimentally relevant quantities such as the susceptibility and the ac conductivity.

714,557
PB86-187754 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Magnetic Field Dependence of the Small Angle Neutron Scattering in HoMo6Se8.
Final rept.
J. A. Gotaas, and J. W. Lynn. 1986, 2p
Grant NSF-DMR83-19936
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Magnetism and Magnetic Materials 54-57, p1529-1530 1986.

Keywords: *Superconductors, Neutron scattering, Magnetic fields, Phase transformations, Reprints, *Holmium molybdenum selenides, *Magnetic superconductors.

The field dependence of the modulated magnetic state in the superconductor HoMo6Se8 has been investigated using small angle neutron scattering. In zero field there is a single peak at the modulation wave vector (q sub c). A magnetic field induces a separate component at smaller q, with both components becoming increasingly anisotropic with field.

714,558
PB86-188463 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Structure of Dicalcium Potassium Heptahydrogen Tetrakis Phosphate Dihydrate, CA2KH7(PO4)4, 2H20, by X-ray and Neutron-Diffraction.
Final rept.
E. Prince, S. Takagi, M. Mathew, and W. E. Brown. 1984, 4p
Pub. in Acta Crystallographica Section C-Crystal Structure Communications 40, p1499-1502 1984.

Keywords: *Crystal structure, Calcium phosphates, X ray diffraction, Neutron diffraction, Chemical bonds, Hydrates, Reprints, *Calcium potassium hydrogen phosphates.

Ca2KH7(PO4)4 . 2H2O, M = 542. 25, triclinic, a = 5.676(1), b = 12.210(2), c = 6.292(1), alpha = 104.10(3) deg, beta = 115.16(2) deg, gamma = 84.25(2) deg, V = 382.79(A cubed), Z = 1, D =2.352 MgM-3. For X-rays, space group P1, lambda = 0.7107, R = 0.024 for 2040 independent observed reflections. For neutrons, space group P1, lambda = 1.273 A. R = 0.051 for 1383 independent observed reflections. The structure is isomorphous with Ca2(NH4)H7(PO4) 4 2H2O. Although K could occupy a center of symmetry, it apparently does not, and two of the three hydrogen bonds that would cross centers of symmetry in P(1 bar) are also markedly asymmetric.

714,559
PB86-189057 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Recent Advances in the Electron Microscopy of Materials.
Final rept.
D. B. Williams, and D. E. Newbury. 1984, 128p
Pub. in Advances in Electronics and Electron Physics 62, p161-288 1984.

Keywords: *Electron microscopy, Crystal structure, Crystal defects, Reprints, Transmission electron microscopy, Scanning electron microscopy.

Modern electron microscopy of materials involves a wide range of techniques, including transmission electron microscopy, scanning electron microscopy, scanning transmission electron microscopy, diffraction, and chemical microanalysis. Advances in instrumentation have made a variety of new techniques possible, including analytical electron microscopy, energy dispersive x-ray spectrometry, electron energy loss spectrometry. High resolution imaging of lattice fringes and structures of thin specimens is possible in the TEM and of thick specimens in the SEM. Contrast mechanisms are available for direct imaging of crystallographic, magnetic, electrical and thermal properties of a specimen. Combinations of imaging, diffraction, and analysis techniques provide complete materials characterization.

714,560
PB86-189180 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Impurity Bands and Band Tailing in Moderately Doped Silicon.
Final rept.
J. R. Lowney. 1986, 6p
Pub. in Jnl. of Applied Physics 59, n6 p2048-2053, 15 Mar 86.

Keywords: *Silicon, Conduction bands, Valence bands, Energy gap, Impurities, Reprints, *Band theory, Semiconductors, Density of states.

The density of states of the valence and conduction bands in silicon has been calculated at room temperature for dopant densities near the transition between the existence of a distinct impurity band and its coalescence with the continuum band to form a band tail. The dopant densities for the three cases considered are (1) 1.5 X 10 to the 18th power acceptors; (2) 6.2 X 10 to the 18th cm-3 acceptor; and (3) 1.2 X 10 to the 19th power cm-3 donors compensated by 6.2 X 10 to the 18th power cm-3 acceptors. The calculation is based on multiple-scattering theory with the self-energy calculated self-consistently to all orders of the interaction. The results show a small but significant amount of effective band-gap narrowing.

714,561
PB86-189198 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Neutron Powder Diffraction Study of the Structure of the Compound Li(sub 0.3125)La(0.5625)MoO4.
Final rept.
E. Lukacevic, A. Santoro, and R. S. Roth. 1986, 7p
Pub. in Solid State Ionics 18/19, p922-928 1986.

Keywords: *Crystal structure, Neutron diffraction, Reprints, *Lithium Lanthanum molybdates, Ionic conductivity, Rietveld method.

The structure of Li(0.3125)La(0.5625)MoO4 has been analyzed by the neutron powder diffraction technique and by the Rietveld method. The compound crystallizes with the symmetry of space group I41/a. The lattice parameters are a =5.3350 (1), C = 11.7584 (3) A. The structure is of scheelite type.

714,562
PB86-190683 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Conductivity in the Fractionally Quantized Hall Effect.
Final rept.
P. M. Platzman, S. M. Girvin, and A. H. MacDonald. 1985, 4p
Pub. in Physical Review B: Solid State 32, n12 p8458-8461, 15 Dec 85.

Keywords: *Hall effect, Electron gas, Reprints, *Fractional Quantum Hall effect, *Quantum Hall effect, Electrical conductivity.

Using the recently proposed single-mode magneto-roton ansatz for the dynamic structure factor of a two-dimensional electron gas in a strong magnetic field and a weak-coupling memory-function expression for the conductivity, the authors calculate the ac and dc conductivity of such systems in the fractionally quantized Hall regime. The results suggest new experimental tests of these ideas.

714,563
PB86-190691 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Calculations of Electron Inelastic Mean Free Paths from Experimental Optical Data.
Final rept.
C. J. Powell. 1985, 12p
Pub. in Surface and Interface Analysis 7, n6 p263-274 1985.

Keywords: *Electron scattering, *Mean free path, Copper, Magnesium, Aluminum, Aluminum oxide, Silver, Gold, Bismuth, Reprints, EV range 100-1000, KeV range 01-10.

Calculations are reported of inelastic mean free paths (IMFPs) for 100-2000 eV electrons in C, Mg, Al, Al2O3, Cu, Ag, Au, and Bi from experimental optical data. These calculations require knowledge of the momentum-transfer dependence of the differential scattering cross section; this information was taken from Penn's calculations. The calculated IMFPs agree reasonably with direct calculations and with measured electron attenuation lengths (ALs). Since accurate measurements of ALs are difficult, it is suggested that calculations of the present type are useful if the needed optical data are available. The present approach is also useful for materials (such as the transition and noble metals) for which it is not possible to make a meaningful distinction between valence-electron and core-electron excitations as required in current IMFP calculations.

714,564
PB86-190709 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Energy Dependence of Electron Attenuation Lengths.
Final rept.
C. J. Powell. 1985, 7p
Pub. in Surface and Interface Analysis 7, n6 p256-262 1985.

Keywords: *Electron scattering, Inelastic scattering, Reprints, Energy dependence, EV range 100-1000, KeV range 01-10.

An analysis has been made of electron attenuation length data for nine materials in terms of the Bethe theory for inelastic scattering in matter. It was found that the Bethe equation adequately described the energy dependence of the data in all materials over the typical range 100-1500 eV. The Bethe equation appears to be superior to the empirical relation proposed by Wagner, Davis, and Riggs (1980).

714,565
PB86-191335 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Local Properties in Orientationally Disordered Crystals with Translation-Rotation Coupling.
Final rept.
K. H. Michel, and J. M. Rowe. 1985, 10p
Sponsored by Institut Interuniversitaire des Sciences Nucleaires, Brussels (Belgium).
Pub. in Physical Review B: Condensed Matter 32, n9 p5827-5836, 1 Nov 85.

Keywords: Phase transformations, Abnormalities, Reprints, *Ferroelasticity.

In orientationally disordered crystals, the translation-rotation coupling affects both collective and local properties near ferroelastic phase transitions. The anomalous temperature behavior of the static mean-square displacements is investigated. The single-particle orientational distribution function in a deformable lattice is calculated and it is shown that molecular symmetry plays an essential role in addition to site symmetry. The theory is applied to a quantitative study of the alkali cyanides in the disordered phase and leads to an understanding of experimental results.

714,566
PB86-192192 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Critical Behavior and Magnetic Ordering in Amorphous TbFe2.
Final rept.
J. J. Rhyne, and C. J. Glinka. 1984, 3p
Pub. in Jnl. of Applied Physics 55, n6 pt2A p1691-1693 Mar 84.

Keywords: Neutron scattering, Transition temperature, Reprints, *Iron terbium, *Magnetic ordering, Amorphous materials, Spin glass state.

The zero field small angle neutron scattering from amorphous TbFe2 above the magnetization-determined Tc=409 K shows a conventional Lorentzian line shape with a spin correlation length which increases to only about 135 A at and just below (T sub c). On application of a field in the range 2-12 kG at 295 K, the overall scattering at finite Q is sharply suppressed indicating an increase in the ferromagnetic component with field. The residual magnetic scattering exhibits a prolate distortion of the intensity with respect

to the direction of H which demonstrates that the remaining spin clusters do not exhibit a ferromagnetic response.

714,567
PB86-192507 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Chemisorption-Induced Changes in Surface Magnetism and Electronic Structure: Oxygen on Ni(110).
Final rept.
A. Seiler, C. S. Feigerle, J. L. Pena, R. J. Celotta, and D. T. Pierce. 1985, 3p
Sponsored by Office of Naval Research, Arlington, VA., National Science Foundation, Washington, DC., and Consejo Nacional de Ciencia y Tecnologia, Mexico City.
Pub. in Physical Review B: Condensed Matter 32, n12 p7776-7778, 15 Dec 85.

Keywords: *Surfaces, *Nickel, Chemisorption, Oxygen, Ferromagnetic materials, Reprints, *Magnetism, *Electronic structure, Band theory, Electron spin polarization, Photoemission.

The effect of oxygen chemisorption on the Ni minority-spin 3d holes-and thus the Ni magnetic moment-is measured by spin-polarized inverse photoemission. A dramatic reduction of the minority-spin 3d holes is observed, indicating a strong involvement of these states in the chemisorptive bond. This reduction can be explained by a Ni3d-O2p interaction which redistributes the density of states; no indication of a reduced exchange splitting is found. Majority-spin sp states are shown to be unchanged at coverages below the onset of nucleation and oxide formation.

714,568
PB86-193208 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Spin Polarized Inverse Photoemission Studies of Surface Magnetism and Electronic Structure.
Final rept.
D. T. Pierce, A. Seiler, C. S. Feigerle, J. L. Pena, and R. J. Celotta. 1986, 5p
Sponsored by Office of Naval Research, Arlington, VA., and National Science Foundation, Washington, DC.
Pub. in Jnl. of Magnetism and Magnetic Materials 54-57, p617-621 1986.

Keywords: *Surfaces, Chemisorption, Nickel, Reprints, *Magnetism, *Electronic structure, Photoelectron spectroscopy, Band theory, Photoemission.

Spin polarized inverse photoelectron spectroscopy (SPIPES) is shown to be a powerful new technique to study surface and near-surface electronic structure and magnetism. The process, the information obtained, and the apparatus required in a spin polarized inverse photoemission measurement are compared to the complementary spin polarized photoemission measurement. Other SPIPES studies, such as the temperature dependent behavior of empty bands in ferromagnetic Fe, and future directions and applications of SPIPES are reviewed.

714,569
PB86-193786 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Neutron Rietveld Analysis of Structural Changes in NASICON Solid Solutions Na(1+X)Zr2 Si()P(-x)O12 at Elevated Temperatures: X = 1.6 and 2.0 at 320 deg C.
Final rept.
J. J. Didisheim, E. Prince, and B. J. Wuensch. 1986, 15p
Grant DE-AC03-76SF00098
Sponsored by Department of Energy, Washington, DC.
Pub. in Solid State Ionics 18/19, p944-958 1986.

Keywords: *Crystal structure, Solid solutions, Sodium inorganic compounds, Zirconium inorganic compounds, Reprints, Rietveld method, Phosphates.

Neutron Rietveld analyses of the structures of NASICON solid solutions as a function of composition have been extended to 320 C for the high-conductivity composition x = 1.6 and 2.0. The transformation from the room temperature monoclinic C2/c structure to the hexagonal high temperature phase involves small atomic displacements, ranging from 0.385A for Na(2) down to shifts of only a few hundredths of an Angstrom for several framework ions. The Na(1) interstice remains fully occupied to the temperature presently examined.

714,570
PB86-197357 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Reliability of the Isothermal Bulk Modulus Deduced from Model Equations of State.
Final rept.
R. G. Munro, S. Block, and G. J. Piermarini. Oct 84, 3p
Pub. in Jnl. of Applied Physics 56, n7 p2174-2176, 1 Oct 84.

Keywords: *Bulk modulus, Equations of state, Compressibility, Reprints, High pressure.

The evaluation of bulk material properties by the technique of fitting model isothermal equations of state to experimental data is discussed. Specifically, the evaluation of the isothermal bulk modulus is considered in terms of eight model equations. A sometimes serious difficulty in the application of model equations is identified, and the relationship between the error in the deduced value of the bulk modulus and the error in the measured lattice parameter or the pressure is investigated. It is found that certain of the eight equations should be avoided, and limits on the reliable application of the remaining equations are identified. Implications for the acquisition of data are discussed.

714,571
PB86-199080 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Spin Polarization of Secondary Electrons in Transition Metals: Theory.
Final rept.
D. R. Penn, S. P. Apell, and S. M. Girvin. 15 Dec 85, 16p
Pub. in Physical Review B 32, n12 p7753-7768, 15 Dec 85.

Keywords: *Transition metals, *Iron, *Nickel, Polarization(Spin alignment), Glass, Reprints, *Electron spin polarization, Secondary electrons.

A theory of the spin polarization of the secondary electrons in transition metals and glasses is presented. In contrast to the secondary-electron intensity distribution, the spin polarization is shown to yield useful information about the electron-electron interaction. The ratio of the lifetimes of majority- to minority-spin electrons can be determined directly from the measured values of the spin polarization. The theory is applied to both Fe and Ni.

714,572
PB86-200417 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Theory of Spin-Polarized Secondary Electrons in Transition Metals.
Final rept.
D. R. Penn, S. P. Apell, and S. M. Girvin. 29 Jul 85, 4p
Pub. in Physical Review Letters 55, n5 p518-521, 29 Jul 85.

Keywords: *Transition metals, Polarization(Spin alignment), Reprints, *Electron spin polarization, Secondary electrons, Magnetism.

It is shown that in contrast to the secondary-electron intensity distribution, the spin polarization, P(E), yields useful information about the electron-electron interaction. The ratio of lifetimes of majority- to minority-spin electrons can be determined directly from the measured values of P(E).

714,573
PB86-200425 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Spin Polarized Secondary Electrons: Theory.
Final rept.
D. R. Penn, S. P. Apell, and S. M. Girvin. 1986, 3p
Pub. in Jnl. of Magnetism and Magnetic Materials 54-57, p1041-1042 1986.

Keywords: Polarization(Spin alignment), Reprints, *Electron spin polarization, Secondary electrons, Magnetism.

It is shown that the spin polarization of the secondary electrons, P(E), yields useful information about the electron-electron interaction. The ratio of majority to minority spin lifetimes is related to the measured values of P(E).

714,574
PB86-201803 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Materials and Processes Div.
Preparation of Device Quality GaAs Using Plasma-Enhanced MO-CVD Technique.
Final rept.
K. P. Pande, and A. C. Seabaugh. 1983, 9p
Pub. in Proceedings of the Symposium on Opto-Electronics Epitaxy and Device Related Processes (3-5), San Francisco, CA., May 9-11, 1983, p201-209. Sponsored by Electrochemical Society, Inc., Pennington, NJ. Electronics Div.

Keywords: *Gallium arsenides, Semiconductors(Materials), Deposition, Epitaxy, Substrates, Plasma(Physics), *Chemical vapor deposition, Reactants.

Low-temperature (<450 C) deposition of single crystal GaAs using a new plasma-enhanced MO-CVD technique is described. In the technique, plasma is created by a dc potential and the substrate is not directly exposed to the plasma. Deposition of GaAs was achieved at extremely low plasma power (<5 W) using trimethylgallium (TMGa) and arsine (or trimethylarsenic) reactants. The resulting epitaxial films show excellent surface morphology and thickness uniformity over a large area substrate. A linear dependence of growth rate upon TMGa concentration was observed with a typical growth rate of 0.1 micrometer per minute for a TMGa flow rate of 15 cu cm per minute. Undoped films were found to be n-type with a room temperature carrier mobility in the range of 5200 sq cm/vs. Measurements on Schottky barrier devices fabricated on n/n(+) layers show uniform impurity doping profile and 55-V reverse breakdown voltage. Temperature dependence of the capacitance indicates a density of deep trapping centers as low as 6.2 x 10 to the 13th power/cu cm. Data on photoresponse of these devices are also presented.

714,575
PB86-202090 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Measurements and Standards Div.
Experimental Constraints on the Parameters Describing Unordered bcc 3He.
Final rept.
C. T. Van Degrift. 1983, 16p
Pub. in Proceedings of the American Institute of Physics Conference on Quantum Fluids and Solids, Sanibel Island, FL., April 11-15, 1983, p16-31.

Keywords: *Helium 3, Spin lattice relaxation, Body centered cubic lattices, Solidified gases, Nuclear magnetic resonance, Specific heat, Elastic properties, Magnetostriction, *Solid helium, Magnetism.

A wide variety of experimental results on the unordered phase of bcc (3) He are reviewed in light of recent high precision magneto-striction measurements made at NBS. Specific formulas are given for the volume dependence of the elastic constants, Debye temperature, exchange parameters J(t) and K(p), and the Zeeman-exchange spectral density function. Some topics for further research are identified.

714,576
PB86-202363 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Effect of Applied Fields on the Magnetic Order of Amorphous Tb(x)Fe(1-x) Alloys.
Final rept.
M. L. Spano, and J. J. Rhyne. 1986, 3p
Pub. in Jnl. of Magnetism and Magnetic Materials 54-57, p300-302 1986.

Keywords: Rare earth alloys, Neutron scattering, Magnetic fields, Reprints, *Iron terbium, *Magnetic ordering, Small angle scattering, Amorphous materials, Magnetism.

The effect of applied magnetic fields on the scattering cross section and spin correlation length xi in the amorphous alloys Tb(75)Fe(25) and Tb(2)F(98) has been studied using small angle neutron scattering. In

Tb(75)Fe(25), which shows effects of strong local random anisotropy, the correlation length at T/T(c) = approx 0.3 and = 0.7 is relatively independent of field up to the maximum 16 kOe used. In contrast, Tb(2)Fe(98) exhibited a sharp reduction in xi with H and a simultaneous abrupt drop in overall scattering intensity reflecting the formation of a near-infinite percolating cluster.

714,577
PB86-202371 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Spin Excitations in TbNi5 by Inelastic Neutron Scattering.
Final rept.
D. Gignoux, and J. J. Rhyne. 1986, 2p
Pub. in Jnl. of Magnetism and Magnetic Materials 54-57, p1179-1180 1986.

Keywords: Neutron scattering, Cryogenics, Single crystals, Magnons, Reprints, *Nickel terbium, Nickel intermetallics, Terbium intermetallics, Spin waves, Crystal field.

Spin waves and single-ion type magnetic excitations have been studied by inelastic neutron scattering at 4 K in a single crystal of the ferromagnetic (T(c) = 23K) hexagonal compound TbNi5 along the (q,0,0) and (O,O,q) propagation directions. One dispersive acoustic mode and two non-dispersive modes were observed. Crystal field and exchange parameters, in reasonable agreement with previous values obtained from magnetization data, were determined by a RPA pseudo-boson analysis.

714,578
PB86-207529 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Effect of Surface Beveling on Carrier Profiles.
Final rept.
J. Albers, C. L. Wilson, and J. L. Blue. 1983, 2p
Pub. in Electrochemical Society Extended Abstracts 83-1, p641-642 1983.

Keywords: *Charge carriers, Semiconductor junctions, Electron density(Concentration), Finite element analysis, Mathematical models, Reprints, *Semiconductors.

The two-dimensional potential distribution is calculated for a beveled structure by means of finite-element techniques. The calculations are presented for several forms of the dopant distribution as well as a number of choices of the surface recombination velocity. The effects of both of these variables on the location of the electrical junction are presented with particular attention to the implications of electrical profile measurements. The principal result of the calculation is that the total depletion width goes to zero where the junction intersects the beveled surfaces.

714,579
PB86-209202 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Methods of Producing Standard X-ray Diffraction Powder Patterns.
Final rept.
H. F. McMurdie, M. C. Morris, E. H. Evans, B. Paretzkin, W. Wong-Ng, and C. R. Hubbard. 1986, 4p
Pub. in Powder Diffraction 1, n1 p40-43 Mar 86.

Keywords: *X ray diffraction, *Crystal structure, Least squares method, Lattice parameters, Reprints, *Powder patterns.

Patterns useful for identification are obtained by automated diffractometer methods. The lattice constants from the experimental work are refined by least-squares methods; reflections are assigned hkl indices consistent with space group extinctions. Relative intensities, calculated densities, literature references, and other relevant data are included.

714,580
PB86-210010 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Investigations of Magnetic Microstructures Using Scanning Electron Microscopy with Spin Polarization Analysis.
Final rept.
J. Unguris, G. Hembree, R. J. Celotta, and D. T. Pierce. 1986, 2p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Magnetism and Magnetic Materials 54-57, p1629-1630 1986.

Keywords: Polarization(Spin alignment), Electron beams, Microstructure, Reprints, *Magnetization, *Electron spin polarization, Scanning electron microscopy, Secondary electrons.

A field emission scanning electron microscope was fitted with electron spin polarization analyzers in order to image submicron magnetic microstructures. Spin polarization analysis of the emitted secondary electrons provides a direct measurement of the magnitude and direction of the magnetization in the area probed by the incident electron beam. The polarization measurement is independent of topographic contrast which is measured simultaneously. The polarization was measured using a new type of analyzer which is very compact, simple, and at least as efficient as a Mott detector. The small detector size allowed the use of multiple orthogonal detectors so that all three components of the magnetization vector could be measured. The apparatus was used to examine the domain structure of various Fe-3% Si crystals.

714,581
PB86-212958 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Quasiparticle States and the Fractional Quantum Hall Effect.
Final rept.
A. H. MacDonald, and S. M. Girvin. 1986, 4p
Pub. in Physical Review B: Condensed Matter 33, n6 p4414-4417, 15 Mar 86.

Keywords: *Hall effect, Elementary excitations, Wave functions, Reprints, *Fractional quantum Hall effect, *Quantum Hall effect, *Quasi particles, Landau levels.

New trial wave functions are proposed for the quasiparticle states relevant to the fractional quantum Hall effect. The wave functions have the virtue that the quasiparticle energy gaps can be simply evaluated in terms of the ground-state correlation functions. In the N=0 Landau level the authors obtained (E sub g) approx = 0.114, (E sub g) approx 0.031 for nu = 1/3, nu = 1/5. In the N = 1 Landau level, for which they present the first estimates, they found (E sub g) approx = 0.059 and (E sub g) approx = 0.043 for the same fractional filling factors. The authors explain the physical origin of the unexpected difference in the nu dependence and comment on its relationship to recent experiments.

714,582
PB86-212966 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Collective Excitations of Frational Hall States and Wigner Crystallization in Higher Landau Levels.
Final rept.
A. H. MacDonald, and S. M. Girvin. 1986, 5p
Pub. in Physical Review B: Condensed Matter 33, n6 p4009-4013, 15 Mar 86.

Keywords: *Hall effect, Reprints, *Fractional quantum Hall effect, *Quantum Hall effect, Heterostructures, Collective excitations, Landau levels.

An expression has been derived for the collective-excitation dispersion for fractional Hall states which occur in higher orbital Landau levels in terms of the electron pair-correlation function in these states. Explicit results for the n = 1 Landau level have been obtained at fractional filling factors nu = 1/2 and nu = 1/5 based on Laughlin's trial wave functions for the ground state. The results at nu = 1/3 are qualitatively different from those in the lowest Landau level and are consistent with a weak quantum Hall effect at this fraction for n = 1. The results for nu = 1/5 are similar to those in the n = 0 Landua level but the collective excitations have a higher energy. The authors associate this increase with a decrease in the fractional filling factor at which Wigner crystallization occurs. A moment sum rule is derived for pair-correlation functions in higher Landau levels.

714,583
PB86-212974 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Disorder and the Fractional Quantum Hall Effect: Activation Energies and the Collapse of the Gap.
Final rept.
A. H. MacDonald, K. L. Liu, S. M. Girvin, and P. M. Platzman. 1986, 7p
Pub. in Physical Review B: Condensed Matter 33, n6 p4014-4020, 15 Mar 86.

Keywords: *Hall effect, Excitation, Reprints, *Fractional quantum Hall effect, *Quantum Hall effect, Heterostructures, Collective excitations.

The broadening of the collective excitations of a fractional quantum Hall state due to disorder is examined. Because of the absence of screening at long wavelength in this regime, the authors believe that the broadening depends mostly on the ionized impurity contribution to the disorder potential. The broadening of the collective excitation spectrum reduces the minimum excitation energy and eventually the gap required for the occurrence of the fractional quantum Hall effect collapses. The authors present some results on the necessary conditions for the gap to remain finite. These depend on some exact sum rules for three-point correlation functions of isotropic states constructed entirely within the lowest Landau level. Finally the relationship between their results and the activation energies seen in the magnetotransport coefficients is discussed.

714,584
PB86-214699 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
New X-ray Powder Diffraction Patterns from the JCPDS Associateship.
Final rept.
H. F. McMurdie, M. C. Morris, E. H. Evans, B. Paretzkin, W. Wong-Ng, and C. R. Hubbard. Mar 86, 21p
Pub. in Powder Diffraction 1, n1 p77-99 Mar 86.

Keywords: *X ray diffraction, *Crystal structure, Least squares method, Reprints, *Powder patterns.

The following new or updated patterns are submitted by the JCPDS Associateship at the National Bureau of Standards. The patterns are a continuation of the series of publications in NBS Circular 539 and NBS Monograph 25. The data for each phase apply to the specific sample described. A sample was mixed with 1 or 2 internal standards, traditionally silicon (SRM 640a), silver (a(0)=4.08651 A), tungsten (a(0)=3.16524 A), or fluorophlogophite (SRM 675). Data were measured with a computer controlled diffractometer, and computer programs were used to locate peak positions as well as to perform variable indexing and least squares cell refinement. Intensities were measured as peak heights above background, and were read manually from strip charts. Details of this procedure are given in another publication.

714,585
PB86-229671 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Effect of Fluid Flow Due to the Crystal-Melt Density Change on the Growth of a Parabolic Isothermal Dendrite.
Final rept.
G. B. McFadden, and S. R. Coriell. 1986, 6p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Crystal Growth 74, p507-512 1986.

Keywords: *Dendritic crystals, *Crystal growth, Supercooling, Fluid flow, Volume, Reprints.

The Ivantsov analysis of an isolated isothermal dendrite (with zero surface tension) growing into a supercooled liquid is extended to include the effects of the fluid flow due to volume contraction or expansion upon solidification. For an axisymmetric paraboloidal dendrite an analytic solution to the Navier-Stokes equations is obtained. The magnitude of the flow is proportional to the relative density change epsilon and the flow becomes negligible far from the surface of the dendrite. The temperature field consistent with the flow can also be found explicitly. The well-known expression that relates the dimensionless supercooling to the Peclet number in the absence of fluid flow is modified for nonzero epsilon, but the effect is of order epsilon and hence is seen to be minor for most values of epsilon and dimensionless supercooling that occur in practice.

714,586
PB86-230380 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Semiconductor Measurement Technology: Analytic Analysis of Ellipsometric Errors.
Final rept.
D. Chandler-Horowitz. May 86, 39p NBS/SP-400/78
Also available from Supt. of Docs as SN003-003-02733-2. Library of Congress catalog card no. 86-600541.

Keywords: *Polarimetry, Silicon, Oxides, Substrates, Thickness, Errors, Films, Computer programs, Fortran, *Ellipsometry, Refractive index, Uncertainty, Semiconductor materials.

A FORTRAN program was developed that calculates the ellipsometric measurement uncertainties for two models of a surface. The first is the simple bare isotropic substrate model. The second is the isotropic nonabsorbing film-substrate model. It is assumed that the sample to be measured ellipsometrically can be best described by one of these two models.

714,587
PB86-231123 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Local Structure at Mn Sites in Icosahedral Mn-Al Quasicrystals.
Final rept.
E. A. Stern, Y. Ma, and C. E. Bouldin. 1985, 4p
Pub. in Physical Review Letters 55, n20 p2172-2175, 11 Nov 85.

Keywords: X ray absorption, Reprints, *Quasicrystalline materials, *Aluminum manganese, Amorphous materials, Aluminum intermetallics, Manganese intermetallics.

Extended x-ray-absorption fine-structure measurements have been made at the Mn K edge of quasicrystalline and crystalline forms of an Al6Mn alloy. Two different quasicrystalline Mn sites are discerned to be populated in the ratio of tau, the golden mean, within experimental error. The more populous site is similar to that in the crystal but with bond-angle distortions and elimination of an unusually short Al-Mn bond, while the other site has additional bond-stretching distortions. The measurements, together with density measurements, indicate that the volume per Mn site is independent of the type of site.

714,588
PB86-238391 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Disclinations.
Final rept.
R. deWit. 1986, 3p
Pub. in Encyclopedia of Materials Science and Engineering, v2 p1208-1210 1986.

Keywords: *Defects(Materials), Magnetic domains, Liquid crystals, Reprints, *Disclinations, Dislocations.

The concept of the disclination is defined and briefly described.

714,589
PB86-238433 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Devices and Circuits Div.
Effect of Bevel Angle and Number of Points on Spreading Resistance Data-Analysis.
Final rept.
J. Albers, C. L. Wilson, and J. L. Blue. 1984, 1p
Pub. in Jnl. of the Electrochemical Society 131, n8 p319 1984.

Keywords: Mathematical models, Charge carriers, Angles(Geometry), Algorithms, Reprints, *Semiconductors, *Spreading resistance, Bevels.

The semiconductor equations are used to obtain the carrier profile along a beveled structure. The spreading resistance is calculated on a scale much finer than the present experimental resolution of the technique. Spreading resistance algorithms are used on data spaced at the present experimental resolution. The difference between atomic and carrier densities along the bevel and the errors inherent in finite-layer algorithms are investigated. This is meant to provide insight into limitations of spreading resistance due to these sources.

714,590
PB86-241361 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
CO Chemisorption on Ni(110): Effect on Surface Magnetism.
Final rept.
C. S. Feigerle, A. Seiler, J. L. Pena, R. J. Celotta, and D. T. Pierce. 1986, 4p
Prepared in cooperation with Consejo Nacional de Ciencia y Tecnologia, Mexico City. Sponsored by Office of Naval Research, Arlington, VA., and National Science Foundation, Washington, DC.
Pub. in Physical Review Letters 56, n20 p2207-2210, 19 May 86.

Keywords: *Carbon monoxide, *Chemisorption, *Nickel, Surfaces, Reprints, *Magnetism, *Electronic structure, Electron spin polarization, Photoemission.

The effect of CO chemisorption on the surface magnetism and unfilled electronic structure of Ni(110) is investigated by spin-polarized inverse-photoemission spectroscopy. A saturation in the reduction of the unfilled minority-spin d density of states is observed near 0.5-monolayer CO coverage and attributed to a reduction in the Ni-atom magnetic moments. Transitions into the CO (pi star) band are also observed with an intensity that increases nearly linearly with coverage. No transference of spin polarization from the Ni substrate to the CO (pi star) is found.

714,591
PB87-105037 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Center for Materials Science.
Contribution to the Theory of Surface Energy Minimizing Shapes.
Final rept.
J. W. Cahn, and J. E. Taylor. 1984, 4p
Pub. in Scripta Metallurgica 18, n10 p1117-1120 1984.

Keywords: *Surfaces, Free energy, Optimization, Reprints, Crystal surfaces, Flat surfaces.

A conjecture about the equilibrated shapes of facetted surfaces, which J. W. Cahn and others have believed true, is disproved by a counterexample.

714,592
PB87-105888 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
CITATION CLASSIC in Current Contents/Physical, Chemical and Earth Sciences.
Final rept.
D. R. Penn. 1985, 2p
Pub. in Current Contents/Physical, Chemical and Earth Sciences 25, n6 p20-21 1985.

Keywords: Dielectric properties, Reprints, *Semiconductors, Penn model.

A simple model for a semiconductor is proposed. The model is isotropic and the electrons occupy a sphere in a momentum space and are surrounded by an isotropic energy gap. The wave-number dependent dielectric function is calculated.

714,593
PB87-106142 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Ferromagnetic Resonance at 9.55 and 23.9 GHz in the Weak Ferromagnet Ni3Al.
Final rept.
B. Heinrich, J. F. Cochran, K. Myrtle, G. Lonzarich, and R. B. Goldfarb. 1986, 2p
Pub. in Jnl. of Magnetism and Magnetic Materials 54-57, p1011-1012 1986.

Keywords: Ferromagnetic materials, Cryogenics, Reprints, *Aluminum nickel, *Ferromagnetic resonance, Nickel intermetallics, Aluminum intermetallics.

Ferromagnetic resonance at microwave frequencies of 9.55 and 23.9 GHz has been measured in the archetypal weak itinerant ferromagnet Ni3Al in the temperature range 4-60 K. The observed FMR lines exhibited a strong Dysonian asymmetry and were well described over the whole temperature range by Maxwell's equations that included eddy currents, and by the Landau-Lifshitz (L-L) equation of motion including either Gilbert or L-L damping terms.

714,594
PB87-107330 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Rapid X-ray Topographic Examination of GaAs Crystals.
Final rept.
R. A. Forman, M. I. Bell, and S. Mayo. 1985, 7p
Pub. in Proceedings of Conference on Defect Recognition and Image Processing in III-V Compounds, Montepellier (France) July 2-4, 1985, p56-62.

Keywords: *Gallium arsenides, Crystal defects, Czochralski method, Crystal growth, *X ray topography, *Dislocations.

The design of a low-cost, high-throughput x-ray topography system is described, and its use in the examination of commercial GaAs wafers is demonstrated. Double-crystal reflection (Bragg) topographs are obtained in two minutes and transmission (Laue) topographs in fifteen minutes, using copper K(alpha) radiation from a conventional 1 KW fine-focus laboratory x-ray source. Reflection topographs of typical GaAs wafers using selected diffracting planes are presented, and their relative sensitivity to various defects are discussed. In crystals grown by the liquid encapsulated Czochralski method, transmission topographs using the (220) planes display the well-known large-scale dislocation patterns produced by relaxation of thermoelastic stress.

714,595
PB87-107371 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Epitaxial Growth and Some Properties of Samarium Crystals on Tungsten.
Final rept.
A. Ciszewski, and A. J. Melmed. 1984, 4p
Pub. in J. Phys., Colloq. C9, p39-42 1984.

Keywords: *Samarium, Vapor plating, Tungsten, Reprints, *Epitaxial growth, Low energy electron diffraction.

Samarium epitaxial crystalline layers have been grown by vapor deposition onto either tungsten field-electron emitters or a single macro-crystal, (011)-oriented tungsten low-energy-electron diffraction specimen. Optimum growth occurred for substrate temperatures in the range 650-750 K. The epitaxial relationship most commonly observed was (0001)Sm // (011)W with (11-20)Sm // (001)W. The surface lattice constant of Sm(0001) appears to be a few percent larger than the bulk value.

714,596
PB87-109864 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 91, Number 4, July-August 1986.
Aug 86, 84p
See also PB87-109872 through PB87-109898, and PB87-100186. Also available from Supt. of Docs as SN703-027-00011-3.

Keywords: *Research, Ophthalmology, Calibrating, Electron tunneling, Measurement, Radiation doses, Electron dosimetry.

Contents: Calibration of Beta-Particle Ophthalmic Applicators at the National Bureau of Standards; Room Temperature Gold-Vacuum-Gold Tunneling Experiments; Conference on Precision Electromagnetic Measurements.

714,597
PB87-109880
(Order as PB87-109864, PC **A05**/MF **A01**)
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Room Temperature Gold-Vacuum-Gold Tunneling Experiments.
E. C. Teague. 24 Apr 86, 45p
Included in Jnl. of Research of the National Bureau of Standards, v91 n4 p171-215 Jul-Aug 86.

Keywords: *Electron tunneling, Work functions, Gold, Vibration isolators, Theses, Scanning tunneling microscopy.

An experiment has been completed which demonstrated quantum mechanical tunneling of electrons between two gold electrodes separated in vacuum. The tunneling current between the gold electrodes has

been measured, for fixed voltages of 0.1 and 0.01 volts, as the electrode spacing was varied from a distance of approximately 2.0 nm down to a point where the electrodes touched. Current changes of over five orders of magnitude were found for electrode spacing changes of approximately 1.2 nm. For the first time, these data enable one to deduce the work function of the electrodes in a tunneling experiment from experimental parameters independent of the tunneling device. Also obtained were current-voltage characteristics for fixed electrode spacings in the direct tunneling region where electrode spacings were less than 2.0 nm.

714,598
PB87-119731 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Equilibrium and Diffusion in Stressed Solid Solutions with Defects.
Final rept.
F. Larche, and J. W. Cahn. 1986, 27p
Pub. in Solute-Defect Interaction: Theory and Experiment, p1-27 1986.

Keywords: *Diffusion, Solid solutions, Stresses, Thermodynamics, Creep properties, Reprints, Dislocations.

The recent developments in the thermodynamics of stressed solids with mobile components and defects are reviewed. Stress affects solubility and phase equilibria. The effect of stress on the composition field is equivalent to an additional elastic compliance and many problems of the equilibrium redistribution of mobile components in a stress field can be formulated as a purely elastic problem using what we call open-system elastic coefficients. The stress fields generated by an inhomogeneous composition field are an implicit part of the formulation. Diffusion in either an applied or self-generated stress field is considered. The concept of open-system elastic coefficients is presented. It greatly simplifies the equations of the thermodynamics of stressed solid solutions. It is used to study the interactions of dislocations and composition in isotropic and cubic crystals. The vacancies equilibrium is reviewed, in the interior and near the surfaces of a solid. The effects of these thermodynamics results on the diffusion equations and on their boundary conditions are examined. Problems connected with diffusional creep are discussed.

714,599
PB87-119756 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Standard X-Ray Diffraction Powder Patterns from the JCPDS Research Associateship.
Final rept.
H. F. McMurdie, M. C. Morris, E. H. Evans, B. Paretzkin, W. Wong-Ng, L. Ettlinger, and C. R. Hubbard. 1986, 14p
Sponsored by JCPDS-International Centre for Diffraction Data, Swarthmore, PA.
Pub. in Powder Diffraction 1, n2 p64-77 Jun 86.

Keywords: *Crystal structure, *X-ray diffraction, *Standards, Reprints, *Powder patterns.

Standard x-ray powder diffraction patterns are presented for 20 substances. These patterns, useful for identification, were obtained by automated diffractometer methods. The lattice constants from the experimental work were refined by least-squares methods, and reflections were assigned hkl indices consistent with space group extinctions. Relative intensities, calculated densities, literature references, and other relevant data are included.

714,600
PB87-119814 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Electron Tunneling Into Superconducting Filaments: Depth Profiling the Energy Gap of NbTi Filaments from Magnet Wires.
Final rept.
J. Moreland, J. W. Ekin, and L. F. Goodrich. 1986, 8p
Sponsored by National Research Council, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Advances in Cryogenic Engineering Materials 32, p1101-1108 1986.

Keywords: *Superconductors, *Electron tunneling, Reprints, *Niobium titanium, *Energy gaps (Solid state), Tunneling spectroscopy.

Squeezable electron tunneling (SET) junctions consisting of superconducting NbTi filaments (extracted from magnet wires) and sputtered Nb thin-film counter electrodes were used to determine the energy gap at the surface of the filaments. The current versus voltage curves of junctions immersed in liquid helium at 4 K were measured for a series of filaments taken from the same wire. Each filament had been etched to remove a surface layer of varying thickness so that the energy gap could be determined as a function of depth into the surface of an 'average' filament. It was found that some manufacturing processes yield filaments having surface layers with reduced energy gaps of 0.4 meV compared to measured interior bulk values ranging from 1.2 to 1.3 meV.

714,601
PB87-122545 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Effects of Crystal Field and Exchange Interactions on the Spin Excitations in Rare Earth Laves-Phase Compounds.
Final rept.,
J. J. Rhyne, and N. C. Koon. 1983, 9p
Pub. in Proceedings of International Conference on Magn. Rare-Earths Actinides, v1 p9-16 1983.

Keywords: Rare earth compounds, Iron intermetallics, Cobalt intermetallics, Neutron scattering, Magnons, *Spin waves, Exchange interactions, Magnetism.

Inelastic neutron scattering techniques have been used to probe the spin excitations of a series of Laves-phase compounds RT2 of rare earths (R) with Fe, Co, and Al (T). In these compounds, the dispersion of the various magnetic modes provides information on the rare earth crystal field interactions, and on the exchange couplings between (1) T elements (T-T), (2) T and R elements (T-R), or (3) between the R elements alone (R-R).

714,602
PB87-125753 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Electromechanical Properties of Superconductors for DOE (Department of Energy) Fusion Applications.
J. W. Ekin, J. Moreland, and J. C. Brauch. Mar 86, 112p NBSIR-86/3044
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.

Keywords: *Superconductors, Superconducting magnets, Critical field, Strains, Electron tunneling, Niobium intermetallics, Tin intermetallics, *Fusion reactors, *Niobium tin, Critical current, Lead molybdenum sulfides.

Contents:
- Uniaxial strain-effect characterization of new high-field experimental superconductors;
- High-field uniaxial strain effect characterization of candidate Nb3Sn superconductors for fusion applications--Internal tin, jelly roll, bronze process;
- Construction and initial testing of a transverse-stress-effect apparatus;
- Thermal contraction of several candidate sheathing and strengthening materials for superconductors;
- Electron tunneling into superconducting filaments using mechanically adjustable barriers;
- Appendix A--Effect of stainless steel reinforcement on the critical current versus strain characteristic of multifilamentary Nb3Sn superconductors;
- Appendix B--Further investigations of the solid-liquid reaction and high-field critical current density in liquid-infiltrated Nb-Sn superconductors;
- Appendix C:
  Japan trip report, December 5-14, 1984.

714,603
PB87-128013 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Thermal Fluctuations in Interfaces: From Fluid-Fluid Interfaces to Small-Angle Grain Boundaries.
Final rept.
C. Rottman. 1986, 10p
Pub. in Materials Science and Engineering 81, p553-562 1986.

Keywords: *Grain boundaries, *Interfaces, Reprints, Capillary waves, Dislocations.

In the tutorial overview, thermal fluctuations in several interfaces, especially small-angle grain boundaries, are considered. The emphasis is placed on large-distance fluctuations, which are important in characterizing equilibrium interfacial phases. Capillary wave fluctuations prove to be crucial in fluid-fluid interfaces and in the high temperature solidfluid interfacial phase. In small-angle grain boundaries the energy cost of simply allowing waves in the dislocation configurations which make up the boundary is much more than that of the corresponding capillary waves in fluid-fluid or solid-fluid interfaces. The introduction of dislocation loops with a different Burgers vector may be an important fluctuation in high temperature small-angle grain boundaries. Possible experimental consequences are presented.

714,604
PB87-128104 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Impurity Bands and Band Tailing in n-Type GaAs.
Final rept.
J. R. Lowney. 1986, 6p
Pub. in Jnl. of Applied Physics 60, n8 p2854-2859, 15 Oct 86.

Keywords: *Gallium arsenides, *Energy bands, Band structure of solids, Impurities, Reprints, N type semiconductors, Density of states.

The density of states of the valence and conduction bands of n-type GaAs has been calculated for a donor density of 10 to the 17th power/cc at 300 and 20 K. Both the donor-carrier and carrier-carrier interactions have been included. Band tails appear on both bands and the energy gap is narrowed. Calculations were also performed for a donor density of 10 to the 15th power/cc at 300 and 20 K. These results show the formation of an impurity band at 20 K, whereas a band tail exists at 300 K.

714,605
PB87-128344 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
High-Field Flux Pinning and the Strain Scaling Law.
Final rept.
J. W. Ekin. 1985, 5p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Proceedings of International Symposium on Flux Pinning and Electromagnetic Properties in Superconductors, Fukuoka (Japan), November 11-15, 1985, p267-271.

Keywords: *Superconductors, *Strains, Critical field, Niobium intermetallics, Tin intermetallics, *Flux pinning, Niobium tin, Scaling laws.

The effects of strain on flux pinning in superconductors are discussed. Significant differences between the strain scaling law, temperature scaling law, and the flux-line-shearing model of Kramer are demonstrated. The strain scaling law is more general than current flux-pinning models, and as such, it may serve as a guide to future work on flux pinning theory. Flux-pinning measurements at fields up to 24 T have been made on a series of high-quality Nb3Sn samples with third (and fourth) element additions. The data show that the usual extrapolation procedures for determining the bulk-average upper critical field in Nb3Sn lead to significant errors when additives such as Ti, Ta, Ga, and Hf are present.

714,606
PB87-128351 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Relationships between Mechanical and Magnetoelectric Properties of Oxygen-Free Copper at 4 K.
Final rept.
F. R. Fickett, and T. E. Capobianco. 1986, 7p
Pub. in Advances in Cryogenic Engineering Materials 32, p421-427 1986.

Keywords: *Copper, *Electrical resistivity, *Magnetoresistivity, Superconductors, Stabilization, Cryogenics, Reprints.

Commercially pure, oxygen-free copper is the material of choice for nearly all superconductor stabilization. Straining relatively pure copper at 4 K can result in significant increases in the residual resistivity and, thus, a decreased ability of the copper to stabilize the super-

conductor. In the paper the authors quantify the effect of strain on the resistivity and magnetoresistivity of a number of oxygen-free coppers from various sources and in various tempers. In addition, the low temperature stress-strain behavior of these materials and its correlation with room temperature data and the residual resistivity ratio (RRR) prior to straining is discussed. An apparatus developed for testing of mechanical properties of relatively small wire samples at low temperatures is described.

714,607
PB87-130050 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Neutron Diffraction Studies of the Icosahedral Phase of Al-Mn Alloys.
Final rept.
B. Mozer, J. W. Cahn, D. Gratias, and D. Shechtman. 1986, 10p
Pub. in Jnl. de Physique 47, n7 pC3-351-C3-360 Jul 86.

Keywords: *Neutron diffraction, *Crystal structure, Crystallography, Grain structure, Crystal lattices, Concentration(Composition), Reprints, *Aluminum manganese alloys, Icosahedral phase, Diffraction analysis.

Powder neutron diffraction studies were performed on three icosahedral alloys of the aluminum manganese system containing 27, 30, and 34 weight percent manganese. All peaks were found at the angles consistent with the icosahedral indexing with a six-dimensional cubic lattice parameter of approximately 0.65 nm that decreased with increasing Mn content. The relative intensities differ significantly from those found for X-rays. The intensities are not consistent with a quasilattice consisting of the 3-dimensional Penrose tiling with a .46 nm edge length along the 5-fold axis. It is consistent with a 1.0 nm edge along the 3-fold axis quasilattice node separation.

714,608
PB87-131801 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Tetrahedron Treatment of the FCC Lattice.
Final rept.
R. Kikuchi, and J. L. Murray. 1985, 38p
Pub. in CALPHAD: Computer Coupling of Phase Diagrams and Thermochemistry 9, n4 p311-348 1985.

Keywords: *Order disorder transformations, *Phase diagrams, Face centered cubic lattices, Computer programs, Reprints, *FCC lattices, Binary alloys, Copper gold.

A computer program for calculating the disorder-order phase diagrams of FCC-based binary alloys is presented. The cluster variation method is used, with the tetrahedron as the basic cluster. Ordered phases are the Cu3Au type (L1 sub 2) and the CuAu type (L1 sub 0). Energy parameters are independent of temperature and composition, and include the many-body effect with a tetrahedron. A detailed explanation of the computer program is presented in the main body of the paper. Three example calculations are shown.

714,609
PB87-134995 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Stacking Fault Tetrahedron.
Final rept.
G. Kalonji, and J. W. Cahn. 1986, 9p
Pub. in Philosophical Magazine A-Defects and Mechanical Properties 53, n4 p521-529 1986.

Keywords: *Crystal defects, *Stacking fault, *Tetrahedrons, Crystallography, Reprints.

Based on symmetry arguments the authors conclude that what is called a stacking fault tetrahedron is really a self-inclusion in which a portion of the same crystal is shifted by 1/4 (111) relative to the enclosing matrix. The included crystal has fewer atoms than would have been required to fill the hole in the matrix crystal with perfect material, and this is a way of accommodating clusters of vacancies. Symmetry shows that for this shift the energy is at an extremum and that the form of the inclusion must conform to the point group 4 bar 3m (tetrahedral). Compared to the usual description this is a simpler model and even the unrelaxed version has lower energy for small sizes. For intermediate sizes it would relax to the same description as the relaxed version of the defect as conventionally described, and at large sizes the stacking fault tetrahedra are unstable with respect to Frank loops.

714,610
PB87-135182 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Electronic Properties, Superconductivity and Stability of the Zr-Rh Alloys.
Final rept.
R. Kuentzler, and R. M. Waterstrat. 1985, 8p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Solid State Communications 54, n6 p517-524 1985.

Keywords: *Superconductors, Band structure of solids, Phase diagrams, Reprints, *Rhodium zirconium, Electronic specific heat, Magnetic susceptibility.

Experimental information on the electronic properties of ordered Zr-Rh alloys is presented through low temperature specific heat and magnetic susceptibility measurements. In general, a low density of states at the Fermi level is deduced and this is explained by a split band regime consistent with the known DOS calculations for the type of ordered structures considered. The existence of a split band is considered as typical of stable ordered structures. Zr2Rh, which is a superconductor with T(c) = 11.2 K, possesses a very high electronic specific heat coefficient. It is suggested that the high gamma value is associated with a decrease of stability of the ordered structure and increased ability to form amorphous alloys when the concentration of Zr increases.

714,611
PB87-135190 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Thermal Fluctuations in Low-Angle Grain Boundaries.
Final rept.
C. Rottman. 1986, 6p
Pub. in Acta Metallurgica 34, n12 p2465-2470 1986.

Keywords: *Grain boundaries, Dislocations, Entropy, Crystallography, Reprints, Thermal fluctuations.

Thermal fluctuations in a low-angle, symmetric tilt boundary composed of a series of dislocations of identical Burgers vectors are studied. At zero temperature the grain boundary is composed of equally spaced, coplanar, straight dislocations. At nonzero temperatures the dislocations are allowed to fluctuate a small distance both in and out of the zero-temperature plane. The energy of a sinusoidal fluctuation is shown to be linear in wave number for oscillations both parallel and perpendicular to the dislocations. These excitations give rise to a decrease in the / theta ln/theta// term of the grain-boundary free energy, where theta is the angle of misorientation between the two grains, linearly proportional to temperature. The grain boundary considered here, with these fluctuations, is argued to be smooth, not rough.

714,612
PB87-136610 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
High Pressure Crystallography.
Final rept.
S. Block, and G. Piermarini. 1983, 3p
Pub. in Crystallography in North America, Ch14, p265-267 1983.

Keywords: *Crystallography, *High pressure.

No abstract available.

714,613
PB87-140174 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Nondestructive Evaluation Activities in the Semiconductor Materials and Processes Division.
R. D. Larrabee, and M. I. Bell. Dec 86, 33p NBSIR-86/3495

Keywords: Electrical resistivity, Semiconductor devices, Line width, Raman spectroscopy, Photoluminescence, *Semiconductor materials, Fourier transform infrared spectroscopy, Deep level transient spectroscopy, Carrier lifetime, Ellipsometry, X ray topography.

This is the first in a planned series of annual reports describing the nondestructive evaluation and measurement development activities of the National Bureau of Standards in the area of semiconductor materials and devices. Present activities include production and certification of standard reference materials, development of new measurement techniques, and coordination of interlaboratory experiments and other activities of voluntary standards organizations.

714,614
PB87-140414 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Crystal Data: Version 1.0 Database Specifications.
Final rept.
J. K. Stalick, and A. D. Mighell. Nov 86, 75p NBS/TN-1229
Also available from Supt. of Docs as SN003-003-02781-2.

Keywords: *Crystal structure, Crystallography, Information retrieval, Minerals, Metals, Organometallic compounds, Tables(Data), Physical properties, Solid state physics, *Crystal data database, National Bureau of Standards.

The NBS Crystal Data database is a file of crystallographic and chemical data covering a broad spectrum of solid-state materials: inorganics, minerals, metals, intermetallics, organics, and organometallics. To be included in the database the unit-cell parameters of a material must be known. With the aid of computer programs, the data were evaluated by the Editors for reasonableness and self-consistency, and errors or possible errors are noted. The data items have been formatted in a standard way to permit searches. Each entry in the database contains unit-cell data (initial cell, convential Crystal Data cell, and reduced cell), space group or diffraction aspect, formula units per cell, observed and calculated densities, literature reference, chemical or mineral name, chemical formula, empirical formula, and an indication of the extent to which the atomic positional parameters have been determined. In addition to identification of unknowns by lattice-matching techniques, the large size of the database along with the combination of crystallographic, chemical and physical information make this file a valuable resource for all of solid-state science. Detailed format and content specifications are given.

714,615
PB87-149480 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
High Resolution Electron Microscopy Study of Irradiation Induced Defects in the B'''-Phase of Potassium Ferrite.
Final rept.,
Y. Matsui, Y. Bando, Y. Kitami, and R. S. Roth. 1985, 6p
Pub. in Acta Crystallographica, Section B, Structure Science B41, n1 p27-32 1985.

Keywords: *Crystal defects, *Ferrites, Electron microscopy, Reprints, *Potassium ferrates, *Physical radiation effects, High resolution.

A high resolution 1 MV electron microscope study of the B'''-type of potassium ferrite, with an ideal formula K2O.4FeO.15Fe2O3, was performed. The compound is beam sensitive and easily suffers from structural degradations during TEM observations, while the isostructural aluminate (B'''-alumina) is much more stable under similar irradiation conditions. The mechanisms of structural changes are discussed based on 1 MV high resolution structure images of electron induced defect blocks.

714,616
PB87-149563 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Polarized Electron Probes of Magnetic Surfaces.
Final rept.,
R. J. Celotta, and D. T. Pierce. 1986, 8p
Pub. in Science 234, p333-340, 17 Oct 86.

Keywords: Reprints, *Electron spin polarization, Polarized beams, Magnetism.

The magnetic properties of surfaces are now being explored with electron spectroscopics that use electron spin polarization techniques. The increased activity in surface magnetic measurements with polarized electron beams is spurred by new scientific and technological challenges and is made feasible by recent advances in the technology of sources and detectors of

polarized electrons. The ability to grow thin films and to engineer artificial structures permits new phenomena to be investigated at magnetic surfaces and interfaces. For such investigations, spin-polarized electron techniques-such as polarized electron scattering, polarized photoemission, polarized Auger spectroscopy, and scanning electron microscopy with polarization analysis-have been and will probably continue to be used to great advantage.

714,617
PB87-150785 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Elastic Interaction of a Wedge Crack with a Screw Dislocation.
Final rept.,
S. M. Ohr, S. J. Chang, and R. Thomson. 15 Mar 85, 5p
Sponsored by Oak Ridge National Lab., TN.
Pub. in Jnl. of Applied Physics 57, n6 p1839-1843, 15 Mar 85.

Keywords: *Screw dislocations, *Cracks, Crack propagation, Reprints, *Wedge cracks, Stress intensity factors.

The elastic field of a semi-infinite wedge crack and its interaction with a screw dislocation under mode III loading conditions are examined. The stress field around the wedge crack is expressed in terms of a wedge stress intensity factor. The rate of falloff of the stress field with distance from the crack tip is found to be a function of the wedge angle. The relationship between the stress intensity factors for the wedge and sharp cracks is derived and used to estimate the magnitude of stress relaxation occurring at the crack tip due to crack blunting. It is found that the emission of dislocations from the crack tip is more difficult when the crack is blunting.

714,618
PB87-151049 PC **A08**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
NBS (National Bureau of Standards) Reactor: Summary of Activities July 1985 through June 1986.
Technical note,
F. J. Shorten. Dec 86, 166p NBS/TN-1231
See also report for Jul 81-Jun 82, PB83-218636.

Keywords: *Neutron beams, *Research projects, Nuclear research and test reactors, Neutron irradiation, Neutron activation analysis, Materials test, Crystal structure.

The report summarizes all those programs which depend on the NBS reactor. It covers the period from July 1985 to June 1986. The programs range from the use of neutron beams to study the structure and dynamics of materials through nuclear physics and neutron standards to sample irradiations for activation analysis, isotope production, radiation effects studies, neutron radiography, and nondestructive evaluation.

714,619
PB87-153664 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Quasiparticle States in the Fractional Quantum Hall Effect.
Final rept.,
A. H. MacDonald, and S. M. Girvin. 1986, 15p
Pub. in Physical Review B 34, n8 p5639-5653, 15 Oct 86.

Keywords: *Hall effect, Wave functions, Reprints, *Fractional quantum Hall effect, Quantum Hall effect, Quasi particles.

The authors propose new trial wave functions for the quasielectron and quasihole states relevant to the fractional quantum Hall effect. The wave functions have the virtue that their charge densities and pair distribution functions can be simply expressed in terms of the distribution functions for the uniform-density ground state. Comparisons are made with other proposed trial wave functions for the quasiparticle states and with existing estimates of their densities and energies. Estimates are also given of quasielectron and quasihole energies in higher-orbital Landau levels which suggest that the relative strengths of the effect at different fractional fillings may be strongly Landau-level dependent.

714,620
PB87-157020 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Small-Angle Neutron Scattering Evidence for the Absence of Long-Range Magnetic Order in Amorphous Fe91Zr9.
Final rept.,
J. J. Rhyne, and G. E. Fish. 15 Apr 85, 3p
Pub. in Jnl. of Applied Physics 57, n8 p3407-3409, 15 Apr 85.

Keywords: Neutron scattering, Reprints, *Iron zirconium, *Magnetic ordering, Exchange interactions, Amorphous materials.

Small angle neutron scattering studies of an amorphous Fe(91)Zr(9) alloy have shown that there is no transition to long-range magnetic order in contrast to previous bulk magnetization results which indicated a transition to a ferromagnetic state at 220 K followed by a re-entrant spin glass state near 60 K. The scattering lineshape is Lorentzian in Q down to below 150 K and yields a spin correlation length which reaches a maximum of only 27 A at the transition (T sub f) = 210 K and exhibits an essentially constant plateau of 23 A down to helium temperature, with no evidence of a second transition in the 60-80 K range. The absence of ferromagnetic order in Fe(91)Zr(9) at Fe concentrations far above the percolation threshold suggests the presence of a very broad distribution of exchange fields arising from the random Fe site coordinates.

714,621
PB87-157079 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Low-Energy Diffuse Scattering Electron-Spin Polarization Analyzer.
Final rept.,
J. Unguris, D. T. Pierce, and R. J. Celotta. Jul 86, 10p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Review of Scientific Instruments 57, n7 p1314-1323 Jul 86.

Keywords: *Analyzers, Polarimeters, Metal films, Gold, Reprints, *Electron spin polarization.

A new, compact (approximately fist sized), efficient electron-spin analyzer is described. It is based on low-energy (150 eV) diffuse scattering from a high-Z target, for example, an evaporated polycrystalline Au film opaque to the incident electron beam. By collecting a large solid angle of scattered electrons, a figure of merit (S squared)/I(0)=0.0001 is achieved with an analyzing power S=0.11. The figure of merit degrades only marginally (<10%) for beams with an energy width of 40 eV or after one month of operation at 10 to the -8th power Torr. The electron optical acceptance is of order 100 (mm squared) sr eV. The details of the design and construction are discussed and its performance is compared to six other spin analyzers. Illustrative results are presented from an application to scanning electron microscopy with polarization analysis (SEMPA) to image magnetic microstructure.

714,622
PB87-161584 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Predictive Modeling of Quantitative Acoustic Emission Waveforms.
Final rept.,
H. N. G. Wadley, J. A. Simmons, and C. Turner. 1984, 15p
Pub. in Proceedings of Annual Review of Progress in Quantitative Nondestructive Evaluation (10th), Sanata Cruz, CA., August 7-12, 1983, p683-697 1984.

Keywords: *Crack propagation, Crystal defects, Ultrasonic radiation, Fractures(Materials), *Acoustic emissions, Acoustooptics, Elastodynamics, Laser applications.

The general elastodynamic theory for acoustic emission from defect sources is reviewed. A multipolar approximation is used to predict the epicenter waveforms for two models of cracking and thermoelastic generation by a laser pulse. The crack waveforms, while qualitatively unaffected by the crack model, exhibit quantitative differences, particularly at the leading edge. These differences indicate the potential of the acoustic emission method as a means of measuring crack growth microdynamics. The laser waveforms contain the effects of thermal diffusion for the first time. They are in excellent agreement with the experiment in two metals confirming the validity of the approach. The approach may provide a possible basis for a new quantitative method of thermal wave microscopy.

714,623
PB87-161600 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Nuclear Gamma-Ray Resonance Observations in a Aluminum-Based Icosahedral Quasi-Crystal.
Final rept.,
L. Swartzendruber, D. Shechtman, L. Bendersky, and J. W. Cahn. 1985, 3p
Pub. in Physical Review B-Condensed Matter 32, n2 p1383-1385 1985.

Keywords: *Aluminum alloys, Iron alloys, Manganese alloys, Mossbauer effect, Crystal structure, Reprints, *Quasicrystals.

Nuclear gamma-ray resonance (Mossbauer effect) results are presented from rapidly solidified Al-(Mn,Fe) alloys which contain the orientationally ordered phase with icosahedral point group symmetry. Detailed analysis of the spectra obtained are consistent with an icosahedral quasi-crystalline model for the structure of this phase.

714,624
PB87-161832 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Coherent Inelastic Neutron Scattering Study of Solid Orthodeuterium at High Pressure.
Final rept.,
J. W. Schmidt, M. Nielsen, and W. B. Daniels. 1984, 12p
Pub. in Physical Review (Section) B: Condensed Matter 30, n11 p6308-6319 1984.

Keywords: *Deuterium, Solidified gases, Neutron scattering, Thermal neutrons, Phonons, Inelastic scattering, Cryogenics, Reprints, *Solid hydrogen, *Solid deuterium, High pressure.

The phonon spectrum of solid deuterium has been measured using coherent inelastically scattered thermal neutrons. Measurements were conducted at a pressure range up to 4.5 kbar and a temperature range between 4K and 50K. Force constants of a harmonic model were calculated from the phonon energies at two densities 15.87 cc/mole and 14.4 cc/mole. Most bulk thermodynamic properties calculated from the force constants are in good agreement with directly measured values. Phonon energy shifts and linewidth increases were measured as functions of temperature.

714,625
PB87-161865 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Comment on 'Local Structure at Mn Sites in Icosahedral Mn-Al Quasicrystals'.
Final rept.,
E. A. Stern, Y. Ma, and C. E. Bouldin. 29 Sep 86, 2p
Pub. in Physical Review Letters 57, n13 p1658-1659, 29 Sep 86.

Keywords: *Crystal structure, Solidification, Silicon, Reprints, *Quasicrystals, *Aluminum manganese.

EXAFS measurements were made on icosahedral MnAl and MnSiAl and on the standards alpha-phase of MnSiAl and orthorhombic phase of MnAl6. Experimental evidence is presented that a cage of Mn atoms at the vertices of an icosahedron is the structural unit in the icosahedral MnSiAl and MnAl phases. The connections among these icosahedral units and between them and the Al atoms are different in the icosahedral phases and in the alpha-phase. As in the alpha-phase, the Mn icosahedra do not share vertices in the icosahedral phases; i.e., they are separated from one another. It is suggested that the i-phase grows by randomly nucleating together Mn icosahedra along their 20 threefold directions, as allowed by local steric constraints.

714,626
PB87-162129 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Suppression of Long-Range Order by Random Fields in Tb(x)Fe(1-x) Alloys.
Final rept.,
M. L. Spano, and J. J. Rhyne. 1985, 3p
Pub. in Jnl. of Applied Physics 57, n8 p3303-3305 1985.

Keywords: Iron intermetallics, Neutron scattering, Reprints, *Iron terbium, *Magnetic ordering, Amorphous materials, Terbium intermetallics.

The effect of random anisotropy and exchange fields on the 'phase transitions' in amorphous magnets has been examined in Tb2Fe98 and Tb75Fe25 using small wave-vector (Q) neutron scattering. These two alloys represent opposite extremes in relative magnitude of random anisotropy fields. The neutron results for the spin correlation lengths show that neither alloy exhibits long-range magnetic order well below its freezing temperature of 210K for Tb75Fe25 and approximately 245K for Tb2Fe98.

714,627
PB87-163648 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Electrical Transport Properties of Silicon.
Final rept.,
W. R. Thurber, and J. R. Lowney. 1985, 14p
Pub. in VLSI Handbook, Chapter 14, p177-190 1985.

Keywords: *Silicon, Semiconductor doping, Transport properties, Electrical resistivity, Carrier mobility, Electric fields, Integrated circuits, Very large scale integration, Temperature dependence, Minority carriers, Carrier lifetime, Metal oxide semiconductors.

This short review of the electrical transport properties of silicon was written as a chapter for a VLSI handbook. The titles of the seven sections are: (1) Definition of transport, transport equation; (2) Conversion between resistivity and dopant density; (3) Mobility of charge carriers; (4) Temperature dependence of resistivity and mobility; (5) Dependence of drift velocity on electric field; (6) Minority- carrier mobility, lifetime, and diffusion length; and (7) Mobility in an MOS inversion layer. The chapter includes five tables, seven figures, and thirty-five references.

714,628
PB87-163655 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
High Dopant and Carrier Concentration Effects in Gallium Arsenide: Band Structure and Effective Intrinsic Carrier Concentrations.
Final rept.,
H. S. Bennett. 15 Oct 86, 9p
Pub. in Jnl. of Applied Physics 60, n8 p2866-2874, 15 Oct 86.

Keywords: *Gallium arsenides, *Semiconductor doping, Band structure of solids, Concentration(Composition), Energy gap, Reprints, Density of states.

The quality and reliability of predictions from numerical simulations of GaAs/AlGaAs devices, such as heterojunction bipolar transistors, depend on model parameters. These parameters include the variations with doping and carrier concentrations of the valence- and conduction-band edges and of the effective intrinsic carrier concentrations for heavily doped p- and n-type gallium arsenide. The Klauder self-energy method is used to calculate the effects of interactions among carriers and dopant ions in heavily doped GaAs at 300 K. The carrier-carrier interactions of exchange and correlation are estimated by interpreting optical absorption measurements and by calculations based on degenerate theory.

714,629
PB87-165783 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Spin Density Wave Magnetism in Copper-Manganese Alloys.
Final rept.,
S. A. Werner, J. J. Rhyne, and J. A. Gotaas. 1985, 4p
Pub. in Solid State Communications 56, n5 p457-460 1985.

Keywords: *Copper manganese alloys, Neutron scattering, Inelastic scattering, Reprints, *Spin waves, Spin glass state, Magnetism, Magnetic ordering.

Extensive neutron diffraction and inelastic scattering experiments on Cu(1-x)Mn(x) single crystals, have been performed with special attention being given to the incommensurate magnetic peaks occurring at (1,0.5 + or - delta, 0) and equivalent positions in reciprocal space. The authors have examined these peaks as a function of composition (x = 0.10, 0.15, 0.20, 0.25), temperature, and energy transfer. Experiments performed under continuously higher resolution conditions show that the elastic component of the scattering cross-section approaches zero in the vicinity of the freezing temperature, and has a temperature behavior closely resembling that expected for an order parameter on approach to a critical point.

714,630
PB87-167672 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Properties of Ion Implanted Polycrystalline SI Layers Subjected to Rapid Thermal Annealing.
Final rept.,
S. R. Wilson, R. B. Gregory, W. M. Paulson, S. J. Krause, J. D. Gressett, A. H. Hamdi, F. D. McDaniel, and R. G. Downing. 1985, 8p
Pub. in Jnl. of the Electrochemical Society 132, n4 p922-929 1985.

Keywords: *Semiconducting films, *Silicon, Semiconductor doping, Polycrystalline, Annealing, Reprints, Ion implantation, Laser applications.

Polycrystalline silicon films have been deposited on thermally oxidized wafers. The films have been implanted with As, B, or BF2 and annealed with a rapid thermal annealer. The system uses infrared radiation from a resistively heated sheet of graphite to heat the entire wafer to temperatures in excess of 1000 degrees C for times on the order of a few seconds. The effects on sheet resistance, sheet carrier concentration and mobility due to exposure time, heater temperature and dopant species and resultant grain size are discussed.

714,631
PB87-172730 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Problems Associated with the Measurement of X-ray Attenuation Coefficients. I. Silicon Report on the International Union of Crystallography X-ray Attenuation Project.
Final rept.,
D. C. Creagh, and J. H. Hubbell. 1987, 11p
Pub. in Acta Crystallographica A43, p102-112 1987.

Keywords: *Silicon, Single crystals, Cross sections, Reprints, *X ray attenuation, Interlaboratory comparisons, KeV range 01-10, KeV range 10-1000.

X-ray attenuation coefficient measurements made on single-crystal silicon specimens by participants in the International Union of Crystallography X-ray Attenuation Project are presented for the energy range 8-60 keV. Twelve laboratories using eight different experimental configurations have provided data for analysis. A comparison is made between measurements using the different techniques at those characteristic wavelengths of interest to crystallographers. No basis was found for preferring one of three current theoretical tabulations of photoelectric absorption cross section over the others.

714,632
PB87-173746 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Conversion-Electron Extended X-ray-Absorption Fine-Structure Measurement of Ion-Damaged GaAs.
Final rept.,
C. E. Bouldin, R. A. Forman, and M. I. Bell. 15 Jan 87, 4p
Pub. in Physical Review B 35, n3 p1429-1432, 15 Jan 87.

Keywords: *Gallium arsenides, Conversion electrons, Reprints, *Physical radiation effects, Ion implantation, Extended x ray absorption fine structure.

Extended x-ray-absorption fine-structure (EXAFS) measurements of ion-implanted GaAs have been made using conversion-electron detection. This total-electron-yield detection technique (termed CEEXAFS) allows near-surface sensitivity with a sampling depth of 700-1000 A. The sampling depth of CEEXAFS has been measured for the first time, using standards with known depth-dependent structure. The CEEXAFS technique greatly reduces Bragg-peak contamination of the EXAFS signal from single-crystal materials, and allows measurement of a variety of samples which cannot be fabricated as thin layers for conventional transmission or fluorescence EXAFS measurements. The method permits examination of the local environment of host atoms (in this case Ga) in the near-surface region without interference from the underlying bulk and without the distortions found in fluorescence EXAFS measurements of concentrated samples.

714,633
PB87-179453 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Simple Model for the Dynamics Towards Metastable States.
Final rept.,
P. H. E. Meijer, M. Keskin, and E. Bodegom. 1986, 18p
Pub. in Statistical Physics 45, n1/2 p215-232 1986.

Keywords: *Quenching(Cooling), *Supercooling, *Metastable state, Reprints, Order parameters.

Circumstances under which a quenched system will 'freeze' in a metastable state are studied in simple systems with long-range order. The model used is the time-dependent pair approximation based on the most probable path (MPP) method. The time dependence of the solution is shown by means of flow diagrams. The fixed points and other features of the differential equations in time are independent of the choice of the rate constants. It is explained qualitatively how the system behaves under varying descending temperature, the role of the initial conditions, the dependence on the quenching rate, and the response to precooling.

714,634
PB87-179461 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Observations of the Diffraction of Evanescent X Rays at a Crystal Surface.
Final rept.,
P. L. Cowan, S. Brennan, T. Jach, M. Bedzyk, and G. Materlik. 10 Nov 86, 4p
Pub. in Physical Review Letters 57, n19 p2399-2402, 10 Nov 86.

Keywords: *X ray diffraction, *Crystal structure, Single crystals, Germanium, Reprints, *Crystal surfaces.

Diffraction of x rays from a crystal during total external reflection imposes structure on the x-ray wave field in three dimensions. Standing-wave interference modulates the x-ray intensity parallel to the surface, while boundary effects damp the intensity with distance normal to the surface both within the crystal and in the region above the surface. Experiments on carefully prepared Ge single crystals show that x-ray wave field can be manipulated to provide model-independent information on the structure of surfaces.

714,635
PB87-181814 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Symmetry and Supersymmetry in Crystals.
Final rept.,
L. H. Bennett, and R. E. Watson. Jan 87, 3p
Contract DE-AC02-76CH00016
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review B 35, n2 p845-847, 15 Jan 87.

Keywords: *Crystal symmetry, Reprints, Supersymmetry, Disclinations, Wigner-Seitz method.

An examination of the disclination network associated with hexagon faces of Wigner-Seitz polyhedra provides new insight into the supersymmetry associated with the three-dimensional space-group representation of centered crystals having nonunique asymmetric units in their description.

714,636
PB87-183117 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Isotope Effects in the PdH System: Lattice Dynamics of PdT(0.7).
Final rept.,
J. M. Rowe, J. J. Rush, J. E. Schirber, and J. M. Mintz. Dec 86, 4p
Pub. in Physical Review Letters 57, n23 p2955-2958, 8 Dec 86.

Keywords: *Lattice vibrations, *Isotope effect, Electron phonon interactions, Neutron scattering, Dispersion relations, Superconductivity, Tritium compounds, Reprints, *Palladium hydrides.

The quasiharmonic phonon dispersion relation of PdT(0.7) has been determined by coherent neutron scattering. Calculation of the phonon terms entering the current models for superconductivity in PdH, PdD, and PdT shows conclusively that the magnitude of the measured anharmonic frequency shifts is not sufficient to explain the reverse isotope effect in these systems. The effect of the large zero-point motion of the hydrogen isotopes on both the electronic structure and the electron-phonon interaction is estimated, and shown to be necessary to explain the experimental data.

714,637
PB87-191169 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Nuclear-Magnetic-Resonance Powder Patterns in Al6Mn, Al4Mn, and Al12Mn Polycrystals.
Final rept.,
G. H. Stauss, M. Rubinstein, E. J. Friebele, L. B. Bennett, and R. J. Schaefer. 1987, 5p
Pub. in Physical Review B35, n6 p2700-2704, 15 Feb 87.

Keywords: *Nuclear magnetic resonance, Polycrystalline, Reprints, *Aluminum manganese, Aluminum intermetallics, Manganese intermetallics, Knight shift, Quasicrystals.

The room-temperature nuclear-magnetic-resonance (NMR) spectra of polycrystalline Al(12)Mn, Al(6)Mn, and Al(4)Mn have been obtained. A resonance lineshape simulation computer program was used to obtain the Hamiltonian parameters which characterize these powder patterns. These three compositions were chosen for study because various workers have suggested that a relationship exists between the quasiperiodic icosahedral Al-Mn structure and one or another of these three Al-Mn compounds. After acquiring the NMR spectra of these three compounds, and obtaining the quadrupole coupling and Knight-shift parameters, the authors conclude that, based on the NMR data, the microscopic structure of quasiperiodic Al-Mn bears little resemblance to any of the compounds studied.

714,638
PB87-193553 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Influence of Individual Reflections on the Precision of Parameter Estimates in Least Squares Refinement.
Final rept.,
E. Prince, and W. L. Nicholson. 1985, 13p
See also report dated Aug 84, DE85-000830.
Pub. in Structure and Statistics in Crystallography, p183-195 1985.

Keywords: *Crystallography, Crystal structure, Least squares method, Precision, Reprints, Parameter estimation.

A formula is derived for determining the effect of additional measurements on the precision of refined parameter estimates when a correct structure model has been established. This formula is used in an analysis of the multiple refinements based on the data from the Single Crystal Intensity Project of the International Union of Crystallography, and it is shown that the weighting scheme used in previous studies places a very heavy emphasis on a small number of weak reflections. It is also shown that, if integrated intensities or values of (absolute value of F)squared are used as the observations, weak reflections have little or no influence on the refinement. An approach to the proper utilization of weak reflections is suggested, and a procedure for improving the precision of parameter estimates when experimental time is limited is proposed.

714,639
PB87-193561 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Long-Range Icosahedral Symmetry in a Metallic Phase Observed by Field Ion Microscopy.
Final rept.,
A. J. Melmed, and R. Klein. Mar 86, 4p
Pub. in Jnl. de Physique 47, pC2-287-C2-290 Mar 86.

Keywords: *Aluminum alloys, *Crystal symmetry, Manganese containing alloys, Reprints, *Quasicrystals, Field ion microscopy.

Direct observations by Field Ion Microscopy of an Al-12 at.% alloy confirm the earlier determination, by diffraction techniques, of icosahedral long range orientational order. Additionally, a large amount of local disorder, replete with defects or antiphase boundaries, is found. There is no evidence for systematic twinning which might acccunt for the observed orientational symmetry.

714,640
PB87-196358 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Properties of Electrodeposited Co-Cu Multilayer Structures.
Final rept.,
M. Dariel, L. H. Bennett, D. S. Lashmore, P. Lubitz, M. Rubinstein, W. L. Lechter, and M. Z. Harford. 1987, 3p
Pub. in Jnl. of Applied Physics 61, n8 p4067-4069, 15 Apr 87.

Keywords: *Electrodeposited coatings, *Metal films, *Cobalt, *Copper, Face centered cubic lattices, Magnetic anisotropy, Laminates, Reprints.

Alternate layers of Co and Cu of individual layer thicknesses from 1.5 to 8.0 nm and total thickness of about 100 layers and of Co bilayers separated by Cu have been electroplated from an electrolyte having a low concentration of Cu and a high concentration of Co atoms. The properties of the resulting structures have been analyzed using SEM, x-ray diffraction, VSM, and FMR methods. X-ray diffraction patterns indicate only the fcc structure. Assuming the Co thickness to be that deduced from the plating charge, the authors infer 4(pi)M values in the range 6.0-14.5 kG from VSM and FMR. Some uniaxial anisotropy is apparent in the system. These results are similar to those of earlier work on thin fcc Co layers in the same range of thicknesses, where the room-temperature moment was reduced but depended only slightly on layer thickness, and where the uniaxial anisotropy was observed to be small.

714,641
PB87-196374 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Where Are the Iron Atoms and Iron Moments in RFe(n)A1(12-n). A Wigner-Seitz Analysis.
Final rept.,
M. Melamud, L. H. Bennett, and R. E. Watson. 15 Apr 87, 3p
Pub. in Jnl. of Applied Physics 61, n8 p4246-4248, 15 Apr 87. See also DE87-001459.

Keywords: *Aluminum alloys, *Iron containing alloys, *Rare earth containing alloys, *Magnetic moments, Crystal structure, X ray diffraction, Neutron diffraction, Mossbauer effect, Reprints, Magnetic ordering, Wigner-Seitz method.

The ternary compounds RF(n)Al(12-n)(n=4,5,6; ThMn12 structure) form an extensive family of alloys having complicated magnetic structures, with the rare earths (R) and Fe ordering at different temperatures. The magnetic ordering has been inferred from magnetization, Mossbauer and neutron diffraction measurements. X-ray results are in disagreement with the magnetic measurements as to which sites are occupied by the Fe, and it is not clear at which of the sites iron has the largest magnetic moment. Recently, the authors have suggested that the occurrence of a substantial magnetic moment at an atomic site in certain magnetic systems can be related to the occurrence of - 72 degree disclination lines connecting atoms on the site. These disclinations are bond lines joining two near-neighbor atoms which have six nearest neighbors and can be recognized by a sixfold face appearing on the Wigner-Seitz polyhedra of the two atoms. The Wigner-Seitz construction and its use in the analysis of this and related problems are presented.

714,642
PB87-197901 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Oxygen Measurements in Thin Ribbon Silicon.
Final rept.,
S. L. Hyland, D. G. Ast, and A. Baghdadi. 1987, 6p
Pub. in Jnl. of Crystal Growth 82, p191-196 1987.

Keywords: *Silicon, *Oxygen, Measurement, Reprints, Fourier transform infrared spectroscopy, Ribbons.

The oxygen content of thin silicon ribbons grown by the dendritic web technique was measured, using a modification of the ASTM method based on Fourier transform infrared spectroscopy. Web silicon was found to have a high oxygen content, ranging from 13 to 19 ppma, calculated from the absorption peak associated with interstitial oxygen and using the new ASTM conversion coefficient. The oxygen concentration changed by about 10% along the growth direction of the ribbon. In some samples, a shoulder was detected on the absorption peak. A similar shoulder in Czochralski grown material has been variously interpreted in the literature as due to a complex of silicon, oxygen, and vacancies, or to a phase of SiO2 developed along dislocations in the material. In the case of web silicon, it is not clear which is the correct interpretation.

714,643
PB87-197976 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Moment Distribution in Amorphous Magnetic Ribbons by Mossbauer Measurements.
Final rept.,
M. Melamud, L. J. Swartzendruber, L. H. Bennett, J. Cullen, and M. Wun-Fogle. 1987, 3p
Pub. in Jnl. of Applied Physics 61, n8 p3644-3646, 15 Apr 87.

Keywords: *Magnetic moments, Mossbauer effect, Reprints, *Iron boride silicides, Amorphous materials, Ribbons.

Mossbauer effect measurements were obtained on smooth-surface Fe(78)B(13)Si(9) amorphous ribbons annealed in a transverse magnetic field at high temperature. Absorption spectra were obtained with the ribbon plane tilted at several angles with respect to the direction of the gamma rays, in an external field ranging from 0 to 10 Oe. Intensity ratios were analyzed to obtain the magnetization as a function of field. A large zero-field spread was deduced, and excess scatter near the anisotropy field was observed.

714,644
PB87-197984 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Initial Susceptibility Studies of Rapidly Solidified Monel.
Final rept.,
L. J. Swartzendruber, L. H. Bennett, and H. Ettedgui. 1987, 3p
Pub. in Jnl. of Applied Physics 61, n8 p3991-3993, 15 Apr 87.

Keywords: *Monel, *Nickel alloys, Copper containing alloys, Alternating current, Reprints, *Magnetic susceptibility, Temperature dependence, Magnetism, Rapid solidification.

The temperature dependence of the ac susceptibility for a Cu-Ni alloy near the monel composition (28 at % Cu) has been measured as a function of temperature for melt-spun material, both in the as-spun condition and after various isothermal anneals. The initial susceptibility of the as-spun material, in the form of a thin ribbon, is significantly affected by the small microscopic compositional inhomogeneity and microstructural defects present after the rapid quenching. Using Curie temperatures estimated from magnetization measurements, the results are compared to a simple model for the ac susceptibility.

714,645
PB87-197992 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Disclinations and Magnetism in Rare-Earth-Transition-Metal Hard Magnets.
Final rept.,
R. E. Watson, M. Melamud, and L. H. Bennett. 15 Apr 87, 3p
Contract DE-AC02-76CH00016
Pub. in Jnl. of Applied Physics 61, n8 p3580-3582, 15 Apr 87. See also DE87-001373. Sponsored by Department of Energy, Washington, DC.

Keywords: Rare earth containing alloys, Crystal structure, Magnetic properties, Magnets, Intermetallics, Reprints, *Iron neodymium, *Iron neodymium borides, *Magnetism, Disclinations, Wigner-Seitz method.

An important class of magnets, involving rare-earth and 3d transition metals and sometimes metalloids, includes Nd2Fe14B and Nd2Fe17. The authors have noted a correlation between the local site magnetism in these two compounds and whether those sites lie on nets of so-called major ligand lines or disclinations, i.e., bond lines shared by six common nearest neighbors. They propose that a criterion for choosing candidate alloys with strong 3d moments is the occurrence of such disclination nets. They have developed a computer program for the calculation of these nets, and using this, several structures having 3d sites with this characteristic have been found.

714,646
PB87-198065 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Antiferromagnetic Structure of the Cubic Superconductor ErPd2Sn.
Final rept.,
H. B. Stanley, J. W. Lynn, R. N. Shelton, and P. Klavins. 1987, 3p
Pub. in Jnl. of Applied Physics 61, n8 p3371-3373, 15 Apr 87.

Keywords: *Superconductors, Neutron diffraction, Intermetallics, Reprints, *Erbium palladium tin, *Antiferromagnetic materials, Cubic lattices, Magnetism, Crystal field, Heusler alloy.

Elastic and inelastic neutron scattering measurements have been made on the cubic Heusler alloy ErPd2Sn, which becomes superconducting at T(s) = 1.17K. Antiferromagnetic correlations are found to develop for T > T(s), with an antiferromagnetic transition occurring at T about 1.0 K. The magnetic structure is found to be type II, in which the fcc Er unit cell doubles along all three crystallographic directions. However, there are additional satellites of the allowed reflections which indicate a modulated component of the magnetization density.

714,647
PB87-198073 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Neutron Scattering Study of the Vibrational Density of States in Icosahedral and Crystalline Al(0.80)Mn(0.20).
Final rept.
P. F. Miceli, S. E. Youngquist, D. A. Neumann, H. Zabel, J. J. Rush, and J. M. Rowe. 1986, 4p
Contract DE-AC02-76ER01198, Grant NSF-DMR83-04890
Sponsored by Department of Energy, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Physical Review B 34, n12 p8977-8980, 15 Dec 86.

Keywords: Neutron scattering, Phonons, Reprints, *Aluminum manganese, *Quasicrystals, Density of states, Icosahedral phase.

An inelastic neutron scattering study was performed of the vibrational density of states, (g bar)(E), for the icosahedral and crystalline phases of Al(0.80)Mn(0.20). At low energy transfers the authors found nearly identical (g bar)(E) varies as E squared dependences indicating that the two materials are elastically similar. In the intermediate energy range, 20-35 meV, the crystalline (g bar)(E) shows weak structure while that of the icosahedral phase remains smooth. Above 40 meV there is an excess of the icosahedral (g bar)(E) compared with that of the crystalline material. These results provide a direct test for models of the interatomic forces and dynamics of the icosahedral phase.

714,648
PB87-198099 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Absolute Measurement of the Ordered Magnetic Moment in Holmium-Rich (Er(1-x)Ho(x))Rh4B4.
Final rept.
Q. Li, J. W. Lynn, and J. A. Gotaas. 1987, 9p
Pub. in Physical Review B 35, n10 p5008-5012, 1 Apr 87.

Keywords: *Magnetic moments, *Holmium, Neutron diffraction, Ferromagnetic materials, Superconductors, Reprints, *Erbium holmium rhodium borides, Form factors, Magnetic ordering.

Powder neutron diffraction measurements have been performed on ferromagnetic (Er(1-x)Ho(x))Rh4B4 for concentrations x=1.0, 0.89, 0.84, and 0.75 to determine the ordered magnetic moment and form factor for holmium. The magnetic scattering intensities have been put on an absolute basis by comparison with pure copper-powder Bragg peaks in order to avoid systematic errors that might be associated with the evaluation of the nuclear structure factors of the samples themselves. For HoRh4B4 the saturated magnetic moment was determined to be (mu sup Z)=(8.61 + or - 0.06) (mu sub B), which is in good agreement with our previous determination. The measurements on the alloys gave the same holmium moment within experimental error.

714,649
PB87-198107 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Magnetic Field-Induced Transition in Y(1-x)Gd(x).
Final rept.,
J. A. Gotaas, J. J. Rhyne, L. E. Wenger, and J. A. Mydosh. 1987, 3p
Grant NSF-DMR84-00711
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Applied Physics 61, n8 p3415-3417, 15 Apr 87.

Keywords: Rare earth alloys, Magnetic fields, Neutron diffraction, Phase transformations, Magnons, Reprints, *Gadolinium yttrium, Spin waves.

The magnetic field dependence of the spin structure in single crystals of Y(1-x) Gd(x) has been studied by neutron diffraction. In zero field, these dilute alloys exhibit long-range helical order with the propagation vector along the c axis and the magnetic moments lying in the basal plane. On applying a magnetic field in the basal plane, the modulation wave vector remains fixed at 0.28c*, and in fields up to 7 T there is no evidence for the development of higher harmonics. At a higher field Hc which depends on concentration and temperature, there is an abrupt reduction by a factor of 2 in the intensity for reflections along the c* axis, with no corresponding change in the intensity of basal plane reflections. This is consistent with a change in magnetic structure from the helical state to a linear modulated state in which the moments are collinear with the applied field in the basal plane but undergo a sinusoidal modulation along the c axis.

714,650
PB87-198123 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Neutron Diffraction and Electron Microscopy Examination of Barium Bromide-Barium Chloride (2/1).
Final rept.,
H. A. Eick, and E. Prince. 1986, 3p
Pub. in Acta Crystallographica C42, p915-917 1986.

Keywords: *Crystal structure, Neutron diffraction, Electron microscopy, Reprints, *Barium bromides, *Barium chlorides.

2BaBr2.BaCl2, BaBr(1.333)Cl(0.667), M(r)=282.312, Pnma, a=8.2031, b=4.8606, c=9.6359 A, V=384.20 A cubed, Z=4, D(x)=4.880 Mg m-3, lambda=1.5500 A, mu=0.023 mm-1, T=298 K; wR=0.0773 for 330 reflections. The anions occupy two crystallographic sites in an arrangement such that the larger square-pyramidal site is filled only with bromine atoms; the smaller tetrahedral site is occupied randomly by both chlorine and bromine atoms. No evidence for ordering of the chlorine and bromine atoms in the tetrahedral site was found.

714,651
PB87-198131 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Spin Dynamics of Amorphous Fe(90-x)Ni(x)Zr10.
Final rept.,
J. A. Fernandez-Baca, J. W. Lynn, J. J. Rhyne, and G. E. Fish. 1987, 3p
Pub. in Jnl. of Applied Physics 61, n8 p3406-3408, 15 Apr 87.

Keywords: Neutron scattering, Inelastic scattering, Magnons, Reprints, *Iron nickel zirconium, *Spin waves, Amorphous materials, Spin glass state.

Neutron inelastic scattering experiments have been performed in order to study the long wavelength spin dynamics of the amorphous Invar system Fe(90 - x) Ni(x)Zr10(for x = 5,10). Spin waves were observed over the entire range of wave vectors (0.05-0.15/A) and temperatures (0.3-0.9 Tc) under study. The spin-wave energies are well described by the quadrati dispersion relation (E sub q) = s(q squared + Delta), where Delta is a small gap due primarily to dipolar interactions. The findings suggest that there might be relevant spin-wave broadening mechanisms, perhaps due to the magnetic disorder in the system, in addition to magnon-magnon interactions.

714,652
PB87-208559 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Development of Standards for Superconductors, Interim Report January-December 1985,
L. F. Goodrich, S. L. Bray, W. P. Dube, E. S. Pittman, and A. F. Clark. Apr 87, 61p NBSIR-87/3066
Contract DE-AI01-76PR06010
See also PB86-128733. Sponsored by Department of Energy, Washington, DC.

Keywords: *Superconductors, *Standards, Intermetallics, Measurement, Stability, *Critical current, Standard reference materials, Niobium tin, Niobium titanium, Aspect ratio.

A cooperative program with the Department of Energy, the National Bureau of Standards, and private industry is in progress to develop standard measurement practices for use in large scale applications of superconductivity. The goal is the adoption of voluntary standards for the critical parameters and other characterizations of practical superconductors. Progress for the period January through December 1985 is reported. The major effort was the measurement of large conductor critical current. Other work reported here includes stability and a discussion of possible future Standard Reference Materials.

714,653
PB87-218319 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Magnetic Properties of Electrodeposited Copper-Nickel Composition-Modulated Alloys.
Final rept.,
L. H. Bennett, D. S. Lashmore, M. P. Dariel, M. J. Kaufman, M. Rubinstein, P. Lubitz, O. Zadok, and J. Yahalom. 1987, 7p
Pub. in Jnl. of Magnetism and Magnetic Materials 67, p239-245 1987.

Keywords: *Copper nickel alloys, Electrodeposited coatings, Magnetic properties, Reprints, Transmission electron microscopy.

Pulsed potentiostatic deposition offers a new technology for the production and stabilization of composition-modulated alloy (CMA) structures. Using this new technology, a series of Cu-Ni-modulated structures with layer thickness in the 1.4 to 6 nm range were prepared. The first transmission electron micrographs of electrodeposited CMA are presented, showing the existence of sharp interfaces. Magnetic properties of the CMA structures were measured by vibrating sample and SQUID magnetometers, and by ferromagnetic resonance.

714,654
PB87-219119 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Off-Diagonal Long-Range Order, Oblique Confinement, and the Fractional Quantum Hall Effect.
Final rept.,
S. M. Girvin, and A. H. MacDonald. 1987, 4p
Pub. in Physical Review Letters 58, n12 p1252-1255, 23 Mar 87.

Keywords: *Hall effect, Ground state, Wave functions, Reprints, *Fractional quantum Hall effect, *Quantum Hall effect.

The authors demonstrate the existence of a novel type of off-diagonal long-range order in the fractional-quantum-Hall-effect ground state. This is revealed for the case of fractional filling factor upsilon = 1/m by application of Wilczek's 'anyon' gauge transformation to attach m quantized flux tubes to each particle. The binding of the zeros of the wave function to the particles in the fractional quantum Hall effect is a (2+1)-dimensional analog of oblique confinement in which a condensation occurs, not of ordinary particles, but rather of composite objects consisting of particles and gauge flux tubes.

714,655

PB87-224523 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Diffraction Patterns from Tilings with Fivefold Symmetry.
Final rept.,
E. Prince. 1987, 8p
Pub. in Acta Cryst. A43, p393-400 1987.

Keywords: Alloys, Reprints, *Crystal structure, Diffraction intensities, Five fold symmetry, Penrose tilings, Quasicrystals.

A procedure involving projection from six-dimensional to three-dimensional space to describe objects that give sharp diffraction with fivefold symmetry can be reduced to the easier problem of projection from two dimensions to one dimension. This result is used to derive an explicit formula for the quasilattice contribution to the diffracted intensity for an arbitrary size and shape of the selection region. The predictions of this formula are compared with the electron diffraction patterns obtained from rapidly solidified aluminium-manganese alloys, and it is concluded that the edges of the rhombic faces of the three-dimensional objects from which models for these alloy structures may be constructed is larger than that used in previous analyses by a factor of tau(3), where tau is the golden mean. It is shown that the quasilattice density is proportional to the volume of the selection region in the complementary three-dimensional space into which a lattice point in six-dimensional space must project in order for the point to be included in the direct space; this results in important constraints on the possible structures of these alloys.

714,656

PB87-224598 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Relaxation of Anisotropic Correlations in (Two-Component) Supercooled Liquids.
Final rept.,
D. Thirumalai, and R. D. Mountain. 1987, 7p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Physics C: Solid State Physics 20, pL399-L405 1987.

Keywords: *Supercooling, Liquids, Glass, Anisotropy, Phase transformations, Reprints, Binary mixtures.

The dynamics of the anisotropic correlations in two-component supercooled liquids and glasses is examined using molecular dynamics. The correlation functions describing the local anisotropy are found to decay very slowly as the temperature is lowered. It is shown that the slow decay of these functions also results in long temporal correlations in the velocity autocorrelation functions. The implications of the study for the dynamical theories of glass transition are outlined.

714,657

PB87-225389 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Ising Spin Exchange Simulations on the MPP (Massively Parallel Processor).
Final rept.,
F. E. Sullivan, and R. D. Mountain. 1987, 5p
Sponsored by National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
Pub. in Proceedings of International Phoenix Conference on Computers and Communications (6th), Scottsdale, AZ., February 25-27, 1987, p74-78.

Keywords: Computerized simulation, Parallel processors, Computation, Algorithms, *Ising model.

The main purpose is to describe a very efficient MPP algorithm for performing one important class of Ising spin simulations. Results and physical significance of MPP calculations using the method described here will be discussed elsewhere. However, the authors will make a few comments on the problem under study and report briefly on results so far.

714,658

PB87-230926 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Variable Radius Curved Crystal Mount.
Final rept.,
A. Henins. 1987, 4p
Pub. in Review of Scientific Instruments 58, n7 p1173-1176 Jul 87.

Keywords: *Mountings, *X ray spectrometers, *X ray diffraction, Reprints.

A crystal mount has been developed which permits adjustment of the radius of curvature of the diffracting crystal in a curved crystal spectrometer without changing the crystal's orientation with respect to the instrument. This mount simplifies x-ray spectrometer design permitting a fixed crystal-to-detector distance. The scale of the instrument is readily changed by changing only this parameter.

714,659

PB87-230934 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Crystal Reflectivity for Bent Crystal Spectrometers.
Final rept.,
E. Kaerts, P. H. M. Van Assche, G. L. Greene, and R. D. Deslattes. 1987, 6p
Pub. in Nuclear Instruments and Methods in Physics Research A256, p323-328 1987.

Keywords: *Gamma spectrometers, *Silicon, *Diffraction, Reflectivity, Crystals, Reprints.

The reflectivity properties of a bent silicon crystal, used as the diffraction crystal in a transmission type Bent-Crystal Diffraction (BCD) spectrometer, were investigated. In particular the energy dependence of the integrated reflecting power was studied. It was found that the integrated reflecting power stayed constant up to unexpectedly high energies, depending on the diffraction order and on the quality of the crystal bending. Beyond an inflexion point this reflecting power decreased with only 1/E instead of 1/E squared with quartz crystals. Both this diffraction behavior and the improved energy resolution extend the usefulness of bent-crystal diffraction spectrometers beyond 1 MeV gamma ray energy. The results are discussed and interpreted in terms of the diffraction theory for perfect crystals.

714,660

PB87-232021 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Theoretical Aspects of the Quantum Hall Effect.
Final rept.,
S. M. Girvin. 1987, 7p
Pub. in Proceedings of the National Academy of Sciences 84, p4698-4700 Jul 87.

Keywords: *Hall effect, Quantum theory, Reprints, *Quantum Hall effect.

The talk focuses on the fractional quantum Hall effect which is a remarkable many-body phenomenon occurring in the two-dimensional electron gas at high magnetic fields and low temperatures. The Hall conductance of a real, macroscopic device is quantized in the form: sigma sub xy = nu(e squared/h, where nu is a rational fractional quantum number. Associated with this are vortex-like excitations which have fractional charge and other bizarre features. There are deep connections between the phenomenon and superfluidity and analogies with models of current interest in high-energy physics. The essence of the effect is that electrons in a magnetic field can turn into bosons by attaching themselves to flux tubes.

714,661

PB87-233383 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Models for Heavy Doping Effects in Gallium Arsenide.
Final rept.,
H. S. Bennett, and J. R. Lowney. 1987, 7p
Pub. in Jnl. of Applied Physics 62, n2 p521-527, 15 Jul 87.

Keywords: *Gallium arsenides, *Semiconductor doping, Charge carriers, Reprints, Doped materials, Density of states.

Klauder's self-energy method is used in a self-consistent calculation of the effects due to the interactions between carriers and dopant ions in GaAs at 300K. The many-body effects due to the interactions among the carriers themselves, exchange, and correlation, are estimated by evaluating expressions similar to those of Abram et al. at 300K. When densities exceed about 5 x 10 to the 16th power/cc in n-type GaAs and 10 to the 18th power/cc in p-type GaAs, carrier-dopant ion interactions and carrier-carrier interactions become significant and should be included in calculations of band structure changes and of properties which depend on the density of states such as carrier transport, effective intrinsic carrier concentrations, and coefficients for optical absorption.

714,662

PB87-233466 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
BCC (Body-Centered Cubic) and FCC (Face-Centered Cubic) Forms of Eu Epitaxially Grown on Re Surfaces.
Final rept.,
A. J. Melmed, V. Maurice, O. Frank, and J. H. Block. 1987, 3p
Pub. in Jnl. of Crystal Growth 84, p123-125 1987.

Keywords: *Crystal growth, *Epitaxy, Reprints, Field electron microscopy, Rare earths, Thin films.

Europium, a body-centered cubic metal, nucleates and grows generally in that form when vapor deposited onto a tungsten or rhenium field electron emitter surface, with no field present. However, on one special planar region of the (curve) rhenium substrate, europium nucleates and grows into a face-centered cubic crystal which is metastable. Field ion microscopy shows that the special surface consists of well-ordered parallel rows of atoms in a small facet which forms a template for epitaxy of (011)FCC Fu.

714,663

PB87-234035 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
New Developments in Neutron Powder Profile Analysis.
Final rept.,
A. Santoro. 1982, 6p
Pub. in God. Jugosl. Cent. Kristalogr. 17, p127-132 1982.

Keywords: *Neutron diffraction, Reprints, *Foreign technology.

No abstract available.

714,664

PB87-234076 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Low-Gravity Experiments in Critical Phenomena.
Final rept.,
M. R. Moldover. 1986, 23p
Pub. in Opportunities for Academic Research in a Low-Gravity Environment, v108, Chapter 2B, p57-79 1986.

Keywords: *Phase transformations, Separation, *Reduced gravity, Microgravity applications.

The opportunities for experiments in the area of critical phenomena which exploit low-g environments are reviewed. To test modern theories, sophisticated experiments are required. These experiments must be accompanied by ground-based research and detailed characterization of the low-g environment.

714,665
PB87-234092 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Challenge of Semiconductor Metrology.
Final rept.,
J. C. French, K. F. Galloway, and R. I. Scace. 1983, 18p
Pub. in Proceedings of Measurement Science Conference (1983), Palo Alto, CA., January 20-21, 1983, p1-18.

Keywords: *Semiconductor devices, *Metrology, Integrated circuits, Measurement, Standards, *Semiconductor materials, Calibration, US NBS.

Semiconductor technology has placed challenging demands on the metrologist to provide state-of-the-art capabilities for measurements of dimensional, electrical, thermal, and other physical properties of semiconductor materials, devices, and circuits in a form suitable for meeting the practical needs of science and of industry and its customers. The National Bureau of Standards is responding to these demands by providing generic new measurement methods, physical standards, and services, highlighted by examples given in the paper.

714,666
PB88-109053 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Matrix Approach to Symmetry.
Final rept.,
V. L. Himes, and A. D. Mighell. 1987, 10p
Pub. in Acta Crystallographica A43, p375-384 1987.

Keywords: *Crystal symmetry, *Matrices(Mathematics), Reprints.

In sharp contrast to other methods which focus on the consequences of symmetry (such as dot products, d spacings etc.), the matrix approach deals with symmetry in its most abstract form-represented as matrices. The basis of the matrix approach is to generate the matrices that transform the lattice into itself. The resulting group of matrices defines the holohedry of the lattice. These matrices may be used both theoretically and practically to analyze symmetry from any cell defining the lattice. The mathematics and algorithms used to analyze symmetry become simple as they are based on manipulating integers and simple rational numbers using elementary linear algebra.

714,667
PB88-110424 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Squeezable Junctions for Electron Tunneling and Surface Electric Field Experiment.
Final rept.,
J. Moreland. 1986, 7p
Pub. in Physics Teacher, p405-411 Oct 86.

Keywords: *Junctions, *Electron tunneling, Superconductors, Surfaces, Electric fields, Electrical measurement, Reprints, Scanning tunneling microscopy, Semiconductors.

Mechanically adjustable junctions can be used for electron tunneling or surface electric field measurements. The article conceptualized their application to semiconductors, superconductors, and surface physics of conducting materials.

714,668
PB88-110648 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Electron Tunneling Measurement of the Energy Gap in a La-Sr-Cu-O Superconductor.
Final rept.,
J. Moreland, A. F. Clark, H. C. Ku, and R. N. Shelton. May 87, 2p
Contract N00014-86-F-0109
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Cryogenics 27, p227-228 May 87.

Keywords: *Superconductors, *Electron tunneling, *Energy gap, Copper oxides, Strontium oxides, Critical temperature, Reprints, *Copper lanthanum strontium oxides, Lanthanum oxides.

The authors have used the break junction technique to determine the energy gap of lanthanum-strontium-copper-oxide, one of the new high critical temperature superconductors. The current-voltage characteristics demonstrated a variety of tunneling behaviors. The best characteristic indicating quasiparticle tunneling between superconducting electrodes implied an energy gap of 7.0 plus or minus 0.1 meV. Derivatives of other characteristics showed weak structure indicating possible energy gaps up to 9 meV.

714,669
PB88-110655 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Josephson Effect above 77 K in a YBaCuO Break Junction.
Final rept.,
J. Moreland, L. F. Goodrich, J. W. Ekin, T. E. Capobianco, A. F. Clark, A. I. Braginski, and A. J. Panson. 1987, 2p
Contracts N00014-86-F-0109, DE-A101-84ER52113
Sponsored by Office of Naval Research, Arlington, VA., and Department of Energy, Washington, DC.
Pub. in Applied Physics Letters 51, n7 p540-541, 17 Aug 87.

Keywords: *Superconductors, Barium oxides, Copper oxides, Yttrium oxides, Critical temperature, Reprints, *Barium copper yttrium oxides, *Josephson effect, Critical current.

The authors have observed the Josephson effect in a YBaCuO break junction. Critical currents as high as 10 mA were measured at 4 K for break junctions with a point contact within the fracture of a sample. The junction was susceptible to microwave radiation showing Shapiro steps with the ratio of V/f of 2.04 plus or minus 0.05 micro V GHz compared to the pair tunneling value of h/2e = 2.068 micro V/GHz. These steps were clearly visible in the current-voltage characteristics at temperatures up to 85 plus or minus 5 K.

714,670
PB88-110762 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Fluorescent Emission Spectra of Lithium Fluoride with Use of Synchrotron Radiation.
Final rept.,
K. L. Tsang, C. H. Zhang, T. A. Callcott, E. T. Arakawa, and D. L. Ederer. 1987, 4p
Grant NSF-DMR84-03541, Contract DE-AC05-84OR21400
Sponsored by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Physical Review B 35, n16 p8374-8377, 1 Jun 87.

Keywords: *Lithium fluorides, Synchrotron radiation, Single crystals, Emission spectra, Fluorescence, Excitons, Reprints, Soft x radiation.

The soft x-ray emission spectra of single-crystal LiF excited with synchrotron radiation are presented. The radiative decay of the lithium ls core exciton is observed. Radiative transitions between the valence band and the core hole are also observed in undamaged samples. Spectra obtained with broadband synchrotron-light excitation are shown to be dominated by diffuse scattering from damaged sample surfaces. Excitation with photon energies between 100 and 150 eV generates true emission spectra. An important result is that electrons excited into the conduction band are frequently trapped in an exciton state before recombining with the core hole.

714,671
PB88-117437 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Free Electronlike Stoner Excitations in Fe.
Final rept.,
D. R. Penn. 1987, 3p
Pub. in Jnl. of Applied Physics 61, n8 p3700-3702, 15 Apr 87.

Keywords: *Iron, Free electrons, Electron beams, Reprints, *Stoner excitations.

Methods have recently developed to probe the Stoner excitation spectrum which has not been amenable to study by neutron diffraction. The experiments have used energy loss spectroscopy combined with spin polarization of the incident electron beam or with spin polarization detection of the scattered beam, or both beam spin polarization and polarization detection. Due to the many possible scattering processes the experiments do not measure the Stoner excitation cross section directly but rather measure the magnitudes of combination of scattering amplitudes. To draw even semiquantitative conclusions regarding the Stoner spectrum requires theoretical analysis. Because Glazer and Tosatti (Solid State Commun. 52, 905 (1984)) give more complete information than previous experiments, it is possible for the first time to carry out a detailed theoretical analysis. The analysis concludes that free electronlike Stoner excitations (FESE) make a much larger contribution to the scattering than d electron Stoner excitations (DESE), the usual type.

714,672
PB88-117569 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Electron Tunneling Measurements of High Tc Compounds Using Break Junctions.
Final rept.,
J. Moreland, L. F. Goodrich, J. W. Ekin, T. E. Capobianco, and A. F. Clark. 1987, 2p
Sponsored by Office of Naval Research, Arlington, VA., and Department of Energy, Washington, DC.
Pub. in Japanese Jnl. of Applied Physics 26, Supplement 26-3, p999-1000 1987.

Keywords: *Superconductors, *Electron tunneling, Barium oxides, Yttrium oxides, Copper oxides, Josephson junctions, Reprints, *Copper lanthanum strontium oxides, *Barium copper yttrium oxides, Lanthanum oxides, Josephson effect.

The authors report on the break junction technique and its application to the high T(c) superconductors LaSrCuO and YBaCuO. In the technique, bulk samples are fractured and the freshly fractured surfaces adjusted to form a tunneling junction with vacuum or liquid helium as the insulating barrier. Precise mechanical adjustment permits the study of electron tunneling phenomena between pieces of a bulk superconductor. The current voltage characteristics of these break junctions are variable indicating sample inhomogeneity. However, some junction settings result in the more familiar quasiparticle signatures in the current voltage characteristics. Low leakage junctions indicate the presence of a sharp superconductive energy gap as well as large variations in junction conductance above the gap edge in both materials.

714,673
PB88-117593 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Evidence for Two Superconducting Components in Oxygen-Annealed Single-Phase Y-Ba-Cu-O.
Final rept.,
R. B. Goldfarb, A. F. Clark, A. I. Braginski, and A. J. Panson. 1987, 6p
Pub. in Cryogenics 27, p475-480 Sep 87.

Keywords: *Superconductors, Barium oxides, Yttrium oxides, Copper oxides, Critical temperature, Critical field, Alternating current, Reprints, *Barium copper yttrium oxides, Magnetic susceptibility.

The complex susceptibility of a sintered Y-Ba-Cu-O superconductor is strongly dependent on a.c. field amplitude, h. Annealing the material in oxygen gives rise to two distinct components, a relatively high-T(c) high-H(Cl), (lower critical field) superconductor (denoted as 'G' or 'good') and a relatively low-T(c), lowH (Cl) superconductor (denoted as 'B' or 'bad'). Two models might explain the susceptibility data. In the grain model, the G component consists of superconducting grains and the B component is either intergranular material, unfavorably orientated anisotropic grains, or oxygen-depleted grain boundaries. In the surface model, the G component is in the interior of the sample and the B component is at the sample's surface. This condition could arise if there was oxygen depletion at the surface subsequent to total enrichment during annealing.

714,674
PB88-117619 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.

Scanning Electron Microscopy with Polarization Analysis: High Resolution Images of Magnetic Microstructure.
Final rept.,
G. G. Hembree, J. Unguris, R. J. Celotta, and D. T. Pierce. 1987, 12p
Pub. in Scanning Microscopy Supplement 1, p229-240 1987.

Keywords: *Magnetic domains, Ferromagnetic materials, Microstructure, Gold, Reprints, *Scanning electron microscopy, *Electron spin polarization, Secondary electrons, Magnetic films, Domain walls.

Secondary electrons from a ferromagnet exhibit a spin polarization related to the net spin density of the valence electrons, i.e., directly proportional to the magnetization. Thus, secondary electron polarization analysis provides a direct measurement of the magnitude and direction of the magnetization in the area probed by the incident electron beam in the Scanning Electron Microscope (SEM). The polarization measurement is independent of topographic contrast and is obtained simultaneously with the conventional topographic image. A new, compact (approximately fist-sized), polarization analyzer utilizing low energy (150 eV) diffuse scattering from a polycrystalline Au target was specially developed for the application of Scanning Electron Microscopy with Polarization Analysis (SEMPA) to study closure domains in permalloy thin film recording heads and to observe the magnetic microstructure of a CoNi thin film recording high density media will be discussed. The variation of the spin within a domain wall of an Fe-based ferromagnetic glass is observed.

714,675
PB88-117684 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Thermodynamic Force on Line-Force Defects.
Final rept.,
J. P. Hirth, and I. H. Lin. 1987, 4p
Grant NSF-DMR83-11620
Sponsored by National Science Foundation, Washington, DC.
Pub. in Philosophical Magazine A 56, n1 p89-92 1987.

Keywords: *Dislocations(Materials), Crystal defects, Stresses, Elastic properties, Reprints, *Crystal dislocations, *Line defects.

The elastic fields of dislocation cores and cylindrical inclusions can be represented by line-force defects. The stress concentration at plate-like precipitates can be represented by pile-up arrays of such line-force defects. An expression is presented for the thermodynamic force on such a defect produced by stresses acting at its core. The result is convenient for treating pile-ups and other defect-interaction problems.

714,676
PB88-121934 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Front Material (Preface) for Proceedings of the 1982 NTD (Neutron Transmutation Doping) Conference.
Final rept.,
R. D. Larrabee. 1984, 326p
Pub. in Neutron Transmutation Doping of Semiconductor Materials, 326p 1984.

Keywords: *Semiconductor doping, *Meetings, *Neutron irradiation, *Transmutation.

No abstract available.

714,677
PB88-123716 PC **A99**/MF **E04**
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Results of the Monte Carlo Calculation of One- and Two-Dimensional Distributions of Particles and Damage: Ion Implanted Dopants in Silicon.
Special pub. (Final),
J. Albers. Sep 87, 675p NBS/SP-400/79
Also available from Supt. of Docs. as SN003-003-02821-5. Library of Congress catalog card no. 87-619864. Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *Silicon, Energy dissipation, Monte Carlo method, Frenkel defects, Semiconductor doping, Integrated circuits, Interstitials, Graphs(Charts), *Ion implantation, *Physical radiation effects, Doped materials, Very large scale integration, TRIM computer program, One dimensional, Two dimensional.

The Transport of Ions in Matter (TRIM) Monte Carlo code was used to calculate the two-dimensional distributions of particles, primary damage, and electronic and nuclear energy loss for implantation of a line beam source into silicon targets. Approximate two-dimensional distributions of the Frenkel pairs (vacancy-interstitial) created by the primary displacement damage of the target atoms were calculated by means of the Kinchin-Pease equation. These particle, damage, and energy loss distributions allowed for the calculation of the one-dimensional distributions of these quantities for implantation into unmasked targets. A superposition technique was used to construct the two-dimensional particle and approximate Frenkel pairs distributions for implantation past a mask edge. The energetic ions used in the calculations were in two groups: those used as intentional dopants in silicon device fabrication and those which either limited lifetime or acted as gettering sites. The particle distributions were parameterized by means of standard polynomial fitting techniques.

714,678
PB88-129671 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
X-ray Crystallographic Studies of Pb Monolayers on Cu (110) Surfaces.
Final rept.,
S. Brennan, P. H. Fuoss, and P. Eisenberger. 1986, 6p
Pub. in Physical Review B 33, n6 p3678-3683, 15 Mar 86.

Keywords: *Lead(Metal), *Monomolecular films, *Crystal structure, Metal films, X ray diffraction, Copper, Substrates, Melting, Reprints, Grazing incidence.

Grazing incident x-ray crystallographic studies of Pb monolayers on Cu (110) surfaces have been performed, and the unit cells of the commensurate p(5x1) phase and the incommensurate phase have been determined. The authors find that the commensurate Pb phase forms a unit cell that consists of four Pb atoms, and the incommensurate Pb cell consists of two atoms with a slightly larger near-neighbor spacing. In addition, the authors find large static displacements perpendicular to the (110) troughs for both phases which may account for some of the unusual two dimensional melting phenomena observed in the system.

714,679
PB88-129788 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Automated Method for Analyzing Images Containing Electron Diffraction Spots.
Final rept.,
D. S. Bright, and E. B. Steel. 1985, 3p
Pub. in Microbeam Analysis 20, p163-165 1985.

Keywords: *Electron diffraction, Polycrystals, Automation, Particles, Reprints, Image analysis, Computer applications.

The authors have applied to the analysis of agglomerate particles, a computer method that automates the analysis of spots in electron diffraction patterns. The method isolates the zone axis diffraction pattern in a polycrystalline diffraction image by isolating the spots from other features of the image, and then by selecting the spots that belong to a regular array. The method gives the basis vectors for the array which can then be used to identify the particle by comparison with standard diffraction data.

714,680
PB88-129911 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Transport Critical Current in Bulk Sintered Y1Ba2Cu3O(x) and Possibilities for Its Enhancement.
Final rept.,
J. W. Ekin. 1987, 6p
Contract DE-AI01-84ER52113
Sponsored by Department of Energy, Washington, DC.
Pub. in Advanced Ceramic Materials 2, n3B p586-591 1987.

Keywords: *Superconductors, Barium oxides, Copper oxides, Yttrium oxides, Reprints, *Barium copper yttrium oxides, Critical current, Superconducting weak links.

Several general processing methods for increasing the critical current density, (J sub c), in bulk sintered Y1Ba2Cu3O(x) superconductor are outlined. Data indicate that the transport Jc in bulk polycrystalline specimens is dominated by a weak-link region between high-Jc grains and that potentially much higher Jc may be possible. Two possible causes of such a weak-link phenomenon are considered: low-(T sub c) phases or impurities localized in the grain boundary region, and anisotropy of the superconducting properties. Several methods for minimizing the weak-link effects to increase the Jc are discussed.

714,681
PB88-134556 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
X-ray Photoelectron and Auger Electron Forward Scattering: A Structural Probe for Studying Ultrathin Epitaxial Films and Interfaces (Summary Abstract).
Final rept.,
W. F. Egelhoff. 1986, 2p
See also PB86-136918.
Pub. in Jnl. of Vacuum Science and Technology A 4, n3 pt1 p758-759 May/Jun 86.

Keywords: *Thin films, *Interfaces, *Epitaxy, Separation, Reprints, *Auger electron spectroscopy, *X ray photoelectron spectroscopy.

The summary abstract reviews recent experimental work and theoretical analyses which have demonstrated that forward scattering of XPS and Auger electrons by lattice atoms can provide very useful structural information on epitaxial films. Above a few hundred eV kinetic energy, an electron wave expanding radially from a lattice atom scatters strongly in the forward direction off of the nearest and next-nearest neighbor atom in the lattice. Constructive interference between the scattered and unscattered parts of the wave occurs along internuclear axes, producing enhanced intensities of core-level and Auger peaks along the internuclear axes. Thus the angular dependence of the spectra exhibit 'searchlights' of enhanced intensities, pointing out the internuclear or bond axes present in the near surface region. This kind of information is very useful for observing and analyzing interdiffusion, surface segregation, and other structural changes in ultrathin eppitaxial films. The high signal intensities obtainable make observations possible in real time. The real time aspect of the technique can yield a wealth of new information on dynamics in ultrathin films.

714,682
PB88-136577 PC **A10**/MF **A01**
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
NBS (National Bureau of Standards) Reactor: Summary of Activities July 1986 through June 1987.
Technical note,
F. J. Shorten. Nov 87, 201p NBS/TN-1240
Also available from Supt. of Docs. as SN003-003-02834-7. See also report dated Jun 83, PB83-218636.

Keywords: *Neutron scattering, Nuclear research and test reactors, Neutron diffraction, Neutron irradiation, Neutron activation analysis, Neutron radiography, Materials tests, Nondestructive tests, Crystal structure, Superconductivity, NBSR reactor, Materials testing reactors, Magnetism.

The report summarizes all those programs which use the NBS reactor. It covers the period for July 1986 through June 1987. The programs range from the use of neutron beams to study the structure and dynamics of materials through nuclear physics and neutron standards to sample irradiations for activation analysis, isotope production, neutron radiography, and nondestructive evaluation.

714,683
PB88-137112 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Interaction of Flows with the Crystal Melt Interface.
Final rept.,
M. E. Glicksman, S. R. Coriell, and G. B. McFadden. 1986, 29p
Pub. in Annual Review of Fluid Mechanics 18, p307-335 1986.

Keywords: *Crystal growth, *Fluid flow, *Interfaces, Alloys, Melts, Solidification, Convection, Reprints.

The interaction between fluid flow and crystal-melt interfaces is reviewed. The crystal-melt interface is a free boundary at which boundary conditions on temperature, solute concentration, and fluid velocity are satisfied. The degree of coupling between fluid flow and crystal-melt interface dynamics can vary widely. Several examples of strong coupling are identified. Topics covered include (1) boundary conditions at the crystal-melt interface, (2) morphological and double diffusive instabilities during directional solidification, (3) helical instabilities in succinonitrile melts, (4) Rayleigh-Benard convection in crystallizing systems, (5) channel segregation and welding, as examples of engineering applications.

714,684
PB88-138730 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
AC Susceptibility Measurements Near the Critical Temperature of a Y-Ba-Cu-O Superconductor.
Final rept.,
R. B. Goldfarb, A. F. Clark, A. J. Panson, and A. I. Braginski. 1987, 3p
Pub. in Proceedings of Symposium S, Spring Meeting of the Materials Research Society, Anaheim, CA., April 23-24, 1987, p261-263.

Keywords: *Superconductors, Barium oxides, Copper oxides, Yttrium oxides, Critical temperature, Alternating current, *Barium copper yttrium oxides, *AC losses, Magnetic susceptibility.

The loss component of complex susceptibility of a Y-Ba-Cu-0 superconductor near its critical temperature is strongly dependent on ac field amplitude but virtually independent of frequency. This implies that magnetic hysteresis is the major loss mechanism in these materials. The temperature at which the loss first becomes positive upon warming corresponds to an equivalence between the amplitude of the ac field and the lower critical field of the superconductor.

714,685
PB88-139043 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Spin Density Waves in Cu-Mn.
Final rept.,
J. A. Gotaas, J. J. Rhyne, and S. A. Werner. 1985, 3p
Sponsored by American Inst. of Physics, New York, and Institute of Electrical and Electronics Engineers, Inc., New York.
Pub. in Jnl. of Applied Physics 57, n8 pt2A p3404-3406, 15 Apr 85.

Keywords: *Copper alloys, *Manganese alloys, Neutron scattering, Magnons, Magnetic alloys, Face centered cubic lattices, Reprints, *Spin waves, Magnetism.

The incommensurate magnetic peaks occurring in Cu(1-x) Mn(x) at (1, 0.5 + or - delta, 0) and equivalent positions in reciprocal space have been studied in an extensive series of neutron scattering experiments. It is found that delta varies linearly with composition, and that the width of these peaks corresponds to a correlation range of about 10 fcc unit cells. The symmetry of the magnetic scattering indicates that there are 12 spin density wave domains. Experiments performed under high resolution conditions (61 mu eV) show that the elastic component of the magnetic scattering cross section at (1, 0.5 + or - delta, 0) approaches zero in the vicinity of the 'freezing' temperature T(f), closely resembling the behavior of an order parameter going to zero at a Neel point.

714,686
PB88-139050 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Reentrant Spin-Glass Order Parameter in (Fe(0.3)Ni(0.7))75P16B6Al3.
Final rept.,
R. W. Erwin, J. W. Lynn, and A. Magerl. 1986, 2p
Sponsored by American Inst. of Physics, New York, Applied Psychological Services, Inc., Wayne, PA., and National Research Council, Washington, DC.
Pub. in Jnl. of Magnetism and Magnetic Materials 54-57, pt1 p101-102 Feb 86.

Keywords: Neutron scattering, Iron alloys, Nickel alloys, Boron containing alloys, Phosphorus containing alloys, Aluminum containing alloys, Reprints, *Spin glass state, Order parameters.

High-resolution neutron backscattering measurements have been performed on the amorphous reentrant spin glass (Fe(0.3)Ni(0.7)75P16B6Al3. These measurements confirm that there are two distinct time scales in the spin-glass temperature regime. The longer time scale can be identified with microdomain lifetimes and thus the resulting elastic scattering measures a spin-glass order parameter, while the characteristic fluctuation times are at least five orders-of-magnitude faster.

714,687
PB88-139068 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Monte Carlo Simulation of Dilute Magnetic Semiconductors for High Concentrations of the Magnetic Component.
Final rept.,
T. M. Giebultowicz. 1986, 2p
Pub. in Jnl. of Magnetism and Magnetic Materials 54-57, p1287-1288 1986.

Keywords: Monte Carlo method, Antiferromagnetism, Reprints, *Magnetic semiconductors, *Semiconductors, Cadmium manganese tellurides, Manganese sulfides.

A model of dilute magnetic semiconductors has been studied by Monte Carlo methods in the concentration range 0.7 = or < x = or < 1. Results obtained for x = 0.7 and x = 1 are compared with experimental data for Cd(0.3)Mn(0.7)Te and beta-MnS. For concentrations 0.85 = or < x = or < 1 the system is found to exhibit a type of 'antiferromagnetic reentrant behavior.'

714,688
PB88-139076 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Long-Range Incommensurate Spin State in Dilute YGd Alloys.
Final rept.,
J. A. Gotaas, J. J. Rhyne, L. E. Wenger, and J. A. Mydosh. 1986, 2p
Pub. in Jnl. of Magnetism and Magnetic Materials 54-57, Part I, p93-94 Feb 86.

Keywords: *Yttrium alloys, Neutron diffraction, Single crystals, Magnetic moments, Reprints, *Gadolinium alloys, *Spin states, Magnetic ordering, Temperature dependence.

Neutron diffraction measurements on single-crystal Y(2.2%Gd) reveal that the alloy orders (T(N)=6.64K) with a long-range periodic incommensurate spin structure with moments in the basal plane and a propagation vector of .28c. The temperature dependence of the Gd moment derived from the integrated neutron intensities is similiar to that of Gd metal.

714,689
PB88-139084 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD.
Periodic and Quasiperiodic Crystals.
Final rept.,
D. Gratias, and J. W. Cahn. 1986, 5p
Pub. in Scripta Metallurgica 20, n9 p1193-1197 Sep 86.

Keywords: Reprints, *Quasicrystals, Hyperspaces, Shechtmanite.

The paper is one of six papers of a 'viewpoint set' examining various aspects of quasicrystals. The authors enlarge the definition of crystals in order to include quasicrystals in a more general crystallography: crystals are solids with long-range orientational and translational, but not necessarily periodic, order and spatial homogeneity. The authors show that quasicrystals arise as a limit, which can either be seen as infinite unit cell crystals, or converge to an irrational cut of a hyperspace periodic crystal.

714,690
PB88-139092 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD.
Pauling's Model Not Universally Accepted.
Final rept.,
J. W. Cahn, D. Gratias, and D. Shechtman. 1986, 2p
Pub. in Nature 319, n6049 p102-103 1986.

Keywords: *Crystal structure, Crystal symmetry, Twinning, Reprints, *Icosahedral phase, *Quasicrystals, Pauling model, Cubic lattices.

This is a reply both to a letter (Nature 317, p. 512, 1985) by Linus Pauling 'Apparent Icosahedral Symmetry is Due to Directed Multiple Twinning of Cubic Crystals' and an editorial (Nature 317, p. 417, 1985) by the editor of Nature, John Maddox, regarding a model Pauling proposed to explain a limited portion of their data while ignoring all of the other data.

714,691
PB88-141353 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Spin Dynamics of Amorphous Fe(0.86)B(0.14).
Final rept.,
J. A. Fernandez-Baca, J. W. Lynn, J. J. Rhyne, and G. E. Fish. 1986, 3p
Pub. in Physica B and C 136, n1-3 p53-55 1986.

Keywords: *Magnons, Iron alloys, Boron containing alloys, Neutron scattering, Inelastic scattering, Invar, Reprints, *Spin waves, Heisenberg ferromagnets, Amorphous materials.

A high resolution neutron inelastic scattering experiment has been performed in order to study the spin dynamics of amorphous Fe(0.86)B(0.14), which exhibits Invar properties. Spin waves were observed in the wave vector range 0.05/A = or < q = or < 0.13/A, at temperatures between 0.53 T(c) and 0.93 T(c). There are no anomalies in the spin-wave lifetimes at long wavelengths which appear to relate to the Invar effect seen in Fe(0.86)B(0.14).

714,692
PB88-141361 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Spin Stiffness Anomaly in the Reentrant Spin-Glass (Fe(0.25)Ni(0.75))(0.75)P(0.16)B(0.06)Al(0.03).
Final rept.,
R. W. Erwin, J. W. Lynn, J. J. Rhyne, and H. S. Chen. 1985, 3p
Sponsored by American Inst. of Physics, New York, and Institute of Electrical and Electronics Engineers, Inc., New York.
Pub. in Jnl. of Applied Physics 57, n8 pt2A p3473-3475, 15 Apr 85.

Keywords: *Ferromagnetic materials, Magnetic alloys, Iron alloys, Nickel alloys, Phosphides, Borides, Aluminides, Neutron scattering, Magnons, Reprints, Spin glass state, Magnetism, Amorphous materials.

Low field magnetization measurements have shown that the amorphous alloy mentioned in the title becomes a demagnetization-limited ferromagnet below a Curie temperature T(c) of 200 K, but that the spontaneous magnetization vanishes again below a reentrant temperature T(R) of 10 K. Inelastic neutron scattering measurements have been performed to study the spin-wave dynamics as the spin-glass state is entered from the ferromagnetic state. An elastic component of the magnetic scattering, attributed to a spin-glass order parameter, is also observed.

714,693
PB88-147236 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Development of Increasing Surface Roughness during Ion Sputtering.
Final rept.,
D. Marton, and J. Fine. 1987, 7p
Pub. in Thin Solid Films 151, p433-439 1987.

Keywords: *Surface roughness, *Ion irradiation, *Sputtering, Statistics, Depth, Resolution, Reprints.

A simple statistical model has been developed to explain the development of surface topography (roughness) during ion sputtering of solid targets. The square root depth dependence of the surface roughness is explained by assuming that the roughness is caused by the differences in sputtering rates obtained on differently oriented crystallographic surfaces, and that the distribution of the sputtering rates is fully random. Deviations from the random distribution of the sputtering rate lead to different types of depth dependence of the surface roughness.

714,694
PB88-147475 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Icosahedral Symmetry Versus Local Icosahedral Environments in Al-Mn Alloys from NMR (Nuclear Magnetic Resonances).
Final rept.,
L. H. Bennett, J. W. Cahn, R. J. Schaefer, M. Rubinstein, and G. H. Stauss. 1987, 2p
Pub. in Nature 326, n6111 p372-373, 26 Mar 87.

Keywords: *Aluminum alloys, *Manganese containing alloys, *Crystal structure, Crystal symmetry, Nuclear magnetic resonance, Twinning, Reprints, *Icosahedral phase, Pauling model, Quasicrystals.

In a recent report, Pauling suggested that the icosahedral diffraction found in the aluminum-manganese system is due to a cubic crystalline phase with a large unit cell of more than 1,000 atoms, multiply twinned to mimic icosahedral symmetry, instead of a crystalline or quasicrystalline phase with fivefold symmetry. Here, the authors report a comparison of the nuclear magnetic resonance (NMR) spectra obtained from aluminum-manganese alloys in the crystalline 'G' phase (in which each of the Mn atoms is surrounded by an icosahedron of Al atoms, exactly as in Pauling's proposal structure) with the spectra of the icosahedral phase. The authors find that the NMR spectrum in the 'G' phase is entirely different from the spectrum in the icosahedral phase. Twinning should not affect the NMR spectra except for a small contribution from atoms on or near the composition planes, so the Al-Mn icosahedral phase is not Pauling's twinned cubic structure.

714,695
PB88-147608 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD.
Indexing of Icosahedral Quasi-Periodic Crystals.
Final rept.,
J. W. Cahn, D. Shechtman, and D. Gratias. 1986, 14p
Pub. in Jnl. of Mater. Res. 1, n1 p13-26 Jan/Feb 86.

Keywords: X ray diffraction, Reprints, *Icosahedral phase, *Quasicrystals, Bravais lattices, Hyperspaces, Shechtmanite, Cubic lattices.

Several problems regarding the indexing of diffraction spots of the newly discovered quasiperiodic icosahedral crystals are examined. Two related six-index notations are proposed, one based on a three-dimensional cubic coordinate system, the other on the six-dimensional cubic lattice. Three of the five six-dimensional bravais lattices lead to different extinction rules in three dimensions. A two-parameter hierarchy of diffraction spots is proposed. It leads to a one-parameter hierarchy of intense lines which is in accord with observed powder diffraction data.

714,696
PB88-152061 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Electronic Properties and Stability of the Ordered Structures of the V-Pd, Nb-Pd and Ta-Pd Systems.
Final rept.,
R. Kuentzler, and R. M. Waterstrat. 1986, 19p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. Less-Common Met. 120, n2 p317-335, 15 Jun 86.

Keywords: Vanadium alloys, Palladium alloys, Intermetallics, Specific heat, Stability, Reprints, *Electronic specific heat, Niobium alloys, Tantalum alloys.

Electronic specific heat data have been measured for the ordered structures occurring in the V-Pd, Nb-Pd and Ta-Pd systems. The coefficients are relatively low, except for V3Pd, and the values decrease for each ordered structure concentration from V-Pd to Nb-Pd to Ta-Pd systems. In most cases gamma(ord) < gamma(dis). The results are discussed within the framework of current theoretical density-of-states calculations. Ordered structures based on an fcc or a bcc lattice appear to be stabilized when the Fermi level falls in a gap in the density-of-states. The gap appears as a result of the ordering and is smeared out for corresponding disordered systems.

714,697
PB88-152343 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Energy Dependence of Electron Inelastic Mean Free Paths.
Final rept.,
C. J. Powell. 1987, 6p
Pub. in Surface and Interface Analysis 10, p349-354 1987.

Keywords: *Aluminum, *Copper, *Silver, *Gold, *Electron energy, *Mean free path, Reprints.

An analysis has been made of the dependence on electron energy of calculated inelastic mean free paths (IMFPs) for aluminum, copper, silver, and gold from four recent sources of data. The analysis was made using Fano plots which clearly show differences in energy dependences. In addition, the slopes of linear regions in the Fano plots can be compared with values calculated from experimental optical data and with values obtained from Fano plots made with experimental attenuation length (AL) data.

714,698
PB88-152350 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Influence of Surface Structure on Ion Emission from TiO2.
Final rept.,
R. L. Kurtz. 1986, 2p
Pub. in Jnl. of Vacuum Science and Technology A 4, n3 p1248-1249 May/Jun 86.

Keywords: *Titanium dioxide, *Ion emission, Reprints, Electron stimulated desorption, Photon stimulated desorption.

Recent experiments have shown that ion angular distributions and desorption yields from TiO2 surfaces are strongly influenced by the local environment of the Ti cation. This work is a detailed study of the electron-stimulated desorption ion angular distributions (ESDIAD) and the total ion yields from two Ti02 surfaces: The (110) and the (001). The variety of sites on these surfaces make them good model systems for studying the influence of local geometry on ion emission.

714,699
PB88-152368 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Proposed Formula for Electron Inelastic Mean Free Paths Based on Calculations for 31 Materials.
Final rept.,
S. Tanuma, C. J. Powell, and D. R. Penn. 1987, 9p
Pub. in Surface Science 192, pL849-L857 1987.

Keywords: *Electrons, *Mean free path, Inelastic scattering, Solids, Electron energy, Surfaces, Reprints, EV range 100-1000, KeV range 01-10.

A new general formula is proposed for determining electron inelastic mean free paths (IMFP's) for 200-2000 eV electrons in solids. The new formula is based on separate IMFP calculations for 27 elements and 4 compounds using an algorithm due to Penn. The formula is believed useful for determining the IMFP dependence on electron energy for a given material and the material-dependence for a given energy. The new formula should also be a reasonable guide to electron attenuation lengths which have been difficult to determine with the needed accuracy.

714,700
PB88-152681 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Detailed Fractographic Analysis of Cleavage Steps in Silicon.
Final rept.,
M. J. Kaufman, and A. J. Forty. 1986, 6p
Pub. in Jnl. of Materials Science 21, n9 p3167-3172 Sep 86.

Keywords: *Silicon, *Cleavage, *Brittle fracturing, Fractography, Cracks, Reprints, Scanning electron microscopy.

A detailed analysis of cleavage steps present on fracture surfaces in pure Si has been carried out using scanning electron microscopy. The results indicate that the mechanisms involved in both the formation of unfractured ligaments, produced when adjacent cleavage facets overlap, and the subsequent fracture of these ligaments to form cleavage steps are quite complex. Specifically it is shown that, during ligament formation, the local crack fronts are deflected from their preferred (111) cleavage plane and that the fracture of these ligaments to form cleavage steps occurs in a very complex fashion producing very small microcleavage steps. It is shown that these latter steps are consistent with cleavage along both (111) and (011) planes.

714,701
PB88-152947 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Experimental Studies of Surface Magnetism with Polarized Electrons.
Final rept.,
D. T. Pierce. 1987, 14p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Surface Science 189/190, p710-723 1987.

Keywords: Thin films, Reprints, *Surface magnetism, Electron spin polarization, Magnetic films.

The same electron spectroscopies that are so powerful for studying surfaces generally, can be made sensitive to magnetic properties when electron spin polarization is included as a parameter, for example by probing with a spin polarized electron beam or measuring the spin polarization of emitted electrons. Such properties as the spontaneous magnetization. Curie temperature, temperature dependence of the magnetic order, anisotropy, spin-dependent electronic structure, magnetization curves, elementary excitations, and magnetic microstructure may be different from the bulk in a thin film or at the surface of a semi-infinite ferromagnet. Recent results on chemisorption induced changes in surface magnetism studied by spin polarized inverse photoemission, on magnetic surface anisotropy investigated by polarized photoemission, and on magnetic microstructure determined by scanning electron microscopy with polarization analysis, have been selected for discussion as illustrations of polarized electron studies of surface magnetism.

714,702
PB88-154026 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Characterization of Alumina Powder Using Multiple Small Neutron Scattering. 1. Theory.
Final rept.,
N. F. Berk, and K. A. Hardman-Rhyne. 1985, 6p
See also PB88-154034.
Pub. in Jnl. of Applied Crystallography 18, pt6 p467-472, 1 Dec 85.

Keywords: *Aluminum oxide, Neutron scattering, Particle size, Powder(Particles), Area, Surfaces, Reprints, Small angle scattering, Multiple scattering.

Microstructural values of high purity alumina powder are determined quantitatively throughout the bulk of the material using small angle neutron scattering techniques. In particular, a theoretical and experimental approach for analyzing multiple scattering data is developed to obtain particle size, volume fraction and surface area values. Polydispersivity and shape effects of the particles are discussed. Neutron scattering results agree with laser light scattering, x-ray sedigraph and scanning electron microscopy results where the mean particle size is 366 nm and the particles are spherical in shape.

714,703
PB88-154034 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Characterization of Alumina Powder Using Multiple Small Angle Neutron Scattering. 2. Experiment.
Final rept.,
K. A. Hardman-Rhyne, and N. F. Berk. 1985, 7p
See also PB88-154026.
Pub. in Jnl. of Applied Crystallography 18, pt6 p473-479, 1 Dec 85.

Keywords: *Aluminum oxide, Neutron scattering, Particle size, Powder(Particles), Surfaces, Area, Reprints, Small angle scattering, Multiple scattering.

Microstructural values of high purity alumina powder are determined quantitatively throughout the bulk of the material using small angle neutron scattering techniques. In particular, a theoretical and experimental approach for analyzing multiple scattering data is de-

Solid State Physics

veloped to obtain particle size, volume fraction and surface area values. Polydispersivity and shape effects of the particles are discussed. Neutron scattering results agree with laser light scattering, x-ray sedigraph and scanning electron microscopy results where the mean particle size is 366 nm and the particles are spherical in shape.

714,704
PB88-155437 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Transport Critical-Current Characteristics of Y1Ba2Cu3Ox.
Final rept.,
J. W. Ekin, A. J. Panson, A. I. Braginski, M. A. Janocko, M. Hong, J. Kuo, S. H. Liou, D. W. Capone, and B. Flandermeyer. 1987, 4p
Contract DE-AI01-84ER52113
See also DE87-011525. Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Symposium S, Spring Meeting of the Materials Research Society, Anaheim, CA., April 23-24, 1987, p223-226.

Keywords: *Superconductors, Barium oxides, Copper oxides, Yttrium oxides, *Barium copper yttrium oxides, *Critical current.

Voltage vs. current (V-I) characteristics were measured at magnetic fields up to 24 T at a temperature of 77 K in several Y1Ba2Cu3Ox samples fabricated at different laboratories. Critical temperatures, T(c), measured by resistivity, were about 93 K. All samples showed linear V-I characteristics at current levels much greater than the critical current, I(c). However, the slope was significantly less than the normal resistance at T(c). The slope increased with magnetic field and reached the normal resistance value only at fields greater than 24 T.

714,705
PB88-162532 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Topology of Local Atomic Environments: Implications for Magnetism and Superconductivity.
Final rept.,
L. H. Bennett, R. E. Watson, and W. B. Pearson. 1986, 2p
See also DE86002933.
Pub. in Jnl. of Magnetism and Magnetic Materials 54-57, pt3 p1537-1538 Feb 86.

Keywords: *Transition element alloys, Magnetism, Superconductivity, Reprints, *Disclinations, Topology, Superexchange, Wigner-Seitz cells.

Wigner-Seitz cells have been constructed, as a function of atomic size, for a number of transition-metal alloys, and a disclination network has been obtained from these. Magnetism in these alloys can be related to the disclination lines, much like the superexchange paths familiar in the magnetism of salts.

Structural Mechanics

714,706
AD-A127 410/9 Not available NTIS
National Bureau of Standards, Boulder, CO.
Double Slip Plane Crack Model.
J. Weertman, I. H. Lin, and R. Thomson. 12 Apr 82, 11p ARO-16810.6-MS
Contract DAAG-ARO-36-82, Grant NSF-DMR76-01057
Availability: Pub. in Acta Metallurgica, v31 n4 p473-482 1983 (No copies furnished by DTIC/NTIS).

Keywords: *Cracks, *Models, *Finite element analysis, Stresses, Crack propagation, Reprints.

No abstract available.

714,707
PB-263 259/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Natural Frequencies of Elastically Supported Orthotropic Retangular Plates.
Final rept.,
E. B. Magrab. Jan 77, 5p
Pub. in J. Acoust. Soc. Am., v61 n1 p79-83 Jan 77.

Keywords: *Plates, *Vibration, Resonant frequency, Orthotropism, Shear properties, Simply supported plates, Clamped plates, Reprints.

An expression is derived from which the natural frequencies of a rectangular orthotropic plate, under any combination of simply supported, elastically supported, or clamped boundary conditions, can be obtained. The Mindlin-Timoshenko theory, which includes the effects of transverse shear and rotary inertia, is used to describe the plate motion. The solution is obtained with a previously developed extension of the Galerkin technique. Comparison of results with the limited results of previous investigations is very good. New results are presented for the fundamental frequencies of rectangular and square plates for boundary conditions on all four edges that vary continuously from simply supported to clamped, and for various combinations of length-to-thickness ratios and material constants. Additional results are presented for orthotropic plates simply supported and clamped on all four edges.

714,708
PB-282 865/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Modified Westergaard Equations.
Final rept.,
R. de Wit. 1977, 5p
Pub. in Proceedings of International Conference on Fracture (4th), Waterloo, Canada 19-24 Jun 77, Fracture 3, pt5 p185-189 1977.

Keywords: *Fractures(Materials), *Elastic properties, Mathematical analysis, Stress analysis, Equations, Westergaard equations.

A restriction of Westergaard's equations for plane problems in linear elasticity, previously discussed and corrected by Sih and Eftis and Liebowitz, is briefly discussed anew. It is shown that the correction can be made very simply by adding the real part of a term in Z squared 2 to the Airy stress function of Westergaard. The result is illustrated by the classical example of a single line crack in an infinite plate under constant remote stress.

714,709
PB-285 152/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Natural Frequencies of Prolate Spheroidal Shells of Constant Thickness.
Final rept.,
C. B. Burroughs, and E. B. Magrab. 1978, 11p
Pub. in Jnl. Sound Vib., v57 n4 p571-581 1978.

Keywords: *Spherical shells, *Resonant frequency, Vibration, Shear properties, Spatial distribution, Numerical analysis, Structural shells, Reprints.

The general displacement-equilibrium equations, which include the effects of transverse shear and rotary inertia, have been derived for a prolate spheroidal shell of constant thickness subject to an harmonically time-varying, arbitrary spatially distributed force normal to the shell surface. The approximate solutions for the two non-torsional displacements of the shell middle surface and the non-torsional rotation of the shell cross-section are obtained by using Galerkin's variational method. Numerical results are presented for the seven lowest axisymmetric natural frequencies of the shell. When 15 term solutions are used for both thick and thin shells, which have eccentricities that vary from 0.13 to 0.89, the approximate natural frequencies for the first seven flexural modes are all found to converge to within less than 8% of the final values given, with most converging to within less than 2%. Good agreement with other published results is obtained for the approximate natural frequencies of thin prolate spheroidal shell and for the exact natural frequencies of a thick spherical shell. Additional results are presented for the natural frequencies of moderately thick shells as a function of shell eccentricity, mode number and shell thickness.

714,710
PB-286 729/9 Not Available NTIS
National Bureau of Standards, Gaithersburg, MD.
Getting the Right Angle.
Final rept.,
R. D. Stiehler. Aug 78, 1p
Pub. in Eng. Educ. v5, no.2, 1p, (Aug 2, 1978)

Keywords: *Rotation, *Units of measurement, Education, Torque, Angular acceleration, Angular momentum, Energy, Angles(Geometry), International system of units, Reprints.

Confusion exists concerning units for torque, energy, and other quantities involving rotation. This confusion stems from the treatment of plane angle and trigonometric functions in schools.

714,711
PB-291 481-T PC **A02/MF A01**
National Bureau of Standards, Washington, DC. Diffusion in Metals Data Center.
Estimation of Interaction of Viscosity Sensors with Fluid (K Rascetu Vzaimodepstviya Datcsikov Byazkosti s Zhidkostuyo).
Y. K. Smirnov. 1974, 10p DMDC-6623, TT-74-53215
Trans. of Akusticheskii Zhurnal (USSR) n12 p 125-127 1966. Sponsored in part by National Science Foundation, Washington, DC. Special Foreign Currency Science Information Program.

Keywords: *Oscillations, Interactions, Fluids, Equations of motion, Decay, Coefficients, Complex variables, Detectors, Submerging, Translations, USSR, *Plates.

A mathematical expression is developed for the solution of the one-dimensional problem of a plate submerged in a fluid and oscillating in its own plane.

714,712
PB-296 182/9 PC **A07/MF A01**
Pennsylvania State Univ., State College. Applied Research Lab.
Vibration Isolation: Use and Characterization.
J. C. Snowdon. May 79, 132p NBS/HB-128
Contract NBS-6-35746
Library of Congress catalog card no. 79-600062.

Keywords: *Vibration isolators, Mechanical impedance, Resonant frequency, Vibration damping, Random vibration, Mountings, Noise reduction, Vibrational spectra, Bibliographies.

The results of a search and critical evaluation of the literature pertinent to both the use and the characterization of the performance of antivibration mountings for the control of noise and vibration are described. First to be discussed are the static and dynamic properties of rubberlike materials that are suited for use in antivibration mountings. This is followed by analyses of the simple (one-stage) mounting system and its subsequent, impaired performance when second-order resonances occur either in the isolator (wave effects) or in the structure of the mounted item itself (nonrigid supporting feet). A discussion is then given to the performance of the compound or two-stage mounting system which possesses superior isolation properties for high frequencies. Next, the four-pole parameter technique of analysis is described and applied, in general terms, to the characterization of the performance of an antivibration mounting with wave effects for both the cases where either the supporting foundation or mounted item are nonrigid. The adopted methods for the direct measurement of antivibration-mounting performance are described, followed by an explanation of how this same experimental determination of transmissibility can also be made using an indirect measurement technique based upon four-pole parameter analysis considerations. Finally, recommendations for future work in various areas of research on antivibration mountings are given.

714,713
PB80-138670 Not available NTIS
National Bureau of Standards, Washington, DC.
Direct Observations-The Essential Ingredients for Discovering Fundamental Mechanisms of Fatigue.
Final rept.,
J. T. Fong. 1979, 5p
Pub. in Proceedings of the ASTM-NBS-NSF Fatigue Mechanisms Symposium, Kansas City, Missouri, May 1978, American Society for Testing and Materials, Special Technical Publication 675, p287-291 1979.

Keywords: *Fatigue(Materials), Microstructure, Mechanical engineering, Observation.

Through two stories from the history of medical science, both related to the theory of bloodletting as a treatment for inflammatory diseases, the importance of direct observations and the use of a numerical scheme in all scientific work, including fatigue mechanism research, are illustrated. Brief remarks on two specific questions arising from two earlier sessions on direct observations are inserted. The two questions are: (1) What is the connection between direct observations and quantitative microscopy. (2) What could

fatigue design and testing engineers learn from the direct observations of fatigue damage at microscopic levels. A cautionary note on the temptation to extrapolate from insufficient direct evidence of fatigue damage is also included.

714,714
PB80-141682 Not available NTIS
National Bureau of Standards, Washington, DC.
Fatigue Mechanism--Key to the Solution of the Engineer's Second Fundamental Problem.
Final rept.,
J. T. Fong. 1979, 6p
Pub. as American Society for Testing and Materials, Philadelphia, PA., Special Technical Pub. 675. Prepared in cooperation with National Science Foundation, Washington, DC.
Pub. in Proceedings ASTM-NBS-NSF Fatigue Mechanisms Symp., Held at Kansas City, MO. on May 78.

Keywords: *Fatigue(Materials), Microstructure, Design, Engineering.

The rationale for studying fatigue and fatigue mechanism is examined by considering two fundamental problems in engineering, namely, the problem of feasibility, by asking whether a product works, and the problem of fatigue, by asking whether a product lasts. It is shown that the first problem (feasibility) is easier than the second (fatigue) because the solution to the second requires experimental information of a time scale incompatible with that available to the engineer or the material scientist. To resolve this dilemma, it is proposed that advances in computer-aided quantitative microscopy, fracture mechanics, and many other allied disciplines, be incorporated in measuring microstructural changes due to fatigue at a time scale workable in a laboratory. It is concluded that such study in discovering fundamental mechanisms of fatigue holds the key to the solution of the second fundamental problem in engineering.

714,715
PB80-212319 Not available NTIS
National Bureau of Standards, Washington, DC.
Fatigue Research.
Final rept.,
J. T. Fong. Feb 80, 4p
Pub. in Stand. News 8, n2 p11-14 Feb 80.

Keywords: *Fatigue(Materials), Research projects, Scientific societies, Reprints.

As a forum for exchanging facts and opinions on the fatigue properties of structural components and systems, subcommittee E9:01 is unique among its peers in ASTM for three specific reasons: (1) The subcommittee is charged not to draft any standards for fatigue testing, but rather to provide an active program of research support to other E9 subcommittees which do write standards. (2) The subcommittee is required to provide research leadership in the subject of fatigue which is multi-disciplinary. (3) The subcommittee actively seeks an international constituency through the sponsorship of conferences, newsletters, and technical visits. Following an introduction of the goals and the organization of the subcommittee, a detailed description of the recent international symposium on fatigue mechanisms (Kansas City, May 1978) is given to illustrate the characteristics and the strength of the subcommittee. A summary of three special activities and some future plans of the subcommittee involving not only members of E9 but also of other ASTM committees is presented.

714,716
PB81-187544 Not available NTIS
National Bureau of Standards, Washington, DC.
Stability and Cold Drawing of Viscoelastic Bars.
Final rept.
B. Bernstein, and L. J. Zapas. 1981, 12p
Pub. in Jnl. of Rheology 25, n1 p83-94 1981.

Keywords: *Bars, *Deformation, Theory, Stability, Cold drawing, Creep properties, Strain rate, Stress relaxation, Strains, Viscoelasticity, Reprints.

A theory of stability for deformation of BKZ viscoelastic bars is developed. This theory is an extension of the one given by Ericksen for elastic bars.

714,717
PB81-196230
(Order as PB81-196198, PC **A08**/MF **A01**)
Illinois Inst. of Tech., Chicago. Dept. of Mathematics.
Isoparametric Finite Element Model for Large-Strain Elastostatics,
D. S. Malkus, and E. R. Fuller. 13 Aug 80, 31p
Sponsored in part by National Bureau of Standards, Washington, DC. National Measurement Lab.
Included in Jnl. of Research of the National Bureau of Standards, v86 n1 p79-109 Jan-Feb 81.

Keywords: *Elastic theory, *Finite element analysis, Numerical integration, Tensor analysis, Stresses, Strains, *Elastostatics, Two-dimensional calculations, Three-dimensional calculations, NTISCOMNBS.

This paper describes a simple finite element model for large-strain elastostatics. The realization of the model in a small-scale computer-code is described. The purpose of the model is to produce test problems for research on the application of penalty techniques in nonlinear elasticity. For this reason the code must balance the requirements of reasonable flexibility with those of computational economy. The current code employs multilinear isoparametric elements. The model is capable of generalization to a variety of element types. The solution method employed is that of incremental loading combined with the Newton-Raphson method. Symmetric, banded systems of equations are produced which are solved in-core. Two- and three-dimensional symmetric bodies which are isoparametric images of a reference 'brick' may be modeled. An example comparing two- and three-dimensional models of a 'dogbone' - shaped A.S.T.M. rubber tensile-test specimen is presented. The results shed some light on the nature of stress-concentrations which occur in specimens of this geometry.

714,718
PB81-196883 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Diffusive Crack Growth Model for Creep Fracture,
T. Chuang. Mar 81, 59p NBSIR-81-2255
Contract DE-A105-800R20679

Keywords: *Fractures(Materials), Creep properties, Crack propagation, Mathematical models, Grain boundaries, Diffusion, NTISCOMNBS, NTISDE.

A grain boundary creep crack growth model is presented here based on the assumptions that the crack propagates along the grain boundary by a coupled process of surface and grain-boundary self-diffusion; the adjoining grains behave elastically; and steady state conditions prevail. Under the action of the applied stress, atoms on the crack surfaces are driven by surface diffusion toward the crack tip from where they are deposited non-uniformly by grain-boundary diffusion along the grain interface so that the grain boundary opens up in a wedge shape ahead of the advancing tip which in turn produces a misfit stress field. The total grain boundary stresses and opening displacements are solved from a system of integro-differential equations.

714,719
PB82-112491 Not available NTIS
National Bureau of Standards, Washington, DC.
Equilibrium Fluctuation Expressions for the Wave-Vector and Frequency-Dependent Shear Viscosity.
Final rept.
D. J. Evans. May 81, 5p
Sponsored in part by Fulbright Foundation, Washington, DC.
Pub. in Physical Review A 23, n5 p2622-2626 May 81.

Keywords: *Shear properties, Viscosity, Correlation, Reprints, Frequency dependent.

An expression for the wavevector and frequency dependent shear viscosity coefficient which involves equilibrium stress-stress time correlation functions was derived. Except at zero wavevector the expression does not have the conventional Kubo form.

714,720
PB82-112517 Not available NTIS
National Bureau of Standards, Washington, DC.
Recommendations for Future Research Sessions III and IV on Prediction of Damage and Failure.
Final rept.
J. T. Fong. 1980, 4p
Pub. in National Science Foundation Workshop on a Continuum Mechanics Approach to Damage and Life Prediction held at Cincinnati, OH., in May 1980, p180-183 1980.

Keywords: *Continuum mechanics, Damage, Fatigue(Materials), Failure, Mathematical models, Predictions.

This note is a brief summary of the contributions at a recent NSF workshop entitled 'Continuum Mechanics Approach to Damage and Life Prediction.' Emphasis is placed on the role of the uncertainties of experimental information in the formulation of a continuum mechanics approach to damage analysis. Promising areas of future research and critical issues for timely resolution are presented and discussed.

714,721
PB82-118365 Not available NTIS
National Bureau of Standards, Washington, DC.
Strain Dependence of the J-Contour Integral in Tensile Panels.
Final rept.
D. T. Read, and H. I. McHenry. 1980, 8p
Pub. in Proceedings of International Conference Fracture Advances in Fracture Research (5th), Cannes, France, March 29-Apr 3, 1981, Paper in Advances in Fracture Research, p1715-1722 1980.

Keywords: *Loads(Forces), Finite element analysis, Panels, Fracture(Mechanics), J integral.

The J contour integral has been experimentally measured as a function of applied strain for single edge notch tensile panels under elastic-plastic loading conditions. The results have been compared to analytical predictions based on finite element analysis and to theoretical estimates based on models representing the two behavioral extremes, uniform strain and perfect plasticity. The experimental, analytical and theoretical results have the expected form: the J-integral initially increases as the square of the applied strain, and at strains above yield the J-integral is a linear function of strain. The experimental and analytical results are in reasonable agreement, while the uniform strain and perfect plasticity models under- and over-estimate J respectively. An extension of the perfect plasticity model is proposed to treat behavior between these two limiting cases.

714,722
PB82-135195 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. National Measurement Lab.
J-Integral Method for Fitness-for-Service Assessment.
Interim progress rept.
D. T. Read, and H. I. McHenry. May 81, 53p NBSIR-81-1648
Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.

Keywords: *Materials tests, *Fractures(Materials), Evaluation, Toughness, Acceptability, Steels, *J integrals, Fracture(Mechanics), Steel HY-130.

The goal of this project is to produce a method for evaluation of material toughness requirements, allowable defect sizes, and sustainable stresses and strains. Yielding fracture mechanics and, specifically, the J-integral are employed. The J-integral is regarded as the crack driving force; applied J values above some critical value are predictive of material tearing. The applied J value is a function of applied stress and strain, crack length, and material tensile properties. The critical J-integral value is measured in material fracture-toughness tests. The experimental focus of the present study is on measurement of the applied J-integral as a function of stress and strain in HY130 specimens with different crack lengths.

714,723
PB82-243163 Not available NTIS
National Bureau of Standards, Washington, DC.
Regular Perturbation Technique for Nonlinearly Coupled Oscillators in Resonance.
Final rept.
R. E. Mickens. 1982, 4p
Pub. in Jnl. of Sound and Vibration 81, n2 p307-310 1982.

Keywords: *Oscillations, *Vibration, Perturbation theory, Resonance, Reprints, *Coupled oscillators, Two degrees of freedom.

A regular perturbation technique is presented for obtaining uniformly valid solutions to systems of weakly coupled nonlinear oscillators which satisfy a resonance condition. The technique allows for the easy determination of possible limit cycles and limit points. To illustrate the procedure, the author applied the technique to a system having two degrees of freedom.

714,724
PB83-165076 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Energy-Release Rate Associated with Diffusional Crack Growth.
T. J. Chuang. Dec 82, 35p NBSIR-82-2628
Contract DE-A105-80OR20679

Keywords: *Crack propagation, Diffusion, Creep properties, Energy, Releasing, Rates(Per time), J integrals.

A general expression for the energy release rate (G) that arise during steady state crack propagation by diffusion is derived from the standpoint of irreversible thermodynamics.

714,725
PB83-179614 Not available NTIS
National Bureau of Standards, Washington, DC.
Dislocation Shielding of a Crack in a Quasi Continuum Approximation.
Final rept.
R. M. Thomson, and E. R. Fuller. 1982, 11p
Sponsored in part by Army Research Office, Durham, NC.
Pub. in Proceedings of Symposium Micro and Macro Mechanics of Crack Growth, Louisville, KY., October 13-15, 1981, p49-59 1982.

Keywords: *Brittle fracturing, Toughness, Elastic properties, Dislocations(Materials), Shielding, Cracks, *Fracture(Mechanics).

Earlier predictions of toughness by Thomson and Weertman are reviewed. The differing predictions of the two authors are shown to be due to different interpretations of the functional dependence of the size of the elastic region on intrinsic surface energy. An analysis of the quasi continuum model in terms of dislocation rearrangements is given, and the nature of the boundary condition on the elastic enclave boundary is discussed.

714,726
PB84-119700 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Determination of the Viscoelastic Shear Modulus Using Forced Torsional Vibrations.
Final rept. 1980-82.
E. B. Magrab. Sep 83, 63p NBSIR-83-2776
Sponsored in part by Naval Ship Research and Development Center, Bethesda, MD.

Keywords: *Shear modulus, Measurement.

A forced torsional vibration system has been developed to measure the shear storage and loss moduli on right circular cylindrical specimens whose diameter can vary to 9 cm and whose length can vary from 2 to 15 cm. The method and apparatus are usable over the frequency range 80 to 550 Hz and a temperature range of -20C to 80C.

714,727
PB84-138551 Not available NTIS
National Bureau of Standards, Washington, DC.
Fluid-Fiber Based Torsion Pendulum: An Alternative to Simply Getting a Bigger Hammer.
Final rept.
J. E. Faller, G. M. Keiser, and P. T. Keyser. Jun 83, 13p
Pub. in Proceedings of 1983 Int. School Symp. Precision Measurement Gravity Experiment, Taipei, Republic of China, Jan 24-Feb 2, 1983, p557-569 Jun 83.

Keywords: *Torsion pendulums, Experimental design, Gravity, Mass, *Eotvos experiment.

The paper describes an alternative to the traditional torsion fiber which the authors have developed in connection with an experiment to check the equivalence of gravitational and inertial mass. This experiment, which asks the question --'Do all materials fall at the same rate, in a gravitational field.'-- is also known as the Eotvos experiment.

714,728
PB84-242494 Not available NTIS
National Bureau of Standards, Washington, DC.
Application of an Elastic-Plastic Model to the Use of Small Specimen Strength Ratio for Measuring Fracture Toughness.
Final rept.
R. deWit, and C. G. Interrante. 1984, 8p
Pub. in. Jnl. of Engineering Fracture Mechanics 19, n6 p1151-1159 1984.

Keywords: *Fractures(Materials), Toughness, Fracture properties, Cracks, Stresses, Mechanical properties, Mathematical models, Reprints.

Data reported by Server and Wullaert correlating specimen strength ratio with fracture toughness were analyzed with the D-BSC-HSW model. This model is based on the Dugdale model, elaborated by Bilby, Cottrell and Swinden, and extended by Heald, Spink and Worthington. The data included instrumented precracked Charpy results on HSST plate 02, as well as static, intermediate, and dynamic tests of 1 - T compact and bend specimens of SA533B-1 steel. The model relates the fracture toughness to the crack length, specimen shape and size, applied failure stress and effective flow strength. The only parameter not provided by the data is the constraint factor, M, the ratio of the effective flow strength to the yield strength. The model was fitted to the data by non-linear least squares methods by which M was determined to be approx. 2.5 for the Charpy data, and from 2.1 to 2.6 for the other specimen data. The fit is considered to be reasonably good throughout the range from linear-elastic fracture mechanics through to plastic collapse. The result for the Charpy data is considered to be as good as that for the other specimens. The determination of only one parameter is needed to establish the relationship between specimen strength ratio and fracture toughness. This relationship then applies to the entire range of fracture regimes.

714,729
PB85-115533 Not available NTIS
National Bureau of Standards, Washington, DC.
Elastic Field of an Inhomogeneous System.
Final rept.
W. C. Johnson, and J. K. Lee. 1982, 5p
Pub. in Proceedings of Solid to Solid Phase Transformations, Pittsburgh, PA., August 10-14, 1981, p151-155 1982.

Keywords: *Elasticity, Heterogeneity, Integral equations, Phase transformations, Strains, Stresses.

An integral equation is derived for the strain field in a general infinite system subjected to arbitrary applied strains and stress-free transformation strains (eigenstrains) when the elastic constants of the material are a function of position. The approach is based upon establishing a reference frame free from strain but not necessarily free from stress. As an illustration, the technique is applied to the case of two misfitting coherent precipitates embedded in a matrix of uniform elastic constants.

714,730
PB85-130847
(Order as PB85-130078, PC **A99**/MF **A01**)
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Super Spring - A Long Period Vibration Isolator.
R. L. Rinker, and J. E. Faller. 1984, 7p
Included in Precision Measurement and Fundamental Constants II, p411-417 1984.

Keywords: *Vibration isolators, Springs(Elastic), Gravity, Measurement, Long period seismometers, Uses.

The authors have devised a new mechanical isolating device which they call a 'super spring.' The super spring isolator makes use of the fact that a mass suspended by a long spring is effectively isolated (from vibrations) for all frequencies higher than the system's natural resonance. The authors have developed a method of electronically terminating a 30 cm-long spring in such a way that the mass suspended from it behaves as if the spring were one kilometer or longer in length. This permits them to provide isolation for frequencies as low as 0.2 Hz. The authors will discuss the principle, the results of shake-table tests, and the implications of this technique for measurement science.

714,731
PB85-135515 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theory of Chemically Assisted Fracture.
Final rept.
E. R. Fuller, and R. M. Thomson. 1980, 10p
Pub. in Proceedings of International Conference on Mechanical Behavior of Materials (3rd), Cambridge, England, August 20-24, 1979, p485-494 1980.

Keywords: *Brittle fracturing, Brittleness, Activation energy, Chemisorption, Reaction kinetics, Stress corrosion, Crack propagation, Theory, Fracture(Mechanics).

A general theoretical framework is developed for chemically assisted fracture in brittle materials. Using the theory of absolute reaction rates, an expression is developed for the subcritical growth of a brittle crack in contact with a reactive gas. The activation energy of the process is analyzed in qualitative terms. Although analytical results can be obtained for certain simplified models, the description presented here was in terms of general arguments that are expected to have wide validity. A distinction is drawn between quantities which have thermodynamic validity, and hence are related to the Griffith criterion for a stable crack, or the K sub ISCC of fracture mechanics, and those quantities which are kinetic in nature and are related to crack growth by thermal fluctuations. The theory is seen to rely heavily on earlier concepts developed for the lattice trapping of crack in brittle solids.

714,732
PB85-141935 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Finite Element and Experimental Evaluation of the J-Integral for Short Cracks.
Final rept.
R. H. Dodds, D. T. Read, and G. W. Wellman. 1983, 23p
Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in American Society for Testing and Materials STP 791, pI-520--I-542 1983.

Keywords: *Cracks, *Finite element analysis, Evaluation, Reprints, *J integrals, Fracture toughness.

Fitness-for-service assessments of critical metal structures such as piping systems, pressure vessels, and ships require accurate predictive methods for fracture of parts containing small flaws or short cracks. Flaw size, geometry, applied loads, fabricator and material characteristics often combine to produce large scale plastic zones inappropriate for evaluation by linear elastic fracture mechanics. The J-integral is widely advocated as a suitable parameter to characterize both material fracture toughness and the driving force in elastic-plastic fracture. Procedures have been proposed to measure the material fracture toughness, J sub Ic, for standard test specimen geometries containing large crack lengths. However, there are no generally accepted methods to predict or experimentally measure the applied J-integral within a structural element containing a small crack (defined here by a crack length to remaining ligament ratio, a/W, < 0.25).

714,733
PB85-145241 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Physics of Fracture.
Final rept.
R. M. Thomson. 1983, 41p
See also PB83-234658. Sponsored by Army Research Office, Research Triangle Park, NC., Office of Naval Research, Arlington, VA., and North Atlantic Treaty Organization, Brussels (Belgium).
Pub. in Atomistics of Fracture, Calcatoggio, Corsica, France, May 22-31, 1981, NATO (North Atlantic Treaty Organization) Conference Series 6: Materials Science 5, p167-207 1983.

Keywords: *Fractures(Materials), Cracks, Crystal lattices, Crack propagation, Computations, Reprints, *Fracture(Mechanics).

The title of the conference in its focus on atomistics certainly hints at the physical dimension, and it gives us our point of departure. However, before diving directly into a full-scale discussion of discrete lattices, I will first provide in the next section a very succinct background statement of the elastic description of a brittle crack. In the third section, discrete lattice theories are addressed directly, but first in one dimension for the purpose of emphasizing the kinds of phenomena for which an atomistic theory is important. This discussion points to the application of discrete lattice theories to the rates of atomic and chemical processes at the crack tip. In the fourth section we lay out the statistical mechanical framework for the thermal equilibrium of a crack and for thermally activated crack growth both for intrinsic lattices, and including interactions with external chemical environments. Then follows in section five a more detailed presentation and critique of the theoretical techniques for calculating the structure of lattices containing cracks in two and three dimensions. A short statement of the current status of the quantum theory of binding as it relates to defects will be included. Finally, in the sixth section, the question of stability of the crack in the lattice with respect to the emission of dislocations is discussed. A concluding

short section summarizes the crucial points where future progress looks most promising.

714,734
PB86-128915 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Waves, Microstructures, and Effective-Medium Approximation.
Final rept.
S. K. Datta, and H. M. Ledbetter. 1985, 11p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in The Mechanics of Dislocations, p213-223 1985.

Keywords: *Microstructure, *Elastic properties, Phase velocity, Plane waves, Wave propagation, Preferred orientation, Anisotropy, Inclusions, Reprints.

Theoretically and experimentally the authors studied phase velocity of a plane wave propagating in an elastic medium with microstructure. Microstructures studied were either inclusions or fibers, which were either aligned or oriented randomly. Preferred orientation of the microstructure causes anisotropic macroscopic physical properties. Here the authors consider the elastic properties. The theoretical model used a wave-scattering approach together with Lax's quasi-crystalline approximation. The model predicts the macroscopic isotropic elastic constants for the case of random orientation and the macroscopic anisotropic elastic constants caused by preferred orientation.

714,735
PB86-129061 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Review of Generalized Failure Criteria Based on the Plastic Yield Strip Model.
Final rept.
R. deWit. 1981, 27p
Sponsored by Federal Railroad Administration, Washington, DC. Office of Rail Safety Research.
Pub. in Proceedings of National Symposium on Fracture Mechanics (14th), Los Angeles, CA., June 30-July 2, 1981, ASTM STP 791, p1-14 - 1-50.

Keywords: *Pressure vessels, Fracture properties, Mechanical properties, Cracks, Failure, Collapse, Fracture(Mechanics).

A review is given of the failure criteria developed by Hahn and Sarrate for through-cracked pressure vessels, whereby they established three failure categories. This work was based on the Dugdale and Bilby-Cottrell-Swinden (D-BCS) model for the crack-tip opening displacement (CTOD) in an infinite plate. The model was extended in an approximate way by Heald-Spink-Worthington (D-BCS-HSW) to finite geometries and structures by combining the effects of plasticity and geometry as multiplicative factors. In this paper the criteria of Hahn and Sarrate are extended to the D-BCS-HSW model. The three failure categories are relabelled: (1) linear-elastic fracture mechanics (LEFM), (2) elastic-plastic fracture mechanics (EPFM), and (3) plastic collapse (PC).

714,736
PB86-138104 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Fatigue Research: Needs and Opportunities.
Final rept.
J. T. Fong. 1985, 5p
Pub. in ASTM (American Society for Testing and Materials) Standardization News 13, n11 p59-63 1985.

Keywords: *Fatigue(Materials), Mechanical properties, Crack propagation, Fatigue tests, Cracking(Fracturing), Reprints.

The significance of fatigue research in engineering and materials science is stated in simple terms through a look at the goals of research and its benefits to society. An overview of the research progress during the last 30 years is given in a historical perspective dating back to as far as the 1840's. The driving forces for research support from the industry and the user community are introduced to place the concept of 'research needs' in a practical setting. Technical difficulties in moving fatigue toward a more scientific basis are discussed.

714,737
PB86-143856 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Dynamic Green's Functions of an Infinite Plate - A Computer Program.
N. N. Hsu. Nov 85, 67p NBSIR-85/3234

Keywords: *Plates(Structural members), *Green's function, *Computer programs, Nondestructive tests, Elastic waves, Waveforms, Fortran, Convolution integrals, *Acoustic emissions.

The report is a FORTRAN program to compute the Green's functions of an infinite plate. The Green's function, G(ij) (xi,x,t), is defined as the ith component of the displacement at x due to a point force of step-function time dependency acting at xi in the jth direction initiated at t=0. The Green's function is the fundamental solution of the transient elastic wave propagation problem. In general, the displacement field u(xi,x,t) at x due to a point force of arbitrary time dependence acting at xi can be computed by a convolution integration. Displacement produced by a dynamic force distributed over a finite area can also be computed by numerical integration using the Green's function as the kernel of the integral over the finite area. The computer program is made available mainly for its application to calibrate acoustic emission systems and sensors.

714,738
PB86-160975 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Elastic-Plastic Fracture Toughness Tests with Single-Edge Notched Bend Specimens.
Final rept.
T. L. Anderson, H. I. McHenry, and M. G. Dawes. 1985, 20p
Sponsored by Minerals Management Service, Washington, DC.
Pub. in Proceedings of the Symposium on Elastic-Plastic Fracture Test Methods: The User's Experience, Louisville, KY., April 20-22, 1983, ASTM (American Society for Testing and Materials) Special Technical Publication 856, p210-229 1985.

Keywords: *Fracture tests, *Toughness, Fracture strength, Mechanical properties, Tests, Crack propagation, Notch tests, Fracture properties, Structural steels.

Fracture toughness tests have been performed on five geometries of single-edge notched bend (SENB) specimens machined from a 25.4-mm (1.0-in.) thick plate of ABS Grade EH36 steel, a normalized carbon-manganese steel. Critical values of the J integral and the crack-tip opening displacement (CTOD) were measured as a function of temperature. Test temperatures, which ranged from -196 to 25 degrees C, covered the entire ductile-to-brittle transition range. On the upper shelf, critical values of J and CTOD at the onset of stable crack growth were insensitive to specimen geometry. However, in the ductile-to-brittle transition region, where fracture occurred by unstable cleavage, fracture toughness decreased with increasing specimen thickness and crack length. The effect of geometry on fracture toughness in the transition region is attributed to changes in crack-tip region constraint with geometry.

714,739
PB86-196649 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Distribution of Stress in a Craze of the Tip of a Uniformly Extending Crack.
Final rept.
E. Passaglia. 1984, 7p
Pub. in Polymer 25, n12 p1727-1733 1984.

Keywords: *Crazing, *Cracks, *Stress concentration, Displacement, Stresses, Reprints.

A model of a craze at the tip of a uniformly extending crack is developed which permits the calculation of the stress distribution in the craze. In accord with experimental observations by Kramer (11) the craze is modelled as a collection of independent fibrils that draw from the substrate by a process akin to the drawing of textile fibers with necking. Except at the very tip of the craze where complex yielding type phenomena occur, the stress in the craze is taken to correspond to the drawing stress. The craze stress is treated as the cohesive crack closing stresses in the Barenblatt treatment of crack tips. The principal fact used in the development is that the drawing stress depends upon the rate of draw and hence upon the slope of the craze displacement. This leads to a non-linear integral equation for the craze stress. Using an empirical relation between drawing stress and rate of draw, the equation is solved for the stress distribution in the craze by numerical methods. The distribution shows peaks at the craze tip and at the crack tip as observed in some experiments. The magnitude of the peaks depends upon the material parameters used. For certain values of these parameters, the constant stress Dugdale model yields a good approximation to the displacement profile.

714,740
PB86-201019 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Institute for Materials Science and Engineering.
Dislocation Shielding of Cracks and the Fracture Criterion.
Final rept.
R. Thomson. 1983, 6p
Sponsored by Chinese Society of Theoretical and Applied Mechanics, Beijing, and Chinese Aeronautics and Astronautics Society, Beijing.
Pub. in Proceedings of ICF International Symposium on Fracture Mechanics, Beijing, China, November 22-25, 1983, p1019-1024 1984.

Keywords: *Fractures(Materials), *Cracks, Dislocations(Materials), Shielding, Theories, *Fracture(Mechanics).

A theory of fracture for review with application to moving cracks in two applications. The results show a brittle break-away effect at a critical stress intensity.

714,741
PB86-245743 PC **A06**/MF **A01**
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Fracture Mechanics Characterization of Crack Arrest and Reinitiation in Two Unconventional Specimens.
T. Teramoto, D. T. Read, and R. B. King. Jun 86, 120p NBSIR-85/3034
Sponsored by Office of Naval Research, Arlington, VA., and David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.

Keywords: *Crack propagation, *Fracturing, Fracture properties, Steel structures, Crack arrest.

A simple elastic-plastic-fracture-mechanics-based model of crack propagation, arrest, re-initiation, and propagation is described. This model requires much less computing resources than dynamic, elastic-plastic finite element calculations, and allows estimates of applied J-integral, load, and crack mouth opening displacement during initial rapid crack propagation, re-initiation and repropagation. A comparison of this new model to other available models and to experimental results indicates that it can successfully reproduce the essential features of the behavior of specimens containing propagating cracks.

714,742
PB87-104758 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Cycle-Counting Methods for Fatigue Analysis with Random Load Histories: A Fortran User's Guide.
Y. W. Cheng, and J. J. Broz. Aug 86, 52p NBSIR-86/3055
Sponsored by Minerals Management Service, Reston, VA.

Keywords: *Fatigue(Materials), *Counting, FORTRAN, Computer programs, Loads(Forces).

Rainflow and mean crossing-range methods are used in counting the stress ranges and cycles of a random load history. Each method is defined and then applied to a simple random load history example. Fortran IV computer programs were written to make analysis of long random load histories possible. The stress ranges and cycles obtained by these programs have been used for fatigue crack growth analysis under sea-wave loading.

714,743
PB87-117958 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.

Acoustic Refraction of Off-Axis Shear Horizontal Waves in Slightly Anisotropic Plates.
Final rept.
A. V. Clark, and P. P. Delsanto. 1986, 6p
Prepared in cooperation with Naval Research Lab., Washington, DC.
Pub. in Ultrasonics, p25-30 Jan 86.

Keywords: *Acoustic refraction, *Anisotropic plates, *Stress analysis, Anisotropy, Reprints, Acoustical birefringence.

Several techniques have recently been proposed to perform acoustic birefringence measurements, using off-axis SH-waves, in order to determine stresses in slightly anisotropic materials. These techniques tacitly assume that refraction effects, due to inhomogeneous stress distributions and/or local variations in material properties are negligible. In the paper the authors investigate the conditions under which this assumption is valid.

714,744
PB87-118550 Not available NTIS
National Bureau of Standards, Boulder, CO. Fracture and Deformation Div.
Fracture Mechanics.
Final rept.
H. I. McHenry. 1985, 6p
Pub. in ASTM (American Society for Testing and Materials) Standardization News, p38-43 Nov 85.

Keywords: Standards, Fractography, Reprints, *Fracture(Mechanics).

The article reviews some of the early ideas that have shaped fracture mechanics, some notable failures that have spurred its development, some ways it is currently used to help prevent fracture, and some work underway in ASTM Committee E-24 to extend its usefulness.

714,745
PB87-149514 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Temperature Considerations in the Study of Surfaces Using a Four-Ball Wear Apparatus.
Final rept.,
R. G. Munro. 1985, 4p
Pub. in Jnl. of Applied Physics 57, n11 p4950-4953 1985.

Keywords: *Surfaces, Thermal conductivity, Conduction, Reprints, Temperature distribution, Coefficient of friction.

The evolution and distribution of temperature has been studied theoretically for a four-ball wear apparatus which can be used to study macroscopic effects of surfaces interacting under frictional conditions. The finite difference method was used to solve the coupled equations of heat generation, conduction, and cooling. Parameters were chosen to represent two types of material, a typical steel with relatively good thermal conductivity, and a ceramic with relatively poor thermal conductivity. Two values for the coefficient of friction were used to simulate dry and lubricated surfaces. A significant dependence on thermal conductivity was found.

714,746
PB87-202990 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Creep Cavitation in the Neighborhood of Stress Concentrations.
Final rept.,
T. S. Liu, T. J. Delph, and R. J. Fields. 1983, 7p
Contract DE-AC01-81ER10816
Sponsored by Department of Energy, Washington, DC.
Pub. in Transactions of the International Conference on Structural Mechanics in Reactor Technology (7th), Chicago, IL., August 22-26, 1983, p79-85.

Keywords: *Creep properties, Finite element analysis, Notch sensitivity, Stress concentration, Reprints.

The results of several experiments into the formation and distribution of creep cavitation in the neighborhood of stress concentrations are reported. Of particular interest is the use of an image analyzing computer to construct quantitative maps of cavity sized and distributions. Comparisons are drawn in one case with the results of a finite element simulation, and some degree of overall agreement is noted.

714,747
PB88-138516 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 92, Number 6, November-December 1987.
1987, 54p
Also available from Supt. of Docs. as SN703-027-00019-9. See also PB88-138524 through PB88-138540 and PB87-230975.

Keywords: *Periodicals, *Measurement, Ceramics, Standards, Plates, Nondestructive tests, Vibration, Finite element analysis, Superconductors, *US NBS.

The issue contains: New briefs and reports on: Standard reference data information; International standards nondestructive testing; and Superconductivity: challenge for the future. Articles on: Transient impact response of thick circular plates; Transient impact response of plates containing flaws and A low noise cascode amplifier.

714,748
PB88-138524
(Order as PB88-138516, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Transient Impact Response of Thick Circular Plates,
M. Sansalone, and N. J. Carino. 1987, 13p
Included in Jnl. of Research of the National Bureau of Standards, v92 n6 p355-367 Nov-Dec 87.

Keywords: *Plates, Impact, Echoes, Nondestructive tests, Finite element analysis, Frequency response, Stress waves, Vibration, Green's function.

The finite element method was used to study the transient response of thick circular plates subjected to point impact. The response of plates having different geometries and subjected to impacts of different duration was studied in both the time and the frequency domains. It is shown that the transient plate response is composed of a number of different modes of vibration including P- and S-waves thickness modes, antisymmetric flexural modes, the rod mode, and P- and S-wave diameter modes. The origin of the diameter modes is discussed. Excellent agreement was found between the calculated frequency values and those obtained from finite element analyses.

714,749
PB88-138532
(Order as PB88-138516, PC **A04**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Transient Impact Response of Plates Containing Flaws,
M. Sansalone, and N. J. Carino. 1987, 13p
Included in Jnl. of Research of the National Bureau of Standards, v92 n6 p369-381 Nov-Dec 87.

Keywords: *Plates, Impact, Echoes, Nondestructive tests, Finite element analysis, Frequency response.

The finite element method was used to study the transient response to point impact of thick circular plates containing disk-shaped flaws. The response was studied in both the time and the frequency domains, and compared to the response obtained from a solid plate. The effects on the response caused by changing the diameter and depth of a flaw, the duration of the impact, and the position where the response is calculated were determined. From the results of these parameter studies, conclusions were drawn which can be used in planning and interpreting impact-echo laboratory and field test results.

714,750
PB88-152491 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Cleavage, Dislocation Emission, and Shielding for Cracks under General Loading.
Final rept.,
I. H. Lin, and R. Thomson. 1985, 20p
Pub. in Acta Metallurgica 34, n2 p187-206 Feb 85.

Keywords: *Dislocations(Materials), *Cleavage, Cracks(Fractures), Loads(Forces), Lattice parameters, Reprints.

The purpose of the paper is to consider the conditions for the existence of a cleavage crack in a lattice and its response to all types of external loads when shielded by neighboring dislocations. The theory will be constrained to cleavage on one plane and crack branching is not permitted.

714,751
PB88-152509 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Dynamic Cleavage in Ductile Materials.
Final rept.,
I. H. Lin, and R. M. Thomson. 1986, 8p
Pub. in Jnl. of Materials Research 1, n1 p73-80 Jan/Feb 86.

Keywords: *Ductile brittle transition, *Cleavage, Crack propagation, Dislocations(Materials), Fracture properties, Velocity, Reprints.

Ductile materials are found to sustain brittle fracture when the crack moves at high speed. The fact poses a paradox under current theories of dislocation emission, because even at high velocities, these theories predict ductile behavior. A theoretical treatment of time dependent emission and cleavage is given which predicts a critical velocity above which cleavage can occur without emission. Estimates suggest that this velocity is in the neighborhood of the sound velocity.

714,752
PB88-153069 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Comparison between Two Theories of Plasticity.
Final rept.,
J. H. Chiou, J. D. Lee, and A. G. Erdman. 1986, 15p
Pub. in Computers and Structures 24, n1 p23-37 1986.

Keywords: *Plastic properties, Continuum mechanics, Stresses, Strains, Theories, Comparison, Reprints, *Plasticity, Elasticity, Constitutive equations.

Among numerous large strain elasto-plasticity theories, Green-Naghdi's theory and E.H. Lee's theory are distinguished and distinctive. In Green-Naghdi's theory, the Green-Lagrange strain tensor is decomposed into the elastic and the plastic parts. On the other hand, E.H. Lee started with a decomposition of the deformation gradient into a product of two parts: elastic and plastic. In the case of simple tension, the essential differences are found between these two theories. In E.H. Lee's theory, the unloading curves are parallel on the plots of Cauchy stress vs natural strain. However, the parallel relation does not exist on the plots of Piola-Kirchhoff stress vs Green-Lagrange strain. In Green-Naghdi's theory, the results are reversed. The unloading curves are not parallel on the plots of Cauchy stress vs natural strain, but parallel on the plots of Piola-Kirchhoff stress vs Green-Lagrange strain. The significance of the finding is further discussed.

714,753
PB88-153770 PC **A07**/MF **A01**
Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.
SEES (Strength Evaluation of Existing Structures): An Expert System for the Strength Evaluation of Existing Structural Members.
Master's Thesis,
J. F. Peters. Jan 88, 139p NBS/GCR-87/538
Sponsored by National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.

Keywords: *Structural members, *Engineering, Concrete construction, Mechanical properties, Theses, Strength, Tests, *Expert systems, *Knowledge based systems, *Computer aided design, Computer applications.

The thesis is a report of the design and implementation of the SEES expert system; a knowledge based system for strength evaluation of existing structural members. The expert system provides engineering knowledge for in situ member evaluation compiled into an interactive computer program to aid in the solution of a characteristically uncertain engineering problem. Not intended to replace engineers, the system's purpose is twofold: provide engineering judgment in a computer program, and attend to details that engineers may let go unnoticed. The result of the study is a generic engineering expert system control structure readily expandable to at least seven other strength evaluation problems and a prototype implementation for reinforced concrete beams.

714,754
PB88-154604 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Wide Plate Crack Arrest Tests: Instrumentation for Dynamic Strain Measurements.
Final rept.,
R. J. Fields, G. A. Danko, S. R. Low, and R. deWit.
1985, 6p
Sponsored by Department of Energy, Washington, DC.
Pub. in ASTM (American Society for Testing and Materials) Standardization News, p42-47 Oct 85.

Keywords: *Metal plates, *Steels, *Cracking(Fracturing), Instruments, Bridges(Structures), Tape recorders, Amplifiers, Test equipment, Reprints.

A series of crack arrest tests on large (10 x 1 x 0.1 m) steel plates is described. Special emphasis is placed on the description of the relevant instrumentation, strain gaging, and data collection systems. Circuit diagrams are given for the bridges and multichannel dynamic amplifiers that were constructed specifically for this type of testing.

General

714,755
AD-A128 834/9 Not available NTIS
Colorado Univ. at Boulder.
Transport Data for the Modeling of Electrical Breakdown and Discharges.
A. V. Phelps. 1981, 25p ARO-17703.2-PH
Contract ARO-8-82
Availability: Pub. in Electrical Breakdown and Discharges in Gases, v89a p109-132 1981 (No copies furnished by DTIC/NTIS).

Keywords: *Electric dischargers, Gases, Electron transport, Ion density, Reprints, Electric breakdown.

No abstract available.

714,756
AD-P002 450/5 PC **A02**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD.
Laser Cooled 9Be+ Accurate Clock.
J. J. Bollinger, W. M. Itano, and D. J. Wineland.
1983, 5p
Pub. in Proceedings of the Annual Symposium on Frequency Control (37th), 1-3 Jun 83, Marriott Hotel, Philadelphia, PA., AD-A136 673, p37-41.

Keywords: *Frequency standards, *Beryllium, *Clocks, Lasers, Cooling, Ions, Accuracy, Measurement, Clouds, Frequency, Doppler effect, Component Reports.

The use of laser cooled stored ions in an atomic frequency standard has the potential of very high accuracy because Doppler effects are greatly suppressed. A clock based on the ground-state hyperfine transition in 201Hg+ has potential accuracy and stability exceeding 1 part in 1015. However, laser cooled 9Be+ ions are experimentally easier to obtain. Therefore a 9Be+ based frequency standard is investigated in order to study the generic problems of laser cooled stored ion frequency standards.

714,757
AD-P002 453/9 PC **A02**/MF **A01**
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
National and International Time and Frequency Comparisons.
D. W. Allan. 1983, 6p
Pub. in Proceedings of the Annual Symposium on Frequency Control (37th), 1-3 Jun 83, Marriott Hotel, Philadelphia, PA., AD-A136 673, p55-60.

Keywords: *Frequency standards, *Atomic clocks, Comparison, Time, Global positioning system, Measurement, Clocks, Accuracy, Methodology, Component Reports.

The advent of satellite time and frequency comparison techniques has provided the opportunity for measuring the time and frequency difference between remote clocks with greatly improved accuracies. The paper will give a brief review of various remote clock comparison techniques; in particular the Global Positioning System (GPS) will be highlighted.

714,758
AD-777 880/6 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Note on Measurement of Multi-Component Fields.
H. V. Cottony. 15 Sep 73, 34p Scientific-B-8, AFCRL-TR-73-0306
Contract PRO-Y-72-860

Keywords: *Electromagnetic fields, Measurement, Field intensity, Multipath transmission, Polynomials, Radar reflections.

The paper considers a propagation model where a signal is propagated via M paths with each component arriving on a horizontal plane from different directions. The M components have random phases, but are coherent with each other. An expression, in the form of a polynomial of complex terms, is derived for the total field strength over the site. By multiplying this polynomical by another with identical but conjugate terms, a polynomial of real terms is obtained; it represents the field intensity distribution and consists of a constant term plus a series of sinusoidal periodicities. (Modified author abstract)

714,759
DE83010760 PC **A02**/MF **A01**
Argonne National Lab., IL.
Overview of Research at NBS Using Synchrotron Radiation at SURF-II.
D. L. Ederer, R. P. Madden, A. C. Parr, G. Rakowsky, and E. B. Saloman. 1982, 6p CONF-821123-40
Contract W-31-109-ENG-38
Conference on the application of accelerators in research and industry, Denton, TX, USA, 8 Nov 1982, Microfiche only, copy does not permit paper copy reproduction.
Pub. in IEEE Trans. Nucl. Science NS-30, n2 p1020-1025 April 83.

Keywords: *Synchrotron Radiation, Ultraviolet Radiation, Monochromatic Radiation, Research Programs, Molecular Structure, Solid State Physics, Atomic Physics, ERDA/430303, ERDA/640300, ERDA/656000.

The National Bureau of Standards (NBS) Synchrotron Ultraviolet Radiation Facility (SURF-II) is used in conjunction with several high throughput monochromators to study the interaction of vacuum ultraviolet photons with solids and gases. Recent work has been concerned with the photon stimulated desorption of atomic and molecular ions from surfaces, with the effect of electric fields on molecular photoabsorption and with the study of molecular photoionization by angle resolved photoelectron spectroscopy. These research programs yield new information about molecular bonding at surfaces, molecular dynamics near ionization thresholds, and the coupling of the electronic and nuclear motion near resonances in molecules. In addition to these programs in basic research SURF-II is used for the calibration of transfer standard detectors over a photon energy range 20 to 250 eV. Calibration of monochromator systems is achieved over the photon energy range 5 to 250 eV by using the now calculable spectral intensity radiated by the electrons, which are confined in a nearly circular orbit. (ERA citation 08:032321)

714,760
DE84004071 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC.
Description of the DLC-99/HUGO Package of Photon Interaction Data in ENDF/B-V Format.
R. W. Roussin, J. R. Knight, J. H. Hubbell, and R. J. Howerton. Dec 83, 23p ORNL/RSIC-46, ENDF-335
Contract W-7405-ENG-26

Keywords: *Photon Transport, *Photons, Beryllium, Coherent Scattering, Computer Codes, Cross Sections, Elements, Form Factors, Hydrogen, Incoherent Scattering, Iron, KeV Range, Lead, Libraries, MeV Range 01-10, MeV Range 10-100, Pair Production, Photoelectric Effect, Uranium, ERDA/654001.

A new photon interaction data library, DLC,-99/HUGO, is described. The library was prepared by incorporating newly evaluated data from the National Bureau of Standards with that from an existing data library, DLC-7F/HPICE, which is the ENDF/B-IV photon interaction data. It contains pair and triplet cross sections, photoelectric cross sections, and atomic form factors and the corresponding coherent scattering cross sections. Evaluated data in INDF/B-V format are provided for elements Z=1 to 100. The data package, available from the Radiation Shielding Information Center (RSIC) at Oak Ridge National Laboratory, will be submitted to CSEWG for consideration as the ENDF/B-V Photon Interaction Library. Two computer codes, EDPHOT for selectively printing the data and COMP23 for comparing two photon interaction libraries, are also provided. (ERA citation 09:009035)

714,761
DE85013104 PC **A05**/MF **A01**
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron Impact Ionization of Multicharged Ions at ORNL: 1980-1984.
D. C. Gregory, D. H. Crandall, R. A. Phaneuf, A. M. Howald, and G. H. Dunn. May 85, 97p ORNL/TM-9501
Contract AC05-84OR21400

Keywords: *Electron-Ion Collisions, Cross Sections, Data Compilation, Electron Temperature, Experimental Data, Ionization, Ions, ERDA/640304, ERDA/700104.

Experimental electron-impact ionization cross sections for thirty-seven target ions are presented, summarizing measurements made at ORNL during the period from 1980 through early 1984. Target ions range in atomic number from Z = 5 (boron) to Z = 73 (tantalum), with charge states ranging from +2 through +6 and energies ranging from below the ionization threshold to 1500 eV in most cases. All data are presented in both tables and graphs. Maxwellian ionization rate coefficients are tabulated over the equivalent temperature range 10 to 3000 eV, and fitting parameters are given to allow the calculation of rates at intermediate electron temperatures or for inclusion in computer programs for plasma modeling. (ERA citation 10:032502)

714,762
DE86002846 PC **A02**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.
Performance of the 100 keV Chopper/Buncher System of the NBS-Los Alamos RTM Injector.
M. A. Wilson, R. I. Cutler, D. L. Mohr, S. Penner, and L. M. Young. 1985, 4p DOE/ER/10527-T2
Contracts AT01-79ER10527, W-7405-ENG-36
Pub. in IEEE Transactions on Nuclear Science NS-32, n5 p3089-3091 1985.

Keywords: *Microtrons, Beam Bunchers, Beam Injection, Performance, ERDA/430302.

The purpose of the chopper/buncher system for the RTM injector is to chop a 100 keV 5 mA dc electron beam into 60 exp 0 -long pulses at 2380 MHz and then bunch these beam pulses to 10 exp 0 at insertion into the 5 MeV injector linac. These beam manipulations must contribute a minimum increase in the phase space of the beam such that, at the entrance to the injector linac, the transverse emittance is less than 5 pi mm-mrad. Phase-shift measurements on the chopped beam indicate that the bunching fields are sufficient to achieve the required longitudinal compression. Beam envelope measurements, using wire scanners on the chopped and bunched beam, show that the emittance remains within design goals. (ERA citation 11:006078)

714,763
DE86002849 PC **A02**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.
NBS/LANL Racetrack Microtron Control System.
R. L. Ayres, N. R. Yoder, E. R. Martin, R. E. Trout, and B. L. Wilson. 1985, 4p DOE/ER/10527-T3
Contracts AT01-79ER10527, W-7405-ENG-36
Also Pub. in IEEE Transactions on Nuclear Science NS-32, n5 p2086-2088 1985.

Keywords: *Microtrons, Computerized Control Systems, ERDA/430300.

The distributed intelligence control system for the NBS/LANL racetrack microtron (RTM) is now nearing completion with all major subsystems implemented and tested, thus providing some operating experience with most of the control system innovations. These include a triple hierarchy of microprocessor-based control elements, consisting of a primary control station and multiple secondary and tertiary control stations; light-link coupling to a tertiary station which operates at

a 100 kV potential; a common database shared by separate microprocessors for handling hardware control and operator interactions; and joy stick control of the entire system. A unique secondary station interpreter program was used to great advantage for testing and checkout of various control and monitoring subsystems. The hardware design of the control system is based on Multibus I crates containing commercial Multibus I boards and a few custom designed boards. The primary-secondary data link is a high speed, bidirectional, full-duplex, 8-bit, "byte" parallel link designed for this application. This link permits very fast updating of the monitored data (>5 per second) and timely response to operator control inputs at the primary station. (ERA citation 11:006079)

714,764
DE88001714 PC **A02**
National Bureau of Standards, Gaithersburg, MD.
Recent Fission Cross Section Standards Measurements.
O. A. Wasson. 1985, 10p CONF-8511312-1
Contract AI01-86ER40275
15. international symposium on nuclear physics - nuclear fission, Gaussig, German D.R. 11 Nov 1985.
Paper copy only, copy does not permit microfiche production.

Keywords: *Plutonium 239 Target, *Uranium 235 Target, *Uranium 238 Target, Californium 252, Cross Sections, Fission, Gas Scintillation Detectors, Integrals, Ionization Chambers, *Neutron Detectors, Neutron Fluence, Neutron Reactions, Neutron Sources, Nuclear Data Collections, Plastic Scintillation Detectors, Proton Spectra, Spontaneous Fission, Standards, ERDA/652020, ERDA/440103.

The sup 235 U(n,f) reaction is the standard by which most neutron induced fission cross sections are determined. Most of these cross sections are derived from relatively easy ratio measurements to sup 235 U. However, the more difficult sup 235 U(n,f) cross section measurements require the use of advanced neutron detectors for the determination of the incident neutron fluence. Examples of recent standard cross section measurements are discussed, various neutron detectors are described, and the status of the sup 235 U(n,f) cross section standard is assessed. 23 refs., 8 figs., 4 tabs. (ERA citation 13:006786)

714,765
PB-263 200/8 PC **A12**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Radiation Physics. Proceedings of the International Symposium on Radiation Physics Held at Bose Institute, Calcutta (India) on November 30-December 4, 1974.
Final rept.,
A. M. Ghose, D. V. Gopinath, J. H. Hubbell, and S. C. Roy. Jan 77, 272p NBS-SP-461
Sponsored in part by Department of Atomic Energy, Bombay (India), and International Atomic Energy Agency, Vienna. (Austria). Prepared in cooperation with Bose Research Inst., Calcutta (India). Nuclear Physics Lab., and Reactor Research Centre, Kalpakkam (India). Library of Congress catalog card no. 76-608379.

Keywords: *Nuclear cross sections, *Nuclear scattering, *Dosimetry, *Radiation shielding, *Meetings, Transport properties, Dose rate, India, Thermoluminescent dosimeters.

These proceedings contain invited and contributed papers presented at the International Symposium on Radiation Physics organized by and held at the Bose Institute, Calcutta, India Nov. 30-Dec. 4, 1974. The purpose of this symposium, recognizing radiation physics as the thread held in common by a variety of medical, engineering and scientific disciplines, was to bring together specialists from these disciplines to report on, exchange, and make available through these proceedings, information and experiences of common interest to workers in these diverse disciplines. Topics thus brought together in this symposium include new measurements, theoretical developments, compilations and applications of basic cross section and transport data for photon, electron, neutron and heavy ion beams interacting with matter.

714,766
PB-263 264/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electroexcitation of the T sub (0)(+1) Giant M1 Resonance in (58)Ni and (60)Ni.
Final rept.,
R. A. Lindgren, W. L. Bendel, E. C. Jones, L. W. Fagg, X. K. Maruyama, J. W. Lightbody, and S. P. Fivozinsky. Nov 76, 11p
Pub. in Physical Review, C. Nuclear Physics, v14 n5 p1789-1799 Nov 76.

Keywords: *Electron scattering, *Nickel isotopes, Inelastic scattering, Nuclear structure, Reprints, Giant resonance, Nickel 58, Nickel 60.

Using inelastic electron scattering, several isobaric analog 1(+) states between 9 and 12 MeV excitation in 58Ni and 60Ni have been found. They are identified as components of the T(0)+1 giant M1 state in 58,60Ni.

714,767
PB-265 056/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Vacuum Ultraviolet Radiometry. 3: The Argon Mini-Arc as a New Secondary Standard of Spectral Radiance.
Final rept.,
J. M. Bridges, and W. R. Ott. Feb 77, 10p
Sponsored in part by National Aeronautics and Space Flight Center, Greenbelt, Md. Goddard Space Flight Center. See Rept. no. 2, COM-75-50648.
Pub. in Appl. Opt., v16 n2 p367-376 Feb 77.

Keywords: *Ultraviolet radiation, *Radiometry, Electric arcs, Argon, Calibrating, Standards, Plasma diagnostics, Hydrogen, Radiance, Reprints, *Argon arcs.

A miniature argon arc has been designed and tested as a new transfer standard of spectral radiance for the wavelength range from 114 nm to 330 nm. Calibration has been performed using two primary standard sources: the hydrogen arc from 130 nm to 330 nm and the blackbody line radiator from 114 nm to 130 nm. The mini-arc provides an intense, stable, and reproducible uv continuum with dc power requirements of less than 1.5 kW. The arc characteristics have been investigated, and the sensitivity of the radiant power output to various operating parameters has been measured. The rms uncertainty in the spectral radiance is estimated to be 5.3% above 140 nm and 10.1% between 114 nm and 140 nm, due primarily to uncertainties in the primary standard sources.

714,768
PB-265 096/8 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Relativistic Many-Body Bound Systems: Electromagnetic Properties.
Monograph rept.,
M. Danos, and V. Gillet. Apr 77, 56p NBS-Mono-147-Suppl-1
Prepared in cooperation with Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires. Library of Congress Catalog Card no. 77-1469. See also report dated Apr 75, COM-75-10614.

Keywords: *Electromagnetic interactions, *Electron scattering, *Quantum theory, Magnetic moments, Nuclear structure, Schodinger equation, Elementary particle interactions, Computation, Form factors.

The formulae for the calculation of the electron scattering form factors, and of the static magnetic dipole and electric quadrupole moments, of relativistic many-body bound systems are derived. The framework, given in NBS Monograph 147, is relativistic quantum field theory in the Schrodinger picture; the physical particles, i.e., the solutions of the interacting fields, are given as linear combinations of the solutions of the free fields, called the parton fields. The parton-photon interaction is taken as given by minimal coupling. In addition, the contribution of the photon-vector meson vertex of the vector dominance model is derived.

714,769
PB-265 428/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Two-Body Electrodisintegration of 3He: Faddeev Calculation,
C. R. Heimbach, D. R. Lehman, and J. S. O'Connell. 1977, 4p
Pub. in Physic Lett., v66B n1 p1-4 Jan 77.

Keywords: *Electron scattering, *Helium 3, Coulomb interactions, Reprints.

3He(e,e')pd and 3He(e,e'p)d cross sections are calculated with Faddeev formalism. At low excitation energies, forward electron scattering cross sections are dominated by the Coulomb monopole transition. Backward electron scattering is dominated by the magnetic quadrupole transition.

714,770
PB-265 431/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Californium-252 Fission Spectrum Irradiation Facility for Neutron Reaction Rate Measurements,
J. A. Grundl, V. Spiegel, C. M. Eisenhauer, H. T. Heaton, D. M. Gilliam, and J. Bigelow. 1977, 5p
Pub. in Nucl. Technol., v32 p315-319 Mar 77.

Keywords: *Neutron cross sections, Neutron scattering, Neutron sources, Californium isotopes, *Californium 252, Reprints.

Spontaneous fission sources of 252Cf, lightly encapsulated and with neutron source strengths approaching 10 to the 10th power n/sec, have been developed especially for integral cross section measurements and neutron reaction rate calibrations. An irradiation facility at the National Bureau of Standards makes use of these sources in two well-investigated geometries. A free-field neutron flux in the range of 10 to the 7th power n/cm squared sec and fluences of up to 10 to the 13th power n/cm squared are established at the facility based only upon a distance measurement and the absolute source strength of the national standard Ra-Be photoneutron source. The error in the 252Cf source strength (plus or minus 1.1%) dominates the total free-field flux uncertainty of plus or minus 1.4% (1 sigma). Neutron scattering effects in source capsule and support structures, and neutron return from concrete and earth boundaries have been calculated and investigated experimentally. In the worst case they contribute plus or minus 0.7% to the total flux response uncertainty for all observed neutron reaction rates, including those with sensitivity to low-energy neutrons.

714,771
PB-266 482/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Low-Momentum-Transfer Elastic Electron Scattering from 3He,
Z. M. Szalata, J. M. Finn, J. Flanz, F. J. Kline, G. A. Peterson, J. W. Lightbody, X. K. Maruyama, and S. Penner. Apr 77, 4p
Pub. in Phys. Rev. C 15, n4 p1200-1203 Apr 77.

Keywords: *Helium 3, *Electron scattering, Elastic cross sections, Carbon 12, Reprints.

Elastic electron scattering cross sections for 3He were measured relative to those of 12C in the range of momentum transfer squared between 0.032 and 0.34 fm sup(-2). The 3He rms charge radius was determined from the data to be 1.90 plus or minus 0.05 fm.

714,772
PB-266 492/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Can Superconductivity Contribute to the Determination of the Absolute Ampere,
D. B. Sullivan, and N. V. Frederick. Jan 77, 4p
Pub. in Proceedings IEEE Conf. Applied Superconductivity, Held at Sanford, California on August 18-20, 1976, IEEE Trans. Magn. MAG-13, n1 p396-399 Jan 77.

Keywords: *Electrical measurement, Units of measurement, Superconductivity, Determination, *Ampere, Josephson effect, Levitation.

The absolute ampere is shown to be derivable from a static levitation of a superconducting mass. The magnetic force which balances the gravitational force can be obtained from a combination of inductance and linear position measurements. A unique feature of the concept is the use of the calculable capacitor for the inductance measurements. Besides the possibility of this specific approach other concepts involving superconductivity are also discussed.

714,773
PB-268 513/9 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Office of Standard Reference Data.

Critical Evaluation of Data in the Physical Sciences. A Status Report on the National Standard Reference Data System, January 1977,
S. A. Rossmassler. May 77, 88p NBS-TN-947
Library of Congress catalog card no. 77-600016.

Keywords: *Standards, *Data retrieval, National government, Evaluation, Information systems, Energy, Environmental surveys, Industrial plants, Materials, Utilization, Standard reference materials, Government agencies, National Bureau of Standards, *National Standard Reference Data System, Physical sciences.

This is a report on the status of the National Standard Reference Data System as of January 1977. Current activities and functions of the Office of Standard Reference Data are summarized. A complete list of data evaluation projects supported by the Office of Standard Reference Data during Fiscal Year 1977 is included; this list also includes projects which received financial support during the previous fiscal year, and which are still actively involved in some aspect of data compilation and evaluation. The list of projects includes continuing data centers in the United States whose activities fall within the scope of the system, but which are not formally affiliated with it. A list of publications resulting from the National Standard Reference Data program is provided.

714,774
PB-268 542/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photon Scattering in the Energy Range 5-30 MeV,
E. Hayward. 1976, 47p
Pub. in Lectures for the Erice Photonuclear School, Sicily, italy, June 3-17, 1976. Paper in Lecture Notes in Physics, n61, Photonuclear Reactions, p340-406 1976.

Keywords: *Nuclear scattering, *Photon scattering, Photonuclear reactions, Polarization, Reprints.

Nuclear elastic photon scattering will be discussed including the resonance fluorescence of discrete energy levels and the scattering from the higher energy continuum. The effect of Doppler broadening and inelastic scattering on the former will be included and the angular distributions for polarized and unpolarized incident radiation will be outlined. The contributions and influence of Thomson, Rayleigh, and Delbruck scattering will also be recognized. The present status of the experiments will be summarized including the work using neutron capture gamma-rays and tagged photons as sources. Areas for future experimentation will be pointed out. These will include the use of polarized beams as well as the polarization analysis of scattered beams.

714,775
PB-269 535/1 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
National Measurement System for Far Ultraviolet Radiometry.
Final rept.,
W. R. Ott. Jun 77, 75p NBSIR-75-941

Keywords: *Far ultraviolet radiation, *Radiometers, *Monitors, Laboratory equipment, Standards, Quality control, Measuring instruments, Plasma diagnostics, Electric arcs, Safety, Instrumentation, National Measurement System.

Contents:
Structure of the measurement system;
Impact, status, and trends of measurement system;
Survey of NBS services;
Summary and conclusions.

714,776
PB-269 736/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Applications of Neutron Capture Gamma-Ray Spectroscopy.
Final rept.,
C. D. Bowman. Mar 75, 6p
Pub. in Proceedings of International Symposium on Neutron Capture Gamma Ray Spectroscopy and Related Topics (2nd), Petten, The Netherlands 2-6 Sep 74 p729-734 Mar 75.

Keywords: *Neutron absorption, *Gamma ray spectroscopy, *Neutron capture gamma rays.

Neutron capture gamma-ray spectroscopy is discussed from the viewpoint of a basic science which is beginning to have a significant impact on applied science. Examples of this are cited in some detail. Probable trends in future applications of neutron capture gamma-ray spectroscopy are discussed along with other challenges in applications which related nuclear physics might wish to address in the future.

714,777
PB-270 206/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Seventy-Five Years of Physics at NBS.
Final rept.,
E. Ambler. 1976, 7p
Pub. in Phys. Today, 7p Aug 76.

Keywords: *Bibliographies, *Nuclear physics, Thermodynamics, Cryogenics, Nuclear spectroscopy, Reprints, *National Bureau of Standards, Fundamental constants.

The article contains a discussion of contributions of the National Bureau of Standards to physics over its 75 year history and the close association between NBS and the American Physical Society. The contributions of NBS in four broad areas namely, nuclear physics, thermal physics (including cryogenics), spectroscopy (including collision parameters), and fundamental constants (including precision measurements) is considered.

714,778
PB-270 316/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Isospin Shift of the Energy of the Giant Resonance.
Final rept.,
B. L. Berman, B. F. Gibson, and J. S. O'Connell.
1977, 5p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Physics Letters, v66B n5 p405-409, 28 Feb 77.

Keywords: *Photonuclear reactions, Nuclear spins, Reprints, *Giant resonance.

Systematics of the peak position of the photonuclear giant resonance are examined to extract the dependence on target isospin. The energy shift with isospin at constant atomic weight is of the same sign and magnitude as the shift with A at constant T in disagreement with theoretical estimates.

714,779
PB-270 723/0 PC **A04**/MF **A01**
National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
Frequency Standards and Clocks: A Tutorial Introduction.
Technical note,
H. Hellwig. Jun 77, 74p NBS-TN-616-Rev-2
Supersedes report dated Mar 74, COM-74-50347.

Keywords: *Frequency standards, *Atomic clocks, Quartz resonators, Crystal oscillators, Cesium frequency standards, Rubidium frequency standards, Masers, Accuracy, Performance, Stability, Reproducibility.

The topic of frequency standards and clocks is treated in a tutorial and non-mathematical way. The concepts of time, frequency, frequency stability and accuracy are introduced. The general physical principles and design features of frequency standards and clocks are described. The design, performance, and limitations of quartz crystal oscillators and atomic devices (cesium, hydrogen, rubidium) are discussed in detail and critically compared for laboratory devices as well as for devices intended for field usage.

714,780
PB-270 863/4 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Radiation Research.
Cross Sections and Yields for High Energy Neutron Source Reactions,
M. A. Lone, L. Stewart, A. D. Carlson, and C. D. Bowman. Jul 77, 41p NBSIR-77-1279
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Prepared in cooperation with Los Alamos Scientific Lab., N. Mex. and Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.

Keywords: *Neutron reactions, *Neutron sources, *Meetings, Neutron spectrum, Dosimetry, Deuteron reactions, Proton reactions, Radiation damage.

Eight papers are presented that were given at a workshop on thick-target yields from high-energy neutron source reactions on March 30th, 1977 in Bethesda, Md. Presentations were made on several source reactions including D(d,n), Li(p,n), Li(d,n), Be(p,n), Be(d,n), and C(d,n) including energy and angular distributions. Special emphasis was placed on these sources due to the needs in medical applications and for studies of radiation damage expected in an operating fusion reactor.

714,781
PB-270 968/1 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Electromagnetic Interactions from 5 to 500 MeV and Nuclear Research--A Position Paper as of March 1977.
Final rept.,
L. C. Maximon. Aug 77, 55p NBS-TN-955

Keywords: *Electromagnetic interactions, Bremsstrahlung, Elastic scattering, Quantum electrodynamics, Electron scattering.

The author presents the current status of both experimental measurements and theoretical expressions for cross sections for the majority of the electromagnetic processes that are intimately connected with nuclear research using electromagnetic probes, emphasizing in particular those theoretical papers which are both reliable and useful for an analysis of the experiments, and indicating those regions in which the theoretical calculations are inadequate. Serving as a structure for this presentation, four areas of experimental research have been chosen, and we discuss in reasonable detail the status of the latest experiments in these areas: Total photoabsorption cross section measurements, Elastic Photon scattering and Delbruck scattering, Electron scattering and its corrections-radiative, recoil, dispersive and relativistic-, and the bremsstrahlung spectrum tip. In addition, a guide to the more pertinent articles (experiment and theory) on the subject of virtual photons is presented.

714,782
PB-271 168/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Metrication - Take the Tide at Its Flood.
Final rept.,
H. J. Milton. 1977, 5p
Pub. in Concrete Constr., v22 n8 p429-431, 440-442 Aug 77.

Keywords: *Metric system, *Construction industry, Standards, Analyzing, Reprints.

The paper presents the impending change to metric (SI) measurement in the construction community as an opportunity and a once-only chance for review, technical improvement and cost reduction. It deals with the analysis of precedent in the change to SI; defines some new terms, such as 'hard conversion' to preferred sizes and descriptions; discusses metrication for benefit; and focuses on the opportunities for rationalization associated with the change. Four principal opportunities are identified: simplification, rationalization, harmonization and standardization, and each one is illustrated by a number of examples. The paper recommends that metrication should be regarded as a worthwhile challenge, rather than as a problem, so that the approach to change is a vigorous and positive one instead of a defensive and negative one. The benefits from opportunities realized should easily pay for the once only cost of the change.

714,783
PB-271 180/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Gallium Melting-Point Standard: Its Role in Our Temperature Measurement System.
Final rept.,
B. W. Mangum. 1977, 8p
Pub. in Clin. Chem., v23 n4 p711-718 1977.

Keywords: *Temperature measurement, *Standards, *Melting points, *Gallium, Enzymes, Reprints, Clinical chemistry.

The latest internationally-adopted temperature scale, the International Practical Temperature Scale of 1968 (amended edition of 1975), is discussed in some detail and a brief description is given of its evolution. The melting point of high-purity gallium (stated to be at least 99.99999% pure) as a secondary temperature

reference point is evaluated. The author believes that this melting-point temperature of gallium should be adopted by the various medical professional societies and voluntary standards groups as the reaction temperature for enzyme reference methods in clinical enzymology. Gallium melting-point cells are available at the National Bureau of Standards as Standard Reference Material No. 1968.

714,784
PB-271 580/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Defining Critical Current.
Final rept.,
A. F. Clark, and J. W. Ekin. Jan 77, 3p
Sponsored in part by Naval Ship Research and Development Lab., Annapolis, Md.
Pub. in IEEE Trans. Magn. MAG-13, n1 p38-40 Jan 77.

Keywords: *Superconductivity, Standards, Criteria, Electric current, Superconductors, Definitions, *Critical current, Reprints.

The superconducting critical current can be defined in a variety of ways such as a specific voltage level, an apparent resistivity, or even the point of the irreversible superconducting-to-normal transition. These different values may differ very little or be meaningless for one given condition, but when comparing superconductors under a variety of conditions, such as different magnetic fields or applied stresses, these different definitions can lead to dramatic differences in behavior. These differences are illustrated using data for the effects of stress on the critical current behavior in wires. As part of an initial effort at the National Bureau of Standards to develop standard practices and definitions for practical superconductors, several critical current criteria are proposed and discussed.

714,785
PB-271 588/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Forecast of New Metrological Directions at NBS.
Final rept.,
B. W. Birmingham. 1977, 4p
Pub. in NCSL Newsletter 18, n3 p12-15 Jun 77.

Keywords: *Metrology, Forecasting, National Bureau of Standards, Reprints.

The manuscript was presented in the form of a speech made at the May 1977 Board of Directors meeting of the National Conference of Standards Laboratories. The speech covered some future directions of metrology at NBS.

714,786
PB-271 589/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pressure Measurement at Low Temperatures.
Final rept.,
J. M. Arvidson, and J. A. Brennan. 1976, 10p
Pub. in Proc. Biennial Symp. on Instrumentation in the Cryogenic Industry (1st), Houston, Texas, October 11-14, 1976, ISA Trans. 1, p607-1-607-9 1976.

Keywords: *Pressure sensors, *Pressure measurement, Cryogenics, Calibrating.

The paper discusses topics related to the questions: (1) What types of pressure transducers show good potential for cryogenic use. (2) What are the output characteristics (stability, sensitivity, etc.) of a transducer when subjected to low temperature environments. and (3) Are methods or apparatus available to cryogenically calibrate pressure transducers under static and dynamic conditions. Some information is available on the low-temperature performance of a relatively few pressure transducer types; however, the information is either in the form of manufacturing specifications or unpublished reports. The results of this study clearly indicate that individual transducers, even from the same manufacturer, can exhibit totally different characteristics when subjected to identical cryogenic test procedures. The previous statement indicates the necessity of calibrating each transducer for use at low temperature. Also included in the discussion is the description of a National Bureau of Standards (NBS) static/dynamic low-temperature pressure transducer calibration facility, which is currently being developed.

714,787
PB-271 595/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
RF Power Measurements Using Quantum Interference in Superconductors.
Final rept.,
D. B. Sullivan, N. V. Frederick, and R. T. Adair. 1977, 9p
Pub. in Proc. IC SQUID (1st), Berlin (Germany), October 5-8, 1976, Paper R-1045 in Superconducting Quantum Interference Devices and Their Applications, p355-363 1977.

Keywords: *Radiofrequency power, *Measurement, Superconductivity, Josephson effect, *Squid devices, Quantum interference.

A SQUID system for high sensitivity and broad dynamic range measurement of rf power at 30 MHz has been developed. The system is a modification of earlier concepts and consists of two SQUIDs, each sensing power in adjacent but slightly overlapping ranges, providing an overall dynamic range of 105 dB. A dc calibration of one of the SQUIDs provides a power uncertainty of less than 0.1 dB for the system at lower levels as low as -131 dBm (approximately 8 x 10 to the minus 17 power watts).

714,788
PB-271 597/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Length Calibrations in the Micrometer and Submicrometer Range.
Final rept.,
R. D. Young. 1977, 6p
Pub. in Annals of the CIRP 25, n1 p245-250 Aug 77.

Keywords: *Length, *Standards, Measurement, Calibrating, Photometry, Optical microscopes, Electron microscopes, Micrometrology, Reprints.

Recent technological shifts toward microcircuits and other microtechnologies have generated unmet demands for length measurements in the micrometer and submicrometer range. The National Bureau of Standards is developing the measurement techniques and physical standards to provide the basis for extending the National Measurement System for Length to the micrometer range. The program involves the following activities: (1) development of a high accuracy scanning photometric microscope with data acquisition system, (2) systematic theoretical and experimental study of the errors in filar and shearing eyepiece measurements with optical microscopes, (3) development of electrically programmable, high resolution stages, (4) design and construction of interferometric stage for scanning electron microscope measurement of micrometer and submicrometer lines and spaces, (5) design and procurement of physical standards for calibration transfer, (6) optical evaluation of microscope objectives and (7) development of new optical instruments for linewidth measurement. Each component of the program will be described along with achievements to date.

714,789
PB-271 629/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Conference Report on Cryogenic Instrumentation Symposium Held at Houston, Texas on October 11-14, 1976.
Final rept.,
P. J. Giarratano. 1977, 3p
Pub. in Cryogenics, v17 n3 p186 Mar 77.

Keywords: *Instrumentation, *Cryogenics, Meetings.

A summary of papers presented at the Instrument Society of America International Conference and Exhibit is given.

714,790
PB-271 746/0 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Threshold Photo and Electroproduction of Pions from Nuclei.
Final rept.,
E. T. Dressler. Sep 77, 41p NBS-TN-957

Keywords: *Photoproduction, *Pions, Nuclear cross sections, Wave functions, *Electroproduction, Gauge conditions.

The nonrelativistic amplitudes for photo and electroproduction of pions are derived using effective pseudoscalar and pseudovector Lagrangian desities. The results for pseudscalar and pseudovector coupling are compared at threshold for charged and neutral pion photo and electroproduction. Cross section formulas and kinematical conditions are also presented.

714,791
PB-271 810/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Relevancy of Measurements by a Systems Approach.
Final rept.,
R. C. Sangster. 1972, 7p
Pub. in Proceedings of Joint Measurement Conference (1972), Boulder, Colorado, June 21-23, 1972, p31-37 1972.

Keywords: *Metrology, *Measurement, Systems analysis.

The complexity of today's technological systems is so high that measurements made in the classical calibration sense, on specific isolated objects or portions of an overall system, may not be at all optimum for telling a client what his system is really doing. Metrology is undergoing an evolution paralleling that in electronics and other fields, to allow it to maintain relevancy by providing effective support to the systems engineer. Specific examples discussed relate to performance assessment in telecommunications systems, coal mine safety, plastic land mine detection, and other areas.

714,792
PB-271 933/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison of Macroscopic and Microscopic Calculations of High Energy 20Ne+238U Collisions.
Final rept.,
A. A. Amsden, J. N. Ginocchio, F. H. Harlow, J. R. Nix, M. Danos, E. C. Halbert, and R. K. Smith. 1977, 4p
Sponsored in part by Energy Research and Development Administration, Washington, D.C.
Pub. in Physical Review Letters, v38 n19 p1055-1058, 9 May 77.

Keywords: *Nuclear reactions, *Nuclear cross sections, Uranium 238, Neon isotopes, Neon 20, Reprints.

For the reaction20Ne + 238U at a laboratory bombarding energy per nucleon of 250 MeV, the authors calculate the cross section for outgoing protons using four different approaches. These are relativistic fluid dynamics, classical many-body calculations with a hard-sphere nucleon-nucleon potential, and two versions of relativistic intranuclear-cascade calculations. These calculations reproduce some features of the experimental data, but some major discrepancies remain.

714,793
PB-271 934/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Some Consequences of Fermi-Type Theory of Weak Interactions.
Final rept.,
M. Danos, and J. Refelski. 1977, 5p
Sponsored in part by Energy Research and Development Administration, Washington, D.C. Div. of Physical Research.
Pub. in Nuovo Cimento Lett. 19, n9 p339-343, 2 Jul 77.

Keywords: *Weak interactions, Computation, Fermi theory, Reprints.

The authors consider qualitatively the consequences of a theory of weak interactions based on a Fermi-type interaction without vector mesons. They compute the renormalization of the Fermi coupling constant and obtain the strength of the induced, neutral current like, coupling.

714,794
PB-272 192/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Absolute Measurement of the Critical Scattering Cross Section in Cobalt.
Final rept.,
C. J. Glinka, V. J. Minkiewicz, and L. Passell. 1975, 3p
Sponsored in part by national Science Foundation, Washington, D.C.
Pub. in Proceedings of AIP Conference on Magnetism and Magnetic Materials (21st), Philadelphia, Pa., December 9-12, 1975 Paper in Magnetism and Magnetic Materials, p499-501 1975.

Keywords: *Cobalt, *Neutron cross sections, Neutron scattering.

Small-angle neutron scattering techniques have been used to study the angular distribution of the critical scattering from cobalt above T(c).

714,795
PB-273 122/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
What Time Is It Really.
Final rept.,
C. N. Smith. 1977, 5p
Pub. in Ind. Res. 19, n3 p70-74 Mar 77.

Keywords: *Time, Time measurement, Time signals, Atomic clocks, Time standards, Frequency standards, Reprints.

Accurate timekeeping, and time and frequency measurements, are necessary to a wide range of scientific and technical activities in industry, commerce, and government. The National Bureau of Standards' research programs in time and frequency standards and measurements have recently produced significant advances in several areas of this field. New methods of disseminating accurate time and frequency information include the use of network television signals as transfer standards between NBS and the user, and the experimental use of geosynchronous satellites to relay time and frequency signals from NBS to users. New instrumentation for evaluating high-quality clocks and for precisely measuring the time differences between them has been developed, along with a new portable atomic clock which provides much greater ease and economy of time transport than existing clocks.

714,796
PB-273 123/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Kind of Passively Operating Hydrogen Frequency Standard.
Final rept.,
F. L. Walls, and H. Hellwig. 1976, 8p
Pub. in Proceedings Annual Symposium on Frequency Control (30th), Ft. Monmouth, New Jersey, June 1976, p473-480 1976.

Keywords: *Frequency standards, Hydrogen, Gas masers, Passive systems.

The philosophy behind a new design of a passively operating hydrogen frequency standard is described. Basically the hydrogen atoms are stored in a conventional, coated quartz bulb, which is contained in a TE(011) cavity. The H-atoms are interrogated by driving the traditional 1,0 to 0,0 transition with an external frequency source and comparing the amplitude and/or phase of the output signal from the cavity with the input signal. The goal of this design is to achieve long term frequency stability of better than 1 part in 10 to the 14th power for measurement times from 1 day to 1 year. This is done by increasing the cavity linewidth and decreasing the hydrogen resonance linewidth as compared to typical values for an oscillating maser. The possibility of significant size reductions based on the use of small dielectric cavities and lower beam intensities, at little or no sacrifice in long term stability, is pointed out. A new cavity control servo is described which allows the rapid stabilization of the cavity resonance frequency to better than 10 to the minus 14th power in its effect of pulling the hydrogen resonance. The reduction of other systematic effects to below 10 to the minus 14th power fractional frequency uncertainty and instability is discussed, including spin exchange and magnetic interactions.

714,797
PB-273 190-T PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C.
International System of Units (SI).
Aug 77, 50p NBS-SP-330 (1977)
Supersedes Rept. no. NBS-SP-330(1974), COM-72-50367.

Keywords: *Metric system, Documents, Translations, Revisions, International system of units.

The translation from the French 'Le Systeme International d'Unites', (SI) published originally by the International Bureau of Weights and Measures (BIPM) has been prepared jointly by the National Physical Laboratory, UK, and the National Bureau of Standards, USA. Included are Resolutions and Recommendations of the General Conference on Weights and Measures (CGPM) on the International System of Units, (ISO) for the practical use of the system. Appendix I gives in chronological order the decisions promulgated since 1889 by CGPM and the International Committee for Weights and Measures (CIPM) on units of measurement and on SI. Appendix II outlines the measurements, consistent with the theoretical definitions given in this document, which metrological laboratories can make to realize the units and to calibrate precision material standards. Appendix III lists the organs of the Metric Convention.

714,798
PB-273 591/8 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
Survey of the National Metric Speakers Bureau,
J. M. Tascher. Nov 77, 60p NBS-TN-960

Keywords: *Metric system, Information, Surveys, Education, National Metric Speakers Bureau, Lecturers.

The National Metric Speakers Bureau was established by the Metric Information Office of the National Bureau of Standards (NBS) in January 1976 in response to the rapidly growing interest in the metric system and metrication. The number of speakers at the end of 1976 was 273 with at least one in every State. NBS supplied a script and other materials to each speaker. A survey of all of the speakers was conducted during November and December 1976. The purpose of the survey was to determine how the Speakers Bureau is working, and how it can be made to work better. NBS wanted to know, for example, what the speakers thought of the speaker materials supplied by NBS, where additional speakers may be needed, what types of expertise the speakers have, and how NBS could further assist the speakers. This report summarizes the findings of the survey. The report also gives a survey of the sources of information on the metric system and metrication. A roster of speakers of the National Metric Speakers Bureau, dated July 1977, appears in an appendix.

714,799
PB-273 948/0 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Basic Standards.
Survey of the Temporal Stability of Angle Blocks.
Final rept.,
R. C. Veale, and C. P. Reeve. Nov 74, 24p NBSIR-74-601

Keywords: *Standards, *Measuring instruments, Angles(Geometry), Calibrating, Stability, *Angle blocks.

The National Bureau of Standards is often asked how frequently a set of angle blocks should be calibrated. In order to provide a basis for answering that question, a survey was made of the long-term stability of several sets of angle blocks over a ten-year period. Data is given concerning the short-term and long-term variability of the measurement process as well as the observed long-term slope of the computed values. The conclusion is that a significant long-term variation in the measurement system does exist, but the long-term slope of the blocks which were surveyed is not significantly different from zero.

714,800
PB-273 951/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Separation of the delta delta and NN Components of the Deuteron by Kinematics of High Energy Pion Deuteron Reactions.
Final rept.,
M. Danos, and H. T. Williams. Sep 77, 5p
Pub. in Physical Review. C. Nuclear Physics, v16 n3 p1082-1086 Sep 77.

Keywords: *Deuteron reactions, *Pions, Nuclear scattering, Reprints.

The kinematics of the reaction Pion + d yields Pion + N + anything is analyzed for 15 GeV incoming pions. It is shown that by observing both the invariant mass and the angular correlations of backward Pion N-events one can insure that the observed particles arise from the decay of a spectator delta in a quasi-free scattering event, i.e., they give a quantitative estimate of the delta delta-admixture of the deuteron. Failure of experimental observation of such events would indicate a failure of the effective Lagrangian formalism.

714,801
PB-274 048/8 PC **A07**/MF **A01**
National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
Structure and Functions of the National Measurement System,
R. C. Sangster. Jul 77, 139p NBSIR-75-949
Report on the 1972-75 Study of the National Measurement System.

Keywords: *Metrology, Measurement, Systems analysis, Publications, *National measurement system.

The National Measurement System consists of the activities and mechanisms--intellectual and operational, technical and institutional--that provide physical measurement data to allow creation of the objective, quantitative knowledge required by our society. This report describes the structural and functional aspects of the system, with emphasis on the technical and institutional infrastructures, the international context, and basic impacts and trends. 16 appendices and an extended bibliography provide back-up detail. Measurement is necessary in conduct of the life of the individual, pursuit of science, operations of society, and employment of technology, for describing, predicting, communicating, deciding, controlling, and reacting in dealing with the physical universe.

714,802
PB-274 994/3 PC **A17**/MF **A01**
National Bureau of Standards, Washington, D.C.
Neutron Standards and Applications,
C. D. Bowman, A. D. Carlson, H. O. Liskien, and L. Stewart. Oct 77, 381p NBS-SP-493
Proc. of the International Specialists Symposium on Neutron Standards and Applications, Held at NBS, Gaithersburg, MD, on March 28-31, 1977. Prep. in coop. with Energy Research and Development Admin., Wsh, DC. Electric Power Research Inst, Palo Alto, CA, American Nuclear Society, Wsh, DC, and American Physical Society, Wsh, DC. Library of Congress Cat. Card no. 77-14317.

Keywords: *Neutron cross sections, *Meetings, Neutron flux, Dosimetry, Standards.

These proceedings contain forty-seven papers, which were presented at the International Specialists Symposium on Neutron Standards and Applications held at the National Bureau of Standards on March 28-31, 1977. The topics addressed at the Symposium include light-element cross section standards, capture and fission cross section standards, integral neutron standards, flux measuring techniques, and medical and personnel dosimetry.

714,803
PB-275 025/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Experiments of Astrophysical Significance Using a Laser Strainmeter.
Final rept.,
J. Levine. 1974, 10p
Grant NSF-GA-36365
Pub. in Proceedings of Laser Spectroscopy Conference, Vail, Colo. 25-29 Jun 73. Paper in Laser Spectroscopy p643-652 1974.

Keywords: *Gravity waves, *Interferometers, Astronomical instruments, Measuring instruments, Instrumentation, Infrared lasers, Laser interferometers, Helium neon lasers.

A 30 meter laser strainmeter is currently being used to investigate the possibility of detecting extra terrestrial sources of gravitational waves using the earth as an antenna. The strainmeter consists of an evacuated Fabry-Perot interferometer, illuminated by a 3.39 micrometer He-Ne laser. A second 3.39 micrometer laser is stabilized by means of saturated absorption in methane, and its wavelength serves as a reference length for the system. Detection of signals from rotating binary star systems may be possible if some means could be found for reducing the earth noise. The authors suggest ways in which this might be accomplished.

714,804
PB-275 189/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Correlation for Heat Transfer to Supercritical Helium in Turbulent Flow in Small Channels.
Final rept.,
L. A. Yaskin, M. C. Jones, V. M. Yeroshenko, P. J. Giarratano, and V. D. Arp. Oct 77, 4p
Pub. in Cryogenics, v17 n10 p549-552 Oct 77.

Keywords: *Helium, *Turbulent flow, *Heat transfer, Liquefied gases, Supercritical flow, Liquid helium, Reprints.

This paper presents a new correlation for the deterioration in heat transfer to turbulent flows of helium, relative to standard constant property correlations. The correlating parameters are arrived at by analogy between the heat transfer process to a gas with high thermal expansion and that which takes place in the presence of gas injection through a porous wall, the idea having been originally proposed by Kruzhilin. The idea appears to be applicable to the ideal gas state as well as the supercritical state. Comparison with available experimental data is made. Not only is the correlation of the data good, but the actual injection equation may be used to predict deterioration by as much as an order of magnitude.

714,805
PB-276 232/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Three-body Calculation of Two-body Threshold Electrodisintegration of 3He and 3H.
Final rept.,
C. R. Heimbach, D. R. Lehman, and J. S. O'Connell. Dec 77, 16p
Pub. in Physical Review, vC16 n6 p2135-2150 Dec 77.

Keywords: *Helium 3, *Tritium, Electron scattering, Three body problem, Reprints.

Threshold two-body electrodisintegration of 3He and 3H is investigated within the context of exact three-body theory. The calculations performed are based on the formalism of Gibson and Lehman. Careful consideration is given to the singularities of the disintegration Born amplitude for this case, since the momentum transfer is not zero, to assure validity of the numerical methods. Calculated results are compared with all the latest threshold 3He electrodisintegration data which sample a range of scattered-electron angles, 92.6 degrees = or < (theta sub e) = or < 180 degrees, and incident electron energies, 40 MeV = or < (E sub 0) = or < 120 MeV.

714,806
PB-277 171/5 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Direct Approach to the Derivation of Electric Dyadic Green's Functions.
Technical note,
A. D. Yaghjian. Jan 78, 70p NBS-TN-1000
See also report dated 1976, PB-261 204.

Keywords: *Electromagnetic theory, *Green's function, Maxwells equations, Delta function, Wave equations, Electric fields, Magnetic fields, Helmholtz equation.

A straightforward approach that does not require delta-function techniques is used to derive a generalized electric dyadic Green's function which remains valid within the source region. Although the electric field expressed by the dyadic Green's function proves to be unique, the exact form of the dyadic itself depends, in the source regions, upon the geometry of its 'principal volume.' The dependence on principal volume is determined explicitly, and the different Green's dyadics derived by a number of previous authors are shown to emerge merely through the appropriate choice for the principal volume. Moreover, delta-function techniques, which by themselves are shown to be inadequate to extract uniquely the proper electric dyadic Green's function in the source region, can be supplemented by a very simple procedure to yield unambiguously the correct Green's function and associated fields.

714,807
PB-277 303/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Uniqueness for the BBGKY Hierarchy for Hard Spheres in One Dimension.
Final rept.,
H. J. Raveche, and C. A. Stuart. 1977, 11p
Pub. in Jnl. of Statistical Physics 17, n5 p311-321 1977.

Keywords: *Statistical mechanics, Spheres, Correlation, *BBGKY equation, Correlation functions, One-dimensional calculations, Reprints.

The authors prove that the stationary BBGKY hierarchy for an infinite system of hard spheres in one dimension has a unique solution for all densities, within a symmetry class that pertains to either a fluid array or to a perfect crystalline array. The solution is shown to correspond to the uniform fluid, which is the only equilibrium state of the infinite system. The proof is subject to the recursion relation for the correlation functions found by Salsburg, Zwanzig and Kirkwood, which, the authors show, exactly reduces the infinite hierarchy to a pair of coupled equations. A brief discussion is given of the existence of multiple solutions of an approximate BBGKY equation.

714,808
PB-278 960/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Redetermination of 198 Au and 192 Ir gamma-Ray Standards between 0.1 and 1.0 MeV.
Final rept.,
E. G. Kessler, R. D. Deslattes, A. Henins, and W. C. Sauder. 1978, 4p
Pub. in Physical Review Letters 40, n3 p171-174, 16 Jan 78.

Keywords: *Gamma rays, *Standards, Helium neon lasers, Gold isotopes, Iridium isotopes, Gold 198, Iridium 192, Reprints.

Prominent gamma-ray reference lines including 198 Au 411 and 675 keV and 192 Ir 205, 295, 308, 316, 468, 484, 588, 604, and 612 keV have been measured with respect to an I2-stabilized He-Ne laser. The 198 Au 411-keV line, a de facto gamma-ray standard, is reported at 3.0107788 pm (0.37 ppm) or 411 804.41 eV, which is 25 ppm higher in energy and forty times more accurate than previous values.

714,809
PB-279 058/2 PC **A05**/MF **A01**
National Bureau of Standards, Boulder, Colo. Cryogenics Div.
Measurements of Combined Axial Mass and Heat Transport in He II.
Technical note,
W. W. Johnson, and M. C. Jones. Feb 78, 84p NBS-TN-1002

Keywords: *Superfluidity, *Liquid helium, *Heat transfer, Helium 4, Mass flow, Conduction, Convection, Measurement.

This is the first report of the results of an investigation of steady-state combined heat transport and fluid flow of the superfluid phase of helium 4 (known as He II) through a long tube. An experiment was performed that allowed measurements of both axial mass and heat transport of He-II in a long tube. The apparatus allowed the pressure difference and the temperature difference across the flow tube to each be independently adjusted, and the resulting steady-state values of net fluid velocity and axial heat transport to be measured. For the larger Reynolds numbers, it was found that the relation between pressure difference and net fluid velocity was nearly indistinguishable from that of an ordinary fluid in turbulent flow. The axial heat transported was found to be suppressed from the values that wre calculated by assuming that 'mutual friction' was unchanged by the net fluid flow, but it was always found to be larger than the 'enthalpy rise' value. Taking this second value as a lower limit, it is shown that a mild extrapolation of these results suggests that (in appropriate circumstances) forced convection would allow much greater heat to be transported in long cooling channels than could be transported by 'natural' convection alone.

714,810
PB-280 391/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Interactions of Charged Particles with Matter: Ions and Electrons.
Final rept.,
R. S. Caswell. 1977, 26p
Sponsored in part by Department of Energy, Washington, D.C. Div. of Biomedical and Environmental Research.
Pub. in Proceedings of International Course at Varenna, Italy Sep-Oct 74, Paper F1 in Ionizing Radiation Metrology p329-354 1977.

Keywords: *Electron irradiation, *Ion irradiation, Charged particles, Interactions, Collision cross sections, Distance, Stopping power.

This paper is a didactic review of the subject of the interactions of charged particles with matter, specifically ions and electrons. Topics discussed include the fundamental collision cross section, stopping power for heavy charged particles, range-energy relations, straggling, delta-ray production, dose distribution and delta-ray flux around charged particle tracks, electron stopping power, and penetration.

714,811
PB-280 399/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutrino Scattering in a Modified GIM Model.
Final rept.,
R. C. Casella. 1 Dec 77, 20p
Pub. in Nuovo Cimento, v42A n3 p377-396, 1 Dec 77.

Keywords: *Neutrinos, Nuclear scattering, Quarks, GIM model, Partons, Reprints.

The high y anomaly in antineutrino-nucleon scattering is explained in terms of scaling violations using a simple cut-off procedure expressing diminution of free-parton scattering in the wee-x region.

714,812
PB-280 419/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Effects of Phonon Transfer on Near-Thermal Neutron Fission Cross Sections.
Final rept.,
C. D. Bowman, and R. A. Schrack. Feb 78, 10p
Pub. in Physical Review C, v17 n2 p654-663 Feb 78.

Keywords: *Fission cross sections, *Phonons, Thermal neutrons, Reprints.

For low energy neutron-induced fission in the thermal and epithermal range, the momentum transferred in forming the compound nucleus is small enough that the compound nucleus may remain bound in the lattice until it decays. Phonons, therefore, may be emitted or absorbed in the neutron absorption process changing the energy of the compound nucleus from that which would be derived simply from measuring the incoming neutron energy. The probability and influence of phonon transfer to and from the lattice is calculated at energies below 1 eV and is shown to have a small but significant effect on the observed cross section. The magnitude of the effect is temperature dependent and ranges in size from a few tenths of 1% for 235U fission at thermal to 5% for 239Pu fission at the 0.3 eV resonance. Some of the effect can be accounted for by applying the usual Doppler broadening approximation in the thermal range.

714,813
PB-280 420/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Structure Limitation on Accuracy of (super 235)U Fission Cross Section Measurements.
Final rept.,
C. D. Bowman, G. P. Lamaze, K. C. Duvall, and R. A. Schrack. 1976, 4p
Pub. in Proceedings of NEANDC/NEACRP Specialists Meeting on Fast Neutron Fission Cross Sections of U-233, U-235, U-238, and Pu-239, Argonne National Lab., 28-30 Jun 76 nos ANL-76-90, ERDA-NDC-5/L, NEANDC(US)-199/L 1976.

Keywords: *Uranium 235, *Fission cross sections, Accuracy, Uncertainty.

High resolution measurements of the 235U fission cross section carried out at LLL in 1970 have been averaged using Gaussian averaging functions with a FWHM = 1%, 2.5%, and 10%. Deviations from the 10% average are calculated and the results expressed in a table which permits an estimate of uncertainties introduced by the cross section fine structure for monoenergetic measurements of known resolution.

714,814
PB-280 453/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Inelastic Electron Scattering from Low-Lying States in the Nuclei (super 36)Ar and (super 40)Ar.
Final rept.,
J. M. Finn, H. Crannell, P. L. Hallowell, J. T. O'Brien, and S. Penner. 1977, 10p
Sponsored in part by National Science Foundation, Washington, D.C.
Pub. in Nuclear Physics A, n290 p99-108 1977.

Keywords: *Nuclear energy levels, Argon isotopes, Electron scattering, Inelastic scattering, *Argon 36, *Argon 40, Reprints.

The low-lying level structure of 36Ar and 40Ar has been investigated using the technique of inelastic electron scattering. Data were collected at the National Bureau of Standards Linear Accelerator with incident electron energies between 65 and 115 MeV and scattering angles of 92.5 degrees and 110 degrees. The data span a range of momentum transfer squared between 0.29 and 0.92 (f sup 2). Tassie model and Helm model analyses have been applied to data for levels at 1.97 and 4.18 MeV in 36Ar and at 1.46, 2.52, 3.21 and 3.68 MeV in 40Ar.A(2+) assignment to the 3.21 MeV state in 40Ar is suggested. Transition strengths, transition radii, and mean lifetimes for these states are computed and compared with results of previous experiments.

714,815
PB-280 524/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pion Electroproduction from 6Li.
Final rept.,
E. L. Tomusiak, and E. T. Dressler. 5 Dec 77, 3p
Sponsored in part by Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs., Atomic Energy Control Board, Ottawa (Ontario), and National Research Council of Canada, Ottawa (Ontario).
Pub. in Physics Letters 72B, n1 p1-3, 5 Dec 77.

Keywords: *Nuclear structure, *Pions, *Nuclear cross sections, Wave functions, Lithium isotopes, Helium isotopes, *Electroproduction, Lithium 6, Helium 6, Reprints.

The pion electroproduction cross section from 6Li is calculated assuming the 6He nucleus is detected. The wave-functions used in this calculation are those which gave the best agreement with the 6Li(gamma, pion +)6He data. The electroproduction experiment will provide a useful check of these wave functions.

714,816
PB-280 536/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Low-Momentum-Transfer Elastic Electron Scattering from 3He.
Final rept.,
Z. M. Szalata, J. M. Finn, J. Flanz, F. J. Kline, G. A. Peterson, J. W. Lightbody, X. K. Maruyama, and S. Penner. Apr 77, 4p
Sponsored in part by National Science Foundation, Washington, D.C. and Energy Research and Development Administration, Washington, D.C.
Pub. in Phys. Rev. C15, n4 p1200-1203, Apr 77.

Keywords: *Helium 3, *Electron scattering, Scattering cross sections, Elastic scattering, Carbon 12, Reprints.

Elastic electron scattering cross sections for 3He were measured relative to those of 12C in the range of momentum transfer squared between 0.032 and 0.34/(fm sup 2). The 3He rms charge radius was determined from the data to be 1.90 + or - 0.05 fm.

714,817
PB-280 537/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electroexcitation of 20Ne Giant Electric-Dipole and -Quadrupole Resonances.
Final rept.,
Z. M. Szalata, K. Itoh, G. A. Peterson, J. Flanz, S. P. Fivozinsky, F. J. Kline, J. W. Lightbody, X. K. Maruyama, and S. Penner. Feb 78, 8p
Contract E(11-1)-2853
Pub. in Physical Review C 17, n2 p435-442, Feb 78.

Keywords: *Nuclear resonance, Electron scattering, Neon isotopes, *Neon 20, *Electroexcitation, Reprints.

Electrons at five energies between 60 and 120 MeV were used to study the giant electric-dipole and -quadrupole resonances in 20Ne. Prominent electric-dipole peaks were found at 17.7, 19.1, 20.2, and 23 MeV in good agreement with photoreaction results. In addition the analysis reveals weaker fragmented electric-dipole strength in the region between 12.5 and 15 MeV. Prominent electric-quadrupole peaks were found at 13.0, 13.7, and 16.2 MeV, and a broad peak was found from 14.2 to 15.9 MeV. Two different analyses reveal a broad quadrupole excitation between 16 and 25 MeV. The dipole and quadrupole resonances deplete about 65% and 100% of the energy-weighted sum rule, respectively.

714,818
PB-281 336/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pion Cross Section Measurements on Aligned (super 165)HO in the (3,3) Resonance Region.
Final rept.,
T. R. Fisher, J. A. Becker, B. A. Watson, and H. Marshak. G. R. Burleson, M. D. Cooper, D. C. Hagerman, I. Halpern, M. J. Jakobson, R. H. Jeppeson, K. F. Johnson, L. D. Knutson, R. E. Marrs, H. O. Meyer, and R. P. Redwine. Dec 77, 9p
Sponsored in part by Department of Energy, Washington, D.C.
Pub. in Physical Review, C. Nuclear Physics, v16 n6 p2367-2375 Dec 77.

Keywords: *Pions, *Meson cross sections, Holmium isotopes, *Holmium 165, Form factors, Reprints.

The removal cross section sigma (Omega) for the interaction of pi(+) abd pi(-) with aligned 165Ho has been measured at E sub pi = 115, 165, and 240 MeV employing a single crystal holmium target with a nuclear alignment B2 = 0.44. The range of Omega was from 0.05 to 0.55 sr. The data on E sub pi and delta sigma (Omega), the difference between the aligned and unaligned cross sections, are compared to the predictions of a coupled-channels optical model calculation employing parameters from recent muonic x-ray data.

714,819
PB-281 465/5 PC **A06**/MF **A01**
National Engineering Lab. (NBS), Boulder, Colo. Thermophysical Properties Div.
Publications and Services of the Cryogenics Division, National Bureau of Standards, 1953-1977.
Technical note,
D. J. Frizen, and J. R. Mendenhall. Apr 78, 105p
NBS-TN-1005
See also report dated Aug 73 for period 1953-1972, COM-73-50729.

Keywords: *Cryogenics, *Bibliographies, Thermodynamics, Liquefied gases, Solid state physics, Materials, Indexes(Documentation), Superconductivity, Metrology, National Bureau of Standards, Cryogenics Division.

This NBS Technical Note catalogs the publications of the Cryogenics Division, along with author and subject indexes, for the period 1953 through 1977. It also contains a listing of available thermodynamic properties charts, bibliographies, and miscellaneous reports of cryogenic interest. A resume of the activities of and services provided by the Cryogenics Division is also included.

714,820
PB-281 908/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
235-U Neutron Fission Cross Section Measurement at the NBS Linac.
Final rept.,
O. A. Wasson. 1976, 25p
Pub. in Proceedings of NEANDC/NEACRP Specialists Meeting on Fast Neutron Fission Cross Sections of U-233, U-235, U-238, and Pu-239, Argonne National Laboratory, Argonne, Ill., June 28-30, 1976, nANL-76-90, ERDA-NDC-5/L, NEANDC(US)-199/L, p183-207 1976.

Keywords: *Uranium 235, *Fission cross sections, Neutrons.

The 235U neutron fission cross section was measured relative to neutron-proton scattering from 5 to 800 keV neutron energy. The experiment was performed on the 200 m flight path at the NBS electron linac using a hydrogen gas proportional counter as a neutron flux monitor. This relative measurement was normalized by means of a second experiment on the 23 m flight path. This experiment, which used a 0.5 mm 6 Li glass for a flux monitor, covered the energy region from 6 eV to 30 keV, and, normalized to an integrated cross section of 238.4 eV b in the 7.8 to 11.0 eV region, yields an average cross section of 2.48 + or - 0.05 b for the 10 to 20 keV interval. The resultant cross section in the 200-800 keV interval is approximately 5% less than the ENDF/B-IV evaluation.

714,821
PB-281 916/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Prompt Fission Neutrons from eV Resonances in 235U: Measurement and Correlation with Other Fission Properties.
Final rept.,
R. E. Howe, T. W. Phillips, and C. D. Bowman. Jan 76, 11p
Pub. in Physical Review C 13, n1 p195-205, Jan 76.

Keywords: *Uranium 235, *Prompt neutrons, *Fission neutrons, Neutron detection, Reprints.

The energy dependence of the fission neutron multiplicity (nu bar) for neutron-induced fission of 235U in the energy region 0.5 to 125 eV has been measured using a continuous spectrum of neutrons from a 100 MeV electron Linac. A new neutron detection technique was used to search for variations in resonance (nu bar) values and possible correlations with other fission properties. Evidence was obtained for a nonstatistical fluctuation in the value of (nu bar) as a function of energy. However, no correlation with resonant spin, fission-fragment asymmetry, or the angular distribution of fission fragments was observed. A comparison of these data with previous (nu bar) measurements also has been included.

714,822
PB-281 917/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fission Cross Sections of 235U, 238U, and 239Pu Averaged over the 252Cf Neutron Spectrum.
Final rept.,
H. T. Heaton, D. M. Gilliam, V. Spiegel, C. Eisenhauer, and J. A. Grundl. 1976, 20p
Pub. in Proceedings of NEANDC/NEACRP Specialists Meeting on Fast Neutron Fission Cross Sections of U-233, U-235, U-238, and Pu-239, Argonne National Laboratory, Argonne, Ill., June 28-30, 1976, nANL-76-90, ERDA-NDC-5/L, NEANDC(US)-199/L, p333-352 1976.

Keywords: *Uranium 235, *Plutonium 239, *Fission cross sections, *Uranium 238, *Californium 252.

A measurement was made in a 252Cf spontaneous fission neutron field to determine the absolute fission cross section of 235U (1205 + or - 27 mb), and at the same time to determine the fission cross section ratio of 238U/235U (0.2644 + or - 0.0035) and 239Pu/235U (1.500 + or - 0.024). Integral results are compared with various differential data sets using an evaluated 252Cf fission spectrum.

714,823
PB-281 958/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Subthreshold Photofission of (super 235)U and (super 232)Th.
Final rept.,
C. D. Bowman, I. G. Schroeder, K. C. Duvall, and C. E. Dick. Mar 78, 3p
Pub. in Physical Review, C17 n3 p1086-1088 Mar 78.

Keywords: *Fission cross sections, *Thorium isotopes, *Uranium isotopes, Photonuclear reactions, *Thorium 232, Uranium 234, Uranium 235, Uranium 236, Reprints.

Photofission cross sections for 232Th, and 236U have been measured in the energy range from 3.25 to 5.75 MeV and for 234U and 236U at 3.5 MeV. The cross sections change by over seven orders of magnitude for this energy range. Cross section shapes are significantly different for different isotopes indicating a strong sensitivity to fission barrier parameters.

714,824
PB-282 119/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Shapes of Deformed Nuclei as Determined by Electron Scattering: 152Sm, 154Sm, 166Er, 176Yb, 232Th, 238U.
Final rept.,
I. Cooper, W. Bertozzi, J. Heisenberg, S. Kowalski, W. Turchinetz, C. Williamson, L. Cardman, S. Fivozinsky, J. Lightbody, and S. Penner. Mar 76, 12p
Grant AT(11-1)-3069
Pub. in Phys. Rev. C 13, n3 p1083-1094 Mar 76.

Keywords: *Nuclear models, Electron scattering, Erbium isotopes, Samarium isotopes, Thorium isotopes, Uranium isotopes, Ytterbium isotopes, Erbium 166, Samarium 152, Samarium 154, Thorium 232, Ytterbium 176, Uranium 238, Reprints.

Electron scattering experiments have been performed on the deformed nuclei, 152Sm, 154Sm, 166Er, 176Yb, 232Th, and 238U at momentum transfers between 0.5/fm and 1.3/fm. The cross sections for 0(+), 2(+), and 4(+) rotational states of these nuclei have been obtained and, together with other information on the electromagnetic properties of these nuclei, these data lead to information about the deformed shapes.

714,825
PB-283 682/3 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Radiation Research.
Comments on the Analysis of Total Photoabsorption Measurements in the Energy Range 10 - 150 MeV,
L. C. Maximon, and H. A. Gimm. Jun 78, 32p NBSIR-78-1456
Prepared in cooperation with Max-Planck-Institut fuer Chemie, Mainz (West Germany).

Keywords: *Photonuclear reactions, *Nuclear cross sections, *Absorption cross sections, Pair production, Compton effect.

This note deals with details of the procedure used to extract photonuclear cross sections from total photon absorption measurements. The authors examine closely some of the approximations implicit in the expressions available for the purely electromagnetic cross sections, most especially pair production, triplet production, and the Compton effect, which must be subtracted from the measured photoabsorption in order to obtain photonuclear cross sections. The authors single out those aspects of the expressions for these electromagnetic processes which most warrant further theoretical research in that they constitute the principal source of uncertainty in the extraction of nuclear data.

714,826
PB-284 499/1 PC **A06**/MF **A01**
National Measurement Lab. (NBS), Washington, D.C. Center for Radiation Research.
Photonuclear Data Index, 1973-1977.
Special pub.,
E. G. Fuller, and H. M. Gerstenberg. Aug 78, 104p
NBS-SP-380-SUPPL-1
See also COM-73-50244.

Keywords: *Bibliographies, *Photonuclear reactions, Tables(Data), Isotopes, Elements, Sources, Nuclear chemistry.

This index, a supplement to NBS Special Publication 380, Photonuclear Reaction Data, 1973, primarily covers data published in the period from January 1965 through December 1977. Organized by element and isotope, each entry in the index is for a specific reaction reported in a given reference. Information is given on the type of measurement, excitation energies studied, source type and energies, detector type and angular ranges covered in the measurement. Also included is an index to the more than 1000 data sets currently available in the Photonuclear Data Center's digital data library.

714,827
PB-284 596/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Higher-Order Effects in Fermi-Type Charged Current Theory of Weak Interactions: Semi-Leptonic Neutral Currents.
Final rept.,
M. Danos, and J. Rafelski. 27 Feb 78, 4p
Pub. in Phys. Rev. 73B n3 p313-316, 27 Feb 78.

Keywords: *Weak interactions, Neutrinos, *Neutral currents, Reprints.

In a convergent field theory rescattering graphs lead to neutral-current effects of the observed magnitude if the effective cut-off momentum is proportional to (G to the -1/2 power), approximately 300 GeV. A perturbation expansion is justified wing to the value f=0.18 of the resulting expansion parameter.

714,828
PB-285 049/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Systematic Transformations of the Asymptotic Aberration Coefficients of Round Electrostatic Lenses (1).
Final rept.,
C. E. Kuyatt. Jun 78, 4p
Pub. in Proceedings Symp. on Electron, Ion, and Photon Beam Technology (14th), Held at Palo Alto, California on May 25-27, 1977, Jnl. Vac. Sci. Technol., v15 n3 p861-864 May/Jun 78.

Keywords: *Electrostatic lenses, Distortion, Asymmetry, Coefficients, Electron optics, Geometrical aberrations, Characteristic functions.

In previous work the author formulated the third-order asymptotic aberration coefficients of round (axially symmetric) electrostatic lenses in a form independent of object and aperture positions, and expressions for the six quantities which are sufficient to specify completely the aberration properties of the lenses were derived in the form of integrals involving derivatives of the axial potential through the fourth order. Because actual calculations involved numerical differentiation of the axial potentials, integrations by parts were used to transform the integrals to two new forms with axial derivatives of lower degree. Many other forms of the aberration integrals can be obtained by further integrations by parts, but the transformations are laborious and it is not easy to predict the forms which are possible nor to determine the sequence of operations which will yield a desired result. However, using a method originally developed by Seman and extended by Hawkes, a completely general formula has been obtained from which all of the possible forms of the asymptotic integrals can be obtained very simply. A few of these possible forms are derived and discussed.

714,829
PB-285 318/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Friction Factors for Flow of Near-Critical Helium in Curved Tubes.
Final rept.,
D. E. Daney, and P. R. Ludtke. Jun 78, 4p
Pub. in Jnl. Cryogenics, v18 n6 p345-348, Jun 78.

Keywords: *Friction, *Liquid helium, *Fluid flow, Cryogenics, Critical point, Turbulent flow, Reprints.

Friction factors have been measured for turbulent flow, $19000 < Re < 110\,000$, of near-critical helium in a helically wound ($D/d = 194$) circular, 4-mm id tube of high aspect ratio ($L/d = 46000$). These measurements are in close agreement with the classical results of Ito for curved pipes. Measured pressure drops in a heated test section with large fluid expansion ratios (delta v/v up to 13) agreed well with calculated pressure drops. Results are also given for a 1.32 mm diameter sharp edge orifice flowmeter operating in near-critical helium.

714,830
PB-285 398/4 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards. Volume 83, Number 3, May-June 1978.
Bi-monthly rept.
1978, 93p
See also Volume 83, Number 2, PB-283 996.

Keywords: *Research, Ytterbium, Thermistors, Silicon, Electrical measurement, Semiconductors, Semiconductor devices, Vitreous state, Gas flow, National Bureau of Standards.

Contents:
- Spectrum and energy levels of triply ionized ytterbium;
- An investigation of the stability of thermistors;
- Photovoltaic technique for measuring resistivity variations of high resistivity silicon slices;
- Detection of deep levels in high power semiconductor materials and devices;
- The thermodynamics of the glassy state--The heat capacity of one-dimensional disordered harmonic systems from moments;
- The equations of motion for thermally driven, buoyant flows.

714,831
PB-286 535/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Angular Distribution of Neutron Scattering from Hydrogen at 27.3 MeV.
Final rept.
J. A. Cookson, J. L. Fowler, M. Hussain, R. B. Schwartz, and C. A. Uttley. May 78, 16p
Pub. in Jnl. Nucl. Phys. A299, p265-380, May 78.

Keywords: *Neutron scattering, Hydrogen, Angular distribution, Protons, Scintillation counters, Neutron beams, Reprints.

The angular distribution for np scattering at 27.3 MeV has been measured at 7 angles between 17 degrees and 57.9 degrees in the lab system. The neutrons scattered by a small plastic scintillator were detected in another plastic scintillator whose absolute efficiency had been measured between 5 and 25 MeV by use of the associated particle method. It was found to be necessary to investigate the effect on the angular distribution of the 12C(n, n'gamma) reaction occurring in the target scintillator. The data overlap, and are combined with, existing angular distribution data at the same energy obtained by detecting recoil protons. The asymmetry about pi/2 of the resulting angular distribution is in better agreement with predictions from phase-shift analyses than with those from meson-theoretical models.

714,832
PB-286 731/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Transient Helium Heat Transfer--Phase I - Static Coolant.
Final rept.,
W. G. Steward. 1978, 12p
Sponsored in part by Air Force Office of Scientific Research, Arlington, VA. Directorate of Information Sciences.
Pub. in International Jnl. Heat Mass Transfer v21, no. 7, p868-874 (1978).

Keywords: *Helium, *Heat transfer, Liquid helium, Superconductors, Cooling, Coolants, Surges, Reprints.

Transient heat transfer data have been obtained for flat heating surfaces in static liquid and supercritical helium. Measurements start 0.00002 s after step power inputs, and cover a heat flux range of 0.05 to 20 W/sq cm, pressures from 0.09 to 0.3 MPa, and four different heater orientations. Initial heat transfer coefficients, being limited primarily by the Kapitza resistance, are 10 to 100 times greater than steady state, and the time to reach steady state varies from 0.00001 s to 1 s. For heat flux below the steady state peak nucleate boiling limit, the temperature follows calculations based on pure conduction to the steady state nucleate boiling level. Above that limit, the transient conduction period leads to an apparent metastable nucleation period, followed by a transition to film boiling.

714,833
PB-286 933/7 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Center for Radiation Research.
Monte Carlo Studies of Electron and Photon Transport at Energies Up to 1000 MeV.
S. M. Seltzer, and M. J. Berger. Jul 78, 50p NBSIR-78-1534
Prepared for Office of Naval Research, Arlington, VA.

Keywords: *Electron beams, Monte Carlo method, Mathematical models, Electron scattering, Computerized simulation, Particle accelerator targets, Water, Air, Lead, Transport theory, *Photon-electron interactions, *MeV range 100-1000, Photon transport, Charged-particle transport, ETRAN computer program, Energy transport.

This report describes calculations of electron-photon showers initiated by electron beams with energies from 50 to 1000 MeV. Results obtained with the Monte Carlo program ETRAN are presented for diverse problems including: (1) the spatial distribution of energy deposited in water, air and lead targets; (2) the escape of scattered electrons and secondary bremsstrahlung from air and lead targets; (3) energy-loss straggling of primary electrons in air; (4) depth-dependent electron spectra (differential tracklength distributions) in air.

714,834
PB-287 020/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Molecular Dynamical Calculations of Energy Transport in Crystalline Solids.
Final rept.,
R. A. MacDonald, and D. H. Tsai. 1978, 41p
Sponsored in part by Army Research Office, Washington, DC.
Pub. in Physics Reports. A Review Section of Physics Letters 46, n1 p1-41 Sep 78.

Keywords: *Heat transfer, *Thermal diffusivity, Thermal shock, Lattice parameters, Pressure, Temperature, Reprints, Molecular dynamics, Second sound, Solitons.

Thermal conductivity (diffusivity), heat pulse propagation, and shock wave propagation in one-, two-, and

three-dimensional lattices have been studied by the method of molecular dynamics, a method well suited to non-equilibrium and strongly anharmonic problems. In this review, particular attention has been paid to the approach to thermal equilibrium after a disturbance. The computer value of lattice thermal conductivity is in agreement with experiment. In pulsed heating, the coupling between the thermal and elastic disturbance generates a composite second sound wave which leads to a simple explanation of the temperature dependent second sound velocity . In shock compression, the thermal relaxation behind the shock front causes the shock profile to be non-steady overall, in contradiction to the steady profile assumed in the usual Hugoniot relations for a continuum. The PVT relationships deduced from shock wave data are affected to a significant extent at high compressions.

714,835
PB-288 524/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron Flux Monitoring and Data Analysis for Neutron Standard Reaction Cross Sections.
Final rept.,
O. A. Wasson, R. A. Schrack, and G. P. Lamaze.
1978, 13p
Pub. in Nuclear Science and Engineering 68, n2 p170-182 1978.

Keywords: *Neutron cross sections, *Neutron flux, Nuclear reactions, Neutron sources, Proportional counters, Lithium 6, Boron 10, Uranium 235, keV range 01-10, keV range 10-100, keV range 100-1000, Reprints.

The common features used in the measurement 6Li(n,alpha), 10B(n,alpha gamma), and 235U(n,f) cross sections presented in three subsequent papers are described. The experiments were performed on the 200-m flight path of the National Bureau of Standards Linac and cover the neutron energy region from 5 to 800 keV. The neutron flux monitor was a hydrogen-filled gas proportional counter located at the end of the flight path, while the primary detectors specific to each of the three cross-section measurements were placed 70 m along the flight path. The properties of the neutron source, the detailed operation of the flux monitor, the data acquisition system, and the data analysis procedure are described. The systematic errors in the neutron flux measurement are given.

714,836
PB-288 531/7 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
New Measurement of the 6Li(n,alpha)T Cross Section.
Final rept.,
G. P. Lamaze, R. A. Schrack, and O. A. Wasson.
1978, 6p
Pub. in Nuclear Science and Engineering 68, n2 p183-188 1978.

Keywords: *Neutron cross sections, Tritium, Lithium, Neutron scattering, Alpha particles, Neutron flux, Nuclear reactions, *Lithium 6, Time-of-flight method, KeV range 01-10, KeV range 10-100, KeV range 100-1000, Reprints.

The shape of the 6Li(n, alpha)T cross-section curve has been measured from 3- to 800-keV neutron energy. The neutrons were produced by the National Bureau of Standards 140-MeV Linac, and the measurements were made along the 200-m above-ground drift tube. The neutron flux was monitored by a 61-cm-long hydrogen gas proportional counter giving a direct ratio of the 6Li(n, alpha) cross section to the H(n,p) cross section. The 6Li(n, alpha) events were detected in a 0.5-mm-thick piece of 6Li glass (NE-912). The results were normalized to ENDF/B-V in the region from 10 to 100 keV. Overall uncertainties in the measurement are about 2% in the range from 10 to 400 keV. Error analysis and comparisons with previous measurements are given.

714,837
PB-288 543/2 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of the 10 B(n, alpha gamma)7 Li Cross Section in the keV Energy Program.
Final rept.,
R. A. Schrack, G. P. Lamaze, and O. A. Wasson.
1978, 8p
Pub. in Nucl. Sci. Eng., v68 n2 p189-196 1978.

Keywords: *Neutron cross sections, Boron, Neutron scattering, Alpha particles, Gamma rays, Neutron flux, Nuclear reactions, *Boron 10, Boron 11, Time-of-flight method, keV range 10-100, keV range 100-1000, Reprints.

The 10B(n, alpha gamma)7Li relative cross section has been measured using the 200-m flight path of the National Bureau of Standards Linac neutron time-of-flight facility. Results are presented from 5 to 700 keV, showing the 5/2(-) level of 11B at 500 keV. The neutron flux was monitored with a hydrogen proportional counter. The known n-p scattering cross section was then used to normalize the data to obtain a relative cross section. No attempt was made to obtain an absolute normalization experimentally. Overall accuracy is estimated to be better than 3 percent from 10 to 400 keV.

714,838
PB-288 804/8 PC **A03**/MF **A01**
National Measurement Lab. (NBS), Washington, DC. Radiation Physics Div.
Influence of Scattering Foils on Absorbed Dose Distributions from Electron Beams.
M. J. Berger, and S. M. Seltzer. Nov 78, 36p NBSIR-78-1552
Prepared for Office of Naval Research, Arlington, VA., National Cancer Inst., Bethesda, MD., and Department of Energy, Washington, DC. Div. of Biomedical and Environmental Research.

Keywords: *Electron beams, *Radiation dosage, *Scattering loss, Bremsstrahlung, Monte Carlo method, Lead foil, Photons, Transport theory, Phantoms, MeV range 01-10, MeV range 10-100.

This paper describes a calculation of the spatial distribution of absorbed dose in a water phantom irradiated by electron beams with energies from 5 to 40 MeV. It is assumed that the initially monoenergetic, monodirectional and narrowly collimated electron beam passes through a lead scattering foil and 100 cm of air before reaching the water phantom. In the first part of the work a calculation is made of the energy spread and angular diffusion of the beam due to its passage through the scattering foil and air. In the second part of the work, a calculation is made of the penetration of the modified beam into the phantom. The second calculation takes into account the limitation of the beam to finite field size at the surface of the phantom, and the contribution of secondary bremsstrahlung generated in the scattering foil to the absorbed dose in the phantom.

714,839
PB-290 705/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Shaking Processes in beta-Decay.
Final rept.,
J. W. Cooper, and T. Aberg. 1978, 14p
Pub. in Nuclear Physics A298, p239-252 1978.

Keywords: *Beta decay, Atomic energy levels, Beta particle reactions, Rearrangement reactions, Wave functions, Atomic orbitals, *K shell, Reprints.

A discussion of theoretical treatments of atomic rearrangement processes accompanying beta decay is presented. A schematic model for K shell ejection or excitation is developed and the expected accuracy of this model and other theoretical treatments using approximate wave functions is discussed. Comparison with experimental evidence reveals that there is some evidence of direct processes but that uncertainties in calculations exist for low energy processes.

714,840
PB-291 708/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Frequency Limit of Bremsstrahlung.
Final rept.,
H. A. Olsen, and L. C. Maximon. Dec 78, 7p
Pub. in Physical Review, A. General Physics 18, n6 p2517-2522, Dec 78.

Keywords: *Bremsstrahlung, Atoms, Ions, Coulomb interactions, Resonance scattering, Potential scattering, Scattering cross sections, High frequency limits, Screening(Coulomb potential), Neutral particles, Reprints.

It is shown that, contrary to common belief, the bremsstrahlung cross section vanishes at the high-frequency limit for a neutral atom. The Sommerfeld finite value at the upper limit is valid only for atomic fields falling off as (1/r) for large distances, i.e., for ionized atoms. The behavior of the cross section at the high-frequency limit is closely connected to the position of bound states close to the continuum limit for the atom. An explicit calculation is performed for a particular screened atomic field. It is shown that the resonances in the bremsstrahlung cross section close to the high-frequency limit found experimentally by Liefield et al. can be explained as final-state resonance scattering.

714,841
PB-291 716/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Influence of Nuclear Data on Calculations of Neutron Energy Deposition.
Final rept.
R. S. Caswell, and J. J. Coyne. 1978, 15p
Sponsored in part by Department of Energy, Washington, DC. Div. of Biomedical and Environmental Research.
Pub. in Proc. Symp. on Neutron Disometry in Biology and Medicine (3rd), Neuherberg/Muchen (Germany, F.R.) May 23-27, 1977, p29-43 (Commission of the European Communities, Directorate-General, Scientific and Technical Information Management, Batiment Jean Monnet, Luxembourg, 1978).

Keywords: *Neutron reactions, *Energy dissipation, Neutron spectra, Neutron cross sections, Nuclear reactions, Kerma, Nuclear data collections, Secondary beams.

It is often assumed that if one has a set of evaluated neutron cross sections such as ENDF/B-IV, that it is then possible to determine physical properties of the neutron energy deposition process, such as kerma factors and secondary particle spectra, unambiguously. While this is true for some elements, it is not true for others. In the case of kerma factor calculations, part of the calculational problem caused by lack of data can be side-stepped by use of the relation: (kerma) = (energy available) - (energy carried off by secondary neutrons) - (energy carried off by gamma rays). In all cases the energy available is known. In elastic scattering the scattered neutron energy is known (if the angular distribution is known) and there are no gamma rays. For (n, charged particle) reactions with cross sections given to known final states the second term is zero and the third term is determined by the cross section. In other reactions, such as (n,n' alpha) (n,n'p), and (n,n'3 alpha), the kerma factor is very sensitive to information about the outgoing neutron energy (direct reaction versus boil-off reaction), and to the final states assumed (i.e. energy carried off by gamma rays). The authors discuss some 'global' assumptions made in kerma factor calculations--uniform assumptions based on reasonable nuclear physics used when specific data is not available. In the case of secondary particle spectra, the above simplifying relation usually does not work since energy distributions of all secondary charged particles are needed. Here the choice of nuclear reaction mechanisms is crucial. Examples are given of alternatives and choices made for specific nuclides.

714,842
PB-292 197/1 Not available NTIS
National Bureau of Standards, Washington, DC.
SU4 in Nuclear Structure.
Final rept.
M. Danos. 1978, 21p
Pub. in Proceedings of the International Conference on Clustering Aspects of Nuclear Structure and Nuclear Reaction (3rd), Held at Winnipeg, Manitoba, Canada on June 19-23, 1978, p48-68, 1978.

Keywords: *Nuclear structure, Nuclear models, Mass number, Alpha particles, Group theory, Lie groups, *SU-4 groups, Weizsaecker formula, Mass formulae, Liquid drop model, SU groups.

The presence of quartets - the more physical term for SU4 structures - is demonstrated for nuclei throughout the table. A very strong indication for quartets is the validity of a mass formula based on SU4. This formula achieves with fewer parameters the classical liquid drop terms then turns out to have at least as good a fit to the data as the usual Weizsacker formula. The physical reasons for quartetting are presented; possible forms of the quartet correlations, different for different regions of the Table, are discussed.

714,843
PB-292 580/8 Not available NTIS
National Bureau of Standards, Washington, DC.

Spin Forces in Charmonium Spectroscopy.
Final rept.,
P. M. Fishbane, D. Horn, and S. Meschkov. 1 Jan 79, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review, D. Particles and Fields 19, n1, p288-290, 1 Jan 79.

Keywords: *Particle spin, Spin spin interactions, Energy levels, Tensors, Hamiltonian functions, Quarks, Selection rules(Physics), Nuclear spin, *Charmonium, Tensor forces, Charm particles, Reprints.

The observed psi prime(3.68)-psi double prime(3.77) structure in e+e- annihilation implies the existence of a tensor-force effect in charmonium spectroscopy. It is shown that the magnitude of the effect is consistent with an analysis of 3P sub J levels using a phenomenological Hamiltonian linear in both L vector . S vector and S(12), the tensor force. Adding a linear sigma(1) . sigma(2) term, one can account for all known charmonium levels below 4 GeV and predict the location of the rest of the spectrum, in particular the 1P sub 1 state at 3.27 GeV.

714,844
PB-294 116/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Method to Measure Magnetic Fields Accurately Using Ampere's Law.
Final rept.,
E. R. Williams, and P. T. Olsen. Dec 78, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-27, n4, p467-469, Dec 78.

Keywords: *Magnetic measurement, Magnetic fields, Protons, Magnetic moments, Particle spin, Angular momentum, Solenoids, Ampere law, Gyromagnetic ratio, Reprints.

A proposed method to measure magnetic fields is described, and a simple demonstration of the new method has been performed. A derivation of the equation used to calculate the field is presented, and some of its implications are discussed. The objective of further experiments is to apply the technique to the measurement of the gyromagnetic ratio of the proton (gamma sub p) to an accuracy near 1 part in 10 to the eighth power, using a precision solenoid whose departures from ideal are small.

714,845
PB-294 166/4 Not available NTIS
National Bureau of Standards, Washington, DC.
Photopion Production in the Fermi-Gas Model.
Final rept.,
W. M. MacDonald, E. T. Dressler, and J. S. O'Connell. Feb 79, 10p
Pub. in Physical Review, C. Nuclear Physics 19, n2, p455-464, Feb 79.

Keywords: *Pions, *Photoproduction, Photonuclear reactions, Fermions, Quantum statistics, Nuclear models, Pauli exclusion principle, Angular distribution, Energy levels, Lithium, Beryllium, *Fermi gas, Fermi statistics, Nuclear potential, Optical models, Reprints.

Differential and total cross sections for (photon, pion) reactions in nuclear matter are calculated using the single particle (photon N pion) amplitudes recently proposed for nuclear calculations. The effect of the Pauli principle on the pion spectrum and angular distribution is examined. Optical potentials for the nucleons and pions are introduced to investigate the influence of the nuclear medium on photopion production. The total photoabsorption cross section is computed and compared with recent data on lithium and beryllium.

714,846
PB-295 143/2 Not available NTIS
National Bureau of Standards, Washington, DC.
Electroproduction and Decay of Giant Resonances.
Final rept.,
J. S. O'Connell. 1979, 6p
Pub. in Comments on Nuclear and Particle Physics 8, n5, p151-156 1979.

Keywords: Electromagnetic radiation, Alpha particle reactions, Nuclear reactions, Photoproduction, Nickel isotopes, Decay schemes, *Giant resonances, *Electroproduction, Nickel 58, Nickel 60, Nickel 62, Reprints.

The experimental technique of comparing electro and photoproduction of nuclear reactions to determine the multipolarity of the absorbed electromagnetic quanta is reviewed. The results for three isotopes of nickel (A = 58, 60, 62) show the isoscalar electric quadrupole giant resonance decays predominantly by alpha particle emission.

714,847
PB-295 144/0 Not available NTIS
National Bureau of Standards, Washington, DC.
Photopion Production in the Fermi Gas Model.
Final rept.,
J. S. O'Connell, W. M. MacDonald, and E. T. Dressler. 1979, 4p
Pub. in Photopion Nuclear Physics, p381-384 1979. Proceedings of the International Symposium on Photopion Nuclear Physics Held at Rensselaer Polytechnic Inst., Troy, NY. on August 10-12, 1978.

Keywords: *Photoproduction, *Pions, Nuclear reactions, Photomesons, Nuclear cross sections, Differential cross sections, Photon cross sections, Nuclear models, Lithium, Beryllium, Fermi gas model, Integral cross sections, Nuclear potential, Optical models.

Differential and total cross sections for (photon, pion) reactions in nuclear matter are calculated using the single particle photon N pion amplitudes recently proposed for nuclear calculations. Optical potentials for the nucleons and pions are introduced to investigate the influence of the nuclear medium on photopion production. The total photoabsorption cross section is computed and compared with recent data on lithium and beryllium.

714,848
PB-295 173/9 Not available NTIS
National Bureau of Standards, Washington, DC.
1978 Nobel Prize in Physics.
Final rept.,
R. P. Hudson. 1 Dec 78, 3p
Pub. in Science 202, p960-962, 1 Dec 78.

Keywords: *Low temperature research, *Nobel prize, *Kapitsa P L, Reprints.

The career of P. L. Kapitsa, 1978 Nobel Laureate in Physics, is summarized.

714,849
PB-296 099/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrodisintegration of 58Ni.
Final rept.
E. Hayward. 1979, 15p
Pub. in Proceedings of the Seminar on Electromagnetic Interactions of Nuclei at Low and Medium Energies (4th) Held at Moscow, USSR on December 13-15, 1977, p125-139 1979.

Keywords: Nuclear reactions, Protons, Alpha particles, Nickel, *Nickel 58, *Electrofission, E1 transitions, E2 transitions, Giant resonance.

The electrodisintegration of 58Ni into protons and alpha-particles has been studied. The yield curves as a function of electron energy have been obtained and a few points measured with a Tantalum radiator interposed. Using the electric dipole and electric quadrupole virtual photon spectra, these yields can be interpreted as resulting from compact E1 and E2 giant resonances. Alpha particle emission is the dominant mode of decay of the isoscalar E2 resonance at 16.5 MeV, while the protons are emitted only by the electric dipole giant resonance at 19 MeV. This technique represents a powerful new tool for determing giant resonance multipolities.

714,850
PB-296 101/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Nuclear Elastic Scattering of Photons.
Final rept.
E. Hayward. 1979, 15p
Pub. in Proceedings of the Seminar on Electromagnetic Interactions of Nuclei at Low and Medium Energies (4th) Held at Moscow, USSR on December 13-15, 1977, p185-199 1979.

Keywords: *Nuclear scattering, *Gamma ray scattering, Elastic scattering, Electric moments, Dipole moments, Polarization(Charge separation), Electrical properties, Rayleigh scattering, Inelastic scattering, *Giant resonance, Nuclear electric moments, Polarizability, Thomson scatting, Delbrueck scattering.

Nuclear elastic scattering in the energy region of the electric dipole giant resonance is reviewed. The interference of the coherent nuclear scattering with Rayleigh, Delbruck, and nuclear Thomson scattring is pointed out. The tensor polarizability of the deformed and vibrational nuclei is pointed out and the results of the experiments that use neutron capture gamma-rays and Ge(Li) detectors are summarized.

714,851
PB-296 103/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Experiences Using a Positron Annihilation Beam.
Final rept.,
E. Hayward, W. R. Dodge, and B. H. Patrick. 1979, 11p
Pub. in Nuclear Instruments and Methods 159, p289-299 1979.

Keywords: Positrons, Annihilation reactions, Photons, Beams(Radiation), Spectrometers, Sodium iodides, Carbon 12, *Positron beams, *Electron-positron collisions, Reprints.

The NBS positron annihilation-in-flight facility is described, along with the procedure for the calibration of the positron beam energy. Details are also given of a large NaI(Tl) spectrometer used with the annihilation photon beam. Response functions of this spectrometer for photons of 15 and 31 MeV have been measured using a photon tagging scheme based on the detection of the annihilation photons in coincidence. The variation in response function caused by the presence of absorbers in front of the spectrometer has been investigated. The response function measured at 15 MeV is compared with that obtained by resonance fluorescence of the 15.1 MeV level in 12C and, from the latter data, the branching ratios for the decay of the 15.1 MeV level to the ground state and the excited states at 4.44 and 7.66 MeV have been extracted.

714,852
PB-296 104/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Decay Modes of Giant Resonances in 58Ni, 60Ni, and 62Ni.
Final rept.,
E. Wolynec, W. R. Dodge, and E. Hayward. 1 Jan 79, 4p
Pub. in Physical Review Letters 42, n1, p27-30, 1 Jan 79.

Keywords: *Nickel isotopes, *Decay schemes, Alpha particles, Nuclear cross sections, Protons, Photons, Electron scattering, *Giant resonance, E1 transitions, E2 transitions, MeV range 10-100, Nickel 58, Nickel 60, Nickel 62, Reprints.

The (e,p) and (e, alpha) cross sections for targets of 58Ni, 60Ni, and 62Ni have been measured in the electron energy range 16 - 50 MeV. They have been analyzed using the DWBA E1 and E2 virtual photon spectra. Protons are emitted primarily following E1 absorption but alpha emission results from a combination of E1 and E2 absorption. The E2 isoscalar giant resonance decays predominantly by alpha emission for these nuclei.

714,853
PB-296 112/6 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrodisintegration of 238U.
Final rept.,
W. R. Dodge, E. Hayward, G. Moscati, and E. Wolynec. Nov 78, 3p
Pub. in Physical Review, C 18, n5, p2435-2437, Nov 78.

Keywords: Uranium, Nuclear reactions, Electrons, Alpha particles, Protons, Oxygen, *Uranium 238, *Electrofission, Energy spectra, E2 transitions, Giant resonance, Oxygen 16, MeV range 10-100, Reprints.

A search has been made for alpha-particles that might stem from an isoscalar E2 giant resonance in 238U near 9 MeV. Using 40 MeV electrons the spectra of protons and alpha-particles emitted in the electrodisintegration of 238U were measured. Peaks in the proton spectrum indicated that the target has an oxygen contamination. The less intense alpha-spectrm contains alpha-particles resulting from the electrodisintegration of 16O, a group that probably stems from ternary fission, and a higher energy feature which may be attributed to the electrodisintegration of 238U. The integrated 238U(e, alpha) cross section is less than 1% of a recently suggested value.

714,854
PB-296 117/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Precise gamma-ray Energies from the Radioactive Decay of 170Tm and 169Yb.
Final rept.,
E. G. Kessler, L. Jacobs, W. Schwitz, and R. D. Deslattes. 1979, 3p
Pub. in Nuclear Instruments and Methods 160, p435-437 1979.

Keywords: *Gamma rays, Gamma emission, Radioactive decay, Decay schemes, Standards, *Thulium 170, *Ytterbium 169, Reprints.

Precise energy values for ten standard gamma-ray reference lines produced in the radioactive decay of 170Tm and 169Yb have been measured relative to an optical standard. These measurements, which have an uncertainty of about 0.5 ppm for the more intense lines, provide precise gamma-ray standards in the 63-307 keV range. Measurements on 169Yb lines constrained by the Ritz principle satisfy the combination principle within the measurement uncertainty.

714,855
PB-296 118/3 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Resonance Scattering in the High Frequency Limit of Bremsstrahlung.
Final rept.,
H. A. Olsen, and L. C. Maximon. 27 Nov 78, 3p
Pub. in Physics Letter 69A, n2, p90-92, 27 Nov 78.

Keywords: *Bremsstrahlung, *Resonance scattering, Resonance cross sections, Reprints.

It is shown that the resonances in the bremsstrahlung cross section close to the high-frequency limit found experimentally by Liefield et al. can be explained as final state resonance scattering.

714,856
PB-296 121/7 Not available NTIS
National Bureau of Standards, Washington, DC.
Monte Carlo Calculations of the Number of Ways to Pack Nonoverlapping Rods on a Square Lattice.
Final rept.,
F. L. McCrackin. 15 Dec 78, 16p
Pub. in Jnl. of Chemical Physics 69, n12, p5419-5423, 15 Dec 78.

Keywords: Rods, Orientation, Entropy, Combinatorial analysis, Liquid crystals, Monte Carlo method, *Square configuration, Reprints.

The number of configurations of nonoverlapping rods on a square lattice is computed for various packing fractions and orientations of the rods. From the number of configurations, the entropies of the configurations are computed and compared with the results of approximate formulas of DiMarzio that are much used in statistical-mechanical theories of liquid crystals. For rods of three lattice sites, our calculations and Dimarzio's formulas agree to within 0.5% for packing fractions less than 0.5. Some calculations for rods of ten lattice sites also showed good agreement.

714,857
PB-296 235/5 PC **A03**/MF **A01**
American National Standards, Inst., New York.
American National Standard N43.1; Radiological Safety in the Design and Operation of Particle Accelerators.
American National Standard (Final).
E. H. Eisenhower. May 79, 28p ANSI-N43.1-1978-REV, NBS/HB-107-REV
Supersedes PB-191 898.

Keywords: *Particle accelerators, *Radiation protection, Safety, Standards, Radiation dosage, Radiation measuring instruments, Radiation shielding, MeV range 01-10, MeV range 10-100.

This American National Standard provides the basic considerations essential to the safe operation of a particle accelerator. It applies principally to particle accelerators with primary energies less than 100 MeV. It considers the characteristics of and controls for radiations as they affect accelerator design, operating procedures, and exposure evaluation. The section on radiation protection design criteria includes radiation shielding considerations and the use of safety systems. Operational health physics requirements are treated extensively, and radiation measurements are discussed in terms of the types of radiation that may be produced and proper techniques for monitoring. The final section, on dose assessment, includes basic exposure considerations such as maximum permissible dose and dose equivalent.

714,858
PB-296 929/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Development of Approaches and Present Status of the Giant Multipole Resonance Theory.
Final rept.
M. Danos. 1979, 19p
Pub. in Proceedings Seminar on Electromagnetic Interactions of Nuclei at Low and Medium Energies (4th), Held at Moscow, USSR on 13-15 Dec 77, p3-21.

Keywords: Nuclear moments, Resonance scattering, Photonuclear reactions, *Giant resonance, *Multipole transitions.

A survey of the present status of the theory of photonuclear giant resonances is presented. The first level of understanding photonuclear processes is completed. The next level of understanding is spotty and contradictory. A direction for future development of theories is indicated.

714,859
PB-296 933/5 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Gravity Effects in Fluids Near the Gas-Liquid Critical Point.
Final rept.,
M. R. Moldover, J. V. Sengers, R. W. Gammon, and R. J. Hocken. Jan 79, 21p
Pub. in Jnl. Rev. Mod. Phys., v51 n1 p79-99 Jan 79.

Keywords: *Fluids, Critical point, Gravitational fields, Reduced gravity, Phase transformations, Boiling, Condensing, Gases, Liquids, Resolution, Thermodynamic equilibrium, *Gravitational effects, Critical phenomena, Reprints.

The presence of gravitational field leads to both practical and fundamental limits of the resolution in critical phenomena experiments in fluids near the gas-liquid critical point. The authors present equations that yield estimates of the gravitational limitations in a variety of critical phenomena experiments for a large number of fluids and as a function of the magnitude of the gravitational field. Various strategies for improving the resolution of such experiments are discussed, including procedures that remove a fluid from thermodynamic equilibrium (e.g., stirring). A comparison is made between the gravitational limitations in earth-bound experiments and those at the microgravitational levels that may become accessible in an orbiting laboratory.

714,860
PB-296 934/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of Thermodynamic Temperatures Using Noise and Nuclear Orientation Thermometers.
Final rept.
H. Marshak, and R. J. Soulen. Aug 78, 2p
Pub. in Proceedings Int. Conf. on Low Temperature Physics (15th), Held at Grenoble, France on 23-29 Aug 78, Jnl. Phys., v6 sup8 n39 pC6/1162-C6/1163, Aug 78.

Keywords: *Temperature measuring instruments, Josephson junctions, Gamma rays, Anisotropy, Cobalt 60, Cryogenics, Temperature measurements, *Cryogenic thermometers, *Noise thermometers, Ultralow temperature.

60Co gamma ray anisotropy and Josephson junction noise thermometers have been compared from 0.011 K to 0.05 K and have been found to agree to within + or - 0.5%.

714,861
PB-296 936/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Superconductive Fixed Points for Temperatures Above 0.5K.
Final rept.
J. F. Schooley. Aug 78, 2p
Pub. in Proceedings Int. Conf. on Low Temperature Physics (15th), Held at Grenoble, France on Aug 23-29, 1978, Jnl. Phys., v6 sup8 n39 pC6/1169-C6/1170, Aug 78.

Keywords: *Temperature measurement, Standards, Niobium, Vanadium alloys, Gallium alloys, Niobium alloys, Tin alloys, Cryogenics, Cadmium, Indium, Aluminum, Lead(Metal), *Ultralow temperature, Temperature scales.

A temperature fixed point device incorporating samples of the elements Cd, Zn, Al, In, and Pb has been available from the NBS for several years. This paper describes current efforts to reduce the temperature uncertainties of the NBS device below the present one milli-kelvin level. It also notes that efforts to produce narrow transition widths in samples of Nb, V3Ga, and Nb3Sn have resulted in widths of 9mK, 40mK and 17mK, respectively.

714,862
PB-296 938/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Small Gas Thermometer for Use at Low Temperatures.
Final rept.
C. T. Van Degrift, W. J. Bowers, D. G. Wildes, and P. B. Pipes. Aug 78, 2p
Pub. in Proceedings Int. Conf. on Low Temperature Physics (15th), Held at Grenoble, France on Aug 23-29, 1978, Jnl. Phys., v6 sup8 n39 pC6/1173-C6/1174, Aug 78.

Keywords: *Temperature measuring instruments, Tunnel diodes, Cryogenics, Temperature measurement, *Cryogenic thermometers, *Gas thermometers, Ultralow temperature.

A small constant volume gas thermometer using a self-contained tunnel diode oscillator is described. It has a sensitivity of 0.2 mK and is highly linear between 0.71 and 10 K.

714,863
PB-297 305/5 PC **A07**/MF **A01**
National Bureau of Standards, Boulder, CO.
Electromagnetic Boundary-Value Problems Based Upon a Modification of Residue Calculus and Function Theoretic Techniques.
J. P. Montgomery, and D. C. Chang. Jun 79, 126p
NBS/MONO-164

Keywords: *Electromagnetic radiation, *Waveguides, Dielectrics, Electromagnetic fields, Boundary value problems, Mathematical residues, Functional analysis, Remote sensing.

The solution to a number of electromagnetic problems, in both closed and open systems, using the modified residue calculus and functional theoretic techniques is presented. The solutions start with known closed region problems and then are extended to new closed region problems and finally to several open region problems. Specific problems considered for the closed region are: (1) the trifurcated waveguide; (2) the dielectrically loaded trifurcated waveguide; (3) the N-furcated waveguide; (4) the dielectrically loaded N-furcated waveguide; (5) determination of the eigenvalues of a ridged waveguide; and (6) scattering by a dielectric stop. Open region problems considered are: (1) a parallel plate radiating into a homogeneous half-space; (2) a finite phased array; (3) remote sensing of the earth using parallel plate waveguides; (4) a flanged waveguide radiating into a half-space; (5) scattering by a thick, semi-infinite plane; and (6) radiation from a slot in a waveguide wall. Some suggested extensions of the techniques to other types of problems are also included.

714,864
PB-297 473/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Evaluation of Frequency Sums for the Free Energy of Superfluid 3He.
Final rept.,
J. C. Rainwater. 1 Oct 78, 2p
Sponsored in part by National Research Council, Washington, DC.
Pub. in the Physical Review, B 18, n7, p3728-3729, 1 Oct 78.

Keywords: *Helium 3, *Superfluidity, Free energy, Frequencies, Reprints.

The three frequency sums which appear in the theory of Rainer and Serene to determine the free energy of superfluid 3He are evaluated here, two analytically and the third to within 0.000001. A sign error has been found in the previously reported value of one of the sums.

714,865
PB-297 911/0 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Gamma-Ray Emission from Oriented Nuclei in a Multiaxis Nuclear Spin System: (166m)Ho(165)Ho.
Final rept.,
H. Marshak, and B. G. Turrell. 1979, 5p
Pub. in Solid State Communications 30, n11 p677-681 1979.

Keywords: *Gamma emission, *Nuclear spin, *Holmium isotopes, Orientation, Atomic properties, Magnetic properties, Nuclear magnetic moments, Measurement, Holmium 165, Holmium 166, Spin orientation, Oriented nuclei, Reprints.

A new method is proposed to measure multiaxis nuclear spin structures using gamma-ray emission from oriented radioactive nuclei. This method, which depends only on angular momentum theory, is presented for helical spin structures. The atomic magnetic structure can also be obtained when the nuclear magnetism is produced by hyperfine interaction. Measurements on (166m)Ho in a single crystal of (165)Ho metal show that the spin axes form a single cone with a half-angle of 80.4 + or - 0.4 degrees.

714,866
PB-298 004/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurements of the 235U Fission Cross Section in the MeV Energy Region.
Final rept.
A. D. Carlson, and B. H. Patrick. 1979, 7p
Pub. in Proceedings Int. Conf. on Neutron Physics and Nuclear Data for Reactors and Other Applied Purposes, Held at Harwell (England) on Sep 25-29, 1978, p880-886 1979.

Keywords: *Uranium 235, *Fission cross sections, Nuclear fission, Nuclear reactions, Neutron reactions, MeV range 01-10, Energy dependence, Time of flight method.

Measurements of the energy dependence of the 235U neutron fission cross section have been made from 1 to 20 MeV at the NBS neutron time-of-flight facility. These data were measured relative to the hydrogen scattering cross section with an annular proton telescope. The error for these shape measurements is 2-3% throughout the entire energy region.

714,867
PB-298 018/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Research Applications of a High Power Induction Linac.
Final rept.,
C. D. Bowman. Feb 79, 2p
Prepared in cooperation with North Texas State Univ., Denton. Sponsored in part by Department of Energy, Washington, DC., and Bureau of Radiological Health, Rockville, MD.
Pub. in Proc. Fifth Conf. on the Applications of Small Accelerators in Research and Industry, North Texas State Univ., Denton, TX, Nov 6-8, 1978, J. L. Duggan, I. L. Morgan, Eds., IEEE Trans. on Nucl. Sci. NS-26, No. 1, Part 2, of Two Parts, 1426-1431 (IEEE Nuclear and Plasma Sciences Society, New York, NY, Feb 1979).

Keywords: *Linear accelerators, *Electron accelerators, Electromagnetic induction, Neutron sources, Gamma rays, Research projects, Reprints.

An induction linac offers a number of previously unexploited advantages for research and practical application. It possesses an inherent capability for high pulsed beam currents, large aperture, simple phasing conditions, arbitrary accelerated particle mass, simple multiplexing capability, and high power conversion efficiency. An accelerator is described with the following parameters: pulsed current - 2000 amps, energy - 36 MeV, repetition rate - 180 pps, and pulse width - 60 ns. As an electron accelerator the facility would be a very intense source of pulsed neutrons or gamma-radiation. Two possible alternative power systems exist based either on multiple spark-gap switches or on magnetic compression methods. The capability of the facility is reviewed for programs in neutron scattering for materials science, neutron nuclear science, photonuclear physics, photonuclear activation analysis, radiation processing, and other research. Neutron production targets capable of handling the full 750 keV of beam power are described.

714,868
PB-298 598/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Influence of Vibrations of Gas Molecules on Neutron Reaction Cross Sections.
Final rept.
C. D. Bowman, and R. A. Schrack. 1979, 6p
Sponsored in part by International Atomic Energy Agency, Vienna (Austria).
Pub. in Proceedings of the Int. Conf. on Neutron Physics and Nuclear Data for Reactors and Other Applied Purposes, Harwell, (England), Sept. 25-29, 1978, p736-741 1979.

Keywords: *Neutron reactions, *Molecular vibration, Neutron cross sections, Gases, Uranium fluorides, Uranium oxides, Uranium 238, Uranium hexafluoride, Uranium oxides U3O8.

The change in molecular vibration energy upon absorption of a neutron by a nucleus bound in a free molecule can influence resonance shape and other aspects of neutron reaction cross sections. A formalism is developed for centrosymmetric molecules such as UF6 and applied to the shape of the 6.67 eV resonance in 238U. The ratio of the resonance shape for 238UF6 gas and for solid U3O8 has been measured and compared with the calculation. Reasonable agreement is obtained indicating the validity of the calculation and the necessity to include vibration effects to avoid large errors in measurements and calculations on gas-containing systems.

714,869
PB-298 652/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of Axial Heat Transport in Helium II with Forced Convection.
Final rept.
W. W. Johnson, and M. C. Jones. 1978, 8p
Pub. in Proceedings of the International Cryogenic Materials Conference (2nd) Held at Boulder, CO. on August 3-5, 1977, p363-370, 1978.

Keywords: *Superfluidity, *Liquid helium, Convection, Liquid flow, Heat transfer, *Helium II.

An experiment was performed that allowed measurements of the effect of forced convection on the axial heat transport of He-II contained in a long tube. The apparatus allowed the pressure difference and temperature difference across the tube to be adjusted independently, and both the resulting heat flow and net fluid flow to be measured. The two-fluid model can be used to display the separate contributions of 'internal convection' and ordinary convection to the heat transport. The results show that, in the limit of large temperature differences and fluid velocities, the behavior is approaching that of a classical fluid; this allows the extrapolation of these results, with reasonable confidence, to conditions (suitable for some applications) where forced convection would allow at least ten times the heat transport of 'internal convection' alone.

714,870
PB-299 781/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Divergence of Perturbation Theory for Anharmonic Oscillators.
Final rept.,
J. Katriel. 1979, 3p
Pub. in Physics Letters 72A, n2 p94-96, 25 Jun 79.

Keywords: *Perturbation theory, Oscillators, Quantum numbers, Energy levels, Divergence, Reprints, *Anharmonic oscillators, Annihilation operators, Creation operators.

Generalized Bose operators are used to reduce the general anharmonic oscillator into an harmonic oscillator with a frequency which depends on the strength of the anharmonicity (lambda) and on the quantum number. The analytic properties of the energy levels as functions of lambda are very transparently exhibited.

714,871
PB-299 784/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Appraisal of Interpolation Instruments for the International Practical Temperature Scale from 630.74 to 1064.43 C.
Final rept.,
L. A. Guildner, H. J. Kostkowski, and J. P. Evans. 1979, 4p
Pub. in Metrologia 15, p1-4 1979.

Keywords: *Temperature measuring instruments, Resistance thermometers, Thermocouples, Interpolation, Temperature measurement, Accuracy, Reprints, Temperature scales.

A better interpolating instrument has long been needed to replace the standard platinum-10% rhodium/platinum thermocouple for the International Practical Temperature Scale. In this paper we compare the characteristics of the high temperature platinum resistance thermometer and the photoelectric spectral pyrometer with those of the standard thermocouple and conclude that the resistance thermometer is the better replacement, in terms of both accuracy and convenience.

714,872
PB-299 826/8 Not available NTIS
National Bureau of Standards, Washington, DC.
Electromagnetic Coincidence Experiments.
Final rept.
J. S. O'Connell, and B. Schoch. 1979, 34p
Pub. in Proceedings of Workshop in Intermediate Energy Electromagnetic Interactions with Nuclei Held at Cambridge, MA. on June 13-14, 1977, 34p 1979.

Keywords: *Photonuclear reactions, *Beta particle reactions, Nuclear reactions, Coincidence circuits, Counting, Electron accelerators, Electrons, Electron reactions.

Counting rate estimates are made for photon and electron induced nuclear reactions in which two products are detected in time coincidence. Measurements to be made with a 100% duty factor electron accelerator are discussed and classified as to their relative scientific interest and feasibility.

714,873
PB-300 574/1 Not available NTIS
National Bureau of Standards, Washington, DC.
Asymptotic Eigensolutions of Fourth and Sixth Rank Octahedral Tensor Operators.
Final rept.,
W. G. Harter, and C. W. Patterson. 1979, 7p
Pub. in Jnl. of Mathematical Physics 20, n7 p1453-1459 Jul 79.

Keywords: *Rotational spectra, Quantum theory, Tensors, Reprints, *Quantum operators, Tensor operators.

Qualitative and quantitative features of high quantum rotational spectra are discussed by appealing to geometrical and topographical representations of the tensor operators. Approximate formulas are derived for level-cluster energies. The approximate conditions for the occurrence of 'anomalous' fourfold clusters are given.

714,874
PB-300 708/5 Not available NTIS
National Bureau of Standards, Washington, DC.
Singularities in Quantum Field Theory,
M. Danos, and J. Rafelski. 1979, 42p
Sponsored in part by Atomic Energy Commission, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Il Nuovo Cimento 49A, n3 p326-367, 1 Feb 79.

Keywords: Field theory(Physics), S matrix theory, Perturbation theory, Quantum theory, Symmetry, Reprints, *Quantum field theory, *Singularity, Lagrangian field theory, Feynman path integral.

The short-range behaviour of certain Feynman integrals reveals mathematical properties which are not those of either functions or distributions--they contain terms which are more singular than distributions and possess inherent ambiguities. Two classes of singularities exist: To the first one belong all those singularities which have a physical meaning in the sense that in a convergent (regularized) quantum field theory they contribute to observable quantities, frequently as renormalization constants. Most of the singularities of the second, the spurious type, violate the symmetries of the Lagrangian. The authors demonstrate that they are associated with certain mathematical difficulties of unregularized theories. Much of our analysis deals with the isolation of singularities of this type and with the study of the properties of the singular products of distribution. It is stated that the four-dimensional integration leading to the S-matrix in the perturbation expansion must be carried out over an open domain which leaves out the contributions from singularities of the

contact type, that is, terms proportional to delta to the fourth power of (x-y).

714,875
PB77-600007 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electromagnetism in Non-Riemannian Space.
C. H. Page. 1977, 3p
Included in Jnl. of Research of the National Bureau of Standards, v81B n1 and 2 p1-3 1977.

Keywords: Anholonomic, Constraint, *Electromagnetism, Hamilton, Maxwell, Momentum, Poynting, Variational.

Maxwell's equations can be interpreted as two conservation laws in a four-dimensional geometric manifold, expressed as the vanishing of a divergence and of a curl.

714,876
PB77-600014 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Establishing a Scale of Directional-Hemispherical Reflectance. Factor I: The Van den Akker Method.
W. H. Venable, J. J. Hsia, and V. R. Weidner. 1977, 27p
Included in Jnl. of Research of the National Bureau of Standards, v82 n1 and 2 p29-55 1977.

Keywords: Absolute reflectance, Diffuse reflectance, Error analysis, Reflectance, *Reflectance factor, Spectrophotometry, *Van den Akker method, *Directional-Hemispherical reflectance.

A thorough study and error analysis was made of the Van den Akker or 'auxiliary sphere' method of determining a scale of directional-hemispherical reflectance factor. The effects of a non-Lambertian distribution of the reflected radiation, including retroreflection, were included in this study. Three working standards were measured to an uncertainty in reflectance of less than plus or minus 0.0015 and these will be used as a basis for a new, more accurate NBS scale of 6 degree hemispherical reflectance factor. The new scale and the NBS scale established in 1965 are in agreement to within the uncertainty of plus or minus 0.005 assigned to the 1965 scale.

714,877
PB77-600071 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mode Gruneisen Parameters of KBr Determined by Inelastic Neutron Scattering.
M. K. Farr, and S. F. Trevino. 1976, 6p
Pub. in Proceedings of a Conf. on Neutron Scattering, Gatlinburg, TN, June 6-10, 1976, p237-242 1976.

Keywords: Anharmonicity, Dispersion curves, High pressure, *KBr, *Mode Gruneisen parameters, *Neutron scattering.

The room temperature acoustic phonon dispersion relations of KBr at 1 bar and 6.4 kbar have been measured using in-elastic neutron scattering techniques. The mode Gruneisen parameters, gamma (q vector j), for the measured modes have been calculated and are compared with several calculations based on various lattice dynamics models. The breathing shell model (BSM) and anharmonic deformation dipole model (ADD) calculations agree well with our acoustic mode measurements.

714,878
PB77-600073 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quasi-elastic Neutron Scattering Study of Single Crystal Ammonium Perchlorate.
N. J. Chesser, and H. J. Prask. 1976, 8p
Pub. in Proceedings of a Conf. on Neutron Scattering, Gatlinburg, TN, June 6-10, 1976, p295-302 1976.

Keywords: Activation energies, Molecular orientations, NH4ClO4, *Quasi-elastic neutron scattering, Residence times, Single crystal.

The theoretical model for instantaneous jump reorientations about C3 axes for XY4 groups has been extended to include the possibility of three distinct residence times among the four Y sites. This is analogous to what is expected for orthorhombic NH4ClO4 in that two of the four NH4 proton sites are equivalent by symmetry. In terms of this model we have analyzed quasi-elastic neutron scattering data from single crystal NH4ClO4 in the temperature range 60-120K. Data were obtained using a three-axis spectrometer at relatively high resolution (FWHM = .084-.113 meV), and fit using a nonlinear least squares routine to obtain values for the relative elastic to quasi-elastic intensities as well as for quasi-elastic widths. Our results are in general agreement with earlier measurements on polycrystalline samples. However, analysis of measured line shapes at optimal points in reciprocal space suggests that the three distinct residence times expected are observed for the temperatures considered.

714,879
PB77-600074 Not available NTIS.
National Bureau of Standards, Gaithersburg, MD.
Coherent Neutron Scattering Study of the Vibrations of Interstitial Deuterium in alpha-VD0.7.
J. J. Rush, J. M. Rowe, J. M. Glinka, C. J. Vagelatos, and H. E. Flotow. 1976, 7p
Pub. in Proceedings of a Conf. on Neutron Scattering, Gatlinburg, TN, June 6-10, 1976, p543-549 1976.

Keywords: Band mode, Elastic constants, Interatomic forces, Interstitial, *Lattice dynamics, *Metal hydrides.

The lattice dynamics of a single crystal of alpha(bcc)VD0.7 has been investigated by coherent inelastic neutron scattering measurements at 295 degree K. Since the scattering cross section of vanadium is almost entirely incoherent, this study offers a unique oportunity to directly measure the 'band' modes associated with vibrational displacements of the light atom interstitials as a function of q vector and omega. Transverse and longitudinal phonon groups were observed in the three symmetry directions at energies up to 27 meV. These are generally at higher energies than comparable modes measured in vanadium by x-ray scattering. The vibrational 'density of states' for V and VD0.7 are also shown to be grossly different. Careful measurement of the 'band mode' intensities for several different phonon branches as a function of q vector and omega indicate that the deuterium motions are strongly coupled to the metal lattice.

714,880
PB77-600077 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Dynamic Order Parameter Fluctuations in a Disordered System.
J. W . Haus, and J. R. Cullen. 1976, 3p
Pub. in Ann. N.Y. Acad. Sci. 279, p45-46 1976.

Keywords: Disordered system, Dynamic susceptibility, *Ginzburg-Landau free energy, Relaxation time.

No abstract available.

714,881
PB78-600019 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 7, Number 3, 1978.
Quarterly rept.
c1978,628p
See also PB78-600020 through PB78-600026.

No abstract available.

714,882
PB78-600027 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 7, Number 4, 1978.
Quarterly rept.
c1978,484p
See also PB78-600028 through PB78-600031.

No abstract available.

714,883
PB78-600066 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 83, Number 5, September-October 1978.
1978,385p
See also PB78-600002 through PB78-600009.

No abstract available.

714,884
PB78-600067 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 7, Number 1, 1978.
Quarterly rept.
c1978,378p
See also PB78-600010 through PB78-600013.

No abstract available.

714,885
PB78-600068 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 7, Number 2, 1978.
Quarterly rept.
c1978,252p
See also PB78-600014 through PB78-600018.

No abstract available.

714,886
PB79-600009 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Relativistic Atomic Form Factors and Photon Coherent Scattering Cross Sections.
J. H. Hubbell, and I. Overbo. c1979, 37p
Included in Jnl. of Physical and Chemical Reference Data, v8 n1 p69-106 1979.

Keywords: *Atomic form factor, Coherent scattering, Cross sections, Gamma rays, Photons, Rayleigh scattering, Tabulations, X rays.

Tabulations are presented of relativistic Hartree-Fock atomic form factors F(x,Z). For Z=1, F(x,Z) is given by the exact expression of Pirenne. For Z=2 to 98, x=0.001 to 2.0 Angstrom (minus 1), the tabulated values are those of Cromer and Waber given in the International Tables for X-Ray Crystallography (Vol. IV, 1974), based in part on the work of Doyle and Turner. For Z=21 to 92, x=2.2 to 6.0 angstrom (minus 1), the present tables are based on the values of Doyle and Turner and additional values (Z=44, 60, 68, and 74) as given by Overbo. For Z=3 to 20, x=2.2 to 45 angstrom (minus 1) the tables are interpolated from values given for 36 elements by Overbo, extended to x=10(9) angstrom (minus 1) using Overbo's corrections to the Bethe-Levinger K-shell expression. The remainder of the table is filled in by interpolation and extrapolation, guided for high x-values by the Bethe-Levinger result.

714,887
PB79-600018 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ideal Gas Thermodynamic Properties of Selected Bromoethanes and Iodoethane.
S. A. Kudchadker, and A. P. Kudchadker. c1979, 8p
Included in Jnl. of Physical and Chemical Reference Data, v8 n2 p519-526 1979.

Keywords: *Bromoethanes, Ideal gas thermodynamic properties, Internal rotation, Iodoethane, Potential barrier heights, Symmetric top, Torsional frequencies.

The available molecular parameters, fundamental frequencies, potential barrier heights, torsional frequencies, and standard enthalpies of formation at 298.15 K for selected bromoethanes and iodoethane containing one symmetric-top group have been critically evaluated and recommended values selected. The chemical thermodynamic properties in the ideal gas state at one atmosphere pressure using the rigid-rotor harmonic-oscillator approximation have been calculated for CH3CH2Br, CH3CHBr2, CH3CBr3, C2Br6, and CH3CH2I. The internal rotational contributions have been obtained from the partition function formed by the summation of internal rotation energy levels.

714,888
PB79-600019 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Thermodynamic Properties of Normal and Deuterated Naphthalenes.
S. S. Chen, S. A. Kudchadker, and R. C. Wilhoit. c1979, 10p
Included in Jnl. of Physical and Chemical Reference Data, v8 n2 p527-536 1979.

Keywords: *Enthalpy of formation, Ideal gas thermodynamic properties, Molecular structure, Normal and Deuterated naphthalenes, Vibrational assignments.

Structural and Spectroscopic data and the standard enthalpy of formation at 298.15 K for C10H8 alpha to the minus C10H4D4, beta to the minus C10H4D4 and C10D8 were reviewed. The selected values were utilized to calculate the ideal gas thermodynamic properties in the temperature range 0 to 1500 K, using the rigid rotor and harmonic oscillator model. The comparison between the third law entropies and the spectroscopically calculated entropies of C10H8 was studied.

The agreement is satisfactory within the experimental uncertainties.

714,889
PB79-600027 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Levels of Aluminum, Al I Through Al XIII.
W. C. Martin, and R. Zalubas. c1979, 48p
Included in Jnl. of Physical and Chemical Reference Data, v8 n3 p817-864 1979.

Keywords: *Aluminum, Atomic energy levels, Atomic spectra, Electron configurations, Ionization potentials.

Energy level data are given for the atom and all positive ions of aluminum (Z = 13). These data have been critically compiled, mainly from published material on measurements and analyses of the optical spectra. We have derived or recalculated the levels for a number of the ions. In addition to the level value in cm to the minus 1 and the parity, the J value and the configuration and term assignments are listed if known. Leading percentages from the calculated eigenvectors are tabulated wherever available, ionization energies are given for all spectra.

714,890
PB79-600028 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Levels of Calcium Ca I through Ca XX.
J. Sugar, and C. Corliss. c1979,52p
Included in Jnl. of Physical and Chemical Reference Data, v8 n3 p865-916 1979.

Keywords: *Atomic energy levels, Atomic spectra, Calcium energy levels.

The energy levels of the calcium atom in all of its stages of ionization, as derived from the analyses of atomic spectra, have been critically compiled. In cases where only line classifications are reported in the literature, level values have been derived. Electron configurations, term designations, j-values, experimental g-values, and ionization energies are included. Calculated percentages of the two leading components of the eigenvectors of the levels are given.

714,891
PB79-600029 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Simplification of Thermodynamic Calculations Through Dimensionless Entropies.
K. S. Pitzer, and L. Brewer. c1979, 4p
Included in Jnl. of Physical and Chemical Reference Data, v8 n3 p917-920 1979.

Keywords: *Dimensionless entropies, Thermodynamic functions.

The advantages of using thermodynamic quantities divided by the gas constant (H/R, G/R, etc.) in calculations are described. It is recommended that thermodynamic tables be presented in this form, so that the entries are either dimensionless or in units of kelvins.

714,892
PB79-600041 Not available NTIS
Professional Loss Control, Inc., Yeadon, PA.
Frequency Stabilizing System and Method for Beam Type Device.
H. W. Hellwig, S. Jarvis, and D. J. Wineland. Filed 18 Jan 78, patented 27 Mar 79, 10p PAT-APPL-870 384, PATENT-4 146 848

Keywords: *Beam type device, Frequency stabilizing system, Microwave interaction regions, Microwave signals.

Frequency stabilization of a beam type device is disclosed that is particularly well suited for avoiding cavity phase shift problems. A beam generator provides a molecular or atomic beam that is directed through a pair of spaced and separate interaction regions to a detector. The two interaction regions, such as cavities, provide independent regions into which different signals are injected with the injected signals being derived from an oscillator such as a crystal oscillator. The signal coupled to the interaction regions may be varied according to a general equation. The first signal may also be coupled into one of the interaction regions at a frequency substantially the same as the resonance frequency of the particles in the beam directed through the cavity, while the signal coupled to the other cavity may be caused to vary abaove and below the resonance frequency. At the detector, the envelope of the pattern impressed on the beam is detected and a correction signal derived therfrom with the correction signal then being coupled as a feedback signal to the oscillator for frequency stabilization therof.

714,893
PB79-600066 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Reference and Standard Benchmark Field Consensus Fission Yields for U.S. Reactor Dosimetry Programs.
D. M. Gilliam, R. G. Helmer, R. C. Greenwood, J. W. Rogers, R. R. Heinrich, R. J. Popek, L. S. Kellog, E. P. Lippincott, G. E. Hansen, and W. H. Zimmer. 1977, 18p
Pub. in Proceedings 2d ASTM-EURATOM Symp. on Reactor Dosimetry: Dosimetry Methods for Fuels, Cladding, and Structural Materials, Palo Alto, CA, Oct. 3-7, 1977, p1289-1306 1977.

Keywords: *Activation analysis, *Benchmark fields, Dosimetry, Fission yields, Measurements, Neutrons, Np-237; Pu-239; U-235; U238.

Measured fission product yields are reported for three benchmark neutron fields--the BIG-10 fast critical assembly at Los Alamos, the CFRMF fast neutron cavity at INEL, and the thermal column of the NBS Research Reactor. These measurements were carried out by participants in the Interlaboratory LMFBR Reaction Rates (ILRR) program.

714,894
PB79-600067 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Utilization of Standard and Reference Neutron Fields at NBS.
C. M. Eisenhauer, D. M. Gilliam, J. A. Grundl, and V. Spiegel. 1977, 15p
Pub. in Proceedings 2d ASTM-EURATOM Symp. on Reactor Dosimetry: Dosimetry Methods for Fuels, Cladding, and Structural Materials, Palo Alto, CA, Oct. 3-7, 1977, p1177-1191 1977.

Keywords: *Benchmark, Fission spectrum, Foils, Neutron fields, Scattering corrections, Sensitivity.

Several neutron fields whose absolute intensity and spectrum are known sufficiently well to serve as calibration facilities for reactor dosimetry are now operational at NBS. These include a fission-neutron spectrum generated by a small point source of 252Cf (phi approximately 1.5 x 10 to the 7th power n/cm sz sec at 5 cm distance), an intermediate-energy standard neutron field (ISNF) at the center of a spherical cavity in the thermal column of the NBS reactor (phi approximately 10 to the 9th power n/cm sq-sec), and a near-1/E spectrum in the same location with about twice that flux. For the 252Cf facility we will discuss recent investigations such as intercomparison of source strength with other laboratories, response of integral detectors in this spectrum, and evaluation of the differential sectrum. For the ISNF facility we will describe the facility and discuss some preliminary integral measurements.

714,895
PB79-600070 Not availabale NTIS
National Bureau of Standards, Gaithersburg, MD.
Standardization of Dosimetry and damage Analysis Work for U.S. LWR, FBR and MFR Development Programs.
W. N. McElroy, D. G. Doran, R. Gold, E. P. Lippincott, J. O. Schiffgens, R. L. Simons, W. C. Morgan, J. A. Grundl, E. D. McGarry, F. B. K. Kam, J. H. Swank, and G. R. Odette. 1977, 44p
Pub. in Proceedings 2d ASTM-EURATOM Symp. on Reactor Dosimetry: Dosimetry Methods for Fuels, Cladding, and Structural Materials, Palo Alto, CA, Oct. 3-7, 1977, p17-60 1977.

Keywords: *Amage analysis, Dosimetry standardization, Fast breeder reactors, Light water reactors.

The results of neutron environmental characterization and damage analysis work for reactor fuels and materials programs for (1) Light Water Reactors (LWR), (2) Fast Breeder Reactors (FBR), and (3) magnetic Fusion Reactors (MFR) will be discussed in the sessions and workshops of this Second ASTM-EURATOM Symposium. The accuracy requirements for various measured/calculated exposure and correlation parameters associated with current dosimetry and damage analysis procedures and practices depend on the accuracy needs of reactor development efforts in testing, design, safety, operations, and surveillance programs. Present state-of-the-art accuracies are estimated to be in the range of plus or minus 2 to 30% (1 sigma), depending on the particular parameter. There now appears to be international agreement, at least for the long term, that most reactor fuels and materials programs will not be able to accept an uncertainty greater than about plus or minus 5% (1 sigma). In order to achieve such an accuracy routinely however, it will be necessary to work towards a better level of accuracy, namely 2 to 5% (1 sigma). International development, standardization, and application of reactor 'benchmark field' and 'test region' validated and calibrated dosimetry and damage analysis procedures and data will be essential for the achievement of this common goal accuracy objective. In this regard, the current status of dosimetry and damage analysis standardization work within the U.S. for LWR, FBR, and MFR is reviewed in this paper.

714,896
PB79-600071 Not availabla NTIS
National Bureau of Standards, Gaithersburg, MD.
Status Report on Dosimetry Benchmark Neutron Field Development, Characterization and Application.
A. Fabry, J. A. Grundl, W. N. McElroy, E. P. Lippincott, and H. Farrar. 1977, 35p
Pub. in Proceedings 2d ASTM-EURATOM Symp. on Reactor Dosimetry: Dosimetry Methods for Fuels, Cladding, and Structural Materials, Palo Alto, CA, Oct. 3-7, 1977, p1141-1175 1977.

Keywords: *Benchmark neutron field development, Dosimetry methods, Gission cross sections, Reactor dosimetry.

This report attempts to present a brief, but comprehensive review of the status and future directions of benchmark neutron field development, characterization and application in perspective with two major objectives of reactor dosimetry: 1)fuel fission rate and burn-up passive monitoring; 2)correlation of materials irradiation damage effects and projection to commercial power plants. The report focuses on the Light Water Reactor and Fast Breeder Reactor program needs. Current interfaces between dosimetry, reactor physics, cross section metrology, solid state research and metallurgy are highlighted through a tentative classification of the benchmark fields and its justification. A summary is given of indications drawn regarding the accuracy of fundamental fission cross sections, of dosimetry sensor nuclear data, of helium production assessment, of dosimetry fission yields, and of some other nuclear cross sections, on the basis of integral measurements in selected benchmark neutron fields. The ENDF/B IV data files are used as reference for the discussions. The success of this benchmark field approach to reactor dosimetry must not hide its present limitations and it is tried to adopt throughout a critical attitude to this respect, so as to delineate the areas where improvements are most needed.

714,897
PB79-600072 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Trends in Light Water Reactor Dosimetry Programs.
F. J. Rahn, C. Z. Serpan, A. Fabry, W. N. McElroy, J. A. Grundl, and J. Debrue. 1977, 23p
Pub. in Proceedings 2d ASTM-EURATOM Symp. on Reactor Dosimetry: Dosimetry Methods for Fuels, Cladding, and Structural Materials, Palo Alto, CA, Oct. 3-7, 1977, 1069-1091 1977.

Keywords: *Dosimetry programs, Light water reactors, Nuclear reactors, Reactor dosimetry.

Dosimetry programs and techniques play an essential role in the continued assurance of the safety and reliability of components of light water reactors. Primary concern focuses on the neutron irradiation embrittlement of reactor pressure vessels and methods by which the integrity of a pressure vessel can be predicted and monitored throughout its service life. Research in these areas requires a closely coordinated program which integrates the elements of the calculational and material sciences, the development of advanced dosimetric techniques and the use of benchmarks and validation of these methods. This paper reviews the status of the various international efforts in the dosimetry area.

714,898
PB79-600073 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Measurements of 15.11-MeV Gamma-ray Flux Produced in the Reactions (12)C(p,p-prime) (12)C(*(15.11 MeV)) and (16)O(p,p-prime alpha) (12)C(*(15.11 MeV)).
J. R. Lapides, C. J. Crannell, H. Crannell, W. F. Hornyak, S. M. Seitzer, J. I. Trombka, and N. S. Wall. 1977, 13p

Keywords: *Cosmic source, Preliminary, Proton interactions, Relative measurements, 12C gamma-rays, 16O gamma-rays.

The flux of 15.11-MeV gamma rays relative to the flux of 4.44-Mev gamma rays, which are emitted from the corresponding states of (12)C, are a sensitive measure of the sectrum of exciting particles in solar flares and other cosmic sources. Emission of 15.11-MeV gamma rays may result not only from the direct excitation of (12)C but also from the interaction (16)O(p,p-prime alpha) (12)C(*(15.11 MeV)). Although the cross sections for the direct reaction has been studied extensively, the cross section for the spallation interaction with (16)O is not reported in the literature. Preliminary measurements have demonstrated the feasibility of measuring the production of 15.11-MeV gamma rays by proton interactions with (16)O using the University of Maryland cyclotron facility. For both carbon and oxygen targets the flux of 15.11-MeV gamma rays is being measured relative to the flux of 4.44-MeV gamma rays. The gamma-ray emission from de-excitation of the Giant Dipole Resonances also is being measured.

714,899
PB80-100860 Not available NTIS
National Bureau of Standards, Washington, DC.
Relativistic Field Theory of Nuclei.
Final rept.,
M. Danos, and V. Gillet. 1979, 25p
Pub. in Mesons in Nuclei, Chapter 21, p841-865 1979.

Keywords: *Nuclei(Nuclear physics), Special relativity, Quantum theory, Field theory(Physics), Quantum field theory.

The concepts and basic principles needed in a fully relativistic description of the stationary states of composite systems in quantum field theory are given. Their connection with the more common time-dependent interaction picture treatment are elucidated. Also, as illustration, some of the expressions encountered in the actual performance of the calculations are derived in detail.

714,900
PB80-104169 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Threshold Reaction Cross Section Ratios in Fission Neutron Fields.
Final rept.,
R. Fleming, and V. Spiegel. Oct 77, 5p
Pub. in Proceedings of the ASTM-EURATOM Symposium on Reactor Dosimetry (2nd) Held at Palo Alto, CA. on October 3-7, 1977, p953-957, Oct 77.

Keywords: *Neutron cross sections, *Nuclear cross sections, Nuclear fission, Californium, Uranium 235, Nickel, Cobalt, Iron, Manganese, Californium 252, Nickel 58, Cobalt 58, Iron 54, Manganese 54.

Direct measurement of ratios of cross sections were carried out in both 252Cf and 235U fission spectra. The results for the reactions 58Ni(n,p)58Co and 54Fe(n,p)54Mn are presented and compared with calculations based on the ENDF/B-IV data file.

714,901
PB80-104268 Not available NTIS
National Bureau of Standards, Washington, DC.
Computer Analysis of Quench Transients in Forced-Flow Cooled Superconductors for Large MHD Magnets.
Final rept.,
V. Arp. May 79, 22p
Pub. in Proceedings of the Superconducting MHD Magnet Design Conference Held at Cambridge, MA., on October 18-19, 1978, p411-432, May 79.

Keywords: *Liquid helium, *Turbulent flow, *Heat transfer, Magnetohydrodynamics, Superconducting magnets, Thermal analysis, Perturbation, Transient response, Stability.

This paper reports preliminary results and conclusions from a recent numerical analysis of a force-cooled superconducting system response to a thermal perturbation. The analysis differs from previous published analyses of such systems in that no approximations are used in the helium hydrodynamics (for one dimension). As a result, the analysis predicts that a thermal perturbation will cause rapid pressure and flow variations moving at sonic velocity within the coolant channel; such variations were not predicted by earlier analyses. These rapid flow variations, and the consequent fluid turbulence, may provide an important heat transfer mechanism even when the helium is initially at rest or only in laminar flow. Such a result may be the qualitative explanation for the recent experimental observations at ORNL and MIT of high super-conductor stability under zero flow conditions. Computed results are presented for superconducting geometries representative of those under experimental study at MIT.

714,902
PB80-104318 Not available NTIS
National Bureau of Standards, Washington, DC.
Single Nucleon Operators in Pion Photoproduction from Nuclei.
Final rept.,
E. Dressler. 1977, 12p
Pub. in Proceedings of the Workshop in Intermediate Energy Electromagnetic Interations with Nuclei (June) Held at Boston, MA. on June 13-24, 1977, p147-154 1977.

Keywords: *Pions, *Photoproduction, Photomesons, Photonuclear reactions, Photon cross sections, Deuterons, Nucleons, Operators(Mathematics), Nuclear cross sections, Quantum operators.

By studying photoproduction of pions from nuclei, it is possible to obtain important information about the single nucleon photoproduction operators. For example, photoproduction of positive pions from deuterium depends on parts of the single nucleon operator which are insignificant in the photon + p yields pion + n cross section.

714,903
PB80-107451 Not available NTIS
National Bureau of Standards, Washington, DC.
Decay of 121 Sn m.
Final rept.,
J. M. R. Hutchinson, F. J. Schima, and B. M. Coursey. Jul 78, 6p
Pub. in Phys. Review C, v18 n1 p408-413 Jul 78.

Keywords: Tin isotopes, Antimony, Radioactive decay, Gamma emission, Reprints, *Tin 121, K conversion.

121Sn(m) has been found to decay by a highly converted isomeric transition to 121Sn(g) with a branching fraction of 0.776 + or - 0.020. The K-shell internal-conversion coefficient alpha sub K for the 37.2-keV transition in Sb, has been found to be 9.45 + or - 0.33.

714,904
PB80-107469 Not available NTIS
National Bureau of Standards, Washington, DC.
Time Evolution of the Electric Field Associated with Breakdown Phenomena in Liquids.
Final rept.,
E. F. Kelley, and R. E. Hebner. 1979, 9p
Pub. in Proceedings Conf. on Electrical Insulation and Dielectric Phenomena, Held at White Haven, PA. in Oct 79; 1979 Annual Report of Conf. on Electrical Insulation and Dielectric Phenomena, p203-211, 1979.

Keywords: *Electrical faults, Nitrobenzenes, Electric fields, Measurement, Liquids.

The paper describes electro-optic measurements of the electric field distribution in the vicinity of prebreakdown structures in nitrobenzene. The measurements indicate that the prebreakdown structures are conducting. This conclusion was reached by modeling the structures as conducting spheres and observing that the fringe patterns calculated using the model spheres are well correlated with those photographed during breakdown.

714,905
PB80-108491 Not available NTIS
National Bureau of Standards, Washington, DC.
Trapped-Flux Spin-Down Torques on a Spherical Superconducting Gyroscope.
Final rept.,
L. B. Holdeman. Mar 78, 4p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Applied Physics 49, n3, p951-954, Mar 78.

Keywords: *Gyroscopes, *Superconductors, Energy dissipation, Magnetic fields, Flux(Rate), Torque, Rotors, Eddy currents, Reprints, Magnetic flux, Flux trapping.

Magnetic flux trapped in the rotor of a superconducting gyroscope can cause the rotor to lose energy through dissipation in a readout loop encompassing the rotor and by the generation of eddy currents in the support electrodes. These losses are calculated and shown to be negligible for the rotor in the gyroscope-relativity experiment, a proposed satellite experiment which is to test predictions of the theory of general relativity.

714,906
PB80-115538 Not available NTIS
National Bureau of Standards, Washington, DC.
Transport Calculations for Very High Current Beams.
Final rept.
S. Penner, and A. Galejs. Jun 79, 4p
Pub. in IEEE Transactions on Nuclear Science NS-26, n3 Pt. 1 p3086-3089 Jun 79.

Keywords: *Particle beams, Space charge, Charged particles, Force, Computerized simulaton, Perturbation, Stability.

A computer program has been developed to calculate the effect of the transverse space charge forces on a particle beam. The method is to divide the beam into a large number, M, of 'beamlets,' and compute the force on each beamlet by summing over the forces due to all the others. M > 1000 is needed to make spurious collisional effects negligible. To the space charge forces, are added the forces due to the physical components of the system such as quadrupoles, solenoids or accelerating gaps. Using this program is verified the prediction that at high current, certain perturbations of the K-V distributions are unstable. In a FODO line tuned to 90 degrees phase advance per cell at zero current, with the phase advance depressed to 30 degrees by space charge it is found that the rms emittance of a perturbed K-V distribution grows by a factor of 2 in about 40 cells, and then remains stable, although no longer having the K-V form. For thin-lens focusing, this result is in good agreement with Haber's calculation. The use of finite quadrupoles rather than thin lenses has remarkably little effect.

714,907
PB80-115595 Not available NTIS
National Bureau of Standards, Washington, DC.
Eddy Currents in a Conducting Cylinder with a Crack.
Final rept.,
R. Spal, and A. H. Kahn. Oct 79, 4p
Pub. in Jnl. of Applied Physics 50, n10 p6135-6138 Oct 79.

Keywords: *Eddy current tests, *Cracks, Cylindrical bodies, Electrical impedance, Solenoids, Nondestructive tests, Eddy currents, Mathematical models, Reprints.

Calculations for the impedance of a long solenoid which surrounds a cylinder of conducting material containing a radial surface crack of constant depth are reported. The calculation is accomplished by solving for the longitudinal ac magnetic field in the interior of the cracked cylinder in terms of an infinite series of cylindrical Bessel functions. All the coefficients in the series are determined in principle by boundary-condition requirements and the most significant terms are obtained numerically by truncation of the series. The resulting impedance is calculated for a wide range of values of the ratios of crack depth to radius and radius to skin depth. The results are tabulated in a form useful for nondestructive testing purposes.

714,908
PB80-117237 Not available NTIS
National Bureau of Standards, Washington, DC.
Explicit Expressions for the Coefficients in Boson Series Expansions of Arbitrary Spin Operators.
Final rept.,
J. Katriel. 1979, 3p
Pub. in Physicia Status Solidi Short Notes B93, pK177-K179 1979.

Keywords: *Particle spin, Bosons, Operators(Mathematics), Reprints, *Pauli spin operators, *Creation operators, *Annihilation operators, Quantum operators, Angular momentum operators.

A generalization of the Holstein-Primakoff representation of spin operators in terms of Boson operators has been proposed by Agranovich and Toshich. A closed form expression of this representation is presented which enables a derivation of the corresponding normal-ordered expansion for arbitrary spin.

714,909
PB80-117294 Not available NTIS
National Bureau of Standards, Washington, DC.
Improved Laser Test of the Isotropy of Space.
Final rept.,
A. Brillet, and J. L. Hall. 26 Feb 79, 4p
Pub. in Physical Review Letters 42, n9, p549-552, 26 Feb 79.

Keywords: *Isotropy, Anisotropy, Frequency shift, Length, Reprints, *Space, Laser applications.

Extremely sensitive readout of a stable 'etalon of length' is achieved with laser frequency-locking techniques. Rotation of the entire electro-optical system maps any cosmic directional anisotropy of space into a corresponding frequency variation. We found a fractional length change delta l/l = (1.5 + or - 2.5) times 10 to the -15th power, with the expected P sub 2 (cosine theta) signature. This null result represents a 4000-fold improvement on the best previous measurement of Jaseja et al.

714,910
PB80-117419 Not available NTIS
National Bureau of Standards, Washington, DC.
High Duty-Cycle Accelerators and New Experimental Possibilities.
Final rept.,
S. Penner. 1979, 15p
Pub. in Lecture Notes in Physics, 108, p99-113 1979.

Keywords: *Electron accelerators, Nuclear physics, Nuclei(Nuclear physics), Resonance, Neutrons, Wave functions, Electron beams, Giant resonance.

New types of nuclear physics experiments are made possible by electron accelerators with cw beams. Experiments not feasible with present day accelerators will contribute greatly to our understanding of two-body correlations and the role of nucleon resonances in nuclei. It will be possible to study neutron wave functions in nuclei with accuracy comparable to what is now possible only for photons. Better methods for studying the giant resonances will also become feasible. Accelerator possibilities for achieving the goal of cw electron beams are discussed. Some considerations of how high an energy might be needed are given.

714,911
PB80-119142 Not available NTIS
National Bureau of Standards, Washington, DC.
Model for Diffusion of a Pencil Beam of Electrons: Angular Distribution.
Final rept.,
C. Eisenhauer. Jun 79, 2p
Pub. in Transactions of the American Nuclear Society 32, p649-650, Jun 79.

Keywords: *Electron beams, *Diffusion, *Mathematical models, Angular distribution, Energy dissipation, Water, Lead(Metal), Monte Carlo method, Reprints, Multiple scattering, MeV range 01-10, KeV range 100-1000.

An approximate one-parameter analytic expression is developed to describe the two-dimensional track-length distribution due to multiple scatter of narrow beam of charged particles. Predictions are compared with distributions calculated by the Monte Carlo method for two types of one-velocity scattering kernels. The analytic model is then applied to electrons of 10, 1, and 0.1 MeV in water and 1 MeV in lead, by introducing the electron range as a cut-off parameter. A correction function is generated by comparing energy deposition determined from a rigorous Monte Carlo calculation with predictions of the model. The correction function is found to be slowly varying, differing from unity by less than 40%. Thus, variations in energy deposition density of three orders of magnitude or more can be expressed by the product of an analytic expression and a slowly-varying tabulated correction function.

714,912
PB80-120876 Not available NTIS
National Bureau of Standards, Washington, DC.
Introductory Remarks - Quark Flavors.
Final rept.,
S. Meshkov. 1978, 6p
Sponsored in part by Department of Energy, Washington, DC. Prepared in cooperation with California Inst. of Tech., Pasadena.
Pub. in New Frontiers in High-Energy Physics 14, Studies in the Natural Sciences, p221-226 1978.

Keywords: *Quarks, Mesons, Flavor model, Vector mesons.

The question of where the next quark flavor n should occur is discussed. It is guessed that it will have a mass of 14-15 GeV by extrapolating from lower heavy quark mass ratios. The corresponding n- bar n vector meson would have a mass of 30 GeV. The excitation spectrum of quarks is contrasted with that of the hydrogen atom. The possibility of regarding flavor as an excitation of some new degree of freedom in the system is also discussed.

714,913
PB80-121338 Not available NTIS
National Bureau of Standards, Washington, DC.
Improved Test of the Isotropy of Space Using Laser Techniques.
Final rept.,
A. Brillet, and J. L. Hall. Oct 79, 9p
Contract N00014-77-C-0656, Grant NSF-PHY76-04761
Pub. in Proc. Int. Conf. on Laser Spectroscopy (4th), Rottach-Egern, Germany, June 11-15, 1979, p12-20 Oct 79.

Keywords: Special relativity, Isotropy, Laser beams, *Light speed, Michelson-Morley experiment, Space, Fundamental constants.

This paper describes a new laser version of the Michelson-Morley experiment, in which the authors achieved a sensitivity (delta c/c = (1.5 + or - 2.5) times 10 to the -15th power). This appears to constitute the most precise test of special relativity yet realized.

714,914
PB80-122880 Not available NTIS
National Bureau of Standards, Washington, DC.
Higher-Order Effects in Fermi-Type Charged Current Theory of Weak Interactions: Semi-Leptonic Neutral Currents.
Final rept.,
M. Danos, and J. Rafelski. 27 Feb 78, 4p
Pub. in Phys. Lett. 73B, n3 p313-316, Feb 27, 1978.

Keywords: *Weak interactions, Perturbation theory, Reprints, *Weak neutral currents, Neutral currents, Charged currents, Quantum field theory.

In a convergent field theory rescattering graphs lead to neutral-current effects of the observed magnitude if the effective cut-off momentum is of the order of 1/(square root of G) is about 300 GeV. A perturbation expansion is justified owing to the value f=0.18 of the resulting expansion parameter.

714,915
PB80-140908 Not available NTIS
National Bureau of Standards, Washington, DC.
Superconductive Device to Provide Reference Temperatures for Use Below 0.5 K.
Final rept.,
R. J. Soulen. 1979, 3p
Pub. in Proceedings of Comite Consultatif de Thermometrie Meeting (12th), Held at Sevres, France on May 9-10, 1978, Annexe T7 pT83-T85 (Bureau International des Poids et Mesures, Pavillon de Breteul, F-92310, Sevres, France, 1979).

Keywords: *Superconductors, *Temperature measurement, Cryogenics, Tungsten, Beryllium, Iridium, Gold intermetallics, Gold alloys, Aluminum alloys, Intermetallics, Indium alloys, Indium intermetallics, Aluminum intermetallics, Ultraflow temperature.

The development of a device containing five superconductive materials W, Be, Ir, AuAl2, and AuIn2 which provides reference temperatures at 0.015 K, 0.024 K, 0.0975 K, 0.159 K, and 0.204 K, respectively, is reported. The reproducibility of three of these prototype units each containing these five superconductors was found to vary from 0.1 to 0.4 mK except for Be where it was 1 mK.

714,916
PB80-146608
(Order as PB80-146566, PC **A04**/MF **A01**)
National Bureau of Standards, Washington, DC. National Measurement Lab.
Practical Test of the Air Density Equation in Standards Laboratories at Differing Altitude,
R. M. Schoonover, R. S. Davis, R. G. Driver, and V. E. Bower. 1 Oct 79, 13p
Included in Jnl. of Research of the National Bureau of Standards, v85 n1 p27-38, Jan-Feb 80.

Keywords: *Weight measurement, *Atmospheric density, Errors, Measurement, Buoyancy, Atmospheric temperature, Atmospheric pressure, Carbon dioxide, Humidity.

A number of weighings of kilogram artifacts have been completed at sites of differing altitude. The artifacts and altitude difference were chosen to amplify the role of the necessary buoyancy corrections and thereby to uncover systematic errors in those corrections as they are usually applied. Small systematic effects were discovered but these are not explainable by buoyancy errors. Rather, it is suggested that their source is a lack of thermal equilibrium between the artifacts and the balance chamber.

714,917
PB80-150485 Not available NTIS
National Bureau of Standards, Washington, DC.
Influence of Vibrations of Gas Molecules on Neutron Reaction Cross Sections.
Final rept.,
C. D. Bowman, and R. A. Schrack. Jan 80, 7p
Pub. in Journal of Physical Review C 21, n1, p58-64, Jan 80.

Keywords: *Neutron cross sections, *Molecular vibration, Neutron reactions, Uranium fluorides, Uranium isotopes, Gases, Nuclear reactions, Resonance, Reprints, *Uranium 238, *Uranium hexafluoride.

The change in molecular vibrational energy upon absorption of a neutron by a nucleus bound in a free molecule can influence resonance shape and other aspects of neutron reaction cross sections. A formalism is developed for centrosymmetric molecules such as UF6 and applied to the shape of the 6.67 eV resonance in 238U. The ratio of the resonance shape for 238UF6 gas and for solid 238U3O8 has been measured and compared with the calculation. Reasonable agreement is obtained, indicating the validity of the calculation and the necessity to include vibration effects to avoid large errors in measurements and calculations on gas-containing systems.

714,918
PB80-165780 Not available NTIS
National Bureau of Standards, Washington, DC.
Shell Model for the Interaction of the Delta 33 with the Nucleus.
Final rept.,
M. Danos, and H. T. Williams. 14 Jan 80, 4p
Pub. in Journal of Physics Letter 89B, n2, p169-172, 14 Jan 80.

Keywords: *Nuclear reactions, Nuclear shell models, Baryon resonances, Potential scattering, Pions, Nuclear scattering, Reprints, *Delta-33 resonances.

The authors propose that the interaction of a Delta-33 baryon resonance with a nucleus can be described by an effective shell-model potential. This hypothesis is tested by computing in a simple manner the pion-nucleus scattering in the Delta-33 resonance region. A value of 150 MeV is found for the depth of the Delta-33 potential well.

714,919
PB80-171168 Not available NTIS
National Bureau of Standards, Washington, DC.
Sum Rule and Classical Limit for Scattering in a Low-Frequency Laser Field.
Final rept.,
L. Rosenberg. Oct 79, 7p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Physics Review A 20, n4, p1352-1358, Oct 79.

Keywords: *Electron scattering, *Light scattering, Laser beams, Scattering cross sections, Frequencies, Photos, Potential scattering, Reprints, Sum rules.

A previously derived low-frequency approximation for scattering in a laser field represents the amplitude for scattering with the absorption or emission of a speci-

fied number of photons in terms of the physical field-free scattering amplitude, a result which holds even with the inclusion of a correction term of first order in the frequency of the field. In the general case, where the polarization of the field is arbitrary and the dipole approximation is not assumed, the cross section depends on the phase as well as the magnitude of the field-free scattering amplitude. It is shown here that this phase dependence disappears when the cross section is summed over all possible final states of the field. The result of this summation is identical (within the limits set by the domain of validity of the low-frequency approximation itself) to that which would be predicted from a classical description of the motion of the electron in the field, the collision taking place instantaneously and without influence from the field. This sum rule and its classical interpretation, obtained here in a nonrelativistic potential scattering model, is of the form derived some time ago by Brown and Goble on the basis of general field-theoretic considerations.

714,920
PB80-177975 Not available NTIS
National Bureau of Standards, Washington, DC.
Infrared Radiation in Potential Scattering.
Final rept.,
L. Rosenberg. Jan 80, 6p
Pub. in Journal of Physics Review A 21 n1 p157-162 Jan 80.

Keywords: *Potential scattering, *Infrared radiation, Transition probabilities, Bremsstrahlung, Electron scattering, Photons, Reprints, Sum rules.

Some time ago Bloch and Nordsieck, working in a model in which the spectrum of the radiation field is cut off beyond some low frequency omega(l), showed that the transition probability for scattering, summed over final photon states, is approximately that which would be obtained if the interaction of the projectile with the radiation field were neglected entirely. Here, within the context of a nonrelativistic treatment of the scattering process, the sum rule is generalized through the inclusion of corrections of first order in omega(l). These corrections can be interpreted in terms of a simple classical picture. In the course of the derivation, a low-frequency approximation for the transition amplitude is obtained which contains as special cases the perturbative result of Low for single-photon bremsstrahlung and the more recently derived approximation for scattering in a low-frequency laser field.

714,921
PB80-178072 Not available NTIS
National Bureau of Standards, Washington, DC.
Coincidence Experiments with GeV Electron Beams.
Final rept.,
J. S. O'Connell. 1980, 7p
Pub. in Nucl. Phys. A, v355 p563-569 1980.

Keywords: *Nuclear scattering, *Electron scattering, Electron beams, Electron accelerators, Reprints, *Hadron-hadron interactions, GeV range, Coincidence spectrometry, Relativistic electron beams.

Coincidence measurements with electron scattering at high momentum and energy transfer to the nucleus are examined from the point of view of determining the basic hadron-hadron interaction parameters. Electron beam characteristics and possible accelerators to produce 100% duty factor beams are discussed.

714,922
PB80-178080 Not available NTIS
National Bureau of Standards, Washington, DC.
Electric Dyadic Green's Functions in the Source Region.
Final rept.,
A. D. Yaghjian. Feb 80, 16p
Pub. in Proc. IEEE, v68 n2 p248-263 Feb 80.

Keywords: *Electric potential, *Green's function, Electric fields, Reprints, Dyadics, Singularity.

A straightforward approach that does not involve delta-function techniques is used to rigorously derive a generalized electric dyadic Green's function which defines uniquely the electric field inside as well as outside the source region. The electric dyadic Green's function, unlike the magnetic Green's function and the impulse functions of linear circuit theory, requires the specification of two dyadics: the conventional dyadic G sub (e) outside its singularity and a source dyadic L which is determined solely from the geometry of the 'principal volume' chosen to exclude the singularity of G sub (e). The source dyadic L is characterized mathematically, interpreted physically as a generalized depolarizing dyadic, and evaluated for a number of principal volumes (self-cells) which are commonly used in numerical integration or solution schemes. Discrepancies at the source point among electric dyadic Green's functions derived by a number of authors are shown to be explainable and reconcilable merely through the proper choice of the principle volume. Moreover, the ordinary delta-function method, which by itself is shown to be inadequate to extract uniquely the proper electric dyadic Green's function in the source region, can e supplemented by a simple procedure to yield unambiguously the correct Green's function representation and associated fields.

714,923
PB80-178106 Not available NTIS
National Bureau of Standards, Washington, DC.
Quartet Effects in Masses and in Charge Exchange Reactions.
Final rept.,
M. Danos. 1980, 13p
Pub. in Proc. Int. Symp. on Future Directions in Studies of Nuclei Far From Stability, Held at Nashville, TN on Sep 10-14, 1979 p195-207.

Keywords: Nuclear structure, Mass, Nuclear reactions, *Quartet model, *Charge exchange, *Mass formulae.

A mass formula based on the quartet model is presented; some differences in its predictions with that of other mass formulae are pointed out. The possibility of reaching highly unstable nuclei by charge exchange reactions is discussed. It is shown that surface quartets play a decisive role in multiple charge transfer processes.

714,924
PB80-178148 Not available NTIS
National Bureau of Standards, Washington, DC.
Model for Diffusion of a Narrow Beam of Charged Particles.
Final rept.,
C. Eisenhauer. 1980, 19p
Pub. in Radiat. Res., v81 p336-354 1980.

Keywords: *Diffusion theory, Particle beams, Electron beams, Energy dissipation, Length, Scattering, Reprints, *Charged-particle transport.

A simple analytic expression is presented to describe the three-dimensional spatial distribution of flux or energy deposition by a narrow beam of charged particles. In this expression distances are expressed in terms of a scaling parameter that is proportional to the mean square scattering angle in a single collision. Finite ranges are expressed in terms of the continuous-slowing-down-range. Track-length distributions for one-velocity particles and energy deposition for electrons are discussed. Comparisons with rigorous Monte Carlo calculations show that departures from the analytic expression can be expressed as a slowly varying function of order unity. This function can be used as a basis for interpolation over a wide range of source energies and materials.

714,925
PB80-183619 Not available NTIS
National Bureau of Standards, Washington, DC.
Mass Measurement at the National Bureau of Standards: A Revision.
Final rept.,
R. M. Schoonover, R. S. Davis, and V. E. Bower. 21 Mar 80, 2p
Pub. in Science, v207 p1347-1348, 21 Mar 80.

Keywords: *Weight measurement, *Atmospheric density, Buoyancy, Atmospheric pressure, Measurement, Errors, Reprints.

In 1975, the results of a series of mass measurements undertaken by the National Bureau of Standards were published in Science. The inconsistencies reported seemed to depend on barometric pressure. An inference to be drawn from the report is that buoyant forces on objects weighed in air are somehow incorrectly accounted for by the usual appeal to Archimedes' principle in which the density of air, rho, is computed from an equation of state. In a new experiment at the National Bureau of Standards, in which more elaborate and precise equipment was used, the calculation of air density from the atmospheric variables is confirmed to within 0.05 percent, hence within the uncertainty usually claimed for the air density and buoyancy calculations.

714,926
PB80-188535 Not available NTIS
National Bureau of Standards, Washington, DC.
Advances in Measurements of Thermophysical Properties by Dynamic Techniques.
Final rept.,
A. Cezairliyan. 1979, 19p
Pub. in High Temp.-High Pressures 11, p9-27 1979.

Keywords: *Measurement, *Thermophysical properties, Thermodynamics, Reprints, High temperature.

Advances during the last decade in the development and use of dynamic techniques (by resistive self-heating of the specimen) for the measurement of selected thermophysical properties in the temperature range 1000 to 10000 K are presented. The principles of subsecond-duration experimentation and the methods of obtaining the properties are briefly discussed. Millisecond- and microsecond-resolution pulse-heating systems developed in various laboratories are described and a summary of the measurements is given.

714,927
PB80-188576 Not available NTIS
National Bureau of Standards, Washington, DC.
Precise gamma-ray Energy Standards.
Final rept.,
E. G. Kessler, R. D. Deslattes, W. C. Sauder, and A. Henins. 1979, 14p
Pub. in Proceedings of Intl. Symp. on Neutron Capture gamma-ray Spectroscopy and Related Topics (3rd), Upton, NY, Sept. 18-22, 1978, p427-440, 1979.

Keywords: *Gamma ray spectroscopy, Energy, Standards, X rays, Gamma ray spectra, Measurement, Gamma rays, KeV range 10-100, KeV range 100-1000.

A number of gamma-ray energy standards have recently been remeasured with respect to a visible standard wavelength with an accuracy of about 0.5 ppm. These measurements which were made on a double axis flat crystal spectrometer established the gamma-ray energy scale in the 50 keV to 1 MeV region about 40 times more accurately than it was previously known. This report describes the measurement steps involved in the visible to gamma-ray comparison. Some results and applications of the results are presented. The extension of the measurement techniques developed for the gamma-ray measurements to X-rays, higher energy gamma-rays, and dense gamma-ray spectra is briefly discussed.

714,928
PB80-189038 Not available NTIS
National Bureau of Standards, Washington, DC.
Standardization of alpha-particle Sources.
Final rept.,
L. L. Lucas. 1980, 13p
Pub. in Proceedings of ASTM Conf. on Effluent and Environmental Radiation Surveillance, Johnson, VT. July 9-14, 1978, Am. Soc. Test. Mater. Spec. Tech. Publ. 698, p342-354 1980.

Keywords: *Ion sources, Alpha particles, Calibrating, Standards, Accuracy, Measurement, *Alpha sources.

The calibration of alpha-particle sources at the National Bureau of Standards began about 1950 with the measurement of 2 pi alpha-particle-emission rates using a hemispherical gas-flow proportional counter. Today activities are also determined using defined-geometry counters with scintillation detectors and 4 pi alpha-gamma coincidence counters. As the measurement techniques have evolved, the overall uncertainty associated with the determination of the activity of an alpha-particle source has decreased by about an order of magnitude, from several percent to several tenths of one percent. The factors contributing to the overall uncertainty fall into two general categories: those associated with the detection system and those associated with the source (such as uncertainties in self-absorption and scattering). These factors are discussed, along with suggestions for minimizing the overall uncertainty.

714,929
PB80-189186 Not available NTIS
National Bureau of Standards, Washington, DC.

Measurement of Thermal Radiation Properties of Materials.
Final rept.,
J. C. Richmond. 1979, 27p
Pub. in High-Temp. High Pressures 11, p355-381 1979.

Keywords: *Thermal measurements, Thermal radiation, Reflectance, Absorptance, Transmittance, Emittance, Materials, Reprints.

The thermal radiation properties, reflectance, absorptance, emittance, and transmittance, are defined, and the equations showing the relationships between these properties are given. The equations relating the amount and the spectral and geometric distribution of the flux emitted by a blackbody or complete radiator to its temperature are given, and it is shown how these equations can be applied to a real material by use of thermal radiation properties of the material. Methods of measuring the thermal radiation properties of the solid materials are briefly described and illustrated, and references are given to the original papers describing such measurements.

714,930
PB80-194434 Not available NTIS
National Bureau of Standards, Washington, DC.
Glueballs: Their Spectra, Production and Decay.
Final rept.,
J. J. Coyne, P. M. Fishbane, and S. Meshkov. 7 Apr 80, 6p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Jnl. of Physics Letter 91B n2 p259-264, 7 Apr 80.

Keywords: Quarks, Reprints, *Gauge theory, *Glueballs.

A systematic enumeration of the glueball spectrum of QCD and other SU(n) gauge theories yields (J sup PC) = odd(-+), even(+-), and 0(--) states in addition to the usual quark model states. Production and decay mechanisms for these new states are discussed. The authors obtain a significant radiative decay width of the psi/J into a 0(-+) glueball via mixing with the (eta sub c).

714,931
PB80-203078 Not available NTIS
National Bureau of Standards, Washington, DC.
Efficient Neutron Production Using Low-Energy Electron Beams.
Final rept.,
C. D. Bowman. 1980, 4p
Pub. in Nuclear Science Engineering 75, p12-15 1980.

Keywords: *Neutron sources, Electron beams, Neutron radiography, Linear accelerators, Bremsstrahlung, Reprints.

A comparison of gamma and atomic cross sections shows that neutron production with an electron beam can be as energy efficient with 10-MeV electrons as with the conventionally used 30- to 100-MeV electrons. Neutron production from tungsten using 100-MeV electrons is compared with a thin tungsten converter followed by a deuterium-containing target using electrons near 10 MeV.

714,932
PB80-205917 Not available NTIS
National Bureau of Standards, Washington, DC.
Scaling Parameter for Backscattering of Electrons at Perpendicular Incidence.
Final rept.,
C. Eisenhauer. Jun 80, 3p
Pub. in Transactions of the American Nuclear Society 34, p654-656 Jun 80.

Keywords: *Electron scattering, Backscattering, Mean free path, Reprints, Scaling factors.

A scaling parameter gamma(r sub 0) is suggested for understanding backscatter of electrons from material. This parameter is the product of r0, the continuous-slowing-down range and gamma, the reciprocal of the transport mean free path. Experimental data for backscattering of electrons of varying energies perpendicularly incident on various materials are plotted as a function of gamma(r sub 0). The results cluster along a single curve for backscatter coefficients ranging from 0.003 to 0.5, for electron source energies between 30 keV and 20 MeV, and for materials with atomic numbers between 6 and 82.

714,933
PB80-211675 Not available NTIS
National Bureau of Standards, Washington, DC.
Nuclear-Decay Data: The Statement of Uncertainties.
Final rept.,
W. B. Mann. Jun 80, 1p
Pub. in International Jnl. of Applied Radiation and Isotopes, Letters to Editorial 31, n6 p387 Jun 80.

Keywords: *Radioactive decay, Decay schemes, Random error, Reprints.

This letter emphasizes the need to state the nature of uncertainties associated with the publication of nuclear-decay data.

714,934
PB80-212301 Not available NTIS
National Bureau of Standards, Washington, DC.
SURF's Up at NBS (National Bureau of Standards): A Progress Report,
G. Rakowsky, and L. R. Hughey. Jun 79, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-26, n3 p3845-3847 Jun 79.

Keywords: *Synchrotrons, Synchrotron radiation, Reprints, *Electron-ring accelerators, Instability.

The NBS Synchrotron UV Radiation Facility (SURF-II) is a 250 MeV single-magnet, weak-focusing electron storage ring, with 10 MeV microtron injector. Circulating beams of up to 35 mA at energies up to 250 MeV have been achieved. Beam lifetime, limited by Touschek effect, is extended to several hours by resonant vertical rf excitation. At low energies bunch shape oscillations occur, involving coherent synchrotron oscillations, negative-mass-type blowup and loss of beam. Effective avoidance and suppression techniques are discussed. A new set of high current gradient correction coils and power supplies, plus additional pancakes for the main field coils are being obtained. These are expected to extend SURF operation to 280 MeV and provide useful light output to 0.4 keV photon energies.

714,935
PB80-215643 Not available NTIS
National Bureau of Standards, Washington, DC.
Intranuclear Cascade Description of Relativistic Heavy-Ion Collisions,
R. K. Smith, and M. Danos. Oct 77, 18p
Pub. in Proceedings of the Topical Conference on Heavy-Ion Collisions, Pikeville, TN., 13-17 Jun 77, CONF-770602, p363-380. Sponsored in part by Oak Ridge National Lab., TN.

Keywords: Relativity, *Heavy ion reactions, *Ion collisions, Quantum field theory.

The principles of the description of heavy ion collisions on the basis of relativistic quantum field theory are given. The results on single particle cross sections are present; also, the detailed histories of the collision process are discussed.

714,936
PB80-216443 Not available NTIS
National Bureau of Standards, Washington, DC.
Corrections to the Faraday as Determined by Means of the Silver Coulometer.
Final rept.,
R. S. Davis, and V. E. Bower. 1980, 5p
Pub. in Proceedings of Conference on Atomic Masses and Fundamental Constants (6th) (AMCO-6), East Lansing, Michigan, September 18-21, 1979, Paper in Atomic Masses and Fundamental Constants, p161-165 1980.

Keywords: *Faraday effect, Constants, Electrochemistry, Errors, Coulometry.

At the last meeting of the conference on Atomic Masses and Fundamental Constants (AMCO-5) experimental results for the Faraday constant as determined by the silver coulometer were presented. Those results included an uncertainty estimated at 2 ppm due to impurities in the silver. The authors are now able to assign an impurity correction based on exhaustive mass spectrographic analysis of the silver used and assumptions concerning the elctrochemical behavior of the impurities. A realistic assignment of uncertainty of the impurity correction has also been obtained. The overall correction has lowered the value of the Faraday reported at AMCO-5 by 2 ppm while reducing the uncertainty due to impurities to 0.5 ppm. The authors believe the impurity analysis to be the most searching ever performed for an electrical determination of the Faraday constant.

714,937
PB80-218464 Not available NTIS
National Bureau of Standards, Washington, DC.
Recirculating Accelerators with Room Temperature RF.
Final rept.,
S. Penner. 1979, 22p
Pub. in Proceedings of the Conference on Future Possibilities for Electron Accelerators, Charlottesville, VA., Jan 8-10, 1979, pG-1--G-22 1979.

Keywords: *Electron accelerators.

This paper discusses the need for cw accelerators for nuclear research, the problems in developing such accelerators, and the NBS/LASL proposal for research aimed at developing recirculating electron accelerators using room temperature rf accelerating techniques.

714,938
PB80-228950 Not available NTIS
National Bureau of Standards, Washington, DC.
Absorption Correction for Weissenberg Diffractometers.
Final rept.,
A. Santoro, and A. Wlodawer. 1980, 9p
Pub. in Acta Cryst. A36, p442-450 1980.

Keywords: *Diffractometers, Absorption, Single crystals, Reprints.

Formulas are derived extending several semi-empirical absorption-correction methods to diffractometers operating in Weissenberg geometries, with particular attention paid to flat-cone geometry. These formulas are useful for a variety of instruments using both area and linear position-sensitive detectors. While a complete data set can sometimes be corrected using a single absorption reflection, it was found that the best corrections are usually obtained by considering two absorption reflections rather than one. A discussion of the optimum choice of absorption correction when a crystal has at least a twofold symmetry axis is presented. The accuracy of the methods and the limits of applicability have been examined by computer simulations.

714,939
PB80-600002 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Levels of Magnesium, Mg I Through Mg XIII.
W. C. Martin, and R. Zalubas.c1980,58p
Included in Jnl. of Physical and Chemical Reference Data, v9, n1 p1-58 1980.

Keywords: *Atomic energy levels, Atomic spectra, Electron configurations, Ionization potentials, Magnesium.

Energy level data are given for the atoms and all positive ions of magnesium (Z is equal to 12). These data have been critically compiled, mainly from published material on measurements and analyses of the optical spectra. We have derived or recalculated the levels for a number of the ions. In additionto the level value in cm to the minus first power and the parity, the J value and the configuration and term assignments are listed if known. Leading percentages from the calculated eigenvectors are tabulated wherever available. Ionization energies are given for all spectra.

714,940
PB80-600007 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Energy Levels of Scandium, Sc I Through Sc XXI.
J. Sugar, and C. Corliss. c1980,40p
Included in Jnl. of Physical and Chemical Reference Data, v9, n2 p473-512.

Keywords: *Atomic energy levels, Atomic spectra, Scandium energy levels.

The energy levels of the scandium atom in all of its stages of ionizaiton, as derived from the analyses of atomic spectra, have been critically compiled. In cases where only line classifications are reported in the literature, level values have been derived. Electron configurations, term designations, J-values, experimental g-vales, and ionization energies are included. Calculat-

ed percentages of the two leading components of the eigenvectors of the levels are given, where available.

714,941
PB80-600019 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pair, Triplet, and Total Atomic Cross Sections (and Mass Attenuation Coefficients) for 1 MeV-100 GeV photons in elements Z = 1 to 100.
J. H. Hubbell, H. A. Gimm, and I. Overbo.
c1980,126p
Included in Jnl. of Physical and Chemical Reference Data, v9, n4 p1023-1148

Keywords: *Attenuation coefficient, Coherent scattering, Compton scattering, Gamma rays, pair production, Photo-electric absorption, Photons, Triplet production, X-rays.

Tables of photon cross sections and mass attenuation coefficients for all elements Z = 1 to 100 are given for photo energies in the range 1 MeV to 100 GeV. The pair and triplet production cross sections take into account recent theoretical work, including atomic form factor and incoherent scattering function data, as well as extensive new total attenuation coefficient measurements at Mainz. Cross section values for the atomic photoeffect and coherent and incoherent (Compton) scattering are explicitly listed and are included in the total cross sections (excluding photonuclear) and mass attenuation coefficients.

714,942
PB80-600022 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Static Dielectric Constant of Water and Steam.
M. Uematsu, and E. U. Franck. c1980,15p
Included in Jnl. of Physical and Chemical Reference Data, v9, n4, p1291-1306.

Keywords: *Critically evaluated data, Critical review, Data compilation, International Formulation, Static dielectric constant, Steam, Water.

This paper reviews and evaluates the experimental works of the static dielectric constant (permittivity) of water and steam over the century. The critically evaluated experimental data are represented by a function of temperature and density. This representation was carefully examined in the light of the criteria for smoothness and physical plausibility. As a result of this work, which was largely stimualted by the activities of the International Association for the Properties of Steam, a new International formulation for the static dielectric constant of water and steam was adopted. This formulation covers a temperature range from 0 to 550 deg C and a pressure range up to 500 MPa.

714,943
PB80-600024 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Systematic Relationships Among Binary Phase Diagrams of the Transition Elements.
Wall chart,
R. M. Waterstrat. 1980,1p NBS-SP-564

Keywords: *Alloy theory, Crystal chemistry, Intermediate phases, Phase diagrams, Phase equilibria, Solid solutions.

A color chart is compiled showing binary phase diagrams of the transition elements. Binary combinations of elements occuring to the right and to the left of the Mn column (column VII B) in the periodic table are arranged in a format related to the arrangement of these elements in the periodic table. The purpose of this chart is to reveal systematic relationship in the occurrence of the various phases and in the solid solubilities which are seldom apparent in the available handbooks. The chart is also intended as a convenient reference to the types of diagrams existing in these binary systems.

714,944
PB80-600037 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Analytical Methods in Determining Elemental Composition from the Apollo X-ray and Gamma-ray Spectrometer Data.
J. I. Trombka, R. L. Schmadebeck, M. J. Bielefeld, L. G. Evans, A. E. Metzger, E. L. Haines, C. S. Dyer, S. M. Seltzer, R. C. Reedy, and J. R. Arnold. 1979, 13p
Pub. in Computers in Activation Analysis and Gamma-Ray Spectroscopy, DOE Symp. Series 49, p26-38 1979.

Keywords: *Apollo-15 and -16, Gamma-ray spectrometers, Lunar chemical analysis, X-ray proportional-counter.

Analytical methods are described which were used in the analysis of data obtained with the x-ray proportional-counter and gamma-ray NaI spectrometers flown on the Apollo-15 and -16 missions for the purpose of mapping the elemental composition of the lunar surface. One method includes (1) procedures for subtracting various background radiation components from the data, (2) a least-squares unfolding of the signal, based on knowledge of the detector response, and (3) the determination of elemental abundances from the photon emission characteristics of excited nuclei. Two simpler, more-approximate methods for the analysis of the gamma-ray data are also described, which are useful in limited energy regions.

714,945
PB80-600042 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Neutron-Capture Prompt Gamma-ray Activation Analysis for Multielement Determination in Complex Samples.
M. P. Failey, D. L. Anderson, W. H. Zoller, G. E. Gordon, and R. M. Lindstrom. 1979, 13p
Pub. in Anal. Chem. 51, n13 p2209-2221 1979.

Keywords: *Instrumental analysis, Multielement analysis, Neutron activation, Neutron capture, Prompt gamma rays, Trace element analysis.

Gamma-ray spectra were taken up to 11 MeV from a wide range of samples and elemental standards while under neutron irradiation to determine the elements whose prompt gamma rays are observable and can be used for analytical measurements. Up to 17 elements from among the set H, B, C, N, Na, Mg, Al, Si, P, S, Cl, K, Ca, Ti, V, Mn, Fe, Cd, Nd, Sm, and Gd are measurable in samples of coal fly ash, orchard leaves, and bovine liver by neutron-capture prompt gamma-ray activation analysis (PGAA). The combination of PGAA and instrumental neutron activation analysis (which uses the same equipment) can be used to measure concentrations of 40 to 50 elements in individual samples of many types of material. Concentrations are reported for the elements measurable by PGAA in National bureau of Standards Standard Reference Materials: coals (SRMs 1632, 1632a, 1635), fly ashes (1633, 1633a), orchard leaves (1571), and bovine liver (1577).

714,946
PB80-600047 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Plasma Poling of Poly(Vinylidene Fluoride): Piezo- and Pyroelectric Response.
J. E. McKinney, G. T. Davis, and M. G. Broadhurst. 1980, 6p
Pub. in Jnl. Appl. Phys. 51, n3 p1676-1681 1980.

Keywords: *Charge, Compressibility, Piezoelectricity, Plasma, Polarization, Poly(vinylidene fluoride), Pyrolectricity, Thermal expansion.

A plasma poling technique and its use with polyvinylident fluoride (PVDF) films is described. Specimens of biaxially drawn (below extruded) PVDF containing both Form I (Beta) and Form II (alpha) crystals were poled under various conditions in a plasma field while the charging current was monitored to determine the polarization. Subsequently, both piezoelectric and pyroelectric activity were measured in order to evaluate their magnitudes with respect to remnant polarization (that is, the polarization remaining after returning the applied field to zero). The results are shown to be in reasonable quantitative ageeement with the predictions of a model of PVDF consisting of a mixture of preferentially aligned crystals in randomized amorphous material.

714,947
PB80-600059 Not availabale NTIS
National Bureau of Standards, Gaithersburg, MD.
Oscillating Slit Mechanism for the Determination of Hydrogen Isotope Ratios in a Microwave Induced Plasma.
F. P. Schwarz, W. Braun, and S. P. Wasik. 1978, 3p
Pub. in Anal. Chem. 50, p1903-1905 1978.

Keywords: *Deuterium, Gas chromatography, Hydrogen, Isotope dilution, Microwave plasma, Oscillating slit mechanism.

A low pressure microwave discharge through deuterated and hydrogenated hydrocarbon mixtures eluting from a gas chromatograph results in fragmentation of the hydrocarbons and eneration of intense atomic hydrogen emission at 6562.8 Angstrom and atomic deuterium emission at 6561.0 Angstrom. By replacing the exit slit mechanism of the monochromator viewing the emissions with anoscillating slit mechanism (OSM), the hydrogen emission is measured alternately with the deuterium emission. The operation of the OSM is based on oscillating mechanically the exit slit aperture twice across the hydrogen line and one across the deuterium line during on cycle of oscillation. Two lock-in amplifiers resolve the modulated emissions into a hydrogen and a deuterium signal. The ratio of the two signals is a linear function of the atomic hydrogen isotope ratio in the isotope hydrocarbon mixtures over one order of magnitude.

714,948
PB81-102014 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Technological Importance of Accurate Thermophysical Property Information.
Final rept.
J. V. Sengers, and M. Klein. Oct 80, 59p NBS-SP-590
Library of Congress catalog card no. 80-600108. Sponsored in part by American Society of Mechanical Engineers, New York. Proceedings of a Session of Winter Annual Meeting of ASME, Held at New York, NY on December 6, 1979.

Keywords: *Thermophysical properties, *Meetings, Utilization, Data, Rocks, Fluids, Geothermal power plants.

These papers were presented at a meeting of the American Society of Mechanical Engineers. The meeting session addressed the role of the accuracy of thermophysical properties data in a number of applications areas. The areas covered included aerospace sciences where such data have played a central role for a number of years, geosciences where first steps are being taken toward using accuracy in describing systems in terms of thermophysical properties. Also included were a discussion of the economic value of accuracy in the chemical process industry, a description of the role of data centers, and a description of several high quality compilations. An example of a specific problem in the design of a heat exchanger for geothermal applications was also presented with the design uncertainties produced by data in accuracies illustrated.

714,949
PB81-112955 Not available NTIS
National Bureau of Standards, Washington, DC.
Systematics of Fission Cross Sections in the MeV Range - An Update.
Final rept.
J. W. Behrens. 1980, 2p
Pub. in Proceedings of the Annual Meeting American Nuclear Society, 1980, Las Vegas, NV., Jun 9-12, 1980, Transactions 34, p770-771 1980.

Keywords: *Fission cross sections, Actinide series, Neutron reactions, *Actinide isotopes, MeV range 01-10.

A study has shown straightforward systematic behavior as a function of constant proton and neutron number for neutron-induced fission cross-sections of the actinide elements in the incident-neutron energy range 3-5 MeV. These trends are re-examined for a total of 57 isotopes of elements ranging from radium through einsteinium.

714,950
PB81-117228 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Nuclear Cross Sections for Technology.
Final rept.
J. L. Fowler, C. H. Johnson, and C. D. Bowman. Sep 80, 1058p NBS-SP-594
Sponsored in part by Department of Energy, Washington, DC., International Union of Pure and Applied Physics, London (England), American Physical Society, Washington, DC., American Nuclear Society, Washington, DC., Oak Ridge National Lab., TN., Tennessee Univ., Knoxville, and International Atomic Energy Agency, Vienna (Austria). Library of Congress catalog card no. 80-600128.

General

Proceedings of the International Conference on Nuclear Cross Sections for Technology Held at the University of Tennessee, Knoxville, Tn, on October 22-26, 1979.

Keywords: *Nuclear cross sections, *Meetings, Nuclear fission, Nuclear fusion, Nuclear fuel cycles, Technology, Standards.

These proceedings are the compilation of 203 papers presented at the International Conference on Nuclear Cross Sections for Technology, October 22-26, 1979. Invited papers reviewed nuclear data needs for standard fission reactors, alternate fuel cycles, fusion reactors, biomedical applications, and applications in industry, as well as integral experiments, cross section measurements, cross section standards, and cross section evaluations. There were 165 contributed papers on these subjects with some emphasis on cross section measurement techniques and evaluation of cross section data.

714,951
PB81-118440 Not available NTIS
National Bureau of Standards, Washington, DC.
Reaction 3He(gamma,2p)n at Intermediate Photon Energies.
Final rept.
F. Prats, E. P. Harper, and L. C. Maximon. Jul 80, 10p
Pub. in Phys. Rev. C. 22, n1 p7-16 Jul 80.

Keywords: *Differential cross sections, Photonuclear reactions, Helium 3, Photoprotons, Gamma rays, Proton reactions, Neutron reactions, Reprints.

Proton energy distributions and the differential cross section for the reaction (3)He(gamma, 2p)n for incident photon energies between 80 and 120 MeV have been calculated. Results are discussed.

714,952
PB81-121014 Not available NTIS
National Bureau of Standards, Washington, DC.
Kerma Factors for Neutron Energies Below 30 MeV.
Final rept.
R. S. Caswell, J. J. Coyne, and M. L. Randolph. 1980, 38p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Radiation Research 83, n2 p217-254 1980.

Keywords: *Neutron cross sections, Hydrogen, Lithium, Boron, Carbon, Nitrogen, Oxygen, Fluorine, Sodium, Magnesium, Aluminum, Silicon, Phosphorus, Sulfur, Chlorine, Argon, Potassium, Calcium, Iron, Reprints, *Kerma factors, *Neutron dosimetry.

Kerma factors for neutrons have been calculated from thermal neutron energies to 30 MeV. In addition to a 'point' at 0.0253 eV, there are 116 contiguous energy bins extending from 0.026 eV to 30 MeV. Values are given for 19 elements or nuclides: H, (6)Li, (7)Li, B, C, N, O, F, Na, Mg, Al, Si, P, S, Cl, Ar, K, Ca, and Fe. The chief source of nuclear data is the Evaluated Nuclear Data File ENDF/B-4. The basis of the calculations is discussed, and comparison is made with some other tabulations.

714,953
PB81-121857 Not available NTIS
National Bureau of Standards, Washington, DC.
What's New in Nuclear Photon Scattering.
E. Hayward. 1980, 20p
Pub. in Proceedings of 1980 RCNP Int. Symp. on Highly Excited States in Nuclear Reactions, Osaka, Japan, May 12-16, 1980, Paper in Highly Excited States in Nuclear Reactions, p523-542 1980.

Keywords: *Photon cross sections, Scattering cross sections, Deuteron reactios, Carbon 12, Dispersion relations, Quadrupole moment, Gamma cross sections, Giant resonance, Dynamic collection model.

Our present understanding of photon scattering is reviewed. The results of new experiments to test the Dynamic Collection Model are summarized. An experimental measurement of the E2 strength in (12)C is described. The photon scattering cross section for the deuteron is also discussed.

714,954
PB81-121881 Not available NTIS
National Bureau of Standards, Washington, DC.
Gamma-Ray Emission from Oriented Nuclei in a Multiaxis Nuclear Spin System: 166mHo(165Ho).
H. Marshak, and B. G. Turrell. 1980, 2p
Pub. in Proceedings of the International Conference on Rare Earth Research (14th) Held at Fargo, ND. on June 25-28, 1979, Paper in The Rare Earths in Modern Science and Technology 2, p285-286 1980.

Keywords: *Nuclear spin, *Gamma rays, *Holmium isotopes, Single crystals, Holmium 165, Holmium 166.

Gamma-ray emission from the multiaxis nuclear spin system (166m)Ho(165)Ho is presented. The results show that the spin axes form a single cone with a half-angle of 80.4 + or - 0.4 degrees.

714,955
PB81-126328 Not available NTIS
National Bureau of Standards, Washington, DC.
Status Report on the Surf II Synchrotron Radiation Facility at NBS,
R. P. Madden. 1980, 8p
Pub. in Nuclear Instruments and Methods Part I 172, p1-8 1980.

Keywords: *Synchrotrons, Far ultraviolet radiation, Radiometry, Reprints, Synchrotron ultraviolet radiation facility, National Bureau of Standards, Storage rings.

Recent work to upgrade the SURF II (Synchrotron Ultraviolet Radiation Facility) storage ring are described, resulting in reliable operation up to 252 MeV at currents in the range 10-20 mA. A wide variety of experiments are now in progress at the facility, encompassing solid state physics, atomic and molecular physics and molecular biology, as well as the all-important radiometric standards work. The instrumentation used for these experiments is described; brief details of the experiments themselves are also given.

714,956
PB81-133308 Not available NTIS
National Bureau of Standards, Washington, DC.
Electroexcitation of 22Ne Below Ex = 8.6 MeV.
Final rept.
X. K. Maruyama, F. J. Kline, J. W. Lightbody, S. Penner, W. J. Briscoe, M. Lunnon, and H. Crannell. May 79, 39p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Phys. Rev. C 19, n5 p1624-1636 May 79.

Keywords: *Neon isotopes, Electron scattering, Inelastic scattering, Scattering cross sections, Nuclear spin, Parity, Reprints, *Neon 22, *Electroexcitation, Form factors.

The states of (22)Ne below 8.6 MeV excitation energy have been studied using the technique of inelastic electron scattering. Ratios of inelastic scattering cross sections were measured at the National Bureau of Standards electron linear accelerator facility with incident electron energies between 60 and 110 MeV and scattering angles of 110 degrees and 128 degrees. Form factors for 14 inelastic transitions were measured for the momentum transfer range 0.4 to 1.0/fm. Reduced transition probabilities for these states have been made.

714,957
PB81-135501 Not available NTIS
National Bureau of Standards, Washington, DC.
Calculation and Measurement of Fission and Delayed Neutron Yields in U3O8 and UO2.
R. A. Schrack, and C. D. Bowman. 1980, 3p
Pub. in Nuclear Science and Engineering Technical Note 75, p275-277 1980.

Keywords: *Uranium 235, *Nuclear fission, *Delayed neutrons, Fission neutrons, Uranium oxides, Phonons, Reprints, *Chemical state, Uranium oxides U3O8, Uranium dioxide.

Theoretical calculations and experimental measurements have been made to look for reported chemical dependence in the yield of delayed neutrons from thermal-neutron-induced fission in (235)U. Using an Einstein model of the lattice phonon distribution, calculations have been made that indicate no significant dependence of the fission cross section on the lattice phonon distribution. Two types of experimental measurements were made. The fission fragment yield was compared for thermal-neutron-induced fission in U3O8 and UO2. The delayed neutron yields from U3O8 and UO2 were also compared. In neither measurement was there a significant difference in yield for the two chemical states of uranium.

714,958
PB81-136780 Not available NTIS
National Bureau of Standards, Washington, DC.
New Atomic and Molecular Lasers and Their Application to the Study of Collision Physics.
W. H. Pence, and S. R. Leone. 1979, 13p
Contract N00014-77-C-0115, Grant NSF-CHE76-2260
Pub. in Proceedings of International Conference on Physics of Electronic and Atomic Collisions, ICPEAC 1979, Kyoto, Japan, August 29-September 4, 1979, p773-785 1979.

Keywords: *Inelastic scattering, Energy transfer, *Laser applications.

New atomic and molecular lasers can be used in a variety of ways to elucidate mechanisms and rates of inelastic collision processes. Examples are given whereby specific energy transfer processes are discovered and studied by laser diagnostic measurements.

714,959
PB81-138679 Not available NTIS
National Bureau of Standards, Washington, DC.
Electro-Optical Detectors and Flash X-Ray Generators for Dynamic X-Ray Diffraction Investigation of Materials.
R. E. Green. 1978, 165p
Pub. in Proceedings of the Workshop on X-Ray Instrumentation for Synchrotron Radiation Held at Stanford University, Stanford, CT. on April 3-5, 1978.

Keywords: *X ray diffraction, Synchrotron radiation, Electrooptics, X-ray detection, X-ray sources.

The desirability of obtaining X-ray diffraction photographs with extremely short exposure times in order to study rapid materials alterations has long been realized. An optimum dynamic X-ray diffraction system must consist of both a high-intensity generator and a high-sensitivity detector which operate in the wavelength regime appropriate for diffraction. This paper gives a brief overview of previous work in apid imaging of X-ray diffraction patterns using conventional X-ray generators, flash X-ray generators, and electro-optical detectors.

714,960
PB81-138778 Not available NTIS
National Bureau of Standards, Washington, DC.
E2 Strength in 12C Determined by Elastic Photon Scattering.
W. R. Dodge, E. Hayward, R. G. Leicht, B. H. Patrick, and R. Starr. 1980, 15p
Pub. in Physical Review Letters 44, n16 p1040-1043, 21 Apr 80.

Keywords: *Carbon 12, Nuclear quadrupole resonance, Dispersion relations, Elastic scattering, Scattering cross sections, Photons, Reprints, Giant resonance.

The elastic photon scattering cross section for (12)C has been measured at 90 degrees and 135 degrees in the energy range from 23.5 to 39 MeV. These data disagree with the predicted scattering, derived from the measured photonuclear absorption cross section, if only E1 transitions are assumed. A large component of the absorption, between 24 and 40 MeV, must be electric quadrupole in order to explain the difference.

714,961
PB81-140295 Not available NTIS
National Bureau of Standards, Washington, DC.
Dependence of Frequency upon Microwave Power of Wall-Coated and Buffer-Gas-Filled Gas Cell Rb87 Frequency Standards,
A. Risley, S. Jarvis, and J. Vanier. Sep 80, 6p
Pub. in Jnl. of Applied Physics 51, n9 p4571-4576 Sep 80.

Keywords: *Rubidium frequency standards, Frequency stability, Reprints, Rubidium 87.

Previous studies of a commercial passive gas cell Rb(87) frequency standard showed a strong dependence of the output frequency, upon the microwave power. A major conclusion of that work was that the dependence of output frequency upon P microwave power was due to a line inhomogeneity effect. The present work has led to a more convincing theoretical demonstration of the line inhomogeneity effect. The

paper discusses some of the details of the analytical procedure.

714,962
PB81-140352 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrodisintegration of 12C.
F. J. Kline, and E. Hayward. May 78, 4p
Pub. in Physical Review C 17, n5, p1531-1534 May 78.

Keywords: *Carbon 12, *Nuclear cross sections, Electron irradiation, Reprints, *Electroexcitation, Giant resonance, Carbon 11, Electronic dipoles.

The cross section for the production of the (11)C activity by bombarding (12)C with 30 MeV electrons has been measured absolutely. The result, 11.9 + or - 0.2 (mu)b has a smaller absolute error than any previous measurement. This value corresponds to a (gamma,nN) cross section integrated to 30 MeV of 41.0 + or - 0.6 MeV mb, based on a DWBA electric dipole virtual photon spectrum.

714,963
PB81-142887 Not available NTIS
National Bureau of Standards, Washington, DC.
Emergence of Periodic Density Patterns.
Final rept.
R. F. Kayser, and H. J. Raveche. Jul 80, 12p
Pub. in Physical Review B 22, n1 p424-435, 1 Jul 80.

Keywords: *Statistical mechanics, Freezing, Phase transformations, Periodic variations, Reprints, BBGKY equation, Bifurcation theory.

This paper analyzes two recent statistical mechanical theories which study periodic patterns for the local density rho 1(r) as solutions of a nonlinear equation. One theory is based upon the direct correlation function and the other upon the pair correlation function.

714,964
PB81-154445 Not available NTIS
National Bureau of Standards, Washington, DC.
Design and Performance of a Long-Pulse High-Current Linear Induction Accelerator at the National Bureau of Standards.
Final rept.
J. E. Leiss, N. J. Norris, and M. A. Wilson. 1980, 12p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Particle Accelerators 10, p223-234 1980.

Keywords: *Linear accelerators, Electron accelerators, Performance evaluation, Design, Reprints, National Bureau of Standards.

A prototype module of a unique long-pulse, low-cost, high-energy, high-current induction linear accelerator has been designed, constructed and tested at the National Bureau of Standards (NBS). Tests prove that such modules are capable of accelerating several kiloamperes at a voltage gradient of better than 0.25 MeV per meter. Combined with a high-current injector, the prototype module has accelerated a 1-kA, 2-microsec (FWHM) electron beam pulse to over 0.8 MeV with a computed energy spread of less than 3% (FWHM).

714,965
PB81-155699 Not available NTIS
National Bureau of Standards, Washington, DC.
Giant Resonances.
Final rept.
E. G. Fuller. 1981, 3p
Pub. in Encyclopedia of Physics, p882-884 1981.

Keywords: Inelastic scattering, Electron scattering, Photonuclear reactions, Reprints, *Giant resonance, Sum rules.

Giant resonances are defined. Various sum rules used to measure their strengths as well as expressions for their energies are presented. Along with a brief summary of experimental systematics for electric dipole and quadrupole resonances, an indication of the problems associated with the determination of giant resonance strengths from experimental data is given. A short bibliography to sources of more detailed information is given.

714,966
PB81-156309 Not available NTIS
National Bureau of Standards, Washington, DC.
Bremsstrahlung.
Final rept.
L. C. Maximon. 1981, 3p
Pub. in Encyclopedia of Physics, p89-91 1981.

Keywords: *Bremsstrahlung, Quantum electrodynamics, Quantum mechanics, Reviews, Reprints.

An introductory survey of the subject of bremsstrahlung is given, relating it to other quantum electrodynamical processes. Its significance, both as a fundamental process in the framework of the theory and application of quantum mechanics and as a process which is central to a number of branches of physics (nuclear, plasma, and astrophysics, among others) is stressed.

714,967
PB81-156317 Not available NTIS
National Bureau of Standards, Washington, DC.
Photonuclear Reactions.
Final rept.
E. Hayward. 1981, 2p
Pub. in Encyclopedia of Physics, p750-751 1981.

Keywords: *Photonuclear reactions, Reviews, Reprints, Giant resonance.

The general features of photonuclear reactions are described for light and heavy nuclei, in the energy region up to 140 MeV.

714,968
PB81-156325 Not available NTIS
National Bureau of Standards, Washington, DC.
CPT Theorem.
Final rept.
R. W. Hayward. 1981, 3p
Pub. in Encyclopedia of Physics, p166-168 1981,

Keywords: Parity, Reprints, *CPT theorem.

A short encyclopedic article on the foundations of the CPT theorem is provided.

714,969
PB81-160939 Not available NTIS
National Bureau of Standards, Washington, DC.
Transient Pool Boiling of Liquid Helium Using a Temperature-Controlled Heater Surface.
Final rept.
P. J. Giarratano, and N. V. Frederick. 1980, 12p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Proc. Cryogenic Engineering Conf., Madison, WI., Aug. 21-24, 1979, Paper in Advances in Cryogenic Engineering, 25 p455-466 1980.

Keywords: *Liquid helium, *Boiling, Heat transfer.

The entire boiling curve of input heat flux versus temperature rise, q vs. Delta T, including transition boiling was obtained for various heating rates of dT/dt ranging from 0 (steady state) to approximately 7500 k/s. This was achieved by using a specially designed electronic temperature controller to linearly vary the temperature versus time of a carbon film heater surface submerged in a liquid helium bath.

714,970
PB81-161895 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Thermodynamic Properties of Helium II from O K to the Lambda Transitions,
R. D. McCarty. Dec 80, 64p NBS-TN-1029

Keywords: *Superfluidity, *Liquid helium, *Thermodynamic properties, *Equations of state, Helium 4, Tables(Data), Computer programs, Cryogenics, *Helium II.

The equation of state of He-II is modeled by an equation of state explicit in pressure as a function of density and temperature. The equation of state is divided into three regions of temperature 0 to .8 K; .8 to 1.2 K and 1.2 to the lambda temperature for which similar functional forms are used with different adjustable parameters. The combined functions are valid over the entire PT range of the superfluid and may be used for all classical thermodynamic properties. Comparisons between calculated and experimental data are presented. A computer program for calculation of thermodynamic properties (PVT, isochoric heat capacity, isobaric heat capacity, internal energy, enthalpy, entropy, and velocity of sound) is included.

714,971
PB81-163040 Not available NTIS
National Bureau of Standards, Washington, DC.
Sources of Polarized Electrons.
Final rept.
R. J. Celotta, and D. T. Pierce. 1980, 57p
Sponsored in part by Office of Naval Research, Arlington, VA.
Pub. in Advances in Atomic and Molecular Physics 16, p101-157 1980.

Keywords: *Electron beams, *Polarization(Spin alignment), *Electron spin, Sources, Reprints.

Sources of spin polarized electron beams are described and compared. Included are discussions of the basis of the polarizing effect, the operating characteristics, features, and applicability of each source. A discussion of relevant electron optical theory and a table comparing available sources are also presented.

714,972
PB81-171472 Not available NTIS
National Bureau of Standards, Washington, DC.
Constants, Fundamental.
Final rept.
B. N. Taylor. 1981, 8p
Pub. in Encyclopedia of Physics, p145-152 1981.

Keywords: *Fundamental constants, Standards, Least squares method, Accuracy, Reprints.

Four main topics are touched upon in this article: (1) The motivation for 'the romance of the next decimal place,' or why the fundamental physical constants are important and their determination to ever greater levels of accuracy can have a profound effect on physics; (2) how a self-consistent set of 'best values' of the fundamental constants is obtained with emphasis on the 1973 least-squares adjustment (the most recent comprehensive study carried out); (3) new developments in the fundamental constants field since the 1973 adjustment and their impact on the recommended set of best values resulting from that adjustment; and (4) future trends - where the field is heading over the next five to ten years.

714,973
PB81-171902 Not available NTIS
National Bureau of Standards, Washington, DC.
Quark Magnetic Moments and E1 Radiative Transitions in Charmonium.
Final rept.
G. Karl, S. Meshkov, and J. L. Rosner. 28 Jul 80, 4p
Pub. in Physical Review Letters 45, n4 p215-218, 28 Jul 80.

Keywords: *Quarks, *Nuclear magnetic moments, Mesons, Reprints, *Charmonium.

No abstract available.

714,974
PB81-172108 Not available NTIS
National Bureau of Standards, Washington, DC.
E(1440): Glueball or Quarkonium.
Final rept.
C. E. Carlson, J. J. Coyne, P. M. Fishbane, F. Gross, and S. Meshkov. 1 Jan 81, 5p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Physics Letter 98B, n1-2 p110-114, 1 Jan 81.

Keywords: *Mesons, *Quarks, Strange particles, Reprints.

The most likely assignment of the E(1440) is that of an ordinary s(s bar), L = 1, (J sup PC) = 1(++) meson, rather than a flavor singlet meson or a (J sup PC) = 0(-+) or 1(++) glueball.

714,975
PB81-182826 Not available NTIS
National Bureau of Standards, Washington, DC.
Importance of the Reaction Volume in Hadronic Collisions.
Final rept.
J. Rafelski, and M. Danos. 1 Dec 80, 4p
Sponsored in part by Deutsche Forschungsgemeinschaft, Bonn-Bad Godesberg (Germany, F.R.).
Pub. in Physics Letter 97B, n2 p279-282, 1 Dec 80.

Keywords: *Pair production, Strong interactions, Reprints, *Hadron reactions, Strangeness.

The pair production in the thermodynamic model is shown to depend sensitively on the (hadronic) reaction

volume. Strangeness production in nucleus-nucleus collisions is treated as an example.

714,976
PB81-197469 Not available NTIS
National Bureau of Standards, Washington, DC.
X-Ray Monochromator Development for Synchrotron Radiation Facilities.
Final rept.
R. D. Deslattes. 1980, 8p
Pub. in Nuclear Instruments and Methods 172, p201-208 1980.

Keywords: *X ray monochromators, Synchrotron radiation, Fluorescence, Reprints, NTISCOMNBS.

This report contains some general comments about monochromators which include crystal dispersive elements. Systems considered include both those appropriate to production of monochromatic incident flux and those used for the analysis of fluorescent or scattered radiation. Results obtained to date with a particular fluorescence experiment using radiation from the SPEAR storage ring are briefly summarized.

714,977
PB81-197519 Not available NTIS
National Bureau of Standards, Washington, DC.
Remeasurement of Gamma-Ray Reference Lines.
Final rept.
R. D. Deslattes, E. G. Kessler, W. C. Sauder, and A. Henins. 15 Oct 80, 56p
Pub. in Annals of Physics 129, n2 p378-434, 15 Oct 80.

Keywords: *Gamma rays, Interferometers, Reprints, Gamma diffractometers, Reference standards, Gold 198, Iridium 192, Thulium 170, Ytterbium 1699, NTISCOMNBS.

Over the last several years, the authors have established a new and significantly improved measurement chain connecting gamma-ray lines with visible reference standards. This chain has three links: First, a Si lattice repeat distance is determined by combined X-ray and optical interferometry. Second, this crystal calibration is transferred to other specimens suited to gamma-ray diffraction. Finally, these crystals are used in a transmission double-crystal instrument to determine gamma-ray wavelengths via the Bragg-Laue equation. To obtain the required precision and accuracy, the spectrometer is fitted with angle interferometers of considerable sensitivity (about 0.05 marcsec) and these are calibrated by summing to closure the external interfacial angles of a 72-sided optical polygon. This report focuses on the apparatus and methodology of the third step but includes descriptions of the first two also. Results are presented from tests of closure using cascade-crossover relations and interorder comparisons. Energies for gamma-transitions in (198)Au, (192)Ir, (179)Tm, (169)Yb, together with the X-ray transition W K(alpha 1) are included. Gamma-ray wavelength accuracies are estimated to be near 0.5 ppm.

714,978
PB81-207227 Not available NTIS
National Bureau of Standards, Washington, DC.
Glueballs: Their Experimental Signature.
Final rept.
C. E. Carlson, J. J. Coyne, P. M. Fisbane, F. Gross, and S. Meshkov. 26 Feb 81, 5p
Pub. in Physic Letters 99B, n4 p353-357, 26 Feb 81.

Keywords: Quarks, Reprints, *Gluons, Quantum chromodynamics, NTISCOMNBS.

The report relates to hadrons with a 2-gluon valence component, emphasizing states not found in the quark model. The authors predict that 0(++), 0(-+), 1(++), and the particularly interesting 1(-+) glueballs will be narrow, with widths ranging from a few MeV to less than one MeV, and that spin 0 glueballs will mimic S(S bar) quarkonium states in their decay. The authors also comment on photonic couplings.

714,979
PB81-211658 Not available NTIS
National Bureau of Standards, Washington, DC.
Nuclear Excitations Using Real and Virtual Photons.
Final rept.
E. Hayward. 1979, 24p
Proceedings of the Giant Multipole Resonance Topical Conference held at Oak Ridge, TN., on October 15-17, 1979.
Pub. in Giant Multipole Resonance 1, p275-298 1979.

Keywords: *Photonuclear reactions, *Electron scattering, Inelastic scattering, Nickel isotopes, Electrodisintegration, Giant resonance, Sum rules, Virtual particles, NTISCOMNBS.

The virtual photon technique is described along with its relationship to inelastic electron scattering and photonuclear physics. The results of a new evaluation of the experiment on the electrodisintegration of the nickel isotopes, which results in a much smaller E2 component in the alpha channel, are presented. The contributions of E0 and E3 excitations as well as nuclear size effects are discussed.

714,980
PB81-215709 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature Dependence of the Magnetic Susceptibility of Fermi Liquid.
Final rept.
J. C. Rainwater. 30 Apr 79, 3p
Pub. in Phys. Lett. 71A, n2-3 p278-280, 30 Apr 79.

Keywords: *Liquid helium, *Helium 3, Reprints, *Fermi liquids, *Magnetic susceptibility, Temperature dependence, NTISCOMNBS.

The form of the temperature expansion for the magnetic susceptibility of a Fermi fluid is derived according to the extension by Ford, Mohling and Rainwater of Landau's Fermi liquid theory. The terms are proportional to, successively, a constant, (T squared)ln T, (T squared), (T to the 4th power) (ln T), T4(ln T), and T4. This result contrasts with several recent articles.

714,981
PB81-215790 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS-SURF II: A Small, Versatile Synchrotron of Light Source.
Final rept.
G. Rakowsky. Apr 81, 3p
Proceedings of Conference Application of Accelerators in Research and Industry, (6th) held in Denton, TX. on November 3-5, 1980.
Pub. in IEEE Trans. Nucl. Sci. NS-28, n2 p1519-1521 Apr 81.

Keywords: *Synchrotrons, *Synchrotron radiation, Ultraviolet radiation, NTISCOMNBS.

Synchrotron radiation sources do not have to be large multi-megadollar installations. SURF II is based on a compact electron storage ring with a radius of only 0.84 m, an operating energy of 250 MeV, and useful light output down to 5nm. Small beam size, high brightness and wide-angle light ports give SURF II unique capabilities. Presently five beamlines are instrumented and operational, supporting experiments in atomic and molecular physics, surface science and materials studies, as well as providing optical calibration services. Nearing completion is a large facility for calibrating optical instruments, especially those intended for space flight. The capability of determing the absolute light flux emitted by SURF II has recently been improved and is now operational. The machine's simplicity contributes to reliability and a high ratio of beam time to downtime.

714,982
PB81-215808 Not avalable NTIS
National Bureau of Standards, Washington, DC.
NBS-LASL CW Microtron.
Final rept.
S. Penner, R. I. Cutler, P. H. Debenham, E. R. Lindstrom, D. L. Mohr, M. D. Wilson, N. R. Yoder, L. M. Young, T. J. Boyd, E. A. Knapp, R. E. Martin, J. M. Potter, C. M. Schneider, D. A. Swenson, and P. J. Tallerico. Apr 81, 5p
Proceedings of Conference Application of Accelerators in Research and Industry (6th), held at Denton, TX. on November 3-5, 1980.
Pub. in IEEE Trans. Nucl. Sci. NS-28, n2 p1526-1530 Apr 81.

Keywords: *Electron accelerators, *Microtrons, US NBS, LASL, NTISCOMNBS.

The NBS-LASL racetrack microtron (RTM) is a joint research project of the National Bureau of Standards and the Los Alamos Scientific Laboratory. The project goals are to determine the feasibility of, and develop the necessary technology for building high-energy, high-current, continuous-beam (cw) electron accelerators using beam recirculation and room-temperature rf accelerating structures. To achieve these goals, a demonstration accelerator will be designed, constructed, and tested. Parameters of the demonstration RTM are: injection energy - 5 MeV; maximum current 550 microamps.

714,983
PB81-220295 Not available NTIS
National Bureau of Standards, Washington, DC.
Glueballs: Their Spectra, Production and Decay.
Final rept.
S. Meshkov. 1980, 17p
Pub. in Recent Developments in High-Energy Physics, p43-59 1980.

Keywords: Quarks, Reprints, *Gluons, Gauge theory.

A systematic enumeration of the glueball spectrum of QCD and other SU(n) gauge theories yields JPC=odd(-+), even(+-), and 0(--) states in addition to the usual quark model states. Production and decay mechanisms for these new state are addressed. We obtain a significant radiative decay width of the psi/J into a 0(-+) glueball via mixing with the (eta sub c).

714,984
PB81-220469 Not available NTIS
National Bureau of Standards, Washington, DC.
Elastic Scattering of Photons by 12C and the E2 Giant Resonance.
Final rept.
E. Hayward, and R. G. Leicht. 15 Sep 80, 12p
Pub. in Annals of the New York Academy of Sciences 40, p99-110, 15 Sep 80.

Keywords: *Carbon 12, Photonuclear reactions, Elastic scattering, Photons, Dispersion relations, Reprints, *Giant resonance, Photon collisions.

The elastic scattering of photons by the nucleus, (12)C has been studied in the energy region of the Goldhaber-Teller oscillation and extending up to 40 MeV. Scattering cross sections were measured at 90 degrees and 135 degrees, and the results are compared with predictions derived from the total photonuclear absorptioncross section by using the optical theorem and the dispersion relation. The results show that for excitation energies below 25 MeV, only electric dipole transitions need be considered, but that in the energy range 30-40 MeV, the magnitude of the electric quadrupole absorption is surprisingly large.

714,985
PB81-221681 Not available NTIS
National Bureau of Standards, Washington, DC.
Study of the Giant Resonances with Virtual and Real Photons.
Final rept.
E. Hayward. 1979, 11p
Proceedings of the International Conference on Nuclear Physics with Electromagnetic Interactions held at Mainz, Germany on June 5-9, 1979.
Pub. in Lecture Notes in Physics 108, p300-310 1979.

Keywords: *Electron scattering, Inelastic scattering, Nickel isotopes, Photons, *Giant resonance, *Electrodisintegration, Virtual particles, Electrofission.

The relationship between inelastic electron scattering and electrodisintegration is discussed, and the definition of the virtual photon spectrum is introduced. Several tests of the E1 virtual photon analysis are cited. The results of the (e,p) and (e, alpha) experiment on the nickel isotopes are discussed, and evidence for the failure of the long wavelength approximation for E2 excitations is presented. A short review of the electrofission experiments follows.

714,986
PB81-227647 Not available NTIS
National Bureau of Standards, Washington, DC.
Elastic Photon Scattering Cross Section for 12C in the Energy Range 20-40 MeV.
Final rept.
E. Hayward. 1979, 9p
Pub. in Electron and Pion Interactions with Nuclei at Intermediate Energies 2, p667-675 1979.

Keywords: *Carbon 12, *Scattering cross sections, *Photon cross sections, Elastic scattering, Dispersion relations, Quadrupoles.

The elastic scattering cross section for 12C has been measured in the energy range 25.5-40 MeV. It has

been found that this scattering results not only from electric dipole, but also from electric quadrupole excitations.

714,987
PB81-227696 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrodisintegration of 58Ni, 60Ni, and 62Ni.
Final rept.
E. Wolynec, W. R. Dodge, R. G. Leicht, and E. Hayward. Sep 80, 13p
Pub. in Physical Review C 22, n3 p1012-1024 Sep 80.

Keywords: *Electron nuclear cross sections, Nickel isotopes, Reprints, *Nickel 58, *Nickel 60, *Nickel 62, *Electrodisintegration, Giant resonance, Quadrupoles.

The (e,p) and (e, alpha) cross sections for targets of 58Ni, 60Ni, and 62Ni have been measured in the electron energy range 16-100 MeV. They have been analyzed using the distorted-wave Born approximation E1 and E2 virtual photon spectra. Protons are emitted primarily following E1 absorption but alpha-emission results from a combination of E1 and E2 absorption.

714,988
PB81-227837 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Tagged Photons: An Analysis of the Bremsstrahlung Differential Cross Section in the Range of Interest for a Tagged Photon System.
L. C. Maximon, A. de Miniac, and T. Aniel. Apr 81, 147p NBSIR-81-2262
Prepared in cooperation with CEA Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette (France).

Keywords: *Bremsstrahlung, *Differential cross sections, *Photonuclear reactions, *Tagged photon method.

The differential cross section are considered for bremsstrahlung for angles and energies in the range of interest for a tagging system. A high energy, small angle approximation is derived for the differential cross section for bremsstrahlung. This approximation is used to determine the maxima and minimum of the cross section and to evaluate it at these extrema. It is shown that the differential cross section has a very sharp dip in the region of small momentum transfers. Coulomb corrections to the Born approximation are considered, and do not fill in this dip.

714,989
PB81-233728 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Inelastic Electron Scattering with (g sub 9/2 O(f(7/2) sup -3))8- Shell-Model Calculations for the T = 1 and T = 2, 8- States in 54Fe.
Final rept.
R. A. Lindgren, J. B. Flanz, R. S. Hicks, B. Parker, G. A. Peterson, R. D. Lawson, W. Teeters, C. F. Williamson, S. Kowalski, and X. K. Maruyama. 1981, 4p
Pub. in Physical Review Letters 46, n11 p706-709, 16 Mar 81.

Keywords: *Nuclear energy levels, Nuclear shell models, Electron scattering, Iron isotopes, Reprints, *Iron 54.

No abstract available.

714,990
PB81-234908 Not available NTIS
National Bureau of Standards, Washington, DC.
Glueball Decay Widths and Glueball Dominance of Quarkonium Decays.
Final rept.
C. E. Carlson, J. J. Coyne, P. M. Fishbane, F. Gross, and S. Meshkov. 1 Jun 81, 4p
Sponsored in part by National Science Foundation, Washington, DC.
Pub. in Physical Review Brief Reports 23, n11 p2765-2768, 1 Jun 81.

Keywords: Reprints, *Gluons.

A realization is given of OZI - violating quarkonium decay dominated by intermediate glueball resonances. This leads to glueball decay widths which interpolate OZI rule allowed and forbidden widths, i.e., glueball widths of the order of tens of MeV.

714,991
PB81-236275 Not available NTIS
National Bureau of Standards, Washington, DC.
Nuclear Orientation of 166mHo In 165Ho Single Crystal.
Final rept.
H. Marshak. 1981, 6p
Pub. in Hyperfine Interactions 10, p1183-1188 1981.

Keywords: *Nuclear magnetic moments, Metastable state, Holmium isotopes, Single crystals, Gamma rays, Reprints, *Holmium 166, Holmium 165.

Nuclear orientation measurements have been made on the system (166m)Ho in single crystal (165)Ho metal. The results for the nuclear magnetic moment, (mu' sub nm)=3.65(13) nm, is in excellent agreement with the recent results by the Oxford group in their work on HoVO4.

714,992
PB81-236606 Not available NTIS
National Bureau of Standards, Washington, DC.
Clocks, Atomic and Molecular.
Final rept.
J. A. Barnes. 1980, 2p
Pub. in Encyclopedia of Physics 1, p124-125 1980.

Keywords: *Atomic clocks, *Frequency standards, *Time measurement, Reprints.

An atomic (or molecular) clock is a device whose rate is controlled by an atomic (or molecular) resonance. A counting device counts the cycles of an oscillator whose frequency is controlled to be in agreement with an atomic (or molecular) resonance. The accumulated count is directly related to time. The definition of the unit of time (the second) is in terms of a resonance of cesium atoms.

714,993
PB81-240236 Not available NTIS
National Bureau of Standards, Washington, DC.
CW Electron Accelerators for Nuclear Physics.
Final rept.
S. Penner. 1981, 7p
Pub. in Proceedings of Particle Accelerator Conference (1981), Accelerator Engineering and Technology, Washington, DC. March 11-13, 1981, IEEE Transactions on Nuclear Science, NS-28, n3 p2067-2073 Jun 81.

Keywords: *Electron accelerators, Nuclear physics, Microtrons.

The need for continuous duty electron accelerators for nuclear physics research is discussed. The various types of accelerators capable of satisfying the physics requirements are described and compared.

714,994
PB81-241135 Not available NTIS
National Bureau of Standards, Washington, DC.
Cerenkov Radiation.
Final rept.
M. Danos. 1980, 2p
Pub. in Encyclopedia of Physics, p106-107 1980.

Keywords: *Cerenkov radiation, Reviews, Reprints.

The principles and uses of Cerenkov radiation are described.

714,995
PB81-241192 Not available NTIS
National Bureau of Standards, Washington, DC.
End Magnet Design for the NBS-LASL CW Microtron.
Final rept.
P. H. Debenham. Jun 81, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Particle Accelerator Conference (1981), Accelerator Engineering and Technology, Washington, DC., March 11-13, 1981, IEEE Transactions on Nuclear Science NS-28, n3 p2885-2887 Jun 81.

Keywords: *Magnets, Design, *Microtrons.

Beam quality and ease of operation in a racetrack microtron (RTM) are critically dependent on the properties of the end magnets. Good field uniformity is essential to maintain the microtron resonance condition, yet is difficult to achieve in a conventional C-magnet having the very large ratio of gap depth to height required in an end magnet. A novel magnet design has been developed for the NBS-LASL CW RTM which has a calculated field uniformity of better than two parts in 10,000. The design incorporates a Purcell filter into a half picture-frame magnet and provides a 25% reduction in weight from an equivalent C-magnet. Dramatic improvement in the field uniformity of picture-frame magnets can be realized with this principle.

714,996
PB81-241275 Not available NTIS
National Bureau of Standards, Washington, DC.
Recirculation Acceleration of High Current Relativistic Electron Beams--A Feasibility Study.
Final rept.
M. Wilson. Jun 81, 3p
Grant N00014-80-F-0019
Pub. in Proceedings of Particle Accelerator Conference (1981), Accelerator Engineering and Technology, Washington, DC., March 11-13, 1981, IEEE Transactions on Nuclear Science NS-28, n3 p3375-3377 Jun 81.

Keywords: *Electron accelerators, Linear accelerators, Recirculation.

One of the advanced accelerator concepts under study at NBS involves multiplying the energy gained by a long-pulse, high current relativistic electron beam by directing the beam several times through the same induction accelerator during the time of one voltage pulse. Should this concept of the recirculation acceleration of intense electron beams be proven feasible, the savings in cost, size, and weight of a high current accelerator would be considerable. Energy gain by recirculation acceleration through a small-scale proof-of principle facility has been demonstrated at NBS. The study employs a 750A, 750keV electron beam pulse, 2 microsec long, generated by a linear induction accelerator of unique design which was also developed at NBS.

714,997
PB81-241283 Not available NTIS
National Bureau of Standards, Washington, DC.
Kaonic Mass by Critical Absorption of Kaonic-Atom X-rays.
Final rept.
G. K. Lum, C. E. Wiegand, E. G. Kessler, R. D. Deslattes, L. Jacobs, W. Schwitz, and R. Seki. Jun 81, 11p
Sponsored in part by Department of Energy, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in Physical Review D. 23, n11 p2522-2532, 1 Jun 81.

Keywords: *Kaons, *Mass, Potassium, Erbium, X rays, Reprints, *Kaons minus.

The energy of x rays from the transition 6h to 5g in kaonic atoms of potassium falls on the K absorption edge of erbium. Measurement of the kaonic-x-ray attenuation in a precisely calibrated set of Er foils yields the x-ray energy 57458.8 + or - 6.3 eV. The kaon mass is related to energy through the Klein-Gordon equation plus corrections for radiative effects, electron screening, and other effects. The negative-kaon mass was found to be 493.640 + or - 0.054 MeV/c squared in agreement with the currently accepted value 493.669 + or - 0.018 MeV/c squared which was determined from x rays emitted by high-Z atoms where the corrections were larger than for Z=19.

714,998
PB81-245086 Not available NTIS
National Bureau of Standards, Washington, DC.
Simplex Method for Fitting Gaussian Profiles to X-ray Spectra Obtained with an Energy-Dispersive Detector.
Final rept.
1979, 11p
Pub. in Proceedings of American Nuclear Society Topical Conference, Mayagues, Puerto Rico, April 30-May 4, 1978. Paper in Computers in Activation Analysis and Gamma-Ray Spectroscopy, Department of Energy, Technical Information Center, Washington, DC., CONF-780421 p139-149 1979.

Keywords: *X ray spectra, Computer programs.

A method is described for the fitting of Gaussian profiles to the pulse-height distributions of overlapping X-ray peaks measured with an energy-dispersive detector. The desired result is to know the areas under individual X-ray peaks in a spectrum in which the peaks are not resolved. A sequential simplex procedure for

selection of the parameters in a mathematical expression that describes a spectral peak is used. Starting and stopping criteria for the procedure are discussed, and a computer program is outlined. Examples of the method applied to peaks obtained from a lithium-drifted silicon (Si(Li)) detector are provided.

714,999
PB81-247298 Not available NTIS
National Bureau of Standards, Washington, DC.
Centennial of the Gibbs-Konovalov Rule for Congruent Points. Its Underlying Theoretical Basis and Its Application to Phase Diagram Evaluation.
Final rept.
D. A. Goodman, J. W. Cahn, and L. H. Bennett.
1981, 6p
Pub. in Bulletin of Alloy Phase Diagrams 2, n1 p29-34 1981.

Keywords: *Phase diagrams, Melting, Solubility, Congruences, Phase transformations, Thermodynamics, Reprints.

One hundred years ago, Konovalov developed and tested the rule that at a congruent transformation the phase boundary reaches an extremum. An important equation for the slopes of phase boundaries, derived by Gibbs five years earlier, provides the underlying theoretical basis for the rule, which is still commonly ignored. Applications of the Gibbs-Konovalov equation to congruent transformations, retrograde solubility, phase boundary inflections, and solid-liquid equilibrium are discussed.

715,000
PB81-247330 Not available NTIS
National Bureau of Standards, Washington, DC.
Coincidence Measurements with High Energy Electrons.
Final rept.
J. S. O'Connell. 1981, 10p
Pub. in Proceedings of the Workshop on Nuclear Physics with Real and Virtual Photons held at Bologna, Italy on November 25-28, 1980, Paper in From Collective States to Quarks in Nuclei, p286-295 1981.

Keywords: *Electron scattering, *High energy particles, Electron beams.

This talk surveys reactions of the type A(e,e'x) where x is a nucleon, two nucleons, pion, nucleon plus pion, or a photon. At high energy and momentum transfer, phenomena are studied that influence classical nuclear physics, but which have not yet been measured or theoretically understood. The interplay between measurement techniques, experimental feasibility, and theoretical interpretability is stressed. A number of examples are given of counting rates for specific measurements with continuous duty factor electron beams with energies between 500 and 3000 MeV.

715,001
PB81-600012 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 10, Number 2, 1981.
1981, 273p
See also PB81-600013 through PB81-600014.

Keywords:

The journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive theoretical nature.

715,002
PB81-600015 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 10, Number 3, 1981.
1981, 245p
See also PB81-600016 through PB81-600017.

Keywords:

The journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primary theoretical nature.

715,003
PB81-600020 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 10, Number 4, 1981.
1981, 389p
See also PB81-600021 through PB81-600027.

Keywords:

The Journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The prinicpal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature.

715,004
PB82-100173 Not available NTIS
National Bureau of Standards, Washington, DC.
Efficient Neutron Production Using 12 MeV Electrons.
Final rept.
C. D. Bowman. Apr 81, 3p
Pub. in Proceedings of Conference on Application of Accelerators in Research and Industry (1980), North Texas State Univ., Denton, TX., November 3-5, 1980, IEEE Transactions in Nuclear Science NS-28, n2 p1485-1487 Apr 81.

Keywords: *Neutron sources, Electron beams, Tungsten, Deuterium compounds, Beryllium hydrides.

A comparison of (gamma,n) and atomic cross sections shows that neutron production with an electron beam can be as energy efficient with 12-MeV electrons as with the conventionally used 30- to 100-MeV electrons. Neutron production from tungsten using 100-MeV electrons is compared with a thin tungsten converter followed by a deuterium-containing target using electrons near 12 MeV. For a BeD2 target, a yield of 2 x 10 to the 12th power neutrons per kilojoule of beam power is predicted.

715,005
PB82-100181 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS 14 MeV Absolute Neutron Beam Facility.
Final rept.
K. C. Duvall, and O. A. Wasson. Apr 81, 2p
Pub. in Proceedings of Conference on Application of Accelerators in Research and Industry (1980), North Texas State Univ., Denton, TX., November 3-5, 1980, IEEE Transactions in Nuclear Science NS-28, n2 p1488-1489 Apr 81.

Keywords: *Neutron flux, *Standards, Neutron sources, Calibrating.

A 14 MeV absolute neutron beam has been established at the NBS 3 MV positive-ion Van de Graaff Accelerator Laboratory. The neutron flux is absolutely determined by the measurement of the associated alpha particle rate in a silicon surface barrier detector positioned at 84 degrees with respect to the beam axis. The facility may be used to measure the absolute response of active neutron monitoring devices with high accuracy. The neutron background contributions may be eliminated in the calibration measurements by using the coincidence between the device and the solid state alpha detector. This method allows a neutron flux in a cone of 2 degree half angle to be placed at 90 degrees with respect to the beam axis.

715,006
PB82-100223 Not available NTIS
National Bureau of Standards, Washington, DC.
Design Aspects of a Laser Gravitational Wave Detector in Space.
Final rept.
R. Decher, J. L. Randall, P. L. Bender, and J. E. Faller. 1980, 5p
Pub. in Proceedings of Active Optical Devices and Applications, Washington, DC., April 10-11, 1981, SPIE 228, p149-153 1980.

Keywords: General relativity, *Gravitational waves, Laser interferometry.

Some of the optical and mechanical aspects of a proposed laser gravitational wave antenna in space are discussed briefly. The proposed concept consists of a free-mass antenna with the test masses separated by 1,000,000 km. A laser heterodyne technique is used to measure the distance change between test masses resulting from gravitational wave interaction. The proposed scheme appears to offer the necessary sensitivity to detect gravitational radiation from binary stars predicted by General Relativity Theory.

715,007
PB82-101304 Not available NTIS
National Bureau of Standards, Washington, DC.
Magnetic Materials.
Final rept.
J. J. Rhyne. 1981, 4p
Pub. in Encyclopedia of Physics, p547-550 1981.

Keywords: *Magnetic materials, Magnetic alloys, Amorphous materials.

This is an introductory article on the subject of magnetic materials with particular emphasis on rare earth-based materials and amorphous magnetic alloys.

715,008
PB82-112632 Not available NTIS
National Bureau of Standards, Washington, DC.
Liquid-Vapor Equilibria in Binary Systems Containing 4He or 3He with nH2 or nD2.
Final rept.
M. J. Hiza. 1981, 25p
Sponsored in part by Atomic Energy Commission, Washington, DC.
Pub. in Fluid Phase Equilibria 6, p203-227 1981.

Keywords: *Helium 4, *Helium 3, *Hydrogen, *Vapor pressure, Binary systems(Materials), Solubility, Deuterium, Cryogenics, Reprints.

Equilibrium liquid and vapor compositions are reported at 2 K intervals for binary systems containing (4)He or (3)He with nH2 or nD2 between 20 and 30 K at pressures up to 20.3 x 10 to the 5th power Pa (20 atm). Vapor pressures measured at 1 K intervals are also reported for nH2 from 20 to 30 K and for nD2 from 20 to 34 K. A vapor-recirculation apparatus was used with equilibrium compositions determined by gas chromatographic analysis. Comparisons are made with corresponding liquid-vapor equilibria and vapor pressure data reported in the literature.

715,009
PB82-118019 Not available NTIS
National Bureau of Standards, Washington, DC.
Nuclear Forces from Quark Dynamics.
Final rept.
M. Danos. 1980, 1p
Pub. in Workshop on Nuclear Physics with Real and Virtual Photons, Bologna, Italy, November 25-28, 1980, Paper in Collective States to Quarks in Nuclei, 1p 1980.

Keywords: *Nuclear binding energy, Quarks, *Nuclear forces, Bag model, Quantum chromodynamics.

In the quark picture the exchange mesons propagate as free off-the-mass-shell particles only in the asymptotic OPEP range. For closer separations they are manifested only as correlations in a deformed dibaryon system. The techniques of computing the model are available from the relativistic nuclear physics.

715,010
PB82-119876 Not available NTIS
National Bureau of Standards, Washington, DC.
Quasiprobability Methods for Nonlinear Chemical and Optical Systems.
Final rept.
P. D. Drummond, C. W. Gardiner, and D. F. Walls. Aug 81, 13p
Pub. in Physical Review A 24, n2 p914-926 Aug 81.

Keywords: *Quantum theory, Nonlinear systems, Photons, Diffusion coefficient, Reprints, *Fokker-Planck equation, Two photon absorption.

A review of quasiprobability methods for transforming chemical and quantum-optical master equations into Fokker-Planck equations is presented. For cases where conventional representations lead to Fokker-Planck equations with non-positive-definite diffusion coefficients; e.g., sub-Poissonian statistics, a generalization of the representation involving an extension to the complex plane enables analytic results to be obtained for certain nonlinear chemical and optical processes. Alternatively, a different integration measure may be chosen which ensures a positive distribution and Fokker-Planck equation with positive-semidefinite diffusion coefficients. This enables stochastic differential equations to be defined. These methods are applied to two-photon absorption and dispersive bistability in quantum optics where nonclassical photon statistics arise and to two models of nonlinear chemical reactions where sub-Poissonian statistics occur.

715,011
PB82-124736 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Effective Thermal Conductivity of a Glass Fibre Blanket Standard Reference Material.
Final rept.
D. R. Smith, J. G. Hust, and L. J. Van Poolen. Aug 81, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Cryogenics 21, n8 p460-462 Aug 81.

Keywords: *Thermal conductivity, Thermal insulation, Glass fibers, Reprints, *Standard reference materials.

This paper describes the results of thermal conductivity measurements at temperatures from 84K to 360K on a glass fiberblanket insulation which is intended to be a Standard Material (SRM). The measurements were performed in an atmosphere of dry nitrogen at a pressure near 84 kPa (630 mm Hg). The results are analyzed and compared to literature data for similar material.

715,012
PB82-129990 Not available NTIS
National Bureau of Standards, Washington, DC.
Stable Lasers and Optical Frequency Standards for Testing the Postulates of Physics.
Final rept.
J. L. Hall. 1981, 30p
Grant NSF-PHY79-04928
Pub. in Atomic Physics 7, p267-296 1981.

Keywords: *Special relativity, Laser beams, Frequency standards, Lorentz transformations, Reprints, *Laser applications.

The applications of precision laser frequency control and measurement techniques to interesting and fundamental experiments for physics is considered. A recent high precision laser version of the Michelson-Morley experiment is discussed in terms of a test theory for (special) relativity due to Mansouri and Sexl. This experiment appears to provide the most stringent test yet of the Lorentz transformation. An improved time dilation experiment is considered.

715,013
PB82-137381 Not available NTIS
National Bureau of Standards, Washington, DC.
Model for the Hadron-Hadron Vertex: Dynamic Origin of the OZI Rule.
Final rept.
M. Danos, and D. Zanon. 1981, 4p
Pub. in Lettere al Nuovo Cimento 31, n2 p61-64 1981.

Keywords: Strong interactions, Reprints, *Hadron-hadron interactions, Quantum chromodynamics.

It is shown that asymptotic freedom leads to a reaction mechanism which explains the experimental data of low energy hadron vertices, including the OZI rule.

715,014
PB82-140625
(Order as PB82-140575, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Upper Limits for the Number of Bound States Associated with the Yukawa Potential.
H. S. Bennett. 23 Jul 80, 6p
Included in Jnl. of Research of the National Bureau of Standards, v86 n5 p503-508, Sep-Oct 81.

Keywords: *Schrodinger equation, *Coulomb potential, *Yukawa potential, *Bound state.

The number of bound-state solutions of the Schrodinger equation for the screened Coulomb potential (Yukawa potential), --(C/r) exp(-alpha r), occurs frequently in theoretical discussions concerning, for example, gas discharges, nuclear physics, and semiconductor physics. The number of bound states is a function of (C/alpha). Three upper limits for the number of bound states associated with the Yukawa potential are evaluated and compared. These three limits are those given by Bargmann, Schwinger, and Lieb. In addition, the Sobolev inequality states that whenever (C/alpha) less than 1.65 no bound state occurs. This agrees to within a few percent of the numerical calculations of Bonch-Bruevich and Glasko. The Bargmann and Lieb limits and the Sobolev inequality are substantially easier to evaluate than the Schwinger limit. Among the three limits, the Schwinger limit gives the most restrictive limit for the existence of only one bound state and, therefore, is the best one to use for the approach to no binding, i.e., 1.65 less than (C/alpha) less than or equal to 1.98. The Lieb limit is the best among the three when (C/alpha) is greater than 1.98. The Bargmann limit is the least restrictive.

715,015
PB82-144122 Not available NTIS
National Bureau of Standards, Washington, DC.
Isospin Splitting of Isovector High Spin 'Stretched' Particle-Hole Excitations in Non-Self-Conjugate Nuclei.
Final rept.
R. A. Lindgren, M. A. Plum, W. J. Gerace, R. S. Hicks, B. Parker, G. A. Peterson, R. Singhal, C. F. Williamson, X. K. Maruyama, and F. Petrovich. 2 Nov 81, 4p
Sponsored in part by Department of Energy, Washington, DC
Pub. in Physical Review Letters 47, n18 p1266-1269, 2 Nov 81.

Keywords: *Isospin, Electron scattering, Reprints, Lane model, Nickel 60.

A simple lane model is used to parametrize the energy systematics of the isospin splitting of high spin magnetic states in non-selfconjugate nuclei. A strength parameter V1 = 106 + or - 10 MeV is found.

715,016
PB82-152364 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface-Enhanced Photoabsorption and Photoyield in Small Spheres.
D. R. Penn, and R. W. Rendell. Oct 81, 4p
Pub. in Physical Review Letters 47, n15 p1067-1070, 12 Oct 81.

Keywords: Spheres, Surfaces, Plasmons, Metals, Reprints, *Photoabsorption.

Calculations of the photoabsorption and photoyield of small metal spheres are reported for photon energies below the plasmon energy. It is found that the excitation of electron-hole pairs due to the presence of the surface results in (1) enhancements in the photoabsorption rates and photoyields that are typically 10-100 and (2) similar enhancements in the threshold photoyields of small spheres relative to plane surfaces in agreement with recent exprimental results.

715,017
PB82-152422 Not available NTIS
National Bureau of Standards, Washington, DC.
Augmented Electric- and Magnetic-Field Integral Equations.
Final rept.
A. D. Yaghjian. 1981, 15p
Pub. in Radio Science 16, n6 p987-1001 Nov/Dec 81.

Keywords: *Electric fields, *Magnetic fields, *Integral equations, Electromagnetic scattering, Reprints.

In 1949 Maue derived an electric-field integral equation (EFIE) and a magnetic-field integral equation (MFIE) for the surface current density Ks excited by arbitrary harmonic fields incident upon a perfectly conducting body in free space. A major flaw in these equations is that they fail to yield a unique solution for Ks at frequencies equal to the resonant frequencies of the corresponding interior cavity. In this paper, methods are presented for augmenting the EFIE and MFIE separately to eliminate the spurious resonant solutions from the exterior region without sacrificing the basic simplicity, solution capability and pure electric- and magnetic-field character of these two elegant equations. Included is an explanation of why the original EFIE and MFIE are deficient in the exterior region.

715,018
PB82-152430 Not available NTIS
National Bureau of Standards, Washington, DC.
Augmented Electric- and Magnetic-Field Integral Equations Which Eliminate the Spurious Resonances.
Final rept.
A. D. Yaghjian. 1980, 4p
Pub. in Proceedings of International URSI-Symposium Electromagnetic Waves, Munich, Germany, August 26-29, 1980, p121 B/1-121 B/4.

Keywords: *Electromagnetic theory, *Integral equations, Electromagnetic scattering, Electric fields, Magnetic fields, Numerical integration.

In 1949, Maue derived an electric-field integral equation (EFIE) and a magnetic-field integral equation (MFIE) for the surface current density (K(vector) sub s) excited by arbitrary harmonic fields incident upon a perfectly conducting body in free space. A major flaw in these equations is that they fail to yield a unique solution for Ks at frequencies equal to the resonant frequencies of the corresponding interior cavity. In this paper, methods are presented for augmenting the EFIE and MFIE separately to eliminate the spurious resonant solutions from the exterior region without sacrificing the basic simplicity, solution capability and pure electric- and magnetic-field character of these two elegant equations. Included is an explanation of why the original EFIE and MFIE are deficient in the exterior region.

715,019
PB82-152455 Not available NTIS
National Bureau of Standards, Washington, DC.
Delta-Distribution Derivation of the Electric Field in the Source Region,
A. D. Yaghjian. 1981, 4p
Pub. in Proceedings of International IEEE Antennas and Propagation Symposium (1981), Los Angeles, California, June 17-19, 1981, IEEE Digest, p334-337.

Keywords: *Electromagnetic theory, Electric fields, Greens function.

The derivation of the expression appropriate for the dyadic Green's function in the source region is considered from the standpoint of the theory of distributions, in which the Green's function corresponding to a delta sequence is obtained for the special case of a spherical principal volume. The previously obtained result follows readily from this special case by circumscribing the arbitrary principal volume by the spherical principal volume and evaluating the resultant principal-value integral.

715,020
PB82-152489 Not available NTIS
National Bureau of Standards, Washington, DC.
Correlation of Thermal Conductivity Data for Helium.
Final rept.
B. A. Hands, and V. D. Arp. Dec 81, 7p
Pub. in Cryogenics 21, n12 p697-703 Dec 81.

Keywords: *Helium, *Thermal conductivity, Cryogenics, Reprints.

A correlation for the thermal conductivity of helium has been developed which covers the temperature range from temperatures just above the lambda line to 830K, and densities up to about 160/cu kgm. The data used incorporate some recent experimental results which cover the temperature range from 4K to 20K including the critical region. The correlation gives an equation which is probably correct to better than + or - 6%.

715,021
PB82-177288 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC.
Polarized Tagged Photons: An Analysis of the Differential Cross Section for Polarized Bremsstrahlung in the Range of Interest for a Tagged Photon System.
L. C. Maximon, E. Ganz, T. Aniel, and A. de Miniac. Jan 82, 129p NBSIR-82-2454
Prepared in cooperation with Stanford Univ., CA. Dept. of Physics.

Keywords: *Bremsstrahlung, *Differential cross sections, Polarized electromagnetic radiation, Photonuclear reactions, Graphs(Charts), *Tagged photon method.

The differential cross section for polarized bremsstrahlung is considered for angles and energies in the range of interest for a tagging system, and a high energy, small angle approximation for this cross section is derived.

715,022
PB82-198656 Not available NTIS
National Bureau of Standards, Washington, DC.
Bohm-Aharonov Effect: The Quantum Mechanics of the Electrical Transformer.
Final rept.
M. Danos. Jan 82, 3p
Pub. in American Jnl. of Physics 50, n1 p64-66 Jan 82.

Keywords: Quantum theory, Reprints, *Bohm-Aharonov effect.

A simple physical picture is presented of the Bohn-Aharonov effect.

715,023
PB82-199548 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of the 235U Mass in a Large Volume Multiplated Fission Ionization Chamber.
Final rept.
O. A. Wasson, and M. M. Meier. 1981, 12p
Pub. in Nuclear Instruments and Methods, n190 p571-582 1981.

Keywords: *Uranium 235, *Mass, Ionization chambers, Neutron beams, Measurement, Reprints.

The mass of (235)U contained in a large-volume multideposit fission ionization chamber used for neutron cross section experiments was measured relative to the National Bureau of Standards reference deposit 25S-2-1. The mass ratio used the thermal neutron induced fission reaction in a uniform 25 cm diameter neutron beam from the thermal column of the NBS reactor. The mass was independent of the geometrical area and areal density variation of the deposits, absolute neutron flux, thermal neutron energy distribution, and neutron cross sections. The (235)U mass in the chamber is 0.1709g with a one standard deviation uncertainty of 1.2%.

715,024
PB82-210378 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of the 235U Neutron-Induced Fission Cross Section at 14.1 MeV.
Final rept.
O. A. Wasson, A. D. Carlson, and K. C. Duvall. 1982, 21p
Pub. in Nuclear Science and Engineering 80, p282-302 1982.

Keywords: *Uranium 235, *Fission cross sections, Neutron beams, Neutron irradiation, Reprints.

The (235)U neutron-induced fission cross section was measured at a neutron energy of 14.1 MeV using the time-correlated associated-particle technique with the (3)H(d, alpha)n reaction at the National Bureau of Standards 3-MV Van de Graaff Laboratory. The areal density and total mass of the (235)U deposits were measured relative to the standard (235)U reference deposit (Los Alamos National Laboratory Spare Number 1) using thermal-neutron-induced fission counting. The total mass was also determined from the alpha-particle decay rate.

715,025
PB82-211020 Not available NTIS
National Bureau of Standards, Washington, DC.
Macroscopic Harmonic Oscillator and Quantum Measurements.
Final rept.
R. W. Hayward. 1982, 28p
Pub. in Proceedings of Marcel Grossmann Meeting (2nd) on General Relativity, Trieste, Italy, July 5-11, 1979, Part B, p977-1004 1982.

Keywords: *Quantum theory, Uncertainty principle, Precision, *Harmonic oscillator models, One dimensional.

A quantum mechanical description of a one-dimensional macroscopic harmonic oscillator interacting with its environment is given. Quasi-coherent states are introduced to serve as convenient basis states for application of a density matrix formalism to characterize the system. Attention is given to the pertinent uncertainty relations and the quantum limits to the precision of measurement of physical observables. Many recent publications on so called 'quantum non-demolition' measurements are shown to be open to question, as arbitrary precision is not attainable in principle.

715,026
PB82-211046 Not available NTIS
National Bureau of Standards, Washington, DC.
Nuclear Orientation of (166m)Ho in (165)Ho Single Crystal.
H. Marshak. Jun 81, 6p
Pub. in Hyperfine Interactions 10, n1-4 p1183-1188 Jun 81.

Keywords: *Nuclear magnetic moments, Metastable state, Single crystals, Gamma rays, Reprints, *Holmium 166, *Gamma ray anisotropy thermometry, Holmium 165.

Nuclear orientation measurements have been made on the system (166m)Ho in single crystal (165)Ho metal. The results for the nuclear magnetic moment, (mu sub nm) = 3.65(13) nm is in excellent agreement with the recent results by the Oxford group in their work on HoVO4. The use of 166mHo as a gamma-ray anisotropy thermometer is also reported.

715,027
PB82-211194 Not available NTIS
National Bureau of Standards, Washington, DC.
Practical Thermometers and Temperature Scales.
Final rept.
B. W. Mangum. 1981, 14p
Pub. in Proceedings of the Workshop on Techniques for Measurement of Thermodynamic Properties, Albany, OR., Aug 21-23, 1979, Bur. Mines Info. Circ. 8853, p27-50 1981.

Keywords: *Temperature measurement, *Cryogenics, Thermodynamic properties, Resistance thermometers, Standards, *Thermometers.

As thermodynamic temperatures are very difficult to measure, a practical scale of temperatures approximating the thermodynamic temperature at several fixed points, with a prescribed procedure for interpolating between those points with standard instruments, was developed. The latest version of the practical scale is the International Practical Temperature Scale of 1968 (amended edition of 1975) (IPTS-68), the lowest temperature of which is at the triple point of hydrogen. In 1978, a provisional scale (EPT-76) extending from 0.5 to 30 K, was promulgated by the International Committee of Weights and Measures in order to correct the lower end of the IPTS-68 and to extend it to lower temperatures. This new scale and its realization are discussed. A discussion is given of some of the advantages and limitations of some of the practical thermometers, with special emphasis on thermistors.

715,028
PB82-211202 Not available NTIS
National Bureau of Standards, Washington, DC.
Platinum Resistance Thermometry in Thermodynamic Measurements.
Final rept.
G. T. Furukawa. 1981, 19p
Pub. in Proceedings of the Workshop on Techniques for Measurement of Thermodynamic Properties, Albany, OR., Aug 21-23, 1979, Bur. Mines Info. Circ. 8853, p7-26 1981.

Keywords: *Resistance thermometers, *Standards, *Platinum, *Calibrating, Thermodynamic properties.

The standard platinum resistance thermometer (SPRT) is the interpolating instrument on the International Practical Temperature Scale of 1968 (IPTS-68) from 13.81 to 903.89 K. The IPTS-68 was designed to be a close approximation to the Kelvin thermodynamic temperature scale within the limits of experimental uncertainty believed at the time of the adoption of the scale. The procedure employed at the National Bureau of Standards in the calibration of SPRT's on the IPTS-68 is described. Except for the extremes of range, the temperature values of SPRT's are reproducible to about + or - 1 mK. Applications of SPRT's and other thermometers in thermodynamic measurements in the range of SPRT's as well as outside the range are discussed.

715,029
PB82-211293 Not available NTIS
National Bureau of Standards, Washington, DC.
Redetermination of the Newtonian Gravitational Constant 'G'.
Final rept.
G. G. Luther, and W. R. Towler. Jan 82, 3p
Prepared in cooperation with Virginia Univ., Charlottesville. Dept. of Nuclear Engineering and Engineering Physics.
Pub. in Physical Review Letters 48, n3 p121-123, 18 Jan 82.

Keywords: Determination, Accuracy, Reprints, *Gravitational constant, *Physical constants.

The universal Newtonian Gravitational Constant is being redetermined at the National Bureau of Standards (NBS) using the method of C.V. Boyes in which the period of a torsion pendulum is altered by the presence of two 10.5 kg tungsten balls. The difference in the squared frequencies with and without the balls is proportional to 'G'. The resulting value of 'G' is: 6.6726 + or - 0.0005 x (10 to the -11th power) (m cubed)/kg (sec squared).

715,030
PB82-212127 Not available NTIS
National Bureau of Standards, Washington, DC.
Quantum Hall Effect: Role of Inversion Layer Geometry.
Final rept.
R. W. Rendell, and S. M. Girvin. 1982, 2p
Pub. in Surface Science 113, p39-40 1982.

Keywords: *Hall effect, Metal oxide transistors, Field effect transistors, Quantum theory, Electrical resistance, Reprints, Density of states.

The quantum Hall effect has attracted much interest because of its potential for providing a quantum standard of resistance and an improved value of the fine structure constant. As a step toward understanding the experimental and fundamental limitations of the effect, the authors present a calculation of end effect errors for MOSFET devices within a simple model of an inversion layer.

715,031
PB82-212135 Not available NTIS
National Bureau of Standards, Washington, DC.
Mass Formula Based on SU(4).
Final rept.
M. Cauvin, V. Gillet, F. Soulmagnon, and M. Danos. 1981, 11p
Pub. in Nuclear Physics A361, p192-212 1981.

Keywords: *Atomic mass, Nuclear shell models, Reprints, SU-4 groups, Binding energy.

The quality of the fit of experimental masses by a mass formula based on the two-body Casimir operator of SU(4) was tested and was found to be at least as good as that of the Weizsacker mass formulae, in spite of the fact that this formula is inherently less flexible. The physical basis for, and some ramifications of, this formula are discussed. A simple form for the shell corrections is then added in the formulae, leading to improved fits without modification of the above conclusions.

715,032
PB82-212234 Not available NTIS
National Bureau of Standards, Washington, DC.

Eotvos Experiment with a Fluid Fiber.
Final rept.
G. M. Keiser, and J. E. Faller. 1982, 8p
Grant NSF-PHY76-04761
Pub. in Proceedings of the Marcel Grossmann Meeting on General Relativity (2nd), Miramare-Trieste, Italy, July 5-11, 1979, p969-976 1982.

Keywords: *General relativity, *Gravitation, *Eotvos experiment.

Recent work aimed at an improved Eotvos experiment is described. Copper and tungsten test masses are contained in a cylindrical float supported by the buoyancy of water which is held at its maximum density point. Electrostatic forces are used to keep the float centered and to provide the torsion constant. Sources of noise associated with convection currents, magnetic fields, seismic noise, changing gradients in the gravitational field, long term drifts in the positions detector, and Brownian motion are described, and recent experimental results are presented.

715,033
PB82-233578 Not available NTIS
National Bureau of Standards, Washington, DC.
Intercomparison of NBS and Helsinki Temperature Scales in the Millikelvin Region.
Final rept.
E. Lhota, M. T. Manninen, J. P. Pekola, A. T. Soinne, and R. J. Soulen. 1981, 2p
Pub. in Physica 107B, p337-338 1981.

Keywords: *Cryogenics, Superconductivity, Helium 3, Tungsten, Beryllium, Transition temperature, Comparison, Reprints, *Temperature scales.

The Helsinki temperature scale, based on platinum NMR, is compared with the NBS noise and nuclear orientation temperature scale by means of three fixed points: the (3)He superfluid transition temperature at zero pressure (Tc) and the superconductive transition temperatures of samples of W and Be. The value for Tc on the NBS scale is found to be 1.025 mK in close agreement with the Helsinki value of 1.04 mK. This result supports the liquid (3)He heat capacity data measured earlier at Helsinki.

715,034
PB82-233636 Not available NTIS
National Bureau of Standards, Washington, DC.
Design and Performance of a Toroidal Grazing Incidence Monochromator for the 20-200 eV Photon Energy Range.
Final rept.
P. K. Larsen, W. A. M. Van Bers, J. M. Bizau, F. Wuilleumier, S. Krummacher, V. Schmidt, and D. Ederer. 1982, 6p
Pub. in Nuclear Instruments and Methods 195, p245-250 1982.

Keywords: *Synchrotron radiation, Far ultraviolet radiation, X rays, Performance, Design, Reprints, *Monochromators.

A new monochromator using holographically rule toroidal gratings, has been built for the A61 beam line at the ACO storage ring in Orsay. The performance of the monochromator was evaluated from photoelectron measurements on photoionized rare gases (PAX technique). Measurements of photon flux, efficiency in the various orders, and resolution are summarized.

715,035
PB82-234923 Not available NTIS
National Bureau of Standards, Washington, DC.
Photon-Fluence Scaling Theorem for Compton-Scattered Radiation.
Final rept.
J. S. Pruitt, and R. Loevinger. Apr 82, 4p
Pub. in Medical Physics 9, n2 p176-179 Apr 82.

Keywords: *Compton effect, *Gamma rays, Ionization chambers, Cobalt 60, Reprints, Phantoms.

This paper concerns a method of scaling photon fluence from one scattering material to another when the photon energies are such that the principal mode of interaction is Compton scattering. Theoretical and experimental justifications are presented. The theory establishes a one-to-one correspondence between points in the two scattering media where the spectra of primary and scattered photons have the same distribution in energy and angle, and where the fluence ratio equals the square of the electron density ratio. Experimental tests were made with cobalt-60 gamma radiation using ionization-chamber measurements in graphite and water phantoms. The experimental results appear to confirm the one-to-one correspondence between photon spectral shapes and angular distributions to within about 0.1%.

715,036
PB82-236704 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Scattering Study of the 10.32 MeV Transition in 40Ca.
Final rept.
P. E. Burt, L. W. Fagg, H. Crannell, D. I. Sober, W. Stapor, J. T. O'Brien, X. K. Maruyama, J. W. Lightbody, and R. A. Lindgren. May 82, 5p
Grant NSF-PHY79-23968
Pub. in Physical Review C 25, n5 p2805-2809 May 82.

Keywords: Electron scattering, Ground state, Reprints, *Calcium 40, *Form factors.

Values of the form factor for the 10.32 MeV transition in (40)Ca have been measured at six different low momentum transfers corresponding to incident electron energies between 31 and 65 MeV and scattering angles of 127.8 degrees and 162.4 degrees. Analysis of the data shows that the transition is transverse and M1. Our data in conjunction with that of earlier workers yield a value of (Gamma sub 0)(M1) = 4.82 + or - 0.26 eV for the ground state transition width. It is shown that in the low momentum transfer range covered in this work, $q<0.55$/fm, this result is essentially model independent. Results for the transition at 9.86 MeV state are also discussed.

715,037
PB82-236720 Not available NTIS
National Bureau of Standards, Washington, DC.
Self-Calibrating Rhodium-Iron Resistive Squid Thermometer for the Range Below 0.5 K.
Final rept.
R. J. Soulen, R. L. Rusby, and D. Van Vechten. 1980, 7p
Pub. in Jnl. Low Temp. Phys. 40, n5-6 p553-569 1980.

Keywords: *Temperature measuring instruments, Resistance thermometers, Cryogenics, Performance, Design, Reprints, *Cryogenic thermometers, *SQUID devices, Noise thermometers.

Experiments are reported relating to a prototype resistive SQUID device which show that it can serve both as a primary and secondary thermometer below 0.5 K. The results of experiments with this prototype are described, its limitations are examined, and ways of improving it are outlined.

715,038
PB82-236787 Not available NTIS
National Bureau of Standards, Washington, DC.
Microdosimetric Energy Deposition Spectra and Their Averages for Bin-Averaged and Energy-Distributed Neutron Spectra.
Final rept.
J. J. Coyne, and R. S. Caswell. 1980, 9p
Grant PHS-CA-26313
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Symposium on Microdosimetry (7th), Oxford, UK, September 8-12, 1980, p689-696 1980.

Keywords: *Neutron beams, Nuclear cross sections, Proportional counters, *Microdosimetry.

Bin-averaged cross sections for hydrogen, carbon, nitrogen and oxygen, which were derived from the latest version of the nuclear data compilation, ENDF/B-V, has been used to calculate energy deposition spectra for a Rossi-type proportional counter filled with propane-based TE gas. The micro-dosimetric parameters y(D) and y(f) are given for contiguous bins extending from 2 MeV to 16 MeV. Energy deposition spectra has also been calculated for the 14.8 MeV neutron beam at TNO including the effects of the low energy neutrons in the beam. Microdosimetric spectra and their averages are given for the conditions: free in air, 10 cm in a water phantom, and 20 cm in a water phantom.

715,039
PB82-236860 Not available NTIS
National Bureau of Standards, Washington, DC.
White Source Use in a Neutron Standards Laboratory.
Final rept.
C. D. Bowman, A. D. Carlson, O. A. Wasson, R. A. Schrack, J. W. Behrens, R. G. Johnson, and K. C. Duvall. Jun 80, 16p
Sponsored in part by International Atomic Energy Agency, Vienna (Austria).
Pub. in Proceedings of IAEA Consultants' Meeting on Neutron Source Properties, Kossuth Lajon University, Debrecen, Hungary, March 17-21, 1980, p119-134 1980.

Keywords: *Neutron beams, Neutron sources, Neutron spectra, Neutron spectroscopy, Calibrating.

Methods are described for accurately characterizing the neutron beam from a white source in spectral shape, absolute intensity, and source brightness distribution. Measurements can be made over more than nine decades of energy from .01 to 2 x 10 to the 7th power eV from a single source. Beams with easily modified spectrum and with total intensity (integrated over energy) of 1,000,000 n/sq cm-sec can be obtained. Over most of the energy range these methods can be implemented with a modest electron linac facility operating in the 10 - 12 MeV range. Such a versatile facility is perhaps within the budgetary range of even a modest laboratory.

715,040
PB82-236894 Not available NTIS
National Bureau of Standards, Washington, DC.
Fixed Points and Thermometric Research Below 0 deg C at the National Bureau of Standards.
Final rept.
G. T. Furukaa, R. S. Kaeser, H. Marshak, E. R. Pfeiffer, J. F. Schooley, R. J. Soulen, and C. T. Van Degrift. 1981, 10p
Pub. in Proceedings of Temperature Measurement in Industry and Science IMEKO TC 12 Symposium, Karlovv Vary, Czechoslovakia, October 20-22, 1981, p32-38 1981.

Keywords: *Temperature measurement, Tunnel diodes, Superconductors, Cryogenics, Reviews, Noise thermometers.

This paper presents a summary of current work at the U.S. National Bureau of Standards in the field of thermometry below 0 deg C. It describes temperature fixed point developments, including pressurized cells of Ar and other low-temperature gases as well as superconductors; a new low-temperature scale noise and nuclear orientation thermometry; studies of the 1976 0.5 K to 30 K Provisional Temperature Scale; and tunnel diode oscillators.

715,041
PB82-239161 Not available NTIS
National Bureau of Standards, Washington, DC.
Status Report on the SURF II Facility at NBS.
Final rept.
A. C. Parr. 1982, 9p
Pub. in Nuclear Instruments and Methods 195, p7-15 1982.

Keywords: *Test facilities, Synchrotron radiation, Reprints, *Synchrotron Ultraviolet Radiation Facility.

The facilities and experimental program at SURF II (Synchrotron Ultraviolet Radiation Facility are reported. The planned upgrading of the storage ring and new beam lines are discussed.

715,042
PB82-248063 Not available NTIS
National Bureau of Standards, Washington, DC.
Design of a High Throughput Grazing Incidence Monochromator for SURF-II.
Final rept.
R. Stockbauer, and R. P. Madden. 1982, 7p
Pub. in Nuclear Instruments and Methods 195, p207-213 1982.

Keywords: *Monochromators, Synchrotron radiation, Far ultraviolet radiation, X rays, Design, Reprints, Synchrotron Ultraviolet Radiation Facility.

Optimization and ray trace calculations have been completed for a high throughput, toroidal grating monochromator. Several unique features have been incorporated into the design. The instrument will use the electron beam as the entrance slit, taking advantage of the small vertical beam size and high brightness of

SURFII. The grating will be placed as close as possible to the storage ring and intercept 51 mrad of horizontal orbit and below 500A, the full vertical light output. Three different gratings will be used to cover the ranges 30-90, 80-200 and 150-600 A.

715,043
PB82-248162 Not available NTIS
National Bureau of Standards, Washington, DC.
Reflectivity and Resolution Measurements of Metallic Multilayers, Beryl and Potassium Acid Phthalate KAP with Synchrotron Radiation in the 1 keV Region.
Final rept.
M. Berland, A. Burek, P. Dhez, J. M. Esteva, B. Gauthe, R. C. Karnatak, and R. E. LaVilla. 1981, 4p
Pub. in SPIE 316, p169-172 1981.

Keywords: *Reflectometers, *Synchrotron radiation, Reflectivity, Resolution, X rays, Reprints.

A recently constructed reflect ometer at LURE used with monochromatized intense synchrotron radiation offers new possibilities for absolute measurements of reflectivity and resolution for metallic multilayers, and natural and synthetic crystals in a wide range of wavelengths. Contrary to the procedure generally used for the reflectivity measurements, in the present arrangement the crystal or multilayer is set at a fixed angle corresponding to a desired energy, and the energy of the highly polarized incident photon beam is varied around this value by means of a double crystal monochromator. The reflectivity versus energy for a given polarization are obtained directly for the sample crystal. In this communication the authors give the first examples for the absolute reflectivity and resolution measurements around 1 keV of metallic multilayers, beryl and KAP, thus illustrating the potential application of this method.

715,044
PB82-261660 Not available NTIS
National Bureau of Standards, Washington, DC.
Relations between Fermion Masses from Effective Potentials in Internal Space.
Final rept.
R. C. Casella. Feb 82, 9p
Pub. in Il Nuovo Cimento 67 A, n4 p289-297, 21 Feb 82.

Keywords: *Fermions, *Mass, Quarks, Leptons, Neutrinos, Reprints.

The assumption of approximately similar effective potentials in internal space acting on 1 scale particles' leads to relations among the quark and lepton masses and their weak-interaction mixing angles. The mass of the t-quark is predicted to be 27 GeV. The model also implies that the (nu sub mu, nu sub e) and (s, d) mixing angles are of comparable magnitude, siding against the high-mass solutions for neutrino oscillation accelerator experiments involving nu sub mu yields nu sub e.

715,045
PB82-264060 Not available NTIS
National Bureau of Standards, Washington, DC.
Absolute Measurement of the Uranium-235 Fission Cross Section from 0.2 to 1.2 MeV.
Final rept.
O. A. Wasson, M. M. Meier, and K. C. Duvall. 1982, 17p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Nuclear Science and Engineering 81, p196-212 1982.

Keywords: *Uranium 235, *Fission cross sections, Nuclear fission, Neutron reactions, Reprints.

The absolute (235)U neutron-induced fission cross section has been measured at the U.S. National Bureau of Standards (NBS) 3-MV Van de Graaff Laboratory from 0.2- to 1.2-MeV neutron energy. The mass of the (235)U contained in a large volume multiplated fission ionization chamber was measured relative to the NBS fissionable isotope mass standards. Pulsed beam time-of-flight techniques were used with neutrons from the 7Li(p,n)7Be reaction while the neutron flux was monitored with a large plastic scintillator whose efficiency was both calculated and measured with the associated-particle technique. The cross sections, which were measured with a typical uncertainty of 2.3% are about 2% lower than the ENDF/B-V evaluation.

715,046
PB82-265679 Not available NTIS
National Bureau of Standards, Washington, DC.
Shift of doublet S (1/2) Hyperfine Splittings Due to Blackbody Radiation and Its Influence on Frequency Standards.
Final rept.
W. M. Itano, L. L. Lewis, and D. J. Wineland. Dec 81, 7p
Pub. in Jnl. Phys. Colloq. C8, 42 n12 p283-287 Dec 81.

Keywords: *Frequency standards, *Hyperfine structure, Stark effect, Zeeman effect, Frequency shift, Atomic clocks, Blackbody radiation, Reprints.

Frequency shifts of hyperfine splittings of doublet S (1/2) states due to the blackbody electric field are calculated. It is shown that they can be estimated from the dc hyperfine Stark shifts, which have previously been measured in the ground states of hydrogen and the alkali atoms. The shifts scale as T to the 4th power. The fractional shift for Cs at 300 K is -1.7 x 10 to the minus 10th power, which is large enough to be significant in primary frequency standards, and should be measurable. A simple method of calculating the hyperfine Stark shifts is described, which is based on the Bates-Damgaard method for determining radial matrix elements and the Fermi-Segre formula for determining the contact hyperfine matrix elements.

715,047
PB83-100289 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
Stopping Powers and Ranges of Electrons and Positrons.
M. J. Berger, and S. M. Seltzer. Aug 82, 168p
NBSIR-82-2550
Sponsored in part by Department of Energy, Washington, DC., and Office of Naval Research, Arlington, VA.

Keywords: *Electrons, *Positrons, Electron scattering, Excitation, Bremsstrahlung, Tables(Data), *Stopping power, *Range.

Tables of stopping powers and related data are given for electrons in 37 elements and 60 compounds, and for positrons in 8 materials. The tables include (1) collison stopping powers (2) radiative stopping powers, (3) total stopping powers, (4) ranges computed in the continuous-slowing-down approximation), (5) radiation yields (fraction of electron energy converted into bremsstrahlung), and (6) the logarithmic derivatives of all these quantities with respect to the mean excitation energy of the medium. These results are given at 81 energies between 1000 MeV and 10 keV. Restricted collision stopping powers are tabulated for selected materials, with cut-off energies of 1, 10 and 100 keV.

715,048
PB83-103697 Not available NTIS
National Bureau of Standards, Washington, DC.
Optical Pumping by Lasers in Atomic Frequency Standards.
Final rept.
L. L. Lewis, and M. Feldman. 1981, 13p
Pub. in Proceedings of the Annual Frequency Control Symposium (35th), Philadelphia, Pennsylvania, May 27-29, 1981, p612-624.

Keywords: *Frequency standards, Optical pumping, Cesium frequency standards, Rubidium frequency standards, Infrared lasers, Near infrared radiation, Frequency stability, Semiconductor lasers.

Single-mode, near-infrared diode lasers may improve the performance of atomic frequency standards. In the case of rubidium standards, the short-term stability may be improved by using laser diodes for optical pumping in place of conventional rf-excited lamps. In cesium beam standards, the lasers may replace both sets of state selection magnets, resulting in greater signal-to-noise, more reliable beam detection, easily reversed beam direction for cavity phase shift measurement, reduced Majorana transitions, and a smaller, more easily regulated C-field. The degree to which these improvements are realized depends upon the characteristics of available lasers. In this paper, the authors report measurements of laser intensity and frequency noise and their effects on clock performance. The light shift in a laser-pumped Rb clock is given, as well as the stability curve for that clock. Preliminary work on optical pumping in a cesium beam is also reported.

715,049
PB83-103705 Not available NTIS
National Bureau of Standards, Washington, DC.
Properties of Signal Sources and Measurement Methods.
D. A. Howe, D. W. Allan, and J. A. Barnes. 1981, 47p
Pub. in Proceedings of the Annual Frequency Control Symposium (35th), Philadelphia, Pennsylvania, May 27-29, 1981, pA1-47.

Keywords: *Frequency stability, Frequency standards, White noise, Measurement, Reviews.

This paper is a review of frequency stability measurement techniques and of noise properties of frequency sources. The final section is devoted to fundamental (physical) causes of noise in commonly used frequency standards. Also transforms from time to frequency domain and vice-versa are given.

715,050
PB83-103762 Not available NTIS
National Bureau of Standards, Washington, DC.
Preliminary Investigation of a New Optically Pumped Atomic Rubidium Standard.
Final rept.
M. Feldman, J. C. Bergquist, L. L. Lewis, and F. L. Walls. 1981, 12p
Pub. in Proceedings of the Annual Frequency Control Symposium (35th), Philadelphia, Pennsylvania, May 27-29, 1981, p546-552.

Keywords: *Frequency standards, *Rubidium frequency standards, Atomic clocks, Optical pumping, Laser beams, Rubidium 87.

Two types of optically pumped glass beam/cells are considered, which do not contain a buffer gas and have no wall coating. The first device is a sealed glass tube of about 1cm diameter and 20cm length. A small amount of (87)Rb metal is localized at one end by temperature gradients which also control the vapor pressure. The cell has the properties of a broad atomic beam for the transport of optically pumped atoms from one end to the other with collimation given by the aspect ratio of the tube. At each end the Rb 'beam' is crossed by a laser. In a second device, graphite inserts are included in the glass tube. The graphite strongly getters Rb and thereby provides collimation and significantly reduces scattering of laser light from background Rb atoms. In the broad beam device the authors have observed the transport of optically pumped atoms between the ends with a S/N ratio of 300:1 in 1 s. A tuneable dye laser was used for the pumping and signal detection. In the collimated beam device, they have observed microwave transitions using a diode laser for pumping and fluorescence detection.

715,051
PB83-103770 Not available NTIS
National Bureau of Standards, Washington, DC.
Proposed Stored (201)Hg(+1) Ion Frequency Standards.
Final rept.
D. J. Wineland, W. M. Itano, J. C. Bergquist, and F. L. Walls. 1981, 9p
Pub. in Proceedings of the Annual Frequency Control Symposium (35th), Philadelphia, Pennsylvania, May 27-29, 1981, p602-610.

Keywords: *Time standards, *Frequency standards, *Atomic clocks, Microwave frequencies, Light(Visible radiation), Atomic spectroscopy, Mercury isotopes, Mercury 201.

In this paper, the authors discuss the performance potential and the problems of implementing a microwave frequency (and time) standard and an optical frequency standard using (201)Hg(+) ions stored in a Penning trap. Many of the discussions apply to ion storage-based frequency standards in general. Laser cooling, optical pumping, and optical detection of the microwave or optical clock transition could be achieved using narrowband radiation at the 194.2 nm transition, while selectively mixing the ground-state hyperfine levels with appropriate microwave radiation. A first-order field-independent microwave clock transition, which is particularly well-suited to the use of the Penning ion trap is the 25.9 GHz hyperfine transition at a magnetic field of 0.534 T. The two-photon Doppler-free transition at 563 nm is a possible candidate for an optical frequency standards. Both standards have the potential of achieving absolute accuracies of better than one part in 10 to the 15th power and frequency stabilities at least ten times better.

715,052
PB83-103788 Not available NTIS
National Bureau of Standards, Washington, DC.
Ultra-Accurate International Time and Frequency Comparison via an Orbiting Hydrogen-Maser Clock.
Final rept.
D. W. Allan, C. O. Alley, N. Ashby, R. Decher, R. F. C. Vessot, and G. M. R. Winkler. Dec 81, 19p
Pub. in Jnl. Phys. Colloq. C8, 42, n12 C8-395-C8-413 Dec 81.

Keywords: *Time standards, *Frequency standards, Frequency stability, Gas masers, Hydrogen, Comparison, Accuracy, Reprints, Hydrogen masers.

Hydrogen maser clocks have exhibited fractional frequency stabilities of better than 1 x 10 to the 15th power for averaging times as large as 20,000 seconds. This represents an rms time deviation of about 20 ps for 1/4 day prediction times. S-band Doppler cancellation frequency comparison techniques have been developed with phase stabilities of a few picoseconds. Laser ranging systems have been developed with accuracies of a few cm. Combining the virtues of these developments and choosing a satellite with an appropriate orbit would allow worldwide time comparisons at the subnanosecond level, and frequency measurement uncertainties of the order of 1 x 10 to the 16th power. Such capability would open up new horizons to the frequency standards laboratories, to the VLBI community, to plate techtonic measurements, to the Deep Space Tracking Network, and to fundamental time and frequency (T/F) metrology on a worldwide basis, as well as greatly assisting the BIH in the generation of UTC and TAI.

715,053
PB83-109330 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Electromagnetic Nuclear Reactions: I. Introduction, Operators, and Sum Rules.
J. S. O'Connell. Sep 82, 120p NBSIR-82-2547

Keywords: *Photonuclear reactions, *Electromagnetic interactions, Electron scattering, Weak interactions, Differential cross sections, Deuterium, Helium 3, Books, Reviews, *Electron reactions, Electrodisintegration, Photoproduction.

This monograph covers the data and theoretical models of nuclear reactions initiated by electrons and photons. The main emphasis is on the nonrelativistic calculations of the differential cross sections of the major reaction channels.

715,054
PB83-127639 Not available NTIS
National Bureau of Standards, Washington, DC.
Field Constraints on Discontinous Solutions of the Maxwell Equations.
Final rept.
A. G. Lieberman. 1981, 6p
Pub. in Proceedings of Optics in Four Dimensions 1980, International Commission for Optics, Ensenada, Mexico, August 4-8, 1980, AIP Conference 65, Subseries on Optical Science and Engineering, n1 p652-657 1981.

Keywords: *Electromagnetic fields, Maxwells equations, Special relativity.

Relations governing changes in the field vectors of a discontinuously electromagnetic field are formulated in this paper within the framework of special relativity theory. The treatment emphasizes the physical aspects of the problem and for this reason the medium supporting the propagation is conveniently assumed to be isotropic but otherwise to have arbitary properties. Four field discontinuity conditions and a relation describing electrical charge conservation at the discontinuity are presented.

715,055
PB83-131557 Not available NTIS
National Bureau of Standards, Washington, DC.
Half-Life of Plutonium-239.
Final rept.
L. L. Lucas, J. R. Noyce, and B. M. Coursey. Aug 78, 3p
Pub. in International Jnl. of Applied Radiat. Isot. 29, n8 p501-503 Aug 78.

Keywords: *Plutonium 239, *Half life, Alpha particles, Scintillation counters, Radioactive decay, Reprints.

The alpha-particle-emission rates of solutions of plutonium-239(I) metal were determined from defined-solid-angle-counter and liquid-scintillation-counter measurements. These results were combined with composition data obtained from other laboratories and the half-life of (239) Pu was calculated.

715,056
PB83-131599 Not available NTIS
National Bureau of Standards, Washington, DC.
Design Considerations and Performance of NBS-6, the NBS Primary Frequency Standard.
Final rept.
L. L. Lewis, F. L. Walls, and D. J. Glaze. Dec 81, 6p
Pub. in Proceedings International Symposium on Frequency Standards and Metrology (3rd), Aussois, France, October 12-14, 1981, Jnl. of Physics Colloq. C8, 42 n12 pC8-241-C8-246 Dec 81.

Keywords: *Frequency standards, *Cesium frequency standards, Performance evaluation, Design.

The construction and performance of NBS-6, the U.S. cesium primary frequency standard, are summarized. A brief description of evaluation procedures and sources of uncertainty are given.

715,057
PB83-131607 Not available NTIS
National Bureau of Standards, Washington, DC.
Impact of Lasers on Primary Frequency Standards and Precision Spectroscopy.
Final rept.
L. L. Lewis, M. Feldman, and J. C. Bergquist. Dec 81, 11p
Pub. in Proceedings of International Instrumentation Symposium on Frequency Standards and Metrology (3rd), Aussois, France, October 12-14, 1981, Jnl. of Physics Colloq. C8, 42, n12 pC8-271-C8-281 Dec 81.

Keywords: *Frequency standards, *Spectroscopy, Atomic beams, Frequency stability, Cesium frequency standards, Metrology, *Laser spectroscopy, Laser applications.

Lasers available at new wavelengths, powers, linewidths, and stabilities have made possible advances in precision atomic frequency standards and spectroscopy. Laser spectrometers with resolving power exceeding 10 to the 11th power have been constructed and used to measure the photon recoil structure of spectral lines and in new tests of relativity. Recent progress in frequency stabilization methods and in laser-cooled ions indicates the possibility of an optical frequency standard with an accuracy and stability of less than 10 to the -15th power. Diode laser may enable the construction of an optically-pumped cesium standard with an order-of-magnitude improvement in accuracy over existing primary standards.

715,058
PB83-135020 Not available NTIS
National Bureau of Standards, Washington, DC.
Photonuclear Reactions Above the Pion Threshold.
Final rept.
J. S. O'Connell. 1982, 25p
Pub. in Proceedings of the International School of Intermediate Energy Nuclear Physics, Verona, Italy, July 16-26, 1981 p189-215.

Keywords: *Photonuclear reactions, Reviews, Feynman diagram, Fermi gas model.

Nuclear reactions initiated by photons on electrons that excite the nucleus more than 140 MeV are reviewed with the aim of describing the nucleon and meson currents inside the nucleus.

715,059
PB83-135251 Not available NTIS
National Bureau of Standards, Washington, DC.
Prospects for Stored Ion Frequency Standards.
Final rept.
D. J. Wineland. 1982, 14p
Pub. in Proceedings of the Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (13th), Naval Research Laboratory, Washington, DC., Dec 1-3, 1981, NASA Conference Publication 2220, p579-591.

Keywords: *Frequency standards, Atomic clocks, Atomic spectroscopy, Ion storage.

Fundamental limitations of possible frequency standards based on stored ions are examined. Practical limitations are also addressed but without regard to size, power consumption, and cost. With these guidelines, one can anticipate that a stored ion frequency standard with accuracy and stability better than 10 to the -15th power is now possible.

715,060
PB83-135269 Not available NTIS
National Bureau of Standards, Washington, DC.
Status of Electron Transport Cross Sections.
Final rept.
S. M. Seltzer, and M. J. Berger. 1982, 2p
Sponsored in part by Department of Energy, Washington, DC., and Office of Naval Research, Arlington, VA.See also PB83-112128.
Pub. in Transactions of the American Nuclear Society 41, p477-478 1982.

Keywords: *Electron irradiation, *Cross sections, *Bremsstrahlung, Monte Carlo method, Reprints, Computer applications.

In this paper the authors highlight improvements to the cross-section data base for various moderate- to high-energy Monte Carlo computer codes such as ETRAN, EGS, SANDYL, TIGER, etc., which are used to calculate the transport of electrons and associated bremsstrahlung at energies from about 10 keV up to 1 GeV. They indicate some work which they have completed, some which is still in progress, and some which may be desirable but for which they lack adequate information. The discussion will be in terms of the cross-section information needed by the ETRAN program, as supplied by the program DATAPAC, and will not involve, for example, collective effects associated with intense beams, cross sections in ionized media, and complications arising at energies about equal or < 1 keV.

715,061
PB83-142836 Not available NTIS
National Bureau of Standards, Washington, DC.
Comments on the Effect of Electron Detachment in Initiating Breakdown in Gaseous Dielectrics.
Final rept.
W. F. Schmidt, and R. J. Van Brunt. 1982, 3p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of Int. Symposium on Gaseous Dielectrics (3rd), Knoxville, TN., March 7-11, 1982, p561-563 1982.

Keywords: *Dielectrics, *Dielectric breakdown, Gas discharges, *Gaseous dielectrics.

This paper represents a summary of the deliberations of a small group discussion meeting held at the Third International Symposium on Gaseous Dielectrics. The relative importance of various electron detachment processes in the initiation of electrical breakdown in electronegative gases is considered and discussed.

715,062
PB83-142943 Not available NTIS
National Bureau of Standards, Washington, DC.
Millikelvin Temperature Standards.
Final rept.
R. J. Soulen. 1982, 11p
Pub. in Proceedings of Int. Conference on Low Temperature Physics (16th), Physica 109 and 110B, p2020-2030 1982.

Keywords: *Temperature measurement, *Cryogenics, *Standards, Liquid helium, Reviews.

The status of temperature scales, fixed points and interpolation devices for the millikelvin region of temperature (approximately 1 mK to 500 mK) is reviewed. It appears on the basis of recent comparisons of temperature scales by means of fixed points that inaccuracies in temperature of 0.5% or less prevail at the upper end of this region and they increase steadily to a level of 5% at the lower end.

715,063
PB83-142968 Not available NTIS
National Bureau of Standards, Washington, DC.

Infinite Conical Well: An Analytic Model for Quantum Mechanical Hindered Rotors.
Final rept.
J. W. Gadzuk, U. Landman, E. J. Kuster, C. L. Cleveland, and R. N. Barnett. 16 Aug 82, 5p
Contract DE-AS05-76ER05489
Pub. in Physical Review Letters 49, n7 p426-430, 16 Aug 82.

Keywords: *Quantum theory, Rotors, Rotation, Reprints.

A new, analytic model for a hindered rotor is presented. The rotational quantum mechanics of this model are worked out, and rotational state distributions of the hindered rotor are given in terms of unhindered rotor states. It is seen that zero-point kinetic energy of the hindered rotor could appear as thermal excitations with respect to the free state in a process involving sudden relaxation of the hindering potential.

715,064
PB83-143321 Not available NTIS
National Bureau of Standards, Washington, DC.
Spectrometer Requirements for (e,e'2N) Studies.
Final rept.
J. W. Lightbody. 1982, 10p
Pub. in Proceedings of the Workshop on High-Resolution, Large-Acceptance Spectrometers, Argonne, Illinois, September 8-11, 1981, Section IV, pJ-1--J-10 1982.

Keywords: *Spectrometers, Momentum transfer, Nucleons, Correlation functions.

The kinematics and dynamics of the (e,e'2N) reaction is discussed in terms of spectrometer requirements. The range of momentum transfer over which one can reasonably access the pair correlation is given. An experimental configuration is described which requires a single spectrometer for detecting both nucleons.

715,065
PB83-143347 Not available NTIS
National Bureau of Standards, Washington, DC.
Measuring Nucleon Charge and Magnetization Inside the Nucleus.
Final rept.
J. S. O'Connell. 1982, 7p
Pub. in Comments on Nuclear and Particle Physics (11), n1 p1-7 1982.

Keywords: *Nucleons, *Electron scattering, Electric charge, Magnetization, Inelastic scattering, Reprints, Response functions.

Deep inelastic scattering of electrons on nuclei measures the response to probes of the nucleon charge and magnetization inside nuclear matter. Recent data show response functions whose shape and area are not in agreement with standard theoretical models.

715,066
PB83-143453 Not available NTIS
National Bureau of Standards, Washington, DC.
Superconductive Thermometric Fixed Points.
Final rept.
J. F. Schooley, and R. J. Soulen. 1982, 10p
Pub. in Proceedings of the International Symposium on Temperature (6th), Washington, DC., March 15-18, 1982. Paper in Temperature - Its Measurement and Control in Science and Industry, p251-260 1982.

Keywords: *Temperature measurement, *Cryogenics, *Superconductivity, Transition temperature, *Fixed points, Standard reference materials.

The authors review the progress since the 5th Temperature Symposium in the development of temperature reference points based upon the transitions of various metal samples between the normal and superconductive states. Two superconductive fixed point devices, known as SRM (Standard Reference Material) 767 and 768, have become available from the National Bureau of Standards. One of these devices provides five of the temperature reference points for the 1976 Provisional 0.5 K to 30 K Temperature Scale; the other provides the mechanism for transmitting an NBS cryogenic temperature scale covering the range 0.01 K to 0.5 K. Current efforts in superconductive fixed-point research are devoted to evaluating superconductive transitions as possible reference temperatures for a replacement scale to succeed the IPTS-68.

715,067
PB83-143487 Not available NTIS
National Bureau of Standards, Washington, DC.
Nuclear Orientation Thermometry from Approximately 0.001 to Approximately 1.2 K.
Final rept.
H. Marshak. 1982, 7p
Pub. in Proceedings of the International Symposium on Temperature (6th), Washington DC., March 15-18, 1982. Paper in Temperature - its Measurement and Control in Science and Industry, p95-101 1982.

Keywords: *Temperature measurement, *Cryogenics, Cobalt 60, Single crystals, *Nuclear orientation thermometry, *Gamma ray anisotropy thermometry, Helmium 166.

We have investigated Gamma ray anisotropy thermometry using both (60)Co in cobalt single crystals ((60)CoCo) and (166m)Ho in Ho single crystals ((166m)HoHo) for their potential use in defining a low temperature scale covering the range from about 0.001 to about 1.2 K.

715,068
PB83-143495 Not available NTIS
National Bureau of Standards, Washington, DC.
4He Second and Third Virial Coefficients from Acoustical Isotherms - the Helmholtz-Kirchhoff Correction at Temperatures Below 35 K.
Final rept.
H. H. Plumb. 1982, 12p
Pub. in Proceedings of the International Symposium on Temperature (6th), Washington, DC., March 15-18, 1982. Paper in Temperature - Its Measurement and Control in Science and Industry, p77-88 1982.

Keywords: *Helium 4, Acoustic velocity, Cryogenics, Correction, *Virial coefficients.

Measurements of acoustical isotherms have been extended up to 200,000 Pa (9 K to 34 K) and hence yielded more accurate isotherm analyses because a determination of the quadratic pressure term permits a more accurate detrmination of the linear pressure term. The isotherm analysis has produced values for the 4He second and third virial coefficients. The isotherm slopes (linear term in pressure) that have been measured experimentally are compared with those that have been colculated from values of the second 4He virial coefficient, B(T), which were determined in other non-acoustical experiments. The close equality of these slope values indicates the inadequacy of the generally accepted 'Holmholtz-Kirchhoff correction' (the theoretical derivation and/or its application to experimental measurements). The correction presumably corrects speed of sound measurement data in a confined tube to values that would have been measured in a free or open gas.

715,069
PB83-143701 Not available NTIS
National Bureau of Standards, Washington, DC.
Effect of Additive Noise and Bandpass Filter on the Performance of a Josephson Junction Noise Thermometer.
Final rept.
R. J. Soulen, D. Van Vechten, and H. Seppa. Sep 82, 8p
Pub. in Review of Scientific Instruments 53, n9 p1355-1362, Sep 82.

Keywords: *Temperature measuring instruments, *Josephson junctions, Bandpass filters, White noise, Accuracy, Reprints, *Noise thermometers.

This article derives the appropriate equations for a Josephson junction noise thermometer and demonstrates that only when rapid measurements of high accuracy are desired must any correction factors associated with the electronics be applied. The authors present experiments which are in very good agreement with these theoretical expressions. They conclude that if inclusion of these small (about 2%) corrections can be tolerated, Josephson junction noise thermometers can be made to operate 100 times faster than has hitherto been reported.

715,070
PB83-143818 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurements of Inelastic Scattering of eV Neutrons.
Final rept.
C. D. Bowman, and R. G. Johnson. 1982, 3p
Pub. in Proceedings IPNS Symp. on Nuetron Scattering, Argonne, IL., August 12-14, 1981. AIP Conference n89 p84-86 1982.

Keywords: *Neutron scattering, Inelastic scattering, Benzene, Momentum transfer, Molecular vibration.

A technique has been demonstrated for studying the inelastic scattering of eV neutrons using a pulsed white source. Measurements have been completed on benzene for incident energies in the range 1.5 to 15 eV and for q values from 13 to 120/A. Details of the method and possibilities for improvement and extension are presented.

715,071
PB83-145557 Not available NTIS
National Bureau of Standards, Washington, DC.
High Resolution Powder Diffraction by White Source Transmission Measurements.
Final rept.
R. G. Johnson, and C. D. Bowman. 1982, 3p
Pub. in Proceedings of IPNS Symposium on Neutron Scattering, Argonne, IL., August 12-14, 1981, AIP Conf. No. 89, p53-55 1982.

Keywords: *Neutron diffraction, Neutron cross sections, Iron, *Neutron powder diffraction, High resolution.

Neutron powder diffraction has been studied by measuring the total neutron cross section using neutron time-of-flight in transmission geometry. This method is equivalent to measurements in scattering geometry of powder diffraction at 2 theta = 180 degrees. Measurements on iron samples were conducted using the NBS 100 MeV electron linac as a pulsed neutron source and using flight paths of 20 and 60 meters. The resolution at 60 m for 25-meV neutrons was limited to d (lambda)/(lambda) = 0.2% primarily by moderator hold-up. Although the change in cross section at the Bragg edges may be quite small, counting rates are high permitting the recording of data with a 0.1% statistical precision in about one day. For the Fe samples, diffraction edges were distinguished as high as n = 196 (where n is the sum of the squares of the Miller indicies) with all edges distinguishable below n = 90.

715,072
PB83-146472 Not available NTIS
National Bureau of Standards, Washington, DC.
Kapitza Resistance.
Final rept.
R. Radebaugh. Apr 82, 2p
Pub. in McGraw-Hill Encyclopedia Science Technology 5, n2 p466-467 Apr 82.

Keywords: *Heat transfer, Liquid helium, Surfaces, Reprints, *Kapitza resistance.

The Kapitza thermal boundary resistance between a solid and liquid helium is defined and explained briefly.

715,073
PB83-162115 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutrino Reactions on the Deuteron.
Final rept.
J. S. O'Connell. Aug 82, 5p
Pub. in Proceedings of Los Alamos Neutrino Workshop, Los Alamos, New Mexico, June 8-12, 1981, p43-47 Aug 82.

Keywords: *Nuclear cross sections, *Deuterons, Electrons, Muons, *Neutrino reactions.

The differential and total cross sections for the production of electrons and muons from deuterium by neutrinos up to 300 MeV is calculated using a simple wave function for the deuteron.

715,074
PB83-162123 Not available NTIS
National Bureau of Standards, Washington, DC.
Neutrino Reactions in the Fermi Gas Model.
Final rept.
J. S. O'Connell. Aug 82, 6p
Pub. in Proceedings of Los Alamos Neutrino Workshop, Los Alamos, New Mexico, June 8-12, 1981, p37-42 Aug 82.

Keywords: *Nuclear cross sections, Electrons, Muons, *Neutrino reactions, Fermi gas model.

The differential and total cross sections for the production of electrons and muons from nuclei by neutrinos up to 300 MeV is calculated using the Fermi gas model of the nucleus.

715,075
PB83-162248 Not available NTIS
National Bureau of Standards, Washington, DC.
Method for Making Coulomb Effect Corrections to Reaction Amplitudes.
Final rept.
L. C. Maximon. 1982, 93p
Pub. in George Washington University, Department of Physics Technical Report GWU/DP/TR-82/2, 93 pages 1982.

Keywords: Wave functions, Integral transformations, Scattering, Correction, *Coulomb wave functions.

A method was developed whereby the l-th partial wave rescattering amplitude including the Coulomb interaction in the final state can be obtained from the -th partial-wave rescattering amplitude without the Coulomb interaction by folding the latter with an analytically known kernel function. This function depends on the relative momentum of the particles involved and on their Coulomb parameter. A simplified expression for this kernel is given in first Born approximation.

715,076
PB83-174904 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Computer Algorithm for Estimating Infiltration and Inter-Room Air Flows.
G. N. Walton. Feb 83, 36p NBSIR-83-2635
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Air flow, Algorithms, Air circulation, Buildings, *Computer applications, *Heat transfer.

This report discusses the extension of an infiltration predicting technique to the prediction of inter-room air movements. The air flow through openings is computed from the ASHRAE crack method together with a mass balance in each room. Simultaneous solution of the mass balances in all rooms having both large and small openings is accomplished by a slightly modified Newton's method.

715,077
PB83-175687 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC.
Stopping Powers and Ranges of Electrons and Positrons (2nd Ed).
M. J. Berger, and S. M. Seltzer. Dec 82, 175p
NBSIR-82-2550-A
Sponsored in part by Department of Energy, Washington, DC. and Office of Naval Research, Arlington, VA.
See also PB83-100289.

Keywords: *Electrons, *Positrons, Electron scattering, Excitation, Bremsstrahlung, Tables(Data), *Stopping power, *Range.

Tables of stopping powers and related data are given for electrons in 25 elements and 46 mixtures and compounds, and for positrons in 14 materials. The tables include: (1) collision stopping powers (ionization and excitation losses); (2) radiative stopping powers (bremsstrahlung losses); (3) total stopping powers; (4) ranges (rectified pathlengths computed in the continuous-slowing-down approximation); (5) radiation yields (fraction of initial electron energy converted to bremsstrahlung in the course of slowing down); and (6) the logarithmic derivatives of all these quantities with respect to the mean excitation energy of the medium (the key parameter of the Bethe stopping power formula).

715,078
PB83-176792 Not available NTIS
National Bureau of Standards, Washington, DC.
Single Integral Equation for Wave Scattering.
Final rept.
E. Marx. Jun 82, 9p
Pub. in Jnl. of Mathematics and Physics 23, n6 p1057-1065 Jun 82.

Keywords: *Electromagnetic fields, *Electromagnetic scattering, *Integral equations, Ware equations, Maxwells equations, Monochromatic radiation, Reprints, Transients.

When an incident wave interacts with an obstacle, the problem of finding the scattered and transmitted fields is often solved by means of a system for integral equations for two unknown fields defined on the surface of the body. The number of these equations can be reduced by half by choosing a more appropriate unknown function, resulting in a single singular integral equation of the first kind. This is done here for a scalar field that obeys the wave equation and for the electromagnetic fields that obey Maxwell's equations, both for transient and monochromatic waves.

715,079
PB83-176974 Not available NTIS
National Bureau of Standards, Washington, DC.
Dyadic Green's Functions for the Time-Dependent Wave Equation.
Final rept.
E. Marx, and D. Maystre. Jun 82, 10p
Pub. in Jnl. of Mathematical Physics 23, n6 p1047-1056 Jun 82.

Keywords: *Electromagnetic fields, *Green's function, *Wave equations, Electromagnetic scattering, Maxwell's equations, Reprints, Transients.

The theory of dyadic Green's functions for a transient electromagnetic field, which obeys the vector wave equation, is presented within the framework of the theory of distributions. First, the elementary solution to the scalar wave equation is derived and then used to solve that equation. After establishing the equivalence between Maxwell's equations and the time-dependent vector wave equation, the dyadic elementary solution is derived and applied to solve the equation. Further properties of dyadic Green's functions for the wave equation are derived within the heuristic approach to the theory of Green's functions. The paper includes a collection of formulas of the theory of distributions intended to help readers who are not very familiar with this subject.

715,080
PB83-177428 Not available NTIS
National Bureau of Standards, Washington, DC.
Surface Photoeffect in Small Spheres.
Final rept.
D. R. Penn, and R. W. Rendell. Sep 82, 21p
Pub. in Physical Review B 26, n6 p3047-3067, 15 Sep 82.

Keywords: *Spheres, Surfaces, Reprints, *Photoabsorption, *Photoyield.

A new method is developed to calculate the photoabsorption and photoyield of small spheres. Numerical results are presented for the case of free-electron spheres for photon energies below the plasmon energies. It is found that the excitation of electron-hole pairs due to the presence of the surface results in enhancements in photoabsorption and photoyields that are typically 10-100 relative to the classical results, which only include the excitation of transverse modes. Furthermore, enhancements of the order 10-100 are found in the photoyield of small spheres relative to plane surfaces. These results are consistent with recent experimental results on a number of non-free-electron materials.

715,081
PB83-179275 Not available NTIS
National Bureau of Standards, Washington, DC.
Inferred 238Pu(n,f) Cross Section in the MeV Range.
Final rept.
J. W. Behrens. Nov 82, 2p
Pub. in Transactions of the American Nuclear Society 43, p722-723 Nov 82.

Keywords: *Plutonium 238, *Fission cross sections, Neutron reactions, Predictions, Reprints, MeV range.

During the past decade, considerable effort has been spent in extending the measurements of fission cross sections of the transactinides in the MeV range. Accurately measured data now exist for 14 nuclides. These data form a basis set that is sufficiently large to justify an attempt to infer fission cross sections for unmeasured nuclei from the systematics of the fission cross sections of neighboring nuclei. This approach is particularly useful in obtaining fission cross sections for the many short-lived nuclides (t1/2 $<$90 years) that are currently difficult, if not impossible, to measure.

715,082
PB83-179457 Not available NTIS
National Bureau of Standards, Washington, DC.
Thermal Response Times of Some Cryogenic Thermometers.
Final rept.
D. Linenberger, E. Spellicy, and R. Radebaugh.
1982, 6p
Pub. in Proceedings of International Symposium on Temperature (6th), Washington, DC., March 15-18, 1982, Paper in Temperature - Its Measurement and Control in Science and Industry, V, p1367-1372 1982.

Keywords: *Temperature measuring instruments, *Cryogenics, Resistance thermometers, Carbon, Germanium, Silicon, *Thermometers, Silicon on sapphire.

The measurement of time-varying temperatures requires sensors with sufficiently fast response times. As an aid to the selection of a satisfactory thermometer, this paper describes the measurement of the thermal time constants of several cryogenic thermometers. The thermal time constants were measured by observing the response of the thermometers to self-heating induced by the injection of a constant current step. Temperatures studied were 4, 77, and 295 K. Measurements were made in both the gas and liquid phases of helium and nitrogen in order to determine the upper and lower limits of the time constants. Specific thermometers investigated include a germanium resistance thermometer, carbon resistors, diodes, and a silicon-on-sapphire resistance device (area about .35 sq mm). In several cases the measurements are compared with the calculated values of the time constants.

715,083
PB83-182683 Not available NTIS
National Bureau of Standards, Washington, DC.
Flowing Gas Target System for Precision Electron Scattering Measurements.
Final rept.
W. J. Stapor, H. Crannell, J. W. Lightbody, X. K. Maruyama, and J. T. O'Brien. 1982, 4p
Pub. in Jnl. of Nuclear Instruments and Methods 203, p97-100 1982.

Keywords: *Electron scattering, Nuclear energy levels, Ground state, Helium 4, Elastic scattering, Reprints.

The authors describe a flowing gas target system which can be used in various electron scattering experiments that require gas density stabilization to one part in 1000. The main advantage of this system is that both target pressure and temperature are directly monitored during the data taking process. This eliminates the need to use extra beam time to measure the dependence of local target density on beam current. The system has been successfully used in an elastic electron scattering experiment to obtain a precise measurement of the nuclear ground state rms charge radius of 4He.

715,084
PB83-183293 PC **A03**/MF **A01**
Factory Mutual Research Corp., Norwood, MA.
Fire Ventilation.
A. Tewarson, and J. Steciak. Feb 83, 32p NBS-GCR-83-423
Contract NB79-NADA-0014

Keywords: *Ventilation, *Air circulation, *Fires, Vents, Air flow.

A ventilation parameter is defined in terms of the availability of oxygen with respect to the stoichiometric combustion requirements. Pagni's normalized flame height for forced air flow conditions has been used to quantify the variations in the fire properties with ventilation. For the experimental conditions used, relationships have been established between Pagni's normalized flame height and ventilation parameter, oxygen consumption in the combustion process, combustion efficiency, and generation efficiencies of various chemical compounds.

715,085
PB83-186775 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Tables of Energy Deposition Distributions in Aluminum and Copper Irradiated by Point-Monodirectional Electron Beams with Energies from 1 to 60 MeV.
M. J. Berger, and S. M. Seltzer. Oct 82, 42p NBSIR-82-2579
Sponsored in part by Office of Naval Research, Arlington, VA. and National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.

Keywords: *Aluminum, *Copper, *Electron irradiation, Electron beams, Tables(Data), Distance.

This report presents tables of energy deposition distributions in aluminum and copper media irradiated by monoenergetic point-monodirectional electron beams. The distributions are given as functions of the depth in the medium and of the radial distance from the incident beam. Results are given for 7 beam energies between 1 MeV and 60 MeV. As shown earlier in National Bureau of Standards Report NBSIR 82-2451 (1982), the tabulated results from monoenergetic, point-monodirectional sources can be used, by superposition, to obtain spatial distributions of the energy imparted to the medium by parallel beams with arbitrary spectrum and finite arbitrary cross section.

715,086
PB83-202531 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Photodisintegration of the Deuteron, 1982.
E. G. Fuller. Mar 83, 23p NBSIR-83-2647

Keywords: *Deuterons, *Photodisintegration, *Nuclear cross sections, Measurement.

Measurements of the deuteron's photodisintegration cross section made over a thirty year time span are evaluated in terms of the cross section for E1 and M1 transitions calculated in the effective range approximation. The energy range covered is from threshold to 44 MeV. Data that do not depend on a knowledge of a bremsstrahlung spectrum's intensity or spectral distribution are shown to be described very well by the effective-range expressions. The values of the deuteron's electric polarizability is shown to be in fair agreement with a value derived from the observed deviation from Rutherford scattering of deuterons by 208Pb. A comparison is made of the experimental data with three recent calculations of the photodisintegration cross section.

715,087
PB83-216358 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Numerical Comparisons of Several Algorithms for Treating Inconsistent Data in a Least-Squares Adjustment of the Fundamental Constants.
Final rept.
B. N. Taylor. Jan 82, 89p NBSIR-81-2426

Keywords: *Fundamental constants, Algorithms, Least squares method, Comparison, Data.

A number of recently proposed algorithms for treating inconsistent or discrepant data in a least-squares adjustment of the fundamental physical constants, along with several new but related algorithms, are compared in detail. The comparisons are first made by means of the numerical results the algorithms yield when applied to the same data considered by Cohen and Taylor in their 1973 adjustment which led to the recommended set of constants adopted by CODATA and in current use. A selected number of the algorithms are then further compared through the numerical results they yield when applied to the data considered by Taylor, Parker and Langenberg in their 1969 adjustment and by Cohen and DuMond in their 1963 adjustment. The principal conclusion of this paper is that the actual algorithm used to carry out an adjustment is much less important than the data finally selected for inclusion in the adjustment.

715,088
PB83-223982 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Perspectives in High Energy Nuclear Collisions.
J. Rafelski, and M. Danos. Jun 83, 85p NBSIR-83-2725
Prepared in cooperation with Frankfurt Univ. (Germany, F. R.) Inst. fuer Theoretische Physik.

Keywords: *Elementary particles, Quarks, *High energy physics, Gluons, Hadrons, Nuclear plasma.

This report has been prepared as a working document for the conception of a research facility devoted to the study of high energy nuclear collisions. Different aspects of hadronic physics to be studied in nuclear collisions are selected, with emphasis placed on the properties and nature of the quark-gluon plasma, the formation of the plasma state in the central region and its anticipated lifetime, and the observability and strangeness content of this new form of nuclear matter.

715,089
PB83-226670 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 87, Number 6, November-December 1982.
Bi-monthly rept.
Dec 82, 86p
See also PB83-226688, PB83-226696 and Volume 87, Number 5, PB83-164541. Library of Congress catalog card no. 62-37059.

Keywords: *Research projects, Sampling, Probability theory, Acceptibility, Heat measurement, Cooling, Thermal diffusivity, Specific heat, Order statistics, Calorimetry.

Contents: Acceptance probabilities for a sampling procedure based on the mean and an order statistic; Mathematical analysis for radiometric calorimetry of a radiating sphere.

715,090
PB83-226696
(Order as PB83-226670, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC. National Engineering Lab.
Mathematical Analysis for Radiometric Calorimetry of a Radiating Sphere.
L. A. Schmid. 15 Sep 82, 52p
Included in Jnl. of Research of the National Bureau of Standards, v87 n6 p513-564 Nov-Dec 82.

Keywords: *Heat measurement, *Cooling, *Thermal diffusivity, *Specific heat, Differential equations, Integral equations, Spheres, *Calorimetry, Temperature dependence.

Equations are derived from which the temperature dependence of both the specific heat and the thermal diffusivity of a spherical sample of material can be calculated from observations of the time dependence of the surface temperature and the time-rate energy loss from the sample, and the resulting equations can be applied not only to radiative cooling, but also to any other cooling mechanism that does not violate the assumed spherical symmetry. The analysis excludes change of phase, but it does take thermal expansion into account. To permit the making of estimates necessary for the design of radiative cooling experiments, a universal temperature-time cooling curve is derived for the post-transient cooling regime of a radiating sphere of any size with arbitrary, but constant, thermal parameters.

715,091
PB83-226704 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Journal of Research of the National Bureau of Standards. Volume 88, Number 1, January-February 1983.
Bi-monthly rept.
Feb 83, 95p
See also PB83-226712 through PB83-226746. Library of Congress catalog no. 63-37059.

Keywords: *Research projects, Atomic clocks, Cesium frequency standards, Time measurement, Spectrophotometry, Standards, Transmittance, Optical filters, Gas chromatography.

Contents: Estimation of parameters in models for cesium beam atomic clocks; Estimating time from atomic clocks; Measurement assurance program transmittance standards for spectrophotometer linearity testing--preparation and calibration; Statistical analysis of some gas chromatography measurements.

715,092
PB83-226712
(Order as PB83-226704, PC **A05**/MF **A01**)
National Bureau of Standards, Washington, DC.
Estimation of Parameters in Models for Cesium Beam Atomic Clocks.
P. V. Tryon, and R. H. Jones. 2 Aug 82, 14p
Prepared in cooperation with Colorado Univ., Denver. School of Medicine.
Included in Jnl. of Research of the National Bureau of Standards, v88 n1 p3-16 Jan-Feb 82.

Keywords: *Atomic clocks, *Cesium frequency standards, Time series analysis, Confidence limits, Kalman filtering, Maximum likelihood estimation, Parameter estimation.

This paper is intended to serve as an introduction to the use of the Kalman filter in modeling atomic clocks and obtaining maximum likelihood estimates of the model paramaters from data on an ensemble of clocks. Tests for the validity of the model and confidence intervals for the parameter estimates are discussed. Techniques for dealing with unequally spaced and partially or completely missing multivariate data are described. The existence of deterministic frequency drifts in clocks is established and estimates of the drifts are obtained.

715,093
PB83-226720
(Order as PB83-226704, PC **A05**/MF **A01**)
Occupational Health Research and Training Facility, Cincinnati, OH.
Estimating Time from Atomic Clock.
R. H. Jones, and P. V. Tryon. 16 Jun 82, 8p
Prepared in cooperation with Colorado Univ. at Denver. Div. of Biometrics.
Included in Jnl. of Research of the National Bureau of Standards, v88 n1 p17-24 Jan-Feb 82.

Keywords: *Atomic clocks, *Cesium frequency standards, *Time measurement, Mathematical models, Time series analysis, Maximum likelihood estimation, Nonlinear estimation.

A Kalman recursive algorithm for estimating time from an ensemble of atomic clocks has been developed. The algorithm allows for the addition or deletion of clocks at any time, and provides automatic error detection and correction. The observation consist of time differences between clocks and may be taken at unequally spaced time points. Maximum likelihood estimates of the unknown parameters are obtained with confidence intervals, as well as hypothesis tests to determine whether the estimated parameters are significantly different from zero. The program is operational on the National Bureau of Standards' Time and Frequency Division's PDP 11/70.

715,094
PB83-233882 Not available NTIS
National Bureau of Standards, Washington, DC.
Shuttle Experiment to Demonstrate High-Accuracy Global Time and Frequency Transfer.
Final rept.
D. W. Allan, C. O. Alley, R. Decher, R. F. C. Vessot, and G. Winkler. Jul 82, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Geoscience and Remote Sensing GE-20, n3 p321-325 Jul 82.

Keywords: *Frequency standards, *Time standards, Masers, Comparison, Reprints, Hydrogen masers, Space shuttles.

The concept of a high accuracy global time and frequency transfer system is discussed. A hydrogen maser clock on board a space vehicle combined with a microwave Doppler cancellation system can provide direct frequency transfer with an accuracy of 10 to the -14th power and time transfer accurate to 1 nanosecond. The addition of short pulse laser techniques provides sub-nanosecond time transfer accuracy which can be used to calibrate the microwave system.

715,095
PB83-234237 Not available NTIS
National Bureau of Standards, Washington, DC.
Comparison of Experimental with Theoretical Photon Attenuation Cross Sections between 10 eV and 100 GeV.
Final rept.
H. Gerstenberg, and J. H. Hubbell. 1983, 3p
Pub. in Nucl. Data Sci. Technol. p1007-1009 1983.

Keywords: *X rays, *Gamma rays, *Nuclear cross sections, Attenuation, Comparison, Reprints, Data bases, Attenuation coefficients.

A computerized photon attenuation data base has been developed by the NBS Photon and Charged Particle Data Center for the photon energy range 10 eV to 100 GeV and for elements, with Z = 1 to 94. An example of use of this data base in the critical evaluation of a theory-based data-set is presented.

715,096
PB83-234369 Not available NTIS
National Bureau of Standards, Washington, DC.

Electric Polarizability of the Deuteron.
Final rept.
J. L. Friar, S. Fallieros, E. L. Tomusiak, D. Skopik, and E. G. Fuller. Mar 83, 3p
Pub. in Physical Review C 27, n3 p1364-1366 Mar 83.

Keywords: *Deuterons, *Polarization, Dispersion relations, Compton effect, Reprints, Photoabsorption.

An experimental value of the electric polarizability of the deuteron is extracted from deuteron photoabsorption data, a dispersion relation, and the low-energy theorem for Compton scattering. The experimental number requires the calculation of several small corrections, which are primarily magnetic in origin. Our value is somewhat smaller than, but consistent with, a recently reported experimental determination.

715,097
PB83-234393 Not available NTIS
National Bureau of Standards, Washington, DC.
Photon Mass Attenuation and Energy-Absorption Coefficients from 1 keV to 20 MeV.
Final rept.
J. H. Hubbell. 1982, 22p
Pub. in International Jnl. of Applied Radiation and Isotopes 33, p1269-1290 1982.

Keywords: *X rays, *Gamma rays, *Dosimetry, Attenuation, Reprints, Attenuation coefficients.

Mass attenuation coefficients mu/rho and mass energy-absorption coefficients (mu sub en)/rho are tabulated in units of (m squared)/kg for photon energies 1 keV to 20 MeV for 40 elements ranging from hydrogen (Z = 1) to uranium (Z = 92). In addition, mu/rho and (mu sub en)/rho values are tabulated over this same energy-range for 45 mixtures and compounds of dosimetric interest, computed from the above data using fractions-by-weight of the constituent elements. Source data for these tables are primarily theoretical.

715,098
PB83-234880 Not available NTIS
National Bureau of Standards, Washington, DC.
Pin-Well - NaI(Tl) Counting of 59.5-keV Gamma-Rays in the Decay of Americium-241.
Final rept.
J. M. R. Hutchinson, and P. A. Mullen. 1983, 4p
Pub. in International Jnl. of Applied Radiation and Isotopes 34, n2 p543-546 1983.

Keywords: *Gamma rays, *Radioactive decay, Reprints, *Americium 241, NaI detectors.

The 59.5-keV gamma-ray-emission rate in the decay of an (241) Am source has been measured using a specially constructed NaI(T1) thin-walled-well detector. From this measurement, and an alpha-particle-emission rate measurement on quantitatively related sources, the 59.5-keV gamma-ray probability per decay is 0.3582 + or - 0.0012.

715,099
PB83-235788 Not available NTIS
National Bureau of Standards, Washington, DC.
Particle Radiation by Hot Quark-Gluon Plasma.
Final rept.
M. Danos, and J. Rafelski. 1 Feb 83, 4p
Pub. in Physical Review D27, n3 p671-674 February 1 83.

Keywords: *Quarks, Pions, Reprints, *Hadrons, *Gluons, Quantum chromodynamics.

Highly excited hadronic matter consisting of quarks and gluons radiates an important fraction of its excitation energy by hadron emission. This relieves the surface pressure and reduces the importance of the expansion to the cooling of the plasma. Qualitative model calculations are presented.

715,100
PB83-235838 Not available NTIS.
National Bureau of Standards, Washington, DC.
Electron Scattering from Baryon Resonances in Nuclei.
Final rept.
M. Danos, and H. T. Williams. 16 Dec 82, 4p
Pub. in Physics Letters 119B, n1,2,3 p43-46 December 16, 82.

Keywords: *Baryon resonances, Electron scattering, Inelastic scattering, Reprints.

A zero parameter model calculation of deep inelastic electron scattering in the energy range of the Delta(1236) resonance is presented. It is assumed that the major effect of the virtual photon is to excite a Delta(1236) from a nucleon, and that this resonance is bound to the remaining nucleons. The results are compared with existing experimental data and with other theoretical results.

715,101
PB83-235911 Not available NTIS
National Bureau of Standards, Washington, DC.
Synchrotron Radiation - A Possible General Purpose Ring Application.
Final rept.
R. D. Deslattes. 1983, 19p
Pub. in Proceedings of Conference on New Horizons Electromagnetic Physics, Charlottesville, VA, April 21-24, 1982, p366-384.

Keywords: *Synchrotron radiation, Crystallography, Spectroscopy, X rays, Utilization, Storage rings.

This report attempts a very brief outline of the present-day synchrotron radiation facilities. It also considers a few applications to which these facilities are uniquely suited. Finally, it contains a provisional discussion of the possible role of a general purpose ring in this area.

715,102
PB83-251363 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Photonuclear Data Index, 1973 through 1981.
E. G. Fuller, and H. Gerstenberg. Aug 83, 155p
NBSIR-82-2543-1
See also COM-73-50244, and PB-284 499.

Keywords: *Photonuclear reactions, *Bibliographies, Tables(Data), Isotopes, Elements, Radiation measuring instruments.

This index, a supplement to NBS Special Publication 380, Photonuclear Reaction Data, 1973, primarily covers data published in the period from January 1973 through December 1981. It supersedes the first supplement to Special Publication 380 issued in August 1978. Organized by element and isotope, each entry in the index is for a specific reaction reported in a given reference. Information is given on the type of measurement, excitation energies studied, source type and energies, detector type and angular ranges covered in the measurement. Also included is an index to the more than 1200 data sets currently available in the Photonuclear Data Group's digital data library.

715,103
PB83-600002 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 12, Number 1, 1983.
c1983, 150p
See also PB83-600003 through PB83-600007.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature. Supplements to the Journal are published at irregular intervals and are not included in subscriptions to the Journal. They contain compilations which are too lengthy for a journal format.

715,104
PB83-600008 Not availabale NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 12, Number 2, 1983.
c1983, 229p
see also PB83-600009 through PB83-600015.

this journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature, nor for review articles of a descriptive or primarily theoretical nature. Supplements to the Journal are published at irregular intervals and are not included in subscriptions to the Journal. They contain compilations which are too lengthy for a journal format.

715,105
PB83-600023 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Journal of Physical and Chemical Reference Data, Volume 12, Number 4, 1983.
c1983, 235p
See also PB83-600024 through PB83-600030.

This journal is published quarterly by the American Chemical Society and the American Institute of Physics for the National Bureau of Standards. The objective of the Journal is to provide critically evaluated physical and chemical property data, fully documented as to the original sources and the criteria used for evaluation. Critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area, are also included. The principal source for the Journal is the National Standard Reference Data System (NSRDS). The Journal is not intended as a publication outlet for original experimental measurements such as are normally reported in the primary research literature nor for review articles of a descriptive or primarily theoretical nature. Supplements to the Journal are published at irregular intervals and are not included in a subscriptions to the journal. They contain compilations which are too lenghy for a journal format.

715,106
PB84-103555 Not available NTIS
National Bureau of Standards, Washington, DC.
Stochastic Models for Atomic Clocks.
Final rept.
J. A. Barnes, R. H. Jones, P. V. Tryon, and D. W. Allan. 1983, 12p
Pub. in Proceedings of the Annual Precise Time Time Interval (PTTI) Applications Planning Meeting (14th), Greenbelt, Maryland, 30 Nov-2 Dec 1982, NASA Conference Publications 2265, p295-306 1983.

Keywords: *Atomic clocks, Random processes, Stochastic processes, Frequency stability, Mathematical models, Maximum likelihood estimation, Parameter estimation.

In general, various combinations of five different power-laws seem to be adequate to describe almost all observed random behavior in atomic clocks. In addition to the random components, oscillators and clocks often show systematic, (i.e., deterministic) trends such as offsets in frequency and time, as well as linear drifts in frequency. For the atomic clocks used in the NBS Time Scales, an adequate model is the superposition of white FM, random walk FM, and linear frequency drift for times longer than about one minute. The model has been tested on several clocks using maximum likelihood techniques for parameter estimation and the residuals have been 'acceptably random.' Conventional diagnostics indicate that additional model elements contribute no significant improvement to the model fit even at the expense of added model complexity.

715,107
PB84-103639 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of Thermodynamic Temperature.
Final rept.
L. A. Guildner, and W. Thomas. 1982, 11p
Pub. in Proceedings of the International Symposium Temperature, Its Measurement and Control in Science and Industry (6th), Washington, DC. 5, p9-19, Mar 15-18, 1982.

Keywords: *Temperature measurement, Thermodynamics, Accuracy, *Thermodynamic temperature, Gas thermometers, Noise thermometers, Acoustic thermometry.

The thermometers with which thermodynamic temperatures can be accurately realized are discussed and results are cited over the range from 2 mK to 1336 K. The deviations of scales from the most accurate realizations of thermodynamic temperatures are presented. Improvements have increased the accuracy of gas thermometry, which is still the most accurate means of determining thermodynamic temperatures from ca 2.5 to 1337 K, but improvements in other techniques have increased their accuracy to nearly the same level. At the extremes of the temperature range, both high and low, techniques other than gas thermometry provide more accurate thermodynamic temperatures.

715,108
PB84-103688 Not available NTIS
National Bureau of Standards, Washington, DC.
Progress on the NBS-LANL CW Microtron.
Final rept.
P. H. Debenham, S. Penner, R. L. Ayers, R. I. Cutler, E. R. Lindstrom, D. L. Mohr, J. E. Rose, M. A. D. Wilson, N. R. Yoder, L. M. Young, R. E. Martin, A. Mitra, J. M. Potter, R. H. Stokes, P. J. Tallerico, and L. Wilkerson. Apr 82, 5p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Proceedings of the Conference Application of Accelerators in Research and Industry (7th), Denton, Texas, Nov 8-10, 1982, Institute of Electrical and Electronics Engineers Transactions on Nuclear Science NS-30, n2, p1391-1395, Apr 83.

Keywords: *Microtrons, Electron accelerators, Magnets, *Racetrack microtron, Beam optics.

The NBS-LANL racetrack microtron (RTM) currently under construction at the National Bureau of Standards is a demonstration accelerator to determine the feasibility of, and to develop the technology necessary for building high-energy, high-current, continuous beam (CW) electron accelerators using beam recirculation through room temperature of accelerating structures. The schedule calls for completion of the accelerator in 1984, followed by a year of detailed beam studies.

715,109
PB84-105980 Not available NTIS
National Bureau of Standards, Washington, DC.
Experimental Test of Virtual Photon Theory.
Final rept.
W. R. Dodge, E. Hayward, and E. Wolynec. Jul 83, 9p
Pub. in Physical Review C 28, n1 p150-158 Jul 83.

Keywords: Electron irradiation, Reprints, *Virtual photons, Virtual particles, Electrodisintegration, Zirconium 90.

An isochromat of the E1 virtual photon spectrum has been measured by counting the number of ground-state protons emitted by the 16.28 MeV isobaric analog state in 90Zr as a function of incident electron energy in the range 17--105 MeV. The experimental results reproduce well the distorted wave Born approximation spectra for a point Zr nucleus for electron energies up to 30 MeV. A radiator was used for electron energies of 60--100 MeV to measure the photodisintegration plus electrodisintegration cross section. These results showed that the Davies-Bethe-Maximon bremsstrahlung cross section magnitude yields the same result as the electrodisintegration results below 30 MeV where size corrections for the finite extent of the nucleus are minimal.

715,110
PB84-106186 Not available NTIS
National Bureau of Standards, Washington, DC.
Total Nuclear Inelastic Electron Scattering Cross Sections Compared to Sum Rule Calculations.
Final rept.
J. S. O'Connell, E. Hayward, J. W. Lightbody, X. K. Maruyama, P. Bosted, K. I. Blomqvist, G. Franklin, J. O. Adler, K. Hansen, and B. Schroder. Jun 83, 20p
Pub. in Physical Review C 27, n6 p2492-2499 Jun 83.

Keywords: *Electron scattering, *Scattering cross sections, Inelastic scattering, Excitation, Reprints, Sum rules, MeV range 100-1000.

The nuclear response to 200 - 350 MeV electrons inelastically scattered at 20 degrees for six nuclei ranging from A = 9 to 181 is given. An excitation energy integral is formed and compared with three theoretical calculations of the total inelastic scattering cross section.

715,111
PB84-106210 Not available NTIS
National Bureau of Standards, Washington, DC.
Electron Spin Polarization Measurements in Atomic and Surface Physics.
Final rept.
R. J. Celotta, and D. T. Pierce. Dec 82, 18p
Pub. in International Symposium on Ionized Gases (11th), Dubrovnik, Yugoslavia, August 23-27, 1982, Paper in Physics of Ionized Gases, p3-20 Dec 82.

Keywords: *Atomic physics, Electron spin, Polarization(Spin alignment), Surfaces, Reviews, *Electron spin polarization, Polarized beams, Magnetism.

Within a few years after Goudsmit and Uhlenbeck introduced the concept of electron spin to explain spectroscopic data in 1925, physicists were studying how spin polarization effects would arise in electron scattering experiments. The production or detection of electron polarization has traditionally been inefficient and cumbersome. Recent technological developments have changed that, however, and a new, and more promising, era of studies of electron spin polarization had begun.

715,112
PB84-106244 Not available NTIS
National Bureau of Standards, Washington, DC.
Elastic and Inelastic Electron Scattering from 50,52,54Cr.
Final rept.
J. W. Lightbody, J. B. Bellicard, J. M. Cavedon, B. Frois, D. Goutte, M. Huet, P. Leconte, A. Nakada, P. X. Ho, S. K. Platchkov, S. Turck-Chieze, C. W. de Jager, J. J. Lapikas, and P. K. Huberts. Jan 83, 20p
Pub. in Physical Review C 27, n1 p113-132 Jan 83.

Keywords: *Electron scattering, Scattering cross sections, Chromium isotopes, Elastic scattering, Inelastic scattering, Ground state, Reprints, *Chromium 50, *Chromium 52, *Chromium 54, Form factors.

Elastic and inelastic electron scattering cross sections are given for (50,52,54)Cr, at momentum transfers between 0.15 and 2.6/fm. Ground state charge distributions are derived from a combined analysis of these data and muonic atom data. Inelastic scattering form factors for 2(+), 4(+), and 6(+) states up to 4 MeV excitation are given along with shell model and phenomenological model fits to that data, B(EL) values, multipole dependence of effective charges, and other model parameters.

715,113
PB84-106368 Not available NTIS
National Bureau of Standards, Washington, DC.
Electrodisintegration of 56Fe, 59Co, and 64Zn.
Final rept.
W. R. Dodge, R. G. Leicht, E. Hayward, and E. Wolynec. Nov 81, 9p
Sponsored in part by National Science Foundation, Washington, DC., and Conselho Nacional de Desenvolvimento Cientifico e Tecnologico, Rio de Janeiro (Brazil).
Pub. in Physical Review C24, n5 p1952-1960, Nov 81.

Keywords: *Nuclear cross sections, Alpha particle reactions, Proton reactions, Iron isotopes, Cobalt isotopes, Zinc isotopes, Reprints, *Iron 56, *Cobalt 59, *Zinc 64, *Electrodisintegration, Giant resonance, Electron reactions, Virtual photons.

The (e,p) and (e, alpha) cross sections for (56)Fe, (59)Co, and (64)Zn have been measured in the electron energy range 16-100 MeV. They have been analyzed using the DWBA E1 and E2 virtual photon spectra. The E1 and E2 components in the proton and alpha channels have been obtained.

715,114
PB84-106384 Not available NTIS
National Bureau of Standards, Washington, DC.
Procedure for Calculating the Radiation Stopping Power for Electrons.
Final rept.
S. M. Seltzer, and M. J. Berger. 1982, 8p
Sponsored in part by Office of Naval Research, Arlington, VA., and Department of Energy, Washington, DC.
Pub. in International Jnl. of Applied Radiation and Isotopes 33, p1219-1226 1982.

Keywords: *Electrons, Bremsstrahlung, Approximation, Computation, Reprints, *Stopping power, GeV range 01-10.

A procedure is described for calculating the radiation stopping power for electrons, i.e., the mean energy loss per unit path length due to the emission of bremsstrahlung photons. For bremsstrahlung in the field of the atomic nucleus, the cross sections used are those of Pratt, Tseng, Lee, and Kissel at low and intermediate energies, and those of Davies, Bethe, Maximon, and Olsen at high energies. For bremsstrahlung in the field of the atomic electrons, the cross section of Haug (modified by a screening correction) is used. The radiation stopping powers in the energy region from 1 keV to 10 GeV have been fitted by a nine-parameter approximation formula. These parameters depend on the atomic number Z and are given for all Z from 1 to 100.

715,115
PB84-106632 Not available NTIS
National Bureau of Standards, Washington, DC.
Tables for Cascade-Summing Corrections in Gamma-Ray Spectrometry.
Final rept.
F. J. Schima, and D. D. Hoppes. 1983, 6p
Pub. in International Jnl. of of Applied Radiation and Isotopes 34, n8 p1109-1114 1983.

Keywords: *Gamma ray spectroscopy, Tables(Data), Reprints, Gamma cascades, Probability, Gamma detection.

Calculations of the spectral distortion caused by the simultaneous detection of cascade radiations in gamma-ray spectrometry involve terms containing the relative probability for the coincident emission of the radiations involved. Here the authors present tables of these probabilities (summing coefficients) for the most probable gamma rays of some frequently encountered radionuclides, to be combined with measured full-energy-peak or total efficiencies of a particular system to calculate emission rates that would be measured without cascade summing.

715,116
PB84-106673 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature-Drift Balancer for Calorimetry.
Final rept.
S. R. Domen. 1983, 2p
Pub. in International Jnl. of Applied Radiation and Isotopes 34, n6 p927-928 1983.

Keywords: Wheatstone bridges, Calorimeters, Radiation dosage, Reprints, *Calorimetry, Temperature effects.

Calorimeters used in radiation measurements often suffer from errors due to thermal drifts at positions of the heat sensors in a Wheatstone bridge. A simple resistance-capacitance circuit can be connected across a Wheatstone bridge in order to balance recorder pen drifts due to gradually changing temperature gradients that often occur in calorimeters.

715,117
PB84-107143 Not available NTIS
National Bureau of Standards, Washington, DC.
Divergence of the Legendre Expansion of the Electron Velocity Distribution.
Final rept.
W. P. Allis. 1983, 9p
Pub. in Proceedings of NATO Advanced Study Institute Electrical Breakdown Discharge on Gases: Fundamental Processes and Breakdown held at Les Arcs (France) on June 28-July 10, 1981, p187-205 1983.

Keywords: *Free electrons, *Electron energy, Boltzmann equation, Divergence, Velocity, Legendre functions.

The author considers the velocity distribution of free electrons in a gas of stationary molecules subjected to an electric field E = -ma/e but with no density gradients. The author first discusses the distribution phi(v vector) when the electrons disappear, by attachment or recombination, at each collision, and then introduce the scattered-in electrons as a separate source function S(v,f) to evaluate the full distribution f(v vector). It will be seen that the functions phi are a recognizable part of the function f. They describe the collision-less 'streaming' of the fast electrons in front of the swarm which gain energy from the field and effectively disappear on collision, whereas the bulk of the distribution is determined by the balance between energy gained from the field and lost to recoil or inelastic collisions.

715,118
PB84-107184 Not available NTIS
National Bureau of Standards, Washington, DC.
UHV (Ultra-High Vacuum) Compatible Two-Crystal Monochromator for Synchrotron Radiation.
Final rept.
P. L. Cowan, J. B. Hastings, T. Jach, and J. P. Kirkland. 15 Apr 83, 5p
Pub. in Nuclear Instruments and Methods 208, n1-3 p349-353, 15 Apr 83.

Keywords: *Synchrotron radiation, *Monochromators, Ultrahigh vacuum, X rays, Design, Tests, Performance, Synchrotrons, Reprints.

For obvious reasons, monochromatic synchrotron radiation studies at soft X-ray energies require that the monochromator be ultra-high vacuum compatible. The authors will describe the design, testing and performance of a linkage based, two-crystal, non-dispersive monochromator for use at synchrotrons. The use of a mechanical linkage reduces the degrees of freedom, and minimizes the number of motion feedthroughs into the vacuum. The linkage chosen maintains a constant output beam position, and assures that the second crystal is always properly positioned. Pertinent design features include direct angular encoding and a feedback controlled correction system to eliminate the effects of mechanical imperfections.

715,119
PB84-107218 Not available NTIS
National Bureau of Standards, Washington, DC.
PIN Diodes as Detectors in the Energy Region 500 eV - 10 keV.
Final rept.
T. Jach, and P. L. Cowan. 1983, 3p
Pub. in Nuclear Instruments and Methods 208, n1-3 p423-425 1983.

Keywords: Reprints, *PIN diodes, *X-ray detection, EV range 100-1000, KeV range 01-10.

PIN diodes offer several advantages over ion chambers in signal-to-noise ratio, size, and ultra-high vacuum compatibility. The authors have evaluated several commercially available PIN diodes, suitable for use in the X-ray region 500 eV = or < E = or < 10 keV, using both brehmsstrahlung and characteristic lines from X-ray tubes between 1.29 and 8.9 keV. They present data on response functions, noise levels, and linearity of response.

715,120
PB84-115831
(Order as PB84-115799, PC **A05**/MF **A01**)
National Bureau of Standards, Boulder, CO.
Nuclear Orientation Thermometry.
H. Marshak. 1 Feb 83, 43p
Included in Jnl. of Research of the National Bureau of Standards, v88 n3 p175-217, May-Jun 83.

Keywords: *Temperature measurement, Low temperature research, Cobalt 60, Gamma rays, Cryogenics, *Nuclear orientation thermometry, *Gamma ray anisotropy thermometry.

Low temperature nuclear orientation thermometry, in particular gamma-ray anisotropy thermometry, is discussed both from a theoretical and practical point of view. Detailed information is given on the most often used gamma-ray anisotropy thermometers, along with a comprehensive description of the gamma-ray anisotropy technique. The (60)Co in (hcp) cobalt single crystal gamma-ray anisotropy thermometer is discussed in considerable detail as it is used more frequently in comparison experiments with other primary thermometers. Recent experimental results using gamma-ray anisotropy thermometers are also reviewed.

715,121
PB84-125301
(Order as PB84-125293, PC **A05**/MF **A01**)
Harvard Univ., Cambridge, MA.
History of Atomic Clocks.
N. F. Ramsey. 21 Jun 83, 76p
Included in Jnl. of Research of the National Bureau of Standards, v88 n5 p301-320, Sep-Oct 83.

Keywords: *Atomic clocks, *Frequency standards, *Time standards, Atomic beams, Accuracy, Stability, Reproducibility, History, Reviews.

The history of atomic and molecular standards of time and frequency is traced from the earliest work on molecular and atomic beam resonance techniques to more recent developments that promise improved standards in the future. The various devices currently used as standards are discussed in detail from an historical prospective. The latter part of the article is devoted to a discussion of prospective developments which hold promise for major improvements in accuracy, stability and reproducibility.

715,122
PB84-135912 Not available NTIS
National Bureau of Standards, Washington, DC.
Measurement of the (235)U(n,f) Cross Section from 0.3 to 3.0 MeV Using the NBS (National Bureau of Standards) Electron Linac.
Final rept.
A. D. Carlson, and J. W. Behrens. 1983, 4p
Pub. in Proceedings of International Conference on Nuclear Data Science Technology Held at Antwerp (Belgium) on September 6-10, 1982, p456-459 1983.

Keywords: *Uranium 235, *Fission cross sections, Neutron flux, Ionization chambers, Neutron sources, Linear accelerators, Neutron detectors, KeV range 100-1000, MeV range 01-10.

Progress is reported on a measurement of the 235U(n,f) cross section from 0.3 to 3.0 MeV using the NBS electron linac as a pulsed neutron source. Fission events were detected using a parallel-plate, ionization fission chamber located 69.5 m from the neutron-producing tungsten target and containing 170.9 plus or minus 2.1 mg of (235)U. The absolute neutron flux was measured with the NBS black neutron detector, located at 200.4 m and coaxial with the fission chamber. A Monte Carlo program was used to calculate the neutron detection efficiency of the black detector. The present paper gives preliminary results.

715,123
PB84-137785 Not available NTIS
National Bureau of Standards, Washington, DC.
SURF II Upgrade Features Magnet and RF System Enhancements.
Final rept.
G. Rakowsky. Aug 83, 3p
Pub. in IEEE Transactions on Nuclear Science NS-30, n4 p3444-3446 Aug 83.

Keywords: Electrons, Magnets, Reprints, *Synchrotron Ultraviolet Radiation Facility, *Storage rings.

The NBS electron storage ring, SURF-II, has been upgraded with a number of major enhancements. The magnet system capability has been increased from 240 to 300 MeV, although actual operation is presently RF limited to 280 MeV. The storage ring magnet has been carefully mapped, resulting in more precise determination of beam energy and better radiometric data. The RF system has been augmented by an auxiliary second harmonic system, terminating in a novel, dual purpose cavity.

715,124
PB84-137843 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS (National Bureau of Standards)-LANLRTM Injector Installation.
Final rept.
M. A. Wilson, R. I. Cutler, E. R. Lindstrom, S. Penner, N. R. Yoder, R. L. Ayres, D. L. Mohr, L. M. Young, and E. Martin. Aug 83, 3p
Pub. in IEEE Transactions on Nuclear Science NS-30, n4 p3021-3023 Aug 83.

Keywords: *Electron guns, Electron beams, Reprints, *Microtrons, *Racetrack microtron, Beam transport, RF systems.

A cw 100 keV electron gun and beam transport system has been installed at NBS for the NBS-LANL Racetrack Microtron (RTM). The function of the gun and transport system is to provide a chopped and bunched electron beam for matched insertion into the capture section of a 5 MeV linac injector for the RTM. The chopper system employs multiple R.F. cavities coupled in phase and amplitude to minimize transverse emittance growth. Preliminary gun tests indicate the design emittance of 4(pi) mm-mrad for 4 mA at 100 keV can be achieved. The electron gun, beam transport system, control system, and r.f. chopping and bunching techniques will be described, along with the results of initial 100 keV beam test.

715,125
PB84-138296 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS (National Bureau of Standards) Proposal for a One GeV CW Racetrack Microtron Facility.
Final rept.
S. Penner. Aug 83, 7p
Pub. in IEEE Transactions on Nuclear Science NS-30, n4 p3279-3285 Aug 83.

Keywords: *Particle accelerators, *Electron accelerators, Electron beams, Reprints, *Racetrack microtrons, *Microtrons, Beam transport, RF systems, GeV range 01-10.

As part of a joint accelerator research project with the Los Alamos National Laboratory, NBS is now building a 200 MeV, high current, CW racetrack microtron (RTM). Upon its completion, scheduled for 1984, we propose to use this machine to provide CW electron beams to nuclear physics experimenters, and also as the injector for a second stage RTM to boost the final energy to one GeV. A building addition of 35,000 square feet will house the second stage RTM and new experimental facilities. Subharmonic RF beam splitting is planned to allow up to three simultaneous beams for experiments, with currents up to 100 microamps each. In addition, low and high energy beams at low currents for tagged-bremsstrahlung experiments can be delivered at the same time. This proposed multi-user facility is intended to be a national center for electromagnetic nuclear physics research.

715,126
PB84-138379 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS-LANL, RTM End-Magnet Field Mapper.
Final rept.
E. R. Lindstrom, P. H. Debenham, D. L. Mohr, and N. R. Yoder. Aug 83, 3p
Pub. in IEEE Transactions on Nuclear Science NS-30, n4 p3605-3607 Aug 83.

Keywords: *Magnetic fields, *Magnets, Measurements, Mapping, Magnetometers, Particle accelerators, Reprints, *Racetrack microtron, *Microtrons, Computer applications.

A computer-controlled magnetic field mapper is under construction at the National Bureau of Standards to map the end magnets of the NBS-LANL racetrack microtron (RTM). The mapper consists of a large, two-dimensional translation stage which simultaneously positions a nuclear magnetic resonance (NMR) magnetometer probe in the 60 cm x 135 cm uniform field region and a temperature-compensated Hall effect probe in the fringe field region. A computer-based control system automatically positions the probes at points on a selected grid and records the measured field values and positions in computer memory. In this paper the authors describe the field mapping requirements, the mapper, its operation, and the field measurements and analysis that are to be performed.

715,127
PB84-138528 Not available NTIS
National Bureau of Standards, Washington, DC.
Opening Remarks -- Symposium on Precision Measurement and Gravity Experiment.
Final rept.
J. E. Faller. 1983, 2p
Pub. in Proceeding of 1983 Int. School Symp. Precision Measurement Gravity Experiment, Taipei, Republic of China, Jan 24-Feb 2, 1983, p5-6 1983.

Keywords: *Measurement, *Precision, Errors, Theories.

The character and philosophy of precision measurement is discussed. Problems relating to systematic errors are mentioned.

715,128
PB84-138536 Not available NTIS
National Bureau of Standards, Washington, DC.
Influence of Physical Property Data on the Design of Shell and Tube Heat Exchangers.
Final rept.
M. Mickley, and H. J. M. Hanley. Nov 82, 3p
Pub. in Proceedings of American Society of Mechanical Engineers 1982 Winter Meeting, Phoenix, AZ, Nov 14, 1982, Paper No. 82-WA/HT-60, p1-3 Nov 82.

Keywords: *Heat exchangers, *Structural design, Heat transfer, Design criteria, Operating costs, Fixed investment, Error analysis.

This paper addresses the physical property data needed to design heat transfer equipment and the effect of imprecision in such data on capital investment and operating costs. An analysis is presented for the design of a shell and tube heat exchanger. For two specific examples chosen, it is shown that a ten percent error in data for the working fluids may result in as much as a 24 percent uncertainty in the optimum size of the heat exchanger, which translates into a 13 percent increase in the installed exchanger cost and a 10 percent increase in the annual fixed costs of the exchanger.

715,129
PB84-141662 Not available NTIS
National Bureau of Standards, Washington, DC.
Transient Forced Convection Heat Transfer to Helium during a Step in Heat Flux.
Final rept.
P. J. Giarratano, and W. G. Steward. May 83, 8p
Pub. in Jnl. of Heat Transfer 105, p350-357 May 83.

Keywords: *Helium, *Convection, Meat transfer, Subcritical flow, Supercritical flow, Reprints, *Forced convection, Transients.

Transient forced convection heat transfer coefficients for both subcritical and supercritical helium in a rectangular flow channel heated on one side were measured during the application of a step in heat flux. Zero flow data were also obtained. The heater surface which served simultaneously as a thermometer was a fast response carbon film. The experimental data and a predictive correlation are presented.

715,130
PB84-148717 PC **A05**/MF **A01**
Max-Planck-Inst. fuer Chemie, Mainz (Germany, F.R.).
Total Photon Absorption Cross Section Measurements, Theoretical Analysis and Evaluations for Energies Above 10 MeV.
H. A. Gimm, and J. H. Hubbell. Jun 78, 81p NBS-TN-968

Keywords: *Absorption cross sections, *Photon cross sections, *Gamma cross sections, Pair production cross sections, Lead, Tantalum, Tin, Copper, Photonuclear reactions, Correction, Tables(Data), Graphs(Charts), *Coulomb correction, MeV range 10-100, MeV range 100-1000, Screening, Triplets.

Atomic photoabsorption cross sections have been calculated in the energy range from 10 MeV to 350 MeV. For Pb, Ta, Sn and Cu total gamma-ray absorption cross sections were measured between 10 MeV and 160 MeV and compared with the theoretical results. An estimate of the uncertainties in the calculated atomic cross sections is given.

715,131
PB84-151562 Not available NTIS
National Bureau of Standards, Washington, DC.
First Nonadiabatic Correction in Model Potential Theory.
Final rept.
D. W. Norcross. Nov 83, 2p
Pub. in Physical Review A 28, n5 p3095-3097 Nov 83.

Keywords: Potential theory, Schrodinger equation, Eigenfunctions, Electrons, Interactions, Correction, Reprints, *Model potentials, Long range interactions.

The derivation of the first nonadiabatic correction in a model potential for one or more electrons outside a spherically symmetric core is considered. Earlier conclusions that no three-body (two electrons plus core) term of this type exists are confirmed. An alternative derivation of this term, with the same conclusion, is sketched. The question of the appropriate normalization of the eigenfunctions of the model Schrodinger equation is also addressed.

715,132
PB84-151794 Not available NTIS
National Bureau of Standards, Washington, DC.
Prototype Measurement of the Newtonian Gravitational Constant Using an Active Magnetic Suspension Torsion Fiber.
Final rept.
J. E. Faller, and W. A. Koldewyn. 1983, 16p
Pub. in Proceedings of 1983 International School Symposium on Precision Measurement Gravity Experiment, Taipei, Republic of China, Jan 24-Feb 2, 1983 p541-556.

Keywords: *Fundamental constants, Measurement, Torsion, Fibers, *Gravitational constant, Magnetic suspension.

The use of an active magnetic suspension torsion fiber to measure G is discussed. The problems encountered and the motivation for trying this new approach are discussed.

715,133
PB84-151885 Not available NTIS
National Bureau of Standards, Washington, DC.
Integral Reaction Rate Measurements in 252Cf and 235U Fission Spectra.
Final rept.
G. P. Lamaze, E. D. McGarry, and F. Schima. 1983, 5p
Pub. in Proceedings of Nucl. Data Sci. Technol., Antwerp, Belgium, September 6-10, 1982, p425-428 1983.

Keywords: *Uranium 235, *Fission neutrons, Nuclear cross sections, Neutron reactions, Proton reactions, Standards, *Neutron dosimetry, *Californium 252, Iron 54, Indium 115, Nickel 58.

In support of the light water reactor pressure vessel (LWR-PV) surveillance dosimetry program established by the U.S. Nuclear Regulatory Commission, the National Bureau of Standards is undertaking a series of measurements to provide a physical basis for neutron dosimetry standards. Reaction rate measurements have been made with both 252 Cf and 235U fission neutron fields. The following reactions have been measured through an activation technique: 115In(n,n') 58Ni(n,p) and 54Fe(n,p). The neutron emission rate of the 252Cf source has been measured with the MnSO4 bath technique, thus permitting a direct measure of the spectrum averaged integral cross section for Cf. The source strength of the 235U fission neutron field has been measured relative to the 252Cf neutron field using the 115In(n,n') reaction. All measurement of cross sections in the 235U fission field are therefore relative measurements.

715,134
PB84-151893 Not available NTIS
National Bureau of Standards, Washington, DC.
Development of Calibrated Transfer Specimens of Thick, Low-Density Insulation.
Final rept.
B. G. Rennex, R. R. Jones, and D. G. Ober. Jan 83, 8p
Pub. in Proceedings of the International Thermal Conductivity Conference (17), National Bureau of Standards, Gaithersburg, MD., June 15-18, 1981, p419-426 Jan 83.

Keywords: *Thermal insulation, Thermal measurements, Thermal conductivity, Thermal resistance, Heat transfer, Heat transmission, Finite element analysis, Reprints.

The Thermal Insulation Group at the National Bureau of Standards has been developing the techniques necessary to provide thick, low-density calibrated specimens to the thermal testing community. Previous research has indicated the need to measure the apparent thermal conductivity or resistance at thicknesses up to 6 inches in order to account for apparatus systematic errors, and in order to understand better the 'thickness effect' due to radiation heat transfer. In order to provide consistency among the heat-flow-meter and guarded-hot-plate apparatuses in the United States, NBS has agreed to provide the above-mentioned samples, in addition to the high-density specimens already provided.

715,135
PB84-152503 Not available NTIS
National Bureau of Standards, Washington, DC.
FASTBUS for Data Acquisition and Control.
Final rept.
L. Costrell, and W. K. Dawson. Aug 83, 17p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-30, n4 p2147-2151 Aug 83.

Keywords: *Data acquisition, Data processing, Parallel processors, Control, Reprints, *FASTBUS system, *Channels(Data transmission), *Data busses, High energy physics, Computerized control systems.

FASTBUS is a standarized modular data-bus system for data acquisition, data processing and control applications. It is the result of an interlaboratory development undertaken to meet the needs of the high energy physics community. However, the versatility, speed and addressing capability of FASTBUS make it attractive for many other types of application. A FASTBUS system consists of bus Segments which operate independently but dynamically link together as needed for operation passing. This parallel processing feature accounts to a great extent for the high throughput of FASTBUS in multisegment systems. Master modules compete for single or multiple Segment Control through a bus arbitration scheme using assigned priorities. Logical, geographical, secondary and broadcast addressing methods are used to access either data space or control and status register space. Features include block transfer, a sparse data scan interrupts.

715,136
PB84-152511 Not available NTIS
National Bureau of Standards, Washington, DC.
High Resolution Wire Scanner Beam Profile Monitor with a Microprocessor Data Acquisition System.
Final rept.
R. I. Cutler, D. L. Mohr, J. K. Whittaker, and N. R. Yoder. Aug 83, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-30, n4 p2213-2215 Aug 83.

Keywords: Data acquisition, Reprints, *Racetrack microtron, *Microtrons, *Beam monitors, *Beam profilers, High resolution, Microprocessors.

A beam profile monitor has been constructed for the NBS-LANL Racetrack Microtron. The monitor consists of two perpendicular 0.03mm diameter carbon wires that are driven through an electron beam by a pneumatic actuator. A long lifetime electroformed nickel bellows is used for the mechanical-motion vacuum feedthrough. Secondary emission current from the wires and a signal from a transducer measuring the position of the wires are simultaneously digitized by a microprocessor to yield beam current density profiles in two dimensions. The wire scanner is designed for use with both pulsed and cw beams.

715,137
PB84-152537 Not available NTIS
National Bureau of Standards, Washington, DC.
Standard Reference Materials for Thermal Conductivity Below 100 K.
Final rept.
R. Berman, N. D. Hardy, M. Sahota, J. G. Hust, and R. J. Tainsh. 1983, 12p
Pub. in Proceedings of Thermal Conductivity 17, held at Gaithersburg, MD. on June 15-18, 1981 p105-116 1983.

Keywords: *Standards, *Thermal conductivity, Cryogenics, Stainless steels, Iron, Tungsten, *Standard reference materials.

As part of a CODATA sponsored measurement intercomparison program, the thermal conductivities of Standard Reference Materials from NBS were measured by several laboratories. This paper describes the results of these measurements and shows, contrary to previous belief, that large discrepancies (up to 20%) occur at low temperatures as they often do at high temperatures. The materials studied, supplied by NBS-OSRM, are stainless steel, electrolytic iron, and tungsten. These materials were chosen in order to minimize the uncertainty caused by material variability and because of the previous extensive characterization performed by NBS and other laboratories. Measured thermal conductivities at temperatures below 100 K from four laboratories are discussed and compared.

715,138
PB84-153097 Not available NTIS
National Bureau of Standards, Washington, DC.
Time and Frequency Standards Based on Charged Particle Trapping.
Final rept.
W. M. Itano, D. J. Wineland, H. Hemmati, J. C. Bergquist, and J. J. Bollinger. Apr 83, 3p
Pub. in IEEE Transactions on Nuclear Science NS-30, n2 p1521-1523 Apr 1983.

Keywords: *Time standards, *Frequency standards, Hyperfine structure, Ions, Reprints, *Atomic frequency standards, Ion traps, Laser cooling, Beryllium ions, Mercury ions, Magnesium ions.

Microwave or optical frequency standards based on internal resonance transitions of ions confined in electromagnetic traps have the fundamental advantages of long observation times and small perturbations. These advantages are somewhat offset by low signal to noise ratios. Work at NBS has concentrated on microwave hyperfine transitions of atomic ions stored in Penning-type ion traps. The use of narrowband, tunable light sources for state selection and detection and for reducing the average kinetic energy of the ions (laser cooling) is an important feature of this work. Results to date include the fluorescence detection and cooling to about 50 mK of a single Mg (+) ion and the observation of a 0.012 Hz linewidth on a 300 MHz (25)Mg(+) hyperfine transition. A frequency standard based on (201)Hg(+) ions is under development. Related work, mostly based on RF-type ion traps, is underway at several other labs.

715,139
PB84-153154 Not available NTIS
National Bureau of Standards, Washington, DC.
Storage Rings as Sources of Soft X-Ray Emission.
Final rept.
R. P. Madden, and S. C. Ebner. 1981, 6p
Pub. in AIP Conference Proceedings 75, p1-5 1981.

Keywords: *Synchrotron radiation, *X rays, Plasma diagnostics, Comparison, Reprints, *Storage rings, *Soft x radiation, Radiometric analysis, Calibration.

The properties of synchrotron radiation are discussed and the outputs and characteristics of the storage rings available in the U.S. are intercompared. The use of these sources for the radiometric calibration of plasma diagnostic instrumentation are discussed in some detail. The importance of the proper treatment of polarization, overlapping orders, and solid angle effects are covered. The experience gained at NBS in the calibration of plasma diagnostics instruments are examined.

715,140
PB84-153667 Not available NTIS
National Bureau of Standards, Washington, DC.
Performance of the NBS-LANL RTM Injection Line Vacuum System.
Final rept.
R. I. Cutler. 1983, 2p
Pub. in IEEE Transactions on Nuclear Science NS-30, n4 p2904-2905 1983.

Keywords: Electron beams, Performance, Reprints, *Racetrack microtron, *Microtrons, *Vacuum systems, *Cryopumps.

A 1000 1/sec cryopump is used to provide the hydrocarbon-free vacuum required for the 100 keV electron beam transport line of the NBS-LANL Racetrack Microtron. The beam line, is 3.5 cm in diameter and 4 m long. To overcome the poor vacuum conductance of the beam line, it is pumped every 1/2 meter by a 15 cm diameter vacuum manifold which is connected to the cryopump. A single cryopump is used rather than several ion pumps to reduce costs and to provide easier starting. An oil-free roughing pump and sorption pump are used in the initial pumpdown. The vacuum system, is all metal sealed. Vacuums of 2 x 10 to the -8th power torr are reached in 8 hours from atmospheric pressure without baking out the system, and ultimate vacuums of 4 x 10 to the -9th power torr are achieved.

715,141
PB84-154590 Not available NTIS
National Bureau of Standards, Washington, DC.
Covariant Concept of Gravitational Energy.
Final rept.
E. Gliner, and I. Dymnikova. 15 Sep 83, 7p
Pub. in Physical Review D 28, n6 p1278-1284, 15 Sep 83.

Keywords: *General relativity, Special relativity, Tensor analysis, Gravitational fields, Reprints, *Gravitational energy, Conservation laws.

The covariant approach is proposed for the energy distribution of matter integrated with gravitation. The approach is based on the generalization of the Special Relativity stress-energy tensor up to the fourth tensor rank which introduces the anisotropies of mass, impulse and their fluxes. The components describing anisotropies form an 'energy deviator' which is a traceless fourth rank tensor corresponding to Weyl's part of gravitation. The approach uses an alternative way to generalize Special Relativity notions other than pseudotensorial approaches and gives an additional opportunity to understand the role and place of the latter.

715,142
PB84-154640 Not available NTIS
National Bureau of Standards, Washington, DC.
Temperature, Strain, and Magnetic Field Measurements.
Final rept.
L. L. Sparks. 1983, 57p
Pub. in Chapter 14 in Materials at Low Temperatures, p515-571 1983.

Keywords: *Temperature measuring instruments, *Strain gages, *Magnetometers, *Cryogenics, Hall effect, Resistance thermometers, Nuclear magnetic resonance, Magnetic fields, Strains, Measurement, Thermocouples.

The measurement of three parameters at low temperature are discussed in this chapter - temperature (T), strain (epsilon), and magnetic field strength (H). Two primary goals are to present information necessary to understand the most widely used devices for measuring T, epsilon, and H, and to discuss techniques and materials used in conjunction with low temperature measurements.

715,143
PB84-155290 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC.
Piece-Wise Analytic Evaluation of the Radiative Tail from Elastic and Inelastic Electron Scattering.
L. C. Maximon, and S. E. Williamson. Dec 83, 108p NBSIR-83-2788
Prepared in cooperation with Illinois Univ. at Urbana-Champaign.

Keywords: *Electron scattering, *Scattering cross sections, Elastic scattering, Inelastic scattering, Differential cross sections, Numerical integration, Computer programs, MSPLTIM computer program.

The report discusses the calculation of the radiative tail from the elastic peak in medium and high energy electron scattering as well as from a discrete inelastic level of the recoiling nucleus. The authors examine the method generally used for this calculation, viz., a numerical integration of the differential cross section over the angles of the unobserved photon, and discuss the difficulties inherent in this numerical integration due to the sharp peaking of the integrand. They present an alternative method for calculating the radiative tail, in which the region of integration is divided into an arbitrary number of subintervals, the structure functions are fitted by cubic spline functions in each subinterval, and the integrations are then performed analytically in closed form. This method has the advantages of greatly increased accuracy and a reduction of the computation time by a factor which can vary between 10 and 1000, depending on the kinematics.

715,144
PB84-217470 PC **A10**/MF **A01**
National Bureau of Standards (NML), Washington, DC. Center for Radiation Research.
Center for Radiation Research (of the National Bureau of Standards) Technical Activities for 1983.
R. S. Caswell. Apr 84, 214p NBSIR-84/2848

Keywords: *Research projects, *Radiation, Plasma radiation, Atomic spectroscopy, Nuclear radiation, Radioactivity, X rays, Far ultraviolet radiation, Spectroradiometers, Radiometry, Radiation measuring instruments, Synchrotron radiation, Sources, National Bureau of Standards, Center for Radiation Research.

This report summarizes research projects, measurement method development, testing and data evaluation activities, carried out during Fiscal Year 1983 in the NBS Center for Radiation Research. These activities fall in the areas of radiation measurements, atomic and plasma radiation, nuclear radiation, radiation physics, radiometric physics, and radiation sources and instrumentation.

715,145
PB84-218049 PC **A08**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Electronics and Electrical Engineering.
Bibliography of Data on Electrical Breakdown in Gases.
Final rept.
R. J. Van Brunt, and W. E. Anderson. Apr 84, 174p NBS/TN-1185
Also available from Supt. of Docs as SN003-003-02571-2. Sponsored in part by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Gases, *Bibliographies, *Electrical faults, *Dielectric breakdown, Vapors, Tables(Data), Surfaces, Electric coronas, Indexes(Documentation), Critical fields, Ionization, Plasmas(Physics).

This report consists of a bibliography of currently published data on electrical breakdown in gases. The bibliography contains a list of archival papers and books published since 1950, an index indicating the references that give particular types of data for each gas, an author index, and a list of relevant, regular technical conferences. The citations given in the bibliography contain experimental or theoretical data on breakdown which include: (1) sparking potentials; (2) breakdown voltages; (3) critical fields, or field-to-gas density ratios; (4) corona inception voltages; (5) voltage-time characteristics; (6) relative and absolute dielectric strengths; and (7) breakdown probabilities. Types of data considered include those which apply to uniform and nonuniform fields; ac, dc, and impulse voltages; and possible effects of particles, surfaces, interfaces, and corona. This bibliography is intended to serve as a guide in locating data on breakdown which are most relevant to particular applications.

715,146
PB84-218460 Not available NTIS
National Bureau of Standards, Washington, DC.
Photon Scattering from 12C and 208Pb in the Delta-Region.
Final rept.
E. Hayward, and B. Ziegler. 1984, 14p
Prepared in cooperation with Max-Planck-Inst. fuer Chemie, Mainz (Germany, F.R.).
Pub. in Nuclear Physics (Section) A414, p333-346 1984.

Keywords: *Photon cross sections, *Carbon 12, *Scattering cross sections, Dispersion relations, Bremsstrahlung, Inelastic scattering, Reprints, *Lead 208, *Cross sections, Delta resonances.

The photon scattering cross sections at 115 degrees for (12)C and (208)Pb have been measured using bremsstrahlung energies E, of 150, 200, 250, 300, 350, and 400 MeV. Scattered photons having energies in the range 0.9 E to E were accepted by the detector. The measured cross sections are much larger than the prediction of a simple model relating the scattering cross section at a large angle to the forward scattering cross section and the form factor for elastic electron scattering. This discrepancy is discussed in terms of collective effects, inelastic scattering, or exchange current distributions.

715,147
PB84-218825 Not available NTIS
National Bureau of Standards, Washington, DC.
Standard Model Constraints on Fermions.
Final rept.
P. Fishbane, S. Meshkov, and P. Ramond. 5 Jan 84, 5p
Pub. in Physics Letters B, v134B n1-2 p81-85, 5 Jan 84.

Keywords: *Fermions, Nuclear models, Leptons, Quarks, Reprints, SU-3 groups, SU-2 groups, U-1 groups.

The authors present a catalog of fermions allowed by the standard model. These new fermions are restricted to sets which are anomaly free, vector-like with respect to electric charge and color, and have either delta(I sub W) = 0 (totally vector-like) or delta(I sub W) = 1/2 (chiral)masses. The authors list some simple examples where the anomalies of the leptons (quarks) cancel among themselves as well as against each other.

715,148
PB84-219468 Not available NTIS
National Bureau of Standards, Washington, DC.
Transient Fields in Dispersive Media.
Final rept.
E. Marx. Nov 83, 6p
Pub. in Jnl. of Mathematical Physics 24, n11 p2602-2607 1983.

Keywords: *Electromagnetic scattering, Electromagnetic fields, Integral equations, Wave equations, Maxwells equations, Plasmas(Physics), Reprints, Three dimensional, Transients.

The problem addressed in this paper is the determination of transmitted and scattered fields produced by a

transient electromagnetic field incident on a three-dimensional body when the body and the surrounding medium are allowed to be dispersive. Instead of decomposing the pulse into its Fourier components, the solution is carried out in the time domain to take advantage of marching-in-time procedures. Maxwell's equations are suitably modified, and the reduction of the problem to the solution of an integral equation for a single tangential vector field is adapted to dispersive media. A simple conductor and a collisionless plasma are studied as examples.

715,149
PB84-219831 Not available NTIS
National Bureau of Standards, Washington, DC.
Electromagnetic Scattering from Perfectly Conducting Rough Surfaces in the Resonance Region.
Final rept.
D. Maystre. Nov 83, 11p
Pub. in IEEE (Institute of Electrical and Electronics Engineers), Transactions on Antennas and Propagation AP-31, n6 p885-895 Nov 83.

Keywords: *Electromagnetic scattering, Light scattering, Cylindrical bodies, Surface roughness, Approximation, Computation, Electric current, Reprints, Computer applications.

A rigorous integral formalism for the problem of scattering from a cylindrical, perfectly conducting rough surface of arbitrary shape is introduced. The computer code issued from this theory enables us to show the low range of the incident field on the surface current density. This phenomenon is explained using a new approximate theory, able to express the scattered field in the form of an integral whose integrand is known in closed form. Using the rigorous computer code, we prove that the new approximate theory is always better than the Kirchhoff approximation in the resonance region. Finally, it is shown that the phenonemon of low range of the incident field permits the rigorous computation of the field scattered from a rough surface of arbitrary width.

715,150
PB84-219963 Not available NTIS
National Bureau of Standards, Washington, DC.
Momentum-Space Solution of a Bound-State Nuclear Three-Body Problem with Two Charged Particles.
Final rept.
L. C. Maximon, D. R. Lehman, A. Eskandarian, and B. F. Gibson. Apr 84, 11p
Sponsored in part by Department of Energy, Washington, DC.
Pub. in Physical Review C 29, n4 p1450-1460 Apr 84.

Keywords: *Three body problem, Nucleons, Wave functions, Charged particles, Perturbation theory, Reprints, *Bound state, Faddeev equations.

Momentum-space wave function equations are derived for the three-body system of one neutral and two charged particles where the separable interaction is spin and charge independent. The three-body wave function is decomposed so that the equations for the 'pure' nuclear components contain the two-nucleon t-matrix, as usual, but the equation for the additional Coulomb component is formulated in terms of the Coulomb potential rather than introducing the Coulomb t-matrix. The relationship of these equations to the scattering-amplitude equation of Veselova, in which the Coulomb t-matrix appears explicitly, as applied to the same problem by Kok et al., is given. The authors conclude that the Coulomb interaction can be incorporated easily into momentum-space three-nucleon, bound-state calculations.

715,151
PB84-220995 Not available NTIS
National Bureau of Standards, Washington, DC.
Scaling Variables for Coincident Electron Scattering.
Final rept.
J. S. O'Connell. 16 Feb 84, 2p
Pub. in Physics Letters 135B, n5-6 p337-338, 16 Feb 84.

Keywords: *Electron scattering, Nucleons, Inelastic scattering, Cross sections, Reprints, *Knock-out reactions, Sum rules, Response functions.

The cross section for quasi-free nucleon knockout by inelastic electron scattering (e,e'N) is shown to depend on two scaling variables: y used in inclusive (e,e') reactions and z = (p(f)/M) sin (theta sub p), the transverse component of the initial and final nucleon velocity. It is shown that for given y and z the coincidence cross section is determined by a single spectral function of (y squared) + (z squared). A sum rule relates the spectral function to the nuclear response measured in inclusive reactions.

715,152
PB84-221001 Not available NTIS
National Bureau of Standards, Washington, DC.
Interpretation of Coincidence Form Factors in Electron-Nucleon Knockout Reactions.
Final rept.
J. S. O'Connell. Apr 84, 6p
Pub. in Physical Review C 29, n4 p1544-1545 Apr 84.

Keywords: *Electron scattering, Nucleons, Cross sections, Reprints, *Knock-out reactions, Form factors.

The author points out that for two extreme reaction mechanisms describing nucleon ejection in the coincidence reaction A(e,e'N)B (resonance or quasifree knockout) the interference form factors can be used to make a longitudinal-transverse separation of the inclusive cross section without change in electron scattering angle (resonance case), or a separation of the convection and spin currents in the transverse form factor (quasifree case).

715,153
PB84-221217 Not available NTIS
National Bureau of Standards, Washington, DC.
NBS (National Bureau of Standards) Measurements of the (235)U Fission Cross Section.
Final rept.
A. D. Carlson. Jul 83, 17p
Sponsored in part by International Atomic Energy Agency, Vienna (Austria).
Pub. in Proceedings of International Atomic Energy Agency Consultants' Meeting U-235 Fast-Neutron Fission Cross-Section, Cf-252 Fission Neutron Spectrum held at Smolenice, Czechoslvakia on March 28-April 1, 1983, p61-77 Jul 83.

Keywords: *Uranium 235, *Fission cross sections, *Cross sections, Nuclear fission, Standards, Neutron reactions.

The results of NBS measurements of the (235)U(n,f) cross section made at the linac, Van de Graaff, and (252)Cf facilities are reviewed.

715,154
PB84-221233 Not available NTIS
National Bureau of Standards, Washington, DC.
Glueballs.
Final rept.
S. Meshkov. 1983, 31p
See also DE82-016963.
Pub. in Proceedings of Hadronic Session (18th) held at Recontre de Moriond, La Plange-Savoie, France on January 23-29, 1983, Gluons and Heavy Flavours 1, p427-440 1983.

Keywords: Mass, Reviews, *Glueballs.

The current status of various glueball properties such as level ordering and masses is reviewed. The leading glueball candidates currently are the phi phi enhancements.

715,155
PB84-221282 Not available NTIS
National Bureau of Standards, Washington, DC.
Prospects for Small Cryocoolers.
Final rept.
R. Radebaugh. 1982, 5p
Pub. in Proceedings of International Cryogenic Conference (9th) held at Kobe, Japan on May 11-14, 1982, p761-765 1982.

Keywords: *Refrigerators, Reliability, Cryogenics, Research, Helium, *Cryogenic refrigerators, *Cryocoolers.

Small cryocoolers are commonly used in the areas of infrared detection, satellite communication, and cryopumps. Some emerging application areas deal with SQUID and Josephson junction devices, which require temperatures of about 8 K or below. The need for high reliability in these small cryocoolers has dictated the use of regenerative-cycle machines, but such machines are presently limited to temperatures above about 8 K. This paper discusses some of the research being done to improve reliability, decrease noise, and reduce the low-temperature limit of small cryocoolers.

715,156
PB84-221332 Not available NTIS
National Bureau of Standards, Washington, DC.
Low Multipolarity Magnetic Transitions in (32)S Excited by Electron Scattering.
Final rept.
P. E. Burt, L. W. Fagg, H. Crannell, D. I. Sober, W. Stapor, W. Stapor, J. T. O'Brien, J. W. Lightbody, X. K. Maruyama, R. A. Lindgren, and C. P. Sargent. Mar 84, 9p
Grant NSF-PHY79-23968
Pub. in Physical Review C 29, n3 p713-721 Mar 84.

Keywords: *Electron scattering, *Scattering cross sections, *Cross sections, *Transition probabilities, Nuclear energy levels, Magnetic dipoles, Nuclear shell models, Reprints, *Sulfur 32, Form factors.

Electron scattering cross section measurements on (32)S have been made at incident electron energies between 34 and 74 MeV and at scattering angles of 162.4 degrees and 180 degrees. Form factors were deduced for transitions to states at 8.11, 9.68, 10.05, 10.78, 11.12, and 11.63 MeV. Additional peaks at 7.12, 12.02, and 13.36 MeV were observed in some spectra. Comparisons of cross sections at different angles show that the above six transitions are transverse.

715,157
PB84-221688 Not available NTIS
National Bureau of Standards, Washington, DC.
Extension of the Congruent Electromagnetic Scale to Gamma-Rays.
Final rept.
R. D. Deslattes. 1983, 18p
Pub. in Proceedings of NATO Advanced Study Inst. Quantum Metrology Fund. Phys. Constants held at Erice, Italy on November 16-28, 1981, p365-382 1983.

Keywords: *Gamma rays, *X rays, Utilization, Measurement, Spectroscopy.

Precision spectroscopy in the region of X-rays and gamma-rays has a considerable range of application in determination of fundamental constants, tests of basic theory and determination of masses of elementary particles. The current panoply of such applications is addressed in the following lecture. The aim of this first presentation is to focus on the measurement technology required to establish secondary reference standards. Intrinsic limitations due to X-ray line shapes and the measurement technologies are summarized. A new stage in this work has now been established using X-ray interferometry followed by small angle diffraction to cover six orders of magnitude in two steps thereby tying gamma-rays to visible light in a way not limited by the characteristics of X-ray lines and without the accumulation of errors characteristic of previous multistep procedures. Present and future limitations are indicated.

715,158
PB84-221787 Not available NTIS
National Bureau of Standards, Washington, DC.
Flexure Pivot Mirror Support.
Final rept.
A. Henins, E. G. Kessler, and P. L. Cowan. 1983, 3p
Pub. in Nuclear Instruments and Methods 208, p287-289 1983.

Keywords: *Mirrors, *Supports, Monochromators, Adjusting, Cylindrical bodies, Design, Toroids, Rotation, Reprints.

Part of a two-mirror and separated crystal monochromator UHV beamline for the 0.5 to 5 keV region being constructed at the NSLS at Brookhaven is a toroidally bent cylindrical mirror. The design of the support architecture for this mirror is here presented. It is desirable that all degrees of freedom are independently adjustable with a minimum of cross-coupling between adjustments.

715,159
PB84-221902 Not available NTIS
National Bureau of Standards, Washington, DC.
New Method for the Experimental Determination of the Detective Quantum Efficiency of X-Ray Screens.
Final rept.
C. E. Dick, J. W. Motz, and H. Roehrig. 1980, 5p
Sponsored in part by Arizona Univ. Health Sciences Center, Tucson.

Pub. in Society of Photo-Optical Instrumentation Engineers 233, p11-15 1980.

Keywords: *Quantum efficiency, Measurement, Calcium tungstates, Rare earth compounds, Experimental data, Reprints, *X ray screens, Oxysulfides.

The authors developed a new experimental method to determine the detective quantum efficiency (DQE) of any given x-ray screen for different x-ray energies. This method employs fast (10 ns) counting and coincidence techniques to directly measure the number, m, of photons emitted from the screen per absorbed x ray, and to determine both the statistical distribution and average value of m. These experimental data have been obtained for a calcium tungstate and a rare earth oxysulfide screen with quasi-mono-energetic x-ray beams in the region from approximately 15 to 70 keV.

715,160
PB84-221910 Not available NTIS
National Bureau of Standards, Washington, DC.
Possibilities for the Use of Electron Spin Polarization in Scanning Electron Microscopy.
Final rept.
R. J. Celotta, and D. T. Pierce. 1982, 3p
Pub. in Proceedings of the Joint Meeting Microbeam Analysis Society, Electron Microscope Society of America, Washington, DC, 11 Aug 82, Paper in Microbeam Analysis, p469-471.

Keywords: *Electron microscopy, Polarization(Spin alignment), Electron beams, Magnetic moments, Feasibility, *Electron spin polarization, *Scanning electron microscopy, *Polarized beams.

No use has been made to date of the intrinsic magnetic moment of the electron in scanning electron microscopy, with good reason: methods for orienting or detecting the orientation of the free electron's moment have traditionally been cumbersome and inefficient. Since the technology for the production and detection of polarized electrons has improved dramatically recently, the time seems appropriate to consider more seriously the possibility of a 'polarized electron microscope'.

715,161
PB84-222033 Not available NTIS
National Bureau of Standards, Washington, DC.
Determination of Silicon Density to High Precision Using a Submersible, Servo-Controlled Balance.
Final rept.
R. S. Davis. 1982, 9p
Pub. in Metrologia 18, p193-201 1982.

Keywords: *Weight measurement, *Density(Mass/volume), *Standards, *Silicon, Single crystals, Weight indicators, Hydrostatics, Precision, Reprints, Standard reference materials, Balances.

Novel use has been made of a high-precision, servo-controlled balance for the hydrostatic weighing of solid objects. The balance is completely immersed in a fluorocarbon fluid. Extensive experience has been gained by using the apparatus in the assignment of density to 70 silicon objects which will be issued as a Standard Reference Material (SRM). The balance contributes about 0.000001 to the relative uncertainty of the final results.

715,162
PB84-222900 Not available NTIS
National Bureau of Standards, Washington, DC.
X-ray Imaging of Extended Objects Using Nonoverlapping Redundant Array.
Final rept.
L. I. Yin, J. I. Trombka, S. M. Seltzer, and M. J. Bielefeld. 15 Jul 83, 6p
Sponsored in part by National Aeronautics and Space Administration, Washington, DC.
Pub. in Applied Optics, v22 n14 p2155-2160, 15 Jul 83.

Keywords: Radiography, Crosstalk, X ray analysis, *X ray imagery, *Tomography, Computerized axial tomography, Image processing, Multiple pinhole arrays, Three dimensional.

A common problem associated with x-ray imaging using coded apertures is the reconstruction of low-intensity extended objects. In the decoding of such objects, the overlapping images from the multiple pinholes give rise to noise cross talk and, in many cases, also to signal cross talk. In this paper, the authors propose an alternate approach based on the principle used in earlier laboratory device for the real-time viewing of x-ray objects. It is shown that with this approach, the nonoverlapping redundant array, the sidelobes in the point spread function are not eliminated but merely displaced through a suitable choice of geometry. In this manner, the sidelobes no longer contribute to the background in the vicinity of a reconstructed image, and both signal and noise cross talks are completely eliminated. It may now be possible to reconstruct extended x-ray objects in 3-D by simple optical correlation and tomographically by a computer.

715,163
PB84-223809 Not available NTIS
National Bureau of Standards, Washington, DC.
Calibration of AC Susceptometer for Cylindrical Specimens.
Final rept.
R. B. Goldfarb, and J. V. Minervini. May 84, 4p
Sponsored in part by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Review of Scientific Instruments, v55 n5 p761-764 May 84.

Keywords: *Magnetic measurement, *Calibrating, Magnetic permeability, Cylindrical bodies, Alternating current, Reprints, *Magnetic susceptibility, *Susceptometers.

The absolute magnetic susceptibility of cylindrical specimens is obtained with an ac susceptometer whose calibration is based on a calculation of mutual inductance.

715,164
PB84-223874 Not available NTIS
National Bureau of Standards, Washington, DC.
Improved Bremsstrahlung Cross Sections for Transport Calculations.
Final rept.
S. M. Seltzer, and M. J. Berger. Dec 83, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-30, n6 p4368-4370 Dec 83.

Keywords: *Bremsstrahlung, *Cross sections, Transport properties, Aluminum, Gold, Electrons, Reprints, KeV range 01-10, KeV range 10-100, KeV range 100-1000, MeV range 01-10, MeV range 10-100, MeV range 100-1000.

The cross section for the emission of bremsstrahlung by electrons in the field of the atomic nucleus has been evaluated by the synthesis of various theoretical results. The synthesis has been carried out for the cross section differential in emitted photon energy. Cross sections are presented here for the bremsstrahlung produced in aluminum and gold by electrons with energies from 1 keV to 1000 MeV.

715,165
PB84-224021 Not available NTIS
National Bureau of Standards, Washington, DC.
Impact of Atomic Physics on Fundamental Constants.
Final rept.
R. D. Deslattes. 1983, 21p
Pub. in Proceedings of Int. Conference Atomic Physics (8th), Goteborg, Sweden, August 2-6, 1982, Atomic Physics 8, p22-42 1983.

Keywords: *Fundamental constants, *Metrology, Atomic spectroscopy, Superconductivity, Hydrogen, Quantum electronics, *Atomic physics, Josephson effect.

Atomic physics determinations of numerical values involves the study of calculable spectra. In the case of hydrogen, inversion of the theoretical expressions for fine structure and hyperfine structure were used to obtain alpha, however their utility depends on the status of theory and experiment as well as on the availability of alternative approaches. Another group of measurements exploit the properties of macroscopic quantum mechanical systems. Among these on the electrical side, the Josephson frequency voltage relationship in superconductors has already a long and productive history. Other related effects such as flux quantization (as a route to the Compton wavelength) have yet to yield results commensurate with their promise. Finally, there remains a family of measurements which are both macroscopic and classical. These seem to be unavoidable thus far and continue to represent the least tractable problems encountered in this area of work.

715,166
PB84-224039 Not available NTIS
National Bureau of Standards, Washington, DC.
Applications of New Absolute Measurements of X-rays and Gamma-rays.
Final rept.
R. D. Deslattes. 1983, 12p
Pub. in Proceedings of NATO Advanced Study Institute Quantum Metrology Fundamental Phys. Constants, Erice, Italy, November 16-28, 1981, p353-364 1983.

Keywords: *X rays, *Gamma rays, Quantum electrodynamics, Kaons, Muons, Pions, Measurement.

The technology described in the previous lecture has resulted in a new array of gamma-ray secondary standards and convenient, accurate procedures for remeasurement of X-ray lines. First use of the new gamma-ray reference lines has been in normalization of muonic and pionic atom spectra. Primary results so far have been in improved tests of QED using muonic spectra and in reconciliation of different routes to the pion mass. Additional work on X-ray absorption edges has led to a new value for the mass of K(-) and will be used in an experiment on pionic deuterium. Re-study of especially mid- to high-Z spectra of normal atoms has been encouraged by newly available relativistic self-consistent field calculations. Detailed comparisons appear informative regarding systematic trends in the discrepancies.

715,167
PB84-224807 Not available NTIS
National Bureau of Standards, Washington, DC.
Inferred Fission Cross Sections in the MeV Range for the Transuranics.
Final rept.
J. W. Behrens. 1983, 3p
Pub. in Transactions 45, p243-245 1983.

Keywords: *Fission cross sections, *Transuranium elements, *Cross sections, Neutron reactions, Reprints, MeV range.

Transuranics are produced in sufficient quantities in commercial nuclear reactors that it is logical to try to find marketable uses for these unique, manmade isotopes. Computer codes have been written which determine optimal conditions for the buildup (or burnout) of transuranic materials in nuclear fuel. These codes require accurate cross section data as input. There are many as yet unmeasured isotopes for which nuclear data are needed. As an alternative to direct measurement, the present approach uses measured data as a basis from which one infers fission cross sections for neighboring, short-lived isotopes. In its present form, this method is applicable in the MeV range.

715,168
PB84-224815 Not available NTIS
National Bureau of Standards, Washington, DC.
Nuclear Photon Scattering by 12C and 16O.
Final rept.
W. R. Dodge, E. Hayward, R. G. Leicht, M. McCord, and R. Starr. Jul 83, 8p
Pub. in Physical Review C 28, n1 p8-15 Jul 83.

Keywords: *Carbon 12, *Scattering cross sections, *Absorption cross sections, *Cross sections, Photonuclear reactions, Elastic scattering, Reprints, *Oxygen 16, Form factors, Giant resonance, Quadrupoles.

The elastic scattering cross sections for (12)C and (16)O have been measured in the energy ranges 23.5-39 and 25-39 MeV, respectively. These data have been compared with the Mainz total photonuclear absorption cross sections and interpreted in terms of a form factor applied to the gauge term of the Thomson amplitude as well as an E2 amplitude.

715,169
PB84-225002 Not available NTIS
National Bureau of Standards, Washington, DC.
Standard Cross-Section Data.
Final rept.
A. D. Carlson. 1984, 49p
Pub. in Progress in Nuclear Energy, v13 n2/35 p79-127 1984.

Keywords: *Neutron cross sections, *Cross sections, *Standards, Reviews, Accuracy, Reprints.

A review is given of the neutron cross section standards. Comparisons are made between recent measurements and evaluations. Techniques for application of the standards are also reviewed. Estimates of the

accuracy of the cross sections are given. Areas where more work needs to be done are discussed. The document includes a significant bibliography.

715,170
PB84-225457 Not available NTIS
National Bureau of Standards, Washington, DC.
Some Theoretical Considerations on the Sigma(Gamma,p)/Sigma(Gamma/n) Ratio in 4He.
Final rept.
P. P. Delsanto, L. C. Biedenharn, M. Danos, and S. Tuan. 1983, 6p
Pub. in Nuovo Cimento Lettere, v37 n10 p369-374 1983.

Keywords: *Helium 4, *Neutron reactions, *Proton reactions, *Photonuclear reactions, Nuclear cross sections, Nuclear shell models, Gamma rays, Excitation, Reprints, MeV range 10-100, Isospin, Symmetry breaking.

Recent measurements have confirmed the value 1.7 + or - 0.3 for the ratio between (4)He (gamma,p) and (gamma,n) reaction cross sections in the excitation energy range 24 = or < (E sub x) = or < 30 MeV. This large deviation from unity implies isospin symmetry breaking an order of magnitude larger than that predicted from direct Coulomb effects using conventional shell model estimates. The authors present a phenomenological model search using continuum calculations, undertaken to identify those features of the problem that more complete future treatments must yield to explain the experimental data. An indirect Coulomb mechanism, which may possibly account for the discrepancy, has been proposed.

715,171
PB84-226240 Not available NTIS
National Bureau of Standards, Washington, DC.
Precision Timekeeping Using a Small Passive Hydrogen Maser.
Final rept.
F. L. Walls, and D. A. Howe. 1980, 18p
Pub. in Proc. Twelfth Annu. Precise Time and Time Interval (PTTI), Goddard Space Flight Center, Greenbelt, Maryland, December 2-4 1980, p785-805.

Keywords: *Frequency standards, *Time standards, *Masers, Frequency stability, Cesium frequency standards, Comparison, *Hydrogen masers.

The time keeping ability of a prototype small passive hydrogen maser developed at NBS was recently compared to UTC(NBS) based on 10 cesium frequency standards including a large primary standard, NBS-4. The frequency of the passive maser was monitored as a function of source pressure, cavity temperature, microwave power, modulation width, and magnetic field. Based on these measurements one would expect a frequency stability of better than 6 x (10 to the - 15th power) over many days, implying a time keeping ability of order 0.5 ns/day. Measurements vs. UTC(NBS) indicate a joint time keeping stability of order 1.2 ns/day.

715,172
PB84-226364 Not available NTIS
National Bureau of Standards, Washington, DC.
Precise Gamma-ray Multipole Mixing Ratios Using Nuclear Orientation.
Final rept.
H. Marshak. 1983, 4p
Pub. in Hyperfine Interact., n15/16 p1043-1046 1983.

Keywords: *Gamma rays, Metastable state, Radioactive decay, Reprints, *Holmium 166, *Mixing ratio, Nuclear orientation.

Directional distribution measurements of gamma-rays from oriented nuclei, although not as universal as gamma-gamma angular correlation measurements, are capable of yielding more precise multipole mixing ratios since they require only singles measurements, whereas the latter require that the two gamma-rays be detected in coincidence. The higher counting rate of the singles measurement can result in a high accuracy if all the other parameters (sample temperature, gain stability of the detector, etc.) of the experiment can be held constant. When this is achieved, corrections often ignored must be applied to the data to obtain precise values for the mixing ratios. The importance of these corrections are discussed and applied to some of the transitions in the decay of (166m)Ho.

715,173
PB84-226836 Not available NTIS
National Bureau of Standards, Washington, DC.
Experiments with Magnetic Spectrometers at Neal.
Final rept.
J. W. Lightbody. 1983, 27p
Pub. in Proceedings of Spectrometer workshop, Williamsburg, Virginia, October 10-12, 1983, pXII-1-XII-27.

Keywords: Electron beams, Polarization(Spin alignment), Resolution, Focusing, Design, *Magnetic spectrometers, Electron spin polarization, Polarized beams.

The author outlines some of the important experiments that will be possible at NEAL, and discusses some of the details associated with their realization. The major points considered are (1) out-of-plane measurements, (2) polarization of the primary electron beam, and (3) the effects of kinematic broadening on resolution requirements of spectrometers and their focussing properties.

715,174
PB84-227032 Not available NTIS
National Bureau of Standards, Washington, DC.
Dipole Radiation in the Presence of a Rough Surface. Conversion of a Surface-Polariton Field into Radiation.
Final rept.
G. S. Agarwal. Nov 82, 11p
Pub. in Physical Review B26, n10 p5832-5842 Nov 82.

Keywords: Gratings(Spectra), Surface roughness, Surfaces, Greens function, Reprints, *Dipole radiation, Polaritons.

The characteristics of the radiation produced by a dipole, located near the rough surface of a material medium, are examined. The field distribution is calculated at any point outside the medium for arbitrary orientation of the dipole moment, thus enabling one to obtain the electromagnetic Green's function in the presence of surface roughness. The medium can have either local or nonlocal dielectric function and the results are valid to first order in roughness. The surface roughness converts the surface polariton field, excited even in the absence of roughness, into radiation and thus leads to the well-defined resonances in the far field radiation pattern. Numerical results for the case of metallic as well as dielectric gratings are given. The effect of the nonlocality of the dielectric function on the resonances in the radiation is shown to be significant in certain cases.

715,175
PB84-227099 Not available NTIS
National Bureau of Standards, Washington, DC.
Operational Considerations of a Reverberation Chamber for EMC Immunity Measurements; Some Experimental Results.
Final rept.
M. L. Crawford, and G. H. Koepke. Apr 84, 8p
Pub. in Proceedings of 1984 IEEE (Institute of Electrical and Electronics Engineers, Inc.) National Symposium Electromagnetic Compatibility, San Antonio, TX, April 24-26, 1984, p47-54.

Keywords: *Electromagnetic compatibility, Measurement, Performance, Microwaves, *Reverberation chambers.

This paper describes measurement procedures and results obtained from evaluation of a 2.74 m x 3.05 m x 4.57 m shielded chamber modified into a mode tuned reverberation chamber. A brief description of the measurement setup and resonant cavity theory is given. The measurements described include an evaluation of the chamber's: (1) excitation and receiving antennas' voltage standing wave ratio and efficiency, (2) mode tuner effectiveness, (3) loss, and (4) electromagnetic test field statistical characteristics. In addition, the measurement results of two techniques to determine the field strength in the reverberation chamber are compared. Results shown cover the frequency range 200 MHz to 18 GHz.

715,176
PB84-229509 Not available NTIS
National Bureau of Standards, Washington, DC.
Lineshapes of Subdoppler Resonances Observable with FM Side-Band (Optical Heterodyne) Laser Techniques.
Final rept.
J. L. Hall, H. G. Robinson, T. Baer, and L. Hollberg. 1983, 28p
Contract NOOO14-77-C-0656, Grant NSF-PHY79-04928
Pub. in Proceedings of NATO Advanced Science Institute (10th), San Miniato, Italy, July 26-August 7, 1981, p99-126 1983.

Keywords: Frequency modulation, Line width, *Laser spectroscopy, High resolution.

In this lecture the authors describe the 'new' technique of FM spectroscopy in which the modulation frequency is greater than the linewidths of interest. With this approach they may almost completely avoid the low frequency noise of a technical nature while recovering undistorted resonance profiles of a simple and characteristic shape with excellent signal/noise ratio. It is the theory of these profiles which forms the main subject for this lecture/paper.

715,177
PB84-239953 Not available NTIS
National Bureau of Standards, Washington, DC.
Laser Gravitational Wave Experiment in Space.
Final rept.
J. E. Faller, P. L. Bender, Y. M. Chan, J. L. Hall, D. Hils, and J. Hough. 1983, 3p
Pub. in Proceedings of International Conference on General Relativity and Gravitation (10th), Padova, Italy, July 4-9 1983, 2, p960-962.

Keywords: *Relativity, *Gravitational radiation, Gravitational waves, Spaceborne experiments, Laser interferometry.

Detection of gravitational radiation is an important research goal in physics and astrophysics. At the Joint Institute for Laboratory Astrophysics, an investigation is being carried out of possible designs for a laser gravitational wave experiment using free masses and baseline lengths of 1,000,000 km or longer.

715,178
PB84-239979 Not available NTIS
National Bureau of Standards, Washington, DC.
Resonance Neutron Radiography.
Final rept.
R. A. Schrack, J. W. Behrens, R. G. Johnson, and C. D. Bowman. 1983, 8p
Pub. in Proceedings of World Conference on Neutron Radiography (1st), San Diego, CA, Dec 7-10, 1981 p495-502 1983.

Keywords: *Neutron radiography, Proportional counters, Helium 3, *Resonance neutron radiography, Resonance neutrons, Multi-channel analyzers, Neutron detectors.

The production of images by the use of neutrons having energies in the resonance region is described. Two-dimensional position-sensitive neutron detectors are used to produce transmission images using neutron time-of-flight techniques at the National Bureau of Standards' electron linac facility. Two types of detectors are described. The first is a crossed-wire proportional counter using (3)He as the neutron-sensitive component. The second type uses a multichannel plate electron multiplier and a resistive anode readout. A lithium glass scintillator is the neutron-sensitive component in the latter detector. Resonance neutron radiography, using these detectors, has the capability of producing images with isotopic and chemical element discrimination in a complex matrix with a resolution of 1 mm or better.

715,179
PB84-244714 Not available NTIS
National Bureau of Standards, Washington, DC.
Distribution of Origins of Sputtered Particles and the Shape of the Target Region Affected by the Cascade Recoils.
Final rept.
M. L. Roush, F. Davarya, G. P. Chambers, T. D. Andreadis, J. He, O. F. Goktepe, and J. Fine. 1984, 4p
Pub. in Nuclear Instruments and Methods in Physics Research B2, p693-696 1984.

Keywords: *Ion irradiation, Silicon, Argon, Computerized simulation, Sputtering, Reprints.

The recoil cascade resulting from Ar bombardment of Si has been studied by computer simulation. The average behavior of the cascade is determined by combining the results for a large number of incident particle histories. By sorting recoils according to the number of scatterings which precede their production, information is assembled concerning the manner in which the recoil cascade grows in size and shape. Results are also presented concerning the distribution of the origins of the particles which sputter. Here, distributions are given in terms of the transverse distance from the point of incidence of the bombarding ion.

715,180
PB84-244748 Not available NTIS
National Bureau of Standards, Washington, DC.
Photon Attenuation Coefficients and Cross Section Data 100 eV to 100 GeV. Current Status and Prospects.
Final rept.
J. H. Hubbell. 1984, 13p
Pub. in Proceedings of International Symposium on Radiation Physics (2nd), Universiti Saino Malaysia, Penang, May 25-29, 1982, p15-27 1984.

Keywords: *Photoelectric emission, Pair production cross sections, Incoherent scattering, Coherent scattering, Pair production, Gamma rays, X rays, Crystallography, *Photon-atom collisions, *Attenuation coefficients, IUCr project.

Recent advances in theoretical and experimental information on photon-atom collision processes (photoelectric absorption, coherent and incoherent scattering, and pair and triplet production) are discussed. Emphasis is on recent pair and triplet production cross section calculations 1 MeV-100 GeV, and also on an International union of Crystallography project to develop x-ray attenuation coefficient measurement standards in the 0.5 to 50 keV region and to coordinate measurements in progress aimed at resolving existing serious discrepancies in available data. Some preliminary results from the IUCr project are presented.

715,181
PB84-245224 PC **A03**/MF **A01**
National Bureau of Standards (NML), Washington, DC. Center for Radiation Research.
Simple Model for the QCD Vacuum.
M. Danos, D. Gogny, and D. Irakane. Jul 83, 29p
NBSIR-83/2759
Prepared in cooperation with CEA Centre d'Etudes de Bruyeres-le-Chatel, Montrouge (France).

Keywords: Quarks, Vacuum, *Quantum chromodynamics, Bag model, Color model, Gluons, Confinement.

By treating the high-momentum gluon and the quark sector as an in principle calculable effective Lagrangian, we obtain a non-perturbative vacuum state for QCD as an infrared gluon condensate. This vacuum is removed from the perturbative vacuum by an energy gap. It is unstable below a minimum size and it has dia-electric and dia-magnetic character indicating expulsion of color-electric and -magnetic fields, i.e., it exhibits all the properties required for color confinement.

715,182
PB85-100337 Not available NTIS
National Bureau of Standards, Washington, DC.
Frequency Measurements of Optical Radiation.
Final rept.
K. M. Baird. Jan 83, 6p
Pub. in Physics Today 36, n1 p52-57 Jan 83.

Keywords: *Frequency measurement, *Frequency standards, *Time standards, Microwave frequencies, Infrared radiation, Light(Visible radiation), Reprints.

This paper presents an overview of recently developed techniques that have made it possible to relate directly the frequencies of microwave and optical radiations by the use of very high speed non-linear devices. The significance of the techniques, which will allow the use of a single spectroscopic transition to define the standards of both time and length, is discussed.

715,183
PB85-104842 Not available NTIS
National Bureau of Standards, Washington, DC.
Comment on Millman Effect in Cesium Beam Atomic Frequency Standards.
Final rept.
D. J. Wineland, and H. Hellwig. 1977, 2p
Pub. in Metrologia 13, n4 p173-174 1977.

Keywords: *Cesium frequency standards, *Frequency shift, Magnetic fields, Reprints, Millman effect.

Data on frequency shifts in cesium beam tubes resulting from magnetic field reversals are discussed. An explanation of this effect is given, based on the mixing of m-states in the region between state selector magnet and interrogation region in conjunction with the distributed cavity phase shift.

715,184
PB85-107423 Not available NTIS
National Bureau of Standards, Washington, DC.
Modeling of Turbulent Diffusion Flames and Fire Plumes for the Analysis of Fire Growth.
Final rept.
Y. Hasemi, and T. Tokunaga. 1983, 9p
Pub. in Proceedings of National Heat Transfer Conference (21st), Fire Dynamics and Heat Transfer, Seattle, WA., July 24-28, 1983, p37-45.

Keywords: *Flames, *Fires, Diffusion flames, Plumes, Heat transfer, Velocity measurement, Model tests, Fire tests.

Measurements of temperature, velocity and irradiance, and observation of flame height were made in the near field of the turbulent diffusion flames from a porous burner with propane as fuel located in a large area simulating semi-infinite space, on a thermally thick wall and in a wall-corner. The data on the upward currents in the semi-infinite space were compared with an integral model of turbulent diffusion flames derived without assuming the entrainment hypothesis. The nature of diffusion flame as an external radiation source is also studied based on the model.

715,185
PB85-115426 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 89, Number 2, March-April 1984.
Apr 84, 85p
See also PB85-115434 through PB85-115467 and PB84-235530. Also available from Supt. of Docs as SN003-003-72086-1.

Keywords: *Glow discharges, *Calibrating, *Shear modulus, *Standards, Curve fitting, Iteration, Ultrasonic radiation, Power, Transferring, Hollow cathodes.

Contents:
Hollow Cathode Discharges - Analytical Applications;
An Iterative Calibration Curve Procedure;
Determination of the Viscoelastic Shear Modulus Using Forced Torsional Vibrations;
An Ultrasonic Absolute Power Transfer Standard.

715,186
PB85-115434
(Order as PB85-115426, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Hollow Cathode Discharges: Analytical Applications.
R. Mavrodineanu. 14 Sep 83, 43p
Also available from Supt. of Docs as SN003-003-72086-1.
Included in Jnl. of Research of the National Bureau of Standards, v89 n2 p143-185 Mar-Apr 84.

Keywords: *Glow discharges, Hollow cathodes, Grimm discharges, Paschen discharges.

The low pressure glow discharges considered in this paper are the hollow cathode (Paschen), and the flat cathode (Grimm). Both discharges have similar voltage--current characteristics which are responsible for their radiation stability. The analytical sample is supplied to the discharge through a sputtering mechanism which provides a stable and non-selective source of particles. Some of the fundamental properties of the glow discharge and sputtering phenomena will be discussed, including the relation between the geometry of the discharge, and the nature and pressure of sustaining gas, and current, on the emission characteristics of the discharges.

715,187
PB85-115517 Not available NTIS
National Bureau of Standards, Washington, DC.
New Kapitza Heat-Transfer Model for Liquid Helium Four.
Final rept.
P. H. E. Meijer, and J. S. J. Peri. 1980, 11p
Pub. in Physical Review B: Condensed Matter 22, n1 p195-205, 1 Jul 80.

Keywords: *Helium 4, *Liquid helium, *Heat transfer, Quantum theory, Cryogenics, Reprints, *Kapitza resistance.

The Kapitza resistance between a solid and liquid helium 4 is explained by two parallel processes. One is the well-known Khalatnikov-acoustic-mismatch channel that has a frequency independent transmission coefficient. The other, we propose hereby, is the difference in quantum effects between the bulk liquid and the compressed surface layers. The crucial point is the presence of an 'optical branch', that is dispersion curve with (omega sub 0) not = 0 for k approaches 0.

715,188
PB85-115681 Not available NTIS
National Bureau of Standards, Washington, DC.
Dimensional Metrology at the National Bureau of Standards.
Final rept.
R. J. Hocken, and P. Nanzetta. 1983, 8p
Pub. in Physics Teacher, v21 n8 p506-513 1983.

Keywords: *Dimensional measurement, *Metrology, Liquefied natural gas, Ships, Tanks(Containers), Polarimetry, Sugars, Reprints, Three dimensional.

This paper describes three current projects of The Dimensional Metrology Group at NBS in a simplified manner suitable for students of Physics and Engineering. Projects in LNG tank measurements on ships, 3-Dimensional Metrology, and polarimetry are described.

715,189
PB85-118339 Not available NTIS
National Bureau of Standards, Washington, DC.
Gas Thermometry.
Final rept.
L. A. Guildner. 1982, 2p
Pub. in McGraw-Hill Encyclopedia of Science Technology, p74-75 1982.

Keywords: *Temperature measurement, Thermodynamics, Reprints, *Gas thermometry.

Gas thermometry is defined, and its application to the determination of thermodynamic temperature is given. The types of gas thermometers are discussed in idealized form, and some of the departures from ideal, as encountered in the laboratory, are cited.

715,190
PB85-118420 Not available NTIS
National Bureau of Standards, Washington, DC.
Nuclear Orientation.
Final rept.
H. Marshak. 1982, 2p
Pub. in McGraw-Hill Encyclopedia of Science Technology, p307-308 1982.

Keywords: Temperature measurement, Polarization(Spin alignment), Nuclear magnetic moments, Nuclear quadrupole resonance, Nuclear spin, Cryogenics, Reprints, *Nuclear orientation, Nuclear orientation thermometry, Nuclear alignment, Polarized beams, Polarized targets.

Nuclear orientation is defined and definitions of nuclear polarization and alignment are given. The static method of nuclear orientation is briefly discussed, along with some general remarks about nuclear orientation and its usefulness in physics.

715,191
PB85-120590 Not available NTIS
National Bureau of Standards, Washington, DC.
Metrology.
Final rept.
J. A. Simpson. 1981, 2p
Pub. in Encycl. Phys., p596-597 1981.

Keywords: *Metrology, Quality control, Measurement, Weight(Mass), Standards, Reprints, Weights and measures.

Metrology is defined as the science of measurement and thus would cover the bulk of experimental physics. The term is usually used in a more restricted sense as

that portion of measurement science used in the service of dissemination of the SI units, to provide support for the legal system of weights and measures enforcement, or as an adjunct to quality control in manufacturing.

715,192
PB85-120749 Not available NTIS
National Bureau of Standards, Washington, DC.
Superconductivity.
Final rept.
R. P. Hudson. 1981, 5p
Pub. in Collier's Encycl. 21, p637-641 1981.

Keywords: *Superconductivity, Superconductors, Cryogenics, Reprints.

The article on SUPERCONDUCTIVITY in Collier's Encyclopaedia is revised and brought up to date.

715,193
PB85-120855 Not available NTIS
National Bureau of Standards, Washington, DC.
Realization of the Ampere at NBS (National Bureau of Standards).
Final rept.
P. T. Olsen, M. E. Cage, W. D. Phillips, and E. R. Williams. 1980, 4p
Pub. in Jnl. of IEEE Transactions on Instrumentation and Measurement 29, n4 p234-237 Dec 80.

Keywords: *Electric current, *Electrical measurement, Dynamometers, Reprints, *Ampere, Superconducting coils, Balances, Laser interferometry.

The authors present a method for the realization of the ampere, based on Faraday's induction law and using a modification of the classic Pellat balance. A preliminary apparatus has been constructed, and initial measurements have been obtained. This balance is also compared with a balance similar to one proposed earlier.

715,194
PB85-121424 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Primer for Mass Metrology.
Final rept.
K. B. Jaeger, and R. S. Davis. Nov 84, 90p NBS/SP-700-1
Also available from Supt. of Docs as SNOO3-003-02621-2. Library of Congress catalog card no. 84-601090. Prepared in cooperation with Lockheed Missles and Space Co., Inc., Sunnyvale, CA.

Keywords: *Metrology, *Mass, *Calibrating, Buoyancy, Air, Correction.

This paper attempts to fill the need for a coherent guide to the many publications which document the NBS program in mass metrology. The topics the authors emphasize are generally those which experience has shown to present the greatest difficulties for metrologists new to the field of mass measurements. Thus the authors have included many worked examples and have retained steps often omitted in more scholarly treatments of the same subjects. A full bibliography is included so that the reader may also consult the primary sources of this work.

715,195
PB85-123396 Not available NTIS
National Bureau of Standards, Washington, DC.
New Laboratory Test of the Equivalence Principle.
Final rept.
P. T. Keyser, J. K. Hoskins, and J. E. Faller. 1983, 3p
Grant NSF-PHY79-04928
Pub. in Proceedings of International Conference on General Relativity and Gravitation (10th), Padova, Italy, July 4-9, 1983, 2, p993-995.

Keywords: *Relativity, *Gravitation, Lead(Metal), Copper, Mass, *Equivalence principle, *Eotvos experiment.

A test of the principle of equivalence using a large fluid (surrogate) fiber Eotvos apparatus is presently being undertaken at the Joint Institute for Laboratory Astrophysics. The authors have embarked on the construction of a 1.27 m diameter system employing approximately 500 kg of lead and 500 kg of copper as the test masses. The current status of their work will be described.

715,196
PB85-123610 Not available NTIS
National Bureau of Standards, Washington, DC.
Milliwatt Stirling Cryocooler for Temperatures below 4 K.
Final rept.
J. E. Zimmerman, and D. B. Sullivan. 1979, 2p
Pub. in Cryogenics 19, n3 p170-171 1979.

Keywords: *Refrigerators, Liquid helium, Cryogenics, Reprints, *Cryocoolers, *Cryogenic refrigerators.

This paper describes a single-stage Stirling machine producing several mW of refrigeration at temperatures in the range of 3 to 4 K and dissipating 50 to 100 mW at temperatures of 8 to 14 K. The cold parts of the system are made of spun-glass epoxy rod and tubing, and the working fluid is helium at subatmospheric average pressure. Part of the working fluid is liquified during operation.

715,197
PB85-124071 Not available NTIS
National Bureau of Standards, Washington, DC.
Half Life of Plutonium-240.
Final rept.
L. L. Lucas, and J. R. Noyce. 1984, 4p
Sponsored in part by Department of Energy, Germantown, MD.
Pub. in International Jnl. of Applied Radiation Isotopes 35, n3 p173-176 1984.

Keywords: *Half life, Nuclear materials management, Alpha decay, Reprints, *Plutonium 240, Safeguards.

The alpha-particle-emission rates of solutions of plutonium-240 oxide were determined from defined-solid-angle-counter measurements. These results were combined with composition data obtained from other laboratories, and the half life of plutonium-240 was calculated to be 6552.2 yr. Associated with this value is a standard deviation of the mean of plus or minus 2.0 yr. and a systematic uncertainty limit of plus or minus 13.8 yr.

715,198
PB85-129344 Not available NTIS
National Bureau of Standards, Washington, DC.
Feynman's Disk Paradox.
Final rept.
G. G. Lombardi. 1983, 2p
Pub. in American Jnl. of Physics 51, n3 p213-214 Mar 83.

Keywords: *Angular momentum, *Electrodynamics, Electromagnetic induction, Reprints, *Feynman disk, Paradoxes.

A paradox involving the apparent violation of angular momentum conservation is discussed. Electromagnetic induction is used to impart angular momentum to a disk of charges. The paradox is resolved by finding the origin of the angular momentum.

715,199
PB85-129385 Not available NTIS
National Bureau of Standards, Washington, DC.
Rational Functions as Profile Models in Powder Diffraction.
Final rept.
N. Pyrros, and C. Hubbard. 1983, 6p
Pub. in Jnl. of Applied Crystallography 16, p289-294 1983.

Keywords: *Rational functions, *X ray diffraction, *Crystal structure, Silicon, Reprints.

Rational functions, the ratio of two polynomials, are shown to be good approximations to powder diffraction profiles. These functions are generalizations of the Lorentzian, the modified Lorentzian, and the profile model of Parrish (Parrish, Huang & Ayers (1976). Trans. Am. Crystallogr. Assoc. 12, 55-73). The simplest of these functions is of the form f(x) = 1/(1 + A(1) (x squared) + A(2) (x to the 4th power) with constants A(1) and A(2) that describe the shape of the profile, x = 2 theta - 2(theta sub 0) and 2(theta sub 0) the position of the peak maximum. This function approximates very well Pearson VII distributions with exponents between 1 and 3. An asymmetric profile model with different A(1), A(2) parameters for the two halves of the peaks was fitted to silicon X-ray powder diffraction profiles and gave unweighted agreement factors from R(2) = 0.02 to 0.04 for peaks varying from 28 to 137 degrees 2 theta.

715,200
PB85-129625
(Order as PB85-129591, PC **A03**/MF **A01**)
Los Alamos National Lab., NM.
Thermal Expansion of Liquid Normal Hydrogen between 18.8 and 22.2 K.
L. A. Schwalbe, and E. R. Grilly. 7 Jun 84, 7p
Included in Jnl. of Research of the National Bureau of Standards, v89 n4 p317-323 Jul-Aug 84.

Keywords: *Hydrogen, *Thermal expansion, Liquefied gases, Cryogenics, *Liquid hydrogen, Temperature dependence, Pressure dependence.

The thermal expansion coefficient alpha of liquid normal hydrogen (n-H2) was measured between 18.8 and 22.2 K in the presence range 5 to 70 bar. The results are compared with those derived from PVT measurements by others on both normal and para (p-H2) hydrogen. Our analysis of the earlier normal data includes fitting an empirical equation of state, and expansion coefficients are derived from this equation by differentiation. We discuss the effects on alpha and the compressibility beta from molecular quadrupole interactions; both theoretical and empirical results suggest these to be on the order of 2% or less for the normal spin mixture. We conclude that our thermal expansion data are consistent with earlier results on both n-H2 and p-H2 in this range of pressures and temperatures.

715,201
PB85-130078 PC **A99**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Precision Measurement and Fundamental Constants II.
B. N. Taylor, and W. D. Phillips. 1984, 651p NBS/SP-617
See also PB85-130086 through PB85-131381. Library of Congress catalog card no. 84-601083. Proceedings of International Conference (2nd) held at the National Bureau of Standards, Gaithersburg, MD., June 8-12, 1981.

Keywords: *Fundamental constants, *Meetings, Standards, Relativity, Frequency standards, Atomic clocks, Quantum electrodynamics, Electric potential, Electrical resistance, Electric current, Magnetic measurement, Gravitational constant, Light speed, Fine structure constant, Ampere, Ohm, Volt, Quantum Hall effect.

No abstract available.

715,202
PB85-130086
(Order as PB85-130078, PC **A99**/MF **A01**)
Queen Mary Coll., London (England). Dept. of Applied Mathematics.
Laws and Constants of Nature.
I. W. Roxburgh. 1984, 9p
Included in Precision Measurement and Fundamental Constants II, p1-9 1984.

Keywords: *Fundamental constants, Gravitation, Plane geometry, Cosmology, Quantum theory, Anthropic principle.

The paper concentrates on a few problems; geometry, mechanics, gravitation, and the large numbers (10 to the 40th power) that relate microphysics to the large scale structure of the universe. The author's purpose is not so much to describe what is known, but to question how well anything is known and to provoke the reader into asking questions and proposing experiments that probe the foundations of our understanding. Is geometry locally Euclidean. Do different clocks keep the same time. Does our existence depend on the exact form of the laws of nature and the exact values of the constants of nature. Do the constants of nature vary in time. Why are there laws at all. Readers can add questions of their own.

715,203
PB85-130094
(Order as PB85-130078, PC **A99**/MF **A01**)
Frequency and Time Systems, Inc., Beverly, MA.
Frequency, Wavelength, and Stored Ions: Frequency Standards Based on Magnetic Hyperfine Structure Resonances.
H. Hellwig. 1984, 9p
Included in Precision Measurement and Fundamental Constants II, p11-19 1984.

Keywords: *Atomic clocks, *Frequency standards, *Hyperfine structure, Cesium frequency standards, Rubidium frequency standards, Hydrogen masers.

Practical frequency standards and clocks use magnetic hyperfine transitions in cesium, rubidium, and hydrogen, and the unit of time is defined--as well as practically realized--via the cesium resonance. This paper explores the basis for this phenomenon which is a result of a combination of mature electronics and physics technologies with proven principles of experimental physics such as beam spectroscopy and optical pumping. This paper will also address the limitations of these 'traditional' or 'microwave' frequency standards as well as opportunities still open for further improvements. These limitations and opportunities center around the desirability to achieve a spectrally narrow line; i.e., a high line-Q within the microwave region. Options to realize improved Q-values will be discussed.

715,204
PB85-130102
(Order as PB85-130078, PC **A99**/MF **A01**)
National Research Council of Canada, Ottawa (Ontario). Div. of Physics.
Performance of the Three NRC (National Research Council) 1-Meter CsVI Primary Clocks.
A. G. Mungall, H. Daams, and J. S. Boulanger. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p21-23 1984.

Keywords: *Atomic clocks, *Cesium frequency standards, *Frequency standards, Frequency stability, Performance, Impurities, Correction.

The performance of the three 1-m interaction length NRC primary cesium clocks, CsVIA, CsVIB, and CsVIC, is outlined for their initial year and a half of operation as primary clocks, which commenced in December, 1979. The potential long-term frequency stability appears to be a few parts in (10 to the 15th power).

715,205
PB85-130110
(Order as PB85-130078, PC **A99**/MF **A01**)
National Bureau of Standards, Boulder, CO. Time and Frequency Div.
Prospects for Cesium Primary Standards at the National Bureau of Standards.
L. L. Lewis, F. L. Walls, and D. A. Howe. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p25-27 1984.

Keywords: *Cesium frequency standards, *Atomic clocks, *Frequency standards, Optical pumping, Frequency stability, Accuracy.

An application of optical pumping, in conjunction with a number of design improvements, may permit the development of a cesium primary standard with an accuracy an order of magnitude better than that of our present primary frequency standards, NBS-4 and NBS-6. Limitations to short-term stability, as well as possible errors in accuracy, are discussed.

715,206
PB85-130128
(Order as PB85-130078, PC **A99**/MF **A01**)
Paris-11 Univ., Orsay (France). Inst. d'Electronique Fondamentale.
Cesium Beam Atomic Clock with Laser Optical Pumping, as a Potential Frequency Standard.
M. Arditi. 1984, 6p
Included in Precision Measurement and Fundamental Constants II, p29-34 1984.

Keywords: *Atomic clocks, *Cesium frequency standards, *Frequency standards, Gallium arsenide lasers, Optical pumping, Atomic beams.

A passive microwave cesium beam resonator using optical pumping and optical detection, with a cw tunable GaAs diode laser, has been realized. The '0-0 clock transition' is detected through a change in the intensity of the fluorescence of the cesium beam. Experimental recordings of the Ramsey pattern agree with a Maxwellian distribution of atomic velocities. Results of preliminary tests, to an accuracy of a few parts in 10 to the 11th power, show good potential for a frequency standard of higher accuracy.

715,207
PB85-130136
(Order as PB85-130078, PC **A99**/MF **A01**)
National Research Council of Canada, Ottawa (Ontario).
Frequency Measurement of Optical Radiation.
K. M. Baird. 1984, 7p
Included in Precision Measurement and Fundamental Constants II, p35-41 1984.

Keywords: *Frequency measurement, Frequency standards, Microwave frequencies, Phase locked systems, Standards, Length, Feasibility, *Visible radiation, Laser radiation.

The feasibility of directly relating the frequency of visible radiation to microwave standards has been demonstrated and a number of frequency comparison systems linking infrared frequencies to the cesium primary standard have already been operated. These have yielded sufficient accuracy that together with wavelength measurement based on the (86)Kr line used to define the Meter, the standard of length can now be based without fear of a significant discontinuity, on a conventional value for the speed of light and the Cs standard for time. This paper reviews present and proposed frequency comparison chains and discusses their possibilities. Limitations for the general use of frequency comparison methods in the optical region are described.

715,208
PB85-130243
(Order as PB85-130078, PC **A99**/MF **A01**)
National Bureau of Standards, Boulder, CO. Time and Frequency Div.
Spectroscopy of Stored Ions.
D. J. Wineland. 1984, 10p
Included in Precision Measurement and Fundamental Constants II, p83-92 1984.

Keywords: *Atomic spectroscopy, *Fundamental constants, Mass spectroscopy, *Ion traps, *Atomic ions, G factor.

The benign environment and long confinement times obtained with ion storage techniques have led to some unique experiments in the area of precision measurements and fundamental constants. This is perhaps epitomized by the single electron g factor measurements at the University of Washington in which a precision of 4 parts in 10 to the 11th power has been attained. Now, use of lasers to cool stored ions has allowed the experimentalist to approach the goal of unperturbed atomic ions nearly at rest; most recently, spectroscopy has been performed on single 'cold' trapped ions. Stored ion experiments in the area of precision measurements and fundamental constants will be briefly reviewed. These include experiments on e(-)/e(+) g factors, mass spectroscopy, lifetimes, and atomic spectroscopy. The intent is to emphasize the unique environment provided by ion storage techniques for these measurements.

715,209
PB85-130250
(Order as PB85-130078, PC **A99**/MF **A01**)
National Bureau of Standards, Boulder, CO. Time and Frequency Div.
Progress Toward a Stored Ion Frequency Standard at the National Bureau of Standards.
W. M. Itano, D. J. Wineland, J. C. Bergquist, and F. L. Walls. 1984, 5p
Included in Precision Measurement and Fundamental Constants II, p93-97 1984.

Keywords: *Frequency standards, Microwave frequencies, Hyperfine structure, Optical pumping, *Ion traps, Visible radiation, Magnesium 25, Mercury 201, Mercury 199, Double resonance methods.

Two fundamental problems with the development of a primary frequency standard based on stored ions have long been apparent--the second-order Doppler shift and the low signal-to-noise ratio. Both problems have been addressed in experiments at the National Bureau of Standards (NBS)--the first by the development of the laser cooling technique and the second by the development of laser-optical-pumping techniques with high detection efficiency. Also, a hyperfine transition in (26)Mg(+1) has been observed by rf-optical double resonance with a linewidth of 0.012 Hz and a Q of 2.4 X 10 to the 10th power. A possible microwave frequency and time standard based on a two-photon transition in (199)Hg(+1) or (201)Hg(+1) are described.

715,210
PB85-130268
(Order as PB85-130078, PC **A99**/MF **A01**)
Mainz Univ. (Germany, F.R.). Inst. fuer Physik.
High Resolution Microwave Spectroscopy on Trapped Ba(+1) Ions.
W. Becker, R. Blatt, and G. Werth. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p99-101 1984.

Keywords: *Microwave spectroscopy, *Frequency standards, Ground state, Hyperfine structure, Time standards, Atomic energy levels, *Barium ions, *Ion traps, Barium 137, Barium 135, Double resonance methods.

The authors performed an optical double resonance experiment on the ground state of (137)Ba(+1) and (135)Ba(+1) ions. About 100,000 particles were confined in an rf quadrupole trap for many hours. Hfs state selection by pulsed laser optical pumping was followed by microwave transitions, which were observed via change in the ionic fluorescence intensity. Linewidths of the order of the laser repetition frequency (1-20 Hz) and a complicated line structure were observed in the 'field independent' F = 1, m = 0 yields F = 2, m = 0 transitions. The statistical uncertainty of the line center was below 0.1 Hz. The results for the hyperfine separations, including corrections to zero magnetic and electric field, are given.

715,211
PB85-130276
(Order as PB85-130078, PC **A99**/MF **A01**)
Texas A and M Univ., College Station. Dept. of Physics.
Observation of High Order Side Bands in the Spectrum of Stored (sup 3)He(+1) Ions.
H. A. Schuessler, and H. S. Lakkaraju. 1984, 5p
Included in Precision Measurement and Fundamental Constants II, p103-107 1984.

Keywords: *Helium 3, *Microwave spectra, *Sidebands, Perturbation theory, Doppler effect, *Ion traps, *Helium ions.

The magnetic resonance spectrum of the 1 doublet S (1/2) ground state of (3)He(+) ions was remeasured using a radio-frequency quadrupole ion trap and the ion storage exchange collision technique. In particular the line shape of the delta F = + or - 1, delta m(F) = + or - 1 hyperfine structure transition was studied. The spectrum was observed to consist not only of the component at the main transition frequency nu(0). A calculation of the spectrum based on the correlation function formalism reproduced the main features of the experimental spectrum although differences are discernible. The dependence of the side-band spectrum on the energy and energy distribution of stored ions in both standing and traveling wave fields was also investigated numerically. The present investigation has a strong bearing on side-band cooling techniques and on improving the precision of spectroscopic measurements.

715,212
PB85-130284
(Order as PB85-130078, PC **A99**/MF **A01**)
Moscow State Univ. (USSR). Dept. of Physics.
Quantum Limits in the Measurements of e.m. Fields and Frequency.
V. B. Braginsky. 1984, 2p
Included in Precision Measurement and Fundamental Constants II, p109-110 1984.

Keywords: *Frequency measurement, *Quantum theory, Electromagnetic fields, Frequency stability, Limits.

No abstract available.

715,213
PB85-130458
(Order as PB85-130078, PC **A99**/MF **A01**)
Cornell Univ., Ithaca, NY. Floyd R. Newman Lab. of Nuclear Studies.
Implications of QED (Quantum Electrodynamics) Theory for the Fundamental Constants.
G. P. Lepage, and D. R. Yennie. 1984, 9p
Included in Precision Measurement and Fundamental Constants II, p185-193 1984.

Keywords: *Fundamental constants, *Quantum electrodynamics, Hyperfine structure, Hydrogen, Muonium, Positronium, Measurement, Precision, Fine structure, Lamb shift.

The authors review the current theoretical status of high precision measurements in quantum electrodynamics (QED). Theoretical predictions in QED fall into one of two general categories: perturbative, as for the magnetic moments of electrons and muons; and nonperturbative, as for the properties of atoms. We contrast these predictions and explore their implications for the fundamental constants of nature.

715,214
PB85-130466
(Order as PB85-130078, PC **A99**/MF **A01**)
California Univ., Davis. Dept. of Physics.
Uncertainties in QED (Quantum Electrodynamics) Fine Structure Calculations.
G. W. Erickson. 1984, 5p
Included in Precision Measurement and Fundamental Constants II, p195-199 1984.

Keywords: *Quantum electrodynamics, *Atomic energy levels, Hydrogen, Protons, Size determination, Dimensions, *Fine structure, Lamb shift, Uncertainty.

The most general calculation of precise one-electron atomic energy levels includes uncertainties which are important in the determination of fundamental constants and in the comparison of QED theory and precision measurements. Besides the ususal Lamb shift splitting S between n S (1/2) and n P (1/2) states, and the fine structure interval delta E between n P (3/2) and n P (1/2) states, the large interval between n P (3/2) and n P (1/2) states has been directly measured to high precision, but the uncertainty in its calculated value is often mistakenly taken to be the combination of uncertainties in S and delta E. This will be clarified, and the sources of these uncertainties in the low-Z calculations will be discussed. Comparisons will be made with independent calculations at high Z and with experimental values. The overall picture is one of general agreement, but with small unresolved discrepancies. It will be seen that a tentative resolution may be obtained by discarding one of the calculations, the most recent proton and alpha particle size measurements, and 7 of the 27 most precise measurements of energy level difference.

715,215
PB85-130474
(Order as PB85-130078, PC **A99**/MF **A01**)
Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Physics.
Sixth Order Contributions to g-2 of the Electron.
M. J. Levine, and R. Z. Roskies. 1984, 2p
Prepared in cooperation with Pittsburgh Univ., PA. Dept. of Physics and Astronomy.
Included in Precision Measurement and Fundamental Constants II, p201-202 1984.

Keywords: *Quantum electrodynamics, *Electron spin, *Magnetic moments, Abnormalities, *G factor, *Fine structure constant, Feynman diagram.

The contributions of 10 graphs to the anomalous magnetic moment of the electron in sixth order are presented to much greater accuracy than in previous evaluations. These results lead to a revised value for the entire sixth order contribution. When this is combined with the preliminary eighth order results, theory and experiment are again in reasonably good agreement.

715,216
PB85-130482
(Order as PB85-130078, PC **A99**/MF **A01**)
Cornell Univ., Ithaca, NY. Floyd R. Newman Lab. of Nuclear Studies.
Calculation of the Eighth Order Anomalous Magnetic Moment of the Electron.
T. Kinoshita, and W. B. Lindquist. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p203-205 1984.

Keywords: *Quantum electrodynamics, *Electron spin, *Magnetic moments, Abnormalities, *Fine structure constant, Feynman diagram.

The authors present a very preliminary result of their calculation of the eighth order QED contribution to the anomalous magnetic moment of the electron. Altogether 891 Feynman diagrams contribute to this term. By a method developed earlier, the authors have compressed them into about 100 integrals, which are evaluated using adaptive Monte Carlo integration routines. The difference between experiment and theory is now -251(154) X 10 to the -12th power.

715,217
PB85-130490
(Order as PB85-130078, PC **A99**/MF **A01**)
Michigan Univ., Ann Arbor. Dept. of Physics.
Experimental Determinations of the Anomalous Magnetic Moments of the Free Leptons.
R. Conti, D. Newman, A. Rich, and E. Sweetman. 1984, 8p
Included in Precision Measurement and Fundamental Constants II, p207-214 1984.

Keywords: *Quantum electrodynamics, *Magnetic moments, Electron spin, Positrons, Muons, Special relativity, Abnormalities, Dipole moments, *G factor.

The ten year period since the First International Conference on Precision Measurements and Fundamental Constants has seen an improvement of approximately one hundred fold in the experimental determination of the (e(-), e(+)) and (mu(-), mu(+)) anomalous magnetic moments. Similar progress has been made in theoretical QED g-2 calculations as well as in the experimental determination of alpha. The substance of this article will be a review of various experiments, a discussion of new work now in progress, and an attempt to predict future possibilities in measuring lepton anomalous moments. The non-QED tests are also discussed.

715,218
PB85-130508
(Order as PB85-130078, PC **A99**/MF **A01**)
Washington Univ., Seattle. Dept. of Physics.
Preliminary Comparison of the Positron and Electron Spin Anomalies.
P. B. Schwinberg, R. S. Van Dyck, and H. G. Dehmelt. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p215-218 1984.

Keywords: *Electron spin, *Positrons, Fundamental constants, Abnormalities, Comparison, Precision, Ion traps, Geonium.

A new double Penning trap structure has been built using various techniques developed in our geonium experiment. Primary positrons are captured in a storage trap, centered, and then transferred into a well-compensated experiment trap where preliminary measurements have yielded the single positron g-factor anomaly a (e+) = (1159652222 + or - 50) X 10 to the -12th power. This value was obtained from four runs at a field of 50.8 kG with the a (e+) values extrapolated to zero spin flip power using the power dependence observed in the electron geonium experiment. The uncertainty is based on the resonance linewidths and an estimate of the remaining systematic errors. When compared to the electron spin anomaly, we obtain a positron/electron g-factor ratio of 1 + (22 + or - 64) X 10 to the -12th power.

715,219
PB85-130516
(Order as PB85-130078, PC **A99**/MF **A01**)
Washington Univ., Seattle. Dept. of Physics.
Geonium Without a Magnetic Bottle - A New Generation.
G. Gabrielse, and H. Dehmelt. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p219-221 1984.

Keywords: *Electron spin, *Magnetic moments, Relativity, Mass, *Geonium, Ion traps, Magnetic bottles.

Work is now underway to improve the accuracy of the electron magnetic moment measurements by 10 to 100; that is, to an accuracy of 1 part per trillion. At this level of accuracy, the magnetic bottle so crucial to previous measurements must be removed. In fact, intrinsic bottles due to the paramagnetism of the trap electrodes must be carefully canceled. A promising replacement for the magnetic bottle is the relativistic mass increase which acts like a magnetic bottle 20 times smaller than the one previously used but with no distortion of the magnetic field. The relativistic mass increase has been observed for 0.5 eV electrons. The authors have also trapped electrons in a new style, compensated Penning trap (described here) which is simpler to construct, promises to be more reliable when cycled to liquid helium temperatures, and can be eaily disassembled.

715,220
PB85-130524
(Order as PB85-130078, PC **A99**/MF **A01**)
Mainz Univ. (Germany, F.R.). Inst. fuer Physik.
Magnetic Moment of Positive Muons in Units of the Proton Magnetic Moment.
E. Klempt, R. Schulze, H. Wolf, M. Camani, and F. N. Gygax. 1984, 5p
Prepared in cooperation with Eidgenoessische Technische Hochschule, Villigen (Switzerland). Lab fuer Hochenergiephysik.
Included in Precision Measurement and Fundamental Constants II, p223-227 1984.

Keywords: *Nuclear magnetic moments, *Muons plus.

The magnetic moment of positive muons in units of the proton magnetic moment was determined. A value of mu(mu)/mu(p) = 3.1833441(17) was found.

715,221
PB85-130540
(Order as PB85-130078, PC **A99**/MF **A01**)
Harvard Univ., Cambridge, MA.
Determination of the Neutron Magnetic Moment.
G. L. Greene, N. F. Ramsey, W. Mampe, J. M. Pendlebury, and W. B. Dress. 1984, 4p
Prepared in cooperation with Sussex Univ., Brighton (England), Institut Max von Laue - Paul Langevin, Grenoble (France), Oak Ridge National Lab., TN., and CEA Centre d'Etudes Nucleaires de Grenoble (France).
Included in Precision Measurement and Fundamental Constants II, p233-236 1984.

Keywords: *Neutrons, *Nuclear magnetic moments, Nuclear magnetic resonance.

The neutron magnetic moment has been measured with an improvement of a factor of 100 over the previous best measurement. Using a magnetic resonance spectrometer of the separated oscillatory field type capable of determining a resonance signal both for neutrons, and for protons in flowing H2O, the authors find mu(n)/mu(p) = 0.68497935(17) (0.25 ppm). The neutron magnetic moment can also be expressed without loss of accuracy in a variety of other units.

715,222
PB85-130565
(Order as PB85-130078, PC **A99**/MF **A01**)
Stanford Univ., CA.
Fundamental Tests and Measures of the Structure of Matter at Short Distances.
S. J. Brodsky. 1984, 8p
Contract DE-AC03-76SF00515
Included in Precision Measurement and Fundamental Constants II, p249-256 1984.

Keywords: *Quantum electrodynamics, Strong interactions, Weak interactions, Field theory(Physics), *Quantum chromodynamics, Unified field theory.

Recent progress in gauge field theories has led to a new perspective on the structure of matter and basic interactions at short distances. It is clear that at very high energies, quantum electrodynamics, together with the weak and strong interactions, are part of a unified theory with new fundamental constants, new symmetries, and new conservation laws. A nontechnical introduction to these topics is given, with emphasis on fundamental tests and measurements.

715,223
PB85-130573
(Order as PB85-130078, PC **A99**/MF **A01**)
Bayreuth Univ. (Germany, F.R.).
Experimental Limit for the Charge of the Free Neutron.
R. Gaehler, J. Kalus, and W. Mampe. 1984, 5p
Prepared in cooperation with Institut Max von Laue - Paul Langevin, Grenoble (France).
Included in Precision Measurement and Fundamental Constants II, p257-261 1984.

Keywords: *Neutrons, *Electric charge, Measurement, *Neutron charge.

The neutron charge has been measured to be q(n) = absolute value of q(e) (-1.5 + or - 2.2) X 10 to the -20th power (q(e) = electron charge) at a confidence level of 90%. This value brings down the known limit by two orders of magnitude. In the experiment slow neutrons of 20 A wavelength passed a strong electric field of 10 m length. The deflection of the neutron beam was measured with respect to reversal of the field. For an increase in sensitivity the beam was focused by a neutron lens to a sharp image in the detector plane. Over a long run time the deflection of the neutron beam due to

the electric field was less than 0.02 micrometer. The result on the neutron charge is in agreement with the commonly accepted neutrality of the neutron.

715,224
PB85-130623
(Order as PB85-130078, PC **A99**/MF **A01**)
Bureau International des Poids et Mesures, Sevres (France).
Radiometric Determination of the Stefan-Boltzmann Constant.
T. J. Quinn, and J. E. Martin. 1984, 7p
Prepared in cooperation with National Physical Lab., Teddington (England).
Included in Precision Measurement and Fundamental Constants II, p291-297 1984.

Keywords: *Thermal radiation, Blackbody radiation, Radiometers, Calorimeters, Cryogenics, *Stefan-Boltzmann constant.

A new determination of the Stefan-Boltzmann constant is being made using a blackbody source of thermal radiation at 273.16 K and a detector in the form of a heat-flow calorimeter at 2 K. From a knowledge of the geometry of the aperture system and the thermodynamic temperature of the blackbody, the Stefan/Boltzmann constant may be deduced.

715,225
PB85-130631
(Order as PB85-130078, PC **A99**/MF **A01**)
National Research Lab. of Metrology, Sakura (Japan).
Radiometric Measurement of the Stefan-Boltzmann Constant at NRLM (National Research Lab. of Metrology).
A. Ono. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p299-302 1984.

Keywords: *Thermal radiation, Blackbody radiation, Radiometers, Emissivity, *Stefan-Boltzmann constant.

Progress at NRLM on the radiometric measurement of the Stefan-Boltzmann constant is described. In the method, the total radiant flux emitted from a blackbody source that is spatially defined by two limiting apertures is measured by an absolute radiometer. A newly developed absolute radiometer is described that has improved uniform responsivity over the surface of the receiver; the variation of responsivity is less than 0.2% over an area 15 mm in diameter. Emissivities of blackbody cavities are calculated by the Monte Carlo method taking into account partial specular reflection of radiation on the cavity walls. An approach to a perfect blackbody cavity is also presented. It is discussed how uncertainties of blackbody source temperature and of diffraction losses of radiant flux are to be minimized.

715,226
PB85-130649
(Order as PB85-130078, PC **A99**/MF **A01**)
National Science Foundation, Washington, DC. Div. of Physics.
Applications of X-ray Interferometry.
R. D. Deslattes. 1984, 9p
Included in Precision Measurement and Fundamental Constants II, p303-311 1984.

Keywords: *Fundamental constants, Optical interferometers, Density(Mass/volume), Gamma rays, Standards, Silicon, Crystal lattices, Reviews, *X ray interferometry, Avogadro constant, Uses.

This review begins by summarizing work at the PTB and NBS on optical interferometry of (220) repeat distances in samples of monocrystalline Si. Distribution of such an initial calibration to other samples and other species is briefly mentioned. The main emphasis is on subsequent applications of these crystals toward determination of fundamental constants, especially N(A) and extension of the congruent electromagnetic scale to gamma-rays as has so far been carried out at NBS. In the last mentioned case, applications emerge which include tests of QED in muonic atoms, determination of mass values for the pion and the kaon, and tests of relativistic self-consistent field calculations for inner vacancy states in atoms.

715,227
PB85-130680
(Order as PB85-130078, PC **A99**/MF **A01**)
Columbia Univ., New York.
High Precision Studies of Pionic X Rays: Some Past Results and Future Prospects.
G. Dugan, L. Delker, C. S. Wu, and D. C. Lu. 1984, 5p
Prepared in cooperation with Yale Univ., New Haven, CT.
Included in Precision Measurement and Fundamental Constants II, p325-329 1984.

Keywords: *Pions, X ray spectrometers, Mass, Precision, *X-ray sources, Pions minus, Pionic atoms, Fine structure, Molybdenum 99.

The development of high intensity pionic x-ray sources has allowed a high precision crystal spectrometer measurement of certain pionic x-ray energies to be made. These energy measurements have resolved the relativistic fine structure and have been used to provide an improved determination of the negative pion mass (accuracy 6.4 ppm). Substantial further increases in pionic x-ray source intensity have been shown to be feasible at LAMPF. These increases will make possible the use of double flat cyrstals and can lead to advances in the study of electron screening in pionic atoms, further high precision pion mass and pionic atom fine structure studies, and possible also high precision muonic x-ray energy measurements.

715,228
PB85-130698
(Order as PB85-130078, PC **A99**/MF **A01**)
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik.
Isotope Shifts of K X-rays of Lead.
G. L. Borchert, O. W. B. Schult, J. Speth, P. G. Hansen, and B. Johnson. 1984, 4p
Contract W-7405-eng-26
Prepared in cooperation with Aarhus Univ. (Denmark). Fysiske Inst., European Council for Nuclear Research, Geneva (Switzerland), and Oak Ridge National Lab., TN.
Included in Precision Measurement and Fundamental Constants II, p331-334 1984.

Keywords: *Lead isotopes, *Isotope effect, *X rays, X ray spectrometers, Nuclear structure, Precision, Resolution, *Spectral shift, Lead 204, Lead 206, Lead 207, Lead 208, K shell.

During the last years progress in nuclear theory has allowed more detailed predictions for ground state properties of heavier elements especially in the vicinity of double magic nuclei. Experimentally the change of the mean square charge radius can be determined by a high resolution measurement of the K x-ray isotope shifts. Therefore, the authors performed a study of the isotope shifts of all stable lead isotopes and compared them to very recent microscopic calculations.

715,229
PB85-130714
(Order as PB85-130078, PC **A99**/MF **A01**)
Auckland Univ. (New Zealand). Dept. of Physics.
Absolute Determination of the Threshold Energies of (7)Li(p,n), (10)B(p,n), and (14)N(p,n).
P. H. Barker, M. J. Lovelock, H. Naylor, R. M. Smythe, and R. E. White. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p345-347 1984.

Keywords: Neutron reactions, Proton reactions, Calibrating, Electric potential, Standards, *Proton-neutron interactions, *Threshold energy, Lithium 7, Boron 10, Nitrogen 14, Heavy ions.

The present status of the Heavy Ion Source System (HISS) for the measurement of nuclear reaction energies is discussed, and some results are presented. In particular, accurate values for the threshold energies of (7)Li(p,n), (10)B(p,n), and (14)N(p,n) are given.

715,230
PB85-130722
(Order as PB85-130078, PC **A99**/MF **A01**)
Washington Univ., Seattle. Dept. of Physics.
Preliminary Proton/Electron Mass Ratio Using a Precision Mass-Ratio Spectrometer.
R. S. Van Dyck, and P. B. Schwinberg. 1984, 4p
Grants NBS-G7-9023, NSF-PHY80-15328
Included in Precision Measurement and Fundamental Constants II, p349-352 1984.

Keywords: *Fundamental constants, Mass spectrometers, Measurement, Precision, Ratios, Proton, Electrons, Mass, *Proton-electron mass ratio, Ion traps, Ion cyclotron resonance spectroscopy, Penning traps.

A new type of compensated Penning trap has its ring electrode split into equal quadrants in order to synchronously detect ion cyclotron resonances. Using this device, the authors have observed intense unshifted resonances with very small relative linewidths ($< 2 \times 10^{-9}$), comparable to that which is attainable in high resolution NMR studies. Thus, cyclotron frequencies of both protons and electrons have been measured in the same magnetic field (5 T) and the same trapping volume ($< 10^{-7}$ cc). From the ratio of these frequencies, a preliminary value of m(p)/m(e) = 1836.15300(25) is obtained with a relative uncertainty of 0.14 ppm. This value agrees well with previous direct measurements within their experimental uncertainties.

715,231
PB85-130730
(Order as PB85-130078, PC **A99**/MF **A01**)
Mainz Univ. (Germany, F.R.). Inst. fuer Physik.
Direct Determination of the Proton-Electron Mass Ratio.
G. Graeff, H. Kalinowsky, and J. Traut. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p353-356 1984.

Keywords: *Fundamental constants, Protons, Electrons, Mass, Ratios, *Proton-electron mass ratio, Ion traps, Penning traps.

The cyclotron frequencies of free protons and electrons have been measured in a magnetic field of 5.81 tesla with a superimposed electrostatic quadrupole field. The increase of energy connected with a transition at the cyclotron frequency is detected by the measurement of the time of flight through an inhomogeneous magnetic field. From the ratio of the measured cyclotron frequencies of both particles, the proton-electron mass ratio is deduced. The result, m(p)/m(e) = 1836.1527(13), agrees within the limits of error (0.69 ppm) with the value of the indirect determination.

715,232
PB85-130755
(Order as PB85-130078, PC **A99**/MF **A01**)
Stanford Univ., CA. Dept. of Physics.
High Resolution Magnetic Measurement on Rotating Superconductors to Determine h/m(e).
B. Cabrera, S. B. Felch, and J. T. Anderson. 1984, 6p
Contract NAS8-32355, Grant NBS-GB-9026
Sponsored in part by Grant NSF-DMR80-26007.
Included in Precision Measurement and Fundamental Constants II, p359-364 1984.

Keywords: *Fundamental constants, Magnetic measurement, Superconductors, Cryogenics, Ratios, Magnetometers, *Electron mass, *Plancks constant, SQUID devices.

The authors have begun a new experiment to determine h/m(e) (Planck's constant divided by the free electron mass) to an accuracy of several parts per million using rotating superconducting rings. This resolution will allow for the first time investigation of recently predicted relativistic corrections at a level of 100 to 200 ppm. Here the authors present initial experimental measurements of h/m(e). These include high precision measurements of the induced magnetic field from the rotating superconducting ring, showing an improvement in resolution by two orders of magnitude over previously reported observations, and a clear demonstration of flux quantization in the 50 mm diameter ring.

715,233
PB85-130763
(Order as PB85-130078, PC **A99**/MF **A01**)
National Physical Lab., Teddington (England). Div. of Quantum Metrology.
High Precision Measurement of the Electron Compton Wavelength (h/m(e)) Using Cryogenic Metrological Techniques.
J. C. Gallop, B. W. Petley, and W. J. Radcliffe. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p365-367 1984.

Keywords: *Fundamental constants, Ratios, Superconductors, Cryogenics, Helium 3, Liquid helium, Nuclear magnetic resonance, Magnetometers, *Electron mass, *Plancks constant, SQUID devices, Fluxoids.

The paper reports progress on the NPL measurement of the Compton wavelength of the electron, which relies on the unique properties obtainable in cryogenic environments. The method is to trap a magnetic field in a superconducting tube. The experimentally measured quantities are the spin precession frequency of the (3)He nuclei in the trapped field, and the cross sectional area of the tube. Novel cryogenic metrology is used for both of these measurements.

715,234
PB85-130771
(Order as PB85-130078, PC **A99**/MF **A01**)
Physikalisch-Technische Bundesanstalt, Brunswick (Germany, F.R.).
Preliminary Determination of h/m(n).
E. Krueger, W. Nistler, and W. Weirauch. 1984, 5p
Included in Precision Measurement and Fundamental Constants II, p369-373 1984.

Keywords: *Fundamental constants, Ratios, Measurement, Precision, Neutron beams, *Plancks constant, *Neutron mass, Polarized beams.

A precisely measured value of the ratio h/m(n) (Planck constant divided by the neutron mass) would be a new input parameter for the least-squares adjustment of the fundamental constants. h/m(n) can be determined by measuring the wavelength and the velocity of reactor neutrons. It is expected that this measurement can be carried out with a relative uncertainty of about 1 X 10 to the -6th power, using a method described in this paper. The method has been successfully tested in a preliminary determination of h/m(n) and the results are reported.

715,235
PB85-130789
(Order as PB85-130078, PC **A99**/MF **A01**)
Bureau International des Poids et Mesures, Sevres (France).
Assignment of Uncertainties to the Results of Experimental Measurements.
J. W. Mueller. 1984, 7p
Included in Precision Measurement and Fundamental Constants II, p375-381 1984.

Keywords: *Measurements, Experimental data, Variance(Statistics), Probability theory, Covariance, Errors, *Uncertainty.

After a brief review of some of the current ways of indicating in a quantitative manner the uncertainties which are associated with an experimental measurement, the main shortcomings of some of the usual practices are indicated. The present situation is unsatisfactory and results in frequent misinterpretations, rendering, for instance, a critical data evaluation a cumbersome task. BIPM recently organized a meeting of experts, chosen by the national standardizing laboratories, for discussion of the relevant problems. This resulted in the establishment of five recommendations concerning the statement of uncertainties which are included in an appendix.

715,236
PB85-130797
(Order as PB85-130078, PC **A99**/MF **A01**)
Physikalisch-Technische Bundesanstalt, Brunswick (Germany, F.R.).
Statement of a Total Confidence Interval Based on the Concept of Randomization of Systematic Errors: Large and Small Sample Sizes.
W. Woeger. 1984, 2p
Included in Precision Measurement and Fundamental Constants II, p383-384 1984.

Keywords: *Measurement, *Confidence limits, Random error, Randomization, Sampling, *Uncertainty, Systematic errors.

Interpreting the systematic error in a measurement series as the realization of a random variable, confidence intervals of the mean for the special cases of large and small sample sizes are constructed by statistical methods, assuming normal distributions. These confidence intervals combine the effects of 'random' and 'systematic' errors and are extensions of the commonly used formulae.

715,237
PB85-130805
(Order as PB85-130078, PC **A99**/MF **A01**)
National Research Council of Canada, Ottawa (Ontario).
Measurement Assurance.
A. F. Dunn. 1984, 5p
Included in Precision Measurement and Fundamental Constants II, p385-389 1984.

Keywords: *Measurement, Standard deviation, Probability theory, Accuracy, *Uncertainty.

Measurement assurance involves combining intrinsic uncertainties of instruments and standards used in a measurement procedure with uncertainties associated with actual use of the instruments, in order to provide a meaningful statement of a total effective uncertainty of the measurement procedure.

715,238
PB85-130813
(Order as PB85-130078, PC **A99**/MF **A01**)
Rockwell International, Thousand Oaks, CA. Science Center.
Extended-Least-Squares Treatment of Discrepant Data.
E. R. Cohen. 1984, 5p
Included in Precision Measurement and Fundamental Constants II, p391-395 1984.

Keywords: *Measurement, *Least squares method, Experimental data, Variance(Statistics), Estimates.

In the usual least squares analysis, the weighting of the data is proportional to the inverse of the assigned variance. As this variance is itself the result of measurement, its value is uncertain. The observed residuals in the least squares adjustment provide a posteriori estimates of the variance. Linear, unbiased, minimum-variance estimators (LUMVE) are derived which provide a means for assigning weights to the experimental data. Using this estimator, data treatment algorithms can be formulated which are a significant improvement on the 'traditional' Birge-ratio procedures.

715,239
PB85-130870
(Order as PB85-130078, PC **A99**/MF **A01**)
Physikalisch-Technische Bundesanstalt, Brunswick (Germany, F.R.).
Mass Unit 'Kilogram', Precision Measurement of Mass, Attainable Uncertainties, and Possibilities of a New Definition.
M. Kochsiek. 1984, 9p
Included in Precision Measurement and Fundamental Constants II, p427-435 1984.

Keywords: *Mass, Weight indicators, Standards, Reviews, Balances, Uncertainty, Kilograms.

In this review, the present state of the dissemination of the unit of mass scale (hierarchy of mass standards, multiples and submultiples), requirements for mass standards, important designs of weighing machines, and the predominant influencing parameters such as air density, in mass determination are discussed. Lately it has become possible to determine air density with smaller uncertainty by way of calculation and experiment. Possibilities are shown for a new definition on the basis of fundamental constants.

715,240
PB85-130888
(Order as PB85-130078, PC **A99**/MF **A01**)
Commonwealth Scientific and Industrial Research Organization, Lindfield (Australia). Div. of Applied Physics.
Measurement of Air Density for High Accuracy Mass Determination.
D. B. Prowse. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p437-439 1984.

Keywords: *Mass, *Atmospheric density, *Air, *Density(Mass/volume), Buoyancy, Measurement, Balances.

A description is given of the air density balance developed for the fundamental determination of the density of air. The method consists of measuring the apparent mass difference between a sphere and a ring of similar mass and large known difference in volume. The two-arm balance used has been modified to give a continuous electrical readout of the air density. The uncertainty (3 standard deviations) in air density given by the method is 3.5 X 10 to the -5th power km/mu cubed. Preliminary results indicate that the air density balance agrees with the values obtained by the equations developed to calculate air density to 2 parts in 10,000. Rapid fluctuations up to 1 in 10,000 of the air density are observed in an air-conditioned laboratory.

715,241
PB85-130896
(Order as PB85-130078, PC **A99**/MF **A01**)
National Research Lab. of Metrology, Sakura (Japan).
More Precise Correction for Buoyancy and Gas Adsorption in Mass Measurement.
Y. Kobayashi. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p441-443 1984.

Keywords: *Mass, *Buoyancy, *Standards, *Adsorption, Precision, Correction, Gases, Atmospheric density, Density(Mass/volume), Air, Kilogram.

Using Pt-Ir Kilogram Prototypes, mass standards made of other materials, for example stainless steel, are usually calibrated in the atmosphere. In this case, the precision is limited by various conditions of the measuring environment. In this study, the increased precision of the correction for buoyancy and the introduction of a correction for water vapor adsorption made it possible to decrease, by one order of magnitude, the errors caused by the measuring environment.

715,242
PB85-130904
(Order as PB85-130078, PC **A99**/MF **A01**)
Commonwealth Scientific and Industrial Research Organization, Lindfield (Australia). Div. of Applied Physics.
Density Standards - The Density and Thermal Dilatation of Water.
G. A. Bell, and J. B. Patterson. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p445-447 1984.

Keywords: *Density(Mass/volume), *Water, *Standards, Weight measurement, Mass, Spheres, Stretching, Dilatation.

A hydrostatic weighing experiment has been done to measure the density of water samples of differing isotopic composition from which values have been derived for the density of SMOW (standard mean ocean water). Measurements are also being made of the dilatation of water in the temperature range 0 to 40 degrees C.

715,243
PB85-130912
(Order as PB85-130078, PC **A99**/MF **A01**)
Istituto di Metrologia Gustavo Colonnetti, Turin (Italy).
Precision Measurements on Solid Artifacts for a Redetermination of the Density of Water.
A. Peuto, A. Sacconi, R. Panciera, W. Pasin, and M. Rasetti. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p449-452 1984.

Keywords: *Density(Mass/volume), *Water, *Standards, *Mass, *Volume, Weight measurement, Spheres, Optical interferometers, Helium neon lasers, Hydrostatics, Iodine 127.

Mass and volume of four spheres made of low thermal expansion glass-ceramic were determined. Mass was measured against stainless steel standards, with + or - 2 X 10 to the -7th power relative uncertainty. The volume of two of the spheres was obtained through correlation of measured diameters and roundness data. Diameters were measured with a two-step interferometric method. Roundness data were taken on nine sections 20 degrees apart. Estimated uncertainty of volume values is + or - 1 X 10 to the -6th power. The volume of all four spheres, at 20 degrees C, was also measured by hydrostatic weighing in water with + or - 3 X 10 to the -6th power relative uncertainty. The comparison between volumes determined through both methods yields results in agreement within 1.5 X 10 to the -6th power. Volume ratios agree within 4 X 10 to the -7th power.

715,244
PB85-130920
(Order as PB85-130078, PC **A99**/MF **A01**)
Bureau International des Poids et Mesures, Sevres (France).
Influence of Dissolved Air on the Density of Water.
G. Girard, and M. J. Coarasa. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p453-456 1984.

Keywords: *Density(Mass/volume), *Water, *Dissolved gases, *Air, Compressibility, Weight measurement, Hydrostatics, Thermal expansion, Isotope ratio.

A knowledge of the density of water to an accuracy of 0.0001 kg/cu m (1 part in one million) has been of metrological importance for a long time. The basic work on the density of water dates from the beginning of the century and at the time included the absolute value itself together with the variations of density as a function of temperature and of amount of dissolved air. In recent years a number of laboratories, BIPM among them, have once again taken up this work. At BIPM, studies have been undertaken of the influence of variations in isotopic composition on the density. A relation has been derived which is valid for all samples of water likely to be encountered in any of the various national metrological laboratories. Recent work at BIPM has been devoted to the question of the effect of dissolved air on the density. The density of samples having different levels of saturation of dissolved air has been measured at various temperatures between 4 and 22 degrees C. The levels of saturation of dissolved oxygen were within the range 0.1 to 0.95.

715,245
PB85-130938
(Order as PB85-130078, PC **A99**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Measurements and Standards Div.
Helium Melting Curve and the Linkage of Fundamental Constants, Pressure, Density, and Mass.
C. T. Van Degrift. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p457-459 1984.

Keywords: *Liquid helium, *Helium, *Melting, *Fundamental constants, Many body problem, Solidified gases, Density(Mass/volume), Pressure, Mass, Quantum theory, Helium 3, Helium 4, Cryogenics, *Solid helium.

Recent progress made toward the calculation of the ground states of liquid and solid helium from first principles suggests that a future pressure standard might be based on the calculated phase diagrams of (3)He and (4)He. The absolute reference pressures of the zero temperature intercepts and minima of the melting curves of these systems would be transfered to room temperature gages and provide a new connection between fundamental constants and density or mass. Already, present experiments suggest that the helium melting curves can provide pressure reference points which are precise within 1 ppm. A summary of the current state of theoretical work is given followed by a discussion of the practical difficulties in realizing the linkages between the melting curve and room temperature pressure, mass and density.

715,246
PB85-130946
(Order as PB85-130078, PC **A99**/MF **A01**)
National Physical Lab., Teddington (England). Div. of Electrical Science.
Realization of the Electrical SI Units.
B. P. Kibble. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p461-464 1984.

Keywords: Electrical resistance, Electric current, Measurement, *Ampere, *Fine structure constant, Quantum Hall effect, Kilograms, Ohm, Moving coil experiments.

The ampere is unique in the set of SI units in that the accuracy with which it can be realized is still insufficient for accurate measurements of the fundamental constants. Possible ways of improving this situation are described. In contrast, the ohm is in good shape, and a new cryogenic phenomenon concerning a quantized Hall effect in a MOSFET structure enables a more accurate non-QED measurement of the fine structure constant to be made in terms of it. A change of base units to eliminate the artifact-based definition of the kilogram is a more speculative possibility.

715,247
PB85-130953
(Order as PB85-130078, PC **A99**/MF **A01**)
Laboratoire Central des Industries Electriques, Fontenay-aux-Roses (France).
Absolute Determination of the Volt at LCIE (Laboratoire Central des Industries Electriques).
N. Elnekave, and A. Fau. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p465-468 1984.

Keywords: *Electric potential, *Standards, Electrometers, Measurement, Precision, *Volt, *Voltage standards.

The absolute determination of the volt using Kelvin's electrometer which was carried out in 1978 is now repeated with an improved volt balance. The new instrument includes a larger active electrode and a reduced gap between it and the guard ring. Second order corrections due to gap effects have been calculated by finite element methods and checked through rheographic mapping. It is estimated that random errors associated with the use of the new instrument will amount to less than 4 ppm.

715,248
PB85-130961
(Order as PB85-130078, PC **A99**/MF **A01**)
Commonwealth Scientific and Industrial Research Organization, Lindfield (Australia). Div. of Applied Physics.
CSIRO (Commonwealth Scientific and Industrial Research Organization) Absolute Volt Project.
G. J. Sloggett, W. K. Clothier, D. J. Benjamin, M. F. Currey, and H. Bairnsfather. 1984, 5p
Included in Precision Measurement and Fundamental Constants II, p469-473 1984.

Keywords: *Electric potential, *Standards, Electrometers, Measurement, Precision, Mercury, Optical interferometers, Helium neon lasers, *Voltage standards, *Volt.

A liquid electrometer of unique design has been constructed to provide a precise absolute voltage standard. In this progress report the instrument is described and critical aspects of its performance are assessed. Known sources of uncertainty are consistent with a volt determination at or below the 1 ppm level. The principal areas of remaining work are discussed.

715,249
PB85-130979
(Order as PB85-130078, PC **A99**/MF **A01**)
National Bureau of Standards (NML), Washington, DC. Electrical Measurements and Standards Div.
Status of the Measurement of the NBS (National Bureau of Standards) Ampere in SI Units.
P. T. Olsen, W. D. Phillips, and E. R. Williams. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p475-478 1984.

Keywords: *Electric current, *Standards, Fundamental constants, Measurement, *Ampere, Current balances.

The authors report on the status of a preliminary measurement of the NBS as-maintained ampere in terms of the SI, or absolute, ampere by a method which avoids the usual determination of dimensions of current-carrying coils. As a result, a major source of uncertainty is removed from the experiment. The preliminary work reported here has a statistical uncertainty on the order of 1 ppm. Systematic errors have not been fully evaluated, but the authors believe them to be on the order of 30 ppm or less.

715,250
PB85-130987
(Order as PB85-130078, PC **A99**/MF **A01**)
Tokyo Univ. (Japan). Faculty of Engineering.
Feasibility Study of an Absolute Determination of the Magnetic Flux Quantum.
K. Hara, F. Shiota, and T. Kubota. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p479-482 1984.

Keywords: *Magnetic measurement, Josephson junctions, Superconductors, Cryogenics, Feasibility, *Magnetic flux, Magnetic levitation, SQUID devices.

The principle and an experimental study of a new method to determine the magnetic flux quantum (phi sub 0) is described. Magnetic energy proportional to (phi sub 0) squared is substituted for and measured in terms of gravitational potential energy. A superconducting magnetic levitation system consisting of a persistent current coil and a superconducting floating body is employed for this energy substitution.

715,251
PB85-130995
(Order as PB85-130078, PC **A99**/MF **A01**)
Vsesoyuznyi Nauchno-Issledovatel'skii Inst. Metrologii, Leningrad (USSR).
Work Done at the Mendeleyev Research Institute of Metrology (VNIIM) to Improve the Values of the Fundamental Constants.
Y. V. Tarbeyev. 1984, 6p
Included in Precision Measurement and Fundamental Constants II, p483-488 1984.

Keywords: *Fundamental constants, Measurement, Protons, Avogadro constant, Rydberg constant, Gyromagnetic ratio.

The work on fundamental constants carried out at VNIIM is a part of the overall effort in metrology aimed at improving measurement standards and systems. The results of work on the Avogadro constant, the gyromagnetic ratio of the proton, the Rydberg constant, and in associated research fields are reported. Improvements in the techniques for adjusting the values of fundamental constants as well as nuclear spectroscopy reference lines are discussed.

715,252
PB85-131001
(Order as PB85-130078, PC **A99**/MF **A01**)
Electrotechnical Lab., Sakura (Japan).
Realization of a Josephson Potentiometer.
M. Koyanagi, T. Endo, and A. Nakamura. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p489-492 1984.

Keywords: *Potentiometers(Instruments), *Electric potential, *Standards, Josephson junctions, Alternating current, Microwaves, *Voltage standards, Josephson effect, Voltage, Uncertainty.

Preliminary experiments have been done on a new Josephson potentiometer. The emf of a standard cell is determined with an uncertainty at the 10 to the -8th power level by using a Josephson voltage of 100 mV which is generated by multiple Josephson junctions.

715,253
PB85-131019
(Order as PB85-130078, PC **A99**/MF **A01**)
Helsinki Univ. of Technology, Espoo (Finland).
Transportable Josephson Voltage Standard.
K. Lahdenperae, H. Seppae, and P. Wallin. 1984, 3p
Prepared in cooperation with Valtion Teknillinen Tutkimuskeskus, Espoo (Finland).
Included in Precision Measurement and Fundamental Constants II, p493-495 1984.

Keywords: *Electric potential, *Standards, Portable equipment, Josephson junctions, Superconductivity, Alternating current, Cryogenics, *Voltage standards.

A transportable cryogenic Josephson effect emf standard has been developed in which all precise measurements are carried out in a helium bath (4.2 K). This standard uses a superconducting current comparator and 0.1 Hz measurement current for the calibration of a resistive potential divider. The cryogenic emf standard has a measurement uncertainty of 2 X 10 to the 8th power (one standard deviation).

715,254
PB85-131027
(Order as PB85-130078, PC **A99**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Electrical Measurements and Standards Div.
Proton Gyromagnetic Ratio in H2O - A Problem in Dimensional Metrology.
E. R. Williams, P. T. Olsen, and W. D. Phillips. 1984, 7p
Sponsored by Department of Energy, Washington, DC.
Included in Precision Measurement and Fundamental Constants II, p497-503 1984.

Keywords: *Fundamental constants, *Protons, Quantum electrodynamics, Water, Dimensional measurement, *Gyromagnetic ratio, *Fine structure constant.

The last 10 years of work on the proton gyromagnetic ratio in H2O, (Gamma prime, sub p), is reviewed. Results from both the low and high field methods are summarized along with short descriptions of several experiments. However, the emphasis is on the results from the low field method and the discrepancies among them. The values of the fine structure constant, alpha, obtained from the low field experiments are compared with several values of alpha obtained from various atomic physics experiments which to varying degrees require quantum electrodynamic theory (QED) for their interpretation.

715,255
PB85-131035
(Order as PB85-130078, PC **A99**/MF **A01**)
Beijing Univ. (China).
Development of Precision Measurement and Fundamental Constants in China.
Z. X. Wang. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p505-508 1984.

Keywords: *Fundamental constants, *Frequency standards, Cesium frequency standards, Helium neon lasers, Gravity, Electrical resistance, Measurement, Iodine, Methane, Stabilization, Protons, China, Gyromagnetic ratio, Hydrogen masers, Ohm.

In China there is some experimental work on precision measurement and fundamental constants, such as cesium and hydrogen frequency standards, iodine and methane stabilized lasers, the determination of the proton gyromagnetic ratio (gamma prime, sub p) and the gravitational acceleration g, the realization of the SI electrical resistance unit, and so on.

715,256
PB85-131043
(Order as PB85-130078, PC **A99**/MF **A01**)
Physikalisch-Technische Bundesanstalt, Brunswick (Germany, F.R.).
(gamma sup p)-Experiment at PTB (Physikalisch-Technische Bundesanstalt).
K. Weyand. 1984, 6p
Included in Precision Measurement and Fundamental Constants II, p509-514 1984.

Keywords: *Fundamental constants, *Protons, Nuclear magnetic resonance, Magnetometers, Magnetic measurement, Precision, *Gyromagnetic ratio, SQUID devices.

This paper will give a brief summary of the mechanical apparatus and the electronic set-up which have been constructed to determine the gyromagnetic ratio of the proton by observing free precession in a low magnetic field. A novel scheme is used to determine the coil constant of a multilayer field coil system consisting of four winding packages by measuring a quantity proportional to the magnetic flux density at a number of points on the axis of the set of coils carrying a stabilized current.

715,257
PB85-131050
(Order as PB85-130078, PC **A99**/MF **A01**)
Yale Univ., New Haven, CT. Dept. of Physics.
New Method for the Determination of the Proton Gyromagnetic Ratio.
G. L. Greene. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p515-517 1984.

Keywords: *Fundamental constants, *Protons, Magnetic resonance, Magnetic measurement, Water, *Gyromagnetic ratio, Ramsey technique.

A method for the determination of (gamma prime, sub p) is proposed which involves the separated oscillatory field magnetic resonance technique with flowing water. An association between the volume integral of a magnetic field in a cylinder (determined by a resonance frequency) and the line integral along its axis (determine by Ampere's law) is made. An accuracy of a few parts in (10 to the 8th power) may be attainable with this technique.

715,258
PB85-131142
(Order as PB85-130078, PC **A99**/MF **A01**)
Physikalisch-Technische Bundesanstalt, Brunswick (Germany, F.R.).
Gravity and Relativity: Experiments Relating to the Newtonian Gravitational Constant.
H. de Boer. 1984, 12p
Included in Precision Measurement and Fundamental Constants II, p561-572 1984.

Keywords: *Fundamental constants, Measurement, Surveys, *Gravitational constant, Uncertainty.

The Newtonian gravitational constant G is one of the natural constants, the exact knowledge of which might give us important answers to cosmological questions and contribute to the support of a theory of gravitation. In a survey, the problems are set forth which are related to the gravitational constant, appertaining measurements are described, and the uncertainties of measurements obtained so far are compiled.

715,259
PB85-131159
(Order as PB85-130078, PC **A99**/MF **A01**)
National Bureau of Standards (NML), Gaithersburg, MD. Center for Absolute Physical Quantities.
Redetermination of the Newtonian Gravitational Constant 'G'.
G. G. Luther, and W. R. Towler. 1984, 4p
Prepared in cooperation with Virginia Univ., Charlottesville. Dept. of Nuclear Engineering and Engineering Physics.
Included in Precision Measurement and Fundamental Constants II, p573-576 1984.

Keywords: *Fundamental constants, Experimental data, Measurement, *Gravitational constant, Uncertainty.

The universal Newtonian gravitational constant, G, has been redetermined at the National Bureau of Standards using the time-of-swing method, in which the period of a torsion pendulum in the form of a dumbbell weighing approximately 5 g is modified by the presence of two 10.5 kg tungsten balls. The difference in the squared frequencies with and without the balls is proportional to G. In this experiment the difference was approximately 3%. The apparatus used, albeit with extensive modification, is the same as used in the previous redetermination done at the National Bureau of Standards, using the method of constant angular acceleration. The apparatus is described, improvements are discussed, data is presented and evaluated. The resulting value of G is in agreement with the generally accepted CODATA value but with significantly smaller uncertainty.

715,260
PB85-131167
(Order as PB85-130078, PC **A99**/MF **A01**)
Cambridge Univ. (England). Cavendish Lab.
Design of a Beam Balance for a Determination of 'G'.
C. C. Speake, and A. J. F. Metherell. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p577-579 1984.

Keywords: *Fundamental constants, Precision, Measurement, Design, *Gravitational constant, Balances, Beam balances.

The authors are currently engaged in the design and construction of a beam balance which will be used for a precision determination of G. The balance is designed to give a value of G to about one part in 100,000. In place of a knife edges the balance employs a cross-strip pivot for its fulcrum and flexure pivots are used to suspend the test masses from the ends of its arms. The balance is servo-controlled so that it maintains its position in the horizontal plane to an angle of about 10 to the -9th power rad. The attracting masses are in the form of rectangular slabs with rectangular holes at their centers. This shape ensures that the test masses suspended from the arms of the balance lie in regions of space where the gravitational field due to the slabs is highly uniform. A precise knowledge of the center-of-mass to center-of-mass distances is therefore unnecessary for a precision determination of G with this device.

715,261
PB85-131175
(Order as PB85-130078, PC **A99**/MF **A01**)
Cambridge Univ. (England). Cavendish Lab.
Optimizing the Shape of the Attracting Mass in Precision Measurements of 'G'.
A. J. F. Metherell, C. C. Speake, Y. T. Chen, and J. E. Faller. 1984, 5p
Prepared in cooperation with Joint Inst. for Lab. Astrophysics, Boulder, CO.
Included in Precision Measurement and Fundamental Constants II, p581-585 1984.

Keywords: *Fundamental constants, *Shape, Measurement, Mass, Precision, Slabs, *Gravitational constant, Circular cylinders, Parallelepipeds.

It is now recognized that the sphere is not necessarily the best shape to use for an attracting mass in a precision measurement of G. Two shapes which minimize the effect of errors in the center-of-mass to center-of-mass distance between the attracting mass and the test mass are (a) the right-circular hollow cylinder and (b) a pair of rectangular parallelepiped slabs with rectangular holes at their centers. The kinematic factors influencing the design of these mass distributions are considered and the optimum design parameters that should be employed with attracting masses of these shapes are determined.

715,262
PB85-131183
(Order as PB85-130078, PC **A99**/MF **A01**)
Eastern Washington Univ., Cheney. Dept. of Physics.
Vacuum Polarization and Recent Measurements of the Gravitational Constant as a Function of Mass Separation.
D. R. Long. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p587-589 1984.

Keywords: *Fundamental constants, Measurement, Mass, Separation, Failure, Correction, *Gravitational constant, *Vacuum polarization, Inverse square laws.

The author notes that the coulomb inverse square law has long been known to fail at small charge separations due to a vacuum polarization effect. He points out that gravitational inverse square law data should be analyzed for a vacuum polarization effect and presents the QED result for the mass density shift of the vacuum due to an inducing mass. He points out that care must be used in analyzing the data because the point mass situation is very different from the case where one of the masses is quite extensive. He analyses the current data for the value of the vacuum polarization parameter lambda. Much of that data has errors too large to give definite results although it tends to agree with the authors earlier result of lambda = 0.002. Of the more precise results, Stacey and Tuck are in agreement with the authors value while Spero et al. disagree. It is pointed out that the vacuum polarization analysis of the Spero et al. result is ambiguous.

715,263
PB85-131191
(Order as PB85-130078, PC **A99**/MF **A01**)
California Univ., Irvine. Dept. of Physics.
Tests of the Gravitational Inverse Square Law Using Torsion Balances.
J. K. Hoskins, R. Newman, J. Schultz, and R. Spero. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p591-594 1984.

Keywords: *Fundamental constants, Gravitation, Torsion balances, Measurement, Tests, *Gravitational constant, *Inverse square laws.

The authors describe experiments at U.C. Irvine to test the inverse square distance dependence of the gravitational force at laboratory distances. One experiment has tested a distance range of approximately 2 to 5 cm, using a test mass suspended from a torsion balance to prove the gravitational field inside a mass tube. Results of this experiment support an inverse square law. A second experiment, now in progress, tests a distance range from 5 cm to 20 m. We discuss the feasibility of an experiment to test the inverse square law at distances less than 1 mm. Methods are discussed for reducing the effect of seismic noise on a torsion balance by damping pendulum oscillation modes of the balance.

715,264
PB85-131209
(Order as PB85-130078, PC **A99**/MF **A01**)
National Tsing Hua Univ., Hsinchu (Taiwan). Dept. of Physics.
Measurement of Gravitational Forces at Separations Around 10 Meters.
H. T. Yu, W. T. Ni, C. C. Hu, F. H. Liu, and C. H. Yang. 1984, 2p
Prepared in cooperation with Chinese Petroleum Corp., Miaoli (Taiwan).
Included in Precision Measurement and Fundamental Constants II, p595-596 1984.

Keywords: *Fundamental constants, Gravimeters, Gravitation, Separation, Mass, Tanks(Containers), Tests, *Gravitational constant, Inverse square laws, Oil tanks.

The authors used a Worden gravimeter to measure the gravitational forces at fixed positions when a large oil tank was full and when it was empty. The results are reported here.

715,265
PB85-131217
(Order as PB85-130078, PC **A99**/MF **A01**)
Queensland Univ., Brisbane (Australia). Dept. of Physics.
Non-Newtonian Gravity: Geophysical Evidence.
F. D. Stacey, and G. J. Tuck. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p597-600 1984.

Keywords: *Fundamental constants, Geophysics, Estimates, Gravitation, Measurement, *Gravitational constant, Inverse square laws.

Six independent geophysical data sets have been used to estimate the value of the Newtonian gravitational constant G, yielding results that are consistently higher than the accepted laboratory-determined value G by 0.5% to 1.5%. Possibilities of unrecognized systematic errors preclude a definite conclusion, so that new large scale measurements of G are needed to clarify the matter. Two such experiments, using masses distributed on quite different scales, both much larger than any laboratory measurement of G, are under development. One determines the gravitational attraction by a 3.5 km layer of sea water by measurements of gravity in a bathyscaphe. The other makes use of frequent level changes of a hydroelectric pumped-storage lake, involving a 10 m layer of water.

715,266
PB85-131225
(Order as PB85-130078, PC **A99**/MF **A01**)
Maryland Univ., College Park. Dept. of Physics and Astronomy.
Experimental Test of a Spatial Variation of the Newtonian Gravitational Constant at Large Distances.
H. A. Chan, and H. J. Paik. 1984, 6p
Included in Precision Measurement and Fundamental Constants II, p601-606 1984.

Keywords: *Fundamental constants, Superconductors, Measurement, Tests, *Gravitational constant, Inverse square laws, Poisson equation, Gravity gradiometers.

The Poisson equation of Newtonian gravitational potential provides a source-independent null test of the Inverse Square Law. A convenient Laplacian detector consists of superconducting gravity gradiometers in three orthogonal directions. Matching and stability of the cryogenic detector are achieved by utilizing superconducting circuits. Since the Laplacian of the gravitational potential produced by an arbitrary source is zero outside the source in the Inverse Square Law, this experiment becomes a source-independent null test for the constancy of the gravitational constant. This characteristic allows a precision test of the Inverse Square Law at geological distances using natural objects like an ocean or the earth. The authors discuss experimental procedures and expected sensitivities of the null experiment for three different sources: a swinging pendulum, an ocean tide, and the earth itself. It appears that the empirical limits in the Inverse Square Law could be improved by three to six orders of magnitude in the range between 1 m and 10 to the 7th power km by this new null experiment.

715,267
PB85-131233
(Order as PB85-130078, PC **A99**/MF **A01**)
University of Central Florida, Orlando. Dept. of Physics.
Measurement of 'G' for Small Inter-Mass Spacings.
W. C. Oelfke. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p607-609 1984.

Keywords: *Fundamental constants, Torsion balances, Measurement, Mass, Design, Operation, Experimental design, Disks(Shapes), *Gravitational constant, Inverse square laws.

An experimental project is currently under way at the University of Central Florida to measure the Newtonian gravitational constant G for inter-mass spacings r in the range 0.3 cm > r > 3 cm. A Cavendish balance for measuring the gravitational attraction between disk-shaped masses has been constructed. This balance functions as a fully automated electrobalance with the incorporation of a microcomputer for the monitoring and recording of data and the manipulation of the balance. A complete description of the design and operation of this Cavendish balance is presented.

715,268
PB85-131241
(Order as PB85-130078, PC **A99**/MF **A01**)
Smithsonian Astrophysical Observatory, Cambridge, MA.
Tests of Gravitation and Relativity.
R. F. C. Vessot. 1984, 14p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Included in Precision Measurement and Fundamental Constants II, p611-624 1984.

Keywords: *General relativity, *Gravitation, *Relativity, *Fundamental constants, Tests, Reviews, *Gravitational constant, Gravitational radiation.

The weak but all pervasive force of gravity governs the overall behavior of the universe. The dramatic discoveries in astrophysics place gravitation in the forefront of interest and raise questions about the range of validity of Einstein's General Theory of Relativity and at what level it may prove to be a classical limit to a quantum theory. At present, after more than seventy years, the General Theory continues to be the most acceptable description of space-time despite continuing tests to challenge it by searching for contradictions to predictions based on this theory. The chief purpose of this paper is to review the results of recent tests and assess the status of experimental gravitation. The status is applicable present technology and developments for future measurements will be discussed.

715,269
PB85-131258
(Order as PB85-130078, PC **A99**/MF **A01**)
Naval Observatory, Washington, DC.
Is the Gravitational Constant Changing.
T. C. Van Flandern. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p625-627 1984.

Keywords: *Fundamental constants, *Cosmology, Gravitation, Universe, *Gravitational constant, Lunar occultation, Lunar orbits, Lunar rangefinding.

Forty-four years after Dirac's original conjecture, experiments have become accurate enough to test for a time variation of the Universal Gravitational Constant. Present results use the lunar orbit, and do give a nonzero result. Interpreting the observed quantities with the Canuto-Hsieh scalar covariant cosmology, (G dot)/G = (-6.4 + or - 2.2) X 10 to the -11th power per year. The implications for relativity and cosmology are briefly discussed.

715,270
PB85-131266
(Order as PB85-130078, PC **A99**/MF **A01**)
Virginia Univ., Charlottesville. Dept. of Physics.
Experiments on Variation of the Gravitational Constant Using Precision Rotations.
G. T. Gillies, and R. C. Ritter. 1984, 6p
Included in Precision Measurement and Fundamental Constants II, p629-634 1984.

Keywords: *Fundamental constants, Rotation, Precision, *Gravitational constant, Magnetic suspension, Matter.

The classical rotor for gravitational studies, the earth, has a varying decay time of about 3 x 10 to the 9th power years and a rotational roughness about 3 x 10 to the -8th power per day. A more rigid, highly protected, laboratory rotor might be made more suitable for gravitational measurements such as tests for the temporal variation of Newton's G and for cosmological matter creation. In this paper past tests for variation of G with other parameters are reviewed and the first room-temperature tests of precision rotors for such 'laboratory cosmology' experiments are discussed. The design of two such experiments at Virginia and the early results are presented for one protected rotor aimed at ultimately testing for matter creation at rates below (m dot)/m approx. = 10 to the -10 power/year.

715,271
PB85-131274
(Order as PB85-130078, PC **A99**/MF **A01**)
Otago Univ., Dunedin (New Zealand).
Interpreting Dirac's Large Numbers Hypothesis.
W. Davidson. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p635-637 1984.

Keywords: *Fundamental constants, *Electromagnetic interactions, Cosmology, *Gravitational constant.

Dirac's large numbers hypothesis (LNH) and its implications are reviewed. Recent work shows that if the LNH is correct then not only does the Newtonian gravitational constant decrease on an atomic time scale (G proportional to 1/t), as inferred by Dirac, but the electrical force between two charged particles becomes stronger relative to their mutual gravitational force regardless of which of Dirac's two space-time scales, atomic or gravitational, is used. This is made explicit by introducing a Coulomb constant gamma analogous to G. The derivation of the two metrics directly from the LNH is demonstrated. Some observational implications of the LNH are listed.

715,272
PB85-131282
(Order as PB85-130078, PC **A99**/MF **A01**)
Joint Inst. for Lab. Astrophysics, Boulder, CO.
New Laboratory Test of the Equivalence Principle.
P. T. Keyser, J. E. Faller, and K. H. McLagan. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p639-641 1984.

Keywords: *General relativity, *Gravitation, Mass, Tests, Lead(Metal), Copper, *Equivalence principle, Eotvos experiment.

A test of the principle of equivalence using a large fluid (surrogate) fiber Eotvos apparatus is presently being undertaken at the Joint Institute for Laboratory Astrophysics. Preliminary measurements using a 0.25 m diameter fluid system were sufficiently encouraging that the authors have embarked on the construction of a five times larger (1.27 m diameter) system employing approximately 500 kg of lead and 500 kg of copper as the test masses. The first experimental results on the equivalence of gravitational and inertial mass with this new large apparatus are expected in 1983 or 1984.

715,273
PB85-131290
(Order as PB85-130078, PC **A99**/MF **A01**)
Colorado Univ. at Boulder. Dept. of Physics and Astrophysics.
What Test Masses Are Best for an Eoetvoes Experiment.
D. F. Bartlett, J. Shepard, and C. D. Zafiratos. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p643-645 1984.

Keywords: *Gravitation, *Mass, Solidified gases, Aluminum, Hydrogen, *Eotvos experiment, *Equivalence principle, Solid hydrogen.

No element lighter than aluminum has been used as a comparison mass in the recent precise tests of the equivalence of gravitational and inertial mass. The authors discuss how the substitution of solid hydrogen for aluminum as the light mass could increase the sensitivity of an Eotvos experiment by a factor between 10 and 100.

715,274
PB85-131308
(Order as PB85-130078, PC **A99**/MF **A01**)
National Tsing Hua Univ., Hsinchu (Taiwan). Dept. of Physics.
Equivalence Principles and Precision Experiments.
W. T. Ni. 1984, 5p
Included in Precision Measurement and Fundamental Constants II, p647-651 1984.

Keywords: *Gravitation, Cosmology, Red shift, Torsion, Tests, *Equivalence principle, Symmetry breaking, Pulsars, Grand unified theory.

The authors use a general framework--the chi-g framework--to study the empirical foundations of the Einstein Equivalence Principle (EEP), and to analyze the theoretical significance of various precision experiments and observations such as timing observations of pulsar signal propagation through galactic gravitational field, the Hughes-Drever experiments, the Eotvos-Dicke-Braginsky experiments, and the Vessot-Levine experiment. These experiments constrain various linear combinations of the components of chi to be metric to various degrees of accuracy, leaving only one component out of 21 not constrained. The theory with this component different from zero can be reformulated as a torsion theory. To test EEP and this theory, experiments on polarized test bodies are suggested.

715,275
PB85-131316
(Order as PB85-130078, PC **A99**/MF **A01**)
Virginia Univ., Charlottesville. Dept. of Physics.
Inertial Clock to Test the Non-Metricity of Gravity.
W. S. Cheung, and R. C. Ritter. 1984, 5p
Included in Precision Measurement and Fundamental Constants II, p653-657 1984.

Keywords: *Gravitation, *Gravity, Clocks, Rotors, Tests, Corotation, Magnetic suspension.

A certain class of non-metric gravitation theories implies that clocks of different electromagnetic nature will interact with local gravity differently and result in slightly different gravitational redshift measurements. As ideal rotating body would have its moment of inertia, hence timekeeping, depend on the rotor dimensions, so that it would act as an 'electrostatic clock.' In the past, precision high speed rotations of small spheres have exhibited long decay times, about 10 to the 10th power/s, and high Q. Simple extrapolation indicates that larger rotors should have much longer decay times. A double magnetic suspension of two rotors--an inner 'proof' rotor and an outer 'shroud' rotor--has been built and is under test as a method for reducing bearing and gas drags. This paper presents a description of a non-metricity test, analysis of the corotation scheme, and details of construction of the first, room-temperature inertial clock.

715,276
PB85-131324
(Order as PB85-130078, PC **A99**/MF **A01**)
Stanford Univ., CA. Dept. of Aeronautics and Astronautics.
Assessment of the Prospects for a Measurement of Relativistic Frame Dragging by 1990.
R. A. Van Patten. 1984, 8p
Contract NAS8-32355
Included in Precision Measurement and Fundamental Constants II, p659-666 1984.

Keywords: *General relativity, Tests, *Relativistic frame dragging, Gyro experiment, Twin satellite experiment.

Relativistic frame dragging, i.e., the Schiff motional effect or the Lense-Thirring effect, has never been measured. Just two experiments proposed to date promise measurement accuracies of a few percent. The two are the gyro experiment and the twin satellite experiment. These two experiments, although very different, have a common element, a 'gyroscope' in a rotating gravity field. With the gyro experiment, a small cryogenic gyro is placed in orbit and its spin axis history is compared with a star to 0.001 arc sec/yr accuracy. With the twin satellite experiment, two drag-free satellites are placed in reverse polar orbits and used as orbit-sized gyros. The sum of the nodal motion is checked to 30 cm against that predicted from earth oblateness using polar satellite-to-satellite Doppler data. This paper compares the errors and risks involved in carrying out each of these very demanding scientific space missions.

715,277
PB85-131332
(Order as PB85-130078, PC **A99**/MF **A01**)
Ohio Univ., Athens. Dept. of Physics.
Status of the Velocity of Light in Special Relativity.
E. Breitenberger. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p667-670 1984.

Keywords: *Special relativity, *Photons, *Fundamental constants, *Light speed, *Rest mass.

The special theory of relativity is shown to be independent of the assumption that the velocity of light, c, is a universal constant. No more than an intuitively obvious monotonicity postulate of velocity addition is needed to prove the existence of a universal, kinematic limit velocity (c sub 0), and the existence of a universal dispersion relation for vacuum waves. The best empirical support for the signal postulate (c sub 0) = c still comes from uncorroborated observations of the Crab Nebula pulsar which admit a photon rest frequency of up to 7 MHz, far above the limit inferred from the consistency of quantum electrodynamics (QED). Existing theory-dependent arguments purporting to demonstrate the constancy of c are shown to be inadequate. Further experimental work on the variability of c with frequency and with source conditions is desirable.

715,278
PB85-131340
(Order as PB85-130078, PC **A99**/MF **A01**)
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Relativistic Time Dilation: A Latter-Day Ives-Stillwell Experiment.
P. Nachman, M. D. Rayman, and J. L. Hall. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p671-673 1984.

Keywords: *Special relativity, Atomic beams, Atomic spectra, Anisotropy, Experimentation, *Time dilation, Two photon spectroscopy, Helium atoms, Light speed.

Two-photon spectroscopy on a fast atomic beam offers the possibility of a dramatically improved test of the special relativistic time dilation. The authors experimental arrangement will allow direct measurement of He atom resonance frequencies displaced from their rest-frame values by time dilation alone. The atomic beam velocity will be determined optically via the Doppler shift. The longitudinal interaction geometry will also permit them to test with increased precision for a possible vector anisotropy in the speed of light, a possibility raising renewed interest because of recent astrophysical discoveries. Further, the authors expect to refine experimental values for the energies of the Rydberg terms in He.

715,279
PB85-131357
(Order as PB85-130078, PC **A99**/MF **A01**)
Utah State Univ., Logan. Dept. of Physics.
Experiment to Measure Relative Variations in the One-Way Velocity of Light.
D. G. Torr, and P. Kolen. 1984, 5p
Included in Precision Measurement and Fundamental Constants II, p675-679 1984.

Keywords: *Fundamental constants, *Special relativity, Rubidium frequency standards, Precision, Measurement, Anisotropy, *Light speed.

In this experiment two rubidium vapor frequency standards were placed approximately 500 m apart and the phase of their signals compared as a function of time. The diurnal rotation of the earth was used to introduce a change in the direction of propagation of the signal, thereby providing a test of the assumption of isotropy of propagation of electromagnetic radiation. The relative phase difference between clocks was also compared for negligible separation of the clocks. The drift rate changed detectably for the separated clocks, while the round-trip velocity remained constant to within 0.0001% c. Typical variations observed in the one-way velocity imply a diurnal modulation of the order of + or - 0.1% to 1.0% c. The relative precision of the measurements amounted to 1 part in 5 x 10 to the 13th power.

715,280
PB85-131365
(Order as PB85-130078, PC **A99**/MF **A01**)
Tokyo Univ. (Japan).
High-Energy Gamma Rays Might Be Faster than Visible Light.
K. Fujiwara. 1984, 4p
Included in Precision Measurement and Fundamental Constants II, p681-684 1984.

Keywords: *Special relativity, *Gamma rays, De Broglie wavelengths, *Light speed, *Visible radiation.

Our possible confusion between the wave and particle pictures arising from the linearity of the de Broglie relation might be the cause of the divergence in field theories. When we assume that every line segment in three-dimensional space has a quantum structure analogous to the atomic chain of atomic distance 2(l sub 0), the de Broglie relation is exponentially nonlinearized at sufficiently high momenta, and the symmetry between the two pictures is broken. It has been shown that, under such situations, the field theories automatically become finite without changing their conventional form. The present theory predicts that high-energy gamma-rays would be faster than visible light, though the detectability of the effect depends on the value of the unknown constant (l sub 0).

715,281
PB85-131373
(Order as PB85-130078, PC **A99**/MF **A01**)
Indian Inst. of Tech., New Delhi. Dept. of Physics.
Fiber Optic Ring as a Gravitational Wave Detector.
C. L. Mehta, D. Ranganathan, and G. Bose. 1984, 3p
Included in Precision Measurement and Fundamental Constants II, p685-687 1984.

Keywords: *Optical interferometers, *Fiber optics, *Detectors, *Gyroscopes, Helium neon lasers, *Gravitational waves, *Sagnac effect, *Laser gyroscopes.

The authors suggest the use of a Sagnac interferometer made of a fiber optic ring for detecting gravitational waves. Any distortion in the geometry of the ring on account of a gravitational wave is detectable as a phase shift between the counter propagating optical signals. In order to discriminate against angular velocity variations and any other local fluctuations, a pair of orthogonal coils is to be used and the system rotated about an axis lying symmetrically between the two coils. It is estimated that a stabilized He-Ne laser used as the source and fiber coils of 1 m diameter with 100 turns rotating with an angular velocity of about 1000 rad/sec will provide adequate sensitivity.

715,282
PB85-131381
(Order as PB85-130078, PC **A99**/MF **A01**)
Joint Inst. for Lab. Astrophysics, Boulder, CO.
Possible Laser Gravitational Wave Experiment in Space.
J. E. Faller, and P. L. Bender. 1984, 2p
Included in Precision Measurement and Fundamental Constants II, p689-690 1984.

Keywords: Binary stars, Experimental design, Spacecraft, *Gravitational waves, Signal detection, Laser applications.

An investigation has been started of possible designs for a laser gravitational wave experiment with baseline lengths of roughly 1,000,000 km or longer. The objectives of the experiment are to search for narrow-band signals with periods of seconds to hours, for pulses of gravitational waves, and for broadband background radiation. One of the main goals is to detect signals from known rotating binary stars, such as Am CVn, WZ Sge, and i Boo. The corresponding gravitational wave periods are 8.76, 40.5, and 193 minutes. The expected strain amplitudes are roughly 0.4, 0.5, and 6 x 10 to the -21st power, respectively, which correspond to equivalent accelerations of 50, 4, and 2 x 10 to the -19th power g for a 1,000,000 km baseline. The main uncertainty in the expected signal strengths comes from the uncertainty in the distances. In view of the extremely tiny equivalent accelerations, care will be needed in designing the experiment in order to minimize spurious accelerations due to forces other than the gravitational attraction of the sun and planetary bodies.

715,283
PB85-134047 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
AVS (American Vacuum Society) in 1981: The State of the Society and the Challenges of Growth.
Final rept.
T. E. Madey. 1982, 5p
Pub. in Jnl. of Vacuum Science and Technology 20, n3 p265-270 1982.

Keywords: *Vacuum, History, Utilization, Reprints, *American Vacuum Society, Uses.

This paper is the text of an address given by the outgoing President of the Society at the 28th National Symposium of the AVS in Anaheim. To commemorate the 50th Anniversary of the American Institute of Physics, of which the AVS is the fastest growing member society, a brief historical overview of the origin of the AVS is provided. The unique role played by the AVS as the most industrially-based AIP society is discussed, and the challenges of rapid growth being experienced by the AVS are explored. The expanding influence of the AVS in the national and international technical community is examined.

715,284
PB85-135531 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Status of Thermophysical Properties Data for Pure Fluids and Mixtures of Cryogenic Interest.
Final rept.
W. M. Haynes, A. J. Kidnay, N. A. Olien, and M. J. Hiza. 1984, 32p
Pub. in Advances in Cryogenic Engineering 27, p919-942 1984.

Keywords: *Thermophysical properties, *Cryogenics, *Fluids, Mixtures, Reprints.

This paper will discuss the importance of accurate thermophysical properties data for pure fluids and fluid mixtures encountered in cryogenic process technology. The most important properties will be identified, the status of data for these properties will be summarized, and recommendations for future work will be proposed. The integrated roles of experiment, basic theory, and correlation techniques in obtaining a fundamental understanding of fluid behavior for the development of techniques for the prediction of thermophysical properties will be discussed.

715,285
PB85-135564 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Transient Boiling Heat Transfer from Two Different Heat Sources: Small Diameter Wire and Thin Film Flat Surface on a Quartz Substrate.
Final rept.
P. J. Giarratano. 1984, 8p
Pub. in International Jnl. of Heat and Mass Transfer 27, n8 p1311-1318 1984.

Keywords: *Boiling, *Heat transfer, Platinum, Quartz, Substrates, Thin films, Wire, Reprints, Liquid nitrogen, Transients.

Transient boiling heat transfer data are reported for two different heater surface geometries submerged in liquid nitrogen. During the early part of the transient heat pulse, the heat transfer coefficient for both geometries generally agrees with values predicted from classical transient pure conduction equations. The agreement persists until the time for onset of convection which varies approximately as 1/(q squared) where q is the heat flux to the fluid.

715,286
PB85-135937
(Order as PB85-135929, PC **A04**/MF **A01**)
Los Alamos National Lab., NM.
Pressure-Volume-Temperature Relationships for Normal Deuterium between 18.7 and 21.0 K.
L. A. Schwalbe, and E. R. Grilly. 19 Dec 83, 22p
Included in Jnl. of Research of the National Bureau of Standards, v89 n3 p227-250 May-Jun 84.

Keywords: *Deuterium, *Thermodynamic properties, Equations of state, Liquefied gases, Solidified gases, Compressibility, Melting, Volume, *Liquid hydrogen, *Solid hydrogen, Triple point, Pressure dependence, Temperature dependence.

Analytical expressions are derived for the melting line and liquid equation of state of normal deuterium near the triple point. Melting pressures were measured between the triple point and 20.4 K. These results combined with existing pressure measurements along the saturated liquid-vapor curve fix an accurate value, (t sub tp) = 18.723 K, for triple-point temperature. Data for the isothermal compressibility and thermal expansion coefficients of the liquid were taken over the temperature and pressure ranges 18.8 to 21.0 K and 4 to 70 bar, respectively. The liquid molar volume was measured at nine points below 20.4 K. All liquid PVT data are shown to be internally consistent. Measurements of the volume changes on melting are also presented. The heat of fusion and the solid molar volume at melting are deduced from these data. Also included are detailed comparisons of our results with existing data. A critical appraisal is given of all measured thermodynamic quantities in this regime.

715,287
PB85-136273 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Improved Procedure for Calculating the Collision Stopping Power of Elements and Compounds for Electrons and Positrons.
Final rept.
S. M. Seltzer, and M. J. Berger. 1984, 12p
Pub. in International Jnl. of Applied Radiation and Isotopes 35, n7 p665-676 1984.

Keywords: Atoms, Molecules, Reprints, *Stopping power, *Electron collisions, *Positron collisions, *Electron-atom collisions, *Electron-molecule collisions, *Positron-atom collisions, *Positron-molecule collisions.

This paper is an addendum to an earlier paper which described a procedure and provided the data base for the quick-and-easy evaluation of electron and positron collision stopping powers. The procedure makes use of Bethe's stopping-power formula and Sternheimer's theory of the density effect, and involves a parametrization such that some parameters depend only on the particle energy and all others only on the properties of the stopping material. The data base for 278 materials has now been updated through an improved evaluation of the density effect within the framework of Sternheimer's theory. The use of the new instead of the old data base can result in stopping-power changes as large as 1 to 2 percent.

715,288
PB85-137461 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Feasibility of a 81Br(Nu, e(-))81Kr Solar Neutrino Experiment.
Final rept.
G. S. Hurst, C. H. Chen, S. D. Kramer, B. T. Cleveland, R. Davis, R. K. Rowley, F. Gabbard, and F. J. Schima. 10 Sep 84, 4p
Contract DE-AC05-84OR21400
Pub. in Physical Review Letters 53, n11 p1116-1119, 10 Sep 84.

Keywords: Sun, Feasibility, Reprints, *Neutrino-electron interactions, *Solar neutrinos, Bromine 81, Krypton 79, Beryllium 7, Resonance ionization spectroscopy.

A solar neutrino experiment using the interaction of (81)Br(nu,e(-))(81)Kr to study the (7)Be neutrino source in the interior of the sun is shown to be feasible. Resonance ionization spectroscopy was used to count less than 1000 atoms of 200,000-yr (81)Kr, making the bromine experiment possible. Except for the method of counting product atoms, the bromine experiment would be very similar to the successful chlorine detector (37)Cl(nu,e(-))(37)Ar, and thus it is a natural sequel to the only solar neutrino experiment to date.

715,289
PB85-140283 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Imaging Strategy in the Scanning Electron Microscope.
Final rept.
D. E. Newbury. 1981, 8p
Pub. in Scanning Electron Microscopy, n1 p71-78 1981.

Keywords: *Electron microscopes, Backscattering, Resolution, Contrast, Reprints, *Scanning electron microscopy, *Optical images, *Imaging techniques.

A strategy for choosing the operating parameters for optimal imaging with the scanning electron microscope is described. This procedure consists of: (1) calculating the contrast produced by the specimen as a result of electron-solid interactions; (2) calculation of the modification of that contrast by the detector response characteristics; (3) calculation of the threshold beam current required to observe the contrast; (4) selection of suitable signal processing to properly display the contrast information on the final image or photograph; and (5) calculation of the spatial resolution limitations due to the gun brightness. Specific calculations for the case of atomic number contrast between pure element couples show that the limiting spatial resolution increases rapidly as the difference in atomic number decreases. For rapid visual searching of image fields at 1 second frame rates, beam currents as high as 500 nA and beam diameters of 1 micrometer or more are necessary to detect contrast levels below 1 percent.

715,290
PB85-140713 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurements of Small Dimensions of Products and By-Products.
Final rept.
D. A. Swyt, and S. W. Jensen. 1980, 8p
Pub. in Proceedings of Society of Photo-Optical Instrumentation Engineers 220, p28-35, 6 Feb 80.

Keywords: *Dimensional measurement, Electron microscopy, Length, Optical microscopes, Particle size, Line width, Displacement, Reprints, Scanning electron microscopy, Transmission electron microscopy, Photomasking.

Mainstays for providing definitive, calibration-quality measurements of small dimensions for industrial and clinical applications are direct-imaging and plane-projection instruments. Light-optical and electron-optical techniques spans six orders of magnitude of sizes measured, from 1000 micrometers to 0.001 micrometer. In the application of each of these techniques, a common assumption is that, above the resolution limit of the device, accurate dimensional measurements of extended objects can be made based on the geometrical optical relation of image size to object size: X(i) = MX(o), where X(i) is the dimension of the image, X(o) is the dimension of the object, and M is the scalar magnification of the device. However, the relationship strictly applies only to distance between points and in the measurements of dimensions such as lengths, widths or diameters of extended objects, the geometric optical relationship fails long before the resolution limit of the device is approached. Evidence of such failure in the form of substantial systematic errors in dimensional measurements appears in industrial applications from particle sizing to photomask metrology. The causes of such difficulties and calibration techniques to overcome them are discussed in the context of work at NBS on the development of SEM and optical techniques for accurate measurements in the range 0.1 to 100 micrometers.

715,291
PB85-141513 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electron Scattering in the Excitation Region of the Delta Resonance on Nuclei with A = 1 to 16.
Final rept.
J. S. O'Connell, W. R. Dodge, J. W. Lightbody, X. K. Maruyama, J. O. Adler, K. Hansen, B. Schroder, A. M. Berstein, K. I. Blomqvist, B. H. Cotlman, J. J. Comuzzi, R. A. Miskimen, and B. Quinn. 22 Oct 84, 3p
Pub. in Physical Review Letters 53, n17 p1627-1629, Oct 22, 1984.

Keywords: *Electron scattering, Inelastic scattering, Hydrogen, Helium, Beryllium, Carbon, Oxygen, Reprints, *Delta resonances, MeV range 100-1000.

The inelastic scattering sections of H, He, Be, C and O were measured for 730 MeV electrons scattered at 37.1 degrees for energy transfers to the nucleus up to 550 MeV. The nuclear response in the delta region is found to be quite similar for the A > 1 targets. Although the differential cross section per nucleon at the peak of the delta region (380 MeV) is suppressed compared to the free nucleon, the area in the 230 - 550 MeV region is enhanced for the A > 1 targets.

715,292
PB85-142131 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Recent Improvement in the Atomic Time Scales of the National Bureau of Standards.
Final rept.
D. W. Allan, D. J. Glaze, F. E. Gray, R. H. Jones, J. Levine, and S. R. Stein. 1983, 12p
Pub. in Proceedings of Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting, Washington, DC., December 6-8, 1983, p29-40.

Keywords: *Frequency standards, *Time standards, Frequency stability, Synchronism, Calibrating, US NBS.

Coincident with the installation of a new measurement system, the National Bureau of Standards has also developed a new philosophy for the generation of both UTC(NBS) and TA(NBS). Several benefits have resulted from this new direction. These are discussed.

715,293
PB85-142164 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Clock Characterization Tutorial.
Final rept.
D. W. Allan. 1983, 17p
Pub. in Proceedings of Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting, Washington, DC., December 6-8, 1983, p459-475.

Keywords: *Frequency standards, *Time standards, Frequency stability, Performance, Reviews.

Managers are often required to make key program decisions based on the performance of some elements of a large system. This paper is intended to assist the manager in this important task insofar as it relates to the proper use of precise and accurate clocks. An intuitive approach will be used to show how a clock's stability is measured, why it is measured the way it is, and why it is described the way it is. An intuitive explanation

of the meaning of time domain and frequency domain measures as well as why they are used will also be given. Explanations of when an 'Allan variance' plot should be used and when it should not be used will also be given. A more efficient way to measure clock frequency drift will be explained. The relationship of the rms time error of a clock to a (sigma sub y) (tau) diagram will also be given. The environmental sensitivities of a clock are often the most important effects determining its performance. Typical environmental parameters of concern and nominal sensitivity values for commonly used clocks will be reviewed.

715,294
PB85-142248 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Can You Describe Optical Surface Quality with One or Two Numbers.
Final rept.
M. Young. 1984, 11p
Pub. in SPIE (Society of Photo-Optical Instrumentation Engineers) 406, p12-22 1984.

Keywords: *Surface roughness, *Optical measurement, *Standards, Light scattering, Reprints, Total integrated scatter standard, Scratch and dig standard.

This talk discusses two optical surface quality standards, total integrated scatter (TIS) and the scratch and dig standard (MIL-0-13830A). The author begins by using Fourier optics to show that the well known expression, (I sub t)/I(0) = 4 (k squared)(sigma squared), which relates scattered power to rms roughness sigma, is truly valid only for certain classes of surfaces. Vector scattering theory applied to a more general case shows that in fact optics can measure only a bandwidth limited roughness that can be related to scattered power only if the surface statistics are known. For this reason, the standard should perhaps be regarded as a scattered light standard and not as a surface roughness standard. The author concludes by describing efforts to develop an objective measurement technique to aid in the manufacture of the artifacts used to implement the scratch standard.

715,295
PB85-142305 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Fundamentals of Alternate Cooling Systems.
Final rept.
R. Radebaugh. 1983, 47p
Pub. in Cryocoolers, Chapter 11, p129-175 1983.

Keywords: *Refrigerators, *Thermodynamics, Electrons, Phonons, Magnetic dipoles, Mixtures, Photons, Electrochemical cells, Cryogenics, Reprints, *Cryogenic refrigerators, *Cryocoolers, Electric dipoles.

This paper is written as Chapter 11 for the book Cryocoolers, by G. Walker. In this chapter, the thermodynamic fundamentals applicable to any refrigeration system are discussed. Emphasis is placed on systems other than the gas-liquid systems normally used in mechanical refrigerators in hopes of stimulating new ideas in refrigeration. Because refrigeration power is proportional to the available entropy of the system, entropy comparisons are used to evaluate the potential of new systems. The systems discussed here include such things as electrons, phonons, magnetic dipoles, electric dipoles, mixtures, electrochemical cells, photons, as well as some gas-liquid-solid systems. A description of how each of these systems can be used for refrigeration, along with the useful temperature range, is presented.

715,296
PB85-142859 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Theory of Charge Exchange and Ionization by Heavy Particles.
Final rept.
B. H. Bransden. 1983, 24p
Pub. in NATO (North Atlantic Treaty Organization) Advances in Science Instrumentation Series B 101, p245-268 1983.

Keywords: *Ionization, Electron capture, Reprints, *Charge exchange, *Ion-atom interactions, Hydrogen atoms.

The theoretical methods employed to calculate charge exchange and ionization in collisions between ions and atoms are surveyed, with particular emphasis on the interaction between fully stripped ions and hydrogen atoms. The range of energies covered is from about 100 eV/amu to about 1 MeV/amu. A bibliography is provided.

715,297
PB85-142958 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Biomagnetism: An Interdisciplinary Approach. Chapter 2. Magnetic Quantities, Units, Materials and Measurements. Chapter 3. Cryogenics.
Final rept.
J. E. Zimmerman. Dec 83, 51p
See also AD-A134 314.
Pub. in Biomagnetism: An Interdisciplinary Approach, Chapters 2 and 3, p17-67 1983.

Keywords: *Magnetic measurement, Units of measurement, Magnetostatics, Magnetic materials, Magnetometers, Detectors, Thermal noise, Cryogenics, Reprints, *Biomagnetism, SQUID devices, Magnetism, Ohm law, Dewars, Cryogenic refrigerators, Nyquist noise.

This publication consists of two chapters for a book entitled Biomagnetism: an Interdisciplinary Approach, to be published by the NATO Advanced Study Institute, written to be intelligible to both physical and medical scientists. Chapter 2 covers the terminology of magnetism, simple theory of magnetostatics, Ohm's Law, electric and magnetic SI units, magnetic materials, magnetic sensors, and magnetic measurements. Chapter 3 covers Nyquist noise and construction of dewars and refrigerators for SQUID magnetometers.

715,298
PB85-143303 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ellipsometry of Rough Surfaces.
Final rept.
T. V. Vorburger, and K. C. Ludema. 1980, 13p
Pub. in Applied Optics 19, n4 p561-573, 15 Feb 80.

Keywords: *Surface roughness, *Polarimetry, Optical measurement, Diffraction, Surfaces, Texture, Reprints, *Ellipsometry, Profilometers, Kirchhoff approximation.

The authors have done ellipsometry measurements on several different kinds of rough surfaces and compared them with stylus measurements of the surface texture. For steeply-sloped, periodic surfaces, the authors observe rapid variations in the ellipsometric angles, delta and psi, versus the angle of incidence for certain angles. This effect is ascribed to interference between the singly and doubly scattered light waves. For a set of Ni replicas of machined surfaces, the surface composition was varied between sets of measurements by evaporating first Al, then Au on them. The systematic effects due to surface roughness are in disagreement both with theory and with previous experiments. The possible reasons for this are discussed, along with the prospects for using ellipsometry as a tool for measuring surface roughness.

715,299
PB85-143337 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
High Energy Forward Elastic Scattering of Electrons: Born Amplitudes for a Pseudostate Model of Atomic Hydrogen.
Final rept.
S. Geltman, and R. K. Nesbet. 1984, 7p
Grant NSF-PHY82-00805
Pub. in Physical Review A: General Physics 30, n4, p1636-1642 1984.

Keywords: *Electron scattering, Elastic scattering, Ground state, Polarization, Reprints, *Hydrogen atoms, *Electron-atom collisions, KeV range 10-100.

Exact second Born elastic scattering amplitudes are computed for a dipole excitation pseudostate model of electron scattering by ground state atomic hydrogen. Calculations at 15, 25, and 35 keV incident energy show a forward peak in the differential elastic cross section. The optical theorem is exactly satisfield by these calculations, and the magnitude of the forward peak is determined primarily by physical values of the atomic static polarizability and oscillator strength. In the energy range considered, the computed peak is smaller by a large factor than the magnitude required to interpret recently observed experimental data in terms of single elastic collisions of electrons with ground state atoms.

715,300
PB85-143394 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Measurement of Thermal Radiation Properties of Materials.
Final rept.
J. C. Richmond. 1984, 60p
See also PB80-189186.
Pub. in Compendium of Thermophysical Property Measurements, Volume 1: Survey of Measurement Techniques, p709-768 1984.

Keywords: *Thermal radiation, Heat transfer, Reflectance, Absorptance, Emittance, Transmittance, Photons, Reviews, Reprints.

The thermal radiation properties of materials are reflectance, absorptance, transmittance, and emittance. They are called thermal radiation properties because they control the rate of heat transfer by radiation between noncontacting bodies at different temperatures, and between a body and its surroundings. Radiant heat transfer is the only mode of heat transfer in a vacuum and becomes the dominant mode of heat transfer between noncontacting solids at high temperatures, such as exist in many industrial furnaces.

715,301
PB85-143907 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Glueballs.
Final rept.
S. Meshkov. 1984, 31p
Pub. in AIP Conference Proceedings, n113 p125-155 1984.

Keywords: Reviews, Reprints, *Glueballs.

The current status of various glueball properties such as level ordering, masses, production, and decay is reviewed. Glueball candidates iota(1440), theta(1670), (g sub T)(2160), (g sub T)(2320), and 0(2.3-3.4) are examined. A simple model which incorporates the mixing of the glueball candidate iota(1440) with quarkonium states eta(549) and (eta prime)(958), and of the theta(1670) with f(1270) and f(1515) is presented; neither the iota(1440) nor the theta(1670) can be consistently interpreted as a glueball in this framework. A 5 x 5 model of Palmer and Pinsky which also includes radial excitation of the eta and (eta prime) yields two solutions for the pseudoscalar system, the preferred one of which has iota(1440) being mainly an s(s bar) radial excitation, and a second solution in which the iota(1440) is mixed strongly with the iota(960) and is about half bare glueball. The current leading glueball candidates are the (phi)(phi) enhancements at 2160 and 2320 MeV.

715,302
PB85-144475 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Position-Sensitive X-ray Detector.
Final rept.
B. P. Duval, J. Barth, R. D. Deslattes, A. Henins, and G. G. Luther. 1984, 5p
Pub. in Nuclear Instruments and Methods in Physics Research 222, p274-278 1984.

Keywords: Transfer functions, Methane, Xenon, Reprints, *X-ray detection, *X-ray detectors.

The authors have constructed a single anode wire position sensitive gas proportional detector with a fwhm of 80 micrometers for a highly collimated monochromatic beam of 8 keV photons over a useful range of 38 mm, operated with 600 Torr Xe/CH4. The transfer function of the detector has been measured and explained by the theoretical charge distribution induced on the cathode.

715,303
PB85-144491 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Absolute, Prompt Gamma-Ray Spectroscopy and the Determination of Fundamental Constants.
Final rept.
R. D. Deslattes, G. L. Greene, and E. G. Kessler.
Mar 84, 6p
Pub. in Jnl. de Physique C3, n45 pC3-41-C3-46 Mar 84.

Keywords: *Fundamental constants, *Gamma ray spectroscopy, Diffractometers, Wavelengths, Optical interferometers, X rays, Single crystals, Reprints, MeV range 01-100.

There currently exists a highly accurate absolute wavelength scale for electromagnetic radiation which extends from microwaves to gamma-rays having ener-

gies less than about 1 MeV. This scale begins with the cesium atomic beam clock (and thus the SI meter) and continues through the iodine stabilized HeNe laser. Such a laser is then used to determine the lattice spacing of a single crystal of Si using x-ray/optical interferometry. Accurately calibrated crystals are then used in a flat diffractometer to determine absolute gamma-ray wavelengths. The authors propose to extend this scale to the region of about 1-10 MeV. This requires the use of in-pile sources for the examination of prompt gamma-rays from n-gamma reactions.

715,304

PB85-144509 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Photon Energy Analysis by Reflectivity Modulation.
Final rept.
P. L. Cowan. 15 May 84, 5p
Pub. in Nuclear Instruments and Methods in Physics Research 222, n1-2 p46-50, 15 May 84.

Keywords: *X rays, *Mirrors, Synchrotron radiation, Reflectivity, Modulation, X ray spectroscopy, Reprints.

X-ray mirror reflectivity versus energy is approximately a step function. By dithering the orientation of an X-ray mirror and phase detecting the reflected photons, one obtains a response function which is the derivative of this step function. A photon response function with a narrow energy resolution is thus produced. This photon energy analysis by reflectivity modulation is analogous to a modulated retarding grid electron energy analyzer. The energy resolution and the peak efficiency of the response function are determined by the optical constants or the mirror, the amplitude of the dither and the collimation of the photons, so the signal can be increased at the expense of energy resolution by altering the dither amplitude. Although the resolving power is low compared with what can be achieved with crystals, reflectivity modulation has several advantages over crystal based monochromators and spectrometers. Reflectivity modulation can be used over a very large energy range, including soft X-rays. For focused applications, the surface of an X-ray mirror is more easily figured than the diffracting planes of a crystal. The response function of a mirror is harmonic free and most importantly, the signal amplitude can be much higher than from crystals.

715,305

PB85-145142 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Quantitative Particle Analysis in Electron Beam Instruments.
Final rept.
J. A. Small. 1981, 15p
Pub. in Scanning Electron Microscopy, n1 p447-461 1981.

Keywords: *Electron microscopy, *Electron probes, *Microanalysis, Particles, Reprints, Electron probe microanalysis.

Various methods which have been developed for the quantitative analysis of particles in electron beam instruments are reviewed. This review includes two procedures, relative sensitivity-factor and local mass methods, which apply to the analysis of particles fitting the thin film criterion. These particles are generally less than a few tenths of a micrometer in diameter and are best analyzed with the analytical electron microscope at beam energies of 100 keV or more. Six additional methods are described including normalization of ZAF results, methods requiring particle standards, normalization of beam raster area modified P-factors, geometric modeling of particle shape, and peak-to-background normalization. These methods are best suited for the SEM/EDS analysis of particles with diameters larger than a few tenths of a micrometer. Included in the discussion of the various methods is the error histogram for 200 particle analyses run with the normalized ZAF method. The various particle effects like mass, absorption, and secondary flourescence which make quantitative particle analysis difficult are also discussed. Finally, the experimental requirements which are unique to each analysis method are reviewed.

715,306

PB85-145209 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Emission Characteristics of Electrically Small Radiating Sources from Tests Inside a TEM Cell.
Final rept.
I. Sreenivasiah, D. C. Chang, and M. T. Ma. 1981, 9p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electromagnetic Compatibility 23, n3 pt1 p113-121 Aug 81.

Keywords: *Dipoles, *Emission, Magnetic dipoles, Dipole moments, Cells, Model tests, Electromagnetic radiation, Reprints, TEM cells.

An electrically small radiating source of arbitrary nature may be modeled by an equivalent dipole system consisting of three orthogonal electric dipoles and three orthogonal magnetic dipoles, each excited with arbitrary amplitude and phase. A method of determining the individual dipole moments and the cross-components of such a dipole system, by tests inside a TEM cell, is presented along with some experimental results.

715,307

PB85-145522 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Pulse Calorimetry.
Final rept.
A. Cezairliyan. 1984, 26p
Pub. in Compendium of Thermophysical Property Measurement Methods Chapter 16, 1, p643-668 1984.

Keywords: *Specific heat, *Heat measurement, Reprints, *Calorimetry, High temperature, High speed.

Developments of pulse calorimetric techniques for the measurement of specific heat of electrically conducting substances are presented. Emphasis is placed on millisecond and microsecond resolution calorimetry as applied to measurements at temperatures above about 1000 K. Experimental difficulties related to the dynamic measurements of experimental quantities, such as power and temperature, are discussed, and sources and magnitudes of errors are given.

715,308

PB85-145571 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Experimental Verification of the D2O-Moderated 252Cf Source Spectrum.
Final rept.
R. B. Schwartz, C. M. Eisenhauer, and J. A. Grundl. 1984, 28p
Sponsored by Nuclear Regulatory Commission, Washington, DC.
Pub. in NUREG/CR-3399, p1-28 1984.

Keywords: *Neutron spectra, Neutron sources, Radiation dosage, Heavy water, Reprints, Californium 252.

The authors have experimentally verified the calculated spectrum for the 15 cm radius D2O-moderated (252)CF neutron source. Using NBS double fission chambers as threshold detectors, they found excellent agreement between their measurements and results derived from the calculated spectrum in the energy range below about 10 keV. The measurements do, however, suggest the existence of small, but significant, discrepancies above about 600 keV, but there is no significant net change in the fluence to dose equivalent conversion.

715,309

PB85-147882 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hybrid Finite Element Method for Scalar Wave Refraction into Three Dimensional Bodies.
Final rept.
P. H. E. Meijer, and G. A. H. Cowart. 1 Oct 84, 11p
Pub. in Jnl. of Applied Physics 56, n7 p1909-1920, 1 Oct 84.

Keywords: *Finite element analysis, *Refraction, Wave functions, Scattering, Reprints, Helmholtz equation, Three dimensional, Cubature.

The hybrid finite element method is a combination of the finite element method in a closed domain and an analytic solution outside this domain. The analytic solution is used in the region of homogeneous dielectric constant, while the finite element method is applied to the region of heterogeneous dielectric constant. Using matching conditions, that are of the nature of a non-local boundary condition, and which were described in a previous article, equations are obtained for the scalar amplitudes of the wave function refracted into an heterogeneous object of general geometry. The problem is described by a functional, containing integrals over the volume and surface of a sperical domain which completely encloses the scattering object. This domain is divided into a set of finite elements by connecting a network of points, called nodes, distributed on and in the spherical domain. The integrals are then approximated and the variation of the functionals results in a system of linear equations in the unknown wave functions at the nodal points of the domain. The new aspect of the method is the use of cubature formulas to reduce the surface integrals to sums. The formulation is tested by comparing results with the analytic solution of the scattering by a homogeneous sphere. The relative errors, as a function of incident wavelength, are given for various points in the scattering sphere.

715,310

PB85-147890 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
National Bureau of Standards (NBS) Temperature Scale in the Range 15 to 200 mK.
Final rept.
J. H. Colwell, W. E. Fogle, and R. J. Soulen. 1984, 2p
Pub. in Proceedings of International Conference on Low Temperature Physics (17th), Karlsruhe, Germany, August 15-22, 1984, p395-396.

Keywords: *Temperature measurement, Josephson junctions, Superconductors, Reproducibility, Cryogenics, *Ultralow temperature.

The authors have studied the reproducibility upon thermal cycling of several types of thermometers. A Josephson junction noise thermometer, a CMN thermometer, and an SRM 768 superconductive fixed-point device were very consistent, while a germanium and a carbon resistance thermometer showed significant irreproducibility.

715,311

PB85-147932 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Superconductive Temperature Reference Points above 0.5 K.
Final rept.
J. F. Schooley, and J. H. Colwell. 1984, 2p
Pub. in Proceedings of International Conference on Low Temperature Physics (17th), Karlsruhe, Germany, August 15-22, 1984, p409-410.

Keywords: *Temperature measurement, Transition temperature, Lead(Metal), Indium, Aluminum, Cadmium, Zinc, Cryogenics, Superconductivity, *Ultralow temperature, Standard reference materials.

Careful preparation and annealing of samples made from high-purity Pb, In, Al, Zn, and Cd have resulted in sample-to-sample (T sub c) variations of less than 0.5 mK. Less-pure Nb samples, while more variable in Tc, still exhibit single-sample reproducibilities better than 0.2 mK. Temperature reference devices incorporating these six elements offer stable, high precision in situ calibration capability.

715,312

PB85-148005 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Theoretical and Experimental Investigations of Loading Effects Due to a Perfectly Conducting Rectangular Cylinder in a Transverse Electromagnetic Cell.
Final rept.
M. Kanda. 1981, 6p
Pub. in Proceedings of Symposium and Technical Exhibition on Electromagnetic Compatibility (4th), Zurich, Switzerland, March 10-12, 1981, p401-406.

Keywords: *Electromagnetic compatibility, Analysis(Mathematics), Electromagnetic interference, Distortion, Moments, Magnetic properties, Conductivity, Electrostatics, Experimental data, Integral equations, Waveguides, Green function.

The study of electromagnetic compatibility (EMC), that is the electric and biological system effects due to electromagnetic (EM) radiation and EM calibration, require accurate EM measurement techniques for defining the EM interference (EMI) characteristics. Thus, fully enclosed rectangular transverse electromagnetic (TEM) transmission lines with thin inner conductors are often used for generating standard known test fields. In all cases it is desirable that only the dominant

TEM mode should propagate. The purpose of this paper is to discuss the loading effects, i.e., the electromagnetic field distortion caused by an object under test in a TEM cell. In the theoretical analysis, the frequency domain integral equation for the magnetic field, or equivalently, the current density on the surface of a perfectly conducting cylinder in a parallel plate waveguide is solved by the method of moments to predict the degree of magnetic field distortion.

715,313
PB85-151611 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Streamer Initiation in Liquid Hydrocarbons under Divergent Field Conditions.
Final rept.
G. J. FitzPatrick, E. O. Forster, R. E. Hebner, and E. F. Kelley. Oct 84, 6p
Pub. in Proceedings of 1984 Annual Report Conference on Electrical Insulation and Dielectric Phenomena, Claymont, DE., October 21-25, 1984, p291-296.

Keywords: *Electric discharges, *Cyclohexene, Cathodes, High voltage, Dielectric breakdown.

The initiation of streamers at the surface of a needle cathode in contact with cyclohexane has been investigated using an improved optical system, allowing for high magnification of the cathode, in conjunction with a high speed framing camera. To cover a broad range of conditions the gap between the electrodes was varied from 0.2 to 0.5, 1.0 and 2.0 cm. Also, the rate of rise of the applied voltage at each gap setting ranged from 17 to 23, 29, and 35 KV/s. The streamer initiation was found to occur at a voltage which was independent of both the gap and the rate of rise of the voltage. The shape of the cathode point was found to influence the scatter of the initiation voltage particularly at the lowest applied voltages but it did not affect the average value. The significance of these observations will be discussed. The implications of these findings on the charge carrier injection process will be analyzed.

715,314
PB85-151728 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Very-Low-Temperature Cooling Systems.
Final rept.
R. Radebaugh. 1983, 79p
Pub. in Cryocoolers, Part 2: Applications, Chapter 12, p177-255 1983.

Keywords: *Refrigerators, Adiabatic demagnetization, Helium 3, Helium 4, Copper, Liquid helium, Nuclear spin, Reprints, *Cryogenic refrigerators, *Cryocoolers, *Ultralow temperature, Magnetic refrigerators, Pomeranchuk cooling.

This paper is written as chapter 12 for the book Cryocoolers, by G. Walker. In this chapter the refrigeration principles and practical examples of the common techniques for reaching temperatures below 1 K are presented. The refrigeration techniques discussed are (3)He refrigerators, (3)He-(4)He dilution refrigerators, Pomeranchuk cooling, and magnetic refrigerators. Record low temperatures of 50 nK for copper nuclei, less than 50 micro K for copper electrons, and 0.21 micro K for liquid (3)He have been reached using adiabatic demagnetization of nuclear spins. Historical development, problem areas, and applications of these various cooling systems are discussed.

715,315
PB85-161271 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 89, Number 5, September-October 1984.
Oct 84, 87p
See also PB85-161289 through PB85-161313 and PB85-129591. Also available from Supt. of Docs as SN003-003-72089-5. Library of Congress catalog card no. 63-37059.

Keywords: *Research projects, Resistance thermometers, Temperature measuring instruments, High temperature tests, Propane, pH, Standards, Coal deposits, PVT properties.

Contents:
- Evaluation of Some high-temperature platinum resistance thermometers;
- Automated High-temperature PVT apparatus with data for propane;
- Radio Propagation in a coal seam and the inverse problem;
- A report on the National Bureau of Standards pH Standards.

715,316
PB85-161289
(Order as PB85-161271, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
Evaluation of Some High-Temperature Platinum Resistance Thermometers.
J. P. Evans. 17 Jul 84, 25p
Included in Jnl. of Research of the National Bureau of Standards, v89n5 p349-373 Sep-Oct 84.

Keywords: *Resistance thermometers, *Temperature measuring instruments, Standards, Platinum, Performance, Stability, Tests, Tables(Data), High temperature, Temperature scales.

Two sets of high-temperature platinum resistance thermometers of different design have been tested in the temperature range 0 to 1100 degrees C. One set was constructed at the National Institute of Metrology, in the People's Republic of China, and the other at the National Bureau of Standards. The results of the tests provide information on long- and short-time thermometer stability, and on other characteristics such as temperature coefficient, immersion, self-heating effect, electrical leakage, and durability. The results also show that the behavior of the two sets is similar enough to allow them to be considered as a single set of thermometers, and that the sets perform as well as, or better than, other sets of thermometers tested earlier. It is expected that this information will aid in the evaluation of the high-temperature platinum resistance thermometer as an interpolating instrument for a practical temperature scale up to the gold point.

715,317
PB85-172195 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Non-Observability of Non-Exponential Decay.
Final rept.
M. Danos, and A. B. Johnson. 15 Dec 84, 3p
Pub. in Physical Review D 30, n12 p2692-2694, 15 Dec 84.

Keywords: *Radioactivity, Quantum theory, Exponential functions, Reprints, *Unified-field theories, Proton decay, Uncertainty.

The decay of an unstable quantum system is treated using covariant relativistic quantum theory. This way all ambiguities existing in a nonrelativistic treatment are avoided. As a first example, it is shown that the proton in the present era decays exponentially. Two examples are then considered where the unstable particle is produced in a scattering experiment. It is shown that the observability of non-exponential decay is limited by the time-energy uncertainty relations.

715,318
PB85-172211 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Experimental Test of the Bremsstrahlung Cross Section.
Final rept.
M. N. Martins, E. Hayward, G. Lamaze, X. K. Maruyama, F. Shima, and E. Wolynec. Dec 84, 6p
Pub. in Physical Review C 30, n6 p1855-1860 Dec 84.

Keywords: Bremsstrahlung, Cross sections, Electron beams, Gamma rays, Reprints, *Bremsstrahlung cross sections, Electrodisintegration, Copper 63, MeV range 10-100, Photon-neutron interactions.

The bremsstrahlung cross section has been studied by measuring the activity induced in (63)Cu by electrodisintegration and when thin radiators of Cu, Mo, Ta, and Th were placed in the electron beam just ahead of the target. The electron energies were varied from 13.5 to 60 MeV for the electrodisintegration and from 20 to 60 MeV for the radiator-in measurements; the (gamma,n) cross section for (63)Cu was determined using virtual photon theory; the radiator data were fitted using various bremsstrahlung cross sections. The best fit is obtained using the synthesized spectrum of Seltzer which differs from the Davies-Bethe-Maximon cross section as given by equation (3CS) of Koch and Motz.

715,319
PB85-177954 PC **A07**/MF **A01**
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering.
Thermal Flanking Loss Calculations for the National Bureau of Standards Calibrated Hot Box.
R. J. Onega, and P. J. Burns. Feb 85, 149p NBSIR-83/2804
Sponsored by Department of Energy, Washington, DC. Prepared in cooperation with Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.

Keywords: *Heat loss, *Test chambers, Calibrating, FORTRAN, Heat transmission, Heat measurement, Walls, Computer programs, Mathematical models, Finite difference theory.

A two-dimensional, finite-difference model was developed to calculate the flanking loss for the NBS Calibrated Hot Box. A new definition of flanking loss is presented, along with the thermal theory, a description of the computer code and some results. This model applies to both steady-state and dynamic boundary conditions.

715,320
PB85-183259 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.
Alternative Interaction Between Spinor and Yang-Mills Fields.
Final rept.
E. Marx. 1984, 11p
Pub. in Il Nuovo Cimento 81 A, n4 p759-769 1984.

Keywords: *Field theory(Physics), *Quantum theory, Relativity, Reprints, *Yang-Mills theory, Gauge theory, Spinors, Isospin.

A new interaction is introduced between the classical spinor-isospinor field and the Yang-Mills field. This interaction is derived from a Lagrangian density that is invariant under local unimodular transformations. New conserved isovector and isoscalar current densities are found; the isoscalar charge is no longer positive definite, which makes this formalism suitable for use in the context of relativistic quantum mechanics.

715,321
PB85-183564 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Correction to the Formula for the London Moment of a Rotating Superconductor.
Final rept.
R. M. Brady. 1982, 18p
Sponsored by Trinity Coll., Cambridge (England)., and Science Research Council, London (England).
Pub. in Jnl. of Low Temperature Physics 49, n1-2 p1-17 1982.

Keywords: *Superconductors, *Rotation, Magnetic fields, Reprints, London equation, Order parameters, Quantum mechanics.

This paper gives full quantum-mechanical analysis of the magnetic field (first discussed by London) which appears spontaneously when a sample of superconductor is set into rotation. It shows that, for slow rotation velocities and using certain approximations, the field B threading a cavity within a superconductor which rotates at angular velocity omega, is given by eB = 2(m sub 0) - W/(c squared) omega, where -e is the charge on the electron, (m sub 0) is the free electron mass, W is the work-function of the superconductor, and c is the velocity of light. In the calculation effects which are second-order in the rotation velocity have been ignored, and the result is only strictly valid at the zero of temperature. The application of this result to experiments using practical, non-ideal apparatus is then illustrated for a simple geometry.

715,322
PB85-187284 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Mechanisms for Inception of DC and 60-Hz AC Corona in SF6.
Final rept.
R. J. Van Brunt, and M. Misakian. 1982, 15p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in IEEE Trans. Electr. Insul. 17, n2 p106-120 Apr 82.

Keywords: *Sulfur hexafluoride, *Electric corona, Avalanche breakdown, Ionization, Measurement, Reprints.

Using a pulse counting technique, inceptions of positive and negative point-plane corona in SF6 under dc and 60-Hz ac conditions were measured. Effects of

gas pressure, uv-radiation, and point electrode size on differences between ac and dc, and between positive and negative inceptions were investigated. Inceptions were also calculated using the streamer criterion. Agreement was obtained with measured negative inceptions for both ac and dc conditions, but not with positive inceptions. The growth in the active-electron initiation volume with applied voltage was calculated and used to explain the observed polarity effect. The magnitude of the polarity effect is predictably reduced either by irradiating the gap or by increasing the diameter of the point electrode.

715,323
PB85-187433 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Standard Technique for Measuring Window Absorption and Other Efficiency Losses in Semiconductor Energy-Dispersive X-Ray Spectrometry.
Final rept.
R. E. Stone, F. J. Walter, D. H. Blackburn, P. Pella, and H. W. Kraner. 1981, 6p
Sponsored by Nuclear Science Society (IEEE), New York.
Pub. in X-Ray Spectrometry 10, n2 p91-96 1981.

Keywords: *X ray spectrometers, *Semiconductor devices, *Standards, Efficiency, Reprints, Standard reference materials.

A standard technique for measuring window absorption and other efficiency losses in semiconductor x-ray spectrometers is described. This technique is in the process of being adopted as an IEEE and IEC standard. A NBS Standard Reference Material Glass, SRM-477, has been developed to promote broad availability for the standard and method throughout the user community. Measurements are reported which have been made to establish limits on the geometry of the technique and to determine the effectiveness of the method.

715,324
PB85-189454 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Standardization of Technetium-99 by Liquid-Scintillation Counting.
Final rept.
B. M. Coursey, J. A. B. Gibson, M. W. Heitzmann, and J. C. Leak. 1984, 10p
Pub. in International Jnl. of Applied Radiation and Isotopes 35, n12 p1103-1112 1984.

Keywords: Standardization, Beta decay, Half life, Gravimetric analysis, Reprints, *Technetium 99, Liquid scintillators.

Technetium-99 has been standardized by comparing its pulse-height response on a liquid-scintillation counter with that of another beta-particle-emitting standard radionuclide. In this work, hydrogen-3, carbon-14, and cobalt-60 were used as the standards, and the results obtained agreed to within 0.32%. The mass of potassium pertechnetate was also measured by gravimetric techniques for the technetium-99 radioactivity standard solution. A half-life value of (2.111 + or - 0.012) x 10 to the 5th power years is suggested. The estimated uncertainty is intended to approximate one standard deviation.

715,325
PB85-189462 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Coincidence Form Factors in Electron Scattering.
Final rept.
J. S. O'Connell. 1984, 21p
Grant NSF-PHY84-09410
Sponsored by Connecticut Univ. Research Foundation, Storrs.
Pub. in Nucleon and Nuclear Structure and Exclusive Electromagnetic Reaction Studies, p1-21.

Keywords: *Electron scattering, Inelastic scattering, Quarks, Pions, Form factors, Nuclear resonance.

The two-body breakup cross section of inelastic electron scattering is presented and discussed. Examples of model calculations and some data are given for resonances, direct reactions, pion production, and scattering from quarks.

715,326
PB85-196285 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Isothermal Equations of State of H2O-VII and D2O-VII.
Final rept.
R. G. Munro, S. Block, F. A. Mauer, and G. Piermarini. 1982, 5p
Pub. in Jnl. of Applied Physics 53, n9 p6174-6178 Sep 82.

Keywords: *Ice, *Lattice parameters, *Equations of state, *Bulk modulus, Heavy water, Deuterium compounds, Reprints, Pressure dependence.

Lattice parameters and cell volumes at room temperature are reported for H2O-VII to 36 GPa and for D2O-VII to 32 GPa. The data are fitted to seven isothermal equations of state from which are derived averaged values of the isothermal bulk moduli and their pressure derivatives as a function of pressure. The procedures employed for treating the data and the reliability of the derived results are assessed for both materials.

715,327
PB85-197481 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Support-Electrode Torque on a Spherical Superconducting Gyroscope.
Final rept.
L. B. Holdeman, and J. T. Holdeman. 1984, 6p
See also DE82-017519.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics 20, n5 p2042-2047 1984.

Keywords: *Gyroscopes, *Superconductors, *Torque, *Relativity, Magnetic fields, Rotation, Boundary value problems, Reprints.

A rotating superconductor generates a magnetic field which can be used as a gyroscope readout. However, the Meissner effect of superconducting support electrodes will produce a torque. That torque is calculated in this paper.

715,328
PB85-197705 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Derivation of the Ornstein-Zernike Differential Equation from the BBGKY Hierarchy.
Final rept.
R. F. Kayser, and H. J. Raveche. 1982, 6p
Pub. in Physical Review A 26, n4 p2123-2128 1982.

Keywords: *Critical point, Correlation, Reprints, *BBGKY equation, *Ornstein-Zernike equation.

The theory of inhomogeneous fluids is applied to a d-dimensional system near its critical point to derive the probability of finding a particle at a distance r from a pair separated by a distance s, given that $r >> xi >> s$, where xi is the correlation length. When this result is used in the BBGKY hierarchy, an approximation-free equation is obtained, from which it follows that the pair correlations for $r >> xi$ satisfy the Ornstein-Zernike differential equation.

715,329
PB85-197721 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Ohmic Friction of an Ion in a Conducting Pore.
Final rept.
R. F. Kayser, and J. B. Hubbard. 1983, 3p
Pub. in Jnl. of Chemical Physics 78, n4 p1935-1937, 15 Feb 83.

Keywords: *Ion currents, Energy dissipation, Reprints, Ionic conductivity.

The authors computed the energy dissipation associated with an ion moving along the axis of a cylindrical pore, the exterior of which is a conductor.

715,330
PB85-197739 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Critical Correlations and the Square-Gradient Theory.
Final rept.
R. F. Kayser, and H. J. Raveche. 1983, 4p
Pub. in Physical Review Letters 50, n5 p298-301, 31 Jan 83.

Keywords: *Fluids, *Critical point, Nonlinear differential equations, Reprints, Correlation functions.

A nonlinear differential equation for the asymptotic decay of the pair correlation function of a fluid at its critical point is obtained from the square-gradient theory (and its extension to fourth-order), and analyzed when the critical exponent eta is either zero or nonzero. Its solutions are shown to be consistent with the correct power-law decay if and only if the ordinary scaling relations together with hyperscaling (for eta > 0) are valid.

715,331
PB85-200145
(Order as PB85-200129, PC **A06**/MF **A01**)
National Bureau of Standards, Boulder, CO.
Standards for Measurement of the Critical Fields of Superconductors.
F. R. Fickett. 21 Nov 84, 19p
Included in Jnl. of Research of the National Bureau of Standards, v90 n2 p95-113 Mar-Apr 85.

Keywords: *Superconductors, *Critical field, *Standards, Measurement.

The origins, definitions, and measurement of the various critical magnetic fields associated with superconductors are reviewed. The potential need for a consensus standard for the measurement of these fields is evaluated. Measurement techniques as practiced both in industry and in the national laboratories and extrapolation techniques commonly used to determine the upper critical fields of the newer materials are presented. Sources of error in the experimental determination of critical fields are assessed for the various common techniques. A comprehensive bibliography of the modern literature on critical field measurement and interpretation is included.

715,332
PB85-201804 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Recent Developments in Self-Contained Cryocoolers for SQUIDS and Other Low-Power Cryoelectronic Devices.
Final rept.
J. E. Zimmerman. 1984, 7p
Pub. in Proceedings of Int. Cryogenic Engineering Conference (10th), Helsinki, Finland, July 31-August 3, 1984, p13-19.

Keywords: *Refrigerators, Cryogenics, *Cryocoolers, SQUID devices.

The particular requirements of refrigeration for very low power cryoelectronic devices have been addressed only during the last few years. A number of laboratory prototypes are now near realization, and commercial systems may be available soon. These include Stirling and Gifford-McMahon machines and a four-stage Joule-Thomson machine, or a combination of one of the former with a final Joule-Thomson stage to achieve 4K, and small liquid-helium cryostats with integral intermittent reliquefying capability. The most difficult technical problem outstanding is to design reliable, non-contaminating, miniature compressors for these machines.

715,333
PB85-201978 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Laser Production of a Very Slow, Monoenergetic Atomic Beam.
Final rept.
J. V. Prodan, W. D. Phillips, and H. Metcalf. 1982, 5p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Physical Review Letters 49, n16 p1149-1153, 18 Oct 82.

Keywords: *Atomic beams, *Sodium, Laser beams, Velocity, Spectroscopy, Reprints, Laser cooling, Laser trapping, High resolution.

Using a resonant, counterpropagating laser beam, the authors have reduced the velocity of atoms in a neutral, thermal sodium beam to 40 m/s, or 4% of their initial velocity. These atoms have a kinetic energy comparable to the well depth of proposed optical traps. The 'temperature' characterizing the atoms' relative-motion was reduced to 70mK.

715,334
PB85-203503 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.

Cascade Effects in Mass-Dependent Preferential Recoil Implantation.
Final rept.
M. L. Roush, F. Davarya, O. F. Goktepe, and T. D. Andreadis. 1983, 12p
Pub. in Nuclear Instruments and Methods in Physics Research 209, p67-78 May 83.

Keywords: Computerized simulation, Reprints, *Ion bombardment, Ion implantation, Recoils.

Under some circumstances, ion bombardment induces preferential recoil implantation of one species of an initially homogeneous binary target. The atomic masses of the target components play a central role in the segregation produced by the ion bombardment if all binding energies are the same. The process of component segregation does not generally take place by single recoil implantation events in which atoms are driven from the surface region inward to the enriched portion. Rather, the motion is one of migration in which a great deal of motion takes place due to atomic mixing and there is a slight directional preference which favors the inward movement of the heavy element. To facilitate a study of their role in recoil implantation, this computer simulation involves grouping of the components of the recoil cascade according to the number of collisions preceding their generation. The authors observe that the recoils of the lighter target species have greater total path lengths but their direction of travel is more random. The heavy species is preferentially implanted due to its retention of the inward-directed momentum.

715,335
PB85-205797 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Role of Photodetachment in Initiation of Electric Discharges in SF6 and O2.
Final rept.
R. J. Van Brunt, and M. Misakian. 1983, 6p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Applied Physics 54, n6 p3074-3079 Jun 83.

Keywords: *Electric discharges, *Sulfur hexafluoride, Oxygen, Avalanche breakdown, Reprints, Photodetachment.

The role of photodetachment in the initiation of electron avalanches near a positive point electrode was investigated using radiation between 295 and 630 nm from a chopped, tunable cw laser or filtered Hg-discharge lamp for a gap in which the negative ion flux was controlled by uv-irradiation of the cathode. Consistent with estimates based on known cross sections, photodetachment for light beams up to 500 mW was found to make a negligible contribution to avalanche initiation in SF6 and O2 at pressures from 50 to 500 kPA. The conditions under which photodetachment might be observed are discussed, and it is shown that for the conditions considered here, the expected dominant electron release mechanism in the gap is through collisional detachment of stable negative ions. Previously reported enhancements in avalanche rates resulting from irradiation of a positive point can be explained as arising from increases in negative ion densities due to attachment of photoelectrons ejected by scattered radiation.

715,336
PB85-207074 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Monopole Detector Studies at NBS (National Bureau of Standards).
Final rept.
F. R. Fickett, M. Cromar, and A. F. Clark. 1984, 4p
Pub. in Proceedings of Monopole 1983, Ann Arbor, MI., October 6-9, 1983, p477-480 1984.

Keywords: Magnetometers, Superconductors, Squid(Detectors), *Magnetic monopoles, Squid detectors.

The work at the National Bureau of Standards has had three major goals. First, to investigate sources of noise in SQUID-based detector systems and to develop techniques to minimize their disruptive effects. Second, to investigate and identify sources of signals similar in size and signature to those expected from a monopole passage and, again, to eliminate them. Third, to participate in the search for the monopole. To these ends, the authors have constructed and operated a two-coil coincidence system in several configurations for well over 1000 hours. Because their efforts have been concentrated on the investigation of anomalous effects, not many of these hours can be considered as true detector time.

715,337
PB85-207116 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Field Theory, Curdling, Limit Cycles and Cellular Automata.
Final rept.
E. A. DiMarzio. 1984, 11p
Pub. in Jnl. of Statistical Physics 36, n5-6 p897-907 1984.

Keywords: *Field theory(Physics), Relativity, Reprints, Fractals, One dimensional, Nonlinear analysis.

It is suggested that the process of curdling is the preeminent question for the science of fractals. A field equation which displays nucleation (curdling) of particles out of a pure radiation field is discussed. The particle formation arises naturally from the non-linear character of the equation rather than from imposed quantization conditions. The relativistically invariant equation is given. It represents material at r,t traveling with the velocity of light in direction (Omega vector). Explicit solutions are given for the case of one dimension. Fields representing particles are obtained and shown to have spacially oscillatory structure with incipient fractal character.

715,338
PB85-221851 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Photoionization of the H Atom in Strong Electric Fields by Resonant Two-Photon Excitation.
Final rept.
K. H. Welge, and H. Rottke. 1984, 7p
Sponsored by Optical Society of America, Washington, DC.
Pub. in Proceedings of Topical Meeting on Laser Techniques Extreme Ultraviolet (2nd), Boulder, CO., March 5-7, 1984, American Institute of Physics Conference Proceedings 119, p213-219 1984.

Keywords: Ultraviolet lasers, Electric fields, *Multiphoton ionization, *Hydrogen atoms, *Photoionization, Laser radiation, Tunable lasers.

The photoionization of the H atom in strong electric fields, F, by resonant two-photon excitation, H(1) + VUV -> H(2) + UV -> H(+1) + e, has been investigated at energies from the classical field ionization saddle point, E(sp) = -2 (the square root of F) a.u., through the zero field ionization limit, E = 0, into the continuum, E > 0. The atoms have been excited to single Stark levels in n = 2 with tunable pulsed VUV laser light around the Lyman-alpha line in an atomic beam with sub-Doppler resolution. The ionization from selected Stark levels by the UV was observed as a function of the UV wavelength.

715,339
PB85-222024 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Possible Interpretation of a New Resonance at 8.3 GeV.
Final rept.
K. Lane, S. Meshkov, and F. Wilczek. 29 Oct 84, 3p
Contract EY-76-C-02-1545, Grant NSF-PHY77-27084
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Physical Review Letters 53, n18 p1718-1720, 29 Oct 84.

Keywords: Reprints, *Pseudoscalers, Nuclear resonance, Tau particles, Gauge theory.

It is discussed whether the recently discovered resonance at 8.3 GeV can be interpreted as a weakly coupled fundamental pseudoscalar. Such a particle is readily incorporated in an SU(2) xU(1) gauge theory framework. The importance of mixing with (eta sub B), (eta prime sub B) for the phenomenology of such a particle is emphasized, and critical tests of their identification are proposed.

715,340
PB85-222321 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Chiral Fermions Beyond the Standard Model.
Final rept.
P. M. Fishbane, S. Meshkov, R. E. Norton, and P. Ramond. 1 Mar 85, 8p
Contracts NSF-PHY81-00257, DE-AS05-81-ER0008
Pub. in Physical Review D 31, n5 p1119-1126, 1 Mar 85.

Keywords: *Fermions, Reprints, Chirality.

A scheme is discussed for constructing anomaly-free, charge-vectorial chiral sets of fermions which acquire masses by coupling to the Higgs doublet of the standard model.

715,341
PB85-222347 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Surface Tension of Liquid Silicon.
Final rept.
S. C. Hardy. 1984, 5p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Crystal Growth 69, p456-460 1984.

Keywords: *Silicon, *Interfacial tension, Liquids, Measurement, Impurities, Reprints, Temperature dependence.

The surface tension of liquid silicon has been measured as a function of temperature in purified argon atmospheres using the sessile drop technique. The measurements show the surface tension is sensitive to low levels of an impurity which is probably oxygen. The highest surface tension values obtained under conditions which minimized the oxygen levels in the apparatus are in good agreement with an isolated previous measurement in pure hydrogen. The surface tension decreases linearly with increasing temperature and has a temperature coefficient of -0.28 mJ/(m squared)K.

715,342
PB85-227668 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Subharmonic Frequency Locking in the Resistive Josephson Thermometer.
Final rept.
M. van Veldhuizen, and H. A. Fowler. 1 May 85, 6p
Pub. in Physical Review B 31, n9 p5805-5810, 1 May 85.

Keywords: *Temperature measuring instruments, Josephson junctions, Electrical impedance, Cryogenics, Reprints, *Thermometers, SQUID devices.

Phase-locked oscillatory solutions are examined as a basis for the dc impedance of the resistive superconducting quantum-interference device Josephson thermometer. The calculations are based on the resistively shunted junction model in the limit 2pi(L sub s)(I sub c)/(Phi sub 0)= or > 1, where (L sub s) is the loop inductance and (I sub c) is the junction critical current, and for a junction resistance large compared with the external shunt resistance. An algorithm for representing frequency entrainment in (kappa, omega) space (drive amplitude, frequency) leads to zones with rotation number p/q having the form of leaf-shaped regions joined and overlapping at their tips. High-resonance zones are very thin and locally similar. No chaotic behavior has been observed. The model can simulate the 'rising' curves of dc impedance as a function of drive amplitude.

715,343
PB85-229284 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
New Atomic Mechanism for Positron Production in Heavy-Ion Collisions.
Final rept.
W. Lichten, and A. Robatino. Feb 85, 4p
Pub. in Physical Review Letters 54, n8 p781-784, 25 Feb 85.

Keywords: Reprints, *Positron sources, Heavy ion reactions.

The Letter gives a newly considered mechanism for positron production which consists of filling of long-lived, supercritical, multiple-vacancy states via higher-order perturbations, with interference terms of the same order of magnitude as in the case of the previ-

ously considered single vacancies. The mechanism could be relevant to the structure in positron energy spectra observed at Gesellschaft fur Schwerionenforschung in heavy-ion collisions. A possible directional anisotropy of positron emission is discussed.

715,344
PB85-230779 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
X-ray Interferometry: The Optical to Gamma-ray Connection.
Final rept.
R. D. Deslattes. 1979, 18p
Pub. in Proceedings of the International Workshop on Neutron Interferometry, Grenoble, France, June 5-7, 1979, p399-415.

Keywords: *X rays, *Gamma rays, Quantum electrodynamics, Diffraction, *Interferometry.

In the recent past, it has been possible to complete an improved measurement chain connecting the hydrogen Rydberg with gamma-ray reference energies in the range $0.06 < E < 1.1$ MeV. Among other applications, these gamma-ray reference energies have been used to calibrate muonic X-ray spectra for tests of QED especially the vacuum polarization terms. Results of this improved calibration of the gamma-ray scale together with improved precision in the mesic X-ray to gamma-ray comparisons have resulted in the emergence of a pattern of substantial harmony between customary QED calculations and experiment. In a second application, the new gamma-ray values are used here as intermediate steps for the re-determination of several high Z X-ray lines where the X-ray to gamma-ray ratios have been previously established with high accuracies. In addition, a smaller number of X-ray lines have already been directly determined. Taken together these results produce an interim set of re-evaluated X-ray lines having higher accuracies than were previously available. When these are compared with recently available Hartree-Fock-Slater calculations, a systematic pattern of significant disagreement is evident.

715,345
PB85-230787 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Comparison of Relativistic Atomic SCF (Self-Consistent Field) Calculations with Improved Experimental Data.
Final rept.
R. D. Deslattes, L. Jacobs, E. G. Kessler, and W. Schwitz. 1982, 10p
Pub. in Advances in X-ray Spectroscopy: A Reference Text in Honour of Professor Y. Cauchois, p144-152 1982.

Keywords: *X ray spectra, X ray spectroscopy, Gamma rays, Comparison.

The paper discusses the results of three comparisons between relativistic self-consistent field calculations and various experimental data. It is shown that by combining certain of the recently available optically referenced X-ray and gamma-ray wavelength measurements with a highly selected group of relative X-ray to X-ray and X-ray to gamma-ray comparisons, an improved, though quite limited, data base of transition energies can be obtained. The result shows deviations increasing with Z in a linear fashion. One possible origin for this result is discussed briefly.

715,346
PB85-230795 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Frequency Measurements from the Microwave to the Visible, the Speed of Light, and the Redefinition of the Meter.
Final rept.
K. M. Evenson. 1983, 28p
Pub. in Proceedings of the North Atlantic Treaty Organization Advanced Study Institute on Quantum Metrology and Fundamental Physical Constants, Erice, Italy, November 16-28, 1981, NATO ASI Series B: Physics, v98 p181-207 1983.

Keywords: *Frequency measurement, *Length, *Metrology, *Standards, Reprints, *Light speed, *Meter, Laser radiation.

The techniques of laser frequency measurement, especially those leading to the measurements of the frequency of visible light, are described. The use of these techniques has led to much higher accuracy in spectral measurements, a hundred-fold increase in the accuracy of the value of the speed of light, and to a proposed redefinition of the meter, fixing the value of the speed of light. The use of stabilized lasers in these measurements, some of the characteristics of the metal-insulator-metal diode used in high speed detection, and the realization of the meter with the proposed new definition are described.

715,347
PB85-233369 PC **A13**/MF **A01**
National Bureau of Standards, Boulder, CO.
Proceedings of the Cryocooler Conference (3rd) Held at Boulder, Colorado on September 17-18, 1984.
R. Radebaugh, B. Louie, and S. McCarthy. May 85, 283p NBS/SP-698
Also available from Supt. of Docs as SN003-003-02662-0. Library of Congress catalog card no. 85-600544. Sponsored by National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center, Naval Research Lab., Washington, DC. and Office of Naval Research, Arlington, VA.

Keywords: *Refrigerators, *Meetings, Superconductors, Infrared detectors, Refrigerating, Cryopumping, Cryogenics, Helium, *Cryocoolers, *Cryogenic refrigerators, Magnetic refrigerators.

The document contains the proceedings of the Third Cryocooler Conference, held at the National Bureau of Standards, Boulder, CO, on Sept. 17-18, 1984. About 140 people from 10 countries attended the conference and represented industry, government, and academia. A total of 26 papers were presented orally at the conference and all appear in written form in the document. The emphasis in the conference was on small cryocoolers in the temperature range of 4-80K. Mechanical and non-mechanical types were discussed in the various papers. Applications of the small cryocoolers include the cooling of infrared detectors, cryopumps, small superconducting devices and magnets, and electronic devices.

715,348
PB86-100690 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Units for Magnetic Properties.
Mar 85, 3p NBS/SP-696
Also available from Supt. of Docs as SN003-003-02668-9.

Keywords: *Units of measurement, *Magnetic properties.

Column headings include the following: Quantity; Symbol; Gaussian and cgs emu; Conversion factor; SI and rationalized mks.

715,349
PB86-101920 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Laser-Cooled-Atomic Frequency Standard.
Final rept.
J. J. Bollinger, J. D. Prestage, W. M. Itano, and D. J. Wineland. 1985, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Physical Review Letters 54, n10 p1000-1003, 11 Mar 85.

Keywords: *Frequency standards, *Atomic clocks, Reprints, Laser cooling, Penning traps, Beryllium ions, Beryllium 9.

The first frequency standard based on laser-cooled atoms is reported. Beryllium atomic ions were stored in a Penning trap and cooled by radiation pressure from a laser. The frequency of the 9Be+ (MI,MJ)=(-3/2, + 1/2)<-->(-1/2, + 1/2) ground-state hyperfine transition at its magnetic-field-independent point was determined to be 303016377.265070(57) Hz. The accuracy of a frequency standard referenced to this transition was comparable to the best frequency standards, which are based on cesium atomic beams.

715,350
PB86-102993 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Around-the-World Relativistic Sagnac Experiment.
Final rept.
D. W. Allan, M. A. Weiss, and N. Ashby. Apr 85, 2p
Sponsored by Colorado Univ. at Boulder. Dept. of Physics and Astrophysics.
Pub. in Science 228, p69-70, 5 Apr 85.

Keywords: *Atomic clocks, *Relativity, Reprints, *Sagnac effect, Global positioning system.

In 1971 Hafele and Keating carried portable atomic clocks east and then west around the world and verified the Sagnac effect, a special relativity effect attributable to the earth's rotation. In the study reported here, observations of the effect were made by using electromagnetic signals instead of portable clocks to make clock comparisons. Global Positioning System satellites transmit signals that can be viewed simultaneously from remote stations on the earth; thus an around-the-world Sagnac experiment can be performed with electromagnetic signals. The effect is larger than that occurring when portable clocks are used. The average error over a 3-month experiment was only 5 nanoseconds.

715,351
PB86-103009 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Transplutonium (sigma sub nf) Systematics in the MeV Range.
Final rept.
J. W. Behrens, J. Trochon, and J. Jary. Jun 85, 3p
Pub. in Transactions of the American Nuclear Society 49, p196-198 Jun 85.

Keywords: *Fission cross sections, *Actinide series, Reprints.

In addition to obtaining nuclear data from measurement and theory, one may also rely on nuclear data phenomenology, the study of systematic trends in nuclear parameters which are accurately known to infer these parameters for nuclides which are not accurately known, often because they are difficult to measure. One such study deals with the systematics of neutron-induced fission cross sections over the incident-neutron energy range from 1 to 20 MeV. Results for a total of over 40 isotopes of the uraniums, neptuniums, and plutoniums have now been completed. Extension of these trends to the transplutoniums, however, yields inferred values which significantly overpredict the fission cross section. This overprediction is primarily caused by the change in the systematics of the inner fission barrier height, near compound nucleus neutron number 146, as will be shown.

715,352
PB86-103595 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Nuclear Data Standards.
Final rept.
A. D. Carlson. 1985, 2p
Pub. in Transactions of the American Nuclear Society 49, p205-206 1985.

Keywords: *Neutron cross sections, *Standards, Reprints.

The rationale, need, and requirements for neutron cross section standards are discussed.

715,353
PB86-110855 PC **A09**/MF **A01**
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Trapped Ions and Laser Cooling: Selected Publications of the Ion Storage Group of the Time and Frequency Division, NBS, Boulder, CO.
Technical note.
D. J. Wineland, W. M. Itano, J. C. Bergquist, and J. J. Bollinger. Jul 85, 195p NBS/TN-1086
Also available from Supt. of Docs as SN003-003-02666-2. Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Bolling AFB, DC.

Keywords: *Frequency standards, *Atomic spectroscopy, Time standards, Atomic clocks, *Ion traps, *Laser cooling, Laser spectroscopy, Penning traps.

The report contains selected publications of the Ion Storage Group of the Time and Frequency Division, NBS, Boulder, Colorado. Partial contents include:

Laser Cooling of Atoms; Spectroscopy of a Single Mg(+) Ion; Laser Cooling of Ions Stored in Harmonic and Penning Traps; Spectroscopy of Stored Ions; Frequency Standard Research Using Stored Ions; Laser-Cooled-Atomic Frequency Standard.

715,354
PB86-111739 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.
Status Report: Electro-Nuclear Physics at NBS (National Bureau of Standards).
Final rept.
S. Penner. 1985, 6p
Pub. in Proceedings of the International School of Nuclear Physics Nuclear and Subnuclear Degrees of Freedom and Lepton Nucleus Scattering, Erice, Italy, April 8-20, 1984, Progress in Particle and Nuclear Physics 13, p237-242 1985.

Keywords: *Research, Electron scattering, Photonuclear reactions, Reviews, Electrodisintegration, Racetrack microtrons.

Electronuclear Physics has a long history at NBS, extending back to the pioneering photonuclear experiments of Fuller and Hayward in the 1950's. Since 1967 the authors have carried out an experimental program in electron scattering, electrodisintegration, and photon scattering using their 140 MeV linac. Although there are still some experiments in progress using the linac, it is approaching the end of its useful life for nuclear physics. The authors are now building a 200 MeV CW racetrack microtron (RTM) and designing apparatus for use in a program of primarily coincidence experiments when the RTM is completed. In the report, the authors summarize the current status of these efforts, as well as experiments being carried out at other laboratories, and a small but active theory program.

715,355
PB86-112059 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Trapped Ions, Laser Cooling, and Better Clocks.
Final rept.
D. J. Wineland. Oct 84, 6p
Pub. in Science 226, p395-400, 26 Oct 84.

Keywords: *Atomic clocks, *Frequency standards, *Atomic spectroscopy, Reprints, *Laser cooling, *Ion traps, Laser spectroscopy.

Ions that are stored in electromagnetic 'traps' provide the basis for extremely high resolution spectroscopy. By using lasers, the kinetic energy of the ions can be cooled to millikelvin temperatures, thereby suppressing Doppler frequency shifts. Potential accuracies of frequency standards and clocks based on such experiments are anticipated to be better than one part in 10 to the 15th power.

715,356
PB86-112372 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.
Note on the Lawson-Penner Limit.
Final rept.
J. D. Lawson, and S. Penner. Feb 85, 1p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Jnl. of Quantum Electronics QE-21, n2 p174 Feb 85.

Keywords: Electron accelerators, Linear accelerators, Reprints, *Lawson-Penner limit, Free electron lasers.

No abstract available.

715,357
PB86-112836 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Atomic Parity Nonconservation Experiments.
Final rept.
E. N. Fortson, and L. L. Lewis. 1984, 56p
Pub. in Physics Reports 113, n5 p289-344 1984.

Keywords: *Parity, Bismuth, Lead(Metal), Cesium, Thallium, Hydrogen, Weak interactions, Reprints, Weinberg-Salam gauge model.

A comprehensive review of theoretical and experimental studies of parity nonconservation in atoms is presented. The authors describe measurements in bismuth, lead, cesium, and thallium which collectively provide confirmation of the Weinberg-Salam-Glashow 'standard model' of electroweak unification. Ongoing experiments in hydrogen are discussed as well. The authors examine the unique role of all atomic experiments in distinguishing alternative versions of the standard theory. Finally, the authors include some discussion of experiments which search for permanent atomic electric dipole moments as potential evidence of time-reversal violation in particle interaction.

715,358
PB86-114055 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Use of Electron Rings in Nuclear Physics Research.
Final rept.
J. S. O'Connell. 1982, 3p
Pub. in Proceedings of Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, October 5-7, 1982, v1 p1-3.

Keywords: *Nuclear physics, *Electron rings.

The use of stored beams of high energy electrons for electromagnetic nuclear reactions studies is discussed in the context of the past and future of nuclear physics.

715,359
PB86-119369 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Virtual Photons in Theory and Experiment.
Final rept.
W. R. Dodge. 1985, 9p
Pub. in Nuclear Instruments and Methods in Physics Research B10/11, p423-431 1985.

Keywords: Reprints, *Virtual photons, Virtual particles, Electrodisintegration, Zirconium 90, Isobaric analogs.

Before the last decade nuclear electrodisintegration experiments in the region of the giant dipole resonance were carried out primarily as an expedient experimental alternative to photodisintegration experiments. Lack of an adequate treatment of Coulomb distortion of the incident and scattered electron's wavefunction in heavy nuclei and recoil in light nuclei when the momentum of the scattered electron was not much smaller than the momentum of the recoiling residual nucleus limited the establishment of the correspondence between photo- and electrodisintegration to roughly s-d shell nuclei. Distorted-wave Born approximation calculations have solved the former problem in virtual photon analysis of (e,X) total cross-section measurements and the effects of recoil on PWBA virtual photons have been recently investigated. In principle, an inclusive (e,X) experiment completely determines the (gamma,X) cross-section. Besides those matrix elements present in the photodisintegration cross-section that are associated with the transverse form factor as q->omega, other terms associated with the Coulomb, interference, and polarization terms of the (e,e'x) cross-section appear in the (e,X) cross-section. Inclusive (e,X) experiments done at NBS to test the limitations of E1 virtual photon theory are described. The proliferation of (e,e'X) experiments will intensify interest in (e,e'X) theory aexperiments, with the X arm singles serving as an important check on the internal consistency of the (e,e'X) results.

715,360
PB86-119427 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Hysteretic Losses in Nb-Ti Superconductors.
Final rept.
R. B. Goldfarb, and A. F. Clark. Apr 85, 3p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Applied Physics 57, n1 p3809-3811, 15 Apr 85.

Keywords: *Superconductors, *Magnetic hysteresis, Hysteresis, Magnetization, Niobium, Titanium, Losses, Reprints.

When subjected to transient magnetic fields, superconductors exhibit losses. At low frequencies, most of the dissipation is hysteretic. Magnetization was measured in an axial field for eight multifilamentary Nb-Ti superconducting wires with different filament sizes and different ratios of copper to superconductor. The full-penetration field H(p) was estimated from the high-field ends of the hysteresis loops. The estimate of H(p) provides a method to assess the critical current density Jc. There was good agreement between measured losses and those predicted from H(p) and the peak applied field.

715,361
PB86-121597 PC **A13**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Technical Activities 1983, Center for Basic Standards.
Final rept.
K. G. Kessler. Jan 84, 276p NBSIR-83/2793
See also PB85-164952.

Keywords: *Research, *Standards, Metrology, Fundamental constants, Pressure, Gravity, Lasers, Length, Mass, Vacuum, Time standards, Frequency standards, X rays, Gamma rays, Temperature, Electrical measurement, Laser applications.

The report is Part II of the 1983 Annual Report of the Center for Basic Standards and contains a summary of the technical activities of the Center for the period October 1, 1982 to September 30, 1983. The Center is one of the five resources and operating units in the National Measurement Laboratory.

715,362
PB86-122793 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Experimental Program at the National Bureau of Standards Synchrotron Ultraviolet Radiation Facility (SURF).
Final rept.
R. P. Madden, D. L. Ederer, and A. C. Parr. 1985, 4p
Sponsored by National Aeronautics and Space Administration, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Nuclear Instruments and Methods in Physics Research B10/11, p289-292 1985.

Keywords: Far ultraviolet radiation, Synchrotron radiation, Surface properties, Photodiodes, Calibrating, Reprints, *Surf II storage ring, Photoelectron spectroscopy.

New beamline development on SURF features toroidal grating instruments for Surface Science studies and Far UV photodiode calibration. The progress and capabilities of these lines will be discussed along with the developments on the high resolution normal incidence spectrometer beam line under construction by the University of Maryland. The ongoing programs in Surface Science and Photoelectron Spectroscopy are reviewed briefly, with a more detailed discussion of the latest results in calibration efforts using electron counting and the calculable spectral distribution of synchrotron radiation.

715,363
PB86-122926 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Stirling Cycle and Cryogenic Refrigerators.
Final rept.
B. Louie, and R. Radebaugh. 1984, 6p
Pub. in Proceedings of IECEC '84 Advanced Energy Systems-Their Role in Our Future (19th), San Francisco, CA., August 19-24, 1984, p2086-2091.

Keywords: *Stirling cycle, Thermodynamic cycles, Reliability, *Cryogenic refrigerators, *Cryocoolers.

The paper reviews the principles and techniques used in cryogenic refrigeration, with particular emphasis on small cryocoolers. Several thermodynamic cycles used in cryocoolers are discussed, as are the design requirements, applications, and current areas of research. The important features of the Stirling cycle used as a prime mover or refrigerator are compared.

715,364
PB86-128923 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Frequency and Time Coordination, Comparison, and Dissemination.
Final rept.
D. W. Allan. 1985, 41p
Pub. in Precision Frequency Control 2, p233-273 1985.

Keywords: *Time standards, *Frequency standards, *Calibrating, Metrology, Coordination, Comparison, Reprints.

The purpose of the chapter is to review both the current and some anticipated metrology techniques useful in comparing or calibrating remotely located time and frequency standards. Typically, the interest in this regard is to make available to a remote user some primary frequency or time standard reference. The techniques usually employed to accomplish this either involve the transport of a secondary standard or the propagation of time and frequency information carried on an electromagentic signal. The accuracy, reasonable coverage areas, convenience to the user, and, in some cases, nominal cost of some of these techniques of comparison and dissemination will be reviewed.

715,365
PB86-128972 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Multisensor Automated EM (Electromagnetic) Field Measurement System.
Final rept.
W. Bensema, G. Reeve, and G. Koepke. 1985, 3p
Pub. in Proceedings of Institute of Electrical and Electronics Engineers 1985 Instrumentation and Measurement Technology Conference, Tampa, FL., March 20-22, 1985, p200-202.

Keywords: *Electromagnetic fields, *Measurement, Reverberation, Monitors.

A system is being developed to monitor and collect electromagnetic (EM) field strength at multiple locations simultaneously. The system has two modes of operation: (1) for sampling EM fields that are stationary for times of the order of 200 ms, and (2) for sampling changing EM fields with a system resolution of 10 micro seconds.

715,366
PB86-128980 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Laser-Cooled Stored Ion Experiments Using Penning Traps.
Final rept.
J. J. Bollinger, D. J. Wineland, and W. M. Itano. 1983, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of International Conference on Lasers '83, San Francisco, CA., December 12-16, 1983, p727-730.

Keywords: Frequency standards, Mass spectroscopy, *Ion storage, Ion traps, Penning traps, Laser cooling, Beryllium 9, Plasma.

Small clouds of 9Be+ ions are stored in a Penning trap and cooled with a laser to temperatures below 200 mK. The ions are detected by their fluorescence induced by the cooling laser. Experiments on high resolution spectroscopy and frequency standards, mass spectroscopy, and one-component plasmas are discussed.

715,367
PB86-128998 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Frequency and Time Standards Based on Stored Ions.
Final rept.
J. J. Bollinger, D. J. Wineland, W. M. Itano, J. C. Bergquist, and J. D. Prestage. 1985, 10p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Proceedings of Annual Precise Time and Time Interval Applications and Planning Meeting (16th), Greenbelt, MD., p49-58 1985.

Keywords: *Time standards, *Frequency standards, Atomic clocks, Microwaves, Doppler effect, *Ion storage, Ion traps, Penning traps, Laser cooling.

The method of ion storage provides a basis for excellent time and frequency standards. This is due to the ability to confine ions for long periods of time without the usual perturbations associated with confinement (e.g. wall shifts). In addition Doppler effects can be greatly suppressed. The use of stored ions for microwave frequency standards and the future possibilities for an optical frequency standard based on stored ions are addressed.

715,368
PB86-129491 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electrical Measurements and Standards Div.
Design and Construction of a Superconducting Magnet System for the Absolute Ampere Experiment.
Final rept.
W. Y. Chen, J. R. Purcell, P. T. Olsen, W. D. Phillips, and E. R. Williams. 1982, 8p
Pub. in Advances in Cryogenic Engineering 27, p97-104 1982.

Keywords: Superconducting magnets, Magnetic fields, Electric current, Standards, Reprints, *Superconducting coils, *Ampere.

The Electrical Measurements and Standards Division of the National Bureau of Standards will undertake an absolute ampere experiment, which will envolve measuring the force exerted on a current-carrying, normal conductor coil by a set of superconducting coils and also measuring the voltage induced in the normal coil as it is moved in the field of the superconducting coils. To achieve the desired accuracy and resolution, the superconducting coils are required to generate nearly purely radial fields of about 0.2 tesla at a radius of 35 cm, over a region of delta R = + or - 0.8 cm and delta Z = + or - 2.5 cm. The quality of the field is represented by the product r(dot)(B sub r) which must be held uniform within 20 ppm over the specified region.

715,369
PB86-130127 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Cold Fragmentation Measurements Using a Very-High-Energy-Resolution Ionization Chamber.
Final rept.
J. Trochon, G. Simon, J. W. Behrens, and F. Brisard. 1985, 1p
Pub. in Transactions of the American Nuclear Society 49, p199 Jun 85.

Keywords: *Nuclear fission, *Nuclear models, Thermal neutrons, Reprints, *Fission fragments, Uranium 235.

The evolution of a fissioning nucleus from saddle point to scission is perhaps the least known stage of nuclear fission at low energy. In a recent 'microscopic analysis of collective dynamics in low energy fission' using a density dependent Hartree-Fock-Bogolyubov approach with an effective force, Berger et al. interpreted the phenomenon as a passage of the nucleus from an elongation valley to a fusion valley. For small elongation, this passage occurs through a striction barrier, which disappears for more elongated configurations. This fission mode is named 'cold configuration' or 'cold fragmentation' because the scission leaves the two fragments in states close to their ground state. In the present measurements, the authors investigated cold fragmentation in the thermal neutron-induced fission of (235)U, i.e., (236)U*, to test the fission dynamics calculation and to contribute to the knowledge of the even-odd effect and of the maximum total fragment kinetic energy for a given fragmentation.

715,370
PB86-130168 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
High-Resolution Spectroscopy of Stored Ions.
Final rept.
D. J. Wineland, W. M. Itano, and R. S. Van Dyck. 1983, 52p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., Office of Naval Research, Arlington, VA., and National Science Foundation, Washington, DC.
Pub. in Advances in Atomic and Molecular Physics 19, p135-186 1983.

Keywords: Mass spectroscopy, Magnetic moments, Electrons, Positions, *Ion storage, Ion traps, Ion spectroscopy, High resolution.

The paper gives a review of high resolution spectroscopy experiments that have employed the stored ion technique. The main elements of the paper are Sections on (1) storage techniques, (2) lepton spectroscopy, (3) mass spectroscopy (4) atomic and molecular spectroscopy (5) negative ion spectroscopy (6) radiative lifetime measurements.

715,371
PB86-132669 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Rochester Gravitational-Wave Detector.
Final rept.
M. F. Bocko, M. W. Cromar, D. H. Douglass, R. Q. Gram, W. W. Johnson, M. Karim, C. C. Lam, D. Macaluso, J. R. Marsden, B. Muhlfelder, L. Narici, and M. Zucker. 1984, 10p
Pub. in Jnl. of Physics E-Scientific Instruments 17, n8 p694-703 1984.

Keywords: Vibration isolators, Superconductors, Reprints, *Gravitational wave detectors, SQUID devices.

In the paper the authors present the first detailed report of the Rochester cryogenic resonant gravitational wave detector. They describe in detail their transducer which makes use of several features (superconducting, wide band, non-contacting) in a unique combination that already has made it possible to achieve the highest mechanical Q for aluminum in a gravitational wave detector (Q = 2 x 10 to the 7th power). They also present encouraging results of preliminary tests, and show how their detector will be able to achieve a competitive ultimate sensitivity even though the detecting mass is smaller than what is commonly used. They include a detailed analysis of the sensitivity and a description of the procedure for the calibration.

715,372
PB86-133642 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Measurements and Standards Div.
Progress in Temperature Measurement.
Final rept.
R. D. Cutkosky, R. E. Edsinger, J. P. Evans, and R. J. Soulen. 1983, 4p
Pub. in Proceedings of the ISA (Instrument Society of America) '83 International Conference and Exhibit, Landmarks in Metrology, Houston, TX., October 10-13, 1983, p13-16.

Keywords: *Temperature measurement, *Standards, Resistance thermometers, Resistance bridges, Thermocouples, Gas thermometers.

The authors review three articles which have had lasting impact on the measurement of temperature and the development of a temperature scale. The authors indicate the role they play in contemporary temperature standards.

715,373
PB86-136819 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Neutron Depth Profiling at the National Bureau of Standards.
Final rept.
R. G. Downing, R. F. Fleming, J. K. Langland, and D. H. Vincent. 1983, 5p
Pub. in Nuclear Instruments and Methods in Physics Research 218, n1-3 p47-51, 15 Dec 83.

Keywords: *Neutrons, Nuclear reactions, Silicon, Helium 3, Reprints, *Depth dose distributions, Semiconductors, Lithium 6, Boron 10, Sodium 22.

The National Bureau of Standards has established a dedicated neutron depth profiling (NDP) facility at its 10 MW research reactor in Gaithersburg, MD. The goal of the program is to provide real-time concentration profiles with the quality necessary to address scientific and technological problems. The depth profiles are obtained by deconvolution of energy spectra measured as monoenergetic charged particles are released by exoergic neutron reactions. The energy the particle retains upon leaving the sample surface is primarily dependent on the depth at which the reaction took place. Initially He-3, Li-6, B-10, and Na-22 are being studied because of their large thermal neutron cross sections and the importance of the nondestructive analysis of these elements in many matrices.

715,374
PB86-136868 Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Mode Coupling from Linear and Nonlinear Kinetic Equations.
Final rept.
J. W. Dufty, and R. F. Rodriguez. 1983, 26p
Pub. in Jnl. of Statistical Physics 33, n2 p261-286 Nov 83.

Keywords: *Kinetic theory, Boltzmann equation, Spheres, Reprints, Klimontovich equation, Mode coupling.

The calculation of mode coupling contributions to equilibrium time correlation functions from the nonlinear Boltzmann equation is reconsidered. It is suggested that the use of a nonlinear kinetic equation is not appropriate in the context, but instead such calculations should be reinterpreted in terms of the Klimontovich equation for the microscopic phase space density. For hard spheres the Klimontovich equation is formally similar to the nonlinear Boltzmann equation, and the similarity is exploited to explain the successful calculation of mode coupling effects from the latter. The relationship of the Klimontovich formulation to the linear ring approximation is also established.

715,375
PB86-139789 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Spectroscopy of Stored Atomic Ions.
Final rept.
D. J. Wineland, W. M. Itano, J. C. Bergquist, J. J. Bollinger, and J. D. Prestage. 1984, 25p
Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Proceedings of International Conference on Atomic Physics (9th), Seattle, Washington, July 23-27, 1984, p3-27.

Keywords: *Atomic spectra, Mass spectroscopy, Reviews, *Atomic ions, *Ion storage, Laser cooling, Laser spectroscopy.

In the paper, the authors briefly review measurements of atomic ion spectra made with the stored ion technique. Included are experiments on rf and optical spectra, mass spectra and laser cooling.

715,376
PB86-139813 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Space Antenna for Gravitational Wave Astronomy.
Final rept.
J. E. Faller, P. L. Bender, J. L. Hall, D. Hils, and M. A. Vincent. 1985, 7p
Pub. in Proceedings of Colloquium on Kilometric Optical Arrays in Space, Corsica, France, October 23-25, 1984, p157-163 1985.

Keywords: Spacecraft, *Gravitational wave antennas, Gravitational radiation, Gravity waves.

The authors are investigating possible designs for a laser gravitational wave antenna in space using free test masses and heterodyne (interferometric) detection. One possibility is to use baselines about one million km long between three spacecraft in nearly circular one-year orbits about the sun. If the orbit elements are chosen properly, the distances between the spacecraft can be kept constant to roughly 1 part in 1000 without orbit corrections. With milliwatt-transmitted laser power levels and 50 cm diameter optics, a strain sensitivity of 10 to the 19th power/(Hz to the 1/2 power) over at least the period range from 10 to 10,000 seconds appears feasible. The primary goal of the measurements is to observe gravitational radiation associated with present or past interactions of supermassive objects.

715,377
PB86-139847 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Fission Cross-Section Measurements in Reactor Physics and Dosimetry Benchmarks.
Final rept.
J. A. Grundl, and D. M. Gilliam. 1983, 2p
Pub. in Transactions of the American Nuclear Society 44, p533-535 Jun 83.

Keywords: *Fission cross sections, *Uranium 233, *Plutonium 239, *Uranium 235, Californium 252, Fission neutrons, Standards, Reprints, *Plutonium 240, *Plutonium 241, *Thorium 232, *Uranium 238, *Neptunium 237, Benchmarks.

Fission cross sections for eight fissionable isotopes of importance for nuclear technology have been measured in two fission neutron spectra and one fission-neutron-driven standard neutron field. New measurements for (240)Pu, (241)Pu, (233)U, and (232)Th, accompany revised values from earlier determinations for (239)Pu, (235)U, (238)U, and (237)Np. The starting point for all of these measurements is an absolute cross section measurement for (252)Cf fission spectrum neutrons. The absolute cross section is determined from a neutron source strength, a source-to-detector distance, and an absolute fission rate. Errors are given at one standard deviation. These benchmark measurement results are intended to provide integral normalizations and a test of differential neutron cross section data.

715,378
PB86-140043 PC **A15**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Technical Activities 1985, Center for Basic Standards.
K. G. Kessler. Oct 85, 331p NBSIR-85/3254
See also PB86-121597.

Keywords: *Research, *Standards, Metrology, Fundamental constants, Pressure, Vacuum, Electrical measurement, Temperature, Atomic physics, Mass, Length, Time standards, Frequency standards, Gravity, X rays, Gamma rays, Laser applications.

The report summarizes the research and technical activities of the Center for Basic Standards during the Fiscal Year 1985. These activities include work in the areas of electricity, temperature and pressure, mass and length, time and frequency, quantum metrology, and quantum physics.

715,379
PB86-140217 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Other Means for Precision Frequency Control.
Final rept.
F. L. Walls. 1985, 11p
Pub. in Precision Frequency Control, v2 ch14 p275-285 1985.

Keywords: *Frequency control, Frequency stability, Tuning forks, Resonators, Quartz, Precision, Superconducting cavity resonators.

The chapter outlines the use of quartz tuning forks, high Q LC resonator strip line resonators, superconducting cavities, and dielectrically loaded cavities for precision frequency control. General noise considerations, practical limitations, as well as potential future uses and developments are indicated.

715,380
PB86-140233 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Frequency and Time, Their Measurement and Characterization.
Final rept.
S. R. Stein. 1985, 42p
Pub. in Precision Frequency Control, v2 ch12 p191-232 1985.

Keywords: *Frequency measurement, *Time measurement, Frequency stability, Atomic clocks, Spectrum analysis, Computer applications.

The document is chapter 12 in the forthcoming book entitled 'Precision Frequency Control' edited by A. Ballato and E. A. Gerber. The book contains contributions from twenty-three authors and an extensive bibliography. Chapter 12 presents the theory and practice of the measurement of frequency and time. Rather than a review of the literature, it is a summary of the best techniques developed during the past twenty-five years. Modern techniques made possible by the proliferation of minicomputers and digital equipment are stressed.

715,381
PB86-140365 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
(e,p) and (e,alpha) Reactions in (90)Zr and (92)Zr.
Final rept.
W. R. Dodge, E. Hayward, M. N. Martins, and E. Wolynec. Sep 85, 8p
Sponsored by Conselho Nacional de Desenvolvimento Cientifico e Tecnologico, Rio de Janeiro (Brazil), and National Science Foundation, Washington, DC.
Pub. in Physical Review C 32, n3 p781-788 Sep 85.

Keywords: Alpha particle reactions, Photodisintegration, Reprints, *Zirconium 90, *Zirconium 92, Electron-proton interactions, Electrodisintegration, Virtual photons.

The yields of protons and alpha particles from 2 mg/sq cm targets of (90)Zr and (92)Zr have been measured in the incident electron energy range 20-100 MeV; the (90)Zr (e,alpha) data were extended to 130 MeV. Photodisintegration plus electrodisintegration yields were also measured for electron energies above 50 MeV. The photodisintegration cross sections, derived from these data, rise continuously from 25 MeV onward for all four reactions. One satisfactory explanation of the phenomenon is that the authors are observing multiparticle emission following virtual photon absorption.

715,382
PB86-140373 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Radiation Measurement.
Estimate of the Proton Yield from Quasi-Elastic Scattering on (sup 16)O at an Incident Electron Energy of 800 MeV.
Final rept.
W. R. Dodge. Jul 85, 2p
Pub. in Proceedings of the Nuclear Physics with Electromagnetic Probes Europhysics Divisional Conference (11th), Paris, France, July 1-5, 1985, p248-249.

Keywords: *Protons, Electrons, Elastic scattering, Estimates, Polarized beams, Response functions, Oxygen 16.

The yield of protons from ((e vector)e'p) on 16O has been calculated using the relativistic singlet P(1/2) and singlet P(3/2) shell response functions of Van Orden et al. The total proton yield for protons with energies from 35 to 155 MeV is given as a function of the laboratory proton angle.

715,383
PB86-141934 PC **A04**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Angular Distribution of High Energy Electrons Following Radiation.
L. C. Maximon, and A. Lepretre. Oct 85, 53p NBSIR-84/2854
Prepared in cooperation with CEA Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette (France). Service de la Metrologie et de la Physique Neutroniques Fondamentales.

Keywords: *Electron scattering, Bremsstrahlung, Scattering cross sections, Angular distribution, Screening, Small angle scattering.

An expression is derived for the angular distribution of high energy electrons which have undergone scattering andd radiated a photon, integrated over the directions of the emitted photon, in the region of small scattering angles, for which the atomic form factor must be taken into account but the nuclear structure may be neglected. This distribution is analogous to Schiff's high-energy small-angle distribution for photons, integrated over the final electron angles. It is shown that the correction to the energy-angle distribution of electrons due to atomic screening is identical in form to the correction to the energy-angle distribution of photons. This correction involves an integral over the atomic form factor, and is evaluated in closed form for the Thomas-Fermi-Moliere model. A very simple expression is obtained for the case of complete screening.

715,384
PB86-142791 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermal Processes Div.
Measurement of Thermal Radiation Properties of Materials.
Final rept.
J. C. Richmond. 1980, 27p
Pub. in Proceedings of the European Thermophysical Properties Conference (6th), Dubrovnik, Yugoslavia,

June 26-30, 1980, High Temperature-High Pressures 11, n4 p355-381.

Keywords: *Thermal radiation, Reflectance, Absorptance, Emittance, Transmittance, Blackbody radiation, Calorimetry, Radiometry, Reprints.

The thermal radiation properties, reflectance, absorptance, emittance and transmittance, are defined, and the equations showed the relationships between these properties are given. The equations relating the amount and the spectral and geometric distribution of the flux emitted by a blackbody or complete radiator to its temperature are given, and it is shown how these equations can be applied to a real material by use of thermal radiation properties of the solid materials are briefly described and illustrated, and references are given to the original papers describing such measurements.

715,385
PB86-143906 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Irreducible Density Matrices.
M. Danos. Nov 85, 27p NBSIR-85/3270

Keywords: *Quantum theory, Angular momentum, Tensor analysis, *Density matrix, Polarization, SU-2 groups.

An expansion of the density matrix is given into irreducible SU(2) tensors, i.e., into quantities of good angular momentum. These irreducible tensors can be handled by all the powerful tools developed in the context of the handling of angular momentum. As examples, the density matrix of a cryogenically alligned nucleus is derived and the construction of the angular distributions of nuclear reactions in terms of density matrices is demonstrated.

715,386
PB86-160108 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Photonuclear Reaction Cross Sections for 12C, 14N and 16O.
Final rept.
E. G. Fuller. Oct 85, 47p
Pub. in Physics Reports: A Review Section of Physics Letters 127, n3 p185-231 Oct 85.

Keywords: *Carbon 12, *Photonuclear reactions, Nuclear cross sections, Reprints, *Nitrogen 14, *Oxygen 16, Giant resonance.

The results of an evaluation of the available photonuclear-reaction data for (12)C, (14)N and (16)O are presented. While some reaction-yield data are given for energies up to 50 MeV, the primary emphasis is on the excitation-energy range extending from the proton separation energies up to 30 MeV. In addition to photodisintegration measurements, cross-section data derived from inverse particle-capture and electrodisintegration experiments are considered. Data are presented in graphical as well as tabular form. Included in the tables are: energy-weighted moments of the cross sections, bremsstrahlung induced reaction-yield data, radioactive-decay properties of reaction products, and reaction separation energies.

715,387
PB86-160512 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Photon Cross Sections 1 keV to 100 GeV: Current NBS (National Bureau of Standards) Compilation.
Final rept.
J. H. Hubbell. 1985, 2p
Pub. in Transactions of the American Nuclear Society 50, p153-154 Nov 85.

Keywords: *Photon cross sections, *Gamma rays, *X-rays, Attenuation, Reprints, KeV range, MeV range, GeV range 01-10, GeV range 10-100.

The current NBS compilation of photon cross section and attenuation coefficient data, developed as part of a continuing project of the NBS Photon and Charged Particle Data Center, is described. Although some mention is made of a new NBS data evaluation project with E. B. Saloman in the soft x-ray region 0.1 keV, the current compilation now being prepared for distribution is for photon energies 1 keV to 100 GeV, including all elements Z = 1 to 100. Associated software by M. J. Berger and S. M. Seltzer, for generating data for arbitrary mixtures of elements, and for arbitrary energies, is also described. Looking to the future, an International Union of Crystallography project, aimed at stimulating new x-ray attenuation coefficient measurements to resolve serious discrepancies in existing 1- to 50-keV data, is mentioned.

715,388
PB86-160520 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Experimental Consequences of a Heavy Neutral Fermion.
Final rept.
P. M. Fishbane, K. Gaemers, S. Meshkov, and R. E. Norton. 1 Sep 85, 12p
Pub. in Physical Review D 32, n5 p1186-1197, 1 Sep 85.

Keywords: Fermions, Muons, Reprints, *Particle decay, W particle, Z particle, Gauge theory, Electroweak interactions.

The authors study the consequences of adding to the standard model a left-right-symmetric, neutral singlet with a large delta=0 mass. The particle mixes with the standard neutrinos by virtue of the coupling to the conventional Higgs doublet. The authors investigate the effects of both Dirac and Majorana mass mixing on the rare low-energy process mu -> e(gamma) and on the decay of the W and Z. Significant and interesting effects on these latter decays can occur without violating the existing limit on the mu -> e(gamma) decay rate.

715,389
PB86-160538 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Interaction of Quasi-Closed Channels with Open-Channel Continua.
Final rept.
P. P. Delsanto, L. C. Biedenharn, and M. Danos. 1985, 4p
Pub. in Lettere al Nuovo Cimento della Societa Italiana di Fisica 42, n2 p59-62 Jan 85.

Keywords: *Nuclear models, *Helium 4, Photonuclear reactions, Reprints.

The Barrett-Delsanto natural boundary-condition treatment of the one-particle continuum is extended to include the interaction with other continua of quasi-closed channels. As an example, the formalism is applied to the study of the quasi-deuteron model of (4)He.

715,390
PB86-160710 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.
Composite Electron.
Final rept.
E. Marx. 1985, 16p
Pub. in International Jnl. of Theoretical Physics 24, n7 p685-700 1985.

Keywords: *Elementary particle theories, *Electrons, *Beta decay, Weak interactions, Electromagnetic interactions, Muons, Pions, Reprints, Intermediate vector bosons, Bound state.

In the paper, the electron is considered a bound state of a neutrino and a negative pion. A model Lagrangian density that combines weak and electromagnetic interactions give rise to equations of motion that define such a state. In the model, the muon is a bound state of an antineutrino and a negative pion, which explains why it cannot decay into an electron and a photon. The decay of unstable particles is reduced to pair creation plus particle recombination. The neutral pion is described by an interference between the charged-pion states. Several variations of the model are also presented.

715,391
PB86-161049 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Glueballs.
Final rept.
P. M. Fishbane, and S. Meshkov. 1984, 27p
Grant NSF-PHY81-00257
Sponsored by National Science Foundation, Washington, DC.
Pub. in Comments on Nuclear and Particle Physics 13, n6 p325-351 1984.

Keywords: Reviews, Reprints, *Glueballs.

The current status of various glueball properties such as level ordering, mass, production, and decay is reviewed.

715,392
PB86-163425 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Nuclear Matter under Extreme Conditions.
Final rept.
J. Rafelski, and M. Danos. 1985, 94p
Pub. in Proceedings of Summer School, University of Cape Town (South Africa), January 16-27, 1984, Lecture Notes in Physics, p63-156 1985.

Keywords: *High energy particles, Quarks, *Nuclear plasma, Nuclear matter, Gluons.

The report gives an overview of some aspects of hadronic physics relevant for the conception of a research facility devoted to the study of high energy nuclear collisions. Several concepts to be studied in nuclear collisions are selected, with emphasis placed on the properties and nature of the quark-gluon plasma, the formation of the plasma state in the central region and its anticipated lifetime, and the observability, through strangeness content, of the new form of nuclear matter.

715,393
PB86-163433 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Pion Radiation by Hot Quark-Gluon Plasma.
Final rept.
J. Rafelski, and M. Danos. 1983, 4p
Pub. in Proceedings of High Energy Ion Study (6th) and Workshop on Anomalons (2nd), Berkeley, CA., June 28-July 1, 1983, p515-518 Dec 83.

Keywords: Quarks, Strong interactions, Antiparticles, Pions, *Nuclear plasma, Quantum chromodynamics, Gluons.

The authors consider an approximately spherical region of the perturbative QCD vacuum, filled with quarks, antiquarks, and gluons. The particle densities are assumed to be reasonably well described by local thermal and chemical equilibrium distributions. The basis for these assumptions is the point that the mean free path of a color-charged particle in the plasma is of the order of 1/3 - 1/2 fm. Outside the perturbation region, colored particles cannot exist and hence any matter found there is in the form of colorless hadrons. Even though indirect evidence supports the picture of the true and perturbative QCD states, they must remember that no direct evidence is available as of now. They regard the observation of the quark-gluon plasma state as the most direct confirmation of the ideas about the nature of strong interactions and quark confinement.

715,394
PB86-163508 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Development of Monoenergetic Electron Beam Sources for Radiation-Instrument Calibration.
Final rept.
C. G. Soares, C. E. Dick, J. S. Pruitt, and J. H. Sparrow. 1985, 5p
Sponsored by Nuclear Regulatory Commission, Washington, DC. Office of Nuclear Regulatory Research.
Pub. in Nuclear Instruments and Methods in Physics Research B10/11, p937-941 1985.

Keywords: *Electron beams, *Dosimetry, *Calibrating, Sources, Reprints, *Beta dosimetry, Electron dosimetry.

Accelerator-produced electron beams are being studied for use in obtaining the response of beta-particle dosimetry instrumentation as a function of electron energy. The NBS 4 MV Van de Graaff and 500 kV cascaded rectifier accelerators are being used to generate electron beams from 200 keV to 2.5 MeV. A device capable of scanning the electron beam in two dimensions over an area large enough to cover radiation-survey instruments uniformly is attached to the beam-handling system of each accelerator. The scanned beam exits from vacuum through a 16 sq cm window consisting of either 25 micrometer Kapton (for energies below 500 keV) or 100 micrometer aluminum. The

electron beams produced have been characterized in terms of (1) spatial distribution, (2) energy spectrum, and (3) absorbed dose to plastic. Spatial distributions were determined using film, while spectra were measured using a 5 mm-deep Si surface barrier detector. An extrapolation chamber is being used for beam standardization in terms of absorbed dose to plastic.

715,395
PB86-163516 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Bremsstrahlung Spectra from Electron Interactions with Screened Atomic Nuclei and Orbital Electrons.
Final rept.
S. M. Seltzer, and M. J. Berger. 1985, 40p
Sponsored by Department of Energy, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Nuclear Instruments and Methods in Physics Research B12, p95-134 1985.

Keywords: *Photon cross sections, *Bremsstrahlung, Electron scattering, Reprints, Electron-electron collisions, Electron-atom collisions, KeV range, MeV range, GeV range 01-10.

Through the synthesis of various theoretical results, a comprehensive set of bremsstrahlung cross sections (differential in the energy of the emitted photons) has been prepared. The set includes results for electrons with energies from 1 keV to 10 GeV incident on neutral atoms with atomic numbers Z=1 to 100. The paper also contains numerous comparisons between calculated and measured bremsstrahlung spectra, which indicate generally good agreement.

715,396
PB86-167327 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Possible Estimation Methodologies for Electromagnetic Field distributions in Complex Environments.
Technical note.
M. Kanda, J. Randa, and N. S. Nahman. Mar 85, 52p NBS/TN-1081

Keywords: *Electromagnetic fields, Distribution, Estimating, Environmments, Hazards, Scanning, Statistical analysis.

The problem of measuring and characterizing complicated multiple-source, multiple-frequency electromagnetic environments is becoming more important and more difficult as electrical devices proliferate. The paper outlines three general approaches to the problem which are currently under investigation at the National Bureau of Standards. The three approaches are: (1) a statistical treatment of the spatial distribution of electromagnetic field intensities; (2) a numerical computation using a finite-difference (or lattice) form of the electromagnetic action functional; and (3) use of a directional probe to scan a volume. All three methods are still in the development stage, but each appears promising.

715,397
PB86-175841 PC **A08**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Investigation of Fundamental Interactions with Cold Neutrons: Proceedings of a Workshop.
Final rept.
G. L. Greene. Feb 86, 167p NBS/SP-711
Also available from Supt. of Docs as SN003-003-02718-9. Library of Congress catalog card no. 86-600501. Sponsored by Department of Energy, Washington, DC.

Keywords: *Meetings, *Neutrons, *Cold neutrons, National Cold Neutron Facility, Research reactors, Lifetime.

The National Bureau of Standards is establishing a National Cold Neutron Facility at its 20 MW reactor located in Gaithersburg, Maryland. In order to provide guidance in the development of research plans for the Facility, the Department of Energy and NBS sponsored, on November 14-15, 1985, a workshop on the Investigation of Fundamental Interactions with Cold Neutrons. The 25 papers presented at the workshop are printed in the proceedings.

715,398
PB86-185857 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Mass Independence of the Electromagnetic Nuclear Response in the Delta Region.
Final rept.
J. Ahrens, and J. S. O'Connell. 1985, 11p
Pub. in Comments on Nuclear and Particle Physics 14, n5 p245-255 1985.

Keywords: *Nuclei(Nuclear physics), Electron scattering, Inelastic scattering, Scattering cross sections, Photons, Absorption, Measurement, Reprints, MeV range 100-1000, Response functions.

Recent measurements of the photon absorption and inelastic electron scattering cross sections on nuclei in the excitation region 140-450 MeV show a response that differs from that of a free nucleon but is quite similar (per nucleon) for complex nuclei.

715,399
PB86-186053 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Electrometer Designs for Use in an Unbound-Quark Search.
Final rept.
E. R. Williams, and G. T. Gillies. 1983, 5p
Pub. in Lettere al Nuovo Cimento della Societa Italiana di Fisica 37, n15 p520-524 1983.

Keywords: *Electrometers, *Quarks, Searching, Reprints.

An instrument capable of modulating a small capacitance is described. It is to be used as an electrometer in a search for stable fractionally charged particles in test masses of several grams each, the largest yet studied. The new approach uses Gauss's law to sense charge directly and does not require the measurement of small forces as has been the case in most previous quark searches. Preliminary results from an unoptimized experiment are encouraging, showing sensitivities of a few 100 e/(square root of Hz) at atmospheric pressures and without any special precautions.

715,400
PB86-189206 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Absolute Detection Efficiencies of Microchannel Plates for 0.1-2.3 keV Electrons and 2.1-4.4 keV Mg(+) Ions.
Final rept.
A. Muller, N. Djuric, G. H. Dunn, and D. S. Belic. 1986, 5p
Contract DOE-EA-01-A-6010
Sponsored by Department of Energy, Washington, DC.
Pub. in Review of Scientific Instruments 57, n3 p349-353 Mar 86.

Keywords: Electrons, Efficiency, Reprints, *Microchannel electron multipliers, KeV range 01-10, Magnesium ions.

The absolute detection efficiencies of detectors consisting of two microchannel plates (MCP) in a chevron arrangement, were experimentally determined for 0.1-2.3-keV electrons and 2.1-4.4-keV Mg(1+) ions. Both detectors tested included a grid with 92.5% transmission in front of the first MCP. For the measurements, the observed detector count rates were compared to the corresponding particle currents collected in a Faraday cup and measured with a vibrating reed electrometer. The electron detection efficiency of the MCP detector, including the grid, decreases from 0.82 at 0.1 keV to 0.65 at 2.3 keV for electrons incident normal to the surface. The Mg(1+) ion detection efficiency for the same arrangement, but with 43 degree incidence angle, increases from 0.49 at 2.1 keV to 0.81 at 4.4 keV.

715,401
PB86-190659 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Laser Cooling of Atomic Beams.
Final rept.
W. D. Phillips. 1984, 1p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Physics Today 37, n1 p26 1984.

Keywords: *Atomic beams, Motion, Reprints, *Laser cooling.

Atomic motion often limits the precision and accuracy with which measurements can be made. Recent experiments at NBS have produced laser - cooled atomic beams where the motion is greatly reduced and is well defined.

715,402
PB86-191905 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
NBS (National Bureau of Standards) Ambient Magnetic Field Meter for Measurement and Analysis of Low-Level Power Frequency Magnetic Fields in Air.
P. M. Fulcomer. Dec 85, 59p NBSIR-86/3330
Sponsored by Department of Energy, Washington, DC.

Keywords: *Magnetic measurement, *Magnetic fields, Calibrating, Field strength, Magnetometers, Magnetic field meters.

The report describes a portable, battery-powered magnetic fieldmeter which has been developed to provide improved accuracy in the measurement and analysis of low-level and ambient power-frequency magnetic fields. Accurate measurement of such fields is becoming increasingly important as public concern grows over the possibility that exposure to such fields may produce effects on human health. Included in the report are a description of the instrumentation, a circuit analysis, a discussion of the calibration procedures together with an uncertainty analysis, and some sample measurement results. The instrumentation enables measurement of power-frequency magnetic field in air with an overall uncertainty of less than one percent over a range from 50 nanotesla (500 microgauss) to 200 microtesla (2 gauss) and an overall uncertainty of less than two percent down to 2 nanotesla (20 microgauss). It also enables the percentage of each harmonic present in the field to be determined to an uncertainty of less than three percent.

715,403
PB86-191947 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Bibliography of the NBS (National Bureau of Standards) Electromagnetic Fields Division Publications.
K. A. Gibson, J. M. Page, and C. K. S. Miller. Feb 86, 80p NBSIR-85/3040
Supersedes PB81-143158.

Keywords: *Bibliographies, *Electromagnetic fields, Antennas, Dielectrics, Electromagnetic interference, Microwaves, Metrology, Electromagnetic noise, Remote sensing, Waveforms, Time domain.

The bibliography lists the publications of the personnel of the National Bureau of Standards Electromagnetic Fields Division in the period from January 1970 through September 1985 with selected earlier publications from the Division's predecessor organizations.

715,404
PB86-192440 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Electron Production in Proton Collisions: Total Cross Sections.
Final rept.
M. E. Rudd, Y. K. Kim, D. H. Madison, and J. W. Gallagher. 1985, 30p
Grants NSF-PHY80-25599, NSF-PHY83-10644
Sponsored by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC.
Pub. in Reviews of Modern Physics 57, n4 p965-994 Oct 85.

Keywords: Proton irradiation, Atoms, Molecules, Electrons, Production, Reprints, *Ionization cross sections.

Existing data on the ionization of neutral atoms and molecules by proton impact are reviewed, and electron production cross-section data are collected. The three major experimental methods are discussed and possible sources of error identified. Some theoretical cross sections are discussed, and well-established methods of relating them to measured cross sections are reviewed. A mathematical equation is fitted to the weighted experimental data for each target, and these fits are adjusted to be consistent with appropriate theoretical calculations and with electron impact and photoionization data. Recommended values of total cross sections for proton-impact ionization are given.

715,405
PB86-192770 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Water Vapor-Enhanced Electron-Avalanche Growth in SF6 for Nonuniform Fields.
Final rept.
R. J. Van Brunt. 1986, 10p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Jnl. of Applied Physics 59, n7 p2314-2323, 1 Apr 86.

Keywords: *Sulfur hexafluoride, *Gas ionization, Water vapor, Reprints, *Electron avalanche.

When water vapor content is increased from 10 to 100 ppm in SF6 at pressures from 200 to 300 kPa, a dramatic enhancement occurs in the mean size of electron avalanches formed near a positive-point electrode. Although the effect can be attributed to a change in gas composition, it is not due to a change in the ionization rate for the gas. It is proposed that the avalanche enhancement is due primarily to an increase in the probability for initiating electron release from minor negative ions associated with water vapor that collisionally detach more readily at a given field strength than the predominant negative ions associated with SF6.

715,406
PB86-193224 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
Collimation of X-rays with Cylindrically Bent, Asymmetrically Cut Crystals.
Final rept.
R. Spal. 1984, 3p
Pub. in Nuclear Instruments and Methods in Physics Research Section A-Accelerators Spectro 222, n1-2 p193-195 1984.

Keywords: *X rays, *Collimators, Diffraction, Crystals, Reprints.

Sagittal and meridional collimation of x-rays from a monochromatic point source, using cylindrically bent, asymmetrically cut crystals, is studied. The optimum bending radius and the width of the angular acceptance window are derived analytically, while the degree of collimation is computer numerically.

715,407
PB86-193307 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Gamma-Ray Energies from the Reaction (35)Cl(n,gamma).
Final rept.
E. G. Kessler, G. L. Greene, R. D. Deslattes, and H. G. Boerner. 1985, 5p
Pub. in Physical Review C 32, n2 p374-378 Aug 85.

Keywords: Neutron reactions, Gamma rays, Reprints, *Chlorine 35, *Gamma spectroscopy.

A two-axis flat-crystal spectrometer has been used to measure accurately gamma-ray energies up to 2 MeV from the reaction (35)Cl(n, gamma). This represents a fourfold extension of the range of direct optically based gamma-ray energies. The crystals and spectrometer have performed in a manner which demonstrates that sub-ppm measurements are possible at energies approx = or >2 MeV. The reported transition energies (in eV) are given. The sum rule is satisfied by three of the lines within an uncertainty of about 1 ppm.

715,408
PB86-193562 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Energy Loss Straggling of Protons in Water Vapour.
Final rept.
M. J. Berger. 1985, 4p
Sponsored by Department of Energy, Washington, DC. Office of Health and Environmental Research, and Office of Naval Research, Arlington, VA.
Pub. in Radiation Protection Dosimetry 13, n1-4 p87-90 1985.

Keywords: *Protons, Water, Reprints, Energy losses, MeV range 01-10, MeV range 10-100.

The paper describes a calculation of energy loss and energy deposition distributions in a 1 micrometer diameter spherical site in a water medium irradiated by 20 MeV or 2 MeV protons. The calculation is designed to indicate the effects of proton energy loss straggling and of energy transport by secondary electrons.

715,409
PB86-193596 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Quarks In the Nuclear Ground State.
Final rept.
M. Danos, and A. Johnson. 1986, 5p
Pub. in Jnl. of Physics G: Nuclear Physics 12, pL13-L17 1986.

Keywords: *Nuclear structure, *Quarks, Reprints, Bag model, Structure functions.

The authors synthesise the recent deep-inelastic electron scattering data of Arnold et al in terms of a two-component nuclear wavefunction based on the MIT bag model. The quarks in one component are confined to the nucleons while in the other they are free to move over the nuclear volume. An admixture proportional to (A to the 1/3 power) which reaches about 9% for gold reproduces the experimental data well.

715,410
PB86-193901 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Direct Determination of the Stored Electron-Beam Current at the NBS (National Bureau of Standards) Electron Storage Ring, SURF-11.
Final rept.
A. R. Schaefer, L. R. Hughey, and J. B. Fowler. 1984, 6p
Pub. in Metrologia 19, n4 p131-136 1984.

Keywords: Electron beams, Measurement, Reprints, *Synchrotron Ultraviolet Radiation Facility, *Storage rings.

A method of determining the absolute beam current in the NBS electron storage ring SURF-II by electron counting is described. Recent improvements and the present implementation of the technique are discussed, along with the results of an intercomparison with the NBS spectral irradiance scale.

715,411
PB86-195799 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
L sup 2 Discretization and Complex Coordinates in the Calculation of Bound-Free Amplitudes in the Presence of Long-Range Forces.
Final rept.
B. R. Johnson, and W. P. Reinhardt. Oct 83, 15p
Pub. in Physical Review A 28, n4 p1930-1944 Oct 83.

Keywords: *Potential scattering, Wave functions, Reprints, Discretization(Mathematics), Photoabsorption.

The formalism of Moller wave operators is shown to provide a stable basis for computation of bound-free transition amplitudes for both short and long range potentials without the direct calculation of scattering wave functions. The method, which relies on the techniques of expansion in finite (L sup 2) bases and rotation of the coordinates into the complex plane, is applied to both an exponential potential and one that behaves asymptotically as -1/(r sup 4). It is demonstrated that one obtains not only accurate magnitudes of the matrix elements, but accurate phases (i.e., the scattering phase shift) as well. Some relevant theoretical results with regard to the application of wave operators are also presented. Although couched in terms of potential scattering, the procedures are readily extendible to multichannel problems.

715,412
PB86-196029 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Stereo Presentation of Monte Carlo Electron Trajectory Simulations.
Final rept.
D. S. Bright, R. L. Myklebust, and D. Newbury. 1984, 8p
Pub. in Jnl. of Microscopy 136, pt1 p113-120 Oct 84.

Keywords: *Particle trajectories, *Electron beams, *Stereoscopy, Monte Carlo method, Simulation, Reprints, Three dimensional.

Electron trajectory data from Monte Carlo simulation techniques is three dimensional in nature, and thus is best represented by methods that most preserve the spatial information. Stereo plotting is a method that gives the three dimensional illusion effectively while not requiring any special equipment beyond what is required to make standard two dimensional plots. Stereo plots of electron trajectories are presented that illustrate the advantages of the spatial illusion in the context of examining in detail some of the interactions of the electron beam with planar bulk metallic samples.

715,413
PB86-197381 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Evaluation of X-ray Loss Due to Electron Backscatter.
Final rept.
R. L. Myklebust. 1984, 2p
Pub. in Jnl. de Physique Colloque, nC2 p41-42 1984.

Keywords: *X rays, *Electron scattering, Back scattering, Monte Carlo method, Elastic scattering, Ionization, Attenuation, Microanalysis, Reprints, Electron microprobe analysis.

The loss of x-ray intensity due to backscattered electrons has been re-evaluated with the aid of a Monte Carlo simulation for electron scattering in solids. Initial electron energies in the range 4-50 KeV were considered and the results are presented as the ratio, R, of x-rays generated within the solid to the total x-rays that would have been generated had none of the electrons backscattered. Polynomial fits are presented and the results compared to previous work.

715,414
PB86-199908 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Laser Cooling of Free Neutral Atoms in an Atomic Beam.
Final rept.
W. D. Phillips, J. V. Prodan, and H. J. Metcalf. 1983, 6p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of International Conference (6th), Laser Spectroscopy 6, Interlaken, Switzerland, June 27-July 1, 1983, p162-167.

Keywords: *Atomic beams, Laser beams, Spectroscopy, *Laser cooling, Sodium atoms.

A free atomic beam of neutral sodium atoms has been decelerated using a near-resonant, counter propagating laser beam. Two methods are described which compensate for the changing Doppler shift of the atoms as they decelerated: Rapidly changing the frequency of the laser, and providing a spatially varying magnetic fields so that the resonant frequency of the atoms changes. Deceleration and dramatic compression of the velocity distribution have been observed for both methods.

715,415
PB86-199916 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Laser Cooling of an Atomic Beam.
Final rept.
W. D. Phillips, J. V. Prodan, and H. Metcalf. 1983, 1p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of Digest of Technical Papers - Conference on Lasers and Electro-Optics, Baltimore, MD., May 17-20, 1983, p34.

Keywords: *Atomic beams, Frequency standards, Laser beams, Spectroscopy, *Laser cooling, Sodium atoms.

A thermal atomic sodium beam is decelerated and cooled by absorbing photons from a counter propagating laser beam. Final velocities as low as 4% of initial thermal velocities and 'temperatures' of 70 mK have been achieved.

715,416
PB86-200383 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.

Magnetism in Amorphous Metallic Glasses.
Final rept.
J. J. Rhyne. 1983, 28p
Pub. in Proceedings of Summer School at the Ettore Majorana Centre Magnetic Phase Transitions, Erice, Italy, July 1-15, 1983, p241-268.

Keywords: *Magnetization, Neutron scattering, Magnetic properties, *Metallic glasses, Amorphous materials.

No abstract available.

715,417
PB86-200730 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
New Determination of the Deutron Binding Energy and the Neutron Mass.
Final rept.
G. L. Greene, E. G. Kessler, R. D. Deslattes, and H. G. Borner. 24 Feb 86, 4p
Sponsored by Institut Max von Laue - Paul Langevin, Grenoble (France).
Pub. in Physical Review Letters 56, n8 p819-822, 24 Feb 86.

Keywords: *Deuterons, *Neutrons, Gamma rays, Reprints, *Binding energy, *Rest mass.

A new value for the deuteron binding energy of B(d) = 2.3881768(24) x 10 to the -3 u is reported based on an absolute wavelength determination of the 2.2-MeV n-p capture gamma ray. Derived values of the n-H and n-p mass differences are also given. The authors also derive M(n)= 1.008 664 919(14) u. The authors note that the uncertainties in the neutron-mass data are now dominated by uncertainties arising from mass spectroscopy.

715,418
PB86-200961 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Streamer Initiation in Liquid Hydrocarbons.
Final rept.
G. J. FitzPatrick, E. O. Forster, E. F. Kelley, and R. E. Hebner. Oct 85, 6p
Pub. in Proceedings of Annual Report Conference on Electrical Insulation and Dielectric Phenomena, Amherst, NY., October 20-24, 1985, p27-32.

Keywords: *Electric discharges, *Dielectric breakdown, Hydrocarbons, Insulation, Toluene.

Using 93x magnification and a framing rate of 2 x 10 to the 7th power frames/s, the initiation of prebreakdown streamers in toluene, isooctane, and a white oil have been photographed. The initial growth from a nm a negative point electrode was a thin pencil-like structure, having a growth rate of 2-3 x 10,000 cm/s, which subsequentiy branched into a tree-like structure. Positive streamers were found to develop into a more filamentary structure than negative streamers. Under nominally identical conditions, a positive streamer may grow then disappear, may grow to bridge the gap, or may grow to a certain length then persist.

715,419
PB86-201753 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Metallurgy Div.
NBS (National Bureau of Standards) Materials Science Beamlines at NSLS.
Final rept.
R. Spal, R. C. Dobbyn, H. E. Burdette, G. G. Long, W. J. Boettinger, and M. Kuriyama. 1984, 4p
Pub. in Nuclear Instrumentation and Methods Phys. Res. Sect. A 222, nl-2 p189-192, 15 May 84.

Keywords: *Synchrotron radiation, Monochromators, Topography, Spectroscopy, Reprints, Small angle scattering, CAMAC system.

Synchrotron radiation beamlines for topography, spectroscopy, and small angle scattering, at energies from 5 to 20 keV, are described.

715,420
PB86-201787 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.

Scattering of Transient Waves by a Dispersive Body.
Final rept.
E. Marx. 1983, 4p
Pub. in Proceedings of the International Symposium Digest - Antennas and Propagation (1983), Houston, TX., May 23-26, 1983, p26-29. Sponsored by Antennas and Propagation Society (IEEE), New York.

Keywords: *Electromagnetic scattering, Electromagnetic fields, Wave equations, Transient waves.

A transient electromagnetic field interacts with a conducting body. The permittivity and conductivity of the medium generally depend on frequency, that is, the medium is dispersive. Instead of decomposing the pulse into its Fourier components, the determination of the scattered and transmitted fields can be carried out in the time domain to take advantage of marching-in-time procedures. Maxwell's equations and the derivation of the fields from a single tangential vector field that obeys a singular integral equation are suitably modified. A simple conductor is presented as an example.

715,421
PB86-201951 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Composite Proton.
E. Marx. Apr 86, 91p NBSIR-86/3370

Keywords: *Elementary particle theories, *Nuclear models, Strong interactions, Weak interactions, Electromagnetic interactions, Leptons, Relativity, Strange particles, Hadrons, Quantum mechanics, Bound state, Beauty model, Charm particles, Composite models, Nuclear resonance.

A model is proposed in which the proton and other baryons are particles composed of only two basic particles: an archaeobaryon (archyon) and one or more pions. Mesons are composed of pions alone. A third basic particle is the neutrino, which is a component of all leptons. The interactions between the three corresponding fields and the electromagnetic field are derived from a Lagrangian density that has only two masses and three coupling constants. The interactions are expressed in terms of conserved currents, one for each particle. All particle reactions are reduced to four processes: particle scattering, antiparticle scattering, pair creation, and pair annihilation. The last two correspond to the reflection of the wave function in the time direction. There is no longer a need for a separate theory of unstable particles. The pion is the only electrically charged particle, which accounts for the equality of the magnitude of all charges of elementary particles. Strong and weak interactions of hadrons are different manifestations of a single interaction; the distinction is related to pair creation or annihilation, energy barriers, and the flux of particles and antiparticles.

715,422
PB86-201993 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Siegert's Theorem and Nuclear Electrodisintegration.
Final rept.
W. R. Dodge, and E. Hayward. Apr 86, 7p
Sponsored by Lewes Physics Center, DE.
Pub. in Physical Review C 33, n4 p1251-1257 Apr 86.

Keywords: Electron scattering, Scattering cross sections, Photons, Reprints, *Siegert theorem, *Electrodisintegration, Form factors, Virtual particles.

The connection between the electron scattering electric dipole coincidence cross section, (e,e'X), and the inclusive electric dipole (e,X) cross section, differential in the angle of the outgoing X particle, is derived. Unlike the (e,e') inclusive cross section which contains contributions from only two of the four terms of the (e,e'X) cross section, the (e,X) cross section contains contributions from all four terms of the (e,e'X) cross section. Data from a previous experiment have been used to obtain the magnitude and sign of the interference term between the transverse and Coulomb reduced matrix elements (form factors) in the limit as q -> omega, from the relationship commonly referred to as Siegert's theorem in the context of inclusive (e,e') scattering.

715,423
PB86-202017 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Shell-Model Interaction Energies in a Relativistic Hamiltonian Formulation (1).
Final rept.
T. Kohmura, T. Suzuki, M. Cauvin, M. Danos, and V. Gillet. 1986, 24p
Pub. in Nuclear Physics A 449, p729-749 1986.

Keywords: *Nuclear shell models, *Mesons, Field theory(Physics), Relativity, Hamiltonian functions, Reprints.

The non-covariant Hamiltonian formulation of relativistic field theory is presented and solved as a secular problem in a discrete representation space. The shell-model two-nucleon interaction in the one-boson exchange picture is used to test the method before applying it to many-body systems. The results of the diagonalization treatment are convergent as a function of the discretized meson space and are close to the usual OBEP when considering the exchange of a single type of meson, thus establishing the numerical feasibility of the method. However a significant deviation between the two approaches appears for the sigma meson or for a mixture of several types of mesons with values of the coupling constants in the 'physical' domain. Also, in the limited momentum space of the nucleons in the lowest shell-model state, the cut-off in the nucleon vertex form factors plays an unimportant role.

715,424
PB86-202389 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Quantum-Mechanical Noise and Squeezed-State Technique in an Interferometer.
Final rept.
W. T. Ni. 1984, 2p
Pub. in Proceedings of the Congress of the International Commission for Optics (13th), Sapporo, Japan, August 20-24, 1984, Optics in Modern Science and Technology, p48-49.

Keywords: Uncertainty principle, *Gravitational wave detectors, *Quantum noise, Laser interferometers.

Several groups around the world are now developing laser interferometers to detect gravitational waves by measuring small relative position changes of suitably separated masses. The fundamental limitations on the sensitivity of such interferometers come from quantum-mechanical noise while the sensitivity of the present gravitational-wave detectors is mainly limited by intensity fluctuations and therefore by power. In the paper we address the problem of correlations of different sources of quantum-mechanical noise and investigate the use of squeezed-state technique in optimizing the power requirement.

715,425
PB86-208428 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Effect of Pressure on Streamer Initiation in n-Hexane.
Final rept.
E. F. Kelley, R. E. Hebner, G. J. FitzPatrick, and E. O. Forster. 1986, 3p
Pub. in Conference Record 1986 IEEE (Institute of Electrical and Electronics Engineers) International Symposium on Electrical Insulation, Washington, DC., June 9-11, 1986, p66-68.

Keywords: *Electric discharges, *Hexanes, *Dielectric breakdown, *Electrical faults, Aliphatic hydrocarbons, High speed photography, Electrical insulation, Pressure effects.

High speed photographs of the breakdown process at pressures in the range 0.1-10 MPa indicate that the structure of the streamer changes with the pressure. The typical structures associated with primary streamers are no longer visible at elevated pressures. Over this range, the average cathode streamer velocity increases from about 0.25 km/s to 2.5 km/s. The anode streamer, however, does not generally exhibit a bushy primary streamer structure and its velocity appears to be less affected by pressure.

715,426
PB86-209327 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

High-Speed Data Systems for Pulsed Power Applications.
Final rept.
R. E. Hebner. 1986, 4p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Pulsed Power Conference (5th), Arlington, VA., June 10-12, 1985 p168-171 May 86.

Keywords: *Data acquisition, *Electrooptics, *Magnetooptics, Calibration, Electromagnetic interference, Standards, Errors, Pulsed power.

Data acquisition systems for pulse power applications generally must provide nanosecond resolution, operate in an environment of high levels of electromagnetic interference, and acquire significant amounts of data simultaneously. To meet these demands, electrical systems have been used and optical systems are being introduced. Voluntary standards have been and are being developed which categorize the errors in the electrical measurement systems. The development of optical systems is too immature for similar standardization.

715,427
PB86-209335 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Electro-Optical Measurement Techniques.
Final rept.
R. E. Hebner. 1986, 21p
Pub. in Fast Electrical and Optical Measurements 1, p5-25 1986.

Keywords: *Electrooptics, *Measurement, Electric fields, Magnetic fields, Currents, Electric potential, Electric charge, Faraday effect, Kerr electrooptical effect, Birefringence, Reprints.

The paper reviews the use of the Faraday effect, the Pockels effect, and the Kerr effect to measure electric fields, magnetic fields, voltages, currents, and space charge density. Each of the three effects is introduced conceptually, the use of Jones or Mueller matrices to describe the optical system is presented, and some applications of these effects are described.

715,428
PB86-209962 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Polymers Div.
Transformation of Time-Domain Relaxation Data into the Frequency Domain.
Final rept.
F. I. Mopsik. 1985, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electrical Insulation EI-20, n6 p957-964 Dec 85.

Keywords: *Dielectrics, Laplace transformation, Errors, Numerical integration, Numerical analysis, Reprints, Frequency domain, Time domain.

A numerical technique is developed for computing the Laplace transform of the time-domain behavior of a dielectric in order to obtain its frequency-domain behavior. The method is based on fitting a cubic spline to the original data and using the spline to define the integration. The error in the computation is investigated for data uniformly spaced on a logarithmic time scale. It is shown that the error is much smaller than with previous methods, is computationally stable, and converges as the fourth power of the sample density. For an error of 0.0001 or less, only 10 points per decade are required for all frequencies that correspond to the time window of the measurement. It is also shown that it is possible to estimate those parts of the integrals that lie outside the measurement window from the data inside the window, so that the errors from the unknown parts are kept small and affect only the extremes of the frequency range.

715,429
PB86-210051 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Fundamental Properties of the Neutron.
Final rept.
G. L. Greene. 1986, 5p
Pub. in Physica B 136, p121-125 1986.

Keywords: *Neutrons, Reviews, Reprints.

In addition to providing a probe of great power in condensed matter and nuclear research, the neutron itself is the object of a considerable research effort. The study of the properties of the neutron can shed light on a variety of questions in particle physics, cosmology, astrophysics, and nuclear physics. A summary of the neutron properties is given, along with the methods used for their determination and their theoretical implications.

715,430
PB86-210077 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Electron Beam Bunch Profile Determination Through Cerenkov Radiation.
Final rept.
X. K. Maruyama, J. R. Neighbours, and F. R. Buskirk. 1985, 3p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-32, n5 p1994-1996 Oct 85.

Keywords: *Electron beams, *Cerenkov radiation, Air, Reprints, Beam profiles, Relativistic range.

The spatial charge distribution of an electron pulse, along with the beam interaction length, determines the Cerenkov radiation distribution as a function of frequency. An angular distribution of the Cerenkov radiation can, in principle, measure its spatial charge distribution. At a measurement angle of 90 degrees with respect to the beam direction, the form factor is unity which allows a measurement of the total charge contained in the pulse. At other angles, Fourier transforms of the charge distribution may be measured. Possible application to intense relativistic beams in air is discussed.

715,431
PB86-210747 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Space Experiments: Report of Workshop C2.
Final rept.
P. L. Bender. 1984, 9p
Pub. in Proceedings of International Conference on General Relativity and Gravitation (10th), Padova (Italy), July 31, 1983, p387-395 1984.

Keywords: *General relativity, *Gravitational waves, Hipparcos satellite, Galileo project, Pulsars, Satellites.

A number of tests of gravitational physics using planned or proposed new space missions were discussed at the Workshop. Among these were the following: the Stanford Gyro Relativity Experiment, which would test the 'gravitomagnetic' effects predicted by general relativity for the first time; new calculations of small relativistic effects for accurately tracked earth satellites; light-bending observations by the HIPPARCOS satellite; planned low-frequency gravitational wave experiments during the Galileo and ISPM missions; and limits on very-low-frequency gravitational waves from pulsar timing measurements.

715,432
PB86-213014 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.
Progress Report on the NBS/Los Alamos RTM (Racetrack Microtron).
Final rept.
S. Penner, R. L. Ayres, R. I. Cutler, P. H. Debenham, E. R. Lindstrom, D. L. Mohr, J. E. Rose, M. P. Unterweger, M. A. D. Wilson, R. Biddle, E. R. Martin, J. E. Stovall, P. J. Tallerico, L. Wilkerson, and L. M. Young. 1985, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-32 n5 p2669-2671 Oct 85.

Keywords: *Electron accelerators, Reprints, *Racetrack microtrons, *Microtrons.

The NBS-Los Alamos 200 MeV Racetrack Microtron is being built under a program aimed at developing the technology needed for high-current intermediate-energy CW electron accelerators. The authors give an overview of the present status of the project. Recent progress is discussed.

715,433
PB86-213022 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.

End Magnets for the NBS-Los Alamos Racetrack Microtron.
Final rept.
P. H. Debenham, E. R. Lindstrom, and D. L. Mohr. 1985, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-32, n5 p3648-3650 Oct 85.

Keywords: *Magnets, Magnetic fields, Reprints, *Microtrons, *Racetrack microtrons.

Two end magnets have been designed and constructed for the 185 MeV NBS-Los Alamos racetrack microtron. The field has been measured in the first magnet and is uniform over a 0.62 sq m area to within + or - 0.0002 at 1 T. The magnet meets all performance specifications. Field measurements are underway on the second magnet. In this paper, design and construction details which play an important role in magnetic performance are described, and the measured fields are compared with calculations.

715,434
PB86-213048 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Heat-Capacity Calorimetry by the Method of Mixtures.
Final rept.
D. A. Ditmars. 1984, 27p
Pub. in Compendium of Thermophysical Property Measurement Methods: Survey of Measurement Techniques, v1 p527-553 1984.

Keywords: *Calorimeters, *Heat measurement, Enthalpy, Specific heat, Thermodynamics, Reprints.

The field of calorimetry, using the method of mixtures, to measure relative enthalpy and heat capacity is surveyed. The aim is to present for the non-specialist in the technique sufficient material concerning its areas of strength and its limitations to assist him in deciding whether or not the technique is applicable to his measurement problem. Following an introduction giving the basic thermodynamic theory of the calorimetric technique, specific calorimeter types are discussed. For each type, basic operating principles, range of utility, strengths, weaknesses and special problems are covered. A comprehensive bibliography of references to applicable calorimetric instrumentation is presented together with brief commentary on salient features of the references.

715,435
PB86-229705 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Application of the Dual Thin Scintillator Neutron Flux in a (235)U(n,f) Cross-Section Measurement.
Final rept.
M. S. Dias, A. D. Carlson, R. G. Johnson, and O. A. Wasson. Jun 85, 4p
Pub. in Proceedings of International Atomic Energy Agency (IAEA) Advisory Group Meeting on Nuclear Standard Reference Data, Geel, Belgium, November 12-16, 1984, p467-470 1985.

Keywords: *Uranium 235, *Fission cross sections, *Neutron cross sections, Neutron flux, MeV range 01-10, Time-of-flight method, Neutron detectors.

The fission cross section for (235)U was measured over the 1 to 6 MeV energy range using the National Bureau of Standards neutron time-of-flight facility at the NBS 100-MeV electron linac. The recently developed dual thin scintillator (DTS) neutron detector was used as the neutron flux monitor. The DTS flux monitor was placed about 200 m from the source. At about 69 m on the same flight path, a well-characterized fission chamber containing about 100 micrograms/sq cm of (235)U was located. The background for both detectors was reduced to negligible levels. Two parameter data (pulse height and time-of-flight) were taken for both detectors with a computer based system. Since the experiment was devised primarily to verify the accuracy of the DTS detector as an absolute neutron flux monitor, only moderate energy resolution was planned (delta E/E = 10%). The cross section uncertainty obtained was about 2%.

715,436
PB86-229713 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Neutron Cross-Section Standards Evaluations for ENDF/B-VI.
Final rept.
A. D. Carlson, W. P. Poenitz, G. M. Hale, and R. W. Peelle. Jun 85, 8p
Pub. in Proceedings International Atomic Energy Agency (IAEA) Advisory Group Meeting on Nuclear Standard Reference Data, Geel, Belgium, November 12-16, 1984, p77-84 Jun 85.

Keywords: *Neutron cross sections, *Standards, Uranium 235, Hydrogen, Neutron reactions, R matrix, Lithium 6, Boron 10, Gold 197.

As a first step in the development of the new ENDF/B-VI file, the neutron cross section standards are being evaluated. These standards evaluations are following a different process compared with that used for earlier versions of ENDF. The primary effort is concentrated on a simultaneous evaluation using a generalized least squares program, R-matrix evaluations, and a procedure for combining the results of the evaluations. The ENDF/B-VI standards evaluation procedure is outlined, and preliminary simultaneous evaluation and R-matrix results are presented.

715,437
PB86-231479 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Do Heavy Quarkonia Have Stringlike Behavior.
Final rept.
P. M. Fishbane, P. Kaus, and S. Meshkov. 1986, 4p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review D: Particles and Fields 33, n3 p852-855, 1 Feb 86.

Keywords: Reprints, *String models, *Quarkonium.

It is shown that heavy q(q bar) systems can be described for r > (R sub c) by the square-root potential K(square root of (r squared - (R sub c) squared)) + (V sub 0) characteristic of strings. (R sub c) approx. = 0.3 fm, a number consistent with Nambu-Goto strings.

715,438
PB86-239399 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Optical and Spectral Characteristics of an Insertion Device Used Both as a Wiggler and an Undulator.
Final rept.
S. Brennan, P. L. Cowan, T. Jach, R. LaVilla, R. C. C. Perera, and H. Winick. 1986, 4p
Sponsored by Department of Energy, Washington, DC., and National Institutes of Health, Bethesda, MD.
Pub. in Nuclear Instruments and Methods in Physics Research A246, p37-40 1986.

Keywords: Reprints, *X-ray sources, Wiggler magnet, Undulators.

For experiments using the energy region below 4 keV the LBL/EXXON insertion device on Beam Line VI-2 at the Stanford Synchrotron Radiation Laboratory (SSRL) can be reconfigured to work as a source of undulator radiation. For example, with a K of 0.94 rather than its normal value of 5-8 the fourth harmonic of the undulator coincides with the Ar K absorption edge at 3.2 keV. Because the total power is relatively low, carbon foils protecting the beryllium window can be removed. Thus there is a net gain the flux at the Ar edge over that obtainable in wiggler mode with carbon absorbers in place. In addition, the beam transmitted by the monochromator has a lower harmonic content and improved energy resolution.

715,439
PB86-239407 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
High Energy Resolution X-ray Spectroscopy Synchrotron Radiation Beamline for the Energy Range 800-5000 eV.
Final rept.
P. L. Cowan, S. Brennan, R. D. Deslattes, A. Henins, T. Jach, and E. G. Kessler. 1986, 5p
Pub. in Nuclear Instruments and Methods in Physics Research A246, p154-158 1986.

Keywords: *Synchrotron radiation, X ray spectroscopy, Monochromators, Mirrors, Reprints, *X-ray sources, NSLS, eV range 100-1000, KeV range 01-10.

A beamline for X-ray spectroscopy of atomic and molecular gases and condensed matter has been designed and installed at the National Synchrotron Light Source. The beamline is UHV compatible to allow windowless operation for improved flux at low photon energies. A double axis crystal monochromator is employed with a collimating premirror and a focusing postmirror. Pairs of beryl, quartz, or silicon crystals define an energy band width of <0.4 eV at an arbitrary energy above 0.8 keV. The premirror acts as a tuneable low-pass filter to minimize heat loading on the first monochromator crystal. At the present operating parameters of NSLS, a flux of 10 to the 9th power - 10 to the 13th power photons/s of highly monochromatic X-rays can be focused onto a 1mm diameter spot. Initial experimental results are presented.

715,440
PB86-240447 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Comment on 'Reanalysis of the Eotvos Experiment'.
Final rept.
P. T. Keyser, T. Niebauer, and J. E. Faller. 1986, 2p
Pub. in Physical Review Letters 56, n22 p2425-2426, 2 Jun 86.

Keywords: Gravitation, Reprints, *Eotvos experiment.

Fischbach et al. (Phys. Rev. Lett. 56, 3 (1986)) present an analysis of the Eotvos, Pekar, and Fekete data from which they suggest the presence of a non-Newtonian coupling to baryon number (i.e., hypercharge). The authors find two flaws: (a) they misinterpret or omit some of the Eotvos et al. data and (b) they reject the work of Janos Renner.

715,441
PB86-240454 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Radiative-Transfer Equations in Broad-Band, Time-Varying Fields.
Final rept.
J. Cooper, and P. Zoller. 1984, 7p
Grant NGL-06-003-057
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 277, n2 p813-819 1984.

Keywords: Maxwell's equations, Reprints, *Radiative transfer, Wigner function.

A derivation of the equation of transfer is obtained by starting with Maxwell's equations in the 'slowly varying envelope' form. Particular attention is paid to characterizing the intensity that is 'seen' by the atom (which is found to be related to a Wigner distribution of the electric field). The equation of transfer is found to be valid for 'broadband' slowly varying radiation fields.

715,442
PB86-241908 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Absolute Measurements of the (235)U(n,f) Cross-Section for Neutron Energies from 0.3 to 3 MeV.
Final rept.
A. D. Carlson, J. W. Behrens, R. G. Johnson, and G. E. Cooper. Jun 85, 5p
Pub. in Proceedings International Atomic Energy Agency (IAEA) Advisory Group Meeting on Nuclear Standard Reference Data, Geel, Belgium, November 12-16, 1984, p162-166 Jun 85.

Keywords: *Uranium 235, *Neutron cross sections, *Fission cross sections, MeV range 01-10, KeV range 100-1000.

Measurements of the (235U) neutron fission cross section have been made at the NBS linac neutron time-of-flight facility. The neutron flux was measured with a Black Neutron Detector located at the 200 m experimental station of the facility. The fission events were detected with a well-characterized (235U) fission ionization chamber located 69 m from the neutron producing target on the same beam line as the Black Detector. The data have been grouped to statistical precisions of about 1%. Total uncertainties are about 2%.

715,443
PB86-241916 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Tritium Form-Factors at Low q.
Final rept.
D. H. Beck, S. B. Kowalski, M. E. Schulze, W. E. Turchinetz, J. W. Lightbody, X. K. Maruyama, W. J. Stapor, H. S. Caplan, G. A. Retzlaff, D. M. Skopik, and R. Goloskie. 1984, 6p
Pub. in Physical Review C: Nuclear Physics 30, n5 p1403-1408 1984.

Keywords: *Tritium, Reprints, *Form factors.

The elastic charge and magnetic form factors of (3)H have been measured in the region 0.0477 < q sup 2 < 2.96/fm squared. Throughout this range, the charge form factor is found to be larger than previous measurements whereas the magnetic form factor agrees with the earlier work. The change in the charge form factor increases the discrepancy between the calculated and observed binding energy difference between (3)H and (3)He.

715,444
PB86-241924 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Comparison of the Filtered-Neutron Beams at the NBS and PTB Reactors by Calibrating a Spherical Rem Meter.
Final rept.
W. G. Alberts, and R. B. Schwartz. 1985, 8p
Pub. in Commission European Communities Report EUR-9762, Radiation Protection 1, p629-636 1985.

Keywords: *Neutron beams, Calibrating, Comparison, Reprints, Remmeters.

Two filtered-neutron beam facilities at the NBS and at the PTB, providing quasi-monoenergetic beams of 2 keV, 24.5 keV and 144 keV, are in use for radiation protection instrument calibration. Measurements are described which were performed to investigate the properties, and compare the calibrations, of these beams at both installations. A 20.8 cm diameter spherical rem counter and an 11 cm diameter sphere served as transfer instruments. The neutron current in the beams was determined with the respective methods in use at either facility. A filter-difference method was used to determine the contribution of high-energy neutron contamination to the count rate of the instruments. The responses of the instruments to the quasi-monoenergetic neutrons at both institutes are compared.

715,445
PB86-247574 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Transient Losses in Superconductors.
Final rept. 1 Oct 82-30 Sep 85.
R. B. Goldfarb. Jun 86, 63p NBSIR-86/3053
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.

Keywords: *Superconductors, Type 2 superconductors, Hysteresis, Magnetization, Magnetometers, Niobium, Filaments, Titanium, Alternating current.

The report deals with hysteresis losses at 4 K measured by magnetization and complex magnetic susceptibility. The theoretical and experimental relationships between ac susceptibility and magnetization as functions of dc field were examined in terms of the critical-state model as developed by Carr and Clem. A theoretical method of calibrating ac susceptometers for cylindrical specimens, which is based on a mutual-inductance calculation, was developed.

715,446
PB87-102422 PC **A99**/MF **E04**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
X-ray Attenuation Coefficients (Total Cross Sections): Comparison of the Experimental Data Base with the Recommended Values of Henke and the Theoretical Values of Scofield for Energies between 0.1-100 keV.
E. B. Saloman, and J. H. Hubbell. Jul 86, 715p NBSIR-86/3431
Sponsored by Department of Energy, Washington, DC., and Department of the Navy, Washington, DC.

Keywords: *X rays, *Absorption cross sections, Tables(Data), Graphs(Charts), Comparison, *Absorption coefficients, Total cross sections, eV range 100-

1000, KeV range 1-10, KeV range 10-100, Photon-atom collisions.

A comparison is carried out, in both graphical and tabular form, over the energy range 0.1-100 keV between the National Bureau of Standards' data base of experimental x-ray attenuation coefficients (total absorption cross sections) and cross sections obtained using two sets of photoionization cross section values: the semi-empirical set of recommended values produced by Henke et al which covers the energy range .03-10 keV; and a theoretical set calculated by Scofield which covered the range 1-1500 keV and was extended by Scofield, at our request, to also cover the 0.1-1 keV range. There has been some disagreement over whether Scofield's results should be subject to renormalization from a Hartree-Slater to a Hartree-Slater to a Hartree-Fock atomic model. Therefore in the tables a comparison is made of Scofield's predictions both with and without the renormalization.

715,447
PB87-102901 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Coordinate Time in the Vicinity of the Earth.
Final rept.
D. W. Allan, and N. Ashby. 1986, 15p
Pub. in Proceedings of International Astronomical Union Symposium No. 114-Relativity in Celestial Mechanics and Astrometry, Leningrad (USSR), May 28-31, 1985, p299-313 1986.

Keywords: *Atomic clocks, General relativity, Accuracy, Comparison, Time standards, Frequency standards.

Atomic clock accuracies continue to improve rapidly, requiring the inclusion of general relativity for unambiguous time and frequency clock comparisons. Atomic clocks are now placed on space vehicles and there are many new applications of time and frequency metrology. The paper addresses theoretical and practical limitations in the accuracy of atomic clock comparisons arising from relativity, and demonstrates that accuracies of time and frequency comparison can approach a few picoseconds and a few parts in 10 to the 16th power, respectively.

715,448
PB87-104071 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Characterization, Optimum Estimation, and Time Prediction of Precision Clocks.
Final rept.
D. W. Allan. 1986, 23p
Pub. in Proceedings of Annual Precise Time and Time Interval Applications (17th) and Planning Meeting, Washington, DC., December 3-5, 1985, p45-67 1986.

Keywords: *Atomic clocks, Standard deviation, Performance, Reviews, Precision, Optimization.

The paper is a partial review of several other papers given in the reference per the guidelines of the title. A few additional calculations are added for completeness of some of the tables, which indicate the uselessness of the standard deviation for a measure of performance of atomic clocks. A proper characterization of both the low-frequency, divergent-power-law processes observed for the random deviations of precision oscillators as well as the environmental sensitivities and systematic characteristics opens the door to: a clear characterization of performance; optimum estimation procedures of systematic parameters; optimum estimation of the influence of environmental parameters; optimum prediction algorithms; and clear specifications which allow system designers and planners to estimate the influence of a given precision oscillator on their system.

715,449
PB87-104469 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Reactor Radiation Div.
Nonlinearity in Weak Magnetic Fields Induced by Neutron-Antineutron Oscillations in Neutron Interferometry and Spin Resonance.
Final rept.
R. C. Casella. 1984, 4p
Pub. in Physical Review Letters 53, n11 p1033-1036 1984.

Keywords: Magnetic fields, Baryons, Nuclear spin, Reprints, *Neutron oscillation, Grand unified theory, Nuclear resonance, Nonlinearity.

In principle these minute effects are observable if regeneration problems can be overcome, but general statistical arguments render this approach non-competitive with direct observation of the neutron.

715,450
PB87-105177 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Research on Practical Superconductors at National Bureau of Standards.
Final rept.
F. R. Fickett. 1985, 7p
Pub. in ATB Metallurgie 25, n4 p265-271 1985.

Keywords: *Superconductors, *Superconducting magnets, Critical field, Copper, Stability, Reprints, Critical current.

The National Bureau of Standards is engaged in a large number of research programs which have as their goals the evaluation of various properties of practical superconductors related to their application in large magnet systems. The NBS work has concentrated on measurement of critical current, critical field, ac losses, and properties of the copper normally used as a stabilizing material. Many parameters must be considered in these investigations. An overview of these research efforts and a selection of recent results are presented. Particular emphasis is given to work performed in cooperation with the International Copper Research Association (INCRA) on properties of oxygen-free copper.

715,451
PB87-106415 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Anomalous Vertical Magnetic Field for Electromagnetic Induction in a Laterally Varying Thin Conductive Sheet.
Final rept.
D. A. Hill, and J. R. Wait. 1986, 5p
Sponsored by Bureau of Mines, Washington, DC.
Pub. in Radio Science 21, n4 p617-621 Jul-Aug 86.

Keywords: *Electromagnetic induction, Magnetic fields, Surface resistivity, Electromagnetic fields, Reprints.

The authors employ a simple model to show how the natural electromagnetic field on the surface of the earth, which has a strong horizontal magnetic field component, can be converted to a significant vertical magnetic field at the surface. Such a conversion mechanism will be caused by lateral variations of the subsurface conductivity structure. Our idealized model is a thin conducting sheet with a periodic variation of the conductivity-thickness product in one horizontal direction only.

715,452
PB87-106712 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Implementation of CRCPD Accreditation Criteria in State Calibration Laboratories.
Final rept.
H. T. Heaton. 1985, 18p
Contract DE-AC06-76RLO-1830
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Workshop on Radiation Survey Instruments and Calibrations, Gaithersburg, MD., July 10-12, 1984, pD.22-D.39 1985.

Keywords: *Laboratories, *Test facilities, *Calibrating, *Ionizing radiation, Quality control, Accreditation.

The paper summarizes the unique aspects of the four state laboratories for calibrating ionizing radiation instruments, with which NBS is presently cooperating. The general requirements of the CRCPD accreditation criteria are reviewed, and the procedures by which the state labs meet the criteria are discussed.

715,453
PB87-110102 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Electron Scattering by Neon in Resonance Regions.
Final rept.
K. T. Taylor, C. W. Clark, and W. C. Fon. 1985, 15p
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 18, p2967-2981 1985.

Keywords: *Electron scattering, *Neon, Inelastic scattering, Atomic structure, Reprints.

The authors present cross sections for excitation and de-excitation of neon by electron impact at energies up to 20 eV above the ground state, calculated by the R-matrix method. Comparison with available experimental data is satisfactory, and a number of transitions between excited states are examined theoretically for the first time. The effect of resonances on the cross section is seen to be quite large in some instances. In addition, calculated values of the oscillator strength and transition probabilities for the 3s-3p transition array of neon are given, and are compared with other recent theoretical and experimental values.

715,454
PB87-110201 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Future Atomic Frequency and Time Standards.
Final rept.
D. J. Wineland. 1981, 12p
Pub. in Seminar on Frequency Standards Measurement and Usage, Basancon (France), March 23-25, 1981, p1-12.

Keywords: *Frequency standards, *Time standards, Atomic beams, Atomic clocks, Cesium frequency standards, Rubidium frequency standards, *Ion storage.

Research towards making improved primary microwave frequency and time standards is reviewed. Two areas are highlighted (1) Advances in atomic beam research, and (2) Prospects for stored ion frequency standards.

715,455
PB87-110219 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Research on Field Usable Cs and Rb Frequency Standards.
Final rept.
D. J. Wineland. 1981, 17p
Pub. in Seminar on Frequency Standards Measurement and Usage, Besancon (France), March 23-25, 1981, p1-17.

Keywords: *Cesium frequency standards, *Rubidium frequency standards, *Frequency standards, Atomic clocks, Time standards, Reviews, Ion storage.

Current research towards improving the 'physics packages' in field-usable Rb and Cs clocks is reviewed. The paper is intended to update other similar reviews.

715,456
PB87-110227 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Optical Pumping of Stored Atomic Ions.
Final rept.
D. J. Wineland, W. M. Itano, J. C. Bergquist, J. J. Bollinger, and J. D. Prestage. 1985, 12p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Ann. Phys. Fr. 10, p737-748 Dec 85.

Keywords: *Optical pumping, Atomic spectroscopy, Reprints, *Ion storage, Laser cooling, Laser spectroscopy, Ion traps.

Optical pumping experiments on atomic ions which are stored in electromagnetic <<traps>> are discussed. Weak relaxation and extremely small energy shifts of the stored ions lead to very high resolution and accuracy in optical pumping-double resonance experiments. In the same spirit of Kastler's proposal for <<lumino refrigeration>> (1950), the kinetic energy levels of stored ions can be optically pumped. This technique, which has been called laser cooling, significantly reduces Doppler frequency shifts in the spectra.

715,457
PB87-110235 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Frequency Standards Based on Stored Ions.
Final rept.
D. J. Wineland. 1986, 4p
Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) 74, n1 p147-150 Jan 86.

Keywords: *Frequency standards, Atomic spectroscopy, Atomic clocks, Reprints, *Ion storage, Laser cooling, Laser spectroscopy.

The state of development of frequency standards based on stored ions is reviewed. Several preliminary demonstrations of the concept have already shown a level of performance approaching that of today's cesium-beam standards (accuracy of one part in 10 to the 13th power). The potential for accurately measuring or reducing all known systematic effects suggests that frequency standards based on stored ions with inaccuracies of one part in 10 to the 15th power are obtainable and eventually they could be orders of magnitude better than this. This performance is a result of extremely high-Q resonances (e.g., millihertz linewidths at microwave frequencies) and a very small second-order Doppler shift which follows with the addition of techniques for ion cooling.

715,458
PB87-111068 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Some Remarks on the Interaction between Precision Physical Measurement and Fundamental Physical Theories.
Final rept.
J. L. Hall. 1983, 15p
Grants N0001477-C-0656, NSF-PHY79-04928
Sponsored by Office of Naval Research, Arlington, VA., and National Science Foundation, Washington, DC.
Pub. in Quantum Optics, Experimental Gravity, and Measurement Theory, p347-361 1983.

Keywords: *Special relativity, *Lorentz transformations, Atomic beams, Precision, Tests, Laser interferometry.

Physicists have been unreasonably successful in framing physical 'laws' by idealization of rather crude experimental results. The author states 'unreasonably' successful because such fundamental physical laws are often found subsequently to agree with the results of sophisticated modern precision measurements at the 9, 12 or 15 digit precision level. This lecture considers some precision laser interferometer and atomic beam experiments which might be suitable for detecting very small departures from the perfect spatial isotropy postulated in special relativity, as well as for more sensitively testing the basic Lorentz transformations.

715,459
PB87-111647 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Limits for Spatial Anisotropy by Use of Nuclear-Spin-Polarized (9)Be(1+) Ions.
Final rept.
J. D. Prestage, J. J. Bollinger, W. M. Itano, and D. J. Wineland. 1985, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Physical Review Letters 54, n22 p2387-2390, 3 Jun 85.

Keywords: Atomic clocks, Hyperfine structure, Nuclear spin, Polarization(Spin alignment), Anisotropy, Reprints, *Beryllium ions, Beryllium 9, Hydrogen masers, Laser cooling, Hughes-Drever experiment.

The frequency of a nuclear spin-flip (/ Delta (m sub 1) / = 1) transition in (9)Be(1+) has been compared to the frequency of a hydrogen maser transition (/ Delta F / = 1. Delta (m sub F) = 0) to see if the relative frequencies depend on the orientation of the (9)Be(1+) ions in space. The present null result represents a decrease in the limits set by Hughes and Drever on a spatial anisotropy by a factor of about 300.

715,460
PB87-114906 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Discussion on 81 WM 014-O 'Dielectric Strength of N2-He Mixtures and Comparison with N2-SF6 and CO2-SF6 Mixtures' by J. M. Pelletier, Y. Gervais, and D. Mukhedkar.
Final rept.
R. J. Van Brunt. 1981, 2p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Institute of Electrical and Electronics Engineers Transactions on Power Apparatus and Systems PAS-100, n8 p3867-3868 Aug 81.

Keywords: *Gas ionization, *Dielectric breakdown, Dielectric properties, Ideal gas law, Pressure, Comparison, Nitrogen, Helium, Carbon dioxide, Sulfur hexafluoride, Reprints, Paschen law, Olivier equation.

Comments are given concerning the limitations and applicability of Oliviers equation used by J. M. Pelletier, et al., to fit data on electrical breakdown for gas mixtures. A connection is drawn between Olivier's equation and Paschen's law, and the effect of deviations from ideal gas behavior at higher pressures is pointed out.

715,461
PB87-116141 PC **A06**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Bibliography of Photon Total Cross Section (Attenuation Coefficient) Measurements 10 eV to 13.5 GeV.
J. H. Hubbell, H. M. Gerstenberg, and E. B. Saloman. Oct 86, 104p NBSIR-86/3461
Sponsored by Department of Energy, Washington, DC., and Office of Naval Research, Arlington, VA.

Keywords: *Photon cross sections, *Far ultraviolet radiation, *X rays, *Gamma rays, *Bibliographies, Bremsstrahlung, Attenuation, *Absorption coefficients, *Total cross sections.

The authors present a bibliography of papers reporting absolute measurements of photon (XUV, x-ray, gamma-ray, bremsstrahlung) total interaction cross sections or attenuation coefficients for the elements and some compounds. The energy range covered is from 10 eV to above 10 GeV. The papers are part of the reference collection of the National Bureau of Standards Photon and Charged Particle Data Center. They cover the period from 1907 to March 1986. Included with each reference are annotations specifying the substances studied and the duplicative references to a total of about 20,000 data points. All these data are available in machine-readable form.

715,462
PB87-117180 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Water Bath Blackbody for the 5 to 60C Temperature Range: Performance Goal, Design Concept, and Test Results.
Final rept.
J. Geist, and J. B. Fowler. Oct 86, 26p NBS/TN-1228
Also available from Supt. of Docs as SN003-003-02767-7. Errata sheet inserted. Sponsored by Aerospace Guidance and Metrology Center, Newark AFS, OH.

Keywords: *Blackbody radiation, *Standards, Performance, Design, Tests.

A water bath blackbody has been built under contract for the Electromagnetic Metrology Engineering Branch at Newark Air Force Station. The performance goal was a large-area, self-calibrating, high-accuracy blackbody covering the majority of the liquid water temperature range. With the exception of self-calibration, these goals were met. The report describes both the conceptual design of the water bath blackbody and the results of the tests that were carried out to characterize the performance of the actual water bath blackbody that was built for Newark Air Force Station. The details of the construction and operation of that water bath blackbody are described in a companion report.

715,463
PB87-118113 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Comparison of Centrifugal and Fountain Effect Pumps.
Final rept.
V. Arp. 1986, 4p
Contract NASA-A-210590
Sponsored by National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.
Pub. in Cryogenics 26, p103-106 Feb 86.

Keywords: *Centrifugal pumps, *Superfluidity, Liquid helium, Comparison, Efficiency, Helium 4, Reprints, *Fountain effect pumps, Helium II.

The efficiency of a pumping system is defined in terms of energy flows into and out of a control volume surrounding the pump. It is shown that the centrifugal pump power requirement is affected little by the heat leaks expected in a planned He II transfer system. In contrast, the power requirement for a superfluid fountain effect pump is greatly dependent on the thermal conduction through both the porous plug and the downstream transfer line. If the downstream conduction is negligible, the efficiency of a fountain effect pump will be significantly less than that of available centrifugal pumps.

715,464
PB87-118709 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Measurement of the Ratio of the Speed of Sound to the Speed of Light.
Final rept.
J. B. Mehl, and M. R. Moldover. 1986, 4p
Pub. in Physical Review A: General Physics 34, n4 p3341-3344 Oct 86.

Keywords: *Acoustic velocity, Temperature measurement, Ideal gas law, Ratios, Reprints, *Light speed.

Measurements of the resonance frequencies of the acoustic modes and of the microwave modes of a single cavity can determine u/c, the ratio of the speed of sound of a gas to the speed of light. Such measurements with a monatomic gas would determine the thermodynamic temperature T with unprecedented accuracy. By judicious choices of cavity geometry and resonance modes, u/c can be measured to part-per-million accuracy using cavities whose geometry is known only to parts per thousand. These techniques can also be applied to measurements of the universal gas constant R. A measurement of R would also require an accurate determination of the average atomic mass of the monatomic gas.

715,465
PB87-118972 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Laser Manipulation of Atomic-Beam Velocities--Demonstration of Stopped Atoms and Velocity Reversal.
Final rept.
W. Ertmer, R. Blatt, J. L. Hall, and M. Zhu. 1985, 4p
Grant NSF-PHY82-00805, Contract N00014-77-C-0656
Sponsored by National Science Foundation, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Physical Review Letters 54, n10 p996-999 1985.

Keywords: *Atomic beams, Reprints, *Laser cooling, Sodium atoms, Atom traps.

Successful modification of the velocity of atomic beam sodium atoms to zero or negative values are reported, by using counter-propagating laser radiation which has been frequency-chirped, using precise electro-optic modulation techniques. The resulting 'gas cloud' had a temperature below 50 milli-Kelvin and a density above one million atoms/cc. Some near future possibilities are considered in atom slowing, deflection, and storage.

715,466
PB87-121315 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Journal of Research of the National Bureau of Standards, Volume 91, Number 5, September-October 1986.
Bi-monthly rept.
Oct 86, 74p
See also PB87-121323 through PB87-121356, and PB87-100186. Also available from Supt. of Docs as SN703-027-00012-1.

Keywords: *Research, Near infrared radiation, Standards, Units of measurement, Calorimeters, Enthalpy, Combustion, Wavelength standards, Quantum Hall effect, Josephson effect, Volt, Ohm, Voltage standards, Resistance standards, Triple points, Solid wastes.

Table of contents includes the following: A wavelength standard for the near infrared based on the reflectance of rare-earth oxides; The triple point of oxygen in sealed transportable cells; A multi-kilogram capacity calorimeter for heterogeneous materials; Possible changes in the U.S. legal units of voltage and resistance.

715,467
PB87-122438 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Corona Excited Supersonic Expansion.
Final rept.
P. C. Engelking. Sep 86, 4p
Pub. in Review of Scientific Instruments 57, n9 p2274-2277 Sep 86.

Keywords: *Ion sources, *Chemical radicals, *Electric corona, Free radicals, Supersonic flow, Plasma devices, Jets, Reprints.

Stable operation of a corona excited supersonic expansion for the production of cold radicals or ions requires control of the geometry, chemistry, and electrical parameters. The nozzle must taper rapidly on the high-pressure side to a throat that opens up into a free expansion on the vacuum side. Optimum radical and ion production is obtained with only a few percent of precursor in an inert carrier gas. Capacitive loading must be kept to a minimum to prevent oscillation. It is shown that the finite response time of the plasma synthesizes an inductance that serves to decouple the negative resistance of the plasma from the rest of the circuit. Practically, oscillation is prevented if the circuit RC time constant is shorter than that which the plasma can follow.

715,468
PB87-128062 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Frequency Standards Based on Optically Pumped Cesium.
Final rept.
R. E. Drullinger. 1986, 3p
Pub. in Proceedings of the Institute of Electrical and Electronics Engineers 74, n1 p140-142 Jan 86.

Keywords: *Cesium frequency standards, *Standards, Atomic beams, Optical pumping, Reprints.

The state of development of optically pumped cesium-beam frequency standards is reviewed. The replacement of magnetic methods for atomic state selection and detection by optical (laser) methods provides potential for major reductions in systematic errors as well as a large increase in useable atomic beam flux. These translate to higher accuracy and better stability (both short and long term) or longer operating life if the beam current is reduced. With current technology it appears possible to construct a laboratory primary standard based on the concept. Simple and inexpensive field standards can also benefit from the optical pumping technology, but additional improvements in stabilized laser diodes will be needed.

715,469
PB87-128187 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Collective Excitation in the Crystalline Nucleus Model.
Final rept.
M. Danos, and A. Johnson. 1986, 4p
Pub. in Europhysics Letters 2, n3 p205-208 1986.

Keywords: *Nuclear models, Wave functions, Reprints, *Cluster model, Giant resonance.

In the paper the authors describe the mass dependence of the giant dipole resonance energy in terms of the crystalline model of the nucleus in which the alpha-particle is the basic unit. The experimental energies can be well reproduced for all nuclei heavier than the He nucleus. Because the success of the model depends on the correct counting of the relevant degrees of freedom, this result strongly suggests that four-particle correlations are an important aspect of the nuclear wave function.

715,470
PB87-128336 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Losses in a Nb-Ti Superconductor as Functions of AC Field Amplitude and DC Transport Current.
Final rept.
M. Dragomirecky, J. V. Minervini, J. W. Ekin, R. B. Goldfarb, and A. F. Clark. 1986, 5p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Proceedings of International Cryogenic Engineering Conference (11th), Berlin (West Germany), April 22-25, 1986, p746-750.

Keywords: *Superconductors, Losses, Alternating current, Direct current, Magnetic fields, Electric current, Hysteresis, *Niobium titanium, Superconducting coils, Two-dimensional calculations.

Hysteretic shielding losses and transport losses were measured in a multifilamentary Nb-Ti superconducting coil as functions of transverse ac field amplitude and dc transport current. The conductor was biased with a dc field. There was significant agreement with the predictions of Minervini's two-dimensional theoretical model.

715,471
PB87-128369 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
AC Losses in Nb-Ti Measured by Magnetization and Complex Susceptibility.
Final rept.
R. B. Goldfarb, and A. F. Clark. 1986, 8p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Advances in Cryogenic Engineering Materials 32, p779-786 1986.

Keywords: *Superconductors, Alternating current, Hysteresis, Losses, Magnetization, Magnetic fields, Direct current, *Foreign technology, *Niobium titanium, Magnetic susceptibility, Transients.

DC magnetization and complex ac susceptibility were measured at 4 K as functions of longitudinal dc field for a multifilamentary Nb-Ti superconductor with no transport current. Minor hysteresis loops were obtained in the dc measurements. The full-penetration field, H(p), a function of applied field, H, was deduced directly for each minor loop. The values for H(p) were fit to the Kim-type equation.

715,472
PB87-128377 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Effect of Aspect Ratio on Critical Current in Multifilamentary Superconductors.
Final rept.
L. F. Goodrich, W. P. Dube, E. S. Pittman, and A. F. Clark. 1986, 8p
Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in Advances in Cryogenic Engineering Materials 32, p833-840 1986.

Keywords: *Superconductors, Magnetic fields, Niobium intermetallics, Tin intermetallics, Titanium intermetallics, Reprints, *Critical current, Niobium titanium, Niobium tin.

Experimental data and discussion are presented on the critical current of straight superconductors as a function of the orientation of a perpendicular applied magnetic field. Commercial, multifilamentary NbTi and Nb3Sn samples were measured in a radial access magnet that allowed an arbitrary angle setting. The change in critical current was measured at different magnetic fields to scale the effect for use in a standard test method. For a NbTi sample, the critical current with the magnetic field parallel to the wider face of the conductor is higher than that with the perpendicular orientation. The effect can be as high as 40% for a NbTi sample with an aspect ratio of six. The effect in Nb3Sn is opposite that in NbTi. A discussion of the most likely cause of the effect, which accounts for the difference between NbTi and Nb3Sn, is given.

715,473
PB87-128385 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Shell-Model Interaction Energies in a Relativistic Hamiltonian Formulation (II).
Final rept.
M. Cauvin, V. Gillet, T. Kohmura, T. Suzuki, and M. Danos. 1986, 14p
Pub. in Nuclear Physics A456, p733-746 1986.

Keywords: Nuclear structure, Nuclear shell models, Degrees of freedom, Hamiltonian functions, Relativity, Reprints, *Nuclear forces.

The two-nucleon interaction energies of light and medium nuclei are discussed in a picture of mesonic degrees of freedom and a pure shell model for nucleons. The role of the different mesons in the interaction energies and the domain of the best values of the coupling constants are explored by calculating the mean square deviation between theoretical and experimental two-nucleon interaction energies. Because of the redundancies between different meson contributions to the interaction energies, the values of the coupling constants are not uniquely determined, and rather large domains of best values are obtained. These domains include sets of values of the coupling constants which are compatible with those from other sources. The experimental data can be reproduced with the same quality as in conventional phenomenological potential models by taking the meson fields, sigma, pi, rho, and omega, and using only vector coupling for the vector fields.

715,474
PB87-131876 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Electro-Optic Field Measurement at a Needle Tip and Streamer Initiation in Nitrobenzene.
Final rept.
E. F. Kelley, and R. E. Hebner. 1986, 6p
Sponsored by Department of Energy, Washington, DC. Office of Energy Systems Research.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) 1986 Annual Report - Proceedings of Conference on Electrical Insulation and Dielectric Phenomena, Claymont, DE., November 3-6, 1986, p272-277.

Keywords: *Electrooptics, *Nitrobenzenes, *Electric discharges, Kerr electrooptical effect, High speed photography, Aromatic hydrocarbons, Streamer initiation.

Kerr-effect electro-optic observations of the impulse field are made in the vicinity of the tip of a needle-sphere electrode geometry. Distortions from the Laplacian field indicate charge injection from the tip along a narrow channel prior to streamer initiation. Estimates reveal charge densities of order 100 micro C/cc exists in the channel. An order of magnitude calculation suggests sufficient energy is deposited in the channel to cause vaporization of the liquid due to joule heating. The streamer will initiate where the charge injection channel touches the electrode.

715,475
PB87-132221 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Nuclear Radiation Div.
Particle-Hole Symmetry in the Interacting-Boson Model: Fermion and Boson Aspects.
Final rept.
A. B. Johnson, and C. M. Vincent. 1985, 6p
Grant NSF-THY82-13597
Sponsored by National Research Council, Washington, DC.
Pub. in Physical Review C: Condensed Matter 31, n4 p1540-1545 Apr 85.

Keywords: *Nuclear structure, Nuclear shell models, Bosons, Fermions, Reprints, Collective model.

It is shown that the S-D subspaces, which are used in the OAI microscopic derivation of the interacting boson model, form a particle-hole-symmetric family. Consequently there exist particle-hole-symmetric prescriptions for determining the structure of the S and D pairs. The result does not (as stated by Talmi) require the Hamiltonian to conserve generalized seniority. Nevertheless there are derivations from particle-hole symmetry when boson matrix elements involving more than two d bosons are calculated in lowest order using the boson mapping procedure of Otsuka, Arima, and Iachello. These deviations are used to estimate the inaccuracies introduced by the lowest-order mapping.

715,476
PB87-134227 Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Atomic-Beam Cooling: A Simulation Approach.
Final rept.
R. Blatt, W. Ertmer, P. Zoller, and J. L. Hall. 1986, 12p
Grants N000014-77-A-0016, NSF-PHY82-00805
Sponsored by Office of Naval Research, Arlington, VA., and National Science Foundation, Washington, DC.
Pub. in Physical Review A: General Physics 34, n4 p3022-3033 Oct 86.

Keywords: *Atomic beams, Mathematical models, Computerized simulation, Reprints, *Laser cooling.

Laser cooling of atoms in an atomic beam is studied theoretically by using a simulation approach derived from a pure-state analysis of resonant radiation pressure. Detailed numerical results are presented discussing the form of the atomic velocity distribution (and its minimum achievable width) and effects due to the spatial (focusing) and frequency variation of a Gaussian laser beam. A comparison of these results with recent experiments is given.

715,477
PB87-134847 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Absorption and Scattering of Photons by the Delta Resonance.
Final rept.
E. Hayward. 1985, 11p
Pub. in AIP (American Institute of Physics) Conference Proceedings on Capture Gamma-Ray Spectrosc. Relat. Top. 125, p131-141 1985.

Keywords: *Photonuclear reactions, Absorption cross sections, Scattering cross sections, Gamma rays, Reprints, N star resonances, Sum rules.

Recently, the experiments on the total photonuclear absorption cross sections have been extended to encompass the Delta resonance in complex nuclei. These important experiments involve at least four different techniques and have been performed in European Laboratories. These results are compared with the total cross sections measured in the giant resonance region and extending up to the meson threshold. The Gell-Mann-Goldberger-Thirring sum provides a connection between the absorption cross sections in these two energy regions and the photo pion cross sections of the nucleon. The total photonuclear absorption cross sections are related to the forward coherent scattering cross sections through the optical theorem and dispersion relation. At backward angles, where measurements are possible, the scattering cross sections are strongly depressed by a form factor. The experimental cross sections do, however, exceed the prediction of a simple model.

715,478
PB87-134854 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Lorentz Transformations.
Final rept.
R. W. Hayward. 1985, 4p
Pub. in Encyclopedia of Physics, 3rd Edition, p666-669 1985.

Keywords: *Lorentz transformations, Elementary particles, Electromagnetism, Parity, Minkowski space, Light speed, Space-time, Conservation laws.

Lorentz transformations are defined in terms of rotations and velocity boosts in Minkowski space of the space-time coordinates or of the physical object. The physical meaning of orbital and spin angular momentum appears.

715,479
PB87-134953 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Frequency Standard Research Using Stored Ions.
Final rept.
D. J. Wineland, W. M. Itano, J. C. Bergquist, J. J. Bollinger, and H. Hemmati. 1984, 4p
Pub. in Progress in Quantum Electronics 8, p139-142 1984.

Keywords: *Frequency standards, Atomic clocks, Atomic spectroscopy, Reprints, Ion storage, Laser spectroscopy.

The authors summarize research undertaken to develop time and frequency standards based on stored ions. The ion storage method for high resolution spectroscopy is also briefly compared to the methods for stored neutrals and slow atomic beams.

715,480
PB87-140315 PC A15/MF A01
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Technical Activities 1986, Center for Basic Standards.
P. L. M. Heydemann. Oct 86, 340p NBSIR-86/3469
See also PB86-140043.

Keywords: *Research, *Standards, Metrology, Fundamental constants, Pressure, Vacuum, Electrical measurement, Temperature, Atomic physics, Frequency standards, Gravity, X rays, Gamma rays, Laser applications.

The report summarizes the research and technical activities of the Center for Basic Standards during the Fiscal Year 1986. These activities include work in the areas of electricity, temperature and pressure, mass and length, time and frequency, quantum metrology, and quantum physics.

715,481
PB87-149522 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Model Line-Shape Analysis for the Ruby R Lines Used for Pressure Measurement.
Final rept.,
R. G. Munro, G. J. Piermarini, S. Block, and W. B. Holzapfel. 1985, 5p
Pub. in Jnl. of Applied Physics 57, n2 p165-169 1985.

Keywords: *Pressure measurement, *Ruby, Fluorescence, Line spectra, Reprints, High pressure, High temperature.

A model spectral lineshape is proposed for the R(1) and R(2) fluorescence lines of ruby. The objectives of the proposal are improvements in the accuracy, the reproducibility, and the standardization of pressure measurements using the ruby fluorescence technique. Other advantages, such as using the ruby method to higher temperatures and using the lineshape analysis to obtain a simultaneous measurement of pressure and temperature, are also achieved. Under nonhydrostatic conditions, quantitative estimates of pressure distributions can also be made.

715,482
PB87-149530 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Bremsstrahlung Energy Spectra from Electrons with Kinetic Energy 1 KeV-10 GeV Incident on Screened Nuclei and Orbital Electrons of Neutral Atoms with Z= 1-100.
Final rept.,
S. M. Seltzer, and M. J. Berger. 1986, 74p
See also DE81-030984. Sponsored by Department of Energy, Washington, DC., and Office of Naval Research, Arlington, VA.
Pub. in Atomic Data and Nuclear Data Tables 35, n3 p345-418 Nov 86.

Keywords: *Bremsstrahlung, Cross sections, Electron irradiation, Energy spectra.

A comprehensive set of bremsstrahlung cross sections (differential in the energy of the emitted photons) is tabulated. The set includes results for electrons with energies from 1 keV to 10 GeV incident on neutral atoms with atomic numbers Z=1 to 100. For bremsstrahlung in the Coulomb field of the atomic nucleus, use was made of (a) results of Pratt, Tseng, and collaborators based on numerical phase-shift calculations for the screened Coulomb potential at energies below 2 MeV; and (b) the analytical high-energy theory (with Coulomb corrections) of Davies, Bethe, Maximon, and Olsen at energies above 50 MeV, supplemented by the Elwert Coulomb correction factor and the theory of the high-frequency limit given by Jabbur and Pratt. In the high-energy region, the effect of screening was included by the use of Hartree-Fock atomic form factors. A numerical interpolation scheme, applied to suitably scaled cross sections, was used to bridge the gap between the low-energy and high-energy theoretical results, and thus to obtain improved cross sections in the intermediate-energy region 2 to 50 MeV. Bremsstrahlung in the field of the atomic electrons was calculated according to the theory of Haug, combined with screening corrections derived from Hartree-Fock incoherent scattering factors.

715,483
PB87-149555 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Current Density Monitor for Intense Relativistic Electron Beams.
Final rept.,
R. B. Fiorito, M. Raleigh, and S. M. Seltzer. 1986, 9p
Sponsored by Office of Naval Research, Arlington, VA., Defense Advanced Research Projects Agency, Arlington, VA., and Naval Sea Systems Command, Washington, DC.
Pub. in Review of Scientific Instruments 57, n10 p2462-2470 Oct 86.

Keywords: *Electron beams, *Current density, Electrical measurement, Monitors, Electron accelerators, Reprints, Relativistic range, High energy.

The authors describe a new type of electric probe which is capable of measuring the time-resolved current density profile of a stable, reproducible, high-energy (>4-MeV) high-current (>1-kA) electron beam. The sensing element of the probe is an open-ended but capped-off 50-ohm coaxial line constructed of graphite. The graphite sensor is 4.3 mm in diameter, 6 cm long, and is range thin to the primary beam electrons. The probe produces a signal proportional to the intercepted beam current. When the sensor is scanned radially through the beam during repeated pulses, a curve of signal versus depth of insertion is produced from which the radial current density profile can be determined. Measurements are presented of the profile of the electron beam from the Experimental Test Accelerator (4.5 MeV, 10 kA) at Lawrence Livermore National Laboratory. In contrast to other systems it requires no radiation shielding, water cooling, or auxiliary support equipment to operate in an intense beam environment.

715,484
PB87-149571 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
General Expression for the Coulomb Interaction in the Presence of a Surface.
Final rept.,
S. P. Apell, and D. R. Penn. 1986, 15p
Pub. in Physical Review B 34, n10 p6612-6626, 15 Nov 86.

Keywords: *Coulomb interactions, Interfaces, Surfaces, Reprints, Coulomb potential, Coulomb field.

A general expression is presented for the Coulomb interaction between two test charges in the presence of an interface. The cases of planar and spherical geometry are considered. The potential is given for the two test particles outside, inside, or on either side of the interface, and appropriate limits are investigated.

715,485
PB87-151254 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Laser Cooling of Atomic Beams.
Final rept.,
H. Metcalf, and W. D. Phillips. 1985, 10p
See also PB86-190659. Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Comments At. Mol. Phys. 16, n2 p79-88 1985.

Keywords: *Atomic beams, Laser beams, Sodium, Reprints, *Laser cooling.

A thermal atomic beam may be decelerated and have its velocity distribution compressed through the action of a resonant, counterpropagating laser beam. A sodium beam with mean thermal velocity of 1000 m/s has been stopped, producing a 'gas' with a velocity spread of less than 20 m/s, equivalent to a temperature less than 1 K.

715,486
PB87-151262 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.

Laser-Cooled Atomic Beams.
Final rept.,
W. D. Phillips, J. V. Prodan, and H. J. Metcalf. 1984, 24p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in At. Phys. 9, p338-361 1984.

Keywords: *Atomic beams, Reviews, Reprints, *Laser cooling, Atom traps.

Atoms in a thermal beam can be cooled, decelerated, and stopped using the radiation pressure from a nearly resonant laser beam. Several groups have already used this laser cooling process on an atomic sodium beam. In the paper, the authors review the techniques and results of the various experimental groups, and discuss possible applications.

715,487
PB87-151353 PC **A02**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Water Bath Black Body Operating Instructions,
J. B. Fowler, and B. J. Belzer. Dec 86, 21p NBSIR-86/3477

Keywords: *Laboratory equipment, *Blackbody radiation, *Radiometry, Temperature control, Thermistors, Instructions, Manuals.

This is an operating instruction manual for the water bath black body built in the Radiometric Physics Division, National Bureau of Standards.

715,488
PB87-151577 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Radiative Tail in High-Energy Electron Scattering.
Final rept.,
L. C. Maximon. 1984, 41p
Pub. in Arkiv for det Fysiske Seminar i Trondheim, Norway, n19 p1-41 1984.

Keywords: *Electron scattering, Bremsstrahlung, Reprints, Born approximation, High energy.

A single expression is derived for the cross section for the radiative tail from high energy electron scattering that satisfies not only the Born approximation, but the low energy theorem and the peaking approximation as well. The estimated errors in the final result are of relative order (k/E)squared (alpha)Z, where k is the energy of the emitted photon, E the incident electron energy, and Z the charge of the target nucleus.

715,489
PB87-151858 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Gamma-Ray Multipole Mixing Ratios Using Orientation: 166 Er.
Final rept.,
H. Marshak. 1985, 9p
Pub. in Hyperfine Interactions 22. n1-4 p413-421 Mar-May 85.

Keywords: Gamma rays, Reprints, *Erbium 166, *Mixing ratio, Nuclear orientation, Uncertainty.

The different methods for obtaining multipole mixing ratios and their uncertainties from nuclear orientation measurement are reviewed. Results using these methods are compared for some E2/M1 transitions in (166) Er.

715,490
PB87-151866 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Determining Multipole Mixing Ratios from Nuclear Orientation Experiments.
Final rept.,
H. Marshak, and C. H. Spiegelman. 1985, 13p
Pub. in Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment A234, n3 p455-467, 15 Feb 85.

Keywords: Confidence limits, Gamma rays, Least squares method, Distribution theory, *Mixing ratio, Erbium 166, Uncertainty, Nuclear orientation.

Statistical methods using weighted nonlinear least squares and noncentral distribution theory to obtain multipole mixing ratios and their uncertainties from nuclear orientation measurements are described. Results using these methods are compared with those obtained from methods currently in use.

715,491
PB87-152898 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Scalar Charged Particle in the Lorentz Gauge.
Final rept.,
E. Marx. 1985, 5p
Pub. in International Jnl. of Theoretical Physics 24, n2 p217-221 Feb 85.

Keywords: Charged particles, Reprints, *Quantum electrodynamics, Quantum mechanics, Klein-Gordon equation, Sealers.

The specification of initial and final conditions in relativistic quantum mechanics leads to a perturbation expansion that was carried out in the Coulomb gauge. Nevertheless, a Lorentz gauge is more natural for a relativistically invariant theory, and the corresponding expansions for the interaction of one scalar particle with the electromagnetic field are developed here.

715,492
PB87-153649 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Innershell Ionization Cross Sections.
Final rept.,
C. J. Powell. 1985, 34p
Pub. in Electron Impact Ionization, Ch. 6, p198-231 1985.

Keywords: *Electron irradiation, *Inner-shell ionization, *Ionization cross sections.

A review is presented of cross-sections for the ionization of inner-shell electrons by electron impact. Calculations, measurements, and empirical formulas are described and compared. Recommendations are given for the selection of cross-section data. Finally, applications of inner-shell ionization cross-section data to materials analysis problems are described.

715,493
PB87-153722 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Extra Dimensions to Remove Singularities and Determine Fundamental Constants.
Final rept.,
A. R. P. Rau. 1985, 4p
Pub. in American Jnl. Physics 53, n12 p1183-1186 Dec 85.

Keywords: *Atomic structure, *Fundamental constants, Reprints, Compactification, Renormalization, One dimensional, High magnetic field research.

The structure of atoms in an intense magnetic field (one trillion gauss) is analyzed as a problem of 'compactification' of dimensions. The motion of the electrons is reduced effectively to one dimension, the dimensions transverse to the field direction being frozen at small values. The analysis shows how a reduction in dimensions accounts for the removal of seeming singularities in the structure of atoms and for the occurrence of what appear to be fundamental constants that govern this structure. Thereby this elementary problem of nonrelativistic quantum mechanics provides analogs of similar studies now being pursued in supergravity and other unified field theories.

715,494
PB87-157038 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Critical and 'Subcritical' Magnetic States of an Amorphous Rare Earth Spin Glass.
Final rept.,
J. J. Rhyne. May 85, 6p
Pub. in Physica B and C 130B+C, n1-3 p253-258 May 85.

Keywords: Rare earth alloys, Neutron scattering, Magnetic properties, Reprints, *Spin glass.

Small angle neutron scattering from amorphous TbFe2 above the magnetization-determined T(sub c) ≐ 409 K shows a conventional Lorentzian line shape with a spin correlation length which increases to only about 135 A at T(sub c). Below T(sub c) the scattering is no longer Lorentzian but can be represented by a sum of Lorentzian and Lorentzian squared terms as predicted theoretically for a random anisotropy field amorphous magnet. Application of an external field in the range 2-12 kG at 295 K sharply suppresses the scattering reflecting an increase in the ferromagnetic component with field. The residual magnetic scattering exhibits a prolate distortion of the intensity with respect to the direction of H, with a marked reduction in the correlation length with field indicating a spin-cluster like response. From the magnitude of the distortion, an average number of spins per cluster as a function of field has been calculated using a super-paramagnet model.

715,495
PB87-157046 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Stopping Atoms with Laser Light.
Final rept.,
J. Prodan, A. Migdall, W. D. Phillips, I. So, H. Metcalf, and J. Dalibard. 1985, 4p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Physical Review Letters 54, n10 p992-995 1985.

Keywords: *Atomic beams, Reprints, *Sodium atoms, *Laser cooling, *Beam cooling, Laser trapping, Atom traps.

The authors have produced a sample of sodium at rest in the laboratory by decelerating atoms in an atomic beam using momentum transfer from a counterpropagating, resonant laser beam. These atoms have a density of about 100,000/cc and a velocity spread of about 15 m/s FWHM corresponding to a kinetic temperature less than 100 mK.

715,496
PB87-157053 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Stopping Neutral Atoms Using Laser Light.
Final rept.,
J. V. Prodan, W. D. Phillips, H. J. Metcalf, and J. Dalibard. 1984, 2p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of International Quantum Electronics Conference (13th), Anaheim, CA., June 18-21, 1984, p90-91.

Keywords: *Atomic beams, *Sodium atoms, Laser cooling, Atom traps, Neutral beam sources, High resolution.

Using laser irradiation of an atomic sodium beam, the authors have produced a sample of neutral atoms with an average velocity near zero and a width of 30 m/s. This corresponds to a temperature of 1 K.

715,497
PB87-161527 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
High Accuracy in Physics.
Final rept.,
D. G. McDonald. 22 Aug 86, 1p
Pub. in Science 233, p829 22 Aug 86.

Keywords: *Accuracy, Time standards, Superconductivity, Measurement, Precision, Reprints, Josephson effect, Voltage.

Philip Abelson, in an Editorial in Science, reviews the National Research Council report 'Physics Through the 1990's' and says 'Of all the quantities in physics, time is by far the most accurately measured'. The present authors argues that the Josephson effect has comparable accuracy.

715,498
PB87-161535 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Hysteresis Losses in Fine Filament Internal-Tin Superconductors.
Final rept.,
R. B. Goldfarb, and J. W. Ekin. Sep 86, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Cryogenics 26, p478-481 Aug-Sep 86.

Keywords: *Superconductors, *Hysteresis, Niobium intermetallics, Tin intermetallics, Reprints, *Niobium tin, AC losses.

Hysteresis losses were measured on a series of fine filament Nb3Sn superconductors made by the internal-tin process. Hysteresis was measured as a function of filament diameter and interfilament separation using a vibrating sample magnetometer in transverse magnetic field. Losses were greater than expected from the critical state model that expresses loss as a function of filament diameter. Micrographs of the reacted wire cross-sections showed some interfilament bridging for all wires. This gave rise to effective filament diameters that were greater than actual diameters. The critical interfilament separation, above which the losses would be expected to follow the critical state model was determined.

715,499
PB87-161543 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Internal Fields in Magnetic Materials and Superconductors.
Final rept.,
R. B. Goldfarb. Nov 86, 2p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Cryogenics 26, p621-622 Nov 86.

Keywords: *Superconductors, *Magnetization, Magnetic hysteresis, Demagnetization, Magnetic materials, Losses, Reprints, Magnetic susceptibility.

The paper reviews some of the concepts needed for the correct analysis of magnetization data, both for magnetic materials and superconductors. Demagnetization factors, initial susceptibilities, and hysteresis losses are discussed.

715,500
PB87-163663 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Tuneable Resonances: Dielectronic Recombination.
Final rept.,
G. H. Dunn. 1986, 6p
Pub. in Resonance Effects in Electron-Ion Collisions, IPPJ-AM-47, p148-153 1986.

Keywords: Angular momentum, Electric fields, Reprints, *Dielectronic recombination, Tuneable resonances.

Dielectronic recombination (DR) has been shown both theoretically and experimentally to be strongly influenced by extrinsic electric fields-- it can be considered to be a process which is 'tuneable' by the fields. Measurements of cross sections for DR under conditions where fields are expected to play no role agree well with theory. Measurements of cross sections for DR under conditions where fields are expected to be important and where the fields are well defined and known agree reasonably well with theory. Measurements under conditions where fields should play a role, but the fields are poorly defined and unknown do not agree with theory when reasonable estimates are made of the fields. Collisions which mix angular momentum states may also 'tune' the cross sections, and the possibility needs further investigation.

715,501
PB87-163721 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.
Quality Control of Measurements - Measurement Assurance.
Final rept.,
R. M. Judish. Jan 86, 3p
Pub. in Proceedings of the Institute of Electrical and Electronics Engineers 74, n1 p23-25 Jan 86.

Keywords: *Measurement, Quality control, Accuracy, Reprints, Traceability, Uncertainty, Calibration.

The ability to relate individual measurements to nationally accepted standards is a requirement of traceability. The paper discusses a perspective in which the goals of traceability are viewed in terms of performance requirements on measurement quality as reflected in a statement of uncertainty.

715,502
PB87-164091 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Generation of Squeezed States by Parametric Down Conversion.
Final rept.,
L. A. Wu, H. J. Kimble, J. L. Hall, and H. Wu. 17 Nov 86, 4p
Grant NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review Letters 57, n20 p2520-2523, 17 Nov 86.

Keywords: *Electromagnetic fields, Reprints, Parametric oscillators, Squeezed states.

Squeezed states of the electromagnetic field are generated by degenerate parametric down conversion in an optical cavity. Noise reductions greater than 50% relative to the vacuum noise level are observed in a balanced homodyne detector. A quantitative comparison with theory suggests that the observed squeezing results from a field that in the absence of linear attenuation would be squeezed by greater than tenfold.

715,503
PB87-165767 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Impact of Quantized Hall Resistance on SI Electrical Units and Fundamental Constants.
Final rept.,
B. N. Taylor. 1985, 3p
Pub. in Metrologia 21, n1 p37-39 1985.

Keywords: *Fundamental constants, *Units of measurement, Reprints, *Quantum Hall effect, Ampere, Volt, Ohm, Fine structure constant.

With the discovery of the quantum Hall effect the SI units ampere, volt, and ohm may be realized with high accuracy by performing four fundamental constant determinations requiring only a consistent set of laboratory electrical units. Accurate values in SI units for most other constants, including the Avogadro and fine-structure constants, may also be obtained from the same measurements.

715,504
PB87-165791 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
International (235)U Fission Foil Mass Intercomparison.
Final rept.,
I. Schroder, D. M. Gilliam, A. D. Carlson, S. W. Bright, and J. M. R. Hutchinson. 1986, 2p
Pub. in Transactions of the American Nuclear Society 53, p473-474 1986.

Keywords: *Uranium 235, *Mass, Alpha particles, Reprints, *Fission foil detectors, Interlaboratory comparisons.

Measurements were made of the mass of two U.S.S.R. fission foils at NBS. These foils are directly traceable to those used in precise measurements of the (235)U(n,f) cross section at 14 MeV neutron energy. The NBS measurements employed low geometry and 2 pi counting facilities. The results obtained are consistent with those obtained at Argonne National Laboratory and at the Khlopin Radium Institute, Leningrad, U.S.S.R.

715,505
PB87-165882 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Report on the New NBS (National Bureau of Standards) Determination of the Proton Gyromagnetic Ratio.
Final rept.,
E. R. Williams, G. R. Jones, J. S. Song, W. D. Phillips, and P. T. Olsen. 1985, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 34, n2 p163-167 1985.

Keywords: *Fundamental constants, *Protons, Magnetic fields, Solenoids, Reprints, *Gyromagnetic ratio, Fine structure constant, Quantum electrodynamics.

The authors describe the proton gyromagnetic ratio in H2O, gamma prime, sub P experiment now in progress at NBS, including a short description of the construction of a single layer precision solenoid; the test they employ when measuring the solenoid's dimensions by inductive technique; and their latest solenoid measurements. They also discuss the improvements over their last gamma prime, sub P determination.

715,506
PB87-166419
(Order as PB87-166401, PC **A05**/MF **A01**)
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Continuity of the Meter: The Redefinition of the Meter and the Speed of Visible Light,
D. A. Jennings, R. E. Drullinger, K. M. Evenson, C. R. Pollock, and J. S. Wells. 15 Sep 86, 6p
Included in Jnl. of Research of the National Bureau of Standards, v92 n1 p11-16 Jan-Feb 87.

Keywords: *Standards, Dimensional measurement, Helium neon lasers, *Light speed, Visible radiation, Iodine 127, Meter.

The product of the frequency and wavelength of the ith hyperfine component of the 11-5, R(127) transition of (127)I2 yields a value for the speed of visible red light. The value of c, the most accurate ever measured for visible light, agrees with the value defined in the redefinition of the meter within the 3o error limits of the krypton length standard.

715,507
PB87-171724 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Tagged Photons: An Analysis of the Bremsstrahlung Cross Section.
Final rept.,
L. C. Maximon, A. de Miniac, T. Aniel, and E. Ganz. Mar 87, 64p
See also PB81-227837.
Pub. in Physics Reports 147, n4 p189-252 Mar 87.

Keywords: *Bremsstrahlung, *Differential cross sections, Reprints, Tagged photon method, Polarized beams, MeV range 10-100, MeV range 100-1000.

The authors consider in detail the differential cross sections for both polarized and unpolarized bremsstrahlung from electrons for angles and energies in the range of interest for a photon tagging system (50 MeV-1 GeV). They derive accurate high energy, small angle approximations to these cross sections. These approximations are then used to determine the maxima and minima of these cross sections as a function of the angles and energies of the final electron and photon and to evaluate them at the extrema.

715,508
PB87-173779 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Coherent Scattering of Low Energy Neutrinos from Macroscopic Objects.
Final rept.,
R. C. Casella. 1986, 2p
Pub. in Proceedings American Institute of Physics Conference on Intersections between Particle and Nuclear Physics, Lake Louise, Canada, May 26-31, 1986, p1040-1041.

Keywords: Antineutrinos, Crystals, *Antineutrino-nucleon interactions, *Neutrino-nucleon interactions, Neutral currents, Coherent scattering.

It is known since the work of Freedman that neutral-current scattering of neutrinos from the nucleons in a nucleus can be coherent, leading, for sufficiently long wavelengths, to cross sections which are proportional to the square of the nuclear baryon number. When extended to macroscopic objects containing N nuclei, it has recently been reported, on the one hand, that coherent cross sections proportional to N squared have been observed, and on the other, that coherence can occur only for wavelengths comparable to the sample size. The author found that coherent scattering can indeed occur on the scale of an entire crystal for incident neutrino wavelengths comparable to the internuclear separation or less, but that the cross section remains linear in N. Hence coherence cannot explain the reported observation of a macroscopic force exerted on a crystal by reactor antineutrinos.

715,509
PB87-173787 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Theory of Coherent Neutrino Scattering from Crystals.
Final rept.,
R. C. Casella. 1986, 9p
Pub. in Il Nuovo Cimento 94 A, n1 p42-50 1986.

Keywords: Crystals, Reprints, *Antineutrino-nucleon interactions, *Neutrino-nucleon interactions, Coherent scattering, Neutral currents.

Recently, Weber has analyzed the scattering of (anti)-neutrinos from a crystal, predicting that the neutrino-nuclear cross-section is multiplied by a coherence factor O(N squared), where N is the number of nuclei in the crystal. This leads to a macroscopic force on the crystal, for which he reports finding preliminary evidence using a fission reactor as a source of electron antineutrinos. Butler has since argued that a factor O(N squared) can enter only when the neutrino wavelength is comparable with the crystal dimension, indicating that coherence occurs only in this ultra-low-energy regime. The author considered the scattering from an ideal crystal of (anti)neutrinos with much smaller wave-lengths, comparable to the lattice spacing or considerably less, leading to coherent Bragg-Laue scattering, analogous to that of X-rays or thermal neutrons. In agreement with Butler, the author found that a coherence factor O(N squared) can occur only for neutrinos with ultra-long wave-lengths.

715,510
PB87-180915 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Polarized-Body Experiments and Equivalence Principles.
Final rept.,
W. T. Ni. 1986, 12p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Proceedings of the Marcel Grossman Meeting on General Relativity (4th), p1335-1346 1986.

Keywords: *Nuclear spin, Nuclear magnetic resonance, Polarization, *Equivalence principle, Lithium 7.

Mass and spin (or helicity in the case of zero mass) are the two independent invariants characterizing irreducible representations of the Poincare group. Both electroweak and strong interactions are strongly polarization-dependent. If there are spin-dependent effects in gravitation, the Einstein Equivalence Principle (EEP) would be violated at a certain appropriate level. In the paper empirical foundations of the Einstein Equivalence Principle are examined. An improved Hughes-Drever experiment with (7)Li is reported. Polarized-Body Experiment can probe previously-untouched aspects of EEP. These macroscopic polarized experiments are also ideal to probe long-range or semi-long-range spin-spin interactions (arions, axions, etc.) in particle physics. Progress of two ongoing polarized-body experiments -- torsion-balance experiment and fluid-fiber experiments-- are reported.

715,511
PB87-181269
(Order as PB87-181251, PC **A05**/MF **A01**)
National Bureau of Standards, Gaithersburg, MD.
CODATA (Committee on Data for Science and Technology) Recommended Values of the Fundamental Physical Constants (1986),
E. R. Cohen, and B. N. Taylor. 14 Jan 87, 11p
Prepared in cooperation with Rockwell International, Thousand Oaks, CA. Science Center.
Included in Jnl. of Research of the National Bureau of Standards, v92 n2 p85-95 Mar-Apr 87.

Keywords: *Fundamental constants, Least squares method, Recommendations, CODATA.

The paper gives the values of the basic constants and conversion factors of physics and chemistry resulting from the 1986 least-squares adjustment of the fundamental physical constants as recently published by the CODATA Task Group on Fundamental Constants and as recommended for international use by CODATA. The new, 1986 CODATA set of recommended values replaces its predecessor published by the Task Group and recommended for internatioonal use by CODATA in 1973.

715,512
PB87-181707 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Photon Scattering by the Proton and Deuteron in the Delta-Region.
Final rept.,
K. P. Schelhaas, B. Ziegler, and E. Hayward. 1984, 4p
Pub. in Few Body Problems in Physics, p299-302 1984.

Keywords: Absorption cross sections, Coherent scattering, Dispersion relations, Reprints, *Photon-proton interactions, *Photon-deuteron interactions.

The available data on photon scattering in the delta-region by the proton and the deuteron have been studied in an attempt to relate these results to the corresponding photon absorption cross sections through the optical theorem and the dispersion relation.

715,513
PB87-183091 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Evidence for Free-Electron-Like Stoner Excitations in Fe.
Final rept.,
D. R. Penn. Feb 87, 4p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Physical Review B 35, n4 p1910-1913, 1 Feb 87.

Keywords: *Iron, Free electrons, Scattering, Reprints, *Stoner excitations, Electron spin polarization.

An analysis of spin-polarized electron-energy-loss experiments in Fe is described which suggests that (1) free-electron-like Stoner excitations are far more probable than the usual type, and (2) exchange events involving relatively large energy losses are much more likely than direct scattering.

715,514
PB87-183109 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Neutron Optics.
Final rept.,
S. A. Werner, and A. G. Klein. 1986, 79p
Pub. in Methods of Experimental Physics 23, p259-337 1986.

Keywords: *Neutron diffraction, Crystals, *Neutron optics, Refractive index, Interferometry.

This is a review of recent advances in neutron optics. This chapter of the book contains the following subject areas: (1) The optical analogy and the refractive index; (2) Refraction and Reflection; (3) Diffraction from macroscopic objects; (4) Interference and interferometry; (5) Applications of neutron interferometry in fundamental physics; (6) Neutron optics in perfect crystals.

715,515
PB87-191151 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Critical Analysis of Soft X-ray Cross Section Data.
Final rept.,
E. B. Saloman, and J. H. Hubbell. 1987, 5p
Pub. in Nuclear Instruments and Methods in Physics Research A255, p38-42 1987.

Keywords: *Photon cross sections, *X rays, Reprints, *Soft x radiation, EV range 100-1000, KeV range 01-10, KeV range 10-100, Photoabsorption.

A project is in progress in the National Bureau of Standards (NBS) Photon and Charged Particle Data Center to collect and evaluate photon cross section data in the X-ray region 100 eV to 100 keV. The project complements earlier NBS evaluations and compilations which focused primarily on energies above 10 keV. The NBS collection of experimental total attenuation coefficients (10 eV to above 10 GeV) abstracted from the literature is now computerized to facilitate use and for future updates. These experimental results have been compared systematically with a theoretical photoabsorption calculation by Scofield, and also with a semi-empirical compilation by Henke et al Sample graphical comparisons of measured data with the Scofield theoretical results are presented here for silicon and uranium Silicon data from an International Union of Crystallography project are also presented. Discrepancies and uncertainties in the various experimental data sets are typically 5 to 50% or more in the soft X-ray region. However, systematic trends can be seen which suggest that the Scofield theoretical values, taken as a whole, are not improved by the Hartree-Slater to Hartree-Fock renormalization in the photon energy region.

715,516
PB87-191177 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Common Parametrizations of Electron Transport, Collision Cross Section, and Dielectric Strength Data for Binary Gas Mixtures.
Final rept.,
R. J. Van Brunt. 1987, 15p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Jnl. of Applied Physics 61, n5 p1773-1787, 1 Mar 87.

Keywords: *Dielectric breakdown, *Dielectric properties, *Collision cross sections, Sulfur hexafluoride, Dichlorodifluoromethane, Halohydrocarbons, Sulfur fluorides, Nitrogen, Ionization, Reprints, Methane/dichloro-difluoro, Binary mixtures.

Previously used parametrizations of dielectric strengths (electrical breakdown data) for gas mixtures in terms of electron collision and transport parameters are reviewed. A new method of fitting experimental data on dielectric strengths for binary electronegative gas mixtures is proposed, based upon the principal assumption that the electron kinetic energy distributions in the gas are Maxwellian. The method provides physical insight into such behavior as pressure-dependent or pressure-independent synergisms, and is useful in checking the consistency between dielectric strength data and available information on electron transport and ionization, attachment, and momentum transfer collision cross sections. The method is applied here to the mixtures SF6/N2, CCl2F2/N2, and SF6/CCl2F2.

715,517
PB87-191193 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Comment on 'Muon-Alpha-Particle Sticking Probability in Muon-Catalyzed Fusion'.
Final rept.,
M. Danos, B. Muller, and J. Rafelski. Mar 87, 3p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 35, n6 p2741-2743, 15 Mar 87.

Keywords: Nuclear fusion, Three body problem, Reprints, *Muon-catalyzed fusion, Muonic molecules.

Ceperley and Alder recently reported (Phys. Rev. A 31, 1999 (1985)) a calculation of the muon sticking probability using three-body Coulomb wave functions of the dt(muon) muomolecule. The authors comment here that such calculations require, in addition, the incorporation of the interplay of the nuclear reaction dynamics with the Coulomb problem.

715,518
PB87-191201 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Detuning Reduction of Muon Sticking in Resonant Muon-Catalyzed d-t Fusion.
Final rept.,
M. Danos, B. Muller, and J. Rafelski. Nov 86, 4p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 34, n5 p3642-3645 Nov 86.

Keywords: *Fusion reactions, Tritium, Deuterium, Reprints, *Muon-catalyzed fusion.

The nuclear fusion reaction in the (dt muon) (1+) molecule is affected by the presence of the muon in the relatively loosely bound mesomolecular orbit. Due to the sharing of the available energy between the muon and the nuclei in the final state, a muon attached to the recoiling alpha particle reduces the energy available to the nuclear fusion reaction by about 90 + or - 50 keV and thus detunes the resonant d-t reaction amplitude by an important factor.

715,519
PB87-197703 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Triplet P(sub 1) - triplet P(sub 2) Magnetic-Dipole Transition in the Ground Configuration of Co XX.
Final rept.,
R. U. Datla, J. R. Roberts, and W. L. Rowan. 1987, 2p
Contracts DOE-EA-77-A-01-6010, DE-AC05-78ET53043
Sponsored by Department of Energy, Washington, DC. Office of Energy Research.
Pub. in Jnl. of the Optical Society of America B 4, n3 p428-429 Mar 87.

Keywords: *Cobalt, *Electron transitions, Magnetic dipoles, Emission spectra, Reprints, *Plasma, Forbidden transitions, TEXT devices, Tokamak devices.

The magnetic-dipole transition between the triplet P1 and triplet P2 levels of 2s(2)2p(4) ground configuration in Co XX has been identified from the emission of a cobalt-seeded plasma in the Texas Experimental Tokamak. The wavelength for the transition is 930.2 + or - 0.3 A.

715,520
PB87-197711 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Development of a Standard 2.5-MeV Neutron Source.
Final rept.,
K. C. Duvall. 1987, 4p
Pub. in Nuclear Instruments and Methods in Physics Research B24/25, p893-896 1987.

Keywords: *Neutron sources, Deutron reactions, Neutron reactions, Calibrating, Standards, Reprints, US NBS, Neutron detection, MeV range 01-10.

The use of radiation for industrial purposes requires that the radiation measurement be reliable and accurate. The reliability of measurement may be verified by comparison measurements in standard radiation fields. Standard radiation sources produce stable, well-characterized reference radiation fields, which are determined with a high degree of accuracy. A 2.5-MeV neutron source produced with a low voltage ion generator and the D(d,n)(3)He reaction, is being developed at the National Bureau of Standards (NBS) for use as a standard radiation source. The source emission rate is stable within a well-defined neutron beam and determined by time-correlated associated-particle (TCAP) measurement. The measurement accuracy is expected to be comparable to that obtained in thermal and 14-MeV reference neutron fields. A standard 2.5-MeV neutron reference field could provide a means of establishing the 2.5-MeV spot energy as an intermediate energy normalization point.

715,521
PB87-198081 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Helium Condensation Observed in Small Angle Neutron Scattering.
Final rept.,
J. W. Lynn. 1986, 3p
Pub. in Physica 136B, p117-119 1986.

Keywords: *Helium, *Condensing, Phase transformations, Polycrystals, Powder(Particles), Ingots, Conduction, Reprints, Small angle neutron scattering.

Small angle neutron scattering (SANS) experiments have been carried out at low temperatures on powdered samples and polycrystalline ingots. A phase transition is observed in which the helium in the sample canister, used for thermal conduction purposes, condenses on the powder particles causing a large decrease in the width of the metallurgical SANS scattering. The phase transition (at constant volume) appears to be continuous and reversible.

715,522
PB87-201794 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Model for the Nuclear Effects of the d-t-muon Fusing State,
M. Danos, L. C. Biedenharn, and A. A. Stahlhofen. Apr 87, 26p NBSIR-87/3532
Prepared in cooperation with Duke Univ., Durham, NC. Dept. of Physics.

Keywords: Nuclear models, Mathematical models, Deuteron reactions, Tritons, Muon-catalyzed fusion.

A simple model is constructed which is used to illustrate the interplay between the strong nuclear forces and the Coulomb molecular forces in the description of the resonant d-t-muon fusion process.

715,523
PB87-203733 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Production of Porous Glass Microspheres by the Nuclear Track Technique.
Final rept.,
B. S. Carpenter, C. Horvath, and C. R. Vogt. 1986, 5p
Pub. in Nucl. Tracks Radiat. Meas. 11, n6 p289-293 1986.

Keywords: Cellular glass, Porous materials, Uranium 235, Etching, Reprints, *Microspheres, Fission tracks, Nuclear track technique.

The nuclear track technique (NTT) used to produce porous glass microspheres. The nuclear tracks randomly penetrate the material so that the resultant pores are interconnected. The result of the process is the creation of latest radiation-damaged regions by the charged particles emitted from the neutron-induced fissioning of (235)U, an isotope of uranium which in trace quantities either naturally occurs in or surrounds the microspheres. The damaged regions, or 'tracks' are then enlarged to optically visible tracks with the aid of a light microscope by chemically etching the material. The number of tracks or pores created both at the surface and within the microsphere is dependent upon the neutron fluence used to induce the fission of (235)U provided that the bulk uranium is constant in the microspheres. Pore diameter is determined by the concentration of the etching solution and the etching time.

715,524
PB87-203832 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Asymmetries in Spectral Lines Due to Plasma-Ion Broadening: Some Unusual Cases and a Possible Test for Plasma Homogeneity.
Final rept.,
D. W. Jones, G. Pichler, and W. L. Wiese. 1987, 6p
Pub. in Physical Review A 35, n6 p2585-2590, 15 Mar 87.

Keywords: *Argon, *Nitrogen, *Spectral lines, Plasmas(Physics), Reprints, *Line broadening.

The authors have measured the profiles of plasma-broadened and slightly red-or blue-shifted spectral lines of neutral argon and nitrogen in a wall-stabilized arc and have performed a detailed line-shape analysis with a computerized data acquisition and processing system. According to Stark broadening theory, isolated lines of neutral atoms in dense plasmas are mostly broadened by electron impact resulting in symmetrical Lorentzian profiles, and are also broadened by the plasma ions, which produce a small additional contribution to the width as well as asymmetries in the line profile. As in two earlier experimental studies, the authors have used the difference in symmetries to study the effects of ion broadening. In the paper they have extended their work to some unusual cases where lines exhibit relatively rare 'blue' shifts and where they study spectral transitions which are appreciaLy broadened because they origininate from high-lying atomic levels. The authors have also used the asymmetries for a check on plasma homogeneity.

715,525
PB87-203931 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Energy Deposition by Electron, Bremsstrahlung, and (60) Co Gamma-Ray Beams in Multi-Layer Media.
Final rept.,
S. M. Seltzer, and M. J. Berger. 1987, 16p
Pub. in Appl. Radiat. Isot. 38, n5 p349-364 1987.

Keywords: *Electron beams, *Gamma rays, *Bremsstrahlung, Monte Carlo method, Diffusion, Laminates, Penetration, Cobalt 60, Reprints, *Photon beams, *Energy absorption, ZTRAN computer program, Depth dose distributions.

The paper presents illustrative applications of the Monte Carlo code ZTRAN, which treats the penetration and diffusion of electrons and photons in targets consisting of multiple layers of different materials. The program, developed for one-dimensional geometry, is applicable to incident electron beams or photon beams, and takes into account all generations of the resulting electron-photon cascade. The Monte Carlo model is the same as that used previously in the ETRAN code for homogeneous media. The output of the program includes information about transmitted and reflected radiation, the spatial distribution of deposited energy and charge, and the energy spectrum of the radiation flux within the target. Results obtained with ZTRAN are presented for energy deposition in multi-layer targets irradiated with electron beams with energies from 0.4 to 60 MeV, by breamsstrahlung beams with end-point energies from 2 to 10 MeV, and by a (60)Co gamma-ray beam. Various comparisons indicate good agreement with experimental results.

715,526
PB87-218343 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Cooling Atoms with a Frequency Chirped Laser.
Final rept.,
W. D. Phillips, and J. V. Prodan. 1984, 8p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Coherence Quantum Opt. 5, p15-22 1984.

Keywords: Atomic beams, Laser beams, Reprints, *Laser cooling, *Beam cooling, *Sodium atoms, High resolution.

The authors have used a counterpropagating, near resonant laser beam to decelerate a beam of neutral sodium atoms. The frequency of the laser was scanned rapidly to compensate for the changing Doppler shift of the decelerating atoms.

715,527
PB87-219184 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Electron-Impact Excitation of Ti X.
Final rept.,
R. U. Datla, J. R. Roberts, and J. B. Mann. 1987, 6p
Contract DOE-EA-77-A-01-6010
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 35, n9 p3849-3854, 1 May 87.

Keywords: Spectral lines, Excitation, Electron irradiation, Reprints, *Titanium ions, Theta pinch.

The absolute intensities of TiX spectral lines emitted from a theta-pinch plasma are measured with a 2.2-m grazing-incidence monochromator which is calibrated in situ by using the branching-ratio technique. An electron temperature of 50 eV and an electron density of 2.2 X 10 to the 16th power/cc of the plasma are determined from the laser scattering. The measured ratios of line intensities are compared with predictions based on the corona model using the excitation rates calculated by a distorted-wave method. It is shown that such a comparison is possible even for line intensities affected by self-absorption provided their optical depth corrections cancel in the ratio. The experimental uncertainty in the measured ratios is estimated to be + or - 30%. The results show good agreement between experiment and predictions.

715,528
PB87-219192 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Magnetic-Dipole Wavelength Measurements in the n=3 Configurations of Highly Ionized Cu, Zn, Ga, As, Kr, and Y.
Final rept.,
J. R. Roberts, T. L. Pittman, J. Sugar, V. Kaufman, and W. L. Rowan. 1987, 5p
Contracts DOE-EA-77-A-01-6010, DE-AC04-78ET53043
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 35, n6 p2591-2595, 15 Mar 87.

Keywords: *Electron transitions, Magnetic dipoles, Spectral lines, Wavelengths, Reprints, *Copper ions, *Zinc ions, *Gallium ions, *Arsenic ions, *Krypton ions, *Yttrium ions, Isoelectronic atoms, Tokamak devices.

Magnetic dipole (M1) transitions between the levels of the ground configurations in the 3s(2)3p(x) Al-like through Cl-like and the 3s 3p Mg-like isoelectronic sequences of Cu, Zn, Ga, As, Kr, and Y have been observed. These elements were introduced into the

Texas experimental Tokomak plasma by laser ablation of metallic thin films and gas puffing. The spectral lines were recorded by using three monochromators with photoelectric detection and a spectrometer with a channel electron multiplier array detector. Twenty-eight newly observed M1 lines were measured and classified.

715,529
PB87-224127 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Multi-Particle Accelerator for Neutron and High-LET Radiation Research.
Final rept.,
R. G. Johnson. 1987, 7p
Pub. in Proceedings of Advisory Group Meeting on Properties of Neutron Sources, Leningrad, USSR, June 9-13, 1986, p29-35 1987.

Keywords: *Linear accelerators, Electron accelerators, Proton accelerators, Ion accelerators, Deuterons, Neutron beams.

The staff of the Center for Radiation Research of the National Bureau of Standards (NBS) has recently analyzed the neutron and high-LET radiation research program at NBS. From this study it was recommended that a full design study of a linear induction accelerator as a possible replacement for the present electron linac be performed. The paper is an updated report on the preliminary study on which that recommendation was based. The accelerator was designed to accelerate up to 250 A of electrons to 100 MeV with a pulse structure of 100-ns maximum length at repetition rates up to 1000 Hz. Because of the versatility of induction linacs, protons and other light ions can also be accelerated with currents limited only by space charge effects. The design includes provision for accelerating protons and deuterons at maximum currents of 2.5 A and 1.2 A, respectively. This accelerator would be a powerful and versatile tool for neutron and high-LET radiation research. Both continuous and quasi-monochromatic beams of neutrons would be available and the light ions could be used directly.

715,530
PB87-227096 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
Electromagnetic Scattering by a Thick Strip on a Half-Space.
Final rept.,
E. Marx. Jun 87, 74p NBS/TN-1236
Also available from Supt. of Docs as SN003-003-02808-8.

Keywords: *Electromagnetic scattering, *Light scattering, Dielectrics, Integral equations, Numerical solution, Computer applications.

The problem of the determination of the scattered fields from an incident plane monochromatic electromagnetic wave on a strip of finite thickness on a half-space is reduced to the numerical solution of integral equations for auxiliary fields defined on the interfaces. These fields are chosen so as to minimize their number. The derivation of the integral equations is given for a perfectly conducting strip on a perfectly conducting half-space, for a dielectric (or other homogeneous material) on a dielectric half space, and for a dielectric strip on a half-space of a different dielectric material. The vector FORTRAN programs written to carry out these calculations are briefly described, and sample outputs are shown.

715,531
PB87-227369 PC **A02**
Rockwell International, Thousand Oaks, CA. Science Center.
Fundamental Physical Constants: 1986 CODATA Recommended Values,
E. R. Cohen, and B. N. Taylor. Jul 87, 2p NBS/SP-731
Supersedes COM74-51190. Prepared in cooperation with National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.

Keywords: *Fundamental constants, Physical properties, International system of units.

The data tabulated here are abstracted from the report of the CODATA Task Group on Fundamental Constants (CODATA Bulletin No 63, November, 1986). Digits in parentheses represent one standard deviation uncertainty in the final digits of the given value, based on a least-squares analysis with five variables and 17 degrees of freedom. These values are recommended for general use by CODATA (the Committee on Data for Science and Technology of the International Council of Scientific Unions, 51 Blvd de Montmorency, 75016 Paris, France).

715,532
PB87-230835 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Regularities of Negative-Ion Resonances.
Final rept.,
C. W. Clark, and S. J. Buckman. 1987, 6p
Pub. in Jnl. of the Optical Society of America B 4, n5 p815-820 May 87.

Keywords: Reprints, *Sodium ions, *Ion resonances, Electron-atom collisions.

Some regularities of doubly excited negative-ion resonances can be identified by comparison of properties along isoionic sequences. The authors discuss in particular the b and c resonances of Ne(1-) and their analogs in neighboring elements, for which a variety of experimental and theoretical data are available. The analysis shows that the 'grandparent' model of these resonances provides an appropriate angular-momentum coupling scheme but that some essential dynamical features are not associated with distinctive properties of an excited electron pair.

715,533
PB87-230843 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Large-Angle Superelastic Electron Scattering from Na(3P).
Final rept.,
J. J. McClelland, M. H. Kelley, and R. J. Celotta. 1987, 4p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Physics B: Atomic and Molecular Physics 20, pL385-L388 1987.

Keywords: *Electron scattering, Elastic scattering, Orientation, Angular momentum, Momentum transfer, Reprints, *Electron-atom collisions, *Sodium atoms, Ev range 01-10.

Measurements of superelastic scattering of 2 eV electrons from oriented Na(3P) atoms have been carried out over the angular range 10 to 120 deg. Results are presented in terms of L perpendicular, the angular momentum transferred perpendicular to the scattering plane. Comparison is made with previous experiments at small angles, and with close-coupling calculations. Good agreement is seen with the earlier experimental work, but significant disagreement is seen with theory at angles beyond 40 deg.

715,534
PB87-230850 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Spin-Orbit and Exchange Effects in Elastic Scattering of Spin-Polarized Electrons from Spin-Polarized Na Atoms.
Final rept.,
J. J. McClelland, M. H. Kelley, and R. J. Celotta. 1987, 3p
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review Letters 58, n21 p2198-2200, 25 May 87.

Keywords: *Spin orbit interactions, Elastic scattering, Polarization(Spin alignment), Reprints, *Electron-atom collisions, *Sodium atoms, Electron spin polarization, Spin orientation, Exchange interactions.

The authors report the first measurements of elastic scattering of spin-polarized electrons from spin-polarized Na atoms as a function of scattering angle. The incident energy is 54.4 eV, and the angular range is 20 deg-135 deg. Data are presented as an exchange asymmetry and a spin-orbit asymmetry. Each asymmetry has a magnitude of 3% to 4%, indicating that both the exchange and spin-orbit interactions must be taken into account to predict their experimental results.

715,535
PB87-230892 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
High Resolution X-ray Experiments.
Final rept.,
R. D. Deslattes. 1987, 7p
Pub. in Nuclear Instruments and Methods in Physics Research B24/25, p52-58 1987.

Keywords: *X ray spectra, Reprints, Heavy ions, High resolution.

Accelerators provide highly charged ions for a variety of experimental studies. In applications involving accurate high resolution spectroscopy, care is needed to keep Doppler corrections manageable and reduce satellite problems. Some aspects of the motivation for such work are reviewed, along with techniques for trying to produce clean spectra.

715,536
PB87-230900 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Multivacancy Effects in Atomic and Molecular Spectra.
Final rept.,
R. D. Deslattes. 1986, 8p
Pub. in Australian Jnl. of Physics 39, p845-852 1986.

Keywords: *X ray spectra, Molecular structure, Emission spectra, Argon, Reprints.

Chemical applications of X-ray spectra are inhibited by the general occurrence of multivacancy processes. These manifest themselves in emission spectra as extra lines (or satellites) while opening of channels to these initial configurations leads to extra detail in absorption spectra. While there are a few simple cases where this situation has been more or less fully discussed, the more interesting areas are those which are both not simple and not understood. There is, however, a fairly general experimental procedure by which this complex situation could, in principle, be clarified. This involves carrying out high resolution emission spectroscopy as a function of exciting photon energy in regions containing both single and multiple vacancy thresholds. In earlier work summarized here, it was possible to demonstrate the procedure for a monatomic gas, argon. Subsequently, the authors have built and now operate a beamline designed specifically for such studies at the National Synchrotron Light Source (NSLS) in Brookhaven. Very recent results from this line and from a few experiments using conventional sources are summarized.

715,537
PB87-231437 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Microwave Cherenkov Radiation as a Diffraction Phenomenon.
Final rept.,
X. K. Maruyama, F. R. Buskirk, and J. R. Neighbours. 1987, 4p
Pub. in Nuclear Instruments and Methods in Physics Research B24/25, p921-924 1987.

Keywords: *Cerenkov radiation, *Diffraction, Microwaves, Reprints.

Cherenkov radiation results when the velocity of a charge particle exceeds the phase velocity of light in a medium. The wave front moves in a direction given by the Cherenkov angle (theta sub c) with respect to the direction of the moving charge. The appearance of the well defined Cherenkov cone is a consequence of the assumption of an interaction length which is infinite when compared to the wavelength of the radiation observed. When the interaction region of the charged particle with the medium is finite, the Cherenkov radiation pattern is modified by diffraction. This condition is readily attained for microwave wavelengths. Microwave Cherenkov radiation in air has been observed to exhibit the diffraction characteristic. Coherence of radiation emitted from all the electrons in a micropulse of an rf linac has also been observed. For electron bunches periodic in time with frequency (nu sub 0), radiation is emitted at (nu sub 0) and harmonics thereof, in contrast to the continuous frequency distribution observed for a single charge. These and additional consequences of a finite interaction length are discussed.

715,538
PB87-231445 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

Cerenkov and Sub-Cerenkov Radiation from a Charged Particle Beam.
Final rept.,
J. R. Neighbours, F. R. Buskirk, and X. K. Maruyama. 1987, 8p
See also AD-A180 612. Sponsored by Naval Sea Systems Command, Washington, DC., Naval Surface Weapons Center, Silver Spring, MD., and Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Jnl. of Applied Physics 61, n8 p2748, 15 Apr 87.

Keywords: *Cerenkov radiation, Electron beams, Charged particles, Reprints.

As a consequence of the relaxation of the phasing condition between the moving charge and radiated wave for finite beam path lengths, the Cerenkov peak is broadened and the threshold energy is lowered. A criterion for the threshold energy is developed which is applicable to charged beams consisting of a single charge bunch of finite size, as well as beams consisting of periodically repeated bunches.

715,539
PB87-231452 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Electromagnetic Excitation of the Delta Resonance in Nuclei.
Final rept.,
J. S. O'Connell, W. R. Dodge, J. W. Lightbody, and X. K. Maruyama. 1987, 9p
Pub. in Physical Review C 35, n3 p1063-1071 Mar 87.

Keywords: Electron scattering, Excitation, Nuclei(Nuclear physics), Reprints, *Delta resonances.

Inclusive cross sections for the proton and nuclear targets of A=4, 9, 12, and 16 were measured for 537 and 730 MeV electrons scattered at 37.1 deg. Systematic features of the continuum scattering data are compared with other electron scattering data and with photoabsorption measurements. A model calculation based on the isobar-hole formalism is compared with the data in the delta resonance region.

715,540
PB87-231460 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Possible Signature for and Early Hadronization Mechanisms of Quark-Gluon Plasma.
Final rept.,
J. Rafelski, and M. Danos. 1987, 5p
Pub. in Physics Letters B 192, n3/4 p432-436, 2 Jul 87.

Keywords: *Quarks, Reprints, *Gluons, Hadrons, Branching ratio, Particle production.

The authors consider the ratio of particle abundances radiated from quark-gluon plasma above mean thermal energy, and point out significant differences expected as compared with global particle yields. Two microscopic processes leading to medium to high E abundances are quantitatively considered, and the means of determining the plasma baryochemical potential are discussed. Strong anomalies in strange antibaryon spectra are found characteristic of the formation of quark-gluon plasma.

715,541
PB87-231478 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Effect of a Thin Conducting Sheet on the Fields of a Buried Magnetic Dipole.
Final rept.,
D. A. Hill. 1987, 9p
Sponsored by Bureau of Mines, Washington, DC.
Pub. in Electromagnetics 7, p71-79 1987.

Keywords: *Magnetic dipoles, Mines(Excavations), Magnetic fields, Reprints, Underground communication, Buried objects, Half space.

The effect of a thin conducting sheet on the fields of a subsurface vertical magnetic dipole has been analyzed. The integral representation of the fields has been evaluated numerically, and numerical results for the vertical magnetic field above the source at the surface are presented in parametric form. It is found that the predicted fields give better agreement with previous transmission measurements than do the fields of a homogeneous half-space model.

715,542
PB87-233391 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Electron-Ion Collisions: Dielectronic Recombination and Ionization.
Final rept.,
A. Muller, G. H. Dunn, D. W. Mueller, N. Djuric, B. D. DePaola, D. S. Belic, C. Timmer, K. Tinschert, C. Achenbach, G. Hofmann, R. Sauer, E. Salzborn, and R. Becker. 1987, 11p
Sponsored by Department of Energy, Washington, DC.
Pub. in Nuclear Instruments and Methods in Physics Research B23, p254-264 1987.

Keywords: Ionization, Reprints, *Electron-ion collisions, *Dielectronic recombination, Colliding beams, Magnesium ions, Krypton ions.

Inelastic electron-ion collisions have been studied by using crossed-beam techniques. The effects of state mixing by extrinsic fields in the collision region were investigated for the dielectronic recombination process Mg(1+)(3s)+e -> Mg(3p, nl) -> Mg(3s,nl)+h(nu). By field ionization of the Rydberg atoms produced, cross sections sigma(n) have been measured. The observed large changes of sigma(n) with alteration of the extrinsic field provided the first incontrovertible experimental evidence that dielectronic recombination can be changed by external fields. Absolute cross sections for electron impact single, double and triple ionization of singly and multiply charged krypton ions were measured. Contributions of inner-shell ionization with subsequent autoionization to double and triple ionization are identified.

715,543
PB87-233482 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Harmonic Rejection Scheme for X-ray Monochromators.
Final rept.,
T. Jach, J. P. Kirkland, P. Wolf, and R. Neiser. 1987, 4p
Contracts N00014-85-C-2628, N00014-86-K-2004
Sponsored by Naval Research Lab., Washington, DC.
Pub. in Nuclear Instruments and Methods in Physics Research A257, p443-446 1987.

Keywords: Reprints, *Harmonics, *X ray diffraction, Monochromators.

X-ray monochromators based on the diffraction of the radiation from crystals suffer from the fact that higher orders of diffraction are always possible. The authors have implemented a scheme for a double-crystal monochromator used with synchrotron radiation which eliminates the problem to a selectable degree. Using two detectors with different sensitivities to the fundamental and harmonic radiation in the second crystal ac feedback loop, the authors are able to discriminate against the harmonic radiation, even while scanning the monochromator in energy.

715,544
PB87-233920 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Relations between Electron-Molecule Scattering and Swarm Experiments and Analysis.
Final rept.,
A. V. Phelps. 1985, 15p
Pub. in Swarm Studies and Inelastic Electron-Molecule Collisions, p127-141 1985.

Keywords: *Collision cross sections, Momentum transfer, Elastic scattering, Inelastic scattering, Reprints, *Electron-molecule collisions.

The purposes of the paper are to review the basic relations between electron-molecule collision cross sections and electron transport and reaction coefficients, and to summarize the current state of research in the area of the determination of cross sections from swarm data.

715,545
PB87-233961 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
New Test of General Relativity: Measurement of de Sitter Geodetic Precession Rate for Lunar Perigee.
Final rept.,
B. Bertotti, I. Ciufolini, and P. L. Bender. 16 Mar 87, 4p
Pub. in Physical Review Letters 58, n11 p1062-1065, 16 Mar 87.

Keywords: *General relativity, Precession, Tests, Reprints, *Lunar range finding, *Lunar orbits, Very long base interferometry, Perigees.

According to general relativity, the calculated rate of motion of lunar perigee should include a contribution of 19.2 msec/yr from geodetic precession. The authors show that existing analyses of lunar-laser-ranging data confirm the general-relativistic rate for geodetic precession with respect to the planetary dynamical frame. In addition, the comparison of Earth-rotation results from lunar laser ranging and from very long-baseline interferometry (VLBI) shows that the relative drift of the planetary dynamical frame and the extragalactic VLBI reference frame is small. The estimated accuracy is about 10%.

715,546
PB87-234068 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Glueball and Meson Spectroscopy.
Final rept.,
S. Meshkov. 1986, 15p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Proceedings of Aspen Winter Particle Physics Conference (2nd), Aspen, CO., January 12-18, 1986, p87-101.

Keywords: Reviews, *Glueballs, *Meson spectroscopy, Flavor model.

The status of various glueball properties such as level ordering and mass predictions is reviewed and updated. The 0(-+) and 2(++) systems of mesons and glueball candidates are discussed in detail, using the latest data, with the primary goal of deciding which of them might be considered as glueballs. The best candidates, at present, are the g(T)(2050), g(T')(2050), and g(T double prime)(2350) 2(++) phi phi resonances. That they are flavor singlets must, however, be verified via the detection of other decay modes and the subsequent comparison of their branching ratios.

715,547
PB88-100706 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Nuclear Orientation Thermometry.
Final rept.,
H. Marshak. 1986, 52p
See also report dated Feb 83, PB84-115831.
Pub. in Low-Temperature Nuclear Orientation, Chapter 16, p769-820 1986.

Keywords: *Temperature measurement, Low temperature research, Nitric oxide, Gamma rays, Reprints, *Nuclear orientation thermometer, *Gamma ray anisotropy thermometry.

The authors have reveiwed the current state of NO thermometry and have described the most frequently used thermometers in considerable detail. Techniques of preparation and criteria for choice (i.e., temperature range, gamma-ray energy, radioactive heating, and magnetic field requirements) have been summarized. It is clear that measurement of temperature accurate to 1-2% is relatively straightforward, while improving precision to approx.0.1% demands great attention to experimental detail. Although most of the NO thermometers presently used operate in a rather limited temperature range (approx.1 to approx. 100 mK), new thermometers are being investigated to extend the range to both higher and lower temperatures. Rare-earth systems (e.g., 166mHoHo(hcp), with their strong magnetic interactions should be useful up to approx. 1 K, whereas systems weith either weak magnetic (e.g. BF NO thermometers, see ch. 9) or pure electric QI (e.g. 190IrRe (hcp) should be useful to approx. 0.1mK. The authors have seen the spread of NO thermometers to experiments in the wider low-temperatures community, both to measure temperatures and thermal gradients, to calibrate secondary thermometers, and in precise comparison experiments with other primary thermometers.

715,548
PB88-109830 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.

XCOM: Photon Cross Sections on a Personal Computer,
M. J. Berger, and J. H. Hubbell. Jul 87, 29p NBSIR-87/3597
Sponsored by Department of Energy, Washington, DC. Office of Health and Environmental Research.

Keywords: *Photon cross sections, Scattering, Computation, Pair production, X rays, Gamma rays, Bremmstrahlung, XCOM computer program, KeV range 01-10, KeV range 10-100, KeV range 100-1000, MeV range 01-10, MeV range 10-100, MeV range 100-1000, GeV range 1-10, GeV range 10-100.

A computer program and data base are presented which can be used to calculate, with a personal computer, photon cross sections for scattering, photoelectric absorption and pair production, as well as total attenuation coefficients, in any element, compound or mixture, at energies from 1 keV to 100 GeV.

715,549
PB88-117445 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Giant 4p-Quadrupole Resonances in the Rare Earths.
Final rept.,
J. A. D. Matthew, F. P. Netzer, C. W. Clark, and J. F. Morar. 1987, 7p
Pub. in Europhysics Letters 4, n6 p677-683, 15 Sep 87.

Keywords: *Cerium, X ray absorption, Rare earth elements, Reprints, *Giant resonance.

X-ray absorption of Ce, obtained by partial secondary yield, is compared with previously obtained electron-energy loss measurements in reflection mode. The absence of a strong feature below 4p(3/2) threshold in photon absorption provides confirmation that the peak in EELS is nondipole in character. Theoretical analysis supports interpretation in terms of a p-f giant quadrupole resonance, a result which broadens the analogy between giant resonances in atomic and nuclear physics.

715,550
PB88-117452 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Term Dependence in the Hartree-Fock Approximation for Heavy Atoms.
Final rept.,
C. W. Clark. 1987, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Physical Review A 35, n11 p4865-4868, 1 Jun 87.

Keywords: *Hartree-Fock approximation, Atomic structure, Electron irradiation, Rare earth elements, Reprints, Giant resonance, Photoabsorption, Electron-atom collisions.

Cases of substantial term dependence are found in the Hartree-Fock approximation for heavy atoms that are not attributable to large dipole exchange interaction. They may be associated with 'giant resonances' in electron impact excitation and ionization.

715,551
PB88-117692 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Thermal Conductivity.
Final rept.,
J. G. Hust. 1986, 23p
Pub. in CODATA Bulletin, n60 p3-7, 12-19, 25-28, 35, 39-43 1986.

Keywords: *Thermal conductivity, *Aluminum, *Copper, *Iron, *Tungsten, Electrical resistivity, Cryogenics, Reprints, Temperature dependence.

Literature data on the thermal conductivity of commercially pure aluminum, copper, iron, and tungsten specimens have been collected, coded, critically analyzed, and correlated with analytical techniques based on theoretical and empirical equations. The resulting functions are presented and used to generate tables and graphs of thermal conductivity as a function of temperature and residual resistivity ratio (RRR). An annotated bibliography of references is included. Discussions are included on the variations in thermal conductivity caused by chemical impurities, physical defects, size effects, and magnetic fields. Smoothed values are presented for temperatures from 1 K to near the melting point and for a large range of RRR values.

715,552
PB88-118047 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Laser Spectroscopy of Trapped Atomic Ions.
Final rept.,
W. M. Itano, J. C. Bergquist, and D. J. Wineland. 1987, 6p
Pub. in Science 237, p612-617, 7 Aug 87.

Keywords: Atomic spectroscopy, Frequency standards, Reprints, *Laser spectroscopy, *Ion storage, Ion trapping, Laser cooling.

Recent developments in laser spectroscopy of atomic ions stored in electromagnetic traps are reviewed with emphasis on techniques that appear to hold the greatest promise of attaining extremely high resolution. Among these techniques are laser cooling and the use of single, isolated ions as experimental samples. Doppler shifts and other perturbing influences can be largely eliminated. Atomic resonances with line widths of a few parts in 10 to the 11th power have been observed at frequencies ranging from the radio frequency to the ultraviolet. Experimental accuracies of one part in 10 to the 18th power appear to be attainable.

715,553
PB88-121009 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Simple Electrodes for Quadrupole Ion Traps.
Final rept.,
E. C. Beaty. 1987, 5p
Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of Applied Physics 61, n6 p2118-2122, 15 Mar 87.

Keywords: *Electrodes, Mass spectroscopy, Reprints, *Ion traps, Penning traps.

Quadrupole traps for charged particles often involve electrodes with portions carefully machined to the shape of hyperboloids. It is shown here that the more important features of such traps can be achieved using electrode shapes which are much easier to fabricate. Detailed numerical calculations are reported on some sample electrodes. The numerical method can be easily extended to other shapes which accommodate specialized laboratory situations.

715,554
PB88-121017 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Long-Term Behaviour of Cavity Phase Difference in NBS-6.
Final rept.,
A. De Marchi, and R. E. Drullinger. 1987, 3p
Pub. in Metrologia 24, p23-25 1987.

Keywords: *Frequency standards, Phase shift, Reviews, Reprints.

A critical review of all beam-reversal phase-shift measurements carried out on NBS-6 (NBS-5) since 1973 is presented. The analysis takes into account a recent study of frequency shifts in atomic-beam frequency standards resulting from overlapping tails of adjacent lines. A strongly correlated variation of the cavity phase difference with time is shown, which appears to fit nicely on an exponential decay curve with a time constant of 3.7 years. The suggestion is made that some mechanical relaxation in the microwave structure may be responsible for the phenomenon. Furthermore, the line-pulling model seems to suggest a better explanation for observations previously attributed to distributed cavity phase shift. Verification of these interpretations through more involved evaluations may allow substantial reductions in the error budget for the standard.

715,555
PB88-121041 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Sympathetic Cooling of Trapped Ions: A Laser-Cooled Two-Species Nonneutral Ion Plasma.
Final rept.,
D. Larson, J. Bergquist, J. Bollinger, W. Itano, and D. Wineland. 1986, 4p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Physical Review Letters 57, n1 p70-73, 7 Jul 86.

Keywords: Reprints, *Ion storage, *Mercury ions, *Beryllium ions, Laser cooling, Ion traps, Mercury 198, Beryllium 9, High resolution, Penning traps, Plasma.

Sympathetic cooling of trapped ions has been demonstrated in an experiment where (198)Hg(1+) ions were confined in a Penning ion trap with laser-cooled (9)Be(1+) ions. (198)Hg(1+) temperatures below 1 K were achieved. Ion plasma sizes, shapes, and rotation frequencies were measured. Dramatic changes in the (9)Be(1+) plasma were observed when the (198)Hg(1+) ions were introduced into the trap. These observations are consistent with the prediction of centrifugal separation for ions of different charge-to-mass ratios.

715,556
PB88-121058 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Laser-Cooling Limits and Single-Ion Spectroscopy.
Final rept.,
D. J. Wineland, W. M. Itano, J. C. Bergquist, and R. G. Hulet. 1987, 13p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in Physical Review A 36, n5 p2220-2232, 1 Sep 87.

Keywords: Atomic spectroscopy, Reprints, *Laser cooling, Penning traps, Ion traps, Ion storage, Laser spectroscopy.

The limitations to the achievement of low kinetic energies for laser cooling of single ions confined in electromagnetic traps are discussed. Sideband cooling of an ion in an rf (Paul) trap is reexamined, including the effects of finite laser bandwidth and the energy of the rf micromotion. The micromotion is the oscillatory motion of the ion at the same frequency as the rf voltage applied to the trap electrodes. Sideband cooling of ions in a Penning trap is examined for the first time. In both cases, cooling to the zero-point energy of the ion in the trap should be possible and a method for verifying this condition is suggested. The implications for high-resolution, high-accuracy spectroscopy are investigated. Under certain conditions, the uncertainty in the second-order Doppler shift may be significantly less than 1 part in 10 to the 18th power.

715,557
PB88-121090 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Recombination-Line Intensities for Hydrogenic Ions-I. Case B Calculations for H I and He II.
Final rept.,
D. G. Hummer, and P. J. Storey. 1987, 20p
Contract NAGW-766
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Monthly Notices of the Royal Astronomical Society 224, p801-820 1987.

Keywords: *Hydrogen, Line spectra, Reprints, *Radiative recombination, *Helium ions.

The relative intensities of H1 and He II recombination lines are calculated, including full collisional effects, for a considerably larger range of temperature, density and principal quantum numbers than before, Case B of Baker & Menzel is assumed, and tables of line opacities are also presented to enable the assumption of negligible optical depth in all but the Lyman series to be checked. Collisional excitation of the n=3 levels from both n=1 and n=2 states is considered, and is found to invalidate Case B theory in some conditions which depend on electron density and the Lyman-alpha escape probability. The regimes of temperature and particle density for which Case B is valid are discussed. Newly calculated collision strengths for the n=1,2 and 3 states of the He(1+) are tabulated.

715,558
PB88-121116 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Experimental Measurements of Field Effects on Dielectronic Recombination Cross Sections and Rydberg Product-State Distributions.
Final rept.,
A. Muller, D. S. Belic, B. D. DePaola, N. Djuric, G. H. Dunn, D. W. Mueller, and C. Timmer. 1987, 15p
Contract DE-AI01-76PR06010
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review A 36, n2 p599-613, 15 Jul 87.

Keywords: Electric fields, Cross sections, Reprints, *Magnesium ions, Dielectronic recombination, Electron-ion collisions, Rydberg states.

Experimental details are presented for the measurement of the effects of extrinsic electric fields on cross sections and Rydberg product-state distributions for dielectronic recombination of Mg(1+) with electrons. A new type of Rydberg state detector is described. Experimental results for dielectronic recombination in the presence of fields are presented for three field values, and these results are compared with theoretical calculations.

715,559
PB88-121926 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Resolution and Measurement in the Scanning Electron Microscope.
Final rept.,
M. T. Postek. 1987, 4p
Pub. in Proceedings of Annual Meeting Electron Microscope Society of America (45th), Baltimore, MD., August 2-7, 1987, p534-537.

Keywords: *Electron microscopes, *Resolution, Metrology, Measurement, *Scanning electron microscopes.

The term ultimate resolution or resolving power is the very best performance that can be obtained from a scanning electron microscope (SEM), given the optimum instrumental conditions and sample. However, as it relates to SEM users, the conventional definitions of the figure are ambiguous. The numbers quoted for the resolution of an instrument are not only theoretically derived, but are also verified through the direct measurement of images on micrographs. However, the samples commonly used for the purpose are specifically optimized for the measurement of instrument resolution and are most often not typical of the sample used in practical applications.

715,560
PB88-122023 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Calibration of GPS Equipment at Time and Frequency Standards Laboratories in the USA and Europe.
Final rept.,
W. Lewandowski, M. Weiss, and D. Davis. 1987, 17p
Sponsored by Bureau International de l'Heure, Sevres (France).
Pub. in Proceedings of the Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (18th), Washington, DC., December 2-4, 1986, p265-281 1987.

Keywords: *Atomic clocks, Frequency standards, Time standards, *Calibration, Synchronous platforms, Interlaboratory comparisons, Time delay.

The method of clock comparisons using GPS satellites in common view is now widely used in the time laboratories which participate in the international unification of time under the coordination of the Bureau International de Poids et Measures (BIPM). The authors report here the results of a campaign of calibration of time delay in GPS receivers under the auspices of the BIPM with the assistance of the National Bureau of Standards (NBS), Boulder, CO. The trip in the United States and in Europe was performed from the 29 September 1986 to 27 October 1986. The Institutes and Laboratories visited during the trip are listed.

715,561
PB88-122031 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Progress Toward an Optically Pumped Cesium Beam Frequency Standard.
Final rept.,
R. E. Drullinger, J. Shirley, D. J. Glaze, L. W. Hollberg, and A. De Marchi. 1986, 4p
Pub. in Proceedings of Annual Symposium on Frequency Control (40th), Philadelphia, PA., May 1986, p428-431 Oct 86.

Keywords: *Cesium frequency standards, Optical pumping, Atomic beams, Cesium beams.

The National Bureau of Standards is planning to build a cesium-beam, primary frequency standard based on the application of optical pumping for state selection and atom detection. The goal is an accuracy of 10 to the 14th power. Elimination of state-selecting magnets together with polarization control of the optical pumping should eliminate effects of Majorana transitions. Optical pumping should also permit simultaneous operation of counter-propagating beams with closer trajectory retrace than is possible with magnetic state selection. Noise measurements have shown that simple monolithic diode lasers produce too much FM noise to allow one to reach the shot noise limit in atom detection. Techniques for control of diode noise and linewidth are being tried and compared.

715,562
PB88-122106 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Evaluation of Thermophysical Property Measurement Methods and Standard Reference Materials.
Final rept.,
A. E. Beck, R. Berman, F. Cabannes, J. G. Hust, M. L. Minges, and G. K. White. 1986, 68p
Pub. in CODATA Bulletin, n60 pi-61 1986.

Keywords: *Thermal conductivity, *Electrical resistivity, *Thermal diffusivity, Thermophysical properties, Specific heat, Laboratories, Reprints, Standard reference materials.

The fundamental objective of the Task Group project was to improve the quality of thermophysical property data on solid materials generated worldwide. The vehicle for accomplishing this was an international measurement program, covering a very board temperature range (4 to 2500 K), which examined both the measurement techniques and the standard reference materials (SRM's) used in connection with the experimental methods for calibration and evaluation of techniques. The measurement program focused on determination of thermal conductivity and electrical resistivity, as, for conductors, these properties can be interrelated quantitatively. Measurement of thermal diffusivity (thermal conductivity divided by volumetric heat capacity) was also included, as this is a popular and relatively simple method of thermal transport property measurement; heat capacity was, of course, determined also. Overall, 19 laboratories representing nine countries conducted measurements and produced 61 sets of new data. A listing of the participating laboratories and the principal investigators is included.

715,563
PB88-122213 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Experimental Study of Path Independence of the J-Integral in an Aluminum Tensile Panel.
Final rept.,
J. F. Cardenas-Garcia, D. T. Read, and J. C. Moulder. 1986, 10p
Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.
Pub. in Proceedings of the SEM (Society for Experimental Mechanics, Inc.) Spring Conference on Experimental Mechanics, New Orleans, LA., June 8-13, 1986, p448-457.

Keywords: *Stress analysis, Stresses, Deformation, Cracks, Fracture properties, Strains, Aluminum, Panels, Reprints, J-integral.

A newly devised video-optical experimental technique allows for the automated determination of the in-plane, plane stress components of the infinitesimal deformation tensor at discrete locations over an area of interest in a loaded specimen. It was used to evaluate a square area enclosing the central crack in a 5052-H32 aluminum panel loaded in tension. These experimental strain tensor values were then used to evaluate the J-integral assuming that the mechanical behavior of the plate material is approximated by deformation plasticity theory.

715,564
PB88-129325 PC **A12**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Technical Activities 1987, Center for Radiation Research,
C. E. Kuyatt. Oct 87, 267p NBSIR-87/3571
See also PB87-140232.

Keywords: *Research projects, Atomic physics, Spectroscopy, Atom collisions, Ionization potential, Plasma radiation, Nuclear physics, Ionizing radiations, Radiation sources, Radiometric analysis.

The report summarizes research projects, measurement method development, calibration and testing, and data evaluation activities that were carried out during Fiscal Year 1987 in the NBS Center for Radiation Research. These activities fall in the area of atomic and plasma radiation, radiation physics, radiometric physics, radiation sources and instrumentation, ionizing radiation, and nuclear physics.

715,565
PB88-129770 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
STEM Calibration by Analysis of Hough Transformed Images of Optical Grating Replicas.
Final rept.,
D. S. Bright, and E. B. Steel. 1985, 4p
Pub. in Microbeam Analysis 20, p155-158 1985.

Keywords: *Electron microscopy, Electron microscopes, Gratings(Spectra), Reprints, *Calibration, Image analysis, Hough transformation.

A STEM calibration technique is presented that features the automated measurement of line spacings on images of shadowed replicas of optical gratings. Rather than averaging a number of intensity profiles, the method involves averaging the data over most of the image by use of the Hough transform. The method works over a wide magnification range, and for any orientation of the lines.

715,566
PB88-129796 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Office of Nondestructive Evaluation.
Modeling of Pressure-Induced Far Infrared Absorption Spectra: Molecular Hydrogen Pairs.
Final rept.,
J. Borysow, L. Trafton, L. Frommhold, and G. Birnbaum. 1985, 11p
Pub. in Astrophysical Jnl. 296, n2 pt1 p644-654, 15 Sep 85.

Keywords: *Hydrogen, *Absorption spectra, Planetary atmospheres, Far infrared radiation, Molecules, Reprints, Pressure effects, Spectral functions.

The collision-induced translational-rotational absorption coefficient for molecular hydrogen pairs has been computed from the fundamental theory by Meyer, Frommhold, and Birnbaum for temperatures from 40 to 300K. Over the frequency range from about 30 to 1,500/cm, theoretical and measured profiles are in close agreement (+ or - 5%). The theory is capable of generating reliable spectra of hydrogen pairs at temperatures for which no laboratory measurements exist. The procedures described in the work, although used for the modeling of the H2-H2 induced spectra, are more broadly relevant to the general problem of fitting line shapes. An application for this work is the accurate computations of radiative transfer in modeling the atmospheres of the outer planets.

715,567
PB88-129804 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Phase Shift and Multiple Scattering in Small Angle Neutron Scattering: Application to Beam Broadening from Ceramics.
Final rept.,
N. F. Berk, and K. Hardman-Rhyne. 1986, 5p
Pub. in Physica B: Physics of Condensed Matter and C: Atomic, Molecular and Plasma Physics, Optics 136, n1-3 p218-222 Jan/Feb 86.

Keywords: *Neutron scattering, *Ceramics, *Aluminum oxide, Phase shift, Small angle scattering.

The single-particle cross-section for small angle neutron scattering from a uniform sphere of arbitrary size is incorporated into a general theory of small angle incoherent multiple scattering from a monodisperse population of particles. The synthesis of these formalisms provides a theory of multiple scattering that is applicable over a wide range of values of the single-particle phase shift, nu--encompassing the transition from diffraction (nu -> 0) to refraction (nu -> infinity) --and a useful tool for extracting particle size and volume fraction from SANS data dominated by multiple scattering. The methods have been used to characterize high purity alumina powder, and have obtained good quantitative agreement with results from laser light scattering and x-ray sedigraph microscopy.

715,568
PB88-138821 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Millisecond Pulsar Rivals Best Atomic Clock Stability.
Final rept.,
L. Rawley, D. Stinebring, J. Taylor, M. Davis, and D. W. Allan. 1987, 14p
Pub. in Proceedings of the Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (18th), Washington, DC., December 2-4, 1986, p453-466 1987.

Keywords: *Atomic clocks, *Frequency stability, Interstellar matter, *Pulsars, Total electron content.

The measurement time residuals between the millisecond pulsar PSR 1937+21 and the reference atomic time scale UTC(NBS) have been significantly reduced. Analysis of data for the most recent 768 day period indicates a fractional frequency stability, (modified Allan variance) of 3 x 10 to the -15th power for an integration time of 240 days. The improved stability relative to the earlier analysis is a result of three significant improvements. Using the information from these measurements allowed us to partially account for dispersion caused by free electrons along the 12,000 to 15,000 light year path from the pulsar to the earth. With data taken every two weeks, the final residuals are nominally characterized by a white phase noise at a level of 243 ns. The total interstellar electron content was found to follow a random walk by up to 12 ppm over the 768 days.

715,569
PB88-138987 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Survey and Compilation of Stopping Power Data Conducted by the International Commission on Radiation Units and Measurements.
Final rept.,
M. Inokuti, and M. J. Berger. 1987, 7p
Contract W-31-109-eng-38
Sponsored by Department of Energy, Washington, DC.
Pub. in Nuclear Instruments and Methods in Physics Research B27, p249-255 1987.

Keywords: *Dosimetry, Electrons, Positrons, Reprints, *Stopping power, ICRU, International Commission on Radiation Units and Measurements.

One of the principal objectives of the International Commission on Radiation Units and Measurements (ICRU) is to recommend internationally acceptable values of physical quantities relevant to radiation measurements and radiological dosimetry. Among a large variety of the physical quantities treated by the ICRU, the stopping power is one of the most fundamental. In 1984, the ICRU issued its Report (No. 37) concerning stopping power for electrons and positrons. Currently the ICRU is preparing a report on data for protons and alpha particles. Work planned for the future concerns heavier charged particles, which include most importantly carbon, oxygen, and nitrogen ions resulting from neutron irradiation of human tissues. The task requires, in addition to mere collection of published data, critical evaluation of those data for their reliability, precision, and accuracy. The critical evaluation in turn requires full knowledge of experimental and theoretical methods for the determination of stopping power. The present article points out key issues and major unsolved problems involved in the determination.

715,570
PB88-139035 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.
Linacs for Microtrons and Pulse Stretchers.
Final rept.,
S. Penner. 1986, 5p
Pub. in Proceedings of the Linear Accelerator Conference, Stanford, CA., June 2-6, 1986, p416-420.

Keywords: *Electron accelerators, *Linear accelerators, Microtrons.

For many applications, continuous (CW) beams of electrons are strongly preferred over the low duty cycle beams available from RF linacs. The two preferred methods for realizing high-energy CW beams are (1) a pulsed linac followed by a pulse-stretcher ring, and (2) a recirculating CW accelerator. In both methods, a high performance electron linac is required. Recent advances in the technology and understanding of standing wave structures appear to make them preferable to travelling wave linacs for the pulse-stretcher method. Recirculating linacs, whether of the racetrack microtron type or some other topology, are built with CW standing wave linacs. Both room temperature and superconducting structures have been used. Recent exciting advances in superconducting structures make them the structures of choice for high energy CW electron accelerators.

715,571
PB88-141080 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Measurement of Electric Field and Ion-Related Quantities.
Final rept.,
R. H. McKnight. 1987, 33p
Sponsored by Department of Energy, Washington, DC.
Pub. in Air Ions: Physical and Biological Aspects, Chapter 3, p23-55 1987.

Keywords: *Electric fields, Atmospheric electricity, Electrical measurement, Space charge, *Ion counters, Ion detection.

Measurements of various quantities to describe the electrical characteristics of the atmosphere have been made for many decades by atmospheric scientists using a variety of instruments and measurement techniques. The purpose of this chapter is to describe those techniques which have application in present day ion-related research. References chosen are representative and it is not intended that they be bibliographic in nature. Summaries, specialized texts and proceedings of conferences are excellent sources for more detailed discussions of particular topics and should be consulted by the interested reader.

715,572
PB88-141148 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Accurate Spectroscopy of Single-Electron and Single-Vacancy Ions.
Final rept.,
R. D. Deslattes. 1985, 14p
Pub. in AIP (American Institute of Physics) Conference Proceedings, n136 p80-93 1985.

Keywords: *X ray spectroscopy, X ray spectra, Wavelengths, Standards, Reprints, Lamb shift.

The report focuses on one-electron and one-vacancy spectroscopy in the X-ray region, where data are of adequate or nearly adequate quality to be of possible interest to the workshop, i.e. data where relativistic and QED effects are not merely noticeable but where measurements having noticeable significance may be found or at least hoped for. Several experimental difficulties are discussed, including production of clear and interpretable spectra; securing appropriate wavelength normalization; and problems of spectator electrons and spectator vacancies. Available experimental results are summarized, and an attempt is made to combine information from single-electron and single vacancy spectra. Brief discussion of some directions in which future progress may be anticipated is also included.

715,573
PB88-141387 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
National Bureau of Standards Cold Neutron Research Facility.
Final rept.,
R. S. Carter. 1987, 3p
Pub. in Transactions of the American Nuclear Society 55, 0003-018X, p188-190 1987.

Keywords: *Neutron sources, Reprints, *Cold neutrons, *Research facilities, US NBS.

In 1984 a National Academy of Sciences Committee was set up to review the need for major facilities in the area of materials and condensed matter science and to make recommendations in priority order. Their top priority for smaller facilities that could be developed quickly to enhance existing programs was the development of cold neutron research facilities (CNRFs) including large neutron guide halls and associated instruments. The National Bureau of Standards (NBS) proposed such a facility and received congressional funding in FY87. The NBS CNRF takes advantage of the large (22 inch D) beam hole originally designed into the reactor to install a large cold source that will be viewed by 8 neutron guides. The guides will transport the neutrons into a new neutron guide hall, 200 feet long and 100 feet wide. NBS will build ten major instruments and it is anticipated that another five will be developed by Participating Research Teams. It is intended that the facility will be a national center for neutron research, and some fraction of all instruments will be made available to outside users at no charge.

715,574
PB88-141403 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Introduction to 'Atomic Excitation and Recombination in External Fields'.
Final rept.,
M. H. Nayfeh, and C. W. Clark. 1985, 14p
Pub. in Atomic Excitation and Recombination in External Fields, p1-14 1985.

Keywords: *Atomic spectra, Stark effect, Zeeman effect, Excitation, Meetings, Dielectronic recombination, Rydberg states, Recombination.

Introduction to the book 'Atomic Excitation and Recombination in External Fields,' which contains contributions from participants at the workshop 'Atomic Spectra and Collisions in External Fields' held at NBS on October 22-23, 1984. Summarizes the separate articles (about 30) in the book, and indicates the ways in which they are related to each other and to other problems of atomic and molecular physics.

715,575
PB88-141411 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Electron-Atom Scattering in External Fields.
Final rept.,
C. W. Clark. 1985, 21p
Pub. in Atomic Excitation and Recombination in External Fields, p17-37 1985.

Keywords: Electric fields, Magnetic fields, Stark effect, Zeeman effect, *Electron-atom collisions, Photoionization, Rydberg states, Negative ions, Photodetachment.

Recent theoretical work on problems of electron-atom scattering in static external fields is reviewed. The processes of greatest experimental interest involve half-collisions, e.g. photoionization of atoms and photodetachment of negative ions in electric or magnetic fields. Attention is therefore focused on phenomena occurring at near-threshold energies.

715,576
PB88-147749 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
New Measurements of the Ratio of the (10)B(n,alpha) to (6)Li(n,t) Cross Sections in the eV Energy Region.
Final rept.,
A. D. Carlson. 1986, 4p
Pub. in Radiation Effects 96, n1-4 p109-112 1986.

Keywords: *Neutron cross sections, Tritons, Reprints, Boron 10, Lithium 6, Alpha reactions.

Measurements have been made of the ratio of the (10)B(n, alpha) to (6)Li(n,t) cross sections from about 1 to 45 eV with statistical uncertainties and systematic errors of less than 1%. Improved experimental data were obtained in this investigation compared with a previous measurement. The measurements are consistent with results obtained from ENDF/B-V cross sections.

715,577
PB88-147756 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Standardization of Samarium-153.
Final rept.,
B. M. Coursey, D. D. Hoppes, F. J. Schima, and M. P. Unterweger. 1987, 4p
Pub. in Appl. Radiat. Isot. 38, n1 p31-34 1987.

Keywords: Half life, Standardization, Gamma rays, Reprints, *Samarium 153, Liquid scintillation detectors.

Samarium-153 has been standardized by 4(pi)(beta) liquid-scintillation counting, with an uncertainty of 0.4%. The probability per decay for the 103.2-keV gamma ray was measured using two germanium detectors to be 0.298 plus or minus 0.004. The half life based on liquid-scintillation measurements over 6.4 half lives and pressurized-ionization-chamber measurements over 4 half lives was found to be 46.27 plus or minus 0.02 hours. The uncertainties in each case are intended to approximate one standard deviation.

715,578
PB88-151949 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
3s-3p, 3p-3d, and 3d-4f Transitions of Sodiumlike Ions.
Final rept.,
J. Reader, V. Kaufman, J. Sugar, J. O. Ekberg, U. Feldman, C. M. Brown, J. F. Seely, and W. L. Rowan. 1987, 8p
Sponsored by Department of Energy, Washington, DC. Office of Magnetic Fusion Energy.
Pub. in Jnl. of the Optical Society of America B 4, n11 p1821-1828 Nov 87.

Keywords: *Electron transitions, Far ultraviolet radiation, Wavelengths, Atomic energy levels, Ultraviolet spectra, Reprints, Copper ions, Zinc ions, Gallium ions, Germanium ions, Arsenic ions, Selenium ions, Bromine ions, Krypton ions, Yttrium ions, Zirconium ions, Niobium ions, Molybdenum ions, Ruthenium ions, Rhodium ions, Palladium ions, Silver ions, Tin ions, Laser-produced plasma.

New measurements have been made for wavelengths of the 3s-3p, 3p-3d, and 3d-4f transitions of the sodium like ions Cu(18+), Zn(19+), Ge(21+), As(22+), Se(23+), Br(24+), Kr(25+), Y(28+), Zr(29+), Nb(30+), Mo(31+), Ru(33+), Rh(34+), Pd(35+), Ag(36+), and Sn(39+). The measurements were made by photographing laser-produced plasmas and tokamak plasmas with grazing-incidence spectrographs. The energies of the transitions were also calculated with Dirac-Fock computer codes. By fitting the differences between the observed and calculated wave numbers to simple formulas, least-squares-fitted wavelengths for all sodiumlike ions from Ar(7+) to Xe(43+) were determined. The estimated uncertainty of the fitted wavelengths is + or - 0.007 A, which makes them useful as reference values. The wavelengths range from 9 to 713 A.

715,579
PB88-151972 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div.
Galilean Test for the Fifth Force.
Final rept.,
T. M. Niebauer, M. P. McHugh, and J. E. Faller. 1987, 4p
Sponsored by Air Force Geophysics Lab., Hanscom AFB, MA.
Pub. in Physical Review Letters 59, n6 p609-612, 10 Aug 87.

Keywords: Relativity, Gravitation, Reprints, *Basic interactions, Free fall.

The authors have carried out a direct free-fall experiment to measure the differential acceleration between two different materials (copper and uranium) falling in the Earth's gravitational field. The differential acceleration was measured to be less than 5 parts in 10 billion of the normal gravitational acceleration. The null result puts new limits on the strength and range of the proposed fifth force.

715,580
PB88-152293 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Electrodisintegration Experiments and Virtual Photon Spectra.
Final rept.,
E. Hayward, R. Bergere, S. Costa, and C. Schaerf. 1985, 31p
See also DE82703189.
Pub. in Proceedings of the International School of Intermediate Energy Nuclear Physics (5th Course), Verona, Italy, June 20, 1985, p132-162.

Keywords: Electron scattering, Plane waves, Scattering cross sections, *Electrodisintegration, Zirconium 90, Virtual particles, Virtual photons.

Beginning with the inelastic electron scattering and the photonuclear cross sections, the plane wave virtual photon spectra are developed. Several experiments that made use of the virtual photon spectra are described. The connection between the electron scattering coincidence cross section and the inclusive electric dipole (e,X) cross section differential in the angle of the outgoing particle is developed. The relative magnitudes of the four terms in the cross section are illustrated, and the application to a previous experiment are discussed.

715,581
PB88-152764 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.
Limits for Spatial Anisotropy.
Final rept.,
J. D. Prestage. 1986, 2p
Pub. in Physics Bulletin 37, n4 p153-154 1986.

Keywords: Atomic clocks, Nuclear magnetic resonance, Reprints, *Lorentz invariance, Hydrogen masers, Laser cooling, Ion traps, Penning effect, Beryllium 9.

By comparing the rates of two atomic clocks, one based on a hydrogen maser transition and the other based on RF transitions in laser cooled (9)Be(1+) ions confined in a Penning ion trap, the authors have tested local Lorentz invariance. The sensitivity of the measurement is compared to other tests of Lorentz invariance.

715,582
PB88-152772 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Transient Heat Transfer and Thermophysical Properties Measurements in Low Gravity.
Final rept.,
P. J. Giarratano, V. D. Arp, R. B. Owen, A. Cezairliyan, and A. P. Miiller. 1987, 14p
Pub. in Low-Gravity Sciences, Science and Technology Series 67, p55-68 1987.

Keywords: *Thermophysical properties, *Reduced gravity, *Heat transfer, Transient response, Melting, Simulation, Reprints, *Containerless melts, KC-135 aircraft.

The National Bureau of Standards Laboratories in Gaithersburg, Maryland and Boulder, Colorado have several low-gravity research projects that are currently supported by the Microgravity Sciences Division of NASA. The paper reviews the preliminary research conducted in relation to two projects. They have been performed on the NASA KC-135 airplane which flies a parabolic flight pattern to simulate a low-gravity level of about 30-seconds duration. A typical flight consists of 30-40 parabolas. The transient nature of both the experiments makes them particularly well suited for operation on the KC135.

715,583
PB88-152863 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Direct Laboratory Determination of the (187)Re Half-Life.
Final rept.,
M. Lindner, D. A. Leich, R. J. Borg, G. P. Russ, J. M. Bazan, D. S. Simons, and A. R. Date. 1986, 3p
Sponsored by Lawrence Livermore National Lab., CA.
Pub. in Nature 320, n6059 p246-248 1986.

Keywords: *Half life, Mass spectroscopy, Osmium, Reprints, *Rhenium 187, Isotope ratio.

The long-lived, naturally occurring radionuclide (187) Re is important in geochemistry and cosmology as a nucleochronometer. Until now there have been no direct laboratory measurements which have avoided the difficulties of both low-energy beta-counting and dependence on radiometric ages of rocks and meteorites. The authors report here a half-life of (4.35 plus or minus 0.13) x 10 to the 10th power yr, based on the growth of (187) Os over a 4-yr period into a large source of osmium-free rhenium. As the result agrees with the best geochemically determined values, no significant revision of the present galactic age limits based on the geochemical values is necessary.

715,584
PB88-153986 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Conceptual Design of an Induction Linac for Neutron Research.
Final rept.,
R. G. Johnson. 1986, 6p
Pub. in Radiation Effects 95, n1-4 p291-296 1986.

Keywords: *Electron accelerators, Ion accelerators, Neutron sources, Design.

The linear induction accelerator principle has been a subject of intense development over the last few years. Recently important technological advances have been made in magnetic pulse compression and iron-alloy metallic glasses. The results of a preliminary design study of an induction linac to be used for neutron and high-LET radiation research are presented.

715,585
PB88-154638 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Experimental Study of Path Independence of the J-Integral in an Aluminum Tensile Panel.
Final rept.,
J. F. Cardenas-Garcia, D. T. Read, and J. C. Moulder. Sep 87, 5p
See also PB88-122213. Sponsored by Naval Sea Systems Command, Washington, DC.
Pub. in Experimental Mechanics 27, n3 p328-332 Sep 87.

Keywords: *Stress analysis, Stresses, Deformation, Cracks, Fracture properties, Strains, Aluminum, Panels, Reprints, J-integral.

A newly devised video-optical experimental technique allows for the automated determination of the in-plane, plane-stress components of the infinitesimal deformation tensor at discrete locations over an area of interest in a loaded specimen. It was used to evaluate a square area enclosing the central crack in a 5052-H32 aluminum panel loaded in tension. These experimental strain-tensor values were then used to evaluate the J integral assuming that the mechanical behavior of the plate material is approximated by deformation plasticity theory. The J integral was evaluated using two series of rectangular paths. The first was symmetrical about a horizontal axis passing through the notch length, using strain-tensor values at points to the left and right of a vertical axis passing through the center of the notch, with varying breadth and height. The second series were asymmetrical about either axis, with varying breadth and height.

715,586
PB88-156724 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Electron and Photon Transport in Multi-Layer Media: Notes on the Monte Carlo Code ZTRAN,
S. M. Seltzer, and M. J. Berger. Sep 84, 50p NBSIR-84/2931

Keywords: *Electrons, *X rays, *Gamma rays, Transport properties, Monte Carlo method, Compton effect, Photoelectrons, Annihilation reactions, Photons, ZTRAN computer program, Radiation doses, One-dimensional calculations.

The report provides a brief description and running instructions for the one-dimensional Monte Carlo code ZTRAN. The program is used to calculate the transport of electrons and photons in heterogeneous multi-layer media.

715,587
PB88-162573 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Proper Choice of the Lagrangian for a Relativistic Particle in External Fields.
Final rept.,
C. Leubner. 1986, 8p
Pub. in European Jnl. of Physics 7, n1 p17-24 1986.

Keywords: Special relativity, Lagrangian functions, Classical mechanics, Reprints, *Relativistic particles.

No abstract available.

PROBLEM-SOLVING INFORMATION FOR STATE & LOCAL GOVERNMENTS

Energy

715,588
PB85-120129 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Criteria for Mechanical Systems in Multifamily Buildings for Residential Weatherization Options.
L. S. Galowin. Sep 84, 79p NBSIR-84/2939
Sponsored in part by Department of Energy, Washington, DC.

Keywords: *Residential buildings, *Heating equipment, *Construction materials, *Cooling systems, Criteria, Maintenance, Replacing, Performance, Regulations, *Weatherization, Retrofitting, Energy conservation.

The National Bureau of Standards (NBS) prepared the original criteria and list of eligible retrofit options adopted for energy conservation by the Department of Energy Conservation in Existing Buildings Act of 1976. NBS was requested to review, update, and expand the criteria and list of retrofits for 1984 amendments to the regulation. This report presents the criteria and reference standards for retrofit options of mechanical equipment and systems in multifamily buildings. Mechanical systems equipment, controls, energy management systems, burners, and boiler/furnace tuneups/repairs were included. The options for retrofit technologies for equipment replacement components include items such as burners, burner controls, combustion chamber refractories, modifications with dampers, turbulators, and waste heat recovery devices. The criteria developed did not include economic factors and statutory constraints under the rulemaking procedures.

General

715,589
PB-273 950/6 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Experimental Technology Incentives Program.
Prototype Procurement - A Case Study in Experimental Technology. Check Wrapping Machines of the U.S. Treasury Department.
Final rept.
Nov 77, 32p NBS-GCR-ETIP-77-39
Prepared by Timbers and Co., Washington, D.C.

Keywords: *Office machines, *Government procurement, *Technology innovation, Purchasing, Management, Government policies, Product development, *Check wrapping equipment, Department of the Treasury.

The report is a case study of a prototype procurement developed by the U.S. Treasury Department for innovative check wrapping equipment now being used by the Division of Disbursement in preparing and mailing millions of government checks issued annually. The case study provides a useful guide to other government agencies for conducting similar experimental procurements which illustrate how innovative purchasing along with management initiative can result in better government operation and lower total cost to the taxpayer. The ETIP objective of stimulating technological innovation through government procurement policies and practices is met through the Treasury study. This application of prototype procurement can be a prime example to various individual federal and other government agencies of how new technological achievements can be accomplished through their own individual initiatives within the existing procurement framework.

715,590
PB-275 120/4 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Administrative Experiment in Public Policy Development.
Final rept.,
R. G. Weiss, and A. S. Libman. 1977, 3p
Pub. in Proceedings of American Inst. for Decision Sciences Annual Meeting (9th), Chicago, Ill. 19-21 Oct 77 p395-397 1977.

Keywords: *Administration, *Public policy, Government policies, Cooperation, National government, State government, Local government, Evaluation, Organizations, Technological change, Private organizations, Federal agencies, Organizational change.

The Experimental Technology Incentives Program (ETIP) is the only program in the federal government which utilizes administrative experimentation as its primary modus operandi. Located in the Department of Commerce, ETIP seeks to affect public policy and process to facilitate technological change in the private sector. The program operates in cooperation with federal, state and local agencies which possess administrative responsibility for governmental regulatory, procurement, R&D, and capital subsidy policies. Changes in policies are designed and implemented on an experimental basis with evaluations conducted to assess agency and commercial impacts. This paper describes the process which ETIP utilizes in this experimental approach to organization change.

715,591
PB78-600069 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Computer Science and Technology: Effective Use of Computing Technology in Vote-Tallying.
R. G. Saltman. 1978, 142p NBS-SP-500-30

Keywords: *Computer security, Computing technology, Election administration, Public administration, State and local government, Systems analysis, Technology utilization, Vote-tallying.

The results of a systems analysis and evaluation conducted on the role of automatic digital processing in vote-tallying are presented. Included in the report are descriptions of hardware, software, and administrative problems encountered in fourteen elections in which electronic computing technology was utilized. Methods of assuring more confidence in the accuracy and security of the vote-tallying process are presented and described. These methods include aids to audits of calculations, physical controls over ballots and computer records, and guidelines for the use of computer programs, computer facilities, and teleprocessing. Methods of improving the election preparation process also are presented and described. These involve the development and implementation of design specifications and acceptance tests for computer programs, election equipment and supplies, and guidelines for pre-election checkout of vote-tallying systems and for assurance of management control. Institutional factors are discussed which should be considered if improved accuracy and security controls and more effective election preparations are to be implemented. Recommendations for additional research and other activities including a possible Federal role are provided.

715,592
PB85-137651 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
State Measurement Laboratories: Program Description (Part 1). Directory (Part 2).
Final rept.
H. V. Oppermann. Nov 84, 73p NBS/SP-686
Library of Congress catalog card no. 84-601142.

Keywords: *Laboratories, *Calibrating, *Measurement, *Directories, *States(United States), Tolerances(Mechanics), *Weights and measures, State agencies.

The National Bureau of Standards receives repeated requests from industry and Federal agencies (e.g., Department of Defense, Nuclear Regulatory Commission) for information about the capabilities of and services provided by State measurement laboratories. This directory is a compilation of such information by State, including a description of the services available and fees charged. The directory will be updated annually in January of each year to coincide with the issuance of annual certification of these laboratories.

715,593
PB85-178879 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
State Weights and Measures Laboratories: Program Description and Directory.
Final rept.
H. V. Oppermann. Jan 85, 75p NBS/SP-686
Supersedes PB85-137651. Library of Congress catalog card no. 84-601142.

Keywords: *Laboratories, *Calibrating, *Measurement, *Directories, *States(United States), Tolerances(Mechanics), *Weights and measures, State agencies.

The National Bureau of Standards receives repeated requests from industry and Federal agencies (e.g., Department of Defense, Nuclear Regulatory Commission) for information about the capabilities of and services provided by State weights and measures laboratories. This directory is a compilation of such information by State, including a description of the services available and fees charged. The directory will be updated annually in January of each year to coincide with the issuance of annual certification of these laboratories.

715,594
PB85-183358 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
State Weights and Measures Laboratories: Program Handbook.
Final rept.
H. V. Oppermann, and J. K. Taylor. Feb 85, 86p NBS/HB-143
See also PB85-178879. Library of Congress catalog card no. 85-600502.

Keywords: *Laboratories, *Calibrating, *Measurement, *Handbooks, *States(United States), Tolerances(Mechanics), Tests, *Weights and measures, State agencies, National type evaluation program, Certification, Authorization.

State weights and measures laboratories are custodians of measurement standards at the State level that serve as the basis for assuring equity in the marketplace and as reference standards for calibration services for indigenous industry. As part of its program to encourage a high degree of technical and professional competence in such activities, the National Bureau of Standards (NBS) has developed performance standards and formalized procedures for the following two purposes: 1. certification of competence for the production of reliable metrological measurements (principally mass, volume, and length), and 2. authorization to conduct initial evaluation of weighing and measuring devices/systems before their use in commerce. Part I of this Handbook describes the procedures followed by NBS in certifying State weights and measures laboratories for competence. A certified laboratory must satisfy general and specific requirements for each competence area in which certification is desired. Part II of this Handbook describes the procedures followed in authorizing certified State weights and measures laboratories to conduct evaluation of weighing and measuring devices and systems under the National Type Evaluation Program (NTEP).

715,595
PB87-152039 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Office of the Director.
Observations on Short-Term and Long-Range Plans for Technology Transfer to State and Local Governments.
Final rept.,
J. M. Wyckoff. 1978, 8p
Pub. in Proceedings of Space Congress (15th), Cocoa Beach, FL., April 26-28, 1978 p2-24-2-31.

General

Keywords: *Local government, *State government, Local planning, Industries, Improvement, *Technology transfer, *Technical information, Industrial development, National Bureau of Standards.

The paper has developed from efforts to understand the short-term plans of those groups involved in the transfer of technology to State and local governments. While the review is intended to support the planning process of the National Bureau of Standards (NBS) and the Intergovernmental Science, Engineering, and Technology Advisory Panel (ISETAP) of the Office of Science and Technology Policy, the long-range 'plans' are a subjective view of some needs for an improved technology transfer system.

SPACE TECHNOLOGY

Extraterrestial Exploration

715,596
PB81-600062 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Hard X-ray and Soft Gamma-ray Telescope Spectrometer.
L. I. Yin, J. I. Trombka, R. L. Schmadebeck, S. M. Seltzer, and M. J. Bielefeld. 1981, 6p
Pub. in SPIE Jnl. Imaging Spectrosc. 268, p97-102 1981.

Keywords: *Gamma ray, Imaging, Multiple-pinhole mask, Spectrometer, Telescope, X-ray,

The authors propose a new design of a hard x-ray and soft gamma-ray telescope spectrometer in the energy domain of 30 keV to 200 keV with reasonable spatial, temporal, and energy resolution for possible space flight missions. The design incorporates a Uniformly Redunant Array (URA) mask in the front end and the Low Intensity X-ray Imaging Scope (Lixiscope) developed in the laboratory as the imaging spectrometer. Using a newly acquired intensifier tube with a digitizing anode, preliminary results indicate that such a complete hard x-ray and soft gamma-ray telescope spectrometer system is indeed feasible.

Manned Spacecraft

715,597
PB85-195899 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Vortex Shedding Flowmeters for Liquids at High Flow Velocities.
Final rept.
J. D. Siegwarth. 1984, 8p
Sponsored by National Aeronautics and Space Administration, Huntsville, AL. Marshall Space Flight Center.
Pub. in Proceedings of MSFC Advanced High Pressure O2H2 Technology Conference 1984, Marshall Space Flight Center, Huntsville, AL., June 27-29, 1984 p33-339.

Keywords: *Flowmeters, Liquids, Flow measurement, Velocity, Liquid oxygen, Tests, Vanes, *Vortex shedding, *Space shuttle main engine.

A number of vortex shedding flowmeter designs for flow measurements in liquid oxygen ducts on the space shuttle main engines have been tested in a high head water flow test facility.

715,598
PB86-100682 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Cryogenic Propellant Scavenging. Final Report August 1982 - March 1985.
B. Louie, N. J. Kemp, and D. E. Daney. Apr 85, 123p NBSIR-85/3023
Contract NASA-T-6077-J
Sponsored by National Aeronautics and Space Administration, Houston, TX. Lyndon B. Johnson Space Center.

Keywords: *Cryogenic rocket propellants, *Scavenging, Liquid propellants, Mathematical models, Pumps, Fuel tanks, Propellant transfer, Equations, Reduced gravity, Leakage, Temperature, Transferring, Thermodynamics, Computer programs, Cryogenic fluids, Space shuttles, Computer applications.

The report is a detailed description of a computer model that has been developed for assessing the feasibility of low g cryogen propellant scavenging from the Space Shuttle External Tank (ET). Either pump-assisted or pressure-induced propellant transfer may be selected. The program will accept a wide range of input variables, including the fuel to be transferred (LOX or LH2), heat leaks, tank temperatures, and piping and equipment specifications. The model has been parametrically analyzed to determine initial design specification for the system.

715,599
PB87-103305 PC **A03**/MF **A01**
National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.
Transport of Electrons and Associated Bremsstrahlung Through a Composite Aluminum-Lead Shield, with Applications to Spacecraft Shielding.
G. Barnea, S. M. Seltzer, and M. J. Berger. Jul 86, 28p NBSIR-86/3429
Sponsored by Department of Energy, Washington, DC. Office of Health and Environmental Research, and Office of Naval Research, Arlington, VA.

Keywords: *Electron irradiation, *Bremsstrahlung, *Radiation shielding, Monte Carlo method, *Spacecraft shielding.

Monte Carlo calculations have been made of the stopping of electrons and the penetration of secondary bremsstrahlung through layered aluminum-lead spacecraft walls. The results are presented in terms of the resultant radiation dose to objects inside. Dose values for monoenergetic incident electrons are given as a function of the aluminum/lead thickness ratio. These data, integrated over a few typical earth-orbit electron spectra, demonstrate the substantial reduction in radiation dose that can be achieved by replacing a portion of an aluminum shield with an inner layer of lead. The main results were obtained by applying a complex-geometry code to spherical-shell configurations. It was found that these results could be reasonably well approximated by an alternative and more economical approach, involving the use of slab-geometry transport results.

715,600
PB87-191037 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Optimization Study of Electron-Bremsstrahlung Shielding for Manned Spacecraft.
Final rept.,
G. Barnea, M. J. Berger, and S. M. Seltzer. 1987, 4p
Sponsored by Office of Naval Research, Arlington, VA., and Department of Energy, Washington, DC.
Pub. in Jnl. of Spacecraft 24, n2 p158-161 Apr 87.

Keywords: *Manned spacecraft, *Radiation shielding, Bremsstrahlung, Aluminum, Lead(Metal), Electron irradiation, Reprints, Space shuttles, Geosynchronous orbits.

Transport calculations based on the Monte Carlo method have been made to study the shielding of spacecraft against electrons and, in particular, secondary bremsstrahlung originating in the shield. These calculations were done for radiation environments encountered in typical shuttle and geosynchronous orbits. The quantitative results indicate that considerable improvement is shielding can be obtained by replacing an aluminum shield with a composite shield of the same total mass thickness and an inner lining of lead.

715,601
PB88-123773 PC **A05**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
NASA/NBS (National Aeronautics and Space Administration/National Bureau of Standards) Standard Reference Model for Telerobot Control System Architecture (NASREM).
Technical note (Final),
J. S. Albus, H. G. McCain, and R. Lumia. Jul 87, 94p NBS/TN-1235
Also available from Supt. of Docs. as SN003-003-02819-3. Sponsored by National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.

Keywords: *Robots, *Computerized control systems, Space stations, Hierarchical control, NASA standard reference model, NASREM model.

The document describes the NASA Standard Reference Model (NASREM) Architecture for the Space Station Telerobot Control System. It defines the functional requirements and high level specifications of the control system for the NASA Space Station document for the functional specification, and a guideline for the development of the control system architecture, of the IOC Flight Telerobot Servicer. The NASREM telerobot control system architecture defines a set of standard modules and interfaces which facilitates software design, development, validation, and test, and make possible the integration of telerobotics software from a wide variety of sources. Standard interfaces also provide the software hooks necessary to incrementally upgrade future Flight Telerobot Systems as new capabilities develop in computer science, robotics, and autonomous system control.

Spacecraft Trajectories & Flight Mechanics

715,602
N83-14606/8 PC **A02**/MF **A01**
Joint Inst. for Lab. Astrophysics, Boulder, CO.
TOPEX Orbit Determination Using GPS Signals Plus a Sidetone Ranging System.
P. L. Bender, and D. R. Larden. 1982, 6p NAS 1.26:169694, NASA-CR-169694
Sponsored in Part by NASA.

Keywords: *Coordinates, *Geophysical satellites, *Orbital mechanics, *Radial distribution, *Satellite observation, *Topex, *Topography, *Trajectory analysis, Altimeters, Geodetic coordinates, Maritime satellites, Position (Location), Satellite tracking.

The GPS orbit determination was studied to see how well the radial coordinate for altimeter satellites such as TOPEX could be found by on board measurements of GPS signals, including the reconstructed carrier phase. The inclusion on altimeter satellites of an additional high accuracy tracking system is recommended. It is suggested that a sidetone ranging system is used in conjunction with TRANET 2 beacons.

715,603
PB81-221707 Not available NTIS
National Bureau of Standards, Washington, DC.
Main Problem in the Theory of Artificial Satellites to Order Four.
Final rept.
A. Deprit. Apr 81, 6p
Pub. in Jnl. of Guidance and Control 4, n2 p201-206 Mar-Apr 81.

Keywords: Hamiltonian functions, Reprints, *Satellite orbits, Orbit calculation.

Software programs are designed to normalize the main problem in the theory of artificial satellites. At the onset, a canonical transformation of a new type, called the elimination of the parallax, reduces the system to a quasi-Keplerian one with varying angular momentum. As the first phase in a step-wise refinement, a separate radial intermediary is extracted from the simplified Hamiltonian; its normalization by a Poincare transformation executed is by a machine to the fourth order in closed form, that is to say, without developing the generator in powers of the eccentricity.

715,604
PB83-135145 Not available NTIS
National Bureau of Standards, Washington, DC.
Third-Order Solution to the Main Problem in Satellite Theory.
Final rept.
S. Coffey, and A. Deprit. Aug 82, 6p
Pub. in Jnl. Guid. Contr. Dyn. 5, n4 p366-371 1981.

Keywords: *Artificial satellites, Spacecraft trajectories, Hamiltonian functions, Reprints, Computer applications.

The paper announces a completely analytic closed-form third-order solution to the main problem in the theory of an artificial satellite. This is the first time an analytic solution of the main problem has been produced to order 3 which is valid for satellites with any eccentricity 0 equal to or less than epsilon less than 1. The solution is accomplished by constructing a progression of three canonical transformations from the state variables to a set of action-angle variables in which the Hamiltonian for the problem is a function of the action variables only.

715,605
PB86-119351 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Elimination of the Parallax in Satellite Theory.
Final rept.
A. Deprit. 1981, 43p
Pub. in Celestial Mechanics 24, p111-153 Jun 81.

Keywords: *Orbits, *Parallax, Perturbation theory, Removal, Elimination, Reprints, *Satellite orbits, Lie transformation.

When the perturbation affecting a Keplerian motion is proportional to (r sup -n)(n = or > 3), a canonical transformation of Lie type will convert the system into one in which the perturbation is proportional to (r sup -2). Because it removes parallactic factors, the transformation is called the elimination of the parallax. In the main problem for the theory of artificial satellites, the elimination of the parallax has been conducted by computer to order 4. The first order in the reduced system may now be integrated in closed form, thereby revealing the fundamental property of the first-order intermediary orbits in line with Newton's Propositio XLIV. Extension beyond order 1 leads to identify a new class of intermediaries for the main problem in nodal coordinates, namely the radial intermediaries. The technique of smoothing a perturbation prior to normalizing the perturbed Keplerian system, of which the elimination of the parallax is an instance, is applied to derive the intermediaries in nodal coordinates proposed by Sterne, Garfinkel, Cid-Palacios and Aksnes, and to find the canonical diffeomorphisms which relate them to one another and to the radial intermediaries.

715,606
PB87-230876 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Critical Inclination in Artificial Satellite Theory.
Final rept.,
S. L. Coffey, A. Deprit, and B. R. Miller. 1986, 42p
Pub. in Celestial Mechanics 39, p365-406 1986.

Keywords: Slope, Dynamics, Hamiltonian functions, Stability, Reprints, *Satellite orbits, Inclination, Bifurcation(Mathematics).

Certain it is that the critical inclination in the main problem of artificial satellite theory is an intrinsic singularity. Its significance stems from two geometric events in the reduced phase space on the manifolds of constant polar angular momentum and constant Delaunay action. In the neighborhood of the critical inclination, along the family of circular orbits, there appear two Hopf bifurcations, to each of which there converge two families of orbits with stationary perigees. On the stretch between the bifurcations, the circular orbits in the planes at critical inclination are unstable. A global analysis of the double forking is made possible by the realization that the reduced phase space consists of bundles of two-dimensional spheres. Extensive numerical integrations illustrate the transitions in the phase flow on the spheres as the system passes through the bifurcations.

Unmanned Spacecraft

715,607
PB-289 003/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
In-Flight Performance of the IUE.
Final rept.,
J. L. Linsky. 5 Oct 78, 9p
Pub. in Nature v225 p377-385, 5 Oct 78.

Keywords: *Scientific satellites, Performance evaluation, Binary stars, Chromosphere, Ultraviolet spectra, Spectrographs, Astronomical cameras, Astronomical telescopes, Data processing equipment, IUE satellite, Spaceborne telescopes, Reprints.

After the IUE's successful launch into eccentric geosynchronous orbit, and following initial spacecraft checkout, observations were made of a set of high priority targets as an insurance against premature failure of the system. These were followed by the systematic performance evaluation of the various spacecraft and scientific instrument sub-systems, some of which were optimized in orbit. The optical performance of the telescope and spectrograph and the photometric performance of the SEC cameras used as spectrum detectors all seem satisfactory, but the ground data processing system, although operational, needs further development.

General

715,608
PATENT-4 014 166 Not available NTIS
Department of Commerce, Washington, DC.
Satellite Controlled Digital Clock System.
Patent.
J. V. Cateora, D. D. Davis, and D. W. Hanson. Filed 13 Feb 76, patented 29 Mar 77, 13p PB-271 817/9, PAT-APPL-657 918
Supersedes PB-250 077.
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, D.C. 20231 $0.50.

Keywords: *Clocks, *Patents, Digital systems, Time signals, Synchronous satellites, Meteorological satellites, Control, PAT-CL-58-26.

The invention relates to a digital clock system which is controlled by a time code transmitted by a satellite in orbit around the earth.

TRANSPORTATION

Air Transportation

715,609
PB-269 953/6 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Validation of an Airport Simulation Model.
Final rept.,
J. F. Gilsinn. 1976, 5p
Sponsored in part by Federal Aviation Administration, Washington, D.C.
Pub. in Proceedings, Bicentennial Winter Simulation Conference, Gaithersburg, Md. 6-8 Jun 76, v1 p273-277 1976.

Keywords: *Airports, *Air traffic, Models, Simulation, Estimating, Rates(Per time), Proving, Air traffic control, DELCAP model.

This paper describes the validation of an airport simulation model, called DELCAP for DELay CAPacity, the two quantities which it measures, for use in estimating the traffic rates attainable at major busy U.S. airports. The simulation model outputs are compared to those of other models for simple cases to which both apply and to actual throughput data for several airports, with differences usually less than 6 to 8 percent.

715,610
PB-275 615/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Near-Field Electric Field Strength Levels of EM Environments Applicable to Automotive Systems.
Final rept.,
J. W. Adams, M. Kanda, J. Shafer, and Y. Wu. 1977, 8p
Sponsored in part by National Highway Traffic Safety Administration, Washington, D.C.
Pub. in Proceedings of IEEE International Symposium on Electromagnetic Compatibility, Seattle, Wash. 2-4 Aug 77, 77CH 1231-0 EMC pp336-343 1977.

Keywords: *Ground vehicles, *Electromagnetic compatibility, *Field strength, Passenger vehicles, Truck tractors, Electric fields, Radio transmitters, Electronic equipment, Medium frequencies, High frequencies, Ultrahigh frequencies, Measurement, Near field.

As the number of electronic systems used on vehicles increases, the need to know the electromagnetic environment in and around these vehicles increases. This knowledge becomes basic information needed by system designers to avoid electronic system failures. Results of electric field strength measurements are reported for the near-field inside and outside of a passenger vehicle and of a tractor-trailer vehicle. These measurements were made with all common combinations of mobile transmitters and antennas. The rf transmitting sources used the maximum legal output power (110 W) at 40, 162, and 416 MHz, and nominal 100 watt power levels in the HF band (3 to 30 MHz). Illegal power levels (about 100 watts) of CB transmissions at 27 MHz were used through a special authorization by the Interagency Radio Advisory Committee (IRAC).

715,611
PB80-109085 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Standard for RF Modulation Factor,
M. G. Arthur, and G. R. Reeve. Sep 79, 94p NBS-TN-1016, FAA/RD-79/94

Keywords: *Modulation, *Standards, Instrument landing systems, Radio beacons, Instruments, Amplitude modulation, Measurement, Signal generators.

A modulation factor standard has been developed to support the Federal Aviation Administration's requirements for a measurement capability for the ILS and VOR navigation systems. The standard consists of both a precision modulation meter and a stable amplitude-modulated signal source. Although designed primarily for ILS and VOR signals, it has general purpose capabilities within an rf range of 10 MHz to 500 MHz and an af range of 20 Hz to 20 kHz. Measurement uncertainty is less than 0.11 percent modulation below 90 percent modulation for ILS/VOR tones of 90 Hz and above, and is somewhat greater at 30 Hz. Included are a circuit description and an error analysis.

715,612
PB80-161151 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Probabilities of Vertical Overlap: A Sensitivity Analysis,
H. K. Hung, J. F. Gilsinn, and K. L. Hoffman. Mar 80, 72p NBSIR-80-1990
Sponsored in part by Federal Aviation Administration, Washington, DC. Office of Systems Engineering Management.

Keywords: *Air traffic, *Aviation safety, Collision avoidance, Air traffic control, Flight paths, Probability distribution functions, Probable error, Standard deviation, *Aircraft separation, Sensitivity analysis, Computer aided analysis.

Because of the potential increase in traffic at FL 290 and above, both current and alternative vertical separation standards are being reviewed. A plan to collect data on the vertical navigational performance of aircraft is also contemplated. This report documents a sensitivity analysis carried out to assess how different assumptions about the probability distribution of 'total vertical error' affect the probability of vertical overlap. The four factors affecting the probability of vertical overlap which are examined in this study are: the functional form of the vertical-error distribution function; the standard deviation of this probability distribution; the vertical dimensions of the aircraft; and the vertical separation standard. Probabilities of vertical overlap were computed over a range of possibilities for each of these four factors in order to discern the effect of each factor. A final section discusses the findings of this study and draws some conclusions.

715,613
PB80-207145 PC **A03**/MF **A01**
National Bureau of Standards, Boulder, CO. National Engineering Lab.

Air Transportation

Fourier Transformation of the Nonlinear VOR (Very-High-Frequency Omni-Directional Range) Model to Approximate Linear Form,
D. F. Vecchia. Jun 80, 31p NBS-TN-1021

Keywords: *Radio navigation, *Mathematical models, *Fourier transformation, Radio beacons, VOR.

This technical note describes a method for transforming a particular nonlinear regression model to a form which is approximately linear in the unknown parameters. The technique involves computation of the fourier coefficients for a set of sample data and uses phase variables to estimate the parameters. The phase spectrum transformation is employed to obtain bearing angle estimates for a model associated with the Very-High-Frequency Omni-Directional Range (VOR) aircraft navigation system. The transformation provides a model linear in relevant phase parameters. Thus, estimation of VOR bearing angle utilizes existing statistical theory. Finally, it is shown that certain generalizations of the VOR model also are reduced to approximate linear form by the phase spectrum transformation.

715,614
PB83-113522 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Assessment of Correlations between Laboratory and Full-Scale Experiments for the FAA Aircraft Fire Safety Program. Part 1: Smoke,
J. G. Quintiere. Jul 82, 54p NBSIR-82-2508, DOT/FAA/CT-82/100
See also Part 2, PB83-113530.

Keywords: *Aircraft fires, *Fire tests, Fire safety, Smoke, Optical density, Visibility.

An extensive review is presented demonstrating the nature of comparison between full-scale fire smoke data and test method results for materials. These correlations are presented in terms of consistent parameters established through a development of the governing equations for smoke concentration and light attenuation. Visibility data pertaining to light transmission through smoke is presented but no general results exist on the sensory irritant effect of smoke on vision. Analysis shows the complex dependence of smoke production on many parameters acting in fire growth and shows the futility and nature of simple correlation attempts. Recommendations are made for further research to establish a sounder basis for correlations, and a practical strategy is suggested for proceeding in the present.

715,615
PB83-113530 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Assessment of Correlations between Laboratory and Full-Scale Experiments for the FAA Aircraft Fire Safety Program. Part 2: Rate of Energy Release in Fire,
J. G. Quintiere. Jul 82, 25p NBSIR-82-2536, DOT/FAA/CT-82/108
See also Part 1, PB83-113522.

Keywords: *Aircraft fires, *Fire tests, Energy transfer, Heat measurement, Heat of reaction, Heat transfer, Fire safety.

The rate of energy release in fire is discussed. The significance of calorimetric measurements of energy release for materials is related to thermal-dynamic parameters, namely heat of reaction and stoichiometric coefficients. It is shown that a common set of parameters is necessary to express ignition, flame spread and mass loss due to combustion and heat transfer in fires. The relationship of ignition and flame spread to rate of energy release in fires is presented along with a presentation on upward spread.

715,616
PB83-113548 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Assessment of Correlations between Laboratory and Full-Scale Experiments for the FAA Aircraft Fire Safety Program. Part 4: Flammability Tests,
J. G. Quintiere. Jul 82, 28p NBSIR-82-2525, DOT/FAA/CT-82/101
See also Part 2, PB83-113530.

Keywords: *Aircraft fires, *Flammability testing, Floor coverings, Fire tests, Flame propagation, Correlation techniques, Fire safety, Room fires, Compartment fires.

A review is made of studies in which full-scale fire growth was compared with laboratory test data on materials. Both room and corridor fires are included in which primarily interior lining materials have been the combustible element. The studies include standard test methods and other laboratory devices used in the United States and other countries. An effort was made to intercompare experimental results in a common basis. For example, maximum room temperature data are compared with ASTM E-84 flame spread classifications for several full-scale tests which involved nearly the same room geometries and same fuel arrangements.

715,617
PB83-113555 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Assessment of Correlations between Laboratory and Full-Scale Experiments for the FAA Aircraft Fire Safety Program. Part 5: Some Analyses of the Post Crash Fire Scenario.
J. G. Quintiere, and T. Tanaka. Jul 82, 27p NBSIR-82-2537, DOT/FAA/CT-82/107
See also Part 4, PB83-113548.

Keywords: *Aircraft fires, *Fire tests, Wind(Meteorology), Aircraft cabins, Doors, Flame propagation, Flow measurement, Fire safety, Mathematical models, Post crash fires, Wind effects.

An attempt is made to develop mathematical predictions for various aspects of the dynamics of post-crash aircraft fires. The basis of the analysis is the experimental simulation scenario under study by the FAA. The effects of wind are considered as well as the effect of interior and exterior fires. Suggestions are presented for estimating cabin door flow rates from measured temperatures.

715,618
PB83-193052 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Assessment of Correlations between Laboratory and Full-Scale Experiments for the FAA (Federal Aviation Administration) Aircraft Fire Safety Program. Part 6: Reduced-Scale Modeling of Compartments at Atmospheric Pressure.
W. J. Parker. Mar 83, 61p NBSIR-82-2598, DOT/FAA/CT-82/160
See also PB83-113555.

Keywords: *Aircraft fires, *Fire tests, Wind(Meteorology), Aircraft cabins, Doors, Flame propagation, Flow measurement, Fire safety, Insulation, Mathematical models, Post crash fires, Wind effects, Room fires.

The temperatures, heat fluxes, air velocities, and times to flashover were compared between a number of previously reported full- and reduced-scale room fire tests. The model tests were usually similar but somewhat less severe than their full-scale counterparts. A simplified analysis is presented to account for the lower temperatures observed in the models. Some recommendations are made with regard to physical modeling of the aircraft postcrash fires.

715,619
PB84-101153 PC **A05**/MF **A01**
Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
Computer Modeling of Aircraft Cabin Fires.
Final rept. Jun 81-Dec 82.
H. W. Emmons, and H. E. Mitler. Jun 83, 95p HOME FIRE PROJECT TR-57, NBS-GCR-83-431
Contract NB81-NADA-2026
Sponsored in part by Federal Aviation Administration, Washington, DC.

Keywords: *Aviation safety, *Aircraft fires, Aircraft cabins, Flame propagation, Time dependance, Plumes, Gas flow, Mathematical models, Combustion gases, Computer applications.

Two aspects of the fire that can occur after an aircraft crash landing were considered. Often a crash opens a hole in the cabin. Frequently, the wing damage opens a fuel tank and fuel spread on the ground catches fire. If the fire occurs below the hole in the cabin, fire gases and flames may enter the cabin and set it afire. Furthermore, after the gases enter the cabin, those gases and any generated by fire in the cabin itself flow as a non-steady ceiling jet down the length of the cabin. Finally, the nature of the fire gas flow into the cabin is influenced by whether or not and where the occupants open a door to escape.

715,620
PB85-207082 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Thermal Response of Aircraft Cabin Ceiling Materials during a Post-Crash, External Fuel-Spill, Fire Scenario.
Final rept.
L. Y. Cooper. 1985, 11p
See also PB85-145647. Sponsored by Federal Aviation Administration, Washington, DC.
Pub. in Proceedings of AIAA (American Institute of Aeronautics and Astronautics) Aerospace Sciences Meeting (23rd), Reno, NV., January 14-17, 1985, AIAA-85-0395, 11p 1985.

Keywords: *Aircraft cabins, *Aircraft fires, *Fire resistant materials, Thermal resistance, Flammability, Tests, Temperature, Fire safety, Algorithms, *Ceilings.

An algorithm is developed to predict the thermal response of aircraft ceiling materials during a post-crash fire scenario. The scenario involves an aircraft's emergency exit doorway which opens directly onto the flames of an external, fuel-spill fire which engulf a large portion of the fuselage. Data of near-ceiling temperatures acquired during a series of eight, full-scale, wide-body aircraft cabin, post-crash test simulations provide indirect validation of the algorithm. These tests involved cabins outfitted with only single, mockup seats. Two other full-scale cabin tests involving fire spread through twenty-one seat arrays with different types of seat construction provide the input data required to exercise the algorithm in evaluations of fully outfitted cabins. Relative to the post-crash scenario, a measure of cabin fire safety is proposed, viz., the post-crash time-to-ceiling-ignition. The measure would be used as a surrogate for the post-crash time available for passengers to safely evacuate the cabin.

Marine & Waterway Transportation

715,621
PB85-203537 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Analysis of the Forced Ventilation in Containership Holds.
Final rept.
H. R. Baum, and J. A. Rockett. 1984, 34p
Sponsored by Coast Guard, Washington, DC.
Pub. in Jnl. of Fluid Mechanics 142, p309-342 1984.

Keywords: *Ventilation, *Cargo ships, Mass transfer, Fluid flow, Computer programs, Hazardous materials, Fires, Reprints, Fire models.

An analysis of the fluid flow and mass transfer induced by ventilation systems in containership holds was carried out. The analysis consists of a detailed calculation of the forced motion through an interconnected set of narrow, stably stratified vertical air passages which represent an idealized containership hold. The results of the calculation are then used in a study of the concentration boundary layers formed by the pickup of spill material assumed to lie at the bottoms of the air passages. The results are incorporated in a computer program which is described in detail. A variety of computed results are presented, together with a listing of the program.

Metropolitan Rail Transportation

715,622
PB-281 383/0 PC **A02**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Fire Research.

Fire Hazard Evaluation of BART Vehicles.
Final rept.,
E. Braun. Mar 78, 24p NBSIR-78-1421
Contract DOT-AT-70007

Keywords: *Subway cars, *Rapid transit railways, *Fire hazards, Evaluation, Design, Recommendations, Fire safety, Urethanes, Urban transportation, Materials, Seats, Fire detection systems, Accident prevention, Mass transportation, Fire protection, Bay Area Rapid Transit.

A fire hazard evaluation of the subway cars used on the San Francisco Bay Area Rapid Transit District was performed. After analyzing the cars' interior and exterior design, five recommendations were made that, if implemented, would improve passenger safety by decreasing the probability of developing a hazardous fire situation. Among these recommendations were the upgrading of current upholstered urethane seat assemblies and the need for the development of a fire detection system appropriate for rapid rail transit vehicles. Those system improvements would not only provide passengers a safer traveling environment but would also provide a modest level of protection for the heavy investment in rail vehicles.

Pipeline Transportation

715,623
PB-243 546/9 PC **A02**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Examination of Failed Four Inch Cast Iron Pipe Natural Gas Main, Philadelphia Gas Works, Philadelphia, Pennsylvania.
Final rept.
T. R. Shives. Oct 74, 24p NBSIR-74-594, DOT/OPS-74/03
See also PB-243 547.

Keywords: *Gas pipelines, Gas pipes, Cast iron, Failure, Fractures(Materials), Safety, Pennsylvania, DOT/4CZ/CD, *Pipeline accidents.

The Office of Pipeline Safety submitted several pieces of four inch diameter cast iron natural gas main pipe to the National Bureau of Standards Mechanical Properties Section for examination. An accumulation of gas that had escaped from a fracture in the pipeline resulted in an explosion in the 1200 block of South Markoe Street in Philadelphia, Pennsylvvania on May 3, 1974. The fracture had occurred in a transverse plane that passed through a service tap hole in the top of the pipe. The fracture was brittle in nature and there was no evidence to indicate the existence of a crack prior to the failure. There was extensive graphitic corrosion in some areas of the pipe, although this does not appear to be related to the failure. A chemical analysis indicated that the phosphorus content of the pipe material was higher than desirable. The microstructure contained a considerable amount of iron-iron phosphide eutectic. Failure apparently occurred from a single stressing event caused by bending loads from an external source.

715,624
PB-281 925/8 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Better LNG Flow Measurement Sought,
J. A. Brennan. 30 Jan 78, 4p
Pub. in Proceedings ASME Energy Technology Conference, Houston, Tex., Sept. 18-23, 1977, Oil Gas Jnl. 76, n5 p168, 173-174, 177, Jan 30, 1978.

Keywords: *Flowmeters, Tests, Liquefied natural gas, Pipelines, Mass flow, Flow measurement, Reprints.

A method of testing flowmeters for use in large diameter LNG pipelines is described and some experimental data presented. Densitometers for use in conjunction with volumetric flowmeters to give mass flow information are discussed and some performance data listed.

715,625
PB-283 536/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Operation and Measurement in Base Load LNG Terminals: Measurement Methods.
Final rept.,
J. A. Brennan. 1977, 4p
Pub. in Proceedings of International School of Hydrocarbon Measurement Symposium (52nd), Oklahoma Univ., Norman, Okla. 12-14 Apr 77 p501-504 1977.

Keywords: *Marine terminals, *Liquefied natural gas, *Flow measurement, Liquid flow, Measurement, Pipeline transportation, Pipeline terminals.

Presently there are no base load LNG terminals operating in the United States. Two facilities are nearing completion and should start operation during late 1977 or early 1978. Some of the measurement systems included in these terminals for measuring the LNG as it moves from the ship to the transmission line are presented.

715,626
PB84-153089 Not available NTIS
National Bureau of Standards, Washington, DC.
Crack Opening Displacement of Surface Cracks in Pipeline Steel Plates.
Final rept.
Y. W. Cheng, H. I. McHenry, and D. T. Read. 1983, 18p
Pub. in American Society for Testing and Materials Special Technical Publication 791 p11-214 - 11-231 1983.

Keywords: *Steels, *Pipelines, Cracking, Deformation, Metal plates, Reprints, *Fracture mechanics.

A series of 30.4-cm x 10-cm x 1.6-cm tensile panels of an API 5LX-70 pipeline steel with different surface crack lengths and depths were tested. Measured crack-mouth-opening displacements (CMOD) were compared with the predictions from linear elastic fracture mechanics (LEFM) plus the modified critical-COD model. Within the range of crack sizes and shapes studied, good agreement between the experimental data and the predictions from the LEFM plus the modified critical-COD model was observed. Surface deformations observed in the neighborhood of the crack are also discussed.

715,627
PB84-165448 PC **A18**/MF **A01**
National Bureau of Standards, Washington, DC.
Fitness-for-Service Criteria for Pipeline Girth Weld Quality.
Final rept.
R. P. Reed, M. B. Kasen, H. I. McHenry, and C. M. Fortunko. Nov 83, 404p NBSIR-83-1695
Sponsored in part by Department of Transportation, Washington, DC. Office of Pipeline Safety Regulation.Portions of this document are not fully legible.

Keywords: *Petroleum pipelines, *Weldments, Weld defects, Nondestructive tests, Ultrasonic tests, Cracks.

Criteria have been developed for applying fitness-for-service analyses to flaws in the girth welds of the Alaska Natural Gas Transmission System pipeline. A critical crack-opening-displacement elastic-plastic fracture mechanics model was developed and experimentally verified. Procedures for constructing flaw acceptance criteria curves based on this model are provided. A significantly improved ultrasonic method for detecting and dimensioning significant weld flaws was developed and demonstrated on pipeline sections. The probability of crack initiation from blunt flaws was shown to be very low under severe low-cycle fatigue. Suggestions are offered for technical implementation of field inspection procedures and for practical implementation of the flaw acceptance criteria.

715,628
PB84-226224 Not available NTIS
National Bureau of Standards, Washington, DC.
Fitness-for-Purpose Criteria for Pipeline Girth Welds.
Final rept.
M. B. Kasen, and C. M. Fortunko. Sep 82, 12p
Sponsored in part by Department of Transportation, Washington, DC. Office of Pipeline Safety Operations. Welding Research Council, New York.
Pub. in Proc. Pipeline Welding Inspection Conf., Houston, Texas, September 21-22 1982, p181-192.

Keywords: *Pipelines, *Weld defects, *Nondestructive tests, *Ultrasonic tests, Welded joints, Radiography, *Fracture mechanics, *Girth welds, Welds.

Results of a program to provide the basis for applying fracture mechanics principles to assessment of flaw significance in pipeline girth welds are reviewed. Subjects discussed are: (1) development of appropriate allowable flaw size curves; (2) development of an improved ultrasonic technique for sizing of sharp flaws; (3) the signficance of blunt flaws; and (4) the demonstration of inherent limitations on the through wall depths of blunt flaws. A series of technical options for field implementation of the results is provided and discussed.

715,629
PB84-226430 Not available NTIS
National Bureau of Standards, Washington, DC.
Significance of Blunt Flaws in Pipeline Girth Welds.
Final rept.
M. B. Kasen. May 83, 6p
Sponsored in part by Department of Transportation, Washington, DC. Office of Pipeline Safety Operations.
Pub. in Welding Jnl. p117s-122s May 83.

Keywords: *Pipelines, *Weld defects, *Crack initiation, Fatigue(Materials), Porosity, Reprints, *Girth welds, Welds.

The probability of crack initiation from porosity, slag, and arc burns in pipeline girth welds was investigated by subjecting highly-flawed welds to severe low-cycle, fully-reversed, strain-controlled fatigue. No effect of the flaw type or content was observed on the number of cyclic reversals to fatigue crack initiation. Fracture was in all cases dominated by the geometrical discontinuity formed by the weld reinforcement. As the applied strain levels were well above yield, these results indicated that the probability of crack initiation from such flaws would be negligible under the essentially static loading to which pipelines are normally subjected. This was corroborated by static tensile testing of flawed welds.

715,630
PB87-108189 Not available NTIS
National Bureau of Standards, Gaithersburg, MD. Fracture and Deformation Div.
Handling Blunt Flaws in a Fitness-for-Service Assessment of Pipeline Weld Quality.
Final rept.
M. B. Kasen, and G. E. Hicho. 1986, 10p
See also PB86-162039. Sponsored by Department of Transportation, Washington, DC. Office of Pipeline Safety Operations.
Pub. in the International Conference and Exposition on Fatigue, Corrosion Cracking, Fracture Mechanics, and Failure Analysis, Salt Lake City, UT., December 2-6, 1985, p295-304 1986.

Keywords: *Pipelines, *Welded joints, Quality, Crack propagation, Slags, Porosity, Fatigue(Materials), Fractures(Materials), Inspection, Defects.

The significance of porosity, slag and arc burns on pipeline integrity is evaluated by assessing the probability of their contributing to crack initiation and to accel erated crack growth during low cycle fatigue.

Railroad Transportation

715,631
PB-280 396/3 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Locomotive In-Cab Noise - Towards a Standardized Measurement Methodology.
Final rept.,
R. M. Clarke, R. D. Kilmer, and D. S. Blomquist. Oct 77, 12p
Sponsored in part by Federal Railroad Administration, Washington, D.C. Office of Rail Safety Research.
Pub. in NOISE-CON Conference on Noise Control Engineering, NASA Langley Research Center, Hampton, Va. 17-19 Oct 77 p431-442 Oct 77.

Keywords: *Locomotives, *Transportation noise, Acoustic measurement, Operators(Personnel), Exposure, Noise pollution, *Noise levels, Locomotive cabs.

The U. S. Federal Railroad Administration, in cooperation with the Association of American Railroads, is currently sponsoring efforts by the National Bureau of Standards to collect locomotive in-cab noise level data. The purpose of the program is to develop a simplified stationary test procedure which will correlate with operational duty cycle, crew exposure, and noise level data, and which is based on current OSHA hearing conservation regulations. This paper describes the measurement methodology and instrumentation system developed for this program. The data and con-

clusions presented are preliminary in nature. The program is scheduled for completion in early 1978.

715,632

PB81-135212 Not available NTIS
National Bureau of Standards, Washington, DC.
Nondestructive Testing of Railroad Rail.
H. Berger. 1980, 5p
Pub. in Transportation Research Record 744, p22-26 1980.

Keywords: *Nondestructive tests, *Railroad tracks, Ultrasonic tests, Magnetic tests, Reviews, Reprints, State of the art.

Techniques for nondestructive testing (NDT) of railroad rail in service are reviewed with the aim of assessing the state-of-the-art and pointing toward future needs.

715,633

PB81-153975 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire Protection Systems for Rail Transportation of Class A Explosives: Interim Report.
R. W. Bukowski. Nov 80, 35p NBSIR-80-2170
Sponsored in part by Federal Railroad Administration, Washington, DC.

Keywords: *Rail transportation, *Bombs(Ordnance), *Fire protection, Box cars, Fire tests, Fire detection systems, Hazardous materials, Thermal insulation, Cost effectiveness.

As a result of several accidents involving fire induced detonation of military explosives during rail shipment, a research project, funded by the Federal Railroad Administration (FRA), was initiated at the Center for Fire Research (CFR) at the National Bureau of Standards (NBS). This project was initiated to evaluate various methods of protection of Class A explosives from fire, and to identify one or more cost-effective approaches which could be explored in greater detail in later studies. Active systems (detection, notification, and extinguishment) and passive systems (thermal insulating barriers) were evaluated regarding cost, feasibility and level of protection provided for the major hazard scenarios involved in rail shipment of explosives. The passive, thermal barrier approach was selected as the most reliable and less costly of the options studied while providing an acceptable level of protection. Small-scale and full-scale tests were conducted to obtain performance data on one specific thermal barrier material. Based on this data, a computer model was developed which can predict temperatures of the boxcar floor, top surface temperature of a thermal barrier, and casing/explosive interface temperature of a wood-pallet mounted bomb for a range of fire sizes. The model predictions compare favorably with measured results from a limited number of experiments. Further experimental data are needed to refine the model and establish an acceptable confidence level in the predicted values. The proposed work necessary to provide this refinement and verification is described.

715,634

PB81-179483 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Metallurgical Evaluation of Two AAR M128 Steel Tank Car Head Plates Used in Switchyard Impact Tests.
Rept. no. 10 (Final).
J. G. Early, and C. G. Interrante. May 80, 67p NBSIR-80-2039
Sponsored in part by Federal Railroad Administration, Washington, DC.

Keywords: *Tank cars, *Impact tests, Railroad cars, Metal plates, Steels, Metallography, Chemical analysis, Tension tests.

This metallurgical evaluation included determining whether the samples conformed with the appropriate specifications and to determine the impact test behavior of both plate samples.

715,635

PB81-205098 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC.
Metallurgical Analysis of an ASTM A212-B Steel Tank Car Head Plate.
Final rept.
J. G. Early. Apr 81, 53p NBSIR-78-1582, FRA/ORD-81/32
Contract DOT-AR-40008

Keywords: *Tank cars, *Metal plates, Metallurgical analysis, Steels, Railroad cars, Impact tests, Pressure vessels, Accident investigations, NTISDOTFRA, NTISCOMNBS.

The sample was taken from the A-head plate of tank car SOEX 3033 involved in an accident near Winder, Georgia. The A-head plate was reportedly produced to specification ASTM A212-65, Grade B steel. The results of laboratory check chemical analyses indicated that the plate sample met the chemical requirements of ASTM A212-65, Grade B steel. The results of ambient-temperature bend tests and tensile tests showed that the plate sample satisfied both the bend requirements and the tensile elongation requirements but failed to meet the minimum ultimate tensile strength and yield point requirements of ASTM A212-65, Grade B steel. The results of metallographic analyses revealed substantial variation in the microstructure in the plate thickness direction. The observed coarse prior austenite grain size and large ferrite grain size is consistent with the coarse-grain steelmaking practice allowed for ASTM A212 steel and a high finishing temperature during fabrication. Hardness measurements of the microstructure correlated well with the measured tensile strength properties. The nil-ductility transition temperature was determined to be 30 F, a value equal to the highest value reported for a group of tank car plate samples, including both accident samples and current and previously allowed tank car plate materials. The results of Charpy V-notch tests established that the 15 ft-lb energy absorption and 50% shear fracture appearance transition temperatures measured for both longitudinal and transverse specimens were all above 60 F and within normal tank car service temperature range. The high transition temperatures are related to both the coarse prior austenite grain size and large ferrite grain size observed in the microstructure and the steel chemistry.

Road Transportation

715,636

PB-268 511/3 PC **A03**/MF **A01**
National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
Report on an Investigation of the High Speed Hazards of Steel Belted Radial Tires on Police Patrol Cars.
Final rept.,
J. J. Collard. Jun 77, 47p NBS-SP-480-18
Library of Congress Catalog Card No. 77-608082.

Keywords: *Automobile tires, *Failure, Wear resistance, Hazards, Velocity, Police, Motor vehicle accidents, Recommendations, *Radial tires, Police patrol cars.

At least two police fatalities and one permanent disability were caused by catastrophic failures of steel-belted, radial-ply tires during high speed police operations. More than 200 other failures were reported by one State highway patrol department. The report concludes that general-use tires, whether steel-belted radial, fabric-belted radial, bias ply, or bias belted, are not suited to high speed use. It recommends that police departments use for high speed patrol only those models that tire manufacturers have tested and certified for use at speeds of at least 125 miles per hour. Tires of all four types are available for such use.

715,637

PB-268 582/4 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
Evaluation of Automotive Fuel Flowmeters,
B. Robertson, and G. P. Baumgarten. Jun 77, 99p NBS-TN-943
Sponsored in part by Department of Transportation, Washington, D.C. Office of the Assistant Secretary for Systems Development and Technology.

Keywords: *Automobiles, *Fuel consumption, *Flowmeters, Temperature measurement, Calibration, Environmental tests, Flow measurement.

Fuel economy measurement procedures being developed by the Transportation Systems Center of the Department of Transportation require flowmeters to measure the gasoline consumed by the engine of an automobile either on the road or on a dynamometer. The contribution of the National Bureau of Standards to this work was to ascertain the environment in which the flowmeters will probably be used, to develop procedures for measuring their performance in a laboratory simulation of that environment, and to carry out illustrative measurements on a number of flowmeters. This report discusses: (1) the environment of the flowmeter in an automobile, i.e., flowmeter temperature; fuel temperature, pressure, density, viscosity, color, opacity, flow pulsations, back flow, and swirl due to elbows; line voltage fluctuations; electromagnetic radiation from ignition; vehicle attitude with respect to the vertical; and vibration, (2) the test set-up and procedure used for evaluating and calibrating these meters in the laboratory under conditions simulating the automotive environment, (3) a discussion of possible sources and magnitudes of errors in the calibration, and (4) results of illustrative tests on seven flowmeters.

715,638

PB-272 945/7 PC **A03**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Seismic Detection of Motor Vehicles.
Final rept. May 74-May 76,
J. M. Kenney. May 76, 35p NBSIR-77-1241, FHWA/RD-76-161
See also report dated Jul 75, COM-75-11127.

Keywords: *Seismic detection, *Vehicle detection, Vibration, Ceramics, Piezoelectric materials, Electronic switches, Piezoelectric transducers, Pressure sensors, Polymers, Vinylidene resins, Lead titanates, Lead inorganic compounds, Zirconates, Feasibility, Lead titanate zirconates.

The technical feasibility of detecting the approach of motor vehicles by seismic means was determined by the recording and analysis of road vibration, and verified by the construction of a seismic switch which was reliably triggered at a distance of 50 metres (164 ft) along the pavement by vehicles travelling at 50 km/h (30 mph).

715,639

PB-273 128/9 Not available NTIS
National Bureau of Standards, Boulder, CO.
Feasibility of Applying the Active TvTime System to Automatic Vehicle Location.
Final rept.,
D. A. Howe. 1974, 7p
Pub. in Jnl. Inst. Navigation 21, n1 p9-15 Spring 1974.

Keywords: *Position finding, *Time signals, Ground vehicles, Television broadcasting, Carrier waves, Radio links, Automatic tracking, Feasibility, Reprints, Automatic vehicle location, Active systems, Range range systems.

The National Bureau of Standards Boulder laboratory has studied the use of television as a carrier for accurate time and frequency signals. The usefulness of the TvTime System applied to locating cars and other vehicles automatically is examined. Such a need exists in transit, police, taxi, utility and many commercial fleets. Past approaches to the problem are outlined. The NBS TvTime System and experimental results are discussed. Two models of a car locating system are outlined, each having three parts: (1) a TV decoder in the car, (2) a radio link such as a mobile channel between car and central dispatch, and (3) a computer which determines the car's position. Results show that this system is capable of achieving a location accuracy of better than 60 m with 95 percent confidence. Some advantages and limitations of the system are discussed and cost estimates for the equipment are given.

715,640

PB-274 509/9 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Electromagnetic Interference (EMI) Measurements for Automotive Applications.
Final rept.,
J. W. Adams, M. L. Crawford, and J. F. Shafer. 1976, 6p
Pub. in Proceedings of SAE Automotive Congress Conference, Detroit, Mich. 23-27 Feb 76 p1-6 1976.

Keywords: *Electromagnetic interference, *Automotive engineering, Measurement, Probes, Electromagnetic fields, Cells, Measuring instruments, Transverse electromagnetic cells.

The paper discusses present electromagnetic interference (EMI) measurement techniques and some of the problems associated with EMI measurements, especially relative to automotive problems. Improved measurement techniques are then discussed, including: (1) use of isotropic probes capable of measuring unperturbed, complex fields close to their sources and (2) transverse electromagnetic transmission cells with expanded applications for both susceptibility and emission measurements. Finally, some suggestions for minimizing automotive EMI problems are given.

715,641
PB-274 985/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Life-Cycle Cost Evaluation of the Personal Patrol Car Program.
Final rept.,
R. T. Ruegg. Sep 77, 9p
Pub. in Jnl. of Police Science Administration, v5 n3 p290-298 Sep 77.

Keywords: *Police, *Motor vehicles, *Cost analysis, Life cycles, Utilization, Maintenance, Benefit cost analysis, Breakeven point, Police patrol cars, Life cycle costs, Alternatives, Reprints.

This paper provides assistance to the police fleet administrator in selecting an economically efficient vehicle program. It presents a general method for evaluating and comparing the costs and benefits of a personal patrol car program (PCP) and a multi-shift, pool car program (MSP). It identifies and illustrates with realistic data the cash flows associated with each of the two vehicle programs, and compares the life-cycle costs of a PCP with an MSP under alternative assumptions.

715,642
PB-276 398/5 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Analyses of Riding Tests for Evaluating the Wet Braking Performances of Bicycles.
Final rept.,
L. Mordfin. Apr 77, 33p NBSIR-78-1416

Keywords: *Bicycles, *Braking, *Consumer affairs, Performance tests, Friction, Pavements, Tires, Road tests, Standards, Brakes(Motion arresters), Wet pavements.

The Consumer Product Safety Commission has expressed interest in the development of a riding test method for evaluating the braking performances of bicycles in wet weather. In this report three different testing approaches for caliper-braked bicycles are examined using kinetic analyses, a review of the literature, and an evaluation of available domestic and foreign test results. On the basis of the findings it is recommended that the riding test include the intentional wetting of both the bicycle brakes and the test pavement; the former to obtain meaningful results and the latter to enhance the repeatability of the test results. A tentative pass-fail criterion is also offered, based on a maximum wet stopping distance which, at this time, appears to be generally attainable only with bicycle wheels having aluminum-alloy rims. Error analyses of the test methods are presented.

715,643
PB-276 530/3 PC **A05**/MF **A01**
National Bureau of Standards, Washington, D.C. Engineering Mechanics Section.
Static Force Calibration of a Skid Resistance Measuring System.
Final rept.,
R. W. Kearns, and J. F. Ward. Dec 76, 88p NBSIR-76-1175

Keywords: *Skid resistance, *Measuring instruments, *Trailers, Calibration, Loads(Forces), Traction, Vehicle wheels, Transducers, Pavements, Traffic safety.

The report describes procedures for the calibration and control of a skid resistance measuring system, the FHWA Interim Reference System. This system employs a tow vehicle and two-wheeled skid trailer. The procedures are chosen to minimize errors, leading to an increased confidence in the measurement results. Equations of static equilibrium for the skid trailer are derived and experimentally verified. The motions of the system in response to static force are measured and shown to depend on tow vehicle as well as trailer characteristics. Variables affecting the force calibration are identified. These include hitch height, trailer weight, lateral force on the test tire, center of support of the test tire, temperature of the test tire and force transducer, and inflation pressure. The use of a force plate as a calibrator is described. It is shown that the calibrator must itself have been calibrated under conditions covering its use with the trailer. Calibration of the force plate under combined vertical and traction force is described. The procedures are adaptable to other similar skid resistance measuring systems.

715,644
PB-279 053/3 PC **A07**/MF **A01**
National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
Auto Headlight Glass: Visible Features of Forensic Utility,
H. L. Steinberg. Feb 78, 142p NBS-SP-480-17
Library of Congress Catalog Card no. 78-600010.
Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, D.C.

Keywords: *Headlamps, *Accident investigations, *Glass, Criminal investigations, Patterns, Marking, Coloring, Identifying, Lenses, Reflectors, Manufacturers, Passenger vehicles.

The report documents those visual aspects of sealed beam headlights which may be of use in criminal investigations involving such evidence. These visual aspects include fluting pattern, lampmaker monogram, mold markings, beam and lamp type markings, and curvature. Only sealed beam headlights used in passenger vehicles having significant U.S. sales are considered.

715,645
PB-282 260/9 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Influence of Some Wetting Parameters on Bicycle Braking Performance.
Final rept.,
L. Mordfin. Jan 78, 15p NBSIR-78-1467

Keywords: *Bicycles, *Braking, Road tests, Brakes(Motion arresters), Safety, Evaluation, Standards, Wet pavements.

One approach toward evaluating the braking capability of a bicycle in wet weather involves riding tests in which the stopping distance of the bicycle with wet brakes is measured from a preselected initial speed. The results of some domestic and foreign riding tests of this kind are reviewed. It is found that the amount of water available at the brake surfaces, above some small minimum, is not significant. There are some sparse data that suggest that the manner of wetting (e.g., hose, trough or rain) may affect the test results but this evidence is questionable due to the uncharacterized influences of other test parameters. Recommendations for additional tests are given.

715,646
PB-289 723/9 PC **A08**/MF **A01**
National Bureau of Standards, Washington, DC. Law Enforcement Standards Lab.
Emergency Vehicle Warning Lights: State of the Art.
Final rept.
G. L. Howett, K. L. Kelly, and E. T. Pierce. Sep 78, 174p NBS-SP-480-16
Library of Congress Catalog Card no. 78-9503. Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, DC.

Keywords: *Warning systems, *Luminaires, *Motor vehicles, Regulations, Visual perception, Luminous efficacy, Color, Luminous intensity, Flash lamps, Reviews, Phase, Motion, Signal lights, Transportation lighting, *Emergency vehicles, State of the art.

Information is presented concerning all aspects of emergency-vehicle warning lights (EVWLs). A survey of the present situation includes: the non-uniformity of state EVWL laws; the factors entering into the choice of an EVWL configuration; a list and photographs of a variety of EVWL types; and a list of EVWL manufacturers and distributors. Background material relating to the perception of EVWL signals includes: an analysis of general warning-signal perception; a description of the visual stimulus pattern confronting a driver being approached by an emergency vehicle from various directions; and a summary of the characteristics of peripheral vision (including luminous efficiency, color perception and discrimination, and flicker and movement perception). Perceptual factors affecting the conspicuity of EVWL signals are discussed, including: effective intensity; flash rate; on-off ratio; pulse shape and flash duration; spatial sweep of beam; color; number and spatial pattern of lights; cross-sectional area; motion; temporal phase relations; and the role of the background. Physical measurements on EVWL units are described, including: angular intensity distribution and beamspread; flash rate; pulse shape and flash duration; effective intensity; color; and variables in rotating devices. A glossary, extensive enough to be helpful in reading the technical literature, is included.

715,647
PB-298 273/4 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Law Enforcement Standards Lab.
Guide to High Speed Patrol Car Tires.
A. C. Lewis, and E. Lewis. 1978, 45p NBS-SP-480-33
Sponsored in part by Law Enforcement Assistance Administration, Washington, DC.

Keywords: *Automobile tires, Guidelines, Braking, Traction, Wear resistance, Safety, Performance, Skid resistance, Police, Maintenance, Selection, Law enforcement, Equipment, Research, *Police patrol cars, Radial tires, Bias ply tires, Bias belted tires, Cornering.

The guide is designed to supply the information needed to select police patrol car tires to suit particular needs and to maintain them for maximum safety, tire life, and performance.

715,648
PB-298 605/7 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Electromagnetic Technology Div.
Electromagnetic Interference (EMI) Radiative Measurements for Automotive Applications.
Technical note.
J. W. Adams, H. E. Taggart, M. Kanda, and J. Shafer. Jun 79, 49p NBS-TN-1014
Sponsored in part by National Highway Traffic Safety Administration, Washington, DC.

Keywords: *Electromagnetic interference, *Ground vehicles, Radio transmitters, Electromagnetic compatibility, Field strength, Measurement, Electromagnetic fields, Electronic control, Electric fields, Magnetic fields, Near field.

This report describes the measured results of the electromagnetic (EM) environment encountered by three different-sized vehicles exposed to a selection of CB and mobile radio transmitters and broadcast stations. The vehicle in these situations is immersed in the near field of the radiating signals and the measured data is near-field data. This report gives measured data of electric and magnetic fields measured independently. The purpose of the report is to identify the EM environmental conditions under different circumstances in order to estimate EMC testing criteria for vehicles and their electronic systems.

715,649
PB80-118698 Not available NTIS
National Bureau of Standards, Washington, DC.
Search for a Safe Police Tire.
Final rept.,
J. J. Collard. Dec 79, 5p
Sponsored in part by Law Enforcement Assistance Administration, Washington, DC.
Pub. in The Police Chief XLVI, n12, p30-34, Dec 79.

Keywords: *Automobile tires, Treads, Wear resistance, Traction, Velocity, Maintenance, Performance, Quality, Requirements, Police.

Tires form one of the major subsystems of an automobile. In 1976, the International Association of Chiefs of Police conducted a survey of 379 police agencies to learn what their most serious tire problems were. These and other important data and information on tread wear, high speed and traction performance and maintenance were published in NBS Special Publication 480-33 entitled, 'Guide to High Speed Patrol Car Tires'.

715,650
PB80-179229 PC **A17**/MF **A01**

National Bureau of Standards, Washington, DC. National Engineering Lab.
Highway Noise Criteria Study: Traffic Noise Data Base.
Final rept.,
D. R. Flynn, C. R. Voorhees, and S. L. Yaniv. Apr 80, 385p NBS-TN-1113-1
Sponsored in part by Federal Highway Administration, Washington, DC.

Keywords: *Highways, *Noise(Sound), Acoustic fields, Motor noise, Acoustic measurement, Sound level meters, Noise pollution, Data acquisition, Statistical data, *Traffic noise, *Noise levels, *Transportation noise.

This report documents a traffic noise data base that was obtained as part of a large research program developed to identify and quantify the important physical parameters which affect human response to time-varying traffic noise and to investigate various procedures for rating such noise so as to enable reliable predictions of subjective response to the noise. Fifteen-minute recordings of actual traffic noise were made at four microphone positions (7.5, 15, 30, and 60 m from the centerline of the near lane) at several times of the day at each of seven sites, five representing nominally constant-speed traffic and two representing stop-and-go intersection traffic. The 107 recordings that resulted were subjected to extensive analysis. The analysis procedures are described and tables and graphs are included which document, for each recording, the 1/3-octave band spectra and numerous noise descriptors computed from the time-histories of the A-weighted sound level. As a separate part of this study, recordings also were made of the noise from single-vehicle passbys and from simulated traffic consisting of controlled drive-bys of up to ten vehicles. These recordings also were extensively analyzed and the results of these analyses are given.

715,651
PB81-147332 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Examination of Distance Measuring Devices.
Final rept.
S. Hasko. Dec 80, 66p NBS-HB-137
Library of Congress catalog card no. 80-600182.

Keywords: *Distance measuring equipment, *Automobiles, Calibration, Inspection, Odometers, Test equipment, Handbooks, Metric system, Motor vehicles, *Metrication, Taximeters.

This is a manual for State and local weights and measures officials, describing distance measuring devices such as odometers and taximeters to be tested, testing equipment and its calibration, inspection and testing procedures, and a reporting system. Provision is made for accommodating a changeover to metric units of device examination in the definitions, tables, procedures, and in reporting a test.

715,652
PB81-152365 PC **A02**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Bicycle Wheel Rim Reflective Materials Test Method Development.
S. D. Toner, and S. K. Wakamiya. Apr 80, 14p NBSIR-80-2035
Sponsored in part by Consumer Product Safety Commission, Bethesda, MD.

Keywords: *Bicycles, *Safety, Materials, Standards, Wheels, Reflective coatings.

A prototype testing apparatus was designed and built for use in conducting abrasion tests on reflective materials applied to bicycle wheel rims. Data obtained on the effects of various arbitrarily selected test parameters on a pressure sensitive reflective tape, used as a model, indicate that the abrader and test procedures are suitable for use in compliance testing of rim-applied retroreflective materials. Materials of this type, intended for use in lieu of spoke reflectors or retroreflective tires, are not included in the current bicycle safety regulations promulgated by the Consumer Product Safety Commission.

715,653
PB82-131723 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Characterization of Auto Headlight Glass by Refractive Index and Density.
Final rept.
Oct 81, 39p NBSIR-81-2286

Keywords: *Automobiles, *Headlamps, *Refractivity, *Glass, Density(Mass/volume), Physical properties, Measurement, Reliability, Motor vehicle accidents, Identifying.

By measurement of some physical property of headlight glass fragments found at the scene of an auto accident, forensic scientists have sometimes found it possible to infer that the glass was molded by a specific manufacturer, or even that it came from a broken headlamp on a specific car. The refractive index (RI) and density of the representative specimens are the most common parameters of interest to forensic scientists. In this study, performed in 1975, automotive headlights were obtained from several sources. From RI and density measurements, it is concluded that partial classification (by manufacturer and/or age) could be reliably achieved.

715,654
PB83-119867 PC **A11**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Failure Prevention in Ground Transportation Systems.
Final rept.
T. R. Shives, and W. A. Willard. Oct 82, 227p NBS-SP-621
Proceedings of the 31st Meeting of the Mechanical Failures Prevention Group, Held at the NBS, Gaithersburg, MD, April 22-24, 1980. Library of Congress catalog card no. 82-600597. Sponsored in part by Office of Naval Research, Arlington, VA., National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center, and Naval Air Systems Command, Washington, DC.

Keywords: *Transportation, *Quality assurance, *Meetings, Rail transportation, Highway transportation, Pipeline transportation, Freight cars, Cargo trucks, Highway bridges, Inspection, Nondestructive tests, Quality control, *Ground transportation, *Transportation safety.

These proceedings consist of 18 submitted entries (16 papers and 2 abstracts) from the 31st meeting of the Mechanical Failures Prevention Group which was held at the National Bureau of Standards, Gaithersburg, Maryland, April 22-24, 1980. The theme of the symposium was failure prevention in ground transportation systems. Areas of interest included rail vehicles and structures, highway and road bridges, pipeline transportation systems, and motor carriers.

715,655
PB84-198829 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Limited Electromagnetic Interference Testing of Evidential Breath Testers.
May 83, 40p DOT-HS-806 400

Keywords: *Electromagnetic interference, Transmitter receivers, Police, Tests, Failure, Damage, *Breathalyzers, Alcohol breath tests.

The anomalous behavior of a specific evidential breath tester (EBT) in the presence of an electromagnetic field from a police transceiver was brought to the attention of the National Bureau of Standards (NBS) by the National Highway Traffic Safety Administration (NHTSA) early in 1982. This report presents the results of a limited study, conducted by the NBS, to identify evidence of potential electromagnetic interference (EMI) problems with a selected sample of EBT's currently used by State and local governments.

715,656
PB86-124146 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
National Cost of Automobile Corrosion.
Final rept.
E. Passaglia, and R. A. Haines. 1980, 13p
Sponsored by National Association of Corrosion Engineers, Houston, TX.
Pub. in Proceedings of Corrosion/80 International Corrosion Forum Devoted Exclusively to the Protection and Performance of Materials, Chicago, IL., March 3-7, 1980, p118.1-118.13.

Keywords: *Automobiles, *Corrosion, Expenses, *Costs, Maintenance costs.

The costs of automobile corrosion presented in the NBS report, 'Economic Effects of Metallic Corrosion in the United States' have been collected from that report and presented separately. Costs are given as incurred by the automobile manufacturing sector for corrosion resistant inputs such as copper and stainless steel, and as incurred by the industrial sectors, the private consumer, the Federal Government and state and local government for maintenance and shortened lifetime. Total costs are given as well as the portion that is avoidable by the use of economic best practice. The uncertainties in the estimates of the costs and their origins are discussed.

715,657
PB86-153517 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Paratransit Advanced Routing and Scheduling System Documentation: Functional Program and Data Specifications.
W. G. Hall, H. K. Hung, and R. E. Chapman. Dec 85, 61p NBSIR-85/3174
Sponsored by Urban Mass Transportation Administration, Washington, DC.

Keywords: *Urban transportation, Scheduling, Automation, *Paratransit, *Dial-a-ride systems, Routing, Computer applications, Control systems, Computer software, Central processing units.

The document specifies functional and data requirements governing automated procedures for routing and scheduling dial-a-ride vehicles. It provides overviews of existing methods and proposed methods, and summarizes improvements and impacts. Requirements for functions, performance, inputs-outputs, data characteristics, and failure contingencies are discussed fully. Three operating systems are specified. Finally, input and output data are described, and data collection procedures are presented.

Transportation Safety

715,658
PB-250 063/5 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Metallurgical Analysis of a Steel Shell Plate Taken from a Tank Car Accident Near South Byron, N.Y.
Final rept.
C. R. Interrante, and G. E. Hicho. Oct 71, 59p NBS-312.01/35, FRA/ORD-75/47
Contract DOT-AR-10023

Keywords: *Metals plates, *Tank cars, Metallurgical analysis, Steels, Metallography, New York, Accidents, Byron(New York), Railroad accidents.

A metallurgical analysis of a steel plate sample (the South Byron sample) was requested by the Federal Railroad Administration. The steel sample was taken from a tank car (number PPGX9990) which had been involved in an accident near South Byron, New York. This sample was reported to have been produced to specification AAR-M-128-65-DTD-1966-Flange Quality-Grade B, and it was reportedly taken from the second course of shell plate of car number PPGX9990. The fracture in this course circumscribed the tank car and resulted in the division of the car into two sections. An investigation was conducted at the National Bureau of Standards to determine if the plate sample conformed with the above Association of American Railroads (AAR) Specifications for Tank Cars and to gather information pertinent to the question of the suitability of this type of steel for use as the shell plate of tank cars.

715,659
PB-250 530/3 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.

Metallurgical Analysis of Five Steel Plates Taken from a Tank Car Accident Near Crescent City, Illinois.
Final rept.
C. G. Interrante, G. E. Hicho, and D. E. Harne. Mar 72, 91p NBS-312.01/39, FRA/ORD-75/48
Contract DOT-AR-10023

Keywords: *Tank cars, *Metal plates, Metallurgical analysis, Steels, Accident investigations, Railroad cars.

A metallurgical analysis of five steel samples (numbered FRA-1 through FRA-5) was requested by the Bureau of Railroad Safety, Federal Railroad Administration, Department of Transportation. These steel samples were taken from two tank cars (numbered SOEX 3037 and SOEX 3219) which had been involved in an accident near Crescent City, Illinois. Samples FRA-1, FRA-4, and FRA-5 were reported to be shell plates and sample FRA-3, a head plate. Sample FRA-2 was a welded sample of head plate and shell plate and it was used for most of the mechanical properties determinations in this report. An investigation was conducted at the National Bureau of Standards to determine if the samples conformed with the appropriate specifications for tank car materials and to gather information pertinent to the question of the suitability of these steels for use as plate materials of tank cars. Samples FRA-1, -2, and -5 were reportedly produced to the specification for ASTM A 212-65 Grade B, flange quality steel (A 212-B); and FRA-3 and -4 were reportedly produced to specification AAR M128 Grade B, flange quality steel (M128-B). Portions of this document are not fully legible.

715,660

PB-250 587/3 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Metallurgical Investigation of a Full-Scale Insulated Rail Tank Car Filled with LPG Subjected to a Fire Environment.
Final rept.
J. G. Early, and C. G. Interrante. Jan 75, 69p NBSIR-75-657, FRA/ORD-75/52
Contract DOT-AR-40008

Keywords: *Tank cars, *Safety engineering, Railroad cars, Metal plates, Steels, Failure, Metallurgical analysis, Fire damage.

An analysis of the failure of an insulated rail tank car, RAX 202, which had been tested to failure in a fire environment at White Sands Missile Range, New Mexico, was requested by the Federal Railroad Administration, Department of Transportation. The tank car, filled with approximately 33,000 gallons of liquified petroleum gas (LPG), failed after approximately 94 minutes of exposure to a JP-4 jet fuel fire. The car fractured into four fragments which were examined in the field. Five plate samples from the four fragments were selected for laboratory study at the National Bureau of Standards.

715,661

PB-255 854/2 PC **A08**/MF **A01**
National Bureau of Standards, Gaithersburg, MD.
Impact Properties of Steels Taken from Four Failed Tank Cars.
Final rept.
C. G. Interrante. Jun 76, 160p NBSIR-75-656, FRA/ORD-75-51
Contract DOT-AR-40008

Keywords: *Steels, *Tank cars, *Safety engineering, Impact tests, Impact strength, Metal plates, Weldments, Failure, Steel A-212.

An overview of the results and metallurgical analyses of the findings of impact tests conducted at the National Bureau of Standards on samples of tank-car materials submitted by the Federal Railroad Administration is presented. The submitted samples were taken from tank cars which had been involved in service accidents during the period January 1970 to January 1971. One of these tank cars had been fabricated from ASTM A212 steel and the remaining four tank cars from AAR TC128 steels. The impact test data were reported earlier in four tank-car accident reports.

715,662

PB-255 907/8 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C.

Mechanical Properties of AAR M128-69-B Steel Plate Samples Taken from Insulated Fire Tested Tank Car RAX 202.
Final rept.
J. G. Early. Jun 76, 60p NBSIR-75-725, FRA/ORD-76/74
Contract DOT-AR-40008
See also PB-251 097.

Keywords: *Tank cars, *Safety engineering, *Metal plates, Steels, Mechanical properties, Failure, Fracture properties.

Studies were undertaken to measure the elevated-temperature mechanical properties and to determine the elevated-temperature fracture behavior of selected AAR M128-B steel plates. In addition, the ambient-temperature mechanical properties were measured to determine if the requirements of specification AAR M128-69-B were satisfied.

715,663

PB-259 127/9 PC **A03**/MF **A01**
Princeton Univ., NJ. Dept. of Aerospace and Mechanical Sciences.
Problem in Fire Safety: Flame Spreading Across Liquid Fuels.
Final rept.,
F. L. Dryer, I. Glassman, and W. A. Sirignano. 15 Sep 76, 30p PUAMS-1308, NBS-GCR-76-79
Grant NSF-AEN75-14285
(PC A03/MF A01)

Keywords: *Aircraft fires, *Aviation fuels, *Flame propagation, Liquids, Experimental data, Theories, Surface tension, Flow distribution, Control, Vortices, Flash point, Temperature, Fire spread.

This report provides a brief summary of experimental and theoretical work carried out at Princeton University on flame spreading across liquid fuels. The importance of surface tension driven flows ahead of the flame front in controlling flame spread across liquids at temperatures below the flash point was demonstrated experimentally. Buoyancy and radiation effects were also present but were of lesser importance. Variations in the temperature of the liquid surface are attributed to eddies in the gas phase ahead of the flame front. These eddies may also play a role in flame propagation across solid combustibles. It is proposed to investigate these eddies by means of laser doppler velocimetry. A two-dimensional, steady-state computer program is under development for use as a tool in studying flame propagation above liquid and solid fuels.

715,664

PB-264 125/6 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. Inst. for Materials Research.
Piezoelectric Polymer Transducers for Dynamic Pressure Measurements.
Final rept.,
A. S. DeReggi, S. Edelman, and S. C. Roth. Jun 76, 42p NBSIR-76-1078
Sponsored in part by National Highway Traffic Safety Administration, Washington, D.C.

Keywords: *Piezoelectric transducers, *Pressure sensors, Vinylidene resins, Bioinstrumentation, Impact, Motor vehicle accidents, Impact tests, Vinylidene fluoride polymers.

The report describes the construction, testing and calibration of piezoelectric polymer sensing transducers of two sizes. The piezoelectric material was obtained by poling 25 micrometer thick, polyvinylidene fluoride sheet. Sensors with an active area of 1 cm diameter, intended for dynamic interface-pressure measurements, were calibrated in a fixture generating normal pressure transients by means of piston impact. Sensors with an active area of 2 mm diameter, intended for measuring dynamic pressures while implanted in the cranium of rhesus monkeys, were calibrated in an oil cell with a piston-cylinder seal which provided hydraulic pressure transients by means of impact on the piston. The larger sensors had a normal-pressure sensitivity around 3 microvolts/Pa (20 mV/psi) and the smaller sensors a hydraulic-pressure sensitivity around 0.7 microvolts/Pa (5 mV/psi).

715,665

PB-268 904/0 PC **A05**/MF **A01**
Michigan Univ., Ann Arbor. Highway Safety Research Inst.
Guidebook on Anthropomorphic Test Dummy Usage.
Final rept. Jul 76-Mar 77,
D. H. Robbins. 31 Mar 77, 84p UM-HSRI-BI-77-19, NBS-GCR-77-91
Grant NBS-6-9011

Keywords: *Anatomical models, *Safety engineering, *Collision research, Research, Standardization, Dynamic tests, Impact tests, Highway transportation, Traffic safety, Buildings, Glass, Glazes, Injuries, Helmets, Children, Bibliographies.

The report addresses the role which may be played by impact test dummies in developing countermeasures to cope with the high incidence of safety problems related to building structures. Possible roles are discussed in safety problem identification, countermeasure development, and in the preparation of standardized test procedures. The parameters of a test using a dummy are grouped according to: (1) representation of a human victim; (2) representation of the environment in which an injury may occur; (3) the interaction between the victim (dummy) and his environment; and (4) the injuries (transducer or other measurements in the case of the dummy) which occur. Dummies are classified according to sophistication ranging from anthropometric form to impact body blocks and finally to sophisticated anthropomorphic test devices used in automotive safety. Test procedures and data processing are discussed. A bibliography, coded by subject, is also included.

715,666

PB-292 600/4 PC **A04**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Fire Research.
Fire Safety Guidelines for Vehicles in a Downtown People Mover System.
Final rept.
R. D. Peacock. Jan 79, 56p NBSIR-78-1586
Sponsored in part by Urban Mass Transportation Administration, Washington, DC.

Keywords: *Fire safety, *Vehicles, *Urban transportation, Safety engineering, Design, Requirements, Passenger transportation, Flammability, Mass transportation, Smoke, Materials, Fire detection systems, Telecommunication, Evacuating(Transportation), Guideway transportation, People movers.

The results of a study to formulate fire safety guidelines to be required for vehicles used in Downtown People Mover (DPM) systems for the movement of people in a congested urban area are presented. Through a review of the design features of existing people mover vehicles and systems, and a review of proposed new systems, fire scenarios are developed and guidelines suggested to minimize the fire risk to passengers. Methods and criteria, based on established test procedures, are proposed for assessing the flammability and smoke generation of interior finish and furnishing materials. Fire and smoke detection and suppression equipment are recommended, along with proposed guidelines for emergency evacuation provisions and emergency communication requirements. An extensive bibliography of flammability in fixed guideway transit systems is included.

715,667

PB-292 978/4 PC **A02**/MF **A01**
National Engineering Lab. (NBS), Boulder, CO. Thermophysical Properties Div.
Radio Frequency Liquid Level Gauging in Propane Tank Car Safety Tests - A Feasibility Study.
J. D. Siegwarth. Jan 79, 15p NBSIR-79-1600

Keywords: *Tank cars, *Liquid level indicators, Resonant frequency, Radio frequencies, Propane, Fire safety, Feasibility, Tests.

Selected radio frequency (rf) resonances of an empty 30,300 liter (8,000 gallon) tank car have been measured to determine whether rf can be used to gauge the propane liquid levels during tank car fire safety tests. The change of resonant frequencies of a small horizontal cylindrical tank as a function of liquid volume has been tested in order to estimate the precision to which the amount of propane in a tank car can be measured. The technique is applicable to routine tank car gauging.

715,668

PB-298 127/2 PC **A03**/MF **A01**

National Bureau of Standards, Washington, DC. Law Enforcement Standards Lab.
Some Psychophysical Tests of the Conspicuities of Emergency Vehicle Warning Lights.
G. L. Howett. Jul 79, 27p NBS-SP-480-36
Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, DC. Library of Congress catalog card no. 79-600089.

Keywords: *Transportation lighting, Brightness, Headlamps, Color, Intensity, Perception, Attention, Visual field, Evaluation, Visibility, Automobiles, Motor vehicles, *Emergency vehicles.

This is a report of some exploratory studies aimed at evaluating the conspicuities (attention-attracting powers) of a group of commercial warning lights meant for use on emergency vehicles. The main experiment used a novel technique of conspicuity matching. Each observer, in turn, fixated straight ahead and viewed two flashing lights peripherally, one located 20 degrees to the left of the fixation point, and one 20 degrees to the right. One of the two lights was always a reference light whose intensity could be adjusted by the observer until the two lights appeared equally conspicuous. All the lights were thereby ranked on a single scale of conspicuity, based on the adjustable-light intensities. There was a good correlation (r=0.90) between these ranks and the measured effective intensities of the lights. Another, very brief, pilot experiment ranked some of the lights according to the number of degrees into the left side of the visual field that the flashes could still be seen. This disappearance-angle rank also correlated well (r=0.86) with conspicuity rank. Problems encountered and suggestions for future improvements are discussed.

715,669
PB81-143539 Not available NTIS
National Bureau of Standards, Washington, DC.
Survey of Altimeter Calibration Accuracy.
C. R. Tilford, S. D. Wood, and A. J. Lundquist. May 80, 6p
Pub. in Proceedings of the Air Data Systems Conference (1980) Held at the U.S. Air Force Academy, Colorado Springs, CO. on May 5-8, 1980, SRDS Tech. Letter Report No. RD-80-6-LR, 6p, 8 May 80.

Keywords: *Altimeters, *Calibration, Aircraft landings, Flight instruments, Setting(Adjusting), Accuracy, Pressure sensors.

Limited data exist from which to determine what altimeter accuracies are actually achieved in field use. In order to acquire some information about altimeter accuracy and, in particular, to evaluate whether or not adequate pressure measurement accuracy is available to the aviation community, a limited measurement survey of altimeter repair and calibration shops has been performed. A commercial transfer-standard quality pressure transducer was modified for field use. It was repeatedly calibrated in the field using a portable calibration unit. This equipment and calibration procedures were able to maintain an uncertainty of .001 in Hg + .01% of reading for the transfer standard. Several instrument repair shops were then asked to calibrate the transfer standard in the same manner they would an altimeter. The results of these comparisons and the details and performance of the equipment used are discussed.

715,670
PB81-219396 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Emergency Vehicle Warning Systems.
A. I. Rubin, and G. L. Howett. May 81, 30p NBS/SP-480-37
Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, DC. Library of Congress catalog card no. 81-600059.

Keywords: *Warning systems, *Emergency vehicles, Sirens, Luminaires, Standards, Color, NTISCOMNBS, NTISJDLEAA.

The subject of visual and auditory warning devices (lights and sirens) for emergency and service vehicles is surveyed from a broad perspective. It is intended that this user guide should provide directly useful information at all levels from the selection of hardware to an understanding of the psychophysical factors determining the effectiveness of these devices. Topics covered include: the theory of warning signals; the present situation and the need for uniform national standards; suggested performance standards for warning light systems and for sirens, including the reasons for the principle requirements; recommendations for actions that can be taken to improve the signal effectiveness of emergency vehicles; an illustrated classification of the many types of emergency-vehicle warning lights; and brief summaries of some of the physical measurements that were made on a selection of lights and sirens.

715,671
PB83-207902 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Statistical Evaluation of Blood Alcohol Measurements.
Interim rept. 1977-Oct 80.
J. A. Lechner. Oct 81, 31p DOT-HS-806 193
Contract DOT-HS-020-2-290

Keywords: *Traffic safety, Alcoholic beverages, Statistical analyses, Laboratories, Accuracy, Measurement, *Drinking drivers, *Blood alcohol concentration.

The National Highway Traffic Safety Administration (NHTSA) has instituted a voluntary program to evaluate the proficiency of laboratories measuring the amount of alcohol in blood. The variability of those measurements were assessed. Differences between labs, between dates for the same lab, and between samples on the same date are quantified. Differences in overall bias for the six different periods (covering two years) are noted. A few of the roughly 120 labs participating were observed to perform considerably less well than the others.

715,672
PB84-217082 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Fire Research.
Decision Analysis Model for Passenger-Aircraft Fire Safety with Application to Fire-Blocking of Seats.
Rept. for Nov 82-Dec 83.
J. R. Hall, and S. W. Stiefel. Mar 84, 105p NBSIR-84-2817, DOT/FAA/CT-84/8
Contract DTFA30-83-A-0034

Keywords: *Fire safety, *Passenger aircraft, *Aircraft seats, Aircraft fires, Benefit cost analysis, Mathematical models, Upholstery, Risk assessment, Cost models.

This report develops a generic model for analysis of the costs and benefits of fire-risk reducing strategies related to passenger airlines. The model calculates incremental costs for installing and operating these options. It also calculates estimated lives saved and property damage avoided, and it provides rules for combining costs and benefits into a single measure of attractiveness for an alternative. This model is then applied to the strategy of fire-blocking seats on passenger airlines, either on U.S. airlines or on all world airlines.

715,673
PB84-217926 PC **A06**/MF **A01**
National Bureau of Standards (NEL), Washington, DC. Center for Fire Research.
Fire Tests of Amtrak Passenger Rail Vehicle Interiors.
Final rept. 1978-83.
R. D. Peacock, and E. Braun. May 84, 119p NBS/TN-1193
Also available from Supt. of Docs as SN003-003-02590-9. Sponsored in part by Federal Railroad Administration, Washington, DC.

Keywords: *Fire safety, *Railroad cars, Passenger vehicles, Tests, Combustion, Flammability, Materials, Calorimeters, Smoke, Rail transportation, Amtrak system, Vehicle interiors.

A series of fire tests was conducted to assess the burning behavior of the interior of passenger rail vehicles. Three types of tests were performed: (1) small-scale laboratory tests to study the flammability and smoke generation characteristics of the individual materials, (2) full-scale calorimeter tests on the seats to determine the rate of heat release from burning seat assemblies, and (3) full-scale tests on mock-ups of the interior of the cars to investigate the potential for fire hazard in the fully furnished vehicles.

715,674
PB85-137685 PC **A06**/MF **A01**
Factory Mutual Research Corp., Norwood, MA.
Modeling of Aircraft Cabin Fires.
M. A. Delichatsios. Sep 84, 116p FMRC-J-I-OHOJ2-BU1, NBS/GCR-84/473
Grant NB82-NADA-3041
Sponsored in part by Federal Aviation Administration Technical Center, Atlantic City, NJ.

Keywords: *Aircraft cabins, *Fires, Mathematical models, Flame propagation, Fuselages, Walls, Predictions.

In this work, simple fire dynamic models for various components of an aircraft cabin fire are developed. These simple integral models can be incorporated in global zone models for aircraft cabin fires occurring in flight or caused by an impact-survivable crash. The major accomplishment of this work was the development of simple expressions for the burning of vertical walls, simulating, for example, the burning of wall panels in the fuselage. Flame heights of vertical wall fires are predicted and correlated by a simple expression. In addition, critical conditions for extinction of rapid flame spread have been investigated for fires in vertical walls consisting of charring materials, allowing for the prediction of flame spread rates.

715,675
PB86-163524 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Role of Aircraft Panel Materials in Cabin Fires and Their Properties.
Final rept.
J. Quintiere, V. Babrauskas, L. Cooper, M. Harkleroad, K. Steckler, and A. Tewarson. Jun 85, 109p
Sponsored by National Aviation Facilities Experimental Center, Atlantic City, NJ.
Pub. in DOT/FAA/CT-84/30, 109p 1985.

Keywords: *Aircraft cabins, *Fires, Combustion, Flammability, Heat transfer, Ignition, Reprints.

The report examines the fire development in the FAA C 133 post crash fire experiments involving a fully furnished cabin section. In particular the rate and involvement of aircraft wall and ceiling panels are examined. For two full-scale experiments the energy release rate of the interior cabin furnishings were estimated and an estimate of ceiling ignition computed. Also flammability data on ignition, combustion, and heat transfer at various external irradiance, for one device at diminished ambient oxygen, were compiled from several test apparatuses for five candidate aircraft panel materials.

General

715,676
PB83-214668 PC **A16**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Damage Prevention in the Transportation Environment.
Final rept.
T. R. Shives. Apr 83, 354p NBS-SP-652
See also PB83-149450. Sponsored in part by Office of Naval Research, Arlington, VA., Naval Air Systems Command, Washington, DC., and National Aeronautics and Space Administration, Goddard Space Flight Center. Library of Congress catalog card no. 83-600521. Proceedings of the Meeting of the Mechanical Failures Prevention Group (34th) held at Gaithersburg, MD., October 21-23, 1981.

Keywords: *Cargo transportation, *Packaging, *Meetings, Rail transportation, Marine transportation, Highway transportation, Shipping containers, Collision research, Hazardous materials, Computer applications.

These proceedings consist of 27 submitted entries (25 papers and 2 abstracts) from the 34th Meeting of the Mechanical Failures Prevention Group which was held at the National Bureau of Standards, Gaithersburg, Maryland, October 21-23, 1981. The subject of the symposium was damage prevention in the transportation environment. Areas of special emphasis included packaging for the transportation environment, research in the railroad industry, damage prevention in the railroad industry, designing for the transportation of hazardous materials, and highways.

URBAN & REGIONAL TECHNOLOGY & DEVELOPMENT

Communications

715,677
PB-258 447/2 PC **A05**/MF **A01**
Office of Telecommunications, Boulder, CO. Inst. for Telecommunication Sciences.
Attenuation of UHF Radio Signals by Houses.
P. I. Wells, and P. V. Tryon. Aug 76, 88p OTR-76-98

Keywords: *Radio transmission, *Attenuation, Ultrahigh frequencies, Microwave communication, Communication satellites, Disasters, Houses, Residential buildings, Warning systems, Radio signals.

The paper presents the results of a measurement program which was conducted to determine the attenuation of UHF radio signals penetrating to the inside of a typical house. This program is part of a study to determine the feasibility of using direct satellite communication to disseminate disaster warning messages. The measurements were made in a manner to determine the building attenuation as a function of frequency, construction type, climate, and the elevation angle to the signal source.

Economic Studies

715,678
PB80-148604 PC **A07**/MF **A01**
Wilson (J.W.) and Associates, Inc., Washington, DC.
Innovative Approaches to Electric Utility Rate Structure: Marginal Costs and Time-Varying Rates, Volume I and Usage and Evaluation.
Final rept.,
R. E. Miller. Nov 79, 143p NBS-GCR-ETIP-79-79
Contract NBS-5-35894

Keywords: *Rates(Costs), *Electric utilities, Cost analysis, Time measurement, Technology innovation, Cost estimates, Performance evaluation, Electric power demand, Electric power generation, Economic analysis, Revenue, Profits, Consumers, Billing.

The report is an analysis of the possibilities for using rate structure innovations to help improve the economic efficiency and equity of the performance of the electric utility industry. It focuses on two such innovations: the use of marginal cost concepts in the ratemaking process; and the introduction of time-varying rates.

715,679
PB81-135840 PC **A06**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Cost Estimation and Cost Variability in Residential Rehabilitation.
Building science series (Final).
R. E. Chapman. Nov 80, 123p NBS-BSS-129
Library of Congress catalog card no. 80-600174.

Keywords: *Residential buildings, *Renovating, *Cost estimates, Construction costs, Operating costs, Profits, Expenses, Material estimates, Labor estimates, Cost comparison, Engineering costs, Economic analysis, Productivity, *Housing rehabilitation.

The study analyzes four methods of estimating the costs of residential rehabilitation. Each method is critiqued with regard to its treatment of changes in the size of the renovation project, the productivity of labor, and the contractor's markup for overhead and profit. Cost comparisons and a discussion of the way in which the inherent riskiness of renovation activities may be assessed are also presented. A theoretical approach for dealing with cost variability which integrates the performance concept with established engineering economics techniques is also developed.

Emergency Services & Planning

715,680
PB81-110389 PC **A99**/MF **A01**
National Bureau of Standards, Washington, DC. National Measurement Lab.
Structure Shielding Against Fallout Gamma Rays from Nuclear Detonations.
Final rept.
L. V. Spencer, A. B. Chilton, and C. M. Eisenhauer. Sep 80, 986p NBS-SP-570
Prepared in cooperation with Illinois Univ. at Urbana-Champaign. Library of Congress catalog card no. 80-600120.

Keywords: *Nuclear warfare, *Civil defense, *Fallout shelters, Structural design, Radiation protection, Radiation shielding, Gamma rays, Radiation contaminants.

This is a summary of theoretical, experimental, and engineering research on the applications of gamma ray transport and dosimetry to the analysis of structures for the shielding properties against gamma rays from radioactive fallout. The first chapter presents historical background; and chapter II follows the developmet of detailed quantitative information on fallout spectra and intensities. Chapters III and IV give information on general gamma ray transport phenomena, as well as properties, theorems, and methods with specific applications to structure shielding. Chapter V presents a wide variety of data types basic to engineering applications. Chapter VI presents experimental results for the fallout radiation environment. Chapters VIII and X then present experimental results for increasingly complex structure types, while Chapters VII and IX present related engineering procedures of analysis of the same or similar, structure types. Chapter XI is very short, and gives general guidance to shielding analysts; and chapter XII concludes with a discussion of the implications of the existing technology for national shelter programs.

715,681
PB84-103548 Not available NTIS
National Bureau of Standards, Washington, DC.
Types of Nuclear Disaster and Their Radiation Environment.
Final rept.
L. V. Spencer. 1982, 4p
Pub. in Proceedings of the NCRP Symposium the Control of Exposure to the Public to Ionizing Radiation in the Event of Accident or Attack, Reston Virginia, Apr 27-29, p4-7, 1981.

Keywords: *Meetings, *Nuclear radiation, *Accidents, *Radiation protection, Radiation hazards, Radiation effects, Disasters, Nuclear reactor accidents, Nuclear warfare, Fallout, Civil defense, Meltdown.

The paper, together with the purpose statement, introduces the published proceedings of NCRP-sponsored Symposium on civil protection from radiation generated in nuclear accidents or attacks. The bulk of the material consists of a summary and rearrangement of contents of a report prepared by P. Dolan for participants in the Symposium, which listed data for multiweapon and single weapon attacks, core melt and no core melt reactor accidents, weapons and spent fuel reactor transportation accidents, and transoceanic fallout from a multiweapon attack. Characteristics of the carrier, the source, the hazard, the radiations, countermeasures, and dosimetry are given.

715,682
PB87-148516 PC **A12**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Theory and Application of Expert Systems in Emergency Management Operations: Proceedings of a Symposium held at the Department of Commerce, Washington, DC, April 24-25, 1985.
Final rept.,
S. I. Gass, and R. E. Chapman. Nov 86, 266p NBS/SP-717
Also available from Supt. of Docs as SN003-003-02784-7. Library of Congress catalog card no. 86-600546. Prepared in cooperation with Maryland Univ., College Park. Coll. of Business and Management. Sponsored by Federal Emergency Management Agency, Washington, DC.

Keywords: Artificial intelligence, National government, State government, Local government, Fire control, Coal mines, Shipboard fire control, *Expert systems, *Emergencies, *Emergency services, Chemical spills, Federal Emergency Management Agency.

The First Symposium on The Theory and Application of Expert Systems in Emergency Management, held at the Department of Commerce, Washington, D.C. (April 24 and 25, 1985) was funded by the Federal Emergency Management Agency and organized by the National Bureau of Standards' Operations Research Division. The purpose of the symposium was to bring together researchers in expert systems, artificial intelligence, and emergency operations in a forum to review the concepts of expert systems and the problems of emergency management, with the objective of determining how expert systems can be used to augment the experience of local, State and Federal emergency managers faced with the difficult tasks of determining the best response to an emergency situation. Speakers addressed the following areas: The theory and uncertainty aspects of expert systems, artifical intelligence's future role in emergency management, technology for building and using expert systems, emergency management decisions and information needs and uses, applications of expert systems in the management of chemical spills and shipboard and coal mine fires, and the role and use of simulation in emergency management expert systems.

715,683
PB87-152104 PC **A09**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Expert Systems and Emergency Management: An Annotated Bibliography.
Final rept.,
S. I. Gass, S. Bhasker, and R. E. Chapman. Nov 86, 181p NBS/SP-728
Also available from Supt. of Docs as SN003-003-02769-3. Library of Congress catalog card no. 86-600591. Sponsored by Federal Emergency Management Agency, Washington, DC.

Keywords: *Bibliographies, *Artificial intelligence, Telecommunication, Information system, *Expert systems, *Emergencies, Computer applications, National Bureau of Standards.

The report is the result of an in-depth review of the recent technical literature on expert systems. The material contained in the report provided a basis for assessing the potential for using expert systems in emergency management operations. In choosing the material for inclusion in the report, special emphasis was placed on those aspects of expert systems which addressed the types of problems encountered in emergency management operations. The report is designed for use as a resource document and as a tutorial on expert systems and emergency management. Each chapter consists of brief topic essay followed by a set of references which expand on the main themes of the essay.

Environmental Management & Planning

715,684
PB81-115958 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
State-of-the-Art Summary of Incentives for Residential Water Conservation.
Final rept.
J. Elder. Oct 80, 39p NBSIR-80-2119
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research.

Keywords: *Water conservation, *Incentives, Government policies, Consumers, Information services, Public relations, Water consumption, Citizen participation, Prices, Water supply, Rates(Costs), Energy conservation, Residential areas.

The report addresses some programs and techniques that have been developed to encourage residential water conservation. Energy conservation techniques that appear to be directly relevant to water conservation have also been included. Specific areas covered are: consumer education and information programs, feedback techniques, possible incentives in mass-metered residences, and the impact of pricing on water consumption. An extensive bibliography is included.

Environmental Management & Planning

715,685

PB82-138280 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Propagation of Urban Construction Site Noise Along Street Corridors.
Final rept.
P. R. Donavan, and J. C. Wyvill. Apr 79, 48p NBSIR-79-1592
Sponsored in part by Environmental Protection Agency, Washington, DC. Office of Noise Abatement and Control.

Keywords: *Urban areas, *Construction, *Noise pollution, Streets, Sound transmission, Site surveys, Acoustic measurement, *Noise levels, Computer aided analysis.

An existing urban sound propagation model has been applied to the specific problem of estimating the propagation of noise from urban construction sites along street corridors. Discussion summarizes the development of the propagation model and computer programs used to estimate sound propagation. The propagation model has been applied to five different construction site orientations resulting from two city block configurations. For each of the site orientations, the estimated values of attenuation versus distance in the streets surrounding individual sites are presented. Assuming the sound level at the construction site is known, the procedure to be used to determine sound levels in the surrounding streets is also provided.

Fire Services, Law Enforcement, & Criminal Justice

715,686

PAT[illegible] Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Handcuff Improvements.
Patent.
J. E. Harris. Filed 3 Mar 80, patented 9 Feb 82, 8p
PB82-600034, PAT-APPL-6-126 591

Keywords: *Handcuffs, Triple backing.

Triple locking handcuffs are provided having a lock which has an abutment therein which pushes against a bolt in the lock to double lock the latch and triple lock the ratchet and pawl of the lock. In the triple locked position a biasing means forces the bolt against the abutment, and to unlock the handcuffs a number of different mechanical means are provided for moving the bolt slightly away from the abutment, whereupon the ordinary handcuff key can be used to unlock the handcuffs. Handcuffs are also provided which automatically double and triple lock upon application to the wrist.

715,687

PB-273 174/3 PC **A06**/MF **A01**
Maryland Univ., College Park. Fire Protection Curriculum.
Goal Oriented Systems Approach,
J. Watts. 12 Jul 77, 122p NBS-GCR-77-103
Grant NBS-7-9007

Keywords: *Buildings, *Fire safety, Building codes, Fire resistance, Fire prevention, Fire protection, Probability theory, Trees(Mathematics), *Fault tree analysis.

This report is an introduction to the goal oriented systems approach to building fire safety based on a review of the available literature. Included are discussions of the environment in which the concept was conceived, the genesis of the formalized procedures, the aspects conductive to reevaluation and the present and projected impact of this concept on the discipline of fire protection engineering. The conclusions drawn are that the goal oriented systems approach attempts to fulfill a significant need but is requisite of additional research.

715,688

PB-280 618/0 PC **A04**/MF **A01**
National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
Development and Testing of a Highly Directional Dual-Mode Electronic Siren.
Final rept. Dec 76,
R. L. Fisher, D. D. Toth, D. S. Blomquist, and J. S. Forrer. Feb 78, 54p NBS-SP-480-28
Sponsored in part by National Inst. of Law Enforcement and Criminal Justice, Washington, D.C.

Keywords: *Sirens, Acoustic arrays, Orientation, Loudspeakers, Ground vehicles, Law enforcement, Phased arrays, Emergency vehicles, Dual mode, Electronic devices.

NBS has developed a dual-mode directional electronic siren which can be electrically switched under manual control from a strong narrow beam of sound in the forward direction for open highway usage to a broader beam for use near roadway intersections. The intense beam of sound is produced by a vehicular-roof-mounted broadside array consisting of four compact commercial 100 watt electronic siren loudspeakers spaced 15.2 cm (6.0 in) apart. Two electronic systems were developed to broaden the inherently narrow beam of the broadside array. One system swept the beam from side to side. The second system involved the use of a filter network. A-weighted sound pressure level measurements made in an anechoic chamber and outdoors on a vehicle showed that the maximum sound pressure level of the NBS dual-mode siren is 7 to 10 dB higher in the desired directions than a single 100 watt commercial electronic siren.

715,689

PB-280 825/1 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optical Microscopy as Used in Unorthodox Ways.
Final rept.,
C. P. Saylor. 1977, 7p
Pub. in SPIE Jnl., v108, Optics in Security and Law Enforcement, p60-66 1977.

Keywords: *Microscopy, *Criminology, Law enforcement, Reprints.

Before the great Government crime laboratories were established, individual scientific workers in the Federal agencies were sometimes called upon to settle important questions that the detectives could not handle. This presentation deals with three episodes involving original procedures. The procedures proved their point in the issues at hand, but the findings were never used in court so far as the author is aware. If a board has been sawed into three pieces of which the middle one is missing, how do you establish that the end pieces were once joined. If a method of recognizing typescript is developed that provides quick and convincing evidence of identity, what are the chances that a sophisticated forger, knowing the technique of recognition, could successfully imitate the identity. What do you do if the exhibits in a murder case are effective and relevant evidence so far as the facts are concerned, but indicate that another and critical piece of evidence is missing. Suppose that without the missing piece, nothing else has firm meaning. These three examples are chosen for presentation because, although the microsopical techniques that were used are interesting, they appear to have lain dormant for over forty years.

715,690

PB-281 805/2 PC **A07**/MF **A01**
National Bureau of Standards, Washington, D.C. Law Enforcement Standards Lab.
Police Patrol Car: Economic Efficiency in Acquisition, Operation, and Disposition,
R. T. Ruegg. Apr 78, 137p NBS-SP-480-15
Supersedes PB-257 466.

Keywords: *Police, *Motor vehicles, *Econometrics, *Management engineering, Cost analysis, Methodology, Decision making, Maintenance, Benefit cost analysis, Utilization, Replacing, Procurement, Size determination, Police patrol cars, Life cycle costs, Alternatives.

This study uses the techniques of life cycle costing to analyze some of the decision problems of police fleet management. It addresses the following questions: (1) What are the cost effects of purchasing different sizes of patrol cars and different optional equipment, (2) What are the advantages and disadvantages of direct ownership of vehicles as compared with leasing vehicles; (3) How do the costs of contracting out maintenance compare with costs of an in-house shop; (4) What are the effects of alternative utilization practices on fleet costs; (5) How often should vehicles be replaced; (6) What method of vehicle disposition is most efficient. The techniques used to compare costs of alternative systems are described in a chapter on life cycle costing methodology. Cost estimates and empirical data are presented in the many tables, exhibits, and charts which support the study. Existing fleet practices are described. Findings of the study are expressed as general guidelines for fleet management. The focus of the study is on police patrol cars, but the methods are applicable to other kinds of vehicles.

715,691

PB-298 175/1 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Environmental Design Research Div.
Evaluation of Safety Symbols.
B. L. Collins, and B. C. Pierman. Jun 79, 38p NBSIR-79-1760

Keywords: *Symbols, *Fire safety, Character recognition, Warning systems, Visual communication, Evaluation, Standardization.

The increasing use of symbols to convey fire safety information nonverbally is described. In addition, the trend toward international standardization of symbols is discussed for transportation and other systems. The need for further research on symbols is discussed in terms of the advantages and disadvantages of symbol use. Advantages include rapid and accurate communication without the barriers of verbal language. Disadvantages include the too rapid proliferation of different symbols and inappropriate or misleading application. Furthermore, the failure to evaluate the understandability of each symbol is cited as a major problem. A case study which documents some of the advantages and disadvantages of a set of proposed fire-safety symbols is presented. Finally, areas for further research on symbol evaluation are discussed.

715,692

PB77-600066 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Trace Vapor Generator for Testing Explosives Vapor Detectors.
P. A. Pella, and R. M. Mills. 1977, 24p
Pub. in LESP-Rpt-0604.00.

Keywords: DNT, EGDN, *Explosive detection, Limits of detection, Sensitivity test, TNT, *Vapor generators, Vapor pressure, Law enforcement.

A vapor generator for law enforcement applications was developed to produce known trace concentrations of vapors of 2,4,6 trinitrotoluene (TNT), 2,4-dinitrotoluene (2,4 DNT), 2,6-dinitrotoluene (2,6 DNT), and ethylene glycol dinitrate (EGDN). Known equilibrium vapor concentrations of these explosives are generated at several temperatures by passing dry nitrogen through a temperature-controlled column packed with the explosive dispersed on an inert support. The equilibrium vapor enters a dynamic gas-blending system in which the vapor is precisely diluted with air to provide output explosives vapor concentrations below 1 ppb. The system was evaluated by measuring output vapor concentrations of TNT, 2,4 DNT, 2,6 DNT, and EGDN using gas-chromatographic analysis. The applicability of the generator for testing sensitivities and limits of detection of commercial explosives vapor detection is demonstrated.

715,693

PB77-600078 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Optics in Security and Law Enforcement.
C. M. Freeman, S. Nudelman, and J. C. Richmond. 1977, 154p
Pub. in Proceedings Symp. on Optics in Security and Law Enforcement, Reston, VA, Apr. 18-21, 1977, 154p 1977.

Keywords: *Law enforcement, *Optics, *Security and law enforcement.

No abstract available.

715,694

PB80-181365 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC.
Study of Handcuff Improvements,
J. E. Harris. Apr 80, 26p NBSIR-80-1989
Sponsored in part by National Inst. of Justice, Washington, DC.

Keywords: *Police, *Law enforcement, Security, Locks(Fasteners), Design, *Handcuffs.

Designs for improving the security of present day ratchet and pawl metallic handcuffs are presented. Two methods utilizing a new lock feature were developed that significantly improve the lock. In addition, several other potential handcuff improvements are discussed in this report.

715,695
PB81-185647 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Assessment of Safety Symbol Understandability by Different Testing Methods.
Final rept.
N. D. Lerner, and B. L. Collins. Aug 80, 61p NBSIR-80-2088

Keywords: *Fire safety, *Symbols, Communicating, Responses, Evaluation.

The paper reports an experiment on the understandability of pictorial symbols proposed for fire-safety alerting. The experiment was designed to determine the understandability of specific symbols and to assess the effects of variations in both presentation and response methods. The symbols were presented as slides, booklets, or placards. Subjects indicated their understanding of each symbol's meaning either by writing down a brief definition or by selecting the correct answer from among four alternatives. For both methods, subjects rated their confidence in the correctness of the answers. In the second phase of the experiment, subjects were given fifteen different messages, and asked to draw a symbol for each idea. Mode of symbol presentation had no effect on understandability, while the use of definition and multiple choice procedures led to generally similar conclusions. The confidence ratings provided additional information about discrepancies between the two response methods.

715,696
PB82-194168 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Effect of Ventilation on the Rates of Heat, Smoke, and Carbon Monoxide Production in a Typical Jail Cell Fire.
B. T. Lee. Mar 82, 83p NBSIR-82-2469
Sponsored in part by National Inst. of Justice, Washington, DC.

Keywords: *Rooms, *Fire tests, Heat transmission, Ventilation, Combustion products, Smoke, Carbon monoxide, Fire hazards, Flammability, *Prison cells, *Room fires.

The rates of heat release and smoke development from a fire in a typical prison cell configuration were examined under four doorway ventilation conditions. Peak heat release rates varied from about 4500 kW for a 3.34 square meters doorway opening down to 340 kW for a 0.17 square meters opening. However, the total and rate of smoke generation were greater with the small opening. The peak carbon monoxide production rate varied from 0.03 kg/s for the large opening to 0.01 kg/s for the smallest opening. The quantity of carbon monoxide generated, however, was highest for the smallest opening with 5.3 kg produced over the fire duration of 1800's. During the peak fire development in the configuration with the larger openings, temperatures inside the room reached about 1000C with roughly two-thirds of the heat lost to the cell room boundaries. Peak thermal fluxes inside the room generally exceeded the ignition threshold value of about 20 kW/square meters for clothing, bedding, and other light combustible fuel for all of the tests.

715,697
PB82-199563 Not available NTIS
National Bureau of Standards, Washington, DC.
Fire Fatality Study.
Final rept.
M. M. Birky, B. M. Halpin, Y. H. Caplan, R. S. Fisher, J. M. McAllister, and A. M. Dixon. 1979, 8p
Pub. in Fire and Materials, v3 n4 p211-217 1979.

Keywords: *Fires, *Casualties, Residential buildings, Autopsy, Carbon monoxide, Cardiovascular diseases, Burns(Injuries), Alcoholic beverages, Houses, Maryland, Reprints, Accident causes, Carboxyhemoglobin, Blood alcohol concentration, Smoking.

Over a six year period, 523 fire fatalities resulting from 392 fires were studied in the State of Maryland. The study had two major objectives; (1) to determine the specific cause of death by a detailed autopsy study of fire victims and (2) to determine the specific cause of fatality-producing fire by an on-the-scene fire investigation. The fire fatality study was limited to residential fires and to fatalities that occurred within six hours of the fire. The results of the toxicological analysis show that (1) 60% of the victims had a COHb value greater than or equal to 50% carbon monoxide saturation, (2) an additional 20% had elevated carboxyhemoglobin with pre-existing cardiovascular disease, (3) 11% of the victims had severe burns, (4) 9% were unexplained and (5) 40% of the victims had positive blood alcohol levels with 30% of these meeting the legal definition of intoxication (blood alcohol = or > 0.1%). The fire investigations confirmed that the predominate fatal scenario is the cigarette ignition of upholstered furniture or bedding. This scenario accounted for 47% of the fires and 44% of the victims. Alcohol also appears to be a significant factor in this scenario.

715,698
PB82-199571 Not avialble NTIS
National Bureau of Standards, Washington, DC.
Correlation of Autopsy Data and Materials Involved in the Tennessee Jail Fire.
Final rept.
M. Birky, M. Paabo, and J. E. Brown. 1980, 6p
Pub. in Fire Safety Jnl. 2, p17-22 1979/80.

Keywords: *Fires, Casualties, Autopsy, Gases, Polymers, Toxicity, Hydrogen cyanide, Packing materials, Tennessee, Reprints, *Jails, Maury County(Tennessee), Carboxyhemoglobin.

During the past year, four major fires have resulted in multiple fatalities. These fires have enhanced concern about toxic gases that are generated from materials involved in the fire. One of these fires, the Maury County Tennessee jail fire, was unique in that the cell padding was the only material involved in the fire. Various state officials provided material samples for polymer identification and biological samples from victims for toxicological evaluation. The results of these measurements are presented with a correlation of toxicology and materials involved in the fire.

715,699
PB82-210873 Not available NTIS
National Bureau of Standards, Washington, DC.
Ballistic Helmets.
Final rept.
N. J. Calvano. Dec 81, 9p
Sponsored in part by National Inst. of Justice, Washington, DC.
Pub. in NIJ Standard-0106.01, 9p 1981.

Keywords: *Police, *Protective clothing, *Helmets, Terminal ballistics, Guns(Ordnance), Armor, Headgear, Materials specifications, *Bulletproof helmets.

This is a standards document. It establishes performance requirements and methods of test for helmets intended to protect the wearer against gunfire. Requirements for face shields are not included in this standard. The standard is a revision of NILECJ-STD-0106.00, dated September 1975. This standard redefines the classification system, and establishes threat levels and test rounds that are consistent with companion NIJ standards for ballistic protective equipment and materials.

715,700
PB82-211145 Not available NTIS
National Bureau of Standards, Washington, DC.
Emergency Vehicle Sirens.
Final rept.
D. S. Pallett, M. Tarica, T. L. Quindry, and F. E. Jones. Dec 81, 10p
Sponsored in part by National Inst. of Justice, Washington, DC.
Pub. in NIJ Standard-0501.00, 10p Dec 81.

Keywords: *Law enforcement, *Motor vehicles, *Sirens, Performance standards, Environmental tests, Acoustic properties, *Emergency vehicles.

This document is a voluntary national standard that establishes minimum performance requirements and describes methods of test that determine the effectiveness of sirens that are intended for use on law enforcement vehicles. The standard classifies sirens on the basis of acoustical performance and addresses other attributes including: design and safety, electrical characteristics, operating life, high and low temperature operation, exposure to dust and moisture, and corrosion resistance.

715,701
PB82-252032 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Rural and Non-Rural Civilian Residential Fire Fatalities in Twelve States.
A. Gomberg, and L. P. Clark. Jun 82, 53p NBSIR-82-2519
Sponsored in part by Federal Emergency Management Agency, Washington, DC.

Keywords: *Fire damage, *Rural areas, *Fire prevention, *Heating equipment, Fire safety, Casualties, Statistical data, Investigation, Evaluation.

The results of an analysis of fire causal factors in over 1600 fire fatalities are presented. The primary emphasis is on the identification of fire causes leading to demonstrated high fatality rates in rural areas. It was found that the most significant rural fire fatality cause was heating equipment, with improper installation and misuse of solid fueled heating equipment predominating. Other fire causes making significant contributions to high rural fatality rates were also investigated and documented. Additional data are currently being collected to enable further evaluation of rural fire problems.

715,702
PB82-600058 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Continuous Signal-Controlled Squelch Systems.
J. C. Blair. 1980, 20p
Pub. in NIJ-Std-0219.00 1980.

Keywords: *Decoder, Digital controlled, Encoder, Law enforcement standard, Selective signaling, Squelch systems, Tone-coding.

This document is a law enforcement equipment performance standard developed by the Law Enforcement Standards Laboratory. It provides performance requirements and test methods for continuous tone-controlled squelch systems (CTCSS) with tone squelch systems (CDCSS) with binary data rates less than 150 baud. The standard lists the principal terms and definitions needed to use the document and provides test methods to measure the 12 primary characteristics of CTCSS systems and 10 primary characteristics of CDCSS systems. It further provides for testing 10 of these characteristics under varying environmental extremes. Some of the characteristics measured are code frequency and data rate, code frequency stability, encoder response time and transmitter tone distortion.

715,703
PB83-103804 Not available NTIS
National Bureau of Standards, Washington, DC.
Metallic Handcuffs.
Final rept.
D. E. Frank. Mar 82, 6p
Sponsored in part by National Inst. of Justice, Washington, DC.
Pub. in National Institute of Justice Standard 0307.01, 6p Mar 82.

Keywords: *Performance standards, Visual inspection, Verification inspection, Acceptable quality level, Acceptability, Salt spray tests, Nondestructive tests, Reprints, *Handcuffs, NIJ standard 0307.01.

This standard establishes minimum performance requirements and test methods for double locking metallic handcuffs intended to be used to restrict the physical movement of apprehended persons. Specific tests are described including visual inspection, dimensional measurements, test loading of handcuffs, test loading of locking mechanism, cheek plate tamper resistance, and salt spray corrosion resistance.

715,704
PB83-131631 Not available NTIS
National Bureau of Standards, Washington, DC.
Research and Development: Federal Programs Develop New Arson Technologies.
Final rept.
N. H. Jason. Aug 81, 2p
Pub. in Firehouse, p54-55 Aug 81.

Keywords: *Fires, *Research management, Crimes, Investigations, Fire safety, Reprints, *Arson.

As part of the Federal fight against arson, the Center for Fire Research (CFR) at the National Bureau of Standards has a statutory mandate to carry out programs related to scientific aspects of the problem. In cooperation with other Federal agencies, CFR researchers have undertaken several projects. They are the Fire Investigation Handbook, arson sniffers, the psychology of arson, arson laboratory accelerant analysis and decision analysis.

715,705
PB83-143545 Not available NTIS
National Bureau of Standards, Washington, DC.
Space Heater - Rural Death Link.
Final rept.
A. Gomberg, and J. R. Hall. Sep 82, 4p
Prepared in cooperation with Fire Administration, Washington, DC.
Pub. in Fire Service Today 49, n9 p18-21 Sep 82.

Keywords: *Fires, *Rural areas, *Space heaters, Mortality, Heating equipment, Surveys, Reprints.

The results of an analysis of fire casual factors in over 1600 fire fatalities are presented. Emphasis in this article is placed on the contribution of area heating equipment to a disproportionately high rural fire fatality rate. The role of solid fueled heating equipment is also discussed.

715,706
PB83-177030 Not available NTIS
National Bureau of Standards, Washington, DC.
Fire Deaths and Toxic Gases.
Final rept.
B. C. Levin. Nov 82, 1p
Pub. in Nature 300, p18, 4 Nov 82.

Keywords: *Fires, *Death, Smoke, Gases, Combustion products, Toxicity, Tests, Health hazards.

Eighty percent of the deaths in fires are attributed to inhalation of smoke and hot gases rather than to burns. Recently, the fire research community has become more acutely aware of the problems of the toxicity of combustion products and the possibility that toxic gases other than carbon monoxide may play an important role. This current awareness has resulted in the development of a number of test methods to measure combustion product toxicity. These test methods are all performed under slightly different laboratory conditions and do not address the problem of total toxic hazard to which a product can contribute under 'real fire' conditions. Many scientists are now turning their efforts to toxic hazard analysis.

715,707
PB83-202424 PC **A04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Evaluation of Exit Symbol Visibility.
Final rept.
B. L. Collins, and N. D. Lerner. Apr 83, 54p NBSIR-83-2675

Keywords: *Fire safety, *Symbols, Visibility, Buildings, Legibility.

The performance of exit symbols was assessed in a laboratory experiment using viewing conditions degraded to resemble smoke. Research participants were presented with color slides showing symbol signs designed to be used in buildings. For each slide the participant indicated if the symbol conveyed the message of 'exit'. A total of 108 symbol slides were used, of which 18 were exit symbols. Each of the 42 participants were familiarized with a random set of 9 of the 18 exit symbols, prior to data collection. During the experiment, the symbol of slides were presented under three levels of viewing difficulty. In general, errors increased as the viewing conditions became more degraded but the increase in errors became much more severe for some symbols than others.

715,708
PB83-236257 Not available NTIS
National Bureau of Standards, Washington, DC.
Assessment of Fire-Safety Symbols.
Final rept.
B. L. Collins, and N. D. Lerner. Feb 82, 10p
Pub. in Human Factors 24, n1 p75-84 Feb 82.

Keywords: *Fire safety, *Symbols, *Comprehension, Standards, Safety engineering, Intelligibility, Perception, Reprints.

Twenty-five internationally proposed symbols for fire-safety alerting were evaluated for understandability by 91 U.S. participants. Three modes of symbol presentation (slides, placards, and booklets) and two modes of participant response (definition and multiple choice) were studied. Confidence ratings and production data (drawings) were also obtained.

715,709
PB84-103449 Not available NTIS
National Bureau of Standards, Washington, DC.
Approach to Enhancing the Value of Professional Judgement in the Derivation of Performance Criteria.
Final rept.
H. E. Nelson. 1982, 7p
Pub. in Proceedings of ASTM/CIB/RILEM Symposium Performance Concept in Building, (3rd), Lisbon, Portugal, Mar 29-2 Apr 1982 p55-61

Keywords: *Fire safety, *Hospitals, *Judgement, Risk, Decision making, Engineers, Decision making, Agreements, *Health care facilities.

The Center for Fire Research of the U.S. National Bureau of Standards has developed an evaluation system for determining the risk to life from fire in health care facilities. The system was based on a development and review approach involving several different professional groups in a manner designed to enhance the judgemental decisions of engineering professionals. The focus of the approach was on achieving consensus regarding the impact of each variable on life safety and ensuring that all aspects of safety were simultaneously satisfied. The use of this system in field investigations as well as computer applications is also discussed.

715,710
PB84-155639 PC **A07**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Fire Performance of Furnishings as Measured in the NBS Furniture Calorimeter. Part 1.
J. R. Lawson, W. D. Walton, and W. H. Twilley. Jan 84, 137p NBSIR-83-2787
Sponsored in part by Department of Health and Human Services, Washington, DC.

Keywords: *Calorimeters, *Furniture, *Fire prevention, Heat transfer, Oxygen, Heat resistant materials, Chairs, Seats, Upholstery, Office equipment, Hospitals, Public health, Thermal radiation, Smoke, Losses.

A heat release rate calorimeter developed at the National Bureau of Standards was used to measure the fire performance of a wide range of furnishings. The heat release rates measured in the calorimeter are determined through the use of oxygen consumption techniques. Data are presented on the free burning characteristics of 28 tests involving 23 different types of furnishings. The furnishings evaluated are classed into the following groups: easy chairs, sofas, waiting room and patient chairs, wardrobe closets, bookcase and bedding. The information presented in this report will provide a basis for selecting types of furniture to be used in health care facilities, hospitals and other living facilities.

715,711
PB84-177153 PC **A08**/MF **A01**
American Inst. of Architects Foundation, Washington, DC.
Escape and Rescue Model: A Simulation Model for the Emergency Evacuation of Board and Care Homes.
D. M. Alvord. Dec 83, 154p NBS-GCR-83-453
Grant NB81-NADA-2037

Keywords: Computerized simulation, Mathematical model, Handicapped persons, Time, Safety, Routes, Buildings, Layout, Rescue systems, Fire safety, Fortran, *Emergency plans, *Evacuation(Transportation), *Boarding homes, *Nursing homes, Mental disabilities, SIMSCRIPT 2.5 programming language, User manuals(Computer programs).

The Escape and Rescue Model is a discrete-event simulation program that simulates the emergency movement involved in escape and/or rescue of people from a Board and Care Home housing a group of persons with varying degrees of physical or mental disabilities, along with a small live-in staff. It can handle a variety of resident disabilities, delays, speeds, and other factors. The Model is designed to be run with specific building layouts inputted by the user, and can reasonably handle a facility with up to 100 residents and 50 rooms. The model computes and prints the time to safety for each resident as well as his egress route, the total time to clear the building, and a record of various significant events that occur in the course of evacuation. The Escape and Rescue Model is structured in a fashion that facilitates easy modification of the simulated situation. Once a facility layout has been converted into network form, many factors may be easily altered and the resultant changes in the evacuation times observed. The Model is written in SIMSCRIPT 11.5, a simulation language. It may be implemented on any machine with a SIMSCRIPT compiler and with sufficient memory. Conversion of the model into the standard programming language FORTRAN would greatly increase its availability to users.

715,712
PB85-127512 PC **A05**/MF **A01**
Washington Univ., Seattle. Dept. of Psychology.
Post Fire Interviews: Development and Field Validation of the Behavioral Sequence Interview Technique.
Final rept.
J. P. Keating, and E. F. Loftus. Oct 84, 92p NBS/GCR-84/477
Grant NB80-NADA-1053

Keywords: *Interview, *Human behavior, Fire safety, Fire prevention, Recording, Buildings, Evacuation.

This report describes the development and field-validation of a research interview instrument which is used for recording how people behave/act after the outbreak of a residential fire. In the first phase of the interview, the witness is invited to recount his story of the fire, free from interference or questions. During the second phase, the witness and interviewer cooperatively generate a comprehensive account of the witness' actions, the reasons for each action, and the situational cue during the fire using a standardized format. During its development, the behavioral sequence technique was used successfully to interview 357 respondents in Seattle and New York City. Responses were coded, quantified and analyzed using a modification of the Breaux technique for developing a graphical representation of response sequences. Statistics regarding the sample of fires and of interviewees are presented.

715,713
PB85-144848 Not available NTIS
National Bureau of Standards, Gaithersburg, MD.
Surveillance Receiver/Recorders.
Final rept.
J. F. Shafer, and H. E. Taggart. Jun 84, 17p
Sponsored by National Inst. of Justice, Washington, DC.
Pub. in NIJ (National Inst. of Justice) Report-0222.00, 17p Jun 84.

Keywords: *Surveillance, *Recording instruments, Receivers, Law enforcement, Audio surveillance.

The standard establishes performance requirements and methods of test for one type of receiving and recording system used for audio surveillance by the law enforcement community. The document lists the principal terms and definitions needed, as well as the most critical items of required test equipment. The standard addresses typical frequency-modulated receivers and tape recorders that use a 4.76 cm/s (1 7/8 in/s) Philips-type cassette. Characteristics measured include receiver sensitivity and selectivity, squelch sensitivity, audio distortion and response, tape speed tolerance and memory retention.

715,714
PB85-189249 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD.
Importance of Product Labeling.
Final rept.
L. K. Eliason. Feb 85, 2p
Sponsored by National Inst. of Justice, Washington, DC.
Pub. in The Police Chief LII, n2 p19-20 Feb 85.

Keywords: Armor, Law enforcement, Marking, Standards, Manufacturers, Litigation, Identifying, Manufac-

turers, Reprints, *Police equipment, *Product labeling, Product liability.

The article discusses labeling of law enforcement equipment from two aspects: proper identification of the various models of such items, and the role of labeling in product liability on the part of manufacturers and local police departments. Examples of problems resulting from inadequate product labeling are presented, as are cases involving litigation arising from product labeling, with emphasis upon police body armor.

715,715
PB85-229649 PC **A05**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Standards Code and Information.
Topological Approach to the Matching of Single Fingerprints: Development of Algorithms for Use on Rolled Impressions.
Final rept.
M. K. Sparrow, and P. J. Sparrow. May 85, 80p NBS/SP-500/124
Also available from Supt. of Docs as SN003-003-02656-5. Library of Congress catalog card no. 85-600541.

Keywords: *Matching, Comparison, Automation, Digital techniques, Topology, Coding, Algorithms, *Fingerprints, *Automated fingerprint processing, Rolled impressions.

The motivation for seeking topological descriptions of single fingerprints is provided by the elasticity of the human skin; successive rolled impressions from the same finger will invariably have suffered a degree of relative distortion (translation, rotation and stretching). Topology based systems should be free from the detrimental effects of plastic distortion. Systems are described for the extraction of simple topological codes from rolled impressions of the pattern types 'loops', 'whorls' and 'arches'. The generated codes take the form of vectors or simple digital arrays. The nature and frequency of changes that may occur in such codes is investigated and fingerprint comparison algorithms, based on these topological codes, are developed. The objective of such algorithms is to draw a score derived from the degree of 'nearness' of the topological codes in such a manner that it intelligently reflects similarity or dissimilarity in the two prints under comparison.

715,716
PB85-229946 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Operations Research Div.
Economics of Fast-Response Residential Sprinkler Systems.
Final rept.
R. T. Ruegg, and S. K. Fuller. 1985, 9p
Pub. in Fire Jnl. 79, n3 p18-22/115-118 May 85.

Keywords: *Sprinkler systems, *Fire protection, Economic analysis, Decision making, Reprints, *Residential buildings, Life-cycle cost, Risk analysis, Benefits.

The article presents in brief, illustrates and discusses a model for assessing the economic feasibility of fast-response sprinkler systems for houses. The model calculates expected net present value benefits as they would accrue to the owner of a system, as well as break-even values for key decision variables. Nine hypothetical cases are based on the application of a specified system in a new, single-family dwelling, 'average' levels of fire risk as indicated by recent aggregate U.S. fire loss statistics, and sprinkler system performance based on the results of laboratory and field tests of system effectiveness. The results have implications of interest to the research and building communities concerned with the economics of home fire protection.

715,717
PB86-127552 PC **A04**/MF **A01**
National Bureau of Standards, Gaithersburg, MD. Office of Standards Code and Information.
Topological Approach to the Matching of Single Fingerprints: Development of Algorithms for Use on Latent Fingermarks.
Final rept.
M. K. Sparrow, and P. J. Sparrow. Oct 85, 73p NBS/SP-500/126
Also available from Supt. of Docs as SN003-003-02680-8. Library of Congress catalog card no. 85-600592.

Keywords: *Matching, Comparison, Automation, Digital techniques, Topology, Coding, Algorithms, *Fingerprints, *Automated fingerprint processing, Latent fingermarks.

The paper naturally follows a previous N.B.S. Special Publication (No. 500-124), in which topological coding schemes were devised for automated comparison of rolled impressions. The contents of that paper are a prerequisite for a proper understanding of this one. The development of topological coding schemes is here extended to cover the automated searching of fragmentary latent marks, such as would be found at the scene of a crime. The benefits to be derived from topological descriptions of fingerprints are a direct result of their immunity to change under ordinary plastic distortion. In the case of latent marks such spatial distortions tend to be exaggerated; hence the importance of applying topology-based systems to them. This paper describes a method of coding fingerprint patterns by a variety of 'topological coordinate schemes', with fingerprint comparison being performed on the basis of localized topological information which is extracted from the recorded coordinate sets. Such comparison is shown to offer a substantial improvement in performance over existing (spatial) techniques. Furthermore, a methods for pictorial reconstruction of a complete fingerprint, from its coordinate representation, is demonstrated.

715,718
PB86-159357 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
National Fire Research Strategy Conference Proceedings, July 22-25, 1985.
Final rept.
B. M. Levin. Dec 85, 126p NBSIR-85/3290
Sponsored by National Fire Protection Association, Quincy, MA.

Keywords: *Fire safety, *Meetings, Research, Fire prevention, Fire fighting, Fire protection, Planning, Risk assessment.

The July 22-25, 1985, meeting of the National Fire Research Strategy Conference was held for the purpose of initiating the development of a coordinated fire research plan to achieve the reduction in fire losses in the United States in accord with the objectives of the Fire Prevention and Control Act of 1974. One hundred and seventeen experts from industry, government, academia, and professional societies were assigned to one of nine panels or workshops to discuss different application areas of fire research and the needed research in the respective areas. The areas included: design and engineering; materials and products; investigation and litigation; regulation and risk; real time fire extinguishment; and fire prevention, safety and survival.

715,719
PB86-213089 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Law Enforcement Standards Lab.
Directory of Law Enforcement and Criminal Justice Associations and Research Centers, 1985 Edition.
Special pub.
S. Lyles. Apr 86, 58p NBS/SP-480/20-1985
Supersedes PB-279246. Sponsored by National Inst. of Justice, Washington, DC.

Keywords: *Directories, *Law enforcement, *Laboratories, *Organizations, User needs, United States, Communication equipment, Security systems, Protective clothing, Criminal justice, Investigative aids.

The Law Enforcement Standards Laboratory (LESL) of the National Bureau of Standards (NBS) furnishes technical support to the National Institute of Justice (NIJ) program to strengthen law enforcement and criminal justice in the United States. LESL's function is to conduct research that will assist law enforcement and criminal justice agencies in the selection and procurement of quality equipment. The document is a law enforcement equipment report developed by LESL under the sponsorship of NIJ as part of the Technology Assessment Program, which is described on page iv. Additional reports as well as other documents are being issued under the LESL program in the areas of protective equipment, communications equipment, security systems, weapons, emergency equipment, investigative aids, vehicles, and clothing.

715,720
PB87-152302 PC **A04**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD.
Evaluation of Electronic Monitoring Devices,
A. G. Perrey, B. A. Bell, and M. J. Treado. Dec 86, 57p NBSIR-86/3501
Sponsored by National Inst. of Justice, Washington, DC.

Keywords: *Monitors, *Criminology, Law enforcement, Frequency measurement, Electromagnetic interference, Receivers, Transmitters, Tables(Data), *Electronic monitoring devices, *Criminal justice, Parole.

Electronic Monitoring Devices (EMDs) are used to monitor the presence of individuals within a given area who are responsible to the criminal justice system but not confined to institutions. Several EMDs were tested to measure operational characteristics such as operating frequency, approximate range of operation, component capability, and tamper resistance. Tests were conducted in an open field, wooden residence, high rise metal building, and in a laboratory environment.

715,721
PB87-162020 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Safety Technology Div.
User's View of Computer Hardware and Software.
Final rept.,
W. D. Walton. May 85, 4p
Pub. in Fire Safety Jnl. 9, n1 p3-6 May 85.

Keywords: *Fire protection, *Fire safety, Computers, Computer systems hardware, Programming languages, Reprints, Computer software, Computer program transferability, Computer applications, User needs, Sharing.

The use of computers is becoming increasingly important in the solution of fire protection engineering problems. To take full advantage of the power of the computer, it is necessary to have a general understanding of computer capabilities and limitations. This paper provides a brief introduction to computer terminology, capabilities, and programming languages. It also presents a discussion of program transfer, a topic of increasing interest as programs are shared within the fire protection community.

715,722
PB87-197885 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Susceptibility of Emergency Vehicle Sirens to External Radiated Electromagnetic Fields.
Final rept.,
R. L. Jesch. 1986, 6p
Sponsored by National Inst. of Justice, Washington, DC.
Pub. in NIJ (National Institute of Justice) Report-200-85, p1-6 May 86.

Keywords: *Sirens, *Radiofrequency interference, Law enforcement, High frequencies, Very high frequencies, Ultrahigh frequencies, Reprints, *Emergency vehicles, *Electromagnetic susceptibility.

The report provides the results of an exploratory study to determine the susceptibility of sirens to interference from typical communications equipment such as the transmitters and antennas likely to be operated in and around a law enforcement vehicle. Tests were performed using five sirens and communications equipment operating at frequencies representing the frequency bands of 25 to 50, 150 to 174, 400 to 512, and 806 to 866 MHz. The sirens were mounted on top of a vehicle equipped with transmitters and roof-mounted antennas and subjected to levels of field strength generated by mobile transmitting equipment having output levels up to 100 W. The control units of the sirens were also subjected to various levels of field strength inside a TEM cell or an anechoic chamber to determine their susceptibility to electromagnetic fields.

715,723
PB88-159462 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Fire Research.
Computer Model of Smoke Movement by Air Conditioning Systems (SMACS),
J. H. Klote. Nov 87, 25p NBSIR-87/3657
Sponsored by Public Buildings Service, Washington, DC.

Keywords: *Safety engineering, *Fire hazards, *Air conditioning, *Smoke, Ventillation, Ducted fans, Air circulation, Ventillation fans, Air pollution, Mathematical models, Computerized simulation.

A computer model for simulation of smoke movement through air conditioning systems is described. A brief overview of air conditioning systems is presented. The methods of calculation of mass flow, smoke transport, fan flow and duct and fitting resistances are presented along with a general description of the program logic.

Health Services

715,724

PB-285 472/7 PC **A03**/MF **A01**
Loyola Univ. of Chicago, Ill. Fire and Human Behavior Research Center.
Impact of Fire Emergency Training on Knowledge of Appropriate Behavior in Fires.
Final rept.,
E. Herz, P. Edelman, and L. Bickman. Jan 78, 48p NBS-GCR-78-137
Grant NBS-6-9015
Sponsored in part by Department of Health, Education, and Welfare, Washington, D.C. Report on the HEW/NBS Life/Fire Safety Program.

Keywords: *Nursing homes, *Fire safety, *Specialized training, Nurses, Decision making, Health care facilities, Personnel development, Human behavior, Fire protection, Evacuation(Transportation), Disaster planning, Attitudes, *Fire emergency training, *Fire drills.

A project was undertaken to determine whether training effectively augmented nursing home staff knowledge of a fire emergency plan, and to assess attitudes and general knowledge of appropriate behavior in fire. Staff members of a nursing home in Evanston, Illinois were divided into two groups: (1) those who attended a lecture (training session) concerning the first page of the institution's fire emergency plan, and (2) those who did not attend the lecture. All staff members in the sample completed a questionnaire designed to assess attitudes toward training and general knowledge of appropriate fire behavior. Items were also included to assess the impact of training on specific knowledge of the fire emergency plan. Results indicated that (1) most respondents were unfamiliar with some aspects of the institution's plan, (2) in some cases, the plan was found to be inadequate, incomplete and unclear, (3) staff members held positive attitudes toward training and were somewhat knowledgeable about appropriate behavior in fire, and (4) the lecture training method adequately conveyed certain types of information to staff members.

715,725

PB-296 281/9 Not available NTIS
National Bureau of Standards, Washington, DC.
Assessment of Fire Hazards from Furniture.
Final rept.
S. Davis. 1978, 30p
Sponsored in part by Department of Health, Education, and Welfare, Washington, DC., Veterans Administration, Washington, DC., Department of Defense, Washington, DC. and Consumer Product Safety Commission, Washington, DC.
Pub. in Proceedings of the International Fire, Security and Safety Exhibition and Conference IFSSEC '78, Held at London England on April 24-28, 1978, 30p.

Keywords: *Hospitals, *Bedding equipment, *Fires, Fire safety, Hazards, Fire tests, *Beds, Health care facilities, Flame spread, Mattresses.

A test program was conducted to assess the hazards of institutional mattresses when subjected to a sustained flaming ignition source. This report gives results on full-scale room burns of ten different mattress types. Tenability and rapid flame spread potential criteria were applied in a hazard assessment which showed a wide range of behavior among mattresses now being used in institutions.

715,726

PB81-132276 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Survey of Field Experience with Smoke Detectors in Health Care Facilities.
Final rept.
R. W. Bukowski, and S. M. Istvan. Oct 80, 38p NBSIR-80-2130
Sponsored in part by Department of Health and Human Services, Washington, DC.

Keywords: *Fire safety, Fire detection systems, Fire alarm systems, Fire protection, Elderly persons, *Smoke detectors, *Health facilities, False alarms.

A survey of health care facilities in eight states was conducted to gather data on experience with smoke detection systems. Requested information included detector manufacturer and model number, number of detectors and time in service, detector locations, numbers of false and real alarms and the methods and frequency of cleaning and testing the detectors. The results of the survey indicate that about 70 percent of the detectors were ionization type, and 30 percent were of the photoelectric type. Fourteen percent of the total number of detectors were single-station, battery-operated, residential-type detectors, most of which were installed in health care facilities in only one of the eight states surveyed. Almost 80 percent of the detectors were installed in corridors and the average age of the detector installation was about five years. The detection systems were found to experience approximately 14 false alarms for each real fire detected with the highest false alarm rate occurring in detectors installed in laundry areas, storage areas, and kitchens. While over 88 percent of the systems were tested at least annually (55 percent tested monthly), almost half (45.7 percent) were never cleaned. Almost 11 percent of the installed systems were maintained under an outside service contract.

Housing

715,727

PB-268 150/0 PC **A06**/MF **A01**
National Bureau of Standards, Washington, D.C. Center for Building Technology.
Analysis of Housing Data Collected in a Lead-Based Paint Survey in Pittsburgh, Pennsylvania. Part I.
Final rept.,
D. R. Shier, and W. G. Hall. Mar 77, 101p NBSIR-77-1250
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Assistant Secretary for Policy Development and Research. See also report dated 1975, PB-255 876.

Keywords: *Lead(Metal), Surface finishing, Assessments, Measurement, Methodology, Distribution, Quantitative analysis, Residential buildings, Pennsylvania, *Pittsburgh(Pennsylvania), Lead based paints, *Housing surveys.

The report is a companion document to a previous report (NBSIR 76-1024) on blood lead levels of children tested during a lead-based paint survey in Pittsburgh, Pennsylvania. The emphasis in this report is on the methodology used and types of housing-related information collected by the survey. It was established that older housing units exhibit considerably greater lead levels than newer housing units. In addition, wet rooms (kitchen and bathrooms) have higher levels than other (dry) rooms, rooms with a poor surface/substrate condition have higher levels than rooms with a good surface/substrate condition, and trim surfaces (e.g., doors, windows, baseboards) have higher levels than walls. Also, exterior surfaces show higher readings than functionally similar interior surfaces. While the present report concentrates on the housing aspect of the survey, subsequent processing of the Pittsburgh data is under way to determine possible relationships among blood lead levels, socioeconomic variables and housing-related characteristics.

715,728

PB-271 745/2 PC **A09**/MF **A01**
National Bureau of Standards, Washington, D.C. Applied Mathematics Div.
Analysis of Housing Data Collected in a Lead-Based Paint Survey in Pittsburgh, Pennsylvania. Part II.
Final rept.,
D. R. Shier, and W. G. Hall. Jun 77, 191p NBSIR-77-1293
Sponsored in part by Department of Housing and Urban Development, Washington, D.C. Assistant Secretary for Policy Development and Research. See also Part 1 dated Mar 77, PB-268 150.

Keywords: *Lead(Metal), Residential buildings, Tables(Data), Age, Classifications, Surface finishing, Blood, Concentration(Composition), Children, Pennsylvania, *Pittsburgh(Pennsylvania), *Lead based paints, *Housing surveys, Public housing.

This report represents Part II of a two-part document describing a lead-based paint survey conducted in Pittsburgh, Pennsylvania. Part I of this document (PB-268 150) presented details of the design, methodology and findings of this survey. The current report (Part II) presents and describes a series of tables summarizing the Pittsburgh survey data base, which includes measured lead levels of various surfaces in dwelling units and blood lead levels of children resident in those units. Most of the data analyses conducted in Part I derive from these tables. Thus, the tabulations given in this report provide not only the basis for those analyses but also a potential source for additional data analyses.

715,729

PB81-214074 PC **A08**/MF **A01**
Harvard-MIT Joint Center for Urban Studies, Cambridge, MA.
Housing Designed for Families. A Summary of Research.
Final rept.
J. Zeisel, and P. Welch. May 81, 172p NBS-GCR-81-320
Grant NBS-G7-9024

Keywords: *Residential buildings, *User needs, Housing studies, Design, Children, Family relations, Quality of life, Research projects, Standards, Regulations, Interpersonal relations, NTISCOMNBS.

Research on the social, psychological and behavioral needs of families in housing is not always easily accessible to the designers and developers of housing. The report compiles this user needs information in a handbook for people involved in regulation setting, home building, and housing design. The report's format reflects the types of decisions designers must make and the basic zones that a living environment comprises. Zones are defined in terms of privacy, formality, territory, and intergroup contact. Housing regulations set health and safety standards for new homes, but to date have incorporated little available user needs research. Because of this, today's homes, particularly those built with government assistance, are safe; but they often lack the simple amenities of design that make them truly livable. This report documents, zone by zone, design problems as they appear in the literature. Each section includes comments on related sections of HUD's Minimum Property Standards (MPS) and Manual of Acceptable Practices. Comments make clear which sections of the two documents are responsive to the needs of tenants, which sections seem to contradict each other, and what changes might enhance the standards' responsiveness to the issues raised by the research.

715,730

PB82-104969 PC **E04**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Methodology for Evaluating Housing in Use: A Case Study Approach,
S. T. Margulis. Jun 81, 225p NBSIR-81-2258
Sponsored in part by Department of Housing and Urban Development, Washington, DC. Office of Policy Development and Research.

Keywords: *Housing studies, *Residential housing, *Evaluation, *User needs.

The National Bureau of Standards (NBS) has prepared a report on the methodology of Project Feedback, the evaluation of Operation Breakthrough housing in use (a post-occupancy housing evaluation). The report introduces housing evaluations and encourages their use by providing both housing questionnaires and a nontechnical, practical discussion of research meth-

ods in general and of survey research in particular. To increase the sophistication of housing evaluation research designs, the report includes a tested approach for selecting control group respondents for housing evaluations. In addition, it summarizes results of NBS's housing evaluations, principally to illustrate ways of categorizing (coding) occupants' answers, but also to introduce these studies and their results. The case study approach is meant to encourage readers to build on NBS's experiences.

715,731

PB82-185976 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Application of an Equivalency Methodology to Building Rehabilitation: A Pilot Study.
J. H. Pielert, R. E. Chapman, and W. G. Hall. Jan 82, 92p NBSIR-81-2416

Keywords: *Housing studies, *Rehabilitation, Building codes, Renovating, Public health, Design, Regulations, Requirements, Residential buildings.

With increased emphasis on the re-use of existing buildings, new approaches must be developed to assist regulators in making code related decisions. The application of performance criteria to building rehabilitation provides flexibility in the use of technically sound design alternatives in lieu of prescriptive provisions which may be restrictive. This report presents the results of a pilot study on the application of an equivalency methodology in achieving regulatory compliance. The use of such a methodology is particularly attractive in this area because prescriptive type provisions have been shown to constrain rehabilitation activities, and in some cases, may be mutually contradictory. Regulatory requirements were chosen so as to explicitly incorporate conflicting requirements as affecting the design of windows and doors -- illumination, ventilation, egress and security. The methodology is computerized to allow the selection of least-cost means of achieving compliance with these requirements. A prototypical townhouse is evaluated using the pilot equivalency methodology and optimal compliance strategies are identified and compared with the cost of prescriptive compliance. The results of the study produced potential savings ranging from 20 to 35 percent depending on the initial conditions of the building.

Regional Administration & Planning

715,732

PB87-168811 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Internal Revenue Service Post-of-Duty Location Modeling System: User's Manual,
P. D. Domich, R. H. F. Jackson, and M. A. McClain. Feb 87, 43p NBSIR-86/3471
Sponsored by Internal Revenue Service, Washington, DC.

Keywords: *Regional planning, *Site surveys, Cost effectiveness, Microcomputers, Manuals, Maps, Models, *Internal Revenue Service, *Interactive graphics, *Site selection, Costs, Computer software, Computer systems hardware, Government agencies.

The report is a user's guide for a microcomputer package which was designed by the National Bureau of Standards to assist the Internal Revenue Service in choosing locations for its posts-of-duty which will minimize costs to the IRS and to the taxpayer. The user may select the types of costs to be considered and may specify potential locations for new posts-of-duty. The system displays maps showing workload for a district, current post-of-duty locations and new post-of-duty locations. This manual provides hardware and software requirements for the system, installation procedures, data file formats, and detailed operating instructions.

715,733

PB88-112420 PC **A03**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Internal Revenue Service Post-of-Duty Location Modeling System - Final Report,
P. D. Domich, K. L. Hoffman, R. H. F. Jackson, and M. A. McClain. Jul 86, 38p NBSIR-86/3482
See also PB87-168811. Sponsored by Internal Revenue Service, Washington, DC.

Keywords: *Regional planning, *Site surveys, Mathematical models, Cost effectiveness, Microcomputers, Maps, *Internal Revenue Service, *Site selection, Menus, Tax districts, User needs, Computer program documentation, Government agencies, Costs.

The report documents a project undertaken by the National Bureau of Standards to develop a mathematical model which identifies optimal locations of Internal Revenue Service Posts-of-Duty. The mathematical model used for the problem is the uncapacitated, fixed charge, location-allocation model which minimizes travel and facility costs, given a specified level of activity. Brief descriptions of the mathematical techniques used and the interactive, user-friendly computer system built to solve the problem are also provided. The system is microcomputer-based and uses menus and graphically displayed maps of tax districts for interactive inputs and solution outputs.

Transportation & Traffic Planning

715,734

PB-292 162/5 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Applied Mathematics.
Elasticity of Transit Demand with Respect to Price: A Case Study.
Final rept.
R. E. Schofer. Mar 78, 45p NBSIR-78-1462
Contract DOT-AT-40018

Keywords: *Urban transportation, *Prices, Travel demand, Travel patterns, Automobiles, Metropolitan areas, Virginia, Maryland, District of Columbia, Public transportation, *Transit fares, Peak hour traffic control, Commuter bus travel, Car pools, Transit buses, Bus priority lanes, Shirley Highway, *Elasticity of demand.

The report describes the methodology and the results of an empirical study of peak-period transit demand elasticity with respect to price (fare). Field observations were structured to capture the reactions of morning (inbound) commuters to a peak-period fare increase introduced on September 1, 1975. The study is limited to bus and automobile travelers on the Shirley Highway and bus passengers on the Lee Highway, both in Northern Virginia. The Shirley buses provide express service on exclusive freeway lanes, whereas the Lee Highway buses provide traditional service on a signalized radial arterial. Various impacts are identified, quantified and compared. Demand for service on the Shirley Highway Express buses is less elastic (-0.274 to -0.218) than that for the traditional Lee Highway bus service (-0.535 to -0.273). There was little evidence of passengers on either service shifting travel outside the peak-periods to avoid higher fares. The fare increase had no effect on auto travel. These results suggest applying different pricing policies to different types of transit service.

715,735

PB81-115941 PC **A05**/MF **A01**
National Bureau of Standards, Washington, DC.
Selecting Rail Properties for Improvement: A Plan for Analysis.
R. E. Schofer, J. F. Gilsinn, W. G. Hall, C. R. Johnson, J. M. McLynn, and R. H. Watkins. Oct 80, 92p NBSIR-79-1724

Keywords: *Rail transportation, *Railroad tracks, *Upgrading, Optimization, Benefit cost analysis, Mathematical models, Networks, Maintenance, Improvement, High speed ground transportation, Transportation planning.

Section 901-(6) of the Railroad Revitalization and Regulatory Reform Act of 1976 (PL 94-210) calls for a listing and prioritization of rail properties to be improved to permit high-speed operations. This report identifies key factors entering the choice of links for such upgrading, and formulates an analytical methodology and implementation plan to support the decision process.

715,736

PB83-149831 PC **A03**/MF **A01**
National Bureau of Standards, Washington, DC. National Engineering Lab.
Highway Noise Criteria Study: Executive Summary.
S. L. Yaniv, and D. R. Flynn. Oct 82, 40p NBSIR-82-2610
Sponsored in part by Federal Highway Administration, Washington, DC.

Keywords: *Highways, Acoustic measurement, Noise(Sound), Sound pressure, Evaluation, Acceptability, Criteria, Noise reduction, *Transportation noise, *Traffic noise, Vehicle noise.

This report summarizes a multifaceted research program carried out by the acoustics staff of the National Bureau of Standards at the request of the Federal Highway Administration. The program was designed to (1) identify and quantify the important physical parameters associated with time-varying highway noise caused by various densities of both free-flowing and stop-and-go traffic conditions; (2) investigate evaluate and compare measures and computational procedures for rating time-varying noise in terms that are relevant to human response; and (3) determine by means of a laboratory study which among several time-varying rating schemes best predicts acceptability and annoyance caused by traffic noise as heard both outdoors and indoors. The results of this program are briefly described and the implications of the major findings discussed.

715,737

PB85-246502 PC **A07**/MF **A01**
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Paratransit Advanced Routing and Scheduling System Documentation: Routing and Scheduling Dial-A-Ride Subsystem.
H. K. Hung, W. G. Hall, and R. E. Chapman. Jul 85, 146p NBSIR-85/3178
Sponsored by Urban Mass Transportation Administration, Washington, DC.

Keywords: Routing, Scheduling, Algorithms, Fortran, *Paratransit, *Dial a ride systems, Computer software, Advanced Routing and Scheduling System.

The Advanced Routing and Scheduling System (ARSS) is a software system designed to route and schedule patrons in a dial-a-ride environment. The system consists of three subsystems: CONENV, a preprocessor which constructs physical and policy environments; RSDAR, which routes and schedules patrons; and GREPOR, which generates hard copy of all necessary reports. This report provides a description of RSDAR. The RSDAR is a heuristic algorithm. It assigns patrons to form subtours in time intervals, and these subtours are linked to become a tour. Patrons are chosen to be included in a subtour on the basis of the best remaining time of the base trip. Subtours are selected to be included in a tour on the basis of the best productivity measure. The model is written in FORTRAN and complies with the American National Standards Institute X3.9-1978 standard for that language.

Urban Administration & Planning

715,738

PB-292 112/0 PC **A03**/MF **A01**
National Engineering Lab. (NBS), Washington, DC. Center for Building Technology.
Historic Preservation Incentives of the 1976 Tax Reform Act: An Economic Analysis.
Final rept.
S. F. Weber. Feb 79, 35p NBS/TN-980
Library of Congress catalog card no. 78-600068.

Keywords: Incentives, Economic analysis, Mathematical models, Renovation, Land development, Comparison, Cost effectiveness, Buildings, Legislation, Taxes, Computer programs, BASIC programming language, Cost models, Life cycle costs, *Historic buildings, *Historic preservation, *Tax Reform Act of 1976.

The Tax Reform Act (TRA) of 1976 includes several provisions which affect the financial position of owners of income-producing historic buildings. The report ana-

lyzes the effect of the TRA on the after-tax cost of two basic alternatives facing the owner: (1) rehabilitate the structure; or (2) demolish it and redevelop the site. A life-cycle minimization model was developed, programmed in BASIC language, and applied in an after-tax comparison of six alternative situations representing rehabilitation and redevelopment both before and after the TRA. Under the assumptions of the model used in this analysis, the TRA has made the rehabilitation option significantly more attractive than previously. The former tax bias in favor of demolition and redevelopment has been reversed. Until now, this information on the life-cycle tax advantages of rehabilitating historic buildings has been unavailable. This report will help corporate investors make cost-effective decisions regarding historic preservation of nonresidential buildings and provide policy makers with information on the effectiveness of these tax incentives. The approach utilized could be adapted to analyze incentives for other types of building rehabilitation.

General

715,739

FIPS PUB 55 DC-4 PC **E99**
National Bureau of Standards, Gaithersburg, MD. Inst. for Computer Sciences and Technology.
Guideline: Codes for Named Populated Places, Primary County Divisions, and Other Locational Entities of the United States and Outlying Areas. The Fourth Printed Version and Ninth Update Tape.
16 Jan 87, 3671p

Keywords: *Census, *Codes, Data, Urban areas, Municipalities, Counties, Airports, National parks, United States.

The guideline implements ANSI X3.47-1977 and provides a two-character FIPS State Code and a five-character FIPS numeric place code to uniquely identify each listed entity. An exhaustive list is carried of names of incorporated places, census designated places (CDPs), primary county divisions (such as townships, New England towns, and census county divisions), counties, and recognized Indian reservations and Alaska Native villages. The listing also includes names of all populated places in the files of the Geographic Names Information System of the U.S. Geological Survey, as well as names of airports, military bases, national parks, and U.S. Post Offices. A two-character class code distinguishes over fifty entity types.

715,740

PB-274 146/0 MF **E09**
National Bureau of Standards, Washington, D.C. Office of ADP Standards Management.
Standard Codes for Named Populated Places and Related Entities of the States of the United States (in microfiche).
Final rept.,
H. E. McEwen. Nov 77, 35 sheets NBS/DF-77/009a
For data file on magnetic tape, see PB-274 150.
Microfiche is at 48X reduction. Price includes paper copy of the 'User Information for Standard Place Code Data File'.

Keywords: *Coding, *Urban areas, Microfilm, Data storage devices, Communities, Rural areas, Parks, Airports, Shopping centers, Military facilities, States(United States), Counties, Indian reservations, *Geocoding.

Included are standard codes for named populated cities, towns, villages, whether incorporated or unincorporated, important military and naval installations, townships, Indian reservations, named places that form parts of other places, places important for transportation, industrial, or commercial purposes, i.e., unpopulated railroad points, airports, and shopping centers. The standard code is seven characters in length, the first two of which identify the State. The last five numeric characters identify the place within the State and provide an alphabetic ordering of the place names. In addition to the place name and its code, the list also provides the name and code for the county (or counties) in which the place is located, the ZIP Code of the servicing post office (or offices) cross-references to former or alternate names, an inclusion code, a class designator code, and a cross-reference to the Worldwide Geographic Location Code issued by the General Services Administration.

715,741

PB-274 150/2 CP **T02**
National Bureau of Standards, Washington, D.C. Office of ADP Standards Management.
Standard Codes for Named Populated Places and Related Entities of the States of the United States.
Data file,
H. E. McEwen, and H. S. White. 1 Jan 77, mag tape NBS/DF-77/009b
Source tape is in ASCII character set. Character set restricts preparation to 9 track one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products, if you have questions. Price includes User's Guide, PB-274 151.

Keywords: *Data file, *Coding, *Urban areas, Magnetic tapes, Communities, Rural areas, Parks, Airports, Shopping centers, Military facilities, States(United States), Counties, Indian reservations, *Geocoding.

The Standard Codes for Named Populated Places and Related Entities of the states of the United States include codes for named populated cities, towns, villages, and similar communities, whether or not incorporated, and several categories of named entities that are similar to these in one or more important respects. In addition to incorporated and unincorporated named populated cities, towns, and villages, this standard provides codes for scattered rural communities; important military and naval installations; townships in the states where such units have governmental powers; Indian reservations, national and state parks, named places that form parts of other places as defined; and named places with no permanent residents, but important for transportation, industrial, or commercial purposes, such as unpopulated railroad points, airports, and shopping centers. The standard code for places is seven characters in length, the first two characters of which identify the state (using the standard state code or abbreviation). The last five numeric characters identify the place within the state and provide an alphabetic ordering of the place names. In addition to the place name and its standard code, the list also provides the name and standard code for the county (or counties) in which the place is located, the postal ZIP code of the servicing post office (or offices), cross-references to former or alternative names, an inclusion code, a class designator code, and a cross-reference to the Worldwide Geographic Location Code issued by the Office of Finance of the General Services Administration.

715,742

PB-274 151/0 PC **A02/MF A01**
National Bureau of Standards, Washington, D.C. Office of ADP Standards Management.
Standard Codes for Named Populated Places and Related Entities of the States of the United States; User's Guide,
H. E. McEwen. Nov 77, 19p NBS/DF-77/009c
For data file on magnetic tape, see PB-274 150.

Keywords: *Coding, *Urban areas, Guidelines, Communities, Rural areas, Parks, Airports, Shopping centers, Military facilities, States(United States), Counties, Data file, Indian reservations, *Geocoding.

Included are standard codes for named populated cities, towns, villages, whether incorporated or unincorporated, important military and naval installations, townships, Indian reservations, named places that form parts of other places, places important for transportation, industrial, or commercial purposes, i.e., unpopulated railroad points, airports, and shopping centers. The standard code is seven characters in length, the first two of which identify the State. The last five numeric characters identify the place within the state and provide an alphabetic ordering of the place names. In addition to the place name and its code, the list also provides the name and code for the county (or counties) in which the place is located, the ZIP Code of the servicing post office (or offices) cross-references to former or alternate names, an inclusion code, a class designator code, and a cross-reference to the Worldwide Geographic Location Code issued by the General Services Administration.

715,743

PB80-144744 PC **A08/MF A01**
Temple, Barker and Sloane, Inc., Lexington, MA.
Performance Evaluation Model: Suggestions for Use and Description of the Model.
Final rept.
Nov 79, 160p NBS-GCR-ETIP-79-74
Contract NBS-5-35894

Keywords: *Public utilities, *Performance evaluation, Mathematical models, Computer programming, Financial management, Forecasting, Technology innovation.

The Performance Evaluation Model, known as PEM, is a set of computer programs for manipulating, displaying and analyzing time-series, cross-section, or pooled data and was designed to facilitate the application of ratio-analysis and multiple regression techniques to the financial and operating data of electric and gas utilities. It can be used by utility commissions and managers to identify potential areas for improving utility efficiency. PEM can also assist utilities and regulatory commissions in surveillance and in making financial and operating projections. The model was developed as part of an Experimental Technology Incentives Program (ETIP) project involving other analytic and management tools designed to improve and accelerate rate case decisions as an incentive to technological innovation. The other tools, described in published reports, deal with automatic and discretionary adjustment, productivity, rate structure, future test year, long range planning and regulatory lag in general.

715,744

PB80-180243 CP **T02**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Standard Codes for Named Populated Places and Related Entities of the States of the United States.
Data file,
J. L. Walkowicz. 25 Apr 80, mag tape NBS/DF-80/001
Supersedes Rept. no. NBS/DF-77/009B, PB-274 150. Source tape is in EBCDIC character set. Tapes can be prepared in most standard 7 or 9 track recording modes for one-half inch tape. Identify recording mode desired by specifying character set, track, density, and parity. Call NTIS Computer Products if you have questions.

Keywords: *Data file, *Coding, *Urban areas, Magnetic tapes, Communities, Rural areas, States(United States), Counties, Data processing, *Geocoding.

The report presents information that users will need to process the data file in this first update of the magnetic tape version of document NBS-FIPS-55, 'Codes for Named Populated Places and Related Entities of the States of the United States'. This update incorporates the changes and additions to the file as published in Change Notices 1, 2, 3 and 5; it also includes a 2-character class code field. NBS plans for modification of the class code structure are discussed. Physical and logical record characteristics are presented.

715,745

PB80-219884 CP **T02**
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Standard Codes for Named Populated Places and Related Entities of the States of the United States, FIPS PUB 55.
Data file,
H. Tom. Aug 80, mag tape NBS/DF-80/002
Supersedes Rept. no. NBS/DF-80/001, PB80-180243.
Source tape is in EBCDIC or ASCII character set. Character set restricts preparation to 9 track one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions.

Keywords: *Data file, *Coding, *Urban areas, Magnetic tapes, Communities, Rural areas, States(United States), Counties, Data processing, *Geocoding.

The report supplies the information that users will need to process the data file in this second update of the magnetic tape version of document NBS-FIPS-55, 'Codes for Named Populated Places and Related Entities of the States of the United States'. This update incorporates the changes and additions that were published in Change Notices 1 thru 9. The report describes the changes that have been made in the record format in order to enable the storage of up to 55 counties per record, without increasing the maximum record length. As a result of these changes, the record

length has been reduced 275 characters per record . The file consists of 4,587 blocks of 30 records each, with the exception of the last block which contains only 5 records. The report also presents a list of the class codes and definitions that have been developed to date.

715,746

PB81-187999 PC **A03**/MF **A01**
New York State Office of General Services, Albany.

Procurement Practices in New York State of Products Containing Recycled Materials.
Final rept.
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The report examines the current State activities, regulations, statutes, and policies, as well as technical institutional and economic barriers relating to the public procurement of products containing recovered or recycled materials. The report also lists the top ten commodities procured by the State in dollars plus a listing of products that, in the opinion of the State, have a high potential for the use of recycled or recovered material. The report includes a list of recommendations or suggested actions that could be taken to potentially improve the manufacture, distribution, and procurement of products containing recovered or recycled materials.

APPENDIX A
List of Depository Libraries in the United States

ALABAMA

Alexander City

Alexander City State Junior College Thomas D. Russell Library (1967)*

Auburn

Auburn University Ralph Brown Draughon Library (1907)

Birmingham

Birmingham Public Library (1895)
Birmingham–Southern College Library (1932)
Jefferson State Junior College James B. Allen Library (1970)
Miles College C. A. Kirkendoll Learning Resource Center (1980)
Samford University Library (1884)

Enterprise

Enterprise State Junior College Learning Resources Center (1967)

Fayette

Brewer State Junior College Learning Resources Center Library (1979)

Florence

University of North Alabama Collier Library (1932)

Gadsden

Gadsden Public Library (1963)

Huntsville

University of Alabama in Huntsville Library (1964)

Jacksonville

Jacksonville State University Houston Cole Library (1929)

Mobile

Mobile Public Library (1963)
Spring Hill College Thomas Byrne Memorial Library (1937)
University of South Alabama Library (1968)

Montgomery

Alabama Public Library Service (1984)
Alabama Supreme Court and State Law Library (1884)
Auburn University at Montgomery Library (1971) REGIONAL
Air University Library Maxwell Air Force Base (1963)

Normal

Alabama Agricultural and Mechanical University J. F. Drake Memorial Learning Resources Center (1963)

Troy

Troy State University Library (1963)

Tuscaloosa

University of Alabama Library (1860) REGIONAL
University of Alabama School of Law Library (1967)

Tuskegee

Tuskegee University Hollis Burke Frissell Library (1907)

ALASKA

Anchorage

Anchorage Law Library (1973)
Anchorage Municipal Libraries Z. J. Loussac Public Library (1978)
University of Alaska at Anchorage Library (1961)
U.S. Alaska Resources Library (1981)
U.S. District Court Library (1983)

Fairbanks

University of Alaska Elmer E. Rasmuson Library (1922)

Juneau

Alaska State Library (1900)
University of Alaska–Juneau Library (1981)

Ketchikan

Ketchikan Community College Library (1970)

AMERICAN SAMOA

Pago Pago

Community College of American Samoa Library (1985)

*Year designated.

ARIZONA

Coolidge

Central Arizona College Instruction Materials Center (1973)

Flagstaff

Northern Arizona University Cline Library (1937)

Glendale

Glendale Public Library (1986)

Holbrook

Northland Pioneer College Learning Resources Center (1985)

Mesa

Mesa Public Library (1983)

Phoenix

Department of Library Archives, and Public Records (unknown) REGIONAL
Grand Canyon College Fleming Library (1978)
Phoenix Public Library (1917)
U.S. Court of Appeals 9th Circuit Library (1984)

Prescott

Yavapai College Library (1976)

Tempe

Arizona State University College of Law Library (1977)
Arizona State University Library (1944)

Tucson

Tucson Public Library (1970)
University of Arizona Library (1907) REGIONAL

Yuma

Yuma City-County Library (1963)

ARKANSAS

Arkadelphia

Ouachita Baptist University Riley Library (1963)

Batesville

Arkansas College Library (1963)

Clarksville

University of the Ozarks Dobson Memorial Library (1925)

Conway

Hendrix College Olin C. Bailey Library (1903)

Fayetteville

University of Arkansas Mullins Library (1907)
University of Arkansas School of Law Library (1978)

Little Rock

Arkansas State Library (1978) REGIONAL
Arkansas Supreme Court Library (1962)
Central Arkansas Library System Main Library (1953)
University of Arkansas at Little Rock Library Ottenheimer Library (1973)
University of Arkansas at Little Rock, School of Law Library (1979)

Magnolia

Southern Arkansas University Magale Library (1956)

Monticello

University of Arkansas at Monticello Library (1956)

Pine Bluff

University of Arkansas at Pine Bluff Watson Memorial Library (1976)

Russellville

Arkansas Tech University Tomlinson Library (1925)

Searcy

Harding University Beaumont Memorial Library (1963)

State University

Arkansas State University Dean B. Ellis Library (1913)

Walnut Ridge

Southern Baptist College Felix Goodson Library (1967)

CALIFORNIA

Anaheim

Anaheim Public Library (1963)

Arcadia

Arcadia Public Library (1975)

Arcata

Humboldt State University Library (1963)

Bakersfield

California State College Bakersfield Library (1974)
Kern County, Beale Memorial Library (1943)

Berkeley

University of California General Library (1907)
University of California Law Library (1963)

Carson

California State University Dominguez Hills Educational Resources Center (1973)
Carson Regional Library (1973)

Chico

California State University, Merriam Library (1962)

Claremont

Claremont Colleges' Libraries Honnold Library (1913)

Compton

Compton Public Library (1972)

Culver City

Culver City Library (1966)

Davis

University of California Shields Library (1953)
University of California at Davis Law Library (1972)

Downey

Downey City Library (1963)

Fresno

California State University, Fresno, Henry Madden Library (1962)
Fresno County Free Library (1920)

Fullerton

California State University at Fullerton Library (1963)
Western State University College of Law Library (1984)

Garden Grove

Garden Grove Regional Library (1963)

Gardena

Gardena Public Library (1966)

Hayward

California State University, Hayward Library (1963)

Huntington Park

Huntington Park Library (1970)

Inglewood

Inglewood Public Library (1963)

Irvine

University of California at Irvine Main Library (1963)

La Jolla

University of California at San Diego Central University Library (1963)

Lakewood

Angelo Iacoboni Public Library (1970)

Lancaster

Lancaster Library (1967)

La Verne

University of La Verne College of Law Library (1979)

Long Beach

California State University at Long Beach Library (1962)
Long Beach Public Library (1933)

Los Angeles

California State University at Los Angeles John F. Kennedy Memorial Library (1956)
Los Angeles County Law Library (1963)
Los Angeles Public Library (1891)
Loyola Marymount University Charles Von der Ahe Library (1933)
Loyola Law School Law Library (1979)
Occidental College Library (1941)
Southwestern University School of Law Library (1975)
University of California, University Research Library (1932)
University of California, Los Angeles Law Library (1958)
University of Southern California Doheny Memorial Library (1933)
University of Southern California Law Library (1978)
U.S. Court of Appeals Ninth Circuit Library (1981)
Whittier College School of Law Library (1978)

Malibu

Pepperdine University Payson Library (1963)

Menlo Park

Department of Interior Geological Survey Library (1962)

Montebello

Montebello Regional Library (1966)

Monterey

U.S. Naval Postgraduate School Dudley Knox Library (1963)

Monterey Park

Bruggemeyer Memorial Library (1964)

Northridge

California State University at Northridge Oviatt Library (1958)

Norwalk

Norwalk Regional Library (1973)

Oakland

Mills College Library (1966)
Oakland Public Library (1923)

Ontario

Ontario City Library (1974)

Palm Springs

Palm Springs Public Library (1980)

Pasadena

California Institute of Technology Millikan Memorial Library (1933)
Pasadena Public Library (1963)

Pleasant Hill

Contra Costa County Library (1964)

Redding

Shasta County Library (1956)

Redlands

University of Redlands Armacost Library (1933)

Redwood City

Redwood City Public Library (1966)

Reseda

West Valley Regional Branch Library (1966)

Richmond

Richmond Public Library (1943)

Riverside

Riverside City and County Public Library (1947)
University of California at Riverside Library (1963)

Sacramento

California State Library (1895) REGIONAL
California State University at Sacramento Library (1963)
Sacramento County Law Library (1963)
Sacramento Public Library (1880)
University of the Pacific McGeorge School of Law Library (1978)

San Bernardino

Don A. Turner County Law Library (1984)
San Bernardino County Library (1964)

San Diego

San Diego County Law Library (1973)
San Diego County Library (1973)
San Diego Public Library (1895)
San Diego State University Library (1962)
University of San Diego Kratter Law Library (1967)

San Francisco

Golden Gate University School of Law Library (1979)
Hastings College of Law Library (1972)
San Francisco Public Library (1889)
San Francisco State University J. Paul Leonard Library (1955)
Supreme Court of California Library (1979)
U.S. Court of Appeals Ninth Circuit Library (1971)
University of San Francisco Richard A. Gleeson Library (1963)

San Jose

San Jose State University Library (1962)

San Leandro

San Leandro Community Library Center (1961)

San Luis Obispo

California Polytechnic State University Robert E. Kennedy Library (1969)

San Mateo

College of San Mateo Library (1987)

San Rafael

Marin County Free Library (1975)

Santa Ana

Orange County Law Library (1975)
Santa Ana Public Library (1959)

Santa Barbara

University of California at Santa Barbara Library (1960)

Santa Clara

University of Santa Clara Orradre Library (1963)

Santa Cruz

University of California at Santa Cruz McHenry Library (1963)

Santa Rosa

Sonoma County Library (1896)

Stanford

Stanford University Libraries (1895)
Stanford University Robert Crown Law Library (1978)

Stockton

Public Library of Stockton and San Joaquin County (1884)

Thousand Oaks

California Lutheran University Library (1964)

Torrance

Torrance Public Library (1969)

Turlock

California State University, Stanislaus Library (1964)

Vallejo

Solano County Library John F. Kennedy Library (1982)

Valencia

Valencia Regional Library (1972)

Ventura

Ventura County Library Services Agency (1975)

Visalia

Tulare County Free Library (1967)

Walnut

Mount San Antonio College Educational Resources Library Center (1966)

West Covina

West Covina Regional Library (1966)

Whittier

Whittier College Wardman Library (1963)

COLORADO

Alamosa

Adams State College Library (1963)

Aurora

Aurora Public Library (1984)

Boulder

University of Colorado at Boulder Norlin Library (1879) REGIONAL

Colorado Springs

Colorado College Tutt Library (1880)
University of Colorado at Colorado Springs Library (1974)
U.S. Air Force Academy Library (1956)

Denver

Auraria Library (1978)
Colorado Supreme Court Library (1978)
Denver Public Library (1884) REGIONAL
Department of the Interior Library (1962)
Regis College Dayton Memorial Library (1915)
U.S. Court of Appeals Tenth Circuit Library (1973)
University of Denver Penrose Library (1909)
University of Denver College of Law Westminster Law Library (1978)

Fort Collins

Colorado State University Libraries (1907)

Golden

Colorado School of Mines Arthur Lakes Library (1939)

Grand Junction

Mesa College Lowell Heiny Library (1978)
Mesa County Public Library (1975)

Greeley

University of Northern Colorado James A. Michener Library (1966)

Gunnison

Western State College Leslie J. Savage Library (1932)

La Junta

Otero Junior College Wheeler Library (1963)

Lakewood

Jefferson County Public Library Lakewood Library (1968)

Pueblo

Pueblo Library District (1893)
University of Southern Colorado Library (1965)

CONNECTICUT

Bridgeport

Bridgeport Public Library (1884)
University of Bridgeport School of Law Library Wahlstrom Library (1979)

Danbury

Western Connecticut State University Ruth A. Haas Library (1967)

Danielson

Quinebaug Valley Community College Audrey P. Beck Library (1968)

Enfield

Enfield Central Library (1967)

Hartford

Connecticut State Library (unknown) REGIONAL
Hartford Public Library (1945)
Trinity College Library (1895)
University of Connecticut School of Law Library (1978)

Middletown

Wesleyan University Olin Library (1906)

Mystic

Mystic Seaport Museum, Inc., G. W. Blunt White Library (1964)

New Britain

Central Connecticut State University Elihu Burritt Library (1973)

New Haven

Southern Connecticut State University Hilton C. Buley Library (1968)
Yale Law Library (1981)
Yale University Seeley G. Mudd Library (1859)

New London

Connecticut College C. E. Shain Library (1926)
U.S. Coast Guard Academy Library (1939)

Stamford

Ferguson Library (1973)

Storrs

University of Connecticut Homer Babbidge Library (1907)

Waterbury

Post College Traurig Library and Learning Resources Center (1977)
Silas Bronson Public Library (1869)

West Haven

University of New Haven Peterson Library (1971)

DELAWARE

Dover

Delaware State College William C. Jason Library-Learning Center (1962)
State Law Library in Kent County (unknown)

Georgetown

Delaware Technical and Community College Library (1968)

Newark

University of Delaware Library (1907)

Wilmington

Wider University School of Law Library (1976)

DISTRICT OF COLUMBIA

Washington

Administrative Conference of the United States Library (1972)
Advisory Commission on Intergovernmental Relations Library (1977)
American University Washington College of Law Library (1983)
Catholic University of America Robert J. White Law Library (1979)
Comptroller of the Currency Library (1986)
Department of the Army Pentagon Library ANRAL(1969)
Department of Commerce Library (1955)
Department of Education (1988)
Department of Health and Human Services Library (1954)
Department of Housing and Urban Development Library (1969)
Department of the Interior Library Natural Resources Library (1895)
Department of Justice Main Library (1895)
Department of Labor Library (1976)
Department of the Navy Library (1895)
Department of State Library (1895)
Department of State Law Library (1966)
Department of Transportation Main Library (1982)
Department of Transportation, U.S. Coast Guard Law Library (1982)
Department of the Treasury Library (1895)
District of Columbia Court of Appeals Library (1981)
District of Columbia Public Library (1943)
Equal Employment Opportunity Commission Library (1984)
Executive Office of the President, Office of Administration, Library & Information Service Division (1965)
Federal Deposit Insurance Corporation Library (1972)
Federal Election Commission Law Library (1975)
Federal Energy Regulatory Commission Library (1983)
Federal Labor Relations Authority Law Library (1982)
Federal Mine Safety & Health Review Commission Library (1979)
Federal Reserve System Board of Governors Research Library (1978)
Federal Reserve System Law Library (1976)
General Accounting Office Technical Library (1974)
General Services Administration Library (1975)
Georgetown University Library (1969)
Georgetown University Law Center Fred O. Dennis Law Library (1978)
George Washington University Melvin Gelman Library (1983)
George Washington University National Law Center Jacob Burns Law Library (1978)
Library of Congress Congressional Research Service (1978)
Library of Congress Serial and Government Publications (1977)
Merit Systems Protection Board Library (1979)
National Defense University Library (1895)
Pension Benefit Guaranty Corporation Legal Dept. Library (1984)
U.S. Court of Appeals Judges' Library (1975)
U.S. Court of Appeals for the Federal Circuit Library (1986)
U.S. Information Agency Library (1984)
U.S. Office of Personnel Management Library (1963)
U.S. Postal Service Library (1895)
U.S. Senate Library (1979)
U.S. Supreme Court Library (1978)
University of the District of Columbia Library Learning Resources Division (1970)
Veterans' Administration Central Office Library (1967)

FLORIDA

Boca Raton

Florida Atlantic University S. E. Wimberly Library (1963)

Clearwater

Clearwater Public Library (1972)

Coral Gables

University of Miami Otto G. Richter Library (1939)

Daytona Beach

Volusia County Library Center (1963)

De Land

Stetson University duPont-Ball Library (1887)

Fort Lauderdale

Broward County Library (1967)
Nova University Law Library (1967)

Fort Pierce

Indian River Community College Library (1975)

Gainesville

University of Florida College of Law Library (1978)
University of Florida Libraries (1907) REGIONAL

Jacksonville

Haydon Burns Public Library (1914)
Jacksonville University Swisher Library (1962)
University of North Florida Thomas G. Carpenter Library (1972)

Lakeland

Lakeland Public Library (1928)

Leesburg

Lake-Sumter Community College Library (1963)

Melbourne

Florida Institute of Technology Library (1963)

Miami

Florida International University Library Tamiami Trail (1970)
Miami-Dade Public Library (1952)

North Miami

Florida International University Bay Vista Campus Library (1977)

Opa Locka

St. Thomas University Library (1977)

Orlando

University of Central Florida Library (1966)

Palatka

Saint Johns River Community College Library (1963)

Panama City

Bay County Public Library (1983)

Pensacola

University of West Florida John C. Pace Library (1966)

Port Charlotte

Charlotte-Glades Library System (1973)

Saint Petersburg

Saint Petersburg Public Library (1965)
Stetson University College of Law Charles A. Dana Law Library (1975)

Sarasota

Selby Public Library (1970)

Tallahassee

Florida Agricultural and Mechanical University Coleman Memorial Library (1936)
Florida State University College of Law Library (1978)
Florida State University Strozier Library (1941)
Florida Supreme Court Library (1974)
State Library of Florida (1929)

Tampa

Tampa-Hillsborough County Public Library (1965)
University of South Florida Library (1962)
University of Tampa Merl Kelce Library (1953)

Winter Park

Rollins College Olin Library (1909)

GEORGIA

Albany

Dougherty County Public Library (1964)

Americus

Georgia Southwestern College James Earl Carter Library (1966)

Athens

University of Georgia Libraries (1907) REGIONAL
University of Georgia School of Law Library (1979)

Atlanta

Atlanta-Fulton Public Library (1880)
Atlanta University Center Robert W. Woodruff Library (1962)
Emory University School of Law Library (1968)
Emory University Woodruff Library (1928)
Georgia Institute of Technology Price Gilbert Memorial Library (1963)
Georgia State Library (unknown)
Georgia State University William Russell Pullen Library (1970)
Georgia State University College of Law Library (1983)
U.S. Court of Appeals 11th Circuit Library (1980)

Augusta

Augusta College Reese Library (1962)
Medical College of Georgia Library (1986)

Brunswick

Brunswick-Glynn County Regional Library (1965)

Carrollton

West Georgia College Irvine Sullivan Ingram Library (1962)

Columbus

Columbus College Simon Schwob Memorial Library (1975)

Dahlonega

North Georgia College Stewart Library (1939)

Dalton

Dalton College Library (1978)

Macon

Mercer University Stetson Memorial Library (1964)
Mercer University Walter F. George School of Law Library (1978)

Marietta

Kennesaw College Library (1968)

Milledgeville

Georgia College Ina Dillard Russell Library (1950)

Rome

Berry College Memorial Library (1970)

Savannah

Chatham-Effingham Liberty Regional Library (1857)

Statesboro

Georgia Southern College Zoah S. Henderson Library (1939)

Valdosta

Valdosta State College Library (1956)

GUAM

Agana

Nieves M. Flores Memorial Library (1962)

Mangilao

University of Guam Robert F. Kennedy Memorial Library (1978)

HAWAII

Hilo

University of Hawaii at Hilo Edwin H. Mookini Library (1962)

Honolulu

Hawaii Medical Library Incorporated (1968)
Hawaii State Library (1929)
Municipal Reference & Records Center (1965)
Supreme Court Law Library (1973)
University of Hawaii Hamilton Library (1907) REGIONAL
University of Hawaii William S. Richardson School of Law Library (1978)

Laie

Brigham Young University Hawaii Campus, Joseph F. Smith Library (1964)

Lihue

Lihue Public Library (1967)

Pearl City

Leeward Community College Library (1967)

Wailuku

Maui Public Library (1962)

IDAHO

Boise

Boise Public Library and Information Center (1929)
Boise State University Library (1966)
Idaho State Law Library (unknown)
Idaho State Library (unknown)

Caldwell

College of Idaho Terteling Library (1930)

Moscow

University of Idaho College of Law Library (1978)
University of Idaho Library (1907) REGIONAL

Nampa

Northwest Nazarene College John E. Riley Library (1984)

Pocatello

Idaho State University Eli Oboler Library (1908)

Rexburg

Ricks College Davis O. McKay Library (1946)

Twin Falls

College of Southern Idaho Library (1970)

ILLINOIS

Bloomington

Illinois Wesleyan University, Sheean Library (1964)

Bourbonnais

Olivet Nazarene University Benner Library & Learning Resource Center (1946)

Carbondale

Southern Illinois University at Carbondale Morris Library (1932)
Southern Illinois University School of Law Library (1978)

Carlinville

Blackburn College Lumpkin Library (1954)

Carterville

Shawnee Library System (1971)

Champaign

University of Illinois Law Library (1965)

Charleston

Eastern Illinois University Booth Library (1962)

Chicago

Chicago Public Library (1876)
Chicago State University Paul and Emily Douglas Library (1954)
DePaul University Law Library (1979)
Field Museum of Natural History Library (1963)
Illinois Institute of Technology Chicago-Kent College of Law Library (1978)
Illinois Institute of Technology Paul V. Galvin Library (1982)
John Marshall Law School Library (1981)
Loyola University of Chicago E. M. Cudahy Memorial Library (1966)
Loyola University School of Law Library (1979)
Northeastern Illinois University Ronald Williams Library (1961)
Northwestern University School of Law Library (1978)
University of Chicago Law Library (1964)
University of Chicago Library (1897)
University of Illinois at Chicago Library (1957)
William J. Campbell Library of the U.S. Courts (1979)

Decatur

Decatur Public Library (1954)

De Kalb

Northern Illinois University Founders' Memorial Library (1960)
Northern Illinois University College of Law Library (1978)

Des Plaines

Oakton Community College Library (1976)

Edwardsville

Southern Illinois University at Edwardsville Lovejoy Memorial Library (1959)

Elsah

Principia College Marshall Brooks Library (1957)

Evanston

Northwestern University Library (1876)

Freeport

Freeport Public Library (1905)

Galesburg

Galesburg Public Library (1896)

Jacksonville

MacMurray College Henry Pfeiffer Library (1929)

Lake Forest

Lake Forest College Donnelley Library (1962)

Lebanon

McKendree College Holman Library (1968)

Lisle

Illinois Benedictine College Theodore F. Lownik Library (1911)

Macomb

Western Illinois University Government Publications & Legal Reference Library (1962)

Moline

Black Hawk College Learning Resources Center (1970)

Monmouth

Monmouth College Hewes Library (1860)

Mount Carmel

Wabash Valley College Bauer Media Center (1975)

Mount Prospect

Mount Prospect Public Library (1977)

Normal

Illinois State University Milner Library (1877)

Oak Park

Oak Park Public Library (1963)

Oglesby

Illinois Valley Community College Jacobs Memorial Library (1976)

Palos Hills

Moraine Valley Community College Learning Resources Center (1972)

Peoria

Bradley University Cullom-Davis Library (1963)
Peoria Public Library (1883)

River Forest

Rosary College Library Rebecca Crown Library (1966)

Rockford

Rockford Public Library (1895)

Romeoville

Lewis University Library (1952)

Springfield

Illinois State Library (unknown) REGIONAL

Streamwood

Poplar Creek Public Library (1980)

University Park

Governors' State University Library (1974)

Urbana

University of Illinois Documents Library (1907)

Wheaton

Wheaton College Buswell Memorial Library (1964)

Woodstock

Woodstock Public Library (1963)

INDIANA

Anderson

Anderson College Charles E. Wilson Library (1959)
Anderson Public Library (1983)

Bloomington

Indiana University Library (1881)
Indiana University Law Library (1978)

Crawfordsville

Wabash College Lilly Library (1906)

Evansville

Evansville and Vanderburgh County Public Library (1928)
University of Southern Indiana Library (1969)

Fort Wayne

Allen County Public Library (1896)
Indiana University-Purdue University at Fort Wayne (1965)

Franklin

Franklin College Library (1976)

Gary

Gary Public Library (1943)
Indiana University Northwest Library (1966)

Greencastle

De Pauw University Roy O. West Library (1879)

Hammond

Hammond Public Library (1964)

Hanover

Hanover College Duggan Library (1892)

Huntington

Huntington College Richlyn Library (1964)

Indianapolis

Butler University Irwin Library (1965)
Indianapolis-Marion County Public Library (1906)
Indiana State Library (unknown) REGIONAL
Indiana Supreme Court Law Library (1975)
Indiana University School of Law Library (1967)
Indiana University-Purdue University Library (1979)

Kokomo

Indiana University at Kokomo Learning Resource Center (1969)

Muncie

Ball State University Alexander M. Bracken Library (1959)
Muncie Public Library (1906)

New Albany

Indiana University Southeast Library (1965)

Notre Dame

Notre Dame Law School Kresge Law Library (1985)
University of Notre Dame Memorial Library (1883)

Rensselaer

Saint Joseph's College Library (1964)

Richmond

Earlham College Lilly Library (1964)
Morrison-Reeves Library (1906)

South Bend

Indiana University at South Bend Library (1965)

Terre Haute

Indiana State University Cunningham Memorial Library (1906)

Valparaiso

Valparaiso University Moellering Memorial Library (1930)
Valparaiso University Law Library (1978)

West Lafayette

Purdue University Libraries (1907)

IOWA

Ames

Iowa State University Library (1907)

Cedar Falls

University of Northern Iowa Library (1946)

Cedar Rapids

Cedar Rapids Public Library (1986)

Council Bluffs

Free Public Library (1885)
Iowa Western Community College Herbert Hoover Library (1972)

Davenport

Davenport Public Library (1973)

Des Moines

Drake University Cowles Library (1966)
Drake University Law Library (1972)
Public Library of Des Moines (1888)
State Library of Iowa (unknown)

Dubuque

Carnegie-Stout Public Library (unknown)
Loras College Wahlert Memorial Library (1967)

Fayette

Upper Iowa University Henderson-Wilder Library (1974)

Grinnell

Grinnell College Burling Library (1874)

Iowa City

University of Iowa College of Law Library (1968)
University of Iowa Libraries (1884) REGIONAL

Lamoni

Graceland College Frederick Madison Smith Library (1927)

Mason City

North Iowa Area Community College Library (1976)

Mount Vernon

Cornell College Russell D. Cole Library (1896)

Orange City

Northwestern College Ramaker Library (1970)

Sioux City

Sioux City Public Library (1894)

KANSAS

Atchison

Benedictine College North Campus Library (1965)

Baldwin City

Baker University Collins Library (1908)

Colby

Colby Community College H. F. Davis Memorial Library (1968)

Emporia

Emporia State University William Allen White Library (1909)

Hays

Fort Hays State University Forsyth Library (1926)

Hutchinson

Hutchinson Public Library (1963)

Lawrence

University of Kansas Law Library (1971)
University of Kansas Spencer Research Library (1869) REGIONAL

Manhattan

Kansas State University Farrell Library (1907)

Pittsburg

Pittsburg State University Leonard H. Axe Library (1952)

Salina

Kansas Wesleyan University Memorial Library (1930)

Shawnee Mission

Johnson County Library (1979)

Topeka

Kansas State Historical Society Library (1877)
Kansas State Library (unknown)
Kansas Supreme Court Law Library (1975)
Washburn University of Topeka Law Library (1971)

Wichita

Wichita State University Ablah Library (1901)

KENTUCKY

Ashland

Boyd County Public Library (1946)

Barbourville

Union College Abigail E. Weeks Memorial Library (1958)

Bowling Green

Western Kentucky University Helm-Cravens Library (1934)

Columbia

Lindsey Wilson College Katie Murrell Library (1987)

Crestview Hills

Thomas More College Library (1970)

Danville

Centre College Grace Doherty Library (1884)

Frankfort

Kentucky Department of Libraries and Archives (1967)
Kentucky State Law Library (unknown)
Kentucky State University Blazer Library (1972)

Hazard

Hazard Community College Library (1988)

Highland Heights

Northern Kentucky University W. Frank Steely Library (1973)

Lexington

University of Kentucky Law Library (1968)
University of Kentucky Libraries (1907) REGIONAL

Louisville

Louisville Free Public Library (1904)
University of Louisville Ekstrom Library (1925)
University of Louisville Law Library (1975)

Morehead

Morehead State University Camden-Carroll Library (1955)

Murray

Murray State University Waterfield Library (1924)

Owensboro

Kentucky-Wesleyan College Library Learning Center (1966)

Richmond

Eastern Kentucky University John Grant Crabbe Library (1966)

Williamsburg

Cumberland College Norma Perkins Hagan (1988)

LOUISIANA

Baton Rouge

Louisiana State Library (1976)
Louisiana State University Middleton Library (1907) REGIONAL
Louisiana State University Paul M. Hebert Law Center Library (1929)
Southern University Law School Library (1979)
Southern University Library (1952)

Eunice

Louisiana State University at Eunice LeDoux Library (1969)

Hammond

Southeastern Louisiana University Sims Memorial Library (1966)

Lafayette

University of Southwestern Louisiana Library (1938)

Lake Charles

McNeese State University Lether E. Frazar Memorial Library (1941)

Monroe

Northeast Louisiana University Sandel Library (1963)

Natchitoches

Northwestern State University of Louisiana Watson Memorial Library (1887)

New Orleans

Law Library of Louisiana (unknown)
Loyola University Government Documents Library (1942)
Loyola University Law Library (1978)
New Orleans Public Library (1883)
Our Lady of Holy Cross College Library (1968)
Southern University in New Orleans Leonard S. Washington Memorial Library (1962)
Tulane University Law Library (1976)
Tulane University Howard-Tilton Memorial Library (1942)
U.S. Court of Appeals 5th Circuit Library (1973)
University of New Orleans Earl K. Long Library (1963)

Pineville

Louisiana College Richard W. Norton Memorial Library (1969)

Ruston

Louisiana Technical University Prescott Memorial Library (1896) REGIONAL

Shreveport

Louisiana State University at Shreveport Library (1967)
Shreve Memorial Library (1923)

Thibodaux

Nicholls State University Ellender Memorial Library (1962)

MAINE

Augusta

Maine Law and Legislative Reference Library (1973)
Maine State Library (unknown)

Bangor

Bangor Public Library (1884)

Brunswick

Bowdoin College Library (1884)

Castine

Maine Maritime Academy Nutting Memorial Library (1969)

Lewiston

Bates College George and Helen Ladd Library (1883)

Orono

University of Maine Raymond H. Fogler Library (1907) REGIONAL

Portland

Portland Public Library (1884)
University of Maine School of Law Garbrecht Law Library (1964)

Presque Isle

University of Maine at Presque Isle Library/Learning Resources Center (1979)

Sanford

Louis B. Goodall Memorial Library (1984)

Waterville

Colby College Miller Library (1884)

MARYLAND

Annapolis

Maryland State Law Library (unknown)
U.S. Naval Academy Nimitz Library (1895)

Baltimore

Enoch Pratt Free Library (1887)
Johns Hopkins University Milton S. Eisenhower Library (1882)
Morgan State University Soper Library (1940)
University of Baltimore Langsdale Library (1973)
University of Baltimore Law Library (1980)
University of Maryland School of Law Marshall Law Library (1969)
U.S. Court of Appeals 4th Circuit Library (1982)

Bel Air

Harford Community College Library (1967)

Beltsville

Department of Agriculture National Agricultural Library (1895)

Bethesda

Department of Health and Human Services National Library of Medicine (1978)
Uniformed Services University of Health Sciences Learning Resource Center (1983)

Catonsville

University of Maryland, Baltimore County Albin O. Kuhn Library & Gallery (1971)

Chestertown

Washington College Clifton M. Miller Library (1891)

College Park

University of Maryland McKeldin Library (1925) REGIONAL

Cumberland

Allegany Community College Library (1974)

Frostburg

Frostburg State University Library (1967)

Patuxent River

Patuxent River Central Library (1968)

Rockville

Montgomery County Department of Public Libraries (1951)

Salisbury

Salisbury State College Blackwell Library (1965)

Towson

Goucher College Julia Rogers Library (1966)
Towson State University Cook Library (1979)

Westminster

Western Maryland College Hoover Library (1886)

MASSACHUSETTS

Amherst

Amherst College Library (1884)
University of Massachusetts University Library (1907)

Boston

Boston Athenaeum Library (unknown)
Boston Public Library (1859) REGIONAL
Boston University School of Law Pappas Law Library (1979)
Northeastern University Dodge Library (1962)
State Library of Massachusetts (unknown)
Suffolk University Law Library (1979)
Supreme Judicial Court Social Law Library (1979)
U.S. Court of Appeals First Circuit Library (1978)

Brookline

Public Library of Brookline (1925)

Cambridge

Harvard College Library (1860)
Harvard Law School Library (1981)
Massachusetts Institute of Technology Library (1946)

Chestnut Hill

Boston College Thomas P. O'Neill Jr., Library (1963)

Chicopee

College of Our Lady of the Elms Alumnae Library (1969)

Lowell

University of Lowell Lydon Library (1952)

Medford

Tufts University Wessel Library (1899)

Milton

Curry College Levin Library (1972)

New Bedford

New Bedford Free Public Library (1858)

Newton Centre

Boston College Law School Library (1979)

North Dartmouth

Southeastern Massachusetts University Library (1965)

North Easton

Stonehill College Cushing-Martin Library (1962)

Springfield

Springfield City Library (1966)
Western New England College Law Library (1978)

Waltham

Brandeis University Library (1965)
Waltham Public Library (1982)

Wellesley

Wellesley College Library (1943)

Wenham

Gordon College Jenks Learning Resource Center (1963)

Williamstown

William College Sawyer Library (unknown)

Worcester

American Antiquarian Society Library (1814)
University of Massachusetts Medical Center Library (1972)
Worcester Public Library (1859)

MICHIGAN

Albion

Albion College Stockwell-Mudd Library (1966)

Allendale

Grand Valley State College Zumberge Library (1963)

Alma

Alma College Library (1963)

Ann Arbor

University of Michigan Harlan Hatcher Graduate Library (1884)
University of Michigan Law Library (1978)

Benton Harbor

Benton Harbor Public Library (1907)

Bloomfield Hills

Cranbrook Institute of Science Library (1940)

Dearborn

Henry Ford Centennial Library (1969)
Henry Ford Community College Library (1957)

Detroit

Detroit College of Law Library (1979)
Detroit Public Library (1868) REGIONAL
Marygrove College Library (1965)
Mercy College of Detroit Library (1965)
University of Detroit Library (1884)
University of Detroit School of Law Library (1978)
Wayne State University Purdy/Kresge Library (1937)
Wayne State University Arthur Neef Law Library (1971)

Dowagiac

Southwestern Michigan College Matthews Library (1971)

East Lansing

Michigan State University Documents Library (1907)

Farmington Hills

Oakland Community College Martin L. King Learning Resources Center (1968)

Flint

Flint Public Library (1967)
University of Michigan-Flint Library (1977)

Grand Rapids

Calvin College & Seminary Library (1967)
Grand Rapids Public Library (1876)

Houghton

Michigan Technological University Library (1876)

Jackson

Jackson District Library (1965)

Kalamazoo

Kalamazoo Public Library (1907)
Western Michigan University Dwight B. Waldo Library (1963)

Lansing

Library of Michigan (unknown) REGIONAL
Thomas M. Cooley Law School Library (1978)

Livonia

Livonia Public Library (1987)
Schoolcraft College Library (1962)

Madison Heights

Madison Heights Public Library (1982)

Marquette

Northern Michigan University Lydia M. Olson Library (1963)

Monroe

Monroe County Library System (1974)

Mount Clemens

Macomb County Library (1968)

Mount Pleasant

Central Michigan University Library (1958)

Muskegon

Hackley Public Library (1894)

Petoskey

North Central Michigan College Library (1962)

Port Huron

Saint Clair County Library (1876)

Rochester

Oakland University Kresge Library (1964)

Royal Oak

Royal Oak Public Library (1984)

Saginaw

Hoyt Public Library (1890)

Sault Ste. Marie

Lake Superior State College Kenneth Shouldice Library (1982)

Traverse City

Northwestern Michigan College Mark Osterlin Library (1964)

University Center

Delta College Library (1963)

Warren

Warren Public Library Arthur J. Miller Branch (1973)

Ypsilanti

Eastern Michigan University Library (1965)

MICRONESIA

East Caroline Islands

Community College of Micronesia Library (1982)

MINNESOTA

Bemidji

Bemidji State University A.C. Clark Library (1963)

Blaine

Anoka County Library (1971)

Collegeville

Saint John's University Alcuin Library (1954)

Cottage Grove

Washington County Library-Park Grove Branch (1983)

Duluth

Duluth Public Library (1909)
University of Minnesota Duluth Library (1984)

Eagan

Dakota County Library—Westcott Branch (1983)

Edina

Southdale-Hennepin Area Library (1971)

Mankato

Mankato State University Memorial Library (1962)

Marshall

Southwest State University Library (1986)

Minneapolis

Minneapolis Public Library (1893)
University of Minnesota Law School Library (1978)
University of Minnesota Wilson Library (1907) REGIONAL

Moorhead

Moorhead State University Livingston Lord Library (1956)

Morris

University of Minnesota, Morris, Rodney A. Briggs Library (1963)

Northfield

Carleton College Library (1930)
Saint Olaf College Rolvaag Memorial Library (1930)

Saint Cloud

Saint Cloud State University, Learning Rescources Center (1962)

Saint Paul

Hamline University School of Law Library (1978)
Minnesota Historical Society Library (1867)
Minnesota State Law Library (unknown)
Saint Paul Public Library (1914)
University of Minnesota Saint Paul Campus Library (1974)
William Mitchell College of Law Library (1979)

Saint Peter

Gustavus Adolphus College Library (1941)

Winona

Winona State University Maxwell Library (1969)

MISSISSIPPI

Cleveland

Delta State University W. B. Roberts Library (1975)

Columbus

Mississippi University for Women John Clayton Fant Memorial Library (1929)

Hattiesburg

University of Southern Mississippi Joseph A. Cook Memorial Library (1935)

Jackson

Jackson State University Henry Thomas Sampson Library (1968)
Millsaps College Millsaps-Wilson Library (1963)
Mississippi College School of Law Library (1977)
Mississippi Library Commission (1947)
Mississippi State Law Library (unknown)

Lorman

Alcorn State University J. D. Boyd Library (1970)

Mississippi State

Mississippi State University Mitchell Memorial Library (1907)

University

University of Mississippi Library (1883) REGIONAL
University of Mississippi James O. Eastland Law Library (1967)

MISSOURI

Cape Girardeau

Southeast Missouri State University Kent Library (1916)

Columbia

University of Missouri at Columbia Library (1862) REGIONAL
University of Missouri-Columbia Law Library (1978)

Fulton

Westminster College Reeves Library (1875)

Hillsboro

Jefferson College Library (1984)

Jefferson City

Lincoln University Inman E. Page Library (1944)
Missouri State Library (1963)
Missouri Supreme Court Library (unknown)

Joplin

Missouri Southern State College Library (1966)

Kansas City

Kansas City Missouri Public Library (1881)
Rockhurst College Greenlease Library (1917)
University of Missouri at Kansas City General Library (1938)
University of Missouri Kansas City Leon E. Bloch Law Library (1978)

Kirksville

Northeast Missouri State University Pickler Memorial Library (1966)

Liberty

William Jewell College Charles F. Curry Library (1900)

Maryville

Northwest Missouri State University B. D. Owens Library (1982)

Rolla

University of Missouri-Rolla Curtis Laws Wilson Library (1907)

Saint Charles

Lindenwood College Margaret Leggat Butler Library (1973)

Saint Joseph

Saint Joseph Public Library (1891)

Saint Louis

Maryville College Library (1976)
Saint Louis County Library (1970)
Saint Louis Public Library (1866)
Saint Louis University Law Library (1967)
Saint Louis University Pius XII Memorial Library (1866)
U.S. Court of Appeals Eighth Circuit Library (1972)
University of Missouri at Saint Louis Thomas Jefferson Library (1966)
Washington University John M. Olin Library (1906)
Washington University Law Library (1978)

Springfield

Drury College, Walker Library (1874)
Southwest Missouri State University Duane G. Meyer Library (1963)

Warrensburg

Central Missouri State University Ward Edwards Library (1914)

MONTANA

Billings

Eastern Montana College Library (1958)

Bozeman

Montana State University Renne Library (1907)

Butte

Montana College of Mineral Science and Technology Library (1901)

Havre

Northern Montana College Vande Bogart Library (1980)

Helena

Carroll College Library (1974)
Montana State Library (1966)
State Law Library of Montana (1977)

Missoula

University of Montana Maurene & Mike Mansfield Library (1909) REGIONAL

NEBRASKA

Blair

Dana College Dana-LIFE Library (1924)

Crete

Doane College Perkins Library (1944)

Fremont

Midland Lutheran College Luther Library (1924)

Kearney

Kearney State College Calvin T. Ryan Library (1962)

Lincoln

Nebraska Library Commission (1972)
Nebraska State Library (unknown)
University of Nebraska-Lincoln College of Law Library (1981)
University of Nebraska-Lincoln D. L. Love Memorial Library (1907) REGIONAL

Omaha

Creighton University Reinert/Alumni Library (1964)
Creighton University School of Law Library (1979)
Omaha Public Library W. Dale Clark Library (1880)
University of Nebraska at Omaha University Library (1939)

Scottsbluff

Scottsbluff Public Library (1925)

Wayne

Wayne State College U.S. Conn Library (1970)

NEVADA

Carson City

Nevada State Library (unknown)
Nevada Supreme Court Library (1973)

Las Vegas

Clark County Law Library (1988)
Las Vegas-Clark County Library (1974)
University of Nevada at Las Vegas James Dickinson Library (1959)

Reno

National Judicial College Law Library (1979)
Nevada Historical Society Library (1974)
University of Nevada-Reno Library (1907) REGIONAL
Washoe County Library (1980)

NEW HAMPSHIRE

Concord

Franklin Pierce Law Center Library (1973)
New Hampshire State Library (unknown)

Durham

University of New Hampshire Library (1907)

Hanover

Dartmouth College Library (1884)

Henniker

New England College Danforth Library (1966)

Manchester

Manchester City Library (1884)
New Hampshire College H. A. B. Shapiro Memorial Library (1976)
Saint Anselm College Geisel Library (1963)

Nashua

Nashua Public Library (1971)

NEW JERSEY

Bayonne

Bayonne Free Public Library (1909)

Bloomfield

Bloomfield Public Library (1965)

Bridgeton

Cumberland County Library (1966)

Camden

Rutgers University Camden Library (1966)
Rutgers University School of Law Library (1979)

Convent Station

College of Saint Elizabeth Mahoney Library (1938)

East Brunswick

East Brunswick Public Library (1977)

East Orange

East Orange Public Library (1966)

Elizabeth

Free Public Library of Elizabeth (1895)

Glassboro

Glassboro State College Savitz Library (1963)

Hackensack

Johnson Free Public Library (1966)

Irvington

Irvington Public Library (1966)

Jersey City

Jersey City Public Library (1879)
Jersey City State College Forrest A. Irwin Library (1963)

Lawrenceville

Rider College Franklin F. Moore Library (1975)

Madison

Drew University Library (1939)

Mahwah

Ramapo College Library (1971)

Mount Holly

Burlington County Library (1966)

New Brunswick

New Brunswick Free Public Library (1908)
Rutgers University Alexander Library (1907)

Newark

Newark Public Library (1906) REGIONAL
Rutgers-The State University of New Jersey John Cotton Dana Library (1966)
Rutgers University Law School Ackerson Law Library (1979)
Seton Hall University Law Library (1979)

Newton

Sussex County Library (1986)

Passaic

Passaic Public Library (1964)

Phillipsburg

Phillipsburg Free Public Library (1976)

Plainfield

Plainfield Public Library (1971)

Pomona

Stockton State College Library (1972)

Princeton

Princeton University Library (1884)

Randolph

County College of Morris Sherman H. Masten Learning Resource Center (1975)

Rutherford

Fairleigh Dickinson University Messler Library (1953)

Shrewsbury

Monmouth County Library (1968)

South Orange

Seton Hall University McLaughlin Library (1947)

Teaneck

Fairleigh Dickinson University Weiner Library (1963)

Toms River

Ocean County College Learning Resources Center (1966)

Trenton

New Jersey State Library (unknown)
Trenton Free Public Library (1902)

Union

Kean College of New Jersey Nancy Thompson Library (1971)

Upper Montclair

Montclair State College Harry A. Sprague Library (1967)

Wayne

Wayne Public Library (1972)

West Long Branch

Monmouth College Guggenheim Memorial Library (1963)

Woodbridge

Woodbridge Public Library (1965)

NEW MEXICO

Albuquerque

University of New Mexico Medical Center Library (1973)
University of New Mexico School of Law Library (1973)
University of New Mexico General Library (1896) REGIONAL

Hobbs

New Mexico Junior College Pannell Library (1969)

Las Cruces

New Mexico State University Library (1907)

Las Vegas

New Mexico Highlands University Donnelly Library (1913)

Portales

Eastern New Mexico University Golden Library (1962)

Santa Fe

New Mexico State Library (1960) REGIONAL
New Mexico Supreme Court Law Library (unknown)

Silver City

Western New Mexico University Miller Library (1972)

Socorro

New Mexico Institute of Mining & Technology Martin Speare Memorial Library (1984)

NEW YORK

Albany

Albany Law School Schaffer Law Library (1979)
New York State Library (unknown) REGIONAL
State University of New York at Albany University Library (1964)

Auburn

Seymour Library (1972)

Binghamton

State University of New York at Binghamton Glenn G. Bartle Library (1962)

Brockport

State University of New York at Brockport Drake Memorial Library (1967)

Bronx

Fordham University Library (1937)
Herbert H. Lehman College Library (1967)
New York Public Library (1973)
State University of New York Maritime College Stephen B. Luce Library (1947)

Bronxville

Sarah Lawrence College Esther Raushenbush Library (1969)

Brooklyn

Brooklyn College Library (1936)
Brooklyn Law School Library (1974)
Brooklyn Public Library Business Library (1984)
Brooklyn Public Library (1908)
Pratt Institute Library (1891)
State University of New York Health Center at Brooklyn Library (1958)

Buffalo

Buffalo and Erie County Public Library (1895)
State University of New York at Buffalo Charles B. Sears Law Library (1978)
State University of New York at Buffalo Lockwood Memorial Library (1963)

Canton

Saint Lawrence University Owen D. Young Library (1920)

Corning

Corning Community College Arthur A. Houghton Jr. Library (1963)

Cortland

State University of New York College at Cortland Memorial Library (1964)

Delhi

State University Agricultural and Technical College Library (1970)

East Islip

East Islip Public Library (1973)

Elmira

Elmira College Gannett Tripp Learning Center (1956)

Farmingdale

State University of New York at Farmingdale Greenley Library (1917)

Flushing

CUNY Law School at Queens College CUNY Law Library (1983)
Queens College Paul Klapper Library (1939)

Garden City

Adelphi University Swirbul Library (1966)

Geneseo

State University of New York at Geneseo Milne Library (1967)

Greenvale

Long Island University B. Davis Schwartz Memorial Library (1964)

Hamilton

Colgate University, Everett Needham Case Library (1902)

Hempstead

Hofstra University Library (1964)
Hofstra University School of Law Library (1979)

Huntington

Touro College Jacob D. Fuchsberg Law Center Library (1985)

Ithaca

Cornell University Library (1907)
Cornell Law Library (1978)
New York State College of Agriculture and Human Ecology Albert R. Mann Library (1943)

Jamaica

Queens Borough Public Library (1926)
Saint John's University Library (1956)
Saint John's University School of Law Library (1978)

Kings Point

U.S. Merchant Marine Academy Schuyler Otis Bland Library (1962)

Long Island City

Fiorello H. LaGuardia Community College Library (1981)

Middletown

Thrall Library (1986)

Mount Vernon

Mount Vernon Public Library (1962)

New Paltz

State University College at New Paltz Sojourner Truth Library (1965)

New York City

City College of City University of New York Cohen Library (1884)
College of Insurance Library (1965)
Columbia University Libraries (1882)
Columbia University School of Law Library (1981)
Cooper Union for the Advancement of Science and Arts Library (1930)
Fordham University School of Law Leo T. Kissam Memorial Library (1987)
Medical Library Center of New York (1976)
New York Law Institute Library (1909)
New York Law School Library (1979)
New York Public Library Astor Branch (1907)
New York Public Library Lenox Branch (1884)
New York University Law Library (1974)
New York University Elmer Holmes Bobst Library (1967)
U.S. Court of Appeals Second Circuit Library (1976)
Yeshiva University Chutick Law Library Cardozo School of Law (1979)
Yeshiva University Pollack Library (1979)

Newburgh

Newburgh Free Library (1909)

Niagara Falls

Niagara Falls Public Library (1976)

Oakdale

Dowling College Library (1965)

Oneonta

State University College at Onenonta James M. Milne Library (1966)

Oswego

State University of New York at Oswego Penfield Library (1966)

Plattsburgh

State University College at Plattsburgh Benjamin F. Feinberg Library (1967)

Potsdam

Clarkson University Harriet Call Burnap Memorial Library (1938)
State University College at Potsdam Frederick W. Crumb Memorial Library (1964)

Poughkeepsie

Vassar College Library (1943)

Purchase

State University of New York at Purchase Library (1969)

Rochester

Rochester Public Library (1963)
University of Rochester Rush Rhees Library (1880)

Saint Bonaventure

Saint Bonaventure University Friedsam Memorial Library (1938)

Saratoga Springs

Skidmore College Library (1964)

Schenectady

Union College Schaffer Library (1901)

Southampton

Long Island University Southhampton Campus Library (1973)

Sparkill

St. Thomas Aquinas College Lougheed Library (1984)

Staten Island

Wagner College Horrmann Library (1953)

Stony Brook

State University of New York at Stony Brook Main Library (1963)

Syracuse

Onondaga County Public Library (1978)
Syracuse University Bird Library (1878)
Syracuse University College of Law H. Douglas Barclay Law Library (1978)

Troy

Troy Public Library (1869)

Uniondale

Nassau Library System (1965)

Utica

Utica Public Library (1885)
SUNY College of Technology Library (1977)

West Point

U.S. Military Academy Library (unknown)

White Plains

Pace University, Law School Library (1978)

Yonkers

Yonkers Public Library Getty Square Branch (1910)

Yorktown Heights

Mercy College Library (1976)

NORTH CAROLINA

Asheville

University of North Carolina at Asheville D. Hiden Ramsey Library (1965)

Boiling Springs

Gardner-Webb College Dover Memorial Library (1974)

Boone

Appalachian State University Carol Grotnes Belk Library (1963)

Buies Creek

Campbell University Carrie Rich Memorial Library (1965)

Chapel Hill

University of North Carolina at Chapel Hill Davis Library (1884) REGIONAL
University of North Carolina Law Library (1978)

Charlotte

Public Library of Charlotte and Mecklenburg County (1964)
Queens College Everett Library (1927)
University of North Carolina at Charlotte Atkins Library (1964)

Cullowhee

Western Carolina University Hunter Library (1953)

Davidson

Davidson College Library (1893)

Durham

Duke University School of Law Library (1978)
Duke University William R. Perkins Library (1890)
North Carolina Central University Law School Library (1979)
North Carolina Central University James E. Shepard Memorial Library (1973)

Elon College

Elon College Iris Holt McEwen Library (1971)

Fayetteville

Fayetteville State University Charles W. Chesnutt Library (1971)

Greensboro

North Carolina Agricultural and Technical State University F. D. Bluford Library (1937)
University of North Carolina at Greensboro Walter Clinton Jackson Library (1963)

Greenville

East Carolina University J. Y. Joyner Library (1951)

Laurinburg

Saint Andrews Presbyterian College DeTamble Library (1969)

Lexington

Davidson County Public Library (1971)

Mount Olive

Mount Olive College Moye Library (1971)

Pembroke

Pembroke State University Mary H. Livermore Library (1956)

Raleigh

Department of Cultural Resources Division of State Library (unknown)
North Carolina State University D. H. Hill Library (1923)
North Carolina Supreme Court Library (1972)

Rocky Mount

North Carolina Wesleyan College Library (1969)

Salisbury

Catawba College Library (1925)

Wilmington

University of North Carolina at Wilmington William M. Randall Library (1965)

Wilson

Atlantic Christian College Hackney Library (1930)

Winston-Salem

Forsyth County Public Library (1954)
Wake Forest University Z. Smith Reynolds Library (1902)

NORTH DAKOTA

Bismarck

North Dakota State Library (1971)
North Dakota Supreme Court Law Library (unknown)
State Historical Society of North Dakota State Archives & Historical Research Library (1907)
Veterans' Memorial Public Library (1967)

Dickinson

Dickinson State College Stoxen Library (1968)

Fargo

Fargo Public Library (1964)
North Dakota State University Library (1907) REGIONAL

Grand Forks

University of North Dakota Chester Fritz Library (1890)

Minot

Minot State University Memorial Library (1925)

Valley City

Valley City State University Allen Memorial Library (1913)

NORTHERN MARIANA ISLANDS

Saipan

Northern Marianas College Olympio T. Borja Memorial Library (1988)

OHIO

Ada

Ohio Northern University J. P. Taggart Law Library (1965)

Akron

Akron-Summit County Public Library (1952)
University of Akron Bierce Library (1963)
University of Akron School of Law Library (1978)

Alliance

Mount Union College Library (1888)

Ashland

Ashland College Library (1938)

Athens

Ohio University Alden Library (1886)

Batavia

University of Cincinnati Clermont College Library (1973)

Bluffton

Bluffton College Musselman Library (1951)

Bowling Green

Bowling Green State University Jerome Library (1933)

Canton

Malone College Everett L. Cattel Library (1970)

Chardon

Chardon Public Library (1971)

Cincinnati

Public Library of Cincinnati and Hamilton County (1884)
University of Cincinnati Central Library (1929)
University of Cincinnati College of Law Marx Law Library (1978)
U.S. Court of Appeals 6th Circuit Library (1986)

Cleveland

Case Western Reserve University Freiberger Library (1913)
Case Western Reserve University School of Law Library (1979)
Cleveland Public Library (1886)
Cleveland State University Cleveland-Marshall College of Law, Joseph W. Bartunek III Law Library (1978)
Cleveland State University Library (1966)
Municipal Reference Library (1970)

Cleveland Heights

Cleveland Heights-University Heights Public Library (1970)

Columbus

Capital University Law School Library (1980)
Capital University Library (1968)
Ohio State University College of Law Library (1984)
Ohio State University Libraries (1907)
Ohio Supreme Court Law Library (1973)
Public Library of Columbus and Franklin County (1885)
State Library of Ohio (unknown) REGIONAL

Dayton

Dayton and Montgomery County Public Library (1909)
University of Dayton Roesch Library (1969)
Wright State University Library (1965)

Delaware

Ohio Wesleyan University L. A. Beeghly Library (1845)

Elyria

Elyria Public Library (1966)

Findlay

Findlay College Shafer Library (1969)

Gambier

Kenyon College Library (1873)

Granville

Denison University Libraries William H. Doane Library (1884)

Hiram

Hiram College Teachout-Price Memorial Library (1874)

Kent

Kent State University Libraries (1962)

Marietta

Marietta College Dawes Memorial Library (1884)

Marion

Marion Public Library (1979)

Middletown

Miami University Middletown Gardner-Harvey Library (1970)

New Concord

Muskingum College Library (1966)

Oberlin

Oberlin College Library (1858)

Oxford

Miami University Libraries King Library (1909)

Portsmouth

Shawnee State University Library (1987)

Rio Grande

Rio Grande College and Community College Jeanette Albiez Davis Library (1966)

Springfield

Warder Public Library (1884)

Steubenville

Franciscan University of Steubenville John Paul II Library (1971)
Public Library of Steubenville and Jefferson County (1950)

Tiffin

Heidelberg College Beeghly Library (1964)

Toledo

Toledo-Lucus County Public Library (1884)
University of Toledo College of Law Library (1981)
University of Toledo Library (1963)

University Heights

John Carroll University Grasselli Library (1963)

Westerville

Otterbein College Courtright Memorial Library (1967)

Wilmington

Wilmington College S. Arthur Watson Library (1986)

Wooster

College of Wooster Andrews Library (1966)

Worthington

Worthington Public Library (1984)

Youngstown

Public Library of Youngstown and Mahoning County (1923)
Youngstown State University William F. Maag Library (1971)

OKLAHOMA

Ada

East Central Oklahoma State University Linscheid Library (1914)

Alva

Northwestern Oklahoma State University J. W. Martin Library (1907)

Bethany

Southern Nazarene University R. T. Williams Learning Resources Center (1971)

Durant

Southeastern Oklahoma State University Henry G. Bennett Memorial Library (1929)

Edmond

Central State University Library (1934)

Enid

Public Library of Enid and Garfield County (1908)

Langston

Langston University G. Lamar Harrison Library (1941)

Lawton

Lawton Public Library (1987)

Norman

University of Oklahoma Libraries Bizzell Memorial Library (1893)
University of Oklahoma Law Library (1978)

Oklahoma City

Metropolitan Library System Main Library (1974)
Oklahoma City University Dulaney Browne Library (1963)
Oklahoma Department of Libraries (1893) REGIONAL

Shawnee

Oklahoma Baptist University Library (1933)

Stillwater

Oklahoma State University Library (1907) REGIONAL

Tahlequah

Northeastern Oklahoma State University John Vaughan Library (1923)

Tulsa

Tulsa City-County Library System (1963)
University of Tulsa College of Law Library (1979)
University of Tulsa McFarlin Library (1929)

Weatherford

Southwestern Oklahoma State University Al Harris Library (1958)

OREGON

Ashland

Southern Oregon State College Library (1953)

Bend

Central Oregon Community College Library/Media Service (1985)

Corvallis

Oregon State University Library (1907)

Eugene

University of Oregon Law Library (1979)
University of Oregon Library (1883)

Forest Grove

Pacific University Harvey W. Scott Memorial Library (1897)

Klamath Falls

Oregon Institute of Technology Learning Resources Center-Library (1982)

La Grande

Eastern Oregon State College Walter M. Pierce Library (1954)

McMinnville

Linfield College Northup Library (1965)

Monmouth

Western Oregon State College Library (1967)

Pendleton

Blue Mountain Community College Library (1983)

Portland

Lewis and Clark College Aubrey R. Watzek Library (1967)
Library Association of Portland (1884)
Northwestern School of Law Lewis and Clark College Paul L. Boley Law Library (1979)
Portland State University Millar Library (1963) REGIONAL
Reed College Library (1912)
U.S Department of Energy Bonneville Power Administration Library (1962)

Salem

Oregon State Library (unknown)
Oregon Supreme Court Law Library (1974)
Willamette University College of Law Library (1979)
Willamette University Main Library (1969)

PENNSYLVANIA

Allentown

Muhlenberg College Haas Library (1939)

Altoona

Altoona Area Public Library (1969)

Bethel Park

Bethel Park Public Library (1980)

Bethlehem

Lehigh University Libraries Linderman Library (1876)

Blue Bell

Montgomery County Community College Learning Resources Center (1975)

Bradford

University of Pittsburgh at Bradford Bradford Campus Library (1979)

California

California University of Pennsylvania Louis L. Manderino Library (1986)

Carlisle

Dickinson College Boyd Lee Spahr Library (1947)
Dickinson School of Law Sheeley-Lee Law Library (1978)

Cheyney

Cheyney University Leslie Pinckney Hill Library (1967)

Collegeville

Ursinus College Myrin Library (1963)

Coraopolis

Robert Morris College Library (1978)

Doylestown

Bucks County Free Library (1970)

East Stroudsburg

East Stroudsburg University Kemp Library (1966)

Erie

Erie County Library System (1897)

Greenville

Thiel College Langenheim Memorial Library (1963)

Harrisburg

State Library of Pennsylvania (unknown) REGIONAL

Haverford

Haverford College Magill Library (1897)

Hazleton

Hazleton Area Public Library (1964)

Indiana

Indiana University of Pennsylvania Stapleton Library (1962)

Johnstown

Cambria County Library System Glosser Memorial Library Building (1965)

Lancaster

Franklin and Marshall College Shadek-Fackenthal Library (1895)

Lewisburg

Bucknell University Ellen Clarke Bertrand Library (1963)

Mansfield

Mansfield University Library (1968)

Meadville

Allegheny College Lawrence Lee Pelletier Library (1907)

Millersville

Millersville University Helen A. Ganser Library (1966)

Monessen

Monessen Public Library (1969)

New Castle

New Castle Public Library (1963)

Newtown

Bucks County Community College Library (1968)

Norristown

Montgomery County-Norristown Public Library (1969)

Philadelphia

Drexel University W. W. Hagerty Library (1963)

Free Library of Philadelphia (1897)
Saint Joseph's University Drexel Library (1974)
Temple University Paley Library (1947)
Temple University Law Library (1979)
Thomas Jefferson University Scott Memorial Library (1978)
U.S. Court of Appeals Third Circuit Library (1973)
University of Pennsylvania Biddle Law Library (1974)
University of Pennsylvania Library (1886)

Pittsburgh

Allegheny County Law Library (1977)
Carnegie Library of Pittsburgh (1895)
Carnegie Library of Pittsburgh Allegheny Regional Branch (1924)
Duquesne University Law Library (1978)
La Roche College John J. Wright Library (1974)
U.S. Bureau of Mines Library (1962)
University of Pittsburgh Hillman Library (1910)
University of Pittsburgh Law Library (1979)

Pottsville

Pottsville Free Public Library (1967)

Reading

Reading Public Library (1901)

Scranton

Scranton Public Library (1895)

Shippensburg

Shippensburg University Ezra Lehman Memorial Library (1973)

Slippery Rock

Slippery Rock University Bailey Library (1965)

Swarthmore

Swarthmore College McCabe Library (1923)

University Park

Pennsylvania State University Libraries Pattee Library (1907)

Villanova

Villanova University Law School Pulling Law Library (1964)

Warren

Warren Library Association Warren Public Library (1885)

Waynesburg

Waynesburg College Library (1964)

West Chester

West Chester University Francis Harvey Green Library (1967)

Wilkes-Barre

King's College D. Leonard Corgan Library (1949)

Williamsport

Lycoming College Library (1970)

York

York College of Pennsylvania Schmidt Library (1963)

Youngwood

Westmoreland County Community College Learning Resources Center (1972)

PUERTO RICO

Mayaguez

University of Puerto Rico Mayaguez Campus Library (1928)

Ponce

Catholic University of Puerto Rico Encamacion Valdes Library (1966)
Catholic University of Puerto Rico School of Law Library (1978)

Rio Piedras

University of Puerto Rico J. M. Lazaro Library (1928)

REPUBLIC OF PANAMA

Balboa Heights

Panama Canal Commission Technical Resources Center (1963)

RHODE ISLAND

Barrington

Barrington Public Library (1986)

Kingston

University of Rhode Island Library (1907)

Newport

U.S. Naval War College Library (1963)

Providence

Brown University John D. Rockefeller Jr. Library (unknown)
Providence College Phillips Memorial Library (1969)
Providence Public Library (1884)
Rhode Island College James P. Adams Library (1965)
Rhode Island State Law Library (1979)
Rhode Island State Library (1895)

Warwick

Warwick Public Library (1966)

Westerly

Westerly Public Library (1909)

Woonsocket

Woonsocket Harris Public Library (1977)

SOUTH CAROLINA

Charleston

Baptist College at Charleston L. Mendel Rivers Library (1967)
The Citadel Military College Daniel Library (1962)
College of Charleston Robert Scott Small Library (1869)

Clemson

Clemson University Cooper Library (1893)

Columbia

Benedict College Library Payton Learning Resources Center (1969)
South Carolina State Library (1895)
University of South Carolina Coleman Karesh Law Library (1983)
University of South Carolina Thomas Cooper Library (1884)

Conway

University of South Carolina Coastal Carolina College Kimbel Library (1974)

Due West

Erskine College McCain Library (1968)

Florence

Florence County Library (1967)
Francis Marion College James A. Rogers Library (1970)

Greenville

Furman University Library (1962)
Greenville County Library (1966)

Greenwood

Lander College Larry A. Jackson Library (1967)

Orangeburg

South Carolina State College Miller F. Whittaker Library (1953)

Rock Hill

Winthrop College Dacus Library (1896)

Spartanburg

Spartanburg County Public Library (1967)

SOUTH DAKOTA

Aberdeen

Northern State College Beulah Williams Library (1963)

Brookings

South Dakota State University H. M. Briggs Library (1889)

Pierre

South Dakota State Library (1973)
South Dakota Supreme Court Library (1978)

Rapid City

Rapid City Public Library (1963)
South Dakota School of Mines and Technology Devereaux Library (1963)

Sioux Falls

Augustana College Mikkelsen Library (1969)
Sioux Falls Public Library (1903)

Spearfish

Black Hills State College Library Learning Center (1942)

Vermillion

University of South Dakota I. D. Weeks Library (1889)

TENNESSEE

Bristol

King College E. W. King Library (1970)

Chattanooga

Chattanooga-Hamilton County Bicentennial Library (1908)
U.S. Tennessee Valley Authority Technical Library (1976)

Clarksville

Austin Peay State University Felix G. Woodward Library (1945)

Cleveland

Cleveland State Community College Library (1973)

Columbia

Columbia State Community College John W. Finney Memorial Library (1973)

Cookeville

Tennessee Technological University Jere Whitson Memorial Library (1969)

Jackson

Lambuth College Luther L. Gobbel Library (1967)

Jefferson City

Carson-Newman College Library (1964)

Johnson City

East Tennessee State University Sherrod Library (1942)

Knoxville

Knoxville County Public Library System Lawson McGhee Library (1973)
University of Tennessee at Knoxville John C. Hodges Library (1907)
University of Tennessee Law Library (1971)

Martin

University of Tennessee at Martin Paul Meek Library (1957)

Memphis

Memphis-Shelby County Public Library and Information Center (1896)
Memphis State University Cecil C. Humphreys School of Law Library (1979)
Memphis State University Libraries (1966)

Murfreesboro

Middle Tennessee State University Todd Library (1912)

Nashville

Fisk University Library (1965)
Public Library of Nashville and Davidson County (1884)
Tennessee State Library and Archives (unknown)
Tennessee State University Brown-Daniel Library (1972)
Vanderbilt University Alyne Queener Massey Law Library (1976)
Vanderbilt University Library (1884)

Sewanee

University of the South Jessie Ball duPont Library (1873)

TEXAS

Abilene

Abilene Christian University Margaret and Herman Brown Library (1978)
Hardin-Simmons University Rupert and Pauline Richardson Library (1940)

Arlington

Arlington Public Library (1970)
University of Texas at Arlington Library (1963)

Austin

Texas State Law Library (1972)
Texas State Library (unknown) REGIONAL
University of Texas at Austin Perry-Castaneda Library (1884)
University of Texas at Austin Edie and Lew Wasserman Public Affairs Library (1966)
University of Texas at Austin Tarlton Law Library (1965)

Baytown

Lee College Library (1970)

Beaumont

Lamar University Mary and John Gray Library (1957)

Brownwood

Howard Payne University Walker Memorial Library (1964)

Canyon

West Texas State University Cornette Library (1928)

College Station

Texas Agricultural and Mechanical University David G. Evans Library (1907)

Commerce

East Texas State University James Gilliam Gee Library (1937)

Corpus Christi

Corpus Christi State University Library (1976)

Corsicana

Navarro College Gaston T. Gooch Library (1965)

Dallas

Dallas Baptist University Vance Memorial Library (1967)
Dallas Public Library (1900)
Southern Methodist University Fondren Library (1925)
University of Texas Health Science Center-Dallas Library (1975)

Denton

North Texas State University Library (1948)

Edinburg

Pan American University Library (1959)

El Paso

El Paso Public Library (1906)
University of Texas at El Paso Library Documents & Maps Library (1966)

Fort Worth

Fort Worth Public Library (1905)
Texas Christian University Mary Couts Burnett Library (1916)

Galveston

Rosenberg Library (1909)

Houston

Houston Public Library (1884)
North Harris County College Learning Resource Center (1974)
Rice University Fondren Library (1967)
South Texas College of Law Library (1981)
Texas Southern University Thurgood Marshall School of Law Library (1982)
University of Houston-Clear Lake Alfred R. Neumann Library (1980)
University of Houston-University Park Library (1957)
University of Houston School of Law Library (1979)

Huntsville

Sam Houston State University Newton Gresham Library (1949)

Irving

Irving Public Library System (1974)

Kingsville

Texas Arts and Industries University Jernigan Library (1944)

Laredo

Laredo Junior College Harold R. Yeary Library (1970)

Longview

Longview Public Library (1961)

Lubbock

Texas Tech University Library (1935) REGIONAL
Texas Tech University School of Law Library (1978)

Marshall

Wiley College Thomas Winston Cole Sr. Library (1962)

Nacogdoches

Stephen F. Austin State University Steen Library (1965)

Richardson

University of Texas at Dallas McDermott Library (1972)

San Angelo

Angelo State University Port Henderson Library (1964)

San Antonio

Saint Mary's University Academic Library (1964)
Saint Mary's University Sarita Kennedy East Law Library (1982)
San Antonio College Library (1972)
San Antonio Public Library (1899)
Trinity University Elizabeth Coates Maddux Library (1964)
University of Texas at San Antonio Library (1973)

San Marcos

Southwest Texas State University Library (1955)

Seguin

Texas Lutheran College Blumberg Memorial Library (1970)

Sherman

Austin College Abell Library (1963)

Texarkana

Texarkana College Palmer Memorial Library (1963)

Victoria

Victoria College/University of Houston Victoria Campus Library (1973)

Waco

Baylor University Law Library (1982)
Baylor University Moody Memorial Library (1905)

Wichita Falls

Midwestern State University Moffett Library (1963)

UTAH

Cedar City

Southern Utah State College Library (1964)

Ephraim

Snow College Lucy A. Phillips Library (1963)

Logan

Utah State University Merrill Library and Learning Resources Center (1907) REGIONAL

Ogden

Weber State College Stewart Library (1962)

Provo

Brigham Young University Harold B. Lee Library (1908)
Brigham Young University Law Library (1972)

Salt Lake City

University of Utah Eccles Health Sciences Library (1970)
University of Utah Law Library (1966)
University of Utah Marriott Library (1893)
Utah State Library (unknown)
Utah State Supreme Court Law Library (1975)

VERMONT

Burlington

University of Vermont Bailey/Howe Library (1907)

Castleton

Castleton State College Calvin Coolidge Library (1969)

Johnson

Johnson State College John Dewey Library (1955)

Lyndonville

Lyndon State College Samuel Reed Hall Library (1969)

Middlebury

Middlebury College Egbert Starr Library (1884)

Montpelier

Vermont Department of Libraries (1845)

Northfield

Norwich University Library (1908)

South Royalton

Vermont Law School Library (1978)

VIRGIN ISLANDS

Saint Croix

Florence Williams Public Library (1968)

Saint Thomas

College of the Virgin Islands Ralph M. Paiewonsky Library (1973)
Enid M. Baa Library and Archives (1968)

VIRGINA

Alexandria

Dept. of the Navy Office of Judge Advocate General Law Library (1963)

Arlington

George Mason University School of Law Library (1981)
U.S. Patent & Trademark Office Science Library (1986)

Blacksburg

Virginia Polytechnic Institute and State University Carol M. Newman Library (1907)

Bridgewater

Bridgewater College Alexander Mack Memorial Library (1902)

Charlottesville

University of Virginia Alderman Library (1910) REGIONAL
University of Virginia Arthur J. Morris Law Library (1964)

Chesapeake

Chesapeake Public Library (1970)

Danville

Danville Community College Learning Resources Center (1969)

Emory

Emory and Henry College Kelly Library (1884)

Fairfax

George Mason University Fenwick Library (1960)

Fredericksburg

Mary Washington College E. Lee Trinkle Library (1940)

Hampden-Sydney

Hampden-Sydney College Eggleston Library (1891)

Hampton

Hampton University Huntington Memorial Library (1977)

Harrisonburg

James Madison University Carrier Library (1973)

Hollins College

Hollins College Fishburn Library (1967)

Lexington

Virginia Military Institute Preston Library (1874)
Washington and Lee University University Library (1910)
Washington and Lee University Wilbur C. Hall Law Library (1978)

Martinsville

Patrick Henry Community College Library (1971)

Norfolk

Norfolk Public Library (1895)
Old Dominion University Library (1963)
U.S. Armed Forces Staff College Library (1963)

Petersburg

Virginia State University Johnston Memorial Library (1907)

Quantico

Federal Bureau of Investigation Academy Library (1970)
Marine Corps Education Center MCDEC James Carson Breckinridge Library (1967)

Reston

Department of the Interior Geological Survey Library (1963)

Richmond

U.S. Court of Appeals Fourth Circuit Library (1973)
University of Richmond Boatwright Memorial Library (1900)
University of Richmond Law School Library (1982)
Virginia Commonwealth University James Branch Cabell Library (1971)
Virginia State Law Library (1973)
Virginia State Library & Archives (unknown)

Salem

Roanoke College Library (1886)

Williamsburg

College of William and Mary Marshall-Wythe Law Library (1978)
College of William and Mary Swem Library (1936)

Wise

Clinch Valley College John Cook Wyllie Library (1971)

WASHINGTON

Bellingham

Western Washington University Mable Zoe Wilson Library (1963)

Cheney

Eastern Washington University JFK Library (1966)

Des Moines

Highline Community College Library (1983)

Ellensburg

Central Washington University Library (1962)

Everett

Everett Public Library (1914)

Olympia

Evergreen State College Daniel J. Evans Library (1972)
Washington State Law Library (1979)
Washington State Library (unknown) REGIONAL

Port Angeles

North Olympic Library System (1965)

Pullman

Washington State University Holland Library (unknown)

Seattle

Seattle Public Library (1908)
University of Washington Suzallo Library (1890)
University of Washington Marian Gould Gallagher Law Library (1969)
U.S. Court of Appeals 9th Circuit Library (1981)

Spokane

Gonzaga University School of Law Library (1979)
Spokane Public Library (1910)

Tacoma

Tacoma Public Library (1894)
University of Puget Sound Collins Memorial Library (1938)
University of Puget Sound School of Law Library (1978)

Vancouver

Fort Vancouver Regional Library (1962)

Walla Walla

Whitman College Penrose Memorial Library (1890)

WEST VIRGINIA

Athens

Concord College J. Frank Marsh Library (1924)

Bluefield

Bluefield State College Hardway Library (1972)

Charleston

Kanawha County Public Library (1952)
West Virginia Library Commission (1975)
West Virginia Supreme Court Law Library (1977)

Elkins

Davis and Elkins College Library (1913)

Fairmont

Fairmont State College Library (1884)

Glenville

Glenville State College Robert F. Kidd Library (1966)

Huntington

Marshall University James E. Morrow Library (1925)

Institute

West Virginia State College Drain-Jordon Library (1907)

Montgomery

West Virginia Institute of Technology Vining Library (1985)

Morgantown

West Virginia University Library (1907) REGIONAL

Salem

Salem College Library (1921)

Shepherdstown

Shepherd College Ruth Scarborough Library (1971)

Weirton

Mary H. Weir Public Library (1963)

WISCONSIN

Appleton

Lawrence University Seeley G. Mudd Library (1869)

Beloit

Beloit College Col. Robert H. Morse Library (1888)

Eau Claire

University of Wisconsin-Eau Claire William D. McIntyre Library (1951)

Fond du Lac

Fond du Lac Public Library (1966)

Green Bay

University of Wisconsin-Green Bay Learning Resources Center (1968)

La Crosse

La Crosse Public Library (1883)
University of Wisconsin-La Crosse Murphy Library (1965)

Madison

Madison Public Library (1965)
State Historical Society of Wisconsin Library (1870) REGIONAL
University of Wisconsin-Madison Memorial Library (1939)
University of Wisconsin-Madison Law Library (1981)
Wisconsin State Law Library (unknown)

Milwaukee

Alverno College Library/Media Center (1971)
Marquette University Law Library (1987)
Medical College of Wisconsin, Inc. Todd Wehr Library (1980)
Milwaukee County Law and Reference Library (1934)
Milwaukee Public Library (1861) REGIONAL
Mount Mary College Haggerty Library (1964)
University of Wisconsin-Milwaukee Library (1960)

Oshkosh

University of Wisconsin-Oshkosh Forrest R. Polk Library (1956)

Platteville

University of Wisconsin-Platteville Karrman Library (1964)

Racine

Racine Public Library (1898)

Ripon

Ripon College Library (1982)

River Falls

University of Wisconsin-River Falls Chalmer Davee Library (1962)

Sheboygan

Mead Public Library (1983)

Stevens Point

University of Wisconsin-Stevens Point Library (1951)

Superior

Superior Public Library (1908)
University of Wisconsin-Superior Jim Dan Hill Library (1935)

Waukesha

Waukesha Public Library (1966)

Wausau

Marathon County Public Library (1971)

Whitewater

University of Wisconsin-Whitewater Harold Anderson Library (1963)

WYOMING

Casper

Natrona County Public Library (1929)

Cheyenne

Wyoming State Law Library (1977)
Wyoming State Library (unknown) REGIONAL

Gillette

Campbell County Public Library (1980)

Laramie

University of Wyoming, Coe Library (1907)
University of Wyoming Law Library (1978)

Powell

Northwest Community College John Taggart Hinckley Library (1967)

Riverton

Central Wyoming College Learning Resources Center (1969)

Rock Springs

Western Wyoming Community College Library (1969)

Sheridan

Sheridan College Griffith Memorial Library (1963)

APPENDIX B
List of District Offices of the U.S. Department of Commerce

ALABAMA

Birmingham–2015 2nd Avenue North, 3rd Floor, Berry Building, 35203, Area Code 205 Tel 254–1331, FTS 8 229–1331

ALASKA

Anchorage–222 W. 7th Avenue, P.O. Box 32, 99513, Area Code 907 Tel 271–5041, FTS 8 271–5041

ARIZONA

Phoenix–Federal Building & U.S. Courthouse, 230 N. 1st Avenue, Room 3412, 85025, Area Code 602 Tel 261–3285, FTS 8 261–3285

ARKANSAS

Little Rock–Suite 811, Savers Federal Building, 320 W. Capitol Avenue, 72201, Area Code 501 Tel 378–5794, FTS 8 740–5794

CALIFORNIA

Los Angeles–Room 810, 11777 San Vicente Blvd., 90049–5076, Area Code 213 Tel 209–6616, FTS 8 793–6616

•**San Diego**–6363 Greenwich Drive, Suite 145, 92122, Area Code 619 Tel 557–5395, FTS 8 895–5395

San Francisco–Federal Building, Box 6013, 450 Golden Gate Avenue, 94102, Area Code 415 Tel 556–5860, FTS 8 556–5868

Santa Ana–116A W. 4th Street, Suite #1, 92701, Area Code 714 Tel 836–2461, FTS 8 799–2461

COLORADO

Denver–Room 119, U.S. Customhouse, 721 19th Street, 80202, Area Code 303 Tel 844–3246, FTS 8 564–3246

CONNECTICUT

Hartford–Room 610–B, Federal Office Building, 450 Main Street, 06103, Area Code 203 Tel 240–3530, FTS 8 244–3530

DISTRICT OF COLUMBIA

Room 1066, HCHB, Department of Commerce, 14th Street & Constitution Avenue, N.W., 20230, Area Code 202 Tel 377–3181, FTS 8 377–3181

FLORIDA

•**Clearwater**–128 N. Osceola Avenue, 33515, Area Code 813 Tel 461–0011, FTS 8 826–3738

•**Jacksonville**–Independence Square, Suite 200A, 32216, Area Code 904 Tel 791–2796, FTS 8 946–2796

Miami–Suite 224, Federal Building, 51 S.W. First Avenue, 33130, Area Code 305 Tel 536–5267, FTS 8 350–5267

•**Orlando**–Room 346, University of Central Florida, 32802, Area Code 305 Tel 648–1608, FTS 8 820–6235

•**Tallahassee**–Collins Building, Room 401, 107 W. Gaines Street, 32304, Area Code 904 Tel 488–6469, FTS 8 965–7194

GEORGIA

Atlanta–Room 625, 1365 Peachtree Street, N.E., 30309, Area Code 404 Tel 347–2271, FTS 8 257–2271

Savannah–120 Barnard Street, A–107, 31402, Area Code 912 Tel 944–4204, FTS 8 248–4204

HAWAII

Honolulu–4106 Federal Building, P.O. Box 50026, 300 Ala Moana Blvd., 96850, Area Code 808 Tel 541–1782, FTS 8 551–1785

IDAHO

Boise (Denver, Colorado District)–700 W. State Street, 83720, Area Code 208 Tel 334–2470, FTS 8 554–9254

ILLINOIS

Chicago–1406 Mid Continental Plaza Building, 55 E. Monroe Street, 60603, Area Code 312 Tel 353–4450, FTS 8 353–4450

•**Palatine**–W. R. Harper College, Algonquin & Rodelle Road, 60067, Area Code 312 Tel 397–3000, x532

•**Rockford**–515 N. Court Street, P.O. Box 1747, 61110–0247, Area Code 815 Tel 987–8123, FTS 8 363–4347

INDIANA

Indianapolis–One N. Capitol, Suite 520, 46204, Area Code 317 Tel 269–6214, FTS 8 331–6214

IOWA

Des Moines–817 Federal Building, 210 Walnut Street, 50309, Area Code 515 Tel 284–4222, FTS 8 862–4222

KANSAS

•**Wichita (Kansas City, Missouri District)**–River Park Place, Suite 565, 727 North Waco, 67203, Area Code 316 Tel 269–6160, FTS 8 752–6160

KENTUCKY

Louisville–U.S. Post Office and Courthouse Building, 601 W. Broadway, 40202, Area Code 502 Tel 582–5066, FTS 8 352–5066

LOUISIANA

New Orleans–432 World Trade Center, No. 2 Canal Street, 70130, Area Code 504 Tel 589–6546, FTS 8 682–6546

•Denotes trade specialist at post or duty station

MAINE

•**Augusta (Boston, Massachusetts District)**–77 Sewell Street, 04330, Area Code 207 Tel 622–8249, FTS 8 833–6249

MARYLAND

Baltimore–415 U.S. Customhouse, Gay and Lombard Streets, 21202, Area Code 301 Tel 962–3560, FTS 8 922–3560

MASSACHUSETTS

Boston–World Trade Center, Suite 307, Commonwealth Pier Area, 02210, Area Code 617 Tel 565–8563, FTS 8 835–8563

MICHIGAN

Detroit–1140 McNamara Building, 477 Michigan Avenue, 48226, Area Code 313 Tel 226–3650, FTS 8 226–3650

•**Grand Rapids**–300 Monroe N.W., Room 409, 49503, Area Code 616 Tel 456–2411, FTS 8 372–2411

MINNESOTA

Minneapolis–108 Federal Building, 110 S. 4th St., 55401, Area Code 612 Tel 349–1638, FTS 8 777–1638

MISSISSIPPI

Jackson–328 Jackson Mall Office Center, 300 Woodrow Wilson Blvd., 39213, Area Code 601 Tel 965–4388, FTS 8 490–4388

MISSOURI

Kansas City–Room 635, 601 E. 12th Street, 64106, Area Code 816 Tel 426–3141, FTS 8 867–3141

St. Louis–7911 Forsyth Blvd., Suite 610, 63105, Area Code 314 Tel 425–3302–4, FTS 8 279–3302

NEBRASKA

Omaha–1133 O Street, 68137, Area Code 402 Tel 221–3664, FTS 8 864–3664

NEVADA

Reno–1755 E. Plumb Lane, Room 152, 89502, Area Code 702 Tel 784–5203, FTS 8 470–5203

NEW JERSEY

Trenton–3131 Princeton Pike Building, Suite 100, 08648, Area Code 609 Tel 989–2100, FTS 8 423–2100

NEW MEXICO

Albuquerque–5000 Marble Avenue, N.E., Suite 320, 87110, Area Code 505 Tel 262–6024, FTS 8 474–2386

NEW YORK

Buffalo–1312 Federal Building, 111 W. Huron Street, 14202, Area Code 716 Tel 846–4191, FTS 8 437–4191

New York–Federal Office Building, 26 Federal Plaza, Foley Square, 10278, Area Code 212 Tel 264–0634, FTS 8 264–0634

•**Rochester**–111 E. Avenue, Suite 220, 14604, Area Code 716 Tel 263–6480, FTS 8 963–6480

NORTH CAROLINA

Greensboro–203 Federal Building, 324 W. Market Street, P.O. Box 1950, 27402, Area Code 919 Tel 333–5345, FTS 8 699–5345

OHIO

Cincinnati–9504 Federal Office Building, 550 Main Street, 45202, Area Code 513 Tel 684–2944, FTS 8 684–2944

Cleveland–Room 600, 668 Euclid Avenue, 44114, Area Code 216 Tel 522–4750, FTS 8 942–4750

OKLAHOMA

Oklahoma City–5 Broadway Executive Park, Suite 200, 6601 Broadway Extension, 73116, Area Code 405 Tel 231–5302, FTS 8 736–5302

•**Tulsa**–440 S. Houston Steet, 74127, Area Code 918 Tel 581–7650, FTS 8 745–7650

OREGON

Portland–Room 618, 1220 S.W. 3rd Avenue, 97204, Area Code 503 Tel 221–3001, FTS 8 423–3001

PENNSYLVANIA

Philadelphia–9448 Federal Building, 600 Arch Street, 19106, Area Code 215 Tel 597–2850, FTS 8 597–2850

Pittsburgh–2002 Federal Building, 1000 Liberty Avenue, 15222, Area Code 412 Tel 644–2850, FTS 8 722–2850

PUERTO RICO

San Juan (Hato Rey)–Room 659, Federal Building, Chardon Avenue, 00918, Area Code 809 Tel 753–4555, Ext. 555, FTS 8 753–4555

RHODE ISLAND

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